

Study on audio PMSE spectrum usage DKE AK 731.0.8 (DIN/VDE)

Management Summary

What are the spectrum needs of PMSE¹?

DKE AK² 731.0.8 have attempted to answer this question by monitoring events using PMSE since 2007. These are standard events that happen all around us all year long: from sports to exhibitions, political activities such as elections, international music productions, open air theatre, exhibitions including international motor shows and the Oktoberfest.

This report attempts to provide answers on that question. DKE AK 731.0.8 monitored PMSE usage during events since 2007 in Austria, Finland, Germany and Switzerland. These are typical events that happen all around us all year long: from sports to exhibitions, political reports such as elections, international music productions, open air theatre, exhibitions such as international motor shows up to the Bavarian Oktoberfest. The demand for quality and clean spectrum, with no interference from other sources, ranges from about several MHz up to the entire UHF-TV-Band (470 to 862 MHz).

Extraordinary large events are not identified within this report: Olympic Games, national days, VIPs visits and similar where it is known that they require the full VHF / UHF Broadcast TV range plus the PMR bands for operation of international reporting teams. All this is endangered if more spectrum from the Broadcast band is reallocated to other services, therefore PMSE needs protection to continue providing content for all cultural, sports, entertainment and media activities. One way to achieve this would be primary or co-primary status in certain frequency ranges to guarantee the ability of future productions to exist and the freedom of production teams to report these events supporting the diversity of opinions and ensuring freedom of speech for the viewer.

From this report and using the newly generated spectrum aggregation it is clear that any additional loss of spectrum will curtail the ability of PMSE to meet the requirements of the cultural, media, sports and entertainment sectors, making many large productions impossible. Advanced technologies may reduce the spectrum needs a little and by this cater for the increasing number of applications required by productions. Before assigning any further spectrum from the broadcast bands to other primary services, Politicians and Administrations should carefully consider the devastating effect on the growing Culture and Creative industries including the employment prospects of their workforce.

¹ PMSE - Programme Making and Special Events

² AK = German Expression to Working Group

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Introduction

Since the 1960s the UHF Range, 470 to 862 MHz, has been exclusively used for TV broadcasts and PMSE. This radio spectrum is the reliable backbone of any wireless production tool. To find out more details in that frequency range since the year 2007 the DKE³ AK 731.0.8 collected data on PMSE use during live operations. The intention was to find out more details on the number of PMSE links in operation at specific events as well as the overall PMSE spectrum needs. As all the scanning reports are based on the same measurement methods a direct comparison between different events is valid. Some of the monitored events happened on a regular basis. It can be concluded from these that the demand for PMSE spectrum is growing.

This is the first detailed report identifying PMSE spectrum usage and the number of PMSE links. Some of these events have in addition to the frequency scans the frequency lists of the organizers which clearly shows that even sophisticated scanning equipment co-located on site can only detect a limited amount of links. Therefore event frequency coordination and allocation rather than scanning methods guarantee an interference-free production.

The DKE AK 731.0.8 wishes to thank all the public, private organizations and individuals for their onsite support: this made the investigations possible. We hope that this report will lead to better understanding and support for the long-term spectrum needs and protection of PMSE.

About DKE

The DKE German Commission for Electrical, Electronic & Information Technologies of DIN and VDE is a modern, non-profit service organisation which ensures that electricity is generated, distributed and used in a safe and rational manner, thereby serving the good of the community at large⁴.

About VDE

VDE, the Association for Electrical, Electronic & Information Technologies is one of the largest technical and scientific associations in Europe with more than 36,000 members.

About DKE AK 731.0.8

The work within the DKE AK⁵ 731.0.8 addresses professional wireless microphone systems and event production tools⁶.

³ DKE - German Commission for Electrical, Electronic & Information Technologies of DIN and VDE

⁴ <http://www.vde.com/en/dke/Aboutourselves/Pages/The%20Mandate%20of%20the%20DKE.aspx>

⁵ AK = German description of a Working Group

⁶ <http://www.vde.com/en/dke/Aboutourselves/DKE%20Business%20Organization/DKEReports/Der%20Orgaplan-Bericht/Orgaplan.pdf>

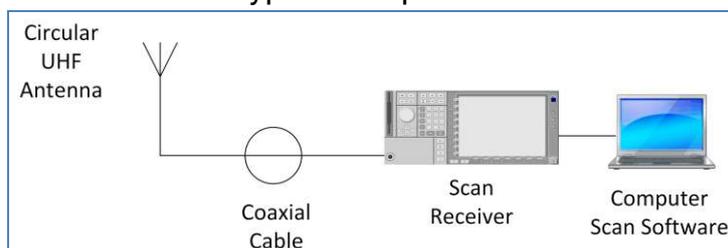
PMSE

The term PMSE (Programme Making and Special Events) covers all the wireless production tools used for front-end solutions in the field of professional multimedia production (from radio and television to art, culture, conferences, trade fairs, entertainment applications, education, sport events and much more). This study focussed on audio PMSE and their spectrum demand.

It should be noted that PMSE operates in white spaces of the VHF/UHF TV band with very low radiated power, typical below 50mW - refer also ECC Report 204 [5].

How to scan PMSE spectrum allocation?

To record the PMSE spectrum allocation one or several RF scanning units are required. This picture shows the typical setup:



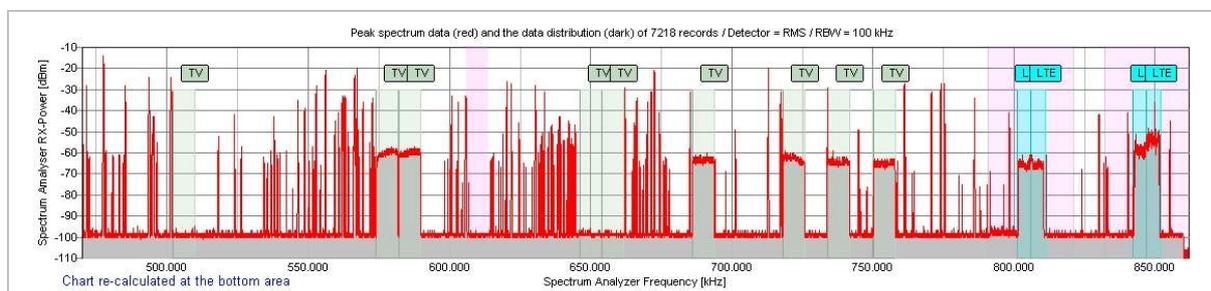
To get the required spectrum resolution the scanning grid is 20 kHz.

Limitation in RF spectrum scans

The RF scanning station is usually in a position that it cannot detect all the PMSE in operation, especially not those that are far away or behind walls or other attenuating structures. This effect is well known as “hidden-node problem”. Besides this in some locations the man-made-noise reduced the sensitivity for the detection of PMSE links to below -70 dBm rather than the normal -115 dBm.

With multiple scanning stations the results are closer to reality, but often do not match with the links in operation that are within the coordinated frequency plan of the operator/producer.

This graph shows a typical spectrum scan summarising a large number (7218) of single scans:



As can be seen local allocated TV channels are marked. A small light red bar shows the TV channel 38 that is allocated to the Radio Astronomy service. Two light red bars right on the graph mark the 800 MHz IMT bands. Light blue marks are LTE base station or LTE user equipment. The small red lines in the spectrum scan represent scanned PMSE links.

Analysis of spectrum scans

To every scanned event a two page report was generated. This report contains general information, a spectrum scan, a spectrum allocation graph referred to as a statistic threshold level and summarizes the detected carriers in a table. See an example table below:

Carrier bandwidth [kHz]	# of carriers	
<200	102	probably small band links
200..500	3	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	10	probably TV or LTE
>10000	0	
Total	115	

How the study estimates the audio PMSE spectrum demand?

Every event report provides an estimated spectrum demand based on the detected carrier and, if available, the frequency plan(s) at the event:

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	61200	probably small band links
200..500	1800	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	80000	probably TV or LTE
>10000	0	
Total	143000	

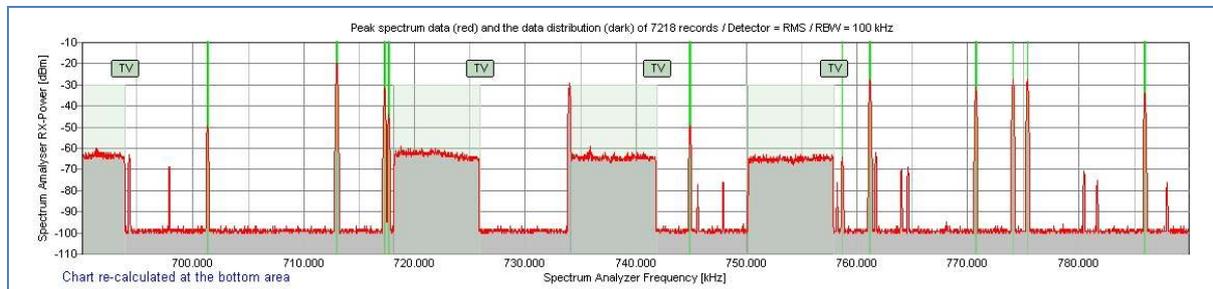
This estimated spectrum demand is based on a 600 kHz grid (based on the linear channel-to-channel allocation) that the latest PMSE technology supports. This calculation model is necessary in order to compare all scans.

It should be noted: **This estimated spectrum demand does not represent the real spectrum demand of PMSE; the real spectrum demand is significant higher. It does not include** In Ear Monitor transmitters combined to a single antenna which cannot be operated in a linear channel grid. In addition the use of IEM and microphones simultaneously on a human body requires a frequency separation of some 15 MHz.

Plausibility check

Check if all detected signals are small band carrier

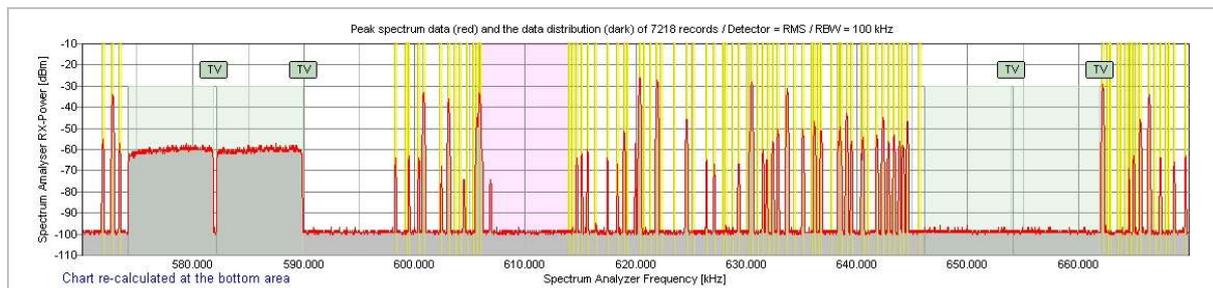
The statistical software can highlight the detected signals in green behind the spectrum scan. This way the results can be visually checked:



As one can see the carrier above the threshold level are detected and carrier below are ignored.

Comparing scans to coordination information

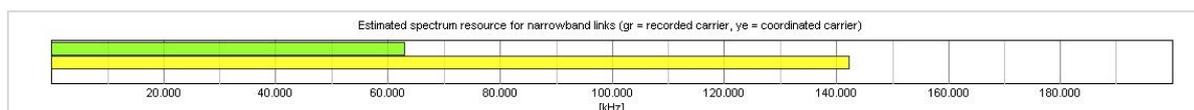
At some events frequency planners provided frequency tables for the different users to avoid interference between the different operators. Where these tables were on hand they were integrated and the yellow lines show frequencies set by the frequency coordinator, the red lines, again, show only the detected frequencies:



As one can see a large number of scanned PMSE links are represented in the coordination table. Some PMSE links in the frequency plan cannot be seen in the scan or only by a very small signal close to noise (hidden-node problem).

Comparison of recorded and coordinated links

This difference - where frequency coordination lists were available - is shown in a graph as follows:



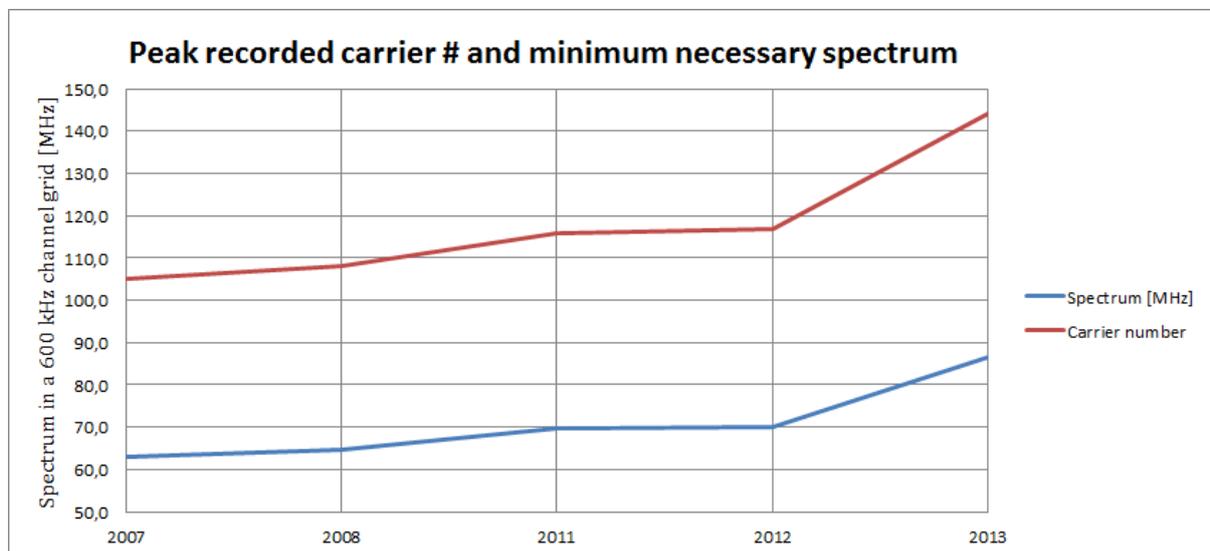
The green line shows the number of actual measured links, the yellow one those that were mentioned in the coordination list. This example is typical: about 43% of the coordinated frequencies show up in scans. For those events where these lists were not available this needs to be taken into consideration when estimating the actual use of spectrum.

Note: up to two frequency plans can be incorporated in the software.

Identification of the PMSE growth rate

Identification by detected carrier

The graph below shows the year on year peak recorded carriers and presents evidence of the annual growth in PMSE use:



Note: from all annually DKE scanned events the event with the maximum carrier number was selected.

This "Scanned peak" information are marked in the summarising tables on next pages.

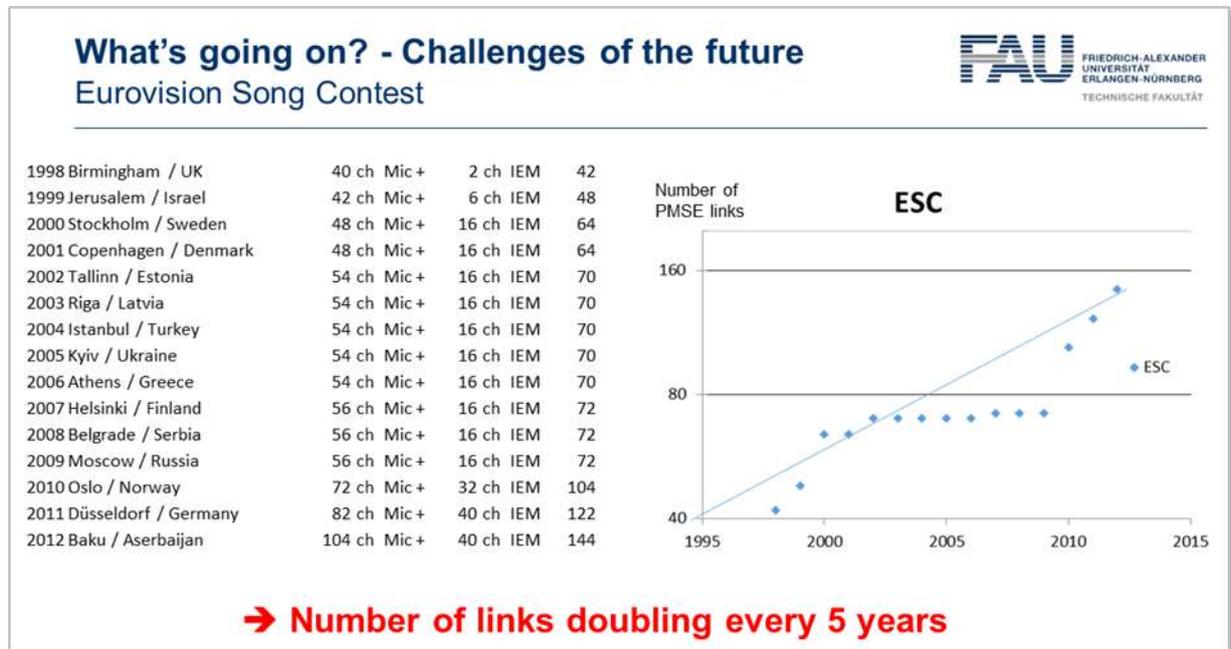
Please also note, majority of scans show only about 50% of the actual operating links.

Important note:

This estimated spectrum demand is based on a 600 kHz grid (based on the linear channel-to-channel allocation) that the latest PMSE technology supports. This calculation model is necessary in order to compare all scans. It should be noted: This estimated spectrum demand does not represent the real spectrum demand of PMSE; the real spectrum demand is significant higher.

Identification by a typical application

The Eurovision Song Contest (ESC) report provides a clear indication of growth PMSE links inside the event. During the European Microwave Week 2013⁷ this report was part of the presentation:



Spectrum required for daily production using audio PMSE

In 2008 the German Federal Network Agency published a study on the spectrum need for PMSE daily operation. The study [6] was conducted by the University of Hanover in the city centre of Berlin and came to the conclusion that PMSE requires 96 MHz for daily production. Comparing this 96 MHz with the DKE investigations one can see that both come to the similar results: please see the table above “Peak recorded carrier # and minimum necessary spectrum”.

⁷ <http://www.apwpt.org/history-of-events-2009-12/germany/2013/index.html>

Summary of spectrum estimation based on scans and coordination tables

2013

Scanned peak 86.6 MHz

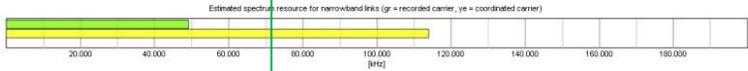
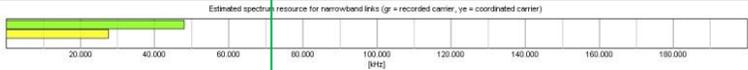
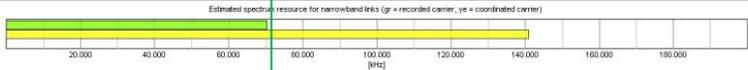
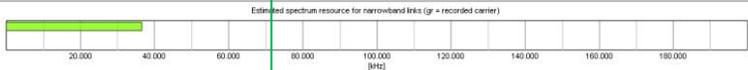
Spectrum graphic	Event	Location	Date	Spectrum [MHz] in a 600 kHz grid	
				Recorded	Coordin.
	Federal state election	Hanover (D)	20.01.13	86.6	166
	National qualification to ESC2013	Hanover (D)	12.02.13	55.8	48.0
	Indoor international Music Fair, Prolight+Sound, Hall 8	Frankfurt (D)	11.04.13	67.2	-
	Outdoor theatre production	Einsiedel (CH)	21.06.13	48.6	45.0
	Federal state election	Munich (D)	15.09.13	63.0	142
	Public outdoor/indoor event	Munich (D)	20.09.13	39.6	-
	National election	Vienna (A)	29.09.13	46.8	51.0
	National business conference	Munich (D)	18.10.13	17.4	-

Important note:

This estimated spectrum demand is based on a 600 kHz grid (based on the linear channel-to-channel allocation) that the latest PMSE technology supports. This calculation model is necessary in order to compare all scans. It should be noted: This estimated spectrum demand does not represent the real spectrum demand of PMSE; the real spectrum demand is significant higher.

2012

Scanned peak 70.2 MHz

Spectrum graphic	Event	Location	Date	Spectrum [MHz] in a 600 kHz grid	
				Recorded	Coordin.
	National football production	Berlin 2012 (D)	12.05.12	49.2	114
	Federal state election	Düsseldorf (D)	13.05.12	48.0	27.6
	Federal state election	Kiel (D)	06.05.12	70.2	141
	Outdoor theatre production	Villach (A)	09.08.12	36.6	-
	Public outdoor/indoor event	Munich (D)	21.09.12	37.8	-

Important note:

This estimated spectrum demand is based on a 600 kHz grid (based on the linear channel-to-channel allocation) that the latest PMSE technology supports. This calculation model is necessary in order to compare all scans. It should be noted: This estimated spectrum demand does not represent the real spectrum demand of PMSE; the real spectrum demand is significant higher.

2011



Spectrum graphic	Event	Location	Date	Spectrum [MHz] in a 600 kHz grid	
				Recorded	Coordin.
	Federal state election	Hamburg (D)	20.02.11	62.40	125.4
	Federal state election	Magdeburg (D)	20.03.11	39.6	64.8
	Federal state election	Stuttgart (D)	27.03.11	69.6	103.8
	Federal state election	Mainz (D)	27.03.11	65.4	58.8
	International event production, ESC2011	Dusseldorf (D)	14.05.11	60.0	84.0
	Federal state election	Bremen (D)	22.05.11	67.8	59.4
	Federal state election	Schwerin (D)	04.09.11	54.0	182.4
	Federal town election	Berlin (D)	18.09.11	68.4	199.8
	National football production	Munich (D)	24.09.11	29.4	-
	National football production	Bremen (D)	25.09.11	19.8	-
	IAA International Motor Show	Frankfurt (D)	15.09.11	32.4	-

Important note:

This estimated spectrum demand is based on a 600 kHz grid (based on the linear channel-to-channel allocation) that the latest PMSE technology supports. This calculation model is necessary in order to compare all scans. It should be noted: This estimated spectrum demand does not represent the real spectrum demand of PMSE; the real spectrum demand is significant higher.

2008



Spectrum graphic	Event	Location	Date	Spectrum [MHz] in a 600 kHz grid	
				Recorded	Coordin.
<p>Estimated spectrum resource for narrowband links (gr = recorded carrier, ye = coordinated carrier)</p>	Federal state election	Hanover (D)	27.01.08	51.0	198
<p>Estimated spectrum resource for narrowband links (gr = recorded carrier, ye = coordinated carrier)</p>	Federal town election	Hamburg (D)	24.02.08	64.8	157.2
<p>Estimated spectrum resource for narrowband links (gr = recorded carrier, ye = coordinated carrier)</p>	Federal state election	Munich (D)	28.09.08	44.4	140.4

Important note:

This estimated spectrum demand is based on a 600 kHz grid (based on the linear channel-to-channel allocation) that the latest PMSE technology supports. This calculation model is necessary in order to compare all scans. It should be noted: This estimated spectrum demand does not represent the real spectrum demand of PMSE; the real spectrum demand is significant higher.

2007



Spectrum graphic	Event	Location	Date	Spectrum [MHz] in a 600 kHz Grid	
				Recorded	Coordin.
	International Music Fair, Prolight+Sound	Frankfurt (D)	28.03.07	63.0	-
	International indoor event production, ESC2007	Helsinki (Fi)	25.04.07	41.4	-
	International outdoor event, LiveEarth	Hamburg (D)	06.07.07	28.2	-
	Outdoor spectrum recording, Berlin town centre	Berlin (D)	17.07.07	46.2	-
	Outdoor theatre production	Bregenz (A)	01.08.07	27.6	-
	International Bicycle Champion Chip	Stuttgart (D)	29.09.07	57.0	-

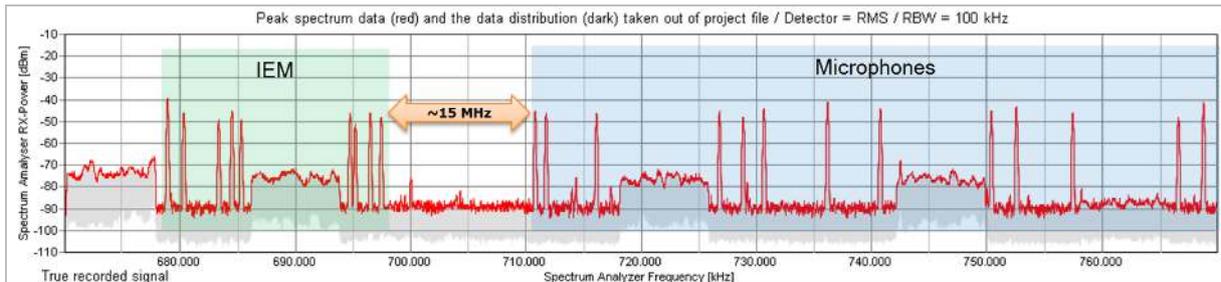
Important note:

This estimated spectrum demand is based on a 600 kHz grid (based on the linear channel-to-channel allocation) that the latest PMSE technology supports. This calculation model is necessary in order to compare all scans. It should be noted: This estimated spectrum demand does not represent the real spectrum demand of PMSE; the real spectrum demand is significant higher.

How to transfer the estimated spectrum demand to real life scenarios?

In a best case scenario wireless microphones could be operated in a linear 600 kHz grid. In reality an intermodulation-free operation is required and the spectrum demand will be much higher.

Current In Ear Monitor (IEM) transmitter technology cannot be operated in a linear grid. In any observed events an intermodulation-free frequency setup was required. The use of audio PMSE and IEM on the presenter or actor's body requires an additional guard band - see the scenario below observed during ESC2011:



Scanned scenarios

In this report, 33 events, recorded in the years 2007 to 2008 and 2011 to 2013, are presented in the annexes. Every event was recorded and analysed with bespoke Software "PMSE Occupation Recorder". This software provides the event reports contained in the annexes, in addition a number of graphs and tables.

Conclusion

Through its spectrum observation at different locations and events, DKE AK 731.0.8 was able to confirm that there was intensive use of the UHF Broadcast spectrum which followed an independent time, location and event process - see also [1] to [4].

This report shows the key-needs of audio PMSE:

- the UHF broadcast band provided and still provides everything that is needed for good wireless productions,
- the spectrum quality with a low noise floor,
- sufficient spectrum for large and very large productions or even several large productions in one location and also
- importantly world-wide harmonized spectrum for cross border operations

all this is happening today!

As productions grow steadily and the density of PMSE users has risen in the band 300 to 3000 MHz (broadcast bands) frequency coordination at events has become a necessity.

From the results of this report and considering the new recorded spectrum aggregation tables, any additional loss of spectrum will seriously curtail the ability of PMSE to meet the requirements of the cultural, media, sports and entertainment sector, making many large productions impossible. Advanced technologies may reduce the spectrum requirement but this will be required for the increasing number of applications as well as usage.

Supplementing literature

- [1] DKE Radio spectrum monitoring in Schwerin (Germany)
Landtag elections of Mecklenburg-Vorpommern (February 2012)
<http://www.apwpt.org/downloads/dke-reportelectionschwerin2011.pdf>
- [2] DKE Radio spectrum monitoring in the context of Eurovision Song Contest 2011
DKE Report on ESC2011 / main part (December 2011)
http://www.apwpt.org/downloads/esc2011_20122011_english_framedoc.pdf
DKE Report on ESC2011 / annex (December 2011)
http://www.apwpt.org/downloads/esc2011_20122011_english_annex.pdf
- [3] DKE spectrum observation at Bremen (Germany)
Elections for the Bremen State Parliament (May 2011)
<http://www.apwpt.org/downloads/short-report-on-the-elections-for-the-bremen-s.pdf>
- [4] DKE spectrum observation at the federal elections in Hannover, Munich, Wiesbaden and the state elections in Hamburg
DKE Report (October 2008)
http://www.apwpt.org/downloads/2008_uhf-frequency-use-by-pmse-at-the-federal-.pdf
- [5] ECC Report 204, Spectrum use and future requirements for PMSE
ECC Reports
<http://www.eroocdb.dk/doks/doccategoryECC.aspx?doccatid=4>
- [6] University of Hannover, Institute of Radiofrequency
Report on the frequency resource requirements of PWMS (October 2008)
<http://www.apwpt.org/downloads/reportonthefrequencyresourcerequirementsofpwms.pdf>

Acknowledgements

We would like to thank all organizations that have supported the DKE event scans, especially:

- Bayerischer Rundfunk (D)
- Bleuel Electronic AG (CH)
- Federal Ministry for Transport, Innovation and Technology (A)
- Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen (D)
- Copsy Communications Consultants (UK)
- ESPRIT arena Düsseldorf
- Grothusen Audio Video Vertrieb (A)
- Harman / AKG (A)
- Hessischer Landtag (D)
- Ideen und Konzepte in Hochfrequenz (D)
- Institut für Rundfunktechnik (IRT, D)
- Landtag Schwerin, Press centre D)
- Messe Frankfurt (D)
- Media Broadcast (D)
- Mitteldeutscher Rundfunk (D)
- Norddeutscher Rundfunk (D)
- Parliament Vienna (D)
- Radio Bremen (D)
- Sennheiser electronic (D)
- SRG SSR (CH)
- Sportcast (D)
- Südwest Rundfunk - SWR (D)
- University of Erlangen-Nürnberg (D)

Queries

Please address your question to: matthias.fehr@apwpt.org

January 31, 2014

Matthias Fehr
Chairman of
DKE AK 731.0.8

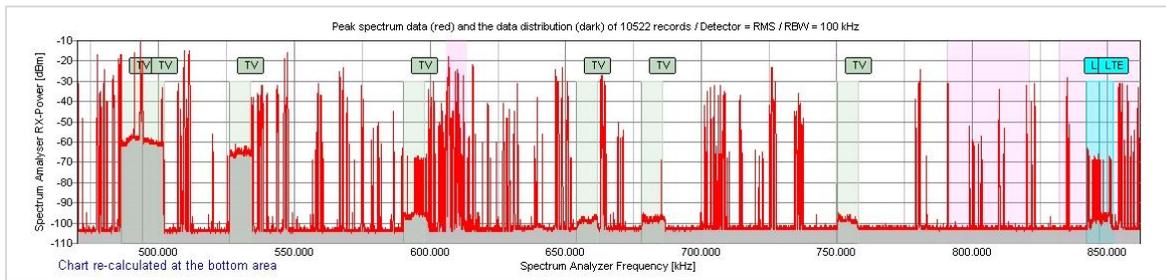
Annex 1: Brief event descriptions for 2013

Federal state election, Hanover, Germany, January 2013

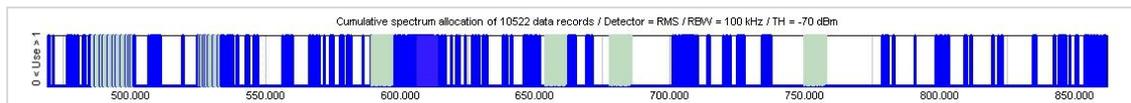
1) Project information

Project name	Lower Saxony state election, Hanover 2013
Company name	DKE AK 731.0.8 (DIN/VDE)
Last known GPS latitude	52.370148
Last known GPS longitude	9.734255
Scan start frequency	470000 kHz
Scan stop Frequency	862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	20.01.13	15:33:19
Project scan ends	20.01.13	21:17:42
Number of scanning units	3	
Number of data records	10521	

Stat creation starts	09.01.2014	21:26:31
Stat software version	PMSE Occupation Recorder	V1.9.110

Stat threshold -70 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	128	probably small band links
200..500	16	probably small band links
500..1000	0	
1000..5000	2	
5000..10000	6	probably TV or LTE
>10000	0	
Total	152	

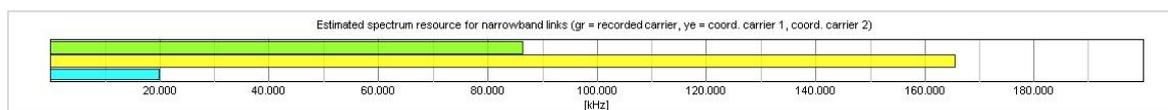
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	76800	probably small band links
200..500	9600	probably small band links
500..1000	0	
1000..5000	11000	
5000..10000	48000	probably TV or LTE
>10000	0	
Total	145400	

Table 3: summary of small band link spectrum estimation

Recorded carrier	86.40	MHz	see green bar below
Carrier listed in coordination list 1	165.60	MHz	see yellow bar below
Carrier listed in coordination list 2	19.80	MHz	see blue bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

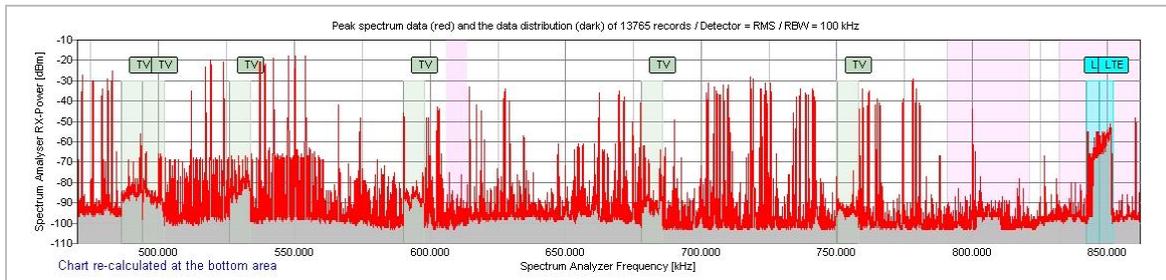
National qualification event for ESC2013, Hanover, Germany, February 2013

1) Project information

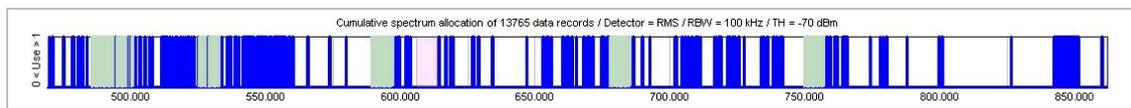
Project name ESC2013 German national qualification at Hanover
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 12.02.13 17:02:46
 Project scan ends 14.02.13 23:35:34
 Number of scanning units 2
 Number of data records 13764

Stat creation starts 14.01.2014 21:22:13
 Stat software version PMSE Occupation Recorder V1.9.110

Stat threshold -70 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	91	probably small band links
200..500	2	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	7	probably TV or LTE
>10000	0	
Total	100	

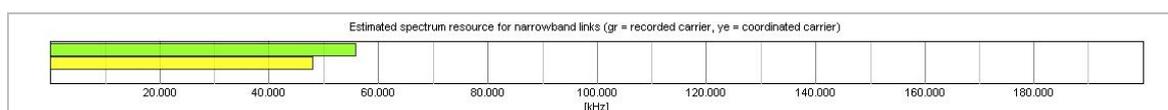
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	54600	probably small band links
200..500	1200	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	56000	probably TV or LTE
>10000	0	
Total	111800	

Table 3: summary of small band link spectrum estimation

Recorded carrier 55.80 MHz see green bar below
 Carrier listed in coordination list 1 48.00 MHz see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

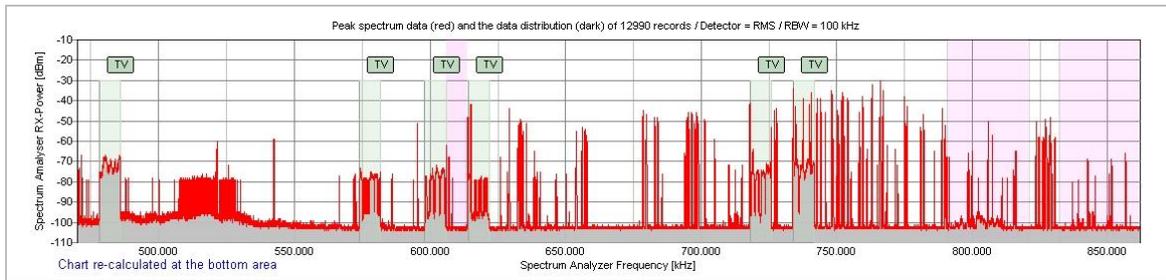
International Music Fair, Frankfurt, Germany, April 2013

1) Project information

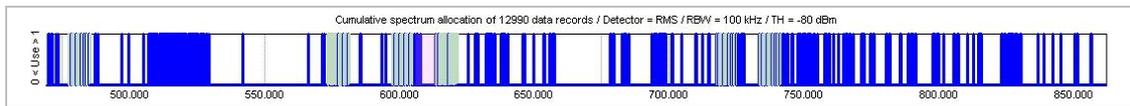
Project name PLS2013, Hall 8
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 11.04.13 16:20:57
 Project scan ends 12.04.13 17:55:21
 Number of scanning units 1
 Number of data records 12989

Stat creation starts 22.01.2014 20:09:45
 Stat software version PMSE Occupation Recorder V1.9.112

Stat threshold -80 dBm
 Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	93	probably small band links
200..500	19	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	3	probably TV or LTE
>10000	0	
Total	115	

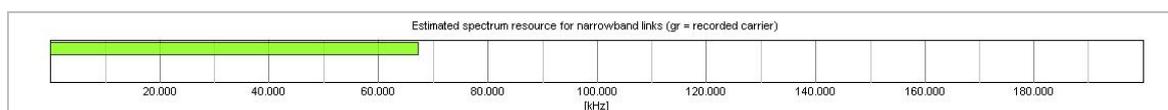
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	55800	probably small band links
200..500	11400	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	24000	probably TV or LTE
>10000	0	
Total	91200	

Table 3: summary of small band link spectrum estimation

Recorded carrier	67.20	MHz	see green bar below
No coordination information on-hand			



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

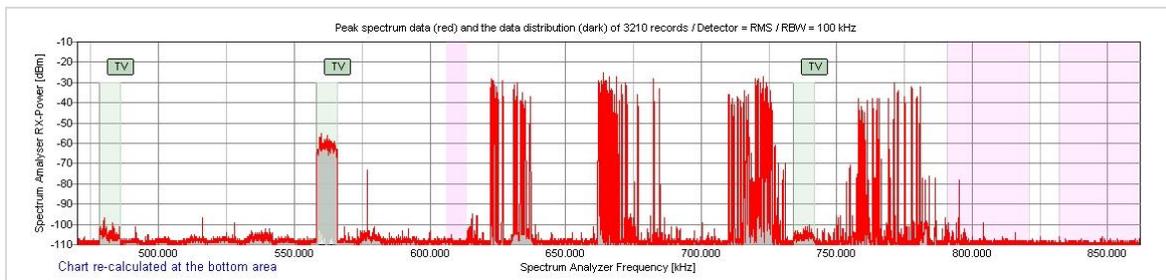
Outdoor theatre production, Einsiedel, Switzerland, June 2013

1) Project information

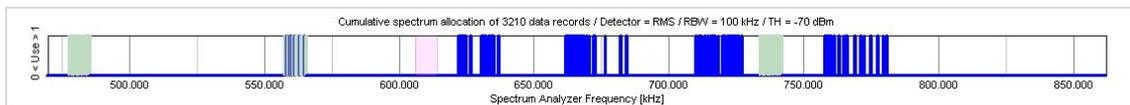
Project name Einsiedler Welttheater (CH)
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 21.06.13 18:44:56
 Project scan ends 21.06.13 22:56:00
 Number of scanning units 1
 Number of data records 3209

Stat creation starts 12.01.2014 09:30:02
 Stat software version PMSE Occupation Recorder V1.9.110

Stat threshold -70 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	72	probably small band links
200..500	9	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	3	probably TV or LTE
>10000	0	
Total	84	

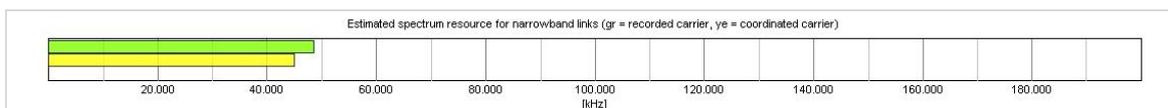
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	43200	probably small band links
200..500	5400	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	24000	probably TV or LTE
>10000	0	
Total	72600	

Table 3: summary of small band link spectrum estimation

Recorded carrier	48.60	MHz	see green bar below
Carrier listed in coordination list 1	45.00	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

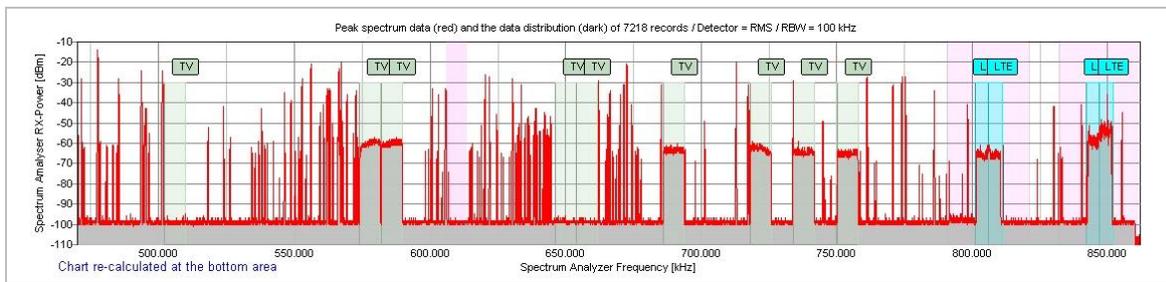
Federal state election, Munich, Germany, September 2013

1) Project information

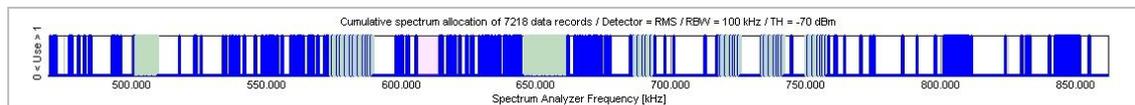
Project name Bavaria state election 2013
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 15.09.13 16:55:25
 Project scan ends 15.09.13 21:13:38
 Number of scanning units 3
 Number of data records 7217

Stat creation starts 22.01.2014 11:07:10
 Stat software version PMSE Occupation Recorder V1.9.112

Stat threshold -70 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	102	probably small band links
200..500	3	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	10	probably TV or LTE
>10000	0	
Total	115	

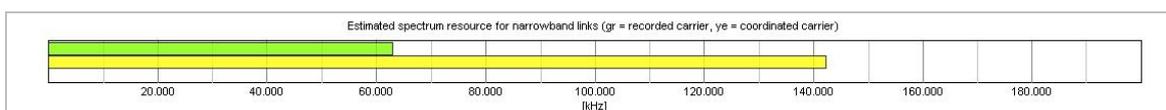
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	61200	probably small band links
200..500	1800	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	80000	probably TV or LTE
>10000	0	
Total	143000	

Table 3: summary of small band link spectrum estimation

Recorded carrier	63.00	MHz	see green bar below
Carrier listed in coordination list 1	142.20	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

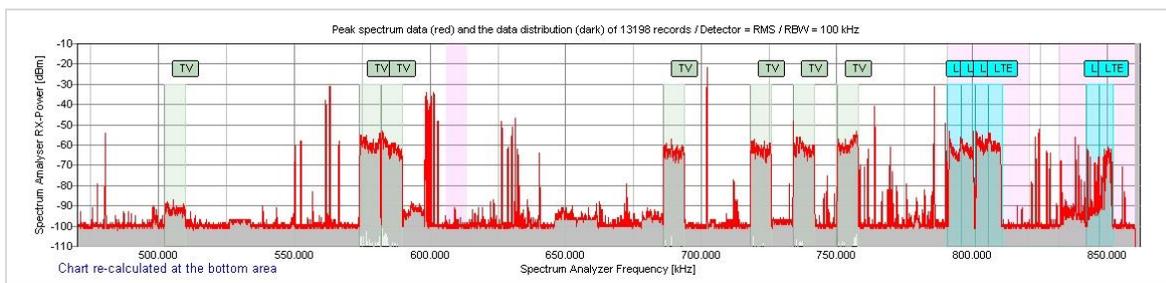
Note: Because of hidden node problem the coordinated figured are different to the recorded ones

Public outdoor/indoor event, Munich, Germany, September 2013

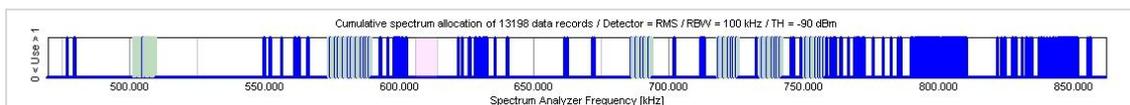
1) Project information

Project name	180th Munich Oktoberfest
Project group	DKE AK 731.0.8 (DIN/VDE)
Last known GPS latitude	48.131678
Last known GPS longitude	11.548165
Scan start frequency	470000 kHz
Scan stop Frequency	862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	20.09.13	23:59:52
Project scan ends	21.09.13	13:59:04
Number of scanning units	2	
Number of data records	13197	

Stat creation starts	12.01.2014	00:59:23
Stat software version	PMSE Occupation Recorder	V1.9.110

Stat threshold -90 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	63	probably small band links
200..500	3	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	8	probably TV or LTE
>10000	0	
Total	74	

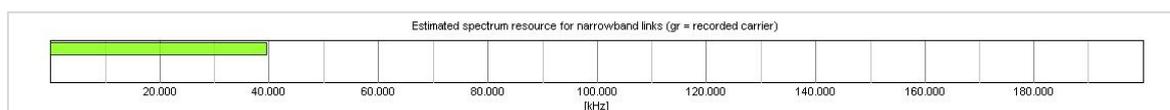
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	37800	probably small band links
200..500	1800	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	64000	probably TV or LTE
>10000	0	
Total	103600	

Table 3: summary of small band link spectrum estimation

Recorded carrier	39.60	MHz	see green bar below
No coordination information on-hand			



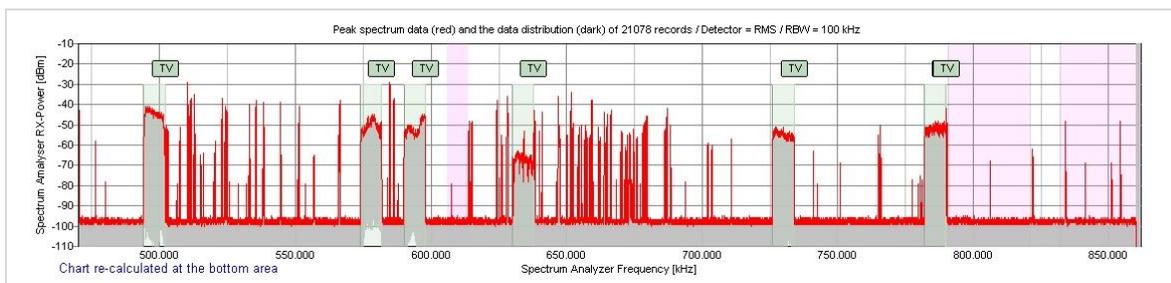
Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

National election, Vienna, Austria, September 2013

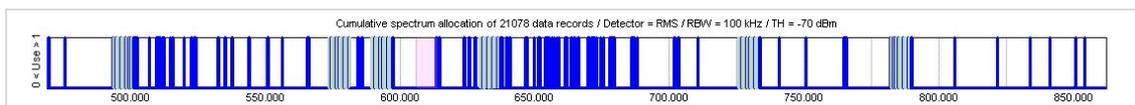
1) Project information

Project name	Nationalratswahl Wien 2013
Project group	DKE AK 731.0.8 (DIN/VDE)
Last known GPS latitude	48.207907
Last known GPS longitude	16.356682
Scan start frequency	470000 kHz
Scan stop Frequency	862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	29.09.13	10:59:55
Project scan ends	29.09.13	21:00:17
Number of scanning units	3	
Number of data records	21077	

Stat creation starts	10.01.2014	08:39:38
Stat software version	PMSE Occupation Recorder	V1.9.110

Stat threshold -70 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	79	probably small band links
200..500	2	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	5	probably TV or LTE
>10000	0	
Total	86	

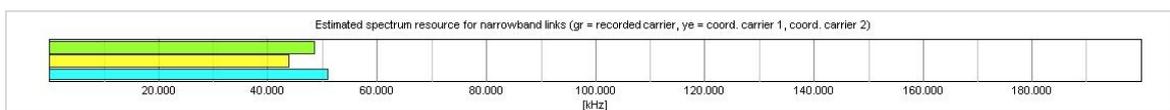
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	47400	probably small band links
200..500	1200	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	40000	probably TV or LTE
>10000	0	
Total	88600	

Table 3: summary of small band link spectrum estimation

Recorded carrier	48.60	MHz	see green bar below
Carrier listed in coordination list 1	43.80	MHz	see yellow bar below
Carrier listed in coordination list 2	51.00	MHz	see blue bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

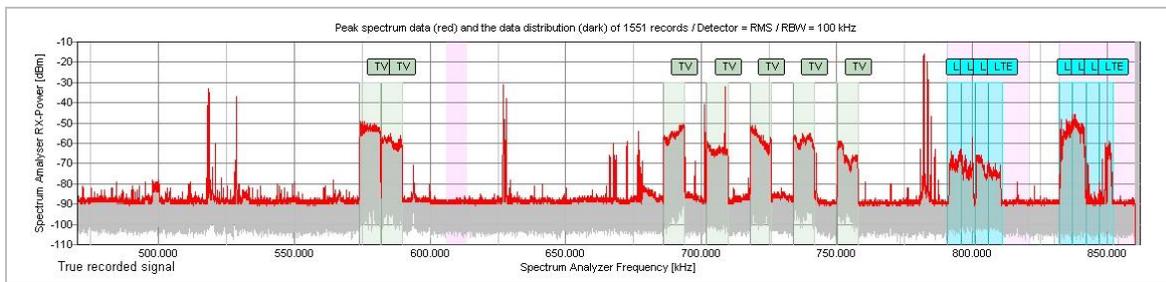
National business conference, Munich, Germany, October 2013

1) Project information

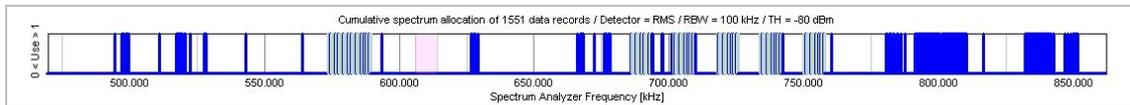
Project name Medientage München
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	18.10.13	14:26:42
Project scan ends	18.10.13	16:10:26
Number of scanning units		1
Number of data records		1550
Stat creation starts	17.01.2014	10:57:51
Stat software version	PMSE Occupation Recorder	V1.9.110
Stat threshold		-80 dBm

Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	29	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	9	probably TV or LTE
>10000	0	
Total	38	

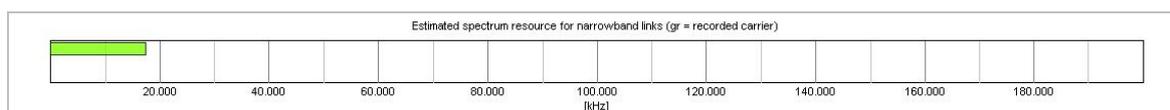
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	17400	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	72000	probably TV or LTE
>10000	0	
Total	89400	

Table 3: summary of small band link spectrum estimation

Recorded carrier	17.40	MHz	see green bar below
No coordination information on-hand			



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Annex 2: Brief event descriptions for 2012

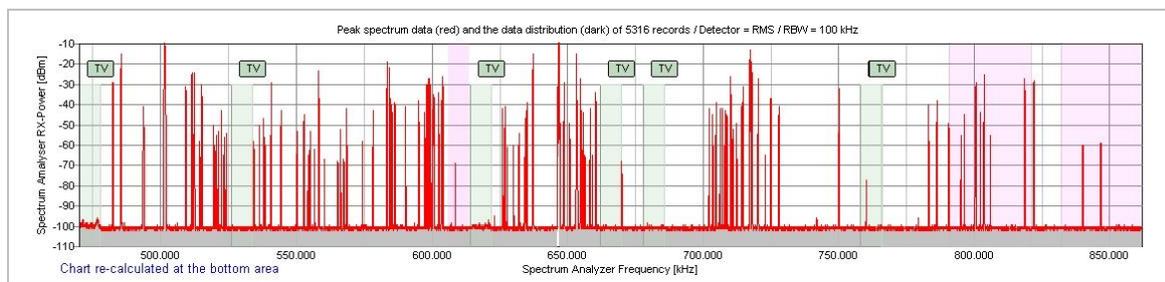
Federal state election, Kiel, Germany, May 2012

1) Project information

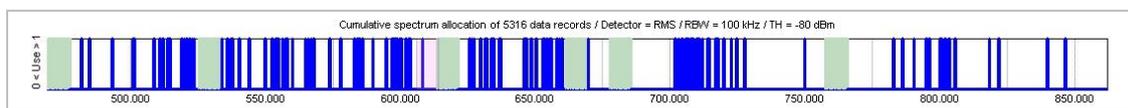
Project name Landtagswahl Kiel
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 06.05.12 16:00:13
 Project scan ends 06.05.12 21:28:29
 Number of scanning units 3
 Number of data records 5315

Stat creation starts 20.01.2014 22:10:39
 Stat software version PMSE Occupation Recorder V1.9.111

Stat threshold -80 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	113	probably small band links
200..500	4	probably small band links
500..1000	0	
1000..5000	1	
5000..10000	6	probably TV or LTE
>10000	0	
Total	124	

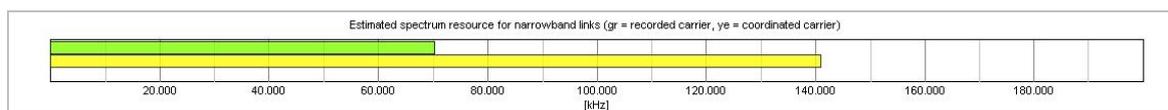
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	67800	probably small band links
200..500	2400	probably small band links
500..1000	0	
1000..5000	5500	
5000..10000	48000	probably TV or LTE
>10000	0	
Total	123700	

Table 3: summary of small band link spectrum estimation

Recorded carrier	70.20	MHz	see green bar below
Carrier listed in coordination list 1	141.00	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

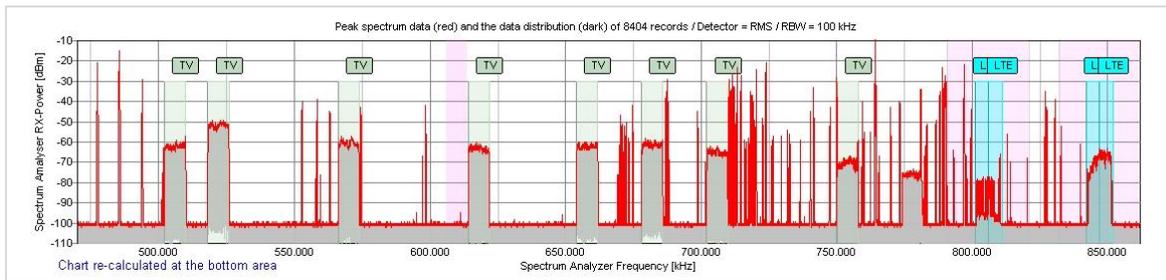
Note: Because of hidden node problem the coordinated figured are different to the recorded ones

National football production, Berlin, Germany, May 2012

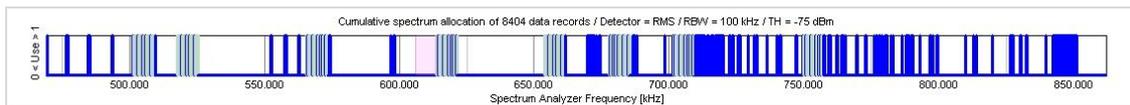
1) Project information

Project name	DFB Pokalfinale Berlin
Project group	DKE AK 731.0.8 (DIN/VDE)
Last known GPS latitude	52.514337
Last known GPS longitude	13.238262
Scan start frequency	470000 kHz
Scan stop Frequency	862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	12.05.12 14:55:30
Project scan ends	12.05.12 23:24:57
Number of scanning units	3
Number of data records	8403

Stat creation starts	11.01.2014 20:25:31
Stat software version	PMSE Occupation Recorder V1.9.108

Stat threshold -75 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	77	probably small band links
200..500	5	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	10	probably TV or LTE
>10000	0	
Total	92	

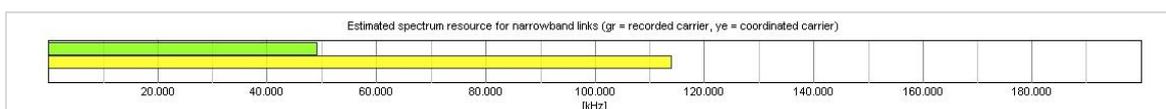
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	46200	probably small band links
200..500	3000	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	80000	probably TV or LTE
>10000	0	
Total	129200	

Table 3: summary of small band link spectrum estimation

Recorded carrier 49.20 MHz see green bar below
 Carrier listed in coordination list 1 114.00 MHz see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

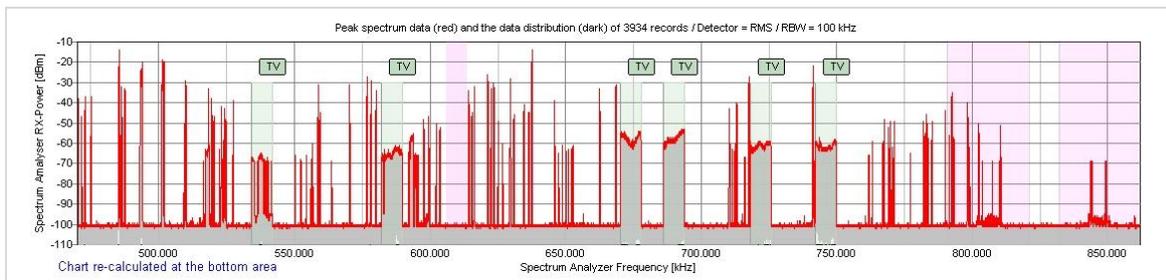
Federal state election, Dusseldorf, Germany, May 2012

1) Project information

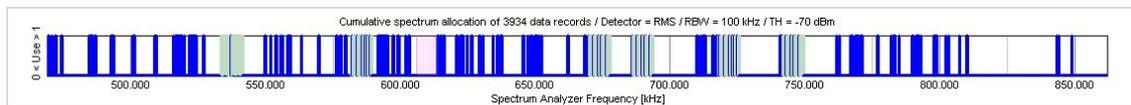
Project name Landtagswahl NRW, Düsseldorf
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 13.05.12 15:24:55
 Project scan ends 13.05.12 20:59:50
 Number of scanning units 2
 Number of data records 3933

Stat creation starts 11.01.2014 20:59:34
 Stat software version PMSE Occupation Recorder V1.9.108

Stat threshold -70 dBm
 Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	77	probably small band links
200..500	3	probably small band links
500..1000	0	
1000..5000	3	
5000..10000	6	probably TV or LTE
>10000	0	
Total	89	

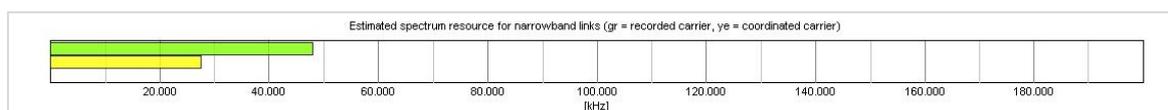
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	46200	probably small band links
200..500	1800	probably small band links
500..1000	0	
1000..5000	16500	
5000..10000	48000	probably TV or LTE
>10000	0	
Total	112500	

Table 3: summary of small band link spectrum estimation

Recorded carrier	48.00	MHz	see green bar below
Carrier listed in coordination list 1	27.60	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

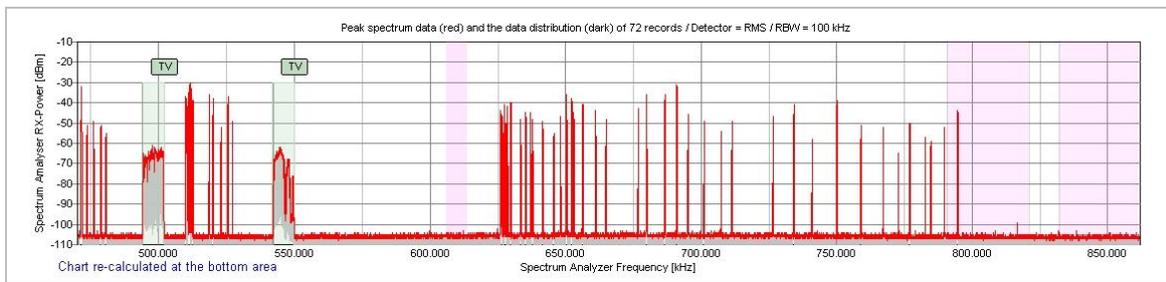
Outdoor theatre production, Villach, Switzerland, August 2012

1) Project information

Project name Open Air Villach 2012
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 09.08.12 16:00:06
 Project scan ends 09.08.12 16:10:18
 Number of scanning units 1
 Number of data records 71

Stat creation starts 17.01.2014 10:33:37
 Stat software version PMSE Occupation Recorder V1.9.110

Stat threshold -90 dBm
 Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	61	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	2	probably TV or LTE
>10000	0	
Total	63	

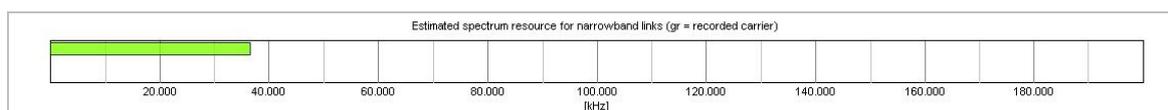
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	36600	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	16000	probably TV or LTE
>10000	0	
Total	52600	

Table 3: summary of small band link spectrum estimation

Recorded carrier	36.60	MHz	see green bar below
No coordination information on-hand			



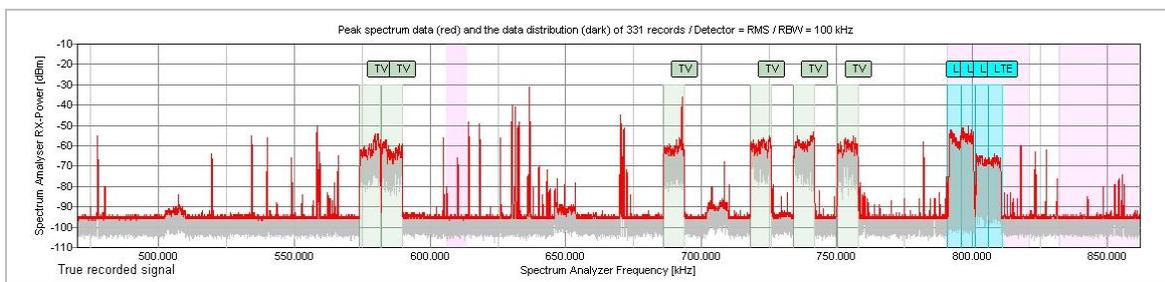
Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Public outdoor/indoor event, Munich, Germany, September 2012

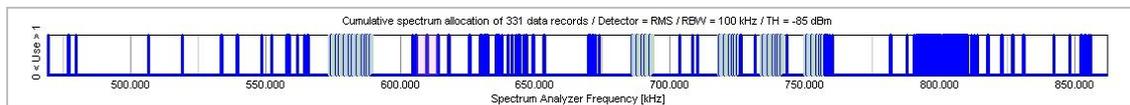
1) Project information

Project name	Oktoberfest 2012	
Project group	DKE AK 731.0.8 (DIN/VDE)	
Scan start frequency	470000	kHz
Scan stop Frequency	862000	kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	21.09.12	15:06:02
Project scan ends	22.09.12	14:39:33
Number of scanning units	1	
Number of data records	330	
Stat creation starts	12.01.2014	00:55:12
Stat software version	PMSE Occupation Recorder	V1.9.108
Stat threshold	-85 dBm	

Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	63	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	7	probably TV or LTE
>10000	0	
Total	70	

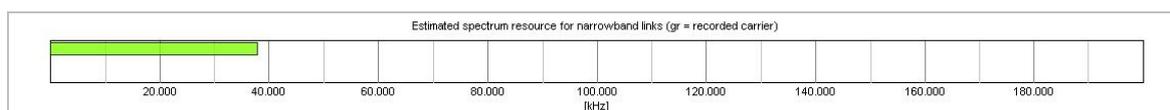
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	37800	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	56000	probably TV or LTE
>10000	0	
Total	93800	

Table 3: summary of small band link spectrum estimation

Recorded carrier	37.80	MHz	see green bar below
No coordination information on-hand			



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Annex 3: Brief event descriptions for 2011

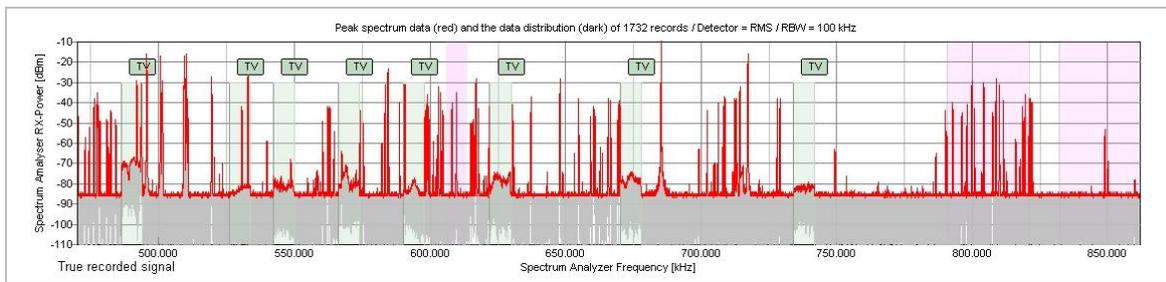
Federal state election, Hamburg, Germany, February 2011

1) Project information

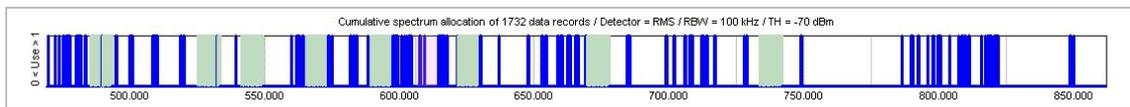
Project name Bürgerschaftswahlen Hamburg 20011
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 20.02.11 16:23:37
 Project scan ends 20.02.11 21:09:09
 Number of scanning units 2
 Number of data records 1731

Stat creation starts 21.01.2014 23:12:20
 Stat software version PMSE Occupation Recorder V1.9.112

Stat threshold -70 dBm
 Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	101	probably small band links
200..500	3	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	7	probably TV or LTE
>10000	0	
Total	111	

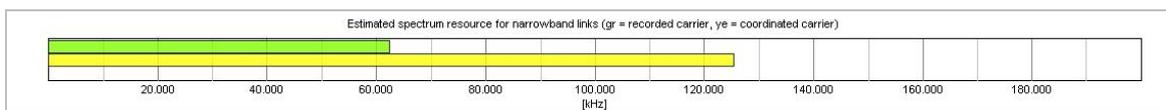
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	60600	probably small band links
200..500	1800	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	56000	probably TV or LTE
>10000	0	
Total	118400	

Table 3: summary of small band link spectrum estimation

Recorded carrier	62.40	MHz	see green bar below
Carrier listed in coordination list 1	125.40	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

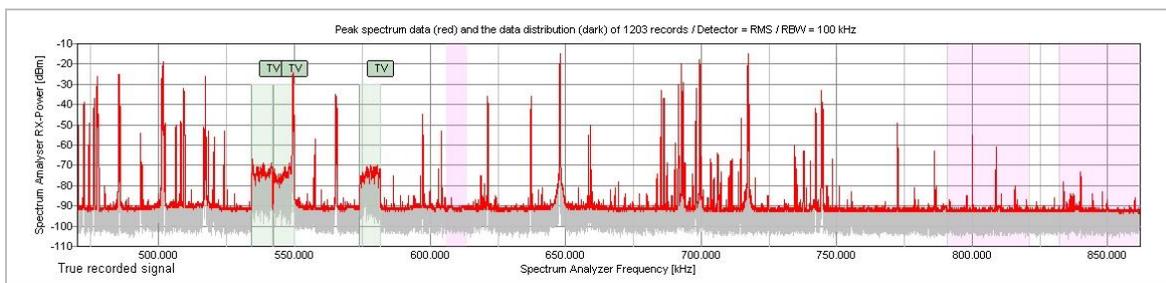
Note: Because of hidden node problem the coordinated figured are different to the recorded ones

Federal state election, Magdeburg, Germany, March 2011

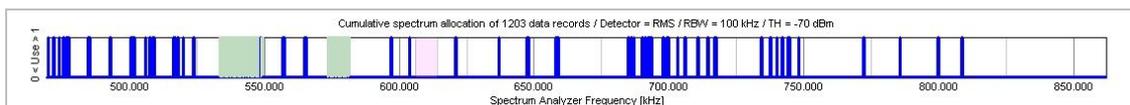
1) Project information

Project name	Landtagswahlen Sachsen-Anhalt 2011
Project group	DKE AK 731.0.8 (DIN/VDE)
Last known GPS latitude	52.126.735
Last known GPS longitude	11.636.153
Scan start frequency	470000 kHz
Scan stop Frequency	862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	20.03.11	16:59:57
Project scan ends	20.03.11	20:26:48
Number of scanning units	2	
Number of data records	1202	

Stat creation starts	21.01.2014	23:22:31
Stat software version	PMSE Occupation Recorder	V1.9.112

Stat threshold -70 dBm

Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	65	probably small band links
200..500	1	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	3	probably TV or LTE
>10000	0	
Total	69	

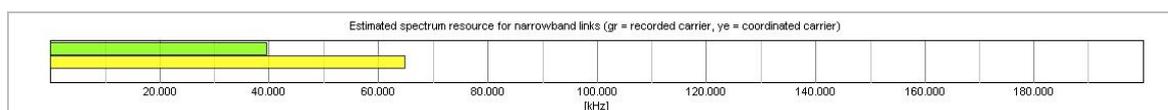
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	39000	probably small band links
200..500	600	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	24000	probably TV or LTE
>10000	0	
Total	63600	

Table 3: summary of small band link spectrum estimation

Recorded carrier	39.60	MHz	see green bar below
Carrier listed in coordination list 1	64.80	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

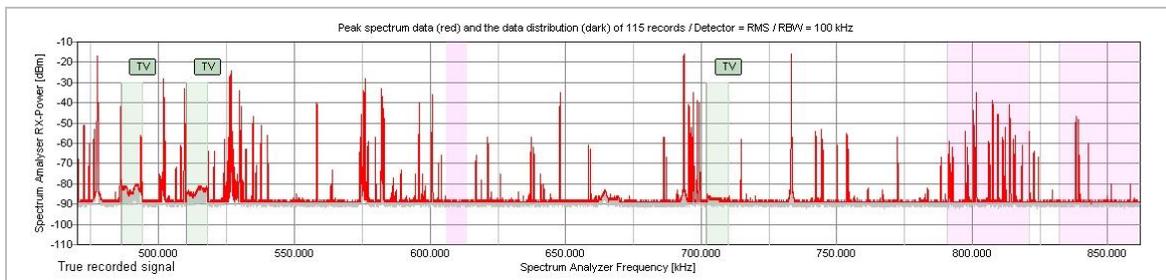
Federal state election, Stuttgart, Germany, March 2011

1) Project information

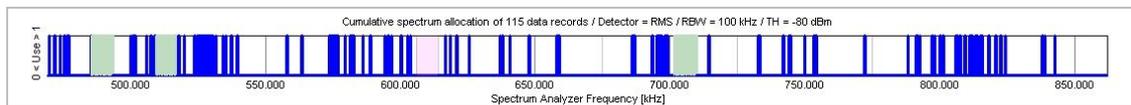
Project name Election Stuttgart 2011
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 27.03.11 17:49:57
 Project scan ends 27.03.11 18:50:23
 Number of scanning units 1
 Number of data records 114

Stat creation starts 21.01.2014 23:48:03
 Stat software version PMSE Occupation Recorder V1.9.112

Stat threshold -80 dBm
 Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	116	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	3	probably TV or LTE
>10000	0	
Total	119	

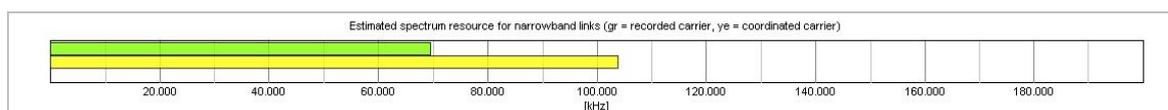
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	69600	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	24000	probably TV or LTE
>10000	0	
Total	93600	

Table 3: summary of small band link spectrum estimation

Recorded carrier	69.60	MHz	see green bar below
Carrier listed in coordination list 1	103.80	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

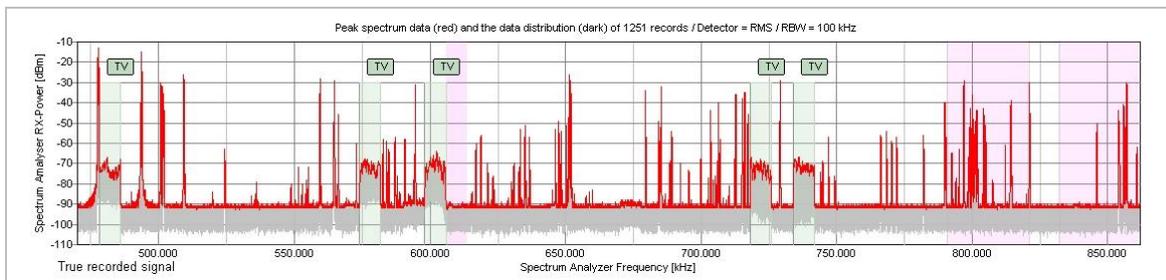
Federal state election, Mainz, Germany, March 2011

1) Project information

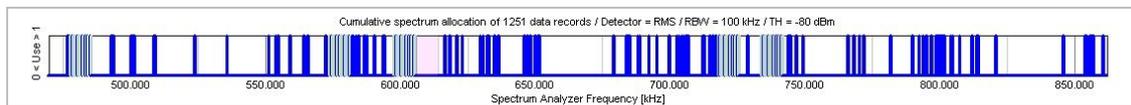
Project name Landtagswahl Rheinland-Pfalz
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 27.03.11 16:12:18
 Project scan ends 27.03.11 20:29:46
 Number of scanning units 2
 Number of data records 1250

Stat creation starts 22.01.2014 00:11:06
 Stat software version PMSE Occupation Recorder V1.9.112

Stat threshold -80 dBm
 Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	104	probably small band links
200..500	5	probably small band links
500..1000	0	
1000..5000	1	
5000..10000	5	probably TV or LTE
>10000	0	
Total	115	

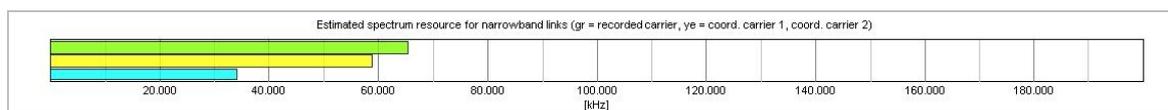
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	62400	probably small band links
200..500	3000	probably small band links
500..1000	0	
1000..5000	5500	
5000..10000	40000	probably TV or LTE
>10000	0	
Total	110900	

Table 3: summary of small band link spectrum estimation

Recorded carrier	65.40	MHz	see green bar below
Carrier listed in coordination list 1	58.80	MHz	see yellow bar below
Carrier listed in coordination list 2	34.20	MHz	see blue bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	100	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	6	probably TV or LTE
>10000	0	
Total	106	

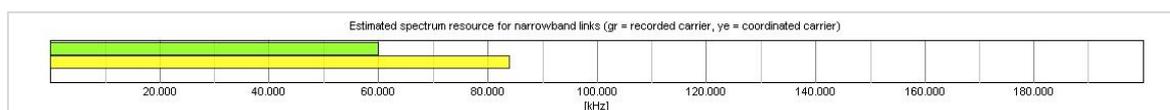
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	60000	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	48000	probably TV or LTE
>10000	0	
Total	108000	

Table 3: summary of small band link spectrum estimation

Recorded carrier	60.00	MHz	see green bar below
Carrier listed in coordination list 1	84.00	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

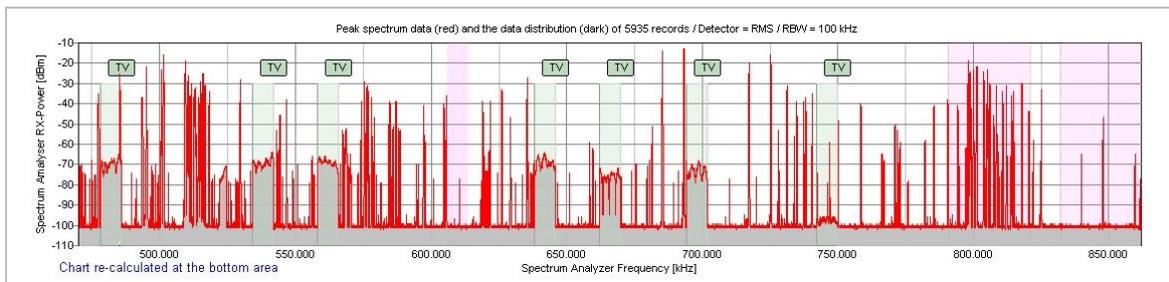
Note: Because of hidden node problem the coordinated figured are different to the recorded ones

Federal state election, Bremen, Germany, May 2011

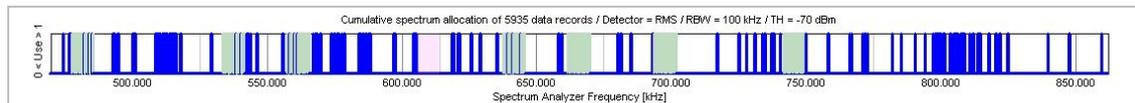
1) Project information

Project name	Bremer Bürgerschaftswahl 2011
Project group	DKE AK 731.0.8 (DIN/VDE)
Last known GPS latitude	53.076063
Last known GPS longitude	8.808495
Scan start frequency	470000 kHz
Scan stop Frequency	862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	22.05.11	11:28:56
Project scan ends	22.05.11	21:13:15
Number of scanning units	2	
Number of data records	5934	
Stat creation starts	21.01.2014	22:52:08
Stat software version	PMSE Occupation Recorder	V1.9.112
Stat threshold	-70	dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	108	probably small band links
200..500	5	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	7	probably TV or LTE
>10000	0	
Total	120	

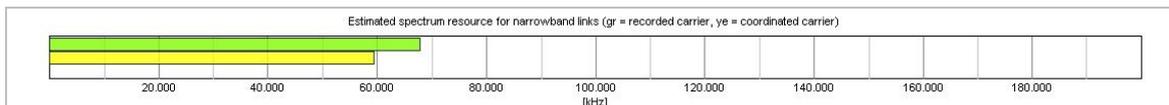
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	64800	probably small band links
200..500	3000	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	56000	probably TV or LTE
>10000	0	
Total	123800	

Table 3: summary of small band link spectrum estimation

Recorded carrier	67.80	MHz	see green bar below
Carrier listed in coordination list 1	59.40	MHz	see yellow bar below



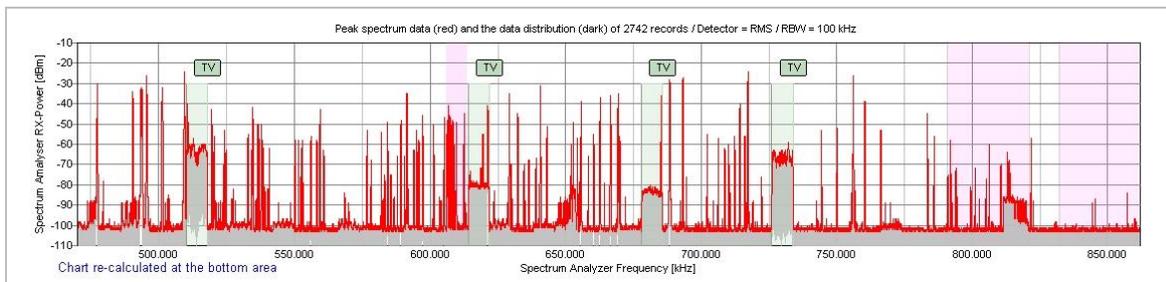
Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Federal state election, Schwerin, Germany, September 2011

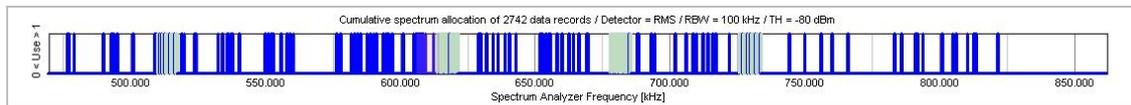
1) Project information

Project name	Schwerin, Landtagswahl 2011
Project group	DKE AK 731.0.8 (DIN/VDE)
Last known GPS latitude	53.624938
Last known GPS longitude	11.417460
Scan start frequency	470000 kHz
Scan stop Frequency	862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	04.09.11	15:03:25
Project scan ends	04.09.11	20:56:35
Number of scanning units	2	
Number of data records	2741	
Stat creation starts	21.01.2014	23:38:40
Stat software version	PMSE Occupation Recorder	V1.9.112
Stat threshold	-80 dBm	

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	90	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	1	
5000..10000	4	probably TV or LTE
>10000	0	
Total	95	

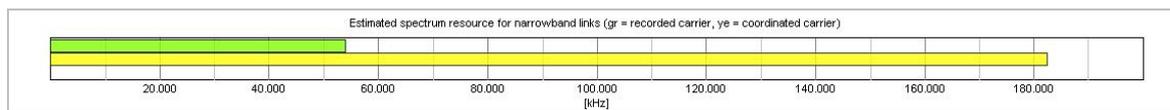
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	54000	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	5500	
5000..10000	32000	probably TV or LTE
>10000	0	
Total	91500	

Table 3: summary of small band link spectrum estimation

Recorded carrier	54.00	MHz	see green bar below
Carrier listed in coordination list 1	182.40	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

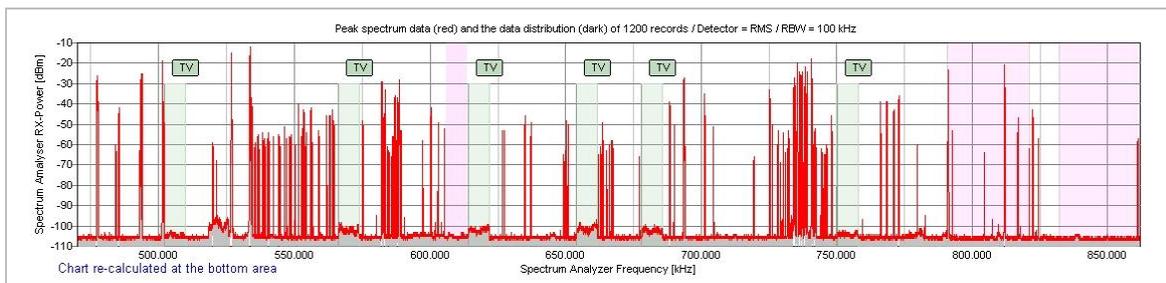
Federal town election, Berlin, Germany, September 2011

1) Project information

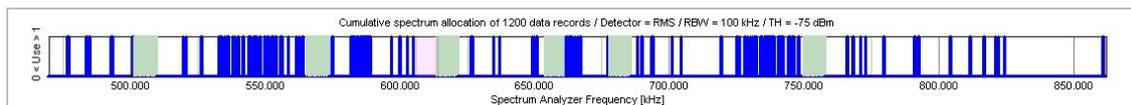
Project name Berliner Abgeordnetenhaus
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 18.09.11 15:56:43
 Project scan ends 18.09.11 21:25:28
 Number of scanning units 1
 Number of data records 1199

Stat creation starts 22.01.2014 00:03:19
 Stat software version PMSE Occupation Recorder V1.9.112

Stat threshold -75 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	114	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	6	probably TV or LTE
>10000	0	
Total	120	

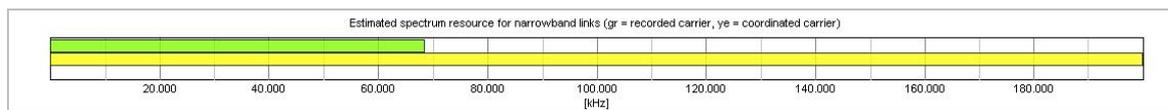
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	68400	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	48000	probably TV or LTE
>10000	0	
Total	116400	

Table 3: summary of small band link spectrum estimation

Recorded carrier	68.40	MHz	see green bar below
Carrier listed in coordination list 1	199.80	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

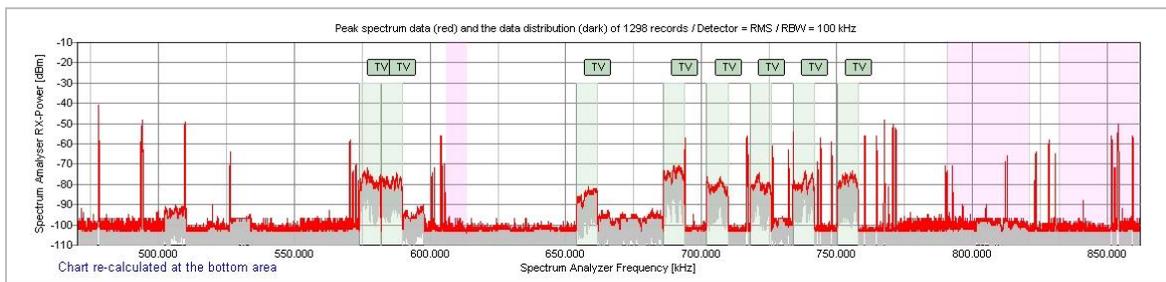
Note: Because of hidden node problem the coordinated figured are different to the recorded ones

National football production, Munich, Germany, September 2011

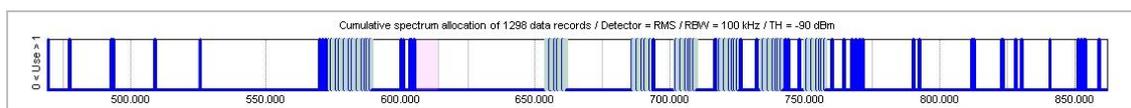
1) Project information

Project name	Allianz Arena Munich
Project group	DKE AK 731.0.8 (DIN/VDE)
Last known GPS latitude	48.219260
Last known GPS longitude	11.624297
Last known GPS latitude	48.219260
Last known GPS longitude	11.624297
Scan start frequency	470000 kHz
Scan stop Frequency	862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	24.09.11	16:05:26
Project scan ends	24.09.11	20:30:52
Number of scanning units		1
Number of data records		1297
Stat creation starts	13.01.2014	17:56:53
Stat software version	PMSE Occupation Recorder	V1.9.108
Stat threshold		-90 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	49	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	7	probably TV or LTE
>10000	0	
Total	56	

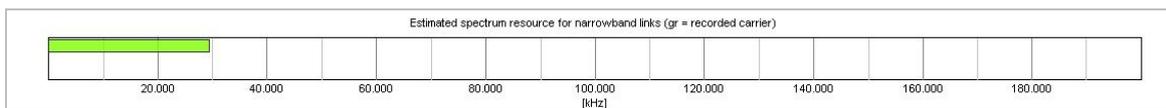
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	29400	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	56000	probably TV or LTE
>10000	0	
Total	85400	

Table 3: summary of small band link spectrum estimation

Recorded carrier	29.40	MHz	see green bar below
No coordination information on-hand			



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

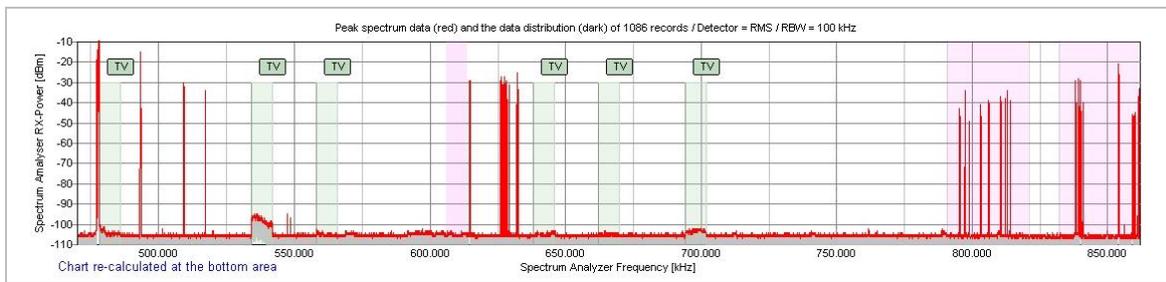
National football production, Bremen, Germany, September 2011

1) Project information

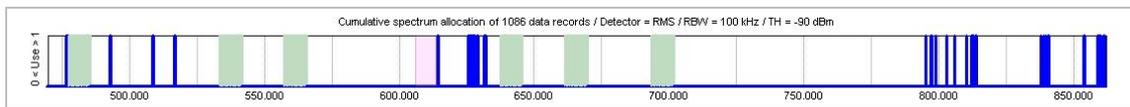
Project name Weserstadion Bremen
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 25.09.11 14:49:34
 Project scan ends 25.09.11 18:05:32
 Number of scanning units 1
 Number of data records 1085

Stat creation starts 13.01.2014 18:04:06
 Stat software version PMSE Occupation Recorder V1.9.108

Stat threshold -90 dBm

Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	33	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	6	probably TV or LTE
>10000	0	
Total	39	

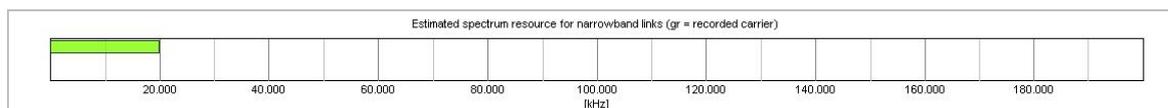
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	19800	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	48000	probably TV or LTE
>10000	0	
Total	67800	

Table 3: summary of small band link spectrum estimation

Recorded carrier	19.80	MHz	see green bar below
No coordination information on-hand			



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

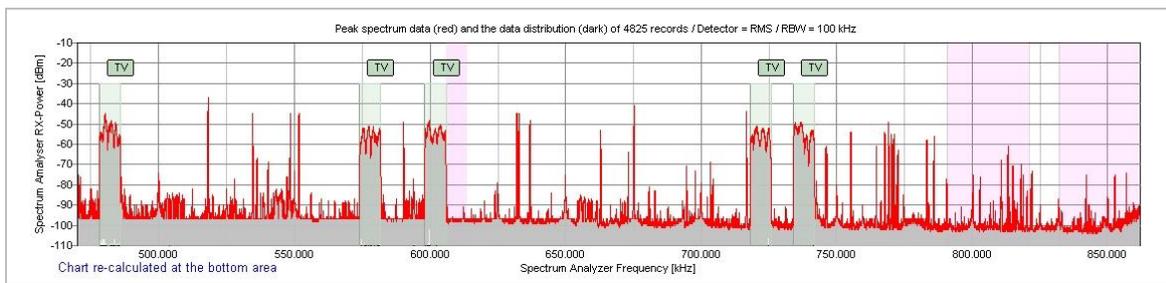
IAA International Motor Show, Frankfurt, Germany, November 2011

1) Project information

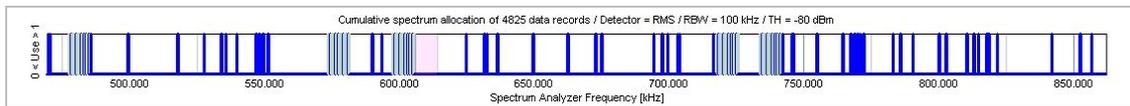
Project name IAA Frankfurt Halle 8 + Halle 11
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 15.09.11 17:33:06
 Project scan ends 16.09.11 13:16:53
 Number of scanning units 1
 Number of data records 4824

Stat creation starts 22.01.2014 16:03:58
 Stat software version PMSE Occupation Recorder V1.9.112

Stat threshold -80 dBm
 Note: data recalculated to stat analysis

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	54	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	5	probably TV or LTE
>10000	0	
Total	59	

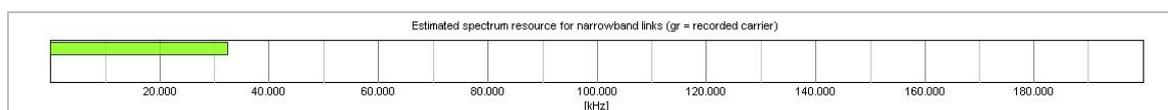
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	32400	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	40000	probably TV or LTE
>10000	0	
Total	72400	

Table 3: summary of small band link spectrum estimation

Recorded carrier	32.40	MHz	see green bar below
No coordination information on-hand			



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Annex 4: Brief event descriptions for 2008

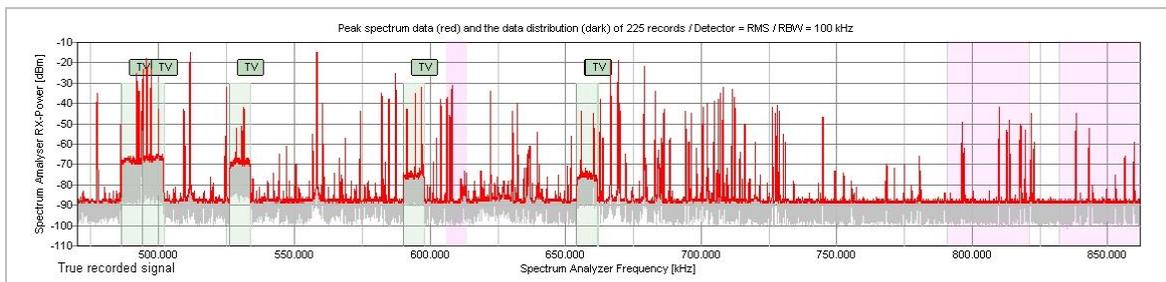
Federal state election, Hanover, Germany, January 2008

1) Project information

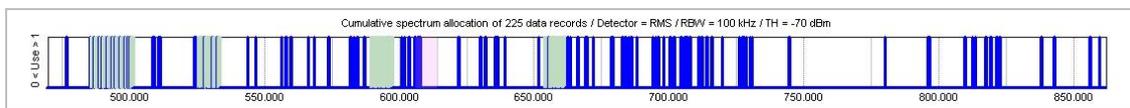
Project name Landtagswahl Niedersachsen / 27.01.2008 / Indoor
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 27.01.08 16:37:51
 Project scan ends 27.01.08 18:59:11
 Number of scanning units 1
 Number of data records 224

Stat creation starts 23.01.2014 16:10:33
 Stat software version PMSE Occupation Recorder V1.9.112

Stat threshold -70 dBm

Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	85	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	5	probably TV or LTE
>10000	0	
Total	90	

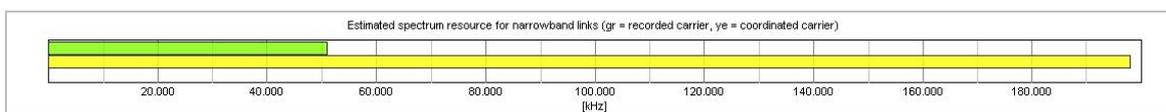
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	51000	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	40000	probably TV or LTE
>10000	0	
Total	91000	

Table 3: summary of small band link spectrum estimation

Recorded carrier	51.00	MHz	see green bar below
Carrier listed in coordination list 1	198.00	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

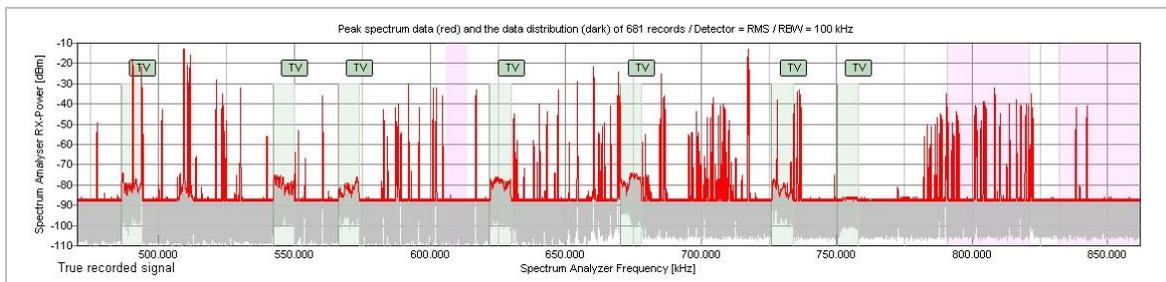
Federal town election, Hamburg, Germany, February 2008

1) Project information

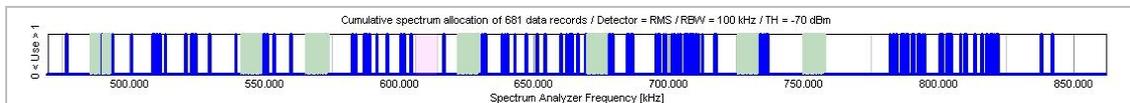
Project name Bürgerschaftswahlen Hamburg
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 24.02.08 15:45:10
 Project scan ends 24.02.08 19:48:01
 Number of scanning units 2
 Number of data records 680

Stat creation starts 23.01.2014 16:21:20
 Stat software version PMSE Occupation Recorder V1.9.112

Stat threshold -70 dBm

Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	108	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	6	probably TV or LTE
>10000	0	
Total	114	

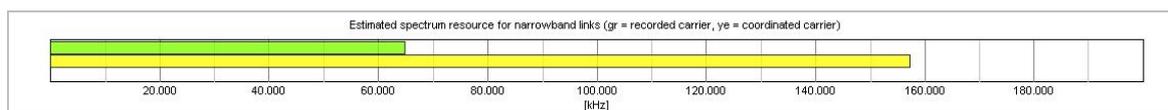
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	64800	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	48000	probably TV or LTE
>10000	0	
Total	112800	

Table 3: summery of small band link spectrum estimation

Recorded carrier	64.80	MHz	see green bar below
Carrier listed in coordination list 1	157.20	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

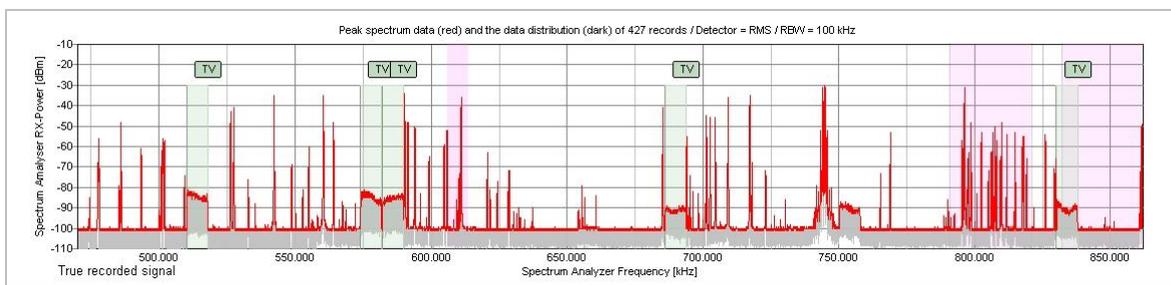
Federal state election, Munich, Germany, September 2008

1) Project information

Project name Bayrischer Landtag
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceeded the stat threshold level

3) Scan statistic information

Project scan starts 28.09.08 16:53:39
 Project scan ends 28.09.08 20:01:04
 Number of scanning units 1
 Number of data records 426

Stat creation starts 23.01.2014 22:28:11
 Stat software version PMSE Occupation Recorder V1.9.112

Stat threshold -80 dBm

Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	74	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	5	probably TV or LTE
>10000	0	
Total	79	

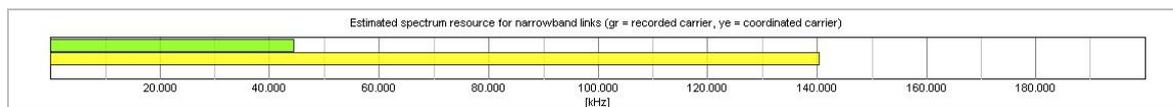
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	44400	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	40000	probably TV or LTE
>10000	0	
Total	84400	

Table 3: summary of small band link spectrum estimation

Recorded carrier	44.40	MHz	see green bar below
Carrier listed in coordination list 1	140.40	MHz	see yellow bar below



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

Note: Because of hidden node problem the coordinated figured are different to the recorded ones

Annex 5: Brief event descriptions for 2007

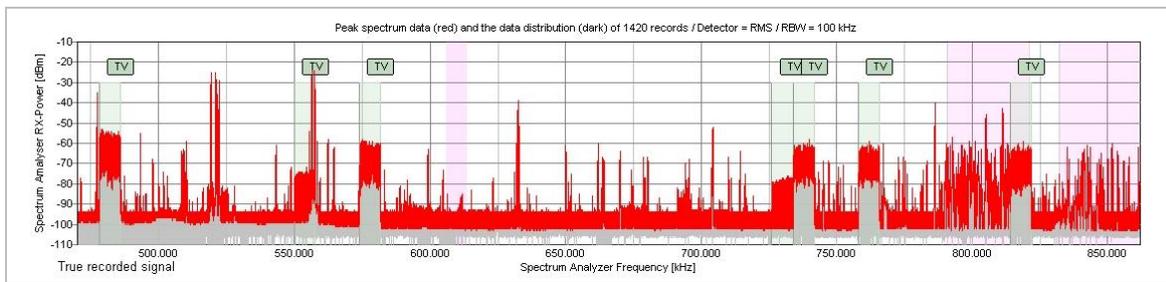
International Music Fair, Frankfurt, Germany, March 2007

1) Project information

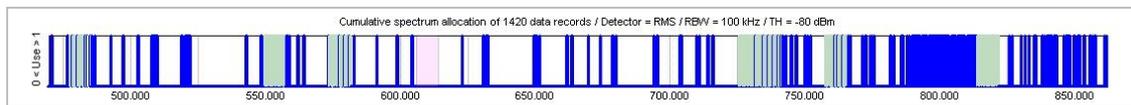
Project name Prolight+Sound 2007 Hall 4
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 28.03.07 08:58:52
 Project scan ends 31.03.07 21:27:28
 Number of scanning units 3
 Number of data records 1419

Stat creation starts 14.01.2014 20:23:01
 Stat software version PMSE Occupation Recorder V1.9.110

Stat threshold -80 dBm
 Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	105	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	7	probably TV or LTE
>10000	0	
Total	112	

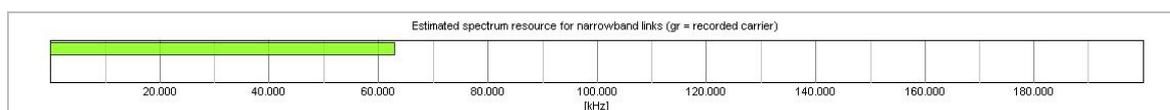
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	63000	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	56000	probably TV or LTE
>10000	0	
Total	119000	

Table 3: summary of small band link spectrum estimation

Recorded carrier	63.00	MHz	see green bar below
No coordination information on-hand			



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

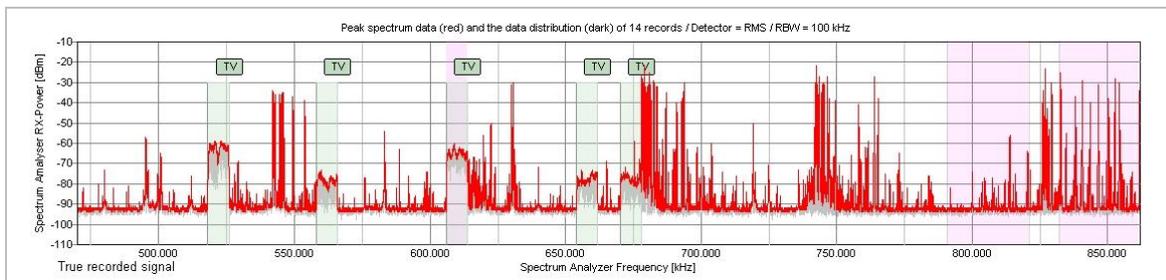
International indoor event production, Helsinki, Finland, April 2007

1) Project information

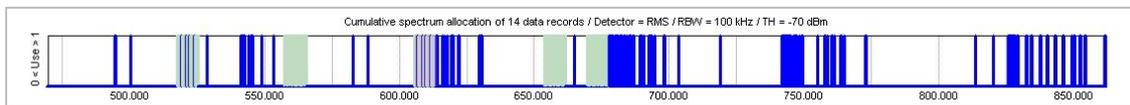
Project name ESC 2007 Helsinki
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 25.04.07 16:13:52
 Project scan ends 28.04.07 18:19:00
 Number of scanning units 1
 Number of data records 13

Stat creation starts 14.01.2014 15:12:18
 Stat software version PMSE Occupation Recorder V1.9.109

Stat threshold -70 dBm
 Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	69	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	5	probably TV or LTE
>10000	0	
Total	74	

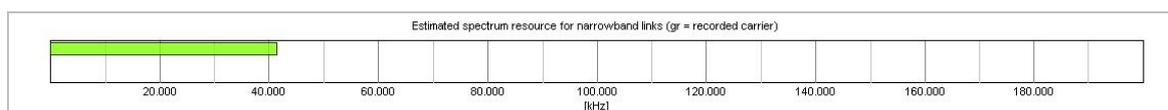
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	41400	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	40000	probably TV or LTE
>10000	0	
Total	81400	

Table 3: summary of small band link spectrum estimation

Recorded carrier	41.40	MHz	see green bar below
No coordination information on-hand			



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

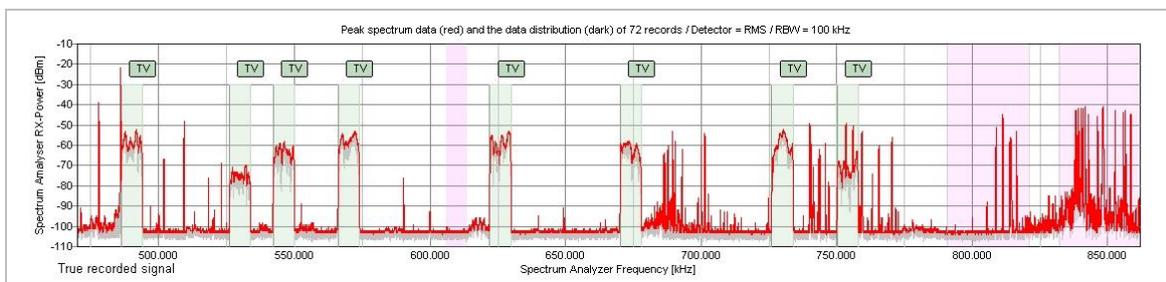
International outdoor event, Hamburg, Germany, July 2007

1) Project information

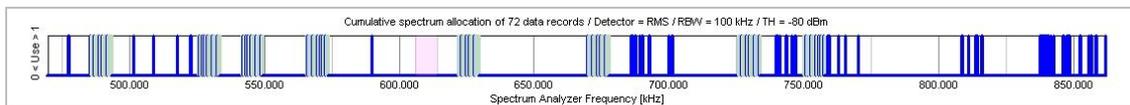
Project name Hamburg, AOL, Live Earth, Rehearsal
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 06.07.07 17:30:51
 Project scan ends 06.07.07 18:36:13
 Number of scanning units 1
 Number of data records 71

Stat creation starts 14.01.2014 20:47:03
 Stat software version PMSE Occupation Recorder V1.9.110

Stat threshold -80 dBm
 Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	47	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	8	probably TV or LTE
>10000	0	
Total	55	

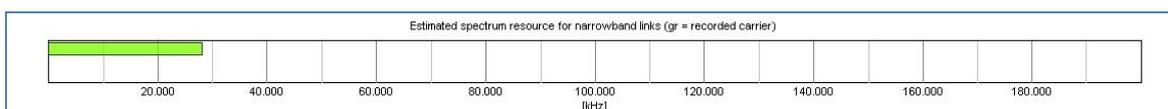
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	28200	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	64000	probably TV or LTE
>10000	0	
Total	92200	

Table 3: summary of small band link spectrum estimation

Recorded carrier 28.20 MHz see green bar below
 No coordination information on-hand

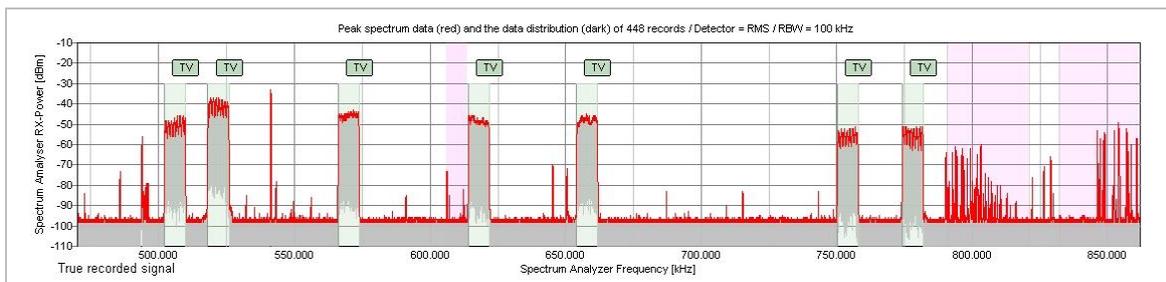


Outdoor spectrum recording, Berlin town centre, Germany, July 2007

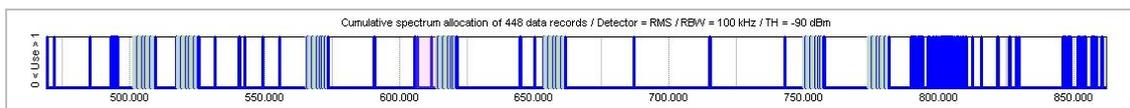
1) Project information

Project name	UHF Spektralmessungen Berlin
Project group	DKE AK 731.0.8 (DIN/VDE)
Last known GPS latitude	52.525352
Last known GPS longitude	13.389252
Scan start frequency	470000 kHz
Scan stop Frequency	862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	17.07.07	09:03:27
Project scan ends	18.07.07	12:47:16
Number of scanning units	1	
Number of data records	447	
Stat creation starts	18.01.2014	15:04:44
Stat software version	PMSE Occupation Recorder	V1.9.110

Stat threshold -90 dBm

Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	76	probably small band links
200..500	1	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	4	probably TV or LTE
>10000	0	
Total	81	

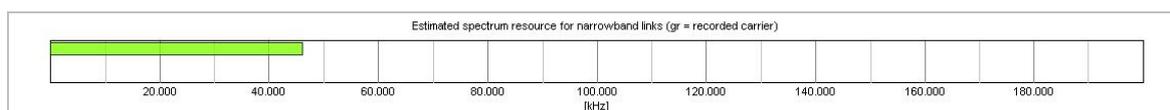
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	45600	probably small band links
200..500	600	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	32000	probably TV or LTE
>10000	0	
Total	78200	

Table 3: summary of small band link spectrum estimation

Recorded carrier	46.20	MHz	see green bar below
No coordination information on-hand			



Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

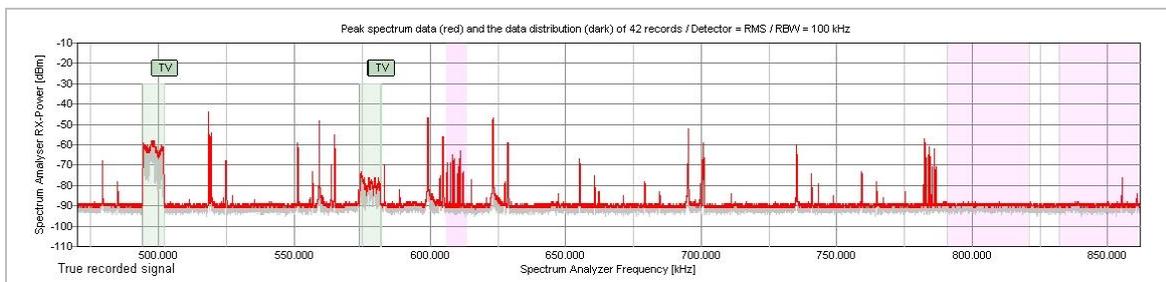
Outdoor theatre production, Bregenz, Austria, August 2007

1) Project information

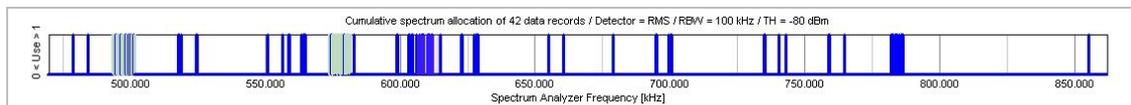
Project name Bregenz Seefestspiele Dach
 Project group DKE AK 731.0.8 (DIN/VDE)

Scan start frequency 470000 kHz
 Scan stop Frequency 862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts 01.08.07 20:32:21
 Project scan ends 01.08.07 21:44:26
 Number of scanning units 1
 Number of data records 41

Stat creation starts 17.01.2014 04:13:07
 Stat software version PMSE Occupation Recorder V1.9.110

Stat threshold -80 dBm

Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	46	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	2	probably TV or LTE
>10000	0	
Total	48	

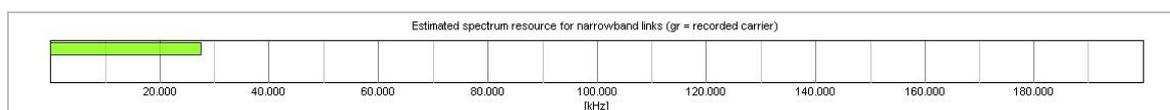
5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	27600	probably small band links
200..500	0	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	16000	probably TV or LTE
>10000	0	
Total	43600	

Table 3: summary of small band link spectrum estimation

Recorded carrier	27.60	MHz	see green bar below
No coordination information on-hand			



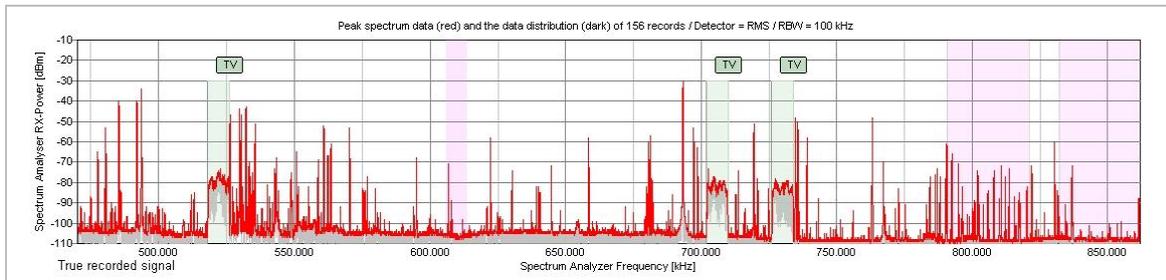
Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

International Bicycle Champion Chip, Stuttgart, Germany, September 2007

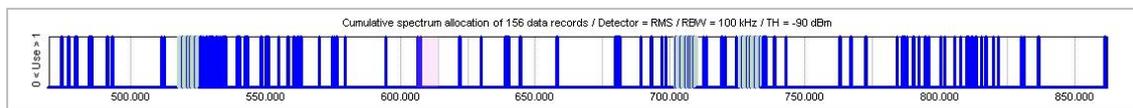
1) Project information

Project name	Road bicycle champion chip Stuttgart 2007
Project group	DKE AK 731.0.8 (DIN/VDE)
Scan start frequency	470000 kHz
Scan stop Frequency	862000 kHz

2) Recorded spectrum allocation



Graphic 1: recorded spectrum allocation



Graphic 2: spectrum allocation which exceed the stat threshold level

3) Scan statistic information

Project scan starts	29.09.07	10:56:45
Project scan ends	30.09.07	17:55:25
Number of scanning units	1	
Number of data records	155	
Stat creation starts	14.01.2014	15:38:58
Stat software version	PMSE Occupation Recorder	V1.9.109
Stat threshold	-90 dBm	

Note: statistical analysis is based on the scanned data

4) Data analysis of scanned spectrum

Table 1: carrier statistic based on scanned carrier above threshold level

Carrier bandwidth [kHz]	# of carriers	
<200	94	probably small band links
200..500	1	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	3	probably TV or LTE
>10000	0	
Total	98	

5) Assessment of the required spectrum resource

Table 2: spectrum estimation of recorded carrier

Carrier bandwidth [kHz]	Spectrum [kHz]	
<200	56400	probably small band links
200..500	600	probably small band links
500..1000	0	
1000..5000	0	
5000..10000	24000	probably TV or LTE
>10000	0	
Total	81000	

Table 3: summary of small band link spectrum estimation

Recorded carrier	57.00	MHz	see green bar below
No coordination information on-hand			

Graphic 3: estimated spectrum resource to scanned and coordinated narrowband links

