PMSE in Events of Content & Event Production

Frequency Management @ SKI World Championship 2017, St. Moritz, CH

Daniel Künzi – Broadcast Wireless Expert

tpc - technology and production center switzerland ag

daniel.kuenzi@tpcag.ch
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The Company – tpc switzerland ag

- Leading broadcast service provider in Switzerland
  - Production
  - Distribution
  - Consulting & planning
- Subsidiary of SRG
- Main customer SRF
- 900 employees
- Based in Zurich
ENG/VJ interviewing player
Why is frequency coordination necessary in CH?

Restricted by legislator since 1 January 2013

- Useable spectrum reduced by about 20% (DD1)
- No longer exclusive frequencies for broadcasters
- Dissolution of the concession obligation for wireless microphones

From about 2019

- Remaining spectrum will again be reduced by about 20% (DD2)

Conclusion = Far greater risk of collision or interference
Why plan in advance?

On-site coordination difficult

- More than two users
- Different arrival times / working locations of the users
- ENG-teams/VJs move around at the event at will
- Certainty that the devices can be used
Project background

For all users

- To simplify coordination
- To reduce the coordination effort
- To highlight the DVB-T interference situation
- Free of charge to encourage acceptance

Objective: To increase operational reliability
Our solution – PMSE-DB

- Online tool
- English
- Accessible at [www.pmse-db.ch](http://www.pmse-db.ch)
- Personal account required
- Supports frequency management at events
Welcome to PMSE-DB

The online frequency coordination tool

PMSE-DB is a web-based tool. It supports frequency planning for events. This ensures smooth operation of wireless devices for all participants. In addition, PMSE-DB shows the interference situation due to DVB-T in Switzerland.

In order to use PMSE-DB you must set up a personal account here. The account is free of charge.

Upcoming events

<table>
<thead>
<tr>
<th>DATE</th>
<th>NAME</th>
<th>LOCATION</th>
<th>REQUEST DEADLINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>08.01 - 10.01.2016</td>
<td>Ski Weltcup Adelboden 2016</td>
<td>Chuenisbärgli, 3715 Adelboden</td>
<td>29.12.2015 17:00</td>
</tr>
<tr>
<td>09.01.2016</td>
<td>Swiss Award 2015</td>
<td>Hallenstadion, 8050 Zürich</td>
<td>04.01.2016 17:00</td>
</tr>
<tr>
<td>11.01.2016</td>
<td>FIFA Ballon d’Or</td>
<td>8005 Zürich</td>
<td>08.01.2016 12:00</td>
</tr>
<tr>
<td>15.01 - 17.01.2016</td>
<td>86. Int. Lauberhornrennen 2016</td>
<td>3823 Wengen</td>
<td>06.01.2016 17:00</td>
</tr>
<tr>
<td>19.01 - 23.01.2016</td>
<td>WEF 2016</td>
<td>Bowling 101 (WEF RED ZONE), 7270 Davos</td>
<td>07.01.2016 12:00</td>
</tr>
</tbody>
</table>

Click on an event and register your wireless devices.
Key features – Current release 3.3.0.0

- Check the DVB-T situation at a particular location (within CH)
- Create events
- Register frequencies easily using device presets
- Intermodulation-free frequency assignment (FM)
- Create company-specific device presets (HFO)
- Common devices on the market are available as presets
PMSE-DB today – Conclusion

- Used by 92 companies and 1090 users
- Broadly accepted across Switzerland
- Massively reduces the coordination effort
- Successfully used at major events
Ski World Championships St. Moritz 2017

Facts
- 6th – 19th February
- tpc host broadcaster
- 15 ski race competitions
- 1800 media representatives
- 165000 spectators
- 134M spectators on tv
- 30 OB-vans
- 16 broadcasters
Mandate of the Local Organisation Committee

Coordination of all licence-free frequencies

- Wireless microphones
- In-Ear monitor systems
- Wireless intercoms
- WIFI channels
Preparing I - Organizing

- Communication of a registration obligation
- Communication together with OFCOM
- Defining frequency control workflow
- On site visits
Preparing II – frequency applications

- Requests of PMSE-devices via PMSE-DB
- WIFI-requests via Excel-sheet
- Request deadline 1st December
- 12th December all OB-vans registered
- ENG/VJ-requests till during event
Preparing III – the frequency assignment

- Frequency assignment via PMSE-DB 1st week of January
- Building of 13 “Location of use”
- Double assignment Finish-Area and Medal-Plaza
- Intermodulation security
  - Finish-Area & Medal-Plaza: 2TX IM3 within location, 2TX IM5 within request
  - ENG/VJ: 2TX IM3 within request
Map of “Location of use”
Collaboration with OFCOM Switzerland

- Coordination of overlapping frequency ranges 470-520 MHz
- High power In-Ear
- Short ways – container neighbours
The work on site

- Monitoring of the UHF spectrum
- Control correct setup of the devices & stickering
- Sticker control
- Active search & post-registration of not coordinated PMSE-users
- Solve problems with assigned frequencies
- Re-assignment of frequencies
Tools for the frequency manager on site

- iPad with access on:
  - PMSE-DB
  - Remote monitoring
  - E-Mail

- Laptop with PMSE-OR software
Tools for the frequency manager on site

- Spectrum analyser R&S FSL-6
- Tracking spectrum analyser R&S PR-100
- Frequency Counter Aceco SC-1
- Stickers
- WIFI-tester Netscout
Spectrum monitoring with PMSE-OR

- Permanent spectrum recording of 470-862 MHz
- Assigned frequencies are marked
- Not coordinated carrier frequencies are simple and fast visible
Spectrum overview
Spectrum details

HiReS radio spectrum scan [dBm@600kHz] (Detector: RMS, RBW: 10kHz (red), RBW: 100kHz (blue))

592.245MHz -67dBm
My workspace
PMSE-DB & scanning computers
Searching uncoordinated PMSE-users
Typical ENG Team
Finish Area
Mixed Zone
Big Mixed Zone
Measurement antenna
Production antennas
TV Compound
## Statistics

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total requests</td>
<td>145</td>
</tr>
<tr>
<td>Total assigned PMSE-frequencies</td>
<td>707</td>
</tr>
<tr>
<td>Total assigned WIFI-channels</td>
<td>48</td>
</tr>
<tr>
<td>effective used frequencies</td>
<td>594</td>
</tr>
<tr>
<td>On site changed frequencies</td>
<td>96</td>
</tr>
<tr>
<td>On site post-registered frequencies</td>
<td>65</td>
</tr>
<tr>
<td>Irregularities discovered with spectrum monitoring</td>
<td>36</td>
</tr>
<tr>
<td>Successful tracking of not coordinated PMSE-users</td>
<td>12</td>
</tr>
</tbody>
</table>
Scan Statistics PMSE-OR

Peak spectrum data (red) and the data distribution (dark) of 127816 records / Detector = RMS / RBW = 100 kHz (red) & 10000 kHz (purple)

Graphic of Aggregated Spectrum

Detected narrow-band signals within time intervals of 5 min (Purple in CoL1, Blue in CoL2, Green in both, Orange=non-coord) / Signals below TH (prey/mint) / TH=-80dBm

Graphic of recorded Spectrum in the time-domain
Scan Statistics PMSE-OR

Table 1: recorded carrier above threshold level

<table>
<thead>
<tr>
<th>Carrier bandwidth (kHz)</th>
<th>Carrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;500</td>
<td>199</td>
</tr>
<tr>
<td>500..1000</td>
<td>0</td>
</tr>
<tr>
<td>1000..5000</td>
<td>0</td>
</tr>
<tr>
<td>5000..10000</td>
<td>14</td>
</tr>
<tr>
<td>&gt;10000</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>213</td>
</tr>
</tbody>
</table>

Note: table contains manual marked carrier

Table 3: summery of narrow band link spectrum estimation

<table>
<thead>
<tr>
<th>Recorded carrier</th>
<th>Carrier</th>
<th>MHz</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>119.60 MHz</td>
<td></td>
<td></td>
<td>see the green bar below</td>
</tr>
<tr>
<td>204.60 MHz</td>
<td></td>
<td></td>
<td>see the yellow bar below</td>
</tr>
<tr>
<td>0.60 MHz</td>
<td></td>
<td></td>
<td>see the blue bar below</td>
</tr>
</tbody>
</table>

Estimated spectrum resource for narrow-band links (gr = recorded carrier, ye = coord. carrier 1, coord. carrier 2):
Conclusions

- All frequency users very cooperative
- Fast tracking of users without permission
- More effort for WIFI coordination than expected
- Only main event areas can be covered by monitoring
- Control of PMSE users in public areas very difficult
Questions
Thank you very much for your attention

daniel.kuenzi@tpcag.ch