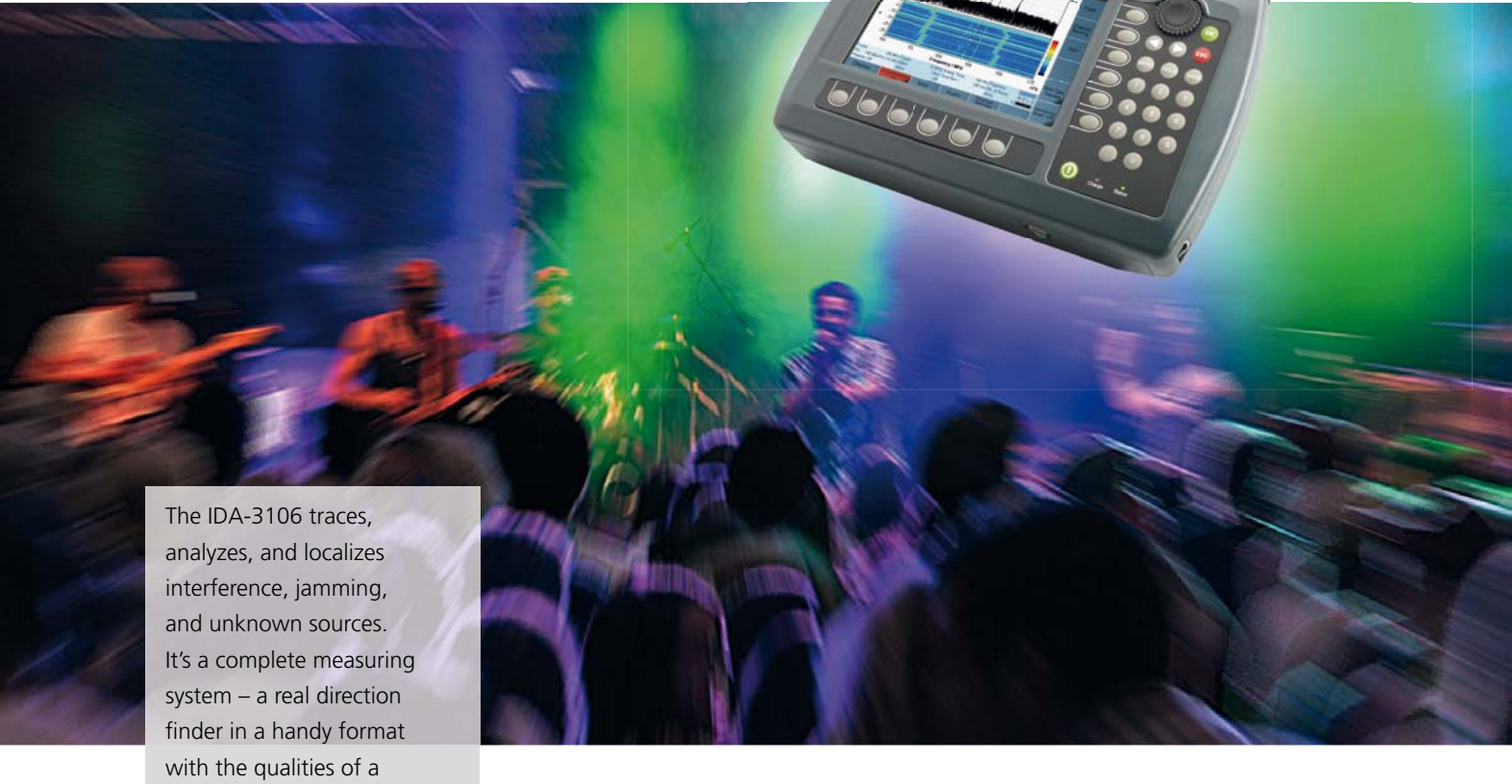
WHO'S ON AIR? WHO'S INTERFERING?

IDA-3106 in action at major events.

smartDF®
INTELLIGENT PEILEN



The IDA-3106 traces, analyzes, and localizes interference, jamming, and unknown sources. It's a complete measuring system – a real direction finder in a handy format with the qualities of a receiver.
Intelligent direction finding with smartDF makes the IDA easy to use and gives unbeatably reliable results.

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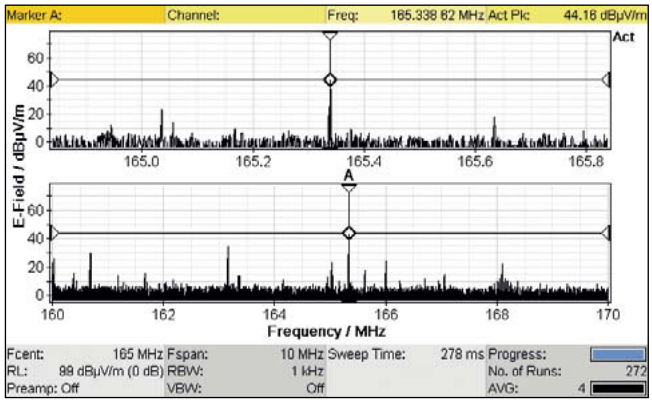
Tracing interference and direction finding are both complex operations. The Interference and Direction Analyzer IDA-3106 has been specially developed for the identification and localization of interferers, jammers, and unknown sources. Wide-ranging features make the task easier and ensure absolutely certain results. An assignment at a major event demonstrates in three steps how the IDA is used: Detect – Analyze – Localize.

Around 40,000 spectators are expected to fill the stadium this evening for the performance. The biggest event of the year is due to start on time at 8 p.m. Preparations are well under way and everything seems to be going smoothly, but then, two hours before the show is due to start, the radio link between the security staff in the stadium and the control center outside the stadium is interrupted repeatedly for several seconds at a time, during which a hissing noise can be heard. The security staff in the stadium can hear the people in the control center clearly, but communications in the other direction from the stadium are disrupted. An alternative channel is also affected by the interference. The cause of this problem needs to be found as soon as possible and eliminated. The task is made more difficult by the sporadic nature of the interference.

The communications link between the security staff in the stadium and the control center uses the standard emergency services radio on the 2-meter band. The recurrent interference affects channel 107 at a nominal 165.33 MHz.

DETECTING THE TYPE OF INTERFERENCE

The first measurement from 160 to 170 MHz from the control center covers a somewhat wider range than the emergency services radio. The values can easily be read off from the IDA, despite the bright sunshine, thanks to the good screen resolution and high contrast display. The communications channel that needs to be protected is focused on with the marker using the *Highest Peak* function. A further key press on *Magnifier* activates this function and shows a 10 % section of the entire measured frequency range in the *Magnification low* setting; the *Magnification high* setting would show 2 % of the range. The center frequency of the enlarged spectrum corresponds to the marker position in the full spectrum, which is the center frequency of the affected channel. It quickly becomes apparent that the interference is wideband, most likely caused by some kind of switching. This initial analysis takes just a few minutes.



An initial overview from the control center shows the allocation and several interferers (below). The Magnifier takes a closer look at the area around the Marker (above).

DETERMINING MEASUREMENT TACTICS

There first needs to be a check to see if there is any other interference. The IDA in *Spectrum* mode shows all the present activity together by means of FFT analysis. The *Spectrogram* setting additionally shows the correlation between frequency, time, and amplitude, which is very useful. The IDA gives even more information by parallel recording of the results from all three detectors – +Peak, RMS, and –Peak – regardless of the detector type chosen for displaying the spectrogram. Each one can be recalled for evaluation by pressing a button.
In the example here, the communications channel can be seen, along with an unstable continuous carrier (wandering signal) and a wideband interferer that covers the entire measured spectrum and occurs every five seconds or so, which is obviously the source of the interference problem.

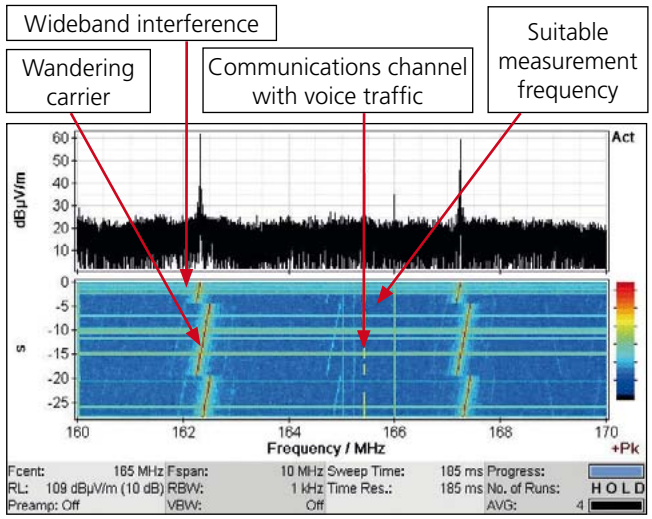
This, then, is where the search needs to be concentrated. When localizing wideband interference, it is always a good idea to choose a measurement frequency that only shows the interference signal. There is heavy traffic on the communications channel itself, so it is unsuitable for measurement in this instance. Several suitable measurement frequencies can be found straight away with the spectrogram, needing just a few seconds to obtain the result. The chosen measurement frequency is 165.49 MHz, and the resolution bandwidth (RBW) set to 16 kHz to correspond to the channel bandwidth of the emergency services radio receiver.

ANALYZING THE INTERFERENCE

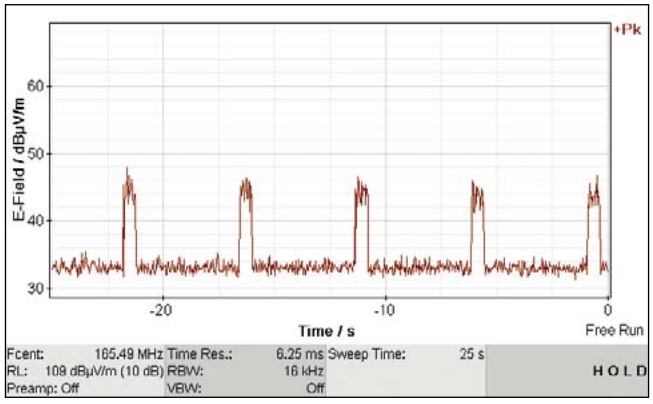
A lot of interference varies in intensity considerably during a burst. This can lead to false bearings. Scope mode with its resolution of down to 32 ns does not just allow a look inside the timeslots of a digital signal. In this case, it shows a relatively constant interference characteristic. The measurement with 16 kHz RBW gives an interference level of 40 dBµV/m. If this is converted to the 120 kHz bandwidth more commonly used in EMC measurements, the result is almost 60 dBµV/m. Such interference values are clearly intolerable

LOCALIZING – OR RATHER, DIRECTION FINDING

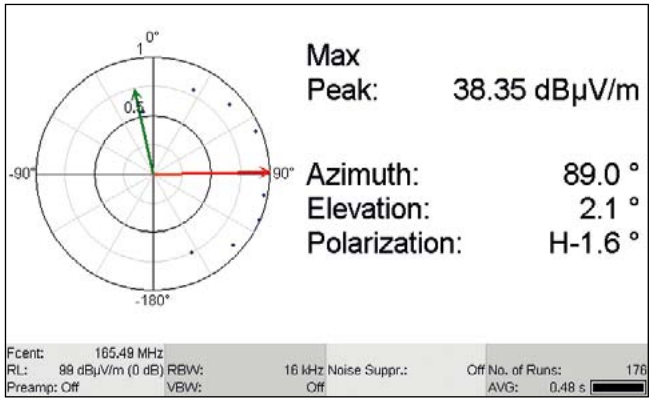
A special feature of the IDA is the Horizontal Scan for transient or intermittent signals: In *Direction Finding* mode this scan can be *Continuous* or *Discrete*, and there is also a *Discrete with Max Hold* setting. With this setting it is also possible to localize pulsed and cyclic or sporadic signals. To do this, the antenna is first positioned in one direction until the interference occurs. The instrument determines the maximum value, which can be added to the scan by pressing a button. This allows individual plausibility testing, as it is possible to select which measurement values are to be added to the diagram. This procedure is repeated for several different directions. As an example,



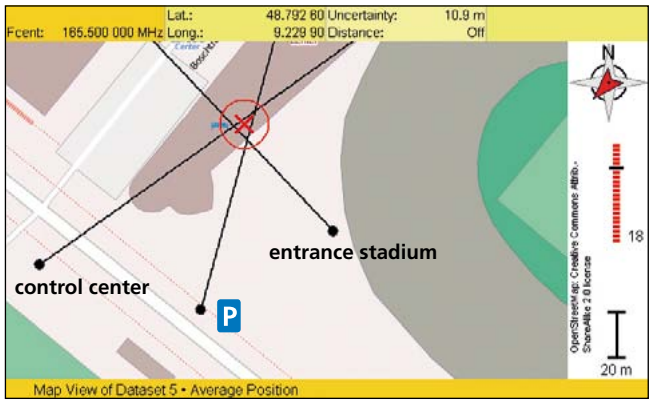
Combined display of spectrum and spectrogram



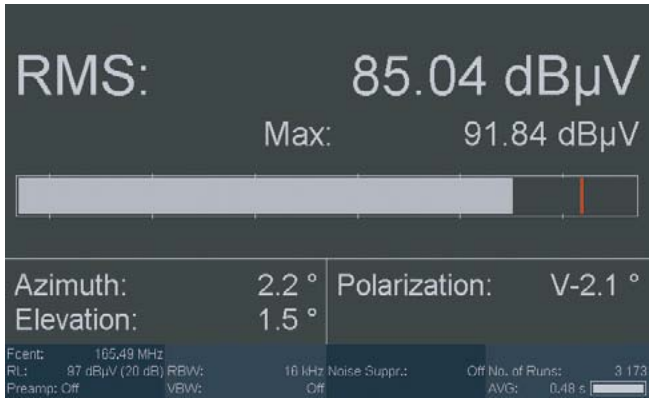
Scope Mode shows the amplitude versus time of the interfering signal



Bearing diagram from seven separate hand-picked measurements



Triangulation from three bearings: 1. Bearing from the control center. 2. Bearing from the hotel car park. 3. Bearing from the stadium entrance.



The bar graph and the Tone Search feature help narrow down the last few meters. The Night setting allows dazzle free viewing of the display even in the dark.

IDA-3106 – Facts and figures

- Up to 6 GHz at 12 GHz/s sweep rate
- Sensitivity -167 dBm/Hz and real-time analysis with resolution down to 32 ns
- Automatic determination of direction, elevation, and polarization
- Display with results superimposed on a map
- Outdoor-capable
- Ergonomic design, robust, with very light weight antennas
- GPS and electronic compass
- Analyzer is radiation proof up to 200 V/m
- Recording and export of I/Q data
- Resolution bandwidth up to 32 MHz

the antenna could be turned round by about 30° to wait for the interference burst again. The points in the polar diagram correspond to the results obtained in this way. The IDA supplements these points with intermediate values determined using special algorithms, so that a complete polar diagram that also shows any side lobes caused by reflections is produced. The IDA automatically determines the main angle of incidence.
At the rate at which the interference is occurring, the IDA takes less than a minute to determine the direction, which points towards the hotel opposite.
Two further horizontal scans are needed for precise location by triangulation. The intersection point is somewhere in the hotel entrance area.
Now the search is focused on the last few meters. The IDA is switched to *Tone Search* to determine the direction by means of the tone pitch and the length of a bar graph. After checking with reception, the concierge leads the way to the hotel cellars, where the field strength of the interference increases significantly. The IDA display can be simply switched to the *Night* setting so that the bar graph can be viewed without glare even in the dimly lit rooms. The highest field strength is measured in front of the door to the building services room. Investigations here reveal a defective control board with a sparking relay. The equipment is temporarily taken out of service and the relay is replaced later. This clears the interference and restores secure communications. The event can go ahead as planned.

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