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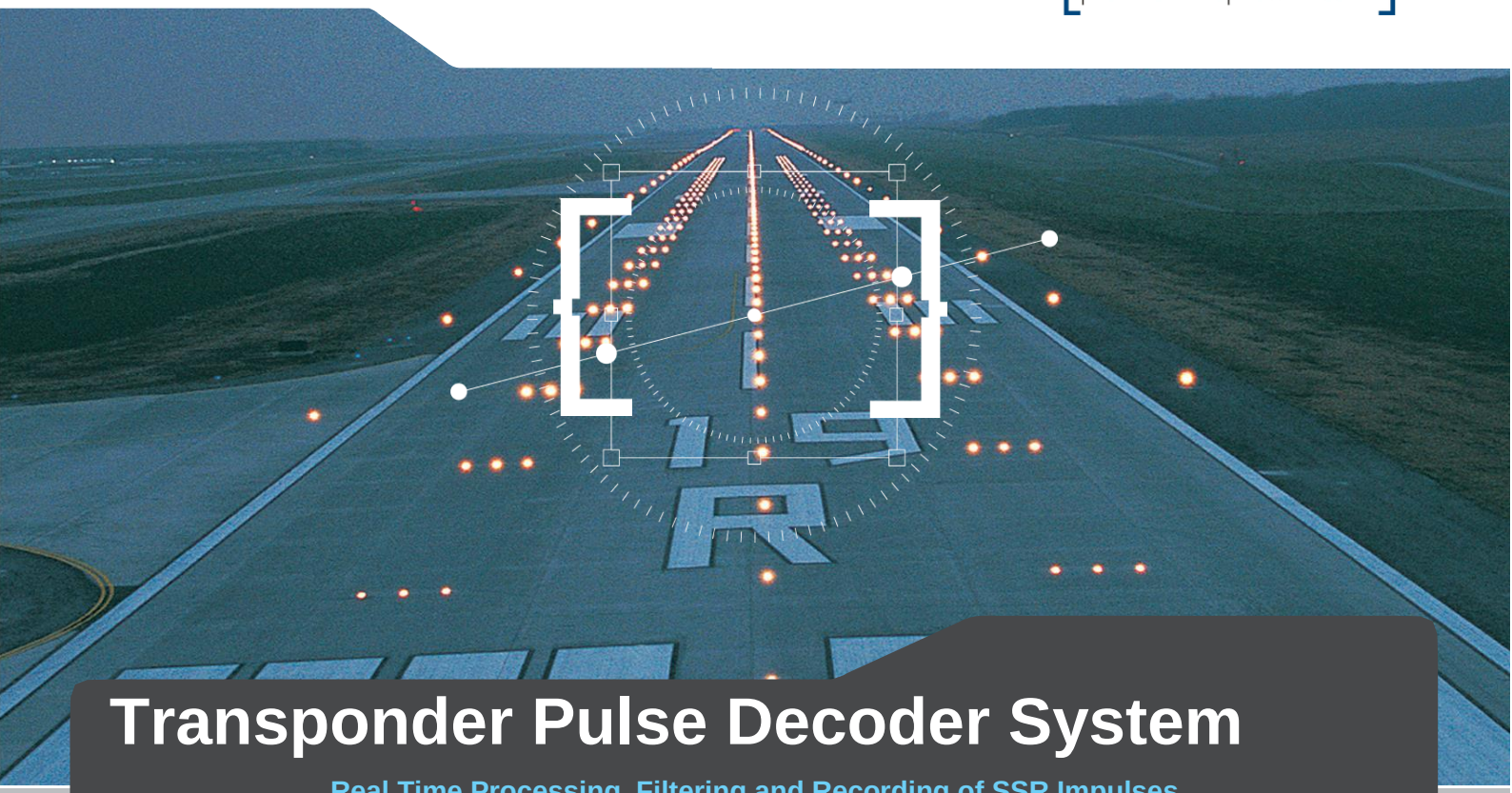

Transponder Pulse Decoder System

Real Time Processing, Filtering and Recording of SSR Impulses
(The Aerodata Way to comply with "Commission Implementing Regulation (EU) No 1207/2011", Article 6, "Spectrum Protection")

Purpose of the Equipment:

The purpose of the Transponder Pulse Decoder System (AD-TPDS) is the real-time processing of Secondary Surveillance Radar (SSR) interrogation impulses and Mode S information for flight inspection purposes. It makes SSR inspections possible without the need of ground support.

The SSR under inspection is filtered by its Mode S P6 Uplink Format 11 (UF11) identification number.

The AD-TPDS consists of a processing hardware (Transponder Pulse Decoder Box (AD-TPDB)) and full AD-AFIS software integration.

Figure 1: AD-TPDB

The interrogations of the Radar are verified by measuring impulse spacings, widths and amplitudes of the related impulses that form the interrogation. Side lobe suppression (SLS) impulses are also considered for the validation of the interrogation. The equipment automatically calculates field strengths and hit rates for all SSR interrogation types (Mode 1, 2, 3/A, S4, S6). An extra set of results is created for the UF11 filtered radar. Additionally, the system can process onboard transponder replies. Those replies are inserted into the data stream that the box delivers for comparing hit rates against reply rates. This provides an overall picture of SSR performance in the inspected area.

Transponder Pulse Decoder System

Compliance Check for Article 6 of EU Regulation No 1207/2011:

Article 6.1 requests that a sufficient, but not excessive number of valid SSR interrogations with sufficient signal in space energy is available on the 1030 MHz uplink band which may elicit replies of an airborne SSR transponder.
Check of compliance is accomplished by the field-strength and hit-rate parameters that are measured and calculated by the AFIS software when a TPDS is connected to the system. The TPDS displays and records all interrogation impulses that are valid and able to elicit replies by transponders. Additionally, it also processes invalid impulse events (e.g. due to impulse width violations) and marks them as “Jam”. Those impulse events are not part of an interrogation, but nevertheless occupy the 1030 MHz uplink band.
Field strength and hit-rate processing can be focused on a Mode S radar by selecting its Uplink Format 11 (UF11) identifiers as special filter inside the TPDS.
Figure 2 displays an online graphic of the above-mentioned parameters for an UF11 filtered radar. This can be used for coverage measurement procedures. Here, only the Mode S6 interrogations of the selected radar are displayed. However, similar parameters and graphics for all other interrogation modes are also available at the same time.

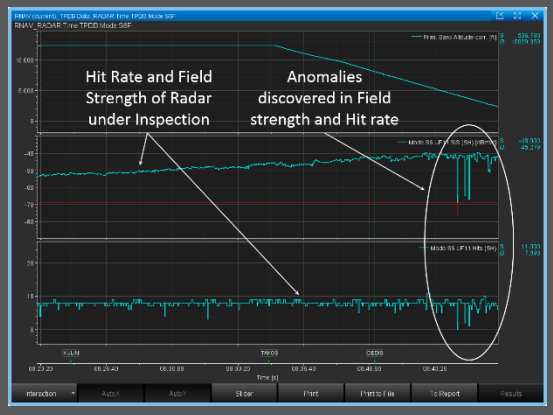

Figure 2: Field strength and hit rate

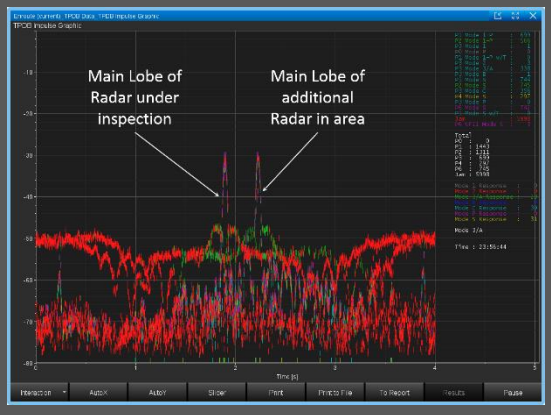

Figure 3: Full Radar sweeps of two Radars

Article 6.2 requests that an airborne transponder does not excessively reply to the ground based Mode A/C/S interrogations.
Check of compliance is accomplished if the TPDS is connected to the suppression line of a standard transponder of the flight inspection aircraft. In that case, the TPDS is able to produce reply data sets that are transferred to the AFIS and can be analysed by the AFIS software in order to determine the reply rate of a standard transponder. These reply data sets are in time relation to the interrogation data sets and it is therefore possible to deeply analyse false replies or excessive reply rates with the recorded impulse data. The fact that the TPDS does record literally all impulses on the 1030 MHz uplink band makes this deep analysis possible.

Figure 3 shows radar sweeps of two radars and contains all impulses that were received over a period of 4 seconds. The display time is configurable and the impulse recording is without interruption.

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Transponder Pulse Decoder System

Article 6.3 requests the possibility to detect interferences of ground-based transmitters on the 1030 MHz band.
Check of compliance is accomplished by the fact that the TPDS provides the impulse type “Jam” for all impulses (or other events) that are present on the 1030 MHz band but not belonging to an interrogation. If the display shown in Figure 3 does show excessive Jam impulses in the main lobe of the radar and less valid interrogation impulses then one could interpret this as the presence of interference. Additionally, the hit-rate number would degrade to a value that would not be sufficient for the required surveillance quality.

AD-TPDS Equipment

The AD-TPDB is a rack mountable unit integrating the following functional parts:

AD-TPDB containing:

- 1030 MHz receiver
- DPSK demodulator for UF11 filtering
- Analog digital converter
- Processing circuitry (FPGA)
- Memory
- Serial interfaces
- Ethernet interface for impulse data transmission

TPDS Software Integration:

The AD-TPDS is fully integrated into the AeroFIS® software.

Radar inspections use UF11 database entries for filtering signals of the Radar under investigation. Graphics and alpha tables are available for parameters like field strength and hit rate (Figure 2) and overall impulse overviews in the “full sweep plot” (Figure 3). All data is recorded for replay analysis.

Solution for Your AeroFIS®

Every AeroFIS® can be upgraded to include the AD-TPDS option. The processing hardware for the system (AD-TPDP, Figure 1) is available in a small form factor in order to fit into available rack space.

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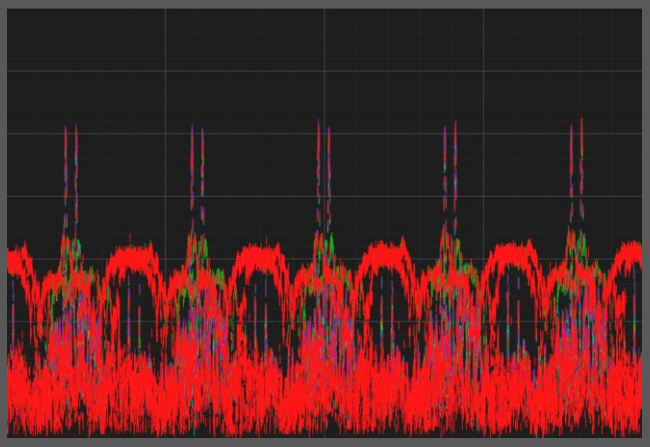
Transponder Pulse Decoder System

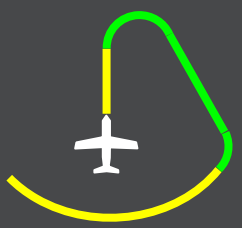
Dimensions and Weight

Dimensions of AD-TPDB case (W x H x D)	105 mm x 65 mm x 225 mm
Weight of AD-TPDB	1.3 kg



AD-TPDS: *"Electrocardiogram for your Radar"*

We keep you on the best path!



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