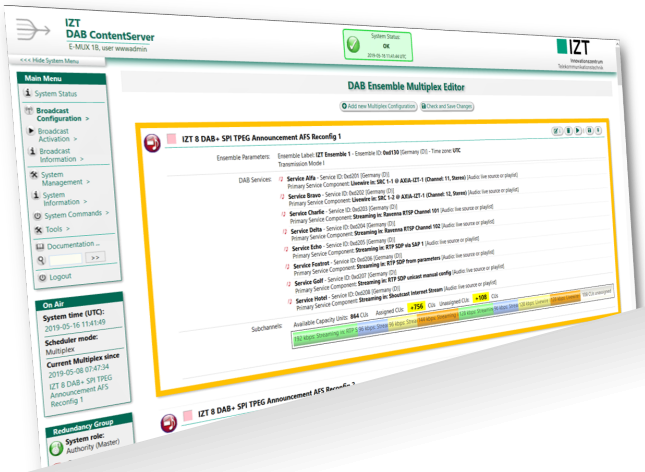
IZT Test and Measurement Solutions
DAB Receiver Testing

Technical Article



- The ETI format for receiver testing
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Digitisation in the automotive sector is constantly increasing the relevance of reliable test equipment. WorldDAB member IZT is there to help when it comes to testing automotive entertainment systems. This article takes a closer look at IZT's DAB solutions, and how combining the IZT S1000/IZT S1010 Signal Generator family with the IZT DAB ContentServer Encoding and Multiplexer system is one of the most efficient ways to put DAB receivers to the test.

Introduction

The entire supply chain of radio receivers can benefit from testing scenarios. This includes product development, validation and production line testing. Chip set manufacturers, suppliers and car manufacturers need to cover a variety of testing scenarios as automotive radio receivers are becoming more and more complex, and user experience increasingly important.

When testing radio receivers for DAB, it is important to cover the whole range of DAB functionality. On one side, encoding and signaling needs to be tested in compliance with the DAB specification, while on the other hand, reception conditions also need to be considered. Finally, the relation between DAB services and other bearers such as FM needs to be taken into account.

The IZT S1000/IZT S1010 and IZT ContentServer form a comprehensive test setup covering these requirements.

The ETI format for receiver testing

The ETI (Ensemble Transport Interface) format has been established as a distribution format for DAB multiplex signals. Designed as an interface between DAB ensemble multiplexers and the transmitter network, an ETI signal carries the complete DAB ensemble to be modulated to RF. Using encapsulation of DAB interfaces (EDI), the ETI format can be distributed over IP networks using UDP (User Datagram Protocol) streaming in multicast or unicast.

ETI streams can be recorded to file and be used for detailed analysis of DAB ensembles as well as input of test modulators for receiver development. Files in the ETI (NI) format have been established for exchanging DAB streams. For example, the format is used by the WorldDAB ETI Library.

DAB Multiplex Generation

The IZT DAB ContentServer makes the complete feature set of DAB available for laboratory use. It is a powerful solution for efficient development and testing of DAB devices such as chipsets, receivers or broadcast equipment.

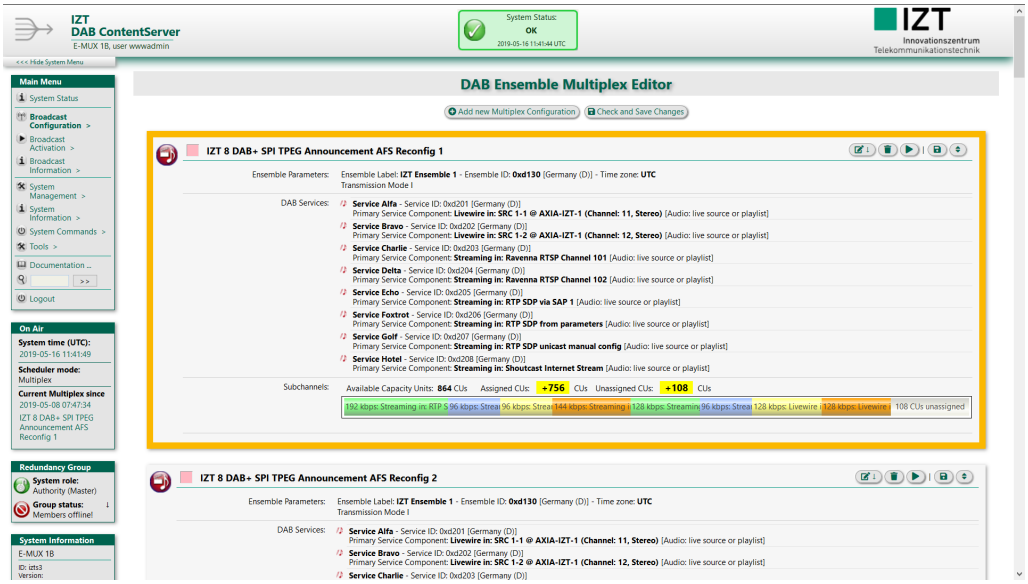

Figure 1: DAB multiplex configurations can conveniently be configured via a web GUI

The system generates a DAB multiplex from all available audio signals and data services. It enables all standardised and proprietary DAB data applications. Audio content can be imported as wav or mp3 files, including playlists. If required, it is possible to upgrade live audio inputs via audio over IP including external converters from analog or AES3 audio.

The Multiplexer component manages all DAB signaling capabilities and generates the complete DAB multiplex. The system outputs the multiplex in the EDI/ETI via UPD/IP. In addition, the IZT DAB ContentServer allows recording of the multiplexer output as an ETI (NI) file.

The IZT DAB ContentServer is a software system and can be operated on standard server hardware while the functionality can be conveniently accessed using a web interface. Alternatively, the IZT DAB ContentServer can directly be run on IZT S1000/S1010 hardware.

RF Signal Generation

The IZT S1000/IZT S1010 Signal Generator enables the generation of various broadcast signals including DAB. It can modulate DAB signals from ETI or EDI. In addition, a direct link between the IZT DAB ContentServer and the IZT S1000/IZT S1010 via EDI can be set up to achieve a complete real-time chain.

The two independent RF outputs of the IZT S1000/IZT S1010 in combination with an instantaneous bandwidth of 120 MHz make it possible to create complex test scenarios for radio receivers. For example, it is possible to simultaneously cover the complete DAB band with one RF output and the FM band with the other RF output. Up to 31 independent signals can be placed flexibly into the output spectrum.

Figure 2: The IZT S1010 Signal Generator can output a variety of RF signals simultaneously

Offline Modulation from ETI

The IZT S1000/IZT S1010 Signal Generator can generate DAB I/Q files from existing files in the ETI(NI) or EDI/ETI format. These ETI files can be recorded at the IZT DAB ContentServer, extracted from on-air recordings with the IZT receivers or other sources such as the WorldDAB ETI Library.

Real-time Modulation

The DAB real-time modulator option can use ETI files directly as input for live modulation of DAB signals to RF. In addition the IZT S1000/IZT S1010 can modulate DAB signals directly from incoming EDI/ETI streams received from the IZT DAB ContentServer in real-time via UDP/IP.

Replaying RF Signals

The IZT S1000/IZT S1010 replays recorded or simulated signals. For example, signal sequences can be recorded with IZT receivers. Instead of recording a signal, the user can also generate plain I/Q data using external tools.

Powerful Testing Scenarios

The combination of IZT DAB ContentServer and IZT S1000/IZT S1010 forms a versatile laboratory setup. Depending on the testing requirements, a subset may be sufficient. In addition, the flexible and scalable option structure makes it possible to adapt to actual requirements while upgrades can be added to the systems anytime later.

Multiplex content

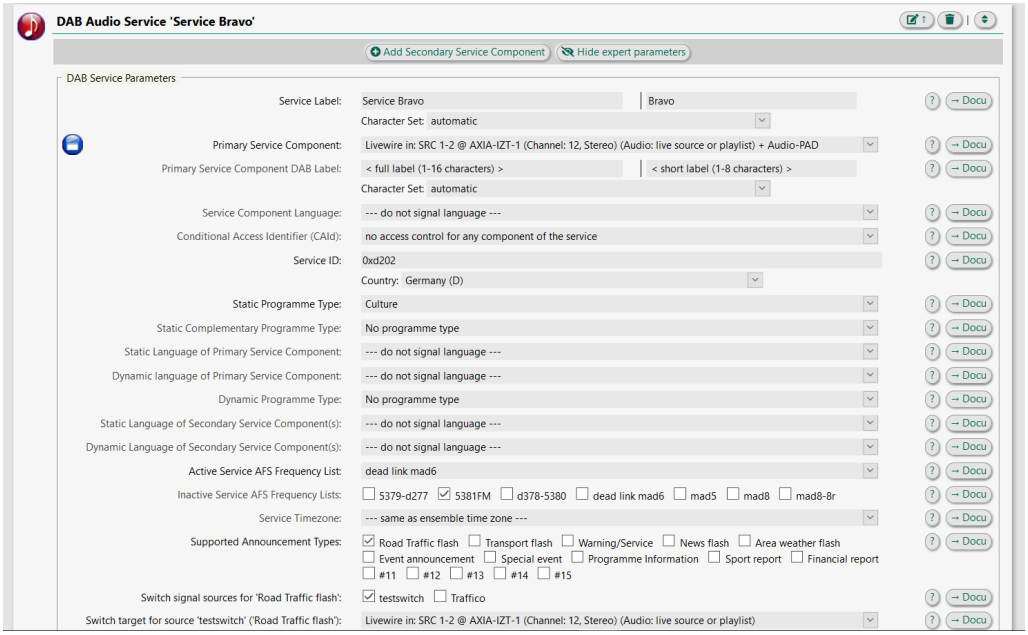

Figure 3: In export mode, the Multiplex Editor makes the complete signaling options of DAB available

The IZT DAB ContentServer supports DAB (MPEG-1 Layer 2) and DAB+ (MPEG-4 HE-AAC v2) encoding in all coding modes and bitrate variations. Furthermore, all specified and proprietary data services can be added to the DAB multiplex as PAD or non-PAD, including Dynamic Labels, Dynamic Labels Plus, Slideshow, TPEG and EPG/SPI.

The IZT DAB ContentServer supports all standardized and broadcaster-specific data applications. The range of standardized DAB applications includes Dynamic Labels, Dynamic Labels+, Journaline®, EPG, Slideshow and TPEG. Open interfaces enable the transmission of any custom-tailored and broadcaster-specific applications.

SPI/EPG can be easily provided and integrated into a DAB multiplex including station logos.

Furthermore, the IZT DAB ContentServer enables the signaling of all specified announcement scenarios as well as Alternative Frequency Signalling (AFS) for service following.

All signaling is automatically performed to comply with the multiplex and services configuration while the multiplex and service parameters can be configured via a web GUI. In addition, custom signaling can be performed with FIC insertion.

Reconfigurations

With dynamic reconfigurations, the DAB standard enables flexible regionalization of services or temporary pop-up radio stations.

The IZT DAB ContentServer and IZT S1000/IZT S1010 Signal Generator facilitate comprehensive testing of reconfiguration scenarios. An unlimited number of multiplex configurations can be set up in the IZT DAB ContentServer. Changes from one configuration to another are performed as standard-conform dynamic reconfigurations.

Service Following

The IZT S1000/S1010 Signal Generator makes it possible simulate a variety of service following scenarios.

By applying power level profiles to the different RF output signals, it is possible to simulate a “drive” through different coverage areas.

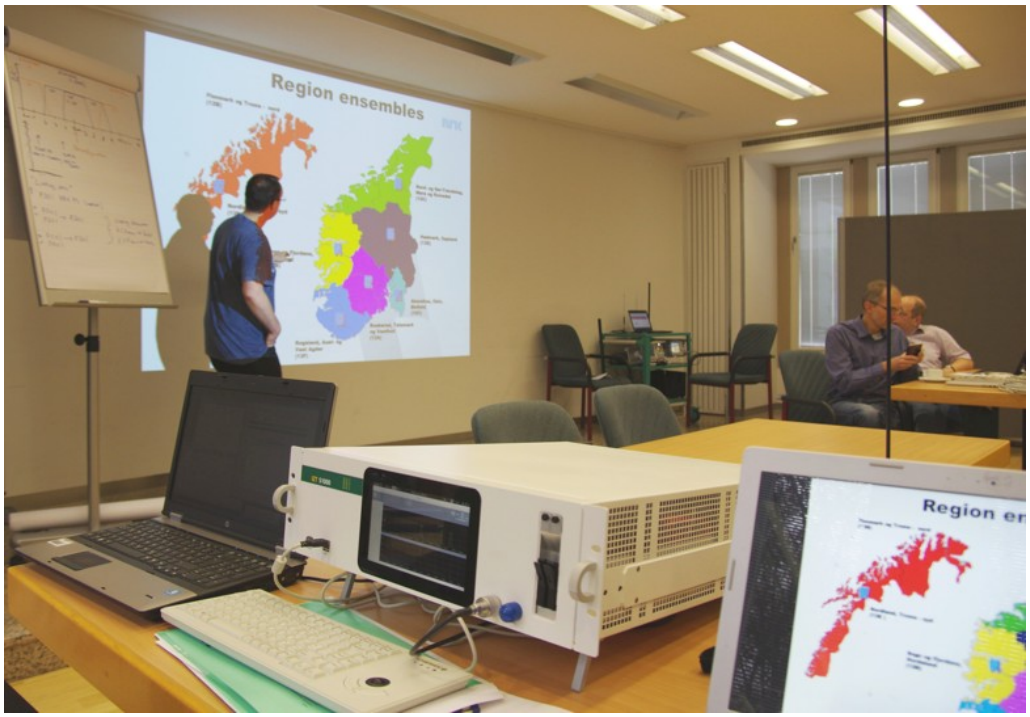

Figure 4: IZT S1010 simulating a "drive" through the regions of NRK’s DAB network during the WorldDAB TC Interoperability workshop

For example, it is possible to reproduce the same ensemble on multiple frequencies (Multi-frequency Network, MFN). Testing of service linking across different DAB ensembles (DAB-DAB linking) can easily be performed as well as service linking from DAB to FM (DAB-FM linking).

With the IZT DAB ContentServer, it is possible to create a selection of ETI files containing appropriate AFS. In parallel, the FM-RDS encoder of the IZT S1000/IZT S1010 enables the creation of AF signaling for the FM signals.

Furthermore, DAB-FM time-alignment can be tested with a real-time setup of IZT DAB ContentServer and IZT S1000/IZT S1010.

Impairments

IZT S1000/IZT S1010 can be equipped with a wide range of simulation tools. Up to 32 fading paths can be allocated flexibly to the used signals and RF outputs. The powerful fading simulation and two RF outputs provide a simple and effective way to test Maximal Ratio Combining (MRC). All paths can apply a time-variant delay, e.g. for Doppler simulation. Different fading models such as Rayleyh, Rice, LOS, GAUSS are supported. Fading models for TU4 / RA6 / TU6 / TU12 / SFN are provided as pre-defined scenarios.

Conclusion

IZT's comprehensive support for DAB provides powerful and convenient solutions to test receivers in the laboratory. Supporting the ETI format, the IZT S1000 can modulate DAB from ETI files as well as from the output streams of DAB Multiplexers.

The IZT DAB ContentServer is the perfect choice to create DAB Ensembles in various configurations, providing an EDI/ETI output stream and the possibility to record ETI files.

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About IZT The Innovationszentrum fuer Telekommunikationstechnik GmbH IZT specializes in the most advanced digital signal processing and field programmable gate array (FPGA) designs in combination with high frequency and microwave technology.

The product portfolio includes equipment for signal generation, receivers for signal monitoring and recording, transmitters for digital broadcast, digital radio systems, and channel simulators. IZT offers powerful platforms and customized solutions for high signal bandwidth and real-time signal processing applications. The product and project business is managed from the principal office located in Erlangen/Germany. IZT distributes its products worldwide together with its international strategic partners. The IZT quality management system is ISO 9001:2015 certified.

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