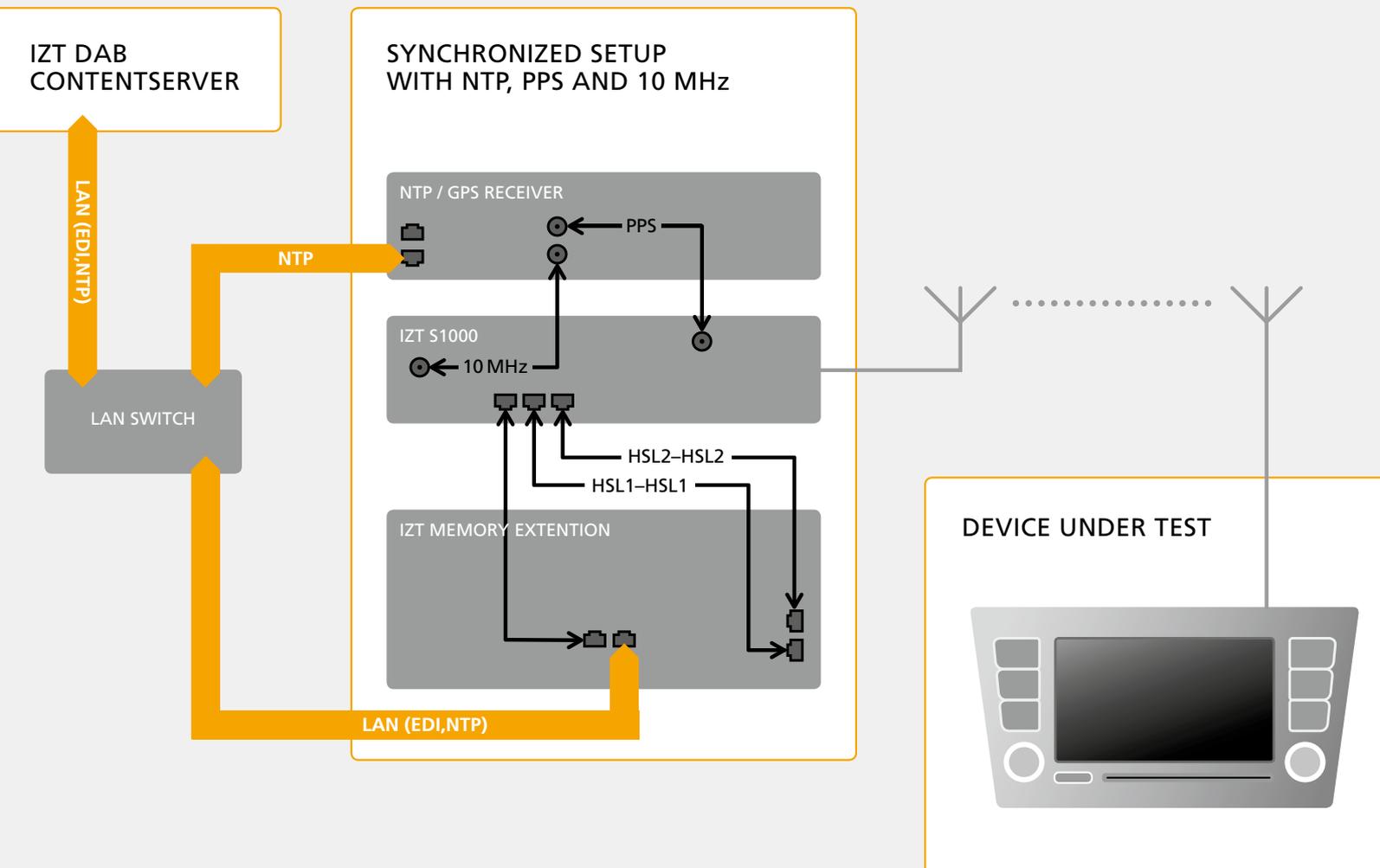


# IZT DAB ContentServer, IZT S1000 Testing DAB Receivers Using ETI



- Real-time and offline modulation from ETI files
- Generating and analyzing ETI files
- Real-time interface using EDI/ETI



# Testing DAB Receivers Using ETI

The IZT S1000 Multi-channel Signal Generator is a powerful test source to generate DAB test signals from the ETI (Ensemble Transport Interface) [1] or EDI/ETI format. In addition, the IZT DAB ContentServer can be used to generate ETI files to be modulated by the IZT S1000. The possibility to directly link the multiplexer output of the IZT DAB ContentServer with the IZT S1000 provides a versatile laboratory setup to test DAB receivers in real-time.

This application note describes how to use the IZT S1000 in combination with the IZT DAB ContentServer to generate signals for DAB receiver testing.

## TECHNICAL BACKGROUND

The ETI format has been designed as an interface between DAB ensemble multiplexers and the transmitter network. 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.

Using Encapsulation of DAB Interfaces (EDI) [2], the ETI format can be distributed over IP networks using UDP (User Datagram Protocol) streaming in multicast or unicast.

Files in the ETI(NI) format have been established for exchanging DAB streams. For example, the format is used by the World DAB ETI Library [3].

## FEATURES

### IZT S1000

The IZT S1000 modulates DAB signals from ETI or EDI. The DAB modulator option S1000-403, applies offline COFDM modulation. The resulting files can be either loaded to the internal memory or streamed from the external Memory Extension. The DAB real-time modulator S1000-203 can use ETI or EDI files directly as input and can be configured multiple times in different VSGs. The DAB real-time modulator is capable of full ETI reconfigurations. The live EDI/ETI streams from a DAB Multiplexer, e.g. the IZT DAB ContentServer.

### IZT DAB ContentServer

The IZT DAB ContentServer can be used to generate ETI files or EDI/ETI streams. A web interface provides convenient access to configure of service components and multiplex. To enable the full feature set of the DAB standards, the IZT DAB ContentServer Developer Edition provides complete functionality – including all standardized and broadcaster-specific data services, reconfigurations and signalling options.

The IZT DAB ContentServer Embedded Edition allows basic testing of DAB receivers and is exclusively available to be combined with the IZT S1000.

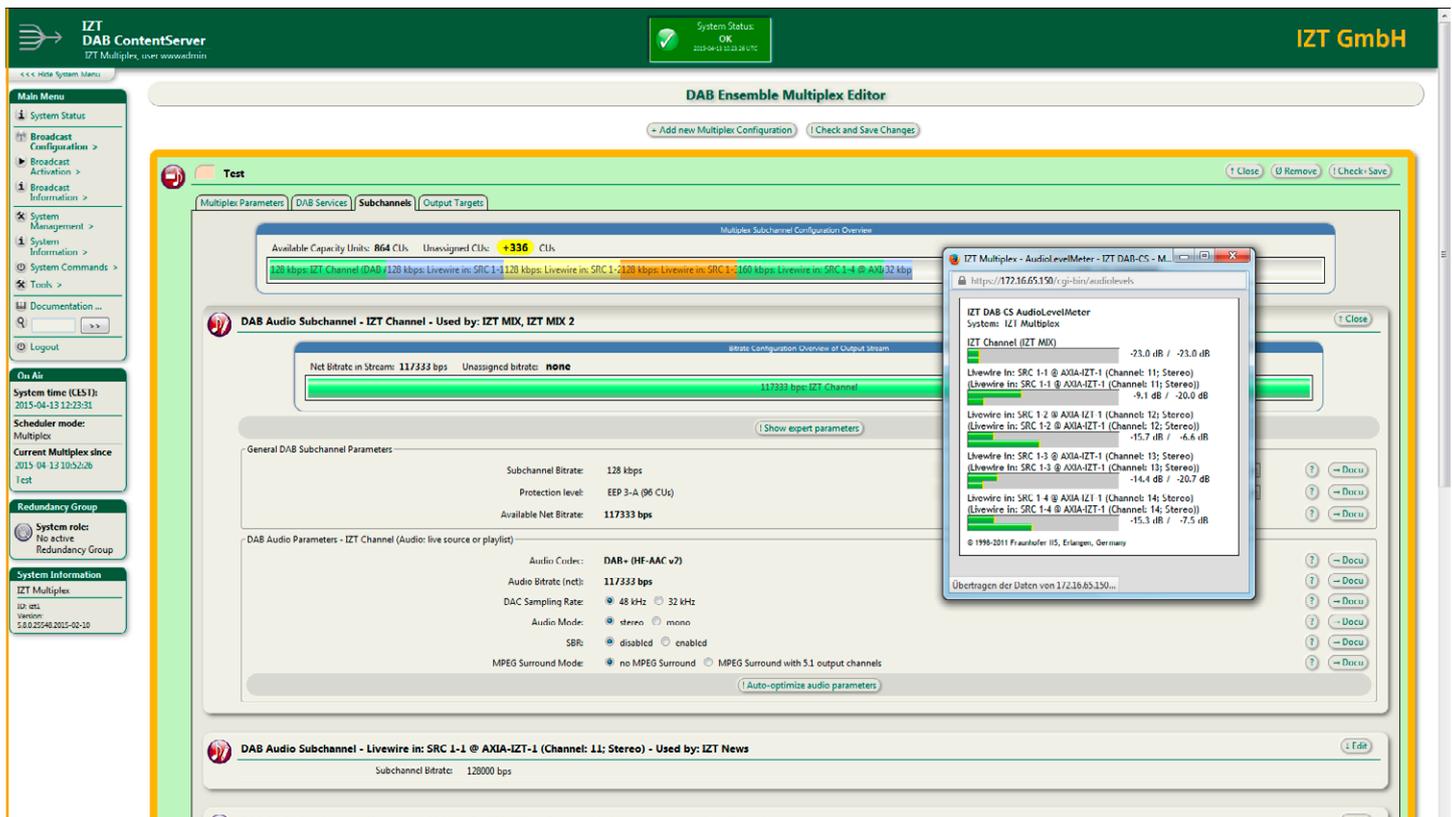


FIGURE 1: WEB INTERFACE OF THE IZT DAB CONTENTSERVER

## FILE-BASED TESTING

The IZT S1000 can modulate DAB signals from existing files in the ETI(NI) or EDI/ETI format. These can be files recorded at the IZT DAB ContentServer, files extracted from on-air recordings with the IZT Receivers or other sources such as the World DAB ETI Library.

### Generating ETI Files

The IZT DAB ContentServer allows recording the multiplexer output. This functionality can be conveniently accessed using the web interface. The multiplexer output is stored as an ETI(NI) file.

To perform recording from the web interface, go to "Broadcast Information" / "Record Output of Multiplex Generator". Figure 2 shows the recording interface which allows setting the duration of the recording and the possibility to download the recorded ETI(NI) file.

Additionally, the ETI Analyzer allows converting the recorded file into EDI/ETI or other formats (Figure 3). The ETI Analyzer is accessible through the web interface and is included in the Developer Edition of the IZT DAB ContentServer. Further, the ETI Analyzer is a powerful tool not only to analyze the complete DAB ensemble but also to extract pre-encoded audio or data subchannels. These can be used for further analysis or as elements of a new multiplex even on a system without enough licenses to generate such a multiplex in real-time.



### Recording Interface of the IZT DAB ContentServer Ensemble MUX A

Available disk space: 123 GB

**Recording command**

**List of recorded files**

20160617T092133\_eti\_ni\_file.dab 7680000 bytes

FIGURE 2: RECORDING ETI FILES WITH IZT DAB CONTENTSERVER

#### Description of DAB Ensemble 1

Ensemble	'Östafjells' (EId: 0xf901)
Ensemble length	4960 frames, 119.040 seconds
Ensemble start	2015-06-29 07:58:05 UTC, local time 2015-06-29 09:58:05 (LTO +02:00), got 30 FIGO/10 (long form), 0/0.0/0 (min/avr/max) ms time jitter (first date/time in ensemble)
Transmission mode	1
Services	16

#### Description of carried services

Service	Used sub channel
<b>Data service 'NRK EPG' (SId 0xe2f30010)</b> Primary Service component (Enhanced Packet Mode, DSCTy: Multimedia Object Transfer (MOT)); SCIdS 0x0 SPI (Service and Programme Information) / EPG (Electronic Programme Guide); User Application data is 01 02: Basic profile; Advanced profile	Enhanced Packet Mode sub channel 54, packet address 1 (SCId 0xfef)
<b>Audio service 'NRK P1' (SId 0xf201), PTy 12: Easy Listening Music</b> Primary Service component (Audio); SCIdS 0x0 MOT Slideshow	Audio sub channel 57; Foreground sound (MPEG Audio Layer II) Audio sub channel 57; X-PAD AppType 12; DSCTy: Multimedia Object Transfer (MOT)
<b>Audio service 'NRK P2' (SId 0xf202), PTy 7: Culture</b> Primary Service component (Audio); SCIdS 0x0 MOT Slideshow	Audio sub channel 50; Foreground sound (MPEG Audio Layer II) Audio sub channel 50; X-PAD AppType 12; DSCTy: Multimedia Object Transfer (MOT)
<b>Audio service 'NRK P3' (SId 0xf203), PTy 10: Pop Music</b> Primary Service component (Audio); SCIdS 0x0 MOT Slideshow	Audio sub channel 51; Foreground sound (MPEG Audio Layer II) Audio sub channel 51; X-PAD AppType 12; DSCTy: Multimedia Object Transfer (MOT)
<b>Audio service 'NRK SÁMI RADIO' (SId 0xf205), no PTy code indicated</b> Primary Service component (Audio); SCIdS 0x0 MOT Slideshow	Audio sub channel 4; DAB+ audio Audio sub channel 4; X-PAD AppType 12; DSCTy: Multimedia Object Transfer (MOT)
<b>Audio service 'NRK NYHETER' (SId 0xf206), PTy 1: News</b> Primary Service component (Audio); SCIdS 0x0 MOT Slideshow	Audio sub channel 5; Foreground sound (MPEG Audio Layer II) Audio sub channel 5; X-PAD AppType 12; DSCTy: Multimedia Object Transfer (MOT)
<b>Audio service 'NRK mP3' (SId 0xf208), DTy: 10: Dan Music</b>	

FIGURE 3: ETI ANALYZER OF THE IZT DAB CONTENTSERVER

#### RDS Data Generator

File Format: FRAMED

DAB Mode: from ETI
 CBB scaling: 
 CBB Resolut:   
 12 bit   
 16 bit

Input:

Project:

Output directory:

gui v0.0.9999

FIGURE 4: OFFLINE TOOL TO GENERATE DAB IQ FILES FROM DIFFERENT ETI FORMATS

# Testing DAB Receivers Using ETI

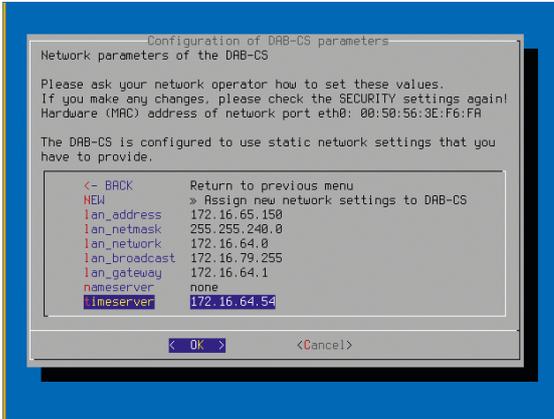


FIGURE 5: SETTING UP DAB CONTENTSERVER NETWORK SETTINGS INCLUDING NTP

## Offline Modulation from ETI Files

The option S1000-403 DAB Waveform includes a DAB Modulator which allows generating DAB IQ files from any ETI File format offline. The waveform is compatible to DAB, DAB+ and DMB. The IQ files can be loaded to the IZT S1000 RAM or streamed from the S1000 Memory Extension harddisk via LAN.

## Real-time Modulation

The DAB real-time modulator can use ETI files directly as input and can be configured multiple times in different VSGs (Virtual Signal Generators of the S1000).

The real-time DAB modulator is capable of dynamic reconfigurations, which is essential to support the full test range of the DAB standard. The powerful impairment features of the S1000 (including multipath fading and time variant profiles) can be applied to the real-time DAB modulator.

## REAL-TIME EDI STREAMING

The IZT S1000 can modulate DAB signals directly from incoming EDI/ETI streams received from the IZT DAB ContentServer in real-time via UDP at the S1000 Memory Extension or Memory Extension+. In combination with the IZT DAB ContentServer, a versatile laboratory setup can be achieved. The DAB real-time modulator option IZT S1000-203 and live EDI input option IZT S1000-203b enable a direct link between the IZT DAB ContentServer and the IZT S1000 with the EDI/ETI protocol.

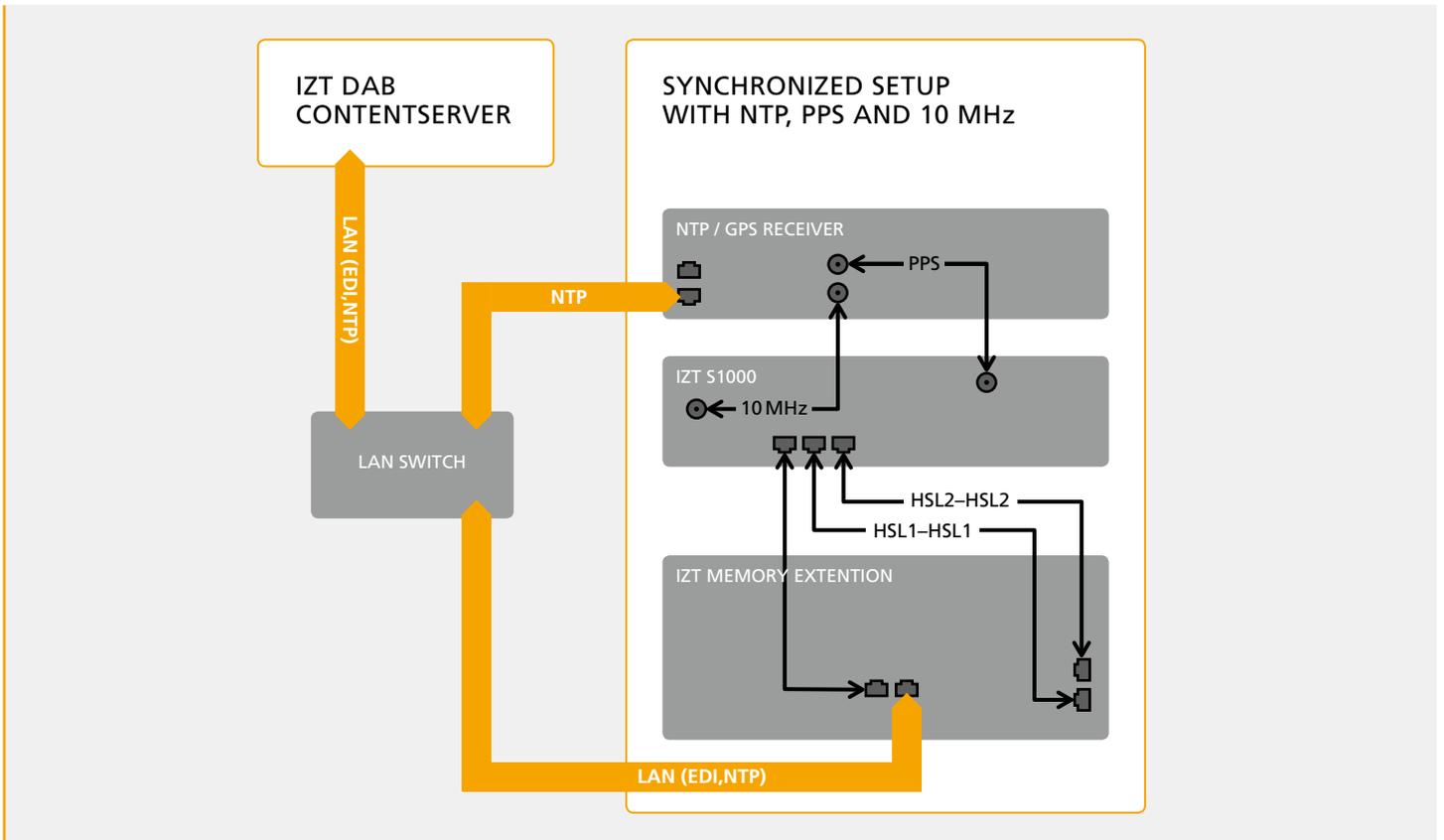


FIGURE 6: SYNCHRONIZED SETUP TO MULTIPLEX AND MODULATE DAB SIGNALS IN REAL-TIME

### Setup and Synchronization

Figure 6 shows a typical setup of the IZT DAB ContentServer, IZT S1000 and Memory Extension(+). The setup has to be synchronized. PPS or 10 MHz need to be provided to the IZT S1000, while Memory Extension(+) and DAB ContentServer are synchronized using NTP (Network Time Protocol). All synchronization sources are derived from the same device.

NTP synchronization can be configured at the system administration dialog of the DAB ContentServer (Figure 5). It has to be made sure that the network settings correspond to those of the setup, e.g. network and netmask include the IP addresses of the S1000.

The IZT Memory Extension and IZT S1000 use a configuration file for the NTP client and server functionality. The necessary tools for NTP are readily installed in a current release and running. To use the NTP Server (time server, Internet NTP, etc.) the configuration file needs to be adapted to the required needs (Figure 7).

The important Configuration Parameters are:

**10 MHz Reference: External** The 10 MHz is received from the Timeserver/ GPS at the external 10 MHz input. When it is received, the red **EXT** will change to the color white **EXT**. This indicates that the level and quality of the 10 MHz signal is sufficient.

**PPS Sync Source: External** In the case the PPS is derived from external, this is the way to set this parameter

### Multiplexer Output Configuration

The multiplexer output of the DAB ContentServer needs to be configured to send a unicast EDI stream to the S1000 where the EDI data is received and modulated.

The multiplexer output can be configured through the ContentServer's web interface. In the main menu, select "Broadcast Configuration" / "Multiplexer Output".

As shown in Figure 8, configure an output target with IP address and port of the corresponding S1000. Make sure that "EDI/DCP, no data protection (plain AF layer, no PFT)" is selected in the field "DCP Parameters" (expert parameter).

It is possible to create multiple Output Targets which can simultaneously address different VSGs, separate IZT S1000 or additional targets (e.g. a PC running

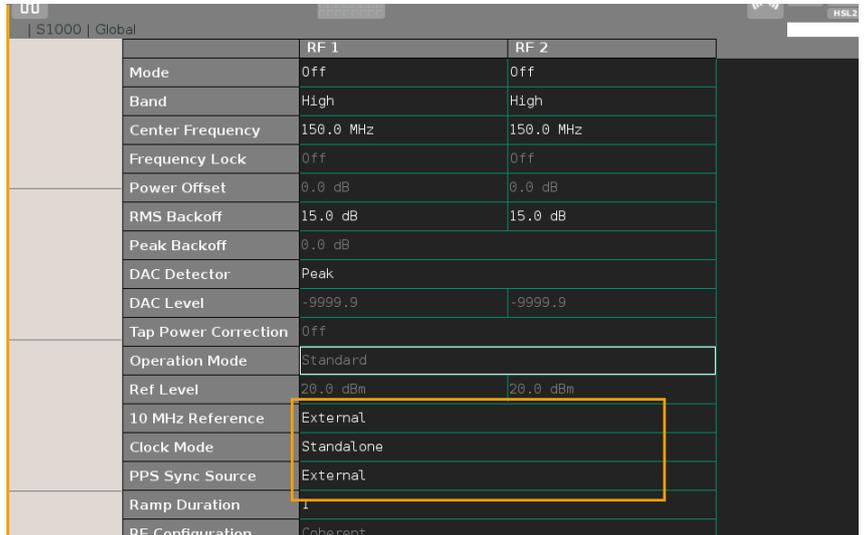


FIGURE 7: SETTING UP SYNCHRONIZATION SOURCES OF THE IZT S1000

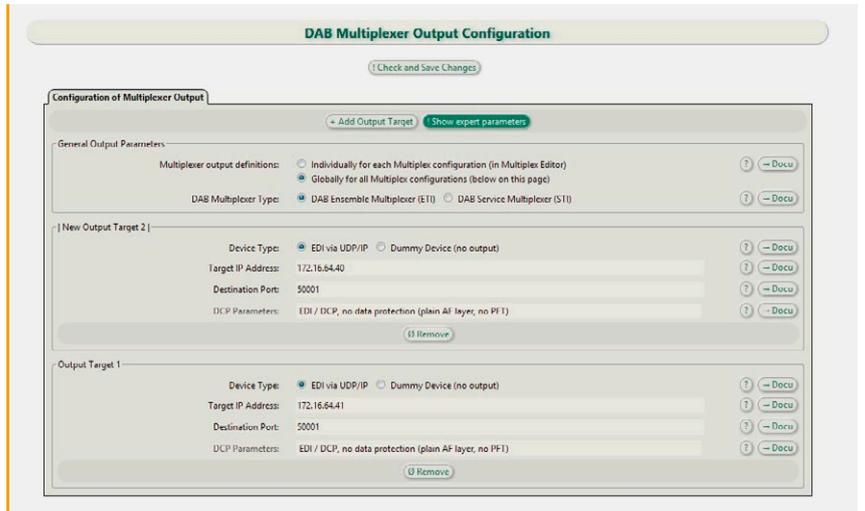


FIGURE 8: MULTIPLEXER OUTPUT CONFIGURATION OF THE IZT DAB CONTENTSERVER

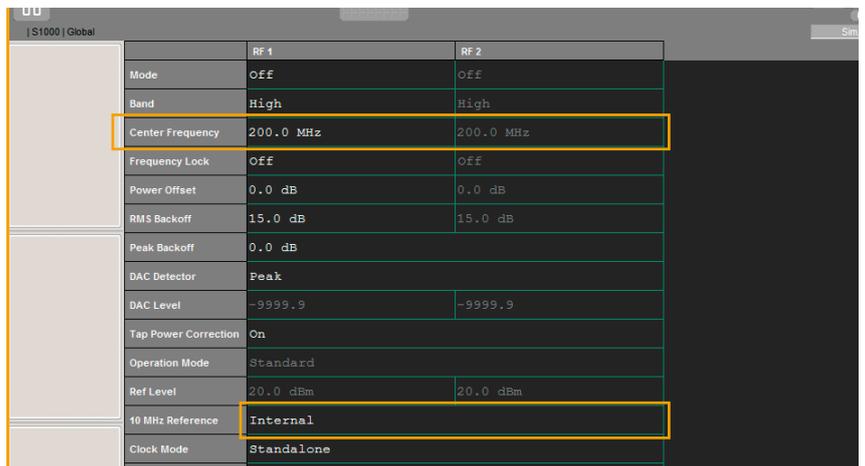


FIGURE 9: SETTING UP THE IZT S1000 FOR DAB MODULATION

# Testing DAB Receivers Using ETI

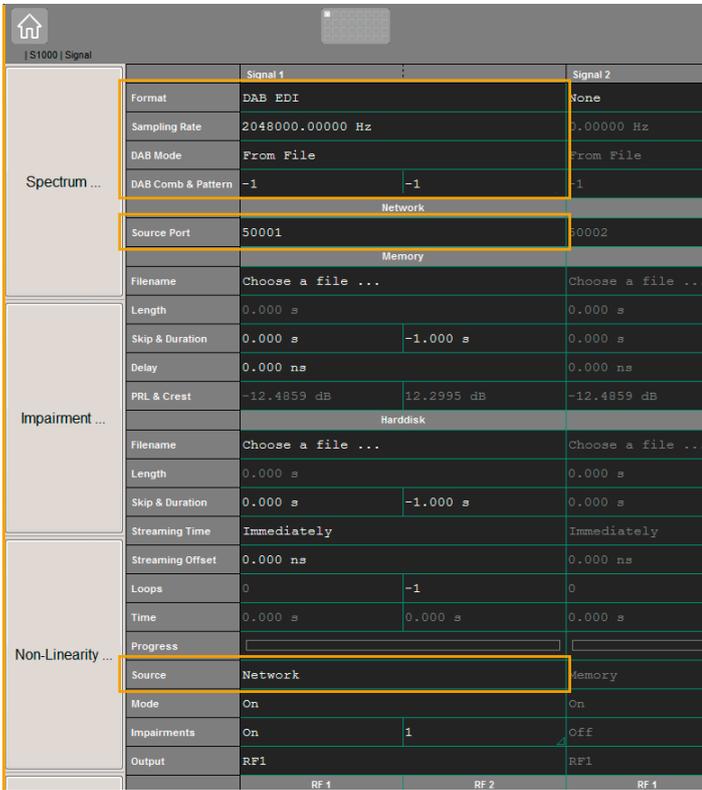


FIGURE 10: CONFIGURING THE EDI SOURCE

the IZT DAB MultimediaPlayer) in parallel. In the shown example, there are two output sections for different target IPs (in this case two separate IZT S1000).

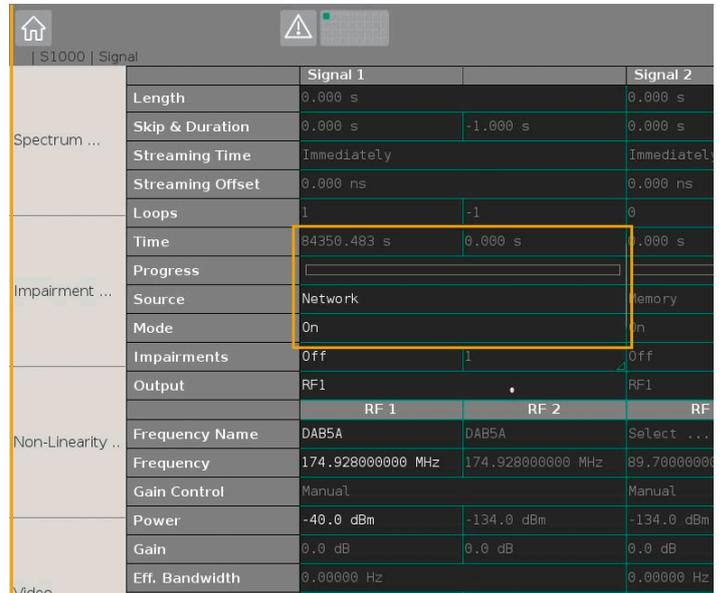


FIGURE 11: CONFIGURING THE EDI SOURCE (2)

## S1000 Settings

As shown in Figure 9 the center frequency of the RF output needs to be configured in the IZT GUI first. When the center frequency is configured, the Format, DAB Mode, DAB Comb and DAB Pattern can be configured (Figure 10).

In the Network settings of the individual VSG, the receiving port of the DAB ContentServer is configured (here 50001). In the last step, the Source is configured to Network.

When the EDI Streaming is running and DAB Modulation is activated, the Time parameter shows the time since the Signal generation has started.

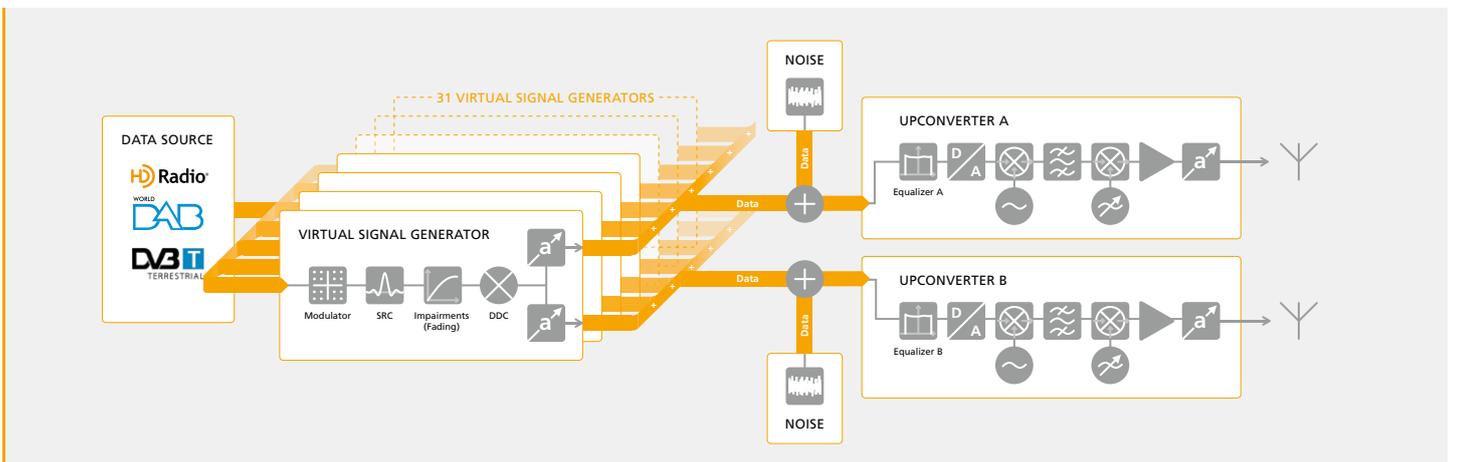


FIGURE 12: BLOCK DIAGRAM OF THE IZT S1000

## REQUIRED HARDWARE AND SOFTWARE OPTIONS

IZT S1000		
<b>Hardware options</b>	<b>IZT S1000-CHS</b>	Chassis and all digital hardware
	<b>IZT S1000-RF3</b>	RF output 9 kHz – 3 GHz
	<b>IZT S1000-RFS3</b>	RF synthesizer 3 GHz
	<b>IZT S1000 Memory Extension</b>	Enhances the IZT S1000 streaming capabilities to wideband signals; provides 2 x 12 TB storage capacity
	<b>IZT S1000 Memory Extension+</b>	Enhances the IZT S1000 streaming capabilities to wideband signals; provides 2 x 9 TB storage capacity with fault tolerance (Alternative to above)
<b>Software options</b>	<b>IZT S1000-GUI</b>	Graphical User Interface
	<b>IZT S1000-110</b>	One Virtual Signal Generator VSG; up to 31 VSGs are possible (one per DAB signal to be generated)
	<b>IZT S1000-120</b>	Streaming input; high-speed LAN streaming, 2 Gbit ports for streaming data
	<b>IZT S1000-203</b>	DAB real-time modulator (Required to support real-time modulation)
	<b>IZT S1000-203b</b>	Live EDI input for IZT S1000-203 (Required to support EDI streaming)
	<b>IZT S1000-403</b>	DAB modulator (Required to support offline IQ modulation)
IZT DAB ContentServer*		
<b>Editions for Receiver Development and Testing</b>	<b>IZT DABCS-060</b>	DAB ContentServer Developer Edition
<b>Typical Options</b>	<b>IZT DABCS-201</b>	DAB Audio Encoder (one per DAB audio service)
	<b>IZT DABCS-202</b>	DAB+ Audio Encoder (one per addtl. DAB+ audio service, one included)

\*Software based on Fraunhofer technology. Hardware according to customer needs.

## CONCLUSIONS

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. The ETI Analyzer is a powerful tool to analyze and convert ETI files.

## REFERENCES

- [1] ETS 300 799 Digital Audio Broadcasting (DAB); Distribution interfaces; Ensemble Transport Interface (ETI)
- [2] TS 102 693 Digital Audio Broadcasting (DAB); Encapsulation of DAB Interfaces (EDI)
- [3] WorldDAB ETI Library:  
<https://www.worlddab.org/membership/eti-library>

