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



The IZT \$1000 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 \$1000. The possibility to directly link the multiplexer output of the IZT DAB ContentServer with the IZT \$1000 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 realtime modulator is capable of full ETI reconfigurations. The live EDI input option S1000-203b provides an interface for receiving 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 \$1000.

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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.

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Programme Guide): User Applic	ormation) / EPG (Electronic		
	Programme Guide); User Application data is 01 02: Basic profile;		
Advanced profile			
/ Audio service 'NRK P1' (SId 0xf201), P1			
Primary Service component (Audio);	SCIdS 0x0	Audio sub channel 57; Foreground sound (MPEG Audio Layer II)	
MOT Slideshow		Audio sub channel 57; X-PAD AppType 12;	
		DSCTy: Multimedia Object Transfer (MOT)	
Audio service 'NRK P2' (SId 0xf202), P1	Ty 7: Culture		
Primary Service component (Audio);	SCIdS 0x0	Audio sub channel 50; Foreground sound	
MOT Slideshew		Audio cab shapped 50: X DAD AppTrove 12:	
WOT SITUESNOW		DSCTv: Multimedia Object Transfer (MOT)	
Audio service 'NRK P3' (SId 0xf203), P	Ty 10: Pop Music	,	
Primary Service component (Audio);	SCIdS 0x0	Audio sub channel 51; Foreground sound	
		(MPEG Audio Layer II)	
MOT Slideshow		Audio sub channel 51; X-PAD AppType 12;	
		DSCTy: Multimedia Object Transfer (MOT)	
Audio service 'NRK SAMI RADIO' (SId (0xf205), no PTy code indicated		
Primary Service component (Audio);	SCIdS 0x0	Audio sub channel 4; DAB+ audio	
MOT Slideshow		Audio sub channel 4; X-PAD AppType 12;	
	206) DT. 1 News	DSCTY: Multimedia Object Transfer (MOT)	
Primer Control of Cont	coo), PTy I: News	And a share of S. Samerand	
Primary Service component (Audio);	SCIDS UXU	(MPEG Audio Layer II)	
MOT Slideshow		Audio sub channel 5; X-PAD AppType 12;	



FIGURE 3: ETI ANALYZER OF THE IZT DAB CONTENTSERVER

zi RDS Data	Generator 🥘	8
RDS AM	A DAB-MOD DAB mux DAB+ mux DMB mux DVB-T About	
	File Format FRAMED	
	DAB Mode from ETI CBB scaling CBB scaling C12 bit	
	Input Browse	
	Project	
	Output directory Browse	
	gui v0.0.9999 START	

FIGURE 2: RECORDING ETI FILES WITH IZT DAB CONTENTSERVER

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



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 \$1000).

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 \$1000 can modulate DAB signals directly from incoming EDI/ETI streams received from the IZT DAB ContentServer in real-time via UDP at the \$1000 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 \$1000-203 and live EDI input option IZT \$1000-203b enable a direct link between the IZT DAB ContentServer and the IZT \$1000 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 \$1000 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 \$1000 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

	1			HSL2
51000 Glot		RF 1	RF 2	
	Mode	Off	Off	
	Band	High	High	
	Center Frequency	150.0 MHz	150.0 MHz	
	Frequency Lock			
	Power Offset			
	RMS Backoff	15.0 dB	15.0 dB	
	Peak Backoff	0.0 dB		
	DAC Detector	Peak		
	DAC Level			
	Tap Power Correction			
	Operation Mode	Standard		
	Ref Level	20.0 dBm	20.0 dBm	
	10 MHz Reference	External		
	Clock Mode	Standalone		
	PPS Sync Source	External		
	Ramp Duration	1		
	RF Configuration	Coherent		

FIGURE 7: SETTING UP SYNCHRONIZATION SOURCES OF THE IZT S1000

	[Check and Save Changes]	
	(reneed and safe changes)	
Configuration of Multiplexer Output		
	+ Add Output Target Show expert parameters	
General Output Parameters		
Multiplexer output definitions:	 Individually for each Multiplex configuration (in Multiplex Editor) Globally for all Multiplex configurations (below on this page) 	?) (-Docu
DAB Multiplexer Type:	OAB Ensemble Multiplexer (ETI) O DAB Service Multiplexer (STI)	() - Docu
New Output Target 2		
Device Type:	EDI via UDP/IP O Dummy Device (no output)	(?) (-Docu
Target IP Address:	172.16.64.40	() -Docu
Destination Port:	50001	?) - Docu
DCP Parameters	EDI / DCP, no data protection (plain AF layer, no PFT)	(?) - Docu
	Ø Remove)	
Output Target 1		
Device Type:	EDI via UDP/IP O Dummy Device (no output)	?) - Docu
Target IP Address:	172.16.64.41	(?) (-Docu
Destination Port:	50001	(?) (- Docu
DCP Parameters:	EDI / DCP, no data protection (plain AF layer, no PFT)	? - Docu
	(Ø Remove)	

FIGURE 8: MULTIPLEXER OUTPUT CONFIGURATION OF THE IZT DAB CONTENTSERVER

I STODO Global					
		RF 1	RF 2		
	Mode	Off			
	Band	High	High		
	Center Frequency	200.0 MHz	200.0 MHz		
	Frequency Lock	Off	Off		
	Power Offset	0.0 dB			
	RMS Backoff	15.0 dB			
	Peak Backoff	0.0 dB Feak			
	DAC Detector				
	DAC Level				
	Tap Power Correction	On			
	Operation Mode				
	Ref Level	20.0 dBm	20.0 dBm		
	10 MHz Reference	Internal			
	Clock Mode	Standalone			

FIGURE 9: SETTING UP THE IZT S1000 FOR DAB MODULATION

<u>ଜ</u>				
S1000 Signal			:	
	F+	Signal 1	ï	Signal 2
	rormat	DAB EDI		None
	Sampling Rate	2048000.00000 Hz		D.00000 Hz
	DAB Mode	From File		From File
Spectrum	DAB Comb & Pattern	-1	-1	-1
		Net	work	
	Source Port	50001		50002
		Mer	mory	
	Filename	Choose a file		Choose a file
	Length	0.000 s		0.000 s
	Skip & Duration	0.000 s	-1.000 s	0.000 s
	Delay	0.000 ns		0.000 ns
	PRL & Crest	-12.4859 dB		
Impairment		Harr	ldisk	
	Filename	Choose a file		
	Length	0.000 s		
	Skip & Duration	0.000 s	-1.000 s	
	Streaming Time	Immediately		
	Streaming Offset	0.000 ns		
	Loops	0		
	Time	0.000 s		
Non Linearity	Progress]	
	Source	Network		Memory
	Mode	On		On
	Impairments	On		
	Output	RF1		RF1
		RE 1	RF 2	RF 1

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 seperate IZT \$1000).

\bigtriangleup				
[[1] S1000 Siar	al			
		Signal 1		Signal 2
	Length	0.000 s		
Spectrum	Skip & Duration	0.000 s		
Spectrum	Streaming Time	Immediately		
	Streaming Offset	0.000 ns		
	Loops	1	-1	0
	Time	84350.483 s	0.000 s	0.000 s
	Progress			
Impairment	Source	Network	Network	
	Mode	0n		0n
	Impairments	Off	1	Off
	Output	RF1		
		RF 1	RF 2	RI
Non-Linearity	Frequency Name	DAB5A		
	Frequency	174.928000000 MHz		
	Gain Control	Manual		
	Power	-40.0 dBm		
	Gain	0.0 dB		
Video	Eff. Bandwidth	0.00000 Hz		

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		
Hardware options	IZT S1000-CHS	Chassis and all digital hardware
	IZT S1000-RF3	RF output 9 kHz – 3 GHz
	IZT S1000-RFS3	RF synthesizer 3 GHz
	IZT S1000 Memory Extension	Enhances the IZT S1000 streaming capabilities to wideband signals; provides 2 x 12 TB storage capacity
	IZT S1000 Memory Extension+	Enhances the IZT S1000 streaming capabilities to wideband signals; provides 2 x 9 TB storage capacity with fault tolerance (Alternative to above)
Software options	IZT S1000-GUI	Graphical User Interface
	IZT \$1000-110	One Virtual Signal Generator VSG; up to 31 VSGs are possible (one per DAB signal to be generated)
	IZT \$1000-120	Streaming input; high-speed LAN streaming, 2 Gbit ports for streaming data
	IZT \$1000-203	DAB real-time modulator (Required to support real-time modulation)
	IZT \$1000-203b	Live EDI input for IZT S1000-203 (Required to support EDI streaming)
	IZT \$1000-403	DAB modulator (Required to support offline IQ modulation)
IZT DAB ContentServe	r*	
Editions for Receiver Development and Testing	IZT DABCS-060	DAB ContentServer Developer Edition
Typical Options	IZT DABCS-201	DAB Audio Encoder (one per DAB audio service)
	IZT DABCS-202	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



INNOVATIONSZENTRUM FÜR TELEKOMMUNIKATIONSTECHNIK GMBH IZT AM WEICHSELGARTEN 5 · 91058 ERLANGEN, GERMANY GENERAL MANAGER: RAINER PERTHOLD · TEL: +49 (0)9131 9162-0 · FAX: -190 · SALES@IZT-LABS.DE · WWW.IZT-LABS.DE