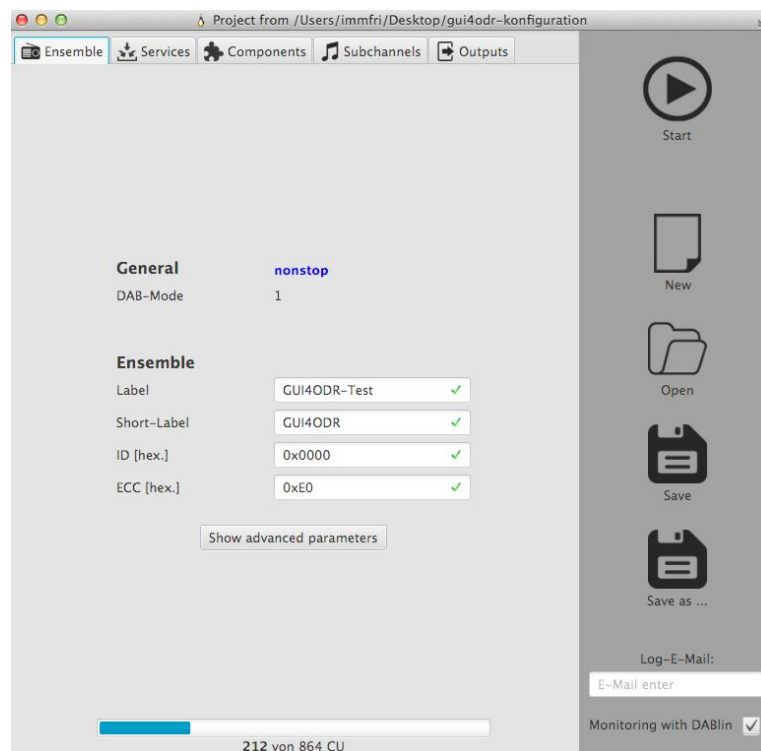


# User Guide of the Graphical User Interface (GUI) for the ODR-mmbTools

## GUI4ODR

- GNU GPL v3 -



Version 0.8 (2017-14-04)

## Table of Contents

<b>1</b>	<b>Contents.....</b>	<b>3</b>
<b>2</b>	<b>Introduction.....</b>	<b>4</b>
<b>3</b>	<b>System requirements.....</b>	<b>5</b>
3.1	Hardware .....	5
3.2	Software .....	5
<b>4</b>	<b>Preparation.....</b>	<b>6</b>
4.1	Linux-Software.....	6
4.2	Java Runtime Environment (JRE) .....	6
4.3	Monitoring.....	6
4.4	Mail-Service.....	7
4.5	Remote.....	7
4.6	GUI4ODR .....	7
<b>5</b>	<b>Commissioning.....</b>	<b>8</b>
5.1	Overview of the GUI.....	8
5.2	Configuration.....	10
5.2.1	Workspace - Ensemble .....	11
5.2.2	Workspace - Services .....	12
5.2.3	Workspace - Components .....	12
5.2.4	Workspace - Sub-channels.....	12
5.2.5	Workspace - Outputs .....	14
5.3	Execution .....	18
5.3.1	Error message .....	19
5.3.2	Monitoring .....	20
5.3.3	Remote control .....	21
<b>6</b>	<b>Appendix.....</b>	<b>22</b>
6.1	Contry ID und ECC.....	22
6.2	Programme Type.....	23
6.3	Language code.....	24
6.4	UA-Type.....	25
6.5	Service Component Types .....	26
<b>7</b>	<b>More Information.....</b>	<b>27</b>
7.1	GUI4ODR: .....	27
7.2	ODR-mmbTools.....	27
7.3	Additional application.....	27
7.4	Technical reports .....	27

## 1 Contents

The open-source software GUI4ODR is an intuitive user interface for the ODR-mmbTools from the organization OpenDigitalRadio.org. With the graphical application can be used to simplify configured the Multiplex of DAB - Digital Radio Broadcasting includes Audioencoding and Modulation. With a correct configuration, this can be executed. During operation, GUI4ODR monitors the running processes. If a task fails, the user is notified.

With the small-scale DAB-Transmitter for local broadcasting, GUI4ODR offers a low-cost alternative to the reliable transmission of DAB radio.

*Created by Immanuel Friedrichsen*

## 2 Introduction

The application – GUI4ODR – allows a graphical configuration of the DAB ensemble based on the ODR-mmbTools.

Tools consist of...

- a **DAB multiplexer** (*ODR-DabMux*),
- a **DAB modulator** (*ODR-DabMod*),
- the **audio encoder** (*ODR-AudioEnc*) und
- the **program associated data encoder** (*ODR-PadEnc*).

The software-based DAB receiver – DABlin - is used to monitor the multiplex data during operation. Optionally, the audio output of DABlin can be visualized using the application Pavumeter.

In addition, a remote software, e.g. Teamviewer the system is supervised and controlled.



For using and to configure of the software requires the expertise of DAB and basic knowledge about the ODR-mmbTools and Linux.

GUI4ODR offers the following functionalities:

- **Configure** the multiplexer and modulator
- **Execute** the complete configuration
- **Monitoring** all running tools

## 3 System requirements

### 3.1 Hardware

An onboard graphics card is completely sufficient for displaying the GUI. No special hardware requirements are necessary for the **configuration**. The hardware should be designed accordingly for **operation** mode.



In mobile use without any special demands on audio, a notebook with integrated sound card can be used!

### 3.2 Software

The application is completely supported under Linux. With other OS (Windows, Mac OS) only the configuration can be created and edited.

The following ODR-mmbTools versions are required for execution:

- ODR-DabMux >= **v1.1.0**
- ODR-DabMod >= **v0.5.4**
- ODR-AudioEnc >= **v2.0.0**
- ODR-PadEnc >= **v2.0.0**



Best of all, the recent version at <https://github.com/Opendigitalradio> installed!



If USRP devices are used, the drivers (UHD<sup>1</sup>) must be properly installed and configured.

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<sup>1</sup> <https://github.com/Opendigitalradio/uhd> (2017-03)

## 4 Preparation

Before GUI4ODR can be started, the system must be prepared.



All steps should be undertaken by the expert.

### 4.1 Linux-Software

For the application GUI4ODR as well as the ODR-mmbTools necessary in the following software components:

- **VLC**-Media player
- **JACK**, for graphical control: **QJackCtl**
- Optional: **MPlayer**

### 4.2 Java Runtime Environment (JRE)

The Java Runtime Environment (JRE) and the additional JavaFX framework must be installed to run GUI4ODR.

For Installation, the following versions are required:

- Java JRE: 1.8.0 (jre-8uXXX)



Instructions and help for installation:

[http://docs.oracle.com/javase/8/docs/technotes/guides/install/install\\_overview.html](http://docs.oracle.com/javase/8/docs/technotes/guides/install/install_overview.html)

### 4.3 Monitoring

If a check of the multiplex is required the DAB receiver **DABlin**<sup>2</sup> must be downloaded and installed. The **Pavumeter**<sup>3</sup> software can be installed for viewing the level meter of the audio output.

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<sup>2</sup> <https://github.com/Opendigitalradio/dablin> (2017-03)

<sup>3</sup> <http://0pointer.de/lennart/projects/pavumeter/> (2017-03)

#### 4.4 Mail-Service

The mail service **mail** on Linux must be installed for the notification via e-mail. After installation, the client must be linked to a valid e-mail account. The mail service is then ready for operation.

#### 4.5 Remote

E.g. **TeamViewer**<sup>4</sup> can be used for the remote software. The user can also execute the simple installation.

#### 4.6 GUI4ODR

Under the link <https://github.com/immfri/gui-dab-odrTools> the JAR file gui4odr-v0.7.jar can be downloaded for execution of the GUI.

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<sup>4</sup> <https://www.teamviewer.com/en/> (2017-03)

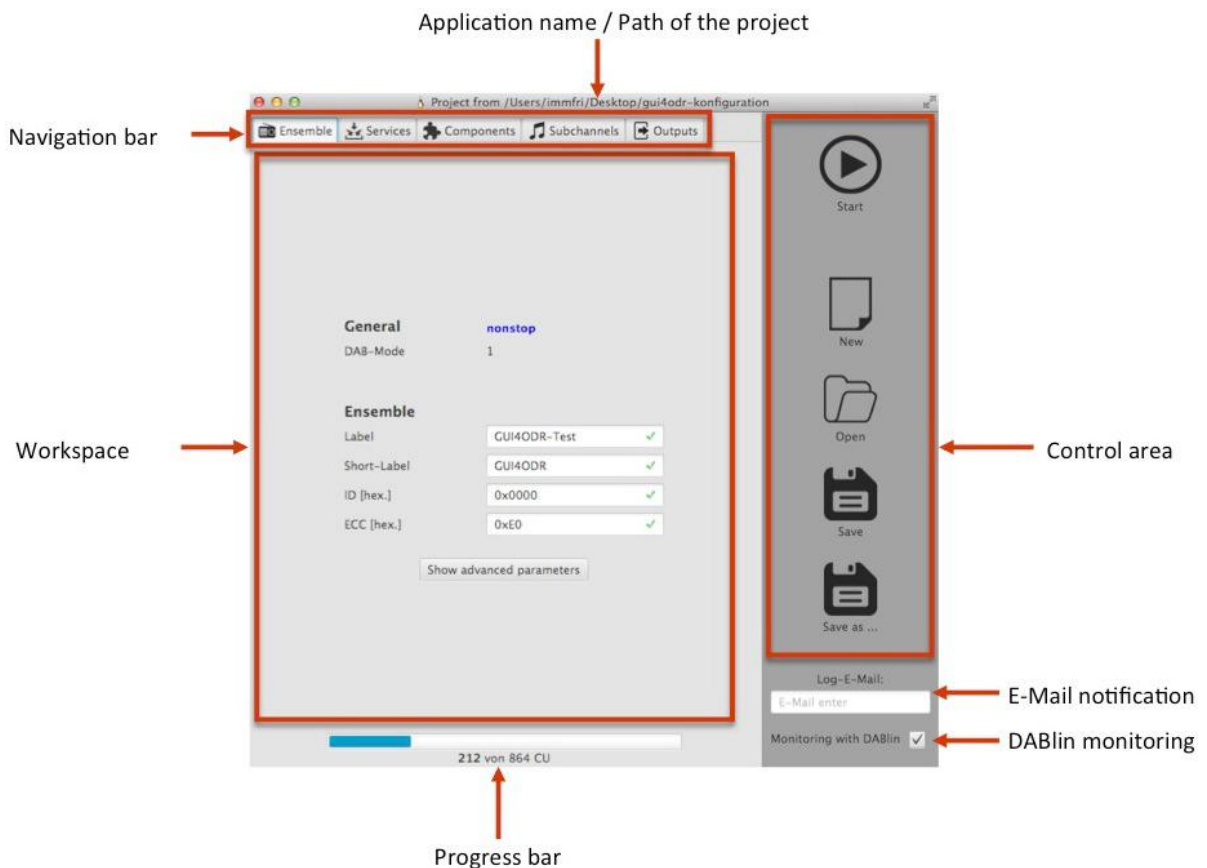
## 5 Commissioning

After a successful installation of all necessary software components the application GUI4ODR can be started.



The executable bit should be set under the properties, with a right-click on the application. Then GUI4ODR is started with a double-click.

### 5.1 Overview of the GUI





### **Application name/Path of the project**

The name of the program or the path is displayed when a project is loaded.

### **Navigation bar**

The workspaces can be changed with the tab bar. Each section of the multiplex configuration is split into separate tabs.

### **Workspace**

In this area, the configuration is implemented.

### **Control area**

This area contains all control elements of the application.

### **E-Mail notification**

This field displays the recipient's e-mail address for notifications.

### **DABlin monitoring**

With the checkbox, DABlin is activated in the execution.

### **Progress bar**

The progress bar shows the occupied and free memory requirements of the multiplex.

## 5.2 Configuration

The configuration of the multiplex, including the modulators, is done in a project folder.



### Create new project

The "New-Button" creates a new and empty configuration. The previous configuration of the project is lost.



### Open project

The "Open-Button" can be used to load a complete project from a folder into the application. The previous configuration also will be lost.



### Save project

With "Save-Button" the current status of the configuration can be saved under the project path. The old project is certainly overwritten.



### Projects save as...

The "Save as..." button is used when newly created configuration or the current configuration is to be stored under a different path.



The new project requires creating or selecting a free folder. This is now the project folder of the complete configuration.

## Change view of workspace

Show advanced parameters

The button labeled "Show advanced / basic parameters" can show or hide advanced parameters in the workspace.

Show basic parameters

## Add/Remove Components

+ Add Service

The "+ Add..." button can be used to add new components to the corresponding category. With the button "- Remove..." open components can be deleted.

- Remove Service

## Validate input



The icons in the text field provide information about correct or incorrect input.



All the names of the list components must be unique.

### 5.2.1 Workspace - Ensemble

The Ensemble workspace contains general settings for the DAB multiplexer. Global parameters of the ensemble are also defined.

General	
DAB-Mode	1
ETI-Frames	0
Telnet-Port	0
Management-Port	0
Logging to syslog	<input type="checkbox"/>
Timestamp	<input type="checkbox"/>
SCCA-Field Writing	<input type="checkbox"/>
Ensemble	
Label	ODR2go
Short-Label	ODR
ID [hex.]	0x1234
ECC [hex.]	0xE0
International-Table	1
Local-Time-Offset [h]	auto

- DAB Transmission mode (1-4), default 1
- Number of ETI-Frames to generate, 0 for continuous operation
- Port of remote control telnet server, 0 for disable
- Port of management server, 0 for disable
- Disable/Enable logging to syslog
- Disable/Enable timestamp definition (necessary for SFN)
- Disable/Enable writing the SCCA field, useful for the Factum ETI analyzer
- Ensemble label, max. 16 characters
- Ensemble short label, max. 8 exactly chars from label in same sequence!
- Ensemble-ID, 4 Hex. numbers
- Country code, 2 Hex. numbers, 0xE0 for Germany (Appendix 6.1)
- Int. Table identification, 2 for North America, else 1
- Local time offset in ETI-Multiplex

## 5.2.2 Workspace - Services

The configuration of the services in multiplex is created and edited as lists in the workspace.

+ Add Service
- Remove Service

▶ Service: serv-bigfm-live

▶ Service: serv-bigfm-edm

▶ Service: serv-bigfm-deutschRap

▼ Service: serv-information

Name	serv-information	✓	
Label	Information	✓	
Short-Label	Info	✓	
Programme-Type [dec.]	3		
Language [hex.]	0x08	✓	
ID [hex.]	0x0001	✓	

← Service element, Press to show/hide

← Service name for unique identification

← Service label, max. 16 characters

← Service short label, max. 8 exactly chars from label in same sequence!

← Program type (0-31), 0 for none (Appendix 6.2)

← Program language, 2 Hex. numbers, 0x08 for german (Appendix 6.3)

← Service-ID, 4 Hex. numbers, optional

## 5.2.3 Workspace – Components

The components of the multiplex are created and edited in this workspace. The associated services and sub-channels are linked to each other in the respective component.

▼ Component: comp-information

Name	comp-information	✓	
Service			
Subchannel			
UA-Type [hex.]	0x002	✓	
Type [dec.]	0		
ID [hex.]	0x001	✓	

← Component element, Press to show/hide

← Component name for unique identification

← Select Service to component

← Select Sub-channel to component

← User application type, 3 Hex. numbers, 0x002 for the use of Slideshows (Appendix 6.4)

← Component type (0-63), default 0 (Appendix 6.5)

← Component-ID, 3 Hex. numbers, optional

## 5.2.4 Workspace – Sub-channels

In this workspace all required sub-channels are created for the ensemble. It is possible to configure audio or data sub-channels, program associated data in the audio program is transmitted called PAD.

### 5.2.4.1 Data Sub-channel

DAB+ Subchannel: subch-data		← Sub-channel element, Press to show/hide
Name	subch-data ✓	← Sub-channel name for unique identification
Type	Data ▼	← Sub-channel type (data, packet, enhanced packet mode)
Source	File ▼	← Sub-channel source, only file sources possible
File	no Data-File ✗	← File path, relative or absolute path specification possible
Bitrate [kbit/s]	16 ▼	← Sub-channel Bitrate (8-192), default 16
Protection Level	3-A ▼	← Sub-channel Protection level, from 1-A high to 4-A low protection
ID [dec.]	no ID ✓	← Sub-channel ID (0-63), optional

### 5.2.4.2 Audio Sub-channel

DAB Subchannel: subch-mp2		← Sub-channel element, Press to show/hide
Name	subch-mp2 ✓	← Sub-channel name for unique identification
Type	MP2-Audio ▼	← Sub-channel type (MP2-Audio for DAB, AAC-Audio for DAB+)
Source	Webstream ▼	← Sub-channel source (Webstream, ALSA (1), JACK (2))
URL	no URL	← Path of the source, URL address of Webstream, Name of ALSA-Interface or JACK-Client
Bitrate [kbit/s]	96 ▼	← Sub-channel Bitrate (MP2: 32-384, AAC: 8-192)
Protection Level	1 ▼	← Sub-channel Protection level, smaller the value => higher the protection
Samplerate	48000 ▼	← Audio Sample rate per sec. (32000, 48000), default 48000
Channel	2 ▼	← Audio Channel (1 for mono, 2 for stereo), default 2
Drift-Compensation	<input type="checkbox"/>	← Disable/Enable audio drift compensation, default disable

#### (1) ALSA:

If the audio input is to be used via the sound card, the - Advanced Linux Sound Architecture (ALSA<sup>5</sup>) can be used as an interface.

#### (2) JACK:

The JACK<sup>6</sup> - Audio Connection Kit - is a sound server under Linux by audio inputs and outputs can be routed. If an audio signal is to be processed in real-time (e.g. with effects) the JACK input is to be used.

<sup>5</sup> Help under <https://wiki.ubuntuusers.de/ALSA/> (2017-03)

<sup>6</sup> Help under <https://wiki.ubuntuusers.de/JACK/> (2017-03)

## Other parameters:

ZeroMQ:	
Buffer	40
Prebuffer	20
Encryption	<input checked="" type="checkbox"/>
Secret-Key	no File <input type="button" value="Browse"/>
Public-Key	no File <input type="button" value="Browse"/>
Encoder-Key	no File <input type="button" value="Browse"/>
ID [dec.]	no ID <input checked="" type="checkbox"/>

Maximum size of audio input buffer in ZeroMQ, default 40  
 Maximum size of pre-buffer, default 20  
 Disable/Enable ZeroMQ encryption, default disable  
 Path of secret-key File from multiplexer (keep this file secret!)  
 Path of public-key File from multiplexer (keep this file secret!)  
 Path of public key file from encoder  
 Sub-channel ID (0-63), optional

### 5.2.4.3 Program associated data (PAD)

PAD:	
PAD-Length [bytes]	58
Dynamic Label	<input checked="" type="checkbox"/>
DLS-Textfile	no File <input type="button" value="Browse"/>
Charset-Encoding	UTF-8
RAW-DLS	<input type="checkbox"/>
Remove-DLS	<input type="checkbox"/>
MOT-Slideshow	<input checked="" type="checkbox"/>
Delay [sec.]	10
Image-Folder	no Folder <input type="button" value="Browse"/>
RAW-Slides	<input type="checkbox"/>
Erase-Slides	<input type="checkbox"/>

PAD length in bytes (8-196), default 58  
 Disable/Enable Dynamic Label Segment  
 Path of DLS Text file, relative or absolute path specification possible  
 Charset encoding (UTF-8, EBU Latin, UCS-2 BE), default UTF-8  
 Disable/Enable to send always the DLS Remove Label, default disable  
 Disable/Enable convert the DLS Text to EBU Latin repertoire, default disable  
 Disable/Enable Slideshow  
 Delay seconds between each slide, default 10  
 Path of Image folder, relative or absolute path specification possible  
 Disable/Enable integrity checks and resizing slides is skipped, default disable  
 Disable/Enable erase slides from directory after transmit, default disable

### 5.2.5 Workspace – Outputs

The output of the multiplexed signal can be configured in the output tab. In addition, the multiplex can be converted in I/Q samples for the OFDM transmission using the DAB modulator and then broadcast with the USRP devices.

+ Add Output ▼	
Device	Output with the <b>ETI card</b> or to the <b>USRP devices</b>
File	<b>ETI or I/Q-Samples</b> output save to a <b>file</b>
Network	Transfer the output stream via the <b>network</b>

- UDP/TCP Protocol (Uni- or Multicast)
- EDI
- ETI or I/Q-Samples



Multiple outputs can be operated simultaneously!

### 5.2.5.1 Device: ETI-Card

▼ Output: out-eti-card

Name	out-eti-card ✓	← Output name for unique identification
Device	FarSync ▼	← Select device (FarSync, Ettus USRP), here FarSync
Source	sync0	← Name of device interface, default sync0

### 5.2.5.2 Device: USRP

▼ Output: out-usrp-b100

Name	out-usrp-b100 ✓	← Output name for unique identification
Device	Ettus USRP ▼	← Select device (FarSync, Ettus USRP), here Ettus USRP
Type	B100 Series ▼	← Select device type (B100, B200, USRP1, USRP2)
DAB-Channel	12A ▼	← DAB channel
Frequenz [kHz]	223936000	← Frequency in Hz
TX-Gain	0 10 20 31	← RF output power in dB
Ref.Clock-Source	internal ▼	← Reference clock source (intern, extern, MIMO, gpsdo, gpsdo-ettus)
PPS-Source	none ▼	← PPS source (none, extern, MIMO, gpsdo)
Master-Clockrate	32768000	← Master clock rate in Hz
<b>Delaymanagement</b>		
Synchronous	<input type="checkbox"/>	← Disable/Enable timestamp for SFN, default disable
Mute-No-Timestamp	<input type="checkbox"/>	← Disable/Enable mute if no-timestamp exist, default disable
Offset	0.0 ✓	← Delay offset for SFN in seconds
<b>Modulator</b>		
Gain-Mode	2 ▼	← Modulator gain mode (0-2), 2 for DAB operation
Sample-Rate	2048000	← Sample rate at the RF signal in Hz, default 2048000
Digital-Gain	0 1 2 3 4 5 6	← Digital gain
FIR-Filter	<input checked="" type="checkbox"/>	← Disable/Enable FIR-Filter used to create a better spectral quality
Filtertaps-File	no File ✗ Browse	← Path of the filter taps file

## Global modulator parameters:

Remote Control	
Telnet-Port	0 <input type="checkbox"/>
ZeroMQ-Port	0 <input type="checkbox"/>
Logging	
Syslog	<input type="checkbox"/>
Filelog	<input checked="" type="checkbox"/>
File	/dev/stderr <input type="checkbox"/> <input type="button" value="Browse"/>
ETI-Input	
Frames-Queue	100

Port of remote control telnet server for Modulator, 0 for disable

Port of zmq remote control server for Modulator, 0 for disable

Disable/Enable logging to syslog, default disable

Disable/Enable logging to file, default disable

Path of log file from Modulator

Maximum of ETI frames can be queued, default 100

### 5.2.5.3 File

Output: out-file-eti	
Name	out-file-eti <input type="checkbox"/>
Type	ETI <input type="button" value="v"/>
File	/dev/stdout <input type="checkbox"/> <input type="button" value="Browse"/>
Format	raw <input type="button" value="v"/>

Output name for unique identification

Select file type (ETI, I/Q-Samples), here ETI

Path of ETI file, relative or absolute path specification possible

Select file format

- for ETI (raw, streamed, framed), default raw

- for I/Q-Samples (complexf, s8), default complexf



For the modulator configuration of the "I/Q-Samples" file type, see previous section 5.2.5.2!



#### 5.2.5.4 Network: EDI

▼ Output: out-net-edi

Name	out-net-edi ✓	← Output name for unique identification
Protocol	UDP	← Select protocol (UDP, TCP), here UDP
Service	EDI	← Select service (EDI, none), here EDI
Destination	10.10.10.10 ✓ : 12000	← Destination-IP-Address and Port
Multicast	<input checked="" type="checkbox"/>	← Disable/Enable Multicast, default disable
Source	192.168.0.1 ✓ : 13000 ✓	← Source-IP-Address and Port
TTL	1	← Range of Multicast packets
PFT-Subsystem	<input checked="" type="checkbox"/>	← Disable/Enable PFT system, default enable
FEC	2	← FEC value (0-9), default 2
Interleaver	0	← Number of delayed ETI frames, default 0
Chunk-Length	207	← Length of Reed-Solomon-Chunks in bytes, default 207
Dump	<input type="checkbox"/>	← Disable/Enable save sending packets under <i>./edi.debug</i> , default disable
Verbose	<input type="checkbox"/>	← Disable/Enable print more info in debug, default disable
Tagpacket-Alignment	0	← Set the alignment of tag packet, default 0

#### 5.2.5.5 Network: ETI over UDP/TCP

▼ Output: out-net-udp-eti

Name	out-net-udp-eti ✓	← Output name for unique identification
Protocol	UDP	← Select protocol (UDP, TCP), here UDP
Service	none	← Select service (EDI, none), here none
Destination	10.10.10.10 ✓ : 12000	← Destination-IP-Address and Port
Multicast	<input checked="" type="checkbox"/>	← Disable/Enable Multicast, default disable
Source	192.168.0.1 ✓ :	← Source-IP-Address
TTL	1	← Range of Multicast packets



The configuration for TCP is equivalent to this. <TCP> is selected under Protocol and <ETI-none> is selected as a service!

### 5.2.5.6 Network: ZeroMQ

The transport via ZeroMQ can be done with data from ETI or I/Q-Samples over the network.

#### ETI by ZeroMQ:

▼ Output: out-net-zmq-eti

Name	out-net-zmq-eti	✓	← Output name for unique identification
Protocol	TCP	▼	← Select protocol (UDP, TCP), here TCP
Service	ETI-ZeroMQ	▼	← Select service (ETI-ZeroMQ, I/Q-ZeroMQ, ETI-none), here ETI-ZeroMQ
Destination	* : 9102	✓	← Destination-Port, see note below

#### I/Q-Samples by ZeroMQ:

▼ Output: out-net-zmq-iq

Name	out-net-zmq-iq	✓	← Output name for unique identification
Protocol	TCP	▼	← Select protocol (UDP, TCP), here TCP
Service	I/Q-ZeroMQ	▼	← Select service (ETI-ZeroMQ, I/Q-ZeroMQ, ETI-none), here I/Q-ZeroMQ
Destination	* : 54000	✓	← Destination-Port, see note below
Socket-Type	pub	▼	← ZeroMQ socket type (pub, rep), default pub



Help for the modulator configuration of the "I/Q-ZeroMQ" service, see section 5.2.5.2!



Be careful when changing the port number. The ports between 9000 and 10000 are required internally for communication of the ODR-mmbTools. If you are unclear, ask a specialist for advice.

## 5.3 Execution

After a completed configuration, this can be put into operation.



#### Start/Stop execution

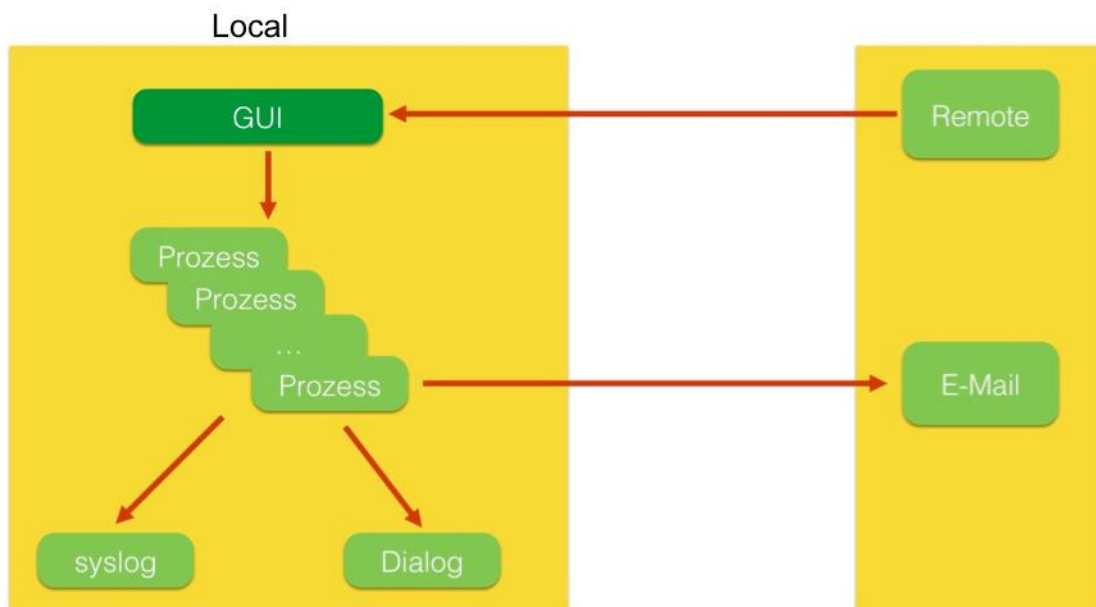
The configuration can be executed with the "Start/Stop-Button". All required tools are started and the monitoring is activated. All processes are set as they are when they are terminated properly.

### ETI-FarSync-Card



If the ETI card is to be used, note that this can only be started with Admin rights!

### Monitoring scheme of GUI4ODR:

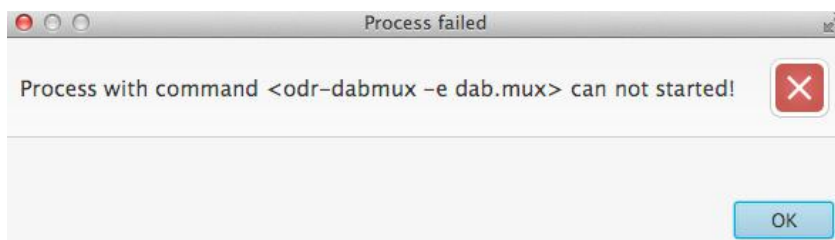


#### 5.3.1 Error message

If processes are terminated prematurely during operation, the user is informed immediately by means of a dialog and if his e-mail address is stored.

##### 5.3.1.1 Notification window

If the multiplexer can't be started, the following message appears:



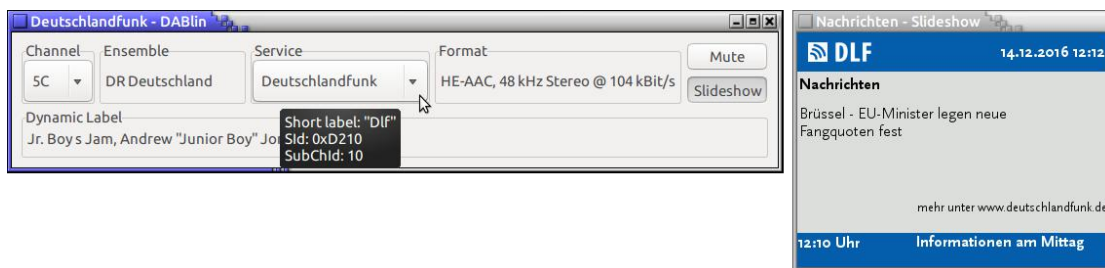
### 5.3.1.2 Notification by E-Mail

In case of a process failure, an e-mail will be sent. The following is a sample mail if the multiplexer could not be started.



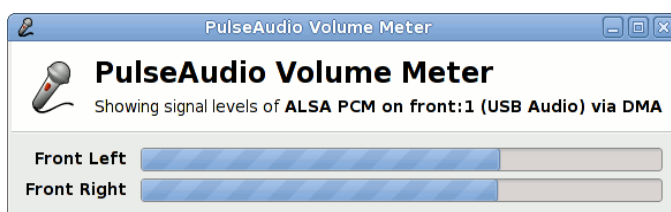
### 5.3.2 Monitoring

When the output "ETI file" is created, this multiplex is routed to **DABlin** at startup.



Under <Service> the audio programs can be selected and listened to. If DLS text and slideshow are included in the service, they can be displayed.

**Display audio level:**



The audio output can be visualized with the **Pavumeter**.

#### Audio problem



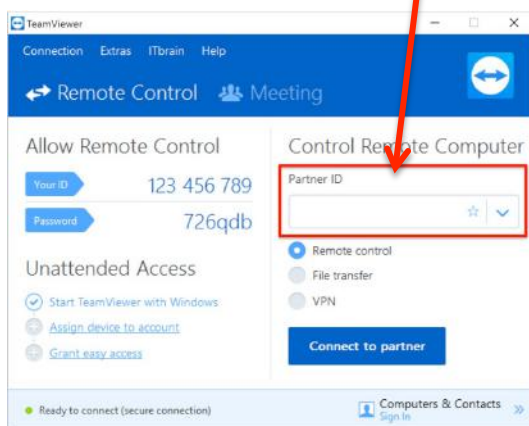
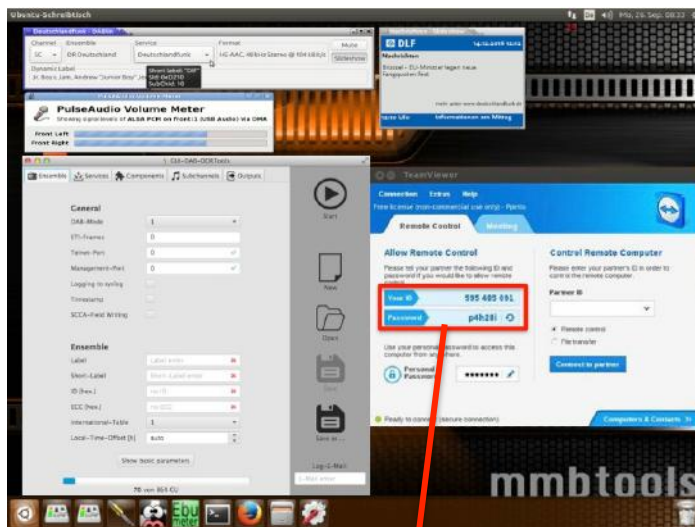
If the system has several sound cards, select the right device under Audio Settings -> Output

### 5.3.3 Remote control

TeamViewer must be started on both computers to remove access to the system.

#### Connection

In the remote system, TeamViewer must enter the partner ID, from the system with the GUI, and the associated password. The connection is then established.



## 6 Appendix

### 6.1 Contry ID und ECC

Table 1:  
Contry ID und ECC gem. ETSI TS 101 756 in ITU Region 1

Country	ITU Code	ECC	Country ID
Albania	ALB	E0	9
Algeria	ALG	E0	2
Andorra	AND	E0	3
Armenia	ARM	E4	A
Austria	AUT	E0	A
Azerbaijan	AZE	E3	B
Azores (Portugal)	AZR	E0	8
Belgium	BEL	E0	6
Belarus	BLR	E3	F
Bosnia Herzegovina	BIH	E4	F
Bulgaria	BUL	E1	8
Canaries (Spain)	CNR	E0	E
Croatia	HRV	E3	C
Cyprus	CYP	E1	2
Czech Republic	CZE	E2	2
Denmark	DNK	E1	9
Egypt	EGY	E0	F
Estonia	EST	E4	2
Faroe (Denmark)	DNK	E1	9
Finland	FNL	E1	6
France	F	E1	F
Georgia	GEO	E4	C
Germany	D	E0	D, 1
Gibraltar (UK)	GIB	E1	A
Greece	GRC	E1	1
Hungary	HNG	E0	B
Iceland	ISL	E2	A
Iraq	IRQ	E1	B
Ireland	IRL	E3	2
Israel	ISR	E0	4
Italy	I	E0	5
Jordan	JOR	E1	5
Kazakhstan	KAZ	E3	D
Kosovo	-	E4	7
Kyrgyzstan	KGZ	E4	3

Country	ITU Code	ECC	Country ID
Latvia	LVA	E3	9
Lebanon	LBN	E3	A
Libya	LBY	E1	D
Liechtenstein	LIE	E2	9
Lithuania	LTU	E2	C
Luxembourg	LUX	E1	7
Macedonia	MKD	E4	3
Madeira	MDR	E2	8
Malta	MLT	E0	C
Moldova	MDA	E4	1
Monaco	MCO	E2	B
Montenegro	MNE	E3	1
Morocco	MRC	E2	1
Netherlands	HOL	E3	8
Norway	NOR	E2	F
Palestine	-	E0	8
Poland	POL	E2	3
Portugal	POR	E4	8
Romania	ROU	E1	E
Russian Federation	RUS	E0	7
San Marino	SM	E1	3
Serbia	SRB	E2	D
SlovaKIA	SVK	E2	5
Slovenia	SVN	E4	9
Spain	E	E2	E
Sweden	S	E3	E
Switzerland	SUI	E1	4
Syria	SYR	E2	6
Tajikistan	TJK	E3	5
Tunisia	TUN	E2	7
Turkey	TUR	E3	3
Turkmenistan	TKM	E4	E
Ukraine	UKR	E4	6
United Kingdom	G	E1	C
Uzbekistan	UZB	E4	B
Vatican	CVA	E2	4

## 6.2 Programme Type

Table 2:  
 Programme type codes and abbreviations in the English language, applying to all  
 countries, except for North America, acc. ETSI TS 101 756

Decimal Number	Code					Programme type	16-character ab- breviation	8-character abbre- viation
	b4	b3	b2	b1	b0			
0	0	0	0	0	0	No programme type	None	None
1	0	0	0	0	1	News	News	News
2	0	0	0	1	0	Current Affairs	Current_Affairs	Affairs
3	0	0	0	1	1	Information	Information	Info
4	0	0	1	0	0	Sport	Sport	Sport
5	0	0	1	0	1	Education	Education	Educate
6	0	0	1	1	0	Drama	Drama	Drama
7	0	0	1	1	1	Culture	Arts	Arts
8	0	1	0	0	0	Science	Science	Science
9	0	1	0	0	1	Varied	Talk	Talk
10	0	1	0	1	0	Pop Music	Pop_Music	Pop
11	0	1	0	1	1	Rock Music	Rock_Music	Rock
12	0	1	1	0	0	Easy Listening Music	Easy_Listening	Easy
13	0	1	1	0	1	Light Classical	Light_Classical	Classics
14	0	1	1	1	0	Serious Classical	Classical_Music	Classics
15	0	1	1	1	1	Other Music	Other_Music	Other_M
16	1	0	0	0	0	Weather/meteorology	Weather	Weather
17	1	0	0	0	1	Finance/Business	Finance	Finance
18	1	0	0	1	0	Children's programmes	Children's	Children
19	1	0	0	1	1	Social Affairs	Factual	Factual
20	1	0	1	0	0	Religion	Religion	Religion
21	1	0	1	0	1	Phone In	Phone_In	Phone_In
22	1	0	1	1	0	Travel	Travel	Travel
23	1	0	1	1	0	Leisure	Leisure	Leisure
24	1	1	0	0	0	Jazz Music	Jazz_and_Blues	Jazz
25	1	1	0	0	1	Country Music	Country_Music	Country
26	1	1	0	1	0	National Music	National_Music	Nation_M
27	1	1	0	1	1	Oldies Music	Oldies_Music	Oldies
28	1	1	1	0	0	Folk Music	Folk_Music	Folk
29	1	1	1	0	1	Documentary	Documentary	Document
30	1	1	1	1	0	Not used		
31	1	1	1	1	1	Not used		

NOTE 1: This table forms part 1 of the International Table Identifier /0000 0001/  
 (see clause 5.7) which references the PTy codes for DAB use, except in North  
 America.

NOTE 2: The notation \_ is used to indicate the use of the "space" character.

### 6.3 Language code

Table 3:  
European languages acc. ETSI TS 101 756

Language	Code (hex)
Unknown/not applicable	00
Albanian	01
Breton	02
Catalan	03
Croatian	04
Welsh	05
Czech	06
Danish	07
German	08
English	09
Spanish	0A
Esperanto	0B
Estonian	0C
Basque	0D
Faroese	0E
French	0F
Frisian	10
Irish	11
Gaelic	12
Galician	13
Icelandic	14
Italian	15
Lappish	16
Latin	17
Latvian	18

Language	Code (hex)
Luxembourgian	19
Lithuanian	1A
Hungarian	1B
Maltese	1C
Dutch	1D
Norwegian	1E
Occitan	1F
Polish	20
Portuguese	21
Romanian	22
Romansh	23
Serbian	24
Slovak	25
Slovene	26
Finnish	27
Swedish	28
Turkish	29
Flemish	2A
Walloon	2B
rfu	2C
rfu	2D
rfu	2E
rfu	2F
Reserved for national assignment	30 to 3F



## 6.4 UA-Type

Table 4:  
User Application Types acc. ETSI TS 101 756

User Application type (hexadecimal)	User Application	Reference
0x000	Reserved for future definition	
0x001	Not used	
0x002	MOT Slideshow	TS 101 499
0x003	MOT Broadcast Web Site	TS 101 498
0x004	TPEG	
0x005	DGPS	
0x006	TMC	TS 102 368
0x007	EPG	TS 102 818
0x008	DAB Java	TS 101 993
0x009	DMB	TS 102 428
0x00a	IPDC services	TS 102 978
0x00b	Voice applications	TS 102 632
0x00c	Middleware	TS 102 635
0x00d	Filecasting	TS 103 177
0x00e to 0x449	Reserved for future definition	
0x44a	Journaline®	TS 102 979
0x44b to 0x7ff	Reserved for future definition	

NOTE: User Application Types marked "Reserved for future definition" are assigned by WorldDAB IRC for user applications whose definition is published by a recognized standards body (e.g. ETSI) or for user applications whose definition is not freely available. WorldDAB IRC retains details of all registrations:

## 6.5 Service Component Types

Table 5:  
Service Component Type for audio (ASCTy) acc. ETSI TS 101 756

b13	b12	b11	b10	b9	b8	Dec	ASCTy types
0	0	0	0	0	0	0	DAB audio (see ETSI TS 103 466)
0	0	0	0	0	1	1	Not used
0	0	0	0	1	0	2	Not used
							Rfu
1	1	1	1	1	1	63	DAB+ audio (see ETSI TS 102 563)

Table 6:  
Service Component Type for data (DSCTy) acc. ETSI TS 101 756

b13	b12	b11	b10	b9	b8	Dec	DSCTy types
0	0	0	0	0	0	0	Not used
0	0	0	0	0	1	1	Not used
0	0	0	0	1	0	2	Not used
0	0	0	0	1	1	3	Not used
0	0	0	1	0	0	4	Not used
0	0	0	1	0	1	5	TDC (see ETSI TS 101 759)
							Rfu
0	1	1	0	0	0	24	MPEG-2 TS (see ETSI TS 102 427)
							Rfu
1	1	1	0	1	1	59	Not used
1	1	1	1	0	0	60	MOT (see ETSI EN 301 234)
1	1	1	1	0	1	61	Proprietary service: no DSCTy signalled
1	1	1	1	1	0	62	Not used
1	1	1	1	1	1	63	Not used

## 7 More Information

### 7.1 GUI4ODR:

<https://github.com/immfri/gui-dab-odrTools> (2017-03)

### 7.2 ODR-mmbTools

More information and help with the **ODR-mmbTools** (2017-03):

Documentation: <http://opendigitalradio.github.io/mmbtools-doc/mmbtools.pdf>

Github: <https://github.com/Opendigitalradio>

Homepage: <http://www.opendigitalradio.org>

Community: <https://groups.google.com/forum/#!forum/crc-mmbtools>

### 7.3 Additional application

**DABlin:**

<https://github.com/Opendigitalradio/dablin> (2017-03)

**Pavumeter:**

<http://0pointer.de/lennart/projects/pavumeter/> (2017-03)

### 7.4 Technical reports

Technical reports and development of the small-scale DAB transmitter in Germany from Rheinland-Pfalz:

<http://drm-radio-kl.eu> (2017-03)

