User manual LR 2x series fiber nodes for HFC/RFoG & RF Overlay

The LR 2x series of fiber nodes are optical nodes for HFC, RFoG or RF Overlay applications.
They can be operated in RFoG (burst-mode) and HFC (continuous wave) mode.

- High RF output level of 117 dBµV for coaxial distribution of FTTC or FTTB signals
- DOCSIS-3.1-compliant frequency range: Downstream up to 1218 MHz, Upstream up to 204 MHz
- Pluggable diplexers enable migration towards DOCSIS 3.1 upstream
- Pluggable output splitters / taps for flexible configuration of the two RF outputs
- Device control via bluetooth app or via handset OH 41
- Optional: Remote control compliant to IEC 60728-14 via FSK receiver module
- Compact housing for outdoor deployment (IP66)
- Powered locally (LR 2x 2xxx) or remotely (LR 2x 6xxx)
- Optical ALC for regulated output levels

CE

1 Safety and warning notes

EN 50 083-1ff
Services and repairs should only be carried out by experts.
Pay attention to live parts or wires! Switch off power supply.

Laser class 1
Keep connector interfaces clean. Always use protection caps on unused connectors.
Avoid mechanical stress for optical fibers. Minimum bending radius is 15 mm.

- Please read these user instructions before using the LR2x.
- The PSU changes mains alternating current to touch-safe low voltage and may be used only under the technical data listed below.
- The PSU should not come into contact with water or dust. Vibrations and special environmental factors on the device are inadmissible.
- The main socket should be easily accessible. In the event of operational error, the plug must be immediately removed from the socket.
- The PSU is started up when the plug is inserted in the socket. To turn off the power supply, the plug must be removed from the socket. Never pull at the cable.
- The PSU contains dangerous voltages. All service or maintenance work should be carried out by qualified personnel who can get assistance by contacting the manufacturer's agent. With visible damages to the device do not use this anymore.
- An internal fuse protects the power supply against short circuiting in the primary circuit. In the event that the fuse needs to be replaced, the same type with the same breaking characteristic and size of fuse should always be used.
- The PSU is provided exclusively for powering of LR 2x (Nodes) from the WISI Communications Company.
- The LR 2x only works with handsets OK41A and OH41. OK41 is outdated and not compatible.

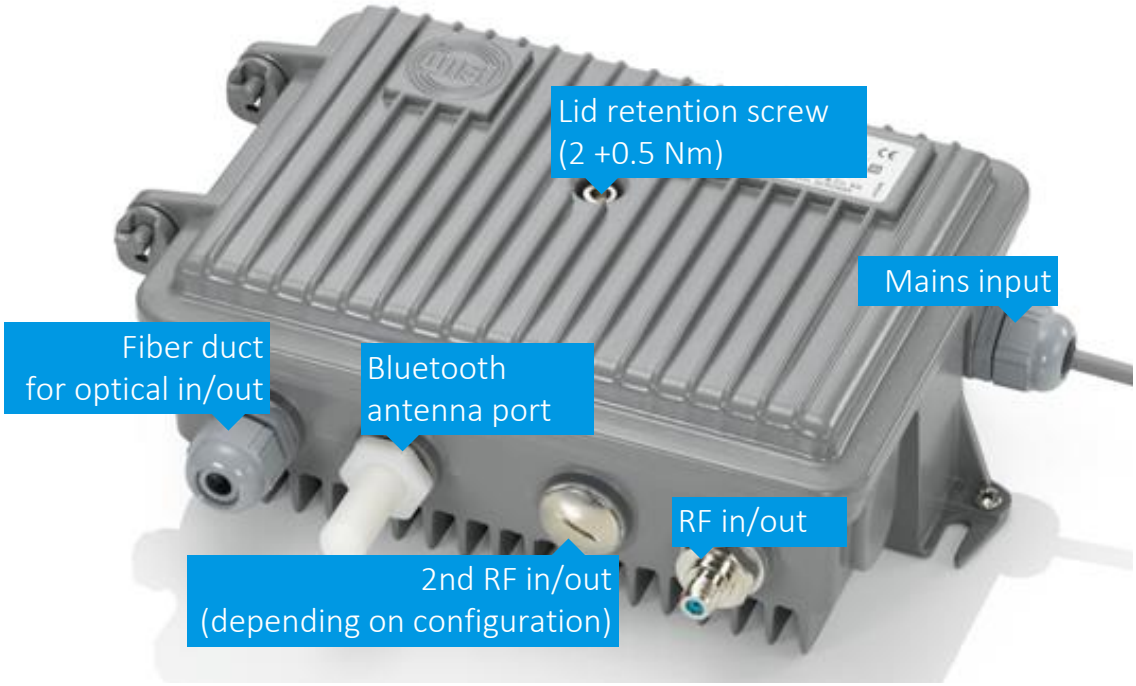
2 Declaration of conformity

Please find the declaration of conformity under:

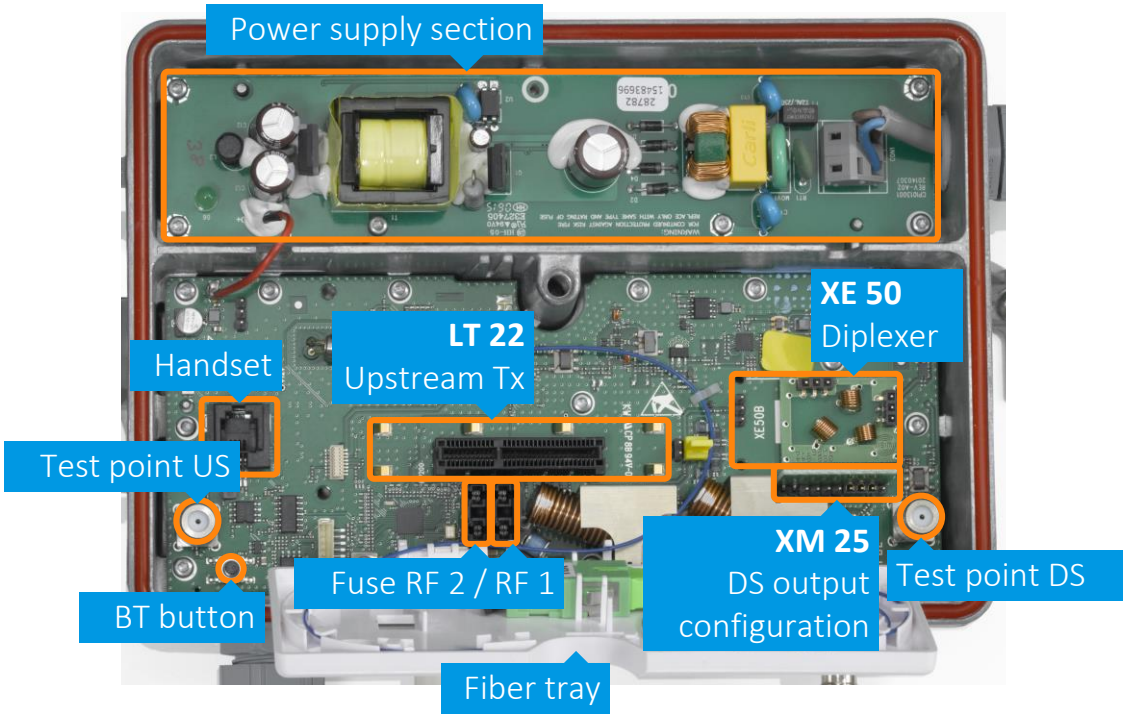
`http://wisi.de/en/business/service/download-area/`

Then navigate through "CE Declarations of Conformity" and select the "LR 22 xxxx, LR 23 xxxx, LR 27 xxxx" document link.

3 Mechanical overview



Outside components and connectors



Internal components and sockets

4 Configuration and maintenance

4.1 NOTE: Upstream transmitter pluggables

The LT 22 upstream module is hot pluggable and should therefore be added **during operation**. A new module is only discovered by the node when plugged in while the node is turned on.

If a module is unplugged or replaced by a new one, the installed module will keep its configuration data stored on the module.

4.2 NOTE: Upstream level alignment

4.2.1 RFoG mode (LR 23/LR 27)

The upstream test point is designed as an OMI test point: A level of 70 dBµV on this interface represents an OMI of 15%.

The upstream attenuator allows the compensation for input levels of 70...100 dBµV.

The factory preset for the attenuator is 0 dB, so an input level of 70 dBµV leads to an OMI of 15%. For higher input levels the upstream attenuator has to be adjusted.

Example for 80 dBµV input level: For an OMI of 15%, adjust the Upstream input attenuator to 10 dB, which leads to 70 dBµV at the test point.

4.2.2 HFC mode (LR 23/LR 27)

The upstream test point is designed as an OMI test point: A level of 70 dBµV on this interface represents an OMI of 10%.

The upstream attenuator allows the adjustment of the OMI in a range of 3...10%.

The factory preset for the attenuator is 5% OMI with the nominal input level of 70 dBµV.

4.2.3 LR 22 HFC

The upstream test point is designed as an OMI test point: A level of 75 dBµV on this interface represents an OMI of 5%.

The upstream attenuator allows the adjustment of the OMI in a range of 3...10%.

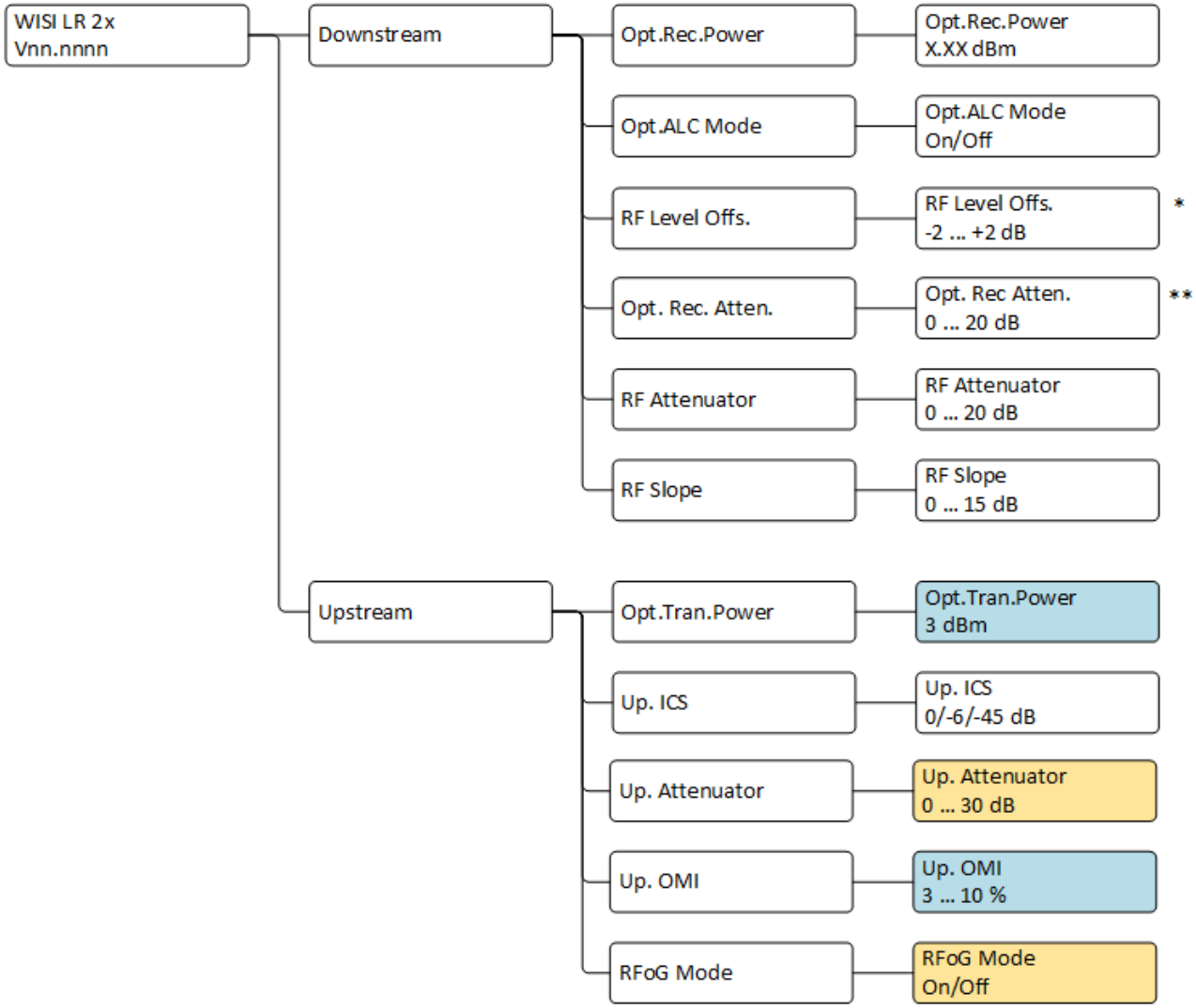
The factory preset for the attenuator is 5% OMI with the nominal input level of 75 dBµV.

4.3 Configuration via handset OH 41

4.3.1 Handset basics

Parameter menu	
▲▼ keys	Select parameter
► key	Open parameter sub-menu
◄ key	Back
Parameter sub-menu	
◄► keys	Select display or value to be changed Cursor blinks under the active digit
▲▼ keys	Change the value
Saving: after completion of all settings, press the key ◄ several times until “Saving data to EEPROM” is displayed. All settings are now saved.	

4.3.2 Menu structure and parameters



NOTE: As a protection from undesired upstream disturbance, changes in the upstream mode (RFoG mode "On" <> "Off") will not become effective unless confirmed by defining the corresponding OMI/attenuation value.

Menu structure continued on next page...

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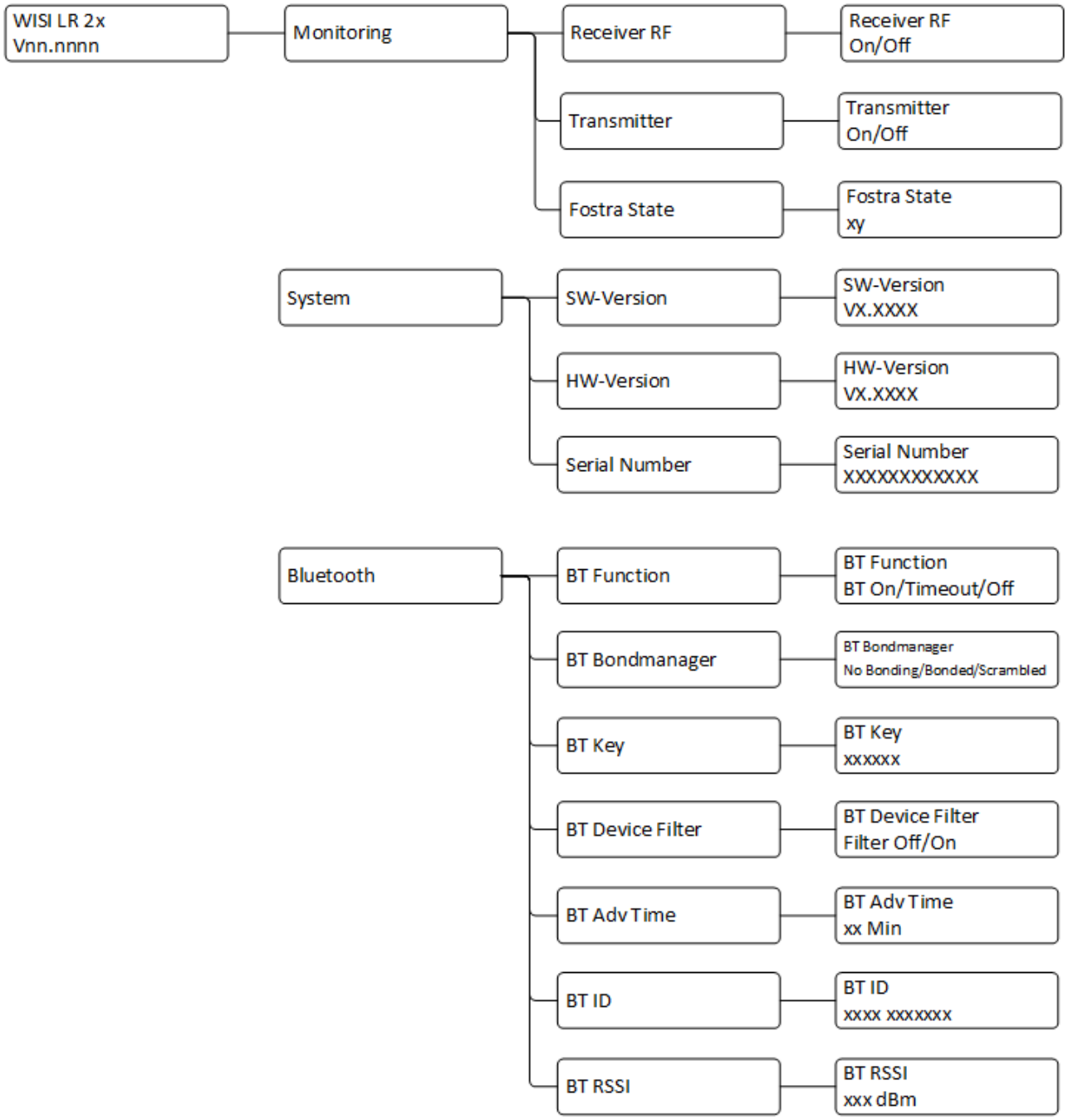

LR 22 only

LR 23 & LR 27 only

* only effective if ALC **on** ** only effective if ALC **off**

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4.4 Configuration via bluetooth

4.4.1 The WISI BLE app

Please install the WISI app through the Google Play Store:

```
https://play.google.com/store/apps/details?id=de.wisi.LR_VX_APP&hl=en
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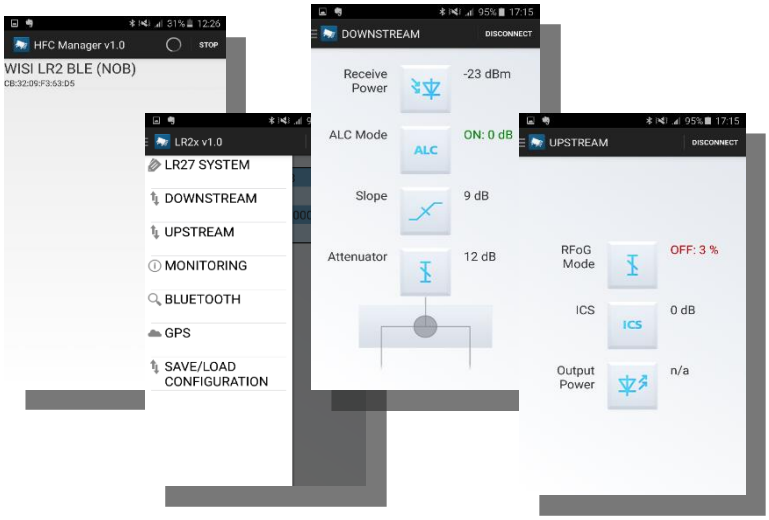
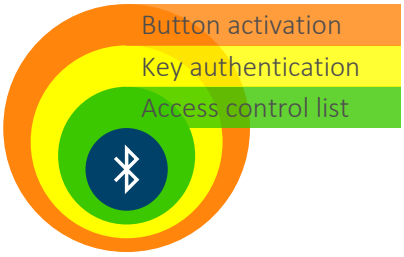


Figure 1, HFC Manager Version 1.0 GUI Examples

4.4.2 Multilevel security implementation

There are three security levels implemented to prevent the node from unauthorized access. The figure below shows the security levels and the according security mechanism.



Level 1: Button activation

The BT activation button inside the node opens the bluetooth interface for connections. The button activation behaviour can be modified via the handset interface (see above).

Level 2: Key authentication

The connecting mobile device needs to authenticate with a configurable password. Initial password is "000000".

NOTE: Please change the initial password during the first setup in order to avoid unauthorized access!

Level 3: Access control list (ACL)

Once paired, a BT device can be put into the access list. If ACL restriction is enabled, the node will only allow clients within this list to connect.

4.4.3 App menu structure

Tapping on each of the items leads to the related parameters for monitoring and control.

LR 2x SYSTEM	
Name:	[LR 22 / LR 23 / LR 27]
Firmware version:	[e.g. 1.0.0.6]
Hardware version:	[e.g. 1.0.0.0]
Serial number:	[e.g. 123456789012]
App version:	[e.g. 1.4.0]

DOWNSTREAM			
Receive power		Optical input power	[dBm, 0.1 dB resolution]
ALC mode		ALC toggle RF level offset (if ALC mode is "on") RF input attenuation (if ALC mode is "off")	[on / off] [-2...+2 dB, 0.5 dB step] [0...31 dB, 0.5 dB step]
Slope		Downstream slope 85-1218 MHz	[0...15 dB, 0.5 dB step]
Attenuator		Downstream interstage attenuation	[0...20dB, 0.5 dB step]

UPSTREAM (inactive for LR 22 without upstream module)			
Upstream mode		Toggling of upstream operation Upstream attenuation (RFoG mode only) Upstream OMI (HFC mode only)	[RFoG / HFC] [0...30 dB, 0.5 dB step] [3...10%, 1% step]
	NOTE: As a protection from undesired upstream disturbance, changes in the upstream mode (RFoG <> HFC) will not become effective unless confirmed by defining the corresponding OMI/attenuation value.		
ICS		ICS setting	[0 / -6 / -45 dB]
Output Power		Optical output power (HFC mode only)	[dBm, 0.1 dB resolution]

MONITORING		
Downstream output:	Toggling of downstream RF output	[on / off]
Upstream output:	Toggling of upstream optical output	[on / off]
Fostra receiver:	Toggling of the Fostra receiver module	[on / off]
Fostra command status:	Latest Fostra commands received	
Downstream output:	Fostra command state for RF output	[on / off]
Upstream output:	Fostra command state for optical output	[on / off]
ICS:	Fostra command state for ICS	[0 / -6 / -45 dB]

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BLUETOOTH		
Status:	Status of the bluetooth connection	[Connected / Disconn.]
Timeout:	Timeout for acceptance of connections after button activation or disconnection	[0...15 min]
ID:	Bluetooth MAC address of the LR 2x	[e.g. AB:CD:EF:01:23:45]
Bonding:	Toggles the authentication mode (Bonding active = Key authentication active)	[Bonding / No Bonding]
Key:	Changes the key for user authentication	[e.g. 123456]
RSSI:	Received bluetooth signal strength	[dBm, 1 dB resolution]

GPS	
Open device localization:	Shows the actual position of the mobile device. Once determined, GPS data will be stored in the .cfg-file via "store current settings" below.

SAVE/LOAD CONFIGURATION		
Stored configurations:	List of configurations stored on the device	[e.g. LR2_example.cfg]
Store current settings	Saves the current LR 2x status as configuration file	
Load settings	Opens the list of stored configuration files for activation	
Delete all	Clears the list of stored configurations	
Delete...	Opens the list of stored configurations for individual deletion	

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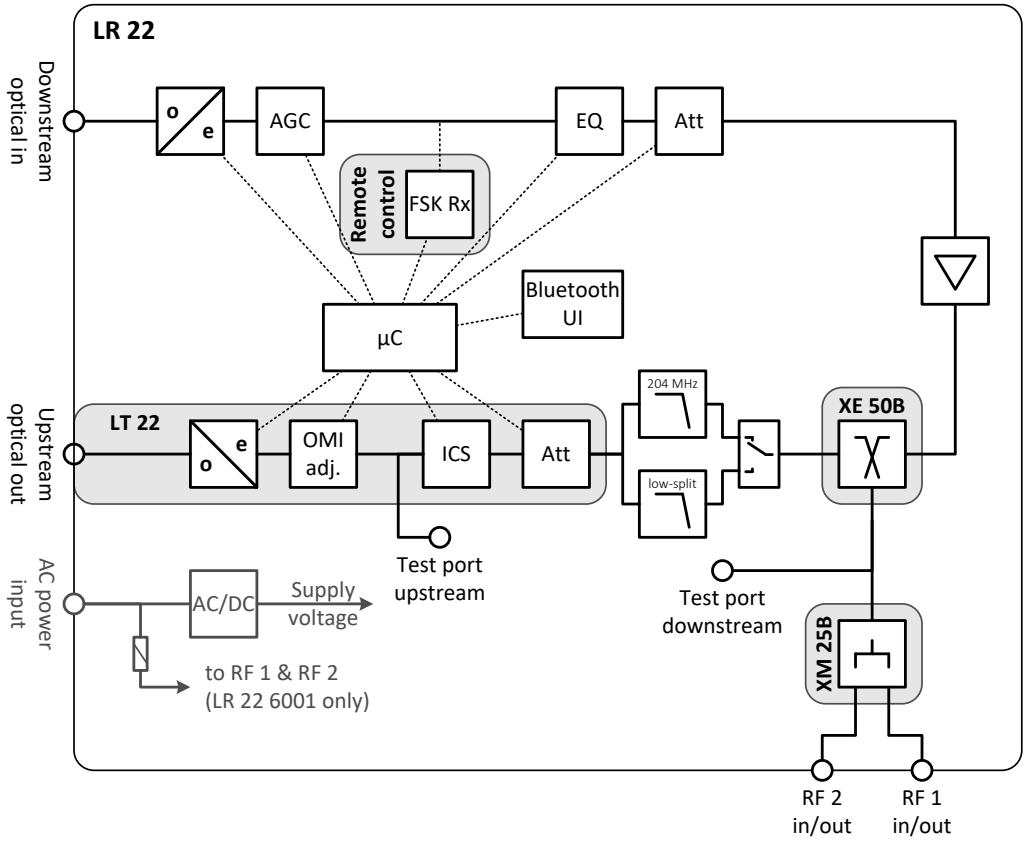
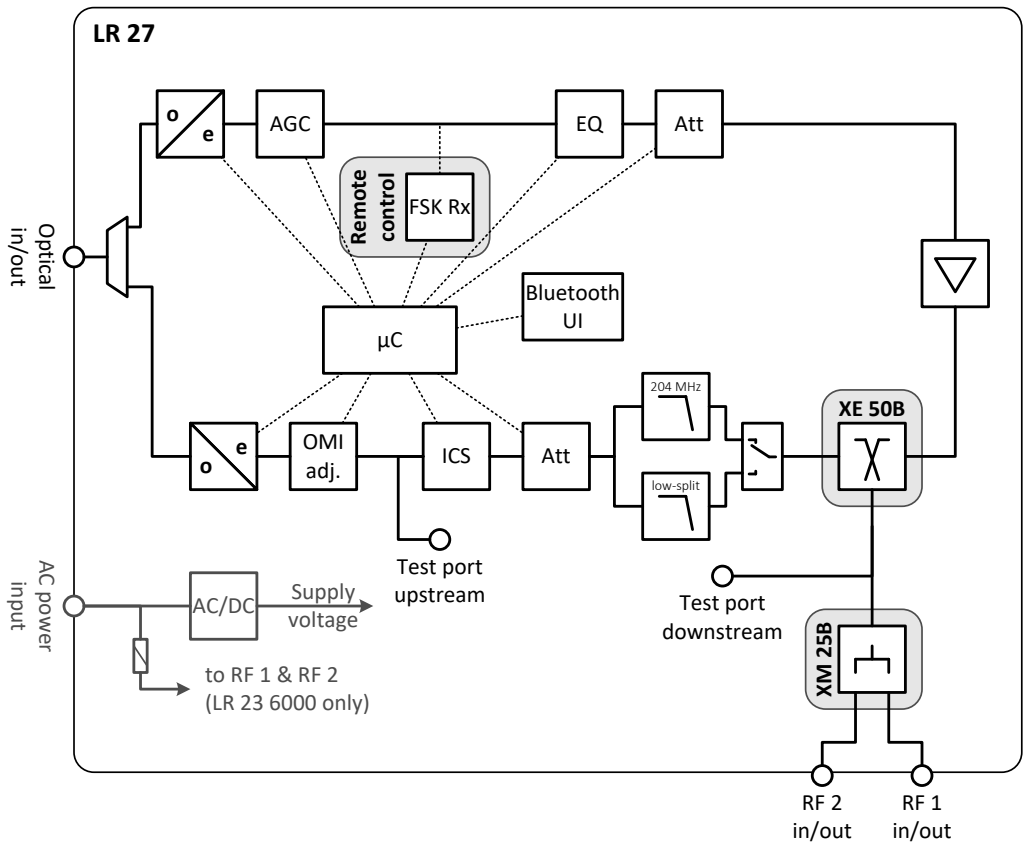
5 Block diagrams





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6 Technical data

Downstream	LR 22	LR 23	LR 27
Optical input power	-8...+2 dBm		
DS wavelength range	1260...1610 nm	1303...1317 nm	1543.5...1556.5 nm
DS frequency range (depending on diplexer)	47...1218 MHz	85...1218 MHz	
DS attenuator	0...20 dB (0.5 dB steps)		
DS equalizer	0...15 dB (0.5 dB steps)		
Max. output level (intermodulation limit)	117 dBµV (CENELEC42, CSO/CTB > 60 dB, 6 dB slope) 114 dBµV (CENELEC42, CSO/CTB > 60 dB, flat) 110 dBµV (30 PAL + 80 QAM, 258...1218 MHz, 5 dB slope)		
Max. output level, 4% OMI (gain limit)	114 dBµV ± 0.75 dB		
Output test point	-20 dB		

Upstream	LR 22 (+ LT 22)	LR 23	LR 27
Optical output power	+3 dBm (with LT 22 3xxx)	+3 dBm	
US wavelengths	1270...1610 nm (see LT 22 order code)	1270...1610 nm (see LR 2x order code)	
US frequency range (depending on diplexer)	5...204 MHz		
US low pass (switchable)	65 / 204 MHz	85 / 204 MHz or 65 / 204 (see LR 2x order code)	
US nominal input level	70 dBµV	70...100 dBµV (see section 4.2)	
US input level adjustment	for 3%...10% OMI	0...30 dB attenuation	
US test point	75 dBµV <=> 5% OMI	70 dBµV <=> 15% OMI (RFoG mode) 70 dBµV <=> 10% OMI (HFC mode)	

Interfaces	LR 22 (+ LT 22)	LR 23	LR 27
SC-APC connectors	1 pc. (DS input) + 1 pc. (LT 22 output)	1 pc. (single fiber in/out)	
PG11 with fiber feedthrough	1 pc.		
PG11 with 75 Ω F female jack	1 pc. (RF in/out)		
RF return loss	> 18 dB, -1 dB/oct., min. 14 dB		
PG11 with dust caps	2 pcs. (slot for BT antenna WISI LB 01, slot for second RF in/out)		
Handset connector RJ11	1x (for WISI OH 41)		
FSK remote management slot	1x (for Fostra-F module)		
Diplexer slot	1x (for WISI XE 50 B)		
Output configuration slot	1x (for WISI XM 25 B)		
DS status LED	DS optical input power (red: low / green: OK / yellow: high)		
US status LED	Laser activity		
Bluetooth version	4.0 / LE (GATT profile, 2.4 GHz)		
Bluetooth app compatibility	Android 4.3 and higher		

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Power supply	LR 2x 2xxx (locally powered)	LR 2x 6xxx (remotely powered)
Supply voltage	180...264 V AC	27...65 V AC
Power consumption	max. 16 W	

7 Order codes

LR 22 x001 HFC node with upstream slot for LT 22

- Power supply:
  - 2 – 230 V locally powered
  - 6 – 65 V remotely powered

LT 22 3xx1 Upstream module for LR 22, +3 dBm

- Upstream wavelength:
  - 27 – 1270 nm
  - 29 – 1290 nm
  - 31 – 1310 nm
  - 33 – 1330 nm
  - 35 – 1350 nm
  - 37 – 1370 nm
  - 39 – 1390 nm
  - 41 – 1410 nm
  - 43 – 1430 nm
  - 45 – 1450 nm
  - 47 – 1470 nm
  - 49 – 1490 nm
  - 51 – 1510 nm
  - 53 – 1530 nm
  - 55 – 1550 nm
  - 57 – 1570 nm
  - 59 – 1590 nm
  - 61 – 1610 nm

LR 2x xxxx Single-fiber RFoG node

- Upstream band edge:
  - 2 – 65 / 204 MHz switchable
  - 3 – 85 / 204 MHz switchable
- Upstream wavelength:
  - 27 – 1270 nm
  - 29 – 1290 nm
  - 31 – 1310 nm (LR 27 only)
  - 33 – 1330 nm
  - 35 – 1350 nm
  - 37 – 1370 nm
  - 39 – 1390 nm
  - 41 – 1410 nm
  - 43 – 1430 nm
  - 45 – 1450 nm
  - 47 – 1470 nm
  - 49 – 1490 nm
  - 51 – 1510 nm
  - 53 – 1530 nm (on special request only)
  - 55 – 1550 nm (LR 23 only)
  - 57 – 1570 nm (on special request only)
  - 59 – 1590 nm
  - 61 – 1610 nm
- Power supply:
  - 2 – 230 V locally powered
  - 6 – 65 V remotely powered
- Downstream wavelength:
  - 3 – 1310 nm
  - 7 – 1550 nm (RFoG standard)

8 Accessories

OH 41	Handset for local device control
XE 50 B 0650	RF diplexer module, 65/85 MHz
XE 50 B 0850	RF diplexer module, 85/105 MHz
XE 50 B 2000	RF diplexer module, 204 / 256 MHz
XM 25 B 0044	Output tap 4 dB / 4 dB
XM 25 B 0082	Output tap 8 dB / 2 dB
XM 25 B 0131	Output tap 13 dB / 1 dB
LB 01	Bluetooth Antenna
LT 22 3xx1	LT 22 Upstream Modules

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9 Service and support

For further information and help, please contact our support organization support@wisiconnect.tv.

Visit www.wisiconnect.tv for more information about configuration and firmware downloads.

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