

5. Functional description

5.1. Block diagram

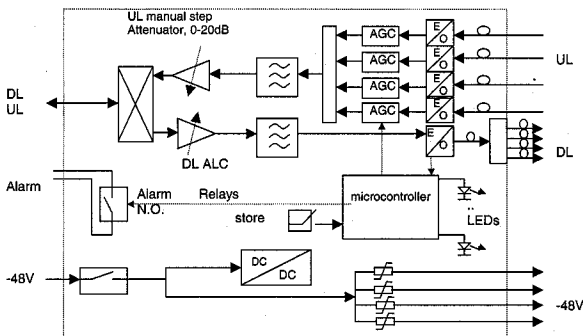


Figure 4 Local Unit (TFLF) Block Diagram

The Local unit is the core of the system and provides the following functionalities:

- RF low power interface and optical conversion.
- Power supply distribution and short/surge protection.
- Alarm interface through dry contact.
- Status and alarm LEDs.
- Automatic Level Control (ALC) in Downlink for overdriving and spurious emission control.
- Automatic Gain Control (AGC) for Uplink optical path loss compensation.
- Microprocessor based supervision and data communication.
- "Store" button for software auto configuration and alarm masking.
- Step attenuator for uplink gain setting.

5.2. Down link operations

In the downlink path the TFLF fulfils the following operations:

Power level adjustment: The TFLF local unit is designed to be interfaced with a wide range of low power BTS and repeaters. For higher power BTS's an external fixed attenuator is required. Refer to the Appendix for the typical and maximum allowed input levels. Because the RF port is duplexed, an external attenuator will add the same downlink loss to the uplink path. To compensate for this loss, the TFLF uplink gain must be adjusted by means of the UL step attenuator.

The DL RF power is limited from the ALC to avoid spurious emissions in case of overdriving inputs.

E/O Conversion: The RF signal modulates the intensity of an optical carrier through an electro-optic device (laser).

Optical Splitting: The modulated optical carrier is split into 4 ways so that it may be transmitted on a maximum of 4 optical links.

5.3. Up link operations

In the uplink path the TFLF fulfils the following operations:

Uplink Gain adjustment: Uplink gain can be adjusted by means of the UL step attenuator to compensate for unwanted external uplink attenuation.

O/E Conversion: There are 4 O/E conversion devices, or optical receivers, in the TFLF, one for each optical link. The modulated optical signal coming from the remote units is detected and demodulated back to an electrical signal. The data link associated with each remote unit is also detected and routed to the microprocessor.

Amplification & AGC: Variable amplification is needed to compensate for the variable optical fibre loss, maintaining a good signal to noise ratio, so that for each link a constant gain is obtained.

RF Combining: Signals coming from all remotes are combined into a single RF path, filtered and duplexed into the RF port.

5.4. Remote supply

The local unit provides connection and distribution for -48VDC supply to the remote units, by means of composite cable, copper wires and optical fibre pairs. Each supply port is protected against overloads, short and surge with a self-recovery fuse and surge protection. The power switch will disconnect the remote supply in case of overcurrent.

✓ **WARNING:** take care not to overcome maximum copper cable length, depending on copper cable section (e.g. 400 meters with 0.75 mm² section).

5.5. Automatic Gain Control

Optical link losses are typically related to:

- Fibre length (0.2-0.4dB/Km @ 1300nm)
- Splices loss
- Optical connectors tolerances and aging

BriteCell™ Fast implements an automatic gain control (AGC) mechanism to maintain constant RF link gain, regardless of the overall optical link losses. The allowed optical loss per link must be in the range of 3dB. Losses outside this window will trigger alarms and warnings according to the following table:

OPTICAL LOSS	OPERATION	ALARM	SEVERITY
0 dB	AGC working, constant RF gain	none	NONE
< 3dB	AGC working, constant RF gain	none	NONE
< 5 dB	AGC not working, RF gain decreases according to 2dB electrical per 1dB optical	AGC out of range: red LED flashes	MINOR
> 5 dB	AGC not working, the optical signal is too low, the receiver is automatically switched off in order to reduce the unwanted noise to the system.	Optical power too low: red LED fixed, relays alarmed.	MAJOR

10. Functional description

10.1. Block diagram

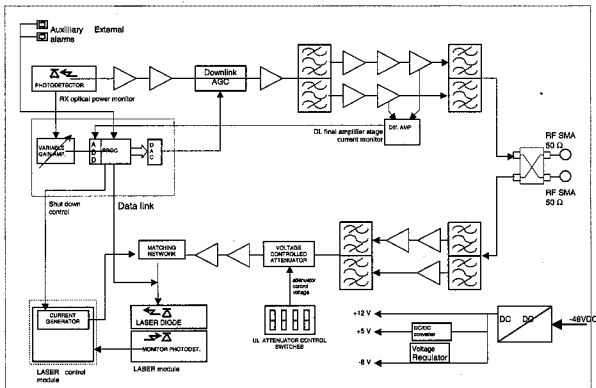


Figure 11 Remote Unit TFAF Block Diagram

10.2. Up link operations

Low noise amplification: the low level signal coming from the antenna and duplexer is amplified and filtered.

E/O Conversion: The RF signal modulates the intensity of an optical carrier through an electro-optic device (laser).

10.3. Down link operations

O/E Conversion: The modulated optical signal coming from the local units is detected and demodulated back to electrical signal.

Amplification & AGC: Variable amplification is needed to compensate for the variable optical fibre loss, maintaining a good signal to noise ratio, to maintain a constant gain for each link. The resultant signal is amplified, filtered and is duplexed to feed the antenna.

10.4. Remote supply

The remote unit is powered with -48VDC supply, positive to GROUND, by means of composite copper wire and fibre cable.

10.5. Automatic Gain Control

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11. Alarms and settings

11.1. Remote unit LEDs

The TFAF is fully managed and supervised by the local microprocessor. The alarms are fully managed by software according to different severity levels, and reported as local visual alarms (LED's) and on the data link to the local unit.

There are 2 LED on the Local unit, one red alarm LED is related to optical link and internal failures, one green LED is for the power supply.



Figure 12 Remote Unit TFAF LED's

REMOTE ALARM DESCRIPTION	LED	STATUS	SEVERITY
UL AGC out of range	RED	Flashing	MINOR
UL optical power too low	RED	Fixed	MAJOR
DL RF amplifier 1	RED	Fixed	MAJOR
DL RF amplifier 2	RED	Fixed	MAJOR
External 1	RED	Fixed	MAJOR
External 2	RED	Fixed	MAJOR

11.2. External alarms

Two external alarm contacts are provided. These contacts are open under non-alarm condition.



Figure 13 Remote Unit TFAF Alarm Connectors