6. Commissioning

Read carefully Chapter 1, *Safety* before commissioning the optical system. See also the safety precautions for the current repeater or hub types.

Check all connections made during the installation. Also, ensure that both the mains plugs for repeaters equipped with two power supply units are connected to outlets supplied from the same fuse.

To fulfill the IP65 weather protective requirements, ensure that the cable strain relief bushings are properly tightened. Also, ensure that the gaskets at the cable inlets on the cabinet are properly fitted and not damaged.

When the installation is checked, commission the optical system as described in the following sections:

Equipment required for the commissioning is listed below.

This chapter contains commissioning instructions only. If you want to read descriptions of the various functions, see the previous chapters in this manual.

Some system configuration examples are found on page 6-6 and the following pages.

If you get problems when commissioning the system, please contact your nearest Powerwave representative.

Equipment Required

To be able to commissioning an optical system you will need the following:

- Optical power meter.
- Laptop with O&M software and an RS232 serial cable.
- Spectrum analyzer.
- Repeater tools.
- Optical clenaer.

Commissioning the Fiber Optic System

Commission the optical transmission system as described in the following instruction. The instruction covers the optical system only and is therefore applicable to all units with optical transmission, for instance BMU, RMU, OCM, FOR, and RH.

Figure 6-1 shows a fiber optic system in a BMU and a FOR. These units are also used as examples in the instruction.

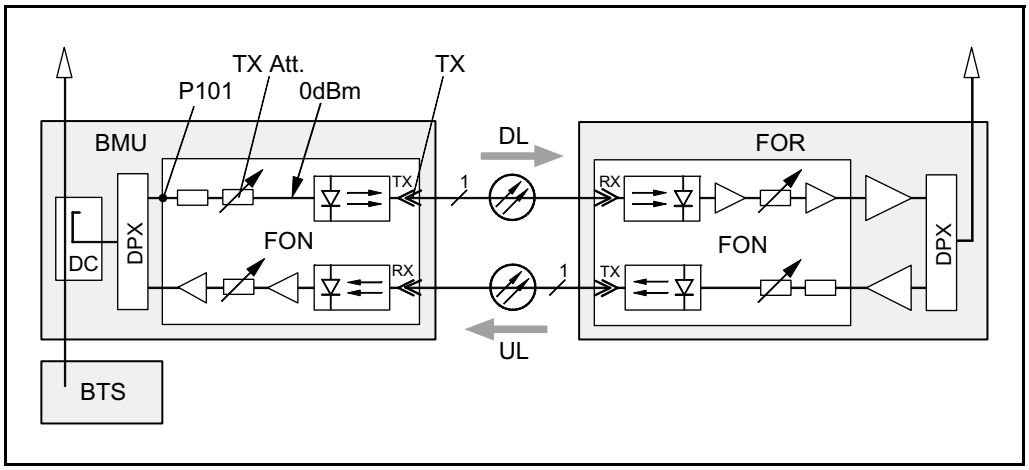

Figure 6-1. Master unit downlink path

Master Unit Downlink Path

1. Make sure the BMU is switched off.
2. Measure the downlink input RF signal power (from the BTS) at the FON board connector ’P101’ in Figure 6-1 (or at the OCM/BMU 19" rack) using a spectrum analyzer.

   The signal power should be between +10dBm and +36dBm.

   Write down the measured power value.
3. Switch the BMU on and wait until it is in operational mode.
4. Connect the O&M software to the FON board.
5. Measure the optical output power from the FON board (TX) using an optical power meter.

   If there is only one slave unit on a short distance, choose the low power range. Otherwise, keep the default high power range.

   If you are in doubt, choose high power and, if needed, change to low power if the received optical power is more than 4dBm at the slave unit.
6. Set the transmitter attenuation (TX Att.) to a value that gives the following optical transmitter an input power of approximately 0dBm. The attenuation is set via the O&M software (FON configuration).

P_{P101} – 20dB – XdB = 0dB

Meassured RF input signal level at P101 minus 20dB minus XdB attenuation equals 0dB. X is the attenuation set via O&M software. Write down the attenuation set.

7. Measure the optical output power from the FON board (TX) using an optical power meter. Write down the measured power value.

It is recommended to set date and time in the FON units, and to assign names to the units for future tracking.

Slave Units

Continue by performing the following on each slave unit.

8. Make sure the FOR/slave unit is switched off.

9. If two fibers are used, then make sure the uplink and downlink fibers are connected correctly in the FOR/slave unit.

   The downlink fiber has to be connected to the RX port and the uplink fiber to the TX port of the FON unit, see Figure 6-2. The FOR in the figure is a compact repeater.

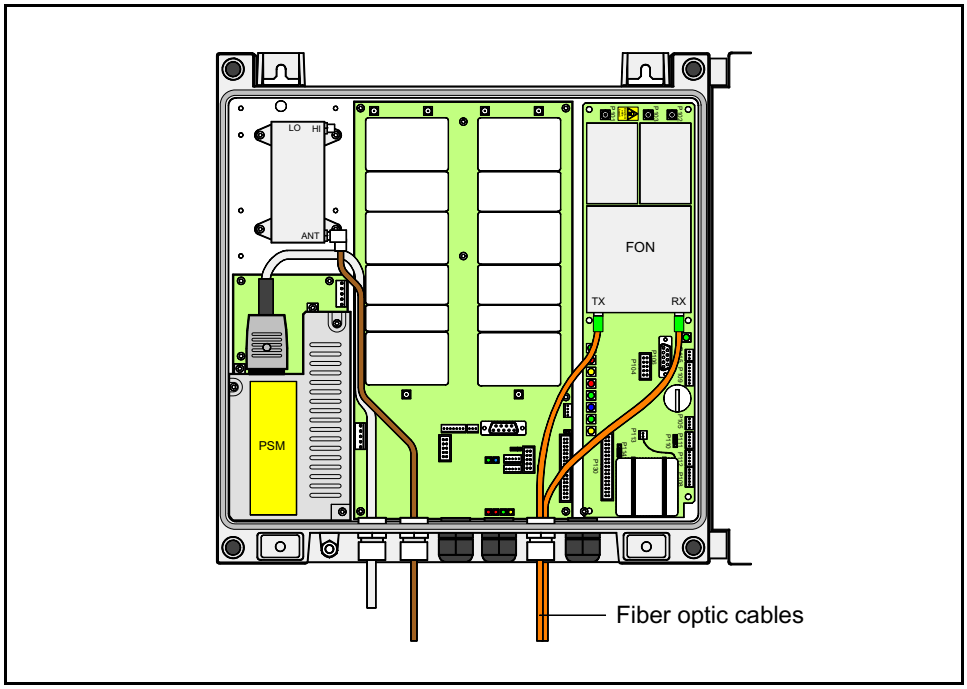

Figure 6-2. Fiber connection in a slave unit

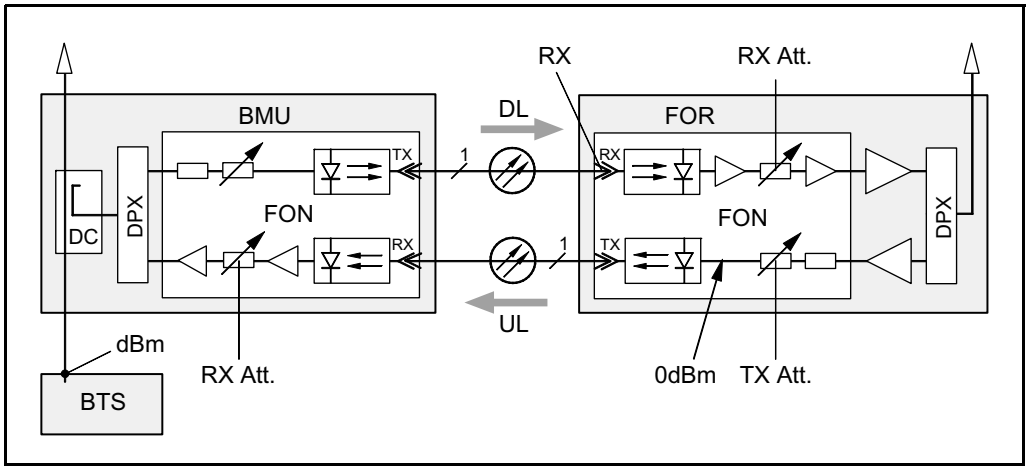

Figure 6-3. Slave unit downlink path, and uplink path

10. Switch the FOR on and wait until it is in operational mode.

11. Connect an O&M software to the FON board.

12. Measure the optical downlink input power ('RX' in Figure 6-3). The receiver level is measured via the O&M software (FON status).

Write down the measured optical power value.

13. Calculate the optical power loss from the TX port of the master FON board (step 5) to the RX port of the FOR/slave unit (step 12).

The loss includes fibers, WDMs, splitters, and connectors used in the current configuration.

The calculated optical loss should not exceed 15dB.

Write down the calculated optical loss value.

14. Set the receiver attenuation (RX Att.) via the O&M software (FON configuration).

An approximate receiver attenuation value can be set according to the calculated loss over the fiber in step 13. Choose value from the table.

Optical loss over fiber	Receiver attenuation
{10dB	10dB
}10dB	5dB

15. Move the O&M software from the FON board to the repeater and set the desired repeater bandwidth and downlink gain.

16. Move the O&M software back to the FON board and set the transmitter attenuation (TX Att.) to a calculated value that gives the following optical transmitter an input power of approximately 0dBm.

17. Choose optical transmitter output power range via the O&M software as described in step 6.

18. Move the O&M software back to the repeater and set uplink attenuation and gain.

Example of downlink and uplink settings are found in the following table.

Unit	Downlink	Uplink
BMU (FON)	5dB att.	10dB att.
FOR (FON)	10dB att.	5dB att.
BMU (RF)	60dB gain	60dB gain

The optical system is now ready for operation. A fine-tuning of the system should be done to get the most out of the system. And, the more nodes in the system the more reason to balance and fine-tune it.

The following section contains some system configuration examples.

System Configuration Examples

Legend:

0dB Fixed values.

0dB Set values via O&M software.

0dB Calculated or resultant values.

0dB Set and resultant UL gain values in red.

▲ ▮ ▼ High, medium, and low values in the example.

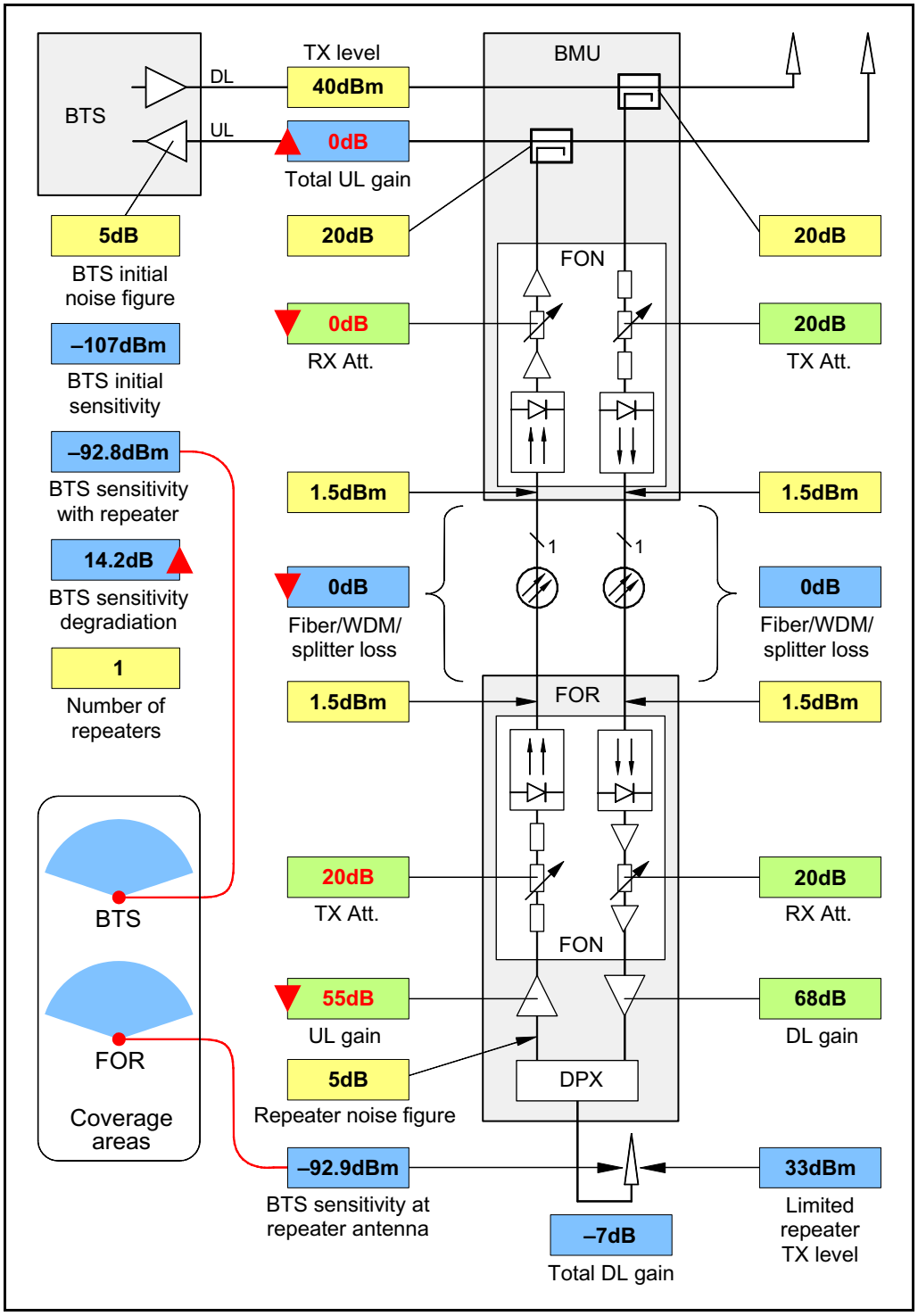

Figure 6-4. One FOR, low optical loss, low uplink gain and attenuation

Figure 6-4 shows a FOR connected with low optical loss, low uplink gain and low uplink attenuation. The *BTS sensitivity degradation* is high.

High total uplink gain and a *BTS sensitivty with repeater* very close to the *BTS sensitivity at the repeater antenna* indicates a similar coverage area for the BTS and the FOR.

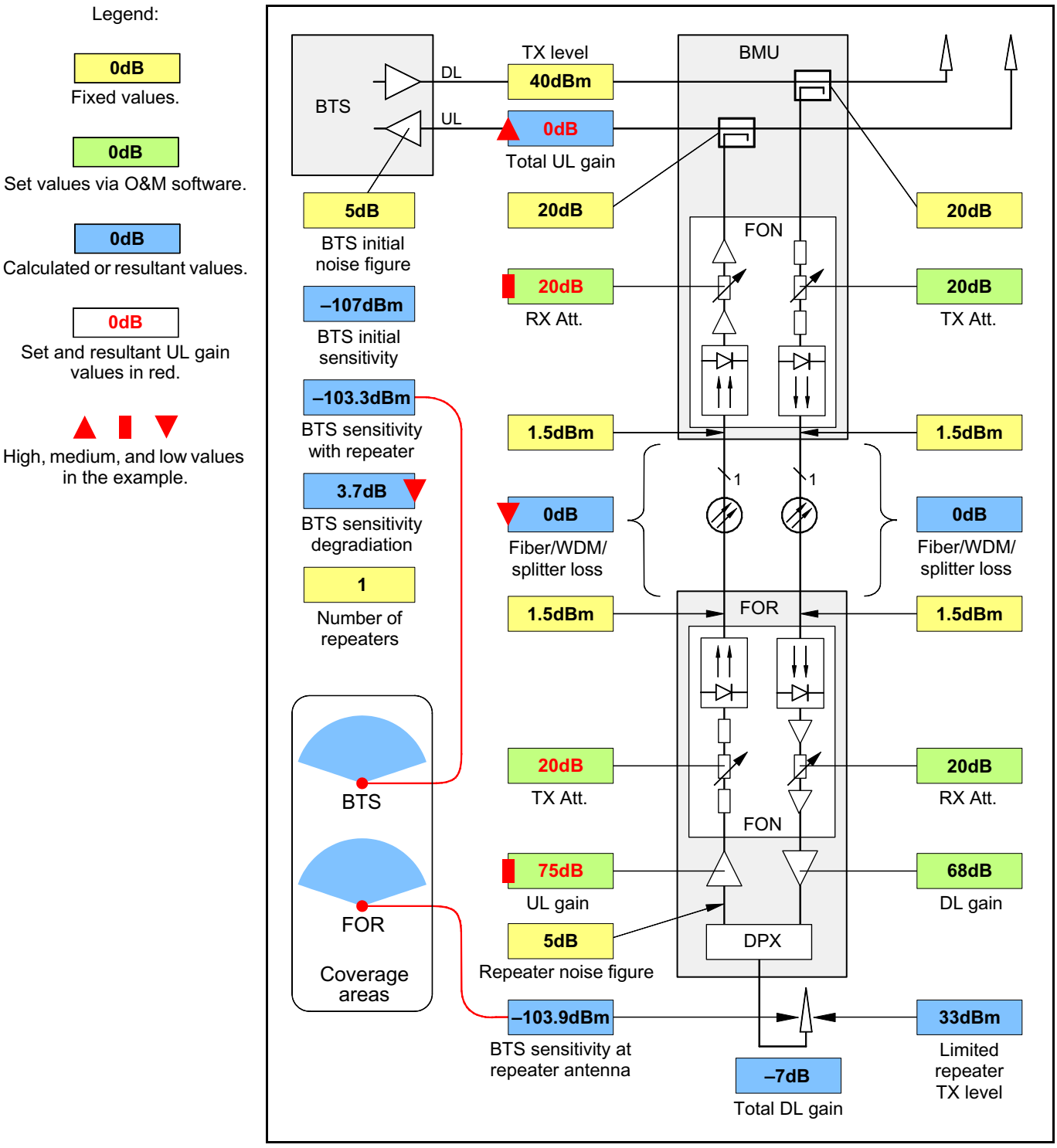

Figure 6-5. One FOR, low optical loss, medium uplink gain and attenuation

Figure 6-5 shows a FOR connected with low optical loss, medium uplink gain and medium uplink attenuation. The *BTS sensitivity degradation* is low.

High total uplink gain and a *BTS sensitivty with repeater* very close to the *BTS sensitivity at the repeater antenna* indicates a similar coverage area for the BTS and the FOR.

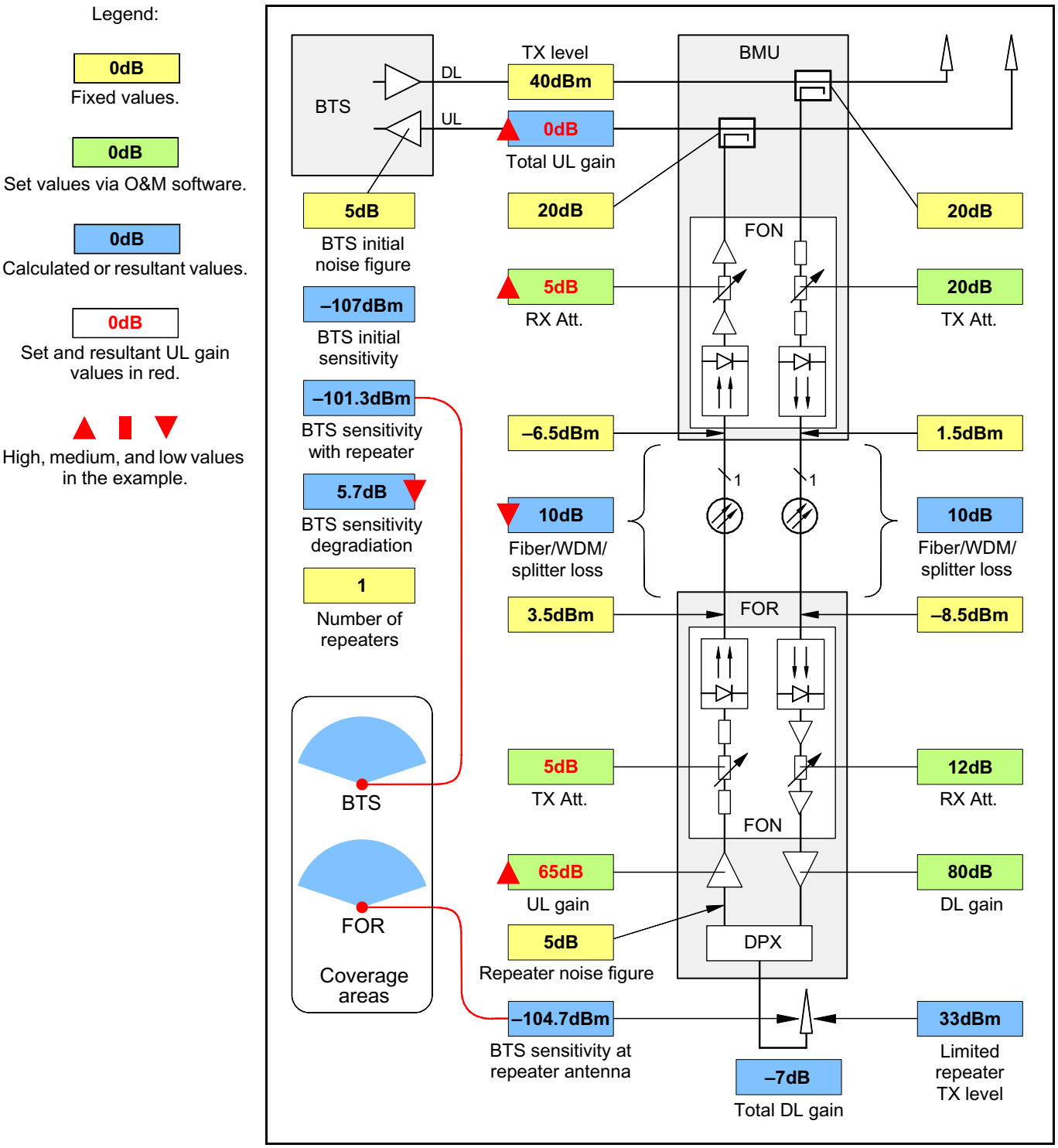

Figure 6-6. One FOR, low optical loss, high uplink gain and attenuation

Figure 6-6 shows a FOR connected with low optical loss, high uplink gain and high uplink attenuation. The *BTS sensitivity degradation* is low.

High total uplink gain and a *BTS sensitivty with repeater* very close to the *BTS sensitivity at the repeater antenna* indicates a similar coverage area for the BTS and the FOR.

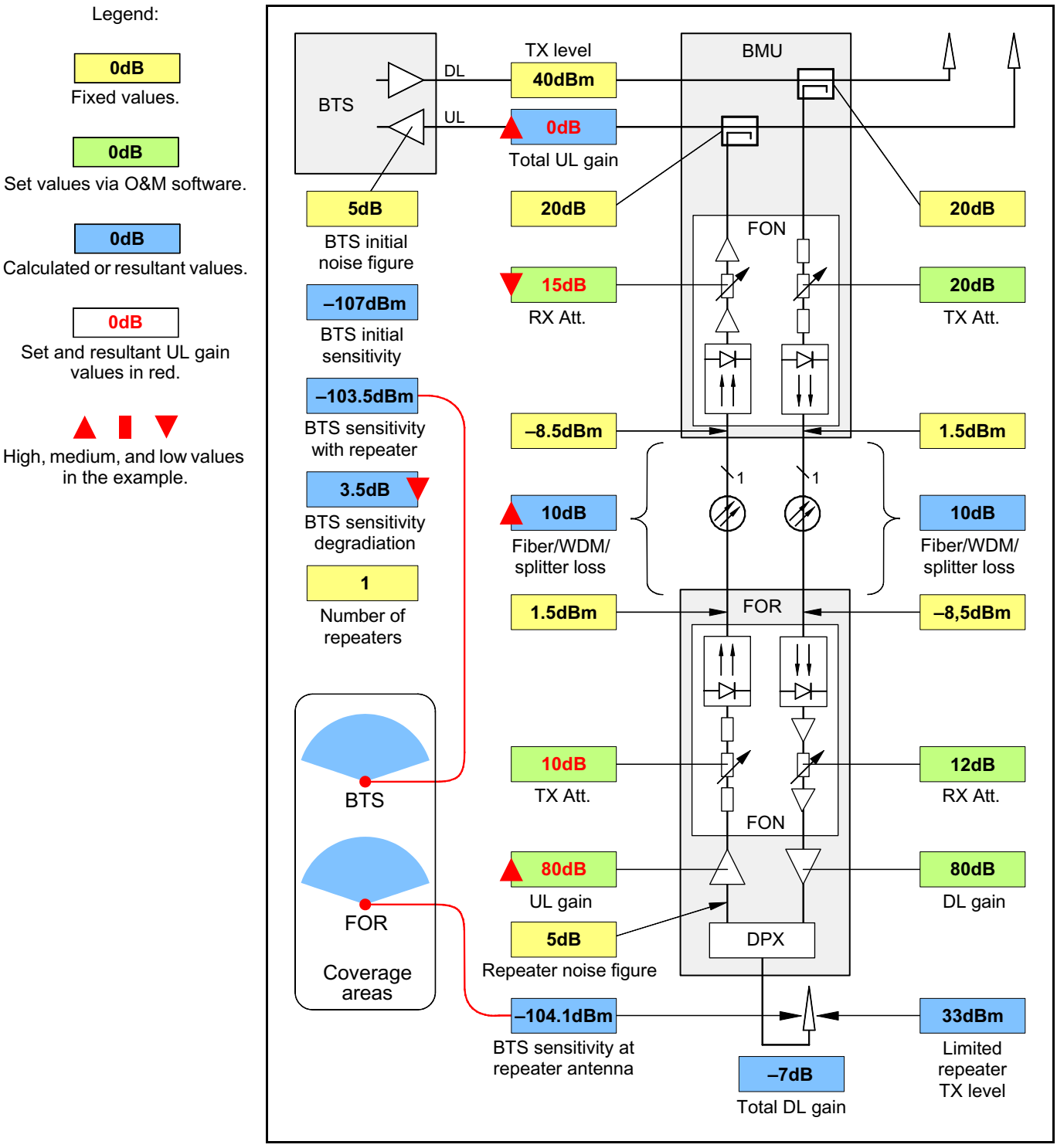

Figure 6-7. One FOR, high optical loss, high uplink gain

Figure 6-7 shows a FOR connected with high optical loss, high uplink gain and an uplink attenuation adapted to the optical loss. The *BTS sensitivity degradation* is low.

High total uplink gain and a *BTS sensitivty with repeater* very close to the *BTS sensitivity at the repeater antenna* indicates a similar coverage area for the BTS and the FOR.

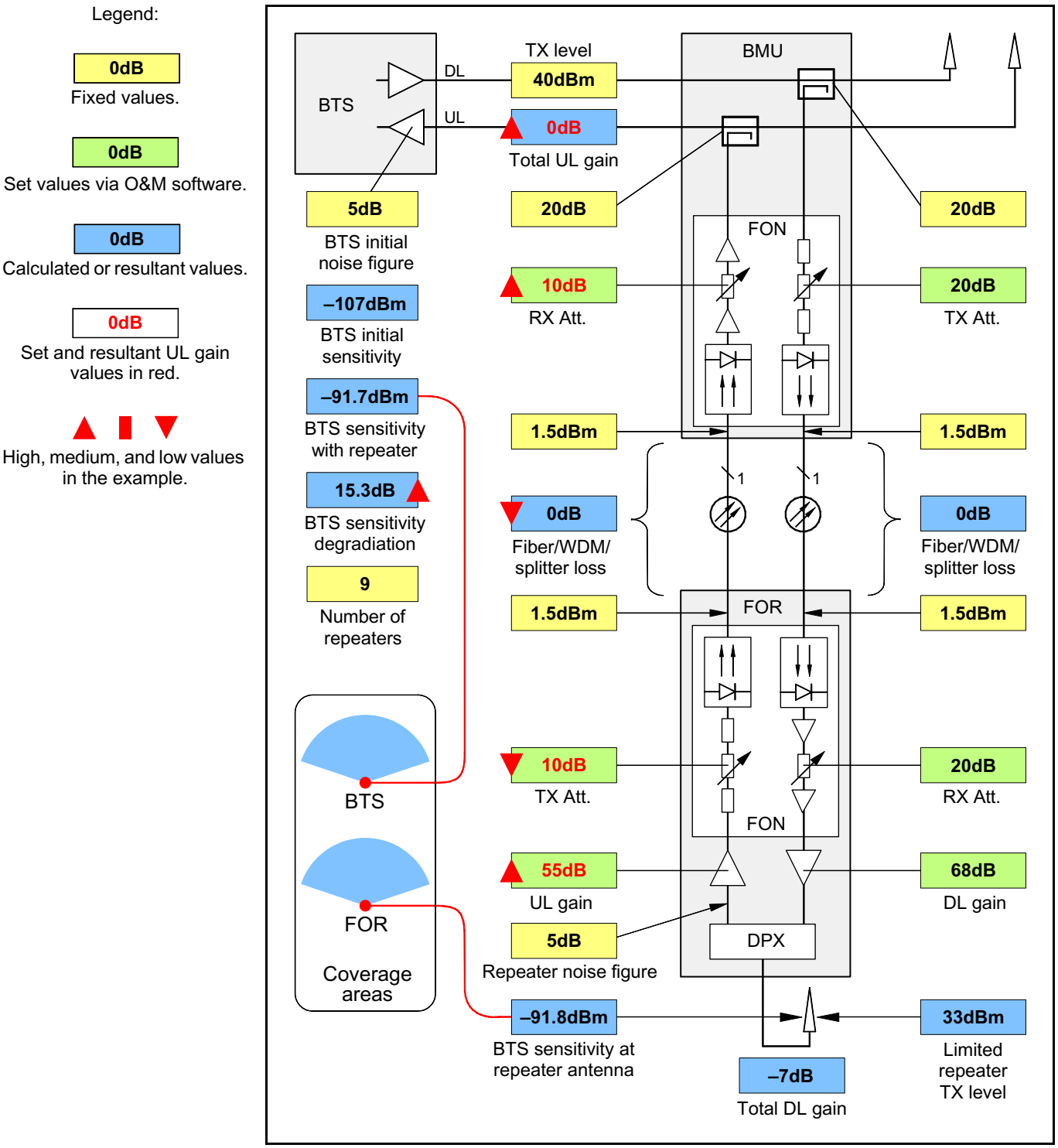

Figure 6-8. Nine FORs, low optical loss, high uplink gain and attenuation

Figure 6-8 shows one of nine FORs connected to one of three FON units in the BMU with low optical loss, high uplink gain and high uplink attenuation. The *BTS sensitivity degradation* is high.

High total uplink gain and a *BTS sensitivty with repeater* very close to the *BTS sensitivity at the repeater antenna* indicates a similar coverage area for the BTS and the FOR.

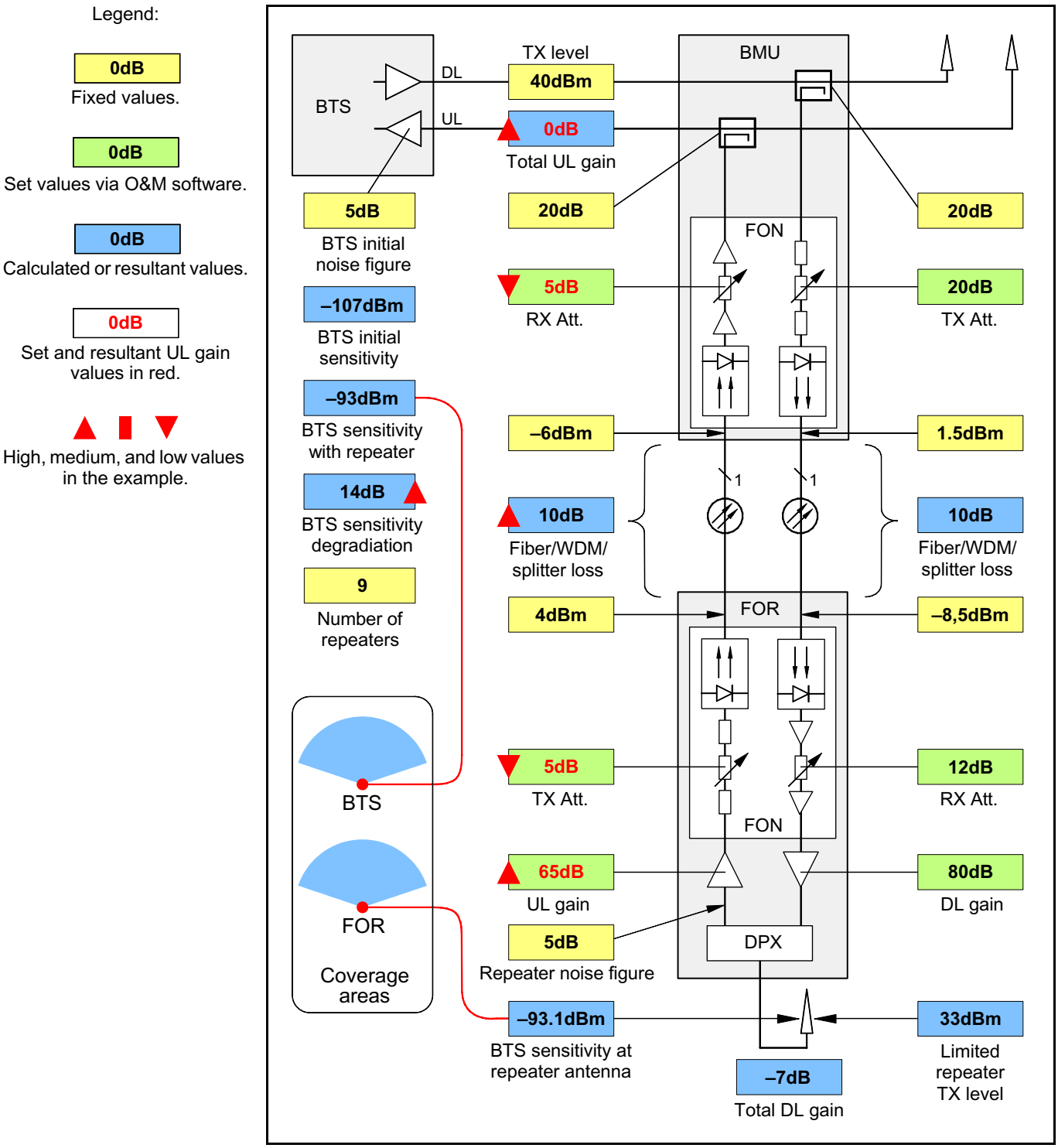

Figure 6-9. Nine FORs, high optical loss, high total uplink gain

Figure 6-9 shows one of nine FORs connected to one of three FON units in the BMU with high optical loss, high uplink gain and an uplink attenuation adapted to the optical loss. The *BTS sensitivity degradation* is high.

High total uplink gain and a *BTS sensitivty with repeater* very close to the *BTS sensitivity at the repeater antenna* indicates a similar coverage area for the BTS and the FOR.

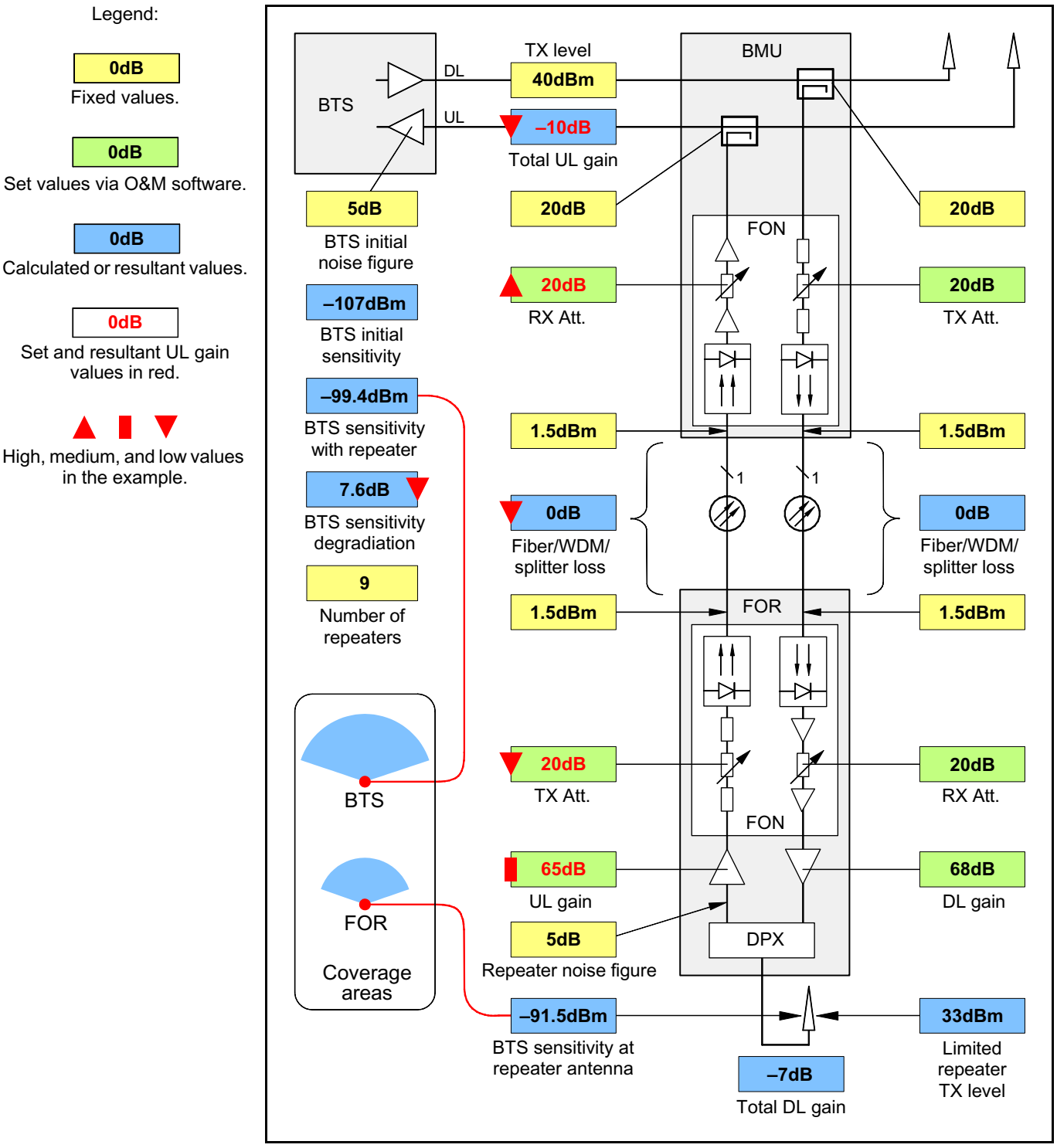

Figure 6-10. Nine FORs, low optical loss, low total uplink gain

Figure 6-10 shows one of nine FORs connected to one of three FON units in the BMU with low optical loss, medium uplink gain and high uplink attenuation. The *BTS sensitivity degradation* is low.

Low total uplink gain decreases the *BTS sensitivty with repeater* under the *BTS sensitivity at the repeater antenna* level, indicating a larger coverage area for the BTS than for the FOR.

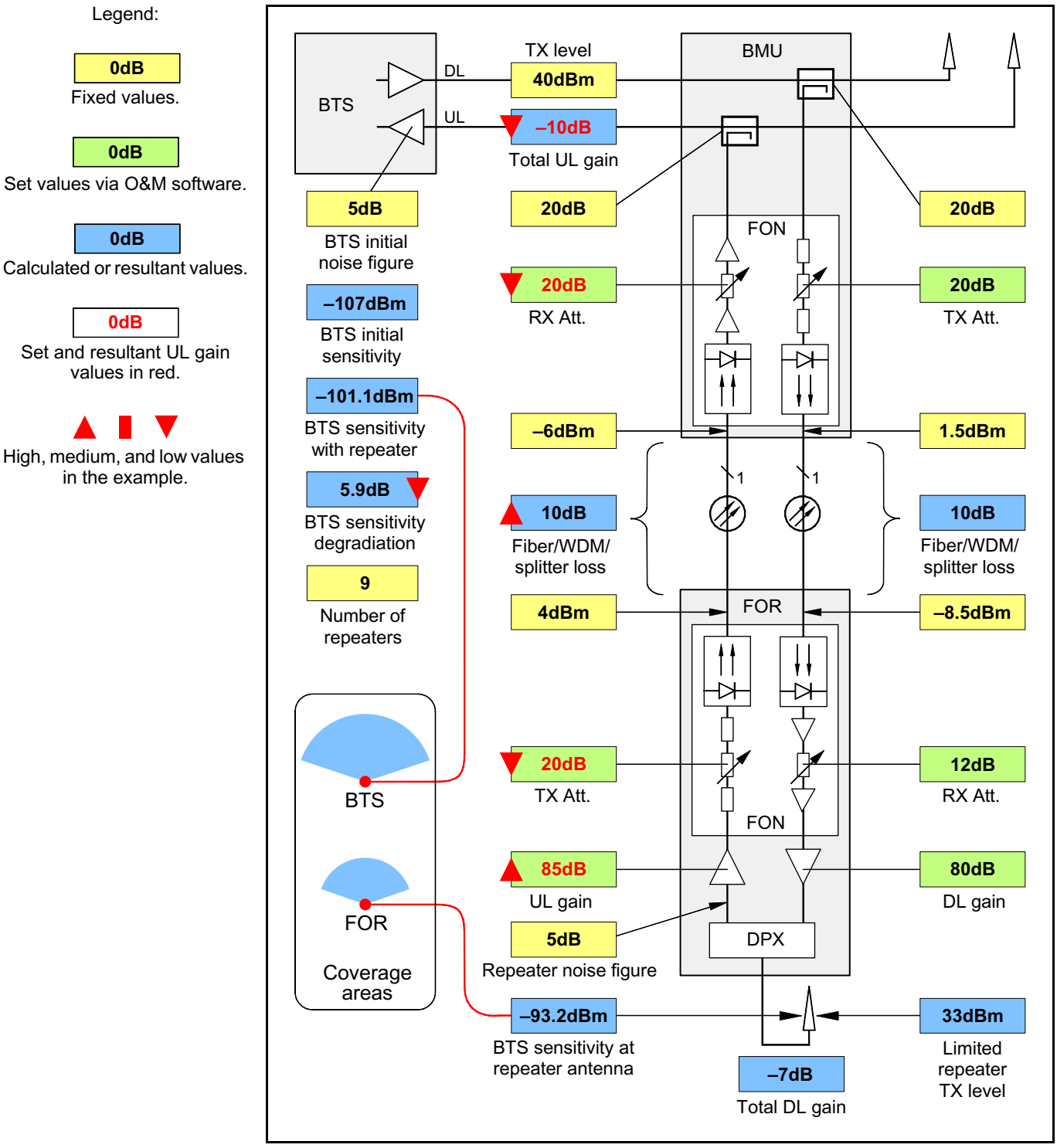

Figure 6-11. Nine FORs, high optical loss, low total uplink gain

Figure 6-11 shows one of nine FORs connected to one of three FON units in the BMU with high optical loss, and an uplink attenuation adapted to the optical loss. The *BTS sensitivity degradation* is low.

Low total uplink gain decreases the *BTS sensitivty with repeater* under the *BTS sensitivity at the repeater antenna* level, indicating a larger coverage area for the BTS than for the FOR.