ILB BT ADIO MUX-PANEL

Basics for Calculating a Larger Distance Between Wireless MUX Module and Antenna

AUTOMATIONWORX

Application Note

Description

The following accessories are available in order to extend the distance between a wireless MUX module and the antenna (see also Figure 1 on page 2):

No.	Description	Type	Order No.
1	Wireless MUX module with panel antenna	ILB BT ADIO MUX-PANEL	28 84 50 9
	Adapter cable MCX -> SMA, 1 m (supplied as standard with the ILB BT ADIO MUX-PANEL)	RAD-PIG-EF316-MCX-SMA	28 67 67 8
2	Adapter cable MCX connector -> N connector, 0.5 m	RAD-PIG-EF316-MCX-N	28 67 68 1
3	Surge protection N socket -> N socket	CN-UB-280DC-BB	28 18 85 0
4	Extension cable 3 m, N connector -> N connector 5 m, N connector -> N connector 10 m, N connector -> N connector 15 m, N connector -> N connector	 RAD-CAB-EF393-3M RAD-CAB-EF393-5M RAD-CAB-EF393-10M RAD-CAB-EF393-15M	 28 67 64 9 28 67 65 2 28 67 66 5 28 85 63 4
5	Adapter cable N socket -> SMA connector, 0.3 m	RAD-PIG-EF316-N-SMA	28 67 69 4
6	Panel antenna, SMA socket (supplied as standard with the ILB BT ADIO MUX-PANEL)	RAD-ISM-2400-ANT-PAN-8-0	28 67 61 0

Additional accessories on request.

Please note that using extension cables reduces the transmission range of the wireless connection.

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Overview of the Recommended Installation Components

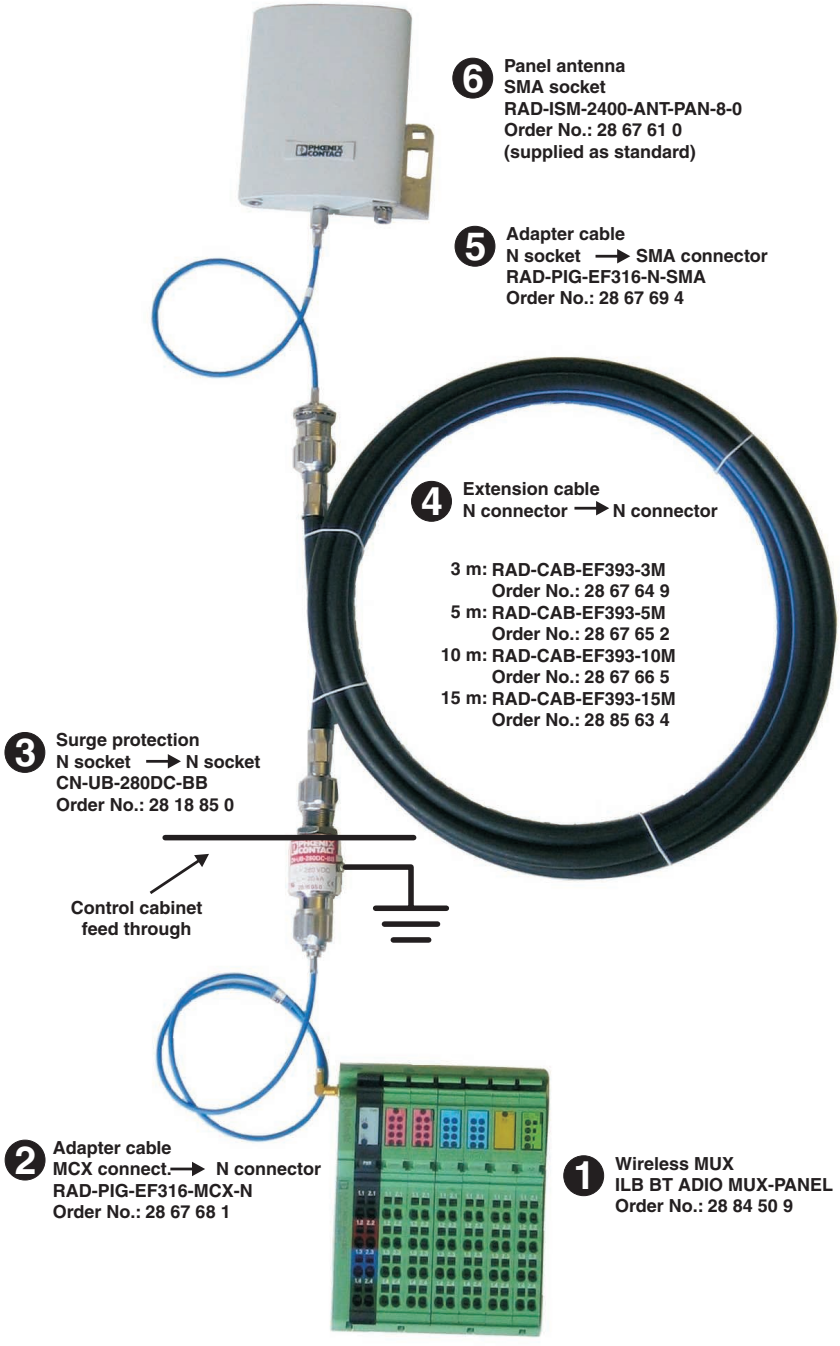

Figure 1 Overview of the recommended installation components

Determining the Transmission Range

Please note:

– This calculation only applies to the ILB BT ADIO MUX-PANEL module with a transmission power of 12 dBm when using the supplied RAD-ISM-2400-ANT-PAN-8-0 panel antenna.

– Calculation of the transmission range can only be a rough guide. Reliable results can only be obtained by means of a local test.

– Calculating the transmission range requires an optimum Fresnel zone. If an optimum Fresnel zone cannot be guaranteed, the transmission range is reduced.

Calculation Process

The maximum transmission range depends on the system performance.

- First, calculate the system performance according to the following formula (1):

System performance = maximum value – attenuation 1 – attenuation 2 (1)

The maximum value is 114 dBm.
The attenuation depends on the length of the antenna cable. Determine the attenuation for each station from Figure 2.

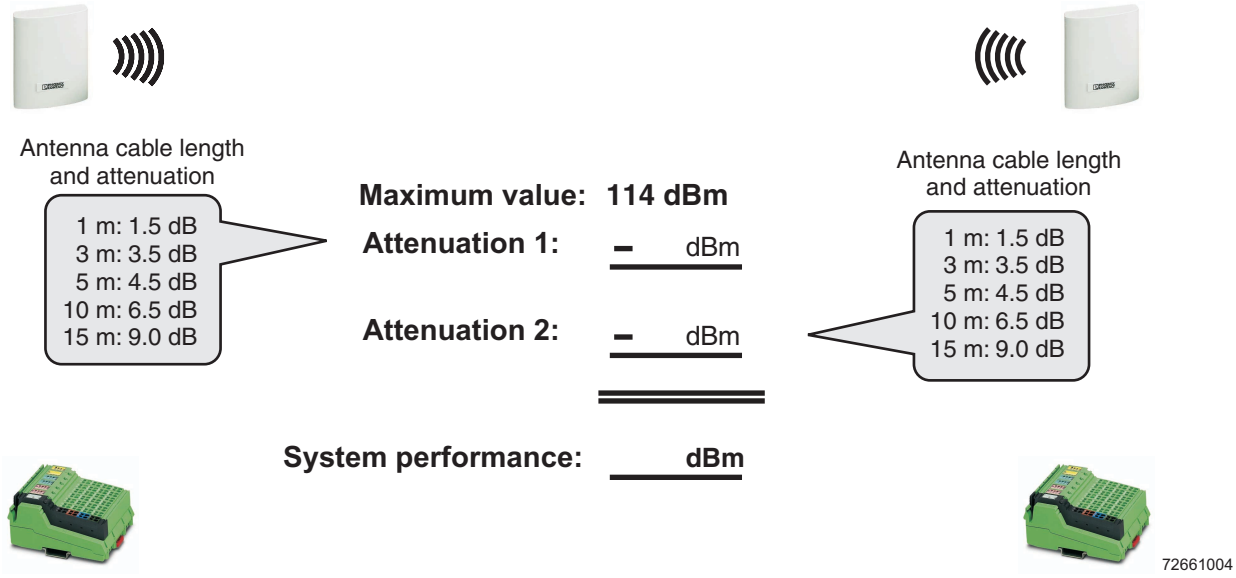

Figure 2 Diagram of radio path and list with attenuation values for calculating the system performance

Example:

Station 1:	Antenna cable length:	5 m
	Attenuation according to Figure 2:	4.5 dB
Station 2:	Antenna cable length:	1 m
	Attenuation according to Figure 2:	1.5 dB (supplied adapter cable)

- Use the values in formula "(1)".
  The example calculation is: system performance = 114 dBm – 4.5 dB – 1.5 dB = 108 dBm

- Determine the transmission range for the calculated system performance values from Figure 3 on page 4.
  The example values are shown in blue/broken line.
  A system performance of 108 dBm results in a transmission range of approximately 250 m with 20 dBm reserve and approximately 800 m with 10 dBm reserve.

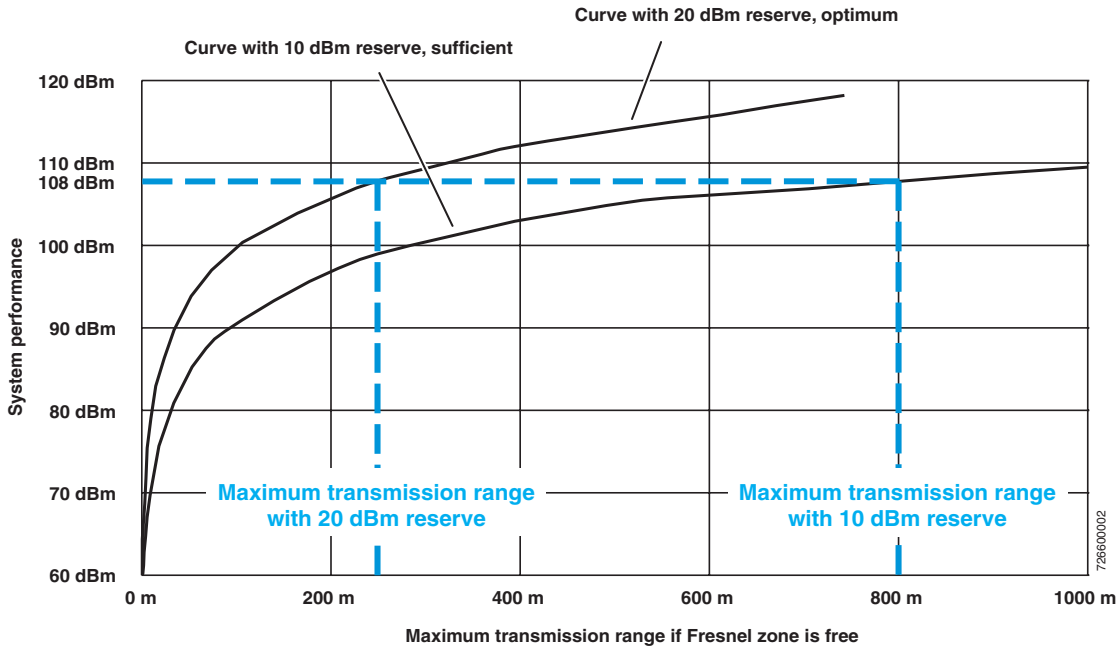

Figure 3 Maximum transmission range in relation to the system performance

The transmission range only applies to radio paths providing a free sight between the antennas and when keeping the Fresnel zone (see Figure 4). Any obstacles on the radio path will reduce the transmission range. Other factors that may affect the transmission range are not taken into account. Therefore, a local test is recommended, especially for a larger transmission range.

A minimum power reserve of 10 dBm (lower curve) should be kept to ensure a stable and reliable wireless connection. However, to ensure adequate performance even in the event of unforeseeable modifications (deterioration) on the radio path, a 20 dBm reserve (upper curve) is recommended.

Effects of the Fresnel Zone on the Radio Coverage

During installation, please observe that there should be a line of sight between two antennas because each obstacle between them deteriorates the connection. Furthermore, please observe that the Fresnel zone expands around the direct line of sight between transmit and receive antennas. If this zone is disturbed by any obstacles or the terrain, the wireless connection is deteriorated. The radius of the Fresnel zone depends on the transmission frequency and the distance between the transmit and receive antennas. For this reason the radius of the Fresnel zone should be selected as the minimum height of the antenna mast. For a Bluetooth system, the mast height can be determined from the curve in Figure 4 depending on the distance to be covered.

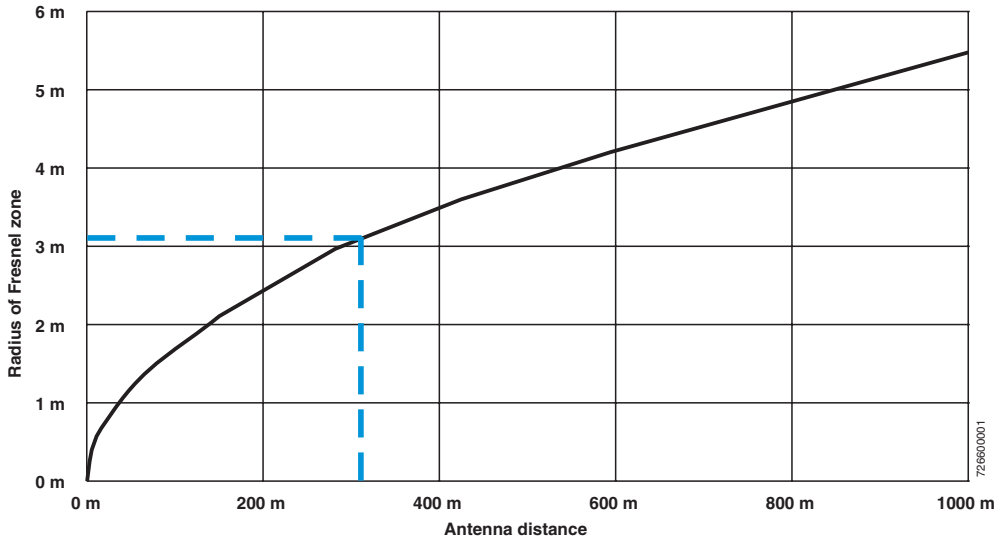

Figure 4 Radius of the Fresnel zone in relation to the antenna distance

Example:

The antenna distance is 300 m.

- Determine the maximum radius of the Fresnel zone from Figure 4.
  For an antenna distance of 300 m, the radius R = 3.1 m.

In Figure 4/Figure 5 the example values are shown in blue/broken line.

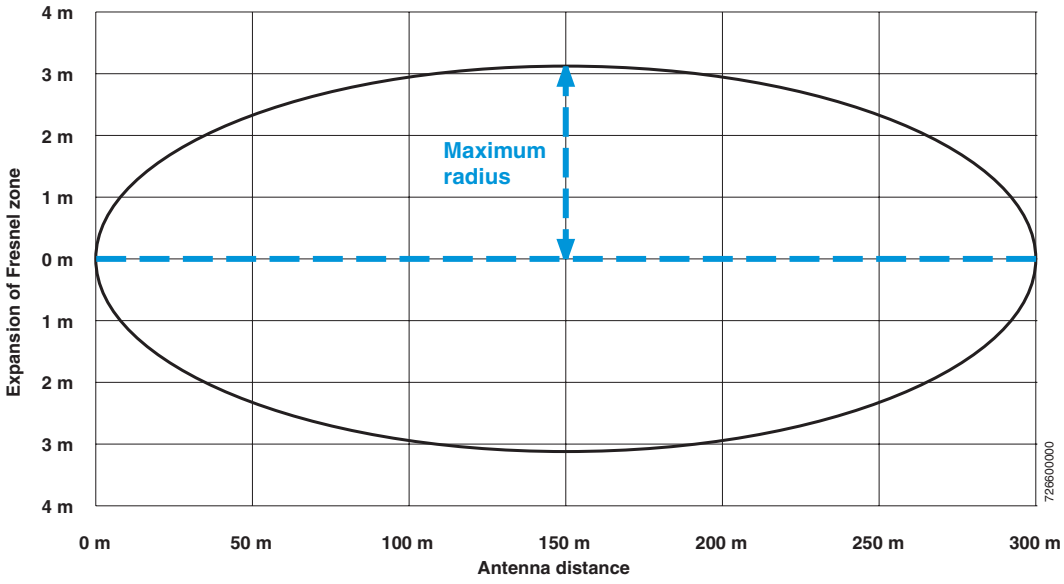

Figure 5 Fresnel zone expansion when using an example antenna distance of 300 m