



*Application Note:
AN_RF_006Ver 1.0
How to extend your wireless range ?*

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Some definitions...

Directional Antenna: A Directional antenna is an antenna which radiates greater power in one or more directions allowing for increased performance on transmit and receive and reduced interference from unwanted sources

Omnidirectional Antenna: An omnidirectional antenna is an antenna system which radiates power uniformly in one plane with a directive pattern shape in a perpendicular plane. This pattern is often described as "donut shaped".

Line of Sight (LOS): Line-of-sight is an unobstructed path between transmitting and receiving antennas

Beamwidth: In the radio regime, of an antenna pattern, the angle between the half-power (-3 dB) points of the main lobe, when referenced to the peak effective radiated power of the main lobe.

Signal-to-noise ratio: (often abbreviated SNR or S/N) is a measure used in science and engineering to quantify how much a signal has been corrupted by noise. It is defined as the ratio of signal power to the noise power corrupting the signal. A ratio higher than 1:1 indicates more signal than noise.



Introduction

The aim of this document is to help the end-user to optimize the wireless range.

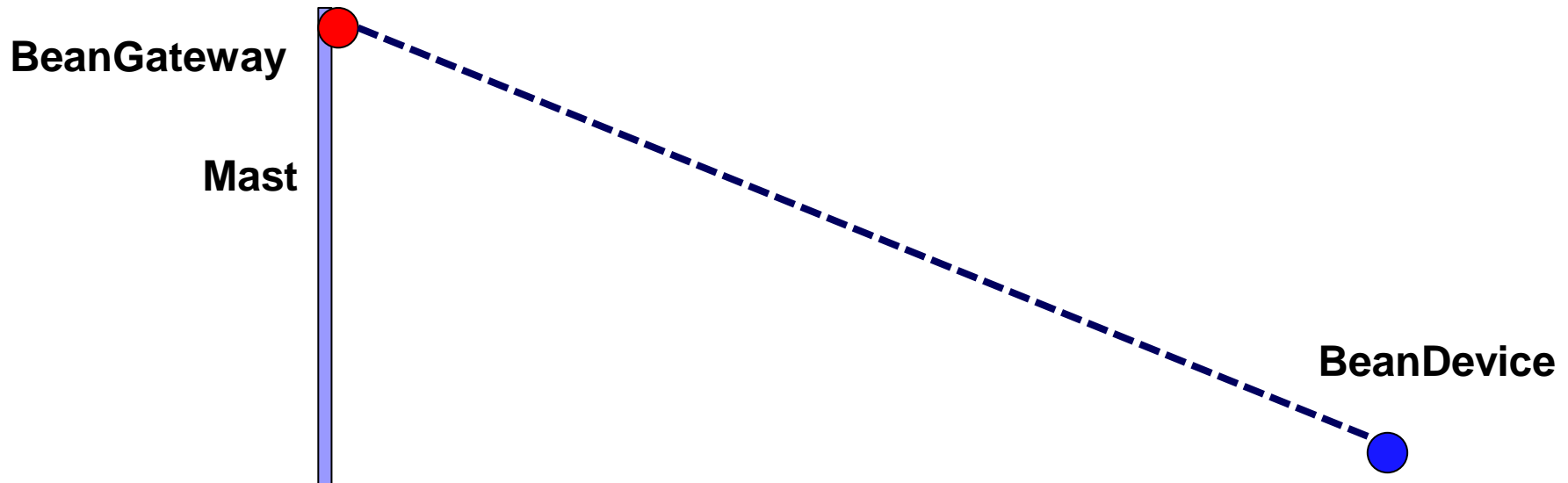
In Long Range application, one antenna may not "see" another because of the earth's curvature.

Two antennas are shown each having the same height. Line-of-sight transmission means the transmitting and receiving antennae can "see" each other as shown. The maximum distance at which they can see each other, occurs when the sighting line just grazes the earth's surface.



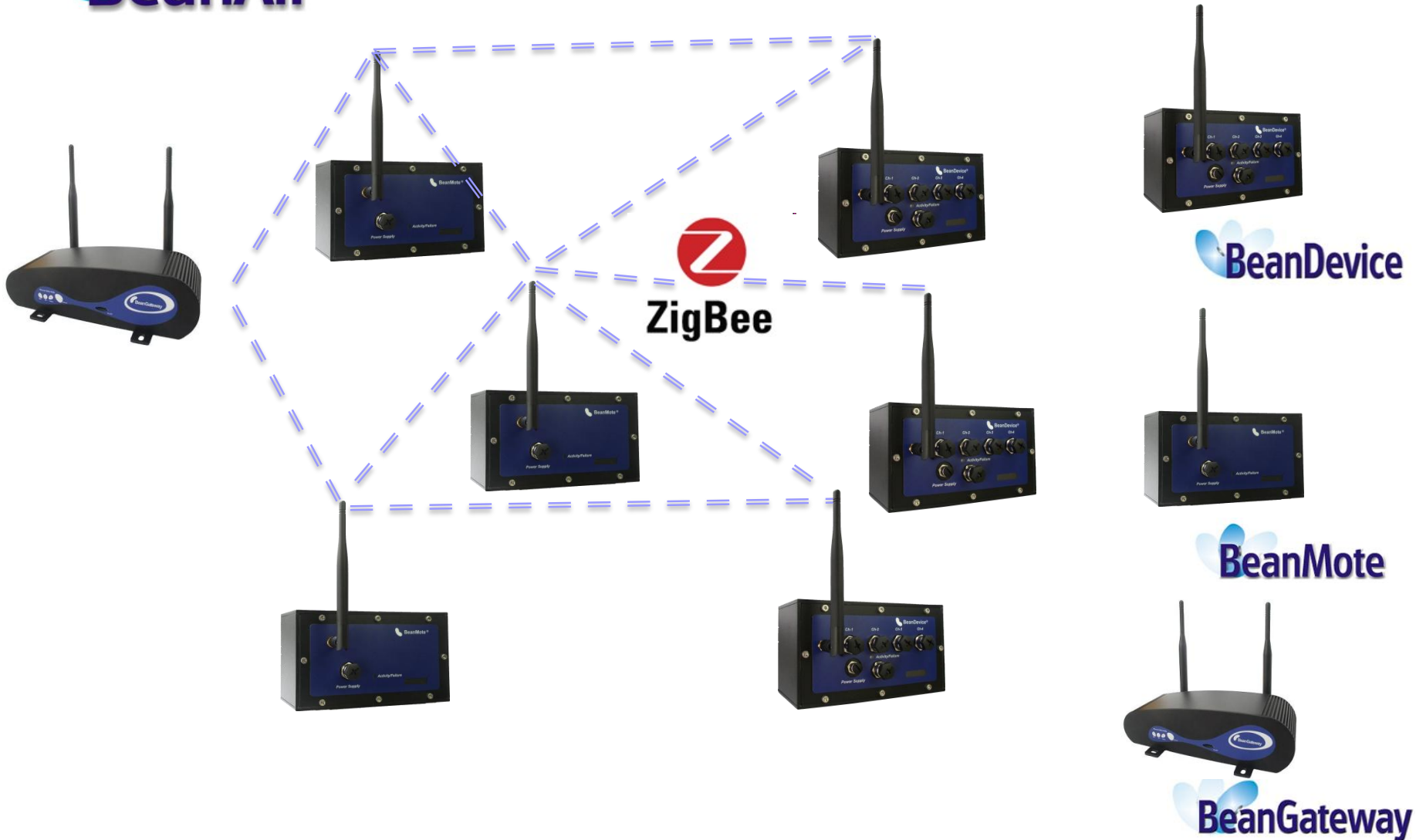
Which solutions is adapted for your application ?

- Use the Maximum TX Power on your BeanDevice. The maximum TX Power authorized in Europe for indoor application is 12 dBm. For Outdoor application, you are authorized to extend the TX Power to 18 dBm. You can easily configure the TX Power on your BeanDevice from your BeanScape WSN software supervision.
- Use a BeanMote (compatible with Zigbee Stack only) in order to extend your wireless range
- Try to configure your receiver antenna and your transmitter antenna on the same antenna pattern (cf. the Beamwidth of your antenna)
- Use a high gain antenna (in outdoor use only) for a better RF Link Budget
- Fix your BeanDevice & BeanGateway on a top of a mast or a building.





Use a BeanMote (wireless Router)



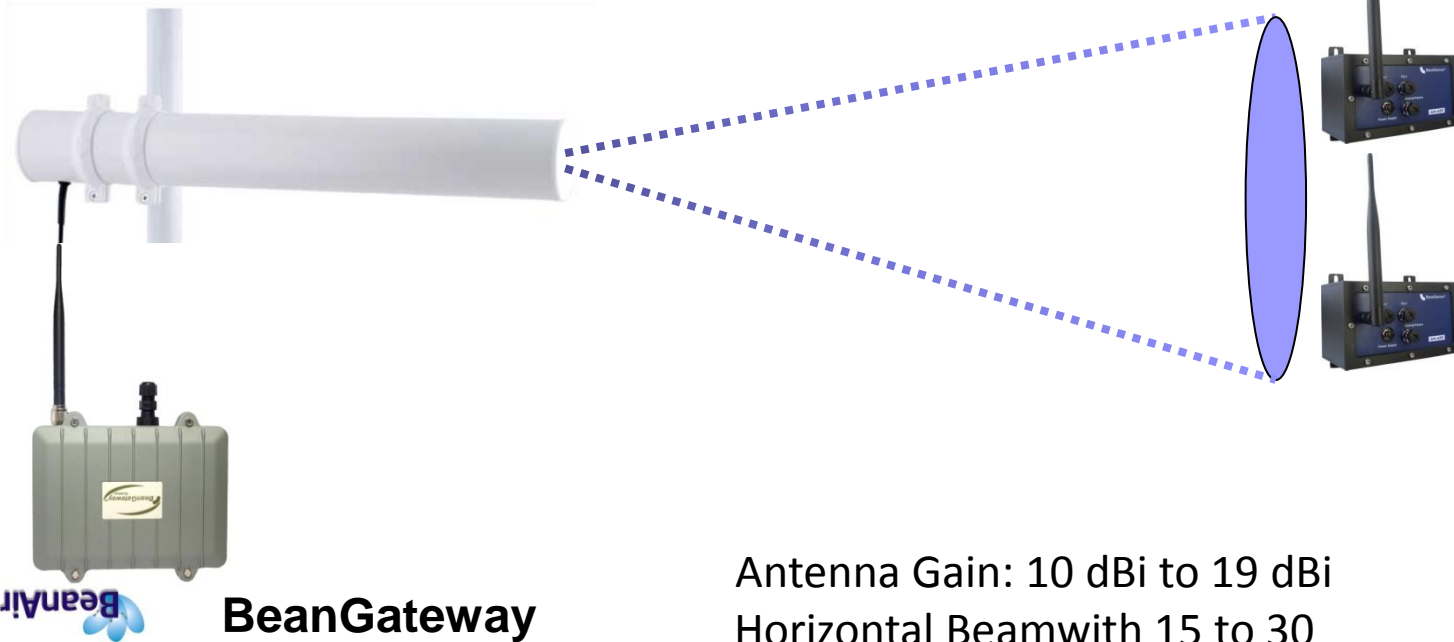
**The BeanMote is only compatible with a BeanDevice integrating a Zigbee stack.
This product can not work on battery/primary cell.**



Use a High gain antenna

Directionnal Antenna

BeanDevice



Antenna Gain: 10 dBi to 19 dBi
Horizontal Beamwith 15 to 30

Vertical Beamwith 15 to 30

Directionnal Antenna

Advantage(s):

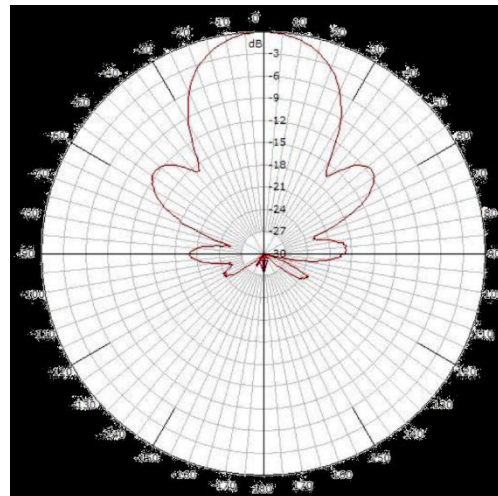
Increase the signal strength by positioning the main lobe in the desired direction.

More adapted for a wireless network with neighbor BeanDevice

Inconvenient(s):

Not adapted for mesh network & star network with distant nodes

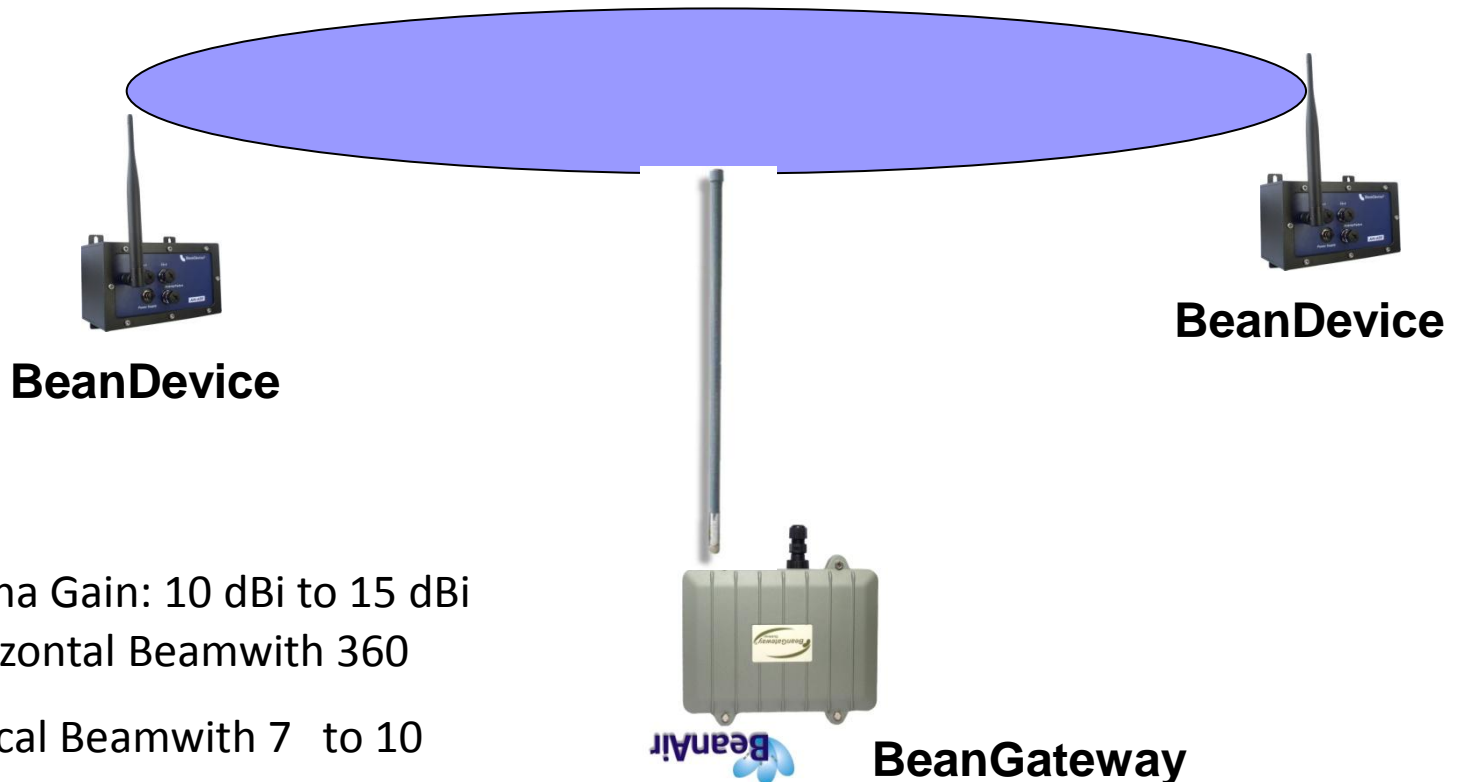
Example of Antenna Pattern:





Use a High gain antenna

Omdirectional Antenna



Antenna Gain: 10 dBi to 15 dBi
Horizontal Beamwith 360
Vertical Beamwith 7 to 10

Use a High gain antenna

Omnidirectional Antenna

Advantage(s):

Adapted for Mesh network & star network with distant nodes

Inconvenient(s):

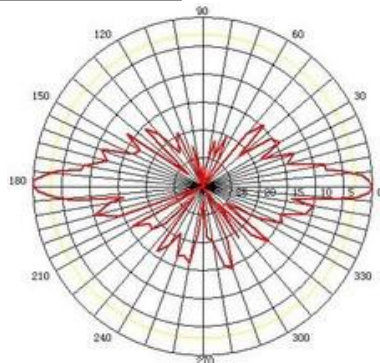
-All signals and noise sources look into the same antenna gain.

-There is neither increase of the desired signal, nor suppression of undesired signals.

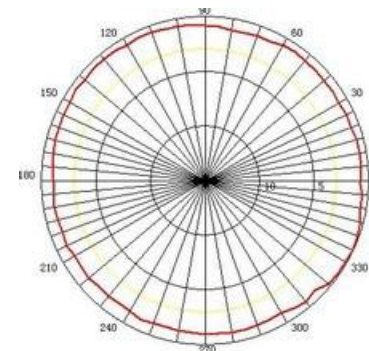
-On a crowded band, the omnidirectional antenna confers no SNR advantage.

Example of Antenna Pattern:

E-Plane



H-Plane



2.4 GHz Antenna Option



Reference	Antenna type	Frequency	Gain	VSWR	Horizontal	Vertical	Connector	Dimensions (mm)	Cable Length	Indoor/Outdoor Use
RF_PAN_12	Directional antenna	2400 - 2500 MHz	12 dBi	< 1,4	360	12	N femelle	928*51*Pi	0,5 m	Outdoor
RF_YAG_10	Directional antenna	2400 - 2483 MHz	10 dBi	</= 1,	50	50	RPSMA male	100*150*22	0,5 m	Outdoor
RF_YAG_12	Directional antenna	2400 - 2500 MHz	12 dBi	1,3:1	> 48	50	RPSMA	210*75*Pi	0,5 m	Outdoor
RF_YAG_16	Directional antenna	2400 - 2500 MHz	16 dBi	1,3:1	> 29	30	RPSMA	575*75*Pi	0,5 m	Outdoor
RF_OM_18	Directional antenna	2400 MHz	18 dBi	1,5:1	27	27		500*50*130	/	Outdoor
RF_OM_5	Omnidirectional	2400 - 2500 MHz	5 dBi	1,92 max	360	linéaire	SMA		/	Indoor