ADAPTIVE®
Adaptive Micro Systems LLC

TechMemo #04-0008

PRIORITY:	Normal
DATE:	September 8, 2004
TITLE:	Maximizing Wireless Transmitter Range
ECO REFERENCE:	n/a
PRODUCT(S) AFFECTED:	900 MHz (Alpha RF900) and 2.4 GHz (Locus) wireless transceivers
SUMMARY:	This document provides information for increasing the range between the wireless transceiver connected to a computer and a wireless transceiver inside a sign. The Alpha RF900 is a 900 MHz transceiver and the Locus transceiver uses 2.4 GHz.

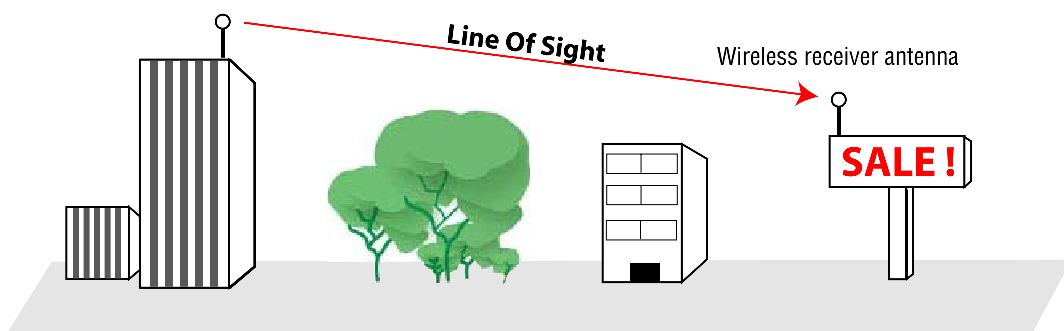
Overview

This document explains how to maximize the range of wireless transceivers by creating a clear path between the computer's (the transmitter) and sign's (the receiver) wireless transceiver antennas.

Transmission range factors

Visual line of sight

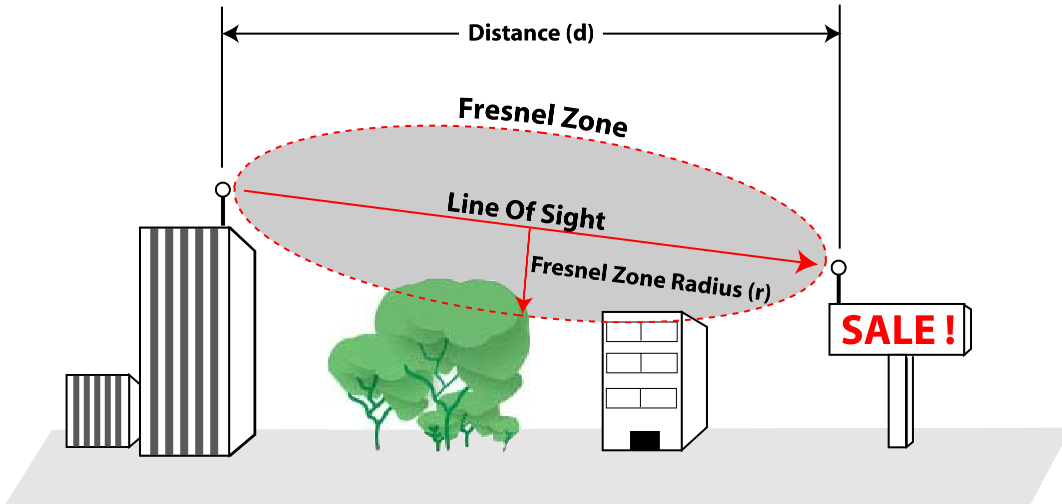
For the most effective communications, there should be a clear *visual* line of sight between the transmitter and receiver antennas:



Fresnel Effect

However, a visual line of sight may not be enough. Radio waves are subject to a property called the Fresnel Effect which creates a football-shaped area (called the Fresnel Zone) that should be free of any obstructions.

For example, in the illustration below, even though there is a clear visual line of sight between the transmitter and receiver antennas, part of a tree and a building are in the Fresnel Zone. These obstructions could interfere with communication.



The size of the Fresnel Zone is determined by the transceiver's frequency and by the distance between the antennas:

Distance (d) between antennas (feet)	[1]Fresnel Zone Radius (r) (feet)		Distance (d) between antennas (feet)	[1]Fresnel Zone Radius (r) (feet)	
	Alpha RF900 transceiver	Locus transceiver		Alpha RF900 transceiver	Locus transceiver
100	2.5	1.5	1900	11.0	6.7
200	3.6	2.2	2000	11.2	6.9
300	4.4	2.7	2100	11.5	7.1
400	5.0	3.1	2200	11.8	7.2
500	5.6	3.4	2300	12.0	7.4
600	6.2	3.8	2400	12.3	7.5
700	6.6	4.1	2500	12.6	7.7
800	7.1	4.4	2600	12.8	7.9
900	7.5	4.6	2700	13.1	8.0
1000	7.9	4.9	2800	13.3	8.1
1100	8.3	5.1	2900	13.5	8.3
1200	8.7	5.3	3000	13.8	8.4
1300	9.1	5.5	3100	14.0	8.6
1400	9.4	5.8	3200	14.2	8.7
1500	9.7	6.0	3300	14.4	8.8
1600	10.1	6.2	3400	14.7	9.0
1700	10.4	6.3	3500	14.9	9.1
1800	10.7	6.5	3600	15.1	9.2

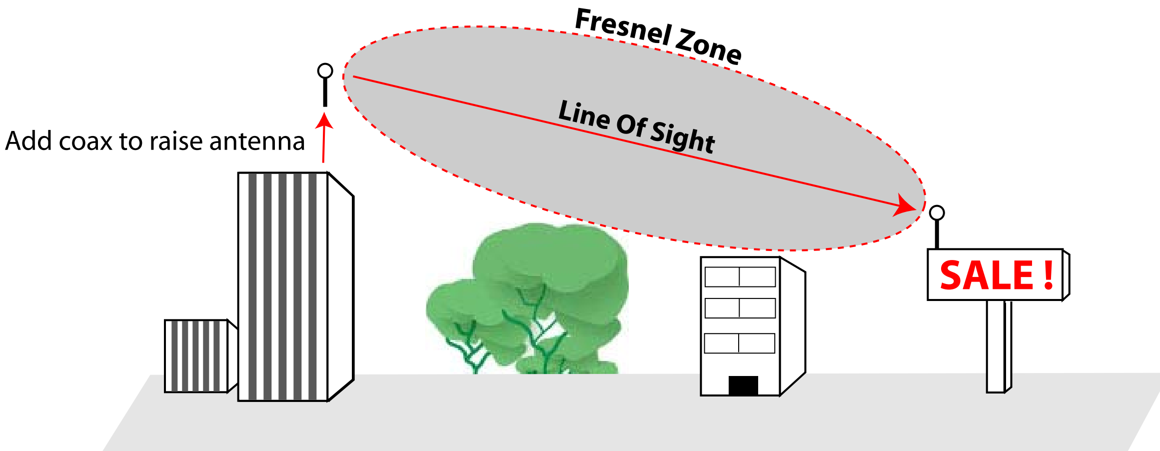
NOTES:
[1] The Fresnel Zone Radius is calculated using this formula: $r = 43.3 \times \sqrt{\frac{d}{4f}}$ where r = radius (ft), d = distance between antennas (ft), and f = frequency (GHz).
However, the value used in the table above is 80% of this calculation because a 20% Fresnel Zone blockage is considered acceptable.

Antenna relocation

If it becomes necessary to move either the transmitter or the receiver antennas, additional coaxial cable can be connected between an antenna and wireless transceiver.

However, there is a trade off — adding more coax cable will attenuate or reduce the effective communication range (see table below).

NOTE: Only Adaptive coax cable (pn 1160-9009A) should be used.



[1]Adaptive Coax Cable Length (ft)	Total Attenuation (dB)	Approximate Visual Line of Sight Distance (ft)
	1	3120
	2	2780
20 feet	3	2470
	4	2200
	5	1960
40 feet	6	1750
	7	1560
	8	1390
60 feet	9	1240

NOTES:

[1] This 20-foot cable (pn 1160-9009A) has an attenuation rate of 0.15dB/foot. For example, a 20-foot length would have a 3dB (20 x 0.15) total attenuation.

This page intentionally left blank.