<u>TOWN OF FALMOUTH, MAINE</u>

REQUEST FOR CONDITIONAL REZONING APPROVAL
TO INCREASE THE HEIGHT
OF AN EXISTING
TIER II PERSONAL WIRELESS SERVICE FACILITY
LOCATED AT
356 US RTE 1, FALMOUTH, ME

PROPOSAL BY
AT&T MOBILITY

EXHIBIT #7

RADIO FREQUENCY
INTERFERENCE ANALYSIS
AT 356 US RTE 1
(PREPARED BY
SCOTT POLLISTER)

Radio Frequency Interference Analysis
356 US Rte 1, Falmouth, ME
Search Ring 1595

Introduction –
Co-location with other service providers on a given tower/installation can provide an effective means to obtain the necessary coverage in a given area while minimizing visual impacts and working within the applicable local ordinance constraints. Co-location analysis needs to not only include equipment on the same physical structure, but also any adjacent structures that are close enough in proximity to potentially cause unwanted interference. This analysis specifically looks at three potential configurations associated with the proposed wireless equipment installation by AT&T at the existing telecommunications facility located on US Rte 1 in Falmouth, ME.

Methodology –
Co-location refers to the physical placement of a providers antennas system with other service providers on (or next to) a given tower/installation. These other operators may be using different technologies, frequencies, antennas and power levels. An important step in the co-location process is to determine the maximum level of interference that can be tolerated without any significant degradation in radio frequency performance to all parties including both incumbents and newcomers. There are several sources of interference that should be considered in determining whether the received interference is above the maximum tolerable level and thus reducing the sensitivity and performance. The types of interference can be categorized into the following:

- Spurious Emissions = energy that is transmitted outside of the defined spectrum
- Receiver Desensitization = strong interference not necessarily at the exact receiver frequency is detected may reduce gain
- Intermodulation = is a product by mixing two or more signals and can appear in the operating band

Interference between collocated systems is the result of insufficient isolation between the systems. (Example: defective or improper antenna placements) Isolation is typically defined between the transmitters and receivers of the collocated operators. Pictorially, the isolation required between the transmitter and receiver is illustrated in Fig. 1.

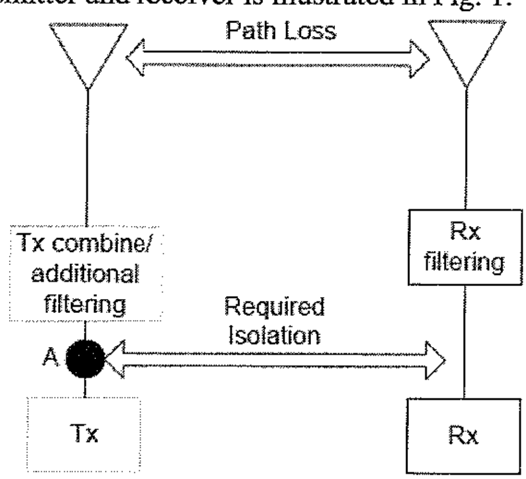


Figure 1

Requirements and Calculation Equations –
Although the exiting configuration of a telecommunication site can be determined (heights, powers, antennas types, operating frequencies, technologies, etc…) it is impossible to determine what it will evolve into as technology is upgraded and the industry changes. As a result, the below table (Table 1) represents a sample of the required isolation values in decibels (dB) given common technologies and operating bandwidths.

Tx / Rx	TDMA/AMPS	ESMR	CDMA	GSM	FCC
TDMA/AMPS	50	56	50	45	72
ESMR	50	56	50	45	72
CDMA	51	57	51	46	73
GSM	50	56	50	45	72

Table 1: typical isolation requirements

The path loss equations that can be used to calculate the predicted isolation between antenna systems area as follows:

Vertical Separation:

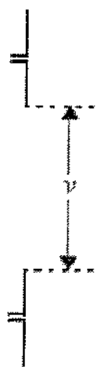


Figure 2: Antenna Vertical separation.

$$PL_v = 28 + 40\log\left(\frac{v \cdot f}{300}\right)$$, for antennas in the same frequency band

$$PL_v = 28 + 40\log\left(\frac{v \cdot f}{300}\right) + L_f$$, for antennas in different frequency bands.

where

v = distance between the antennas tip-to-tip (in feet)

f = frequency (MHz)

L_f = frequency mismatch loss, 10 dB.

Horizontal Separation:

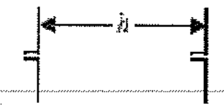


Figure 3 Antenna horizontal separation.

$$PL_h = 22 + 20\log\left(\frac{h \cdot f}{3x10^8}\right) - G_r - G_t$$, for antennas in the same band

$$PL_h = 22 + 20\log\left(\frac{h \cdot f}{3x10^8}\right) + L_f - G_r - G_t$$, for antennas in different bands

where

h = distance between the antennas side-to-side (in feet)

f = frequency (MHz)

G_r = Gain of receive antenna in direction of transmit antenna in dBi

G_t= Gain of transmit antenna in direction of receive antenna in dBi

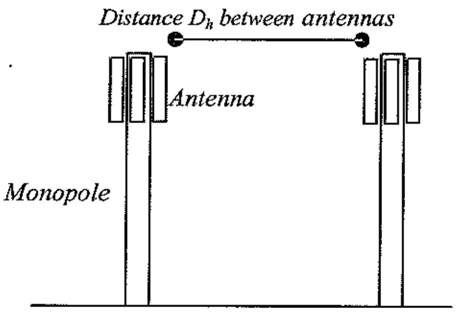
L_f = frequency mismatch loss, 10 dB

Specific Calculations for facility located at 356 US Rte 1, Falmouth ME –
Since the technology of the antennas operating on the two towers can not be guaranteed over time, all of the following calculations will assume an average of 50 dB (approximate average of the values in Table 1) of isolation would be required between operators. In addition, although there are numerous antenna models with slightly varying specifications, these calculations assume an average maximum antenna gain of 13.5 dBi for the 850 MHz band and 16 dBi for the 1900 MHz band.

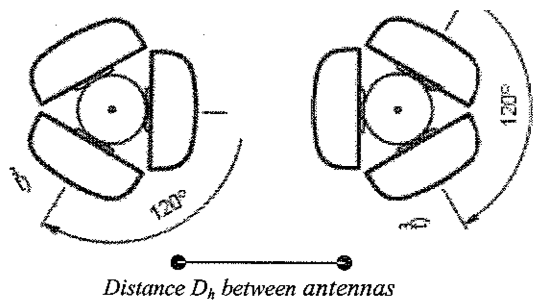
Configuration A:

Site configuration A assumes that a second monopole will be constructed adjacent to the existing facility at the same above ground height and ground elevation. The diagrams below illustrate the side and top view of this configuration.

Side View



Top View



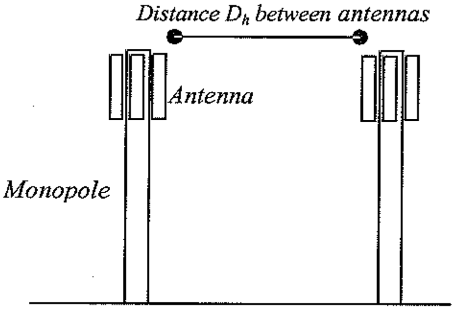
Using the above equations for calculating horizontal path loss the results would be as follows:

D_h (850 MHz and antennas at different bands) =	206 feet
D_h (850 MHz and antennas at same band antennas) =	650 feet
D_h (1900 MHz and antennas at different bands) =	164 feet
D_h (1900 MHz and antennas at same band antennas) =	518 feet

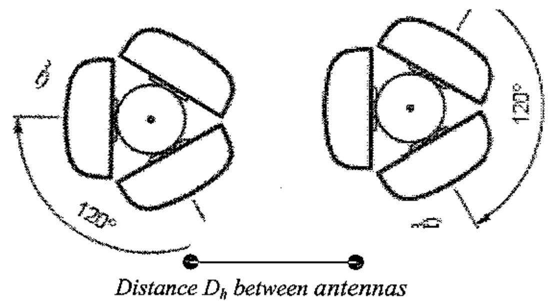
Configuration B:

Site configuration B assumes that a second monopole will be constructed adjacent to the existing facility at the same above ground height and ground elevation. However, in this case, we are assuming that the antennas will be offset and not directly pointed at each other (antenna gain is half of maximum). The diagrams below illustrate the side and top view of this configuration.

Side View



Top View



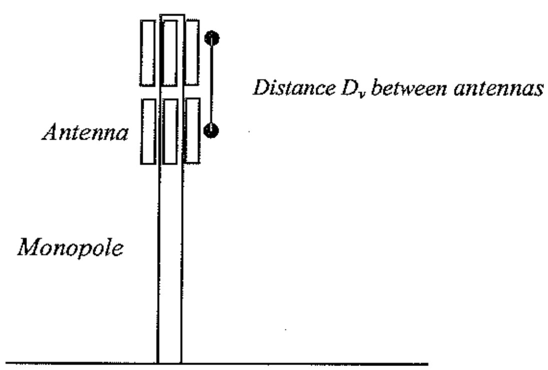
Using the above equations for calculating horizontal path loss the results would be as follows:

D_h (850 MHz and antennas at different bands) =	44 feet
D_h (850 MHz and antennas at same band antennas) =	138 feet
D_h (1900 MHz and antennas at different bands) =	82 feet
D_h (1900 MHz and antennas at same band antennas) =	40 feet

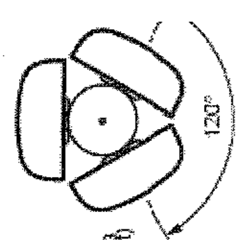
Configuration C:

Site configuration C assumes that the existing monopole is extended by 10 feet to accommodate the AT&T antenna installation. This case's calculations will be completed using the vertical separation equation. In this case the off angle antenna gain will assume to be at least -20 dB down from maximum because of the typically narrow vertical beam-width on sector antennas. The diagrams below illustrate the side and top view of this configuration.

Side View



Top View



Using the above equations for calculating horizontal path loss the results would be as follows:

D_v (850 MHz and antennas at different bands) =	6.5 feet
D_v (850 MHz and antennas at same band antennas) =	2.0 feet
D_v (1900 MHz and antennas at different bands) =	5.2 feet
D_v (1900 MHz and antennas at same band antennas) =	1.6 feet

Conclusion –

As shown in the above calculations the required distance between transmit and receive antennas from multiple operators depends on a number of factors (antenna types, antenna orientations, technology, frequency bands, and many other). Unfortunately, these variables can easily change technology evolves, new spectrum auctions, and corporate acquisitions. As a result, the safe practice of co-locating multiple operators within or on a single wireless facility is to incorporate vertical separation. That type of configuration provides the best isolation and therefore the best protection from interference. Any attempts to co-locate on the same horizontal plane, can require large distances of separation to prevent interference assuming a worst case site configuration.

Signature –

I certify to the best of my knowledge that the statements in this report and the associated calculations are true and accurate.

Scott Pollister
Radio Frequency Engineer

8/5/2008
Date

References –

All calculations were conducted in accordance to AT&T Mobility standards document ND-00113 "*Antenna Co-Location Guidelines*" Rev. 2.0 3/27/2008