



Effect of Weather on Business Only Broadband Availability and Transmission Utilization

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Business Only Broadband network is engineered to maintain annual network availability of 99.995% or above during peak rain periods in a given region based on rain models measuring the past 25 years of rain events.

Introduction

This white paper addresses the measured effects of weather on Business Only Broadband's fixed wireless network. The effects are measured in two distinct ways. The first is using "Engineered Rain Models" that estimate the effects of weather on a specified link within a specific market. The second method is through empirical data measured over a specified time period inclusive of adverse weather conditions on a specific link within a specified market.

Engineered Rain Models

This is an example of how the Business Only Broadband network is engineered to maintain annual network availability of 99.995% or above during peak rain periods in a given region based on rain models measuring the past 25 years of rain events.

If you consider a rain rate of 43.90mm per hour which is the worst month experienced in the NYC region, (1.7283") the models demonstrate the link will maintain an annual availability of 99.995% or above.

This model uses the 23GHz licensed spectrum using our DragonWave radio at a typical design distance under 5 miles. Its output shows that the typical dBm (signal to noise) levels for proper transmission would be approximately -35dbm during normal weather conditions. Note, the signal to noise level (measured in dB) is the strength of the radio's transmission signal over background noise to support the required transmission utilization. Typically, this dBm is established well below the Receiver Threshold levels of -60dBm that eventually effects the links availability and transmission characteristics. Essentially the link is designed to have a margin of 24dBm before its quality and availability is impacted. Typically, heavy rain will have an impact on the dBm levels. However, given the dBm margin built into this design, reaching this Receiver Threshold due to weather only occurs at minimal instances leading to no more than 11.45 minutes a year of potential impact.



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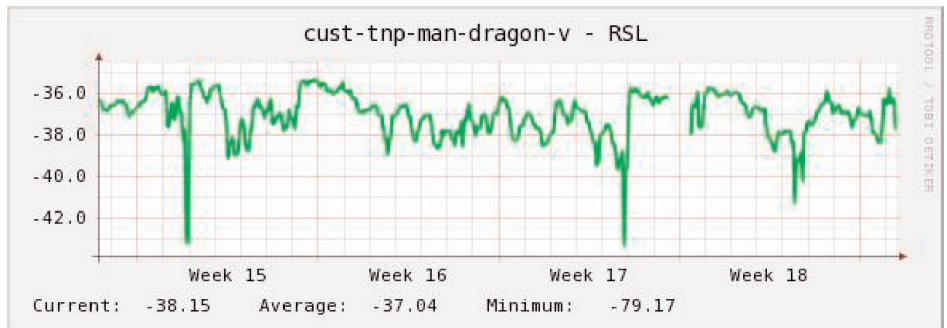
As you can see, the link is designed to be extremely resilient to the effects of bad weather.

DragonWave Radio Product:	Duo HP 23 GHz HD728 in 50MHz
Frequency (GHz):	22.400
Polarization:	Horizontal
Link length (m):	2782.12
Un-Faded Rx Signal Level (dBm):	-35.97
Receiver Threshold (dBm):	-60.00
Link Margin (dB):	24.03
0.01% Rain Rate (mm/hr):	43.90
Rain Availability (%):	99.998
Geoclimatic Factor:	5.50E-04
Cumulative Availability (%):	99.998
Cum. Error Minutes (min/yr):	11.45

Availabilities calculated using ITU-R P.530-9 Methodology

Empirical Data

Now let's look at empirical data to support the claims mentioned above. Below is the actual link measurement over a (4) week period. These measurements are collected constantly through our network management systems. As noted, the average measured transmission levels during good weather are -36 to -38dBm, in line with the -35.97 mentioned in the above model. However, there are (3) instances where the dBm levels dropped to -40dBm or greater. These drops occurred during (3) rainy days. As noted above, this drop was not near the "Receiver Threshold Levels" of -60dBm as advertised above and as such, the effect of those (3) rainy days had no impact on the links availability and transmission utilization.



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Engineering of Business Only Broadband Links

Business Only Broadband's specified engineering of the links is the most critical element to our advertised availability and assured transmission utilization. The two (2) most relevant variables are the choice of spectrum and the distance between the links.

The choice of spectrum can dictate the resiliency of the link and potential for interference. Business Only Broadband has chosen to use only licensed spectrum between its links to ensure that the FCC clears all effects of interference for a 10 year period. Furthermore, we primarily use spectrum at the 11GHz, 18GHz, and/or 23GHz frequency as they support the required 1Gbps bandwidth speeds while maintaining our 99.995% SLA and required needs of the enterprise market.

Distance, in conjunction with the frequency mentioned above, drives the amount of dBm loss (referred to as signal loss) that occurs especially during bad weather. The distance combined with frequency, transmission power of the radios, and general weather conditions are directly related. As such, Business Only Broadband has chosen to keep its distance between radio links typically below 5 miles to ensure that given our standardized choice in frequency of spectrum and associated transmission power levels the signal loss is minimized and the effect of rain doesn't exceed the "Receiver Threshold" levels that affect availability of transmission.

Summary

In summary, Business Only Broadband is able to maintain its high level of availability and SLA's because it has chosen a spectrum and engineered distance between radios based on the conservative estimates of the Rain Models. These Rain Models are further validated by the constant monitoring of the signal levels (dBm) to ensure they remain within tolerance to avoid the effects of weather. Because of this, the end customer can enjoy the availability and transmission utilization that they expect regardless of weather effects and achieve the production oriented results expected.