WHITEPAPER

Effects of weather on Fixed Wireless availability and transmission utilization

Engineered rain models and empirical data demonstrate how Windstream Enterprise Fixed Wireless maintains annual network availability of 99.995% or above—even accounting for bad weather

This white paper addresses the measured effects of weather on the Windstream Enterprise Fixed Wireless network. The effects are measured in two distinct ways.

The first is by using "engineered rain models" that estimate the effects of weather on a specific link within a specified market.

The second method uses empirical data measured over a specified time period inclusive of adverse weather conditions on a specific link within a specified market.

Executive takeaways

You will learn the following from this white paper:

1. The measured effects of weather using the "engineered rain models" method
2. The measured effects of weather using empirical data
3. The engineering of fixed wireless network links
4. The overall measured effects of weather on the Windstream Enterprise Fixed Wireless network

Engineered rain models

The Windstream Enterprise Fixed Wireless 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. For example, in its worst month of weather on record, New York City experienced a maximum rain rate of 43.9 mm (1.7283") per hour. The engineered rain models demonstrate that the link will maintain an annual availability of 99.995% or above even under these conditions.

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These models use the 23 GHz licensed spectrum using our DragonWave radio at a typical design distance under 5 miles. Its output shows that the typical signal-to-noise level for proper transmission—the strength of the radio's transmission signal over background noise to support the required transmission utilization—would be approximately -35 dBm (decibel-milliwatts) during normal weather conditions. Typically, this dBm is established well below the receiver threshold level of -60 dBm that eventually affects the availability and transmission characteristics of the link.

The link is designed to have a margin of 24 dBm before its quality and availability is impacted, and heavy rain will typically have an impact on the dBm levels. However, given the dBm margin built into this design, reaching this receiver threshold due to weather occurs very rarely, leading to no more than 11.45 minutes per year of potential impact.

Disruption to the availability and transmission characteristics of the link occurs very rarely, leading to no more than 11.45 minutes per year of potential impact.

In short, the link is designed to be extremely resilient to the effects of bad weather:

DragonWave radio product
Duo HP 23 GHz HD728 in 50M

Frequency
22.400 GHz

Polarization
Horizontal

Link length
2,782.12 m

Un-faded Rx signal level
-35.97 dBm

Receiver threshold
-60.00 dBm

Link margin
24.03 dB

0.01% rain rate
43.9 mm/h

Rain availability
99.998%

Geoclimatic factor
5.50E-04

Cumulative availability
99.998%

Cumulative error time
11.45 min/yr

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

Empirical data

Empirical data supports the claims mentioned above. The Windstream Enterprise network management systems observed the link over a four-week period. The average measured transmission levels during good weather were -38 to -41 dBm, in line with the -35.97 produced by the above model. However, there were five instances where the dBm levels dropped to -42 dBm or below. These drops occurred during five rainy days. However, this drop was not near the receiver threshold level of -60 dBm and, as such, those five rainy days had no impact on the availability and transmission utilization of the link.

Engineering of Fixed Wireless links

The specified engineering of the links in Windstream Enterprise Fixed Wireless is the most critical element to our advertised availability and assured transmission utilization. The two 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 the potential for interference. Windstream Enterprise has chosen to use only licensed spectrum between its Fixed Wireless links to ensure that the FCC clears all effects of interference for a 10-year period. Furthermore, we primarily use spectrum at the 11 GHz, 18 GHz and/or 23 GHz frequency, as they support the required 1 Gbps bandwidth speeds while maintaining our 99.995% SLA and meeting the needs of the enterprise market.

Distance, in conjunction with frequency, drives the amount of dBm loss (referred to as “signal loss”) that occurs, especially during bad weather. The distance, frequency and transmission power of the radios and the general weather conditions are directly related. As such, Windstream Enterprise has chosen to keep the distance between its Fixed Wireless radio links typically below five 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.

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The Windstream Enterprise advantage

Windstream Enterprise Fixed Wireless is a diverse, unique Ethernet Internet access solution that can be used to address your long- or short-term Internet/data network access needs. It provides a fast, reliable and secure network with last mile access and rapid deployment for your business.

Fixed wireless is unique because, unlike other terrestrial access methods your business may be using today, it is provided through digital microwave technology with a fixed beam transmission from one radio to another via a dedicated, licensed and regulated spectrum (6–86 GHz). Windstream Enterprise manages and operates an extensive fixed wireless network in select markets where the service is available, and we continue expanding the service into new markets to support your growing business. In addition, Windstream Enterprise Fixed Wireless can be used to support the entire line of Windstream Enterprise products and services, such as MPLS and VoIP.

Conclusion

In summary, Windstream Enterprise Fixed Wireless is able to maintain its high level of availability and SLAs because we have chosen a spectrum and engineered distance between radios based on conservative engineered rain model estimates. These rain models are further validated by the constant monitoring of the signal levels (dBm) to ensure they remain within tolerances to avoid the effects of weather. Because of this, you can enjoy the availability and transmission utilization you expect and achieve the production-oriented results you require, no matter the weather.

About the author

Chris Craven was the chief operating officer (COO) of Business Only Broadband (BOB) prior to their acquisition by Windstream in October, 2014. Mr. Craven brings over 40 years of telecommunications experience dating to his time in the U.S. Air Force, when he assumed various duties as a telecommunications technical controller in the United States and Europe.

Upon leaving military service in 1983, Mr. Craven joined MCI Telecommunication and was directly responsible for the successful deployment of the company's Remote Access and Testing System, REACT, a computer-driven quality control system for the testing of the company's inventory of interconnection facilities with the Bell Telephone Operating group of companies.

About Windstream Enterprise

Windstream Enterprise collaborates with businesses across the U.S. to drive digital transformation by delivering solutions that solve today's most complex networking and communication challenges.

To learn more about Fixed Wireless, visit windstreamenterprise.com

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