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How to Configure Miracast™ Wireless Display Implementations for Maximum Performance

Actiontec® | ScreenBeam™

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Are wireless interference and excessive channel use causing frustration and down time for your wireless users? Do you struggle with Miracast wireless display connections dropping?

In this white paper we illustrate best practices for troubleshooting wireless environments and helping various technologies play together correctly in the same frequencies. We explore the root causes of these issues and how to solve them. For ScreenBeam wireless display receivers, proper configuration is key to getting the most powerful and reliable signal.

A Poor Wireless Environment: Three Common Causes

There are three common causes to the issues organizations experience with their wireless environments.

Physical design, improper planning and excessive power all can contribute to a poor wireless environment.

1. **Physical Design and Infrastructure:** The organization's physical design and infrastructure may interfere with the wireless signal.
2. **Adjacent Channel Interference:** Improper channel planning, plus miscellaneous Wi-Fi and non-Wi-Fi devices, may contribute to adjacent channel interference, also known as overlapping channel.
3. **Transmitting Power:** Excessive transmission power may cause high channel utilization and interfere other wireless connectivity using the same wireless channel.

1. Physical Design and Infrastructure

Understanding the Nature of Radio Frequency Waves

Issue

If an access point (AP) does not receive successful data transmission from a source device because of distorted radio wave (also known as Network Packet Loss), it will not respond to the source device. APs are half duplex, meaning they can only send or receive at any given moment; they cannot do both at once. On a shared medium, multiple sources all sense the medium for a clear channel, then contend for a period of time to transmit their packets.

Network packet loss forces a re-transmission attempt from the source device, which slows the network down.

Background

Radio waves may become distorted by coming in contact with the building's physical infrastructure. Some obstacles that radio waves must navigate cause them to lose power or signal strength prior to arriving at the receiving device. Figure 1 illustrates an environment in which radio waves may lose their strength.

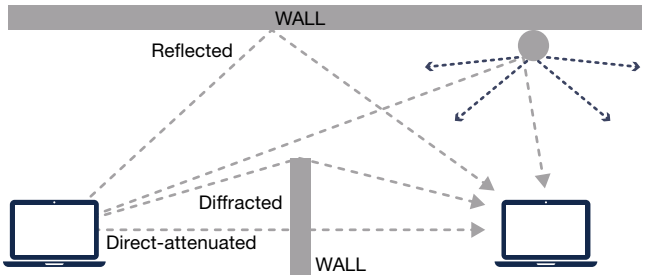

Figure 1: How radio waves may lose their strength

Radio waves may:

Attenuate: When wireless signals move through a medium such as walls, brick or concrete, they gradually lose intensity.

Diffract: When a wave encounters an obstacle, it bends around the corner of the obstacle or aperture, into the region of the obstacle's geometrical shadow.

Reflect: Signal power may be reflected back to its origin, rather than being carried all the way to its destination.

Scatter: Upon encountering a convex structure, such as a glass window, door or water cooler, the waves shatter into little bits and scatter in various directions.

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The placement of the ScreenBeam wireless display receiver is critical to its performance. Take into consideration that radio frequency (RF) waves are omnidirectional, meaning when radio waves leave the antenna, they travel in all different directions.

Figure 2 illustrates what an omnidirectional antenna looks like when radio waves leave an antenna. Anything directly below the antenna is a dead zone, and anything below the "x" area is reflected upwards. Placing a ScreenBeam receiver on a metal surface will cause the radio waves to reflect off of the metal surface and propagate upwards, instead of in their intended outward direction.

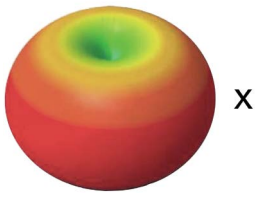

Figure 2: Omni-directional radio waves

Solution

Best practices to mitigate the attenuation, diffraction, reflection and scattering of radio frequency waves and to return the strongest RF signal are to:

1. Establish a good line of sight from the client system transmitting to the ScreenBeam.
2. Conduct a site survey; examine each room for anything that may cause RF wave deflection or damage.

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2. Adjacent Channel Interference

Improper Wireless Planning

The 2.4 GHz wireless spectrum is limited to only three non-overlapping 20MHz channels.

Issue

Most enterprise-grade wireless APs are set to use dual-band with auto channel and/or auto transmit, which gives client systems the opportunity to choose the best possible Wi-Fi connection at any given time, anywhere in the building.

In the 5 GHz spectrum, there's no 20 MHz channel partial overlap. The 2.4 GHz wireless spectrum however, is limited to only three non-overlapping 20 MHz channels: 1, 6, and 11 (within the USA and the majority of the world).

Figure 3 below shows channels 1, 6, and 11 highlighted in green, non-overlapping when set respectively. Channel 3, if enabled, can overlap with both channels 1 and 6, which introduces adjacent channel interference.

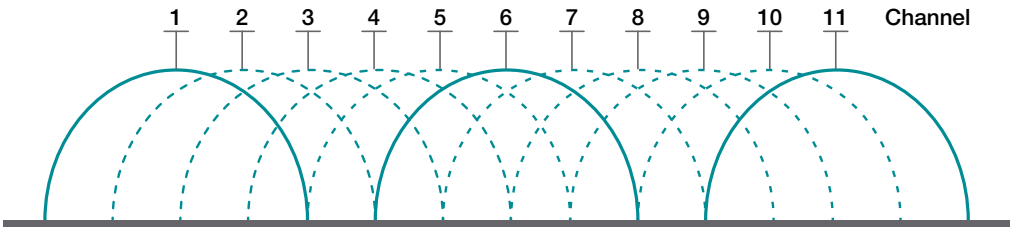

Figure 3: 2.4 GHz channels

When communications signals are competing with each other, the transmissions become garbled and severely interfere with Miracast wireless display connections. This adjacent channel interference is the worst type of Wi-Fi interference.

If channel bonding is used in 2.4 GHz to increase the throughput, then it is highly susceptible to adjacent channel interferences from other 2.4 GHz radios, as seen in Figure 4.

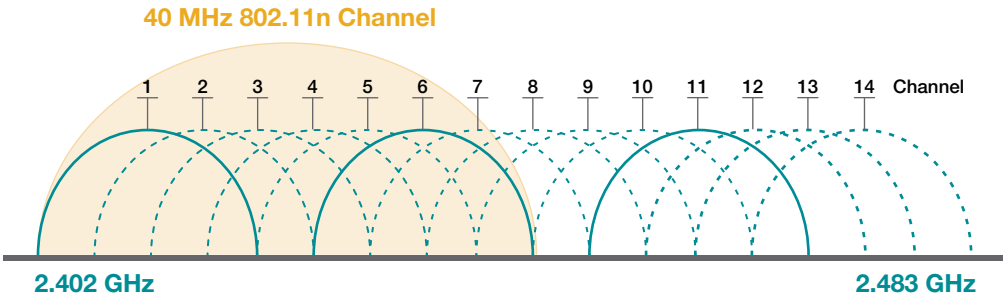

Figure 4: Adjacent channel interferences in 40 MHz

Solution

1. Our recommended best practice for constant and reliable connection in these high-transient environments is for APs to maintain set channels. To achieve this, AP channels should have good separation from neighboring APs. The Wi-Fi industry standard recommendation for 2.4 GHz and 5 GHz is that no channels should be next to each other.
2. Figure 5 illustrates 2.4 GHz channels set at 1, 6 and 11.

Adjacent channel interference is the worst type of Wi-Fi interference

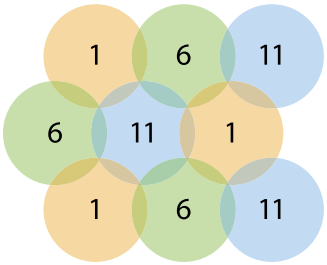

Figure 5: Proper configuration for 2.4 GHz to avoid adjacent channel interference.

Setting the APs to channels 1, 6 and 11 ensures that the channels will not overlap with each other and cause adjacent interference.

3. Do not enable channel bonding in the 2.4 GHz band.
4. Disable or remove unnecessary third-party Wi-Fi and non-Wi-Fi 2.4 GHz radios (such as a Bluetooth device) that may attribute to adjacent channel interference.

3. Transmitting Power

Configuring Access Points

Issue

When the radio frequency noise floor raises, it changes the signal-to-noise ratio (SNR), causing the transmitting power to increase. The cells of the radio frequency footprint get so large that they bleed into neighboring rooms. Since 2.4 GHz signals propagate better than 5 GHz, a 2.4 GHz signal with the same amount of transmission power can be received farther away. Thus, they often cause overlapping coverage cells when multiple APs reuse the same channels 1, 6, and 11.

Overlapping coverage cells using the same channel can lead to high channel utilization. When multiple client systems are connected to neighboring APs using similar channels, two or more client systems transmitting at the same time can result in garbled transmissions. If there are excessive signal collisions, data would never be transmitted successfully, and the wireless network would be unusable. This can also severely affect Miracast wireless display connection and streaming performance.

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Since 2.4 GHz signals propagate better than 5 GHz, a 2.4 GHz signal with the same amount of transmission power can be received farther away.

Figure 6 below provides an example of potential high utilization for channel 11, indicated by dark red areas.

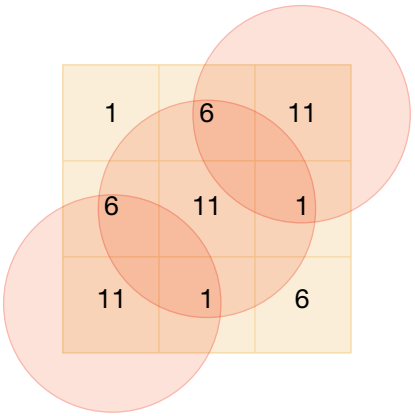

Figure 6: Overlapping coverage cells using the same channel can lead to high channel utilization

Solutions

1. Manually set the transmit power for the 2.4 GHz APs. In the AP's WLAN controller, pick a series of four rooms and manipulate the power so the RF footprints are not overlapping. Run a quick site survey with an on-site technician doing spectrum analysis. Have the technician determine the center of each room and take some readings, then mimic that across the entire campus.

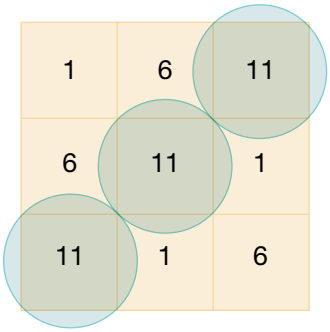

Figure 7: Reducing transmitting power mitigates high channel utilization

2. The similar implementation using 5 GHz should see less of an issue, since there are more channels available, and the signal travels less than 2.4 GHz signals.

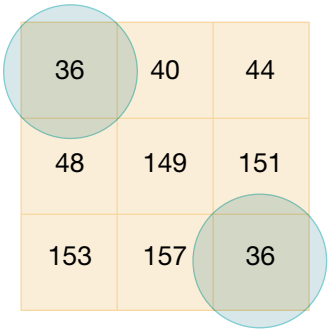

Figure 8: 5 GHz implementation has less channel utilization concern

Proper Configuration is the Cure

Fine tune your access points with these best practices that make ScreenBeam wireless display experience more reliable.

Assigning Channel for Miracast session: Reserve 5 GHz Channel

Per the Wi-Fi Alliance standard, all Miracast receivers—including ScreenBeam—are designed to operate in Negotiated Group Owner (NGO) mode. In this mode, the client system is the group owner, and the wireless channel used for Wi-Fi is also used for the Miracast session. For example, when the client Wi-Fi connects to an AP using channel 6, the Miracast session also operates on channel 6.

This is fine if the wireless infrastructure is properly configured as recommended above. Not all wireless infrastructures are deployed with proper configuration however, and 2.4 GHz implementation is still a preferred choice for broader coverage. Also, with more third-party Wi-Fi and non-Wi-Fi host devices operating on 2.4 GHz and being introduced to an already congested wireless environment, interferences are almost unavoidable for Miracast sessions.

Actiontec's latest products, ScreenBeam 750 and ScreenBeam 960, feature the ability for an organization to designate wireless channel(s) specifically for Miracast sessions. Instead of sharing the same wireless band and channel as the wireless infrastructure, an organization with a congested wireless environment can enable ScreenBeam to be the Wi-Fi-Direct group owner, commonly referred to as an Autonomous Group Owner (AGO). Thus, the wireless network admin could reserve known-clear 5 GHz channel(s) for ScreenBeam to operate on, to assure a smooth and reliable Miracast wireless display experience for end users.

In this mode, the client system wireless adapter has strong Different Channel Mode (DCM) support, to allow different communication paths on separate wireless channels. If AGO is considered for your deployment, we recommend that client systems have wireless adapters with known-good DCM support. To find out if your adapter has known-good support, go to the ScreenBeam support site at https://actiontec.zendesk.com/hc/en-us/ and search for "DCM adapter".

The good news is existing ScreenBeam Education 2 product can be updated to the ScreenBeam 750 software, allowing it to take full advantage of the peer-to-peer (P2P) channel selection feature.

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Support Contact

To continue this conversation, have your questions answered, or discover how ScreenBeam can simplify your conferencing and presentations, we want to hear from you. Contact our tech support team:

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IndustryLeader

ScreenBeam wireless display is the only solution that truly enables commercial deployment of secured and IT manageable wireless display. ScreenBeam wireless display is the industry standard for benchmarking and device interoperability, making it the most broadly compatible solution available. ScreenBeam solutions are used as the validation platform for wireless display functionality by companies like Microsoft, Intel, and leading PC OEM and device companies.

Actiontec is Microsoft's co-engineering partner for wireless display technologies in Windows. Because of Actiontec's status as the industry leader, and our ongoing investment in supporting industry device manufacturers, you can be assured that you're deploying the most broadly compatible, feature-rich wireless display platform.

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