

How to Prevent RF Interference from Affecting your Business

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RF INTERFERENCE AND YOUR BUSINESS

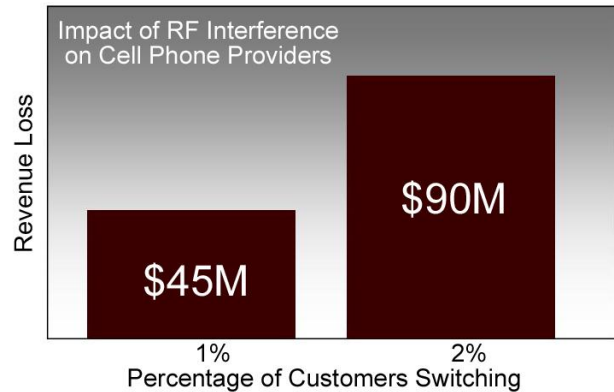
Does RF interference affect your business? And when I say *business* I mean revenue, profit and customer retention. For some the answer is an obvious: *Yes*. For others it may be: *I think so, but I'm not quite sure*. It's not enough to know if RF interference affects your business; you have to know how to prevent it from affecting your business in order to retain your customers. In this way, you protect your revenue and profits.

The first step to prevention is the detection and analysis of problem sources. Once the causes are known, solutions can be built to avoid them. In the event that causes are not completely avoidable, a reaction plan can be put in place *before* RF interference affects your business.

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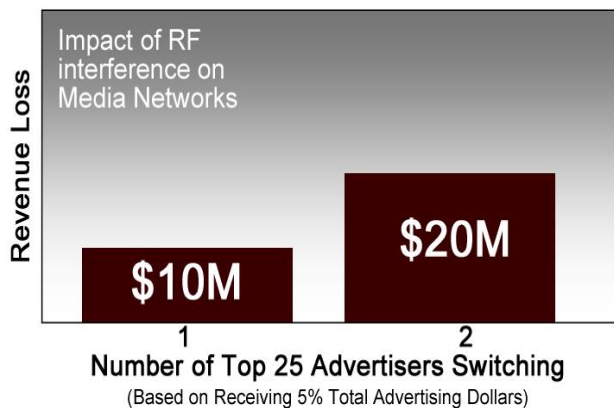
What are some ways that RF interference might affect your business? The most obvious is failure to deliver content due to a long term outage which results in a customer's unwillingness to pay for the content delivery. Continued short-term interruptions due to RF interference become a nuisance and negatively portray the content as well as the delivery network. This may result in customers finding a different distribution provider. Continued disturbances also prevent the service provider from charging a premium for the delivery of content. The impact of RF interference varies depending on your business but it is significant for all businesses that are dependent on RF transmissions.

Figure 1: Revenue Loss from Cell Phone Customers Switching Due to RF Interference



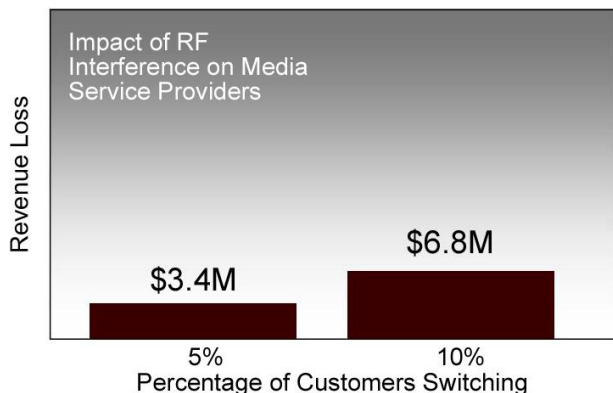
If 1% of a cell phone provider's customers switch carriers each year due to perceived quality problems that result from signal interference, they would lose up to \$45M annually in revenue.

Figure 2: Revenue Loss from Advertisers Switching Networks Due to RF Interference



The top 25 TV advertisers spent \$1.269B in the first quarter of 2007 – that's an average of \$50.7M each. If your network received just 5% of the advertisers' revenue and one of them moves to another network, your network would lose \$2.5M in a single quarter.

Figure 2: Revenue Loss from Customers Switching Service Providers Due to RF Interference



The top 20 Teleport operators received about \$1.373B in 2006 from RF satellite services, which is an average of \$68M each. If a customer switched providers due to quality problems, you would lose \$3.4M a year.

Looking into the immediate future, two-way financial transactions will become the norm on consumer video and phone networks. Simple purchases will become common, such as buying a soda with your cell phone from a vending machine or using your TV remote to buy the brand of golf glove used by Tiger Woods. In these instances, RF interference in your network will cause million dollar losses.

WHAT CAUSES RF INTERFERENCE?

The first step to preventing RF interference's affect on your business is to identify its major sources. Not every source can be known before interruption. A number of sources may be known but are outside the engineer's control. Knowing sources of RF interference may be helpful, but does not always give the engineer the ability to correct the problem. However, there are ways to minimize or negate the affect that the interference has on your business.

There are ways to minimize or negate the effect that interference has on your business.

Weather is a major source of RF interference for many businesses. Internet Service Providers with wireless infrastructures have reported issues due to fog. Satellite users have issues due to rain.

Increasing power to transmit through rain may also cause an issue if power is not decreased once the rain clears out. Wide temperature changes can causes issues with outdoor RF equipment such as LNBS. The sun can also be a source of RF interference during those times when the transmitter, receiver and sun all align, creating a sun outage.

RF interference can be caused by:

- aircraft
- radar detectors
- cellular networks
- WiFi networks
- WiMax networks

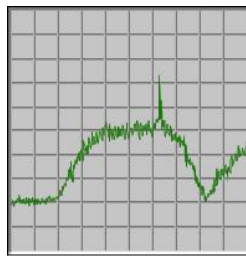
These sources of interference disrupt TV studio to Transmitter Microwave Links, Satellite Communication, as well as Wireless Links in Cellular and Internet Service Provider Networks.

Microwave, Cellular, WiFi and WiMax networks may have interference from objects like buildings, construction equipment and trees. Often this type of interference occurs gradually over time and is not as obvious to detect. However, when it becomes a problem, removing the objects or bypassing them can be challenging.

Human error and equipment failures are two other common sources of RF interference and disruptions. Human error is the primary cause for someone transmitting on top of a carrier, commonly called **dual illumination**. In the case of equipment failure, the interference could result in a complete loss of RF. When a carrier is monitored at varying points along the transmission path, a problem can be quickly identified, making RF restoration much faster and automatic when systems are attached to an automation control system.

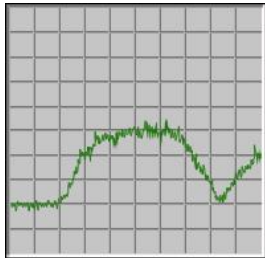
DETECTING AND IDENTIFYING RF INTERFERENCE

Detecting RF interference is obviously an important step when attempting to prevent future interference or when it is necessary to take corrective action after unpreventable disturbances. With old analog video systems, RF interference was easier to see because video degraded gradually, usually starting with visual



Interference Spike

sparkles. Corrections could then be made, often before customers and viewers noticed it. RF interference of digital video and data RF signals is not always apparent, thanks to improved modulation, filtering and error correction methods. If RF interference increases, however, the signal will eventually be lost with no warning, leaving no time to react. The best way to detect RF interference is to constantly monitor the RF carrier and the receiving equipment parameters, such as **bit error rate**.



Interference Corrected

There are companies that specialize in RF interference detection. Quite often, it makes sense to use their services. A company can also dedicate someone to watch a spectrum analyzer for intermittent interference, but this is expensive and does not provide a lot of objective evidence that can be analyzed. An **RF spectrum monitoring system** is a great tool for detecting a problem due to RF interference. Several of these are on the market.

How does one choose the right company and product when dealing with RF interference? When choosing a system to protect your revenue and profits from the effects of RF interference, some required features are not as obvious as others. The most essential features are those that give the engineer the ability to:

- detect interference
- analyze causes
- protect business



Using a **spectrum monitoring system** to simply detect a problem is not good enough. The system must assist with the identification of the source. More importantly, it must help prevent RF interference from affecting business. All the other technical bells and whistles may be nice to have, but if they don't have the benefit of protecting business then they are not worth the money.

The best way a system can help an engineer analyze causes is by capturing what happened to the RF, especially during very short periods of interference. A **spectrum monitor and recorder system** can do this easily. The recorder feature of

the system allows the engineer to search and review what really happened to the RF during interference. From this data the solutions team will be better able to identify the source of the RF interference and propose corrective action.

Crystal's Sentry™ spectrum monitor and recorder system allows for recording to be triggered by an interference event. In order to aid analysis, the system records a few seconds of cached spectral data prior to the actual beginning of the interference. Therefore, during the analysis you can search for the beginning of the interference, backup a few seconds and analyze exactly what happened during the entire interference event.

Crystal's Sentry™ spectrum monitor and recorder system allows for recording to be triggered by an interference event.

Occasionally, due to automatic level control on high-power RF relays, there may be some low-power RF that does not disrupt the overall spectrum amplitude, but still causes interference. To detect this type of interference it may be necessary to temporarily lower power to observe what other signals may be lurking within a given frequency range. This type of diagnostic step is best done with a combination of **Crystal's Sentry™ spectrum monitor and recorder system** and an automation control system, such as **CrystalVision NMC**. The operator, through the automation control system; lowers RF power for very short periods of time while **Crystal's Sentry™** system captures the previously hidden RF causing the interference. Once the system detects the RF interference and identifies the source, the solutions team can take the necessary steps to prevent it from affecting business.

PREVENTING AND REACTING TO RF INTERFERENCE

There two types of RF interference: *preventable* and *unpreventable*. The majority of unpreventable interference requires a reaction on the part of engineers. The time it takes to implement the proper reaction affects how much, if at all, the interference will disrupt business.

Once interference is detected, the person responsible for RF operations should be notified.

When an automation control system is used in conjunction with **Crystal's Sentry™** system, the notification may occur as part of automated corrective actions. Depending on the effect of the RF interference, the notification may be urgent enough to sound an alert or send an **SMS message** or email. Otherwise, a non-interruptible indicator, such as a color change or log message, may be all that is required. **Crystal's Sentry™** is easy to use and enables the operator on duty to identify and react to alerts caused by RF interference. Any networked computer, including VPN-enabled workstations, can view **Crystal's Sentry™** system. If remote engineering support is necessary, it can be activated.

The steps required to prevent certain types of RF interference may involve building an RF shield, adding RF filtering equipment, or even taking legal action against an offender. Once the specific sources are known, the cost-benefit analysis can be calculated to determine if preventative measures are viable. For RF interference that is unpreventable, operators are left with only one choice, react and **react quickly**. For the RF interference that gradually worsens proactive measures can often prevent the RF interference from affecting business.

Crystal's Sentry™ is easy to use and enables the operator on duty to identify and react to alerts caused by RF interference.

Weather is a prime example of this type of interference. Weather related interference generally has some sort of gradually worsening affect. Of course, the rate of signal degradation varies based on the type of weather. If the severity is measured using **Crystal's Sentry™** system, corrective action can be taken quickly and automatically. The required action may involve switching to a new transmission location for satellite uplinks. **Crystal's Sentry™** system verifies when the switch is successful. With **Crystal's Sentry™** system, the spectrum data can be analyzed and timing parameters can be adjusted to minimize the effect that location switching may have.

Other unpreventable RF interference occurs instantaneously. The goal in these situations is to minimize the impact of the disturbance. A prime example of this type of interference is **dual**

illumination of a satellite transponder. The two possible reactions involve having the satellite owner assist with contacting the offender and shutting them down, or quickly switching to a backup transponder. The latter does not require action outside of your network, but it does require some control mechanism on the receiving end. This mechanism may be pre-programmed logic internal to the receive equipment. It can also be an external distribution control system that takes action initiated by the **Sentry™** system. **Crystal's Sentry™** system interfaces cleanly into **Crystal's CrystalVision NMC** system along with any third party network management system.

With Crystal's Sentry™ system, the spectrum data can be analyzed and timing parameters can be adjusted to minimize the effect that location switching may have.

TAKE ACTION AGAINST RF INTERFERENCE

If you transmit or receive RF, then RF interference should be a concern. If ignored, it will eventually affect your business in negative ways. Therefore, it is important to act on this issue *before* you lose business. The best solution for addressing RF interference involved figuring out a few things. Determine the kind of financial impact RF interference has for your company. Then, look for a carrier monitor and recorder system that will allow you to detect RF interference and assist your staff with identifying disruption sources. When it is time to choose your carrier monitor and recorder system, make sure the one you choose provides a means to quickly react to RF interference, giving your solutions team the ability to prevent it from affecting your business. This means choosing a system backed by a company with enough experience to provide real solutions that protect your business.

Crystal's Sentry™ spectrum monitor and recorder system is the solutions tool of choice for alleviating RF interference's impact on business.

For more Information on Crystal Solutions' solution to RF interference, visit www.crystalcc.com, where you can see a demonstration of **Crystal's Sentry™** system.

ABOUT THE AUTHOR

Roger Franklin is President & CEO of Crystal Solutions. Crystal has been creating reliable control system solutions for the broadcast, satellite and communications industries since 1986. Mr. Franklin holds a Math degree from Georgia Tech and has been implementing cutting edge solutions with Crystal for over 18 years.

THE CRYSTAL COMMITMENT

As the largest independent provider of monitor and control solutions, Crystal understands our products are only as good as the company that stands behind them. Crystal Solutions' Customer Care Center provides support 24 hours-a-day, 365-days-a-year – we know those are your business hours! Crystal custom tailors a support plan to fit the unique requirements of your business.

For more information on Crystal and our commitment to customer support, check us out on the web at www.crystalcc.com.