

15 Meter RFI Generated by the SecureView Wireless Surveillance Camera

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Overview

The SecureView wireless surveillance camera has been discovered to radiate a substantial amount of radio frequency interference (RFI) across the entire 15 meter Amateur Radio band. The camera is cleverly packaged in the form of a standard floodlight. A normal 120 VAC line powers the camera through its threaded light bulb-type base, and also serves as the video signal path. The baseband black and white video signal is shifted up to approximately 20.5 MHz to 22.0 MHz. A companion receiver extracts the video from the AC power line, transforms it back to baseband video, and provides a video output signal.

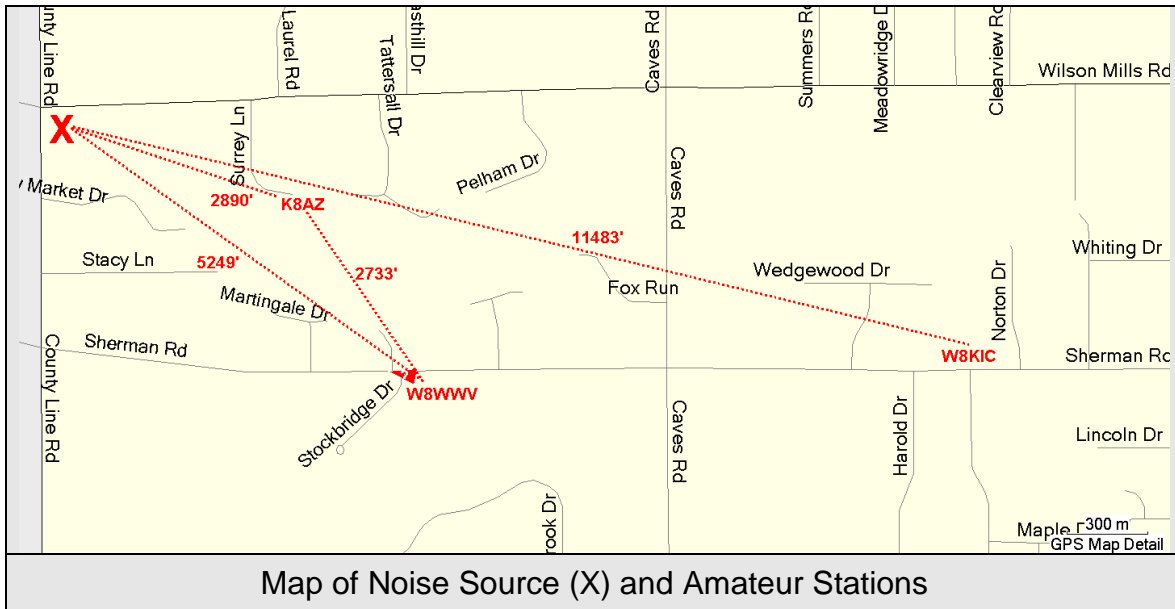
All building power lines, including the lines to the street, function as a combination of desired transmission line and undesired antennas. The topology of the lines will strongly influence the amount the RFI present. In our situation, the RFI was easily detected and reported as being *over S9* at a distance of more than two miles.

This note describes our experiences with this product.

History

On March 20, 2008, I received an email from a nearby amateur, Tom, K8AZ. Tom asked me if I could hear the same interference that both he and Val, W8KIC, were detecting on 15 meters. The noise spanned the entire band. At my location (W8WWV), the signal level was approximately S9 on an ICOM 756PRO radio (both preamps on, 3 element Yagi at a height of 60 feet). At Tom's location (K8AZ) the signal level was approximately S9 +20db on a Yaesu FT1000MP (preamp on, 6 element Yagi at a height of 60 feet). At Val's location, the signal level was above S9 on an Icom IC-765 (preamp on, 6 element Yagi at a height of 100 feet). Based upon rotatable antenna bearings, we all agreed that the noise was coming from the west-northwest direction.

The following map, taken from GPS mapping software, establishes the distances between the three amateur stations (W8WWV, K8AZ, W8KIC) and the noise source. Yes, "X" marks the location of the noise.



In table format, the distances (approximately) are:

Distances Between Stations and Noise		
Distance	From	To
2890 Feet	Noise	K8AZ
5249 Feet	Noise	W8WWW
11483 Feet	Noise	W8KIC
2733 Feet	W8WWW	K8AZ

The bearing information from our station antennas suggested an approximate location for the noise source. We used a mobile station with a three different antennas (roof mounted vertical, single turn loop, tuned circuit “sniffer”) to narrow the noise source location down to approximately 200 feet of cables along utility poles, or, two houses fed from a single AC transformer on those poles.

We hoped to be able to determine if the RFI was on the AC, telephone, or cable TV lines so that we would know what utility to contact. Sadly, we were unable to determine that because the RF level was consistently strong near all of the lines over a rather large area. Fortunately, Tom, K8AZ, knew the owners of one of the two suspected houses. The owner was extremely helpful, cooperative, and also curious about what could be causing the interference. After two short phone calls, we created a list of devices that were potential suspects. When we started to discuss when the noise started, the owner remembered that around the same time he had installed a wireless security camera that used the AC lines to carry the video signal to a companion receiver. This immediately became the prime suspect. The circuit was controlled by a wall switch, and when the owner flipped the switch, the noise, after many weeks, suddenly stopped.

The owner said that the camera was obtained from Sporty's (<http://www.sportys-catalogs.com>). We then purchased the same model, with the intention of testing it, and, on the off chance that the installed unit was malfunctioning, and normally did not radiate. If it was RFI due to a malfunction, we would have a ready replacement unit.

Links

The original camera, and the test camera, were purchased from Sporty's. Their web site URL is:

<http://www.sportys-catalogs.com>

This does not appear to be the only retail outlet. For example, Brick House Security:

<http://www.brickhousesecurity.com/secureview-video-over-electric-wiring.html>

The approximate retail price for a camera/receiver system is \$160.00.

The original manufacturer appears to be PowerLinx. Their web site URL is:

<http://www.power-linx.com>

The particular camera is sold under the brand name of SecureView. The URL is:

<http://www.secureviewvideo.com>

The link for the camera is:

<http://www.secureviewvideo.com/secureview.html>

The product consists of the camera, a companion receiver, and a video cable with phono plug ends.

This page has links to technical information. There are two versions of the camera – one designed for indoor use, and the other for outdoor use. Our experiences have been with the outdoor version, but it is expected that the RFI performance of the indoor version would be identical.

It is believed that US patent 6812970 covers this device. The link to the patent information is:

<http://www.freepatentsonline.com/6812970.html>

Testing

Tom, K8AZ, and I spent some time testing the purchased camera system. Our first hope was that the original unit was generating RFI because of a malfunction. I installed the purchased camera in a desk lamp at my house, while Tom listened on 15 meters at his station. When the lamp was turned on, the signal was immediately detected. The level, however, was substantially less than the level detected from the original camera.

The GPS map indicates that the distance from Tom's to the two cameras is nearly identical – 2733 feet versus 2890 feet. We believe that the difference in signal level is due to the different *antennas* at the two transmitting locations. At my location, the lamp was a few feet above a concrete slab floor, and there was no more than approximately 16 feet of power line in the wall before entering a circuit breaker box. The remaining AC wiring is all underground.

At the original noise source location, the camera is mounted in an open garage ceiling, with hanging AC wiring going from the street to garage. The lines run for approximately 150 feet, and are 20 to 25 feet off of the ground. This provides a much better antenna.

From this test we concluded that the RFI was a fundamental characteristic of the camera design, and was not due to a defect in a single unit.

With the camera at my house, the signal level on my ICOM 756PRO receiver was approximately 30 dB over S9. This was picked up on a 3 element Yagi approximately 120 feet from the camera.

By contrast, with the camera still at my house, with Tom's antenna pointed at my house, the video signal level on Tom's FT1000MP receiver was audible, but not measurable on the S-meter. This was picked up on a 6 element Yagi approximately 2900 feet from the camera. (Note that the original noise source, at that same distance -- but with significantly more above-ground wiring in play -- measured S9 +20 db at Tom's using the same radio and antenna, with the antenna pointed at that noise source.)

The main signal radiation from the camera spanned from approximately 20.5 MHz through 22.0 MHz. RFI, at a much lower level, was also detected on the 12 meter band, and the 10 meter band.

We connected the receiver to a TV monitor, and attempted to use the camera as it was intended. We obtained a clear and clean picture when the camera was connected to AC outlets in the same room as the TV monitor. When we moved

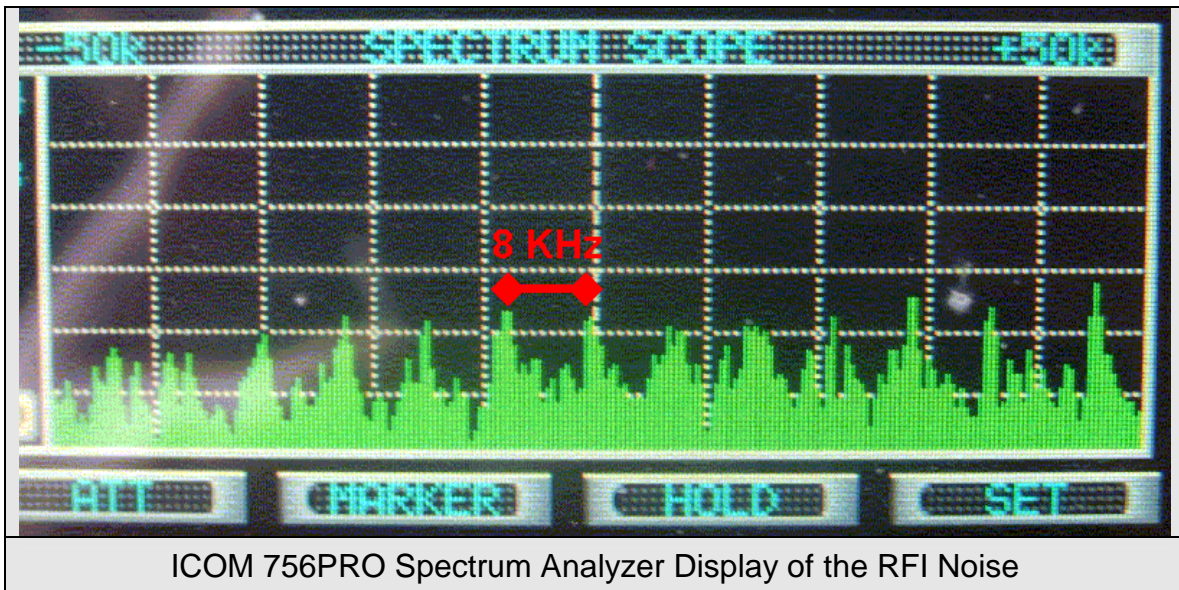
the camera further away, such as to outdoor outlets or a second building on the same property, the picture became unacceptably noisy.

The camera documentation advises against powering through a surge suppressor. We agree. When we inserted a surge suppressor outlet, noise appeared on the picture.

We attempted to filter the AC line with three type 43 ferrite toroid cores. Regardless of the number of turns tried (up to 4 turns), the RFI level did not drop.

We decided to see if an Amateur transmitter could affect the picture quality. At the 100 watt power level, a constant carrier at 21.100 MHz caused the TV monitor to report "No Signal". In other words, the carrier so disrupted the video signal that the TV monitor synchronization circuit was not able to detect a valid signal. The distance between the camera and the antenna was approximately 120 feet.

The following picture is from my ICOM 756PRO radio. Its shows the spectrum analyzer display of the noise. The pattern is similar to broadband impulse noise. Peaks occur approximately every 8 KHz.



Conclusions

As a surveillance camera, we found the picture quality to be very sensitive to the location of the camera and receiver outlets. At my location, I don't think that I would ever find the camera acceptable – unless I wanted the camera and the receiver in the same room. The camera does produce an acceptable video signal

at the original location of the RFI. That appears to be good luck for surveillance, but bad luck for Amateur Radio.

When connected to AC lines that are acting as a good 15 meter antenna, the potential for RFI is very large. W8KIC, who reported a *loud* signal, is slightly more than **2 miles** from the camera! The fact that the second camera had a lower signal level than the first when measured at approximately the same distance suggests that the total RFI level will be a function of the camera *and* its AC wiring (antenna) environment.

At the same time, an Amateur transmitter, operating at the 100 watt level, on 15 meters, would probably render the camera useless for a distance of up to several hundred feet.

In my opinion, the bottom line is that the camera is marginal in its intended application, and is incompatible with Amateur Radio operation on 15 meters. The camera will create a high noise level across the *entire* band, and a nearby amateur transmitter can knock out the camera signal. Because the ubiquitous AC wiring is acting as an antenna, the interference can propagate for miles; well over two miles in our case.

The design is effectively *video over power lines* (VPL). As in the case of the controversial *broadband over power lines* (BPL), there is a large potential for interference with radio services licensed to use the same frequency spectrum.

In our situation, our conclusion is that we are going to suggest that the camera be replaced with a wireless device that uses the 2.4 or 5.8 GHz band.

Additional Potential Problem Devices

In the aftermath of this negative experience, I've become sensitive to the announcement of any product that uses AC wiring as an underlying signal path.

While reading the June, 2008, issue of *Maximum PC*, page 54, I noticed a product called the **WiLife Camera System**. It is a security camera system that sends the video signal over AC wiring. Like the SecureView camera, the product advises against using a surge suppressor device in the signal path. Unlike the SecureView camera, it supports multiple cameras.

The web site is:

www.wilife.com

The technology is based upon HomePlug™. WiLife is owned by Logitech.