

**Understanding Digital Television: Seeing  
the Big Picture**

**By Greg Zancewicz, Director Broadband Marketing  
Microtune, Inc**

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There's no doubt about it, digital TV (DTV) is here. Energized by consumer interest and government insistence, TV designers and manufacturers around the world are gearing up for a historic switchover to digital transmission and the effective shut down of analog TV. An unprecedented, massive worldwide technology transformation is underway.

In the U.S., Congress has set February 17, 2009 as the date when all analog broadcasts will end. Consumers who have not switched to digital by then will not be able to watch television. In order to receive digital broadcasts, they will either need new TVs, digital cable service, satellite service with off-air capability, or a digital-to-analog converter box. In addition to consumer TVs, every consumer device that depends on an off-air transmission signal, including digital video recorders (DVRs), DVDs, PC-TVs and even automotive TVs, will also require the capability to receive digital TV broadcasts. Without a digital tuner or converter box, analog consumer electronics devices will no longer produce a picture.

This means that more than 320 million\* Advanced Television Systems Committee (ATSC) receivers will be needed in North America, Canada, Mexico and Korea alone to convert to TVs and their TV peripheral devices to digital broadcast.

### MULTIPLE TV STANDARDS WILL CO-EXIST

There are numerous standards around the world that govern the performance of TVs, either analog or digital:

NTSC:	Acronym that stands for "National Television Systems Committee" and the name of the current analog transmission standard used in the U.S.
ATSC:	Acronym that stands for "Advanced Television Systems Committee" and the name of the current digital transmission standard used in the U.S.
A/74:	Minimum receiver performance guidelines defined by the ATSC. (Analog-to-digital converter boxes in the U.S. that are eligible for the coupon program are required by government agencies to meet or exceed most of the radio frequency (RF) requirements of this standard.)
Digital Cable Ready (DCR):	FCC rules that facilitate the direct connection of television sets to digital cable systems. It is a term applied to TVs or set-top boxes (STBs) that provide access to cable TV programming without requiring the service provider to provide a set-top box.

**Figure 1: The World of TV Acronyms**

During the next year and a half (longer in Canada and Mexico), multiple standards will co-exist in North America, which means that U.S. consumers need analog TV devices today that can also support tomorrow's DTV broadcasts.

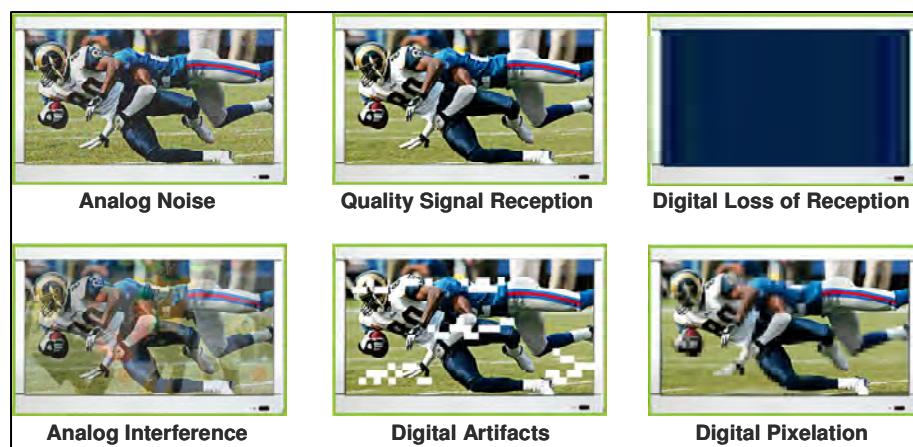


**Figure 2: Multiple TV Standards Will Continue to Co-exist in North America**

**THE TUNER DRIVES THE QUALITY OF THE TV EXPERIENCE**

So far, many of the publicized concerns about digital TV have focused on the TV display, with countless technical articles and consumer information published about aspect ratios and resolution. However, a consumer can have the highest-quality display available in the world, but if it is not backed up by a high-quality TV tuner, then it is merely a high-resolution view of a poor-quality picture.

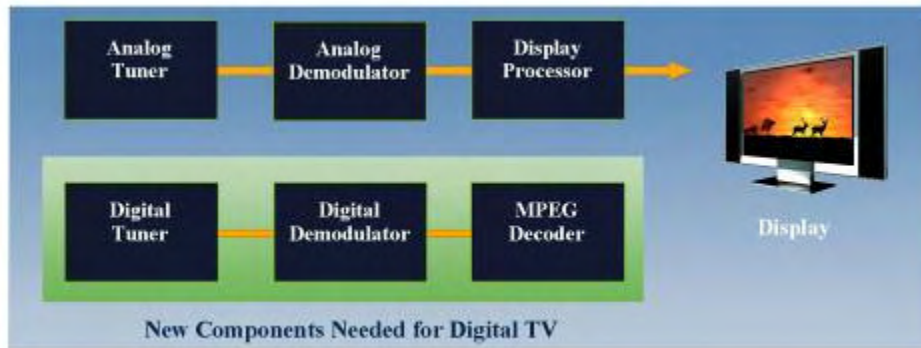
The radio frequency (RF) tuner drives the quality of the user experience. It is the first component in the receive signal chain, and it ultimately controls the quality of the signal that is passed on to the other electronics in the system. In an analog system, a poor tuner leads to a degraded signal and a poor picture. For digital signals, there is no degradation process; the picture is perfect, it is pixilated or frozen, or it is gone.



**Figure 3: High-Performance Tuners Avoid Common Reception Problems**

## HOW DOES THE TUNER FIT IN?

A digital tuner, digital demodulator and MPEG decoder are necessary to add digital reception to a TV design. An integrated tuner, such as Microtune's flagship three-in-one tuner (the MicroTuner™ MT2131) receives analog, digital and cable signals all on one chip, replacing many components that are used in a traditional design.



**Figure 4: TVs require a digital tuner, demodulator, and MPEG decoder to add DTV capability.**

## HOW DOES THE TUNER IMPACT WHAT YOU SEE ON THE SCREEN?

It's important to note that not all tuners are created equal. In fact, the FCC conducted two surveys of available receivers and published its findings, concluding that there is a wide range of quality in DTV tuners, and a higher price does not necessarily equate to better performance.<sup>1</sup>

The National Telecommunications and Information Administration (NTIA) has established minimum performance requirements and features for set-top converter boxes that can be considered eligible in the government-funded consumer coupon program. This \$1 billion program will subsidize the purchase of converter boxes for U.S. consumers who wish to continue to use their analog TVs after February 2009, when U.S. analog broadcasts will be shut off. The NTIA, the agency of the U.S. Department of Commerce that is charged with overseeing the consumer coupon program, essentially requires conformance with the A/74 Receiver Performance Guidelines adopted by the ATSC.

Microtune had been a strong supporter of establishing minimum tuner performance standards, based on the ATSC A/74 RF technical parameters, not only for converter boxes, but for all digital TV devices. Conformance to the standard ensures that the tuner can pick up even the weakest signals (or those very far away), and reject nearby channels in order to ensure a good picture. It helps to ensure reliable, stable, error-free TV viewing for the consumer.

## FINDING WEAK SIGNALS

The tuner's sensitivity has a direct effect on its ability to pick up weaker signals. The quality of the tuners in consumers' TV receivers can limit coverage area of a DTV broadcaster's tower. Improving a tuner's sensitivity, as Microtune did in its three-in-one cable tuner, increases the coverage area shown by 10% to 30%, allowing consumers farther away from the broadcast tower to receive the transmitted signals.

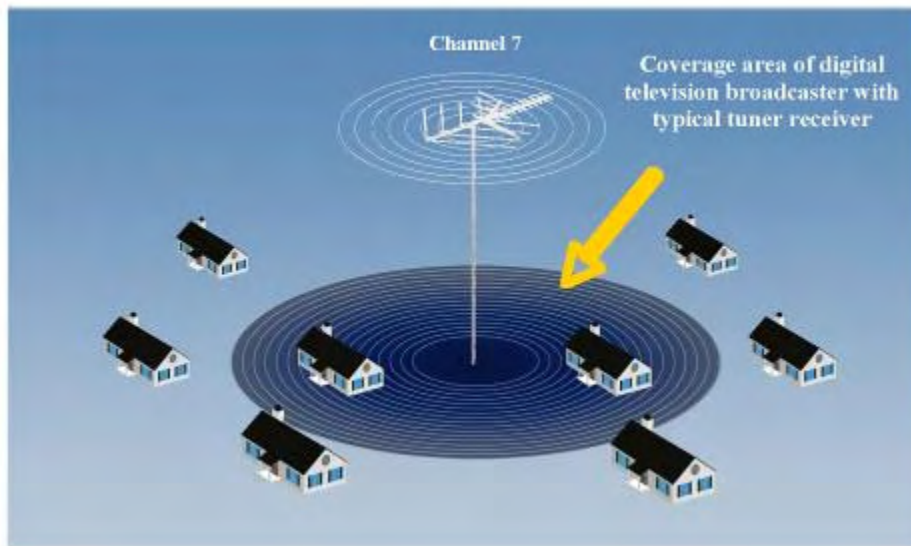


Figure 5: The coverage area of typical DTV receivers for off-the-air signals.

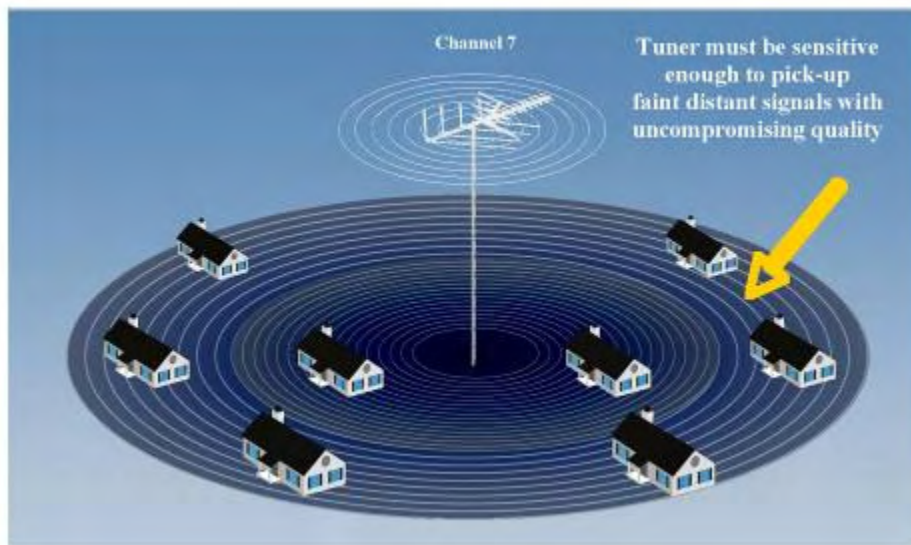
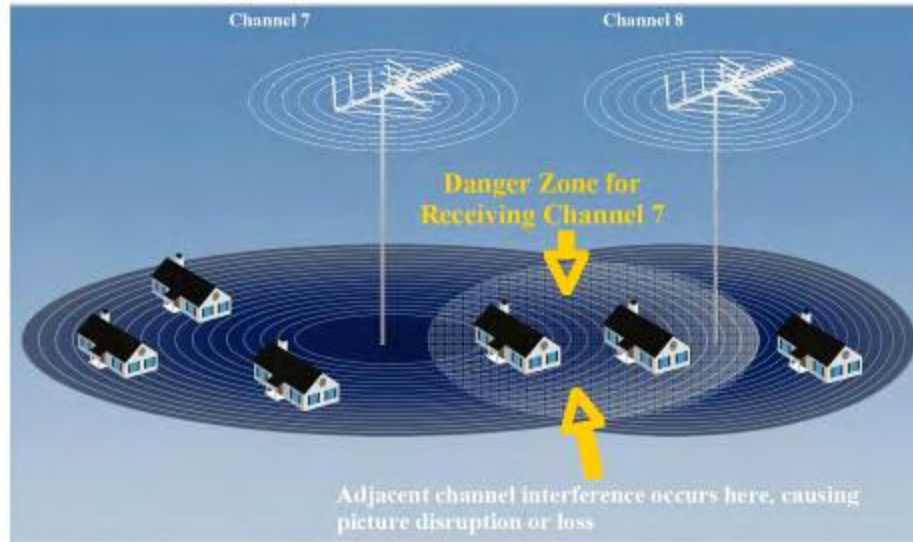


Figure 6: Microtune's three-in-one tuner (the MicroTuner MT2131) is engineered to result in an increased in coverage area, as compared to other available tuners<sup>ii</sup> that the FCC analyzed.

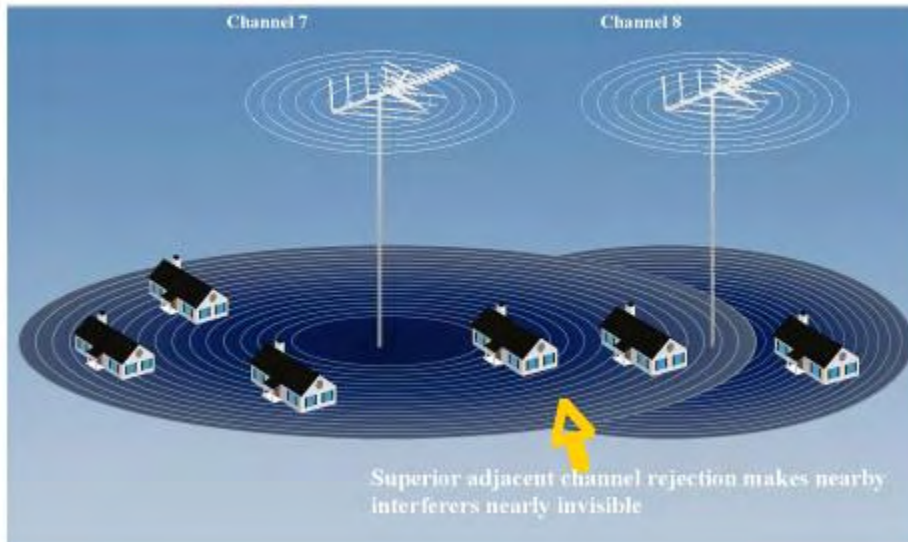
In addition to improving the consumer's ability to pick up off-the-air DTV signals, improved sensitivity can also help simplify antenna installation. For instance, when a tuner offers industry-leading sensitivity, the consumer can place the antenna in an attic, instead of having to mount it outside on the roof.

## REJECTING UNWANTED CHANNELS

Because the television spectrum in North America is crowded, adjacent channel rejection is particularly important for digital tuners. When a television tuner is not selective enough to reject the channel(s) above or below the one being viewed, severe picture impairments may result. Consumers demand a great picture all of the time, so eliminating the risks from nearby channels is crucial. The graphics below show where adjacent channel interference is most likely to occur and illustrates how a good tuner can eliminate the risk of interference from unwanted channels.



**Figure 7: If a DTV tuner picks up the signals from unwanted channels, the display will go blank.**



**Figure 8: With good adjacent channel rejection, a tuner can eliminate the risk from nearby interfering signals.**

The secret to success in eliminating the risk from unwanted channels is for a tuner to have good adjacent channel rejection without sacrificing sensitivity. Microtune's MT2131 tuners are engineered to exceed ATSC A/74 tuner guidelines.

### **SUPPORT FOR DIGITAL CABLE**

The digital transition is also well underway for cable networks. In the late 1990s, cable operators began adding digital channels to their existing analog line-ups. Each digital channel, employing a special "quadrature amplitude modulated" (QAM) signal, is able to carry multiple standard- and high-definition video programs in the same amount of spectrum that was required to carry a single legacy analog channel. Recently, a few cable operators have eliminated the analog channels altogether.

Although there are more than 60 million cable television households in the United States, less than half of the televisions in these households are serviced by a cable set-top box. What this means is that subscribers are accustomed to their TVs being 'cable ready'. Continuing to satisfy this expectation during and after the digital transition places new burdens on the TV tuners beyond those mentioned above.

For instance, cable operators are expanding the frequency range of their plants up to 1 GHz, which is a dramatic increase from a bandwidth of 550 to 750 MHz. The wider frequency range allows operators to support up to 150 channels, which is a substantial increase from the 50 to 70 channels previously supported. Not only does the TV tuner have to support this wider frequency range, but it must also be able to quickly and efficiently select the desired channel despite the larger number of nearby signals.

Digital cable signals use a modulation format different than off-air digital signals, which imposes additional unique performance requirements on the tuner. Finally, despite the disappearance of analog signals in terrestrial broadcasting, recent proposed rulemaking in the U.S. by the FCC suggests that cable operators may have to carry local broadcast channels in analog format for some time to come.

The net result is that TVs must support analog off-air, digital off-air, analog cable, and digital-cable reception. One way that TV manufacturers could address this complex scenario is the use of CableCard™ products – devices that enable conditional access in digital televisions. Consumer acceptance of these products, however, has been low, yet manufacturers still must ensure that the receivers are capable of working with all four signal formats. The best way to address this problem, then, is with a versatile, low-cost, high-performance broadband tuner.

### **KEYS TO DTV SUCCESS**

Microtune's new MT2131 three-in-one tuner is an integrated silicon tuner can offer significant reduction in costs, 64% fewer components, decreased complexity and footprint as compared to traditional ATSC tuners. The MT2131 tuner is also engineered to exceed the minimum requirements for RF phase noise, adjacent channel rejection, taboo channel rejection, and minimum and maximum input signal levels—the key tuner-related parameters specified for receiver performance in a NTIA coupon-eligible converter box (CECB)\*. Furthermore, the MT2131 design draws from lessons learned from Microtune's extensive involvement in the U.S. cable set-top box industry. As a result, the part is designed to provide best-in-class digital cable reception in addition to outstanding digital off-air performance.

For the consumer, this translates into higher reliability, better reception, easier antenna installation, and higher-performance TVs. With an integrated tuner that handles analog, digital, and cable signals, DTVs will be simultaneously compatible with today's analog broadcasts, as well as be prepared to handle the all digital signals in the future.



★ Based on Microtune estimates and latest ITU data from North America, Canada, Korea, and Mexico

<sup>1</sup> <http://www.fcc.gov/oet/info/documents/reports/SHVERA/SHVERA-FCC-05-199.doc>

<sup>1</sup> <http://www.fcc.gov/oet/info/documents/reports/OET-FCC-07-TR-1003.doc>

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