

MICROTUNE®

Attacking Mobile TV Interference Problems

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Including mobile TV functionality in a handset isn't just about squeezing in more circuitry, it's critical that handset designers understand the impact of tuner performance on service availability and quality.

Mobile TV is gaining a lot of media and consumer attention. The launch of services in time for this past summer's World Cup matches brought the technology front and center and caught the attention of many semiconductor design houses, marketing professionals, and industry analysts as a hot market. The challenge is that broadband services are not cellular services with bigger channels. Tuning in video is not the same as receiving voice signals. There are unique technical considerations when adding TV to a mobile handset, and, without careful design, the mobile TV product is likely to fail in real-world environments.

Unfortunately, there are no universal global standards and only basic performance specifications. While laboratory validation is a necessary first step, it takes real-world broadband TV experience and a clear understanding of the inner workings of a mobile handset to make mobile TV work well. The danger to such a new market is that the quality of every mobile TV product has a direct impact on early adopters' experiences. Poor-quality first-generation products could seriously damage the prospects of such a promising market.

In-Stat projects that by the end of 2010, mobile TV broadcast subscribers worldwide will reach 102 million, up from 3.4 million in 2006. The reality is that mobile TV is still developing, and those working in it are daily gaining understanding on the market, business models and technical dynamics. For instance, Microtune's mobile TV tuners were used in the historic commercial launch of services by 3 Italia in the summer of 2006. Within the first six weeks, 3 Italia attracted more than 110,000 subscribers and was well on the way to its target of 500,000 subscribers by the end of the year.^[1] Mobile TV services have also launched in Korea and Japan and more than forty field trials are being conducted worldwide. These implementations are yielding powerful data about tuner quality, interference, power management needs, and performance metrics.

Lack of Industry Certification Risks Quality

Until it is deployed in a real mobile environment, it is difficult to tell if a device or handset will measure up. Laboratory testing is not an alternative to real-world experience and field-proven designs, and this is especially true in the mobile market with its challenging, often hostile, reception environments.

For most mobility standards, the risks of poor performance are mitigated by having some established body of authority that ensures products meet specifications. For instance, with GSM there is a process called "Final Type Approval." This certification process was particularly important in early implementations, and it remains a crucial step for manufacturers who are new to designing for GSM.

In the early days of the GSM standard, all new handsets were sent to recognized test houses to make sure that they complied. Then, they were certified. As the industry matured, this process was no longer necessary for those with appropriate experience, so these manufacturers developed their own in-house test and certification processes.

Currently, the dominant global standard for mobile TV is Digital Video Broadcasting-Handheld (DVB-H), and there is no analogous certification process in place. In fact, there are no requirements that handsets be tested in any kind of standard way. As a result, each company will likely interpret the standard in its own way, and the result will be different levels of performance based on a specific interpretation of the specification. In the end, all handsets may "pass," but it is highly unlikely that they will all work the same. The lack of a verification process within the industry is a risk to interoperability, perceived service quality, and, ultimately, to market success.

Service and picture quality are the main things that early adopters will notice and comment on to their peers. If mobile TV devices are not rigorously tested or the environment in which they will need to operate is not fully understood, handsets will fail when the user is watching TV.

In a mobile TV market without an industry certification process, subscribers will have different experiences based on their service provider and handset type. For instance, one consumer might receive a very poor picture in a doctor's waiting room, while the person sitting in the next seat receives ones that is perfectly clear. Until there is a benchmark for comparing handsets, there will be different levels of performance.

Ensuring Quality in Mobile TV

In the absence of a benchmark, handset designers need to think carefully about the devices they choose for their handset. For mobile TV, the make-or-break device is the tuner. The secret is to choose a device that has the best performance across all of the criteria laid out in the DVB-H and MBRAI specifications, not just focus on one particular specification. GSM handset designers, for instance, are well trained on the importance of sensitivity in the handset, or the ability of the mobile to detect a very small signal. But handset designers need to think differently for broadband TV applications. If they are looking only at sensitivity, they are missing half of the picture. Selectivity, or the ability to distinguish the desired signal from the rest, is more important.

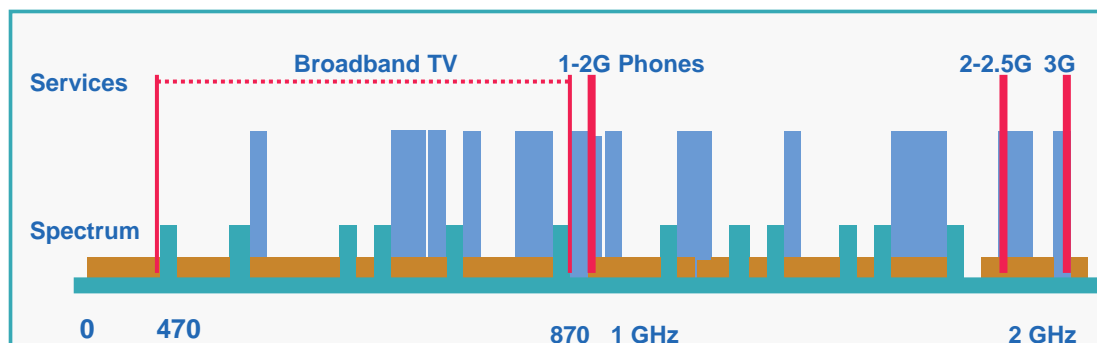
To be successful, the tuner needs to have a broad dynamic range and the ability to discriminate the desired signal from adjacent TV channels or in-band interference, which could even be a mobile phone's normal transmissions. There is an added incentive for wireless providers to select handsets with high-quality mobile TV functionality. If the sensitivity and selectivity performance in the handset is of high-quality, then there is a potential to reduce the overall cost of the infrastructure. Sensitive handsets enable broader coverage ranges, and this could reduce the number of tower and broadcast sites.

Sensitivity

One challenge to mobile TV reliability is its operating environment. Depending on how far the handset is from the transmission site, it may receive a very large or very small signal, and both can be challenging for a tuner to target. To be successful, the tuner must have a broad dynamic range.

DVB-H CELL PHONES BRING BROADBAND TV INTO A NARROWBAND SYSTEM

DVB-H tuners must tune over a wider frequency range, as illustrated below by the European UHF band. The tuner must retain high-signal integrity, while preserving battery life.

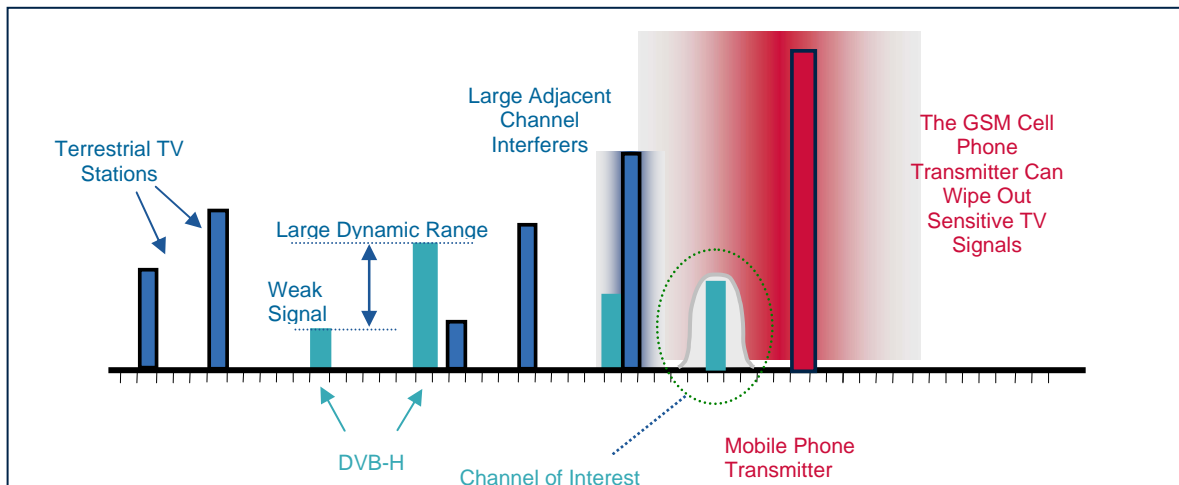


To ensure good quality reception, the receive system in the handset must be able to pick up a large signal, which could be -25 dBm or higher, as well as detect the smallest signal, amplify it, and pass it through the system in the presence of many other distorting signals that could be much stronger than the desired minimum signal level signal. The relative undesired signal power to the desired signal power ratio can be >45 dB (and as much as 56 dB for certain conditions). This means that the receiver needs to be able to amplify the desired signal in the presence of an interfering signal that is >45 dB higher. If it cannot do that, the tuner cannot deliver the performance necessary to ensure a quality end-user experience.

Selectivity

In addition to good sensitivity, the tuner must have the ability to discriminate the wanted signal from adjacent TV channels or other in-band interference, which could even be a mobile phone's own transmissions. Mobile phone receivers typically operate in narrow frequency bands of 20 to 30 MHz. To improve reliability in these systems, designers can put a filter in front of the receiver and effectively eliminate potential interferers across a broad spectrum.

MULTIPLE INTERFERERS, INCLUDING THE CELL PHONE POWER AMP, IMPACT MOBILE TV PERFORMANCE



In contrast, a mobile TV receiver has a wider band. The first DVB-H tuners will need to tune across the UHF band IV-V frequencies (470 MHz to 750 MHz range) with 6-MHz, 7-MHz or 8-MHz channel bandwidth in Europe and the L-band 5-MHz channel (1670 MHz to 1675 MHz) range in North America. The situation is particularly challenging in Europe, where the spectrum is fragmented by country, and cellular transmitters are often spread into the same bands as mobile TV.

In response, the DVB-H standards committee has reduced the usable bandwidth for mobile TV within the allocated band up to 702 MHz, but there are a number of companies that would like to use the higher frequencies. Modifying the available spectrum is only a short-term fix, and a new tuning technology is required.

One way to improve tuning for mobile TV is to use on-chip filtering techniques. Developed by leveraging experience in cable set-top box, traditional television, and automotive TV systems, Microtune's ClearTune™ technology works in conjunction with the external filters that attenuate the out-of-band carriers by reducing a significant number of the in-band signals that cannot be stopped by external filters.

With a conventional receiver architecture, the low noise amplifier (LNA) saturates in the presence of strong in-band carriers. As soon as this occurs, the sensitivity of the receiver collapses. With a receiver using ClearTune technology, no sensitivity collapse occurs across the entire band of interest in DVB-H. This approach offers a major benefit, especially in the presence of a transmitted GSM carrier, which represents the biggest adjacent channel that a handset designer must contend with. Generally speaking, sensitivity can degrade by 3, 4, or 5 times simply due to the presence of a GSM carrier. In a practical application, this means that a

subscriber can be watching mobile TV and, if an SMS is received or the handset polls the network, the TV signal can break up or the signal can be lost.

ClearTune on-chip filtering techniques significantly reduce the impact of signals from the power amplifier (PA) in the mobile phone as well as other unwanted signals. By attenuating nearby signals, the tuner can better decode the desired signals. It can significantly reduce impairment to audio and video signals, which has a direct impact on perceived quality.

Tuner Selection Checklist

When selecting a tuner for mobile TV, handset designers should look for one that was specifically designed for this application, and make sure it is equipped with the necessary on-chip filters and low noise amplifiers (LNAs) to prevent interference. The main priorities (in order of importance) when selecting a tuner should be:

1. *Quality of reception.* If the application performance is weak in the early years of mobile TV launch, it can lead to poor adoption, criticism from media and users, and ultimately, delayed penetration into the high volume mobile phone market.
2. *Field Proven Technology.* A manufacturer with technological experience and field-proven broadband products is a safer bet than selecting a new player in this extremely challenging field.
3. *Low Cost.* In addition to enabling penetration into low-tier markets, a low-cost device offers the benefit of economies of scale for high-volume market.
4. *Size.* Look for a tuner that offers small size and low height
5. *Power consumption.* The power consumption of the tuner is very low compared to the display back-light and video decoder, so does not have a big impact on the power budget.

The Future of Mobile TV

As with all functions in a mobile handset, the future of mobile TV circuitry must involve smaller form factors. Initial handsets used separate tuner and demodulator devices with external components on board, covering an approximate area of 20 x 15mm. This is too big for one function in a mobile handset, and the industry is already moving towards a single packaged solution, such as system in package (SiP). Currently, some mobile TV subsystems are evolving to SiPs, and they may integrate passive components as well as a tuner, demodulator, and memory. In the future, as more radio frequency (RF) functions, including Bluetooth or Global Positioning Systems, are added to the phone, the nature of the components in a SiP may vary. All the RF functions (tuner, Bluetooth, GPS) may be combined together, while the other digital functions, including demodulation, may be absorbed into the application processor

To the handset designer, the type of form factor matters little; what is important is overall functionality, size, and cost. In response, some manufacturers, such as Microtune, are also making their technology available in new wafer-level chip-scale packages (WLCSPs) that meet

the demands of this market, shrink footprint, and still maintain extremely high performance. The future of mobile TV is bright, and tuner and demodulator manufacturers with broadband experience are carefully developing the devices to ensure its success.

^[1] <http://www.iht.com/articles/2006/07/20/technology/italia.php>

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