

The Digital Broadcasting Industry Moves Forward

The Industry Moves Forward...

Over the past decade and a half, the broadcast industry as a whole put forth great effort in defining robust digital broadcast standards to enable new and enhanced services. As a result, we are witness today to the plethora of digital broadcasting services rolling-out almost constantly, on a worldwide scale. This transition from all-analog broadcasting to all-digital broadcasting has in turn produced needed additional advances in broadcast transmitter technology.

Why Digital?

The drivers for digital broadcasting technology have been the following:

- Clearer, higher-quality video and sound can be received as compared with analog broadcasting.
- Provides much more efficient use of any given broadcast frequency spectrum (more channels and more services per Hz), allowing valuable spectrum to be freed-up for new uses.
- All broadcast television services are improved – terrestrial TV, cable TV, and satellite TV.
- All broadcast radio services are improved.
- New, higher-quality mobile video/TV services are now possible (and are currently being deployed).

Impacts of Digital Broadcasting Technology on RF Power Transmitters

Digital broadcasting technology standards have driven the need for the following transmitter enhancements:

- Since the peak to average ratio (PAR) is higher with digital video broadcast (versus analog), there is an absolute need for increased linearity in the transmitter amplifiers. This is especially true in the digital broadcast standards employing COFDM (coded orthogonal frequency division multiplex) modulation.
- Power efficiency must therefore be increased (while maintaining high-linearity) to help contain operating expenses for broadcasters.

These advanced requirements have led to increased demand for new high-linearity digital broadcast transmitters. At Richardson RFPD, we have the broadcast engineering expertise necessary to help you select the best components for your digital broadcast transmitter design. Key components for this design include driver amplifiers, high-power RF amplifiers, amplifier linearization technology, power splitters (dividers/combiners), hybrid couplers, RF terminations, protectors/arrestors, and advanced thermal management solutions.

Increased Amplifier Linearity

As mentioned previously, implementing transmitters that can handle the complex digital modulation schemes (with their higher peak-to-average power ratio) requires much higher linearity in the power amplifier (PA) design than was required with traditional analog modulation. Normally, this would require using PA semiconductor devices with very high peak power capability, a design implementation that allows those devices to operate in a very linear region of their safe operating area (i.e. at severe power back-off), and also maintain very good thermal performance over the entire ambient temperature range. However, if the power amplifier is designed in this straight-forward fashion for optimum linearity, component cost increases and power efficiency decreases.

To achieve goals for high-linearity, reasonable device cost, and high efficiency, modern PA design methodology includes using one or more enhanced amplifier linearization techniques. These methods can include digital pre-distortion, RF pre-

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correction, and envelope tracking. Richardson RFPD can help to design highly linear, highly efficient, reasonable cost power amplifiers using methods such as these.

Thermal Management Solutions

Although soldering down RF power transistors to the amplifier heat plate provides the best overall thermal resistance characteristics, broadcast engineers generally prefer to bolt down the transistors for ease of long-term maintenance. Richardson RFPD therefore provides RF power transistor clamp solutions to optimize the thermal resistance, and yet retain ease of maintenance. In addition to the transistor clamping solutions, Richardson RFPD provides both off-the-shelf and custom thermal management solutions for broadcast transmitter designs.

Current Digital Broadcasting Technology Standards

For digital broadcast television, North America uses the ATSC Standard (Advanced Television Systems Committee), which includes the use of 8-VSB modulation along with standard 6 MHz channels. 8-VSB stands for vestigial sideband modulation with 8 discrete amplitude levels. Europe and some other parts of the world use a group of standards known as DVB (terrestrial digital TV is DVB-T). The more flexible DVB-T signal format, which uses COFDM modulation (instead of 8-VSB), can accommodate channels of 6, 7, or 8 MHz. In Japan, the Digital Terrestrial TV Standard is known as ISDB-T. A version of ISDB-T is also now in use in most of South America. In China and Hong Kong, the respective group of digital television standards is called DTMB (Digital Terrestrial Multimedia Broadcast).

ATSC (Terrestrial)

The terrestrial ATSC signal is more susceptible to changes in radio propagation conditions than DVB-T and ISDB-T. It also lacks true hierarchical modulation, which would allow the SDTV part of an HDTV signal (or the audio portion of a television program) to be received uninterrupted even in fringe areas where signal strength is low. For this reason, an additional modulation mode, enhanced-VSB (E-VSB) has been introduced, allowing for a similar benefit.

In spite of ATSC's relatively fixed transmission mode, it provides for a very robust signal under various conditions. 8-VSB was chosen over COFDM in part because many areas of North America are rural and have a much lower population density, thereby requiring larger transmitters and resulting in large fringe areas. In these areas, 8-VSB was shown to perform better than other systems.

Digital Modulation System for DVB-T, ISDB-T, DVB-H and America's New HD Radio

COFDM (digital modulation) is used in DVB-T and ISDB-T, as well as DVB-H (Mobile) and also HD Radio in the United States. In metropolitan areas, where the great and increasing majority of North Americans live, COFDM has a slight advantage at handling multipath propagation.

Mobile Digital Video/TV Standards

Mobile Video/TV services are still in their infancy. Japan has the most services and the most customers in this very new application for "TV-type" broadcast services to handheld devices (PDAs, I-phones, etc.). Mobile DTV standards include DVB-H, DVB-SH (satellite), China's DMB-H (handheld), plus Korea's T-DMB (terrestrial) and S-DMB (satellite). Please visit this page often, as we will provide more information on this website about the new mobile video standards and the new mobile services from time to time.

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