DRM News And Views

Transmitter Combining DRM For FM: Building An Extended DRM Multiplex

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The analog FM band is crowded in many metropolitan areas around the globe and only offers 25 to 30 audio services to the listener with subjectively good quality and limited multimedia support. The Digital Radio Mondiale (DRM) standard heralds from medium wave and shortwave transmission, but can also be applied to VHF Band I, II, and III using transmission mode E occupying a 96 kHz channel bandwidth designed to fit within a standard FM channel allocation. Three audio services and multimedia data can in practice be supported by DRM on a single channel, and can optionally be broadcast with an analog FM carrier at a frequency offset of 150 kHz or 200 kHz typically at 10 to 25 percent of the FM carrier power for comparable coverage.

Maximizing Existing Spectral Resources

Due to its narrow signal bandwidth, DRM can effectively exploit whitespace in between FM allocations while broadcasting at lower comparable power levels to achieve FM comparable coverage. DRM lends itself nicely for signal combining within a single transmitter and broadcasting from a single antenna. This effectively utilizes the available bandwidth and unlocks new channel allocations that are unusable for FM broadcasting or by using traditional channel combiners. Using shared transmission infrastructure, including a high-power broadcast transmitter, many of the benefits found in Digital Audio Broadcasting (DAB) can now be carried into the FM band as part of a migration strategy towards all-digital broadcasting. Unlike DAB, broadcasters remain in full control of their own DRM signal within the extended multiplex each with its own connected audio and data services.

Facilitates Channel Combining

At the 2019 IBC Show in Amsterdam, we demonstrated the broadcasting of as many as six individual DRM signals from a single transmitter. Each DRM signal is generated in a bank of individual modulators transmitting up to six pure digital DRM channels, as shown in Figure 1. One DRM channel carries two to three audio programs, so on a single transmitter one could broadcast as many as 18 programs in pure DRM mode. Each modulator is connected to its own dedicated DRM Content Server creating independent air chains.

Transmitter combining of DRM signals creates new channel allocations at 100 kHz intervals, which are limited only by the exciter and transmitter bandwidth. Reception of all DRM sidebands were demonstrated on a professional grade DRM modulation monitor which displayed a clean 16-QAM constellation with better than 40 dB MER (Figure 1). Reception on a number of consumer DRM receiver models was also demonstrated.

Each individual DRM signal is defined by the ITU standard, therefore, all DRM receivers just worked out-of-the-box as transmitter combining is not a new signal standard. Also supported is a combined analog and digital "simulcast" mode with a single FM carrier at the center and as many as two DRM sidebands on either side with up to 12 DRM programs in simulcast mode (Figure 2).

The narrow bandwidth of 96 kHz makes DRM well suited for exploiting whitespace within busy FM allocations and allows it to be injected into standard channel combiner

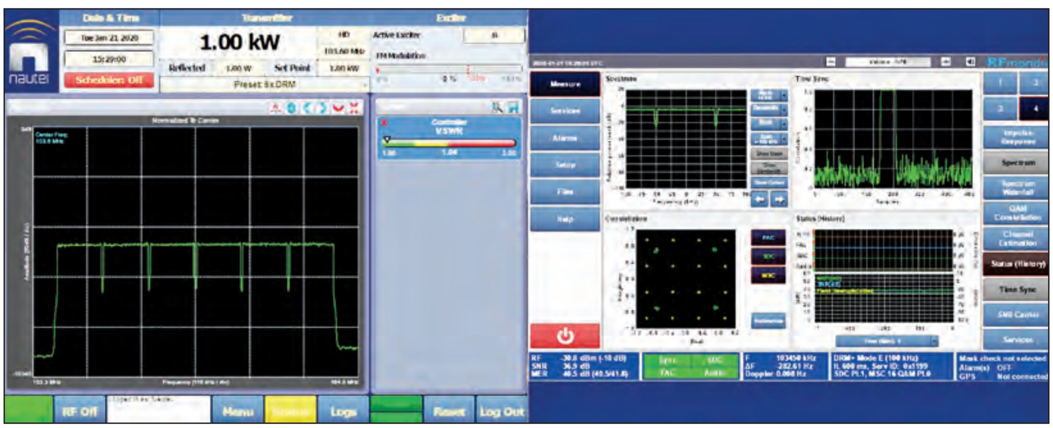

Figure 1. Six DRM signals combined in a Nautel GV transmitter.

ports. Figure 3 illustrates a transmission site with two existing FM allocations occupying 200 kHz each. Adding an additional combiner branch allows the insertion of a single DRM signal at a reduced power level such as to not interfere with out-of-town co-channel allocations. If bandwidth is available, two DRM signals can be transmitter-combined before injection into a combiner branch. Two DRM signals occupy less than 200 kHz bandwidth, fully utilizing the space of a regular FM allocation and can be allocated satisfying all necessary protection ratios.

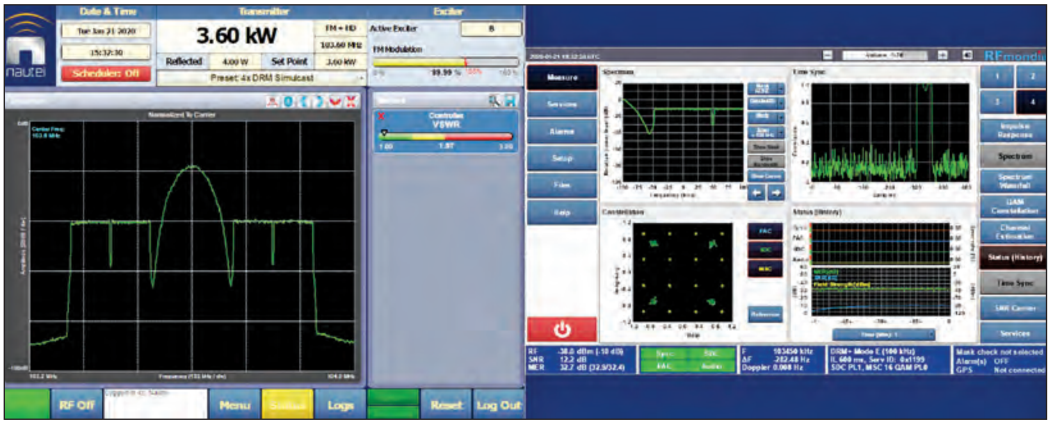

Figure 2. Four DRM signals combined with a single FM carrier in a Nautel GV transmitter.

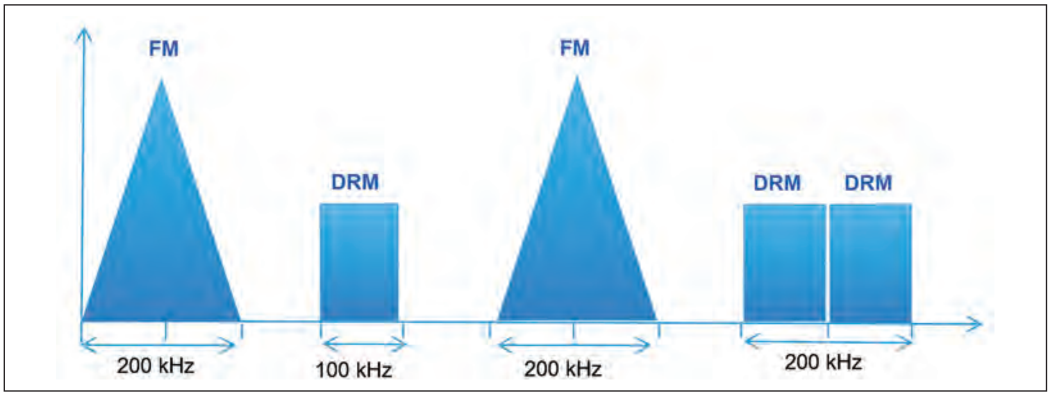

Figure 3. Integrating DRM into existing channel allocations at a transmission site.

Traditional analog channel combiners cannot be used to combine two DRM signals within a single FM allocation as there is not enough frequency separation. Transmitter combining is ideal for closely packed DRM signals and can be used effectively with analog channel combiners at shared transmission sites for signals spaced out in frequency. The ability to freely mix and combine analog and multiple digital DRM signals, in adjacent channels, with individually varying power levels, supporting single frequency networks, allows broadcasters, network regulators and frequency planners a new dimension of possibilities for planning and operating digital radio networks using established planning parameters for both DRM and FM services.

Broadcast operations will benefit from lower operating costs due to lower digital power levels, and also realize savings based on shared broadcast infrastructure with a single transmitter and antenna network. The superior signal propagation characteristics of VHF Band II allows large geographic coverage using single frequency networks (SFNs) with fewer high-power transmitters compared to a DAB-based network. The new channel allocations can be used to provide national, regional and local services by SFN, grouping individual DRM signals in the extended multiplex. The same receiver base for FM and DRM allows a gradually migration to all-digital broadcasting without requiring a hard switchover date. An extended DRM multiplex can be built out with increasing consumer demand, adding one DRM signal at a time to the same transmitter. Eventually, DRM can provide hundreds of audio and data services in the FM band. We will continue to develop this concept and hope to report on progress and further testing efforts soon.

About The Authors

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