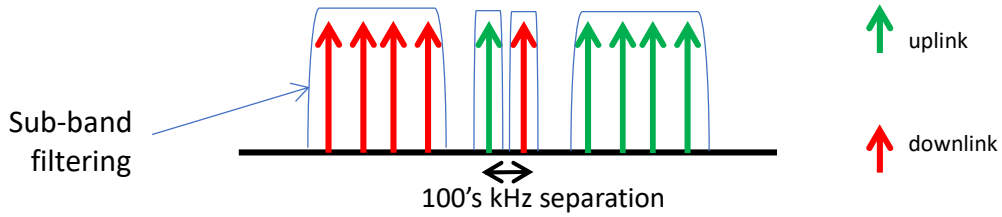
Application Note AN-VU3

The Challenge in the VHF and UHF Bands

VHF and UHF Interlaced and Close-in TX-RX pairs

A highly configurable "sub-band" filtering front-end design addresses interlaced frequencies and avoids large, costly and long lead duplexers while eliminating desensing and intermodulation.

The SAFE-Com Wireless BDA and Fiber DAS Emergency Responder Radio Coverage System (ERRCS) is unique in that in can handle interlaced frequencies and close-in TXRX frequency pairs often found in the VHF and UHF bands. An example of the challenging frequency set is shown below:



The SAFE-1000 series BDA and Fiber DAS is unique in that, for the first time, a modular card system with "sub-band filtering" has been introduced to address the need to provide in-building public safety radio coverage with interlaced frequencies. "Sub-band filtering" means a modular filter system designed to place variable passband filters around segments of the receive spectrum that need to be isolated from adjacent transmit frequencies that can cause interference or receiver desensing – usually from your own transmit frequencies.

In the example above, the SAFE-1000 uses multiple narrowband filters placed around the receive frequencies - right at the input of the receiver- to reject the close transmit frequencies that threaten to overload or desense the receive path. In the example above we use a Class A filter to protect a single frequency at the center of the band. Plus also we use a broader filter (100kHz, 250kHz, 800kHz, 1MHz, 1.5 MHz – whatever is needed) to isolate an additional batch of frequencies.

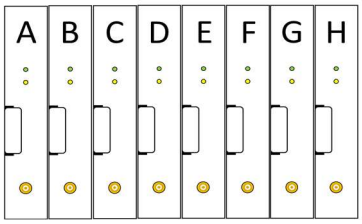
The two key features of this advanced BDA and Fiber DAS are:

1. Robust Sub-band filtering, and
2. Robust front-end narrow-band receiver design

The robust high-power handling front-end receiver – starting at the first stage all the way down the RF chain until the IF filtering stages - is critical to the solution as it has to handle the high level TX signal ingress without gross distortion, intermodulation and desensitization. Again, usually these are your own TX channels coming back into the receiver. The sub-band filtering must also be able to handle high signal levels all the way down the RF chain until it gets to the narrow-band filtering stages which

is where it ultimately rejects the unwanted high-powered signals from your own transmitter and passes the desired receive channels.

The card line-up in the BDA will look like this:
Card A: Sub-band filter 1 uplink
Card B: Sub-band filter 2 uplink
Card C: Sub-band filter 1 downlink
Card D: Sub-band filter 2 downlink
Card E: Downlink Power Amp
Card F: Uplink Power Amp



Safe-Com 1000 Series Modular Card System

The result: A highly selective BDA or Fiber DAS that filters complex signals cleanly and compactly – often with multiple bands in one NEMA enclosure. This approach avoids large, costly, long lead item duplexers and provides rejection not feasible by cavity filters.

Wont that digital Class A BDA take care of these problems?.....NO, it wont.

First off, a digital Class A system has an RF stage upfront – at the very input to the receiver. This stage uses a wide preselection filter and an RF LNA. Its usually used to AGC the signal levels coming in so that they are low enough for the ADC (Analog to Digital Convertor) to handle them. This being a wide band stage, the high powered close-in or interlaced frequencies have already entered the system and may be setting the AGC point of the front end. That means the desired signals are attenuated – or worst yet – lost because your own transmit frequencies are higher in level than the desired receive signals.

Secondly – a digital front end ADC can only handle low level signals and over a restricted dynamic range. This means two things:

1) The stronger undesired transit frequencies dominate and overload the system before you get to the digital filtering stage and
2) The AGC sets the input level based in the strong (undesired near) signal and therefore the weaker desired signal, the far - has been severely attenuated or worst yet – dropped.

The digital processing occurs far later in the process – after the input was dominated by the strong signal, where intermods were likely generated and the weaker receive signals are dropped or attenuated severely.

The only way to handle these types of interlaced frequencies is to place robust narrow-band receivers right up front in the BDA that can handle the strong incoming signals coming in from your own transmitters and immediately reject them while passing and amplifying the desired weaker receive channels cleanly and without distortion or loss of fidelity.

Conclusion: SAFE-Com 100 Series has unique capability in handling close-in TXRX pairs as well as interlaced frequencies. Call us toll-free at 855-SAFE-025 to solve your RF challenge.

For more information, contact sales at 855-SAFE-025 (723-3025) or info@safe-comwireless.com