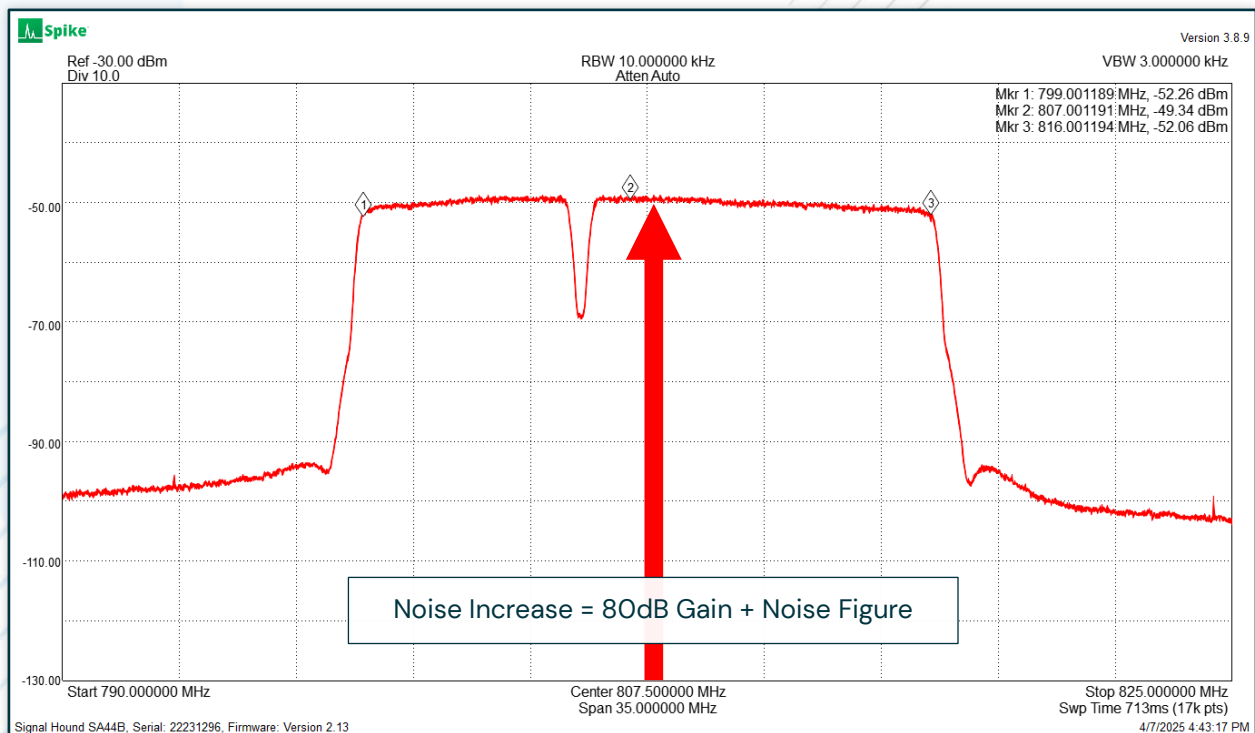


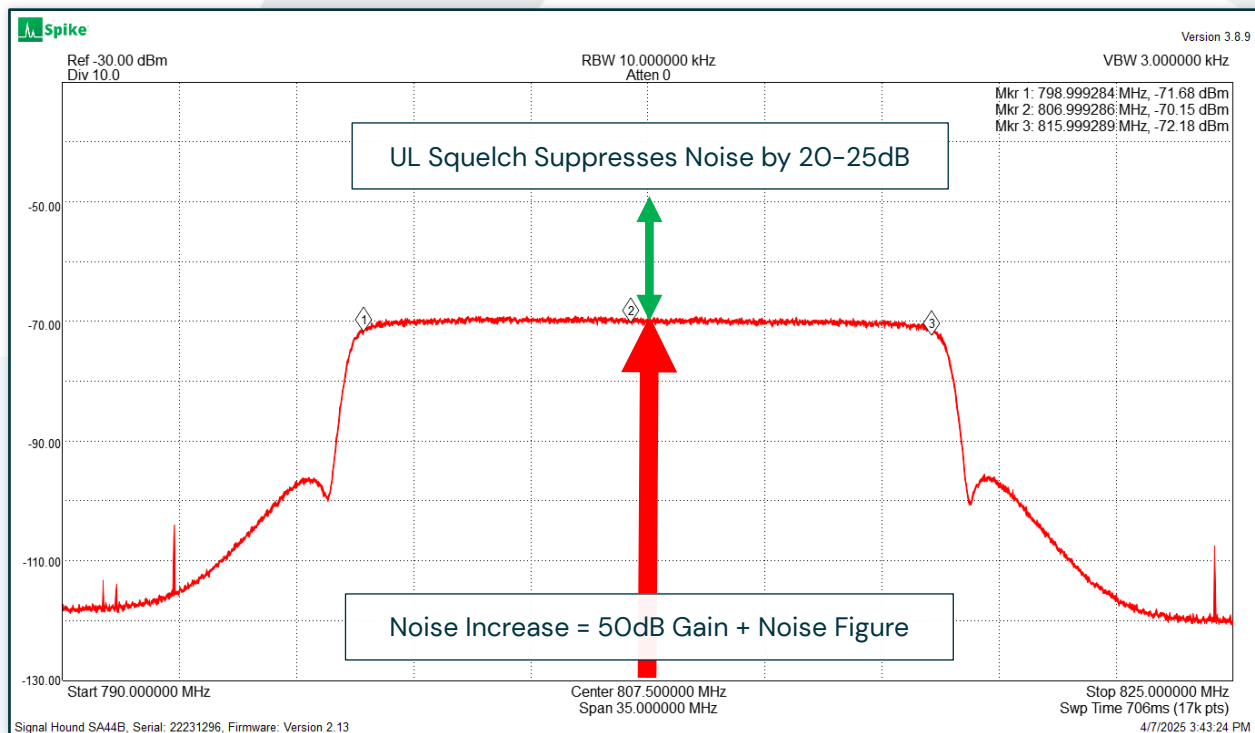
## Protecting the Public Safety Communications Network

Did you know that many Class B Signal Boosters, also known as Class B Bi-Directional Amplifiers, transmit continuously, even when there is no radio traffic in the building, which means it is transmitting noise across the entire designed passband all the time? If this amplified noise is not sufficiently attenuated, it will desense the repeater site and degrade widespread communications. Figure 1 below shows a spectrum analyzer measurement of the Uplink Noise Output of a class B wideband BDA when it is idle (No Squelch Circuitry). The BDA has an UL Gain setting of 80dB. Notice the wide shelf of noise that extends across the entire passband of the BDA from around 799–816MHz (700/800 Public Safety Narrowband). If this noise is not managed properly, it can arrive at a high level at the PS repeater site, or neighboring sites, and decrease the sensitivity of the communications, placing lives at risk!



**Figure 1:** Spectrum Analyzer Measurement of Wideband Class B BDA Uplink Noise in 700/800 PS Band

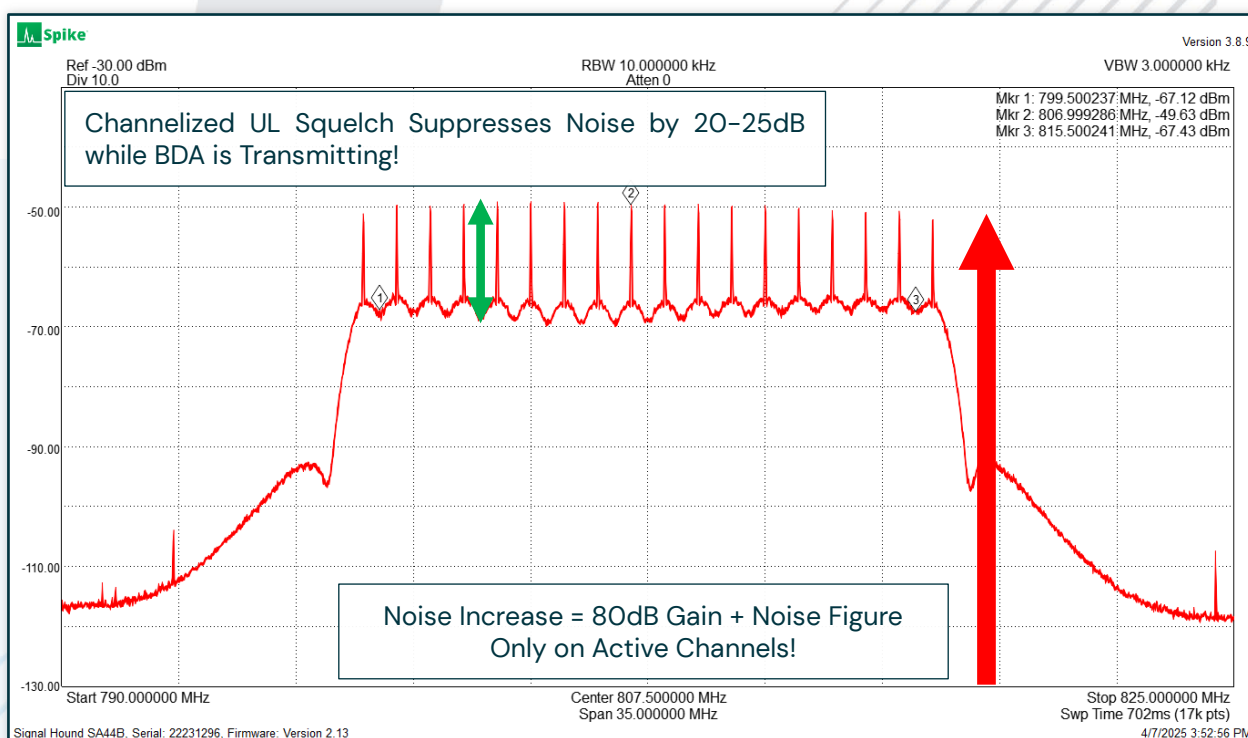
Some Class B BDAs now have a digital architecture and contain Digital Signal Processor/Field-Programmable Gate Array (DSP/FPGA) circuitry which can help reduce noise transmission by employing squelch circuits. The UL Squelch feature in a digital Class B BDA will prevent UL Noise from passing through the digital section of the BDA's Uplink path when there is no active UL channels detected. However, the Uplink Power Amplifier always remains active, producing 40–50dB of the BDA's UL Gain. Therefore, when the BDA is not detecting any Uplink Signals and is squelched, it will still transmit 40–50dB of UL Noise continuously. Furthermore, when the BDA detects an UL Signal, the BDA will un-squelch and transmit that UL Signal, but with added noise across its entire programmed passband, as shown previously in Figure 1.



**Figure 2:** Spectrum Analyzer Measurement of Wideband Class B BDA Uplink Noise with Uplink Squelch

Figure 2 above shows a spectrum analyzer measurement of the Uplink Noise Output of a digital class B wideband BDA with UL Squelch when it is idle (No UL Signals Active). The BDA has an UL Gain setting of 80dB. Notice the wide shelf of noise that extends across the entire passband of the BDA from around 799–816MHz (700/800 Public Safety Narrowband). The UL Squelch feature suppresses around 20–25dB of UL Noise when the system is idle, however, the 40–50dB of UL Noise from the final UL Power Amplifier remains. If this noise is not managed properly, it can arrive at a high level at the PS repeater site, or neighboring sites, and decrease the sensitivity of the communications.

Class A narrowband BDAs are certainly better at reducing noise than Class B devices, however even Class A BDAs do transmit some noise when idle. DSP/FPGA circuits used in most Class A BDAs today offer superior digital channel filtering and squelch circuits, meaning essentially only active channels get transmitted. However, the output from DSP/FPGA circuitry is low power and still needs to be amplified. This is where the BDA's UL Power Amplifier (PA) takes over and offers wideband amplification to all channels that make it through the digital sections. The UL PA is generally responsible for 40–50dB of the BDA's UL Gain. Therefore, even with a Class A BDA, when idle, we may see upwards of 50dB of noise being transmitted continuously, like that of the Class B digital BDA. Figure 3 below shows a spectrum analyzer measurement of the Uplink Noise Output of a class A channelized BDA with UL Squelch OFF. As you can see, with a Class A channelized BDA, you will only see the full noise increase on the specific channel filters that are programmed in the BDA. The DSP only allows full Gain on the programmed digital filters and suppresses any signals or noise in between the programmed filters. This allows for a much cleaner UL Noise output and reduces the UL Noise level generated to adjacent channels or systems which could be nearby.

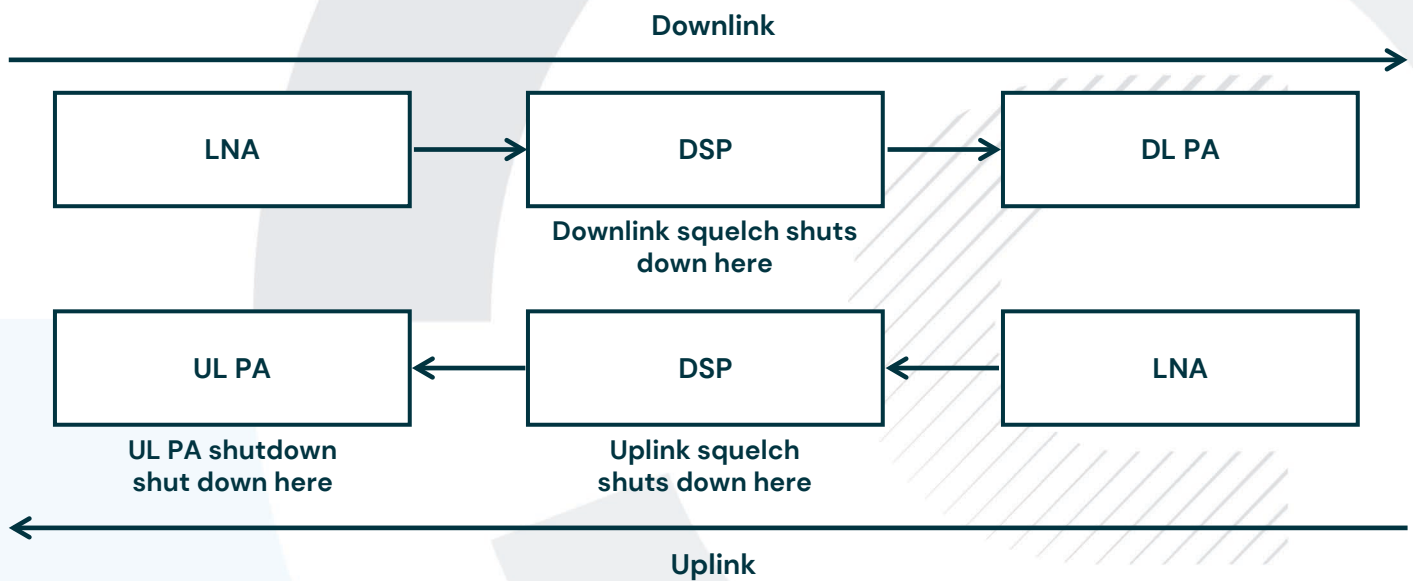


**Figure 3:** Spectrum Analyzer Measurement of Channelized Class A BDA Uplink Noise

Even though both Class A and Class B BDAs can have UL Squelch circuits to reduce the amount of noise being transmitted during idle periods by 100–1000 times, a 40–50dB noise rise from the final UL PA may still cause interference. If, for example, we take a major metro area where possibly 100 BDAs are installed in surrounding buildings, we have essentially 100 noise generators where additive noise powers can be harmful to the repeater site. Furthermore, with a growing number of buildings being equipped with Emergency Responder Radio Communications Enhancement Systems (ERCES/ERRCS), it has become imperative that cellular and public safety radio work in harmony. No one can question the value of cellular services in keeping the public safe, and for that reason every effort should be made to prevent public safety systems out-of-band noise from interfering with commercial systems and vice versa.

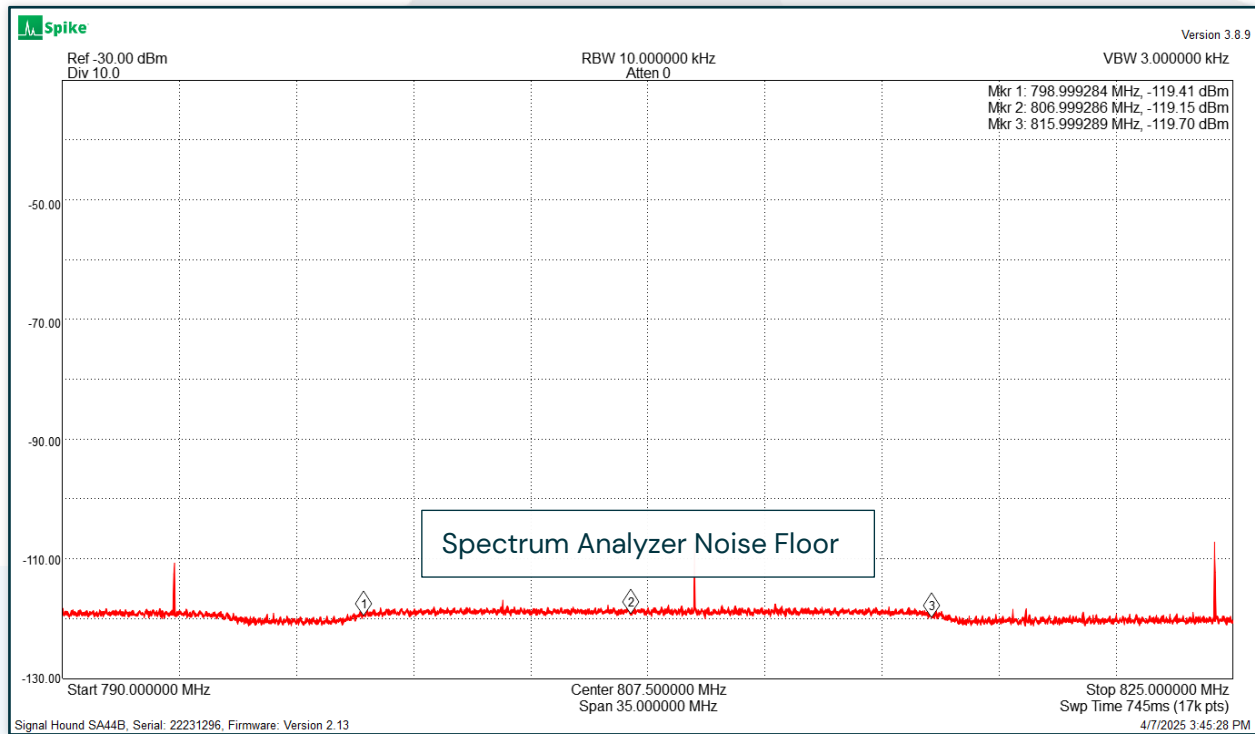


In an ideal world, a BDA would transmit no in-band or out-of-band noise. Comba has introduced a new feature in our V3 CriticalPoint™ Public Safety NG product line called **NetProtect™**, which is as close to an ideal no-noise BDA as physics will allow. This new feature applies to both Class A and Class B models and places the BDA's Uplink Power Amplifier in standby mode when no RF is detected over a given period. In this mode, the UL PA does not transmit, which means ZERO noise emissions during idle periods. Once the DSP detects RF above the UL Squelch level on a programmed band/channel filter, the UL PA turns on and instantaneous transmission resumes with no loss of performance or quality of communications. See Figure 4 below which shows a high-level diagram of a Comba BDA and how the DSP, Squelch, and **NetProtect™** UL PA muting work together to mitigate any UL Noise generation during idle periods.



**Figure 4:** Comba BDA High Level Diagram Showing DSP, Squelch, and UL PA Muting architecture

The following Figure 5 shows a spectrum analyzer measurement of the Uplink Noise Output of a Comba Class A or Class B BDA with **NetProtect™** active. As you can see, the measured noise level is essentially the noise floor of the Spectrum Analyzer.



**Figure 5:** Spectrum Analyzer Measurement of Comba Channelized Class A BDA with NetProtect™ Active

See Table 1 below which lists the Comba BDA products that support the **NetProtect™** Uplink Power Amplifier Muting feature.

Product	Model Number	Notes
CriticalPoint V1 700/800MHz BDA Class A	RX7W22-xxxxxxxx	V1 Class A Models Only!
CriticalPoint V3 700/800MHz BDA Class A	RX78V3-Axxxxxx-xx	Supported on all Class A Models
CriticalPoint V3 700/800MHz BDA Class B	RX78V3-Bxxxxxx-xx	Supported on all Class B Models
CriticalPoint V3 700/800MHz NG Fiber DAS Class A	RX78V3-Axxxxxx-xx RH78V3- Axxxxxx-xx	Supported on Class A Models with Hardware Version >= 1.0.0
CriticalPoint V3 700/800MHz NG Fiber DAS Class B	RX78V3-Bxxxxxx-xx RH78V3- Bxxxxxx-xx	Supported on Class B Models with Hardware Version >= 1.0.0
CriticalPoint V3 VHF/UHF NG BDA Class A/B	RX14V3-APO-xxxxxx	Supported by all Models

**Table 1:** Comba Products that Support NetProtect Uplink Power Amplifier Muting

The **NetProtect™** feature is another example of Comba's commitment to the safety of our First Responders. Comba listens to the concerns of Radio Licensees, AHJs and our Public Safety community and strives to deliver innovative, reliable, benchmark products and services.