

Meeting Missile Program Upgrade Requirements With Power-Efficient, Future-Proof, and Low-Noise Transmitters



Challenge

- Increase missile range
- Ensure low-risk transmitter qualification
- Transmitter Interference with other onboard electronics

Solution

- The most power-efficient transmitters
- Experienced and proven supplier
- Specially designed modulator and EMI filtering

Results

- Missile effective range increased
- Smooth qualification program and low risk re-qualification capability
- No problematic transmitter interference

Challenge

An upgrade program to produce a variant of a widely used and well-established missile was undertaken to enhance the missile's capabilities and compatibility with modern aircraft. The organization with responsibility for the program faced a number of challenges to successfully meet the upgrade's objectives.

One such challenge was extending the missile's range. This meant battery power needed to be conserved which required onboard electronics to be more power efficient. A significant source of power drain was the transmitter, which relative to other onboard electronics, required a large amount of power to amplify signals to ensure data could be reliably telemetered.

Every time a missile is integrated into a different platform, it is necessary to perform some kind of qualification as each platform has its own unique environment (e.g. shock and vibration), and it's important to validate the missile's performance. This presented another challenge in addition to range extension. As well, the organization needed to trust that the supplier would be capable of performing additional qualifications in the future, if and when the missile needed to be integrated into another aircraft platform.

The third challenge the program faced was due to interference. Missiles are using more modern digital transmitters that can, under some circumstances, generate interference of sufficient power to, in effect, jam other systems. This is because digital systems use square waves which can result in pulses of wideband interference being generated, unlike analog transmitters that generate interference in very specific frequencies.



TTS-5545: multimode transmitter

Solution

The organization selected the [TTS-5545](#) series of multimode transmitters from Curtiss-Wright thanks to its low power, the company's extensive qualification and flight experience, and its low electromagnetic interference (EMI).

The TTS-5545 is a digital based transmitter that utilizes gallium nitride (GaN) semiconductor technology. These are far more efficient and draw up to 50% less power than the existing analog counterpart. This is because GaN transistors are more efficient and work at much higher voltages than bipolar and LDmos technology. Curtiss-Wright was the first company to use this technology for aerospace transmitters and maintains the lead in low power usage.

Curtiss-Wright has extensive experience developing and qualifying products for use in challenging environments, including on missiles for similar platforms. As result of this, we needed to run a pre-qualification program, and then another qualification program following the adoption of the missile by another aircraft program that had not at that time been fielded. The aircraft has subsequently been deployed in a number of environments and thus a new qualification program was required.

Curtiss-Wright specially designed its transmitters using EMI filtering and other techniques in the modulator to mitigate EMI level interference sufficiently to be compatible with other electronics and avoid problems. As far as the author is aware, this ability to reduce the noise to such a low level is unique to our transmitters.

Results

The missile was able to perform at the specified range thanks to more power-efficient electronics. A significant proportion of this was due to Curtiss-Wright's multi-mode transmitter that was able to operate using approximately half the power from the battery as its predecessor.

The TTS-5500 series multimode transmitter also provided the user with state-of-the-art modulation compatibility to IRIG-106-04, with user programmability for center frequency and modulation options.

One of the reasons Curtiss-Wright won the contract was the confidence in our qualification and overall product program performance, and this was proven true. This is vital given the high quantity of transmitters being provided and the need for low risk future qualifications. The high production runs also further help lower costs and improve reliability and quality.

The supplied transmitters do not interfere with other onboard electronics enough to cause any issues thanks to its unique design to operate without the risk of excessive EMI.