

## Limiter Case Studies

CAP Wireless has extensive experience developing and integrating solid state power protection limiters within low noise amplifiers. These low loss elements provide a high degree of amplifier protection in both CW and pulse environments, while limiting the impact to noise figure performance of the amplifiers.

Our experience also shows that limiter testing is a long and tedious process. Protected device (FETS) failure mechanisms are extremely difficult to accelerate without inducing secondary, unrelated failures. The limiter and the protected amplifier must be tested and carefully monitored for minute changes and trends over a lengthy time period to ensure that gradual degradation will not occur in the field due to extended exposure to power.

Some recent examples of integrated limiter performance include:

- 1) Multichannel UHF-L Band microwave network protecting from input levels to +38 dBm

This octave+ band protection was implemented using a dual PIN diode configuration to provide a high degree of high power limiting without degrading 3<sup>rd</sup> OIP. Typical performance is shown in the Figure 1 below. This configuration provides almost 40 dB of attenuation at rated power. Unlike more typical PIN/Schottky configurations, this PIN/PIN limiter exhibits a power limiting characteristic wherein the absolute leakage power decreases as the input power increases (to a limit), providing substantial protection against higher power signals.

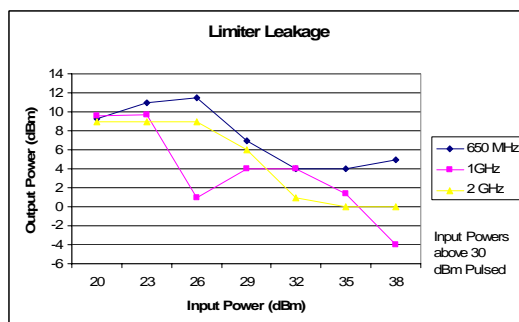


Figure 1

- 2) UHF High Power limiter

This limiter is designed for receiver protection for power levels exceeding 500 Watts peak with >15 mS pulse widths and 25% duty factors. It comprises two stages of limiting, the first stage limiting to a level of +22 dBm peak, the second further limiting down to +5 dBm out. Insertion loss is less than 0.3 dB.

- 3) S Band low power limiter

This relatively low power limiter was designed as the second stage in a high power limiter application for a low noise radar receive amp. The original limiter design was intended to limit input powers of 30 dBm to no more than +18 dBm out. Subsequent testing revealed that the input receive devices were potentially subject to damage at power levels of 15 dBm.

The limiter was redesigned (shown below in Figure 2 as "Improved Limiter") to limit the output power to less than 12 dBm by changing the architecture of the limiter and the types of diodes used to provide the limiting action. The overall noise figure of the S Band amplifier, including a limiter and isolator, was maintained at less than 1 dB.

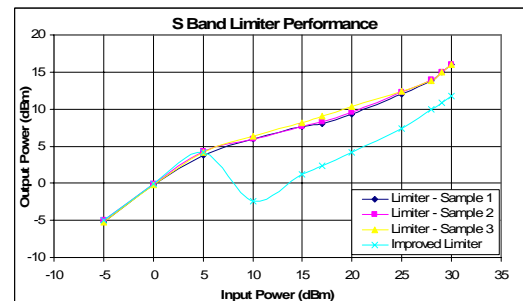


Figure 2

## Summary

These three examples are a small sample of the application specific limiters CAP Wireless has integrated into its LNAs and microwave subassemblies. Integrated solid state limiters covering a wide range of frequencies, powers, and applications are available to protect delicate receive amplifiers.

CAP Wireless is an ISO 9000:2000 registered, premier designer of application specific RF and microwave amplifiers and circuit assemblies.