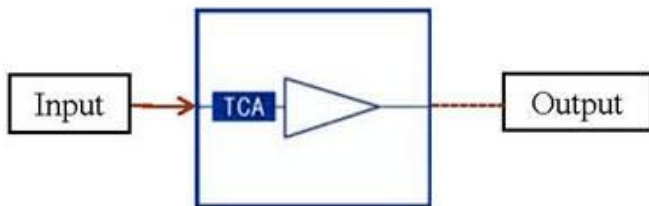


Temperature Compensated “Chip” Attenuators

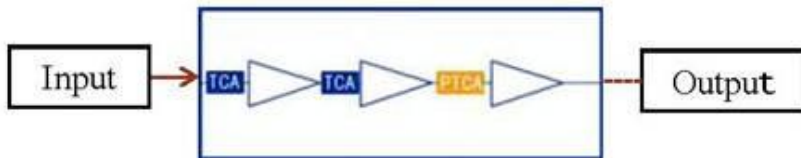
The use of TCA's in amplifier line-ups has puzzled engineers since their invention and introduction back in the 1970's. Prior to their invention and use, conventional solutions used noise generating resistor/capacitor matching networks as well as AGC loops. These circuits introduced noise, non-linear distortions, phase shifts and signal delays, all unacceptable approaches to good RF circuit design practices. These approaches also increased component count, reducing system level reliability.

INPUT PROTECTION & EXACTING MATCH



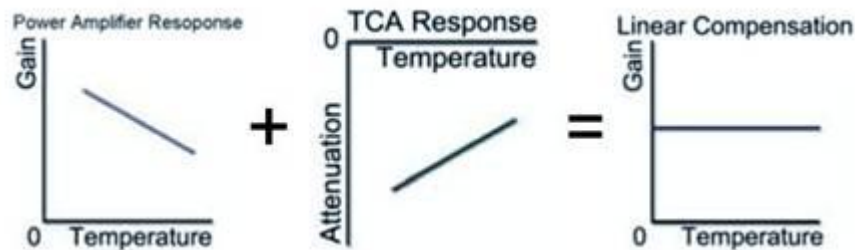
The application of a TCA device to the input side of a single stage Power Amplifier limits the power to the expensive semiconductor device, as these first gain stages typically use high electron mobility semiconductors to keep noise to a usable level, but are susceptible to high energy pulses (fast rising spikes) that can destroy or damage that semiconductor. This is a very low cost approach to protecting your expensive semiconductors.

RELIABLE INTRA-STAGE LINEAR COMPENSATION

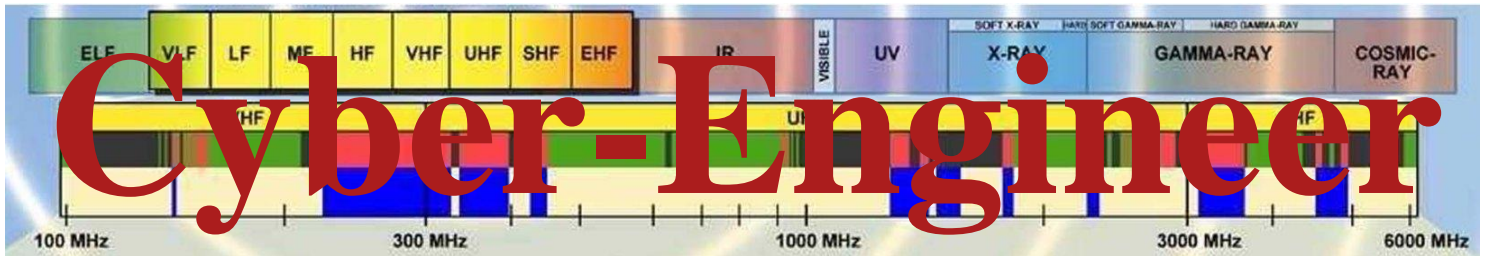


The application of a TCA device to the intra-stage provides improved return loss performance, improved VSWR, provides limited isolation to keep devices stable (reduce oscillation), as well as provide the real time temperature compensation that your semiconductors negative gain slope introduces to the lineup. These TCA devices do not increase distortion, phase shift or delay of your RF signals. This is the simplest and lowest cost correction scheme that can be used to correct for the deficiencies of modern day semiconductor technology, thus improving reliability of the system.

1 NEGATIVE SLOPE GAIN STAGE + 1 POSITIVE SLOPE TCA = FLAT GAIN ACROSS TEMP



These SMT planar-style chip designs are designed to provide a variety of positive gain slopes to compensate for the fall-off over temperature associated with all the different semiconductor materials, including Si, Ge, Si-Ge, Al GaAs, GaAs, InGaP and wide band-gap materials, SiC and GaN, all exhibit negative gain slopes. All you have to do is pick the correct Temperature Coefficient and temperature range you are trying to cover. These TCA devices are available in a range of 1dB through 9dB of attenuation in 1dB increments with tolerances down to +/- 0.3dB, resulting in compensations of -0.003 through -0.009 dB/dB/°C and an operating temperature range of -55° to +150°C.



SO WHERE DID THE OTHER GUYS GO WRONG...



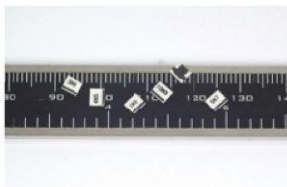
Yantel introduced a new internal circuit configuration adopting an innovative micro-strip circuit approach which makes it MORE suitable for wide RF frequency applications and higher power RF circuit applications vs the other guys standard π -type circuit configuration. Yantel's micro-strip approach allows for higher attenuation compensation ranges and tighter tolerance devices in the product offering. **Yantel's TCA Series** uses a substrate material better suited for thermal conduction as well, relieving thermal stresses on the device.

Yantel applied for a US patent in 2007 and received their first utility patent # US7362196B2. During 2008, Yantel was awarded the second utility patent # US7528677B2, as well as awarded a European Invention Patent Publication #EP1750369, two Chinese Invention Patents #ZL200410027307.7 ZL200410027307.7 and finally the Taiwan Invention Patent #I257110. The innovative technology of Yantel TCA is proved again through the success in passing strict audit by the Intellectual Property Office in their country. It also means that Yantel TCA is protected by law globally.

Yantel's temperature compensation attenuator chip products are patented and protected under USA law.

ADVANTAGES OF YANTEL TCA CHIPS vs the other guys...

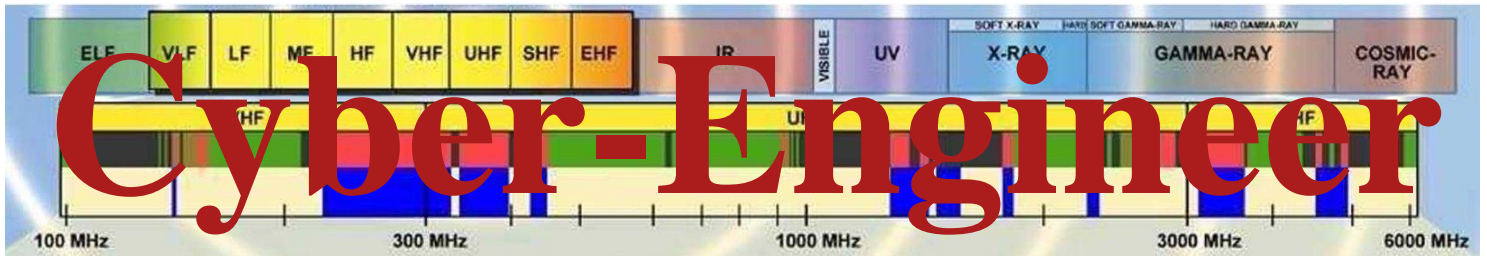
- **Higher Reliability** through the use of advanced Thick Film Process firing at 850°C
- Higher power ratings in smaller chip sizes
- **Better VSWR** rating is standard
- Wider frequency band of operation (WiMAX & LTE)
- Tighter tolerances are standard
- Wider attenuation ranges standard
- **Lowest cost (2:1 cost savings)**



Yantel TCA Series Products:

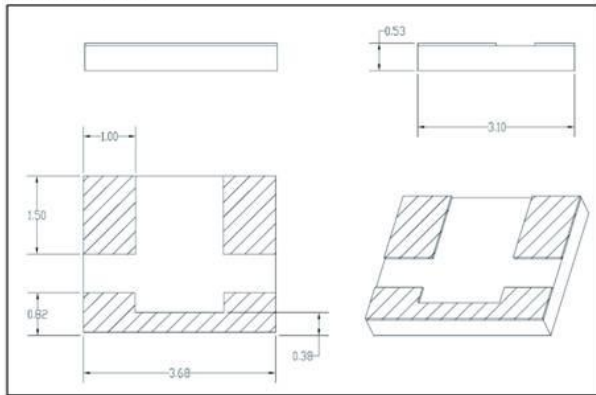
TCA Series	2 Watt chip	50 ohm	DC to 6GHz	
STCA Series	100mWatt chip	50 ohm	DC to 6GHz	industry smallest TCA chip = EIA0805
HTCA Series	200mWatt chip	50 ohm	DC to 18GHz	
MTCA Series	200mWatt chip	50 ohm	DC to 12.4GHz	
PTCA Series	5 Watt chip	50 ohm	DC to 6GHz	
BTCA Series	2 Watt chip	75 ohm	DC to 6GHz	


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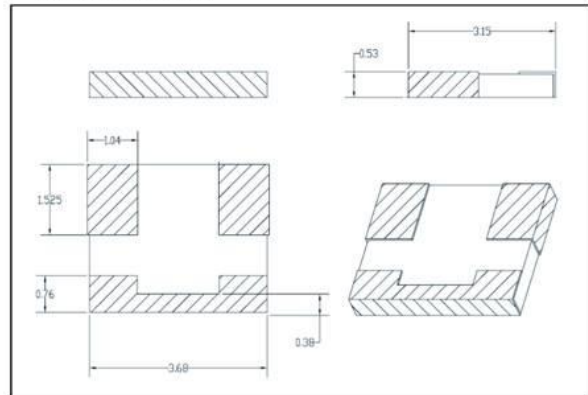


- All TCA Series products come in fixed attenuation values of 1dB up to 10dB or higher (specials) – Tape & Reel is standard.
- Individual Temperature Coefficient Codes (dB/dB/degree C) range from N3 through N9 (typically)
- Green TCA Series is very low lead content (<1000ppm), NO RoHS exemption necessary - TCA, STCA, MTCA, HTCA, BTCA and PTCA Series available

Planar Configuration



Triple Wrap Configuration



- Termination metallization(s): planar (no code), planar Gold (G – MTCA & HTCA only), single (W1) or triple (W3) wrapped, as well as Wire Bond (WB1 – MTCA only) terminations are available for Yantel TCA products.

**All Yantel products are stocked and distributed in the USA by
CAM RPC in Pittsburgh PA - <http://www.camrpc.com/index.htm>**

If you need additional information on these Yantel TCA Products or would like assistance in your selection process, please contact the undersigned MRE. We also have Reliability Reports, Production cpk data and distribution curves, Qualification Data, evaluation boards and samples in our offices. Should you need a formal Quotation, please contact your territory MRE and we will get in to you in a timely fashion. We will support you and your application as you have come to know the MRE members here at Theta-j Associates.



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