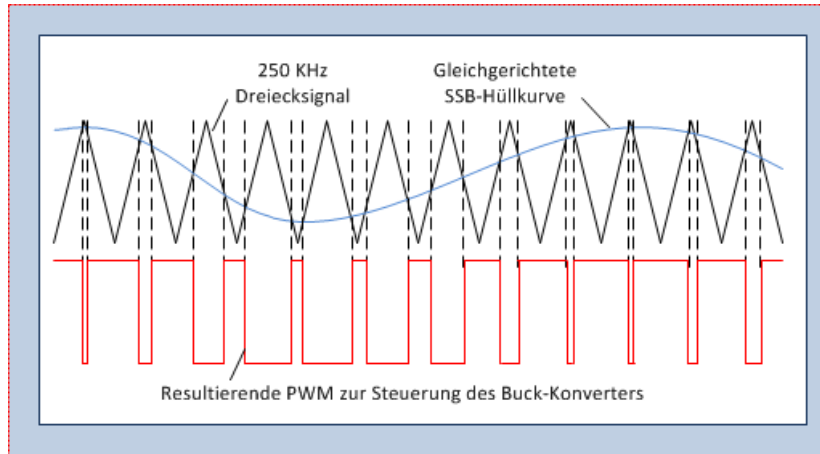
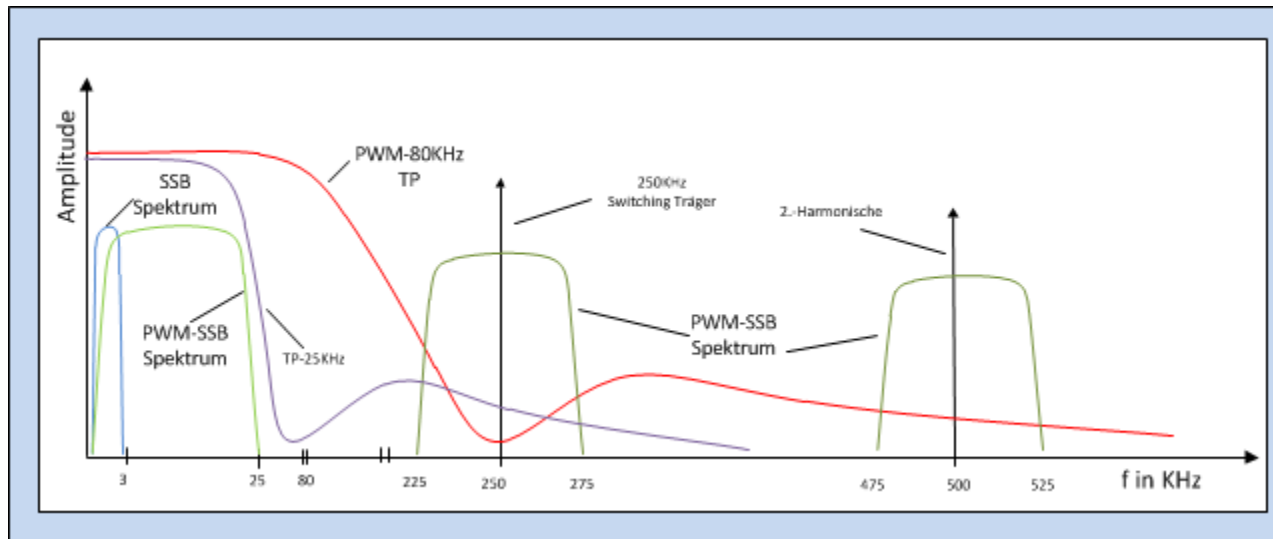


## 2. Pulse Width Modulation (PWM) using Hermes and PowerSDR software

# PWM principles, PWM spectrum



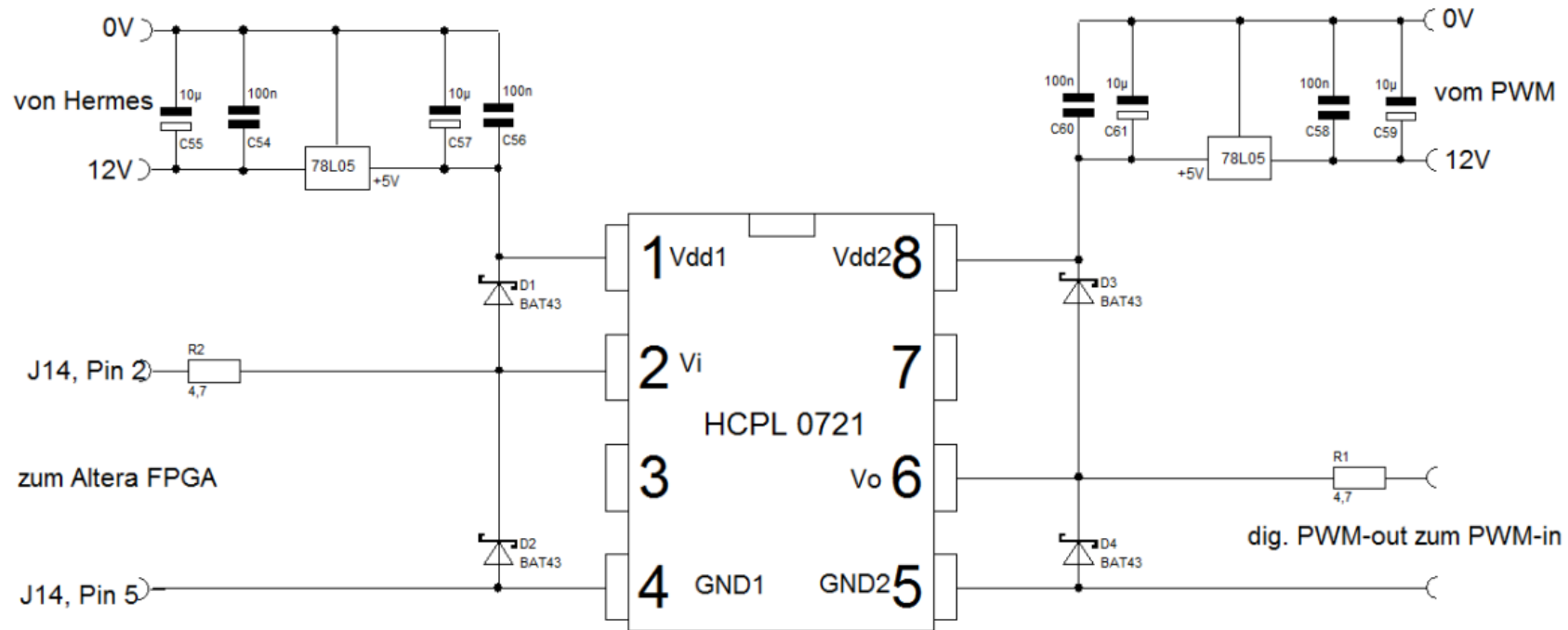
- The width of pulses is varied in proportion to the instantaneous amplitude of the SSB envelope
- The digital PWM signal has more bandwidth than the original SSB signal (25 to 32 KHz)
- Around the switching carrier and the harmonic carriers you see also the digital PWM LSB and USB



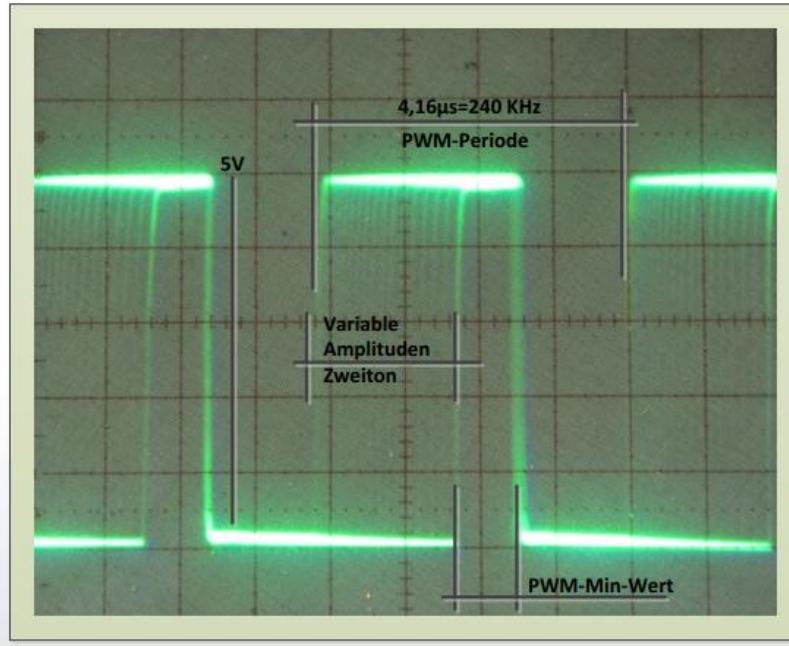
# Getting PWM from Hermes board on J14/Pin2



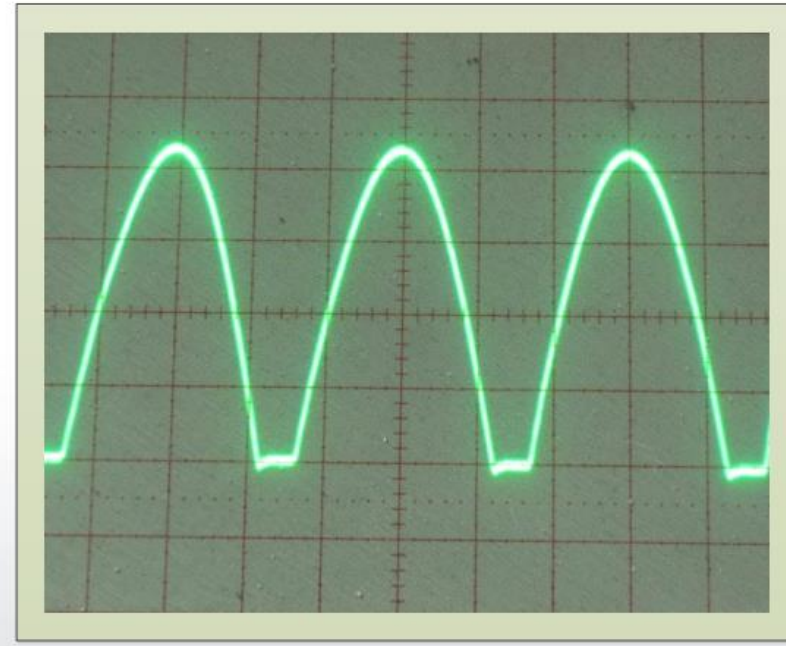
# Circuit diagram PWM adapter



# PWM Two Tone and Analog PWM Envelope Signal

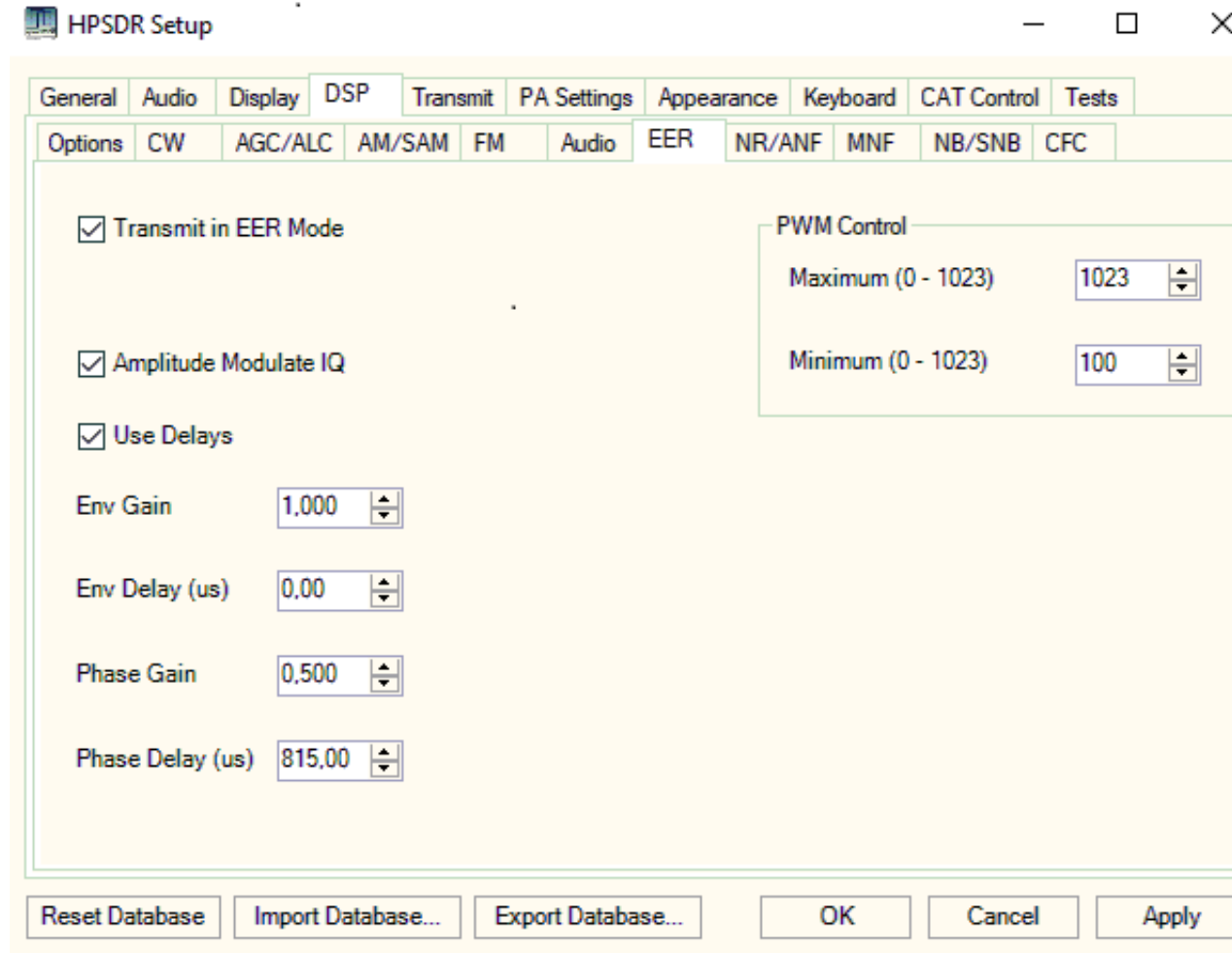


Digital 5 volts PWM

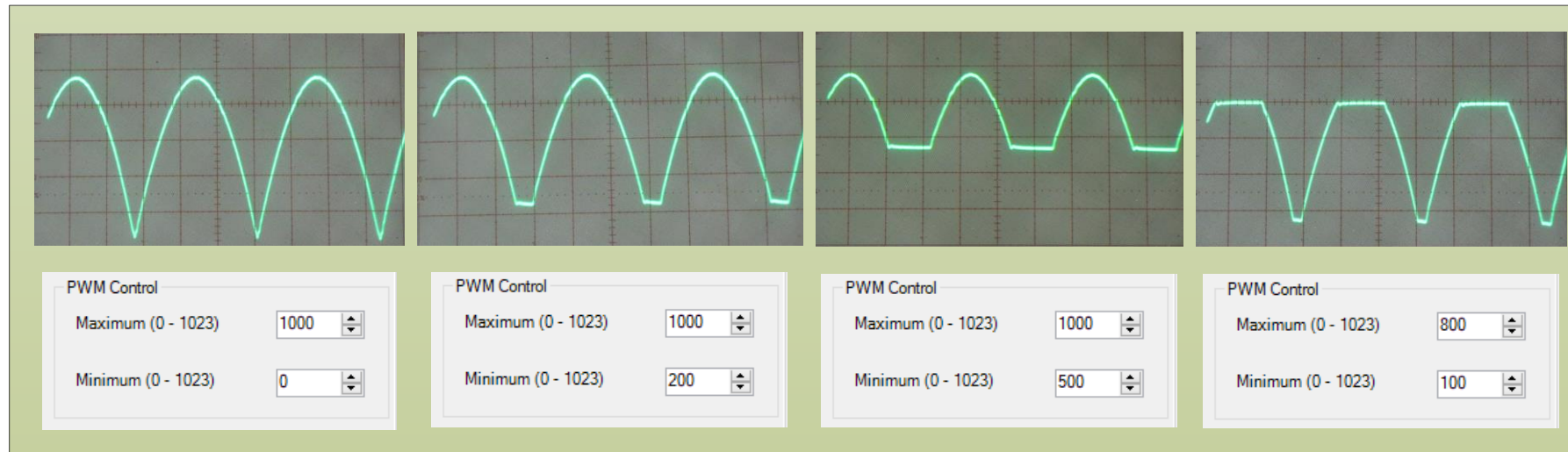


Filtered Analog Envelope Signal

# EER menu in Power SDR software



# PWM control function in PowerSDR



EER Mode

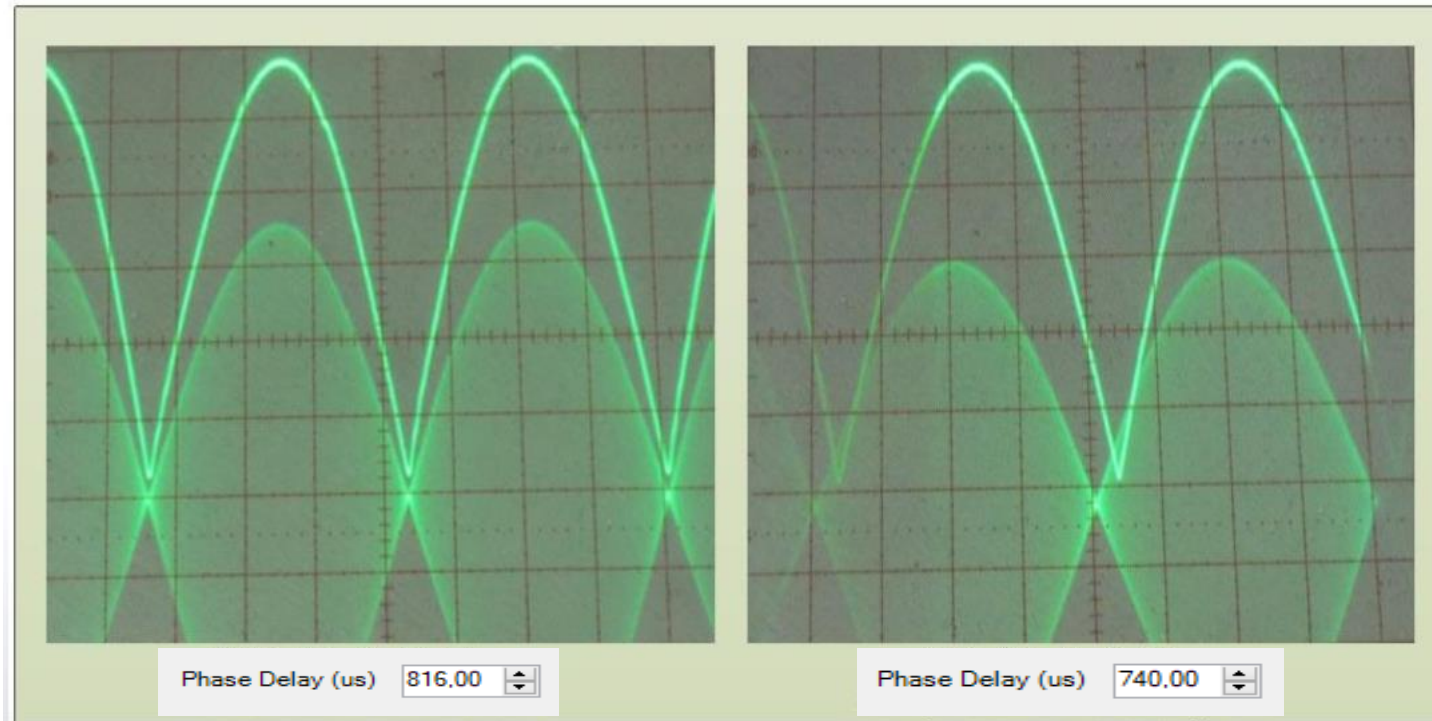
ET Mode

ET Mode

ET Mode

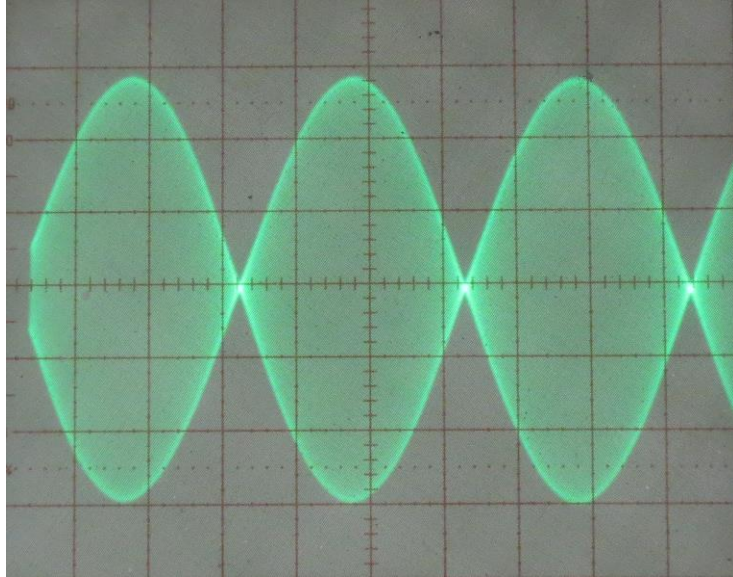


# Time alignment between Envelope and Phase



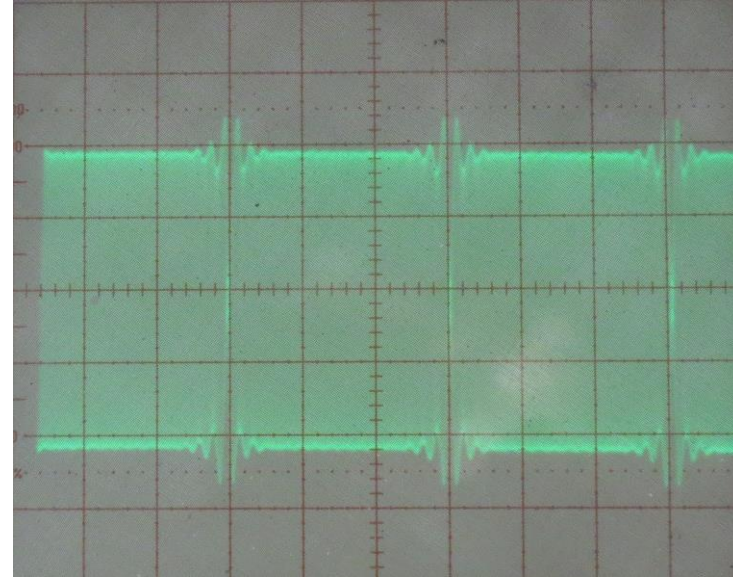


# Two types of SSB Phase Signals



☒ Amplitude Modulate IQ

Amplitude Modulate Phase Signal

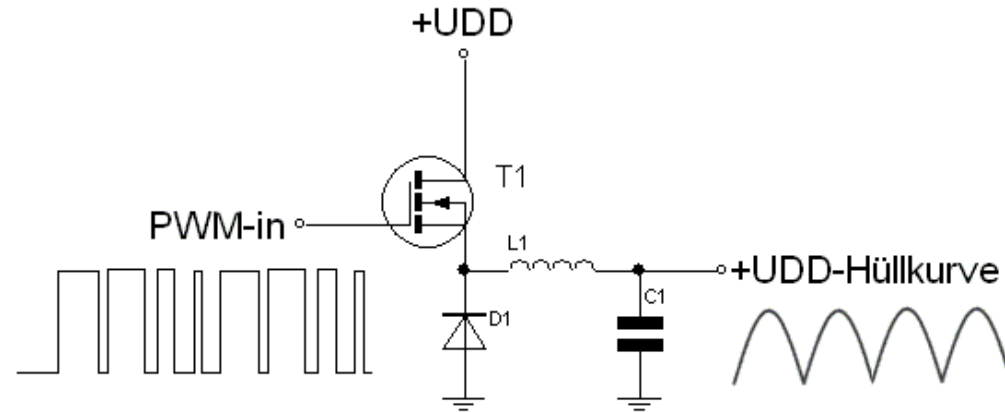


☐ Amplitude Modulate IQ

Constant Amplitude Phase Signal

# PWM Class S-modulator

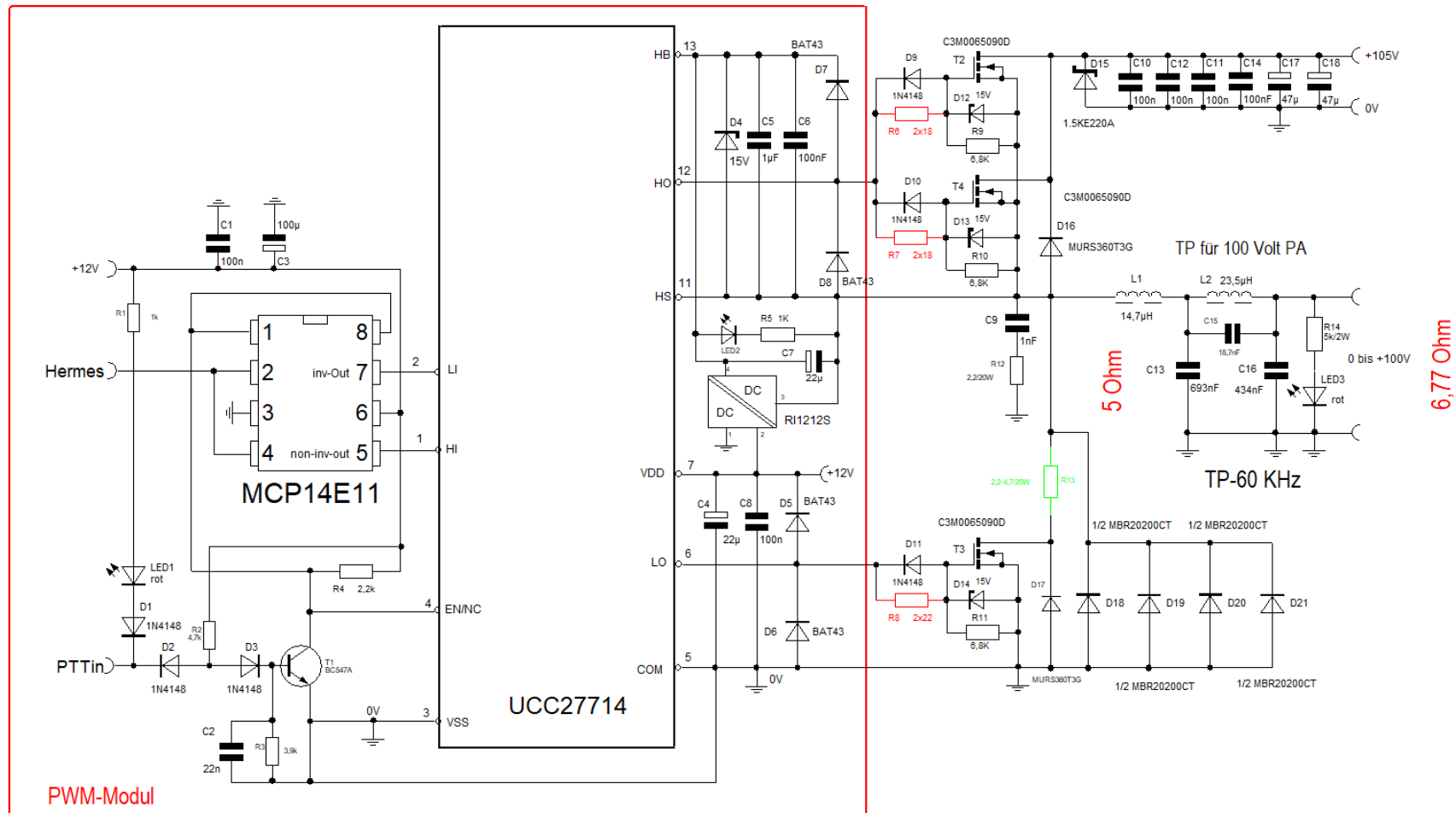
- In PWM the most widely used high-level modulator is class S
- A transistor and diode act as a two-pole switch to generate a rectangular waveform with a switching frequency several times that of the output signal (for instance 240 KHz and higher).



- The width of pulses is varied in proportion to the instantaneous amplitude of the desired output signal, which is recovered by a low-pass filter.
- Class S is ideally 100% efficient and it can have high efficiency over a wide dynamic range.

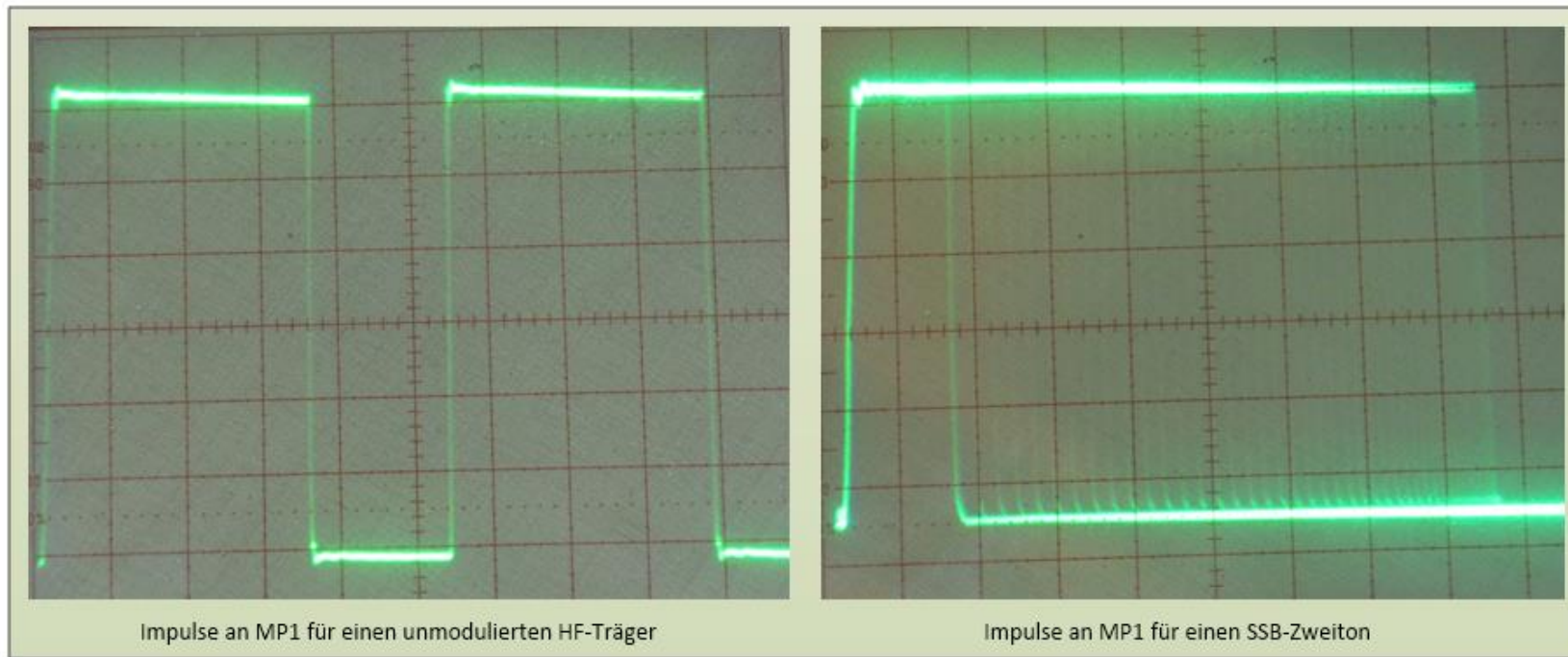
# Gen 2 PWM circuit diagram for Hermes transceivers

PWM-30-12-2017



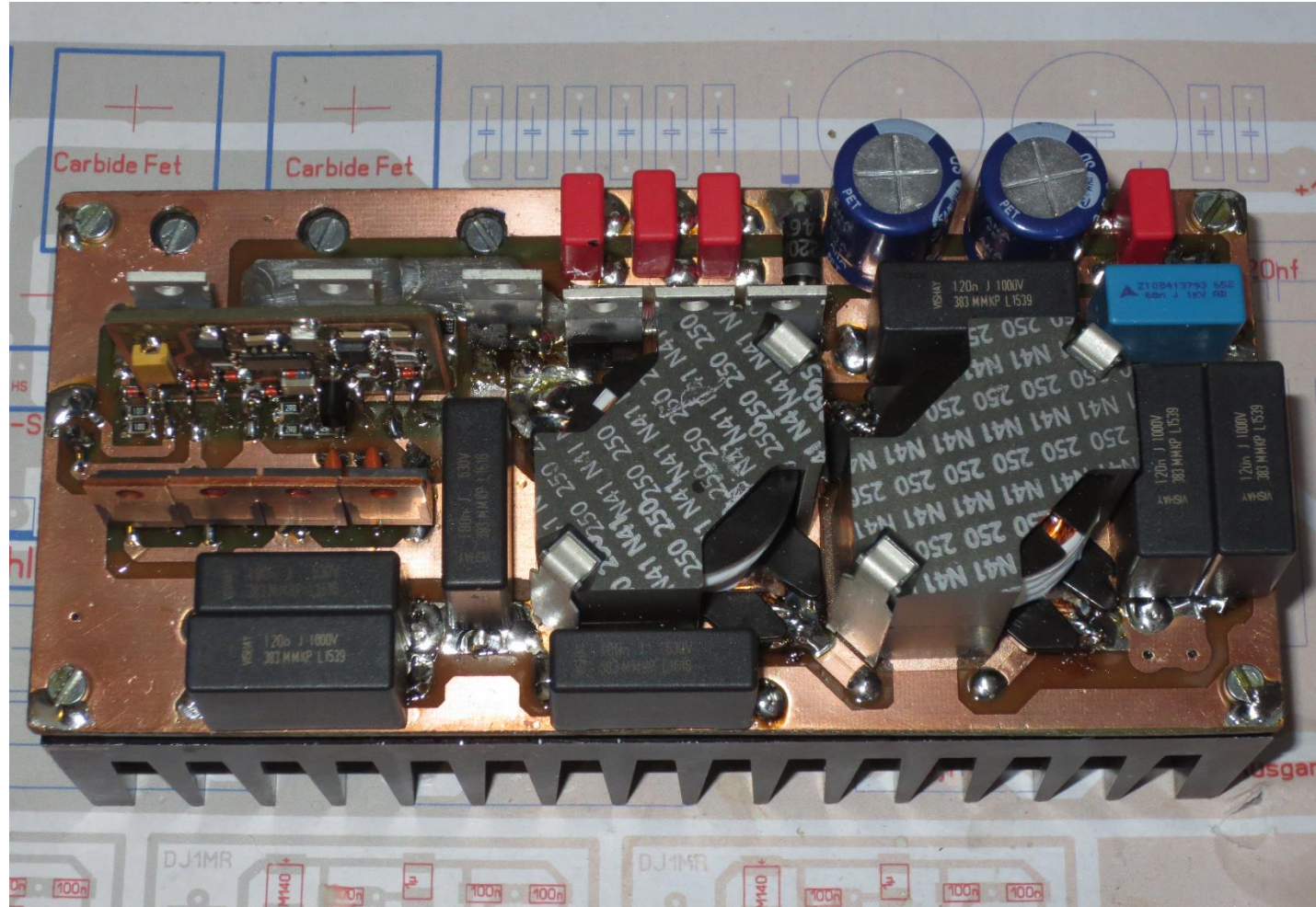
DJ1MR

# Impulses on HS PIN UCC27714

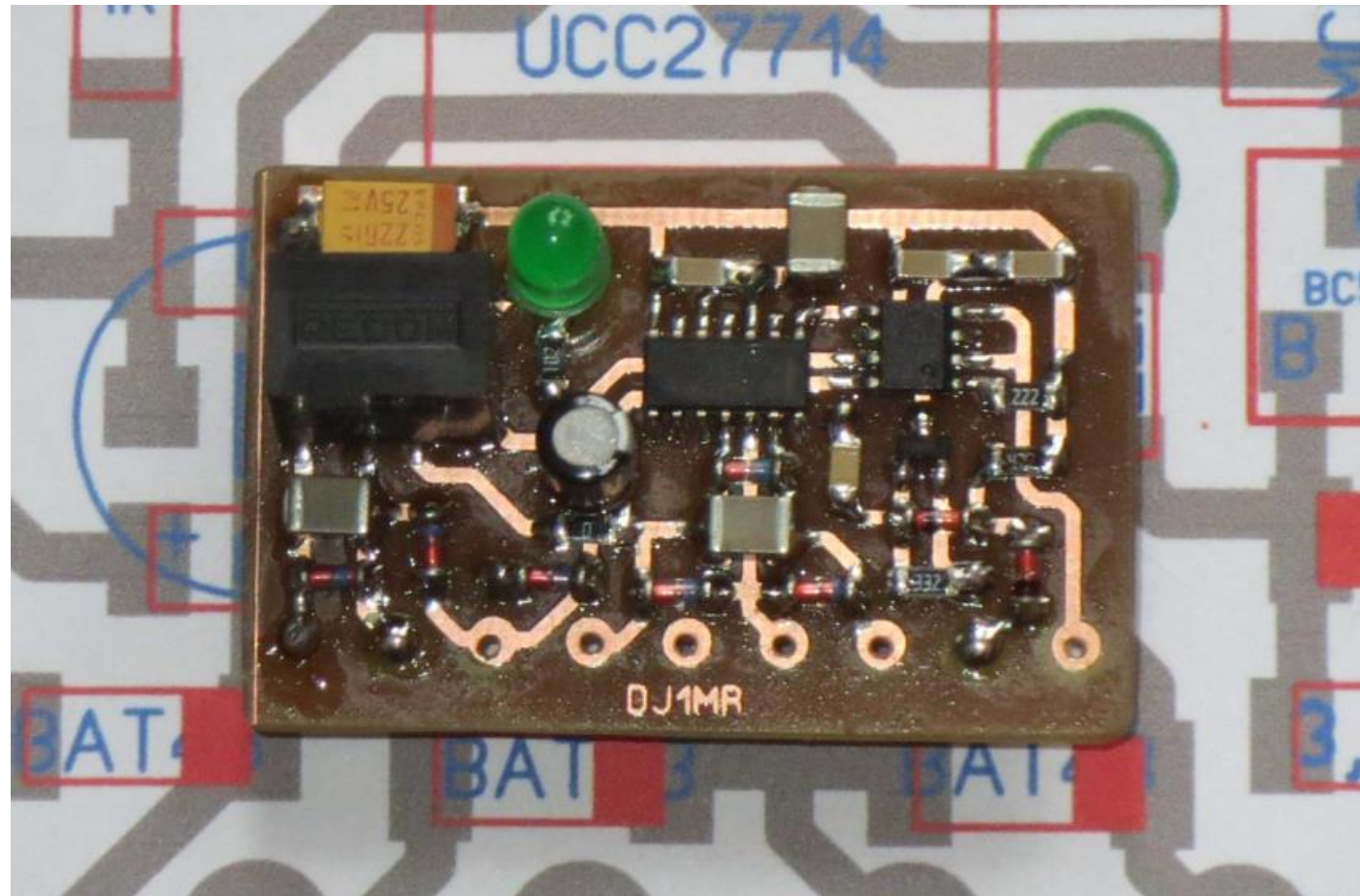




## Gen 2 1KW PWM Prototype



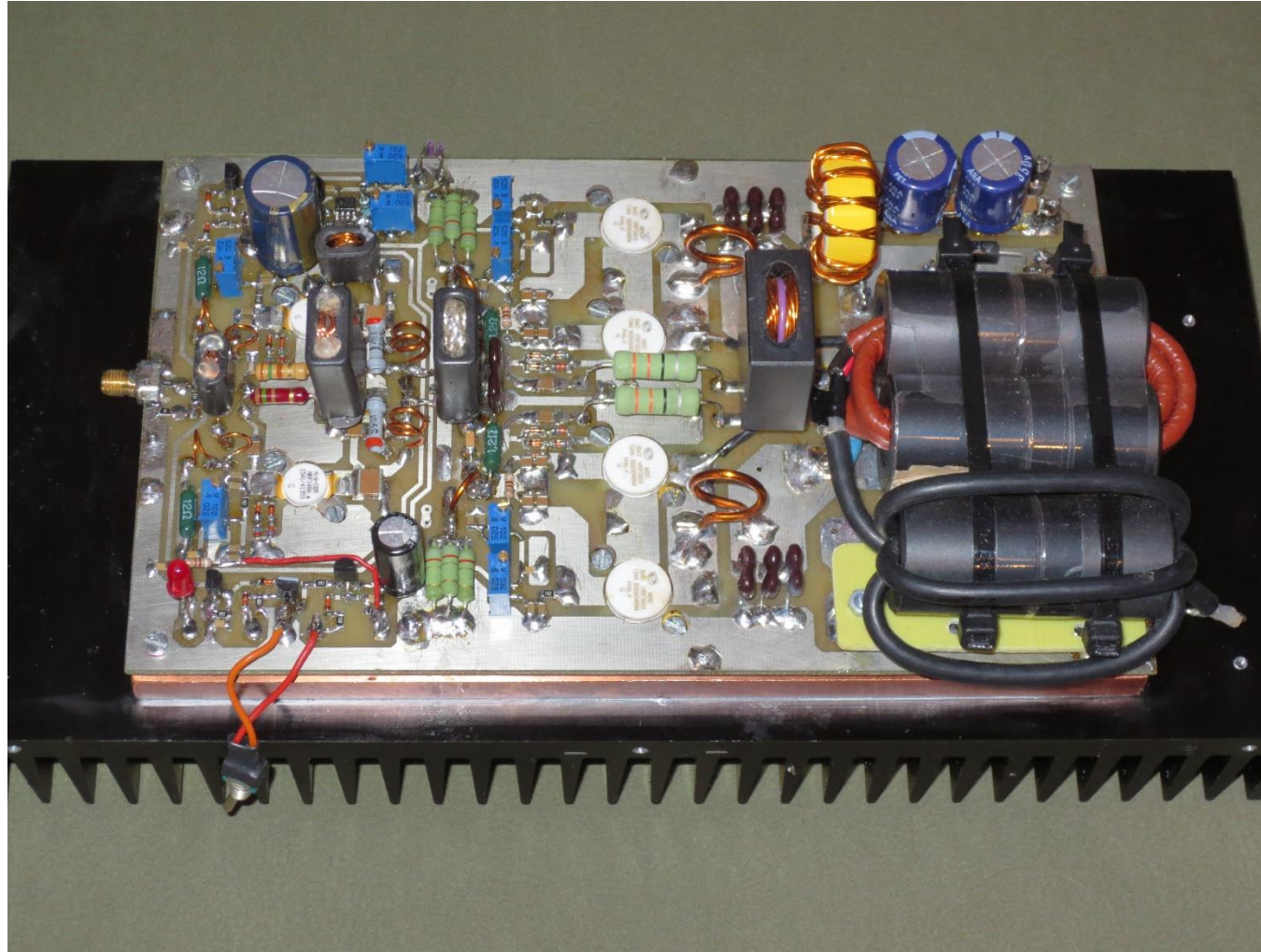
# PWM control driver modul



DJ1MR



## Realized 160 m – 6 m 1 KW ET amplifier



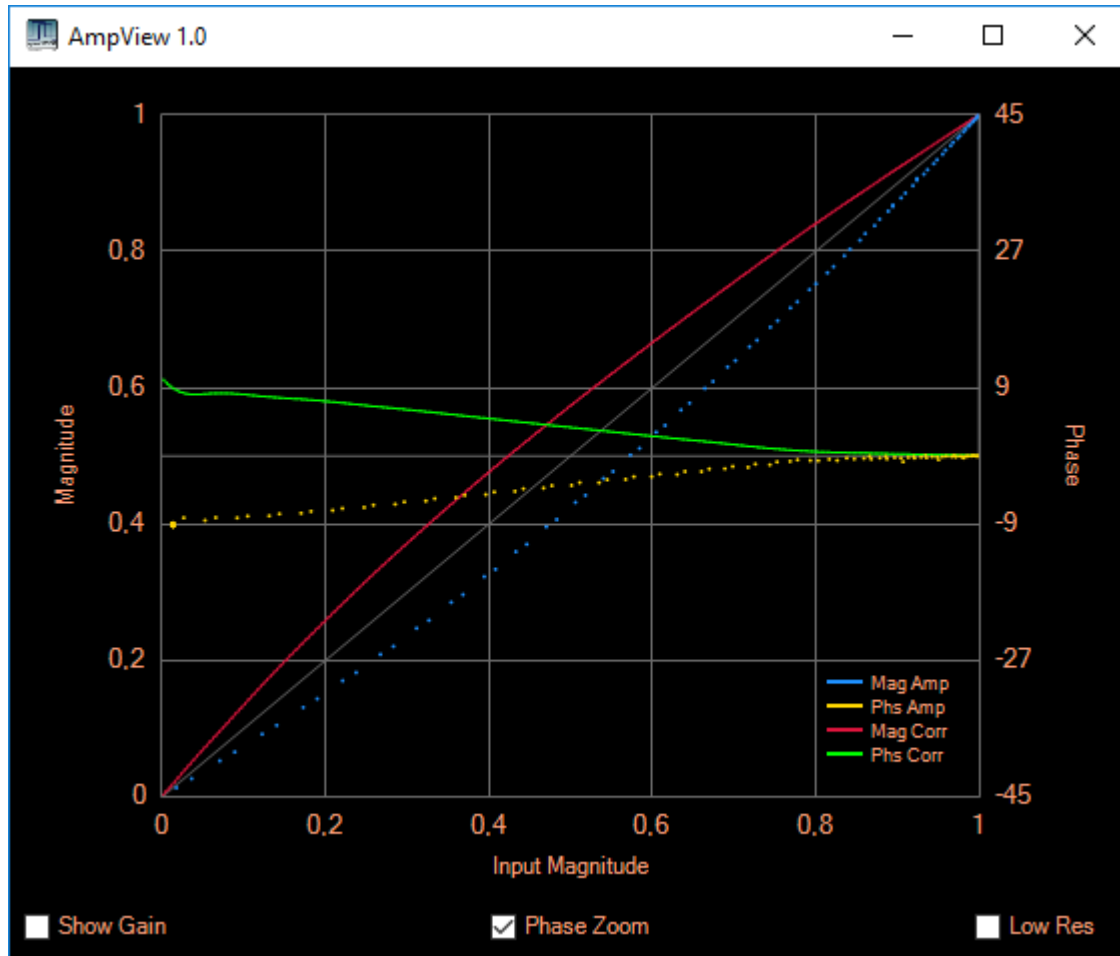


# IMD3 with linearity 750 W out

nHPSDR mRX PS v3.4.9 (3/19/18)



# Linearity correction with PowerSDR



- AmpView ET PA 750 Watt
- No memory effect