Multi-Phase Signal Source for Millimeter-Wave Applications

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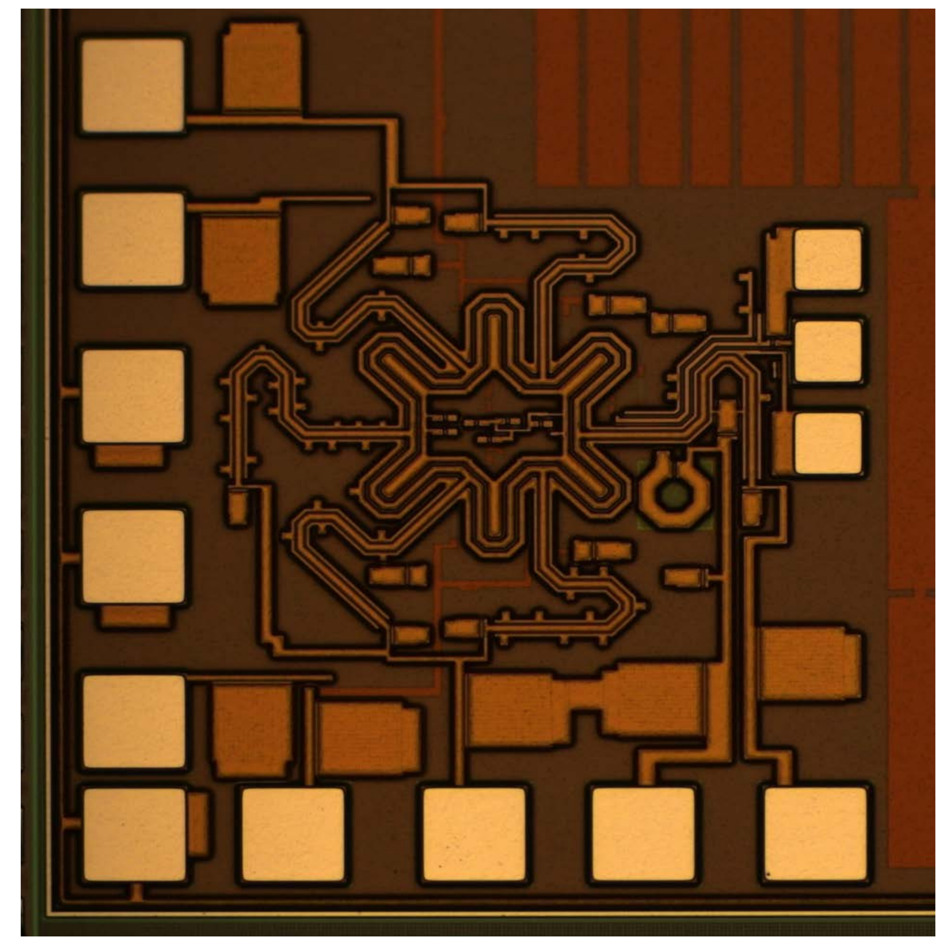
Abstract

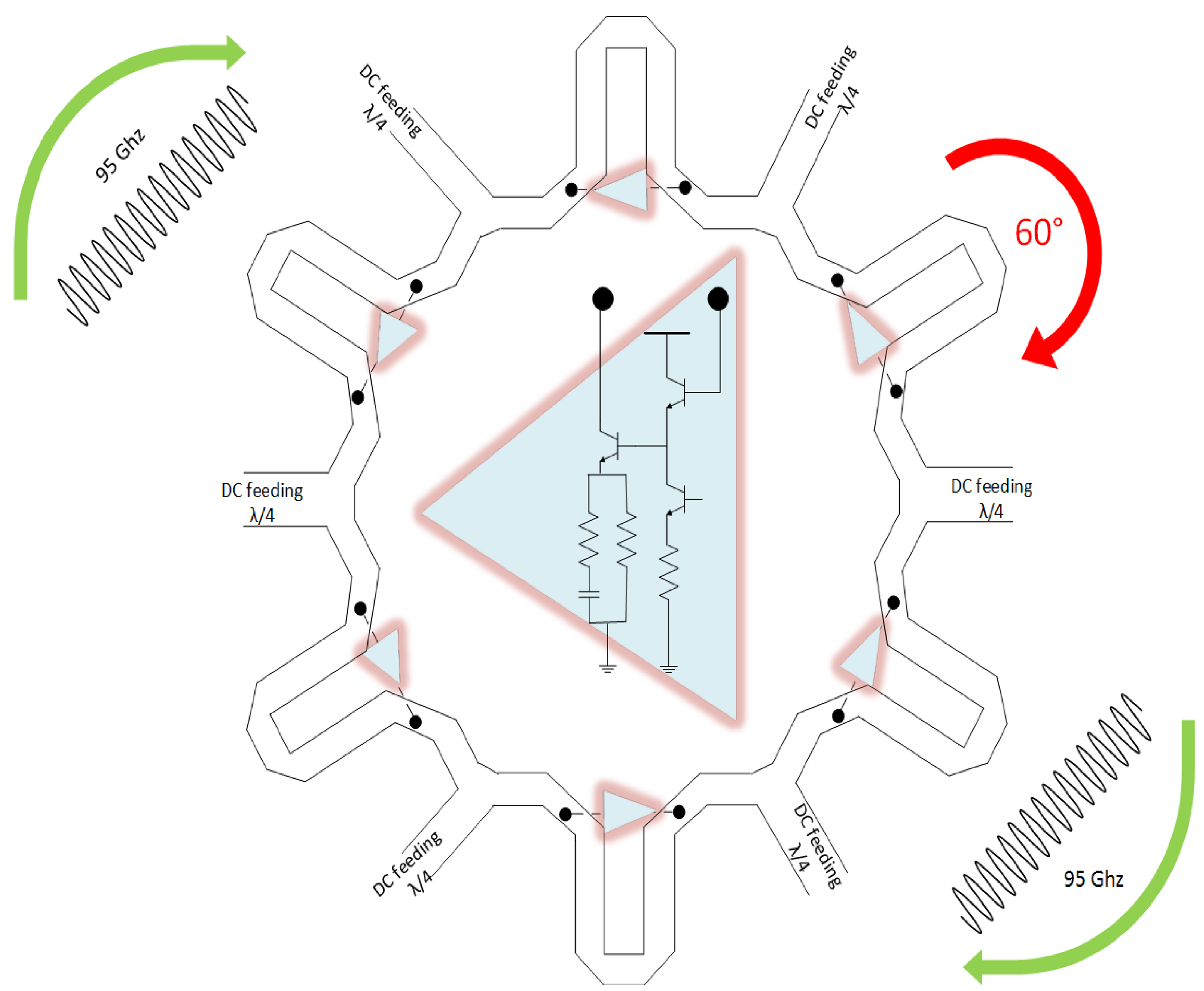
• Multi-phase signal sources play an important role in design and implementation of millimeter-wave circuits and systems. Multi-phase signals can be combined to generate signals at harmonic frequencies [doubler($2f_o$) or tripler($3f_o$)]. They could also be used as local oscillator in receivers or transmitters.

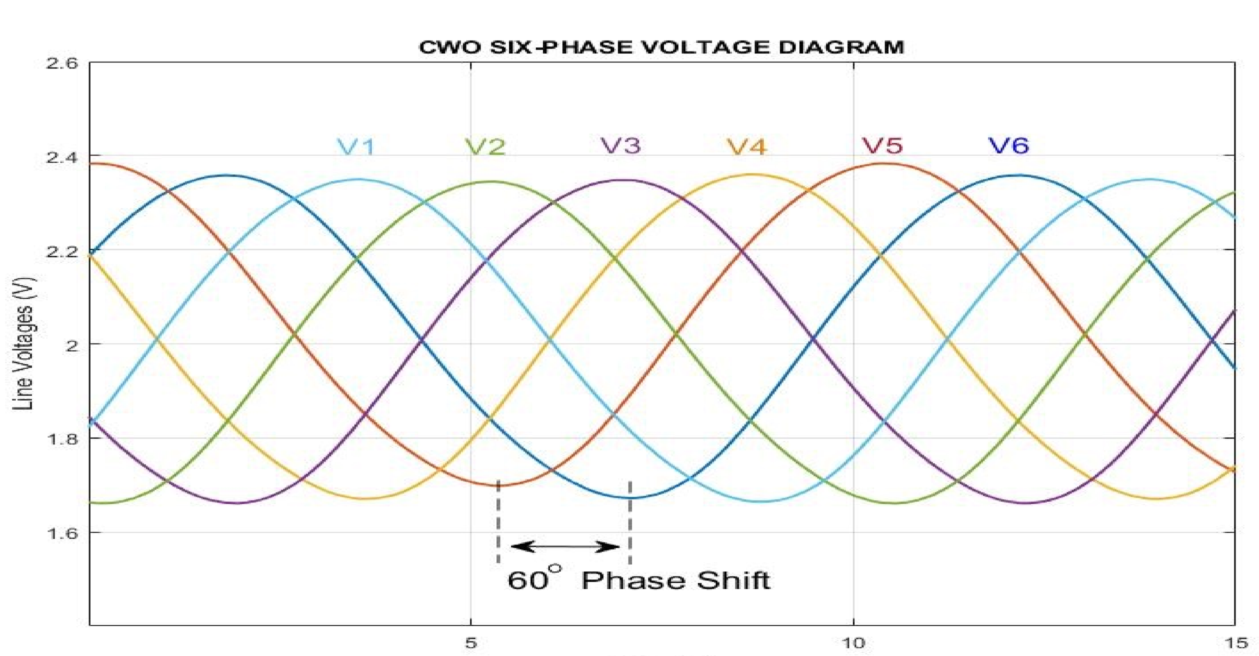
• Two traveling-wave based signal generators (i) Constructive-Wave Oscillators (CWO), and (ii) Multi-Ring Rotary Traveling-Wave Oscillators (RTWO) were implemented in Global Foundry's (GF) 0.13 µm BiCMOS Technology.

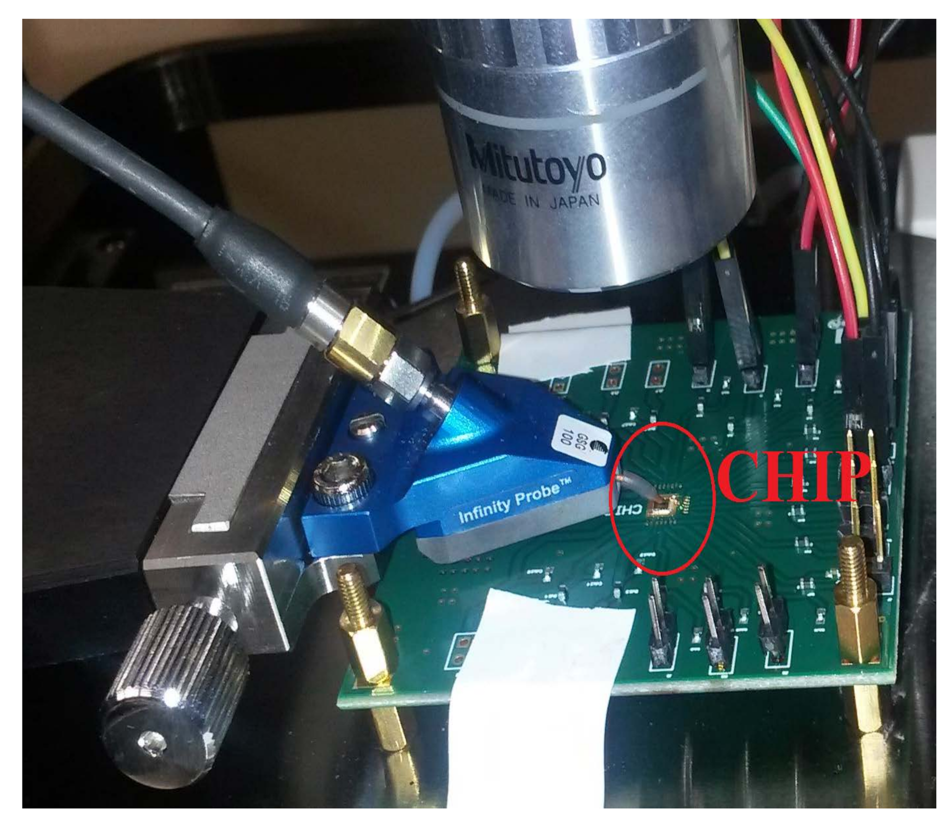


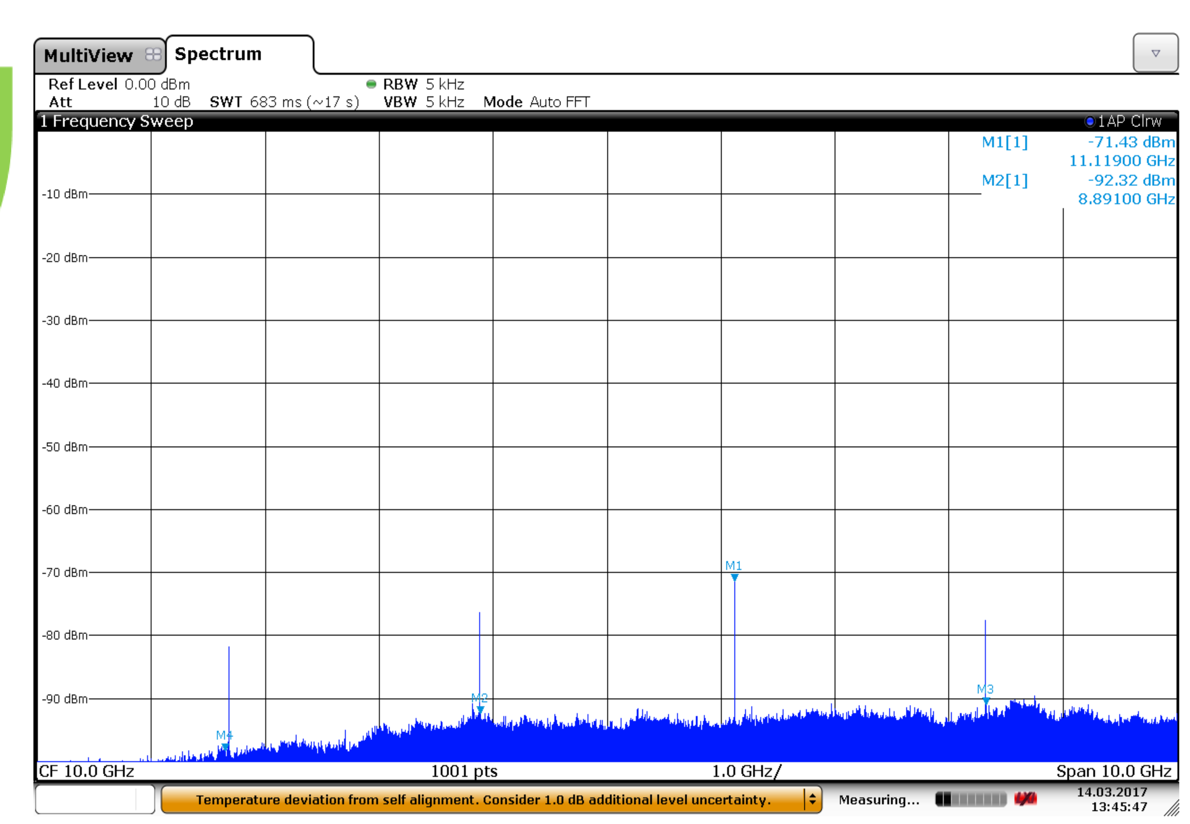
6-section CWO

• CWO relies on positive feedback to produce gain from each amplifier-transmission line section. Six distinct phases are produced along the ring. This architecture is ideal for a frequency tripler, $3f_o$ power and surface area.





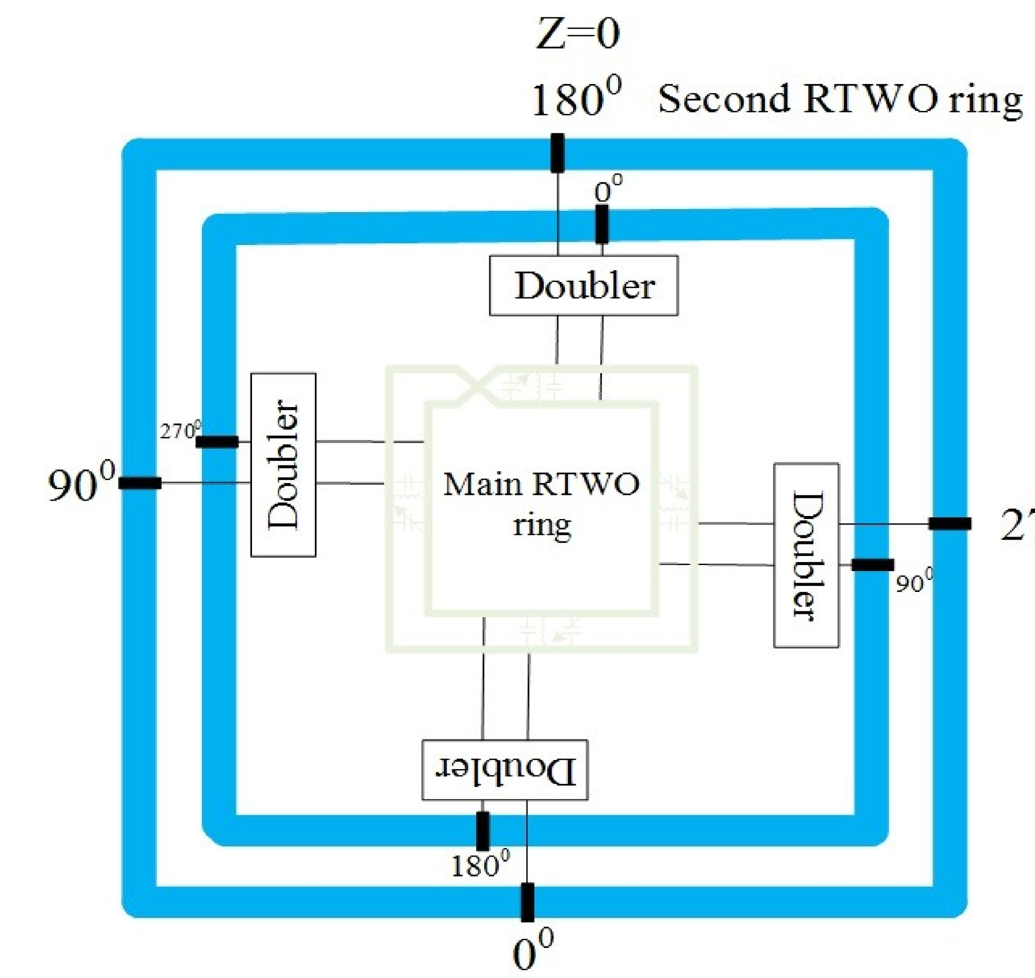


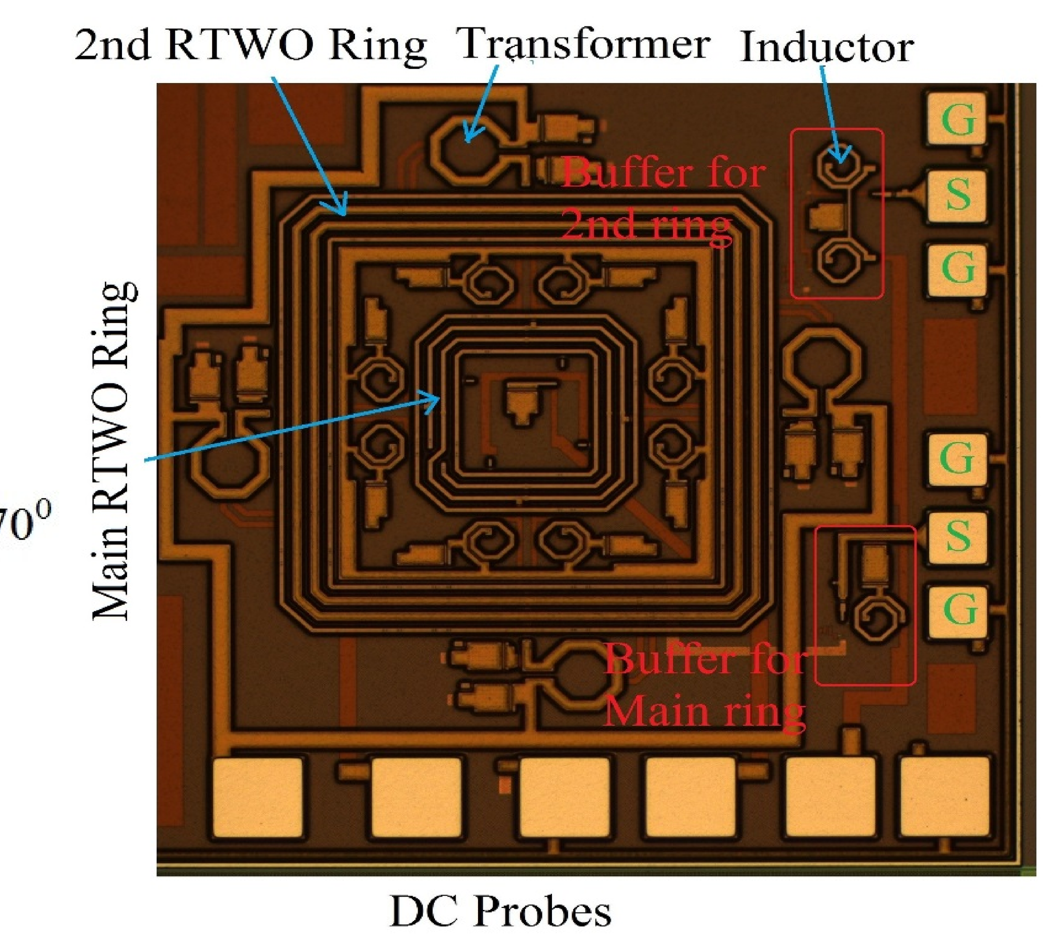


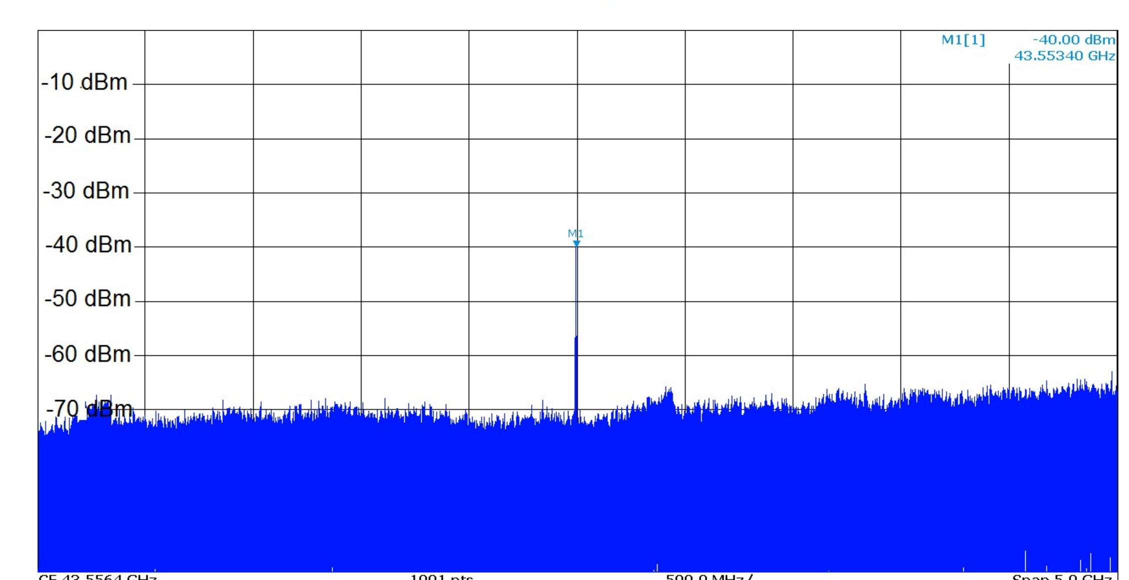
91 GHz, 2 V supply, 95 mW

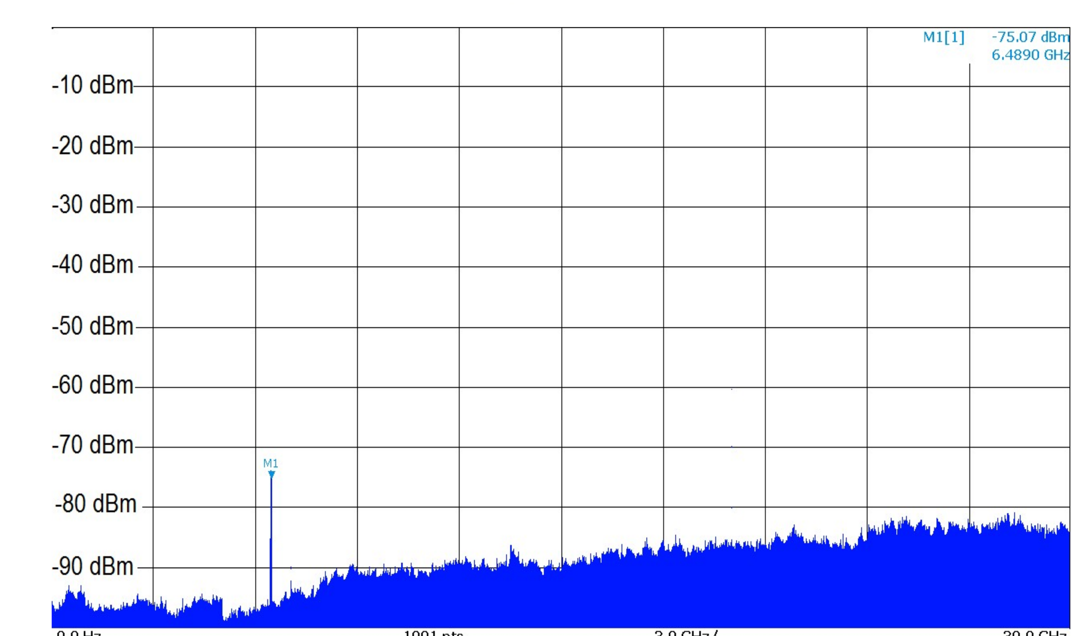
Multi-Ring RTWO

• CWO relies on positive feedback to produce gain from each amplifier-transmission line section. Six distinct phases are produced along the ring. This architecture is ideal for a frequency tripler, $3f_o$ power and surface area.



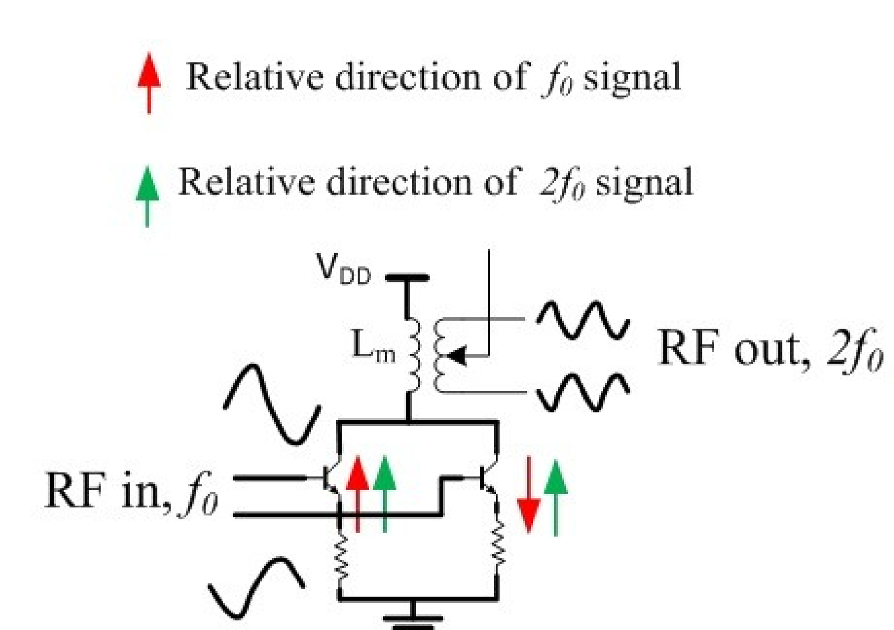




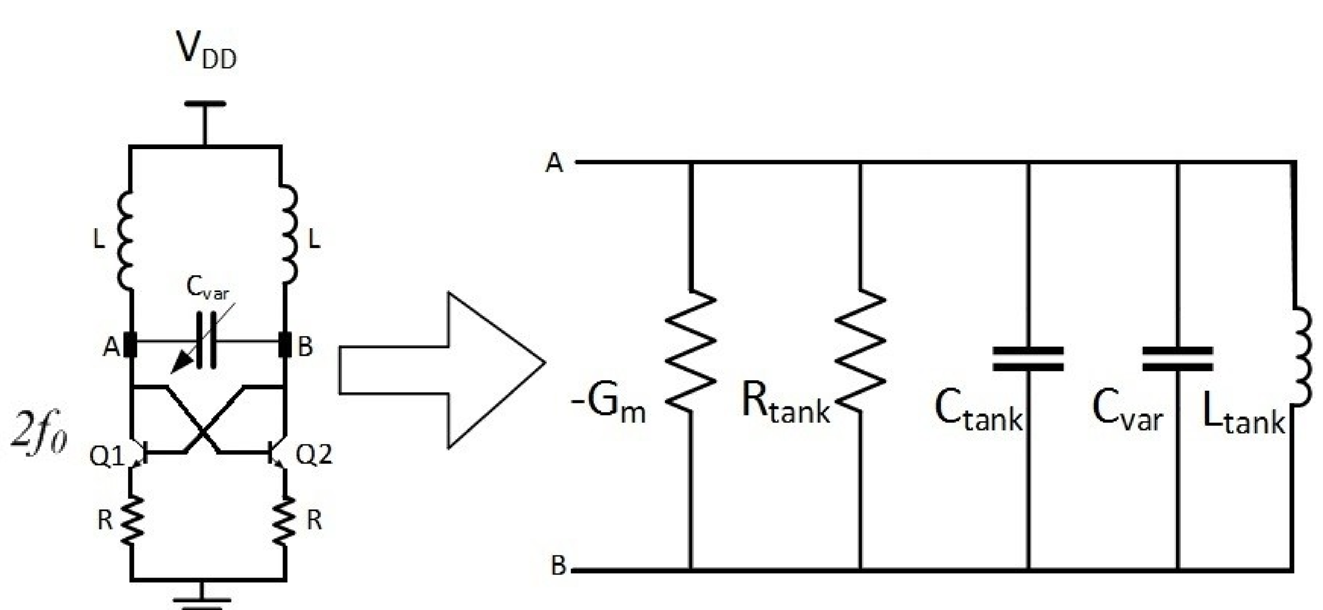


Tuning range at the main ring is 41.06 to 43.43 GHz (2.37 GHz),tuning range in the outer ring is 82.12 to 86.86 GHz (4.74 GHz range)

Main Ring, 1 V supply, 38 mA currrent
Outer Ring, 2 V supply, 15 mA current



Doubler



Gain stage for the main ring