

Micro-Watt Radio Transceivers Operating around 10GHz

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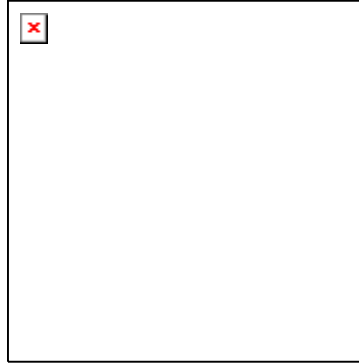
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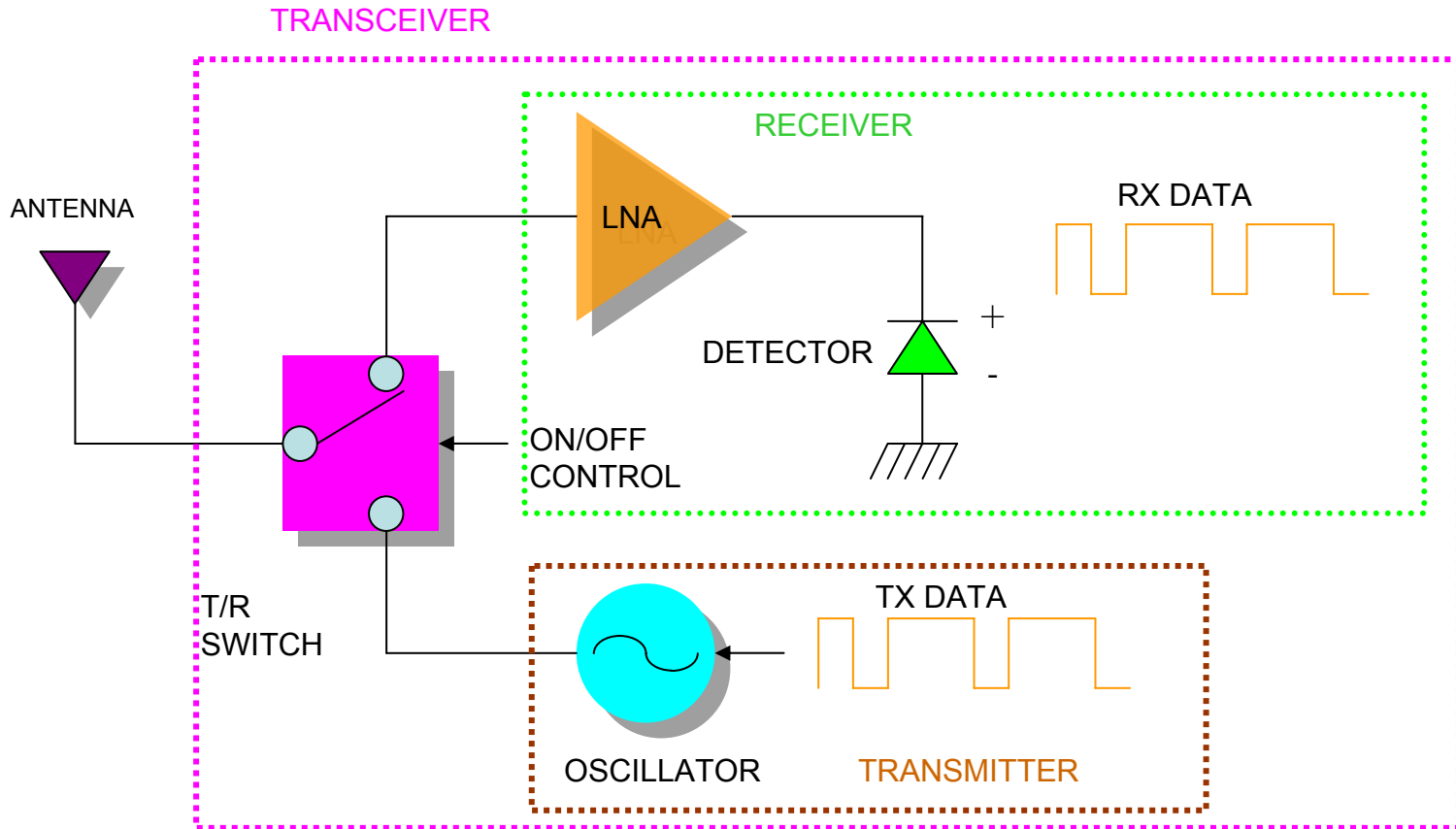


- Requirements of RF Transceiver for WSN.
- Transceiver Architecture.
- Individual Circuit Design.
 - Oscillator Design & Performance
 - Amplifier Design & Performance
 - Switch Design & Performance
 - Detector Design & Performance
- RF Transceiver.
- Summary.

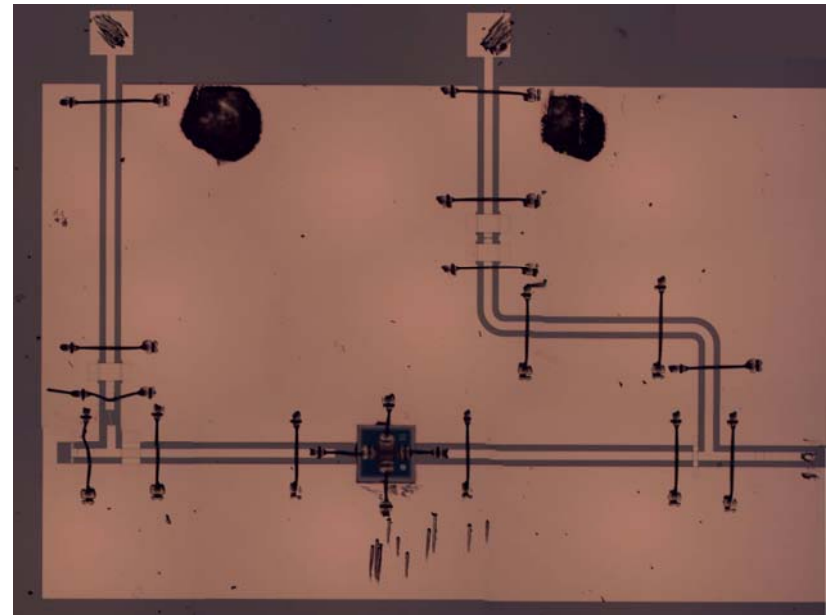
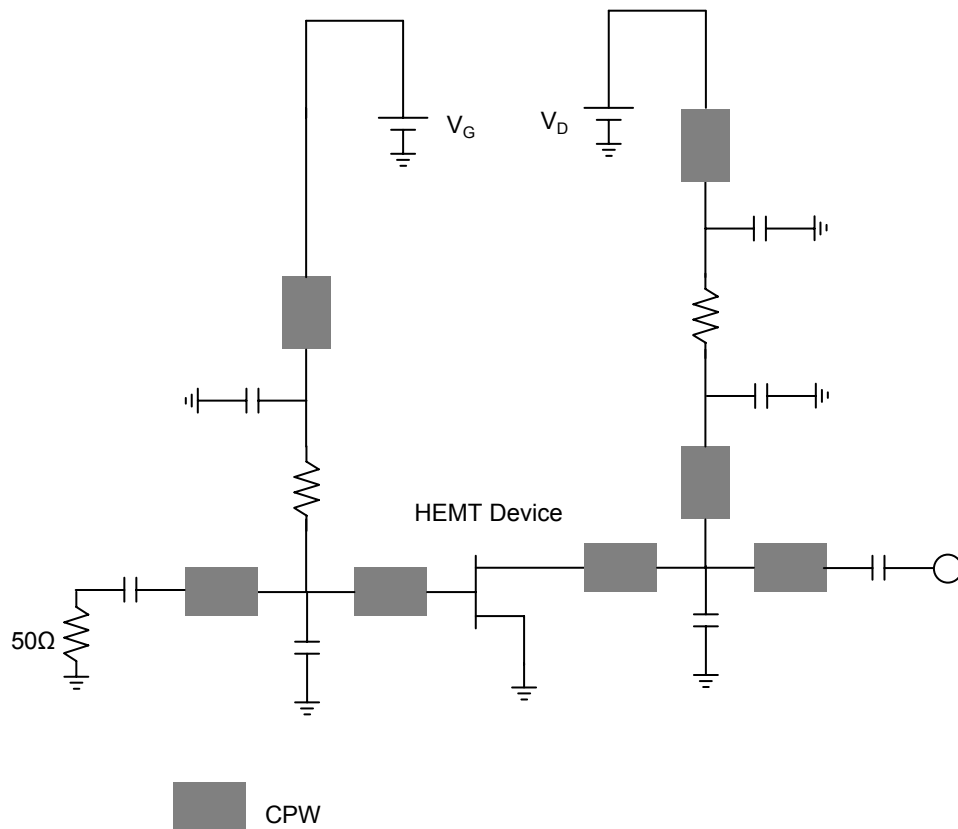


- Compact size for low cost and wide range applications.
- Ultra-low power consumption($<1\text{mW}$) for using small size battery and renewable energy source.
- Connect directly to analogue interface to communicate with baseband layer.
- Ultra-low power consumption is the most important issue for RF transceiver of wireless sensor networks (WSN).

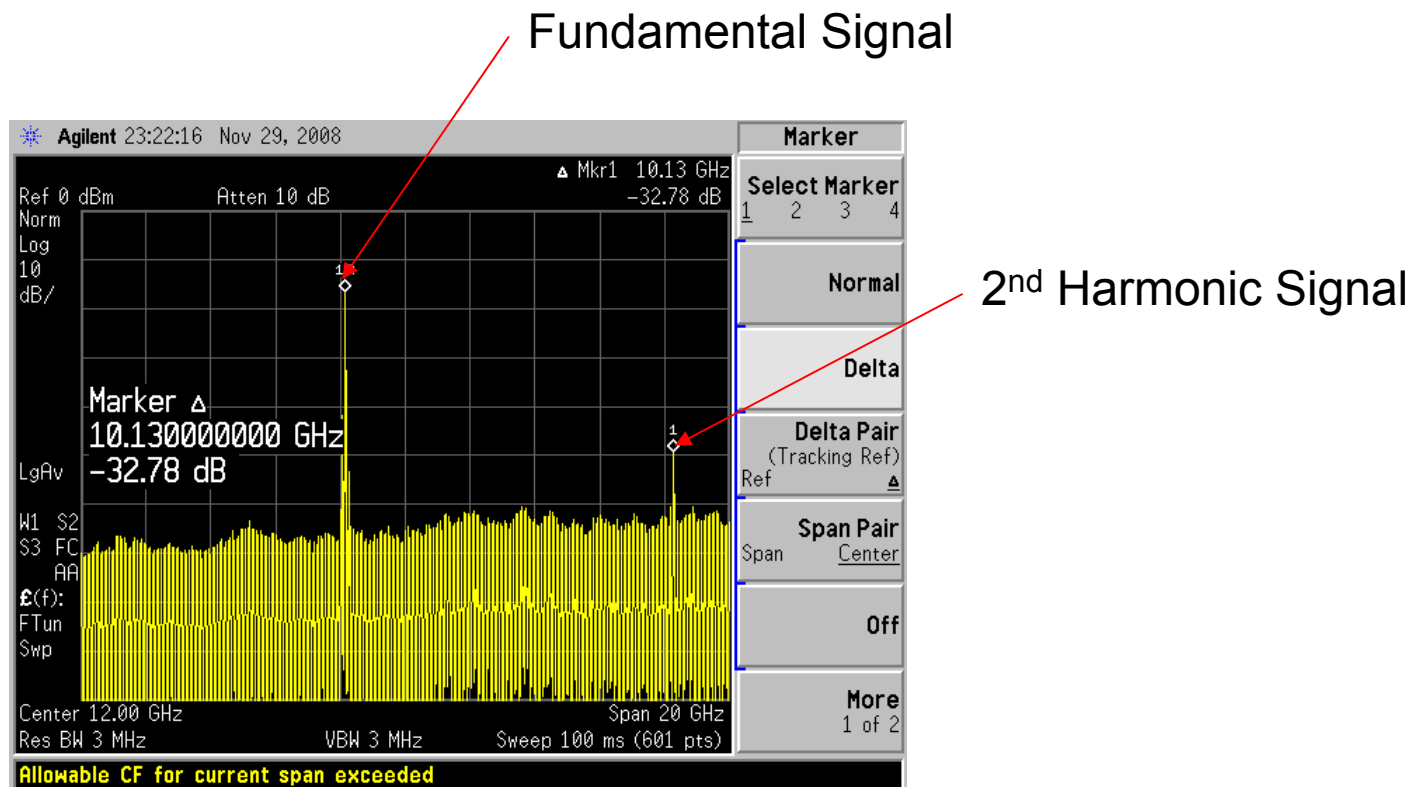
Transceiver Architecture



Oscillator Design

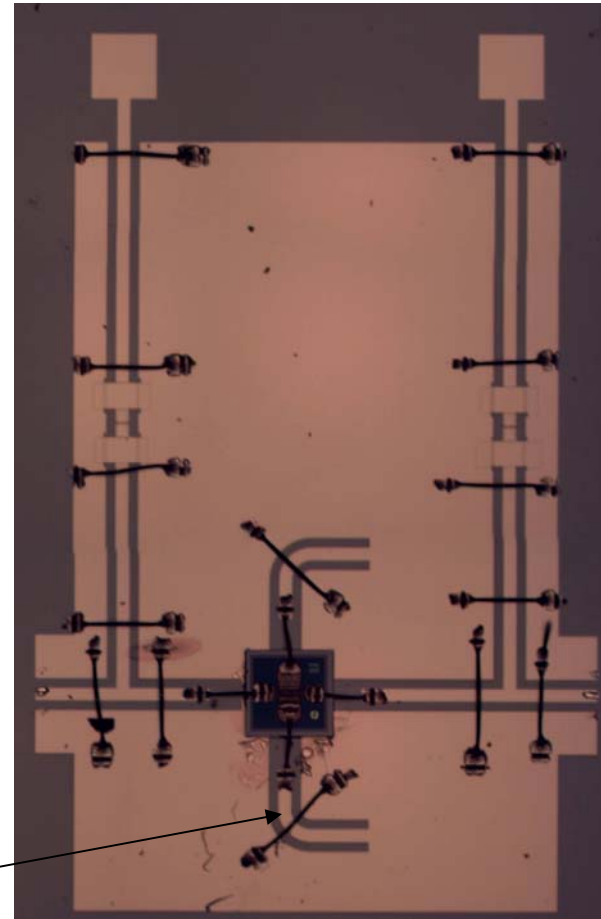
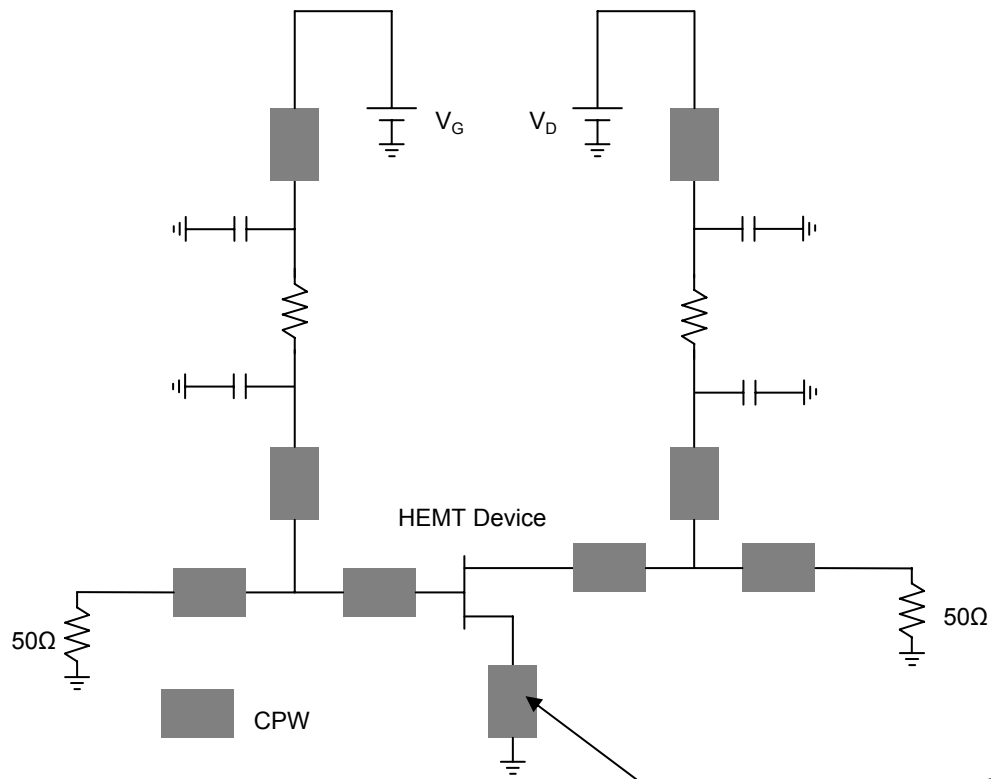


Oscillator Performance



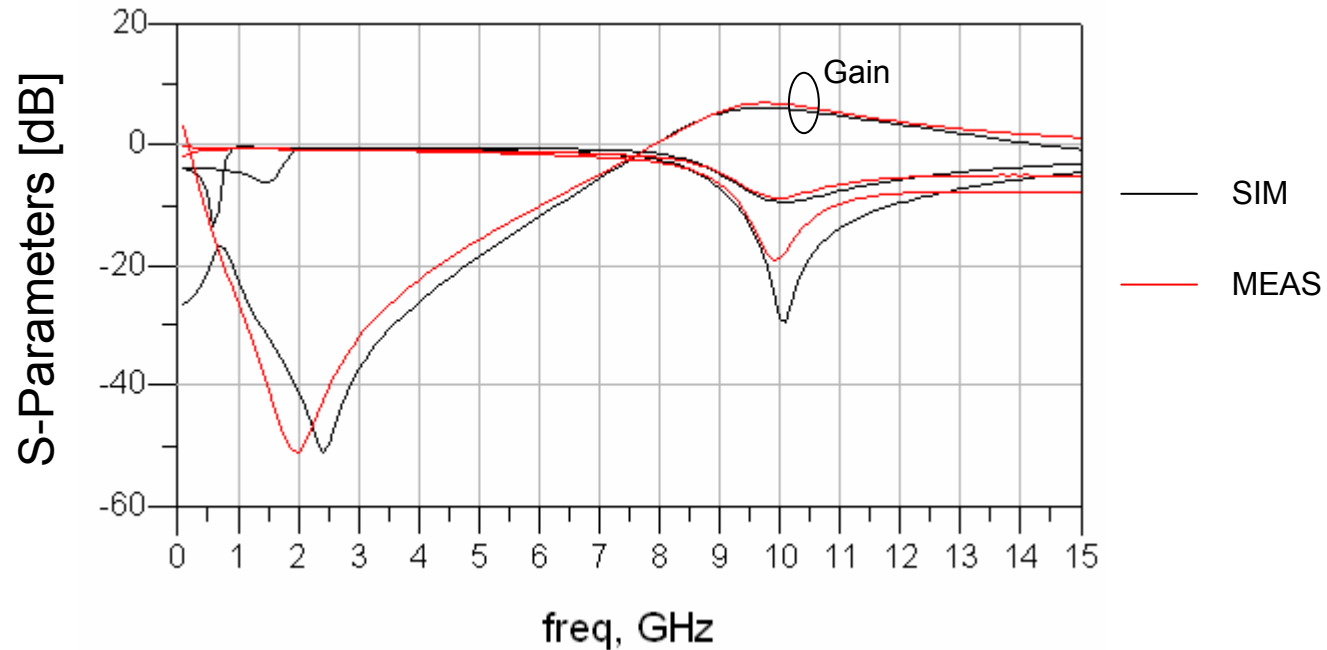
- Fundamental Frequency : 10.1GHz
- Oscillator Output Power : -15dBm
- Power Consumption : < 0.4mW (Vd=0.3V, Id=1.3 mA)
- Harmonic Rejection : -32.7dBc

Amplifier Design



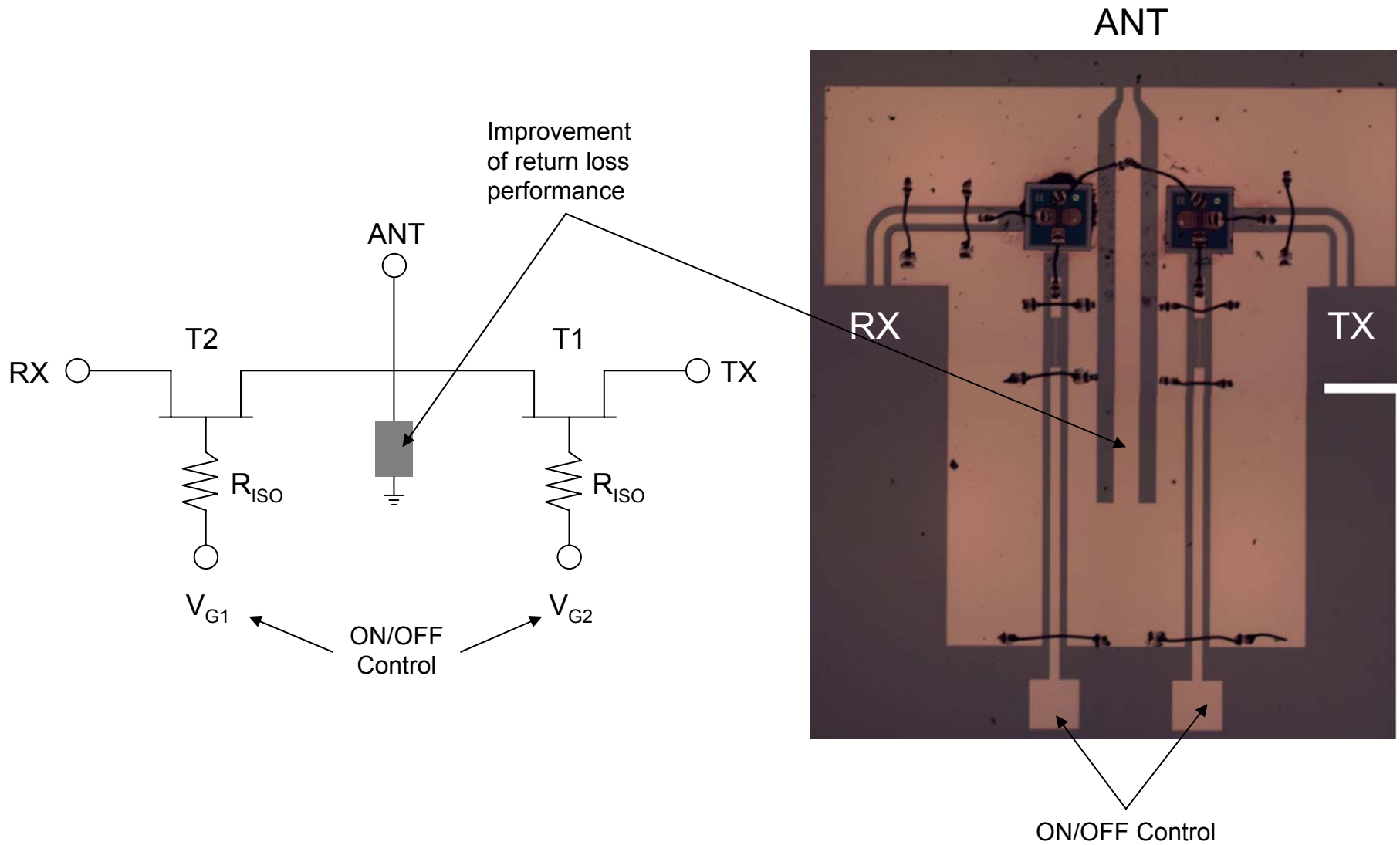
Source Inductance for stability

Amplifier Performance

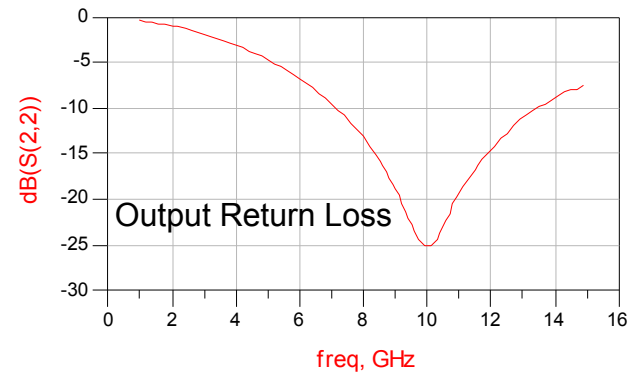
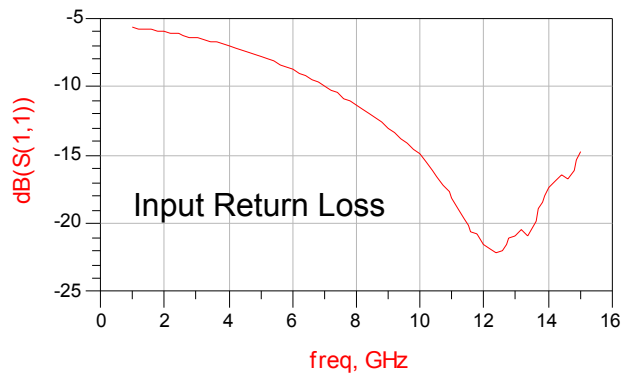
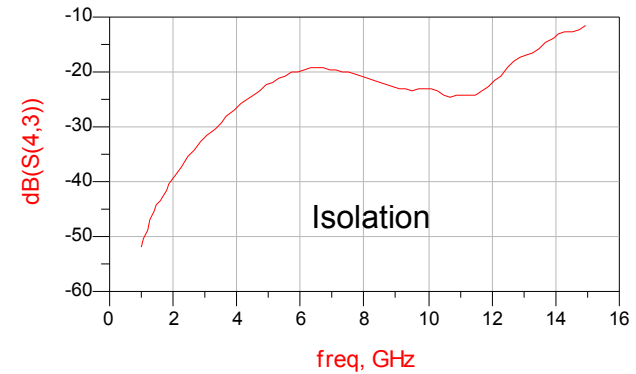
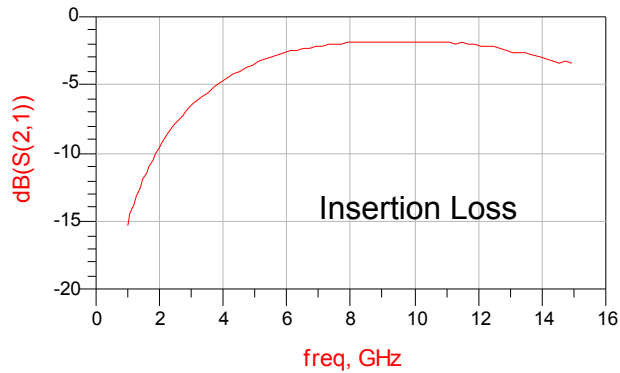


- Centre Frequency : 10GHz
- Amplifier Gain : 6.8dB
- In/Out Return Loss : -10dB and -18dB
- Power Consumption : < 0.4mW ($V_d=0.3V$, $I_d=1.3mA$)

Switch Design

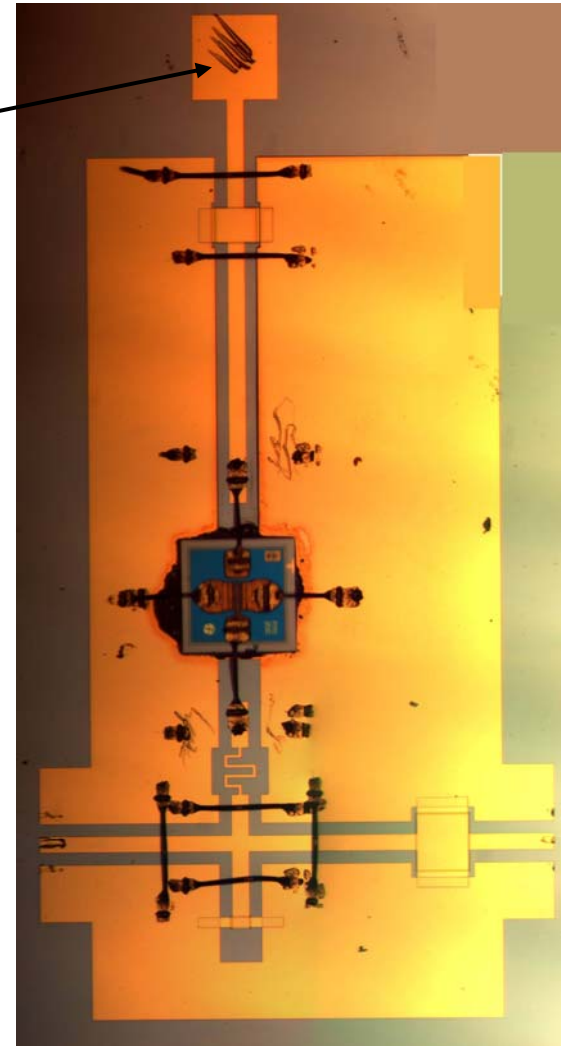
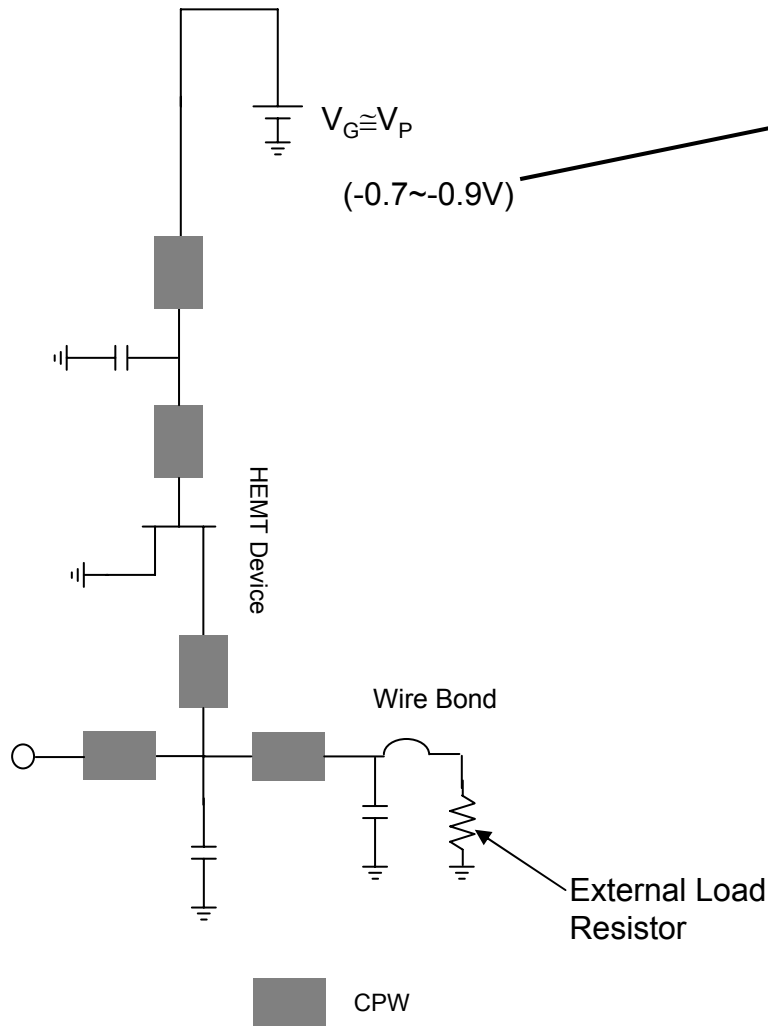


Switch Performance (ON/OFF State)

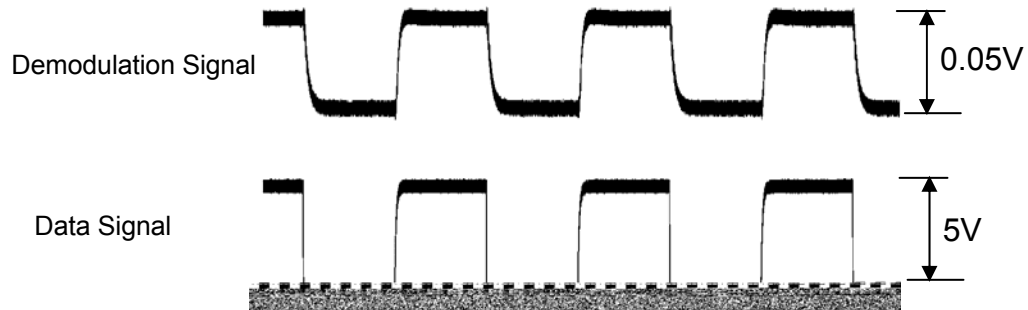


- Centre Frequency : 10GHz
- Insertion Loss : -1.85dB
- Isolation : -23dB
- Input / Output Return Loss : <-15dB
- ON/OFF State Bias Condition : 0.4V, -1.2V (Gate Voltage)

Detector Design



Detector Performance



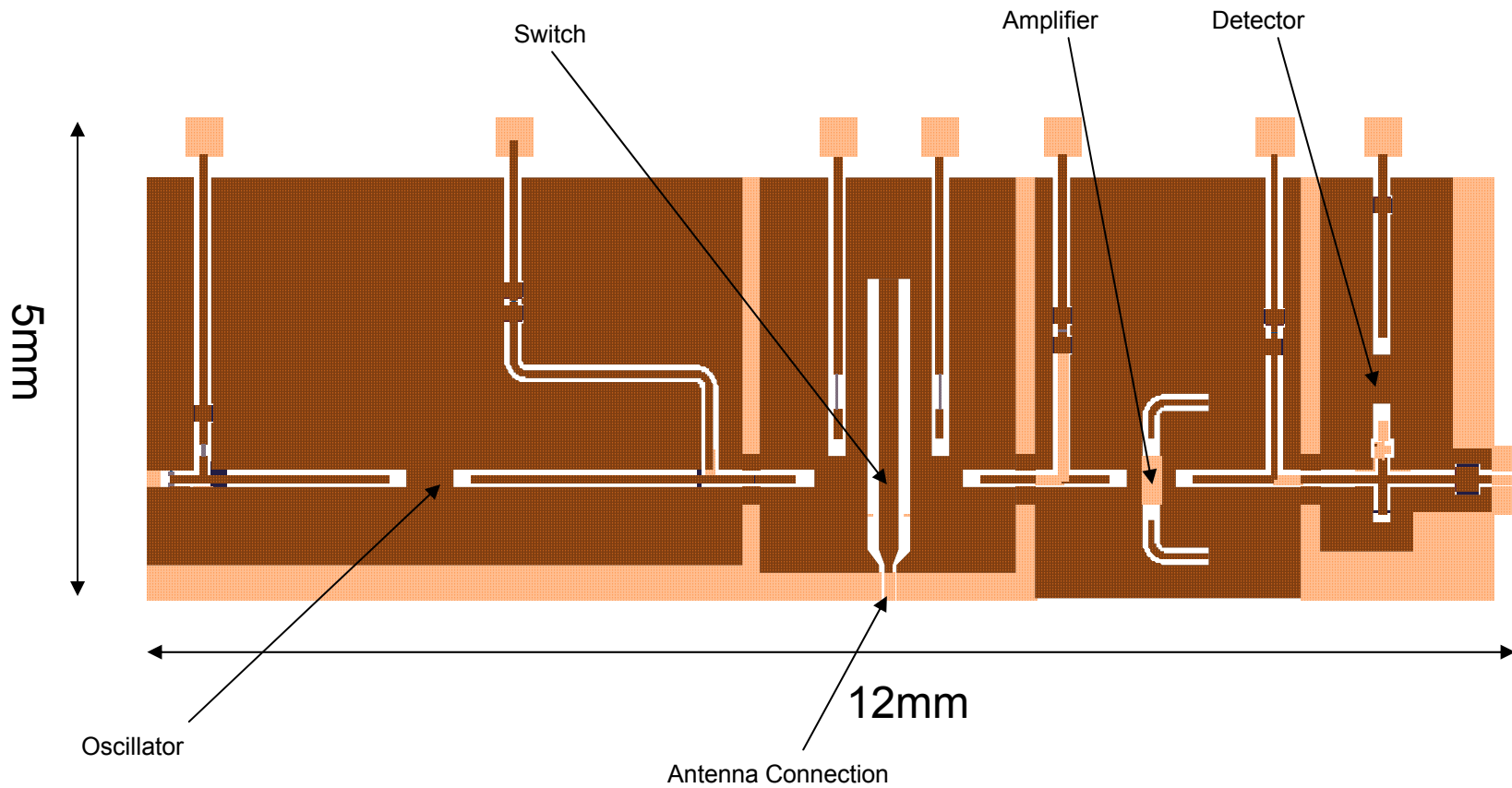
Demodulation (100KHz), RF input Power : -10dBm



Input Matching

- Centre Frequency : 8.1GHz
- Sensitivity : 6mV @ -36dBm
- Input Return loss : <-22dB
- Maximum Data Frequency : 510KHz

X-Band RF Transceiver (10GHz)



- Using the direct detection transceiver for ultra-low power consumption.
- Design and measurement of individual circuit.
- Obtaining the total power consumption less than 1mW for RF transceiver circuits.
- Transceiver size of 12mm ×5mm.
- Implementation of working sample.