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Design of RF Frequency converter-systematic approach

This paper demonstrates step by step approach to designing the Up converter or down converter module of any RF Frequency converter. We will take example of designing the Up-converter module which translates IF frequency in the range of about 70MHz to RF frequency of about 6GHz. This RF frequency is used in satellite applications.

Step 1: Find out Mixers, Local oscillator, MMICs, synthesizer, OCXO reference oscillator, attenuator pads generally available.

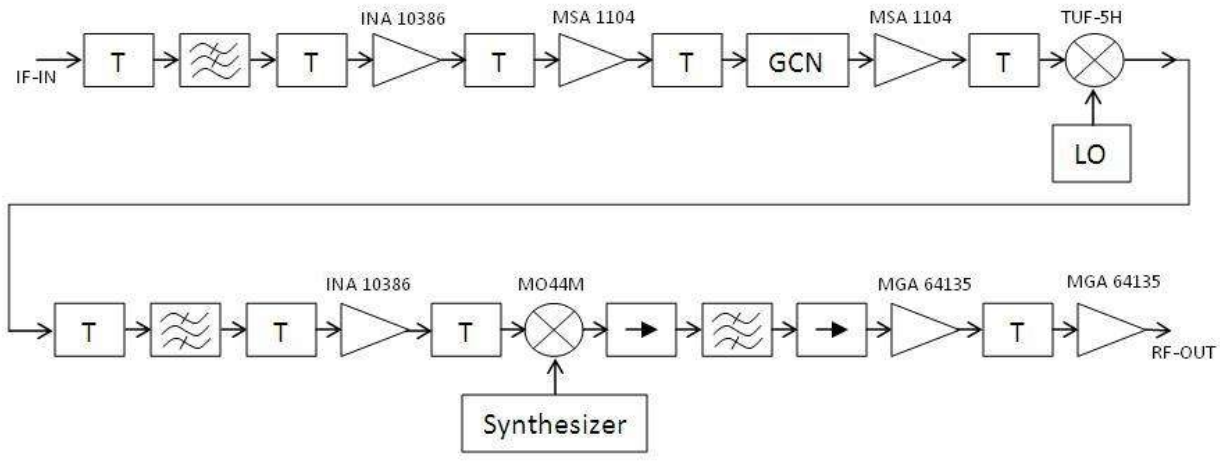
Step 2: Do the power level calculation at various stages of the lineup especially at the input of MMICs such that it will not exceed 1dB compression point of the device.

Step 3: Design and proper Micro strip based filters at various stages to filter out unwanted frequencies after mixers in the design based on which part of frequency range you want to pass.

Step 4: Do the simulation using microwave office or agilent HP EEsof with proper conductor widths as required at various places on the PCB for chosen dielectric as required for RF carrier frequency. Do not forget to use shielding material as enclosure during simulation. Check for S parameters.

Step 5: Get the PCB fabricated and solder the purchased components and solder the same.

Check the design in the block schematic for the up converter, which converts 70 MHz IF frequencies to RF frequency in the range 5925-6425 MHz.



As depicted in the block schematic, appropriate attenuator pads of either 3 dB or 6dB need to be used in between to take care of 1dB compression point of the devices (MMICs and Mixers).

Local oscillator and Synthesizer of appropriate frequencies need to be used based. For 70MHz to C band conversion, LO of 1112.5 MHz and Synthesizer of 4680-5375MHz frequency range is recommended. The rule of thumb for choosing mixer is the LO power should be 10 dB greater than the highest input signal level at P1dB.

GCN is Gain Control Network designed using PIN diode attenuators which vary attenuation based on analog voltage.

Remember to use Band Pass and Low pass filters as and when required to filter out unwanted frequencies and pass the wanted frequencies.