A CONCURRENT DUAL BAND 2.4/6 GHz LOW NOISE AMPLIFIER.

ShalmaleeGhagSayaliGadakhKanchan Sonar Prof.U.V.Bomble

Department of E&TC Engineering, MES College of Engineering, Pune, India. shalmalee.ghag11@gmail.com

Department of E&TC Engineering, MES College of Engineering Pune, India. sayali.gadakh16@gmail.com

Department of E&TC Engineering, MES College of Engineering, Pune, India. sonarkanchan12@gmail.com

Department of E&TC Engineering, MES College of Engineering, Pune, India. usha.bomble@mescoepune.org

Abstract*—*The idea of this paper is to propose the design of a low noise amplifier operating on a concurrent dual-band of 2.4 GHz and 6 GHz. LC resonant network is implemented to obtain the required gain and impedance matching at both ends. A 0.13-um CMOS process is used for fabrication of LNA. The power gain results for 2.4 GHz is 30.96 dB and for 6 GHz is 24.58 dB and noise figure results for 2.4 GHz is 2.59 dB and for 6 GHz is 2.54 dB respectively.

Keywords—Concurrent, Dual Band, LNA

I. INTRODUCTION

Wireless Communication has been advancing recently quite fast. The need for high speed communication over longer distance has increased the need of wireless communication. Various standards for instance, Industrial Scientific Medical (ISM), Bluetooth, WLAN, etc are mainly used. The extending demand for remote communication has increased the need for a multi-band signal operation on a single communication system. A direct methodology for working on various frequencies is using switch. The LC matching presents simultaneous dual band characters which can extend chip size and eliminate the problem of signal feedback.

A better LNA is required to have a low NF (e.g. 1 dB), good gain for signal enhancement (e.g. 10 dB) and a high compression point (P1dB) to obtain the required results. Further parameters of LNA are the working data transfer capacity (BW), gain evenness, stability, Voltage Standing Wave Ratio (VSWR). The basic factors in LNA configuration are: gain, noise figure, non-linearity and impedance matching.

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II. LITERATURE SURVEY

L.-H. Lu *et al* [6]proposed acompletely integrated 2.4-GH/5.2-GHz LNA having a CMOS process of 0.18-um. The gain at 2.4 GHz is 10.1 dB and at 5.2GHz is 10.9 dB, and values for NF are 2.9 dB at 2.4GHz and 3.7 dB at 5.2GHz.

H.S. *et* al [1]proposed a 1.8 GHz /2.14 GHz dual-band CMOS LNA, using a 0.13um technology and supply voltage of 1.5 V. The power dissipation is 7.5 mW. The gain obtained is 14.54 dB and 16.6 dB at 1.8/2.14 GHz. The noise figures at 1.8/2.4 GHz are 1.75 dB and 1.97 dB respectively. P1dB at 1.8-GHz is 16dBm and at 2.14 GHz is 14.8dBm and IIP3 are 5.8dBm at the 1.8 GHz and 5.3dBm at the 2.14 GHz.

S. Wang and B.-Z. Huang [8]proposed a CMOS LNA for 2.4/5.2GHz. The fabrication of LNA is done using a 0.18um CMOS technology. The rate of power consumption is 7.2mW. Gain obtained is 14.2 dB at 2.4 GHz and 14.6 dB at 5.2 GHz. The values obtained for noise figures at 2.4GHz and 5.2GHz are 4.4dB and 3.7dB respectively.

AbolfazlZokaei, Amir Amirabadi[7]presented the design of a LNA for multi band using 0.18µm CMOS process. The desired frequency bands are around 3.4 to 3.6GHz and 5.2 to 5.9GHz. An IIP3 of about -1.3 dBm and -5.2 dBm are provided for lower and upper bands. The gain provided is 12.9 dB, input return loss is -10.3 dB and noise figure is 3.3 dB. Power supply requirement is of 1V and it dissipates 9.12 mW.

III. CIRCUIT DESIGN METHOD

The circuit design presents a low noise amplifier whichoperates on a band between 2.4GHz and 6GHz, for which two single stage low noise amplifier circuits are cascaded in series to enhance the gain.

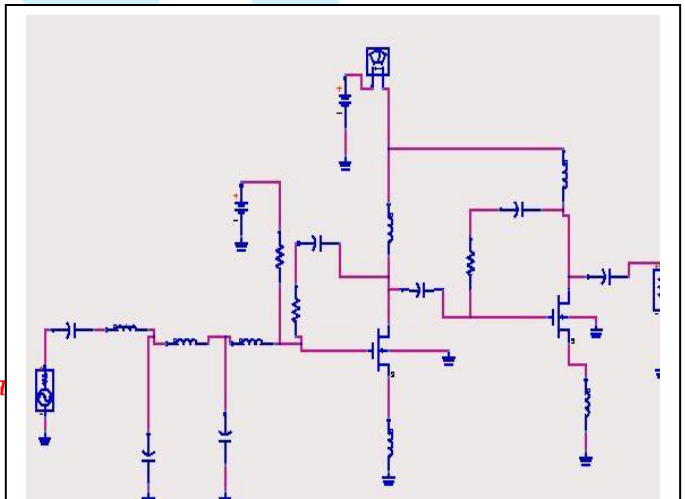

Fig.1. Circuit Diagram

IV. MEASUREMENT RESULTS

The LNA is designed to operate on a band between 2.4GHz and 6GHz for which a CMOS Technology of 0.13um is used for fabrication.

The results show different parameters such as stability factor, noise factor and the S parameter measurements. Input return loss for 2.4 GHz is -10.48 dB and for 6 GHz is -11.45 dB. The gain (S21) at 2.4 GHz is 30.96 dB and at 6 GHz is 24.58 dB. The stability factor of the amplifier is 2.92 at 2.4 GHz and 4.49 at 6 GHz. Noise Figure at 2.4GHz and at 6GHz is 2.59dB and 2.54dB respectively. Measurement of output power corresponding to P1dB is 14.47dB.

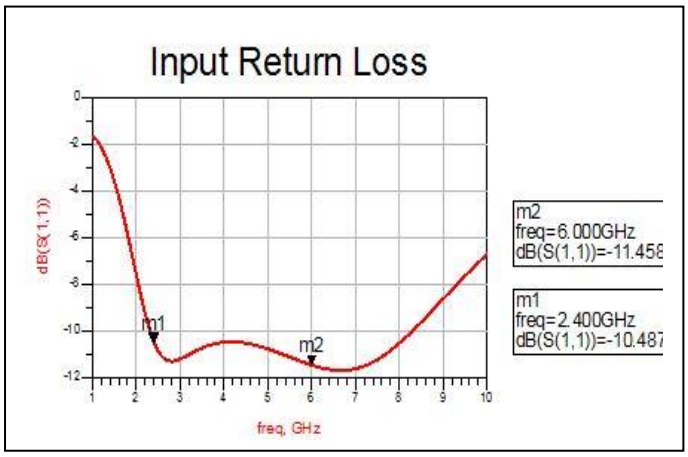

Fig. 2. Input Return Loss

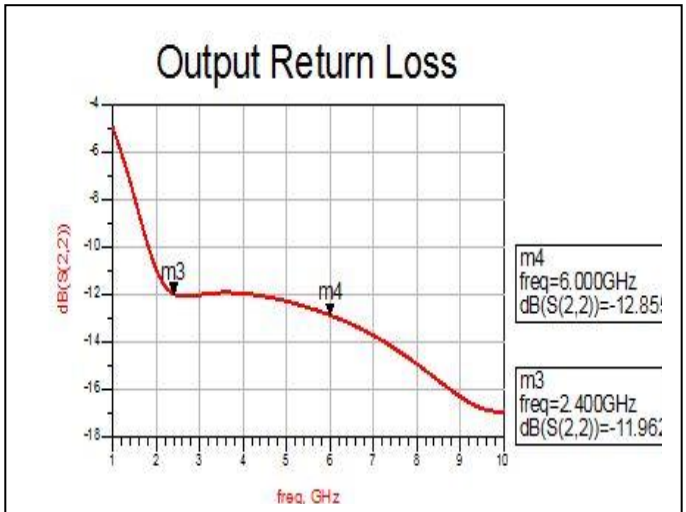

Fig. 3. Output Return Loss

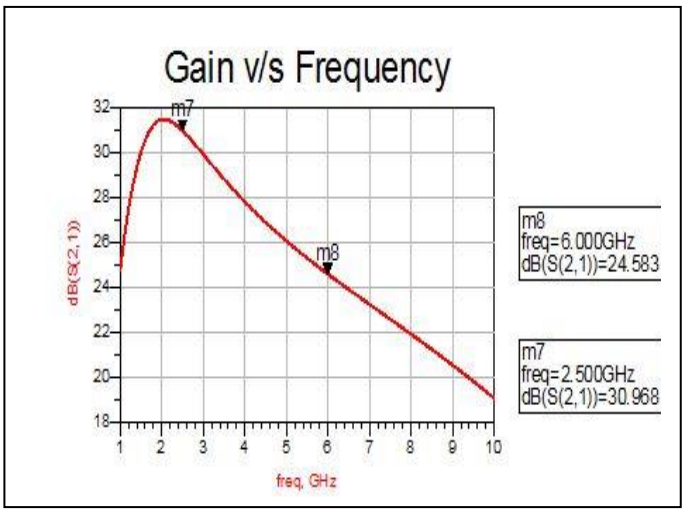

Fig. 4. Gain (S(2,1))

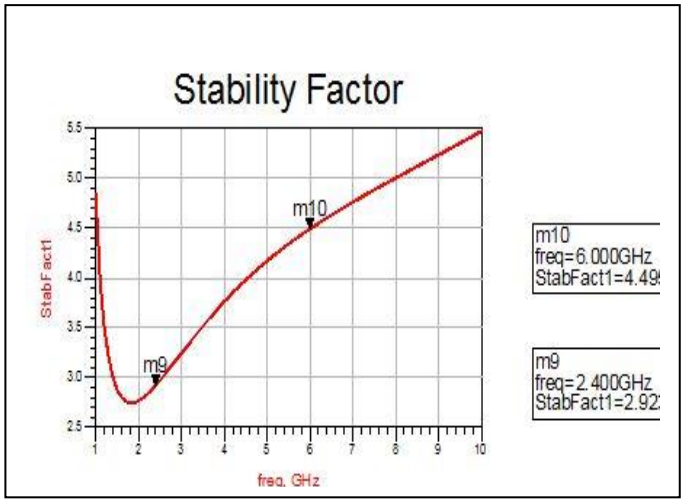

Fig. 5. Stability Factor

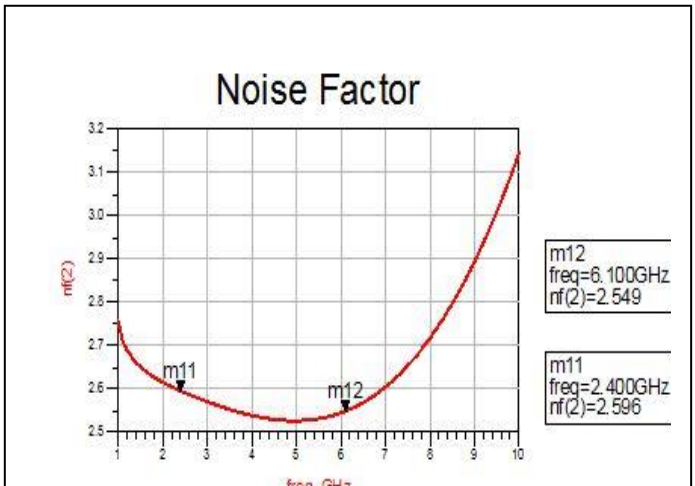

Fig. 6. Noise Factor

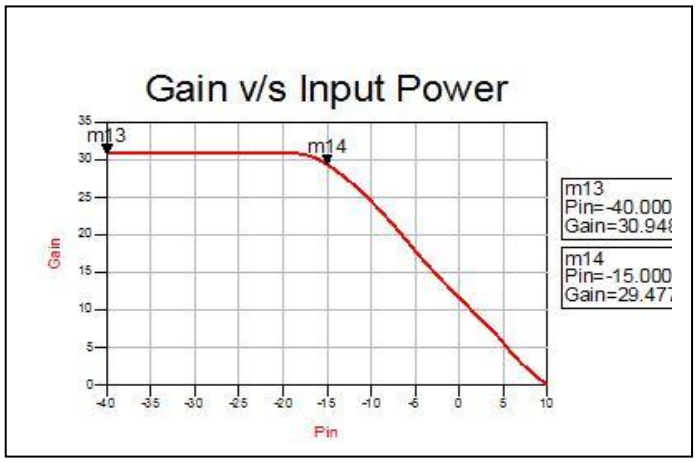

Fig. 7. Input Power

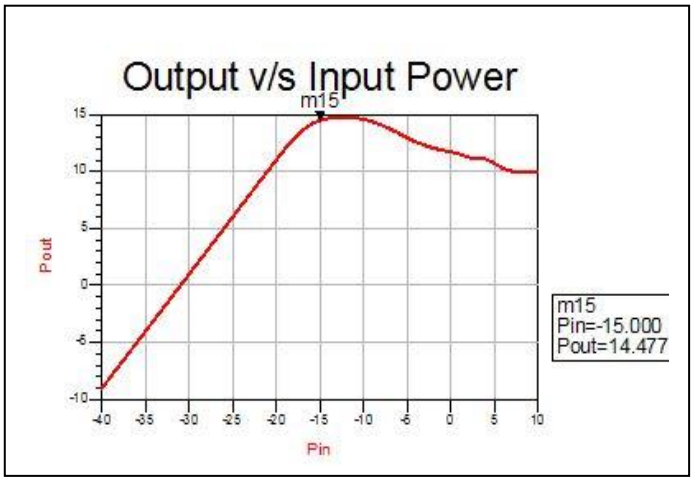

Fig.s 8. Output Power

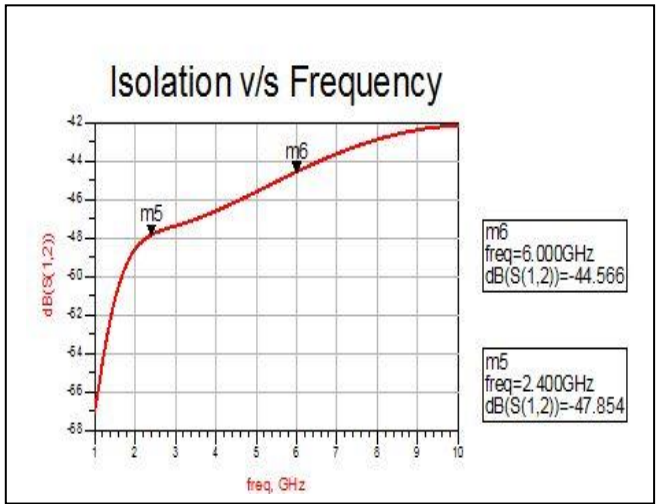

Fig. 9. Isolation (S(1,2))

V. ADVANTAGES

A general LNA has –

1. Around 20 dB power gain.
2. Signal-to-Noise ratio can be reduced up to 3 dB.
3. Operating Voltage required can be as low as 1V.
4. Low power consumption.
5. Noise Reduction.

VI. APPLICATIONS

1. ISM radios.
2. Cellular and PCS handsets
3. Wireless LANs, wireless Data
4. GPS receivers, cordless phones.
5. Automotive remote keyless entry devices.
6. Also present in satellite communication systems, where the LNA is connected to ground station receiving antenna.

VII. CONCLUSION

The paper proposes a double band 2.4 GHz and 6 GHz LNA based on LC matching circuits. LC resonant matching is used for proper matching at both ends for 2.4/6 GHz at the same time. A 0.13 um CMOS process is used for fabrication of LNA.

VIII. REFERENCES

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