

INTISARI

Very High Frequency (VHF) di Indonesia dimanfaatkan sebagai saluran televisi. Namun saluran televisi banyak berpindah ke *Ultra High Frequency* (UHF) yang mengakibatkan kosongnya saluran televisi pada VHF dan tidak dipakai. Saluran televisi ini sering disebut sebagai *TV White Spaces* (TVWS). TVWS perlu dimanfaatkan karena memiliki banyak manfaat utamanya adalah jangkauannya yang hingga 10 km. Dari jangkauan TVWS ini sangat cocok untuk mengatasi kesenjangan internet yang terjadi di Indonesia. Namun dalam pemanfaatan TVWS diperlukan perangkat tambahan berupa *receiver*. Dalam *receiver* tersebut diperlukan sub-perangkat yang berfungsi untuk menguatkan isyarat yang diterima sekaligus menekan *noise* yang ada sehingga isyarat dapat diterima dengan baik. Sub-perangkat tersebut adalah *Low-Noise Amplifier* (LNA). Dalam tugas akhir ini dilakukan perancangan LNA menggunakan *dc analysis*. *Dc analysis* digunakan untuk didapatkan nilai-nilai komponen pada LNA agar didapatkan hasil sesuai spesifikasi. Spesifikasi LNA yang digunakan sesuai dengan standard *Institute of Electrical and Electronics Engineering* (IEEE) 802.22 tentang spesifikasi teknis *Wireless Regional Area Network* (WRAN) untuk pengembangan dan penggunaan spektrum televisi (TV) tidak terpakai.

Simulasi pada LTSpice XVII dilakukan dengan transistor *Bipolar Junction Transistor* (BJT) *Negative-Positive-Negative* (NPN) yaitu 2N3904. Hasil simulasi LTSpice XVII (frekuensi 200 kHz) $S_{21} = -25,2$ dB. Hasil simulasi LTSpice XVII (frekuensi 88 MHz) $S_{11} = -5,72$ dB, $S_{12} = -41,57$ dB, $S_{21} = 15,07$ dB dan $S_{22} = -4,76$ dB, *noise figure* (NF) = 3,9 dB, *input third order intercept point* (IIP3) = 2,21 dBm, *power consumption* 45,39 mW. Hasil uji coba komponen diskret dengan NI ELVIS II+ (frekuensi 200 kHz) $S_{21} = -44,4$ dB. Hasil uji coba komponen diskret dengan MiniVNA TINY (frekuensi 88 MHz) $S_{11} = -6,13$ dB, (frekuensi 88 MHz) $S_{21} = 0,74$ dB.

Penelitian ini diharapkan dapat berguna untuk pengembangan prototipe LNA baik pada TVWS maupun pada frekuensi lainnya.

Kata kunci : *low-noise amplifier*, *TV white spaces*, VHF, WRAN.

ABSTRACT

Very High Frequency (VHF) in Indonesia is used as a television channel. However, many television channels have moved to Ultra High Frequency (UHF) which have caused television channels to be empty on VHF and not used. This television channel is often referred to as White Spaces TV (TVWS). TVWS needs to be used because it has many key benefits, its range is up to 10 km. From the reach of TVWS, it is very suitable to overcome the internet gaps that occur in Indonesia. However, the use of TVWS requires additional equipment such as a receiver. The receiver needs sub-devices that function to amplify the received signal while suppressing the existing noise so that the signal can be received properly. The sub-device is the Low-Noise Amplifier (LNA). In this final project, LNA design using DC analysis is carried out. Dc analysis is used to get the values of components in the LNA to get results according to specifications. The LNA specifications used are in accordance with the Institute of Electrical and Electronics Engineering (IEEE) 802.22 standard on Wireless Regional Area Network (WRAN) technical specifications for the development and use of unused television (TV) spectrum.

Simulations on LTSpice XVII were carried out with a Negative-Positive-Negative (NPN) Bipolar Junction Transistor (BJN) transistor, 2N3904. The results of LTSpice XVII simulation (frequency 200 kHz) $S_{21} = -25.2$ dB. The results of LTSpice XVII simulation (frequency 88 MHz) $S_{11} = -5.72$ dB, $S_{12} = -41.57$ dB, $S_{21} = 15.07$ dB and $S_{22} = -4.76$ dB, noise figure (NF) = 3.9 dB, the input third order intercept point (IIP3) = 2.21 dBm, 45.39 mW power consumption. Test results for discrete components with NI ELVIS II + (200 kHz frequency) $S_{21} = -44.4$ dB. Test results for discrete components with MiniVNA TINY (88 MHz frequency) $S_{11} = -6.13$ dB, (88 MHz frequency) $S_{21} = 0.74$ dB.

This research is expected to be useful for the development of prototype LNA both on TVWS and at other frequencies.

Keywords : low-noise amplifier, TV white spaces, VHF, WRAN.