Cairo University
Faculty of engineering
Dept. of Electronics and Electrical Communications
Second Year

ELECTRONICS
ELC 2020
RF amplifier

Answer Sheet

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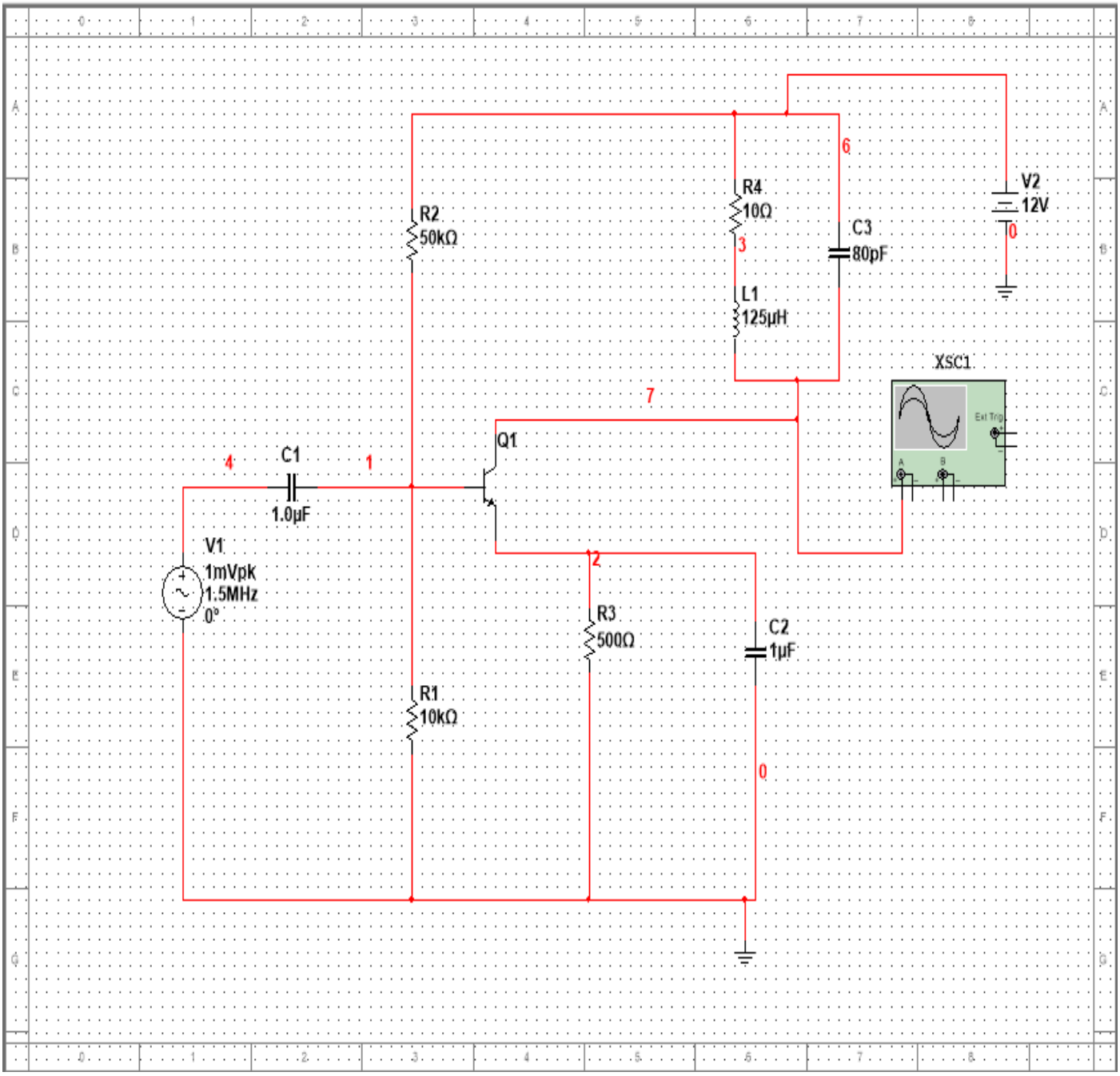
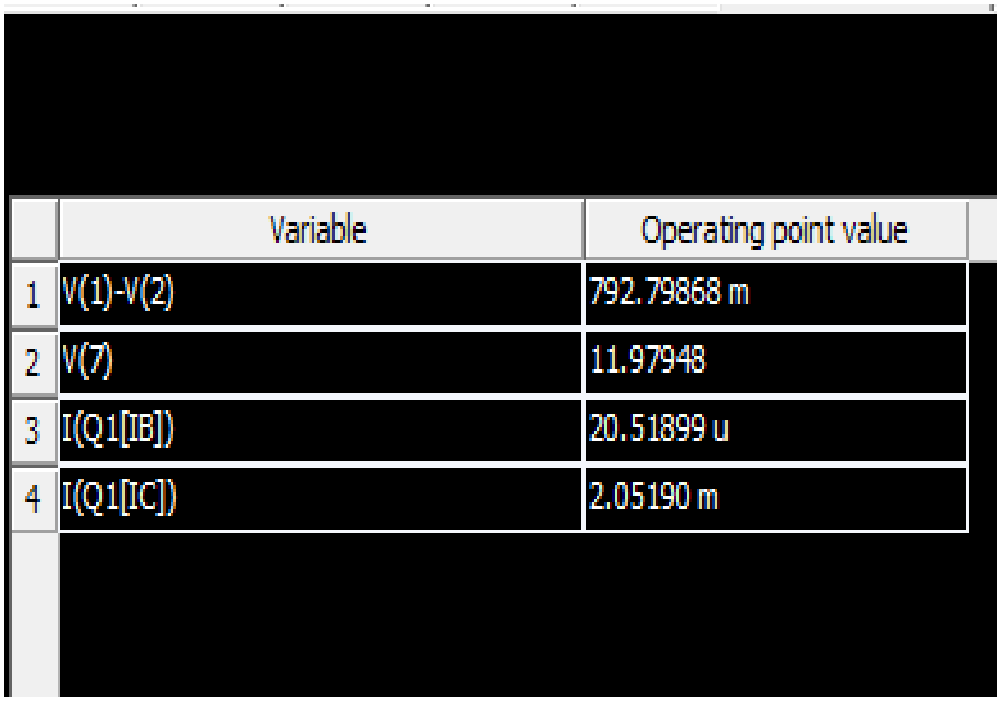
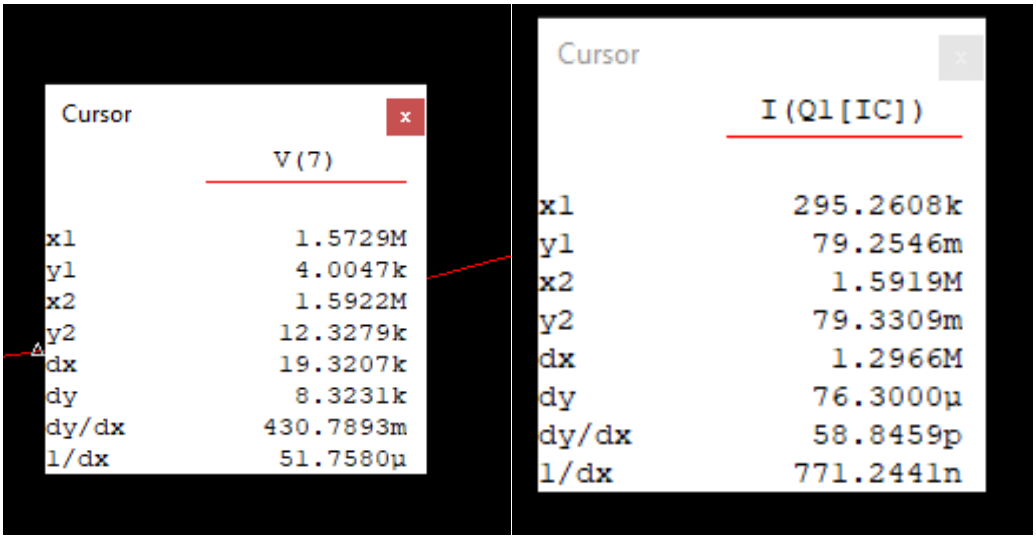
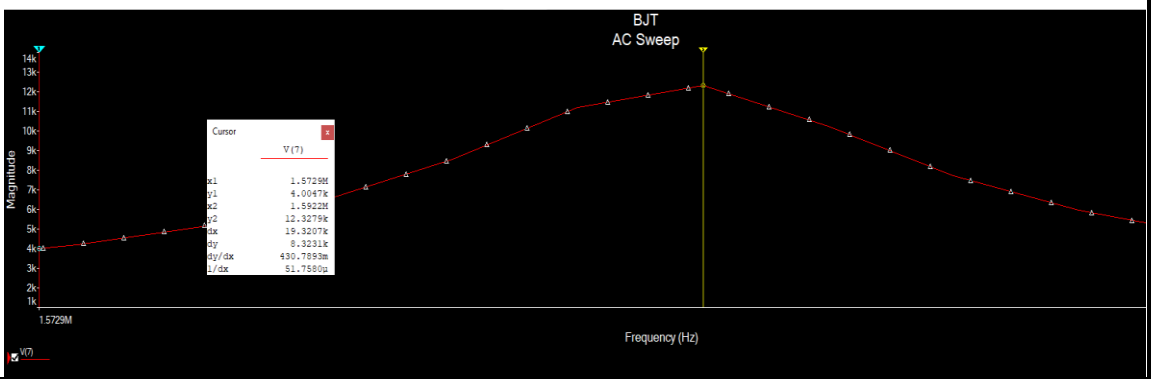
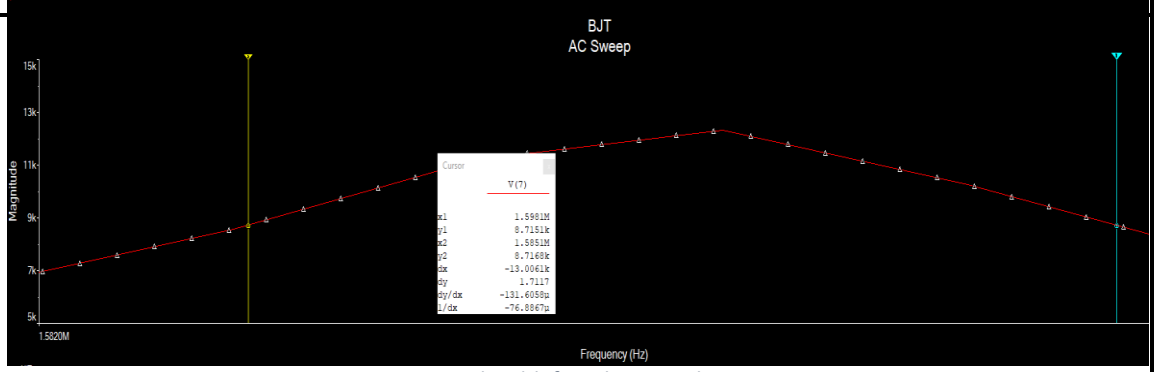
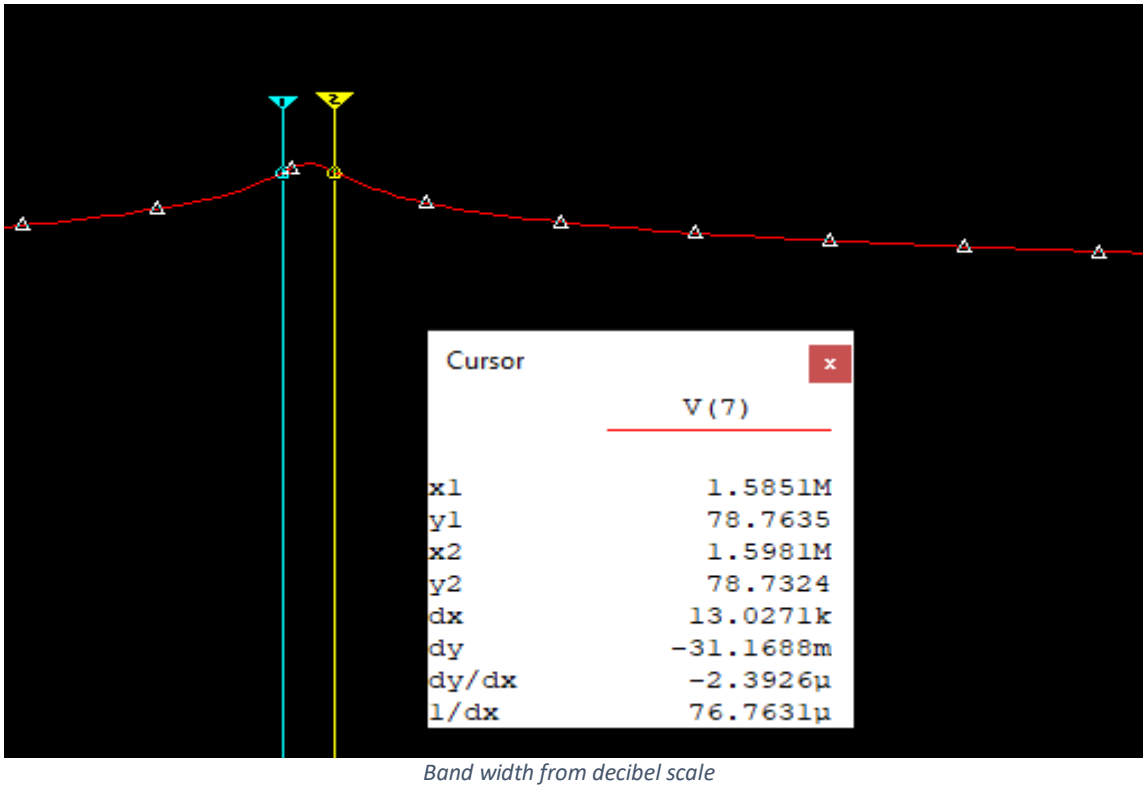
	Expression	Calculated Values	Simulated Values
BE Junction Voltage	V_{BE}	**0.7 V**	**0.792 V**
Base Current	$I_B = \frac{V_{BB} - V_{BE}}{R_{BB} - (\beta + 1)R_E}$ $V_{BB} = V_{CC}\frac{R_3}{R_2 + R_3}, R_{BB} = R_2 \| \| R_3$	**22.096 µA**	**20.519 µA**
Collector Current	βI_B	**2.2096 mA**	**2.0519 mA**
Collector Voltage	$V_{CC} - I_C * R_1$	**11.9779 V**	**11.9794 v**
Load Impedance At Resonance	$Z_{res} = \frac{L_1}{R_1 C_2}$	**0.15625 MΩ**	**0.155 MΩ**
Quality Factor	$Q = \frac{Z_{res}}{X_L}$	**125**	**121.541**
Center Frequency	$F_c = \frac{1}{2\pi\sqrt{L_1 C_2}}$	**1.59154 MHZ**	**1.5922 MHZ**
BW	$\frac{F_c}{Q}$	**12732.32 HZ**	**13000 HZ**

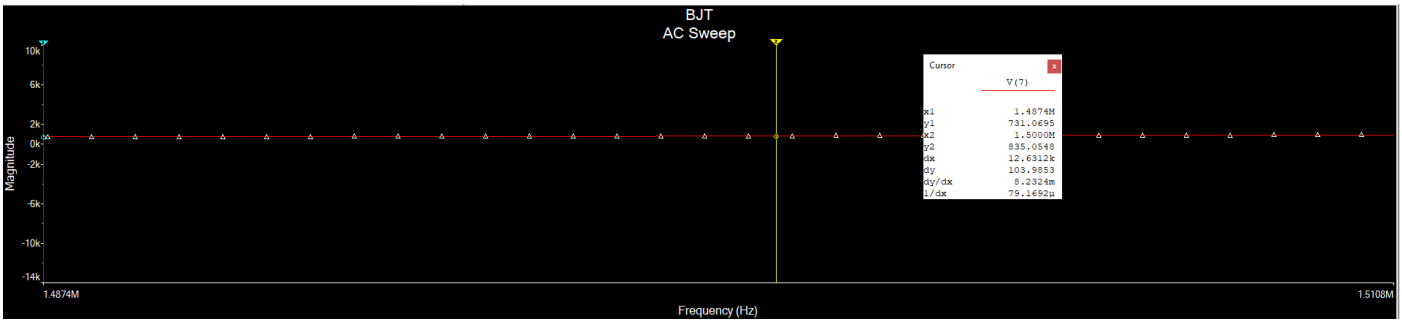


The simulated Circuit

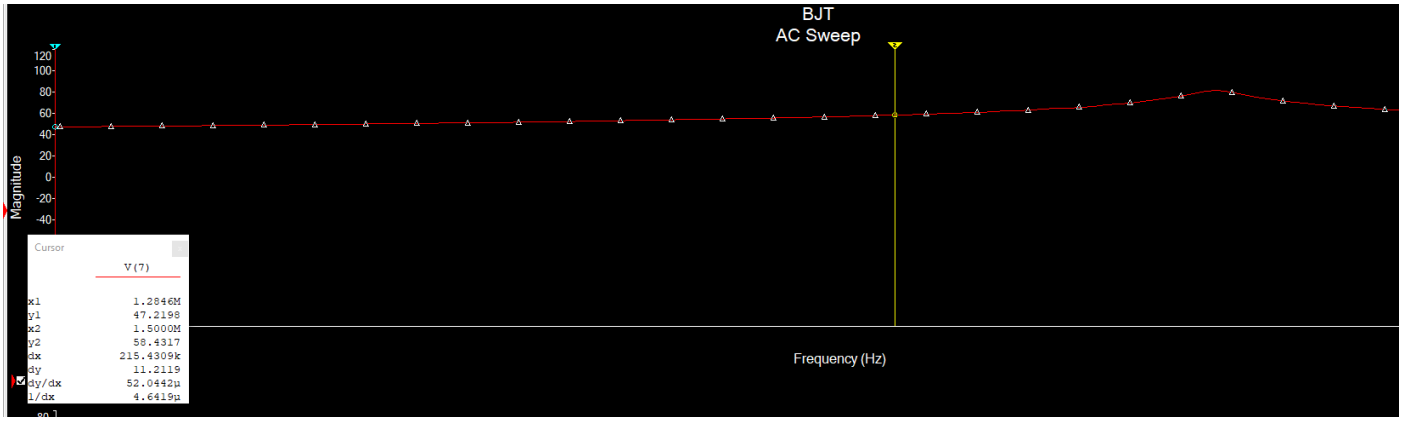
	Simualtion
1.BE Junction Voltage **2.Collector Voltage** **3.Base Current** **4.Collector Current**	 | | Variable | Operating point value | |---|---|---| | 1 | V(1)-V(2) | 792.79868 m | | 2 | V(7) | 11.97948 | | 3 | I(Q1[IB]) | 20.51899 u | | 4 | I(Q1[IC]) | 2.05190 m |
Load Impedance At Resonance	**We calculated the load impedance at resonance by dividing the voltage at center frequency by the current at the center frequency.**  Cursor V(7) x1 1.5729M y1 4.0047k x2 1.5922M y2 12.3279k dx 19.3207k dy 8.3231k dy/dx 430.7893m 1/dx 51.7580µ Cursor I(Q1[IC]) x1 295.2608k y1 79.2546m x2 1.5919M y2 79.3309m dx 1.2966M dy 76.3000µ dy/dx 58.8459p 1/dx 771.2441n **Load Impedance = $\frac{12.3279\ \text{kV}}{79.3309\text{mA}}$ = 155400Ω=0.1554kΩ**
Quality Factor	**Quality Factor is calculated by dividing the simulated center frequency by the bandwidth.**

Center Frequency	
BW	 *Band width from linear scale*  *Band width from decibel scale*

Q2) The gain at 1.5MHz = 58.43 DB= 835.05 V/V

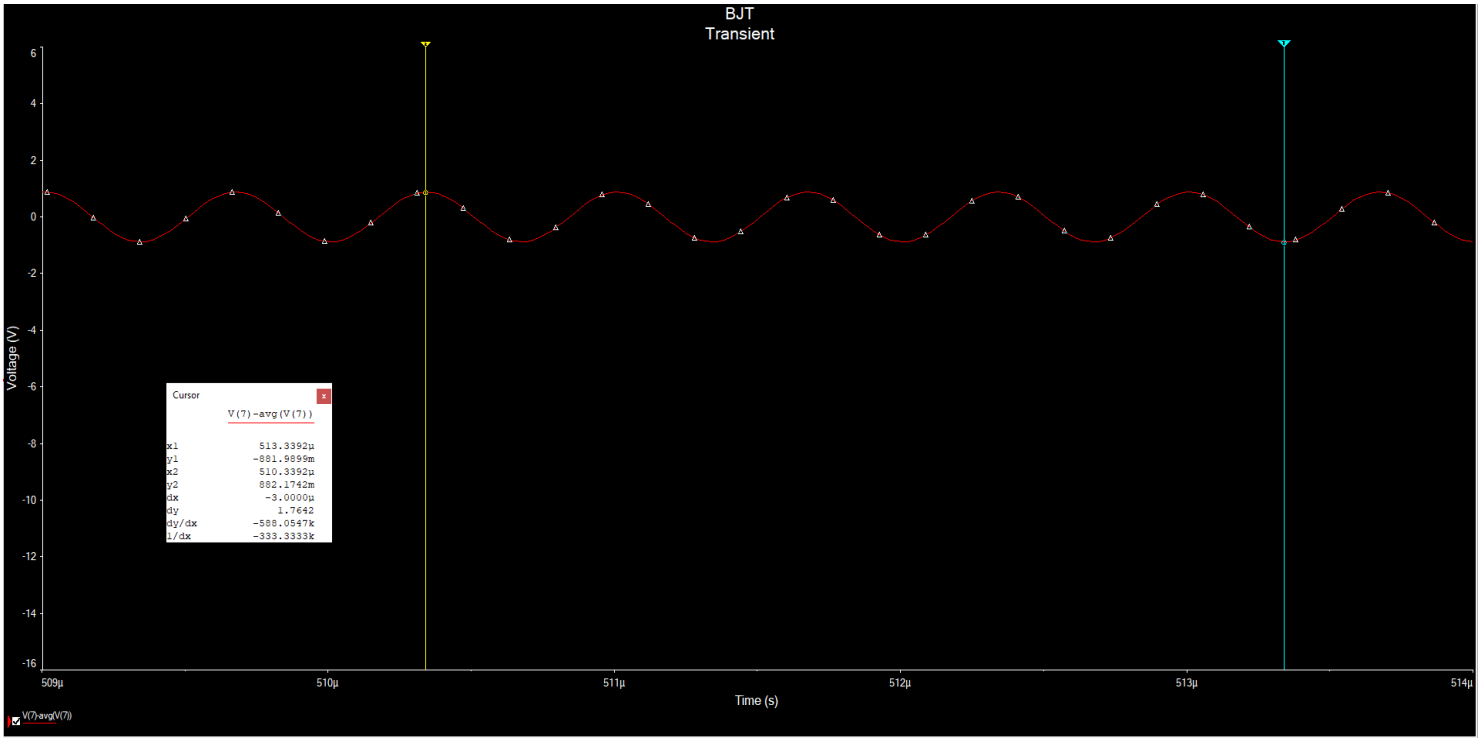


Gain



Decibel gain

Q3)



Collector node voltage

- **The Amplitude at 1.5MHz = 882 mV.**
- **The Expected Value from AC Simulation = 835.05 mV.**