Indian Institute of Information Technology, Allahabad

Electronics and Communication Engineering Department

Course Name: Radar & Satellite Communication

Experiment No. 3

Aim :- To Measure the variable speeds of moving objects using Target Emulator.

OBJECTIVE:
To emulate the variable speeds of moving objects using Target Emulator.

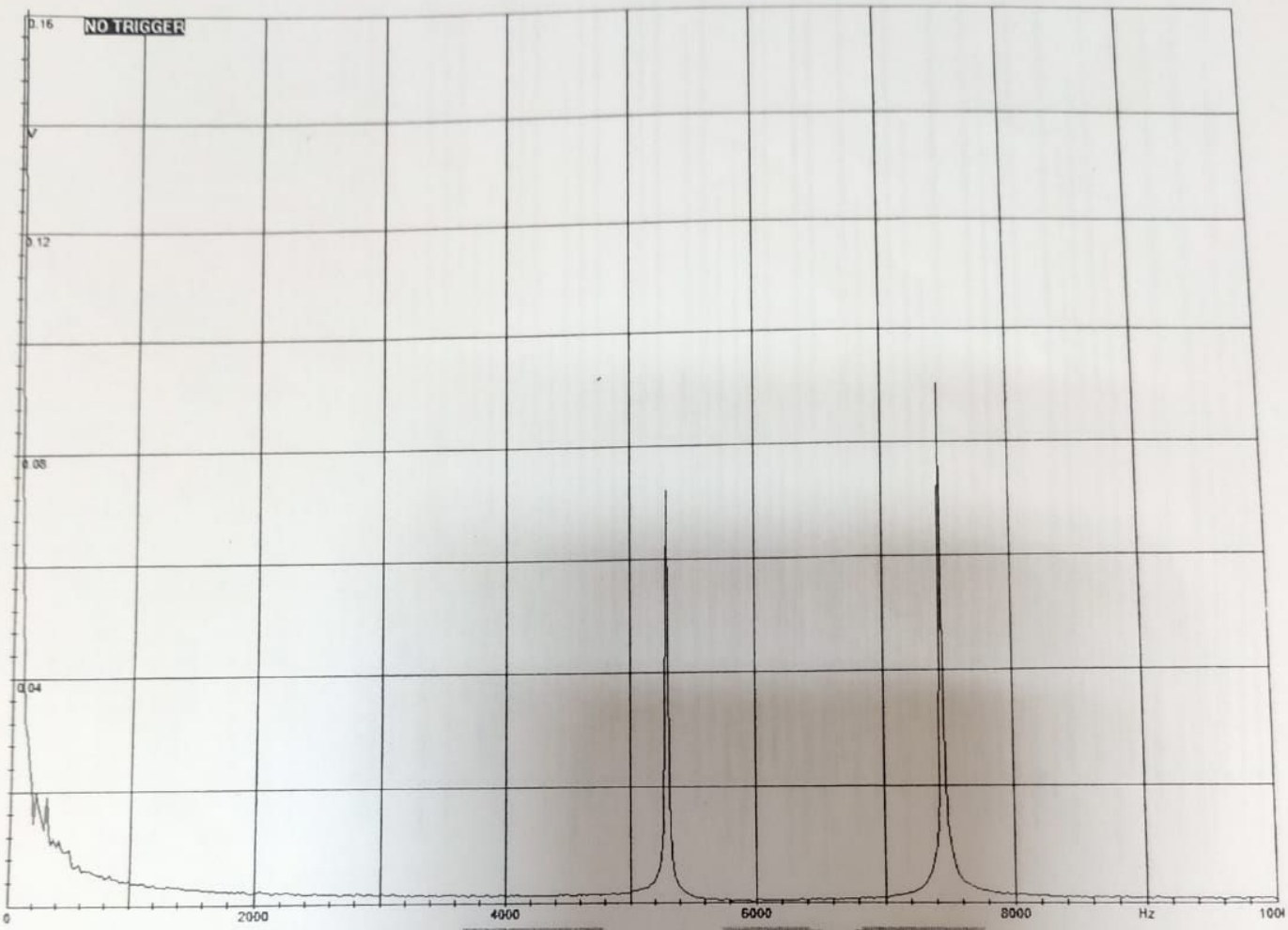
EQUIPMENT REQUIRED:

Procedure:

1. Place the Target Emulator in front of radar such that both face each other.
2. Avoid any movement 3 – 5 ft from setup.
3. Connect the Doppler radar to the PC "mic in" input at back and open the software window.
4. See if CRO Display in PC is quite. Now, switch on the Target Emulator.
5. Vary the Frequency of Target Emulator and measure what velocity does Doppler Radar detect.
6. Increase the distance of the Target Emulator from radar antenna and observe the fall in signal level.
7. Keep the Target Emulator at different angles to the parabolic dish and estimate the beam width of the parabolic antenna.
8. Measure the limit of the speeds that can be emulated by Target Emulator.

Result:

When a square wave is modulated on Target Emulator, it transmits the modulated signal at a frequency of 10.5 GHz, which is also the frequency at which radar transmits as well as receives. Hence the radar will presume as if it had transmitted a frequency in CW mode at 10.5GHz and is receiving a modulated 10.5GHz frequency after being reflected by some moving object due to which the transmitted wave has been shifted in phase. Now, as the amount of phase shift depends on the speed of moving object, increasing the frequency of modulated square wave being transmitted by Target Emulator gives the same effect to radar as if the reflecting object is moving with a faster speed. Thus, increasing the frequency of modulating signal on Target Emulator has same effect to radar as if the object is moving faster. Hence it is called Target Emulator because it gives the effect of variable speed of moving object. The Target Emulator is modulated with a frequency from DC to around 20 KHz, which for a factor of 19.49Hz/Km/Hr results in a velocity simulation of 0-1000 Km/Hr. Real objects moving at these speeds can be dangerous and expensive to reproduce in lab environments. The signal received by the radar goes down as the distance between the simulator and radar is increased. This effect is much more visible with software operating in FFT mode. Although the Target Emulator can be modulated upto 20KHz, the PC software might have difficulty in counting at that high frequency due to limitation of processing speeds. In case of difficulty the results could be crosschecked using a digital scope with FFT say Tektronix TDS1002.



Target Emulator signal captured by radar.

* Students can experiment the effect of multiple targets.
* Students can experiment the effect of Radar Jammer on Target detection / Multiple Target detection.