An earth station (E/S) transmits four separate signals at different frequencies to a GEO satellite through the same high power amplifier (HPA). The HPA has an output power of 240 W. The signals have different bandwidths and frequencies as shown in Table I below.

The saturated power output of the satellite transponder is 80.0 W and the transponder is operated with 3.0 dB output back off. The transponder down converts all received signals by 2.90 GHz.

In parts a, b and c of this question, enter your answers in Table I in the appropriate column.

**Table I** FDMA frequencies and powers

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Signal No. | Frequency (GHz) | Bandwidth (MHz) | E/S outputPower (watts) | Satellite Frequency | Satellite Power (watts) |
| 1 | 14.00 | 8.0 |  |  |  |
| 2 | 14.10 | 6.0 |  |  |  |
| 3 | 14.20 | 4.0 |  |  |  |
| 4 | 14.25 | 2.0 |  |  |  |
|  |  |  |  |  |  |

1. Complete the fourth column of Table I for the output power of the earth station HPA.
2. Complete the fifth column of Table I for the frequency at the output of the satellite transponder
3. Complete the sixth column of Table I for the output power of the satellite transponder HPA.
4. Why is the transponder HPA output power reduced from the saturated value of 80 W by 3 dB?