

# WELCOME TO Adda247

*"If you can think, you can  
Achieve"  
So start thinking..*

*Renu Raj Garg  
M.Tech (VLSI Design)  
13 Year of Teaching  
Experience  
Worked 10 Year in NTRO*



# GATE 2024



**प्रवाह** Batch

## COMMUNICATION

**BAND PASS SAMPLING  
IMPORTANT CONCEPT**

**TIME- 9:00PM**

**RENU SIR**





Chapter-2

**Digital Communications**

*In today's lecture we will cover the following Topics :*

1. *Band-Pass Sampling (Part-3)*





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# GATE 2023 RESULT



**Congratulations**  
**FROM ADDA 247 FAMILY**

|   |   |   |   |  |   |
|---|---|---|---|--|---|
| <b>AIR</b><br><b>03</b><br><b>ME</b><br>KUSHAGRA<br>DUTT  | <b>AIR</b><br><b>05</b><br><b>PI</b><br>HARSHIT<br>KUMAR      | <b>AIR</b><br><b>07</b><br><b>ME</b><br>RUSHI<br>PRADIPKUMAR KARIYA | <b>AIR</b><br><b>11</b><br><b>CE</b><br>VINEET JAIN           | <b>AIR</b><br><b>30</b><br><b>CE</b><br>RITIK<br>BANSAL  | <b>AIR</b><br><b>36</b><br><b>ECE</b><br>SUMIT<br>KUMAR   |
| <b>AIR</b><br><b>64</b><br><b>CE</b><br>UTKARSH<br>MISHRA | <b>AIR</b><br><b>71</b><br><b>EE</b><br>SONESH<br>SANIY PAWAR | <b>AIR</b><br><b>76</b><br><b>CE</b><br>BIPANKAR<br>DAS             | <b>AIR</b><br><b>87</b><br><b>EC</b><br>SURAJIT<br>RABI DAS   | <b>AIR</b><br><b>91</b><br><b>EE</b><br>RISHABH<br>GUPTA | <b>AIR</b><br><b>111</b><br><b>ES</b><br>ANIL GUPTA       |
| <b>AIR</b><br><b>130</b><br><b>EE</b><br>SAURAV<br>PATEL  | <b>AIR</b><br><b>136</b><br><b>CE</b><br>RUPESH<br>SACHDEVA   | <b>AIR</b><br><b>200</b><br><b>ECE</b><br>WASIUZZAMA                | <b>AIR</b><br><b>212</b><br><b>IN</b><br>WASIUZZAMA           | <b>AIR</b><br><b>217</b><br><b>ME</b><br>VISHAL<br>KUMAR | <b>AIR</b><br><b>219</b><br><b>ME</b><br>NITISH<br>KUMAR  |
| <b>AIR</b><br><b>258</b><br><b>EE</b><br>MANAV            | <b>AIR</b><br><b>348</b><br><b>EE</b><br>AMAN<br>NAMDEV       | <b>AIR</b><br><b>392</b><br><b>EE</b><br>GAURAV<br>MAHAJAN          | <b>AIR</b><br><b>403</b><br><b>EC</b><br>MOHAN<br>KUMAR SINGH | <b>AIR</b><br><b>567</b><br><b>EE</b><br>SHANKAR<br>JHA  | <b>AIR</b><br><b>571</b><br><b>ME</b><br>VLENDER<br>MEENA |





GATE

**Know How You Can**

**Ask Your Doubts 24x7.**



**Direct interaction with Adda247 Faculty team**

**No Subscription Required**



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BILINGUAL

# PRACHAND BATCH FREE FOR ALL

ELECTRICAL,  
ELECTRONICS COMMUNICATION ENGINEERING

GATE 2024 & ALL PSU's



Start Apr 11, 2023

7:30 AM to 11:30 PM



# You **Tube** Classes Schedule



## EE & EC ENGINEERING

| EXAM TARGET  | SUBJECT            | TIME     | FACULTY    |
|--------------|--------------------|----------|------------|
| ALL PSUs     | ENGINEERING MATHS  | 11:00 AM | ANANT SIR  |
| GATE 2024-25 | NETWORK THEORY     | 6:00 PM  | RAVI SIR   |
| GATE 2024-25 | ELECTRICAL MACHINE | 7:30 PM  | SANTAN SIR |
| GATE 2024-25 | COMMUNICATION      | 9:00 PM  | RENU SIR   |



# FREE APP CLASS SCHEDULE



**EE & ECE ENGINEERING**



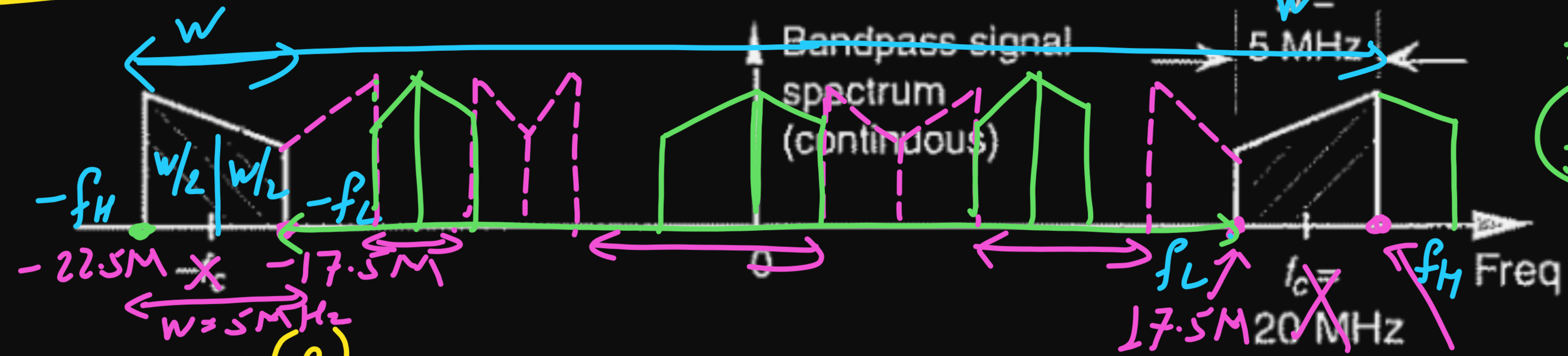
|                                    |                            |                     |
|------------------------------------|----------------------------|---------------------|
| <b>NETWORK THEORY</b>              | <b>SATURDAY Live @11AM</b> | <b>RAVI SIR</b>     |
| <b>COMMUNICATION</b>               | <b>WEDNESDAY Live @8PM</b> | <b>RENU SIR</b>     |
| <b>ANALOG<br/>ELECTRONICS</b>      | <b>THURSDAY Live @8PM</b>  | <b>LAWRENCE SIR</b> |
| <b>ENGINEERING<br/>MATHEMATICS</b> | <b>FRIDAY Live @11AM</b>   | <b>ANANT SIR</b>    |
| <b>ELECTRICAL<br/>MACHINE</b>      | <b>MONDAY Live @8PM</b>    | <b>SANTAN SIR</b>   |



BPS → SSB

$$\frac{5M}{3} = 1.66 \text{ MHz}$$

$$2W + 1.66 = 11.66 \text{ MHz}$$



$$f_s \geq 2W$$

$$f_s \geq 10 \text{ MHz}$$

$$f_s > 10 \text{ MHz}$$

$$\frac{2f_c - W}{2W} = \frac{35 \text{ MHz}}{10} = 3.5$$

$$\frac{2f_L}{2W} = \frac{35}{10} = 3.5 \approx 3$$

≠ Integer ≈ 3

$$\frac{35}{3} = 11.66$$

$$\frac{2f_c}{m} = 11.66$$

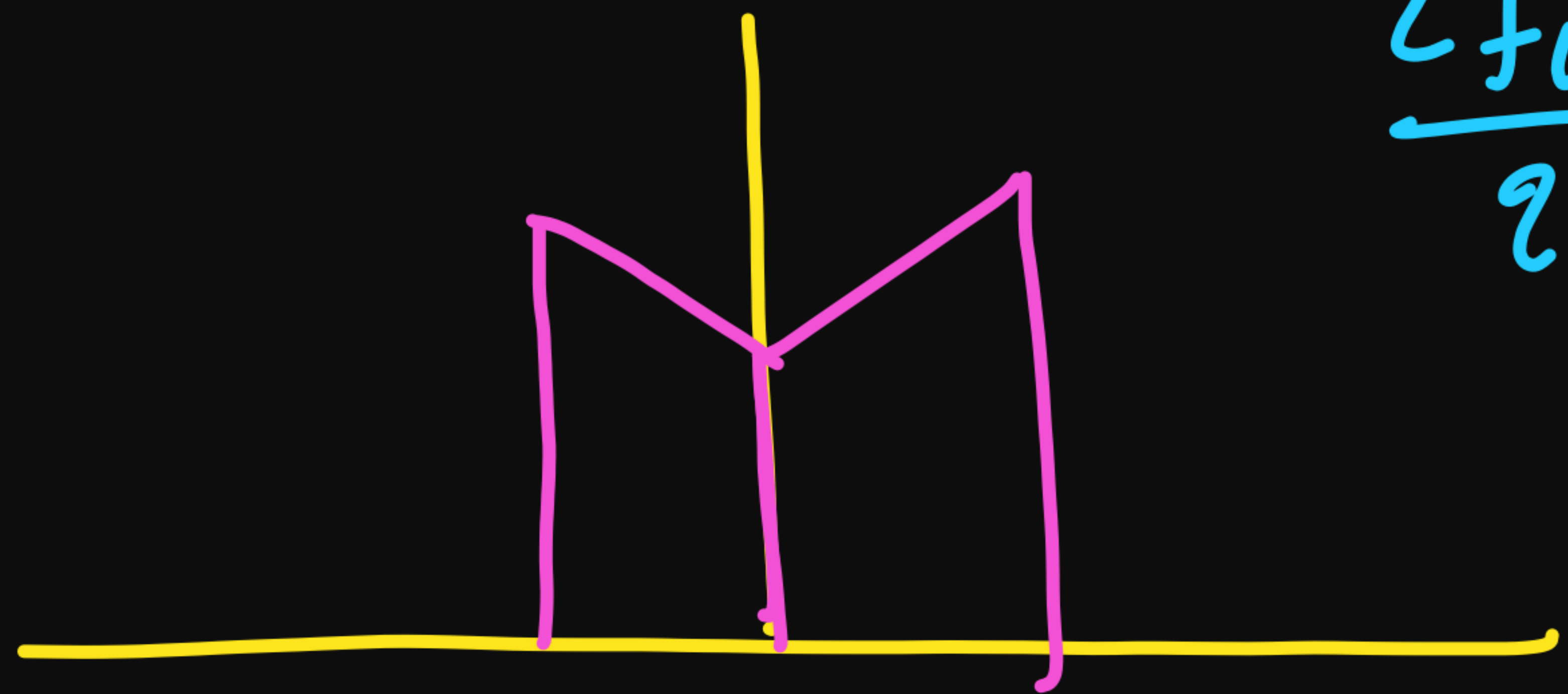
$$\frac{2f_H}{2W} = \frac{45}{10} = 4.5$$

$$\approx 4$$

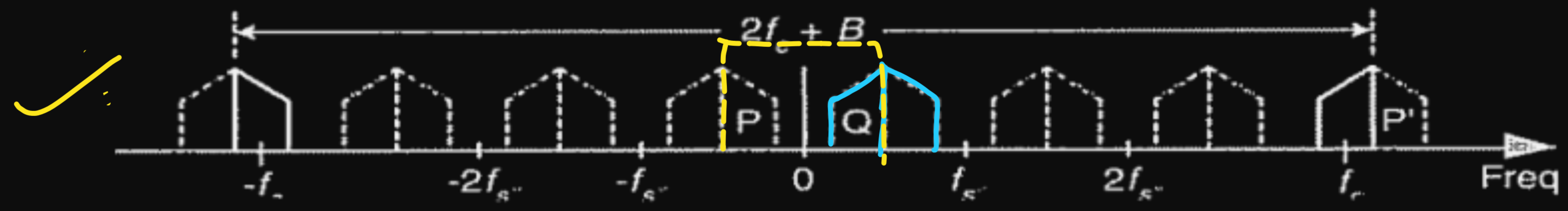
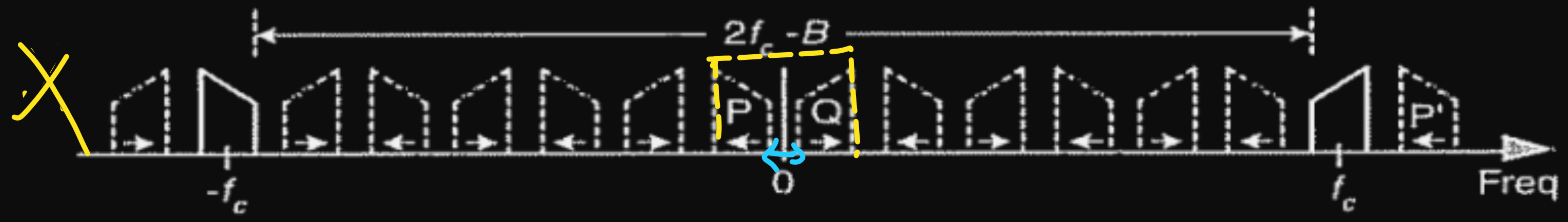
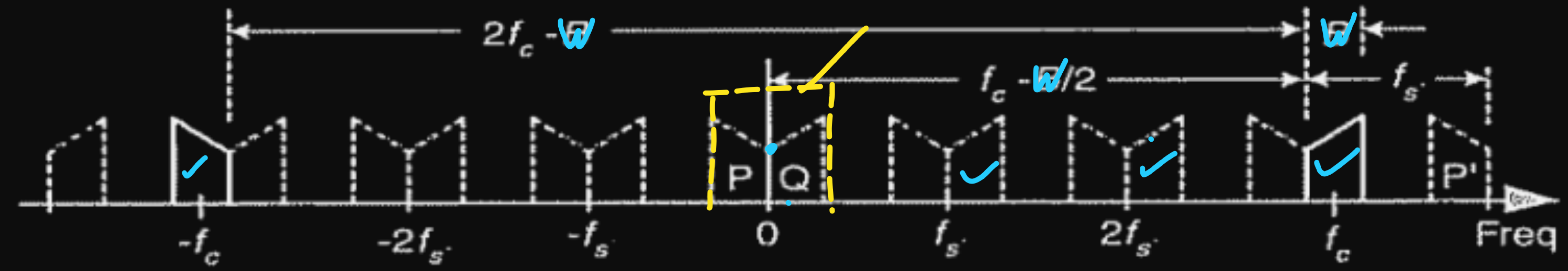
$$\frac{45}{4} = 11.25$$

$$\approx m+1$$

$$\frac{2f_H}{m+1} = 11.25$$

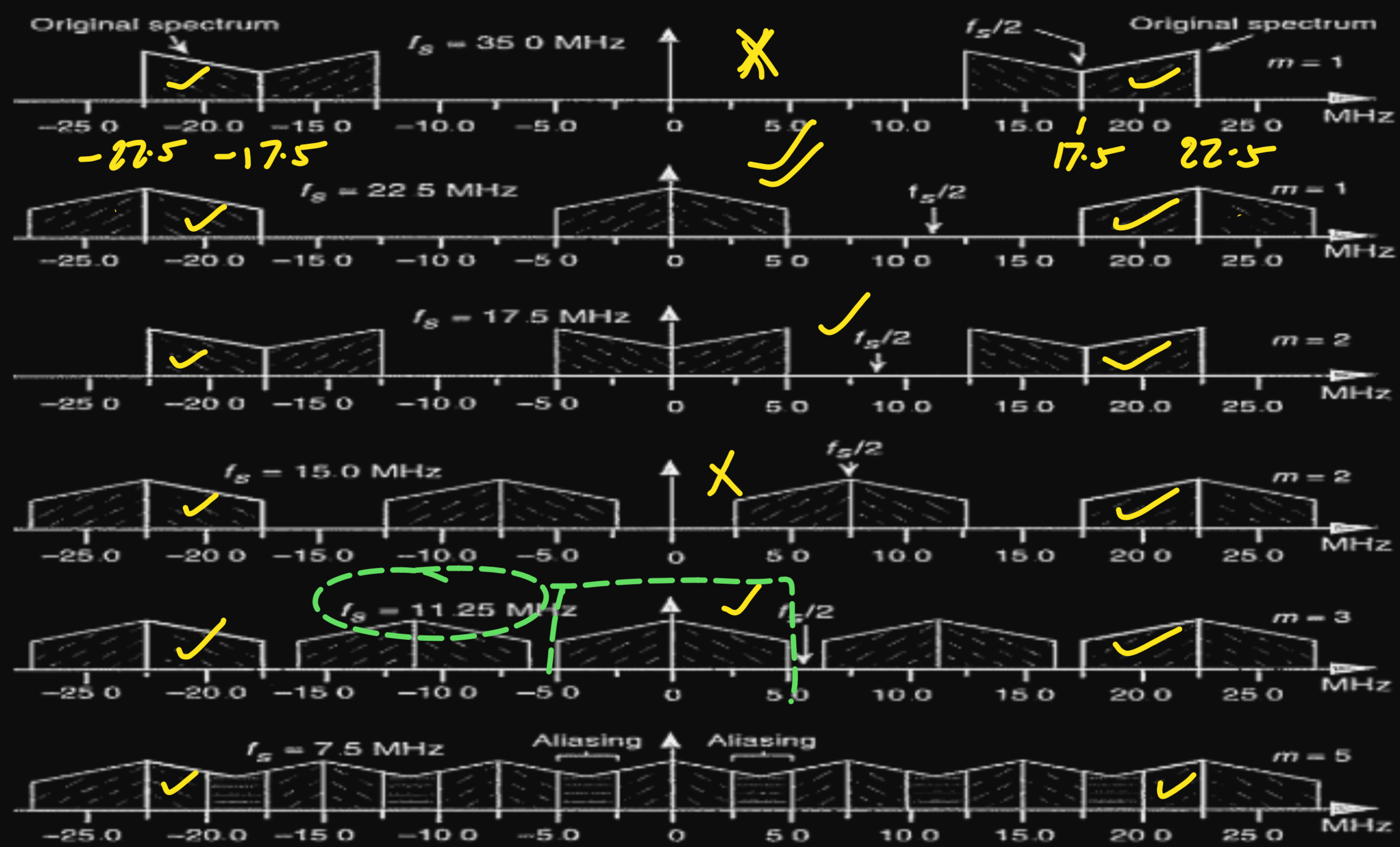








$m=1$   
 $m=1$   
 $m=2$   
 $m=2$   
 $m=3$   
 $m=4$





| $m$ | $\frac{2f_L}{m}$<br><del><math>(2f_c - B)/m</math></del> | $\frac{2f_H}{(m+1)}$<br>$(2f_c + B)/(m+1)$ | Optimum sampling rate |
|-----|--|--|-----------------------|
| 1   | 35.0 MHz ✗   | 22.5 MHz ✓                                 | 22.5 MHz ✓            |
| 2   | 17.5 MHz ✓   | 15.0 MHz ✗                                 | 17.5 MHz ✓            |
| 3   | 11.66 MHz ✗  | 11.25 MHz ✓                                | 11.25 MHz ✓           |
| ✗ 4 | 8.75 MHz   | 9.0 MHz                                    | ✗                     |
| ✗ 5 | 7.0 MHz  | 7.5 MHz                                    | ✗                     |

$$11.25 \text{ M} \leq f_s \leq 11.66 \text{ M}$$

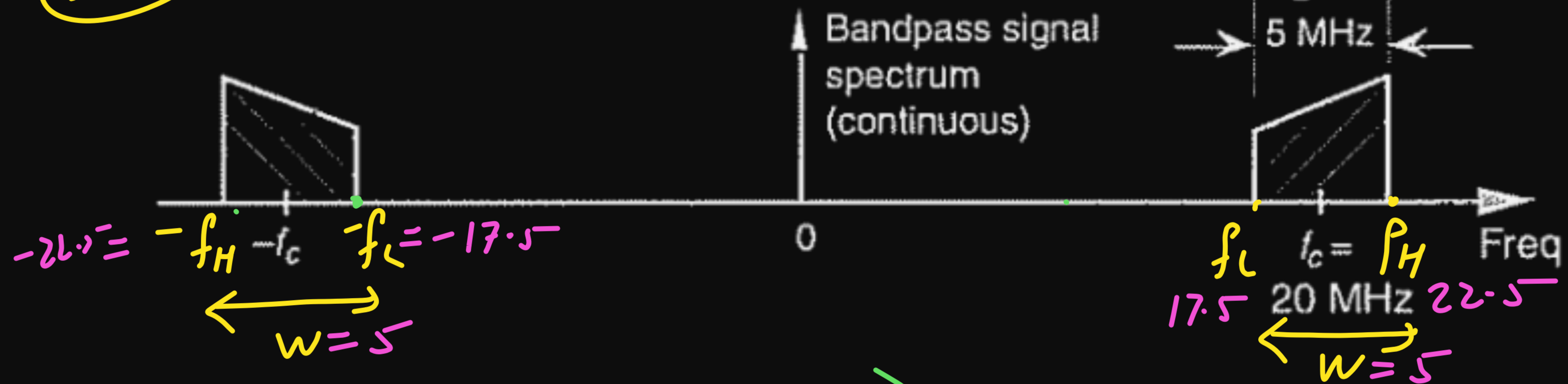
$$f_L = 17.5 \text{ MHz}$$

$$f_H = 22.5 \text{ MHz}$$



SAB BPJ

$$11.25\text{M} \leq f_c \leq 11.66\text{M}$$



$$\frac{2f_L}{2W} = \frac{35}{10} = 3.5 \approx 3 = m$$

$$\frac{2f_H}{2W} = \frac{45}{10} = 4.5 \approx 4 = m+1$$

$m=3$   
 $m+1=4$

$$\frac{2f_L}{m} = \frac{35}{3} = 11.66\text{ MHz}$$

$$\frac{2f_H}{m+1} = \frac{45}{4} = 11.25\text{ MHz}$$



$$\left. \begin{aligned} f_L &= 17.5 \\ f_H &= 22.5 \end{aligned} \right\} W = 5$$



$m=2$

$$\frac{2f_L}{m} = \frac{35}{2} = 17.5 \text{ MHz} \quad \checkmark$$

$$\frac{2f_H}{m+1} = \frac{45}{3} = 15 \text{ MHz} \quad \times$$

$$15 \text{ MHz} \leq f_s \leq 17.5 \text{ MHz}$$

$m=1$

$$\frac{2f_L}{m} = \frac{35}{1} = 35 \text{ MHz}, \quad \frac{2f_H}{m+1} = \frac{45}{2} = 22.5$$

$$22.5 \text{ MHz} \leq f_s \leq 35 \text{ MHz}$$



$m=4$

$$\frac{2f_L}{m} = \frac{35}{4} = 8.75 \text{ MHz}$$

$$\frac{2f_H}{m+1} = \frac{45}{5} = 9 \text{ MHz}$$

$$8.75 \text{ MHz} \leq f_s \leq 9 \text{ MHz}$$

$$f_s \geq 2W$$

$$f_s > 10 \text{ MHz}$$

$m=5$

$$\frac{35}{5} = 7 \text{ M}$$

$$\frac{45}{6} = 7.5 \text{ MHz}$$

$$7 \text{ M} \leq f_s \leq 7.5 \text{ M}$$

X



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