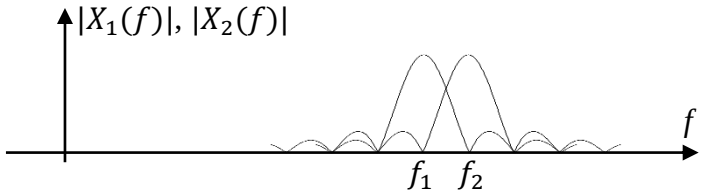
No : Answers **Name : Solutions**
Eskişehir Osmangazi University, Faculty of Engineering and Architecture
Department of Electrical Engineering & Electronics, "*Communications*" Final 15.06.2023

Upload until : 09:55
Two individual spectrums for two sub-channels of an OFDM communication system is shown below. The OFDM symbol duration T_s is given by T_s=10+d μs where d is the 11th digit (second from the last) of your student-id. Find two sets of (f_1, f_2) where f_1 ≥10 MHz.



Put your calculations/results **in the** drawing canvas below. **Do not** change anything else except putting your name/id on top of the page.

Solution:

$f_n = \frac{n}{(10+d)10^{-6}}$ and $f_{min} \geq 10 \times 10^6$
Therefore, $n \geq 10 \times 10^6(10+d)10^{-6}$
$n \geq 100 + 10d$ and n is a positive integer.
Therefore n must be greater than or equal to 100 if your digit is d=0, 110 if d=1, 120 if d=2, so on. In that case;
$f_1 = \frac{100+i+10d}{(10+d)10^{-6}}$ Hz and $f_2 = \frac{101+i+10d}{(10+d)10^{-6}}$ Hz where i=0, 1, 2,...integers
(put your digit into these)

Let us chose the minimum 2 appropriate numbers as n for f_1 and f_2 (an arbitrary selection) (i=0 and i=1)
d=0, (10 MHz, 10.1 MHz) or (10.1 MHz, 10.2 MHz) or ...
d=1, (10 MHz, 10.0909 MHz) or (10.0909 MHz, 10.1818 MHz) or ...
d=2, (10 MHz, 10.0833 MHz) or (10.0833 MHz, 10.1667 MHz) or ...
d=3, (10 MHz, 10.0769 MHz) or (10.0769 MHz, 10.1538 MHz) or ...
d=4, (10 MHz, 10.0714 MHz) or (10.0714 MHz, 10.1429 MHz) or ...
d=5, (10 MHz, 10.0667 MHz) or (10.0667 MHz, 10.1333 MHz) or ...
d=6, (10 MHz, 10.0625 MHz) or (10.0625 MHz, 10.1250 MHz) or ...
d=7, (10 MHz, 10.0588 MHz) or (10.0588 MHz, 10.1176 MHz) or ...
d=8, (10 MHz, 10.0556 MHz) or (10.0556 MHz, 10.1111 MHz) or ...
d=9, (10 MHz, 10.0526 MHz) or (10.0526 MHz, 10.1053 MHz) or ...

Keep in mind that both f_1 and f_2 must be integer multiples of $1/T_s$. Arbitrary (random) selection of f_1 and determining f_2 accordingly does not work. If done so, one will obtain asked spectral shape but the signals (in time domain) will not be orthogonal. That is, 50% overlap of individual spectrums is a result of orthogonality, the reverse of this statement is not correct. I needed to add this explanation here because so many students seem to have selected arbitrary frequencies.

Upload your answer (word or pdf) before 09:55. **No e-mails** will be accepted.