4. A 5G NR gNodeB has a channel bandwidth of 400 MHz and is operating in a hypothetical environment where the root mean square delay spread is measured to be 350 ns. Table 2 shows the subcarrier spacings and corresponding cyclic prefix durations that are being considered for the system.

Table 2

Subcarrier Spacing (kHz)	Cyclic Prefix Duration (μs)	Slot Duration (ms)
15	4.7	1
30	2.3	0.5
60	1.2	0.25
120	0.59	0.125
240	0.29	0.0625

(a) Which subcarrier spacing from the above list are most suitable for the channel conditions and can achieve maximum bandwidth occupancy with the least number of subcarriers? [Hint: Maximum number of subcarriers is 3300]

Answer: $350\ ns = 0.35\ \mu s < 0.59\ \mu s$

$120\ kHz \times 3300 = 396\ MHz < 400\ MHz$

∴最大传输 速率时可采用 120 kHz 子载波间隔

(b) The gNodeB has 4 bandwidth parts it can configure for any User Equipment (UE) and they are shown in Table 3 as follows:

Table 3

Bandwidth Part #	Subcarrier Spacing (kHz)	Number of Resource Blocks
1	15	20
2	30	80
3	60	80
4	120	20

(i) A UE connects to the gNodeB and reports that it can only support an operating bandwidth of up to 5 MHz. Which bandwidth part(s) can be configured for the UE? [Hint: each resource block has 12 subcarriers]

Answer:

Part	子载波个数	带宽
1	240	$240 \times 15 kHz = 3.6\ MHz$
2	960	$960 \times 30 kHz = 28.8\ MHz$
3	960	$960 \times 60 kHz = 57.6\ MHz$
4	240	$240 \times 120 kHz = 28.8\ MHz$

∵ $3.6\ MHz < 5\ MHz$
∴选 Bandwidth Part 1

(ii) A second UE with higher capability connecting to the gNodeB can support an operating bandwidth of up to 30 MHz. Calculate bandwidth of each bandwidth parts and state if each of the bandwidth part in Table 3 can or cannot be configured for this UE.

1, 2, 4 可以分配给 UE2 用

3 不可以, 带宽超过了.