## SC4022/CE/CZ4022 Assignment

Deadline of Submission: 17 Nov 2023 (Fri) 2359 hours Total Marks = 20

## **Mode of Submission:**

- Complete the Table starting from page 2 and submit (either in Microsoft Word or pdf) via Wi-Fi Experiment link in Assignments on the left tab menu of NTULearn.

- A maximum of 3 submissions is allowed. Grading will be based on the last submission.

## **Instructions:**

- 1. Hardware resource required: Wi-Fi enabled smartphone or laptop or desktop.
- 2. Software resource required: Any suitable free Wi-Fi Analyzer app(s) you can download from Apple App Store or Google Play Store or from the Web which can allow you to conduct the experiment and answer the questions set out in this assignment.
- 3. If your phone/laptop/desktop has basic/advanced features (either in normal mode or in developer's mode) to monitor the Wi-Fi networks such that you can populate the following Table without the need to download any app, it will be most convenient.
- 4. Populate the Table based on the experiment you have performed. Attach the relevant screenshot for each of Items 1 through 9 so that your answers can be verified. A completed Table without the respective screenshots means your answers cannot be verified and no marks will be awarded for those Items with missing screenshots.

		Fill in your data and insert the relevant screenshot
Name of Student		Goh Zongye Benjamin
Date	of Experiment	4 November 2023
1.	Your smartphone/laptop/desktop brand and/or model and/or name.	Kohjinsha ML6SL16A  Screenshot:  benjababe@kuma OS: Gentoo Linux i686 Host: ML Series Kernel: 6.1.12-gentoo Uptime: 3 mins Packages: 716 (emerge) Shell: bash 5.1.16 Resolution: 1024x600 Terminal: /dev/pts/1 CPU: Genuine Intel N270 (2) @ 1.600GHz [31.0°on] GPU: Intel Mobile 945GSE Express Memory: 104MiB / 2002MiB Local IP: 192.168.1.248
2.	MAC address of your device.	D8:FC:93:6D:13:61  Screenshot:  benjababe@kuma ~ \$ iw dev wlp2s0 info Interface wlp2s0     ifindex 4     wdev 0x1     addr d8:fc:93:6d:13:61     type managed     wiphy 0     channel 36 (5180 MHz), width: 80 MHz, center1: 5210 MHz     txpower 22.00 dBm
3.	Wi-Fi network name (SSID).	Screenshot: Connected to 88:c3:97:c1:35:0a (on wlp2s0) SSID: BenjaWrt-5GHz freq: 5180 RX: 67681 bytes (482 packets) TX: 55360 bytes (344 packets)
4.	MAC address of the	88:C3:97:C1:35:0A

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Access Point (AP).
                                     Screenshot:
                                     Connected to 88:c3:97:c1:35:0a (on wlp2s0)
                                                  SSID: BenjaWrt-5GHz
                                                  freq: 5180
                                                  RX: 67681 bytes (482 packets)
                                                  TX: 55360 bytes (344 packets)
5.
      Wi-Fi channel number
                                    36
      used by your device.
                                     Screenshot:
                                      penjababe@kuma ~ $ iw dev
                                     phy#0
                                             Interface wlp2s0
                                                     ifindex 4
                                                     wdev 0x1
                                                     addr d8:fc:93:6d:13:61
                                                     type managed
                                                        annel 36 (5180 MHz), width: 80 MHz, center1: 5210 MHz
                                                     txpower 22.00 dBm
      Frequency of the Wi-Fi
                                    5180 MHz
6.
      channel used by your
      device. State the unit.
                                     Screenshot:
      NB: The exact frequency
                                      oenjababe@kuma ~ $ <mark>iw dev</mark>
      has to be given. Stating 2.4
                                     phy#0
      or 5 GHz is not an
                                             Interface wlp2s0
                                                     ifindex 4
      acceptable answer.
                                                     wdev 0x1
                                                     addr d8:fc:93:6d:13:61
                                                     type managed channel 36 (5180 MHz), width: 80 MHz, center1: 5210 MHz
                                                     txpower 22.00 dBm
7.
      Width of the frequency
                                     80 MHz
      channel used by your
      device. State the unit.
                                     Screenshot:
                                      enjababe@kuma ~ $ iw dev
                                     phy#0
                                             Interface wlp2s0
                                                    ifindex 4
                                                    wdev 0x1
                                                    addr d8:fc:93:6d:13:61
                                                    type managed channel 36 (5180 MHz), width: 80 MHz, center1: 5210 MHz txpower 22.00 dBm
      Link speed of the Wi-Fi
                                    520Mbps Down / 866.7Mbps Up
8.
      channel used by your
      device. State the unit.
                                     Screenshot:
                                     benjababe@kuma ~ $ iw dev wlp2s0 link
Connected to 88:c3:97:c1:35:0a (on wlp2s0)
                                             SSID: BenjaWrt-5GHz
                                             freq: 5180
                                             RX: 77245 bytes (569 packets)
                                             TX: 63358 bytes (403 packets)
                                             signal: -20 dBm
                                                         520.0 MBit/s VHT-MCS 5 80MHz short GI VHT-NSS 2
866.7 MBit/s VHT-MCS 9 80MHz short GI VHT-NSS 2
9.
      Wi-Fi
                         strength
                                     -20dBm
                signal
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	received by your device. State the unit.	ber	njab	ted SS fr RX TX si	kuma to 88 ID: E eq: 5 : 772 : 633 gnal: bitr	~ \$ iw do 3:c3:97:c1 8enjaWrt-! 1180 '45 bytes 58 bytes -20 dBm rate: 520	(569 (403	Da (on packet packet it/s VH	wlp2s0) s) s) T-MCS 5	80MHz					
10.	State the Wi-Fi standard of the network (e.g. 802.11g, 802.11n, 802.11ac etc). Give a reason for your answer based on your understanding of the various Wi-Fi standards.	RX GI and Re ma	802.11ac. Output from 'iw dev' indicates VHT-MCS index 5 and 9 fo RX and TX respectively at the 80MHz bandwidth, with short (0.4 µs GI and 2 spatial streams and with speeds of 520 and 866.7 Mbps for RX and TX respectively.  Referring to the MCS table here: <a href="https://mcsindex.com/">https://mcsindex.com/</a> , the value match with the speeds provided.  OFDM (Prior 11ax)  OFDM (Prior 11ax)  Spatial Metablica Coding  20MHz  ADMHz  ROMHZ  ROMHZ												
	NB: Stating that it is	нт	VH T	HE	Stream		Coding	0.8µs GI	0.4µs GI	0.8µs GI		<u> </u>	0.4µs GI		
	shown in the app or the	0	0	0	1	BPSK	1/2	6.5	7.2	13.5	15	29.3	32.5		
	router supports a particular	1 2	1	1 2	1	QPSK QPSK	1/2 3/4	13 19.5	14.4 21.7	27 40.5	30 45	58.5 87.8	65 97.5		
		3	3	3	1	16-QAM	1/2	19.5	28.9	40.5 54	60	117	130		
		4	4	4	1	16-QAM	3/4	39	43.3	81	90	175.5	195		
	acceptable answer.	5	5	5	1	64-QAM	2/3	52	57.8	108	120	234	260		
		6	6	6	1	64-QAM	3/4	58.5	65	121.5	135	263.3	292.5		
		7	7 8	7 8	1	64-QAM 256-QAM	5/6 3/4	65 78	72.2 86.7	135 162	150 180	292.5 351	325 390		
			9	9	1	256-QAM	5/6	N/A	N/A	180	200	390	433.3		
				10	1	1024-QAM	3/4								
				11	1	1024-QAM	5/6								
		8	0	0	2	BPSK	1/2	13	14.4	27	30	58.5	65		
		9	1 2	1 2	2	QPSK	1/2 3/4	26 39	28.9	54	60 90	117	130		
		10	3	3	2	QPSK 16-QAM	1/2	52	43.3 57.8	81 108	120	175.5 234	195 260		
		12	4	4	2	16-QAM	3/4	78	86.7	162	180	351	390		
		13	5	5	2	64-QAM	2/3	104	115.6	216	240	468	520		
		14	6	6	2	64-QAM	3/4	117	130	243	270	526.5	585		
		15	7 8	7 8	2	64-QAM 256-QAM	5/6 3/4	130 156	144.4 173.3	270 324	300 360	585 702	650 780		
			9	9	2	256-QAM	5/6	N/A	N/A	360	400	780	866.7		
11.	What does the acronym RSSI stand for in Wi-Fi networks?  Explain what is RSSI.	Stands for Received Signal Strength Indicator.  It is the received signal strength from the Access Point after loss ove the air or antenna. RSSI is measured in dBm and a higher measuremen indicates stronger signal strength which can either mean the device in near the Access Point or there is little noise in the area.										nent			

Legend: One mark each for Items 1 to 5. Two marks each for Items 6 to 9. 3 marks for Item 10 and 4 marks for Item 11.