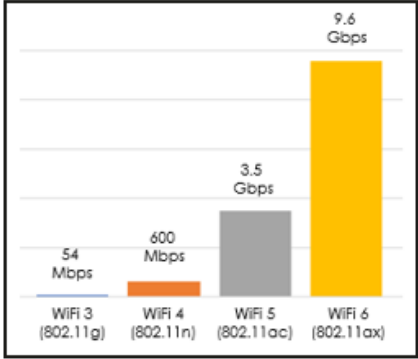
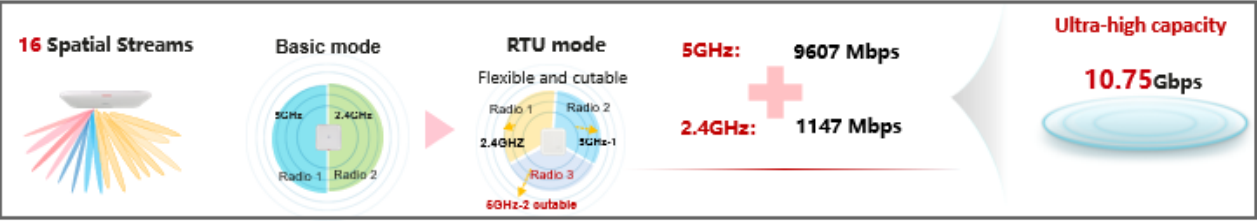
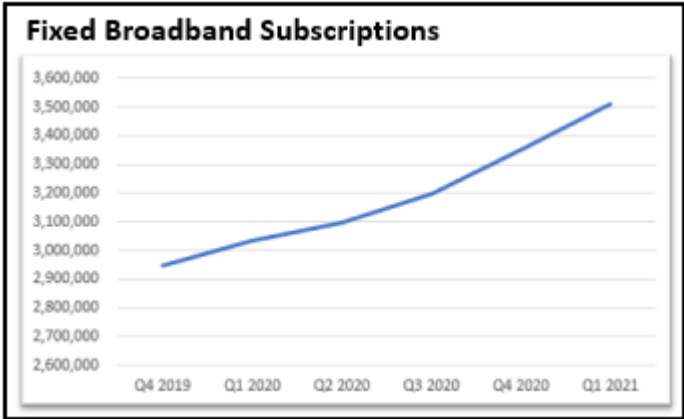
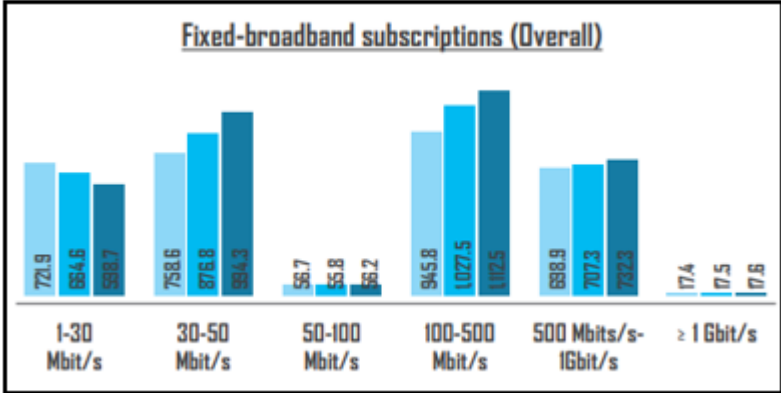


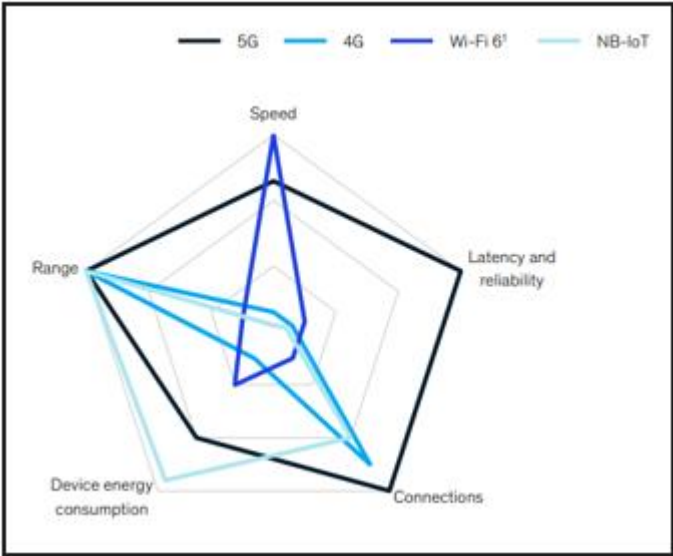
**Celcom’s Response to Public Consultation Paper on Wireless Local Area Network (“WLAN”) in the 6GHz Frequency Band**

Question	Response
<p><b>Question 1</b></p> <p>MCMC seeks your views and comments on the demand for spectrum for Wi-Fi in the 6 GHz frequency band.</p>	<p>In our opinion, there is no urgent demand for spectrum for Wi-Fi in the 6GHz band in Malaysia due to the following justifications:</p> <p>a) Currently, Wi-Fi 6 at 5GHz band can reach 9.6Gbps without the need for additional spectrum:</p>  <p><i>Source: IEEE standard maximum throughput speeds</i></p> <p>b) Wi-Fi 6 operating at existing spectrum bands can provide a capacity of 10.75Gbps through technology advancement including the following:</p> <ul style="list-style-type: none"> <li>• Dynamic frequency assignment</li> <li>• Dynamic bandwidth adjustment</li> <li>• Intelligent roaming load balancing</li> <li>• Smart antenna</li> </ul> <p>From user perspective, Wi-Fi 6 in 5GHz band could deliver similar experience as future Wi-Fi in 6GHz band. As such, there is no urgent need to consider 6GHz band for Wi-Fi in view that Wi-Fi 6 in 5GHz band is able to fulfill the requirement for gigabit access in Malaysia.</p>  <p><i>Source: Huawei</i></p>

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	<p>c) Demand for ultra-high capacity Wi-Fi depends very much on fixed broadband penetration and subscription. According to MCMC’s “Communication and Multimedia: Facts &amp; Figures”, we can see a low yearly increment of approximately 3 to 5% for fixed broadband subscriptions:</p> <div data-bbox="634 358 1312 773" data-label="Figure">  <table border="1"> <caption>Fixed Broadband Subscriptions (Estimated)</caption> <thead> <tr> <th>Quarter</th> <th>Subscriptions</th> </tr> </thead> <tbody> <tr> <td>Q4 2019</td> <td>~2,950,000</td> </tr> <tr> <td>Q1 2020</td> <td>~3,050,000</td> </tr> <tr> <td>Q2 2020</td> <td>~3,100,000</td> </tr> <tr> <td>Q3 2020</td> <td>~3,200,000</td> </tr> <tr> <td>Q4 2020</td> <td>~3,350,000</td> </tr> <tr> <td>Q1 2021</td> <td>~3,500,000</td> </tr> </tbody> </table> </div> <p data-bbox="634 784 1140 808"><i>Source: Derived from aforesaid MCMC's reports</i></p> <p>In addition, we observed that the subscription for fixed broadband package with speed more than 1Gbps in Q1 2021 constitute only 0.5% of overall fixed broadband subscriptions. While we understand the offer of gigabit fixed broadband is still limited, we could imply that the demand is very low due to various reasons.</p> <div data-bbox="634 979 1409 1369" data-label="Figure">  <table border="1"> <caption>Fixed-broadband subscriptions (Overall) - Q1 2021</caption> <thead> <tr> <th>Speed Category</th> <th>Subscriptions</th> </tr> </thead> <tbody> <tr> <td>1-30 Mbit/s</td> <td>721.9</td> </tr> <tr> <td>30-50 Mbit/s</td> <td>875.8</td> </tr> <tr> <td>50-100 Mbit/s</td> <td>56.7</td> </tr> <tr> <td>100-500 Mbit/s</td> <td>1,027.5</td> </tr> <tr> <td>500 Mbits/s-1Gbit/s</td> <td>707.3</td> </tr> <tr> <td>≥ 1Gbit/s</td> <td>17.4</td> </tr> </tbody> </table> </div> <p data-bbox="634 1380 793 1404"><i>Source: MCMC</i></p>	Quarter	Subscriptions	Q4 2019	~2,950,000	Q1 2020	~3,050,000	Q2 2020	~3,100,000	Q3 2020	~3,200,000	Q4 2020	~3,350,000	Q1 2021	~3,500,000	Speed Category	Subscriptions	1-30 Mbit/s	721.9	30-50 Mbit/s	875.8	50-100 Mbit/s	56.7	100-500 Mbit/s	1,027.5	500 Mbits/s-1Gbit/s	707.3	≥ 1Gbit/s	17.4
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	<p>Considering the above circumstances, we opine that there is no urgent demand for spectrum for Wi-Fi in 6GHz band whereby the operation of Wi-Fi in existing spectrum bands (i.e. 2.4GHz and 5GHz) would be able to achieve national aspiration of gigabit access for fixed broadband.</p>												
<p><b>Question 2</b></p> <p>MCMC seeks your views and comments on the emerging technologies utilising the 6 GHz frequency band.</p>	<p>We understand that some countries are considering entire 6GHz band i.e. 5925 - 7125MHz for IMT such as China. We opine that entire 6GHz band should also be considered for IMT in Malaysia in view that there is no urgent demand for additional spectrum for Wi-Fi as stated in our comments for Question 1 above. On the other hand, there is high demand for additional spectrum for IMT/ 5G especially from the mid-band in Malaysia:</p> <ol style="list-style-type: none"> <li>6GHz band offers a good combination of propagation and capacity for cities for 5G connectivity. Larger bandwidth size being made available for 5G would yield more benefits as compared to Wi-Fi.</li> <li>It is expected that Malaysia would have more than 15mil 5G subscribers in coming years, a significant number of connections that demand for additional IMT spectrum.</li> <li>As mentioned in “Estimating the Mid-band Spectrum Needs in the 2025-2030 Time Frame” published by GSMA in July 2021, it is estimated that 5G needs approximately 2GHz of mid-band spectrum over the next decade to deliver on its full potential. To-date, Malaysia has only allocated 200MHz in the mid-band for 5G deployment.</li> </ol> <table border="1" data-bbox="573 862 1346 1000"> <thead> <tr> <th></th> <th>Minimum estimate</th> <th>Maximum estimate</th> </tr> </thead> <tbody> <tr> <td>High income cities</td> <td>1,260 MHz</td> <td>3,690 MHz</td> </tr> <tr> <td>Upper middle income cities</td> <td>1,020 MHz</td> <td>2,870 MHz</td> </tr> <tr> <td>Lower middle income cities</td> <td>1,320 MHz</td> <td>3,260 MHz</td> </tr> </tbody> </table> <p>Source: Coleago</p> <p>We would like to capture several important points highlighted in the aforesaid publication for MCMC’s reference:</p> <ul style="list-style-type: none"> <li>Additional mid-band spectrum before 2030 would enable mobile operators to deliver the ITU-R IMT-2020 requirements, notably the user experienced data rates of 100 Mbit/s and upload data rates of 50 Mbit/s in cities and to deliver smart cities in an economically feasible manner.</li> <li>Using additional mid-band spectrum for 5G FWA would reduce the cost of delivering future-proof fibre-like fixed wireless access services to households and enterprises.</li> <li>In countries where affordability is an issue, the economic implications associated with additional mid-bands are even more apparent. FWA is the fastest growing method of bringing fixed broadband to the unconnected due to the limited availability of copper and fibre broadband.</li> </ul>		Minimum estimate	Maximum estimate	High income cities	1,260 MHz	3,690 MHz	Upper middle income cities	1,020 MHz	2,870 MHz	Lower middle income cities	1,320 MHz	3,260 MHz
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<p data-bbox="163 885 319 912"><b>Question 3</b></p> <p data-bbox="163 951 491 1448">MCMC seeks your views and comments on the frequency range within the 6 GHz frequency band that could be considered for Wi-Fi under the Class Assignment in Malaysia. Should MCMC consider allowing Wi-Fi to operate in the entire 1200 MHz (5925 MHz to 7125 MHz frequency band) or only in the 500 MHz (5925 MHz to 6425 MHz</p>	<p data-bbox="520 885 1913 1081">As stated in our comments for Questions 1 and 2 above, we opine that Malaysia should prioritise the entire 6GHz band (i.e. 5925 - 7125MHz) for licensed IMT/ 5G. A broad contiguous bandwidth in 6GHz band would be able to reduce the need for network densification and make IMT/ 5G connectivity more affordable for all. We believe that Malaysia could benefit from the economy of scale due to similar adoption and deployment by China that may also attract more countries especially from Asia Pacific to support the full 6GHz band for IMT.</p> <p data-bbox="520 1118 1913 1315">In addition, 5G offers many advantages over other wireless technologies including Wi-Fi according to the study conducted by McKinsey &amp; Company as recorded in its publication entitled “The 5G Era: New Horizons for Advanced Electronics and Industrial Companies”. With Ultra Reliable Low Latency Communications (“URLLC”) and Massive Machine Type Communications (“mMTC”), we believe that 5G will provide higher efficiency than Wi-Fi for Industry 4.0 use cases and brings more advantages to the economy of Malaysia.</p>																								

Question	Response																														
frequency band)?	<div data-bbox="575 240 1243 792" data-label="Figure">  <p>The radar chart compares four technologies across five metrics. The legend indicates: 5G (black line), 4G (cyan line), Wi-Fi 6 (blue line), and NB-IoT (light blue line). The metrics are Speed, Latency and reliability, Connections, Device energy consumption, and Range. 5G shows the highest performance in Speed and Range, while NB-IoT shows the lowest performance in Speed and Latency and reliability.</p> <table border="1"> <caption>Relative Performance Comparison (Estimated from Radar Chart)</caption> <thead> <tr> <th>Technology</th> <th>Speed</th> <th>Latency and reliability</th> <th>Connections</th> <th>Device energy consumption</th> <th>Range</th> </tr> </thead> <tbody> <tr> <td>5G</td> <td>High</td> <td>Medium</td> <td>High</td> <td>Medium</td> <td>High</td> </tr> <tr> <td>4G</td> <td>Medium</td> <td>Medium</td> <td>High</td> <td>Medium</td> <td>High</td> </tr> <tr> <td>Wi-Fi 6</td> <td>High</td> <td>Medium</td> <td>Medium</td> <td>Medium</td> <td>Medium</td> </tr> <tr> <td>NB-IoT</td> <td>Low</td> <td>Low</td> <td>Medium</td> <td>High</td> <td>Medium</td> </tr> </tbody> </table> </div> <p data-bbox="575 802 861 828"><i>Source: McKinsey analysis</i></p> <p data-bbox="520 863 1902 993">Nevertheless, in the event MCMC opines that a part of the spectrum (i.e. 5925 - 6425MHz) should be considered for WLAN, it is important to note that unlicensed use may impose constraint on future refarming if Malaysia decided to assign the specified frequency range for licensed use (IMT/ 5G) as it is very challenging to migrate unlicensed devices.</p>	Technology	Speed	Latency and reliability	Connections	Device energy consumption	Range	5G	High	Medium	High	Medium	High	4G	Medium	Medium	High	Medium	High	Wi-Fi 6	High	Medium	Medium	Medium	Medium	NB-IoT	Low	Low	Medium	High	Medium
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Question	Response
<p><b>Question 4</b></p> <p>MCMC seeks your views and comments on:</p> <ul style="list-style-type: none"> <li>i. the coexistence between Wi-Fi and incumbent services (i.e. fixed service and fixed-satellite service); and</li> <li>ii. the potential interference mitigation between these services.</li> </ul>	<p>We do not have any comments.</p>
<p><b>Question 5</b></p> <p>MCMC seeks your views and comments on the potential technical and operational conditions to be imposed if the 6 GHz frequency band is introduced for Wi-Fi under the Class Assignment. Should part of the frequency band be limited to indoor operation? Should standard power devices operating under the Automatic Frequency Coordination (AFC) system be adopted in Malaysia?</p>	<p>As stated in our comments for Questions 1 and 2 above, we opine that Malaysia should prioritise the entire 6GHz band (i.e. 5925 - 7125MHz) for licensed IMT/ 5G. In the event Wi-Fi is allowed to operate in 6GHz band under class assignment, we opine that its operation should be controlled in strict conditions i.e. low power and limited for indoor usage only so that it will not cause problems to incumbent services. In view that there will be no register for devices under Class Assignment, the risk will become significantly higher with future growth of these devices.</p> <p>To our knowledge, there is no successful implementation of AFC globally at the moment. We opine that the consideration on AFC should be taken cautiously in order to protect incumbent services. We opine that a more conservative approach such as power limitation would be a better approach.</p>
<p><b>Question 6</b></p> <p>What other key issues need to be considered in introducing Wi-Fi in the 6 GHz frequency range?</p>	<p>Please refer to our comments stated in Questions 3 and 5 above.</p>