PUBLIC CONSULTATION

NATIONAL 5G TASK FORCE FINDINGS AND RECOMMENDATIONS TO THE GOVERNMENT

Publication date: **14 August 2019**

Closing date for responses: **12.00 noon, 30 August 2019**

PREAMBLE

The National 5G Task Force (Task Force) invites submissions from industry players, interested parties and members of the public on the questions raised and proposals in the National 5G Task Force Public Consultation Paper.

All submissions should include detailed arguments and evidence to support the respondent's views and recommendations including source references. Written submissions should be provided in full to the Task Force, in electronic form using the template provided (see Appendix 2) by 12 noon, 30 August 2019 (Friday) to the email address below:

Email: **5g.publicconsultation@mcmc.gov.my**

Addressed to: The Chairman, National 5G Task Force

In the interest of fostering an informed and robust consultative process, the Task Force in consultation with the Malaysian Communications and Multimedia Commission ("MCMC"), proposes to make submissions received available to interested parties upon request. The Task Force and MCMC also reserves the right to publish extracts or entire submissions received. However, for any party who wishes to make a confidential submission, the information should be provided under a separate cover clearly marked 'CONFIDENTIAL'.

Contents

INTRODUCTION 1
SECTION 1: BUSINESS CASE 4
General Information 4
Technology mapping for proposed 5G use cases 5
Internet of Things 6
Augmented Reality/ Virtual Reality 7
High Definition Camera 9
Oil and Gas (O&G) 10
Connected Vehicle/ Connected Ambulance 12
Digital Healthcare 13
Drone surveillance/ Drone usage 14
Artificial intelligence/ Data Analysis 16
Cloud Services/ Blockchain 17
Retails & Services 19
SECTION 2: SPECTRUM MANAGEMENT AND ALLOCATION 21
Background 21
Priority 1 new spectrum bands for 5G deployment in Malaysia 21
3.5 GHz band (Priority 1 Spectrum) 22
26/28 GHz Band (Priority 1) 25
Priority 2 Bands 27
SECTION 3: INFRASTRUCTURE 30
SECTION 4: REGULATORY 34
a. Ensuring sufficient resources and promoting sustainable investment 34
b. Facilitating timely infrastructure deployment 35
c. Ensuring safe and secure 5G 36
d. Assessing regulatory conditions on 5G use cases 38
APPENDIX 1: LIST OF QUESTIONS 40
APPENDIX 2: TEMPLATE FOR RESPONSE 43

INTRODUCTION

The 5G National Task Force ("Task Force") was established in November 2018 to recommend a holistic strategy for 5G implementation in Malaysia. Its desired outcomes include: -

a. A guide for Malaysia's overall adoption of 5G technology for the benefit of the nation; and
b. Plans that support the NFCP's targets.

The Task Force is expected to provide a comprehensive report on *5G Key Challenges and 5G Nationwide Implementation Plan* by Quarter 4 of 2019.

The Task Force has 4 main working groups looking into the following specific focus areas:-

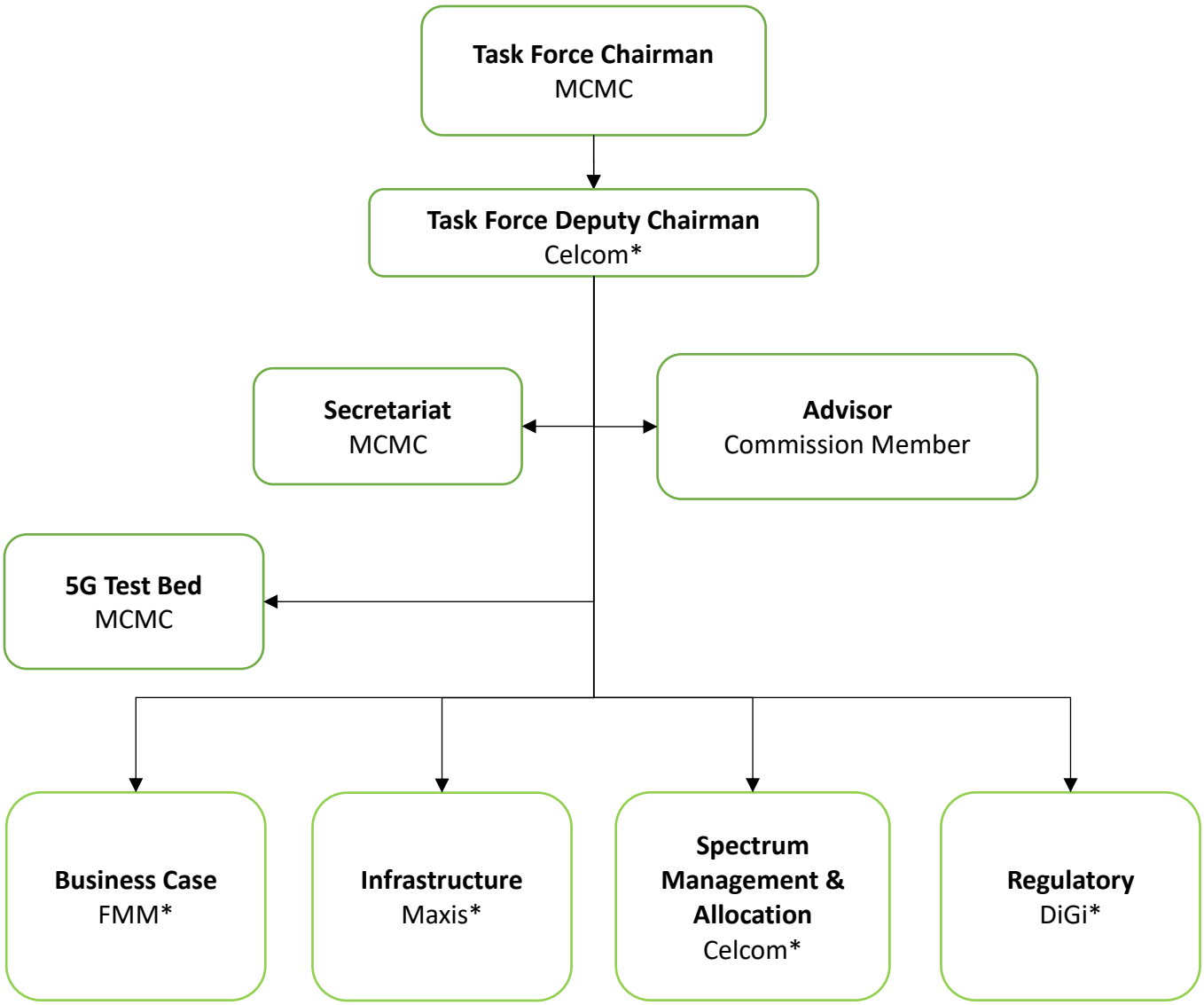
Figure 1: National 5G Task Force Focus

WORKING GROUP	FOCUS AREAS
Business Case (BCWG)	• Economic areas/verticals and benefit to the nation i.e. GDP growth, creation of new jobs, etc.; • User trends, requirements and demand study - industry and general public; and • Proposals to encourage 5G adoption.
Spectrum Management & Allocation (SWG)	• Current progress for spectrum allocation at ITU, APT and Malaysia; • Required bandwidth to support national targets; • Identified spectrum bands for Malaysia; and • Timeline for spectrum allocation.

WORKING GROUP	FOCUS AREAS
Infrastructure (IWG)	• Infrastructure requirements and coverage for optimum 5G deployment for a range of different services; • Gap analysis on current networks to deliver 5G nationwide, including challenges & indications of cost; • Infrastructure planning, approval and addressing right-of-way issues; and • Strategy to deliver 5G coverage to urban and rural areas.
Regulatory (RWG)	• Assess fit-for-purpose regulations to cover the areas below:- a. To ensure sufficient resources and promote sustainable investment; b. To facilitate timely infrastructure deployment; c. To ensure safe and secure 5G; and d. Sectoral regulatory settings needed across the identified use case verticals.

This is a multi-stakeholder Task Force and members include service providers, business associations, communications equipment vendors, academia, ministries, agencies and MCMC. There are 113 participating organisations in the Task Force as at 30 July 2019.

Figure 2: National 5G Task Force Structure



* - Elected by Task Force members

SECTION 1: BUSINESS CASE

General Information

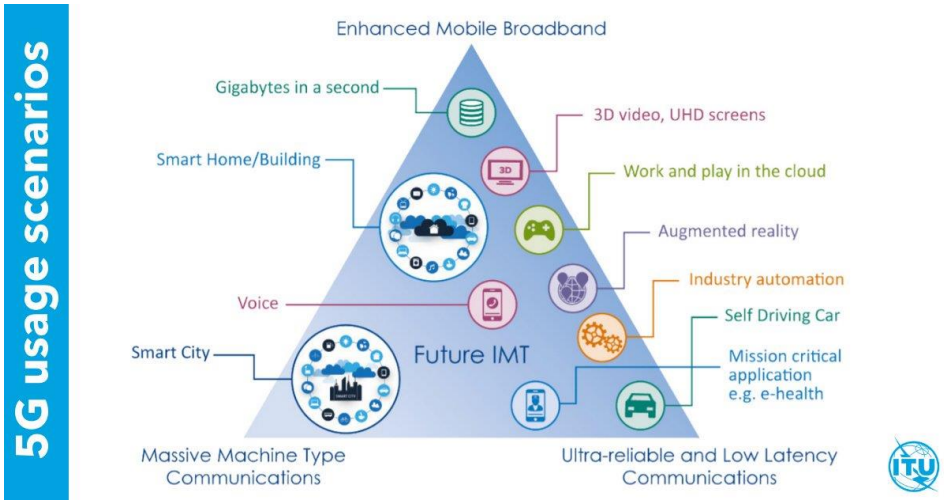
The Task Force set up 9 verticals from various industries and sectors. Overall 6 of these sectors contribute more than 80% of Malaysia's Gross Domestic Product (GDP) today. Additionally, 3 more verticals i.e. Digital Healthcare, Education and Smart City were included to see the impact and the possibilities for further growth in future-oriented sectors.

There are three (3) key new/enhanced capabilities which are to be introduced by 5G as follows:

1. eMBB (Enhanced Mobile Broadband)
2. mMTC (Massive Machine Type Communications)
3. URLLC (Ultra Reliable Low Latency Communications)

These terms and concepts are referred to frequently in the later sections, and are the basis on which 5G use cases are identified.

Figure 3: 5G use cases scenarios



Source: ITU

Question 1:

We seek views on optimizing investment strategies for R&D (Research and Development) as 5G will enable new applications that will transform the way we live, work and engage with our environment.

Technology mapping for proposed 5G use cases

The following section will describe 6 main applications that the BCWG has developed. Indeed, the opportunity for 5G is very wide and huge and therefore not all aspects and details have been considered into the finest details.

Figure 4: 5G use cases mapping

	Power Networks and Energy Savings	IoT/ IoMT Sensors	Ultra-High Definition Camera	RFID/ Indoor location	Tactile Internet	Remote Monitoring & Remote Control	Connected Vehicles/ Connected Ambulance	Drone surveillance/ Drone usage	Artificial Intelligence & Data Analytics	Cloud Services/ Blockchain	Robotics & Automation	Augmented Reality/ Virtual Reality
Agriculture	X	X				X	X	**O**	X		X	X
Banking and Finance		X	X	X					X	**O**		X
Digital Healthcare		X	X		X	X	**O**		**O**			X
Education		X							X	X		**O**
Manufacturing and Process Industries	X	X	X	X	X	X		X	**O**	X	X	X
Oil and Gas	X	X	**O**			X		X	X	X	X	X
Retail and Services	X	X	X	X				X		**O**		X

	Power Networks and Energy Savings	IoT/ IoMT Sensors	Ultra-High Definition Camera	RFID/ Indoor location	Tactile Internet	Remote Monitoring & Remote Control	Connected Vehicles/ Connected Ambulance	Drone surveillance/ Drone usage	Artificial Intelligence & Data Analytics	Cloud Services/ Blockchain	Robotics & Automation	Augmented Reality/ Virtual Reality
Smart City	X	X	**O**	X		X	X	X	X	X		X
Smart Transportation		X				X	**O**	X	X			X

Legend:

X: Potential application

O: High potential application – used as example

About 70 experts and industry leaders have been working on various cases accumulated hundreds of hours of discussion and knowledge sharing. Major 5G Technology providers shared their roadmaps and insights for the upcoming years to enable the teams with their strategy and define the use cases as realistic as possible.

Internet of Things

The Internet of Things (IoT) is the extension of Internet connectivity into physical devices and everyday objects. Embedded with electronics, Internet connectivity and other forms of hardware (such as sensors), these devices can communicate and interact with others over the Internet and they can be remotely monitored and controlled. Two (2) broad types of IoT applications can be identified with very different characteristics:

1. Massive machine-type communications (M-MTC) – Applications of this type are characterised by huge volumes of end-points and connections, using devices and modules for wireless sensor networks. Examples include:

- numerous IoT applications in agriculture such as collecting data on temperature, humidity and soil content;
- seamless integration of various manufacturing devices equipped with identification, processing and networking capabilities; and
- Internet of Medical Things (IoMT) is an application of the IoT for medical and health related purposes including data collection and analysis for research and monitoring.

2. Mission-critical applications – These are machine-to-machine (M2M) applications where high reliability and low latency are essential. Examples include connected cars/ambulances, industrial automation and some applications in health, such as remote surgery.

Question 2:

We seek views on the above recommendation that IoT is fuelling the need for massive connectivity of devices, and also a need for ultra-reliable, ultra-low-latency connectivity over Internet Protocol.

Augmented Reality/ Virtual Reality

Education

Augmented Reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real-world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic and etc. These devices are wirelessly connected and need low latency and high reliability to enable real-time experiences.

Virtual Reality (VR) is a simulated experience that can be similar to or completely different from the real world. Applications of VR can include entertainment (i.e. gaming) and educational purposes (i.e. education and healthcare).

Figure 5: Virtual reality

Source: https://www.viar360.com/education-schools-using-virtual-reality/

In education, students may tour the human body or visit other planets in VR. With AR, they can explore concepts through touch, pinching and zooming through the Earth's layers as fast as they think it. Meanwhile in healthcare, VR therapy has become an innovative way to benefit patients and help them recover from chronic pain or injuries.

Question 3:

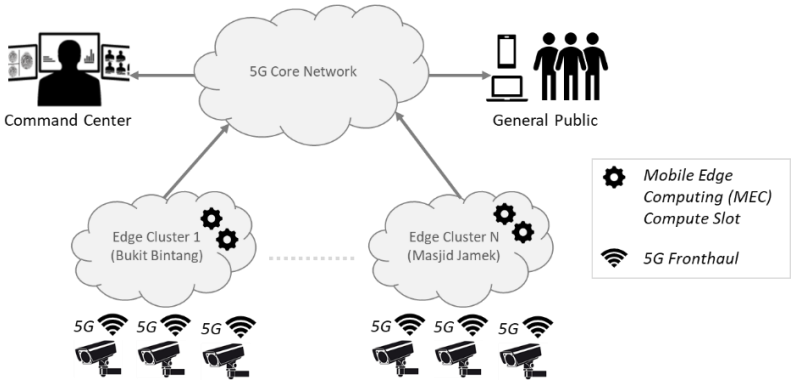
We seek views on the above recommendation that it is important to have a reliable 5G network as this will help AR and VR applications to evolve to the next level.

High Definition Camera

Smart City

Public safety in Malaysia has been an area of concern to policy makers and the public at large, especially in cities like Kuala Lumpur where a large proportion of crime occurs. An effective means to deter crimes in cities is the use of Closed-Circuit Television (CCTV) surveillance. CCTV has been demonstrated to deter crimes from occurring, with up to 40% effectiveness.

Figure 6: Use of closed-circuit television (CCTV) surveillance



Source: MIGHT Info graphics

The recommendation is to deploy a vast number of 5G wireless CCTV cameras to increase the surveillance coverage, thus ensuring greater public safety in Malaysian towns and cities. Besides increased coverage areas, high-definition video streaming enabled by the 5G network can support more advanced features such as face recognition, which could further enhance the authorities' ability to maintain public safety.

The key advantages of such systems are (i) improved coverage areas; (ii) rapid deployment; (iii) high-quality images; and (iv) minimal cost to redeploy CCTVs into new hotspot areas. The proposed approach is a public-private partnership, whereby the private sector (telco or Application Service Providers) will provide the Government with last mile connectivity of CCTVs as a service, via their 5G networks. By leveraging

on telco's 5G infrastructures, the need for the Government to invest into dedicated CCTV networks can be avoided, hence reducing the need for additional capital expenditures and averting the duplication of network infrastructures.

Question 4:

We seek views on the above recommendation to improve public safety in Malaysia's towns and cities, through the deployment of 5G wireless CCTVs to support authorities in ensuring public safety.

Oil and Gas (O&G)

For the Oil and Gas Industry safety at oil and gas facilities is a critical aspect to ensure non-interrupted production at the plant, personnel and asset safety, and curb environmental impact. The adoption of 5G technologies will enable the oil-fields/facilities to improve operational efficiency, enable predictive maintenance programs, optimize workforce and asset. Real time monitoring and data analytics are the major contributing factors to achieve the above objective. One of the enabler to realize the intended target for remote monitoring and control is through deploying automated devices such as IoT sensors, high-definition cameras, drones, head mounted wearables, robots etc.

Figure 7: Drilling platform

Source: https://www.firstrecruitmentgroup.com/candidates/it-candidate-news/what-does-5g-mean-oil-gas-and-engineering-industries-first-recruitment-group#

Installing camera is a way to monitor not only worker safety, it also allows to monitor environmental safety. Especially for oil rigs in the sea, can be an issue for the environmental safety and the marine life as well. However, similar to smart cities, the distance from an oil rig to the coast can be up to 100 km. This makes cabling expensive and limit the amount of installation that are required to optimize the monitoring on an oil rig.

O&G see massive potential for the industry to capitalize in this 5G technology deployment to enhance productivity, system efficiency, operational security and safety and protect the environment.

Question 5:

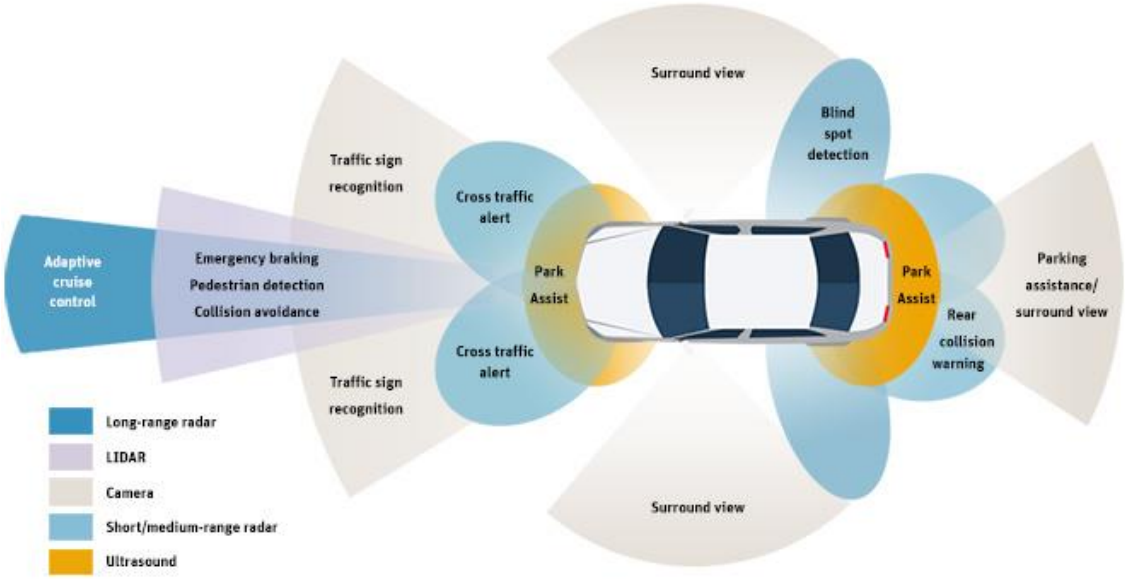
We seek views on the above recommendation, that the adoption of 5G private network will benefit the Oil & Gas industry and the nation thus grant them to operate 5G network independently on their own due to the nature of their business.

Connected Vehicle/ Connected Ambulance

Smart Transportation

Autonomous, Automated and Connected Vehicle (AACV) will usher in a revolution in both safety and fuel efficiency. Addressing first, the safety aspects, a study from McKinsey & Company found the potential for a reduction of up to 90 percent in driving fatalities by using self-driving cars is due to the fact that computers are so much better drivers than error-and-distraction-prone humans. In the U.S. alone, this would equate to about 30,000 lives saved each year and up to $190 billion in annual savings from healthcare costs associated with accidents. This translates to 10 million lives saved globally each decade.

Figure 8: Autonomous vehicle sensors



Source: https://www.ansys.com/blog/optimizing-autonomous-vehicle-adas-radar-systems-virtual-world

By right-sizing each vehicle for each trip, the needless transportation of tons of steel would be dramatically reduced from today's highly wasteful default driving situation. AACV senses their surroundings with techniques such as radar, LIDAR, GPS, odometry, and computer vision. Advanced control systems interpret sensory

information to identify appropriate navigation paths, as well as obstacles and relevant signage.

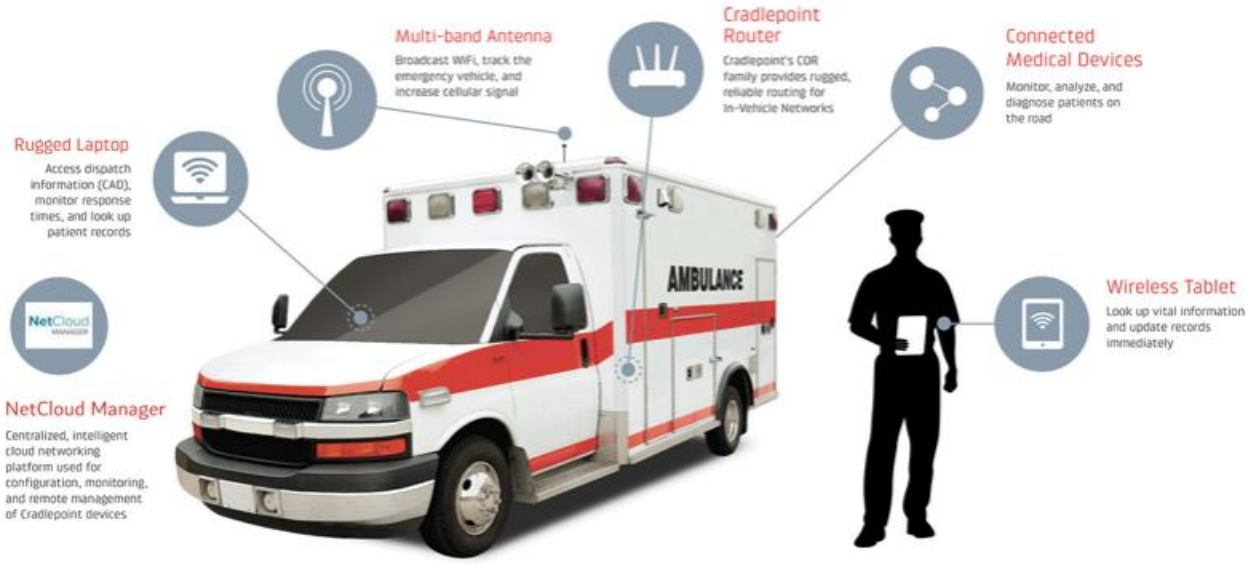
Question 6:

We seek views on the above recommendation, that connected vehicles will increase transportation safety and improve the environmental aspect by leveraging 5G technology for massive machine communication.

Digital Healthcare

5G-connected ambulance is an ambulance that is equipped with multi-technology and advanced communication services that responds to health emergencies.

Figure 9: Connected ambulance



Source: Overview of a 5G-connected ambulance, 5G Barcelona

The ambulance will be using a 5G network that has the following:

- dedicated communication;
- speeds of up to 5Gbps;
- lower latency for communications and sending data; and
- enables network slicing for urgent needs.

The connectivity is used to receive remote real-time High Definition (HD) video while carrying a patient and the ambulance may incorporate vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2i) capabilities to give access to clearer roads to the hospital.

The ambulance will be able to transmit live HD video back to the hospital, enabling clinicians to observe the patient in real-time and to advise the paramedics on treatments to administer, ahead of the patient's arrival at A&E (Accident & Emergency).

Question 7:

We seek views on the above recommendation, that the adoption of 5G-connected ambulance services can improve emergency medical care and probability of better patient outcomes.

Drone surveillance/ Drone usage

Agriculture

Precision farming has become key for achieving high yield and optimised utilization of fertilizer. This will lead in a higher productivity while jobs in the field can be automated. Cameras and IoT sensors are required to define the area of farming as well as protecting the environment from drone collision. A special interest is in the operation from drones with the line of sight. Although sensors have protective

function that drone protect the drone as well as the environment, remote control drones have to be always in sight of the operator. Should there be terrain or the requirement for flying without seeing the drone directly, video streaming is required. Beside the transmission of collect data, such as images and other environmental condition, video stream has to be without delay, as the operator has to navigate instantly.

Figure 10: Use of drone in agriculture sector

Source: https://www.maverickdrone.com/pages/agricultural

For the collected data, as complex algorithm and models are required, the data have to be sent directly and wireless to the data centre. The huge amount would be challenging to store and to process at the drone itself.

Question 8:

We seek views on the above recommendation, that 5G technology will bring a positive impact towards agriculture sector and help to optimize resources.

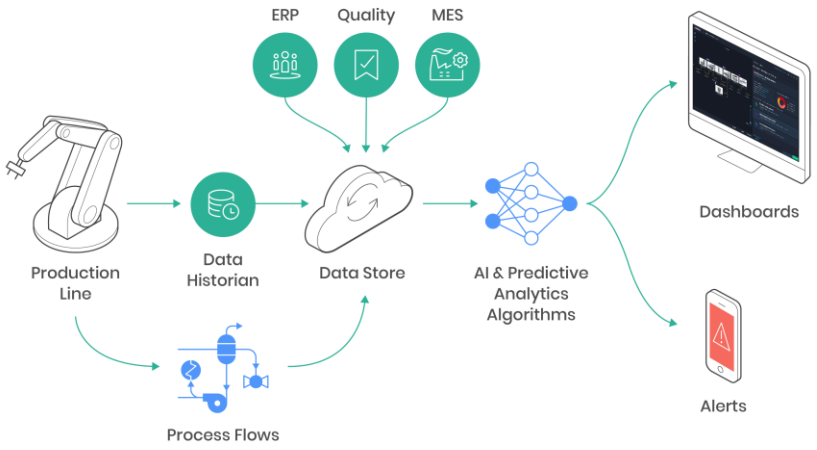
Artificial intelligence/ Data Analysis

Manufacturing

Advances in deep learning have allowed for very complex algorithms being applied in everyday applications. This has been made possible due to the petabytes of data generated by networks and services on the internet and otherwise.

Predictive maintenance is one of the key factors for the manufacturers to optimize their resources. This is including man power, tool, spare parts and material for the whole production environment. IoT sensor becoming more important for machine builder now as it allows wireless communication and over wider distances. As previously mentioned, the data density to do detailed AI driven analyses is extremely high. Giga Bytes of data will be collected from various machines and send for high end server to run complex analytical models. One of the focus points in the industry is the lifetime for tools.

Figure 11: Automations in manufacturing sector



Source: https://www.seebo.com/predictive-maintenance/

Furthermore, processes between machines can be enhanced as machines are communicating with each other. This increases the overall productivity which requires massive machine communication as well as ultra-reliable low latency communication.

Question 9:

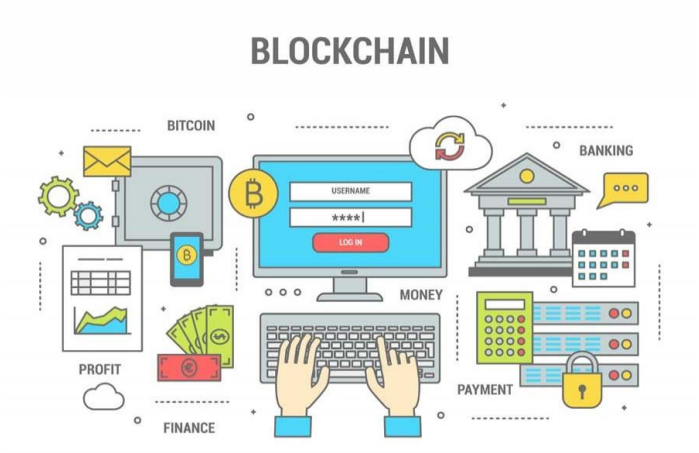
We seek views on the above recommendation that 5G supported AI and Data Analytics will be integrated and embedded into production systems and manufacturing environments to enhance and improve productivity.

Cloud Services/ Blockchain

Banking and Finance

Products and services provided by Banking and Financial sector have been the cornerstone for the country to function properly. They ensure people have access to financial products to save, borrow, invest and protect the individual/corporate from financial loss. The banking and financial sector is also being operated by huge workforces and thus, constant demand in resources is expected. However, the banking and financing sector is exploring more cloud-based services and is increasingly looking at enhancing its digital presence. Today most of the transactions are online, instant and mobile.

Figure 12: Future banking



Source: https://thefinancialexpress.com.bd/views/views/blockchain-technology-and-the-future-of-banking-1519312303

Blockchain will be one of the future technologies to ensure safe and clearly identified transactions between the consumer and the bank. Identification is crucial in the finance sector. Besides having a virtual ID, personal feature recognition is required. Beyond mobile banking, other banking activities such as opening an account that requires to go to the bank today can directly be done online by verifying the person's authenticity via high definition video stream through the smartphone. These more complex solutions require a high bandwidth so that consumers can communicate with their bank in a proper and secured way.

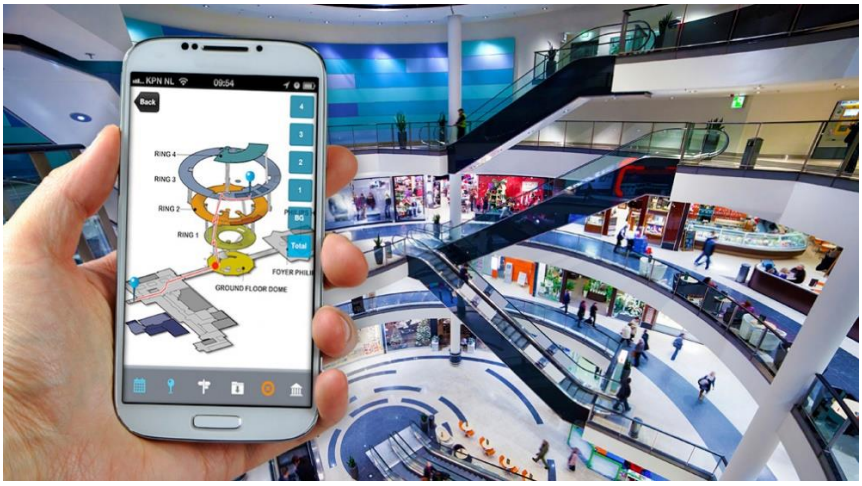
Question 10:

We seek views on the above recommendation, that 5G will enable Malaysians to communicate with their banks in a more secure and proper way.

Retails & Services

Personalised Advertisement in shopping malls use two key features of 5G networks, cloud services and indoor location. Mobile consumers demand relevant advertising. In shopping malls, the ability to deliver accurate location and the right advertisement is crucial in a competitive market. Information such as "store level / floor level" of not just a single venue but an entire market ensures that your message will be received where it is most relevant, and most welcome. Just as "Grab", "Uber" & "Air BnB" is enabled from outdoor location services through GPS, 5G-enabled indoor localisation can enable new services & businesses to consumers.

Figure 13: Indoor location services



Source:
https://www.google.com/search?q=indoor+gps&rlz=1C1CHZL_enMY844MY844&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjjxrC8jebjAhVIuY8KHRMXCGMQ_AUIESgB&biw=1920&bih=937#imgrc=t_EG8qO_R0FU_M:

The advertisement itself that a business wants to send to their customer cannot be a simple text message anymore as customer seeking for more in depth and convincing information. Audio and video advertisement offer a new user experience to the customer of a shopping mall. Therefore, a highly demanded bandwidth is required.

Question 11:

We seek views on the above recommendation that 5G supported personalised advertisement and indoor GPS will enhance user experience.

SECTION 2: SPECTRUM MANAGEMENT AND ALLOCATION

Background

Spectrum are the crucial building block to enable 5G rollout. The success of 5G ambition is heavily relying on appropriate spectrum allocation. Two (2) criteria are used to identify the suitable 5G spectrum allocation:

1. Significant amount of new harmonised spectrum

    a. Near 100 MHz contiguous blocks of spectrum for 5G mid-bands (between 1 GHz to 6 GHz) and around 1 GHz contiguous blocks of spectrum for 5G high-bands (>6 GHz); and
    b. Combination of mid and high-bands to balance coverage and capacity needs.

2. Ecosystem maturity including user devices, and network equipment readiness.

Priority 1 new spectrum bands for 5G deployment in Malaysia

- To meet the national 5G needs, 2 spectrum bands have been identified as the priority 1 spectrum for 5G deployment:

    1. 3.5 GHz band (range of 3.3 GHz to 4.2 GHz); and
    2. 26/28 GHz band (range of 24.25 GHz to 29.5 GHz).

- Band selection is based on global 5G trends (commercial launches) and ecosystem maturity and these bands are:

    1. 3.5 GHz band
        - This mid-band spectrum (<6 GHz) is emerging as the core band for 5G globally due to the technical characteristic that offers an optimal

balance of high capacity (amount of traffic supported) and coverage (the distance of the signal travelled); and

2. 26/28 GHz band
    - Due to the availability of large contiguous bandwidth, these high-band spectrums (>6 GHz) are important to provide extremely high data speeds and ultra-reliable services in 5G.

- The proposed timeline for priority 1 spectrum allocation for 5G are as below:

1. 3.5 GHz band to be allocated for 5G in 1st half of 2021 (to allow for allocation process and coexistence preparation); and

2. 26/28 GHz band to be allocated for 5G in 2nd half of 2021 (to complement C-band network).

Question 12:

a. We seek views on the recommendations on 3.5 GHz and 26/28 GHz as the priority 1 spectrum bands for Malaysia 5G deployment. Are there any other spectrum bands that could be considered as Priority 1?

b. We seek views on the proposed spectrum allocation timeline.

3.5 GHz band (Priority 1 Spectrum)

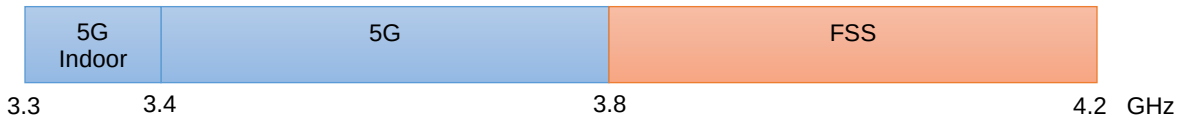
Spectrum Management & Allocation Working Group ("SWG") has conducted a study in the 3.5 GHz band for potential spectrum allocation for 5G. The 3.5 GHz band or popularly known as C-band is heavily utilised for Fixed Satellite Service ("FSS") in Malaysia. The Malaysian satellite operator and other FSS operators currently operate in the 3.4-4.2 GHz band.

Figure 14 illustrates the existing allocation of 3.5 GHz band in Malaysia along with the proposed allocation for 5G. This band is also popularly known as C-Band.

Figure 14: Current usage in 3.5 GHz band

Based on the analysis, an initial total of 100 MHz (limited to indoor use) and 400 MHz (general use) are proposed to be allocated for 5G deployments, with the following arrangement on the C-Band frequencies (Figure 15).

Figure 15: Proposed frequency arrangements for C-Band



a) **3.3 – 3.4 GHz (100 MHz)** – 5G (Indoor use only)
   - **4 blocks x 25 MHz**

b) **3.4 – 3.8 GHz (400 MHz)** – 5G*
   - **4 blocks x 100 MHz**

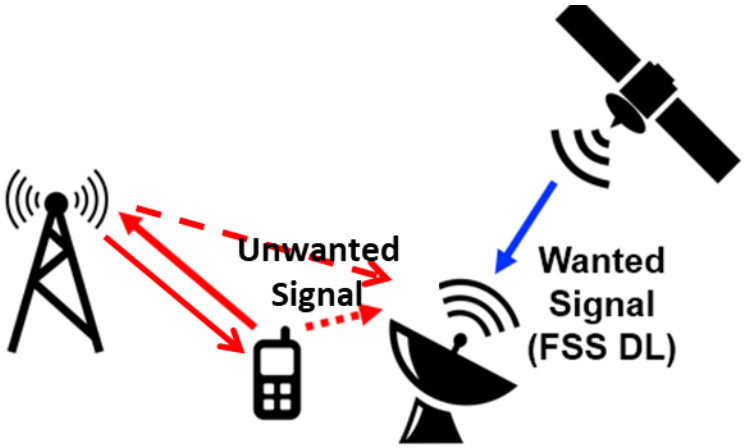
c) **3.8 – 4.2 GHz (400 MHz)** – Satellite*

** Guard band between 5G and fixed-satellite service is needed (The actual amount will be determine when the time comes)*

Due to the technically sensitive nature of FSS operation within the 3.5 GHz system, there are potential for harmful frequency interference being introduced with the proposed allocation of 5G system and FSS system. This frequency interference is due to spectrum bands that are adjacent or overlapping between FSS and 5G system. Figure 16 illustrates this whereby FSS earth stations receiving signals in the 3.5 GHz

band can be interfered by the unwanted signal from 5G base stations and mobile terminals.

Figure 16: Potential Interference Scenario from 5G to FSS



The Task Force is planning to conduct technical studies to assess the feasibility of 5G deployment within the vicinity of FSS system. Among others, this technical study aims to specify the necessary guard band, emission power limits, separation distance, filter specifications, etc. needed to mitigate interference and enable co-existence of the two systems. These techniques are proposed based on global best and existing practices, to be verified by theoretical study and field trial as these techniques would be used as the interference mitigation approach for both local and cross-border scenarios.

Malaysia's close proximity with Brunei, Indonesia, Singapore and Thailand requires Malaysia to ensure cross-border coordination and harmonisation on the use of the proposed spectrum for 5G within 3.4 – 3.8 GHz band.

Question 13:

We seek comments on the recommendation for 3.5 GHz re-assignment and the interference mitigation approach for both local and cross-border scenarios.

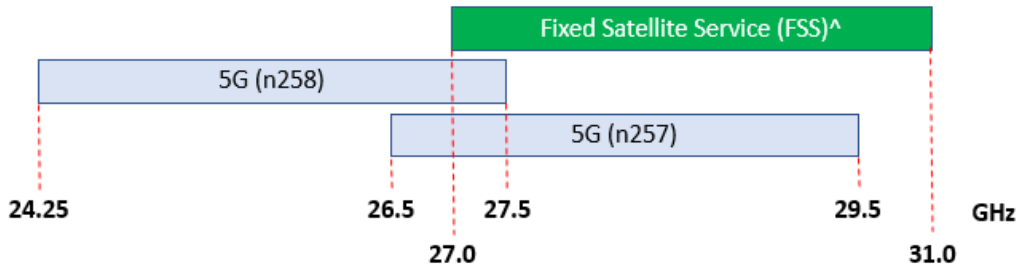
26/28 GHz Band (Priority 1)

The 26/28 GHz band are the spectrum bands being considered internationally for 5G, and ranges from 24.25 - 29.5 GHz. This includes the 26 GHz 3GPP band, n258 (24.25 - 27.5 GHz) and the 28 GHz band, n257 (26.5 GHz to 29.5 GHz).

Although the 26/28 GHz band is not suitable for ubiquitous 5G nationwide coverage and has relatively poor outdoor to indoor penetration, it is more suitable for outdoor hotspot, in-building coverage and fixed wireless access ("FWA") with outdoor customer-premises equipment ("CPE"). The 26/28 GHz is important in the overall 5G ecosystem as it will address specific 5G use case requirements and demands.

In most use cases, the 26/28 GHz band is a complementary "layer" to 3.5 GHz and other lower bands to deliver 5G services. The band is seen to have huge potential due to its characteristics to provide very high capacity, speeds, low latency and easier to manage interference compared to mid band spectrum. The current usage of 26 GHz and 28 GHz bands in Malaysia is depicted in the Figure 17 below.

Figure 17: Existing FSS in the 24.25 GHz to 31 GHz



In view that co-existence between FSS and 5G is possible and 26 GHz is important to enable operators to meet the speed, latency, reliability and capacity requirements of 5G, it is recommended that:

a) **24.25 – 27.0 GHz** frequency range with total of 2.75 GHz bandwidth is recommended to be allocated to 5G with no requirement for exclusion zone for FSS earth station hub. Considering that WRC-19 agenda item 1.13 will be reviewing the outcome of ITU-R studies additional constraints (i.e. to protect Earth Exploration Satellite Services) may be determined after the WRC meeting.

b) **27.0 - 29.5 GHz** frequency range with total of 2.5 GHz bandwidth is recommended to be allocated to 5G with appropriate interference mitigation. 5G base station transmitting in the range of 27.0 to 29.5 GHz will potentially be interfered by the FSS earth stations.

5G networks typically would require large amounts of contiguous spectrum and allocating insufficient spectrum block size may delay geographical deployment and curtail the benefits and innovations that 5G technologies would deliver in Malaysia.

Hence, the 26/28 GHz band could be allocated to 5G with the following bandwidth options:

a) 6 blocks of 400MHz

400 MHz	400 MHz	400 MHz	400 MHz	400 MHz	400 MHz

b) 3 blocks of 800MHz

800 MHz	800 MHz	800 MHz

It is recommended that at least 800 MHz of contiguous spectrum per network for early deployment of 5G as radio products are designed to aggregate that amount of spectrum with sufficient power for optimum 5G performance.

Question 14:

We seek comments on the recommendation for 26/28 GHz allocation for 5G and the approach or each limitation for the spectrum bands.

Priority 2 Bands

The SWG has yet to finalise the study on the Priority 2 spectrum bands and therefore the subsequent views in this section are preliminary.

The SWG is considering all other 5G spectrum bands defined in 3GPP for Priority 2 bands. In shortlisting the extensive list of other bands to a focused list, the SWG considers the following criteria for prioritization:

1. **Priority 2:** Spectrum bands with complete ecosystem supported currently (comprising chipset, network equipment and user devices) shall be prioritised first.

2. **Other spectrum under Radar**: Spectrum bands with in-complete ecosystem supported but with planned readiness (some indication from equipment providers/manufacturers to have the network equipment and user devices made ready) shall be prioritised second.

3. Spectrum bands without any indication of ecosystem readiness are not considered in the Priority 2 plan.

Hence, as a result of the above criteria, SWG is proposing the following bands as priority 2 bands:

Figure 18: Priority 2 bands

Priority	5G NR Spectrum bands	Duplex	DL	UL	Total bandwidth
2	n28	FDD	758MHz – 803MHz	703MHz – 748MHz	2x45
	n79	TDD	4400MHz – 5000MHz		600
	n260	TDD	37.0GHz – 40.0GHz		3000
	n3	FDD	1805MHz – 1880MHz	1710MHz - 1785MHz	2x75
	n38	TDD	2570MHz – 2620MHz		50
Other spectrum under radar	n1	FDD	2110MHz – 2170MHz	1920MHz – 1980MHz	2x60
	n5	FDD	869MHz – 894MHz	824MHz – 849MHz	2x25
	n7	FDD	2620MHz – 2690MHz	2500MHz – 2570MHz	2X70
	n8	FDD	925MHz – 960MHz	880MHz – 915MHz	2x35
	n40	TDD	2300MHz – 2400MHz		100

In terms of timeline, in general SWG believes that the Priority 2 spectrum bands should be made available based on maturity of the ecosystem.

Question 15:

We seek comments on the proposal for priority 2 spectrum bands.

SECTION 3: INFRASTRUCTURE

In order to achieve the higher capacity required for eMBB, 5G networks require:

- allocation of specific bandwidth in the appropriate spectrum bands (as discussed above)
- additional radio sites
- more sophisticated, and often physically larger antennas
- significant fibre backhaul

In turn, the increased spectrum and more sophisticated antennas require more electrical power than previous generations; in some cases, the physical infrastructure supporting antennas must be strengthened to support the additional weight and wind load and the power facilities at each site upgraded to meet the new demands. This drives both initial build cost for 5G and increased operational cost compared with 4G networks.

Although 5G networks may be constructed in numerous ways, the Task Force expects that the most likely decision by Operators will be to deploy 5G networks based on existing 4G sites, and that at launch the most likely mode of operation will be the 'Non Stand Alone' ("NSA") mode in which 5G interworks closely with an existing 4G network to achieve improved coverage area for each 5G site. On this basis, the Task Force estimates that the number of 5G (New Radio in C-band) sites required to cover an area will be similar to but higher than the number of 4G (L1800) sites required to cover the same area. This increase in required site count is sometimes termed 'densification'.

Over time network architectures are likely to evolve from wide area mobility networks toward more advanced configurations including 'Stand Alone' operation and 'Centralised RAN' radio architectures.

Smaller scale deployments or deployments for specific applications (e.g. fixed wireless access) may use alternative approaches.

Question 16:

We seek views on the likely radio deployment models for 5G in Malaysia including the degree of 'densification' to be expected in urban and rural areas.

The Task Force further anticipates that 5G operators will continue to utilize both fibre and microwave to connect their radio sites. The proportion of 5G sites connected by fibre is anticipated to be higher than existing 4G networks and expected to increase over time.

The need for additional sites and increased fiberisation must be supported by appropriate policy and conducive regulations to encourage timely and cost effective deployment of such infrastructure. Further recommendations and questions related to this are outlined below in Section 4 (Regulatory).

Key challenges that 5G network operators will face include:

- Achievement of similar **coverage and quality** compared to the now matured 4G networks without driving excessive cost.
- Acquisition of **additional sites**, including increased use of 'Low Impact' sites, within the frameworks of national, state regulation without incurring excessive costs.
- **Upgrade of existing sites** (power requirements, structural strength, etc.) while continuing to meet aesthetic and other regulatory requirements.
- **Widespread deployment of fibre**, particularly challenges relating to seeking right of way and practical installation / approval processes.
- **Investments** required to upgrade existing networks (active network and passive infrastructure) and incurring increased operational costs (e.g. from additional sites and increased power per site) in support of anticipated (but unproven) increased economic benefit / revenues associated with 5G.

Question 17:

We seek views from the public on whether the list above captures the key challenges to 5G deployment, and proposed solutions. (Note that regulatory and policy interventions to overcome some of these challenges are covered by separate questions in the Regulatory section.)

In urban areas 5G requires a denser network architecture than 4G in order to deliver its best performance. Although a combination of different types of structures will be used to provide coverage, a large proportion of the 5G antennas will be mounted on 'street furniture' (e.g. lamp posts, CCTV poles, advertisement boards, etc.) to facilitate expansion of network coverage using small cells as part of network densification process.

In order to deliver higher capacities to users, a large number of small cells located on street furniture will be deployed. These will be complemented by existing cells located on rooftops, ground based towers (GBT) and in-building systems (IBS), etc.

Questions will arise with regards to the capability of street furniture to accommodate the additional load of 5G antenna and backhaul equipment. Furthermore, as these structures are usually located at common areas, public acceptance to the visual impact from large scale use of street furniture needs to be considered.

Question 18:

We seek views on the suitability of different types of structures to support smooth 5G roll out in Malaysia including the level of street furniture deployment expected.

As with previous cellular network generations, the Task Force expects that 5G network deployment will occur progressively and that the timing of network deployment in specific areas (and for specific purposes) will be driven by perceived market demand. Deployment in some areas will likely be commercially unviable for operators, as has also been the case in previous cellular generations, and Government support may be required to encourage investments. Recommendations and queries on this matter are also covered in the Regulatory section below.

A further change which the Task Force anticipates as part of the 5G evolution is a change in network architectures (both mobile and fixed) which moves some historically 'centralised' resources (such as data storage and cloud computing services as well as some underlying network functions) closer to the 'edge' of the network and so to the end customer. This is expected to enable higher capacity and lower latency in some applications. Such architectures are referred to as 'Mobile Edge Compute' or 'Multi-Access Edge Compute' (MEC) architectures.

Question 19:

We seek views on the likely timing and compelling use cases for Mobile / Multi-Access Edge Compute in Malaysia.

SECTION 4: REGULATORY

The Task Force and MCMC are cognisant that the communications regulatory framework will need to be sufficiently flexible to address the emergence of new technologies and business models. Today, the Communications and Multimedia Act 1998 ("CMA98") is a legislation enacted to provide for and to regulate the converging communications and multimedia industries. Taking forward the 5G requirements, some aspects the CMA98 and sectoral regulatory frameworks need to be updated to take advantage of 5G.

During the Task Force discussion, four policy pillars emerge as the underlying requisite to ensure that the existing regulatory environment is updated or reviewed to ensure that they are fit-for-purpose.

a. Ensuring sufficient resources and promoting sustainable investment

5G network is expected to be different from the legacy networks implemented today in addition to higher capacity requirements on fiber transport to backhaul to support 5G sites. It will have significant impact to investment, it is therefore important that the government policies support sustainable investment over the long-term

- Investment assurance by having optimal spectrum allocation, timely spectrum availability, transparent spectrum assignment and award process, modest spectrum price, and sensible rollout terms, guided by regulatory best practice.

- Government's support to deliver 5G infrastructure deployment in rural areas by way of Universal Service Provision ("USP") funding.

- Incentivizing long-term investment, e.g. tax deductions and rollout incentive programs.

Question 20:

We seek views on the recommendations set out to ensure sufficient resources and to promote sustainable investment. Are there any other important areas that could be considered by the government?

b. Facilitating timely infrastructure deployment

5G is expected to require additional infrastructure in new forms, including smaller cells and more densely located sites particularly in the use of high-band spectrum. Today, the laws and regulations for infrastructure built and approval are imposed at state, territory and local government requirements rather than in a streamlined national way.

The Task Force views that it is important to make it easier to build mobile networks and ensure that planning and approval requirements will not be a barrier to deploy 5G sites and infrastructure. Rapid deployment of 5G will introduce advanced communications to benefit the local community and conversely, hindrance to deployment will hamper adoption of ICT services.

- Amendments to relevant legislation (e.g. Town Country & Planning Act 1976) to fully operationalize the treatment of telecommunications services as public utilities, with simplified approval processes, to facilitate more efficient roll-out.

- Streamline policies concerning infrastructure planning and approval mechanism with coherent adoption by all local governments in order to allow for timely deployment of 5G infrastructure.

- Embedding new infrastructure standards required for 5G in the relevant guidelines for infrastructure planning and implementation.

Coordination and approvals to efficiently and effectively deploy 5G infrastructure will require support from the local governments to alleviate challenges associated with 5G infrastructure deployment. Close engagements with local governments will be critical to facilitate a timely 5G delivery in Malaysia. The Task Force recommends that the government establish a coordination committee comprising senior officials from relevant government departments at federal and states level and private sectors.

Question 21:

We seek views on the recommendations set out to facilitate timely infrastructure deployment noting that 5G is expected to require additional infrastructure in new forms. Are there any other important areas that could be considered?

c. Ensuring safe and secure 5G

As 5G will enable substantial massive-IOT connected devices and evolving nature of services, this increases the cyber security consideration including the ability to detect threats, authenticate users, and practice good operation. 5G provides an opportunity for better security with more enhanced security requirements on the basis of network evolution and adapting learning from earlier technologies.

We recommend leveraging on the expertise of various stakeholders in cyber security, such as National Cyber Security Agency ("NACSA") and Malaysian Technical Standards Forum Berhad ("MTSFB"). As the initial step, we recommend:

- Robust security architecture in 5G networks to be guided by standardised minimum security assessment checklist to be developed by NACSA and MCMC.

- Development of technical codes, supported by MTFSB, to ensure that Malaysia best meets the up-to-date technical standards in relation to 5G security.

Question 22:

We seek views on the recommendations set out to ensure secure 5G implementation. Are there any other important areas that could be considered by the government?

Another important aspect for 5G is to ensure human safety from the radio frequency radiation of 5G networks. Supported by MTFSB, the strict exposure limits for electromagnetic fields has been applied for 2G, 3G and LTE networks in line with the international standards. We recommend the development of technical codes in relation to 5G technology and human exposure to radio frequency electromagnetic wave so that we can best meet the up-to-date technical standards. We also recommend further improvement of public's understanding on 5G and radio frequency to be undertaken jointly by MCMC, Nuclear Agency, MTFSB, Consumer Forum of Malaysia ("CFM") and the mobile operators.

Question 23:

We seek views on the recommendations set out to ensure safe 5G implementation. Are there any other important areas that could be considered by the government?

d. Assessing regulatory conditions on 5G use cases

The use cases for 5G especially across vertical industries are endless. Noting the benefits of 5G in other sectors than telecommunications, it will be important to begin assessing sectoral regulatory settings needed across the identified verticals.

As a starting point, the Ministry of Communications and Multimedia with MCMC and 5G Task Force, initiated a workshop on 27 June 2019 to bring together engagement across the government and industry. The key common recommendations are: -

- Update of current legislation in the relevant sectors to support and promote digitalisation, automation and connectivity – that will be critical for 5G adoptions;

- Consider test bed set-up within selected use cases to allow for regulatory sandbox whereby credible arrangements for these use cases can be tested in a controlled environment and regulatory risks can be fittingly identified and managed with light regulations;

- Development of guidelines and technical codes to fittingly cater for 5G requirements of the identified use cases as initial reference point to support the respective Ministries in updating sectoral policies and regulatory frameworks;

- Monitor privacy and personal data protection requirements; if required a code of practice can be recommended to Personal Data Protection Department ("PDPD"); and

- Consider simplifying the existing requirements imposed on obtaining approvals and permits across multi-agencies settings, for example, the approvals for rollout of drone and IOT implementation

Question 24:

We seek views on the recommendations set out in assessing the sectoral regulatory settings needed across the identified use cases vertical.

APPENDIX 1: LIST OF QUESTIONS

National 5G Task Force Public Consultation

No	Question
Section 1: Business Case	
1	We seek views on optimizing investment strategies for R&D (Research and Development) as 5G will enable new applications that will transform the way we live, work and engage with our environment.
2	We seek views on the above recommendation that IoT is fuelling the need for massive connectivity of devices, and also a need for ultra-reliable, ultra-low-latency connectivity over Internet Protocol.
3	We seek views on the above recommendation that it is important to have a reliable 5G network as this will help AR and VR applications to evolve to the next level.
4	We seek views on the above recommendation to improve public safety in Malaysia's towns and cities, through the deployment of 5G wireless CCTVs to support authorities in ensuring public safety.
5	We seek views on the above recommendation, that the adoption of 5G private network will benefit the Oil & Gas industry and the nation thus grant them to operate 5G network independently on their own due to the nature of their business.
6	We seek views on the above recommendation, that connected vehicles will increase transportation safety and improving the environmental aspect by leveraging 5G technology for massive machine communication.
7	We seek views on the above recommendation, that the adoption of 5G-connected ambulance services can improve emergency medical care and probability of better patient outcomes.

No	Question
8	We seek views on the above recommendation, that 5G technology will bring a positive impact towards agriculture sector and help to optimize resources.
9	We seek views on the above recommendation that 5G supported AI and Data Analytics will be integrated and embedded into production systems and manufacturing environments to enhance and improve productivity.
10	We seek views on the above recommendation, that 5G will enable Malaysians to communicate with their banks in a more secure and proper way.
11	We seek views on the above recommendation that 5G supported personalised advertisement and indoor GPS will enhance user experience.
Section 2: Spectrum Management & Allocation	
12	a. We seek views on the recommendations on 3.5GHz and 26/ 28GHz as the priority 1 spectrum bands for Malaysia 5G deployment. Are there any other spectrum bands that could be considered as Priority 1? b. We seek views on the proposed spectrum allocation timeline
13	We seek comments on the recommendation for 3.5GHz re-assignment and the interference mitigation approach for both local and cross-border scenario
14	We seek comments on the recommendation for 26/ 28GHz allocation for 5G and the approach or each limitation for the spectrum bands
15	We seek comments on the proposal for priority 2 spectrum bands
Section 3: Infrastructure	
16	We seek views on the likely radio deployment models for 5G in Malaysia including the degree of 'densification' to be expected in urban and rural areas.

No	Question
17	We seek views from the public on whether the list above captures the key challenges to 5G deployment, and proposed solutions. (Note that regulatory and policy interventions to overcome some of these challenges are covered by separate questions in the Regulatory section.)
18	We seek views on the suitability of different types of structures to support smooth 5G roll out in Malaysia including the level of street furniture deployment expected.
19	We seek views on the likely timing and compelling use cases for Mobile / Multi-Access Edge Compute in Malaysia.
Section 4: Regulatory	
20	We seek views on the recommendations set out to ensure sufficient resources and to promote sustainable investment. Are there any other important areas that could be considered by the government?
21	We seek views on the recommendations set out to facilitate timely infrastructure deployment noting that 5G is expected to require additional infrastructure in new forms. Are there any other important areas that could be considered?
22	We seek views on the recommendations set out to ensure secure 5G implementation. Are there any other important areas that could be considered by the government?
23	We seek views on the recommendations set out to ensure safe 5G implementation. Are there any other important areas that could be considered by the government?
24	We seek views on the recommendations set out in assessing the sectoral regulatory settings needed across the identified use cases vertical.

APPENDIX 2: TEMPLATE FOR RESPONSE

National 5G Task Force Public Consultation

The Task Force and MCMC invites written comments from the industry players, interested parties and members of the public on the proposed recommendations in this PC document.

The format of response shall observe the below.

Section A: Respondent Information

Name of Company	[To be filled]
Contact person Name	[To be filled]
Designation	[To be filled]
Contact number	[To be filled]
Email	[To be filled]

Section B: Respondent Comment (Please insert additional row if necessary).

The consultation paper comprises of four key sections, namely Business Case, Infrastructure, Spectrum Management & Allocation and Regulatory. The responses for each of section shall be clearly marked as 'SPECTRUM MANAGEMENT & ALLOCATION', or 'BUSINESS CASE' etc., in addition the response shall be provided as per the template below.

No	**Question**	**Comment and Proposed Recommendations (if any)**
Section 1: Business Case		
1.	Question 1	[To be filled]

2.	Question 2	[To be filled]
3.	Question 3	[To be filled]
4.	Question 4	[To be filled]
5.	Question 5	[To be filled]
6.	Question 6	[To be filled]
x.	Question x	[To be filled]