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Attention:
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28 January 2019

**Draft IMT roadmap 2018**

Dear Mr. Makgotlho,

Huawei would like to thank ICASA for the opportunity to comment on the draft IMT Roadmap 2018, published in the Government Gazette #42021 of 9th November 2018.

Huawei is the leading supplier of infrastructure equipment for the telecommunications industry in South Africa and globally, as well as a major manufacturer of mobile handsets and other electronic consumer goods.

Huawei would like to submit the comments below for your consideration. Please do not hesitate to contact us if you have any question.

Yours sincerely,

César Gutiérrez

**Comments from Huawei on ICASA´s Draft IMT roadmap 2018**

Huawei fully supports ICASA efforts in the regulatory process of enabling further spectrum for access by IMT services. We provide below comments on South Africa broadband policy, on the overall framework of spectrum for IMT, and on a few specific spectrum topics.

# 1 South Africa Connect

ICASA introduces the South Africa Connect policy in section 5.3, with a list of key success factors at the end of that section. In our view, a factor that is missing in ICASA´s assessment is the affordability of handsets. Unfortunately, South Africa and other African countries do not do not have the ability drive the handset eco-system. This should be taken into account when deciding on bands for IMT. Huawei thinks that ICASA should select the bands with most mature eco-system in order to maximize the social and economic benefits.

Section 9.4 provides indication of possible coverage obligations in different bands. This is a difficult topic and we recognize that ICASA will need to balance goals of the government´s broadband policy with the realities of the cost of network deployment. We wish to comment on the specific point of the 450 MHz obligation. Whilst the 450 MHz band has a huge advantage in terms of coverage range, it is not as well supported in the handsets as other bands. We think this is likely to remain the case in the middle term. Therefore, a coverage obligation based on this band is unlikely to have the same benefits for society as one in higher frequency bands (700 MHz or 800 MHz). In our view, the coverage obligation should be linked to handset penetration, otherwise it would not generate value. Alternatively, an operator should be allowed to fulfil the obligation using any of the bands that it holds.

# 2 Spectrum for mobile private networks

While we note that the focus of the draft roadmap is on IMT we would like to highlight to the authority the need for a holistic approach to encompass the requirements for non-commercial users of spectrum. The paradigm shift from the voice centric services to multiservice platform also applies to mission critical services in the vertical industry. These include among others the Public Protection and Disaster Response (PPDR), Rail and Mining.

## 2.1 PPDR

The diversity and every increasing scope of the public safety challenges (traffic management, boarder management, disaster management (fire, floods), criminal activities

(drugs, theft etc.)), as well as the data needs of the advanced applications that are required to address these challenges mean that the dedicated existing mission critical voice centric networks would not be capable to carry the services. None of these challenges is an exclusive mandate of one entity, thus the diverse PPDR Stakeholders – Police (SAPS and Metro Police), Emergency rescuers (firefighters and medical rescue), defence (Navy, Army and Air force) – must have effective collaboration with real-time exchange of mission critical data, video and voice in order to mitigate and respond to incidences effectively.

Globally there have been initiatives to ensure that the broadband spectrum is allocated to PPDR mission critical networks. The WRC-15 recognized the continued need of narrow band public safety wireless and the complimentary role of mobile broadband, and resolved to harmonize the 694-894 MHZ band as a global frequency range for public safety mobile broadband. We recommend to ensure coexistence of PPDR systems and the IMT700. Some countries such as US (band 28) and Korea (band14) have already deployed in this band after allocating 2x10 MHz spectrum for broadband PPDR. We recommend ICASA to give careful consideration to a band within the globally identified spectrum, as this brings obvious benefits in terms of the product ecosystem.

In addition, this would assists in ensuring the enhancement of safety and security of the country as well as significant cost savings from socio economic benefits (Grous, 2013). The figure below, based on the UK case study, summaries potential savings from allocating 2x10 MHz spectrum in 700 MHz to public safety.

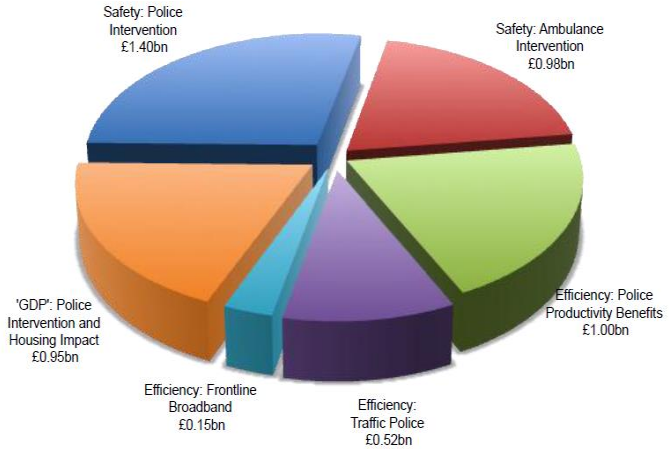



Figure 1: Socioeconomic Value of Mission Critical Mobile Applications for Public Safety in the UK1

[1] Source: Dr Alexander Grous, London School of Economics: “Socioeconomic Value of Mission Critical Mobile Applications for Public Safety in the UK: 2x10MHz in 700MHz” 2013

### 2.2 Other verticals such as Rail, Mining and Utilities

Evolved requirements and applications for these industries are inevitable, for example the mining sector is faced by diverse challenges that include, among others, new mining regulations that mandate collision detection, fatigue detection tracking and location, as well as automation of some of operations, in particular in high risk areas, and security of the minerals.

Similarly, the need for universal and affordable broadband access in South Africa´s rail is driven by the service requirements and coverage distances. Real time mobile broadband applications are driven by security and safety operational requirements .The critical services in rail environment require a dedicated network to cover the entire rail network. Wide geographical coverage within national rail operators in South Africa would be facilitated with lower spectrum bands. They would also need the leverage from the ecosystem of public mobile networks to reduce equipment cost, in the same way GSM-R built on the public GSM.

Mining, transport (rail) and utilities have operations that are mostly localized. As a result, the spectrum may appear inefficiently used. However they do have critical operations that rely on private networks and they are spectrum efficient. Our recommendation is that the IMT 450 band is shared with verticals.

## 3 Spectrum requirements across multiple layers

To address diversified requirements from IMT and in particular the envisioned IMT2020 usage scenarios, IMT needs access to "high", "medium" and "low" frequencies (Figure 2), exploiting specific characteristics of different portions of the spectrum: frequencies between 2 and 6 GHz (e.g. 3300-3800 MHz, TDD 2500-2690 MHz and TDD 2300-2400 MHz) in combination with frequencies below 2 GHz (e.g. 700 MHz) and above 6 GHz (e.g. 24.25-29.5 and 37-43.5 GHz). A sufficient amount of harmonized spectrum in each layer should be made available in a timely manner to enable mobile operators to deliver 5G services.


Figure 2: Multi-layer frequencies approach for 5G usage scenarios

Bands below 6 GHz are crucial to support most IMT2020 use scenarios in a wide-area. The 3300-3800 MHz, TDD 2500-2690 MHz and TDD 2300-2400 MHz frequency ranges are suitable to deliver the best compromise between wide-area coverage and good capacity. For the early deployment of IMT2020, it is recommended that each network gets an 80-100 MHz contiguous spectrum block in these frequency ranges in order to support user experienced data rate of 100 Mbps anywhere anytime and other IMT2020 technical requirements.

Low frequencies (below 2 GHz) will continue to be essential to extend the IMT mobile broadband experience to wide areas and in deep indoor environments. The mMTC and URLLC usage scenarios will also greatly benefit from the low frequencies' extended coverage. Low frequency mobile bands (e.g. 700, 800, 900, 1800 and 2100 MHz) may be exploited for LTE/NR uplink spectrum sharing in combination with NR on the medium frequencies to allow operators to ensure faster and cost-effective deployment.

High frequencies (above 6 GHz) will prove indispensable for providing additional capacity and delivering the extremely high data rates required by some IMT2020 eMBB applications. 800 MHz per network of contiguous spectrum bandwidth from high frequencies is recommended for the deployment of 5G.

The assignment of contiguous wide spectrum bandwidth in each layer reduces system complexity associated with carrier aggregation, which will improve energy efficiency and reduce network cost.

## 4 LTE TDD take-up

Huawei would like to provide ICASA with an update on the status of TDD-LTE deployments globally (section 5.7 in the draft roadmap). According to the latest GSA report[2],

- There are 147 TDD-based LTE networks in operation worldwide
- 219 operators that are investing in TD-LTE networks
- 207 operators in total hold licences to use TDD spectrum for LTE services
- 147 operators in 73 countries have launched TD-LTE networks
- A further 72 operators are either trialling, hold licences to use TDD spectrum, or are actively deploying TD-LTE networks
- Operators are investing in TD-LTE in some form or another in 87 countries

The figure below, from the GSA, shows TDD licences and launches as of November 2018:

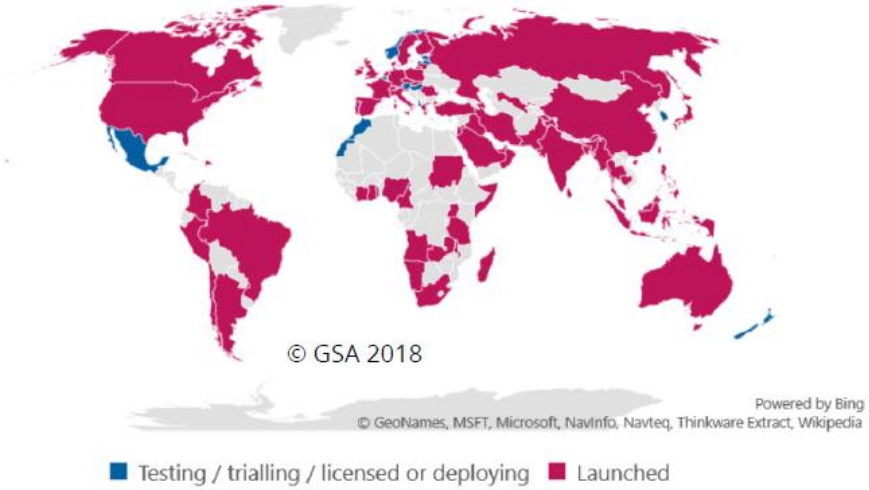



Figure 3: TDD licences and launches (source: GSA)

## 5 1427 – 1518 MHz (L band)

The L band can be seen as the combination of three blocks: 1452-1492 MHz (the core L band), 1427-1452 MHz and 1492-1518 MHz (both identified as the extended L band). The band has been specified by 3GPP under various bandplans (TDD, FDD and SDL, suplementary downlink) for both LTE and 5G NR. The band is harmonised for SDL in Europe. Networks have been deployed in Europe in the core L band for SDL use. The CITEL, APT and ASMG regions are considering which bandplan to use

Huawei considers the L band as an important band for IMT. It provides a good trade-off between coverage and capacity, sine 90 MHz could potentially be available. Our recommendation for South Africa is to release the core L band block, which we understand

[2] https://gsacom.com/paper/td-lte-snapshot-november-2018/

is unused currently, in the middle term. We recommend a SDL bandplan as means to add downlink capacity to existing networks, and technology neutrality so that users can seamless migrate to 5G NR in the future.

# 6 2500-2690 MHz and 2300-2400 MHz

## 6.1 2500-2690 MHz

The ITU identified the medium frequency spectrum 2500-2690 MHz as a global band for IMT and it was formally included in the Radio Regulations in accordance with Resolution 223 (Rev.WRC-15). Importantly, this frequency band is available globally across all three ITU regions. Three 3GPP-defined LTE spectrum bands sit within this frequency range:

- Band 7 is an FDD band with separate DL and UL spectrum blocks at 2500–2570 MHz and 2620–2690 MHz.
- Band 38 is a TDD block sitting between the Band 7 ranges, running from 2570 to 2620 MHz.
- Band 41 uses the entire block of spectrum for TDD services, running from 2500 to 2690 MHz.

Band 7 and band 38 align with frequency arrangement C1 in ITU-R recommendation M.1026, whereas Band 41 aligns with frequency arrangement C3 in the same recommendation.

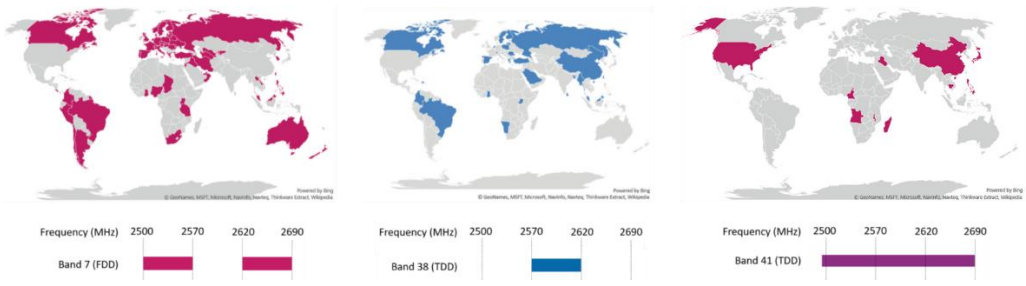



Figure 4: 3GPP LTE spectrum bands in the 2600MHz and countries with launched LTE networks of each band (source: GSA)

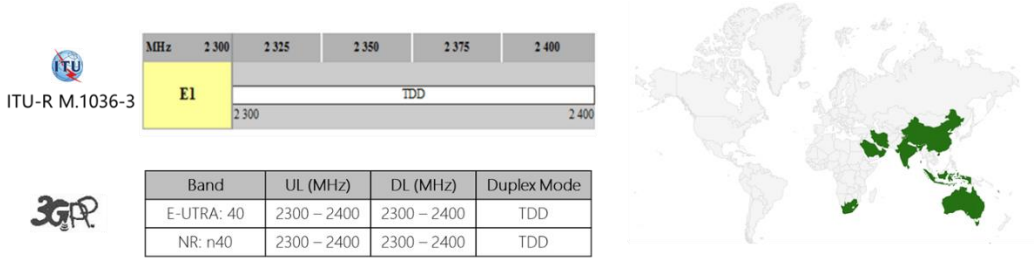
Driven by China, Japan, India and the United States, TDD 2600 MHz (Band 41) is now harmonised globally. The use of the LTE Band 41 unpaired configuration gives significant benefits over employing the hybrid LTE Bands 7/38 configuration:

- Advantages in dealing with traffic asymmetry
- Provides more capacity and increased efficiency
- Comparable network coverage

- Avoids inter-band interference
- Simplified network operation
- Key global roaming band
- Typically lower spectrum cost for TDD spectrum
- Easier to transition LTE Band 41 to 5G NR

## 6.2 2300-2400 MHz

The 2300-2400 MHz band was identified for IMT in WRC-07 (footnote RR 5.384A). It is also known as 3GPP Band 40. It is the eighth most popular band used by public mobile operators for LTE network deployments, and is globally deployed due to the wide availability of spectrum. The short propagation range permits deployment dense coverage for maximum capacity. Many countries have existing regulatory framework for this band and mobile carriers have flexibility to deploy LTE using it as a single band or as part of a multi-band network, with reportedly over 40 commercial networks (April 2018).




| Band | UL (MHz) | DL (MHz) | Duplex Mode |
|---|---|---|---|
| E-UTRA: 40 | 2300 – 2400 | 2300 – 2400 | TDD |
| NR: n40 | 2300 – 2400 | 2300 – 2400 | TDD |

Figure 5: Identification of 2300-2400 MHz frequency band in IMT/3GPP and Countries that use LTE Band 40 (Source: ITU & Huawei)

One of the most important technical requirements towards 5G technology is to maximize spectrum efficiency. With the utilization of TDD technology providing significant advantages with respect to spectrum efficiency, network performance and capacity – TDD technology offers a viable evolution path from 4G towards 5G networks and services. So the bands of TDD 2300 and TDD 2600 MHz are also included in 3GPP 5G NR Rel-15, renamed as n40/n41.

Huawei recommends a TDD bandplan for the 2500-2690 MHz and 2300-2400 MHz bands as it provides not only large contiguous spectrum blocks (290 MHz in total) for the countries with insufficient C-band spectrum but also a good trade off between coverage and capacity.

# 7 3300-3600 MHz

## 7.1 3300-3400 MHz

3300-3400 MHz was identified for IMT at WRC15 by many African countries and a few countries from other regions, notably India. Use of the band for IMT is an African aspiration, and Huawei has collaborated with the African administrations since WRC15 to make this a reality in particular providing support in 3GPP and in ITU.

ITU WP5D started studies after WRC15 on the compatibility of IMT systems with radar systems operating in the 3300-3400 MHz band and below 3400 MHz. It is expected that these studies will conclude this year, and it is likely that an ITU Recommendation will be produced as a result. Huawei and several African administrations, including South Africa, have been very active in this work as reported in ICASA´s draft roadmap.

Huawei understands that the South Africa government currently operates Defence radars in the 3300-3400 MHz block. Taking the results from the WP5D studies into consideration, it appears that coexistence of IMT and radar in the same band will require significant separation distances in most scenarios. On the other hand, adjacent channel coexistence appears feasible. Huawei therefore recommends ICASA to engage discussions with the government to study the feasibility of tuning the current radars to a band below 3300 MHz, or alternatively relocating the radars to low population areas.

## 7.2 TDD bandplan

Huawei supports a TDD bandplan for the 3300-3600 MHz under consideration in the IMT roadmap. TDD is globally agreed as the best approach for IMT2020 in this band. The key advantages over an FDD duplex are the UL/DL traffic asymmetry and the ability to exploit channel reciprocity for effective implementation of massive MIMO and beamforming.

ICASA identifies desensitisation of receivers in case of transmission in neighbouring blocks as risk in bands with a TDD bandplan (section 5.7.3 of the draft roadmap). Huawei´s view is that networks operating in the above frequency ranges should be synchronised to avoid this problem. Network synchronisation means that, at any given time, two networks in adjacent frequency blocks will both transmit in the uplink, or both transmit in the downlink. If networks are not synchronised, stringent out of block emissions or guardbands (or a combination of both) will be needed to protect the receivers in the adjacent channel. On the other hand, synchronisation requires that all licensees in the same band should use:

- A common phase clock reference (e.g. UTC)

- A compatible frame structure to avoid simultaneous UL / DL transmission. This requires to determine a specific DL / UL transmission ratio and frame length. If licensees in the band use different technologies (such as LTE and 5G NR), it may still be possible to have a compatible frame but there may be costs in terms of flexibility, latency or performance.

Unsynchronised operation may be possible in certain scenarios. ECC Report 296[3] provides detailed assessment of the unsynchronised scenarios and guidance for implementing a national synchronisation regulatory framework.

Huawei suggests ICASA to establish a single synchronisation framework for the 3300-3600 MHz band, instead of splitting the band in two blocks: one that prioritises downlink traffic and another that prioritises uplink traffic. In our view the most important use of the band will be eMBB services, which are strongly downlink biased. Furthermore, a split in two blocks will require a guardband, which is likely to be larger than the 5 MHz estimated by ICASA. Secondly, we recommend that ICASA defines a "general framework" for synchronisation in the band. This framework would establish:

- The technical parameters for synch operation notably the frame structure
- The scope of synch and unsynch operation in terms of geographical areas and type of cells

The licensees would reach agreement on remaining details starting from the "general framework". The definition and agreement with stakeholders of such general framework before the migration and potential award would lead to greater market certainty.

## 7.3 Managed spectrum parks

Huawei does not support the introduction of managed spectrum parks in the 3400-3600 MHz. We think that is band is key for the introduction of 5G services in South Africa by the country MNOs. Availability of large blocks will be a key driver for this, and hence all spectrum in the band should be dedicated to 5G provision by MNOs and no block should be set aside for experimentation.

[3] ECC Report 296: National synchronisation regulatory framework options in 3400-3800 MHz: a toolbox for coexistence of MFCNs in synchronised, unsynchronised and semi-synchronised operation in 3400-3800 MHz

### 7.4 5G NR coverage aspects in the 3500 MHz band

ICASA rightly identifies the uplink as the bottleneck in TDD systems operating in the 3300-3600 MHz band (section 5.7.4 of the draft roadmap). On a typical scenario, the uplink budget is 10-15 dB worse than that of the downlink. This means that to achieve ubiquitous coverage using the 3300-3600 MHz band only, approximately twice the number of cell sites of an 1800 MHz LTE network need to be deployed. The best solution to this problem is the Supplementary Uplink functionality specified by 3GPP for 5G NR. This functionality allows to use resources in a lower frequency band, such as 1800 MHz or 2100 MHz, to provide the uplink connectivity for devices that are far from the base station. These devices will still get the downlink connectivity in 3300-3600 MHz, and hence benefit from the high data rates that can be achieved in this band. The figure below illustrates this concept.

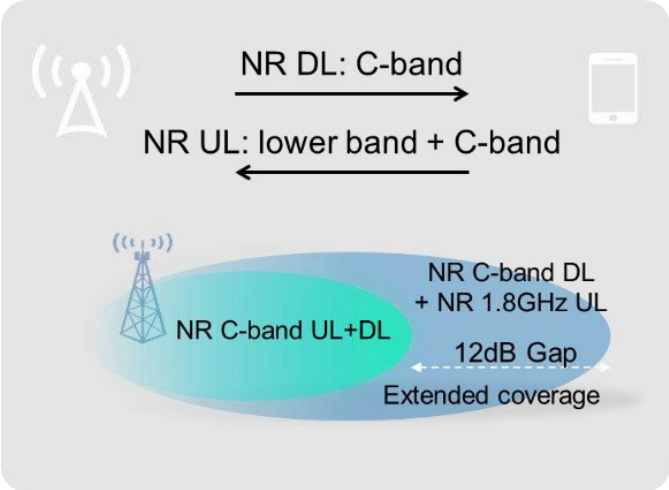



Figure 6: 3GPP supplementary uplink feature

## 8 1700 – 2290 MHz

ICASA presents in Figure 14 of the draft roadmap a proposal for extension of the IMT2100 band. We bring to the attention of ICASA that 3GPP has already standardised the extended IMT2100 band as LTE Band 65 (1920 – 2010 MHz UL paired with 2110 – 2200 MHz DL). We understand that Korea has plans to open this band for IMT. We consider it could be an interesting option for South Africa in the longer term.

## 9 Bands under consideration of WRC19 Agenda Item 1.13

Huawei supports the identification of new spectrum globally for IMT (5G NR) under WRC-19 agenda item 1.13. Huawei strongly supports and promotes with highest priority the

24.25 – 27.5 GHz and 37.0 – 43.5 GHz frequency ranges for an identification for IMT at WRC-19 agenda item 1.13.

Spectrum within these two ranges provides the opportunity for very high data rates for indoor and outdoor hot-spot deployments. A number of administrations are considering licencing spectrum within these ranges by 2020 while some countries have already done so. 3GPP has specified several bands from these ranges within Rel-15 and products and ecosystems supporting different portions of these frequency ranges will be available from 2018. So these two ranges are expected to be the early 5G mmWave bands globally.

Huawei does not support identification of 31.8-33.4 GHz for IMT and agrees NOC as the only method as defined in CPM text. The band is preferred for general backhaul solutions under the Fixed Service (FS) allocation and has challenges from sharing with incumbent services.

Huawei supports consideration at WRC-19 of an identification for IMT in the ranges 45.5-50.2 GHz and 50.4-52.6 GHz. The range 47.2-48.2 GHz is already allowed for fixed and mobile applications and is anticipated to be used for 5G NR in the USA which will stimulate market demand in other countries and regions. We recognise that there may be challenges due to the passive services on both sides of the band 50.4-52.6 GHz and its limited size.

Huawei supports IMT identification for the 66-71 GHz range. This range is important for 5G NR to enable high data rate and low latency communications and applications. This range is available for unlicensed use in North America (USA and Canada) in the context of making additional spectrum available for mobile use. This range is also being studied for unlicensed use in Europe. Other countries are considering licensing schemes but have not made any decisions yet. In any event, identification to IMT would facilitate harmonisation and increase regulatory clarity for IMT. Identification also gives the option to some countries to adopt licensing schemes for IMT and thereby allowing deployments with high transmit (Tx) powers, better interference control, etc., that may not be possible under a unlicensed scheme. We note however that licensing is a national issue and not under discussion within the frame of the WRC-19, the ITU Radio Regulations or WRC Resolutions.

Huawei considers that the studies in ITU TG5/1 show that it is possible to share the 71-76 GHz and 81-86 GHz bands (the E-band) between IMT and the incumbent services. Huawei considers the E-band is a key band for mobile backhaul, in particular for future deployments

of 4G and 5G, and that introduction of IMT-2020 should be made in a way that ensures continued access and protection of the fixed service.