

# **Keysight Technologies**

## **Submission to IMDA's Second Consultation On 5G Mobile Services and Networks**

FOR THE ATTENTION OF :  
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## Executive Summary

Keysight Technologies appreciates the opportunity to contribute towards the 5G development in Singapore and we hereby submit our comments to the Infocomm Media Development Authority's 2nd consultation paper on 5G mobile services and networks.

Keysight Technologies a global leader in wireless network testing technology, develops, manufactures and markets network testing solutions for wireless network operators, infrastructure manufacturers, mobile terminal manufacturers and network roll-out and optimization service providers.

Keysight offers products for measuring and analyzing wireless networks with reliable and accurate measurement functions and user-friendly interfaces. Keysight's global customer base covers more than 400 mobile operators, network equipment manufacturers, service contractors and regulatory bodies from over 100 countries worldwide.

For over 20 years, Keysight, through its acquisition of Anite, has developed reliable, state-of-the-art measurement and testing solutions for the latest network technologies and services. The exact and detailed data recorded with Nemo-branded tools is optimal for network roll-out, tuning, verification, maintenance, optimization, troubleshooting and benchmarking purposes.

Learn more about Keysight Nemo Wireless Network Solutions at [www.keysight.com/find/nemo](http://www.keysight.com/find/nemo)

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## Keysight's Comments :

The consultation paper covers a wide scope of topics on 5G. Keysight Nemo Wireless Solution's expertise remains in mobile network testing and performance monitoring. Our involvement in 5G is mainly in area of network testing. Hence, our comments are limited to the following question:

**Question 6: IMDA would like to seek views, comments and suggestions on:**

- i) The proposed network rollout and performance obligations to be imposed on the spectrum right holders;**
- ii) The methodology and measurement criteria for the coverage obligation;**
- iii) The network design and resilience challenges of 5G (in particular, enabling technologies, such as SDN, NFV and Cloud Computing that may fundamentally change how the network would be designed and deployed) and possible measures to address them, and whether there are other aspects that should be considered to enable trusted and resilient 5G network; and**
- iv) The framework for the provision of 5G wholesale services**

In accordance to the recent 3GPP Release 15 standard that covers 5G NR, the first wave of networks and devices will be classified as Non-Standalone (NSA) in which the 5G NR networks will be supported by existing 4G infrastructure. 5G enabled devices will be able to connect to 5G frequencies for data-throughput improvements but will still relay on 4G for non-data related activities.

This will be focused on enhanced mobile broadband (eMBB) to provide increased data-bandwidth and connection reliability via two new radio frequency band namely FR1 and FR2.

The 5G NR Standalone (SA) network which initial standardisation has been approved by 3GPP as part of 3GPP release 15 standard will be focused on simplification and improved efficiency which will reduce the cost of the devices and improve the performance in data rates up to the edge of the network, while also assisting development of new cellular use cases such as ultra-reliable low latency communications (URLLC)

According to the 3GPP standard with the initial intention of moving towards 5G NR SA as the final network setup for 5G NR network, it will be focused on to fulfill the following key performance indicators (KPIs):

- Improved peak rates for the enhanced mobile broadband (eMBB)
- Increase coverage for massive machine type communications (MMTC)
- Improved latency for ultra reliable low latency communications (URLLC)

However, the spectrum right holders will have concern related to the cost of replacing 5G NSA to SA architecture in which maybe the contributing factors for determine the proposed network rollout.

With the above KPIs being layout by 3GPP standard, 5G operators will have a sets of acceptance criteria which will be based on 5G NSA network.

Below are one such example acceptance criteria in which an service operator in US is proposing:

- 1) 5G NR Carrier Peak PDSCH DL throughput  $\geq 115\text{Mbps}$
- 2) 5G NR Carrier Peak PDSCH UL throughput  $\geq 30\text{Mbps}$
- 3) LTE + 5G NR CA Peak PDSCH DL throughput  $\geq 445\text{Mbps}$
- 4) LTE + 5G NR CA Peak PDSCH UL throughput  $\geq 40\text{Mbps}$
- 5) 5G NR connection Setup Time  $\leq 0.5\text{Sec}$
- 6) 5G NR RTT  $< 75\text{ms}$
- 7) Handover counter clock wise successful between all sectors
- 8) Handover counter clock wise Latency  $< 60\text{ms}$
- 9) Handover clock wise successful between all sectors
- 10) Handover clock wise Latency  $< 60\text{ms}$

The methodology for the site verification is:

- 1) Stationary test in the main beam of each sector for:
  - a. Peak DL and UL Throughput testing using IPERF data session
  - b. Connection Setup time of IPERF session
  - c. RTT of Ping test
- 2) Mobility Testing
  - a. Clockwise and counter clockwise drives for handover testing between sectors and handover latency

Note they have 5G deployed as a carrier on their LTE sites (NSA) and they don't measure 5G coverage as an acceptance criteria.