TELIKOM LIMITED

TELIKOM | bmobile 4G LTE

Response to NICTA's Public Consultation on:
1) Channeling Plan for 2.6 GHz and Proposed TDD Synchronization
2) Draft Band Plan 3500 MHz; and
3) Market-based Spectrum Assignment and Pricing in PNG

19th June, 2023

Telikom Limited comments on NICTA Public Consultation – May 2023

1 Introduction

1.1 NICTA conducted a public consultation from April to June 2023 on the following subjects:

4) Channeling Plan for 2.6 GHz and Proposed TDD Synchronization
5) Draft Band Plan 3500 MHz
6) Market-based Spectrum Assignment and Pricing in PNG

1.2 Telikom acknowledges the reasons for the consultations as expressed in NICTA's consultation papers for the respective (above) three subject matters. Telikom notes that the rapid iterative development of mobile voice, data and broadband services (2G to 5G) through the decades since the member states of the International Telecommunication Union (ITU) first defined the IMT 2000 (International Mobile Telecommunication 2000) standards in the 1990's. Industry stakeholders the world over through their ITU member states have continued to propose additional amendments to the International Radio Regulations and Frequency Allocation Table to accommodate the needs of IMT 2000. IMT 2000 has since evolved to IMT2020.

1.3 Telikom therefore understands and appreciates the need for NICTA to review at this time the assignment and licensing of spectrum especially those bands that attract high demand by current and potential licensees. With the recent entry by Vodafone PNG into the PNG mobile telecommunication market it is expected that at least the mobile service spectrum bands, assignment and licensing of same would require an appropriate review. Operators including Telikom would have made prior indication to NICTA on their need for spectrum including the 2600 MHz and 3500 MHz bands for mobile broadband services.

1.4 Telikom's comments for the three subjects of this consultation are listed in the following pages of this single submission. The main concerns are highlighted below:

(1) The main concern with the proposed 2600 MHz band plan is the actual choice of channel arrangement and synchronization. Telikom prefers the GSMA proposed/supported arrangement channel and synchronization arrangement C1.

(2) The proposed 3500 MHz band plan for 5G mobile broadband services should take into consideration vital Telikom services currently using that band. Consultations must continue to further address timelines. Use of 5G 3500 MHz requires more towers built in high density urban areas. NICTA must therefore remove restrictions on tower construction.

(3) Market-based spectrum assignment and licensing only should not be used.

2. Subject #1: Channeling Plan for 2.6 GHz & Proposed TDD Synchronization

2.1 Telikom notes that NICTA prefers C3 of Flexible FDD/TDD channel arrangement as per ITU-R Rec. M.1036-5 (2015).

2.2 Telikom does not agree with NICTA's proposal to use Flexible TDD (C3) as the channeling plan for 2600MHz. Telikom recommends C1 option or Single Channel TDD because of the factors that follow.

2.3 According to GSMA[1], ITU channel arrangement C1 (ITU option 1) is the preferred option to be adopted for licensing the band as "it will allow for deployment of FDD services without the interference from TDD services" and "is the only full technology-neutral option" and is "far superior to ITU option 3" (C3). Many countries have adopted C3 and that uncommon allocations of the band will have issues with device availability.

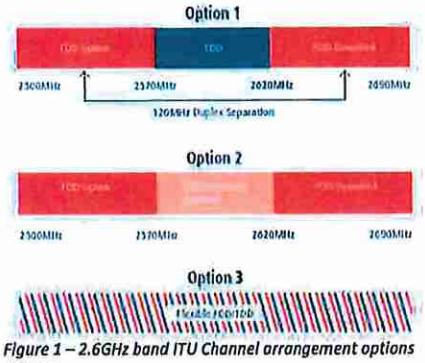


Figure 1 – 2.6GHz band ITU Channel arrangement options (GSMA)

1. **Simplicity:** Single Channel TDD has a simpler configuration with only one channel to manage. This simplifies network planning, deployment, and operation, reducing complexity for operators.
2. **Spectrum Efficiency:** Single Channel TDD utilizes the entire available bandwidth for both uplink and downlink traffic, maximizing spectrum efficiency. It eliminates the need for guard bands or unused portions of the spectrum between multiple channels.
3. **Lower Interference:** With a single channel, there is no interference between different channels or overlapping transmission timeslots, reducing the potential for interference-related issues.
4. **Cost-Effectiveness:** Implementing and managing a Single Channel TDD system can be more cost-effective compared to Multi-Channel TDD. It requires fewer hardware components, simplifies radio frequency planning, and may result in lower operational expenses.
5. **Easier Device Compatibility:** Single Channel TDD typically has better device compatibility and interoperability since devices only need to support one channel configuration. This can lead to a wider range of compatible devices and easier device integration into the network.
6. **Smooth Migration:** Single Channel TDD provides a smoother migration path for operators who are transitioning from legacy systems or deploying TDD technology for the first time. It allows for a gradual network expansion and scaling without the complexity of managing multiple channels.

2.4 However, if NICTA chooses to implement Flexible TDD on 2600MHz, Telikom recommends NICTA to consider implementing the following:

a) **Regulatory Framework:** NICTA should review and update the regulatory framework to accommodate the deployment of 2600MHz Flexible TDD. This includes ensuring that spectrum allocations, licensing conditions, and technical requirements are in place to support the implementation of Flexible TDD networks.

b) **Interference Management:** NICTA should establish guidelines and regulations for managing interference in Flexible TDD networks. This includes defining interference limits, coordinating spectrum usage among operators, and promoting the use of advanced interference mitigation techniques to minimize interference and ensure efficient spectrum sharing.

[1] www.gsma.com/spectrum/wp-content/uploads/2012/07/Spectrum-The-2-6GHz-band-Opportunity-for-global-mobile-broadband-English.pdf (pages 12-13)

c) **Device Certification and Interoperability:** NICTA should establish certification processes and requirements for devices that support 2600MHz Flexible TDD. Ensuring device interoperability and compliance with technical standards will facilitate a diverse range of compatible devices and promote a healthy ecosystem.

d) **Network Planning and Deployment Guidelines:** NICTA should provide guidelines and best practices for network planning and deployment of 2600MHz Flexible TDD networks. This includes considerations for coverage requirements, capacity planning, interference coordination, synchronization requirements, and network optimization techniques.

e) **Monitoring and Compliance:** NICTA needs to establish mechanisms for monitoring and enforcing compliance with regulations and technical requirements related to 2600MHz Flexible TDD. This includes conducting regular audits, spectrum monitoring, and addressing any non-compliance issues promptly to ensure fair competition and efficient spectrum usage.

2.5 By considering these factors, NICTA can create a favourable regulatory environment that promotes the successful implementation of 2600MHz. Flexible TDD networks, fosters fair competition, and facilitates efficient spectrum utilization for the benefit of both operators and consumers.

3. Subject # 2: Draft Band Plan for 3500 MHz

3.1 Telikom applauds NICTA in its move to plan ahead for the future deployment of 5G in PNG. Though 5G has been internationally agreed and implemented using 3500MHz, domestically several vital Telikom services are currently using this spectrum. It is Telikom's view that before reallocation of services on this spectrum, continuous consultation and agreed timelines must be discussed.

3.2 The WRC-19 recognized the importance of protecting existing services operating in adjacent bands to the 3500MHz band. Measures were adopted to minimize the risk of interference with services such as fixed satellite services (FSS), radio astronomy, and other incumbent services, ensuring coexistence and continuity of these services.

3.3 In addition, the current NICTA directive to halt all mobile tower constructions near residential areas does not help with the implementation of this draft papers as implementing 5G on 3500MHz will require more towers to meet the 5G coverage & capacity requirements.

3.4 Before implementing 3500MHz on 5G, Telikom proposes to NICTA to consider the following to help drive the implementation of 5G in PNG:

a) Lift restrictions on MNOs to constructs more mobile towers in urban areas

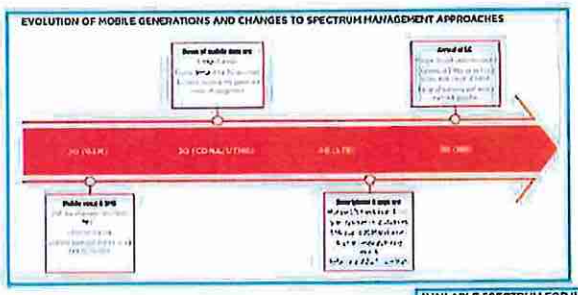
b) Create policy to allow MNOs to build more towers

c) Reduce/Remove Import Duty Tax (15%) on telecommunication towers

d) Create policy to increase more Internet Gateways for internet break-out

e) Remove GST at customs for importation of fiber cables

3.5 The following Fig by GSMA[2] indicates the available spectrum for IMT in 3.5 GHz band as GSMA foresaw the evolution of mobile generations and changes to the spectrum management approaches.



[2] www.gsma.com/spectrum/wp-content/uploads/2022/04/Roadmaps-for-awarding-5G-spectrum-in-the-APAC-region.pdf

3.6 The following tables show Telikom's views with regard to the 5G bands and its current and planned use with options of the concerned specific bands in the 2300 MHz to 3800 Mhz band.

Range	Main 5G bands	Main incumbent use	Notes
Mid-bands	2300 MHz 2600 MHz 3300-3800 MHz 3800-4200 MHz 4400-5000 MHz 6425-7125MHz	Fixed satellite Fixed service (point-to-point, point-to-multipoint)	Initial phase of 5G rollout has focused mainly on 3400-3800 MHz though some countries are also considering the range 3300-3400 MHz as well as alternative bands

Telikom Spectrum use and requirement	Planned Network	Notes
2300 MHz *(2300.00 - 2360.00 MHz)*	5G and WTTx	Ex Wimax and unused but planned for WTTx. I Telikom is unable to secure 2600, it will keeps this band.
2600 MHz	5G and WTTx	Preferred spectrum for 5G & WTTx as it is common in the market
3300-3800 MHz	1) DOMSAT Restoration.	Satellite service on C-Band:
	1) Existing PtMP and PTP system using 3550MHz to 3600MH	Radwin and Cambium under Apparatus License. Equipment were deployed since 2016

3.7 The following table indicates Telikom's position with regards to the 2300 MHz, 2600 MHz and 3500 MHz bands.

Telikom Spectrum use and requirement	SERVICES ALLOCATION	RECOMMENDATION
2300 MHz *(2300.00 - 2360.00 MHz)*	5G and WTTx	NICTA MAKE A DESCISION TO SHARING EQUAL BANWIDTH TO ALL OPERATORS ON 2600MHZ. TELIKOM CAN RELINQUISE THIS AS PART OF SWAP.
2600 MHz	5G and WTTx	NICTA MAKE A DESCISION TO SHARING EQUAL BANWIDTH TO ALL OPERATORS
3300-3800 MHz (3550MHz to 3600MHz)	Existing PTmP and PTP system using 3550MHz to 3600MHz	TELIKOM PREFERES TO KEEPS SAME AND REDPLOY TO 5G (NR) WHEN NEEDED.

4. **Subject #3: Market-Based Spectrum Assignments and Pricing in PNG**

4.1 **Issues for Consultation (Question 1) - Do you agree on the principle and process of designating High Demand Spectrum (HDS) bands? Kindly justify your response.**

a) Telikom understand that the spectrum resource is a scarce public good and the principle of equitable access to the spectrum is essential to spectrum assignment and licensing. However, NICTA's definition of 'high demand' spectrum is not fully clear. NICTA seems to indicate to the public that there is spectrum congestion in all the bands identified as High Demand Spectrum (HDS). It would be helpful to provide data to demonstrate that the spectrum is congested and what would be the accepted technical quantification for congestion.

b) We therefore agree in the principles of designating high demand spectrum bands to the extent that the technical criteria being used to justify 'high demand' is more clearly defined and further suggest that assignment and licensing must ensure equitable distribution to all licensees.

c) The following table contains Telikom's comments for each of the proposed HDS bands.

	NICTA Proposed HDS band	Telikom Comment/Suggestion
1	*450MHz*	*No comment*
2	*600MHz*	*No comment*
3	*700MHz*	*Telikom is using on spectrum aggregation with LTE1800 to boost speed, reduce congestion and at the same time increase 4G coverage where 1800 cannot reach. This is ideal to 4G expansion into the rural population wider coverage is possible with 700MHz. The 700MHz spectrum has been evenly shared with all three MNOs (15MHz each). There is no need apply market-base designation. If there is a 4th MNO in the PNG market, Telikom recommends reforming of this spectrum for even distribution.*
4	*850MHz Band 5*	*Telikom will migrate services to 900MHz. However this spectrum should also be subject to Market based assignment and licensing.*
5	*850MHz Band 27 (Expansion)*	*No comment*
6	*900MHz*	*Needs re-forming to three operators for 3G. This is classic inefficient use of spectrum. Other APAC countries have more than three operators using the same spectrum and why PNG cannot efficiently use this premium spectrum?*
7	*1800MHz:*	*Majority of MNO are using this spectrum for 4G. Spectrum should be reformed for equal allocation to licensed MNO*
8	*2100MHz*	*Spectrum should be made available and allocated equally to all licensed MNOs*
9	*2300MHz*	*There is sufficient spectrum available between 2300MHz and 2700MHz*
10	*2600MHz:*	*Available spectrum is insufficient to cater for all players considering its market dominance in infrastructure deployment and device availability. Spectrum should be made available and allocated equally to all licensed MNOs*
11	*3500MHz*	

12	*VHF Band III*	*The current 8xChannel plan is insufficient to cater for Multi-Channel for the existing players like Kundu, EMTV and DigicelTV to migrate the analog services to the DVB-T2 Digital TV and also make it Commercially viable and affordable.*

4.2 Issues for Consultation (Question 2) - Do you agree with NICTA's proposed definition of HDS spectrum? Kindly justify your response.

a) Telikom's views on the two-point definition of HDS spectrum are given in the following table.

NICTA Proposed HDS band	Telikom Comment/Suggestions
NICTA HDS Definition	
(a)	*Telikom agrees with insufficient spectrum to adequately accommodate all industry players. Some spectrum are share between large MNO including small operators in the ISP sectors.*
(b)	*Telikom believes that NICTA is not able to conclusively substantiate and prove that there is inefficient use of spectrum in PNG given the small market. Telikom require NICTA to provide detailed technical report to justifying its claim of inefficient use of spectrum for following:* *Example:* *1) 700MHz –Was used by Telikom as 4G LTE aggregation to improve quality and coverage* *2) 850MHz currently used by Telikom has only 2x5MHz carriers available. Once relinquished by Telikom it can be reassigned by NICTA.* *3) 900MHz – A premium spectrum were assigned to only two MNO. That inefficient allocation.* *4) 2100MHz for UMTS – Telikom is unable to access this spectrum*

b) Telikom agrees in principle to the definitions outlined in paragraphs 2.3(a) and 2.3(b). Telikom however requests NICTA to specify in detail the 'competition checks' the renewal or relicensing will be subjected to.

4.3 Issues for Consultation (Question 3) - Do you agree that HDS spectrum licenses and renewals going forward would be issued on a market basis ONLY? Kindly justify your response.

a) Telikom disagrees that HDS spectrum licenses and renewals be issued on market basis only.
b) There is only three major MNO in PNG unlike other markets. These three operators will be only ones who can afford these HDS spectrum. Small operators will be unfairly disadvantaged from securing a market space if the cost of spectrum increases. The basis that market-based assignment and licensing is to reduce economic costs needs to be clearly specified especially when the opportunity cost for licensees is high in providing services in areas where take-up is low. Market basis licensing and renewals should take into consideration such operator opportunity costs and help reduce same by lowering spectrum fees for spectrum used on such areas.
c) Here are some common challenges we may encounter:

i. **Spectrum Availability:** Market-based spectrum licensing relies on the availability of sufficient spectrum for allocation. In some cases, regulators may not have enough spectrum resources to meet the demands of all telco operators, leading to scarcity and increased competition for available frequencies.

ii. **Cost:** Market-based spectrum licensing can be expensive for telco operators. The bidding process for acquiring spectrum licenses typically involves auctions where operators must compete financially to secure the desired frequencies. This can result in high costs, especially in cases where operators engage in bidding wars to gain an advantageous position.

iii. **Unequal Access:** In market-based spectrum licensing, telco operators with more financial resources may have an advantage over smaller or new entrants in the market. Larger operators may be able to outbid their competitors, potentially leading to an imbalance in

access to spectrum resources. This can hinder competition and limit opportunities for smaller players.

iv. **Limited Coverage**: Market-based spectrum licensing can lead to fragmented spectrum holdings among operators. This fragmentation can result in challenges related to achieving nationwide or seamless coverage. Telco operators may need to acquire spectrum in multiple frequency bands and regions to ensure comprehensive network coverage, which adds complexity and costs.

v. **Spectrum Hoarding**: Some telco operators may engage in spectrum hoarding, acquiring more spectrum than they currently require to restrict competition. This practice can limit the availability of spectrum for other operators, leading to inefficiencies and reduced innovation in the market.

vi. **Regulatory Complexity:** Market-based spectrum licensing often involves complex regulatory frameworks and processes. The rules and procedures for spectrum auctions, license renewals, and transfers can be intricate and time-consuming. Complying with these regulations can be a burden for telco operators, requiring them to invest significant resources in legal and administrative activities.

vii. **Uncertainty and Risk**: Market-based spectrum licensing introduces a level of uncertainty and risk for telco operators. The outcome of spectrum auctions can be unpredictable, making it challenging for operators to plan and allocate resources effectively. The investment in spectrum licenses also carries a risk if the expected return on investment does not materialize.

d) NICTA need to consider these issues while designing market-based spectrum licensing frameworks to ensure a fair and competitive environment that promotes efficient spectrum allocation and optimal use.

4.4 Issues for Consultation (Question 4) - Do you agree with the proposed bands that NICTA has *provisionally* designated as HDS spectrum bands? Kindly justify your response.

a) Telikom disagrees. For effective and competitive playing field, NICTA should be seen to be encouraging competition down to the small players and a significant way is with reasonably priced spectrum.
b) MNO's will only be the only ones affording 3G, 4G and 5G spectrum, however the others will be impacted so how would NICTA demarcate these market space.
c) 800MHz must be included in this list.
d) As mentioned above, the case for HDS for each band should be quantified especially with regard to where congestion is concerned in the currently assigned bands.

4.5 Issues for Consultation (Question 5) - Do you agree or not with the rationale for spectrum pricing on a market basis for designated HDS spectrums?

a) The current spectrum pricing formulae adequately addressed value of those spectrum below the 2600MHz. Though the per MHz minimum unit cost should be reviewed considering broadband channel requirement these days are around 5MHz minimum.
b) For effective and competitive playing field, NICTA should be seen to be encouraging competition down to the small players and the only way is with reasonably priced spectrum.
c) Mobile network will only be the only ones affording 3G, 4G and 5G spectrum, however the others will be impacted so how would NICTA demarcate these market space.

d) While market-based spectrum sharing pricing for designated High-Density Spectrum (HDS) brings certain advantages, it also presents some challenges and issues. Here are some common concerns associated with this approach:

i. **Cost Barrier:** Market-based spectrum sharing pricing can create a significant cost barrier for smaller or new entrant operators. The high prices set through auctions or bidding processes may limit their ability to access HDS spectrum. This can result in a concentration of spectrum resources in the hands of larger, financially stronger operators, potentially stifling competition and innovation.

ii. **Unequal Access:** Market-based pricing may lead to unequal access to HDS spectrum. Operators with greater financial resources are better positioned to secure spectrum sharing rights, while smaller or regional operators may struggle to compete. Unequal access can perpetuate market dominance and hinder market entry, leading to a lack of diversity and competition in the telecommunications sector.

iii. **Limited Participation:** Market-based spectrum sharing pricing can restrict participation from non-traditional stakeholders, such as community networks or public interest organizations. These entities may not have the financial means to compete in spectrum auctions, limiting their ability to provide innovative and locally relevant services. This can result in a lack of diversity in service offerings and limited representation of community interests.

iv. **Lack of Predictability:** The market-based approach introduces uncertainty and unpredictability in spectrum pricing. The outcome of auctions or bidding processes may be difficult to anticipate, making it challenging for operators to plan and allocate resources effectively. The volatility in pricing can create risks for operators and impact long-term investment decisions.

v. **Spectrum Fragmentation:** Spectrum sharing arrangements may result in fragmented spectrum holdings among operators. This fragmentation can complicate network planning and coordination efforts, as operators may need to navigate interference issues and negotiate spectrum sharing agreements. It can also lead to inefficiencies in spectrum utilization and suboptimal network performance.

vi. **Speculative Behavior:** Market-based pricing may incentivize speculative behavior, where operators acquire spectrum sharing rights with the intention of reselling them for profit rather than utilizing the spectrum themselves. This can distort the market, drive up prices, and limit access to HDS spectrum for operators genuinely seeking to provide services.

vii. **Administrative Complexity:** The implementation of market-based spectrum sharing pricing requires robust administrative mechanisms to design and manage auctions, ensure compliance, and resolve disputes. The associated administrative complexity can be burdensome for both regulators and operators, requiring substantial resources and expertise.

e) NICTA needs to carefully address these issues when implementing market-based spectrum sharing pricing for designated HDS spectrum. Balancing competition, affordability, and efficient spectrum utilization is crucial to promote a healthy telecommunications market and ensure access to HDS spectrum for a diverse range of operators.

4.6 Issues for Consultation (Question 6) - Do you agree with NICTA's proposed approaches to conservatively derive the market-based spectrum fees? Any further comments?

a) This would depend on how far "Conservatively" means. Telikom is convinced there is no demand nationwide for spectrum, except some main centers.

b) There are potential issues associated with these approaches:

i. Relevant actual PNG spectrum auctions and/or spectrum tenders: One issue could be the lack of transparency or fairness in the auction or tender process, which may result in inflated or distorted fees. Additionally, if there is limited participation or competition in the auctions, it might not accurately reflect the true market value of the spectrum.

ii. Relevant PNG spectrum beauty contests or first/second price sealed bid auctions: Similar concerns regarding transparency, fairness, and lack of competition could arise with beauty contests or sealed bid auctions. It might not effectively capture the market value of the spectrum if the process is flawed.

iii. Benchmarking from other carefully chosen auctions or tenders from other countries: The main issue here is the potential mismatch between the spectrum market conditions in other countries and the specific context of PNG. Market dynamics, demand, and other factors can significantly vary between countries, making direct benchmarking less reliable.

iv. Administered Incentive Pricing (AIP) set to reflect opportunity cost: One issue with AIP is the determination of the opportunity cost itself. Estimating the true cost of spectrum usage can be challenging and subject to interpretation. If the opportunity cost is incorrectly assessed, it may result in either overcharging or undercharging for the spectrum.

v. Annual License Fees (ALFs): The problem with ALFs lies in determining the appropriate fee level. Setting fees at the full market value can potentially burden users or discourage spectrum utilization. On the other hand, setting fees too conservatively might not incentivize efficient spectrum use. Striking the right balance becomes crucial.

c) In summary, while market-based fees aim to promote efficient use of HDS spectrum in PNG, there are challenges in accurately determining the fees using the mentioned approaches. Transparency, fairness, competition, context, and accurate assessment of costs are essential factors to consider in order to achieve an effective market-based fee system.

4.7 Issues for Consultation (Question 7) - Do you have any comments on how NICTA proposes to proceed on the Conversion and/or Marketing plans consistent with the Radio Spectrum Regulations? Kindly justify your response.

a) Telikom notes that NICTA's proposed approach on the Conversion/Marketing plans is consistent with the Radio Spectrum Regulations and appreciates the example provided in the Annex. Telikom is however concerned at the effect NICTA's conversion plan may have on the licensee's plans for the deployment of particular spectrum in question. Telikom therefore anticipates that the approach also takes into consideration all necessary justification on the choices it makes of methods, processes, parameters and conditions in the information package under Section 13(1) of the Radio Spectrum Regulations.

b) Here are some recommendations to improve the proposed approach:

i. **Enhance stakeholder engagement:** While public consultation is mentioned in the information paper, it is crucial for NICTA to actively engage with a wide range of stakeholders throughout the planning process. This includes industry players, consumer groups, civil society organizations, and other relevant entities. NICTA should consider organizing workshops, forums, or meetings to gather input and feedback from stakeholders, ensuring a more inclusive and comprehensive approach.

ii. **Provide greater clarity and detail:** The information indicates the inclusion of various elements in the Conversion and Marketing Plans, such as procedures, timetables, spectrum lots, reserved portions, and conditions tied to licenses. It would be beneficial for NICTA to provide more specific details and guidelines for each of these elements. Clear instructions, criteria, and parameters will help applicants understand the requirements and expectations, facilitating a smoother application process.

iii. **Consider international best practices:** NICTA can benefit from studying and incorporating international best practices in spectrum allocation and market-based approaches. Analyzing successful case studies from other countries with similar contexts can provide valuable insights and help improve the effectiveness, fairness, and efficiency of NICTA's plans. This includes examining methodologies for determining reserve prices, spectrum coverage obligations, and other conditions tied to licenses.

iv. **Increase transparency in decision-making:** While the information mentions the publication of draft plans on the public register, NICTA should provide further transparency by sharing relevant documents, reports, and analysis related to the Conversion and Marketing Plans. This will enable stakeholders to have a better understanding of the decision-making process, the rationale behind certain choices, and the assessment criteria used by NICTA. Transparent decision-making builds trust and fosters a more collaborative environment.

v. **Monitor and evaluate the effectiveness of the plans:** NICTA should establish a system to monitor and evaluate the outcomes and impact of the Conversion and Marketing Plans. This can include assessing the efficiency of the allocation process, the level of competition, the extent to which public and community services are accommodated, and the overall utilization of the spectrum. Regular evaluation will help identify any shortcomings or areas for improvement and allow for adjustments to be made in future iterations of the plans.

c) By incorporating these recommendations, NICTA can enhance the development of the Conversion and Marketing Plans, ensuring a more robust, inclusive, and effective approach to spectrum allocation in Papua New Guinea.

...../end