Qualcomm India Private Limited

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Unit No 306 & Unit No 307, 3rd Floor, Tolstoy House, 15 Tolstoy Marg, New Delhi 110001; Tel: +91-11-1169010163

Date: 4th November 2025

Shri Akhilesh Kumar Trivedi,
Advisor (Networks, Spectrum and Licensing)
Telecom Regulatory Authority of India
4th, 5th, 6th & 7th Floor, Tower-F,
World Trade Centre, Nauroji Nagar,
New Delhi: 110029

Subject: **Consultation Paper on the Auction of Radio Frequency Spectrum in the Frequency Bands Identified for International Mobile Telecommunications (IMT)**

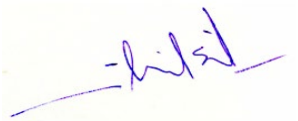
Dear Sir,

Qualcomm sincerely thanks the Telecom Regulatory Authority of India (TRAI) for the timely release of its consultation paper on spectrum auction and for inviting stakeholder input. This proactive step reinforces TRAI's commitment to shaping India's digital future through informed and inclusive policymaking.

As a global leader in wireless innovation, Qualcomm has been instrumental in advancing mobile technologies from 3G to 5G and is now driving the evolution toward 6G. Our pioneering contributions to telecom standards and spectrum efficiency have enabled transformative connectivity across India and the world. We welcome the opportunity to contribute to this consultation and ensure that TRAI's decisions are guided by global best practices, technical depth, and a forward-looking vision for India's wireless leadership. Our response is limited to some key questions related to APT600 MHz band (3GPP Band n105), 6 GHz band auction timelines and L Band (1427-1518 MHz) in the attached Annexure.

Kindly contact me at jitendra@qti.qualcomm.com (mob-9871115660) with any questions or if Qualcomm can be of further assistance.

Sincerely,



Jitendra Singh
Head Govt. Affairs (India & South Asia) and Spectrum Strategy & Policy (APAC)
Mobile: +91 9871115660
mailto:jitendra@qti.qualcomm.com

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Annexure

Q10. Whether the spectrum in the 600 MHz band should be put to auction in the forthcoming auction? If yes, whether the band plan n105 should be adopted for the 600 MHz band, or otherwise? Please provide a detailed response with justifications.

Q11. In case it is decided to auction the spectrum in the 600 MHz band in the forthcoming auction, -

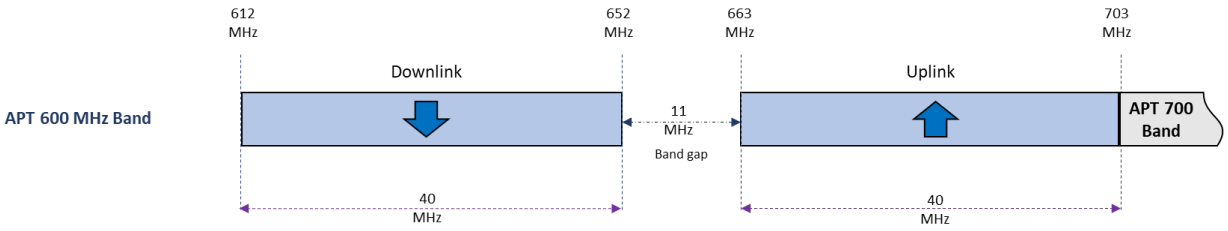
a. Should the entire available spectrum in the 600 MHz band be put for bidding in the forthcoming auction?

b. Whether the eligibility criteria, associated eligibility conditions, block size, minimum bid quantity of spectrum, validity period for the assignment of spectrum, area of assignment on Telecom Circle/ Metro Area-basis, spectrum cap and roll out obligations for the spectrum in the 600 MHz band in the forthcoming auction should be kept the same as those in the spectrum auction of 2022, or otherwise? Please provide a detailed response with justifications.

Response :

Yes, the spectrum in 600 MHz band should be put up in the forthcoming auction. India stands at a pivotal moment in its 5G journey, and adopting Band n105 for the 600 MHz spectrum presents a strategic opportunity to accelerate broad-based digital growth. Band n105, standardized by 3GPP after rigorous technical studies, is tailored for the 600 MHz range and offers exceptional propagation characteristics. Its low-frequency signals penetrate buildings and cover vast rural and semi-urban areas with fewer base stations, significantly reducing infrastructure costs. The band supports Frequency Division Duplexing (FDD), ensuring robust uplink and downlink performance. For India, where rural connectivity remains a challenge, n105 can bridge the digital divide, extend mobile broadband, and empower sectors like agriculture, education, and healthcare.

Technically, Band n105 aligns with the Asia-Pacific Telecommunity (APT) harmonized band plan for IMT- also known as APT600 MHz Band -which has been endorsed by Qualcomm and finalized by the AWG as the preferred option for Asia-Pacific countries. The AWG's technical studies (APT/AWG/REP-79(Rev.2), Sept 2024) and updated recommendations (APT/AWG/REC-08) support this harmonization. ITU-R has also recognized this frequency arrangement as A13 in its M.1036-7 release (Dec 2023). The details of this APT600 MHz band are as shown below –



The APT600 MHz band uses a single filter, reducing bill of materials, software complexity, and enabling simpler carrier aggregation. Importantly, India faces no DTV broadcast constraints below 612 MHz, unlocking an additional 5 MHz of sub-1 GHz spectrum—an invaluable asset. With compatibility across LTE and NR deployments, economies of scale in device manufacturing, and potential for wide bandwidths, India should auction the entire available 600 MHz spectrum under Band n105 to future-proof its digital infrastructure and align with global best practices.

From a strategic standpoint, embracing Band n105 positions India as a leader in spectrum innovation across the Asia-Pacific region. As global markets increasingly align with APT600 MHz, early adoption ensures India's telecom ecosystem remains interoperable with international networks, fostering cross-border roaming, seamless device compatibility, and global investment appeal. This alignment also supports India's ambitions to become a manufacturing and export hub for telecom equipment and 5G-enabled devices, leveraging economies of scale and standardized components. By adopting n105, India sends a clear signal of regulatory foresight and technological readiness, attracting foreign direct investment and accelerating its digital economy.

Moreover, the 600 MHz band offers a unique opportunity to address India's spectrum scarcity in sub-1 GHz frequencies. With increasing demand for mobile broadband and IoT services, especially in remote and agricultural zones, sub-GHz spectrum is critical for deep indoor coverage and wide-area connectivity. Band n105's efficient spectrum utilization and simplified network design reduce operational complexity and long-term costs. Auctioning the entire available 600 MHz spectrum under n105 would not only unlock immediate economic value but also lay the foundation for scalable, resilient, and inclusive 5G infrastructure—ensuring that no region or citizen is left behind in India's digital transformation.

The chipset ecosystem for 3GPP band n105 has been steadily maturing since the band was specified in 3GPP. The band is part of FR1 NR extensions, and the standards work explicitly added n105 support and coexistence rules, which lets chipset, RF-front end and module vendors build multi-band parts that include 600 MHz. Hardware suppliers and semiconductor partners are supporting n105. Inclusion in 3GPP NR channel for this band makes it straightforward for handset, fixed wireless and IoT device makers to add support as they launch new multi-band SKUs — accelerating the availability of handsets and CPE that can

operate with n105. Qualcomm has added hardware capability for n105 across our new generation of RFIC product portfolio. It's a default band on all of our new RFIC's with chipset attaches spanning our Mobile Handset and MBB, CPE/FWA platforms (Default Off). Following modem-RF solutions from Qualcomm support the n105 band (info also available at GAMBOD):

- Snapdragon X75 5G Modem-RF System
- Snapdragon X80 5G Modem-RF System
- Qualcomm X85 5G Modem-RF

Many countries (e.g. New Zealand, Vietnam, parts of Latin America and some emerging markets etc.) have taken a keen interest in adoption of n105. However, adoption remains uneven globally (some markets still follow other regional plans), but the policy momentum and regional coordination efforts make n105 a realistic path for many countries seeking low-band 5G capacity.

Device support for newer bands is a function of regulatory certainty, motivating the device vendors to start offering a certain band within the cost-sensitive market like India. It may well be recalled that in the initial 5G time in India, most of the 5G devices (mobile phones) in India had only a single band support (3.5 GHz, n79). It was only after regulatory and mobile network operator certainty, that the device OEMs started to offer additional bands. All along, the chipset within these very same mobile phones were already capable of additional bands, but the bands populated by a device OEM are based on their specific business considerations and market certainty.

As per the latest 3GPP specifications[1], the following CA combinations that are applicable for India's spectrum bands are already fully specified.

[1] 3GPP TS 38.101-1 for NR CA combinations, 3GPP TS 38.101-3 for EN-DC CA combinations

Figure: NR CA Combinations (Applicable for India)

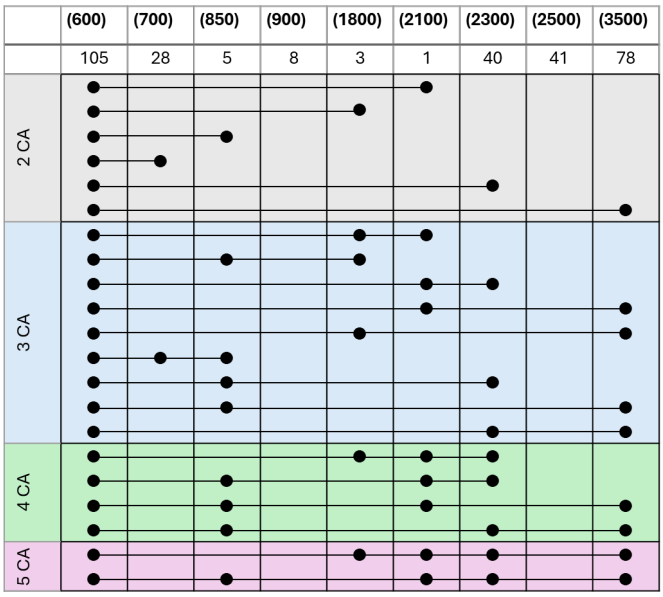
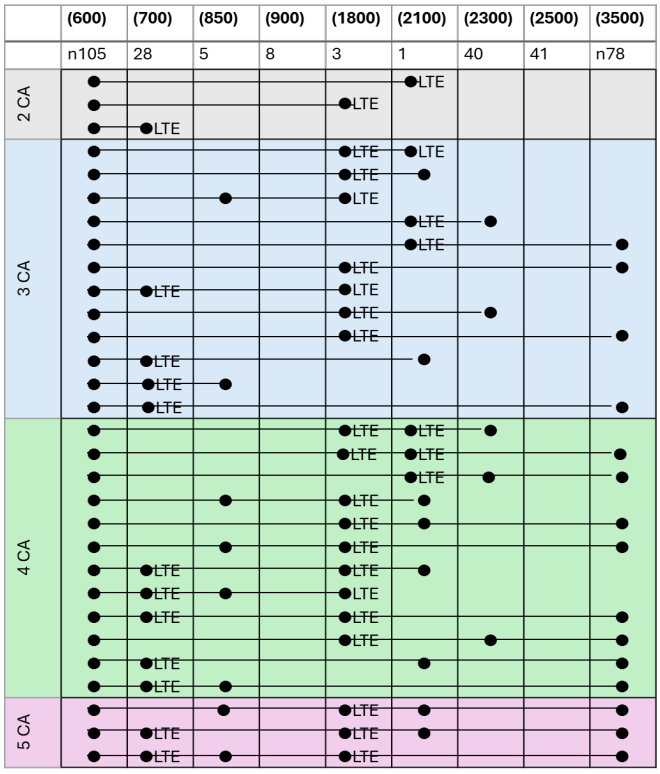


Figure: EN-DC CA Combinations (Applicable for India)



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Q14. Whether the spectrum in 6425-6725 MHz and 7025-7125 MHz ranges in the upper 6 GHz band should be put to auction for IMT in the forthcoming auction? Kindly provide a detailed response with justifications.

Q15. In case you are of the opinion that the spectrum in 6425-6725 MHz and 7025-7125 MHz ranges should not be put to auction in the forthcoming auction, what should be the timelines for auctioning of this spectrum for IMT? Kindly provide a detailed response with justifications.

Response :

The entire Upper 6 GHz band (including 6425–6725 MHz and 7025–7125 MHz spectrum bands) should continue to be earmarked for IMT, and revisited post-WRC-27, aligning with global harmonization efforts and India's strategic 6G ambitions. This would enable India to look at the contiguous spectrum range from 6425 MHz and above into the 7-8 GHz band (based on WRC-27 outcome).

India stands at a pivotal juncture in shaping its 6G future. The decision to auction the 6425–6725 MHz and 7025–7125 MHz bands prematurely could undermine long-term national and global objectives.

Here's a detailed justification:

(a) **WRC-27: Awaiting Global Consensus**

The *World Radiocommunication Conference 2027 (WRC-27)* is set to deliberate on the harmonization and identification of spectrum in 7-8 GHz range for International Mobile Telecommunications (IMT) under Agenda item 1.7. Premature auctioning risks misalignment with global standards, potentially leading to fragmentation, interference issues, and reduced economies of scale for equipment manufacturers. By waiting for WRC-27 outcomes, India can ensure its spectrum strategy is globally synchronized, fostering cross-border compatibility and cost-effective deployment. Also, in India G.S.R. 1046(E) dated 18th Oct 2018 applies with respect to some other low power applications in this frequency range on non-interference, non-protection and shared on non-exclusive basis.

(b) **Greenfield Spectrum: A Strategic Asset**

The 6425–7125 MHz range and possible additional spectrum in 7-8 GHz range is considered *greenfield spectrum*, meaning it is largely unencumbered by legacy IMT services. This makes it ideal for next-generation technologies like 6G, which demand clean, contiguous, and interference-free bands. Auctioning it now for 5G or transitional use could lead to suboptimal utilization, spectrum fragmentation, and costly refarming later. Preserving this band ensures a pristine runway for 6G innovation. This could also allow India to leverage its 6G R&D efforts in this new greenfield spectrum.

(c) **Operator Needs: 200–400 MHz Per Operator**

6G is expected to require *200–400 MHz of mid-band spectrum per operator* for initial deployments to deliver ultra-high throughput, low latency, and massive connectivity. The upper 6 GHz band and spectrum in 7-8 GHz range offers a unique opportunity to meet this demand. If auctioned prematurely, operators may be left with fragmented or insufficient allocations, hampering India's ability to deliver world-class 6G services. Strategic reservation of this band ensures future readiness and equitable access.

(d) **India's 6G Leadership: PM's Vision**

Hon'ble Prime Minister's vision for *India as a global 6G leader* hinges on strategic foresight and innovation. India The Bharat 6G Vision Document emphasizes indigenous development, global collaboration, and leadership in standard-setting. Auctioning key spectrum before global consensus contradicts this vision and risks relegating India to a reactive rather than proactive role in 6G evolution. The government's vision to have initial 6G pilots launch in 2028 will need green field bands. Hence delaying the auction till 2027 supports India's ambition to lead, not follow.

(e) **Bharat 6G Alliance: Protecting the Golden Band**

The *Bharat 6G Alliance* has also identified the 6425–7125 MHz and 7.125-8.4 GHz range as a *"golden band"* for 6G. This designation reflects its unmatched potential for delivering high-capacity, low-latency services. Preserving this band aligns with the B6GA's roadmap and ensures that India's research, development, and deployment strategies remain coherent and future-proof.

Conclusion

India must resist the temptation of short-term spectrum monetization and instead prioritize strategic long-term economic and national security gains. The Upper 6 GHz band is critical for mobile growth in India and it may be noted that several other countries like China, Brazil and European countries are considering the entire 700 MHz in this Upper 6 GHz band for 6G. By deferring the auction of the 6425–6725 MHz and 7025–7125 MHz bands until after WRC-27, India safeguards its 6G future, aligns with global standards, and honors its leadership aspirations.

In view of above, we urge the Authority to strongly recommend earmarking the entire upper 6 GHz band for IMT and refrain from immediately auctioning the 6425–6725 MHz and 7025–7125 MHz spectrum bands and revisit this spectrum post-WRC-27, aligning with global harmonization efforts and India's strategic 6G ambitions. This approach ensures optimal spectrum utilization, supports operator needs, and reinforces India's position as a visionary force in global telecommunications.

Q21. Considering the need to assign a contiguous 24 MHz block in the 1427-1518 MHz range to the Government user,

a. **Which band plan and duplexing scheme should be adopted for IMT in the 1427-1518 MHz range?**
b. **Which range of spectrum (a contiguous block of 24 MHz) should be assigned to the Government user? Kindly provide a detailed response with justifications.**

Q22. Are there any other inputs/ issues related to the spectrum in the 1427-1518 MHz range? Suggestions may be made with detailed justifications.

Response :

The L Band (1427–1518 MHz) is particularly well-suited for Supplemental Uplink (SUL) applications due to its superior propagation characteristics compared to higher frequency TDD bands such as 3.5 GHz and 6 GHz. The fundamental physics of radio wave propagation dictate that as frequency increases, free-space path loss also increases, leading to reduced signal strength over distance. In uplink communication, where the transmission originates from user devices with limited power budgets, this attenuation becomes critical. The L Band's lower frequency enables it to penetrate buildings, foliage, and other obstructions more effectively, ensuring that signals from user equipment reach the base station reliably, even under challenging urban and suburban conditions. This makes it an ideal candidate for enhancing uplink coverage in heterogeneous 5G networks.

Furthermore, uplink transmission constraints are fundamentally different from downlink. Base stations can transmit at higher power levels and employ massive MIMO arrays to improve downlink coverage and capacity at higher frequencies like 3.5 GHz and 6 GHz. However, user equipment, typically smartphones or IoT devices, are limited to lower transmit powers due to battery, health, and hardware constraints. At higher frequencies, these limitations result in rapid signal degradation and reduced uplink range. By offloading or supplementing uplink traffic onto the L Band, network operators can overcome these asymmetries. The L Band's favorable link budget ensures that even devices at cell edges maintain robust uplink connectivity, thereby improving overall network reliability and user experience.

It was for the propagation reason only that the L Band was considered to enhance 2100 MHz band's downlink capacity for enhancing downlink capacity and larger distance coverage as 2100 MHz band (also known as Band 1) had uplink at 1920-1980 MHz and downlink at 2110-2170 MHz. Since downlink was at much higher range, L band from 1452 to 1496 MHz (44 MHz of SDL spectrum) was adopted by some European countries for Supplemental Downlink (SDL) to enhance their 3G band downlink capacity and coverage.

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In today's hyperconnected world, telecom technology is experiencing an unprecedented shift toward heavy uplink demand, transforming how networks are designed and optimized. Traditionally, telecom systems were built with a strong focus on downlink capacity—enabling users to download videos, stream content, and browse data effortlessly. However, the digital ecosystem has evolved dramatically, with millions of users now generating, sharing, and uploading vast amounts of data every second. From high-definition video calls, live streaming, and cloud gaming to remote work collaboration tools, IoT devices, and user-generated content on social platforms, the volume of uplink traffic has skyrocketed. Modern smartphones, smart homes, surveillance systems, and connected vehicles continuously transmit data to the cloud, pushing network operators to prioritize upload efficiency and low-latency performance. With technologies like 5G, massive MIMO, and edge computing, telecom networks are being reengineered to support symmetrical data flow, enabling faster and more reliable uploads. This growing emphasis on uplink capacity is not only essential for enhancing user experience but also for supporting emerging technologies such as virtual reality, telemedicine, autonomous vehicles, and industrial IoT, which rely on real-time, two-way communication. As consumers and businesses increasingly act as both data creators and consumers, the traditional model of download-dominant traffic has become obsolete. Therefore, today's telecom evolution is defined by the urgent need to strengthen uplink capacity, ensuring that the digital infrastructure can sustain the continuous, heavy flow of data uploads that power our connected world.

The propagation efficiency of the L Band also directly translates to enhanced uplink spectral efficiency and reduced interference. Due to its lower frequency, the L Band supports wider coverage per cell and allows for better reuse of resources across a given geography. This makes network planning more efficient, as fewer base stations are required to achieve the same uplink coverage area compared to higher frequency bands. Additionally, because of its balanced trade-off between bandwidth availability and propagation performance, the L Band can be deployed alongside existing mid-band downlink carriers to create a highly efficient frequency complement. This dual-band strategy enables operators to exploit large bandwidths of 3.5 GHz or 6 GHz for high downlink throughput while leveraging the L Band to maintain strong, consistent uplink channels.

From a network optimization perspective, implementing Supplemental Uplink in the L Band helps balance uplink and downlink performance in asymmetric 5G networks. As modern mobile traffic is increasingly dominated by data-intensive applications such as video calls, live streaming, and cloud-based uploads, uplink quality becomes as crucial as downlink speed. When only higher-frequency spectrum is used, uplink coverage shrinks significantly, causing frequent connection drops and reduced throughput, particularly at the cell edge. The L Band can effectively mitigate this problem by expanding uplink coverage and ensuring more consistent service quality. As a result, operators can achieve a more uniform experience for users

regardless of their proximity to the base station, improving perceived quality of service and reducing customer churn.

Lastly, the economic and technical feasibility of deploying Supplemental Uplink in the L Band further justifies its selection. Many regions already have portions of the L Band allocated or lightly used, allowing operators to repurpose it efficiently without the high costs of new spectrum acquisition or dense small-cell deployment required at higher frequencies. Additionally, existing antenna and RF front-end technologies can easily accommodate L Band integration due to its proximity to legacy LTE and sub-2 GHz bands, simplifying device compatibility and reducing deployment costs. The combination of excellent propagation characteristics, efficient spectrum reuse, and cost-effective implementation makes the L Band the optimal choice for Supplemental Uplink, ensuring that 5G networks deliver not just exceptional downlink speeds but also resilient and high-quality uplink performance.

Currently, there is no 3GPP band plan for Supplemental Uplink (SUL) for L-Band. Creation of L Band SUL band plan is being considered. In ITU-R, as per Recommendation ITU-R M.1036 following are the frequency arrangements recommended for Lband (1427-1518 MHz) -

(i) G1 : 1427-1517 MHz (SDL)
(ii) G2 : 1427-1470/1475-1518 MHz (FDD)
(iii) G3 : 1427-1517 MHz (TDD)

As per 3GPP, the current band plans for L band are as listed below –

(i) Band 11 (b11) : 1427.9-1447.9/1475.9-1495.9 MHz (FDD)
(ii) Band 21 (b21) : 1447.9-1462.9/1495,9-1510.9 MHz (FDD)
(iii) Band 32 (b3) : 1452-1496 MHz (SDL)
(iv) Band 74 (n74) : 1427-1470/1475-1518 MHz (FDD)
(v) Band 75 (n75) : 1432-1517 MHz (SDL)
(vi) Band 76 (n76) : 1427-1432 MHz (SDL)
(vii) Band 45 (b45) : 1447-1467 MHz (TDD)
(viii) Band 50 (n50) : 1432-1517 MHz (TDD)
(ix) Band 51 (n51) : 1427-1432 MHz (TDD)

Noting that there is a government decision to reserve 24 MHz of spectrum from L Band for government usage, it is clear that bands 11 (b11), 21 (b21), 32 (b32), 74 (n74), 76 (n76), 45 (b45) and 51 (n51) cannot be considered.

It is important to understand the requirement of the spectrum requirements of the government agency which intends or is using this 24 MHz in L Band. Since this usage requirement by the government agency

was in discussion since 2015, when L Band was identified for IMT (RR Footnote 5.341C, 5.346A and Resolution 223 (WRC-23)), it is important to have a clarity on this at earliest. However, it is recommended that a contiguous 24 MHz block in the 1427-1518 MHz range be planned for the government user, and it is preferred that it should be on one side of the L band (preferably 1427-1451 MHz). This will help in creation of 3GPP band plan for SUL, equipment design planning and will ensure that the telecom operators get a clean contiguous spectrum for their network deployments. This will also help in future, when the Government user surrenders back the 24 MHz of L Band spectrum and multiple harmonization by telecom operators can be avoided.

Keeping above in view, it is recommended that the Authority considers adoption of Supplemental Uplink (SUL) in L Band and wait for outcome of 3GPP discussions on this band.

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Annex: APT 600 MHz band plan history

AWG has been working for 600 MHz frequency arrangements that is optimal for APT countries since 2020 (AWG-26). There has been a significant amount of work that has been already completed within APT and 3GPP on this topic in the last more than 8 years. A quick recap of most important and prominent milestones in this work is listed below:

1. 2017 September: 3GPP completed its work on TR 36.755 on "US 600 MHz Band for LTE", which eventually was called band 71 (35+35 MHz)
2. 2017 September: APT/AWG published the APT/AWG/REP-79 "APT Report on Frequency Arrangements for IMT in the Band 470-698 MHz"[2] in Sep. 2017, in which the recommended harmonized band plan for 470-698 MHz band aligns with that of 3GPP Band 71 (35+35 MHz) which was the "US 600 MHz band for LTE".
3. 2020 September: AWG-26 meeting (14-18th of September 2020) considered proposals for additional frequency arrangements of IMT on 600 MHz frequency band and informed 3GPP that AWG will undertake a study for 600 MHz frequency arrangements that is optimal for APT countries. This included an arrangement that was presented as Option B1 to 3GPP (for 40 + 40 MHz) provided in a LS to 3GPP RAN Plenary and 3GPP RAN4 (AWG-26/OUT-22).
4. 2021 September: Further, the AWG-28 meeting invited 3GPP to start a work item to include giving a band number and appropriate modifications of relevant 3GPP specifications for the APT option of 600 MHz band plans. Also, AWG informed of a preference to call this band as: "APT 600 MHz band". This was provided in an LS to 3GPP (AWG-28/OUT-17).
5. 2022 September: AWG-30 approved the revision to APT/AWG/REP-79 for REV.1[3] that included APT Harmonized Band Plan for IMT (APT 600 MHz) that included the information reproduced below:

> *"The APT 600 MHz band plan for implementation of IMT in the band 470-703 MHz is provided in Figure 2. It is noted it has been developed with the consideration of a sharing/coexistence studies with the Broadcasting and Radio astronomy services and other applications in the Mobile service The APT 600 MHz band plan is a reverse duplex arrangement of 2 x 40 MHz that fits well with the APT 700 MHz band plan (with ordinary duplex) starting at 703 MHz.*

[2] https://www.apt.int/sites/default/files/Upload-files/AWG/APT-AWG-REP-79_APT_Report_Arrangement_470-698_MHz.docx

[3] https://new.apt.int/sites/default/files/2022/09/APT-AWG-REP-79Rev.1_-_APT_Report_on_frequency_arrangements_for_IMT_in_the_band_470-703_MHz.docx

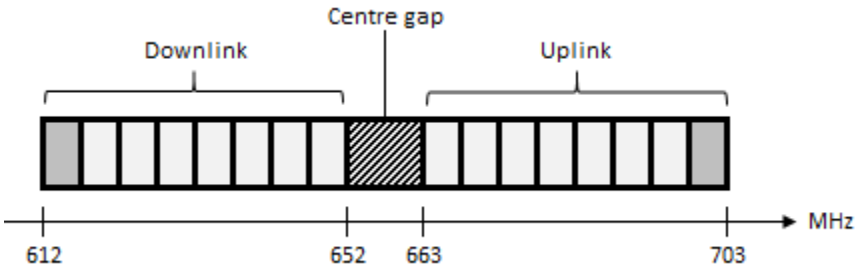

Figure 2: APT 600 MHz band plan for 470-703 MHz band"

In the same AWG-30 meeting, AWG developed a LS to 3GPP RAN4 thanking them of the progress (AWG-30/OUT-19).

6. 2023 May: At the AWG-31 Meeting, 3GPP informed APT about completion of the normative standardization work for "APT 600 MHz band plan" with the assigned band number n105. AWG-31 also developed a LS to 3GPP thanking 3GPP for completing the standardization activity for "APT 600 MHz band plan" (AWG-31/OUT-03).
7. 2023 December: Radio Assembly 2023 (RA-23) approved the revision to ITU-R Recommendation M.1036 (ITU-R M.1036-7)[4] that incorporated this new frequency arrangement as A13 reproduced below:

[4] https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.1036-7-202312-I!!PDF-E.pdf

TABLE 2

Frequency arrangements in the 610-960 MHz frequency range

Frequency arrangements	Paired arrangements (FDD)				Un-paired arrangements (TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
A1	824-849	20	869-894	45	None
A2	880-915	10	925-960	45	None
A3	832-862	11	791-821	41	None
A4	698-716 776-793	12 13	728-746 746-763	30 30	716-728
A5	703-748	10	758-803	55	None
A6					698-806
A7	703-733	25	758-788	55	None
A8	698-703	50	753-758	55	None
A9	733-736	52	788-791	55	None
A10	External		738-758		None
A11 (harmonized with A7 and A10)	703-733 External	25	758-788 738-758	55	None
A12	663-698	11	617-652	46	None
A13	663-703	11	612-652	51	None

8. 2024 September: AWG-33, incorporated all the completed 3GPP references and information in the Report 79 and approved the APT/AWG/REP-79 Rev.2[5] which is the latest version of the AWG Report. The same AWG-33 meeting, based on input contributions, considered revision of APT/AWG/REC-08.

In summary, the work on APT 600 MHz band plan (3GPP band number n105) with the reverse duplex frequency arrangement (2 x 40 MHz) involving downlink from 612-652 MHz and uplink from 663-703 MHz has considered all the technical aspects in detail within APT and 3GPP. This band was developed to further extend the US 600 MHz Band for LTE (3GPP band 71) which is reverse duplex frequency arrangement (2 x 35 MHz) that was defined in 3GPP for the US market situation.

[5] https://apt.int/sites/default/files/report/2024/09/APT_AWG_REP-79_Rev_2__APT-AWG-REP-79%28Rev.2%29.docx