



ITU-APT Foundation of India (IAFI)¹

**PROPOSALS FOR FURTHER UPDATES TO WORKING DOCUMENT TOWARDS A
DRAFT REVISION OF APT REPORT ON FREQUENCY ARRANGEMENTS FOR IMT
IN THE BAND 470-703MHZ**

1. Background

At its 29th meeting, the AWG further developed the working document towards a draft revision of APT report on frequency arrangements for IMT in the band 470-703 MHz, based on the input contributions. AWG-29 also sent a reply LS to 3GPP specifying any preference between Option B1

2. Discussion

The 29th meeting of the APT Wireless Group (AWG-29) had concluded with the final approval of the new APT 600 MHz band plan that hoped to open an additional 40+40 MHz prime UHF spectrum. A similar approach back in 2013 resulted in the 45+45 MHz in the 700 MHz band, known in 3GPP as n28.

During the last year or so, 3GPP RAN 4 has completed a study item on the feasibility of various duplex filter options for use in this band. The results of this study are documented in TR 38.860. This study was sent to the AWG in an LS RP-212629 in Sep 2021 with a request to provide guidance on a preferred band plan and information on regulatory aspects for the normative work to begin. The AWG 28 meeting has considered the request of the 3GPP and has provided a response to this LS. In this response the LS has indicated a preference for option B1 (full band) and has also requested for the work to begin immediately with a view to completion by Dec 2022. Additionally, the answers to the regulatory questions sought by the 3GPP were provided via a reply LS RP 221045 from AWG-29. Based on this LS, 3GPP TSG RAN 96 approved a new work item to standardize the APT 600 MHz band plan.

3. Proposal

Based on the above, we provide further updates to the working document towards a draft revision of APT report on frequency arrangements for IMT in the band 470-703 MHz as **highlighted in yellow** in the attached document

¹ ITU-APT Foundation of India (IAFI) is an Affiliate member of APT. Details of IAFI can be seen at itu-apt.org

WORKING DOCUMENT TOWARDS A DRAFT REVISION OF APT REPORT ON FREQUENCY ARRANGEMENTS FOR IMT IN THE BAND 470-703 MHz

[Editor's note: the revisions without any highlight are from AWG-26/INP-08 and 23, and the revisions with cyan highlighted are from AWG-27/INP-82, and the revisions with yellow highlighted are from AWG-28/INP-43 and Annex highlighted in green is from AWG-29/INP-36R1; this document has not been reviewed by AWG-26 and AWG-27 and AWG-28 and AWG-29.]

The AWG-29 meeting has agreed the following principles and the working document should be modified accordingly.

- Keep Option A as it is in the Report-79

- Among different options among Option B, that B1 is the preferred option for APT and be referred to as the 'APT 600 MHz' band. AWG has invited 3GPP to immediately start work on the technical specifications to support Option B1.

- That B2 may be considered as an option for later standardization should it be required (in a 35 MHz + 35 MHz configuration)]

1 Introduction

The 470-694 MHz frequency range is allocated to the broadcasting service and mobile service on a co-primary basis in Region 3. The frequency band 470-698 MHz, or parts thereof, was identified by WRC-15 in 7 countries in Region 3 through new footnote No. **5.296A** for use by those administrations as listed wishing to implement terrestrial IMT systems. In addition, there is interest from other significant markets to do the same. Elsewhere, USA, Mexico and several other countries in Region 2 also identified this band for IMT through footnotes **5.295** and **5.308A**. It is noted that *resolves* 2 of revised Resolution **224 (Rev.WRC-19)** to encourage administrations to take into account results of the existing relevant ITU Radiocommunication Sector studies, when implementing IMT applications/systems in the frequency bands 694-862 MHz in Region 1, in the frequency band 470-806 MHz in Region 2, in the frequency band 790-862 MHz in Region 3, in the frequency band 470-698 MHz, or portions thereof, for those administrations mentioned in No. **5.296A**, and in the frequency band 698-790 MHz, or portions thereof, for those administrations mentioned in No. **5.313A**;

Spectrum below 1 GHz is exceptionally well suited for mobile broadband applications. In particular, the unique propagation characteristics of the bands below 1 GHz allow for wider area coverage, which in turn requires fewer infrastructures and facilitates service delivery to rural or sparsely populated areas. In this regard, the 700MHz ecosystem is growing swiftly: there are over 34 commercial networks deployments.² The APT700 band plan coming out from region 3 played a huge role in its success globally. Outside of APAC, **some** countries in Region 2 have adopted or plan to adopt the APT700 band plan (3GPP **Band** 28) for LTE system deployments. The lower duplexer of APT700 plan has also been adopted **in some countries of** Region 1 since the conclusion of WRC-15.

As the utilisation the 700MHz spectrum increases over time, it is desirable to look at additional spectrum that could be considered as a companion to 3GPP Band 28. Therefore the use of parts of the 600MHz band for the mobile broadband service would provide a vital means of delivering

² <https://gsacom.com/paper/gsa-apt700-global-status-regulatory-deployments-devices/>

high quality, wide area broadband services including in rural areas and deep inside buildings. The timely availability of frequency arrangements is essential for the development of IMT specifications and standards and the early consideration by Administrations in the footnotes referred to above of suitable frequency arrangements.

The APT region is very diverse and consists of highly developed and developing countries and some with extremely large and rural population base. The sub 1 GHz bands is well suited for the later.

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The band plan for the option B1 that has a single duplexer or full band- is shown in Table 1 below.

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RP-221778
(revision of RP-221062)

Table 1: NR operating band (option B1)

Operating Band	Uplink (UL) operating band BS receive UE transmit	Downlink (DL) operating band BS transmit UE receive	Duplex Mode
	$F_{UL_low} - F_{UL_high}$	$F_{DL_low} - F_{DL_high}$	
	663 MHz – 703 MHz	612 MHz – 652 MHz	FDD

The Tx-Rx is "reverse-duplex"; in other words, the downlink frequency band is below the duplex gap while the uplink frequency band is above the duplex gap. This arrangement is opposite to conventional notation; however, for this band, it provides the benefit of aligning the uplink band adjacent to 3GPP band 28 thereby minimizing interference conditions at the 703 MHz boundary.

2 Scope

This Report covers aspects related to the harmonized frequency arrangement for the band 470-698 MHz. The objective is to develop possible harmonized frequency arrangements on 470-703 MHz in Asia Pacific Region based on the frequency allocation and arrangement in ITU and other Regions, for those countries in the APT region that wish to implement IMT in the existing primary mobile allocation in Region 3. There are two options of harmonized band plans provided for consideration when implementing IMT in spectrum below the APT700.

3 Vocabulary of terms

APT Asia Pacific Telecommunity

IMT International Mobile Telecommunications
WRC World Radiocommunication Conference
3GPP Band 28 UL 703-748 MHz DL 758-803 MHz
3GPP Band 71 UL 663 – 698 MHz DL 617-652 MHz

4 References

Final Acts of the World Radiocommunication Conference (WRC-15)

Recommendation ITU-R M.1036-5, “Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)”.

APT Report APT/AWG/REP50, “APT survey report on frequency bands in relation to study on WRC-15 Agenda Item 1.1”.

5 Key Considerations for Frequency Arrangements

To maximize the benefits for APT countries, the frequency arrangements for IMT should be harmonized to the maximum practical extent to facilitate interoperability, for economies of scale and to enable seamless roaming by users. As far as practical, these arrangements should also reflect the importance of efficient usage of the spectrum.

In the ITU-R WP5D New Zealand, Mexico and Pacific Islands nations submitted a joint input (Document 162), proposing a band plan for the 600 MHz band. The proposed frequency arrangement is based on a reverse FDD configuration, where the frequency range 617-652 MHz is for base-station transmitter and the frequency range 663-698 MHz is for mobile-station transmitter.

The US arrangement for 614-698 MHz after the FCC incentive auction is **similar to the band plan proposed in Document WP5D/162, and** includes 7 blocks of 2 x 5 MHz of licensed spectrum in a FDD arrangement.

The interest from many other countries using the same provides for a harmonization and possible healthy ecosystem.

The preference towards reverse FDD configuration is to ensure compatibility with existing frequency arrangements in the band above 698 MHz and the flexibility in implementing measures to protect lower adjacent services in the band below 617 MHz.

The **APT** 600MHz band **Plan for IMT (option A)** has been included in Release 15 of 3GPP and approved in its RAN#77 meeting. The band is defined as Band 71 and its frequency band arrangements matches the proposed APT band plan below. The related document 3GPP TR 36.755 is attached in the appendix.

6 APT Harmonized Band Plan for IMT

There are two options for a harmonized band plan in the 600 MHz frequency range:

- **Option A : Harmonized with some countries in ITU Region 2 and proposed plans of some APT countries**
- **Option B : Harmonised within APT countries and possibly some countries in Region 1**

Option A

The recommended harmonized band plan for implementation of IMT in the band 470-698 MHz is provided in Fig. 1 for this option. It is noted that it has been developed with the consideration of a sharing/coexistence study with the Broadcasting and Radio astronomy services and other applications in the Mobile service.

- Reverse FDD configuration

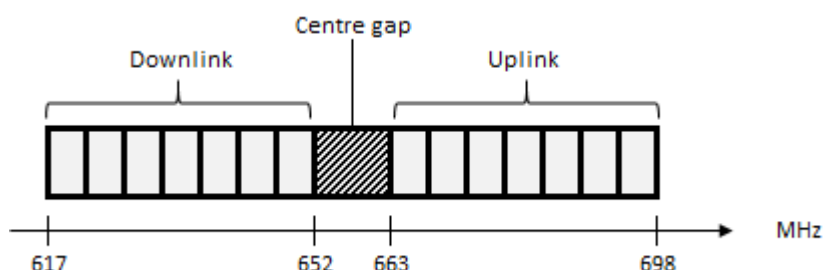


Figure 1: Harmonised band plan for 470-698 MHz band in Option A (Note: The centre gap is also known as duplex gap)

Option B

There are two options to consider for option B that needs to be considered for APT countries. Option (B) (Options B1 and B2) provides a better utilization of spectrum, in conjunction with the existing APT 700 MHz band plan. In option A the 5 MHz spectrum block in 698- 703 MHz is not fully utilized):

Option B1

This option is based on an extension to band n71 and is shown in Fig 2 below:

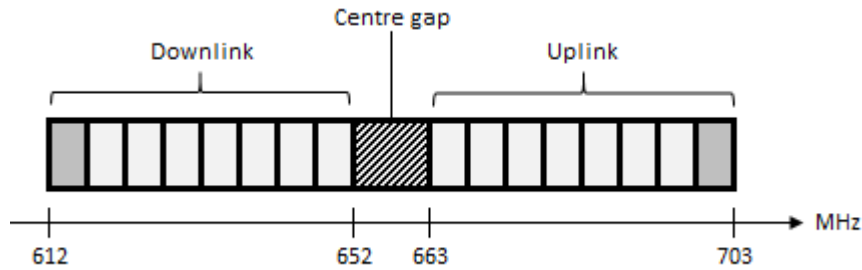


Figure 2: Harmonized band plan for 470-698 MHz band- Option B

In this option the frequency arrangement in Option A is extended upwards and downwards by 5 MHz being a better utilization of spectrum that is achieved with existing APT band that is 703-748 (UL) paired with 758- 803 MHz (DL) (otherwise the spectrum 698- 703 MHz is not fully utilized).

Some countries in Region 3 have RA on a coprimary basis (foot notes: 5.305 and 5.307). and as a consequence, co-existence/sharing with these other services will need to be studied.

Duplex Direction

The extended band proposal is a reverse duplex and in the lower part of the FDD band (below the duplex gap) is down link as compared to up link that is the ordinary convention but this is better suited for co-existence with APT 700 MHz band (band 28) at the upper edge of the band but also with possible broadcasting at the lower edge.

Channel Bandwidth

The revised proposal will result in 2x 40 MHz of FDD spectrum.

Duplex distance

The duplex distance is 51MHz. The frequency plan can support full band or split duplexer as is already the case for 3GPP band 28

Carrier Bandwidths supported

The extended bandwidth will support NR carrier bandwidths up to 30 MHz and LTE bandwidths up to 20 MHz

Co-existence with existing services

Co-existence with the following services will need study:

- Broadcast television below 612 MHz and size of guard band required. We expect this will be similar to band n71
- Radio Astronomy.

Radio astronomy is a receive only service that uses highly sensitive receivers. We expect IMT services using this band will need geographical separation with RAS receivers, but this will a Administration specific issue.

- Un licenced white space devices and Wireless microphones

Wireless microphones are permitted to operate even with band 71 in part of the duplex gap. This has certain limits proposed in 3GPP TR 36 755. These limits will not change. This proposal is not making any changes to the duplex gap.

Option B2

This option uses two duplexers as shown in Fig 3 below and the duplex distance is 46 Mhz as is the case with option A. Also the bottom duplexer is the same as that of option A, with an additional upper duplexer that should have as large possible overlap as possible with the lower duplexer in option A but at the same time being able to handle the duplex gap of 6 MHz. The size of this upper duplexer needs to be studied and decided prior to being specified. **This upper duplexer is a better utilization of spectrum that is achieved with existing APT 700 MHz bandplan (otherwise the spectrum 698- 703 MHz is not fully utilized).** It can be considered to have variable bandwidths ranging from 35 MHz to 10 MHz respectively. Like option B1, this arrangement B2 is also a reversed duplex arrangement.

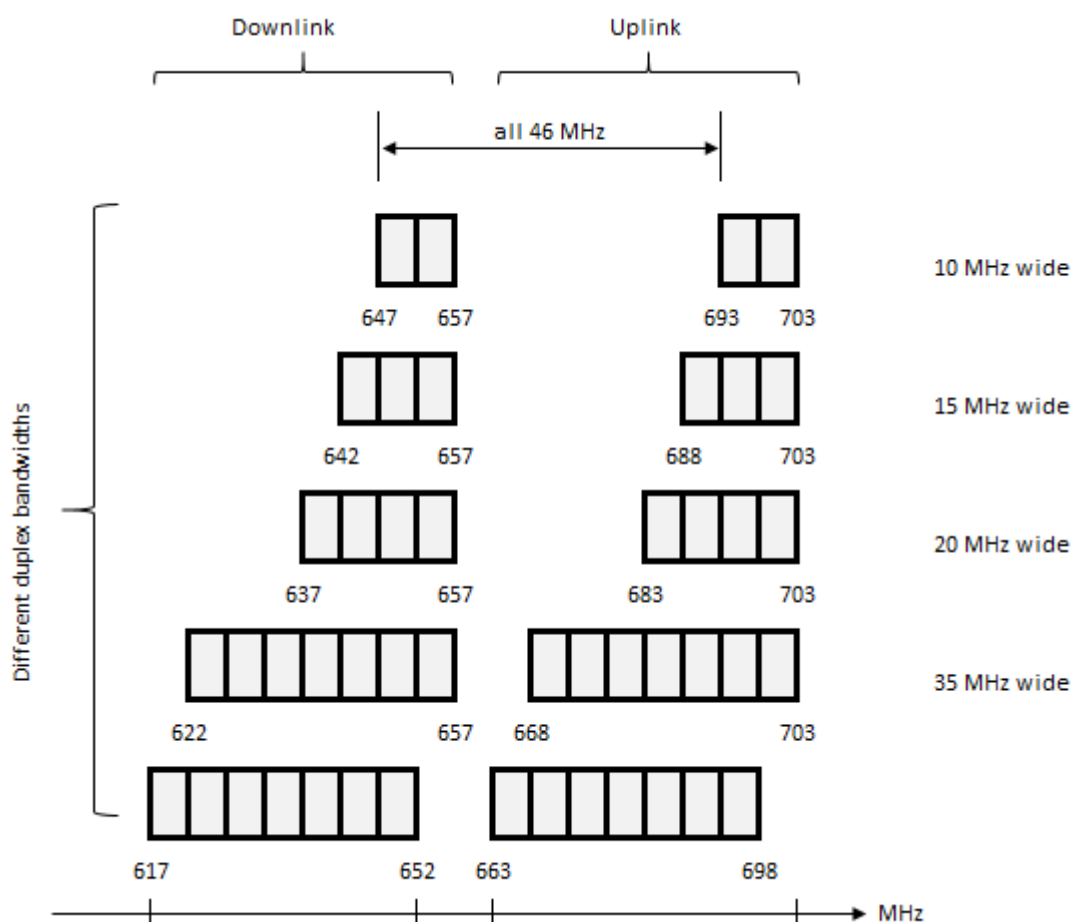


Fig 3: Option B2- two duplexers

This option B2 retains economies of scale advantages by adopting one duplexer being the same as that of option A and the duplex distance same as option A but the duplex gap is now reduced to 6 MHz. **In addition, Option B2 networks can work with option A's user devices, so could facilitate**

the global circulation of such devices. Further study of this is required to determine if this is feasible.

Also in this option there is no issue with RAS co-existence as is the case with option A.

APPENDIX

**3GPP SPECIFICATION ON
600 MHZ BAND FOR LTE**



RP-171631_TR 36

Annex

Technical Considerations for new band options (B1 and B2)

