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ITU-APT Foundation of India (IAFI)[1]

PROPOSALS FOR REPLY LIAISON STATEMENT TO 3GPP RAN, 3GPP RAN4 ON FREQUENCY ARRANGEMENTS FOR IMT IN THE BAND 470–703 MHZ

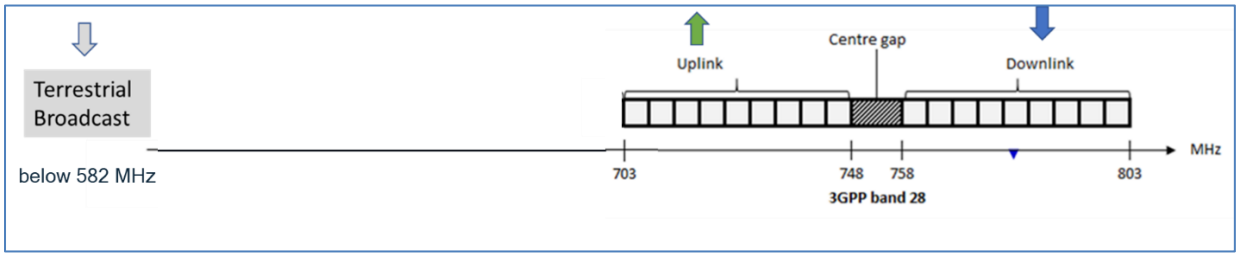
1. Background

At its 28th meeting, the AWG developed a working document in AWG-28/TMP-51, based on the input contributions. It is noted that AWG - SWG SA&H has not fully reviewed this working document and decided to carry forward the working document AWG-28/TMP-51 to next meeting. AWG-28 also initiated an informal correspondence activity to further deliberate on the preference between option B1 and B2 for "APT 600 MHz Band".

In 28th Meeting of AWG, reply LS to 3GPP was sent via Doc AWG-28/OUT-17 without specifying any preference between Option B1 and Option B2.

2. Discussion

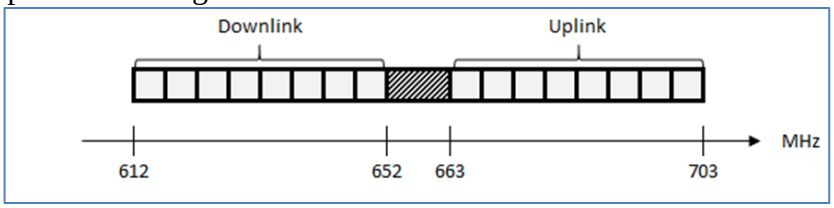
Based on further discussions and considerations from terrestrial DTV usage in India, there is no existing or planned DTV utilization beyond 582 MHz[2].



Further, both B1 and B2 options are new frequency arrangements and will involve creation of a new 3GPP Band Plan.

While Option B1 modifies the duplex gap (51 MHz duplex gap instead of 46 MHz for n71), Option B2 reduces the band gap to just 6 MHz.

Option B1 is depicted in the figure below:



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

[2] https://trai.gov.in/sites/default/files/Additional_information_30122021_0.pdf

Contact: Name **Email:**
Organization, Country

2.1 Considerations for a preferred option

Both Option B1 and Option B2 with work best with new n71 devices that will have the desired redesigned filters to support the additional duplex spacing or the narrow band gap respectively. Option B1 can be implemented with a single duplexer and Option B2 requires two duplexers.

The usage of DTV in a country like India is well below 612 MHz, comfortably more than the guard bands discussed in 3GPP.

For protection of RAS a separation distance may be utilized. This would be an administration matter to be resolved by mutual coordination within the country during implementation.

Due to considerations of cost, implementation complexity, and ecosystem, it would be preferable to go with Option B1 for "APT 600 MHz Band".

3. Proposal

We provide our proposals for a draft LS to 3GPP in track changes to the previous LS Doc AWG-28/OUT-17 highlighted in yellow.

ANNEX

LIAISON TO 3GPP FROM AWG-29

Sub Working Group on Spectrum Arrangements and Harmonization

REPLY LIAISON STATEMENT TO 3GPP RAN, 3GPP RAN4

Title of the Liaison Statement:	FREQUENCY ARRANGEMENTS FOR IMT IN THE BAND 470 – 703 MHZ
Objective:	For Information and comments
Origin:	APT Wireless Group
Contacts:	Mr. Le Van Tuan, Chairman, AWG

The AWG is pleased to acknowledge liaison statements (R4-2114750) from TSG RAN4 and is pleased to know that the 3GPP has completed the 3GPP Rel-17 Study Item (SI) on the extended 600MHz NR band for APT region[3]

AWG invites 3GPP to start a work item to include giving a band number and appropriate modifications of relevant 3GPP specifications for the options of 600 MHz band plans.

AWG -29 has considered the information and issues from the 3GPP liaison statement regarding the development of the APT 600 MHz band plan. AWG would like to provide the following views and information to 3GPP:

1. **Band Name**

   It is the AWG preference to call this band as: "APT 600 MHz band"

2. **Preference for Options B1**

   AWG has decided that Option B1 is the preferred option, and it should be known as the "APT 600 MHz band". .

3. **Options B2 and B2a**
   Options B2 and B2a are not preferred options for APT
   As previously indicated option B2a is not a priority for the AWG.

4. **Time frame of work completion**

AWG kindly invites 3GPP to finalize the relevant specifications by September 2022, and requests 3GPP to respond upon the feasibility of this request.

5. Other existing users in the 600 MHz band and in adjacent bands

Different APT administrations will have chosen to implement different systems in different portions of the band to suit their national requirements. This may be radio systems under the Fixed, Mobile and Broadcasting Services. Typical existing systems include Digital Terrestrial Television and Radio Microphones / Program Making and Special Events. Some countries allow Television White space devices. The 606 – 614 MHz may also be used by stations of the Radio Astronomy Service (see ITU Radio Regulations footnote No. 5.149), some countries are listed in ITU Radio Regulations footnotes as having an additional allocation in the 606-614 MHz and 608-614 MHz bands (see RR No. 5.305 and No. 5.307). An overview of spectrum usage is given in Figure 1 below. It should be noted that many countries may still use DTT channels throughout the 600 MHz band but it is assumed that APT 600 and DTT will not be able to share in the same area. Radio Microphones / Program Making and Special Events and Television White space devices operate in the spaces / gaps in the spectrum (spectrum that is unused in an area) and are shown as an underlay / secondary user. Some APT counties are listed in a footnote in the ITU Radio Regulations as having an International Mobile Telecommunications (IMT) identification in the 610-698 MHz frequency range (see RR No. 5.296A).

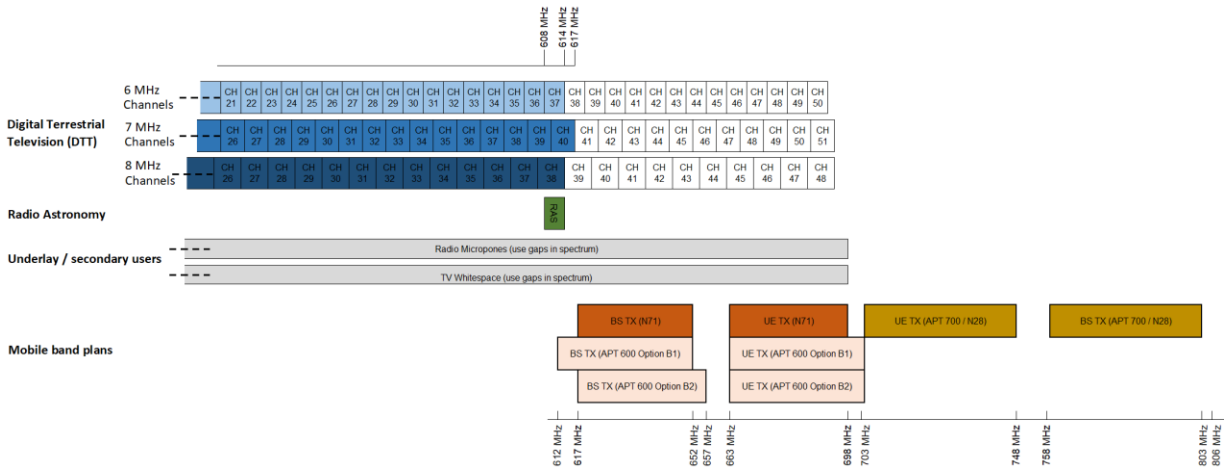


Figure 1 - Likely spectrum use cases compared with the proposed APT 600 MHz plan

1.1. Digital Terrestrial Television (DTT) characteristics

Digital Terrestrial Television (DTT) may be used throughout the 470 to 698 MHz band in many APT countries. The amount of usage will vary from country to country. Some countries may have relatively light usage of DTT or not have many / any stations in the 600 MHz band while other countries could have dense usage throughout both the 500 and 600 MHz bands.

Different technologies are used in different countries which may use different channel sizes in the APT region, this includes 6, 7 and 8 MHz (see Recommendation ITU-R BT.798-1). The common technologies used by APT countries are:

- DVB-T
- ATSC
- ISDB

- DTMB
- DMB

Typical technical characteristics can be found in Report ITU-R BT.2383-3 *"Typical frequency sharing characteristics for digital terrestrial television broadcasting systems in the frequency band 470-862 MHz"* A summary of the reference broadcasting networks for fixed reception can be found in Annex 1.

1.2. Radio microphone / audio Program Making and Special Event (PMSE) characteristics

Radio microphones / audio Program Making and Special Events utilise frequencies that are not used by other transmissions in that area (e.g. DTT). Some countries allow radio microphones under general authorisation (e.g. licence exemption / unlicenced) while others have a licensing scheme (particularly for professional users). Radio microphones usage is widespread with major events requiring a large number of channels. Information on radio microphones can be found in ECC Report 323 ECC Report 204, EN 300 422-1 V2.1.2, EN 300 422-2 V2.1.1, EN 300 422-3 V2.1.1 and AS/NZS 4268. A summary of the characteristics can be found in Annex 1.

1.3. Television White Space (TVWS) users

Some countries may permit the use of Television White Space (TVWS) devices that operate in the UHF television spectrum as a secondary user, working around other primary users to avoid interference. Many implementations utilise a database while some implementations are manually configurable (may be licenced instead of a database). Technical characteristics for these devices can be found:

- FCC CFR Title 47, Part 15, Subpart H - Television Band Devices 15.701 – 15.717; or
- ETSI EN 301 598 V1.1.1 and EN 301 598 V2.1.1 'White Space Devices (WSD); Wireless Access Systems operating in the 470 MHz to 790 MHz TV broadcast band

1.4. Radio astronomy within 608 -614 MHz

Some countries may be operating Stations under the Radio Astronomy Service within the 608 – 614 MHz band at specific locations. These receivers are very sensitive as they are trying to detect weak / distant signals. They may be susceptible to both in band and unwanted emissions. Typically Radio Astronomy Stations are located away from populated areas (often located far away from urban centres) and are protected through the implementation of a co-ordination zone around those specific locations on a case by case basis. The threshold levels detrimental to radio astronomy observations for the relevant frequency bands can be found in Recommendation ITU-R RA.769.

The clearing of the band for mobile/IMT use is a national issue in the Administrations

6. 5G NR band combinations used in APT countries

5G NR deployments in APT countries are based on band combinations that are available in those individual countries. It is common for many APT countries to use a combination of bands from different regions (e.g. combinations of bands commonly used in North America and Europe). It is important that APT band combinations are supported to maximise the utility of APT 600 MHz. 5G NR deployments could be

either Non-Stand-Alone (NSA) or Stand Alone (SA) modes and could be used in Carrier Aggregation (CA) or Dual Connectivity (DC) configurations between Frequency Range 1 (FR1) and Frequency Range 2 (FR2) configurations.

7. **Compatibility of options for 600 MHz with the APT 700 MHz band plan**

   APT 700 MHz (Band 28) has widespread deployment many APT countries with many thousands of base stations and numbers are continuing to grow. Other countries planning are also planning to implement APT 700 MHz (B28 or n28) in the future. It is essential that any 600 MHz APT band plan is compatible with APT 700 MHz (B28 or n28). Any country considering APT 600 MHz is likely to have implemented APT 700 MHz.

AWG would appreciate 3GPP to provide any feedback before the next 30th APT Wireless Group (AWG-30) meeting, scheduled in xx 2022, if any.

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AWG will keep 3GPP informed of the progress and outcomes of relevant studies in future AWG meetings.

Mr. Le Van Tuan
Chairman
APT Wireless Group

Annex 1

Table 1: Summary of the reference broadcasting networks from Report ITU-R BT.2383-3 for fixed reception

Parameter	DVB-T / DVB-T2	ATSC	ISDB	DTMB
Channel bandwidths	8 MHz & 7 MHz	6 MHz	8 MHz & 6 MHz	8 MHz
High power transmitters / main stations				
ERP (W)	200 000	1000000	30000	200 000
EIRP (dBW)	55.16	62.15	46.92	55.16
Effective antenna height (m)	300			
Antenna height AGL (m)	200			
Antenna Height Above Average Terrain – HAAT (m)		365	100	
Medium Power transmitters / relay station				
ERP (W)	5000	400000	50	5000
EIRP (dBW)	39.14	58.17	19.14	39.14
Effective antenna height (m)	150			150
Antenna height AGL (m)	75			
Antenna Height Above Average Terrain – HAAT (m)		550	20	
Low Power transmitters / repeater				
ERP (W)	250	50000	0.05	250
EIRP (dBW)	26.13	49.14		26.13
Effective antenna height (m)	75			75
Antenna height AGL (m)	30			30
Antenna Height Above Average Terrain – HAAT (m)		1800	10	
Receivers				
Antenna Gain (dBi)[4]	13.3	13.3	13.3	13.3
Antenna height above ground (m)	10	10	10	10
Feeder loss (dB)[5]	4	4	4	4
Polarisation discrimination (dB)[6]	0	0	0	0
Receiver signal bandwidth (MHz)	7.6 /7.77	6	5.6 /7.4	7.56

Thermal noise (kT_0) (dBm/Hz)	-173.98	-173.20	-173.98	-173.98
Receiver noise figure (dB)	7 / 6	7	7	7
Receiver noise floor (dBm/Hz)	-166.98 / -167.98	-166.2	-166.98	-166.98
Carrier to noise ratio (dB)	20	15	21[7]	19
Minimum field strength dBuV/m	55.2 /54.3	41	55 / 56.2	50

Further technical found in technical characteristics can be found in Report ITU-R BT.2383-3. Further detail on DVB-T / DVB-T2 transmitters can be found in EN 302 296 V2.2.1 and further detail on DVB-T / DVB-T2 EN 303 340 V1.2.1

Table 2: Summary of Radio Microphone Characteristics

Parameter	**Wireless microphone**	**In Ear Monitor (IEM)**	**Audio / RF link**
Transmitter characteristics			
Modulation	Analogue FM wideband or Digital modulation	Analogue FM wideband or Digital modulation	Analogue FM wideband or Digital modulation
RF output power	10 mW to 100 mW (Typical – periodically some higher power levels may be used up to 500mW)	10 mW to 100 mW (Typical – periodically some higher power levels may be used up to 500mW)	10 mW to 100 mW (Typical – periodically some higher power levels may be used up to 500mW)
Transmitter bandwidth	200 kHz (Typical)	200 kHz (Typical)	2 x 200 kHz (Typical)
Receiver characteristics			
Receiver bandwidth	200 kHz (Typical)	200 kHz (Typical)	2 x 200 kHz (Typical)
Thermal noise	-121 dBm / 200 kHz	-121 dBm / 200 kHz	-121 dBm / 200 kHz
Noise figure	6 dB (Typical)	6 dB (Typical)	6 dB (Typical)
Receiver noise floor	-115 dBm / 200 kHz	-115 dBm / 200 kHz	-115 dBm / 200 kHz

Further technical details on radio microphones can be found in ECC Report 323 ECC Report 204, EN 300 422-1 V2.1.2, EN 300 422-2 V2.1.1, EN 300 422-3 V2.1.1, and AS/NZS 4268