



Recommendation ITU-R M.1036-5
(10/2015)

**Frequency arrangements for
implementation of the terrestrial
component of International Mobile
Telecommunications (IMT) in
the bands identified for IMT
in the Radio Regulations (RR)**

M Series
**Mobile, radiodetermination, amateur
and related satellite services**

Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

Policy on Intellectual Property Right (IPR)

ITU-R policy on IPR is described in the Common Patent Policy for ITU-T/ITU-R/ISO/IEC referenced in Annex 1 of Resolution ITU-R 1. Forms to be used for the submission of patent statements and licensing declarations by patent holders are available from <http://www.itu.int/ITU-R/go/patents/en> where the Guidelines for Implementation of the Common Patent Policy for ITU-T/ITU-R/ISO/IEC and the ITU-R patent information database can also be found.

Series of ITU-R Recommendations

(Also available online at <http://www.itu.int/publ/R-REC/en>)

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

Electronic Publication
Geneva, 2015

© ITU 2015

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without written permission of ITU.

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)

(Question ITU-R 229-2/5)

(1994-1999-2003-2007-2012-2015)

Scope

This Recommendation provides guidance on the selection of transmitting and receiving frequency arrangements for the terrestrial component of IMT systems as well as the arrangements themselves, with a view to assisting administrations on spectrum-related technical issues relevant to the implementation and use of the terrestrial component of IMT in the bands identified in the RR. The frequency arrangements are recommended from the point of view of enabling the most effective and efficient use of the spectrum to deliver IMT services – while minimizing the impact on other systems or services in these bands – and facilitating the growth of IMT systems.

This Recommendation is complemented by other ITU-R Recommendations and Reports on IMT that provide additional details on a number of aspects including unwanted emission characteristics for the bands addressed in this Recommendation and radio interface specifications.

Keywords

IMT, frequency arrangements, terrestrial component of IMT

Introduction

IMT-2000, third generation mobile systems, started service around the year 2000 and provide access by means of one or more radio links to a wide range of telecommunication services supported by the fixed telecommunication networks (e.g. PSTN/ISDN/Internet protocol (IP)) and to other services specific to mobile users. Since then, IMT-2000 has been continually enhanced.

A range of mobile terminal types is encompassed, linking to terrestrial and/or satellite-based networks, and the terminals may be designed for mobile or fixed use.

International Mobile Telecommunications-Advanced (IMT-Advanced) systems are mobile systems that include the new capabilities of IMT that go beyond those of IMT-2000. Such systems provide access to a wide range of telecommunication services including advanced mobile services, supported by mobile and fixed networks, which are increasingly packet-based.

IMT-Advanced systems support low to high mobility applications and a wide range of data rates in accordance with user and service demands in multiple user environments. IMT-Advanced also has capabilities for high-quality multimedia applications within a wide range of services and platforms providing a significant improvement in performance and quality of service.

International Mobile Telecommunications (IMT) encompasses both IMT-2000 and IMT-Advanced collectively.

Key features of IMT-2000 and IMT-Advanced are contained in Recommendations ITU-R M.1645 and ITU-R M.1822. Frequency aspects and unwanted emission parameters are contained in Recommendations ITU-R M.1580, ITU-R M.1581, ITU-R M.2070 and ITU-R M.2071. Frequency arrangements may be included in Recommendation ITU-R M.1036 before the associated companion Recommendations are updated to provide the generic unwanted emission characteristics of mobile and base stations using the terrestrial radio interfaces of IMT.

Limits on the maximum unwanted emission characteristics are necessary to protect other radio systems including those in adjacent bands and to help establish the coexistence between different technologies for the bands addressed in this Recommendation.

The capabilities of IMT systems are being continuously enhanced in line with user needs and technology trends.

The following bands are identified for IMT in the Radio Regulations (RR) edition 2012. This identification does not preclude the use of these bands by any application of the services to which they are allocated or identified and does not establish priority in the Radio Regulations. It has to be noted that different regulatory provisions apply to each band. The Regional deviations for each band are described in the different footnotes applying in each band, as shown in Table 1.

TABLE 1

Band (MHz)	Footnotes identifying the band for IMT
450-470	5.286AA
698-960	5.313A, 5.317A
1 710-2 025	5.384A, 5.388
2 110-2 200	5.388
2 300-2 400	5.384A
2 500-2 690	5.384A
3 400-3 600	5.430A, 5.432A, 5.432B, 5.433A

Also, administrations may deploy IMT systems in bands allocated to the mobile service other than those identified in the RR, and administrations may deploy IMT systems only in some or parts of the bands identified for IMT in the RR.

The ITU Radiocommunication Assembly,

considering

- a) that the ITU is the internationally recognized organization that has sole responsibility to define and to recommend the standards and globally harmonized frequency arrangements for IMT systems, with the collaboration of other relevant organizations;
- b) that globally harmonized spectrum and globally harmonized frequency arrangements for IMT are desirable;
- c) that a minimized number of globally harmonized frequency arrangements in the bands identified for IMT will reduce the overall cost of IMT networks and terminals by providing economies of scale, and facilitating deployment and cross-border coordination;
- d) that, when frequency arrangements cannot be harmonized globally, a common base and/or mobile transmit band would facilitate the development of terminal equipment for global roaming. A common base transmit band, in particular, provides the possibility to broadcast to roaming users all information necessary to establish a call;
- e) that, when developing frequency arrangements, possible technological constraints (e.g. cost efficiency, size and complexity of terminals, high speed/low power digital signal processing and the need for compact batteries) should be taken into account;
- f) that guardbands for IMT systems should be minimized to avoid wasting spectrum;

- g) that when developing frequency arrangements, current and future advances in IMT (e.g. multimode/multiband terminals, enhanced filter technology, adaptive antennas, advanced signal processing techniques, techniques associated with cognitive radio systems, variable duplex technology and wireless connectivity peripherals) may facilitate more efficient use and increase overall utilization of radio spectrum;
- h) that individual subscriber traffic in IMT systems is expected to be dynamically asymmetric where the direction of asymmetry can vary rapidly within short (ms) time-frames;
- i) that per-cell level traffic for IMT systems is expected to be dynamically asymmetric where the direction of asymmetry will vary based on the aggregate subscriber traffic;
- j) that IMT network traffic may change in asymmetry over the longer term;
- k) that the IMT-2000 radio interfaces are detailed in Recommendation ITU-R M.1457 and currently include two modes of operation – frequency division duplex (FDD) and time division duplex (TDD);
- l) that the IMT-Advanced radio interfaces are detailed in Recommendation ITU-R M.2012 and include both FDD and TDD modes;
- m) that there are benefits in the use of both FDD and TDD modes in the same band; however, this usage needs careful consideration to minimize the interference between the systems, as per the guidance provided in *considering o*); especially if flexible FDD/TDD boundaries are selected, there may be a need for additional filters in both transmitters and receivers, guardbands that may impact spectrum utilization, and the use of various mitigation techniques for specific situations;
- n) that selectable/variable duplex technology is considered to be one technique that can assist in the use of multiple frequency bands to facilitate global and convergent solutions. Such a technology could bring further flexibility that would enable IMT terminals to support multiple frequency arrangements;
- o) that Reports ITU-R M.2030, ITU-R M.2031, ITU-R M.2045, ITU-R M.2109, ITU-R M.2110 and ITU-R M.2041 can assist in determining means to ensure coexistence (e.g. guardband requirements between the FDD and TDD systems) and compatibility between the satellite and terrestrial components of IMT,

noting

that Attachments 1 through 3 provide information on specific vocabulary and terms utilized in this Recommendation, the implementation objectives of IMT and a listing of related Recommendations and Reports,

recognizing

- a) that Resolution **646 (Rev.WRC-12)** encourages administrations to consider the following identified frequency bands, amongst others, for public protection and disaster relief when undertaking their national planning:
- in Region 2: 746-806 MHz, 806-869 MHz;
 - in Region 3¹: 806-824/851-869 MHz;
- b) that the identification of the above frequency bands/ranges for public protection and disaster relief does not preclude the use of these bands/frequencies by any application within the services to which these bands/frequencies are allocated and does not preclude the use of nor

¹ Some countries in Region 3 have also identified the bands 380-400 MHz and 746-806 MHz for public protection and disaster relief applications.

establish priority over any other frequencies for public protection and disaster relief in accordance with the Radio Regulations;

c) that at WARC-92, 230 MHz of spectrum was identified for IMT-2000 in the bands 1 885-2 025 MHz and 2 110-2 200 MHz, including the bands 1 980-2 010 MHz and 2 170-2 200 MHz for the satellite component of IMT-2000, in No. **5.388** and under the provisions of Resolution **212 (Rev.WRC-07)**;

d) that Resolution **212 (Rev.WRC-07)** notes that the availability of the satellite component of IMT in the bands 1 980-2 010 MHz and 2 170-2 200 MHz simultaneously with the terrestrial component of IMT in the bands identified in No. **5.388** would improve the overall implementation and the attractiveness of IMT,

recommends

1 that the frequency arrangements in Sections 1 to 6 should be used for the implementation of IMT in the bands identified for IMT in the Radio Regulations (RR); and

2 that the implementation aspects detailed in Annex 1 should be taken into account when implementing the frequency arrangements in Sections 1 to 6.

Annex 1

Implementation aspects applicable to the frequency arrangements in Sections 1 to 6

The order of the frequency arrangements within each Section does not imply any priority. Administrations may implement any of the recommended frequency arrangements to suit their national conditions. Administrations may implement all or part of each frequency arrangement.

It is noted that Administrations may implement other frequency arrangements (for example, arrangements which include different duplex schemes, different FDD/TDD boundaries, etc.) to fulfil their requirements. These administrations should consider geographical neighbouring deployments as well as matters related to achieving economies of scale, facilitating roaming, and measures to minimize interference.

Administrations should take into account the fact that some of the different frequency arrangements in the same band have an overlap of base station transmitter and mobile station transmitter bands. Interference problems may result if different frequency arrangements with such overlaps are implemented by neighbouring administrations.

Sections 1 to 6 are parts of this Recommendation, and they should be considered in their entirety when implementing frequency arrangements.

Traffic asymmetry implications

It is recommended that administrations and operators consider asymmetric traffic requirements when assigning spectrum or implementing systems. Applications supported by IMT may have various degrees of asymmetry. Report ITU-R M.2072 describes not only download dominant applications such as e-newspaper, but also upload dominant applications such as observation (network-camera) and upload file transfer. Also, the degree of asymmetry of other applications such

as high-quality video telephony, mobile multicasting, and videoconference depends on their requirements.

In this context, asymmetry means that the basic amount of traffic may differ between the uplink and the downlink direction. As a possible consequence, the amount of resources needed for the downlink may differ from that of the uplink. Estimates for a mix of traffic are described in Report ITU-R M.2023, Report ITU-R M.2078 and Recommendation ITU-R M.1822. Suitable techniques to support asymmetric traffic are described in Report ITU-R M.2038.

It is noted that traffic asymmetry can be accommodated by a variety of techniques including flexible timeslot allocation, different modulation formats, and different coding schemes for the uplink and downlink. With equal FDD pairing for uplink and downlink, or TDD, varying degrees of traffic asymmetry can be accommodated.

Segmentation of the spectrum

It is recommended that the frequency arrangements not be segmented for different IMT radio interfaces or services except where necessary for technical and regulatory reasons.

It is recommended that the frequency arrangements should, to maintain flexibility of deployment, be available for use in either FDD mode, TDD mode, or both, and should not, ideally, be segmented between FDD and TDD modes in paired spectrum except where necessary for technical and regulatory reasons.

Duplex arrangement and separation

It is recommended that, for bands identified for use by IMT, IMT systems operating in FDD mode should maintain the conventional duplex direction, with mobile terminal transmit within the lower band and base station transmit within the upper band.

In the conventional duplex direction for FDD terrestrial mobile systems, the mobile terminal transmits at the lower frequencies and the base station at the higher frequencies. This is because the system performance is generally constrained by the uplink link budget due to the limited transmit power of terminals.

In order to facilitate coexistence with adjacent services, in some instances it may be desirable to reverse the duplex direction, with the mobile terminal transmit within the upper band and base station transmit within the lower band. These cases are specified in the applicable Sections.

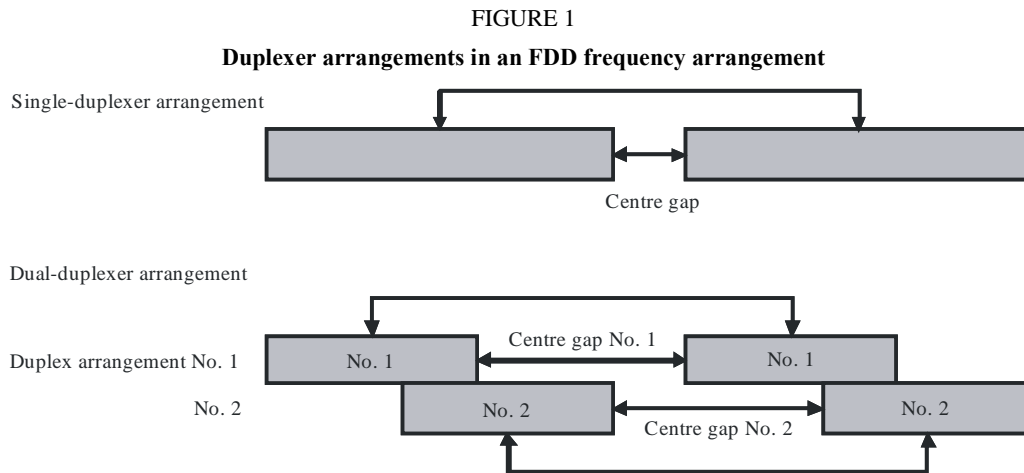
It is recommended that for administrations wishing to implement only part of an IMT frequency arrangement, the channel pairing should be consistent with the duplex frequency separations of the full frequency arrangement.

Dual duplexer

The duplex separation, the duplexer bandwidth, and the centre gap in an FDD frequency arrangement influence the duplexer performance:

- larger duplex separation brings better isolation performance between downlink and uplink (i.e. less self-desensitization);
- larger duplexer bandwidth reduces the overall duplexer performance, resulting in both worse self-desensitization and higher interference from MS to MS or BS to BS;
- smaller centre gap may lead to higher interference from MS to MS or BS to BS.

One way to reduce the duplexer's bandwidth in an FDD system, while keeping a larger duplex separation and total bandwidth, is to use a dual duplexer. From an implementation point of view, a dual duplexer arrangement can be implemented according to Fig. 1 below.



M.1036-01

A fixed overlap between duplex arrangement #1 and #2 enables the use of common equipment to meet the operational requirements of deployments. The size of the overlap is likely to be the same for all implementations, and it would be decided in accordance with filter design when establishing the band plan.

Due to the two adjacent duplex arrangements, the gap between DL (downlink) and UL (uplink) blocks can be made smaller than the duplex gap in a single duplexer FDD arrangement. Such two-duplexer arrangement can be implemented by standard filter technology. This would minimize the cost and complexity of equipment.

However, the small gap between UL and DL blocks will put additional filtering requirements on the terminals to avoid MS-MS interference. The BS-BS interference can be handled by additional filtering using conventional technologies.

Frequency availability

It is recommended that administrations make available the necessary frequencies for IMT system development in a timely manner.

SECTION 1

Frequency arrangements in the band 450-470 MHz

The recommended frequency arrangements for implementation of IMT in the band 450-470 MHz are summarized in Table 2 and in Fig. 2, noting the guidelines in Annex 1 above.

TABLE 2

Frequency arrangements in the band 450-470 MHz

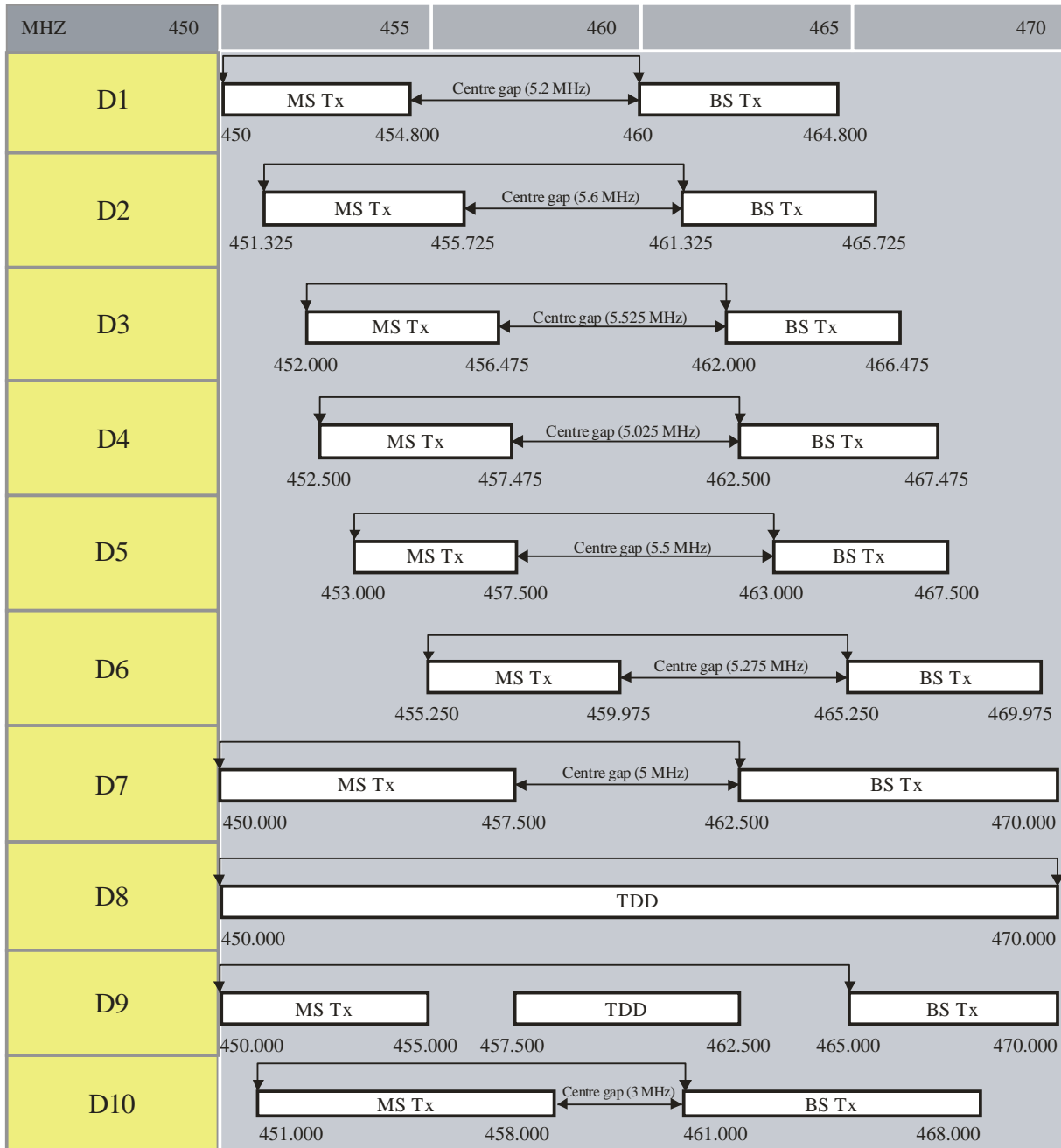
Frequency arrangements	Paired arrangements				Un-paired arrangements (e.g. for TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
D1	450.000-454.800	5.2	460.000-464.800	10	None
D2	451.325-455.725	5.6	461.325-465.725	10	None
D3	452.000-456.475	5.525	462.000-466.475	10	None
D4	452.500-457.475	5.025	462.500-467.475	10	None
D5	453.000-457.500	5.5	463.000-467.500	10	None
D6	455.250-459.975	5.275	465.250-469.975	10	None
D7	450.000-457.500	5.0	462.500-470.000	12.5	None
D8					450-470 TDD
D9	450.000-455.000	10.0	465.000-470.000	15	457.500-462.500 TDD
D10	451.000-458.000	3.0	461.000-468.000	10	None
D11	450.500-457.500	3.0	460.500-467.500	10	None

Notes to Table 2:

NOTE 1 – The number of frequency arrangements given in Table 2 reflects the fact that administrations have had to accommodate incumbent operations, while for example maintaining a common uplink/downlink structure (uplink in the lower 10 MHz, downlink in the upper 10 MHz) for FDD arrangements.

NOTE 2 – Arrangements D7, D8 and D9 can be implemented by administrations that have the whole 450-470 MHz band available for IMT. Arrangement D8 can also be implemented by administrations having only a subset of the band available for IMT.

FIGURE 2
(See notes to Table 2)



SECTION 2

Frequency arrangements in the band 694-960 MHz

The recommended frequency arrangements for implementation of IMT in the band 694-960 MHz are summarized in Table 3 and in Fig. 3, noting the guidelines in Annex 1 above.

TABLE 3

Paired Frequency arrangements in the band 694-960 MHz

Frequency arrangements	Paired arrangements				Un-paired arrangements (e.g. for 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	None	None	None		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

Notes to Table 3:

NOTE 1 – Due to the different usage in the bands 698-960 MHz between Regions, there is no common solution possible at this time.

NOTE 2 – In A3, IMT systems are operating in FDD mode and use a reversed duplex direction, with mobile terminal transmit within the upper band and base station transmit within the lower band. Such an arrangement provides better conditions for coexistence with the lower adjacent broadcasting service.

It is noted that Administrations which do not wish to use this plan or which do not have the full band 790-862 MHz available may consider other frequency arrangements including, e.g. partial implementation of frequency arrangement described in A3, a TDD frequency arrangement (with a guardband of at least 7 MHz above 790 MHz) or a mixed introduction of TDD and FDD frequency arrangements.

NOTE 3 – In A4, administrations can use the band solely for FDD or TDD, or some combination of FDD and TDD. Administrations can use any FDD duplex spacing or FDD duplex direction. However, when administrations choose to deploy mixed FDD/TDD channels with a fixed duplex separation for FDD, the duplex separation and duplex direction as shown in A4 are preferred. Individual band blocks in the mixed channel arrangement may include further subdivisions to accommodate both duplex methods.

NOTE 4 – The frequency arrangements for the band 698-960 MHz have been developed taking into consideration the *recognizing* above.

The frequency arrangements for PPDR systems using IMT technologies in the bands identified in Resolution 646 (WRC-03), according to *considering h*) and *resolves 6* of that Resolution, are outside the scope of this Recommendation. There are inherent benefits of deploying IMT technologies for PPDR applications in this band, including advantages of large coverage area and possible interoperability across the 700 and 800 MHz bands, noting the differences in operational requirements and implementations.

NOTE 5 – In A5, 2 × 45 MHz FDD arrangement is implemented by using sub-blocks with dual duplexer solution and conventional duplex arrangement. Internal guardbands of 5 MHz and 3 MHz are provided at the lower and upper edge of the band for better co-existence with adjacent radiocommunication services.

NOTE 6 – In A6, taking into account the external 4 MHz guardband (694-698 MHz), a minimum internal guardband of 5 MHz at the lower edge (698 MHz) and 3 MHz at the upper edge (806 MHz) needs to be considered.

NOTE 7 – The frequency arrangement in A7 aligns with the lower duplexer from A5.

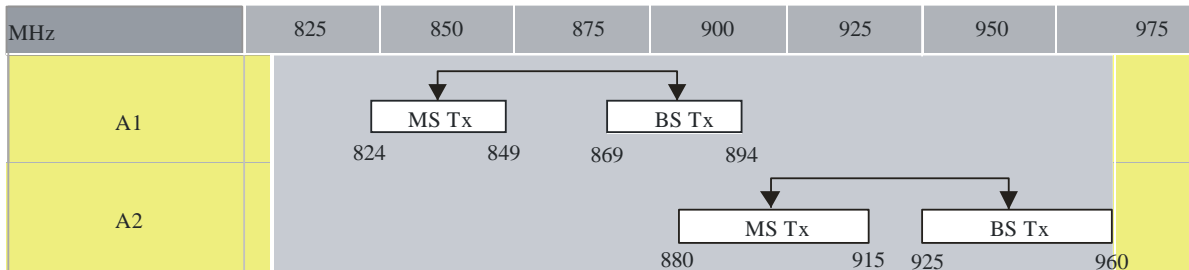
NOTE 8 – Administrations can implement the A8 arrangement alone or in combination with parts of A7 (e.g. UL: 698-718/DL: 753-773 MHz), provided that coexistence with the services below 694 MHz is ensured.

NOTE 9 – The frequency arrangement in A9 aligns with part of the upper duplexer of A5.

NOTE 10 – For A10 and A11, zero to four frequency blocks of 5 MHz in 738-758 MHz could be used to complement the downlink capacity of a frequency arrangement in this or other bands.

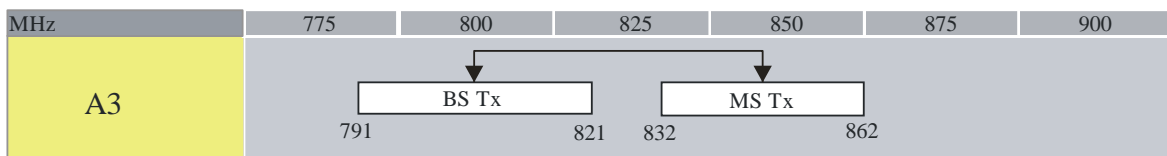
NOTE 11 – For administrations having implemented the A7 arrangement, this arrangement can be combined with the A10 arrangement, i.e. A11.

FIGURES 3A1 and 3A2
(See notes to Table 3)



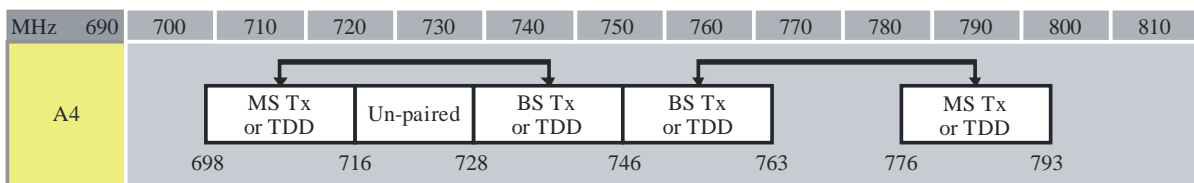
M.1036-03-A1-2

FIGURE 3A3



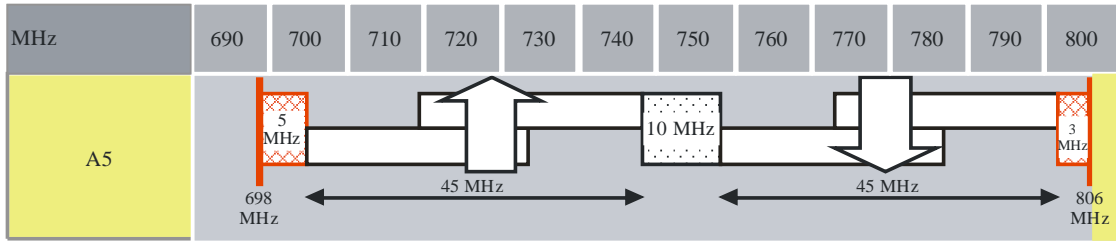
M.1036-03-A3

FIGURE 3A4



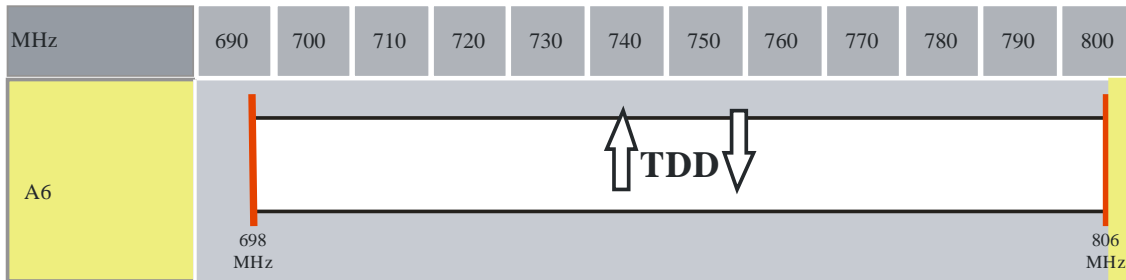
M.1036-03-A4

FIGURE 3A5



M.1036-03-A5

FIGURE 3A6



M.1036-03-A6

FIGURE 3A7

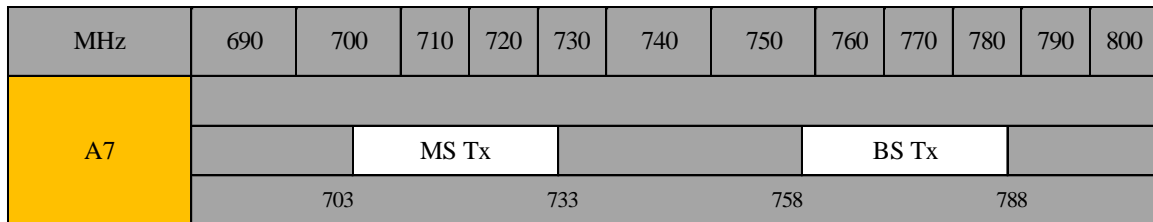


FIGURE 3A8

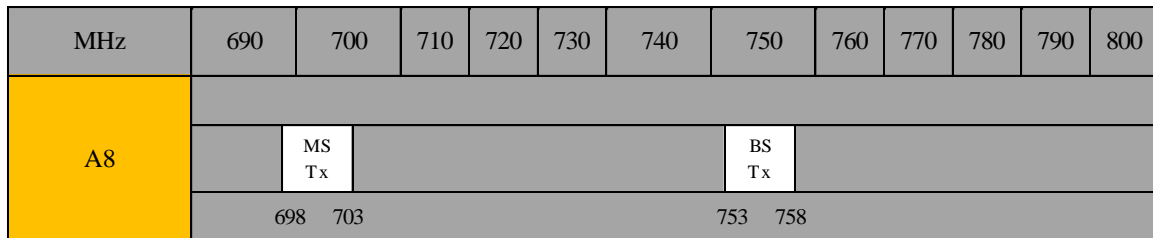


FIGURE 3A9

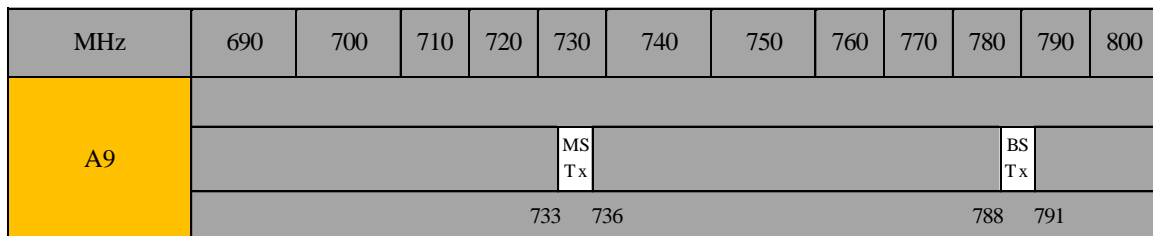


FIGURE 3A10

MHz	690	700	710	720	730	740	750	760	770	780	790	800
A10												
						BS Tx						
	738						758					

FIGURE 3A11

MHz	690	700	710	720	730	740	750	760	770	780	790	800
A11												
			MS Tx			BS Tx		BS Tx				
	703			733 738			758			788		

SECTION 3

Frequency arrangements in the band 1 710-2 200 MHz²

The recommended frequency arrangements for implementation of IMT in the band 1 710-2 200 MHz are summarized in Table 4 and in Fig. 4, noting the guidelines in Annex 1 above.

TABLE 4

Frequency arrangements in the band 1 710-2 200 MHz

Frequency arrangements	Paired arrangements				Un-paired arrangements (e.g. for TDD) (MHz)	Relevant Notes
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)		
B1	1 920-1 980	130	2 110-2 170	190	1 880-1 920; 2 010-2 025	1, 2, 4
B2	1 710-1 785	20	1 805-1 880	95	None	1
B3	1 850-1 920	10	1 930-2 000	80	1 920-1 930	1, 2, 5
B4 (harmonized with B1 and B2)	1 710-1 785 1 920-1 980	20 130	1 805-1 880 2 110-2 170	95 190	1 880-1 920; 2 010-2 025	1, 2, 4
B5 (harmonized with B3 and partially harmonized with the downlink of B1 and the uplink of B2)	1 850-1 920 1 710-1 780	10 330	1 930-2 000 2 110-2 180	80 400	1 920-1 930	1, 2, 3, 5
B6	1 980-2 010	160	2 170-2 200	190	None	4, 5
B7	2 000-2 020	160	2 180-2 200	180	None	5

Notes to Table 4:

NOTE 1 – In the band 1 710-2 025 MHz and 2 110-2 200 MHz three basic frequency arrangements (B1, B2 and B3) are already in use or planned to be used by public mobile cellular systems including IMT. Based on these three arrangements, different combinations of arrangements are recommended as described in B4 and B5. The B1 arrangement and the B2 arrangement are fully complementary, whereas the B3 arrangement partly overlaps with the B1 and B2 arrangements.

For administrations having implemented the B1 arrangement, B4 enables optimization of the use of spectrum for paired IMT operation.

For administrations having implemented the B3 arrangement, the B1 arrangement can be combined with the B2 arrangement. B5 is therefore recommended to optimize the use of the spectrum:

- B5 enables the use of spectrum to be maximized for IMT in administrations where B3 is implemented and where the band 1 770-1 850 MHz is not available in the initial phase of deployment of IMT in this frequency band.

NOTE 2 – TDD may be introduced in unpaired bands and also under certain conditions in the uplink bands of paired frequency arrangements and/or in the centre gap between paired bands.

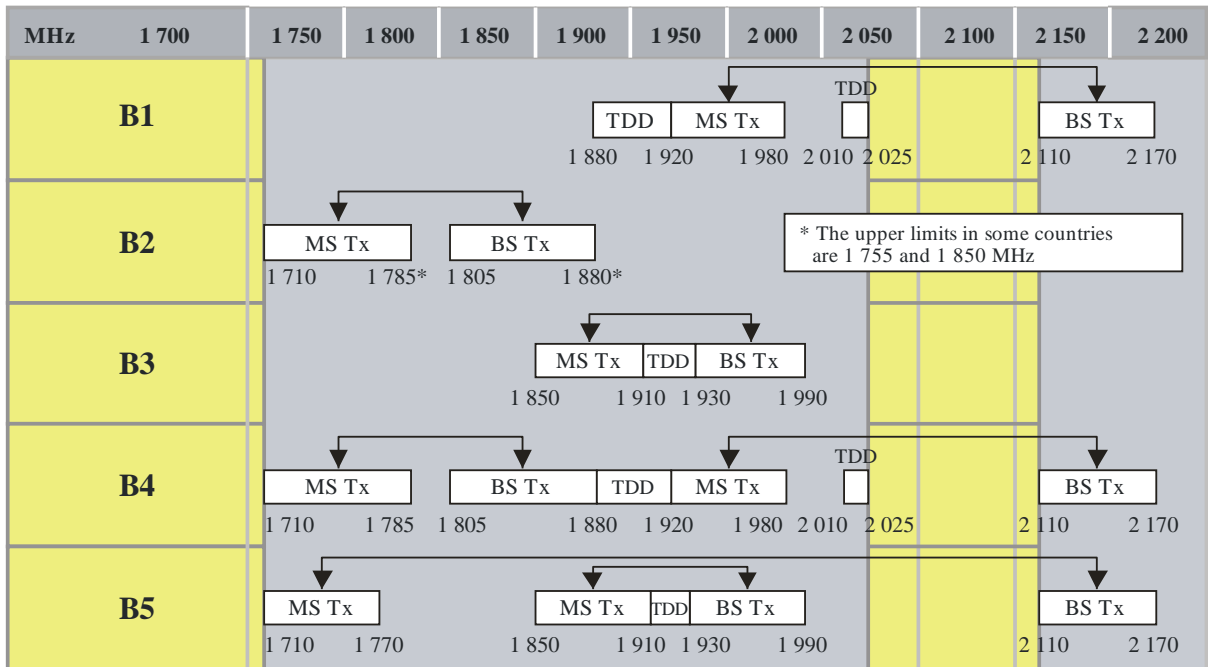
NOTE 3 – If selectable/variable duplex technology is implemented within terminals as the most efficient way to manage different frequency arrangements, the fact that neighbouring administrations could select B5 will have no impact on the complexity of the terminal. Further studies are necessary.

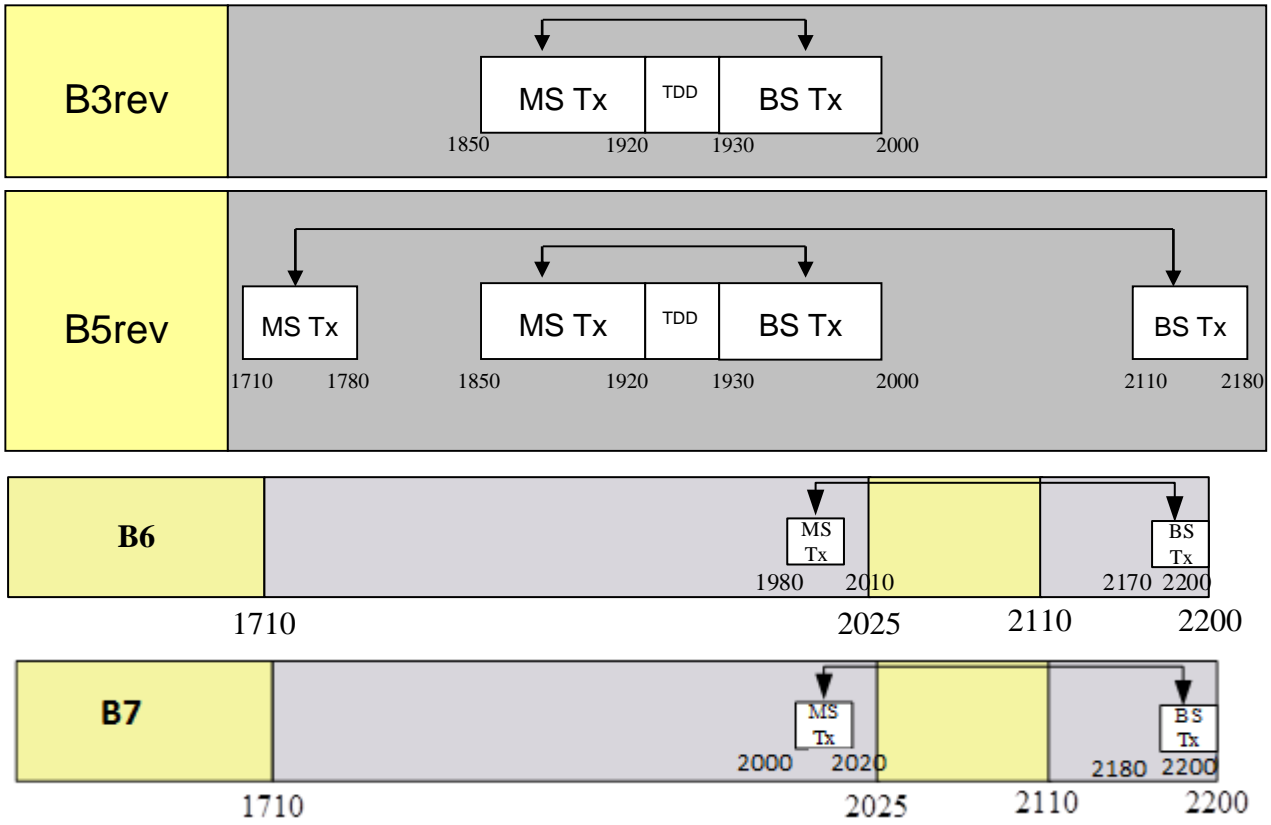
NOTE 4 – The bands 1 980-2 010 MHz and 2 170-2 200 MHz in the frequency arrangement B6 are intended to be used in combination with the frequency arrangements B1 or B4 which provides even further optimization of the use of spectrum for paired IMT operation (see Note 1).

² The 2 025-2 110 MHz band is not part of this frequency arrangement.

NOTE 5 – A unique situation exists for the frequency arrangements B6 and B7 and parts of arrangements B3 and B5 in the bands 1 980-2 010 MHz and 2 170-2 200 MHz as outlined in *recognizings c) and d)*. Co-coverage, co-frequency deployment of independent satellite and terrestrial IMT components is not feasible unless techniques, such as the use of an appropriate guardband, or other mitigation techniques are applied to ensure coexistence and compatibility between the terrestrial and satellite components of IMT. When these components are deployed in adjacent geographical areas in the same frequency bands, technical or operational measures need to be implemented if harmful interference is reported. Further studies by ITU-R are required in this regard.

FIGURE 4
(See notes to Table 4)





SECTION 4

Frequency arrangements in the band 2 300-2 400 MHz

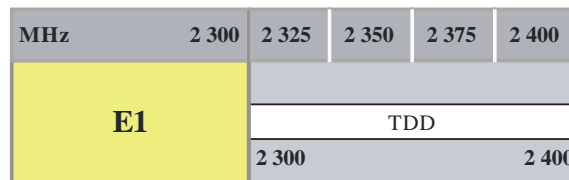
The recommended frequency arrangements for implementation of IMT in the band 2 300-2 400 MHz are summarized in Table 5 and in Fig. 5, noting the guidelines in Annex 1 above.

TABLE 5

Frequency arrangements in the band 2 300-2 400 MHz

Frequency arrangement	Paired arrangements				Un-paired arrangements (e.g. for TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
E1					2 300-2 400 TDD

FIGURE 5



SECTION 5

Frequency arrangements in the band 2 500-2 690 MHz

The recommended frequency arrangements for implementation of IMT in the band 2 500-2 690 MHz are summarized in Table 6 and in Fig. 6, noting the guidelines in Annex 1 above.

TABLE 6
Frequency arrangements in the band 2 500-2 690 MHz
 (not including the satellite component)

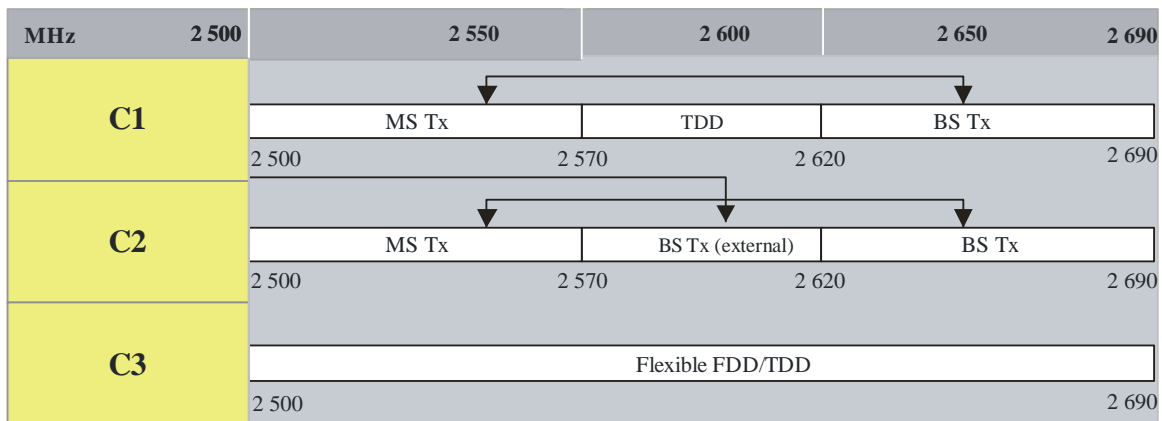
Frequency arrangements	Paired arrangements					Un-paired arrangements (e.g. for TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	Centre gap usage	
C1	2 500-2 570	50	2 620-2 690	120	TDD	2 570-2 620 TDD
C2	2 500-2 570	50	2 620-2 690	120	FDD	2 570-2 620 FDD DL external
C3	Flexible FDD/TDD					

Notes to Table 6:

NOTE 1 – In C1, in order to facilitate deployment of FDD equipment, any guardbands required to ensure adjacent band compatibility at the 2 570 MHz and 2 620 MHz boundaries will be decided on a national basis and will be taken within the band 2 570-2 620 MHz and should be kept to the minimum necessary, based on Report ITU-R M.2045.

NOTE 2 – In C3, administrations can use the band solely for FDD or TDD or some combination of TDD and FDD. Administrations can use any FDD duplex spacing or FDD duplex direction. However, when administrations choose to deploy mixed FDD/TDD channels with a fixed duplex separation for FDD, the duplex separation and duplex direction as shown in C1 are preferred.

FIGURE 6
 (See notes to Table 6)



SECTION 6

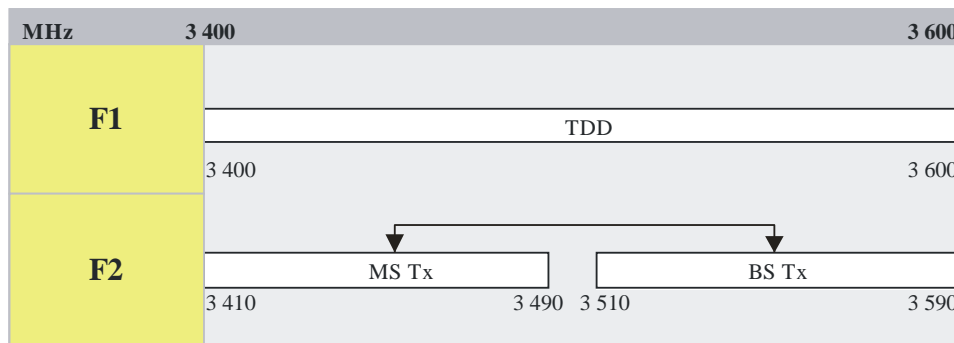
Frequency arrangements in the band 3 400-3 600 MHz

The recommended frequency arrangements for implementation of IMT in the band 3 400-3 600 MHz are summarized in Table 7 and in Fig. 7, noting the guidelines in Annex 1 above.

TABLE 7

Frequency arrangements	Paired arrangements				Un-paired arrangements (e.g. for TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
F1					3 400-3 600
F2	3 410-3 490	20	3 510-3 590	100	None

FIGURE 7



M.1036-07

Attachment 1

Vocabulary of terms

Entre gap – The frequency separation between the upper edge of the lower band and the lower edge of the upper band in an FDD paired frequency arrangement.

Duplex band frequency separation – The frequency separation between a reference point in the lower band and the corresponding point in the upper band of an FDD arrangement.

Duplex channel frequency separation – The frequency separation between a specific channel carrier in the lower band and its paired channel carrier in the upper band of an FDD arrangement.

Conventional duplex arrangement – Duplex arrangement with mobile terminal transmit within the lower band and base station transmit within the upper band.

Reverse duplex arrangement – Duplex arrangement with the mobile terminal transmit within the upper band and base station transmit within the lower band.

Acronyms and abbreviations

DL	Downlink
FDD	Frequency Division Duplex
IMT	International Mobile Telecommunications
TDD	Time Division Duplex

Attachment 2

Objectives

In planning the implementation of IMT, the following objectives are desirable:

- to ensure that frequency arrangements for the implementation of IMT have longevity, yet allow for the evolution of technology;
- to facilitate the deployment of IMT, subject to market considerations and to facilitate the development and growth of IMT;
- to minimize the impact on other systems and services within, and adjacent to, the bands identified for IMT;
- to facilitate worldwide roaming of IMT terminals;
- to integrate efficiently the terrestrial and satellite components of IMT;
- to optimize the efficiency of spectrum utilization within the bands identified for IMT;
- to enable the possibility of competition;
- to facilitate the deployment and use of IMT, including fixed and other special applications in developing countries and in sparsely populated areas;
- to accommodate various types of traffic and traffic mixes;
- to facilitate the continuing worldwide development of equipment standards;
- to facilitate access to services globally within the framework of IMT;

- to minimize terminal costs, size and power consumption, where appropriate and consistent with other requirements;
- to facilitate the evolution of pre-IMT-2000 systems to any of the IMT terrestrial radio interfaces and to facilitate the ongoing evolution of the IMT systems themselves;
- to afford flexibility to administrations, as the identification of several bands for IMT allows administrations to choose the best band or parts of bands for their circumstances;
- to facilitate determination, at a national level, of how much spectrum to make available for IMT from within the identified bands;
- to facilitate determination of the timing of availability and use of the bands identified for IMT, in order to meet particular user demand and other national considerations;
- to facilitate development of transition plans tailored to the evolution of existing systems;
- to have the ability for the identified bands, based on national utilization plans, to be used by all services having allocations in those bands.

The following guiding principles have been applied in determining frequency arrangements:

- harmonization;
- technical aspects;
- spectrum efficiency.

Attachment 3

Related Recommendations and Reports

Recommendation ITU-R M.687:	International Mobile Telecommunications-2000 (IMT-2000).
Recommendation ITU-R M.816:	Framework for services supported on International Mobile Telecommunications-2000 (IMT-2000).
Recommendation ITU-R M.818:	Satellite operation within International Mobile Telecommunications-2000 (IMT-2000).
Recommendation ITU-R M.819:	International Mobile Telecommunications-2000 (IMT-2000) for developing countries.
Recommendation ITU-R M.1033:	Technical and operational characteristics of cordless telephones and cordless telecommunication systems.
Recommendation ITU-R M.1034:	Requirements for the radio interface(s) for International Mobile Telecommunications-2000 (IMT-2000).
Recommendation ITU-R M.1035:	Framework for the radio interface(s) and radio sub-system functionality for International Mobile Telecommunications-2000 (IMT-2000).
Recommendation ITU-R M.1073:	Digital cellular land mobile telecommunication systems
Recommendation ITU-R M.1167:	Framework for the satellite component of International Mobile Telecommunications-2000 (IMT-2000).

- Recommendation ITU-R M.1224: Vocabulary of terms for International Mobile Telecommunications-2000 (IMT-2000).
- Recommendation ITU-R M.1308: Evolution of land mobile systems towards IMT-2000.
- Recommendation ITU-R M.1390: Methodology for the calculation of IMT-2000 terrestrial spectrum requirements.
- Recommendation ITU-R M.1457: Detailed specifications of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000).
- Recommendation ITU-R M.1579: Global circulation of IMT-2000 terminals.
- Recommendation ITU-R M.1580: Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-2000.
- Recommendation ITU-R M.1581: Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-2000.
- Recommendation ITU-R M.1645: Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000.
- Recommendation ITU-R M.1768: Methodology for calculation of spectrum requirements for the future development of the terrestrial component of IMT-2000 and systems beyond IMT-2000.
- Recommendation ITU-R M.1797: Vocabulary of terms for the land mobile service.
- Recommendation ITU-R M.1822: Framework for services supported by IMT.
- Recommendation ITU-R M.2012: Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced).
- Recommendation ITU-R M.2070: Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-Advanced.
- Recommendation ITU-R M.2071: Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-Advanced.
- Recommendation ITU-R SM.329: Unwanted emissions in the spurious domain.
- Report ITU-R M.2030: Coexistence between IMT-2000 time division duplex and frequency division duplex terrestrial radio interface technologies around 2 600 MHz operating in adjacent bands and in the same geographical area.
- Report ITU-R M.2031: Compatibility between WCDMA 1800 downlink and GSM 1900 uplink.
- Report ITU-R M.2038: Technology trends.
- Report ITU-R M.2045: Mitigating techniques to address coexistence between IMT-2000 time division duplex and frequency division duplex radio interface technologies within the frequency range 2 500-2 690 MHz operating in adjacent bands and in the same geographical area.
- Report ITU-R M.2072: World mobile telecommunication market forecast.
- Report ITU-R M.2078: Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT-Advanced.

- Report ITU-R M.2109: Sharing studies between IMT-Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands.
- Report ITU-R M.2110: Sharing studies between radiocommunication services and IMT systems operating in the 450-470 MHz band.
- Report ITU-R M.2113: Report on sharing studies in the 2 500-2 690 MHz band between IMT-2000 and fixed broadband wireless access systems including nomadic applications in the same geographical area.
-