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| **Report ITU-R M.2289-0**  **(12/2013)** |
| **Future radio aspect parameters for use with the terrestrial IMT spectrum estimate methodology of Recommendation ITU‑R M.1768-1** |
| **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.

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| Series of ITU-R Reports  (Also available online at <http://www.itu.int/publ/R-REP/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 |

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| ***Note****: This ITU-R Report was approved in English by the Study Group under the procedure detailed in Resolution ITU-R 1.* |

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REPORT ITU-R M.2289-0

Future radio aspect parameters for use with the terrestrial IMT spectrum estimate methodology of Recommendation ITU-R M.1768-1

(2013)

# 1 Scope

This Report presents the future radio aspect parameters for use with the terrestrial IMT spectrum estimate methodology of Recommendation ITU-R M.1768-1 in conjunction with developing the future spectrum requirement estimate for terrestrial IMT systems, principally focused towards the years 2020 and beyond.

# 2 Introduction

This Report provides results of technical studies on the radio parameters for the various Radio Access Technique Groups (RATG) that are identified in Recommendation ITU-R M.1768-1. This includes:

*Group 1*: Pre-IMT systems, IMT-2000 and its enhancements

This group covers the digital cellular mobile systems, IMT-2000 systems and their enhancements.

*Group 2*: IMT-Advanced systems as described in Recommendation ITU-R M.2012

*Group 3*: Existing radio LANs and their enhancements

*Group 4*: Digital mobile broadcasting systems and their enhancements.

# 3 Related documents

Recommendation ITU-R M.1768-1: Methodology for calculation of spectrum requirements for the terrestrial component of International Mobile Telecommunications

Report ITU-R M.2074: Radio aspects for the terrestrial component of IMT-2000 and systems beyond IMT-2000

Report ITU-R M.2078: Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT-Advanced

# 4 Parameters from Recommendation ITU-R M.1768-1

TABLE 1

List of applicable parameters from Recommendation ITU-R M.1768-1

|  |  |
| --- | --- |
| Parameters | Associated Table number(s) in Report ITU-R M.2078 |
| Assumed cell area per radio environment | Table 15  \* The values of this Table are derived considering Table 3 in Report ITU-R M.2074. |
| Radio parameters for RATGs  • Application data rate  • Supported mobility classes  • Guard band between operators  • Minimum deployment per operator per radio environment  • Granularity of deployment per operator per radio environment (MHz)  • Support for multicast  • Number of overlapping network deployment | Tables 18-21  \* The values of these Tables are derived considering the values in Table 1 in Report ITU‑R M.2074. |
| Area spectral efficiency for RATGs | Tables 22, 23  \* The values of these Tables 22 and 23 are derived considering the values in Table 1 in Report ITU-R M.2074. |

# 5 Relevant Tables from Report ITU-R M.2078

TABLE 15

Assumed cell area per radio environment (km2)

b)  With penetration loss

|  |  |  |  |
| --- | --- | --- | --- |
| Radio environment | Teledensity | | |
| Dense urban | Sub-urban | Rural |
| Macro cell | 0.10 | 0.15 | 0.87 |
| Micro cell | 0.07 | 0.10 | 0.15 |
| Pico cell | 0.0016 | 0.0016 | 0.0016 |
| Hot spot | 0.000065 | 0.000065 | 0.000065 |

NOTE – Hot spots are geographically isolated from each other.

TABLE 18

Radio parameters for RATG1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameters | Macro cell | Micro cell | Pico cell | Hot spot |
| Application data rate (Mbit/s) | 20 | 40 | 40 | 40 |
| Supported mobility classes | Stationary/ pedestrian, low, high | Stationary/ pedestrian, low | Stationary/ pedestrian | Stationary/ pedestrian |
| Guard band between operators (MHz) | 0 | | | 0 |
| Minimum deployment per operator per radio environment (MHz) | 20 | 20 | 20 | 20 |
| Granularity of deployment per operator per radio environment (MHz)  *(NOTE – This is a new parameter in Recommendation ITU-R M.1768-1)* | 20 | 20 | 20 | 20 |
| Support for multicast | Yes | | | Yes |
| Number of overlapping network deployment | 1 | | | |

TABLE 19

Radio parameters for RATG2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameters | Macro cell | Micro cell | Pico cell | Hot spot |
| Application data rate (Mbit/s) | 50 | 100 | 1 000 | 1 000 |
| Supported mobility classes | Stationary/ pedestrian, low, high | Stationary/ pedestrian, low | Stationary/ pedestrian | Stationary/ pedestrian |
| Guard band between operators (MHz) | 0 | | | |
| Support for multicast | Yes | | | |
| Minimum deployment per operator per radio environment (MHz) | 20 | 20 | 120 | 120 |
| Granularity of deployment per operator per radio environment (MHz)  *(NOTE – This is a new parameter in  Recommendation ITU-R M.1768-1)* | 20 | 20 | 20 | 20 |
| Number of overlapping network deployment | 1 | | | |

TABLE 20

Radio parameters for RATG3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameters | Macro cell | Micro cell | Pico cell | Hot spot |
| Application data rate (Mbit/s) | – | – | 50 | 500 |
| Supported mobility classes | – | – | Stationary/ pedestrian | Stationary/ pedestrian |
| Support for multicast (yes = 1, no = 0) | Yes | | | |

TABLE 21

Radio parameters for RATG4

|  |  |
| --- | --- |
| Parameters | Macro cell |
| Application data rate (Mbit/s) | 2 |
| Supported mobility classes | Stationary/pedestrian, low, high |

TABLE 22c

Area spectral efficiency RATG1 2020 (bit/s/Hz)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Unicast area spectral efficiency (bit/s/Hz/cell) | | | | |  | Multicast area spectral efficiency (bit/s/Hz/cell) | | | | |
| Tele­density | Radio environments | | | |  | Tele­density | Radio environments | | | |
| Macro cell | Micro cell | Pico cell | Hot spot |  | Macro cell | Micro cell | Pico cell | Hot spot |
| Dense urban | 2 | 4 | 4 | 4 |  | Dense urban | 1 | 2 | 2 | 2 |
| Suburban | 2 | 4 | 4 | 4 |  | Suburban | 1 | 2 | 2 | 2 |
| Rural | 2 | 4 | 4 | 4 |  | Rural | 1 | 2 | 2 | 2 |

TABLE 23d

Area spectral efficiency RATG2 in year 2020 (Set 1)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Unicast area spectral efficiency (bit/s/Hz/cell) | | | | |  | Multicast area spectral efficiency (bit/s/Hz/cell) | | | | |
| Tele­density | Radio environments | | | |  | Tele­density | Radio environments | | | |
| Macro cell | Micro cell | Pico cell | Hot spot |  | Macro cell | Micro cell | Pico cell | Hot spot |
| Dense urban | 4 | 5 | 5 | 7.3 |  | Dense urban | 2.25 | 3 | 3.75 | 4.5 |
| Suburban | 4 | 5 | 5 | 7.3 |  | Suburban | 2.25 | 3 | 3.75 | 4.5 |
| Rural | 4 | 5 | 5 | 7.3 |  | Rural | 2.25 | 3 | 3.75 | 4.5 |

NOTE – The spectrum efficiency values in Tables 22c and 23d are to be used only for spectrum requirement estimation by Recommendation ITU-R M.1768-1. These values are based on a full buffer traffic model in accordance with Report ITU-R M.2135. They are combined with the values of many other parameters within the Recommendation ITU‑R M.1768-1 methodology to develop spectrum requirement estimate for IMT. In practice, such spectrum efficiency values are unlikely to be achieved due to the random nature of traffic, errors caused by radio channel conditions or packet losses. Furthermore, stochastic “file transfer” simulation models show that actual spectral efficiency values are lower than the values shown in Tables 22c and 23d above, depending on inter-site distance.

# 6 Conclusions

The tables of radio parameters provided in this Report should serve as input for use with the terrestrial IMT spectrum estimate methodology of Recommendation ITU-R M.1768-1 in conjunction with developing the future spectrum requirement estimate for terrestrial IMT systems, principally focused towards the years 2020 and beyond.

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