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Joint Task Group 1-6-8-9

LIAISON STATEMENT TO ITU-R WORKING PARTIES 1B, 4A, 6E, 6M, 7E, 8A, 8F, 9B, JRG 8A-9B AND ITU-T STUDY GROUP 16(Q.5/16)

TERRESTRIAL WIRELESS INTERACTIVE MULTIMEDIA APPLICATIONS (WRC-03 AGENDA ITEM 1.21)

ITU-R Joint Task Group 1-6-8-9 (JTG 1-6-8-9) held its third meeting during 16-23 May 2002, and finalized the work on the draft CPM text for WRC-03 agenda item 1.21 concerning terrestrial wireless interactive multimedia (TWIM) applications.

JTG 1-6-8-9 received a number of input contributions on this issue from contributing or interested Working Parties (or Joint Rapporteur Group). Taking into account these contributions the draft CPM text was produced to be sent to the Chapter Rapporteur for the final editing process of the draft CPM Report.

The JTG extends its appreciation to all the contributing and interested groups for their important contributions through the liaison statements. The draft CPM text developed at the May 2002 meeting is attached to this document for information.

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Attachment: Draft CPM text on Agenda Item 1.21.

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DRAFT CPM TEXT FOR CHAPTER 7.1

1 WRC-03 agenda item 1.21

"to consider progress of the ITU-R studies concerning the technical and regulatory requirements of terrestrial wireless interactive multimedia applications, in accordance with Resolution **737 (WRC-2000)**, with a view to facilitating global harmonization".

2 Summary of technical and operational studies

2.1 Terms related to the studies

Most of the terms used in relation to WRC-03 agenda item 1.21 are defined in one or more ITU Recommendations. Due to the fact that the definitions have been developed in different groups and at different times there may be variations in the definitions. It is considered important to get a common understanding of the terms used in this chapter of the CPM Report and a list of references providing definitions has been developed to achieve this goal (see below).

The terms and definitions in the references list should be read in addition to those in the Radio Regulations. In some cases the same term may have been defined differently in an ITU-R Recommendation from that in the Radio Regulations (or even the Constitution). In these cases, the definition in the basic instruments of the ITU shall prevail.

Term	**Reference**
Bidirectional	Recommendation ITU-R V.662
Broadband	ITU-T Recommendation I.113
Broadband wireless access (BWA)	Recommendation ITU-R F.1399-1
Broadcasting	Recommendation ITU-R V.662
Core network (CN)	ITU-T Recommendation Y.101
Downstream	Recommendation ITU-R F.1399-1
End-user	Recommendation ITU-R F.1399-1
Fixed wireless access (FWA)	Recommendation ITU-R F.1399-1
Fixed wireless systems (FWS)	Recommendation ITU-R F.592-3
High Density applications in the Fixed Service (HDFS)	Recommendation ITU-R F.592-3
Interactive service	Recommendation ITU-R M.1224
Mobile wireless access (MWA)	Recommendation ITU-R F.1399-1
Multimedia service	Recommendation ITU-R M.1224 ITU-T Recommendation I.113
Multimedia wireless system (MWS)	Recommendation ITU-R F.1399-1
Narrow-band wireless access	Recommendation ITU-R F.1399-1
Network	Recommendation ITU-R M.1308
Nomadic wireless access (NWA)	Recommendation ITU-R F.1399-1

Term	Reference
Service	Recommendation ITU-R M.1308
Station	Recommendation ITU-R F.1399-1
System	Recommendation ITU-R M.1308
Unidirectional	Recommendation ITU-R V.662
Universal personal telecommunications (UPT) service	ITU-T Recommendation I.114
Upstream	Recommendation ITU-R F.1399-1
User	Recommendation ITU-R F.1399-1
Wideband wireless access	Recommendation ITU-R F.1399-1
Wireless access	Recommendation ITU-R V.573-4 Recommendation ITU-R F.1399-1

2.2 General characteristics (technical and operational) of terrestrial wireless interactive multimedia systems, various applications and technologies

2.2.1 Technical and operational characteristics

With regard to earlier studies within ITU, issues related to "terrestrial wireless interactive multimedia" (TWIM) applications have resulted in a number of Recommendations (see Section 2.1 above).

In order to support TWIM applications, a system should be capable of carrying simultaneously many different Radiocommunication Services offered to individuals and capable of delivering specific information to individuals.

A key requirement is the availability of downstream and upstream communication between the provider(s) of the multimedia content and the user. The systems used for the downstream and upstream channels could be the same, or different, and might operate within the same or different Services, as defined in the Radio Regulations.

The wireless access network traffic to and from users may be symmetrical or asymmetrical depending on the variety of communication services offered to these users.

The downstream and upstream bandwidth requirements will depend on the type of the multimedia content, the user interface devices, the desired quality, etc. The support of some services (for instance, “high definition television” (HDTV)) will require the capability for broadband access.

Other technical characteristics of these systems that are important for some types of TWIM applications include:

- support of various levels of quality of service (QoS);
- seamless[1] services across such systems and networks;
- roaming capability and interoperability between existing systems and future systems as they become available;
- the ability of the system to efficiently use the available bandwidth of the upstream and downstream channels.

[1] Seamless: connection between end-user and information source without the user being aware that the communication path may have used many different networks or connections.

2.2.2 Applications and technologies

Examples of applications that may be supported by TWIM:

- alternate scenario dramas
- broadcasting service on demand
- car navigation and passenger information and entertainment
- database access
- electronic newspapers
- emergency and alert functions
- file transfers and photo albums
- form filling and submission
- game show and talk show participation
- Internet and intranet access
- multi-camera angle sport viewing and replay
- e-mail
- e-education
- shopping and "electronic funds transfer at point of sale" (EFTPOS)
- e-health
- travel information
- video and music on demand
- video content contribution
- video games including multi-players
- virtual private networks services
- voting
- voice and video calls and conferencing
- web-casting and web-cameras

Table 1 provides technical characteristics of example systems, which could be considered relevant to enable TWIM applications.

TABLE 1

Some typical technical characteristics of example systems

System		Transmitted data rate	Typical frequency range	Information data rate
Cellular/MWA	Pre IMT-2000 systems (Note 1)	14.4 kbit/s	0.8-2 GHz	14.4 kbit/s
	IMT-2000	2 Mbit/s (pico cells) 384 kbit/s (micro cells) 144 kbit/s (macro cells)	0.8-2.7 GHz	2 Mbit/s (pico) 384 kbit/s (micro) 144 kbit/s (macro)
	Systems beyond IMT-2000	(under study)	(under study)	(under study)
TICS (Note 2)		Up to 54 Mbit/s	0.9-6 GHz	Up to 54 Mbit/s
RLAN/wireless home networks		Up to 54 Mbit/s	0.9-6 GHz	Up to 54 Mbit/s
FWA/BWA (Note 3)		56 kbit/s up to 312 Mbit/s	1 to 66 GHz (Note 4)	n×1.5 Mbit/s (Note 6) n×2 Mbit/s (Note 6) n×6.3 Mbit/s(Note 6) 45 Mbit/s 52 Mbit/s 156 Mbit/s ≤10 Mbit/s(Note 7) ≤ 100 Mbit/s (Note 8)
LMCS/LMDS/MMDS/MVDS/ MCS/MWS (Note 5)		up to 156 Mbit/s	2 to 6 GHz, above 20 GHz (Note 4)	-
Broadcasting (Note 9)	Sound (digital)	up to 1.843 Mbit/s (Note 10) (stationary) 1.152 Mbit/s (mobile)	0.54-1 500 MHz	-
	DTTB (Note 11)	up to 32 Mbit/s (stationary) 5 Mbit/s (mobile)	45-900 MHz	-

NOTE 1 - It is recognized that some pre-IMT-2000 systems can provide some Internet browsing and an interactive channel for broadcasting systems.

NOTE 2 - Traffic Information Control System

NOTE 3 - BWA: Wireless access in which the connection(s) capabilities are higher than the primary rate.

NOTE 4 - Systems operating at a lower frequency range typically have a lower data rate.

NOTE 5 - It is noted that there are also other abbreviations used for these systems (Local Multipoint Communication System/Local Multipoint Distribution System/Multichannel Multipoint Distribution System/ Multichannel Video Distribution System/ Multipoint Communication System/Multimedia Wireless System).

NOTE 6 - n = 1, 2, 3, 4

NOTE 7 - Maximum per one direction for Ethernet access interface, Point-to-Multipoint only (10 Base-T as defined in IEEE 802.3).

NOTE 8 - Maximum per one direction for Ethernet access interface, Point-to-Multipoint only (100 Base-T as defined in IEEE 802.3).

NOTE 9 - When using broadcasting, interactivity can be provided through another service.

NOTE 10 - In some countries, where single channel systems are used, the transmitted data rate is lower.

NOTE 11 - Digital Terrestrial Television Broadcasting

2.3 Summary of sharing studies

A number of studies have been made on frequency sharing between the terrestrial Fixed or Mobile Service and other Radiocommunication Services in certain bands, and the results are summarized in Table 2.

TABLE 2

Summary of sharing study results between the Fixed or Mobile Service (including FWA and NWA systems) with other services

Other service, which is sharing the band with the FS or MS	Frequency band	Recommendation
FSS	3.4-3.8 GHz	SF.1486
	5.15-5.25 GHz	M.1454
	37.5-42.5 GHz	SF.1484 SF.1573
MS	800-900 MHz	F.1402
	1.8-1.9 GHz	F.1402, F.1518
BSS	1.4-1.5 GHz	F.1338
RL	3.4-3.7 GHz	F.1489
ISS	24-27 GHz	F.1249, F.1509
RN	31.8-33.4 GHz	DNR F.[Doc. 9/BL/27]
EESS (active) / SR (active)	5.25-5.35 GHz	DNR F.[Doc. 9/130] PDNR M.[WAS5GHz-EESS]
	5.47-5.57 GHz	PDNR M.[WAS5GHzexpansion-EESS]

3 Analysis of the results of studies

3.1 Scope of terrestrial wireless interactive multimedia

Terrestrial wireless interactive multimedia (TWIM) is a concept that is emerging in the marketplace and is not synonymous with any specific existing or planned system; it is, rather, more of a vision of future wireless applications.

In studies for preparation of the CPM Report it has been understood that the TWIM concept is a multi-network, multi-access, multi-service and interactive arrangement. This suggests the need for convergence:

– in the access network;
– of network management;
– of format of content;
– in methods of information exchange;
– of database functions and capabilities.

These functions and capabilities will likely include:

– integral seamless wireless access through broadcasting, fixed and mobile infrastructures,

– location and navigation facilities, and

– on-demand service,

supporting person-to-person, person-to-many persons, many persons-to-person, person-to-machine, machine-to-person and machine-to-machine communications. These understandings of the scope have been derived from the experience of the increased usage of Internet downstream capabilities, the accelerated penetration by mobile telephones, and the integration of FWA functionality into mobile systems.

This concept encompasses systems that allow the delivery of multimedia content with which the user may interact, as well as systems capable of conveying multimedia information and providing interactive functions between the user and the server or between users.

The term "interactive" implies a two-way, but not necessarily symmetrical, communication system in either a simplex or duplex form. More specifically, the term "interactive" implies not only two-way physical transport of information but also the functionality of conveying end-users' reaction or response to the network in order to provide a certain application. Depending on the application, interactivity can be real-time, such as voice communications, or non-real-time such as e-mail. Many applications are expected to deliver larger amounts of multimedia data in the downstream direction compared to the amount of data carried from the user in the upstream direction.

In consideration of the above, the following is a working description for the scope of TWIM applications:

– Applications in one or more of the terrestrial Mobile, Fixed and Broadcasting Services that are capable of supporting bi-directional exchange of information of more than one type (e.g. video, image, data, voice, sound, graphics) between users or between users and servers.

  NOTE - The bi-directional exchange of information may be provided with different levels of interactivity and mobility.

3.2 Current situation of spectrum use and sharing scenarios

3.2.1 Current use and future trends for spectrum

Since it is anticipated that there will be many different TWIM applications, the systems will inevitably operate in many different frequency bands, typically, but not exclusively, across the range up to 66 GHz, with higher mobility systems tending to favour the lower frequency bands.

The frequency bands which are currently allocated to the Broadcasting Service may, in time, be more efficiently used through the conversion from analogue to digital transmission. Under certain circumstances and with appropriate transition measures, the introduction of TWIM applications to the end user may take place.

Since Broadcasting is a Service which may have the capability for some personalized addressable applications, the downstream data from interactive multimedia and non-interactive applications may be combined with conventional broadcasting applications and therefore use the same channel. However, in order to provide interactivity, the upstream channel must be provided either by another radiocommunication service or by non-radio means. In principle, multimedia applications provided by broadcasting operators may use a variety of frequency bands for the upstream channel in the Fixed or Mobile services through national planning and coordination. If the upstream and downstream channels share the same frequency band, this could provide some economies of scale due to reuse of some existing user equipment, such as the antenna. In the case where the

Broadcasting Service shares the same frequency band with the Mobile Service, Fixed Service, or both services, the above sharing of upstream and downstream channels can also be achieved by national planning or bilateral coordination. The other cases should be further considered.

For the Mobile Service, the spectrum used by mobile applications and technologies is heavily used, and studies are under way to both increase the spectrum efficiency of those systems, and the identification of additional spectrum that could be used.

For the Fixed Service, the ITU-R is currently considering certain bands in the 5-20 GHz range with a view to accommodating FWA applications in bands where there is little growth of traditional point-to-point systems. Moreover, work is being undertaken to identify spectrum in bands above 70 GHz for short-range, broadband FWA applications. Further, studies are also ongoing on how to use mobile-derived technologies for FWA systems underlining the convergence process (see for example, draft revised Recommendations ITU-R F.1401 and ITU-R F.757).

Some administrations are considering making TWIM applications available in rural and remote areas. To this effect, access to sufficient spectrum for broadband channels below 1 GHz would help service providers reach subscribers in areas with clutter and difficult terrain and allow greater reach for the base stations. Some other administrations from developing countries do not think that spectrum for broadband channels for such applications below 1 GHz is required, due to intensive use by these administrations of the bands below 1 GHz for existing Services.

The demand for spectrum for wireless access systems including radio local area networks (RLANs) is being studied by the ITU-R under WRC-03 agenda item 1.5, Resolution 736 (WRC-2000), *resolves* 1, which address a possible new allocation to the Mobile Service in the 5 GHz bands, and the studies have shown that spectrum requirements consistent with the bands covered by this *resolves* (455 MHz) is justifiable. Such a possible allocation is conditioned by the sharing analysis in section 2.2.2.1 of this Report.

3.2.2 Band sharing scenarios with other Services

Systems carrying TWIM applications may require minimal technical and operational constraints with regards to sharing with other Radiocommunication Services. In this regard, special frequency coordination procedures may be necessary. For example, given the expected ubiquitous nature of these systems, it may not be practical to require frequency coordination on a site-specific basis with stations in other Radiocommunication Services. However, it may be possible to establish sharing conditions on the basis of technical and operational limits.

The feasibility of spectrum sharing will depend on the technologies used in different bands, wideband vs narrowband, high power vs low power etc.; the nature of the terminal and the type of system modulation. It is believed that the sharing scenarios for systems carrying TWIM applications will be similar to those for a broadcasting system, a high-density land mobile system or a high-density FWA system where TWIM applications may be provided on a geographical basis.

The feasibility of spectrum sharing and need for frequency coordination procedures (if any) should be studied further.

3.3 Future Trends

The convergence of certain telecommunication and broadcasting technologies and service aspects is expected over the next several years to satisfy the need for flexible use of spectrum, at reasonable cost, to users for delivery of a range of multimedia applications. The delivery of such applications to the end user will be achieved through systems carrying TWIM applications.

There are systems starting to appear that can offer a number of applications provided separately by the terrestrial Mobile, Fixed and Broadcasting Services. This situation may result in economies of scale by which the same user equipment is used to support applications within combinations of these three services complementing each other. A number of administrations believe that such trends will lead towards more efficient utilization of the spectrum and resources.

Multi-service networks supporting terrestrial Mobile, Fixed and Broadcasting Services may be developed in the future, forming a truly global phenomenon, and may become a dominant model for all further mainstream development of radiocommunications.

3.3.1 Market trends

A number of possible market trends, resulting from development of the above-mentioned multi-service networks and multi-purpose user equipment, may include:

- the further growth of Internet use and broadband applications, where users can access on-demand multimedia content;
- an increasing demand for miniature equipment that is driven by the phenomenal expansion of personalized, information services for which the user equipment is always accessible;
- the compelling case for e-services/applications (e.g. e-commerce);
- increasing strong demand for high-speed Internet, broadband telecommunication services and interactive broadcasting in semi-rural, rural and remote areas in developed countries;
- emergence of multiple wireless service providers offering various grades of service to meet specific requirements of client groups.

These trends will be driven by the emerging convergence in technology and applications in the field of terrestrial wireless services.

3.3.2 Technology trends

One trend that is already emerging and is anticipated to be further developed over the coming years is the integration of low power broadband wireless access devices to support coverage in limited geographical areas ("hot-spot" coverage), which may develop in the future to provide contiguous coverage through e.g. cellular-like re-use. Consequently, it is expected that such devices may facilitate more efficient use of the spectrum and the delivery of high-speed multimedia applications.

A further trend is the increasing use of packet-based transport and in particular the use of packet-based protocols in the access network for most end-user and enterprise-based applications. It is also foreseen that the core network will increasingly become packet-based, supporting a wide variety of different user speed/mobility/coverage scenarios. Thus it will become possible to support such requirements as security [(1)], authentication and billing in a more flexible way than with currently operating digital transmission systems.

Asymmetric nature in communication will also be a factor of the future trends. The notion of point-to-multipoint mode in terrestrial broadcasting, fixed and mobile systems will be integrated in the access network to end users, in particular in delivering a set of services simultaneously to small as well as to large user groups. In the case of terrestrial Fixed and Mobile Services, increase of downstream access transport will be achieved by:

- upgrading of existing system capability,
- supplementary or additional downstream connection through bearers operating in one of the three terrestrial Services.

[(1)] There is no Recommendation on security in the ITU.

For extended interactivity, upstream access transport will also be a factor for more flexibility through the converged technologies including multi-service network and multi-service user equipment.

Such trends will further facilitate the convergence of systems which are now considered as being distinct (e.g. example systems given in Table 1, relevant to enable TWIM applications).

Advances in technologies, including the development of "software defined radio" (SDR), could facilitate the following functions:

- switching of the operating mode, e.g. public network, office network, home link;
- adaptive multi-states modulation and adaptive bit rate;
- adaptive array antenna;
- different grade of service;
- multiband operation including interactivity.

One of the SDR impacts is that manufacturers could develop a common hardware platform on which various SDR functions are implemented, and that a single hardware platform is economically applied to many operators' different specifications. The impact of SDR on spectrum utilization depends largely on adaptability of the software that defines the above-listed functions. Highly adaptive SDR may change its technical parameters on a real-time basis. For example, one SDR may operate in different systems in different Radiocommunication Services according to the designed software. SDR technology may become an important enabler to the future development of TWIM applications as well as to the possible enhancement of the spectrum utilization.

3.4 Future studies in ITU-R

The convergence of technologies and applications considered in this text may require future studies by ITU-R on whether modifications to ITU Radio Regulations Service definitions, or other Regulations, are necessary. It may also be necessary to review whether any such modifications may have an impact on the existing international frequency coordination procedures as well as future use of frequency spectrum.

Studies may also be necessary to identify possible spectrum with a view to facilitating the development of TWIM applications. Studies may also be required to evaluate the extent to which TWIM applications may be introduced in frequency bands, which are not shared by all three terrestrial Services (Fixed, Mobile, Broadcasting).

Additional studies may also be required to assess the advantages and disadvantages of global and regional harmonization of spectrum for systems carrying TWIM applications, bearing in mind that this factor is important for potential cost advantages through economy of scale and the possible need to recognize the aspect of harmonization in the Radio Regulations. At the same time, studies should look at the potential advanced technologies, which could be used to lessen such need for global or regional harmonization.

4 Methods to satisfy the agenda item for consideration by the WRC-03

Method A

In order to complete the work associated with this agenda item it will be necessary to conduct further studies with the results to be completed and reported to the WRC-05/06. WRC-03 may revise Resolution 737 (WRC-2000), based on considerations of Sections 2, 3 and 5 of this text. In doing so, relevant parts of Sections 2, 3 and 5 may be included in an Annex to the Resolution.

Further recommended exploration of issues related to the TWIM concept include:

– Study possible frequency bands for TWIM applications, taking into account the scope of TWIM systems as described in Section 3.1 above (including sharing between different Radiocommunication Services, Section 3.2).

– Study the advantages and disadvantages of global and regional harmonization of spectrum for TWIM applications and the possible need for recognition of such harmonization within the Radio Regulations.

– Review the existing Radiocommunication Service definitions, including how they are used to determine the use of frequency bands and the consequences they may have on international frequency coordination procedures.

Method B

It may be possible to conclude this agenda item at WRC-03 on the basis that no regulatory impediments have been identified. Resolution 737 (WRC-2000) may be suppressed. The Study Groups within ITU-R may prepare relevant Questions and continue their work under the normal activities in order to examine any issues related to the deployment of TWIM applications.

Method C

Some administrations in Region 1 consider that no regulatory impediments have been identified, with the exception of the Broadcasting Service in Region 1 in the frequency range 470-790 MHz, where there is no co-allocation to the Broadcasting, Fixed or Mobile Services (as noted in § 3.2.1). This will restrict the possibilities for those countries in Region 1 that so wish, to develop TWIM applications associated with the Broadcasting Service. Noting that this frequency range will be the subject of re-planning for the introduction of digital broadcasting by two Regional Radiocommunication Conferences (the first in 2004), it may be appropriate to have an item on the agenda of WRC-05/06 to consider if there are any consequential issues for terrestrial Services (Fixed, Mobile, Broadcasting) arising from this re-planning exercise that would need to be taken into consideration by WRC-05/06. WRC-03 may replace the general agenda item relating to TWIM applications by this item on the agenda of WRC-05/06. The general studies on TWIM applications may continue within the normal activities of the ITU-R.

5 Regulatory and procedural considerations

The distinctions between the terrestrial Fixed, Mobile and Broadcasting Services have been clear and unambiguous, and the traditional national regulatory processes and the organization of the ITU-R were designed to reflect those distinctions. It is believed that the definitions of the three Radiocommunication Services are still valid and applicable; however it should be understood that systems are starting to appear that are capable of operating within two or even all of the three Radiocommunication Services.

Apart from that identified in Method C, there is no evidence at this time that there are any Radio Regulations impediments to the development of TWIM applications. However, it may be necessary to continue to study the boundaries between existing Radiocommunication Services to determine if any impediments to such TWIM applications may appear.

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