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| Canada |
| Proposed Advice to the BR Concerning RA-12 Resolution 62 |

**1 Introduction**

This contribution is to provide advice to the BR Director through RAG on the actions that may need to be undertaken as a result of RA-12’s Resolution 62 concerning Conformance and Interoperability Testing of radio equipment and systems with the following operative text of this Resolution.

“ that ITU‑R collaborate with, and provide information when requested by, ITU‑T and ITU‑D on conformance and interoperability testing within its existing mandate consistent with Resolution 177 (Guadalajara, 2010) (see noting b)),

instructs the Director of the Radiocommunication Bureau

1 to prepare a report on the progress made to better understand the unique problems of developing countries with respect to radiocommunication equipment conformance and interoperability and the testing thereof, based on, *inter alia*, contributions from Member States and Sector Members;

2 to submit this report to the ITU Council at its 2013 session for consideration and possible actions,

invites the Radiocommunication Advisory Group

to provide advice to the Director for activities in this area based on inputs received from Member States and Sector Members.”

**2 Discussion**

This contributions’ objective is to provide information to the ITU-R about the processes used for the development of standards and testing carried out for verifying conformance against them. Additionally it describes interoperability testing (IOT) of the radio equipment/systems employed in the Radio Access Networks (RAN) part of a telecommunication network. Radio communications equipment is produced by many manufacturers worldwide for various radio services based on standards developed by industry through participation in recognized SDOs (Standards Development Organizations) or partnership projects between SDOs. This contribution focuses on the standards and testing carried out for mobile radio service.

There is an important role played by the national regulators in assessing conformance against those standards which aim to ensure the efficient use of the spectrum and deal with the prevention of interference to other users of the spectrum, i.e. prevention of third party harm. On top of this testing needed for regulatory purposes as described in the Annexes, industry regularly performs compliance testing of all relevant aspects of the applicable standards including both conformance and interoperability testing (CIT).

ITU R Recommendations are not standards which are normally used for CIT. These Recommendations are typically developed to address those characteristics of the RAN related to frequency usage and spectrum management, and thus they frequently address subjects such as channeling plans, channeling arrangements, and protection requirements. However, they do not define radio interfaces in any detail nor do they cover the entire telecommunications network; therefore, they cannot be used to ensure interoperability. Furthermore ITU R recommendations are not mandatory unless incorporated by reference into the Radio Regulations.

The ITU in some situations has provided an overall framework and requirements for systems such as IMT. However, the related core global specifications have been developed by other SDOs or partnership projects between SDOs which have undertaken the detailed standardization. Typically, ITU-R Recommendations do not characterize standards and equipment in sufficient detail for compliance testing, and the ones that exceptionally do rely on standards from external organizations. For example, for the technologies referred to in the ITU-R Recommendation M2012 for IMT advanced, industry organizations, 3GPP, IEEE 802.16 and WiMax forum not only provide detailed specifications but also necessary test cases to ensure complete testing and certifications can be carried out by relevant bodies.

Thus ITU-R Recommendations in many cases make extensive use of references to externally developed standards, which continually evolve, without inclusion of those detailed specifications within the Recommendation. As such it is compliance with the external standards which is relevant for an efficient and faultless operation as opposed to compliance with the ITU-R recommendations.

With regards to recommendations incorporated by reference, while conformance with such recommendations becomes mandatory by being in the Radio Regulations, these recommendations do not deal with equipment and systems standards. A good part of these Recommendations describe operational procedures for maritime and aeronautical services and others provide systems technical characteristics, propagation models, reference antenna patterns to be used in conducting sharing studies .

**3 Proposal**

Based on the discussion above and the detailed information describing standards development and CIT processes in the attached Annexe:

* ITU-R recommendations are important for establishing sharing conditions among different radio services in order to prevent harmful interference;
* ITU-R recommendations do not contain the necessary details on which to base CIT;
* There are well established industry lead bodies that certify conformance to standards and interoperability through testing carried out by accredited laboratories. The ITU-R should not duplicate these efforts.

Thus, a possible role for ITU-R could be to provide a facility for sharing and dissemination of information relevant for CIT of equipment/systems already available and used in mobile radio services and possibly for other radio services as necessary*.*

**ANNEX**

**CONFORMANCE and INTEROPERABILITY**

**1) Introduction.**

Radio communications equipment for mobile radio services is produced by many manufacturers worldwide. Service providers of mobile services can select products from any of these manufacturers for their networks. This can only be possible if the radio equipment is developed and built in such a way that it meets the relevant standards*.* Typically, a product needs to comply with a multitude of standards and there are means to ensure that this occurs. There are two issues: Firstly, the product must conform to all mandatory requirements defined within the standards, and secondly, the product must be capable of interoperating with corresponding products from other manufacturers. This is achieved through Conformance testing and Interoperability testing.

Conformance testing concentrates on ensuring that a unit meets all aspects of a standard through tests that are executed under controlled conditions and using a dedicated test system. In general this testing deals with specific components of a system related to a single standard.

Interoperability testing concentrates on system testing rather than unit testing. It is most commonly applied to end to end testing over the networks. It shows, from a user’s point of view, that certain functionality is accomplished (but not how). Interoperability testing gives a high-level of confidence that devices will interoperate with other devices against which it has been tested, but it does not prove conformity (interoperating systems may not be conformant).

**2) Standards**

The capabilities of Radio technology are continuing to expand through extensive research and development. This R&D normally leads to a manufacturer’s specification for a product. Such a specification, in addition to input from other sources, can then be introduced to the appropriate Standards Development Organization (SDO) as a proposal where it would be developed into a recognized standard, taking into consideration other proposals. In addition to the functional core specification, the SDO will typically develop a test specification which can be used to demonstrate the compliance with the core specification. The test specification includes the test procedures needed to ensure that a product that claims to meet the core standard does indeed do so. The SDOs are composed of industry with some well-known bodies being: 3GPP, IEEE, ETSI, TIA, ATIS and WIMAX forum etc.

Standards treat the unit as a black box and cover items such as input requirements, expected outputs, radio spectrum issues such as occupied bandwidth, spurious and unwanted emissions.

The above is a brief simplified description of the standards development process.

**3) Testing of standard compliance**

Compliance testing of radio equipment can be separated into two categories, namely:

1) Testing for regulatory purposes – this is conformance testing, with the aim to ensure the efficient use of the spectrum and avoid interference;

2) Testing for industry/market purposes – this includes the testing of 1) above, as well as additional conformance testing (with a much wider scope) and interoperability testing.

The goal of these categories is somewhat different.

**3a)** **Conformance testing for regulatory purposes**

The description below is based on examples of current regulatory practice in some countries or regions of the world. Regulatory processes in other parts of the world may be different. However, the purpose of regulatory testing is common globally, that is to ensure the effective use of the spectrum and thus avoid interference.

In the case of radio systems there is an important role for national regulators to avoid interference between different radio systems and services. Standards play an important role, but different from that for a service provider. In this case testing for conformity involves assessment of the potential for interference. The regulator normally publishes standards/rules (or, e.g. within the European environment, a list of the Harmonized Standards), based on input from industry, which radio equipment must meet to prevent interference while meeting the other operational requirements expected by service providers. When a product is tested and conforms to a standard, the regulator certifies the compliance and records the information for public record. In some parts of the world, e.g. in Europe under the R&TTE Directive, assessment of the conformity of a product with the requirements of the Directive is a responsibility for the manufacturer. The manufacturer therefore does not need to obtain approval from a regulatory body for placing a product on the market. Regulatory bodies will only initiate testing for market surveillance purposes and/or in case of contentious issues. It is the responsibility of a manufacturer to provide general information on standards compliance to the public, e.g. via the CE mark.

Compliance with a standard in the regulatory process also plays an important role in trans-border agreements between Administrations in that the use of the equipment by one Administration should not adversely impact another Administration.

In general, conformance testing treats a piece of radio equipment as a black box and verifies the input and output specifications such as occupied bandwidth, throughput, out of band emissions etc. National regulators are concerned with the RF issues in the context of interference both within the radio service and to other radio services. In this context these concerns are common to regulators worldwide. Also radio equipment is manufactured globally and the conformance testing for each country can place a significant burden on these manufacturers. As a result regulators have undertaken measures to enable one Administration to carry out conformance assessment for another Administration. These are Mutual Recognition Agreements (MRAs)

MRA’s are umbrella agreements between and within regional organizations such as CITEL, APT etc. and brought into effect by bilateral action. The process involves initially exchanging test reports and finally moving to full reciprocal certification of products. Each Administration accredits testing labs within its jurisdiction to carry out conformance testing to the other Administration’s standards and also selects organizations to certify compliance. These bodies are known Conformance Assessment Bodies (CAB) and Certification Bodies (CB). The MRA includes a dispute resolution mechanism in the case where difficulties arise. These MRAs only deal with conformance to the specifications contained in the standard including those that relate to the potential for interference. They do not guarantee that the products of different manufacturers will operate together.

**3b) Requirements for a Conformance Process for Regulatory purposes**

The Conformance assessment process for radio communications products for regulatory purposes requires the following elements:

* A detailed standard containing the specifications of the product
* A detailed test procedure which is capable of providing repeatable results and whose parameters are traceable to international standards (e.g. standard frequency and time)
* Legal authority to certify and mark the equipment as conforming to the standard
* A post market surveillance procedure to ensure continued conformance
* Authority to remove non-conforming equipment from the market place.

Even if this procedure is followed it does not mean that products from different manufacturers will interoperate as the procedure treats a product as a black box and so implementations of the product can differ while conforming to the standard. These difference in implementation may give rise to difficulties when interact with a product employing a different implementation.

**3c) Compliance testing for industry/market purposes**

In these sections in order to describe testing carried out by industry, some excerpts are taken directly from the description given in Refs1 and 2

Testing is carried out by the equipment manufacturer throughout the development and production process. This includes certification testing of the final product to ensure successful certification by the appropriate body (see examples in addendum). Industry testing looks at all aspects of the performance of the equipment including the potential for causing interference. It also verifies that the equipment will operate as expected meeting the requirement that it is intended to satisfy. In order to achieve these objectives, testing includes both conformance testing and interoperability testing.

Conformance testing in the current context encompasses much more test areas than those looked at when performing regulatory conformance testing. These test areas include all requirements relevant for the correct interworking with the radio network infrastructure such as the detailed Tx and Rx RF parameters, Radio Resource Management functions, protocol aspects, mobility management, session management, network optimization etc.

Additionally, interoperability testing is performed to enable interoperability in a multi-vendor, multi-network, multi-service environment. For this purpose, different equipment manufacturers work together through industry based organizations and/or bilaterally to verify the standards compliant interfaces between their network elements on a functional level, in a controlled environment using suitable test cases. Mobile phones and wireless devices are becoming ever more sophisticated.The need for co-existence of multiple radio technologies – GSM, 3G, HSPA and LTE for wide area communications, together with others such as WiFi or GPS for location-specific services - is increasingly the norm. Device functionality and capabilities are increasingly diverse: text, multimedia, email and web browsing are fast becoming as ubiquitous as voice. Before accepting a new device, mobile operators want to be sure it will work well on their own networks and those of their roaming partners. As the number of technologies and functions grow, the complexity and cost of undertaking conformance and interoperability testing increases exponentially. As it is neither practical nor economically viable for a mobile operator to undertake comprehensive testing of every new device, there are standards developed by industry lead SDOs e.g. 3GPP, ETSI and others. Some of these standards are referenced in the ITU-R recommendations for IMT as appropriate. Also, there are certification bodies to ensure compliance to these standards. For example, for mobile devices, GCF Certification has been established to provide an assurance that the core functionality in today’s GSM family of mobile devices will fulfill customers’ expectations with regard to interoperability of services and the operators’ expectations with regard to correct network interoperability. By combining conformance and interoperability tests undertaken in laboratories with field trials on multiple live commercial networks, GCF Certification verifies the interoperability of a mobile phone or wireless device across different network elements and infrastructure equipment from different suppliers. In order to ensure availability of expertise in all aspect of standards development and testing, membership in these industry lead bodies is from all interested parties i.e. manufacturers, operators and testing community. A list of GCF certified devices is available publicly.

**3d) Key Organizations involved in CIT**

Some of the key organizations involved in conformance and IOT against industry based standards are:

[**Global Certification Forum**](http://www.globalcertificationforum.org)  
The GCF operates a certification scheme for mobile phones and wireless devices that are based on 3GPP standards. A [database of certified equipment](http://www.globalcertificationforum.org/Application/onlinecertification/terminallist/) is available.

**CTIA – The Wireless Association**  
The [CTIA – The Wireless Association](http://www.ctia.org/business_resources/certification/) administers the:

* PTCRB (originally the PCS Type Certification Review Board) certification scheme for GSM and UMTS devices – a [database of certified products](http://www.ptcrb.com/vendor/complete/complete_request.cfm?tab=Certified) is available
* [CDMA Certification Forum](http://globalccf.org/) program for CDMA2000 devices for the global market – [database of certified CDMA devices](http://www.globalccf.org/devices.php)
* [CTIA Battery Certification Program](http://www.ctia.org/business_resources/certification/index.cfm/AID/10624) for IEEE 1725 – 2006 and IEEE 1625 – 2008 rechargeable batteries
* [Bluetooth Compatibility Certification Program](http://www.ctia.org/business_resources/certification/index.cfm/AID/11528)

**WiFi Alliance**  
The [WiFi Alliance operates certification programs](http://www.wi-fi.org/certification_programs.php)  for products based on IEEE 802.11 standards. Lists of [Wi-Fi Certified products](http://www.wi-fi.org/search_products.php) are available.

**WiMAX Forum**  
The [WiMAX Forum Certification Program](http://www.wimaxforum.org/certification/certification-overview) certifies interoperability of IEEE 802.16e products. Lists of [WiMAX Forum certified products](http://registry.wimaxforum.org/certification/certified-product-showcase) are provided.

**4) Certification/Accreditation of testing labs**

For conformance against industry based standards, testing is performed by:

1. labs accredited under ISO/IEC 17025, and/or
2. labs recognized by an SDO or Forum, and/or
3. Certification bodies, and/or
4. 1st/2nd/3rd party for Suppliers Declaration of Conformity.

**5) References:**

1. Global Certification Forum (GCF): GCF Certification; “Test once, use anywhere” certification for mobile devices; A white paper from the Global Certification Forum. Updated December 2011.  
   <http://www.globalcertificationforum.org/WebSite/public/news_events.aspx>
2. ETSI White Paper No. 3: Achieving Technical Interoperability - the ETSI Approach.   
   3rd edition - April 2008  
   http://www.etsi.org/website/technologies/whitepapers.aspx

3. http://www.nist.gov/itl/ssd/is/overview.cfm

4. CCF (CDMA Certification Forum); <http://globalccf.org/>

5. WiFi Alliance; <http://www.wi-fi.org/>

6 <http://www.itu.int/net/ITU-T/cdb/Cschemes.aspx>

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