OFDMA Broadband Mobile Wireless Access System (WiMAX™ applied in Japan)

ARIB STANDARD

ARIB STD-T94 Version 3.3

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Association of Radio Industries and Businesses

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Foreword

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ARIB Standards include "government technical regulations" (mandatory standard) that are set for the purpose of encouraging effective use of frequency and preventing interference with other spectrum users, and "private technical standards" (voluntary standards) that are defined in order to ensure compatibility and adequate quality of radio equipment and broadcasting equipment as well as to offer greater convenience to radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

This ARIB Standard is developed for OFDMA Broadband Mobile Wireless Access System (WiMAX™ applied in Japan). In order to ensure fairness and transparency in the defining stage, the standard was set by consensus at the ARIB Standard Assembly with the participation of both domestic and foreign interested parties from radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

ARIB sincerely hopes that this ARIB Standard will be widely used by radio equipment manufacturers, telecommunication operators, broadcasting equipment manufacturers, broadcasters and users.

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The lists of Essential Industrial Property Rights (IPRs) are shown in the following Attachments.

Attachment 1	List of Essential Industrial Property Rights (selection of option 1)
Attachment 2	List of Essential Industrial Property Rights (selection of option 2)
Reference	This is the list of Essential Industrial Property Rights (IPRs) filed or applied to countries other than Japan. These are listed here as a reference, as the companies voluntarily informed ARIB of these IPRs.

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Chapter 1 General Descriptions

1.1 Outline

This standard specifies requirements of the radio equipment of radio stations stipulated in the Ministry of Internal Affair and Communications (MIC) Ordinance Regulating Radio Equipment, Article 49.28 and 49.29 (this refers to the radio equipment of radio stations of OFDMA Broadband Mobile Wireless Access System) using 2.5 GHz band. It also specifies the radio communication for OFDMA Broadband Mobile Wireless Access System using 2.5 GHz band (hereinafter referred to as "Mobile WiMAX™ System") defined as the technology for personal wireless broadband services based on all-IP core network.

The standard shall be in accordance with MIC Ordinance Regulating Radio Equipment, Article 49.28 and 49.29 (including related notifications) when the Mobile WiMAX facilities are used in Japan. The system shall also conform to the WiMAX™ mobile System Profile and the WiMAX End-to-End Network Systems Architecture specified by WiMAX Forum®. It should be noted that the mobile System Profile refers to IEEE802.16 and 3GPP for the specifications of physical layer and MAC layer. Also it should be noted that the WiMAX End-to-End Network Systems Architecture refers to IETF standards and ITU-T's recommendations.

1.2 Scope of the Standard

The Mobile WiMAX network consists of Mobile Station (MS), Access Service Network (ASN) and Connectivity Service Network (CSN), and the scope of the standard is shown in Figure 1-1.

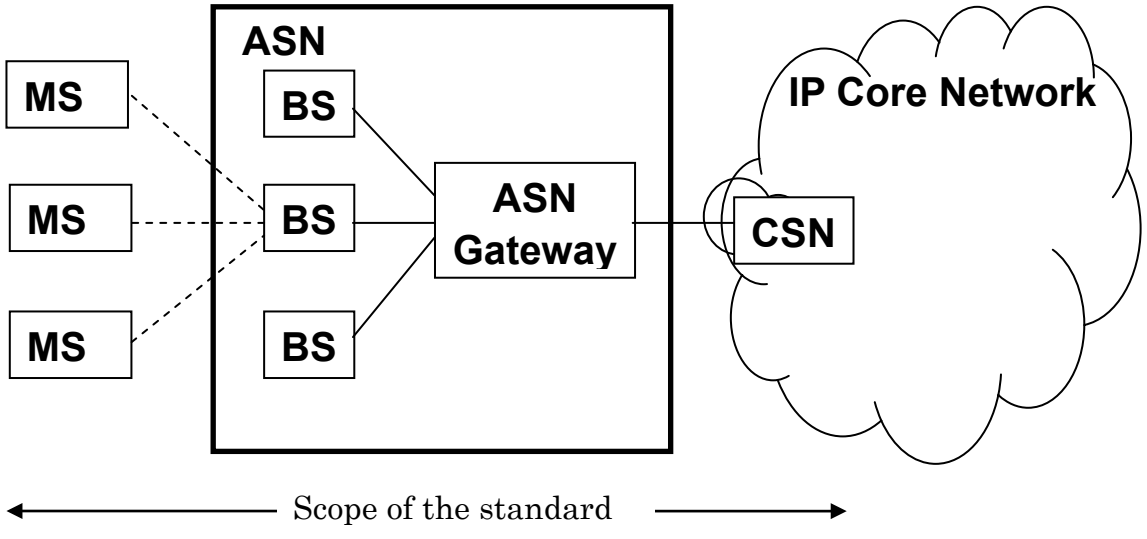

Figure 1-1 Configuration of Mobile WiMAX Network

MS is used by the end users to access the network. ASN comprises Base Stations (BS) and ASN gateways. BS is responsible for providing the air interface to the MS, while ASN gateway typically acts as layer 2 traffic aggregation within an ASN. CSN provides IP connectivity and all IP core network functions.

This standard defines the minimum level of specifications required for connection and services for the Mobile WiMAX system. This consists of three different specifications, i.e., Japanese regulatory specifications applied for radio systems, Physical and MAC layers specifications and Upper layers specifications. The Japanese regulatory specifications are developed by national regulatory administration, i.e. MIC. The physical and MAC layers specifications and the Upper layers specifications are developed by WiMAX Forum.

This standard is intended to combine the national regulations and the international specifications, however in case of inconsistency between them, the national regulations shall prevail. The national regulations are the mandatory requirements for operation of the Mobile WiMAX in Japan.

The physical layer and MAC layer specifications are produced by IEEE802.16 Working Group and 3GPP standards. These documents offer a variety of fundamentally different design options in the physical layer and the MAC layer. For practical reasons of interoperability, WiMAX Forum defined a limited number of system profiles from these documents as summarized in the WiMAX mobile system profile.

Since these specifications do not define the end-to-end WiMAX network, WiMAX Forum has developed a network reference model called End-to-End Network Systems Architecture as the architecture framework for WiMAX deployment and to insure interoperability among various WiMAX equipment and operators.

1.3 Reference Regulations

The acronyms of the referenced regulations used in this standard are as follows;

ORE : Ordinance Regulating Radio Equipment

NT: Notification of the Ministry of Posts and Telecommunications if issued in 2000 or earlier, and a Notification of the Ministry of Internal Affairs and Communications if issued in 2001 or later

1.4 Reference Documents

- WiMAX Forum Mobile System Profile
- WiMAX End-to-End Network Systems Architecture

Chapter 2 System overview

The Mobile WiMAX RTT (Radio Transmission Technology) is consistent with the WiMAX Forum Mobile System Profile being commercialized by members of WiMAX Forum under the name “Mobile WiMAX™”. The WiMAX Forum Mobile System Profile as illustrated in Figure 2-1 is derived from the mandatory and optional feature sets described in IEEE Std 802.16 and 3GPP. This profile is used for air interface certification to foster global interoperability. WiMAX Forum Mobile profiles include recommended 5, 10 and 20MHz bandwidth, aligned with Mobile WiMAX proposal, for global deployment.

The WiMAX Form Mobile System Profile Release 1.0 was first issued with the basic functionalities to meet the global deployment. Since then WiMAX Forum has been developing additional features to the Release 1.0 over time.

The WiMAX Forum Mobile System Profile Release 1.5 was issued with additional functions, such as FDD mode of operation and the enhancement of the system performance.

The WiMAX Forum Mobile System Profile Release 2.0 was issued with advanced air interface function to provide performance improvements.

The WiMAX Forum Mobile System Profile Release 2.1 was issued to support “additional elements” which are additional broadband wireless access technologies and devices beyond WiMAX Release 1.0, 1.5 and 2.0.

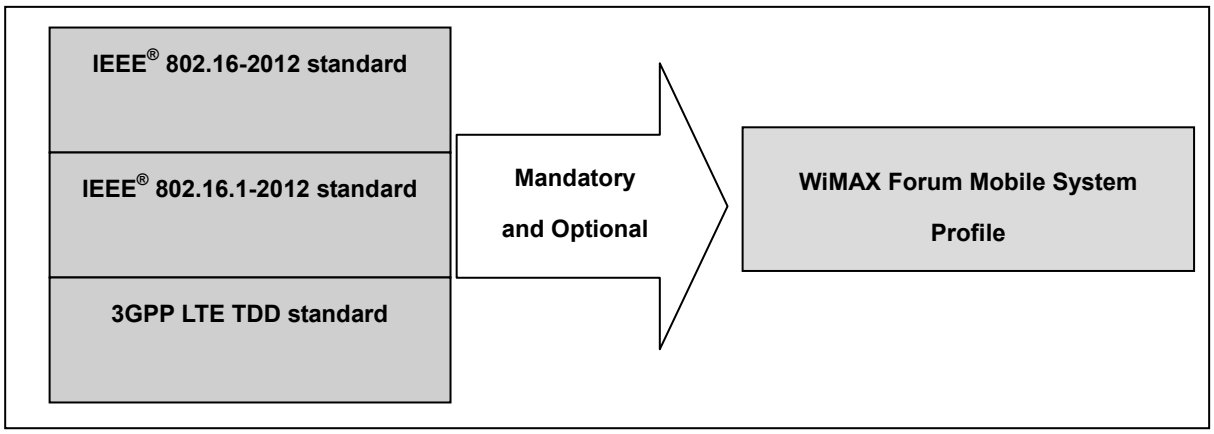

Figure 2-1 WiMAX Forum Mobile System Profile

The WiMAX Mobile System Profile supports the deployment of fully interoperable systems compatible with Mobile WiMAX. The profile includes optional Base Station features providing flexibility for various deployment scenarios and regional requirements to enable optimization for capacity, coverage, etc.[1]

2.1 Mobile WiMAX Network Architecture

The Mobile WiMAX radio interface is suitable for use in an all-IP (Internet Protocol) architecture, with support for IP-based packet services. This allows for scalability and rapid deployment since the networking functionality is primarily based on software services.

In order to deploy successful and operational commercial systems, there is need for support beyond the IEEE802.16 air interface specifications, which only address layers 1 and 2 (PHY (Physical) and MAC (Media Access Control) layers). The WiMAX Forum specifies the Mobile WiMAX Network Architecture describing the upper layer of the Radio Access Network and Core Network. Furthermore, the systems can also operate with core network of other IMT-2000 systems. Note that this section is not applicable for WiMAX Release 2.1 Additional Elements.

2.1.1 Architecture Principles

The following basic principles have guided the Mobile WiMAX Network Architecture development.

[1] Mobile WiMAX – Part I: A Technical Overview and Performance Evaluation.
http://www.wimaxforum.org/news/downloads/Mobile_WiMAX_Part1_Overview_and_Performance.pdf

1. The architecture is based on a packet-switched framework, including native procedures based on IEEE Std 802.16, appropriate IETF (Internet Engineering Task Force) RFCs (Request For Comments) and Ethernet standards.
2. The architecture permits decoupling of access architecture (and supported topologies) from connectivity IP service. Network elements of the connectivity system are independent of the IEEE802.16 radio specifics.
3. The architecture allows modularity and flexibility to accommodate a broad range of deployment options such as:
   - Small-scale to large-scale (sparse to dense radio coverage and capacity) networks
   - Urban, suburban, and rural radio propagation environments
   - Licensed and/or license-exempt frequency bands
   - Hierarchical, flat, or mesh topologies, and their variants
   - Co-existence of fixed, nomadic, portable and mobile usage models

Support for Services and Applications: The End-to-End Mobile WiMAX Network Architecture includes a) Support of voice, multimedia services and other mandated regulatory services such as emergency services and lawful interception, b) Access to a variety of independent ASP (Application Service Provider) networks in an neutral manner, c) Mobile telephony communications using VoIP, d) Support interfacing with various interworking and media gateways permitting delivery of incumbent/legacy services translated over IP (for example, SMS (Short Message Service) over IP, MMS (Multimedia Message Service), WAP (Wireless Application Protocol)) to WiMAX access networks and e) Support delivery of IP Broadcast and Multicast services over WiMAX access networks.

Interworking and Roaming is another key strength of the End-to-End Mobile WiMAX Network Architecture with support for a number of deployment scenarios. In particular, there will be support of a) Loosely-coupled interworking with existing wireless networks such as those specified in 3GPP (3G Partnership Project) and 3GPP2 (3G Partnership Project 2) or existing wireline networks such as DSL (Digital Subscriber Line) and MSO (Multi Service Operator), with the interworking interface(s) based on a standard IETF suite of protocols, b) Global roaming across WiMAX operator networks, including support for credential reuse, consistent use of AAA (Authentication, Authorization, Accounting) for accounting and billing, and consolidated/common billing and settlement, c) A variety of user authentication credential formats such as subscriber identify modules (SIM/USIM (Subscriber Identity Module/Universal Subscriber Identity Module), R-UIM (Removable User Identity Module)), username/password, digital certificates.

2.2 WiMAX Network Reference Model

IEEE Std 802.16 specifies a radio interface but not the network in which it is to be used, instead leaving an open interface to higher network layers. The WiMAX Forum specifies the NRM (Network Reference Model) to describe a practical and functional network making use of the Mobile WiMAX air interface. This NRM is described here because it serves as a framework for evaluating the performance of the Mobile WiMAX radio interface. Note that this section is not applicable for WiMAX Release 2.1 Additional Elements.

The NRM is a logical representation of the network architecture. The NRM identifies functional entities and reference points over which interoperability is achieved between functional entities. The architecture has been developed with the objective of providing unified support of functionality needed in a range of network deployment models and usage scenarios (ranging from nomadicity to full mobility).

Figure 2-2 illustrates the NRM, consisting of the logical entities MS, ASN, and CSN, as well as clearly identified reference points for interconnection of the logical entities. The figure depicts the key normative reference points R1-R5. Each of the entities, MS, ASN and CSN, represents a grouping of functional entities. Each of these functional entities may be realized in a single physical device or may be distributed over multiple physical devices according to allocation defined by ASN profiles[2].

The intent of the NRM is to allow multiple implementation options for a given functional entity, and yet achieve interoperability among different realizations of functional entities. Interoperability is based on the definition of communication protocols and data plane treatment between functional entities to achieve an overall end-to-end function, for example, security or mobility management. Thus, the functional entities on either side of a reference point represent a collection of control and bearer plane end-points.

[2] An ASN profile represents an allocation of functional entities (e.g. authenticator, radio resource manager, etc.) to the various elements belonging to the access network.

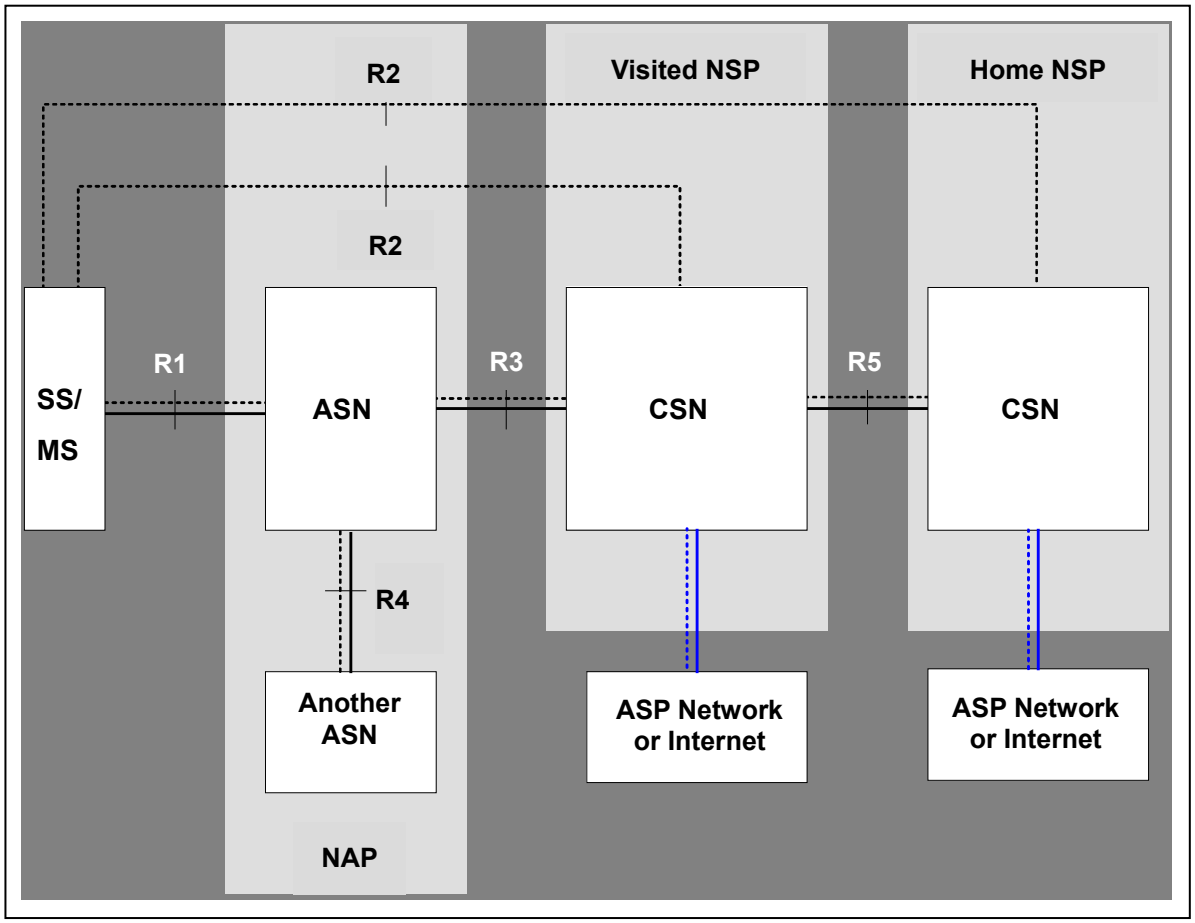

Figure 2-2 WiMAX Network Reference Model

The ASN defines a logical boundary and represents a convenient way to describe aggregation of functional entities and corresponding message flows associated with the access services. The ASN represents a boundary for functional interoperability with WiMAX clients, connectivity service functions, and aggregation of functions embodied by different vendors. Mapping of functional entities to logical entities within ASNs as depicted in the NRM may be performed in different ways. The CSN (Connectivity Service Network) is defined as a set of network functions that provide IP connectivity services to the subscriber stations. A CSN may comprise network elements such as routers, AAA proxy/servers, user databases and Interworking gateway devices. Figure 2-3 provides a more basic view of the many entities within the functional groupings of ASN and CSN.

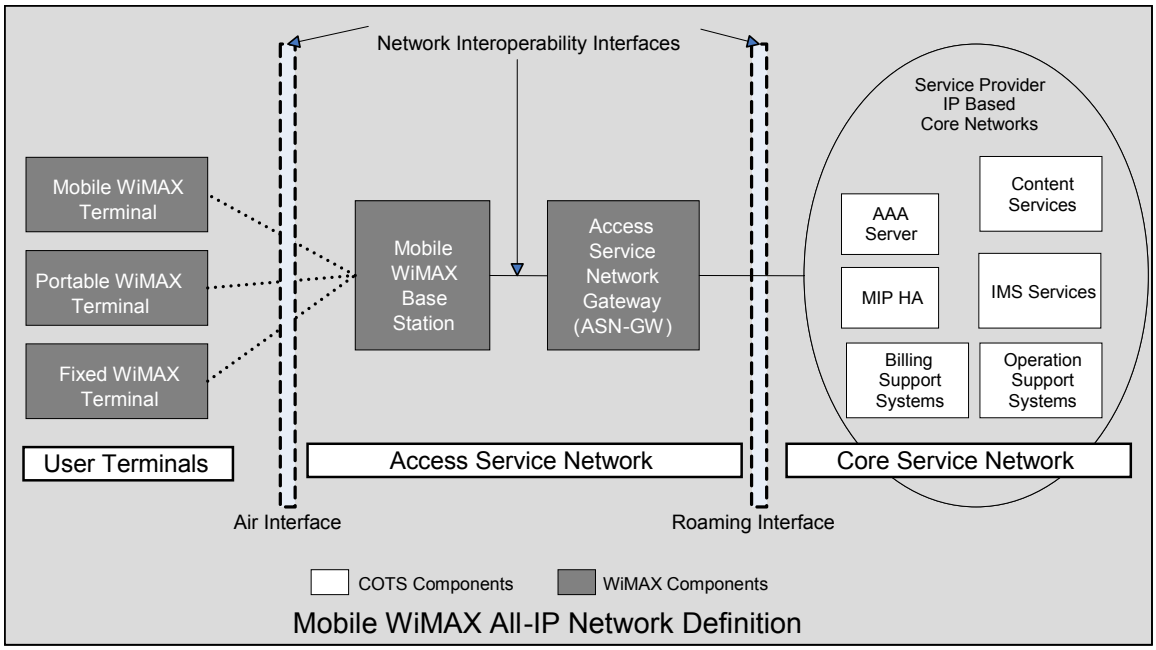

Figure 2-3 ASN and CSN Entities

Some general tenets have guided the development of the Network Architecture and include the following: a) Logical separation of IP addressing, routing and connectivity management procedures and protocols, to enable use of the access architecture primitives in standalone and interworking deployment scenarios, b) Support for sharing of ASN(s) of a NAP (Network Access Provider) among multiple NSPs, c) Support of a single NSP (Network Service Provider) providing service over multiple ASN(s) – managed by one or more NAPs, d) Support for the discovery and selection of accessible NSPs by an MS, e) Support of NAPs that employ one or more ASN topologies, f) Support of access to incumbent operator services through internetworking functions as needed, g) Specification of open and well-defined reference points between various groups of network functional entities (within an ASN, between ASNs, between an ASN and a CSN, and between CSNs), and in particular between an MS, ASN and CSN to enable multi-vendor interoperability, h) Support for evolution paths between the various usage models subject to reasonable technical assumptions and constraints, i) Enabling different vendor implementations based on different combinations of functional entities on physical network entities, as long as these implementations comply with the normative protocols and procedures across applicable reference points, as defined in the network specifications and j) Support for the most basic scenario of a single operator deploying an ASN together with a limited set of CSN functions, so that the operator can offer basic Internet access service without consideration for roaming or interworking.

The Mobile WiMAX architecture also supports IP services, in a standard mobile IP compliant network. The flexibility and interoperability supported by this network architecture provides operators with the opportunity for a multi-vendor implementation of a network even with a mixed deployment of distributed and centralized ASNs in the network. The Mobile WiMAX network architecture has the following major features:

Security

The End-to-End Network Architecture is based upon a security framework that is independent of the ASN topology and applies consistently across both new and internetworking deployment models and various usage scenarios. In particular, it supports: a) Strong mutual device authentication between an MS and the network, based on the IEEE802.16 security framework, b) All commonly deployed authentication mechanisms and authentication in home and visited operator network scenarios based on a consistent and extensible authentication framework, c) Data integrity, replay protection, confidentiality and non-repudiation using applicable key lengths, d) Use of MS initiated/terminated security mechanisms such as VPNs (Virtual Private Networks), and e) Standard secure IP address management mechanisms between the MS and its home or visited NSP.

Mobility and Handovers

The End-to-End Network Architecture has extensive capabilities to support mobility and handovers. It a) supports IPv4 or IPv6 based mobility management. Within this framework, and as applicable, the architecture accommodates MS equipment with multiple IP addresses and simultaneous IPv4 and IPv6 connections, b) supports roaming between NSPs, c) utilizes mechanisms to support seamless handovers at up to vehicular speeds— satisfying well-defined bounds of service disruption. Some of the additional capabilities for mobility include the support of: i) dynamic and static home address configurations, ii) dynamic assignment of the Home Agent in the service provider network as a form of route optimization, as well as in the home IP network as a form of load balancing and iii) dynamic assignment of the Home Agent based on policies.

Scalability, Extensibility, Coverage and Operator Selection

The End-to-End Network Architecture has extensive support for scalable, extensible operation and flexibility in operator selection. In particular, it a) enables a user to manually or automatically select from available NAPs and NSPs, b) enables ASN and CSN system designs that easily scale upward and downward – in terms of coverage, range or capacity, c)

accommodates a variety of ASN topologies - including hub-and-spoke, hierarchical, and/or multi-hop interconnects, d) accommodates a variety of backhaul links, both wireline and wireless with different latency and throughput characteristics, e) supports incremental infrastructure deployment, f) supports phased introduction of IP services that in turn scale with increasing number of active users and concurrent IP services per user, g) supports the integration of BSs of varying coverage and capacity - for example, pico, micro, and macro BSs and e) supports flexible decomposition and integration of ASN functions in ASN deployments in order to enable use of load balancing schemes for efficient use of radio spectrum and network resources.

Additional features pertaining to manageability and performance of the Network Architecture include: a) Support for a variety of online and offline client provisioning, enrollment, and management schemes based on open, broadly deployable, IP-based, industry standards, b) Accommodation of OTA (Over-The-Air) services for MS terminal provisioning and software upgrades, and c) Accommodation of the use of header compression/suppression and/or payload compression for efficient use of the radio resources.

Multi-Vendor Interoperability

Another key aspect of the Network Architecture is the support of interoperability between equipment from different manufacturers within an ASN and across ASNs. This includes interoperability between: a) BS and backhaul equipment within an ASN, and b) Various ASN elements (possibly from different vendors) and CSN, with minimal or no degradation in functionality or capability of the ASN.

Quality of Service

The Network Architecture has provisions for support of the QoS (Quality Of Service) mechanisms defined in IEEE Std 802.16. In particular, it enables flexible support of simultaneous use of a diverse set of IP services. The architecture supports: a) differentiated levels of QoS, coarse-grained (per user/terminal) and/or fine-grained (per service flow), b) admission control, c) bandwidth management and d) implementation of policies as defined by various operators for QoS based on their SLAs (Service Level Agreement) (including policy enforcement per user and user group as well as factors such as location, time of day, etc.). Extensive use is made of standard IETF mechanisms for managing policy definition and policy enforcement between operators.

Interworking with Other Networks

The Network Architecture supports loosely coupled interworking with existing wireless or

wireline core networks such as GSM/GPRS (Global System for Mobile Communications/General Packet Radio Service), UMTS (Universal Mobile Telecommunications System), HSDPA (High Speed Downlink Packet Access), CDMA2000 (Code Division Multiple Access 2000), RLAN (Remote Local Area Network), DSL, and cable modem operator networks on the basis of the IP/IETF suite of protocols.

2.3 Physical Layer Description

2.3.1 OFDMA Basics

OFDM (Orthogonal Frequency Division Multiplexing) is a multiplexing technique that subdivides the bandwidth into multiple frequency sub-carriers as shown in Figure 2-4. In an OFDM system, the input data stream is divided into several parallel sub-streams of reduced data rate (thus increased symbol duration) and each sub-stream is modulated and transmitted on a separate orthogonal sub-carrier. The increased symbol duration improves the robustness of OFDM to delay spread. Furthermore, the introduction of the CP (cyclic prefix) can completely eliminate ISI (Inter-Symbol Interference) as long as the CP duration is longer than the channel delay spread. The CP is typically a repetition of the last samples of data portion of the block that is appended to the beginning of the data payload as shown in Figure 2-5. The CP prevents inter-block interference and makes the channel appear circular and permits low-complexity frequency domain equalization. A perceived drawback of CP is that it introduces overhead, which effectively reduces bandwidth efficiency. While the CP does reduce bandwidth efficiency somewhat, the impact of the CP is similar to the “roll-off factor” in raised-cosine filtered single-carrier systems. Since OFDM signal power spectrum has a very sharp fall of at the edge of channel, a larger fraction of the allocated channel bandwidth can be utilized for data transmission, which helps to moderate the loss in efficiency due to the cyclic prefix.

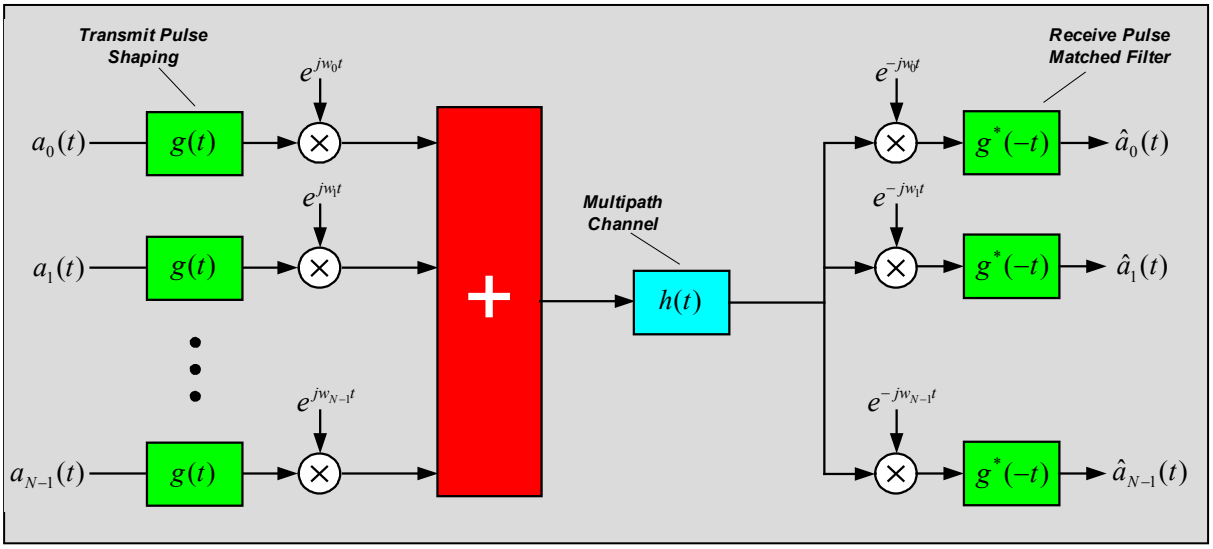

Figure 2-4 Basic Architecture of an OFDM System

OFDM exploits the frequency diversity of the multipath channel by coding and interleaving the information across the sub-carriers prior to transmissions. OFDM modulation can be realized with efficient IFFT (Inverse Fast Fourier Transform), which enables a large number of sub-carriers with low complexity. In an OFDM system, resources are available in the time domain by means of OFDM symbols and in the frequency domain by means of sub-carriers. The time and frequency resources can be organized into subchannels for allocation to individual users. OFDMA (Orthogonal Frequency Division Multiple Access) is a multiple-access/multiplexing scheme that provides multiplexing operation of data streams corresponding to multiple users onto the downlink subchannels. It also supports multiple access of various users by means of uplink subchannels.

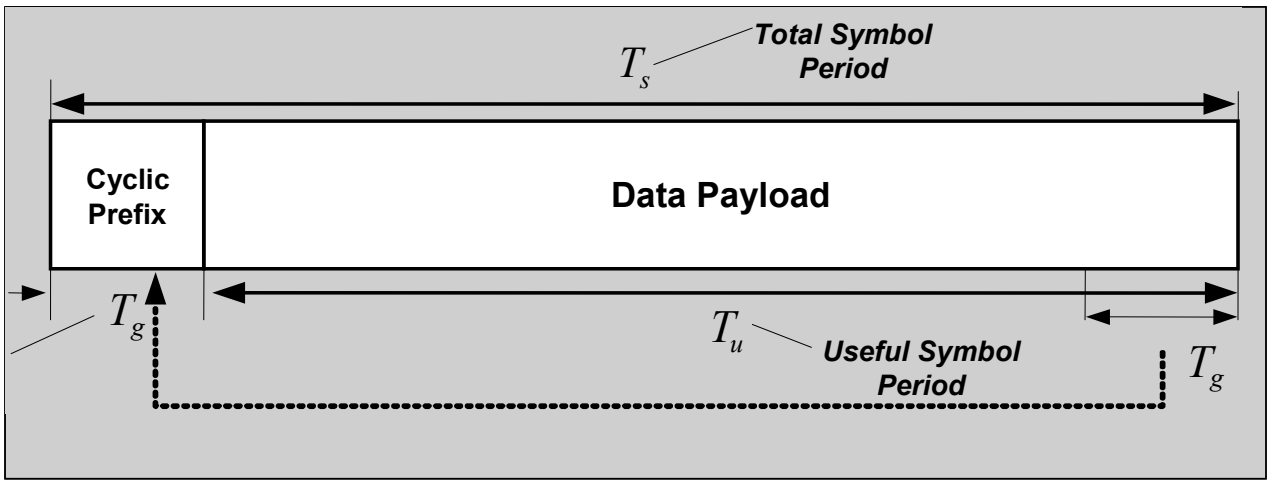

Figure 2-5 Insertion of Cyclic Prefix (CP)

2.3.2 OFDMA Symbol Structure and Subchannelization

The OFDMA symbol structure consists of three types of sub-carriers as shown in Figure 2- 6.

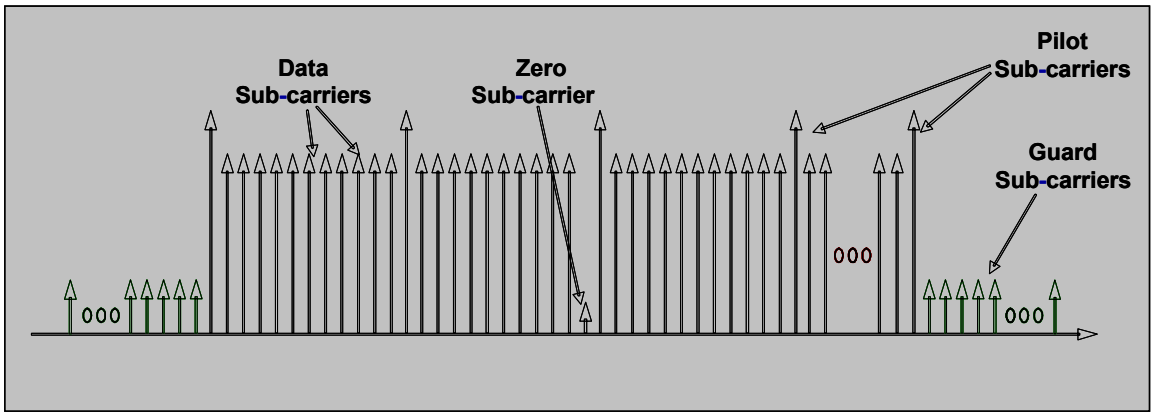

Figure 2-6 OFDMA Sub-Carrier Structure

- Data sub-carriers for data transmission.
- Pilot sub-carriers for estimation and synchronization purposes.
- Null sub-carriers for no transmission; used for guard band and zero Hertz sub-carriers.

Active (data and pilot) sub-carriers are grouped into subsets of sub-carriers called subchannels. The Mobile WiMAX PHY supports subchannelization in both DL (Down Link) and UL (Up Link). The minimum frequency-time resource unit of subchannelization is one slot, which is equal to 48 data tones (sub-carriers).

There are two types of sub-carrier permutations for subchannelization; diversity and

contiguous. The diversity permutation draws sub-carriers pseudo-randomly to form a subchannel. It provides frequency diversity and inter-cell interference averaging. The diversity permutations include DL FUSC (Fully Used Subchanelozation), DL PUSC (Partially Used Subchannelization) and UL PUSC and additional optional permutations. With DL PUSC, for each pair of OFDM symbols, the available or usable sub-carriers are grouped into clusters containing 14 contiguous sub-carriers per symbol, with pilot and data allocations in each cluster in the even and odd symbols as shown in Figure 2- 7.

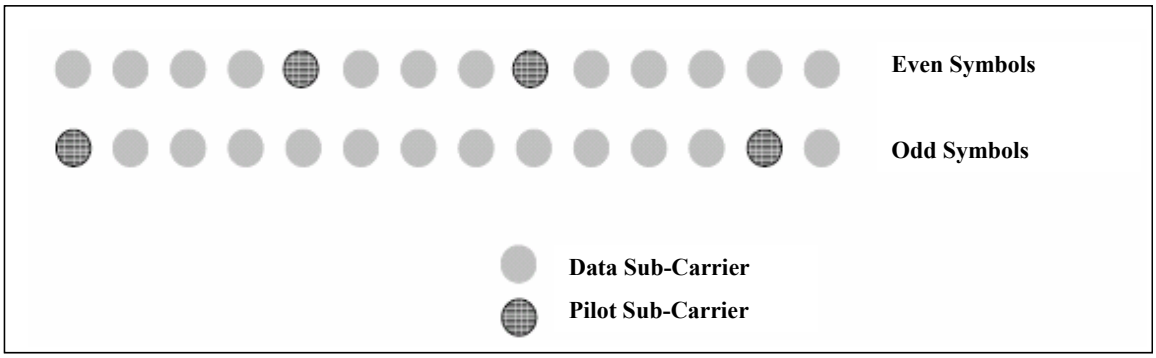

Figure 2-7 DL Frequency Diverse Subchannel

A re-arranging scheme is used to form groups of clusters such that each group is made up of clusters that are distributed throughout the sub-carrier space. A subchannel in a group contains two (2) clusters and is comprised of 48 data sub-carriers and eight (8) pilot sub-carriers. The data subcarriers in each group are further permuted to generate subchannels in the group. Therefore, only the pilot positions in the cluster as shown in Figure 2- 7. The data subcarriers in the cluster are distributed to multiple subchannels.

Analogous to the cluster structure for DL, a tile structure is defined for the UL PUSC whose format is shown in Figure 2-8.

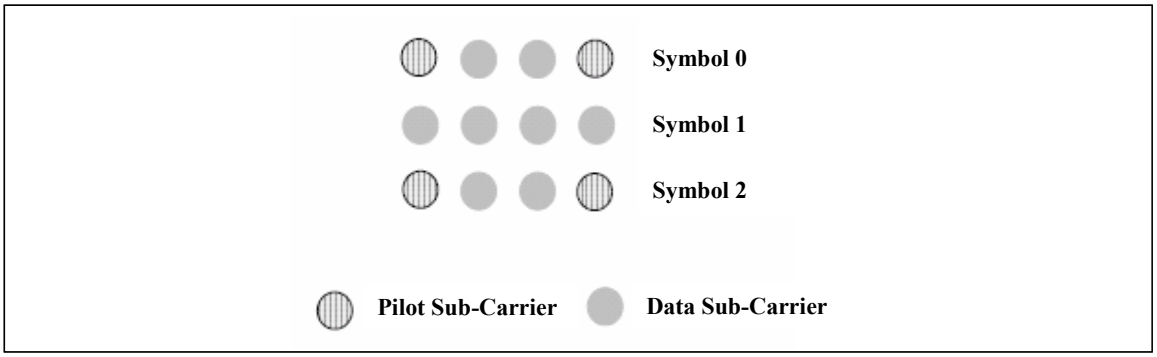

Figure 2-8 Tile Structure for UL PUSC

The available sub-carrier space is split into tiles and six (6) tiles, chosen from across the entire spectrum by means of a re-arranging/permutation scheme, are grouped together to form a slot. The slot is comprised of 48 data sub-carriers and 24 pilot sub-carriers in 3 OFDM symbols.

The contiguous permutation groups a block of contiguous sub-carriers to form a subchannel. The contiguous permutations include DL AMC (Adaptive Modulation and Coding) and UL AMC, and have the same structure. A bin consists of 9 contiguous sub-carriers in a symbol, with 8 assigned for data and one assigned for a pilot. A slot in AMC is defined as a collection of bins of the type (N x M = 6), where N is the number of contiguous bins and M is the number of contiguous symbols. Thus the allowed combinations are (6 bins, 1 symbol), (3 bins, 2 symbols), (2 bins, 3 symbols) or (1 bin, 6 symbols). AMC permutation enables multi-user diversity by choosing the subchannel with the best frequency response.

In general, diversity sub-carrier permutations perform well in mobile applications while contiguous sub-carrier permutations are well suited for fixed, nomadic, or low mobility environments. These options enable the system designer to trade-off mobility for throughput.

Following figure demonstrates the physical and Logical subchannel allocation in a OFDMA frame.

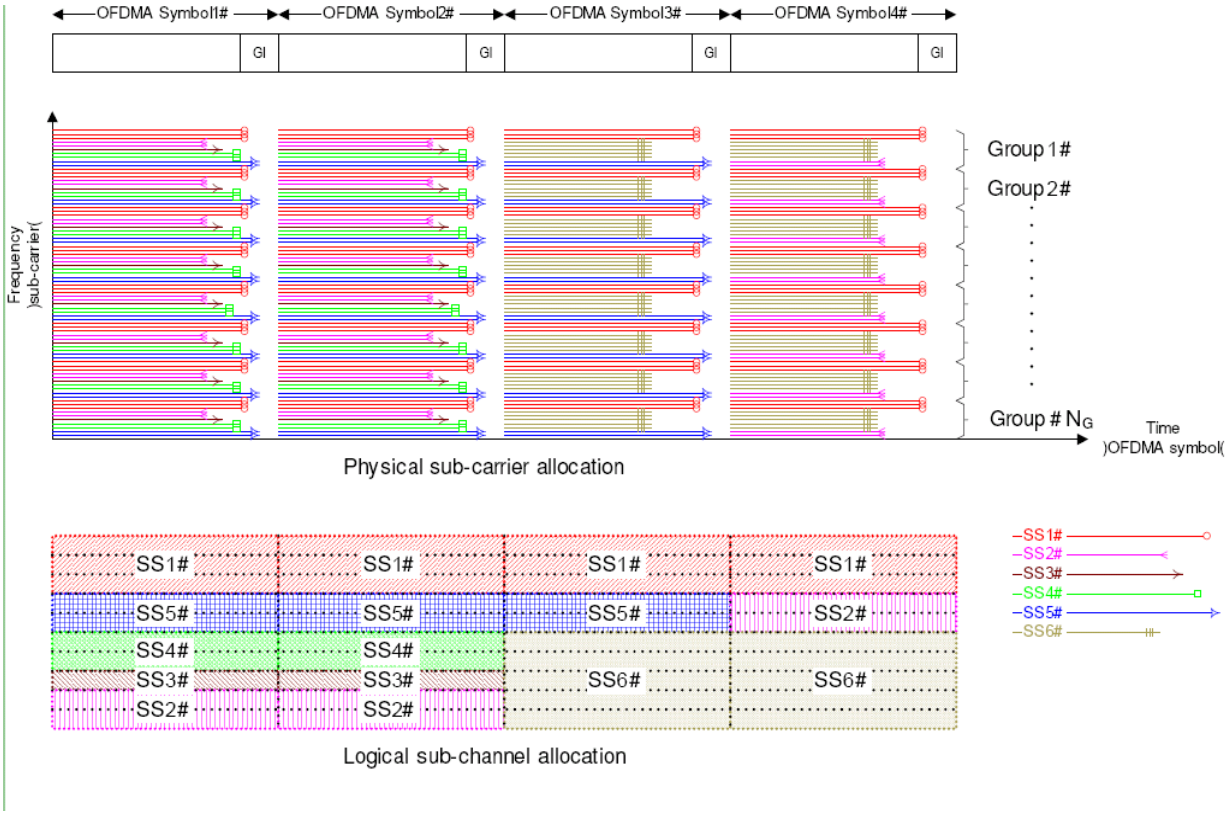

Figure 2-9 Physical and Logical Subchannel Allocation

2.3.3 Scalable OFDMA

Mobile WiMAX mode is based upon the concept of Scalable OFDMA. The scalability is supported by adjusting the FFT (Fast Fourier Transform) size while fixing the sub-carrier frequency spacing at 10.94 kHz. Since the resource unit sub-carrier bandwidth and symbol duration is fixed, the impact to higher layers is minimal when scaling the bandwidth. The Mobile WiMAX parameters are listed in Table 2-1.

Table 2-1 OFDMA Scalability Parameters

Parameters	Values	
System Channel Bandwidth (MHz)	5	10
Sampling Frequency (F_p in MHz)	5.6	11.2
FFT Size (N_{FFT})	512	1024
Number of Subchannels	8	16
Sub-Carrier Frequency Spacing	10.94 kHz	
Useful Symbol Time ($T_b = 1/f$)	91.4 μs	
Guard Time ($T_g = T_b/8$)	11.4 μs	
OFDMA Symbol Duration ($T_s = T_b + T_g$)	102.9 μs	
Number of OFDMA Symbols (5 ms Frame)	48 (including ~1.6 symbols for TTG/RTG)	

2.3.4 TDD Frame Structure

The Mobile WiMAX PHY makes use of TDD (Time Division Duplexing). To counter interference issues, TDD does require system-wide synchronization; nevertheless, TDD has numerous advantages:

- TDD enables adjustment of the downlink/uplink ratio to efficiently support asymmetric downlink/uplink traffic, while with FDD (Frequency Division Duplexing), downlink and uplink always have fixed and, generally, equal DL and UL bandwidths. As shown in Table 2-2, recommended number of UL/DL OFDM symbols can flexibly realize a range of asymmetric downlink/uplink traffic ratio.

Table 2-2 Number of OFDM Symbols in DL and UL

Description	Base Station Values
Number of OFDM Symbols in DL and UL for 5 and 10 MHz BW	(35: 12), (34: 13), (33: 14), (32: 15), (31: 16), (30: 17), (29: 18), (28: 19), (27: 20), (26: 21)

- TDD assures channel reciprocity for better support of link adaptation, MIMO and other closed loop advanced antenna technologies. Also, TDD is the preferred mode of operation with respect to the beamforming systems using phased array antennas.
- Unlike FDD, which requires a pair of channels, TDD only requires a single channel for both downlink and uplink, providing greater flexibility for adaptation to varied global spectrum allocations.
- Transceiver designs for TDD implementations are less complex.

Figure 2-10 illustrates the OFDM frame structure for a TDD implementation. Each frame is divided into DL and UL sub-frames, separated by Transmit/Receive and Receive/Transmit Transition Gaps (TTG and RTG, respectively) to prevent DL and UL transmission collisions. In a frame, the following control information is used:

- Preamble: The preamble, used for synchronization, is the first OFDM symbol of the frame.
- FCH (Frame Control Header): The FCH follows the preamble. It provides the frame configuration information, such as MAP message length, coding scheme, and usable subchannels.
- DL-MAP (Down Link Map) and UL-MAP (Up Link Map): The DL-MAP and UL-MAP provide subchannel allocation and other control information for the DL and UL sub-frames respectively.
- UL Ranging: The UL ranging subchannel is allocated for MSs to perform closed-loop time, frequency, and power adjustment as well as bandwidth requests. Four types of ranging are defined. The different types of ranging are identified by a code and a 2D region in the UL subframe.
    - Initial Ranging- when MS enters (or re-enters) the network,
    - Periodic Ranging once the connection is set up between the MS and the BS,
    - Hand Over Ranging (in case of Hard HO in drop situations), and
    - Bandwidth Request.

- UL CQICH (Up Link Channel Quality Indication Channel): The UL CQICH channel is allocated for the MS to feedback channel-state information.
- UL ACK (Up Link Acknowledge): The UL ACK is allocated for the MS to feedback DL HARQ (Hybrid Automatic Repeat Request) acknowledgement.

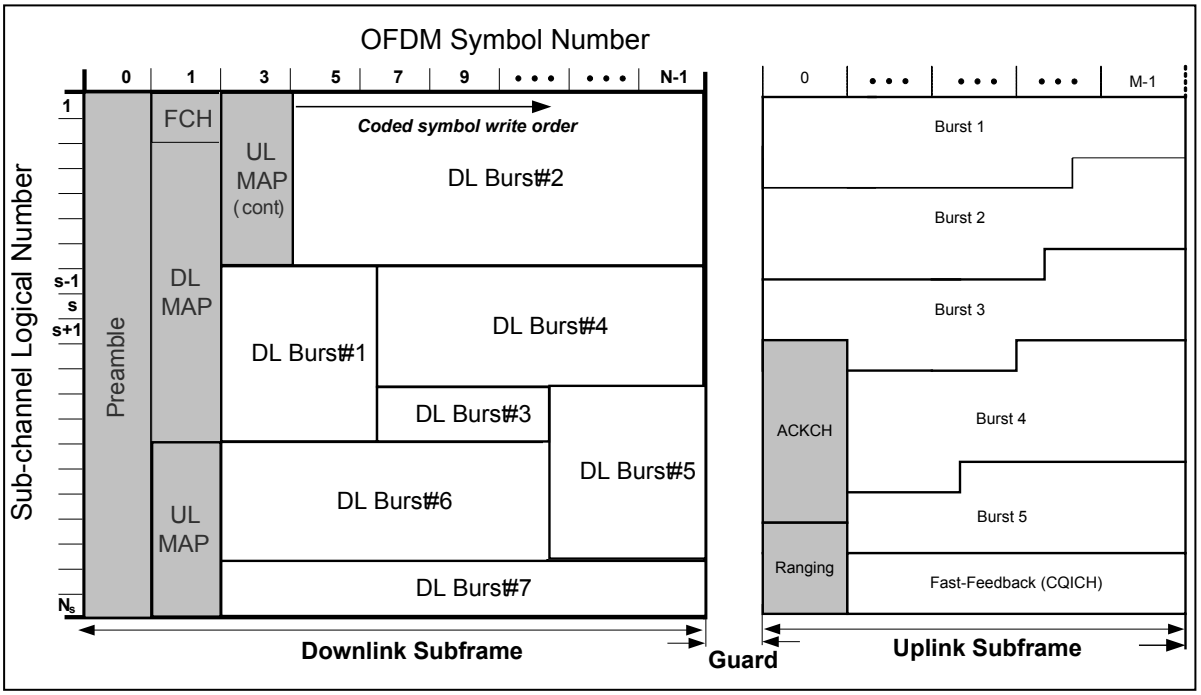

Figure 2-10 Mobile WiMAX Frame Structure

2.3.5 Other Advanced PHY Layer Features

Adaptive modulation and coding, HARQ, CQICH, and multiple antenna technologies provide enhanced coverage and capacity in mobile applications.

Support for QPSK (Quadrature Phase Shift Keying), 16QAM (Quadrature Amplitude Modulation) and 64QAM are mandatory in the DL. In the UL, 64QAM is optional. Both CC (Convolutional Code) and CTC (Convolutional Turbo Code), with variable code rate and repetition coding, are supported. Table 2-3 summarizes the coding and modulation schemes supported in Mobile WiMAX.

Table 2-3 Supported Coding and Modulation Schemes

		DL	UL
Modulation		QPSK, 16QAM, 64QAM	QPSK,16QAM, (64QAM optional)
Rate	CC	1/2, 2/3, 3/4, 5/6	1/2, 2/3, (5/6 optional)
	CTC	1/2, 2/3, 3/4, 5/6	1/2, 2/3, (5/6 optional)
	Repetition	x2, x4, x6	x2, x4, x6

The numerology of WiMAX PHY with the system bandwidth of 5 MHz and 10 MHz is shown in Table 2-4. Table 2-5 assumes PUSC subchannels with frame duration of 5 milliseconds. Each frame has 48 OFDM symbols, with 44 OFDM symbols available for data transmission. The highlighted values indicate data rates for optional 64QAM in the UL.

Table 2-4 Mobile WiMAX PHY Numerology

Parameter	Downlink	Uplink	Downlink	Uplink
System Bandwidth	5 MHz		10 MHz	
FFT Size	512		1024	
Null Sub-Carriers	92	104	184	184
Pilot Sub-Carriers	60	136	120	280
Data Sub-Carriers	360	272	720	560
Subchannels	15	17	30	35
Symbol Period, T_S	102.9 μs			
Frame Duration	5 ms			
OFDM Symbols/Frame	48 (including ~1.6 symbols for TTG/RTG)			
Data OFDM Symbols	44			

Table 2-5 Mobile WiMAX PHY Data Rates with PUSC Subchannel[3]

Modulation	Code Rate	5 MHz Channel		10 MHz Channel	
		Downlink Rate, Mbit/s	Uplink Rate, Mbit/s	Downlink Rate, Mbit/s	Uplink Rate, Mbit/s
QPSK	1/2 CTC, 6x	0.53	0.38	1.06	0.78
	1/2 CTC, 4x	0.79	0.57	1.58	1.18
	1/2 CTC, 2x	1.58	1.14	3.17	2.35
	1/2 CTC, 1x	3.17	2.28	6.34	4.70
	3/4 CTC	4.75	3.43	9.50	7.06
16QAM	1/2 CTC	6.34	4.57	12.07	9.41
	3/4 CTC	9.50	6.85	19.01	14.11
64QAM	1/2 CTC	9.50	6.85	19.01	14.11
	2/3 CTC	12.67	9.14	26.34	18.82
	3/4 CTC	14.26	10.28	28.51	21.17
	5/6 CTC	15.84	11.42	31.68	23.52

The BS scheduler determines the appropriate data rate (or burst profile) for each burst allocation based on the buffer size, channel propagation conditions at the receiver, etc. A CQI (Channel Quality Indicator) channel is utilized to provide channel-state information from the user terminals to the BS scheduler. Relevant channel-state information can be fed back by the CQICH including: Physical CINR (Carrier to Interference + Noise Ratio), Effective CINR, MIMO (Multiple Input Multiple Output) mode selection and frequency selective subchannel selection. Because the implementation is TDD, link adaptation can also take advantage of channel reciprocity to provide a more accurate measure of the channel condition (such as sounding).

HARQ is enabled using N channel “Stop and Wait” protocol, which provides fast response to packet errors and improves cell edge coverage. Chase Combining and, optionally, Incremental Redundancy are supported to further improve the reliability of the retransmission. A dedicated ACK channel is provided in the uplink for HARQ ACK/NACK signaling. Multi-channel HARQ

[3] PHY Data Rate=(Data sub-carriers/Symbol period)x(information bits per symbol).

operation is supported. Multi-channel stop-and-wait ARQ with a small number of channels is an efficient, simple protocol that minimizes the memory required for HARQ and stalling. Mobile WiMAX provides signaling to allow fully asynchronous operation. The asynchronous operation allows variable delay between retransmissions, which gives more flexibility to the scheduler at the cost of additional overhead for each retransmission allocation. HARQ combined together with CQICH and adaptive modulation and coding provides robust link adaptation in mobile environments at vehicular speeds in excess of 120 km/hr.

Multiple antenna technologies typically involve complex vector or matrix operations on signals due to the presence of multiple antenna links between the transmitter and receiver. OFDMA allows multiple antenna operations to be performed on a per-subcarrier basis, where the vector-channels are flat fading. This fact makes the multiple antenna signal processing manageable at both transmitter and receiver side since complex transmitter architectures and receiver equalizers are not required to compensate for frequency selective fading. Thus, OFDMA is very well-suited to support multiple antenna technologies. Mobile WiMAX supports a full range of multiple antenna technologies to enhance system performance. The supported multiple antenna technologies include:

- Beamforming (BF) for both the uplink and the downlink: With BF, the system uses multiple-antennas to both receive and transmit signals to improve the coverage and capacity of the system and reduce the outage probability. The BS is usually equipped with two or more antennas, with a typical number being four antennas, and determines so-called antenna weights for both uplink reception and downlink transmission, while the MS is usually equipped with one or two antennas for downlink reception and one antenna for uplink transmission. Note that different BF techniques can be applied in Mobile WiMAX since there is no limitation imposed either to the distance among the antenna elements of the BS or the algorithm employed at the BS transceiver; the possibility of beamforming the pilot subcarriers during downlink transmission (feature of dedicated pilots in the mobile WiMAX system profiles) makes the application of specific BF algorithms transparent to the MS receiver.
- Space-Time Coding (STC) for the downlink: Two-antenna transmit diversity is enabled in Mobile WiMAX through the use of a space-time block coding code widely known as the Alamouti code. STC is a powerful technique for implementing open-loop transmit diversity, while its performance is further increased in Mobile WiMAX since a second antenna is mandated to be present at the MS receiver. Further, STC offers favorable performance in all propagation environments, i.e., it is not constrained by the MIMO channel quality usually represented by the spread of the MIMO channel eigenvalues. As in the BF case where one

spatial stream is transmitted over one OFDMA symbol per subcarrier, STC cannot lead to link throughput increase because it transmits two spatial streams over two OFDMA symbols per subcarrier.

- Spatial Multiplexing (SM) for the downlink: Spatial multiplexing is supported to apply higher peak rates and increased throughput whenever this is possible. With spatial multiplexing, two data streams are transmitted over one OFDMA symbol per subcarrier. Since the MS receiver is also equipped with two receive antennas, it can separate the two data streams to achieve higher throughput compared to single antenna, BF, and STC systems. In Mobile WiMAX, with 2x2 MIMO SM increases the peak data rate two-fold by transmitting two data streams.
- Collaborative Spatial Multiplexing (CSM), also referred to as virtual spatial multiplexing, for the uplink: In the uplink, each MS is equipped with a single transmit antenna. To increase the uplink performance, two users can transmit collaboratively in the same frequency and time allocation as if two streams were spatially multiplexed from two antennas of the same user. The advantage of the uplink CSM compared to the downlink SM is related to the fact that the transmitted spatial streams are uncorrelated since they originate from spatially displaced MSs. By additionally considering that the channel correlation factor at the BS can be kept at lower values than that at the MS receiver (space limitations at the MS usually apply leading to smaller inter-antenna distances and, thus, higher correlation values, especially if cross-polarized antennas are not employed), an improved performance of the spatial stream demultiplexing is expected in the uplink compared to the downlink.

Regarding the MIMO operation in the downlink (use of the STC and SM modes), Mobile WiMAX supports adaptive switching between STC and SM to maximize the benefit of MIMO depending on the channel conditions. For instance, SM improves peak throughput. However, when channel conditions are poor, e.g., when the signal-to-interference ratio is low or the channel correlation factor is relatively high, the PER (packet error rate) can be high and thus the coverage area where the target PER is met may be limited. STC on the other hand provides large coverage regardless of the channel condition but does not improve the peak data rate. Mobile WiMAX supports adaptive switching between multiple MIMO modes to maximize spectral efficiency without compromising on the coverage area.

2.4 MAC Layer Description

Mobile WiMAX supports the delivery of broadband services, including voice, data, and video. The MAC layer can support bursty data traffic with high peak rate demand while

simultaneously supporting streaming video and latency-sensitive voice traffic over the same channel. The resource allocated to one terminal by the MAC scheduler can vary from a single time slot to the entire frame, thus providing a very large dynamic range of throughput to a specific user terminal at any given time. Furthermore, since the resource allocation information is conveyed in the MAP messages at the beginning of each frame, the scheduler can effectively change the resource allocation on a frame-by-frame basis to adapt to the bursty nature of the traffic.

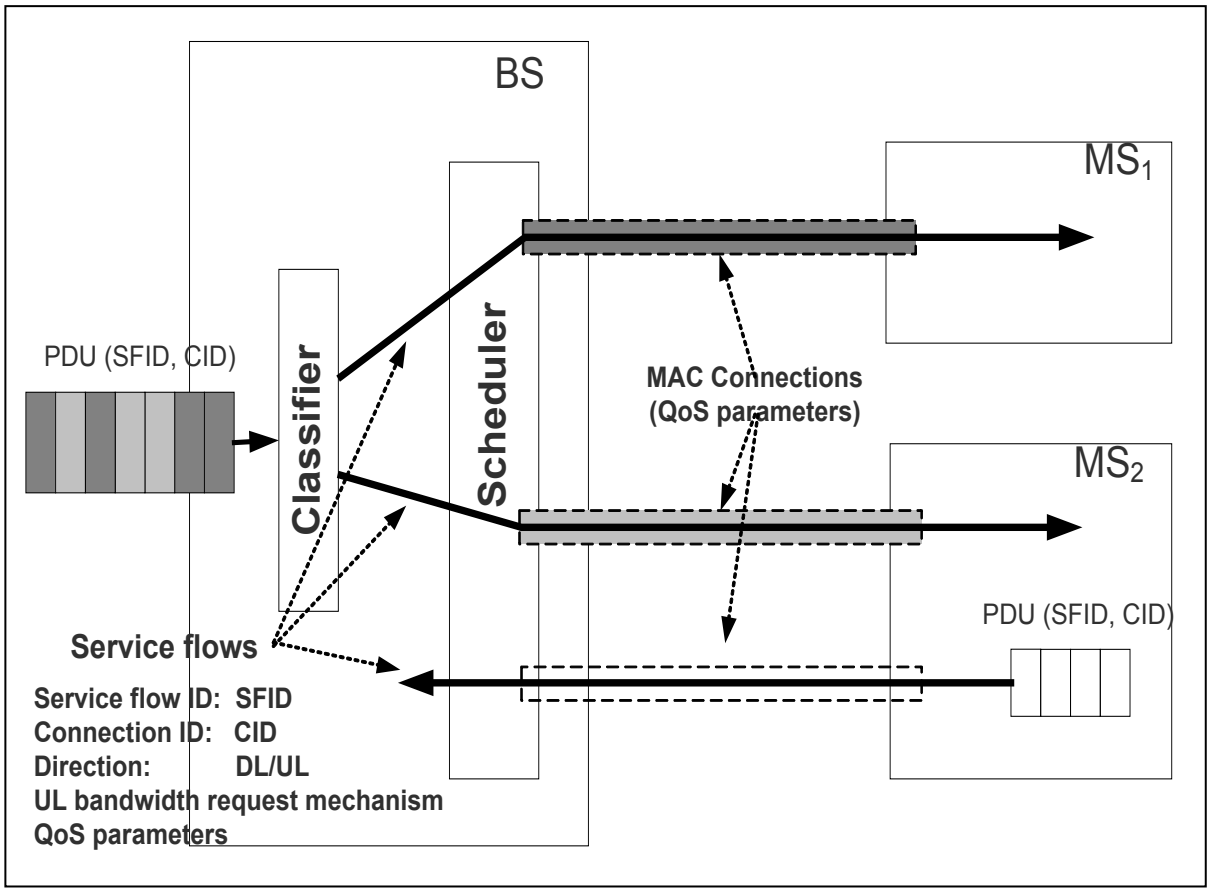

Figure 2-11 Mobile WiMAX QoS Support

2.4.1 Quality of Service (QoS) Support

With fast air link, symmetric downlink/uplink capacity, fine resource granularity and a flexible resource allocation mechanism, Mobile WiMAX can meet QoS requirements for a wide range of data services and applications.

In the Mobile WiMAX MAC layer, QoS is provided via service flows as illustrated in Figure

2-11. A service flow is a unidirectional flow of packets provided with a particular set of QoS parameters. Before providing a certain type of data service, the BS and MS first establish a unidirectional logical link between the peer MACs, called a connection. The outbound MAC then associates packets traversing the MAC interface into a service flow to be delivered over the connection. The QoS parameters associated with the service flow define the transmission ordering and scheduling on the air interface. The connection-oriented MAC can therefore provide accurate QoS control over the air interface. Since the air interface is usually the bottleneck, the connection-oriented MAC can effectively enable end-to-end QoS control. The service flow parameters can be dynamically managed through MAC messages to accommodate the dynamic service demand. The service flow based QoS mechanism applies to both DL and UL to provide improved QoS in both directions. Mobile WiMAX supports a wide range of data services and applications with varied QoS requirements. These are summarized in Table 2-6.

Table 2-6 Mobile WiMAX Applications and Quality of Service

QoS Category	Applications	QoS Specifications
UGS: Unsolicited Grant Service	VoIP	Maximum Sustained Rate Maximum Latency Tolerance Jitter Tolerance
rtPS: Real-Time Packet Service	Streaming Audio or Video	Minimum Reserved Rate Maximum Sustained Rate Maximum Latency Tolerance Traffic Priority
ErtPS: Extended Real-Time Packet Service	Voice with Activity Detection (VoIP)	Minimum Reserved Rate Maximum Sustained Rate Maximum Latency Tolerance Jitter Tolerance Traffic Priority
nrtPS: Non-Real-Time Packet Service	File Transfer Protocol (FTP)	Minimum Reserved Rate Maximum Sustained Rate Traffic Priority
BE: Best-Effort Service	Data Transfer, Web Browsing, etc.	Maximum Sustained Rate Traffic Priority

2.4.2 MAC Scheduling Service

The Mobile WiMAX MAC scheduling service is designed to efficiently deliver time-sensitive broadband data services including voice, data, and video over time-varying broadband wireless channel. The MAC scheduling service has the following properties that enable this real-time

broadband data service:

- Fast Data Scheduler: The MAC scheduler must efficiently allocate available resources in response to bursty data traffic and time-varying channel conditions. The scheduler is located at each BS to enable rapid response to traffic requirements and channel conditions. The data packets are associated to service flows with well defined QoS parameters in the MAC layer so that the scheduler can correctly determine the packet transmission ordering over the air interface. The CQICH channel provides fast channel information feedback to enable the scheduler to choose the appropriate coding and modulation for each allocation. The adaptive modulation/coding combined with HARQ provide robust transmission over the time-varying channel.
- Scheduling for both DL and UL: The scheduling service is provided for both DL and UL traffic. In order for the MAC scheduler to make an efficient resource allocation and provide the desired QoS in the UL, the UL must feedback accurate and timely information as to the traffic conditions and QoS requirements. Multiple uplink bandwidth request mechanisms (such as bandwidth request through ranging channel, piggyback request, and polling) are specified. The UL service flow defines the feedback mechanism for each uplink connection to ensure predictable UL scheduler behavior. Furthermore, with orthogonal UL subchannels, there is no intra-cell interference. UL scheduling can allocate resource more efficiently and better enforce QoS.
- Dynamic Resource Allocation: The MAC supports frequency-time resource allocation in both DL and UL on a per-frame basis. The resource allocation is delivered in MAP messages at the beginning of each frame. Therefore, the resource allocation can be changed on frame-by-frame in response to traffic and channel conditions. Additionally, the amount of resource in each allocation can range from one slot to the entire frame. The fast and fine granular resource allocation allows superior QoS for data traffic.
- UL and DL QoS: The MAC scheduler handles data transport on a connection-by-connection basis. Each connection is associated with a single data service with a set of QoS parameters that quantify the aspects of its behavior. With the ability to dynamically allocate resources in both DL and UL, the scheduler can provide QoS for both DL and UL traffic.
- Frequency Selective Scheduling: The scheduler can operate on different types of subchannels. For frequency-diverse subchannels such as PUSC permutation, where sub-carriers in the subchannels are pseudo-randomly distributed across the bandwidth, subchannels are of similar quality. Frequency-diversity scheduling can support a QoS with fine granularity and flexible time-frequency resource scheduling. With contiguous permutation such as AMC permutation, the subchannels may experience different

attenuation. The frequency-selective scheduling can allocate mobile users to their corresponding strongest subchannel. The frequency-selective scheduling can enhance system capacity with a moderate increase in CQI overhead in the UL.

- Admission Control: Admission Control admits service flows based on resource availability. That is, a service flow is either admitted or rejected during service flow creation transaction. Admission Control is implemented on the various network elements: Server, BS and MS.
- Policing: A service flow is prohibited from injecting data traffic that exceeds its Maximum Sustained Traffic Rate. Policing enforces this restriction.

2.4.3 Power control and boosting

Mobile WiMAX defines two modes of power control.

- Closed Loop Power Control, in which the BSs regularly adjusts the transmission level of each terminals based on the measurements done on received data from this terminal.
- Open Loop Power Control, in which the terminal adjusts its transmission level based on the signal strength measured on the received preamble from the serving BS. The serving BS is furthermore allowed to correct this transmission level, based on received signal strength. This correction is normally performed at very low frequency rate, enough to meet the requirement of the BS.

Furthermore, power boosting on data is a mechanism that can be used by the BS in order to extend its coverage. It is particularly convenient in an OFDMA scheme, where some subchannels can be boosted and some others attenuated, on the same OFDM symbol(s). The BS is hence able to use such boosting for further increasing the granularity of its link adaptation and the network load balancing.

2.4.4 Mobility Management

Battery life and handover are two critical issues for mobile applications. Mobile WiMAX supports Sleep Mode and Idle Mode to enable power-efficient MS operation. Mobile WiMAX also supports seamless handover to enable the MS to switch from one BS to another at vehicular speeds without interrupting the connection.

2.4.5 Power Management

Mobile WiMAX supports two modes for power efficient operation – Sleep Mode and Idle Mode. Sleep Mode is a state in which the MS conducts pre-negotiated periods of absence from the Serving BS air interface. These periods are characterized by the unavailability of the MS, as observed from the Serving BS, to DL or UL traffic. Sleep Mode is intended to minimize MS power usage and minimize the usage of the Serving BS air interface resources. The Sleep Mode also provides flexibility for the MS to scan other BSs to collect information to assist handover during the Sleep Mode.

Idle Mode provides a mechanism for the MS to become periodically available for DL broadcast traffic messaging without registration at a specific BS as the MS traverses an air link environment populated by multiple BSs. Idle Mode benefits the MS by removing the requirement for handover and other normal operations and benefits the network and BS by eliminating air interface and network handover traffic from essentially inactive MSs while still providing a simple and timely method (paging) for alerting the MS about pending DL traffic.

2.4.6 Handover

There are three handover methods supported within the IEEE 802.16 standard – Hard Handover, Fast BS Switching, and Macro Diversity Handover. Of these, the HHO is mandatory.

WiMAX Forum Mobile System Profile specifies a set of techniques for optimizing handover within the framework of the IEEE 802.16. These improvements have been developed with the goal of keeping Layer 2 handover delays to less than 50 milliseconds.

When FBSS (Fast Base Station Switching) is supported, the MS and BS maintain a list of BSs that are involved in FBSS with the MS. This set is called an Active Set. In FBSS, the MS continuously monitors the BSs in the Active Set. Among the BSs in the Active Set, an Anchor BS is defined. When operating in FBSS, the MS communicates only with the Anchor BS for uplink and downlink messages, including management and traffic connections. Transition from one Anchor BS to another (i.e. BS switching) is performed without invocation of explicit HO signaling messages. Anchor update procedures are enabled by communicating signal strength of the serving BS via the CQICH. A FBSS handover begins with a decision by an MS to receive or transmit data from the Anchor BS that may change within the active set. The MS scans the neighbor BSs and selects those that are suitable to be included in the active set. The MS reports the selected BSs and the active set update procedure is performed by the BS and MS. The MS continuously monitors the signal strength of the BSs that are in the active set and selects one BS from the set to be the Anchor BS. The MS reports the selected Anchor BS on CQICH or MS

initiated HO request message. An important requirement of FBSS is that the data is simultaneously transmitted to all members of an active set of BSs that are able to serve the MS.

2.4.7 Security

Mobile WiMAX supports mutual device/user authentication, flexible key management protocol, strong traffic encryption, control and management plane message protection, and security protocol optimizations for fast handovers.

The usage aspects of the security features are:

- Key Management Protocol: Privacy and Key Management Protocol Version 2 is the basis of Mobile WiMAX security as defined in the IEEE 802.16. This protocol manages the MAC security using PKM (Public Key Management)-REQ/RSP (Request/Response) messages. PKM EAP (Extensible Authentication Protocol) authentication, Traffic Encryption Control, Handover Key Exchange, and Multicast/Broadcast security messages all are based on this protocol.
- Device/User Authentication: Mobile WiMAX supports Device and User Authentication using the IETF EAP protocol, providing support for credentials that are based on a SIM, USIM, Digital Certificate, or User Name/Password. Corresponding EAP-SIM, EAP-AKA (Extensible Authentication Protocol-Authentication and Key Agreement), EAP-TLS (Extensible Authentication Protocol-Transport Layer Security), or EAP-MSCHAPv2 (Extensible Authentication Protocol-Microsoft Challenge Handshake Authentication Protocol Version 2) authentication methods are supported through the EAP protocol. Key deriving methods are the only EAP methods supported.
- Traffic Encryption: AES-CCM (Advanced Encryption Standard-Counter with Cipher-block chaining Message authentication code) is the cipher used for protecting all the user data over the Mobile WiMAX MAC interface. The keys used for driving the cipher are generated from the EAP authentication. A Traffic Encryption state machine with a periodic key refresh mechanism enables sustained transition of keys to further improve protection.
- Control Message Protection: Control data is protected using AES based CMAC (block Cipher-based Message Authentication Code) or MD5-based HMAC schemes.
- Fast Handover Support: A 3-way handshake scheme is supported by Mobile WiMAX to optimize the re-authentication mechanisms for supporting fast handovers. This mechanism is also useful to prevent man-in-the-middle-attacks.

2.5 Enhancements in the WiMAX Forum System Profile Release 1.5

- FDD mode of operation: The WiMAX deployment in paired spectrum by extending the TDD based system profile is enabled.
- Advanced services: Location based service and improved multicast/broadcast services are added.
- MAC layer efficiency: MAP overhead is lowered especially for VoIP traffic and reduction of latencies
- Closed-loop MIMO: Closed-loop MIMO is included to improve coverage and capacity.

2.6 Low Power Repeater

2.6.1 Outline

The Low Power Repeaters for Mobile WiMAX are operated in the frequency band of 2.5GHz which are assigned for BWA system in Regenerative and Non-regenerative relay manner. The requirements are compliant to the paragraphs 3.3, Regulation Article 49.28 of the ORE and other related Regulation Articles.

2.6.2 Configuration

The Mobile WiMAX repeater consists of Toward Base Station Node and Toward Mobile Station Node and antennas in both uplink and downlink directions. The scope of this standard is shown in Figure 2-12. This standard specifies the minimum radio-frequency performance requirements of the Mobile WiMAX repeater to be deployed under the blanket license in Japan.

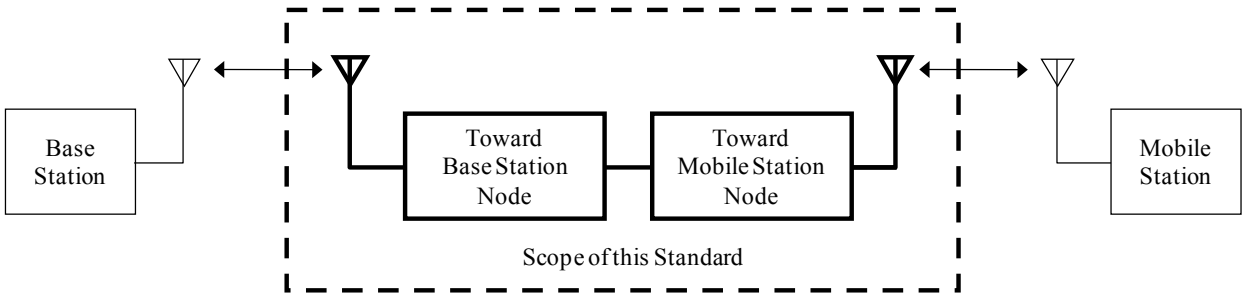

Figure 2-12 Repeater Configuration

2.7 Advanced Air Interface in the WiMAX Forum System Profile Release 2.0

An overview of the enhancements incorporated in the WiMAX Release 2.0 based on IEEE802.16m standard is described as follows;

- Increased Spectral Efficiency: The following enhancements included in IEEE802.16m will improve spectral efficiency for data services, as shown table
  (1) Extended and improved MIMO modes with emphasis on multi-user MIMO(MU-MIMO) on both DL and UL to enable support for up to 8 data streams in the DL and up to 4 data streams in the UL
  (2) Improved open-loop power and closed-loop control
  (3) Advanced interference mitigation techniques including fractional frequency reuse and inter-base station coordination
  (4) Enhanced control channel design on both DL and UL

Table 2-7 Spectral Efficiency Performance for IEEE802.16m

Parameter	Antenna Configuration	Performance
Peak DL Spectral Efficiency	(2x2)MIMO (4x4)MIMO	8.5 bps/Hz 17.0 bps/Hz
Average DL Spectral Efficiency	(4x2)MIMO	3.2 bps/Hz 0.32 bps/Hz/User
DL Cell-Edge User Throughput	(4x2)MIMO	0.09 bps/Hz
Peak UL Spectral Efficiency	(1x2)SIMO (2x4)MIMO	4.6 bps/Hz 9.3 bps/Hz
Average UL Spectral Efficiency	(2x4)MIMO	2.6 bps/Hz 0.26 bps/Hz
UL Cell-Edge User Throughput	(2x4)MIMO	0.11 bps/Hz

- Increased Data Capacity: The spectral efficiency enhancements of WiMAX Release2.0 based on IEEE802.16m, lead directly to increased channel data capacity and increased peak data rates. And also, the IEEE802.16m amendment supports channel aggregation of contiguous or non-contiguous channels to provide an effective bandwidth up to 100MHz.
- Lower Latency: Latency improvements with IEEE802.16m are achieved with the use of a new sub-frame based frame structure rather than a fixed 5ms frame as used with WiMAX Release 1.0. This enables faster air-link transmissions and retransmissions resulting in shorter user plan and control plan latencies.
- Interworking with other Wireless Networks: To facilitate global roaming and internetwork connectivity, WiMAX Release 2.0 based on IEEE802.16m ensures backwards compatibility with WiMAX Release 1.0 based on IEEE802.16-2009 and improves coexistence and enhances interworking with other Radio Access Technologies (RAT).

- Power Conservation: To improve battery life in mobile stations, IEEE802.16m provides enhancements in Sleep Mode and Idle Mode operation for the reduction in power consumption in IEEE802.16m-based mobile stations.

2.8 Additional Elements in the WiMAX Forum System Profile Release 2.1

For flexibility to manage an ever-increasing demand for broadband data, the WiMAX Forum has embraced a network evolution path to accommodate harmonization and coexistence across multiple broadband wireless access technologies within a WiMAX Advanced network. In order to support additional broadband wireless access technologies and devices beyond WiMAX Release 1.0 and 2.0, Release 2.1 specifications have been defined. WiMAX Release 2.1 consists of 3 modes as follows;

- R1 mode (refers IEEE802.16e)
- R2 mode (refers IEEE802.16m)
- Additional elements (refers 3GPP LTE TDD)

2.9 Release 2.2 features

To prompt co-existent and smooth migration between WiMAX Release 1.0, 1.5, 2.0 and 2.1 AE, Release 2.2 supports features of load balancing and interworking between R1 mode / R2 mode and additional elements based on release 2.1. Both features are defined by network functions with existing release 2.1 AE air interface.

2.10 Carrier Aggregation

2.10.1 Outline

Carrier Aggregation (CA) is a throughput enhancement technique by increasing the bandwidth as shown in Figure 2-13. Table 2-8 shows maximum DL throughput of CA.

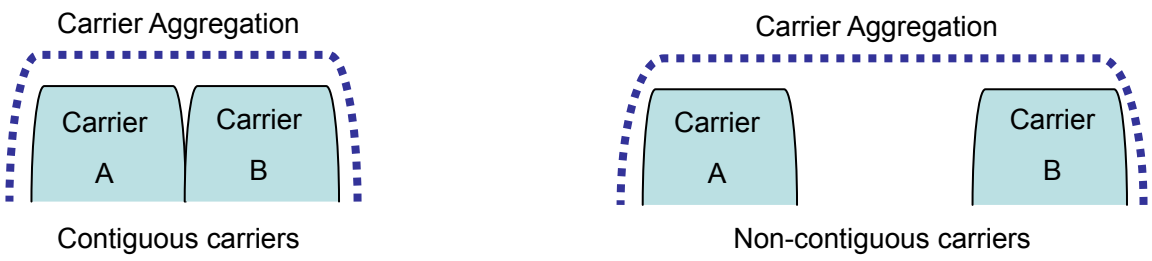

Figure 2-13 Carrier Aggregation

Table 2-8 Max. DL throughput of Carrier Aggregation (DL:UL=3:1)

		2x2MIMO	4x4MIMO	8x8MIMO
Carrier Aggregation (Bandwidth)	20MHz	112.5Mbps	225Mbps	450Mbps
	40MHz	225Mbps	450Mbps	900Mbps
	60MHz	337.5Mbps	675Mbps	1.35Gbps
	80MHz	450Mbps	900Mbps	1.8Gbps
	100MHz	562.5Mbps	1.125Gbps	2.25Gbps

2.10.2 CA types

CA has two scenarios as shown in Figure 2-14. In this standard, Scenario-2 will be described.

- Scenario-1
  Several downstream links (toward Mobile station) and upstream links (toward Base station) will be aggregated respectively.
- Scenario-2
  Several downstream links only will be aggregated.

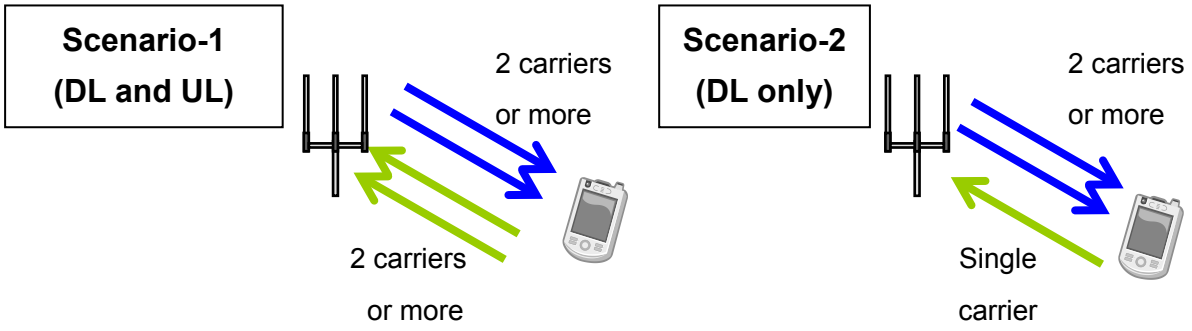

Figure 2-14 Usage scenarios

In the Scenario-2, the CA for downstream has two types as shown in Figure 2-15.

- Type-1
  Downstream links which are transmitted by several Base stations will be aggregated.
- Type-2
  Downstream links which are transmitted by single Base station will be aggregated.

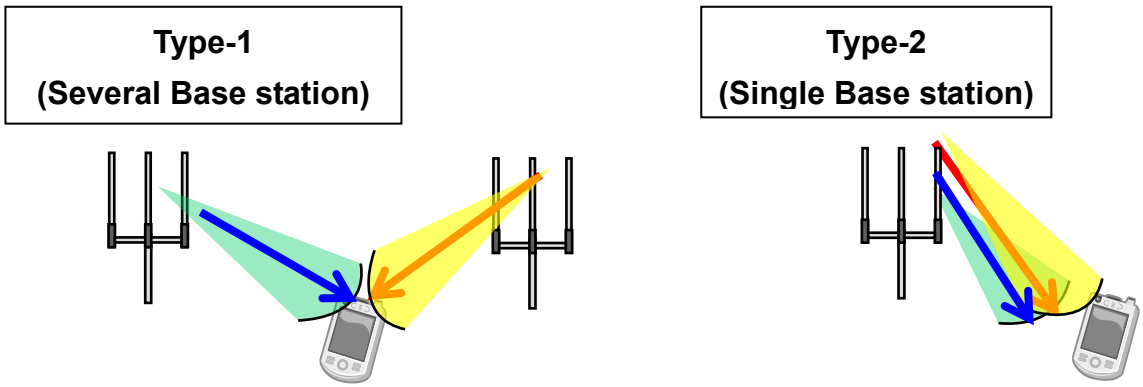

Figure 2-15 DL CA type

2.10.3 Transmitter requirements

In case of the Type-1 in Scenario-2, each Base station is required to same as the existing transmitter requirements of single Base station as shown in Figure 2-16.

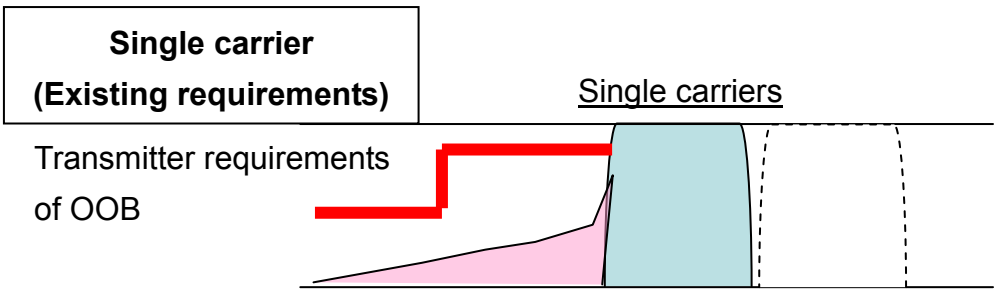

Figure 2-16 Transmitter requirements of OOB (1)

In case of the Type-2 in Scenario-2, single Base station which transmits several carriers is required to same as the existing transmitter requirements of single Base station as shown in Figure 2-17.

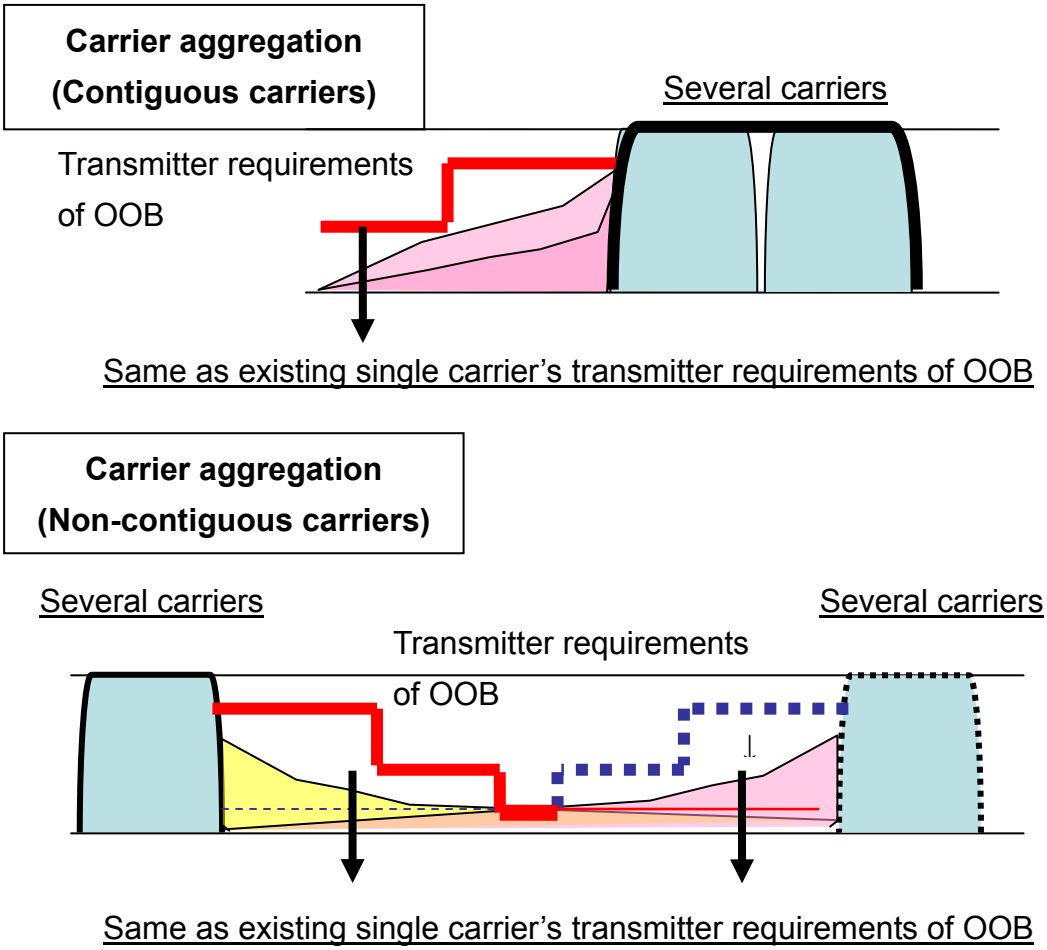

Figure 2-17 Transmitter requirements of OOB (2)

Chapter 3 Technical Requirements for WiMAX Systems

For the mobile communications system of a WiMAX system using the 2.5 GHz band, the following prerequisites shall be satisfied.

This chapter is translated into English from the original regulations contained in MIC Ordinances and related Notifications. The original in Japanese shall prevail if any ambiguity exists between the following requirements and the original in Japanese.

3.1 WiMAX Release 1.0, 1.5 and 2.0

3.1.1 Overview

It is assumed that the types of radio equipment are as follows:

<1> Mobile station

<2> Base station

<3> Repeater station (radio station that relays a signal when direct broadband mobile radio communications between a BS and a MS is not possible. The technical prerequisites for MSs shall apply to the upstream links, while those for the BS shall apply to the downstream links.)

3.1.2 General condition

(1) Communications system

Time Division Duplex (TDD) system

(2) Frequency (ORE, Article 49.28)

2545MHz – 2655MHz

(3) Multiplexing system

a Mobile station (upstream link)

Orthogonal Frequency Division Multiple Access (OFDMA) system

b Base station (downstream link)

Composite system using an Orthogonal Frequency Division Multiplexing (OFDM) system and a Time Division Multiplexing (TDM) system

(4) Modulation system (ORE, Article 49.28)

a Mobile station (upstream link)

QPSK, 16QAM or 64QAM

b Base station (downstream link)

BPSK, QPSK, 16QAM, or 64QAM

(5) Transmission synchronization

a Transmission burst repetition period

5 ms

b The transmission burst lengths for Base stations and Mobile stations in Table 3-1 (NT No.435, 2012)

Table 3-1 Maximum Permissible Transmission Burst Length

Maximum permissible transmission burst length [ms]	
Base station	Mobile station
3.65	1.35
3.55	1.45
3.45	1.55
3.35	1.65
3.25	1.75
3.15	1.85
3.05	1.95
2.95	2.05
2.85	2.15
2.75	2.25
2.5	2.5
1.95	3.0

Transmission Burst Lengths Tolerance

Base Station: +10μs or less, -90μs or over

Mobile Station: +10μs or less, -130μs or over

(6) Authentication, secrecy, and information security

The assignment of numbers specific to mobile station equipment so as to prevent unauthorized use, the application of authentication procedures, the use of secrecy functions for communications information, and other appropriate measures shall be implemented.

(7) Electromagnetic measures

Sufficient consideration shall be given to the mutual electromagnetic interference between Mobile stations and automotive electronic devices and medical electronic devices.

(8) Conformance to the radio radiation protection guidelines

Mobile stations, as well as devices using radio waves shall conform to Regulations for Enforcement of the Radio Law, Article 21.3 and Ordinance Regulating Radio Equipment, Article 14.2.

(9) Mobile station identification numbers

It is preferable for the procedures for assigning and subsequently sending identification numbers to Mobile stations be established with sufficient consideration given to the selection of networks by users, roaming, the assurance of communications security, the supervision of radio stations, and so on.

(10) Stopping emission of radio waves in the event of a fault in a Mobile station's transmission equipment

The functions below shall be executed at the same time, but independently of each other.

a Function whereby, if a Base station detects an error in a Mobile station, the Base station issues a request to that Mobile station to stop transmission.

b Function whereby, if a Mobile station itself detects an internal error, the Mobile station stops transmission upon the timeout of the error detection timer.

(11) Structure of transmitter

The main part of the transmit device (RF and Modem devices, except Antenna device) shall not be opened easily.

(12) Functions to ensure Model-1 Mobile station to be used only indoor coverage

As a general rule, input power source for Model-1 Mobile station shall be AC (alternate current). However, for Mobile station that require DC power source shall not start its operation before it receives operation starting signal from the parent device. (PC etc.)

(13) Definitions of the Models for Fixed Wireless Access system with antenna gain for Mobile station more than 2dBi.

In case of the Mobile station communicating with the Base station whose antenna gain is 17dBi or less;

- Model-1 Mobile station: Radio equipment with more than 2dBi and 10dBi or less antenna gain.
- Model-2 Mobile station: Radio equipment with more than 10dBi antenna gain.

In case of the Mobile station communicating with the Base station whose antenna gain is more than 17dBi.

Model-3 Mobile station: Radio equipment with more than 17dBi and 25dBi or less antenna gain.

(14) Restrictions on FWA system deployment (NT No.435, 2012)

a Restrictions for Base stations

Note 1: Following Base stations shall be limited for use in depopulated areas, mountain villages, isolated island areas or the areas authorized by Minister of Internal Affairs and Communications.

- The Base station that communicates with the Mobile station with 2dBi or greater antenna gain or repeater station.
- The Base station whose antenna gain is greater than 17dBi.

Note 2: The Base station whose antenna gain is greater than 17dBi shall only communicate with only a single radio station.

b Restrictions for Mobile stations

In case of Mobile station that communicates with the Base station with the antenna gain of 17dBi or less.

Note 1: Mobile station with the antenna gain of greater than 2dBi but not exceeding 10dBi shall be limited for use in a closed environment or equivalent place.

Note 2: Mobile station whose antenna gain is more than 2dBi shall be limited for use in depopulated areas, mountain villages, isolated islands or the areas authorized by Minister of Internal Affairs and Communications.

Note 3: Mobile station whose antenna gain is greater than 2dBi shall not start its operation under any Base station that is installed in places other than those specified in Note 2. At least one of the functions below should be implemented for this purpose.

- Function to enable the Mobile station with high gain antenna to determine, by using WiMAX broadcast message, whether the area is authorized or not.

- Function to enable terminal authentication on the network side to deny the network entry by the high gain antenna Mobile stations within the unauthorized area, if it is agreed upon between WiMAX operators.

- Other functions which have been agreed upon between the WiMAX operators.

In case of Mobile station that communicates with the Base station whose antenna gain is greater than 17dBi

Note 1: Mobile station shall be limited for use in depopulated areas, mountain villages, isolated islands or the areas authorized by Minister of Internal Affairs and Communications.

Note 2: Mobile station shall not start operation under any Base station that is installed in places other than those specified in Note 1. At least one of the functions below should be implemented for this purpose.

- Function to enable the Mobile station to determine, by using WiMAX broadcast message, whether the area is authorized or not.

- Function to enable terminal authentication on the network side to deny the network entry by the Mobile stations within the unauthorized area, if it is agreed upon between WiMAX operators.

- Other functions which have been agreed upon between the WiMAX operators.

3.1.2.1 Transmitter requirement

3.1.2.1.1 Frequency tolerance (ORE, Article 5,Table 1)

Mobile station: Within 2 x 10^{-6}

Base station: Within 2 x 10^{-6}

3.1.2.1.2 Occupied band width (ORE, Article 6,Table 2)

5 MHz system: 4.9 MHz or less

10 MHz system: 9.9 MHz or less

20 MHz system 19.9MHz or less

3.1.2.1.3 Output power (ORE, Article 49.28)

Mobile station: 400 mW or less

Base station: 40 W or less*

* In the case that the bandwidth is 5MHz or 10MHz, 20W or less.

3.1.2.1.4 Output power tolerance (ORE, Article 14)

Mobile station: ±50%

Base station: ±50%

3.1.2.1.5 Adjacent channel leakage power (NT No.435, 2012)

(1) Mobile station

(i) 5MHz system

Channel space: 5MHz

Occupied bandwidth: 4.8MHz

Permissible adjacent channel leakage power: -1dBm or less*

*In the case that the transmit frequency is 2545MHz or more and 2625MHz or less, 5dBm or less.

(ii) 10MHz system

Channel space: 10MHz

Occupied bandwidth : 9.5MHz
Permissible adjacent channel leakage power: -3dBm or less*
*In the case that the transmit frequency is 2545MHz or more and 2625MHz or less, 3dBm or less.

(iii) 20MHz system
Channel space: 20MHz
Occupied bandwidth : 19.5MHz
Permissible adjacent channel leakage power: -3dBm or less

(2) Base station

(i) 5MHz system
Channel space: 5MHz
Occupied bandwidth: 4.8MHz
Permissible adjacent channel leakage power: 7dBm or less

(ii) 10MHz system
Channel space: 10MHz
Occupied bandwidth: 9.5MHz
Permissible adjacent channel leakage power: 3dBm or less

(iii) 20MHz system
Channel space: 20MHz
Occupied bandwidth: 19.5MHz
Permissible adjacent channel leakage power: 6dBm or less

3.1.2.1.6 Spectrum mask (NT No.435, 2012)

(1) Mobile station

(i) 5MHz system

In the case that the transmit frequency is 2545MHz or more and 2625MHz or less,

offset frequency: Δf	Permissible level
7.5MHz or more and less than 8MHz,	less than -20-2.28x(Δf-7.5) dBm/MHz
8MHz or more and less than 17.5MHz,	less than -21-1.68x(Δf-8) dBm/MHz
17.5MHz or more and less than 22.5MHz,	less than -37dBm/MHz

In the case that the transmit frequency is 2625MHz or more and 2655MHz or less,

offset frequency: Δf	Permissible level
7.5MHz or more and less than 8MHz,	less than -23-2.28x(Δf-7.5) dBm/MHz
8MHz or more and less than 17.5MHz,	less than -24-1.68x(Δf-8) dBm/MHz

17.5MHz or more and less than 22.5MHz, less than -40dBm/MHz

(ii) 10MHz system

In the case that the transmit frequency is 2545MHz or more and 2625MHz or less,

offset frequency: Δf	Permissible level
15MHz or more and less than 20MHz,	less than -21-32/19x(Δf-10.5) dBm/MHz
20MHz or more and less than 25MHz,	less than -37dBm/MHz

In the case that the transmit frequency is 2625MHz or more and 2655MHz or less,

offset frequency: Δf	Permissible level
15MHz or more and less than 20MHz,	less than -24-32/19x(Δf-10.5) dBm/MHz
20MHz or more and less than 25MHz,	less than -40dBm/MHz

(iii) 20MHz system

offset frequency: Δf	Permissible level
30MHz or more and less than 35MHz,	less than -25dBm/MHz
35MHz or more and less than 50MHz,	less than -30dBm/MHz

(2) Base station

(i) 5MHz system

offset frequency: Δf	Permissible level
7.5MHz or more and less than 12.25MHz,	less than -15-1.4x(Δf-7.5) dBm/MHz
12.25MHz or more and less than 22.5MHz,	less than -22dBm/MHz

(ii) 10MHz system

offset frequency: Δf	Permissible level
15MHz or more and less than 25MHz,	less than -22dBm/MHz

(iii) 20MHz system

offset frequency: Δf	Permissible level
30MHz or more and less than 50MHz,	less than -22dBm/MHz

3.1.2.1.7 Spurious emission (NT No.435, 2012)

(1) Mobile station

Frequency band	Permissible Level

9kHz or more and less than 150kHz,	less than -16dBm/kHz* *In the case of the following condition, -13dBm/kHz
150kHz or more and less than 30MHz,	less than -16dBm/10kHz* *In the case of the following condition, -13dBm/10kHz
30MHz or more and less than 1000MHz,	less than -16dBm/100kHz* *In the case of the following condition, -13dBm/100kHz
1000MHz or more and less than 2505MHz,	less than -16dBm/MHz* *In the case of the following condition, -13dBm/MHz
2505MHz or more and less than 2530MHz,	less than -40dBm/MHz* *In the case of the following condition, -37dBm/MHz
2530MHz or more and less than 2535MHz,	less than 1.7f-4341dBm/MHz* *In the case of the following condition, 1.7f-4338dBm/MHz
2535MHz or more and less than 2630MHz,	less than -21dBm/MHz* *In the case of the following condition, -18dBm/MHz
2630MHz or more and less than 2630.5MHz,	less than -21dBm/MHz* *In the case of the following condition, -13-8/3.5x(f-2627)dBm/MHz
2630.5MHz or more and less than 2655MHz,	less than -21 dBm/MHz*
2655MHz or more,	less than -16dBm/MHz* *In the case of the following condition, -13dBm/MHz

Permissible level for 2535MHz or more and less than 2655MHz should be applied to the frequency range where a frequency offset from the center frequency of a carrier is equal to or more than 2.5 times of the system frequency bandwidth.

Condition

The transmit frequency and the bandwidth are as follows.

· Frequency 2545Hz or more and less than 2625Hz
· Bandwidth 5MHz and 10MHz

(2) Base station

Frequency band	Permissible Level
9kHz or more and less than 150kHz,	less than -13dBm/kHz
150kHz or more and less than 30MHz,	less than -13dBm/10kHz
30MHz or more and less than 1000MHz,	less than -13dBm/100kHz
1000MHz or more and less than 2505MHz,	less than -13dBm/MHz
2505MHz or more and less than 2535MHz,	less than -42dBm/MHz
2535MHz or more,	less than -13dBm/MHz

Permissible level for 2535MHz or more and less than 2655MHz should be applied to the frequency range where a frequency offset from the center frequency of a carrier is equal to or more than 2.5 times of the system frequency bandwidth.

3.1.2.1.8 Intermodulation (NT No.435, 2012)

(1) 5 MHz System

Intermodulation emission generated by mixing a desirable emission within regulated power and disturbing waves at ±5MHz offset and at ±10 MHz offset from the desired emission with powers of 30dB less than that of desirable emission should be less than permissible level of the spurious emission and adjacent channel leakage power.

(2) 10 MHz system

Intermodulation emission generated by mixing a desirable emission within regulated power and disturbing waves at ±10MHz offset and at ±20 MHz offset from the desired emission with powers of 30dB less than that of desirable emission should be less than permissible level of the spurious emission and adjacent channel leakage power.

(3) 20 MHz system

Intermodulation emission generated by mixing a desirable emission within regulated power and disturbing waves at ±20MHz offset and at ±40 MHz offset from the desired emission with powers of 30dB less than that of desirable emission should be less than permissible level of the spurious emission and adjacent channel leakage power.

3.1.2.1.9 Standby output power (ORE, Article 49.28)

Mobile station: -33dBm or less

Base station: -30dBm or less

3.1.2.1.10 Antenna gain (ORE, Article 49.28)

Mobile station: 5dBi or less*

Base station: 17dBi or less

*If an antenna gain of mobile station is over 2dBi, EIRP shall be 28dBm or less.

3.1.2.1.11 Cabinet radiation

Cabinet radiation in EIRP shall be 4nW/MHz or less or the value obtained by adding 0dBi to the permissible spurious emission* in the spurious region measured at the antenna input terminal.

(* Refer to subclause 3.1.2.1.7 for the spurious emission.)

3.1.2.2 Receiver requirement

3.1.2.2.1 Reception sensitivity

(1) Definition

The reception sensitivity shall be defined by the minimum receiver input level (dBm) which yields a bit error rate (BER) of $1x10^{-6}$ for the QPSK case under AWGN channel. This is the definition for the specified reception sensitivity as well.

(2) Specification

5MHz bandwidth system

Mobile station: -91.3dBm or less

Base station: -91.3dBm or less

10MHz bandwidth system

Mobile station: -88.3dBm or less

Base station: -88.3dBm or less

20MHz bandwidth system

Mobile station: -85.3dBm or less

Base station: -85.3dBm or less

3.1.2.2.2 Spurious response rejection ratio

(1) Definition

The spurious response rejection ratio shall be defined as the level ratio of the interfering signal to the desired signal, specified by the following statement:

The level of desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity*. The level of interfering signal shall be the one yielding a bit error rate of $1x10^{-6}$ on the desired signal for the QPSK case. The interfering signal shall not be modulated.

(* Refer to subclause 3.1.2.2.1 for the specified reception sensitivity.)

(2) Specification

Mobile station: The spurious response rejection ratio shall be 11dB or more.

Base station: The spurious response rejection ratio shall be 11dB or more.

3.1.2.2.3 Adjacent signal selectivity

(1) Definition

The adjacent signal selectivity shall be defined as the level ratio of the interfering signal to the desired signal, specified by the following statement:

The level of desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity*. The level of interfering signal shall be the one yielding a bit error rate of $1x10^{-6}$ on the desired signal for 16QAM. The interfering signal shall be 16QAM and tuned on the first adjacent channel.

(* Refer to Section 3.1.2.2.1 for the specified reception sensitivity)

(2) Specification

Mobile stations: The adjacent signal selectivity shall be 11dB or more.

Base station: The adjacent signal selectivity shall be 11dB or more.

3.1.2.2.4 Intermodulation performance

(1) Definition

The intermodulation performance shall be defined as the level of the interfering signal, specified by the following statement:

The level of desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity*. The level of each one of two interfering signals shall be the one yielding a bit error rate of $1x10^{-6}$ on the desired signal. The interfering signals shall be

tuned on the first and second adjacent channel.
(* Refer to Section 3.1.2.2.1 for the specified reception sensitivity)

(2) Specification
Mobile stations:
The non-modulated interfering signal on the first adjacent channel shall be -55dBm.
The modulated interfering signal on the second adjacent channel shall be -55dBm.

Base station:
The non-modulated interfering signal on the first adjacent channel shall be -45dBm.
The modulated interfering signal on the second adjacent channel shall be -45dBm.

3.1.2.2.5 Conducted Spurious (ORE, Article 24)

Less than 1GHz:	4nW or less
1GHz or more:	20nW or less

3.1.2.3 Transmitter requirement for FWA equipment

3.1.2.3.1 Frequency tolerance (ORE, Article 5,Table 1)

Land mobile station:	Within 2 x 10^{-6}
Base station:	Within 2 x 10^{-6}

3.1.2.3.2 Occupied band width (ORE, Article 6,Table 2)

5 MHz system:	4.9 MHz or less
10 MHz system:	9.9 MHz or less
20 MHz system:	19.9 MHz or less

3.1.2.3.3 Output power (ORE, Article 49.28)

Land mobile station

Model-1:	200mW or less
Model-2:	
Antenna gain	
20dBi or less:	200mW or less

More than 20dBi and 23dBi or less: 100mW or less
More than 23dBi and 25dBi or less: 63mW or less

Model-3 :
Antenna gain
23dBi or less: 200mW or less
More than 23dBi and 25dBi or less: 126mW or less

Base station
Antenna gain
17dBi or less: 40W or less*
* In the case that the bandwidth is 5MHz or 10MHz, 20W or less.

However that only for Model-3, output power is specified as follows.

More than 17dBi and 20dBi or less: 10W or less
More than 20dBi and 23dBi or less: 5W or less
More than 23dBi and 25dBi or less: 3.2W or less

3.1.2.3.4 Output power tolerance (ORE, Article 14)

Land mobile station: ±50%
Base station: ±50%

3.1.2.3.5 Adjacent channel leakage power (NT No.435, 2012)

(1) Mobile station
(i) 5MHz system
Channel space: 5MHz
Occupied bandwidth: 4.8MHz
Permissible adjacent channel leakage power: -1dBm or less*
* In the case that the transmit frequency is 2545MHz or more and 2625MHz or less, 5dBm or less.

(ii) 10MHz system
Channel space: 10MHz

Occupied bandwidth: 9.5MHz
Permissible adjacent channel leakage power: -3dBm or less*
* In the case that the transmit frequency is 2545MHz or more and 2625MHz or less, 3dBm or less.

(iii) 20MHz system
Channel space: 20MHz
Occupied bandwidth: 19.5MHz
Permissible adjacent channel leakage power: -3dBm or less

(2) Base station
(i) 5MHz system
Channel space: 5MHz
Occupied bandwidth: 4.8MHz
Permissible adjacent channel leakage power: 7dBm or less
(ii) 10MHz system
Channel space: 10MHz
Occupied bandwidth: 9.5MHz
Permissible adjacent channel leakage power: 3dBm or less
(iii) 20MHz system
Channel space: 20MHz
Occupied bandwidth: 19.5MHz
Permissible adjacent channel leakage power: 6dBm or less

3.1.2.3.6 Spectrum mask (NT No.435, 2012)

(1) Mobile station
(i) 5MHz system

In the case that the transmit frequency is 2545MHz or more and 2625MHz or less,

offset frequency : Δf	Permissible level
7.5MHz or more and less than 8MHz,	less than -20-2.28x(Δf-7.5) dBm/MHz
8MHz or more and less than 17.5MHz,	less than -21-1.68x(Δf-8) dBm/MHz
17.5MHz or more and less than 22.5MHz,	less than -37dBm/MHz

In the case that the transmit frequency is 2625MHz or more and 2655MHz or less,

offset frequency : Δf	Permissible level

7.5MHz or more and less than 8MHz,	less than -23-2.28x(Δf-7.5) dBm/MHz
8MHz or more and less than 17.5MHz,	less than -24-1.68x(Δf-8) dBm/MHz
17.5MHz or more and less than 22.5MHz,	less than -40dBm/MHz

(ii) 10MHz system

In the case that the transmit frequency is 2545MHz or more and 2625MHz or less,

offset frequency : Δf	Permissible level
15MHz or more and less than 20MHz,	less than -21-32/19x(Δf-10.5) dBm/MHz
20MHz or more and less than 25MHz,	less than -37dBm/MHz

In the case that the transmit frequency is 2625MHz or more and 2655MHz or less,

offset frequency : Δf	Permissible level
15MHz or more and less than 20MHz,	less than -24-32/19x(Δf-10.5) dBm/MHz
20MHz or more and less than 25MHz,	less than -40dBm/MHz

(iii) 20MHz system

offset frequency : Δf	Permissible level
30MHz or more and less than 35MHz,	less than -25dBm/MHz
35MHz or more and less than 50MHz,	less than -30dBm/MHz

(2) Base station

(i) 5MHz system

offset frequency : Δf	Permissible level
7.5MHz or more and less than 12.25MHz,	less than -15-1.4x(Δf-7.5) dBm/MHz
12.25MHz or more and less than 22.5MHz,	less than -22dBm/MHz

(ii) 10MHz system

offset frequency : Δf	Permissible level
15MHz or more and less than 25MHz,	less than -22dBm/MHz

(iii) 20MHz system

offset frequency : Δf	Permissible level
30MHz or more and less than 50MHz,	less than -22dBm/MHz

3.1.2.3.7 Spurious emission (NT No.435, 2012)

(1) Mobile terminal

Frequency band	Permissible Level
9kHz or more and less than 150kHz,	less than -16dBm/kHz* *In the case of the following condition, -13dBm/kHz
150kHz or more and less than 30MHz,	less than -16dBm/10kHz* *In the case of the following condition, -13dBm/10kHz
30MHz or more and less than 1000MHz,	less than -16dBm/100kHz* *In the case of the following condition, -13dBm/100kHz
1000MHz or more and less than 2505MHz,	less than -16dBm/MHz* *In the case of the following condition, -13dBm/MHz
2505MHz or more and less than 2535MHz,	
For model-1	less than -70dBm/MHz
For model-2	less than -68dBm/MHz
For model-3	less than -61dBm/MHz
2535MHz or more and less than 2630MHz,	less than -21dBm/MHz* *In the case of the following condition, -18dBm/MHz
2630MHz or more and less than 2630.5MHz,	less than -21dBm/MHz* *In the case of the following condition, -13-8/3.5x(f-2627)dBm/kHz
2630.5MHz or more and less than 2655MHz,	less than -21 dBm/MHz
2655MHz or more,	less than -16dBm/MHz* *In the case of the following condition, -13dBm/kHz

Permissible level for 2535MHz or more and less than 2655MHz should be applied to the frequency range where a frequency offset from the center frequency of a carrier is equal to or more than 2.5 times of the system frequency bandwidth.

Condition

The transmit frequency and the bandwidth are as follows.

· Frequency 2545Hz or more and less than 2625Hz
· Bandwidth 5MHz and 10MHz

(2) Base station

Frequency band	Permissible Level
9kHz or more and less than 150kHz,	less than -13dBm/kHz
150kHz or more and less than 30MHz,	less than -13dBm/10kHz
30MHz or more and less than 1000MHz,	less than -13dBm/100kHz
1000MHz or more and less than 2505MHz,	less than -13dBm/MHz
2505MHz or more and less than 2535MHz,	less than -42dBm/MHz
2535MHz or more,	less than -13dBm/MHz

Permissible level for 2535MHz or more and less than 2655MHz should be applied to the frequency range where a frequency offset from the center frequency of a carrier is equal to or more than 2.5 times of the system frequency bandwidth.

3.1.2.3.8 Intermodulation (NT No.435, 2012)

(1) 5 MHz System

Intermodulation emission generated by mixing a desirable emission within regulated power and disturbing waves at ±5MHz offset and at ±10 MHz offset from the desired emission with powers of 30dB less than that of desirable emission should be less than permissible level of the spurious emission and adjacent channel leakage power.

(2) 10 MHz system

Intermodulation emission generated by mixing a desirable emission within regulated power and disturbing waves at ±10MHz offset and at ±20 MHz offset from the desired emission with powers of 30dB less than that of desirable emission should be less than permissible level of the spurious emission and adjacent channel leakage power.

(3) 20 MHz system

Intermodulation emission generated by mixing a desirable emission within regulated power and disturbing waves at ±20MHz offset and at ±40 MHz offset from the desired emission with powers of 30dB less than that of desirable emission should be less than permissible level of the spurious emission and adjacent channel leakage power.

3.1.2.3.9 Standby output power (ORE, Article 49.28)

Mobile station: -30dBm or less

Base station: -30dBm or less

3.1.2.3.10 Antenna gain (ORE, Article 49.28)

Mobile station:

Model-1: 10dBi or less

Model-2: 25dBi or less

Model-3: 25dBi or less

Base station:

17dBi or less. However that only for Model-3, it shall 25dBi or less.

3.1.2.3.11 Cabinet radiation

During idle mode cabinet radiation shall not greater than following level.

Spectrum band	Permissible level
1000MHz or less:	-54dBm/MHz
More than 1000MHz and less than 2505MHz:	-47dBm/MHz
2505MHz or more and 2535MHz or less:	
Model-1	-62dBm/MHz
Model-2	-50dBm/MHz
Model-3	-47dBm/MHz

3.1.2.4 Receiver requirement for FWA equipment

3.1.2.4.1 Reception sensitivity

(1) Definition

The reception sensitivity shall be defined by the minimum receiver input level (dBm) which yields a bit error rate (BER) of $1x10^{-6}$ for QPSK under AWGN channel.

This is the definition for the specified reception sensitivity as well.

(2) Specification

5MHz bandwidth system

Mobile station : -91.3dBm or less

Base station: -91.3dBm or less

10MHz bandwidth system

Mobile station：-88.3dBm or less

Base station：　-88.3dBm or less

20MHz bandwidth system

Mobile station：-85.3dBm or less

Base station：　-85.3dBm or less

3.1.2.4.2 Conducted Spurious (ORE, Article 24)

During reception mode, output power level at the antenna port shall not greater than following level.

Mobile station

Spectrum band	Permissible level
9kHz or more and less than 150kHz	-54dBm/kHz
150kHz or more and less than 30MHz	-54dBm/10kHz
30MHz or more and less than 1000MHz	-54dBm/100kHz
1000MHz or more and less than 2505MHz	-47dBm/MHz

2505MHz or more and 2535MHz or less;	
Model-1	-70dBm/MHz
Model-2	-68dBm/MHz
Model-3	-61dBm/MHz
More than 2535MHz	-47dBm/MHz

Base station

(i) Antenna gain is 17dBi or less

Spectrum band	Permissible level
1GHz or less	4nW
More than 1GHz	20nW

(ii) Antenna gain is more than 17dBi

Spectrum band	Permissible level
9kHz or more and less than 150kHz	-54dBm/kHz
150kHz or more and less than 30MHz	-54dBm/10kHz
30MHz or more and less than 1000MHz	-54dBm/100kHz
1000MHz or more and less than 2505MHz	-47dBm/MHz
2505MHz or more and 2535MHz or less	-61dBm/MHz
More than 2535MHz	-47dBm/MHz

3.1.3 Low Power Repeater

This section applies only to the Mobile WiMAX repeaters, which complies with the requirements for the blanket license in Japan. The Mobile WiMAX repeaters are utilized to improve the radio access environments.
Unless otherwise stated, all requirements in this standard apply to both the uplink and downlink directions.

3.1.3.1 General Condition

(1) Frequency and channel spacing

The operating frequency bands shall be 2.5GHz bands assigned for the BWA system.
The channel spacing shall be 5MHz, 10MHz or 20MHz.

(2) Type of Repeating

The repeater shall be of Non-regenerative and Generative repeating type.

Table 3-2 Type of Repeating

Type of Repeating	Non-regenerative repeating		Generative repeating	
Relay frequency	Same frequency	Different frequency	Same frequency	Different frequency
Number of channels	3 channels (max)		3 channels (max)	
Configuration	Integrated or separated type		Integrated or separated type	

(3) Communications system

Time Division Duplex (TDD) system

(4) Multiplexing system

a. Toward Base station (upstream link)

Orthogonal Frequency Division Multiple Access (OFDMA) system

b. Toward Mobile station (downstream link)

Composite system using an Orthogonal Frequency Division Multiplexing (OFDM) system and a Time Division Multiplexing (TDM) system

(5) Modulation system (ORE, Article 49.28)

a. Toward Base station (upstream link)

QPSK, 16QAM or 64QAM

b. Toward Mobile station (downstream link)

BPSK, QPSK, 16QAM or 64QAM

(6) Transmission synchronization

a. Transmission burst repetition period

5 ms±10μs or less

b. The transmission burst lengths for Mobile stations and Base stations in Table 3-3 (NT No.435, 2012)

Table 3-3 Maximum Permissible Transmission Burst Length

Maximum permissible transmission burst length [ms]	
Toward Mobile station	Toward Base station
3.65	1.35
3.55	1.45
3.45	1.55
3.35	1.65
3.25	1.75
3.15	1.85
3.05	1.95
2.95	2.05
2.85	2.15
2.75	2.25
2.5	2.5
1.95	3.05

3.1.3.1.1 System condition

(1) Maximum number of repeaters (in case of Non-regenerative repeating type)

Maximum number of repeaters per Base station shall be 100.

(2) Compliance with the radio protection guidelines

The repeater shall conform to the Regulations for Enforcement of the Radio Law, Article 21.3 and Ordinance Regulating Radio Equipment, Article 14.2.

3.1.3.2 Transmitter Requirement for Low Power Repeater

3.1.3.2.1 Frequency tolerance (ORE, Article 5, Table1)

Downstream link (Toward Mobile station): Within $2x10^{-6}$

Upstream link (Toward Base station): Within $2x10^{-6}$

3.1.3.2.2 Occupied band width (ORE, Article 6,Table 2)

5 MHz system: 4.9 MHz or less

10 MHz system: 9.9 MHz or less

20 MHz system: 19.9 MHz or less

3.1.3.2.3 Output power (ORE, Article 49.28)

(1) Non-regenerative repeating

Downstream link (Toward Mobile station): 200mW or less*

Upstream link (Toward Base station): 400mW or less*

*Total power is the aggregate of the output power of the downstream and upstream links. And the maximum number of the transmission channel is 3,when operated simultaneously.

(2) Regenerative repeating

Downstream link (Toward Mobile station): 200mW or less*

Upstream link (Toward Base station): 400mW or less*

*Total power is the aggregate of the output power of the downstream and upstream links. And the maximum number of transmission channel is 3, when operated simultaneously.

3.1.3.2.4 Output power tolerance (ORE, Article 14)

Downstream link (Toward Mobile station): ±50%

Upstream link (Toward Base station): ±50%

3.1.3.2.5 Adjacent channel leakage power (NT No.435, 2012)

(1) Downstream link (Toward Mobile station)

(i) 5MHz system

Channel space: 5MHz

Occupied bandwidth: 4.8MHz

Permissible adjacent channel leakage power: -1dBm or less*

*In the case that the transmit frequency is 2545MHz or more and 2625MHz or less, 2dBm or less.

(ii) 10MHz system

Channel space: 10MHz

Occupied bandwidth : 9.5MHz

Permissible adjacent channel leakage power: -3dBm or less*

*In the case that the transmit frequency is 2545MHz or more and 2625MHz or less, 0dBm or less.

(iii) 20MHz system

Channel space: 20MHz

Occupied bandwidth : 19.5MHz

Permissible adjacent channel leakage power: -3dBm or less

(2) Upstream link (Toward Base station)

(i) 5MHz system

Channel space: 5MHz

Occupied bandwidth: 4.8MHz

Permissible adjacent channel leakage power: -1dBm or less*

*In the case that the transmit frequency is 2545MHz or more and 2625MHz or less, 2dBm or less.

(ii) 10MHz system

Channel space: 10MHz

Occupied bandwidth : 9.5MHz

Permissible adjacent channel leakage power: -3dBm or less*

*In the case that the transmit frequency is 2545MHz or more and 2625MHz or less, 0dBm or less.

(iii) 20MHz system

Channel space: 20MHz

Occupied bandwidth : 19.5MHz

Permissible adjacent channel leakage power: -3dBm or less

3.1.3.2.6 Spectrum mask (NT No.435, 2012)

(1) Downstream link (Toward Mobile station)

(i) 5MHz system

In the case that the transmit frequency is 2545MHz or more and 2625MHz or less,

offset frequency: Δf	Permissible level
7.5MHz or more and less than 8MHz,	less than -20-2.28x(Δf-7.5) dBm/MHz
8MHz or more and less than 17.5MHz,	less than -21-1.68x(Δf-8) dBm/MHz
17.5MHz or more and less than 22.5MHz,	less than -37dBm/MHz

In the case that the transmit frequency is 2625MHz or more and 2655MHz or less,

offset frequency: Δf	Permissible level
7.5MHz or more and less than 8MHz,	less than -23-2.28x(Δf-7.5) dBm/MHz
8MHz or more and less than 17.5MHz,	less than -24-1.68x(Δf-8) dBm/MHz
17.5MHz or more and less than 22.5MHz,	less than -40dBm/MHz

(ii) 10MHz system

In the case that the transmit frequency is 2545MHz or more and 2625MHz or less,

offset frequency: Δf	Permissible level
15MHz or more and less than 20MHz,	less than -21-32/19x(Δf-10.5) dBm/MHz
20MHz or more and less than 25MHz,	less than -37dBm/MHz

In the case that the transmit frequency is 2625MHz or more and 2655MHz or less,

offset frequency: Δf	Permissible level
15MHz or more and less than 20MHz,	less than -24-32/19x(Δf-10.5) dBm/MHz
20MHz or more and less than 25MHz,	less than -40dBm/MHz

(iii) 20MHz system

offset frequency: Δf	Permissible level
30MHz or more and less than 35MHz,	less than -25dBm/MHz
35MHz or more and less than 50MHz,	less than -30dBm/MHz

(2) Upstream link (Toward Base station)

(i) 5MHz system

In the case that the transmit frequency is 2545MHz or more and 2625MHz or less,

offset frequency: Δf	Permissible level
7.5MHz or more and less than 8MHz,	less than -20-2.28x(Δf-7.5) dBm/MHz
8MHz or more and less than 17.5MHz,	less than -21-1.68x(Δf-8) dBm/MHz
17.5MHz or more and less than 22.5MHz,	less than -37dBm/MHz

In the case that the transmit frequency is 2625MHz or more and 2655MHz or less,

offset frequency: Δf	Permissible level
7.5MHz or more and less than 8MHz,	less than -23-2.28x(Δf-7.5) dBm/MHz
8MHz or more and less than 17.5MHz,	less than -24-1.68x(Δf-8) dBm/MHz
17.5MHz or more and less than 22.5MHz,	less than -40dBm/MHz

(ii) 10MHz system

In the case that the transmit frequency is 2545MHz or more and 2625MHz or less,

offset frequency: Δf	Permissible level
15MHz or more and less than 20MHz,	less than -21-32/19x(Δf-10.5) dBm/MHz

20MHz or more and less than 25MHz,	less than -37dBm/MHz

In the case that the transmit frequency is 2625MHz or more and 2655MHz or less,

offset frequency: Δf	Permissible level
15MHz or more and less than 20MHz,	less than -24-32/19x(Δf-10.5) dBm/MHz
20MHz or more and less than 25MHz,	less than -40dBm/MHz

(iii) 20MHz system

offset frequency: Δf	Permissible level
30MHz or more and less than 35MHz,	less than -25dBm/MHz
35MHz or more and less than 50MHz,	less than -30dBm/MHz

3.1.3.2.7 Spurious emission (NT No.435, 2012)

(1) Downstream link (Toward Mobile station)

Frequency band	Permissible Level
9kHz or more and less than 150kHz,	less than -16dBm/kHz* *In the case of the following condition, -13dBm/kHz
150kHz or more and less than 30MHz,	less than -16dBm/10kHz* *In the case of the following condition, -13dBm/10kHz
30MHz or more and less than 1000MHz,	less than -16dBm/100kHz* *In the case of the following condition, -13dBm/100kHz
1000MHz or more and less than 2505MHz,	less than -16dBm/MHz* *In the case of the following condition, -13dBm/MHz
2505MHz or more and less than 2530MHz,	less than -40dBm/MHz* *In the case of the following condition, -37dBm/MHz
2530MHz or more and less than 2535MHz,	less than 1.7f-4341dBm/MHz* *In the case of the following condition, 1.7f-4338dBm/MHz
2535MHz or more and less than 2630MHz,	less than -21dBm/MHz* *In the case of the following condition,

	-18dBm/MHz
2630MHz or more and less than 2630.5MHz,	less than -21dBm/MHz*
	*In the case of the following condition, -13-8/3.5x(f-2627)dBm/MHz
2630.5MHz or more and less than 2655MHz,	less than -21 dBm/MHz
2655MHz or more,	less than -16dBm/MHz*
	*In the case of the following condition, -13dBm/MHz

Permissible level for 2535MHz or more and less than 2655MHz should be applied to the frequency range where a frequency offset from the center frequency of a carrier is equal to or more than 2.5 times of the system frequency bandwidth.

Condition

The transmit frequency and the bandwidth are as follows.

- Frequency 2545Hz or more and less than 2625Hz
- Bandwidth 5MHz and 10MHz

(2) Upstream link (Toward Base station)

Frequency band	Permissible Level
9kHz or more and less than 150kHz,	less than -16dBm/kHz*
	*In the case of the following condition, -13dBm/kHz
150kHz or more and less than 30MHz,	less than -16dBm/10kHz*
	*In the case of the following condition, -13dBm/10kHz
30MHz or more and less than 1000MHz,	less than -16dBm/100kHz*
	*In the case of the following condition, -13dBm/100kHz
1000MHz or more and less than 2505MHz,	less than -16dBm/MHz*
	*In the case of the following condition, -13dBm/MHz
2505MHz or more and less than 2530MHz,	less than -40dBm/MHz*
	*In the case of the following condition, -37dBm/MHz

2530MHz or more and less than 2535MHz,	less than 1.7f-4341dBm/MHz* *In the case of the following condition, 1.7f-4338dBm/MHz
2535MHz or more and less than 2630MHz,	less than -21dBm/MHz* *In the case of the following condition, -18dBm/MHz
2630MHz or more and less than 2630.5MHz,	less than -21dBm/MHz* *In the case of the following condition, -13-8/3.5x(f-2627)dBm/MHz
2630.5MHz or more and less than 2655MHz,	less than -21 dBm/MHz
2655MHz or more,	less than -16dBm/MHz* *In the case of the following condition, -13dBm/MHz

Permissible level for 2535MHz or more and less than 2655MHz should be applied to the frequency range where a frequency offset from the center frequency of a carrier is equal to or more than 2.5 times of the system frequency bandwidth.

Condition

The transmit frequency and the bandwidth are as follows.

- Frequency 2545Hz or more and less than 2625Hz
- Bandwidth 5MHz and 10MHz

3.1.3.2.8 Standby output power (ORE,Article 49.28)

Downstream link (Toward Mobile station): -30dBm or less

Upstream link (Toward Base station): -33dBm or less

3.1.3.2.9 Antenna gain (ORE,Article 49.28)

Downstream link (Toward Mobile station): 2dBi or less

Upstream link (Toward Base station): 5dBi or less*

*If an antenna gain of mobile station is over 2dBi, EIRP shall be 28dBm or less.

3.1.3.2.10 Cabinet radiation

Cabinet radiation in EIRP shall be 4nW/MHz or less or the value obtained by adding 0dBi to the permissible spurious emission* in the spurious region measured at the antenna input terminal.

(* Refer to subclause 3.1.3.2.7 for the spurious emission.)

3.1.3.2.11 Out of band gain (ORE Article 49.28)

In case of Non-regenerative repeating, out of band gain refers to the gain of the repeater outside the pass band. The gain outside the pass band shall not exceed the maximum level specified in the Table 3-4.

Table 3-4 Out of band gain limits

Frequency Offset from the Edge Frequency, f_offset	Maximum Gain
5MHz	35dB
10MHz	20dB
40MHz	0dB

3.1.3.2.12 Intermodulation (NT No.435, 2012)

(1) 5 MHz System

Intermodulation emission generated by mixing the desirable emission within the regulated power limit and the disturbing waves at the ±5MHz offset and at the ±10 MHz offset from the desired emission with powers of 30dB less than that of the desirable emission should be less than the permissible level of the spurious emission and adjacent channel leakage power.

(2) 10 MHz system

Intermodulation emission generated by mixing the desirable emission within the regulated power limit and the disturbing waves at the ±10MHz offset and at the ±20 MHz offset from the desired emission with powers of 30dB less than that of the desirable emission should be less than the permissible level of the spurious emission and adjacent channel leakage power.

(3) 20 MHz system

Intermodulation emission generated by mixing the desirable emission within the regulated power limit and the disturbing waves at the ±20MHz offset and at the ±40 MHz offset from the desired emission with powers of 30dB less than that of the desirable emission should be less than the permissible level of the spurious emission and adjacent channel leakage power.

3.1.3.3 Receiver Requirement for Low Power Repeaters

3.1.3.3.1 Reception sensitivity (in case of Regenerative repeating type)

The reception sensitivity shall be defined by the minimum receiver input level (dBm) which yields the bit error rate (BER) of $1x10^{-6}$ for QPSK under AWGN channel.
This is the definition for the specified reception sensitivity as well.

(1) Downstream link (Toward Mobile station)

5MHz system: -91.3dBm or less
10MHz system: -88.3dBm or less
20MHz system: -85.3dBm or less

(2) Upstream link (Toward Base station)

5MHz system: -91.3dBm or less
10MHz system: -88.3dBm or less
20MHz system: -85.3dBm or less

3.1.3.3.2 Spurious response rejection ratio

The spurious response rejection ratio shall be defined as the level ratio of the interfering signal to the desired signal, specified by the following statement:
The level of the desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity*. The level of the interfering signal shall be the one yielding the bit error rate of $1x10^{-6}$ on the desired signal for QPSK. The interfering signal shall not be modulated.
(* Refer to subclause 3.1.3.3.1 for the specified reception sensitivity.)

(1) Downstream link (Toward Mobile station)

The spurious response rejection ratio shall be 11dB or more.

(2) Upstream link (Toward Base station)

The spurious response rejection ratio shall be 11dB or more.

3.1.3.3.3 Adjacent signal selectivity

The adjacent signal selectivity shall be defined as the level ratio of the interfering signal to the desired signal, specified by the following statement:
The level of the desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity*. The level of the interfering signal shall be the one yielding the bit error rate of $1x10^{-6}$ on the desired signal for 16QAM. The interfering signal shall be 16QAM and tuned on the first adjacent channel.

(* Refer to Section 3.1.3.3.1 for the specified reception sensitivity)

(1) Downstream link (Toward Mobile station)

The adjacent signal selectivity shall be 11dB or more.

(2) Upstream link (Toward Base station)

The adjacent signal selectivity shall be 11dB or more.

3.1.3.3.4 Intermodulation performance

The intermodulation performance shall be defined as the level of the interfering signal, specified by the following statement:

The level of the desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity*. The respective level of the two interfering signals shall be the one yielding the bit error rate of $1x10^{-6}$ on the desired signal. The interfering signals shall be tuned on the first and second adjacent channel.

(* Refer to Section 3.1.3.3.1 for the specified reception sensitivity)

(1) Downstream link (Toward Mobile station)

The non-modulated interfering signal on the first adjacent channel shall be -55dBm.

The modulated interfering signal on the second adjacent channel shall be -55dBm.

(2) Upstream link (Toward Base station)

The non-modulated interfering signal on the first adjacent channel shall be -55dBm.

The modulated interfering signal on the second adjacent channel shall be -55dBm.

3.1.3.3.5 Conducted Spurious (ORE, Article 24)

Less than 1GHz:	4nW or less
1GHz or more:	20nW or less

3.1.3.3.6 Requirements for Blanket License Application

The repeater shall be equipped with operation interruption function which is to stop repeating except the data signal is received from the Base stations or the Mobile stations of the BWA operator.

3.1.3.3.7 Requirements for Interference Avoidance to Other Radio Stations

The repeater shall be equipped with the runaway oscillation avoidance function which is to stop repeating in case the repeater emits distorted radio wave due to runaway oscillation.

3.2 WiMAX Release 2.1 Additional Elements

3.2.1 Overview

It is assumed that the types of radio equipment are as follows:

<1> Mobile station

<2> Base station

<3> Repeater station (radio station that relays a signal when direct broadband mobile radio communications between a BS and a MS is not possible. The technical prerequisites for MSs shall apply to the upstream links, while those for the BS shall apply to the downstream links.)

3.2.2 General condition

(1) Communications system

Time Division Duplex (TDD) system

(2) Frequency (ORE, Article 49.29)

2545MHz – 2655MHz

(3) Multiplexing system

a Mobile station (upstream link)

Combination of SC-FDMA and TDMA

Combination or SC-FDMA, TDMA and SDMA

b Base station (downstream link)

Combination of OFDM and TDM

Combination of OFDM, TDM and SDM

(4) Modulation system (ORE, Article 49.29)

a Mobile station (upstream link)

BPSK, QPSK, 16QAM or 64QAM

b Base station (downstream link)

BPSK, QPSK, 16QAM, or 64QAM

(5) Transmission synchronization

a Transmission burst repetition period

5 or 10 ms

b The transmission burst lengths for Base stations and Mobile stations in Table 3-1 (NT

No.435, 2012)

Table 3-1 Maximum Permissible Transmission Burst Length

Maximum permissible transmission burst length [μs]	
Base station	Mobile station
Within P×1,000	Within Q×1,000
(note) · P+Q=5 or 10 · P, Q: positive decimal value	

Transmission Burst Lengths Tolerance

Base Station: Within ±10μs

Mobile Station: Within ±10μs

(6) Authentication, secrecy, and information security

The assignment of numbers specific to mobile station equipment so as to prevent unauthorized use, the application of authentication procedures, the use of secrecy functions for communications information, and other appropriate measures shall be implemented.

(7) Electromagnetic measures

Sufficient consideration shall be given to the mutual electromagnetic interference between Mobile stations and automotive electronic devices and medical electronic devices.

(8) Conformance to the radio radiation protection guidelines

Mobile stations, as well as devices using radio waves shall conform to Regulations for Enforcement of the Radio Law, Article 21.3 and Ordinance Regulating Radio Equipment, Article 14.2.

(9) Mobile station identification numbers

It is preferable for the procedures for assigning and subsequently sending identification numbers to Mobile stations be established with sufficient consideration given to the selection of networks by users, roaming, the assurance of communications security, the supervision of radio stations, and so on.

(10) Stopping emission of radio waves in the event of a fault in a Mobile station's transmission equipment

The functions below shall be executed at the same time, but independently of each other.

a Function whereby, if a Base station detects an error in a Mobile station, the Base station issues a request to that Mobile station to stop transmission.

b Function whereby, if a Mobile station itself detects an internal error, the Mobile station stops transmission upon the timeout of the error detection timer.

3.2.2.1 Transmitter requirement

3.2.2.1.1 Frequency tolerance (ORE, Article 5,Table 1)

Mobile station: Within 3 x 10^{-6}

Base station: Within 3 x 10^{-6}

3.2.2.1.2 Occupied band width (ORE, Article 6,Table 2)

10 MHz system: 10MHz or less

20 MHz system 20MHz or less

3.2.2.1.3 Output power (ORE, Article 49.29)

Mobile station: 200 mW or less

Base station: 40 W or less*

* In the case that the bandwidth is 10MHz, 20W or less.

3.2.2.1.4 Output power tolerance (ORE, Article 14)

Mobile station: Within +87%, -47%

Base station: Within +87%, -47%

3.2.2.1.5 Adjacent channel leakage power (NT No.435, 2012)

(1) Mobile station

(i) 10MHz system

Channel space: 10MHz

Occupied bandwidth : 10MHz

Permissible adjacent channel leakage power: 2dBm or less

(ii) 20MHz system

Channel space: 20MHz
Occupied bandwidth : 20MHz
Permissible adjacent channel leakage power: 3dBm or less

(2) Base station

(i) 10MHz system

Channel space: 10MHz
Occupied bandwidth: 10MHz
Permissible adjacent channel leakage power: 3dBm or less

(ii) 20MHz system

Channel space: 20MHz
Occupied bandwidth: 19.5MHz
Permissible adjacent channel leakage power: 6dBm or less

3.2.2.1.6 Spectrum mask (NT No.435, 2012)

(1) Mobile station

(i) 10MHz system

offset frequency: Δf	Permissible level
15MHz or more and less than 20MHz,	less than -25dBm/MHz
20MHz or more and less than 25MHz,	less than -30dBm/MHz

(ii) 20MHz system

offset frequency: Δf	Permissible level
30MHz or more and less than 35MHz,	less than -25dBm/MHz
35MHz or more and less than 50MHz,	less than -30dBm/MHz

(2) Base station

(i) 10MHz system

offset frequency: Δf	Permissible level
15MHz or more and less than 25MHz,	less than -22dBm/MHz

(ii) 20MHz system

offset frequency: Δf	Permissible level
30MHz or more and less than 50MHz,	less than -22dBm/MHz

3.2.2.1.7 Spurious emission (NT No.435, 2012)

(1) Mobile station

Frequency band	Permissible Level
9kHz or more and less than 150kHz,	less than -13dBm/kHz
150kHz or more and less than 30MHz,	less than -13dBm/10kHz
30MHz or more and less than 1000MHz,	less than -13dBm/100kHz
1000MHz or more and less than 2505MHz,	less than -13dBm/MHz
2505MHz or more and less than 2530MHz,	less than -30dBm/MHz
2530MHz or more and less than 2535MHz,	less than -25dBm/MHz
2535MHz or more and less than 2655MHz,	less than -30dBm/MHz
2655MHz or more,	less than -13dBm/MHz

Permissible level for 2535MHz or more and less than 2655MHz should be applied to the frequency range where a frequency offset from the center frequency of a carrier is equal to or more than 2.5 times of the system frequency bandwidth.

(2) Base station

Frequency band	Permissible Level
9kHz or more and less than 150kHz,	less than -13dBm/kHz
150kHz or more and less than 30MHz,	less than -13dBm/10kHz
30MHz or more and less than 1000MHz,	less than -13dBm/100kHz
1000MHz or more and less than 2505MHz,	less than -13dBm/MHz
2505MHz or more and less than 2535MHz,	less than -42dBm/MHz
2535MHz or more and less than 2655MHz	less than -22dBm/MHz
2655MHz or more	less than -13dBm/MHz

Permissible level for 2535MHz or more and less than 2655MHz should be applied to the frequency range where a frequency offset from the center frequency of a carrier is equal to or more than 2.5 times of the system frequency bandwidth.

3.2.2.1.8 Intermodulation (NT No.435, 2012)

(2) 10 MHz system

Intermodulation emission generated by mixing a desirable emission within regulated power and disturbing waves at ±10MHz offset and at ±20 MHz offset from the desired emission with powers of 30dB less than that of desirable emission should be less than permissible

level of the spurious emission and adjacent channel leakage power.

(3) 20 MHz system

Intermodulation emission generated by mixing a desirable emission within regulated power and disturbing waves at ±20MHz offset and at ±40 MHz offset from the desired emission with powers of 30dB less than that of desirable emission should be less than permissible level of the spurious emission and adjacent channel leakage power.

3.2.2.1.9 Standby output power (ORE, Article 49.29)

Mobile station: -30dBm or less

Base station: -30dBm or less

3.2.2.1.10 Antenna gain (ORE, Article 49.29)

Mobile station: 4dBi or less

Base station: 17dBi or less

3.2.2.2 Receiver requirement

3.2.2.2.1 Reception sensitivity

(1) Definition

Reception sensitivity is the minimum receiving power measured by antenna terminal which is required to receive QPSK modulated signal with the specified quality (more than 95% of the maximum throughput). It shall not exceed the following value (reference sensitivity) in static characteristic.

(2) Specification

Mobile station: -94dBm or less

Base station: -101.5dBm or less

3.2.2.2.2 Spurious response rejection ratio

(1) Definition

Spurious response is a measure of the receiver ability to receive a desired signal in the existence of a non-modulated interference signal. When the desired signal and non-modulated interference signal are added by the following condition, QPSK modulated signal shall be received with the specified quality (more than 95% of the maximum throughput).

(2) Specification

Mobile station:
desired signal reference sensitivity +9dB
non-modulated interference signal -44dBm
Base station:
desired signal reference sensitivity +6dB
non-modulated interference signal -45dBm

3.2.2.2.3 Adjacent channel selectivity

(1) Definition

Adjacent channel selectivity is a measure of the receiver ability to receive a desired signal in the existence of modulated interference signal assigned to adjacent carrier frequency. When the desired signal and modulated interference signal in adjacent frequency band are added by the following condition, QPSK modulated signal shall be received with the specified quality (more than 95% of the maximum throughput).

(2) Specification

Mobile stations:
desired signal reference selectivity +14dB
modulated interference signal -54.5dBm
Base station:
desired signal reference selectivity +6dB
modulated interference signal -52dBm

3.2.2.2.4 Intermodulation characteristic

(1) Definition

Intermodulation characteristic is a measure of the receiver ability to receive a desired signal in the existence of two non-modulated interference signals which are equal in power and can generate the third-order intermodulation or either modulated interference signal of such two interference signals. When the desired signal and both of non-modulated and modulated interference signals, which can generate the third-order intermodulation, are added by the following condition. QPSK modulated signal shall be received with the specified quality (more than 95% of the maximum throughput).

(2) Specification

Mobile stations:
Desired signal: reference sensitivity +9dB
Non-modulated interference signal (adjacent channel): -46dBm

Modulated interference signal (second adjacent channel): -46dBm

Base station:
Desired signal: reference sensitivity +6dB
Non-modulated interference signal (adjacent channel): -52dBm
Modulated interference signal (second adjacent channel): -52dBm

3.2.2.2.5 Conducted Spurious (ORE, Article 24)

(1) Definition

Conducted spurious component is spurious emissions while reception, which are any emissions present at the antenna terminals of the equipment.

(2) Specification

Frequency band	Permissible Level
9kHz or more and less than 150kHz,	less than -54dBm/kHz
150kHz or more and less than 30MHz,	less than -54dBm/10kHz
30MHz or more and less than 1000MHz,	less than -54dBm/100kHz
1000MHz or more	less than -47dBm/MHz

3.2.3 Low Power Repeater

3.2.3.1 General Condition

(1) Frequency and channel spacing

The operating frequency bands shall be 2.5GHz bands assigned for the BWA system.
The channel spacing shall be 10MHz or 20MHz.

(2) Type of Repeating

The repeater shall be of Non-regenerative and Generative repeating type.

Table 3-2 Type of Repeating

Type of Repeating	Non-regenerative repeating		Generative repeating	
Relay frequency	Same frequency	Different frequency	Same frequency	Different frequency
Configuration	Integrated or separated type		Integrated or separated type	

(3) Communications system

Time Division Duplex (TDD) system

(4) Multiplexing system

a. Toward Base station (upstream link)*

Combination of SC-FDMA and TDMA

Combination or SC-FDMA, TDMA and SDMA

*Generative repeating only

b. Toward Mobile station (downstream link)*

Combination of OFDM and TDM

Combination of OFDM, TDM and SDM

*Generative repeating only

(5) Modulation system (ORE, Article 49.29)

a. Toward Base station (upstream link)*

BPSK, QPSK, 16QAM or 64QAM

*Generative repeating only

b. Toward Mobile station (downstream link)*

BPSK, QPSK, 16QAM or 64QAM

*Generative repeating only

(6) Transmission synchronization

a. Transmission burst repetition period

5 or 10ms

b. The transmission burst lengths for Mobile stations and Base stations in Table 3-3 (NT No.435, 2012)

Table 3-3 Maximum Permissible Transmission Burst Length

Maximum permissible transmission burst length [μs]	
Toward Mobile station (downstream link)	Toward Base station (upstream link)
Within P×1,000	Within Q×1,000
(note) · P+Q=5 or 10 · P, Q: positive decimal value	

Transmission Burst Lengths Tolerance

Base Station: Within ±10μs

Mobile Station: Within ±10μs

3.2.3.1.1 System condition

(1) Maximum number of repeaters (in case of Non-regenerative repeating type)

Maximum number of repeaters per Base station shall be 100.

(2) Compliance with the radio protection guidelines

The repeater shall conform to the Regulations for Enforcement of the Radio Law, Article 21.3 and Ordinance Regulating Radio Equipment, Article 14.2.

3.2.3.2 Transmitter Requirement for Low Power Repeater

3.2.3.2.1 Frequency tolerance (ORE, Article 5, Table1)

Downstream link (Toward Mobile station): Within $3x10^{-6}$

Upstream link (Toward Base station): Within $3x10^{-6}$

3.2.3.2.2 Occupied band width (ORE, Article 6,Table 2)

10 MHz system: 10MHz or less

20 MHz system: 20MHz or less

3.2.3.2.3 Output power (ORE, Article 49.29)

(1) Non-regenerative repeating

Downstream link (Toward Mobile station): 200mW or less*

Upstream link (Toward Base station): 200mW or less*

*Total power is the aggregate of the output power of the downstream and upstream links.

(2) Regenerative repeating

Downstream link (Toward Mobile station): 200mW or less*

Upstream link (Toward Base station): 200mW or less*

*Total power is the aggregate of the output power of the downstream and upstream links. Though the number of channel is unlimited, maximum output power of the downstream and upstream links is 600mW or less, respectively.

3.2.3.2.4 Output power tolerance (ORE, Article 14)

Downstream link (Toward Mobile station): Within +87%, -47%

Upstream link (Toward Base station): Within +87%, -47%

3.2.3.2.5 Adjacent channel leakage power (NT No.435, 2012)

(1) Downstream link (Toward Mobile station)

(i) 10MHz system

Channel space:	10MHz
Occupied bandwidth :	10MHz
Permissible adjacent channel leakage power:	2dBm or less

(ii) 20MHz system

Channel space:	20MHz
Occupied bandwidth :	20MHz
Permissible adjacent channel leakage power:	3dBm or less

(2) Upstream link (Toward Base station)

(i) 10MHz system

Channel space:	10MHz
Occupied bandwidth :	9.5MHz
Permissible adjacent channel leakage power:	2dBm or less

(iii) 20MHz system

Channel space:	20MHz
Occupied bandwidth :	20MHz
Permissible adjacent channel leakage power:	3dBm or less

3.2.3.2.6 Spectrum mask (NT No.435, 2012)

(1) Downstream link (Toward Mobile station)

(i) 10MHz system

offset frequency: Δf	Permissible level
15MHz or more and less than 20MHz,	less than -25dBm/MHz
20MHz or more and less than 25MHz,	less than -30dBm/MHz

(iii) 20MHz system

offset frequency: Δf	Permissible level
30MHz or more and less than 35MHz,	less than -25dBm/MHz
35MHz or more and less than 50MHz,	less than -30dBm/MHz

(2) Upstream link (Toward Base station)

(i) 10MHz system

offset frequency: Δf	Permissible level
15MHz or more and less than 20MHz,	less than -25dBm/MHz
20MHz or more and less than 25MHz,	less than -30dBm/MHz

(ii) 20MHz system

offset frequency: Δf	Permissible level
30MHz or more and less than 35MHz,	less than -25dBm/MHz
35MHz or more and less than 50MHz,	less than -30dBm/MHz

3.2.3.2.7 Spurious emission (NT No.435, 2012)

(1) Downstream link (Toward Mobile station)

Frequency band	Permissible Level
9kHz or more and less than 150kHz,	less than -13dBm/kHz
150kHz or more and less than 30MHz,	less than -13dBm/10kHz
30MHz or more and less than 1000MHz,	less than -13dBm/100kHz
1000MHz or more and less than 2505MHz,	less than -13dBm/MHz
2505MHz or more and less than 2530MHz,	less than -30dBm/MHz
2530MHz or more and less than 2535MHz,	less than -25dBm/MHz
2535MHz or more and less than 2655MHz,	less than -30dBm/MHz
2655MHz or more,	less than -13dBm/MHz*

Permissible level for 2535MHz or more and less than 2655MHz should be applied to the frequency range where a frequency offset from the center frequency of a carrier is equal to or more than 2.5 times of the system frequency bandwidth.

(2) Upstream link (Toward Base station)

Frequency band	Permissible Level
9kHz or more and less than 150kHz,	less than -13dBm/kHz
150kHz or more and less than 30MHz,	less than -13dBm/10kHz
30MHz or more and less than 1000MHz,	less than -13dBm/100kHz
1000MHz or more and less than 2505MHz,	less than -13dBm/MHz
2505MHz or more and less than 2530MHz,	less than -30dBm/MHz

2530MHz or more and less than 2535MHz, less than -25dBm/MHz
2535MHz or more and less than 2655MHz, less than -30dBm/MHz
2655MHz or more, less than -13dBm/MHz*

Permissible level for 2535MHz or more and less than 2655MHz should be applied to the frequency range where a frequency offset from the center frequency of a carrier is equal to or more than 2.5 times of the system frequency bandwidth.

3.2.3.2.8 Standby output power (ORE,Article 49.28)

Downstream link (Toward Mobile station): -30dBm or less
Upstream link (Toward Base station): -33dBm or less

3.2.3.2.9 Antenna gain (ORE,Article 49.28)

Downstream link (Toward Mobile station): 4dBi or less
Upstream link (Toward Base station): 4dBi or less

3.2.3.2.10 Cabinet radiation

Cabinet radiation in EIRP shall be 4nW/MHz or less or the value obtained by adding 0dBi to the permissible spurious emission* in the spurious region measured at the antenna input terminal.
(* Refer to subclause 3.1.3.2.7 for the spurious emission.)

3.2.3.2.11 Out of band gain (ORE Article 49.28)

In case of Non-regenerative repeating, out of band gain refers to the gain of the repeater outside the pass band. The gain outside the pass band shall not exceed the maximum level specified in the Table 3-4.

Table 3-4 Out of band gain limits

Frequency Offset from the Edge Frequency, f_offset	Maximum Gain
5MHz	35dB
10MHz	20dB
40MHz	0dB

3.2.3.2.12 Intermodulation (NT No.435, 2012)

(2) 10 MHz system

Intermodulation emission generated by mixing the desirable emission within the regulated power limit and the disturbing waves at the ±10MHz offset and at the ±20 MHz offset from the desired emission with powers of 30dB less than that of the desirable emission should be less than the permissible level of the spurious emission and adjacent channel leakage power.

(3) 20 MHz system

Intermodulation emission generated by mixing the desirable emission within the regulated power limit and the disturbing waves at the ±20MHz offset and at the ±40 MHz offset from the desired emission with powers of 30dB less than that of the desirable emission should be less than the permissible level of the spurious emission and adjacent channel leakage power.

3.2.3.3 Receiver Requirement for Low Power Repeaters

3.2.3.3.1 Reception sensitivity (in case of Regenerative repeating type)

The reception sensitivity shall be defined by the minimum receiver input level (dBm) which yields the bit error rate (BER) of $1x10^{-6}$ for QPSK under AWGN channel.
This is the definition for the specified reception sensitivity as well.

(1) Downstream link (Toward Mobile station)

10MHz system: -88.3dBm or less

20MHz system: -85.3dBm or less

(2) Upstream link (Toward Base station)

10MHz system: -88.3dBm or less

20MHz system: -85.3dBm or less

3.2.3.3.2 Spurious response rejection ratio

The spurious response rejection ratio shall be defined as the level ratio of the interfering signal to the desired signal, specified by the following statement:
The level of the desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity*. The level of the interfering signal shall be the one yielding the bit error rate of $1x10^{-6}$ on the desired signal for QPSK. The interfering signal shall not be modulated.
(* Refer to subclause 3.2.3.3.1 for the specified reception sensitivity.)

(1) Downstream link (Toward Mobile station)

The spurious response rejection ratio shall be 11dB or more.

(2) Upstream link (Toward Base station)

The spurious response rejection ratio shall be 11dB or more.

3.2.3.3.3 Adjacent signal selectivity

The adjacent signal selectivity shall be defined as the level ratio of the interfering signal to the desired signal, specified by the following statement:

The level of the desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity*. The level of the interfering signal shall be the one yielding the bit error rate of $1x10^{-6}$ on the desired signal for 16QAM. The interfering signal shall be 16QAM and tuned on the first adjacent channel.

(* Refer to Section 3.2.3.3.1 for the specified reception sensitivity)

(1) Downstream link (Toward Mobile station)

The adjacent signal selectivity shall be 11dB or more.

(2) Upstream link (Toward Base station)

The adjacent signal selectivity shall be 11dB or more.

3.2.3.3.4 Intermodulation performance

The intermodulation performance shall be defined as the level of the interfering signal, specified by the following statement:

The level of the desired signal shall be set to +3 dB higher than the level of the specified reception sensitivity*. The respective level of the two interfering signals shall be the one yielding the bit error rate of $1x10^{-6}$ on the desired signal. The interfering signals shall be tuned on the first and second adjacent channel.

(* Refer to Section 3.1.3.3.1 for the specified reception sensitivity)

(1) Downstream link (Toward Mobile station)

The non-modulated interfering signal on the first adjacent channel shall be -55dBm.

The modulated interfering signal on the second adjacent channel shall be -55dBm.

(2) Upstream link (Toward Base station)

The non-modulated interfering signal on the first adjacent channel shall be -55dBm.

The modulated interfering signal on the second adjacent channel shall be -55dBm.

3.2.3.3.5 Conducted Spurious (ORE, Article 24)

Less than 1GHz:	4nW or less
1GHz or more:	20nW or less

3.2.3.3.6 Requirements for Blanket License Application

The repeater shall be equipped with operation interruption function which is to stop repeating except the data signal is received from the Base stations or the Mobile stations of the BWA operator.

3.2.3.3.7 Requirements for Interference Avoidance to Other Radio Stations

The repeater shall be equipped with the runaway oscillation avoidance function which is to stop repeating in case the repeater emits distorted radio wave due to runaway oscillation.

3.3 Carrier Aggregation

3.3.1 Overview

The regulation for CA is applied to the following system.

- WiMAX Release 1.0
- WiMAX Release 1.5
- WiMAX Release 2.0
- WiMAX Release 2.1 Additional Elements

3.3.2 General Condition

It is assumed that the conditions of CA are as follows;

- Downstream link only
- Contiguous and Non-contiguous carriers
- Occupied bandwidth which are assigned as BWA system
- Single Base station which transmits several carriers

3.3.2.1 Transmitter Requirement

Single Base station which transmits several carriers is required to same as the existing transmitter requirements regarding the following items.

- Adjacent channel leakage power

- Spectrum mask
- Spurious emission
- Intermodulation

3.3.2.2 Low Power Repeater

(1) WiMAX Release1.0, 1.5 and 2.0

- Upstream link (toward Base station) 400mW or less*
- Downstream link (toward Mobile station) 200mW or less*

*Total power is the aggregate of the output power of the downstream and upstream links. The number of aggregated channel is unlimited.

(2) WiMAX Release2.1 Additional Elements

- Regenerative relay 600mW or less* (200mW or less / carrier)
- Non-regenerative relay 200mW or less*

*Total power is the aggregate of the output power of the downstream and upstream links. The number of aggregated channel is unlimited.

Chapter 4 System Profile

The system profile of the 2.5 GHz Mobile WiMAX is defined in "WiMAX Forum™ Mobile System Profile" provided by WiMAX Forum as shown in Attachment 3 which is linked to the following electrical document.

4.1 Release 1.0

Attachment 3-1 WiMAX Forum™ Mobile SystemProfile Release 1.0
WMF-T23-001-R010v09

4.2 Release 1.5

Attachment 3-2-1 WiMAX Forum™ Mobile System Profile Release 1.5 Common Part
WMF-T23-001-R015v01

Attachment 3-2-2 WiMAX Forum™ Mobile System Profile Release 1.5 TDD Part
WMF-T23-002-R015v01

4.3 Release 2.0

Attachment 3-3 WiMAX Forum™ Mobile System Profile Release 2.0
WMF-T23-001-R020v02

4.4 Release 2.1

Attachment 3-4 WiMAX Forum™ Mobile System Profile Release 2.1
WMF-T23-001-R021v04

4.5 Release 2.2

Attachment 3-5 WiMAX Forum™ Mobile System Profile Release 2.2
WMF-T23-001-R022v01

Chapter 5 Network Architecture

The End-to-End Network Systems Architecture of the 2.5 GHz Mobile WiMAX is defined in "WiMAX forum network architecture Stage 2-3" provided by WiMAX Forum as shown in Attachment 4 which is linked to the following electrical documents.

5.1 Release 1.0

Attachment 4-1-1 End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 2: Architecture Tenets, Reference Model and Reference Points)
[Stage 2 and Stage 3 Abbreviations]
WMF-T32-005-R010v05

Attachment 4-1-2 End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 2: Architecture Tenets, Reference Model and Reference Points)
[Part 0]
WMF-T32-001-R010v05

Attachment 4-1-3 End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 2: Architecture Tenets, Reference Model and Reference Points)
[Part 1]
WMF-T32-002-R010v05

Attachment 4-1-4 End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 2: Architecture Tenets, Reference Model and Reference Points)
[Part 2]
WMF-T32-003-R010v05

Attachment 4-1-5　End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 2: Architecture Tenets, Reference Model and Reference Points)
[Part 3 – Informative Annex]
WMF-T32-004-R010v05

Attachment 4-1-6　End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 2: Architecture Tenets, Reference Model and Reference Points)
[WiMAX Interworking with DSL]
WMF-T37-005-R010v03

Attachment 4-1-7　End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 2: Architecture Tenets, Reference Model and Reference Points)
[3GPP – WiMAX Interworking]
WMF-T37-001-R010v03

Attachment 4-1-8　End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 2: Architecture Tenets, Reference Model and Reference Points)
[3GPP2 – WiMAX Interworking]
WMF-T37-003-R010v03

Attachment 4-1-9　End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 3: Detailed Protocols and Procedures)
WMF-T33-001-R010v05

Attachment 4-1-10　End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 3: Detailed Protocols and Procedures)
[Annex: WiMAX - 3GPP Interworking]
WMF-T37-002-R010v03

Attachment 4-1-11　End-to-End Network Systems Architecture
WiMAX Forum Network Architecture

(Stage 3: Detailed Protocols and Procedures)
[Annex: WiMAX - 3GPP2 Interworking]
WMF-T37-004-R010v03

Attachment 4-1-12　End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 3: Detailed Protocols and Procedures)
[Annex: Prepaid Accounting]
WMF-T33-002-R010v05

Attachment 4-1-13　End-to-End Network Systems Architecture
WiMAX Forum Network Architecture
(Stage 3: Detailed Protocols and Procedures)
[Annex: R6/R8 ASN Anchored Mobility Scenarios]
WMF-T33-003-R010v05

5.2　Release 1.5

Attachment 4-2-1　WiMAX Forum® Network Architecture
Detailed Protocols and Procedures
Base Specification
WMF-T33-001-R015v03

Attachment 4-2-2　WiMAX Forum® Network Architecture
Detailed Protocols and Procedures
[Informative Annex: Hooks and Principles for Evolution]
WMF-T33-004-R015v01

Attachment 4-2-3　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures
IP Multimedia Subsystem (IMS) Interworking
WMF-T33-101-R015v02

Attachment 4-2-4　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures
Emergency Services Support

WMF-T33-102-R015v02

Attachment 4-2-5　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures
WiMAX Over-The-Air General Provisioning System Specification
WMF-T33-103-R015v03

Attachment 4-2-6　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures
WiMAX Over-The-Air Provisioning & Activation Protocol based on OMA DM Specifications
WMF-T33-104-R015v04

Attachment 4-2-7　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures
Over-The-Air Provisioning & Activation Protocol based on TR-069 Specification
WMF-T33-105-R015v01

Attachment 4-2-8　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures
WIMAX Lawful Intercept - NORTH AMERICAN REGION
WMF-T33-107-R015v02

Attachment 4-2-9　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures
Robust Header Compression (RoHC) Support
WMF-T33-108-R015v01

Attachment 4-2-10　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures
Policy and Charging Control
WMF-T33-109-R015v03

Attachment 4-2-11　WiMAX Forum® Network Architecture
Protocols and Procedures for Location Based Services
WMF-T33-110-R015v02

Attachment 4-2-12　WiMAX Forum® Network Architecture
System Requirements, Network Protocols and Architecture for Multi-cast Broad-cast Services
(MCBCS Subteams Common Sections)
WMF-T33-111-R015v01

Attachment 4-2-13　WiMAX Forum® Network Architecture
System Requirements, Network Protocols and Architecture for Multi-cast Broad-cast Services
Dynamic Service Flow Based (MCBCS – DSx)
WMF-T33-112-R015v02

Attachment 4-2-14　WiMAX Forum® Network Architecture
System Requirements, Network Protocols and Architecture for Multi-cast Broad-cast Services
(MCBCS Application Layer Approach)
WMF-T33-113-R015v01

Attachment 4-2-15　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures
WiMAX-SIM Application on UICC
WMF-T33-114-R015v01

Attachment 4-2-16　WiMAX Forum® Network Architecture
Universal Services Interface (USI)
An Architecture for Internet+ Service Model
WMF-T33-115-R015v01

5.3　Release 2.0

Attachment 4-3-1　WiMAX Forum® Network Architecture
Architecture Tenets, Reference Model and Reference Points
Base Specification
WMF-T32-001-R020v01

Attachment 4-3-2　WiMAX Forum® Network Architecture

Architecture Tenets, Reference Model and Reference Points WiMAX Broadband Access Lawful Intercept：Overview
WMF-T32-106-R020v02

Attachment 4-3-3　WiMAX Forum® Network Architecture
Detailed Protocols and Procedures
Base Specification
WMF-T33-001-R020v01

Attachment 4-3-4　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures IP Multimedia System(IMS) Interworking
WMF-T33-101-R020v02

Attachment 4-3-5　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures WiMAX Over-The-Air Provisioning & Activation Protocol based on OMA DM Specifications
WMF-T33-104-R020v01

Attachment 4-3-6　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures Policy and Charging Control
WMF-T33-109-R020v01

Attachment 4-3-7　WiMAX Forum® Network Requirements
Recommendations and Requirements for WiMAX Messaging Services (WMS)
WMF-T31-125-R020v01

Attachment 4-3-8　WiMAX Forum® Network Requirements
Recommendations and Requirements for WiMAX ASN Local Routing of the Bearer Traffic
WMF-T31-126-R020v01

Attachment 4-3-9　WiMAX Forum® Network Architecture
Architecture, detailed Protocols and Procedures WiMAX Device Reported Metrics & Diagnostics (DRMD)
WMF-T33-116-R020v01

Attachment 4-3-10　WiMAX Forum® Network Architecture

Architecture, Detailed Protocols and Procedures WiMAX® - 3GPP EPS Interworking
WMF-T37-009-R020v01

5.4 Release 2.1

Attachment 4-4-1 WiMAX Forum® Network Architecture
Architecture Tenets, Reference Model and Reference Points
Base Specification
WMF-T32-001-R021v03

Attachment 4-4-2 WiMAX Forum® Network Architecture
Detailed Protocols and Procedures
Base Specification
WMF-T33-001-R021v03

5.5 Release 2.2

Attachment 4-5-1 WiMAX Forum® Network Architecture
Architecture Tenets, Reference Model and Reference Points
Base Specification
WMF-T32-001-R022v02

Attachment 4-5-2 WiMAX Forum® Network Architecture
Detailed Protocols and Procedures
Base Specification
WMF-T33-001-R022v02

Chapter 6 Measurement Method

As for the items stipulated in Ordinance Concerning Technical Regulations Conformity Certification etc. of Specified Radio Equipment Appendix Table No.1 item 1(3), measurement methods are specified by MIC Notification (Note) or a method that surpasses or is equal to the method.

Note: This Notification refers to MIC Notification No.88 “The Testing Method for the Characteristics Examination” (January 26, 2004) as of the date of the revision of this standard version 1.0 (issued in December, 2007). Thereafter, the latest version of Notification would be applied if this Notification or contents of this Notification would be revised.

Attachment 1　List of Essential Industrial Property Rights　　(selection of option 1)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO. 〔Applied in Japan 〕	備考 （出願国名） REMARKS
(N/A)	(N/A)	(N/A)	(N/A)

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
NOKIA Corporation *10	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.1.0		
NTT DoCoMo Inc. *10	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.1.0		
Motorola, Inc. *10	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.1.0		
Qualcomm Inc. *10	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.1.0		
FUJITSU LIMITED *10	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.1.0		
KDDI CORPORATION *10	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.1.0		

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
NEC Corporation *10	(1) 可変変調通信方法	特許第2776094号	
	(2) 多方向多重通信システムの送信出力電力制御方法	特許第2982724号	
	(3) 直交周波数分割多重変復調回路	特許第3786129号	
	(4) 送信電力制御方法、送信電力制御装置、移動局、基地局及び制御局	特許第3358565号	
	(5) 移動通信システム及び通信制御方法並びにそれに用いる基地局、移動局	特許第3675433号	
	(6) 位置登録方法および位置登録方式	特許第2748871号	

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./APPLICATION NO.	備考 （出願国名） REMARKS
NTT DoCoMo Inc. *11	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.1.1		

*11: This patent is applied to the revised part of ARIB STD-T94 Ver.1.1.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
Motorola, Inc. *10	パケット構造フィールドを有する通信システム	特表平3-501079	WO, AT, AU, BE, CH, DE, FR, GB, IT, KR, LU, NL, NO, SE,US
	電話通信システムにおける加入者の真正証明および保護のための方法	特表平5-503816	WO, AT, AU, BE, CA, CH, DE, DK, ES, FR,U, NL, SE
	時間領域パイロット成分を有する通信信号	特表平5-501189	WO, AT, AU, BE, BR, CA, CH, DE, DK, ES, FR, GB, GR, IT, KR, LU, NL, SE, US
	電気通信システムにおける加入者の真正証明及び保護のための方法	特表平5-508274	WO, CA, US
	QAM通信システムにおけるピーク対平均電力比の軽減方法	特表平6-504175	WO, AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE, US
	時間領域パイロット成分を有する通信信号	特表平6-504176	WO, AU, BR, CA, GB, KR
	通信システムにおいてデータ・ストリームの暗号化保護を提供する方法および装置	特表平8-503113	WO, CA, FI, KR, AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, US

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
Motorola, Inc. *10	ターボコード構造を使用する適応ハイブリッドARQ	特表2003-515268	WO, BR, CA, KR, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, US
	マルチチャネル・ストップ・アンド・ウェイトARQ通信のための方法および装置	特表2003-514486	WO, BR, CA, KR, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, US
	通信システムにおいて別個の順方向専用チャネル及び共用制御チャネルを与える装置及び方法	特表2003-531534	WO, AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
Motorola, Inc. *10	広帯域の通信システム内で狭帯域の信号を送信および受信するための方法および装置	特表2007-525930	WO, AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW
	Multi-mode hybrid ARQ scheme	WO2006055171A1	WO, AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
NOKIA CORPORATION *10	多重アクセス通信システム及び多重アクセス通信方法、並びにその通信装置	特許第 3090300 号	
	無線電話システム、及び無線電話ネットワーク内でのデータ送信方法、無線電話器並びに固定局	特許第 3842805 号	
	無線電話ＴＤＭＡシステムにおいてパケットデータを伝送するシステム	特許第 3880642 号	
	ＴＤＭＡシステムにおける無線容量の動的割り振り方法	特許第 3155010 号	
	ハンドオーバ方法及びセルラ無線システム	特許第 3825049 号	
	情報の暗号化方法およびデータ通信システム	特開 2006-262531	

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
NOKIA CORPORATION *10	アイドルタイムを割り振る方法、移動及びネットワーク	特許第 3943253 号	
	データ伝送を暗号処理する方法とその方法を利用するセルラ無線システム	特開 2006-271010	
	無線資源制御方法	特許第 3542705 号	
	移動通信システムにおいてある複数プロトコルに従ってある複数層でデータを処理するための方法と装置	特許第 3445577 号	
	複数アンテナ送信用の非ゼロ複素重み付けした空間－時間符号	特表 2005-503045	
	移動局の内部タイミングエラーを補償する方法及び回路	特許第 3923571 号	

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
KDDI株式会社 *10 株式会社KDDI研究所 *10 京セラ株式会社 *10	(1) OFDM信号復調装置	特願平11-159320	
	(2) OFDM信号復調用シンボルタイミング検出回路	特願2000-022459	
	(3) OFDM受信装置の周波数及び位相誤差補正装置	特願2000-070186	
	(4) OFDM信号復調用シンボルタイミング検出方法及び装置	特願2000-246978	

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
KDDI株式会社 *10	(5) 無線パケット通信システム及び基地局	特願2000-368610 特許3731469 米国特許7012910	US
	(6) 多ビームセルラ無線基地局、移動機及びスペクトル拡散信号送信方法	特願2001-115422	
	(7) 無線基地局	特願2001-190109	
	(8) フレーム同期回路	特願2002-037926 特許3826810	
	(9) 直交周波数分割多重方式の受信装置及び受信方法	特願2002-114677 特許3846356	
	(10) OFDM信号の周波数誤差を補正する受信装置	特願2002-135473 特許3885657	
	(11) 伝搬路推定を行うOFDM受信装置	特願2002-229887 特許3791473	

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
KDDI株式会社 *10 小林英雄 *10	(12) 伝送路特性推定装置および伝送路特性推定方法、無線復調装置、コンピュータプログラム	特願2002-373986	
	(13) 伝送路特性推定装置および伝送路特性推定方法、無線復調装置、コンピュータプログラム	特願2003-025910	
	(14) CNR推定装置、CNR推定方法、CNR推定プログラム、適応伝送無線システム、無線装置	特願2003-067938	
KDDI株式会社 *10	(15) 伝送路特性推定装置、コンピュータプログラム 受信装置及び受信方法	特願2003-204611	
	(16) 伝達関数推定装置及び、伝達関数推定方法	特願2006-082414	
	(17) 受信装置、送信装置	特願2006-094340	
	(18) 無線フレーム制御装置、無線通信装置及び無線フレーム制御方法	特願2006-192128	
	(19) 無線フレーム制御装置、無線フレーム制御方法、および無線通信装置	特願2007-93760	

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
三菱電機株式会社 *10	データ伝送方法、データ受信方法、データ伝送システム、送信機及び受信機	特許第 3,895,745 号	EP(DE,FR,IT,PT,GB), US, CA, AU

*10: This patent is applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
株式会社　日立コミュニケーションテクノロジー *10	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.1.0		

*10: This patent is applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *10	Method and apparatus for measuring channel state information	JP2003-530010	US, AU, BR, CA, EP, HK, ID, IL, IN, JP, KR, MX, NO, WO, RU, SG, TW, UA
	Multiplexing of real time services and non-real time services for OFDM systems	JP2004-503181	US, BR, CN, EP, HK, KR, TW, WO
	Method and apparatus for utilizing channel state information in a wireless communication system	JP2005-502223	US 6,771,706, US 20040165558, BE, BR, CN, DE, EP, ES, FI, FR, GB, HK, IE, IT, JP, KR, LU, NL, SE, TW, WO
	Rate selection for an OFDM system	JP2005-533402	US 7,012,883, US 20060087972, BR, CN, EP, HK, KR, TW, WO
	Diversity Transmission Modes for MIMO OFDM Communication Systems	JP2005-531219	US 7,095,709, US 20060193268, AU, BR, CA, CN, EP, HK, ID, IL, IN, KR, MX, NO, RU, SG, TW, UA, WO
	Random Access for Wireless Multiple-Access Communication Systems	JP2006-504338	US, AU, BR, CA, CN, EP, HK, ID, IL, IN, KR, MX, RU, TW, UA, WO
	Reverse Link Automatic Repeat Request	JP2006504337	US, AU, BR, CA, CN, EP, HK, ID, IL, IN, KR, MX, RU, TW, UA, WO

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *10	MIMO System with Multiple Spatial Multiplexing Modes	JP2006-504339	US 20040136349, US 12/115,522, US 12/115,523, AU, BR, CA, CN, EP, HK, ID, IL, IN, KR, MX, RU, TW, UA, WO
	Transmit Diversity Processing for a Multi-Antenna Communication System	JP2006-504366	US 7,002,900, US 20060039275, AU, BR, CA, CN, EP, HK, ID, IL, IN, KR, MX, RU, TW, UA, WO
	A method and apparatus of using a single channel to provide acknowledgement and assignment messages	JP2007-520169	US, AU, CN, HK, IN, KR, WO
	Shared signaling channel for a communication system	JP2008-507896	US, CA, CL, CN, EP, HK, IN, KR, MY, TW, WO
	Apparatus and Method for Reducing Message Collision Between Mobile Stations Simultaneously Accessing a Base Station in a CDMA Cellular Communications System	JP3152353	US 5,544,196, US 6,615,050, AT, AU, BE, BR, BG, CA, CH, DE, DK, KP, EP, ES, FI, FR, GB, GR, HK, HU, IE, IL, IT, KR, MX, NL, WO, CN, PT, RU, ZA, SE, SK

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *10	Method and apparatus for performing mobile assisted hard handoff between communications Systems	JP2001-508625	US, AM, AU, AZ, BR, BY, CA, CL, IL, DE, EPC, EP, ES, FI, FR, GB, HK, ID, IE, IN, IT, KG, KR, KZ, MD, MX, NL, NZ, WO, CN, TW, RU, ZA, SE, SG, TJ, TM, UA
	Method and Apparatus for High Rate Packet Data Transmission	JP2001522211	US 7,079,550, US 20060280160, US 20070066320, US 20070019567, US 20070025267, AR, AT, AU, BE, BR, CA, CH, CL, CN, CY, CZ, EP, HK, NZ, DE, DK, ES, FI, FR, GB, GR, HU, ID, IE, IL, IN, IT, JP, KR, LU, MY, MC, MX, NL, NO, WO, PL, PT, RO, RU, ZA, SE, SG, UA, VN
	Method and Apparatus for Coordinating Transmission of Short Messages with Hard Handoff Searches in a Wireless Communications System	JP2002-514844	AU, BR, US 20060120490, US 20070153941, CA, DE, EP, FI, FR, GB, HK, IL, IT, JP, KR, MX, NO, WO, CN, TW, SE, SG
	Reservation Multiple Access	JP2002-528017	US, CN, EP, HK, KR, WO

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
Panasonic Corporation *10	直交周波数分割多重信号の伝送方法ならびにその送信装置および受信装置 受信装置、送信装置及び送信方法	特許第3539522号 特許第 3836019 号	

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
株式会社　日立コミュニケーションテクノロジー*10	(1)　無線通信装置	特開2005-160035	CN, KR, US
	(2)　同期配信方法	特開2007-019960	CN, EP, US
	(3)　基地局	特開2007-312435	CN, KR, US
	(4)　無線端末	特開 2007-312436	CN, KR, US

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
Panasonic Corporation *10	(1) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3008651 号 US09/677421 USRE40134 USRE40779	JP US US US
	(2) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3061053 号	JP
	(3) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3061054 号	JP
	(4) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3109522 号 US6256357 US7302007 EP1039682 EP1330090	JP US US EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL,LI EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL
	(5) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3114727 号	JP

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
Panasonic Corporation *10	(6) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3154704 号 EP1039675 EP1330089	JP EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL,LI EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL
	(7) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3154705 号 EP1049284 EP1330088	JP EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL,LI EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE
	(8) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3154706 号 EP1045541 EP01118510.5	JP EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL,LI EP
	(9) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3154707 号 EP1039680	JP EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL
	(10) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3154708 号 US7146092	JP US

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
Panasonic Corporation *10	(11) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3154709 号 US7280806	JP US
	(12) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3231035 号	JP
	(13) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3231036 号 US6728467 EP1035693 EP1439678	JP US EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL
	(14) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3233625 号 US6724976 EP1035695 EP1439679	JP US EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL,LI EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL
	(15) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3233626 号 EP1257104	JP EP,IT,AT,BE,CH,DK,ES,GR,IE,PT,SE,FR,DE,GE,NL

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
Panasonic Corporation *10	(16) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3248807 号	JP
	(17) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3327914 号 US09/740068	JP US
	(18) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3327915 号	JP
	(19) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3327916 号 US10/301737	JP US
	(20) 受信装置、受信方法	特許第 3359327 号	JP
	(21) 送信装置、受信装置、伝送装置、送信方法、受信方法	特許第 3410085 号	JP
	(22) 受信装置、受信方法	特許第 3588460 号	JP
	(23) 受信装置、受信方法	特許第 3643834 号	JP
	(24) 受信装置、受信方法	特許第 3643835 号	JP
	(25) 送信装置、受信装置、送信方法、受信方法	特許第 3829141 号	JP

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
NEC Corporation *10	移動無線通信におけるデータ伝送方式	特許第 2503888 号	JP, US
	移動通信システムのハンドオフ方法及び移動端末	特許第 3120809 号	JP
	移動通信システムにおける基地局及び交換局	特許第 3214500 号	JP
	移動通信システムの送信電力制御方式	特許第 2823034 号	JP

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Approved by the 76th Standard Assembly

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
QUALCOMM Incorporated *20	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.2.0		

*20: This patent is applied to the part defined by ARIB STD-T94 Ver. 2.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *10	Method and apparatus for adaptive transmission control in a high data rate communication system	JP 2003-531518	BR, CN, EP, FI, FR, DE, HK, IT, KR, NL, ES, SE, TW, GB, US 7,088,701
	Method and apparatus for fast closed-loop rate adaptation in a high rate packet data transmission	JP 2004-515932	AU, BE, BR, CA, CN, EP, FI, FR, DE, HK, IN, ID, IE, IL, IT, JP, KR, MX, NL, NO, RU, SG, ES, SE, TW, UA, GB, US 7,245,594, US 20070064646, US 20070263655
	Method and Apparatus for Multiplexing High-Speed Packet Data Transmission with Voice/Data Transmission	JP 4068455	AU, BR, CA, CN, EP, HK, IN, ID, IL, JP, KR, MX, NO, RU, SG, TW, UA, US 6,775,254, US 20040240401
	Method and apparatus for power control in a wireless communication system	JP 2004-510390	BR, CN, EP, FR, DE, HK, IN, KR, NO, SG, TW, GB, US 6,801,759
	Coding scheme for a wireless communication system	JP 2004-535694	BR, CN, EP, HK, KR, TW, US 6,961,388, US 20050276344
	Power control for a channel with multiple formats in a communication system	JP 4505221	CN, EP, HK, IN, JP, KR, TW, US 6,983,166, US 7,376,438, US 20080233995

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *10	Method and system for a multicast service initiation in a communication system	JP 2005-533414	BR, CN, EP, HK, JP, KR, TW, US 6,876,636, US 20050169203
	Multiplexing for a Multi-Carrier Cellular Communication System	JP 2008-503935	AU, BR ,CA, CL, CN, EG, EP, HK, IN, ID, IL, JP, KR, MY, MX, NZ, NO, PH, RU, SG, ZA, TW, UA, US 7,724,777, US 20100195360, VN
	On-demand reverse-link pilot transmission	JP 2008-546226	AU, CA, CN, EP, HK, IN, ID, KR, NZ, NO, PH, RU, UA, US 7,706,324, US 20100238896, VN
	Method and apparatus for reliable transmit power and timing control in wireless communication	JP 2009-508371	CN, EP, IN, KR, TW, US 20070054691
	Neighbour cell measurements for cell re-selection	JP 4465491	EP, FI, FR, DE, JP, NL, GB, US 6,377,803
	Diversity transmitter and diversity transmission method	JP 3978426	CA, CN, EP, IN, ID, KR, US 7,158,579, US 7,623,590, US 20100098187
	Transporting QoS Mapping Information in a Packet Radio Network	JP 3625769	AU, BE, CA, CN, EP, FI, FR, DE, IT, MX, ES, CH, GB, US 7,167,447, US 20060126547

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *10	Measurement reporting in a telecommunication system	JP 4122132	CA, CN, EP, FI, FR, DE, HK, IT, NL, ES, SE, GB, US 7,003,290, US 7,499,701
	A method for controlling connections to a mobile station	JP 3515073	BE, BR, CN, EP, FI, FR, DE, IT, JP, NL, ES, SE, GB, US 6,807,421, US 7,684,361
	Method and apparatus for providing configurable layers and protocols in a communications system	JP 2003-524328	AU, BR, CA, CN, EP, FI, FR, DE, HK, IN, ID, IL, IT, KR, MX, NL, NO, RU, SG, ES, SE, TW, UA, GB, US 6,539,030, US 7,106,779, US 7,158,537
	Pilot signal transmission for an orthogonal frequency division wireless communication system	JP 2008-533928	BR, CA, CL, CN, EP, IN, KR, RU, SG, TW, TH, US 20060209670
	Pilot signal transmission pattern for a multi-user OFDMA system	WO 2010059650	TW, US 20090213950
	A technique for compressing a header field in a data packet	JP 4159287	AU, BE, BR, CA, CN, EP, FI, FR, DE, IN, IE, IT, JP, KR, MX, NL, RU, ES, SE, GB, US 6,680,955

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *10	Method and Apparatus for Correction and Limitation of Transmitter Power on the Reverse Link of a Mobile Radio Telephone System	JP 3452930	AU, BR, CA, CN, EP, FI, FR, DE, HK, IN, ID, IT, KR, MX, RU, ES, SE, GB, US 5,452,473, US 5,590,408, US 5,655,220, VN
	Soft Handoff in a CDMA Cellular Telephone System	JP3014753	AT, AU, BE, BR, CA, CH, CN, DE, DK, EP, ES, FI, FR, GB, GR, HK, IN, IL, IT, KR, LU, MY, MX, NL, NO, TW, SE, SG, ZA

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *20	A Method of Providing a Gap Indication During a Sticky Assignment	JP 2008-507904	AU, BR, CA, CL, CN, EP, HK, ID, IL, IN, KR, MX, MY, NO, NZ, PH, RU, SG, TH, UA, US 20060034173, VN
	Use of supplemental assignments	JP 2008-533836	AU, BR, CA, CL, CN, EP, HK, ID, IL, IN, KR, MX, NO, NZ, PH, RU, SG, TH, TW, UA, US 20060205414, VN
	Method of ciphering data transmission and cellular radio system employing the method	JP 4555261	AT, AU, BR, CN, DE, EP, ES, FI, FR, GB, IN, IT, KR, NL, US 6,535,979
	Use of supplemental assignments to decrement resources	JP 2008-541578	AU, BR, CA, CN, EP, HK, ID, IL, IN, KR, MX, NO, NZ, PH, RU, SG, SG, UA, VN
	Method and apparatus for performing mobile station assisted hard handoff using off line searching	JP 4152587	CN, DE, EP, FR, GB, HK, KR, TW, US 6,134,440, ZA

*20: These patents are applied to the part defined by ARIB STD-T94 Ver. 2.0.

Approved by the 80th Standard Assembly

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
QUALCOMM Incorporated *22	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.2.2		

*22: This patent is applied to the part defined by ARIB STD-T94 Ver. 2.2.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *10	A handover method, and a cellular radio system	JP 3825049	US6,198,928; AU; BE; CH; CN; DE; EP; ES; FR; GB; IT; NL; NO; SE

*10: This patent is applied to the part defined by ARIB STD-T94 Ver. 1.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *20	Method and apparatus for low-overhead packet data transmission and control of reception mode	JP2010-501148	US20080056229; AU; BE; BG; BR; CA; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; RO; RU; SE; SG; TW; UA; VN

*20: This patent is applied to the part defined by ARIB STD-T94 Ver. 2.0.

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)
[Ver. 1.0]

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated	A method and an apparatus for a quick retransmission of signals in a communication system	JP2003-533078	AU, BE, BR, CA, CN, DE, EP, ES, FI, FR, GB, HK, ID, IE, IL, IN, IT, KR, MX, NL, NO, RU, SE; SG, TW, UA, US6694469, US7127654, US7613978, US20100046497
	Method and apparatus for link quality feedback in a wireless communication system	JP2004-531114	AU, BR, CA, CN, DE, EP, ES, FI, FR, GB, HK, ID, IE, IL, IN, IT, KR, MX, NL, NO; RU, SG, TW, UA, US6985453
	Multiplexing and transmission of multiple data streams in a wireless multi-carrier communication system	JP2007-525102	AU, BR, CL, CN, EP, HK, IL, IN, KR, MX, PH, RU, SG, TH, TW, VN, US7221680, US20080291860

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)
[Ver. 2.0]

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated	Methods and systems for sticky region allocation in OFDMA communication systems	JP2011-524694	CN, EP, IN, KR, US20090310477, US20090310543

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)
[Ver. 3.0]

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
QUALCOMM Incorporated	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver.3.0		

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)
[Ver. 3.0]

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated	Synchronized pilot reference transmission for a wireless communication system	JP4607407	US7,289,473; US20080008136; US20100323748; BR; CN; DE; EP; ES; FI; FR; GB; HK; IT; KR; NL; SE
	Method, Apparatus and System for Signal Prediction	JP2004-506206	US6,775,802; JP; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IN; IT; KR; MX; NL; NO; PL; PT; RO; SE; SG; VN
	Method for performing radio resource level registration in a wireless communication system	JP4607411	US7,155,222; US7,773,987; US8,010,104; BE; BR; CN; DE; DK; EP; ES; FI; FR; GB; HK; IE; IT; KR; NL; SE; TW
	Handoff method for digital base stations with different spectral capabilities	JP4795608	US6,535,739; US6,853,843; US7,151,933; US7,373,149; AU; BE; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; ID; IE; IL; IN; IT; KR; MX; NL; NO; RU; SE; SG; TW; UA
	GPS Satellite Signal Acquisition Assistance System and Method in a Wireless Communications Network	JP4018535	US7,254,402; USRE42,543; AU; CA; CN; EP; HK; ID; IL; IN; KR; MX; SG; VN
	Method and Apparatus for Gated ACK/NAK	JP4933019	US7,042,869; BR; CA; CL; CN; DE;

	Channel in a Communication System		EP; ES; FI; FR; GB; HK; ID; IL; IN; IT; KR; MX; NL; NO; NZ; RU; SE; SG; TW; UA
	Method and apparatus for satellite positioning system based time measurement	JP4316676	US5,812,087; US6,052,081; US6,239,742; JP; BR; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; IE; PT; SE
	Method and system for using altitude information in a satellite positioning system	JP4938172	US6,061,018; US6,307,504; JP; AU; BE; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; ID; IE; IL; IN; IT; KR; MX; NL; SE; SG
	Method and apparatus for operating a satellite positioning system receiver	JP2002-530628	US6,104,338; JP; AU; BE; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; ID; IE; IL; IN; IT; KR; MX; NL; SE; SG
	Satellite positioning system augmentation with wireless communication signals	JP5026634	US5,999,124; JP; AU; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; ID; IL; IN; IT; KR; MX; NL; SE; SG
	Method and apparatus for determining a data rate in a high rate packet data wireless communications system	JP4083578	US6,973,098; US20050254465; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; ID; IE; IL; IN; IT; KR; LI; MX; NL; PT; RU; SE; SG; TW; UA
	Method and apparatus for handoff of a wireless packet data services connection	JP4194840	US7,079,511; US7,860,061; US7,561,555; BR; CA; CN; DE; EP; FI; FR; GB; HK; ID; IL; IN; IT; KR; MX; NO; RU; SE; SG; TW; UA
	Method and apparatus for controlling uplink transmissions of a wireless communication system	JP4307847	US7,042,856; US20060262750; JP; BR; CN; DE; EP; GB; KR; TW
	Method and apparatus for testing assisted	JP4593925	US6,760,582; AU; BR; CN; EP; HK;

	position location capable devices		IL; IN; KR; RU
	Synchronization of stored service parameters in a communication system	JP4426187	US7,499,698; US7,881,714; US7,747,283; US7,778,631; JP; BE; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; IE; IN; IT; KR; NL; SE; TW
	Ceasing transmission of data rate control information in a CDMA communication system when the mobile station transmits to the idle open state	JP4236579	US7,103,021; US7,924,781; US20110243082; BR; CN; DE; EP; FR; GB; HK; KR; NO; TW
	Method and apparatus for call setup latency reduction	JP4903362	US7,180,879; US7,417,976; US8,126,469; US7,986,674; US7,894,403; JP; BE; BG; CN; CZ; DE; EP; ES; FI; FR; GB; HK; IE; IN; IT; KR; NL; SE; TW
	Method and apparatus for security in a data processing system	JP4282992	US8,121,296; JP; BR; CA; CN; EP; HK; KR; MX; TW
	Method and system for signaling in broadcast communication system	JP4307998	US6,980,820; US7,415,283; US7,689,226; JP; BE; BG; CN; CZ; DE; EP; ES; FI; FR; GB; HK; IE; IN; IT; KR; NL; SE; TW
	Method and apparatus for security in a data processing system	JP4732687	US7,352,868; US20080226073; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; RU; SG; TW
	Concatenated encoding and decoding for multilayer communication protocol	JP4274942	US7,649,829; US20100107041; US20100272124; BR; CN; DE; EP; ES; FR; GB; IT; KR; NL; TW
	Handoff in a hybrid communication network	JP4554212	JP; AR; CL; CN; EP; IN; KR; MY; SG; TH; ZA
	Frame formatting, coding and transmit	JP4508865	US7,177,658; US7,583,977;

	power control method for a multicast/broadcast system		US8,451,770; US7,593,746; JP; BR; CN; EP; HK; KR; TW
	Handoff in dormant mode in a packet data network	JP4472528	US7,110,377; US8,023,464; JP; BR; CA; CN; DE; EP; FI; FR; GB; ID; IL; IN; IT; KR; MX; RU; SE; TW; UA
	Key generation in a communication system	JP4897215	US7,190,793; US8,094,821; JP; AU; BR; CA; CN; EP; HK; IN; KR; RU; TW
	Beam-steering and beam-forming for wideband MIMO/MISO systems	JP5021164	US6,940,917; US7,194,040; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; RU; TW; UA
	MIMO WLAN System	JP4943654	US8,320,301; US20080285488; US20080285669; US8,462,643; BE; BG; BR; CA; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; ID; IE; IL; IN; IT; KR; MX; NL; RO; RU; SE; TW; UA
	Method and system for a multicast service initiation in a communication system	JP4727986	US7,796,631; JP; AT; BE; BR; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IT; KR; NL; PT; RO; SE; TW
	Uplink pilot and signaling transmission in wireless communication systems	JP5122746	US6,928,062; US7,042,857; US20060279435; JP; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IL; IN; IT; KR; MX; NL; NO; PH; PL; PT; RO; RU; SE; SG; TW; ZA
	Transmission Schemes for Multi-Antenna Communication Systems Utilizing Multi-Carrier Modulation	JP4833830	US7,095,790; US7,606,326; BR; CA; CL; CN; EP; HK; IL; IN; KR; MX; RU; SG; TW; VN
	Method, user agent, application gateway	JP2011-125033	US8,037,188; US20110317667; JP;

	and program for soft handoff across different networks assisted by an end-to-end application protocol		AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; RU; TW; UA
	Pilots for MIMO communication systems	JP4657918	US7,986,742; US20110235744; JP; AT; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; NL; NO; PL; PT; RO; RU; SE; TW; UA
	Rate adaptive transmission scheme for MIMO systems	JP4965127	US6,873,606; US7,675,886; US20100119005; JP; BR; CA; CN; DE; EP; ES; FR; GB; HK; IL; IN; IT; KR; MX; NZ; RU; TW
	Download and display of system tags in wireless communication systems	JP4472531	US7,043,239; US7,292,852; US8,086,231; BE; BG; BR; CA; CN; CZ; DE; EP; ES; FI; FR; HK; HU; ID; IE; IL; IN; IT; KR; MX; NL; RO; RU; SE; TW; UA
	Pilot transmission schemes for wireless multi-carrier communication systems	JP2006-517759	US7,280,467; JP; BR; CA; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; RU; TW; UA
	Hybrid protocol to support communications with multiple networks	JP2006-512867	US7,916,715; JP; AU; BR; CA; CN; DE; EP; GB; IL; IN; KR; MX; NO; RU; SG; TW
	Method, station and medium storing a program for a priority based scheduler with variable scheduling periods and variable scheduled periods	JP4494411	US8,165,148; JP; BR; CA; CN; EP; HK; IN; KR; RU; TW
	Method and apparatus to count broadcast	JP4376898	US7,062,272; US7,409,212;

	content recipients in a wireless telephone network		US7,251,487; US7,813,732; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; RU; TW; UA
	System and method for managing reverse link communication resources in a distributed communication system and corresponding apparatus	JP4713470	US7,979,078; US7,197,319; US8,000,717; JP; CN; EP; HK; KR; TW
	Variable packet lengths for high packet data rate communications	JP4537382	US7,280,562; JP; BR; CA; CN; DE; EP; ES; FR; GB; HK; ID; IL; IN; IT; KR; MX; RU; TW; UA
	Incremental redundancy transmission in a MIMO communication system	JP4741495	US20050052991; JP; AR; BE; BG; BR; CA; CL; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; IE; IL; IN; IT; KR; MX; NL; PH; PL; RO; RU; SE; SG; TW; VN
	Apparatus and method for a secure broadcast system	JP2007-529147	US20050010774; AU; BR; CA; CN; EP; HK; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; VN
	Method and apparatus for providing an efficient control channel structure in a wireless communication system	JP4409576	US20050120097; JP; BR; CA; CN; EG; EP; HK; ID; IL; IN; KR; MX; NO; NZ; PH; RU; SG; TW; UA; VN; ZA
	Method and apparatus for security in a data processing system	JP2007-531337	JP; AU; BR; CA; CN; EP; HK; IL; IN; KR; MX; PH; RU; SG; TH; TW; VN
	Method and apparatus for automatic configuration of wireless communication networks	JP2008-533857	US20060203746; JP; CN; EP; HK; IN; KR; TW
	Pilot transmission and channel estimation	JP2007-519368	US7,339,999; US8,537,908;

	for an OFDM system with excess delay spread		US8,027,399; JP; BR; CA; CL; CN; EP; HK; IL; IN; KR; MX; PH; RU; SG; TH; TW; VN
	Outer coding methods for broadcast/multicast content and related apparatus	JP4768615	US7,318,187; US8,171,381; US8,175,090; US8,291,300; JP; BR; CA; CN; EP; HK; IN; KR; MX; TW
	Method and apparatus for acknowledging reverse link transmissions in a communications system	JP4668908	US7,957,263; JP; BR; CA; CN; DE; EP; GB; HK; IN; KR; MX; TW
	Method and system for signaling in broadcast communication system	JP4546475	US7,912,485; US20110170470; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; RU; TW; UA
	Systems and methods for multiplexing control data For multiple data channels onto a single control channel	JP4382817	US7,613,144; BR; CA; CN; DE; EP; ES; FR; GB; HK; ID; IL; IN; IT; KR; MX; RU; TW; UA
	Systems and methods for communicating control data using multiple slot formats	JP4409574	US7,474,643; US8,023,474; BE; BG; BR; CA; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; IE; IL; IN; IT; KR; MX; NL; PL; RO; RU; SE; TW; UA
	Spatial spreading in a multi-antenna communication system	JP4607901	US8,204,149; US20120250788; BR; CA; CN; DE; EP; ES; FR; GB; HK; IL; IN; IT; KR; MX; PH; RU; SG; TW; VN
	High speed media access control	JP4490432	US8,483,105; US20130287043; JP; AT; BE; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IN; IT; KR; NL; PL; PT; RO; SE; TW
	Staggered pilot transmission for channel	JP5048481	US7,457,231; US7,907,593; JP; BE;

	estimation and time tracking		BG; CA; CL; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; IE; IN; IT; KR; NL; PL; RO; SE; TH; TW
	Transmission of signaling information for broadcast and multicast services	JP4705048	US8,144,735; BR; CA; CN; DE; EP; ES; FR; GB; HK; ID; IL; IN; IT; KR; MX; NL; NZ; RU; TW; UA
	System and method for power control in wireless communication systems	JP4938644	US20050201180; US20080200204; JP; BE; BG; CA; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; IE; IN; IT; KR; NL; PL; RO; SE
	Methods and apparatus for mitigating multi-antenna correlation effect in communication systems	JP4965458	US7,974,359; AR; CN; EP; HK; IN; KR; TW
	Signal acquisition in a wireless communication system	JP4763692	US8,027,372; JP; AR; AT; AU; BE; BR; CA; CH; CL; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IL; IN; IT; KR; MX; MY; NL; NO; PH; PL; PT; RO; RU; SE; TH; VN
	OFDM system with code spreading of signalling data	JP2011-217401	US7,852,746; US20110069737; AR; CA; CL; EP; MY; TW
	Continuous beamforming for a MIMO-OFDM system	JP4643632	US20050265275; US20090290657; JP; CA; CN; EP; HK; IN; KR; MY; TW
	Systems and methods for reducing uplink resources to provide channel performance feedback for adjustment of downlink MIMO channel data rates	JP4796122	US20060205357; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Connected-state radio session transfer in	JP4542140	US8,515,424; US13/947,431; BR;

	wireless communication systems		CA; CN; EP; HK; IN; KR; MX; MY; TW
	Adaptive pilot insertion for a MIMO-OFDM system	JP4690401	US8,000,221; US8,547,820; JP; CA; CN; DE; EP; ES; FR; GB; HK; IN; IT; KR; MY; TW
	Method and apparatus for performing position determination with pre-session action	JP4653180	US7,747,258; US20100261483; JP; EP; HK; IL; KR; SG
	Dynamic assignment of home agent and home address in wireless communications	JP4787250	US20060002356; JP; BR; CA; CN; DE; EP; ES; FR; GB; HK; IN; IT; KR; MX; NL; TW
	Coded-bit scrambling for multi-stream communication in a MIMO channel	JP2008-512053	JP; BE; BG; BR; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; IE; IN; IT; KR; MX; NL; RO; SE; TW
	Efficient signaling over access channel	JP4625079	US20060018336; JP; AR; AT; AU; BE; BG; BR; CA; CH; CN; CZ; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IL; IN; IT; KR; MX; NL; PH; PL; PT; RO; RU; SE; SG; TH; TW; VN
	Method and apparatus for pseudo-secret key generation to generate a response to a challenge received from service provider	JP2011-234381	CA; CN; EP; HK; IN; KR; MY; TH
	Initial pilot frequency selection	JP4950068	US8,009,551; JP; CL; CN; DE; EP; ES; FR; GB; HK; IN; IT; KR; TW
	Default configurations with differential encoding in a wireless communication system	JP2008-510395	US8,254,921; JP; BR; CN; DE; EP; FI; FR; GB; HK; IL; IT; KR; MX; RU; SE; TW; UA
	Apparatus, system, and method for	JP4598074	US7,899,480; US8,359,060; JP; AT;

	managing transmission power in a wireless communication system		BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IN; IT; KR; MX; NL; PL; PT; RO; SE; TW
	Minimizing feedback by sending a quality indicator for a non-restrictive reuse set and a vectored quality indicator for other reuse sets	JP4664378	US7,548,752; US20100002597; JP; AR; CA; CN; EP; HK; IN; KR; TW
	Time multiplexing of unicast and multicast signals on a downlink carrier frequency in a wireless communication system	JP4653174	US20060098567; JP; BR; CN; EP; HK; IN; KR; MX; MY
	Method and apparatus for enhancing signal-to-noise ratio of position location measurements	JP4902638	US7,920,544; US8,144,682; US8,606,220; JP; CA; EP; HK; RU
	Method of communicating a frame having a plurality of modulation schemes	JP2011-193484	US8,179,876; CA; CL; CN; EP; HK; IN; KR; MY; TW; VE
	Interference control in a wireless communication system	JP5166577	US20060209721; US20120270582; AR; AU; BR; CA; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Method and apparatus for high rate data transmission in wireless communication	JP5306807	US20060221883; JP; BR; CA; CN; EP; HK; IN; KR; MY; RU; SG; TW
	Methods and systems for providing enhanced position location in wireless communications	JP2009-521192	US7,893,873; US20110149863; US7,876,265; JP; BR; CA; CN; EP; IN; KR; RU; TW
	Pilot transmission and channel estimation	JP2008-536359	US8,135,088; US20120188994; JP;

	for a communication system utilizing frequency division multiplexing		AR; AT; AU; BE; BR; CA; CH; CL; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Wireless handoffs between multiple wireless networks	JP4981790	US20060245395; CN; EP; IN; KR
	Systems and methods for control channel signaling	JP4752003	US20060223449; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; NO; PH; RU; SG; TW; UA; VN
	Method and apparatus for enhanced file distribution in multicast or broadcast	JP2008-536405	US8,351,363; JP; CN; EP; HK; IN; KR; MY; TW
	Multi-carrier operation in data transmission systems	JP4750843	US7,961,700; JP; AT; AU; BE; BG; BR; CA; CH; CN; CZ; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Ciphering and re-ordering packets in a wireless communication system	JP2008-539678	US8,228,917; JP; CN; EP; IN; KR; MY; TW
	Code division multiplexing in a single-carrier frequency division multiple access system	JP2012-239186	US20070041404; CL; CN; EP; HK; IN; KR; TW
	Negotiated channel information reporting in a wireless communication system	JP4559521	US7,907,958; US20120188883; CN; EP; IN; KR; MY
	Method and apparatus for adaptive registration and paging area determination	JP2008-547279	US8,254,924; JP; AU; BR; CA; CL; CN; EP; ID; IL; IN; KR; MX; NZ; PH; RU; SG; TW; UA; VN
	Enhanced frequency division multiple access	JP2008-541671	US8,077,692; US8,503,421; JP; BE;

	for wireless communication		BG; CL; CZ; DE; EP; ES; FI; FR; GB; HK; HU; IE; IN; IT; KR; MY; NL; PL; RO; TW
	VOIP emergency call handling	JP5155165	US20070060097; JP; BR; CA; CN; EP; HK; KR; RU; SG; TW
	Distributed protocol over a wireless connection	JP2009-506649	US7,899,004; AR; BR; EP; HK; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Efficient periodic location reporting in a radio access network	JP2009-513036	US20060293066; JP; BR; CA; EP; HK; IL; IN; KR; RU; SG
	Methods and apparatus for efficient providing of scheduling information	JP4787319	US8,098,667; US20120093136; JP; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Method and apparatus for selection of virtual antennas	JP4819897	US8,073,068; JP; AR; BR; CA; CN; EP; HK; ID; IL; KR; MX; NO; NZ; RU; TH; TW; UA; VN
	Inter-system handover using legacy interface	JP4902651	US8,553,643; CN; EP; IN; KR; MY; TW
	Method and apparatus for providing antenna diversity in a wireless communication system	JP2009-506656	US20070041457; US20120140798; US20120140838; US20120120925; JP; CL; CN; EP; HK; IN; KR; TH; TW
	Method and apparatus for pilot multiplexing in a wireless communication system	JP2009-524362	US8,130,857; US20100142490; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Reverse link power control for an OFDMA	JP2009-506654	US7,965,789; US8,520,745;

	system		US20100034315; JP; AR; AT; BE; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IN; IT; KR; NL; PL; PT; RO; SE; TH; TW
	Method and apparatus for packet communications in wireless systems	JP4865795	US8,094,595; US8,098,635; JP; CN; DE; EP; ES; FR; GB; IN; IT; KR; TW
	System and method for multi-network coverage	JP5080502	US20070211675; US20080304461; US20100110993; JP; CN; DE; EP; GB; HK; IN; KR
	A method and apparatus for pre-coding frequency division duplexing system	JP4763797	US20070097889; BR; CA; CL; CN; EP; HK; IL; IN; KR; MX; MY; NO; NZ; PH; RU; TH; TW; UA; VN
	Unitary precoding based on randomized FFT matrices	JP2009-516942	US20070097856; JP; CN; EP; HK; IN; KR; TW
	Pilot symbol transmission in wireless communication systems	JP4902660	US20070098050; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; UA; VN
	Precoding for segment sensitive scheduling in wireless communication systems	JP2009-514400	US20070098099; JP; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; LI; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; UA; VN
	Resource allocation during tune-away	JP4814334	US20070099614; BR; CA; CN; EP; IL; IN; KR; MX; MY; NO; RU; TW; UA; VN
	A method and apparatus for bootstraping information in a communication system	JP5038320	US20070097897; BR; CA; CN; DE; EP; GB; HK; IL; IN; KR; MX; MY; NO; NZ; PH; RU; TW; UA; VN
	Methods and apparatus for saving power by	JP4824766	US20070097894; BR; CA; CN; EP;

	designating frame interlaces in communication systems		HK; ID; IL; IN; KR; MX; MY; NO; RU; SG; TH; UA; VN
	Shared signaling channel	JP4960369	US20070097853; AR; AU; BR; CA; CL; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Method and apparatus for achieving flexible bandwidth using variable guard bands	JP2012-010351	US20070147226; JP; AR; BR; CA; CN; EP; HK; IN; KR; SG; TW
	Frequency hopping of pilot tones	JP2009-538058	BR; EP; HK; IN; RU
	Efficient transmission on a shared data channel for wireless communication	JP4875098	US8,489,128; US13/942,700; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Data state transition during handoff	JP4843052	US20070177547; AR; CN; EP; HK; IN; KR; TW
	Flexible medium access control (MAC) method for ad hoc wireless networks	JP4965577	US8,081,592; US8,416,728; US8,391,199; JP; AR; BR; CA; CN; EP; HK; IN; KR; RU; TH; TW
	Methods and apparatus for determining the location of a mobile device in an OFDM wireless network	JP4819910	US7,706,328; US8,489,124; US20130163458; BR; CN; EP; IN; KR; RU; SG; TW
	Localized and distributed allocation multiplexing and control	JP5215191	US8,503,373; JP; BR; CA; CN; EP; IN; KR; RU; TW
	Privacy protection in communications systems	JP2009-523396	US20070168662; BR; EP; IN; KR; RU
	Global navigation satellite system	JP2008-550408	US7,768,449; US8,334,807; JP; CN; EP; IN; KR
	Selection of an access point in a	JP5102296	US20080049702; JP; CN; EP; HK;

	communications system		IN; KR; TW
	Open loop power offset update	JP5265675	US7,957,757; US8,548,515; AU; BR; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; MY; NZ; RU; UA; VN
	An apparatus and method for fast access in a wireless communication system	JP5107939	US20070183361; BE; BG; BR; CA; CL; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; RO; RU; SE; TW; VN
	Methods and apparatuses for transmitting non-decodable packets	JP2010-521162	AU; BR; CN; EP; ID; IL; IN; KR; MX; MY; NZ; RU; TW; UA; VN
	Orthogonal frequency division multiplexing based spread spectrum multiple access	JP3703002	US6,473,418; AU; BR; CA; CN; DE; EP; ES; FI; FR; GB; ID; IN; IT; KR
	Communications system employing orthogonal frequency division multiplexing based spread spectrum multiple access	JP4593767	US6,553,019; AU; BE; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; IE; IN; IT; KR; NL; SE
	Methods and apparatus of providing transmit and/or receive diversity with multiple antennas in wireless communication systems	JP4685789	US7,039,370; US7,610,024; US8,571,493; JP; CA; CN; EP; HK; IN; KR
	Efficient paging in a wireless communication system	JP4638497	US7,711,377; US20100190514; US20100178942; JP; BR; CA; CN; EP; HK; IL; IN; KR; MX; NO; NZ; PH; RU; SG; UA; VN; ZA
	Methods and apparatus for communicating transmission backlog information	JP5006337	US8,437,251; US20130242888; AR; AT; BE; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IN; IT; KR; NL; PL; PT; RO; SE; TH; TW
	Methods and apparatus of implementing	JP5096367	US20070149227; JP; AR; AT; BE;

	and/or using a dedicated control channel		CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IN; IT; KR; NL; PL; PT; RO; SE; TH; TW
	Methods and apparatus for flexible reporting of control information	JP4885980	US20070149228; BE; BG; CL; CN; CZ; DE; EP; ES; FI; FR; GB; HU; IE; IN; IT; KR; NL; PL; RO; SE; TH; TW
	Methods and apparatus for communicating and/or using transmission power information	JP4801172	US8,514,771; US20130230027; JP; CN; EP; IN; KR; TW
	Grouping of users for MIMO transmission in a wireless communication system	JP2009-530987	US20070223423; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; TW; UA; VN
	Resource allocation to support single-user and multi-user MIMO transmissions	JP4944186	US8,059,609; BR; CA; CL; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; VN
	Uplink channel estimation using a signaling channel	JP2009-530992	US20080032630; JP; AR; CN; DE; EP; ES; FR; GB; HK; IN; IT; KR; TW
	Methods and apparatus for supporting mobile virtual network	JP4927939	US8,213,934; CN; EP; HK; IN; KR; TW
	Methods and apparatus related to using a wireless terminal scrambling identifier	JP5306991	US8,139,660; AR; CN; EP; IN; KR; TW
	Pseudo wires for mobility management	JP2013-102468	US8,406,191; US20130163562; CN; EP; IN; KR
	Feedback of channel state information for MIMO and sub-band scheduling in a wireless communication system	JP5107998	US8,014,455; US8,503,555; AR; BE; BG; BR; CA; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; IE; IN; IT; KR; NL; PL; RO; RU; SE; SG; TW
	An apparatus and method for fast access in a	JP4965642	US20080019306; AU; BR; CA; CL;

	wireless communication system		CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Expedited handoff	JP4938849	US8,064,401; US20120034921; JP; CN; EP; HK; IN; KR; TW
	Method and apparatus for quick-paging of terminals in a wireless communication system	JP5129250	US20080014969; JP; CN; EP; HK; IN; KR; TW
	Uplink access request in an OFDM communication environment	JP5065389	US7,869,421; US20110075639; JP; CN; EP; IN; KR
	Method and apparatus for enhanced paging	JP5080560	US20070254679; US20110201361; JP; AT; AU; BE; BG; BR; CA; CH; CL; CN; CZ; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	A broadcast channel for E-UTRA	JP5215291	US20080072269; JP; AR; BR; CA; CN; EP; HK; IN; KR; RU; TW
	Dynamic frequency allocation and modulation scheme for control information	JP2009-543528	US8,374,161; US20130142149; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; TW; UA; VN
	Propagating session state changes to network functions in an active set	JP5001360	US8,601,130; BR; CA; CN; EP; HK; IN; KR; RU; TW
	Signal acquisition in a wireless communication system	JP5043934	US20080285526; JP; BR; CA; CN; EP; IN; KR; RU; SG; TH; TW
	Signal acquisition for wireless communication systems	JP2009-544178	US20070281642; JP; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Preamble structure and acquisition for a	JP2009-540769	US20080279220; JP; BR; CA; CN;

	wireless communication system		DE; EP; ES; FR; GB; HK; IL; IN; IT; KR; MX; NO; NZ; PH; RU; TW; UA; VN
	Using codewords in a wireless communication system	JP5199283	US7,839,308; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Data routing via lower layers in a communication system	JP2009-542119	US20080101356; JP; CN; EP; HK; IN; KR
	Method and apparatus for selection mechanism between OFDM-MIMO and LFDM-SIMO	JP4976491	US8,081,698; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Frequency hopping in an SC-FDMA environment	JP2009-544189	US20080089286; JP; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; LI; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Method and apparatus for frequency selective and frequency diversity transmissions in a wireless communication system	JP2009-544258	US8,369,424; US20130070724; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; NO; NZ; PH; RU; TW; UA; VN
	Method and apparatus for fragmenting a control message in a wireless communication system	JP5096495	US8,000,326; CN; EP; IN; KR; TW
	Variable control channel for a wireless communication system	JP5016044	US20080095106; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Method and apparatus for sending signaling	JP5185268	US8,477,593; US20100284377; JP;

	for data transmission in a wireless communication system		BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Method and apparatus for random access in an orthogonal multiple-access communication system	JP5086349	US8,295,243; US20130016701; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Methods and apparatus for power allocation and/or rate selection for UL MIMO/SIMO operations with PAR considerations	JP2010-509863	US20100029320; JP; AU; BR; CA; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Feedback of precoding control indication (PCI) and channel quality indication (CQI) in a wireless communication system	JP2010-502114	US20080043867; JP; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Method and apparatus for flexible pilot pattern	JP2010-502118	US8,174,995; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; RU; TW; VN
	Semi-persistent scheduling for traffic spurts in wireless communication	JP2010-502127	US20080117891; JP; AU; BR; CA; CN; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Acquisition in frequency division multiple access systems	JP2010-502128	US8,223,625; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Systems and methods for key management for wireless communications systems	JP4965655	US20080070577; BR; CA; CN; EP; IN; KR; RU; TW
	Method and apparatus for acknowledgment repetition in orthogonal systems	JP2010-503291	US20080095109; JP; AU; BR; CA; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Method and apparatus for data symbol and	JP4903872	US8,363,606; US20130136112; BR;

	control symbol multiplexing		CN; EP; HK; ID; IL; IN; KR; MX; NO; NZ; PH; RU; UA; VN
	Signaling transmission with localized spreading for wireless communication	JP2010-503348	US8,457,221; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Codeword permutation and reduced feedback for grouped antennas	JP2010-503335	US20080080641; JP; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Method and apparatus for preparing connection transfer between an IP based communication system (LTE/SAE) and a PDP context based communication system (UMTS/GPRS)	JP2010-506462	US7,920,522; JP; BR; CA; CN; EP; IN; KR; RU; TW
	Dynamic channel quality reporting in a wireless communication system	JP5021748	US8,068,427; JP; BR; CA; CN; EP; IN; KR; RU; TW
	Semi-connected operations for wireless communications	JP2010-541330	US8,284,706; JP; BR; CA; CN; DE; EP; ES; FR; GB; IN; IT; KR; RU; TW
	Synchronization transmissions in a wireless communication system	JP5074508	US8,509,267; US20130279448; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Sub-band dependent resource management	JP5329417	US20100027502; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; RU; TW; VN
	Method and apparatus for processing primary and secondary synchronization signals for wireless communication	JP5038427	US8,503,485; US20130259013; BR; CA; CN; DE; EP; ES; FR; GB; IN; IT; KR; RU; TW
	Random access signaling transmission for	JP5001373	US8,599,706; JP; AU; BR; CA; CN;

	system access in wireless communication		EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Re-synchronization of temporary UE IDS in a wireless communication system	JP4981914	US8,374,150; US20130155981; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Method and apparatus for handling user equipment capability information	JP5139436	US20090093280; BR; CA; CN; DE; EP; GB; HK; IN; KR; RU; SG; TW
	Frequency domain PN sequence	JP2012-501600	BR; EP; KR; MX; MY; NZ; RU; SG; UA
	Uplink ACK transmission for SDMA in a wireless communication system	JP4995916	US8,300,582; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Method and apparatus for increasing ack resources for a wireless communication system	JP2010-508783	US20100034156; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Space division multiple access channelization in wireless communication systems	JP2010-506546	US7,903,615; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; TW; VN
	A method and apparatus for setting reverse link CQI reporting modes in wireless communication system	JP4865802	US7,924,800; US8,599,712; US14/033,322; CN; EP; HK; IN; KR
	A method and apparatus for bit demultiplexing in a wireless communication systems	JP4785930	US7,864,819; CN; EP; HK; IN; KR
	Reverse link resource assignment and reverse link power control for wireless communication systems	JP2010-507288	US8,050,701; US8,423,073; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; UA; VN
	Inter-cell power control in the presence of	JP5265559	US20100105406; BR; CA; CN; EP;

	fractional frequency reuse		IN; KR; RU; TW
	Apparatus and method of random access for wireless communication	JP5166427	US20100093386; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; PH; RU; SG; TW; UA; VN
	Reliable uplink resource request	JP2010-508786	US20100074193; JP; AU; BR; CN; EP; HK; ID; IL; IN; KR; MX; NO; NZ; PH; RU; UA; VN
	Method and apparatus for hybrid FDM-CDM structure for single carrier based control channels	JP5275245	US20100118855; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Systems and methods for using internet mobility protocols with non internet mobility protocols	JP5166424	US8,155,078; BR; CA; CN; EP; IN; KR; RU; TW
	Multiplexing of control and data with varying power offsets in a SC-FDMA system	JP5080585	US20100027450; AU; BR; CA; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Frame structures for wireless communication systems	JP2010-507993	US20090232079; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Method and apparatus for codebook exchange in a multiple access wireless communication system	JP2010-508720	US7,961,640; US20110222627; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; TW; VN
	Inter-enode B handover procedure	JP2009-535426	US20100238903; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Selective phase connection establishment	JP4927990	US20080310378; BR; CA; CN; EP;

			HK; IN; KR; RU; TW
	MIMO transmission with layer permutation in a wireless communication system	JP2013-123240	US8,588,319; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Method for transmit power control dependent on subband load	JP5113184	US20100093363; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; UA; VN
	Uplink timing control	JP5199335	US20080279131; JP; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Providing antenna diversity in a wireless communication system	JP5215317	US20080117999; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Codeword level scrambling for MIMO transmission	JP2010-509860	US20100074350; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; PH; RU; SG; TW; UA; VN
	Method and apparatus for SRNS relocation in wireless communication systems	JP2010-509870	US7,995,534; JP; BR; CA; CN; DE; EP; ES; FR; GB; HK; IN; IT; KR; RU
	System selection based on application requirements and preferences	JP2010-531565	BR; EP; HK; IL; IN; KR; MX; NZ; PH; RU; TW; UA; VN
	Methods and apparatus for implementing proxy mobile IP in foreign agent care-of address mode	JP5226690	US8,406,237; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; PH; RU; TW; UA; VN
	Methods and apparatus for transferring a mobile device from a source eNB to a target eNB	JP5199276	US20080130580; JP; CN; EP; HK; IN; KR; TW
	Methods and apparatus for RLC re-transmission schemes	JP4965666	US8,290,428; BR; CA; CN; EP; HK; IN; KR; RU; TW
	MIMO transmission with rank-dependent	JP5096497	US7,995,671; US8,503,567; AU; BR;

	precoding		CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Using DTX and DRX in a wireless communication system	JP2010-516208	US20090122736; US13/967,234; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; UA; VN
	Method and apparatus for utilizing other sector interference (OSI) indication	JP2010-516113	US8,433,357; US20130215760; BR; CA; CN; DE; EP; ES; FR; GB; HK; IN; IT; KR; NL; RU; SG; TW
	Fast cell search	JP2010-516204	US20090131037; US20120122446; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; UA; VN
	Radio resource connection (RRC) establishment for wireless systems	JP2013-102464	US20080167042; BR; CA; CN; EP; HK; IN; KR; RU; TW
	Pilot transmission in a wireless communication system	JP5021763	US8,457,315; US20130243039; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	CQI reporting for MIMO transmission in a wireless communication system	JP5108027	US20080188259; US20110286353; BR; CA; CN; EP; HK; IN; KR; RU; TW
	Transmission of information using cyclically shifted sequences	JP2010-516203	US20080165893; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Pilot structure with multiplexed unicast and SFN transmissions	JP5265575	US8,077,801; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	A method and apparatus for new key	JP5209703	US20080267407; AU; BR; CA; CN;

	derivation upon handoff in wireless networks		EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Mapping uplink acknowledgement transmission based on downlink virtual resource blocks	JP5185290	US8,169,956; US20120201217; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; LI; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; UA; VN
	Flexible DTX and DRX in a wireless communication system	JP5301467	US8,169,957; US20130258919; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; TW; UA; VN
	Method and apparatus for emergency broadcast using an emergency broadcast-multicast service	JP5074525	US20080227428; BR; CA; CN; EP; HK; IL; IN; KR; MX; MY; NZ; PH; RU; TW; UA; VN
	Demodulation of a subset of available link assignment blocks	JP5048789	US8,238,295; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Method an apparatus for power control during DTX operation	JP4965668	US7,881,742; US8,060,130; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Hopping structures for broadband pilot signals	JP5307033	US8,213,483; JP; BR; CA; CN; EP; HK; IL; IN; KR; MX; MY; PH; RU; TW; UA; VN
	Method and apparatus for inter-system handover	JP2010-519855	US8,208,925; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Methods and apparatus for performing	JP5290271	US20080239992; BR; CA; CN; EP;

	channel tree operations		HK; IL; IN; KR; MX; MY; NZ; RU; SG; TW; VN
	Method and apparatus for handoff between access systems	JP4988873	US8,289,920; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Scheduling of dynamic broadcast channel	JP5290210	US8,457,093; US20130250926; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Configurable acknowledgement processing in a wireless communication system	JP2010-524282	US20080253318; BR; CA; CN; EP; IN; KR; RU; TW
	Pilot transmission by relay stations in a multihop relay communication system	JP2010-521928	US20080227386; BR; CA; CN; EP; IN; KR; RU; TW
	Hybrid pilot configuration	JP2010-521890	US20080225993; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; RU; TW; UA; VN
	User profile, policy, and PMIP key distribution in a wireless communication network	JP4965671	US20080263631; BR; CA; CN; EP; IN; KR; RU; TW
	PICH-HS timing and operation	JP5054125	US20080227449; US20120147816; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Method and apparatus for polling in a wireless communication system	JP5054128	US20080225824; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Connection independent session handoff	JP5016102	US20080261598; BR; CA; CN; EP;

	from source session reference network controller to target SRNC		HK; IL; IN; KR; MX; MY; NZ; PH; RU; TW; UA; VN
	Backhaul communication for interference management	JP2010-522516	US20080233967; BR; CA; CN; EP; IN; KR; RU; TW
	Apparatus and method of performing a handoff in a communication network	JP4927991	US20080240039; AU; BR; CA; CN; EP; HK; IL; IN; KR; MX; PH; RU; SG; TW; UA; VN
	Method and apparatus for determining broadcast messages in wireless signals	JP2010-522523	US20080232294; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Circular buffer based rate matching	JP2010-523064	US20090049359; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Handoff of data attachment point	JP2010-524359	US8,059,595; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Enhanced pilot signal	JP5231536	US20090124265; BR; CA; CN; EP; HK; IL; IN; KR; MX; MY; NZ; PH; RU; VN
	Method and apparatus for providing gateway relocation when performing a handover	JP5248597	US8,483,174; JP; CN; EP; IN; KR; TW
	Extended microsleep for communications	JP2010-526495	US20090016252; JP; AU; BR; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Position location for wireless communication systems	JP2010-529419	US8,326,318; US20130065610; JP; CN; EP; IN; KR
	Flexible signaling of resources on a control	JP5296056	US20090325585; JP; AT; AU; BE;

	channel		BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Method and apparatus for UL ACK allocation	JP2010-527543	US20080273513; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Method and apparatus for efficient support for multiple authentications	JP5144751	US8,145,905; BR; CA; CN; EP; IN; KR; RU; TW
	Mobile IP home agent discovery	JP5237362	US8,559,321; US14/054,327; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Scrambling methods for synchronization channels	JP5096566	US7,920,598; CN; EP; HK; IN; KR; TW
	Method and apparatus for sending scheduling information for broadcast and multicast services in a cellular communication system	JP5231540	US20090046617; US14/056,181; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Pseudo-random sequence mapping in wireless communications	JP5102353	US20080305788; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; NZ; PH; RU; TW; UA; VN
	Self-configuration for femtocells	JP2011-514566	US8,467,304; BR; EP; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; VN
	Quality of service information configuration	JP2010-531097	US20080310303; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; PH; RU; TW; VN
	Methods and apparatus for neighbor	JP2010-530723	US20080311914; BR; CA; CN; EP;

	discovery of base stations in a communication system		HK; ID; IL; IN; KR; MX; NZ; RU; TW; VN
	Rate matching with multiple code block sizes	JP5242680	US20090041110; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Method and apparatus for PDCP reordering at handoff	JP2010-531115	US20080310367; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Delivery of handover command	JP5209710	US20090046656; JP; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Multiplexing of sounding singals in ACK and CQI channels	JP2010-530724	US8,493,873; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; RU; TW; UA; VN
	Method and apparatus for fast inter-system handover	JP5199347	US20090016300; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Control channel format indicator frequency mapping	JP5180296	US8,391,400; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Encryption of the scheduled uplink message in random access procedure	JP5215388	US8,180,058; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Recovery from handoff error due to false detection of handoff completion signal at access terminal	JP4927994	US20090029706; JP; BR; CA; CN; DE; EP; ES; FR; GB; HK; IL; IN; IT; KR; MX; NZ; PH; RU; TW; UA; VN
	Scrambling codes for secondary	JP2011-501517	US8,503,547; AU; BR; CA; CN; EP;

	sychronization codes in wireless communication systems		HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	MIP/PMIP concatenation when overlapping address space are used	JP2010-534034	US8,228,935; AU; BR; CN; EP; HK; ID; IL; IN; KR; MX; PH; RU; TW; UA; VN
	Mobile IP multiple registrations and PCC interactions	JP5054202	US20090196231; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Methods and systems for CDMA network switching notification in a WIMAX network	JP5329652	US20090285186; BR; CN; EP; IN; KR; SG
	Methods and apparatus for resolving pilot pseudorandom noise code conflicts in a communication system	JP2010-534036	US8,571,553; US20120263032; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Optimizing in-order delivery of data packets during wireless communication handover	JP2010-537505	US20090052397; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Methods and apparatus for in-order delivery of data packets during handoff	JP5184633	US8,467,349; BR; CA; CN; EP; HK; IL; IN; KR; MX; PH; RU; SG; TW; UA; VN
	Multiplexing and transmission of traffic data and control information in a wireless communication system	JP2010-536260	US8,467,367; US20130250895; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; TW; VN
	Switching carriers to join a multicast session in a wireless communications network	JP5318939	US20090252076; BR; CA; CN; EP; IN; KR; RU
	Quality of service continuity	JP5129349	US20090201884; AU; BR; CA; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; MY; NZ; RU; SG; TW; UA; VN
	Frequency diverse transmissions in a	JP5296075	US8,526,371; JP; BR; CA; CN; EP;

	wireless communication system		HK; ID; IL; IN; KR; MX; MY; PH; RU; TW; UA; VN
	Method and apparatus for supporting broadcast and multicast services in a wireless communication system	JP5038502	US20090047942; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Mimo transmission with spatial pre-coding	JP2011-517373	US20090046800; JP; BR; CA; CN; DE; EP; GB; IL; IN; KR; MX; MY; RU; SG; TW; VN
	Resource scaling in wireless communication systems	JP5175359	US20090116389; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Improved blind decoding in a mobile environment	JP5254341	US20090067378; CN; EP; IN; KR; TW
	Paging user devices in a wireless access network	JP5129334	US8,520,698; US20130012206; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Resolving node identifier confusion	JP5155407	US20090132674; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Configuring an access point of a FEMTO cell	JP5113260	US20090129354; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; RU; TW; UA; VN
	Methods and apparatus for including	JP5275354	US7,860,036; US20110064007; BE;

	communication mode information (TDD or FDD) in a transmission frame for system acquisition		BG; BR; CA; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; PL; RO; RU; SE; TW; UA; VN
	FEMTO cell synchronization and pilot search methodology	JP2011-501526	US20090097452; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Method and apparatus of power control for a public warning system	JP2011-501885	US8,260,249; US20120280792; AT; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; PL; PT; RO; RU; SE; TW; VN
	Integrity protection and/or ciphering for UE registration with a wireless network	JP2012-501604	US20100054472; CN; EP; IN; KR; TW
	Assisted initial network acquisition and system determination	JP5290331	US20090221283; AU; BR; CA; CN; DE; EP; ES; FR; GB; HK; ID; IL; IN; IT; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Medium access control header format	JP5096586	US20090141670; BR; CA; CN; EP; HK; IL; IN; KR; MX; MY; RU; TW; VN
	Method and apparatus for implementing LTE RLC header formats	JP2010-528104	US20090086710; BR; CA; CN; EP; HK; IL; IN; KR; MX; MY; RU; TW; UA; VN
	Mobile access in a diverse access point network	JP5175356	US8,588,738; US14/082,646; BR; CN; EP; HK; IL; IN; KR; MX; MY; NZ; PH; TW; UA; VN
	Efficient system identification schemes for	JP2011-504310	US20090129298; JP; AU; BR; CA;

	communication systems		CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Access point configuration based on received access point signals	JP5296089	US20090122773; JP; BR; CA; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; TW; UA; VN
	Methods and apparatus for self configuring network relations	JP2011-504674	US8,285,281; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Arrangement and method for transmitting control information in wireless communication systems	JP5199378	US8,254,244; US20120307787; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Methods and systems for HFN handling at inter-base station handover in mobile communication networks	JP4976558	US8,208,498; US20120230298; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Service data unit discard timers	JP2011-504675	US8,208,394; AU; BR; EP; HK; ID; IL; IN; KR; MX; RU; TW; VN
	Time slot reservation for a dominant interference scenario in a wireless communication network through direct communication between interferred and Interfering base station	JP2011-504062	US20090131065; JP; BR; CA; CN; EP; HK; IL; IN; KR; MX; MY; RU; TW; UA; VN
	Interference management in a wireless communication system using adaptive path loss adjustment	JP5275363	US20090137241; BR; CA; CN; EP; HK; IL; IN; KR; MX; MY; RU; TW; UA; VN
	Control information allocation method in a communications system	JP2011-514727	US20090196247; JP; BR; CA; CN; EP; IN; KR; RU; TW
	Method and apparatus for sending and	JP2011-509565	US20090156194; AT; AU; BE; BR;

	receiving random access response in a wireless communication system		CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Method and apparatus for transfer of a message on a common control channel for random access in a wireless communication network	JP5318884	US20090163211; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	System information modification notification and detection in wireless communications	JP4991941	US8,180,335; US20120220329; BR; CA; CN; EP; IL; IN; KR; MX; MY; PH; RU; TW; UA; VN
	Resource allocation randomization	JP2011-514028	US20090181692; JP; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; RU; TW; UA; VN
	Policy control and charging (PCC) rules based on mobility protocol	JP5102369	US8,155,020; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Wireless network synchronization	JP2011-514716	US8,213,405; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; PH; PL; PT; RO; RU; SE; SG; TW; UA
	Configuring an identifier for an access point of a FEMTO cell	JP5059945	US20090129291; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Enhanced multiplexing system and technique for uplink control channels	JP2011-511603	US20090201869; BR; CA; CN; EP; HK; IL; IN; KR; MX; MY; NZ; PH; RU; TW; UA; VN
	Policy control for encapsulated data flows	JP5175366	US20090199268; AU; BR; CA; CN;

			EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Methods and apparatus for controlling transmission of a base station	JP5118210	US20090213825; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Methods and systems for parallel acquistion of system information from multiple base stations	JP5199475	US20100067448; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Transmission and reception of dedicated reference signals	JP5265755	US20100062783; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Providing multiple levels of service for wireless communication	JP2011-519195	US8,179,903; US20130107702; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Dynamic assignment of ACK resource in a wireless communication system	JP2011-517191	US20090245194; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Method of network management by assistance from terminal using control-plane signaling between terminal and network	JP2011-515955	US20090257353; US13/970,135; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Fast carrier allocation in multi-carrier systems	JP2011-517895	US20090257387; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Filtering semi-persistent scheduling false	JP5290395	US20090257385; AT; AU; BE; BR;

	alarms		CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Method and apparatus for resource management in a wireless communication system	JP2011-517892	US20090238131; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Cell selection and reselection in deployments with home nodeBs	JP5123426	US20090238114; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Dynamic home network assignment	JP2011-519198	US8,503,460; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Method and apparatus to report and manage cells in a multi carrier system	JP2011-519508	US8,165,026; AU; BR; CA; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Device managed access point lists in wireless communications	JP2011-517186	US20090245176; JP; AU; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Encoding and decoding of control information for wireless communication	JP2011-518496	US20090245284; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Method and apparatus for mapping virtual resources to physical resources in a wireless communication system	JP2011-516006	US8,493,835; US13/948,021; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Scrambling and modulation to constrain the	JP2011-516008	US20090245421; AT; AU; BE; BR;

	constellation size of ACK/NAK transmission on the data channel		CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Method and apparatus for resource allocation in wireless communication systems	JP5329640	US20090279493; US20130155982; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Methods of reliably sending control signal	JP2011-519205	US20090257449; JP; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Method and system for facilitating execution of automatic neighbor relation functions	JP2011-517905	US8,437,752; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Determinative segmentation resegmentation and padding in radio link control (RLC) service data units (SDU)	JP2011-517904	US8,396,083; US13/794,451; JP; AU; BR; CA; CN; DE; EP; FR; GB; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Using multicast broadcast single frequency network (MBSFN) subframes to send unicast information	JP2011-521512	US20090252077; JP; BR; CA; CN; EP; ID; IL; IN; KR; MX; MY; NZ; PH; RU; TW; UA; VN
	Systems and methods to define control channels using reserved resource blocks	JP2011-517234	US20090257388; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Selective bearer establishment in evolved	JP5280517	US20090252132; BR; CA; CN; EP;

	universal terrestrial radio access (E-UTRA) and evolved packet system (EPS)		HK; ID; IL; IN; KR; MX; MY; NZ; RU; TW; UA; VN
	Bundling of ACK information in a wireless communication system	JP2011-520394	US20090279460; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Interference reduction between OFDM carriers by carrier spacing optimization	JP5204302	US8,494,065; BR; CN; EP; IN; KR; RU; SG; TW
	Uplink resource management in a wireless communication system	JP5290404	US20090274100; CN; EP; IN; KR; TW
	Method and apparatus for management of automatic neighbor relation function in wireless networks	JP2011-518531	US8,583,119; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Interference mitigation by transmitting on a second, lower, power level	JP2011-526468	US20090325626; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Methods and apparatuses for uplink control and data transmission in a mixed single and multiple carrier network	JP2013-500630	US20110176498; CN; EP; IN; KR; TW
	Partial radio link control status report	JP2011-521537	US8,526,440; AU; BR; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; RU; TW; VN
	Method and apparatus for downlink data arrival	JP2011-521540	US20090274077; CN; EP; IN; KR; TW
	Method and apparatus for uplink	JP2011-520360	US20090274109; AU; BR; CA; CN;

	ACK/NACK resource allocation		EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Autonomous downlink code selection for FEMTO cells	JP2011-522468	US20100118801; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Anchor carrier in a multiple carrier wireless communication system	JP2011-530966	US20100034163; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Multi-carrier design for control and procedures comprising pairing of carriers	JP2011-530965	US20100035625; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Downlink grants in a multicarrier wireless communication system	JP5269996	US20100034303; JP; AU; BR; CA; CN; EP; HK; IL; IN; KR; NZ; RU; SG; TW
	Multi-carrier grant design	JP5231646	US20100040004; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	A method and apparatus for PCC enhancement for flow based mobility	JP2013-186794	US20090305701; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Correlating registrations originating from a device	JP2011-530887	US20100197305; JP; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Using identifiers to establish communication	JP2011-504690	US20090132675; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Registration and access control in FEMTO	JP2011-523308	US20090305699; AU; BR; CA; CN;

	cell deployments		DE; EP; ES; FR; GB; HK; ID; IL; IN; IT; KR; MX; MY; NL; PH; RU; SG; TW; UA; VN
	Method and apparatus for managing interaction between DRX cycles and paging cycles	JP5313341	US20090310503; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Apparatus and method for generating performance measurements in wireless networks	JP5118251	US8,098,590; JP; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Conveying session continuity information in a multi-component communication session	JP2011-525752	US20090319676; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	System and method for network management	JP2011-529304	US20100022263; US20120290720; US20120289248; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Coordinated transmission between cells of a base station in a wireless communications system	JP2011-530884	US8,340,605; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Management of UE operation in a multi-carrier communication system	JP2011-525782	US8,184,599; JP; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	MIMO and SDMA signaling for wireless very high throughput systems	JP2011-523951	US20100046542; EP; IN; KR
	Method and apparatus for power control of	JP2011-525786	US8,494,572; US13/946,802; JP; AU;

	first data transmission in random access procedure of FDMA communication system		BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Network element configuration scheme	JP5313346	US8,184,647; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Synchronous TDM-based communication in dominant interference scenarios	JP2011-527876	US20100008282; US20130242959; US20130250855; JP; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Method and apparatus for handling measurement gaps in wireless networks	JP5254445	US20100034126; US14/077,783; BR; CA; CN; DE; EP; ES; FR; GB; IN; IT; KR; RU; SG; TW
	Method and apparatus for initiating random access procedure in wireless networks	JP5199468	US20100034141; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Methods and apparatuses for requesting/providing assistance data associated with various satellite positioning systems in wireless communication networks	JP2011-528785	US20100013701; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Cell identifier assignment and selection	JP2011-529303	US8,391,158; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	RNTI-dependent scrambling sequence initialization	JP2011-530892	US8,588,150; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	System and method for cell search and	JP5209789	US8,588,773; US14/056,641; CN;

	selection in a wireless communication system		EP; IN; KR
	Wireless communication channel blanking	JP2013-514722	US20110151790; CN; EP; IN; KR; TW
	Processing polling requests from radio link control peers	JP2011-530899	US20100034095; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Intra-frequency cell reselection restriction in wireless communications	JP2011-530864	US8,285,285; CN; EP; IN; KR; TW
	Utilizing HARQ for uplink grants received in wireless communications	JP2011-530896	US20100037113; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Methods and apparatuses for processing measurement gaps in a wireless communication system	JP5237453	US20100034158; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Systems, methods and apparatus for facilitating buffer status report robustness	JP5155451	AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Handling uplink grant in random access response	JP2012-500528	US20100040001; US20130163549; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Control plane solution for location service to support wireless access	JP5215470	US20100041418; JP; CA; EP; TW
	Relay architecture framework	JP2012-501155	US20100046418; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Supporting multiple access technologies in a	JP2012-501603	US8,325,661; US20130094462; JP;

	wireless environment		AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Efficiently identifying system waveform in uplink transmission	JP2012-502600	US20100067591; CN; DE; EP; GB; IN; KR
	Interference management for different wireless communication technologies	JP5313353	US20100067469; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Method and apparatus for managing a new data indicator in a wireless communication system	JP5329667	US20100067468; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Reference signal design for LTE advanced	JP2012-503446	US20100075706; AU; BR; CA; CN; EP; HK; ID; IN; KR; MX; MY; RU; SG; TW; ZA
	Apparatus and method for facilitating transmit diversity for communications	JP2012-503949	US20100074210; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; TW; ZA
	Highly detectable pilot structure	JP2012-503777	US8,391,401; US20130176946; US20130182667; US20130182784; US20130176947; BR; CN; EP; IN; KR; TW
	Synchronizing a base station in a wireless communication system	JP5199476	US20100074180; US14/081,893; JP; BR; CA; CN; EP; HK; ID; IN; KR; PH; RU; TW; ZA
	Network and mobile device initiated quality of service	JP5242797	US20100074109; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Method and apparatus for reducing	JP2012-503951	US20100075680; CN; EP; IN; KR

	successive pre-registration attempts by access terminals		
	Synchronizing bearer context	JP2012-504375	US20100081444; JP; AE; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; TW; VN; ZA
	Channel quality feedback in multicarrier systems	JP2012-508543	US20100118817; JP; BR; CA; CN; EP; HK; ID; IN; KR; MY; RU; TW; ZA
	Method and apparatus for separable channel state feedback in a wireless communication system	JP2012-507203	US8,385,452; US20130136062; CN; EP; IN; KR
	System and methods to facilitate connections to access networks	JP2012-512609	US20100205099; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; UA; VN; ZA
	Methods and apparatus for system selection in a multimode wireless device	JP2012-506679	US20100099412; AE; AU; BR; CA; CN; EP; HK; ID; IN; KR; RU; TW; UA; VN; ZA
	Apparatus and method for establishing a data connection between a remote station and a wireless network	JP2012-509026	US8,457,599; BR; CN; EP; IN; KR; TW
	Support for multiple access modes for home base stations	JP2012-507957	US20100112980; JP; AE; AU; BR; CA; CN; EP; HK; ID; IN; KR; RU; TW; ZA
	Methods and systems using same base station carrier handoff for multicarrier support	JP2012-509027	US20100124201; JP; CN; EP; IN; KR
	A method and apparatus for supporting the large service data unit (SDU)	JP5270003	US20100135212; CN; EP; IN; KR; TW
	Transport block size (TBS) signaling	JP3850826	US7,289,452; AU; BR; CA; CN; DE;

	enhancement		EP; ES; FR; GB; HK; HU; IN; IT; KR; MX; MY; NL; RO; RU; TW
	Signalling method	JP3502604	US6,751,227; USRE41,773; AT; AU; BR; CA; CH; CN; DE; EP; ES; FI; FR; GB; IT; KR; MX; NL; SE; TR
	Services on demand in mobile communications system	JP2009-144220	US6,957,063; US7,266,366; US7,873,354; JP; BE; CN; DE; EP; ES; FI; FR; GB; IE; IT; NL; SE
	Radio resource management	JP4619621	US7,072,663; JP; AU; BR; CA; CN; DE; EP; FR; GB; IT; NL; RU
	A method for initiating in a terminal of a cellular network the measurement of power levels of signals and a terminal	JP4933099	US7,096,021; AT; BR; CA; CH; CN; DE; EP; ES; FI; FR; GB; IT; KR; NL; SE
	Data and control multiplexing in wireless communications	JP2012-526464	US20110110296; CN; EP; IN; KR; TW
	Hearability improvements for reference signals	JP2012-514908	US20100172311; JP; AE; BR; CA; CN; EP; HK; ID; IN; KR; MX; PH; RU; TW; ZA
	DGNSS correction for positioning	JP2012-509463	US8,259,008; CN; EP; IN; KR; TW
	Method and apparatus for synchronization during a handover failure in a wireless communication system	JP2012-514428	US8,520,632; CN; EP; IN; KR; TW
	Transmission of reference signal on non-contiguous clusters of resources	JP2012-531169	US20110141982; BR; CN; EP; IN; KR; TW
	Provision of inter-frequency subframe configuration in wireless communication	JP2011-544663	US8,526,419; CN; EP; IN; KR; TW
	Method and apparatus for computing and	JP2012-515469	US8,432,873; US20130128759; JP;

	reporting channel quality indication (CQI)		CN; EP; IN; KR; TW
	Frequency hopping in a wireless communication network	JP2012-516633	US20100189032; CA; CN; EP; HK; ID; IN; KR; MY; RU; TW; UA; ZA
	Flexible data and control multiplexing	JP2012-518967	US20100214938; BR; CA; CN; EP; HK; ID; IN; KR; PH; RU; TW; ZA
	Antenna virtualization in a wireless communication environment	JP2012-517154	US8,503,572; AE; BR; CA; CN; EP; HK; ID; IN; KR; PH; RU; TW; ZA
	PCFICH design for multicarrier operation	JP2012-525801	US20110096734; BR; CN; EP; IN; KR; TW
	Systems, methods and apparatus for facilitating discontinuous reception in a multi-carrier wireless communication system	JP2012-525463	US20110105069; CN; EP; IN; KR
	Method and apparatus for maintaining location continuity for a UE following handover	JP2012-517748	US20100202407; JP; CN; EP; IN; KR; TW
	Multiplexing and coding schemes for multiple transmit antennas in a wireless communication system	JP2012-517745	US20100202559; CN; EP; IN; KR; TW
	Managing access control to closed subscriber groups	JP2012-517749	US8,571,550; CN; DE; EP; ES; FR; GB; IN; IT; KR; TW
	Fall back using mobile device assisted terminating access domain selection	JP2012-523175	US20100303012; BR; CA; CN; EP; HK; ID; IL; IN; KR; PH; RU; UA; ZA
	Timing adjustment for synchronous operation in overlaid wireless networks	JP2012-519455	US20100222068; JP; BR; CN; EP; IN; KR; TW
	Position location using multiple carriers	JP2012-521181	US8,577,387; US13/942,531; CN;

			EP; IN; KR
	Discontinuous uplink transmission operation and interference avoidance for a multi-carrier system	JP2012-521160	US20100260121; CN; EP; IN; KR
	Methods and apparatus for adjacent channel interference mitigation in access point base stations	JP2012-520631	US20100234040; JP; BR; CN; DE; EP; ES; FR; GB; IN; IT; KR; NL; TW
	Method and apparatus for handling inconsistent control information in a wireless communication system	JP2012-521163	US8,503,316; AE; AU; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; TH; TW; ZA
	Apparatus and method for dual-cell high-speed uplink packet access	JP5301027	US8,416,706; CN; EP; IN; KR; TW
	Method and apparatus for uplink power control in a multicarrier wireless communication system	JP2012-526471	US20110111788; JP; AE; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; TW; ZA
	Re-establishment procedure for an emergency call	JP2012-523182	US20100255807; CN; EP; IN; KR; TW
	Methods and apparatus for generation and use of reference signals in a communications system	JP2012-503666	US20100246527; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; TH; TW; ZA
	Error-correcting multi-stage code generator and decoder for communication systems having single transmitters or multiple transmitters	JP4773356	US7,139,960; US7,451,377; US20090158114; JP; CN; DE; EP; FR; GB; HK; IN; KR
	Conveying synchronization stratum information	JP2012-523767	US20100260168; AU; BR; CA; CN; EP; HK; ID; IN; KR; PH; RU; TH; TW; ZA
	Minimizing the impact of self	JP2012-523766	US20100260169; BR; CN; DE; EP;

	synchronization on wireless communication devices		ES; FR; GB; IN; IT; KR; NL; TW
	Control of radio links in a multiple carrier system	JP2012-524477	US8,599,771; CN; EP; IN; KR
	Method, apparatus and computer program product for determining QOS of communications based on CSG membership	JP2012-524461	US8,599,701; BR; CN; EP; IN; KR; TW
	Systems, methods, and devices to enable selection of radio access technology	JP2012-524503	US8,396,040; AE; BR; CA; CN; EP; HK; ID; IN; KR; MY; RU; TW; VN; ZA
	Method and apparatus for control and data multiplexing in a MIMO communication system	JP2012-525087	US20110103498; BR; CA; CN; EP; HK; ID; IN; KR; MX; MY; PH; RU; TH; TW; ZA
	Establishing packet data network connectivity for local internet protocol access traffic	JP2012-525064	US20100272013; JP; AU; BR; CA; CN; EP; HK; ID; IN; KR; PH; RU; TH; TW; VN; ZA
	Systems, apparatus and methods for facilitating emergency call service in wireless communication systems	JP2012-525804	US20100279648; AE; BR; CN; EP; ID; IN; KR; RU; TH; TW; ZA
	Transmission and detection of overhead channels and signals in a wireless network	JP2012-525805	US20100278132; JP; BR; CN; EP; IN; KR; TW
	PDCCH search space design for LTE-A multi-carrier operation	JP2012-525803	US20110110316; BR; CN; EP; IN; KR; TW
	Semi-persistent scheduling for multi-carrier wireless communication	JP2012-526472	US20110116454; CN; EP; IN; KR; TW
	Multicarrier retransmission feedback	JP2012-526481	US20110116457; JP; BR; CA; CN;

			EP; HK; ID; IN; KR; MY; PH; RU; TH; TW; ZA
	Transaction management	JP2012-527844	US20110130157; AE; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; SG; TW; UA; VN; ZA
	Control information signaling	JP2013-506383	US8,433,251; BR; CN; EP; IN; KR; TW
	Dynamic selection of subframe formats in a wireless network	JP2012-528547	US20100303013; AT; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IN; IT; KR; NL; NO; PH; PL; PT; RO; RU; SE; TW; UA; ZA
	Downlink assignment indicator design for multi-carrier wireless communication	JP2012-529238	US20110128922; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; PH; RU; SG; TW; ZA
	Method and apparatus for facilitating radio link monitoring and recovery	JP2012-529869	US20110143675; JP; CN; EP; IN; KR; TW
	Data prioritization for a power-limited UE in a wireless communication system	JP2012-530398	US20110141959; BR; CN; EP; IN; KR; TW
	A method and apparatus for dispatching a channel quality indicator feedback in multicarrier system using an anchor carrier scheme	JP2013-189906	US20110141926; AE; BR; CA; CN; EP; HK; ID; IL; IN; KR; PH; RU; TW; ZA
	Method and apparatus for network optimization using SON solutions	JP2012-531167	US20100325267; CN; EP; IN; KR; TW
	Methods and apparatus for coordination of	JP2012-531170	US20100322227; US13/942,928;

	sending reference signals from multiple cells		US13/942,941; US13/942,967; JP; AE; BR; CA; CN; EP; HK; ID; IN; KR; MX; MY; PH; RU; TH; TW; ZA
	Method and apparatus that facilitates a timing alignment in a multicarrier system	JP2012-531121	US20110158116; BR; CA; CN; EP; HK; ID; IN; KR; MX; PH; RU; SG; TH; TW; ZA
	Managing video adaptation algorithms	JP2012-530469	US8,537,699; AE; AU; BR; CA; CN; EP; IL; IN; KR; SG; TH; TW
	Method and apparatus that facilitates measurement procedures in multicarrier operation	JP2012-531120	US20100322079; JP; BR; CA; CN; EP; HK; ID; IN; KR; PH; RU; TH; TW; ZA
	Selecting a quality of service class identifier for a bearer	JP2012-531172	US20100322069; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; PH; RU; TH; TW; ZA
	Transport of LCS-related messages for LTE access	JP2012-531165	US20110143771; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA
	Hybrid automatic repeat request operation and decoding status signaling for uplink multiple-input multiple-output	JP2013-501419	US20110026622; CN; EP; IN; KR; TW
	Downlink control channel for relay resource allocation	JP2012-532575	US20110164550; CN; EP; IN; KR; TW
	Positioning reference signals in a telecommunication system	JP2012-532513	US20110158200; CN; EP; IN; KR; TW
	Method and apparatus for communicating antenna port assignments	JP2012-532563	US20110158351; CN; EP; IN; KR; TW
	Low reuse preamble	JP2012-533933	US20110013531; BR; CN; EP; IN;

			KR; TW
	Extension of UE-RS to DWPTS	JP2013-501472	US20110205954; AE; AU; BR; CA; CN; EP; HK; ID; IN; KR; RU; TW; VN; ZA
	Synchronization of devices in a wireless communication network	JP2013-500640	US20110176483; CN; EP; IN
	Determining control region parameters for multiple transmission points	JP2013-501423	US20110026473; CN; EP; IN; TW
	Adaptive transmissions in coordinated multiple point communications	JP2013-501409	US20110026421; BR; CN; EP; IN; KR; TW
	Resource specification for broadcast/multicast services	JP2013-502178	US20110194477; CN; EP; IN; KR; TW
	Method and apparatus for physical uplink control channel (PUCCH) resource mapping with transmit diversity	JP2013-501418	US20110026631; BR; CN; EP; IN; KR; TW
	Method and apparatus for uplink power control for multiple transmit antennas	JP2013-501469	US8,462,741; CN; EP; IN; KR; TW
	Support for optional system parameter values	JP2013-501427	US20110182234; CN; EP; IN; KR; TW
	Method and apparatus for supporting single-user multiple-input multiple-output (SU-MIMO) and multi-user mimo (MU-MIMO)	JP2013-502171	US20110194504; BR; CN; EP; IN; KR; TW
	MIMO related signaling in wireless communication	JP2013-502835	US20110188587; BR; CN; EP; IN; KR; TW
	Multiple carrier indication and downlink	JP2013-504942	US20110070845; AE; BR; CA; CN;

	control information interaction		EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; ZA
	Methods and apparatus for subframe interlacing in heterogeneous networks	JP2013-504984	US20110188481; BR; CA; CN; EP; HK; ID; IL; IN; KR; PH; RU; TH; TW; VN; ZA
	Method and apparatus for conducting measurements when multiple carriers are supported	JP2013-507074	US20110242999; BR; CN; EP; IN; KR; TW
	Signaling identification of machine to machine devices and services	JP2013-506387	US20110256896; BR; CN; EP; IN; KR; TW
	Uplink control channel resource allocation for transmit diversity	JP2013-506386	US20110228731; BR; CN; EP; IN; KR; TW
	Scalable channel feedback for wireless communication	JP2013-507075	US20110237282; CN; EP; IN; KR; TW
	UE-RS sequence initialization for wireless communication systems	JP2013-507060	US20110237267; BR; CN; EP; IN; KR; TW
	Methods and apparatuses for rate adaption in response to network congestion	JP2013-507058	US20110075563; BR; CN; EP; IN; KR; TW
	MBSFN subframe generation and processing for unicast	JP2013-507834	US20110103286; CN; EP; IN; KR; TW
	Downlink control information for efficient decoding	JP2013-507843	US8,379,536; US20130128838; CN; EP; IN; KR; TW
	Carrier indicator field for cross carrier assignments	JP2013-507090	US20110080883; BR; CN; EP; IN; KR; TW
	Method and apparatus for using channel	JP2013-507846	US20110244877; BR; CN; EP; IN;

	state information reference signal in wireless communication system		KR; TW
	Uplink resource allocation for LTE advanced	JP2013-507840	US20110085513; CN; EP; IN; KR; TW
	Method and apparatus for reference signal resource allocation	JP2013-509042	US20110249767; CN; EP; IN; KR
	Improved downlink association set for uplink ACK/NACK in time division duplex system	JP2013-509035	US20110255484; CN; EP; IN; KR; TW
	Method and apparatus for uplink multi-carrier power amplifier/antenna operation and channel prioritization	JP2013-509098	US20110092219; JP; BR; CN; EP; IN; KR; TW
	Resource management and admission control for non-members of a closed subscriber group in home radio access networks	JP2013-509823	US20110218004; BR; CN; EP; IN; KR; TW
	TDM-FDM relay backhaul channel for LTE advanced	JP2013-509848	US20110103296; CN; EP; IN; KR; TW
	Method, apparatuses and computer program product for a circuit switched fallback procedure handling conflict when handover occurs during CS fallback	JP2013-509831	US20110216645; BR; CN; EP; IN; KR; TW
	Apparatus and method for providing relay backhaul communications in a wireless communication system	JP2013-509834	US20110103295; CN; EP; IN; KR; TW
	Apparatus and method for joint encoding of user specific reference signal information in wireless communication	JP2013-509847	US20110268050; CN; EP; IN; KR; TW
	Restricting access point transmissions	JP2013-510518	US20110275361; CN; EP; IN; KR;

			TW
	Sounding reference signal enhancements for wireless communication	JP2013-513311	US20110294529; BR; CN; EP; IN; KR; TW
	Method and apparatus for managing a select IP traffic offload for mobile communications based on user location	JP2013-513317	US20110235546; AE; AU; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; TH; TW; ZA
	Apparatus and method for assigning frequency to support high-speed downlink packet access service in orthogonal frequency division multiplexing mobile communication system	JP4243264	US7,826,415; AU; EP; IN; KR
	Method for configuring and managing channel in a wireless communication system using AMC channel and diversity channel, transmission/reception apparatus therefor, and system thereof	JP2008-541548	US8,310,994; AU; BR; IN; KR; RU
	Methods and apparatus for channel quality indication feedback in a communication system	JP2011-509559	US20090163142; JP; CN; EP; IN; KR
	Method and apparatus for multiplexing data and control information in wireless communication systems based on frequency division multiple access	JP4319665	US7,613,245; US7,697,631; US7,929,590; US8,571,122; AU; CN; EP; IN; KR; RU
	Appareil et procede de generation de turbocodes quasi complimentaires	JP3636708	US7,093,185; US7,200,796; JP; AU; BR; CA; CN; DE; EP; FI; FR; GB; IN; IT; KR; RU; SE
	Apparatus and method for transmit-response timing for relay operation in wireless communications	JP2013-515397	US20110149774; CN; EP; IN; KR; TW
	Cross-carrier signaling in a multi-carrier	JP2013-516148	US20120009923; AE; BR; CA; CN;

	system		EP; HK; ID; IN; KR; PH; RU; TH; TW; VN; ZA
	Interaction between accumulative power control and minimum/maximum transmit power in LTE systems	JP2013-516843	US20110159914; BR; CN; EP; IN; KR; TW
	Multiplexing demodulation reference signals in wireless communications	JP2013-516943	US20120014318; AE; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; TW; ZA
	Channel feedback based on reference signal	JP2013-517707	US8,599,708; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; TW; ZA
	Apparatus and method for allocating data flows based on indication of selection criteria	JP2013-517708	US20110188376; CN; EP; IN; KR; TW
	Method and apparatus for power scaling for mutli-carrier wireless terminals	JP2013-518470	CN; EP; IN; KR; TW
	Aperiodic sounding reference signal transmission method and apparatus	JP2013-520091	US20110199944; BR; CN; EP; IN; KR; TW
	Methods and systems for uplink transmit diversity	JP2013-520141	US20120044881; CN; EP; IN; KR; TW
	Resource block mapping for cross-carrier assignments	JP2013-520883	US20120045014; CN; EP; IN; KR; TW
	Channel state information reference signals	JP2013-520935	US20120058791; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; SG; TW; VN; ZA
	Method and apparatus for channel quality indicator (CQI) enhancements	JP2013-521719	US20110216682; BR; CN; EP; IN; KR
	Methods of resolving PDCCH payload size	JP2013-523022	US20110228732; CN; EP; IN; KR;

	ambiguity in LTE		TW
	Random access design in a multiple component carrier communication network	JP2013-523025	US20120063302; BR; CN; EP; IN; KR; TW
	User-specific search space design for multi-carrier operation	JP2013-523023	US20110228724; CN; EP; IN; KR; TW
	Data radio bearer mapping in a telecommunication network with relays	JP2013-523057	US20110235514; CN; EP; IN; KR; TW
	Method and apparatus for multi-radio coexistence	JP2013-528972	US20110256834; BR; CN; EP; IN; KR
	Feedback of control information for multiple carriers	JP2013-531905	US20110243012; CN; EP; IN; KR; TW
	Aperiodic channel state information request in wireless communication	JP2013-530559	US20120076017; BR; CN; EP; IN; KR
	Power headroom reporting	JP2013-527667	US20120082041; BR; CN; EP; IN; KR; TW
	Method and apparatus for signaling user equipment capabilities	JP2013-524689	US20110243083; CN; EP; IN; KR
	Methods and apparatuses for radio resource management measurements of a user equipment in a heterogeneous network	JP2013-526155	US20120088516; US20130229933; AE; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; PH; RU; TH; UA; ZA
	CQI estimation in a wireless communication network	JP2013-528989	US20110250919; AE; AU; BR; CA; CN; EP; HK; ID; IN; KR; MY; RU; TH; TW; ZA
	Channel state information reporting in a wireless communication network	JP2013-524735	US20110249643; AE; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; TH; ZA
	Aperiodic CQI reporting in a wireless	JP2013-528031	US20110249584; AE; BR; CA; CN;

	communication network		EP; HK; ID; IN; KR; MY; PH; RU; VN; ZA
	Radio link monitoring (RLM) and reference signal received power (RSRP) measurement for heterogeneous networks	JP2013-526158	US20110256861; AE; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; TH; TW; ZA
	Determination of radio link failure with enhanced interference coordination and cancellation	JP2013-528032	US20120087250; AE; AR; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; TH; TW; ZA
	Resource partitioning information for enhanced interference coordination	JP2013-526154	US20110275394; US20130250927; AE; BR; CA; CN; EP; HK; ID; IN; KR; PH; RU; TH; UA; VN; ZA
	Adaptive resource negotiation between base stations for enhanced interference coordination	JP2013-524737	US20110249642; CN; EP; IN; KR
	Method and apparatus for managing local internet protocol offload	JP2013-527680	US20120082090; AR; CN; EP; IN; KR; TW
	Resource availability for physical downlink shared channel (PDSCH) in relay backhaul transmissions	JP2013-529020	US20110268064; CN; EP; IN; KR
	Methods and systems for SRS power scaling in carrier aggregation	JP2013-529022	US20110275335; CN; EP; IN; KR; TW
	Method and apparatus for control and data multiplexing in wireless communication	JP2013-531407	US20110268080; BR; CN; EP; IN; KR; TW
	Uplink power control in aggregated carrier communication systems	JP2013-529030	US20110275403; BR; CN; EP; IN; KR
	Transmission of control information on uplink channels	JP2013-532411	US8,588,252; US14/070,550; CN; EP; IN; KR; TW
	Methods and apparatuses for downlink	JP2013-531924	US20120120882; CN; EP; IN; KR

	channel resource assignment		
	System, apparatus and method for control channel configuration in wireless communication systems	JP2013-530626	US20110280201; CN; EP; IN; KR
	Method and apparatus for providing uniform machine-to-machine addressing	JP2013-539617	US20120016942; CN; EP; IN; KR
	Power headroom reporting for multicarrier LTE systems	JP2013-533673	US20110292874; CN; EP; IN; KR
	Methods and apparatuses facilitating synchronization of security configurations	JP2013-515563	US20110312299; AR; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TH; TW; UA; VN; ZA
	Method and apparatus for relay node management and authorization	JP2013-515562	US20110314522; AR; CN; EP; IN; KR; TW
	Rate matching for data and control channels in wireless communication systems	JP2013-536604	US20120155362; CN; EP; IN; KR
	Interaction between maximum power reduction and power scaling in wireless networks	JP2013-535863	US20110319120; CN; EP; IN; KR
	Resource utilization measurements for heterogeneous networks	JP2013-535175	US8,515,427; US13/944,838; BR; CN; EP; IN; KR
	System, apparatus, and method for utilizing network access parameters in wireless communication systems	JP2013-516805	US20110317661; CN; EP; IN; KR
	Demodulation reference signals (DM-RS) for PHICH or PDCCH based retransmission in LTE-A wireless communication	JP2013-537734	US8,520,658; US13/975,850; BR; CN; EP; IN; KR
	Apparatus and methods for inter-user	JP2013-524900	US20120137008; CN; EP; IN; KR

	equipment transfers		
	Aperiodic channel quality indicator report in carrier aggregation	JP2013-539281	US20120039199; BR; CN; EP; IN; KR
	Power control on a deactivated component carrier	JP2013-537022	US8,600,426; CN; EP; IN; KR
	Channel state information feedback for carrier aggregation	JP2013-524891	US20120039252; CN; EP; IN; KR
	Physical uplink control channel resource allocation for multiple component carriers	JP2013-535937	US20120039275; BR; CN; EP; IN; KR
	Interleaving for relay physical downlink control channel (R-PDCCH)	JP2013-525980	US20120039220; CN; EP; IN; KR
	Search space design for relay physical downlink control channel (R-PDCCH)	JP2013-524934	US20120039283; CN; EP; IN; KR
	UE receiver reference signal processing that utilizes resource partitioning information	US20120057480*	JP; CN; EP; IN; KR
	Uplink control channel resource mapping for carrier aggregation	JP2013-540387	US20120236771; CN; EP; IN; KR; TW
	Aperiodic SRS for carrier aggregation	JP2013-531874	US20120257582; CN; EP; IN; KR
	Devices for determining a reference subframe and determining a mode	JP2013-532872	US20120082049; CN; EP; IN; KR
	Power headroom for simultaneous voice and long term evolution	JP2013-539323	US20120082046; CN; EP; IN; KR
	Method and apparatus for PUCCH and PUSCH dual code block encoding and interleaving	JP2013-532868	US20120082075; CN; EP; IN; KR
	Control channel resources for multi-bit	JP2013-532883	US20120263121; CN; EP; IN; KR

	ACK/NAK		
	Reference signal configuration and relay downlink control channel	JP2013-532970	US20120087299; CN; EP; IN; KR
	Resource assignments for uplink control channel	JP2013-539951	US20120263124; CN; EP; IN; KR; TW
	Hybrid automatic repeat request feedback transmission in a multi component-carrier communication system using scheduling request resources	JP2013-537736	US20120134305; CN; EP; IN; KR; TW
	Restricted resource in a wireless network	JP2013-537689	US20120275322; AE; AU; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; TH; VN; ZA
	Method and apparatus for rate matching with muting	JP2013-537794	US20120113917; AE; BR; CA; CN; EP; ID; IN; KR; MY; PH; RU; TH; ZA
	Method and apparatus for specific absorption rate backoff in power headroom report	JP2013-537815	US8,565,205; AR; CN; EP; IN; KR; TW
	Inter-frequency measurement control in a multi-carrier system	US20120113866*	JP; BR; CN; EP; IN; KR
	System and method for assisting in powering on sleeping network entities	US20120142328*	JP; CN; EP; IN; KR
	CQI-only transmission on the PUSCH	JP2013-538828	US20120113849; CN; EP; IN; KR
	Carrier grouping for power headroom report	JP2013-538859	US20120115537; CN; EP; IN; KR
	Method and apparatus for improving uplink transmission mode configuration	JP2013-538836	US20120113869; CN; EP
	Improved acknowledgement / negative	JP2013-538878	US20120287828; CN; EP; IN; KR

	acknowledgement feedback for TDD		
	Method and apparatus for improving acknowledgement/negative acknowledgement feedback	JP2013-539954	US20120294204; CN; EP; IN; KR; TW
	Interference randomization for uplink signaling	JP2013-546429	US20120163159; CN; EP; IN; KR
	Method and apparatus for determining timing information for cells	JP2013-550635	US20120190373; CN; EP; IN; KR
	Method and apparatus for enabling channel and interference estimations in macro/RRH system	US20120207043*	JP; CN; EP; IN; KR
	Uplink transmit antenna selection in carrier aggregation	US20120213154*	JP; CN; EP; IN; KR
	Methods and apparatus for employing different capabilities for different duplexing modes	US20120218922*	JP; CN; EP; IN; KR
	Methods and apparatus for effective allocation of adaptive resource partitioning information (ARPI) to pico enhanced Node B by macro enhanced Node B in heterogeneous network	WO2012129556*	US20120243488; JP; CN; EP; IN; KR
	System and method for configuring remote radio heads	WO2012154561*	US8,570,971; JP; BR; CA; CN; EP; IN
	System and method for managing invalid reference subframes for channel state information feedback	WO2012149028*	US20120275398; JP; CN; EP; IN
	Downlink control with control-less	WO2013009987*	US20130016692; TW

	subframes		
	Synchronized radio link control	WO2012149144*	US20120275399
	Power headroom reporting related to power management maximum power reduction	WO2012154588*	US20120281568; JP; BR; CA; CN; EP; IN
	Allocating physical hybrid ARQ indicator channel (PHICH) resources	WO2013020012*	US20130034028
	Transmission of control information in a wireless network with carrier aggregation	WO2013016525*	US20130028205
	Methods and apparatus for updating the UE capability in an E-UTRAN	WO2013063793*	US13/823,706
	Signaling of supported carrier bandwidths for carrier aggregation	WO2013082303*	US20130142139; TW
	Systems and methods for priority based session and mobility management	WO2013112976*	US20130195038
	Signaling of virtual cell identifiers and fallback operation	WO2013138389*	US20130235821
	eMBMS service activation and maintenance procedure in multi-frequency networks	WO2013148032*	US20130258934
	Devices, methods, and apparatuses for mobile device acquisition assistance	WOPCT/US2013/052427*	US13/732,071
	Method and apparatus for transmitting the sync channel message in a multi-carrier communication system	JP4499299	US6,925,067; US7,486,653; US7,447,189; US7,508,790; US8,095,142; AU; BR; CA; CN; EP; HK; ID; IN; KR; MX; NO; RU; SG; TW; UA
	Method and apparatus for estimating	JP4668491	US6,397,070; BR; CN; DE; EP; GB;

	reverse link loading in a wireless communication system		HK; KR; TW
	Method and apparatus for beamforming in a wireless communication system	JP2011-055507	US6,778,507; JP; AT; BE; BR; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; IE; IT; KR; NL; NO; PL; PT; RO; SE; TW
	Method and apparatus for supervising a potentially gated signal in a wireless communication system	JP4773009	US7,054,284; JP; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; ID; IE; IL; IN; IT; KR; MX; NL; NO; PT; RU; SE; SG; TW; UA
	Method and apparatus for providing mobility within a network	JP4638109	US6,366,561; US7,272,138; JP; AT; AU; BE; BR; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; IE; IT; KR; NL; PT; SE
	Method and apparatus for concurrently processing multiple calls in a spread spectrum communications system	JP4307772	US6,625,198; US7,184,459; US7,466,741; JP; AU; BR; CA; CN; DE; EP; FI; FR; GB; HK; ID; IL; IN; IT; KR; MX; NO; RU; SE; SG; TW; UA
	An Improved GPS Receiver Utilizing a Communication Link	JP2001505309	US5,841,396; US6,064,336; JP; CH; DE; DK; EP; ES; FI; FR; GB; GR; HK; IE; IT; KR; NL; PT; SE
	Method and apparatus for determining time for GPS receivers	JP2001-505665	US5,945,944; US6,150,980; US6,433,734; JP; BE; CH; DE; DK; EP; ES; FI; FR; GB; GR; HK; IE; IT; KR; LI; NL; PT; SE
	Method and apparatus for acquiring satellite positioning system signals	JP5128732	US6,133,874; JP; AU; BE; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; ID; IE; IL; IN; IT; KR; MX; NL; SE; SG
	Method and apparatus for satellite	JP2003-523500	US6,377,209; US6,583,757; JP; AU;

	positioning system (SPS) time measurement		BE; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; IE; IN; IT; KR; MX; NL; SE
	Call setup latency reduction by encapsulating signalling messages	JP4163108	US6,952,411; BE; BG; CN; CZ; DE; EP; ES; FI; FR; GB; HK; IE; IN; IT; KR; NL; SE; TW
	Method and apparatus for secure data transmission in a mobile communication system	JP4927330	US7,185,362; US20070116282; JP; BR; CA; CN; EP; HK; IN; KR; MX; TW
	Method and apparatus for data packet transport in a wireless communications system using an internet protocol	JP2005-534202	US7,184,789; JP; BE; BG; BR; CA; CN; CZ; DE; EP; ES; FI; FR; GB; HK; IE; IL; IN; IT; KR; MX; NL; NO; SE; SG; TW
	Packet flow processing in a communication system	JP2005-529554	US8,514,773; US20110273984; JP; BR; CN; DE; EP; GB; HK; KR; TW
	User terminal-initiated hard handoff from a wireless local area network to a cellular network	JP2009-512354	US7,706,796; US20110064058; JP; CN; EP; IN; KR
	Power control for a wireless communication system utilizing orthogonal multiplexing	JP4616339	US8,452,316; US8,543,152; US8,478,202; JP; AU; BE; BG; BR; CA; CL; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; ID; IE; IL; IN; IT; KR; MX; NL; NO; NZ; PH; PL; RO; RU; SG; TW; UA; VN; ZA
	Systems and methods for providing channel quality feedback for downlink MIMO transmission adjustment	JP5144662	US20070105503; JP; CN; EP; HK; IN; KR; TW
	Frame structures for a wireless communication system with multiple radio technologies	JP2011-124992	US7,920,884; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; RU; TW; UA
	Wireless communication system with	JP4612046	US8,577,299; JP; AU; BR; CA; CN;

	configurable cyclic prefix length		EP; HK; ID; IL; IN; KR; MX; MY; RU; TW; UA
	Interference control in a wireless communication system	JP2008-533924	US20060285503; US20130107740; JP; AR; AT; AU; BE; BR; CA; CH; CL; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TH; TW; UA; VN
	Pilot signal transmission for an orthogonal frequency division wireless communication system	JP2013-081211	US20060209732; AR; AU; BR; CA; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Systems and methods for beamforming in multi-input multi-output communication systems	JP4723632	JP; AR; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Frequency hopping design for IFDMA, LFDMA and OFDMA systems	JP4897793	US20060233124; US20120063441; JP; BE; BG; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; IE; IN; IT; KR; NL; PL; RO; SE; TW
	Method and Apparatus for Locating a Wireless Local Area Network in a Wide Area Network	JP4791545	US8,477,731; US20130210485; AR; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; NO; NZ; PH; RU; SG; TW; UA; VN
	Acknowledgement of control messages in a wireless communication system	JP5059870	US8,477,684; BR; CA; CN; EP; IN; KR; RU; TW
	Resource allocation for shared signalin channels in OFDM	JP5289965	JP; AU; BR; CA; CL; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Scalable frequency band operation in	JP2012-105272	US8,045,512; US20120002623; CN;

	wireless communication systems		EP; HK; IN; KR; TW
	Global navigation satellite system	JP2010-533862	US7,893,869; US20110187593; JP; CN; EP; IN; KR
	Enhanced techniques for using core based nodes for state transfer	JP4746044	US7,668,541; US20110019614; JP; CA; CN; EP; HK; IN; KR
	Methods and apparatus for determining, communicating and using information including loading factors for interference control	JP4782841	US20070140168; CL; CN; DE; EP; ES; FR; GB; IN; IT; KR; NL; TH; TW
	Methods and apparatus for controlling a base station's transmission power	JP4782842	US20070253385; CL; CN; EP; HK; IN; KR; TH; TW
	Communications methods and apparatus using physical attachment point identifiers	JP2009-521846	US20070147377; JP; BR; CA; CL; CN; EP; HK; IN; KR; RU; SG; TH; TW
	Method and apparatus for end node assisted neighbor discovery	JP4733190	US20070147283; US20120087312; AR; BE; BG; BR; CA; CN; CZ; DE; EP; ES; FI; FR; GB; HU; IE; IN; IT; KR; NL; PL; RO; RU; SE; SG; TW
	Methods and apparatus related to selecting reporting alternative in a request report	JP5265386	US20070253358; JP; BE; BG; CN; CZ; DE; EP; ES; FI; FR; GB; HK; HU; IE; IN; IT; KR; NL; PL; RO; SE; TW
	Methods and apparatus related to selecting a request group for a request report	JP4976418	US20070253357; CN; DE; EP; GB; HK; IN; KR; TW
	Method and apparatus for efficient reporting of information in a wireless communication system	JP5107935	US20070168326; CN; EP; HK; IN; KR; TW
	Methods and apparatus for communicating	JP4950217	US20070149137; BE; BG; CN; CZ;

	control information		DE; EP; ES; FI; FR; GB; HK; HU; IE; IN; IT; KR; NL; PL; RO; SE; TW
	Methods and apparatus for communicating information utilizing a plurality of dictionaries	JP4950218	US20070149138; CN; DE; EP; ES; FR; GB; HK; IN; IT; KR; TW
	Methods and apparatus for selecting control channel reporting formats	JP5074419	US20070149132; AT; BE; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IN; IT; KR; NL; NO; PL; PT; RO; SE; TW
	Methods and apparatus of implementing and/or using a dedicated control channel	JP5074418	US20070149131; AT; BE; BG; CH; CN; CZ; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IN; IT; KR; NL; NO; PL; PT; RO; SE; TW
	Provision of a move indication to a rescource requester	JP5001283	US20070086389; CN; EP; IN; KR
	Provision of QOS treatment based upon multiple requests	JP2009-509467	US8,509,799; JP; CN; EP; IN; KR
	Methods and apparatus for supporting quality of service in communication systems	JP2009-533982	US8,170,572; JP; CN; EP; IN; KR
	PN code based addressing methods, computer readable medium and apparatus for airlink communications	JP4955762	US8,134,952; BR; CA; CL; CN; DE; EP; ES; FR; GB; IN; IT; KR; RU; TW
	Methods and systems for processing overhead reduction for control channel packets	JP4976489	US8,374,200; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; NO; NZ; PH; RU; TW; VN
	Method and apparatus for cell search in an	JP2010-508788	US20100103906; JP; AU; BR; CA;

	orthogonal wireless communication system		CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Reference signal design for cell search in an orthogonal wireless communication system	JP2010-508789	US20100035611; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NO; NZ; PH; RU; SG; TW; UA; VN
	Resource requests for a wireless communication system	JP4988865	US20080186931; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Cyclic delay diversity and precoding for wireless communication	JP5180233	US20080247364; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Preamble based uplink power control for LTE	JP2010-518787	US7,986,959; US8,559,889; US14/026,500; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Uplink power control for LTE	JP2010-518788	US8,437,792; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Positioning using enhanced pilot signal	JP5323859	US8,412,227; US20130217401; BR; CA; CN; EP; HK; IL; IN; KR; MX; MY; NZ; PH; RU; TW; UA; VN
	Pilot structures for ACK and CQI in a wireless communication system	JP2010-528534	US20080298502; JP; AT; BE; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IN; IT; KR; NL; NO; PL; PT; RO; SE; TW
	Method and apparatus for beamforming of	JP2010-537516	US8,009,617; JP; AU; BR; CA; CN;

	control information in a wireless communication system		EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Methods and apparatus for mobility support and IP multimedia subsytem (IMS) registration in a multimode network environment	JP5329550	US20090103455; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Utilizing restriction codes in wireless access point connection attempts	JP2011-504055	US20090137228; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Utilizing broadcast signals to convey restricted association information	JP2011-504057	US20090129338; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Classifying access points using pilot identifiers	JP2011-504059	US20090135784; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Access management for wireless communication	JP5248617	US20090094680; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Provisioning communication nodes	JP2011-501917	US20090093232; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Access terminal configuration and access control	JP5290303	US20090094351; JP; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Method and apparatus for supporting positioning for terminals in a wireless network	JP2012-524906	US20110098057; AE; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MY; PH; RU; SG; TH; TW; UA; VN; ZA
	Wireless communication paging utilizing	JP2011-512070	US20090181672; AU; BR; CA; CN;

	multiple types of node identifiers		EP; HK; ID; IL; IN; KR; MX; MY; PH; RU; SG; TW; UA; VN
	Concentrator for multiplexing access point to wireless network connections	JP2011-526457	US20090316629; AT; AU; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; MX; MY; NL; NO; NZ; PH; PL; PT; RO; RU; SE; SG; TW; UA; VN
	Method of communicating between an access terminal and a femto node, wireless communication apparatus, and computer program product	JP5108150	US20100040019; AU; BR; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Access terminal assisted node identifier confusion resolution using a time gap	JP5323930	US20090316654; AU; BR; CA; CN; EP; HK; ID; IL; IN; KR; MX; MY; NZ; PH; RU; SG; TW; UA; VN
	Access terminal assisted node identifier confusion resolution	JP2011-525342	US20090316655; JP; AU; BR; CN; EP; ID; IL; IN; KR; MX; MY; NZ; PH; SG; TW; VN
	Method and apparatus for preamble creation and communication in a wireless communication network	JP2011-504015	US8,234,552; CN; EP; IN; KR
	Techinques for supporting relay operation in wireless communication systems	JP2012-504912	US20100080139; BR; CN; EP; IN; KR; TW
	Techniques for supporting relay operation in wireless communication systems	JP2011-530149	US20100080166; CN; EP; IN; KR; TW
	Cell relay network attachment procedures	JP2012-507205	US20100103857; JP; BR; CN; DE; EP; ES; FR; GB; IN; IT; KR; NL; TW
	Bearer QoS mapping for cell relays	JP5209796	US20100103863; CN; EP; IN; KR;

			TW
	Transmission of feedback information for multi-carrier operation	JP2012-526473	US20110110246; CN; DE; EP; GB; IN; KR; TW
	Transmission of feedback information in multi-carriers systems and determination of up-link ACK/NACK resources from down-link CCE of the down-link grant	JP2012-526474	US20110116455; AU; BR; CA; CN; EP; HK; ID; IN; KR; RU; TW; VN; ZA
	Switching wireless network selection modes in conjunction with selection of a wireless cell set	JP2012-508512	US20100113020; AE; BR; CA; CN; EP; HK; ID; IN; KR; PH; RU; TW; VN; ZA
	Maintaining closed subscriber group information for access control	JP5199486	US20100161794; BR; CN; EP; IN; KR; TW
	Radio link failure reporting	JP2012-509618	US20100124173; AU; BR; CA; CN; EP; HK; ID; IN; KR; RU; TW; ZA
	Mobility management based on radio link failure reporting	JP2012-509617	US20100124918; JP; BR; CA; CN; EP; HK; ID; IN; KR; RU; TW; ZA
	Access point handover control based on closed subscriber group subscription information	JP2012-513734	US20100157943; CN; EP; IN; KR
	Handover control based on closed subscriber group subscription information	JP2013-138460	US20100157944; JP; CN; EP; IN; KR; TW
	Handover failure messaging schemes	JP2012-514948	US20100173633; CN; DE; EP; ES; FR; GB; IN; IT; KR; NL; TW
	Adaption of handover parameters	JP2012-514949	US20100173626; CN; EP; IN; KR; TW
	Method and apparatus for enabling multiple	JP2012-515471	US20100177810; BR; CN; EP; IN;

	transmission modes in a wireless communication system		KR; TW
	CSG membership indication	JP5270009	US20100197285; BR; CN; EP; IN; KR; TW
	QOS mapping for relay nodes	JP2012-523776	US20100260129; CN; EP; IN; KR; TW
	Device mobility for split-cell relay networks	JP2012-523805	US8,532,056; US14/023,164; CN; EP; IN; KR
	Maintaining controllee information in collaborative sessions	JP2012-527197	US20100312834; BR; CN; EP; IN; KR; TW
	Controlling media and informing controller status in collaborative sessions	JP2012-527198	US20100312841; BR; CN; EP; IN; KR; TW
	Rank and precoding indication for MIMO operation	JP2012-525089	US20110103510; CN; EP; IN; KR; TW
	Access mode-based access control	JP2012-526467	US20100278147; BR; CN; EP; IN; KR; TW
	Access mode-based access control	JP2012-526468	US20100279687; BR; CN; EP; IN; KR; TW
	Domain selection for mobile-originated message service	JP2013-502010	US20110191430; AE; BR; CA; CN; EP; HK; ID; IN; KR; MY; PH; RU; TW; UA; ZA
	Identifying a domain for delivery of message service information	JP2013-502161	US20110188448; AE; AU; BR; CA; CN; EP; HK; ID; IN; KR; MY; RU; TW; ZA
	Method and apparatus to control visited network access for devices	JP2013-521745	US20110217978; CN; EP; IN; KR
	Method and apparatus to control local	JP2013-521746	US20120057574; CN; EP; IN; KR

	internet protocol access for devices		
	Muting schemes for channel state information reference signal and signaling thereof	JP2013-527670	US20120076106; BR; CN; EP; IN; KR; TW
	Reference signal patterns	JP2013-532427	US20120134273; BR; CN; EP; IN; KR
	ACK/NACK transmission for multi-carrier operation	JP2013-534392	US20120039279; BR; CN; EP; IN; KR
	Method and apparatus for enabling channel and interference estimations in macro/RRH system	US20120208547*	JP; CN; EP; IN; KR
	Method and System for Providing Personal Base Station Communications	JP4318860	US6,381,230; CA; CN; DE; EP; ES; FI; FR; GB; HK; IE; IT; KR; MX; SE
	A subscriber unit and method for use in a wireless communication system	JP4132088	US6,678,311; US6,621,875; AR; AT; AU; BE; BR; CA; CH; CL; CN; CY; CZ; DE; DK; EP; ES; FI; FR; GB; GR; HK; IE; IL; IT; KR; LU; MC; MX; NL; NO; NZ; PT; RU; SE; SG; VN
	A wireless communication device and method	JP4790879	US6,011,978; JP; AU; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; IL; IT; KR; MX; NO; RU; SE; SG
	Method of and apparatus for encrypting signals for transmission	JP4260896	US6,075,859; US6,385,316; US6,768,797; US7,995,751; US20120207304; BE; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; IE; IN; IT; KR; MX; MY; NL; RO; RU; SE; ZA
	A Method of and Apparatus for Paging a	JP3983818	US6,393,295; JP; AR; AT; AU; BE;

	Wireless Terminal in a Wireless Telecommunications System		BR; CA; CH; CL; CN; CY; CZ; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; ID; IE; IL; IN; IT; KR; LI; LU; MC; MX; MY; NL; NZ; PL; PT; RU; SE; SG; TW; UA; ZA
	Methods and apparatuses for fast power control of signals transmitted on a mulitple access channel	JP4499285	US6,275,478; US7,286,499; US8,406,802; JP; CN; DE; EP; FR; GB; HK; KR; TW
	Distributed infrastructure for wireless cata communications	JP5048179	US6,215,779; JP; CN; DE; EP; FR; GB; HK; KR
	Distributed infrastructure for wireless data communications	JP2004-525578	US7,248,572; US7,715,356; US8,274,948; JP; AT; BE; BR; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; ID; IE; IL; IN; IT; KR; MX; NL; NO; PT; RU; SE; SG; UA
	Method for robust handoff in wireless communication system	JP4536926	US6,360,100; US7,233,794; US8,588,777; JP; AU; BE; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; ID; IE; IL; IT; KR; MX; NL; NO; RU; SE; SG; UA
	Reservation multiple access	JP4638052	US6,788,937; JP; CN; DE; EP; ES; FI; FR; GB; HK; IT; KR; NL; SE
	Method and apparatus for sequentially synchronized network	JP2003-505977	US6,671,291; JP; DE; EP; GB; ID; RU

Approved by the 92nd Standard Assembly

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)
[Ver. 3.2]

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
ソニー株式会社	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver. 3.2		
QUALCOMM Incorporated	A comprehensive confirmation form has been submitted with regard to ARIB STD-T94 Ver. 3.2		

Attachment 2　List of Essential Industrial Property Rights　(selection of option 2)
[Ver. 3.2]

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated	Method and apparatus for allocating resources in a multiple-input multiple-output (MIMO) communication system	JP4537004	US7,907,972; US7,248,879; US6,662,024; US8,489,107; AU; BR; CA; CN; DE; EP; ES; FR; GB; HK; ID; IL; IN; IT; KR; MX; NL; NO; RU; SG; TW; UA
	Method and apparatus for out-of-band transmission of broadcast service option in a wireless communication system	JP4615828	US6,909,702; BR; CA; CN; DE; EP; FR; GB; KR; MX; TW
	Method and apparatus for broadcast signaling in a wireless communication system	JP4087713	US7,693,508; BR; CN; EP; KR; NO; TW
	Method and apparatus for overhead messaging in a wireless communication system	JP4773042	US7,349,425; JP; AU; BR; CN; DE; EP; GB; ID; IL; IN; KR; MX; NO; RU; SG; TW; UA
	Wireless network optimization through remote device data	JP2005532717	US7,263,351; JP; AR; AU; BR; CL; CN; DE; EP; GB; HK; ID; IL; IN; KR; MX; NZ; PE; RU; SG; VE; VN
	System and method for controlling broadcast multimedia using plural wireless network connections	JP2006523386	US7,925,203; US20110143653; JP; BR; CN; EP; HK; IL; IN; KR; MX

	Methods and apparatus to optimize delivery of multicast content using probabilistic feedback	JP2007-519371	US7,127,655; JP; CN; HK; IN; KR; TW; ZA
	Spatial processing with steering matrices for pseudo-random transmit steering in a multi-antenna	JP5139473	AU; BR; CA; CN; EP; HK; IL; IN; KR; MX; PH; RU; SG; TW; VN
	Methods and Apparatus for Creation and Transport of Multimedia Content Flows	JP4870662	US7,912,457; US8,472,930; JP; AU; BR; CN; DE; EP; ES; FR; GB; HK; IL; IN; IT; KR; MX; NL; PH; RU; VN
	Bearer control of encrypted data flows in packet data communications	JP5112864	US8,042,170; JP; BR; CN; DE; EP; GB; HK; IN; KR; MX; TW
	Spatial spreading with space-time and space-frequency transmit diversity schemes for a wireless communication system	JP4564060	US7,894,548; AR; AT; BE; CA; CH; CN; DE; DK; EP; ES; FI; FR; GB; GR; HK; HU; IE; IN; IT; KR; NL; PL; PT; RO; SE; TH; TW
	Systems, methods and apparatus for determining a radiated performance of a wireless device	JP4625087	US7,773,964; US8,467,756; CN; EP; HK; IN; KR
	1x and 1xEV-DO hybrid call setup	JP4880706	US8,706,144; US20140141817; CN; DE; EP; GB; IN; KR; TH
	Transmit spatial diversity for cellular single frequency networks	JP2008-547267	US8,059,608; US8,570,982; JP; CN; DE; EP; ES; FR; GB; IN; IT; KR; MY; NL; TW
	Geography-based filtering of broadcasts	JP5254019	US20070124395; JP; CN; DE; EP; GB; IN; KR; TW

	Fast channel switching in a multimedia broadcast system	JP5059782	US8,638,714; JP; BR; CA; CN; EP; HK; IN; KR; RU; SG; TW
	Discovery of neighbor cells	JP5118135	US20070291770; BR; CA; CN; DE; EP; ES; FI; FR; GB; IN; IT; KR; NL; RU; SE; TW
	Method and apparatus for determining a radiated performance of a wireless device	JP5502478	US7,925,253; CN; EP; IN; KR
	Pilot Tones In a Multi-Transmit OFDM System Usable to Capture Transmitter Diversity Benefits	JP4891239	US7,792,208; US7,372,913; CN; EP; TW
	Methods and systems for mobile WIMAX three-way downlink concurrent processing and three-way handover	JP2011-523280	US8,223,622; US8,565,061; CN; EP; IN; KR
	Handover between mobile communication networks	JP3433186	US6,385,451; CN; DE; EP; FI; FR; GB; HK
	Performing packet flow optimization with policy and charging control	JP5611973	US8,325,638; US8,582,480; JP; BR; CN; EP; IN; KR; TW
	System and method for packet acknowledgment using an acknowledgment codebook	JP5536101	US8,737,374; US20130242948; JP; CN; DE; EP; GB; IN; TW
	Transmission of control information across multiple packets	JP2012-532516	US8,605,584; CN; EP; IN; KR; TW
	Method and apparatus for signaling expansion and backward compatibility preservation in wireless communication systems	JP2013-518535	US20110188462; CN; EP; IN; KR; TW

	Apparatus and method for random access channel power prioritization	JP2013-531427	US20120127931; JP; CN; EP; IN; KR
	System, apparatus, and method for improving circuit switched fallback call setup delay in wireless communication systems	JP5654125	US20110312321; CN; EP; IN; KR
	Method and apparatus for transport of dynamic adaptive streaming over HTTP (DASH) initialization segment description fragments as user service description fragments	JP2014-527745	US20130036234; BR; CA; CN; EP; IN; KR; RU
	Support of multiple timing advance groups for user equipment in carrier aggregation in LTE	JP2014-526834	US20130064165; CN; EP; IN; KR
	Adaptive control channel design for balancing data payload size and decoding time	JP2014-530575	US20130083666; CN; EP; IN; KR
	Uplink resource management under coordinated multipoint transmission	JP2014-528677	US20130083754; CN; EP; IN; KR
	Method and apparatus for uplink transmission power control and timing in coordinated multipoint transmission schemes	JP2014-528672	US20130084913; BR; CN; EP; IN; KR
	Half-duplex/full-duplex operation for TDD carrier aggregation	JP2014-533900	US20130083704; CN; EP; IN; KR
	User equipment, base stations, and methods allowing for handling of colliding channel state information reports	JP2014-540229	US20130114455; CN; EP; IN; KR

	Structure of enhanced physical downlink control channel (e-PDCCH) in long term evolution (LTE)	JP2014-540064	US20130114565; BR; CN; EP; IN; KR
	Resource management for enhanced PDCCH	JP2014-534777	US20130114419; BR; CN; EP; IN; KR
	Search space design for e-PDCCH in wireless communication networks	JP2014-533047	US20130114529; BR; CN; EP; IN; KR
	Method and apparatus for managing retransmission resources	JP2014-533050	US20130114530; BR; CN; EP; IN; KR
	Processing enhanced PDCCH (ePDCCH) in LTE	JP2014-550412	US20130170449; BR; CN; EP; IN; KR; TW
	Improved reference signals design for time tracking in LTE-A	JP2014-549154	US20130163530; CN; EP; IN; KR
	Method and system for transitions of broadcast dash service receptions between unicast and broadcast	JP2014-552386	US20130182643; BR; CN; EP; IN; KR
	Maximum power reduction for interference control in adjacent channels	JP2014-552403	US20130182663; BR; CN; EP; IN; KR
	Method and apparatus to solve physical layer issues related to multiple timing advance group support	JP2014-554737	US20130195084; CN; EP; IN; KR
	Flexible radio resource management (RRM) measurements for wireless networks	US20130196603*	JP; CN; EP; IN; KR
	Resource allocation for enhanced physical downlink control channel (EPDCCH)	JP2014-555840	US20130201975; CN; EP; IN; KR

	Secure reception reporting	US20130267202*	US14/557,273; US14/557,315; JP; CN; EP; IN
	Method and apparatus for LTE radio access network sharing	US14/387,836*	JP; CN; EP; IN; KR
	Channel state information dependent ACK/NAK bundling	US20130258960*	JP; CN; EP; IN
	H-ARQ timing determination under cross-carrier scheduling in LTE	US20130258864*	JP; CN; EP; IN; KR
	Channel state information reference signal (CSI-RS) configuration and CSI reporting restrictions	US20130258965*	JP; CN; EP; IN; KR
	Rank-specific feedback for improved MIMO support	WO2013169666*	US20130301560; JP; CN; EP; IN; KR
	Network driven cell reselection method for UEs playing eMBMS content in unicast idle mode	WO2014004927*	US20140003390; JP; CN; IN
	Methods and apparatus for coordinated multipoint (CoMP) communications	WO2014022209*	US20140036806; IN
	Multiple timing advance groups (TAGS)for UL carrier aggregation (CA)	WO2014028908*	US20140050194
	Interleaver and deinterleaver for use in a diversity transmission communication system	JP4574866	US7,158,498; US6,356,528; AU; BR; CA; CN; DE; EP; ES; FI; FR; GB; HK; ID; IL; IN; IT; KR; MX; NL; NO; RU; SE; SG; UA
	Method and apparatus for encrypting transmissions in a communication system	JP2011-172244	US8,787,578; US6,980,658; JP; AU; BR; CN; DE; EP; ES; FI; FR; GB; HK; ID; IL; IN; IT; KR; MX; NL; NO; RU; SE; SG; UA

Reference (Not applied in Japan)

特許出願人 PATENT HOLDER	発明の名称 NAME OF PATENT	出願番号等 REGISTRATION NO./ APPLICATION NO.	備考 （出願国名） REMARKS
Motorola, Inc. *10	Multiple user communication system, device and method with overlapping uplink carrier spectra	US5828660A	
	Synchronous coherent orthogonal frequency division multiplexing system, method, software and device	US5867478A	
	Multicarrier reverse link timing synchronization system, device and method	US5802044A	
	Communication system having a packet structure field	US4860003A	
	Method and apparatus for providing cryptographic protection of a data stream in a communication system	US5319712A	
	Wideband signal synchronization	US5272724A	
	Communication signal having a time domain pilot component	US5519730A	
	Dynamic control of a data channel in a TDM wireless communication system	US5598417A	
	Method for authentication and protection of subscribers in telecommunications systems	US5572193A	
	Communication unit and method for performing neighbor site measurements in a communication system	US6249678B1	
	Variable rate spread spectrum communication method and apparatus	US6275488B1	
	Apparatus and method for providing separate forward dedicated and shared control channels in a communications system	US6934275B1	
	Multi-mode hybrid ARQ scheme	US7096401B2	
	Adaptive hybrid ARQ using turbo code structure	US6308294B1	
	Method and apparatus for transmission and reception of narrowband signals within a wideband communication system	US7047006B2	
	Multi channel stop and wait ARQ communication method and apparatus	US7065068B2	

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Reference (Not applied in Japan)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *10	Mobile Station Assisted Soft Handoff in a CDMA Cellular Communications System	US5,640,414	US 5,267,261
	Method and Apparatus for Utilizing Channel State Information in a Wireless Communication System	US 7,006,848	
	Remote Transmitter Power Control in a Contention Based Multiple Access System	US 5,604,730	

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Reference (Not applied in Japan)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
Panasonic Corporation *10	(26) Method of transmitting orthogonal frequency division multiplex signal, and transmitter and receiver employed therefor	US5682376 EP95119990	US EP
	(27) Transmitting apparatus, receiving apparatus, transmission method, and reception method	US7328389	US

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Reference (Not applied in Japan)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 (出願国名) REMARKS
QUALCOMM Incorporated *10	Enhanced Channel Interleaving for Optimized Data Throughput	US 6,987,778	US 20060114910
	Methods and apparatus for operating mobile nodes in multiple states	US 6,788,963	HK, TW
	Data transmission in a TDMA system	US 7,158,489	AT, EP, FR, DE, GB
	Time division multiple access radio systems	US 6,967,943	AU, AT, CN, EP, FI, FR, DE, IT, NL, RU, SE, GB
	Message encoding with irregular graphing	US 6,163,870	

*10: These patents are applied to the part defined by ARIB STD-T94 Ver. 1.0.

Reference (Not applied in Japan)

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated *20	Apparatus and method for use in effecting automatic repeat requests in wireless multiple access communications systems	EP 1576837	CA
	A method of providing a gap indication during a sticky assignment	US 20060164993	
	Use of supplemental assignments to decrement resources	US 20070211668	

*20: These patents are applied to the part defined by ARIB STD-T94 Ver. 2.0.

Reference (Not applied in Japan)
[ver. 1.0]

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated	Multiplexing and transmission of multiple data streams in a wireless multi-carrier communication system	US20090175210	EP, TW

Reference (Not applied in Japan)
[ver. 3.0]

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated	Method and System for Data and Voice Transmission Over Shared and Dedicated Channels	US6,985,510	US20060109890
	GPS Receiver Utilizing a Communication Link	US5,874,914	
	Reducing Satellite Signal Interference in a Global Positioning System Receiver	US6,236,354	
	Channel allocations in a communications system	US7,826,414	US8,547,916; US14/042,402
	Method and apparatus for message segmentation in a wireless communication system	US7,542,482	
	Packet Flow Processing in a Communication System	US7,277,455	
	Data transfer procedure for transferring data of a data sequence between a transmitting entity and a receiving entity	US7,720,079	BR; GB; HK; IL; IN; KR; SG
	Scheduled and Autonomous Transmission and Acknowledgement	US7,155,236	US8,526,966; US20130022004; AU; BR; CA; CN; EP; HK; ID; IL; KR; MX; RU; TW; UA

	System and method for scheduling transmissions in a wireless communication system	US8,150,407	
	Methods and apparatus for content based notification using hierarchical groups	US8,301,598	US20130007172
	Method and apparatus for seamless and efficient wireless handoffs	US8,059,581	TW
	Control channel assignment in a wireless communication network	US8,160,046	US8,488,566; AR; AU; BR; IL; MX; PH; RU; SG; TH; TW; VN
	Methods and apparatus for mobile terminal-based radio resource management and wireless network optimization	US20080032677	US20100173653
	Mobile device-initiated measurement gap request	US8,358,629	AR; BR; CA; CN; EP; IN; KR; RU; SG; TW
	Allocating a channel resource in a system	CA2547913	EP
	Signaling method in an OFDM multiple access system	US7,295,509	US8,014,271; US8,295,154; US20130016678; US8,199,634; US8,218,425; US8,223,627; US7,623,442; US8,098,568; US7,990,843; US7,924,699; US7,916,624; US7,990,844; US8,098,569; AT; BE; CH; DE; DK; EP; ES; FI; FR; GB; GR; HK; IE; IT; NL; PT; SE; TW
	OFDM communications methods and apparatus	US20020044524	AT; BE; CH; DE; DK; EP; ES; FI; FR; GB; GR; HK; IE; IT; NL; PT; SE; TW

	Method for extending mobile IP and AAA to enable integrated support for local access and roaming access connectivity	US6,785,256	US7,525,937; US8,179,840
	Method to convey uplink traffic information	US7,382,755	
	Methods and apparatus for the utilization of core based nodes for state transfer	US6,862,446	US6,990,337; US7,369,855; US7,962,142; AU; CA; CN; EP; IN
	Method and apparatus for optimization of SIGCOMP UDVM performance	US7,685,293	US8,478,886
	Synchronization of wireless nodes	US8,374,163	
	Generation and detection of synchronization signal in a wireless communication system	US20080273522	
	Time orthogonalization of reference signals	US20110085606	TW
	Buffer status report triggers in wireless communications	US20100070814	US20130294337; TW
	Concurrent transmission of ACK/NACK, CQI and CQI from user equipment	US20100232311	
	Dedicated reference signal	US20110280333	TW
	Signalling methods for MMSE precoding with eigenmode selection	US8,363,587	
	Cell detection for mobile location with grouping diversity	US20100227612	
	Reprioritization of wireless networks for reselection to support voice call	US20100113010	

	Utilizing a same target cell during circuit-switched and packet switched handover	US7,643,450	CA; CN; EP; IN; MY; TW
	Channel allocation for communication system	US7,986,660	AT; BE; CH; DE; DK; EP; ES; FI; FR; GB; GR; IE; IT; NL; PT; RU; SE
	Methods and systems for mobile station location determination in WIMAX	US20110019649	TW
	Random access channel (RACH) optimization for a self-organizing network (SON)	US20100232318	EP; TW
	Joint layer 3 signalling coding for multicarrier operation	US20110110441	TW
	Method and apparatus for assisted positioning in a wireless communication system	US20110117925	
	Precoding control channels in wireless networks	US20110141927	TW
	Rate matching for coordinated multipoint transmission schemes	US20120182946	BR; CN; EP; IN; KR
	Target cell selection for multimedia broadcast multicast service continuity	US20120236776	BR; EP; IN; KR
	Transmission of control information for FDD-TDD carrier aggregation	WO2012142123	US20120257552; EP; IN
	A channel state information feedback for carrier aggregation with flexible carrier configurations	WO2012161914	US20120300641; CA; EP; IN

	GPS Receiver Utilizing a Communication Link	US6,208,290	US6,421,002
	GPS Receiver Utilizing a Communication Link	US6,400,314	
	Method and apparatus for time-aligning transmissions from multiple base stations in a CDMA communication system	US7,433,321	US7,903,633; US8,477,742; US7,796,549
	Signal acquisition in a wireless communication system	US8,068,530	
	Resource allocation for shared signaling channels	US20070211616	
	Method and apparatus for performing position determination with a short circuit call flow	US7,974,639	US20110319095
	Controlling hand-off in a mobile node with two mobile IP clients	US7,020,465	US7,509,123; US8,095,130
	Methods and apparatus for tunneling between different addressing domains	US7,366,147	
	Methods and apparatus for aggregating MIP and AAA messages	US7,564,824	
	Packet forwarding methods for use in handoffs	US20030193912	
	Synchronization Techniques for a Wireless System	US7,133,354	CA
	Wireless timing and power control	US7,668,573	US20100130220

	Method and apparatus for using a MAC protocol for broadcast	US8,014,331	TW
	Seamless context switching for radio link protocol	US20080186920	
	Method and apparatus for handoff between source and target access systems	US8,576,795	US14/061,491
	Secondary synchronization codebook for E-UTRAN	US8,009,701	US20110305237
	Cell relay packet routing	US20100103861	
	Data transmission in a TDMA system	US6,819,937	
	Cross-carrier/cross-subframe indication in a multi-carrier wireless network	US20110105050	
	Method and Apparatus for Controlling Transmission Power in a CDMA Cellular Mobile Telephone System	MYMY-110833-A	
	Method for Using Only Two Base Stations for Determining the Position of a Mobile Subscriber in a CDMA Cellular Telephone System	US6,034,635	
	Dual Event Slotted Paging	US6,832,094	US8,224,356; US8,046,005; US7,983,695; US7,970,420; US7,555,302; US8,068,859
	Method and Apparatus for Transmitting and Receiving Data Multiplexed onto Multiple Code Channels, Frequencies and Base Stations	US6,215,777	US6,359,868
	Reservation Multiple Access	US6,987,982	US7,613,462; US8,014,805

Reference (Not applied in Japan)
[ver. 3.2]

特許出願人 (PATENT HOLDER)	発明の名称 (NAME OF PATENT)	出願番号等 (REGISTRATION NO. / APPLICATION NO.)	備考 （出願国名） REMARKS
QUALCOMM Incorporated	Communique Subscriber Handoff Between A Narrowcast Cellular Communication Network And A Point-To-Point Cellular Communication Network	US6,681,115	AU; CA; DE; EP; ES; FR; GB; IT
	Methods and apparatus for separating home agent functionality	US7,697,501	US8,077,695; US8,457,099;
	Apparatus and method for determining multi-antenna radiated performance of wireless devices	US8,412,110	TW
	File delivery over a broadcast network using file system abstraction, broadcast schedule messages and selective reception	US8,914,471	US14/569,318
	Method and apparatus for sending channel state information using subframe-dependent control channel formats	US20130121270	
	Systems, apparatus, and methods for managing information in a smart storage device	WO2014078473	US20140141760; TW
	Phase difference signaling in MIMO mode uplink	US20130176868	

	Method for configuring a home node with a secure address for an operator network node	US20130258944	US20140098751
	A method to enable LTE RAN sharing between multiple HRPD operators	PCT/CN2012/080622	
	Method and apparatus for processing control and shared channels in an LTE system	WO2014022165	US20140036804
	Multiband eMBMS enhancement using carrier aggregation	US20140119265	
	Reference signals for an enhanced physical downlink control channel	WO2014058594	
	Managing cross-carrier scheduling in carrier aggregation with EPDCCH in LTE	WO2014070761	
	EPDCCH resource and quasi-co-location management in LTE	WO2014070311	

Change History

Version	Date	History
Ver. 1.0	December 12, 2007	Enacted by the 68th ARIB Standard Assembly
Ver. 1.1	March 19, 2008	Approved by the 69th ARIB Standard Assembly
Ver. 1.2	June 6, 2008	Approved by the 70th ARIB Standard Assembly
Ver. 1.3	September 25, 2008	Approved by the 71st ARIB Standard Assembly
Ver. 1.4	March 18, 2009	Approved by the 73rd ARIB Standard Assembly
Ver. 1.5	July 29, 2009	Approved by the 74th ARIB Standard Assembly
Ver. 2.0	April 26, 2010	Approved by the 76th ARIB Standard Assembly
Ver. 2.1	March 28, 2011	Approved by the 79th ARIB Standard Assembly
Ver. 2.2	July 7, 2011	Approved by the 80th ARIB Standard Assembly
Ver. 2.3	February 14, 2012	Approved by the 83rd ARIB Standard Assembly
Ver. 2.4	July 3, 2012	Approved by the 84th ARIB Standard Assembly
Ver. 3.0	July 3, 2013	Approved by the 88th ARIB Standard Assembly
Ver. 3.1	March 18, 2014	Approved by the 91st ARIB Standard Assembly
Ver. 3.2	July 31, 2014	Approved by the 92nd ARIB Standard Assembly
Ver. 3.3	March 17, 2015	Approved by the 95th ARIB Standard Assembly

Change History List of Standards Ver.1.1

No.	Item No.	Title	Page	Change Summary
1	Chapter 3.2	(14), b, Note 3 and Note 2 (greater than 17dBi)	31,32, 32a	Addition of function on usage restriction for high gain antenna mobile station
2	Attach-ment 2	Industrial Property Rights for Ver1.0	AT2-4～ AT2-7	Addition of IPR list

Change History List of Standards Ver.1.2

No.	Item No.	Title	Page	Change Summary
1	Attach-ment 2	Industrial Property Rights for Ver1.0	AT2-8,9	Addition of IPR list

Change History List of Standards Ver.1.3

No.	Item No.	Title	Page	Change Summary
1	Attach-ment 2	Industrial Property Rights for Ver1.0	AT2-10～ 13	Addition of IPR list
2	Attach-ment 2	Industrial Property Rights for Ver1.0	AT2-1～3 AT2-5～9	Correction of footnote

Change History List of Standards Ver.1.4

No.	Item No.	Title	Page	Change Summary
1	Attach-ment 2	Industrial Property Rights for Ver1.0	AT2-14～ 18	Addition of IPR list

Change History List of Standards Ver.1.5

No.	Item No.	Title	Page	Change Summary
1	Attach-ment 2	Industrial Property Rights for Ver1.0	AT2-19~ 25	Addition of IPR list

Change History List of Standards Ver.2.0

No.	Item No.	Title	Page	Change Summary
1	Chapter 2.5	Enhancements in the WiMAX Forum System Profile Release 1.5	28	Addition of description regarding enhancements in the WiMAX Forum System Profile Release 1.5
2	Chapter 2.6	Low Power Repeater	29	Addition of outline and configuration of Low Power Repeater
3	Chapter 3.3	Low Power Repeater	46	Addition of technical requirements for Low Power Repeater
4	Chapter 4.2	Release 1.5	55	Addition of Attachment 3-2-1”WiMAX Forum™ Mobile System Profile Release 1.5 Common Part” and Attachment 3-2-2

				"WiMAX Forum™ Mobile System Profile Release 1.5 TDD Part"
5	Chapter5.2	Release 1.5	57	Addition of Attachment 4-2-1 through 4-2-16 "WiMAX Forum™ Network Architecture"
6	Attachment 2	Industrial Property Rights for Ver2.0	AT2-24	Addition of IPR list
7	Reference	List of Essential IPRs, Reference	REF-1~3	Separation of References (Not applied in Japan) from Attachment 2

Change History List of Standards Ver.2.1

No.	Item No.	Title	Page	Change Summary
1	Attachment 2	List of Essential IPRs for Ver1.0 and Ver2.0	AT2-25～29	Addition of IPR list
2	Reference	List of Essential IPRs, Reference	REF-4～5	Addition of IPR list

Change History List of Standards Ver.2.2

No.	Item No.	Title	Page	Change Summary
1	Chapter 3.2 (4) a	Modulation system (Mobile station)	30	Addition of 64QAM
2	Chapter 3.2.1.3	Output power (Mobile station)	35	Changed to "400mW or less"
3	Chapter 3.2.1.5 (1) (i)	Adjacent channel leakage power (Mobile station)	35	Changed to "5dBm or less"
4	Chapter 3.2.1.5 (1) (ii)		35	Changed to "3dBm or less"
5	Chapter 3.2.1.10	Antenna gain (Mobile station)	38	Changed to "5dBi or less" with remarks
6	Chapter 3.3.1(5) a	Modulation system (toward Base Station)	47	Addition of 64QAM
7	Attachment 2	Industrial Property Rights for Ver2.2	AT2-30	Addition of IPR list

Change History List of Standards Ver.2.3

No.	Item No.	Title	Page	Change Summary
1	Attachment 2	List of Essential IPRs for Ver1.0 and Ver2.0	AT2-31～32	Addition of IPR list

Change History List of Standards Ver.2.4

No.	Item No.	Title	Page	Change Summary
1	Attachment 2	List of Essential IPRs for Ver1.0	AT2-33	Addition of IPR list
2	Reference	List of Essential IPRs, Reference	REF-6	Addition of IPR list

Change History List of Standards Ver.3.0

No.	Item No.	Title	Page	Change Summary
1	Chapter 1.1	Outline	1	Addition of the following description or sentence - MIC Ordinance Regulation Radio Equipment, Article 49.29 - 3GPP - "Also it should be noted that the WiMAX End-to-End Network Systems Architecture refers to IETF standards and ITU-T's recommendations." Deletion of the following sentence - "with 5ms of transmission burst repetition period"
2	Chapter 1.2	Scope of the Standard	2	Addition of the following description - 3GPP Deletion of the following description - IEEE802.16 standard
3	Chapter 2	System overview	3～4	Addition of the following description - 3GPP - WiMAX Release 2.0 and 2.1 Deletion of the following description - IEEE802.16
4	Chapter 2.1	Mobile WiMAX Network Architecture	4	Addition of the following sentence - "Note that this section is not applicable for WiMAX Release 2.1 Additional Elements." Modification of URL
5	Chapter 2.2	WiMAX Network Reference Model	6	Addition of the following sentence - "Note that this section is not applicable for WiMAX Release 2.1 Additional Elements."
6	Chapter 2.7	Advanced Air Interface in the WiMAX Forum System Profile Release 2.0	29～30	Addition of description regarding the WiMAX Release 2.0
7	Chapter 2.8	Additional Elements in the WiMAX Forum System Profile Release 2.1	30～31	Addition of description regarding the WiMAX Release 2.1
8	Chapter 3.1	WiMAX Release	32～64	Modification and addition of technical

		1.0 and 2.0		requirements regarding WiMAX Release 1.0 and 2.0
9	Chapter 3.2	WiMAX Release 2.1 Additional Elements	65～81	Addition of technical requirements regarding the WiMAX Release 2.1 Additional Elements
10	Chapter 4.3	Release 2.0	82	Addition of Attachment 3-3 “WiMAX Forum™ Mobile System Profile Release 2.0”
11	Chapter 4.4	Release 2.1	82	Addition of Attachment 3-4 “WiMAX Forum™ Mobile System Profile Release 2.1”
12	Chapter 5.3	Release 2.0	86～87	Addition of Attachment 4-3-1 through 4-3-10 “WiMAX Forum™ Network Architecture” and “WiMAX Forum™ Network Requirements”
13	Chapter 5.4	Release 2.1	87	Addition of Attachment 4-4-1 through 4-4-2 “WiMAX Forum™ Network Architecture”
14	Attachment 2	List of Essential IPRs for Ver2.0 and Ver3.0	AT2-34 ～ 35	Addition of IPR list

Change History List of Standards Ver.3.1

No.	Item No.	Title	Page	Change Summary
1	Attachment 2	List of Essential IPRs for Ver3.0	AT2-36～ 109	Addition of IPR list
2	Reference	List of Essential IPRs, Reference	REF-7～ 12	Addition of IPR list

Change History List of Standards Ver.3.2

No.	Item No.	Title	Page	Change Summary
1	Reference	Attachment 3-1 Attachment 3-2-1 Attachment 3-2-2 Attachment 3-3 Attachment 4-1-1 Attachment 4-1-2 Attachment 4-1-3 Attachment 4-1-4 Attachment 4-1-5 Attachment 4-1-6 Attachment 4-1-7 Attachment 4-1-8 Attachment 4-1-9 Attachment 4-1-10 Attachment 4-1-11 Attachment 4-1-12 Attachment 4-1-13 Attachment 4-2-1	v - xii	Update to latest reference document

		Attachment 4-2-3 Attachment 4-2-5 Attachment 4-2-6 Attachment 4-2-5 Attachment 4-2-8 Attachment 4-2-10 Attachment 4-2-11 Attachment 4-2-13 Attachment 4-3-1 Attachment 4-3-2 Attachment 4-3-3 Attachment 4-3-4 Attachment 4-3-5 Attachment 4-3-6 Attachment 4-3-7 Attachment 4-3-8 Attachment 4-3-9 Attachment 4-3-10		
2	Reference	Attachment 3-4 Attachment 4-4-1 Attachment 4-4-2	v - xi	Upgrade WiMAX Release 2.1 reference for supporting 3GPP Release 11
3	Reference	Attachment 3-5 Attachment 4-5-1 Attachment 4-5-2	v, xii	Add WiMAX Release 2.2 reference
4	Chapter 4	Attachment 3-1 Attachment 3-2-1 Attachment 3-2-2 Attachment 3-3	81	Update to latest reference document
5	Chapter 4.3	Attachment 3-4	81	Upgrade WiMAX Release 2.1 reference for supporting 3GPP Release 11
6	Chapter 4.4	Attachment 3-5	81	Add WiMAX Release 2.2 reference
7	Chapter 5	Attachment 4-1-1 Attachment 4-1-2 Attachment 4-1-3 Attachment 4-1-4 Attachment 4-1-5 Attachment 4-1-6 Attachment 4-1-7 Attachment 4-1-8 Attachment 4-1-9 Attachment 4-1-10 Attachment 4-1-11 Attachment 4-1-12 Attachment 4-1-13 Attachment 4-2-1 Attachment 4-2-3 Attachment 4-2-5 Attachment 4-2-6 Attachment 4-2-5 Attachment 4-2-8 Attachment 4-2-10 Attachment 4-2-11	82 - 88	Update to latest reference document

		Attachment 4-2-13 Attachment 4-3-1 Attachment 4-3-2 Attachment 4-3-3 Attachment 4-3-4 Attachment 4-3-5 Attachment 4-3-6 Attachment 4-3-7 Attachment 4-3-8 Attachment 4-3-9 Attachment 4-3-10		
8	Chapter 5.4	Attachment 4-4-1 Attachment 4-4-2	89	Upgrade WiMAX Release 2.1 reference for supporting 3GPP Release 11
9	Chapter 5.5	Attachment 4-5-1 Attachment 4-5-2	89	Add WiMAX Release 2.2 reference
10	Attachment 2	List of Essential IPRs for Ver3.2	AT2-110	Addition of IPR list

Change History List of Standards Ver.3.3

No.	Item No.	Title	Page	Change Summary
1	Attachment 2	List of Essential IPRs for Ver3.2	AT2-111 ～116	Addition of IPR list
2	Reference	List of Essential IPRs, Reference	REF-13～ 14	Addition of IPR list

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Communication Note of ARIB Standard-related Proposals, etc.

ARIB Standard Name (No.)	**OFDMA Broadband Mobile Wireless Access Systems (WiMAX™ applied in Japan) (ARIB STD-T94)**

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OFDMA Broadband Mobile Wireless Access System
(WiMAX™ applied in Japan)

ARIB STD-T94 Version 3.3

Version 1.0	December	12th	2007
Version 1.1	March	19th	2008
Version 1.2	June	6th	2008
Version 1.3	September	25th	2008
Version 1.4	March	18th	2009
Version 1.5	July	29th	2009
Version 2.0	April	26th	2010
Version 2.1	March	28th	2011
Version 2.2	July	7th	2011
Version 2.3	February	14th	2012
Version 2.4	July	3rd	2012
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