Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	Comment on 16j usage model document
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Re:	Call for submissions on 16m relay usage model
Abstract	This contribution proposes comments on 16j usage model document.
Purpose	Discuss in 16m
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Comment on 16j usage model document

1. Introduction

IEEE 802.16j usage model document [1] defines 4 types of usage models: Fixed Infrastructure, In-building coverage, Temporary coverage and Coverage on mobile vehicle. Each of these usage models has a few cases and assumptions in which it can be used. Every single case in every 16j usage model does not need to be supported in 16m relay. To meet the 16m schedule, it may be worth considering which of the cases in 16j usage models should be supported in 16m relay. Some considerations and suggestions are provided.

The fixed infrastructure model utilizes the RS for permanent coverage extension or capacity enhancement. But when we say “the RS owned by clients”, it also implies the position is left at the discretion of the clients and this in turn changes the coverage and interference characteristics. In that sense, we think it is natural to consider only the RS owned or installed by the service provider as the infrastructure RS. Moreover, it also clarifies the difference between fixed infrastructure and in building coverage usage models or between fixed infrastructure and temporary coverage usage models.
The case of RSs owned by the client can be covered under the "Temporary coverage model" [1]."

2. Modifying 16j Usage Models for 16m relay

For ‘Fixed infrastructure’ usage model, RSs which are fixed and installed by the service provider should be considered. These RSs will be used to extend coverage, fill the coverage hole and improve throughput for cell edge users. The ‘Fixed infrastructure’ usage model will not include the support of stationary client device or military usage.
For ‘Temporary coverage’ usage model, instead of destroyed fixed infrastructure stations, any type of RS can be used to recover disaster and provide coverage. The ‘Temporary coverage’ usage model will not include the support of military usage.
Whether or not to support duplicate paths is not related to usage model discussions. So, sentences related to the description of duplicate path should be deleted.

3. Proposed text change

[Change subclause 4.1 as follows:]

4.1 Fixed Infrastructure Usage Model

In this usage model a service provider deploys RSs and MMR-BSs within their network to improve coverage, capacity or per user throughput in areas which are not sufficiently covered in the MMR-BS cell or to extend coverage to areas that are beyond the boundaries of the MMR-BS coverage area. Fixed relay stations that are owned by the infrastructure provider are utilized in this model. RSs can range from simple to complex. They can be mounted on towers, poles, tops or sides of buildings, lamp posts, or in other locations. The provider can plan the locations of RS antennas to obtain LOS channels between the MMR-BS and RSs, but this will not always be practical, so NLOS channel conditions on links between MMR-BS and RSs can be expected. ~~Another potential deployment strategy is to integrate small, simple RSs with stationary client devices mounted on rooftops or within buildings. Stationary client system examples include not just private and business stationary~~

~~systems, but also hot-spots owned by utilities, municipalities, and others.~~ In general, RSs will enter the network when they are deployed and remain in the network under the management of the infrastructure provider. ~~In the case of RSs collocated with stationary client devices, RSs may enter and leave the network unexpectedly based on the actions of the clients that own them.~~ Topologies can include communication paths that range from 2 hops to multiple hops. ~~Redundant routes are possible and can be utilized to provide fault tolerance and to balance the traffic load.~~

~~In some environments such as those encountered within military use case scenarios, the RS site may be pre-planned and carefully designed to provide enhanced connectivity and capacity to MS/SS users. Antenna heights may be significantly less than commercial deployments, such as cell towers or high rises due to operational safety concerns, area of operation, and amount of infrastructure available. Redundant routes are often used to provide fault tolerance and to balance the traffic load.~~

Figure 1 illustrates some of the use cases that appear in this usage model. These include deployment of RSs to provide coverage extension at the edge of the cell, to provide coverage for indoor locations, to provide coverage for users in coverage holes that exist due to shadowing and in valleys between buildings, and to provide access for clusters of users outside the coverage area of the BS.

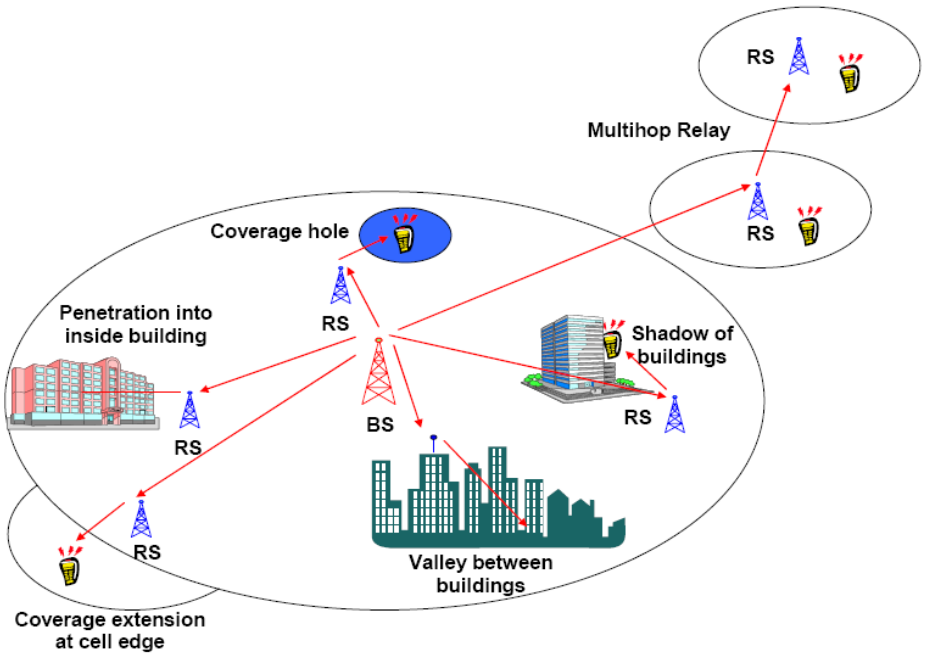

Figure 1 Example Use Cases from the Fixed Infrastructure Usage Model

[Change subclause 4.2 as follows:]

4.2 In-Building Coverage Usage Model

In this usage model RSs are deployed to provide better coverage and higher throughput in a building, tunnel or underground such as on a subway platform. There can be one RS that services a small building, tunnel or underground location, or multiple RSs that service a larger building, tunnel or underground location. The RSs can be owned by the infrastructure provider or by the customer and will generally need to be simple and low cost. They can be fixed or nomadic. Channel conditions between the MMR-BS and RSs will generally be NLOS, but it is possible that the RS has one or more antennas mounted to the exterior of the building to provide

the link between it and the upstream RS or MMR-BS and one or more antennas mounted inside the building to provide coverage to downstream RSs and MSs. In this usage model RSs owned by the infrastructure provider will enter the network when they are deployed and remain in the network under the management of the infrastructure provider, while client owned RSs may enter and exit the network unexpectedly based on the actions of the clients that own them. Topologies can include communication paths that range from 2 hops to multiple hops. ~~Redundant routes are possible and can be utilized to provide fault tolerance and to balance the traffic load.~~ The RS may be deployed inside the building, or outside. RSs will generally be connected to a power source, but may need to operate under battery power.

Figure 2 illustrates some examples of in-building coverage. In the left of the figure is an example of a RS which services underground location. In the right upper half of the figure is an example of a nomadic RS that is placed in a location in which it receives a sufficient signal to the MMR-BS or to another RS. The nomadic RS then provides access to subscribers within the room or building. In the left lower half of the figure is pictured the case where a number of RSs are deployed within a larger building such as a multi-tenant dwelling or office building. Data is relayed among the RSs in the building and out to an RS or MMR-BS outside the building.

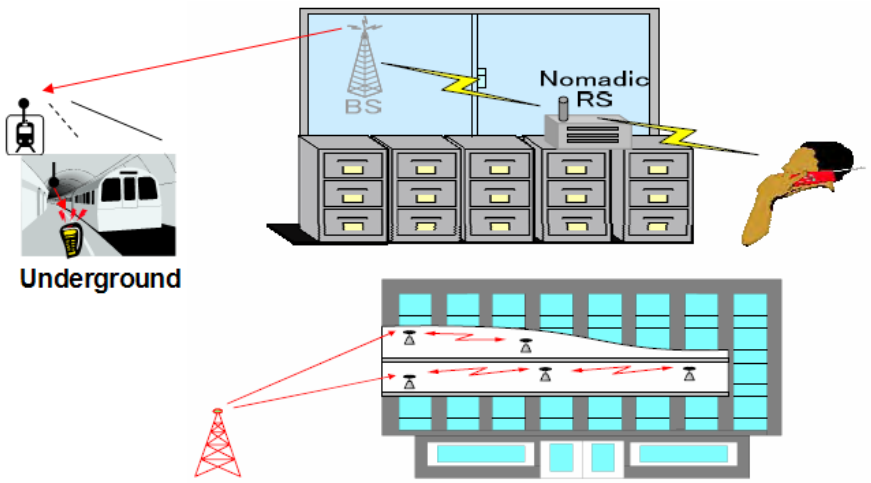

Figure 2 Examples of In-building Coverage Usage Models

[Change subclause 4.3 as follows:]

4.3 Temporary Coverage Usage Model

In this usage model ~~nomadic~~ RSs are deployed temporarily to provide additional coverage or capacity in an area where the MMR-BS and fixed infrastructure RSs do not provide sufficient coverage or capacity. RSs deployed in this usage model can range from small and simple to large and complex. In this usage model RSs will enter the network when they are deployed and will exit the network when the temporary situation for which they were deployed has ended. Topologies can include communication paths that range from 2 hops to multiple hops. LOS or NLOS channel conditions can be expected between MMR-BS and RSs. RSs will generally be connected to a power source, but may need to operate under battery power.

Some examples of the situations in which temporary coverage is required are:

- Emergency / Disaster Recovery – In this case parts of the fixed infrastructure may have been destroyed or coverage is required in areas that are not serviced by fixed infrastructure deployments.
- Temporary Coverage for Event – In this case an event such as a sporting event or fair requires that coverage be provided for the duration of the event.

~~In some environments such as those encountered within military scenarios, RS sites can be pre-planned to some extent, but may have to be placed in an arbitrary manner due to unanticipated environmental anomalies or deployment dynamics. Typically, antenna heights are relatively low, such as vehicle-mounted masts; one purpose being quick deployment and fast tear-down. RS in this configuration may have some limitations in size, weight, and power to minimize the amount of support equipment and infrastructure necessary to allow proper functionality of RS.~~

The detailed usage scenarios in this model are similar to those of the fixed infrastructure usage model in that RSs are deployed to provide coverage, range extension, and/or capacity. Some examples of this usage model are illustrated in Figure 3.

Reference:

[1] 802.16j-06_015, Harmonized contribution on 802.16j (Mobile Multihop Relay) usage models.