

IEEE 802.16 Working Group on Broadband Wireless Access<http://WirelessMAN.org>

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Dr.-Ing. Jamshid Khun-Jush, Chairman, ETSI BRAN
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Dear Jamshid:

On behalf of IEEE 802.16, I would like to update you on 802.16's Session #12, which was held this week. For more details, please see our report <<http://ieee802.org/16/meetings/mtg12/report.html>>.

Significantly, IEEE 802.16 has reconstructed and renumbered its three air interface projects, bringing them into harmony as extensions of a single base document with a common MAC sublayer. Details are provided in [IEEE 802.16-01/10](#). The new identities are:

- 802.16: Local and Metropolitan Area Networks - Part 16: Standard Air Interface for Fixed Broadband Wireless Access Systems (formerly 802.16.1)
- 802.16a: Local and Metropolitan Area Networks — Amendment to Standard Air Interface for Fixed Broadband Wireless Access Systems — Media Access Control Modifications and Additional Physical Layer for 2-11 GHz (formerly 802.16.3)
- 802.16b: Local and Metropolitan Area Networks — Amendment to Standard Air Interface for Fixed Broadband Wireless Access Systems — Media Access Control Modifications and Additional Physical Layer for License-Exempt Frequencies (formerly 802.16.4)

As you see from titles, 802.16a and 802.16b will be amendments to the 802.16 base standard.

We very much appreciate your letter of 2 February 2001 (our document IEEE 802.16l-01/08) and were gratified to learn that your HIPERMAN Working Group accepted our request to evaluate the compliance of our 802.16a project (formerly 802.16.3) with its functional requirements.

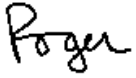
As you know, the 802.16a project is still evolving. However, we have taken the opportunity to participate in your evaluation. Attached please find our current assessment on the responsiveness of the proposed 802.16a standard to the HIPERMAN Functional Requirements described in Report BRAN/DTR 101 856. Our assessment is based on the 802.16a Functional Requirements Document (IEEE 802.16.3-00/02r4). For simplicity, we have inserted our responses directly into your document, leaving untouched its assessments regarding HIPERACCESS and HIPERLAN/2.

2001-03-15

IEEE 802.161-01/09

As usual, we welcome your members to participate in our process in any way. Please let me know if there is anything we can do to assist in this process.

Best regards,

A handwritten signature in cursive script that reads "Roger".

Dr. Roger B. Marks
Chair, IEEE 802.16 Working Group on Broadband Wireless Access

cc: Jim Carlo, Chair, IEEE 802 LAN/MAN Standards Committee
Jay Klein, IEEE 802.16 Liaison to ETSI HIPERACCESS
Marianna Goldhammer, IEEE 802.16 Liaison to ETSI HIPERMAN
Demos Kostas, Alternate IEEE 802.16 Liaison to ETSI HIPERMAN

A.1 Mandatory Requirements

#	Section	Layer	Requirement
M01	4.4	DLC	The system SHALL support PMP topology
		802.16a MAC/PHY	Complies – FRD M5
		HIPERACCESS	Complies The topology of Hiperaccess is point-to-multipoint
		HIPERLAN/2	Complies The system SHALL support PMP topology, but it may also support. Direct Mode between terminals. (Direct mode is optional))
M02	4.4	DLC	In PMP systems, all data traffic SHALL go through the base station that SHALL serve as a radio resource supervisor.
		802.16a MAC/PHY	Complies – FRD M4
		HIPERACCESS	Complies
		HIPERLAN/2	Complies In PMP systems, the usage of the channel shall be controlled by the base station, but the data traffic in direct link goes from a station to another.
M03	4.4	DLC	In [optional] mesh systems, the base station SHALL serve as a global radio resource supervisor and SUs serve equally as local radio resource supervisors.
		802.16a MAC/PHY	Does not comply
		HIPERACCESS	Does not comply Does not support mesh
		HIPERLAN/2	Does not comply Does not support mesh.
M04	4.5	PHY SPC	Therefore, NLOS operation SHALL be supported.
		802.16a MAC/PHY	Complies
		HIPERACCESS	Does not comply. The use of microwave frequencies makes it necessary for the antenna at the customer premises to be in LOS with the transmitter or a signal repeater. Implementing PHY at 3.5 GHz would not resolve delay spread.
		HIPERLAN/2	Does not comply, requires modifications.
M05	4.5	PHY	The system MUST be robust in adverse channel conditions
		802.16a MAC/PHY	Complies
		HIPERACCESS	Does not comply. For example large delay spreads as occur around 3.5 GHz are not considered.
		HIPERLAN/2	Does not comply, would require modifications
M06	4.5	PHY DLC	The system SHALL be bandwidth/spectrally efficient, both in single and multi-cell architectures.
		802.16a MAC/PHY	Complies
		HIPERACCESS	Complies
		HIPERLAN/2	Does not comply, multi-cell architecture is not considered.
M07	4.6.1	SPC	The standard SHALL be optimized for radio systems in the frequency band 3.4 to 4.2 GHz
		802.16a MAC/PHY	Complies – PAR
		HIPERACCESS	Does not comply, the target spectrum is above 11 GHz
		HIPERLAN/2	Does not comply, standard is optimised for indoor operation in 5 GHz
M08	4.6.2	PHY DLC SPC	The standard SHALL support systems based on FDD or TDD or FDD and TDD efficiently.
		802.16a MAC/PHY	Complies – FRD M32
		HIPERACCESS	Complies HIPERACCESS will be based on FDD and a TDD version will be specified based on the FDD standard. Support for H-FDD terminals interoperable with FDD is required. TDD operation would enable usage of unpaired frequency allocations.
		HIPERLAN/2	Does not comply. Standard is based on TDD only.
M09	4.6.2	PHY DLC SPC	In FDD mode, the base station SHALL support full-duplex FDD.
		802.16a MAC/PHY	Complies
		HIPERACCESS	Complies
		HIPERLAN/2	Does not comply, standard is based on TDD only.

M10	4.6.3	SPC	HIPERMAN standards SHALL adhere to channel plans described in [9] and [8] (current version E or later) for 3400-3600 and 3600-4200 MHz bands respectively. However, sufficient flexibility MUST be provided to allow operation in regions where these recommendations are not followed and in other frequency bands below 11 GHz.
802.16a MAC/PHY			TBD
HIPERACCESS			Does not comply
HIPERLAN/2			Does not comply
M11	5.1	DLC	The system MUST be optimized to transport variable length IP datagrams. Both IP versions 4 and 6 MUST be supported.
802.16a MAC/PHY			Complies
HIPERACCESS			May not comply. HA is optimised for ATM, because the cell-size is fixed.
HIPERLAN/2			Does not comply. HL/2 is optimised for ATM, because the cell is fixed.
M12	5.3	DLC PHY	The system SHALL support voice communications. The voice access transport SHALL be packet based. The system MUST support the QoS requirements of these services.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies, even supports circuit switched voice and ISDN
HIPERLAN/2			Complies
M13	5.4	DLC	The system SHALL facilitate unicast, multicast, as well as broadcast services.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies. HIPERACCESS must support unicast and multicast. (broadcast ?)
HIPERLAN/2			Complies. The system SHALL provide user data and control unicast and control broadcast. The system MAY provide user data multicast and user data broadcast.
M14	6.1	NMS	The standard SHALL define a network management interface based on existing open standard protocols.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies It will follow ITU-T Rec. G.902 and M.3010, as well as, ETSI V5 and VB5, where applicable
HIPERLAN/2			Partly complies. MIB standardized, but incomplete for HIPERMAN type network.
M15	6.1	NMS	The [management] protocols MUST enable fault and performance monitoring, as well as provide means for local and remote testing.
802.16a MAC/PHY			TBD
HIPERACCESS			Complies or very similar.
HIPERLAN/2			Does not comply, not defined
M16	6.1	NMS	The management functionality MUST include reboot, reactivation and shutdown capabilities.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies or very similar
HIPERLAN/2			Does not comply, not defined
M17	6.1	NMS	The [management] protocols MUST enable both local and remote configuration including the updating of software in any device in the network without service interruption.
802.16a MAC/PHY			TBD
HIPERACCESS			Complies or very similar
HIPERLAN/2			Does not comply, not defined
M18	6.1	NMS	The system SHALL enable centralized authentication and authorization services.
802.16a MAC/PHY			Complies – FRD M50-M55
HIPERACCESS			Complies
HIPERLAN/2			Partly complies, centralised authentication (the scope for the authentication is limited to the local WLAN) enabled, but no authorization.
M19	6.1	NMS DLC	The [management] protocols MUST permit operators to enforce service level agreements (SLAs) with subscribers by restricting access to the air link, discarding data, dynamically controlling bandwidth available to a user or other appropriate means.
802.16a MAC/PHY			TBD
HIPERACCESS			Under standardization
HIPERLAN/2			Does not comply, taking care of on an AP by AP basis: e.g. resource grants, (dis)association
M20	6.1	NMS	The protocols MUST permit performance monitoring of the provided services by the subscriber at the delivery point.
			TBD

HIPERACCESS			Under standardization
HIPERLAN/2			Does not comply
M21	6.1	NMS	The network management system SHALL enable provisioning and operation of a number of different SUs provided by several suppliers on a BS.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies
M22	6.1	NMS	The system management framework, architecture, protocols, and managed objects MUST allow for operators to effectively administer accounting and auditing, by making available the relevant information to an external billing system.
802.16a MAC/PHY			TBD
HIPERACCESS			Similar
HIPERLAN/2			Does not comply,not defined
M23	6.1	NMS	An operator MUST be able to account for time- and bandwidth-utilization and the various QoS parameters for each subscriber.
802.16a MAC/PHY			TBD
HIPERACCESS			Not defined
HIPERLAN/2			Does not comply,not defined
M24	6.1	NMS DLC	Any radio relay or repeater function SHALL be a managed element.
802.16a MAC/PHY			TBD
HIPERACCESS			Complies Any radio relay or repeater function should be a managed element. BS does not necessarily know anything about repeaters.
HIPERLAN/2			Does not comply,not defined
M25	6.2.1	DLC	The DLC convergence layer at the BS SHALL be packet-based.
802.16a MAC/PHY			Complies
HIPERACCESS			Does not comply
HIPERLAN/2			Does not comply
M26	7	DLC	Priority information given to the convergence layer SHALL be used for the QoS mechanism.
802.16a MAC/PHY			Complies
HIPERACCESS			Under standardisation
HIPERLAN/2			Complies
M27	7.1	DLC	A HIPERMAN system SHALL provide services without requiring information on the type of application.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies
M28	7.2.1	DLC	The system SHALL provide Quality of Service (QoS) support as follows (see Error! Reference source not found.).
802.16a MAC/PHY			Complies – FRD M11, M36
HIPERACCESS			Under standardisation
HIPERLAN/2			Partially complies, traffic classification is different (among others)
M29	7.2.1	DLC	The protocols SHALL support QoS guarantees to provide the services that the system SHALL transport. Thus, the protocol standards SHALL define interfaces and procedures that accommodate the requirements of the services with respect to allocation of prioritization of bandwidth.
802.16a MAC/PHY			Complies – FRD M11, M36-M43
HIPERACCESS			Under standardisation
HIPERLAN/2			Partially complies The convergence layers do perform mapping from service classes of higher layer protocols onto user connections over radio interface. It is up to the vendor how to realise the QoS. The protocol involved in resource allocation for user connections is RLC.
M30	7.2.1	DLC	The system SHALL support different classes for service quality in terms of delay, jitter, packet error ratio and data rates.
802.16a MAC/PHY			Complies – FRD M36-M42
HIPERACCESS			Under standardisation
HIPERLAN/2			Does not comply, can comply according to implementation
M31	7.2.2	DLC	Three classes of service [] SHALL be supported [: Expedited Forwarding, Assured

			Forwarding, Best Effort]
802.16a MAC/PHY			Complies – FRD M37
HIPERACCESS			Under standardisation
HIPERLAN/2			Does not comply, can comply according to implementation
M32	7.2.3	DLC	The basic mechanism available within the systems for supporting QoS/service class requirements SHALL be able to allocate various bandwidths to various services. The protocols SHALL include a mechanism that can support dynamically variable bandwidth channels and paths. This mechanism SHALL be done as a negotiation between convergence layer and higher layer.
802.16a MAC/PHY			Complies – FRD M36-M42
HIPERACCESS			Under standardisation
HIPERLAN/2			Partially complies
M33	7.3	PHY DLC	To accommodate changes in the channel characteristics, the PHY and DLC protocols SHALL specify functions and procedures to adjust parameters such as transmit power and modulation.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies
M34	7.4	DLC	The system SHALL efficiently support [highly] asymmetric traffic.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies HIPERACCESS systems must support both symmetric and asymmetric data flows, which may be duplex or simplex.
HIPERLAN/2			Complies
M35	7.4	NMS DLC	The system SHALL enable the operator to grant asymmetric traffic contracts.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Does not comply, not defined
M36	7.5.1	PHY DLC	It is desirable for the system to support a data rate at the APT of 25 Mbit/s, which SHALL be shared among the users or SHALL be capable of being allocated to one user.
802.16a MAC/PHY			TBD
HIPERACCESS			Complies
HIPERLAN/2			Complies
M37	7.5.1	DLC	The system SHALL accommodate different types of SU's with different maximum data rates.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies
M38	7.5.2	PHY	systems SHALL use different modulation and/or coding options for different links to increase the overall system throughput.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies
M39	7.6	PHY	The system SHALL permit radio links to be engineered for different link availabilities, based on the preference of the system operator.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies
M40	7.8	DLC NMS	The system SHALL provide secure means of authentication, authorization and adequate means of encryption to ensure privacy.
802.16a MAC/PHY			Complies – FRD M50-M56
HIPERACCESS			Complies
HIPERLAN/2			Complies
M41	7.8.1	DLC	Initial Authentication [of the subscriber station to the access network] SHALL be strong. The DLC layer SHALL support this level of authentication.
802.16a MAC/PHY			Complies - FRD M50-M56
HIPERACCESS			Complies or very similar

HIPERLAN/2			Complies
M42	7.8.1	DLC NMS	The authentication mechanisms SHALL be secure.
802.16a MAC/PHY			Complies - FRD M50-M56
HIPERACCESS			Complies
HIPERLAN/2			Complies
M43	7.8.1	DLC	Passwords and secrets SHALL NOT be passed "in the clear" through the air interface.
802.16a MAC/PHY			TBD
HIPERACCESS			Under standardisation
HIPERLAN/2			Complies
M44	7.8.2	NMS DLC	The standard SHALL identify a standard set of [authorization] credentials and allow for vendors to extend the defined credentials with non-standard credentials.
802.16a MAC/PHY			TBD
HIPERACCESS			Under standardisation
HIPERLAN/2			Does not comply
M45	7.8.3	DLC	Facilities SHALL also be defined in the [recommended privacy] protocol for the use of alternate cryptographic algorithms that can be supported.
802.16a MAC/PHY			Not comply
HIPERACCESS			Under standardisation
HIPERLAN/2			Does not comply. The HiperLAN/2 standard requires DES. Change of security mechanism is not allowed by the standard, but DES and triple DES is provided by the standard, nothing more.
M46	8.1.2	-	HIPERMAN systems SHALL therefore allow economic deployment in areas with fairly low user density, but have adequate growth potential to maintain a good grade of service as the user density increases.
802.16a MAC/PHY			TBD
HIPERACCESS			Does not comply. Coverage limited to 4 km.
HIPERLAN/2			Does not comply
M47	8.3	-	A HIPERMAN ODU (if the SU includes an ODU) including antenna on customer premises MUST be small (less than 45cm in all dimensions).
802.16a MAC/PHY			Beyond the standard
HIPERACCESS			Complies
HIPERLAN/2			Complies
M48	8.3	-	End-User installation SHALL be supported.
802.16a MAC/PHY			TBD
HIPERACCESS			More difficult
HIPERLAN/2			Complies
M49	8.5	PHY DLC NMS	The system MUST be technically able, by using coverage overlap, repeaters or other techniques, to improve range and coverage.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Does not comply
M50	8.6	PHY DLC	The system SHALL incorporate system features to monitor and if possible maintain the QoS in the face of [radio path obstruction, sporadic co- and adjacent channel interference, network growth] effects.
802.16a MAC/PHY			TBD
HIPERACCESS			Complies
HIPERLAN/2			Complies, (radio channel monitoring with DFS, adjacent channel scanning is implemented, C/I is monitored)
M51	8.7	PHY DLC	The equipment SHALL meet appropriate classes defined in ETS 300 019.
802.16a MAC/PHY			Beyond the scope
HIPERACCESS			Complies, the equipment must meet ETS 300 019 class 4.1, and may have to meet other regional standards.
HIPERLAN/2			Complies (though do not defined in the standard)
M52	8.8	PHY DLC	The system SHALL conform to the EMC standards EN 301 489-1, ETS 300 385 A1 and ETS 300 386-2.

802.16a MAC/PHY			Beyond scope
HIPERACCESS			HIPERACCESS systems will conform to all applicable EMC standards.
HIPERLAN/2			HIPERLAN/2 systems will conform to all applicable EMC standards.
M53	8.9		The HIPERMAN standard SHALL describe the PHY and DLC layers, which SHALL be core network independent. The core network specific Convergence sublayer(s) SHALL be specified as part of the standard.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies
M54	8.9	NMS PHY DLC	The standard, to be developed by ETSI Project BRAN, MUST support interoperability.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies

A.2 Recommended Requirements

#	Section		Requirement
R01	4.2	DLC PHY	Broadband fixed wireless access (BFWA) networks SHOULD support a wide range of applications in use today and be extendable to support future services.
802.16a MAC/PHY			Complies, Packet based services with QoS support through MAC (FRD M10-M13)
HIPERACCESS			Complies
HIPERLAN/2			Complies HL/2 is designed for WLAN and for its applications
R02	4.3	DLC PHY	The main features for HIPERMAN networks SHOULD be: [User installable terminals, Interoperable air interface, Very rapid scalable infrastructure deployment, Efficient spectrum usage Modular cost-effective growth (The system SHOULD allow easy customer installation of SUs and it SHOULD be easily expanded.), provision of packet-based services with QoS support.]
802.16a MAC/PHY			Complies (FRD M11, M13)
HIPERACCESS			Partially complies, Packet based services with QoS support through CL
HIPERLAN/2			Partially complies, No terminal installation, but packet based services with QoS support, interoperable air interface
R03	4.5	-	To counter channel condition variations and maximise spectral efficiency, the system SHOULD be able to trade-off throughput with robustness.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies
R04	4.5	DLC	The system SHOULD be able to support various convergence sublayers.
802.16a MAC/PHY			Complies (FRD Sec. 4)
HIPERACCESS			Complies
HIPERLAN/2			Complies
R05	4.6.1	-	It SHOULD be demonstrated that the deployment of FWA systems of the FS can coexist with existing services.
802.16a MAC/PHY			Complies
HIPERACCESS			
HIPERLAN/2			
R06	4.6.2	PHY DLC	The SU SHOULD be able to operate in half-duplex FDD to reduce equipment cost.
802.16a MAC/PHY			TBD
HIPERACCESS			Complies
HIPERLAN/2			Does not comply
R07	4.6.3	PHY DLC	The standard SHOULD offer a choice of channel arrangements which allow coexistence with pre-existing narrow band systems.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies. Coexistence problems with already existing satellite and radar systems have been taken

			into account in the DFS mechanism in the standard, and radio link power as well.
R08	4.6.4	SPC PHY	The systems SHOULD be able to operate within frequency assignments which are typically offered in the 3.5 and 10.5 GHz bands which are far from consistent throughout Europe and can be as small as 14 MHz.
	802.16a MAC/PHY		Complies
	HIPERACCESS		Does not comply
	HIPERLAN/2		Does not comply
R09	5.1	DLC	For efficient transport of IPv6, TCP/IP header compression over the air interface SHOULD be supported.
	802.16a MAC/PHY		Complies (FRD R3)
	HIPERACCESS		Under standardization
	HIPERLAN/2		Does not comply
R10	5.1	DLC	It SHOULD be possible to support the emerging IP-QoS efforts.
	802.16a MAC/PHY		Complies (FRD M11, R4)
	HIPERACCESS		Under standardization
	HIPERLAN/2		Complies
R11	5.2	DLC	The protocols SHOULD support bridged LAN service and Remote LAN access capabilities.
	802.16a MAC/PHY		Complies (FRD R5)
	HIPERACCESS		Under standardization
	HIPERLAN/2		Complies
R12	7.2.1	-	Jitter generated in the system SHOULD be taken into account in the design of the buffers.
	802.16a MAC/PHY		Beyond standard
	HIPERACCESS		Beyond standard
	HIPERLAN/2		Beyond standard
R13	7.3	PHY	Due to the multipath inherent in the targeted frequency bands, the system SHOULD be capable of handling several μ s of delay spread with limited performance degradation.
	802.16a MAC/PHY		Complies (FRD, NLOS definition is $>10\mu$ s, SUI-6 channel model is 20μ s)
	HIPERACCESS		Does not comply
	HIPERLAN/2		Does not comply
R14	7.3	SPC	Although optimized for the 3.4-4.2 GHz band, the characteristics of different frequency bands below 11 GHz SHOULD be taken into account when defining HIPERMAN parameters.
	802.16a MAC/PHY		Complies
	HIPERACCESS		Does not comply
	HIPERLAN/2		Does not comply
R15	7.3	PHY	The system SHOULD be such that it supports typical link distances as listed in <ref?>
	802.16a MAC/PHY		Complies (FRD R13, 50km)
	HIPERACCESS		Does not comply
	HIPERLAN/2		Does not comply
R16	7.3	DLC	Because large distances can be expected between terminal and base station, time delay compensation SHOULD be provided by the standard.
	802.16a MAC/PHY		Complies (FRD R9, Max range up to 50km)
	HIPERACCESS		Complies
	HIPERLAN/2		Does not comply
R17	7.4	PHY DLC	In TDD mode, a global asymmetry in the range of 10% upstream, 90% downstream to 90% upstream, 10% downstream SHOULD be supported.
	802.16a MAC/PHY		TBD
	HIPERACCESS		
	HIPERLAN/2		Complies
R18	7.4	PHY DLC	In FDD mode, the modulation type and coding SHOULD be adjustable to maximize total sector capacity and near the capacity asymmetry to the traffic asymmetry.
	802.16a MAC/PHY		TBD
	HIPERACCESS		Partially complies
	HIPERLAN/2		Does not comply
R19	7.6	SPC	HIPERMAN based systems SHOULD support an availability of at least 99.9% for the ranges as shown in <ref?>. Rain effects may further deteriorate these numbers depending on the targeted spectrum.
	802.16a MAC/PHY		Complies (FRD M25)
	HIPERACCESS		Does not apply

HIPERLAN/2			Does not comply
R20	7.7	PHY DLC	The protocols SHOULD allow for different capacities and performance for the system instances.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies
R21	7.7	PHY DLC	The system SHOULD support features to maximize the scalability of a deployment.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Does not comply
R22	7.8.1	-	The second level of authentication, between the user and the NMS, SHOULD be handled by higher layer protocols.
802.16a MAC/PHY			Beyond the standard
HIPERACCESS			Under standardisation
HIPERLAN/2			Complies
R23	7.8.3	DLC	The system SHOULD allow a cryptographic algorithm to be employed that is internationally applicable.
802.16a MAC/PHY			Complies (FRD R19)
HIPERACCESS			Under standardisation
HIPERLAN/2			Complies
R24	8.1.1	-	In suburban areas HIPERMAN SHOULD be able to support at least 20% penetration of the market, and in urban areas at least 15%. In dense city centre areas HIPERMAN need only to be able to support at least 10% penetration.
802.16a MAC/PHY			Beyond the standard
HIPERACCESS			Complies
HIPERLAN/2			Does not comply
R25	8.1.2	-	In rural areas, HIPERMAN systems SHOULD target clustered households, such as villages, and not isolated houses.
802.16a MAC/PHY			Beyond the standard
HIPERACCESS			Complies
HIPERLAN/2			Does not comply
R26	8.1.2	-	HIPERMAN SHOULD be designed on the assumption that, in each type of region (suburban, urban, city centre) it should support the same penetration of the SOHO and Small Enterprises customer base as the residential customer base.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Does not comply
R27	8.3	-	The HIPERMAN system SHOULD allow a design to include any functionality necessary to enable the economical installation of subscriber equipment.
802.16a MAC/PHY			Complies
HIPERACCESS			Partially complies (theoretically possible)
HIPERLAN/2			Not applicable
R28	8.3	-	Easy installation with a minimum of manual configuration SHOULD be the goal.
802.16a MAC/PHY			Complies
HIPERACCESS			More difficult
HIPERLAN/2			Partially complies (complies in WLAN scenarios)
R29	8.5	PHY DLC	It SHOULD be possible to trade-off service bandwidth against range when deploying a HIPERMAN system.
802.16a MAC/PHY			Complies
HIPERACCESS			Complies
HIPERLAN/2			Complies.
R30	8.7	PHY	The equipment SHOULD meet relevant regional [EMC] standards [other than ETS 300 019].
802.16a MAC/PHY			TBD
HIPERACCESS			Complies
HIPERLAN/2			Complies
R31	8.8	PHY	The emerging EMC standard EN 301 753 SHOULD be taken into consideration.

802.16a MAC/PHY			TBD
HIPERACCESS			
HIPERLAN/2			
R32	8.9	SPC	The coexistence issues SHOULD be handled by ETSI TM4.
802.16a MAC/PHY			Agreed – for Europe
HIPERACCESS			Not applicable
HIPERLAN/2			Not applicable

A.3 Optional Requirements

#	Section	Layer	Requirement
O01	4.4	DLC	The system [] MAY support mesh topology.
802.16a MAC/PHY			Does not comply
HIPERACCESS			Does not comply (does not support mesh topology).
HIPERLAN/2			Does not comply (does not support mesh topology).
O02	4.6.1	PHY SPC	The standard [] MAY be applicable to the range from 2 GHz to 11GHz.
802.16a MAC/PHY			Complies
HIPERACCESS			Does not comply
HIPERLAN/2			Does not comply
O03	4.6.1	DLC	It MAY support other interfaces, e.g. Ethernet, USB, and POTS.
802.16a MAC/PHY			Complies
HIPERACCESS			Under standardization
HIPERLAN/2			Partially complies
O04	8.1.1	-	HIPERMAN systems MAY be installed both in regions of relatively low household densities (rural areas) and regions with very high household densities (urban areas including city centres).
802.16a MAC/PHY			Complies
HIPERACCESS			Partially complies (theoretically possible)
HIPERLAN/2			Not applicable
O05	8.6	-	As the network grows new BSs MAY be built to increase capacity or extend or "fill-in" coverage.
802.16a MAC/PHY			Complies
HIPERACCESS			Partially complies (theoretically possible)
HIPERLAN/2			Complies (in WLAN scenarios)

Note: "FRD" refers to the IEEE 802.16a Functional Requirements Document ("Functional Requirements for the 802.16.3 Interoperability Standard"), which is Document [IEEE 802.16.3-00/02r4](#). The associated numbers beginning with "M" refer to numbered items in that document's Table 2 ("Mandatory Requirements").