

Guidance Document on 5 GHz Wireless LANs.

Background

The WG FM at its 43rd meeting in Warsaw 16-20 September 2002 agreed on a guidance document for Notified bodies and CEPT Administrations when introducing national interim arrangements allowing Wireless LANs not fully compliant with the ERC Decision(99)23¹

The present document is intended to provide such a guidance. The technical part of the document is in particular intended as a guidance to the Notified bodies who in accordance with the R&TTE Directive have to give an opinion to manufacturers on compliance when a harmonised standard is not yet available. The document has been developed in co-operation with the JPT5G-group within the ECC and comments from this group have been included in the document. It has also been discussed at the TCAM 11 meeting as part of the consultation process.

A guidance document has no official status in the normal ECC Documentation. It is therefore agreed that the document is published in the minutes to the WG FM meeting and is forwarded to the R&TTE Compliance Association.

1. Introduction

The ERC decision ERC/DEC(99)23 designates the frequency bands 5150 - 5350 MHz and 5470 - 5725 MHz for HIPERLANs. Both DFS (Dynamic Frequency Selection) and TPC (Transmitter Power Control) are required with the exception of HIPERLANs Type 1 equipment in the band 5150-5250 MHz where implementation of DFS and TPC is not required. The reference to HIPERLAN in the ERC/DEC(99)23 should be understood to refer to all 5 GHz High Performance RLANs meeting the requirements of the decision and not to any specific technology.

It should be noted that:

- There are no HIPERLAN type 1 products on the market.
- HIPERLAN Type 2 equipment will be fully compliant with the ERC/DEC(99)23.
- ETSI is working on a harmonised standard (draft EN 301 893) for 5 GHz high performance RLANs operating in the bands 5150 - 5350 MHz and 5470 - 5725 MHz. The first draft (ver 1.1.1) did not include DFS conformance testing, however the current version (ver 1.2.1) does include a quite mature conformance test framework for DFS. This draft, which is now in the Public Enquiry phase, is expected to be finalised during 2003. The Notified Bodies have given various interpretations on alternative methods of implementing DFS and TPC in originally IEEE 802.11a products.
- IEEE 802.11h equipment will be fully compliant with the ERC/DEC(99)23, since similar to the draft ETSI harmonised standard, the DFS performance testing will need to be implemented in that technology. This will be done when the work on DFS is finalised.
- IEEE 802.11a equipment is a 5 GHz RLAN that can operate in the band 5150 - 5350 MHz but standard 802.11a equipment has no DFS, as defined in ERC/DEC(99)23. However, in some countries the use of IEEE 802.11a equipment has been allowed but restricted to the band 5150 - 5250 MHz.

As there is no HIPERLAN type 1 equipment on the market, and as the IEEE 802.11h standard is not finalised, the majority of the equipment currently available are IEEE 802.11a and some pre-HIPERLAN type 2 without the full implementation of the DFS.

Some manufacturers of IEEE 802.11a equipment claim to have implemented or indicated a willingness to implement a mechanism that enables devices operating within 5150-5350 MHz to spread their occupancy across the available channels and the Transmitter Power Control on their equipment. It should be noted that such equipment if they don't have the DFS and TPC feature built in, can not be considered as fully

¹ The French Administration indicated that it does not accept the content of the guidance document adopted by the 43rd WG FM for the following reasons

- it contradicts the requirements on DFS as adopted in the ERC/DEC(99)23 applicable to the 5250 – 5350 MHz band;
- it does not promote a harmonised solution for the European market;
- it will cause undue interference to radars in a number of CEPT countries.

compliant with the ERC/DEC(99)23, nevertheless CEPT Administrations should be invited to implement a national interim solution for those types of equipment that are available today.

2. Current situation in ECC member states

Some Administrations have already followed the general guidelines or implemented similar solutions to meet the pressure from industry. Annex 2 to this document provides an overview of the current situation for 5 GHz Wireless LANs in some of the CEPT countries. It also contains information where the national arrangements accommodate equipment, which is not fully compliant with ERC/DEC(99)23, such as equipment without DFS and/or TPC.

3. Guidance on 5 GHz Wireless LANs

Background:

- a) The work on the specification of DFS performance characteristics including the radar detection mechanism, is under development but not yet finished. DFS is an essential feature to achieve compatibility between RLANs and radars and also with other users.
- b) Because of the above, industry currently can not produce equipment fully compliant with the ERC/DEC (99)23.
- c) Some manufacturers however now have their first 5 GHz products available. Most of this is 802.11a equipment, however some pre-HIPERLAN type 2 (without the DFS performance requirement) will be available soon.
- d) The DFS specification, including the radar detection mechanism, that will allow manufacturers to meet all the requirements of the ERC/DEC(99)23 decision, is expected to be finalised by the end of 2002.
- e) IEEE 802.11a and IEEE 802.11h use the same modulation (OFDM) and if deployed in Europe, the same channel plan and spectrum mask as HIPERLAN Type 2 equipment.
- f) There is some pressure from industry for an interim solution to allow Wireless LAN products operating in the band 5150-5350 MHz (802.11a products) to be placed on the market in Europe.
- g) Many CEPT Administrations have an existing regulation in place that allows HIPERLAN type 1 equipment (without DFS and without TPC) on the market in the band 5150 - 5250 MHz or in some cases from 5150 - 5350 MHz.
- h) Some CEPT Administrations already have an interim solution in place allowing equipment not fully compliant with the ERC/DEC(99)23 on their market with specific restrictions/limitations. (See annex 2)
- i) WG FM decided to study the issue and to provide guidance for CEPT Administrations to consider an interim solution for 5 GHz RLANs not fully compliant with the ERC/DEC(99)23.
- j) There is no reason to change the ERC/DEC(99)23 designating a total 455 MHz of spectrum for future use by 5 GHz Wireless LANs. Furthermore changing the ERC Decision at this point in time may impact the CEPT preparations for the WRC-03.
- k) The IEEE 802.11h specification is expected to be finalised by the end of 2002 and this standard will be fully compliant with ERC/DEC(99)23.

Guidelines:

- a) CEPT Administrations may implement an interim solution as detailed in the section '*technical parameters*' below, in order to allow Wireless LAN products which do not fulfil all the requirements in ERC/DEC(99)23 to operate in the band 5150-5350 MHz for indoor use only.
- b) Such an interim solution, which is applicable to countries where radars are not used in the 5250-5350 MHz band, would be implemented on a national basis only. For most countries where radars are deployed in the 5250-5350 MHz band, Wireless LAN products without DFS can only operate in the band 5150-5250 MHz in the interim period.
- c) As the interim solution is intended for equipment not fully compliant with all requirements of the ERC/DEC(99)23, CEPT Administrations should define additional mitigation

parameters/power limits to achieve equivalent protection for other services, comparable to that which can be achieved with DFS and TPC in line with ERC/DEC(99)23.

- d) The suggested interim solution should be of a temporary nature and should be withdrawn when the work on the DFS is finished and the Harmonised Standard is published in the Official Journal of the European Communities. CEPT Administrations may consider a transition period of e.g. 6 to 9 months to give sufficient time for industry to implement the DFS requirement into their product.
- e) The reference to HIPERLAN in the ERC/DEC(99)23 should be understood to refer to all 5 GHz High Performance RLANs meeting the requirements of the decision and not to any specific technology.

Technical parameters for the interim solution:

The band 5150 - 5350 MHz can be used as an interim solution to allow 5 GHz Wireless LANs not implementing DFS but otherwise in line with the ERC/DEC(99)23, for indoor use only.

- a) Channel selection shall be undertaken to promote, on aggregate, a spread of the loading across the available spectrum.
- b) The maximum permitted power level (mean eirp²) is dependent on whether TPC (Transmitter Power Control) is implemented or not.
- c) The maximum permitted power level for systems operating in the band from 5150-5350 MHz (8 channels), is derived from the maximum permitted power level currently defined in the ERC/DEC(99)23 for indoor systems spreading over the required 330 MHz (14 channels) and is such that the aggregate power on any given channel in the proposed band (8 channels) is not higher than if those systems were spreading over all 14 channels (330 MHz). See annex 1 for more details.
- d) Taking into account the technical parameters ‘a’ to ‘c’ above, the maximum permitted power should be as indicated in the table below:

Spreading band (MHz)	Mean eirp ² (mW) for indoor use only		
	Systems with TPC		No TPC (single power level)
	Highest level	Lower level	
5150 – 5350 ³	120	30	60
5150 - 5250	60	15	30

² The mean EIRP refers to the EIRP averaged over the transmission burst at the highest power control setting.

³ For most countries where radars are deployed in the 5250-5350 MHz band, Wireless LAN products without DFS can only operate in the band 5150-5250 MHz in the interim period.

Annex 1 – Detailed technical parameters

This annex provides more details with regard to the suggested interim solution.

IEEE 802.11a (and also 802.11h) equipment use the same modulation as HIPERLAN type 2 and when deployed in Europe, it will also use the same channel plan and spectrum mask as applicable to HIPERLAN type 2. Therefore the proposal is derived from the existing requirements for HIPERLAN Type 2 equipment currently in the ERC/DEC(99)23.

Spreading refers to the requirement for the entire population of RLANs to operate on all available channels such that the emitted energy across the population is as uniformly spread as possible. This requirement is mainly due to the result of sharing studies with space services, to avoid concentrating the energy into a specific part of the band. It implies that an RLAN Access Point or device selects an operating channel with no particular bias to any specific operating channel. The choice could be ensured in principle by requiring a user to randomly assign the channel, by an algorithm in a device to assign a random channel number, via the DFS algorithm which will also take account of the radio interference environment, or other implementation-specific method.

All RLANs will be operating in a smaller band during the interim period compared to and prior to the full deployment of ERC/DEC(99)23 compliant equipment.

Therefore, in order not to increase the aggregate power of all co-channel RLANs in the footprint of a satellite (compared to the levels that would result from a full implementation of the ERC/DEC(99)23), the max power for a single device should be reduced as indicated in the table below to compensate for the smaller band in which they operate. Any higher power levels permitted by Administrations would need to take into account their ability to predict or control the density of RLAN deployment.

For each of the frequency ranges, the table defines 2 power levels for systems that have TPC implemented and a single power level for systems without TPC.

According to the ERC/DEC(99)23, the TPC feature should result in a further reduction of the aggregate power of all Wireless LAN devices in the footprint of a satellite by a minimum of 3 dB. Client devices that are at the edge of the coverage area of an access point will need to transmit at full power while other devices which are in close proximity can use a lower power setting without affecting the quality of the link.

Spreading band (MHz)	Mean eirp (mW) ² for indoor use only		
	Systems with TPC (**)		No TPC (single power level)
	Highest level	Lower level	
Max Spreading (*) (330 MHz)	200	50	n.a.
5150 – 5350 ⁴	120	30	60
5150 - 5250	60	15	30

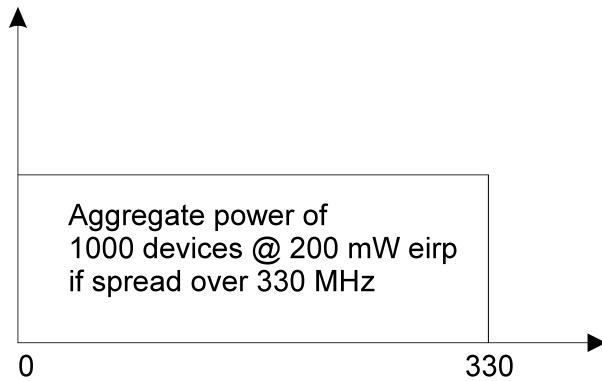
(*) The Max Spreading over 330 MHz and the corresponding eirp level of 200 mW is taken from the ERC/DEC(99)23 and is here only used as the reference to derive the other figures.

(**) The 6 dB difference in the limits for both power levels of systems with TPC is derived from the current version of the Harmonised Standard EN 301 893.

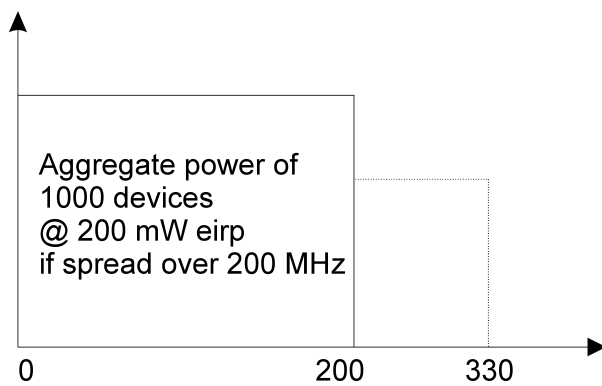
⁴ For most countries where radars are deployed in the 5250-5350 MHz band, Wireless LAN products without DFS can only operate in the band 5150-5250 MHz in the interim period

The example below explains the approach taken in this proposal.

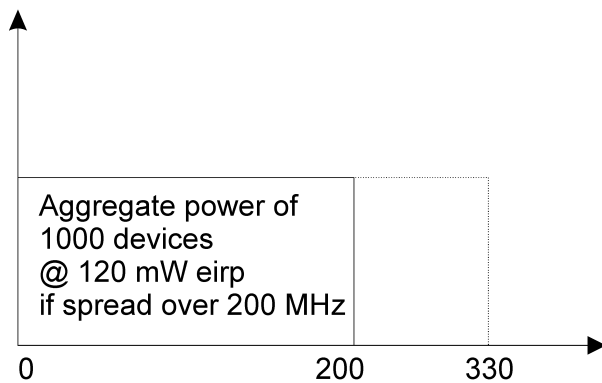
This example assumes a fixed number of RLAN devices installed in a hotspot area in the footprint of a satellite.



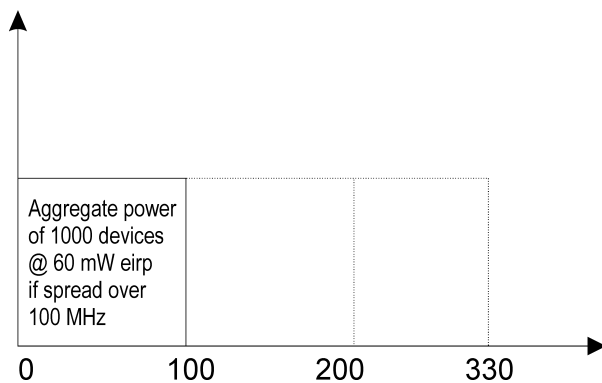
Current situation in ERC/DEC(99)23 for indoor devices that spread over the 330 MHz.



Result of the same number of RLAN devices, operating at the same power level as in the previous situation, but now restricted to 200 MHz. The aggregate power level at any given frequency has increased which is not acceptable.



New situation if the maximum power for a single device has been reduced to 120 mW. The aggregate power on any given channel is now more or less again identical to the initial situation



The maximum power needs to be further reduced if the same number of devices is further restricted to operating in a 100 MHz band only.

FICORA Note 11.10.2002: *Information in Annex 2 might not be up-to-date, as is the case in Finland.*

Annex 2 National solutions and regulations

This annex contains an overview on the current situation in some of the member states. It also contains information in case they have already implemented an interim solution for equipment not fully compliant with the ERC/DEC(99)23.

Austria

For HIPERLAN type 2 the DFS and TPC features are obligatory. Equipment based on IEEE 802.11a is currently not allowed in Austria but under consideration.

The band 5450-5725 MHz is not available in Austria and thus wireless LAN equipment can not apply the spreading requirement in ERC DEC(99)23.

Belgium

Prepared to open the band 5150-5350 MHz for the use of IEEE 802.11a as the risk of interference to outdoor radar systems and other outdoor services is very low due to the additional indoor-to-outdoor building attenuation. As it would not be possible to spread over the entire 330 MHz as required by the ERC Decision the max power should be further reduced to result in the same aggregate power.

Denmark

In accordance with Danish radio interface specification the band 5150-5250 MHz is made available for wireless LANs with 50 mW eirp for indoor use only and without DFS and TCP.

Finland

Has implemented ERC DEC (99)23. IEEE 802.11a equipment does not meet the requirements for DFS and TPC and can therefore not be used in Finland in accordance with the current regulations. The Finnish licence-exemption regulations cover HIPERLAN Type 1 but this should not be interpreted to mean that IEEE 802.11a equipment with restricted frequency band would be covered by that regulation.

France

For the frequency band 5150-5350 MHz France allows the use of wireless LANs for indoor applications with 200 mW with DFS and TPC. Within the band 5150-5250 MHz equipment may be used without DFS and TCP.

The band 5450-5725 MHz is not available in France and thus wireless LAN equipment can not apply the spreading requirement in ERC DEC(99)23.

Germany (Press Release of Reg TP, 9th July 2002)

Following a thorough technical, economic and regulatory analysis the Regulatory Authority for Telecommunications and Posts (Reg TP) has concluded that wireless local area networks (WLANs) will not pose a threat to UMTS competitively, but that the two systems will supplement each other effectively for the benefit of all market players," said Matthias Kurth, President of Reg TP, at a press conference in Bonn 9th July 2002. "Reg TP will therefore provide further frequencies in the 5 GHz band for new WLAN applications in addition to those in the 2.4 GHz band. This will also help to promote UMTS services."

WLANs, not designed as cellular networks covering wide areas, but as solutions for so-called hot spots, are only capable of providing comparatively small areas with wireless services at high transmission rates; this means however that they do not provide mobility. Unlike WLANs, UMTS networks are cellular mobile networks offering services to customers across the country. Similar to WLANs, UMTS provides broadband data transmission, but its performance is much lower in stationary operation than WLANs'.

"However, UMTS is a much more appropriate system to meet user requirements for relatively high transmission rates and for full mobility over the largest possible coverage area," Mr Kurth continued. Substitution between UMTS and WLAN data transmission will thus only occur if there is no need for mobility and wide area availability. However, whenever such requirements were crucial to users, UMTS might be substituted for WLANs.

Summing up, Mr Kurth declared: "Using WLAN frequencies for public applications too will therefore be in the interest of UMTS and will more likely lead to the commercial success of UMTS than if public WLANs were prohibited."

According to Reg TP, UMTS network operators might offer WLANs to their customers on the basis of self-operated networks or as service providers or "roaming partners". In a market of this nature such a

"composite product" of mobile and WLAN services would be market-oriented and ultimately in the interest of all market players. On these grounds, RegTP has prepared a draft for generally assigning frequencies in the 5 GHz band for WLANs. However, to secure transparent, objective and non-discriminatory proceedings, a public consultation on the proposed general frequency assignment in the 5 GHz band will be organised and published in the Reg TP Official Gazette of 10 July 2002. The consultation will also provide information to the market on further Reg TP action and thus give planning security prior to general assignment.

Ireland

Prepared to implement the band 5150-5250 MHz for wireless LANs with 50 mW eirp for indoor use only and without DFS and TPC.

Italy

Italy has implemented ERC DEC (99)23; 5150-5350 MHz (for indoor use only) and 5450-5725 MHz (with TPC and DFS) are allocated to Wireless Lan. For private use only

Switzerland

Currently only the band 5150-5250 MHz is available for indoor operated wireless LANs. Opening of the bands 5250-5350 MHz /200mW e.i.r.p. and 5470-5725 MHz / 1000mW e.i.r.p. for HIPERLAN/2 (and IEEE802.11a meeting the same requirements) both with mandatory TPC and DFS for sharing is under investigation.

Norway

Has allowed IEEE 802.11a equipment in the band 5150-5250 MHz with a maximum radiated power of 50 mW for indoor use only. TPC or DFS not required.

The Netherlands

Implement the band 5150-5350 MHz in accordance with the ERC REC 70-03 but without indoor/outdoor restriction.

Sweden

The exemption from the license obligations in accordance with the Swedish regulations apply as follows

5150 - 5250 MHz (HIPERLAN type 1)

5150 - 5350 and 5470 - 5725 MHz (HIPERLAN type 2)

The maximum radiated power (e.i.r.p.) shall not exceed 200 mW in the frequency band 5150 - 5350 MHz. Radio equipment that is used within this frequency band may only be used indoors.

The maximum radiated power (e.i.r.p.) shall not exceed 1 W in the frequency band 5470 - 5725 MHz.

Those radio equipment that are used within the frequency bands in accordance with the above, with an exemption for HIPERLAN type 1 or equivalent technical specifications within the frequency band 5150 – 5250 MHz, shall have automatic power control (at least 3 dB power reduction) and dynamic frequency selection.

UK

Prepared to open the band 5150-5350 MHz HIPERLAN type 1 or IEEE 802.11a equipment at 60 mW (no DFS or TPC) or 120 mW (no DFS). Restricted to indoor use only.

National indications from CEPT Administrations on the current (Sept 2002) use of the band 5250-5350 MHz for Radars in the Radiolocation Service

CEPT Country	Radars in 5250-5350 MHz⁵
Austria	Yes, above 5.3 GHz
Belgium	Yes
Bulgaria	Yes
Czech	Yes
Denmark	No
Estonia	No
France	Yes
Germany	Yes
Greece	Yes
Hungary	No
Latvia	No
Liechtenstein	No
Lithuania	No
Luxembourg	No
Netherlands	Yes
Norway	Yes
Poland	Yes
Portugal	Yes
Slovak	Yes
Slovenia	No
Sweden	Yes
Switzerland	Yes
Turkey	Yes
UK	Yes

⁵ Note that the frequency band 5200-5350 MHz is also allocated to the Earth Exploration Satellite Service (active)

ANNEX 3 Extract from Rec. ITU-R M.1450

Technical parameters for broadband RLAN applications

Network standard	IEEE Project 802.11b	IEEE Project 802.11a ⁽¹⁾	ETSI BRAN HIPERLAN 1 ETS 300-652	ETSI BRAN HIPERLAN 2 ^{(1), (2)}
Access method	CSMA/CA, SSMA	CSMA/CA	TDMA/EY-NPMA	TDMA/TDD
Modulation	CCK (8 complex chip spreading)	64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM	GMSK/FSK	64-QAM-OFDM 16-QAM-OFDM QPSK-OFDM BPSK-OFDM
Data rate	1, 2, 5.5 and 11 Mbit/s	6, 9, 12, 18, 24, 36, 48 and 54 Mbit/s	23 Mbit/s (HBR) 1.4 Mbit/s (LBR)	6, 9, 12, 18, 27, 36, 48 and 54 Mbit/s
Frequency band	2 400-2 483.5 MHz	5 150-5 250 MHz 5 725-5 825 MHz 5 250-5 350 MHz ⁽³⁾	5 150 to 5 300 MHz Limited in some countries to 5 150 to 5 250 MHz ⁽³⁾	5 GHz bands are currently under study in CEPT ⁽³⁾
Channelization	25/30 MHz spacing 3 channels	20 MHz channel spacing	23.5294 MHz (HBR) 3 channels in 100 MHz and 5 channels in 150 MHz 1.4 MHz (LBR)	20 MHz channel spacing 4 channels in 100 MHz
Tx power	1 000 mW e.i.r.p. ⁽⁴⁾ 100 mW e.i.r.p. ⁽⁵⁾ 10 mW/MHz e.i.r.p. density ⁽⁶⁾	5 150 to 5 250 MHz 10 mW/MHz 200 mW e.i.r.p. in 20 MHz channel 5 250-5 350 MHz 1 W e.i.r.p. 5 725-5 825 MHz 4 W e.i.r.p. ⁽⁷⁾	Three different classes of power levels depending on country Administration 1 W e.i.r.p., 100 mW e.i.r.p., 10 mW e.i.r.p. ⁽⁸⁾	Current power limits for various bands are under study in CEPT
Sharing considerations	<ul style="list-style-type: none"> – CDMA allows orthogonal spectrum spreading. – CSMA/CA provides “listen before talk” access etiquette 	<ul style="list-style-type: none"> – OFDM provides low power spectral density. – CSMA/CA provides “listen before talk” access etiquette. – In 5 150-5 250 MHz e.i.r.p. density limit should be subject to Recommendation ITU-R M.1454 	In 5 150-5 250 MHz e.i.r.p. density limit should be subject to Recommendation ITU-R M.1454	<ul style="list-style-type: none"> – OFDM provides low power spectral density. – In 5 150-5 250 MHz e.i.r.p. density limit should be subject to Recommendation ITU-R M.1454

⁽¹⁾ Common parameters for the physical layer are now under study between IEEE 802.11a and ETSI BRAN HIPERLAN 2.

⁽²⁾ WATM (Wireless ATM) and advanced IP with QoS are intended for use over ETSI BRAN HIPERLAN 2 physical transport.

⁽³⁾ For the band 5 150 to 5 250 MHz, RR No. S5.447 applies.

⁽⁴⁾ This requirement refers to FCC 15.247 in the United States of America.

⁽⁵⁾ This requirement refers to EUROPE ETS 300-328.

⁽⁶⁾ This requirement refers to JAPAN MPT ordinance for Regulating Radio Equipment, Article 49-20.

⁽⁷⁾ All values from FCC amendment of the Commission’s Rules to Docket No. 96-102 provide for operation of unlicensed NII (RM-8648) devices in the 5 GHz frequency range (RM-865).

⁽⁸⁾ Some restrictions on maximum output power are under study in the band 5 150-5 250 MHz within CEPT.