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See distribution list

## DECISION CONCERNING INTERFERENCE CAUSED BY POWER LINE COMMUNICATIONS TO A CABLE TELEVISION NETWORK

### PARTIES INVOLVED

KPY Kaapelitelevisio Ltd (cable television company subsidiary to Kuopio Telephone company)

Kuopio Energy

### 1. REQUEST FOR ACTION

KPY Kaapelitelevisio Ltd (KPY) has requested the Finnish Communications Regulatory Authority (FICORA) to measure the interference level of power line communications (PLC) provided by Kuopio Energy and caused to the broadband cable TV Internet service provided by KPY. It has also requested FICORA to act in such a way that KPY could continue the business without disturbance.

According to KPY's notification, the frequency band 15-42 MHz used for the cable television Internet service return path is interfered with by the signalling of the power line communications provided by Kuopio Energy. Interference occurs on the transmission bands used for power line communications, the centre frequencies being 19.8 MHz, 22.4 MHz and 24.6 MHz. The bandwidth of each transmission carrier for power line communications is approximately 2 MHz (-10 dBc).

According to KPY, the bandwidth of its return path is 3.2 MHz. The lowest carrier frequencies for return path are 20 MHz and the highest 37 MHz. In the area of Jynkkä, the currently used return path frequencies are 31 MHz and 35 MHz. According to KPY's request for action, KPY would need the entire frequency band for the return path as the number of its customers is growing and so is the use of the service.

## 2. RELATED PROVISIONS

### Quality requirements for communications networks and communications services

According to section 128(1)(2) of the Communications Market Act (393/2003), public communications networks and communications services and the communications networks and communications services connected to them shall be planned, built and maintained in such a manner that the networks and services withstand normal, foreseeable climatic, mechanical, electromagnetic and other external interference.

According to section 128(1)(6), the communications networks and communications services shall be planned, built and maintained in such a manner that the networks and services do not cause unreasonable electromagnetic or other interference.

### Requirements for a customer premises community aerial network

Provisions on radiated interference of customer premises community aerial networks and systems and of their elements are included in FICORA's regulation on the customer premises community aerial network and community aerial system (FICORA 21 D/2003 M).

According to section 12 of the regulation, the power of radiated interference in a customer premises community aerial network and system shall not exceed 27 – 20 dB(pW) (decreases linearly with the logarithm of the frequency) in the frequency band 5 – 30 MHz, 20 dB(pW) in the frequency band 30 – 950 MHz, 43 dB(pw) in the frequency band 950 – 2500 MHz or 57 dB(pW) in the frequency band 2500 – 3000 MHz. However, the limit for the radiated interference power may be 40 dB(pw) in the frequency band 47 – 68 MHz, 87.5 – 109 MHz, 174 – 308 MHz, 319 – 328.6 MHz and 335.4 – 400 MHz as regards customer premises community aerial networks constructed before January 1, 1986 and possibly renovated afterwards, provided that unnecessary interference is not caused to radio traffic. This means exceeding that field strength within the radio system coverage area which is calculated by subtracting the required protection ratio from the protected field strength of the relevant radio system. The power of radiated interference is in this case measured within the bandwidth used by the interfered radio system.

The list of standards related to the regulation contains a reference to EN 50083-2 and EN 50083-8, as regards power of radiated interference for customer premises community aerial networks and systems and their elements.

### Requirements for a cable television network

The current Communications Market Act or the regulations issued thereunder do not include any requirements for emission or immunity in cable television networks. For radiated interference, however, standards EN 50083-2 and EN 50083-8 have been generally applicable in cable television networks and a reference of these standards is made in FICORA's Regulation 21 D/2003 M that deals with community aerial networks and systems.

### Requirements for a PLC network

For the time being there are no special requirements for PLC networks on radiated interference or protection ratio. A pan-European standard and EU Commission's recommendation on the issue are still being drafted.

### Elimination of interference

According to section 131 of the Communications Market Act, if a communications network or equipment item causes danger or interference to a communications network, equipment, communications network user or another person, the telecommunications operator or the keeper of another communications network or equipment shall take measures immediately to rectify the situation and, if necessary, disconnect the communications network or equipment from the public communications network. In this case, FICORA may order rectification measures and disconnection of the network or equipment.

### FICORA's authority

Section 126 of the Communications Market Act contains provisions on the resolution of disputes by FICORA. According to subsection 1, if a telecommunications operator or a person whose right or benefit is affected by the matter considers that someone is acting in violation of the Communications Market Act and the provisions issued under it, the telecommunications operator or person may refer the matter for examination by FICORA.

According to section 126(3), FICORA shall promote cooperation among telecommunications operators and aim at resolving disputes between telecommunications operators primarily through mediation.

## 3. EXAMINATION OF THE MATTER

### 3.1 DEALING WITH THE MATTER AT FICORA

FICORA conducted inspections in Kuopio on 27-28 October 2003 in the presence of KPY's and Kuopio Energy's representatives. The measurements were carried out in Jynkkä, which is a part of the town Kuopio. The exact addresses were Siiviläkuja 2, Soikkokuja 8 and Maitotie 5.

During the inspection it was found out that in-house signalling of the PLC is coupled from the mains network into the cable television network. The interference signals from the PLC network are summed up at the distribution points of the branches of the cable television network and are further amplified within the return path amplifier chain. At the cable television core network, before the connection into the optical connection, the induced voltage from the PLC was measured to be in the magnitude of 10 dB below the return path signalling. The standard EN 50083-10 specifies the requirement for the return path signal to noise ratio to be better than 20 dB for the 16QAM modulation.

PLC interference seems to couple into the cable television network via the in-house antenna outlets and equipment connected to the customer premises community aerial network. During inspection and measurements it was not found that the interference was coupled through the core network cabling or internal distribution cabling of the customer premises community aerial network. The problem occurs because of the high electromagnetic field which is generated inside the flats from the PLC and which induces interference currents and voltages into the cables and equipment connected to the customer premises community aerial network. These are further connected via the antenna outlets and customer premises community aerial network to the cable television distribution network in the frequency band used for the return path and is further amplified at the amplification chain of the return path.

On 14 January 2004, FICORA asked Kuopio Energy to give a report on possible measures which would enable elimination of problems caused by PLC to the cable television network by minimising electromagnetic interference of PLC. Kuopio Energy was also requested to give an estimation of costs incurred for the measures.

On 14 January 2004, FICORA also asked KPY to give a report on measures which would enable elimination of problems caused by PLC by improving immunity to interference of the cable television network, the customer premises community aerial network or equipment connected to these networks. KPY was also requested to give an estimation of costs incurred for the measures.

The parties were asked to submit to FICORA any other documents they wish to refer to or to let FICORA or the other part know about.

On 4 March 2004, FICORA submitted Kuopio Energy's statement to KPY for information and reserved KPY an opportunity to present its view on it.

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### 3.2 KUOPIO ENERGY'S STATEMENT

Kuopio Energy submitted its statement to FICORA on 26 February 2004.

Kuopio Energy states that it has started delivery of Internet connections to customers through the mains network in April 2003. For the implementation of the Internet connections, Kuopio Energy uses Ascom Powerline Ag's, a Swiss company's, PLC equipment. At the moment, 43 distribution substations and 116 buildings are equipped with PLC equipment in Jynkkä, Peltonen, Puijonlaakso and in the centre of Kuopio. Adoption of the PLC technology has succeeded well, and the connections have been reliable, states Kuopio Energy.

Kuopio Energy has plans for the future use of the mains network not only as an information transmission channel in the provision of Internet services but also for its own use in power quality monitoring and in remote reading of customers' meters, which is likely to be stipulated by law.

From the customers' point of view, new entrants to the broadband market are welcomed by Kuopio Energy as competition as well as customers' possibilities to choose will increase. According to Kuopio Energy, the traditional actors in the field may regard that PLC is some kind of threat to their own Internet services.

Kuopio Energy says that in September 2003 KPY informed having found a presence of PLC carrier wave signal interference in the cable television network in the Jynkkä area. Having received the information, Kuopio Energy started settling the matter in cooperation with KPY. In joint investigations the companies found that the signal originates from PLC equipment, but the exact generation of the interference could not be immediately detected.

According to the statement, Kuopio Energy used some 100 working hours for various investigations in the matter and arranged entrance to their customers' homes for measuring and testing. Kuopio Energy also constructed a small PLC cell for testing in the building addressed by KPY. Some measurements in the cable television network, such as KPY's own target in Jäniksenpolku, were totally interference-free.

Kuopio Energy states that it has strived to settle the matter in cooperation with KPY. However, Kuopio Energy's representative was not invited to each of the KPY's measurement events. For instance, Kuopio Energy's representative and KPY had visited Siiviläkuja 2 earlier, but Kuopio Energy's representative was not invited to the actual measurement occasion. Measurements in Maitotie 5 did not take place in this building but in the cable television network distribution cabinet outside the building.

In FICORA's measurements the matter could be settled better, says Kuopio Energy. It was noticed that the PLC signal was transmitted to the cable network in Soikkokuja 8 F from an apartment that is not Kuopio Energy's PLC customer. It was detected that in the apartment, PLC generates an electromagnetic field inducing interference currents and voltages into the equipment and cables connected to the aerial network. The signal leaked further via apartment antenna outlets into the cable television network and was further amplified through amplifiers. As the PLC signal is detected to leak into the cable television network only in individual buildings, Kuopio Energy regards that there is reason to assume that the aerial network of these premises has a technical fault or is insufficiently protected. Kuopio Energy says that PLC signal is in no way deliberately fed into the cable television network.

As alternative resolutions are considered, Kuopio Energy wishes to point out that KPY at present does not provide any services in the frequency band in question and therefore, KPY does not suffer from interference in any way. According to its statement, KPY does not use the return path below 15 MHz at all because of interference occurring in the band. According to Kuopio Energy, this proves that the cable television network is also interfered with by other sources than just PLC. This also supports Kuopio Energy's opinion of the defective protection of the aerial networks.

Kuopio Energy claims that the cable television network or the mains network was not originally planned for data transmission. As using the cable

television network for data transmission was initiated as late as 1998 and as the aerial network for most parts is much older, Kuopio Energy says that it is possible that the cable television network does not for all parts comply with the requirements for data transmission.

According to Kuopio Energy, the PLC equipment delivered by Ascom Powerline Ag is automatically adjusted to the minimum transmission power. The manufacturer declares that the equipment being used complies with all the provisions and regulations issued on it. The equipment is also installed according to manufacturer's instructions and orders. The equipment can be adjusted manually, but such possibilities are in practice very small.

Forcing the transmission power manually below the automatically adjusted level will inevitably mean that the PLC connection is lost in the relevant buildings. For in-house transmission the frequencies are fixed (19.8 MHz, 22.4 MHz and 24.6 MHz) and cannot be changed in any other way than by removing the carrier entirely. As all carriers are not necessarily in use due to interference in the mains network (caused by other electrical equipment), switching off the carriers will also cause loss of the PLC connection. Such an equipment causing interference is for instance a frequency converter. If the PLC equipment transmission power (max 20 dBm) can not compensate the network interference, the PLC equipment will isolate the carrier in question entirely.

As the real reason for interference is, according to Kuopio Energy, in the building's aerial network, adjusting PLC equipment or removing them does not solve the problem. Equipment using the same frequency band may appear in the building at a later stage. For instance, LA (CB) radio-telephones or other radio transmissions may, in appropriate circumstances, cause corresponding interference. If a frequency converter or a switching power supply is installed in the building, it may cause corresponding interference or interference in several frequencies.

On the basis of Kuopio Energy's own practical experience, measurements in the relevant frequency band have revealed that interference caused by frequency converters would require 36 dBm transmission power for the PLC equipment to reach the optimal level of data transmission, which is not possible. The real reason for the problem can only be removed by fixing the faulty aerial cable network by installing for instance multimedia antenna outlets. Price for the outlets is 10-18 euros apiece. According to Kuopio Energy, the building owners should be responsible for costs incurred by the change. Another alternative in Kuopio Energy's opinion would be to locate the antenna outlets that cause the problems and to change them in cooperation with the parties concerned, that is the building owners, KPY and Kuopio Energy.

If the interference cannot be eliminated with these actions, Kuopio Energy suggests the possibility to change the PLC equipment in the transforming areas. This is expensive and should be used as the last action and earliest at the stage where KPY actually takes the frequency band in use. In its own letter KPY has motivated the need to eliminate the interference so that it would need the entire frequency band for the return path for future need as the use of services is growing. Kuopio Energy, however, claims not having seen any concrete schedule for the adoption.

The new generation PLC equipment with new methods of modulation (OFDM) that will enable smaller transmission power and more dynamic adjustment of the transmission band can be adopted by the end of 2004, says Kuopio Energy. If other methods do not help or otherwise come in question, adoption of this equipment may be considered. Renewal of PLC equipment in one transforming area will cost some 5 000 euros according to Kuopio Energy.

### 3.3 KPY'S STATEMENT

KPY submitted its own statement to FICORA on 26 February 2004.

KPY states that its network has been planned and constructed in accordance with the Communications Market Act, authorities' regulations and standards. KPY states that it has maintained the network according to provisions and repaired the network for several years. The network has operated without problems until 2003 when Kuopio Energy started providing PLC in KPY's area. As a result to the interference caused by Kuopio Energy, KPY has not been able to use the entire frequency band for the return path in those areas where Kuopio Energy has PLC users. The interference hampers KPY's business, as KPY will need the entire frequency band in order to keep the service level and to be able to provide sufficient service to its customers.

PLC interference does not, according to KPY, arise in its network, but from the powerful electromagnetic field in the building caused by Kuopio Energy's PLC service. The electromagnetic field couples from apartments to KPY's cable television network through antenna outlets and equipment connected to the customer premises community aerial network. The community aerial networks of the buildings are the owners' responsibility, not KPY's. Interference could not be anticipated when KPY's network was being built, and KPY could not have been able to prevent the interference, as it does not arise in KPY's network.

KPY states that interference with the network started when Kuopio Energy started providing PLC. Interference problems are unreasonable to KPY as it cannot guarantee its service quality to customers or to expand the business. In KPY's opinion, Kuopio Energy has not complied with the Communications Market Act as it constructed the network in such a way that the provided communications services cause unreasonable interference to KPY's network.

Kuopio Energy's PLC service causes interference to KPY's cable television network and to KPY's customers using cable TV Internet connections. Kuopio Energy has not taken any actions in order to rectify the situation although it has been aware of the problem since last autumn and the interference has been detected in several measurements in the presence of Kuopio Energy's representatives. Since Kuopio Energy has not taken any measures to eliminate the interference, KPY regards that FICORA should order Kuopio Energy to do so.

KPY does not support the view presented by FICORA in the request for information that measures could also be targeted at the communications network or equipment being interfered with, if it is seen more appropri-

ate or if the interference problem cannot be solved in any other way. According to KPY's opinion, section 131 of the Communications Market Act must be interpreted so that the obligation to repair the fault can only concern the party that causes the problem, in this case Kuopio Energy. Neither does the preamble to the government proposal include a statement that would enable measures directed to the victim's communications network or equipment.

KPY claims also that the customer premises network and equipment connected to it are not KPY's responsibility but the house owners' who also make all decisions on matters relating to the in-house networks. KPY has constantly improved the cable television network's immunity to interference by making new investments and enhancing quality. The mains network, however, is not planned for distribution of data. Interference caused by PLC to the cable television network has been unpredictable and so powerful that KPY cannot prevent it by improving network quality.

The interference could be eliminated if Kuopio Energy would start using a frequency band under 5 MHz for the delivery of PLC, as this band is below the frequency KPY uses for the return path in its cable television network. The powerful transmission carrier type of signal, however, generates side bands spreading over a larger return path area and may interfere the frequency band over 5 MHz. FICORA should investigate all possible frequencies before this alternative could be possible. Another way is to use WLAN service for the distribution of PLC, as the frequency in this solution is so high that it will not cause interference. According to KPY's information, other energy companies have tried distribution of PLC but given it up due to interference problems or started using WLAN for the distribution of PLC.

In the inspection report of 30 October 2003 FICORA regarded that one solution to the problem would be the change of antenna outlets with new so-called multimedia outlets equipped with TV and radio connectors where coupling of return path signals to the cable television network is attenuated by filters. According to KPY's view, the problem is not resolved by changing antenna outlets as such multimedia outlets whose attenuation level would be as good as that of the current sockets do not exist. Especially in old buildings with cascaded aerial networks, attenuation of throughput in multimedia outlets is too high. This, again, would require additional cabling or change of in-house network equipment so that the signal level of antenna outlets would comply with the limits.

Building owners are responsible for the customer premises network. They also decide whether or not the antenna outlets are changed. Therefore, KPY regards this alternative somewhat problematic in case FICORA would decide to suggest it, as building owners cannot be forced to change the antenna outlets. If FICORA comes to this decision, KPY regards important that Kuopio Energy is obliged to change the antenna sockets on its own cost so that not costs would incur to the owners and that Kuopio Energy would offer change of antenna outlets as part of the PLC service.

KPY will also pay attention to FICORA's regulation of 6 June 2003 on the customer premises community aerial network and community aerial system (21 D/2003 M) which contains limits for the radiated interference with the community aerial network. KPY regards that Kuopio Energy's mains network should comply with the same radiated interference re-

quirements as the community aerial network as regards radiated interference when operating PLC service is in the return path frequency band.

### 3.4 KUOPIO ENERGY'S REPLY TO KPY'S STATEMENT

Kuopio Energy submitted its reply to KPY's statement on 22 March 2004.

Kuopio Energy claims incorrect that KPY could not have used the entire frequency band for return path in those areas where Kuopio Energy has PLC users. According to Kuopio Energy, KPY itself has said that for the time being it does not use this frequency band but could use it in the future. What is more, Kuopio Energy has been informed of PLC interference only at three addresses in Jynkkä area of the town. No interference has been detected or measured at other addresses where PLC is distributed. According to Kuopio Energy's opinion, interference with cable television networks result from weak or insufficiently protected antenna networks of individual buildings.

Kuopio Energy also claims that the interface between KPY and the customer premises community aerial networks remains unclear. Kuopio Energy asks in which way KPY will see to that the customer premises community aerial network complies with the requirements for a communications network and how it is seen to that interference will not be generated in either KPY's or Kuopio Energy's network through network interfaces. Kuopio Energy suggests that KPY install a damper or a filter at the network interface between the cable television network and the community aerial network so that interference in the customer premises community aerial network would not reach KPY's cable television network.

According to Kuopio Energy's opinion, KPY's claims about unreasonable interference were being exaggerated since KPY does not use the frequency band in question or has not given any schedules to take it into use.

Kuopio Energy states that it has not taken any one-sided actions in the matter because questions about responsibility are unclear and because KPY does not actively use the frequency band.

Kuopio Energy also questions KPY's opinion regarding responsibility to fix the interference problem, which, according to KPY lies on the party that has caused the interference. Kuopio Energy does not regard itself being responsible for reparations in a situation where the interference with the cable television network is caused by, for example, a faulty customer premises community aerial system. According to Kuopio Energy, many electrical devices may also cause corresponding interference to aerial network. Kuopio Energy thinks that in that case the reparation requirement should lie on the owner of the building.

Kuopio Energy informs that it is still prepared to cooperate with the owners and KPY in locating and repairing antenna outlets causing problems, provided that division of costs and principles are agreed upon in advance.

### 3.5 KPY'S REPLY TO KUOPIO ENERGY'S STATEMENT

KPY submitted its reply to Kuopio Energy's statement on 23 March 2004.

In the reply, KPY absolutely denies having taken measures just because competition would be at threat to KPY's business. As stated also by Kuopio Energy, new entrants to the broadband market are welcomed. Competitors (i.e. Elisa, Sonera, MTV3, IW-Net) have existed in KPY's operating area already before PLC was introduced, and PLC has thus not caused any changes to the functional competitive situation.

KPY has tackled the PLC problems expressly because the service has caused problems in the operation of KPY's cable television network. The problems also impede KPY's business operations, as KPY has had to limit the use of the frequency band and therefore cannot increase the business and simultaneously maintain the good service level to customers.

KPY does not see any problems in using the mains network for power quality monitoring and for remote reading of customers' meters since Kuopio Energy probably can, in this usage, hinder the generation of an electromagnetic field inside the whole building, and thus transmission of interference to KPY's cable television network.

At first, KPY has noticed the interference in its own measurements, then in measurements with Kuopio Energy and later also in measurements with representatives from FICORA being present. KPY has, as far as possible, continued observing the return path. It has stated that interference is continuing although the level is somewhat different at different times of day.

Kuopio Energy informs that it has arranged entrance to PLC customers' homes for measurements. One such occasion took place in Luolatie 6, a detached house at Jynkkä area. The interference at this address could be clearly detected.

In a terraced house in Siiviläkuja 2 measurements were conducted first with Kuopio Energy and later with representatives from FICORA. Kuopio Energy's representatives were not present in the second measuring occasion, but the interference was, however, detected at both times. If something special had been detected, Kuopio Energy would, naturally, have been notified about it.

KPY arranged a measurement occasion also in a detached house in Jäniksenpolku 13, although the building was not a PLC customer and although PLC was not generally used in the area. This was a kind of demonstration. No interference was detected. Reason for this was either a complete renovation of the mains network in the house or unsuccessful imitation of the actual situation. Measurement of an electromagnetic field inside the house would have revealed whether or not there was interference field in the house. However, KPY did not have the measuring equipment required for this measurement at its disposal.

In the presence of FICORA's, KPY's and Kuopio Energy's representatives, the interference signal from the distribution cabinet outside Maitotie 5 was so powerful that it indicated radiated interference in several buildings in the area. Interference in Soikkokuja 8 and Siiviläkuja 2 could not

affect this measurement, since both buildings belong to a different core cable, and interference signal does not couple into the distribution place for Maitotie 5.

In a terraced house in Soikkokuja 8, KPY arranged entrance to customers' homes; the representative of Kuopio Energy was also invited in the measurement occasion. Measurements were conducted twice, and the second time FICORA's representatives were present.

It was detected in the measurements that the interference did not depend on whether or not the apartment in question subscribed to PCL, if there were PLC users in the building. FICORA's representatives measured a powerful electromagnetic field in one of the apartments. When the television receiver in the apartment was connected to the antenna outlet, an interference signal was detected in the distribution point downstairs. The electromagnetic field induced interference from the apartment to the community aerial network through television receiver and the television connection cable. Change of the connection cable did not eliminate the interference. Neither was it relevant whether or not the television receiver was connected to the wall socket. When the television connection cable was disconnected from the wall socket, it was detected in the distribution point that the interference had ceased to exist and that the interference did not couple into the community aerial network through the antenna outlet, if the television receiver was not connected to the antenna outlet.

KPY is surprised with Kuopio Energy's claim about the presumption that the community aerial network is faulty and leaking. A television receiver is not a part of a community aerial network but the network ends at the antenna outlet. In case the community aerial network had been faulty, the interference signal should have coupled into the distribution point downstairs also when the television receiver was not connected to the antenna outlet.

When a cable modem was connected to the antenna outlet it was detected that the interference was not coupled into the community aerial network. Some television receivers certainly couple interference more easily than others, but KPY thinks that it cannot be required that a customer buy a television set according to whether or not there are PLC households in the building. The used television receiver was old but certainly fulfilled the requirements for a receiver.

In order to locate interference, KPY has asked Kuopio Energy to submit information about buildings where PLC is being used, but Kuopio Energy has informed that it will not give any such addresses. In its own measurements, KPY has detected interference for instance in the following buildings, and has unfortunately found more addresses where interference exists:

Aittolammentie 1  
Aittolammentie 13  
Kermatie 3  
Norokuja 3  
Pyörönkaari 9.

Regarding alternative solutions, Kuopio Energy's starting point is that for the time being, KPY does not provide any services in the frequency band

below 15 MHz. The claim is not correct, as KPY uses the band below 15 MHz for transmission of control and pilot signals of amplifiers and fibre equipment. In the frequency band below 15 MHz there is more background noise than in the rest of the return path area. The current CMTS equipment, however, enables the use of this frequency band according to manufacturer's specifications.

Kuopio Energy also states that the cable television network was originally not designed for data transmission and that the cable television network would not in all cases comply with the requirements set for use as a data transmission line. The older cable television network included equipment whose radiated interference would not comply with today's requirements. KPY has, however, changed this equipment in the 1990's. In 1996, KPY made plans to increase the upper frequency limit for the cable television network and to introduce bidirectionality of the network. The plans were carried out so that in 2003, the whole cable television network was bidirectional, it operated in the frequency band 5-606 MHz and complied with the regulations for the provision of cable data services.

For the time being, KPY's cable data service uses frequency bands 23.4-42 MHz with totally 45 return path carriers whose bandwidth is 3.2 MHz for each. The return path areas using frequency of 25 MHz are utilized by 25 cases. These cover almost all areas of Kuopio and the return path carriers overlap in some of the current areas using PLC. At the end of 2003, there were in some areas centre frequencies of 19 MHz due to old amplifier equipment. These centre frequencies were transferred to upper frequency band after update of the amplifiers.

According to Kuopio Energy, it is incorrect when KPY claims that the adoption of the system does not harm KPY. In the Jynkkä area, for instance, KPY had to avoid the PLC frequency band. When conducting measurements, KPY detected an interference which later proved to be caused by PLC. Kuopio Energy's possible expansions will increase overlapping frequency bands, which incurs more problems.

Also according to KPY, it is incorrect when Kuopio Energy claims that KPY has not presented any plans for the adoption of frequency bands overlapping with PLC service. KPY doubled the return path capacity by investments in 40 return path frequencies for CMTS equipment. This investment took place in January 2004. The new frequencies are placed in bands which are currently free. New frequencies are being used, and they are mostly placed in the 25 MHz frequency band which has proved to be a good and reliable band. When the 25 MHz band capacity is fully used, the following enlargements will take place below this band. A suitable band is, for example, 21.6 MHz when the frequency bands do not overlap. According to manufacturer's specifications, the CMTS equipment, certified according to DOCSIS 1.0 standard, and cable modems are capable of operating in the 5-42 MHz frequency band. There are plans for making use of the entire band.

Kuopio Energy regards that the real reason for the problem could be eliminated only if the antenna outlets were replaced by multimedia outlets. According to KPY, the ultimate reason for the problem is the high electromagnetic field caused by Kuopio Energy's PLC service and the interference source is the PLC equipment placed in the mains network. The problem cannot be totally eliminated by changing the antenna outlets.

KPY will still stress the fact that change of antenna outlets and costs incurred from the change cannot be KPY's responsibility, because in-house networks are the house owners' responsibility. KPY's network has operated without problems until Kuopio Energy started providing PLC. KPY regards that by virtue of section 131 of the Communications Market Act, Kuopio Energy should take actions to eliminate the interference. According to KPY's estimate, the cost of changing one multimedia outlet is 30 – 40 euros, installation work included.

KPY is interested of what Kuopio Energy has done to keep the radiated interference in reasonable limits. Kuopio Energy says that there will be new equipment with lower transmission power. This would certainly be a good improvement. The problem cannot be eliminated with current equipment, even though the transmission power would be the lowest possible.

#### 4. FICORA'S DECISION AND CRITERIA

##### 4.1 CRITERIA

According to section 128 of the Communications Market Act, which regards quality requirements for communications networks and services, communications networks and communications services shall be planned, built and maintained in such a manner that the networks and services withstand normal, foreseeable climatic, mechanical, electromagnetic and other external interference. On the other hand, the communications networks and communications services shall be planned, built and maintained in such a manner that the networks and services do not cause unreasonable electromagnetic or other interference. FICORA's regulations include more detailed quality requirements.

During measurements carried out in Kuopio 27-28 October 2003, FICORA has considered that the PLC in-house signalling couples from the mains network to the cable television network through the customer premises community aerial network. On the basis of measurements, PLC indicated to cause a high electromagnetic field inside the building, inducing interference voltages and currents in equipment and cables connected to the customer premises community aerial network. Through apartment antenna outlets they are further coupled into the cable television network in the frequency band used for the return path and further amplified at the amplification chain of the return path.

On the basis of the inspection and received statements, it can be regarded that the cable television network and the customer premises community aerial network comply with FICORA's regulations and pan-European standards and also comply with the quality requirements set in section 128 of the Communications Market Act. In measurements, the interference could not be detected to couple into the cable television network through the cables of the actual cable television network or through distribution cables of the customer premises community aerial network. During FICORA's measurements it was revealed also that cabling used in the customer premises community aerial network has double shielding (braid and foil), which is assumed to provide for the shielding attenuation of > 80 dB required for a customer premises community aerial network.

For the time being, there are no national requirements for the PLC radiated interference level, and the pan-European standards and recommendations dealing with it are still being drafted. In 2001, FICORA informed that it will follow the German NB30-norm for the evaluation of interference level, until a pan-European norm will be completed. According to measurements conducted, Kuopio Energy's PLC service exceeds clearly the NB30 limits. In practice, however, these limits have not been applicable in Finland because the EU and the European standardisation bodies are drafting PLC limit values on the European level.

When the pan-European standard or recommendation on the radiated interference of PLC is completed, the unreasonableness of electromagnetic interference can be evaluated on the basis of this document. As there are no binding juridical limit values, the unreasonableness has in this case been evaluated on the basis of the harmful effects caused by interference.

CMTS equipment used by KPY for the provision of the cable modem service complies with standard Docsis 1.0 and the return path of this equipment operates in the 5-42 MHz frequency band. From the beginning of 2004, the return path capacity of CMTS equipment was expanded up to 80 return path carrier frequencies. KPY, however, cannot exclusively use the frequency band for the implementation of the return path of the cable modem service. Due to interference caused by other equipment or systems it is not, according to KPY, reasonable to use frequencies under 15 MHz, or for example, the 27 MHz frequency, which is used by LA (CB) radiotelephones, for the return path of the cable modem service.

FICORA regards that KPY cannot motivate that interference caused by Kuopio Energy's PLC service is unreasonable just because of future needs for increasing cable modem service. If the frequency band used by PLC is not used by the return path of the cable modem service, the PLC interference does not become concrete. What is more, along with the increase of the cable modem service users, it is possible for KPY to extend the use of the frequency bands to higher frequencies.

FICORA does not regard that the electromagnetic interference caused by Kuopio Energy's PLC service is unreasonable for those houses where the interference does not couple into the cable television network. Therefore, it does not either disturb the frequency band of the return path used in the cable modem service.

Instead, FICORA regards that electromagnetic interference caused by PLC is, in the sense of section 128 of the Communications Market Act, unreasonable for those parts that concern coupling of interference into the cable television network and KPY has had to or will have to remove the return path of the cable modem service from the frequencies used for the PLC service due to interference problems.

Provisions on elimination of interference are included in section 131 of the Communications Market Act. According to this section, if a communications network or equipment item causes danger or interference to a communications network, equipment, communications network user or another person, the telecommunications operator or the keeper of another communications network shall take measures immediately to rec-

tify the situation and, if necessary, disconnect the communications network or equipment from the public communications network.

According to FICORA's opinion, the party causing interference is responsible for rectifying the situation and the rectifying methods should primarily concern the communications network or equipment causing interference. This means that interference with KPY's cable television network should primarily be fixed by minimizing the radiated electromagnetic interference caused by Kuopio Energy's PLC service. If, however, this is not possible, interference impacts can also be minimized by enhancing interference protection of antenna outlets or connection cables of the television receivers. FICORA's opinion is that Kuopio Energy is responsible for costs incurred for the rectifying measures regardless of the network or equipment to be repaired.

FICORA regards that as long as the pan-European standard on the allowed limits for PLC interference are under preparation, it is reasonable to require that Kuopio Energy will not extend the frequencies used for PLC to other frequencies used for the cable modem return path in those buildings where interference may occur.

## 4.2 DECISION

For what concerns the case where PLC interference does not couple into the cable television network or the frequencies used by the PLC service are not used by the cable television modem service, FICORA is of the opinion that both operators can run their business on an adequate basis in the existing circumstances. Since the common European standards and recommendation for the PLC interference are still under preparation, FICORA does not see it necessary to require Kuopio Energy to reduce the PLC radiation into to a certain level in general. This can be reassessed after the standards and recommendation have been adopted.

In those buildings where it has been found that Kuopio Energy PLC service causes harmful interference to cable television network and Kuopio Telephone Company has been forced to change their frequencies used for the cable television modem return path into frequency bands where PLC does not exist, Kuopio Energy is requested to initiate a dialog with Kuopio Telephone Company on the measures to remove the interference or minimise it.

As a main rule Kuopio Energy will be responsible for the costs caused by the necessary measures regardless of which network is being repaired.

In addition within those buildings in which PLC may cause interference to cable television network, Kuopio Energy is not allowed to expand its operation to those frequency bands which already are in use for CTV modem return path and thereby increase interference from its present level.

Kuopio Energy is requested to provide a clarification on the results of the dialogue and measures taken by 1 October 2004. This decision must be followed, notwithstanding appeal, unless the appellate authority orders otherwise.

## 5. APPEAL

Any person who is dissatisfied with this decision or to whom this decision is addressed or whose right, obligation or interest is directly affected by the decision may appeal against this decision to Supreme Administrative Court as provided in the Administrative Judicial Procedure Act (586/1996). Direction of appeal is annexed to this decision.

For further information about this decision, contact Sanna Hughes, tel. +358 9 6966 870.

Director Tapani Rantanen

Legal Counsel Sanna Hughes

ANNEX Direction of appeal

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Kuopio Energy

CC Ministry of Transport and Communications, Communications Department