

Sennheiser electronic GmbH & Co. KG • Am Labor 1 • 30900 Wedemark, Germany

Ms Aileen Chia
Deputy Director General Telecoms and Post)
Infocomm Development Authority of Singapore
10 Pasir Panjang Road
#10-01 Mapletree Business City
Singapore 117438

Sennheiser electronic GmbH & Co. KG

Am Labor 1
30900 Wedemark, Germany
Tel +49 (0) 5130 600-0
Fax + 49 (0) 5130 600-300

www.sennheiser.com

Contact person: Norbert Hilbich
ext.: 393

04.09.2013

CONSULTATION PAPER ISSUED BY THE INFO-COMMUNICATIONS DEVELOPMENT AUTHORITY OF SINGAPORE

PROPOSED REGULATORY FRAMEWORK FOR TV WHITE SPACE OPERATIONS IN THE VHF/UHF BANDS

The INFO-COMMUNICATIONS DEVELOPMENT AUTHORITY OF SINGAPORE invited spectrum users to comment the above mentioned proposed regulatory framework to TV White Space operations.

These comments are given by Sennheiser electronic GmbH & Co KG, Germany

Dear Ms. Chia,

Sennheiser thanks the Singapore spectrum authorities iDA for the opportunity to actively support them in their spectrum policy and to take care of the users interests of wireless microphones and in-ear monitor systems that are essential part of the everyday communication in Singapore.

About Sennheiser

The Sennheiser Group, with its headquarters in Wedemark near Hanover, Germany, is one of the world's leading manufacturers of microphones, headphones and wireless transmission systems. In 2012 the family company, which was founded in 1945,

achieved a turnover of around 584 million euros. Sennheiser employs more than 2,300 people worldwide, and has manufacturing plants in Germany, Ireland and the USA. The company is represented worldwide by subsidiaries in Australia, France, Great Britain, Belgium, the Netherlands, New Zealand, Switzerland and Liechtenstein, Germany, Denmark (Nordic), Russia, Hong Kong, India, Singapore, Japan, China, Canada, Mexico and the USA, as well as by long-term trading partners in many other countries. Also part of the Sennheiser Group are Georg Neumann GmbH, Berlin (studio microphones and monitor loudspeakers), and the joint venture Sennheiser Communications A/S (headsets for PCs, offices and call centres).

Answers and comments

Question 1:

IDA invites views on adopting a licence-exempt approach for WSDs in Singapore, subject to the devices meeting the conditions set by IDA.

Answer:

We do not agree to a license exempt approach for TVWS in the VHF, UHF range or other broadcast spectrum as this will harm the operations of the current spectrum users seriously.

Deployment of these devices in the UHF range can only be done if it is secured that they only use the spectrum at times when the existing services are not in operation. It needs to be guaranteed that these existing services can go on air also with short notice and are respected by those who want to use the spectrum as well.

If the license exempt approach for the UHF range will come into operation the UHF range will de facto be turned into an ISM Band for WSD. We disagree to this as the production quality will not be predictable any more.

Background information to the answer:

The VHF and UHF spectrum, is assigned to broadcast as primary user. Secondary users are PMR - Private Mobile Radio, also known as PMSE - Programme Making and Special Events - namely wireless microphones and in-ear monitor systems. They use the "white spaces" since many decades successfully in conjunction with the primary user broadcast. PMSE is an essential part of everyday communication and needs for its

operation "quality" spectrum: no interference from other source is allowed during any wireless production.

PMSE uses these gaps in the broadcast spectrum already long time before they were named "white spaces."

We like to introduce the approach of the European Radio Spectrum Policy Group, RSPG. The RSPG mentions PMSE in its Consultation document as follows:

"In a number of bands (mainly public spectrum and broadcasting) additional (secondary) users share the spectrum with an incumbent user under certain restrictions (mainly geographical and temporary restrictions) e.g. PMSE (Programme Making and Special Events) within TV white spaces, SAB/SAP services (Services Ancillary to Broadcast/Services Ancillary to Production), ENGs (Electronic News Gathering). Whether or not such use would be considered under the License Shared Access, LSA, approach depends on the level of protection provided with the rights of use of a shared band. When the shared rights of use are provided on non-interference, non-protection basis and no licence is granted, it would not be an example of LSA. However, when a license is granted to the additional users it could be seen as an LSA case." (RSPG Statement)

We agree with these findings. In general we encourage and support the concept of LSA - License Shared Access.

The PMSE industry already has experience with spectrum sharing iDA could draw from: for many years PMSE - especially wireless microphone manufacturers and users - have gained valuable experience on how to share spectrum with the broadcasters in the VHF/UHF TV band. For instance, public/private spectrum sharing could potentially be enabled by a joint data base of available spectrum for public and private users in certain bands. We believe that spectrum sharing with PMSE is a LSA case and the broadcasters use the VHF/UHF TV bands as licensees.

Today, PMSE equipment is embedded in many sectors and its use is rapidly expanding to meet increasing demand for more sophisticated productions and advanced audio services. Instead of losing frequencies and being forced to migrate to other bands, using license shared access instead could be a viable alternative for the spectrum users, provided that there are no interference issues (see more detailed comments below).

Furthermore the current secondary status of SAB/SAP is a possible thread to ignore the interests of PMSE users as the secondary user uses the UHF spectrum on a non-interference, non-protection basis. This status is not in balance with the importance that PMSE has already proven in past 65 years of its existence.

During the World Radio Conference 2007, WRC 07, in region 1, Europe and Africa, the upper end of the UHF range was assigned to on co-primary level to IMT - International Mobile Telecom, wireless phones and broadband services. This spectrum, namely 790 - 862 MHz (Europe) was or is on the way to being cleared of users - in Germany until end of 2015. All these users had to move into the spectrum below 790 MHz: TV transmitters and PMR/PMSE. The estimation for Germany is that about 800.000 PMSE are affected and have to move down. - These are just those operating on professional level, consumer items are not in the count.

By this change the density in the spectrum below 790 MHz has risen drastically. Producers have recognized this already as the frequency planning for medium and large events are now more sophisticated, take more time and can only be done by specialists to secure interference free productions.

Any kind of production costs money. The return of investment is given when distributing this production, either to the audience in a hall/a venue, a conference centre, church, stakeholder meeting, political gathering etc. or via TV or Internet, or on CD, DVD, Blue Ray, etc. If these productions suffer from interference they cannot be sold! Interference during a production often will lead to cancel it. That causes an increase in costs. At a live event one has to repay the money to the audience or the event has to be repeated. This will especially not be accepted by those who travelled a long way to join the production. Cancelling a production due of interference may bring the producer in bankruptcy. Therefore it needs to be made for certain that a planned production runs free of interference.

Interference in a production means to the company which delivers the technical service is in charge. It will not get fully paid or even not paid as the expected quality was not given. Again: it is required to maintain the current spectrum quality for predictable operations.

It is stated by the iDA for PMSE:

The device is intended for operating in unprotected and shared frequency bands. Its operation shall not cause interference with other authorised radio-communication services, and be able to tolerate any interference caused by other radio-communication services, electrical or electronic equipment.

So far, as mentioned above, the risk of operation in especially the UHF range can be really reliably calculated as the TV stations are reliable primary users. They seldom change their operating frequency and if, they usually do it with long term notice. This was and is the main reason for the reliable, interference free operation of PMR/PMSE.

TVWS will be operated by consumers who have no technical understanding of RF - Radio Frequency - operation. It is only a matter of time until the UHF spectrum is spoiled with users and their devices like the 2.4 GHz range currently is and the 5GHz range will shortly be. If they experience that the operation of their TVWS devices does not have the expected performance or is excluded from operation because e.g. PMSE have higher priority, software modifications will turn up on the web to overcome the protection mechanism. By this the quality of professional productions cannot be predicted any more as these devices may be used in the audience next to PMR/PMSE.

The World Radio Conference 2012, WRC 2012, has decided to open the spectrum from 694 - 790 MHz directly after the WRD 2015 for IMT on co-primary basis. That means that another 100 MHz will be lost for terrestrial TV and PMSE. - if the national governments will follow this resolution.

They are not “forced” to open this spectrum to IMT services. One example: during the last years the German Upper House of Parliament, the “Bundesrat”, has made several decisions NOT to give this spectrum to IMT and to keep it for terrestrial TV services for the future development of DVB-T2, HD - 3D - Spatial Audio, as well as for the PMSE operations serving the various needs of public, commercial and private operations.

Even without this decision one has to take into consideration that the loss of another 100 MHz of spectrum means that the current users of UHF will have to move below 694 MHz with the effect that the density of users once again goes up. - In this case more drastically than ever before. The investigations and the documentations of the DKE, German Commission for Electrical, Electronic & Information Technologies of DIN and VDE - the world’s largest organization- shows that the remaining spectrum, 470 - 694 MHz, cannot cater for all the PMSE services which currently use the spectrum. If there will be no substitute spectrum assigned to PMSE a lot of services and events will suffer or even will be cancelled.

Taking all this into consideration there are two results:

- there will be only little or no space for TVWS devices to operate in the UHF range
- PMSE will need in the future dedicated spectrum and protection to guarantee the services required for the flawless operation of our community. This was already

stated by Prof. Dr. Ulrich Reimers et.al.¹, father of Digital TV, in his study in 2013, for the Germany Ministry of Economics and Technologyⁱ.

This leads to the questions:

- Why can WSD not operate as in the mobile cell phone network? These frequencies are not always fully used.
- Is it intended to build up a new market segment incompatible to cell phone networks? If so, why should it be compatible to PMSE and TV?

Question 2:

IDA invites views on designating a restricted number of TVWS channels to support the deployment of services that require certainty of spectrum access.

Answer:

We do not agree to give a restricted number of channels to WSD. Because of the importance of PMSE and the long term successful activities in the VHF/UHF spectrum a certain amount of channels should be given to PMSE to maintain these services and guarantee the production quality - save harbour channels. This is the approach of regulators like the US FCC and the UK OFCOM to protect PMSE. Beside these fixed channels there may be some others to be shared with other users like TV White Space devices as long as this can be fully controlled by the regulator. It is important that PMSE has to have a certain priority for the operation in these shared channels to maintain its current operation especially at medium or large scale events.

Background information to the answer:

Before taking away spectrum from current users and assigning this spectrum to users which already have spectrum they may use the 2.4.GHz and recently the added 5 GHz range for the exchange of data. , It has to have priority to protect the existing services. There must also be a chance for further development for the current users.

In the text, leading to the above question, iDA also points out “a licence-exempt approach for WSDs would lower costs for users. One concern is the lack of guaranteed spectrum availability. This might be a barrier for the industry to deploy services that require certainty of spectrum access.” It might not only be a barrier for the industry to

¹ Reimers et.al. A study of future spectrum requirements for terrestrial TV and mobile services and other radio applications in the 470-790 MHz frequency band, including an evaluation of the options for sharing frequency use from a number of socioeconomic and frequency technology perspectives, particularly in the 694-790 MHz frequency sub-band; <http://www.bmwi.de/EN/Service/publications,did=556500.html>

deploy such devices, but it also is a motivation for the users to modify the operating software in a way that ignore the rules for protecting other services. By this nothing will be predictable any more - the guarantee of quality of service will be lost for all spectrum users!

Before opening a spectrum for new users there should be an investigation, summing up results, listening to the various stakeholders and then coming to a decision.

During the last years, namely since WRC 2007, a lot of spectrum decisions were done without these investigations especially, but not only, when it comes to secondary services. The For the first time WRC 12 has set the Agenda Point 1.2 and a sub-aspect “find a solution for SAP/SAB (Services Ancillary to Production/Services Ancillary to Broadcast)” - namely wireless microphones and in-ear monitor systems. This group has met several times, last in July 2013 in East London, South Africa.

The members of the ITU, International Telecom Union - organizing the WRC, have started to recognize the importance of PMSE.

If WSD are intended as a new application in the TV bands this scenario should be considered at ITU-R JTG 4-5-6-7 Sub Working Group 2.3.

Before opening the spectrum for new users this investigation has figure out how to to protect the current users. A lot of nations have already regulated in their Telecommunication Laws and Rules: a new service is not allowed to interfere with an existing one.

This we also claim for the PMSE services.

PMSE are used for several reasons. We like to describe the most important ones:

- Intelligibility is always given! Someone using a wireless microphone can move however he/she wants: as the microphone is always with them the understanding is guaranteed as long as the transmitter in in range of the receiver. This is the case at any event where this technology is used. With PMSE even venues can be used which normally are not suitable for productions.
- PMSE saves production costs! Set-up and break-down time for an event is reduced drastically because all can be done outside the venue. The racks with the technology are brought to the venue, antennas are set up, power is connected and the microphone/monitoring part is done. No cables have to be laid down. Cables

the may be causing accidents for people to fall down. By using wireless technology time is saved and the venue rent goes down as it is used for less time. In mostly at night the set-up is done and after the event it is dismantled immediately. Finally: less production costs!

- Flexibility! Changes in the set-up for the event can be done with short notice; even very close to the start of the event. Additional mics can be added for additional guests of VIPs, the rostrum or tables can be moved as no cables need to be taken care of.

Because of this various users have invested into this technology to enjoy these benefits. Not only that: this technology also has fired new genres and new applications which let the application itself grow at a rate of about 6-8% per year.

PMSE is the backbone of all activities that happen in the so called “Culture and Creative Industry”. According to the investigations of the European Commission, this industry grew even in the years of the European crisis more than the average of the market. And there is more potential which wants to be released. It currently guarantees about 8.5 million citizens a job and stands for 3.5% of the European GDP. The value of the Culture and Creative Industry should not be underestimated: for Germany, according to the investigations of the Federal Ministry of Economy, it is industry No 2 after the automotive industry and before the chemical industry.

It also needs to be mentioned that the growth of the application itself was managed so far by intelligent frequency arrangement of the frequency coordinators in charge. These coordinators controlled a complete event/venue and assigned frequencies accordingly. By this the density of users in a given location and in the given available spectrum was built up to the maximum by using frequencies again at a certain distance to the same frequency and also using the required guard bands between frequencies in one location for those in a different one by “combing” these.

Another very important point for PMSE is the 100% duty cycle. There is no chance for a second try: the signal has to arrive at the receiver in production demanded quality at the first time as latency is not accepted due to the real time audio monitoring of the involved users.

For data transmission the functionality is different: data is sent in packages. These packages are checked at the receiver: if they are incomplete and cannot being rebuilt by the error correction code the receiver requests the same package again at the

transmitter. By this a delay is usually not recognized by the user as the latency of data transmission is by far more uncritical for standard application as it is for PMSE. To guarantee the required production quality PMSE always needs continuous contact between transmitter and receiver. For this reason PMSE always uses Diversity operation - also known as MIMO (Multiple Input Multiple Output).

The frequency coordinators have to guarantee for all the participants in the spectrum interference free operation in their designated location.

Taking these few points into account PMSE significantly contributes to the community.

UHF is used for PMSE for several reasons:

- UHF has very little man-made-noise. With its little radiated power PMSE can cover even very large venues.
- UHF, because of its wave propagation, has the ability to penetrate stage scenery, walls up to a certain extend and through the audience. Wherever a reporter, an artist or a moderator operates, backstage, in the stage scenery or in the audience, the signals of his receiver will find the way to the antenna. For PMSE the usage of the UHF range is essential - at least for a wide number of its applications. Contrary to this TVWS are mostly operated in a room in which the antenna has a line of sight to the user's device. For this application UHF is not needed. TVWS can also deploy its services in higher frequencies, 3 GHz and above, as the usage of the 5 GHz range for this application proves.
- UHF is internationally used for broadcast. PMSE devices worldwide have in general the same or similar set-up. These economies of scale are welcomed by the users that receive excellent technical devices at acceptable prices. A clear advantage for the users due to the competition of the manufacturers. As UHF is the international production spectrum the exchange of productions and by this the exchange of cultural developments is easy - almost same technical rules all over the world. Exchange of cultural developments leads to the exchange of opinions and mutual understanding: finally it leads to more tolerance and respect for unknown culture.

The diversity of opinions will be maintained and not destroyed. Also for this UHF is required for PMSE as there is no other spectrum that can provide this.

The only alternative which can support PMSE on the spectrum losses is so far the L-Band: 1.452 - 1.492 MHz (1.518 MHz). This L-Band is able to take over some of the PMSE services, but not all due to the description above.

- UHF provides currently enough spectrum for all kinds of productions. Even several productions can operate in close proximity free of interference. All the big productions require that entire UHF range: reporting on political elections and gatherings, VIP visits, concerts, national and international sports events. Olympic Games or national/international championships. These big events are known to everyone. The Netherlands Broadcast has made an investigation and came to the result that there are about 6 events per month that require the entire available UHF spectrum for these kind of events.

No other spectrum then UHF can accommodate the required technical equipment that is needed to give the audience the excitement they want to experience which generates the sustainability wanted for the event. I also guarantees the production quality which is required to get return on investment.

Question 3:

In the event where IDA designates channels to support such services, IDA invites views on the appropriate regulatory approach in designating and managing these TVWS channels and the regulatory framework for the operations of prioritised WSDs.

Answer:

Priority must be given to the current spectrum users and their needs as it has been done in the past to secure their operations and the communications within the community. By this WSDs cannot have priority as there are numerous events where PMSE requires the entire UHF spectrum. The recently held international Formula 1 event may be named as one example. The very high user density in Singapore also requires spectrum to give these users the required reliability and operational safety.

A significant contradiction should be noted:

On the one hand we have the quality expectation from the PMSE user's perspective that is fulfilled until today without limitation - under practical aspect PMSE "is protected" - mainly by the reliability of the primary user and, as PMSE is handled by professionals, their ability to build up non interfering systems. By these two aspects the required operational security is given. On the other hand there is no guaranteed quality for secondary applications - they are unprotected. These different views need to be taken into consideration.

PMSE needs to get a “co-primary” status in regard of WSD and other potential spectrum users. PMSE not always requires the full spectrum. During the time of low

PMSE activity WSD may use the spectrum. There must be a regulation that PMSE has short notice access to the spectrum if required.

Another regulatory aspects are the spurious emissions generated by WSD. We are concerned that LTE or similar technology will be used that may spoil significant parts of the spectrum with their unwanted radiation into adjacent channels. Please see for details the report of the APWPT: <http://www.apwpt.org/downloads/lte-interference-potential-to-micros30062012.pdf>

It needs to be made for certain that regulators introduce regulations that the operation of WSD will not interfere on adjacent channels.

Background information to the answer:

It is questionable if the precious UHF spectrum is suitable for TVWS. If the political decision makers prefer to get individual data exchange into this range rather than maintain and expand the operations for the community in the culture and creative industry it needs be made for certain to secure the services of PMSE in a different frequency range. This will not limit these services, but also will give them the space required to expand and improve the current applications and to guarantee its quality of service.

Protection is essential for PMSE. By all the changes happening in the UHF range it seems to be appropriate to find reliable frequencies for PMSE. They have to be long term secure for reliable planning and for encouraging the involved parties to invest into this equipment to maintain their services for the community and giving them a chance to get a return on the investment made.

Looking at the interference that WSD could cause in the different bands, there is no room for failure. We are concerned that the WSD principle will lead to an interference with PMSE equipment that comes to life all of a sudden, especially as this equipment is planned to be license exempt or governed by a general license. PMSE equipment would lose this band if WSD users appear unannounced and claim the first right of use for their

equipment. This is not acceptable. The same, of course, is valid for the reception of terrestrial TV.

This concerns in particular the UHF spectrum. In particular, the technical advantages of the UHF TV band spectrum for PMSE, and the fact that other major markets support PMSE operations in the UHF TV bands, we believe that the UHF TV band is and remains the best spectrum choice for wireless microphones. UHF TV band spectrum is uniquely suited for wireless audio uses based on its favourable combination of wavelength, low body absorption, shadowing, and low ambient noise.

PMSE equipment requires known, clean spectrum. Incumbent users, especially wireless microphones, require greater accuracy to accommodate the often fluid spectrum environment in which wireless microphones operate particularly with wireless-intensive large events. Thus in many cases frequency coordinators conduct site surveys days or weeks before events to ensure they understand the ambient RF levels on channels contemplated for wireless microphones and complementary low-power broadcast auxiliary transmitters. The random introduction of unlicensed devices in fractional channels within broader UHF TV band channels through WSD already occupied by wireless microphones would result in an unpredictable and constantly changing RF environment unsuitable for high-profile PMSE operations. Unlicensed WSD devices for instance, which would operate co-channel with protected incumbents may disrupt live or broadcast events, and may also present an acute threat to public safety announcements should they prevent breaking news, announcements and alerts from being disseminated.

Placing new devices with PMSE in the same band could also increase the risk of interference related to intermodulation (“IMD”) product. This occurs when multiple signals from different sources in close proximity combine to produce unwanted new signals, as well as creating interference related to out-of-band emissions from nearby TV band devices. Finally, WSD should not be introduced by iDA in a way that it will hinder advances in spectral efficiency. High-density PMSE systems require a significantly lower noise floor than conventional wireless microphones to facilitate tighter spacing while minimizing IMD. Therefore, thorough studies of CEPT and other technical bodies may be required before WSD can be introduced in bands that PMSE uses.

Taking the statements into consideration that are given above on the existing services in the UHF range and those of the TVWS that the iDA is planning to add we see the regulation as follows:

Some explanation for technical understanding:

PMSE transmitters usually operate at 50 mW radiated power and a channel bandwidth of 200 kHz. According to component tolerances and the physical limitations of filter components next to an existing PMSE link (link = transmitter and receiver - a complete operating unit), a second one can be placed at a distance of about 400 kHz.

When these two units operate in close proximity, intermodulation is generated in both transmitters, which do not allow placing a third unit again at a distance of 400 kHz. As the intermodulation can be calculated an irregular frequency setting is required to make for certain that the production itself is finally free of intermodulation. Taking this into consideration a frequency coordinator can set up in one TV channel, 8 MHz bandwidth, 10 wireless links for which he can guarantee, even for demanding productions, interference free operation. This means finally 10 independent users can operate in 8 MHz without any limitation.

TVWS also called WSD - White space Devices - are designed to operate in broadband: they occupy more spectrum per unit than the PMSE, they use will usually use one full TV channel for their operation - 8 MHz. So one TV channel can only accommodate one user - not 10 users as it is with PMR/PMSE. The data rate and spectral efficiency of analogue PMSE is equivalent if not higher compared to the current standards of IMT.

As mentioned already above TVWS will most likely use LTE technology to apply its services. From tests done by the DKE and others it is known the LTE devices currently have uncontrolled unwanted spurious emissions that effect the frequency range adjacent to the LTE operations up to 32 MHz above and below. It is mandatory that the manufacturers of LTE devices use state of the art filtering that keeps the spectrum above the assigned spectrum free of spurious emissions! Only by this a waste of precious spectrum can be avoided.

Digital services in general increase the amount of man-made noise in the spectrum if not special action is taken - meaning sufficient filtering.

Another aspect is important as well: there will not only be one device operating but plenty. By this the summarizing effect or aggregated effect plays an important role. All this spurious emissions will increase the amount of man-made noise in a way that the operational parameters for PMSE cannot be guaranteed for an interference free operation.

History: the 8m-Band, 32 - 45 MHz, was used by wireless microphones up to the late 1970s. If the 8m band would be free from interference and could therefore be reliably used for operating wireless microphones, current technology would allow 12 channels to be reliably operated in parallel in the 13 MHz of freely available bandwidth (32 MHz - 45 MHz).

The introduction of digital control systems for stage equipment in the 1970s as well as the application of computers and digital sound/light/show control systems made the further use of these frequencies impossible. Instead, the VHF band was used as an alternative.

The 8m-Band as well as the VHF band cannot be used today for professional wireless microphones. The clock rates of computers are much higher in the meantime and have hardly any influence. However, there are now other components in use that also cause interference to wireless microphones. These include energy saving bulbs, digital mixing consoles, lighting control systems and, to an increasing extent, switching power supplies, which in the meantime have clock frequencies in the MHz range. As a result, these devices cause interference to almost the entire short wave band. Other sources of interference are low-energy light bulbs and fluorescent lamps with an electronically controlled choke. Also computer networks contribute to the man-made noise.

The VHF Band, 174 - 230 MHz, was used from the 1970s as it was not subject to interference at that time. Furthermore, it allowed the use of shorter antennas, which made the equipment, and in particular the transmitters, easier to handle. The VHF band also has the advantage of better signal propagation conditions: the range is greater for the same power, which also gives the operator of wireless microphones additional transmission security. Attenuation in urban areas of the VHF band is only a few dB.

Over time, interference in the VHF band increased, which led to a change of wireless production tools to the UHF band. It also needs to be mentioned that the VHF range, with only 50 MHz of bandwidth, does not offer sufficient space to meet the requirements of today's productions. Even medium-sized applications already have difficulties. The VHF band offers around 15% of the bandwidth available in the UHF band.

The major manufacturers of wireless microphones no longer produce VHF systems, as there is no longer a demand for them - due to the unwanted man made noise and the limited spectrum for productions.

Question 4:

IDA invites views on allowing operation of WSDs in the 694 MHz – 806 MHz band until IDA allocates these frequencies for IMT deployment.

Answer:

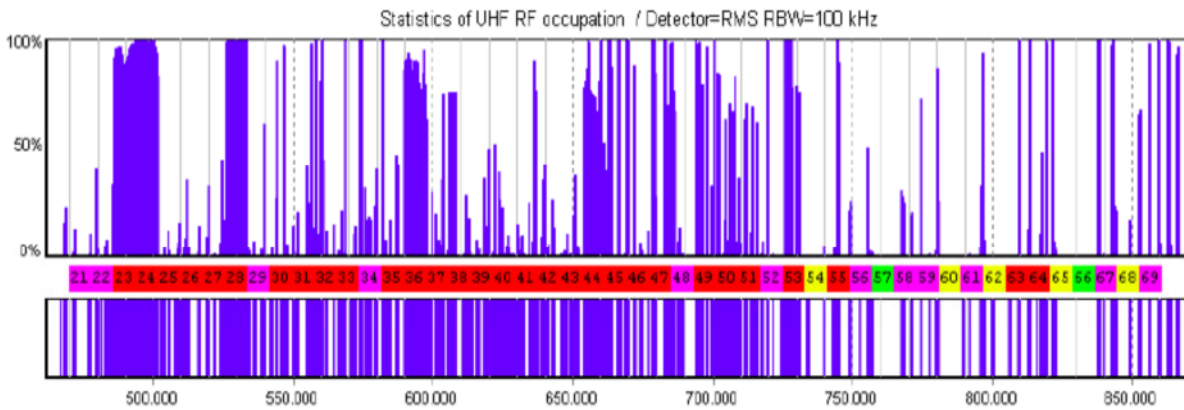
Detailed studies have to be done before the iDA authorities decide to allow the WSDs to operate in this spectrum. They should investigate if the existing services can get arranged with the wanted assignments or will suffer.

iDA also will have to get prepared for the changes that they indicate 2020. Where shall the existing services migrate to?

Background information to the answer:

To support this decision of making studies and to give some background to the thoughts leading to this remark we like to introduce some PMSE applications and their need for spectrum as it can be found in the DKE investigations (German Commission of Electrotechnique, Electronic and Information Technology of DIN and VDE). We are for certain that this will be quite similar for Singapore if not more dramatic as the density of users in Singapore is significantly higher than those of the lower populated areas of Germany where these investigations were taken. So far the DKE is the only organization that has made documentations on the use of spectrum for a long period - they started in 2007.

We like to give an example of spectrum use from the recent past: the State election in Lower Saxony, Germany, in 2008/2013. The following shows you the usage of the spectrum as documented by the DKE in 2008:



The picture shows in the lower part the used frequencies for the named event on the evening of the election. With few exceptions the spectrum is fully occupied; 2008 380 PMSE used the spectrum at the evening of the election, in 2013 it were 425. When assigning a significant part to IMT, 694 to 806 MHz, where should all these services maintain their operations on events like this?

Currently these ranges are used for TV and as secondary service for PMSE. Before iDA intends to give the spectrum 694 to 806 MHz to IMT it essential to find a solution for PMSE: where will these services in future deploy their manifold services in a long term reliable environment. Long term for PMSE is 15 years.

If now WSD will be allowed to enter this spectrum as well: what will happen to them when IMT will be allowed to operate in that spectrum - where will the WSD have to move to maintain their services? If iDA invites users into a spectrum - iDA also has the responsibility to long term secure these services in this or a different spectrum. It also needs to be mentioned that if a spectrum is assigned to a different user there will have to be a transition time that gives the current users an acceptable time for the migration into the new spectrum: acceptable time means also the time for informing the local spectrum users and their decision makers to arrange a new budget, go through the quotation and submission process and finally the installation time that often is limited to certain windows in the year due to the nature of their operations (theatre, musical etc.).

Question 5:

IDA invites views on adopting a database approach as the mandated method to access white space spectrum.

General statements regarding the usage of a database:

Why may a flexible coordination of spectrum through external service providers fail?

- Because of the costs involved. Not PMSE related services as coordination organization will have higher costs for the management.
- Too little competence. Not PMSE related organizations have to protect the nomadic PMSE application. These organizations will have to install a frequency monitoring for their quality control and this already will add on their costs.
- Too slow. These not PMSE related organizations will have to set up protection tables which have to be made public, will be very dynamic and need to be updated when changes occur. PMSE users will have to get their operational data into these tables. This whole process is expected to be too slow.
- Critical business concept for the company managing the database. If external companies will not get the expected return on investment it may be that too many WSD are installed already and run out of control.

Answer:

Database Sharing is an innovative technology that could be used to provide Internet access to a database to ensure that applications designed to use the same frequencies of spectrum. They are not using them at the same time and interfering with each other. There are at least two types of sharing being discussed in the United States and in Europe:

- **Geographic sharing:** The public entities would allow commercial providers to use the spectrum in areas where they are not (fully) using the spectrum.
- **Time-shifted sharing:** Allowing commercial providers to use spectrum during certain periods of time when the government is not using it.

The database approach needs to be introduced by the iDA only in a manner that it protects the PSME equipment from interference to maintain the PMSE achieved Quality of Service, QoS.

Background to the answer:

One potential solution for WSD is indeed that the iDA establishes a regulatory system ensuring that there is/are database(s) of all equipment with “real time” interference control. However, any registration database approach is still relatively new and no database has yet received final approval in any administration jurisdiction to operate as the principal means of interference avoidance.

There is no real-world experience with the implementation of a registration database. Accordingly, iDA should proceed cautiously in implementing a database solution. Without going too much into the details, it will be absolutely critical that the iDA thoroughly evaluate and validate any proposed database administrators and their untested, complex system architectures. It is also imperative that the administrator be an impartial, neutral party rather than an interested provider of devices or technology that will have strong incentives to prohibit database access to incumbents and unaffiliated devices.

While we hope that companies participating in the database proposal process would not engage in discriminatory, preferential treatment, as a matter of sound public policy, it is essential for the iDA to ensure the impartiality of the chosen database administrator or administrators by requiring a neutral party unaffiliated, directly or indirectly, with any interested party. iDA should also consider a designation of multiple entities to operate the database. Moreover, strong authentication as the most effective deterrent against security risks must also be adopted for the data bases. It will be upon the iDA to make these determinations. Database administrators are not policy makers and are not authorized to determine the substantive rights of spectrum use participants.

Finally, the iDA needs to ensure that the operator of the database is financially stable and provides its services to all band users at a reasonable rate. On the one hand, the database services should not set up financial obstacles and high fees for PMSE users that deter them from participating and from registering their devices in the database. On the other hand, an unreliable or financially unstable data base operator would be devastating for all spectrum users. It will be upon the iDA to balance these factors and insure that the regulation works as intended. A potential solution could be that the iDA operates the database itself to ensure that it works and delivers the desired benefits.

QoS, Quality of Service must always be ensured under any iDA arrangement.

The criterion QoS (Quality of Service) gives rise to concerns because it is very vague. Much of the PMSE equipment needs to be on standby and ready to transmit 24 hrs. / 7 days a week. This is in particular true for wireless microphones, in-ear devices and cameras that are used for ENG (Electronic Newsgathering). In addition, this requirement for 24/7 readiness becomes more and more the standard for PMSE equipment that is used for ENG content production, conferences and tours.

Equipment that is used for these purposes cannot cope with any interference from other devices. In addition, unforeseen technical problems or demand may force a

frequency coordinator at a political meeting/conference, a large sporting event, an award ceremony, or concert to reassign equipment to new, previously unreserved frequencies for PMSE. Regardless of how the need arises, when new channels are needed immediately for urgent incumbent use there must be a mechanism to accommodate these users and set aside channels.

What is needed are pre-defined license conditions and clearly defined sharing arrangements, including sufficient reserved capacities for “emergencies” and nearly real-time updates and synchronization between different users of the spectrum to ensure a certain quality of service (QoS) and a minimum of interference for PMSE. The incorporation of nearly real-time updates and synchronization into these agreements will encourage the users of the bands to reserve channels only for the period of time they actually need to operate on the frequencies, promoting spectral efficiency by making channels more rapidly available for use after the conclusion of a protected incumbent’s broadcast, production or event.

The goal is to allow sharing, while at the same time safeguarding the PMSE rights as the incumbent users in accordance with footnote 5.296 of the ITU Treaty mentioning the use of ENG in the 470 to 790 MHz / 698 MHz band.

Question 6:

IDA invites views on the proposed general requirements for the database query and registration.

Answer:

Currently we see the database request as the only reliable method for WSD to check the availability of free spectrum to operate in. Only by this the interference with the existing spectrum users can be avoided. The WSD must be able to receive the information from the database before it starts any operation.

The operation radius of not more than 50 m seems to be acceptable as well the need to check the database frequently if the spectrum situation has changed.

The database will keep the information where and when PMSE intends to use the spectrum. A WSD shall be only allowed to make use of spectrum after contacting the database and if there are no PMSE operations. The WSD needs to register in this database and there is a need to identify the WSD and its user in order to follow up directly on possible interference given by this device. There must also be the possibility to immediately cease the operation of the WSD through this database.

Question 7:

IDA invites views on the three situations in which a WSD must query the database. In particular, IDA invites views on defining 50m as the maximum distance that WSDs are allowed to move from its original location, without contacting the geolocation database.

Answer:

The named 50 m are also valid in large buildings; especially those in Singapore that often combine shopping, restaurants, conference, houses of worship and entertainment facilities. Exceeding the named 50 m an operation shall only be allowed after contacting the database and getting the information which part of the spectrum can be used.

Question 8:

IDA invites views on the output power transmission of WSDs as shown in Table 2.

Answer:

100 mW seems feasible as long the requirement for database connection is mandatory before starting the operation. This must be valid for all units - also the fixed one. We think that also the fixed one must have a mechanism that stops it from operation if the location is changed.

4 W of power for a WSD is not acceptable as this device will have an uncontrolled radius of operation especially in Singapore. PMSE have higher sensitivity and dynamics compared to the “consumer” WSD and are therefore more sensitive to interference. The requirement for the higher PMSE sensitivity is given due to its nature having the needs of operating in the backstage area, the on stage scenery and the audience area. The risk of interference from a 4 W WSD device operating on the same frequency is still given at a distance of 10 km and more.

As WSD will be a secondary service similar to PMSE a limitation of the output power at 100 mW is acceptable as the range of operation is more likely to be calculated. For comparison: PMSE usually operates at 50 mW power.

The question is why WSD fixed devices should have 4 W output power. By this they have a wide range and can only make use out of this wide range by communication with another fixed device. The mode 2/3 devices with their 100 mW will only be able to operate in close proximity to each other or the fixed device. If fixed devices communicate with each other we see already the remaining spectrum filled with these devices. That means we will have within very short time conditions in the UHF range like they are current in the 2.4 GHz range.

Even if PMSE is given priority for its operations there is the very high risk that the aggregated effects of having many WSD in the UHF range will increase the man-made-noise and by this shorten the range of operation for TV and PMSE reception.

Question 9:

IDA invites views on allowing the Fixed Devices to have tuneable output power that is capped at a maximum of 4Watts EIRP.

Answer:

Please remarks in Answer 8. We do not agree to the 4 W output power of a WSD - this is far too high. With these WSD operating on towers or top of houses its radius of operation will be uncontrolled - especially in Singapore and so a threat for the other spectrum users.

If WSD is introduced to the UHF range it should have the same or similar output power like PMSE. By this both users have a chance to arrange each other to share the spectrum when PMSE does not require the entire range.

Question 10:

IDA invites views on the requirement of a Unique WSD Identifier and for this identifier to be based on standards developed by recognised standards organisations.

Answer:

The database will hold the information which PMSE will operate when and where. The user easily can be identified and contacted. Same must be valid for the WSD user - the units must be personalized, the user must be able to be identified.

Background information to the answer:

In the UHF range professional wireless production takes place - since many years successfully and under reliable operating conditions that allow the technical designers of these systems to get the required production quality. All these productions are based on the mentioned Quality of Service.

Data transmission as intended with the WSD currently happens in the ranges 2.4 and 5 GHz. In this spectrum the wireless operators know about the risk of interference and accept certain delays in the transmission of data. As mentioned already above it is not allowed that WSD uncontrolled enter a spectrum like they can do at 2.4 or 5 GHz. The UHF spectrum especially is the backbone of wireless productions. It is absolutely essential the users of WSD can be identified and contacted.

Any kind of production costs money and the money is earned back by distributing the production. If a production experiences interference it is damaged and the value is lowered significantly and cannot be sold anymore or may have to be repeated. Both are a significant loss of money!

The question here is about liability if a WSD, no matter if operating above 100 mW or below, interferes with a wireless production? Will there be an insurance that pays in such an event for the costs of the damage done to this production? In any case it is required to find out who is the WSD operator in order to contact him - similar to the operation of wireless phones today.

Question 11:

IDA invites views on the proposed maximum transmission level of 100mW EIRP for WSDs operating in channels adjacent to a local broadcast channel.

Answer:

WSD will not only operate adjacent to TV, but also adjacent to PMSE. The 100 mW EIRP seems to be acceptable as it will be distributed over the 8 MHz of the WSD used TV channel. Most important is the filtering at the edges of the used channel this is valid for both the TV operating in the adjacent channel as well as the PMSE. It needs to be made for certain that the out of band emissions of the WSD will not harm PMSE or Broadcast operating in the adjacent channel.

This remark is also valid for the planned 4 W version of the WSD to which we do not agree. To the points mentioned before it can be expected that the spurious emissions that affect the adjacent channels are significantly higher than those of the 100 mW versions if not special action is taken.

Background information to the answer:

Due to the running discussions it can be expected that the WSD will use LTE or similar technology to deploy its services. Measurements of the DKE have shown that LTE technology currently emits significant uncontrolled radiation into adjacent channels that make the operation of other wireless equipment questionable if not impossible. These investigations of the DKE focused on the duplexgap in the 800 MHz range. Results can be found here:

<http://www.apwpt.org/downloads/lte-interference-potential-to-micros30062012.pdf>

It was and in some case still is denied that these uncontrolled emissions exist. This denying is based on the measurement method taken as there are methods that do not show these emissions. But operating PMSE equipment in the adjacent channels inevitably will make these uncontrolled interferences audible. It also needs to be mentioned that the current LTE 800 devices are better in this regard than those being deployed after the start of LTE 800 operations. That shows that there are methods to improve the performance and to cease the emission of these spurious emissions.

Question 12:

IDA invites views on the proposed OOB emission limit of -56.8dBm, which will be imposed on WSDs operating in channels that are directly adjacent to a local broadcast service.

Answer:

Using the Hata model, can be used in this case as Hata uses for the first 60 to 70m free path loss estimation only. For this reason we will use it as well in the following example calculation:

-56.8dBm, rounded -56dBm, will be referred to a WSD output power of 100mW.

Does this mean a WSD device operating on 4W output power provides a 16dB higher adjacent channel interferer level? If yes, we have to calculate with this higher level! This will be $-56\text{dBm} + 16\text{ dB} = -40\text{dBm}$. Now this calculation looks much worse and it can be seen the effect on other spectrum users will be quite dramatic: taking into consideration the protection level of PMSE at -115dBm (published in several documents: e.g. ETSI TR 102 546 v111 or ITU-R WP6A R12-JTG4567-C-0127!!MSW-E) the difference between the two, -40dBm to -115dBm, equals to 70dB.

This 70 dB has to be provided by protection distance or additional shielding or path loss. This means a protection distance for PMSE operation in the adjacent TV channel above 100m.

This is the calculated example for just one operating WSD. It can be expected plenty of these units active and causing aggregated effects - making this calculation even worse by increasing the required distance to PMSE for interference free operation.

Operating in a channel with this amount of spurious emissions it will reduce the range of operation for PMSE drastically. If the PMSE receiver detects the WSD signal to be stronger than the signal of the corresponding PMSE transmitter it will demodulate the WSD signal what will lead to very loud, at full modulation, random noise at the output of the PMSE receiver or it may mute the output of the PMSE receiver. Both are not acceptable as it will spoil the operation of the PMSE link.

When looking at the graph that was added in the consultation paper it can be interpreted that the mentioned interferer level are at the border of the used WSD TV Channel. From the graph it also can be seen that the spurious emissions will minimum fill half of the TV channel above and below the WSD used channel. For the PMSE operations it means that another full channel is lost due to the required operational safety a production needs. For one TV Channel a WSD needs another TV channel for its operation as

guard-band for the operation of the current existing spectrum users. This is a waste of spectrum that cannot be accepted.

The TV operators will have to judge as well if this is acceptable for the save operation of the receiving devices at the peoples home, in their cars etc. The problem is that the WSD as transmitter is “in the user’s pocket” and by this close to the TV receivers as

well. Also into consideration has to be taken the effect on TV cable networks in the peoples home: the risk of interfering with these or the set-top boxes of the viewers is also very high. Tests have been done and show that it is critical to implement in the UHF range WSD or later the much stronger IMT units.

When looking at these figures one also has to take into consideration that the WSD will be used in close proximity to TV receiving devices as well as to PMSE. These WSD will be portable and become integrated part of the mobile phones being carried around by the users. By this they are in any venue, in any location and close to PMSE which will bring an unpredictable risk of interference to producers.

These figures mentioned above need to be improved.

Special focus when judging the spurious emissions of WSD has to be given on the transients that are generated by these devices. For the LTE technology these transients are mainly responsible for the audible interference in the PMSE devices operating in adjacent channels. Also these transients have to be below the mask that finally will be agreed to.

Question 13:

IDA invites views on defining the OOB emission limits for WSD to WSD operations.

Answer:

In general the answer to question 13 contains already all points that need to be mentioned. The text that leads to question 14 again brings up the impression that besides TV and WSD there seems to be no other spectrum user - contrary to statements given previously. iDA wants to lower the out of band emissions for WSD if not operating adjacent to an occupied TV channel. This is not acceptable. A waste of spectrum especially in the background that reduced emissions is possible next to a TV channel!

It needs to be mentioned that PMSE also requires protection from WSD. PMSE is more sensitive to interference as the receivers operate at the physical limit to pick up signals in order to allow users also acceptable operations under not so favourable circumstances.

Question 14:

IDA invites views on the proposed approach to manage coexistence between a WSD and the other secondary services within the TVWS channels.

Answer:

This proposal is feasible as PMSE since decades follows successfully this approach. Finding the right measures for WSD can be the base for sharing the spectrum in avoid interference of the operations. Co-channel operation in close proximity will be the end of any PMSE production.

Background information to the answer

For PMSE there is usually one frequency coordinator who performs various measurements at a location to set the reliability of the used wireless links up to a maximum. By this the coordinator detects the wireless services on air and their changes. It will be hard to pack this accumulated experience of a frequency coordinator into a database to protect the various services. One reason for it is the quality of the measurement equipment involved and the physical rules used for this coordination. In urban areas this even more complicated as the wave propagation is hardly predictable based on the height above ground, the style of the building environment etc.

Question 15:

IDA invites views on the proposed propagation model and parameters used to determine the maximum transmission power level of a WSD.

iDA has given some noise floor measurements in Table 3 on page 13. To interpret this data it is required to know with which bandwidth these figures were measured.

Answer:

We do not agree to use any of these models as they are not sufficient for the application in Singapore. The preferred Hata model especially is only valid for operation on the ground. Due to the nature of the Singapore urban structure this will hardly be the case and also the drawings show that it is expected to operate certain WSD on roofs or towers. Wireless devices on elevated levels reduce the signal attenuation significantly. Meaning: the risk of interference grows for other spectrum users. One also has to consider that Hata is only a model and does not describe the actual situation.

Question 16:

IDA invites views on its proposal for the protection of licence-exempt and licensed wireless microphones. IDA also invites views and comments on the optimal number of safe harbour channels required to ensure that licence-exempt wireless microphones can continue to be used once WSDs are deployed.

Answer:

It cannot be accepted that none of the services, the existing as well as the new one, will have any protection. Just by introducing a new spectrum user like WSD the so far achieved operational reliability is not allowed to be reduced. The WSD will have to follow rules that this new service will not influence the operations of the existing services. In quite a lot of countries this is already embedded in the laws of Telecommunications and is applicable here as well.

If this general rule is not obeyed no operation can be predicted and the currently well used spectrum will be wasted. Rules have to be established that allow all services reliable operation. Otherwise it will be a significant step back and professional productions will end in an interference chaos.

We can imagine that the safe harbor channels are those for the general use of PMSE. This can be the license exempt wireless microphones. Professional production will consider the location of their production when choosing the frequencies to operate on. In an isolated environment they will also start in their planning with the usage of the safe harbour channels before looking for licensing additional channels in the remaining spectrum.

If the location is not isolated, part of an uncontrolled environment where multiple user may use these channels, professional productions will operate all their equipment on licensed channels to secure the production. Professional users in general prefer to

operate on licensed channels as this already gives them a certain protection - even today. Taking into consideration the cost of a production and the cost of a failure due to uncontrolled interference the additional cost for the licensing of the wireless equipment for its protection is feasible.

Taking into consideration the high density in Singapore and the various operators in close proximity the number of eight safe harbour channels seems to be appropriate. Eight TV channels can accommodate between 30 and close to 60 PMSE depending on the arrangement of these channels. Today's standard productions use between 40 up to 70 wireless channels with an increasing trend due to the higher usage of in-ear monitoring.

This picture also shows the efficiency and the contribution of data transmission: while 8 TV channels can accommodate 8 WSD it can accommodate instead minimum 30 or up to 60 PMSE.

Question 17:

IDA invites views on the need to develop a registration process for users of licence-exempt wireless microphones that require additional channels beyond the safe harbour channels.

Answer:

A registration for those PMSE which operate outside the safe harbour channels seems to be acceptable as long this registration also guarantees protection. This registration should preferably allow online registration to also be able to use channels with short notice as needed by changing conditions of wireless operations and due to the needs of ENG, SAB, SAP. To make for certain that this protection is given the WSD database will need an almost real-time update to follow the changing environment.

Question 18:

IDA invites views on whether the proposed demarcation zone approach is sufficient in terms of managing cross border interference issue and if there are any other factors IDA should consider.

Answer:

We cannot justify the effect of this demarcation zone approach as we have no information on spectrum usage behind this zone. To our knowledge PMSE was not experiencing interference from cross border operations.

But we can state, that the neighbours of Singapore will not be delighted if operation according to table 1, page 28, will be allowed. This will be the end of any PMSE production within and around Singapore.

Question 19:

IDA invites views on the aggregate interference effect of WSD and whether any adjustment in terms of technical requirement is needed.

Answer:

To our knowledge there have not been qualified tests on the aggregated effects so far. OFCOM once planned it, but it was not executed. The efforts to run test like this are high due to the large number of WSD needed.

Another effect that needs to be taken into consideration is the one of intermodulation interference. As it can be expected that the WSD operate in close proximity there will be intermodulation distortions caused by these WSD in the adjacent channels. These intermodulation distortions again can harm the operations of PMSE and destroy productions. Before allowing WSD to commence operation this intermodulation effect needs to be investigated for the protection of PMSE.

Question 20:

IDA invites views on using GPS as the method to determine location accuracy, and on whether 50m is a sufficient location accuracy requirement for the operation of WSDs.

Answer:

The 50 m seems to be acceptable - it needs to be made for certain that PMSE and WSD do not operate in the same building on the same channel.

Question 21:

IDA invites views on allowing the manual input and internal storage of geographic coordinates for indoor Fixed Devices.

Answer:

Finally the owner of the device is liable for its determined operation. So he will also be liable for the changes as long as he can proof the changes are done by a professional, certified installer.

Here, again, the question is asked for the liability of the programming and possible manipulation of it. This question needs to be answered before these units are deployed into the market.

Question 22:

IDA invites views on the requirement of an approval process for the installer of indoor Fixed Devices and the necessary conditions for approval.

Answer:

Please see answer under question 21.

Question 23:

IDA invites views on the possible types of TVWS network topologies and use case scenarios.

Answer:

According to the plan the “Fixed Device network, where all devices have geolocation capability and access to the database” seems to be the safest one as all devices can at any time check their location and align it with the given database at any time. In this set-up we see the highest operational security.

The fixed device is said to be able to control an area of about 4 km radius with its 4 W output power. By this it knows which channels are available in that range and which are taken. So it can allow mode 2 or 3 devices to start operation. These mode 2/3 devices will get their allowance of operation for the fixed device only. As the output power of the mode 2/3 devices are the said 100 mW they will be only able to operate in close proximity to the fixed device. If this is the case we see this scenario as a possible one that will give security to the other spectrum users.

We are against a scenario where a fixed device as master controls a mode 2/3 device and that one controls another mode 2/3 device. If there is a fixed device as master it

may control several slaves, but the slaves are not allowed to become master for other units. Chain forming has the risk that it will run out of control.

Question 24:

IDA invites views on the payment of fees for the use of database services.

Answer:

From PMSE user point of view a reasonable fee will be accepted for reliable access to the spectrum. This will have to include protection against interference from other sources within the assigned channels.

For medium or large events the frequency coordinator may request a certain frequency range or a number of TV channels in which he himself will arrange his PMSE links according to the location and production needs. In this case he is responsible for his quality of transmission within the given ranges for which he has protection against interference coming from outside.

Question 25:

IDA invites views on both approaches in managing the database (i.e. industry-managed or government-managed database).

Answer:

One potential solution for the spectrum users is indeed that the iDA establishes a regulatory system ensuring that there is/are database(s) of all equipment with “real time” interference control. However, any registration database approach is still relatively new and no database has yet received final approval in any regulation to operate as the principal means of interference avoidance. To date, there is no real-world experience with the implementation of a registration database. Accordingly, iDA should proceed cautiously in implementing a database solution. Without going too much into the details, it will be absolutely critical that the iDA thoroughly evaluate and validate any proposed database administrators and their untested, complex system architectures. It is also imperative that the administrator be an impartial, neutral party rather than an interested provider of devices or technology that will have strong incentives to prohibit database access to incumbents and unaffiliated devices.

We expect companies participating in the database proposal process would not engage in discriminatory, preferential treatment, as a matter of sound public policy, it is essential

for the iDA to ensure the impartiality of the chosen database administrator or administrators by requiring the administrator to be a neutral party unaffiliated, directly or indirectly, with any interested party. iDA should also consider a designation of multiple entities to operate the database. Moreover, strong authentication as the most effective deterrent against security risks must also be adopted for the data bases. It will be upon the iDA to make these determinations. Database administrators are not policy makers and are not authorized to determine the substantive rights of all the spectrum users.

Finally, the iDA need to ensure that the operator of the database is financially stable and provides its services to all band users at a reasonable rate. On the one hand, the database services should not set up financial obstacles and high fees for PMSE users that deter them from participating and from registering their devices in the database. On the other hand, an unreliable or financially unstable data base operator would be devastating for the spectrum users. It will be upon the iDA to balance these factors ensure that the spectrum users can work as intended. A potential solution could be that the iDA operates the database to ensure that it works and delivers the desired benefits.

Question 26:

To better gauge the level of interest from the industry, IDA invites companies that are interested in developing and managing the database for Singapore to register its interest with us and share the following details:

- i) Funding for database development and management (i.e. self-funded, cost recovery, etc)*
- ii) Business models considered when providing database services*
- iii) Possible fees involved for TVWS users*

Answer:

There is no interest from our side to develop and manage the database.

Question 27:

IDA invites views on the proposed preliminary conditions for the operation and administration of the databases

Answer:

In general these milestones of the iDA should be the base for its start. The iDA will closely have to monitor the practical operation to insure the target of this database is met: fast access and interference free operation of the spectrum users. This must be given to all potential spectrum users - not only to the named WSD, but to the current users as well as those that may get spectrum access in the future.

A question that will have to be discussed: who liable when an assigned WSD operation interferes with a PMSE production? As PMSE has to get a license for the operation outside the save harbor channels the user is known with all his contact details. Same has to be given for TVWS as well. As TVWS users will have to pay a fee to maintain the geolocation database this should be relatively easy and reliable. TVWS has to become a personal device similar to mobile phones for which all the contact data is available.

Question 28:

IDA invites views on the proposed approach and communications protocols between the following:

- i) WSD and IDA website containing the list of authorised database administrators*
- ii) WSD and the database*

Answer:

As PMSE user we cannot contribute to these administrative questions.

Question 29:

IDA invites views on the proposed frequency of update for Time A validity and Time B validity.

Answer:

Please see answer under question 30.

Question 30:

IDA invites views on requiring the adjustment of the value for Time A validity and Time B validity, and for this to be within the range of 6 to 24 hours.

Answer:

There are two categories of PMSE operations: those that are planned in advance and those that happen with short notice. For all those PMSE operations that have this planning process the given time frame seems to be feasible.

For the operations that happen with short notice the proposed time frame is not acceptable as it reduces the given quality for the spectrum access of PMSE drastically - makes it almost impossible for PMSE to operate. Namely all news and film/video productions will suffer from this long update time and for that reason it is not acceptable - especially in the age of real-time operations.

ENG, Electronic News Gathering, and video and film productions always operate on short notice - this is the nature of this business. ENG relies on the activities of the community and the needs to deliver reports. Video and Film productions are very often weather depended and have to choose their operation according to these often changing conditions.

For both operations a real-time update is required or at least an update that is in the range of 5 to 10 minutes. Looking at other existing services this should be the goal from the update frequency at the user device in the field.

Question 31:

IDA invites views on the benefits and costs of a requirement for WSD to report its operational parameters to the database.

Answer:

As there will be a communication with the database anyway to allow operation to the WSD and to hand over the parameters for it - the WSD can provide in exchange its identification as well as the operational parameters. This can be very detailed of the parameters can be fixed in classes to reduce the amount of data.

Having the operational parameters of the WSD the iDA database can decide on the assignment of this used frequency to another WSD in close proximity. This can help to a more efficient use of the spectrum allowing more users at the same time.

Question 32:

IDA invites views on the benefits of including within the TVWS regulations a requirement for WSD to register its contact parameters to the database.

Answer:

The iDA as spectrum authority must have at any time the overview on the spectrum and its usage - otherwise it cannot control the efficiency of the usage and cannot follow up on the needs of the spectrum users. The required PMSE protection parameter are known for decades already and have not changed ever since as they are sufficient so far - also due to the low man made noise in the UHF range. When applying for the operation outside the save harbor channels the PMSE user data will be given to the authorities - this is the case today in a lot of countries already.

WSD will have to do the same especially to follow up on possible interference that may turn up for PMSE or for WSD during operation.

In case of emergency iDA can through its database switch of WSD and stop them from accessing the spectrum in a specific area or on certain channels. It seems to be essential that iDA knows about the WSD user so that they can inform on the reason for ceasing the WSD operation.

Final remark:

If the spectrum is further reduced, seems that 694 - 806 MHz will be given to IMT, the current services will have to use the remaining spectrum and the user density will go up again; on top of the growing application. First the primary service will occupy the remaining spectrum and in the Singapore area those TV signals coming from abroad have to be coordinated with their own ones. Only by this the remaining "White Spaces" will be reduced drastically: in a way that they cannot cater for PMSE on its own any more. To maintain PMSE additional spectrum has to be assigned and, as can be read in the Mobile Media 2020 Study of Prof. Reimers, Germany, special protection needs to be given to PMSE to guarantee its services also for the future: PMSE needs to get Primary Status in certain ranges to guarantee its long term operations. One feasible spectrum is the L-Band that is already mentioned by ETSI since 2006 for the expansion of the PMSE services.

We are for certain after the assignment of additional spectrum to IMT there will be no room any more for WSD in the UHF range.

Norbert Hilbich, Head of Application Engineering, Sept. 4th, 2013

Sennheiser electronic GmbH & Co KG, Germany

Norbert Hilbich
