CEPT ECC
Electronic Communications Committee

ECC Report 182

Survey about the use of the frequency band 863-870 MHz

September2012

0 EXECUTIVE SUMMARY

WGFM adopted at their September 2010 meeting a questionnaire on the use of the frequency band 863-870 MHz by Short Range Devices (SRD).

In total, 76 responses were received at the European Communications Office (ECO).

SRD/MG endorsed the ECO summary and made some suggestions for further improvement. It was considered that the type of questionnaire demonstrated that it was very good at collecting market and usage information but at the same time difficult to summarise, evaluate and draw conclusions. A lot of suggestions from the responders would need time for evaluating of them. SRD/MG#52 agreed to work via correspondence on the subject and to include boxes below the individual question summary with the aim to identify the preliminary SRD/MG conclusions in these boxes. This correspondence work was agreed to be carried out via the ECO Forum and all proposals to be consolidated by means of three electronic meetings (3 -4 May 2011). SRD/MG at their meeting in September 2011 finalised the review and the assessments were provided to WG FM at their October 2011 meeting.

WG FM endorsed the present summary from the ECO and the assessments from the SRD/MG at their 73rd meeting in Lille, October 2011. It is expected that SRD/MG will continue to work on the 863-870 MHz during the UHF Roadmap activities.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
ACEA	European Automotive Manufacturer Association
AFA	Adaptive Frequency Agility
AM	Amplitude Modulation
ASK	Amplitude Shift Keying
BSIA	British Security Industry Association
CEPT	European Conference of Postal and Telecommunications Administrations
DAA	Detect and Avoid
DC	Duty Cycle
DECT	Digital Enhanced Cordless Telecommunication
DSSS	Direct Sequence Spread Spectrum
ECC	Electronic Communications Committee
ECO	European Communications Office
e.i.r.p.	Equivalent Isotropic Radiated Power
ETSI	European Telecommunication
FH	Frequency Hopping
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
FSK	Frequency Shift Keying
GFSK	Gaussian Frequency Shift Keying
GMSK	Gaussian Minimum Shift Keying
GSM	Global System for Mobile Communications
ICASA	The Regulator for the South African Communications
ISO	International Organisation for Standardisation
ITU-R	International Telecommunication Union-Recommendation
LBT	Listen Before Talk
LDC	Low Duty Cycle
LPRA	Low Power
MSK	Minimum-shift keying
NRA	National Rifle Association
PR-ASK	Phase Reversed Amplitude Shift Keying
RF	Radio Frequency
RFID	Radio Frequency Identification
RIS	Research and Information System
SRD-MG	Short Range Devices-Management Group
TDMA	Time Division Multiple Access
TX	Transmitters
UHF	Ultra High Frequency
WG FM	Working Group Frequency Management
ZVEI	Central Association for Electrical and Electronic Industry

1 WHO RESPONDED

5 administrations replied. Of these, 3 European administrations provided feedback stating that they could not contribute answers to the questionnaire. Administrations from South Africa and the Ukraine contributed some material and are included in the evaluation of the responses.

All other responses have been received from industry. 5 industry/ trade associations provided a response, i.e. the British Security Industry Association (BSIA), Digital Europe, Swiss Verband fuer Sicherheitsanlagen, Euro alarm and European Automotive Manufacturer Association (ACEA). Some responses included answers from more than one product/business unit from the respective company.

The activity of the responders was indicated as follows in **Error! Reference source not found.** (multiple choices possible):

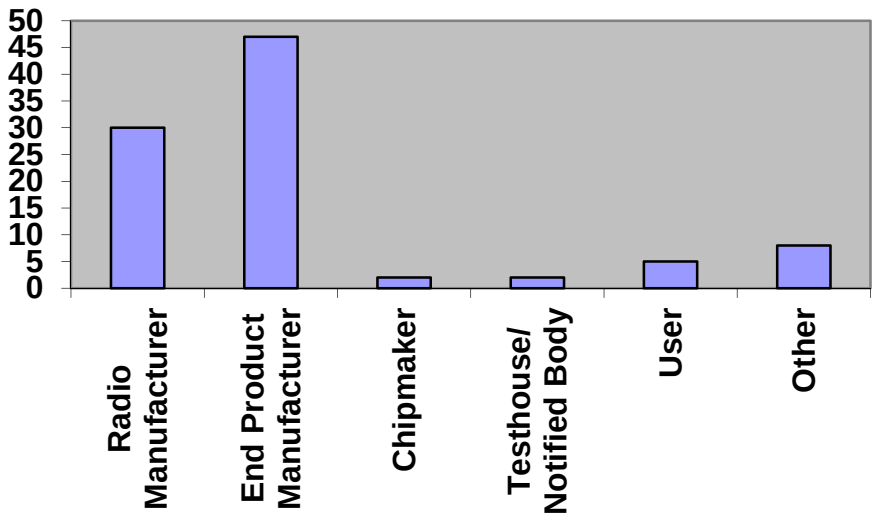

Figure 1: Field of activity of the responders

As can be seen, the vast majority of all answers have come from manufacturers of wireless products, either the radio module or the end product.

The persons' responsibility at the company who was in charge of sending a response was indicated as follows:

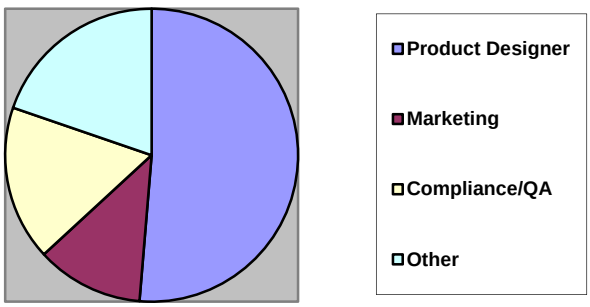

Figure 2: Responsibility of the person who provided the response

This shows that it can be assumed that the responders had a good knowledge of the current regulations. Almost all responders stated that there is a person responsible for the compliance of their product with the regulatory and standards' framework in their company/organisation.

In addition, all responders stated that they had understood the aim of the questionnaire and that they already provide products operating in all or parts of the 863-870 MHz range.

The latter point made question 4 of the questionnaire obsolete since the question was only applicable if the manufacturer was in the product planning stage. Some responders used question 4 to indicate that they see the need for additional UHF spectrum in the future.

Table 1: Responses received

Responses from the following industries and organisations were received	
ACEA	JAY
Adeunis RF	Kamstrup
Administration of Iceland	Legrand Euroalarm
Administration of South Africa	Lutron
Administration of the Czech Republic	MaxID
Administration of the Slovak Republic	Metrona Union
Administration of the Ukraine	Michelin
Alliander	Neopost ID
ASK	NEWSTEO
Atral Secal	Novar
Atus	Novar Honeywell SRD
Bayerdynamic	NXP
BOSCH Automotive	RSI
BOSCH Social Alarms & Call systems	RWO
BOSCH Wireless Intrusion and Alarms	SAPPEL
British Security Industry Association	Schneider Electric
BT Siemens	Schneider Electric Lifespace
Busch Jaeger	Securitas Direct
Continental	Securiton
Cooper Security	Sensormatic

Responses from the following industries and organisations were received	
Coopper Safety	Sensus
Digital Europe	SES Switzerland
Elster (Coronis)	Siemens Austria
EMH Metering	Smart Dutch
EMS	Smart Signs Solutions
Enexis	SOMFY
Euroalarm	SONY
France Telecom / Orange	Swiss Gas Metering
Gerda Security	Systerel
Hager	Techem
Hekatron	TYCO
Homerider	TYCO fire and Security
Honeywell	USIF
Honeywell Security and Com.	UTC Fire and Security NL
Hydrometer	UTC Fire and Security Spain
Impingj	Velux
Industry South Africa	
INSTA	
ISTA	
Itron	

The approximate number of wireless devices either sold or bought annually in Europe was given as follows:

- 24 responses representing > 1 million devices (one responder stating that it was rather 10 millions instead of 1 million devices);
- 14 responses representing > 100 000 devices;
- 25 responses representing less than 100 000 devices (but more than 1 000):
- 10 responses representing less than 1 000 devices (but more than 100);
- 1 response indicating less than 100 devices.

The following minimum numbers of devices operating in 863-870 MHz sold annually amongst application fields from the above responses can be assumed conservatively as follows (this only includes those who provided an answer and does not represent the whole market, i.e. the real numbers in the market are likely to be higher. For example, the current device population for social/personal alarms is estimated to be around 3 millions):

All kinds of Metering:	> 10 millions
Home automation (incl. all kinds of remote controls)	> 10 millions
Alarms (incl. intrusion sensing)	> 10 millions
Automotive	> 5 millions
Industrial, including sensors in industry	> 2 millions
Audio	> 2 millions
RFID	> 100 000 readers with millions of tags
Social/personal alarms	> 100 000 units annually.

The above is only to show the approximate weighting of the respective application field as represented in the responses. It is also to note that many answers indicated that they see a strong growth of their respective wireless device sector. Such statements were made across all the above application fields.

2 APPLICATIONS

Table 2: Applications

The following applications were named in the answers	
2-way communications	Payment transactions
Access control	People and goods tracking
Alarms	Personal attack protection
Applications for elderly people	Personal security
Applications for prisons	Remote Control
Audio & Imaging	RFID Readers & tags and associated applications
Audio transceivers	Security
Building automation	Sensors/actuators/wireless com at machines/ industrial field
Call points	Smoke detectors
Digital signatures	Social Alarms
Emergency lighting, lighting control, blind control, control of lighting load	Telemetry
Healthcare	Vehicle remotes
Home control	Vehicle tracking
Intrusion control	Wireless Audio/ Cordless Audio/Audio/Tourguides
	Wireless gateways

3 SPECTRUM ACCESS AND BANDWITH USED

The responders declared that they would use the following spectrum access mechanisms:

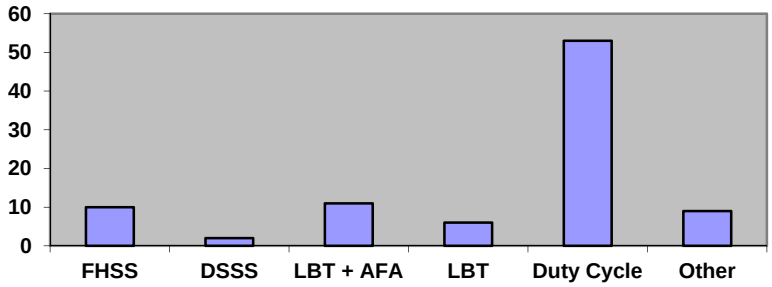

Figure 3: Spectrum access mechanisms in use

Some answers included under <other> also combinations such as LBT + DC, or other access methods such as manual access. In addition, UHF RFID manufacturers either did not select a category at all, or selected either <other> or <duty cycle>. However, it is clear from the answers that RFID manufacturers use the current 4- reader channel plan.

Nevertheless, the answers clearly show that using the duty cycle is the dominant access technology in the market which is used by metering, alarms and automotive applications to a great extent, and almost exclusively.

The stated modulation schemes in the answers indicated that FSK, GFSK, MSK and GMSK modulations are by far the most used modulation schemes (greater than 50 of the respondents). ASK, PR-ASK, FM, AM were also mentioned several times.

Both narrowband (up to 25 kHz bandwidth) and wideband modulations are used in 863-870 MHz with the number of mentions shown below in Figure 4.

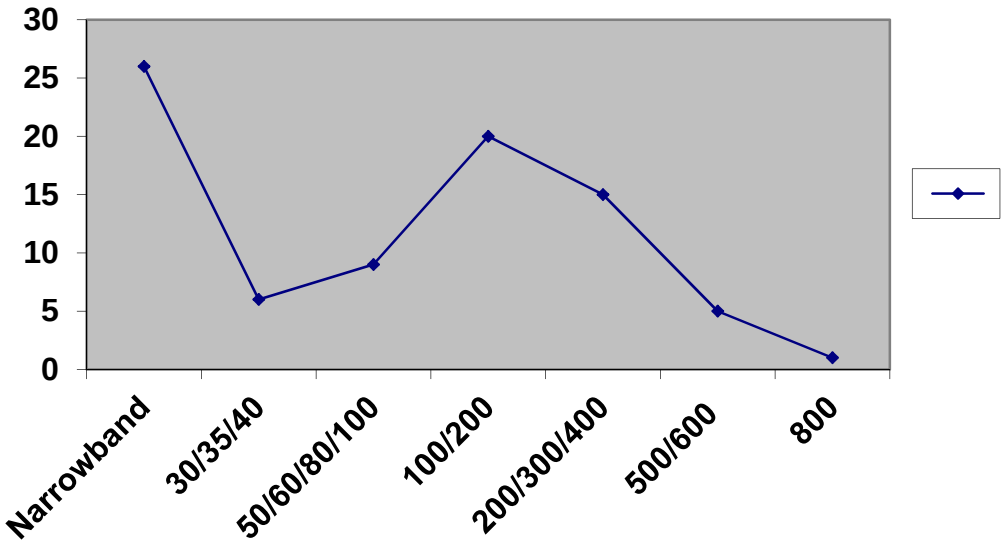

Figure 4: Modulation bandwidth used

4 DETAILED QUESTIONS

Question 5:
Is the existing ERC/REC 70-03 [1] Annex 1 easy to understand?

48 answers were given with YES representing roughly a 75% majority opinion.

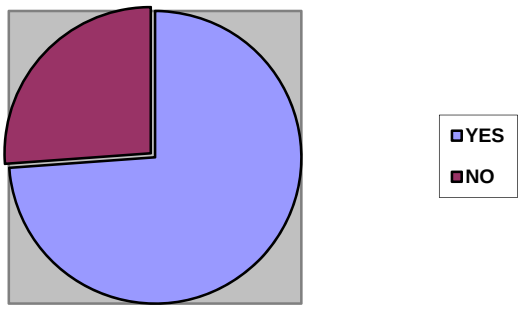

Figure 5: ERC/REC 70-03 [1] easy to understand?

There have been points mentioned by those who stated NO which shows that there is room for improvements:

- there is some lack of clarity between EC/ECC decisions on one side, and the ERC/REC 70-03 [1] on the other side;
- exact understanding of the access technologies needs to also look into ETSI EN 300 220 [2], i.e. ERC/REC 70-03 [1] does not provide the full picture;
- annex 1 is very complex if one wants to use the whole 863-870 MHz band with LBT;
- difficult to read for external, i.e. non CEPT/ECC/ETSI experts;
- too many footnotes in annex 1;
- the rationale/background information is not included in ERC/REC 70-03 [1];
- definitions are sometimes unclear;
- missing graphics;
- too many references and spectrum access combinations;
- difficult interpretations;
- lot of overlapping segmentation and constraints;
- developments in ERC/REC 70-03 [1] in recent years led to more specific regulations and has increased complexity, especially in annex 1 of ERC-REC 70-03 [1];
- if a specific frequency band is used through more than one ERC/REC 70-03 [1] annex (i.e. family application) it is important to manage a cross reading;
- it was not at all easy for digital communications where one protocol carry multiple applications (voice, pictures, signals etc).

Assessment
Removal of footnotes was subject to criticism from many. Change of the annex format to landscape is necessary. Possibility of removal was demonstrated in the RIS format exercise for Annex 1. It was decided to remove footnotes and to add illustrations where appropriate.

Question 6:
Do the existing 863-870 MHz regulations suit your application(s)?

40 answers were given with YES.

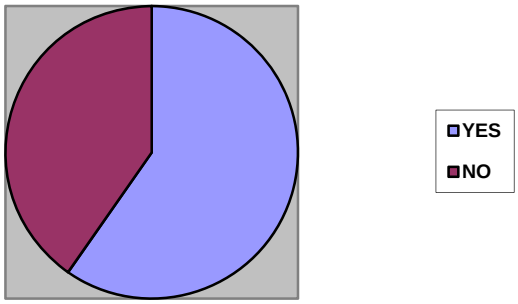

Figure 6: Satisfaction with the current regulations

There seems to be a quite reasonable balance between all regulated application families. The positive responses saw mainly that reliable operations are quite ensured by sharing compatibility ECC studies, inclusive of SRDs intra-sharing.

Reasons for indicating NO have been stated as follows:

- more power/operating range needed for alarms;
- more power/bandwidth needed for RFID;
- more power/operating range for smart metering;
- a dedicated/ individual band for smart metering needed;
- too small bandwidth, esp. for wideband application > 300 kHz BW;
- too much segmentation;
- 4 RFID reader channels was insufficient;
- RFID tags: too far away in frequency from US and other countries;
- band does not fit future increasing spectrum demand and/or safety aspects (automotive, alarms);
- need for new provisions to take into account meshed networks;
- more 100% DC spectrum needed for industrial applications;
- potential collision of simple devices (with Duty cycle) with LBT/AFA devices having a long channel occupation;
- home applications, like wireless sensor networks, cannot meet all their spectrum need with the current regulation;
- for application needing “longer ranges” (200 – 500m) 25 dBm e.i.r.p. limits is too low, and the 500 mW band is too narrow;
- Wideband modulation (FHSS, DSSS) very difficult to use in an efficient manner.

Assessment

There seems to be a quite reasonable balance between all regulated application families. However, some voices from industry request more bandwidth or power. Answers to **questions 1 and 3** also clearly indicate the dominance of DC as the low-cost, simple and energy efficient spectrum access method. Discuss a better utilisation of (an improved) LBT+AFA (DAA) medium access and maximising intra-SRD sharing in order to optimise the use of the existing spectrum available for SRD usage.

Question 7:
Do the existing spectrum access techniques (FHSS, DSSS, LBT, DC, etc), for the use of the frequency band 863-870 MHz; suit your application(s)?

FHSS

35 responders stated NO.

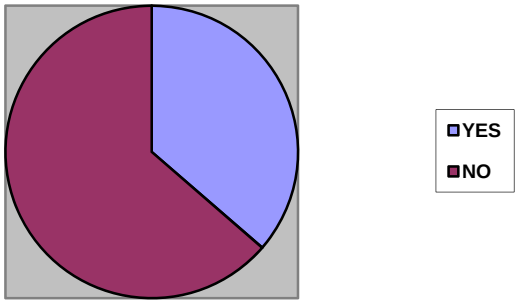

Figure 7: FHSS suitability

The main reasons for stating No to FHSS were considered to be due to the respective application(s) not being energy efficient enough or that it does not fit protocols with many short messages and the high number of mandatory FHSS channels compared with the US regulation.

Other statements included:

- not well aligned with other regions; FHSS power would swamp any alarm signals;
- no real advantage as available frequencies are too close together for FHSS to deliver benefit;
- FHSS is not justified for sub-Giga frequencies, there is no benefit;
- Furthermore it is a technique that jams the whole band and is necessarily limited in use time with a restricted duty cycle. This duty-cycle is not compatible with many home automation applications;
- Moreover there is not enough room in that band for implementing FHSS.

Assessment

FHSS systems do not work as energy spreading systems in relative narrow frequency bands but merely as a set of parallel (frequency agile) DC based systems. It may cause more harm than benefit in general. Consider reviewing and possibly removing the FHSS regulation in these narrow bands and simplify the regulation for frequency agile medium access technologies (including equipment supporting higher duty cycles).

a) DSSS

38 responders stated NO.

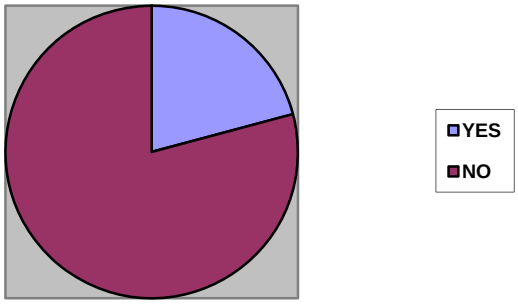

Figure 8: DSSS suitability

The main reasons for stating No were seen in the non-availability of DSSS chipsets or DSSS seen under the current regulation as too complex (it would need at least 5 MHz contiguous bandwidth with higher power/PSD), not energy efficient enough, being too sensitive to high power adjacent applications, too low DC and LBT not feasible.

The minimisation of design variants for the DSSS for the worldwide market was seen as a possibility for improvements.

Assessment
Review the existing DSSS regulation with regard to its impact on LBT+AFA devices. DSSS works only as a mitigation technique when sufficient spectrum is available and only when relatively expensive, good quality receivers are used. There is clearly a mismatch with most of the other access techniques in the 863-870 MHz band but with the low power levels currently in regulation not much harm is done. At the present time, no changes are advocated for DSSS medium access rules in the regulations.

b) LBT + AFA

36 responders stated NO.

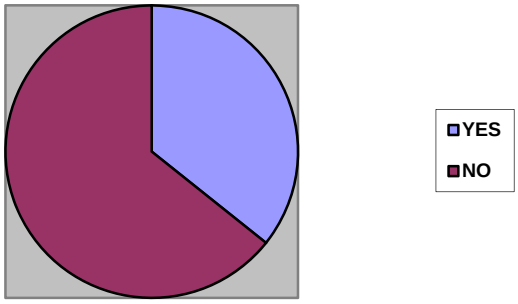

Figure 9: LBT+AFA suitability

The main reasons for stating No was seen in LBT + AFA being too complex, too costly, not energy efficient enough (listen-time) or TX-only being not possible.

LBT-AFA was also seen as not suitable for audio applications with 100% duty cycle or applications with a very high activity factor > 80%, or in fields of application where a100% Identification rate was required.

LBT would also mean a possible denial of service or the principle of LBT in contradiction to the application and consequently whole application sectors (e.g. industrial, automotive) seem to exclude this access method.

Frequency agility was however seen as a suitable tool to reduce interference.

ETSI EN 300 220 [2] LBT definitions were seen by a couple of responders as not properly defined.

It was further stated that LBT + AFA was not suited to work alongside wireless life safety systems.

Nevertheless, LBT-AFA is used, in particular for many applications in the home automation application fields.

Assessment
LBT+AFA give a benefit to the device using it, as well as to other devices sharing the band. On one hand, almost half of the responders think LBT+AFA could suit their application. On the other hand, many users do not consider the usage of LBT+AFA because of its higher cost and complexity or to maintain the status quo. The use of LBT+AFA should be rewarded. In addition, LBT+AFA should not block out DC only devices. A better and more complete definition of LBT+AFA for these specific sharing situations should be developed.

c) LBT

42 responders stated NO.

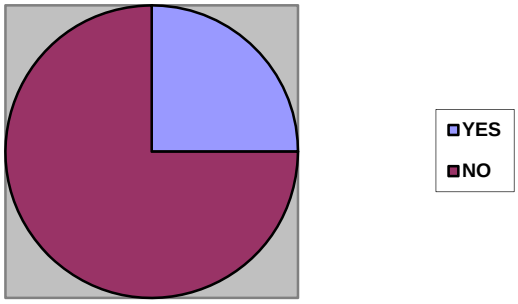

Figure 10: LBT suitability

Main reasons for stating No were the same as for LBT + AFA. In addition, statements indicated that LBT-only might not be suitable for applications operating on a strict time basis, for audio applications or where an absolutely predictable reaction time would be needed.

Furthermore, the fixed LBT threshold was criticized, also increasing the risk of being falsely triggered. AFA was seen by a number of responses as absolutely essential/ indispensable for LBT, to ensure message delivery in a deterministic manner.

Although LBT “only” (i.e. without AFA) might be suitable for more simple and less reliable applications, it is felt that the present electronic components state of art and cheap available solutions are driving the market as a whole rather to LBT+AFA.

Assessment

LBT only, without describing further actions and timing issues, is by some administrations considered a method that does not guarantee equal spectrum access. Industry confirms this.

A better and more complete definition of LBT defining the thresholds and timings should be developed for the benefit of the users, i.e. to achieve higher performance. Consider setting up incentives for using LBT.

d) Duty Cycle (DC)

56 responders stated YES.

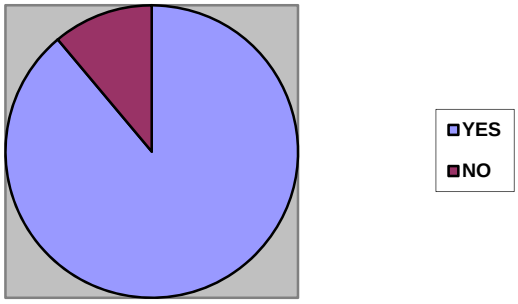

Figure 11: Duty Cycle suitability

DC is seen by the vast majority of all responders as a simple, efficient, reliable, proven and less energy consuming as well as a less costly measure. It is clearly the almost only mitigation technique used in a number of application sectors such as metering, alarms and automotive. In addition, battery-life considerations for battery operated equipment very often lead to duty cycle implementations. Some of the responders proposed to start discussions on even a new Low Duty Cycle category. Some others, stating NO, indicated that they would need also some higher, less restrictive duty cycle categories because of a somewhat higher transmit activity or to ensure a close to 100% throughput or identification rate. DC is not considered suitable for analogue audio applications with 100% transmit activity requirements.

Assessment

Consider the results from ETSI STF411 on LDC (Low Duty Cycle). If duty cycle is used as the only sharing mechanism at a certain frequency, then higher duty cycles are not possible there. In such cases, other mitigation techniques or e.g. geographic separation might be needed as additional medium access requirement.

e) Others

Especially RFID reader manufacturers used this category to mention that they use the 4-reader channel UHF RFID utilisation plan as adopted in ERC/REC 70-03 [1], ETSI EN 302 208 [4] as well as ISO 18000-6C [5]. Three manufacturers indicated that they use user-defined “free” LBT or LBT+DC combinations (not exactly as standardised in ETSI EN 300 220 [2]), one indicated to use a user-defined FHSS. Other mentionings included manual spectrum access (push-to-send) and coordinated random access algorisms. Some manufacturers provide systems with control channel capabilities using a TDMA spectrum access as in GSM and DECT, mainly to ensure close-to 100% throughput and absolutely predictable reaction time (e.g. alarms, industrial, and intrusion applications).

The South African regulator indicated that for now their spectrum access mechanisms are limited to LBT+AFA and DC. The industry there was mostly compliant and follows CEPT and ETSI as regulated by ICASA.

Assessment
Mitigations defined in ETSI EN 300 220 [2] do not provide a solution for everybody. There are solutions such as user-defined LBT mechanisms. The freedom to define such user-defined mitigation mechanisms should be kept while ensuring that the mitigation effect is at least equivalent or better.

Question 8:
Do you have knowledge of situations where the normal operation of your SRD application/device is affected by congestion of the spectrum or harmful interference?

34 responders answers YES which represents a slight majority of all responses received.

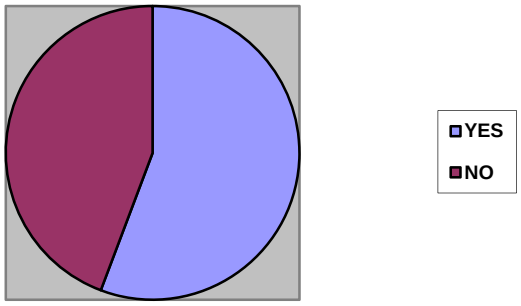

Figure 12: Experience with interference

However, almost all depict the occurrences of harmful interferences as rare and occasional.

Most of the reported interference cases were evaluated.

Reasons for such occurrences were experienced as follows:

- Too dense or too close operation (e.g. in RFID dense reader mode) and not sufficient distance to other SRD transmitters operating at the same frequency;
- Lower power SRD interfered by higher power RFID.
- Disturbances from IT equipment or heating equipment;
- Interference from wireless audio equipment operating in the adjacent spectrum;
- false triggering of the LBT;
- RFID experiencing temporary performance degradation;
- SRD operating locations in public mobile “hotspots” or “spillage zones” suffering from unwanted emissions from mobile stations operating in 880-915 MHz.

The measures to improve the interference situation were stated as follows:

- shift to another frequency of operation;
- additional bandwidth and/or more channel spacing;
- reduce power of the interferer;
- remove defective device;

- add pre-filter in the reception path;
- increase frequency agility;
- switch off the interferer.

Assessment
The existing situation seems acceptable. It was also noted that the draft revised R&TTE directive acknowledges the importance of the receiver performance on the efficient use of spectrum. A number of interference cases are the result of the receiver performance. Increased future SRD usage densities and the change in the noise environment may increase interference problems (e.g. LTE mobile station unwanted emissions in adjacent frequency bands).

Question 9:
If you are producing products for the world market, how important is harmonisation between different regions to you.

64 responses clearly emphasized the importance on harmonisation between different regions.

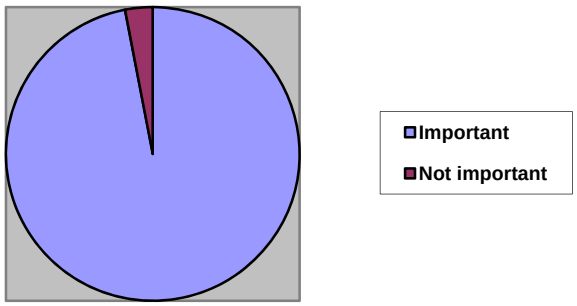

Figure 13: Importance of harmonisation

The main reason is the economic consideration (economy-of-scale) and the possibility to reduce costs. Especially the industrial and automotive industry stressed this point where the radio devices are only used as secondary feature of the end product which is normally machines or cars.

However, some declared global harmonisation of the frequency utilisation conditions as being wishful thinking (“a dream”) and almost impossible to achieve. Even if the frequency utilization would be harmonised, local application standards would often need to be adopted. Therefore, at least a European harmonisation would be needed.

The differences between the USA and Europe were several times mentioned in answers as a particular problem. Having smaller differences in the exact frequency utilisation in the 800/900 MHz range for SRDs and RFIDs between the USA and Europe could avoid the need of using different antennas.

Assessment
Worldwide harmonisation is seen as important in particular for RFID application; in particular studying frequencies in 915-921 MHz would support the idea of global harmonisation. This clear result seems also supporting actions towards the ITU-R.

Question 10:
Please give your views on the rate of change of the regulations.

The answers to the provided answering options were very clear. 56 answers prefer change to be gradual and consider stability as being very important.

The clear majority even could not agree to a 2-years update cycle, mentioning acceptable change cycles between 4 and 15 years. Almost all answers (12 out of 13) in the second category (whether an update on 1 or 2 year cycle would be acceptable) indicated 2 years as the preference over 1 year.

Under improvements as soon as possible, the main consideration was on limiting this action to de-bugging and unclear descriptions. In addition, some understood this question to be primarily an option for new applications.

Quite a number of answers under this question referred to the recent revision of ETSI EN 300 220 [2] and that this was considered as an improvement in the situation, i.e. description of the channel access rules, possible combinations and techniques, therefore, contemplating that a certain stability point has now been reached for the 863-870 MHz band.

Single voices stated that backwards compatibility is important, should changes be unavoidable, or the effect of changes should be limited to software or new products only.

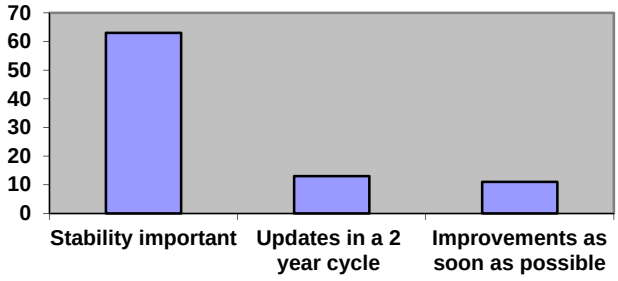

Figure 14: Importance of stability

Responders indicated that their source of information about the regulation and intended changes would be ETSI and the ECC/ECO primarily, partly by participating in ETSI and respective ECC meetings directly. Other information sources mentioned were the NRA (12 mentionings), the web, national standardisation committee, LPRA or ZVEI.

Assessment
Changing regulation in general or adding new bands to for example 70-03 or the EC SRD decision is not the point here but restricting the use of existing bands in the current regulation should only be done on a clearly justified basis, i.e. after a detailed ECC study.

Question 11:
Would you prefer an increase or a decrease in the number of spectrum access techniques (DC, LBT, FHSS, DSSS, AFA etc.) in the regulations?

The clears majority of answers with 50 responses indicated “leave it as it is”. The existing options would provide enough options and sufficient flexibility.

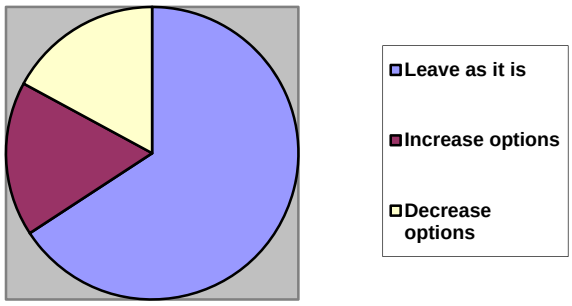

Figure 15: Importance of stability (II)

Those who could agree to more options put this under the conditions that a new option should only be introduced after proper analysis and as long as it would not increase the perturbations to other users operating with one of the existing techniques.

The main reason for advocating a decrease was seen as simplification. Other issues raised under question 10 were suggestions for more bandwidth or more detailed specifications to make the sharing of frequencies more predictable, especially regarding LBT+AFA.

Assessment
The main concern is that a change in regulation may mean a costly change in a manufacturer's product. Introducing more flexibility within the existing options may need to be considered.

Question 12:
Would you support the consolidation of ERC Recommendation 70-03 Annexes 1, 7, 10, 11, 13 into fewer annexes?

40 answers indicated NO, representing 2/3 of all answers received for question 12.

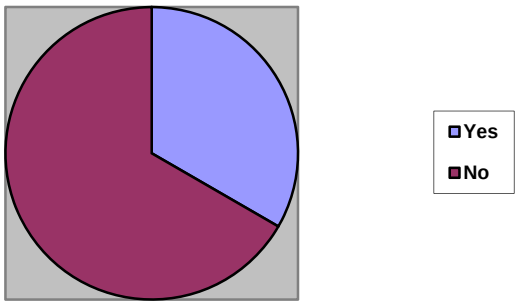

Figure 16: Supporting consolidation of ERC/REC 70-03 [1]

This was regarded by those stating NO as not necessary or rather too complex. Instead, the existing categories would reflect the market situation very well and would provide a better overview.

Several answers from alarm system manufacturers put their YES under the condition that alarms still should be kept separated. Other indicated that they do not want to see audio and digital sections combined. Several mentioned the application-scoping of ERC/REC 70-03 [1] annexes was already very wide.

Assessment
No sufficient support for the consolidation of the annexes in ERC/REC 70-03 [1].

Question 13:
Alternatively, should Annexes 1, 7, 10, 11, 13 be kept separate but have cross references added to show where they refer to the same spectrum.

42 answers stated YES.

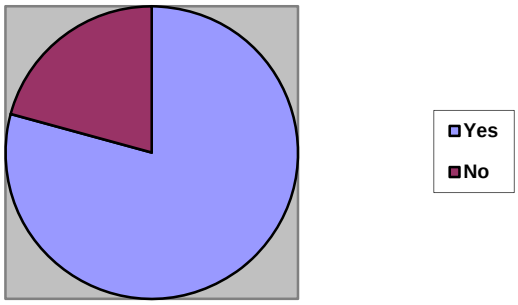

Figure 17: Cross-references welcomed

Cross references were considered by the majority as helpful and would ease the use of ERC/REC 70-03 [1]. An alternative was also proposed: add a matrix view with frequencies vs. applications.

Others warned that cross-references could also lead to confusion and complexity.

Assessment
Add cross-references where annexes refer to the same spectrum.

Question 14:
Do you think certain applications require some kind of protection in regulation?

42 answers indicated YES.

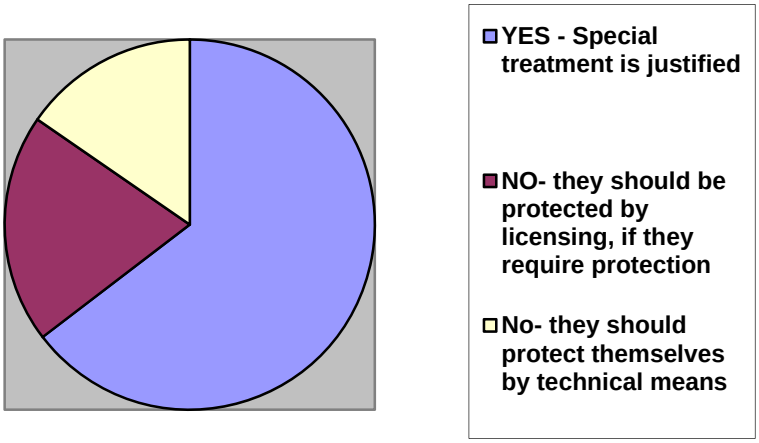

Figure 18: Special treatment justified?

The applications mentioned for which special treatment was considered justified were fire alarms (application with the most mentioning), alarms, intrusion alarms, protection/security of persons and goods, health applications as well as hospital usage, road safety related, social alarms due to their socio-economic benefits.

Other applications mentioned were metering/energy/utility management, RFID, home automation and industrial applications due to their high commercial value involved and economic benefits as well as a certain mission criticality of the related applications. Some answers linked those applications to licensing, should protection be required.

Another main reason for metering applications was seen in the coexistence with applications using continuous or very long transmission/spectrum usage (game consoles, headphones) which was very critical and should be separated through spectrum regulation.

Question 15:
If the answer was yes, then how such protection should be achieved?

46 answers indicated that protection should be achieved by spectrum management.

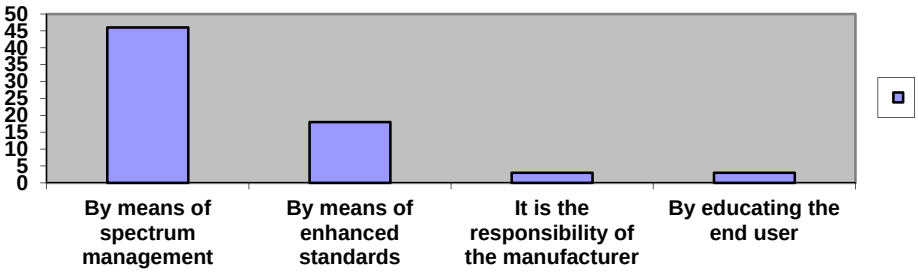

Figure 19: How protection should be achieved

18 answers suggested that standards in general or increasing the scope of ETSI EN 300 220 [2] could achieve protection. However, more than half of these 18 answers see this as complementing spectrum management.

Some responders recommended better receivers to improve the situation (category 1 receivers as defined in ETSI EN 300 220 [2]). Another technical suggestion was that intrusion/fire wireless life safety systems were designed for the protection of people and property, hence should have overriding priority over generic/non-specific SRDs.

Education of the end users was not considered a realistic option for achieving protection. Nevertheless, it could be helpful.

Assessment (with regard to question 14 and question 15):

The summary represents the views from industry. Many application sectors claim to deserve special treatment, i.e. protection.

In general, true protection may only be realised in three ways
1. By spectrum management with licensing
2. By spectrum management without licensing
3. A combination of equal spectrum access mandated by standards in combination with self-protection in the form of for example redundancy, acknowledgement mechanisms or error correction.

The problem with certain SRD applications is that nowadays is chosen for “options 2 with a little bit of option 3”.
Option three should be the preferred one in the future creating an environment of constant average availability of spectrum.

Should spectrum management be needed for special SRD applications, the proponents would need to provide the evidence which would support extra treatment, i.e. dedicated spectrum with/without licensing?

Question 16:
Do you feel it is possible to enhance the existing 863-870 MHz band regulations? E.g. reducing further band segmentation.

30 answers were provided YES and 26 answers were provided NO.

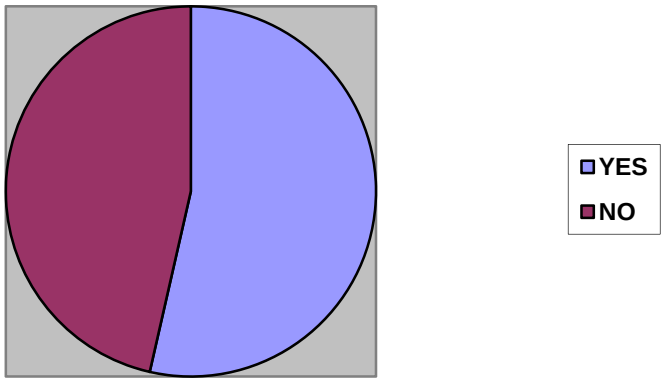

Figure 20: Can one enhance the existing 863-870 MHz regulation?

The following statements were made by those who responded with YES:

- more simplicity could be reached;
- remove 300 kHz restriction in the g subband;
- RFID: elimination of 100 ms RFID off-time;
- Regular audits are necessary to remove old “died out” regulations;
- Remove dedicated alarm bands;

- Open to 500 kHz wide, max 25 mW under DC regime (would be more in line with current RF semiconductors on the market and would support higher data rates);
- Existing regulation would block the development of new applications (voice in some bands not possible). Therefore, open "green fields" and be more open towards new applications, and possibly also to larger and free use, also supporting possible disturbances; in other words: make the spectrum regulation more liberal to allow for easier development of new services and applications. The regulations as they are now are one of the major blockers for development of new applications;
- Move RFID closer to 915 MHz like in USA and Japan;
- Remove unnecessary band segmentations (or channel spacings) and allow for more continuous bandwidth; also: reducing the regimentation of windows such as alarm systems;
- Group bands g1 and g2;
- Combine the whole 863-870 MHz spectrum under one regulation;
- More RF channels;
- Limit number of access technologies;
- Remove impractical features such as FH+LBT+AFA;
- Reconsider extremely low duty cycle (0,1%);
- The whole band 863-870 MHz would be usable if one could apply a free LBT;
- There are opportunities to combine application segments and make those bands more versatile.

The following statements were made by those who responded with No:

- Leave as it is because changes have a huge effect on many products
- The current solution has the right balance;
- The current solution works;
- Do not allow less stringent methods. Regulation should be more aggressive against RF hungry methods.
- The latest update of ERC/REC 70-03 Annex 1 [1] was a reasonable arrangement that balance legacy and technical innovation well keeping highest interference free possible reliable operation meanwhile offering flexibility.

Changes were also seen as providing adverse effects as well as positive outcomes for some existing users. Some users have products which were designed using one access protocol and limited applications in the available channels so there was no conflict. Moving to another protocol or combining with users having another protocol would mean redesigning existing products and potentially adding significant costs. If this was planned there would need to be a long term plan with a known timeline so that care can be taken of the existing user base as well as available products (bearing in mind that some products have long in-use service lives).

Assessment

Consider a number of the suggestions in detail.

Review alarm bands and associated restrictions. This concerns not only alarms but also other SRD applications having similar requirements, i.e. investigate a more application neutral usage of these frequencies. It is noted that an ETSI SRDoc is in preparation. A concept could be investigated taking into account the existing and additional frequencies for alarms and applications having similar requirements. In addition, a solution for grouping of the frequencies from 868 MHz to 869.2 MHz may need to be investigated in this context. The change of the <<noise environment>> may also have some influence.

Input from the WGFM workshop showed that there are many applications using extreme low duty cycles. A review of the low duty cycle, also in combination with the transmitter activity factor and/or instantaneous duty cycle may open new spectrum usage opportunities for SRD applications and is therefore proposed to be

Assessment

studied. ETSI STF 411 [3] is also studying this subject.

Opportunities for combining frequency bands will need to be discussed more in detail. This can avoid "unintended band edges". A similar statement as in the EC Decision or in ETSI EN 300 220 [2] could be introduced to ERC REC 70-03 [1] with the meaning that SRDs could use adjacent bands provided that the specific conditions of each of the adjacent frequency bands are met.

Question 17:
Are there emerging market needs or requirements for your business applications that would fall in any portion of the 863-870 MHz band? If yes, may they be fitted in the present 863-870 MHz regulations?

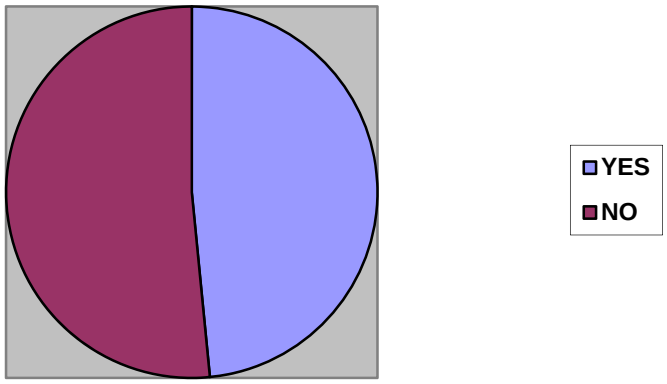

Figure 21: Do you see emerging market needs or requirements?

Those who answered the question with YES (31 answers) indicated emerging needs as follows:

- Imaging transfer for alarm systems;
- More power needed for their applications;
- Wireless sensor technology and networks;
- Existing spectrum would reach saturation. This would lead to congestions and more interference;
- Especially, the smart metering, meshed systems and home automation applications were considered in a large number of replies as needing more spectrum in the future;
- A dedicated frequency spot needed for DC/LDC applications (e.g. alarms, metering); LBT+AFA on one side and LDC on the other side being considered as incompatible since LBT would not detect the LDC application.
- M/441 mentioned;
- Too little for future demand;
- Integration of different applications in one system should be possible;
- The standard requirements under the Machinery Directive (2006/42/EC) lead to continued transmission for safety applications requiring performance levels c to e. (only 12 frequencies in 869.7-870 MHz suitable know.
- LBT systems which use extremely the transmission time are seen as critical for devices using DC. So the last change in the regulation is seen as a good step for the coexistence issue. A better protection of DC/LDC devices is considered necessary.

- Furthermore the current frequency band between 863-870MHz is extremely used and a new spectrum would be helpful for the market needs.(e.g. 870-876 MHz);
- Only 250 kHz bandwidth for 500mW applications to compare to 26 MHz for 1W in USA/Canada, 13 MHz in Australia, 6.5 MHz in New Zealand;
- Devices with extremely long transmission time (LBT) are seen as very critical for coexistence issues. The latest changes in the standard ETSI EN 300 220 [2] are seen as the right step for coexistence.
- Consider that a large number (>10Mio) of smart meters following Cenelec EN13757-4 on the 868 MHz band are expected to be deployed in the next few years all over Europe. Hence, a new spectrum for SRD devices is seen to be necessary for the developments in the field of smart meters;
- RFID applications are growing fast, additional spectrum will be required
- Need for a special utility band since the eenergy data management based on metering and sub-metering devices (e.g. using the consumption data from individual radiators to control the heating system according to the actual demand or to improve the efficiency of boilers) thus actively contributing to the reduction of CO_2 emissions.

The answers were indecisive regarding whether the suggestions should be treated as generic (non-specific) or as a specific type, i.e. about half of the answers said YES, the other half NO.

Assessment

It was noted a large number of responses being related to smart metering and should consider liberation and perhaps expansion of spectrum usage possibilities for the metering segment.

Question 18:
Do you agree with the principle of "application and technology neutrality"?

The majority with 38 answers indicated that segmentation should be retained.

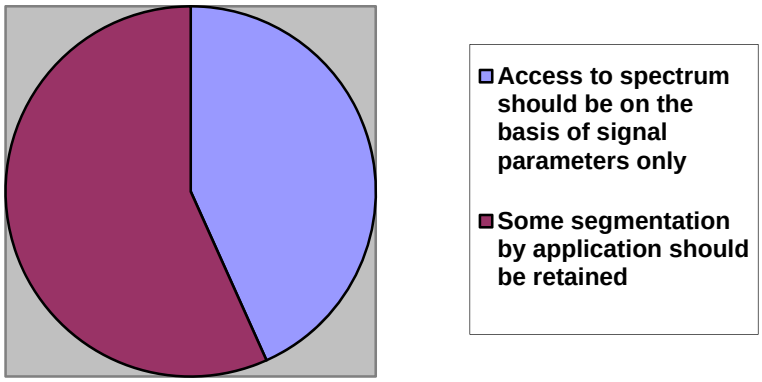

Figure 22: Technology neutrality or segmentation preferred?

Alarm system manufacturers in general considered it as difficult to accept an alarm application category to be withdrawn. Some of these manufacturers supported the principle of application and technology neutrality and answered YES, only on the basis of the alarm category being excluded from it. In general, the answers showed that many responders feel that the protection of persons and goods should be given a higher priority than entertainment.

On the other side, some clearly stated that commercial and public interest should also be taken into account. A considerable number of responders also see a co-existence issue between more transmission-active applications and those using a rather low duty cycle in the long-term and therefore, based on the nature of

application and the usage, some segmentation for certain applications should be maintained. As for applications such as audio that require 100 % DC transmission, LBT or AFA were not feasible. Other opinions expressed:

- As far as smoke detectors are going to be made mandatory by the EU Commission in every private house throughout Europe, some sub-bands should be kept reserved for this specific alarm devices;
- There are many existing products designed for the current regulation and segmentation of the bands;
- Every change would mean a huge effort for the manufacturers;
- LBT considers only the environment of the transmitter and thus does not guarantee that the RF field is free from the receiver side;
- Follow the spectrum access rules regardless what application is behind as long as full spectrum usage/blocking is not possible;
- For hospitals it is important to have some proof that the use of the 868 MHz band is safe the foreseen expansion in a 870-876MHz (sub-)band would be helpful;
- Although technology neutrality principle should be sought there are operational border lines that do not allow this principle to be applied 100%.
- SRDs are operating on a licence-free spectrum shared basis that appears difficult to balance with key market requirement for reliable operation. Some segmentation by application or by homogeneous technical requirements of different applications dramatically helps reliability. In this respect the CEPT ECC intra-sharing compatibility studies are of the utmost importance;
- Because of the heterogeneity of parameter values for various applications (transmitter power, EIRP, duty cycle, frequency bandwidth, mitigation techniques, etc.) which share frequency bands, the principle of “application and technology neutrality” could prevent an increase of spectrum efficiency use in whole, as well as prevent implementation of regulatory estimation of efficiency parameters of spectrum use;
- Segmentation would be needed because there is no proven spectrum access technology, which shows a significant improvement of compatibility of ultra-low duty cycle, battery operated devices, wireless audio and video occupies the channel for long time. This is not compatible with low duty cycle operation leading to short latency times. Medium and high power should not be mixed with low power. Alarms have to provide short latency times. Therefore the spectrum of alarms should be dedicated to these applications and should not be overlapped by other applications (protect life first and spectrum second).

Assessment

It would be better to differentiate between application neutrality (i.e. the possibility to combine application that have similar spectrum requirements) and technology neutrality (i.e. the same application can use different technologies for the spectrum access). The concept of application neutrality seems to be more accepted than the concept of technology neutrality. Therefore, to keep application neutrality may be a key point for changing regulation in the future. On the other side, this means that spectrum sharing is important and applications with similar spectrum requirements need to share spectrum to maximize the spectrum usage.

Questions 19 and 20:
Do you have proposals and descriptions of modifications to the technical parameters keeping in mind that the use of the spectrum has to be as much as possible technology neutral meanwhile ensuring that other SRD applications (incl. existing ones) have to share the same spectrum on equal basis and work properly?

Any other suggestions?

Only a limited number of responders delivered contributions under these two questions. However, a lot of suggestions was already made earlier under the other questions, in particular questions 16 to 18. The following suggestions were received under question 19 and 20:

- Within the last 5 years CEPT ECC conducted many investigations on SRDs (see its Strategic Reports as relevant). ETSI starting from 2008 addressed further demands by System Reference Documents TR 102 649-2, TR 102 886 and TR 103 055. There is a clear understanding about the huge SRDs, RFID and Smart Metering market that supports all citizens in terms of social and economic daily benefits. The growth by quantity and by application is dramatic; this well justifies 863-870MHz expansion to the underused 870-876MHz spectrum;
- Limit the number of power categories (e.g. 25 mW / 500 mW);
- Move closer to the rest of the world in terms of frequencies;
- All SRDs to be treated equally;
- All backscatter devices to be treated equally;
- Remove notes in Annex 1 of ERC/REC 70-03 [1];
- Move FHSS closer to the rest of the world (i.e. less nb of channels); allow more power for FHSS;
- Consider new LDC mode, however with more power for increased range;
- Consider some control mechanisms that only designated spectrum is used by the respective applications;
- Consider the 3 ETSI SRDocs containing spectrum utilization proposals in the adjacent duplex band above 870 MHz taking into account that growth in quantity and by applications ;
- Consider spectrum for higher quality equipment (category 1);
- Consider a 24 h duty cycle with busy hour and idle hours:
- Consider some DC-only bands;
- Alarms should go out of 863-870 MHz;
- RFID: Additional bandwidth with more channels with 0.6 or 1.2 MHz spacing;
- Reservation of 868,3 and 868,95 MHz as centre frequencies for wireless M-Bus (wM-Bus) and meter reading;
- For FHSS without LBT, duty cycle could be specified as 0,1% per channel in the band 863-870 MHz or 1% per channel in the band 865-868 MHz in order to be consistent with the same specification already allowed for frequency agility without LBT;
- Possibility to use FHSS with less than 47 channels, that is 25 channels as for the 902-928 MHz ISM band in the USA;
- Use of limited Duty Cycles or Spectral Power Density;
- Designate different bands for different neutral technology specifications;
- Remove a maximum of notes in REC 70.03 Annex 1 [1].
- Introduce a new type of use which is application and technology neutral based on the following principle: If the max cumulated transmitter-on-time over one hour reach 90s in any portion of 200 kHz spectrum, the device shall move to another frequency at least 200 kHz away. Description: If the device transmits a few bits, it can be done at the same frequency. If a device transmits a lot of data, it can be done but after 90s, it has to move to another frequency in the band;
- FHSS technology must be authorized with a duty cycle relax. Otherwise, there is no interest to develop a hopping frequency system;
- Avoid limitations which will prevent technical creativity which considers the efficient use of the spectrum;

- Publish manufacturers / users per spectral slot and allow them to describe their application. Transparency of usage is greatly welcomed.

Statements about keeping the status quo or about other spectrum than 863-870 MHz under these questions were not included in this summary.

Assessment
Consider a number of the suggestions in detail. The principle of having a cumulated Tx-on-time in any portion of 200 kHz spectrum is going to be investigated under SE24 WI_23. This principle has already been incorporated in ETSI EN 300 220 [2] but may need further refinement. The more frequency agile the SRD equipment, the higher the cumulated Tx-on time. Therefore, a simpler set of rules may be possible substituting the existing FH and frequency agility rules.

5 CONCLUSIONS

WG FM endorsed the final 863-870 MHz review report from SRD/MG.

The assessments include inter-alia:

- Removal of footnotes, change in format and adding of cross-references;
- Study Low Duty Cycle mitigation technique (already undertaken in SE24 and based on ETSI STF411 work);
- Review FHSS spectrum access;
- A large number of responses being related to smart metering and should consider liberation and perhaps expansion of spectrum usage possibilities for the metering segment;
- Worldwide harmonisation is seen as important in particular for UHF RFID applications, in particular studying frequencies in 915-921 MHz would support the idea of global harmonisation. This clear result seems also supporting the SRD/MG actions towards the ITU-R WP1B;
- It would be better to differentiate between application neutrality (i.e. the possibility to combine application that have similar spectrum requirements) and technology neutrality (i.e. the same application can use different technologies for the spectrum access). The concept of application neutrality seems to be more accepted than the concept of technology neutrality. Therefore, to keep application neutrality may be a key point for changing regulation in the future. On the other side, this means that spectrum sharing is important and applications with similar spectrum requirements need to share spectrum to maximize the spectrum usage;
- The summary represents the views from industry. Many application sectors claim to deserve special treatment, i.e. protection. In general, true protection may only be realised in three ways:
    1. By spectrum management with licensing
    2. By spectrum management without licensing
    3. A combination of equal spectrum access mandated by standards in combination with self protection in the form of for example redundancy, acknowledgement mechanisms or error correction.

  The problem with certain SRD applications is that nowadays is chosen for “options 2 with a little bit of option 3”.

  Option three should be the preferred one in the future creating an environment of constant average availability of spectrum.

  Should spectrum management be needed for special SRD applications, the proponents would need to provide the evidence which would support extra treatment, i.e. dedicated spectrum with/without licensing;

- Review alarm bands and associated restrictions. This concerns not only alarms but also other SRD applications having similar requirements, i.e. investigate a more application neutral usage of these frequencies. It is noted that an ETSI SRDoc is in preparation. A concept could be investigated taking into account the existing and additional frequencies for alarms and applications having similar requirements. In addition, a solution for grouping of the frequencies from 868 MHz to 869.2 MHz may need to be investigated in this context. The change of the <<noise environment>> may also have some influence;
- Input from the WG FM workshop showed that there are many applications using extreme low duty cycles. A review of the low duty cycle, also in combination with the transmitter activity factor and/or

instantaneous duty cycle, may open new spectrum usage opportunities for SRD applications and is therefore proposed to be studied. ETSI STF 411 is also studying this subject.

- Opportunities for combining frequency bands will need to be discussed more in detail. This can avoid “unintended band edges”. A similar statement as in the EC Decision or in ETSI EN 300 220 [2] could be introduced to ERC/REC 70-03 [1] with the meaning that SRDs could use adjacent bands provided that the specific conditions of each of the adjacent frequency bands are met.

Overall, these assessments were considered in line with the activities under the UHF roadmap and also principles to follow when considering the 5th update of the technical annex of the EC Decision for SRD.

ANNEX 1: LIST OF REFERENCE

[1] ERC/REC 70-03: RELATING TO THE USE OF SHORT RANGE DEVICES (SRD);

[2] ETSI EN 300 220: Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW;

[3] ETSI STF411: ETSI Special Task Force STF411: Method for a harmonized definition of Low Duty Cycle Transmission (LDC) as a passive mitigation technique used by SRDs;

[4] ETSI EN 302 208: Electromagnetic compatibility and Radio spectrum Matters (ERM); Radio Frequency Identification Equipment operating in the band 865 MHz to 868 MHz with power levels up to 2 W

[5] ISO 18000-6C: Information technology -- Radio frequency identification for item management -- Part 6: Parameters for air interface communications at 860 MHz to 960 MHz

[6] Machinery Directive (2006/42/EC): Mechanical engineering on machinery

[7] Cenelec EN 13757-4: Communication systems for meters and remote reading of meters - Part 4: Wireless meter readout (Radio meter reading for operation in the 868 MHz to 870 MHz SRD band)