



International Amateur Radio Union Region 1

Europe, Middle East, Africa and Northern Asia

Founded 1950

EMC Committee – Interim Meeting 16-17 April 2016 InterCity Hotel, Vienna

Subject	Structure and Status Quo in EMC Standardization		
Society	EMC Chair	Country:	Germany
Committee:	EMC	Paper number:	C7-09
Author:	Thilo Kootz, DL9KCE		

Introduction

This being the first meeting of the newly formed EMC Committee, it may be necessary to make the participants aware of how standardization is organized in the world, how IARU and Region 1 fit in, and where we stand at the moment. This information forms the content of this paper.

CISPR

CISPR (Comité International Spécial des Perturbations Radioélectriques - English: International Special Committee on Radio Interference) is a worldwide active standardization committee and the head body of the International Electrotechnical Commission (IEC). Amongst the other 77 Technical committees under the IEC, CISPR is "special", as stated in the name, for two reasons. First CISPR sets standards for the protection of radio reception by controlling emissions from electric and electronic devices. It takes a priority role, because even if another of the 77 IEC committees sets limits for EMC issues in their standards, CISPR standards always take precedence. There is even a built in automated process for the technical officer of CISPR, to look through all other produced standards and bring possible issues to the attention of CISPR. A good example of that process in action, was the introduction of WPT emission limits for charging stations on cars, which were first produced in TC69 and published in IEC 61980-1.

The second reason why CISPR is "special" is, because it is globally constituted and internationally recognized. While the members in all 77 IEC committees are countries only, CISPR has additional members, which are CEPT, CIGRE, EBU, ECMA, ETSI, IARU, ISO, ITU, ITU-R, ITU-T (those underlined are active). International or I-members have the same rights as any country in the form of their national committee (NC) except for voting. Additionally I-members also have a seat in the steering committee, which is not open to the NC but only to the Chairs of the Subcommittees.

CISPR is structured in Subcommittees, which are displayed in the following table:

Subcommittee	Responsible participant	Standards	Remarks
CISPR S	DL9KCE	-	Steering Committee
CISPR A	PA0JMG	CISPR 16 series except CISPR 16-4-4	Measurement of radio interference and statistical methods
CISPR B	DL9KCE	CISPR 11 CISPR 18	Measurement of interference regarding industrial, scientific or medical (ISM) equipment, high voltage equipment, power lines, or traction devices
CISPR D	None	CISPR 12 CISPR 25	Interference in motor vehicles
CISPR F	DL9KCE	CISPR 14-1 CISPR 14-2 CISPR 15 CISPR 30	Interference in household appliances, tools, and lighting equipment
CISPR H	DL9KCE	IEC 61000-6-3 IEC 61000-6-4 CISPR 31, CISPR 16-4-4	Limitations to protect radio frequencies

International Amateur Radio Union Region 1

Registered at the Swiss Association Register, Chamber of Commerce, c/o Baer-Nutz-AG,
Scheuermattstrasse 8A, CH-6330 Cham ZG, File No CH660.0.019.990-11.

CISPR I	OZ8CY	CISPR 22 CISPR 20 CISPR 24 CISPR 13 CISPR 32 CISPR 35	Electromagnetic compatibility of information technology (IT) equipment (e.g. computers), multimedia / hi-fi devices and radio equipment (receivers)
---------	-------	--	---

The table also shows what is done in each committee, who participates from IARU at the moment, and which standards are maintained where. Depending on time and development of products, there is more or less activity in the maintenance of different standards. Here is a list on the current status of the standards.

CISPR 16 series contains everything about measurement including apparatus, ancillary equipment, antennas, calibration procedures of gear and test site. Figure 1 shows the details.

CISPR 16
CISPR 16-1
Consists of five parts, specifies voltage, current and field measuring apparatus
<ul style="list-style-type: none"> • Part 1-1: Measuring apparatus • Part 1-2: Ancillary equipment: – Conducted disturbances • Part 1-3: Ancillary equipment: – Disturbance power • Part 1-4: Ancillary equipment: – Radiated disturbances • Part 1-5: Antenna calibration test sites for 30 MHz to 1 000 MHz
CISPR 16-2
Consists of five parts and specifies the methods for measuring high-frequency EMC phenomena, dealing both with disturbances and immunity
<ul style="list-style-type: none"> • Part 2-1: Conducted disturbance measurements • Part 2-2: Measurement of disturbance power • Part 2-3: Radiated disturbance measurements • Part 2-4: Immunity measurements • Part 2-5: In situ measurements for disturbing emissions produced by physically large equipment
CISPR 16-3
Is a non-normative IEC Technical Report rather than an International Standard that contains specific technical reports and information on the history of CISPR
CISPR 16-4
Consists of five parts and contains information related to uncertainties, statistics and limit modelling
<ul style="list-style-type: none"> • Part 4-1: Uncertainties in standardized EMC tests • Part 4-2: Uncertainty in EMC measurements • Part 4-3: Statistical considerations in the determination of EMC compliance of mass-produced products • Part 4-4: Statistics of complaints and a model for the calculation of limits • Part 4-5: Conditions for the use of alternative test methods

Figure 1: Basic structure of CISPR 16 publications

The influence of correct basic standards is often underestimated. While the CISPR 16 series does not have direct impact on amateur radio, its indirect impact can be huge. The product committee will take building blocks out of the basic standard. If a measurement method is changed, then a relaxation in EMC requirements can slip in through the back door. One example of this is the AVG RMS Detector. While this new detector offers many advantages when doing measurements, and showing congruence with the QP-detector with digital modulation, for analog modulation techniques, the new detector underestimates the risk for the radio services.

CISPR 11th scope covers "Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement", which encompasses a huge amount of different equipment. Under 'industrial' we find welding equipment, charging station for Wireless Power Transfer (WPT), Photovoltaic installation (PV), and lot of heavy industry equipment in production lines. CISPR 11 is very big and very complicated but nevertheless very important to us. Hot issues at the moment are WPT and PV. IARU helped a lot to push for limits for the DC port of PV inverters in the current edition and the work continues.

In the current maintenance cycle, we find topics like, DC ports to storage devices (batteries), DC/DC-Optimizers in PV installations, DC/DC-converters, WPT charging stations for electric vehicles and more.

CISPR 14-1 covers emission requirements of household appliances, electric tools and the like. We do not have issues with the old version of this standard but we are looking for the industry not to relax measurements. There is a tendency to change from voltage measurement on the control port, to current measurement for the benefit of better reproducibility. Generally, this is acceptable, if the current measurement is properly terminated.

With a new work item - WPT – however, we have some issues. CISPR F wants to handle WPT items by just applying the old limits and measurement methods of induction cooking devices to all WPT equipment. I commented negatively on this for several reasons, the most important being the number of the devices in the field. While induction- cooking devices are rare, only in use a limited amount of time only, the relaxation due to place and time correlation is high. This was taken into account when the limits were developed. For WPT charging stations for cell phone for example, those considerations are no longer valid and need to be revisited.

CISPR 14-2 covers immunity requirements of household appliances, electric tools and similar appliances. We do not have any issues here except for preventing any relaxation as in Part 1.

CISPR 15 covers lights and luminaries. We did have issues in the past, especially for LED lights used as retrofit devices in existing luminaries. Those gaps were closed with a relaxation of 26 dB when those devices connect to a DC grid instead of the mains. The justification of the limit is the fact, that a DC network is symmetrical and has a much higher LCL than the mains. However investigations are going on into this issue in CISPR/H/WG1/AHG2, of which I am the convener. Another issue under discussion is the measurement setup in the case of LED measurements. LED lamps are often much closer to a possible earthed bulb holder, opening a common mode path to remote ground. This effect is not sufficiently covered by the old "cone". There is ongoing work to define a new "cone", with more capacity to remote ground. (not sure if a definition of "cone" is needed here?)

IEC 61000-6-3 and **IEC 61000-6-4** are the generic standards for residential, commercial and industrial environments. These are used when no specific product standard applies. Unfortunately in Europe every standard listed in the Official Journal of the European Union can be used to show conformity. So actually a manufacturer may use the generic even though a product standard exists. This is not so in the rest of the world. Unfortunately the generics are rather "loose", which is not really logical. One would think, that for an unknown EUT more tests would be required than for a known EUT, which is generally so. This is not reflected in the generic, there are large gaps: No DC-line measurement, exemption when connected cables are shorter than 30 m and no field strength measurement below 30 MHz. In the last meeting there was progress on the 30 m issue, it was agreed to shorten this to 3 m. Let's hope this survives the voting. The radiated measurement was postponed until the next maintenance cycle, as there is a necessity to measure DC-ports. A little progress here, because the table is informative, but contains a clear signal to industry. See Figure 2.

Table 6 – Requirements for conducted emissions, DC power port (Informative)

Table Clause	Measurement Network	Frequency range MHz	Limits dB(μV) Detector	Measurement Specifics	Limitations and restrictions
8.1	AMN	0.15 - 0.5	89 Quasi peak	Instrumentation, CISPR 16 1 1, Clauses 4 & 8 Networks, CISPR 16 1 2, Clause 4	See Annex A, for DC power ports that require testing
			70 Average	Method, CISPR 16-2-1, Clause 7 Set up, CISPR 16 2 1, Clause 7	
		0.5 - 30	83 Quasi peak		
			70 Average		

Note a: The user of the standard should be aware, that this table is likely to become normative in the next edition. Within this table, the version of the references are as follows:
CISPR 16 1 1 is CISPR 16 1 1 : 2015, CISPR 16 1 2 is CISPR 16 1 2 : 2014 + AMD 1 : 2012, CISPR 16 2 1 is CISPR 16 2 1 : 2014

Figure 2: Authors proposed and adopted Note a

CISPR31 is a list of radio services and their typical parameters. This list has existed for several years, but has not been added to for a long time. The author filled the list recently with amateur radio service and broadcast services, but the rest is missing. The current status (see outtake in figure 3) is publically available under <http://www.iec.ch/emc/database/>. This list does not serve any function at the moment, but there is a procedure in CISPR 16-4-4 on how to verify new limits if necessary. For this procedure, which has so far never been used, the parameter of the table is required to estimate interference potential.

Radio Services Database										
Table search: <input type="text"/>										
Freq. [MHz]	Sensitivity [dBμV/m]	Protect. Ratio [dB]	RX Ant Gain [dBi]	band-width [kHz]	Isolation Distance [m]	System. Isolation [dB]	Number of Units	Oper. Period [%]	Mod.	FRP [W]
Amateur Radio (19) Ref doc: N/A Usage: Worldwide Fixed or Mobile: both Safety related: in some countries										
1.81 to 2.00	5	10	2.15	up to 2.7	30		Up to 1 Million	10%	all	Up to 2000
3.5 to 4.0	0	10	2.15	up to 2.7	30		Up to 1 Million	10%	all	Up to 2000
7.0 to 7.5	-10	10	2.15	up to 2.7	10		Up to 1 Million	10%	all	Up to 2000
10 to 10.15	22	10	5	up to 0.5	10		Up to 1 Million	10%	all	Up to 3500
14.00 to 14.35	22	10	5	up to 0.5	10		Up to 1 Million	10%	all	Up to 3500

Figure 3: Radio Service Database of CISPR

CISPR 16-4-4 is a report containing information on how to validate limit proposals. It is very comprehensive even at the CD-stage. A new project includes pure magnetic radiators, which is an off spin of the IARU's effort to have a PlasmaTV emission standard, which finally became IEC/PAS 62825: "Methods of measurement and limits for radiated disturbances from plasma display panel TVs in the frequency range 150 kHz to 30 MHz". Furthermore, there is a project going on, for the validation of the newly defined DC-limits for photovoltaic inverters in CISPR 11. This work is done in CISPR/H/AHG2 of which the author is the convener. When finished, this information is also for inclusion into 16-4-4, as a third project, which deals with the radiation characteristics of extra low voltage lines and networks which has just started in AHG2.

CISPR 22 is the "old" emission standard for IT and similar equipment. It has been superseded by CISPR 32 and will be withdrawn in 2017.

CISPR 20 is the "old" immunity standard for radio/TV and similar equipment. It has been superseded by CISPR 35 and will be withdrawn in 2017.

CISPR 24 is the "old" immunity standard for IT and similar equipment. It has been superseded by CISPR 35 and will be withdrawn in 2017.

CISPR 13 is the "old" emission standard for radio/TV and consumer electronics. It has been superseded by CISPR 32 and will be withdrawn in 2017.

CISPR 32 is the new multimedia emission standard and basically the unification of CISPR 13 and 22. It is very comprehensive, with the document being worked on for at least 10 years. After 2017, the usage of this document becomes mandatory, since all of the above will become invalid. The Amateur Services do not have many urgent issues in this standard. We should still try to get radiated measurement below 30 MHz as a requirement (for PlasmaTV) before the PAS 62825 becomes invalid.

CISPR 35 is the new multimedia immunity standard and basically the unification of CISPR 20 and 24. This unification did not run as smoothly as in the emission standard. For example two different immunity levels (1 V and 3 V) existed in the preceding standards, which were unified by frequency dependence (3 V at low frequencies, 1 V at high frequencies). Furthermore there is the primary function issue. One can imagine a multimedia EUT having many different functions and an immunity test should ideally be made for each and every function but this would lead to enormous costs. So it was decided, that only the primary functions would be tested. An EUT can theoretically pass the test, but does not show immunity in the case of a secondary function, which could be for example the

USB-recording function on a television. There is also an issue with immunity test below 80 MHz against radiated fields. It does not exist, and HF amateurs may have problems with a lack of immunity to radiated fields. Luckily direct field coupling is rare in this frequency range, there are many more cases involving conducted coupling, which is tested down to 150 kHz.

CENELEC, one of the two European standardization organizations, has a single EMC standardization group called TC210, which has numerous working groups. Since almost all relevant EMC standards are made internationally (in CISPR), this group is only active in European modification to existing international standards and where a European standard is being drafted. One example of the latter would be the 50561 series on PLC, which is handled in WG11. IARU Region 1 recently became an official liaison organization within CENELEC and is represented by the author in the meetings.

EN 50561-1 is listed and valid for PLC in-home devices in the frequency range up to 30 MHz. It fully protects the Amateur Services and safety of life services and partially protects the broadcast services. Unfortunately it is not used by industry at the moment, due to the transition period. It remains to be seen, if industry starts to use it in the future, or will decide the other way by showing compliance with the Essential Requirements as outlined in the EMC Directive. But that is another topic. The standard has some flaws, namely it does not cover the so-called MIMO devices, and lacks a test on intermodulation effects. The next maintenance cycle will address the MIMO issue.

FprEN 50561-2 is in the final stage and the analogue for Part 1 for access PLC devices. It has basically the same thinking behind it as for Part 1 which has been implemented, but additionally it allows broadcast protection on the basis of a database, containing receivable broadcast stations. Since the experience with Part 1 has shown that it does not really help in real life, IARU registered a negative vote.

FprEN 50561-3 contains the extension of Part 1 in the frequency range up to 80 MHz, but allows much lower levels. Still the amateur bands (50 and 70 MHz) are permanently notched out. This standard will probably come, but will have the same issues as Part 1. Nobody will use it unfortunately, because the level of the wanted signal is too low for industry.

ETSI

Region 1 has also been a member in ETSI for years. In former times, we had a great deal of activity in the so-called Joint Working Group on PLT, which was attended by Hilary, G4JKS, for many years. The project was then stopped as no consensus could be reached and the work was transferred to CISPR. In CISPR/I/PT-PLT the discussion continued until stopped again unfinished at the international level. Later CENELEC took over resulting in the production of the EN 50561-x series.

ERM TG26 handles the radio standards including the two standards for commercially available amateur radio equipment. Those need to have a certificate of conformity, which is often obtained by declaring against EN 301 489-15 (EMC) and EN 301 783-2 (R&TTE or RED). This TG is being watched closely, even though we do not currently have an IARU Region 1 person in attendance.

ERM TG28 handles short range devices and currently has a new work item, wireless power transfer, in competition to CISPR/B. Just recently we put a member of the EMC Committee, Jan Janssen, PA0JMG, on to this group to watch over developments there. ETSI usually is a lot faster than CISPR/CENELEC, so it may be possible that a new WPT standard from ETSI will be adopted for Europe.

Thilo Kootz, DL9KCE
EMC Committee Chair