FINAL REPORT

Benchmark on

ready-made connecting devices

(receiver leads with IEC- or F- connectors)

in cooperation with Germany, Switzerland and The Netherlands

(2012)

Report date: 31st of October 2012

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A. EXECUTIVE SUMMARY

A trilateral benchmark in the area of Electromagnetic compatibility of equipment ('EMC') Directive 2004/108/EC has been carried out between end of May and beginning November 2012.

The benchmark was carried out by three European market surveillance authorities ('MSA') who are participating members of the EMC ADCO (Administrative Cooperation), by name Bundesnetzagentur (DE), OFCOM (CH) and Agentschap Telecom (NL).

This benchmark focused on ready-made coaxial connecting devices (receiver leads) for cable TV and IT services with IEC and F- connectors. Other types of ready-made connecting devices - which also have to be viewed with a critical eye - such as SCART or HDMI cables were excluded from this benchmark, due to the fact of missing standards (and therefore common limits).

The purpose of this benchmark was to assess the current quality of ready-made connecting devices (receiver leads) with IEC and F- connectors available on the market in the three countries in terms of their screening effectiveness and mechanical resistance.

In summary the results of the trilateral benchmark showed that when assessed against current standards (EN 50083-2 and EN 60966-1):

- **57.6 %** of the 85 products surveyed comply with the assessed first test screening effectiveness of the above mentioned standards
- **68.2 %** of the 85 products surveyed comply with the mechanical resistance test (pulling force test) of the above mentioned standards
- Overall, only **42.4 %** of the 85 products surveyed comply with the assessed technical requirements of the above mentioned standards

The principal conclusions drawn from the benchmark were as follows:

- The level of compliance of ready-made connecting devices (receiver leads) with IEC and F- connectors assessed during this benchmark present on the three European markets is too low. However the result from Switzerland shows significant better results as from Germany and The Netherlands.
- The results of the benchmark show that a European approach is necessary to improve the situation. The quality of ready-made connecting devices (receiver leads) with IEC and F-connectors needs to be improved and customer should be protected.

A full list of all the conclusions and recommendations are shown in chapter "D" of the report.

B. ELEMENTS OF THE BENCHMARK

1. Reasons for the benchmark

At the 17th meeting of the EMC Working Party in December 2011, the German administration drew attention to problems occurred in Germany in the field of ready-made connecting devices (receiver leads).

At the present time, ready-made coaxial connecting devices for cable TV and IT services are not covered by the EMC Directive. Due to the lack of legal provisions in Germany and Switzerland, the use of ready-made connecting devices with other consumer electronic products can lead to interference with radio communication services when connecting devices are used which do not have sufficient screening effectiveness. This problem was observed in national-level German studies and also during the third European market surveillance campaign (televisions, DVD and Blu-ray players). The concise report of the joint working group “Digital Dividend” pointed out this problem too.

In the Netherlands – on a national basis - a voluntary approbation scheme “KabelKeur[1]” is in operation that should provide adequate quality.

After discussions the Commission services recognized the importance of the issue but questioned if the inclusion of these devices under the scope of a future EMC Directive is a proportionate solution. Commission services agreed to further analyze the issue.

In order to support the Commission, the German administration (Bundesnetzagentur) conducted together with the market surveillance authorities Agentschap Telecom (NL) and OFCOM (CH) a benchmark for ready-made connecting devices (receiver leads).

The benchmark should assess the current quality of ready-made connecting devices (receiver leads) on the market in terms of their screening effectiveness and mechanical resistance.

2. Scope of the benchmark

For this benchmark only ready-made connecting devices (receiver leads) with various connectors were assessed. Other types of ready-made connecting devices - which also have to be viewed with a critical eye - such as SCART or HDMI cables were excluded from this benchmark due to the fact of missing standards (and therefore assessable limits).

The following types of connectors had been assessed:

- IEC-connector, type 9.52 mm (according to EN 61169-2)
- F-connector, various diameters (according to EN 61169-24)

A few of the assessed ready-made connecting devices (receiver leads) had an IEC-connector on one end and an F-connector on the other end.

[1] NL Kabel the association of Dutch cable providers has issued a quality certification mark for in house cabling system components under the brand name „KabelKeur“. More information under www.kabelkeur.nl

3. Timing

The benchmark started end of May 2012 and is finalized with the publication at the next EMC ADCO and EMC Working Party in Brussels from 13th until 15th of November 2012.

The measurement of the EUT had been carried out in September/October 2012 in the accredited test laboratory of the Federal Network agency in Kolberg (Germany).

The present document constitutes the report of the benchmark.

4. Selected product types and sampling

Germany selected forty-two (42), Switzerland selected twenty-two (22) and The Netherlands selected twenty-one (21) ready-made connecting devices from appropriate sources (e.g., electronics stores such as Media Markt and Saturn, superstore and super markets, online sources) as a quantity structure for this benchmark.

The aim was to obtain the broadest possible view of the products on the marketplaces. Therefore, a quasi-random sampling was performed by taking products over the whole price range, and from all origins (national, EFTA, and imported from third countries). Furthermore the available product characteristics like double shielded and effect screening loss had been recorded in order to assess its reality.

In total forty-five (45) different manufacturers of ready-made connecting devices had been taken as samples for the benchmark.

Of the 21 samples from The Netherlands three (3) had been marked as “KabelKeur” they were found to be qualified as such.

5. Documents

A Code of Practice had been drawn up to provide guidance and a common understanding of the purpose of the benchmark and to ensure, as far as possible, the adoption of harmonised practices during the carrying out of the benchmark.

6. Basic requirements / Tests criteria used

The following test criterions are used during this benchmark:

Test criterion	Limit	Method of measurement (standard)
Measurement of screening loss/attenuation in the frequency band: 30 – 862 MHz	Class A: ≥ 85 dB	EN 55020: Sound and television broadcast receivers and associated equipment – Immunity characteristics – Limits and methods of measurement
Pull force test	> 45 N	EN 60966-1: Radio frequency and coaxial cable assemblies - Part 1: Generic specification; general requirements and test methods

Table 1: Test criteria for the benchmark

The attached Annex 1 describes the method of the carried out measurements.

7. Contact points for the trilateral benchmark

The following contact points had been established for the trilateral benchmark:

Germany:
Bundesnetzagentur (BNetzA)
Section 411 – Market Surveillance; Matters related to EMC and R&TTE
Stephan.Winkelmann@bnetza.de; +49 61 31 18 12 42

Switzerland:
Federal Office of Communications (OFCOM)
Section Market access and conformity
Lucio.Cocciantelli@bakom.admin.ch; +41 32 327 55 59

The Netherlands:
Radiocommunications Agency (RA)
Section Supervision
Jan.Robijns@agentschaptelecom.nl; +31 50 58 77 30 8

C. RESULTS

1. Number of samples (EUT)

A total of eighty-five (85) EUT were selected and evaluated, as follows

Countries	Number of EUT	PASS all assessments (Screening effectiveness // pulling force // 2nd screening effectiveness)
DE	42	11 EUT (26.2 %)
CH	22	17 EUT (72.3 %)
NL	21	08 EUT (38.1 %)
Sum	85	36 EUT (42.4 %)

Table 2: Overall assessment result

2. Technical compliance with product standards

All EUT were assessed for their screening effectiveness as described in Annex 1. After the first assessment of the screening effectiveness a pull force test was carried out for all EUT. After the pull force test a second assessment of the screening effectiveness take place for those EUT which pass the pull force test.

2.1 First assessment of screening effectiveness

The measured result of each EUT was compared directly with the limit in the product standard (85 dB) taking into account the measurement uncertainty of the test facility (4.5 dB). A non-compliance had been determined if the limit value of the relevant standard was below 80.5 dB.

Eighty-five (85) EUT were assessed for screening effectiveness. Of these, 49 met the screening effectiveness, representing 57.6% of the ready-made connecting devices (receiver leads).

The technical compliance rate of the EUT tested for screening effectiveness was as follows:

Countries	Number of EUT	PASS the first assessment screening effectiveness (≥ 85 dB) (before the pulling force test)
DE	42	18 EUT (42.9 %)
CH	22	20 EUT (90.1 %)
NL	21	11 EUT (52.4 %)
Sum	85	49 EUT (57.6 %)

Table 3: Assessment 1st screening effectiveness

2.2 Testing mechanical resistance (pulling force test)

After assessing the screening effectiveness the mechanical resistance test (pulling force test) was carried out. To determine the mechanical resistance of the device when subjected to a pulling force, a force of 45 N must be applied for a period of 60 seconds on both connectors together or individually one after another.

Eighty-five (85) EUT were tested through a pulling force test. Of these, 58 met the requirements, representing 68.2% of the ready-made connecting devices (receiver leads).

The technical compliance rate of the EUT tested for the pulling force test was as follows:

Countries	Number of EUT	PASS the assessment "pulling force test" (45 N / 60 s)
DE	42	24 (57.1 %)
CH	22	19 (86.4 %)
NL	21	15 (71.4 %)
Sum	85	58 (68.2 %)

Table 4: Assessment pulling force test

2.3 Repeating screening effectiveness assessment after the pulling force test

The measurement of the screening effectiveness was repeated after the mechanical resistance test (pulling force test) taking into account the measurement uncertainty of the test facility (4.5 dB). A non-compliance had been determined if the limit value of the relevant standard was below 80.5 dB.

As a result of the pulling force test, 27 EUT were destroyed, i.e. the connection between the plug and the cable was disconnected. Thus only a reduced number of EUT could be assessed a second time for screening effectiveness.

The 58 remaining EUT after the pulling force test were assessed a second time for screening effectiveness. 36 EUT out of this 58 EUT has passed the first screening effectiveness assessment. 11 EUT out of this 36 EUT did not meet the repeated screening effectiveness assessment, representing 30.6 %.

The technical compliance rate of the ready-made connecting devices (receiver leads) assessed again for screening effectiveness was as follows:

Countries	Number of EUT	PASS the first screening effectiveness assessment	FAIL the second screening effectiveness assessment
DE	24	11 EUT	07 EUT
CH	19	17 EUT	01 EUT
NL	15	08 EUT	03 EUT
Sum	58	36 EUT	11 EUT

Table 5: Comparison 1st / 2nd screening effectiveness

2.4 Special evaluations related to different connectors

In Annex 2 further special evaluations related to different connectors can be found

D. CONCLUSIONS AND RECOMMENDATIONS

1. Overall conclusions

- The overall fulfilment of the compliance levels of the tested ready-made connecting devices (receiver leads) were low, with only 42.4% of the EUT passing only two of several relevant requirements laid down in the relevant standard tests. However, the result from Switzerland shows significant better results as from Germany and The Netherlands.
- The EUT were taken randomly from the market taking into account the whole price range (cheap, middle and high price products) and outlet types (general consumer electronics). The market penetration of the ready-made connecting devices (receiver leads) could not be taken into account. Also, other countries besides the 3 participants have not been considered
- The electromagnetic environment for this equipment will change dramatically in the near future because of the introduction of new radio serviced in the 800 MHz and further usage whites spaces radio services in the entire UHF band. If the low level of ready-made connecting devices (receiver leads) remains on the market a rising number of disturbance will occur.
- This benchmark showed different results between the participating countries and that an European approach would be necessary to improve the situation. At least ready-made connecting devices (receiver leads) with IEC and F- connectors needs to be improved and customer should be protected against insufficient ready-made connecting devices (receiver leads).

1.1 Conclusion from “Germany”

- Taken into account the national German situation on disturbances it is necessary to focus on a general solution (in order to raise immunity of receivers and raise the quality of screening effectiveness and mechanical resistance).
- An introduction of ready-made connecting devices in the EMC Directive would set mandatory requirements for all ready-made connecting devices with pursuable rules to be assessed during market surveillance activities of MS.
- The results from this benchmark shows to the German extend that a voluntary system like “KabelKeur” would raise compliance (if followed). If not followed the situation remains unsatisfactory.

1.2 Conclusion from “Switzerland”

- The situation in Switzerland is different and much more satisfying as in the other participating MS and no special action is needed.

1.3 Conclusion from “The Netherlands”

- The three tested ready-made connecting devices (receiver leads) marked with “KabelKeur” fulfil the requirements assessed in this benchmark. However, only 3 out of the 21 EUT from The Netherlands were marked with "KabelKeur". From those "not marked" 18 EUT only 8 met the test requirement.
- The consumer – TV watcher should replace the cables, particularly the plugs, in his/her home with materials of sufficient immunity.

- Agentschap Telecom may, by guidance and mediation, in dialogue with stakeholders groups, stimulate consumers to install cables and specifically plugs with adequate screening. However, the measures taken should not lead to unnecessary extra costs.

2. Recommendations

It is recommended that:

a. The results of the benchmark should be published widely throughout Europe and the other member states where the products originate. Publicity should target all economic operators in the area of multimedia equipment
b. An harmonized European approach is recommended
c. The KabelKeur approach, voluntary in the Netherlands, should be promoted as a first step of a possible solution
d. Cable operator and manufacturer should have the responsibility for good engineering practices and stimulate and inform the customer on a suitable manner.
e. The manufacturer of TV-sets should guarantee that the receiver leads supplemented to the TV-set, meet the requirement of the relevant product standards (EN60966-2-x-series).
f. State of the art products have to be used to connect the relevant electronic devices (TV-sets,
Set-Top-Boxes, etc.)
g. A similar benchmark should be considered on the same basis after a certain period to assess the effect on the market.
h. A similar benchmark should be considered for other types of ready-made connecting devices - which also have to be viewed with a critical eye - such as SCART or HDMI to determine the actual situation on the Market

Annex 1

Method of measurement

a) Absorbing clamp measuring method
The first measuring test of sreening effecetiveness will be executed with the absorbing clamp measuring method. The EUT have to meet the limit values for Class A equipment in the frequency range 30 MHz to 862 MHz due to standards EN 60966-2-4 and EN 60966-2-5 of 85 dB. For the ease of the test, the limit values for EUT due to EN 60966-2-6 were also reduced to a limit value of 85 dB (in the standard EN 60966-2-6 a limit value of 95 dB is stated in the frequency range 30 MHz to 1000 MHz).

b) Pull force test
A force of 45 N must be applied for a period of 60 seconds on both connectors together or individually one after another. This pulling force test ensures that the mechanical contact of the connectors and the connection between the connector and coaxial cable withstand this stress without the contact being broken and without the installed connectors being damaged

c) Absorbing clamp measuring method after the pull force test
The second measuring test of sreening effecetiveness after the pull force test should show the changes due to mechanical influences. Either the results are equivalent to the first tests or due to streching of the cable or less conduction with the screem this number will be reduced.

Screening effectiveness test

The screening effectiveness is the ratio of the maximum peak power at the input end of the equipment under test (EUT) to the measured radiated disturbance power for each frequency used in the test. The results may not exceed the limits laid down in EN 60966-2-4, EN 60966-2-5 and EN 60966-2-6.

Screening effectiveness will be tested with an absorbing clamp (MDS 21) in accordance with EN 55020.

Firstly it was foreseen to apply the absorbing clamp test method described in the standard EN 50083-2, referencing to the EN 55013. However, during the preparation of the test one find out, that this method is very time consuming without getting more accurate results. At least it took us more than 1 hour to test only one EUT. That means, for the entire 85 EUT we would need a measuring time frame of about 100 hours. Therefore we decided to change the measurement procedure to the S-4-standard method described in EN 55020 (passive method). We decided to evaluate the following frequency ranges:

Frequency	55,25 MHz	375,25 MHz	855,25 MHz

Table 6: Frequency ranges to be tested

The following equipment will be needed for conducting measurements with an absorbing clamp MDS 21:

- A signal generator which covers the frequency range that is to be examined and provides sufficient output power;

- An absorbing clamp (MDS 21) in accordance with EN 55016-1-1;

- Measuring equipment with the correct impedance which covers the frequency range to be examined;

- A highly shielded measuring cable with a length of at least λ/2 (based on the lowest frequency that is to be examined) plus 0.6 m and the correct impedance. The used cable had an impedance of 120 Ω and a length of 4.40 meter.

- Shielded terminating resistors with the correct impedance and style;

- All the required couplers in the appropriate style for the respective coupler;

- A mains filter that is able to filter external interference from the electrical power system out of the frequency range that is to be examined;

- Absorbing elements such as ferrite tubes which can be used to sufficiently suppress the signals from the input cable and power cable of the equipment under test;

- An appropriate coaxial cable change-over switch.

The test setup and the layout of the equipment for conducting the test with the absorbing clamp (30 MHz to 1,000 MHz) are shown in Figure 1. The equipment under test (EUT) is to be placed at a height of approximately 0,8 to 1,0 meter above the floor on a non-metallic base on which the absorbing clamp can also be set and moved. The EUT is connected with the unmodulated signal of the signal generator (1) applying the relevant test frequency. The signal level is determined by the selectivity of the measurement receiver and the software used for the test. The absorbing clamp starts the searching for the maximum at the antenna input and will be moved to get the maximum value. The maximum value will be noted.

The value of the screening effectiveness can by calculated with the following formula:

$S\ [dB] = L_s\ [dB(\mu V)] – a_m\ [dB] - L_r\ [dB(\mu V)] – a_k\ [dB] - a_f\ [dB]$

With:

L_s output level of signal generator

a_m correction value for the network to the highly shielded coaxial cable

L_r display of the measuring receiver

a_k insertion loss of the absorbing clamp and correction value for calibration

a_f correction for the connecting cable absorbing clamp to the measuring receiver

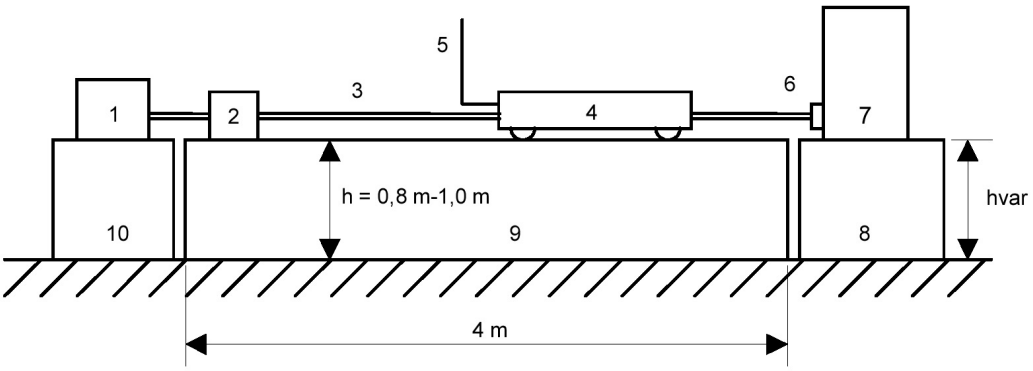

Figure 1: Measuring screening effectiveness with an absorbing clamp (EN 55020)

1 Signal generator
2 Network
3 Highly shielded measuring cable (120 dB)
4 Absorbing clamp
5 to the measuring receiver
6 Highly shielded connector
7 EUT
8 Non metallic table T 1 (Height 0.8 – 1.0 m)
9 Non metallic table T 2
10 Table T 3

Annex 2

Special evaluations related to the different connectors

Countries	Number of EUT	PASS the second test screening effectiveness (≥ 85 dB) (after the pulling force test)
DE	21	8 EUT (26.2 %)
CH	13	11 EUT (72.3 %)
NL	14	6 EUT (38.1 %)
Σ (Sum)	**48**	**25 EUT (52.1 %)**

Table 7: Test results for IEC connectors (straight)

Countries	Number of EUT	PASS the second test screening effectiveness (≥ 85 dB) (after the pulling force test)
DE	4	1 EUT (25.0 %)
CH	-	not applicable
NL	-	not applicable
Σ (Sum)	**4**	**1 EUT (25.0 %)**

Table 8: Test results for F-connectors and IEC-connectors on the other side

Countries	Number of EUT	PASS the second test screening effectiveness (≥ 85 dB) (after the pulling force test)
DE	3	0 EUT (0.0 %)
CH	3	1 EUT (33.3 %)
NL	4	1 EUT (25.0 %)
Σ (Sum)	**10**	**2 EUT (20.0 %)**

Table 9: Test results for IEC connectors (right-angle connector)

Countries	Number of EUT	PASS the second test screening effectiveness (≥ 85 dB) (after the pulling force test)
DE	14	2 EUT (26.2 %)
CH	6	5 EUT (72.3 %)
NL	3	1 EUT (33.3 %)
Σ (Sum)	**23**	**8 EUT (34.8 %)**

Table 10: Test results for F connectors

Connectors	Number of EUT	PASS all the tests
IEC-connector (straight)	48	25 EUT (52.1 %)
F-connector	23	8 EUT (34.8 %)
IEC-connector (right-angle connector)	10	2 EUT (25.0 %)
F-connector // IEC-connector	4	1 EUT (25.0 %)
Σ (Sum)	***85***	***Φ (Average) 42,4%***

Table 11: Test results for all kind of connectors