KABEL KEUR

Requirements for active and passive
in-home cable network materials ("*PvE 5.0*")

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1. INTRODUCTION

Background

In 2008 NLkabel, back then the association of Dutch cable operators, has issued a quality certification mark for in-house cable network components under the brandname “Kabel Keur”. Kabel Keur’s goal is to help consumers find and select coaxial cables, splitters, connectors and amplifiers with a quality level that at least equals or even exceeds requirements set by the cable operators. These requirements are set to enable customers to enjoy uninterrupted cable services including state-of-the-art multimedia services offered by Dutch cable providers.

The growing number of services and the increase of inteference caused by e.g. LTE have become more demanding for high quality in-house cable networks. Frequently the outdated and/or inferior in-house cable networks, with components such as coaxial cables, splitters, connectors and amplifiers are causing a reduced quality of service to the customer. Therefore customers can wrongly perceive this as a poor quality of the service provided by the cable operator.

To guide consumers and installation companies buying qualified products and materials within a broader market of (sometimes inferior) products, a the quality mark like “Kabel Keur” has become more and more relevant. “Kabel Keur” identifies independently inspected and approved materials and products. Only materials and products, which have passed approval tests successfully, get the qualification mark “Kabel Keur”.

Ownership VodafoneZiggo

Since UPC and Ziggo (the largest contributors within NLkabel over the years.) merger into Ziggo and most recently into VodafoneZiggo (VZ), there is only one key player left in the cable operator domain.
Therefore VZ left NLkabel by the end of 2016 and took over the owership Kabel Keur. VZ is responsible for the requirements document and managing the quaility mark end to end.

Ziggo geschikt

Although Kabel Keur exists since 2008, the brand awareness is very limited. This is due to the fact that Kabel Keur has not been promoted the way it was intended. This also resulted in a very limited number of sales. Therefore VZ decided to added “Ziggo geschikt” as an add-on to all certified products. This means that there still is only one set of requirements. Once a product passed certification succesfully, a manufacturer / vendor is entitled to use both logo’s on the (packaging of the) product.
With over 4 million Ziggo customers a quality brand that contains Ziggo, will help to unleash the potential of certified high quality products. Research and practice both already proved this.

Requirements document

This specification document is dynamic. In general once a year the college of experts within VZ decides if the document needs editing to assure that consumers get the quality of products to assure a high quality of service. Proposed changes are announced and discussed with the participating partners before becoming formal and operational. For all products, both for new products and for products that already received a “Kabel Keur” certification mark, there is a 3-year transition period. It is required that new products comply with the latest requirements from the start.

Qualify for certification

To qualify for certification a manufacturer or vendor can ask the Keurmerkinstituut (KMI) to investigate and test its products. The KMI is an independent accredited agency, selected by VodafoneZiggo, and well equipped to ensure that the certification procedure is operated according to the “Kabel Keur” mark rules and regulations. Firstly, KMI investigates whether the technical requirements in theory meet the requirements. To make this possible, the requesting supplier hands over a completed application form. By handing over this form the requesting supplier enters into consent with VodafoneZiggo and KMI.

This consent regulates the full process of acquiring and applying the “Kabel Keur” certification mark. Requesting suppliers bear the costs involved. The application form can be found on the KMI website

2. SCOPE

The Kabel Keur quality certification mark is applicable to in-house components of an integrated multimedia cable network suitable for Ziggo products in general and in principle as well for the products of all Dutch cable operators in general.
An in-home cable network that entirely consists of Kabel Keur products is suited best for full enjoyment of the coax and IP based products that are delivered by Ziggo and other cable providers.

Focus is in coax based products, but technology is moving toward IP based products. That means that an IP network will become more and more important. In the meanwhile a hybrid in-house network will become relevant.

Passive components	Active components
• RF one port wall-outlet • RF + Ethernet wall-outlet • 2-way splitter wall-mount • 2-way splitter push-on • 3-way splitter wall-mount • 3-way splitter push-on • 4-way splitter wall-mount • 4-way splitter push-on • Coax installation cable (C9/12) • Coax fly-lead • IEC connector • F-connector • RJ45 connector • RTV diplex/data filter • Port terminator • Ethernet installation cable • Ethernet patch cable • HDMI cable	• Amplifier 862 MHz • Amplifier 1218/65 MHz

Table 2-1 Components in scope

3. PROCEDURE: QUALIFYING FOR KABEL KEUR-ZIGGO GESCHIKT

The flowchart in figure 3-1 shows the certification procedure for Kabel Keur. Certified Kabel Keur products marketed under private labels need the be certified separately. Aspects that are not subject to difference from the originally certified product (original product), including technical requirements, may be excluded in the certification process for private label products.

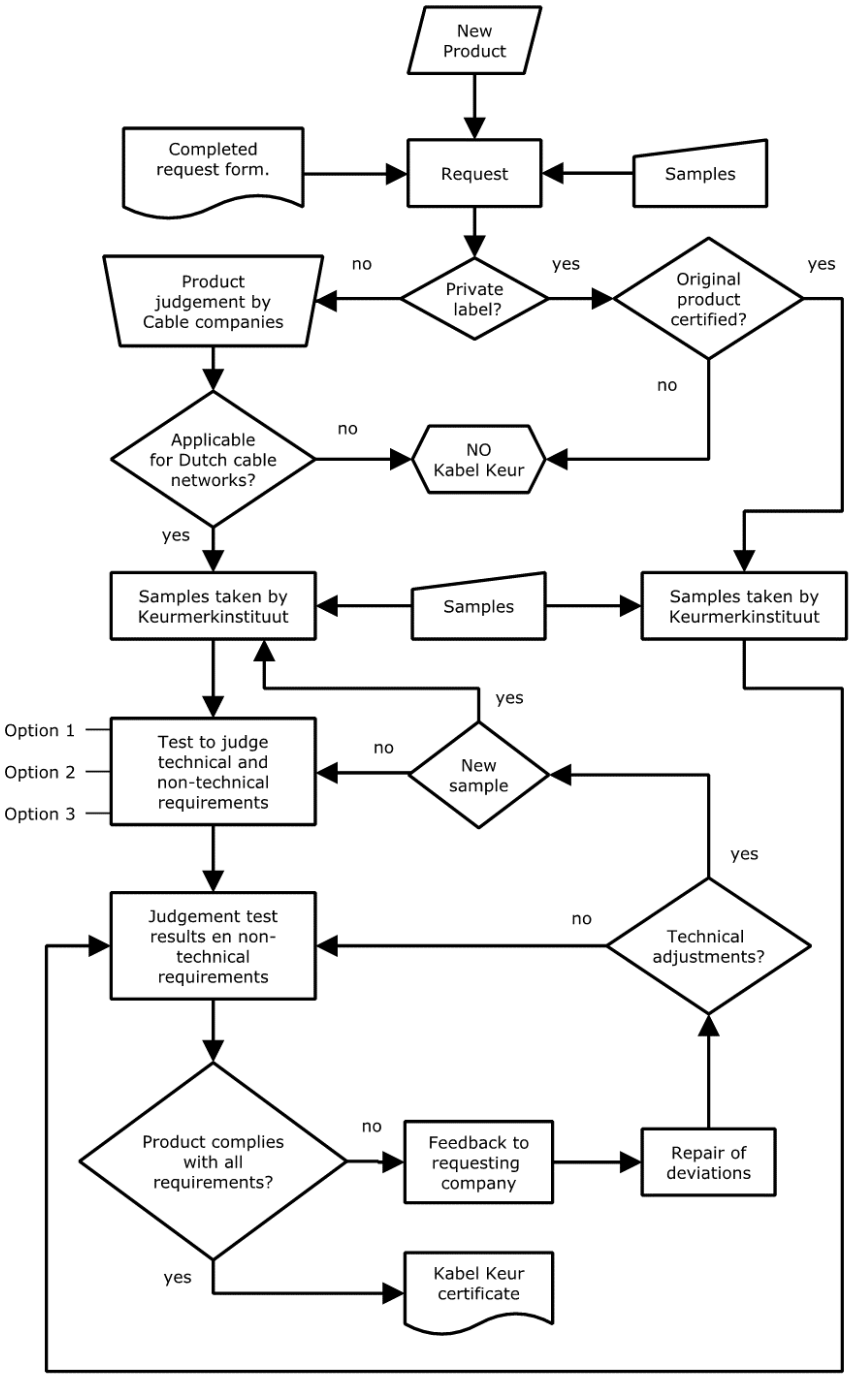


Figure 3-1 Flowchart certification procedure

3.1 REQUIREMENTS

This document describes the requirements products have to meet to qualify for the “Kabel Keur” certification mark. The “Kabel Keur” certification mark is protected and registered by VodafoneZiggo. A college of experts represented by (technical) experts within VZ and Delta as well as leading manufacturers draft these requirements. The final set of requirements is defined by VodafoneZiggo.

3.2 APPLICATION

To apply for certification, requesting suppliers can obtain an application form from KMI. Only completed and signed forms will be considered. This includes the required attachments named on the application form. By signing the form the requesting supplier declares to abide the rules and regulations for using the certification “Kabel Keur” mark as stated in this requirements document. After a completed entry form has been received, KMI will judge whether the products in the application are within the scope of the requirements document. VZ technical experts will decide whether the products can be applied successfully for VZ products and services and the Dutch cable operation environment in general. The interoperability of products is a key decisive factor. If not, the certification procedure will be stopped. Products that are not part of this requirements document are not covered.

3.3 QUOTE

After receipt of a completed and signed application form KMI shall offer a proposal for examination and will charge the costs of application upfront. If the contract is granted, these application costs will be deducted from the final bill.

3.4 CERTIFICATION PROCEDURE

To be able to complete the certification procedure for original products, KMI requires the information specified in the requirements (method). This generally means the following:

- Product specification sheet;
- Representative product samples (see 3.5 for details), including product marking (batch codes, product codes, logo’s etc.);
- Packaging samples, including any directions for use;
- Declarations and statements regarding CE, RoHS, Besluit beheer verpakkingen;
- An ISO 9001 certificate for the production process;
- Complaints procedure and complaints file (registration after initial certification);
- Any other documents to show compliance with the requirements;
- Valid Chamber of Commerce registration extract.

For the purpose of the certification, a product includes any packaging, information and labeling as it is sold. If factory packaging is applicable the supplier should indicate this.

Testing of compliance to technical requirements is reported to KMI by a qualified laboratory.
A representative sample is tested in one of these three ways:

Option 1
The applicant requests a qualified laboratory to test the product. The laboratory reports to KMI and all communication with the laboratory is through KMI.

Option 2
KMI boards testing of the product to a qualified laboratory. The laboratory reports to KMI and communication with the laboratory is through KMI.

Option 3
The applicant arranges the product testing. KMI has a qualified laboratory witness the testing and this laboratory reports to KMI.

Based on the laboratory report KMI will evaluate validity of the tests and the compliance with technical requirements. KMI also evaluates the validity of the tested sample and the qualification of the laboratory.

3.5 SAMPLES

The requestng manufacturer/vendor informs KMI when the first production batch is available. From this batch a number of samples must be selected for testing and evaluation. The quantity is product related, determined by the spread of production parameters and the batch quantity, but will minimal consist of:

- Coaxial cables: 25 samples of 6 meters
- All other passive products, including fly-leads: 50 samples
- Active products: 25 samples

From these samples KMI will select a number of products to be tested for Kabel Keur.

3.6 PROTOTYPES

If the available samples cannot be considered to be representative for the production series, they will be handled as a prototype. Prototypes can be tested and assessed the same way as real certification, except that the prototype will not be certified. As soon as representative samples become available, test results wfrom the prototype tests can be re-used after an assessment confirms that these samples are technical identical to the prototype.

3.7 INTERMEDIATE RESULTS

The requestng manufacturer / vendor will be offered the opportunity to solve deviations from the requirements if needed. After modification, compliance with the requirements concerned will have to be assessed again. VZ will judge wether technical modifications require additional retesting of requirements that may be influenced by the modification. Extra costs will be charged additionally.

3.8 USE OF KABEL KEUR AND ZIGGO GESCHIKT QUALITY MARK / LOGO

During the certificate validity period the certificate holder has the right to display both “Kabel Keur” and “Ziggo geschikt” quality marks on the products and packaging. In order to use these logo’s the right way the ‘Richtlijnen gebruik’ logo “Kabel Keur” need to be taken into account.

3.9 TRACEABILITY OF CERTIFIED PRODUCTS

On behalf of VZ KMI will maintain and manage an overview of certified products. This overview will be made available for customers, manufacturers, vendors and all other stakeholders via Kabel Keur website and on KMI guestpage.

3.10 ANNUAL SURVEILLANCE

Within the time period that the certificate is valid, intermediate inspections will be carried out to safeguard continuous fulfillment of the requirements of the “Kabel Keur” certification mark. KMI has established a process and procedure for this. The costs of these intermediate inspections will be charged to the quality mark holder in agreement with the initial quote for inspection when possible.

At least the following aspects will be evaluated during an annual surveillance:

- Verification of the (agreed) requirements or parts of (agreed) requirements (= administrative check)
- Evaluation of customer/operator complaint registration
- Inspection of the quality system (of the certification holder and/or of the production location)
- Product labeling

3.11 RECERTIFICATION

When a certificate expires, the right to use the Kabel Keur and Ziggo geschikt logo’s on a product automatically ends. To continue the right to use the logo’s, the product needs to be re-certified. A re-recertification assessment has to show that the product meets all requirements that are part of the requirements that are applicable at that point in time.

Verification of (parts of) the (agreed) technicial requirements takes place by labaratory testing.
At least two parameters will be measured if product specifications are unmodified, and requirements are unchanged. If product specifications are modified, at least the modified parameters will be measured. If requirements have changed, at least the changed parameters will be measured.

3.12 DISAPPROVAL UPON SURVEILLANCE

When a surveillance or recertification reveals that a product deviates from one or more requirements, the certificate holder is given the opportunity to respond with a cause and extent analysis and corrective/preventive measures. KMI evaluates the response and measures and verifies their implementation. In the case of a technicial non-conformity, the voting members of the college of experts will be consulted in assessing the response and planning the verification. Information about the product and the assessment is shared or brought out only after explicit permission of the certificate holder. If conformity can not be demonstrated within the deadline, the certificate for the respective product is revoked. If after that it is demonstrated that the requirements are met, the Kabel Keur certificate can still be extended.

3.13 LAYING AN APPEAL

Products can be rejected for inspection (see 4.2) or can be given the judgement “failed” in the certification process. In either case the requesting supplier can lodge an appeal at the college of appeal. This college is comprised of two independent subject experts who are not employed by any of the parties involved in VZ. This college will judge whether there are reasons to revise the decision taken by VZ to reject a certification. If this is the case the requesting supplier can request the college to ask that the tests are repeated by another qualified laboratory. If possible, costs for this will be charged to the party responsible for the need to re-evaluate the tests.

4. VALIDITY & ABUSE

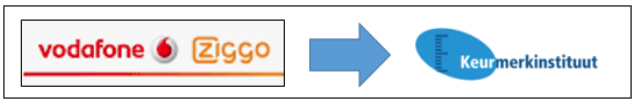
The validity period of a certificate is 3 years. After this period the product must be recertified. In case the requirements for the product are unchanged there is the possibility to extend this period ones with 2 years. An annual surveillance inspection will be carried out.

Whenever a manufacturer/vendor wants to change the product specifications and/or production of certified products, it is the manufacturer/vendor's responsibility to first contact KMI about these changes. Before intended changes to certified products are implemented, it has to be ensured that the Kabel Keur requirements are still met. Technical changes are submitted to the voting members the college of experts. It is then decided whether additional measurements are necessary. Additional measurement start a new certification period of 3 years.. When it is decided that no measurements are needed, the current certification period remains unchanged. Non-technical changes may still require other means of verification, like ISO 9001 certification of production (see general requirements|) in case of change of manufacturer. If additional verification is necessary, the supplier will be informed accordingly.

In case a participating or non-participating manufacturer / vendor uses the Kabel Keur and/or Ziggo geschikt logo illegal, VodafoneZiggo will take juridical steps to stop and prevent such abuse.

5. ORGANIZATION

VodafoneZiggo appointed a group of technical experts. This group defines the requirements for high performance components for In-house cable networks. These requirements are documented in this requirements document. This document is public and along with other documents, published on a dedicated KMI guest website . New versions of the Kabel Keur specificaiton document will be published on this website and will be distributed by e-mail to all stakeholders.



VZ has an agreement with Keurmerkinstituut, in which is stated that KMI executes and coordinates all operational activities. In the end VZ by all means is responsible for version control and distribution of all process documentation and for all operational activities to enable requesting suppliers to obtain the certification mark. All operational costs linked to obtaining the certification mark, such as the costs which KMI makes and the laboratory costs for the testing, are at the expense of the requesting suppliers.

A requesting supplier who wants to acquire the certification mark for certain products can submit a request for this to KMI. Materials can only be inspected if the requesting supplier agrees with the set of rules and regulations that have been laid down by VZ in this document. This set of rules and regulations indicates how the testing process is organized and what the general conditions are. KMI boards the testing to a qualified laboratory by default (see 3.4 for details).

The laboratory examines the material on behalf of KMI according to the testing requirements (according to this requirmeents document) and reports the results to KMI. KMI assesses the outcome and notifies to the requesting supplier on its findings. If the materials are approved then KMI, after being instructed to do so by VZ, will issue a certificate that allows the requesting supplier to bear the certification mark for the examined material. On the certificate the type and validity period of the inspected material is stated.

KMI reports the results of the certification process and which materials have obtained a certificate to VZ. VZ ensures that a list of approved material is available for consumers and retailers (for example by publication on the Internet site).

6. SPECIAL PRODUCTS

VodafoneZiggo and all other Dutch cable operators prefer to certify all in-home cable network products. This makes it easier for customers and even installation companies to identify high quality approved products. Kabel Keur certified products are normally sold to the customer via a retail and/or web shop for use in all Dutch in-home cable networks.

Nevertheless the vast majority of Kabel Keur products is brought into the customers home via or on behalf of VodafoneZiggo. Distribution of these products takes place via so-called self-install installation kits used by customers. Next to that, these product are used by technicians in customers homes during installation and repair visits.

Some of those products, like wall-outlets, fly-leads and splitters are specifically made on request of VZ or another individual cable operator. These products need to meet all technical requirements as well, but will essenatially not become available for selling those in retail and/or web shops.

The big advantage of also certifying these products for Kabel Keur is that Kabel Keur/Ziggo geschikt logo's are on these products. This confirms quality of the deliverd products, and makes customers aware of the quality mark itself.

Requirements for special products are normally not incorporated in this requirements document. This is due to the competitor-sensitivity of the specs. However the requirements of Kabel Keur products as specified in chapter 7 are nonetheless also required for special products.

Special products must, apart from the Kabel Keur logo, contain a notification to which Dutch cable operator the product applies.

7. REQUIREMENTS

This chapter details general information for all products that opt for Kabel Keur certification.
All information that is provided by the applicant may be verified. Any misleading information is not permitted.

7.1 GENERAL REQUIREMENTS

Item	Description	Remark	Method
7.1.1	Standard product specification sheet is available	In Dutch or English	Demonstration of document
7.1.2a	Compliance to applicable EU directives	In Dutch or English	CE declaration
7.1.2b	Compliance as applicable to: ROHS	In Dutch or English	Certificate / statement
7.1.2c	Compliance as applicable to: WEEE	In Dutch or English for active components	Membership to a collective or individual notification
7.1.2d	Besluit beheer verpakkingen[1]	Dutch implementation of EU Directive[2]	Vendor statement
7.1.4	Use of PVC's and PVdC's not allowed	for additions to the technical product, including packaging, cover parts and other components that are not covered in the technical requirements	Material specifications
7.1.5a	ISO 9001 certification of the production process leading to the product		Certificate from an accredited institute
7.1.5b	Requesting supplier must have a compliant registration system and must report once per half year on the "Kabel Keur" items.		Complaints file and procedures
7.1.6	The product is given permission to continue the certification procedure.	The usability of a product in the Dutch cable market is reviewed (usability in Dutch market situation, see 4.2)	Review by the representatives of the Dutch Cable Providers of the College of Experts (CVD)
7.1.7	Materials used for all contact interfaces must have good electrical-, corrosion-, cpd- and durability characteristics	The used alloy materials in the device must have a low step voltage (≤ 0,5V electro chemical potential difference referenced to copper) in relation to each other to minimize corrosion effects	Information on the elements used in the (plating) material. This is generally included on the specification sheet (8.1.1).
7.1.8	Operational temperature range 0-55°C,unless specified differently in the product requirements tables hereafter	Specs will only be tested at a temperature of 20-25°C unless otherwise specified	Vendor statement. This is generally included on the specification sheet (8.1.1).

[1] Directive 94/62/EC of the European Parliament and of the Council of the European Union of 20 December 1994 on packaging and packaging waste (OJ L 365), as last amended by Directive 2004/12/EC of the European Parliament and the Council of the European Union of 11 February 2004 (OJ L 47) and Articles 10.15 to 10.18, 10.64, second paragraph, and 15.32 of the Environmental Management Act

Item	Description	Remark	Method
7.1.9	At least ~~a~~ 3 years warranty	Within the warranty period the provider shall replace failing products for free as long they are used in accordance with the instructions for use provided	Product information

Table 7-1 General requirements

7.2 Product labeling and packaging requirements

Identification labeling items:

a. Article number
b. Product identification and number
c. Batch number
d. Contact details vendor
e. Logo complete monochrome[2]
f. Logo simplified[2]
g. Logo complete full color[2]
h. Text "Kabel Keur certified"[2]
i. Installation instruction[3]
j. User guide[4]
k. Area of application[5]

Item	Description	Remark	Method
7.2.1	Consumer packaging carries the labeling items a, b, d, g and k	Identification refers to labeling item list under 8.2	Sample
7.2.2	Factory packaging carries the label items a, b, c and d	Identification refers to labeling item list under 8.2; If c is on the product itself, it is not required on the factory packaging	Sample
7.2.3	Factory packaging is only used for supply to Private label companies (re-brand and re-pack) and for direct deliveries to contractors and/or cable companies for installation purposes. Suppliers and their customers do not sell or resell the product without an approved Consumer packaging to consumers. The holder of the certificate and his customers and/or resellers ensure that this will formally be contracted by means of an agreement between the supplier and the customer (for example in the terms of delivery)	Coaxial cable may be sold to consumers in factory packaging as an exception	Agreement (example letter in appendix G)
7.2.4	The product carries the label items specified under "Remark" per product type	Identification refers to labeling item list under 8.2	Sample

[2] Refers to: "Richtlijn Logo gebruik Kabel Keur", appendix A. For a minimum required logo's, g > f > e > h.

[3] An installation instruction has the intention to show the user how the product must be assembled, installed, mounted or fitted and what is the purpose of the product. The form of an Installation instruction can be a booklet or leaflet with text and images or the Installation instruction can be printed on the packaging. The installation instruction is packet in combination with the product. The text is drafted (at least) in Dutch. Required information is specified per product type in appendix H.

[4] A user guide, also commonly known as manual, is a technical communication document intended to give assistance to users for installation and usage of the product. There is a user guide per Kabel Keur product and it explains both in written text and associated images the operation of the product and a clear installation instruction. The user guide is packed in combination with the product and is drafted (at least) in Dutch. Required information is specified per product type in appendix H.

[5] The area of application defines the area where a product can be practiced and must be printed on the Consumer packaging of a product.

Item	Description	Remark	Method
	1. Wall Outlet 2. Two way splitter 3. Connector 4. Port terminator 5. Adaptor 6. Cable 7. Fly lead 8. Amplifier 9. HDMI cable 10. UTP cable 11. Diplex filter 12. Special product	b, c, f, i b, c, f, i i not applicable not applicable b, c, f b, c, f b, c, g, j b, c, f b, c, f b, c, f, i b, c, f, i/j If a batch number (c) is on every available packaging, it is not required on the product itself A user guide (j) is not required in a Factory packaging	

Table 7-2 Product labeling and packaging

7.3 TECHNICAL REQUIREMENTS PASSIVE COMPONENTS

7.3.1 WALL OUTLET HF

Product description: one port HF wall-outlet

For measurement purposes the tested samples shall be fitted with a Kabel Keur certified cable of 15 cm and a Kabel Keur F-type connector. Applicant is responsible for correct fitting of the cable and connector supplied by KMI.

Item	Description	Remark	Specification	Measurement Protocol
7.3.1.1	Impedance	5 - 2000 MHz	75 Ω	Vendor statement
7.3.1.2	Connector in		cable clamp[6] / f (C9, C12)	Appendix D / B
7.3.1.3	Connectors out		F, IEC male	Appendix B, C
7.3.1.4	Insertion loss after power surge[7]	5 - 1006 MHz	≤ 0,5 dB	IEC 60728-4 §4.3
		1006 - 1218 MHz	≤ 1,0 dB	
		1218 - 2000 MHz	≤ 1,2 dB	
7.3.1.5	Return loss after power surge	5 - 12 MHz	≥ 13 dB	IEC 60728-4 §4.6
		12 - 40 MHz	≥ 20 dB	
		40 - 2000 MHz	≥ 20 dB - 1.5 dB/oct.	

[6] No specific design or protocol is mandatory for the cable clamp ('butterfly'), direct screw connection is not allowed. Cable clamp must be designed to fit cable types as specified in chapter 10.3

[7] A power surge of 1 kV pulse as specified in IEC 61000-4-5, level 2 (rise time 1.2 µsec/fall time 50 µsec) is put on the input before measurement.

Item	Description	Remark	Specification		Measurement Protocol
7.3.1.6	Galv. Isolation 2120 V DC ≥ 1 min.	Inner conductor input > inner conductor output	≤ 0,7 mA >3 MΩ		IEC 60728-11 §10
7.3.1.7	Galv. Isolation 230 V AC 50 Hz	Inner conductor input > inner conductor output	≤ 8.0 mA RMS		IEC 60728-11 §10
7.3.1.8	Screening effectiveness:	Transfer impedance Triaxial Tube in Tube Method	5 - 15 MHz	≤ 5 mΩ	IEC 62153-4-7
			15 - 30 MHz	≤ 2,5 mΩ	
			30 - 300 MHz	≥ 95 dB	
			300 - 470 MHz 470 - 950 MHz 950 - 2000 MHz	≥ 90 dB ≥ 85 dB ≥70 dB	

Table 7-3 Specification wall outlet HF

7.3.2 Wall outlet HF, combined with Ethernet port.

Product description: one port HF wall-outlet with Ethernet cable input and RJ45 outlet.

For measurement purposes, the tested samples shall be fitted with a Kabel Keur certified cable of 15 cm and a Kabel Keur F-type connector. Applicant is responsible for correct fitting of the cable and connector supplied by KMI.

The HF port requirements:

Item	Description HF port	Remark	Specification		Measurement Protocol
7.3.2.1	Impedance	5 - 2000 MHz	75 Ω		Vendor statement
7.3.2.2	Connector in		cable clamp[8] / (C9, C12)/F		Appendix D / B
7.3.2.3	Connectors out		F, IEC male		Appendix B, C
7.3.2.4	Insertion loss after power surge[9]	5 - 1006 MHz	≤ 0,5 dB		IEC 60728-4 §4.3
		1006 - 1218 MHz	≤ 1,0 dB		
		1218 - 2000 MHz	≤ 1,2 dB		
7.3.2.5	Return loss after power surge	5 - 12 MHz	≥ 13 dB		IEC 60728-4 §4.6 with a relaxation as specified in §5.3.4.1
		12 - 40 MHz	≥ 20 dB		
		40 - 2000 MHz	≥ 20 dB - 1.5 dB/oct.		
7.3.2.6	Galv. Isolation 2120 V DC ≥ 1 Min.	Inner conductor input > inner conductor output	≤ 0,7 mA >3 MΩ		IEC 60728-11 §10
7.3.2.7	Galv. Isolation 230 V AC 50 Hz	Inner conductor input > inner conductor output	≤ 8.0 mA RMS		IEC 60728-11 §10
7.3.2.8	Screening effectiveness:	Transfer impedance	5 - 15 MHz	≤ 5 mΩ	IEC 62153-4-7
			15 - 30 MHz	≤ 2,5 mΩ	
		Triaxial Tube in Tube Method	30 - 300 MHz	≥ 95 dB	
			300 - 470 MHz 470 - 950 MHz 950 - 2000 MHz	≥ 90 dB ≥ 85 dB ≥70 dB	

[9] A power surge of 1 kV pulse as specified in IEC 61000-4-5, level 2 (rise time 1.2 µsec/fall time 50 µsec) is put on the input before measurement.

Ethernet port requirements:

Item	Ethernet port	Remark	Specification	Protocol
7.3.2.9	Ethernet cable input		minimum category 6	IEC 61156-5
7.3.2.10	Type	Mounting Keystone Cat6	Wall Outlet or Keystone for modular use.	
7.3.2.11	Color-coding			EIA/TIA 568 A & B
7.3.2.12	Connectors		RJ45 with 50 µm gold plated contacts	IEC 60603-7-41:2010
7.3.2.13	Suitable for		10/100/1000 Base-T	
7.3.2.14	Test reports	All the requirements shall be verified on the basis of the vendor statement.	A full test report for verification to the IEC and EIA/TIA protocols must be supplied	Vendor statement

Table 7-4 Wall outlet HF combined with ethernetport

7.3.3 TWO WAY SPLITTER, EITHER WALL MOUNTED OR PUSH ON.

Item	Description	Remark	Specification		Measurement Protocol
7.3.3.1	Impedance	5 - 1218MHz	75 Ω		Vendor statement
7.3.3.2	Connector in/out		F and/or IEC		Appendix B, C
7.3.3.3	Insertion loss in > out	5 - 860 MHz	3,7±0,3 dB		IEC 60728-4 §4.3
		860 - 1006 MHz	4,0±0,4 dB		
		1006 - 1218 MHz	4,4 ±0,5 dB		
7.3.3.4	Return loss	5 - 12 MHz	≥ 13 dB		IEC 60728-4 §4.6
		12 - 40 MHz	≥ 20 dB		
		40 - 1218 MHz	≥ 20 dB - 1.5 dB/oct.		
7.3.3.5	Isolation out > out	5 - 15 MHz	≥ 20 dB		IEC 60728-4 §4.2
		15 - 40 MHz	≥ 26 dB		
		40 - 1218 MHz	≥ 26 dB - 1.5 dB/oct.		
7.3.3.6	Intermodulation	While applying two carriers (60 & 65 MHz), out to out, @ 115 dBµV, after a 1kV pulse (1,2µS rise time/50µS duration) has been applied at each port.	A minimum IMD of -105 dBc shall be measured at the output(s)		Test setup according to IEC 60728-4 §4.8
7.3.3.7	Screening effectiveness:	Transfer impedance	5 - 15 MHz	≤ 5 mΩ	IEC 62153-4-7
			15 - 30 MHz	≤ 2,5 mΩ	
			30 - 300 MHz	≥ 95 dB	

Item	Description	Remark	Specification		Measurement Protocol
		Triaxial Tube in Tube Method	300 - 470 MHz 470 - 950 MHz 950 - 1218 MHz	≥ 90 dB ≥ 85 dB ≥70 dB	

Table 7-5 Two way splitter

Remark: Splitters are restricted to 1218 MHz due to the contact pressure demands of the f-connectors and the PIM demands of the ferrite. Beside this, the expectation is that no frequencies above 1218 MHz will be transported over the " in-home network" in the future.

7.3.4 THREE WAY SPLITTER, EITHER WALL MOUNTED OR PUSH ON.

Item	Description	Remark	Specification		Measurement Protocol
7.3.4.1	Impedance	5 - 1218 MHz	75 Ω		Vendor statement
7.3.4.2	Connector in/out		F and/or IEC		Appendix B, C
7.3.4.3	Insertion loss in > out	5 - 860 MHz	5,7 ± 0,3 dB		IEC 60728-4 §4.3
		860 - 1006 MHz 1006 - 1218 MHz	6,0 ± 0,4 dB 6,4 ± 0,5 dB		
7.3.4.4	Return loss	5 - 12 MHz	≥ 13 dB		IEC 60728-4 §4.6
		12 - 40 MHz	≥ 20 dB		
		40 - 1218 MHz	≥ 20 dB - 1.5 dB/oct.		
7.3.4.5	Isolation out > out	5 - 15 MHz	≥ 20 dB		IEC 60728-4 §4.2
		15 - 40 MHz	≥ 26 dB		
		40 - 1218 MHz	≥ 26 dB - 1.5 dB/oct.		
7.3.4.6	Intermodulation	While applying two carriers (60 & 65 MHz), out to out, @ 115 dBµV, after a 1kV pulse (1,2µS rise time/50µS duration) has been applied at each port.	A minimum IMD of -105 dBc shall be measured at the output(s)		Test setup according to IEC 60728-4 §4.8
7.3.4.7	Screening effectiveness:	Transfer impedance	5 - 15 MHz	≤ 5 mΩ	IEC 62153-4-7
			15 - 30 MHz	≤ 2,5 mΩ	
		Triaxial Tube in Tube Method	30 - 300 MHz	≥ 95 dB	
			300 - 470 MHz 470 - 950 MHz 950 - 1218 MHz	≥ 90 dB ≥ 85 dB ≥70 dB	

Table 7-6 Three way splitter

Remark: Splitters are restricted to 1218 MHz due to the contact pressure demands of the f-connectors and the PIM demands of the ferrite. Beside this, the expectation is that no frequencies above 1218 will be transported over the " in home network" in the future.

7.3.5 FOUR WAY SPLITTER, EITHER WALL MOUNTED OR PUSH ON.

Item	Description	Remark	Specification		Measurement Protocol
7.3.5.3	Impedance	5 - 1218 MHz	75 Ω		Vendor statement
7.3.5.2	Connector in/out		F and/or IEC		Appendix B, C
7.3.5.3	Insertion loss in > out	5 - 860 MHz	7,3 ± 0,3 dB		IEC 60728-4 §4.3
		860 - 1006 MHz	7,6 ± 0,4 dB		
		1006 - 1218 MHz	8,0 ± 0,5 dB		
7.3.5.4	Return loss	5 - 12 MHz	≥ 13 dB		IEC 60728-4 §4.6
		12 - 40 MHz	≥ 20 dB		
		40 - 1218 MHz	≥ 20 dB - 1.5 dB/oct.		
7.3.5.5	Isolation out > out	5 - 15 MHz	≥ 20 dB		IEC 60728-4 §4.2
		15 - 40 MHz	≥ 26 dB		
		40 - 1218 MHz	≥ 26 dB - 1.5 dB/oct.		
7.3.5.6	Intermodulation	While applying two carriers (60 & 65 MHz), out to out, @ 115 dBµV, after a 1kV pulse (1,2µS rise time/50µS duration) has been applied at each port.	A minimum IMD of -105 dBc shall be measured at the output(s)		Test setup according to IEC 60728-4 §4.8
7.3.5.7	Screening effectiveness:	Transfer impedance	5 - 15 MHz	≤ 5 mΩ	IEC 62153-4-7
			15 - 30 MHz	≤ 2,5 mΩ	
		Triaxial Tube in Tube Method	30 - 300 MHz	≥ 95 dB	
			300 - 470 MHz 470 - 950 MHz 950 - 1218 MHz	≥ 90 dB ≥ 85 dB ≥70 dB	

Table 7-7 Four way splitter

Remark: Splitters are restricted to 1218 MHz due to the contact pressure demands of the f-connectors and the PIM demands of the ferrite. Beside this, the expectation is that no frequencies above 1218 will be Transported over the ” in-home” network in the future.

7.3.6 COAX 12 INDOOR MOUNTING CABLE

Product description: **For measurement purposes the tested samples (length 6 m) shall be fitted with Kabel Keur certified F-type connectors. Applicant is responsible for correct fitting of the connectors supplied by KMI.**

Item	Description	Remark	Specification	Tolerance	Measurement protocol
7.3.6.1	Impedance	5 - 2000 MHz	75 Ω		Vendor statement
7.3.6.2	Material center conductor		Solid copper / silver cladded copper		Vendor statement
7.3.6.3	Material outer conductor		Aluminum/copper laminated foil which is bonded to the dielectric, a tinned, copper cladded or full copper braid or a combination		Vendor statement
7.3.6.4	Material dielectric		PE		Vendor statement
7.3.6.5	Material jacket: UV resistent	The cable should meet the NEN 8012(CPR), class Cca.	The PVE assumes a minimal fire class: Cca, concerning simple low rise buildings.		Vendor statement
7.3.6.6	Bend without damage and electrical defects	90 degrees angle	70 mm radius		Bend and stretch cable four times in the specified angle and bending radius. Inspect for visible damage
7.3.6.7	Insertion loss	@ 862 MHz	≤ 27 dB/100m		IEC 60728-4 §4.3
7.3.6.8	Return loss	5 - 30 MHz	≥ 27 dB		IEC 60728-4 §4.6 NEN-EN 50117-2-4
		30 - 470 MHz	≥ 23 dB		
		470 - 1006 MHz	≥ 20 dB		
		1006 - 2000 MHz	≥ 18 dB		
7.3.6.3	Screening effectiveness class A+	5 - 15 MHz	≤ 5 mΩ/m (transfer impedance)		IEC 62153-4-(3 -4) Triaxial method
		15 - 30 MHz	≤ 2,5 mΩ/m (transfer impedance)		
		30 - 1000 MHz	≥ 95 dB		
		1000 - 2000 MHz	≥ 85 dB		
7.3.6.10	Diameter jacket		7,00 mm	+ 0,0 mm / -0,7 mm	Vendor statement
7.3.6.11	Diameter dielectric		4,8 mm	± 0,2 mm	Vendor statement
7.3.6.12	Diameter dielectric plus foil		<5,1 mm		Micrometer method
7.3.6.13	Diameter Center conductor		0,7 - 1,15 mm		Micrometer method

Table 7-8 Coax 12 indoor mounting cable

7.3.7 COAX 9 INDOOR MOUNTING CABLE

Product description: **For measurement purposes the tested samples (length 6 m) shall be fitted with Kabel Keur certified F-type connectors. Applicant is responsible for correct fitting of the connectors supplied by KMI.**

Item	Description	Remark	Specification	Tolerance	Protocol
7.3.7.1	Impedance	5 - 2000 MHz	75 Ω		Vendor statement
7.3.7.2	Material center conductor		Solid copper / silver cladded copper		Vendor statement
7.3.7.3	Material outer conductor		Aluminum/copper laminated foil which is bonded to the dielectric, a tinned, copper cladded or full copper braid or a combination		Vendor statement
7.3.7.4	Material dielectric		PE or Gas injected PE		Vendor statement
7.3.7.5	Material jacket: UV resistent	The cable should meet the NEN 8012(CPR), class Cca.	The PVE assumes a minimal fire class: Cca, concerning simple low rise buildings.		Vendor statement
7.3.7.6	Bend without damage and electrical defects	90 degrees angle	70 mm radius		Bend and stretch cable four times in the specified angle and radius. Inspect for visible damage
7.3.7.7	Insertion loss	@ 860 MHz	18 dB/100m	+0% / -10%	IEC 60728-4 §4.3
7.3.7.8	Return loss	5 - 30 MHz	≥ 27 dB		IEC 60728-4 §4.6
		30 - 470 MHz	≥ 23 dB		
		470 - 1006 MHz	≥ 20 dB		
		1006 - 2000 MHz	≥ 18 dB		
7.3.7.9	Screening effectiveness class A+	5 - 15 MHz	≤ 5 mΩ/m (transfer impedance)		IEC 62153-4-(3-4) Triaxial method
		15 - 30 MHz	≤ 2,5 mΩ/m (transfer impedance)		
		30 - 1000 MHz	≥ 95 dB		
		1000 - 2000 MHz	≥ 85 dB		
7.3.7.10	Diameter jacket		7,10 mm	± 0,2 mm	
7.3.7.11	Diameter dielectric plus foil		<5,1 mm		Micrometer method
7.3.7.12	Diameter dielectric		4,80 mm	± 0,15 mm	
7.3.7.13	Diameter Center conductor		1,10 mm	± 0,05 mm	

Table 7-9 Coax 9 indoor mounting cable

7.3.8 ETHERNET INSTALLATION CABLE

Product description: Cable for Ethernet / IP transmission

Item	Description	Remark	Specification	Protocol
7.3.8.1	Type		Minimum Category 6.	**IEC 61156-5**
7.3.8.2	Material jacket: UV resistent	The cable should meet the NEN 8012(CPR), class Cca	The PVE assumes a minimal fire class: Cca, concerning simple low rise buildings.	Vendor statement
7.3.8.3	Wire pairs and diameter		AWG 23 solid copper wire min 0,57 mm.	
7.3.8.4	Test reports	All the requirements shall be verified on the basis of the vendor statement.	A full test report for verification to the IEC protocol must be supplied	Vendor report

Table 7-10 Ethernet installation cable

7.3.9 CONNECTORS AND ADAPTORS

Product description: an adaptor is a combination of two connectors. The specifications are valid for adaptors and separate connectors. For measurement purposes the tested samples shall be fitted with a Kabel Keur certified cable of 15 cm. Applicant is responsible for correct fitting of the cable and connectors supplied by KMI.

Item	Description HF connector	Remark	Specification		Protocol
7.3.9.1	Mounting principles	For F-type only	Not twist-on type		
7.3.9.2	Impedance	5 - 2000 MHz	75 Ω		Vendor statement
7.3.9.3	Pull force	Connector to connector, after 10 insertions	≥ 20 N		Appendix E[10]
7.3.9.4	Mechanical parameters				Appendix B, C
7.3.9.5	Return loss	5 - 40 MHz	≥ 20 dB		IEC 60728-4 §4.6
		40 - 2000 MHz	≥ 20 dB - 1.5 dB/oct.		
7.3.9.6	Screening effectiveness:	Transfer impedance	5 - 15 MHz	≤ 5 mΩ	IEC 62153-4-7
			15 - 30 MHz	≤ 2,5 mΩ	
		Triaxial Tube in Tube Method	30 - 300 MHz	≥ 95 dB	
			300 - 470 MHz 470 - 950 MHz 950 - 2000 MHz	≥ 90 dB ≥ 85 dB ≥70 dB	

Table 7-11 Connectors HF

[10] Push on male F connectors will be measured according to the procedure mentioned in appendix E.

Item	Description RJ 45 connector	Remark	Specification	Protocol
7.3.9.7	Connectors		RJ45 with 50 µm gold plated contacts	IEC 60603-7-41: 2010
7.3.9.8	Suitable for		10/100/1000 Base-T	
7.3.9.9	Test reports	All the requirements shall be verified based on the vendor statement.	A full test report for verification to the IEC protocol must be Supplied	Vendor report

Table 7-12 Connector RJ45

7.3.10 DIPLEX FILTER

Product description: RTV diplex/data filter

Item	Description	Remark	Specification		Protocol
7.3.10.1	Impedance	5 - 1006 MHz	75 Ω		Vendor statement
7.3.10.2	Connector in/out		In IEC female TV IEC male R IEC female		Appendix C
7.3.10.3	Insertion loss in -> TV	5 - 70 MHz	≤ 1,0 dB		IEC 60728-4 §4.3
		120 - 140 MHz	≤ 1,0 dB		
		140 - 862 MHz	≤ 0,5 dB		
		862 - 1006	≤ 0,8 dB		
7.3.10.4	Insertion loss in -> R	5 - 70 MHz	≥ 25,0 dB		IEC 60728-4 §4.3
		87,5 - 108 MHz	≤ 2,0 dB		
7.3.10.5	Return loss TV	5- 70 MHz 120 – 1006 MHz	≥14 dB ≥14 dB		IEC 60728-4 §4.6
7.3.10.6	Return loss R	87,5 - 108 MHz	≥10 dB		IEC 60728-4 §4.6
7.3.10.7.	Return loss In	5 - 70 MHz	≥14 dB		IEC 60728-4 §4.6
		87,5 - 108 MHz	≥10 dB		
		120 - 1006 MHz	≥14 dB		
7.3.10.8	Isolation TV-R	5 - 70 MHz	≥ 25 dB		IEC 60728-4 §4.2
		87,5 - 108 MHz	≥16 dB		
		120 - 1006 MHz	≥ 25 dB		
7.3.10.9	Screening effectiveness:	Transfer impedance	5 - 15 MHz	≤ 5 mΩ	IEC 62153-4-7
			15 - 30 MHz	≤ 2,5 mΩ	
			30 - 300 MHz	≥ 95 dB	

Item	Description	Remark	Specification		Protocol
		Triaxial Tube in Tube Method	300 - 470 MHz 470 - 950 MHz 950 - 1006 MHz	≥ 90 dB ≥ 85 dB ≥70 dB	

Table 7-13 Diplex filter

7.3.11 PORT TERMINATOR

Product description: Termination resistor

Item	Description	Remark	Specification		Protocol
7.3.11.1	Impedance	5 - 2000 MHz	75 Ω		Vendor statement
7.3.11.2	Frequency range	5 - 2000 MHz			
7.3.11.3	Return loss	5 - 40 MHz	≥ 20 dB		IEC 60728-4 §4.6
		40 - 2000 MHz	≥ 20 dB - 1.5 dB/oct.		
7.3.11.4	Torque (rotation) F-type (if applicable)		≥ 5 Nm		
7.3.11.5	Connector		F/IEC-connector		Appendix B, C
7.3.11.6	Screening effectiveness:	Transfer impedance	5 - 15 MHz	≤ 5 mΩ	IEC 62153-4-7
			15 - 30 MHz	≤ 2,5 mΩ	
		Triaxial Tube in Tube Method	30 - 300 MHz	≥ 95 dB	
			300 - 470 MHz 470 - 950 MHz 950 - 2000 MHz	≥ 90 dB ≥ 85 dB ≥70 dB	

Table 7-14 Termination resistor

7.3.12 COAX CABLE (EQUIPMENT FLY-LEAD)

Product description: coaxial cable with fixed connectors

Item	Description	Remark	Specification	Measurement Protocol
7.3.12.1	Impedance	5 - 2000 MHz	75 Ω	Vendor statement
7.3.12.2	Bend without damage and electrical defects	90 degrees angle	75 mm radius	Bend and stretch cable four times in the specified angle and radius. Inspect for visible damage
7.3.12.3	Connector in / out		F and / or IEC	Appendix B, C
7.3.12.4	F male max. nut torque	When equipped with F-connectors	3,95 Nm	
7.3.12.5	Return loss	5 - 40 MHz	≥ 20 dB	IEC 60728-3[11]
		40 - 2000 MHz	≥ 20 dB - 1.5 dB/oct.	
7.3.12.6	Insertion Loss	Measurement freq. 862 MHz	Cable attenuation ≤0,5 dB/m, connector loss ≤ 0,4 dB per connector, max. fly-lead attenuation ≤ 5,8 dB	IEC 60728-4 §4.3[10]
7.3.12.7	Intermodulation	While applying two carriers (60 & 65 MHz), out to out, @ 115 dBµV, after a 1kV pulse (1,2µS rise time/50µS duration) has been applied at each port.	A minimum IMD of -105 dBc shall be measured at the output(s)	Test setup according to IEC 60728-4 §4.8
7.3.12.8	Screening effectiveness A++	5 - 15 MHz	≤ 5 mΩ/m (transfer impedance)	IEC 62153-4- (3-4) Triaxial method
		15 - 30 MHz	≤ 2,5 mΩ/m (transfer impedance)	
		30 - 1000 MHz	≥ 105 dB	
		1000 - 2000 MHz	≥ 95 dB	

Table Coax flylead

[11] A pull force of 60 N is applied to the housing of the connectors in the direction of the cable for 60 seconds before the measurement.

7.3.13 HDMI cable (4K)

Product description: HDMI (High-Definition Multimedia Interface) is a compact audio/video interface for transmitting uncompressed digital data. HDMI supports, on a single cable, any TV or PC video format, including standard, enhanced, and high-definition video, up to 8 channels of digital audio and the Consumer Electronics Control signal.

Item	Description	Remark	Specification	Protocol
7.3.13.1	Construction		Fully shielded cable. Molded ends. Inner hood connected 360 degrees to the connector for complete end shielding.	HDMI Specification High Speed (category 2 or higher)
7.3.13.2	Interface		HDMI-A Interface	HDMI Specification High Speed (category 2 or higher)
7.3.13.3	Marking		HDMI label is printed on the connector	Label format corresponding to www.hdmi.org
7.3.13.4	HDMI approved	All the requirements shall be verified on the basis of the vendor statement.	The vendor must provide a certificate of HDMI ATC compliance and an ATC testing result	Vendor certificate

Table 7-15 HDMI cable

7.3.14 Ethernet patch cable

Product description: Twisted pair patch cable

Item	Description	Remark	Specification	Protocol
7.3.14.1	Type		Minimum Category 6	IEC 61156-5
7.3.14.2	Wire pairs and diameter		AWG 23 stranded wire min 0,57 mm.	
7.3.14.3	Connectors		RJ45 with 50 µm gold plated contacts	IEC 60603-7-41:2010
7.3.14.4	Suitable for		10/100/1000 Base-T	
7.3.14.5	Max. length		30 m	
7.3.14.6	Test reports	All the requirements shall be verified on the basis of the vendor statement.	A full test report for verification to the IEC protocol must be supplied	Vendor test report

Table 7-16 Ethernet patch cable

7.4 TECHNICAL REQUIREMENTS ACTIVE COMPONENTS

7.4.1 AMPLIFIER 862 MHZ

Product description: Amplifier (862 MHz) with one or multiple outputs. Wall mounted or push-on.

Item	Description		Remark	Specification	Tolerance	Protocol
7.4.1.1	Gain forward path (port – port) range		85 - 862 MHz	1 - 9 dB equal or stepped and not adjustable	± 1,5 dB[12]	IEC60728-3 §5.6
7.4.1.2	Cable compensating slope		85 - 862 MHz	≤ 1,5 dB, see figure 1		
7.4.1.3	Gain return path (port – port) range - Forward gain ≥7 dB - Forward gain <7 dB - Gain ripple/error		5 - 65 MHz	 0 - 5 dB 0 - 2 dB	 ± 1,0 dB	IEC60728-3 §5.6
7.4.1.4	Connectors in- out			F and/or IEC		Appendix B, C
7.4.1.5	Isolation	RF-In to Outputs	5 - 65 MHz	≥ 26 dB		IEC 60728-4 §4.2
		Outputs to RF-In	85 - 862 MHz	≥ 26 dB		
		Outputs to Outputs	5 - 15 MHz	≥ 20 dB		
		Outputs to Outputs	15 - 65 MHz	≥ 30 dB		
		Outputs to Outputs	85 - 862 MHz	≥ 26 dB		
7.4.1.6	Return loss input		5 - 40 MHz	≥ 18 dB		IEC60728-3 §5.5
			40 - 65 MHz	≥ 18 dB - 1.5 dB/oct., ≥ 10 dB		
			85 - 862 MHz	≥ 18 dB F > 40 MHz - 1.5 dB/oct., ≥ 10 dB		
7.4.1.7	Return loss output		5 - 40 MHz	≥ 18 dB		IEC60728-3 §5.5
			40 - 65 MHz	≥ 18 dB - 1.5 dB/oct., ≥ 10 dB		
			85 - 862 MHz	≥ 18 dB (F > 40 MHz - 1.5 dB/oct., ≥ 10 dB		
7.4.1.8	Noise figure		5 - 65 MHz 85 - 862 MHz	≤ 18 dB ≤ 8 dB		IEC 60728-3 §4.4
7.4.1.9	Nominal input level (PAL)			≤ 77 dBµV		
7.4.1.10	Forward path distortion	Noise Power Ratio with a load: 75 * 256 QAM 8 MHz signals from 256 MHz to 862 MHz. Output level over 8 MHz: (68 + gain), (70 + gain) (72 + gain) dBuV.		CINR better than 50 dB.		

[12] Gain forward path tolerance including temperature variation and gain ripple are indicated in figure 7.1 and 7.2.

Item	Description		Remark	Specification	Tolerance	Protocol
7.4.1.11	Reverse path distortion (in band)	Noise Power Ratio curve with a load: 6 * 64 QAM 6,4 MHz signals from 5 MHz tot 65 MHz. Output level over 6,4 MHz: (104 + gain), (108 + gain), (112 + gain) dBuV.		CINR better than 45 dB.		
7.4.1.12	Reverse path distortion into forward path	While applying a load: 2 * 64 QAM 6,4 MHz upstream signal, at 50 MHz and 60 MHz. Input level over 6,4 MHz: 112 dBuV.		Distortion level at the downstream output: ≤ 10 dBuV over 6,4 MHz.		After 1 kV pulse (1,2 µs rise time and 50 µS duration) at the downstream input.
7.4.1.13	Spurious/oscillation		5 - 65 MHz 85 - 862 MHz	≤ -20 dBµV	To be measured on all in- and output ports. All ports terminated.	Measuring method spectrum analyzer, no additional signals connected
7.4.1.14	Group delay 5-10 MHz		Δ 2 MHz	≤ 30 ns		IEC 60728-3 §5.9
	Group delay 10-65 MHz		Δ 2 MHz	≤ 10 ns		
	Group delay 85-120 MHz		Δ 4,43 MHz	≤ 20 ns		
	Group delay 120-862 MHz		Δ 4,43 MHz	≤ 10 ns		
7.4.1.15	Surge protection		1 kV on input, rise time 1.2 µsec/fall time 50 µsec			IEC 60728-11 §10
7.4.1.16	Galv. Isolation 2120 V DC ≥ 1 min.		Inner conductor input >inner conductor output	≤ 0.7 mA >3 MΩ		IEC 60728-11 §10
7.4.1.17	Galv. Isolation 230 V AC		Inner conductor input >inner conductor output	≤ 8.0 mA RMS		IEC 60728-11 §10
7.4.1.18	Screening effectiveness, class A		5 - 30 MHz 30 - 300 MHz 300 - 470 MHz 470 - 862 MHz	≥ 85 dB ≥ 85 dB ≥ 80 dB ≥ 75 dB		IEC 60728-2
7.4.1.19	Operating temperature range			0 – 40 ^{0}C		Vendor statement
7.4.1.20	Power		Including power supply if applicable	< 5 W		
7.4.1.21	Grounding		Not applicable for push-on amplifiers	Connection for 2,5 mm cable		
7.4.1.22	Port termination		n-1 output have a 75 ohm termination			

Table 7-17 Amplifier 862 MHz

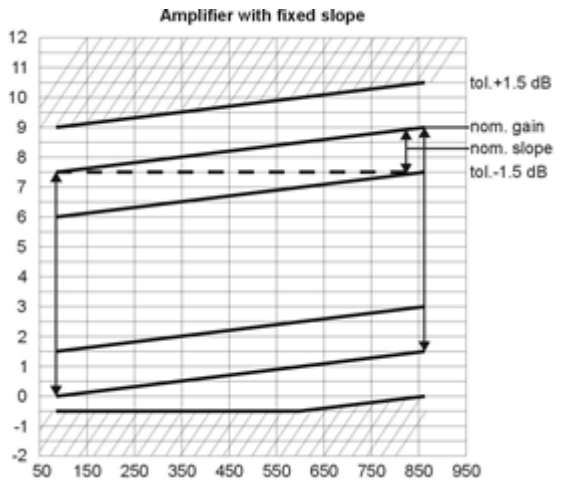


Figure 7-1 Amplifier with fixed gain (862 MHz)

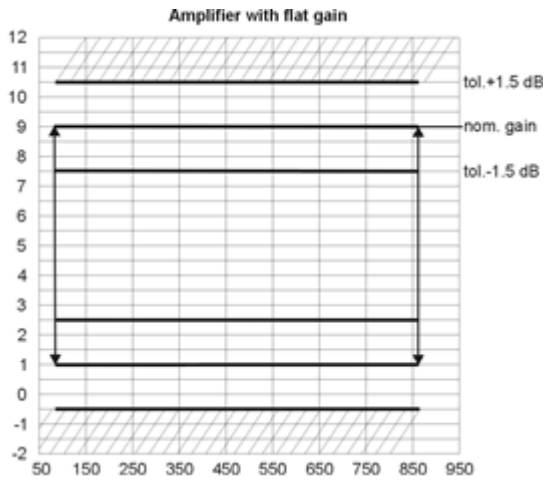


Figure 7-2 Amplifier with flat gain (862 MHz)

7.4.2 AMPLIFIER 1218/65 MHZ

Product description: Amplifier (1218 MHz downstream, 65 MHz upstream) with one or multiple (n) outputs, wall mounted or push-on.

Item	Description		Remark	Specification	Tolerance	Protocol
7.4.2.1	Gain forward path (port – port) range		85 - 1218 MHz	1 - 11,5 dB equal or stepped and not adjustable	± 1,5 dB[13]	IEC60728-3 §5.6
7.4.2.2	Cable compensating slope		85 - 1218 MHz	≤ 2,5 dB, see figure 2		
7.4.2.3	Gain return path (port – port) range - Forward gain ≥7 dB - Forward gain <7 dB - Gain ripple/error		5 - 65 MHz	 0 - 5 dB 0 - 2 dB	 ± 1,0 dB	IEC60728-3 §5.6
7.4.2.4	Connectors in- out			F and/or IEC		Appendix B, C
7.4.2.5	Isolation	RF-IN to Outputs	5 - 65 MHz	≥ 26 dB		IEC 60728-4 §7.4.2
		Outputs to RF-IN	85 - 1218 MHz	≥ 26 dB		
		Outputs to Outputs	5 - 15 MHz	≥ 20 dB		
		Outputs to Outputs	15 - 65 MHz	≥ 30 dB		
		Outputs to Outputs	85 - 1218 MHz	≥ 26 dB		
7.4.2.6	Return loss input		5 - 40 MHz	≥ 18 dB		IEC60728-3 &5.5
			40 - 65 MHz	≥ 18 dB - 1.5 dB/oct.		
			85 - 1218 MHz	≥ 18 dB - 1.5 dB/oct., ≥ 10 dB		
7.4.2.7	Return loss output		5 - 40 MHz	≥ 18 dB		

[13] Gain forward path tolerance including temperature variation and gain ripple are indicated in figure 7.3 and 7.4.

Item	Description	Remark	Specification	Tolerance	Protocol
		40 - 65 MHz	≥ 18 dB - 1.5 dB/oct.		
		85 - 1218 MHz	≥ 18 dB F > 40 MHz - 1.5 dB/oct., ≥ 10 dB		
7.4.2.8	Noise figure	5 - 65 MHz 85 - 1218 MHz	≤ 18 dB ≤ 8 dB		IEC 60728-3 §4.4
7.4.2.9	Nominal input level (PAL)		≤ 77 dBuV		
7.4.2.10	Forward path distortion	Noise Power Ratio with a load: 92 * 256 QAM 8 MHz signals and 1 * OFDM 192 MHz signal (at the end of the band) from 256 MHz to 1218 MHz. Output level over 8 MHz: (68 + gain), (70 + gain) (72 + gain) dBuV.		CINR better than 50 dB.	
7.4.2.11	Return path distortion (in band)	Noise Power Ratio curve with a load: 6 * 64 QAM 6,4 MHz signals from 5 MHz tot 65 MHz. Output level over 6,4 MHz: (104 + gain), (108 + gain), (112 + gain) dBuV.		CINR better than 45 dB.	
7.4.2.12	Reverse path distortion into forward path	While applying a load: 2 * 64 QAM 6,4 MHz upstream signal, at 50 MHz and 60 MHz. Input level over 6,4 MHz: 112 dBuV.	Distortion level at the downstream output: ≤ 10 dBuV over 6,4 MHz.		After 1 kV pulse (1,2 µs rise time and 50 µS duration) at the downstream input.
7.4.2.13	Spurious/oscillation	5 - 65 MHz 85 - 1218 MHz	≤ -20 dBµV	To be measured on all in- output ports. All ports terminated.	Measuring method spectrum analyzer, no additional signals connected
7.4.2.14	Group delay 5-10 MHz	Δ 2 MHz	≤ 30 ns		IEC 60728-3 §5.9
	Group delay 10-65 MHz	Δ 2 MHz	≤ 10 ns		
	Group delay 85-120 MHz	Δ 4.43 MHz	≤ 20 ns		
	Group delay 120-1218 MHz	Δ 4.43 MHz	≤ 10 ns		
7.4.2.15	Surge protection	1 kV on input, rise time 1,2 µsec/fall time 50 µsec			IEC 60728-11 §10
7.4.2.16	Galv. Isolation 2120 V DC ≥ 1 min.	Inner conductor input >inner conductor output	≤ 0.7 mA ≥3 MΩ		IEC 60728-11 §10
7.4.2.17	Galv. Isolation 230 V AC	Inner conductor input >inner conductor output	≤ 8.0 mA RMS		IEC 60728-11 §10
7.4.2.18	Screening effectiveness, class A	5 - 30 MHz 30 - 300 MHz 300 - 470 MHz 470 - 1218 MHz	≥ 85 dB ≥ 85 dB ≥ 80 dB ≥ 75 dB		IEC 60728-2

Item	Description	Remark	Specification	Tolerance	Protocol
7.4.2.19	Operating temperature range		0 - +400 C		Vendor statement
7.4.2.20	Power	Not applicable for push-on amplifiers	< 5 W		
7.4.2.21	Grounding		Connection for 2,5 mm cable		
7.4.2.22	Port termination	n-1 output have a 75 ohm termination			

Table 7-18 Amplifier 1218/65 MHz

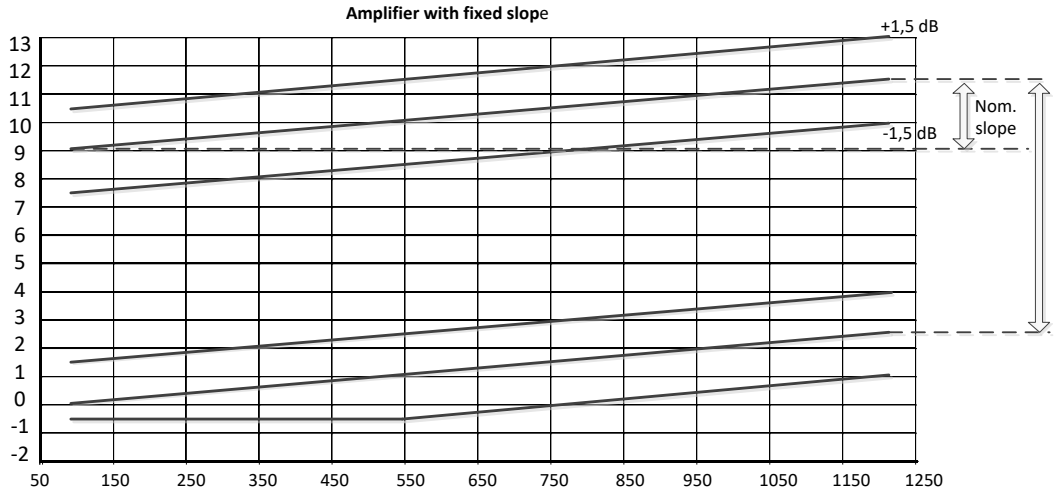


Figure 7-3 Amplifier with fixed slope (1218/65 MHz)

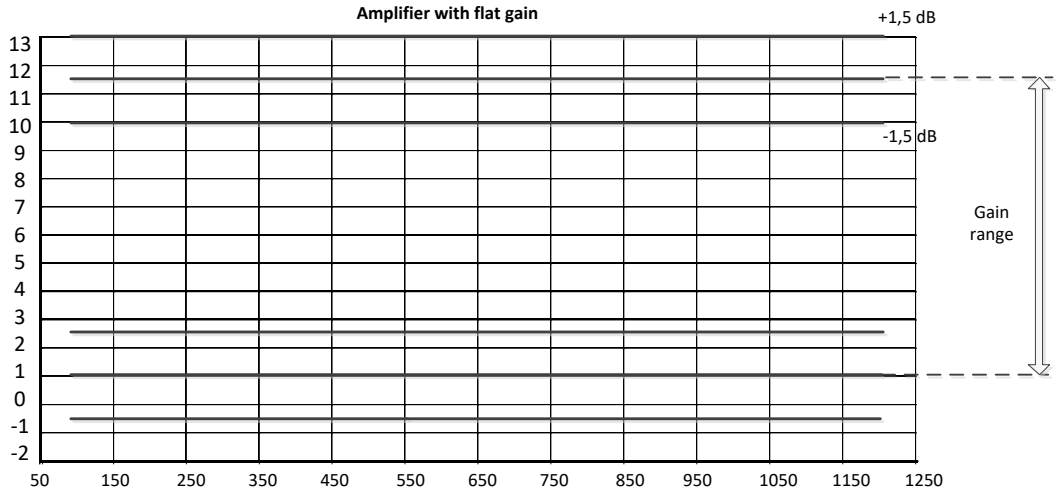


Figure 7-4 Amplifier with flat gain (1218/65 MHz)

APPENDIX

I. Definitions

"Kabel Keur"	"Kabel Keur" is a Dutch certification mark, owned by VodafoneZiggo. Products carrying this mark as a label enable, if applied properly, the construction of a high quality in-home Multimedia network in order to enjoy most of products and services provided by Dutch cable operators
Consumer packaging	A packaging for end-user application.
Factory packaging	A packaging for private label companies and installation contractors. Not for end-user sale / resell purposes.
Coaxial cable	Asymmetrical cable that is in this context the most suitable transport medium for Multimedia signals of a broad frequency spectrum.
Wall outlet	A device to connect the customer equipment to the fixed in-house network.
Splitter	A device that is a part of the connection between one source to two or more destinations in a multimedia coaxial home network.
Connector	A device that connects a coaxial cable to a source or a destination in a multimedia home network.
Adaptor	A device that enables matching between two connections.
Amplifier	A device that is able to increase the signal level to cover larger distances or/and to split the signal.
HDMI cable	HDMI cable (High-Definition Multimedia Interface) is a compact cable for transmitting uncompressed digital data.
Diplex filter	A device that combines or separates frequency ranges.
Terminator	A device that terminates a connection.
Special product	A product specially designed for a single Dutch Cable Operator.
Kabel Keur requirements document (aka "Programma van Eisen", aka PvE)	The document the describes all requirements that products have to meet to obtain the "Kabel Keur" certification mark, as well as guidelines and instructions for the use of the "Kabel Keur" certification mark.
Amendment	Changes, additions to the requirements document, being an integral part of the current requirements document.
Private label products	Certified products that are sold under a different (private) label.
College of Experts (CoE)	Experts drafting the requirements within the requirements document.
Dutch Cable Operators	Dutch HFC based Multi Service Operators (MSO's) .
NLkabel	The former association of Dutch cable operators. This association was founder of Kabel Keur. The association existed till the end of 2016 as Ziggo withdraw their membership. Remaining members founded NLConnect as a new branch organization.
Participating partners	Parties involved in Kabel Keur certification.
Certification Agency	Independent institute contracted by VZ to execute the qualification process.
Qualified product certification agency	A qualified product certification agency is an institution accredited by the Council of accreditation (Netherlands), or foreign sister organization, for the concerned subject. The council of accreditation must be dovetailed to the European Cooperation for Accreditation and/or international Accreditation forum, INC.
Qualified lab or laboratory	A qualified lab or laboratory is a test facility which has sufficient competence for performing the measurements. This means qualified and experienced lab technicians and sufficient test equipment to make possible reproducible measurements
Vendor statement	A written statement that a product fulfills a requirement in the PVE.

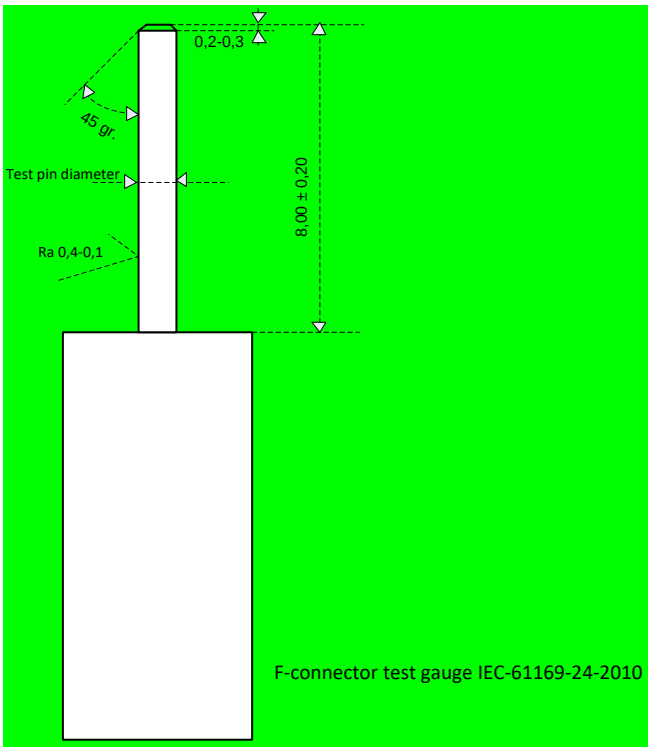
II. Normative references

Reference norm	Name	Version
NEN-EN 50083-2	Cable networks for television signals, sound signals and interactive services - Part 2: Electromagnetic compatibility for equipment	2012
NEN-EN 50083-2:A1	Amendment A1	2015
NEN-EN 50117-2-1	Coaxial cables - Part 2-1: Sectional specification for cables used in cabled distribution networks - Indoor drop cables for systems operating at 5 MHz - 1000 MHz	2005
NEN-EN 50117-2-4	Coaxial cables - Part 2-4: Sectional specification for cables used in cabled distribution networks - Indoor drop cables for systems operating at 5 MHz - 3000 MHz	2004
NEN-EN 50117-2-4:A1	Amendment A1	2008
NEN-EN 50117-2-4:A2	Amendment A2	2013
NEN-EN 50289-1-6	Communication cables - Specifications for test methods Part 1-6: Electrical test methods - Electromagnetic performance	2002
IEC 61000-4-5	Electromagnetic compatibility (EMC) Part 4-5: Testing and measurement techniques - Surge immunity test	2014
IEC 60068-1	Environmental testing – Part 1: General and guidance	2014
NEN-IEC 60728-2	Cable networks for television signals, sound signals and interactive services - Part 2: Electromagnetic compatibility for equipment	2010
NEN-EN-IEC 60728-3	Cable networks for television signals, sound signals and interactive services – Part 3: Active wideband equipment for cable networks	2011
NEN-EN-IEC 60728-4	Cable networks for television signals, sound signals and interactive services - Part 4: Passive wideband equipment for coaxial cable networks	2008
NEN-EN-IEC 60728-11	Cable networks for television signals, sound signals and interactive services - Part 11: Safety	2017
NEN-EN-IEC 61169-1	NEN-EN-IEC 61169-1:2013 en - Radio-frequency connectors - Part 1: Generic specification - General requirements and measuring methods	2013
NEN-EN-IEC 61169-2	Radio-frequency connectors - Part 2: Sectional specification - Radio frequency coaxial connectors of type 9,52	2007
NEN-EN-IEC 61169-24	Radio-frequency connectors - Part 24: Sectional specification - Radio frequency coaxial connectors with screw coupling, typically for use in 75 Ω cable networks (type F)	2010
NEN-EN-IEC 62153-4-3 NEN-EN-IEC 62153-4-4 NEN-EN-IEC 62153-4-7	Metallic communication cable and components test methods: Electromagnetic compatibility (EMC) Test method for: Screening attenuation, transfer impedance with Triaxial method.	3: 2013 4: 2015 7: 2016

III. F-connectors

Description of F-connectors
This type of connectors has screw locking with a 3/8-32UNEF-2”B” thread. Normally, the plug will be a free connector, the socked a fixed connector. The design of the male connector is such that the inner conductor of the cable serves as the male contact. The physical characteristics of the F-connector must be accordance the dimensions as stated in IEC 61169-24 2010.

Test gauge F-female connector



The female contact of the F-connector shall at least be able to accept male contacts/test gauges with a diameter range between **0,70-1,2** mm.

Clamp force/withdrawal test
To verify that the center female contact of the socket does **not suffer from deformation,** when mated with the range of inner conductors specified, a test has been prescribed which measures the force, required to withdraw the selection of precision test gauges, out of the female connector under test.

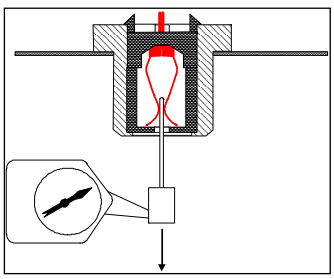


Figure 4: Example of Clamp force test set up

General Products					
Test sequence	1	2	3	4	5
Test gauge diameter (mm)	0,70	1,20	0,70	1,20	0,70
Clamping force min. (grams)	115		115		115
Clamping force tests must be performed at room temperature					
Test gauge tolerance: +/- 0.01 mm					

Insertion force test
To verify that the range of center male contacts of the connector does **not suffer from deformation** when mated with the inner socket conductor, a test has been prescribed which measures the force, required to insert the selection of precision test gauges, into the female connector under test.

Depending on the test gauge diameter a sliding scale of the insertion force is presented in the table below:

	General Products			
Test sequence	1	2	3	4
Test gauge diameter (mm)	0,70	0,80	1,136	1,20
Insertion force (grams)	≤ 800	≤ 1500	≤ 2000	≤ 3000
	Test must be performed at room temperature			
	Test gauge tolerance: +/- 0,01 mm			

The insertion force applied at the applicable test gauge diameter, as mentioned in this table, shall not exceed mentioned insertion force values.

Mechanical strength/withstand tightening torque
The F-ports shall be able to withstand the minimum specified tightening torque of 5 Nm without damage.

IV. IEC-connectors

Description of IEC type connectors (type 9,52)
This type of connector has a push pull fitting with or without locknut (M14). Normally, the plug will be a free connector, the socked a fixed connector. The physical characteristics of the IEC-connector should be accordance the dimensions as stated in IEC 61169-2, 2007, except for the deviations stated below.

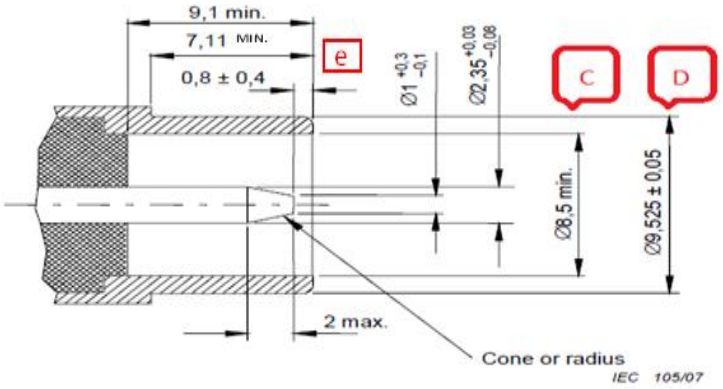
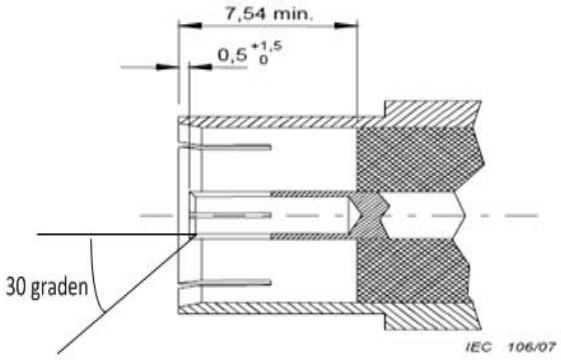


Figure 1a – Sliding male connector

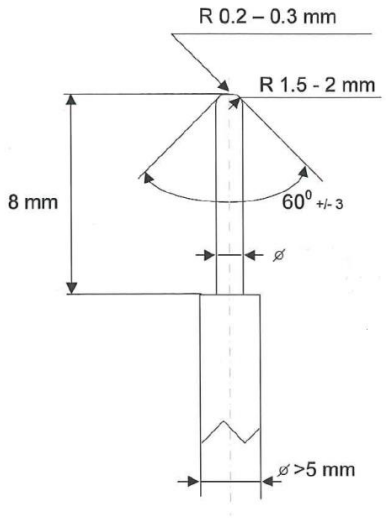


For the IEC connector, without M14 locknut, the length of the outer conductor, size "e", shall be extended from 7,11 mm tot 9,0 mm, Tolerance -0 mm +0,2 mm.

For molded IEC-connectors there are relaxations to the dimensions as stated in IEC-61169-2:
- For size "C" there is a relaxation from 8,5 mm min. to 7,9 mm min. due to tooling angle.
- For size "D" there is a relaxation from 9,525 ± 0,05 mm (9,475 to 9,575 mm) to 9,45 - 9,57 mm (no tolerance).

IEC acceptance tests
These tests are to determine:
A. Resilience of the inner-conductor of the female connector.
B. Resilience of the outer-conductor of the female connector.
C. Torque resistance of the inner-pin of the male connector.

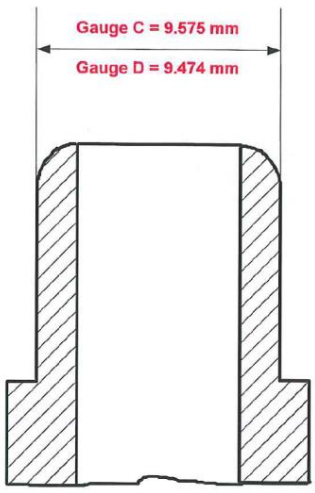
A. The test gauge dimensions for "**resilience tests of the inner-conductor**" are shown as follows:



	Dimensions (mm)	
		Tolerance
Test gauge A Ø	2,40	0,- -0,01
Test gauge B Ø	2,29	+0,01, 0
Weight of test gauge B should be 80 grams		

First insert the test gauge A with the maximum diameter. This gauge must be inserted fully into the inner-conductor of the IEC-female connector. Then insert fully the test gauge B with the minimum diameter. The test gauge B must not fall out after inserting the maximum diameter gauge A and sufficient clamping force should be left.

B. The test gauge dimensions for "**resilience tests of the outer-conductor**" are:



	Dimensions (mm)	
		Tolerance
Test gauge C Ø	9,575	0, -0,01
Test gauge D Ø	9,474	+0,01, 0
Weight of test gauge D should be 500 grams		

First insert the test gauge C with maximum diameter, this gauge must be inserted fully into the outer-conductor of the IEC-female connector.
Then insert the test gauge D with the minimum diameter. Test gauge D must not fall out after inserting the maximum diameter gauge C and sufficient clamping force should be left.

Torque resistance of inner-pin
This test is to check rotation of the inner-conductor of the IEC-male connector.
The inner-pin must withstand an applied force of **0,2 Nm without any signs of rotation** or damage.

Torque test example:

V. Cable clamp of wall outlets

Description of center conductor construction
The type of the cable clamp and its center conductor construction is depending on the manufacturer. The design of the center conductor construction should be such that the inner conductor of the cable serves as the male contact.

Physical dimensions
Depending on supplier construction.

Mechanical strength/withstand tightening torque
N/A

Test gauge acceptance cable clamp center conductor construction
The center conductor construction of a cable clamp regarding Wall Outlets shall at least be able to accept male contacts/test gauges with a diameter range between 0,70-1,2 mm according to the F-connector center conductor.

Clamp force/withdrawal test

Center conductor with a spring construction only:
To verify that the center conductor construction of the cable clamp does not suffer from deformation when mated with the range of inner conductors specified, the same test as for the F-connector center conductor shall be applied.

Center conductor with spring construction in combination with fixing screw:

Wall Outlet center conductor construction		
Test sequence	1	2
Test gauge diameter (mm)	0,70	1,2
Clamping force min. (grams)	115	180
Clamping force tests must be performed with a duration of 10 seconds and at room temperature		
Test gauge tolerance: +/- 0,01 mm		

Insertion force test
To verify that the center conductor construction of the cable clamp does not suffer from deformation when mated with the range of inner conductors specified, the same test as with the F-connector inner conductor shall be applied.

VI. Pull force IEC connector

The pull force is the force required to pull an IEC connector fully out, without mechanical assistance.
The Connector Under Test shall be new and unused.
The extraction force measurement shall be done after a number of insert/extract cycles. The test uses a hardened steel gauge conform to the dimensions given in IEC 61169-2. No lubrication of the test gauge is permitted for any of the tests.

- Insert/extract the test gauge fully, co-axially, ensuring there is no side force applied.
- Apply 10 insertion/extraction cycles.
- Physically inspect the terminals and body of the connector for wear, and test for electrical continuity.
- If the connector meets the pass/fail criteria, continue the test.

Use a gauge A (IEC 621169-2) to measure the extraction force of the connector.

- Insert the test gauge fully co-axially ensuring there is no side force applied.
- Measure and record the extraction force.

Pass/fail criteria:

- The extraction force shall be within the limits: 30 N≥ force ≥ 20 N.
- Physically inspect the terminals and body of the connector for wear, and test for electrical continuity.

VII. Measurement protocol ferrite HDMI cable

Ferrite specification and test method:

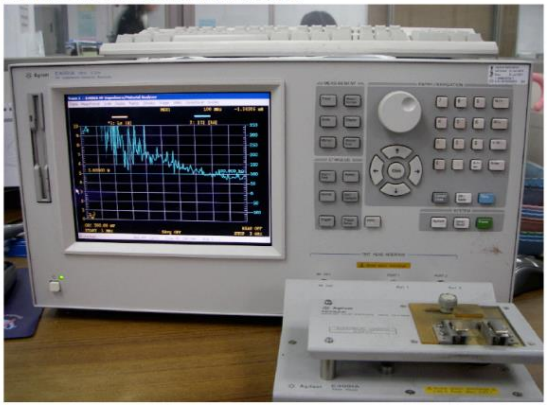
1. Ferrite impedance

Both sides of the HDMI-cable should contain a ferrite to prevent unwanted e-gress and ingress (shortcut shielding current 0-1GHz).

2. Test method

Test equipment: an LCR meter with text fixture capable of measuring the ferrite impedance up to 1000 MHz. E.g. Impedance Analyzer HP4991A or Test fixture HP16092A

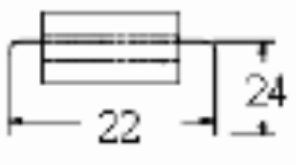
IMPEDANCE ANALYZER:E4991A



Test Fixture

Test wire dimensions: Ø 0.5mm x 70mm (length)

Turns: 1



Remark: the test wire should be centrered inside the ferrite.

3. Interpretation result

Due to possible deveations a tolerance of -10% (≥ 180 Ohm) can be accepted.

VIII. **Logo's**

Once a product passed Kabel Keur certification succesfully, a set of high resolution files will be handed over to the applicant in order to use the Kabel Keur and Ziggo geschikt logo's in the correct way on packaging and products.

Figure 7-5 Color logo Kabel Keur

Figure 7-6 logo Kabel Keur

Figure 7-7 Logo Ziggo geschikt