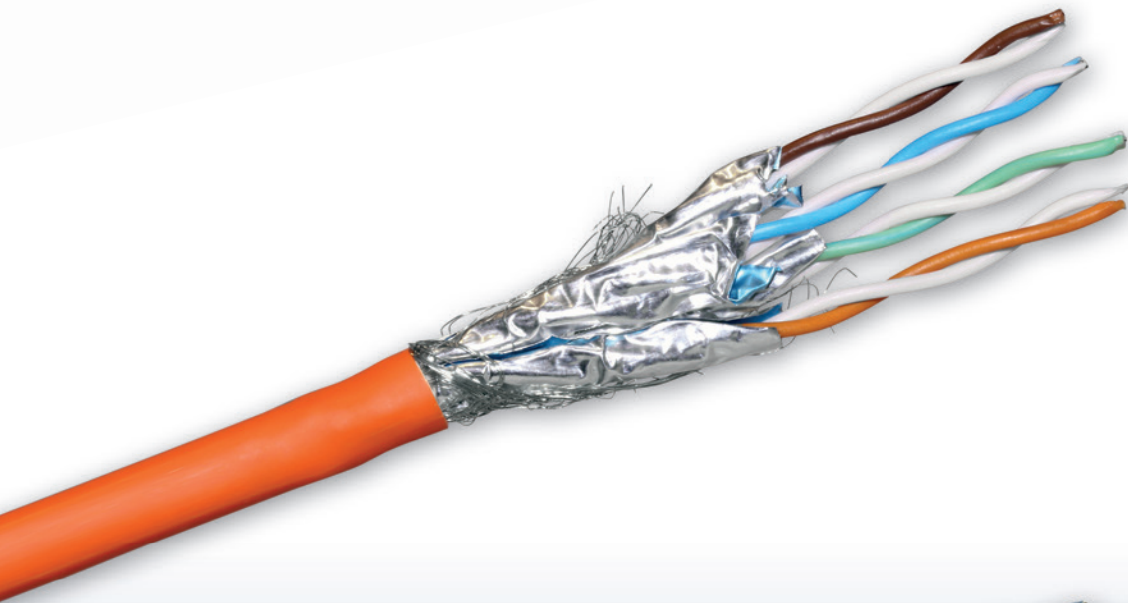


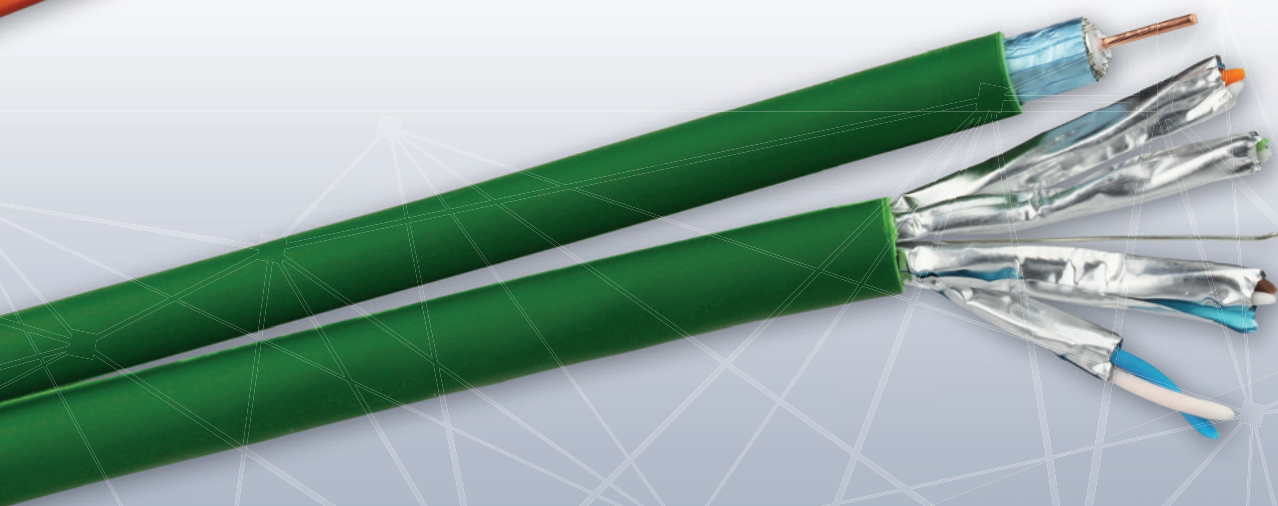


# Planning overview for TV and radio signals in data networks

Network technology from Kathrein



**NEW**



**KATHREIN** | Digital Systems GmbH

# Who we are and **what** we stand for

## We ensure the best possible radio and TV reception

With decades of experience, Kathrein Digital Systems is an innovation and technology driver in the field of satellite reception. Our comprehensive portfolio ranges from antennas and components for signal processing to extensive installation accessories and high quality measuring instruments.

Thanks to extensive know-how in development and unsurpassed quality standards in production, our solutions and systems are absolutely top class. High-quality satellite reception systems in conjunction

with sophisticated solutions for signal distribution, whether in single-family homes or in large building complexes, bring the signals to the receiving equipment in best HD quality.

New technologies such as SAT>IP, optical SAT distribution or modular headend technology for hotel TVs are closing the gap between traditional signal distribution and modern optical fibre and network technology.

Kathrein Digital System's advanced solutions are also the best choice for mobile TV reception in caravans and mobile homes.

Find out more about us at [www.kathrein-ds.com](http://www.kathrein-ds.com)

Our awards:

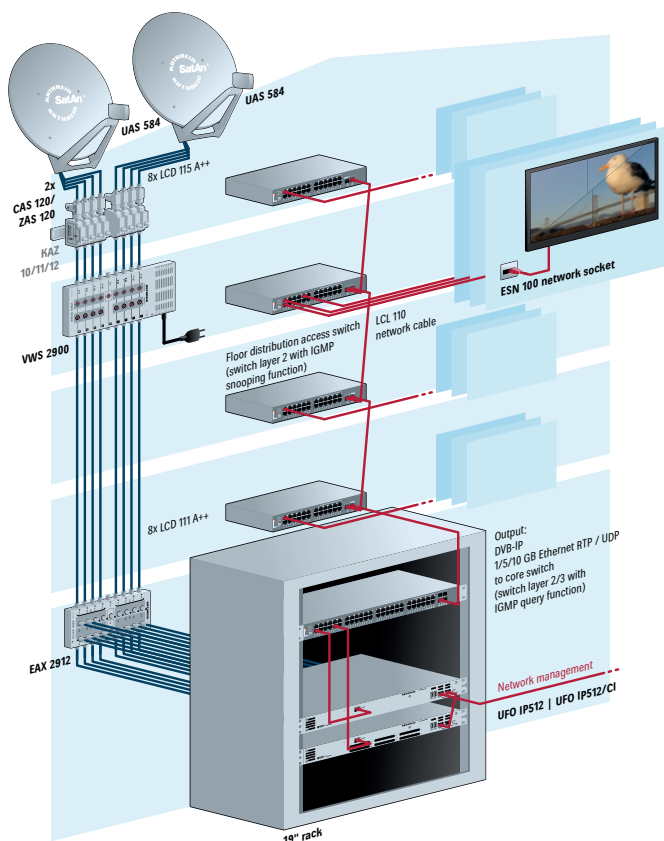


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## IPTV network

Please note that in publishing this document Kathrein are simply making a recommendation for the configuration of an IPTV network. Kathrein offers no warranty for the existing network. For a core switch Kathrein recommends the use of a managed layer 2/3 switch with a high data transmission rate and IGMP querier function. For an access switch a layer 2 switch with IGMP snooping function is used. Otherwise the network can be overloaded by the data rate of the channels (streams). The data rate of the network is determined by the number of channels that are fed in (SD channel ~8 Mbps / HD channel ~16 Mbps), the

number of participants, the Internet traffic, and so on ... In order to protect fault-free IPTV transmission and avoid interference from other infrastructure systems, the IPTV network should be operated in a network with separate hardware. The configuration must be a star structure. The cabling within the network is dependent on the local conditions. Kathrein always recommends Cat-7A networks. For existing networks and smaller networks, Cat-6E may be sufficient for fault-free IPTV transmission. If on site there is a single network which serves multiple applications, VLANs must always be configured.



**Recommendation for switches:**

- ZYXEL XGS4600 series (core switch)
- ZYXEL XG2210/GS2210 series (access switch)

**PLEASE NOTE:**

- Data transmission rate (Backplane/ports for the switches)
- IGMP querier (core switch)
- IGMP snooping (access switch)
- At least IGMP V2
- Switch ports that are linked to each other must have the same SFP data rates

**UFO**  
compact  
plus

**UFO** 19"-Series

## > Features, advantages and system requirements for IP processing

- Transmission of max. 512 SPTS data services (HD + SD-TV channels, radio channels, other data services)
- Just a single network structure for all data transmission, TV and radio broadcasts
- Clear cost savings at installation
- Reduced costs for power consumption and maintenance work (options for remote access)
- Options for informal additional services such as hotel TV, campus TV and the like (bandwidth reduction due to signal configuration with individual participant activation)
- Recommended for use on closed data network for relevant systems (hotels, hospitals, campus applications etc.)



Participants' terminals must be DVB-IP-capable. Hotel TV sets with DVB-IP functionality are available from Samsung, LG, Philips and Panasonic, amongst others. DVB-IP-capable bedside terminals are available for instance from Bewatec and Siemens HiMed.

## > Headend UFO IP512

- Stand-alone 19" headend (1HU) with 16 DVB-S(2) with DiSEqC™ 1.0 support and two DVB-S(2)/T(2)/C multi-standard front-ends (standards cannot be combined, no DiSEqC™ support for DVB-S(2) input 9)
- Conversion to DVB-IPTV. Simultaneous service pool with 494 SPTS and 18 MPTS or 512 SPTS
- 8 SAT IF inputs with DiSEqC™ 1.0 functionality for SAT multi-switches, flexible splitting to 2 × 8 front-ends (input 1–4 | 5–8) plus one input (non-switchable DVB-S(2)) for the two multi-standard front-ends
- Hot swap capability for the power supply unit and fan
- Two redundant wide-range power supply units
- Remote maintenance and remote configuration can be performed using the USW 800 configuration software
- Renaming of service names/channel names
- Supports SAP (Session Announcement Protocol) and M3U power supply for two LNB and one active antenna
- Unlimited cascading via IP network or the internal switch (system network). Joint administration and configuration of system network (NIT, LCN, channel assignment etc.)
- SNMP preparation
- 1HU in the 19" cabinet



UFO IP512, front view



UFO IP512, rear view



They are also available as a CI variant (UFO IP512/CI)



We briefly explain below the most important terms used in connection with the IPTV network topic.

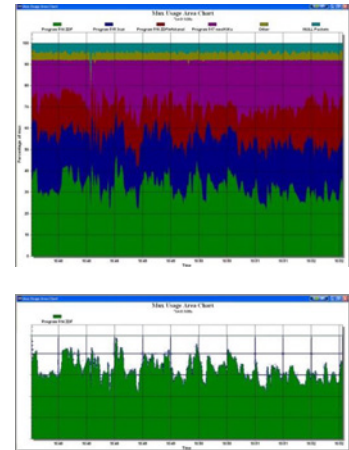
## > MPTS/SPTS

### MPTS – Multiple Program Transport Stream

- Multiple channels are transmitted concurrently in a single TS at a constant data rate

### SPTS – Single Program Transport Stream

- Only a single program is transmitted in a single TS at a variable data rate
- This is also used in most IPTV systems (such as “Das Erste” with 2–8Mbits/s – “Das Erste HD” with 18–25Mbits/s)



## > Multicast/Unicast

### DVB-IP (Multicast)

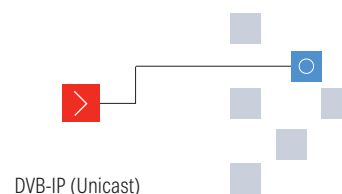
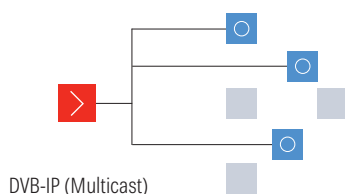
Data are transported in a network from one end point via a node to any number of end points in a network. The node performs the splitting/duplication and transmission of the data to the interested end points (recipients). Usually the node is aware of the interested recipients based on the Multicast addresses of the end points.

- System solution for hotels / hospitals etc.
- Observe the bandwidth and network structure
- Restricted choice of terminals for private users (therefore not recommended for domestic systems)
- Significantly more expensive than conventional solutions for domestic systems with a wide variety of transmitters

### DVB-IP (Unicast)

Data are transported in a network from one end point to precisely one end point (one to one).

- Attractively priced solution for domestic use or use by small companies
- Solution for mobile terminals (smartphones/tablets)
- Observe the bandwidth (Gigabit Ethernet or greater)
- Restricted choice of terminals



## > IGMP

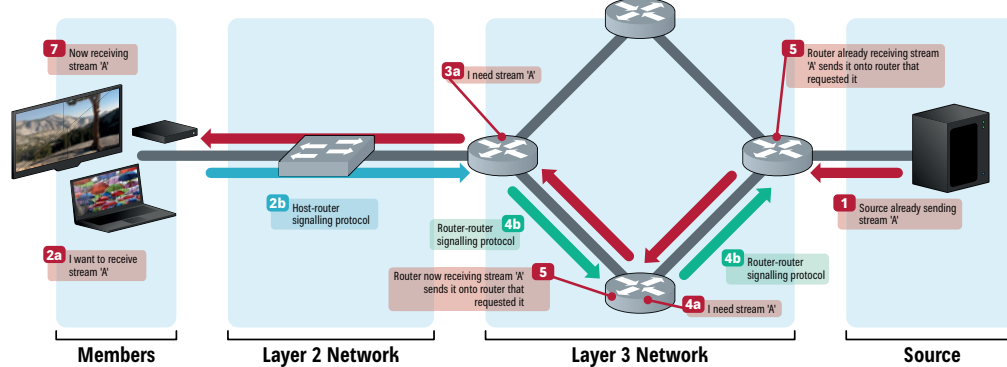
### IGMP- Internet Group Management Protocol

- The network protocol of the Internet protocol family is used for organisation of Multicast groups
- Terminals join the Multicast groups and the router/switches forward the data as required
- The network load is increased only where it is actually required

### IGMP snooping

- By this means the Multicast packets are delivered only to a port for which the connected device has made a registration using IGMP

### Multicast Service Model Overview



## > UDP/RTP

### UDP - User Datagram Protocol

- Contactless (makes demands only on the server, user data to the client)
- No checking functions
- Used amongst other things for DVB-IP streaming, SNMP, DNS

### RTP - Real Time Protocol

- To a large extent identical to UDP (is based on UDP)
- Additional information (RTP header) including time stamp (synchronisation) and sequence number (for detection of loss of data)
- Used amongst other things for DVB-IPTV streaming, SIR, RTSP

### TCP/IP protocol stack

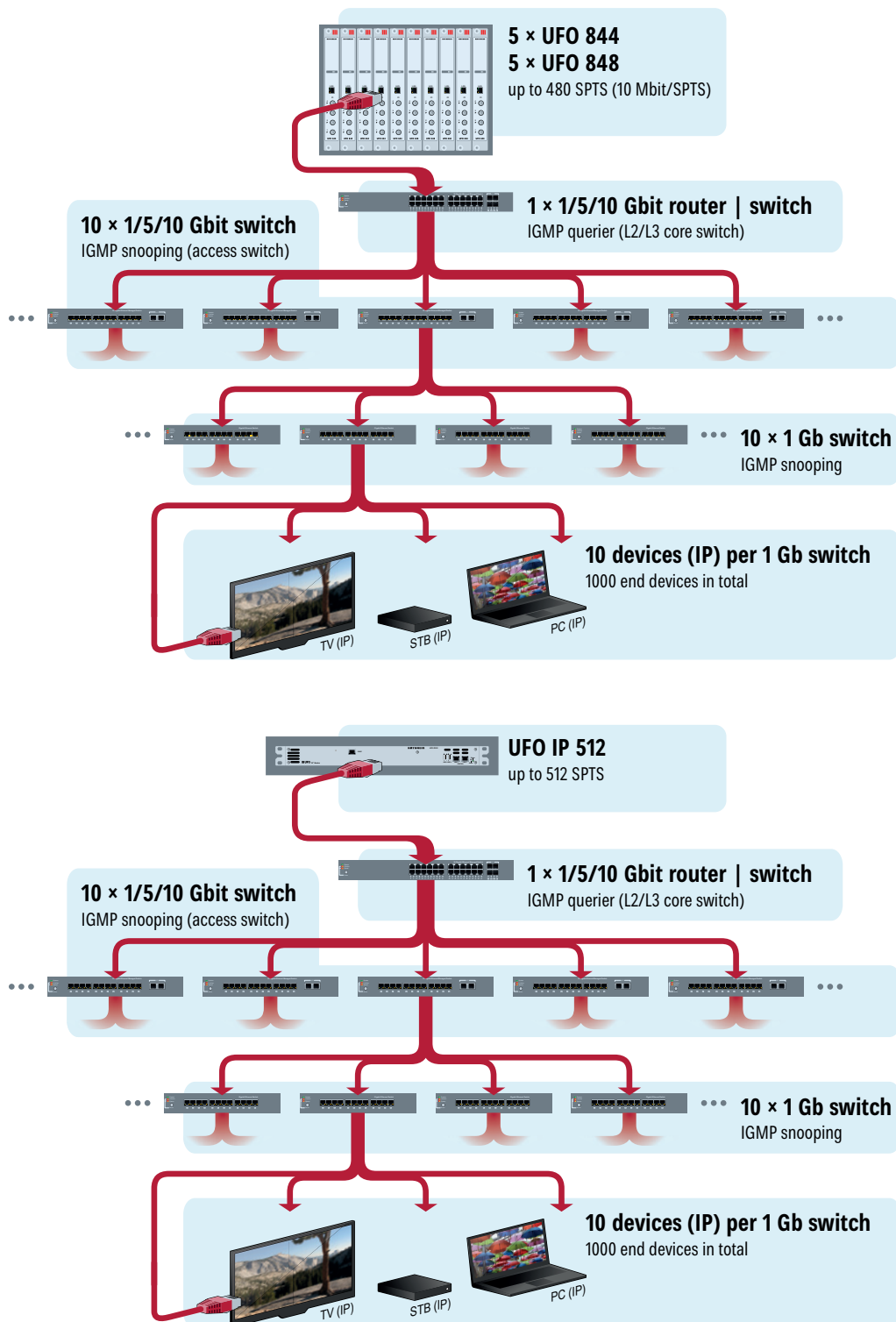
Application	HTTP, SMTP, FTP, Telnet, SSH
Transport	TCP, UDP
Network	IP, ICMP, IGMP
Link	Interface to physical layer

## > SAP

### SAP - Session Announcement Protocol

- By this means the IP streamer announces to the network which services it offers, for instance "Das Erste" can be received via the address udp://239.4.3.114:8264
- A recipient (edge devices or IP box) can use this information to create an IP station list

> Data rates in the Multicast network, system structure





## The SAT>IP system

### > SAT TV without a satellite receiver: SAT>IP makes it possible

With SAT>IP you can offer your customer additional added value in respect of information media and entertainment media. This means that in addition to the classic satellite reception terminals such as receivers or TV sets, Internet-based terminals such as PCs, laptops/tablets, smartphones, games consoles and media players in the household can be supplied with TV channels. It is the SAT>IP communications protocol which enables this, as it converts the signals from the satellite into the IP world. This allows top-quality satellite TV reception even on devices that are not equipped with their own satellite receivers. The digital signals can be transported over any IP infrastructure, with or without cable.

#### What are the advantages for the user?

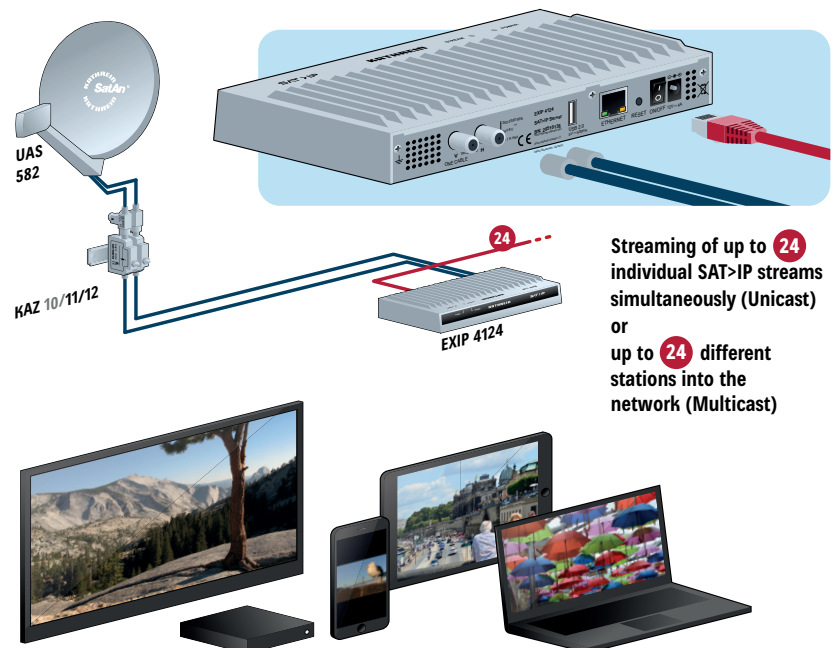
The advantages for the user are plain to see. Users can watch TV channels on different terminals and screens in the usual high quality offered by satellite TV without media disruption or additional cabling – and without having to use an Internet connection. On many of these terminals this live content currently could not be watched at all or could be watched only in poor quality. Furthermore, use of IP networks would result in high additional expenses.

#### What does SAT>IP cost viewers?

Apart for costs for hardware and software (clients), there are no additional costs. SAT>IP is merely a new standard for

the distribution of satellite signals to IP devices. No fees are charged for the transmission of linear free-TV channels to the IP network. All free-to-air channels stay free to air. Pay-TV channels can also be transmitted to the home network over SAT>IP. All TV providers are free to draw up special offers.

# SAT > IP™

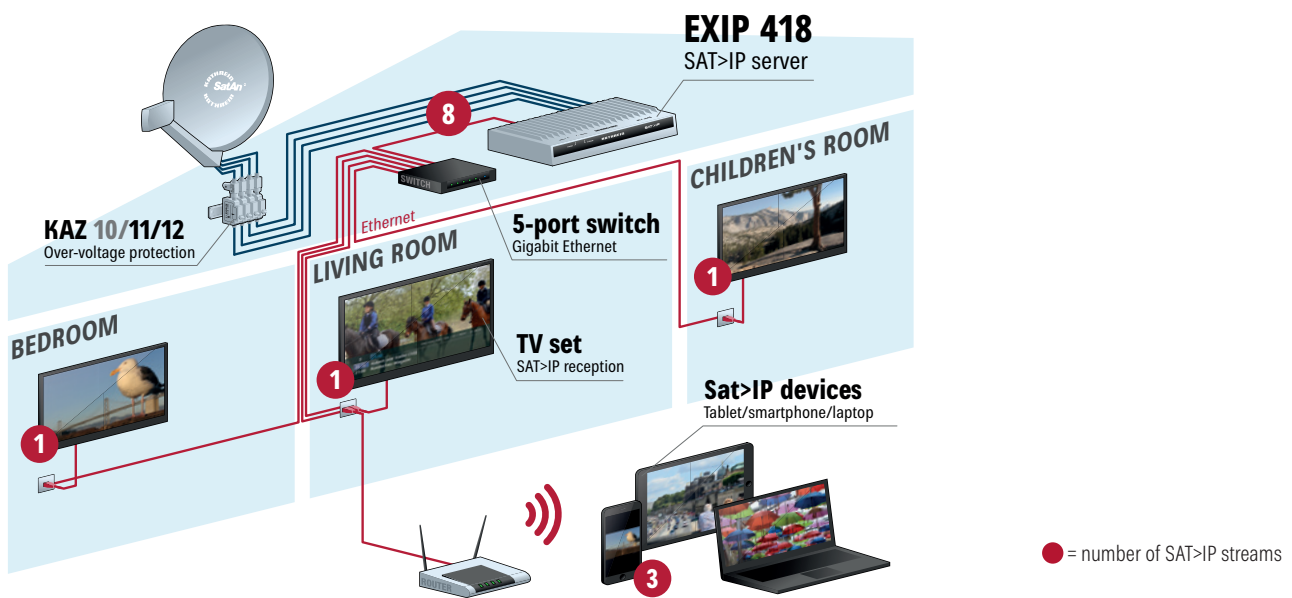


TV set | streaming box | smartphone | tablet | laptop | PC ● = number of SAT>IP streams



In a SAT>IP environment, each IP device is automatically suitable for the reception of satellite signals as soon as it has the required software – whether tablets, PCs, laptops, smartphones, connected TVs, games consoles, media players, or IP set-top boxes etc. Many require only a software update or an app to make the respective hardware SAT>IP-capable.

## > System example for a SAT>IP system



## > Video

Our video animation "SAT>IP with EXIP" shows you how you can receive top-quality satellite TV on terminals that are not equipped with their own satellite receivers. It can be called up at <https://www.kathrein-ds.com/newsroom/mediacenter/>

## >

Use this QR code to access the video portal directly:



# Home network with K-LAN

Kathrein LAN system products allow you to create a home network using the coaxial cable structure already existing in the house for your satellite reception system.

### Advantages

- Ideal for the network connection of receivers, TV sets and Blu-ray players
- Convenient connection of devices and PCs that can be networked via a router (such as FRITZ!Box)
- Reduced cost of installation
- No need to lay new cables
- Outstanding transmission characteristics
- Interference-free transmission of IP signals up to 700 m
- Autoprovisioning

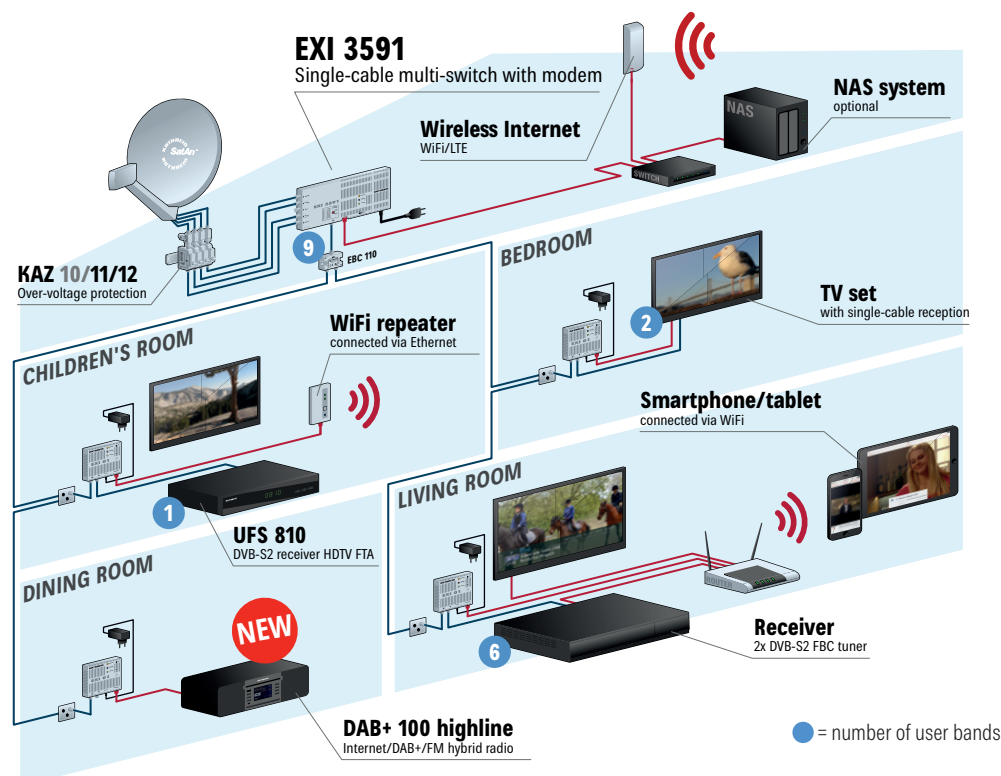
### Security of the home network

The built-in modem within the EXI 3591 multi-switch and the EXI 01 modem are each protected with a factory-installed network key. The "pairing" facility offers additional security. The EXI 90 high-pass filter prevents reception and emission (the

EXI 3591 is already built-in). This means that the home network is limited to the outputs of the multi-switch and is thus not accessible by third parties.



Use this QR code in order to access the video "Simple home networking with coaxial cable and K-LAN":



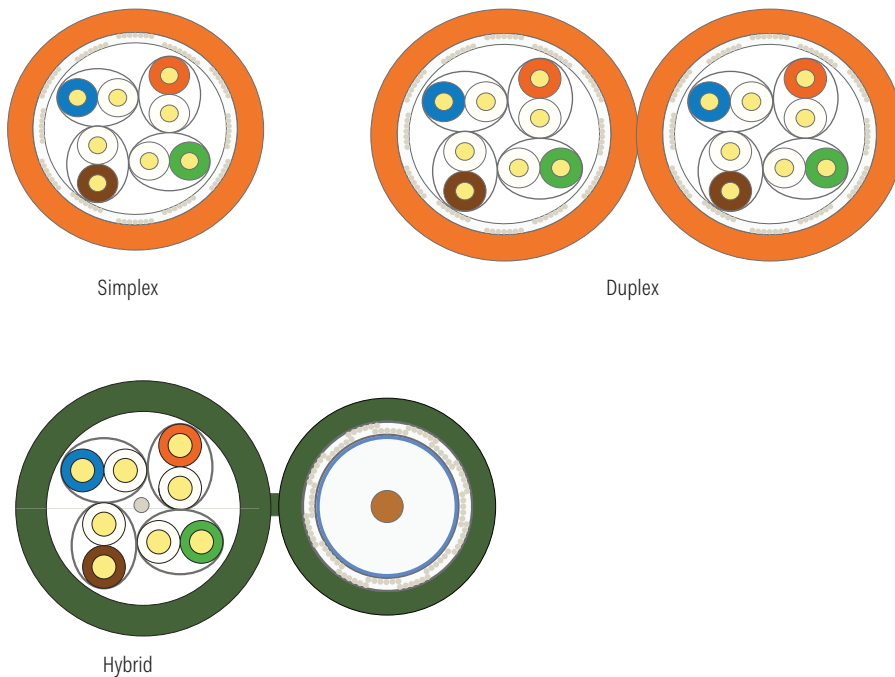
● = number of user bands

## Cables and accessories

### > Designs

When designing network cables in general the distinction is made between simplex and duplex cables. In our case a hybrid cable consists of a combination of a network cable and a coaxial cable.

- Simplex:** 8 cores (4 pairs) => 4×2×AWG23/1 S/FTP (PIMF)  
**Duplex:** 16 cores (8 pairs) => 2×4×2×AWG23/1 S/FTP  
**Hybrid:** 8 cores (4 pairs) => 4×2×AWG24/1 S/FTP (PIMF) + coaxial



### > Designations by AWG

AWG is a standard coding for wire diameters in electrical technology. In particular it is used for the diameters of conductive copper wires and copper cross sections, disregarding the insulation or the sheathing. It originated with inch sizes in the USA, but the AWG designation is also used in Europe.

AWG stands for American Wire Gauge. The AWG number arises from the manufacturing process and describes the number of drawing operations for wire drawing. AWG23 for instance means that there were 23 successive drawing operations before the AWG23 diameter was achieved.

Table for conversion of AWG into metric, mm and mm<sup>2</sup>

AWG	d (mm)	A (mm <sup>2</sup> )	R (Ohm/km)	Metric (mm <sup>2</sup> )
22	0.6438	0.326	54.7	0.34
23	0.5733	0.258	67	LCL 110
24	0.5106	0.205	87	LCH 120
25	0.4547	0.162	110	–

## > Widely-used types of twisted-pair cables

Category	Bandwidth	Type	Class	Examples of applications
Cat 5	100 MHz	UTP	D	100BASE-TX and 1000BASE-T or SONET
Cat 6/ 6A	250/500 MHz	UTP or STP	E	1000BASE-T, 10GBASE-T or 155-Mbit-ATM and 622-Mbit-ATM
Cat 7/7A	600/1000 (1200) MHz	S/FTP – U/FTP	F or FA	10GBASE-T
Cat 8	1600/2000 MHz	S/FTP	G	40GBASE-T and 100GBASE-T

## > Designation system for twisted-pair cables to ISO/IEC-11801

### Overall screening, conductor pair screening and type of stranding

#### Overall screening

- U = no screen (unscreened)
- F = foil screen (coated plastic foil)
- S = braided screen (braided wire)
- SF = braided screen and foil screen

#### Conductor pair screening

- U = no screen (unscreened)
- F = foil screen (coated plastic foil)
- S = braided screen (braided wire)

#### Type of stranding

TP = Twisted Pair (as a rule)      QP = Quad Pair

### Overview of twisted pair cables

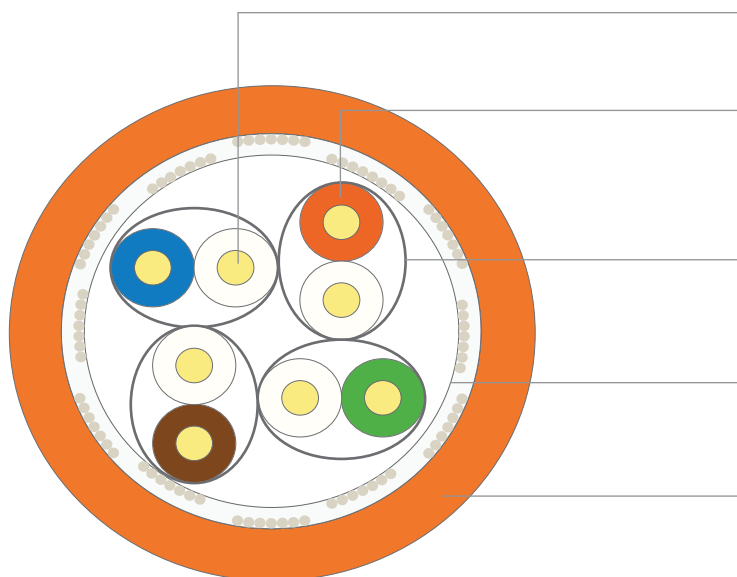
Twisted pair cables (TP)		U/UTP	S/UTP	U/FTP	S/FTP	F/FTP	SF/FTP
Overall screen	Wire braiding (S)	–	yes	–	yes	–	yes
	Foil (F)	–	–	–	–	yes	yes
Conductor pair screen	Wire braiding (S)	–	–	–	–	–	–
	Foil (F)	–	–	yes	yes	yes	yes

## > Network cables LCL 110

<b>LCL 110/250m</b>	215500001
<b>LCL 110/500m</b>	215500003
<b>LCL 110/1000m</b>	215500004



- Network cables Cat 7A S/FTP
- Metre marking
- Complies with: ISO/IEC 11801 2nd ed., IEC 61156-5, EN 50173-1, EN 50288-9-1
- Construction Products Regulation 305/2011 EN 50575  
Fire classification: Cca s1a,d1,a1
- Halogen-free
- Suitable for installation in the home
- Available in 250 m, 500 m and 1000 m lengths
- Compatible RJ45 network connector: EMP 12 (order no.: 212500001), field configurable without tools



Bare copper conductor AWG23

Insulation of a special PE mixture, colour code: TIA 568 70 °C, EN 50290-2-23

Cable pairs screened with plastic-coated aluminium foil, 100 % coverage

Cable screened with braided tinned copper wires

LSZH/LSOH - RAL 2003 orange, Ø 7.7 mm  
70 °C, EN 50290-2-27

**Technical data**

Type   Order no.			LCL 110/250m 215500001	LCL 110/500m 215500003	LCL 110/1000m 215500004
Length		m	250	500	1000
Packaging			One-way reel	One-way drum	One-way drum
Inner conductor AWG23		mm	8 × 0.259		
Insulation		mm	8 × 0.573		
Outer conductor			Al/pet foil – CuSn mesh		
External sheathing			LSZH/LSOH – RAL 2003 orange, 7.7 mm		
Bending radius		mm	> 31		
Attenuation at	1 MHz	dB/100 m	1.9		
	4 MHz		3.5		
	10 MHz		5.4		
	100 MHz		17.4		
	200 MHz		24.9		
	250 MHz		27.8		
	500 MHz		40.1		
	600 MHz		43.8		
	800 MHz		50.1		
	1000 MHz		59.0		
1200 MHz	64.0				
Return loss 862–1000 MHz		dB	≥ 23		
Copper content <sup>1)</sup>		kg/km	25.4		
Maximum permissible tensile force		N	120		
Permissible ambient temperature		°C	-20 to +60		
BauPVO 305/2011 – Fire classification			Euro classification Cca s1a d1 a1		
Installation location			Indoors		
Weight		kg/100 m	6.3		

<sup>1)</sup> DEL notice copper base price 150 €/100 kg for copper surcharge in €/km

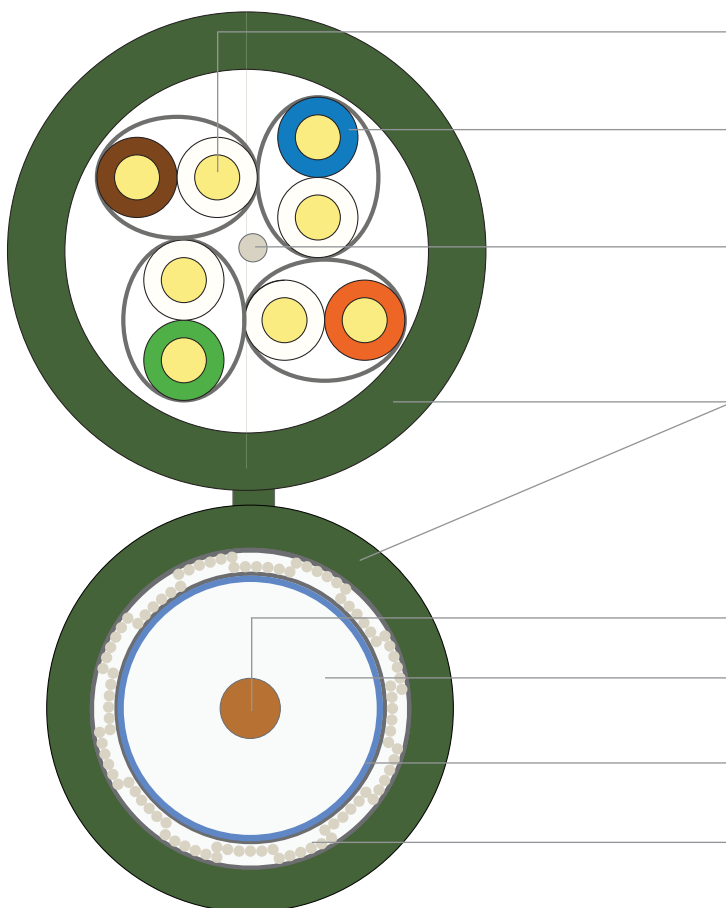
## > Hybrid fibre optic cable LCL 120

**LCH 120/100m** 215500002

**LCH 120/250m** 215500005



- Hybrid network and coaxial cable
- Cat 7 U/FTP and coaxial cables, screening class A+
- Complies with: EN 50117, IEC 61156
- Metre marking
- Construction Products Regulation 305/2011 EN 50575  
Fire classification: Eca
- Halogen-free
- Suitable for installation in the home
- Available in 100 m and 250 m lengths
- Compatible RJ45 network connector: EMP 12  
(order no.: 212500001), field configurable without tools



Bare copper conductor AWG24

Insulation of a special PE mixture,  
colour code: TIA 568, 70 °C, EN 50290-2-23

Cable pairs screened with plastic-coated aluminium foil 100 % coverage and with braided tinned copper wires

LSZH – RAL 6010 green,  $\varnothing 6.5 \pm 0.20 \times 13.00 \pm 0.40$  mm, 70 °C, EN 50290-2-27  
coax side:  $\varnothing 5.5 \pm 0.20$  mm

Bare copper conductor,  $\varnothing 0.50 \pm 0.01$  mm

Insulation of a special PE mixture,  
 $\varnothing 3.50 \pm 0.10$  mm 70 °C, EN 50290-2-23

Plastic-coated aluminium foil,  
100 % coverage

Cable screened with braided tinned copper wires



**Technical data**

Type   Order no.			LCH 120/100 m 215500002	LCH 120/250 m 215500005
Length		m	100	250
Packaging			One-way reel	
Inner conductor Cat 7 AWG24		mm	8 × 0.5/U/F24	
Insulation Cat 7			Plastic coated aluminium 100 %	
Coaxial outer conductor			Al/pet foil – CuSn mesh	
External sheathing			LSZH/LSOH – RAL 6018 green, 6.5 mm & 6 mm	
Bending radius		mm	> 65	
Attenuation for (Cat 7)	10 MHz	dB/100 m	6.3	
	100 MHz		21.3	
	250 MHz		35.7	
	500 MHz		49.0	
	600 MHz		58.0	
Attenuation for (coaxial)	5 MHz	dB/100 m	2.13	
	50 MHz		5.95	
	400 MHz		16.64	
	862 MHz		24.82	
	1350 MHz		31.53	
	2150 MHz		40.62	
Return loss for	862–1000 MHz	dB	≥ 16	
	1000–2150 MHz		≥ 15	
DC resistance		Ω/km	95	
Screening loss 30–1000 MHz		dB	≥ 95 (A+)	
Coupling resistance 5–30 MHz		mΩ/m	≤ 2.5	
Maximum permissible tensile force		N	150	
Permissible ambient temperature		°C	-20 to +60	
BauPVO 305/2011 – Fire classification			Euro classification Eca	
Installation location			Indoors	
Weight		kg/100 m	7.5	

## > Network sockets

**ESN 100** 211500002



- 2-way network socket Cat 6A
- Concealed, compatible with all standard switch ranges (UAE)
- Class EA (500 MHz) 10 GigaBit in compliance with ISO/IEC 11801
- 40° outlet, LSA terminals
- RJ45 contacts made of phosphor-bronze, 40–80 μ" nickel plated, contact area flash gold plated
- Wire thickness suitable for AWG22/1 to AWG26/1
- Marking plate with transparent cover
- Fully screened aluminium die-cast housing
- Including centre piece DIN49075 50 × 50 mm and ABS cover frame 80 × 80 mm
- Suitable for installation in switch boxes, cavity wall boxes and recessed channels
- POE-compatible in compliance with IEEE 802.3af 15.4 W, IEEE 802.3at 30 W and IEEE 802.3bt 90 W



### Technical data

Type   Order no.		ESN 100   211500002
Colour		White (RAL 9010)
Colour coding standard		TIA/EIA 568 A and TIA/EIA 568 B
Numerical pair coding		5-4, 1-2, 3-6, 7-8
Insulation resistance	MΩ	1000
Contact resistance	mΩ	< 100
Max. current load	A	1.5
Service life		> 750 plug-in cycles
Permissible ambient temperature	°C	0 to +70
Packaging unit/weight	pc./kg	1 (60)/0.174

ESN 300 211500004



- Hybrid network socket CAT 6A and TV/SAT (F socket)
- POE-compatible in compliance with IEEE802.3af (44–57 V, 15.4 W) and IEEE802.3at (44–57 V, 25.5 W)
- For use as a wall-mounted or concealed box, consisting of:
  - Cat 6A keystone module, fully screened
  - F antenna module
  - 2-way support frame, multi-design
  - Wall outlet frame
- Note: For concealed installation use a sufficiently large wall cup with a size of at least 68 × 60 mm to ensure sufficient space for the installation. Cable feed must be from above.
- CAT 6A 500 MHz RJ45 module 10 GBit fully screened:
  - For AWG22/1 to AWG24/1
  - No LSA tools required
  - Installation in modular splitter fields up to 24-port/1HU
  - Connection box 1-3 port
  - Pair management for IDC strip 568A/B coded
  - Strain relief by cable clips
  - CAT 6A components certified (delta)

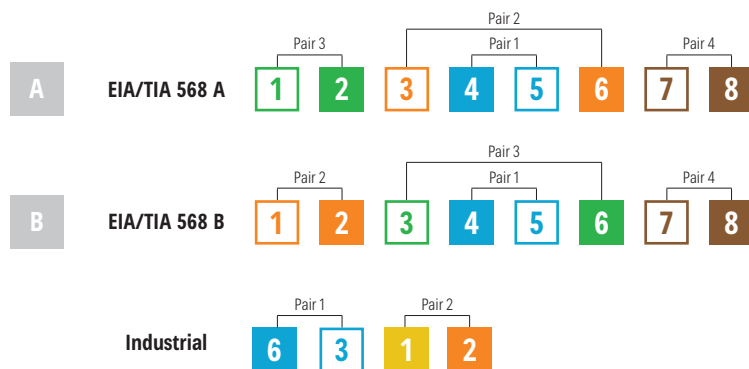


**Technical data**

Type   Order no.		ESN 300   211500004
Colour		White (RAL 9010)
Dielectric test voltage	V AC	100 (RMS 60 Hz)
Contact coating	μ"	50
Insulation resistance	MΩ	> 500
Contact resistance	mΩ	< 20
Max. current load	A	1.5
Service life		> 750 plug-in cycles
Casing material		Plastic
Installation depth	mm	20.1
Permissible ambient temperature	°C	-40 to +66
Packaging unit/weight	pc./kg	1/0.153

## > Different pin assignments on network plugs

The standards for RJ45 pin assignments differ above all by swapping over the conductor pairs green and orange. Whilst for RJ45 pin assignments to the standard EIA/TIA 568A the conductor pair 2 is white/orange and the conductor pair 3 is white/green, for RJ45 pin assignments to the standard EIA/TIA 568B this is exactly the opposite way round.



## >

The abbreviation “RJ” stands for “Registered Jack”, which means a standard socket. RJ45: This standard specifies the layout of plugs and sockets and also the pin assignments.

### PIN assignment

	TIA/EIA T568A	TIA/EIA T568B	Industrial
1	White/green	White/orange	Yellow
2	Green	Orange	Orange
3	White/orange	White/green	White
6	Orange	Green	Blue
4	Blue	Blue	
5	White/blue	White/blue	
7	White/brown	White/brown	
8	Brown	Brown	

## > EML 12 network plug

EML 12 212500001



- RJ45 plug Cat 6A 500MHz screened
- Very high quality RJ45 plug, can be assembled in the field (can be assembled quickly and easily in the field – without special tools)
- POE+ compatible
- Compact cable pre-sorter for AWG22/7, AWG27/7
- Fully screened zinc die-cast housing with separate dust-proof cap and anti-kink sleeve
- Best EMC characteristics, especially in an industrial environment

- Insulation displacement contact technology and low contact resistances
- Pair management to TIA/EIA 568 A/B colour codes
- Service life: >750 plug-in cycles
- Temperature range: -40 °C to +66 °C
- Contact coating: 50 µ" gold-plated
- Protection class IP20

### Technical data

Type   Order no.	EML 12   212500001	
Colour coding standard	TIA/EIA 568 A and TIA/EIA 568 B	
Permissible ambient temperature	°C	-10 to +60
Packaging unit/weight	pc./kg	1 (50, 500)/0.022

## DAB+ radio receivers

- Additional multi-media services
- Streaming via network/W-LAN
- Digital sound quality

### > DAB+ 100 highline

- Internet radio/DAB+/FM-RDS
- Bluetooth for audio streaming
- UNDOK™ app for playback activation
- UPnP/DMR music transmission
- Colour display with backlighting
- CD player (MP3 and WMA)
- Recording function (SD card/USB stick)
- RJ45 network port

NETWORK  
INTEGRATION  
over  
LAN or WiFi  
capable







Your specialist supplier:

#### **Domestic sales**

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89081 Ulm, Germany  
order@kathrein-ds.com

#### **Austrian sales**

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**KATHREIN**  
Digital Systems GmbH