



Ready for the future

| LTE/4G-protected antennas and accessories



your ultimate connection

What is LTE/4G?

| 4th generation –
super-fast mobile communication

LTE / 4G

Worldwide frequency bands traditionally used for DTT (Digital Terrestrial TV) reception are gradually being discontinued for DTT use in favor of emerging high speed mobile broadband services such as LTE (Long Term Evolution) and/or LTE Advanced technology. In Europe, LTE now uses the 800MHz band (790-862MHz - previously TV channels 61-69) in addition to the 1.8GHz and 2.6GHz bands, which were previously the only available LTE frequencies. LTE/4G mobile technology operating in the 800MHz frequency band raises challenges within pre-existing DTT and CATV (Cable TV) networks, which, since the 1950's, were developed to operate within these frequencies.



LTE/4G high-speed mobile data transmission has already been introduced in more than 85 countries, and is already the preferred transmission method for telecommunication operators across the world. Telecommunication operators can, for example, transmit data at speeds compatible with HD media (LTE: downlink 300 Mbit/s uplink 75 Mbit/s, LTE Advanced: downlink up to 1 Gbit/s, uplink 500 Mbit/s), whilst benefitting from favourable infrastructure implementation costs. LTE/4G data is currently transmitted over three bands (800 MHz, 1.8 GHz, and 2.6 GHz) in Europe, and will be expanded to utilise the 700 MHz band before 2020. The 700 MHz and 800 MHz bands are of particular interest for mobile telecommunication operators due to their favourable signal propagation characteristics (longer range and coverage). The number of LTE/4G hotspots will increase dramatically, providing subscribers (You) with exciting content opportunities and telecommunication operators with increased revenue streams.

Ensure best picture quality

| TRIAX has developed a range of products that protect TV signals from LTE/4G mobile broadband interference.

DTT (Digital Terrestrial TV)

Challenges with Frequency Separation:

LTE/4G transmissions (starting from 791 MHz, previously DTT channel 61) are very close to the upper DTT channel 60; potentially resulting in neighboring and near-channel interference.

Solution(s)

- (to reject LTE/4G signals in DTT systems):
 - Use high performance band stop filters
 - Use new antennas that are customized to only receive up to channel 60.
 - Use high-quality, high shielding coax cables (Class A, or better)

Challenges with Mast amplifiers/TV-tuner overload:

Problems are seen and expected to grow as LTE/4G is implemented in rural areas. This is where LTE/4G transmission levels are expected to be at their highest, potentially causing an overload of DTT mast amplifiers and TV-tuners that are located in close proximity to a LTE transmitter.

Solution(s)

- Use new antennas customized to only receive up to channel 60.
- Use high performance band stop filters,
- Use low noise/high input amplifiers,
- Use high-quality, high shielding coax cables (Class A, or better)



CATV (cable-TV)

Challenge with co-existence of CATV signals and LTE signals:

CATV is considered a closed network distribution and channels 61-69 will continue to be used in CATV networks for TV distribution. In other words, CATV cable TV channels 61-69 will have to co-exist with over-the-air LTE/4G transmissions, and will potentially cause disturbance and interference.

Solution(s)

- Strong shielding in CATV networks is critical and is something that CATV network operators have been well aware of and are also impacted by EU CATV network regulations. CATV network operators will continue to use utilize high quality/high shielding products for many years to come. Recent studies, however, indicate that even higher shielding than current EU regulations stipulate, may be required in some future installations. New, higher shielding classes (Class A+, Class A++) are currently being implemented and are expected to be stipulated in future EU requirement, expanding the existing Class A shielding class requirement.



LTE is a trademark of ETSI

- The 'LTE-protected-by TRIAX' logo is displayed on products that meet LTE/4G protection requirements.

Total solution

| DVB-T against LTE/4G interference

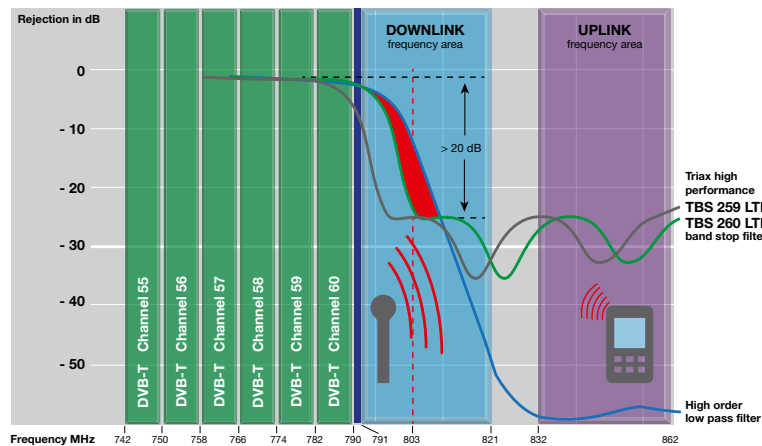
Current Digital Terrestrial TV and LTE/4G transmissions in Europe:

Bandwidth	DVB-T channels (470-790 MHz): 8 MHz blocks LTE/4G channels (791-862 MHz): 5 MHz blocks
DVB-T ch 55-60	Frequency mark shows channel centre frequency (eg channel 60, 782-790 MHz = 786 MHz)
0 dB	Relative typical antenna output
- 3 dB	The transition point is the frequency where the given filter performance starts rejecting the signal (previous frequencies are "passed", not filter function)
470-622 MHz	UHF Band IV
622-790 MHz	UHF Band V
790-862 MHz	ECN/LTE/Band V (details below)
	790-791 MHz 1 MHz Guard Band
	791-821 MHz Downlink - LTE base station transmissions
	821-831 MHz 11 MHz Duplex gap. Not used for LTE. No permission required, free use for wireless microphones
	832-862 MHz Uplink - LTE terminal transmission (dongle, tablet, LTE phone, etc)

The LTE/4G technology operating in the 790-862MHz frequency range may cause problems for installed DTT and CATV (cable TV) networks which historically have been developed to operate within these frequencies.

Triax provides you with a full range of products, designed to protect your network from LTE/4G mobile broadband interference and disturbance.

Look for the "LTE Protected – by Triax" logo, to ensure that your future product meets the Triax requirements so you experience the perfect TV picture experience.





Products carrying the “LTE Protected – by Triax” certificate logo meet the strict requirements of Triax for attenuation above channel 60.

- New Low Pass Antenna UFO-, Digi- and Yagi-series; designed with high performance LTE/4G signal attenuation in mind.
- All antennas use F-connectors for optimum shielding.

- High input-level mast electronics/amplifiers with overload and filter protection.
- High-performance Stop Band LTE filters for both indoor and outdoor use.
- High-performance, high shielding Class A coax cables
- High-shielded wall socket outlets
- See a full list of Triax LTE approved products at:

www.com
www.com



WORTH NOTING ABOUT LTE/4G

- LTE/4G transmissions are vertically polarised
- Cross-polar 15dB rejection between polarities can be achieved
- Re-align antenna to reduce the impact on LTE/4G signal level
- Relocate antenna and use the building to screen it from LTE/4G signals

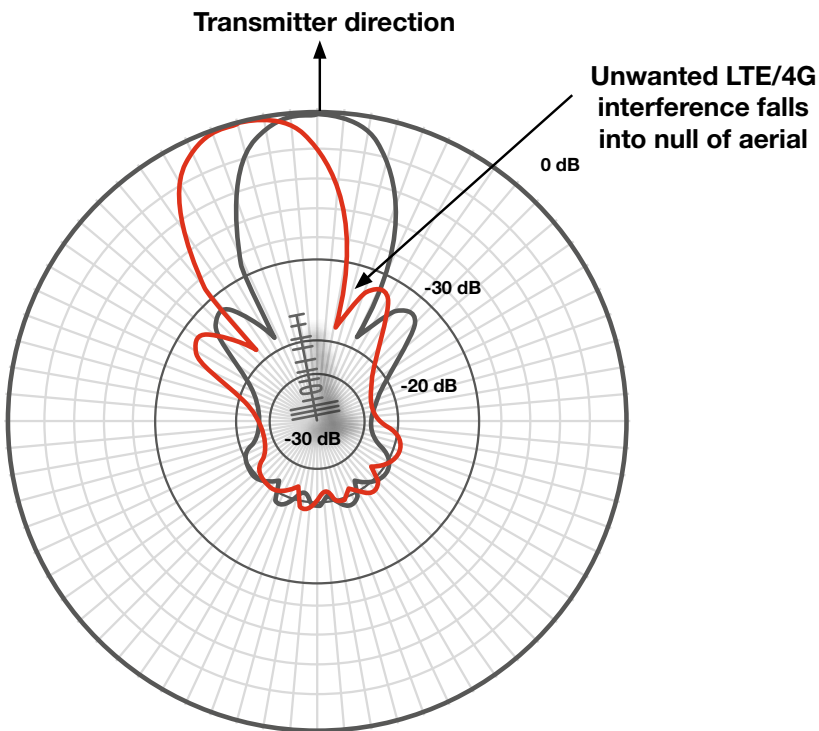


LTE/4G product portfolio

| Triax LTE aerials - can help you

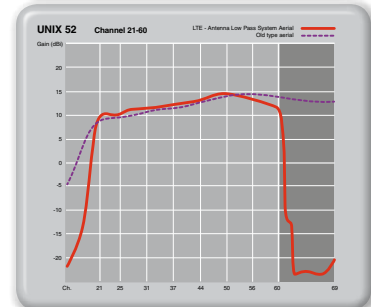
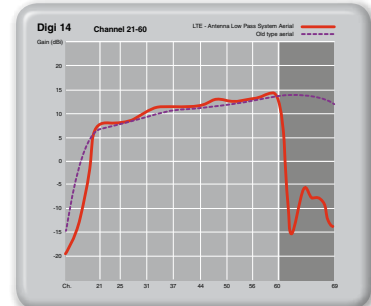
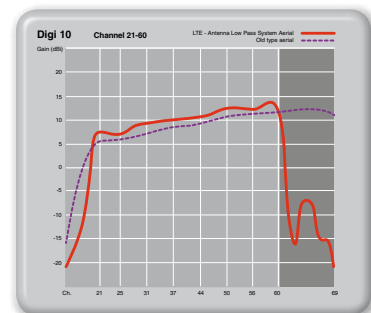
Triax has developed a wide range of aerials especially designed with high performance attenuation of the signal above channel 60 to address the challenges associated with LTE/4G.

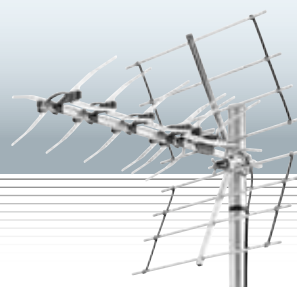
- Quick-install clip-on dipole
- Impedance-matched BalUn with rear-facing F-connector to optimize maximum signal transfer, ensuring that the cable routing does not affect side lobes
- Rear-mounted HQ F-connector > 20dB RLR
- Sealed pre-assembled housing with weatherproof F-connector
- Purpose-designed weather boot to fit all types of F-connectors
- Can be used to incorporate LTE/4G filter
 - When CAI specification becomes available
 - Combi VHF and UHF antennas for Europe



Good to know

- To try to eliminate the LTE/4G signals, the installer can detune the 'peaked' level and use the natural nulls within the aerial's design in order to reduce the unwanted signal level.





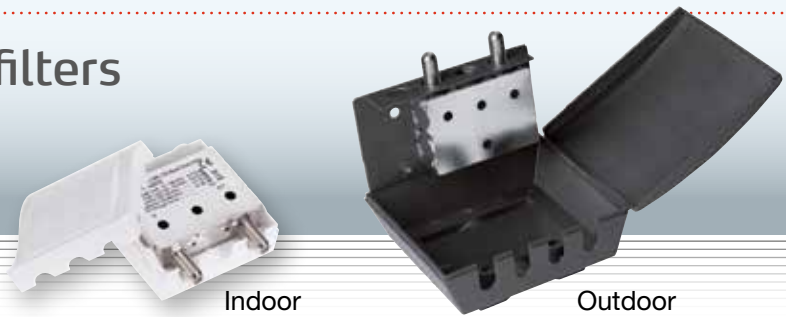
Aerials with built-in LTE/4G filter function

Type		Digi 6	Digi 10	Digi 14	Digi 18	Unix 32	Unix 52
Art. No. - Scantainer		108380	108381	1083xx	1083xx	1083xx	1083xx
Art. No. - Boxed		108387	108388	108382	108383	108384	108385
Frequency range							
Channel		21-50	21-60	21-60	21-60	21-60	21-60
Band		BIV/B	BIV/B	BIV/B	BIV/B	BIV/B	BIV/B
Elements		6	10	14	18	32	52
Front-to-back ratio	dB	17	17	25	25	24	25
Beam width (horizontal degrees)	dB	± 25	± 25	± 21	± 18	± 20	± 15
Wind load	N	14	14	54	59	58	96
Material		Alu.	Alu.	Alu.	Alu.	Alu.	Alu.
Connector		F-connector	F-connector	F-connector	F-connector	F-connector	F-connector
Gain							
474 MHz (Ch.21)	dBI	5.0	6.5	7.5	8.0	8.5	11.0
538 MHz (Ch.29)	dBI	7.0	7.5	9.5	10.0	11.0	11.0
602 MHz (Ch.45)	dBI	9.0	10.0	12.0	13.0	12.5	14.0
730 MHz (Ch.53)	dBI	10.0	12.5	13.0	14.5	12.5	14.5
785 MHz (Ch.60)	dBI	10.0	13.0	13.5	12.5	10.5	13.0
Rejection							
811 MHz (LTE D1)	dBI	- 5.0	- 5.0	- 5.0	- 4.0	0.0	- 5.0
821 MHz (LTE D6)	dBI	- 10.0	- 11.0	- 11.0	- 8.0	- 3.0	- 10.0
832 MHz (LTE U1)	dBI	- 12.0	- 11.0	- 11.0	- 10.0	- 6.0	- 10
862 MHz (LTE D1)	dBI	- 10.0	- 8.0	- 8.0	- 10.0	- 20.0	- 15.0
Dimensions							
Length	mm	718	718	1015	1446	791	1297
Width	mm	330	330	420	420	500	500
Weight	kg	0.45	0.45	0.77	1.05	1.45	1.63
Remarks		Antenna low pass filter	Antenna low pass filter	Antenna low pass filter	Antenna low pass filter	Antenna low pass filter	Antenna low pass filter



Filters

| Band stop and In-line filters



Indoor

Outdoor

Triax high-performance band stop filters prevent strong LTE/4G signal levels from causing interference with DVB-T signals.

Triax's high-performance filters are optimised to provide the required degree of protection in the 791-821 MHz LTE/4G mobile broadband 'downlink' frequency spectrum, where LTE signal levels are highest.

Band stop filters									
Type		TBSx 257	TBSx 259	TBSx 260	R4G 058	R4G 059	R4G 100	R4G 101	LTE/4G Filter Kit
Art. no. - TBSI (Indoor)		314074	314070	314072	360112	360113	360110	360111	314080
Art. no. - TBSI (Outdoor)		314075	314071	370109					
Input/Output		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Frequency	MHz	47-766	47-782	47-790	5-774	5-782	5-788	5-788	5-782
Channel		2-57	2-59	2-60	2-58	2-59	2-60	2-60	2-59
Through loss/Rejection									
750 MHz (incl. E55)	dB	1.5	0.9	0.8					
758 MHz (incl. E56)	dB	1.8	1.0	0.9					
766 MHz (incl. E57)	dB	2.3	1.2	1.0					
774 MHz (incl. E58)	dB	< 3.8	1.4	1.4					
782 MHz (incl. E59)	dB	≥ 9.4	< 3.0	1.9	≤ 3	≤ 3	≤ 5	≤ 5	≤ 4
790 MHz (incl. E60)	dB	≥ 25.5	≥ 8.0	< 3.0					
791 MHz	dB	≥ 28.2	≥ 10.0	≥ 3.3	-45	-30	-12 / -10	-12 / -10	
796 MHz	dB	≥ 29.7	≥ 22.0	≥ 7.0	-50	-45	-25 / -25	-25 / -25	
800 MHz	dB	≥ 29.0	≥ 20.0	≥ 18.0	-55	-60	-40 / -30	-40 / -30	
803 MHz	dB	≥ 29.9	≥ 25.0	≥ 25.0					
821 MHz	dB	≥ 33.1	≥ 28.0	≥ 30.0					-25
832 MHz	dB	≥ 28.4	≥ 21.0	≥ 24.0					
862 MHz	dB	≥ 30.2	≥ 23.0	≥ 22.0	-55	-60	-50 / -45	-50 / -45	
Cross band with partly rejection	MHz	782-792	782-791	790-800					
Return loss 47-766	MHz	> 12.0	> 12.0	> 12.0					
Impedance	Ohm	75	75	75	75	75	75	75	
Shielding efficiency	dB	≥ 75.0	≥ 75.0	≥ 75.0					
Shielding measured	dB	≥ 79.0	≥ 79.0	≥ 79.0					
DC pass	mA	Yes	Yes	Yes	30V / 1A	30V / 1A	500	500	12V/300A
Connectors - in		F-con	F-con	F-con	F-male/	F-male/	F-female	F-female/	IEC-female/
- out					F-female	F-female		IEC-male	IEC-male
Weight	kg	0.150	0.150	0.150	0.100	0.100	0.100	0.100	0.100
Dimensions H x D x W									
- indoor	mm	75x36x75	75x36x75	75x36x75	25x25x110	25x25x110	25x25x110	25x25x110	25x25x110
- outdoor	mm	108x50x120	108x50x120	108x50x120					

*) according to EN 50083-2 & 60728-2 typical

Amplifiers

Masthead amplifiers



Triax range of masthead amplifiers are designed to cut off channel 61-69 where 4G/LTE mobile broadband services are transmitted:

- Input/output: BIII (DAB/UHF up to 790 MHz) (E60)
- High-quality waterproof mast housing
- Build-in green LED power indicator light
- Adjustable gain on all inputs
- Low noise figures
- Simple and easy mounting on mast or wall

Masthead amplifiers with built-in LTE/4G filter

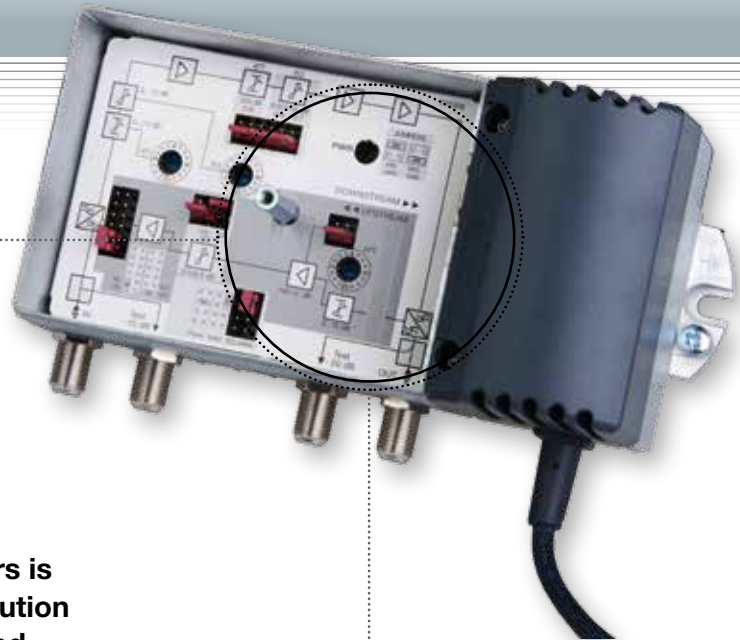
Type		MFA 611	MFA 621	MFA 656	MFA 641	MFA 642	MFA 661
Art. no.		340611	340621	340656	340641	340642	340661
Inputs		1	2	3	2	2	1
Outputs		2	1	1	1	1	1
Frequency	MHz	174-230/ 470-790	174-230/ 470-790	470-790	470-790	470-790	470-790
Gain	dB	15-30/10-25	5-15/20-35	20-35	24-34	24-34	17
Noise figure VHF/UHF	dB	< 3.5/< 3.5	< 2.5/< 2.5	< 2.5/< 2.5	< 4.5/< 2.5	< 2.5	< 2.2
Max. output @-60 db IMA	dB μ V	103	103	103	105	105	112
Power	VDC	12-24	12-24	12-24	12-24	12-24	12-24

Power supplies - 100mA

Type		LTE F 100/1	LTE IEC 100/1	LTE F 100/1	LTE F 100/2
Art. no.		370111	370112	370102	370109
Inputs/outputs		1/1	1/1	1/1	1/2
Frequency	MHz	5-790	5-790	5-790	5-790
Insertion loss	dB	< 2	< 2	< 2	6
Rejection @ 821 MHz	dB	> 18	> 18	> 18	> 23
DC voltage		12	12	12	12
Maximum current mA		100	100	100	100
Mains power supply	VAC	230 \pm 10 %/50 Hz			
Connectors		F-con	IEC	F-con	F-con
Mains plug		BS plug	BS plug	VDE	VDE

CATV distribution

| Indoors amplifiers for all applications



| GHV 500

The GHV 500 range of indoors amplifiers is designed as a low-noise coaxial distribution amplifier for use in small headend-based communal installations where no return path is needed.

- Optimised 1 GHz technology
- Downstream 21...30 dB amplification/ high output level
- Adjustable attenuation settings in 1 dB steps using rotary switches and jumpers for easily readable and easily reproducible settings
- Fixed 3 dB interstage equalisation
- High-quality F-connectors for secure connection and protection against LTE/4G signal ingress
- Built-in energy-saving mains-fed power supply
- Extensive ESD and surge protection

| GHV 900

The GHV 900 range of indoors amplifiers is designed as a high-performance amplifier for small to mid-sized buildings with active/passive return path.

- Optimised 1 GHz technology
- Downstream 20/30/35/40 dB amplification/ high output level
- Adjustable attenuation and equalisation settings in 1 dB steps using rotary switches and jumpers for easily readable and easily reproducible settings
- Switchable VHF band I or 5-65 MHz return path (ON/OFF)
- Upstream 20...32 dB amplification/ high output level
- High-quality F-connectors for secure connection and protection against LTE/4G signal ingress
- Built-in energy-saving mains-fed power supply
- Extensive ESD and surge protection



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GHV series							
Type		GHV 520	GHV 530	GHV 920	GHV 930	GHV 935	GHV 940
Art no.		323138	323142	323150	323158	323162	323166
Frequency range							
Forward path (switchable)	MHz	47-1006	47-1006	47-1006/ 85-1006	47-1006/ 85-1006	47-1006/ 85-1006	47-1006/ 85-1006
Return path (switchable)	MHz	-	-	5-65	5-65	5-65	5-65
Gain forward path							
Gain @ 1006 MHz	dB	21	30	20	30	35	40
Attenuation low/high jumper		0-15	0-22.5	0-15	0-15	0-15	0-15
Input attenuator - 1dB step (rotary switch)	dB	-	-	0-15	0-15	0-15	0-15
Input equalizer - 1dB step (rotary switch)	dB	-	-	0-15	0-15	0-15	0-15
Interstage attenuator (jumper)	dB	-	-	0/6	0/6	0/6	0/6
Interstage equalizer/slope (jumper)	dB	3 fix	3 fix	0/3/7/10	0/3/7/10	0/3/7/10	0/3/7/10
Gain return path							
Gain @ 60MHz (jumper)	dB	-	-	20	22/28	24/30	26/32
Input attenuation (rotary switch)	dB	-	-	0-15	0-15	0-15	0-15
Interstage equalizer/slope (jumper)	dB	-	-	0/3/6/9	0/3/6/9	0/3/6/9	0/3/6/9
Linearity frequency response							
@ 47...1006 MHz	dB	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0
@ 5...65 MHz (return)	dB	-	-	± 1.0	± 1.0	± 1.0	± 1.0
Noise figure							
Forward (VHF I „on“)	dB	5.5	4.5	6.5	6.5	6.5	6.5
Return path (RP „active“)	dB	-	-	5.0	5.0	5.0	5.0
Return loss							
Forward	dB	> 18	> 18	> 18	> 18	> 18	> 18
Return path	dB	-	-	> 18	> 18	> 18	> 18
Output level forward (max)							
CSO (42 ch. 862 MHz) Slope 0/7 dB	dBµV	101	102	98/100	103/105	103/105	107/109
CTB Cenelec 42 ch. 862 MHz, Slope 0/7 dB	dBµV	104	105	98/100	103/105	103/105	107/109
Output level return path							
16 QAM (KDG1TS140 - C)	dBµV	-	-	120	120	120	-
16 QAM (KDG1TS140 - D)	dBµV	-	-	-	-	-	120
RF connectors (75 Ohm)							
Input / Output		F-female	F-female	F-female	F-female	F-female	F-female
Test point in-/output: uni-directional	dB	- 20	- 20	- 20	- 20	- 20	- 20
Test point return path: bi-directional	dB	- 20	- 20	- 20	- 20	- 20	- 20
Operating conditions							
Power supply voltage (50-60 Hz)	V	190-264	190-264	190-264	190-264	190-264	190-264
Power consumption	W	< 3	< 3	< 5	< 7	< 9	< 11
Operating temperature	°C	-25...+55					
Protection class	KV	10/1					
Housing protection degree		II					
Dimensions W x H x D	mm	170 x 90 x 65					
Weight	kg	0.75					
Reference standards							
Product standards/safety/EMC		EN 60728-3 Class 2 / EN 607728-11, EN 60065 / EN 50083-2					
RoHS 2002/95/EG compliant	dB	Yes					
Classes Cable Network Operators							
Unitymedia/KBW UM TS 404 ²						1-3 WE/ 4-6 WE	7-12 WE/ 13-18 WE
KDG 1TS140	dB	Yes		B 1.1/C 1.1	B 3.2/C 3.2	B3.2/C 3.2	C 4.3/D 4.3

Accessories

| Installation cables, connectors and fly leads

Triax cables are designed for in-house and outdoor installations. The wide frequency range allows the cable to carry signals for both radio, television, satellite receivers etc., whether it comes from satellite, cable or antenna.

■ KLASSE
A
■ CLASS

| KOKA 110 HD CABLE

- Is an universal coaxial cable for TV broadcast in-house cabling. The low attenuation, the optimised shielding and the high return loss predestine the cable for use in both Sat-IF and CATV applications.
- Low sensitivity against corrosion
- Low attenuation due to the thick copper centre conductor and the physical foamed PE dielectric

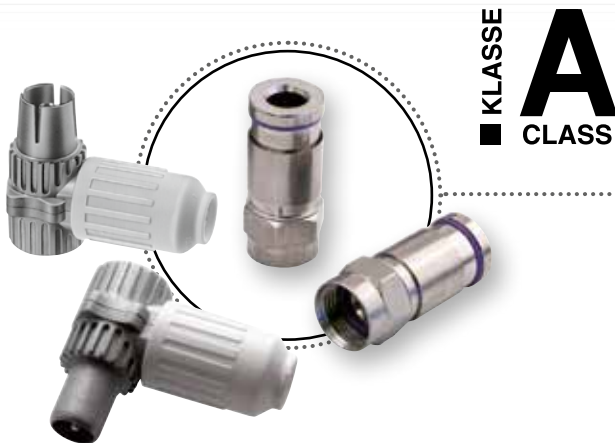


| KOKA 500 CABLE

- Triax KOKA 500 cable is designed to meet high-quality requirements. Due to the full copper inner conductor, the loss in the cable is extremely low, this means high performance even over long distances.
- Class A - according to EN50117-4
- Approved by YouSee and Stofa (Danish Cableoperators).



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■ **KLASSE**
A
■ **CLASS**

| IEC- AND F-CONNECTORS

Wide range of high-quality IEC- and F-connectors with very low loss, superior shielding and very easy for connector fitting, for professional installation of TV systems.

| RG11 CABLE

- ideal for entry point feed systems running to a building and applications to each floor of residential buildings. The RG 11 types are durable quality cables offering high stability in many years to come.
- To protect the signals from interferences, the cables are engineered with a high shielding efficiency - class A.
- The Low Smoke Zero Halogen jacket is ideal where fire resistance is a requirement.



| TV/RADIO FLY LEADS

- RF-Cable - IEC male/female
- High shielded antenna cable suitable for both analogue and digital signals. The cable has integrated ferrit cores at both ends, which secure optimal reception without noise in LED, LCD and plasma tv's.
- The Low Smoke Zero Halogen jacket is ideal where fire resistance is a requirement.

Accessories

| Outlets for LTE protected networks



■ **KLASSE**
A
■ **CLASS**

| MULTIMEDIA, SATELLITE, RETURN, TV AND RADIO OUTLETS

A complete range of Triax antenna outlet sockets with convincing forward-looking technology and easy mounting

- Rapid and comfortable mounting
- Third keyhole – Improved fixing
- Reduced depth and diameter
- Excellent electrical parameters
- Push-lock terminal



| TOU SATELLITE, TV AND RADIO OUTLETS

Die cast aluminium construction.
Suitable for Ø60 mm in-wall box insertion
or surface mounted in a TOU frame.



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**| GRID/SCREENDED
OUTLETS**

Comprehensive range for domestic and system applications.



**| FUGA MULTIMEDIA,
SATELLITE, RETURN,
TV AND RADIO OUTLETS**

TRIAX FUGA Multimedia, Satellite, Return, TV and radio outlets feature improved shielding and quick mounting.



| OPUS TV/RADIO OUTLETS

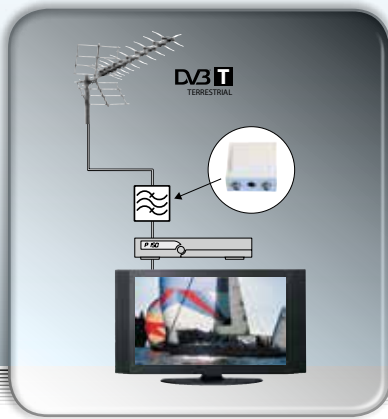
Triax high-quality OPUS TV/radio outlets feature improved shielding and quick mounting. The design, in which backplate and terminals are die cast in one piece, sets new standards in regard to shielding and mechanical stability.

Your antenna system

| What to do..?

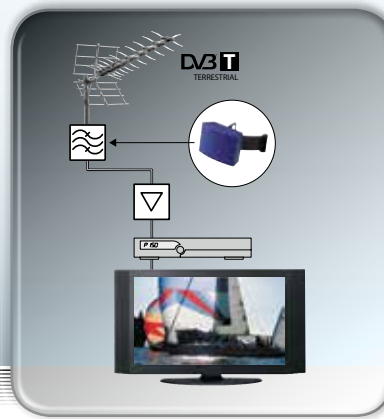


Below we have illustrated different types of antenna systems and what you can improve on your antenna system when the new LTE/4G transmitters start to transmit which may interfere with your TV signals.



Passive antenna system - without amplifier

Use a high performance band stop filter placed in front of the set top box of the existing system.



Active antenna system - with outdoor amplifier

Use a high performance band stop filter placed close to the antenna before the amplifier of your existing system.



New antenna system - with amplifier and antenna

Use a high performance band stop filter placed close to the antenna, an amplifier with low noise figure/high input level and a new TV antenna designed for reception of up to channel 60 only.



Cable-TV system - closed network with Ch60-69

Efficient high shielding is crucial to avoid interference in a cable-TV network. It is important that antenna cables, connectors and taps and splitters as well as outlets live up to the norms of highest shielding class (Class A or A+).

For full details on our new LTE product portfolio please visit

www.triax.com
M M M * C L I 9 X * C O W

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your ultimate connection