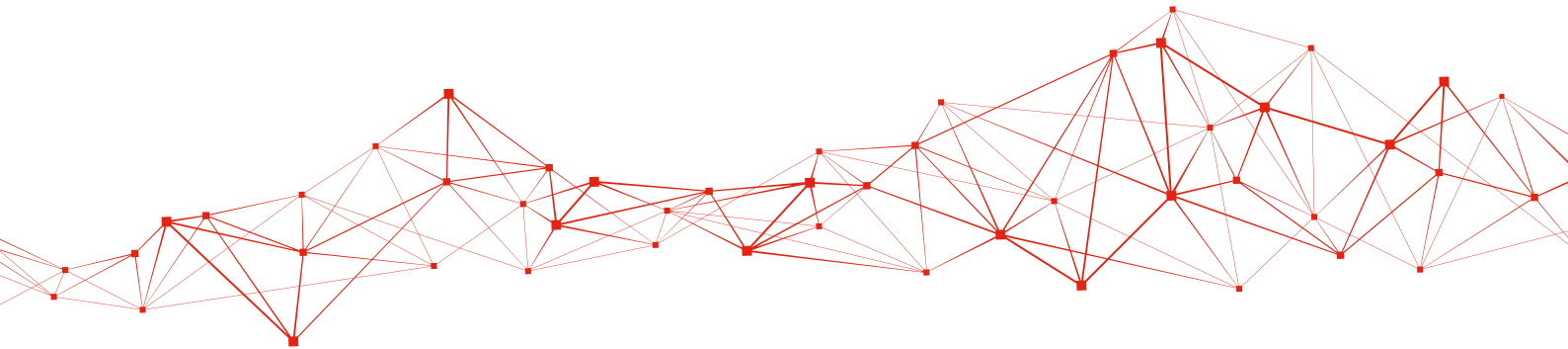


In-Building Wireless Solutions

Passive Distributed Antenna Systems



KATHREIN

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Who we are and what we stand for

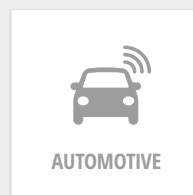
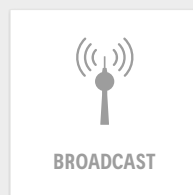
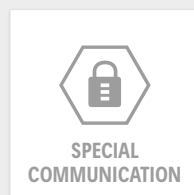
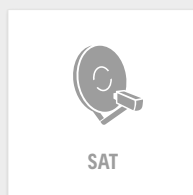
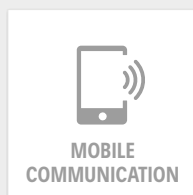
Kathrein is a specialist for reliable, high-quality communication technologies.

The company is driving innovation and technology in today's connected world. Its ability to provide solutions and services enables people all over the world to communicate, access information and use media, whether at home, at the office or on the road.

The business covers a broad spectrum: from mobile communication, RFID and special solutions, to satellite reception and broadcast technology, to transmission and reception systems in vehicles.

As a hidden champion and family-owned enterprise, Kathrein has been working on the technologies of tomorrow since 1919. The company takes pride in its dedicated employees and passion for customers and quality.

Our Solutions



Find out more about us at www.kathrein.com

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Passive Distributed Antenna Systems

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With increasing data traffic and the need for mobile access any time and anywhere, additional availability of mobile networks in indoor environments is indispensable. The network coverage supplied by macro sites is not sufficient to overcome the high penetration losses due to the used façade material of most buildings resulting in poor indoor coverage. To overcome this, distributed antenna systems (DAS) are numerous installed in typical indoor venues like shopping malls, hotels, transportation and hospitals etc.

Today, everyone is talking about active DAS, allowing flexible capacity adaption and easy network modification. Depending on the size of the venue and the specific application, it is still often a more cost-effective solution to use a passive DAS. Although passive DAS are relatively unflexible to retroactive changes in the system setup, the clear advantages are the simple design, low material costs, low maintenance efforts, high reliability and easy coverage deployment. Hence in venues without significant change in requirements over time the use of a passive DAS may often be reasonable.

According to an ABI research study from January 2016, the size of the in-building wireless market is predicted to more than double in revenue by 2020. These numbers reflect the importance of in-building systems in the future and show the indispensability of indoor DAS installations.

With more than 3 million indoor products sold and more than 20 years of experience in passive indoor systems, Kathrein is a trusted partner for future investments in the indoor sector. Not only do we supply high quality products for DAS but we also provide complete installation and planning services.

Indoor Antennas



In indoor applications, the antennas are mostly the only elements in the whole system which are visible. Thus, it is essential that the visual impact is kept to a minimum. The unobtrusive broadband design of Kathrein indoor antennas makes them highly versatile for a wide range of applications.

- Frequency ranges of 370–470 MHz / 694–6000 MHz
- Ceiling or wall mounting
- Omnidirectional or directional
- MIMO capability

The choice of antenna normally depends on the coverage and installation requirements of a building. There is a

clear trend towards complete integration of the antennas into intermediate floors and suspended ceilings as well as towards partial integration of the antennas, e.g. into the ceiling. An example of a partially integrated Kathrein indoor antenna is shown in the picture above.

If the system supports MIMO, it is recommended to use special MIMO antennas with two polarisations instead of using two single antennas which would need to be separated in space and provoke a higher visual impact. During the planning phase, it is important to include potentially needed MIMO setups beforehand in order to provide the correct cabling – for MIMO, double cabling may be needed.

Signal Distribution

In order to distribute the sum of signals to the various floors/ spots, the correct splitting of the signals is essential. The signals may need to be split equally or unequally to achieve the correct signal level at the antenna.

Splitters provide the possibility to equally split the input signal:

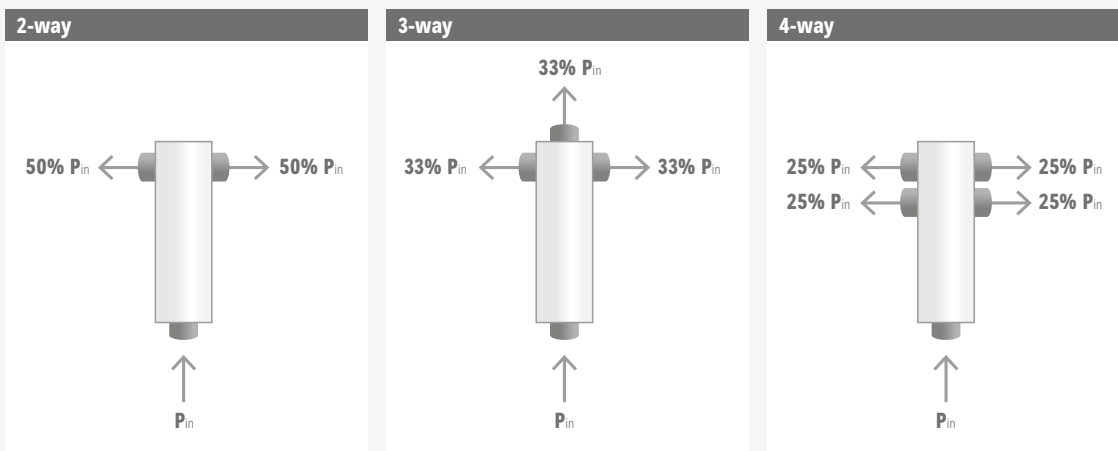
- 2, 3 or 4 output ports
- 380–3800 MHz

Tappers can split the input signal with unequal distribution at the output ports:

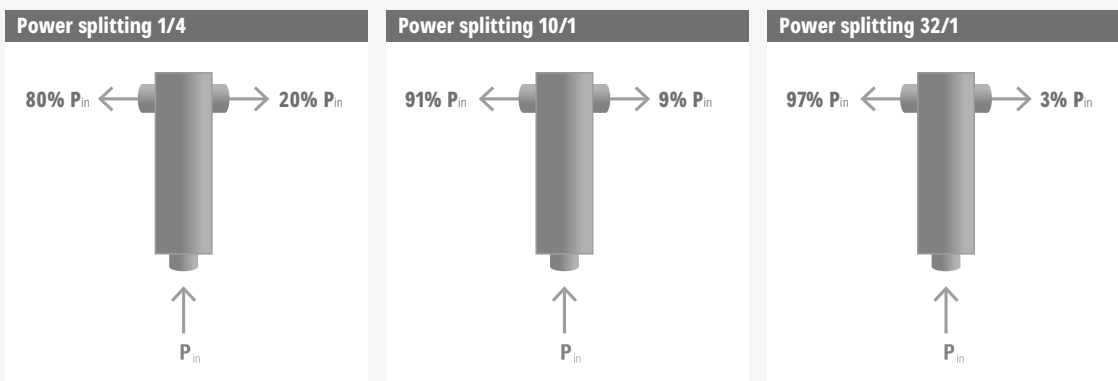
- 2 output ports
- Different splitting ratios
- Adjustable versions available
- 380–5920 MHz

> Example of Different Power Distributions for Splitters and Tappers

Splitters



Tappers



The choice of the correct device depends on the architecture of the building and the needed signal distribution. An example of the RF power split with Kathrein electrical accessories is shown on page 9.

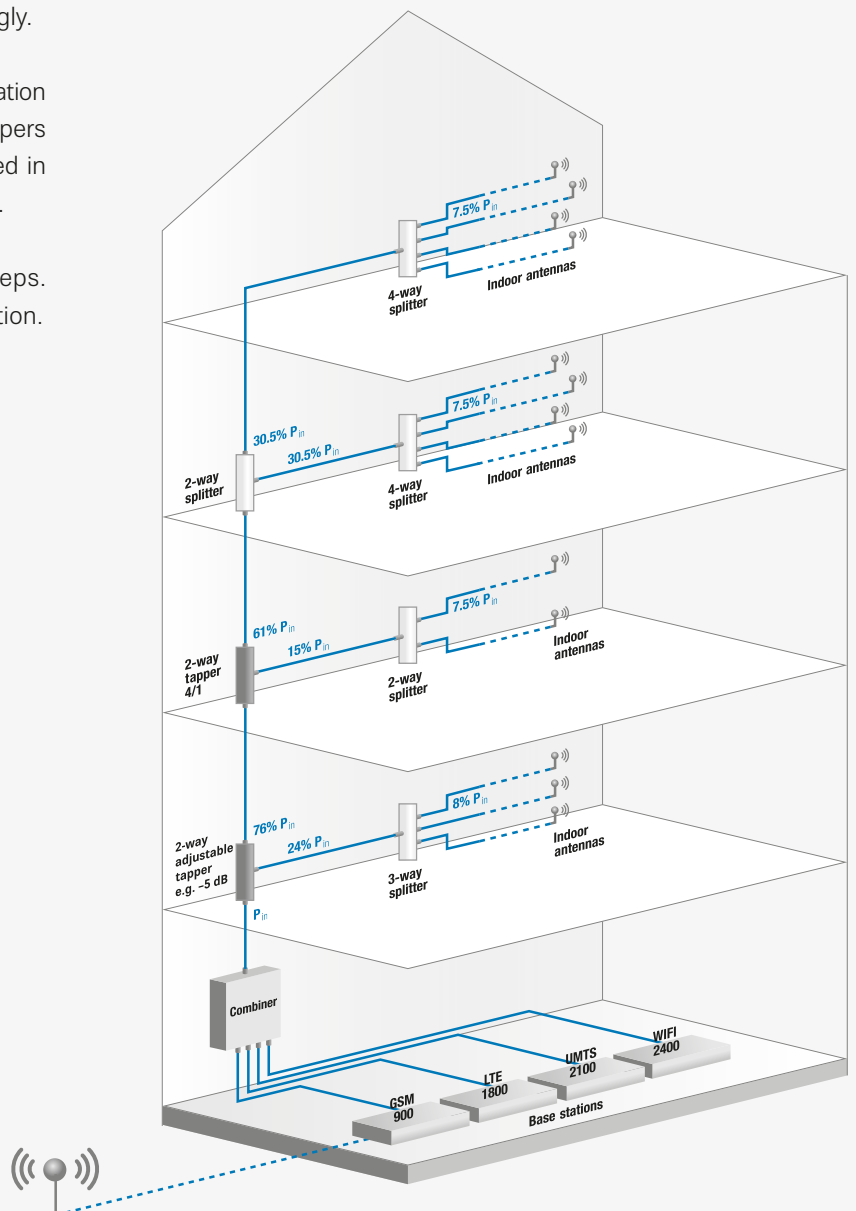
Signal Distribution in a Passive DAS

> Calculation Example

In order to achieve a similar RF power distribution on each floor of a four-storey building, different splitter and tapper versions can be deployed. By choosing different devices, the power levels can be adapted accordingly.

The picture on this page shows the calculation for this scenario. The splitters and tappers split the power with the ratios indicated in the Chapter *Signal Distribution*, page 8.

The values are rounded to 0.5% steps. Losses are not included in the calculation.



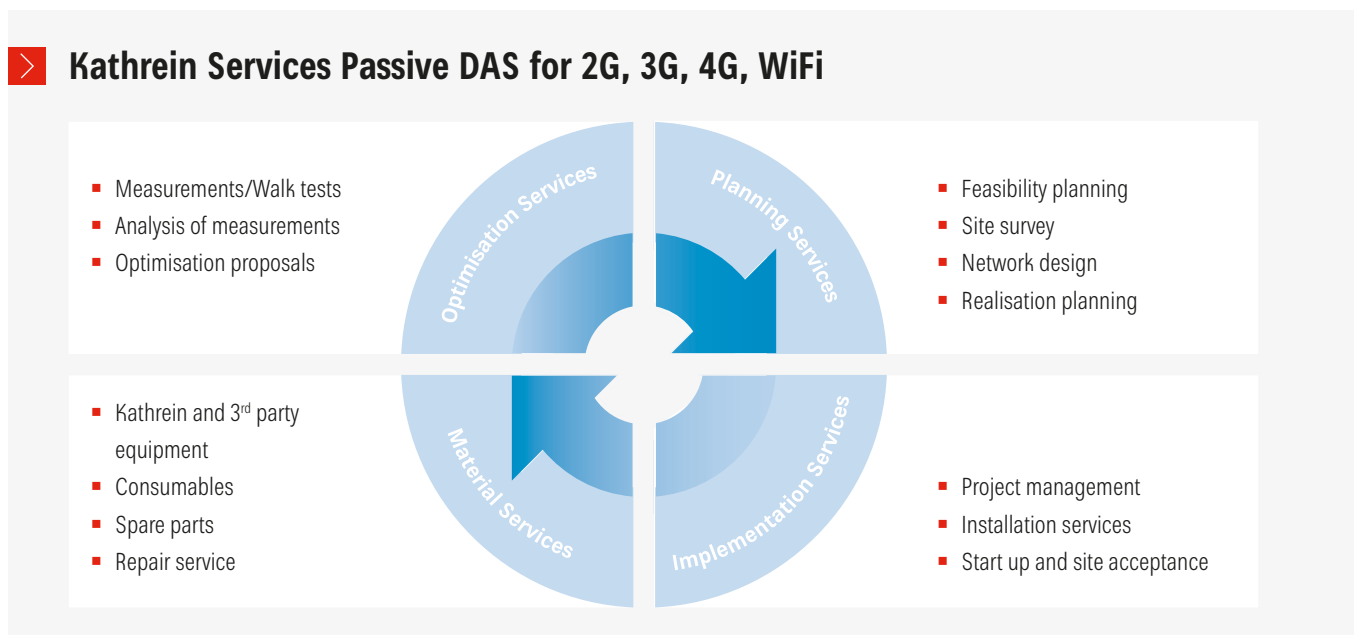
Kathrein Services for Passive DAS

Kathrein offers a variety of support services for the entire life-cycle of passive DAS projects. Our broad experience as an innovation and technology driver and the dedication of our motivated and committed staff are uniquely combined with Kathrein services. Our highly experienced teams at the headquarters in Rosenheim and our service hub in Bucarest as well as our local sales partners provide expert support.

Top quality is a synonym for Kathrein products and this quality also guides our implementation of Kathrein services. We help to realise passive DAS projects with the benefit and reliability for which Kathrein is known in the market. We focus on our customers' needs – our support is available for single tasks as well as complete projects. We perform the service works so that our customers can concentrate on their main tasks.

The following services are provided:

- **Planning services**
Support during the initial setup and all further upgrades like additions of network operators and technologies. We offer the whole range of planning: from feasibility planning over initial walk tests up to detailed CAD plans.
- **Implementation services**
Local customer care for each implementation step. We have a qualified team from local Kathrein departments and partners who gives support over the whole project life cycle. An experienced project management team takes care that everything is in place on time.
- **Material services**
Turn-key and on-time delivery of all material. We make all the logistics and take care of the spare part chain.
- **Optimisation services**
Providing the quality which mobile users expect. We perform and analyse site surveys and walk tests and make optimisation proposals in compliance with the planning objectives. In case of troubles in the field, we send our local team on-site to evaluate the system performance and suggest next steps.



Examples of Successfully Installed Passive DAS

> Indoor DAS – for the Romanian Operator RCS & RDS

Romanian operator RCS & RDS knows that mobile access in indoor environment is a crucial topic. In Kathrein's Romanian subsidiary, Romkatel, they found a trusted and reliable partner to build up indoor DAS (Distributed Antenna System) in a variety of buildings, from the design phase, over full material delivery, up to the implementation services. During the last year, Romkatel professionally and successfully implemented more than 70 passive DAS in shopping malls, supermarkets and office buildings on behalf of RCS & RDS. In total, 700 Kathrein indoor antennas, 300 splitters and 350 tappers were installed for the RCS & RDS single-operator projects. Typical antennas in these installations were e.g. bidirectional antennas, wall-mounted directional antennas and ceiling mounted omni-antennas. The reliability of Kathrein indoor products, the 100% availability and expertise of the Romkatel design and implementation team were key factors for RCS & RDS in their supplier selection process. With Romkatel as a partner and its complex portfolio of materials and services, including iBwave design, successful turnkey projects are a guarantee.

Indoor DAS in Romania	
Country	Romania
Facility	Shopping malls, super markets, office buildings
Operator	RCS & RDS
Year of Installation	2015 until present
Kathrein Sales Partner	Romkatel



Shopping mall with Kathrein antennas

> Indoor Passive DAS in Mauritius

When Mauritius Telecom was searching for a supplier to provide reliable mobile network coverage in public buildings, they chose Kathrein's African sales partner Kathrein Africa Ltd. as their supplier. The key for choosing Kathrein Africa's professionalism was their long-term experience in RF. During 2015, Kathrein Africa successfully completed passive DAS for Mauritius Telecom in the following buildings:

1. Nexteracom Office Building floors 1–14, 103 antennas, 14 tappers, 55 splitters
2. Nexteracom Office Building floors 2–13, 86 antennas, 13 tappers, 51 splitters
3. Nexteracom Office Building floors 3–8, 57 antennas, 6 tappers, 30 splitters
4. Citadelle Shopping Mall floors, 22 floors, 134 antennas, 17 tappers, 66 splitters

These projects ensured mobile connectivity in the buildings. As a complete solution supplier, Kathrein Africa Ltd. successfully guided this project from planning to installation.

Indoor DAS in Mauritius	
Country	Mauritius
Facility	Office buildings, shopping mall
Operator	Mauritius Telecom
Year of Installation	2015
Kathrein Sales Partner	Kathrein Africa Ltd.



Lobby of Nexteracom office building with Kathrein antennas

Overview Omnidirectional/Directional Antennas

	Page	Ports	Type	380	694	790	876	960	1425	1710	2500	2700	3400	3800	4000	5150	5920	6000	
78711019 78712019	13	1	Omn		SISO						SISO								
78711029	14	1	Omn		SISO						SISO								
80010249 80020249	15	1	Omn			SISO				SISO							SISO		
78712031	16	1	Omn		SISO						SISO								
78712033	17	1	Omn		SISO						SISO			SISO					
78712035	18	1	Omn		SISO						SISO			SISO					
78712041	19	1	Omn		SISO						SISO								
78712043	20	1	Omn		SISO						SISO			SISO					
78712045	21	1	Omn		SISO						SISO			SISO					
78711014 78712014	22	2	Omn		SISO						MIMO								
78510802V02 78510802V03	23	2	Omn		SISO						MIMO								
78711020 78712020	24	2	Omn		MIMO						MIMO								
78711030 78711030V01 78712030 78712030V01	25	2	Omn.		MIMO						MIMO								
78712032	26	2	Omn		MIMO						MIMO			MIMO					
78712034	27	2	Omn		MIMO						MIMO			MIMO					
80010712	28	2	Omn		MIMO						MIMO			MIMO				MIMO	
78711313 7812313	29	1	Direct.		SISO						SISO								
80010677	30	2	Direct.			SISO					MIMO								
80010882	31	2	Direct.		MIMO						MIMO								
78510801V02 78510801V03	32	2	Direct.		MIMO						MIMO								
78711311 78712311	33	2	Direct.		MIMO						MIMO								
78712330	34	2	Direct.		MIMO						MIMO								

1-Port Omni Antennas

> 78711019 / 78712019

698–960 (SISO), 1710–2700 (SISO), V-Pol, N / 4.3-10 Connector

Type no.		78711019	78712019
Electrical specifications			
Frequency range	MHz	698–960, 1710–2700	
Polarisation		Vertical	
Gain	dBi	698–960 MHz: 2.0	
	dBi	1710–2700 MHz: 4.5	
Impedance	Ω	50	
Maximum effective power	W	50	
VSWR		< 1.8	
Passive intermodulation IM3	dBc	< -150 @ 2×43 dBm carrier	
Mechanical specifications			
Connector quantity, type		1 × N female	1 × 4.3-10 female
Mounting type		Ceiling-mounted	
Diameter	mm	186 (antenna only)	
Height	mm	86 (antenna only)	
Packaging size	mm	170 × 180 × 180	
Material, colour		Reflector: aluminium; radome: ABS, white	
Pigtail	mm	≈ 300	
Net weight	kg	0.25	
Operating temperature	°C	-40 to +65	



> 78711029

698–960 (SISO), 1710–2700 (SISO), V-Pol, N Connector

Type no.		78711029
Electrical specifications		
Frequency range	MHz	698–960, 1710–2700
Polarisation		Vertical
Gain	dBi	698–960 MHz: 2.0
	dBi	1710–2700 MHz: 4.0
Azimuth beamwidth	°	360
Elevation beamwidth	°	698–960 MHz: 90
		1710–2700 MHz: 55
Impedance	Ω	50
Maximum effective power	W	50
VSWR		698–960 MHz: < 1.8
		1710–2700 MHz: < 1.5
Passive intermodulation IM3	dBc	< -153 @ 2 × 43 dBm carrier
Mechanical specifications		
Connector quantity, type		1 × N female
Mounting type		Ceiling-mounted
Diameter	mm	∅ 200 (antenna only)
Height	mm	120 (antenna only)
Packaging size	mm	170 × 170 × 180
Material, colour		Reflector: aluminium; radome: ABS, white
Pigtail	mm	≈ 300
Net weight	kg	0.27
Operating temperature	°C	-40 to +65



> 80010249 / 80020249

790–960 (SISO), 1425–3800 (SISO), 5150–6000 (SISO), V-Pol, N / 4.3-10 Connector

Type no.		80010249	80020249
Frequency range	MHz	790–960, 1425–3800, 5150–6000	
Polarisation		Vertical	
Gain, typ.	dBi	≈ 2	
Impedance	Ω	50	
VSWR		790–806 MHz: < 1.7 806–960 MHz: < 1.5 1425–1710 MHz: < 2.0 1710–2200 MHz: < 1.4 2200–3800 MHz: < 1.6 5150–5300 MHz: < 2.4 5300–6000 MHz: < 2.0	
Intermodulation IM3	dBc	790–3960 MHz: < -140 (2 × 40 dBm carrier) 1710–3800 MHz: < -140 (2 × 40 dBm carrier) 5150–6000 MHz: not relevant	
Max. power	W	50 (at 50 °C ambient temperature)	
Input		1 × N female	1 × 4.3-10 female
Protection class		IP 30	
Weight	g lb	Approx. 500 approx. 1.1	
Diameter	mm inches	258 10.2	
Height	mm inches	94 (without connector) 3.7 (without connector)	
Packaging size	mm inches	278 × 278 × 171 10.9 × 10.9 × 6.7	
Fire load	kWh	2.12	
Material, colour		Reflector: aluminium; radome: high impact polystyrene, white; additional painting is possible	
Mounting		Three holes in the base enable a mounting on the ceiling; two types of screws are supplied; for the N and 4.3-10 connector a hole in the ceiling with a diameter of 35 mm 1.4 inches is required	
Available accessories		Broadband power splitters and tappers	



∅ 258 mm | 10.2 inches

> 78712031

698–960 (SISO), 1690–4000 (SISO), V-Pol, 4.3-10 Connector

Type no.		78712031
Electrical specifications		
Frequency range	MHz	698–960, 1690–4000
Polarisation		vertical
Gain	dBi dBi	698–960 MHz: 2.0 1690–4000 MHz: 4.0
Impedance	Ω	50
Maximum effective power	W	50
VSWR		698–960 MHz: < 1.8 1690–4000 MHz: < 1.5
Passive intermodulation IM3	dBc	< -153 @ 2 × 43 dBm carrier
Mechanical specifications		
Connector quantity, type		1 × 4.3-10 female
Mounting type		ceiling-mounted
Diameter	mm	∅ 200 (antenna only)
Height	mm	120 (antenna only)
Packaging size	mm	170 × 170 × 180
Material, colour		Reflector: brass; radome: ABS, white
Pigtail	mm	≈ 300
Net weight	kg	0.27
Operating temperature	°C	-40 to +65



> 78712033

CARD, 698–960 (SISO), 1690–2700 (SISO), 3400–4000 (SISO), H-Pol, 4.3-10 Connector

Type no.	78712033	
Electrical specifications		
Frequency range	MHz	698–960, 1690–2700, 3400–4000
Polarisation		Horizontal
Gain	dBi	698–806 MHz: 2.5 806–960 MHz: 3.5 1690–2700 MHz: 5.0 3400–4000 MHz: 4.0
Impedance	Ω	50
Maximum effective power	W	50
VSWR		698–2700 MHz: < 1.8 3400–4000 MHz: < 2.0
Passive intermodulation IM3	dBc	< -153 @ 2 × 43 dBm carrier
Mechanical specifications		
Connector quantity, type		1 × 4.3-10 female
Mounting type		Ceiling-mounted
Dimensions	mm	180 × 110 × 7 (antenna only)
Material, colour		Reflector: PCB; radome: ABS, white
Pigtail	mm	≈ 300
Net weight	kg	≈ 0.3
Operating temperature	°C	-40 to +65



> 78712035

SLIM, 698–960 (SISO), 1690–2700 (SISO), 3400–4000 (SISO), H-Pol, 4.3-10 Connector

Type no.		78712035
Electrical specifications		
Frequency range	MHz	698–960, 1690–2700, 3400–4000
Polarisation		Horizontal
Gain	dBi	698–806 MHz: 2.5 806–960 MHz: 3.5 1690–2700 MHz: 5.0 3400–4000 MHz: 3.5
Impedance	Ω	50
Maximum effective power	W	50
VSWR		698–2700 MHz: < 1.8 3400–4000 MHz: < 2.0
Passive intermodulation IM3	dBc	< -153 @ 2 × 43 dBm carrier
Mechanical specifications		
Connector quantity, type		1 × 4.3-10 female
Mounting type		Ceiling-mounted
Diameter	mm	190 (antenna only)
Height	mm	7.3 (antenna only)
Material, colour		Reflector: PCB; radome: ABS, white
Pigtail	mm	≈ 300
Net weight	kg	≈ 0.3
Operating temperature	°C	-40 to +65



> 78712041

380–520 / 600–960 / 1690–2700 / 2700–4300 / 4300–6000 (SISO), V-Pol,
4.3-10 Connector

Type no.	78712041					
Electrical specifications						
Frequency range	MHz	380–520	600–960	1690–2700	2700–4300	4300–6000
Polarisation		Vertical				
Gain	dBi	1.5	2.5	4.5	5.0	5.5
Impedance	Ω	50				
Maximum effective power	W	50				
VSWR		≤ 3.0	≤ 2.0	≤ 2.0	≤ 2.0	≤ 2.0
Passive intermodulation IM3	dBc	≤ -150 @ 2×43 dBm carrier				
Mechanical specifications						
Connector quantity and type		1 \times 4.3-10 female				
Mounting type		Ceiling-mounted				
Radome		Material: ABS colour: white				
Reflector material		Aluminium				
Pigtail	mm	≈ 300				
Dimensions	mm	Antenna only: $\varnothing 285 \times 135$				
Net weight	kg	≈ 0.85				
Operating temperature	$^{\circ}\text{C}$	-40 to +65				



> 78712043

CUBICAL, Outdoor, 698–960 / 1710–2700 / 3300–4000 (SISO), V-Pol, 4.3-10 Connector

Type no.		78712043
Electrical specifications		
Frequency range	MHz	698 – 960 1710 – 2700 3300 – 4000
Polarisation		Vertical
Gain	dBi	698 – 960 MHz: 3 1710 – 2700 MHz: 4 3300 – 4000 MHz: 4.5
Azimuth beamwidth	°	360
Elevation beamwidth	°	698 – 960 MHz: 80 1710 – 2700 MHz: 52 3300 – 4000 MHz: 38
Impedance	Ω	50
Maximum effective power	W	100
VSWR		< 1.8
Passive intermodulation IM3	dBc	< -150 @ 2 × 43 dBm carrier
Mechanical specifications		
Connector quantity and type		1 × 4.3-10 female
Mounting type		Pole-mounted; mounting clamp for a pole diameter of 38 – 52 mm included
Radome		Material: UV-ABS colour: white
Reflector material		Aluminium
Dimensions	mm	Antenna only: 66 × 66 × 190 packaging size: 97 × 97 × 255
Net weight	kg	0.55
Operating temperature	°C	-40 to +65



> 78712045

CYLINDRICAL, Outdoor, 698–960 / 1710–2700 / 3300–4000 (SISO), V-Pol, 4.3-10 Connector

Type no.		78712045
Electrical specifications		
Frequency range	MHz	698 – 960 1710 – 2700 3300 – 4000
Polarisation		Vertical
Gain	dBi	698 – 960 MHz: 3 1710 – 2700 MHz: 4 3300 – 4000 MHz: 4.5
Azimuth beamwidth	°	360
Elevation beamwidth	°	698 – 960 MHz: 80 1710 – 2700 MHz: 52 3300 – 4000 MHz: 38
Impedance	Ω	50
Maximum effective power	W	100
VSWR		< 1.8
Passive intermodulation IM3	dBc	< -150 @ 2 × 43 dBm carrier
Mechanical specifications		
Connector quantity and type		1 × 4.3-10 female
Mounting type		Pole-mounted; mounting clamp for a pole diameter of 38 – 52 mm included
Radome		Material: UV-ABS colour: white
Reflector material		Aluminium
Dimensions	mm	Antenna only: ∅ 66 × 190 packaging size: 97 × 97 × 255
Net weight	kg	0.55
Operating temperature	°C	-40 to +65



2-Port Omni Antennas

> 78711014 / 78712014

698–960 (SISO), 1710–2700 (MIMO), VH-Pol, N / 4.3-10 Connector

Type no.	78711014 / 78712014					
Electrical specifications						
Frequency range ¹⁾	MHz	698–800	800–960	1710–2700	1710–1880	1880–2700
Polarisation		Vertical		Horizontal		
Gain ¹⁾	dBi	1.5		3.5	4.0	
Isolation	dB	> 26				
Impedance	Ω	50				
Maximum effective power ²⁾	W	50				
VSWR ¹⁾		< 1.8	< 1.5	< 1.8	< 1.5	
Passive intermodulation IM3	dBc	< -150 @ 2×43 dBm carrier				
Mechanical specifications						
Connector quantity, type		78711014: 2 × N female 78712014: 2 × 4.3-10 female				
Mounting type		Ceiling-mounted				
Diameter	mm	203				
Height		113				
Packaging size	mm	170 × 180 × 180				
Material, colour		Reflector: brass; radome: ABS, white				
Pigtail	mm	≈ 300				
Net weight	kg	≈ 0.37				
Operating temperature	°C	-40 to +65				



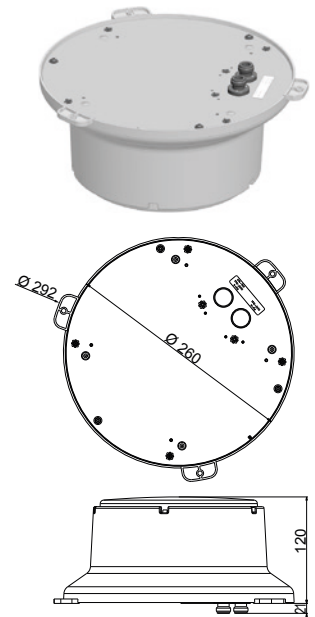
¹⁾ valid for port 1 and port 2

²⁾ per port

> **78510802V02 / 78510802V03**

694–960 (SISO), 1710–2690 (MIMO), VH-Pol, N / 4.3-10 Connector

Type no.		78510802V02	78510802V03
MAIN port: Frequency range, polarisation	MHz	694–960, 1710–2690, vertical	
MIMO port: Frequency range, polarisation	MHz	1710–2690, horizontal	
Gain	dBi	~ 2	
VSWR		< 2.0	
Isolation (MAIN <-> MIMO)	dB	> 25	
Passive intermodulation IM3	dBc	< -140 (@ 2 × 40 dBm carrier)	
Max. total RF Power	W	20 (@ 50 °C ambient temperature)	
RF ports, connector type		2 x N (female)	2 x 4.3-10 (female)
Impedance	Ω	50	
Diameter	mm	292	
Height	mm	120 (without connectors)	
Packaging size	mm	173 × 325 × 325	
Weight	kg	0.65	
Protection class		IP 30	
Storage temperature	°C	-25 to +70	
Operational temperature	°C	-5 to +55	



> 78711020 / 78712020

698–960 (MIMO), 1710–2700 (MIMO), VV-Pol, N / 4.3-10 Connector

Type no.		78711020	78712020
Electrical specifications			
Frequency range ¹⁾	MHz	698–960, 1710–2700	
Polarisation		Dual vertical	
Gain ¹⁾	dBi	698–960 MHz: 3.0 1710–2700 MHz: 4.5	
Isolation	dB	> 20	
Impedance	Ω	50	
Maximum effective power ²⁾	W	50	
VSWR ¹⁾		698–960 MHz: < 2.0 1710–2700 MHz: < 1.7	
Passive intermodulation IM3	dBc	< -150 @ 2×43 dBm carrier	
Mechanical specifications			
Connector quantity, type		2 × N female	2 × 4.3-10 female
Mounting type		Ceiling-mounted	
Diameter	mm	215 (antenna only)	
Height	mm	47 (antenna only)	
Packaging size	mm	155 × 120 × 225	
Material, colour		Reflector: brass/PCB; radome: ABS, white	
Pigtail	mm	≈ 300	
Net weight	kg	≈ 0.45	
Operating temperature	°C	-40 to +65	

¹⁾ valid for port 1 and port 2

²⁾ per port



> 78711030(V01) / 78712030(V01)

698–960 (MIMO), 1710–4000 (MIMO), VV-Pol, N / 4.3-10 Connector

Type no.		78711030	78711030V01	78712030	78712030V01
Electrical specifications					
Frequency range ¹⁾	MHz	698–960, 1710–4000			
Polarisation		Dual vertical			
Gain ¹⁾	dBi	698–960 MHz: 3.0 1710–4000 MHz: 4.5			
Isolation	dB	> 20			
Impedance	Ω	50			
Maximum effective power ²⁾	W	50			
VSWR ¹⁾		698–960 MHz: ≤ 2.0 1710–4000 MHz: ≤ 1.7			
Passive intermodulation IM3	dBc	≤ -153 @ 2×43 dBm carrier			
Mechanical specifications					
Connector quantity, type		2 × N female		2 × 4.3-10 female	
Mounting type		Ceiling-mounted			
Diameter	mm	215			
Height	mm	47			
Packaging size	mm	155 × 120 × 225			
Material, colour		Reflector: brass, PCB Radome: ABS, white			
Pigtail	mm	≈ 300			
Net weight	kg	≈ 0.45			
Operating temperature	°C	-40 to +65			

¹⁾ valid for port 1 and port 2

²⁾ per port



78711030 / 78712030



78711030V01 / 78712030V01

> 78712032

CARD, 698–960 / 1710–2700 / 3300–4000 (MIMO), HH-Pol, 4.3-10 Connector

Type no.	78712032			
Electrical specifications				
Frequency range	MHz	698 – 960	1710 – 2700	3300 – 4000
Polarisation		Dual horizontal		
Gain ¹⁾	dBi	3.0	5.0	5.5
Isolation		> 20	> 23	> 23
Azimuth beamwidth	°	360		
Elevation beamwidth	°	113	68	102
Impedance	Ω	50		
Maximum effective power ¹⁾	W	50		
VSWR		< 2.0	< 1.8	< 1.8
Passive intermodulation IM3	dBc	< -150 @ 2 × 43 dBm carrier		
Mechanical specifications				
Connector quantity and type		2 × 4.3-10 female		
Mounting type		Ceiling-mounted		
Radome		Material: ABS colour: white		
Reflector material		PCB		
Pigtail	mm	≈ 300		
Dimensions	mm	Antenna only: 150 × 250 × 8 packaging size: 165 × 255 × 100		
Net weight	kg	≈ 0.4		
Operating temperature	°C	-40 to +65		



¹⁾ per port

> 78712034

SLIM, 698–960 / 1710–2700 / 3300–4000 (MIMO), HH-Pol, 4.3-10 Connector

Type no.	78712034			
Electrical specifications				
Frequency range	MHz	698 – 960	1710 – 2700	3300 – 4000
Polarisation		Dual horizontal		
Gain ¹⁾	dBi	3.0	5.0	5.5
Isolation		> 20	> 23	> 23
Azimuth beamwidth	°	360		
Elevation beamwidth	°	110	42	31
Impedance	Ω	50		
Maximum effective power ¹⁾	W	50		
VSWR		< 2.0	< 1.8	< 1.8
Passive intermodulation IM3	dBc	< -150 @ 2 × 43 dBm carrier		
Mechanical specifications				
Connector quantity and type		2 × 4.3-10 female		
Mounting type		Ceiling-mounted		
Radome		Material: ABS colour: white		
Reflector material		PCB		
Pigtail	mm	≈ 300		
Dimensions	mm	Antenna only: ∅ 280 × 8 packaging size: 295 × 285 × 115		
Net weight	kg	≈ 0.55		
Operating temperature	°C	-40 to +65		



¹⁾ per port

> 80010712

694–960 / 1427–1518 / 1695–2690 / 3400–3800 / 4920–5920 (MIMO), VV-Pol,
4.3-10 Connector

Type no.	80010712					
Frequency range ¹⁾	MHz	694–960	1427–1518	1695–2690	3400–3800	4920–5920
Polarisation		Dual vertical				
Gain, typ.	dBi	2				
Gain, max.	dBi	4.0–5.5	5.0–5.5	5.0–7.5	5.5–7.0	7.0–8.0
Impedance	Ω	50				
VSWR		< 2.0				
Isolation	dB	> 20				
Intermodulation IM3	dBc	–150 @ 2 × 40 dBm carrier				not relevant
Max. power per input ²⁾	W	20		10	5	
Max. effective power ²⁾³⁾	W	20				
Input		2 × 4.3-10 female ⁴⁾				
Protection class		IP 30				
Weight	g lb	950 2.1				
Diameter antenna only	mm inches	320 12.6				
Height antenna only	mm inches	89 3.5				
Packaging size	mm inches	350 × 350 × 150 13.8 × 13.8 × 5.9				
Fire load	kWh	3.18				
Material, colour		Reflector: aluminium; radome: ASA/PC blend, colour: white; additional painting is possible				
Mounting		On-ceiling mounting: Mounting kit 85010200 required Concealed antenna installation (ceiling thickness 3–35 mm/0.12–1.38 inches): mounting kit 85010201 required Hidden antenna installation in double layer ceiling, floors or similar: no additional mounting kit required				
Accessories ⁵⁾		On-ceiling mounting kit: 85010200 Support ring for concealed antenna installation: 85010201				



¹⁾ per port

²⁾ @ 50 °C ambient temperature

³⁾ for the antenna

⁴⁾ angular connector required

⁵⁾ antenna only

⁶⁾ order separately if required

1-Port Directional Antennas

> 78711313 / 78712313

698–960 (SISO), 1710–2700 (SISO), V-Pol, N / 4.3-10 Connector

Type no.		78711313	78712313
Electrical specifications			
Frequency range	MHz	698–960, 1710–2700	
Polarisation		Vertical	
Gain	dBi	698–960 MHz: 7.0 1710–2700 MHz: 9.0	
Azimuth beamwidth	°	65	
Elevation beamwidth	°	55	
Impedance	Ω	50	
Maximum effective power	W	50	
VSWR		698–960 MHz: ≤ 2.0 1710–2700 MHz: ≤ 1.8	
Passive intermodulation IM3	dBc	≤ -150 @ 2×43 dBm carrier	
Mechanical specifications			
Connector quantity, type		1 × N female	1 × 4.3-10 female
Mounting type		Wall-mounted or pole-mounted (pole Ø: 38 to 52 mm)	
Dimensions	mm	165 × 155 × 50 (antenna only)	
Packaging size	mm	200 × 170 × 70	
Material, colour		Reflector: brass, PCB; radome: ABS, white	
Pigtail	mm	≈ 300	
Net weight	kg	0.4	
Operating temperature	°C	-40 to +65	

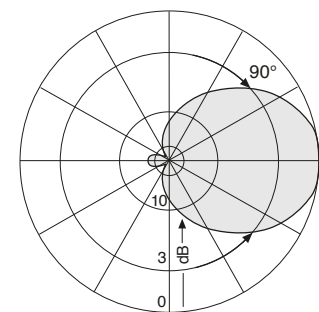
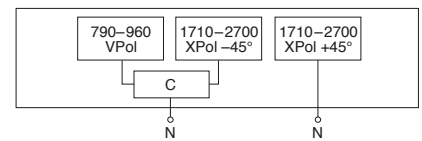


2-Port Directional Antennas

> 80010677

790–960 (SISO), 1710–2700 (MIMO), VX-Pol, N Connector

Type no.		80010677	
Frequency range	MHz	790–960	1710–2700
Polarisation		Vertical	+45°, -45°
Gain	dBi	≈ 7	≈ 2 × 7
Half-power beam width	°	Horizontal: ≈ 90	
Impedance	Ω	50	
VSWR		< 2.0	
Isolation	dB	> 25	
Max. power	W	50 (at 50 °C ambient temperature)	
Input		2 × cable RG 223/CU of 1 m length, white, with N female connector	
Protection class		IP 30	
Weight	g lb	600 1.32	
Dimensions	mm	232 × 140 × 50	
	inches	9.1 × 5.5 × 2.0	
Packaging size	mm	363 × 152 × 62	
	inches	14.3 × 6.0 × 2.4	
Fire load		1.6 kWh	
Material, colour		Reflector: aluminium; radome: high impact polystyrene, colour: white; additional painting is possible; mounting plates: stainless steel	
Mounting		Position: wall and ceiling possible; two holes of 6 mm 0.24 inches diameter in the mounting plate; screws are not supplied; avoid stressing the cable; no stress on the hexagonal crimp; minimum cable bending radius: 30 mm 1.18 inches without tensile load; cable must be fixed	
Available accessories		Broadband power splitters and tappers (790–2700 MHz)	



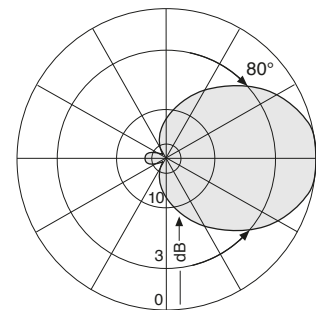
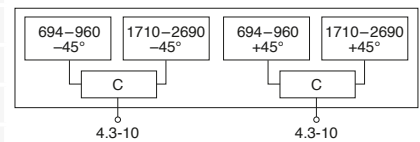
Horizontal Pattern

80010882

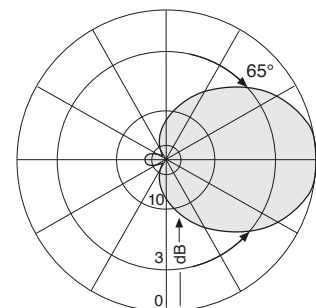
694–960 (MIMO), 1710–2690 (MIMO), XX-Pol, 4.3-10 Connector

Type no.	80010882		
Frequency range	MHz	694–960	1710–2690
Polarisation	°	+45, -45	+45, -45
Gain	dBi	7	8
Half-power beam width ¹⁾	°	Typ. 80	typ. 65
Impedance	Ω	50	
VSWR		≤ 2.2	
Isolation	dB	694–806 MHz: ≥ 16 806–960 MHz: ≥ 20	≥ 20
Max. power per port	W	20 @ 50 °C ambient temperature	
Passive intermodulation PIM 3	dBc	< -140 @ 2 × 26.5 dBm carrier	
Input		2 × 4.3-10 female	
Protection class		IP 30	
Weight	kg lb	1.6 3.5	
Dimensions	mm	399 × 237 × 63	
	inches	15.7 × 9.3 × 2.5	
Packaging size	mm	417 × 281 × 141	
	inches	16.4 × 11.1 × 5.6	
Operating temperature	°C	-5 to +55	
Fire protection classification		UL 94-V2	
Fire load	kWh	5.3	
Material		Reflector: brass; radome: ASA/PC, colour: white	
Mounting		Position: wall and ceiling possible The antenna is mounted with four screws: 4.5 mm 0.18 inches nominal diameter, screw head diameter ≤ 9 mm 0.35 inches. The screws are not supplied. After mounting the antenna, install the antenna cover.	
Available accessories		Broadband power splitters and tappers 380–5920 MHz	

¹⁾ horizontal, vertical



Horizontal/vertical pattern
694–960 MHz



Horizontal/vertical pattern
1710–2690 MHz

> 78510801V02 / 78510801V03

694–960 (MIMO), 1710–2690 (MIMO), XX-Pol, N / 4.3-10 Connector

Type no.		78510801V02	78510801V03
Frequency range	MHz	694–960 (MIMO), 1710–2690 (MIMO)	
Polarisation		X-pol +45° (MAIN port) X-pol -45° (MIMO port)	
Gain	dBi	≈ 7	
Horizontal half power beam width		694–960 MHz: typ. 80° 1710–2690 MHz: typ. 65°	
Vertical half power beam width		694–960 MHz: typ. 80° 1710–2690 MHz: typ. 60°	
VSWR		694–960 MHz: ≤ 2.2 1710–2690 MHz: ≤ 2.2	
Isolation (MAIN ↔ MIMO)	dB	694–806 MHz: ≥ 16 806–960 MHz: ≥ 20 1710–2690 MHz: ≥ 20	
Passive intermodulation IM3	dBc	< -140 @ 2 × 26.5 dBm carrier	
Max. total RF power	W	20 @ 50 °C ambient temperature	
RF ports, connector type		2 × N female	2 × 4.3-10 female
Impedance	Ω	50	
Weight	kg	1.5	
Dimensions	mm	422 × 200 × 60	
Packaging size	mm	444 × 252 × 145	
Protection class		IP 42	
Storage temperature	°C	-25 to +70	
Operational temperature	°C	-5 to +55	



> 78711311 / 78712311

698–960 (MIMO), 1710–2700 (MIMO), XX-Pol, N / 4.3-10 Connector

Type no.		78711311	78712311
Electrical specifications			
Frequency range ¹⁾	MHz	698–960, 1710–2700	
Polarisation		±45°	
Gain ¹⁾	dBi	698–960 MHz: 7.0 1710–2700 MHz: 8.0	
Isolation	dB	> 23	
Azimuth beamwidth	°	698–960 MHz: 75 1710–2700 MHz: 65	
Elevation beamwidth	°	698–960 MHz: 70 1710–2700 MHz: 65	
Impedance	Ω	50	
Maximum effective power ²⁾	W	698–960 MHz: 100 1710–2700 MHz: 50	
VSWR ¹⁾		698–960 MHz: < 2.0 1710–2700 MHz: < 1.8	
Passive intermodulation IM3	dBc	< -150 @ 2×43 dBm carrier	
Mechanical specifications			
Connector quantity, type		2 × N female	2 × 4.3-10 female
Mounting type		Wall-mounted	
Dimensions	mm	315 × 197 × 70 (antenna only)	
Packaging size	mm	435 × 210 × 85	
Material, colour		Reflector: brass, PCB; radome: ABS, white	
Pigtail	mm	≈ 300	
Net weight	kg	≈ 0.7	
Operating temperature	°C	-40 to +65	



¹⁾ valid for port 1 and port 2

²⁾ per port

> 78712330

698–960 (MIMO), 1710–4000 (MIMO), VH-Pol, 4.3-10 Connector

Type no.	78712330				
Electrical specifications					
Frequency range ¹⁾	MHz	698–864	870–960	1710–2700	3300–4000
Polarisation		Vertical, horizontal			
Gain ¹⁾	dBi	6.5	6.5	8.5	7.5
Isolation	dB	20			
Azimuth beamwidth	°	80	80	65	45
Elevation beamwidth	°	70	70	60	35
Impedance	Ω	50			
Maximum effective power ²⁾	W	50			
VSWR		≤ 2.0	≤ 2.0	≤ 1.8	≤ 2.0
Passive intermodulation IM3	dBc	≤ -153 @ 2 × 43 dBm carrier			
Mechanical specifications					
Connector quantity, type		2 × 4.3-10 female			
Mounting type		Wall-mounted			
Dimensions	mm	315 × 195 × 68 (antenna only)			
Packaging size	mm	435 × 210 × 85			
Material, colour		Reflector: aluminium; radome: ABS, white			
Pigtail	mm	≈ 300			
Net weight	kg	0.65			
Operating temperature	°C	-40 to +65			



¹⁾ valid for port 1 and port 2

²⁾ per port

Power Splitters

> 78761022 / 78761032 / 78761042

698–2700, 300 W, N Connector, 2-way / 3-way / 4-way

Type no.		78761022	78761032	78761042
Frequency range	MHz	698–2700		
For connecting ... antennas		2	3	4
Insertion loss	dB	3.0	4.8	6.0
Impedance	Ω	50		
VSWR		≤ 1.25		
Intermodulation IM3	dBc	≤ -155 @ 2×43 dBm carrier		
In-band ripple	dB	± 0.3	± 0.5	± 0.8
Max. power	W	300		
Temperature	$^{\circ}\text{C}$	-40 to +65		
Connector		N female		
Net weight	kg	0.5		
Dimensions ¹⁾	mm	197 × 25 × 25	233 × 25 × 25	235 × 25 × 25
Packaging size		240 × 80 × 35	240 × 80 × 35	240 × 80 × 35
Mounting		Wall-mounted with bracket		
Protection class		IP65		

¹⁾ Without connectors and brackets



> 78762023 / 78762033 / 78762043
698–3800, 500 W, 4.3-10 Connector, 2-way / 3-way / 4-way

Type no.		78762023	78762033	78762043
Frequency range	MHz	698–3800		
For connecting ... antennas		2	3	4
Insertion loss	dB	3.0	4.8	6.0
Impedance	Ω	50		
VSWR		≤ 1.25		
Intermodulation IM3	dBc	≤ -160 @ 2×43 dBm carrier		
In-band ripple	dB	± 0.4	± 0.5	± 0.8
Max. power	W	500		
Temperature	$^{\circ}\text{C}$	-40 to +65		
Connector		4.3-10 female		
Net weight	kg	0.28	0.40	0.47
Dimensions ¹⁾	mm	215 × 61 × 42	269 × 61 × 42	272 × 61 × 60
Mounting		Wall-mounted with bracket		
Protection class		IP65		



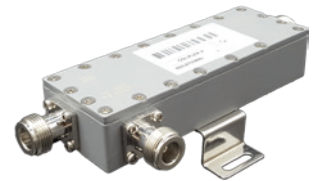
78762043

¹⁾ Without connectors and brackets

Directional Couplers

> 78761105 / 78761106 / 78761108 / 78761110 / 78761113 / 78761115
 698–2700, 5/6/8/10/13/15 dB Coupling Loss, N Connector

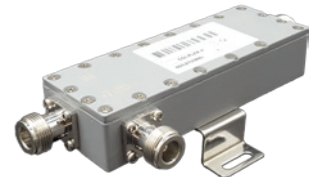
Type no.		78761105	78761106	78761108	78761110	78761113	78761115
Frequency range	MHz	698–2700					
Input ↔ COP	dB	5	6	8	10	13	15
Coupling bias	dB	±0.3	±0.3	±0.3	±0.3	±0.6	±0.6
Output ↔ COP	dB	≥ 25	≥ 25	≥ 25	≥ 28	≥ 33	≥ 33
Input ↔ output	dB	≤ 1.6	≤ 1.6	≤ 1.6	≤ 0.7	≤ 0.5	≤ 0.5
Impedance	Ω	50					
VSWR		≤ 1.2					
Intermodulation IM3	dBc	≤ -155 @ 2×43 dBm carrier					
Max. power	W	300					
Connector		N female					
Temperature	°C	-40 to +60					
Net weight	kg	0.5					
Dimensions ¹⁾	mm	43×121×21					
Mounting		Wall-mounted with bracket					
Protection class		IP65					



¹⁾ Without connectors and brackets

> 78762105 / 78762106 / 78762108 / 78762110 / 78762113 / 78762115
698–3800, 5/6/8/10/13/15 dB Coupling Loss, 4.3-10 Connector

Type no.		78762105	78762106	78762108	78762110	78762113	78762115
Frequency range	MHz	698 – 3800					
Input ↔ COP	dB	5	6	8	10	13	15
Coupling bias	dB	± 0.3	± 0.3	± 0.3	± 0.3	± 0.6	± 0.6
Output ↔ COP	dB	≥ 25	≥ 25	≥ 25	≥ 28	≥ 33	≥ 33
Input ↔ output	dB	≤ 1.6	≤ 1.6	≤ 1.6	≤ 0.7	≤ 0.5	≤ 0.5
Impedance	Ω	50					
VSWR		≤ 1.2					
Intermodulation IM3	dBc	≤ -160 @ 2×43 dBm carrier					
Max. power	W	500					
Connector		4.3-10 female					
Temperature	°C	-40 to +60					
Net weight	kg	0.5					
Dimensions ¹⁾	mm	43 × 121 × 21					
Mounting		Wall-mounted with bracket					
Protection class		IP65					



¹⁾ Without connectors and brackets

Power Tappers

> 86010136 / 86010137 / 86010138

694–2700, 7.0/1.0 dB, N Connector

694–2700, 10.4/0.4 dB, N Connector

694–2700, 15.1/0.1 dB, N Connector

Type no.		86010136	86010137	86010138
Frequency range	MHz	694–2700		
Tap loss				
Input ↔ P ₁	dB	-1.0	-0.4	-0.1
Input ↔ P ₂		-7.0	-10.4	-15.1
For connecting ... antennas		2		
Insertion loss	dB	< 0.05		
Impedance	Ω	50		
VSWR		694–790 MHz: < 2.0 790–2500 MHz: < 1.5 2500–2700 MHz: < 2.0		
Intermodulation IM3	dBc	< -150 @ 2 × 43 dBm carrier		
Max. power	W	100 W @ 50 °C ambient temperature		
Connector		N female		
Weight	g	500		
Dimensions	mm	244 × 64 × 25		
Profile cross-section	mm	25 × 25		
Packaging size	mm	267 × 95 × 111		
Material		Housing: aluminium; inner conductor: brass		
DC capability		DC transmission only between input and port P ₁ , P ₂ is coupled capacitively		
Environmental conditions		IP52		



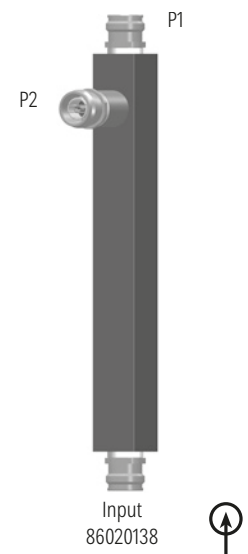
> 86020136 / 86020137 / 86020138

694–2700, 7.0 /1.0 dB, 4.3-10 Connector

694–2700, 10.4/0.4 dB, 4.3-10 Connector

694–2700, 15.1/0.1 dB, 4.3-10 Connector

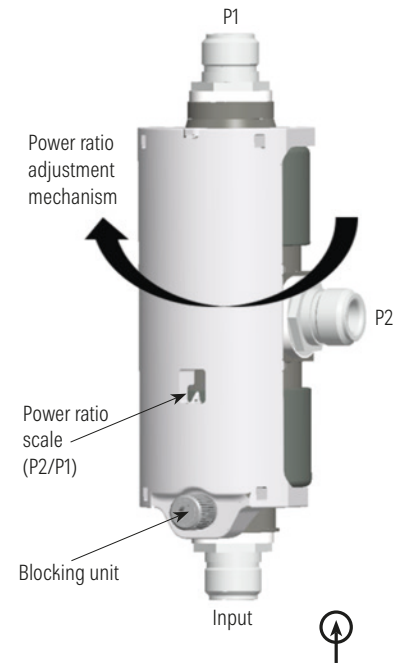
Type no.		86020136	86020137	86020138
Frequency range	MHz	694–2700 MHz		
Tap loss				
Input ↔ P ₁	dB	-1.0	-0.4	-0.1
Input ↔ P ₂		-7.0	-10.4	-15.1
For connecting ... antennas		2		
Insertion loss	dB	< 0.05		
Impedance	Ω	50		
VSWR		694–790 MHz: < 2.0 790–2500 MHz: < 1.5 2500–2700 MHz: < 2.0		
Intermodulation IM3	dBc	< -150 @ × 43 dBm carrier		
Max. power	W	100 @ 50 °C ambient temperature		
Connectors		4.3-10 female		
Weight	g lb	500 1.1		
Dimensions	mm inches	247 × 66 × 25 9.7 × 2.6 × 1.0		
Profile cross-section	mm inches	25 × 25 1.0 × 1.0		
Packaging size	mm inches	253 × 73 × 92 10.0 × 2.9 × 3.6		
Material		Housing: aluminium; inner conductor: brass		
DC capability		DC transmission only between input and port P ₁ ; P ₂ is coupled capacitively		
Environmental conditions		IP 65		



> 86010160 / 86020160

380–960 / 1695–2700 / 3400–3800 / 4920–5920, Continuously Adjustable Splitting Ratio, N / 4.3-10 Connector

Type no.		86010160 / 86020160			
Frequency range	MHz	380–960	1695–2700	3400–3800	4920–5920
Power ratio between outputs (P_2/P_1)	dB	–5 to –20, continuously adjustable			
For connecting ... antennas		2			
Insertion loss	dB	0.2	0.2	< 0.5	< 0.7
Impedance	Ω	50			
VSWR		< 1.5	< 1.5	< 1.7	< 1.7
Intermodulation IM3	dBc	< –150 @ 2 × 43 dBm carrier			not relevant
Max. power	W	100 @ 50 °C ambient temperature			
Connector		86010160: N female 86020160: 4.3-10			
Weight	kg lb	0.4 0.9			
Environmental conditions		Indoor and outdoor use			
Protection class		IP 65			
Profile diameter	mm inches	50 2.0			
Dimensions, max. including connectors	mm inches	160 × 70 × 55 6.3 × 2.8 × 2.2		160 × 63 × 52 6.3 × 2.5 × 2.0	
Packaging size	mm inches	190 × 80 × 60 7.5 × 5.0 × 2.4		225 × 80 × 62 8.9 × 5.0 × 2.4	
Material		Housing: aluminium; inner conductor: brass			
DC capability		DC transmission only between input and port P_1			



Splitting table – typical values

P_2 / P_1 [dB]	Splitting ratio P_1 / P_2	Splitting attenuation	
		P_1 / P_{Input} [dB]	P_2 / P_{Input} [dB]
–5	3.2	–1.30	–6.30
–6	4.0	–1.05	–7.05
–7	5.0	–0.85	–7.85
–8	6.3	–0.70	–8.70
–9	8.0	–0.60	–9.60
–10	10.0	–0.50	–10.50
–11	12.6	–0.40	–11.40
–12	15.8	–0.35	–12.35
–13	20.0	–0.25	–13.25
–14	25.1	–0.20	–14.20
–15	31.6	–0.15	–15.15
–16	39.8	–0.14	–16.14
–17	50.1	–0.12	–17.12
–18	63.1	–0.11	–18.11
–19	79.4	–0.10	–19.10
–20	100.0	–0.09	–20.09

KATHREIN Solutions GmbH
Anton-Kathrein-Straße 1–3
83022 Rosenheim, Germany
Phone +49 8031 184-0
www.kathrein.com | ics-sales@kathrein-solutions.com

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