PASSIVE DAS
SELECTION GUIDE
High-Performance Indoor Solutions

2nd Edition

Radio Frequency Systems

Two major trends drive the need to deploy a dedicated wireless in-building communications solution:

Peoples' behaviors and **new network technologies**

People are in buildings, consuming more data

Today, people spend most of their time in buildings – at home, at work, in shopping malls and at entertainment venues. Even when traveling, people spend much of their time in buildings.

While indoors, people are constantly using smartphones and tablets to stay in touch, entertain themselves and complete work tasks. The increasing demand for wireless services – particularly data services – from within buildings is exhausting macro networks to capacity.

Wireless in-building solutions bring the network inside the buildings where people spend their time. People enjoy access to uninterrupted wireless services and operators can address network challenges.

Dedicated in-building solutions:

- Improve capacity and coverage indoors
- Offload the outdoor macro network
- Enable more efficient use of the available spectrum
- Support of MIMO technology to maximize the network capacity
- Support commercial and mission-critical communications requirements

Bringing **wireless networks** closer to

Networks and buildings are evolving

Advanced wireless technologies, such as 4G/5G, give people access to the speeds needed to consume vast quantities of data. However, high-speed services often operate at high frequencies that don't penetrate buildings well. Adding to the challenge, modern buildings are often constructed with reinforced concrete and steel that resist wireless signal penetration.

Wireless in-building solutions solve these challenges by taking network technologies within building walls.

In-building solutions only make technical and financial sense if they:

- Support multiple frequency bands, network technologies and operators
- Reduce total cost of ownership (TCO)
- Provide highly reliable communications
- Comply with safety regulations

Passive distributed antenna system (DAS) solutions from Radio Frequency Systems deliver all of the capabilities needed to give people better access to wireless services in buildings while meeting technical and financial requirements.

people . . .

Multi-band, multi-technology, multi-operator support

Solutions are transparent from a radio frequency (RF) perspective.

- A single passive DAS solution can be shared by multiple operators that deliver different commercial and mission-critical wireless services using different technologies and frequency bands.
- Operators and frequencies can be added or changed to support new macro network providers or technologies, including 4G LTE.
- DAS solutions are radio access network (RAN) vendor-agnostic.

High quality and reliability

All solution components deliver high-quality and highly reliable commercial and mission-critical wireless services in buildings.

- RF cables combine flexibility and strength with low attenuation and high power ratings.
- Non-cable components maintain overall system performance and key performance characteristics such as passive intermodulation (PIM) performance.
- RF-over-fiber repeaters can be used to reamplify signals over long distances.

Built for compliance and safety

Cable materials and construction are all thoroughly tested to ensure they meet national, regional and local fire and flame-retardant specifications.

A full-service partner

RFS provides professional services to help customers deploy passive DAS solutions that are optimized for cost and performance. RFS can assist customers with specific stages of design and deployment or provide a turnkey solution.

Low TCO

Once installed, RFS passive DAS solutions require no maintenance and consume no electricity.

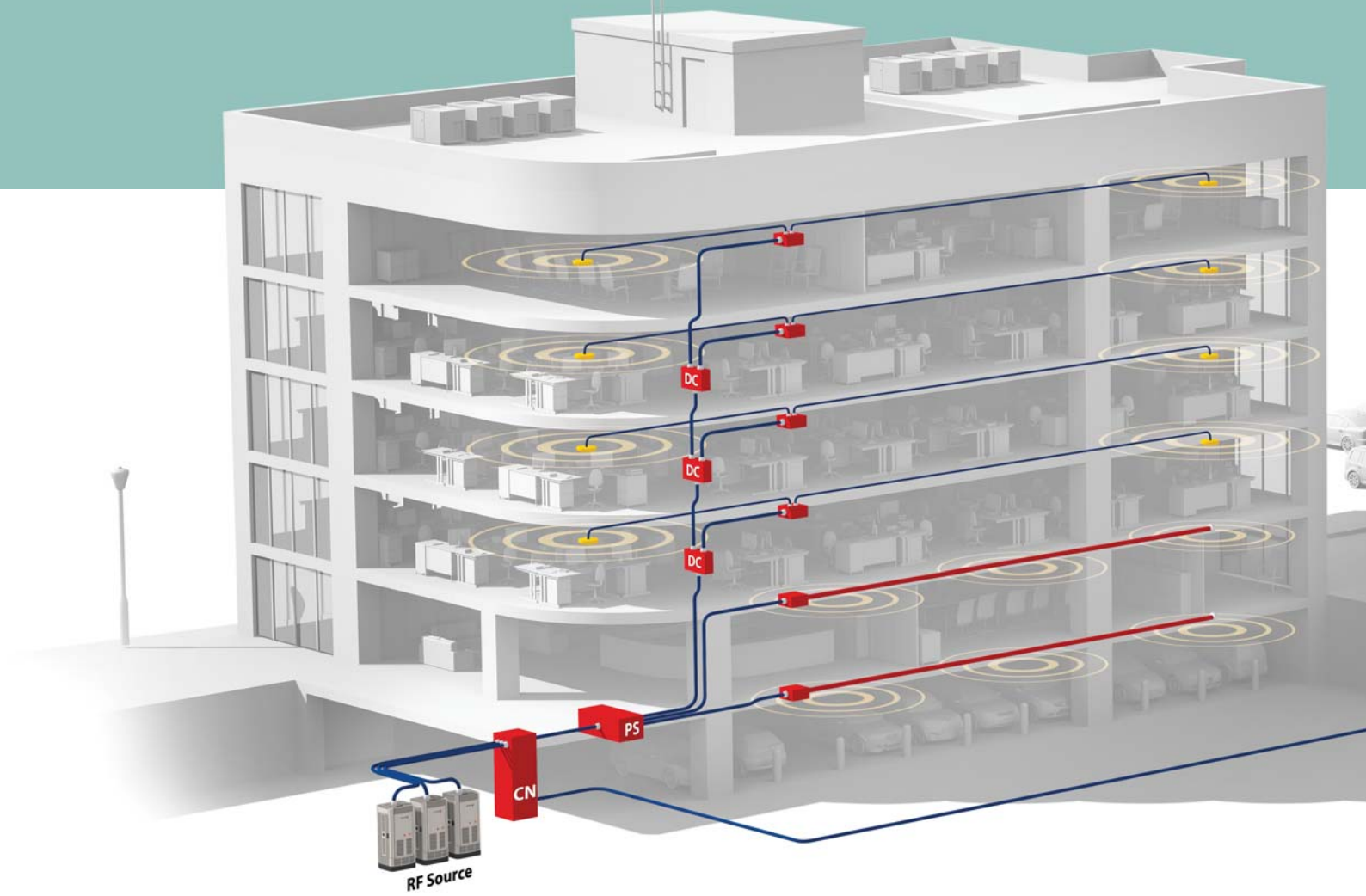
This keeps costs down and ensures error-free operation and high system availability – key requirements for mission-critical services.

RFS passive DAS solutions are scalable for installation in buildings of all types, and sizes.

Bring wireless communications to:

- Apartments, condominium buildings and hotels
- Airport terminals and train stations
- Office and industrial complexes
- Shopping malls
- Stadiums and arenas
- Hospitals
- School campuses
- Conference centers
- Public buildings such as museums, art galleries, concert halls and libraries

Wireless **in-building solutions** tailored for **your**



Flexible designs for commercial and mission-critical communications

Any complexity, any business model.

Every RFS passive DAS solution is purpose-built to match business objectives, application requirements and physical environment.

Solutions can be designed to support simple environments with a single operator, service and frequency, or highly sophisticated environments with multiple operators, services and frequencies. Services supported can include any combination of:

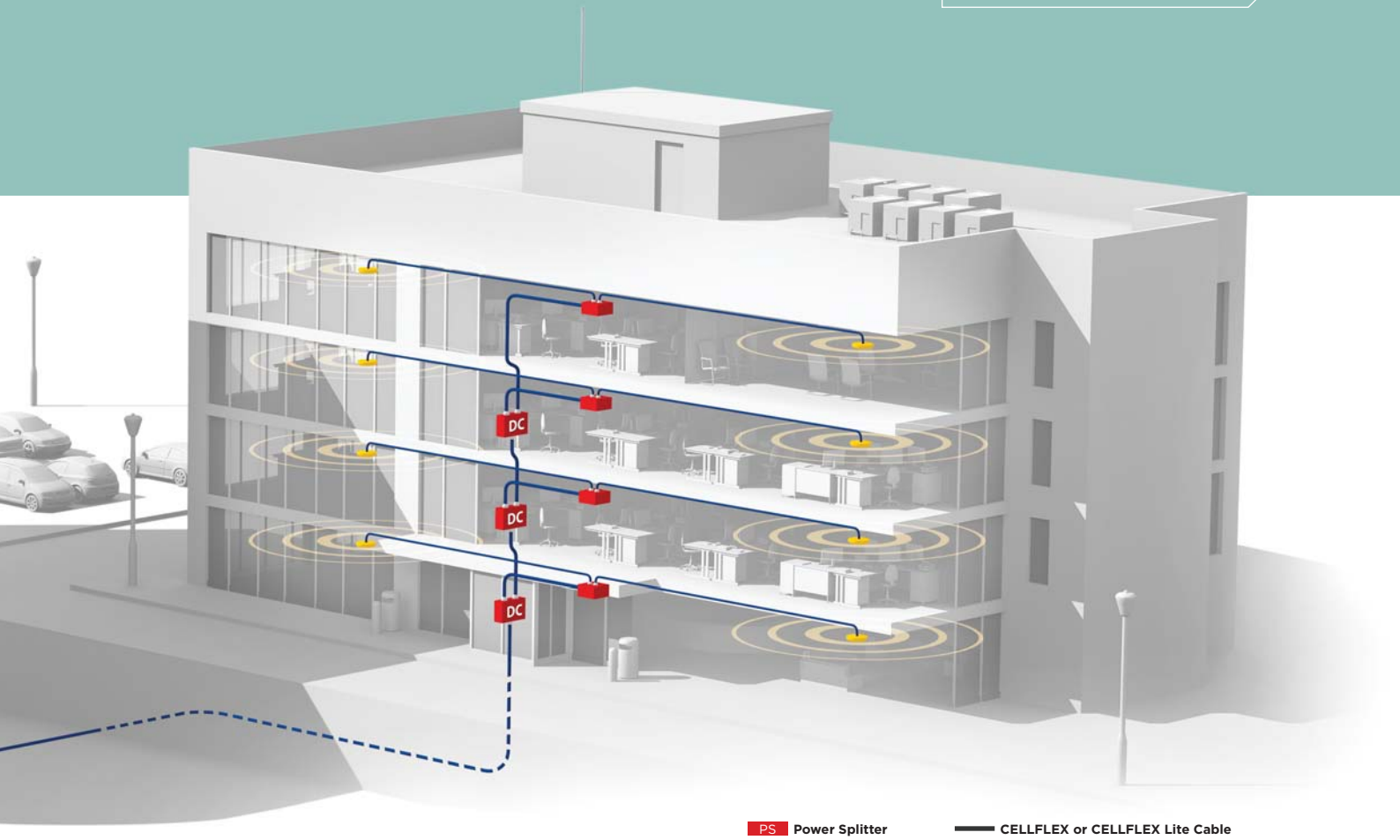
- **Cellular wireless services based on 2G, 3G, 4G and 5G technologies**
- **Analog and digital security and emergency services**
- **Wireless LAN (WLAN) services based on 802.11 standards**

needs . . .

Complete wireless in-building solutions

RFS wireless in-building solutions include all of the components needed to deploy an end-to-end passive DAS.

- CELLFLEX® and CELLFLEX® Lite low-loss foam dielectric coaxial cables
- High-performance RADIAFLEX® radiating cables
- High-quality connectors that maintain system performance
- Broadband and ultra-broadband indoor antennas
- Broadband and ultra-broadband indoor passive DAS components as well as combiners, couplers and splitters with low insertion loss



PS Power Splitter
DC Directional Coupler
CN Combining Network

CELLFLEX or CELLFLEX Lite Cable
RADIAFLEX Cable
In-Building Antennas

Cables and **connectors** for every **DAS application . . .**

RFS coaxial and **radiating** cables are designed to meet **in-building communications** requirements today and tomorrow. Our high- quality connectors maintain **signal integrity end-to-end**.

CELLFLEX® low-loss copper and aluminum cables

The CELLFLEX and CELLFLEX Lite duo make up the largest corrugated transmission-line portfolio in the wireless infrastructure industry. The foam dielectric cables combine remarkable flexibility with high strength and superior electrical performance to ensure uninterrupted communications throughout buildings. This premium transmission line family is backed by a complete line of accessories, including the renowned OMNI FIT™ connector range. Twenty unique CELLFLEX types, ranging in size from 1/4" to 1-5/8", provide users with a perfect match for even the most complicated and demanding applications. Every cable comes with a guarantee of reliability, performance and cost-effectiveness.

Low attenuation

Low attenuation enables extremely efficient signal transfers.

CELLFLEX Factory-Fit Jumper Assemblies

RFS offers models with outdoor-rated jacket types, of varying lengths in m (ft) increments.

	Model Number	Characteristic	Connector A	Connector B	Length, m (ft)
1/2"	43M43ML12F-0100FFP	Low Loss	4.3-10 Male	4.3-10 Male	1 (3.3)
	43M43ML12F-0200FFP	Low Loss	4.3-10 Male	4.3-10 Male	2 (6.6)
	43M43ML12F-0300FFP	Low Loss	4.3-10 Male	4.3-10 Male	3 (9.9)
	7M7ML12F-0100FFP	Low Loss	7-16 DIN Male	7-16 DIN Male	1 (3.3)
	7M7ML12F-0200FFP	Low Loss	7-16 DIN Male	7-16 DIN Male	2 (6.6)
	7M7ML12F-0300FFP	Low Loss	7-16 DIN Male	7-16 DIN Male	3 (9.9)
	NMNML12F-0100FFP	Low Loss	N Male	N Male	1 (3.3)
	NMNML12F-0200FFP	Low Loss	N Male	N Male	2 (6.6)
	NMNML12F-0300FFP	Low Loss	N Male	N Male	3 (9.9)
	43M43MS12F-0100FFP	Super Flexible	4.3-10 Male	4.3-10 Male	1 (3.3)
	43M43MS12F-0200FFP	Super Flexible	4.3-10 Male	4.3-10 Male	2 (6.6)
	43M43MS12F-0300FFP	Super Flexible	4.3-10 Male	4.3-10 Male	3 (9.9)
	NMNMS12F-0100FFP	Super Flexible	N Male	N Male	1 (3.3)
	NMNMS12F-0200FFP	Super Flexible	N Male	N Male	2 (6.6)
	NMNMS12F-0300FFP	Super Flexible	N Male	N Male	3 (9.9)
	7M7MS12F-0100FFP	Super Flexible	7-16 DIN Male	7-16 DIN Male	1 (3.3)
	7M7MS12F-0200FFP	Super Flexible	7-16 DIN Male	7-16 DIN Male	2 (6.6)

CELLFLEX Flame-Retardant Cables

	Cable	Characteristic	Fire Class/Jacket Type	
			JFN(A)	CPR
1/2"	SCF12-50	Super Flexible	B2ca s1a d0 a1	B2ca s1a d0 a1
	LCF12-50	Low Loss	B2ca s1 d0 a1	B2ca s1a d0 a1
7/8"	LCF78-50	Low Loss	B2ca s1a d0 a1	B2ca s1a d0 a1
1 1/4"	LCFS114-50	Low Loss	B2ca s1b d2 a1	B2ca s1b d0 a1
1 5/8"	LCF158-50	Low Loss	Cca s1a d2 a1	Cca s1a d0 a1

Please check the last status of Declaration of Performance (DoP) on rfsworld.com.
http://www.rfsworld.com/declaration-of-performance,677,1.html

Complete shielding

The solid outer conductor on CELLFLEX coaxial cables creates a continuous RFI/EMI shield that minimizes system interference.

Low VSWR

Special low voltage standing wave ratio (VSWR) CELLFLEX variants help maintain system integrity.

Outstanding intermodulation performance

The solid inner and outer conductors virtually eliminate intermodulation.

High power rating

Low attenuation, excellent heat transfer properties and temperature stabilized dielectric material ensure safe, long-term operation at high transmit power levels.

Wide range of applications

CELLFLEX cables support frequency bands up to 6000 MHz to enable a wide range of in-building applications.

RFS' ICA plenum-rated wideband cables, available in **copper** or lighter-weight **aluminum** models, deliver **outstanding electrical performance** and support all wireless **in-building** applications.

These air dielectric coaxial cables are thoroughly tested for safe use within the "environmental air handling space" in ceilings as well as in more traditional plenum applications.

Clearfill® Line plenum-rated

Wideband operation
RFS plenum-rated cables support technologies and applications in bands ranging from 380 MHz to 6000 MHz.

Continuous (star-shaped) dielectric for total inner conductor support
RFS plenum-rated cables eliminate electrical and mechanical problems in tight bending areas.

Complete shielding
RFS plenum-rated cables' solid outer conductor creates a continuous RFI/EMI shield that minimizes system interference.

Outstanding performance
RFS plenum-rated cables offer low attenuation, outstanding heat transfer properties and temperature stabilized dielectric materials.

cables . . .

Plenum-Rated Cables

	Model Number	Jacket Color	Cable Weight, kg/m (lb/ft)	Outer Conductor Material
1/2"	**ICA12-50JPL**	Blue	0.37 (0.25)	Corrugated Copper
	ICA12-50JPLLW	White	0.19 (0.13)	Corrugated Aluminum
	ICA12-50JPLW	White	0.37 (0.25)	Corrugated Copper
	ICA12-50JPLR	Red	0.4 (0.27)	Annularly Corrugated Copper

RFS red plenum coaxial cables for public safety applications are best-in-class UHF/VHF cables that enable outstanding electrical performance for iDAS and oDAS emergency communication applications.

Plenum-Rated Jumper Cables

RFS offers models with white jackets, 1/4" diameter cable, of varying lengths in m (ft) increments.

	Model Number	Characteristic	Connector A	Connector B	Length, m (ft)
1/2"	**43M43MI12P-030FFP**	Blue, PVC	4.3-10 Male	4.3-10 Male	0.91 (3)
	43M7MI12P-030FFP	Blue, PVC	4.3-10 Male	7-16 Male	0.91 (3)
	43MNMI12P-030FFP	Blue, PVC	4.3-10 Male	N Type Male	0.91 (3)
	7M7MI12P-030FFP	Blue, PVC	7-16 Male	7-16 Male	0.91 (3)
	7MNMI12P-030FFP	Blue, PVC	7-16 Male	N Type Male	0.91 (3)
	NMNMI12P-030FFP	Blue, PVC	N Type Male	N Type Male	0.91 (3)

Low-smoke and halogen-free **cabling solution** that meets all major international **flame and fire-retardancy** standards.

RADIAFLEX®
radiating cables

RADIAFLEX is the world's leading "radiating" cable solution for contoured indoor RF coverage.

The RCF series is a small bending radii cable with a corrugated outer conductor and is ideal for heavy-duty applications in buildings and underground in mines.

The RSF series is a flexible cable with a corrugated outer conductor and is ideal for in-vehicle applications.

The RLK series is a low-coupling-loss cable and is ideal for tunnel and building applications.

All RFS cables meet International Electrotechnical Commission (IEC), European Standard (EN) and Association of Electrical, Electronic and Information Technologies (VDE) standards for:

- **IEC 60754-1/-2: Halogen-free and non-corrosive jacket tests**
- **IEC 60332-1: Flame tests**
- **IEC 60332-3-24: Cable bundle tests**
- **IEC 61034: Low-smoke emission tests**

Broadband solution

RADIAFLEX cables support all major services up to 6 GHz, making them ideal for multi-operator and multi-band applications in challenging locations such as parking garages, tunnels and mines.

Flame and fire retardant

RADIAFLEX cables are low-smoke and halogen-free to meet all major international flame- and fire-retardancy standards.

Low loss

RADIAFLEX cables offer low longitudinal loss and are available in low coupling-loss variants that are specifically designed for building and tunnel applications.

RADIAFLEX® Cable Selection Guide

Cable types	FM PMR 75-110 MHz	PMR 150-170 MHZ	TETRA PMR TETRAPOL 380-500 MHz	CDMA TDMA GSM900 GSM-R LTE UMTS900 698-960 MHz	LTE1800 GSM1800 PCN DECT 1.7-1.9 GHz	UMTS2100 1.9-2.2 GHz	LTE ISM WLAN WIFI WiMax 2.2-2.7 GHz	WiMax 3.5 GHz	WLAN WIFI 5-6 GHz	Remarks
	Technology (Frequency)									
RLF78-50A	•••	••	•	••	-	-	-	-	-	Negligible influence of dust/salt/moisture accumulation
RLF114-50A	•••	••	•	••	-	-	-	-	-	
RLF158-50A	••	••	•	••	-	-	-	-	-	
RLFU78-50A	••	••	•	••	•••	•••	-	-	-	
RLFU114-50A	••	••	•	••	••	•••	-	-	-	
RLFU158-50A	••	••	•	••	•••	•••	-	-	-	
RLK12-50A	••••	•••	••••	•••	-	-	-	-	-	Low coupling loss 1/2" to 7/8": Recommended in buildings 7/8" to 1 5/8": Recommended for tunnels
RLK78-50A	••••	•••	••••	•••	-	-	-	-	-	
RLK114-50A	••••	••	••••	•••	-	-	-	-	-	
RLK158-50A	••••	••	••••	•••	-	-	-	-	-	
RLKW12-50A	••••	•••	•••	••••	••••	-	-	-	-	
RLKW78-50A	••••	•••	•••	••••	••••	-	-	-	-	
RLKW114-50A	•••	•••	•••	••••	••••	-	-	-	-	
RLKU12-50A	••	••	•	•••	•••	••••	••••	-	-	
RLKU78-50A	••	••	•	••	•••	••••	••••	-	-	
RLKU114-50AH	••	•	•	•••	••••	••••	••••	-	-	
RLKU158-50AH	••	•	•	•••	••••	••••	••••	-	-	
RE60 (Waveguide)	-	-	-	-	-	-	-	-	••••	Leading-edge solution for in-tunnel wireless applications in the 5-6 GHz band
RAY78-50A	•••	••	•••	••••	-	-	-	-	-	Low coupling loss Optimized for digital transmission
RAY114-50A	••	•	•••	••••	-	-	-	-	-	
RAY158-50A	••	•	•••	••••	-	-	-	-	-	
RAYA158-50A	••	••	••	•••	••••	••••	••••	-	-	
RSF12-50	•	•	•	•	•	•	•	•	•	Corrugated outer conductor Robust, low bending radius
RCF12-50	•	•	•	•	•	•	•	•	•	
RCF78-50A	•	•	•	•	•	•	•	•	-	
RCF114-50A	•	•	•	•	•	•	•	-	-	
RCF158-50A	•	•	•	•	•	•	•	-	-	
RHCA12-50	•	•	•	•	•	•	•	•	•	Plenum rated

Legend: •••• Best in class; ••• Recommended; •• Operating properly; • Functional; - Not functional

Cable	Characteristic	Fire Class/Jacket Type		
		JFNA	JFLA	CPR
RLK12-50	up to 1GHz	Cca s1 d1 a1	Cca s1a d0 a1	B2ca s1a d0 a1
RLK78-50	up to 1GHz	Dca s1b d2 a1	Dca s1b d2 a1	Cca s1a d0 a1
RLK114-50	up to 1GHz	Dca s1 d2 a1	Dca s1 d2 a1	Cca s1b d0 a1
RLK158-50	up to 1GHz	Dca s2b d2 a1	Cca s1b d1 a1	B2ca s1 d0 a1
RLKU12-50	up to 2.7GHz	Cca s1a d1 a1	Cca s1a d0 a1	B2ca s1a d0 a1
RLKU78-50	up to 2.7GHz	Dca s1b d2 a1	Dca s1b d2 a1	Cca s1a d0 a1
RLKU114-50	up to 2.7GHz	Dca s1 d2 a1	Dca s1 d2 a1	Cca s1b d0 a1
RLKU158-50	up to 2.7GHz	Dca s2b d2 a1	Cca s1b d1 a1	B2ca s1 d0 a1

Please check the last status of Declaration of Performance (DoP) on rfsworld.com.
http://www.rfsworld.com/declaration-of-performance,677,1.html

Radio Frequency Systems cable products comply with the EU's **Construction Products Regulation (CPR)**

CPR

Safety is key

CPR-Compliant Cables are Ideal for Indoor Applications

RFS offers a wide variety of RADIAFLEX® radiating cables and CELLFLEX® feeder cables that are certified as compliant with the highest classification criteria in the European Union's Construction Products Regulation (CPR).

The RFS cables meet the requirements for fire performance in cables in the European standard EN 50575 to comply with Regulation (EU) No 305/2011, which took effect July 1, 2017.

RFS was the first vendor in the world to offer RF cables with the highest levels of fire safety performance.

The highest fire safety ratings for the ultimate protection

RFS' CPR-compliant cables feature a specially developed RF cable jacket that allows the foam-dielectric coaxial cables to achieve best-in-class ratings for low smoke emission (s1), zero droplets (d0) and acidity rating (a1), the most important criteria for safe operation of cables in indoor environments.

All cables with the CPR jacket option have been tested and certified by an external notified body according to EN 50575. In addition, RFS' manufacturing facility in Hannover, Germany has been audited and meets the highest system 1+ requirements for type approvals, regular production audits, as well as regular sampling and testing of products by the notified body.

CPR-compliant cables for any application

The CPR series of cables features:

- **CELLFLEX cables**, including **LCF12-50CPR** and **LCF78-50CPR**, with the fire protection class B2ca (subclasses B2ca s1 d0 a1)
- **RADIAFLEX cables**, including **RLK78-50CPR** and **RLK114-50CPR**, with the fire protection class Cca (subclasses Cca s1 d0 a1)

Building on a history of innovation and safety

RFS' CPR-compliant cables were already designated as low-smoke, zero-halogen (LSZH) cables and meet the International Electrotechnical Commission (IEC) standards for flame spread, smoke acidity and smoke emission.

Compatible with existing accessories

RFS simplifies deployments by offering user-friendly compatibility with existing connectors, factory-assembled RF jumpers, grounding kits and clamps, as well as trimming and preparation tools.

Get more information

For a full list of RFS' CPR-compliant products, the CPR classification for existing indoor cables, and mandatory Declarations of Performance (DoP), see the RFS leaflet **Safety Is Key** and the **CPR section** of the RFS web site.

What does CPR imply?

- Cables placed on the market as construction products must comply with Regulation No. 305/2011[1] of the European Union.
- CPR regulates the requirements on cables in terms of their reaction to fire.
- The regulations apply to cables that are permanently installed above and below ground level.

What countries require CPR?

All countries in the European Union must convert the new requirements into national regulations.

Other countries are also expected to adopt the regulations.

Why is CPR required?

The LSZH certification is no longer considered to be an adequate measure of the fire safety performance of cables.

CPR provides a harmonized set of standards so that product purchasers can easily confirm that cables meet the more stringent fire safety requirements in European Standard EN 50575.

RFS products will be classified according to the following criteria in compliance with the European Union CPR requirements.

Classification Criteria

CLASS	Flame spread (EN 50399)	Total heat release	Peak heat release	Fire growth rate	Flame spread (EN 60332-1-2)	FIRE SAFETY
B2ca	≤ 1,5m	15 MJ	≤ 30kW	≤ 150 Ws-1	≤ 425 mm	+++
Cca	≤ 2,0m	30 MJ	≤ 40kW	≤ 300 Ws-1		++
Dca	-	70 MJ	≤ 400kW	≤ 1300 Ws-1		+
Eca	Minimum fire performance classification					--
Fca	Not advisable for public places				> 425 mm	---

The table below explains the CPR class codes using the rating for our CELLFLEX cables as an example: B2ca s1 d0 a1.

European class code labelling example

B2	ca	s1	d1	a1
Fire performance class	Application to cable	Smoke ratio	Droplets rating	Acidity rating

Smoke opacity		Droplets		Acidity	
s1		d0	-	a1	
s2		d1		a2	
s3		d2		a3	

RFS passive DAS solutions are highly flexible. They support **350 MHz** to **6000 MHz** applications, all wireless standards and technologies as **2G/3G/4G/5G** cellular services, analog and digital mission-critical radio, and **WIFI/WLAN** networks.

Broadband and ultra-broadband indoor antennas designed for long-life solutions with outstanding electrical performance

BROADBAND and ultra broadband **antennas**

Performance, design, versatility

All RFS indoor antennas are designed for high performance and low visual impact. Antennas can be mounted on walls or ceilings. Antennas and the cables connecting them can also be painted to match surrounding colors and blend into the building aesthetic.

RFS indoor antennas feature:

- Sealed, UV-stable radomes
- Low VSWR, high gain, stable performance
- Compact, lightweight designs

RFS provides four types of indoor antennas to meet every in-building requirement.

- Omnidirectional antennas
- Panel antennas
- Directional antennas
- Bidirectional antennas

In-Building Antennas

Frequency Band 698-2700MHz	
Indoor omni-directional antenna, SISO, broadband 698-960MHz / 1710-2700MHz, PIM rating 150dBc at 2x20W, N-female connector	I-ATO5-698/2700
Indoor panel antenna, SISO, broadband 698-960MHz / 1710-2700MHz, PIM rating 150dBc at 2x20W, N-female connector	I-ATP5-698/2700
Indoor omni-directional antenna, MIMO, broadband 698-960MHz / 1710-2700MHz, PIM rating 150dBc at 2x20W, N-female connector	I-ATO5-698/2700M
Indoor panel antenna, MIMO, broadband 698-960MHz / 1710-2700MHz, PIM rating 150dBc at 2x20W, N-female connector	I-ATP5-698/2700M
Indoor omni-directional antenna, SISO, broadband 698-960MHz / 1710-2700MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATO5-43-698/2700
Indoor panel antenna, SISO, broadband 698-960MHz / 1710-2700MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATP5-43-698/2700
Indoor omni-directional antenna, MIMO, broadband 698-960MHz / 1710-2700MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATO5-43-698/2700M
Indoor panel antenna, MIMO, broadband 698-960MHz / 1710-2700MHz, PIM rating 150dBc at 2x20W, N-female connector	I-ATP5-43-698/2700M

In-Building Antennas

Frequency Band 698-4000MHz	
Ultra Slim Indoor omni-directional antenna, SISO, broadband 698-960MHz / 1710-2700MHz / 3400-4000MHz, PIM rating 153dBc at 2x20W, N-female connector	I-ATO5-698/4000
Indoor panel antenna, SISO, broadband 698-960MHz/1710-2700MHz/3400-4000MHz, PIM rating 150dBc at 2x20W, N-female connector	I-ATP5-698/4000
Indoor omni-directional antenna, MIMO, broadband 698-960MHz / 1710-2700MHz / 3400-4000MHz, PIM rating 150dBc at 2x20W, N-female connector	I-ATO5-698/4000M
Indoor panel antenna, MIMO, broadband 698-960MHz / 1710-2700MHz / 3400-4000MHz, PIM rating 150dBc at 2x20W, N-female connector	I-ATP5-698/4000M
Ultra Slim Indoor omni-directional antenna, SISO, broadband 698-960MHz / 1710-2700MHz / 3400-4000MHz, PIM rating 153dBc at 2x20W, 4.3-10-female connector	I-ATO5-43-698/4000
Indoor panel antenna, SISO, broadband 698-960MHz / 1710-2700MHz / 3400-4000MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATP5-43-698/4000
Indoor omni-directional antenna, MIMO, broadband 698-960MHz / 1710-2700MHz / 3400-4000MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATO5-43-698/4000M
Indoor panel antenna, MIMO, broadband 698-960MHz / 1710-2700MHz / 3400-4000MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATP5-43-698/4000M
Frequency Band 698-3800MHz incl. 1400MHz	
Indoor omni-directional antenna, SISO, broadband 698-960MHz / 1427-3800MHz, PIM rating 153dBc at 2x20W, 4.3-10-female connector	I-ATO5-698/3800
Indoor panel antenna, SISO, broadband 698-960MHz/1427-3800MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATP5-698/3800
Indoor omni-directional antenna, MIMO, broadband 698-960MHz / 1427-3800MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATO5-698/3800M
Indoor panel antenna, MIMO, broadband 698-960MHz / 1427-3800MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATP5-698/3800M
Indoor omni-directional antenna, SISO, broadband 698-960MHz/1427-3800MHz, PIM rating 153dBc at 2x20W, 4.3-10-female connector	I-ATO5-43-698/3800
Indoor omni-directional antenna, MIMO, broadband 698-960MHz / 1427-3800MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATO5-43-698/3800M
Indoor panel antenna, SISO, broadband 698-960MHz / 1427-3800MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATP5-43-698/3800
Indoor panel antenna, MIMO, broadband 698-960MHz / 1427-3800MHz, PIM rating 150dBc at 2x20W, 4.3-10-female connector	I-ATP5-43-698/3800M
Ultra-Broadband Antennas	
Ultra Slim Indoor omni-directional antenna, SISO, broadband 380-520 / 698-960 / 1710-2700MHz, PIM rating 140dBc at 2x20W, N-female connector	I-ATO5-380/2700
Ultra Slim Indoor omni-directional antenna, SISO, broadband 380-520 / 698-960 / 1710-2700MHz, PIM rating 140dBc at 2x20W, 4.3-10-female connector	I-ATO5-43-380/2700
Indoor panel antenna, SISO, broadband 380-530 / 698-960 / 1710-2700MHz, , PIM rating 140dBc at 2x20W,N-female connector	I-ATP5-380/2700
Indoor panel antenna, SISO, broadband 380-530 / 698-960 / 1710-2700MHz, , PIM rating 140dBc at 2x20W, 4.3-10-female connector	I-ATP5-43-380/2700
Indoor Omnidirectional Antenna 380-6000MHz, PIM 153dBc, N-female	I-ATO5-380/6000
Indoor Omnidirectional Antenna 380-6000MHz, PIM 153dBc, N-female	I-ATO5-43-380/6000
Indoor Omnidirectional Antenna 350/600Hz, N-female	I-ATO5-350/600

Passive system components

RFS passive system components provide maximum flexibility and optimum electrical performance.

- **Combiners** support one service per frequency band, multiple services per band, and multi-band applications. RFS also offers standardized combiner modules in 19-inch rack technology.
- **Hybrid combiners and hybrid couplers** combine multiple signals in the same wireless band onto a common feeder cable.
- **Directional couplers and tappers** uniformly distribute RF signals.
- **Diplexers and triplexers** combine and separate signals in different wireless bands.
- **DC blocks** prevent the flow of direct current and low-frequency current surges along the inner and outer conductors of a transmission line, while permitting the unimpeded flow of RF signals.
- **Power splitters** evenly split input signals with minimal reflections or loss.
- **Loads** terminate all types of open RF ports.
- **Attenuators** adapt RF power levels to meet different system requirements.

PIM Optimized Products

PIM Optimized Products	698–2700MHz	694–3800MHz
Hybrid Combiners		
3dB Directional Hybrid Combiner, N female, IP65, PIM 155dBc	CDSE2x2-698/2700-01	CDSE2x2-694/3800
3dB Directional Hybrid Combiner, 7/16 female, IP65, PIM 160dBc	CDSDE2x2-698/2700-01	CDSDE2x2-694/3800
3dB Directional Hybrid Combiner, 4.3-10 female, IP65, PIM 160dBc	CDS2x2-43-698/2700-01	CDS2x2-43-694/3800
4*4 Hybrid Combiner, N female, IP65, PIM 155dBc	CDSE4x4-698/2700-01	CDSE4x4-694/3800
4*4 Hybrid Combiner, 7/16 female, IP65, PIM 160dBc	CDSDE4x4-698/2700-01	CDSDE4x4-694/3800
4*4 Hybrid Combiner, 4.3-10 female, IP65, PIM 160dBc	CDS4x4-43-698/2700-01	CDS4x4-43-694/3800
Power Splitters		
2-way power splitter, reactive, N female, IP65, PIM 155dBc	PDS2E-698/2700-01	PDS2E-694/3800
3-way power splitter, reactive, N female, IP65, PIM 155dBc	PDS3E-698/2700-01	PDS3E-694/3800
4-way power splitter, reactive, N female, IP65, PIM 155dBc	PDS4E-698/2700-01	PDS4E-694/3800
6-way power splitter, reactive, N female, IP65, PIM 155dBc	PDS6E-698/2701-01	PDS6E-694/3800
2-way power splitter, reactive, 7/16 female, IP65, PIM 160dBc	PDS2DE-698/2700-01	PDS2DE-694/3800
3-way power splitter, reactive, 7/16 female, IP65, PIM 160dBc	PDS3DE-698/2700-01	PDS3DE-694/3800
4-way power splitter, reactive, 7/16 female, IP65, PIM 160dBc	PDS4DE-698/2700-01	PDS4DE-694/3800
2-way power splitter, reactive, 4.3-10 female, IP65, PIM 160dBc	PDS2-43-698/2700-01	PDS2-43-694/3800
3-way power splitter, reactive, 4.3-10 female, IP65, PIM 160dBc	PDS3-43-698/2700-01	PDS3-43-694/3800
4-way power splitter, reactive, 4.3-10 female, IP65, PIM 160dBc	PDS4-43-698/2700-01	PDS4-43-694/3800
6-way power splitter, reactive, 4.3-10 female, IP65, PIM 160dBc	PDS6-43-698/2700-01	PDS6-43-694/3800

PIM Optimized Products	698--2700MHz	694--3800MHz
Directional Couplers		
6dB Directional Coupler, N female, IP65, PIM 155dBc	CDS6E-698/2700-01	CDS6E-694/3800
10dB Directional Coupler, N female, IP65, PIM 155dBc	CDS10E-698/2700-01	CDS10E-694/3800
15dB Directional Coupler, N female, IP65, PIM 155dBc	CDS15E-698/2700-01	CDS15E-694/3800
20dB Directional Coupler, N female, IP65, PIM 155dBc	CDS20E-698/2700-01	CDS20E-694/3800
30dB Directional Coupler, N female, IP65, PIM 155dBc	CDS30E-698/2700-01	CDS30E-694/3800
6dB Directional Coupler, 7/16 female, IP65, PIM 160dBc	CDS6DE-698/2700-01	CDS6DE-694/3800
10dB Directional Coupler, 7/16 female, IP65, PIM 160dBc	CDS10DE-698/2700-01	CDS10DE-694/3800
15dB Directional Coupler, 7/16 female, IP65, PIM 160dBc	CDS15DE-698/2700-01	CDS15DE-694/3800
20dB Directional Coupler, 7/16 female, IP65, PIM 160dBc	CDS20DE-698/2700-01	CDS20DE-694/3800
30dB Directional Coupler, 7/16 female, IP65, PIM 160dBc	CDS30DE-698/2700-01	CDS30DE-694/3800
6dB Directional Coupler, 4.3-10 female, IP65, PIM 160dBc	CDS6-43-698/2700-01	CDS6-43-694/3800
10dB Directional Coupler, 4.3-10 female, IP65, PIM 160dBc	CDS10-43-698/2700-01	CDS10-43-694/3800
15dB Directional Coupler, 4.3-10 female, IP65, PIM 160dBc	CDS15-43-698/2700-01	CDS15-43-694/3800
20dB Directional Coupler, 4.3-10 female, IP65, PIM 160dBc	CDS20-43-698/2700-01	CDS20-43-694/3800
30dB Directional Coupler, 4.3-10 female, IP65, PIM 160dBc	CDS30-43-698/2700-01	CDS30-43-694/3800
Tappers		
5dB / 3:1 Unequal Power Divider / Tapper, N female, IP65, PIM 155dBc	TPS5E-350/2700-01	TPS5E-694/3800
6dB / 4:1 Unequal Power Divider / Tapper, N female, IP65, PIM 155dBc	TPS6E-350/2700-01	TPS6E-694/3800
8dB / 6:1 Unequal Power Divider / Tapper, N female, IP65, PIM 155dBc	TPS8E-350/2700-01	TPS8E-694/3800
10dB / 10:1 Unequal Power Divider / Tapper, N female, IP65, PIM 155dBc	TPS10E-350/2700-01	TPS10E-694/3800
13dB / 20:1 Unequal Power Divider / Tapper, N female, IP65, PIM 155dBc	TPS13E-350/2700-01	TPS13E-694/3800
15dB / 30:1 Unequal Power Divider / Tapper, N female, IP65, PIM 155dBc	TPS15E-350/2700-01	TPS15E-694/3800
20dB / 100:1 Unequal Power Divider / Tapper, N female, IP65, PIM 155dBc	TPS20E-350/2700-01	TPS20E-694/3800
30dB / 1000:1 Unequal Power Divider / Tapper, N female, IP65, PIM 155dBc	TPS30E-350/2700-01	TPS30E-694/3800
5dB / 3:1 Unequal Power Divider / Tapper, 7/16 female, IP65, PIM 160dBc	TPS5DE-350/2700-01	TPS5DE-694/3800
6dB / 4:1 Unequal Power Divider / Tapper, 7/16 female, IP65, PIM 160dBc	TPS6DE-350/2700-01	TPS6DE-694/3800
8dB / 6:1 Unequal Power Divider / Tapper, 7/16 female, IP65, PIM 160dBc	TPS8DE-350/2700-01	TPS8DE-694/3800
10dB / 10:1 Unequal Power Divider / Tapper, 7/16 female, IP65, PIM 160dBc	TPS10DE-350/2700-01	TPS10DE-694/3800
13dB / 20:1 Unequal Power Divider / Tapper, 7/16 female, IP65, PIM 160dBc	TPS13DE-350/2700-01	TPS13DE-694/3800
15dB / 30:1 Unequal Power Divider / Tapper, 7/16 female, IP65, PIM 160dBc	TPS15DE-350/2700-01	TPS15DE-694/3800
20dB / 100:1 Unequal Power Divider / Tapper, 7/16 female, IP65, PIM 160dBc	TPS20DE-350/2700-01	TPS20DE-694/3800
30dB / 1000:1 Unequal Power Divider / Tapper, 7/16 female, IP65, PIM 160dBc	TPS30DE-350/2700-01	TPS30DE-694/3800
5dB / 3:1 Unequal Power Divider / Tapper, 4.3-10 female, IP65, PIM 160dBc	TPS5-43-350/2700-01	TPS5-43-694/3800
6dB / 4:1 Unequal Power Divider / Tapper, 4.3-10 female, IP65, PIM 160dBc	TPS6-43-350/2700-01	TPS6-43-694/3800
8dB / 6:1 Unequal Power Divider / Tapper, 4.3-10 female, IP65, PIM 160dBc	TPS8-43-350/2700-01	TPS8-43-694/3800
10dB / 10:1 Unequal Power Divider / Tapper, 4.3-10 female, IP65, PIM 160dBc	TPS10-43-350/2700-01	TPS10-43-694/3800
13dB / 20:1 Unequal Power Divider / Tapper, 4.3-10 female, IP65, PIM 160dBc	TPS13-43-350/2700-01	TPS13-43-694/3800
15dB / 30:1 Unequal Power Divider / Tapper, 4.3-10 female, IP65, PIM 160dBc	TPS15-43-350/2700-01	TPS15-43-694/3800
20dB / 100:1 Unequal Power Divider / Tapper, 4.3-10 female, IP65, PIM 160dBc	TPS20-43-350/2700-01	TPS20-43-694/3800
30dB / 1000:1 Unequal Power Divider / Tapper, 4.3-10 female, IP65, PIM 160dBc	TPS30-43-350/2700-01	TPS30-43-694/3800
Low PIM Termination		
Termination Load N female 50W,698-3.8GHz, Indoor, PIM 155dBc	TER-E-2700-50W	TERP-E-3800-50W
Termination Load 7/16 female 50W,698-3.8GHz, Indoor, PIM 160dBc	TER-DE-2700-50W	TERP-DE-3800-50W
Termination Load 4.3-10 female 50W,698-3.8GHz, Indoor, PIM 160dBc	TER-43-2700-50W	TERP-43-3800-50W
Termination Load N female 100W,698-3.8GHz, Indoor, PIM 155dBc	TER-E-2700-100W	TERP-E-3800-100W
Termination Load 7/16 female 100W,698-3.8GHz, Indoor, PIM 160dBc	TER-DE-2700-100W	TERP-DE-3800-100W
Termination Load 4.3-10 female 100W,698-3.8GHz, Indoor, PIM 160dBc	TER-43-2700-100W	TERP-43-3800-100W

PIM Optimized Products	698--2700MHz	694--3800MHz
Standard Termination		
Termination Load N male 2W,0-3.8GHz, Indoor, no PIM	N-TER-02	TER-E-3800-2W
Termination Load N male 5W,0-3.8GHz, Indoor, no PIM	N-TER-05	TER-E-3800-5W
Termination Load N male 10W,0-3.8GHz, Indoor, no PIM	N-TER-10	TER-E-3800-10W
Termination Load N male 20W,0-3.8GHz, Indoor, no PIM	N-TER-20	TER-E-3800-20W
Termination Load N male 30W,0-3.8GHz, Indoor, no PIM	N-TER-30	TER-E-3800-30W
Termination Load N male 50W,0-3.8GHz, Indoor, no PIM	N-TER-50	TER-E-3800-50W
Termination Load N male 100W,0-3.8GHz, Indoor, no PIM	N-TER-100	TER-E-3800-100W
Termination Load 7/16 male 5W,0-3.8GHz, Indoor, no PIM	716-TER-05	TER-DE-3800-5W
Termination Load 7/16 male 10W,0-3.8GHz, Indoor, no PIM	716-TER-10	TER-DE-3800-10W
Termination Load 7/16 male 20W,0-3.8GHz, Indoor, no PIM	716-TER-20	TER-DE-3800-20W
Termination Load 7/16 male 30W,0-3.8GHz, Indoor, no PIM	716-TER-30	TER-DE-3800-30W
Termination Load 7/16 male 50W,0-3.8GHz, Indoor, no PIM	716-TER-50	TER-DE-3800-50W
Termination Load 4.3-10 male 2W,0-3.8GHz, Indoor, no PIM	716-TER-50	TER-43-3800-2W
Termination Load 4.3-10 male 5W,0-3.8GHz, Indoor, no PIM	43-TER-5	TER-43-3800-5W
Termination Load 4.3-10 male 10W,0-3.8GHz, Indoor, no PIM	not available	TER-43-3800-10W
Termination Load 4.3-10 male 20W,0-3.8GHz, Indoor, no PIM	not available	TER-43-3800-20W
Termination Load 4.3-10 male 30W,0-3.8GHz, Indoor, no PIM	not available	TER-43-3800-30W
Termination Load 4.3-10 male 50W,0-3.8GHz, Indoor, no PIM	not available	TER-43-3800-50W
Termination Load 4.3-10 male 100W,0-3.8GHz, Indoor, no PIM	not available	TER-43-3800-100W

Radio Frequency Systems

Ultra-Broadband Products

Ultra-Broadband Products	698--2700MHz
Hybrid Combiners	
3dB Directional Hybrid Coupler, 380-2700MHz, N female, IP65, PIM 150dBc	CDS3E-380/2700
3dB Directional Hybrid Coupler, 380-2700MHz, 7-16 female, IP65, PIM 150dBc	CDS3DE-380/2700
Power Splitters	
2-way power splitter, reactive, 380-2700MHz, N female, IP65, PIM 150 dBc	PDS2E-380/2700-01
3-way power splitter, reactive, 380-2700MHz, N female, IP65, PIM 150 dBc	PDS3E-380/2700-01
4-way power splitter, reactive, 380-2700MHz, N female, IP65, PIM 150 dBc	PDS4E-380/2700-01
2-way power splitter, reactive, 380-2700MHz, 7-16 female, IP65, PIM 150 dBc	PDS2DE-380/2700-01
3-way power splitter, reactive, 380-2700MHz, 7-16 female, IP65, PIM 150 dBc	PDS3DE-380/2700-01
4-way power splitter, reactive, 380-2700MHz, 7-16 female, IP65, PIM 150 dBc	PDS4DE-380/2700-01
Directional Couplers	
6dB Directional Coupler, 380 - 2700 MHz, 6 dB, N female, IP65, PIM 150dBc	CDS6E-380/2700
10dB Directional Coupler, 380 - 2700 MHz, 10 dB, N female, IP65, PIM 150dBc	CDS10E-380/2700
15dB Directional Coupler, 380 - 2700 MHz, 15 dB, N female, IP65, PIM 150dBc	CDS15E-380/2700
20dB Directional Coupler, 380 - 2700 MHz, 20 dB, N female, IP65, PIM 150dBc	CDS20E-380/2700
30dB Directional Coupler, 380 - 2700 MHz, 20 dB, N female, IP65, PIM 150dBc	CDS30E-380/2700
6dB Directional Coupler, 380 - 2700 MHz, 7-16 female, IP65, PIM 150dBc	CDS6DE-380/2700
10dB Directional Coupler, 380 - 2700 MHz, 7-16 female, IP65, PIM 150dBc	CDS10DE-380/2700
15dB Directional Coupler, 380 - 2700 MHz, 7-16 female, IP65, PIM 150dBc	CDS15DE-380/2700
20dB Directional Coupler, 380 - 2700 MHz, 7-16 female, IP65, PIM 150dBc	CDS20DE-380/2700
30dB Directional Coupler, 380 - 2700 MHz, 7-16 female, IP65, PIM 150dBc	CDS30DE-380/2700
Tappers	
2:1 Unequal Power Divider / Tapper, 350-2700 MHz, N female, IP65, PIM 150dBc	TPS2E-350/2700
3:1 Unequal Power Divider / Tapper, 350-2700 MHz, N female, IP65, PIM 150dBc	TPS3E-350/2700
4:1 Unequal Power Divider / Tapper, 350-2700 MHz, N female, IP65, PIM 150dBc	TPS4E-350/2700
6:1 Unequal Power Divider / Tapper, 350-2700 MHz, N female, IP65, PIM 150dBc	TPS6E-350/2700
10:1 Unequal Power Divider / Tapper, 350-2700 MHz, N female, IP65, PIM 150dBc	TPS10E-350/2700
20:1 Unequal Power Divider / Tapper, 350-2700 MHz, N female, IP65, PIM 150dBc	TPS20E-350/2700
30:1 Unequal Power Divider / Tapper, 350-2700 MHz, N female, IP65, PIM 150dBc	TPS30E-350/2700
2:1 Unequal Power Divider / Tapper, 350-2700 MHz, 7-16 female, IP65, PIM 150dBc	TPS2DE-350/2700
3:1 Unequal Power Divider / Tapper, 350-2700 MHz, 7-16 female, IP65, PIM 150dBc	TPS3DE-350/2700
4:1 Unequal Power Divider / Tapper, 350-2700 MHz, 7-16 female, IP65, PIM 150dBc	TPS4DE-350/2700
6:1 Unequal Power Divider / Tapper, 350-2700 MHz, 7-16 female, IP65, PIM 150dBc	TPS6DE-350/2700
10:1 Unequal Power Divider / Tapper, 350-2700 MHz, 7-16 female, IP65, PIM 150dBc	TPS10DE-350/2700
20:1 Unequal Power Divider / Tapper, 350-2700 MHz, 7-16 female, IP65, PIM 150dBc	TPS20DE-350/2700

For more information, please contact the nearest RFS sales office:

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