Broadband Wireless Antennas

Introduction

In recent times new operators worldwide have launched various systems for Broadband Wireless Applications in competition to fix wire operators and mobile network operators. Well known are Wireless Local Loop (WLL) systems, Local Multipoint Distribution Systems (LMDS) and Multichannel Multipoint Distribution Service (MMDS). In addition to these services WiMAX systems will be deployed.

Radio Frequency Systems offers a growing line of antennas for these applications. Several frequency bands have already been allocated for Point-to-Multipoint applications. The main frequency ranges are 2.5, 3.5, 5.8, 26 and 28 GHz. No matter what your frequency and broadband antenna application, RFS has the most technically advanced line of products to meet the needs. For decades RFS has earned the reputation for bringing the most innovative and advanced solutions to the market in a range of antenna products.

RFS has taken full account of the frequency bands already allocated. The RFS antenna program will be extended continuously to give new operators more flexibility to optimize and improve their networks. All antennas comply with specifications of European Telecommunication Standard Institute, better known under its acronym of ETSI, and to the US-standard of Federal Communication Commissions (FCC).

Optimization of the network

Operators are permanently under pressure to optimize their networks in terms of cost and increase of capacity. Application of a Wireless Local Loop system does not require total coverage of a given area. The terminal station at the subscribers' end is in a fixed location, which is entirely different than in mobile applications. There is therefore no point in covering an area where there are no subscribers (houses) (Figure 1).

Figure 1

Instead of two antennas each with a 180-deg. sector, the network is optimized with a 90-deg. sector antenna (town above base station) and a 30-deg. antenna (village below base station). In these cases it is possible to use antennas that have a higher gain compared to a 180-deg antenna. This both extends the range and saves costs because less power is needed from the active equipment in order to obtain good signal strength within the sector.

A successful operator will very soon have to improve the capacity in a sector. This could be done, for example, by employing new frequencies. In general this is not an option due to the lack of availability of frequency spectrum. Therefore the operator has to divide the main sector into several sub-sectors (Figure 2).

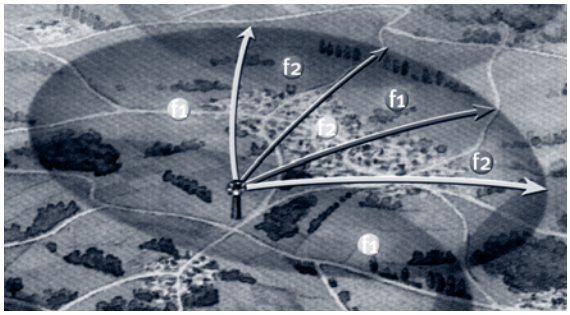


Figure 2

The original 90-deg. sector with the frequency f2 is decoupled from the adjacent sectors using frequency f1. Replacing the 90-deg. antenna with 3 x 30-deg. antennas allows use of the same frequency decoupling method.

The main advantage is that the existing terminal antennas can continue to be used without the need for adjustment or re-alignment. The increase of capacity can be achieved solely by software means.

Decoupling by polarization is more difficult because all terminal station antennas in one of the sectors will have to be readjusted as a result of the change in polarization (rotate by 90-deg).

WiMAX Application

The term WiMAX (Worldwide Interoperability for Microwave Access) has become synonymous with the IEEE 802.16 Wireless Metropolitan Area Network (MAN) air interface standard.

Filling the gap between Wireless LANs and wide area networks, WiMAX-compliant systems will provide a cost-effective fixed wireless alternative to conventional wire-line DSL and cable in areas where those technologies are readily available. And more importantly the WiMAX technology can provide a cost-effective broadband access solution in areas beyond the reach of DSL and cable.

The ongoing evolution of IEEE 802.16 will expand the standard to address mobile applications thus enabling broadband access directly to WiMAX-enabled portable devices ranging from smart phones and PDAs to notebook and laptop computers.

RFS is considering the increased antenna demands and provides antennas in the three frequency bands that are of primary interest for WiMAX applications with today's prevailing regulations:

The licensed 2.5 GHz bands:

The bands between 2.5 and 2.69 GHz have been allocated in the U.S., Mexico, Brazil and some Southeast Asian countries. Also prevalent in Southeast Asia (including Australia, South Korea & New Zealand), is the 2.3 GHz band.

The licensed 3.5 GHz bands:

The primary licensed spectrum allocated for BWA applications in this general vicinity lies between 3.4 and 3.6 GHz although there are some new allocations between 3.3-3.4 and 3.6-3.8 GHz.

Bands between 3.4 and 3.6 GHz have been allocated for BWA in the majority of countries, with the exception of the U.S.

The license-exempt 5.8 GHz Band

Because in the majority of countries license-exempt spectrum is "free" to use, this band is strategic for enabling grass roots deployments in underserved, low population density rural and remote markets. Different from Wi-Fi which is primarily targeted for Local Area Network (indoor) applications, WiMAX is targeted for longer range Metropolitan Area (indoor & outdoor) applications and thus benefits from higher allowable power output levels. In the upper 5 GHz band (5.725-5.850 GHz), many countries allow higher power output (4 Watts vs 1 Watt EIRP) which makes this band more attractive to WiMAX applications.

The band 5.725-5.850 GHz is mainly used in US.

In addition to single antennas RFS is also developing MIMO (Multiple Inputs Multiple Outputs) antennas in the 2.5 and 3.5 GHz bands.

Adaptive antenna systems (AAS) are an optional part of the 802.16 standard providing beam forming properties that can steer their focus to a particular direction or directions. This means that while transmitting, the signal can be limited to the required direction of the receiver; like a spotlight. Conversely when receiving, the AAS can be made to focus only in the direction from where the desired signal is coming from. They also have the property of suppressing co-channel interference from other locations. AASs are considered to be future developments that could improve the spectrum re-use and capacity of a WiMAX network.

Antennas for 2.5 GHz ISM and WiMAX systems

RFS offers antennas in the 2.4 - 2.69 GHz band 65, 90 and 120 deg sector sizes.

All antennas have five degree vertical beam width, which minimizes the effect of tower sway and wide enough for the optimum amount of gain versus aperture size. The vertical patterns of this product family have been tailored to a cosecant-squared power taper, which produces the optimum amount of null fill and upper sidelobe suppression. This type of vertical pattern yields optimum fixed wireless coverage from close-in to fringe regions in the coverage area. Null fill insures that the fixed wireless subscribers has maximum signal to noise ratio (S/N), which translates to maximum achievable data bandwidth. Conversely deep lower nulls create low S/N for the close-in users, which reduces data bandwidth.

The high Cross-Polarization Isolations of 30dB ensures conformance to FCC rules and provides low interference from orthogonal polarized sources. This ensures protection from signals originating from other MMDS systems which share orthogonally polarized transmission in the same service area.

Antennas are supplied with either a fixed pipe mount or an optional mechanical down tilt bracket for optimizing your coverage needs from 0 to 10 degrees. Connectors are located at the bottom and are available with N- female connector.

For more details contact RFS.

Antennas for 3.5 GHz WLL and WiMAX systems

RFS has designed several antenna solutions to cover the needs of an optimized network in the frequency band 3.4 – 3.6 GHz for Wireless Local Loop applications.

The easiest way to cover a large service area is to use antennas with an omnidirectional radiation characteristic (VOA-Series).

RFS currently offers antennas with two different gain values. The difference in gain is 3 dB. This enables a larger range to be covered but it has to be considered that the half-power beamwidth becomes narrower.

Antennas with a sector characteristic concentrate power within a specific azimuth area (SEC-Series).

RFS has designed different sectors for network optimization. Apart from the most common 90 deg. sector, 60, 120 and 180 deg sector antennas are available.

Two different gain values are available for each sector size. The adjacent half-power beamwidths are comparable to antennas for omnidirectional power distribution.

These antennas are designed for a survival windspeed of 250 km/h.

The connector for all antennas is an N-female type.

SEC-Series

VOA-Series

Antennas for 26/28 GHz LMDS systems

The frequency ranges 24.5 - 26.5 and 27.35 - 29.5 GHz are used for Local Multipoint Distribution Systems (LMDS). These bands require slightly different antenna solutions. Only short radio links from base station to subscribers are viable due to disadvantageous atmospherical influences. But nevertheless more capacity becomes available with these frequencies.

At frequency ranges above 20 GHz it is possible to employ very small antennas on account of the short wavelengths involved. This is a feature that is popular with operators who are always looking for so-called 'invisible antennas'.

RFS has designed 90 deg sector antennas with very sharply defined slopes in the radiation pattern at the sector edge for central station applications. This was achieved by using modified horn antennas with additional shielding (SEC-series).

Antennas can be easily prepared for customized applications.

For terminal applications small RFS CompactLine Antennas can be used.

SEC-Series

Antenna Selection Guide

FREQUENCY	MODEL NUMBER	ANTENNA TYPE	MIDBAND GAIN
3.4 – 3.6GHz	SEC35-60ANVH	60° Sector	17.4dBi
3.4 – 3.6GHz	SEC35-60ANVL	60° Sector	15.2dBi
3.4 – 3.6GHz	SEC35-60ANHH2	60° Sector	18dBi
3.4 – 3.6GHz	SEC35-90ANVH	90° Sector	15.6dBi
3.4 – 3.6GHz	SEC35-90ANVH2	90° Sector	16.7dBi
3.4 – 3.6GHz	SEC35-90ANHH2	90° Sector	16.7dBi
3.4 – 3.6GHz	SEC35-90ANVL	90° Sector	13.7dBi
3.4 – 3.6GHz	SEC35-120ANVH	120° Sector	15.3dBi
3.4 – 3.6GHz	SEC35-120ANVL	120° Sector	12.2dBi
3.4 – 3.6GHz	SEC35-180ANVH	180° Sector	13.4dBi
3.4 – 3.6GHz	SEC35-180ANVL	180° Sector	10.7dBi
3.4 – 3.6GHz	VOA35-360ANVH	Omni directional	11.1dBi
3.4 – 3.6GHz	VOA35-360ANVL	Omni directional	8.2dBi
3.4 – 3.6GHz	SU1-35AN	Parabolic	20.5dBi
3.4 – 3.6GHz	SU2-35AN	Parabolic	24.5dBi
3.4 – 3.6GHz	PAL4-35AN	Parabolic	30.8dBi
3.4 – 3.6GHz	PAL6-35AN	Parabolic	34.0dBi
3.4 – 3.6GHz	PAL8-35AN	Parabolic	36.0dBi
24.25 - 26.75GHz	SEC260-90ABH	90° Sector	16.1 dBi
24.25 - 26.75GHz	SEC260-90ABV	90° Sector	14.9dBi
27.35 - 29.5GHz	SEC280-90ABH	90° Sector	15.9dBi
27.35 - 29.5GHz	SEC280-90BBV	90° Sector	15.5dBi

3.4 - 3.6 GHz, Antenna Input – N Female

MODEL NUMBER	HEIGHT mm (in)	3dB BEAMWIDTH Az (deg)	3dB BEAMWIDTH Elev (deg)	GAIN (dBi) Low	GAIN (dBi) Mid	GAIN (dBi) High	F/B RATIO (dB)	XPD (dB)	VSWR/ R L (dB)	WINDSPEED km/h (mph)
OMNIDIRECTIONAL ANTENNAS										
VOA35-360ANVH	880 (34.5)	360	6.5	11.1	11.2	10.7	–	20	1.50 / 14.0	250 (156)
VOA35-360ANVL	520 (20.5)	360	11.5	8.2	8.7	7.2	–	20	1.50 / 14.0	250 (156)
SECTOR ANTENNAS										
SEC35-120ANVH	815 (32.2)	120	6.3	15.1	15.3	15.6	25	20	1.50 / 14.0	250 (156)
SEC35-120ANVL	495 (19.6)	120	11.5	12.1	12.2	12.3	25	20	1.50 / 14.0	250 (156)
SEC35-180ANVH	815 (32.2)	180	6.5	13.3	13.4	13.8	25	20	1.50 / 14.0	250 (156)
SEC35-180ANVL	495 (19.6)	180	11.5	10.6	10.7	10.8	20	20	1.50 / 14.0	250 (156)
SEC35-60ANVH	815 (32.2)	60	6	17	17.4	17.6	30	20	1.50 / 14.0	250 (156)
SEC35-60ANVL	495 (19.6)	60	11	15.1	15.2	15.3	30	20	1.50 / 14.0	250 (156)
SEC35-60ANHH2	815 (32.2)	60	6.7	17.5	18	18	30	20	1.50 / 14.0	250 (156)
SEC35-90ANVH	815 (32.2)	90	6.5	15.1	15.6	15.8	30	20	1.50 / 14.0	250 (156)
SEC35-90ANVH2	815 (32.2)	90	6.2	16.2	16.7	16.7	35	20	1.50 / 14.0	250 (156)
SEC35-90ANVL	495 (19.6)	90	11.5	13.6	13.7	13.8	25	20	1.50 / 14.0	250 (156)
SEC35-90ANHH2	815 (32.2)	90	6.9	16	16.7	16.7	30	20	1.50 / 14.0	250 (156)

MODEL NUMBER	DIAMETER ft (m)	3dB BEAMWIDTH Az (deg)	3dB BEAMWIDTH Elev (deg)	GAIN (dBi) Low	GAIN (dBi) Mid	GAIN (dBi) High	F/B RATIO (dB)	XPD (dB)	VSWR/ R L (dB)	FINE ADJUSTMENT Az (deg)	FINE ADJUSTMENT Elev (deg)	WINDSPEED km/h (mph)
PARABOLIC ANTENNAS												
SU1-35AN	1 (0.3)	15.5	14	20.2	20.5	20.7	30	30	1.40 / 16.0	± 5	± 25	250 (156)
SU2-35AN	2 (0.6)	9.5	8.7	24	24.5	25	30	30	1.50 / 14.0	± 5	± 15	250 (156)
PAL4-35AN	4 (1.2)	4.9	4.9	30.4	30.8	31.2	40	28	1.20 / 21.0	± 5	± 10	200 (125)
PAL6-35BN	6 (1.8)	3.2	3.2	33.5	34	34.5	45	30	1.20 / 21.0	± 5	± 5	200 (125)
PAL8-35AN	8 (2.4)	2.4	2.4	35.5	36	36.5	47	30	1.20 / 21.0	± 5	± 5	200 (125)

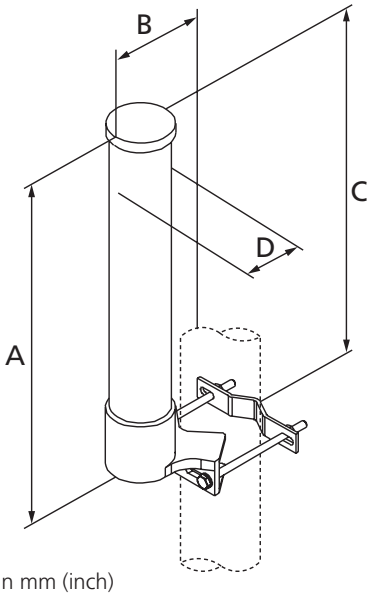
24.25 - 26.75 GHz, Antenna Input – PBR 220

MODEL NUMBER	HEIGHT mm (in)	3dB BEAMWIDTH Az (deg)	3dB BEAMWIDTH Elev (deg)	GAIN (dBI) Low	GAIN (dBI) Mid	GAIN (dBI) High	F/B RATIO (dB)	XPD (dB)	VSWR/ R L (dB)	WINDSPEED km/h (mph)
SECTOR ANTENNAS										
SEC260-90ABH	190 (7.5)	90	9	16	16.1	16.2	40	35	1.50 / 14.0	250 (156)
SEC260-90ABV	190 (7.5)	90	9	14.4	14.9	15.3	40	30	1.50 / 14.0	250 (156)

27.5 - 29.5 GHz, Antenna Input – PBR 320

MODEL NUMBER	HEIGHT mm (in)	3dB BEAMWIDTH Az (deg)	3dB BEAMWIDTH Elev (deg)	GAIN (dBI) Mid	F/B RATIO (dB)	XPD (dB)	VSWR/ R L (dB)	WINDSPEED km/h (mph)	ANTENNA INPUT
SECTOR ANTENNAS									
SEC280-90ABH	190 (7.5)	90	8.5	15.9	40	30	1.50 / 14.0	250 (156)	PBR 320
SEC280-90BBV	190 (7.5)	90	8.5	15.5	40	30	1.50 / 14.0	250 (156)	PBR 320

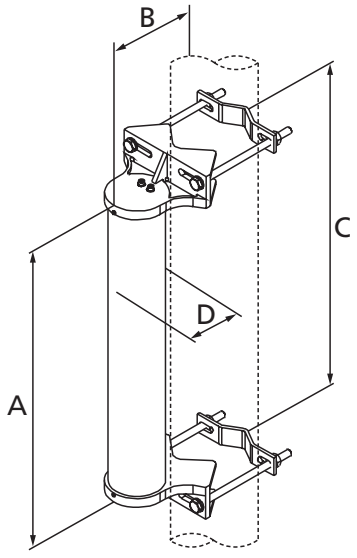
Omnidirectional Antennas
VOA35-360ANVL
VOA35-360ANVH



All dimensions in mm (inch)

ANT TYPE	A	B Ø114	C	D
VOA35-360ANVL	520 (20.5)	112(4.4)	910(36)	80(3.2)
VOA35-360ANVH	880(34.5)	112(4.4)	550(21.8)	80(3.2)

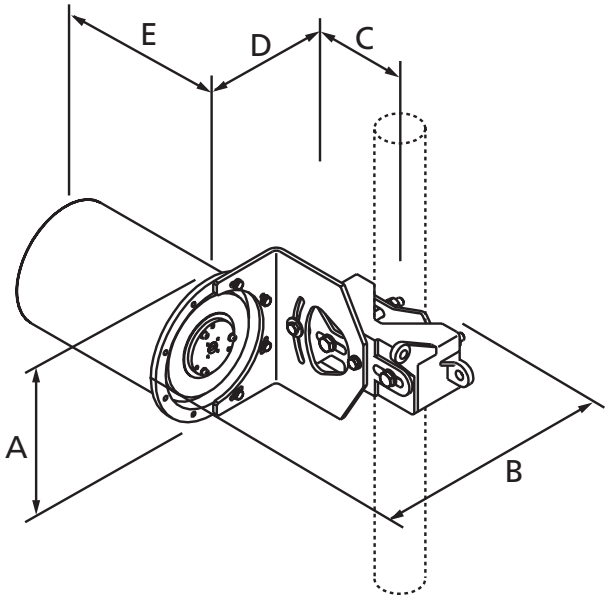
Sector Antennas
SEC-35L Series
SEC-35H Series



All dimensions in mm (inch)

ANT TYPE	A	B Ø114	C	D
SEC-35L Series	495(19.6)	134(5.3)	570(23)	80(3.2)
SEC-35H Series	815(32.2)	134(5.3)	900(35.6)	80(3.2)

Sector Antennas
SEC260 Series
SEC280 Series

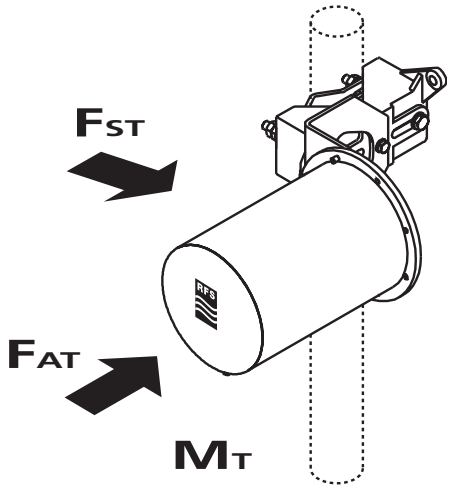


All dimensions in mm (inch)

ANT TYPE	ØA	B	C	DØ114	E
SEC260 Series	190(7.5)	370(14.6)	125(5)	204(8)	245(9.7)
SEC280 Series	190(7.5)	370(14.6)	125(5)	204(8)	245(9.7)

Forces and Twisting Moments Due to Wind

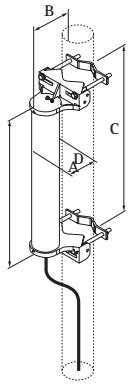
ANTENNA TYPE						
Forces Moments	Pipe Diameter 51mm Wind Speed		Pipe Diameter 90mm Wind Speed		Pipe Diameter 114mm Wind Speed	
	110 km/h (68mph)	200 km/h (125mph)	110 km/h (68mph)	200 km/h (125mph)	110 km/h (68mph)	200 km/h (125mph)
SEC35-60ANVL, SEC35-90ANVL, SEC35-120ANVL, SEC35-180ANVL						
FAT max N (lb)	17 (3.8)	57 (12.8)			17 (3.8)	57 (12.8)
FST max N (lb)	17 (3.8)	57 (12.8)			17 (3.8)	57 (12.8
MT max Nm (ft lb)	1.8 (1.3)	6 (4.5)			2.5 (1.9)	8.3 (6.1)
SEC35-60ANVH, SEC35-90ANVH, SEC35-120ANVH, SEC35-180ANVH, SEC35-90ANVH2, SEC35-60ANHH2, SEC35-90ANHH2						
FAT max N (lb)	28 (6.3)	93 (20.8)			28 (6.3)	93 (20.8)
FST max N (lb)	28 (6.3)	93 (20.8)			28 (6.3)	93 (20.8)
MT max Nm (ft lb)	3 (2.2)	10 (7.4)			4 (3)	14 (10.4)
SEC260-90 ABH, SEC260-90 ABV, SEC 280-90ABH, SEC280-90 BBV						
FAT max N (lb)	25 (5.6)	85(19)			25(5.6)	85 (19)
FST max N (lb)	26 (5.8)	87 (20)			26 (5.8)	87 (20)
MT max Nm (ft lb)	5 (3.7)	17 (12.7)			5 (3.7)	17 (12.7)
VOA35-360ANVL						
FAT max N (lb)	22 (4.9)	73 (16.4)			22 (4.9)	73 (16.4)
FST max N (lb)	22 (4.9)	73 (16.4)			22 (4.9)	73 (16.4)
MT max Nm (ft lb)	1.9 (1.4)	6.2 (4.6)			2.4 (1.8)	8.1 (6)
VOA35-360ANVH						
FAT max N (lb)	31 (6.9)	102 (22.8)	31 (6.9)	102 (22.8)		
FST max N (lb)	31 (6.9)	102 (22.8)	31 (6.9)	102 (22.8)		
MT max Nm (ft lb)	2.6 (1.9)	8.7 (6.4)	3.4 (2.5)	11.3 (8.4)		



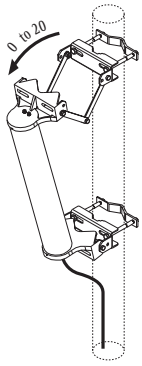
Tilt Mounts/Dividers/Couplers

Tilt Mount for 3.5 GHz sector antennas

The optional tilt mount enables the network planer to optimize the coverage within a cell by adjusting the down tilt from 0 up to -20 deg in elevation.

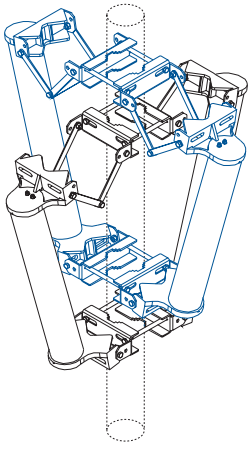


Standard Mount



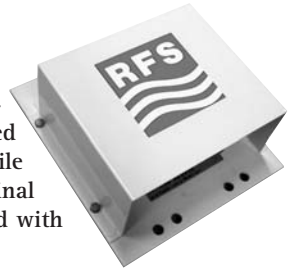
Tilt Mount (Optional)

It can be applied to all sector antennas in different array configurations. An example is shown with 4 x 90 deg sector antennas.

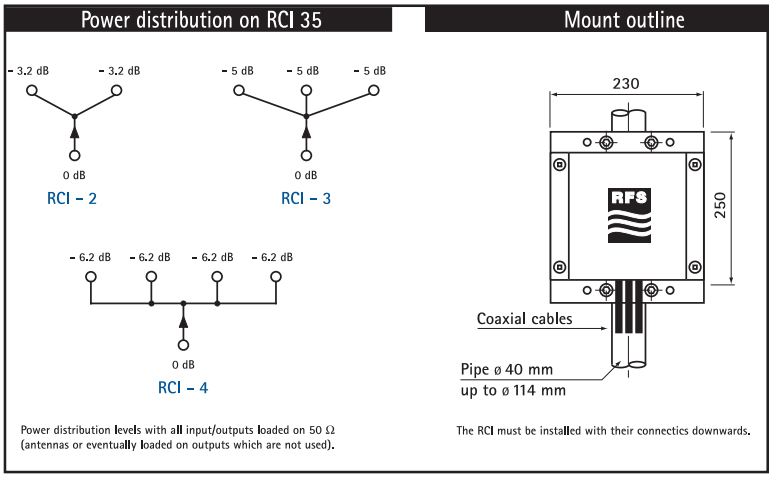


Configuration with 4 x SEC 35-90-13 V on tilt mounts, for a 360° coverage.

Divider/Coupler



- The RCI 35, couplers-dividers enable to feed or add up energy while complying with nominal impedance (50W) and with low insertion losses.
- Their main applications are the coupling of 2, 3, or 4 antennas with the same phase and the same amplitude. These antennas can be either different or identical.
- Main advantages:
  - Low SWR
  - Wide band
  - Low insertion losses
  - Small bulk
  - Good protection against running water
- The N-type connects enables to use coaxial cables RG 213 U or RG 214 U.
- The coaxial input/ouputs receptacles are made in N-Female connects and located on a 7.5 cm plate set back from the lower part of cover. The connections are completely protected against weather aggression.



3.4 – 3.7 GHz
Input/Output Flange: N Female

Frequency Range 3.4 - 3.7 GHz	Number of outputs	VSWR / R.L. [dB]	Input/Output Impedence [W]	Insertion loss [dB]	Max. Input Power [W]	Net Weight [kg]
RCI-2NN3500	2	1.2/20.8	50	< 0.3	100	2.1
RCI-3NN3500	3	1.2/20.8	50	< 0.3	100	2.1
RCI-4NN3500	4	1.2/20.8	50	< 0.3	100	2.1