

InnoSenT

Innovative Sensor Technology



Standard Products

Version: 2009-01-28

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About InnoSenT

Who is InnoSenT?

InnoSenT GmbH is a component manufacturer offering both products and solutions. InnoSenT develops, manufactures and distributes radar front ends in the 24GHz frequency band. The product range is not limited to pure doppler radars. We also offer FSK, FMCW and pulse radars that provide information about the speed and distance of an object.



Donnersdorf facility

Our philosophy

Innovation – quality – on-time delivery

- Innovation** means, InnoSenT builds radars a bit different to others
- Quality** gets designed in, while our production processes are carefully monitored
- on-time delivery** because we want to make our customers feel happy



managing directors

Technology and method

The designs from InnoSenT are based on a unique planar microstrip technology. Ultrathin patch antennas enable the realization of a various spectrums of antenna patterns. State-of-the-art technologies for oscillators and mixers are naturally used.



development dept.

Certifications

- DIN EN ISO 9001:2000
- DIN EN ISO 14001
- customer audited according to VDA 6.3 (comparable with the QS 9000)
- DIN ISO TS 16949 scheduled for Q2/2009



development dept.

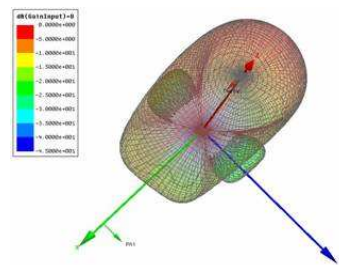
Our products

The following pages list all of our standard products, together with the most important data.

We offer the following radar principles:

- CW doppler radar for moving objects
- FMCW / FSK radar for detection of moving and stationary objects including measurement of velocity, direction of motion, range and angle of arrival
- Multi-mode-radars including pulse-functionality

If you can't find what you are searching for, don't hesitate to contact us (contact information on the last page). With the help of our development department and our production department we are confident that we shall find the right solution to your problem.



3D – antenna simulation

New Products

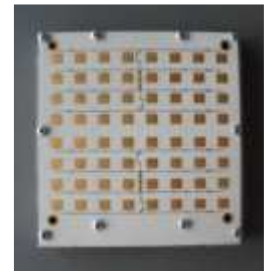
InnoSenT is proud to present a new generation of K-Band Transceiver, all based on brand new and unique 24GHz MMIC technology.

Multifunctional K-Band Transceiver IMS-944

NEW

Description:

- The IMS-944 (InnoSenT **M**ultifunctional **S**ensor) is the advanced version of the famous InnoSenT K-Band Transceiver IPS-144.
- The sensor provides a special RF-design for maximum sensitivity in long range applications like traffic monitoring or speed enforcement.
- New and smart features like programmable Tx-frequency or 2 power options give the user new options in the field of marketing and stock keeping.



Features IMS-944:

- radar-based motion detector working in the 24GHz ISM Band
- stereo (dual channel) operation for direction of motion identification
- integrated RF-pre-amplifier
- programmable IF-amplifier
- 2 selectable output power levels (ETSI / FCC)
- automatic gain control (AGC) of output power over temperature
- integrated PLL-circuit for high frequency stability
- frequencies are programmable by customer
 - one constant frequency
 - changing of frequencies by customers by external digital control circuitry

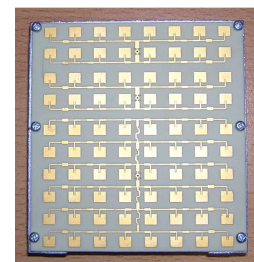
For technical Details please contact factory: Tel: 0049 – 9528 – 9518 – 0 or E-Mail: info@innosent.de

Monopulse/FSK/FMCW-capable K-Band VCO-Transceiver IVQ-905

NEW

Description:

- K-Band VCO radar-transceiver
- MMIC oscillator
- monopulse/CW/FSK/FMCW modes
- four receiver channels for monopulse operations
- Separate PLL oscillator for frequency calibration
- RF-pre-amplifier for lowest noise operation
- separate transmit and receive path for maximum sensitivity
- IF-pre-amplifier



Features IVQ-905:

The IVQ-905 is the first generation of an angle measuring K-Band VCO Transceiver that allows the customer to set the transmit frequency in comparison to a PLL locked reference source.

It will be possible to limit the range of frequency used and/or linearization of the VCO curve. Furthermore, it will be possible to fix the frequency drift over temperature.

For technical Details please contact factory: Tel: 0049 – 9528 – 9518 – 0 or E-Mail: info@innosent.de

CW doppler radar for moving objects

Most radar-modules today are utilizing the CW-Doppler principle. With these modules you can measure speed and the direction of movement of an object. The sensor can also be used for presence detection. These measurement options are very important in application areas like

- traffic monitoring
- automatic door openers
- alarm equipment
- sanitary equipment
- sport applications

InnoSenT GmbH offers a multitude of different radar modules for these application areas.

The standard products are listed on the following pages.

If your requirements are different, don't hesitate to contact us, we are sure that we shall find the right solution to your problem.

Overview CW doppler radar for moving objects

<u>model</u>	<u>mixers</u>	<u>amplifier</u>		<u>no. of antennas</u>	<u>antenna pattern</u> [°]		<u>side lobe suppr.</u> [dB]	<u>bandwidth limited</u>	<u>bandwidth</u>	<u>page</u>
		IF	RF		horiz.	vert.				
IPS-144	Stereo	✓	✓	2	12	25	H = 20 / V = 13	✓	50Hz...10kHz	6
IPS-146	Stereo	✓	✓	2	30	32	typ. 20	✓	50Hz...10kHz	7
IPS-154	Stereo	✓	x	2	45	38	typ. 13	✓	DC...50kHz	8
IPS-155	Stereo	✓	x	2	70	36	typ. 13	✓	DC...50kHz	9
IPS-168	Stereo	✓	✓	2	5	21	typ. 15	✓	50Hz...10kHz	10

Abbreviations:

IF = intermediate frequency
RF = radio frequency

K-Band Transceiver: IPS-144

not recommended for new developments; module will be replaced by IMS-944

Description:

- radar-based motion detector
- available in different frequency ranges: IPS-144, IPS-144_UK, IPS-144_F
- advanced PHEMT-oscillator with low current consumption
- RF-pre-amplifier for lowest noise operation
- split transmit and receive path for maximum gain
- stereo (dual channel) operation for direction of motion identification
- IF-pre-amplifier, bandwidth limited for lowest noise performance
- compact outline dimensions

Absolute Maximum Ratings:

Parameter	Symbol	Rating
supply voltage	V _{CC}	5.5 V
operating temperature (out of spec)	T _{OP}	- 40 °C / + 85 °C
storage temperature	T _{STG}	+ 90 °C

Interface:

The sensor provides a 2 mm pitch 6 pin connector Molex P/N 51004-0600.

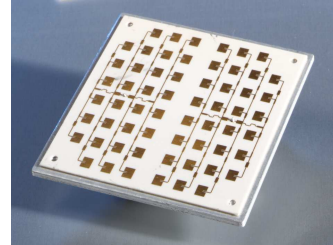
Pin #	Description	In/Out	Comment
1	enable	input	active low
2	V _{CC}	input	supply voltage (+5 V)
3	GND	input	analog ground
4	IF2	output	Signal Q(uadrature)
5	IF1	output	Signal I(nphase)
6	not connected		

mates with: Molex P/N 53014, 53015 and 53025

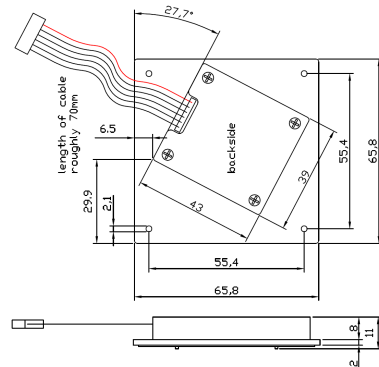
Electrical Characteristics:

Parameter	Symbol	min.	typ.	max.	units	comment
transmit frequency	f _{IPS-144}	24.000	24.125	24.250	GHz	
	f _{IPS-144_UK}	24.150	24.200	24.250	GHz	
	f _{IPS-144_F}	24.075	24.125	24.175	GHz	
output power (EIRP)	P _{out}		20		dBm	
temperature drift	Δf		- 500		kHz/°C	
antenna pattern	horizontal		12		°	azimuth
	vertical		25		°	elevation
side lobe suppression	horizontal		20		dB	azimuth
	vertical		15		dB	elevation
I/Q balance	amplitude			6	dB	
	phase	60	90	120	°	
IF output	voltage offset		V _{CC} /2		V	
IF-amplifier	gain		50		dB	
	bandwidth		50 – 10k		Hz	
supply voltage	V _{CC}	4.75	5.0	5.25	V	
supply current	I _{CC}		60	80	mA	IF-amp included
operating temperature	T _{OP}	- 20		+ 60	°C	
outline dimensions		~ 65.8 x 65.8 x 11			mm	

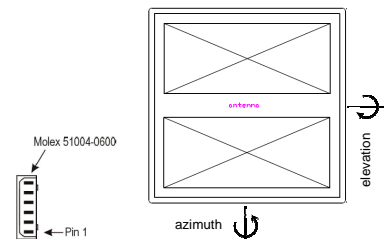
Product Picture:



Mechanical Outlines: (dimensions in mm)



Pin Description / Antenna Planes



K-Band Transceiver: IPS-146

Description:

- radar-based motion detector
- available in different frequency ranges: IPS-146, IPS-146_UK, IPS-146_F
- advanced PHEMT-oscillator with low current consumption
- RF-pre-amplifier for lowest noise operation
- split transmit and receive path for maximum gain
- stereo (dual channel) operation for direction of motion identification
- IF-pre-amplifier, bandwidth limited for lowest noise performance
- enable input for oscillator shut down
- small outline dimensions

Absolute Maximum Ratings:

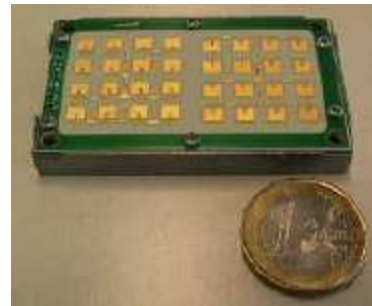
Parameter	Symbol	Rating
supply voltage	V_{CC}	5.5 V
operating temperature (out of spec)	T_{OP}	- 40 °C / + 85 °C
storage temperature	T_{STG}	+ 90 °C

Interface:

The sensor provides a 2.54 mm grid, pin header (square pin \square 0.635 mm).

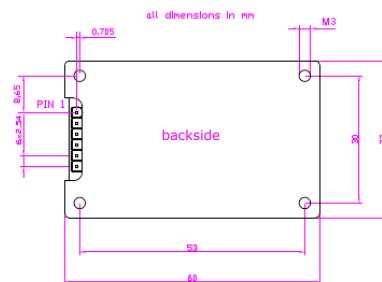
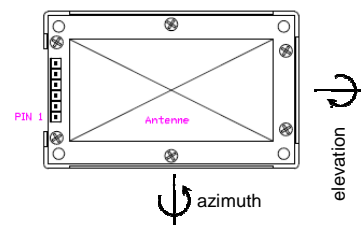
Pin #	Description	In/Out	Comment
1	NC		not connected
2	enable	input	active low
3	V_{CC}	input	supply voltage (+5 V)
4	GND	input	analog ground
5	IF2	output	Signal Q(uadrature)
6	IF1	output	Signal I(nphase)

Product Picture:



Mechanical Outlines:

(dimensions in mm)



Electrical Characteristics:

Parameter	Symbol	min.	typ.	max.	units	comment
transmit frequency	$f_{IPS-146}$	24.000	24.125	24.250	GHz	
	$f_{IPS-146_UK}$	24.150	24.200	24.250	GHz	
	$f_{IPS-146_F}$	24.075	24.125	24.175	GHz	
output power (EIRP)	P_{out}		18		dBm	
temperature drift	Δf		- 1		MHz/°C	
antenna pattern	horizontal		30		°	azimuth
	vertical		32		°	elevation
side lobe suppression	horizontal		20		dB	azimuth
	vertical		20		dB	elevation
I/Q balance	amplitude			6	dB	
	phase	60	90	120	°	
IF output	voltage offset		$V_{CC}/2$		V	
IF-amplifier	gain		50		dB	
	bandwidth		50 – 10k		Hz	
supply voltage	V_{CC}	4.75	5.0	5.25	V	
supply current	I_{CC}		60	80	mA	IF-amp included
operating temperature	T_{OP}	- 20		+ 60	°C	
outline dimensions		~ 60 x 37 x 9			mm	

K-Band Transceiver: IPS-154

Description:

- radar-based motion detector
- available in different frequency ranges: IPS-154, IPS-154_UK, IPS-154_F
- advanced PHEMT-oscillator with low current consumption
- split transmit and receive path for maximum gain
- stereo (dual channel) operation for direction of motion identification
- IF-pre-amplifier, bandwidth limited for lowest noise performance
- economic flat-pack housing, extra small outline dimensions
- enable input for oscillator shut down

Absolute Maximum Ratings:

Parameter	Symbol	Rating
supply voltage	V _{CC}	5.5 V
operating temperature (out of spec)	T _{OP}	- 40 °C / + 85 °C
storage temperature	T _{STG}	+ 90 °C

Interface:

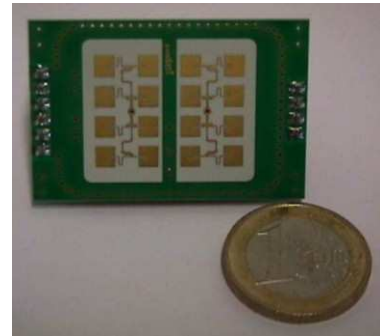
The sensor provides a 2.54 mm grid, pin header (square pin □ 0.635 mm).

Pin #	Description	In/Out	Comment
1	NC		not connected
2	enable	input	active low
3	V _{CC}	input	supply voltage (+5 V)
4	GND	input	analog ground
5	IF1	output	Signal I(n)phase
6	IF2	output	Signal Q(uadrature)
7	NC		not connected
8	NC		not connected
9	GND	input	analog ground
10	NC		not connected

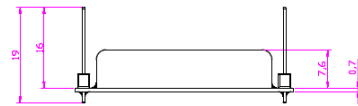
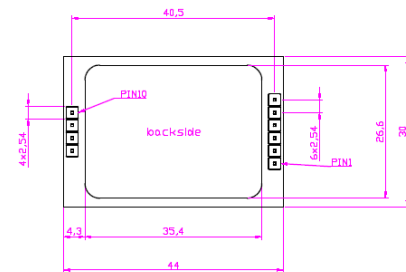
Electrical Characteristics:

Parameter	Symbol	min.	typ.	max.	units	comment
transmit frequency	f _{IPS-154}	24.000	24.125	24.250	GHz	
	f _{IPS-154_UK}	24.150	24.200	24.250	GHz	
	f _{IPS-154_F}	24.075	24.125	24.175	GHz	
output power (EIRP)	P _{out}		16		dBm	
temperature drift	Δf		- 1		MHz/°C	
antenna pattern	horizontal		45		°	azimuth
	vertical		38		°	elevation
side lobe suppression	horizontal		13		dB	azimuth
	vertical		13		dB	elevation
I/Q balance	amplitude			6	dB	
	phase	60	90	120	°	
IF output	voltage offset	1.0	2.2	4.0	V	
IF-amplifier	gain		20		dB	
	bandwidth		DC – 50k		Hz	
supply voltage	V _{CC}	4.75	5.0	5.25	V	
supply current	I _{CC}		35	50	mA	IF-amp included
operating temperature	T _{OP}	- 20		+ 60	°C	
outline dimensions		~ 44 x 30 x 8.3 (19)			mm	

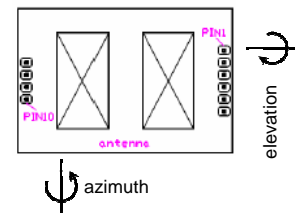
Product Picture:



Mechanical Outlines: (dimensions in mm)



Pin Description / Antenna Planes:



K-Band Transceiver: IPS-155

Description:

- radar-based motion detector
- available in different frequency ranges: IPS-155, IPS-155_UK, IPS-155_F
- advanced PHEMT-oscillator with low current consumption
- split transmit and receive path for maximum gain
- stereo (dual channel) operation for direction of motion identification
- IF-pre-amplifier, bandwidth limited for lowest noise performance
- economic flat-pack housing, extra small outline dimensions
- enable input for oscillator shut down

Absolute Maximum Ratings:

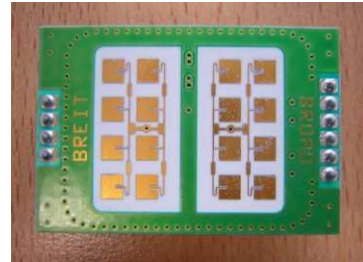
Parameter	Symbol	Rating
supply voltage	V _{CC}	5.5 V
operating temperature (out of spec)	T _{OP}	- 40 °C / + 85 °C
storage temperature	T _{STG}	+ 90 °C

Interface:

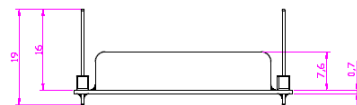
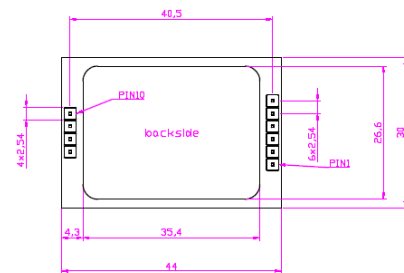
The sensor provides a 2.54 mm grid, single row pin header (square pin □ 0.635 mm).

Pin #	Description	In/Out	Comment
1	NC		not connected
2	enable	input	active low
3	V _{CC}	input	supply voltage (+5 V)
4	GND	input	analog ground
5	IF1	output	Signal I(nphase)
6	IF2	output	Signal Q(uadrature)
7	NC		not connected
8	NC		not connected
9	NC		not connected
10	NC		not connected

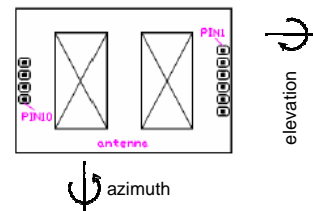
Product Picture:



Mechanical Outlines: (dimensions in mm)



Pin Description / Antenna Planes:



Electrical Characteristics:

Parameter	Symbol	min.	typ.	max.	units	comment
transmit frequency	f _{IPS-155}	24.000	24.125	24.250	GHz	
	f _{IPS-155_UK}	24.150	24.200	24.250	GHz	
	f _{IPS-155_F}	24.075	24.125	24.175	GHz	
output power (EIRP)	P _{out}		15		dBm	
temperature drift	Δf		- 1		MHz/°C	
antenna pattern	horizontal		70		°	azimuth
	vertical		36		°	elevation
side lobe suppression	horizontal		13		dB	azimuth
	vertical		13		dB	elevation
I/Q balance	amplitude			6	dB	
	phase	60	90	120	°	
IF output	voltage offset	1.0	2.2	4.0	V	
IF-amplifier	gain		20		dB	
	bandwidth		DC – 50k		Hz	
supply voltage	V _{CC}	4.75	5.0	5.25	V	
supply current	I _{CC}		35	50	mA	IF-amp included
operating temperature	T _{OP}	- 20		+ 60	°C	
outline dimensions		~ 44 x 30 x 8.3 (19)			mm	

K-Band Transceiver: IPS-168

Description:

- radar-based motion detector centered @ 24.125 GHz
- advanced PHEMT-oscillator with low current consumption
- RF-pre-amplifier for lowest noise operation
- split transmit and receive path for maximum gain
- stereo (dual channel) operation for direction of motion identification
- IF-pre-amplifier, bandwidth limited for lowest noise performance
- enable input for oscillator shut down
- compact outline dimensions

Absolute Maximum Ratings:

Parameter	Symbol	Rating
supply voltage	V_{CC}	5.5 V
operating temperature (out of spec)	T_{OP}	- 40 °C / + 85 °C
storage temperature	T_{STG}	+ 90 °C

Interface:

The sensor provides a 2 mm pitch 6 pin connector Molex P/N 51004-0600.

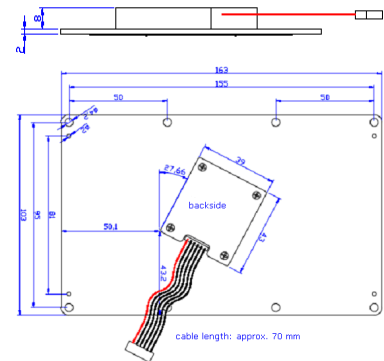
Pin #	Description	In/Out	Comment
1	enable	input	active low
2	V_{CC}	input	supply voltage (+5 V)
3	GND	input	analog ground
4	IF2	output	Signal Q(uadrature)
5	IF1	output	Signal I(nphase)
6	not connected		

mates with: Molex P/N 53014, 53015 and 53025

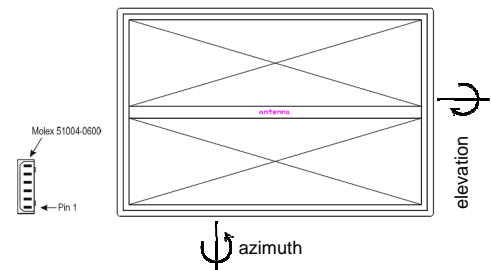
Product Picture:



Mechanical Outlines: (dimensions in mm)



Pin Description / Antenna Planes:



Electrical Characteristics:

Parameter	Symbol	min.	typ.	max.	Units	Comment
transmit frequency	f	24.000	24.125	24.250	GHz	
output power (EIRP)	P_{out}		20		dBm	
temperature drift	Δf		- 500		kHz/°C	
antenna pattern	horizontal		5		°	azimuth
	vertical		22		°	elevation
side lobe suppression	horizontal		15		dB	azimuth
	vertical		15		dB	elevation
I/Q balance	amplitude			6	dB	
	phase	60	90	120	°	
IF output	voltage offset		$V_{CC}/2$		V	
IF-amplifier	gain		50		dB	
	bandwidth		50 – 10k		Hz	
supply voltage	V_{CC}	4.75	5.0	5.25	V	
supply current	I_{CC}		60	80	mA	
operating temperature	T_{OP}	-25		+60	°C	
outline dimensions		~ 163 x 103 x 11			mm	

FMCW/FSK radar for moving and stationary objects

In commercial applications the FMCW radar principle becomes more and more interesting, since transceiver modules are available at low cost. In many applications the sensor shall provide data about stationary objects or in case of moving objects additional information like speed and range.

The FMCW radar principle offers this possibility and is providing information

in the case of **moving objects**

- instantaneous velocity and direction of motion (like the usual doppler radar)
- instantaneous distance of the object from the sensor
- the angle of arrival of the object with a certain receiver arrangement

in the case of **stationary objects**

- the distance from the sensor
- the angle of the object with a certain receiver arrangement.

With proper processing of the low-frequency receive signals the FMCW is **multitarget-capable**, that means it can distinguish between different objects regarding velocity and range and regarding the instantaneous coordinates in space.

Overview FMCW/FSK radar for moving and stationary objects

model	mixers	amplifier		no. of antennas	antenna pattern [°]		side lobe suppression [dB]	bandwidth limited	bandwidth	Page
		IF	RF		horiz.	vert.				
IVS-148	Stereo	✓	✓	2	12	25	typ. 15	✓	50...100kHz	12
IVS-162	Stereo	✓	x	2	45	38	typ. 13	✓	DC...50kHz	13
IVS-163	Stereo	✓	x	2	70	36	typ. 13	✓	DC...50kHz	14
IVS-167	Stereo	x	x	1	7	11	typ. 15	x	50Hz...25kHz	15
IVS-179	Stereo	✓	✓	2	7	28	typ. 15	✓	50Hz...25kHz	16

Abbreviations:

IF = intermediate frequency
 RF = radio frequency

K-Band VCO-Transceiver: IVS-148

Description:

- K-Band VCO radar transceiver
- CW / FSK / FMCW modes
- advanced PHEMT-oscillator with low current consumption
- RF-pre-amplifier for lowest noise operation
- separate transmit and receive path for maximum sensitivity
- stereo (dual channel) operation for direction of motion identification
- IF-pre-amplifier, bandwidth limited for lowest noise performance

Absolute Maximum Ratings:

Parameter	Symbol	Rating
supply voltage	V_{CC}	5.5 V
operating temperature (out of spec)	T_{OP}	- 40 °C / + 85 °C
storage temperature	T_{STG}	+ 90 °C

Interface:

The sensor provides a 2 mm pitch 6 pin connector Molex P/N 51004-0600.

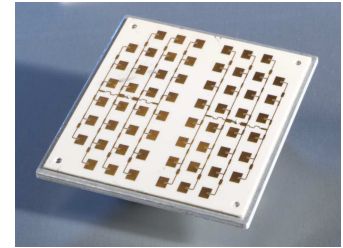
Pin #	Description	In/Out	Comment
1	Enable	input	active low
2	V_{CC}	input	supply voltage (+ 5 V)
3	GND	input	analog ground
4	IF2	output	Signal Q(uadrature)
5	IF1	output	Signal I(nphase)
6	V_{tune}	input	varactor tuning voltage

mates with: Molex P/N 53014, 53015 and 53025

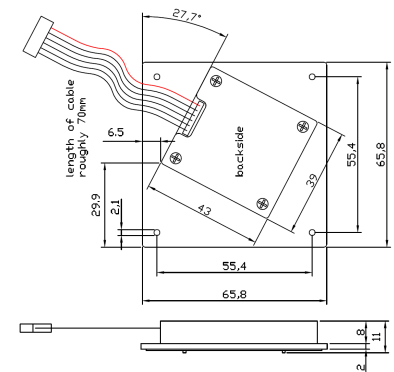
Electrical Characteristics:

Parameter	Symbol	min.	typ.	max.	units	Comment
transmit frequency	f		24.000 – 24.250		GHz	depending on V_{tune} voltage
varactor tuning voltage	V_{tune}	0.5		10	V	
varactor input impedance			10 k		Ω	
modulation input				150	kHz	
tuning slope			50		MHz/V	
output power	P_{out}		20		dBm	
temperature drift	Δf		- 900		kHz/°C	
antenna pattern	horizontal		12		°	azimuth
	vertical		25		°	elevation
side lobe suppression	horizontal		15		dB	azimuth
	vertical		15		dB	elevation
I/Q balance	amplitude			6	dB	
	phase	60	90	120	°	
IF output	voltage offset		$V_{CC}/2$		V	
IF-amplifier	gain		30		dB	
	bandwidth		50 – 100k		Hz	
supply voltage	V_{CC}	4.75	5.0	5.25	V	
supply current	I_{CC}		60	80	mA	
operating temperature	T_{OP}	- 20		+ 60	°C	
outline dimensions		~ 65.8 x 65.8 x 11			mm	compare drawing

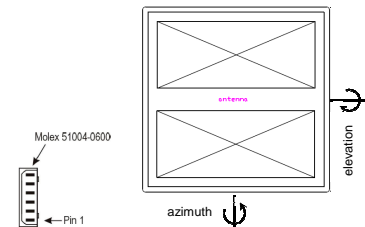
Product Picture:



Mechanical Outlines: (dimensions in mm)



Pin Description / Antenna Planes



K-Band VCO-Transceiver: IVS-162

Description:

- K-Band VCO radar transceiver for FMCW/FSK applications
- advanced PHEMT-oscillator with low current consumption
- split transmit and receive path for maximum gain
- stereo (dual channel) operation for direction of motion identification
- IF-pre-amplifier, bandwidth limited for lowest noise performance
- economic flat-pack housing, extra small outline dimensions

Absolute Maximum Ratings:

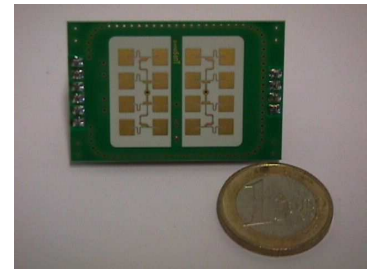
Parameter	Symbol	Rating
supply voltage	V_{CC}	5.5 V
operating temperature (out of spec)	T_{OP}	- 40 °C / + 85 °C
storage temperature	T_{STG}	+ 90 °C

Interface:

The sensor provides a 2.54 mm grid, pin header (square pin \square 0.635 mm).

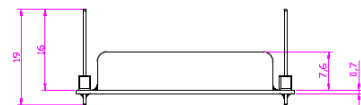
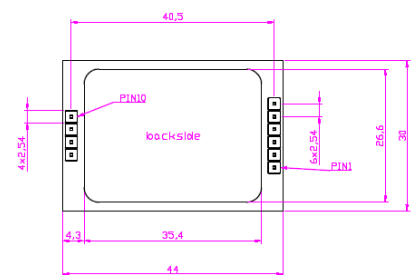
Pin #	Description	In/Out	Comment
1	V_{tune}	input	varactor tuning voltage
2	enable	input	active low
3	V_{CC}	input	supply voltage (+5 V)
4	GND	input	analog ground
5	IF1	output	Signal I(nphase)
6	IF2	output	Signal Q(uadrature)
7	NC		not connected
8	NC		not connected
9	GND	input	analog ground
10	GND	input	analog ground

Product Picture:

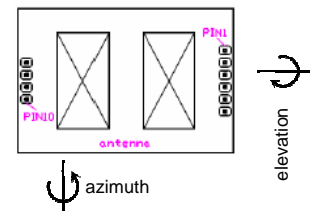


Mechanical Outlines:

(dimensions in mm)



Pin Description / Antenna Planes:



Electrical Characteristics:

Parameter	Symbol	min.	typ.	max.	units	comment
transmit frequency	f		24.000 – 24.250		GHz	depending on V_{tune} voltage
varactor tuning voltage	V_{tune}	0.5		10	V	
varactor input impedance			1 k		Ω	
modulation input				150	kHz	
tuning slope		40			MHz/V	
output power	P_{out}		15		dBm	
temperature drift	Δf		- 1		MHz/°C	
antenna pattern	horizontal		45		°	azimuth
	vertical		38		°	elevation
side lobe suppression	horizontal		13		dB	azimuth
	vertical		13		dB	elevation
I/Q balance	amplitude			6	dB	
	phase	60	90	120	°	
IF output	voltage offset	1.0	2.2	4.0	V	
IF-amplifier	gain		20		dB	
	bandwidth		DC – 50k		Hz	
supply voltage	V_{CC}	4.75	5.0	5.25	V	
supply current	I_{CC}		35	50	mA	
operating temperature	T_{OP}	- 20		+ 60	°C	
outline dimensions		~ 44 x 30 x 8.3 (19)			mm	compare drawing

K-Band VCO-Transceiver: IVS-163

Description:

- K-Band VCO radar transceiver for FMCW/FSK applications
- advanced PHEMT-oscillator with low current consumption
- split transmit and receive path for maximum gain
- stereo (dual channel) operation for direction of motion identification
- IF-pre-amplifier, bandwidth limited for lowest noise performance
- economic flat-pack housing, extra small outline dimensions

Absolute Maximum Ratings:

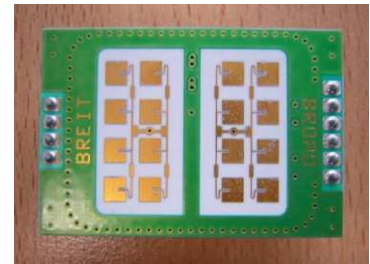
Parameter	Symbol	Rating
supply voltage	V _{CC}	5.5 V
operating temperature (out of spec)	T _{OP}	- 40 °C / + 85 °C
storage temperature	T _{STG}	+ 90 °C

Interface:

The sensor provides a 2.54 mm grid, pin header (square pin □ 0.635 mm).

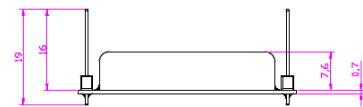
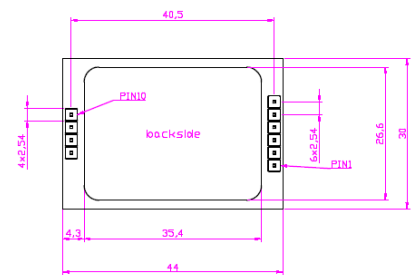
Pin #	Description	In/Out	Comment
1	V _{tune}	input	varactor tuning voltage
2	enable	input	active low
3	V _{CC}	input	supply voltage (+5 V)
4	GND	input	analog ground
5	IF1	output	Signal I(nphase)
6	IF2	output	Signal Q(uadrature)
7	NC		not connected
8	NC		not connected
9	NC		not connected
10	GND	input	analog ground

Product Picture:

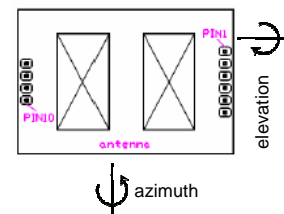


Mechanical Outlines:

(dimensions in mm)



Pin Description / Antenna Planes:



Electrical Characteristics:

Parameter	Symbol	min.	typ.	max.	units	comment
transmit frequency	f		24.000 – 24.250		GHz	depending on V _{tune} voltage
varactor tuning voltage	V _{tune}	0.5		10	V	
varactor input impedance			1 k		Ω	
modulation input				150	kHz	
tuning slope		40			MHz/V	
output power	P _{out}		15	20	dBm	
temperature drift	Δf		- 1		MHz/°C	
antenna pattern	horizontal		70		°	azimuth
	vertical		36		°	elevation
side lobe suppression	horizontal		13		dB	azimuth
	vertical		13		dB	elevation
I/Q balance	amplitude			6	dB	
	phase	60	90	120	°	
IF output	voltage offset	1.0	2.2	4.0	V	
IF-amplifier	gain		20		dB	
	bandwidth		DC – 50k		Hz	
supply voltage	V _{CC}	4.75	5.0	5.25	V	
supply current	I _{CC}		35	50	mA	
operating temperature	T _{OP}	- 20		+ 60	°C	
outline dimensions		~ 44 x 30 x 8.3 (19)			mm	compare drawing

K-Band VCO-Transceiver: IVS-167

Description:

- K-Band VCO radar transceiver for FMCW/FSK applications
- advanced PHEMT-oscillator with low current consumption
- stereo (dual channel) operation
- integrated planar antenna

Environmental Tests and Handling Precautions:

- This InnoSenT sensor is sensitive to damage from ESD.
- Additional pre-cautions regarding ESD are required
- Applying multimeters e.g. for resistance measurement between any of the connector pins may cause damage to the module.



Absolute Maximum Ratings:

Parameter	Symbol	Rating
supply voltage	V_{CC}	5.5 V
operating temperature (out of spec)	T_{OP}	- 40 °C / + 85 °C
storage temperature	T_{STG}	+ 90 °C

Interface:

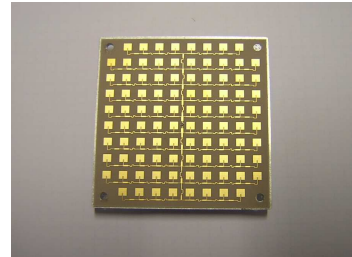
The sensor provides a 2.54 mm grid, single row pin header (square pin \square 0.635 mm).

Pin #	Description	In/Out	Comment
1	IF1	output	Signal I(nphase)
2	IF2	output	Signal Q(uadrature)
3	GND	input	analog ground
4	V_{CC}	input	supply voltage (+5 V)
5	V_{tune}	input	varactor tuning voltage

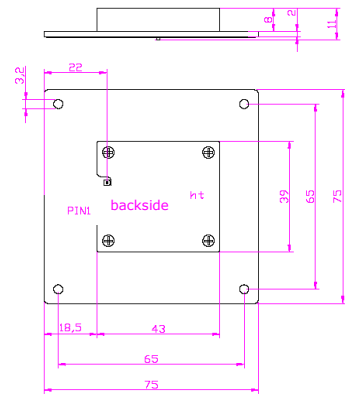
Electrical Characteristics:

Parameter	Symbol	min.	typ.	max.	units	comment
transmit frequency	f		24.000 – 24.250		GHz	depending on V_{tune} voltage
varactor tuning voltage	V_{tune}	0.5		8	V	
varactor input impedance			1 k		Ω	
modulation input				150	kHz	
tuning slope			50		MHz/V	
output power	P_{out}		18	20	dBm	
temperature drift	Δf		- 1		MHz/°C	
antenna pattern	horizontal		11		°	azimuth
	vertical		11		°	elevation
side lobe suppression	horizontal		15		dB	azimuth
	vertical		15		dB	elevation
I/Q balance	amplitude			6	dB	
	phase	60	90	120	°	
supply voltage	V_{CC}	4.75	5.0	5.25	V	
supply current	I_{CC}		33	40	mA	
operating temperature	T_{OP}	- 20		+ 60	°C	
outline dimensions		~ 75 x 75 x 11			mm	compare drawing

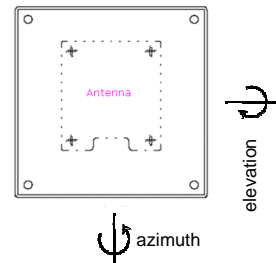
Product Picture:



Mechanical Outlines: (dimensions in mm)



Antenna Pattern:



K-Band VCO-Transceiver: IVS-179

Description:

- K-Band VCO radar transceiver
- CW / FSK / FMCW modes
- advanced PHEMT-oscillator with low current consumption
- RF-pre-amplifier for lowest noise operation
- separate transmit and receive path for maximum sensitivity
- stereo (dual channel) operation for direction of motion identification
- IF-pre-amplifier

Absolute Maximum Ratings:

Parameter	Symbol	Rating
pos. supply voltage	V_{CC}	5.5V
neg. supply voltage	V_{SS}	-5.5V
operating temperature (out of spec)	T_{OP}	- 40 °C / + 85 °C
storage temperature	T_{STG}	+ 90 °C

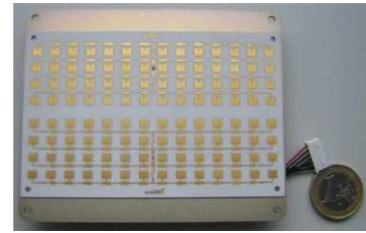
Interface:

The sensor provides a 2 mm pitch 6 pin connector Molex P/N 51004-0600.

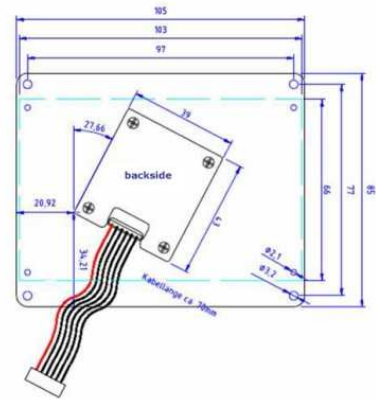
Pin #	Description	In/Out	Comment
1	enable	input	enable
2	V_{CC}	input	positive supply voltage (+ 5 V)
3	GND	input	analog ground
4	IF2	output	Signal Q(uadrature)
5	IF1	output	Signal I(nphase)
6	V_{tune}	input	varactor tuning voltage (0.5 V – 10 V)

mates with: Molex P/N 53014, 53015 and 53025

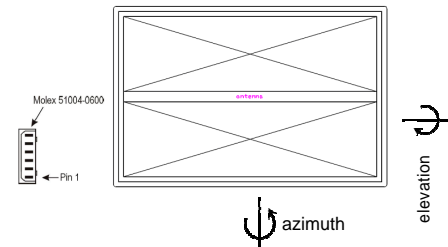
Product Picture:



Mechanical Outlines: (dimensions in mm)



Pin Description / Antenna Planes:



Electrical Characteristics:

Parameter	Symbol	min.	typ.	max.	units	comment
transmit frequency	f		24.000 – 24.250		GHz	depending on V_{tune} voltage
varactor tuning voltage	V_{tune}	0.5		10	V	
varactor input impedance			10 k		Ω	
modulation input				150	kHz	
tuning slope			50		MHz/V	
output power	P_{out}			20	dBm	
temperature drift	Δf		- 1		MHz/°C	
antenna pattern	horizontal		7		°	azimuth
	vertical		28		°	elevation
side lobe suppression	horizontal		15		dB	azimuth
	vertical		15		dB	elevation
I/Q balance	amplitude			6	dB	
	phase	60	90	120	°	
IF output	voltage offset		$V_{CC}/2$		V	
IF-amplifier	gain		33		dB	
	bandwidth		50 – 25k		Hz	
positive supply voltage	V_{CC}	4.75	5.0	5.25	V	
positive supply current	I_{CC}		60	80	mA	
negative supply voltage	V_{SS}	- 5.25	- 5.0	- 4.75	V	
negative supply current	I_{SS}		10	20	mA	
operating temperature	T_{OP}	- 20		+ 60	°C	
outline dimensions		~ 105 x 85 x 11			mm	compare drawing

Universal Low-Cost radar transceivers

The highly appreciated product line of Low-Cost radar transceivers offers the possibility of universal applications at very attractive prices.

The specific products can be particularly characterized by their extra small outline dimensions and high sensitivity. The typical application areas of these modules include:

- Intrusion alarm and security
- Home automation (e.g. motion detector for automatic light switch)
- Automatic door openers

The standard products are listed on the following pages.

If your requirements are different, don't hesitate to contact us, we are sure that we shall find the right solution to your problem.

Overview universal Low-Cost radar transceivers

Low-Cost CW doppler radar for moving objects

<u>model</u>	<u>Mixers</u>	<u>no. of antennas</u>	<u>antenna pattern</u>		<u>side lobe suppression</u>	<u>supply voltage</u>	<u>page</u>
			horizontal	vertical			
IPM-165	Mono	2	80°	32°	typ. 13 dB	5 V	18
IPM-170	Mono	2	70°	70°	typ. 13 dB	5 V	18
IPM-365	Mono	2	80°	32°	typ. 13 dB	3 V	18
IPM-190	Mono	2	$\lambda/4$ dipole rod antennas			5 V	18

Environmental Tests and Handling Precautions:



- The InnoSenT universal Low-Cost radar transceivers are sensitive to damage from ESD.
- Additional pre-cautions regarding ESD are required
- Applying multimeters e.g. for resistance measurement between any of the connector pins may cause damage to the module.

Low-Cost CW doppler radar transceivers

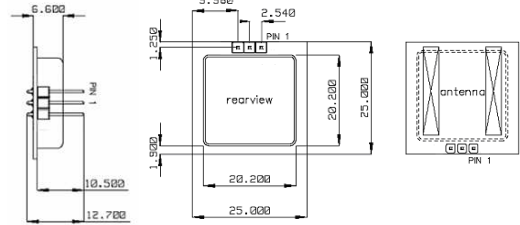
K-Band Transceivers: IPM-165 / IPM-170 / IPM-190 / IPM-365

Description:

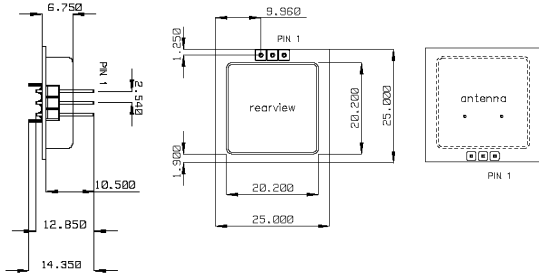
- radar-based motion detector
- available in different frequency ranges: Standard; _F and _UK variants
- advanced PHEMT-oscillator with low current consumption
- split transmit and receive path for maximum gain
- mono (single channel) operation for motion detection
- very small outline dimensions

Outline dimensions: (all dimensions in mm)

a) IPM-165/ IPM-170 / IPM-365:



b) IPM-190:



Absolute Maximum Ratings:

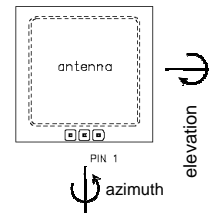
Parameter	Symbol	Rating
supply voltage IPM-165, IPM-170, IPM-190	V_{CC}	5.5 V
supply voltage IPM-365	V_{CC}	3.6 V
operating temperature (out of spec)	T_{OP}	- 40 °C / + 85 °C
storage temperature	T_{STG}	+ 90 °C

Interface:

The sensor provides a 2.54 mm grid, single row pin header (square pin \square 0.635 mm).

Pin #	Description	In/Out	Comment
1	V_{CC}	input	supply voltage
2	IF1	output	signal output
3	GND	input	analog ground

Pin Description / Antenna Planes



Common electrical characteristics:

Parameter	Symbol	min.	typ.	max.	Units	Comment
transmit frequency	$f_{Standard}$	24.000	24.125	24.250	GHz	
	$f_{UK_variant}$	24.150	24.200	24.250	GHz	
	$f_{F_variant}$	24.075	24.125	24.175	GHz	
temperature drift	Δf		- 1		MHz/°C	
IF output	voltage offset	-300		300	mV	
supply current	I_{CC}		30	40	mA	continuous operation
pulse length	t_{pulse}		10		μs	oscillator start time using V_{CC}
operating temperature	T_{OP}	-20		+60	°C	

Specific electrical characteristics:

Parameter	Symbol	IPM-165			IPM-170			IPM-365			IPM-190		
output power (EIRP)	P_{out}	typ. 16 dBm			typ. 16 dBm			typ. 13 dBm			typ. 10 dBm		
antenna pattern	horizontal	typ. 80°			typ. 70°			typ. 80°			λ/4 dipole rod antennas		
	vertical	typ. 32°			typ. 70°			typ. 32°					
side lobe suppression	horizontal	typ. 13 dB			typ. 13 dB			typ. 13 dB					
	vertical	typ. 13 dB			typ. 13 dB			typ. 13 dB					
supply voltage	V_{CC} [V]	min. 4.75	typ. 5.0	max. 5.25	min. 4.75	typ. 5.0	max. 5.25	min. 2.85	typ. 3.0	max. 3.3	min. 4.75	typ. 5.0	max. 5.25
outline dimensions*	dim [mm]	~ 25 x 25 x 7 (12.7)			~ 25 x 25 x 7 (12.7)			~ 25 x 25 x 7 (12.7)			~ 25 x 25 x 7 (14.4)		

Cells marked in light green distinguish the respective sensor from the IPM-165.

* the numbers in brackets specify the size of the respective sensor including connector- and antenna pins. Compare drawing

Special Products

In addition to the already presented standard products, InnoSenT offers special products are useful in production of radar equipment.

Doppler-Simulator: IDS-208

Description:

Doppler simulator IDS-208 simulates an object moving with constant speed in one direction by electronic means. This enables the user of CW-Doppler sensors to evaluate and measure the low frequency output signals of

- single-channel mono modules regarding amplitude and frequency (and therefore velocity)
- dual-channel stereo modules (I/Q versions) regarding amplitude, frequency (and therefore velocity) of each individual channel and phase/amplitude balance of the I/Q signals.

Therefore bulky and complex mechanical constructions to simulate a moving object are no longer required.

Product Picture:



Absolute Maximum Ratings:

Parameter	Symbol	Rating	Units
supply voltage RF-simulator (IDS-208)	V_{CC}	+ / - 6	V (DC)
supply voltage driver-generator (ISG-207)	V_{CC}	16	V (DC)
modulation voltage	V_{CC}	5	V (peak-peak)
operating temperature (out of spec)	T_{OP}	+ 70	°C
storage temperature	T_{STG}	+ 70	°C

Electrical Characteristics:

Parameter	Symbol	min.	typ.	Max.	units	comment
<i>Doppler Simulator IDS-208</i>						
operational frequency	f	24.000	24.125	24.250	GHz	
antenna pattern	horizontal		11		°	azimuth
	vertical		21		°	elevation
side lobe suppression	horizontal		20		dB	azimuth
	vertical		20		dB	elevation
operating temperature	T_{OP}	+ 15		+ 30	°C	
supply voltage	$V_{CC_IDS-208}$		+ / - 5		V	
supply current	$I_{CC_IDS-208}$		135		mA	
outline dimensions		~ 110 x 90 x 38			mm	
<i>Driver-Generator ISG-207</i>						
supply voltage	$V_{CC_ISG-207}$	14	+ / - 5	16	V	
supply current	$I_{CC_ISG-207}$		90		mA	
outline dimensions					mm	

Doppler Frequencies:

Switch setting	Frequency [Hz]	Comment	
0	0	0 km/h	0 mph
1	44	1 km/h	0,63 mph
2	63	1,43 km/h	0,89 mph
3	224	5 km/h	3,11 mph
4	393	8,9 km/h	5,53 mph
5	679	15,4 km/h	9,56 mph
6	904	20,54 km/h	12,76 mph
7	1116	25,36 km/h	15,75 mph
8	4450	101,1 km/h	62,82 mph
9	10420	236,8 km/h	147,14 mph

Appendix A: Antennendiagramme / antenna patterns

K-Band Transceiver

<u>model</u>	<u>no. of antennas</u>	<u>antenna pattern [°]</u>		<u>side lobe suppr. [dB]</u>	<u>comment</u>	<u>page</u>
		horiz.	Vert.			
IPS-144	2	12	25	H = 20 / V = 13		31
IPS-146	2	30	32	typ. 20		32
IPS-154	2	45	38	typ. 13		33
IPS-155	2	70	36	typ. 13		34
IPS-168	2	5	21	max. 15		35

K-Band VCO-Transceiver

<u>model</u>	<u>no. of antennas</u>	<u>antenna pattern [°]</u>		<u>side lobe suppr. [dB]</u>	<u>comment</u>	<u>page</u>
		horiz.	Vert.			
IVS-148	2	12	25	typ. 15		31
IVS-162	2	45	38	typ. 13		33
IVS-163	2	70	36	typ. 13		34
IVS-167	1	11	11	typ. 15		36
IVS-179	2	7	28	typ. 15		37

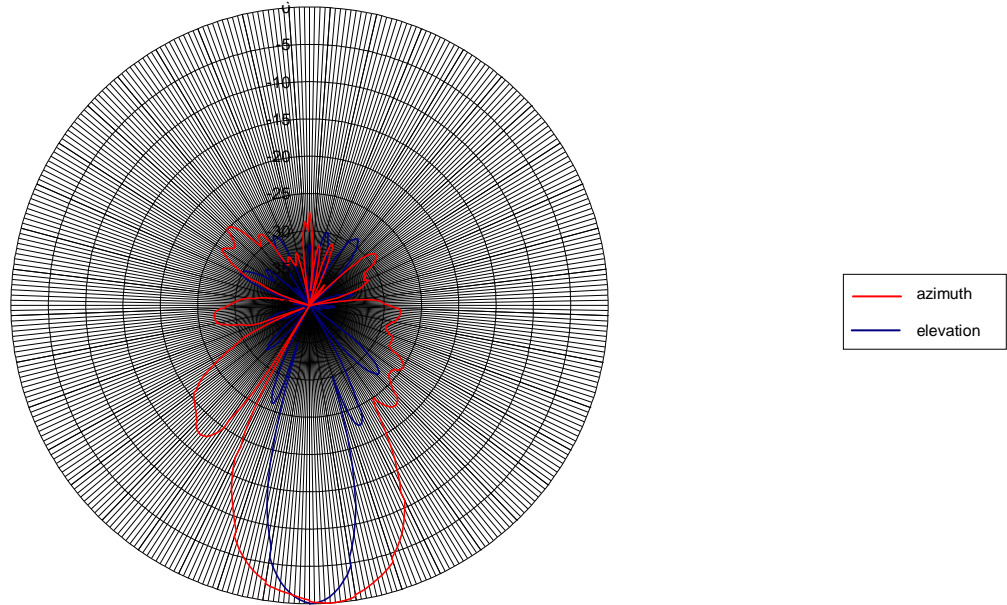
Universal Low-Cost radar transceivers

<u>model</u>	<u>no. of antennas</u>	<u>antenna pattern [°]</u>		<u>side lobe suppr. [dB]</u>	<u>comment</u>	<u>page</u>
		horiz.	Vert.			
IPM-165	2	80	32	typ. 13		38
IPM-170	2	70	70	typ. 13		39
IPM-365	2	80	32	typ. 13		38
IPM-190	2	$\lambda/4$ dipole rod antennas				40

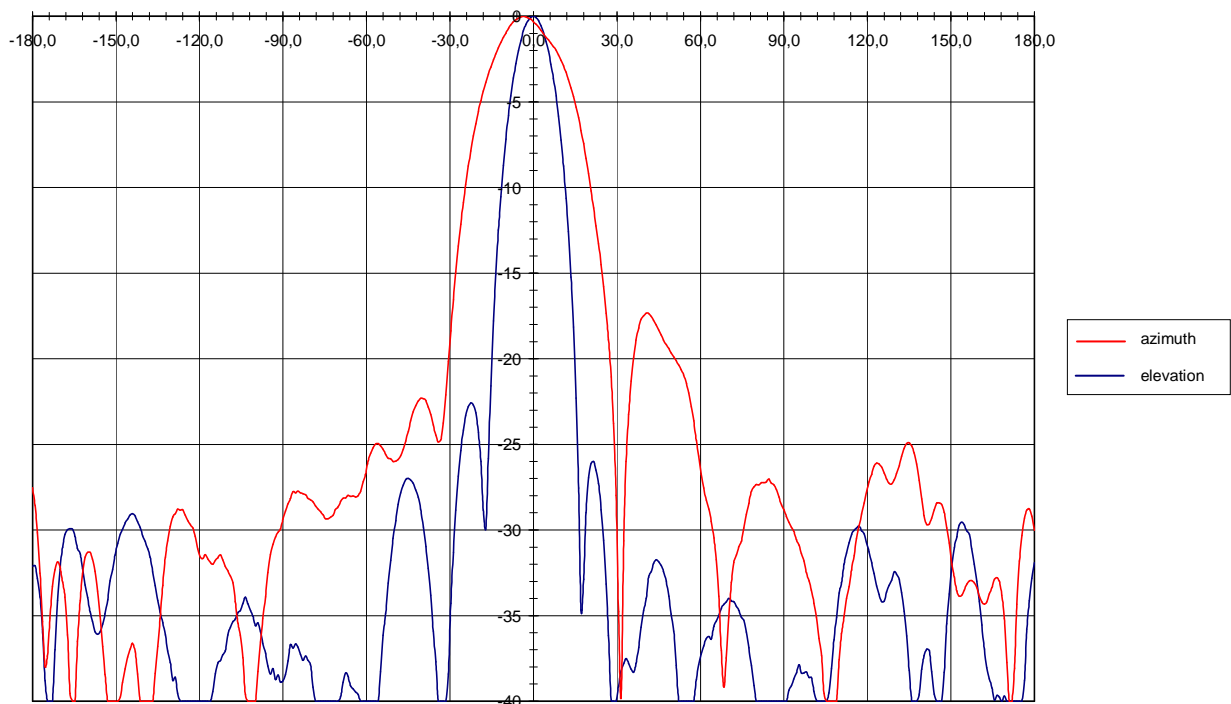
K-Band Transceiver: IPS-144

K-Band VCO Transceiver: IVS-148

Polardiagramm / radiation pattern



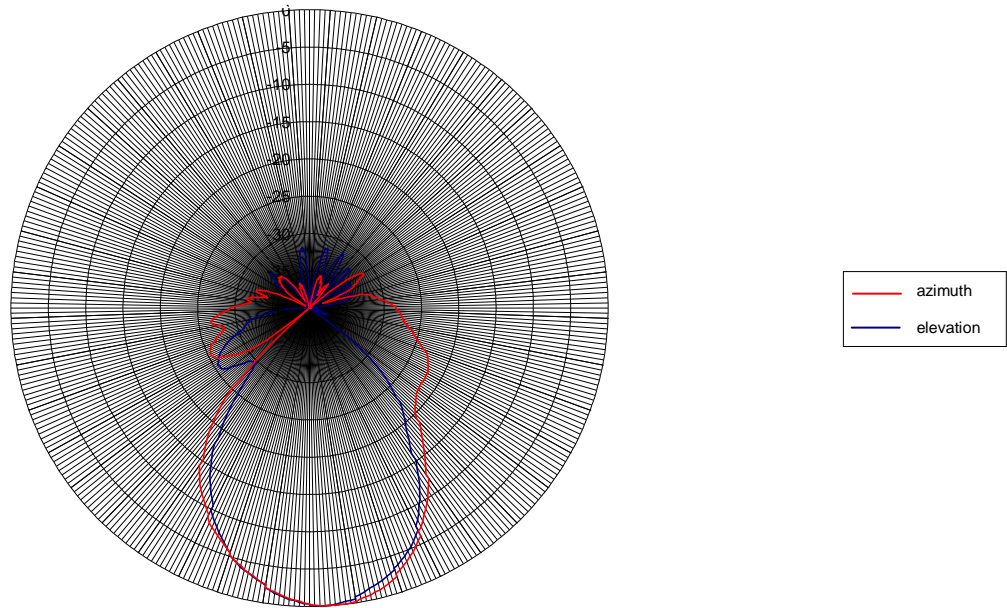
Richtdiagramm / radiation pattern



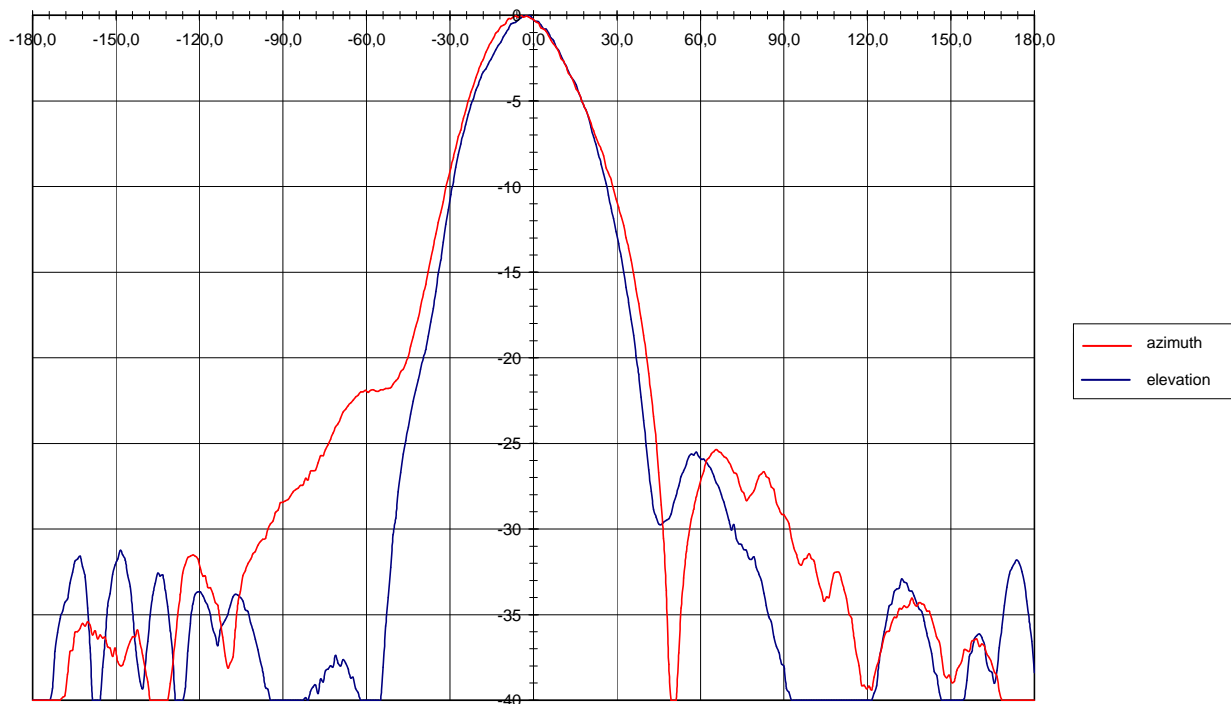
Parameter	Symbol	min	typ.	max.	units	comment
antenna pattern	horizontal		12		°	azimuth
	vertical		25		°	elevation
side lobe level	horizontal		-20		dB	azimuth
	vertical		-13		dB	elevation

K-Band Transceiver: IPS-146

Polardiagramm / radiation pattern



Richtdiagramm / radiation pattern

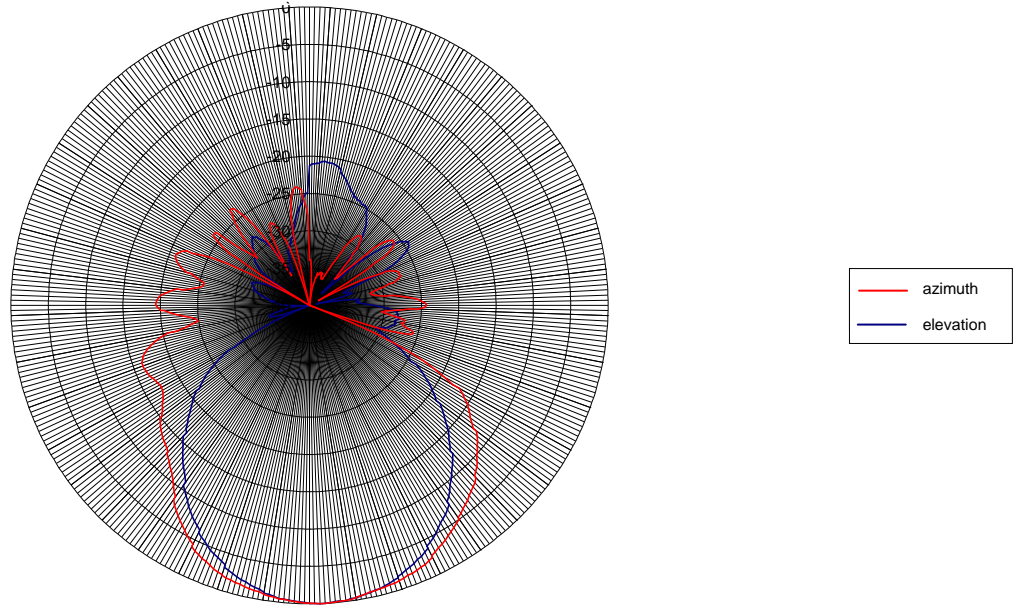


Parameter	Symbol	min	typ.	max.	units	comment
antenna pattern	horizontal		30		°	azimuth
	vertical		32		°	elevation
side lobe level	horizontal		-20		dB	azimuth
	vertical		-20		dB	elevation

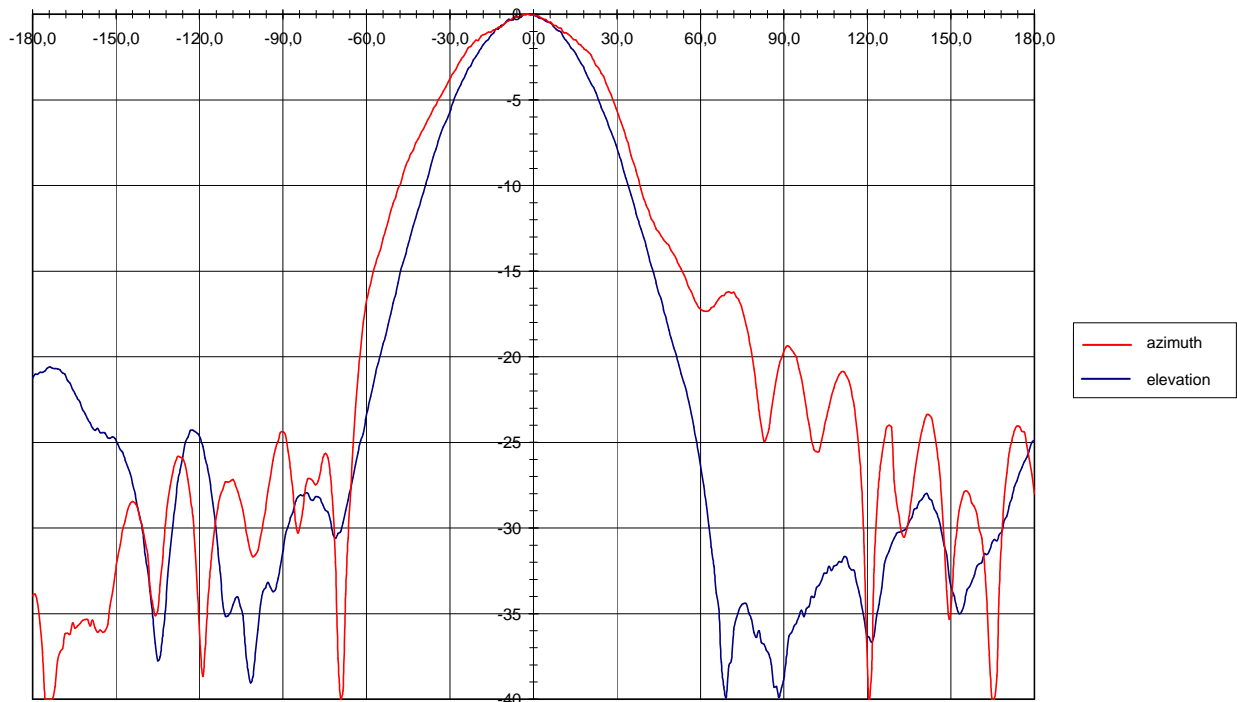
K-Band Transceiver: IPS-154

K-Band VCO Transceiver: IVS-162

Polardiagramm / radiation pattern



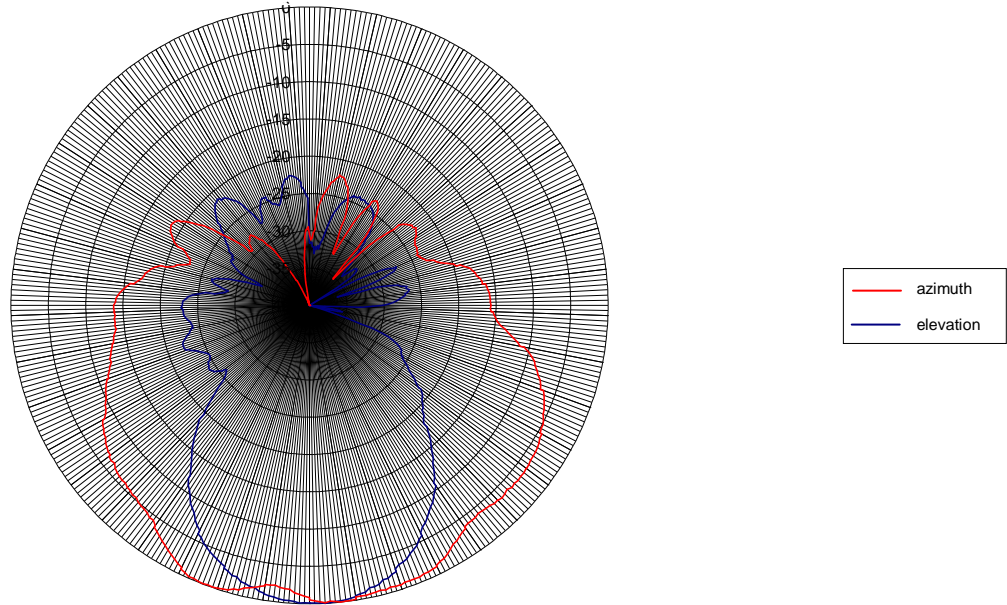
Richtdiagramm / radiation pattern



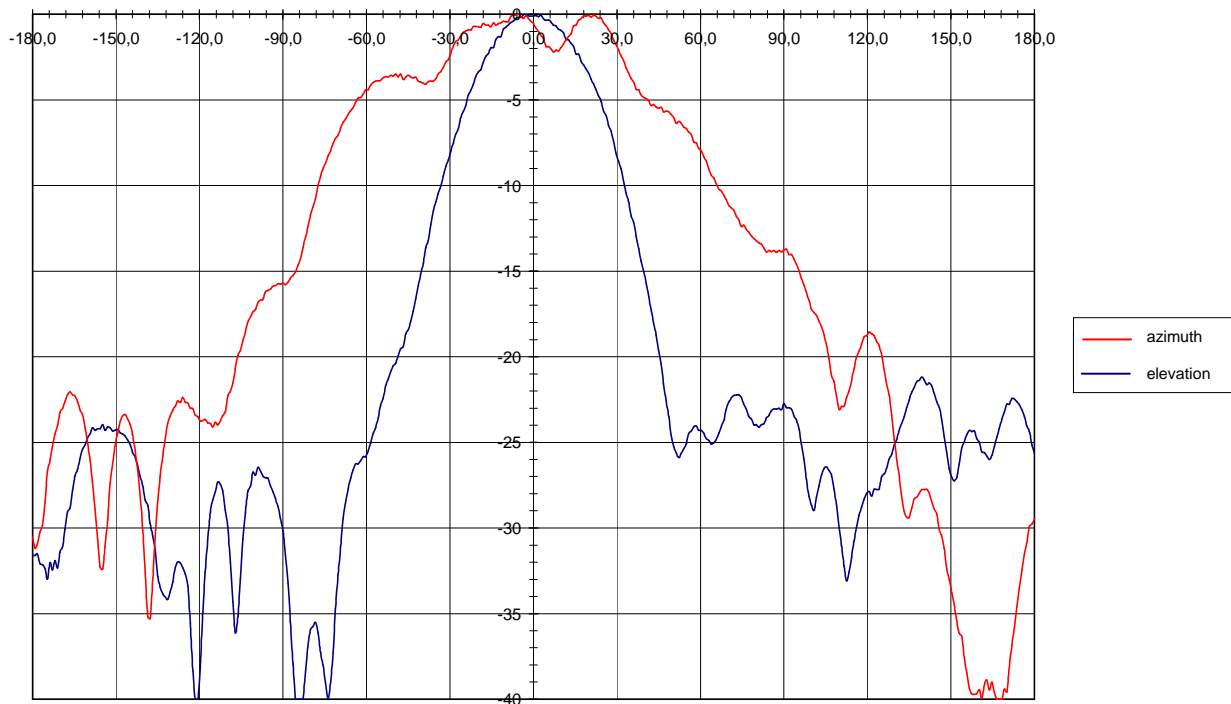
Parameter	Symbol	min	typ.	max.	units	comment
antenna pattern	horizontal		45		°	azimuth
	Vertical		38		°	elevation
side lobe suppression	horizontal		13		dB	azimuth
	Vertical		13		dB	elevation

K-Band Transceiver: IPS-155 K-Band VCO Transceiver: IVS-163

Polardiagramm / radiation pattern



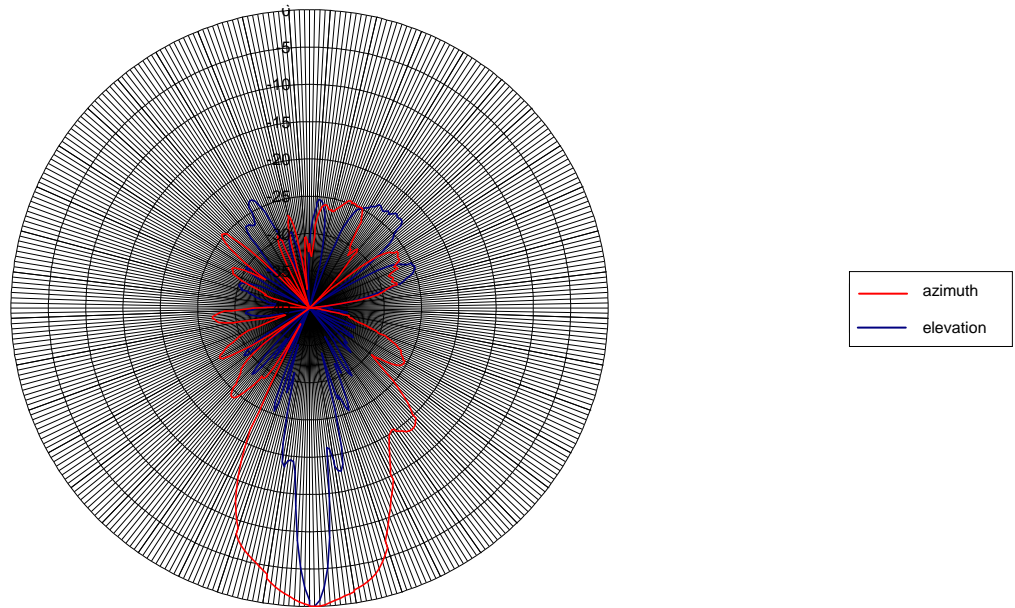
Richtdiagramm / radiation pattern



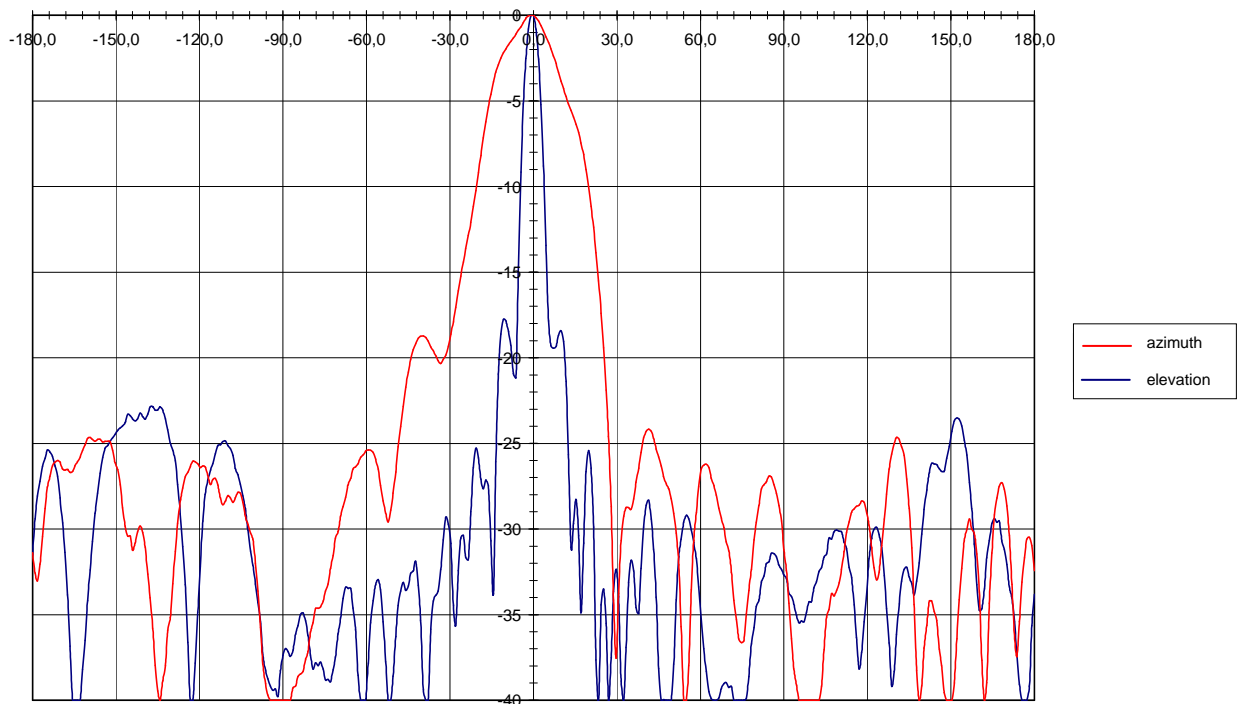
Parameter	Symbol	min	typ.	max.	units	comment
antenna pattern	horizontal		70		°	azimuth
	Vertical		36		°	elevation
side lobe suppression	horizontal		13		dB	azimuth
	vertical		13		dB	elevation

K-Band Transceiver: IPS-168

Polardiagramm / radiation pattern



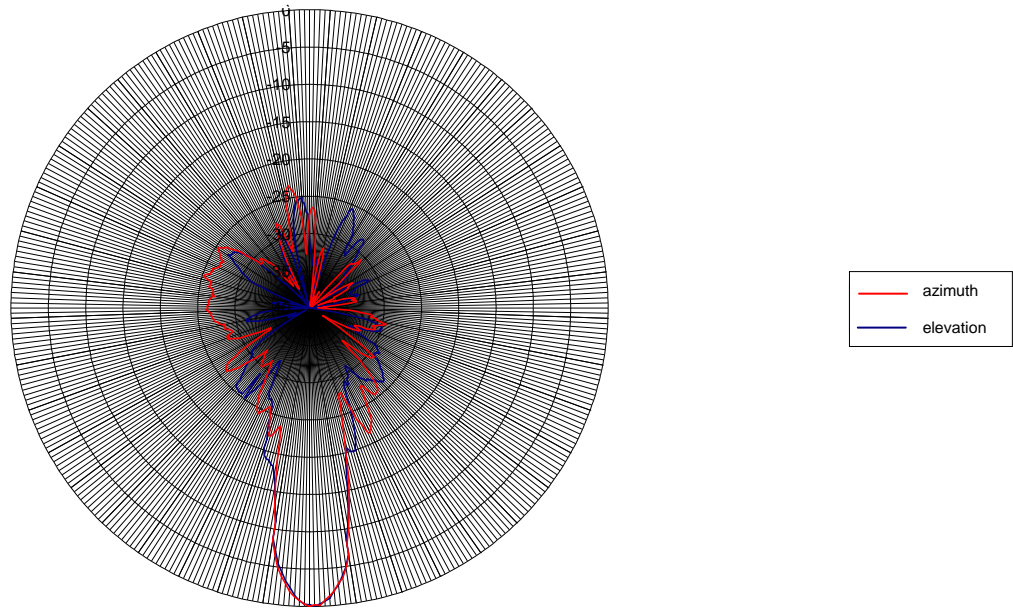
Richtdiagramm / radiation pattern



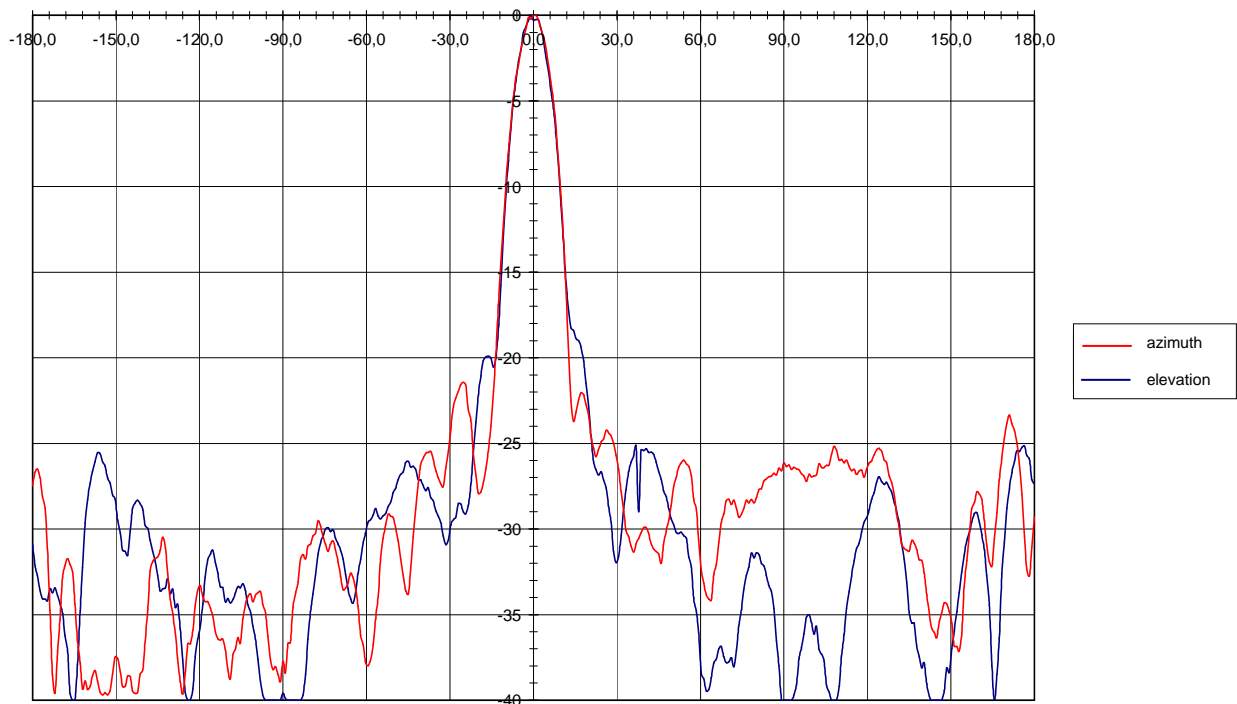
Parameter	Symbol	min	typ.	max.	units	comment
antenna pattern	horizontal		5		°	azimuth
	vertical		21		°	elevation
side lobe level	horizontal			-15	dB	azimuth
	vertical			-15	dB	elevation

K-Band VCO Transceiver: IVS-167

Polardiagramm / radiation pattern



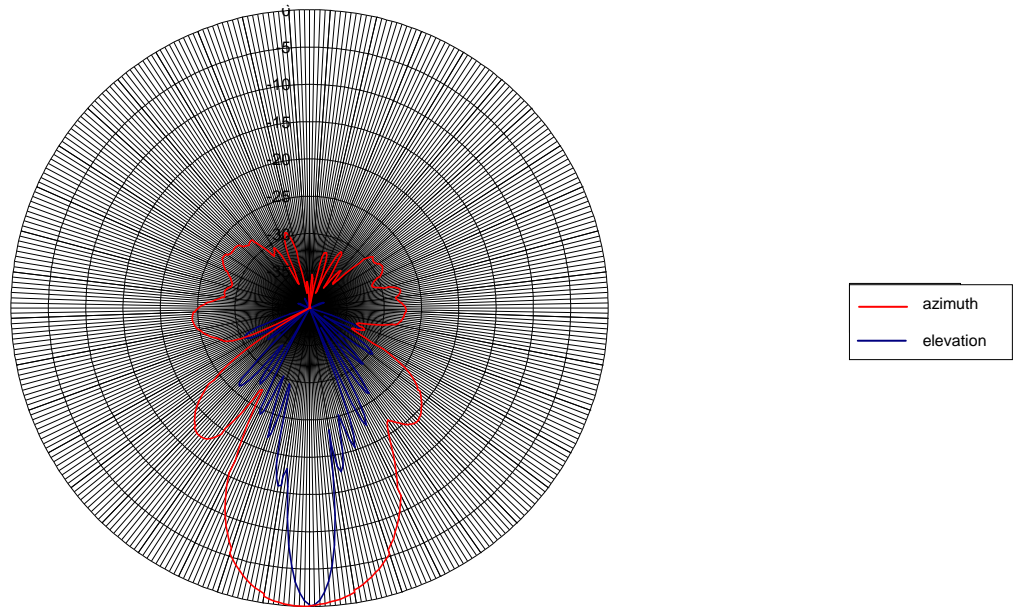
Richtdiagramm / radiation pattern



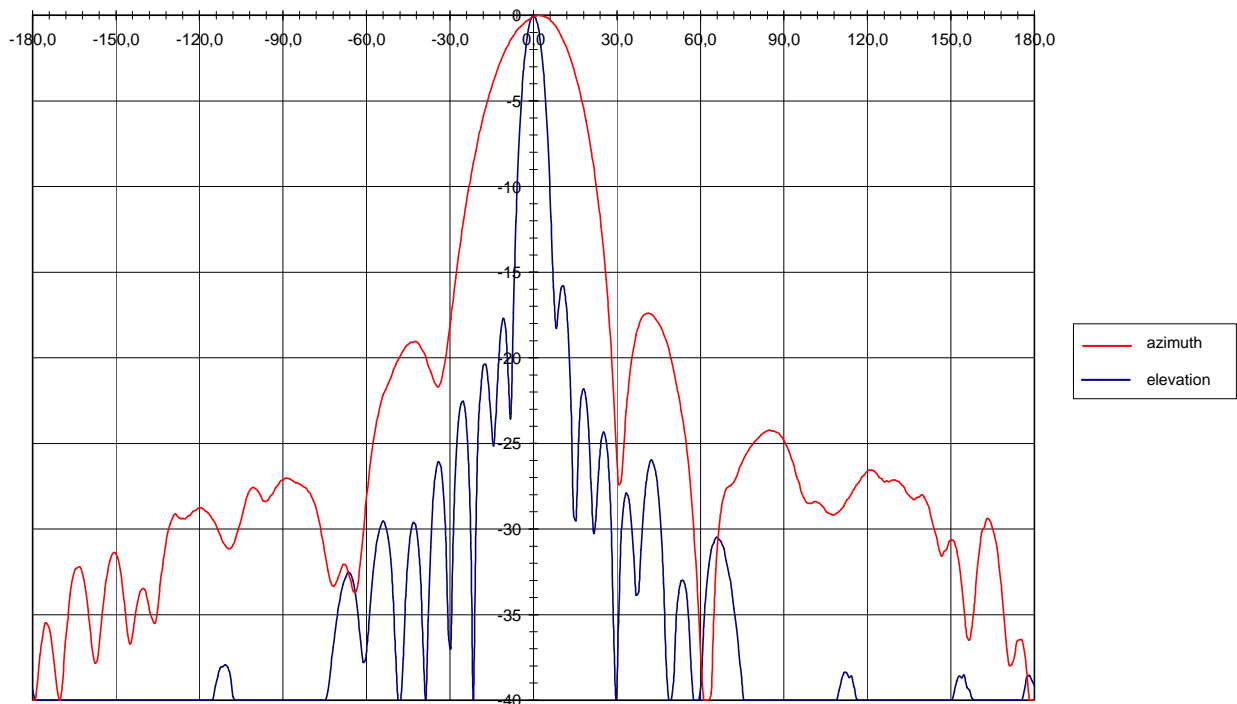
Parameter	Symbol	min	typ.	max.	units	comment
antenna pattern	horizontal		11		°	azimuth
	vertical		11		°	elevation
side lobe suppression	horizontal		15		dB	azimuth
	vertical		15		dB	elevation

K-Band VCO Transceiver: IVS-179

Polardiagramm / radiation pattern



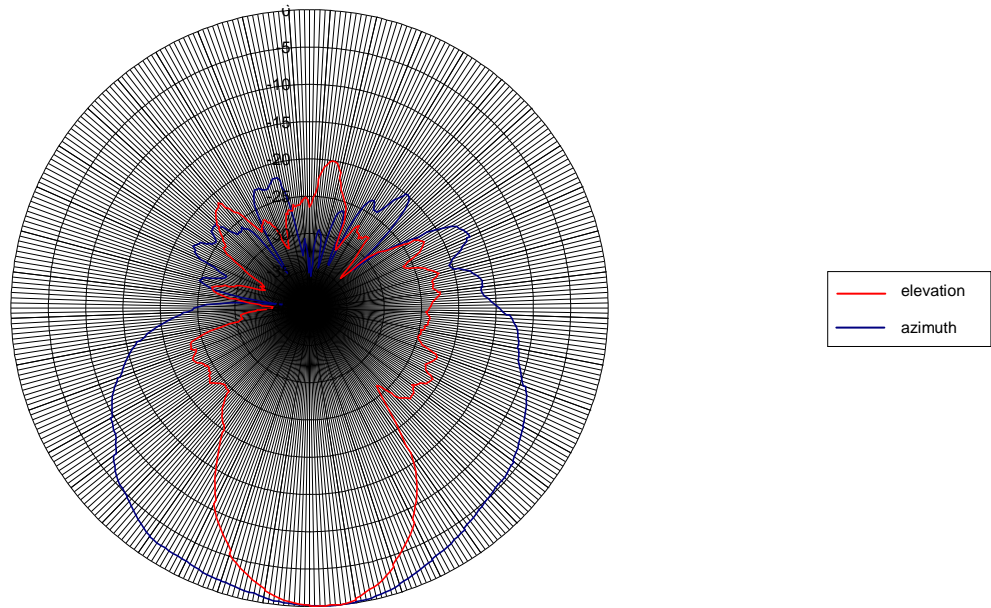
Richtdiagramm / radiation pattern



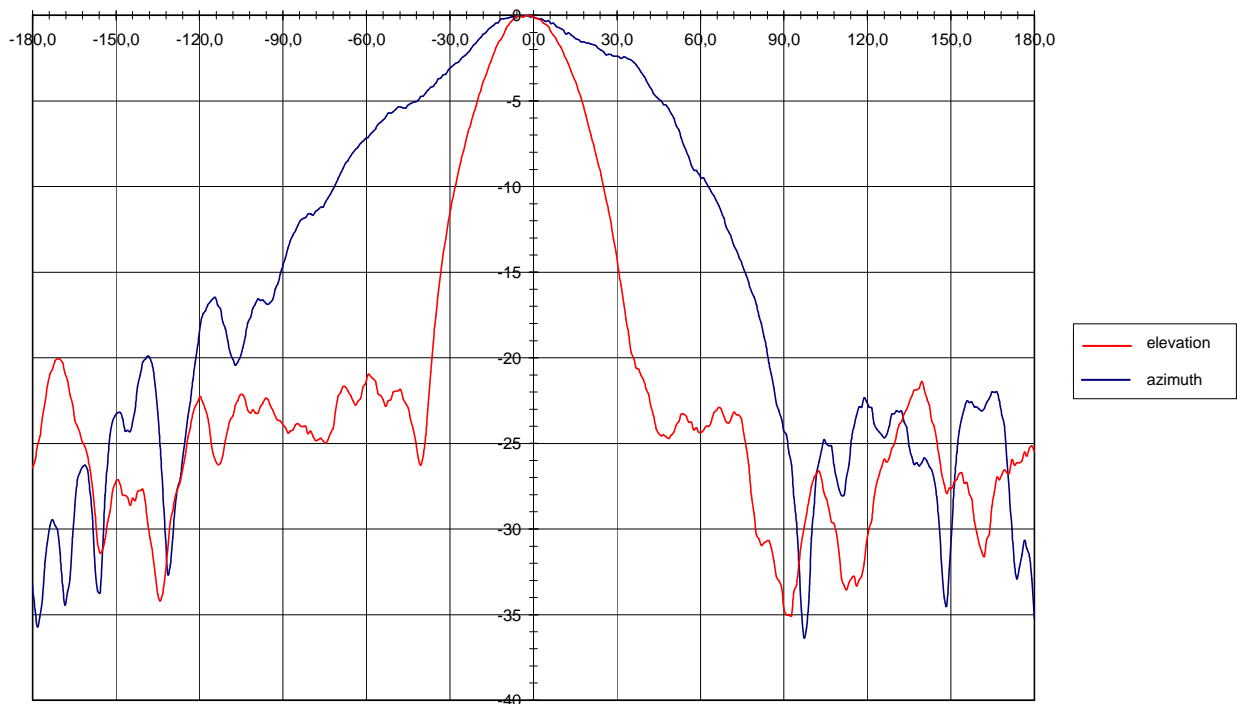
Parameter	Symbol	min	typ.	max.	units	comment
antenna pattern	horizontal		7		°	azimuth
	vertical		28		°	elevation
side lobe level	horizontal		15		dB	azimuth
	vertical		15		dB	elevation

Low-Cost K-Band Transceiver: IPM-165 / IPM-365

Polardiagramm / radiation pattern



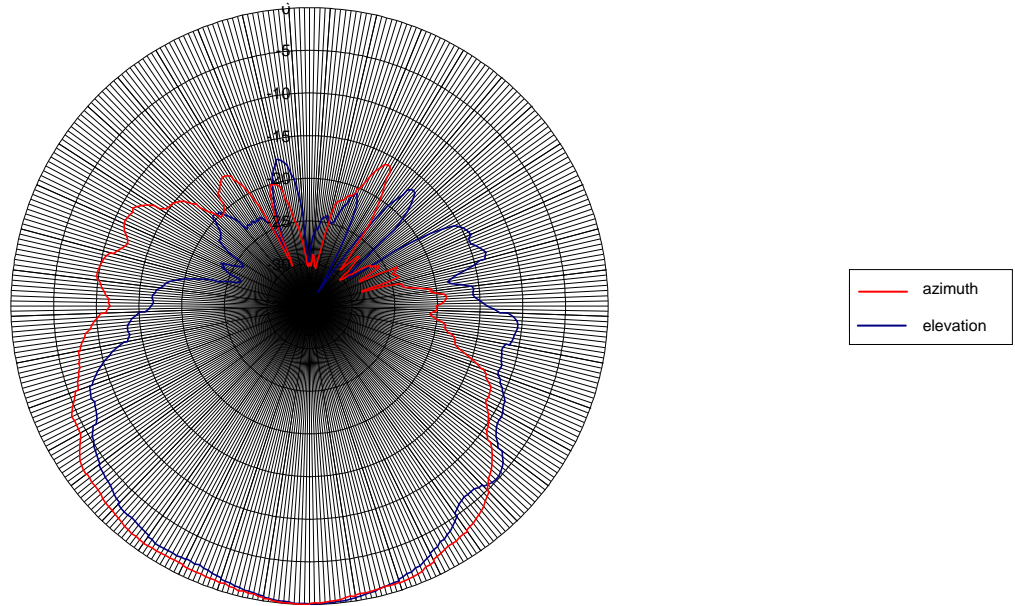
Richtdiagramm / radiation pattern



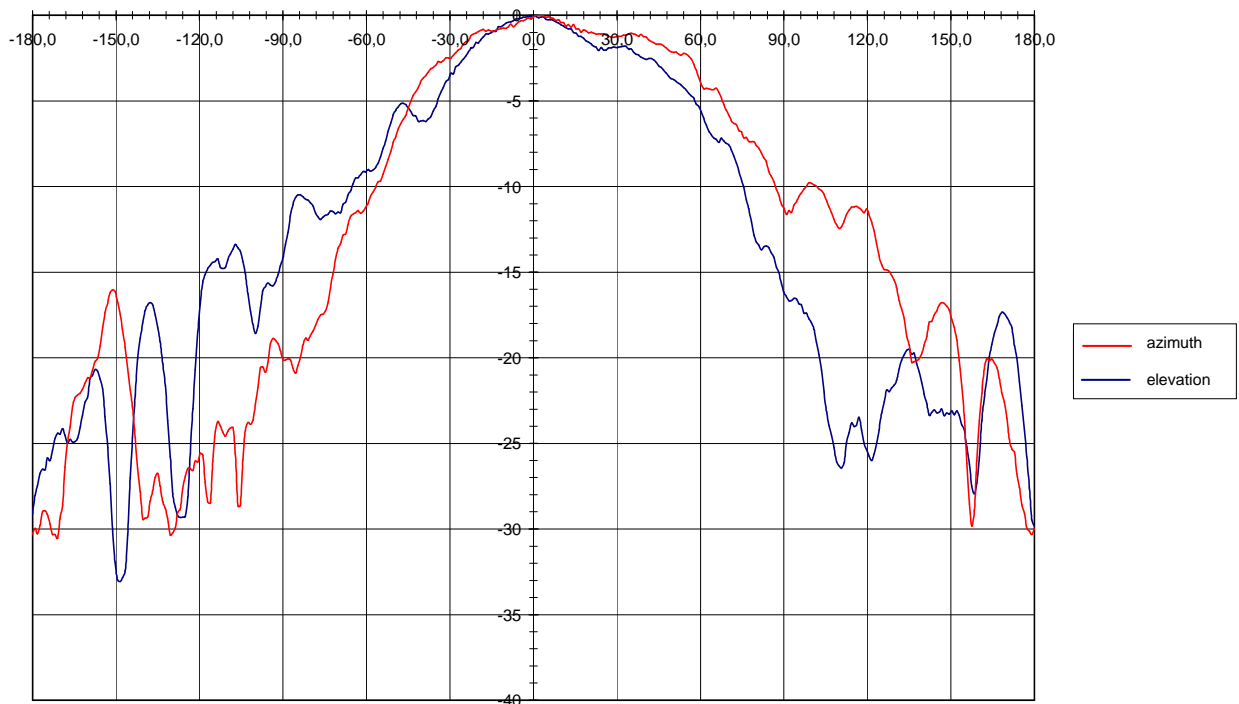
Parameter	Symbol	min	typ.	max.	units	comment
antenna pattern	horizontal		80		°	azimuth
	vertical		32		°	elevation
side lobe suppression	horizontal		13		dB	azimuth
	vertical		13		dB	elevation

Low-Cost K-Band Transceiver: IPM-170

Polardiagramm / radiation pattern



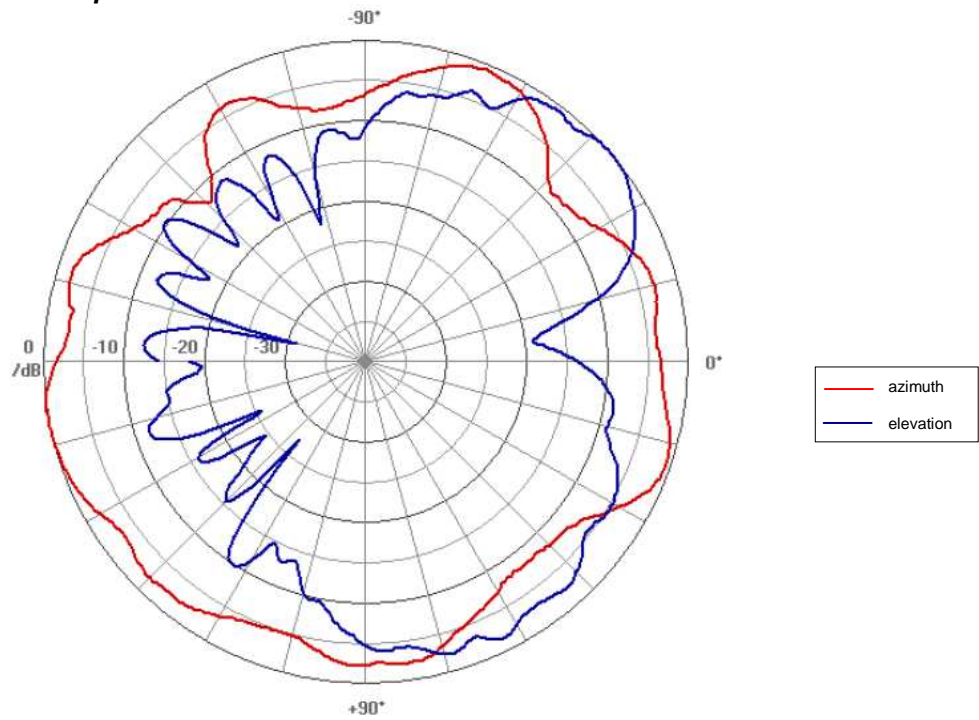
Richtdiagramm / radiation pattern



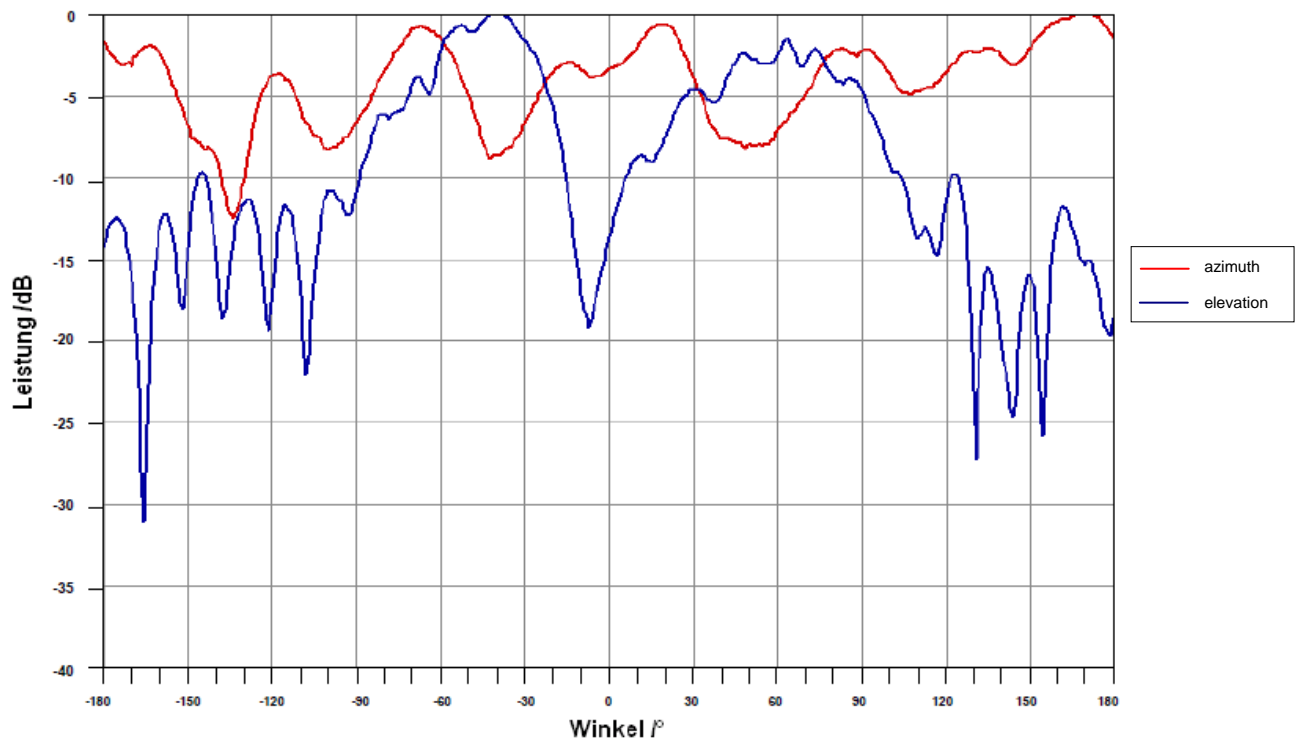
Parameter	Symbol	min	typ.	max.	units	comment
antenna pattern	horizontal		70		°	azimuth
	vertical		70		°	elevation
side lobe suppression	horizontal		13		dB	azimuth
	vertical		13		dB	elevation

Low K-Band Transceiver: IPM-190

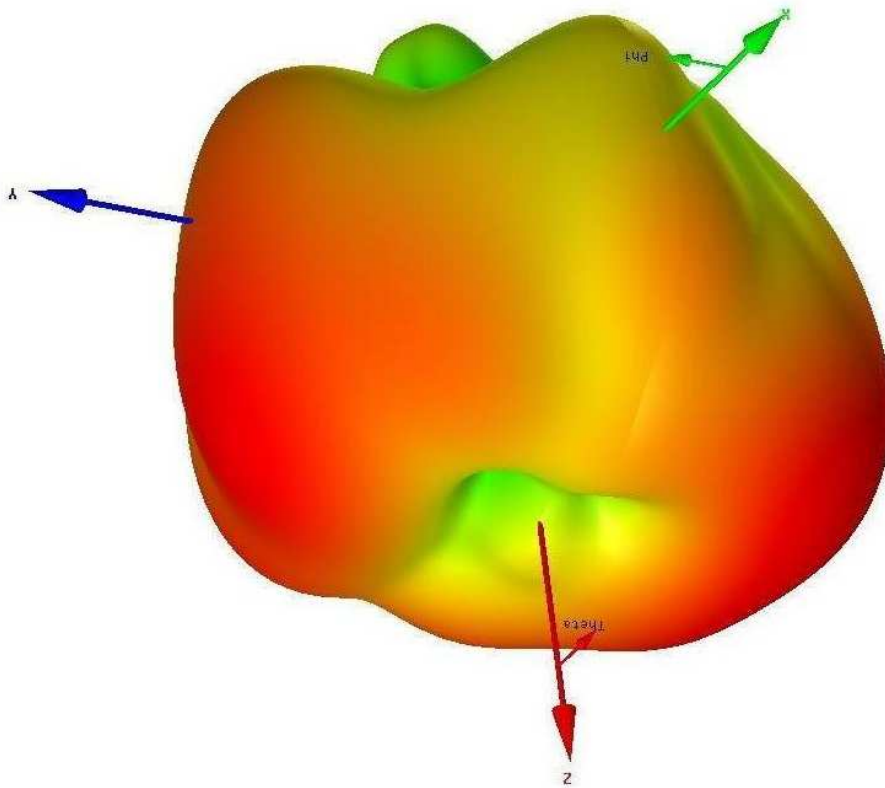
Polardiagramm / radiation pattern



Richtdiagramm / radiation pattern



3D Antennendiagramm / 3D antenna pattern



Parameter	Symbol	min	typ.	max.	units	comment
antenna pattern	horizontal	$\lambda/4$ dipole rod antenna				azimuth
	vertical					elevation
side lobe suppression	horizontal	$\lambda/4$ dipole rod antenna				azimuth
	vertical					elevation

Have you got further questions regarding our products?

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