IDR-2050 Data Sheet

Version 1.1

PRODUCT FAMILY

InnoSenT Distance Radar

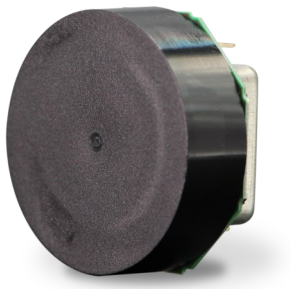
- Movement
- Velocity
- Direction
- Presence
- Distance
- Angle

APPLICATIONS

- Distance Measurement Sensor
- Level Measurement
- Collision Avoidance
- Presence Detection
- Profile Measurement
- Flow Measurement

FEATURES:

- Radar-based mmWave distance measurement sensor at 60 GHz
- Distance measurement with millimeter accuracy
- Output of point cloud and range profile via UART
- Small form factor for easy integration into customer housing
- Configurable detection range
- Narrow beamwidth (azimuth and elevation)



DESCRIPTION

The IDR-2050 is a radar sensor operating at 60 GHz. The integrated µC unit provides customers an easily integrable sensor for level measurement and other industrial applications. The sensor allows precise distance measurement to stationary and moving objects within a narrow beam. The small, flat design allows integration even into off-the-shelf housings.

With innovative DSP algorithms and advanced calibration techniques the sensor reaches millimeter accuracy.

CERTIFICATES

InnoSenT GmbH has established and implements a quality system for development, production and sales of radar sensors for industrial and automotive sensors.

See more information on our quality standards at: https://www.innosent.de/en/company/certifications/

ADDITIONAL INFORMATION

This is an InnoSenT Standard Product.
Changes will not be notified as long as there is no impact on form, fit or specified function of the product described within this data sheet.

PARAMETERS

The IDR-2050 consists of a 60 GHz Radar front end with FMCW-modulation and a DSP for measurement of distance and velocity of stationary and moving objects. The sensor outputs a target list.
Parameters were verified in accordance with DIN EN IEC 62828-4 by simulated targets in an anechoic chamber.

PARAMETER	MIN	TYPICAL[1]	MAX	UNIT
Regulatory				
Transmit Frequency Band		60		GHz
Output Power (EIRP)			20	dBm
Range				
Standard Detection Range[2,]	0.02 | 0.06		10 | 33	m | ft
Range Accuracy[3]		± 5 | ± 0.2		mm | in
Speed				
Speed Range	-14.92 | -48.95		14.92 | 48.95	m/s | ft/s
Speed Accuracy		0.25 | 0.82		m/s | ft/s
Angle				
Field of View: Azimuth[2]	7	8	9	°
Field of View: Elevation[2]	7	8	9	°
Point Cloud				
Update Rate[4]		10 | 100	20 | 50	ms | Hz
Maximum Amount of Targets[4]		1	10	
Baud Rate[4]		115.2 Kbps	1.25 Mbps	
Start Up Time[4]			350	ms

[1] typical specifications are for general understanding and may vary, if not other stated

[2] standard detection field @-3dB beam width; the detection range for specific media and object types differs please see chapters „Detection Field of View“ and „Detection of different media“

[3] please see chap. „Measurement Accuracy“ for more details

[4] please see chapters „Measuring Modes“ and „Timing Diagram“

PARAMETERS

The IDR-2050 consists of a 60 GHz Radar front end with FMCW-modulation and a DSP for measurement of distance and velocity of stationary and moving objects. The sensor outputs a target list.
Parameters were verified in accordance with DIN EN IEC 62828-4 by simulated targets in an anechoic chamber.

PARAMETER	MIN	TYPICAL[1]	MAX	UNIT
Power supply				
Operating Voltage[5]	3.15	3.3	3.45	V
Supply Current[5] AVG		73		mA
Supply Current PK[5, 6]		251		mA
Power Consumption AVG[5]		240		mW
Power Consumption PK[5, 6]		830		mW
Environment				
Temperature (Operating and Storage)	-40		+85	°C
Mechanical				
Dimension[7]: Height		21.4 | 0.8	29.8[8] | 1.2	mm | in
Dimension[7]: Diameter		46.3 | 1.8		mm | in
Weight		24 | 0.8		g | oz

[5] recommended and valid at 25°C

[6] peak current during emission 1.25ms (Tx ON)

[7] see drawings for tolerances

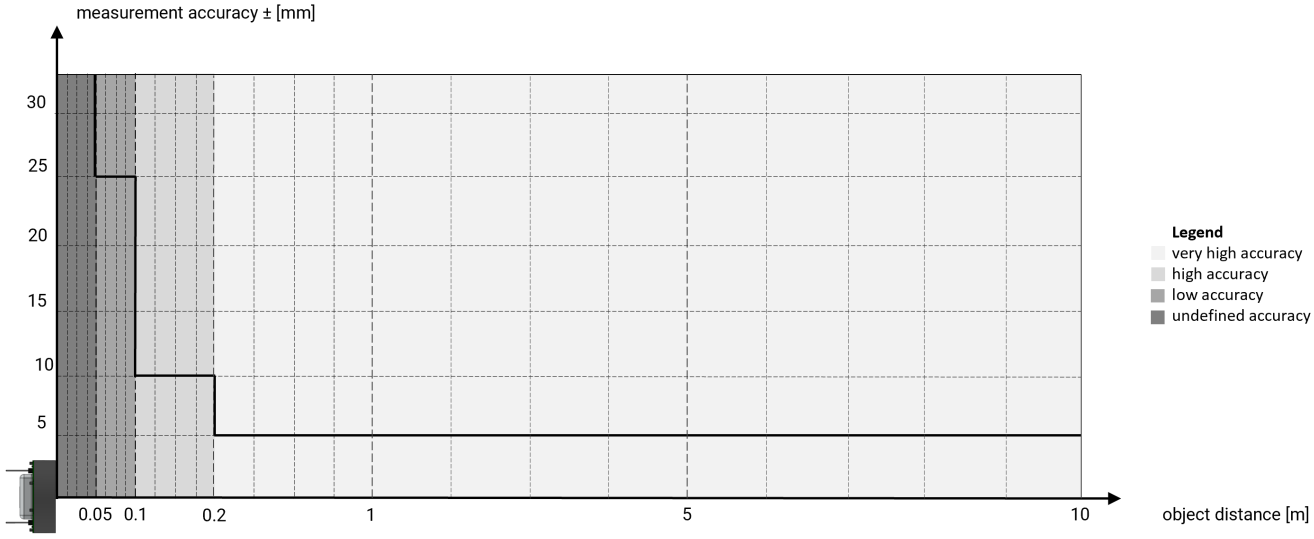
[8] with connectors

OPERATION

Measurement Accuracy

The accuracy depends on the object's distance.

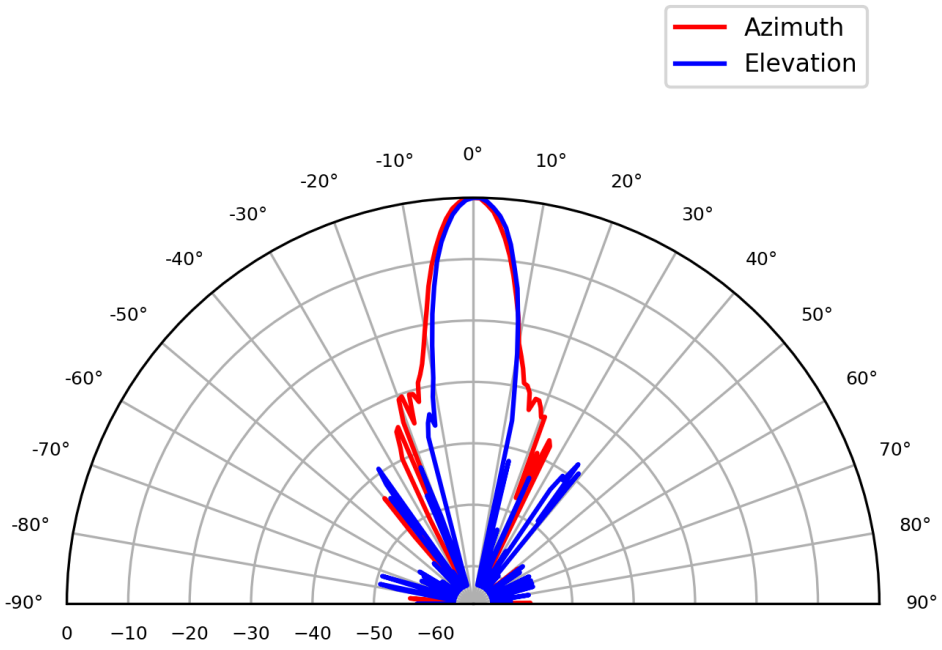
Note: Illustration not to scale.



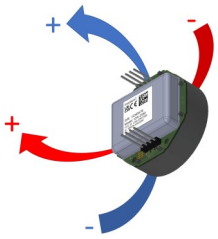
Measurement Accuracy					UNIT
Object Distance	[0...0.05[| [0...2[	[0.05...0.1[| [2...3.9[	[0.1...0.2[| [3.9...7.9[	[0.2...10] | [7.9...393.7]	m | in
Accuracy	undefined	± 25 | ± 1	± 10 | ± 0.4	± 5 | ± 0.2	mm | in

Detection Field of View

The antenna beamwidth in degrees specifies the off-boresight angle where the transmitted or received energy has dropped down to 50 percent of the maximum value (3dB-beamwidth). It does not imply that beyond this point no transmission or reception is possible. Due to this fact, the detection range of the sensor can vary depending on the RCS (radar cross section) of the detected object.



Specification of azimuth and elevation.



PARAMETER	MIN	TYPICAL	MAX	UNIT
System Pattern[2]				
Azimuth	7	8	9	°
Elevation	7	8	9	°
Side Lobe Suppression > 30 °				
Azimuth		-40	-30	dB
Elevation		-40	-30	dB
Squint Angle				
Azimuth	- 1	0	1	°
Elevation	- 1	0	1	°

Measuring Modes

Two measuring modes are available. Each one has different properties.
Standard is Measuring Mode 1.

Note: The latest setting will be restored after power up.

NR	MEASURING MODE	TARGETS	UPDATE RATE [ms]	DESCRIPTION	USE CASES
1	Single-Target-Mode (default)	max. 1	10	nearest detection; default setting	fill level, distance, vehicle detection,
2	Ten-Target-Mode	max. 10	20	nearest detections	profile measurement, flow velocity, collision avoidance

Output

The sensor output can be captured via the Serial API and Interface Control (HEX-Commands).

The sensor cyclically provides data that must be retrieved within the required time. If this does not happen, the old data will be overwritten with new data.

See [2] for detailed information.

Point Cloud

Detections are provided in the point cloud. It consists of meta information and the detections.

In ten-target mode, they are sorted in ascending order of distance.

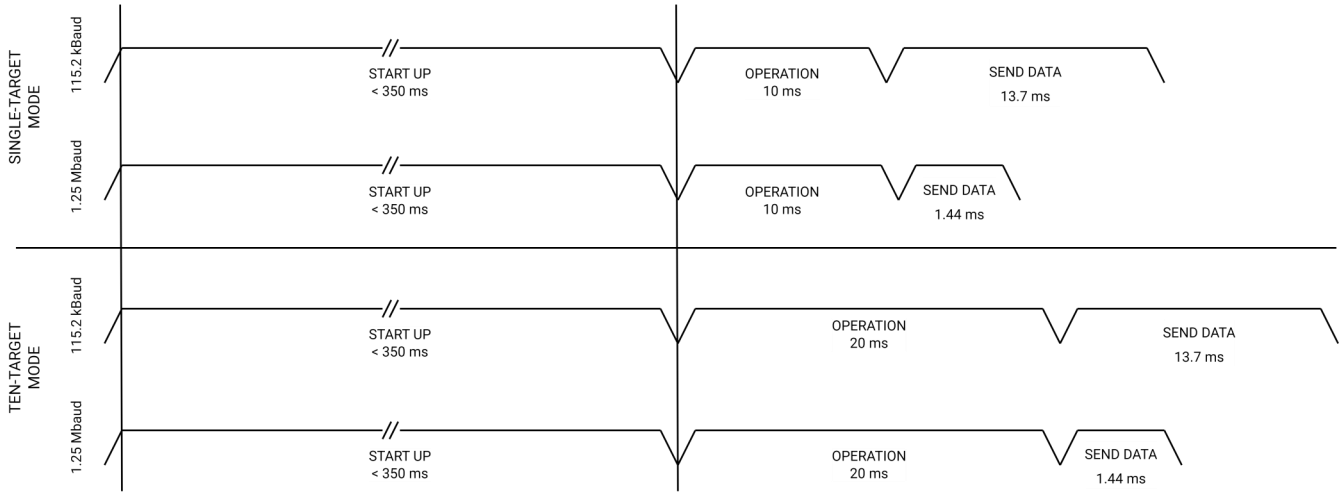
Note: Depending on the set measuring mode, the point cloud contains up to 10 targets. The number of targets also depends on the environment. An environment with fewer potential detections in the FoV also generates fewer targets in the point cloud.

Range Profile

The range profile contains the magnitudes of the range bins in ascending order.

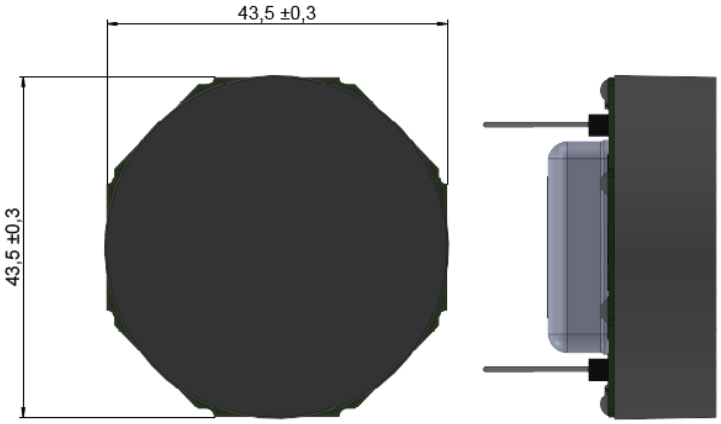
Meta information is also provided.

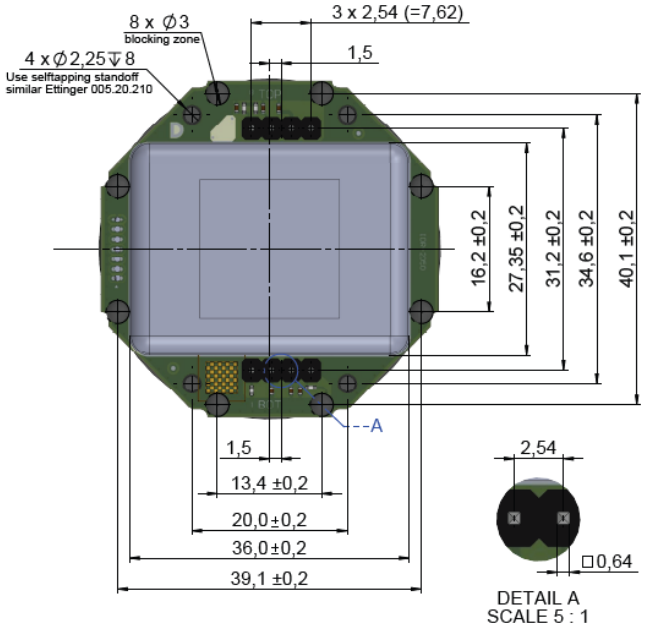
Timing Diagram

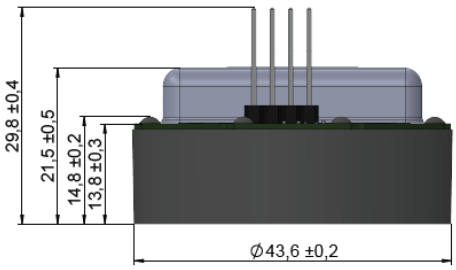


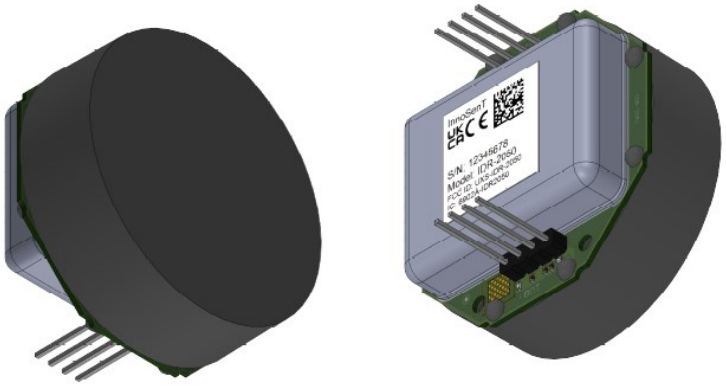
MECHANICAL DRAWING

Note: All dimensions in mm









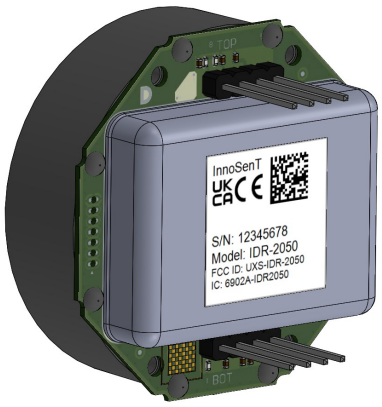
MECHANICAL FIXATION

For proper mechanical fixation, InnoSenT recommends to use spacer studs with the predrilled holes in the PCB and lens.

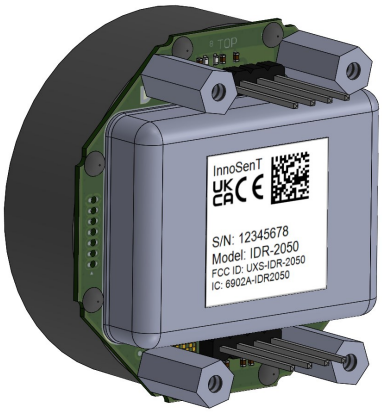
The IDR-2050 is designed to fit with spacer studs of type ST2,6/M2,5 x 11 mm.

Note: The device is delivered without spacer studs.

Without spacer studs (standard delivery)



With spacer studs (no delivery)



Installation Recommendation

To protect the sensor, it is recommended to install it in a housing that provides protection from moisture, dust, ESD, and other mechanical influences such as shock and vibration.

Note: The front of the sensor is the zero point of the measurement. The distance to the front of the radome must be taken into account when evaluating the measurement result.

If you anticipate mechanical stresses such as vibration or shock in your application, we recommend using the spacer bolts.

Advice: We are happy to assist you with integration into your housing. Contact your Key Account Manager or use our corporate contact information on the last page.

Lens condition

The lens may have air inclusions, be slightly cloudy or scratched. This is a result of the manufacturing process and is purely cosmetic in nature. This has no effect on the sensor function.

INTERFACE

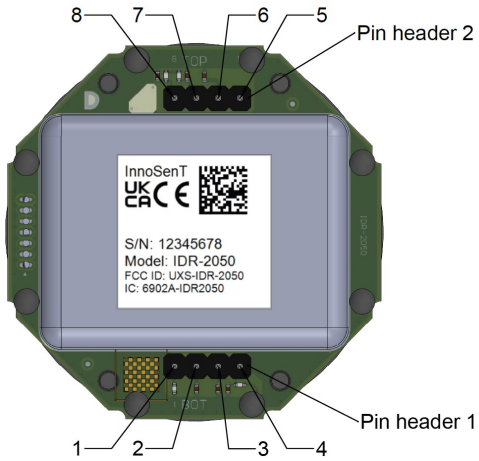
The IDR-2050 provides two 4x1, 2.54mm pitch Pin header.

Sensors pin header type: W+P 943-18,3-004-00: C=2,3
Female counterpart: W+P 153-004-1-50-00

Note: Pin header 1 is non-functional and used for manufacturing. Do not connect it.

Data Interface

Data interface is UART +3.3V TTL level with a default baud rate of 115200 kbps.

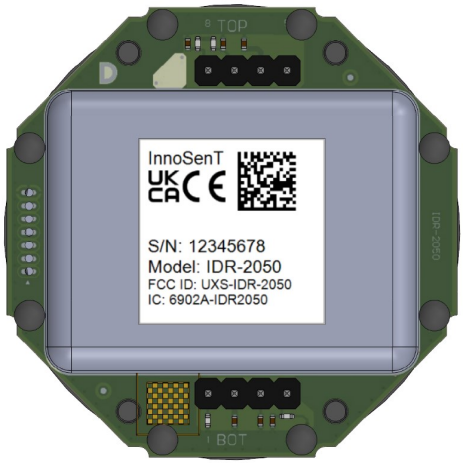


Pinout

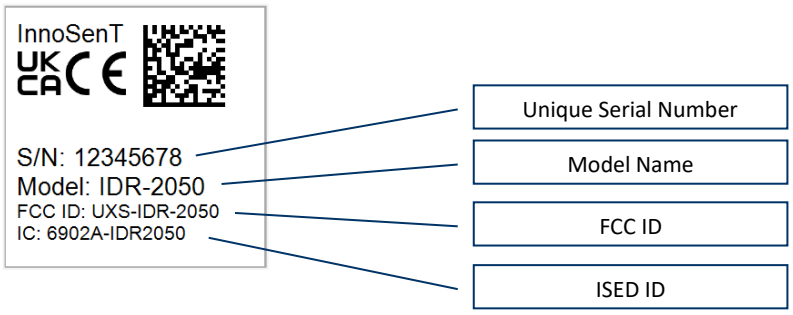
PIN #	DESCRIPTION	IN/OUT	COMMENT
1	D.N.C.	IN/OUT	Do not connect
2	D.N.C.	IN	Do not connect
3	D.N.C.	IN/OUT	Do not connect
4	D.N.C.	IN/OUT	Do not connect
5	GND		Ground
6	VIN	IN	Supply voltage 3.3 V nom.
7	UART_RX[9]	IN	UART receive, supply voltage level
8	UART_TX[9]	OUT	UART transmit, supply voltage level

[9] sensor is point of view for transmission direction

LABEL LOCATION



LABEL DESCRIPTION



DISPOSAL

The device is to be disposed of according to the European Community Directive 2012/19/EU on waste electrical and electronic equipment.
Devices must not be disposed of with consumer waste.
For environmentally compatible recycling and disposal of the device, please contact a certified waste management company or send the device back to InnoSenT GmbH.

FREQUENCY INFORMATION

The information that will be given below is only a broad overview; for details please contact the regional approval agency. An overview over the frequency bands in Europe can also be found in the REC 70-03 which is available under www.cept.org.

In general, the IDR-2050 can be used in EU, USA, Canada and UK, as well as other regions which apply to those regulations.

COMPLIANCES

Declarations of conformity, certificates and test reports can be provided upon request.

STANDARD	COMMENT
Conformity / Certificates	
CE	Declaration of Conformity
UKCA	Declaration of Conformity
FCC 47 Part 15, Subpart C §15.255	Tested by external TCB and applies to relevant regulatory limitations.
ISED RSS-210 Issue 10	Tested by external TCB and applies to relevant regulatory limitations.
RF / Electrical / Mechanical / Other	
EN 305 550 V1.2.1	
EN 301 489-1 V2.2.3	
EN 301 489-3 V2.3.2	
DIN EN 62311	
DIN EN 62368-1	

FCC & ISED COMPLIANCE

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s) and complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage.
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

FCC §15.21

Changes or modifications made to this equipment not expressly approved by InnoSenT GmbH may void the FCC authorization to operate this equipment.

FCC §15.105

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

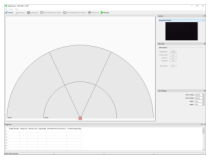
RF Exposure

This equipment complies with FCC and ISED radiation exposure limits set forth for an uncontrolled environment.
This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.
Ce transmetteur ne doit pas etre place au meme endroit ou utilise simultanement avec un autre transmetteur ou antenne.

EVALUATION KIT

Order number: 80.00000591

ACCESSORY	ORDER NUMBER	PICTURE	DESCRIPTION
IDR-2050	80.00000539		IDR-2050 Distance Radar
SparkFun Beefy3	36.00000054		to convert from UART to USB
Jumper Cables	70.00000854		connect Beefy3 to sensor
Software Package	download at InnoSenT download portal		Software Package: - IDR RadarScan - Interface Control - Firmware Update - Documentation

ESD-INFORMATION

This InnoSenT sensor is sensitive to damage from ESD. Normal precautions as usually applied to CMOS devices are sufficient when handling the device. Touching the signal output pins has to be avoided at any time before soldering or plugging the device into a motherboard.

CO-APPLICABLE DOCUMENTS

REFERENCE	DOCUMENT
[1]	IDR-2050 User Manual
[2]	IDR-2050 Interface Control
[3]	IDR-2050 Quick Start Guide

APPROVAL

This data sheet contains the technical specifications of the described product. Changes of the specification must be in written form. All previous versions of this data sheet are no longer valid.

VERSION	DATE	COMMENT
1.0	10.02.2025	Initial Release
1.1	18.02.2025	Update specifications for power supply and sidelobe suppression

InnoSenT GmbH
Am Rödertor 30
97499 Donnersdorf
GERMANY
Tel.: +49 9528 9518 0
E-Mail: info@innosent.de
URL: www.innosent.de