

# miRadatm

## MIMO Radar Platform

English Edition



Healthcare



Autonomous Machines



Security



Safety

\* "miRadatm" was registered Trademark at 8 countries.

## About Sakura Tech

- |                |                                    |
|----------------|------------------------------------|
| ▶ Establish    | Oct. 7 <sup>th</sup> , 2008        |
| ▶ Head Quarter | Shin-Yokohama, Kohoku-ku, Yokohama |
| ▶ Capital      | 10 Myen                            |
| ▶ Employee     | 10                                 |
| ▶ CEO          | Fuminori Sakai, Ph.D               |

## Development and Sales of Millimeter-wave / Microwave imaging sensors using MIMO technology

## CEO Message

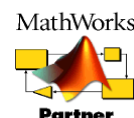
Since its founding in October 2008, Sakura Tech has been developing imaging sensors and high-performance microwave / millimeter wave components using ultra wideband technology. In particular, we have developed a compact, high-performance radar platform (miRadar®8) that uses Multiple-Input Multiple-Output (MIMO) technology and commercialized it as an obstacle monitoring radar. Using the same radar platform, we have developed an algorithm that can measure the vital signs (heartbeat, respiration) of multiple people at the same time, and we are the first in the world to sell an evaluation kit, which has been evaluated by many manufacturers. Radio wave sensors are becoming indispensable in the fields of autonomous driving in the IoT society, the security field aiming for a safe and secure society, and the field of watching over the elderly. Sakura Tech will continue to contribute to society by providing human-friendly, high-performance sensors that use radio waves.



**Fuminori Sakai / CEO & Founder**



**Head Quarter: Yokohama, Kanagawa, Japan**



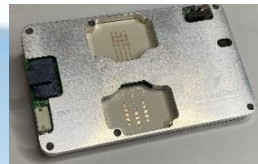
# miRadar® Family Roadmap

2021

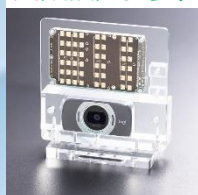
miRadar®8 «Handy»



miRadar®12e «Card»



miRadar®8-EV2



miRadar®8 «IoT»



miRadar®8 «Card»



miRadar®48e-EV



2020

miRadar®128 «3D»



2019

miRadar®8 «VSM»



2018

miRadar®8 «IMU»



2017

miRadar®8 «gradar»



Sensor

Signal processor

Display

miRadar®8 «Panorana»



2016

miRadar®8



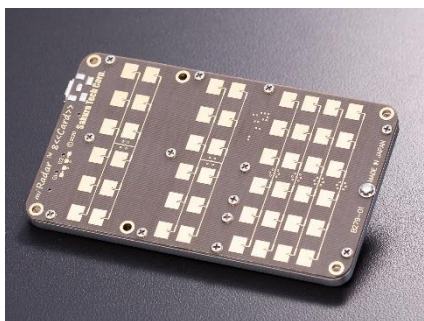
miRadar®8-EV2



## Card-size 24GHz FMCW MIMO Radar Platform

### Overview

- 24GHz FMCW MIMO Radar sensor
- Tx 2ch, Rx 4ch / 8ch virtual array
- Business Card size, right-weight Module
- Support both distance and Vital Sign data
- microUSB interface



### Features

- Contactless sensing even when Blankets and Clothing exit, and no-affect Brightness
- Simultaneous and Multiple target detection

### Specifications

- Frequency; 24GHz
- Certification: ARIB-T73 (Japan)
- Tx Power: -4/2/8 dBm (selectable)
- # of Antenna: Tx 2, Rx 4 MIMO
- FoV : Elevation  $\pm 8^\circ$  / Azimuth  $\pm 45^\circ$
- Resolution: Distance 0.8m / Azimuth  $13^\circ$
- Size (mm): 92 x 55 x 5
- Signal processing: External PC
- Power: DC+5V, <0.9A (USB Bus Power)
- Operating Temp. -20 to +60°C

### Applications

- Care Services  
Simultaneous multiple people monitoring of Vital Sign Monitoring, Heart and Respiration rates even Blankets and Clothing exist
- Security
  - Intrusion detection
  - Avoidance detection
  - Human detection over a wall (note) in visible and in dark-night.
- Construction field
  - People detection of prohibits area
- Parking / Multi storey Car Park
  - Intrusion detection
  - Child Presence Detection
- Backward Monitoring  
Prevention of a collision with a vehicle approaching from behind, or blind spot.





## System configuration (example)

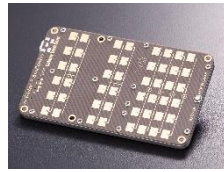
Open data platform for advanced analytics and machine learning



Sensor to Cloud



Multiple targets

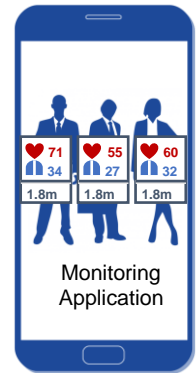


miRadar® 8 <Card>

USB



Radar and VSM algorithm

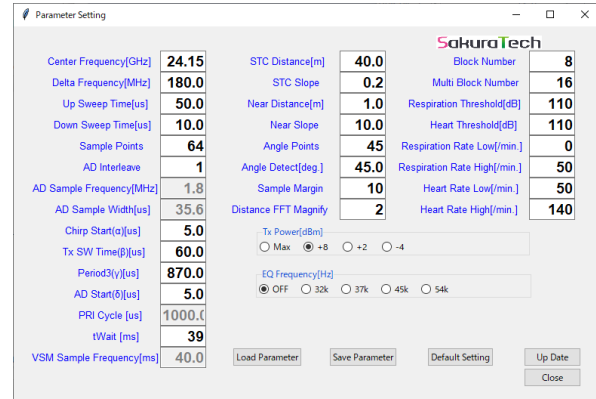
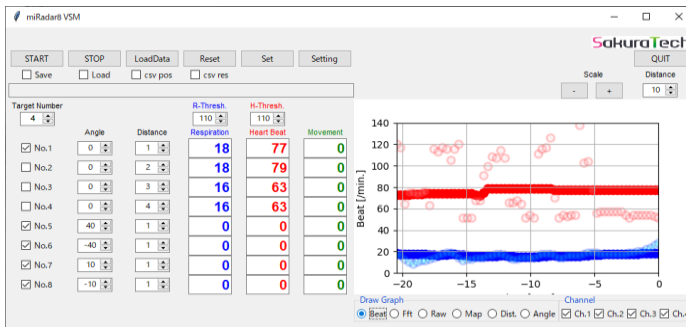


Monitoring Application

- USB data communication and USB Bus-Power
- Application software running on the PC

## Software Development Kit for VSM Application (example)

- Python open source-code available for user development
- Instruction manual



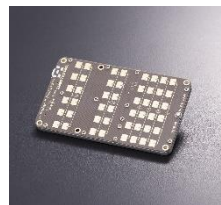
## Ordering Guide

Product Name	Product Number	Comments
miRadar®8 <Card>	B279-01	Card size, 24GHz FMCW MIMO Radar Platform
miRadar®8-EV2 <Card>	B279-01-EV2	Radar Evaluation hardware bundled B279-SW001 and B279-SW002
miRadar®8-VSM <Card>	B279-01-VSM	VSM Evaluation hardware bundled B279-SW007
Radar Evaluation software	B279-SW001	Radar Evaluation software (starter version) – bundled EV2 evaluation kit.
Radar Evaluation software	B279-SW002	Radar Evaluation software (standard version) – bundled EV2 evaluation kit.
VSM Evaluation software	B279-SW007	VSM Evaluation software – bundled VSM evaluation kit
VSM SDK (Matlab)	B279-SW009	SDK for VSM. Opened some source code for MATLAB / Windows
VSM SDK (Python)	B279-SW011	SDK for VSM. Python code for user development

## Radar Evaluation platform for CARD

### Overview

- Used miRadar<sup>®</sup> 8 <Card> Radar Sensor
  - Business Card size
  - 24GHz FMCW MIMO radar
  - Tx 2ch, Rx 4ch Virtual 8ch
- Radar processing software runs on Windows PC
- Multiple targets are overlayed with Camera picture
- Possible save data with moving picture and replay



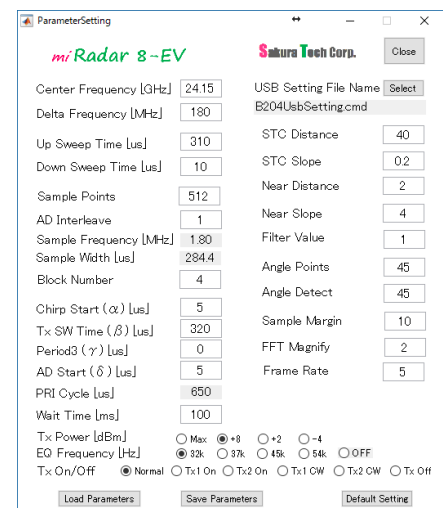
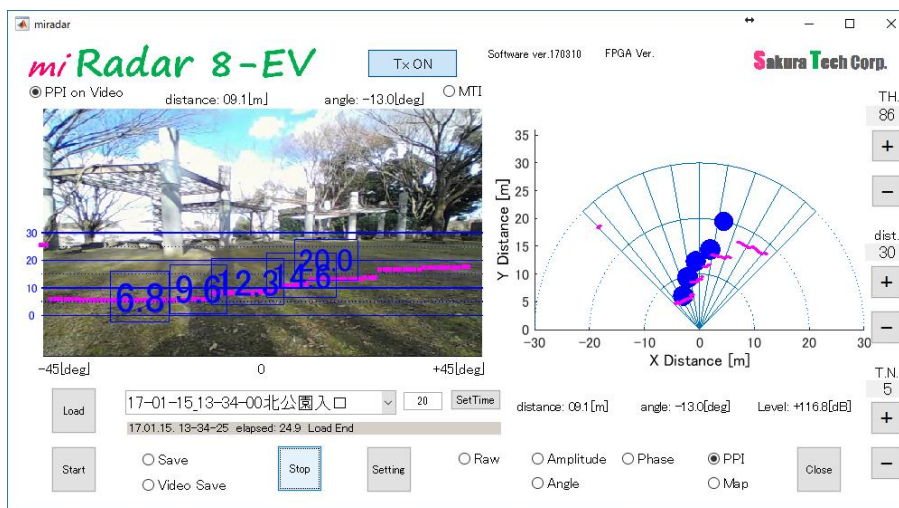
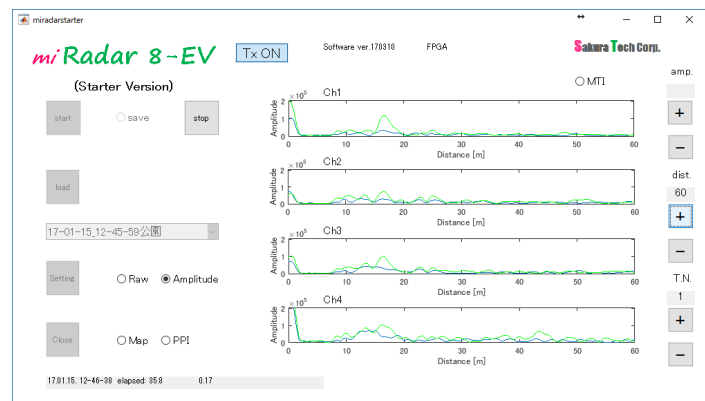
miRadar 8 <Card>



miRadar 8-EV2 <Card>

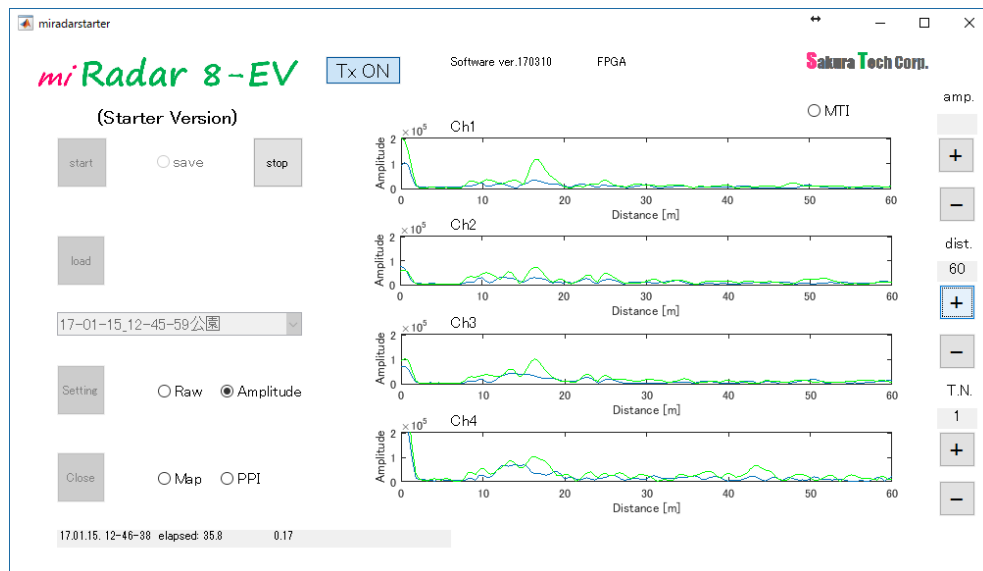
### Radar Evaluation Software

- Consideration of Radar operation and analysis
- Save and Load of measurement data with video enable offline analysis
- MATLAB execution file
- Real-Time graphical display
- Many variety of radar parameters can be changed
- Starter version is available for simple confirmation of radar operation



## Evaluation Software (Starter Version)

- No camera imaging and simplified version



## Ordering Guide

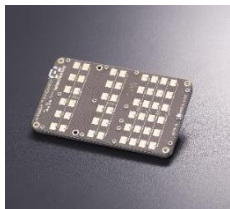
Product Name	Product Number	Comments
miRadar®8-EV2 <Card>	B279-01-EV2	Radar Evaluation hardware bundled B279-SW001 and B279-SW002
Radar Evaluation software	B279-SW001	Radar Evaluation software (starter version)
Radar Evaluation software	B279-SW002	Radar Evaluation software (standard version)

# miRadar<sup>®</sup> 8-VSM «Card»

## Vital Sign Monitor (VSM) Evaluation platform for Card

### OVERVIEW

- Used miRadar<sup>®</sup> 8-EV2 <Card> Radar sensor
  - Business card size
  - 24GHz FMCW MIMO radar
  - VSM signal processing on PC
- Simultaneous measurement of multiple people Heart and Respiration rates
- Vital data is overlaid on camera picture, useful target position.
- Algorithm development platform is available for user development and used application development and flexible user settings.



miRadar 8 <Card>    miRadar 8-VSM <Card>

### VSM Evaluation Software B279-SW007

Both Vital and Camera video data can be stored in the connected PC. The stored data can be replayed and reused to set several thresholds to see the best setting at offline condition.



### ALGORITHM DEVELOPMENT PLATFORM

- SDK: Python code for user Algorithm development, B279-SW011
- SDK: Opened some MATLAB source code of Eval. Software, B279-SW009

### VSM Functions

- Contactless sensing even when Blankets and clothing exist
- Measurable vital data of multiple people with Azimuth / Elevation positions at same time
- 24/7 monitoring

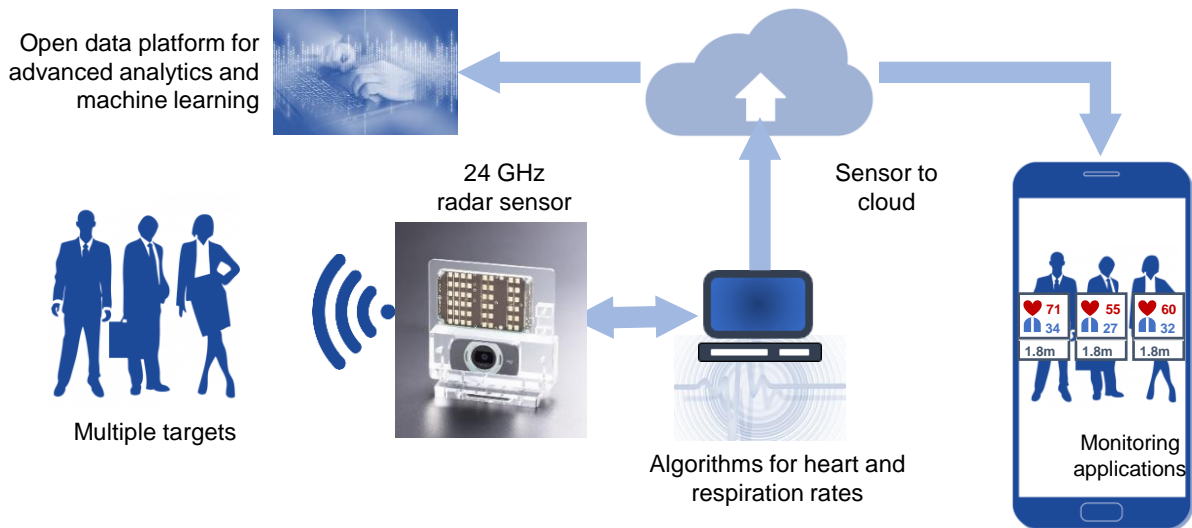
### APPLICATIONS

- Development of an advanced analysis tool using the algorithm development platform.
- Consideration and examination to find best setup for Heart and Respiration rates data collection.





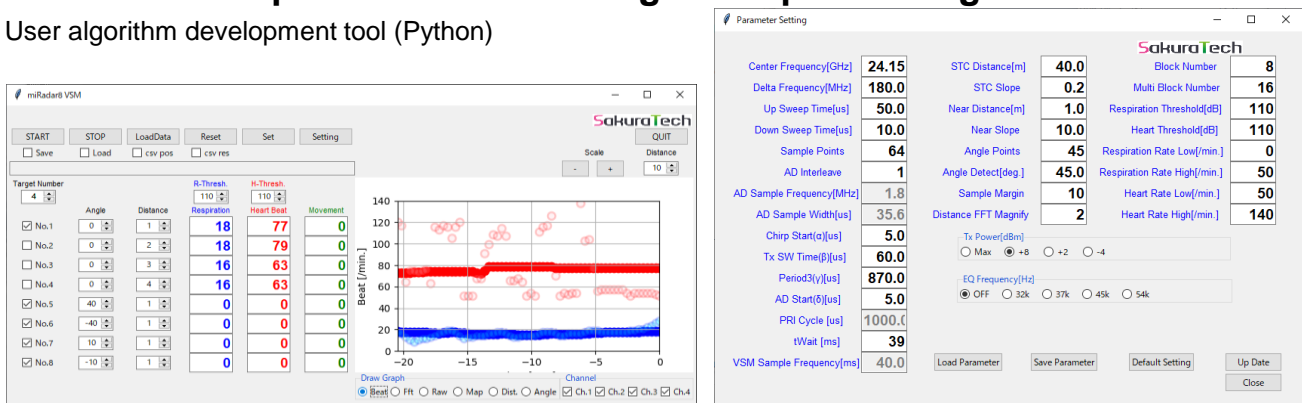
## VSM monitoring system (example)



- Direct connection and control between cloud and the eval. hardware.
- Data logging for either local sensor data (CSV format) or IoT cloud storage
- Sensor data with time stamp and device ID data
- Customizable algorithms

## Software Development Kit for Vital Sign data processing B279-SW011

- User algorithm development tool (Python)

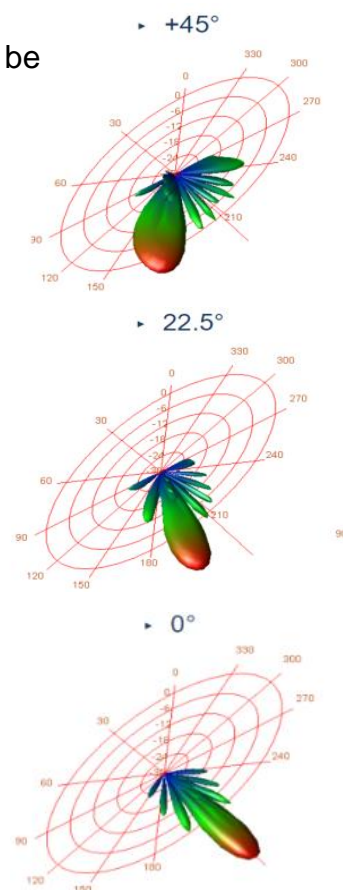
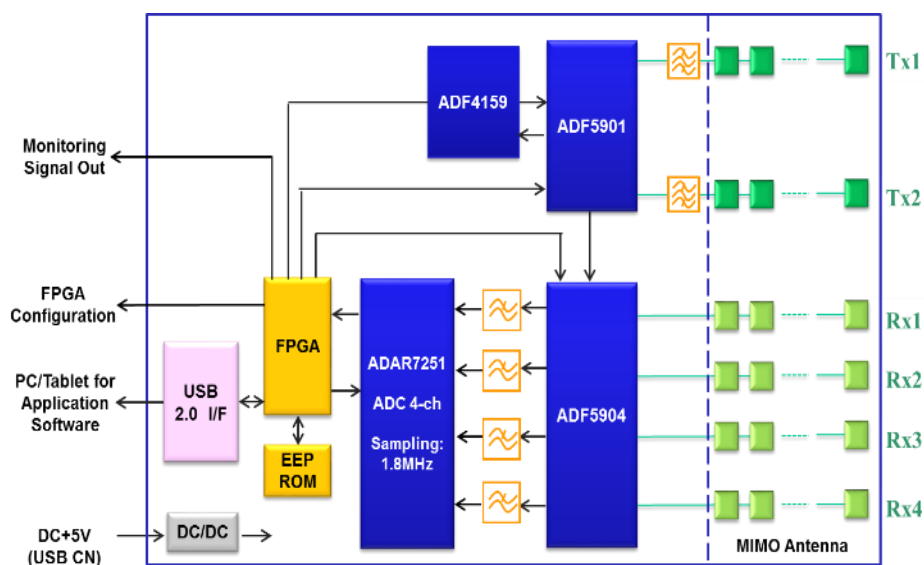


## Ordering Number

Product Name	Product Number	Comments
miRadar®8-VSM <Card>	B279-01-VSM	VSM Evaluation hardware bundled B279-SW007
VSM Evaluation software	B279-SW007	VSM Evaluation software
VSM SDK (Matlab)	B279-SW009	SDK for VSM. Opened some source code for MATLAB / Windows
VSM SDK (Python)	B279-SW011	SDK for VSM. Python code for user development
VSM RRI analyzer	B279-SW014	RR Interval Analyzer SDK

# High Performance 24GHz FMCW MIMO Radar Platform

**miRadar® 8** module is highly integrated with a high-performance radar chip set, low electric power consumption FPGA, etc., and can be connected to signal processing devices such as a PC via USB interface.

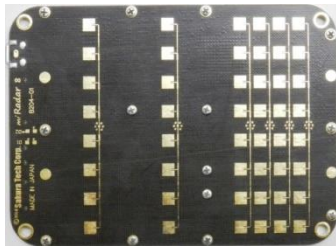


**miRadar® 8** module consists of two elements of transmitting Tx antenna and four elements of Rx receiving antenna. The azimuth detection accuracy equivalent to eight elements can be obtained by MIMO radar signal processing, including the beamforming method, as shown in antenna simulation patterns in the figure below. MIMO radar signal processing software by Matlab is available and can be used as a reference

### H-plane module (standard)

**miRadar®8 (B204-01)**

Accessory: Document  
USB cable

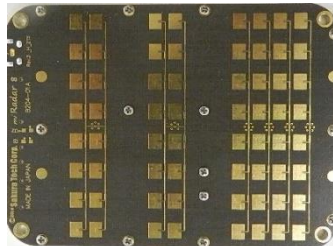


Tx 2ch Rx 4ch

### H-plane module (custom)

**miRadar®8 (B204-06C01)**

Accessory: Document  
USB cable



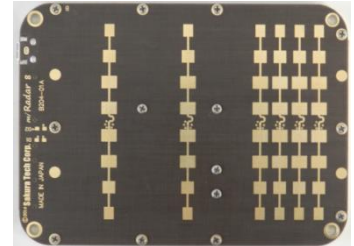
Tx 2ch Rx 4ch

A customized module with improved directivity of the Tx antenna of the standard module

### V-plane module (custom)

**miRadar®8 (B204-03C01)**

Accessory: Document  
USB cable



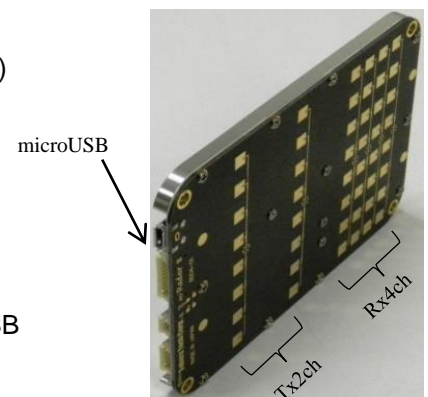
Tx 2ch Rx 4ch

A customized V polarization module with the polarization face rotated by 90° in the standard module

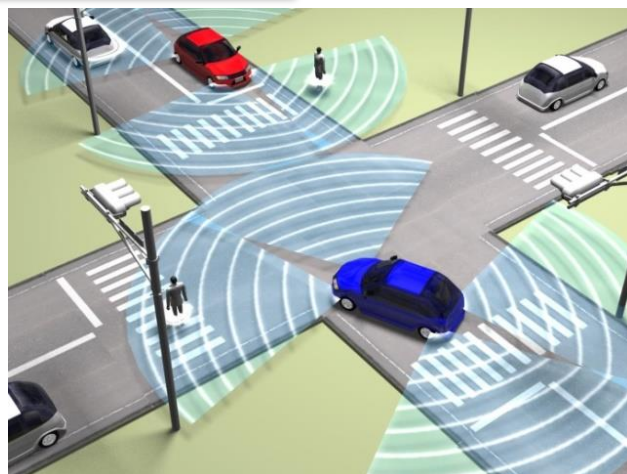
For those who purchase only modules and make their own software using the optional interface library, or those who purchase additional modules only.

#### Specifications:

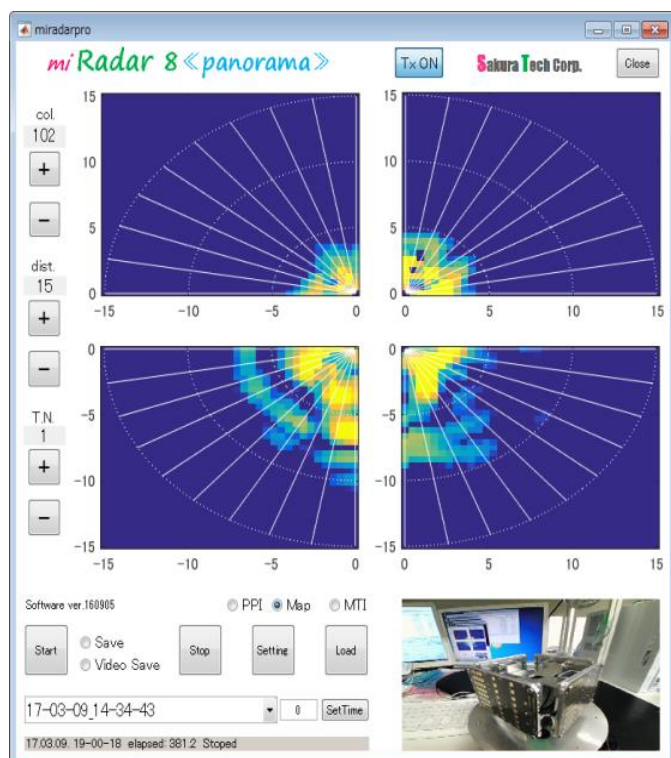
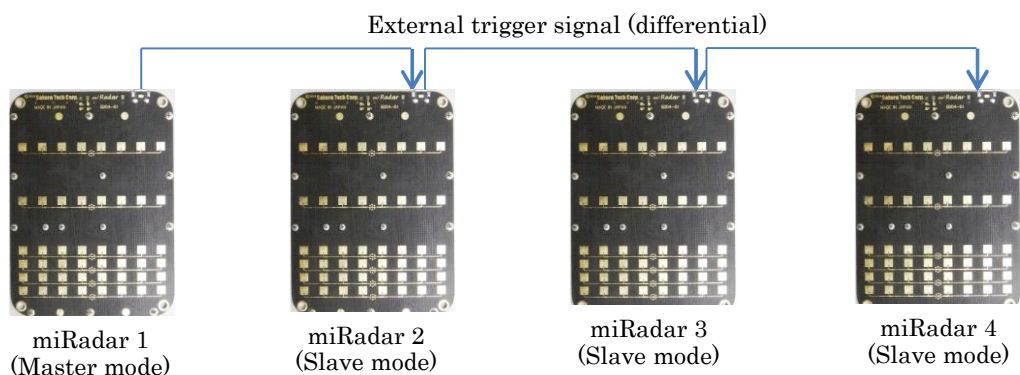
- Radar methodology: MIMO FMCW 24 GHz (ARIB-STD-T73)
- Antenna: 2 Tx, 4 Rx
- Azimuth detection range:  $\pm 45^\circ$
- Scan speed: 0.1 s (max)
- Range of detection: 60 m (min) within Car detection case
- Output power: -4/2/8 dBm (3 levels)
- Module size: 104 mm (W) × 76 mm (H) × 6 mm (D)
- Interface: USB2.0, Micro B connector
- Power supply: +5 VDC, 1.5 A (max), powered via USB
- Operating temp. range: -20°C to 60°C



Although four miRadar8 modules can detect targets in an entire circumference (360°), simultaneously operating multiple radars at close range will generally produce radio wave interference. To prevent this, coordinating operation can be controlled to output transmissions of multiple miRadar8 with their timing shifted so they do not overlap.



Connecting external trigger I/O signals enables multiple miRadars to operate in synchronization. miRadar1 is set to master mode because it does not have an external trigger signal input. miRadar2, 3, and 4 are set to slave mode, which operates in synchronization by an external trigger signal input. Please contact us to order a trigger signal cable.



Evaluation software (Professional Version) is a Matlab execution file that controls coordinating operation for a maximum of four miRadar8 and displays processing results.

A chart for the following data can be displayed:  
 (1) Color mapping data after azimuth detection processing  
 (2) PPI data symbolized from azimuth detection results.

As with the Standard Version, a mechanism is provided to output processing results in files to interface them with other software. This enables software to be created for conducting post-processing of radar detection results.

Note 1) When miRadar module is connected via a USB hub, self-power feeding of 3A or more is required per four ports.

Note 2) With an increased number of modules, a PC with a higher processing capacity of Core-i7, etc., and a larger number of cores is required.

### C++ USB Interface SDK [Windows] (B204-OP001-01)

Visual Studio 2015 C++ edition

The instruction manual for C++ SDK is included in the USB interface library of the module. If a unique signal processing software is created, SDK is required to use the USB interface for module.

This supports Windows Visual Studio 2015. SDK is Static Library. SDK with source code for Library section is available. Please use it if necessary.

### C++ USB interface SDK [Linux] (B204-OP001-02)

Linux(ubuntu x86/64) g++ edition

Linux edition for the above C++ SDK. This supports x86/x64 Ubuntu. Only Linux edition with source code is available.

### Matlab SDK software (Professional Version) (B204-SW005)

This allows a system software prototype to be developed with signal processing results of multiple radars.

This SDK is a release for which Matlab p-code and m-code are mixed in the above Professional edition. The signal processing core section, etc. are in p-code and the interface section, etc. are in m-code. Adding the system software code allows prototypes to be developed in a short time.

### Matlab SDK software (Pro1 Version) (B204-SW006)

Software limited to one radar processing for Professional Version of software supporting multiple radars. This allows system software prototypes to be developed with radar signal processing results of evaluation software.

This is a release for which Matlab p-code and m-code are mixed. The signal processing core section, etc. are in p-code and the interface section, etc. are in m-code. Adding the system software code allows prototypes to be developed in a short time.

Note) The above Matlab SDK software requires Image Acquisition Toolbox and Image Processing Toolbox. Matlab functions have been checked for R2015b (32-bit) and R2016a (64-bit) versions.

## ■ Ordering Guide

Model	Description	Comments
B204-01	miRadar8 H-plane module (Standard)	
B204-06C01	miRadar8 H-plane module (Custom, Tx 2ch)	
B204-03C01	miRadar8 V-plane module (Custom)	
B204-04C01	No Antenna	
B204-07C01	miRadar8 V-plane module (Custom,, Tx 2ch)	
B204-SW004	Evaluation software (Professional Version)	
B204-SW005	MATLAB SDK software (Professional Version)	
B204-SW006	MATLAB SDK software (Pro1 Version)	
B204-OP001-01	C++ USB interface SDK [Windows]	
B204-OP001-02	C++ USB interface SDK [Linux]	
B204-OP101	Sync. Trigger standard cable (50cm x 3)	
B204-OP102	Sync. Trigger cable for Waterproof case (5m x 1)	
B204-01-WP01	miRadare8 module in waterproof case	



## Radar Evaluation Kit

### Overview

- miRadar<sup>®</sup>8-EV2 Evaluation kit is packaged both miRadar<sup>®</sup>8 module and evaluation software, and user can start evaluation quickly and easily at the field.

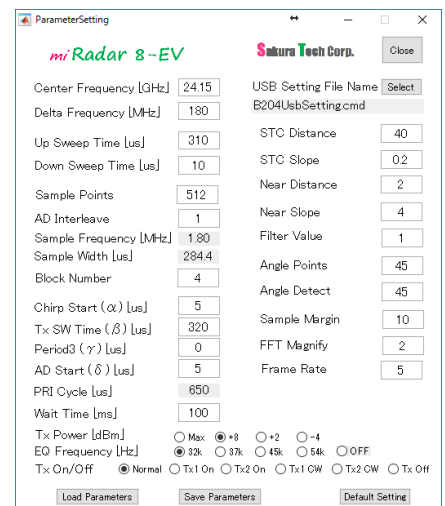
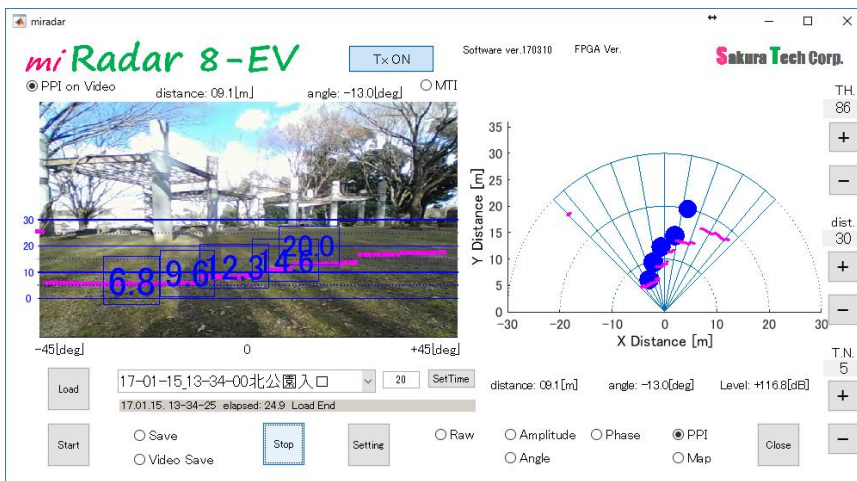


- For those who want to verify Radar operation in detail or who are new to radar. Installation standard version software from bundled CD into your Windows PC. It can save and replay with both Camera image data and radar detection signal at the same time.
- Using PC with fast processing speed makes possible to shorter detection cycle.

Accessory: Document and USB cable

### Evaluation software B204-SW002 (Standard Version)

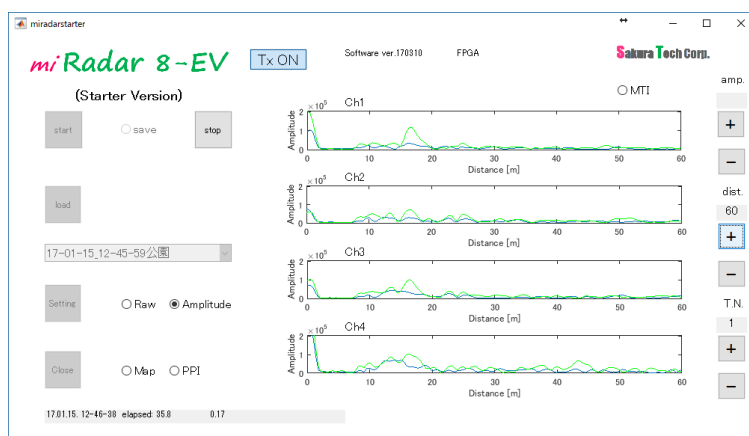
- Evaluation software is attached to the evaluation kit (Standard Version). This is a Matlab execution file, which allows various types of processing results to be plotted on a chart and to be overlaid on camera images on a real-time basis. It also allows images and radar raw data signals to be simultaneously saved, loaded, and reprocessed



- Software menu includes a setting screen for changing parameter settings for various types of radar functions. For chipsets used in the module, more detailed parameters can be set by the registry setting. The registry setting is in a text file that can be edited freely.
- A mechanism is provided to output processing results in files to interface them with other software. This enables software to be created for conducting post-processing of radar detection results.

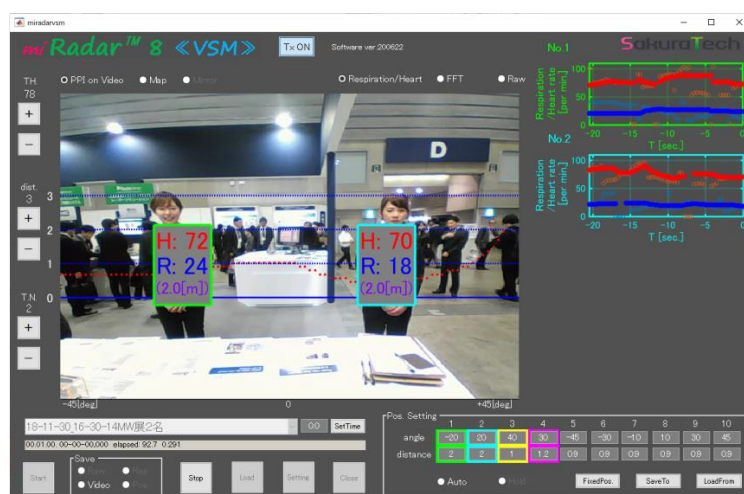
## ■ Evaluation Software B204-SW001 (Starter Version)

Basic functions of Radar operation can be checked after installing simplified software (Starter Version) on your Windows PC.  
 Camera images overlay is not supported.



## ■ VSM Evaluation software B204-SW007

Both Vital and Camera video data can be stored in the connected PC.  
 The stored data can be replayed and reused to set several thresholds to see the best setting at offline condition.



## ■ Ordering Number

Model	Contents	Comments
B204-01-EV2	Radar Evaluation hardware, bundled B204-SW001/002	
B204-01-VSM	VSM Evaluation hardware, bundled B204-SW007	
B204-SW001	Evaluation software (Starter version)	Bundled w/eval kit
B204-SW002	Evaluation software (Standard version)	Bundled w/eval kit
B204-SW004	Evaluation software (Professional Version)	
B204-SW005	MATLAB SDK software (Professional Version)	
B204-SW006	MATLAB SDK software (Pro1 Version)	
B204-OP001-01	C++USB interface SDK (Windows)	
B204-OP001-02	C++USB interface SDK (Linux)	
B204-SW007	VSM Evaluation software	Bundled w/eval kit
B204-SW009	VSM SDK (MATLAB toolbox)	Windows

# miRadar®128 «3D»

## 24GHz MIMO 3D Radar Platform

Preliminary

### ■ Overview

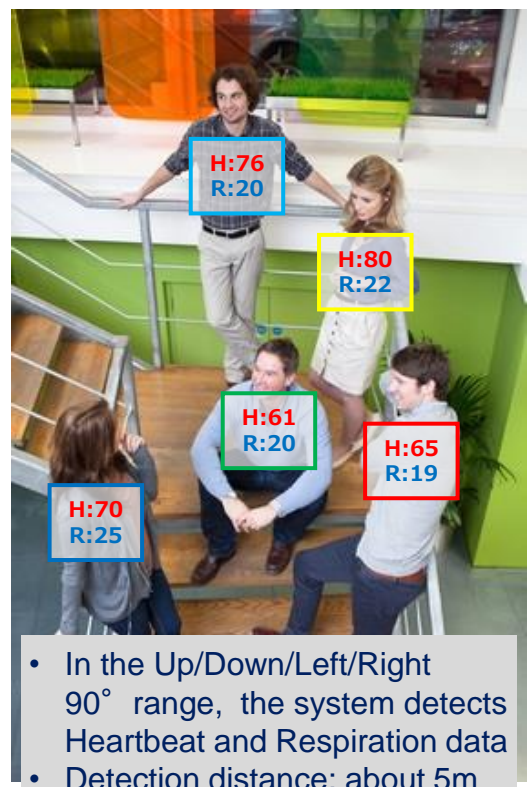
- miRadar®128 «3D» is a 24GHz 3D Radar platform with 3 dimensions Electric beam scan.
- With MIMO (Multi Input Multi Output) radar method, it makes possible to detect with accurate and wide 3 dimensions
- miRadar®128 «3D»-EV is an evaluation kit is an evaluation platform and transmits receiving signal to the PC via high speed USB3.0, and it makes possible quick evaluation at field.
- Certified Japan Radio regulation

### ■ Application

- Obstacle avoidance (Drone, AGV, etc)
- Service Robot
- Vital sign detection
- People's flow line monitoring



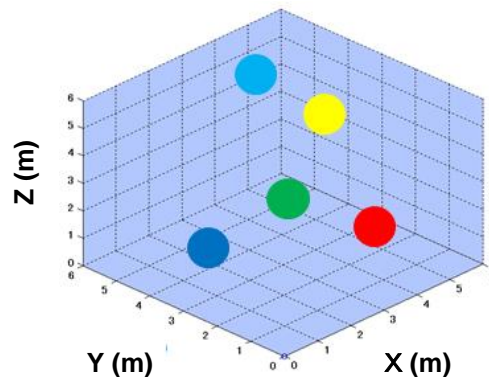
Overlaid Radar data into the camera image (Photo is a sample image)



## ■ Specifications

Radar Type:	MIMO FMCW 24GHz (ARIB-STD-T73)
Antenna:	8Tx, 16Rx
Electric Beam Range:	Azimuth (horizontal) $\pm 45^\circ$ , Elevation (Vertical) $\pm 45^\circ$
Beam width:	Azimuth $10^\circ$ , Elevation (Vertical) $10^\circ$
Scanning speed:	0.1s (at maximum speed) with Intel CORE i7 or equivalent MPU performance
Detection Range:	60m (max) @car, 5m (max) @Vital detection
Output Power:	1/7/13dBm, 3-levels
Module size:	117mm (W)×105mm (H) × 35mm (L) Including MIMO Patch Antenna and FPGA boards
Interface:	USB Type-C, USB camera: USB2.0 micro-B
Power Supply:	DC+12V, 10W (average)
Option:	Customized version of originated Antenna layout and an IP in FPGA.

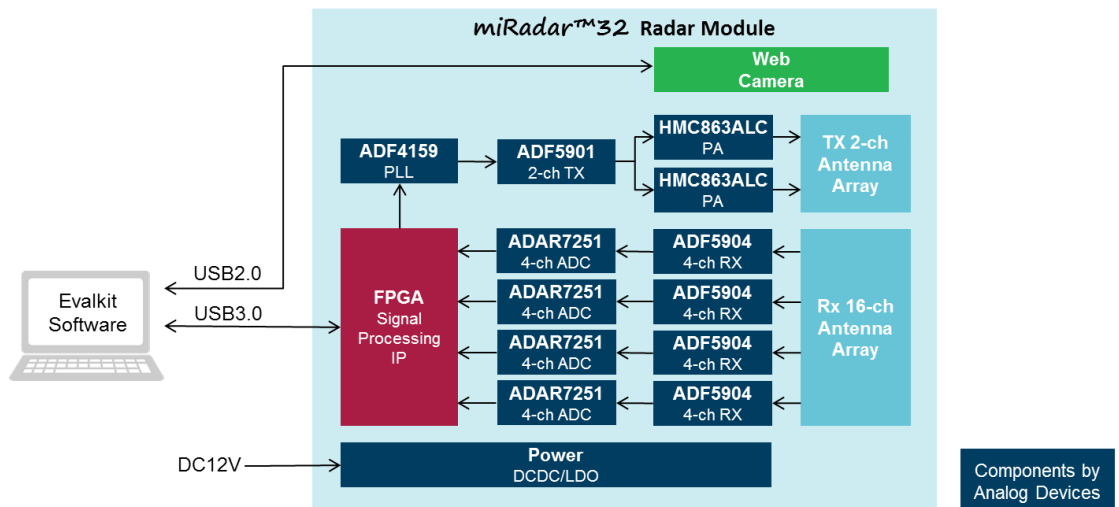
## 3 Dimension Target detection algorithm



## Evaluation Kit block diagram

**miRadar®128 «3D» EV**

Note: indicate the peak signal



24GHz MIMO  
Millimeter wave Radar Platform

Preliminary

Overview

- 79GHz millimeter wave Radar Sensor module
- Onboard Radar signal processing
- Multiple target detections with distance, azimuth, and velocity data
- High resolution (azimuth and distance): 10° , 0.1m
- CAN/RS-485 interface
- IP67 case
- ROS compatible (in development)

Applications

- Collision avoidance, Obstacle detection
- Target's Flow monitoring, Intrusion detection

Custom option

- 76GHz band (ARIB-T48) certification
- FoV modification / Antenna layout change
- Ethernet interface option (ex. 100BASE-T1L)
- PoE/PoDL for power supply

Specifications

Frequency	79GHz (ARIB STD-T111) certified
Tx Power	10dBm (no license required)
Radar type	MIMO FMCW
MIMO virtual channels	Tx 3ch, Rx 4ch (12 elements)
Detection Range	50m @car
FoV	Elevation±12°, Azimuthl±45°
Resolution	Distance 0.1m, Azimuth 10°
Number of Simultaneous detection	8
Update rate	100Hz
Power supply	DC12V, 10W (average)
Interface	CAN / UART
Size	120 x 80 x 30 (IP67 Case) 92 x 55 x 9 (miRadar12e module)

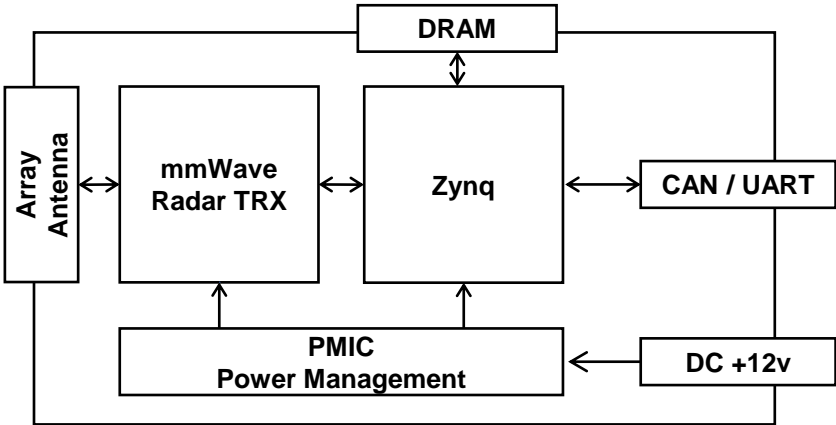


IP67 case

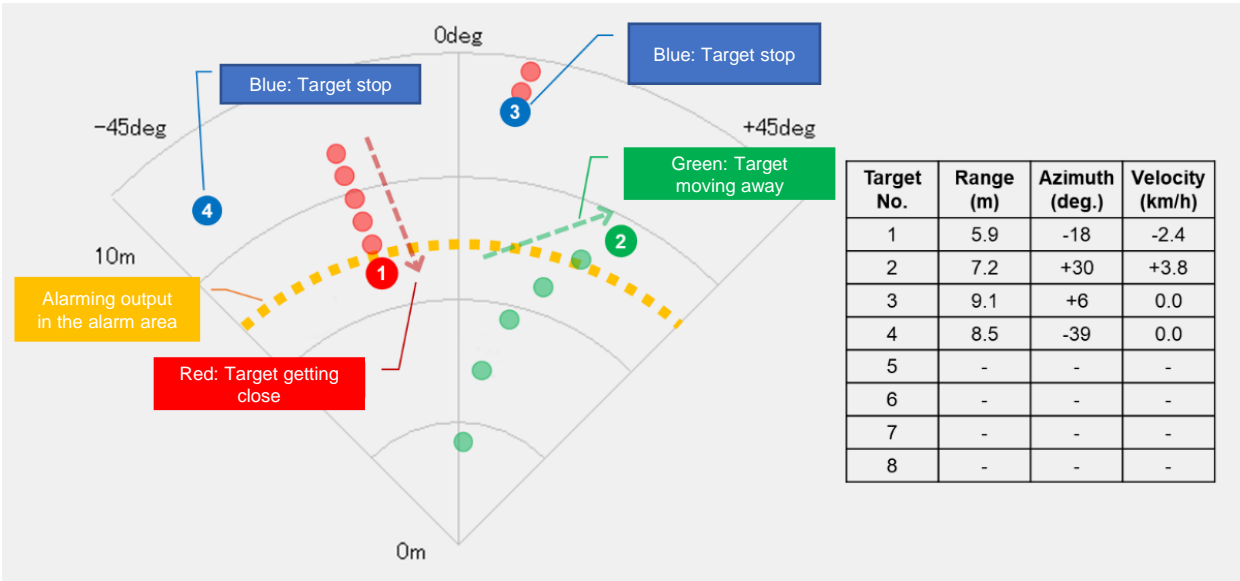
Note: Product Image, it may differ from the final package.



■ **Hardware block diagram**



■ **Reference application software (display example / in development)**



■ **Ordering Guide**

Product Name	Product Number	Comments
miRadar®12e-CAN	B290-01-CAN	79GHz MIMO Radar module, CAN interface
miRadar®12e-RS485	B290-01-RS485	79GHz MIMO Radar module, RS485 interface

# miRadar<sup>®</sup>48e-EV

## 79GHz MIMO Radar Platform

### ■ FEATURES

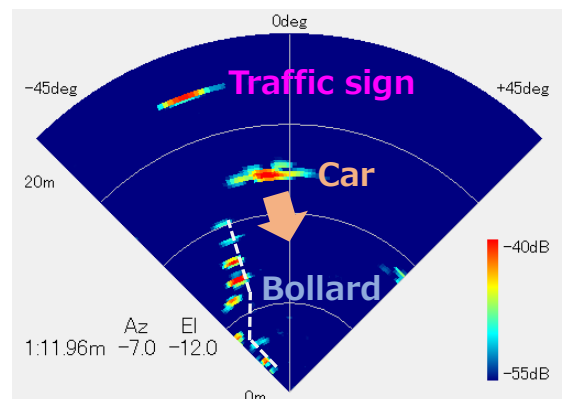
- miRadar<sup>®</sup>48e is a 79GHz radar sensor module that can identify distance, azimuth angle, elevation angle, and speed of the target.
- High accuracy 3D detection by 48elements virtual array using MIMO technology
- Excellent distance resolution by 4GHz wide bandwidth
- USB3.0 super speed interface

### ■ APPLICATIONS

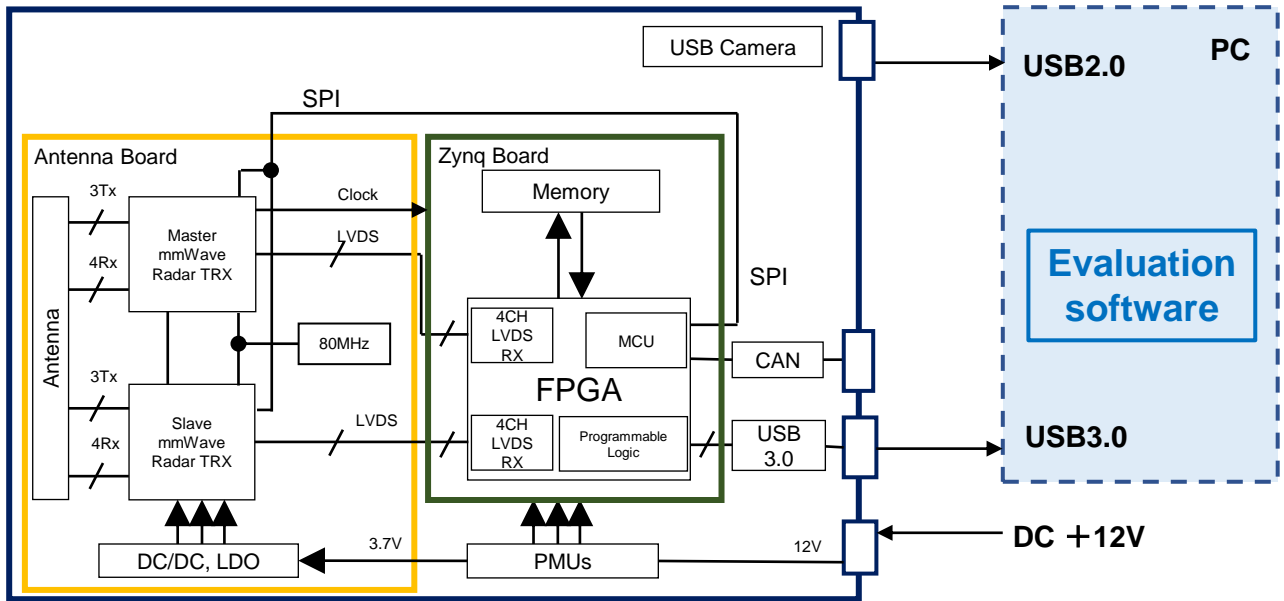
- Obstacle detection system for drone and AGV
- Traffic monitoring system
- Blind spot monitoring system for construction machine
- Social welfare service robot
- Respiratory monitor human sensor
- Human tracking system ...etc

### ■ SPECIFICATIONS

- Frequency: 79GHz
- Type of radar system: MIMO FMCW 79GHz (ARIB-STD-T111 Japan)
- Output power: 10 dBm
- Number of antenna: Tx 6ch, Rx 8ch
- Detection angle: Elevation  $\pm 10^\circ$  & Azimuth  $\pm 45^\circ$
- Resolution: Distance 0.1m & Azimuth  $3^\circ/6^\circ$
- Size(mm): 150 x 205 x 60
- Interface: USB Type-C for radar  
USB 2.0 for camera
- Power: DC+12V, 15w

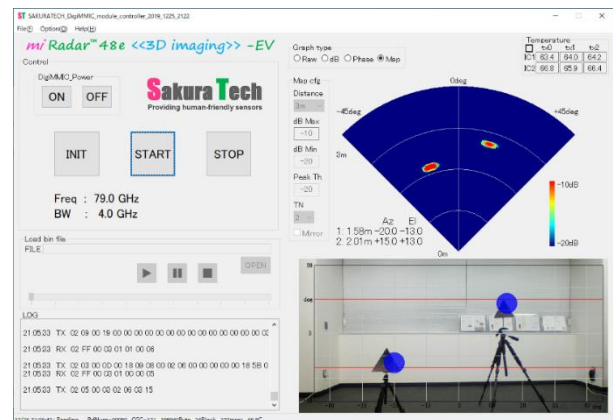


## BLOCK DIAGRAM



## EVALUATION SOFTWARE

- Hardware setup & control
- Indicate status information, Raw data, FFT, and distance vs Amplitude & Phase
- Load and Save data function, and CSV file conversion
- Polar chart
- Target detection, distance and angle (Az & El)
- Speed detection
- Overlaid Radar data into the camera image



GUI

## Ordering Guide

Product Name	Product Number	Comments
miRadar®48e SK1	B283-01	79GHz MIMO Radar Eval Kit, Antenna Pattern SK1, 2Tx / 8Rx (virtual 16ch)
miRadar®48e SK2	B283-02	79GHz MIMO Radar Eval Kit, Antenna Pattern SK2, 4Tx / 8Rx (virtual 32ch)
Evaluation software	B283-SW	79GHz Evaluation Kit software

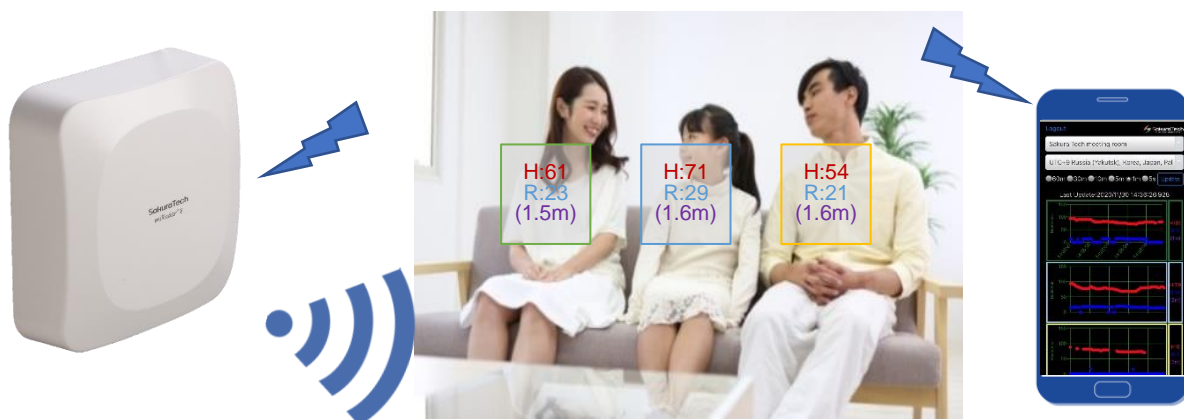
## Vital Radar Sensor Device (Vital Sign Monitor)

### FEATURES

- Integrated the miRadar<sup>®</sup>8 Radar sensor module and Signal Processing unit
- Four human data of Heart & Respiration Rates can be measured simultaneously
- Distance and Angle data included
- Works with IoT Cloud system
- Ethernet / WiFi interface for remote monitoring

### Applications

- Intrusion / People detection system without camera for Security
- Nursing care service 24/365 day monitoring for daily Health check
- Wellness / Fitness Health monitoring



### Specifications

- 24GHz FMCW Radar, certified ARIB-STD-T73 (Japan)
- Detection Range: less than 5 meters (up to 10m dependent upon environment)
- Field of View:  $\pm 40^\circ$  Horizontal,  $\pm 8^\circ$  Vertical
- Number of detection: 4
- Power: 5 Vdc
- Interface: Wireless-LAN, TCP/IP
- Size: 125 x 125 x 45 mm

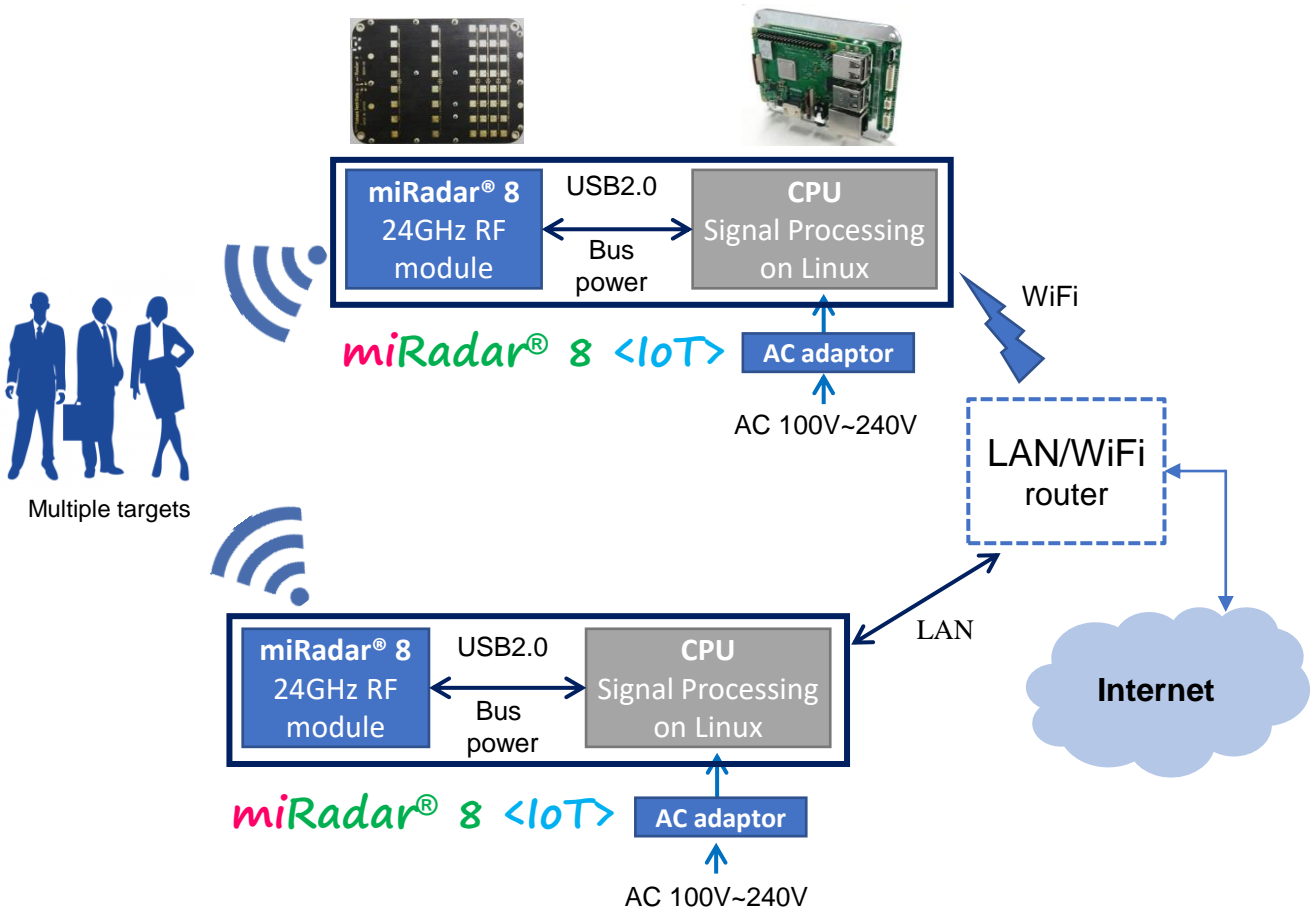
### Host Interface

- Ethernet TCP/IP
- WiFi 2.4GHz

### Software

- API command-based control over TCP/IP
- Sensor parameter configurations for measurement modes
- Data detection for distance, azimuth, heart rate, breathing rate, and so on.
- Data format: polar plot, range plot.
- Data storing and restoring (CSV format)

Application Example



Ordering Guide

Product Name	Product Number	Comments
miRadar®8<IoT>	B278-02	Vital Radar Sensor (VSM), bundled AC Adaptor
Wall attachment for <IoT>	DsM-008	
AC Adaptor(+5Vdc)	DsU-010	Prepared for additional case.



## HANDY Vital Radar Sensor Device (Vital Sign Monitor)

Preliminary

### FEATURES

- Complete model, Vital Sign Monitor with onboard Display
- Handy size, 112 x 75 x 46 mm
- Measurement multiple vital data of Heart & Respiration Rates simultaneously
- Distance and Angle data included
- Ease to use and quick start

### Applications

- Intrusion / People detection system without camera
- Nursing care service 24/365 day monitoring for daily Health check
- Wellness / Fitness Health monitoring



## Specifications

- 24GHz FMCW Radar, certified ARIB-STD-T73 (Japan), UL and CE are in progress.
- Detection Range: 5 - 10 meters
- Field of View:  $\pm 40^\circ$  Horizontal,  $\pm 8^\circ$  Vertical
- Number of detection: >4 (one person on display)
- Power: 5 Vdc
- Interface: Wireless-LAN (Software TBD)
- Size: 112 x 75 x 46 mm

## Software

- No software configuration required for standalone use
- Wireless LAN connection (TBD)

## ■ Ordering Guide

Product Name	Product Number	Comments
miRadar8<Handy>	B293-01	Vital Radar Sensor / Vital Sign Monitor onboard display

## Backward Monitoring System for Grader Machine

### Feature

- Designed to prevent a collision with a vehicle approaching from back or with an object in the driver's blind spot
- Used miRadar®8 24GHz FMCW MIMO radar platform that provides accurate distance and azimuth of the vehicle
- Can be used for construction and agriculture machines.



1. Sensor Unit: DsB229S
  - Installed in rear side with an attachment for absorption of vibration
  - Mounted the miRadar®8 Radar sensor module
  - W 150mm x D 110mm x H 40mm



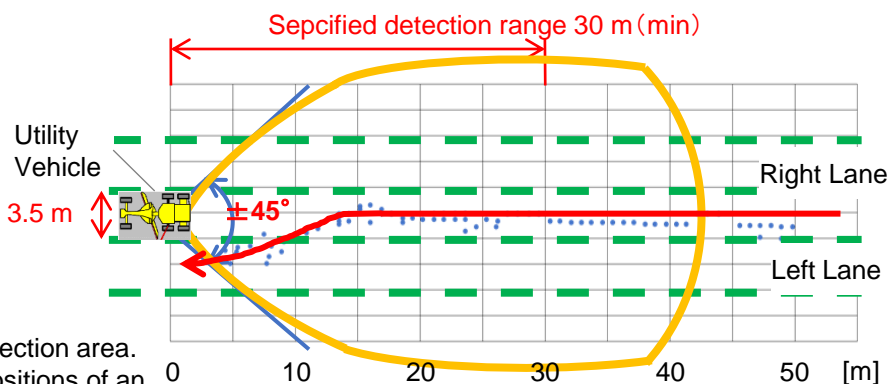
2. Signal Processing Unit: DsB229P
  - Installed in cabin
  - W 228mm x D 180mm x H 50mm



3. Alarm unit: DsB229A
  - Installed in a front of driver's seat.
  - W 100 mm x D 40 mm x H 80 mm

### Functionality

- Measurement of positions and speed of approaching vehicles from back and detects collision risk
- Alarming to the driver with a buzzer and a LED when the collision risk is detected
- A solid yellow line indicates the detection area.
- Blue dots indicate the measured positions of an approaching vehicle.
- A solid red line indicates the route of the vehicle approaching from behind.



# Applications

- Backward monitoring system for Grader machines
- Rear monitoring of Construction and/or Agriculture machines, and obstacle detection



# Ordering Number

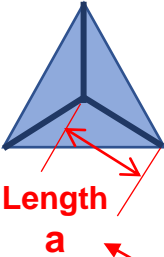
Product Name	Product Number	Comments
miRadar®8 <gradar>	B229S	Sensor unit
	B229P	Signal Processing Unit
	B229A	Alarm unit
	B229R	Connection cable

# Trihedral Corner Reflector

## DsA004-T Series

### Features

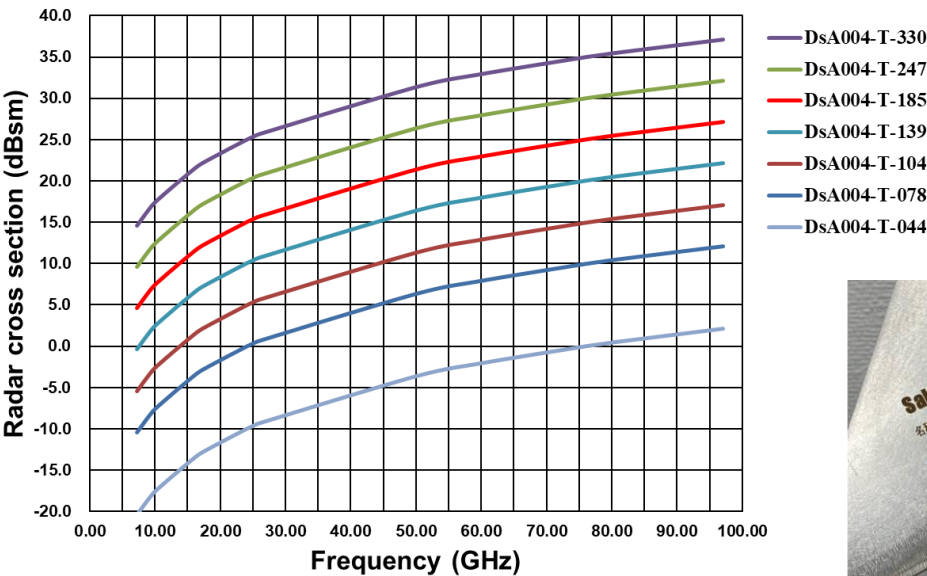
- Stainless construction.
- Radar system calibration
- Camera Tripod connection
- Gold plate finish available



### Specifications

Trihedral Corner Reflector

型名	DsA004-T-044		DsA004-T-078		DsA004-T-104		DsA004-T-139		DsA004-T-185		DsA004-T-247		DsA004-T-330	
長さ a [m]	0.0439		0.078		0.104		0.139		0.185		0.247		0.33	
重さ [kg]	0.06		0.15		0.25		0.4		0.65		1.3		2.2	
[GHz]	[m <sup>2</sup> ]	[dBSm]	[m <sup>2</sup> ]	[dBSm]	[m <sup>2</sup> ]	[dBSm]	[m <sup>2</sup> ]	[dBSm]	[m <sup>2</sup> ]	[dBSm]	[m <sup>2</sup> ]	[dBSm]	[m <sup>2</sup> ]	[dBSm]
7.25	0.009	-20.4	0.1	-10.4	0.3	-5.4	0.9	-0.4	2.9	4.6	9.1	9.6	29.0	14.6
8.75	0.013	-18.8	0.1	-8.8	0.4	-3.8	1.3	1.2	4.2	6.2	13.3	11.2	42.3	16.3
10.25	0.018	-17.4	0.2	-7.4	0.6	-2.4	1.8	2.6	5.7	7.6	18.2	12.6	58.0	17.6
16.00	0.044	-13.5	0.4	-3.6	1.4	1.4	4.4	6.5	14.0	11.4	44.3	16.5	141.3	21.5
18.00	0.056	-12.5	0.6	-2.5	1.8	2.5	5.6	7.5	17.7	12.5	56.1	17.5	178.8	22.5
24.15	0.101	-10.0	1.0	0.0	3.2	5.0	10.1	10.1	31.8	15.0	101.0	20.0	321.9	25.1
25.00	0.108	-9.7	1.1	0.3	3.4	5.3	10.9	10.4	34.1	15.3	108.3	20.3	345.0	25.4
26.00	0.117	-9.3	1.2	0.7	3.7	5.7	11.7	10.7	36.9	15.7	117.1	20.7	373.1	25.7
50.00	0.432	-3.6	4.3	6.3	13.6	11.3	43.4	16.4	136.3	21.3	433.1	26.4	1379.8	31.4
60.00	0.622	-2.1	6.2	7.9	19.6	12.9	62.5	18.0	196.3	22.9	623.6	27.9	1987.0	33.0
76.00	0.998	0.0	10.0	10.0	31.4	15.0	100.4	20.0	314.9	25.0	1000.6	30.0	3188.0	35.0
77.00	1.025	0.1	10.2	10.1	32.3	15.1	103.0	20.1	323.2	25.1	1027.1	30.1	3272.4	35.1
79.00	1.079	0.3	10.8	10.3	34.0	15.3	108.4	20.4	340.2	25.3	1081.1	30.3	3444.6	35.4
81.00	1.134	0.5	11.3	10.5	35.7	15.5	114.0	20.6	357.7	25.5	1136.6	30.6	3621.3	35.6
97.00	1.626	2.1	16.2	12.1	51.2	17.1	163.5	22.1	512.9	27.1	1629.9	32.1	5193.2	37.2





# Spherical Reflector DsA004-SPH Series

## Features

- Reference for Radar system calibration
- High Sphericity  $\pm 0.5\text{mm}$
- Light weight Aluminum construction
- No directionality
- Constant Radar Cross Section and independent Frequency
- Camera Tripod connection



## Specifications

Model Number	Diameter (mm)	Weight (g)	Radar Cross Section	
			m <sup>2</sup>	dBsm
DsA004-SPH-50	50	177	0.002	-27.07
DsA004-SPH-100	100	1,360	0.008	-21.05
DsA004-SPH-200	200	4,300	0.031	-15.03

# miRadar<sup>®</sup> 8 Optional Services

## Customized design services for hardware (antenna, outer shape, etc.)

Please contact us a customization requirement in terms of different antenna design such as layout change and/or increasing number of elements such as from 4ch to 8ch and 16ch.

## E-mail Technical Support (Bxxx-OP100)

We recommend to add Technical Support package in case of first-time usage of the evaluation board

Note : Any product appearances, specifications, etc. are subject to change for improvement without prior notice. When exporting the product, confirm the country of destination, application, and customer. If any of them falls into an objective requirement, please take the necessary procedures, including export certificate application.

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### ALLIANCE PARTNERS

