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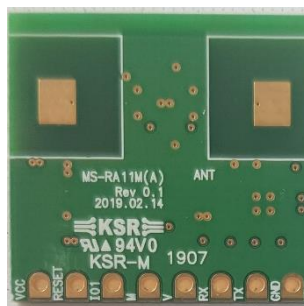
# Introduction of Radar Development

# 1. Radar Development - Models

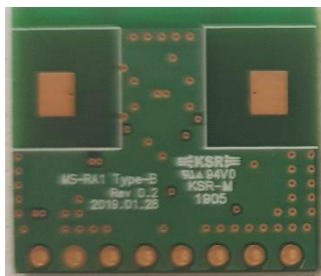
Model Name	Features	Detection Range (RCS 1m <sup>2</sup> )	Antenna	Post Processing	Comment
MS-RA11N	<ul style="list-style-type: none"> <li>Motion / Velocity</li> <li>BGT24LTR11N</li> <li>External MCU</li> </ul>	5M	<ul style="list-style-type: none"> <li>Single Patch</li> <li>FR4 PCB</li> <li>1T1R</li> </ul>	<ul style="list-style-type: none"> <li>Motion Detection with threshold control</li> <li>256 FFT for velocity</li> </ul>	<ul style="list-style-type: none"> <li>Size : 22 x 19 x 4 mm</li> <li>Sample : available</li> <li>Evaluation Board &amp; SDK</li> <li>W/O MCU is available</li> </ul>
MS-RA11M	<ul style="list-style-type: none"> <li>Motion / Velocity</li> <li>BGT24LTR11N</li> <li>MCU (Cortex M0)</li> </ul>	5M	<ul style="list-style-type: none"> <li>Single Patch</li> <li>FR4 PCB</li> <li>1T1R</li> </ul>	<ul style="list-style-type: none"> <li>Motion Detection with threshold control</li> <li>256 FFT for velocity</li> </ul>	<ul style="list-style-type: none"> <li>Size : 22 x 20 x 4 mm</li> <li>Sample : March</li> <li>Evaluation Board &amp; SDK</li> </ul>
MS-RA14N	<ul style="list-style-type: none"> <li>Motion / Velocity</li> <li>BGT24LTR11N</li> <li>External MCU</li> </ul>	10M	<ul style="list-style-type: none"> <li>4 Array Patch</li> <li>FR4 PCB</li> <li>1T1R</li> </ul>	<ul style="list-style-type: none"> <li>Motion Detection with threshold control</li> <li>256 FFT for velocity</li> </ul>	<ul style="list-style-type: none"> <li>Schedule is not fixed</li> </ul>
MS-RA14M	<ul style="list-style-type: none"> <li>Motion / Velocity</li> <li>BGT24LTR11N</li> <li>MCU (Cortex M0)</li> </ul>	10M	<ul style="list-style-type: none"> <li>4 Array Patch</li> <li>FR4 PCB</li> <li>1T1R</li> </ul>	<ul style="list-style-type: none"> <li>Motion Detection with threshold control</li> <li>256 FFT for velocity</li> </ul>	<ul style="list-style-type: none"> <li>Size : 34 x 34 x 4 mm</li> <li>Sample : April</li> <li>Evaluation Board &amp; SDK</li> </ul>
MS-RA24M	<ul style="list-style-type: none"> <li>Motion / Velocity</li> <li>Distance</li> <li>FMCW</li> <li>MCU (Cortex M4)</li> </ul>	10M	<ul style="list-style-type: none"> <li>4 Array Patch</li> <li>FR4 PCB</li> <li>1T1R</li> </ul>	<ul style="list-style-type: none"> <li>2D FFT</li> <li>Motion Detection with threshold control</li> <li>256 FFT for velocity</li> </ul>	<ul style="list-style-type: none"> <li>Size : 38 x 34 x 4 mm</li> <li>Sample : October</li> </ul>
MS-RA28M	<ul style="list-style-type: none"> <li>Motion / Velocity</li> <li>Distance</li> <li>FMCW</li> <li>BGT24MTR11N</li> <li>MCU (Cortex M4)</li> </ul>	20M	<ul style="list-style-type: none"> <li>8 Array Patch</li> <li>Ceramic PCB</li> <li>1T1R</li> </ul>	<ul style="list-style-type: none"> <li>2D FFT (128 or 256)</li> <li>Clutter Remover</li> <li>Motion Detection with threshold control</li> <li>256 FFT for velocity</li> </ul>	<ul style="list-style-type: none"> <li>Size : 34 x 34 x 4 mm</li> <li>Sample : December</li> </ul>

# 1. Radar Development - Models

MS-RA11M



MS-RA11N



MS-RA14M

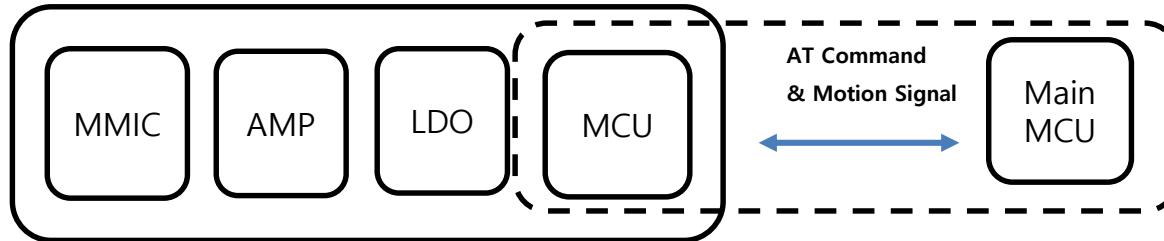


## 2. What is different?

- **High Performance own cortex MCU**
  - ✓ ABOV Cortex M0, M3, M4 for post processing
  - ✓ Very low cost is available for radar project (ABOV is our sister company)
- **Easy development with EVB & GUI program**
  - ✓ Evaluation Board and GUI program
  - ✓ Software Development Package with signal processing libraries
- **FR4 PCB**
  - ✓ Cost effective solution but small gain
  - ✓ Amp with noise reduction filter
- **Co-business with Communication module**
  - ✓ Sug-Giga & BLE module
- **Many electronic companies**

# 3-1. How to make low cost?

## ➤ AT Command Control & Motion Detection with MCU



①

1) Change expensive Ceramic PCB to FR4 PCB



2) Change packages of parts for Low Cost  
3) Remove LDO

=> **COST DOWN**

②

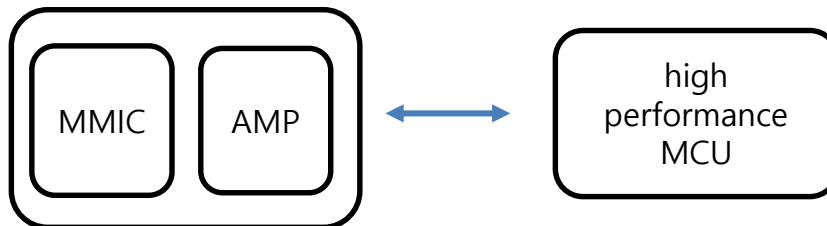
1) Low cost, high performance own MCU



2) Merge two MCU to one MCU  
3) EVB with GUI for easy development

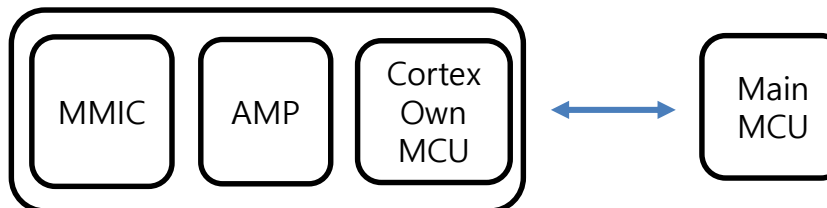
4) SDK with Software Library

MS-RA11N  
MS-RA14N



ABOV Cortex M0 40MHz  
A31G111L (16K Flash/4K SRAM)  
A31G112L (32K Flash/4K SRAM)  
ABOV Cortex M3 75MHz  
A33G524L (128K Flash/24K SRAM)

MS-RA11M  
MS-RA14M  
MS-RA24M



# 3-2. Own Cortex MCU

## ➤ Cortex MCUs

: M0, M3, M4 solutions are available

### Overview

#### 1.1 Introduction

The A31G11x series is a microcontroller based on ARM Cortex-M0+ Core with a flash memory of up to 32 KB, and an SRAM of 4 KB. The operation voltage of the device is 1.8V to 5.5V. It provides a highly flexible and cost effective solution for many embedded control applications. The A31G11x series has 16-bit timers, 32-bit timers, a 16-bit timer with 6-channel PWM, 12-bit ADC, CRC generator, UART, USART, I2C, LCD driver/controller, etc. The A31G11x series also has a POR, LVR, LVI, and an internal RC oscillator. The A31G11x series support sleep and deep sleep modes to reduce power consumption.

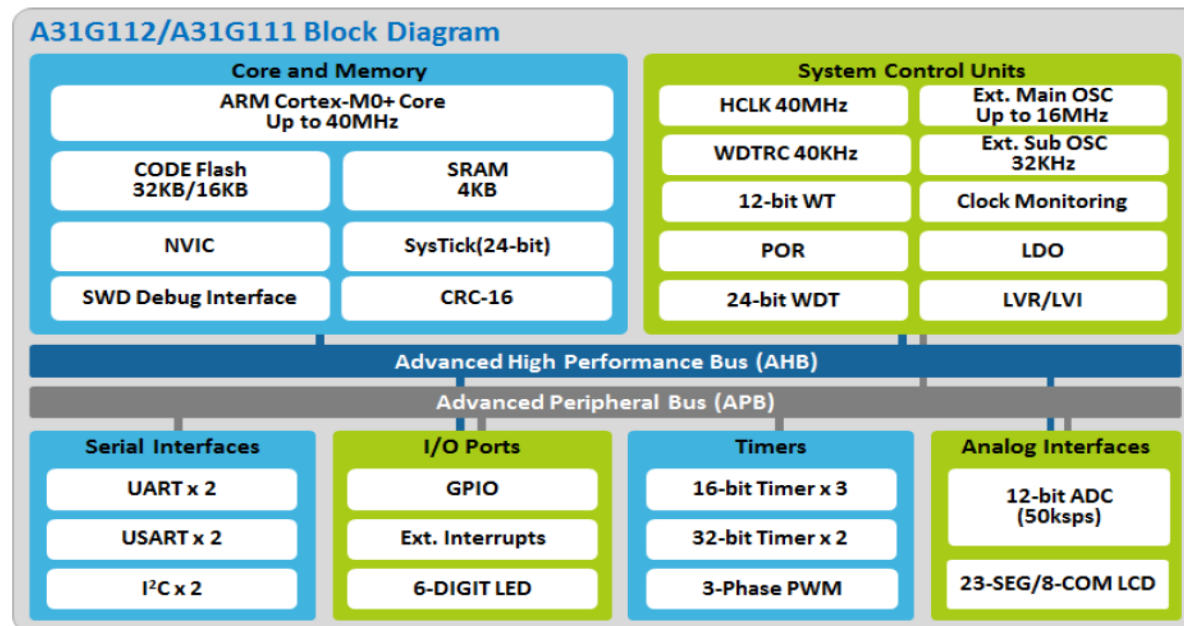
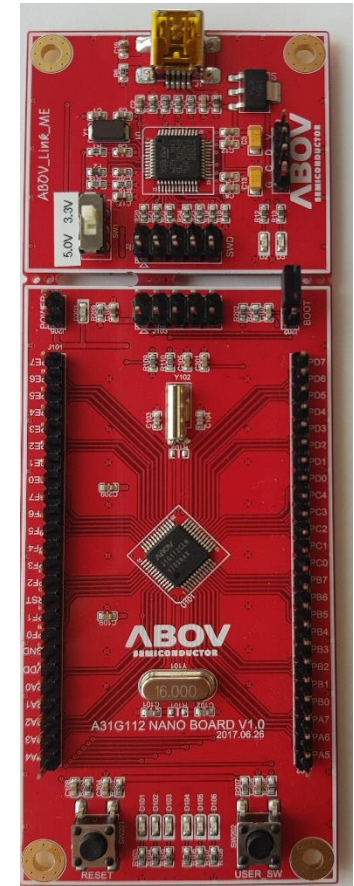
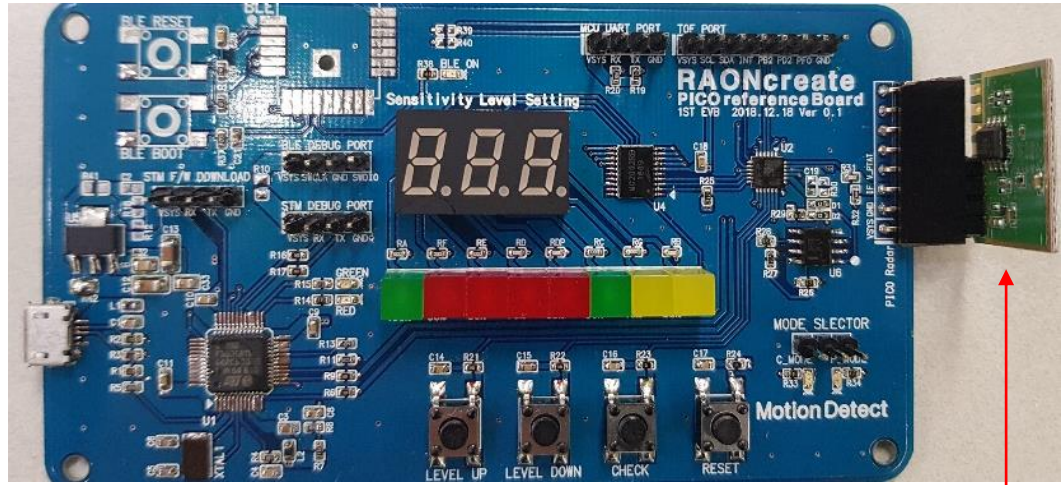


Figure 1.1 Block Diagram



# 4. EVB

PC with  
Evaluation  
software

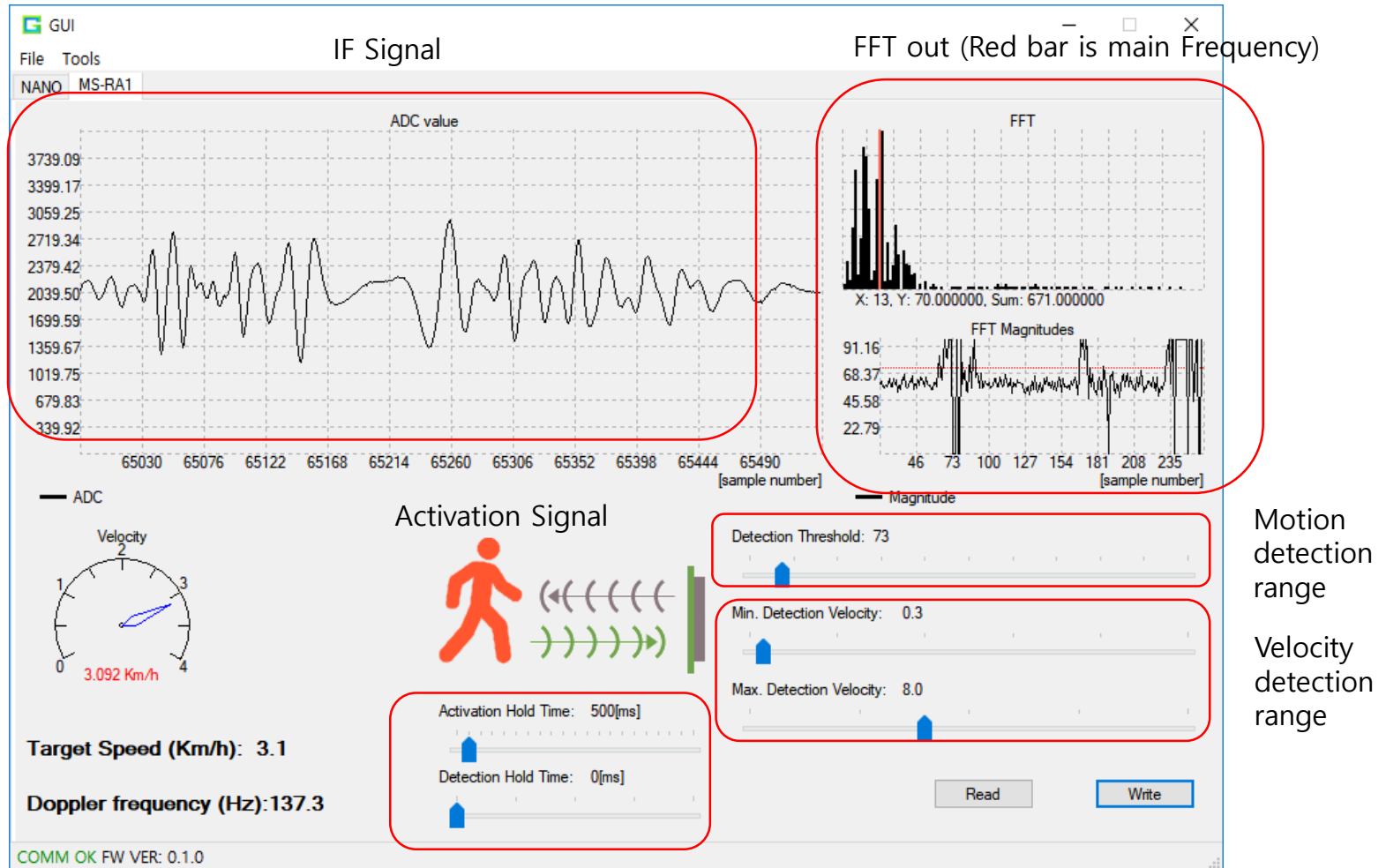


Evaluation Board

Radar Sample



# 5. GUI Program for development



Hold Time controls

Motion detection range

Velocity detection range



# 6. Applications of Users

1. Black Box for power saving (10M detection, small size, low cost)
2. Light control sensor for front door (Very low cost, Large quantity)
3. Light control for living room with wireless communication
4. Light control for bath room (automatically turned on at night)
5. Security of Truck Freight (Low power consumption, 10M detection)
6. Automatic Door (Detection range control)
7. Back side alarm of motor cycle (Velocity Detection)
8. Present detection (UWB radar for living room & CW radar for bath room)
9. Present sensor for Bidet (Temperature control of seat)

**End of Presentation**

**Thank you.**