nRF52832_DM-S Module

Rev 1.2

Sep 30, 2021

Contributors

Prepared by Tae Hun KIM

For further information, please contact the: Tae Hun KIM, thkim@dmtech.ne.kr

Document History

Version	Date	Title
Rev 1.0	Mar. 15, 2021	-. Initial Document
Rev 1.1	Mar. 30. 2021	-. Reflow
Rev 1.2	Sep. 30. 2021	-. KC Registration

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1. Introduction

Nordic 사의 nRF52832 을 이용한 BLE5.x SMD Type module 이다.
nRF52832_DM_REV1.0 은 nRF52832 chipset 을 기본으로 하여 mobile 제품, 또는 smart watch 등과 같이 소형화를 요구하는 제품에 적용하기에 적합하도록 구성하여 제공할 수 있도록 디자인되었다.
이 module 은 nRF52832-QFAA 를 장착하여 one chip solution 을 기반으로 설계되었고, SPI 통신을 통해 external core 를 사용하여 제어가 가능하도록 설계되었다.
기존의 nRF52832_DM-S_REV1.0 에서 HID, Central, Peripheral 기능을 추가하여 재개발하게 되었으며 이로 인해 적용범위를 넓히고자 한다.

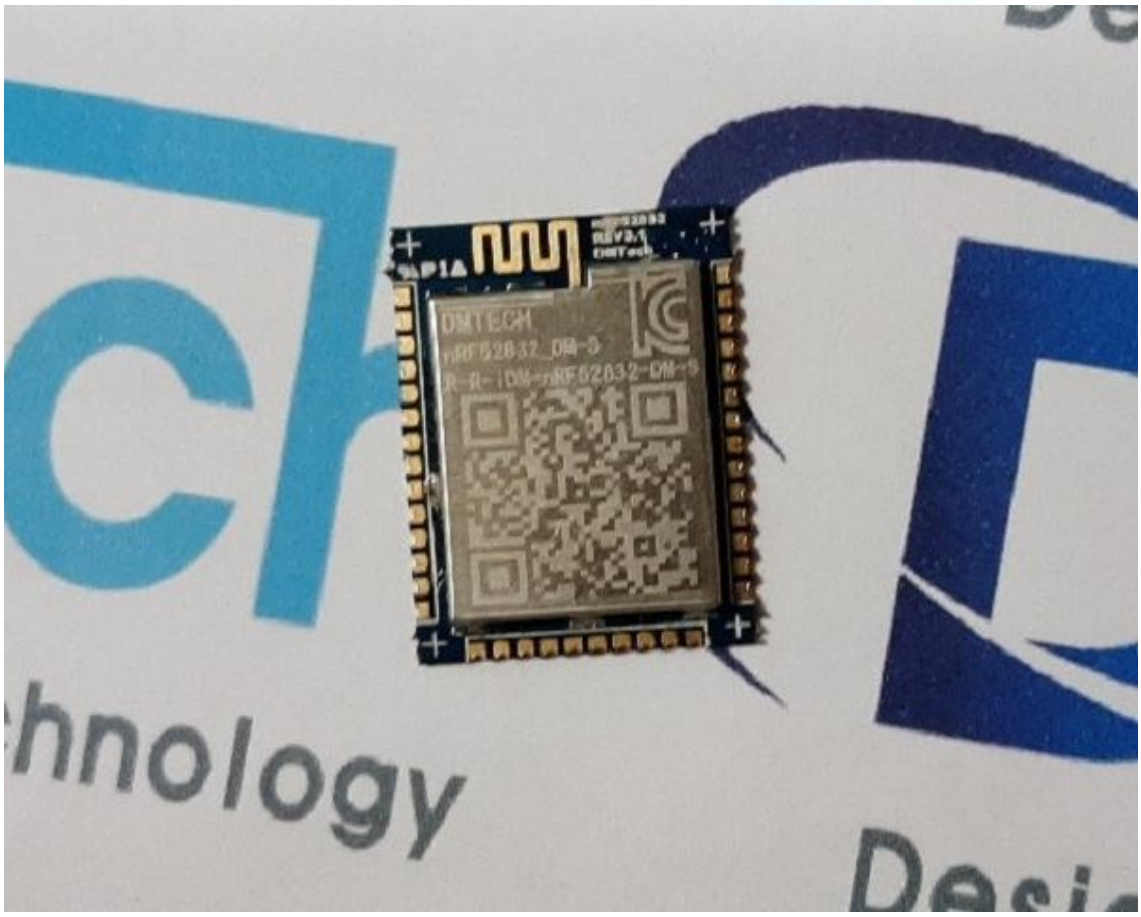


Figure 1 nRF52832_DM-S Module

nRF52832 의 기본적인 사양은 Nordic 사 http://www.nordicsemi.com 를 통해서 확인 할 수 있다.

1.1 Key Features

- 2.4 GHz transceiver
    - -96 dBm sensitivity in *Bluetooth®* low energy mode
    - Supported data rates: 1 Mbps, 2 Mbps *Bluetooth®* low energy mode
    - -20 to +4 dBm TX power, configurable in 4 dB steps
    - On-chip balun (single-ended RF)
    - 5.3 mA peak current in TX (0 dBm)
    - 5.4 mA peak current in RX
    - RSSI (1 dB resolution)
- ARM® Cortex®-M4 32-bit processor with FPU, 64 MHz
    - 215 EEMBC CoreMark® score running from flash memory
    - 58 µA/MHz running from flash memory
    - 51.6 µA/MHz running from RAM
    - Data watchpoint and trace (DWT), embedded trace macrocell (ETM), and instrumentation trace macrocell (ITM)
    - Serial wire debug (SWD)
    - Trace port
- Flexible power management
    - 1.7 V–3.6 V supply voltage range
    - Fully automatic LDO and DC/DC regulator system
    - Fast wake-up using 64 MHz internal oscillator
    - 0.3 µA at 3 V in System OFF mode
    - 0.7 µA at 3 V in System OFF mode with full 64 kB RAM retention
    - 1.9 µA at 3 V in System ON mode, no RAM retention, wake on RTC
- Memory
    - 512 kB flash/64 kB RAM
    - 256 kB flash/32 kB RAM
- Nordic SoftDevice ready
- Support for concurrent multi-protocol

- Type 2 near field communication (NFC-A) tag with wakeup-on-field and touchto-pair capabilities
- 12-bit, 200 ksps ADC - 8 configurable channels with programmable gain
- 64 level comparator
- 15 level low power comparator with wakeup from System OFF mode
- Temperature sensor
- 32 general purpose I/O pins
- 3x 4-channel pulse width modulator (PWM) unit with EasyDMA
- Digital microphone interface (PDM)
- 5x 32-bit timer with counter mode
- Up to 3x SPI master/slave with EasyDMA
- Up to 2x I2C compatible 2-wire master/slave
- I2S with EasyDMA
- UART (CTS/RTS) with EasyDMA
- Programmable peripheral interconnect (PPI)
- Quadrature decoder (QDEC)
- AES HW encryption with EasyDMA
- Autonomous peripheral operation without CPU intervention using PPI and EasyDMA
- 3x real-time counter (RTC)
- Single crystal operation
- Package variants
    - QFN48 package, 6 × 6 mm
- nRF52832_DM-S Package Type
    - half through hole SMD Type 1.27mm Pitch 38Pin
    - SIZE : 23(L) x 18(W) x 2.9(H) mm Compact Size

1.2 Applications

- Internet of Things (IoT)
    - Home automation
    - Sensor networks
    - Building automation
    - Industrial
    - Retail
- Personal area networks
    - Health/fitness sensor and monitor devices
    - Medical devices
    - Key fobs and wrist watches
- Interactive entertainment devices
    - Remote controls
    - Gaming controllers
- Beacons
- A4WP wireless chargers and devices
- Remote control toys
- Computer peripherals and I/O devices
    - Mouse
    - Keyboard
    - Multi-touch trackpad
    - Gaming

2. nRF52832_DM-S Module 의 사양

nRF52832_DM-S module 은 Nordic 사의 nRF52832_QFAA chipset 을 사용하여 설계하였다.

2.1 nRF52832_DM-S Module

Module 사이즈는 23.0*18.0mm, 0.8T 로 제작하여 mobile type 에 적용가능 하도록 소형화 하는데 목적을 두고 제작하였다.
Pin out 은 최대한 가용할 수 있는 Pin 을 사용 가능하도록 설계 하였다.

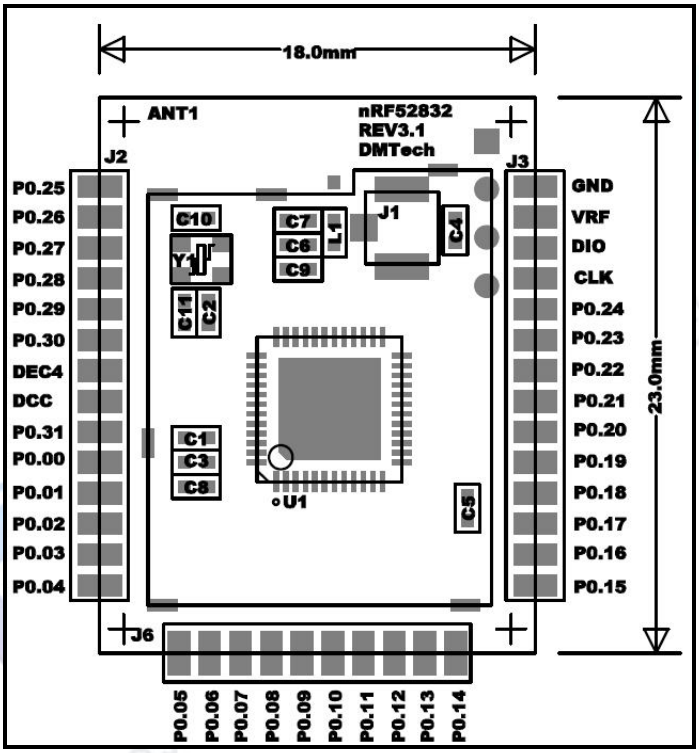


Figure 2 nRF52832_DM-S Module Dimension

2.2 nRF52832_DM-S Pin Assignment

Table 1 Supply & Programming Terminal Description

Pin Name	Pin Number	Type	DESCRIPTION
GND	38	GND	GND
VRF	37	VRF	Supply voltage range 1.8 V to 3.6 V
DIO	36	Digital Input	Hardware debug and flash programming I/O.
CLK	35	Digital I/O	Hardware debug and flash programming I/O.

Table 2 I/O terminal Description_1

Pin Name	Pin Number	Type	DESCRIPTION
P0.25	1	Digital I/O	General purpose I/O pin.
P0.26	2	Digital I/O	General purpose I/O pin.
P0.27	3	Digital I/O	General purpose I/O pin.
P0.28	4	Digital I/O Analog input	General purpose I/O pin. ADC/LPCOMP input 4.
P0.29	5	Digital I/O Analog input	General purpose I/O pin. ADC/LPCOMP input 5.
P0.30	6	Digital I/O Analog input	General purpose I/O pin. ADC/LPCOMP input 7.
DEC4	7	Digital I/O Analog input	General purpose I/O pin. ADC/LPCOMP input 7.
DCC	8		
P0.31	9	Digital I/O Analog input	General purpose I/O pin. ADC/LPCOMP input 7.
P0.00	10	Digital I/O XL1	General purpose I/O pin. Connection for 32.768 kHz crystal.
P0.01	11	Digital I/O XL2	General purpose I/O pin. Connection for 32.768 kHz crystal
P0.02	12	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input.
P0.03	13	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input.
P0.04	14	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input.
P00.5	15	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input.
P0.06	16	Digital I/O	General purpose I/O pin.
P0.07	17	Digital I/O	General purpose I/O pin.
P0.08	18	Digital I/O	General purpose I/O pin.
P0.09 NFC1	19	Digital I/O NFC Input	General purpose I/O pin. NFC antenna connection.

Table 3 I/O terminal Description_2

Pin Name	Pin Number	Type	DESCRIPTION
P0.09 NFC2	19	Digital I/O NFC Input	General purpose I/O pin. NFC antenna connection.
P0.11 UART_TX	21	Digital I/O	General purpose I/O pin. UART RX Port, PULL-UP
P0.12 UART_RX	22	Digital I/O	General purpose I/O pin. UART TX Port.
P0.13	23	Digital I/O	General purpose I/O pin.
P0.14	24	Digital I/O	General purpose I/O pin.
P0.15	25	Digital I/O	General purpose I/O pin.
P0.16	26	Digital I/O	General purpose I/O pin.
P0.17	27	Digital I/O	General purpose I/O pin.
P0.18	28	Digital I/O	General purpose I/O pin.
P0.19	29	Digital I/O	General purpose I/O pin.
P0.20	30	Digital I/O	General purpose I/O pin.
P0.21	31	Digital I/O	General purpose I/O pin.
P0.22	32	Digital I/O	General purpose I/O pin.
P0.23	33	Digital I/O	General purpose I/O pin.
P0.24	34	Digital I/O	General purpose I/O pin.

3. AT Command List

3.1 UART 통신 TEST

Table 4 통신 TEST

	CAMMAND	RESPONSE
예제)	AT+	OK

3.2 BAUD RATE / PARITY 변경

Table 5 BAUD RATE / PARITY 변경

	CAMMAND	RESPONSE
	AT+B_<X><Y>	OK_<R><P>
예제)	AT+B_6N	OK_19200None

Table 6 Baud Rate

<X>	<R>
1	**1200**
2	**2400**
3	**4800**
4	**9600**
5	**14400**
6	**19200 (Default)**
7	**38400**
8	**57600**
9	**115200**

Table 7 Parity

<Y>	<P>
N	**None**
E	**Even**

3.3 DEVICE NAME 변경

Table 8 DEVICE NAME 변경

	CAMMAND	RESPONSE
	AT+N_<NAME>	OK_<NAME>
예제)	AT+N_DM-123456789A	OK_DM-123456789A

<NAME> : 영문자(대/소문자 구분), 숫자, 기호를 포함하여 13글자까지 가능하다.

3.4 DEVICE 정보 (VERSION/NAME) 가져오기

Table 9 DEVICE 정보(VERSION/NAME) 가져오기

	CAMMAND	RESPONSE
	AT+V	OK_<Ver><NAME>
예제)	AT+V	OK_V1.0.0/DM-123456789A

3.5 기타

Factory Default UART Setting : 19200, N, 8, 1
모든 명령의 마지막에는 0x5C(₩)를 추가해야 한다.
AT COMMAND 실행 후 전원을 재 인가해야 변경 내용이 적용된다.

3.6 AT COMMAND 예제

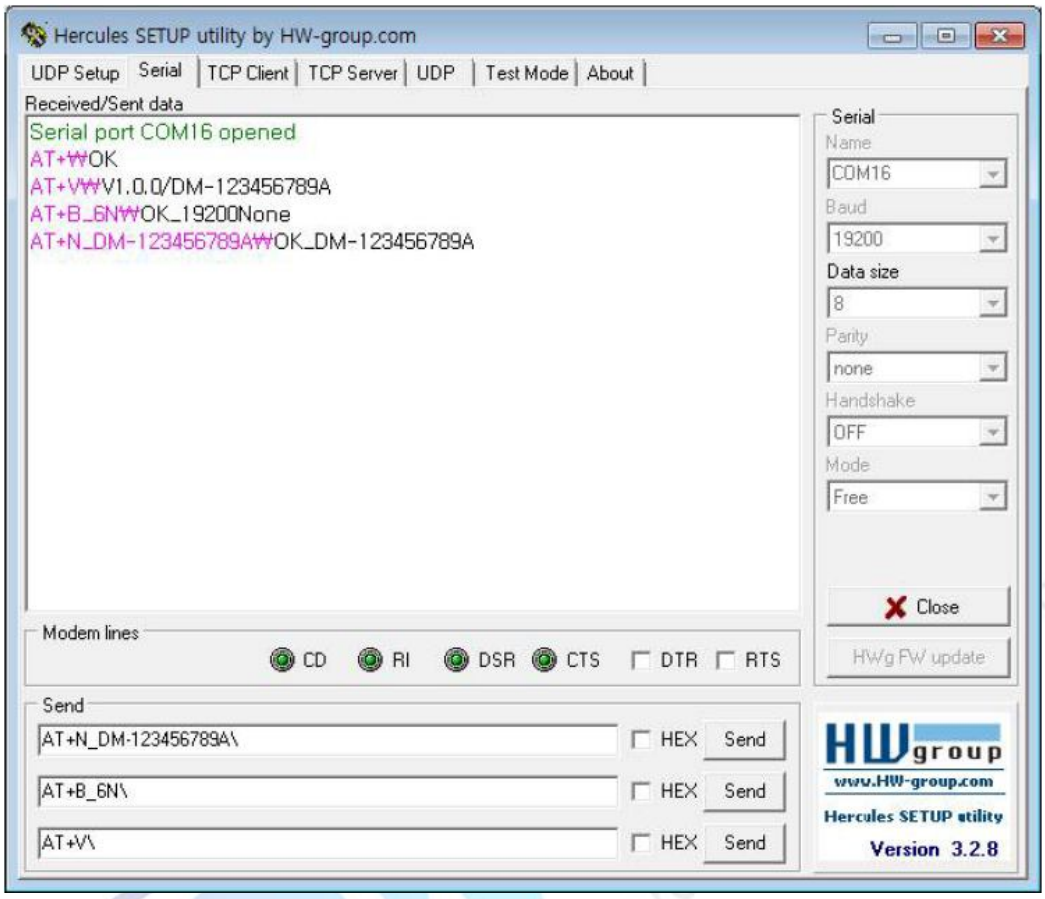


Figure 3 AT Command 예제

4. Dimension

4.1 nRF52832_DM-S Module 의 Dimension

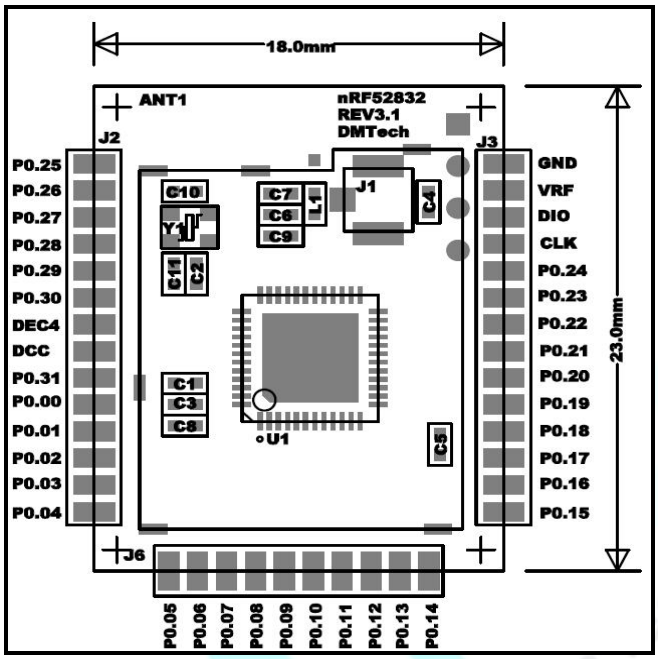


Figure 4 Dimension

4.2 nRF52832_DM-S Module 의 REFERENCE NUMBER SILK

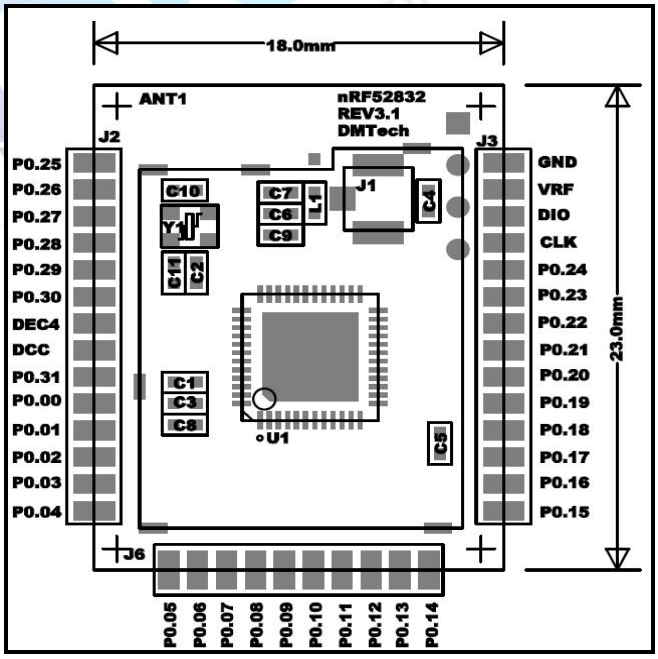


Figure 5 Reference Number Silk

4.3 nRF52832_DM-S Module 의 PCB Footprint

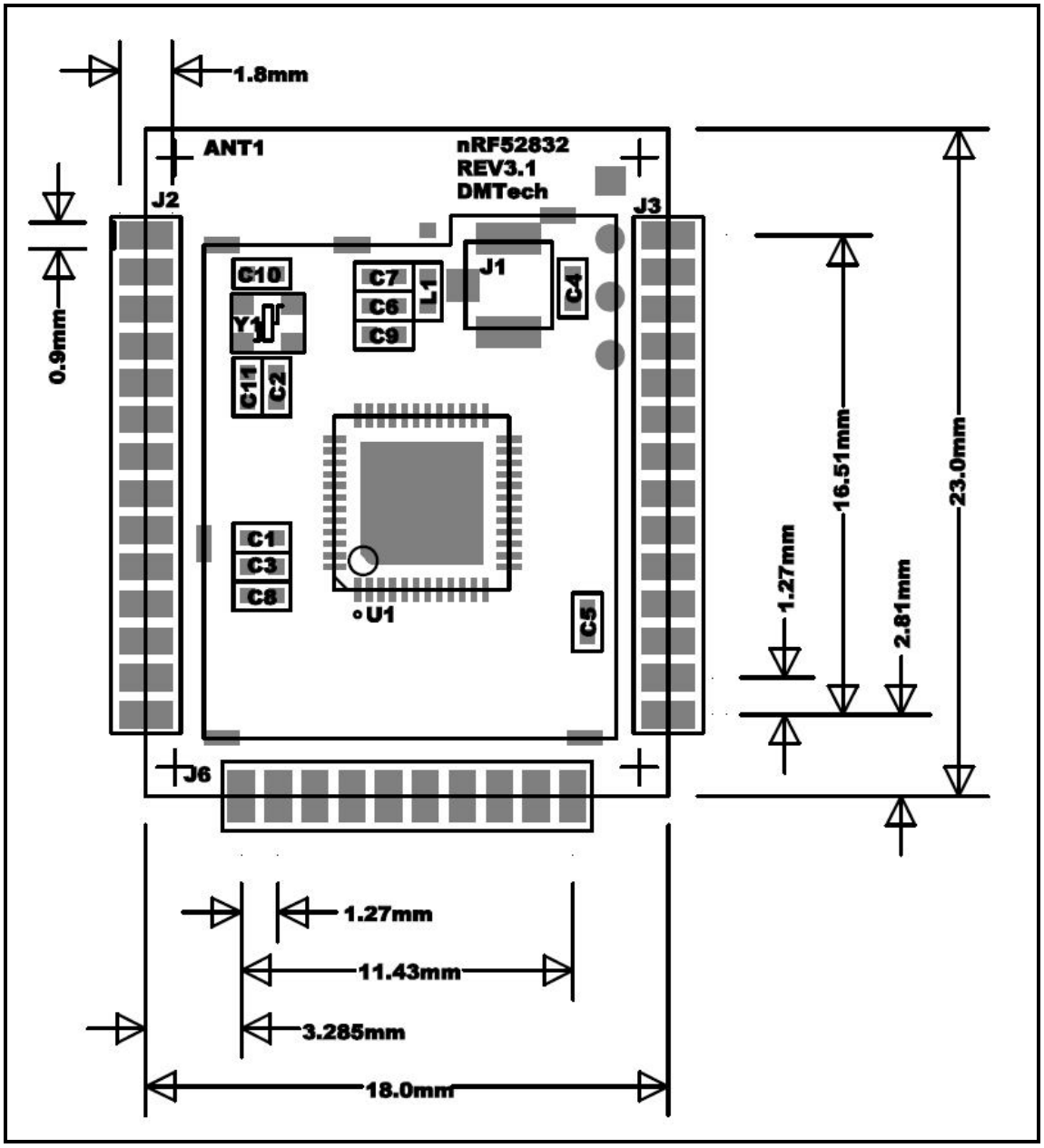


Figure 6 PCB Footprint

4.4 Reflow Soldering

일반적인 증가 속도는 최대 3°C / 초입니다.
Reflow 최대 온도는 250 ° C를 초과하지 않아야 합니다.
최소 3-zone 이상의 열전대를 사용하는 것이 좋습니다.
무 세정 페이스트를 권장합니다.

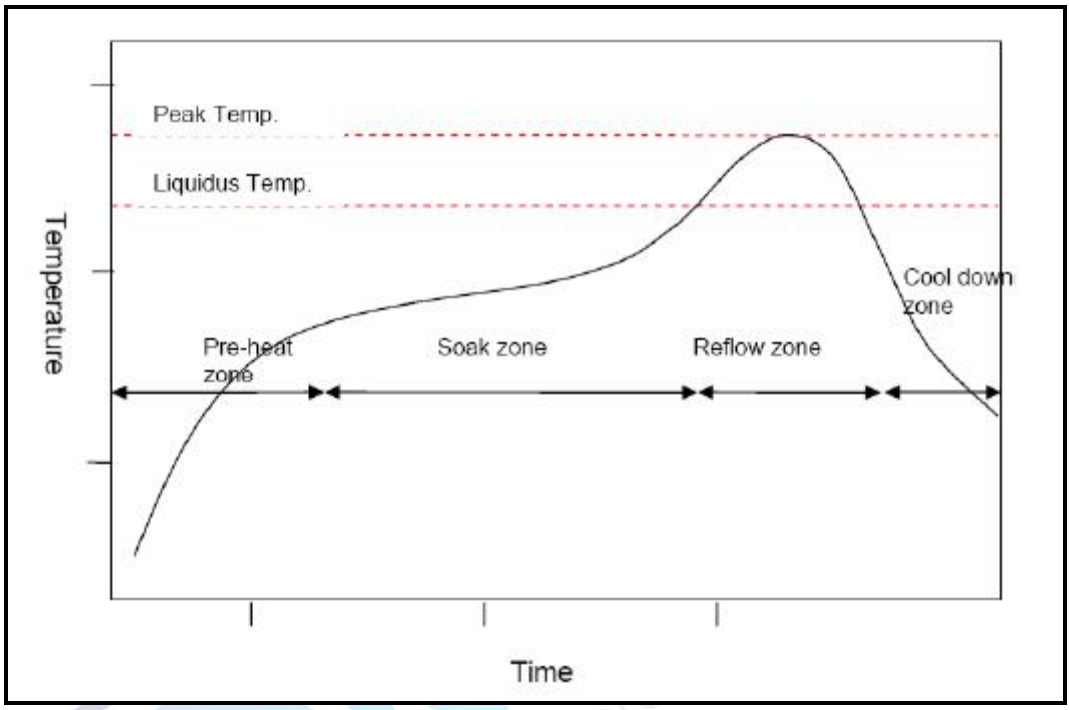


Figure 7 Typical convection reflow soldering phases and profile.

5. Basic Application Schematic

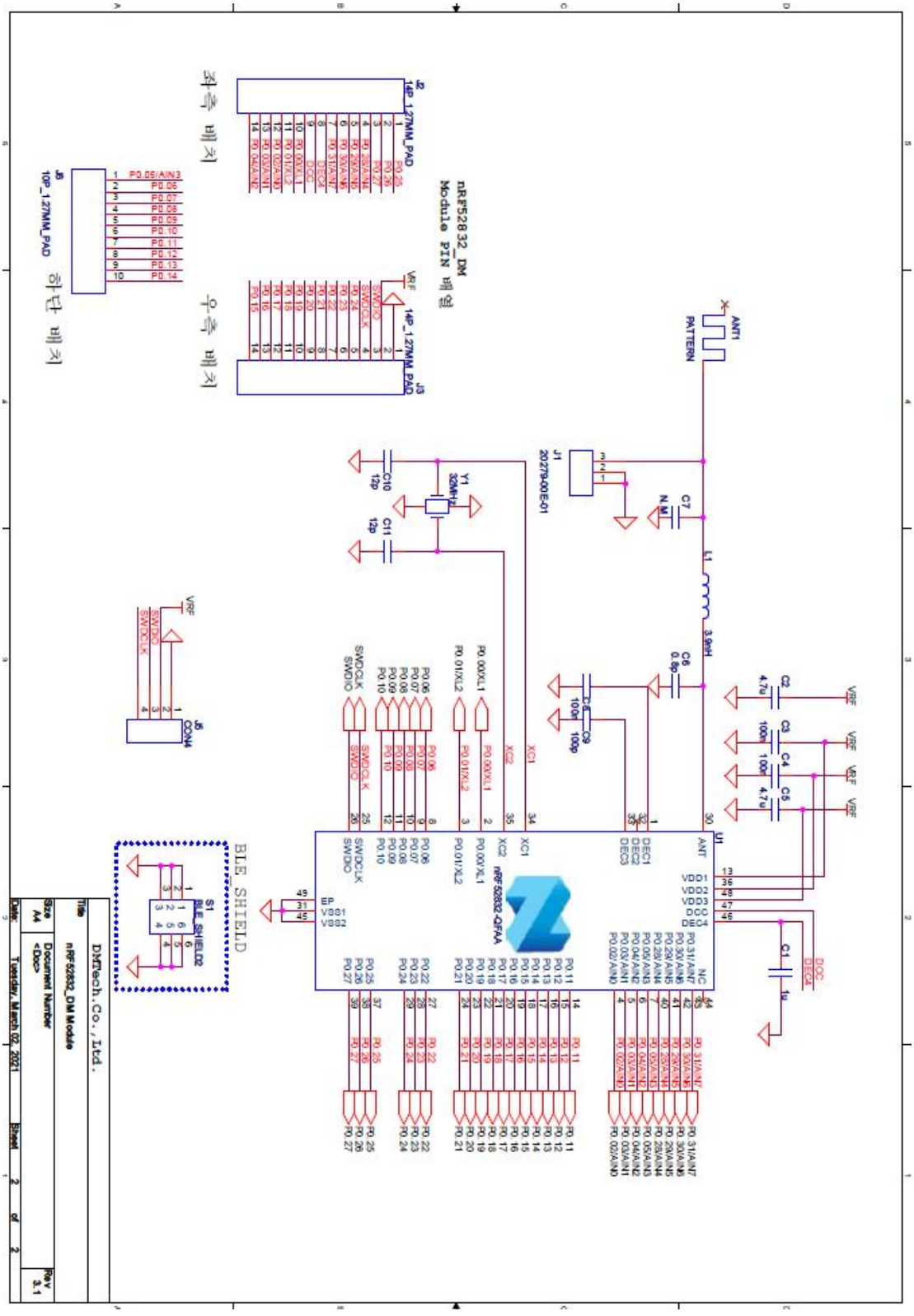


Figure 8 Schematics

5.1 ISP Connector

1.27mm 4Pin Connector
Program Download 용 으로 사용
공장 출하 시 UART 용 Firmware Download 되어 출하

5.2 RS232 to USB

Serial to USB 단자로 사용
UART 또는 AT Command 용으로 사용
P0.12 (UART RX) : TTL TX Pull up 필요
P0.11 (UART TX) : TTL RX Pull up option

5.3 전원 및 GND

nRF52832 의 공급 전원이 MAX 3.6V 이므로 LDO 를 사용하여 인가한다.
GND 는 Main GND 와 RF GND 를 분리하여 사용한다

5.4 BLE DATA

Supports 1 Mbps and 2 Mbps Bluetooth LE modes
Wide supply voltage range (1.7 V to 3.6 V)
UART 로 송신하는 Data 마지막에 0x0D 추가 필요
UART 로 송신하는 Data 에는 0x5C(₩) 사용 불가. (AT Command 와 중복)

6. Marking on Metal Shield

6.1 LABEL

Figure 9 LC QR Code

6.2 KC Registration No.

DMTECH
nRF52832DM-S
R-R-iDM-nRF52832-DM-S

Figure 10 KC Registration No.

6.3 KC Certification (South Korea)

E758-1236-E933-2298

방송통신기자재등의 적합등록 필증

Registration of Broadcasting and Communication Equipments

상호 또는 성명 *Trade Name or Registrant*	디엠테크
기자재명칭(제품명칭) *Equipment Name*	BLUETOOTH BLE 5.x Module
기기부호/추가 기기부호 *Equipment code /Additional Equipment code*	LARN8
기본모델명 *Basic Model Number*	nRF52832_DM-S
파생모델명 *Series Model Number*	
등록번호 *Registration No.*	R-R-iDM-nRF52832-DM-S
제조자/제조국가 *Manufacturer/Country of Origin*	디엠테크 / 한국
등록연월일 *Date of Registration*	2021-09-16
기타 *Others*	

위 기자재는 「전파법」 제58조의2 제3항에 따라 등록되었음을 증명합니다.

It is verified that foregoing equipment has been registered under the Clause 3, Article 58-2 of Radio Waves Act.

2021년(Year) 09월(Month) 16일(Day)

국립전파연구원장

Director General of National Radio Research Agency

※ 적합등록 방송통신기자재는 반드시 "적합성평가표시" 를 부착하여 유통하여야 합니다.
위반시 과태료 처분 및 등록이 취소될 수 있습니다.

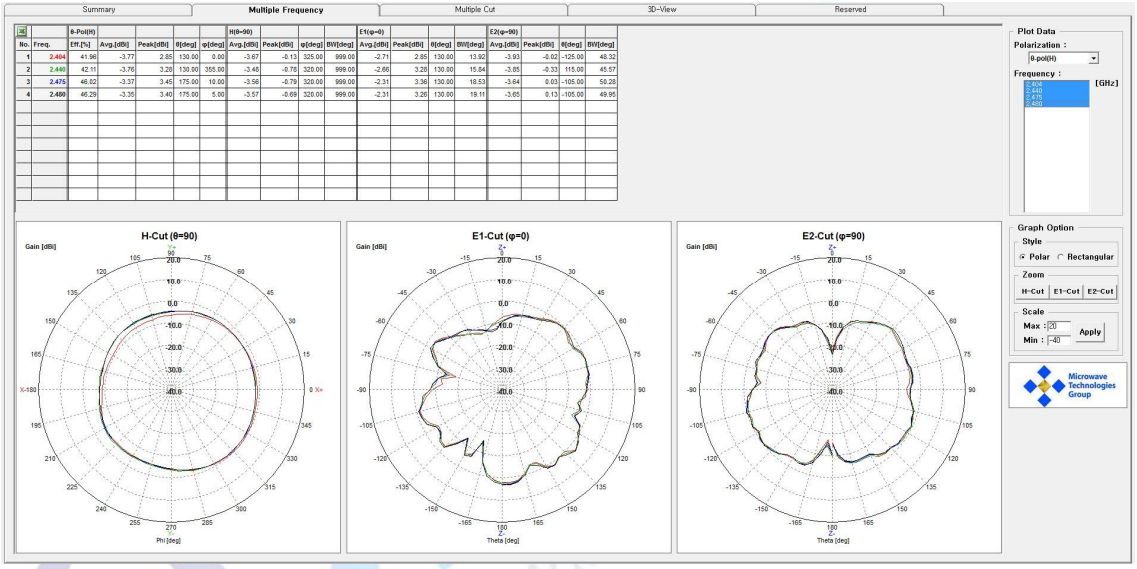
Figure 11 KC Certification

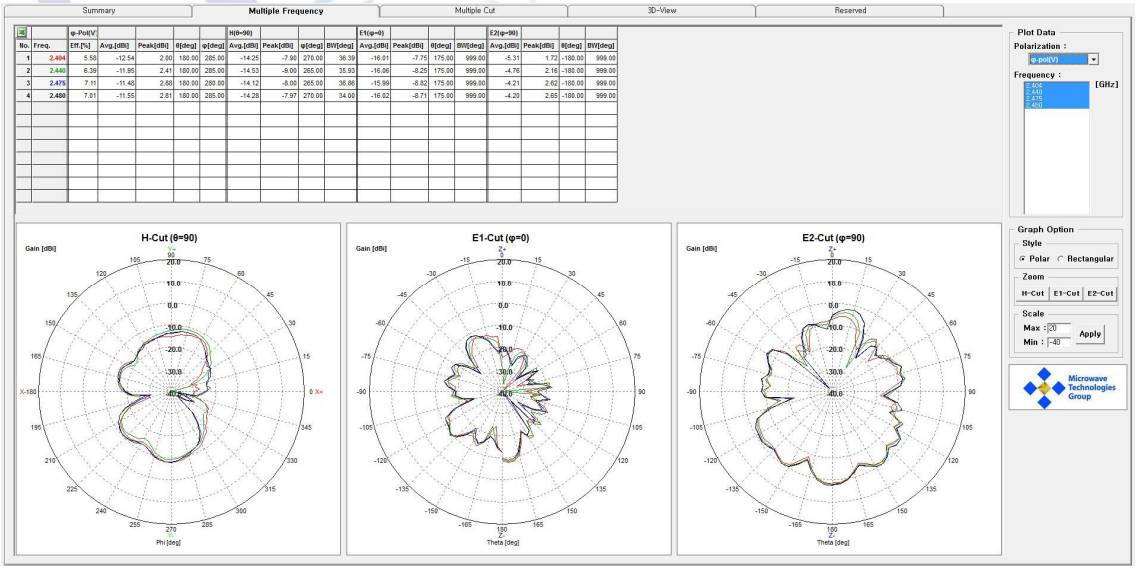
7. ANTENNA

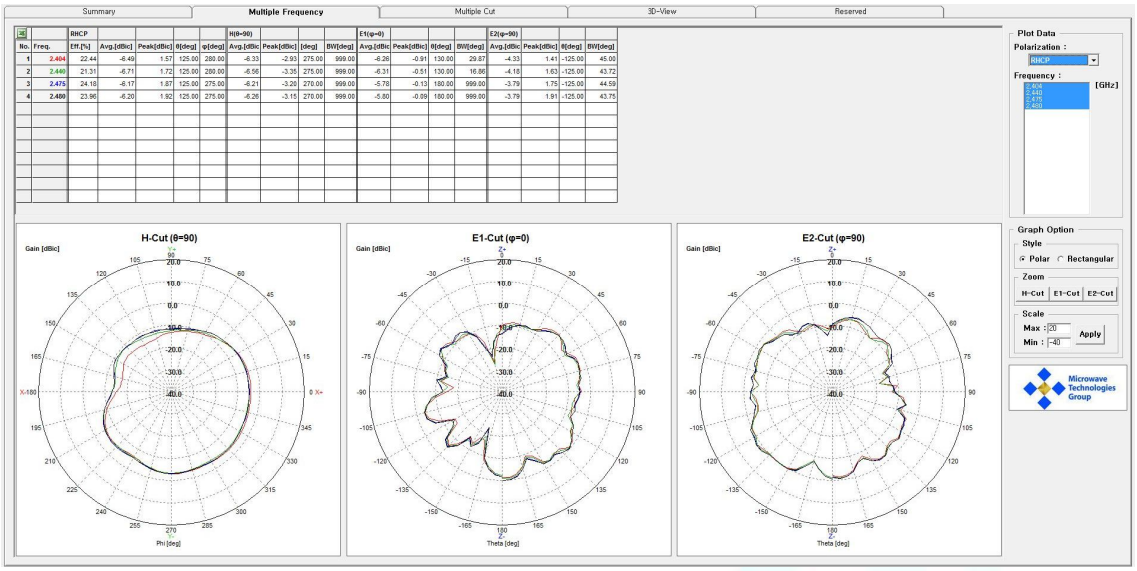
7.1 nRF52832_DM-S

Table 10 Test Result

	θ-Pol(H)					φ-Pol(V)					PwrSum				
Freq.[GHz]	Eff.[%]	Avg.[dBi]	Peak[dBi]	θ[deg]	φ[deg]	Eff.[%]	Avg.[dBi]	Peak[dBi]	θ[deg]	φ[deg]	Eff.[%]	Avg.[dBi]	Peak[dBi]	θ[deg]	φ[deg]
2.404	48.53	-3.14	2.85	130.00	0.00	10.65	-9.73	2.00	180.00	285.00	59.18	-2.28	2.89	130.00	0.00
2.440	49.61	-3.04	3.28	130.00	355.00	11.95	-9.23	2.41	180.00	285.00	61.55	-2.11	3.34	130.00	355.00
2.475	52.97	-2.76	3.45	175.00	10.00	13.47	-8.71	2.88	180.00	280.00	66.44	-1.78	3.49	175.00	10.00
2.480	52.93	-2.76	3.40	175.00	5.00	13.47	-8.71	2.81	180.00	285.00	66.40	-1.78	3.57	175.00	355.00



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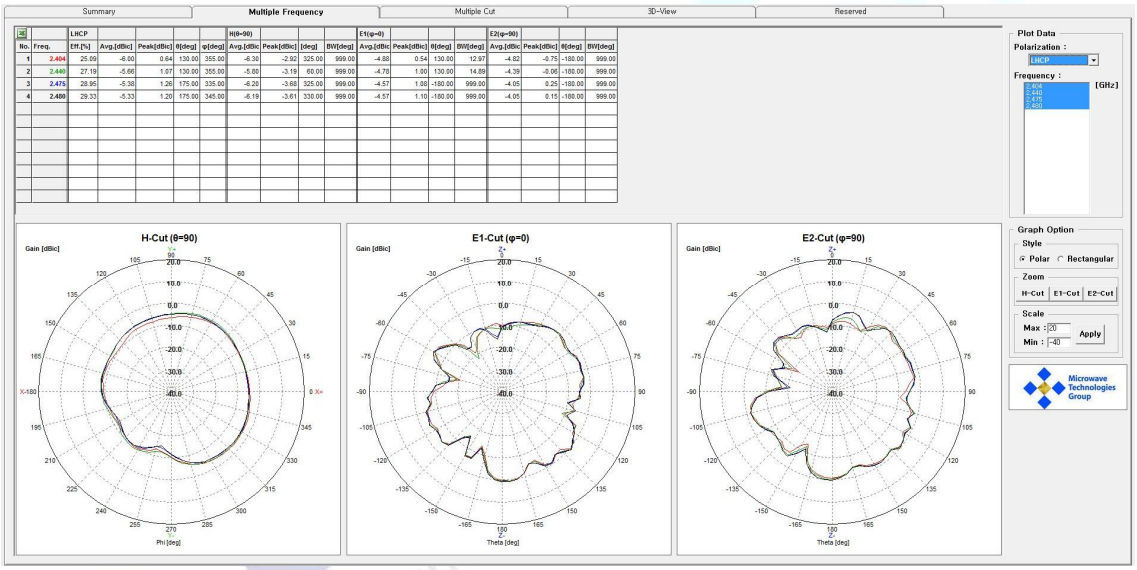
Multiple Frequency
Multiple Cut
3D-View
Reserved
RHCP
H-Cut (θ=90)
E1-Cut (φ=0)
E2-Cut (φ=90)
Plot Data
Polarization :
Frequency :
[GHz]
Graph Option
Style
Polar
Rectangular
Zoom
H-Cut
E1-Cut
E2-Cut
Scale
Max : 20
Min : -40
Apply
Microwave Technologies Group
Gain [dBic]
Phi [deg]
Theta [deg]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Multiple Cut
3D-View
Reserved
LHCP
H-Cut (θ=90)
E1-Cut (φ=0)
E2-Cut (φ=90)
Plot Data
Polarization :
Frequency :
[GHz]
Graph Option
Style
Polar
Rectangular
Zoom
H-Cut
E1-Cut
E2-Cut
Scale
Max : 20
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Apply
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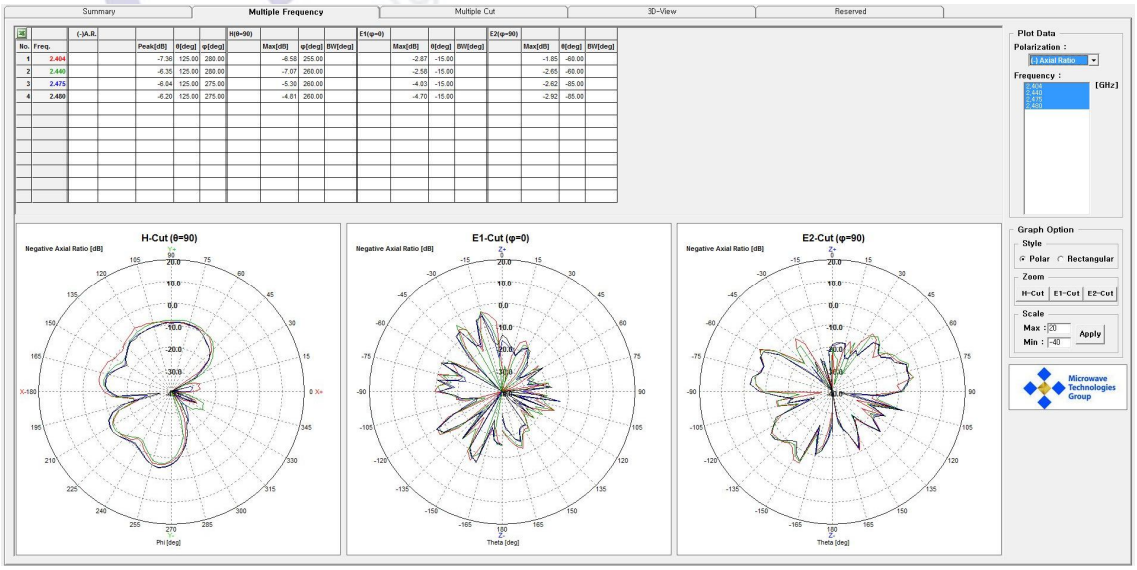
Gain [dBic]
Phi [deg]
Theta [deg]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Multiple Cut
3D-View
Reserved
(-)A.R.
H-Cut (θ=90)
E1-Cut (φ=0)
E2-Cut (φ=90)
Plot Data
Polarization :
(-) Axial Ratio
Frequency :
[GHz]
Graph Option
Style
Polar
Rectangular
Zoom
H-Cut
E1-Cut
E2-Cut
Scale
Max : 20
Min : -40
Apply
Microwave Technologies Group
Negative Axial Ratio [dB]
Phi [deg]
Theta [deg]

8. Order Code

Table 11 Ordering Code

Model	Description	MOQ	Ordering Code
nRF52832_DM-S	BLE5.x Module	500Pcs	nRF52832_DM-S-500R
nRF52832_DM-S	BLE5.x Module		nRF52832_DM-S

9. References

[1] nRF52832_Product Specification V1.4 for NORDIC.

[2] nRF52 BLE Module AT Command List (V1.0.1)

10. Contact Information

Sales :

thkim@dmtech.ne.kr

Office :

Tel. 032-684-7270

Fax. 032-684-7271

Address :

#1419, Sambo Techno Tower, 122, Jomaru-ro, 385 beon-gil,
Bucheon-si, Gyeonggi-do, Korea.