TX-M2540 Datasheet

Zigbee + BLE5.0 Combo Module

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Revision History

Revision	Date	Description
0.0	2018.11.09	Draft version release
1.0	2019.07.08	Initial release
2.0	2022.04.07	Renewal

Table of Contents

1. Scope

The TX-M2540 is Bluetooth LE + IEEE802.15.4 multi-standard wireless solution with internal Flash and audio support, which combines the features and functions needed for all 2.4GHz IoT standards into a module. The TX-M2540 combines the radio frequency (RF), digital processing, protocols stack software and profiles for multiple standards into a module. The module supports standards and industrial alliance specifications including Bluetooth Low Energy (up to Bluetooth 5), BLE Mesh, 6LoWPAN, Zigbee, RF4CE, HomeKit and 2.4GHz proprietary standard.

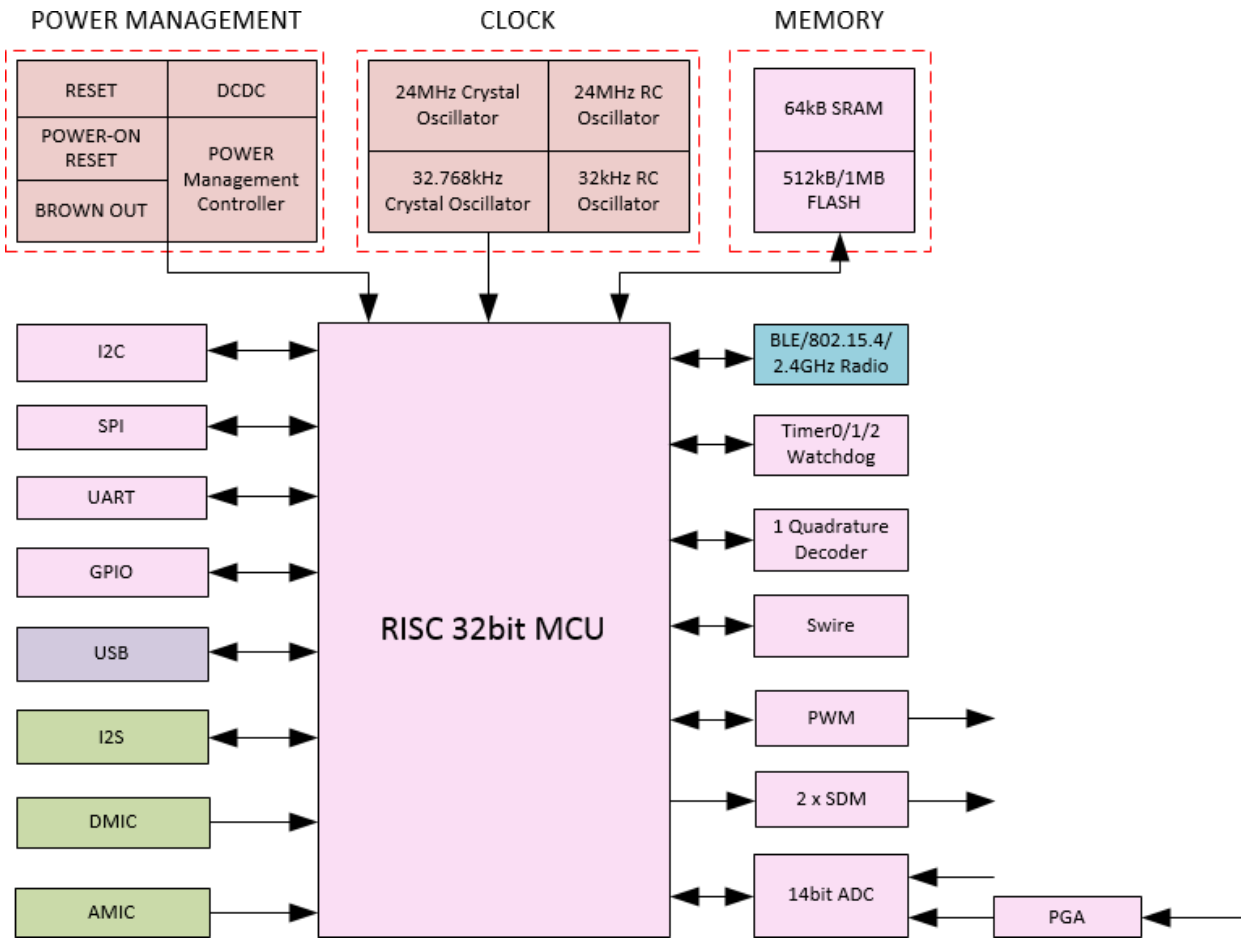
Application :

- Smartphone and tablet accessories
- RF Remote control
- Sports and fitness tracking
- Wearable devices

2. Features

- Embedded32-bit high performance MCU with clock up to 48MHz.
- Program memory: internal 512KB Flash
- Data memory: 64KB on-chip SRAM.
- 24MHz & 32.768KHz Crystal and 32KHz/24MHz embedded RC oscillator.
- Up to +10dBm TX power.
- RX sensitivity: -96 dBm @ BLE 1 Mbps, -99.5 dBm @ IEEE 802.15.4 250 kbps mode
- Up to 32 GPIOs
- DMIC (Digital Mic).
- AMIC (Analog Mic)
- Stereo audio output.
- UART with hardware flow control
- SPI/ I2C/ I2S/ USB/ Debug Interface.
- Up to 6 channels of PWM, 1-channel IR.
- Sensor: 14-bit 10-channel (only GPIO input) SAR ADC, with 4-channel differential input PGA/Temperature sensor.
- One quadrature decoder.
- Embedded hardware AES.

3. Block Diagram

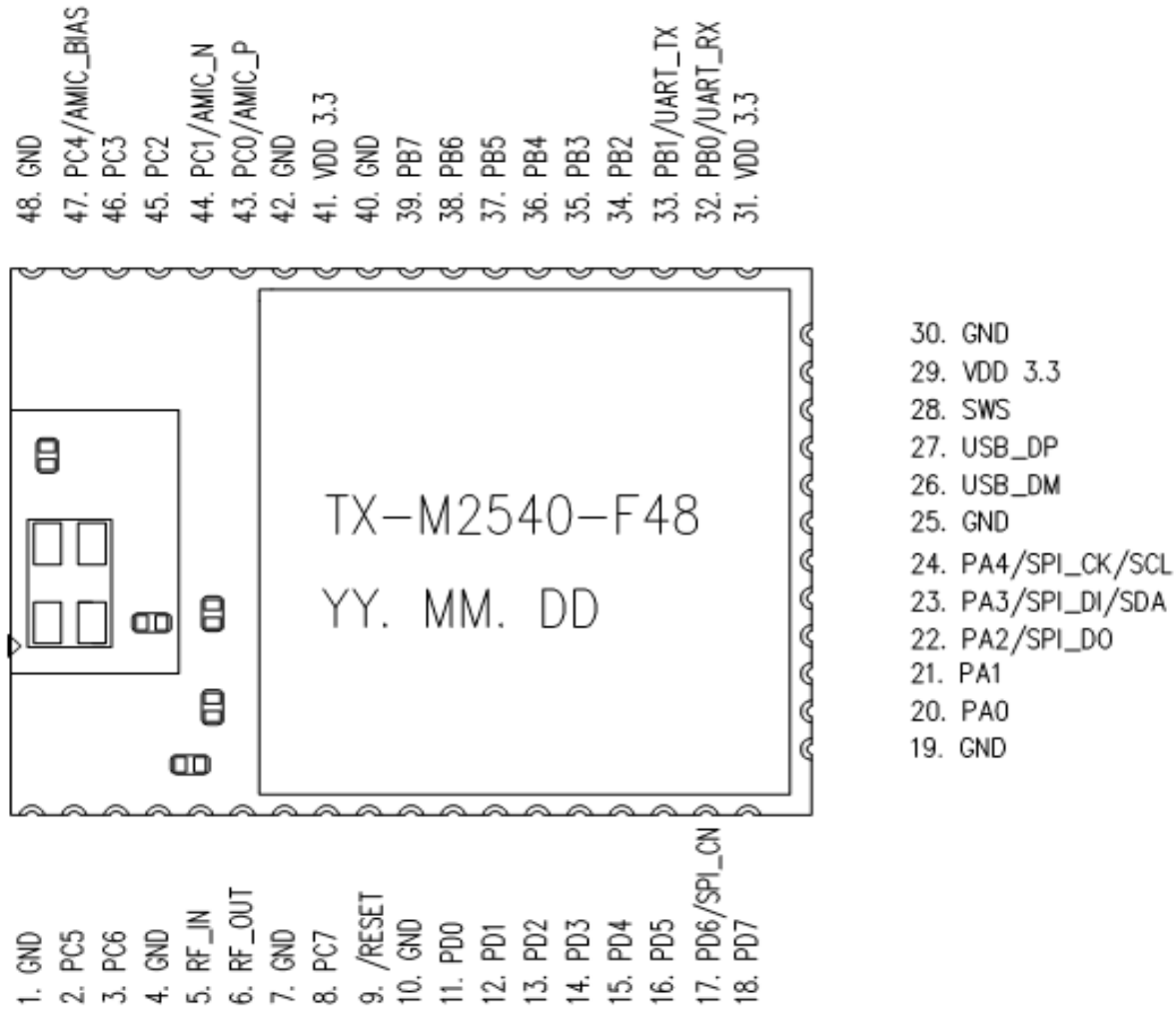


4. Product Information

4.1 Temperature Information

- Operating temperature	-40℃ ~ +85℃
- Storage temperature	-40℃ ~ +125℃

5. Pin Description



Pin	Name	Type	Description
1	GND	GND	Ground
2	PC5	I/O	PC[5] / PWM3 inverting output / SAR ADC input
3	PC6	I/O	PC[6] / PWM4 inverting output
4	GND	GND	Ground
5	RF_IN	RF_IN	RF_input (connect to 'RF_out' when using chip ANT)
6	RF_OUT	RF_OUT	RF_ out
7	GND	GND	Ground
8	PC7	I/O	PC[7] / PWM5 inverting output
9	/RESET	Reset	Power on reset, Active low
10	GND	I/O	Ground
11	PD0	I/O	PD[0]
12	PD1	I/O	PD[1]
13	PD2	I/O	PD[2] / I2S_LR / PWM3 output
14	PD3	I/O	PD[3] / I2S_SDI
15	PD4	I/O	PD[4] / I2S_SDO
16	PD5	I/O	PD[5]
17	PD6/SPI_CN	I/O	PD[6] / SPI_CN (Active low)
18	PD7	I/O	PD[7] / I2S_BCK / I2C_SCK
19	GND	GND	Ground
20	PA0	I/O	PA[0] / PWM[0] inverting output
21	PA1	I/O	PA[1] / I2S_CLK
22	PA2/SPI_DO	I/O	PA[2] / SPI_DO / PWM0 output
23	PA3/SPI_DI	I/O	PA[3] / SPI_DI / PWM1 output
24	PA4/SPI_CK	I/O	PA[4] / SPI_CK / PWM2 output
25	GND	GND	Ground
26	USB_DM	I/O	USB_DM / PA[5]
27	USB_DP	I/O	USB_DP / PA[6]
28	SWS	I/O	Single Wire Slave / PA[7]
29	VDD	PWR	3.3V Power Supply
30	GND	GND	Ground
31	VDD	PWR	3.3V Power Supply
32	PB0/UART_RX	I/O	PB[0] / UART_RX / PWM3 output
33	PB1/UART_TX	I/O	PB[1] / UART_TX / PWM4 output
34	PB2	I/O	PB[2] / UART_CTS / PWM5 output / SAR ADC input
35	PB3	I/O	PB[3] / UART_CTS / SAR ADC input

Pin	Name	Type	Description
36	PB4	I/O	PB[4] / SDM_P0 / PWM4 output / SAR ADC input
37	PB5	I/O	PB[5] / SDM_N0 / PWM5 output / SAR ADC input
38	PB6	I/O	PB[6] / SDM_P1 / SAR ADC input
39	PB7	I/O	PB[7] / SDM_N1 / SAR ADC input
40	GND	GND	Ground
41	VDD	PWR	3.3V Power Supply
42	GND	GND	Ground
43	PC0/AMIC_P	I/O	PC[0] / Analog MIC Left positive input
44	PC1/AMIC_N	I/O	PC[1] / Analog MIC Left negative input
45	PC2	I/O	PC[2] / Analog MIC right positive input
46	PC3	I/O	PC[3] / Analog MIC right negative input
47	PC4/AMIC_BIAS	I/O	PD[0] / AMIC_BIAS
48	GND	GND	Ground

6. Electrical Specification

6.1 Absolute Maximum Rating

Item	Min	Max	Unit
Supply Voltage	-0.3	3.6	V
Voltage on input Pin	-0.3	VDD+0.3	V
Output Voltage	0	VDD	V
Storage temperature Range	-65	150	℃

CAUTION: Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

6.2 Recommended Operating condition

Item	Min	Typ	Max	unit	Condition
Power Supply Voltage	1.8	3.3	3.6	V	
Supply rise time (from 1.6V to 2.8V)			10	ms	
Operating temperature range		-40	85	℃	

6.3 Current Consumption

Item	Min	Typ	Max	unit	Condition
Tx	-	4.8	-	mA	Whole chip @ 0 dBm with DCDC
Rx	-	5.3	-	mA	Whole chip
Deep sleep with 8 KB SRAM retention	-	1.0	3.1	uA	Without 32K
Deep sleep with 16 KB SRAM retention	-	1.2	3.3	uA	
Deep sleep with 32KB SRAM retention	-	1.4	3.5	uA	
Deep sleep without SRAM retention	-	0.4	-	uA	

6.4 AC characteristics

6.4.1 Digital inputs/outputs

Item	Min	Typ	Max	unit	Condition
Input high voltage	0.7VDD	-	VDD	V	
Input low voltage	VSS	-	0.3VDD	V	
Output high voltage	0.9VDD	-	VDD	V	
Output low voltage	VSS	-	0.1VDD	V	

6.4.2 USB Characteristics

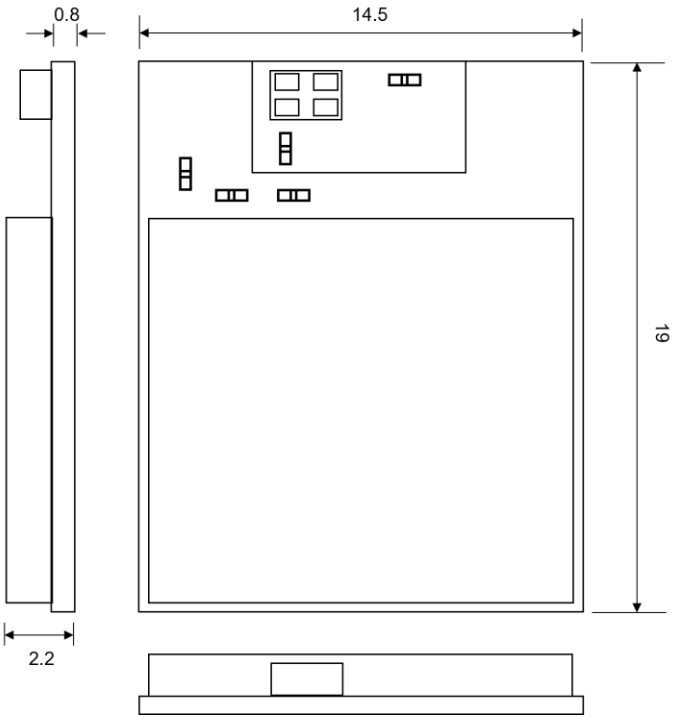
Item	Min	Typ	Max	unit	Condition
USB Output Signal Cross-over Voltage	1.3	-	2.0	V	

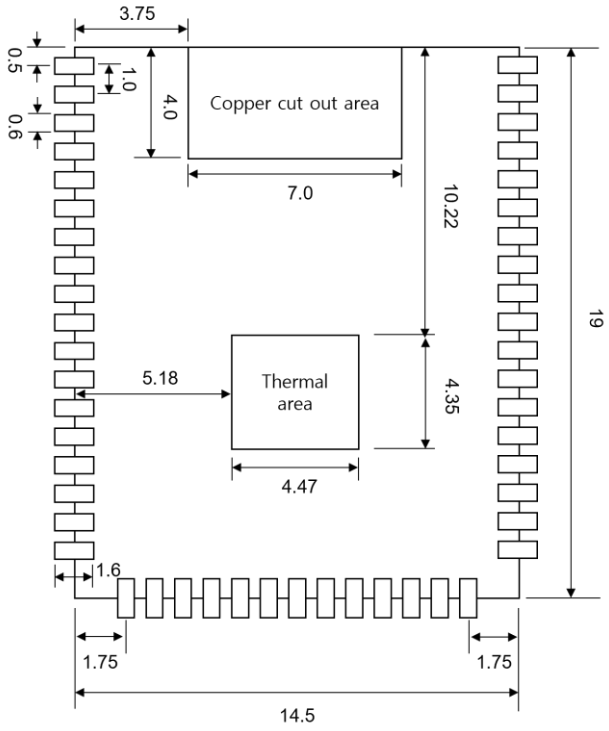
7. RF Specification

Nomal Condition : T=25℃, VDD=3.3V

Item		Min	Typ	Max	unit	Condition
RF frequency range		2380		2500	MHz	Programmable in 1MHz step
Data rate		BLE/2.4G proprietary 1Mbps, ±250kHz deviation BLE/2.4G proprietary 2Mbps, ±500kHz deviation BLE 125kbps, ±250kHz deviation BLE 500kbps, ±250kHz deviation IEEE 802.15.4 250kbps, ±500kHz deviation 2.4G proprietary 500kbps, ±125kHz deviation 2.4G proprietary 250kbps, ±62.5kHz deviation				
BLE 1Mbps RF_Rx Performance (±250kHz Deviation)						
Sensitivity	1Mbps		-96		dBm	
Frequency offset tolerance		-250		+300	kHz	
Co-channel rejection			11		dB	Wanted signal at -67dBm
In-band blocking rejection (equal modulation interference)	+1/-1MHz offset		-1/-3		dB	Wanted signal at -67dBm
	+2/-2MHz offset		-37/-39		dB	
	≥3MHz offset		-42		dB	
Image rejection			-37		dB	Wanted signal at -67dBm
BLE 1Mbps RF_Tx Performance						
Output power, maximum setting			10	12	dBm	
Output power, minimum setting			-45		dBm	
Programmable output power range		55			dB	
Modulation 20dB bandwidth			1.4		MHz	
IEEE 802.15.4 250kbps RF_Rx Performance (±500kHz Deviation)						
Sensitivity	250kbps		-99.5		dBm	
Frequency offset tolerance		-300		+300	kHz	
Adjacent channel rejection (-1/+1 channel)			-42/-42		dB	Wanted signal at -82dBm
Adjacent channel rejection (-2/+2 channel)			-42/-42		dB	Wanted signal at -82dBm
IEEE 802.15.4 250kbps RF_Tx Performance						
Output power, maximum setting			10	12	dBm	
Output power, minimum setting (resolution)			-45		dBm	
Programmable output power range		55			dB	
Modulation 20dB bandwidth			2.7		MHz	
Error vector magnitude (EVM)				2	%	Max(10dBm) power output

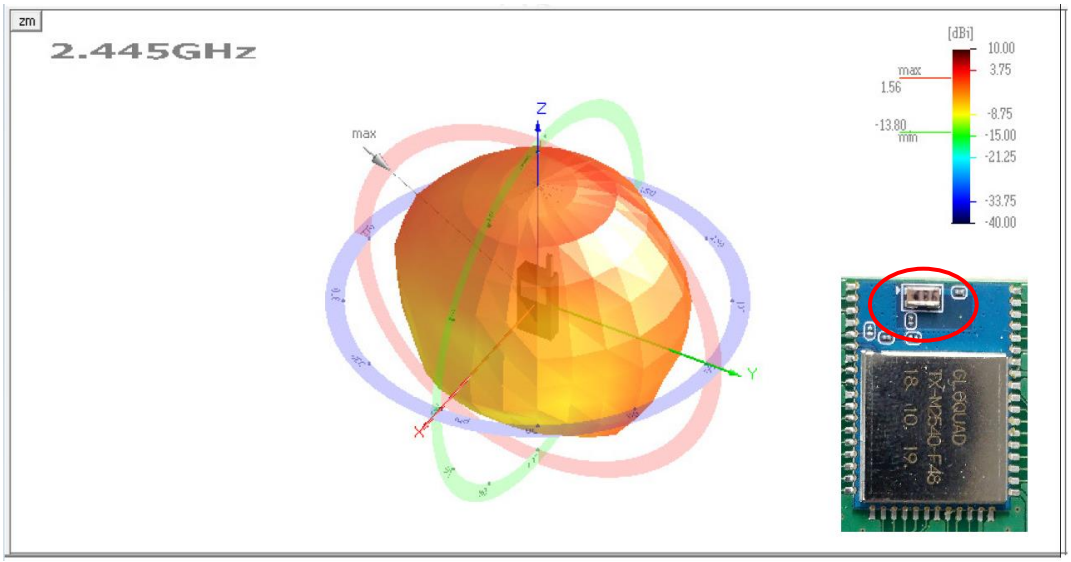
8. Physical Dimensions (Unit :mm)





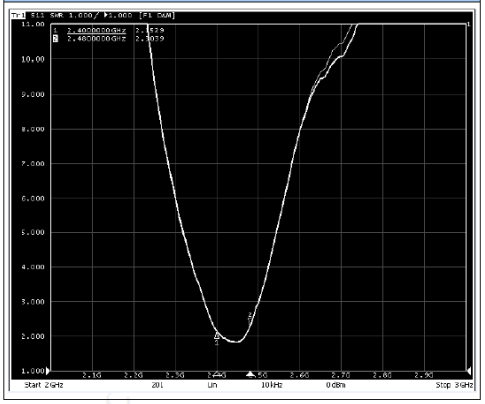
9. Chip ANT 3D Radiation Pattern

9.1 Antenna Gain

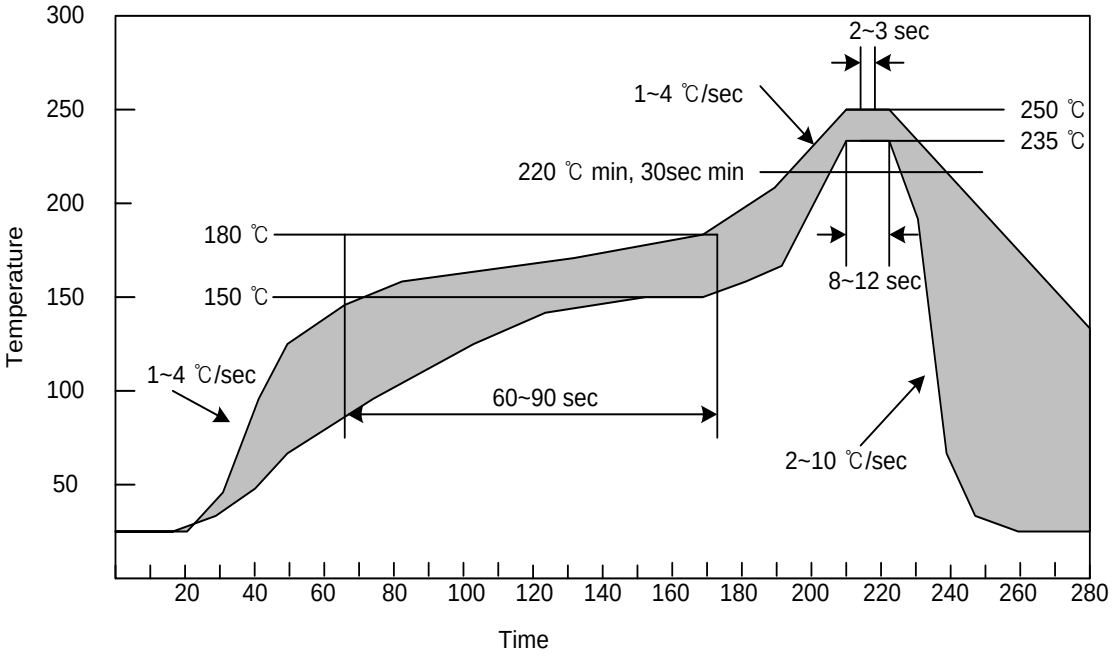


	Peak[dBi]	Average[dBi]	Efficiency(%)
2400MHz	-0.07	-3.54	44.22
2425MHz	1.18	-2.45	56.90
2445MHz	1.56	-2.05	62.32
2465MHz	0.62	-2.99	50.23
2485MHz	1.33	-2.41	57.36

VSWR

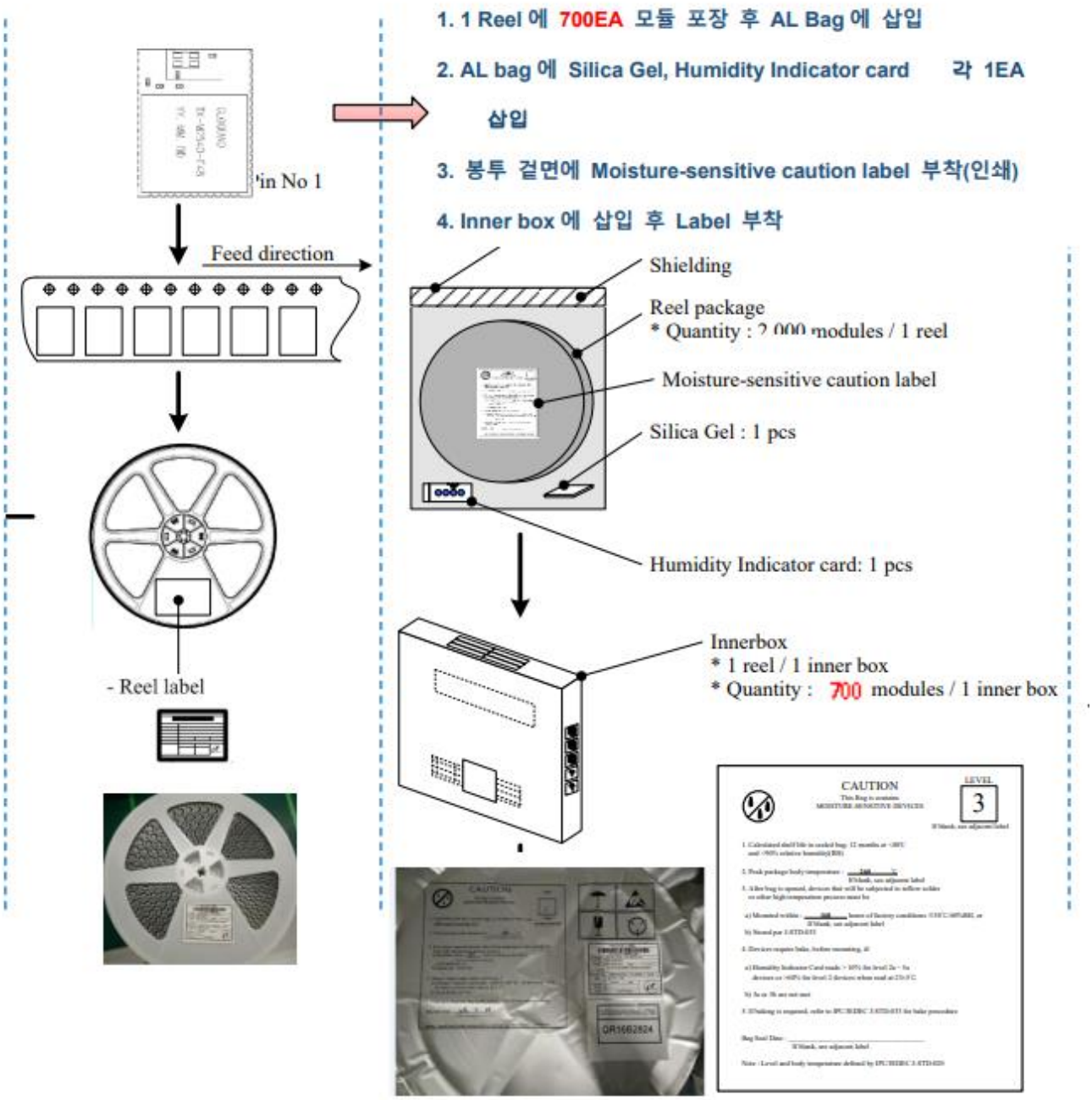


10. SMT Temperature Sequence (Pb-free)



Process	Parmeter	Data
Reflow Profile	Conveyer Speed	min 0.8m/min max 0.95m/min
	02 농도	3000 ppm以下
	Pre-Heating	150~180℃[60~90sec]
	Heating	220℃[30~60sec]
	Peak	235~250℃

11. Packing Information



1. 5EA Inner box 를 1EA 의 Outer box 에 삽입 후 Label 부착

(수량 : 700EA Modules * 5EA Inner box = 3,500EA Modules)

2. Outer box 에 Label 부착