

To KLT

Approval Number

ISSUE

1

RoHS

H/F

APPROVAL SHEET



Model : APP-B2452-EK-0001

Part Name : LK-EXPL r (Bluetooth/BLE)

Part Number : AWA-00017

KLT Part No. :

KLT Approval		Reviewer	Consensus	Approver
	Department			
	Name			
	signature			

Supplier Approval		Writer	Reviewer	Approver
	Department	R&D	R&D	
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	signature			

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Approval list

Revision history	Date	Item	Contents	REV.
ISSUE 1.0	2025.04.30	—	First publication	A
Issue ___ → ___				
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1. Summary

This approval document establishes electrical & mechanical specifications for AWAVE company antennas to be mounted on to the KLT Automatic Grease Dispenser, and any changes or modifications to the approval documents may be reflected under consultation between AWAVE and KLT.

2. General Specifications

2-1. Description and Model

- 1) Model : APP-B2452-EK-0001 (LK-EXPL r) (Automatic Grease Dispenser)
- 2) Frequency Band: Antenna for Bluetooth / BLE band support
- 3) Ant. Type : Press
- 4) Size (Width X Length X Thickness) : 15.35mm X 3.70mm X 7.40mm
- 5) Weight : 0.34g
- 6) Contact type : Soldering
- 7) Material : SUS304 (0.5T)
- 8) Operating temperature : -30°C ~ +80°C

2-2. Parameter definition

- 1) Frequency Range
 - Bluetooth / BLE

SYSTEM	Frequency
Bluetooth / BLE	2400MHz ~ 2480MHz

2) Radiation pattern

- 2D Radiation pattern (Gain)

3) dBi : dB(Decibel) + I(Isotropic Source)

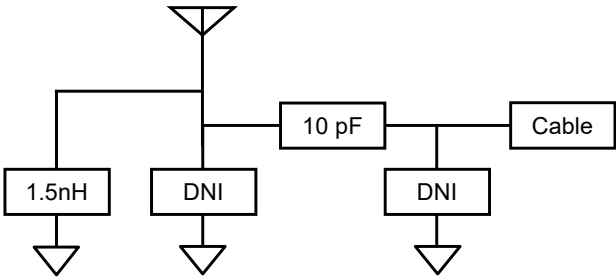
4) VSWR : Voltage Standing Wave Ratio

5) $W[\text{Power}] = V[\text{Voltage}] \cdot A[\text{Ampere}]$

3. Electrical specification

- 1) Matching Impedance : 50Ω
- 2) Polarization : Vertical
- 3) Radiation Pattern : Omni-Directional
- 4) Max Power : 2 Watt
- 5) VSWR

SET JIG (LK- EXPL r) - Start : 2000MHz, Stop : 3000MHz (Protek A338)

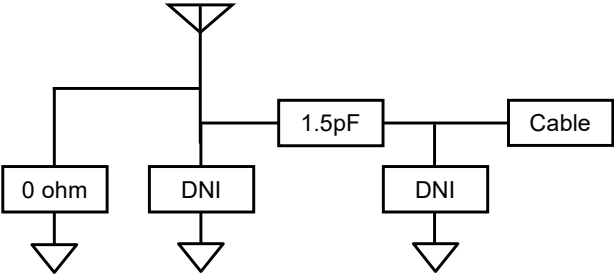
Electrical Specification				
Bluetooth / BLE				
Frequency		2400 MHz	2440 MHz	2480 MHz
VSWR	SET JIG	3.0 : 1 Less than	3.0 : 1 Less than	3.0 : 1 Less than
Gain	Avg. [dB]	-4.6 dB Greater than	-5.1 dB Greater than	-4.8 dB Greater than
	Peak.[dB]	-1.0 dB Greater than	-1.6 dB Greater than	-0.2 dB Greater than
Set Jig Matching Value				

3D GAIN DATA

BT(2400~2480MHz)

Frequency [MHz]	2400	2440	2480
Average Gain [dBi]	-3.65	-4.10	-3.91
Efficiency [%]	43.1	38.9	41.7
Peak Gain [dBi]	-0.01	-0.62	0.21

Single- Product JIG (LK- EXPL r) - Start : 1000MHz, Stop : 1800MHz (Protek A338)

Electrical Specification			
		<i>Bluetooth / BLE</i>	
Frequency		<i>1350 MHz</i>	<i>1450 MHz</i>
VSWR	SET JIG	3.7 : 1 Less than	3.7 : 1 Less than
Single Product Jig Matching Value			

6) Radiation Pattern Note1) Note2) : Refer to Attachment 1.

※ Note 1), Note 2) are items guaranteed by the VSWR values in the electrical characteristics.

7) Pattern Category

7-1) Bluetooth / BLE

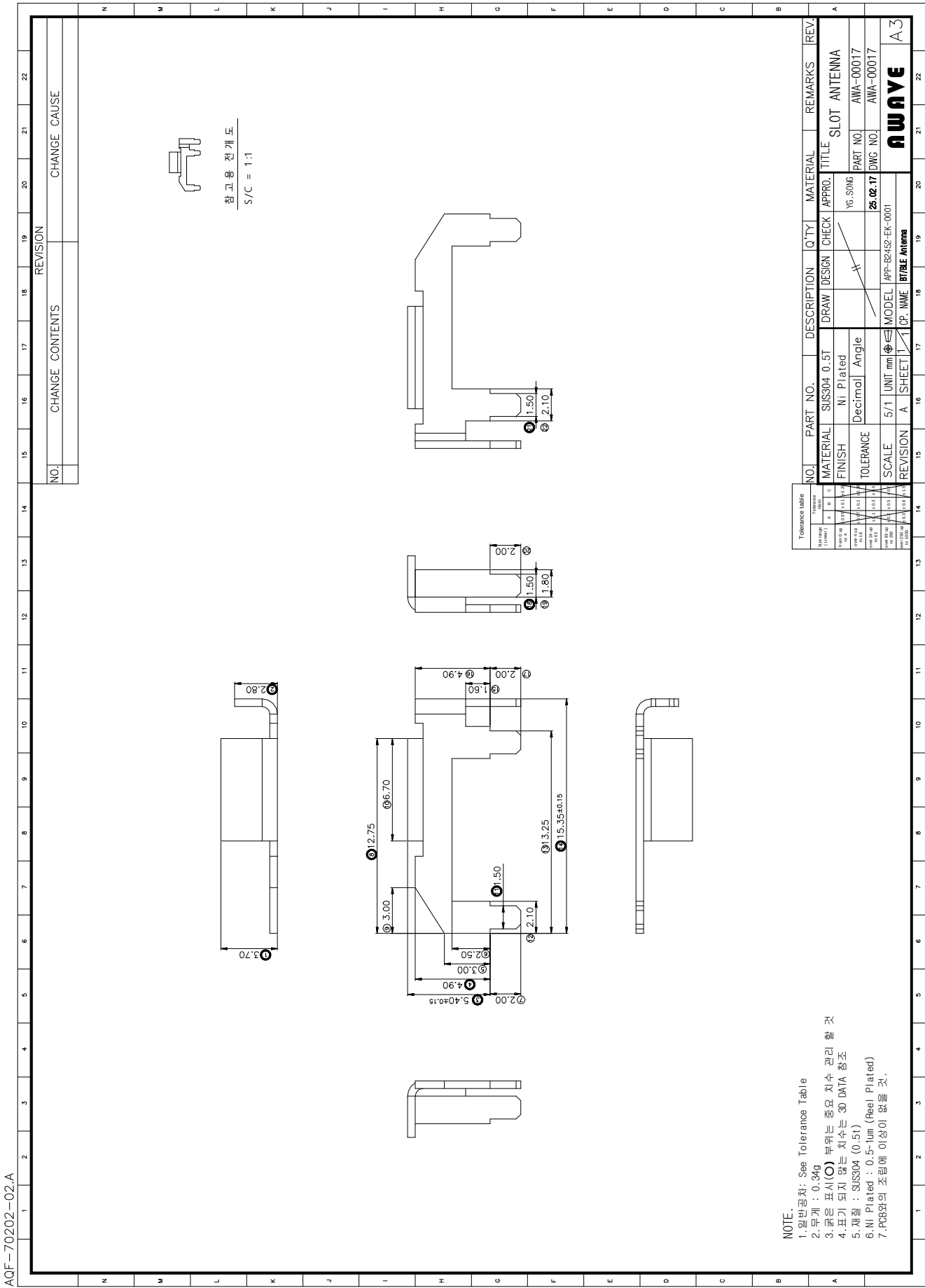


(Front)



(Back)

4. Mechanical specification



5. Test method and evaluation standard

1) Appearance

There should be no cracks, marks, corrosion, etc. on the exterior of the antenna, and the specifications (standard, pattern, marking, etc.) stated in the approval source Should be consistent.

2) Outline dimensions and design

The outline dimensions and design specifications are in accordance with the mechanical drawings in Mechanical specification.

3) VSWR

	Test condition			Q'ty	Result	Remarks
VSWR	Band	Frequency		20	VSWR Spec.	
		BT / BLE				
	VSWR (Single Part JIG)	1350 MHz	1450 MHz			
	3.7 : 1 Less than	3.7 : 1 Less than				

6. Part List

PART LIST						Approval		Created by	Check by	Proved by
										
										3/20
	Customer	KLT	Item	Antenna	Created date	2025. 03. 20		Revision	1	
	Model Name	APP-B2452-EK-0001	Model Number	AWA-00017	Created	Y.G.SONG		Update date		
	Part Name	Part Number	Size	Material	Finish	Color	Manufacturing method	Quantity	Name of company	
1	SLOT	AWA-00017	15.35X3.70X7.40	SUS304(0.5t)	Ni-P	-	Press	1	Yuhan	
2	REEL	-	Φ330 X 80	PS	-	-	-	11/6,600		
3	Carton Box	-	500 X 380 X 370	Kraft Paper	-	-	-	1/6,600		
4										
5										

7. Warranty and Post-Support

AWave is responsible for defects or defects in components that occur during the warranty period of the product from the date of supply, and excludes other problems caused by malfunction or misuse of the equipment from the warranty.

Type	Storage conditions (temperature, humidity)	Expiration date (finished product)
LDS / LMA / LPA	Temperature : 20°C±15°C , Humidity : 50±30%	24 months
SIMA		24 months
STS		24 months
FPCB	Temperature : 15°C~30°C, Humidity : 50±10%	12 months
NFC		12 months

8. Environment and precautions for use

1) Storage

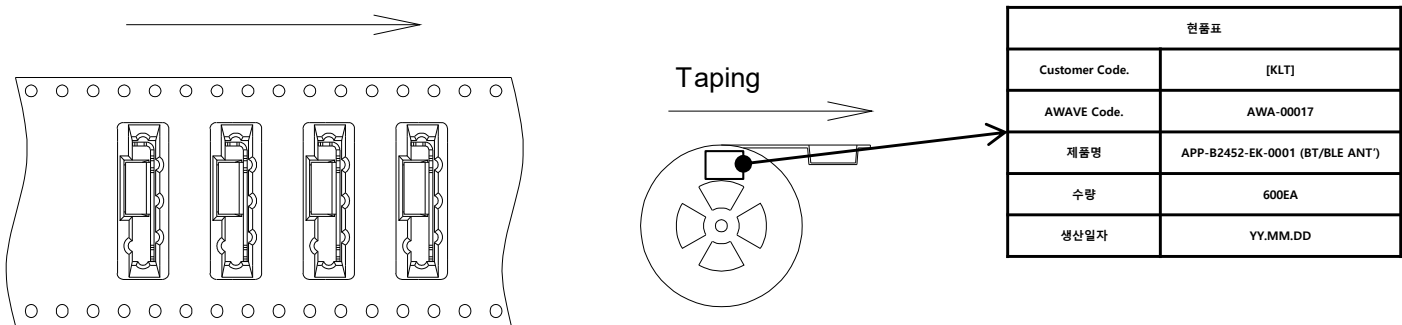
- (1) Avoid hot and humid areas..
- (2) Avoid place with highly corrosive hydrogen sulfoxide gas.
(Sulfuric acid, chlorine, ammonia, etc.) Acid corrodes the appearance of the antenna and may degrade performance)

2) Transportation

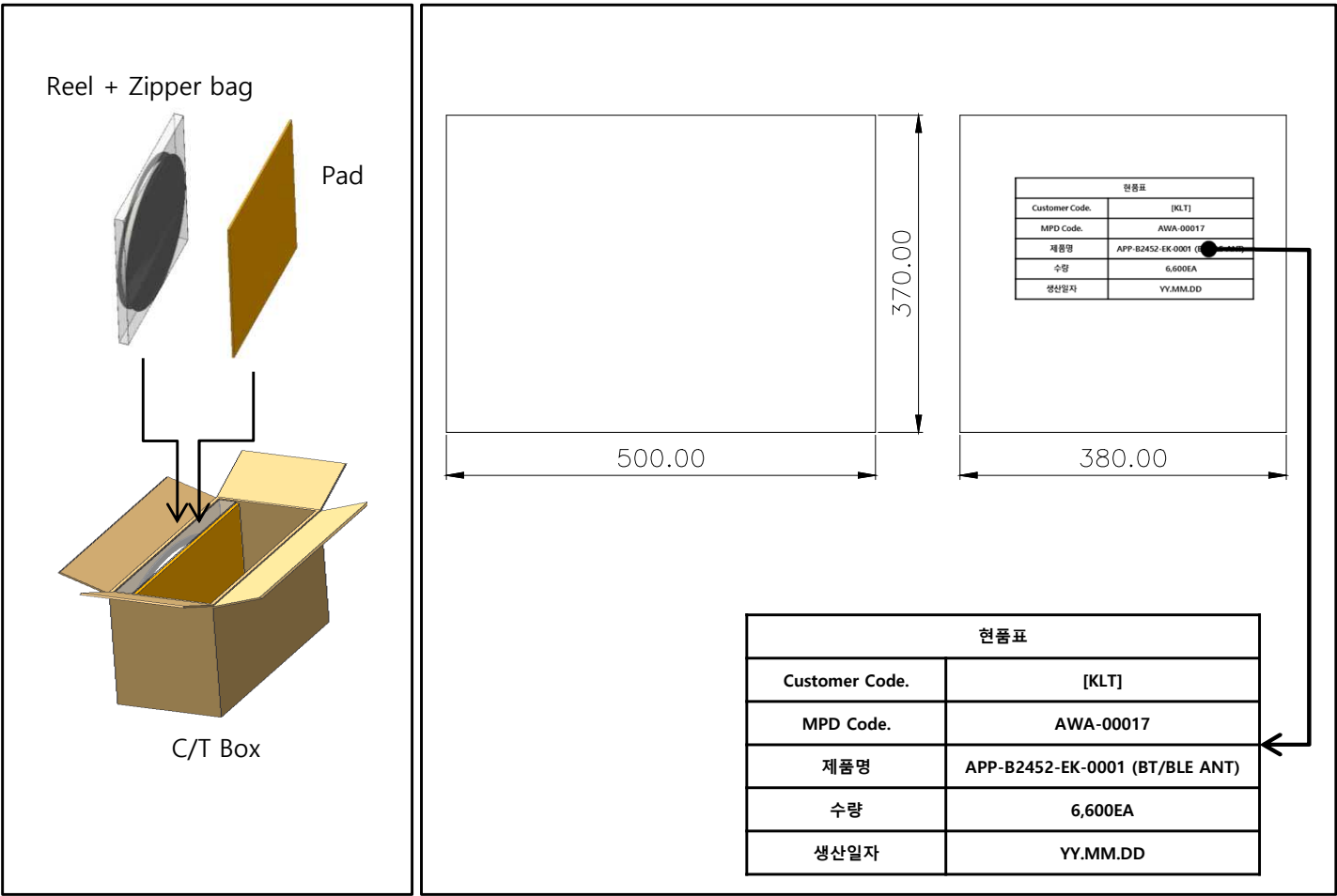
- (1) If the contact terminal of the antenna is bent or pressed, the contact may be unstable and the characteristics may be reduced.
- (2) Do not touch the antenna directly with your bare hands when transporting it.
(If you touch the antenna with your own hands, fingerprints may get on the antenna.
This fingerprint can cause corrosion on the antenna surface)

9. Packing

1) Reel Packing



2) C/T BOX Packing



- PART LIST

NO	PART NO	DESCRIPTION	Q'TY	MATERIAL	REMARKS	REV.
1	-	REEL	11/6,600	PS	N/A	A
2	-	ZIPPER BAG	11/6,600	LDPE	N/A	A
3	-	PAD	10/6,600	KLB Paper	N/A	A
4	-	CARTON BOX	1/6,600	KLB Paper	N/A	A

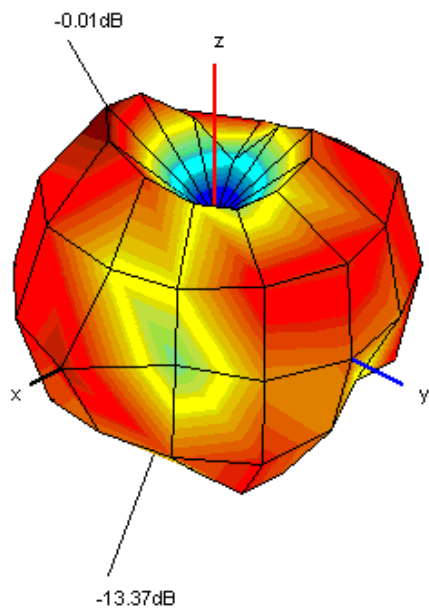
Appendix

Appendix 1. Antenna Radiation Pattern

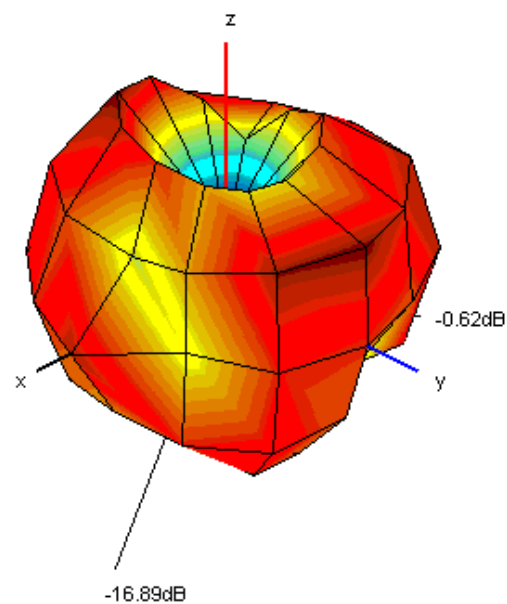
< LK- EXPL r > 3D Passive gain & Radiation Pattern

	1	2	3	4	5	6	7	8	9	10	11	12
Frequency [MHz]	2360	2380	2400	2420	2440	2460	2480	2485	2500	2520	2540	2560
Efficiency [dB]	-3.59	-3.84	-3.65	-3.92	-4.10	-3.71	-3.79	-3.91	-4.06	-4.04	-3.82	-3.98
Efficiency [%]	43.8	41.3	43.1	40.5	38.9	42.6	41.7	40.7	39.2	39.4	41.5	40.0

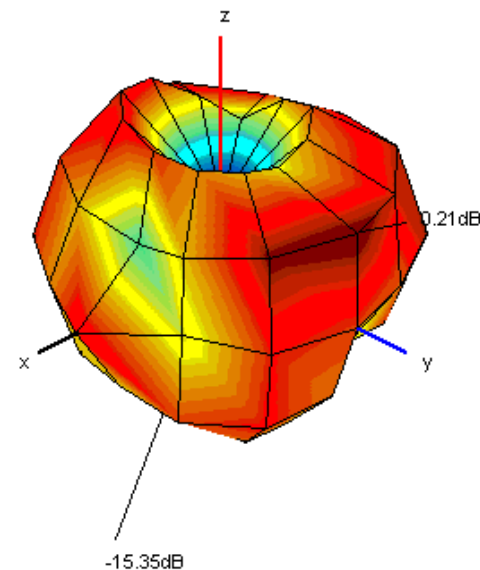
@2400 MHz



@2440 MHz



@2480 MHz



Appendix 2. Antenna Electrical Specification Test Procedure(VSWR)

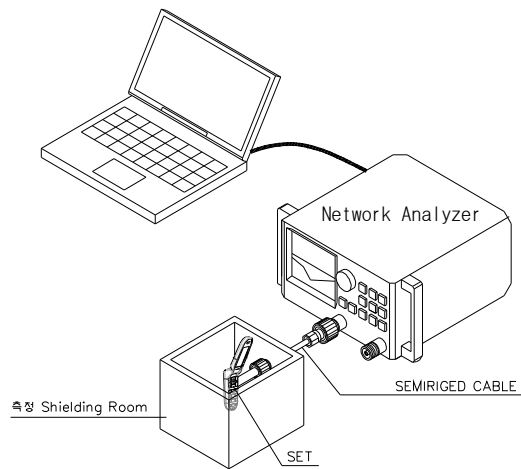
1. VSWR (Maximum)

1- 1) (SET Jig) Data on the Measurement Jig for Electrical Characteristics

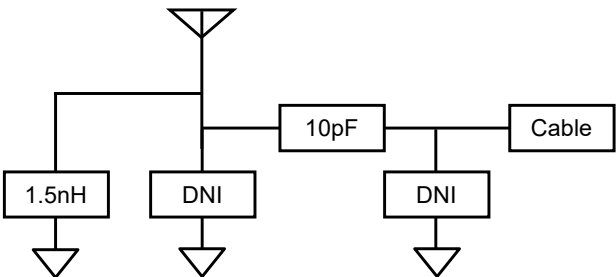
The VSWR measurement data of the assembled set may vary depending on assembly deviations, and therefore, the VSWR requirements of the measurement jig specified below must be met.

SET JIG (LK- EXPL r) - Start : 2000MHz, Stop : 3000MHz (Protek A338)

Electrical Specification				
		Bluetooth / BLE		
Frequency		2400 MHz	2440 MHz	2480 MHz
VSWR	SET JIG	3.0 : 1 Less than	3.0 : 1 Less than	3.0 : 1 Less than
Gain	Avg. [dB]	-4.6 dB Greater than	-5.1 dB Greater than	-4.8 dB Greater than
	Peak.[dB]	-1.0 dB Greater than	-1.6 dB Greater than	-0.2 dB Greater than

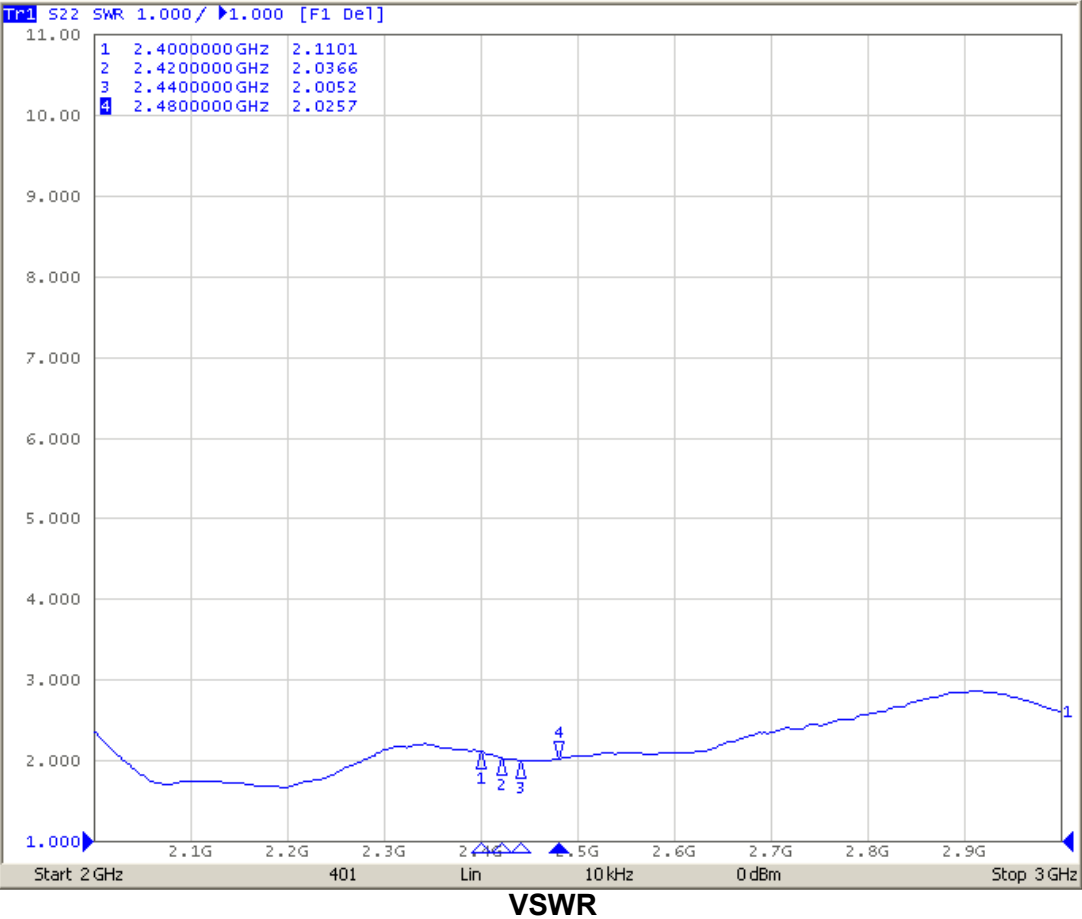


< Matching Network >



1- 2) (Set Jig) Electrical Characteristics Measurement Jig DATA

SET JIG LK- EXPL r



[KLT]
(LK-EXPL r)
Antenna Sample Ver.
2025.02.28.

TEST PERFORMED:
INPUT MATCHING
MEASURED IN VSWR

TEST CONDITIONS:
Built- in Antenna
(TEST SET : SET JIG)

MATCHING CIRCUIT

[SET JIG]

(FEED)
SHUNT 1:DNI
SERIES 1: 10pF
SHUNT 2: DNI
GND : 1.5nH

TEST POSITION:
CHART 1 : LK- EXPL r

TEST EQUIPMENT:
NETWORK ANALYZER
(Protek A338)

Electrical Engineer
: Hyungeun. Park

Date of test :
2025.2.28.

Appendix 2. Antenna Electrical Specification Test Procedure(VSWR)

2-1) (Single-Product Measurement JIG) Electrical Characteristics Measurement Jig DATA

The antenna shall meet the requirements for the VSWR specified in the electrical specifications as follows.

<Antenna>

START : 1000 MHz, STOP : 1800 MHz (Equipment : Protec A338)

Band	Bluetooth / BLE	
	1350 MHz	1450 MHz
VSWR (Single-Product)	3.7 : 1 Less than	3.7 : 1 Less than

**JIG Measurement Method

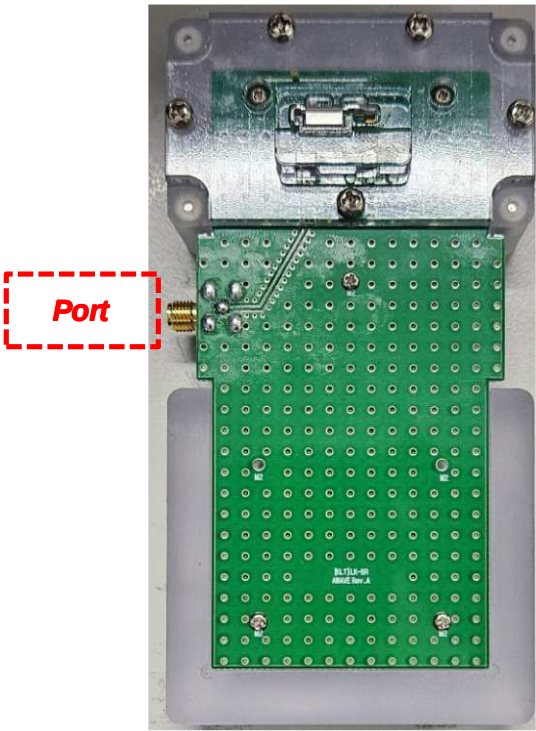
Raise the measuring jig press plate and place the antenna in the correct position.

☞ Antenna Direction Caution (Place Antenna Inside Guide)

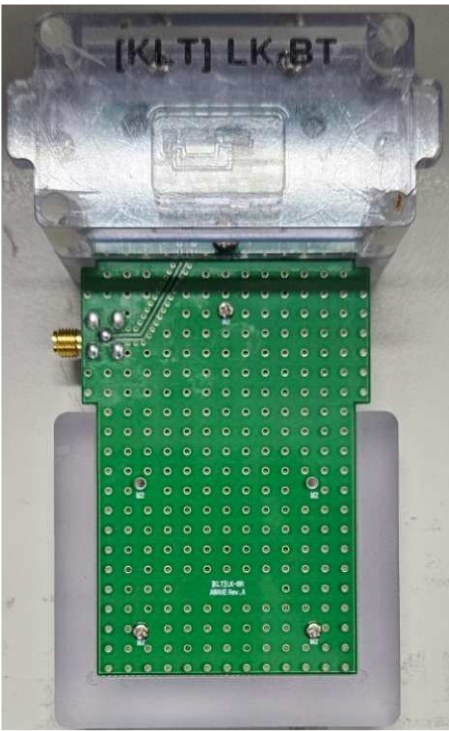
Press the antenna with the press plate

☞ Check the location of the antenna and contact terminal / Make sure the antenna is close to the JIG.

1

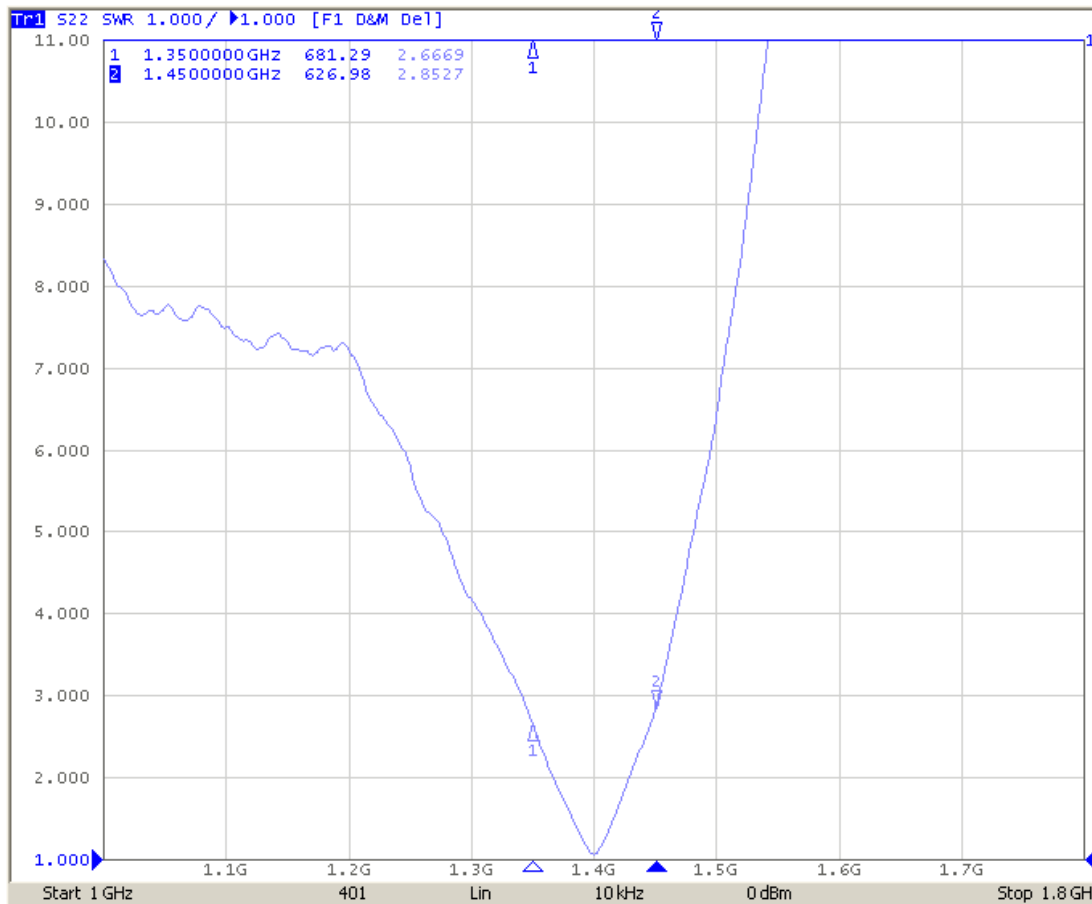


2



2-2) (Single-Product Measurement JIG) Electrical Characteristics Measurement Jig DATA

Single-Product JIG (Free space)



[KLT]
(LK-EXPL r)
Antenna Sample Ver.
2025.02.28.

TEST PERFORMED:
INPUT MATCHING
MEASURED IN VSWR

TEST CONDITIONS:
Built- in Antenna
(TEST SET : Single-
Product JIG)

MATCHING CIRCUIT

[Single- Product JIG]

(FEED)
SERIES 1: 1.5pF
(GND)
SERIES 1: 0 ohm

TEST POSITION:
CHART 1 : LK- EXPL r

TEST EQUIPMENT:
NETWORK ANALYZER
(Protek A338)

Electrical Engineer
: Hyungeun. Park.

Date of test :
2025.02.28.

Appendix 3. VSWR MEASUREMENT DATA

3-1) VSWR JIG

LK-EXPL r Antenna Outgoing Report (VSWR data)	Model	LK-EXPL r	Producted	Awave
	Customer	KLT	Measured	2025.02.28.
	Lot No.		Written by	Hyungeun, Park
	Single-Product JIG			
	Bluetooth/BLE			
	1350 MHz		1450 MHz	
	3.7:1 Less than		3.7:1 Less than	
1	2.65		2.66	
2	2.67		2.72	
3	2.53		2.69	
4	2.66		2.71	
5	2.62		2.67	
6	2.65		2.69	
7	2.64		2.71	
8	2.62		2.74	
9	2.60		2.72	
10	2.62		2.70	
11	2.58		2.73	
12	2.56		2.72	
13	2.60		2.72	
14	2.62		2.74	
15	2.59		2.73	
16	2.58		2.77	
17	2.59		2.76	
18	2.56		2.74	
19	2.56		2.71	
20	2.58		2.73	
USL	3.7		3.7	
LSL				
Xbar	2.60		2.72	
Max	2.67		2.77	
Min	2.53		2.66	
R	0.14		0.11	
StDev	0.04		0.03	
Cpk	9.61		12.01	

Appendix 4. Product inspection report

1) dimension_ check data

APP-B2452-EK-0001																dimension_ check data		
	Dimension															Remark		
도번	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
기준값	3.70	2.80	5.40	4.90	3.00	2.50	2.00	12.75	3.00	6.70	1.50	2.10	13.25	15.35	1.60			
상한스펙	0.10	0.10	0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.15	0.10			
하한스펙	-0.10	-0.10	-0.15	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.15	-0.10			
1	3.674	2.771	5.480	4.914	2.995	2.492	1.992	12.780	3.052	6.707	1.506	2.104	13.271	15.424	1.627			
2	3.671	2.782	5.489	4.922	2.993	2.504	1.980	12.783	3.056	6.708	1.512	2.101	13.282	15.428	1.630			
3	3.675	2.770	5.475	4.909	2.990	2.495	1.998	12.775	3.040	6.714	1.495	2.107	13.282	15.420	1.636			
4	3.682	2.764	5.475	4.918	3.002	2.493	1.984	12.788	3.055	6.699	1.507	2.114	13.275	15.425	1.619			
5	3.664	2.782	5.486	4.912	3.007	2.484	1.983	12.786	3.057	6.712	1.514	2.092	13.270	15.430	1.639			
6	3.667	2.773	5.480	4.909	2.983	2.493	1.995	12.771	3.045	6.707	1.512	2.115	13.278	15.420	1.619			
7	3.684	2.771	5.471	4.926	3.001	2.484	2.002	12.777	3.046	6.713	1.498	2.104	13.274	15.429	1.631			
8	3.681	2.778	5.483	4.915	3.006	2.482	2.001	12.785	3.056	6.699	1.509	2.104	13.264	15.434	1.635			
9	3.673	2.774	5.487	4.923	3.002	2.502	1.982	12.785	3.056	6.703	1.511	2.104	13.280	15.427	1.618			
10	3.676	2.772	5.470	4.904	2.987	2.502	1.991	12.782	3.056	6.712	1.515	2.112	13.277	15.414	1.631			
USL	3.80	2.90	5.55	5.00	3.10	2.60	2.10	12.85	3.10	6.80	1.60	2.20	13.35	15.50	1.70			
LSL	3.60	2.70	5.25	4.80	2.90	2.40	1.90	12.65	2.90	6.60	1.40	2.00	13.15	15.20	1.50			
Xbar	3.675	2.774	5.480	4.915	2.997	2.493	1.991	12.781	3.052	6.707	1.508	2.106	13.275	15.425	1.629			
Max	3.684	2.782	5.489	4.926	3.007	2.504	2.002	12.788	3.057	6.714	1.515	2.115	13.282	15.434	1.639			
Min	3.664	2.764	5.470	4.904	2.983	2.482	1.980	12.771	3.040	6.699	1.495	2.092	13.264	15.414	1.618			
R	0.020	0.018	0.019	0.022	0.024	0.022	0.022	0.017	0.017	0.015	0.020	0.023	0.018	0.020	0.021			
StDev	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01			
Cpk	3.87	4.39	3.50	4.02	3.91	3.90	3.70	4.24	2.66	5.55	4.60	4.61	4.33	4.28	3.15			
	Dimension								Remark									
도번	16	17	18	19	20	21	22											
기준값	4.90	2.00	1.50	1.80	2.00	1.50	2.10											
상한스펙	0.10	0.10	0.10	0.10	0.10	0.10	0.10											
하한스펙	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10											
1	4.932	1.973	1.500	1.795	1.992	1.536	2.118											
2	4.939	1.974	1.497	1.801	1.974	1.542	2.129											
3	4.921	1.971	1.512	1.793	1.976	1.532	2.122											
4	4.941	1.984	1.495	1.807	1.975	1.546	2.106											
5	4.941	1.974	1.496	1.798	1.982	1.524	2.125											
6	4.943	1.969	1.499	1.787	1.995	1.547	2.109											
7	4.938	1.980	1.507	1.804	1.973	1.525	2.126											
8	4.942	1.982	1.501	1.793	1.979	1.542	2.122											
9	4.941	1.979	1.500	1.788	1.983	1.542	2.127											
10	4.944	1.967	1.498	1.798	1.973	1.535	2.118											
USL	5.00	2.10	1.60	1.90	2.10	1.60	2.20											
LSL	4.80	1.90	1.40	1.70	1.90	1.40	2.00											
Xbar	4.938	1.975	1.501	1.796	1.980	1.537	2.120											
Max	4.944	1.984	1.512	1.807	1.995	1.547	2.129											
Min	4.921	1.967	1.495	1.787	1.973	1.524	2.106											
R	0.023	0.017	0.017	0.020	0.022	0.023	0.023											
Cpk	2.98	4.41	6.34	4.94	3.40	2.57	3.49											
Quality Assurance Dept.																		

3) Plating Thickness Measurement data

APP-B2452-EK-0001 Antenna Plating Thickness Measurement DATA

Product Information	
COMPANY	AWAVE
MODEL	APP-B2452-EK-0001
Part Name	ANTENNA

Measurement Information	
Measurement date	2025.02.13
Lot No.	250210
target selection	Sampling

Measuring conditions	
App	N/A
Measuring time	10 seconds (per ingredient)
Tester	
Equipment	XRAY

Management Standards	
BASE	Ni
BOTTOM	-
MIDDLE	-
TOP	Ni 0.5μm~1μm

POINT		a		
No	Ni			
1	0.820			
2	0.830			
3	0.810			
4	0.830			
5	0.800			
6	0.820			
7	0.810			
8	0.810			
9	0.820			
10	0.800			
USL	1.00			
LSL	0.50			
Xbar	0.82			
Max	0.83			
Min	0.80			
R	0.03			
StDev	0.01			
Cp	7.72			
k	0.26			
Cpk	5.71			

