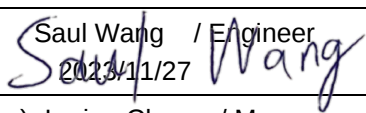
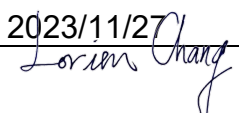


Antenna Measurement Report

Model:	WBZ451HPA
Equipment Name:	WBZ451HPA
Brand (Trade) Name:	Microchip
Applicant:	Microchip 6 F., No. 24-2, Gongye E. 4th Rd., East Dist., Hsinchu City 30077, Taiwan
Manufacturer:	Microchip 6 F., No. 24-2, Gongye E. 4th Rd., East Dist., Hsinchu City 30077, Taiwan
Antenna Type:	Internal Antenna
Tested by (name / position & signature)	Saul Wang / Engineer 2023/11/27 
Approved by (name / position & signature)	Lorien Chang / Manager 2023/11/27 
Date of issue	2023/11/27

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Competences and guarantees

DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification.

Data provided by the client

The following data has been provided by the client:

1. No

DEKRA Testing and Certification declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Testing period and place

Test Location	DEKRA Testing and Certification No. 26, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan
Date (start)	2023/11/7
Date (finish)	2023/11/16

Document history

Report number	Revision	Date	Description
23B0171R-A324150030	Rev. 1.0	2023/11/27	First release

Environmental conditions

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	22 °C – 28 °C
Relative Humidity air	< 60%

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Information:	Info
Not measured:	N/M

Used Equipment

Name	Manufacturer	Type/Model	Serial Number	Calibration
				Last Cal.
Vector Network Analyzer	Anritsu	MS46522A	1409101	2023/5/11
Measurement Software	ETS-Lindgren	EMQuest 1.16	1475	N/A

Appendix A: Test results

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1. TEST CONDITIONS

1.1 Power supply (V)

Power supply (V) under test:

N/A

1.2 Temperature (°C)

Tn = +22 to +28

The subscript n indicates normal test conditions.

1.3 Test frequencies and Output Power

In all required operating bands the measurements for Total Radiated Power (TRP) and Total Isotropic Sensitivity (TIS) measurements were performed on lowest, middle and highest channels defined by the standard [1]. Continuum of channels across each supported band was performed for Intermediate Channel Sensitivity (ICS) tests.

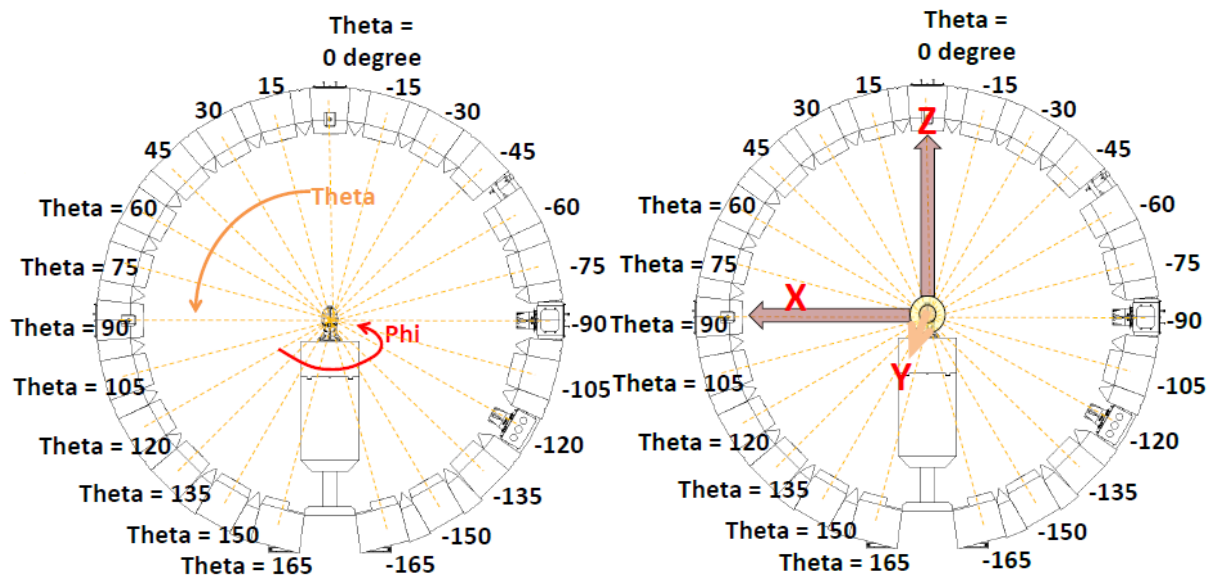
The output power of the device was set to maximum for all tests.

1.4 Device orientation and Setup Requirements

The EUT has only one mechanical configuration and it was tested in the scenario required by the standard [1]:

- “Free-space” configuration, whereby the EUT has been placed directly on a support.

The EUT is rotated along two different spherical axes: theta (θ) and phi (Φ). The relationship between the 3D Cartesian coordinate system (X, Y, Z) and the theta and phi axes is illustrated in the following figure.



- Locate the two rotational axes
 Theta – the ring, multiple antennas
 Phi – the turntable
- Define X,Y and Z directions
 X – Theta = 90 degree
 Y – Theta rotational axis
 Z – Theta = 0 degree

2. TEST RESULTS

2.1 Summary

2.2 Antenna_Passive

WBZ451HPA with Ground plane 3D_Passive 2400MHz-2500MHz

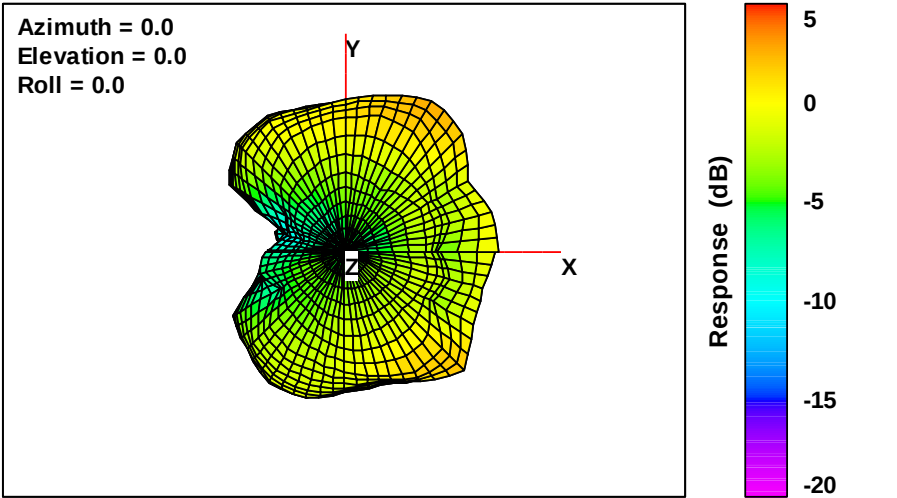
Frequency (MHz)	Tot. Rad. Pwr. (dBm)	Peak EIRP (dBm)	Directivity (dBi)	Efficiency (dB)	Efficiency (%)	Gain (dBi)	NHPRP $\pm\pi/4$ (dBm)	NHPRP $\pm\pi/6$ (dBm)
2400	-2.26	3.09	5.35	-2.26	59.38	3.09	-3.60	-5.60
2410	-2.23	3.05	5.28	-2.23	59.87	3.05	-3.56	-5.56
2420	-2.19	3.04	5.23	-2.19	60.44	3.04	-3.52	-5.52
2430	-2.16	2.93	5.08	-2.16	60.88	2.93	-3.49	-5.47
2440	-2.18	2.90	5.08	-2.18	60.57	2.90	-3.51	-5.49
2450	-2.28	2.74	5.02	-2.28	59.21	2.74	-3.61	-5.58
2460	-2.48	2.56	5.04	-2.48	56.50	2.56	-3.82	-5.78
2470	-2.58	2.50	5.07	-2.58	55.27	2.50	-3.92	-5.87
2480	-2.52	2.52	5.04	-2.52	55.96	2.52	-3.86	-5.79
2490	-2.37	2.50	4.86	-2.37	57.99	2.50	-3.70	-5.62
2500	-2.44	2.23	4.67	-2.44	57.02	2.23	-3.78	-5.70

WBZ451HPA 3D_Passive_2400MHz-2500MHz

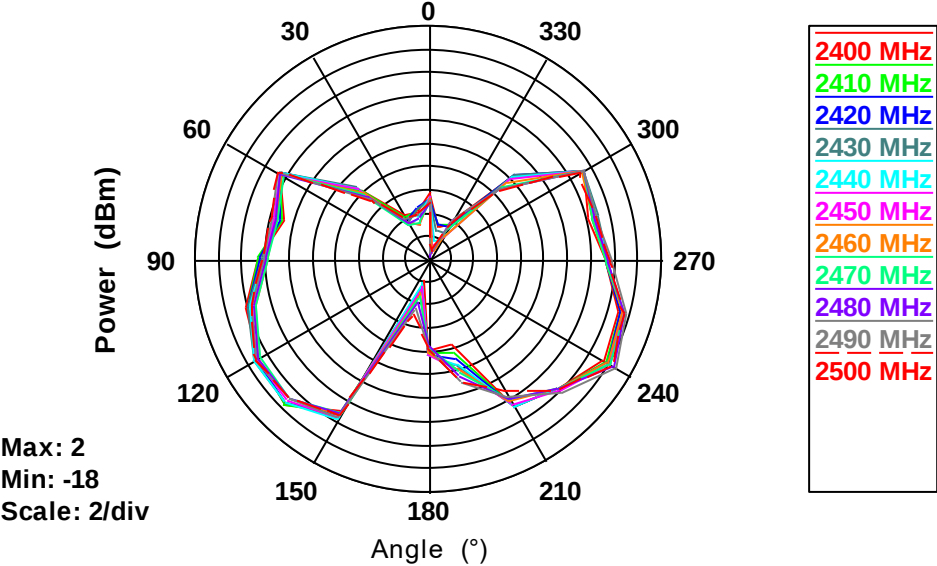
Frequency (MHz)	Tot. Rad. Pwr. (dBm)	Peak EIRP (dBm)	Directivity (dBi)	Efficiency (dB)	Efficiency (%)	Gain (dBi)	NHPRP $\pm\pi/4$ (dBm)	NHPRP $\pm\pi/6$ (dBm)
2400	-2.61	4.03	6.64	-2.61	54.83	4.03	-4.19	-5.99
2410	-2.57	4.03	6.60	-2.57	55.36	4.03	-4.15	-5.96
2420	-2.47	4.06	6.54	-2.47	56.60	4.06	-4.05	-5.87
2430	-2.40	4.08	6.48	-2.40	57.55	4.08	-3.97	-5.78
2440	-2.43	4.03	6.46	-2.43	57.08	4.03	-4.00	-5.81
2450	-2.52	3.99	6.51	-2.52	56.00	3.99	-4.08	-5.90
2460	-2.69	3.81	6.50	-2.69	53.83	3.81	-4.26	-6.08
2470	-2.72	3.73	6.45	-2.72	53.47	3.73	-4.29	-6.11
2480	-2.57	3.80	6.37	-2.57	55.33	3.80	-4.13	-5.95
2490	-2.36	3.97	6.33	-2.36	58.05	3.97	-3.91	-5.73
2500	-2.38	3.96	6.34	-2.38	57.79	3.96	-3.92	-5.76

2.3 3D Plots

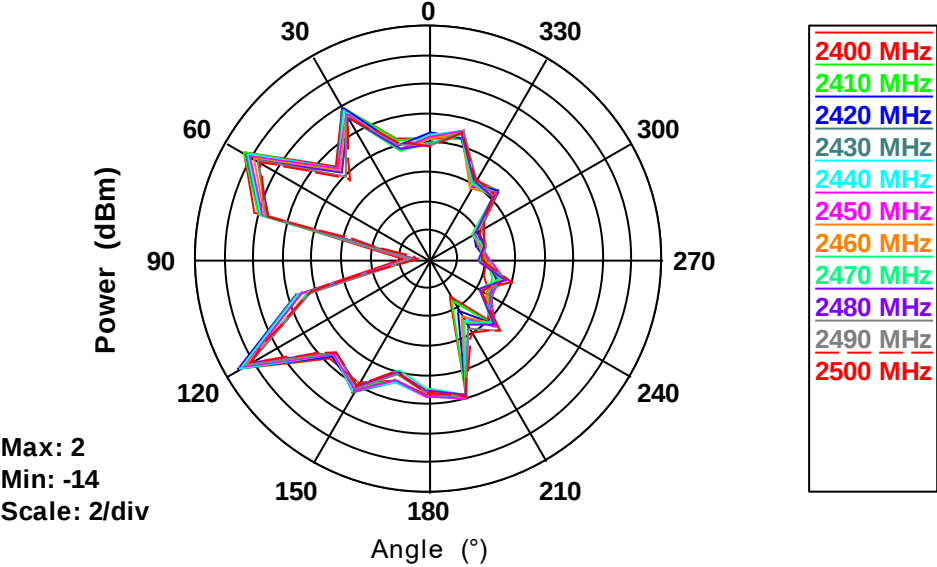
WBZ451HPA with Ground plane 3D_Passive

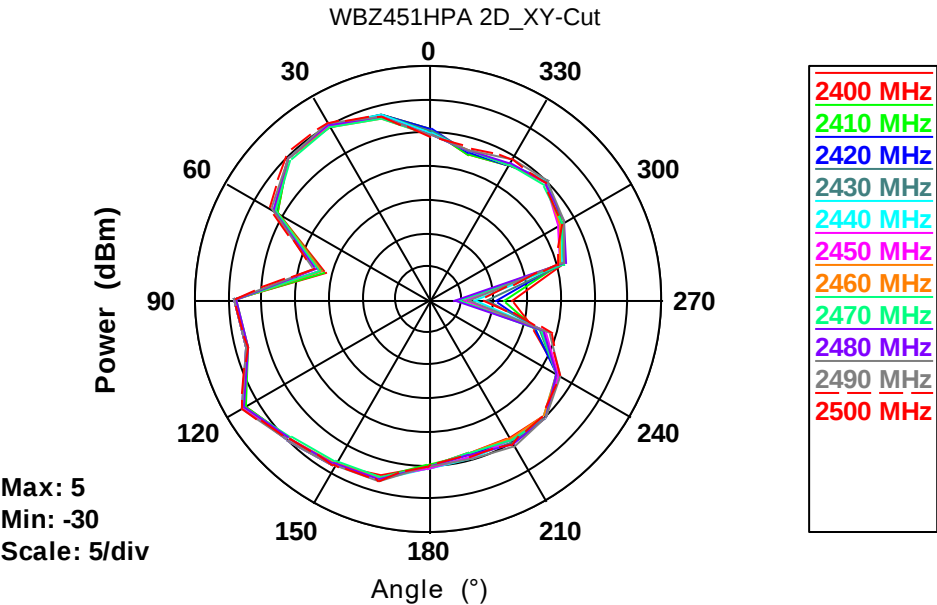
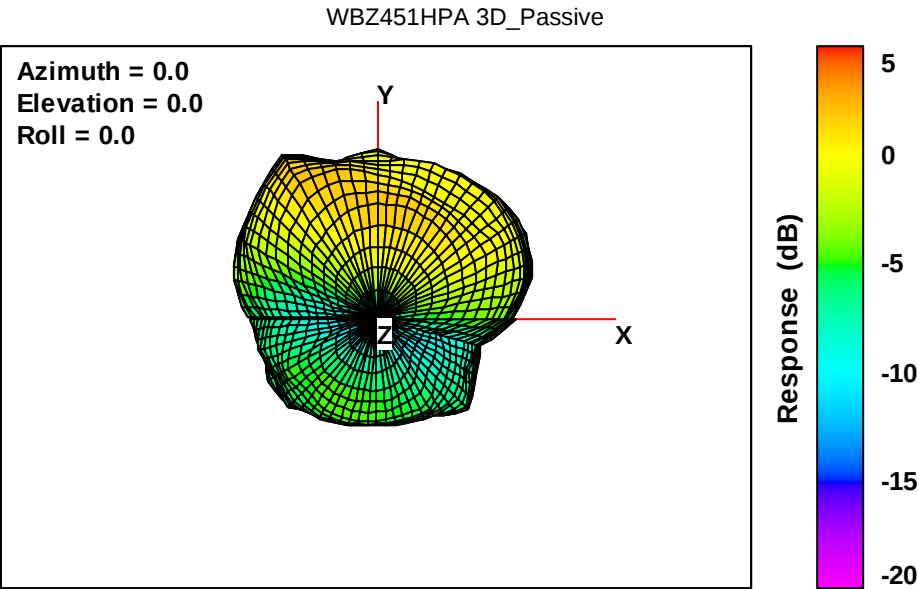
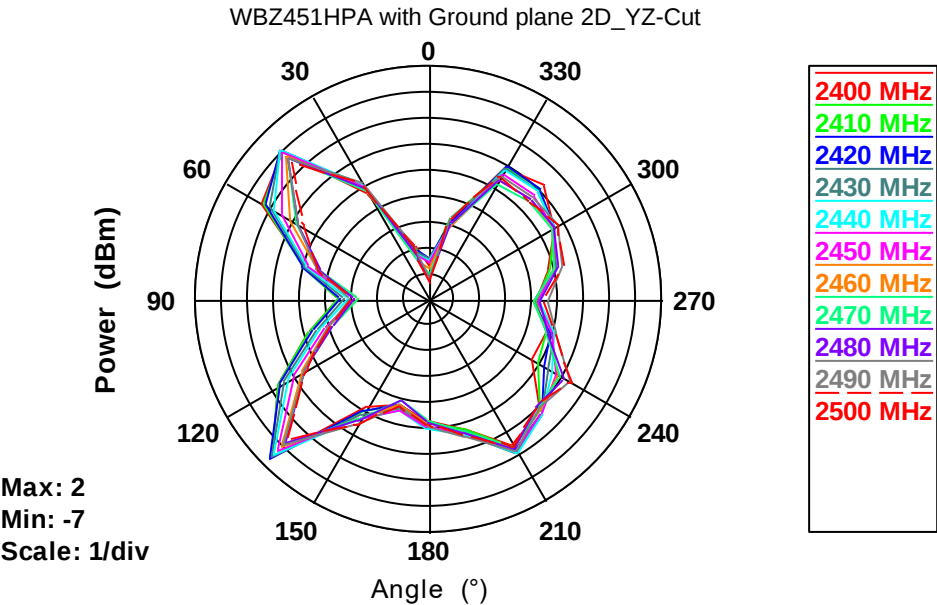


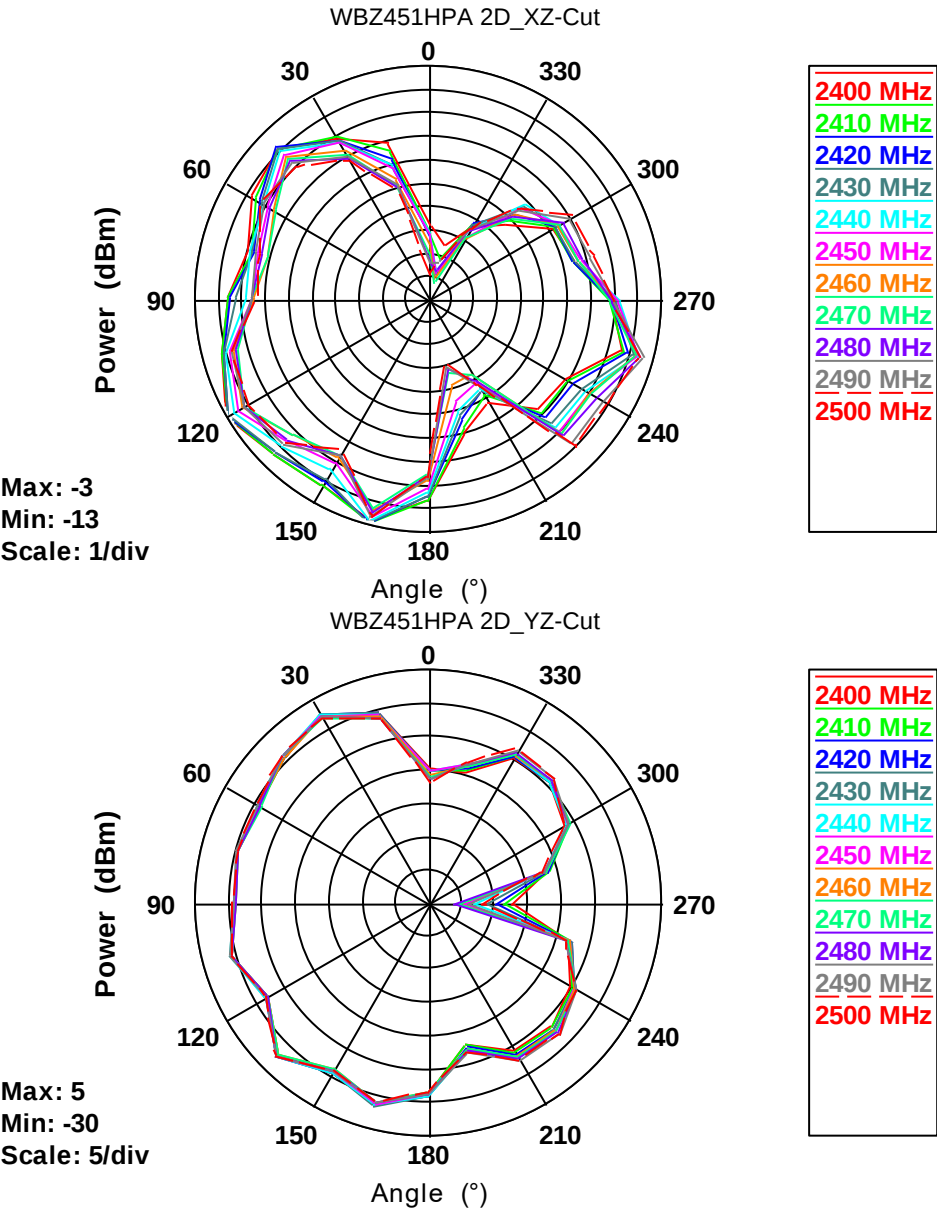
WBZ451HPA with Ground plane 2D_XY-Cut



WBZ451HPA with Ground plane 2D_XZ-Cut







2.4 PHOTOGRAPHS

Equipment under test:

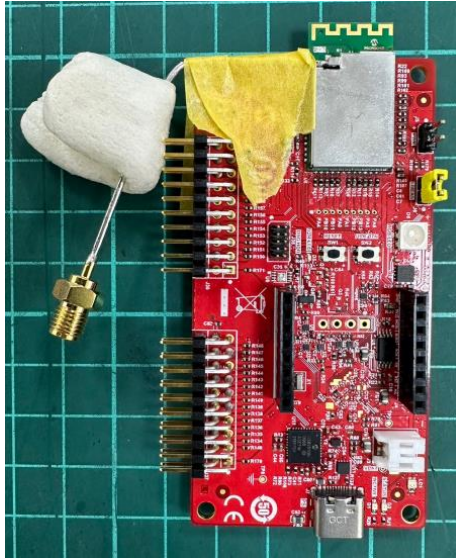
- WBZ451HPA with Ground plane EUT front view:



- WBZ451HPA with Ground plane EUT back view.



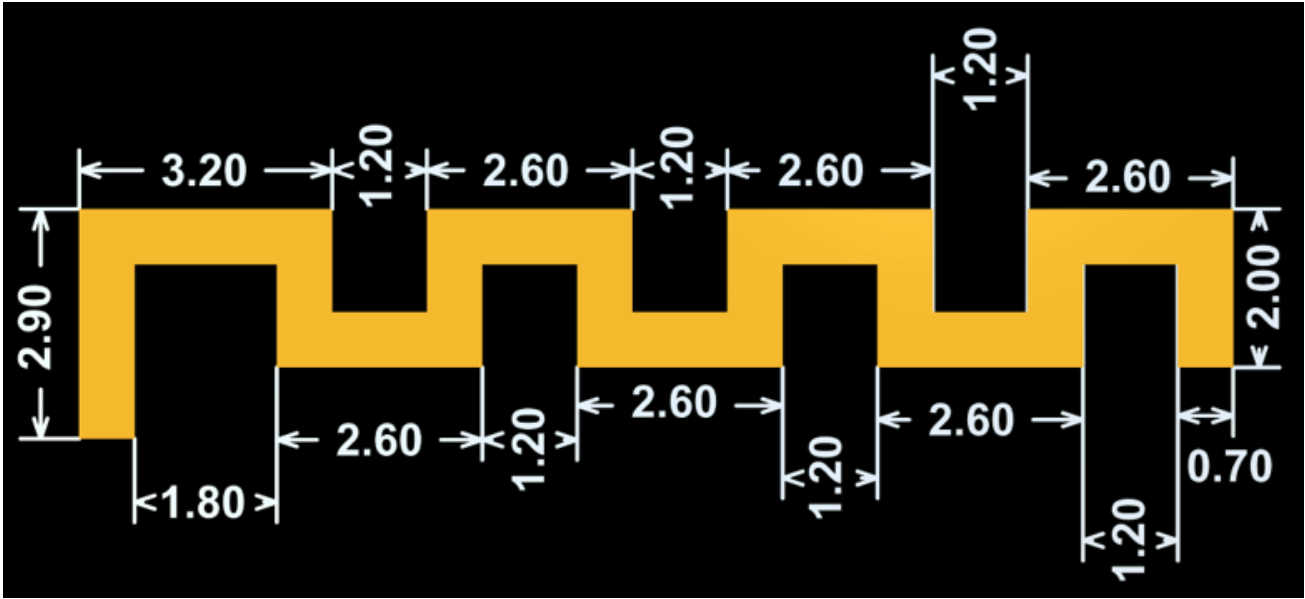
• **WBZ451HPA EUT front view:**



WBZ451HPA EUT back view.



Antenna view



All the dimensions are in millimeter

2.5 Test Setup

