

20 Park Ave. II, Hsinchu Science Park, Hsinchu 308, Taiwan.

DHSK-MB20

ES0 Antenna Test Report (Optimized in open space)

Dec. 16. 2022

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Antenna Performance Summary

- **VSWR**

- Under 2 for 2.4GHz

Ant0

Ant1

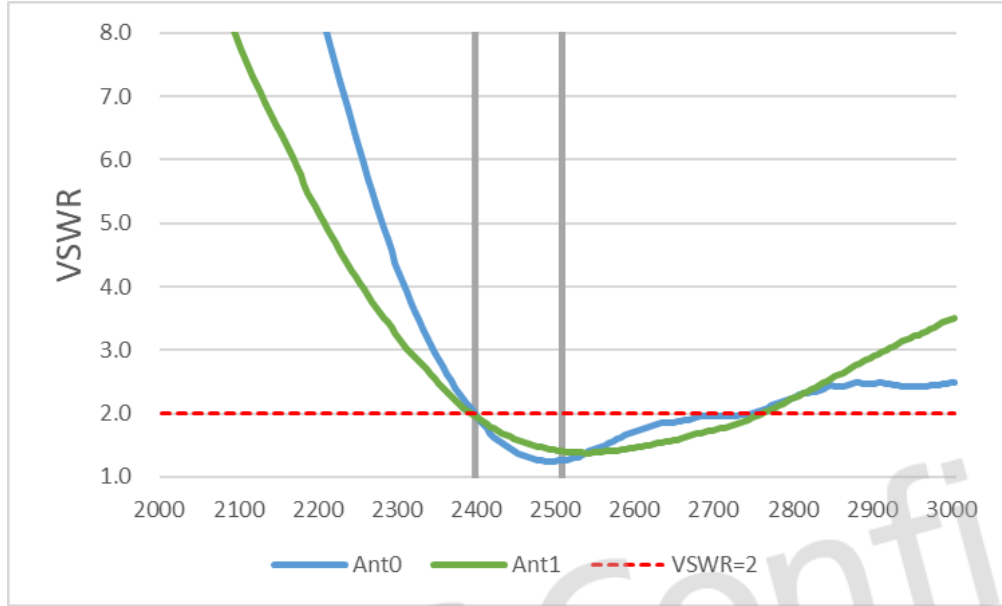
- **Average radiation efficiency**

- 55%~63% for 2.4GHz

- **Peak gain**

- Max 1.13dBi for 2.4GHz

VSWR



Efficiency & Peak Gain

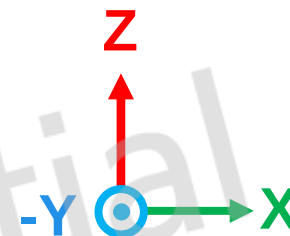
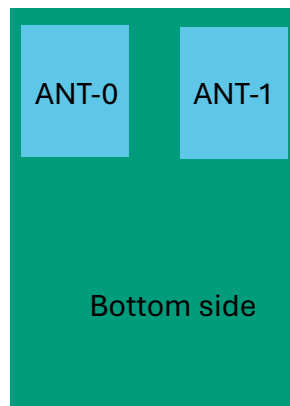
	Frequency (MHz)	2400	2450	2500	Avg.
Ant.0	Efficiency	55%	58%	57%	57%
	Average gain (dBi)	-2.60	-2.37	-2.44	
	Peak gain (dBi)	0.54	0.77	1.13	
	Peak Gain@	Theta= -152° Phi=110°	Theta= 118° Phi=129°	Theta= 113° Phi=135°	
Ant.1	Efficiency	60	63	61	61%
	Average gain (dBi)	-2.22	-2.01	-2.15	
	Peak gain (dBi)	0.03	0.02	0.23	
	Peak Gain@	Theta= 28° Phi=82°	Theta= 31° Phi=82°	Theta= 31° Phi=79°	

The above peak gain was measured at the above angle using the substitution method.

The substitution method involves setting up our calibrated reference antenna over a radiated path across the chamber, then normalizing (or “zeroing”) that path loss to 0 dB.

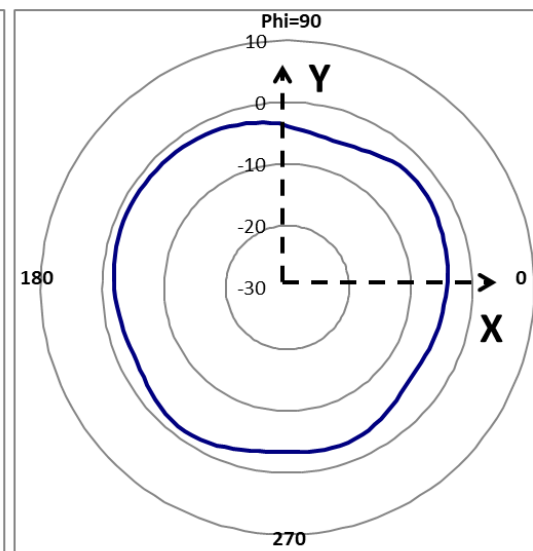
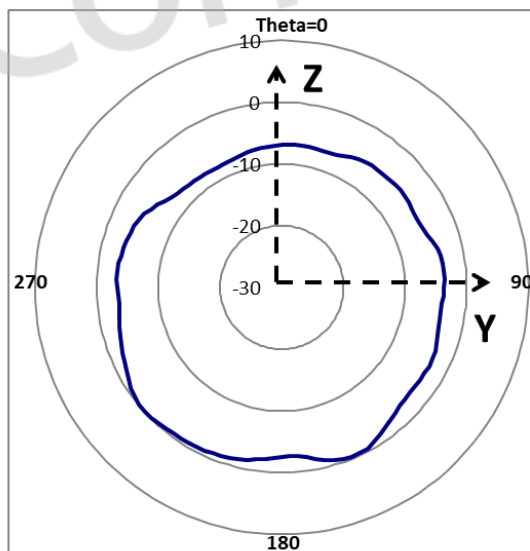
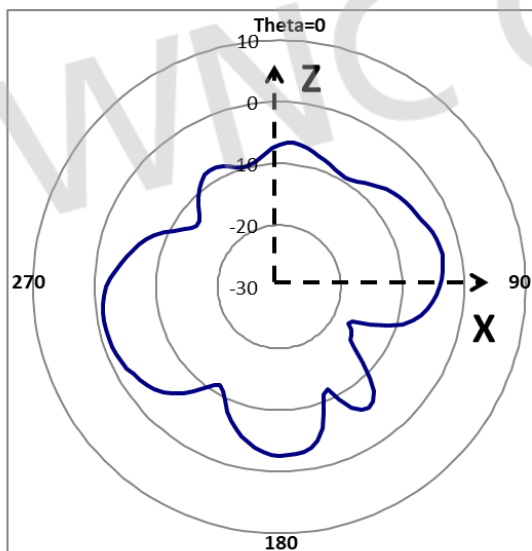
Then we substitute our antenna in place of our reference antenna, and re-measure the change in path loss. By simply adding our reference antenna’s calibrated gain (in dBi) to the change in path loss, to determine the antenna gain in dBi.

Radiation Pattern for Ant0

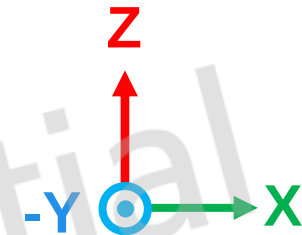
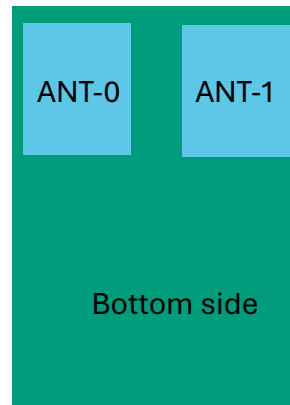


2.4GHz Radiation Pattern

— Ant0

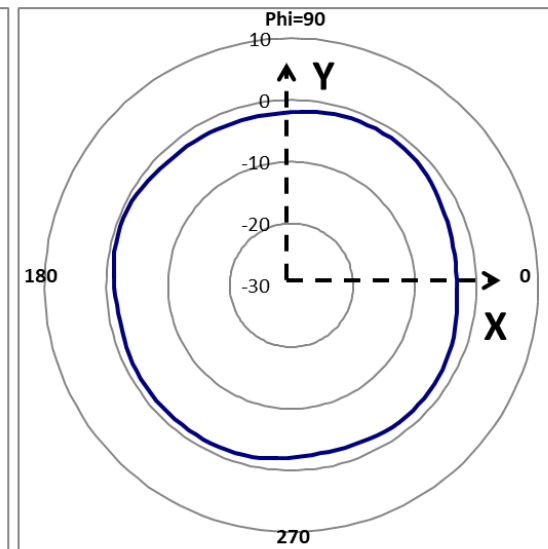
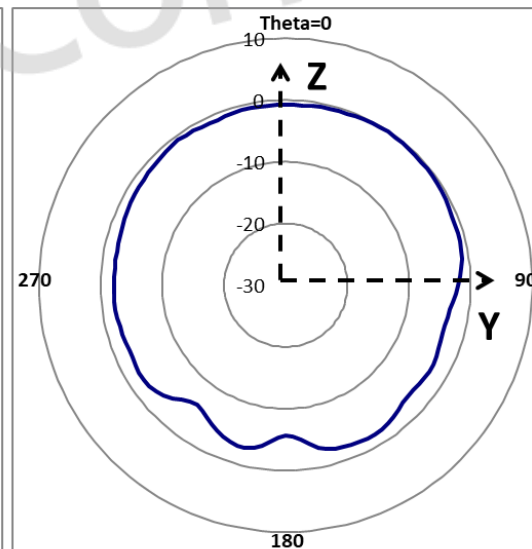
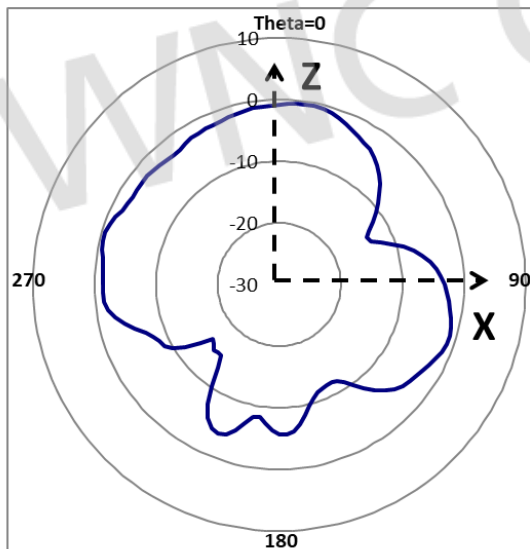


Radiation Pattern for Ant1

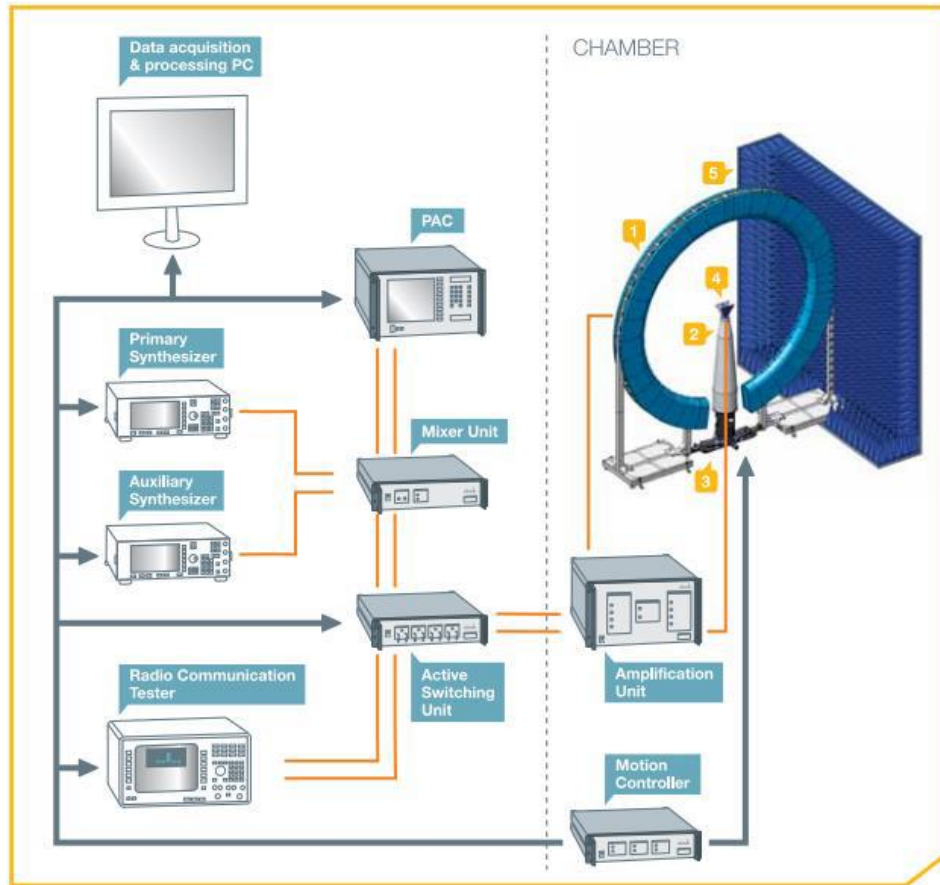


2.4GHz Radiation Pattern

— Ant1



Measurement Setup & Test Method



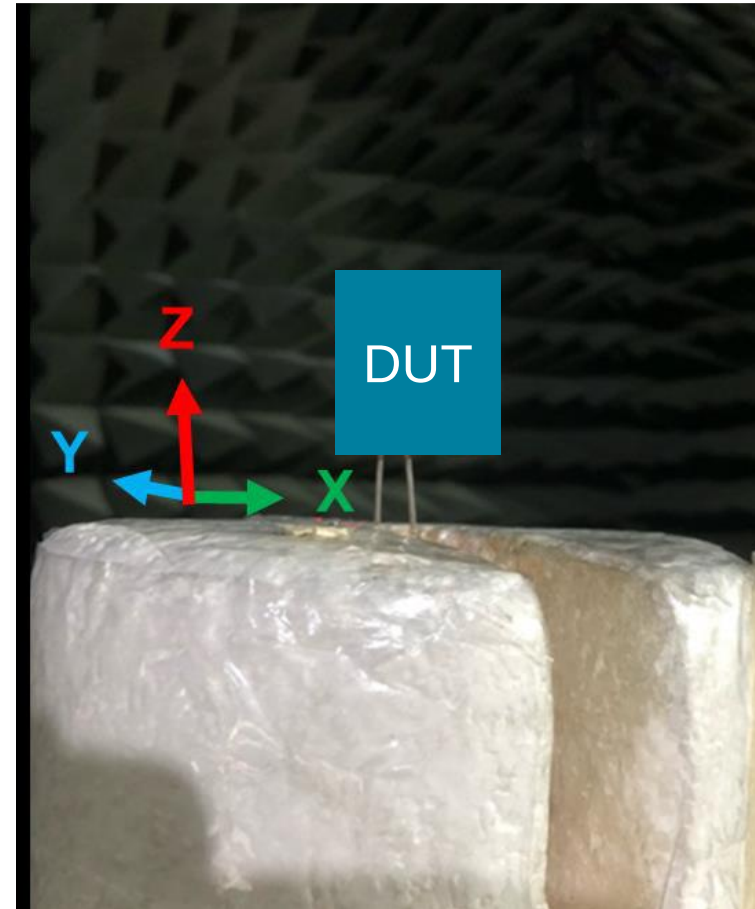
SG 64 uses analog RF signal generators to emit EM waves from the probe array to the antenna under test (AUT) or vice versa.

It uses the NPAC as an RF receiver for antenna measurements. The NPAC also drives the electronic scanning of the probe array.

The NPAC includes the fastest and most accurate sources and receivers on the market.

Test Procedure & SW

- Place the device at the center of the chamber.
- Connect the antenna cable to RF cable of the chamber
- Run Satimotest SW (NPAC Spherical Measurement, v1.5.4 (GIT E6965664)) which is Satimo's proprietary SW.
- Get 3D data in 2.8125 degree step from phi $0^{\circ} \sim 360^{\circ}$ and theta $90^{\circ} \sim +90^{\circ}$, including efficiency, peak gain, 2D & 3D radiation pattern.
- This is passive measurement, which means the device is off and not in any operating mode.



Calibration and Measurement Equipment List

Device	Type/Model	S/N	Manufacturer	Characteristics	Calibrated Date	Calibrated until
SG64 antenna test chamber	Standard	SG64	MVG	400MHz ~ 6GHz	2024/03/30	2025/03/30
Turn table	Customization	-	Machinery Dept.	-	2024/03/30	2025/03/30
New probe array controller	N/A	1102341-4535	MVG	400MHz ~ 6GHz	2024/03/30	2025/03/30
Power supply unit	N/A	1103211-13204	MVG	-	2024/03/30	2025/03/30
Active switching unit	N/A	1102347-7214	MVG	400MHz ~ 6GHz	2024/03/30	2025/03/30
Tx amplification unit	N/A	1102527-5909	MVG	400MHz ~ 6GHz	2024/03/30	2025/03/30
Rx amplification unit	N/A	1102536-3823	MVG	400MHz ~ 6GHz	2024/03/30	2025/03/30
Transfer switching unit	N/A	1102183-3351	MVG	400MHz ~ 6GHz	2024/03/30	2025/03/30
Mixer unit	N/A	1102545-7208	MVG	400MHz ~ 6GHz	2024/03/30	2025/03/30
Power and control unit	N/A	1102706-7209	MVG	-	2024/03/30	2025/03/30
Antenna probe	DP 400-6000	-	MVG	400MHz ~ 6GHz	2024/03/30	2025/03/30
Cable 13.7m – 400MHz to 18GHz	SS402	00100A1F5A1XXS	Woken	-	2024/03/30	2025/03/30
Temperature & Humidity meter	HTC-01	-	Metravi	-	2024/03/30	2025/03/30

Note:

1. There're 63 set antenna probes in WNC's SG64 test chamber.
2. This antenna test chamber is located at WNC (address: 20 Park Ave. II, Hsinchu Science Park, Hsinchu 300, Taiwan)

Manufacturer

Manufacturer: Wistron NeWeb Corporation (WNC)
Address: 20 Park Ave. II, Hsinchu Science Park, Hsinchu 300, Taiwan.
TEL: +886 3 666 7799

製造商: 啟碁科技股份有限公司
地址: 300新竹科學園區園區二路20號
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WNC

Wistron NeWeb Corp.

