TOYO

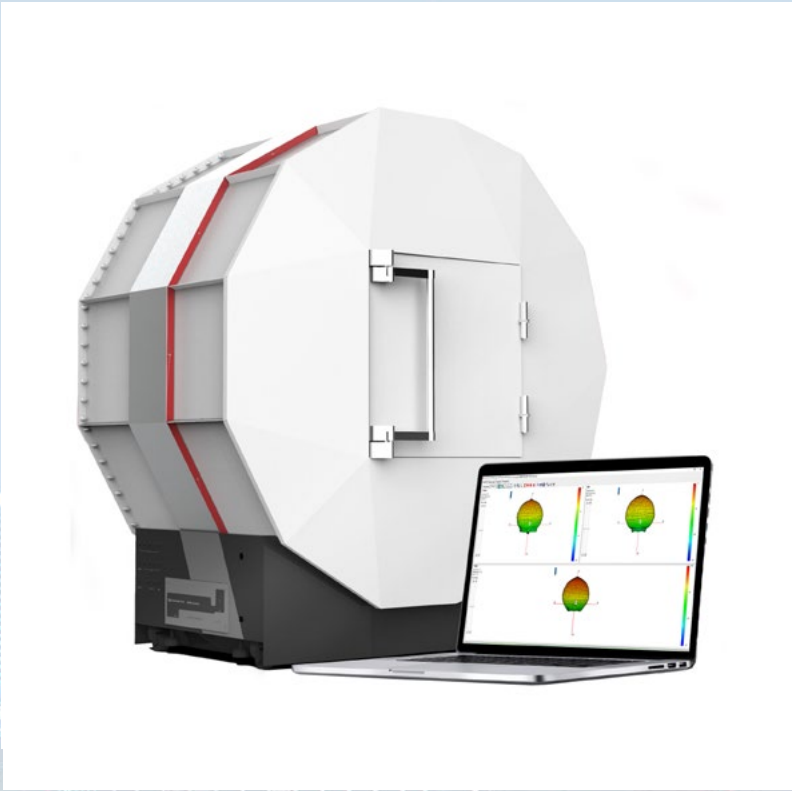
RayZone® 1800
5G (FR1) SISO/MIMO Compact Antenna/OTA Test System
PRODUCT BROCHURE

INTRODUCTION

As mobile terminals undergo continuous miniaturization, assessing built-in low-directionality antennas becomes crucial in R&D testing. This reveals drawbacks in large far-field chambers, such as their substantial size, slow testing processes, high costs, and reduced cost-effectiveness.

Leveraging an in-depth study of near-field radiation, we introduced a groundbreaking testing theory. Key indicators like TRP, TIS, and antenna pattern peaks are intricately linked, allowing precise measurements of the Device Under Test (DUT) with the RayZone 1800 (see *figures 1&2*), a product exemplifying this theory.

- Built on a novel testing theory, it achieves an efficient near-field radiation test by adopting a distinctive asymmetric multi-probe system architecture tailored to the low directivity of the Device Under Test (DUT) antenna.
- To safeguard the antenna performance and system stability from temperature and humidity fluctuations, the antennas are isolated from the absorbers
- The absorbers are directly affixed to the inner surface, aligning with the electromagnetic wave propagation end surface. This design ingeniously attains the maximum theoretical efficiency in utilizing shielding space
- All RF cables and the turntable's controlling mechanism are housed in external trunkings or the chamber base. Alongside the wave-transparent fixture, the RayZone 1800 establishes a pristine test environment



The RayZone 1800 utilizes an innovative 13-sided polygon design (see Figures 1 and 2). Through a 180-degree transformation of specific sampling points, it achieves a 15° sampling step, adhering to CTIA standards with only 12 test antennas. The asymmetric shape optimizes test probe distribution, maximizing measurement distance in a compact chamber. Aligning antenna quantity with spacing minimizes direct reflection and adjacent coupling. The RayZone 1800 achieves comparable measurement performance to a large certified chamber in one-fifth of the size.

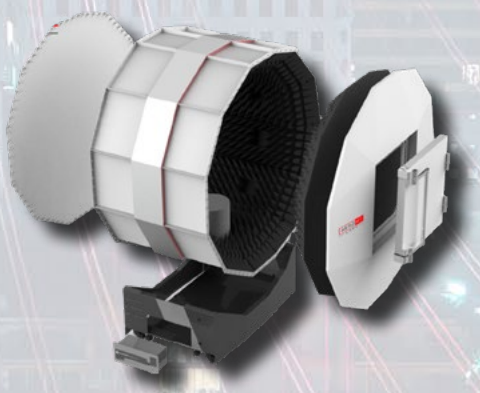


Figure 2: RayZone 1800 (isometric view)

FUNCTIONS

- Comprehensive wireless standards: 2G/3G/4G/5G(FR1)/GNSS/A-GNSS/Wi-Fi/Bluetooth/UWB
- IoT standards: LTE Cat NB1 (NB-IoT)/Cat-M1 (e-MTC)
- SISO TRP/TIS/EIRP/EIS testing; 2×2 MIMO throughput testing
- Passive antenna, Desense and ICS testing
- Frequency range: 0.4-7.5GHz
- Environment-friendly EPP rigid foam absorbers, low RCS/high gain antennas and customized fixture
- Wavex Libra test software for antenna/OTA test with visual data analysis
- Fast MIMO testing; certified-level accuracy
- Integrated design; plug & play; easy maintenance

ABSORBING MATERIALS

The RayZone 1800's absorbing materials use full-band simulation and optimized designs to obtain the best absorbing performance structure, ensure excellent electromagnetic wave absorption performance.

ABSORBING MATERIALS	
Electric Property	EPP has small dielectric constant, small sur¬face reflection, sufficient internal attenuation, and good absorbing effect in the microwave frequency band
Fire Resistance	meets UL94 HF-1, GB8624 B2 standard
Limit Oxygen Index	>27%
Working Temperature	long-term -50°C to 100°C , short-term 120°C
Environment Protection	Non-toxic raw materials, odor-free, and no harmful gas released, no dust
Final Product	meets RoHS standard
Physical Appearance	Precise size, uniformity color

Frequency (GHz)	0.4	0.6	0.7	1	3	5	12
Absorber Reflection	-28	-28	-42	-45	-50	-55	-55

LOW RCS PROBE

As an integral component of the OTA test system, the RayZone 1800 is equipped with customized, low Radar Cross-Section (RCS) probe antennas to enhance system testing accuracy.

- Operating in a frequency range of 0.4-7.5 GHz
- Maintaining gain flatness within the entire frequency range at ≤±0.25dB
- Optimizing antenna feed to enhance the standing-wave-ratio
- Employing a modular design for consistent performance and straightforward maintenance
- Compact size and integration with surrounding absorbers achieve low RCS characteristics

PRODUCT PRECISION

To enhance test accuracy, we have made available a range of accessories for test systems. Recognizing challenges in measuring passive antennas due to common current issues, which make RF connectors and test cables integral to the Antenna Under Test (AUT), specially designed choke beads. These beads suppress common current, reducing external cable and connector interference in test results.

The RayZone 1800 offers an ideal testing environment for antenna engineers, enabling accurate antenna pattern measurements of small-sized AUTs at low frequencies and different positions. Rigorous system-level hardware simulations informed every aspect of the RayZone 1800's design, including customized testing probes, new-generation EPP absorbers, and a full wave-transparent, customizable fixture design to enhance accuracy.

Through meticulous system improvement efforts, the RayZone 1800 achieves test results comparable to large far-field systems. It aligns with lab simulations and provides the full testing capability of an expensive, certified chamber. The measured results are outlined in the table below.

RAYZONE 1800 ACTIVE TEST RESULT VS. CERTIFIED CHAMBER'S										
Band	TRP					TIS				
	Channel	Freq	Ray Zone 1800	Certified Lab	Difference	Channel	Freq	Ray Zone 1800	Certified Lab	Difference
GSM 850	251	848.4	26.55	26.70	-0.15	251	893.8	-104.58	-104.60	-0.02
GSM 900	124	914.8	26.95	26.40	0.55	124	959.8	-103.16	-102.40	0.76
GSM 1800	885	1784.8	26.52	25.90	0.62	885	1879.8	-106.52	-106.30	0.22
GSM 1900	810	1909.8	26.38	25.50	0.88	810	1989.8	-105.90	-105.50	0.40
LTE (B3)	19900	1780	20.31	19.90	0.14	19900	1875	-97.50	-97.40	0.10
LTE (B5)	20600	844	19.71	19.90	-0.19	20600	889	-96.52	-97.20	-0.68
LTE (B7)	21350	2560	20.16	20.30	-0.14	21350	2680	-94.74	-94.00	0.74
LTE (B17)	23800	711	17.14	17.80	-0.66	23800	741	-96.14	-96.80	-0.66
LTE (B40)	39550	2390	18.89	18.70	0.19	39550	2390	-93.25	-93.80	-0.55

WAVEX® LIBRA: PROFESSIONAL ANTENNA/OTA TEST SOFTWARE

The control and test automation software of the Wavex Libra system is engineered on the .NET Framework 4.0 platform. It is fully aligned with CTIA test standards and consistently updated to reflect the latest specifications. Wavex Libra offers a diverse array of applications, adaptable configurations, seamless test processes, stable operation, and a user-friendly GUI. Designed to meet various test requirements across different product stages, it spans the entire product life cycle—from R&D and pre-certification to conformance and Quality Assurance (QA) in manufacturing.

- Supports 3D measurement, selectable 2D measurement cutting, and single-point measurement
- Comprehensively manages raw test data and log files. Ensures traceability and a non-modifiable test process
- Batch processing function supports the creation of task lists for continuous and automated unattended tests
- Offers a wide variety of test assistant functions, including anti-drop-call, auto-recall, and abnormal situation warnings. Enhances the reliability and fluency of testing processes
- Allows arbitrary selection of test points for reviewing all associated test data.
- Includes resourceful built-in templates with preconfigured parameters compatible with different instruments and test platforms. Simple manipulations effectively prevent operational errors
- Permits user-defined test steps, test angles, and test configurations
- Supports 3D display, antenna pattern arbitrary angle rotation, viewing, and cutting to assist R&D engineers in visually analyzing and diagnosing problems

ADVANTAGES

The RayZone 1800 belongs to a series of electromagnetic environment simulation testing systems, offering extensive applications, powerful functions, and flexible configurations. In comparison to certified chambers, the RayZone 1800 achieves the same level of accuracy but with faster test speeds and improved repeatability. This is attributed to its unique asymmetric polygon structure, a result of the new testing theory and system design, ingeniously multiplying Device Under Test (DUT) sampling points and striking a balance between compact size and comprehensive functionality.

The RayZone 1800 fully supports Single-Input Single-Output (SISO) Over-the-Air (OTA) throughput tests and Radiated Two-Stage (RTS) Multiple-Input Multiple-Output (MIMO) OTA tests with only software upgrades required. Positioned as a cost-effective tool for 4G/5G wireless pre-certification tests, its compact size and mobility allow for easy transportation to customer sites. Unlike conventional chambers requiring lengthy installation and calibration processes, the RayZone 1800 enables customers to save significant time, space, and human resources.

As an accurate, stable, simple, delicate, flexible, convenient, and efficient test solution, the RayZone 1800 embodies our product philosophy. Every innovation stems from our commitment to creating additional value for our customers.

- Full wireless standards coverage
- Comprehensive coverage of standard test items
- Capability for passive, active, and phantom testing
- 2D/3D pattern display functionality
- Desense testing support
- Wide selection of instruments
- Availability of various debugging information for R&D purposes
- Minimum 15° sampling resolution
- Auxiliary tool for optimizing Device Under Test (DUT) hardware

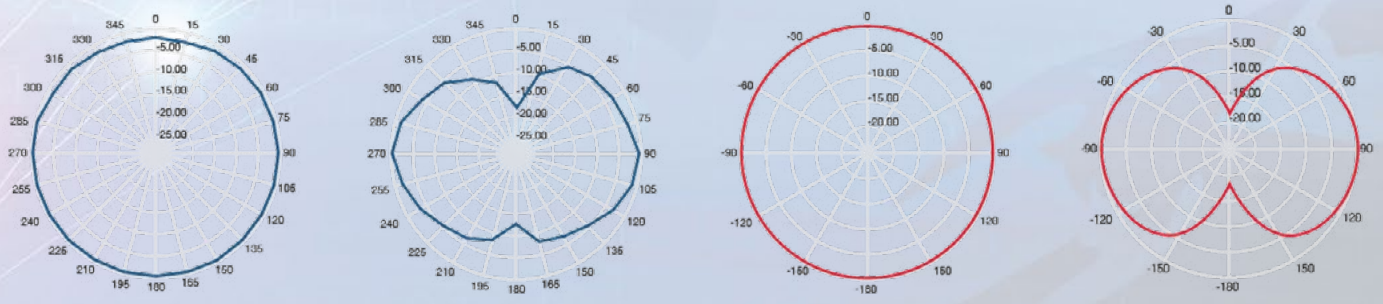


Figure 3: RayZone 1800 Passive Test Results vs. Simulations

RAYZONE 1800 SHIELDING ENCLOSURE	
Hardware	Chamber, Shielding Door, Absorber, Dual Polarized Narrow Beam Probe Antennas, RF Switch Box, RF Cable, Positioner, System Controller and Turntable

WAVEX LIBRA SOFTWARE MODULES	
Wavex Libra V2.1 Base Module	System Control/Instrument Drivers/ Passive Test
3D Pattern Pad	3D Data Viewer
GSM/GPRS/EGPRS/CDMA/ CDMA 1xRTT	TRP/TIS/EIRP/EIS/ICS
WCDMA/CDMA 1xEVDO	TRP/TIS/EIRP/EIS/ICS
TD-SCDMA	TRP/TIS/EIRP/EIS/ICS
Wi-Fi	UE/AP/TRP/TIS/Throughput
LTE SISO (FDD/TDD)	TRP/TIS/EIRP/EIS/ICS
5G FR1 SISO (NSA/SA)	TRP/TIS/EIRP/EIS/ICS
LTE/FR1 MIMO 2×2	Data Throughput
LTE/FR1 ECC	Passive ECC/Active ECC
GPS/A-GPS	C/N0 /EIS/TIS
BeiDou	TIS
Desense	Wi-Fi/Cellular/GPS
NB-IoT/Cat-M	TRP/TIS/EIRP/EIS

INSTRUMENTS SUPPORTED (OPTIONAL)	
VNA	Keysight, R&S, Anritsu and etc.
Signal Generator	Keysight E4438C, Keysight MXG N5182B, Spirent GSS6100/6300, GSS6560/6700 etc.
Channel Emulator	Keysight UXM E7515A/B, Anite F32/F64, Spirent VR5
Base station Emulator	Keysight UXM E7515A/B, Keysight 8960 (E5515C), R&S CMW500, CMX500, CMU200, Anritsu MT8820C/8821, MT8860C, MT8000A, StarPoint SP6010

SERVICE & TECHNICAL SUPPORT	
System Calibration	One free calibration at system delivery
Product Warranty	Free upgrades for 12 months
Software Upgrade	Free upgrades for 12 months

TECHNICAL SPECIFICATIONS		
General	Functions	Antenna Test, OTA SISO Test, Wi-Fi MIMO Test, RTS MIMO Test
	Technologies	Direct far-field conical-cut-scanning, Radiated two stageZ(RTS) MIMO method, Patented smart test algorithem
	Antenna Test	Antenna 2D/3D Pattern, Gain, Efficiency, Drictivity, Beamwidth, Cross- Polarization ratio, Front-to-back ratio, Axis ratio, PCO, PCV, ECC, etc.
	OTA Test	EIRP, EIS, TRP, TIS, NHPRP, NHPIS, Throughput, Bluetooth, ICS, ECC, TWR, AOA, PDOA, 4CC, Wi-Fi MIMO, RTS MIMO, etc.
	Wireless Standards	2G/3G/4G/5G(FR1)/ GNSS/A-GNSS / Wi-Fi(a/b/g/n/ac/ax/6E)/Bluetooth/ NB-IoT/e-MTC/ZigBee/Lora/NFC/RFID/ CA/Desense/ICS, etc.
	Frequency Range	0.4~7.5GHz (12GHz Option, UWB Supported)
	Dynamic Range	60dB (Typical)
Shielding Enclosure	Exterior Dimensions (L×W×H)	1.83×1.1×1.95m (Customizable)
	Recommended Working Space (L×W×H)	3×2×2.2m
	Shielding	≥80dB
	Door Size (L×W×H)	0.71×0.71m
	Weight	about 350kg
Measurement Capabilities	Number Of Vertical Antennas	12
	Angle Between Vertical Antennas	15°
	Number Of Horizontal Antennas	N/A
	Angle Between Horizontal Antennas	N/A
	θ-Axis Resloution (Min.Spacing)	15°
	Φ-Axis Positioner Resolution	0.5°
	Φ-Axis Positioner Accuracy	0.5°
	Φ-Axis Positioner Rotation Speed	30°/s
	Positioner Rotation Range	0~360°
	Test Distance	0.85m
DUT	Max.Size	25cm (Black Box Test)
	Max.Weight	20kg
Quiet Zone	Dimensions (L×W×H)	25cm
	Reflection	≤-25dB (Typical)
Test Probe	Type	Low RCS Vivaldi antenna
	Polarization	Dual-polarized
	Frequency Range	0.4~7.5GHz (12GHz Optional)
Absorber	Base Material	EPP (Expended Polypropylene)
	Height	200mm
	Absorbing Rate	≥40dB (Typical)
	Fire Resistance	Class B2 (standard) (per GB8624-2012 with 3rd party test report) Class B1 (Option) (per GB8624-2012 with 3rd party test report)
	Oxygen Index	>28% (per GB/T 2406.2-2009 with 3rd party test report)
	GHS Classifications	Non-hazardous. (per IEC62321 with 3rd party test report) No volatilization, no odor, no toxicity, no harmful gas (formaldehyde etc.) release

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