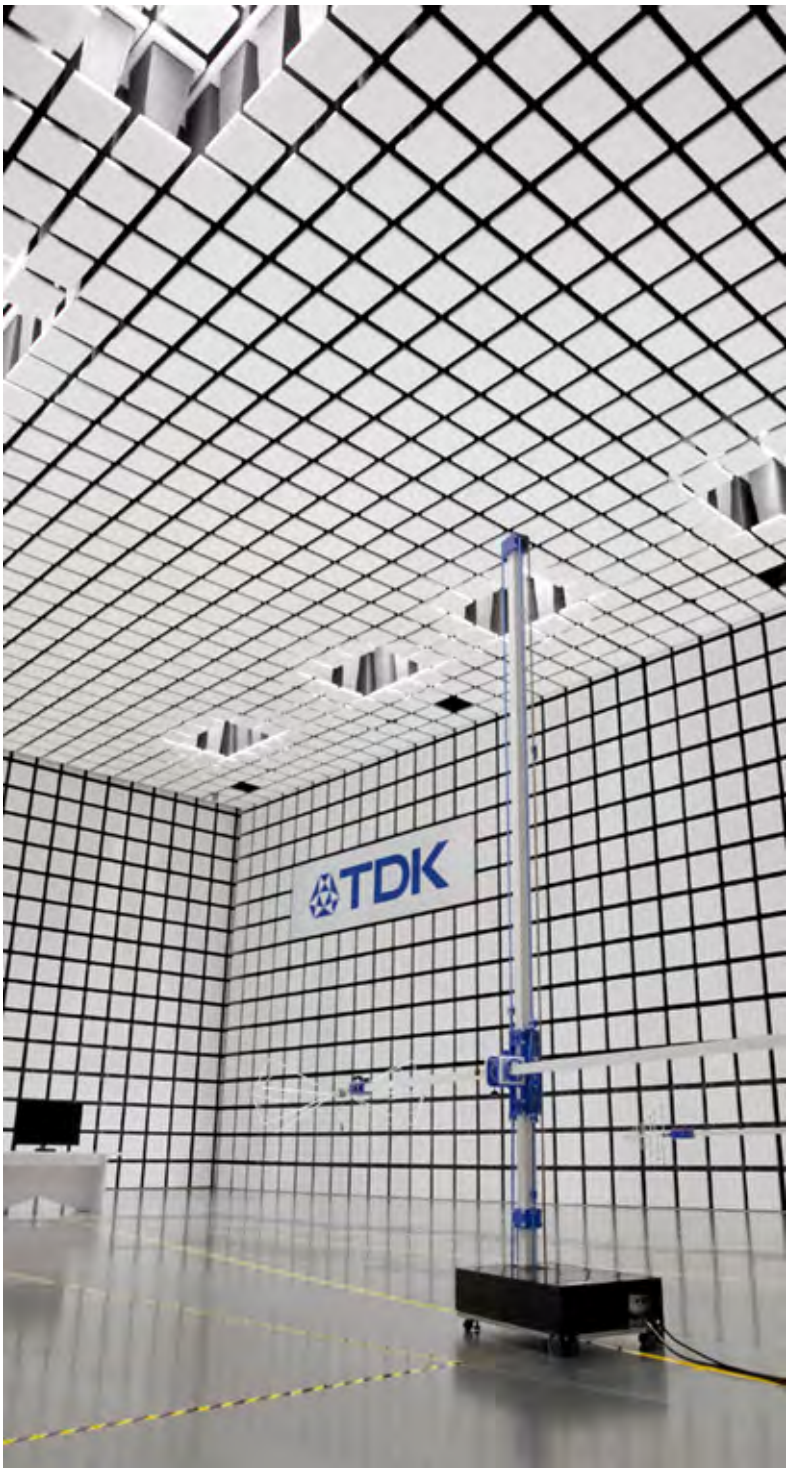
Electromagnetic Wave Anechoic Chambers
Electromagnetic Wave Absorbers

For EMC Compliance, Antenna Measurement




POWER METER · NRVD
REM
We provide the state of the art of
electromagnetic wave anechoic chambers of
all types from economical to premium.

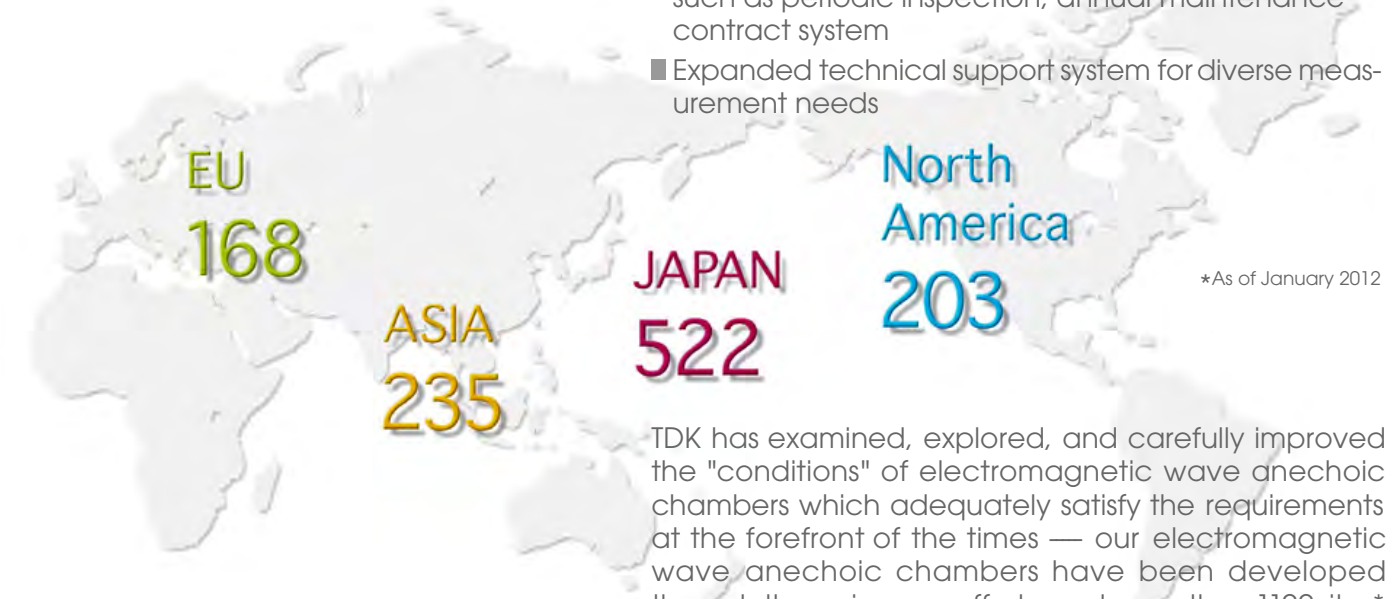
Electromagnetic Wave Anechoic Chambers

Electromagnetic Wave Absorbers

Ever since we developed the world's first electromagnetic wave anechoic chamber with Composite type (so called Hybrid type) ferrite electromagnetic wave absorber in 1969, TDK's electromagnetic wave anechoic chambers have been responding to the high expectations and advanced demands from numerous public and private corporations which aspire to next-generation technologies.

Needs for EMC measurement have been changing and becoming more sophisticated as electronics technologies evolve.

- Smaller, more efficient, longer life electromagnetic wave absorber
- Robust framework design and safety construction management
- Operator friendly circumstances such as brightness, cleanliness and acoustics.
- Reinforced reliability and rational, efficient designs of doors and ancillary facilities
- Dedicated/maintenance service system established such as periodic inspection, annual maintenance contract system
- Expanded technical support system for diverse measurement needs



*As of January 2012

TDK has examined, explored, and carefully improved the "conditions" of electromagnetic wave anechoic chambers which adequately satisfy the requirements at the forefront of the times — our electromagnetic wave anechoic chambers have been developed through these rigorous efforts, and more than 1100 sites* have been installed worldwide.

For EMC Compliance, Antenna Measurement

The achievement is just one of our many developments. For device designers who seek ideal EMC circuit design essential for electronics development, electromagnetic wave anechoic chambers with even better performance and a more comfortable measurement environment, and measurement systems with extended rationality and efficiency are necessary.

To support these efforts in a steady and detailed fashion, we will do our best to reinforce your strategic endeavors by further improving the characteristics/performance, upgrading design/constructing processes, innovating device development environment of the "World standard electromagnetic wave anechoic chambers", for which we have received admiration and acclamation from countless customers.

Our efforts toward realizing alternatives to CALTS (Calibration Test Site)

Next-generation 10m Test Range electromagnetic wave anechoic chamber achieved electromagnetic environment required for traceability standard site

Realizing the similar performance of an Open Area Test Sites (OATS) in the anechoic chambers

OATS which are constructed in a distant location for optimal electromagnetic environment pose the inevitable limitations in accelerating and streamlining EMI measurements, being susceptible to weather conditions, and time-consuming when transporting equipment and personnel. But OATS with a small deviation, within ±1dB, which is a requirement of CALTS, play an imperative role as a site for antenna calibration and as a traceability standard site which guarantees the reliability of EMI measurement of the 3m Test Range and 10m Test Range electromagnetic wave anechoic chambers.

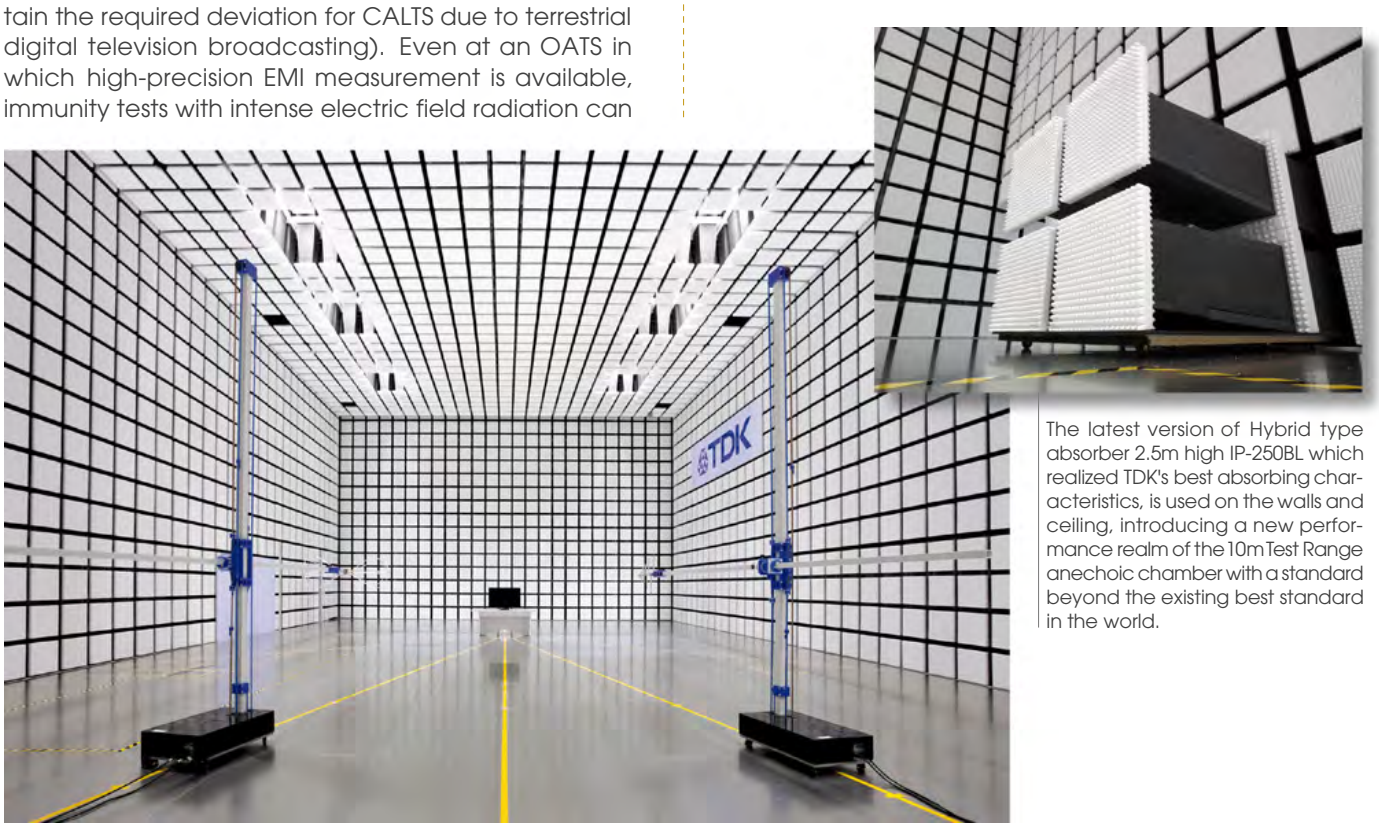
But there have been unavoidable changes in electromagnetic environment near the OATS around the globe as mobile phones and many kinds of wireless telecommunication programs rapidly evolve and expand (A growing number of areas can no longer maintain the required deviation for CALTS due to terrestrial digital television broadcasting). Even at an OATS in which high-precision EMI measurement is available, immunity tests with intense electric field radiation can not be performed due to radio wave codes and regulations of the countries in which the site is located.

Given the changes in electromagnetic environment and limitations in rationalized measurement, an electromagnetic wave anechoic chamber with a similar electromagnetic environment to that of CALTS standard OATS with a deviation within ±1dB, that is, performance required to be an alternative to CALTS specification/standard OATS, has been much sought after.

The 10m Test Range electromagnetic wave anechoic chamber supports the approach to developing next-generation devices in an accelerated and cost-saving measurement.

The 10m Test Range electromagnetic wave anechoic chamber promises site performance which satisfies the CALTS conditions — a highly anticipated electromagnetic environment by many enginerrs worldwide.

The chamber alone can of course provide a high-efficiency measurement/development environment. But adding one to the apex of traceability with the conventional measurement facilities, such as 3m Test Range anechoic chambers, permits construction of EMI/EMS measurement systems that overcome the issues regarding the OATS and limitations in measurement efficiency with superior reliability as good as that of CALTS specification of the OATS.



The latest version of Hybrid type absorber 2.5m high IP-250BL which realized TDK's best absorbing characteristics, is used on the walls and ceiling, introducing a new performance realm of the 10m Test Range anechoic chamber with a standard beyond the existing best standard in the world.

Advantages/Site attenuation characteristics

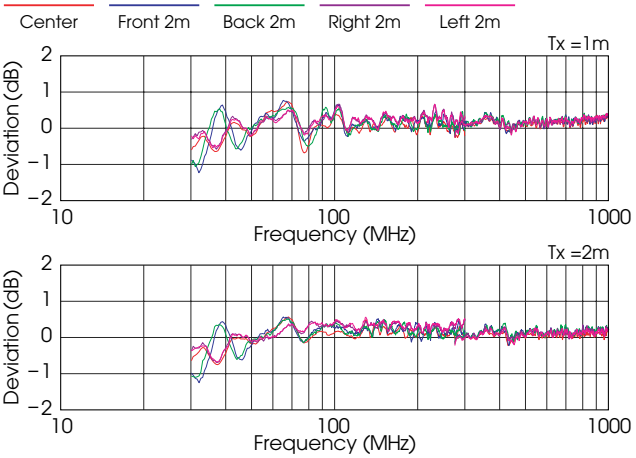
- ANSI C63.4 Normalized theoretical site attenuation within ±1.3dB was achieved : Realizing next-generation electromagnetic environment even more optimal than the attenuation level of the conventional high-performing 10m Test Range electromagnetic wave anechoic chambers (within ±2.5dB).
- Achieved levels within CALTS +0.4, −0.8dB, REFTS* ±0.6dB: Complying with antenna calibration test site conditions.
  *REFTS (Reference Test Site): The site attenuation of vertical polarized wave measurement facility. Deviation value required for antenna calibration test site (standard site) is in review at CISPR (as of December, 2010).
- Height pattern characteristics : Excellent height pattern characteristics, almost equivalent to theoretical figures and those of open sites were achieved.
- Site attenuation uniformity : ϕ6m (evaluated at 50cm intervals each direction of horizontal and vertical) area variable within ±1.3dB was achieved, realizing a superior field uniformity which measurement environment surpasses the conventional levels.
- Supports Site VSWR : Compatible with the requirements of the conformance evaluation method (Site VSWR) in CISPR 16-1-4 Ed3.0 and VCCI technical standard 5.3.4 which are required for 1-18GHz.

Antenna evaluation anechoic chamber (800MHz to 110GHz): Installing the electromagnetic wave absorber IS-030A on the floor between radiation antenna and EUT (equipment under test) (25 units of 3*3m in this case) can significantly reduce reflected waves from the floor and achieve the Site VSWR standard (SVSWR: 6dB or lower).

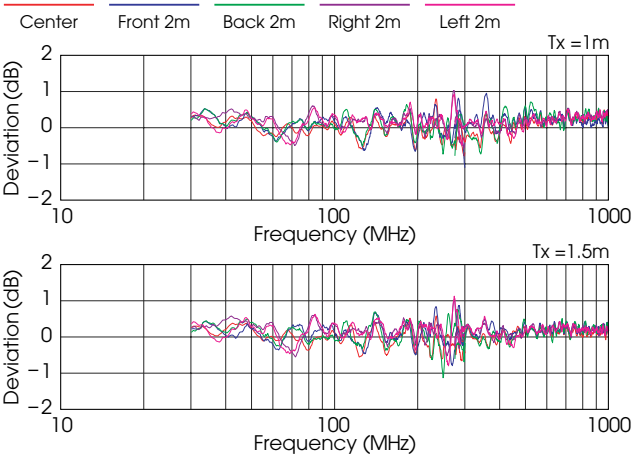
Reference site method

New test site evaluation method which replaces NSA (Normalized Site Attenuation)
Site evaluation method based on APR (Antenna Pair Reference) reference site: Liberty Labs.

Horizontal polarized wave



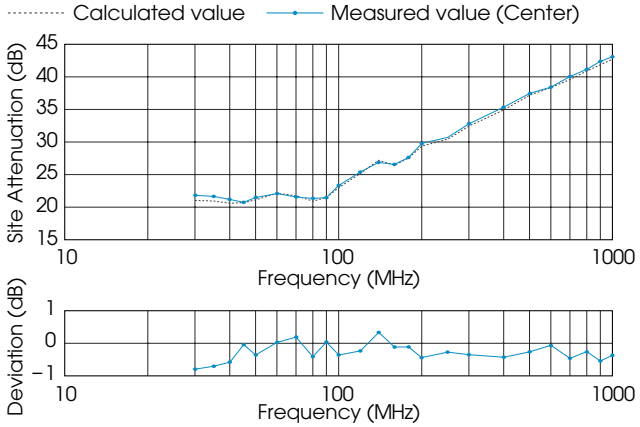
Vertical polarized wave



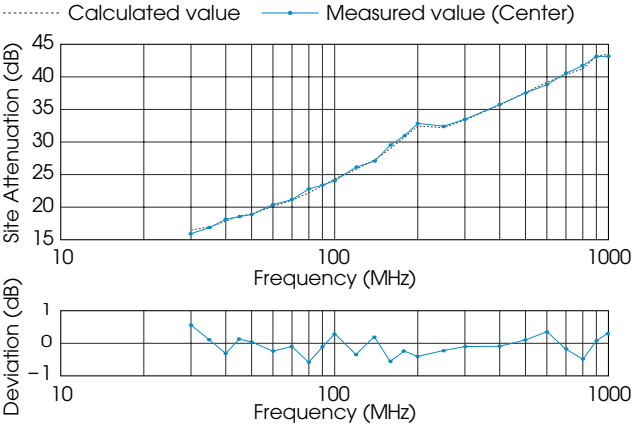
Site performance evaluation using reference dipole antennas

Evaluation through the antenna calibration test site testing method stipulated in CISPR 16-1-5:
Using reference dipole antennas which allow theoretical calculation (moment method and such).

CISPR16-1-5 CALTS (Horizontal polarized wave)



CISPR/A/860/CD REFTS (Vertical polarized wave)



TDK's original technologies have been shaped through countless applications and demands from actual measurement sites.

Unparalleled specifications and design know-how in both EMC compliance/evaluation and antenna design/evaluation fields can be offered.

We perform all tasks within the company, from developing and manufacturing high-performance electromagnetic wave absorbers, to designing shield panels, chambers, and buildings. Our own know-how, proven through rich construction achievement, such as room lighting/sound design seeking comfortable "livability", and the external sliding barrier-free shield doors, which greatly improve work efficiency, are used.

For EMC compliance electromagnetic wave anechoic chambers, efforts are made to provide the highest level quality, which is supported by waste-free rational design and accurate simulation technologies to respond to each demand of diverse values, from inexpensive economy sites, for which a site validation limit value "within ±4dB" is maintained, to standard sites which can improve measurement capability with a deviation of around ±3dB, to semi-premium sites with a deviation as low as ±2dB, and to the latest CALTS premium sites which provide traceability standard sites required performance within ±1dB.

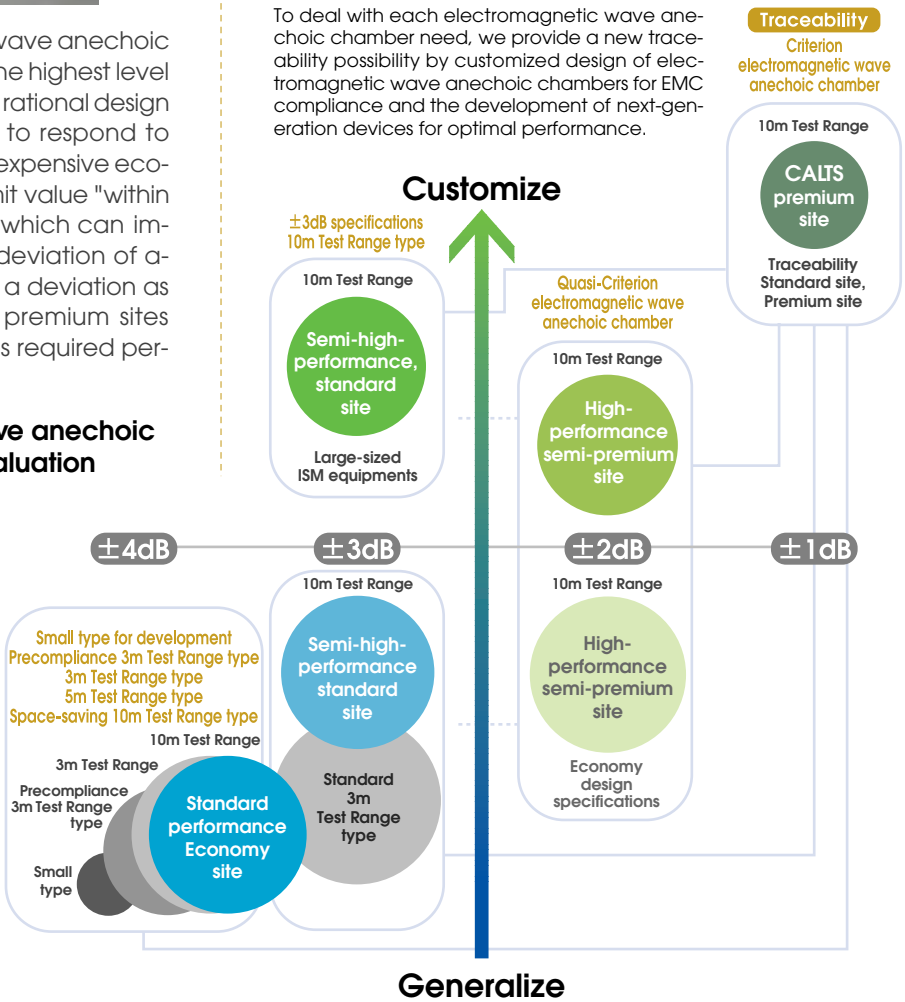
Advantages of electromagnetic wave anechoic chambers for EMC compliance/evaluation

A line of high-performance electromagnetic wave absorber in combination with the world's best ferrite electromagnetic wave absorbers and graphite-containing formed polystyrol electromagnetic wave absorbers has been produced, reinforcing optimal site construction for EMI measurement and immunity testing of equipment and devices supporting to request details.

- A most appropriate space-effective measurement environment is realized with specifications which fully conform to international EMC standards such as EN, FCC, VCCI, CISPR, ISO, and so forth.
- Solid construction of body and building through the original design and construction standards based on first-class architect licenses and specific builder licenses
- Material designs, for which ease of use and efficiency were sought, optimal designs for purposes and EUT, and construction management systems have been established.
- Our rich construction achievements, in which diverse, sophisticated requests from test certification authorities such as UL and leading international companies have been responded, can be fully provided.
- Led by the TDK EMC Center, where the know-how of electromagnetic wave anechoic chambers has been developed and accumulated, comprehensive EMC technical services are provided.

In the field of electromagnetic wave anechoic chambers for antenna design/evaluation, our superior site construction demonstrates a clear distinction from competitive products. Using original and flexible design know-how based on our extensive construction experience, including large and custom constructions, delivers the ultimate product and the greatest satisfaction.

To deal with each electromagnetic wave anechoic chamber need, we provide a new traceability possibility by customized design of electromagnetic wave anechoic chambers for EMC compliance and the development of next-generation devices for optimal performance.

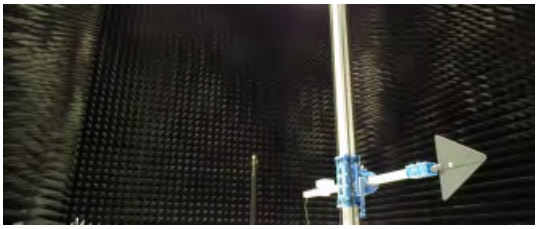


The world's most ideal level of quality and technology to respond to each variable demand

The key to this is an electromagnetic wave absorber for microwave/millimetric waves which was developed to realize electromagnetic wave absorber characteristics best suited for installation locations. We have established the original design know-how for the uses, purposes, size and so forth through the electromagnetic environment simulation technology of the chamber based on accurate dynamic characteristics analytical data achieved from our lot of experience.

Advantages of electromagnetic wave absorbers /anechoic chambers for antenna design/evaluation

- Using formed polyethylene with kneaded carbon, we provide a line of wide-range electromagnetic wave absorbers supporting microwave/submillimetric waves with superb environmental durability and unparalleled electromagnetic wave absorbing characteristics, and a line of original in-house designed oblique incidence electromagnetic wave absorbers for microwave/millimetric waves. By these materials, the highest levels of site performance have been achieved.



- A line of Hybrid type absorber (ferrite and graphite-containing formed polyethylene electromagnetic wave absorbers) is also available. These provide optimal electromagnetic characteristics for wide-band measurement ranging from FM, to microwave, to millimetric wave (76MHz-100GHz).

- The products have successfully satisfied the needs for high-grade characteristics and reliability (characteristic stability/long life) in numerous applications at the Ministry of Defense, and other governmental agencies/organizations, and private research institutes.
- Optimal designs for rationalized site construction and management are provided to deal with diverse demands in the private sector, such as mobile communication device, automobile glass antenna evaluation, and such.

Abundant construction experience and optimal designs will also satisfy your needs for multi-functioning and special specifications.

Unprecedented design/construction of special-specification electromagnetic wave anechoic chambers, such as electromagnetic wave anechoic chambers for EMC compliance/evaluation as well as antenna design/evaluation, and chambers for acoustic and electromagnetic wave tests, have received the highest acclaim as a result of our comprehensive application of our original design/construction know-how.

Rich global networks and subsequent support systems after installation

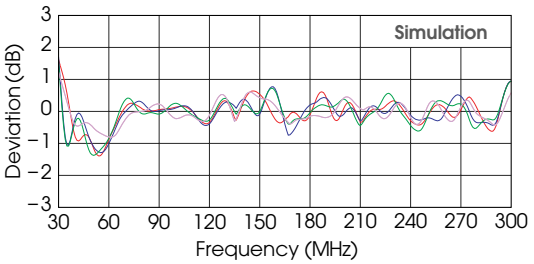
Highly-reliable and durable construction based on first-class architect licenses and specific builder licenses are undertaken. We provide construction overseas through our global networks of certified affiliates following our standard construction manuals. Even after construction, our agile support system, which links our regional representatives to headquarters and technicians, always maintains customers measurement environment in optimum condition. Our periodical inspection and maintenance contract systems are also fully available.

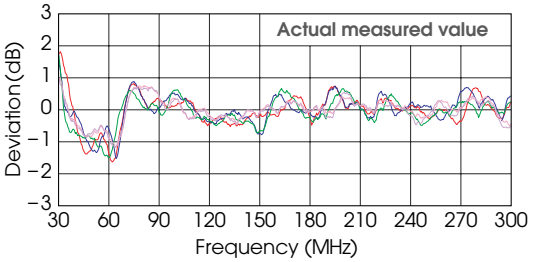
Comparison of simulation data at the designing stage and actual measurement results when the system is complete.
An actual example of the 10m-method electromagnetic wave anechoic chambers for EMC compliance

L25m x W14m x H9m
Absorber : IP-130BLB (H:1300mm)
ANSI : ±3.0dB VCCI : ±1.5dB

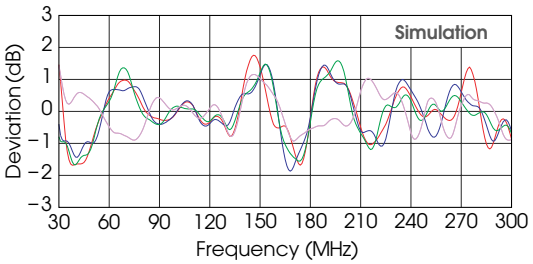
Tx =1m
- Center
- Front 2.5m
- Back 2.5m
- Right 2.5m
- Left 2.5m

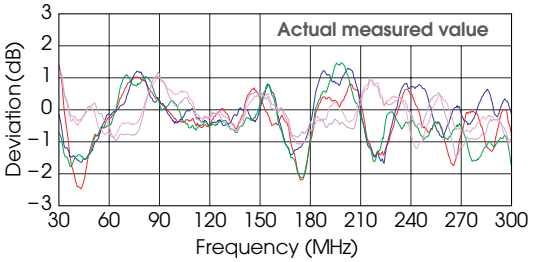
Horizontal polarized wave





Vertical polarized wave





Construction example of electromagnetic wave anechoic chambers for EMC countermeasure/evaluation

CALTS-specification premium
10m Test Range anechoic chamber

Specification examples

Dimensions between shield surfaces	L30×W20×H11.6m
Dimensions between internal walls	L25×W15×H9.1m
Electromagnetic wave absorbers	IB-017(L100×W100×T5.2mm)
	IP-250BL(L600×W600×H2,500mm)
Turntable	φ3m(1ton)/φ6m(4ton) Dual

Site attenuation
30MHz to 18GHz : ±1.5dB max.(φ6m area)

Evaluation as antenna calibration test site
CALTS : ±1.0dB max.
REFTS : ±1.0dB max.

High-performance semi-premium
10m Test Range anechoic chamber

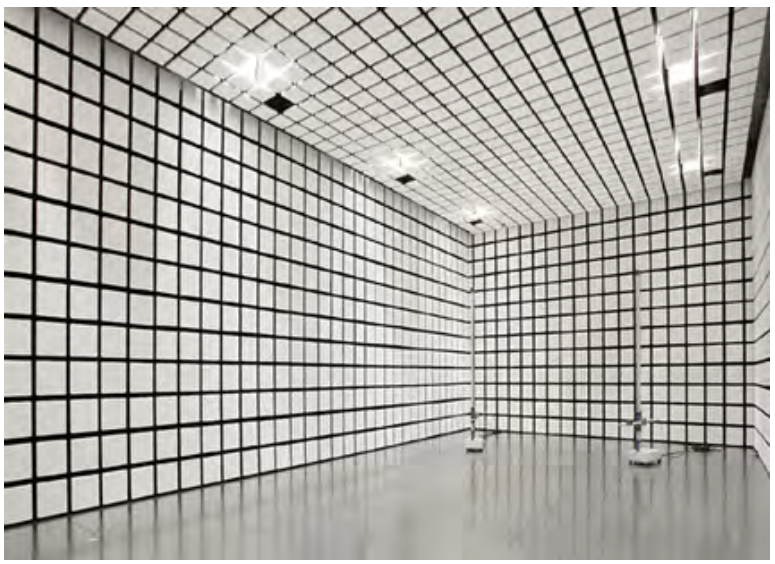
Specification examples

Dimensions between shield surfaces	L24×W15.2×H11.2m
Dimensions between internal walls	L24×W15.2×H11.2m
Electromagnetic wave absorbers	IB-017(L100×W100×T5.2mm)
	IP-180BL(L600×W600×H1,800mm)
	ICM-006(L100×W100×H60mm)*
Turntable	φ2m(0.5ton)/φ5m(3ton) Dual

* EMS absorbing plate with ICM-006 mounted on the surface+ Fully-automated beneath floor storage device

Site attenuation
30MHz to 18GHz : ±2dB max.(φ5m area)

Evaluation as antenna calibration test site
CALTS : ±1.0dB max.



Semi-high performance standard
10m Test Range anechoic chamber

Specification examples

Dimensions between shield surfaces	L25×W14×H9m
Dimensions between internal walls	L22.4×W11.4×H7.7m
Electromagnetic wave absorbers	IB-017(L100×W100×T5.2mm)
	IP-130BLB(L600×W600×H1,300mm)
	ICM-006(L100×W100×H60mm)*
Turntable	φ3m(0.5ton)/φ6m(4ton) Dual

* EMS absorbing plate with ICM-006 mounted on the surface+ Fully-automated beneath floor storage device

Site attenuation
30MHz to 18GHz : ±3dB max.(φ5m area)

Construction example of electromagnetic wave anechoic chambers for EMC countermeasure/evaluation

Semi-high performance standard 3m Test Range anechoic chamber

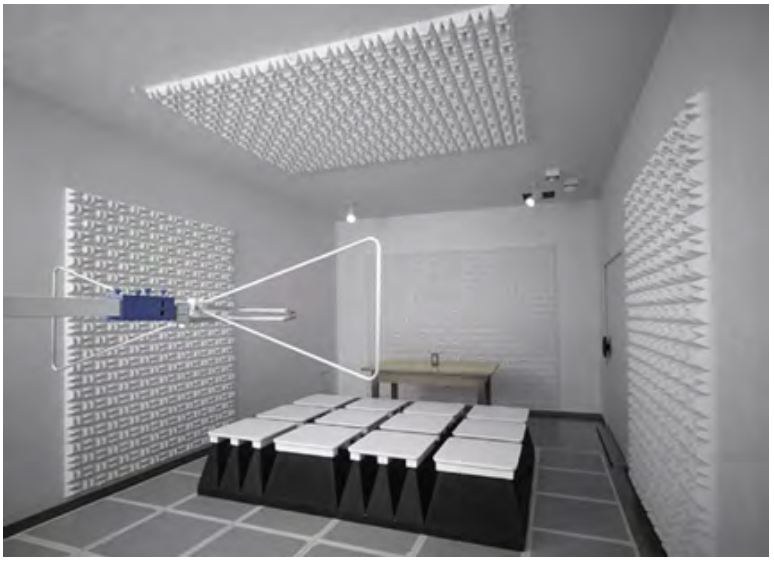
Specification examples

Dimensions between shield surfaces	L12×W8.5×H6m
Dimensions between internal walls	L10.6×W7.1×H5.3m
Electromagnetic wave absorbers	IB-017(L100×W100×T5.2mm)
	IP-065BL(L600×W600×H650mm)
	IP-045C(L600×W600×H450mm)*
Turntable	φ3m(1ton)

*Floor-installed EMS-absorbing electromagnetic wave absorber

Site attenuation

30MHz to 18GHz: ±3dB max.(φ3m area)



Precompliance 3m Test Range small anechoic chamber

Specification examples

Dimensions between shield surfaces	L7×W4×H3m
Dimensions between internal walls	L6.9×W3.8×H2.9m
Electromagnetic wave absorbers	IB-017(L100×W100×T5.2mm)
	ICM-006(L100×W100×H60mm)
	IP-045C(L600×W600×H450mm)*
Turntable	φ1.2m(300kg)

*Floor-installed EMS-absorbing electromagnetic wave absorber

Site attenuation

30MHz to 18GHz: ±4dB max.*

*Compensation coefficients introduced

Anechoic chambers for whole vehicle evaluation and testing

Specification examples

Dimensions between shield surfaces	L16×W12×H6.5m
Dimensions between internal walls	L14×W10×H5.5m
Electromagnetic wave absorbers	IB-017(L100×W100×T5.2mm)
	IP-090BLB(L600×W600×H950mm)
Turntable*	φ8m(5ton)

*Chassis-dynamometer equipped

Site attenuation

30MHz to 18GHz: ±3dB max.(φ5m area)

The forefront of electromagnetic wave absorber evolution processes is here

Material/structural advantages of electromagnetic wave absorbers for EMC compliance/evaluation

Small/light-weight composite electromagnetic wave absorber development technologies were established to provide ideal electromagnetic wave absorbing characteristics throughout a wide band using ferrite electromagnetic wave absorbers with the world's top level electromagnetic wave absorbing characteristics and graphite-containing formed polystyrol electromagnetic wave absorbers, as well as design know-how to match their impedances in the most suitable way.

Diverse lines of electromagnetic wave absorbers for diverse purposes, such as EMI measurement, immunity evaluation, and antenna evaluation, have been launched, providing the world's premier electromagnetic environmental characteristics through product selection, and design arrangement optimized, based on the scale of the anechoic chamber and types of measurement.

The "stability" of the electromagnetic environment is also excellent.

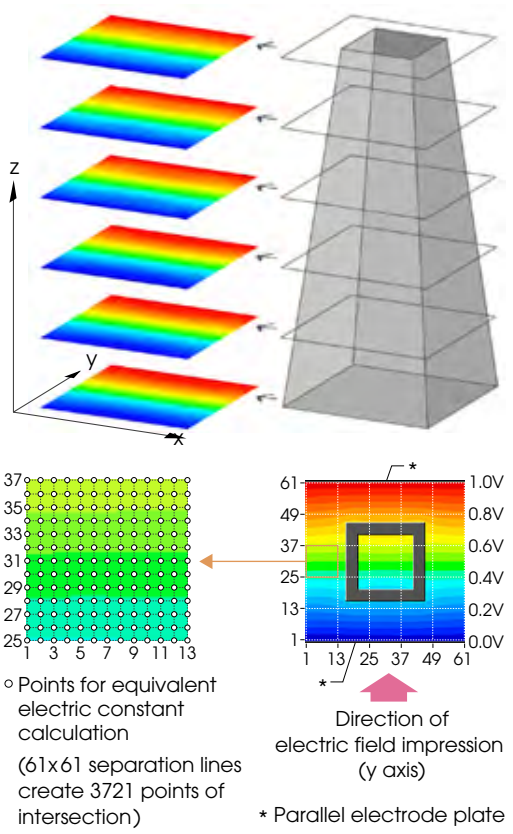
- Its operational life is long: no significant change in electromagnetic wave absorbing performance occurs even after 30 years.
- The ferrite electromagnetic wave absorbers its electromagnetic wave absorbing characteristics semi-permanently. With a humidity-resistant closed-cell structure, graphite-containing formed polystyrol electromagnetic wave absorbers allow superb reliability despite environmental changes, and prevent almost any change through aging.
- All TDK electromagnetic wave absorbers are manufactured within the company. The quality and reliability required to respond to sophisticated demands are guaranteed through our strict quality management system which permits no dust from product deterioration, so maintaining a clean interior at all times.
- Burning causes no highly toxic cyanide gas or such.
- A white end-cap protects electromagnetic wave absorbers from contact and shock by other materials during transport in and out of the chamber, and provides ample brightness in the entire chamber.

This is another case of original technology directed at providing the world's best anechoic chambers at all levels, from economy to premium.

The equivalent permittivity simulation technology accurately evaluates the "ability" of electromagnetic wave absorber while it is being designed. TDK-EPC is also active in advanced efforts in this field.

The two-dimensional difference method, which is a new method of calculation designed to improve the conventional simulation methods (the synthesized capacitance model), was used for the latest IP-BLB series.

The calculation method separates the tapered section of graphite-containing formed polystyrol electromagnetic wave absorbers into thin plates which cross the Z axis at right angles in order to calculate electric potential at microscopic lattice points (3721 points in the example) marked on each plate via the two-dimensional difference method.



○ Points for equivalent electric constant calculation

(61x61 separation lines create 3721 points of intersection)

Direction of electric field impression (y axis)

* Parallel electrode plate

Synthetic volume is calculated through the electrical potential distribution obtained, and it is considered an equivalent complex permittivity.

The reflection coefficient vs. frequency characteristics of electromagnetic wave absorber obtained by this method - accurately traces the actual measured values, allowing electromagnetic wave anechoic chamber performance simulations which are much more accurate than those performed by conventional means (Examples shown on Page 7).

The forefront of electromagnetic wave absorber evolution processes is here

Material/structural advantages of electromagnetic wave absorbers for EMC compliance/evaluation

Hybrid type wave absorber IP-BLB series

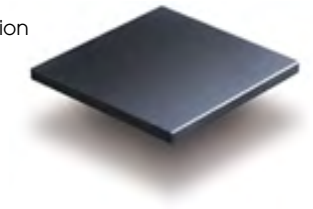
Hybrid type wave absorber IP-090BLA solves the limitations of decreasing size and weight of the conventional wedge-shaped casting type, and reinforces wave absorbing characteristics through a wide range. The new series IP-BLB further expands the innovative original structure of IP-090BLA.

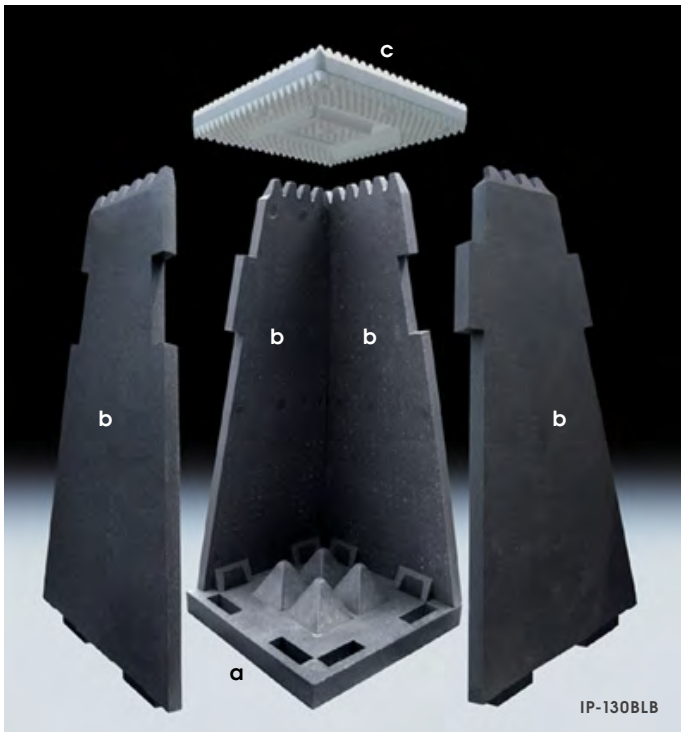
IP-090BLA's highly-acclaimed outstanding absorbing characteristics are maintained intact, and further weight saving and rationalization have been made. We provide one of the industry's smallest occupied volume and the best wave absorbing characteristics for all kinds of anechoic chambers, such as special-purpose large anechoic chambers, as well as the 3m Test Range and 10m Test Range anechoic chambers.

Ferrite electromagnetic wave absorber IB-017

5.2mm thin electromagnetic wave absorber material with optimum control of ferrite's magnetic resonance loss characteristics at high frequencies.

L100 x W100mm
Band in which reflection attenuation is more than 20dB : 30 to 360MHz





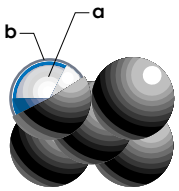
a Graphite-containing formed polystyrol electromagnetic wave absorber/base part (600 x 600mm)
b Graphite-containing formed polystyrol electromagnetic wave absorber/tapered part
c Formed polystyrol white end-cap (515 x 515mm)
Overall height (base part + tapered part + end-cap) : 1300mm

Original dielectric loss electromagnetic wave absorber design, in combination of base part and tapered plate part, realized significant weight loss, and saving in space and cost, while storing and transporting. Improved installation accuracy at construction sites and increased construction efficiency shortened the construction period shortened by 38% (10m Test Range) compared to the conventional wedge-shaped casting type unit.

Main applicable anechoic chambers

Anechoic chambers of the 3m Test Range type, 5m Test Range type, for automobile, and large type for special uses

Features of IP-130BLB base material (characteristic comparison with other materials)

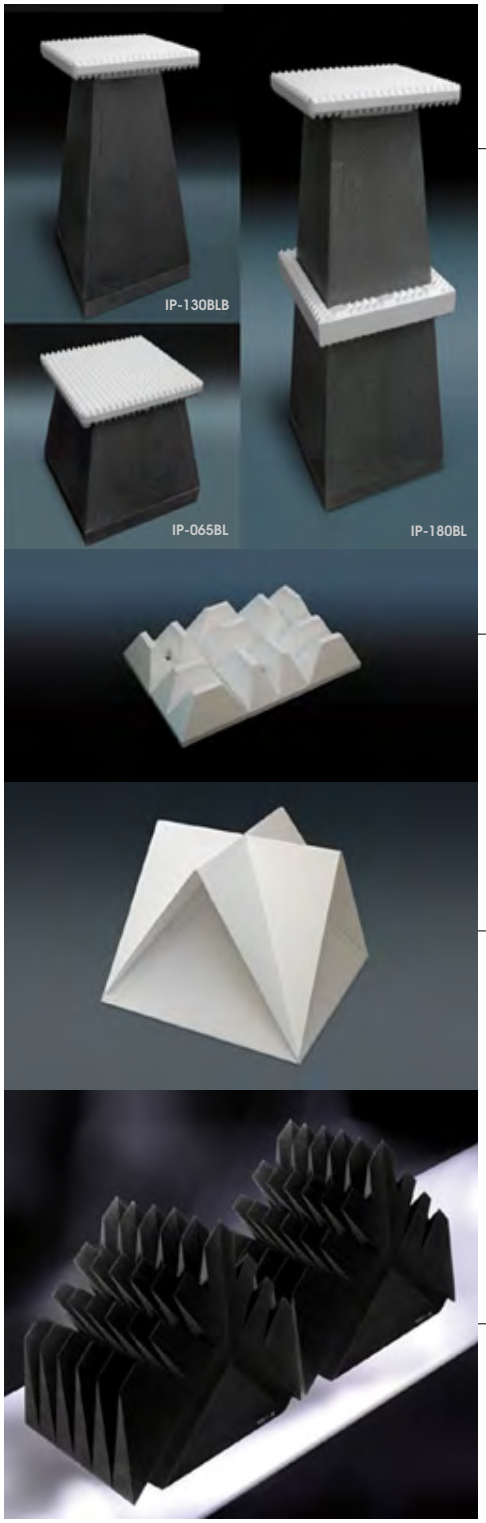


Applied material	Formed polystyrol	Example of other materials: polyurethane
Base material structure	Closed cell	Open cell
Tensile strength	4kg/cm^2	2kg/cm^2
Chemical resistance	Eroded with organic solvent	Eroded with acid and base
Strength/longevity	No change over 10 years	Weakens in a few years
Burning resistance	NRL, UL standards complied with	NRL standard complied with
Combustion gas	Aromatic	Chlorine and cyan
Adhesiveness	Good	Precautions against peeling off of thick types

a : Formed polystyrol beads **b** : Graphite-containing paint

Electromagnetic wave absorbers for EMC compliance/evaluation

Main product lineup

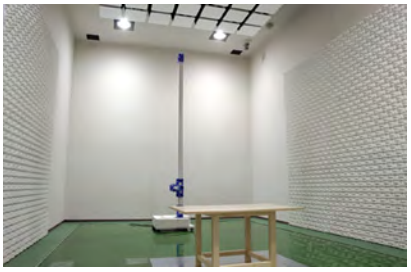


Electromagnetic wave absorber for EMC measurement/evaluation electromagnetic wave anechoic chambers

IP-065BL, IP-090BLB, IP-130BLB, IP-180BL

L600 x W600mm

IP-045BLB : H450mm / IP-065BL : H650mm
IP-090BLB : H950mm / IP-130BLB : H1300mm
IP-180BL : H1800mm / IP-250BL : H2500mm



ICM-006

Noncombustible electromagnetic wave absorber material which provided H60mm. Despite its small size, it allows construction of 3m Test Range anechoic chambers and small anechoic chambers through the combination with ferrite electromagnetic wave absorbers in a space-effective way with superb electromagnetic wave absorbing characteristics even at low frequencies.

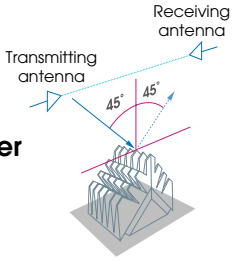
L100 x W100 x H60mm
Picture : x 6 pieces

Non flamable certification number : NM-0582

ID-045

A light-weight electromagnetic wave absorber material with high flammability. A cross-wedge shape is formed to obtain optimal electromagnetic wave absorbing efficiency with thin-plate electromagnetic wave absorber material in which special conductive fabric is incorporated with inorganic-organic mixed base materials. Outstanding wave absorbing performance from 30MHz, low frequency, up to 18GHz of high frequency in combination with ferrite electromagnetic wave absorber materials is realized. Flat-pile supported separated/folded structures greatly reduce the cubic capacity during transportation, realizing a single mass of 1kg, as well as decreasing the environmental burden.

L600 x W600 x H450mm
Flammability : JIS A1322 flameproof 1st degree, UL94V-0, VTM-0



Floor-installed electromagnetic wave absorber for radiated field immunity test

IS-080S

Floor-installed oblique incidence electromagnetic wave absorber which effectively absorbs the floor reflection of waves emitted from antennas.

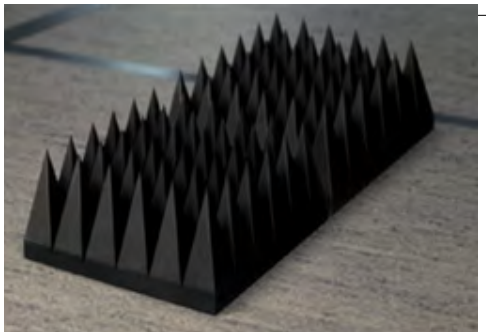
L840 x W600 x H780mm
Picture : x 2 pieces

Example of 45-degrees oblique incidence characteristic

Band in which reflection attenuation is more than 20dB : 200MHz to 40GHz

Electromagnetic wave absorbers for EMC compliance/evaluation

Main product lineup



Electromagnetic wave absorber for GHz band radiation noise measurement

IS-030A

30cm-high pyramid-shaped electromagnetic wave absorber which has proven its outstanding performance in microwave/millimetric wave electromagnetic wave anechoic chambers.

Wide frequency range 800MHz-110GHz is covered with high abosorption ratio and easy handling to set up for Site VSWR standard-complied anechoic characteristics.

More than 10 years of mechanical longevity without creep (sagging) at the tip has been achieved. Many years of superb electromagnetic wave absorbing performance is maintained.

L600 x W600 x H300mm
Picture : x 2 pieces

* The measurement of Site VSWR (Site Voltage Standing Wave Ratio) is a method stipulated in CISPR16-1-4 Ed3. as an evaluation method for over 1GHz for the EUT.

Example of the construction for antenna design/evaluation anechoic chambers

Our original absorber materials and design know-how dedicated to realize the ideal Quiet Zone

High-precision large size anechoic chambers for the evaluation of radar and large antennas

Specification examples

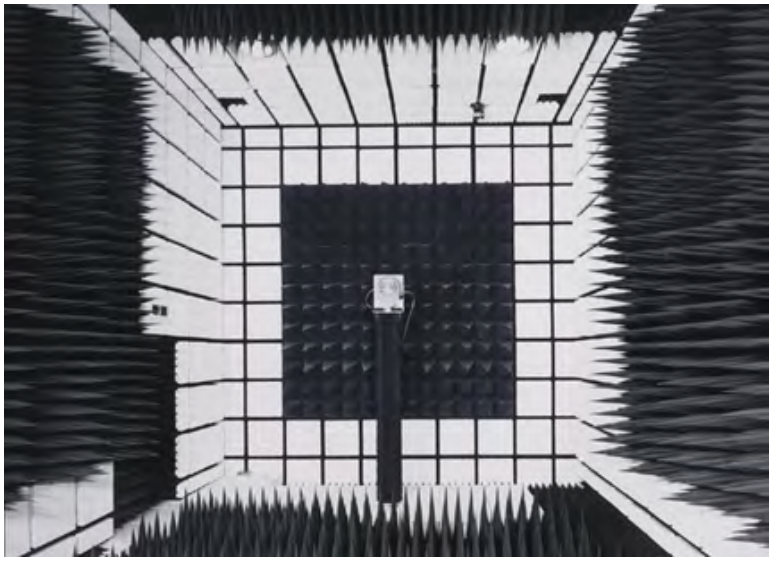
Dimensions between shield surfaces	L33.6×W13.6×H13m
Dimensions between internal walls	L33×W12.6×H12m
Electromagnetic wave absorbers	IS-M030*(L600×W600×H300mm)
	IS-SM050**(L600×W600×H500mm)
Quiet Zone (QZ) dimension : ϕ3m sphere	
Distance (between QZ center and EUT) : 20m	

*For main walls for millimeter wave
**For long sidewalls, ceilings, and floors

Unwanted incidental characteristics of Quiet Zone

4GHz～: −45dB / 10GHz～: −45dB / ～75GHz: −50dB

- This high-performance anechoic chamber can be used to evaluate large-scale radar scattering cross-sectional areas.



High-precision middle size anechoic chambers for antenna evaluation

Specification examples

Dimensions between shield surfaces	L12×W6×H6m
Dimensions between internal walls	L10×W4×H4m
Electromagnetic wave absorbers	IS-100*(L600×W600×H1000mm)
	IS-SM100**(L840×W600×H1000mm)
Quiet Zone (QZ) dimension : ϕ2m sphere	
Distance (between QZ center and EUT) : 6m	

*For main walls **For long sidewalls, ceilings, and floors

Unwanted incidental characteristics of Quiet Zone

0.8GHz～: −30dB / 1.6GHz～: −35dB / 2.5GHz～: −43dB
5.5GHz～: −50dB / 27～100GHz: −53dB

High-precision small anechoic chambers for antenna evaluation

Specification examples

Dimensions between shield surfaces	L7×W4×H3m
Dimensions between internal walls	L5.8×W3×H2m
Electromagnetic wave absorbers	IS-060*(L600×W600×H600mm)
	IS-SM050**(L840×W600×H500mm)
Quiet Zone (QZ) dimension : ϕ0.6m sphere	
Distance (between QZ center and EUT) : 3m	

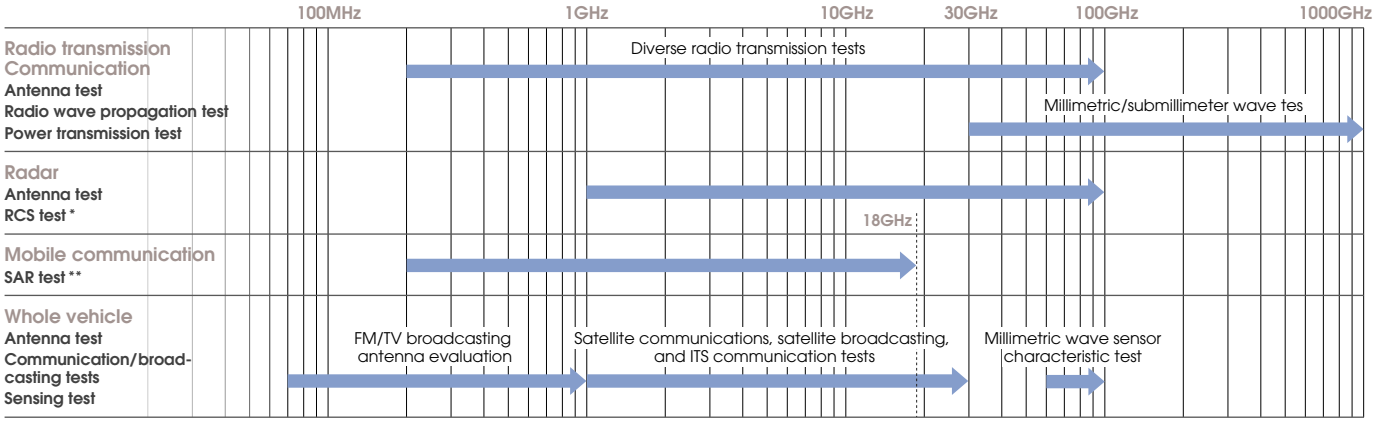
*For main walls **For long sidewalls, ceilings, and floors

Unwanted incidental characteristics of Quiet Zone

0.8GHz～: −30dB / 1.0GHz～: −35dB / 2.5GHz～: −40dB
5.5～100GHz: −50dB

Material advantages of microwave/millimetric wave-supporting electromagnetic wave absorbers

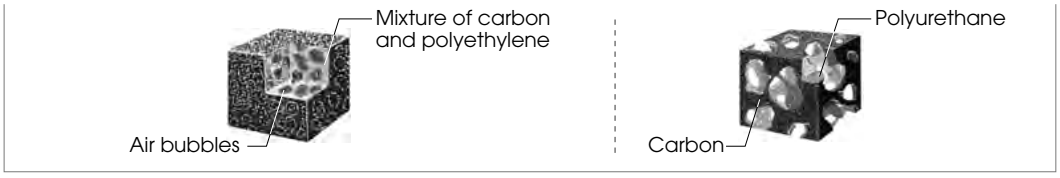
Major applications and measurement frequency ranges of electromagnetic wave anechoic chambers for antenna design/evaluation



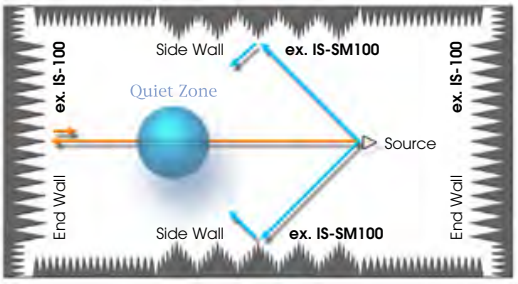
* RCS (Radar Cross Section) test : radar reflection cross-section area (stealth property) test
** SAR test : specific absorption rate test of electromagnetic wave energy

Features of the IS, IS-SM Series base material (characteristic comparison with other materials)

Applied material	Formed polyethylenel	Example of other materials: polyurethane
Base material structure	Closed cell	Open cell
Tensile strength	4kg/cm^2	2kg/cm^2
Chemical resistance	Eroded with oxidation agent	Eroded with acid and base
Strength/longevity	No change over 10 years	Weakens in a few years
Burning resistance	NRL, UL standards complied with	NRL standard complied with
Combustion gas	Aromatic	Chlorine and cyan
Adhesiveness	Good	Precautions against peeling off of thick types



Design concept of electromagnetic wave anechoic chambers for antenna evaluation



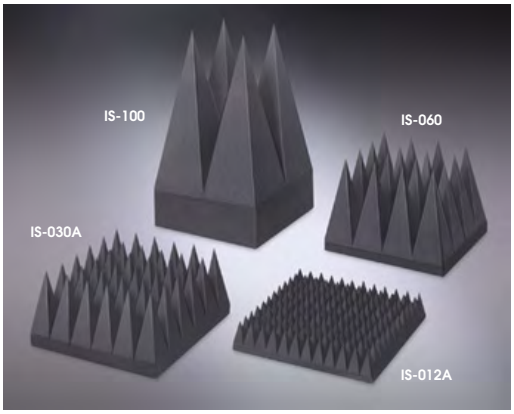
IS-SM Series – high-performance oblique incidence-dedicated electromagnetic wave absorbers – and IS Series – high-performance vertical incidence electromagnetic wave absorbers – were applied.

Vertical incidence characteristics → and oblique incidence characteristics ↙↖ were improved and reinforced to reduce the level of unwanted incident wave into the quiet zone, realizing the world's best measurement accuracy.

Quiet Zone ● : A space where the level of unwanted waves reflected from the walls, floors, and ceilings is always under a preset value. The quietness guarantees the measurement of the actual performance of the chambers.

Microwave/millimetric wave-supporting electromagnetic wave absorbers

Main product lineup



Electromagnetic wave absorber supporting microwave - submillimetric wave band

Pyramid-shaped electromagnetic wave absorber using carbon ohmic resistivity with formed polystyrol base material.

IS-012A, IS-030A, IS-060, IS-100

Heights from 50mm through 1000mm have been made in series, covering a wide range, from 200MHz millimetric waves to over 100GHz submillimetric wave bands. Heights are selected based on operational frequency and absorbing performance. With its closed cell structure, superb environmental resistance can be maintained for long periods.

L600 x W600 mm
IS-005A : H50mm / IS-012A : H120mm / IS-030A : H300mm / IS-060 : H600mm / IS-100 : H1000mm
Fire-retrardant : UL 94 HBF

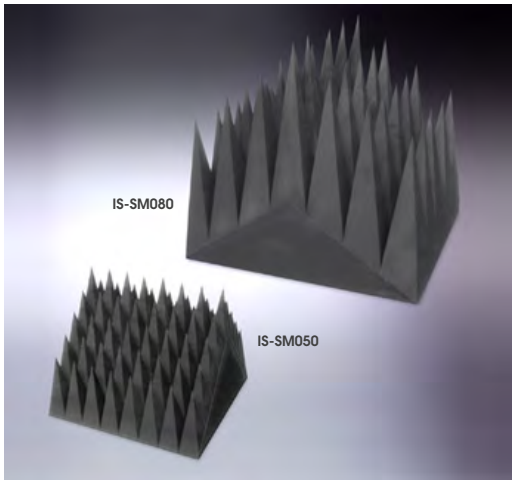
Electromagnetic wave absorber supporting FM - microwave band

For microwave graphite-containing formed polystyrol electromagnetic wave absorber.

IP-100BX, IP-130BX, IP-175BX, IP-200BX

By combining with ferrite absorbers, superior wave absorbing characteristics from the FM band (70MHz and higher) through the microwave range are provided.

L600 x W600 mm
IP-100BX : H1m / IP-130BX : H1.3m / IP-175BX : H1.75m / IP-200BX : H2m
Fire-retrardant : UL 94 HBF



Oblique incidence electromagnetic wave absorber for microwave - millimetric wave band

Electromagnetic wave absorber designed exclusively for oblique incidence.

IP-100BX, IP-130BX, IP-175BX, IP-200BX

Mounted at the center of anechoic chamber's sidewalls easily provides an outstanding electromagnetic environment. Formed polyethylene base material, which is also used in the IS series, is molded into a custom designed multi-axial pyramid shape, providing superior oblique incidence characteristics. These out-perform conventional pyramid-shaped electromagnetic wave absorbers in a wide range covering microwave-millimetric waves.

IS-SM050 : L600 x W600 x H500mm
IS-SM080 : L840 x W600 x H800mm
Fire-retrardant : UL 94 HBF

Guaranteed first-class quality and safety as architecture — It's TDK's fundamental philosophy. It has satisfied requirements all over the world.

As architecture, anechoic chambers must be of premier quality — TDK's original construction standard / Design performed at the headquarters and global construction network systems.

- All construction is undertaken with our rich electromagnetic wave anechoic chamber construction know-how and construction standards (electromagnetic wave anechoic chamber construction policies) based on strict checklist items.
- All design of construction inside/outside Japan is performed at the design department of the TDK headquarters. Through in-house design based on first-class architect licenses, and specific builder licenses, robust body/housing design is strictly observed to deal with diverse demands of actual measurement sites.
- Constructions outside Japan is undertaken by TDK's certified partners based on the construction standards (electromagnetic wave anechoic chamber construction policies) and under the design/guidance systems of TDK headquarters.

View of large turntable installation
(φ3m/10m Dual type, Withstand weight : 30t)

Body design and construction with safety and workability prioritized

- Long shield panel welding method, providing both the world's best quality shield characteristics and stout structures
- Safety nets to protect from the fall of electromagnetic wave absorbers from the ceiling are included in the standard set.
- Standardized absorber mounting work based on construction manuals and efficient management systems are provided.
- Floors are structured with robust foundation structures and 3.2mm thick steel plate.
- Diverse door structures, such as entrances and exits without steps, outside sliding door method, and so forth, are developed and applied to provide superior safety and work efficiency.

Environmental design of electromagnetic wave anechoic chamber interior

- We are making further effort to reduce the fatigue of measurement operators and to increase the efficiency and comfort of test work.
- Bright work space: The lighting intensity is set at 300 lux on the turntable. The brightness necessary for duties is maintained in the entire chamber.
- Reduction of sound reflection : An acoustic environment as comfortable as that in the living room of a general residential house is realized.
- Excellent cleanness : Sources of dust, which cause detachment due to surface deterioration of electromagnetic wave absorber materials — a frequent concern in competitors' chambers — have been eliminated.

High-performance / high-precision ancillary facilities

- Example of slip-ring system turntable which supports high capacities (270kVA)
  - Error range of rotation angle : 1°
  - Adjustment range of rotation speed : 0.5 - 5rpm
- Example of antenna positioner
  - Error range of stop position : 1cm

Main components / facilities of the 10m-method electromagnetic wave anechoic chambers

Shield room constructional elements

- Light-gauge steel structure
- Ceiling reinforcing structure
- Shield panel
  Wall surface/ceiling jointing welding method
- Shield door
  Barrier-free no-step structure/Diverse door structures, such as external sliding and swinging types
- Air-conditioning vent
- Signal-line panel
- Filter box
- Filter opening
  For fire alarms and emergency lighting

Electromagnetic wave absorber component materials

- Ferrite electromagnetic wave absorbers
- Graphite-containing formed polystyrol electromagnetic wave absorbers
- Epoxy glue
- Interior materials (environment-friendly materials are used)

Electrical facility

- Power-line filter
- Insulating transformer
- Lighting devices (incandescent and LED lights)
  Internal lights and, "Emergency" and "Occupied" indicators
- Intercom/fire alarm systems
- Electrical outlets/switches

Ancillary facilities

- High-hat lighting automatic up/down system
- Barrier-free shield door
- Turntable
- Turntable pit access hatch
- Automated storing device
  for EMS electromagnetic wave absorbers
- Storage system for associated equipment
- Antenna positioner
- Beneath-floor projector system
- ITV (monitoring camera) system
- Low-reflection EUT table

What is the optimal solution for users?
We repeat this question to ourselves : That's how we design and construct.

Each request from our clients is based on their original concept in all details.
We understand all of the details and integrate them into a concrete shape.

What we value most, from the initial discussions with clients, through all of the processes up to completion, is the "passion" of the actual users of our anechoic chambers.

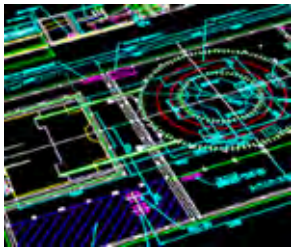
Regardless of the size of the anechoic chambers, our customers' biggest aspirations and their original strategies are included in each request.

In every stage of the process, from specification discussions to completion, we understand our customers' intentions, and apprise them of all of our technologies and know-how so that the optimum solution can be obtained.

If we consider it necessary to satisfy a customer's needs, we will even develop a new electromagnetic wave absorber.

Discussions about specifications

Mechanical specifications
Power line specifications
Signal line specifications
Safety measures
Ease of maintenance
Management
Designs, etc.



Design

Our original design technologies with our rich construction experience allow optimum electromagnetic space for your requirements.

In-person observation of the construction (improvement/adjustment)

In the presentce of customers, production of ancillary equipments, such as Turntable, doors are inspected for improvement or adjustment.
Not only at design stage, but also in the process of these ancillary equipment, we listen to customers' needs and reflect in the production of the facilities.

Onsite assembly/ verifying operation and completion

At the final inspection, you can take a close look at the features of the completed fittings, facilities and their operation.

Electromagnetic wave anechoic chamber construction steps

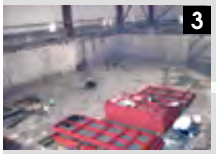
10m-method electromagnetic wave anechoic chamber specification

Groundwork

1 Turntable pit

2 Assembling steel frames

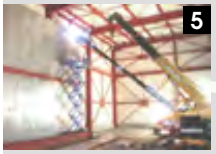
Exterior wall construction



3 Assembling shield panel

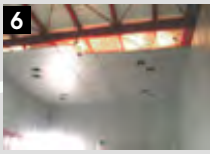
4 Floor shield construction

Installing shield panels



5 Installing shield panels on the side walls

6 Installing shield panels on the ceiling

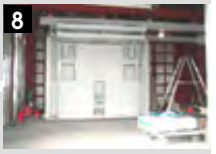


7 Jointing shield panels by electrical welding

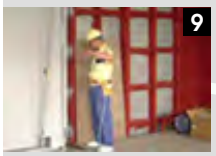
Testing welding conditions

Assembling/installing fixtures
8 such as shielding doors

9 Intermediate shield condition test

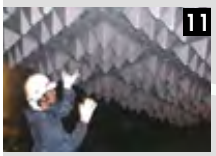


Mounting electromagnetic wave absorbers



10 Mounting ferrite electromagnetic wave absorbers

Testing/managing gaps between each ferrite electromagnetic wave absorber



11 Assembling and installing graphite-containing formed polystyrol electromagnetic wave absorbers

Assembling and installing ancillary facilities

12 13 Installing the turntable

Finishing up the floor

Testing the accuracy of floor installation

Final test
Judging if the completion standard is met

14 Completed

Major ancillary equipment

Actual examples of 10m Test Range anechoic chambers

High-hat lighting automatic up and down device

- The lighting is suspended in a box space (high-hat), which is surrounded by electromagnetic wave absorbers far above the ceiling so that no electromagnetic wave reflects on the metal lighting fixtures.
- Through the electric elevation system, the lighting fixtures can be lower to the height of your hands so that you can safely and quickly perform maintenance tasks, such as changing light bulbs or inspecting abnormalities.
- The system automatically halts at preset heights when being lifted or lowered so that you won't accidentally cause the lighting to fall on the floor*.

  * It also stops automatically if the system detects a malfunction while ascending or descending.

You can not see the lighting fixtures even when you are close to them. This is the basic principle of wave reflection prevention.

The lighting fixtures are installed deep in a box space which is surrounded by electro-magnetic wave absorbers and far enough away for the waves to reach them.

The lighting can be lowered to this level for easy maintenance works.

Outside sliding barrier-free shielding door

- Fully-automated electrically opening/closing shielded door. Unlike the conventional structure which lifts and lowers the threshold on the floor to provide a barrier-free environment, this original structure drives the shield pieces, which are installed between the door surfaces, with a motor. With moveable shielding pieces being fastened with shield fingers, an optimum, seamless shielding performance is realized.
- The entire door is fastened by moving the built-in shielding pieces. The inner face of the door with electromagnetic wave absorbers can therefore be opened and closed without tampering with their performance.
- As opposed to the conventional type, which lifts and lowers the doorframe on the floor, there's no need to cut the lower part of the electromagnetic wave absorber, so allowing the maintenance of the best condition without hindering the performance particular to electromagnetic wave anechoic chambers.
- The whole door hangs from a ceiling rail on which the door moves to open and close the chamber. No guiding rail or gutter is required on the front surface of the door or on the moving path. Influence of dust or foreign particles can be avoided when opening and closing the door. The lifter of the threshold part rises when the door opens to provide a completely barrier-free system without gutters or bumps.
- Shield fingers, whose anti-wear properties and environmental resistance were reinforced with robust nickel plating, are attached. Initial shield performance can be maintained for a long period.
- External power outlets are provided on the control box, allowing the door to open in an emergency, such as power failure by switching to backup power.

Fully shielded/closed (Example of shielding door size : W3.6 x H3m)

The door has been fully moved, waiting to be slid to the left (the lifter elevates)

Sliding is completed/barrier-free open status

Major ancillary equipment

Actual examples of 10m Test Range anechoic chambers

Swinging barrier-free shielding door

- Motorized opening/closing, tightening operations provide superior shielding performance.
- The electric threshold which descends when being opened provides a barrier-free floor.
- The shield fingers are nickel plated which protects them from corrosion and abrasion. This feature maintains the initial shield performance for a long period.
- For safety, the brake on the tightening rotation handle motor is released during power failures so that the door can be manually opened.

The threshold is up.

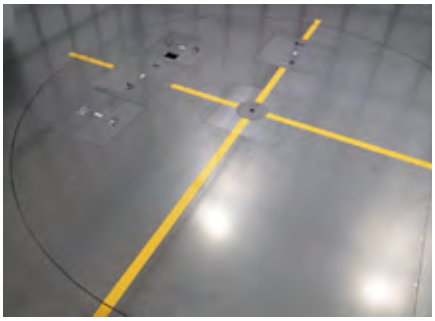
Elevating threshold with nickel-plated shield fingers

The threshold is down.

The opening is sealed to provide a barrier-free floor.

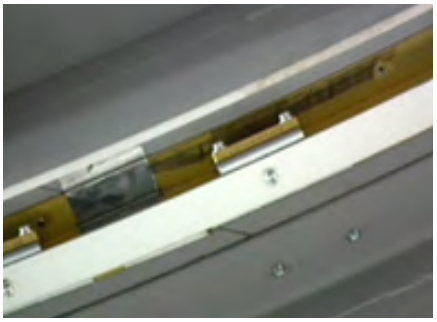
Turntable

- A new individual structure, which doesn't require deflected-load bearing roller on the back side of the table to prevent deflections around the outer edge, was developed. The risk of electromagnetic interference, such as electric-charge/discharge noise from the rollers, was eliminated.
- The design of the gap between the floor and turntable, which is cost effective and in compliance with performance design of the anechoic chambers, can be proposed through the rich data compilation and sophisticated integration technologies.
- We selected a motor with the most appropriate specifications, such as rotational speed and control accuracy, for desired turntable performance. Appropriate noise countermeasures depending on motors are implemented, so minimizing interference with the anechoic chamber performance.
- High-precision AC servo motors can also be available.
- A wide range of requests for diverse facilities and devices, such as chamber exhaust, water drainage, chassis dynamometers, as well as special power source devices, can be fulfilled.



The gap between the floor and turntable can strictly be set depending on the performance of the anechoic chambers.

View of the lower structure from the pit. This entire structure rotates in the new system.



The unique brush structure of the rotor provides excellent electrical conductive properties at the ground plane on the floor and electromagnetic shield.

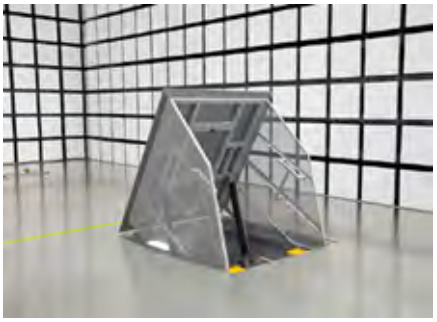
Major ancillary equipment

Actual examples of 10m Test Range anechoic chambers

Turntable pit access hatch

- Electric open/close hatch structure can be operated with a remote controller. Safety is our priority.
- With the doors, which open/close manually, you first pull out handrails to a certain position, and fix them there, when the hatch is open. This system allows all of these operations to be done via a remote controller at certain distance from the opening gate.
- The tightening operation is called "double steps action system", the hatch stops at a certain position before it is closes, and another button on the remote controller must be pushed. This double action safety feature prevents unforeseen accidents.
- An escape door is installed in the center of the hatch so that one can escape safely in case of emergency, such as power failures, and so forth.

The hatch halted at the predetermined position. Another switch must be activated to close it entirely.



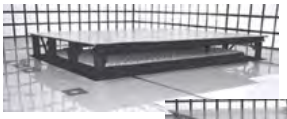
The hatch is fully open status through the remote-control operation.

View of the stairway seen from the pit side, a safety-first electric open/close structure.

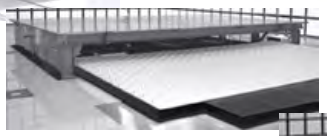
Automatic storage system for EMS absorbers

- Removing and storing wave absorber panels with a floor-installed wave absorber can be performed safely and quickly in a fully-automated positioning sytems. This contributes to the shortened operational period and improvement of measurement accuracy.
- The remote controller allows fine-tuning the position of the absorber panels extracted in the backward and forward directions, based on the EUT size.

The interior of the anechoic chamber* when the devices are stored. *10m Test Range type



Storage device is elevated.



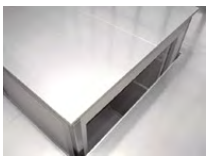
A panel with absorbers travels forward.

The example of the electromagnetic wave absorber used
ICM-006 L100 x W100 x H60mm

A wide range of electromagnetic absorption characteristics is provided through combined effects with ferrite electromagnetic wave absorber materials installed on the panels.

Installation of panel with bsorbers is completed.

Storage system for associated equipment



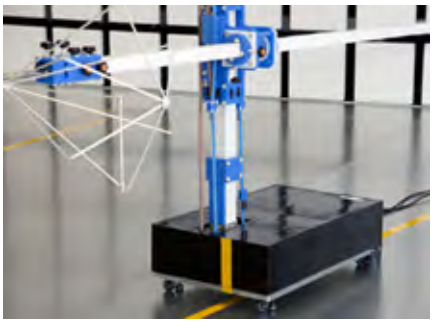
- This electric storage unit transfers diverse equipment, such as operational computers connected to EUT on the turntable, directly from the chamber to the underground pit.
- Ascending and descending movements are operated via a remote controller containing a limit switch for increased security.
- The double-action operation, in which another switching is required when descending, delivers superior safety.

Left : The unit is fully elevated.
Right : Double action provide safety when lowering

Major ancillary equipment

Actual examples of 10m Test Range anechoic chambers

Antenna positioner



- Downsizing the base unit reduces electric wave reflection. The top and four side surfaces are covered with ferrite wave absorber materials to minimize the influence of the reflection on the chamber performance.
- Operational stability is assured when attaching antennas.

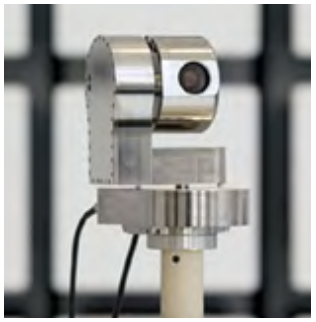
Base size : L95 x W60 x H30cm

Underground projector storage system

The projection board uses white-colored materials, in consideration of electromagnetic wave reflection.

- This system allows real time measurement and counter-measure of the data from the measurement room, such as analyzer waves, at the same time as they are collected.
- The projector unit is stored under the floor to reduce its influence on the anechoic chamber characteristics.
- The projection angle can be adjusted from the turntable pit under the floor. Controlling the power is also possible inside the anechoic chamber.

ITV system (EUT monitoring system)



- The body size was downsized to reduce its influence on the anechoic chamber characteristics.
- Detailed operational conditions of small EUT, such as mobile phones, can be inspected by the zoom of 35X.
- As a system dedicated to the anechoic chambers, comprehensive EMC design is performed from the camera body to the power cable.

Low-reflection EUT setup table

- This EUT setup table is composed of hard foam and plastic plate panels, dedicated to the anechoic chambers.
- Excellent low-reflection characteristics, which greatly exceed those of wooden tables, are provided up to the GHz band.
- It is light compared to wooden board of similar shape, resistant to warp stress, and a simple assemble kit. It is easy to store and carry.
- Two types, widths of 150cm and 200cm, are available (100cm deep x 80cm high).

Comprehensive support systems help make your measurement tasks run efficiently.

Anechoic chamber maintenance/modification services

We provide periodical diagnosis/maintenance contract systems, in which inspection/adjustments/component replacement of moving parts, such as the turntable, entrance and exit doors, etc., are conducted to support efficient execution of measurement tasks in the best measurement conditions. Through periodic diagnosis and early response based on rich experience and accumulated data, we can help you avoid unforeseen errors and reduce your maintenance costs.

Requests for improvement and modification of electromagnetic environments according to the trend of the EMI standards of each nation, such as expansion or alteration of the measurable frequency range, can be satisfied through optimized designs with advanced technological know-how.

For information,
please call TDK Technical Center/EMC&RF Engineering Business Division at +81 47 378 9765

FCC, VCCI filing application representation services

Based on our abundant achievements and experience, we perform, upon request, FCC and VCCI filing applications and revision procedures for electromagnetic wave anechoic chambers on behalf of clients. Through our measurement services performed by dedicated engineers, collection of the measurement data required for applications and improvement measures can be efficiently performed.

For information,
please call TDK Technical Center/EMC&RF Engineering Business Division at +81 47 378 9765

EMC measurement services at the TDK EMC Center

Effective data collection of all measurement items required by the EMC standard of each country, such as the measurement of radiation electric field intensity, terminal disturbance voltages, and magnetic field intensity, is available.

We have dedicated technicians for EMC measurement/compliance working full time to ensure your measurement/compliance is prompt and effective.

The four electromagnetic wave anechoic chambers at the EMC centers have obtained and comply with ISO/IEC17025, the EMC-related test site technical/management standard.

As measurement data of a certified test site, FCC, VCCI, CE marking, and test reports for car-installed devices can be issued.

10m Test Range anechoic chamber (2 sites)

Registered with FCC, VCCI, CE marking
Certified by TÜV Rheinland, NVLAP, A2LA

3m Test Range anechoic chamber (2 sites)

Registered with FCC, VCCI
Certified by TÜV Rheinland, NVLAP, A2LA
Registered with GM, FORD, EMC test site

Microwave/millimetric wave anechoic chamber

CTIA compliance evaluation of OTA performance/diverse communication devices

For inquiries and application for the use of the services,
please contact the following : TDK EMC Center
+81 47 378 9483

Total Test System Integration Technology

TDK promotes the "Total Test System Integration Technology" to support the installation and construction of high-efficiency automatic measurement systems best suited for measurement content, measurement conditions, and sizes of the anechoic chambers, from a precompliance test system to full-compliance options to support all test conditions/standards worldwide.

We provide EMI/EMS automated test systems*, which achieved the world's best measurement accuracy, efficiency, and reliability.

*This efficiency-prioritized EMI/EMC measurement-task-integrated package optimizes measurement devices, ancillary facilities, and such, based on diverse measurement needs, through the latest operational system of TDK RF Solutions Inc., a TDK group company which leads the world's advanced technologies in the EMC automated measurement field.

EMC automated measurement system

High-power antenna system for radiated field immunity test

- 100V/m of electric field strength is realized from 20MHz(10kW) at predetermined points.
- High efficiency design provides the 100V/m of electric field strength with 1kW at 100MHz.
- Automated measurement is available from low frequencies to high frequencies.

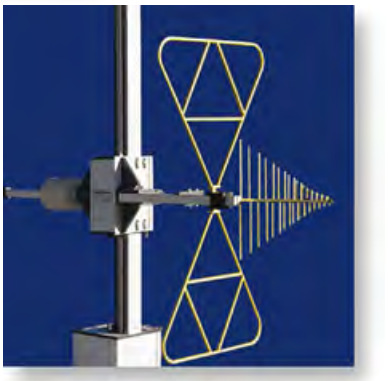
20MHz >>>>> 100MHz

Biconical antenna
Frequency : 20 to 100MHz
Withstand power : 15kW/ Gain : 3 to 6dBi
VSWR : 2.5 : 1(ave), 5.8 : 1(max)
Size : W3.6 x D3.9 x H1.4m

80MHz >>>>> 1GHz

V-log periodic antenna
Frequency : 80MHz to 1GHz
Withstand power : 3.5kW/ Gain : 6 to 7dBi
VSWR : 1.5 : 1(ave), 6 : 1(max)
Size : W1.9 x D1.9 x H0.9m

EMC/SAR measurement system, monitoring system	
System	Applied standard
EMC measurement system for mobile telecommunications (RE/RI,CE/CI,TR,Antenna)	IMT-2000,PDA,WLA(IEEE802.11) SRD(25MHz to1GHz) ISM Device(Bluetooth)
EMC measurement system for vehicle	Reverberation Chamber High-power radiation test
Cellular phone, Wireless LAN equipment SAR measurement system	ENV 50166-2 / FCC OET Bulletin 65 (Ed. 97-01) Supplement C FCC 96-326 / ANSI/IEEE C95.1-1999 ETSI TR 134 925 IEEE Std-1528-200X (Draft) prEN 50361:200 (Draft)
Automatic monitoring system (audio, video monitor)	



Hybridlog™ antenna HLP2006C

Both EMI tests and radiation immunity tests are supported. This advanced high-performance/small antenna increases the efficiency of measurement tasks.

- A wide range - from 26MHz to 6GHz - is covered.
- Smallness and best wide-range performance are both realized.
- The dual mode reduce the measurement time.

In Your Future — TDK's Technology & Philosophy

TDK Global Website

www.global.tdk.com

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