

EMC Selection Catalog



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EMC Solution Overseas Sales Network



TOYO's Strong Overseas Network

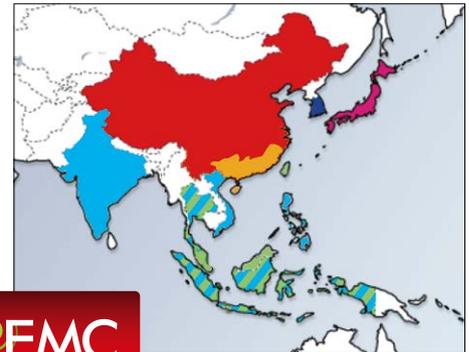
Since 1995, we have sold more than 200 of our EMC systems in the Southeast Asian markets, where JS Denki (Singapore) has been our distributor since 2002. In addition, we have sold more than 150 of our EMC systems in the Korean market, where Eretec has been our distributor since 2003. Making the most of these experiences, we set up JS TOYO Corporation, a joint venture with JS Denki specializing in EMC system and software sales, in Shenzhen, China in 2008.

To further strengthen our focus on the Chinese market, we established TOYO Corporation China, a wholly-owned subsidiary, in Shanghai in October 2010. JS TOYO is now responsible for Taiwan and the southern part of China encompassing Shenzhen. TOYO Corporation China sells our EMC and other original systems in the other area in China and to Japanese companies all over China.

In 2012, we launched sales in India with Quantel as a distributor.

In 2015, we established TOYO Tech LLC, a wholly owned subsidiary, to expand sales of EMC systems in North America.

- Technical support comparable to what is provided by TOYO Corporation in Japan
- Close and frequent communication to accurately grasp individual customer needs
- The best solution selected from among instruments of a wide variety of manufacturers



<http://www.toyochina.com.cn/>

| Company Name | Address | Region |
|---------------------------------------|--|------------------------------|
| TOYO Corporation China | Room 310 Enterprise Square, No.228 Mei Yuan Road, Zha Bei Area, Shanghai 200070, P.R. China | China Japanese enterprise |
| TOYO Corporation China Beijing Office | Room 301, Building C, Yeqing Plaza, No.9 Wangjing North Rd, Chaoyang District, Beijing, (100102) P.R.China | |



<http://www.toyotechus.com/>

| Company Name | Address | Region |
|--------------|---|---------------|
| TOYOTech LLC | 42840 Christy Street, Ste.110 Fremont, CA 94538 | North America |



<http://www.jstoyo.cn/>

| Company Name | Address | Region |
|--------------------------|---|---|
| JS TOYO Corporation | 2-25G, China Phoenix Building, Futan CBD, Shenzhen, 518026, P. R. China | China (Guangdong, Fujian, Hainan, Taiwan) |
| JS TOYO Hong Kong Office | 1004 AXA Centre, 151 Gloucester Road, Wan Chai, Hong Kong | |



<http://www.jsdenki.com.sg/v3/>

| Company Name | Address | Region |
|-------------------|---|--|
| JS Denki Pte Ltd. | 51 Bukit Batok Crescent #07-35 Unity Centre TECH PK 21 Singapore 658077 | Singapore, Malaysia, Indonesia, Thailand, Taiwan |



<http://www.eretec.com/www/main/main.asp>

| Company Name | Address | Region |
|--------------|---|-------------|
| Eretec Inc. | 77, Gunpocheomdansaneop 2-ro, Gunpo-si, Gyeonggi-Do, 15880, South Korea | South Korea |



<http://www.quantel.com.sg/index.htm>

| Company Name | Address | Region |
|-----------------|---|---------------------------------------|
| Quantel Pte Ltd | 46 Lorong 17 Geylang #05-02 Enterprise Industrial Building Singapore 388568 Tel: +65 6745 3200 | India, Thailand, Philippines, Vietnam |

TOYO Corporation EMC Solution



EMC Solution & Service We provide

We have over 35 years experiences and satisfactory results in EMC measurement field, and TOYO Corporation is in a position to provide EMC measurement solutions conforming to a wide range of standards, including those for home appliances, automobiles, wireless equipment, and information communication equipment, and the coverage extends even to the MIL Standards.

■ Emission (EMI) measurement solution

We provide optimal system, product, and accessories which meet the various from the simple measurement for the EMI evaluation and the measure of research and a development phase to the final authenticated measurement and site evaluation of the anechoic chamber in accordance with the standard.

Product range

- Measurement system
 - For compliance
 - Home appliances (CISPR, EN, ETS, FCC, VCCI, etc.)
 - Vehicle (each radiation / conduction emission standard, each automaker's standard)
 - Airplane, MIL
 - Medical equipment(IEC60601-1-2, CISPR 11)
 - Wireless equipment TS51.010-1, TS34.121 (3GPP) Mobile phone EN300 328, EN301 893 (ETSI) Wireless LAN and others
 - For pre-compliance
 - G-TEM Cell
 - G-Cell
 - Pre-compliance EMI measurement package
- Measurement software
 - EP5 series, EP7 series, EP9 series, EPX series
- EMI Test receiver(applied to CISPR16-1-1)
- Accessories
 - Antenna : 20Hz-40GHz
ETS-Lindgren, TESEQ, Schwarzbeck and others
 - Preamplifier : 9kHz-40GHz
SONOMA, TOYO Corporation
 - Artificial mains network
TESEQ, Schwarzbeck, PMM, Rohde & Schwarz
 - ISN
TESEQ, FCC
 - Absorbing clamp
TESEQ
 - Comb generator
COM POWER, YORK, SEIBERSDORF, TESEQ
- Harmonics • Flicker measurement system
California Instruments, TOYO Corporation

■ Immunity (EMS) measurement solution

We provide the optimal power amplifier system that can respond to RF immunity test according to the various product specifications, and it can ensure an examination efficiently by carrying out the automatic control of a signal generator, electric field probe, power meter, antenna mast, etc.

We have the broad product corresponding to various standards also in pulse immunity test equipment.



Product range

- Measurement system
 - For compliance
 - Home appliances(IEC, EN, CISPR, JEITA, JIS and others, Immunity standard of each country)
 - Airplane, MIL
 - Vehicle (ISO , Each automobile maker's standard)
 - Medical equipment
 - Mobile phone(EN 301 489)and others
 - Measurement software
 - IM5 series, VI5
 - Power amplifier : 9kHz-40GHz
TOYO, MILMEGA, TESEQ, BONN and others
 - Accessories
 - Antenna : 10kHz-40GHz
ETS-Lindgren, TESEQ, Schwarzbeck and others
 - Power meter sensor : 9kHz-40GHz
Keysight, PMM and others
 - CDN(applied to CISPR16-1-2)
TESEQ, FCC
 - Electric field sensor : 10kHz-40GHz
PMM, ETS-Lindgren
 - Current probe
FCC, ETS-Lindgren
 - Optical fiber link system
Auido(PONTIS), EMC tools, Michigan scientific
 - Pulse immunity system (TESEQ Corporation)
 - ESD test machine(applied to IEC61000-4-2, ISO10605)
 - Pulse immunity simulator (applied to IEC610004-4, IEC61000-4-5 and others)
 - Pulsed immunity test system for onboard equipment
 - EMC test system for vehicle
 - Radiation immunity measurement system
 - Microwave radiation immunity test system
 - Cell method(G-TEM, TEM CELL, TriPlate, Strip Line) Immunity test system
 - BCI method immunity test system
 - Proximity irradiation immunity test system

EMI Test System for Consumer Product



Brief Introduction

With the digitization and mobilization of high precision and high integration of electronic instruments, the selection and countermeasure of noise source become more and more difficult. Therefore, it requires us to enlarge the upper limit of the measuring frequency in specific measuring and to collect and save the complicated noise data to the largest extent corresponding to the annually-revised standards.

Based on these requirements, we carry out the development of EPX series software and the improvement of EP9, EP7 series software; moreover, we provide various users with the most suitable EMI measuring scheme and system. No matter the user is a green hand or a practitioner, he can operate the EMI easily through the simple user interface. Accurate and efficient automation measurement can be accomplished from the simple measurement of EMI countermeasure to the final certified test.



Basic Measuring Functions

- Obtain frequency spectrum data.
- Select the interfering frequency that should perform QP measuring.
- Measure at the position of maximum radiation (turntable angle, antenna height and position of absorbing clamp)
- Perform QP measurement and AV measure for the interference wave level.
- Display, output and save the measuring results.
- Correspond the latest version of Windows operating system.
- Optimize the hardware configuration.

Software

- Measuring software for Consumer products

EPX series NEW

- EPX/RE: Radiated emission measurement and analysis software
- EPX/CE: Conducted emission measurement and analysis software

EP7 series

- EP7/RE: Evaluation and measurement software for radiated emission.
- EP7/CE: Evaluation and measurement software for conducted emission.

EP5 series

- EP5/RE: Measurement software for radiated emission.
- EP9/CE: Measurement software for conducted emission.
- EP5/RFP: Measurement software for RF power.
- EP5/NSA: Measurement software for site attenuation
- EP5/ME: Pre-compliance EMI measurement software.
- EP5/RSE: Measurement software for spurious emission

- SVSWR measurement software

- Measurement software for audio and video

- EP5/AT: Software for measurement noise of antenna terminal
- EP5/RET: Software for measurement radiation noise of frequency regulator.

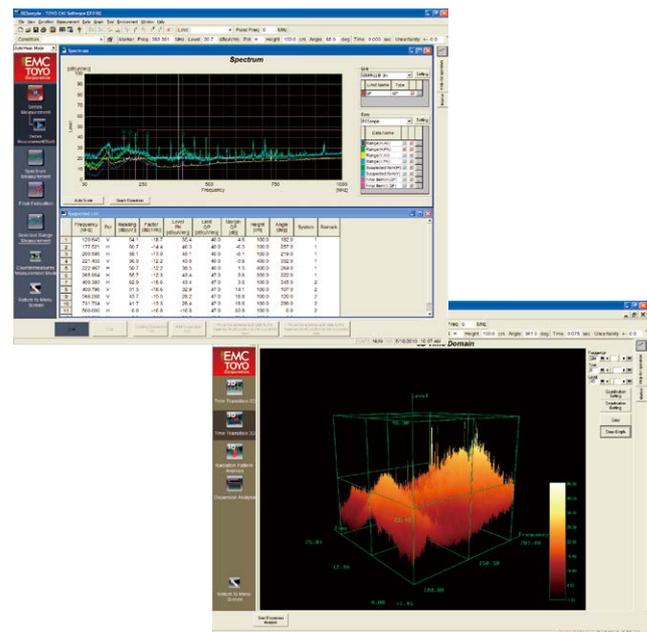
- Measurement software for Vehicle

EP9 series

- EP9/VE: EMI measurement software for Vehicle and relative components.

Corresponding Standards

- Consumer Equipments: CISRP, EN, ETS, FCC, VCCI, etc.
- Vehicle: SAE, CISPR25, JASO, ECE R10



EP7/RE

EMI Test System for Consumer Product

Test System

1. Radiated Emission (30MHz-40GHz)

The system uses an antenna to receive the radiation noise of the equipment under test (EUT), obtain the data of frequency spectrograph and perform the QP measurement for the receiver, carry out countermeasure against noises and process the final certified test.

With the extension of the 1GHz-40GHz frequency range, we carry out an optimal combination among the antenna, the preamplifier, the frequency spectrograph and the receiver in order to provide our customers with best suitable test system scheme.

2. Conducted Emission/ Radiated Magnetic Field (9kHz-30MHz)

The system obtains the conductive noise by using equipment such as artificial mains network or current probe and measures the frequency and level of noise by using frequency spectrograph and receiver.

Impedance stabilization network (ISN) can be also used for the communication line terminal corresponding to CISPR.

3. Testing Disturbance Power (30MHz-1GHz)

The system detects the noise power of EUT by using a power absorbing clamp and measures the frequency and level of noise by using frequency spectrograph and receiver. Use an automatic slide rail device of the absorbing clamp.

4. Testing Voltage of Antenna Terminal

As for AV equipment with coaxial antenna terminal, use frequency spectrograph and receiver to measure the frequency and level of noise in accordance with CISPR13.

5. Testing Site Attenuation

In order to measure the amount of attenuation, such system performs the semiautomatic measurement by using dipole antenna and performs the automatic measurement by using broad-band antenna.

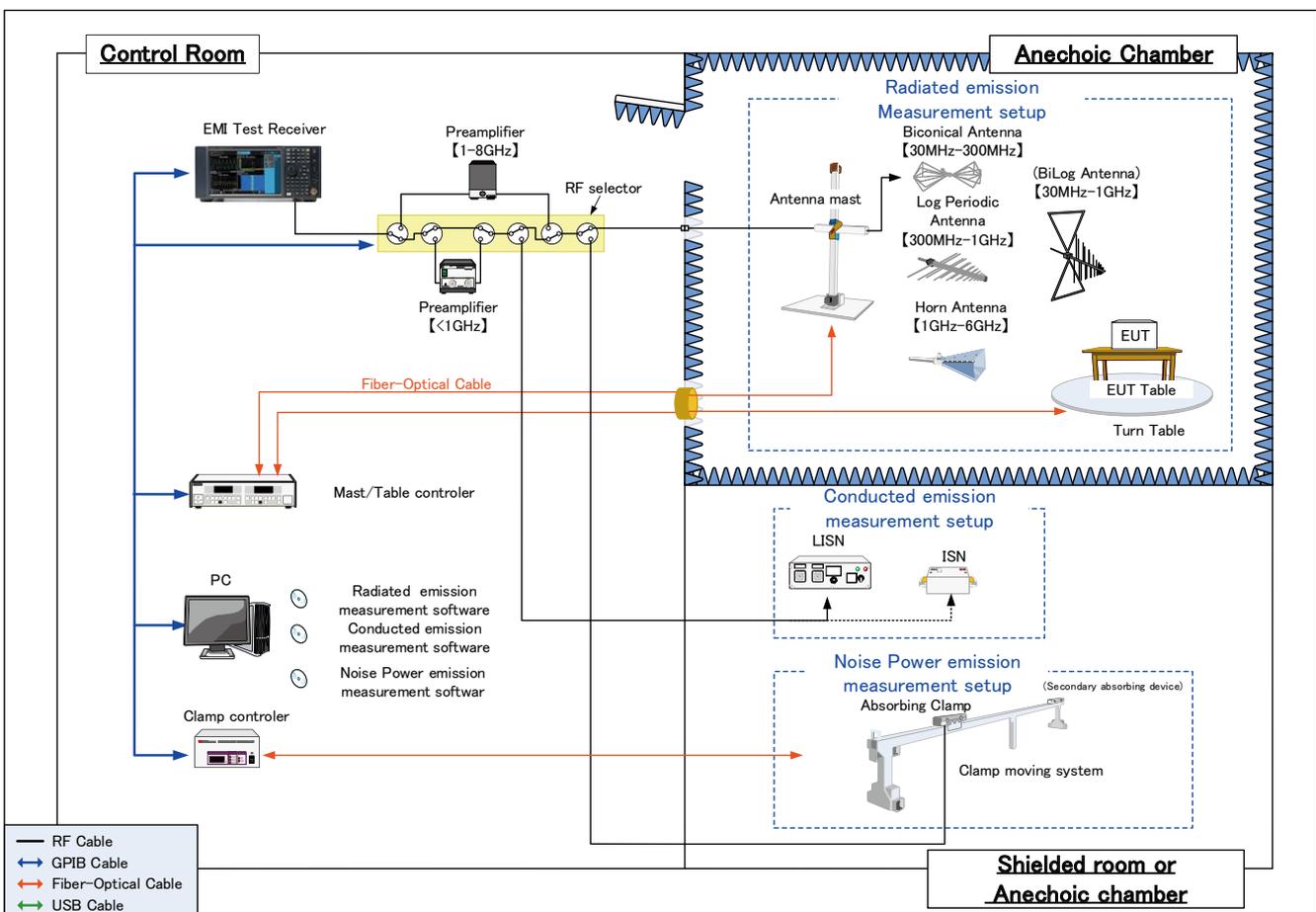
The Normalized Site Attenuation (NSA) is corresponded to the three antennas method or based on ANSIC63.4.

6. Site Voltage Standing Wave Ratio (SVSWR)

The system is used for the SVSWR method to perform site evaluation for GHz frequency. And the system can perform a high-reproducibility measurement through a dedicated transmission antenna positioner.

7. Radiated Spurious Emission

The system is used for detecting the radiated spurious emission of mobile phones, wireless LAN and other equipments and is capable of performing the actual radiation power detection and stray detection corresponding to the 3rd Generation Partnership Project (3GPP) standard and European Telecommunication Standards Institute (ETSI) standard.



Radiated Emission/Conducted Emission/Disturbance Power Measurement System

EMI Test Receiver N9048B PXE

NEW



New EMI test receiver with W-TDS covering the widest band in the industry!!

Keysight Technologies' EMI test receiver, "N9048B PXE" is fully compliant with CISPR 16-1-1 and MIL-STD-461 with no doubt. It also supports a feature called Wideband Time Domain Scan (W-TDS) covering 350MHz, the widest frequency range in the industry. With this feature, emission measurement can be conducted much faster and with higher accuracy.

- Fully compliant with CISPR 16-1-1 and MIL-STD-461
- Industry leading sensitivity/dynamic range
- Time Domain Scan (TDS) significantly reduces overall test time
- Intuitive multi-touch user interface
- Code compatible with Keysight MXE EMI receiver
- Instrument upgrade available at any time for future EMC test requirements

Keysight Technologies' new EMI receiver "N9048B PXE" supports the W-TDS feature that covers "350MHz" (FFT band), the widest band in the world and is able to convert the data into spectrum for this band at one time. Being a time domain scan feature, it is greatly different from the FFT feature of the oscilloscope - it has good pulse response and enables evaluation of detector having a long time constant such as QP detection.

Taking the radiated noise measurement in a range of 30MHz to 1000MHz as an example, you need to perform scan in 13 receive frequency steps for peak value detection. With the W-TDS feature in place, you need to perform scan in only 3 steps for QP value detection though you needed 40 steps before. This will dramatically reduce the measurement time - especially for QP measurement, scan is completed only in 6 seconds. This feature also directly leads to the reduction in the evaluation time in EMI measurement for vehicle and on-vehicle electronics.

Such substantial reduction in evaluation time has other benefits too. For example, you can greatly reduce the number of measurement error called "gap in noise level" that occurred due to insufficient monitoring time since high-speed scan enables you to have a sufficiently long monitoring time. Even if you have 10-second monitor time, the measurement is done in 1 minute though it took 13 minutes and 20 seconds to do the same measurement in the past. The W-TDS feature will help you obtain highly reliable measurement results in a short time.

High-speed data transfer is possible within FFT band even for QP value detection!!

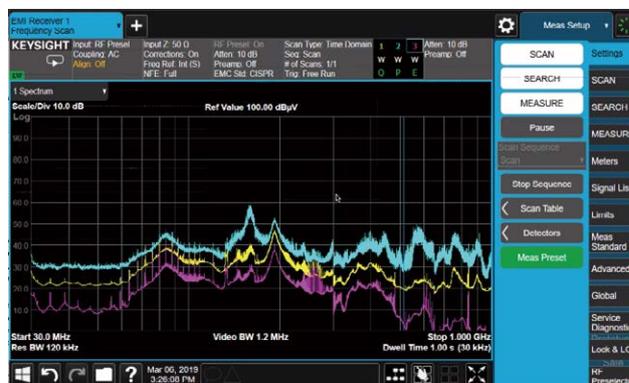
For spectrum analysis within the FFT band, "gapless measurement" is possible - in this measurement, all the spectrum is monitored at all times in the measurement frequency range. You will not miss any noise with the PXE even when the turntable or antenna mast is operated because QP value can be transferred at high-speed within the FFT band.

Though only experienced EMC engineers were able to find the correct maximum QP value from their hunch and experience before, anyone can conduct QP measurement at a correct frequency with the W-TDS feature as you can display the QP spectrum in the pre-scan result.

Moreover, if you use Keysight PXE, a new EMI receiver supporting W-TDS feature, anyone can conduct the correct measurement in a short time even in a wide frequency range like those used for radiated noise measurement.



- N9048B-503 Frequency range: 2Hz - 3.6GHz
- N9048B-508 Frequency range: 2Hz - 8.4GHz
- N9048B-526 Frequency range: 2Hz - 26.5GHz



Radiated Emission Measurement Software EPX/RE

NEW


KEYSIGHT
TECHNOLOGIES

Latest EMC measurement software “EPX/RE” leading the W-TDS feature a success

The “EPX/RE”, completely new radiated emission measurement and evaluation software enables highly reliable EMI measurement without missing any noise, which is achieved by embedding in its auto measurement sequence the W-TDS feature, an optional feature for Keysight Technologies’ N9048B PXE EMI receiver. The measured noise data are also quite effective for taking countermeasures against noise as you can analyze the behavior of noise in relation to frequency but also in time sequence.

Having a feature of monitoring noise at all frequencies in the FFT band at all times, the W-TDS feature has a much wider FFT band than before, namely 350MHz. If you use this feature, gapless measurement can be conducted in only 3 ranges in a band of 30 to 1000MHz. Scan can be performed at the same speed as the sweep method while the monitor time for each frequency will be much longer. As an FFT band of 350MHz is maintained for QP measurement, pre-scan measurement is possible using QP detector. The menu and parameters on GUI have been designed based on our own EP9 software, which has long been well received in the market. So, both the existing users as well as new users of EMI software can easily operate the EPX/RE.

Anyone can conduct accurate measurement without missing any noise automatically and easily on the “EPX/RE,” which makes the best use of the W-TDS feature and embeds it into the measurement sequence. The measurement results you will get on the “EPX/RE” have the same accuracy as those obtained by the experienced EMC engineer.

Feature to remove unnecessary impulse

Necessary noise spectrum may be hidden when not-to-be-measured impulse such as static electricity or click is entered because the W-TDS feature offers gap-less measurement. The “EPX/RE” is capable of separating such impulse based on the frequency of occurrence of such noise and removing unnecessary spectrum. With this feature, only noise to be measured is displayed, which makes the analysis easier.

The “EPX/RE” is the best solution for those who would like to address issues with noise measurement including intermittently seen noise that cannot easily be reproduced.



TOYO Corporation is committed to contribute to the product development and development of the industries by solving issues with noise measurement all engineers have by providing the “EPX/ER” and future EPX series software.

Feature to evaluate conformance to standard

Pre-selector having a wide pass band is required for using the W-TDS feature though the dynamic range for obtaining the correct pulse response will be insufficient for pulses at low repetition frequencies (PRF). The “EPX/RE,” however, measures the peak, average and QP values at the same time and automatically detects the pulse having low PRF. When such a pulse exists, the results conforming to CISPR16 are shown by measuring it by a narrow-band pre-selector. Users can perform compliance tests as before with no special care.

Main features

- Highly reliable automatic measurement sequence with W-TDS feature embedded
 - Super reliable measurement sequence giving higher priority to in-band gap-less measurement
 - W-TDS step measurement sequence giving higher priority to the reduction in measurement time
- QP detector also available for Pre-scan
- Noise analysis is possible after removing impulse (PK/Maxhold) that hides noise in a wide range
- Automatically set the appropriate Dwell Time based on the analysis of noise
- Evaluation of chronological noise data
- Report feature customizable by users
- Accelerate time-to-market

Microwave EMI measurement accessories



High gain preamplifier TPA series

TPA series preamplifier realized the high gain and low noise figure which are demanded by EMI measurement over 1 GHz.

It is designed by the following specification, and even if it installs in measuring indoor, EMI measurement can be performed by sufficient sensitivity.

Moreover, since this is a small size, it can be also installed the pit in anechoic chamber and directly under a receiving antenna.



TPA0108-40

Specification

| Specification/Model | TPA0108-40 | TPA0118-35 |
|-----------------------------|----------------------------|----------------------------|
| Frequency | 1~8GHz | 1~18GHz |
| Gain | 42dB (Min) | 35 dB (Min) |
| Flatness | ± 1dB | ± 2.7dB |
| Noise figure | 1.6dB (Max.) | 2.5dB (Typ.) |
| Output electric power | +13dBm (Min.) | +10dBm (Min.) |
| VSWR (in/out) | 2.0:1 (Max.) | 2.5:1 (Max.) |
| Input and output connectors | SMA type (female) | SMA type (female) |
| Outside dimension | 2.8(W) × 9.9(H) × 8.3(D)cm | 2.8(W) × 9.9(H) × 8.3(D)cm |

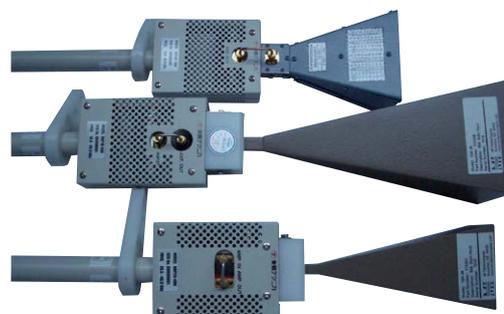
※DC power supply standard attached

Horn antenna preamplifier assembly HAP model series

HAP series can amplify a received signal efficiently, and can raise measurement sensitivity to the utmost by direct connection assembling a receiving antenna and a preamplifier. Since assemble is prepared for every frequency band of a horn antenna, the user can set up the optimal measurement system only by performing antenna exchange.

Moreover, between an antenna and a preamplifier can be separated and insertion of filter and proofreading of antenna & reamplifier can be performed separately.

- Antenna and preamplifier are connected directly
- For EMI measurement of GHz band
- Improved Utmost in measurement S/N
- DC power supply standard attached



HAP Series

Specification

| type | Narrow beam | | | | Wide beam | | |
|-----------------------------------|-----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|
| | HAP08-12N | HAP12-18N | HAP18-26N | HAP26-40N | HAP06-18W | HAP18-26W | HAP26-40W |
| Specification/Model | HAP08-12N | HAP12-18N | HAP18-26N | HAP26-40N | HAP06-18W | HAP18-26W | HAP26-40W |
| Frequency(GHz) | 8~12 | 12~18 | 18~26.5 | 26.5~40 | 6~18 | 18~26.5 | 26.5~40 |
| Antenna Gain(dBi) | 22.1 | 24.7 | 24.7 | 24.7 | 5~16 | 16.8 | 17 |
| E plane 3dB band width (EUT size) | 12 (0.63m) | 9 (0.47m) | 9 (0.47m) | 9 (0.47m) | 29 (1.55m) | 27 (1.44m) | 27 (1.44m) |
| H plane 3dB band width (EUT size) | 13 (0.68m) | 10 (0.52m) | 10 (0.52m) | 10 (0.52m) | 27 (1.38m) | 27 (1.44m) | 27 (1.44m) |
| Preamp gain dB(Typ.) | 42 | 45 | 45 | 59 (24+35) | 45 | 45 | 59 (24+35) |
| Preamp NF dB(Typ.) | 1.5 | 1.3 | 2.5 | 3.3 | 1.5 | 2.5 | 3.3 |
| Maximam output(dBm) | 10 | 10 | 10 | 16 | 10 | 10 | 16 |
| input connector | SMA (m) | SMA (m) | 3.5mm (m) | K (m) | SMA (m) | 3.5mm (m) | K (m) |
| low loss cable | SF 104A 5.5m | SF 104A 5.5m | SF104A 5.5m | SF 102A 5.5m | SF104A 5.5m | SF 104A 5.5m | SF102A 5.5m |

Accessories for Test System

■ Absorbing clamp moving system MAC600G model

Absorbing such as MAC600G model is CISPR14, Electrical Appliance and Material Safety Law, EN55020, etc.

The measurement using clamp is applied (main quality of the material: FRP), and the automatic run by the manual operation from a controller or GPIB control.

- Automatic control by GPIB
- Running speed in 3 steps, maximum 45 cm/s
- Clamp is freely-movable in manually by servo free function
- Low noise-ization by optical interface
- Limit operation in free position is possible by optical sensor and acceleration-and-deceleration operation.



MAC600G

■ RF Selector

NS series RF Selector include 10 groups of radio frequency switches for switching the signal path from the antenna. The products are not only limited to the full-automatic control of General Purpose Interface Bus (GPIB), which can be also switched via the buttons of the front panel. The quantity of relative selector switches can be selected according to the configuration of customer's system; correspondingly, the quantity of the switches can be updated later so as to meet more requirements of system update towards the signal path.

Features

- Input Frequency : DC-12.4GHz
- Interface :50ohms, Ntype, SMA type
- Maximum Input Power : 150W
- Power Supply : AC100, 120, 220-240V.50-60Hz
- Control Terminal : GPIB



NS4900 Series RF Selector

■ Band Selector for Power Amplifier Switching

The BS series path selectors manufactured by our company follow the operation instruction of the anti-interference system to automatically switch the connections of different instruments. The equipment is fully automatically controlled by GPIB; besides, engineers can manually control the equipment through the buttons of the front panel so as to process manual confirmation and calibration for the system. An emergency interlocking device is contained into the selector, which can start automatically under emergent situations and can also start via the emergency pushbutton of the control console. The 50ohm terminator which is automatically connected to the input end of the power amplifier after starting is able to protect personal safety and system safety. Such device is controlled by hardware, which can also run automatically even when the software is not started. (the software can be directly started)

Features

- Frequency Range : DC-18GHz
- Input Power: 1200-3000W (1GHz)/900W (1GHz above)
- Maximum Input Power: 12 paths (can be updated later)
- Main Configuration: Emergency Interlocking Device Operation Button (group switch)
- Main Function: Automatically switch different paths of the system (instrument combination)



BS5000 Series Frequency Band Selector

When emergent situation occurs, cut off the signal input (in parallel connection) with the 50ohm terminal.

Immunity Test System



Brief Introduction

The automatic measurement system for radiated Immunity is used for evaluating the immunity levels of electronic device against the electromagnetic interference. Such system is able to automatically control the measuring instruments such as signal generator, power amplifier system, field probe, power meter or antenna tower. Even the beginners can easily perform high-efficiency and accurate measurement and can also print and save the measuring results.

Test Standards Complied

- IEC61000-4-3
- IEC61000-4-6

Basic Function

Field Uniformity Measurement

A newly-added constant electric field method of IEC61000-4-3 can be selected; besides, a test substitution method with the frequency more than 1GHz that is defined corresponding to "Appendix J" can be also adopted. (namely, "independent window method")

Linear Verification of System

A linear verification for test system that is newly added in IEC61000-4-3 can be executed. However, test systems that are incapable of meeting 2dB correction cannot use the linear verification.

Measurement of Electric-Field Reference Value/ Measurement of Electric-Field Verification

Such measurements are performed to improve the measuring accuracy of the immunity measurement.

Immunity Measurement

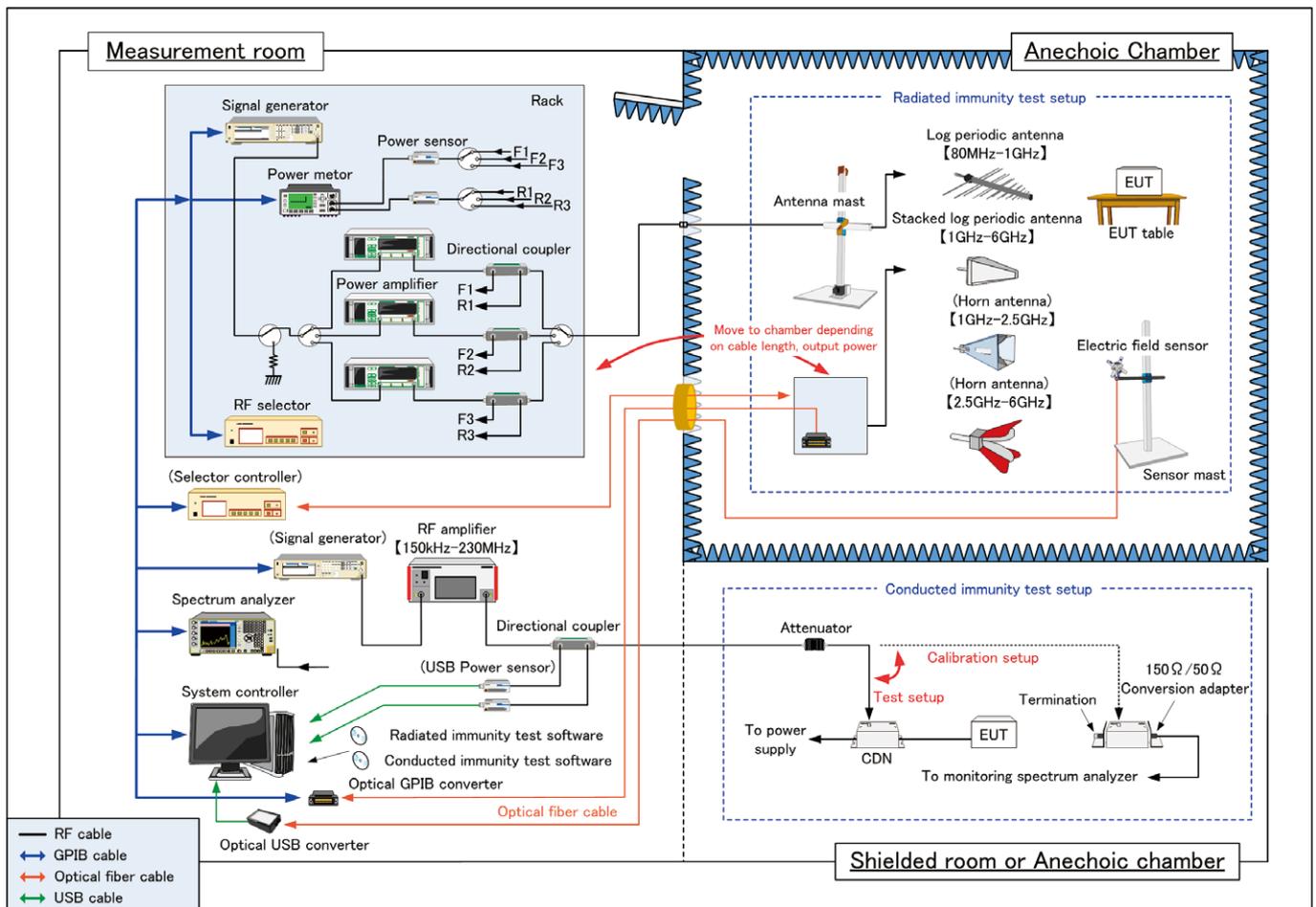
Use the reference factor obtained by the uniformity measurement and the factor obtained by the electric-field verification to exert field strength for EUT and so as to perform immunity measurement.

Display Measuring Results

The system can debug the measuring result windows corresponding to the selected measuring types on which the measuring results are displayed. Such windows can be further printed or the data of the windows can be saved in a Comma Separated Value (CSV) format.

Prepare Test Report

Output all data of various measurements into a test report with specified format in a method of automatic guide.



Radiated Immunity/Conducted Immunity Test System

Immunity Test System

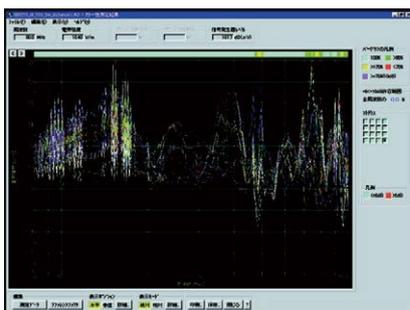
EMC TOYO



Immunity Test System



Immunity Test System



IM5/RS

■ Radiated Immunity Test System

A best test system is structured with the radiated immunity test software IM5/RS as its core according to the customer's requirement. TOYO can provide you with suggestions for system building according to your need and budget, including the configuration suggestions of instruments such as selective antenna, power amplifier, the field probe and radio frequency cable, so as to generate a uniform electromagnetic field and an electromagnetic strength.

- Comply with the Radiated Immunity Test Standard of the third version of IEC61000-4-3.
- Automobile orders ECE R10, ISO11452-1/2, SAE,JASO.
- Field strength: above 10V/m with the distance of 1m-3m.
- Frequency: 80MHz-6GHz (maximum is 40GHz)
- Uniformity measurement and automatic measurement functions of field strength.
- The test software IM5/RS supports the latest Window operating system.

■ Conducted Immunity Test System

Except the optional signal amplifiers and radio-frequency amplifiers, TOYO can also provide you a measuring system with the conducted immunity measuring software IM5/CS as the core according to your need; the measuring system comprises various optional coupling network system, calibration measurement tool and calibration program software.

- Comply with the Immunity Test Standard of IEC61000-4-6
- Test Level: above 10V (emf)
- Frequency: 150kHz-80MHz (9kHz-230MHz)
- Test Software IM5/CS supports the latest Windows operating system.
- Simultaneously meet the requirements of automobile standards (BCI) ECE R10 and ISO11452-4.

The immunity measuring of digital radio receiving device.

■ Software

Immunity Test Software

IM5/RS Radiated Immunity Test Software

IM5/CS Conducted Immunity Test Software

EMC Test Software for Vehicle

VI5/RS Radiated Immunity Test Software for Vehicle

IM5/CS Immunity Test Software for Bulk Current Injection (BCI)

EMC test system for Vehicle



EMC Test System for vehicle and on-vehicle components

EMI Test System

The system is used for testing the electromagnetic radiation disturbance emitted from the GH automobile with test frequency of 150KHz-18(40GHz) and automobile parts, receiving signals by arranging antenna into the chamber and then performing the test by an EMI test receiver.

Supported Standards

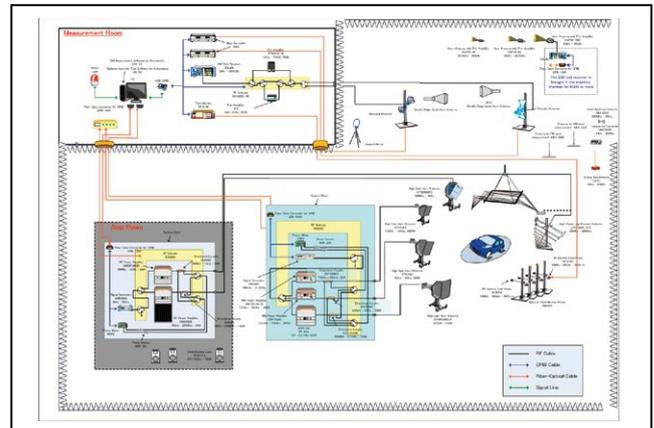
- CISPR 12 2007 (Ed6)
- CISPR 25 2016 (Ed4)
- ECE R.10
- Common Standards Used by Vehicle Manufactures

EMS Test System

The system is used for performing radiated immunity test for Vehicle and on- vehicle components in a frequency range of 10KHz-18GHz.

Supported Standards

- ISO 11452-1, ISO11452-2
- ECE R.10
- Common Standards Used by Vehicle Manufactures



Graphic Symbol of Vehicle EMC System

Test Software for Vehicle

EP9/VE Type: EMI Test Software for Vehicle and on- vehicle components.

Supported Standards:

CISPR12, Ed.6

CISPR25, Ed.4

VI5/RS Type: Radiated Immunity Test Software for Vehicle

Supported Standards

ISO11451-2 / 11452-2, 3, 5, 9

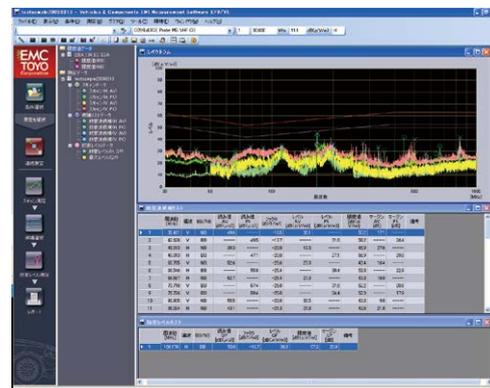
Vehicle manufacturer's internal Standards

IM5/CS Type: BCI Immunity Test Software

Supported Standards

ISO11451-4 / 11452-4, 7, 8

Vehicle manufacturer's internal Standards



EMC Test System for Vehicle

EMC TOYO

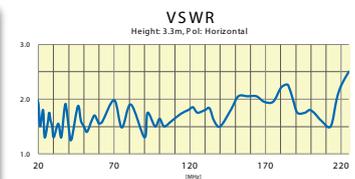
Radiated Immunity Test System (for vehicle: ISO11451-2) Large Log Periodic Antenna

The radiated immunity test system is used to test the resistance of the vehicle to electromagnetic interference by exposing the vehicle to strong electromagnetic noise. Systems suitable for various standards such as ISO11451-2 and those set by respective vehicle manufacturers can be proposed. TOYO will select the antenna, power amplifier, field sensor, RF cable and other products that best suit your needs.

- Supported standard: ISO11451-2, ECE R10, vehicle manufacturers' own standards
- Supported spec:
 - Frequency band: 10kHz - 18GHz
 - Magnetic field strength: 200V/m Distance (d) = 2m
- Antennas and power amplifiers from various manufacturers are available - TOYO will propose a system comprised of the best combination of equipment.
 - Antenna manufacturer: FSA, ARA, ETS, Schwarzbeck, TESEQ
 - Power amplifier manufacturer: Milmega, TESEQ, BONN, AR
- 100% operation guarantee at both short / open
- Auto-control by TOYO's own software supporting the latest Windows OS
- Frequency and electric field strength can easily be changed.

Model TLP2200 is a large log periodic antenna supporting the standard for vehicle immunity test (ISO 11451-2). For increasing the electric field strength at low frequency range, low VSWR (ave. 2.1 or lower) is achieved particularly in a range of 20M-30MHz.

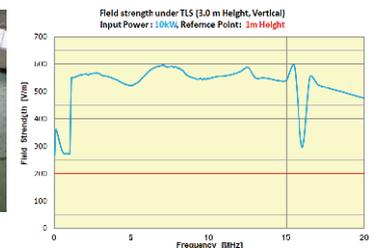
- Frequency range: 20MHz-220MHz
- VSWR (nominal): 2.0:1
- Max RF input: 10kW (LC connector)
- Comes with non-metallic mast
 - Height, polarization and tilt (elevation) are adjusted automatically
- Rotary joint supporting large coaxial cable is mounted



Stripline for vehicle (Self-standing)

Model TS1025 is a transmission line system (TLS) for vehicle immunity test (ISO 11451-2-compliant). This self-standing system can be assembled in the chamber with no extra parts and does not need to be hung from the ceiling of your chamber.

- Frequency range: 10kHz-25MHz
- VSWR (nominal): 2.0:1
- Max RF input: 15kW
- Height: 2.0 - 3.0m, changeable
- Magnetic field strength generated: 200V/m or higher (at 10kW input)



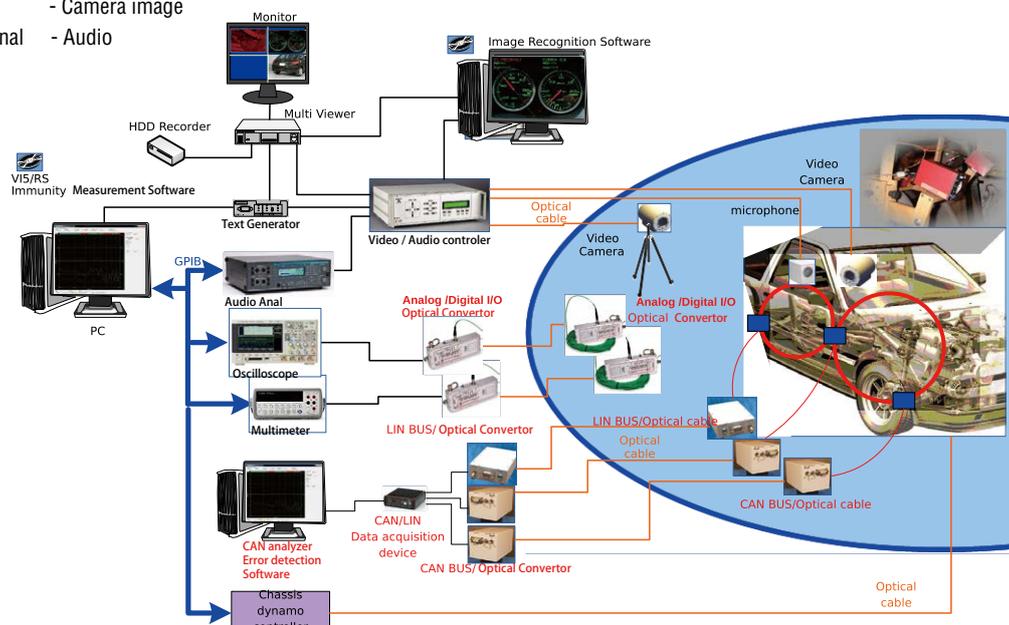
Automotive Monitoring System for Radiated Immunity Test

Engineers used to determine whether there was any malfunction on the vehicle during the radiated immunity test. As the test lasted for a long time, the task required a lot of labor and was inefficient - engineers were unable to keep their concentration at all times and always need to be present at the test. Our proposed monitoring system monitors the operation of electronic devices mounted on the vehicle by converting the status to various signals and retrieving them and also monitors, records and judges the abnormal behavior of other devices such as meter movement, blinking of LED, blinking of tail - lamps and abnormal engine sound. We can customize the system to your needs.

- This monitoring system can control hardware - chassis dynamometer, mast, turntable and others and retrieve data. Our proposed system is an integrated system built based on our own radiated immunity test software and operates together with a PC and measuring equipment for making judgement.

Items to be monitored:

- CAN/LIN Bus
- Camera image
- Digital/analog signal
- Audio



EMC test system for Vehicle

EMI Measurement System (for CISPR25, Auto manufacturers' own standards)

The electromagnetic radiated noise emitted from on-vehicle components in a frequency range of 150kHz-18(40)GHz is measured by an EMI test receiver after received by an antenna installed in an anechoic chamber.

Supported standards:

CISPR25 2016(Ed4)

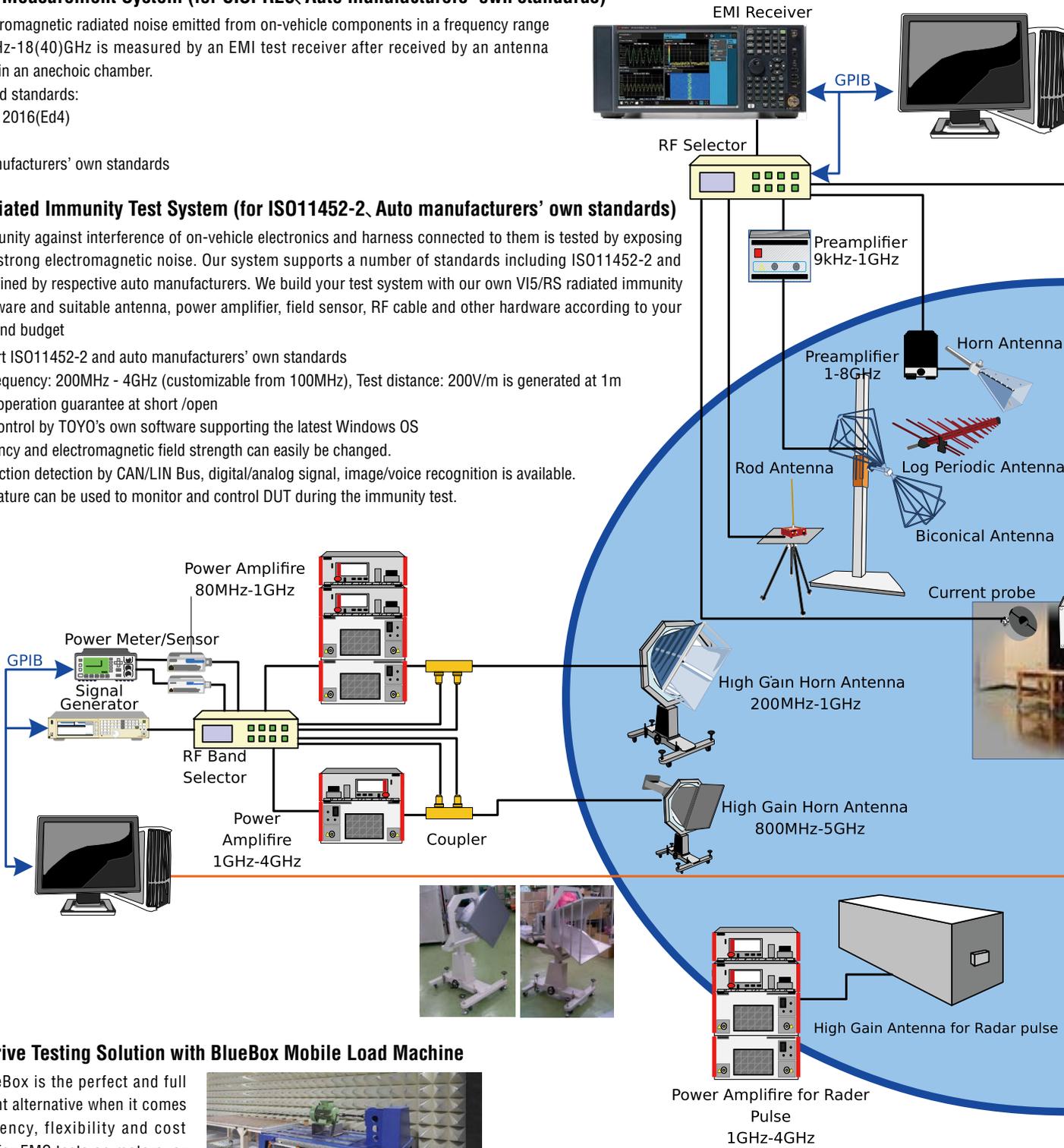
ECE R.10

Auto manufacturers' own standards

Radiated Immunity Test System (for ISO11452-2, Auto manufacturers' own standards)

The immunity against interference of on-vehicle electronics and harness connected to them is tested by exposing them to strong electromagnetic noise. Our system supports a number of standards including ISO11452-2 and those defined by respective auto manufacturers. We build your test system with our own VI5/RS radiated immunity test software and suitable antenna, power amplifier, field sensor, RF cable and other hardware according to your request and budget

- Support ISO11452-2 and auto manufacturers' own standards
- Test frequency: 200MHz - 4GHz (customizable from 100MHz), Test distance: 200V/m is generated at 1m
- 100% operation guarantee at short /open
- Auto-control by TOYO's own software supporting the latest Windows OS
- Frequency and electromagnetic field strength can easily be changed.
- Malfunction detection by CAN/LIN Bus, digital/analog signal, image/voice recognition is available. This feature can be used to monitor and control DUT during the immunity test.



E-Drive Testing Solution with BlueBox Mobile Load Machine

The BlueBox is the perfect and full compliant alternative when it comes to efficiency, flexibility and cost savings for EMC tests on motors, or in combination with battery tests.

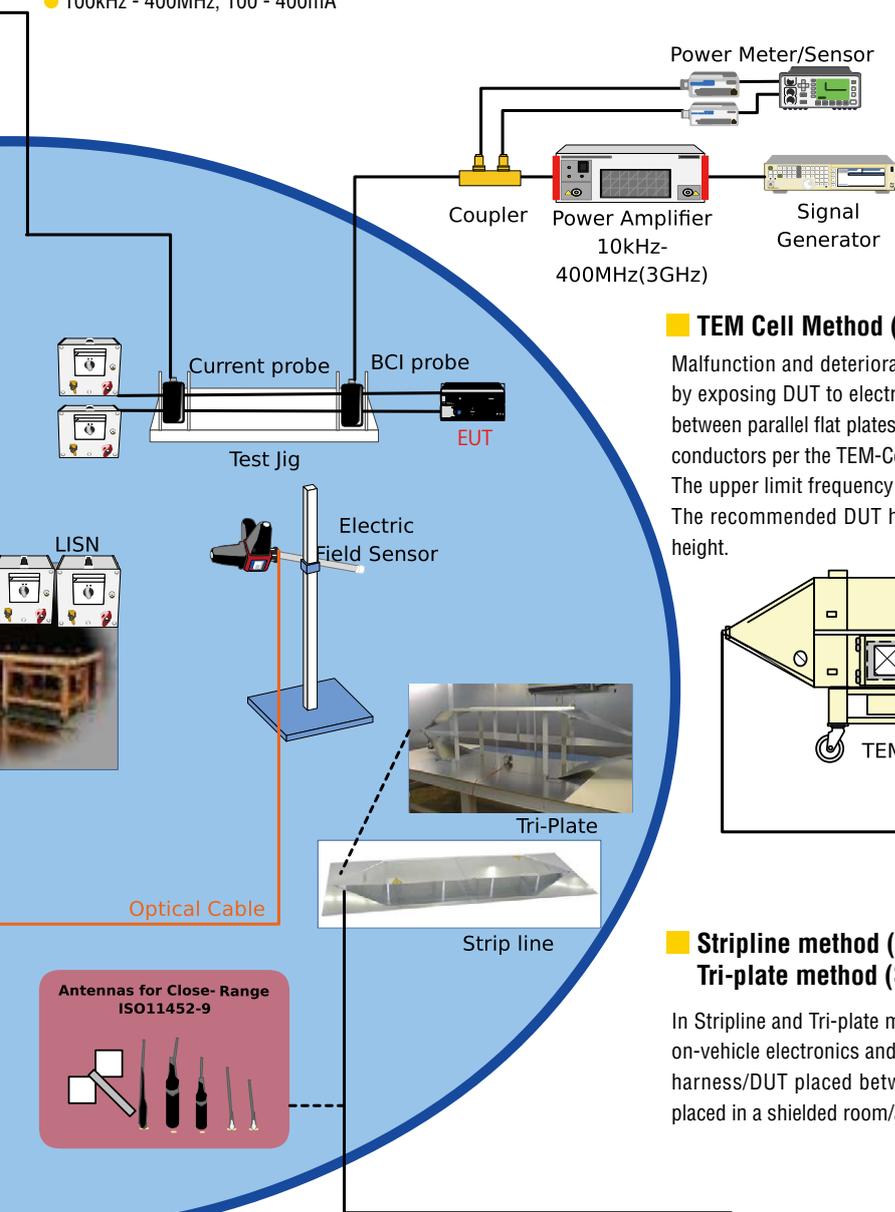
BlueBox is compliant according to CISPR 25 Ed. 4



■ Bulk Current Injection (BCI) Immunity Test System (ISO11452-4, auto manufacturers' own standards)

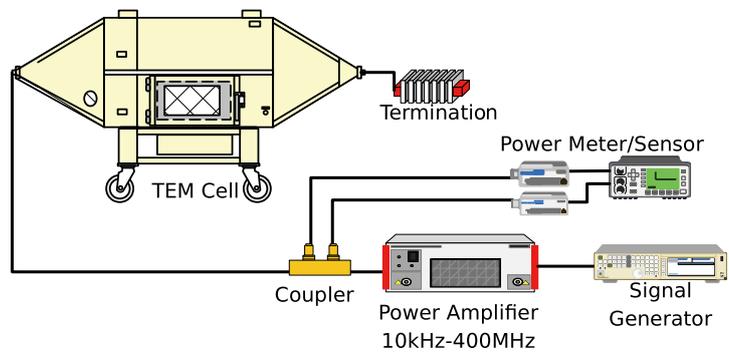
This is a BCI immunity test system for tests compliant with various standards including ISO11452-4, ECE R.10, SAE and JASO. The immunity of DUT is checked by injecting noise to each line (harness) using a BCI probe. For this test, two test methods are available in the IM4/CS Conducted Immunity Test Software - one is the substitution method that uses correction values (factor) measured by a BCI probe calibration jig in advance and the other is called the closed loop method in which the test is conducted while the noise injection level is monitored with a current probe. Various automatic error detection features and measurement sequences are ready for use if DUT malfunctions in the immunity test.

- 1MHz - 3GHz, 100mA ISO11452-4, Auto manufacturers' own standards
- 100kHz - 400MHz, 100 - 400mA



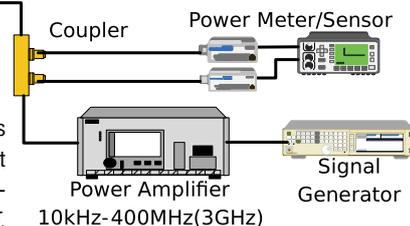
■ TEM Cell Method (ISO11452-3)

Malfunction and deterioration of DUT are evaluated by exposing DUT to electromagnetic field generated between parallel flat plates of the central and external conductors per the TEM-Cell method. The upper limit frequency is determined by cell size. The recommended DUT height is less than 1/6 cell height.



■ Stripline method (ISO11452-5, auto manufacturers' own standards) Tri-plate method (SAE1113/25)

In Stripline and Tri-plate methods, the immunity against interference is evaluated by exposing on-vehicle electronics and harness to strong electromagnetic field. The test is conducted with harness/DUT placed between the parallel flat plates. The stripline and tri-plate need to be placed in a shielded room/anechoic chamber as they are open-type TEM-mode generator.



Stripline: 10kHz - 400MHz, 200V/m
ISO11452-5, SAE J1113-23
Tri-plate: 100kHz - 1GHz, 200V/m
SAE J1113-25

■ Near-field Radiated Immunity Test System (ISO11452-9)

This test system simulates the electromagnetic field generated by devices such as wireless equipment and portable transmitter, and DUT's immunity is tested against it. Placing antennas for respective frequency ranges required by each auto manufacturer's standard (mobile antenna, helical antenna, sleeve antenna, etc) near EUT, you can test EUT under a strong electromagnetic field of a few hundred volts per meter. ISO11452-9, 2012 was published in 2012 in which the use of antennas produced by three manufacturers in Europe, US and Japan are recommended.

EMC Test System for Vehicle

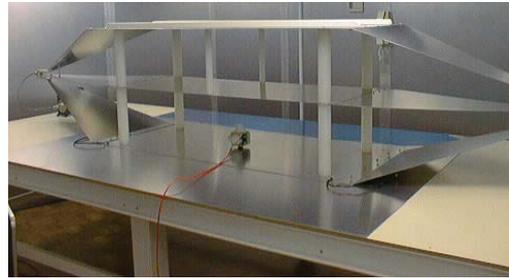
EMC TOYO

Small Chamber Method (G-TEM, TEM CELL, TriPlate, Strip Line) Immunity Test System

This radiated immunity test system provides a "small chamber method" for the car-mounted electronic device, such method conforms to the standard of ASEJ1113/25 1995-09 and various automobile manufacturers. TriPlate is a structural which is designed by removing the side plate of TEM small chamber so as to generate uniform electromagnetic field between the central conductor and the upper/lower ground plane. TriPlate can cover a frequency range which is two times larger than TEM small chamber.

The frequency bandwidth of G-TEM small chamber is DC-18GHz, and it can provide small chambers of various sizes for selection according to the size of EUT. The software adopts replacement method or feedback method to perform the electric-field radiated immunity test.

- Comply with radiated immunity test standard for small chamber method, such as SAEJ113/25 1995-09 and the standards of automobile manufactures.
- Be equipped with all 90ohm strip lines according to BMW Company.
- Be capable of providing the whole set of system containing all configurations.
- The MS-Windows compatible software VI5/RS independently developed by TOYO has the characteristics of simple operation and very high maneuverability.
- Test data can be easily pasted, edited and organized in Word files and Excel files.
- The user can select the test instruments that are needed for the test system and produced by different manufacturers.



Triplate

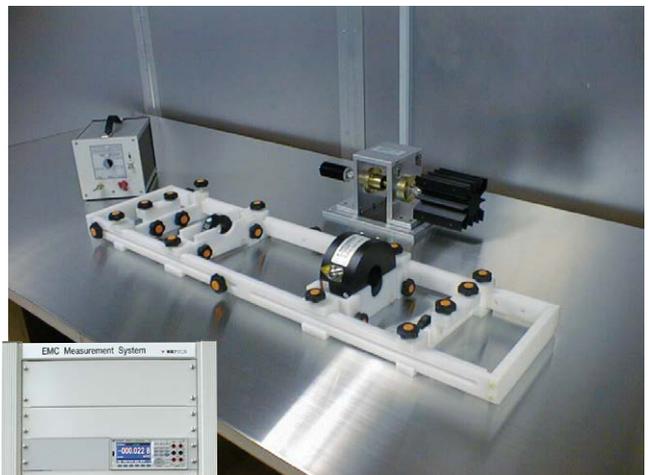


G-TEM cell

BCI Method Immunity Test System

As for car-mounted electric devices that comply with ECE R10 and SAE, ISO, JASO and other standards, such radi ated immunity test system uses BCI (big current Injection) to perform the measuring. This method uses a BCI probe to inject the noise current into various cables so as to confirm the immunity without causing any failures. There are two options for selecting the measuring methods of automatic measuring software IM5/CS. The method for replacing corrected value (factor) is adopted. The corrected value is pretested by using a correcting tool of BCI probe. Or, use a feedback method which uses a current probe to monitor the noise and inject an electric level and meanwhile performing the test. Although there are some failures when the equipment lies in immunity test period, such software can also provide various error detection functions and measuring sequences.

- Comply with BCI immunity test standard, such SAE, JASO, ISO11452-4 etc.
- Be capable of providing the whole set of system containing all configurations.
- Be capable of providing multiple error detection functions (optional) that are suitable for equipment under test.
- The MS-Windows compatible software VI5/RS independently developed by TOYO has the characteristics of simple operation and very high maneuverability.
- Test data can be easily pasted, edited and organized in Word files and Excel files.
- The user can select the test instruments that are needed for the test system and produced by different manufacturers.



BCI Test System



EMC Test System for Vehicle

Near-field Radiated Immunity Test System ISO11452-9

This test system simulates the electromagnetic field generated by devices such as wireless equipment and portable transmitter for immunity test. With antennas for respective frequency ranges (mobile antenna, helical antenna, sleeve antenna, etc) placed near EUT, a strong electromagnetic field of a few hundred volts per meter is applied. The test method conforms to auto manufacturers' own standards for near-field radiated test method for wireless equipment and cell phone antenna and immunity test for portable transmitter. The input power to antenna is determined based on the level that can generate the defined electromagnetic field strength, and the signal generator is controlled so that the required power is obtained. An international standard published in 2012, ISO11452-9, 2012 recommends the use of the antennas produced by three manufacturers in Europe, US and Japan.

- Conforms to auto manufacturers' standards for near-field radiated test for wireless equipment and cell phone antenna and immunity test for portable transmitter (with recommended antennas)
- Measure the power to the defined electromagnetic field using pre-calibration feature
- Immunity test by the substitution or closed-loop method
- Output the test report with wizard feature
- Feature to conduct heat run test for power amplifier before the test
- Support ISO11452-9, 2012

Sleeve antenna for near-field test of wireless device antenna (recommended by ISO11452-9)

| Model | Frequency | Item Name |
|-----------|-----------|------------------------------|
| CV07-144 | 144MHz | 1/4 λ sleeve antenna |
| CV07-430 | 430MHz | 1/4 λ sleeve antenna |
| CV07-835 | 835MHz | 1/4 λ sleeve antenna |
| CV07-900 | 900MHz | 1/4 λ sleeve antenna |
| CV07-940 | 940MHz | 1/4 λ sleeve antenna |
| CV07-1280 | 1280MHz | 1/4 λ sleeve antenna |
| CV07-1440 | 1440MHz | 1/4 λ sleeve antenna |
| CV07-1750 | 1750MHz | 1/4 λ sleeve antenna |
| CV07-1880 | 1880MHz | 1/4 λ sleeve antenna |

General model: the diameter of sleeve is 200mm(Φ), the diameter of antenna is 2mm Φ ; Connector: BNC (J)

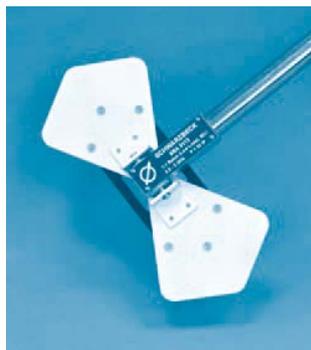
- Mast for AM2800+ AH-CV07 sleeve antenna



CV07-430 430MHz 1/4 λ Sleeve antenna
 CV07-1880 1880MHz 1/4 λ Sleeve antenna
 CV07-835 835MHz 1/4 λ Sleeve antenna

Biconical antenna supporting immunity test for portable transmitter (recommended by ISO11452-9)

| Model | Frequency | Antenna (Recommended by FORD) |
|--------|---------------|--|
| 420 NJ | 360MHz-2.7GHz | Bi-Conical Antenna (SBA9113 Balancer is additionally required) |



420NJ+SBA9113 Bi-Conical Log Periodic Antenna

Support the immunity test for portable transmitter (recommended by ISO11452-9)

| Model | Product Name and Frequency |
|---------------|---|
| EKG 900 | Monopole Antenna for 890-915MHz |
| EKG 1860 | Monopole Antenna for 1710-2025MHz |
| PCD 2440 | Monopole Antenna for 2402-2480MHz |
| HLC 27 | Monopole Antenna for 26,96 - 27.4MHz |
| HLC 146 | Monopole Antenna for 144 - 148MHz |
| HLC 170 | Monopole Antenna for 168 - 173MHz |
| Ferrite cable | Cable with ferrites to block braid currents evolving during the test especially with the HLC antennas |
| FAN 405 | Monopole Antenna for 380 - 430MHz |
| FAN 450 | Monopole Antenna for 430-470MHz |



Handy antenna for immunity test for portable transmitter

| Model | Frequency | Product Name |
|---------|-----------|----------------------------|
| EMC-28 | 28MHz | 28MHz Helical Antenna 20W |
| EMC-40 | 40MHz | 40MHz Helical Antenna 20W |
| EMC-52 | 52MHz | 52MHz Helical Antenna 20W |
| EMC-75 | 75MHz | 75MHz Helical Antenna 20W |
| EMC-125 | 125MHz | 125MHz Helical Antenna 20W |
| EMC-145 | 145MHz | 145MHz Helical Antenna 20W |
| EMC-155 | 155MHz | 155MHz Helical Antenna 20W |
| EMC-165 | 165MHz | 165MHz Helical Antenna 20W |
| EMC-190 | 190MHz | 190MHz Helical Antenna 20W |
| EMC-223 | 223MHz | 223MHz Helical Antenna 20W |
| EMC-350 | 350MHz | 350MHz Helical Antenna 20W |

- Model AT5000 Transmitter simulator unit (requires BS5000 or NS 01-B)
- Model 1000 Interlock foot switch (requires BS5000 or NS 01-B)
- Model NS01-B Coaxial AT5000/FS1000
- Model BS5000 RF band selector

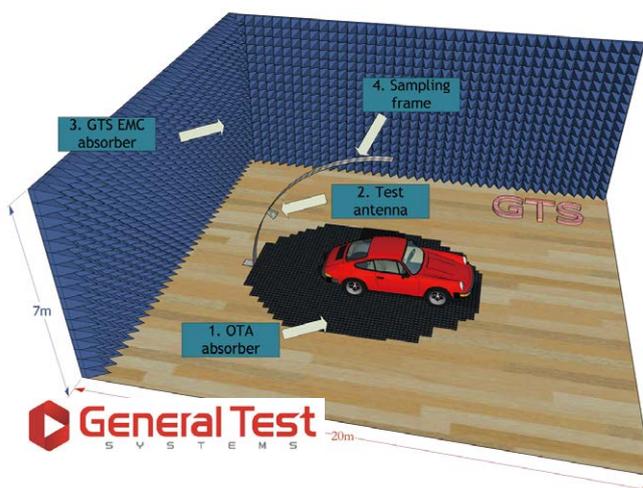


CV145 HW 145MHz 1/4 λ sleeve antenna
 CV1456 1SA 1450MHz 1/4 λ sleeve antenna
 AT5000 Analog Emission Device

MIMO OTA

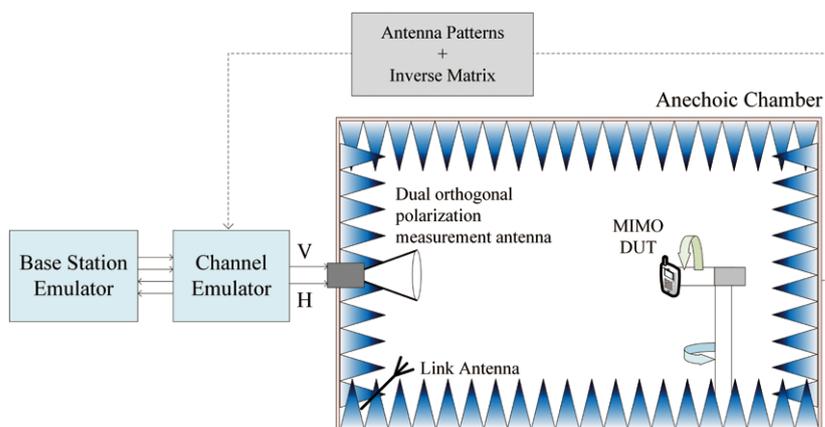
Evaluation of V2x communication

As typified by the word "connected car", various functions have come to be realized by wireless communication of cars. In the concept of Intelligent Transport System (ITS), two wireless communications are assumed. The first is "V2V" (inter-vehicle communication) in which vehicles exchange information by wireless communication at intersections with poor visibility. The second is "V2I" (road-to-vehicle communication), which transmits infrastructure information from a roadside device to a vehicle via wireless communication using radio waves. Information from the infrastructure includes traffic light information, regulatory information, pedestrian information, etc. V2x technology has been developed to support these safe driving. By using Multiple Input Multiple Output (MIMO) technology, communication capacity can be increased (multistream transmission) and communication errors can be reduced (single stream redundant transmission). Wireless equipment using MIMO technology that allows multiple antennas to transmit and receive communications to form multiple independent propagation paths will be implemented in vehicles from now on. Evaluation of communication quality is extremely important to secure communication performance, and demand is increasing. In particular, implementing a wireless device intended for autonomous driving, it is necessary to guarantee absolute communication performance in order to directly connect to safety. However, when evaluating the performance of in-vehicle wireless devices, it is not possible to ignore the interference from large metal bodies and other electronic devices mounted in the vehicle. For vehicles equipped with wireless equipment using MIMO technology, it is necessary to evaluate in the MIMO OTA (Over The Air) test to evaluate throughput performance (transmission capacity of communication data) by the MIMO function.



Radiated two-stage method MIMO OTA measurement

Connecting and evaluating performance via an antenna of a wireless device is called OTA performance test, but there are several methods for this test. These include the multi-probe method, the reverberation chamber method, and the two-stage method (Conducted Two Stage: CTS method). In the case of the most common multi-probe method, the measurement system is large to accommodate the size of the vehicle and the cost is correspondingly high. Therefore, General Test Systems (GTS) proposes a new automotive MIMO OTA measurement solution that can reduce costs by applying its own-developed Radiated Two Stage (RTS) method to automotive MIMO OTA testing. The RTS method is one of the two-stage methods that improves the CTS method, and is a method that solves the problems while keeping all the advantages of the CTS method. It was proposed by GTS to 3GPP, a standardization body, and was newly added to the standard (TS 37.544 v14.5.0 (2018-03)) in March 2018.



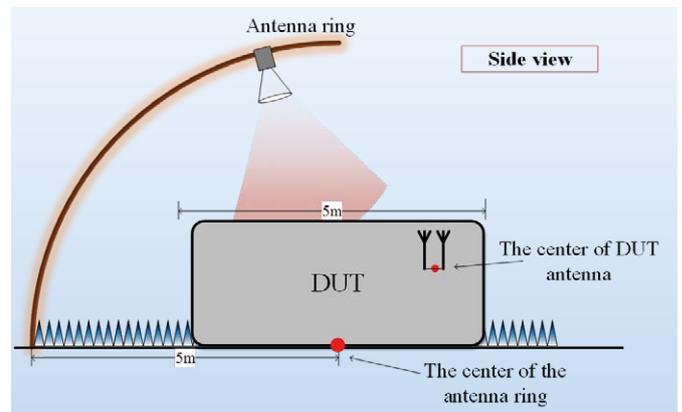
Stage 1: Test the radiation characteristics of multiple antenna branches in a conventional common anechoic chamber. The measurement system must perform complete three-dimensional antenna pattern measurement for both transmit and receive radiation performance and measure two orthogonal linear polarization components (generally θ polarization and ϕ polarization). Measure the amplitude and relative phase of the antenna of the DUT to measure antenna patterns independent of each other.

Stage 2: The antenna pattern measured in the first stage is combined with the MIMO propagation channel model. Furthermore, the inverse matrix of the portion corresponding to the RF space from the measurement antenna in the anechoic chamber to the measurement space and the antenna of the DUT is calculated, and a test signal is generated to cancel this RF characteristic. With the DUT fixed in an anechoic chamber (both position and orientation with respect to the transmit antenna), the MIMO channel model is emulated by the channel emulator, and signals are supplied to the transmit antenna to perform a MIMO throughput test.

In a 2×2 MIMO throughput test configuration, the horizontal and vertical polarization of one measurement antenna can be used as two independent measurement antennas. By transmitting the test signal through space rather than the RF cable, the antenna of the DUT remains connected, and the MIMO throughput can be measured without interruption to assess the effects of desensitization and self-interference. Because there is no cable connection to the DUT in the second stage, the DUT can be measured as it is located in an anechoic chamber, unaffected by the entire test.

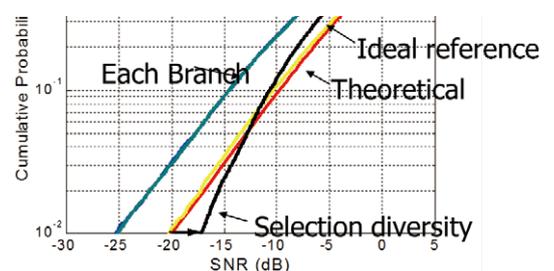
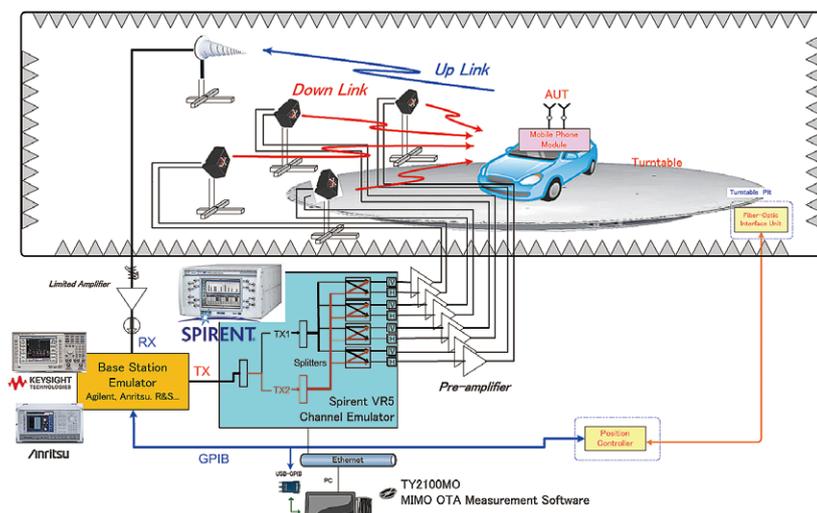
Source reconstruction method Near field to Far field conversion

When measuring antenna radiation patterns, it is common to place the antenna of the DUT at the center of rotation of the turntable. However, because the size of the car is large, even if the anechoic chamber equipped with a turntable with a diameter of 6 m, if the antenna is located at the end of the vehicle, it cannot be placed at the center of rotation. In addition, the vehicle height is different between the sedan and the one box. For this reason, if an antenna is installed on the roof, a lifting function is required. Without the gantry (or arch) lift mechanism used for 3D radiation pattern measurement, it can not be aligned with the elevation center of rotation. In radiation pattern measurement, it is premised that the wave source is at the center of rotation, and the misalignment of these installation positions is a major error factor. The spherical near-field far-field conversion software of the "source reconstruction" method provided by GTS has a function to correct the position of the wave source of the antenna, so it is possible to correct such a positional deviation to obtain an accurate far-field radiation pattern data.



Performance Evaluation of MIMO Multi-Antenna(Correlation, diversity gain)

In order to obtain sufficient transmission performance of MIMO, it is important to obtain multiple independent propagation paths. No matter how good the performance of a single antenna is, independent propagation paths cannot be obtained if similar signals are received from each antenna. In other words, the correlation coefficient, which is the characteristic between antenna branches, is important. The lower the correlation, the more independent the signal is being received. In addition, if antenna elements are close to each other, they will be mutually affected (coupling) and the efficiency of the antenna will be reduced. The antenna requirements of MIMO require more consideration of the location of each branch and the surrounding environment than the performance of a single unit. In the past, antenna evaluation used to measure the radiation pattern and gain of an antenna in an anechoic chamber that simulates a free space without reflected waves. So what kind of evaluation should we use when using multiple antennas? Whether it is reception diversity or MIMO, it is an antenna system that assumes operation in a multipath environment where reflected waves exist, so an environment close to that is desirable. In a propagation path where there are no direct waves and the number of reflected incoming waves is large, the I and Q components of the complex received signal have a normal distribution (amplitude fluctuation and phase fluctuation are random). At this time, the amplitude of the received signal has a Rayleigh distribution, which is considered to be an environment created by the synthesis of many scattered waves with almost equal levels. If you place the antenna in a Rayleigh-distributed fading environment and observe the reception level for a sufficient time, the reception level will be low (fading dip) with a certain probability. By graphing and comparing the cumulative probability distribution of the reception level data, it is possible to quantitatively evaluate how much the reception level is improved. By measuring the same set of antennas in different arrangements, the effectiveness of diversity can be evaluated. In other words, even if the performance of a single antenna is the same, the diversity effect greatly changes depending on the placement. This means that in a multi-antenna system, the implementation of the antenna element greatly affects the reception performance.



Corporate Profile



Since its founding in 1953, TOYO has been striving to serve as an interface between Japan and the rest of the world with advanced technology both in hardware and software. To this end, TOYO has been a leader in the importing of cutting-edge measuring equipment and software development tools from the around the world.

Company name : TOYO Corporation
 Founded : September 4, 1953
 Capital : 4158 million yen
 Owned capital : 25,800 million yen
 Employees : 446
 Headquarters : 1-6 Yaesu1-chome, Chuo-ku, Tokyo, Japan
 TEL : +81-(0)3-3279-0771
 FAX : +81-(0)3-5205-2030



Reliable Customer Support

TOYO has been developing its own original products at our Electro-Technical Center with more than 100 technical professionals. Our products are designed to meet our customers' technical demands utilizing the technologies and experiences we have cultivated since our founding. TOYO EMC software is 100% proprietary because it is 100% developed from original designs and concepts of our Electro-Technical Center engineering staff. This is why we can guarantee that our customers will receive the highest quality product and the best possible after-sales service.

This is also why TOYO software products are always up to date with the latest measurement methods, revisions in EMC standards, test equipment, and user needs.

To ensure a high standard of quality and provide maximum satisfaction to customers, our Electro-Technical Center has obtained ISO9001 certification for design, development, manufacture, inspection, delivery, installation, calibration, and servicing (repair) of electronic measuring instruments.

Calibration Laboratory

TOYO provides calibration services to enable customers to use their instruments for extended periods of time with high precision. With ISO/IEC17025 accreditation, the Calibration Laboratory provides various calibration services from DC to 40 GHz.



TOYO Corporation

EMC & Microwave Systems

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