EMC Measurement Software
SELECTION CATALOG

2021

EMC TOYO

TOYO Corporation
Quest for Precision

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INTRODUCTION

Every advancement in electronics technology introduces more electronics to provide more features. These devices, however, are often generators of electromagnetic energy, which can impair the normal function of other peripheral electronic devices; for example, digital signal processing equipment is both susceptible to, and generates, electromagnetic interference (EMI). EMI has become so serious that it has recently been labeled as a social problem. The intensity of electromagnetic emissions from electronic equipment must be measured and restricted if an environment is to be assured free from mutual interference between electronic devices.

Electromagnetic energy emitted by electronic devices that interferes with the proper operation of peripheral electronic equipment is called electromagnetic interference (EMI). The degree that a device is immune to — or affected by — EMS is called electro-magnetic susceptibility (Immunity/EMS). Electromagnetic compatibility (EMC) is a generic term combining the concepts of EMI and EMS; that is, the EMC of the device is its ability to operate without producing an excessive level of EMI, and to operate normally when subjected to EMI. Many countries have EMC regulations.

With TOYO Software, users of all levels can now collect repeatable and reliable results. The software provides a unifying framework for engineers to bring their wide variety of equipment from different manufacturers together under one common interface. Our intuitive interface allows for quick and accurate test condition settings. All settings can be saved in a template that includes the equipment selection, and they can be recalled for a later time. With a click of a button, fully automated measurements (from spectrum data collection), final evaluation and report creation are available. At any given time, users can manually take control and if there is a suspected frequency that they would like to investigate, they can simply zoom in the graph, send the span to the analyzer and collect data for that span size. The software will display it with a different colored line so that it is easily distinguishable. Report creation supports multiple formats, such as Excel, Word and PDF.

STANDARDS BODIES

ANSI   American National Standards Institute, Inc. (U.S.A.)

CISPR   Comite International Special des Perturbations
               Radio-electrique

DENAN   Electrical Appliance and Material Safety Law (Japan)

EN   European Norm (Cenelec)

FCC   Federal Communications Commission (U.S.A.)

GB   Guojia Biaozhum (People's Republic of China)

IEC   International Electrotechnical Commission

ISO   International Organization for Standardization

JEITA   Japan Electronics & Information Technology Industries
               Association (Japan)

MIL   Military Specifications and Standards (U.S.A.)

VCCI   Voluntary Control Council for Interference by Data
               Processing Equipment and Electronic Office Machines (Japan)

SOFTWARE SELECTION GUIDE

*PXE: Keysight's Newest EMI Receiver

"DATA PLUS AI" TO HELP YOU REDUCE EMI NOISE

EMINT is the software that helps product developers troubleshoot EMI noise by finding similar noise patterns from past measurement data and learning about the countermeasures taken at that time to address the noise.

COLLECTIVE INTELLIGENCE THROUGH DX

Collect data for EMINT using the knowledge each individual development engineer has on countermeasures against noise emission and integrate all the collected information, correlating it to relevant technical information and measurement data.

SUGGESTION FROM PAST DATA

The AI-powered EMINT will help you find noise from past measurement data that has similar characteristics to the one that needs countermeasures.

You can get clues for effective countermeasures from the previous comments left when the similar noise was handled in the past.

LIST TO NARROW DOWN NOISE SOURCE

EMINT will find a noise source from the list of parts that make up the product based on clock frequencies. This feature will help identify the noise source that needs countermeasures.

DATA GROUPING

Create units called "Projects" to help you manage measurement data in groups.

POWERFUL DATA SEARCH

Search by file name or metadata value; the search can be refined further by using spectrum characteristics, improving the data search experience.

COMMENTS

A comment can be added for a certain frequency point of measurement data and a link can be set to past data.

PATENTED TECHNOLOGY

Patented technology is used for the algorithm to find waveforms with similar characteristics. This patent was awarded in Japan.

OVERVIEW

When you test modern electronic equipment which is being increasingly digitized and mobilized with the use of high-density packaging, it has become more and more difficult to identify electromagnetic noise sources and take measures against such noise. It is required to always comply with various relevant standards as they update every year, and to collect and save as much data as possible on noise that behaves in a complicated manner.

To satisfy such requirements, TOYO has developed the EPX and ES10 series. With a broad range of EMI software products, we can propose and supply the EMI measurement system that best suits your needs.

On these new series, the software operability has dramatically improved with the new sophisticated and modern user interface. TOYO's EMI measurement software has been used by a wide range of users from laymen to experts. All measurements from simplified measurement for testing EMI countermeasures to the standard-compliant final tests have been automated to ensure that all users can complete their measurement efficiently.

EPX
EMC Intelligence

Emission Measurement Analysis Software
EPX Version 2020.04.000

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PRODUCT PORTFOLIO

| SERIES	PRODUCT	DESCRIPTION
EPX	EPX/RE	Radiated emission measurement using RTS of PXE
	EPX/CE	Conducted emission measurement using RTS of PXE
	EPX/VE	EMI measurement using RTS of PXE for vehicle
	EPX/VIEW	Viewer software for EPX series
ES10	ES10/RE	Radiated emission measurement (successor to EP5/RE and EP7/RE)
	ES10/CE	Conducted emission measurement (successor to EP7/CE and EP9/CE)
	ES10/VE	EMI measurement for vehicle (successor to EP9/VE)
	ES10/VIEW	Viewer software for ES10 series
EP5	EP5/RSE	Software for carrier and spurious emission measurement
	EP5/NSA	Normalized site attenuation measurement

"EPX implements Accelerated Time Domain Scan technology to realize highly reliable emission automatic measurement without missing noise."

EPX SERIES - INDUSTRY-LEADING PERFORMANCE

" ... contributes to a significant reduction in total EMI evaluation time."
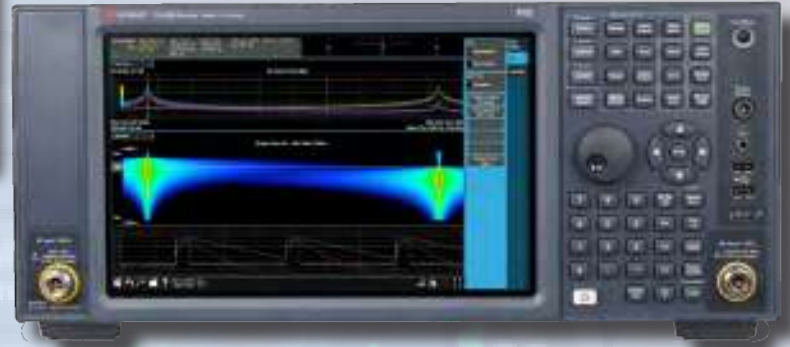
"EPX introduces new technologies & showcases the reliable automatic measurement sequence."

POWERFUL COMBINATION WITH KEYSIGHT N9048B PXE A-TDS 350MHZ GAPLESS MEASUREMENT

EPX realizes many advanced functions by making full use of the Accelerated Time Domain Scan (A-TDS) function, which is an option of the "N9048BPXE" receiver. The A-TDS feature has an FFT bandwidth of 350MHz that far exceeds that of a conventional EMI receiver. If you are to conduct a measurement in a range from 30MHz to 1000MHz with this FFT bandwidth, you need to measure noise only in three ranges and you are done. Within each FFT bandwidth, noise is constantly monitored at each frequency, which enables gapless measurement. Also, by integrating A-TDS into the automatic measurement sequence, "EPX" offers automated measurement with enhanced reliability. You will never miss any noise with this solution.

Automatic Measurement Sequence Incorporating A-TDS

Analysis of Noise Behavior on the Time Axis

Evaluation Algorithm Using in-FFT Bandwidth Measurements

35+ Years of EMC Software Development Experience

The automatic measurement sequence has been built so as to best utilize the Real Time Scan mode of A-TDS. Improvements are made in each step of the measurement to avoid missing noise. The graphic below shows the measurement sequence using the PXE receiver and the EPX software.
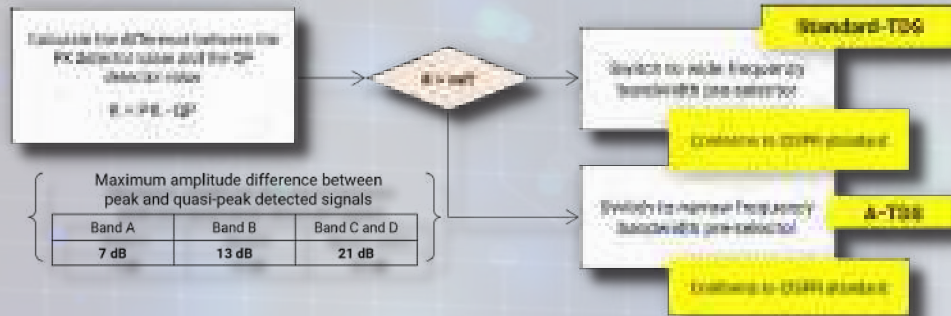
01 QP Pre-Scan

02 Noise Characteristic Analysis

03 Automated Measurement Sequence

04 RTS Final Measurements

05 Automated Compliance Judgment

EPX SERIES - TWO KEY TECHNOLOGIES

The "EPX series" has two features that use TOYO's self-developed technologies – "Impulse noise removal feature" and "Compliance evaluation feature", both of which solve the issues that could occur during wideband measurement using the "N9048B PXE" EMI receiver.

EPX AUTOMATIC COMPLIANCE CHECK FUNCTION

Pulses with a repetition frequency of 20 Hz or less are measured by switching to a pre-selector with a narrow bandwidth. CISPR16-2-3 Ed.4 (2016) Annex E (Normative reference) is used to determine whether the repetition frequency is 20 Hz or less.

Maximum amplitude difference between peak and quasi-peak detected signals		
Band A	Band B	Band C and D
7 dB	13 dB	21 dB

EPX IMPULSE NOISE FILTER

On the spectrum graph, the maximum level noise measured during scan measurement is displayed as a spectrum.

If wide-band and high-level impulse noise is received during scan measurement, other noise may not be visible when displayed on the spectrum graph because peak detection receives a high level noise over the entire measurement band. In such cases, the impulse noise filter function displays the spectrum from which infrequent noise is removed. The impulse noise filter reproduces the results when no unwanted impulses happened. And no re-measurement is needed with no influence of unnecessary impulses.

For example, assume there is the following broadband noise in the spectrum graph of the scan measurement result (see A below). If you are measuring high-level noise only once then review the time domain graph (see B). However when [Impulse Nose Filter] at the bottom right of the spectrum graph screen is set to [ON], the maximum spectrum excluding impulsive noise is displayed (see D).
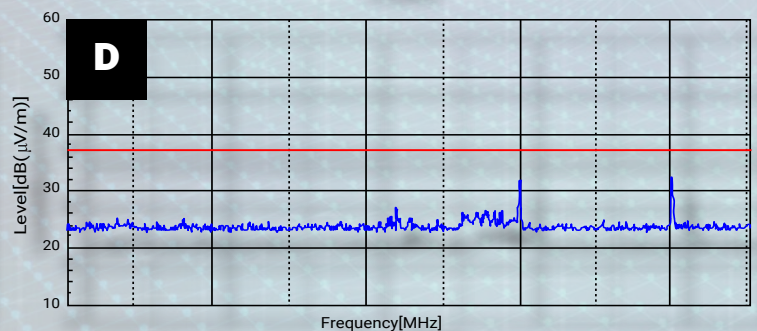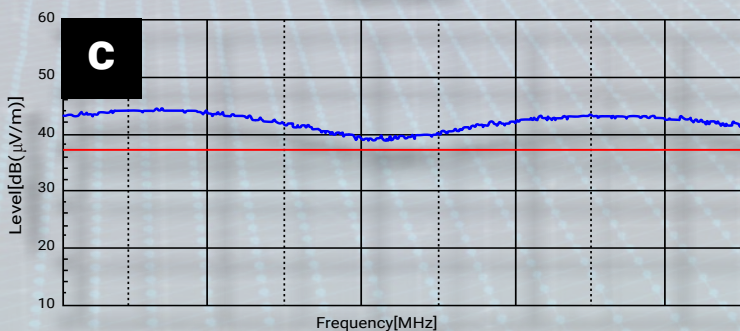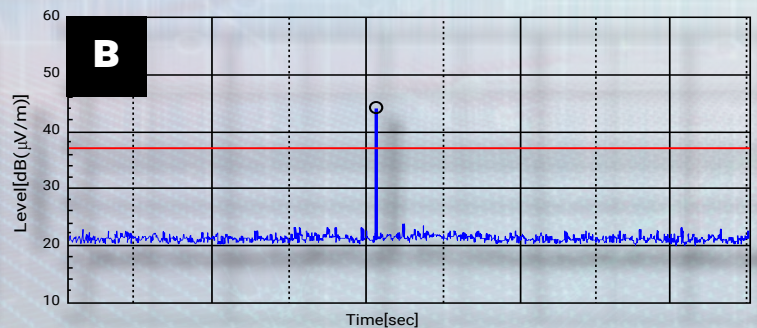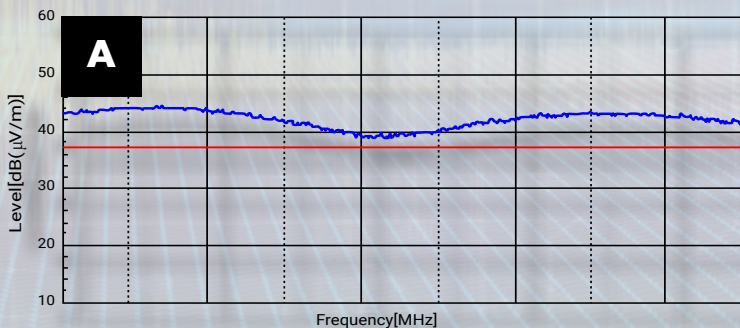
Impulse Noise Filter ○ ON ● OFF

Impulse Noise Filter ● ON ○ OFF

ES10 SERIES - NEXT-GEN INDUSTRY STANDARD

" ... helps significantly reduce total EMI evaluation time."

"Measurement results by PXE + EPX always conform to CISPR standards."

NEXT-GENERATION INDUSTRY STANDARD SOFTWARE – SUPPORTS A VARIETY OF HARDWARE

Our EMI measurement software has further evolved into the new ES10/RE software, integrating our renowned and industry standard EMI measurement software, EP5/RE and EP7/RE. Utilizing the "Time Domain Scan" feature implemented in the latest EMI receivers, the software allows you to accurately and quickly measure increasing complex noise and evaluate your planned countermeasures.

It employs an evaluation algorithm that uses in-FFT bandwidth measurement techniques. TOYO has been developing EMC software development experience for over 35 years.

New features include:

- Support "Time Domain Scan" measurement on EMI receivers
- Function to display differences between multiple sets of measurement data for easy comparison and analysis
- Use of substantially improved user interface operability implemented in our flagship software, "EPX" series
- Flexible and customizable GUI (Incl. support of extended display)
- Time domain view of spectrum data
- New upgrade program: New features added at regular intervals – Latest software downloadable from the designated download site (offered under a chargeable upgrade program contract)

STEP 1: LOAD A TEMPLATE OR CONDITION FILE

Load a template file to save all the settings required for measurement, such as limit, instruments, conditions and comments, or a condition file to save the measurement parameters settings in advance. This simple step helps you start the measurement immediately after start-up without setting complicated parameters before the measurement.

01

STEP 2: EXECUTE SCAN MEASUREMENT

Soon after you start the EMI measurement, check the frequencies at which noise is output from the EUT. This scan measurement is executed to acquire the noise spectrum in the desired frequency range. Some standards require scan measurement data acquisition itself as an analysis target.

02

STEP 3: CREATE A SUSPECTED LIST

Select and list interference to execute measurement using a detector (i.e. QP detector) as required by the standard. In addition, for standards that require scan measurement data acquisition results as an analysis target, you can list typical noise from a scan measurement result and use it along with the graph.

03

Template File and Condition File

The Template File contains instruments settings, environment settings, options, used measurement condition file names and others. You can set the required settings by choosing and loading a suitable template file.

The Condition File contains detailed measurement conditions such as standard matrix, scan measurement conditions, conditions for creating suspected list, and final evaluation conditions. It is good practice to prepare template files and condition files to perform measurements as to save time when creating settings. In addition, if you have a template file on your desktop, the software can be started by clicking the template icon with the settings saved in it.

Easy to Start

Just Click [Scan Measurement] on the navigation menu or click [Scan Measurement] on the [Measurement] menu.

Creating a Suspected List

Noises (frequencies) that should undergo the final measurement using a detector (i.e. QP detector) required by the standard are included in the Suspected List. Executing the final measurement at the listed frequencies can provide more accurate results according to the standard.

The noise (frequency) is added to the suspected list through any of the following methods:

- TOYO software selects candidates automatically based on the scan measurement result using the specified conditions (peak search)
- Move the marker on a graph to register any certain point
- Enter the noise (frequency) directly (direct input)

STEP 4: EXECUTE FINAL EVALUATION

Execute measurement for each frequency listed in the suspected list using a detector complying with the standard requirement and create a final data list. This list corresponds to a final result of the measurement required by the standard.

04

Executing Final Evaluation

Receive the signal at each frequency listed in the suspected list using a receiver and execute measurement with a detector complying with the standard requirement. In the final evaluation, in order to confirm the characteristics of the listed noise, "noise evaluation" is performed at each frequency, and there is a function to confirm the frequency deviation and noise stability. In the case of radiation emission measurement, the maximum radiation position is searched. In the final measurement, since enough time is spent for one measurement, the noise is usually more accurately evaluated, not only by a detector with long time constants, such as a QP detector, but also by an AV detector and a PEAK detector. In order to prevent the highest fluctuating noise level from being overlooked, the highest value is recorded by acquiring the level for a preset monitoring time.

The final measurement results obtained from Final Evaluation are registered in a final data list.

STEP 5: OUTPUT A REPORT

Follow the instructions of the Report Wizard to print reports in a format of your choice.
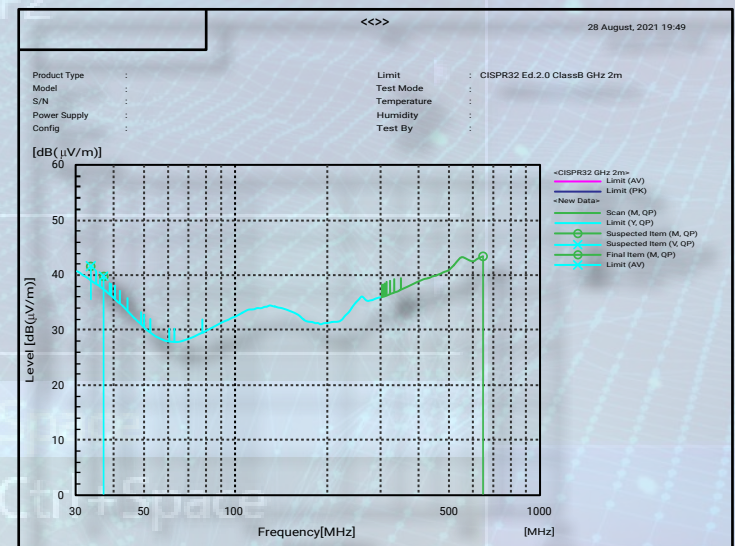
A preview image of the report to be printed can be checked by clicking the <Preview> button.
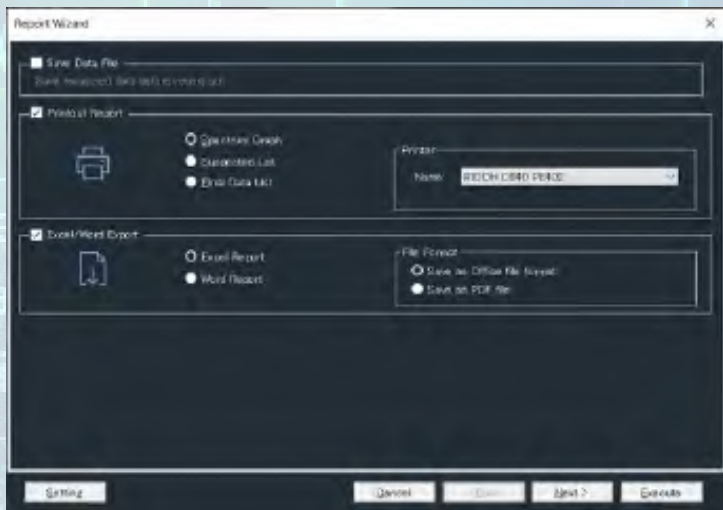
Running Reports

The following three reporting functions are available.

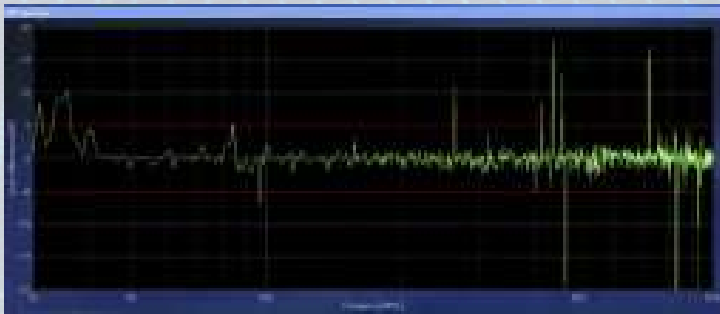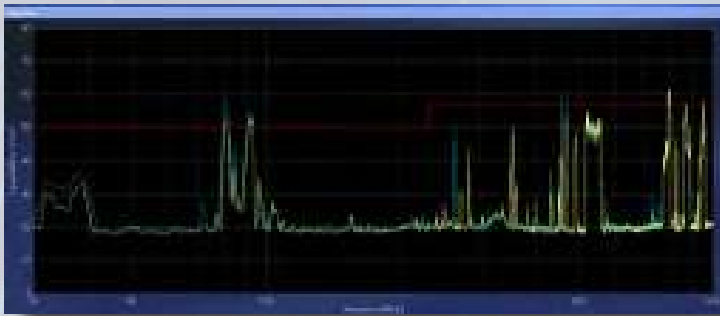| REPORTING CAPABILITY	DESCRIPTION
Save Data File	Allows you to save the measurement result collected during measurement. (This has the same effect as selecting [File]- [Save Data].)
Printout Report	Allows you to print measurement data directly using a printer for report types.
Excel/Word Export	Allows you to output measurement data to Excel, Word or PDF files.

TIME AXIS DISPLAY FUNCTION FOR NOISE

Just click on the spectrum of the pre-scan result to see the temporal variation of the noise level.

DIFFERENCE DISPLAY FUNCTION THAT SHOWS THE RESULT OF NOISE SUPPRESSION

This makes it possible to see at a glance the change in the level of each noise in multiple measurement results. The graph above shows the two measurement results of interest.

And it is possible to see at a glance the change in the level of each noise in multiple measurement results.

NOISE EVALUATION-FREQUENCY FINE TUNING BY TDS

PK detection is easily affected by momentary level fluctuations. AV detection may have a different frequency response than QP detection. Time domain scans can be used to find frequencies that maximize the level of fluctuating noise.

Frequency fine-tuning by PK detector of spectrum analyzer

Frequency fine-tuning by QP detecto of TDS
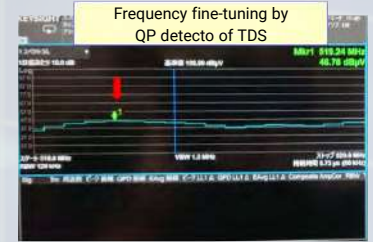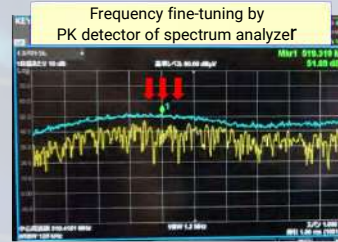
Thus frequency fine tuning by QP detector of TDS contributes to improving the reliability of measurement results.

Here's a flow chart to demonstrate to one performs noise evaluation-time variation evaluation. Evaluate the time variation of the level for each noise to be evaluated.

> ### CHECK TIME FLUCTUATION OF NOISE LEVEL

> ### FOR NOISE WITH STABLE LEVELS, MOVE THE MAST/TABLE FASTER DURING THE MAXIMUM RADIATION POSITION SEARCH.

> ### FOR NOISE WITH LARGE LEVEL FLUCTUATIONS AND FREQUENT OCCURRENCE, MOVE THE MAST/TABLE SLOWER DURING THE MAXIMUM RADIATION POSITION SEARCH.

> ### FOR NOISE WITH LARGE LEVEL FLUCTUATIONS AND INFREQUENT OCCURRENCE, THE MAST/TABLE IS STEPPED DURING THE MAXIMUM RADIATION POSITION SEARCH.

Adjust the operation speed and monitor time according to the time fluctuation of the noise level. Contributes to shortening measurement time without compromising reliability.

"Prevents evaluations of benign noise and helps identify non-benign noise sources."

FLEXIBLE WINDOW LAYOUT

The layout and size of each child window can be changed freely. To change the placement of each child window, drag the tab portion of the window to the desired position.
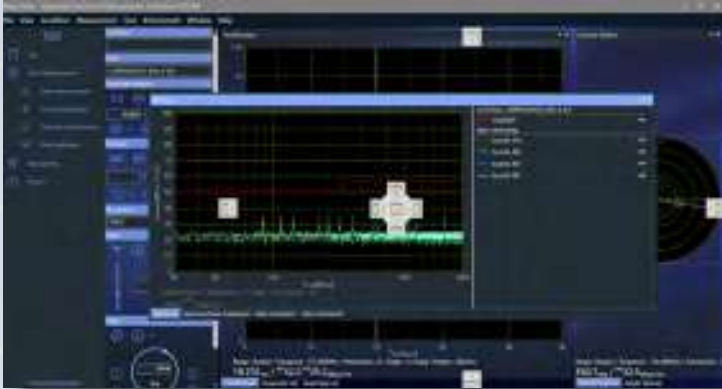
SIMPLE SPECTRUM MEASUREMENT

The software also provides a new user interface that supports dragging the mouse over a span of frequencies on the zoomed graph. From there, a range can be selected [Send Frequency Span] from the Right Click menu to transfer the enlarged frequency span to the spectrum analyzer.

The spectrum analyzer can be set up manually to load the waveform on the analyzer into the application.
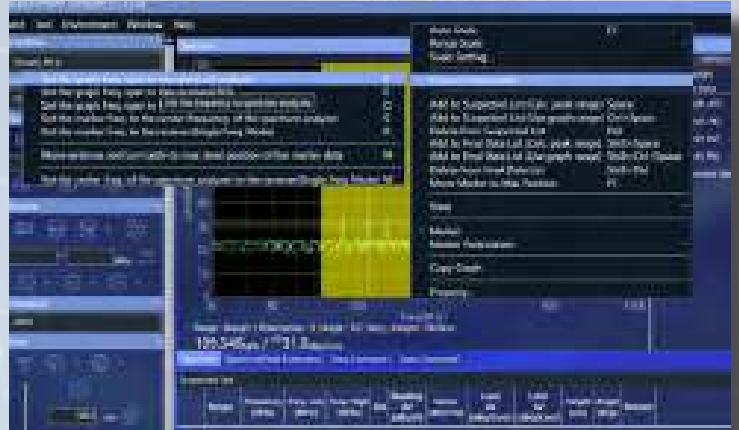
VERSATILE TURN TABLE / MAST SCAN SEQUENCE

The scanning method of the turn table and antenna mast is important in order to prevent the noise emitted by the EUT from being overlooked in the pre-scan measurement.

EPX/ES10 / RE can select various scanning methods shown here according to the characteristics of the noise generated by the EUT.
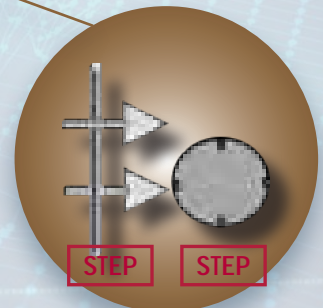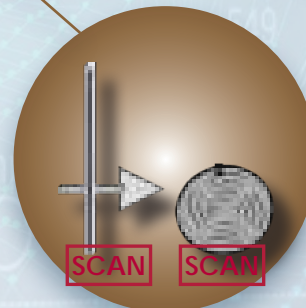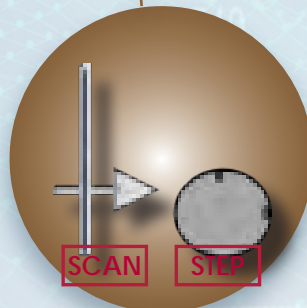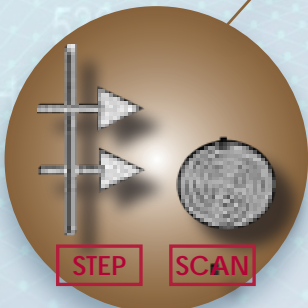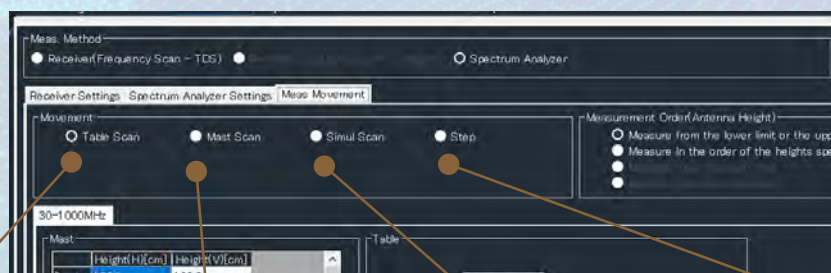
EMISSIONS SOFTWARE FUNCTION TABLE

CATEGORY	FUNCTION	EPX	ES10
PreScan	MaxHold trace using a spectrum analyzer	✓	✓
	Average trace using a spectrum analyzer	✓	✓
	Capture all clear/write spectrum data using the clear/write trace of spectrum analyzer	✓	✓
	Calculate average value from clear/write trace of a spectrum analyzer	✓	✓
	Re-measurement of a specific frequency range	✓	✓
	Receiver scan measurement (stepped scan)	✓ (only VE, CE)	✓ (only VE, CE)
	Measurement using MaxHold trace of FFT time domain scan	✓ (only VE, CE)	✓ (only VE, CE)
	Get all clear/write spectrum data using clear/write trace of FFT time domain scan (only Keysight receiver)	✓	✓
	Get gapless data using PXE's realtime scan mode	✓	
	Impulse Noise Filter	✓	
Suspected list	Pick up suspected noise frequencies in ascending order of margin from limit value	✓	✓
	Set the maximum number of pickups	✓	✓
	Set the minimum number of pickups	✓	✓
	Pickup number specification per frequency range	✓	✓
	Specific frequency pickup (spot frequency pickup)	✓ (only VE, CE)	✓ (only VE, CE)
	Repeated frequency compliance judgment by QP-PK level difference	✓	
Final evaluation	Fine-tune the frequency using a spectrum analyzer	✓	✓
	Fine-tune the frequency using MaxHold trace of FFT time domain scan	✓	✓
	Fine-tune the frequency using Clear/Write trace of FFT time domain scan (only Keysight receiver)	✓	✓
	Fine-tune the frequency using PXE's real-time scan mode	✓	
	Final measurement using a receiver	✓	✓
	Final measurement using a spectrum analyzer	✓	✓
	Simultaneous measurement of multiple detections using a receiver	✓	✓
	Make final measurement using MaxHold trace of FFT time domain scan	✓	✓
	Make final measurement using Clear/Write trace of FFT time domain scan (only Keysight receiver)	✓	✓
	Make final measurements using PXE's real-time scan mode	✓	
	Display of level during final measurement	✓	✓
Print	Print	✓	✓
	Print a combination of graphs and lists	✓	✓
	Graph, 1/2 graph, 1/4 graph printing	✓	✓
	Excel / Word report output	✓	✓
	PDF output	✓	✓
	Output spectrum measurement data numerically (Excel format)	✓	✓
Analysis	Time domain graph	✓	✓
	Difference spectrum graph	✓	✓
	Difference list	✓	✓
Others	Manual operation window of each device such as a spectrum analyzer or receiver	✓	✓
	System input protection function	✓	✓
	Frequency unit change (GHz / MHz / kHz)	✓	✓
	Level unit change (dB (μV), dB (μA), dB (pT))	✓	✓
	Instrument connection check	✓	✓
	Path factor measurement	✓	✓
	Path factor check	✓	✓
	Number of paths	10	10
	Number of configurable factor files per path	100	100
	Password	✓	✓
	Comment	✓	✓
	Child window display of comments	✓	✓
	Load and save measurement results	✓	✓
	Load and save measurement conditions	✓	✓
	Load and save template (measurement environment)	✓	✓
	Window style change	✓	✓
	Editing spectrum measurement results	✓	✓
instruments	VISA (LAN, USB, GPIB, RS232C) control	✓	✓
	Factor transfer function to instrument	✓	✓
	Many supported instruments		✓

EMISSIONS SOFTWARE FUNCTION TABLE

MODEL	FUNCTION	13	EPX/RE	ES10/RE
RE	Table scan measurement		✓	✓
	Mast scan measurement		✓	✓
	Step measurement		✓	✓
	simultaneous scan		✓	✓
	Height and azimuth pattern smoothing display		✓	✓
	Measurement distance correction function		✓	✓
	2 antenna mast measurement		✓	✓

MODEL	FUNCTION	EPX	ES10/CE
CE	Maximum number of phases, number of positions	9 (AMN) / 100 (Probe)	9 (AMN) / 100 (Probe)
	Determining function at measurement	✓	✓
	LISN phase switching remote control	✓	✓

MODEL	FUNCTION	EPX/VE	ES10/VE
VE	Maximum number of phases, number of positions	9 (AMN) / 100 (Probe)	9 (AMN) / 100 (Probe)
	Determining function at measurement	✓	✓
	2 antenna mast measurement	✓	✓
	CISPR25 Annex I measurement	✓	✓

EP5/RSE - AUTOMATIC RADIATED SPURIOUS EMISSIONS MEASUREMENTS
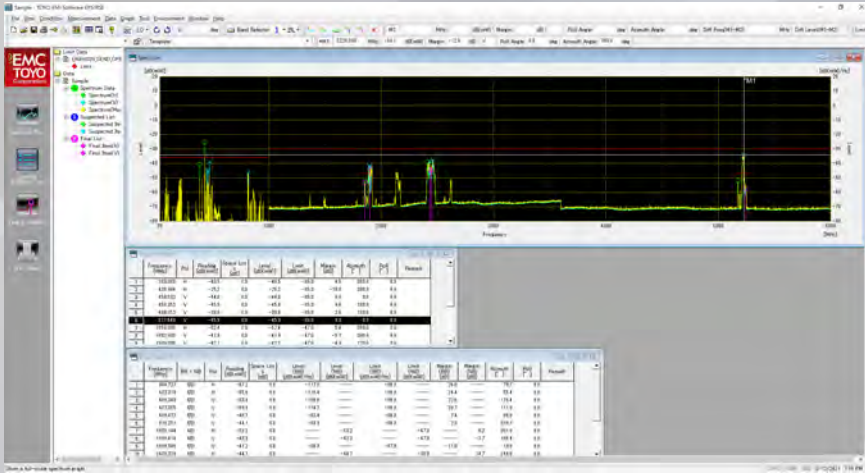
EP5/RSE - AUTOMATIC RADIATED SPURIOUS EMISSION MEASUREMENT

Radio communication instruments, which intentionally radiate RF signals, need to be subjected to wireless measurements that confirm to individual countries' radio laws, in addition to normal EMC measurements. These instruments need to undergo carrier and spurious emission measurements that comply with wireless communication standards such as the European Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive (ETSI) and Federal Communications Commission (FCC) in the US. Since most electronic equipment to be developed are expected to have wireless communication capability included the need for spurious emission measurement is a high priority.

The EP5/RSE software supports the carrier and spurious emission measurements by the radiated method required to test EUTs with built-in antennas. Backed by ample experience in the EMC measurement field, we provide the most suitable measurement system to each individual customer need.

SUPPORTED STANDARDS
- TS51.010-1, TS34.121 (3GPP) Mobile phones (GSM, WCDMA)
- EN300 328, EN301 893 (ETSI) W-LAN, Bluetooth

FEATURES
- Supports radiated method measurements on EUTs with built-in antennas
  - Relevant standards specify radiated methods and conducted methods. EP5/RSE can perform carrier and spurious measurements by using the radiated method for EUTs from which no signal can be directly obtained through its antenna terminal.
- Supports various measurement items required by relevant standards
  - Spurious measurement
  - Carrier measurement (e.g. EIRP measurement, maximum power density measurement)
  - Spatial loss calibration measurement
  - Supports a wide variety of hardware
  - Equipped with a sophisticated user interface

EIRP MEASUREMENT/SPATIAL LOSS | MEASUREMENT/SUBSTITUTION METHOD

Effective Isotropic Radiated Power (EIRP) is the receiving power radiated from the EUT and is observed in a certain direction - it is normalized with reference to the power radiated by a point source. You can obtain the EIRP if you rotate the EUT with a built-in antenna (having no antenna port) on a turntable in an anechoic chamber, search for the maximum radiation point in the H/V polarizations and substitute the acquired value with that of a calibrated signal source and a standard gain antenna. In the spatial loss measurement, you can obtain a spatial loss value if you generate a 0dBm output with a standard gain antenna and a signal generator and receive the signal with an antenna and a receiver.

Special Note:
- For spurious measurements with the electric field strength required for FCC and TELEC certification tests, use ES10/RE (EP5/RSE does not support these measurements).
- For the measurement of other communication systems or RFID, feel free to contact us for details.

EMC STANDARDS AND MEASUREMENTS FOR WLAN DEVICES

STANDARD	SECTION	FREQUENCY BAND	MEASUREMENT ITEM
EN300328	6. Transmitter spurious emissions 7. Receiver spurious emissions	Bluetooth 2.4GHz	Spurious
EN300328	1. Maximum transmission power 2. Maximum EIRP spectral density 3. Frequency range	2.4GHz	Carrier EIRP
EN301893	1. Transmitter unwanted emissions outside the 5 GHz RLAN bands 2. Transmitter unwanted emissions within the 5 GHz RLAN bands	5GHz	Spurious
EN301893	3. Nominal channel bandwidth and occupied channel bandwidth 4. RF RF output power, Transmission power control (TPC) and output power density	5GHz	Carrier

EMC STANDARDS AND MEASUREMENTS FOR MOBILE PHONES

STANDARD	SECTION	FREQUENCY BAND	MEASUREMENT ITEM
3GPP TS51.010-1	12.2. Radiated spurious emission /12.2.1. MS allocated a channel	GSM850 / 900 / 1800 / 1900	Spurious
3GPP TS51.010-1	12.2. Radiated spurious emissions /12.2. Transmission frequency channel (MS in idle mode)	GSM850 / 900 / 1800 / 1900	Spurious
3GPP TS51.010-1	14 Receiver (Receiving frequency channel)	GSM850 / 900 / 1800 / 1900	Spurious
3GPP TS34.121-1	5.11 Spurious emissions (Transmission frequency channel)	WCDMA 1800 /1900	Spurious
3GPP TS34.121-1	6 Spurious emissions (Receiving frequency channel)	WCDMA 1800 /1900	Spurious
3GPP TS34.121-1	5.2 Total radiated power (TRP)	All bands for GSM and WCDMA	EIRP

IEC61000-4-3/-6 COMPLIANT IMMUNITY MEASUREMENT SOFTWARE

The IM5 series of automatic immunity measurement software is a line of software products developed to evaluate the susceptibility of electronic equipment to electromagnetic interference.

The software automatically controls the immunity measurement apparatus; this includes the signal generator, power amplifier, field-strength meter, power meter, and turntable/antenna mast controller. This makes it simple for even junior engineers to conduct measurements, print them out and/or save them to a file.

Courtesy of the IEC. Please visit https://webstore.iec.ch/ to purchase official IEC standards documents.

SUPPORTED STANDARDS
- IEC, EN, CISPR, MIL, JIS and other domestic immunity standards

FEATURES
- Sophisticated user interface
- Measurement procedure that dramatically reduces measurement time
- Capable of exporting measurement data in CSV format
- Capable of saving standard values, factors and measurement conditions to files, enabling them to be set, edited and created easily
- Supports a wide range of hardware by various manufacturers
- Various password functions are provided for a range of access levels, from the staff in charge of making measurements and to the system administrator
- Supports Windows 10

IM5 SERIES IMMUNITY TEST SOFTWARE
- IM5/RS Radiated immunity test software
- IM5/CS Conducted immunity test software

SUPPORTED TEST EQUIPMENT
- Signal Generators
Keysight Technologies	N5171B, N5181B PSG, ESG, 8648, 8656 Series and (Agilent) others
Rohde & Schwartz	SMA, SMB, SML, SMR, SMY, SMT, SMP, SMG IF Series, and others
AMETEK	NSG4070, ITS6006
IFR	2080, 2023, 2024
Other	Anritsu, ETS-Lindgren, Panasonic, Fluke

- Power Amplifiers   AMETEK, AR, Bonn, and others

- Field-strength Meters, Field Probes
ETS-Lindgren	HI-6005, HI-6006, HI-6105, HI-6153 and others
Narda	EP-600, EP-602
AR	FM7004, FL7006, and others

- Power Meters, Voltmeters
Keysight Technologies	N1912A, N1914A, E4417
Others	Rohde & Schwartz, Bird, Keithley

- Level Measurement Instruments (Spectrum Analyzers)
Keysight Technologies	N9030x, N9020x, N9010x, N9000x Series. PSA/E4440 Series and others FSL Series, FSU Series, FSP Series and others
Other	Anritsu, Tektronix, Narda

- Turntables and Antenna Masts
  ETS/EMCO, INNCO, SunAR(SUNOL), Maturo, Frankonia, TDK, Tokin, Device, and others (Ask TOYO for other makers/models)

SUPPORTED STANDARDS			
PRODUCT	STANDARD	REVISION	TARGET
EPX/RE, ES10/RE	CISPR11	6.0 (2015-06)	Electric field
	CISPR14-1	6.0 (2016-08)	Electric field
	CISPR15	8.0 (2013-05)	Electric field
	CISPR32	2.0 (2015-03)	Electric field
	FCC	Part 15 Subpart B	Electric field
EPX/CE, ES10/CE	CISPR11	6.0 (2015-06)	Conducted
	CISPR14-1	6.0 (2016-08)	Conducted
	CISPR15	8.0 (2013-05)	Conducted
	CISPR32	2.0 (2015-03)	Conducted
	FCC	Part 15 Subpart B	Conducted
EPX/VE, ES10/VE	ECE R10	05 (2014-10)	Electric field, Conducted
	CISPR12	6.0 (2007-05)	Electric field
	CISPR25	3.0 (2008-03)	4.0 (2016-10)	Electric field, Conducted
	MIL	MIL-STD-461G	Electric field, Conducted

IM5/RS: RADIATED IMMUNITY MEASUREMENT SOFTWARE

TOYO's IM5/RS is the radiated immunity measurement software that is compliant with IEC61000-4-3.

SUPPORTED STANDARDS

- IEC61000-4-3 EN61000-4-3 and JIS C 61000-4-3 JEITA IT-3001, etc.

BASIC FUNCTIONS

- **CALIBRATION FUNCTION.** The software checks the electric distribution around the equipment under test (EUT), and checks whether the measurement site is suitable for immunity measurement. The software determines the output level of the RF signal generator to obtain the electric field that the EUT is to be subjected to in immunity measurement.

UNIFORMITY MEASUREMENT

- **CAPABLE OF MEASURING UP TO 50 POSITIONS.** The frequency scale can be set to a linear or logarithmic scale. If uniformity cannot be obtained at a constant antenna height, the height can be changed to obtain more data. The software changes the antenna height automatically during immunity testing, eliminating the need for interrupting the test to change antenna height.
- **CLEAR EVALUATION OF UNIFORMITY.** The software can visually compare data in different measurement positions, making it easy to check whether the measurement results conform to the chosen standard.
- **BAR GRAPH.** The bar graph displayed at the top of the graph shows what percent of the measurement positions fall within 6 dB by using different colors for each frequency. You can tell whether the measurement results conform to the standard field uniformity characteristic.
- **MATRIX.** At a frequency indicated to by the cursor, the software displays positions where measured uniformity is within 6 dB in a different color from those with uniformity 6 dB. The field can be evaluated and analyzed for uniformity at each frequency.

SYSTEM LINEARITY VERIFICATION

The performance evaluation of a power amplifier at maximum output, which is a major component of a test system, will not be good enough. If you use a power amplifier with a low compression point (output that assures linearity), the system cannot generate the AM 80% modulation demanded by the immunity test and the degree of modulation becomes shallow. This compromises the reliability and reproducibility of the test. To prevent such a problem, a test system linearity verification that was newly added to the IEC61000-4-3rd Edition is performed. A test system that does not satisfy 2dB compression cannot be used. This measurement is performed in order to verify linearity of a power amplifier after the end of a calibration measurement or before the start of an immunity measurement. In order to perform this measurement, calibration reference measurement must be completed and the measurement result needs to be obtained.

- **ELECTRIC FIELD REFERENCE VALUE MEASUREMENT/ELECTRIC FIELD CHECK MEASUREMENT.** These measurements are performed in order to improve the accuracy of immunity measurement. Before performing the immunity measurement, this software corrects the reference factor and measures the correction value in order to generate a more accurate and uniform electric field strength.
- **REPORT PRINTING.** The Report Wizard is available to output a report of the measurement results in the specified format.

BASIC FUNCTIONS(2)

- **IMMUNITY MEASUREMENT.** The software performs immunity measurement by subjecting the EUT to the specified electric field using the reference factor obtained from the uniformity measurement and the factor obtained by the field check measurement.
- **EASY TO START MEASUREMENT.** To start immunity measurement, click on the <Start> button after selecting a measurement condition file. To perform additional measurements using existing measurement results, load the measurement results.
- **SEAMLESS MEASUREMENT ENVIRONMENT.** The <Start> button causes the software to start an automatic scan through the test frequency range (selectable: linear or logarithmic scale). You can also easily move to an arbitrary frequency by dragging the cursor or by entering the appropriate numbers. Also, the progressive wave/reflected wave levels of the power amplifier and the field levels at arbitrary positions can be obtained at the same time and displayed on a graph. The software also supports the feedback test method, in which the field strength is maintained at a constant level at the field sensor position. If the EUT fails the immunity test, you can perform the following operations to detect and register the error level on the current screen.
  - Changing the frequency or test level
  - Turning on/off the RF output/modulations of the signal generator
  - Controlling the antenna mast and turntable
  - Registering the error point
  - Viewing the error point list
  - Registering an error point

  Pressing the <Error Point Register> button brings up the registration dialog box. Select a status from the list or enter a new comment. The current measured value is recorded along with the comment.
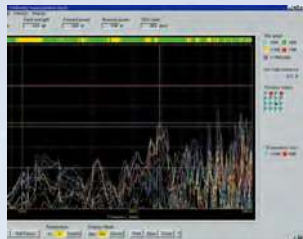- **DISPLAYING MEASUREMENT RESULTS.** Measurement results are displayed on a graph. The frequency and level at the cursor are displayed in the text boxes above the graph.
- **ENTERING COMMENTS.** Enter desired comments, if any, for each measurement. Right-click the mouse to display the input assistance menu. Use this menu to enter the date and time and to save the comments entered. You can copy a comment and add it to other measurement file when it is saved. Therefore, you do not need to enter the same comment again if you have saved it previously. After saving a comment, you can add such comments to other measurement files, making it unnecessary to reenter the comment manually in the future.
- **REPORT PRINTING.** The Report Wizard is available to output a report of measurement results in the specified format.

START IM5/RS SOFTWARE

▼

UNIFORMITY MEASUREMENTS

▼

SYSTEM LINEARITY VERIFICATION

▼

ELECTRIC FIELD REFERENCE VALUE MEASUREMENT/ELECTRIC FIELD CHECK MEASUREMENTS

▼

OUTPUT A REPORT

START IM5/RS SOFTWARE

▼

LOAD A CONDITION FILE

▼

START MEASUREMENTS

▼

DISPLAYING RESULTS

▼

ENTERING COMMENTS

▼

CREATE A REPORT

OVERVIEW

IM5/CS is automatic measurement software compliant with the IEC61000-4-6 standards designed to evaluate the level of conducted immunity to an RF electromagnetic field from the power line, conductive line, or signal conductor of electronic equipment. The software can calibrate the CDN, EM clamp, and system connection paths and save their calibration data to be used as correction values during measurement.

BASIC FUNCTIONS

The software measures attenuator and cable losses that must be determined in order to measure the interference level of the EUT port, which is provided on the CDN or EM clamp, using a spectrum analyzer and/or RF voltmeter.

- **SYSTEM CALIBRATION.** The software measures the transmission factor from the RF signal generator to the 150 Ω side of the 150 Ω adapter.
- **IMMUNITY MEASUREMENT.** The software performs immunity testing by applying a specified interference signal to an EUT port, such as a coupled/decoupled circuit network. The <Start> button causes the software to start an automatic scan through the test frequency range (linear or logarithmic scale). You can also easily move to an arbitrary frequency either by dragging the cursor or by entering numeric values. Also, the progressive wave/reflected wave levels of the power amplifier and the voltage level of an arbitrary transmission subsystem can be obtained at the same time and displayed on a graph.
- **ERROR DETECTION OPTION.** Adding this error detection option provides automatic immunity measurement execution. The error detection option of IM5/CS has the same specifications as that of IM5/RS.

IMMUNITY MEASUREMENT SOFTWARE FOR VEHICLES & VEHICLE COMPONENTS

VI5/RS: RADIATED IMMUNITY MEASUREMENT SOFTWARE

BASIC FUNCTIONS
- Electric field uniformity test
- Radiated immunity test by the substitution method
- Radiated immunity test by the feedback method
- Measurement result display: supporting all major formats
- Report output: supporting all major formats
- Measurement result saving: supporting all major media

MEASUREMENT OVERVIEW
VI5/RS evaluates the radiated electric field uniformity of the measurement area in compliance with the measurement conditions of relevant standards. On this software, you can switch between the uniformity evaluation methods of UN ECE R10 and ISO11451/2 with a single button. Based on the data acquired by these methods, VI5/RS performs a radiated immunity test by using either the substitution method or the feedback method.

In the substitution method, electric field strength can be adjusted either by the electric power (forward power, net power) or by the signal generator output level. In the feedback method, electric field strength is adjusted through feedback from the sensors located in the anechoic chamber.

When more than one radiation antenna is needed to cover a wide frequency band, the turntable will be automatically controlled so that the EUT will face the antennas.

ERROR DETECTION OPTION
The Error Detection Option monitors the EUT during an immunity test and automatically determines the EUT as having exhibited an erroneous behavior when any of the thresholds set by the user is exceeded. Error Detection is done in the two ways described below.
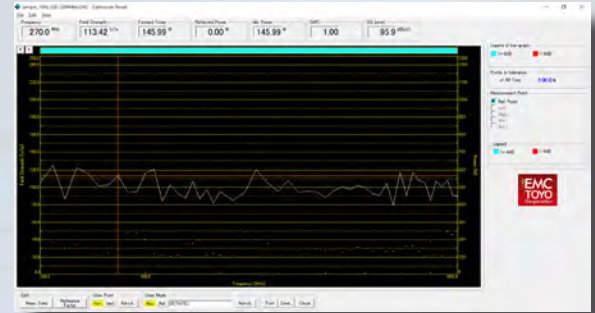
THROUGH CAN/LIN BUS MONITORING
During an immunity test, an erroneous behavior of the EUT can be automatically detected through CAN/LIN bus monitoring. When an electric field is being emitted (for a few seconds to a few tens of seconds), the following information is recorded:
- Typical measurement data at each frequency on the CAN/LIN channels
- Pass/Fail decision

THROUGH IMAGE RECOGNITION
During an immunity test, an erroneous behavior of the EUT can be automatically detected from numerical speed data (obtained by monitoring an analog speed meter on an automobile dashboard with a camera) and LED status. When an electric field is being emitted (for a few seconds to a few tens of seconds), the following information is recorded:
- Numerical speed data at each frequency, obtained from an analog speed meter
- LED on/off status at each frequency
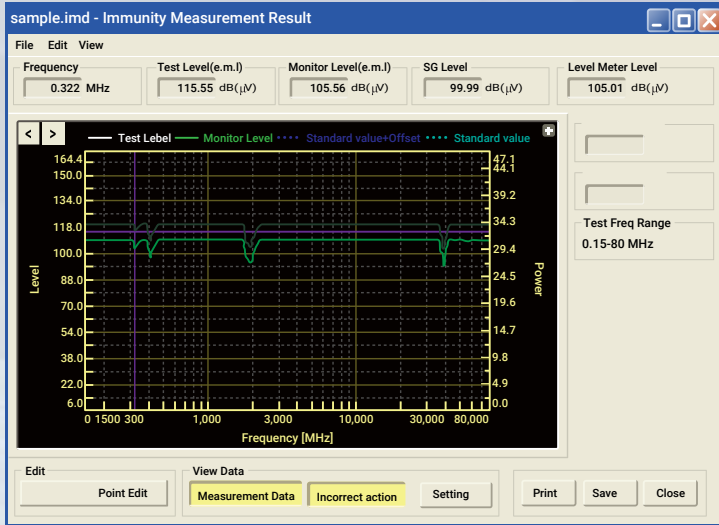- Still images of the automobile dashboard

IM5/CS: AUTOMATIC BCI IMMUNITY SOFTWARE

BASIC FUNCTIONS

- BCI probe calibration data acquisition
- BCI through calibration power feedback
- BCI through current probe feedback
- BCI by the substitution method
- Measurement result display: supports all major formats
- Report output: supports all major formats
- Measurement result saving: supports all major media

MEASUREMENT OVERVIEW

In compliance with the relevant standards, IM5/CS measures the power (forward power, reverse power, net power) and the signal generator output level, which are both required to obtain the target test current. Then, based on this data, IM5/CS performs the BCI immunity test either by the substitution method or by the feedback method.

The feedback method is controlled so that the forward power and net power obtained through calibration will be the same as the test power.

You can add an option for detecting a malfunction signal from the EUT. With this option, the malfunction detection signals can be recorded on a graph, and the current application level can be controlled so that the detection signal will be of the level specified.

OPERATING ENVIRONMENT

WINDOWS	
Processor	Multicore (i7 or higher) Intel processor (with 64-bit support) 1.5GHz or higher
Operating system	Windows 10 Professional (64-bit)
RAM	Minimum 16 GB of RAM (more than 16 GB recommended)
Storage	SSD required; 512 GB (minimum) of available storage space for installation
Monitor resolution	1920 X 1080 or better
Drivers	National Instruments VISA
Supporting Applications	Microsoft Office 2019/2016/365 (for Excel & Word Reporting feature)
Notes	All Clear/Write spectrum data can be saved during measurements. However the file size for each measurement can be up to a few hundred megabytes in size. It is advised that you have as much free storage space as possible.

ABOUT TOYO CORPORATION

TOYO Corporation (TSE: 8151) is a Japanese technology company headquartered in Tokyo, Japan, with subsidiaries in the United States and China. Since its founding in 1953, TOYO has become the leading distributor of advanced measurement instruments and systems in Japan. TOYO also engages in original product designs and develops advanced solutions for many of markets that its serves including automotive, sustainable energy, and cyber security industries. TOYO's innovative products are used by many leading companies in Japan, the United States and APAC countries, helping TOYO's customers accelerate development, reduce time-to-market, and improve product quality.

The company serves major market segments including:
- Automotive Test and Measurement
- Information Communication Technology/Cyber Security Services
- Mechatronics/Noise & Vibration/Sensors
- Materials/Energy
- Electromagnetic Compatibility/Antenna Systems
- Ocean/Defense & Security
- Software Quality and Productivity
- Nano Imaging
- Medical Systems

TOYO Corporation has designed and developed EMC measurement software for more than 40 years. Throughout the world, more than 1,500 TOYO systems have been chosen by governmental communications, regulating agencies and major companies to form the core and standard of their test and evaluation installations.

Supporting a wide range of needs, from design improvement to final qualification test, TOYO continues as the world's first choice in integrated EMC test systems and software because TOYO places exceptional importance on user feedback.

ABOUT TOYOTECH

TOYOTech, founded in Fremont, California in 2015, is a wholly owned local subsidiary of TOYO Corporation. TOYOTech provides the customers in the US and several other countries with TOYO Corporation's self-developed products incorporating the know-how and technologies accumulated over many decades, as well as TOYOTech's own-developed products that are unique in the markets – these include test and measurement solutions for automobile, new materials, ICT, and EMC applications among others.

At the same time, TOYOTech keeps a keen eye on the newly emerging technologies and up-to-date information in Silicon Valley, an area of innovation, actively collaborating with startups and seeking M&A opportunities.

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