

Overview of TDK's EMC Management/Evaluation Service

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1. Introduction

Electronic devices have become digitized, allowing them to be small and to perform multiple functions. The usable frequencies of logic circuits have also become higher, which makes EMC management more important.

In recent years, basic technologies have changed from analog to digital. During the "analog" period, one important issue related to EMC management was minimizing interference with broadcasts and communications. As broadcasting and communication transmissions have become more digitized, EMC has become more focused on mutual interference and communication quality. It can be said that EMC pursues two issues; emission and immunity.

With emission measurement methods and control values, the frequencies used for broadcasting and communications have become higher than during the analog period, so EMC measurement methods at high-frequency bands (e.g. over 1GHz EMI) have been discussed and have begun to be implemented by international standards organizations (e.g. CISPR) and by national standards organizations (e.g. FCC, EN, and VCCI).

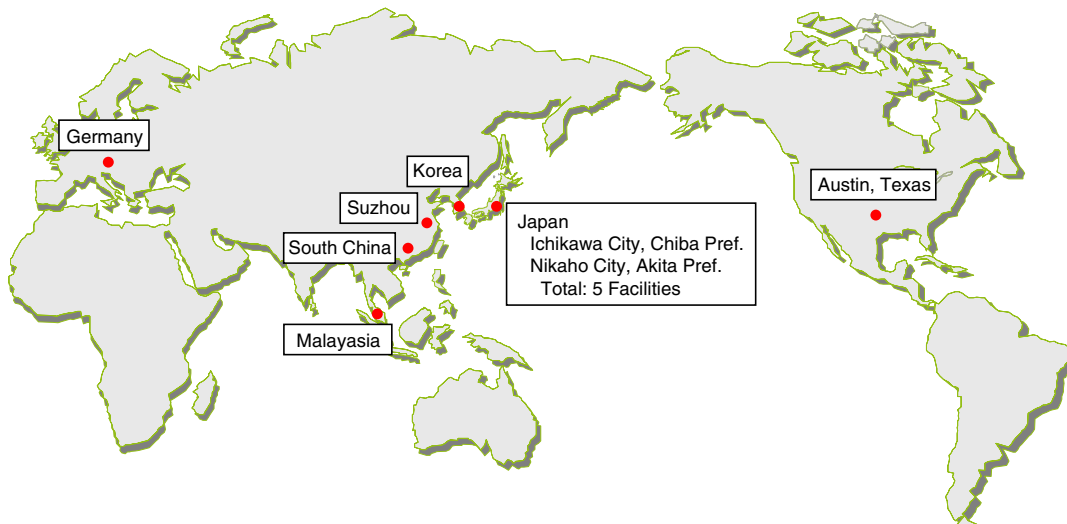
Immunity measurement method standardization has already been discussed by international standards organizations. However, only CE mark regulations implemented in Europe are legally binding. The background of this, where government agencies in charge of radio wave management including the assigning frequencies for broadcasting and communications handle EMC regulations for commercial and industrial devices, cannot be ignored.

The concept of immunity regulations has been discussed more because of device safety and mobility and because of more severe external environments (e.g. electronic devices equipped in vehicles exposed to high temperature and high humidity).

Photo1 10m anechoic chamber



TDK's Global EMC Evaluation System



2. TDK's EMC measurement/evaluation system

In order to respond to changes in concepts of EMC, it is more important than ever to accurately evaluate EMC issues. In Japan,

TDK has made a total of five 3m and 10m anechoic chamber evaluation facilities, especially for EMC measurement/evaluation. Overseas, mainly in the US and China, TDK has more than five facilities for establishing more accurate measurement environments for compliance with various regulations (see p.1 TDK's Global EMC Evaluation System).

Using these measurement evaluation facilities, not only can we evaluate client products, we can also dynamically evaluate our EMC components. As a result, feedback can be made to develop high-functionality EMC components based on our slogan, "TDK Total EMC Solution."

Table 1 shows the main measurement/evaluation items.

Table 1 Major measurement/evaluation items

EMC		Standard	
EMI	Conduction noise	CISPR22, FCC, VCCI	
	Conduction noise	CISPR25	
	Emission noise	CISPR22, FCC, VCCI	
	Emission noise	CISPR25	
EMS	Emission immunity	Ford, GM, Bosch	
	Static electricity	61000-4-2	
	Emission immunity	61000-4-3	
	First transient	61000-4-4	
	Lightning surges	61000-4-5	
	Conduction immunity	61000-4-6	
	Magnetic field immunity	61000-4-8	
	Voltage dips	61000-4-11	
	Static electricity	Ford, GM	
	BCI	Ford, GM	
	Power source line immunity	Ford, GM	
	Signal line immunity	Ford, GM	
	Magnetic near-field measurement	Magnetic near-field measurement	

Conduction and emission levels can be measured based on CISPR22, and with the representative IEC61000-4 Series, immunity can be measured for commercial, information, and industrial devices. It is also possible to test for emissions and conduction according to CISPR25, and to test for induction immunity (BCI, ESD, and immunity to power sources and signal lines) in order to comply with recent digitization trends in vehicles.

TDK is making an effort to develop products and markets in the environment and energy fields. We are especially promoting the development of products that can be used with hybrid and electronic vehicles. We are deeply involved with EMC evaluation and management

of such vehicles. We are registered as an EMC test location for GM and Ford so that they can conduct EMC measurements of vehicle electronic devices. TDK is able to perform final authentication tests. We can use these final authentication test facilities for our in-house products and for client products, which allows us to minimize variance related to correlation and facilities. As a result, this helps to reduce development time (Table 2).

Table 2 Test items for vehicle electronic devices

	Standard	Test	Test conditions	Ford	GM
EMI	CISPR25	Emission noise	0.15M-2.5GHz	OK	OK
		Conduction noise	0.15M-108MHz	OK	OK
	ISO11452-4	BCI	1M-1000MHz, 200mA	OK	OK
EMS	ISO10650	ESD	(±)1-25kV	OK	OK
	ISO7637-2	Power source line surge	Pulse 1,2,3a.3b.4,5,6,7	OK	Some restrictions

Our test facilities have received ISO17025 certification from NVLAP and A2LA. Therefore, our test procedures and the credibility and accuracy of our test results are officially certified. We plan to continue this.

3. Development of measurement methods and evaluation methods

Improving measurement and control technologies are an important part of our test facilities. Therefore, in addition to compliance with various regulations for measurement methods determined by international standards organizations, we are developing measurement and evaluation methods for device self-jamming, which does not have any standard measurement/evaluation method. We have been developing and improving evaluation tests for mobile phone receiver sensitivity degradation related to internal logic, and EMC management and evaluation methods to improve communication quality such as immunity of 1seg receivers for digital broadcasts.

EMC standard control values that are used by regulatory authorities are based on evaluation of far-field electromagnetic waves in order to prevent interference with broadcasts and communications. On the other hand, near-field measurements are used for electromagnetic interference from semiconductors due to high-frequency/multifunctional ICs and LSIs. However, as devices have become smaller and have improved mobility, problems related to self-jamming have increased.

For example, interference can occur due to the proximity of the communication portion and control logic portion.

This makes it necessary to study EMC and evaluation methods for communication devices. TDK believes that

electromagnetic field behavior between the near field and far field needs to be analyzed and evaluated to deal with such problems. There are some evaluation issues related to EMC that cannot be analyzed using only standardized EMC measurement techniques. For example, digital error rates need to be evaluated using actual communications based on software technologies, and based on an understanding of communications and radio propagation. We at TDK believe that development and implementation of these evaluation methods are important in order to develop EMC techniques and EMC components, which is why we are making efforts to improve and develop evaluation methods.

4. Efforts related to wireless communication measurement

TDK uses anechoic chambers and electromagnetic wave analysis/evaluation techniques not only for EMC evaluation but also for development of communication device components and modules. Since 2004, we have been handling measurements, evaluation, and registration for UWB (Ultra Wideband) communication certification and licensing in the United States and Japan.

UWB measurements consist of measurements of UWB signal propagation and measurements related to UWB signal radiated electromagnetic field intensity. Propagation measurements measure the signal reflection, inflection, and scattering, and measure communication speed, PER, and EVM. These measurements include connectivity tests for UWB devices.

Control values for measuring radiated electromagnetic field intensity are set by the FCC (US) and Japan. Devices can be certified for operation by receiver type certification or licensing after meeting technical standards.

In the market, next-generation high-speed communication technologies are being developed. TDK is involved from the forming of communication standards to the development of components and establishment of evaluation techniques. We are developing new communication system technologies in collaboration with our major clients.

5. Measurement service

TDK often uses anechoic chambers for evaluating EMC for developing and designing our in-house products. We also provide measurement services for other

companies using these chambers as ISO17025 certified test sites. We provide measurement services for VCCI certification reports, FCC self-declaration reports, CE mark compliance reports for the EU (some restrictions), and GM and Ford electronic device EMC reports (some restrictions) at a reasonable cost. Many of our clients use these services for EMC evaluation of their developing products. At our overseas anechoic chambers, we mainly provide evaluation support services. Our system is flexible, so we can keep up with future changes to EMC regulations and standards, and we expect many clients to continue using our services.

6. Conclusion

The importance of EMC evaluation and immunity measures will continue to become more important in the future. Therefore, measurement and evaluation time per item will take longer. Because of this, we are constructing a new high-performance 10m anechoic chamber, a 3m anechoic chamber for immunity measurement, and antenna chamber for communication device testing in Ichikawa City, Chiba Prefecture, and these will begin operation in the spring of 2010 (Table 3).

Table 3 Overview of our new chambers

Chamber name	Main measurements objects
10m anechoic chamber	Information appliances, information equipment, vehicles
3m anechoic chamber	Vehicle electronic devices
Antenna measurement chamber	Various antenna equipment
Shield room (Total: 4 rooms)	Various electronic devices and magnetic near-field measurement

Currently, we are only able to conduct partial high-output immunity tests for vehicles, but after these new chamber begin operating, we will be able to conduct all such standard certification tests (Photo 2).

Photo 2 New anechoic chamber facility



Based on our accumulated evaluation techniques for EMC and wireless communications, we will continue to improve our measurement services and evaluation techniques in order to contribute toward EMC management of advanced and more demanding electronic devices.

We aspire to be an "EMC Technology Center."

• Please note that the articles from the February 12, 2009 Edition of the Dempa Shimbun contained in this chapter have been edited by our company.