



Acquisition of iNARTE-EMC, Radio Wave Test Engineer's Qualification

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1 What Is the Radio Wave Test Engineer's Qualification "iNARTE-EMC"?

"iNARTE-EMC" is an international engineer's qualification that certifies electromagnetic compatibility (hereinafter referred to as "EMC"^{Note 1)} engineers' skills regarding electronic and electric products.

This was launched when a U.S. non-profit organization "iNARTE"^{Note 2)} established an engineer's qualification system in the field of EMC in 1998 upon request of a government agency. In Japan, the "iNARTE JAPAN Committee" was organized in 1998 within the KEC Electronic Industry Development Center, and the iNARTE-EMC qualification test was introduced.

As of April, 2015, there are 2,289 iNARTE-EMC holders in 26 countries worldwide, and 1,081 of them are Japanese, covering approximately half of iNARTE-EMC holders worldwide.

Effects of iNARTE-EMC are internationally recognized in the field of EMC. Below are some examples:

- ① EMC tests sometimes require that the person who obtained the measurement data is an iNARTE-EMC holder.
- ② The American Association for Laboratory Accreditation A2LA recommends that iNARTE-EMC is used as a qualification for judges.
- ③ An automobile manufacturer requires that EMC evaluation examiners are iNARTE-EMC holders.

As you can see, iNARTE-EMC is a qualification that certifies that the person is an EMC technology specialist and can be considered as a qualification that is suitably regarded especially in the practical field. Therefore, iNARTE-EMC holders are required to understand the principles/fundamental rules of EMC and to have the skills to extract EMC evaluation results that are socially reliable based on this understanding.

Note 1) Abbreviation for "Electro Magnetic Compatibility"

Note 2) Abbreviation for "The International Association for Radio, Telecommunications and Electromagnetics"

2 Extremely Difficult Test!

First of all, iNARTE-EMC is not a qualification test that anyone can take. It requires that your profession involves

EMC work and experience in terms of a number of years. For example, the iNARTE-EMC engineer qualification test requires that the person has at least three years of experience with practical work in the case of a bachelor's degree holder. The person also has to have references who can prove the above facts. Unless the person satisfies these prerequisites, he/she cannot take the test.

The major characteristic of the iNARTE-EMC qualification test is that it does not test memory like many Japanese qualification systems. This test focuses on solving presented questions, meaning that this qualification test specializes in practical work.

Below are detailed contents of the actual test.

- ① The test involves four hours each in the morning and afternoon. There are 48 questions, each in the morning and afternoon, with eight questions you can eliminate. Among the 80 answers, 70% must be correct to pass the exam.
- ② The test is an open book test, allowing you to bring materials, such as scientific calculators, reference materials, your own notebooks, and PC/tablet (no Internet connection available). There is no limit to the number of books or electronic data you can bring. In this test, you utilize the materials, which you brought, to solve the questions.

You would think you can easily pass this qualification test since you are allowed to bring so many materials. However, the reality is otherwise. The passing rates for iNARTE-EMC in recent years have been on the decline. After the peak in 2014 (26%), it has declined to 20% in 2015 and 17% in 2016. Despite the fact that materials are allowed, the passing rate is this low, indicating the difficulty of the iNARTE-EMC test.

Even if you pass this qualification test, you are still not qualified with iNARTE-EMC. Those who passed the qualification test are required to submit assignments to be qualified, and you are not certified as an iNARTE-EMC holder until you pass this assignment review.

In addition, the iNARTE-EMC qualification must be updated every year, and qualification holders must submit an annual activity report in English upon update.

At our Development/Experiment Sect., Electronics Technology Center, members have been taking the iNARTE-EMC Engineer test since 2015. Four members took the test and two of them passed in 2015. Two

members took the test and one of them passed in 2016. As of now, there are a total of three members holding the iNARTE-EMC qualification. We can say that this pass rate is extremely high, compared to the aforementioned pass rate.

Some of the factors that have enabled us to achieve this high pass rate, despite the low overall pass rate of approximately 20% in the past few years, are:

- ① We possess our own radio wave testing facility, enabling us to internally perform the entire process from consideration of testing plans, interpretation of radio wave testing standards, determination of results, and summary. Particularly notable is that radio wave test examiners were able to thoroughly perform trouble-shooting in case of abnormal data as well as surveys during the tests by themselves without restrictions in terms of time, which allowed them to come to the correct solutions.
- ② To prepare for the introduction and internalization of the radio wave testing facility, the entire radio wave test group simultaneously started studying to acquire the qualification. The group members supported and encouraged each other through joint voluntary study sessions, following up on those who were behind, etc.

Photo 1 shows the iNARTE-EMC certification.

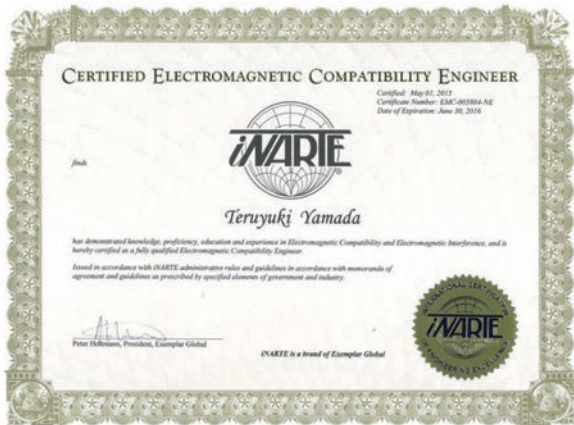


Photo 1 iNARTE-EMC Engineer certification

3 Test Contents

EMC evaluation is not simply about “arranging and measuring”. We must provide “a sense of security” to customers based on the measured data. Therefore, examiners are required to not only correctly understand the target product but also understand the rules and principles of EMC and extract evaluation results that are socially reliable.

In order to certify such technical capabilities, the iNARTE-EMC qualification test requires knowledge in the following fields:

- ① Magnetics
Maxwell's Equations, radio wave propagation

- ② Antenna properties
Structures, principles, basic properties
- ③ Countermeasure technology
Countermeasure components, shielding effect, materials
- ④ Electric circuits
Various laws, distributed constant circuits, coupled lines
- ⑤ Electronic circuits
Digital circuits, amplifiers, noise factors
- ⑥ Electric math
Complex numbers, approximation, waveform analysis
- ⑦ Communication methods
Modulators and demodulators, noise theory
- ⑧ Measurement technology
Fundamentals of receivers, reliability
- ⑨ Practical work management
Website management, antenna calibration
- ⑩ EMC design
Printed circuit boards
- ⑪ Standards
CISPR, IEC, ISO
- ⑫ Biological effects
Surrounding electromagnetic fields, ICNIRP

The scope of questions cover extremely broad fields. Therefore, the test requires judgment/application, rather than memory.

4 Thoughts of a Successful Examinee

I would like to introduce the thoughts of a successful examinee below:

iNARTE-EMC is a very difficult qualification test due to the low passing rate as well as expertise and vast scope of required knowledge, so examinees have great concerns about the test. On the other hand, hearing about the efforts toward the test by other companies and external testing sites also made me realize that this qualification holds a high status for engineers in the field of EMC and feel that it would be rewarding to take on the challenge.

I am very happy to know that the fact that I have been certified indicates that my skills and knowledge from high-functioning EPS-ECU EMC evaluations, introduction of KYB's first anechoic chamber, actual tests, and work that I have managed and promoted have been highly received in an objective manner.

We expect that promotion of electronic control and wireless communication will accelerate further, as we can see in the examples of electronic cars becoming more popular and automatic driving. EMC test standards are also being updated and established along changes of EMC environment. We are making concerted efforts to respond to changes in terms of facilities and testing skills and perform optimal tests.

Photo 2 shows the 3 iNARTE holders of the Development/Experiment Sect., Electronics Technology Center.



Photo 2 iNARTE holders of the Development/Experiment Sect. (From left: Mr. Honda, Mr. Yamada, and Mr. Mizuno)

5 Evaluation/System of Electronic Products in the KYB Group

The Electronics Technology Center, Engineering Div., was established in October 2012. The Development/Experiment Sect. was positioned in Gifu North Plant as a sector in charge of performing reliability evaluation.

The Electronics Technology Center develops not only products for various businesses of KYB but also product hardware/software in response to the needs of the KYB Group. Reliability evaluations in the Development/Experiment Sect. cover a broad scope throughout the KYB Group, so they require a number of testing facilities and great skills of experimental technicians. The below items introduce the evaluations/systems of electronic products.

5.1 Electronic Experiment Building

The operation of the Electronic Experiment Building began in April 2012 as a designated facility to evaluate the reliability of electronic/electric products, which are used in products of various companies in the KYB Group.

Photo 3 shows the appearance, and Table 1 shows the major overview.



Photo 3 Appearance of Electronic Experiment Building

5.2 Anechoic chamber and testing facility

We have newly introduced an anechoic chamber, which was the first to be introduced to the KYB Group, and a radio wave testing facility when the Electronic Experiment

Table 1 Overview of Electronic Experiment Building

Overview of the construction		2-floor steel construction Total floor area: 1,560m ²
Operation start		April, 2012
Major facilities	Radio wave-related	4 anechoic chambers (Including 2 shield rooms)
	Physical environment-related	16 units
	Power/surge-related	4 units
	Property tester	1 unit

Building was built. The minimum requirement for the anechoic chamber was that it would enable us to guarantee the reliability of KYB products. We also gave consideration so that it would enable us to evaluate customer products, which use KYB products, as much as possible. With automobile-related products, which are ultimately used with higher frequency, we formulated the anechoic chamber specifications so that we could perform tests with actual vehicles.

Photo 4 shows the inside of the biggest 3m-method anechoic chamber, and Photo 5 shows a scene from an actual radio wave test.

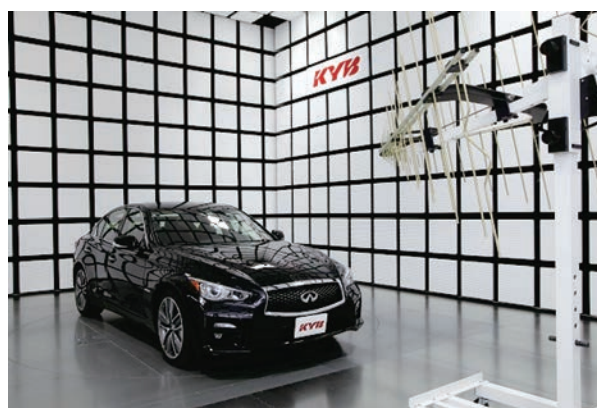


Photo 4 3m-method anechoic chamber

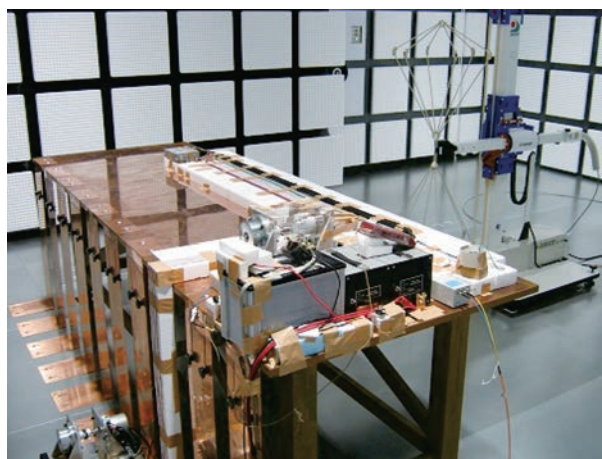


Photo 5 Example of a radio wave test

5.3 Physical environment-related facilities

KYB products, which are used in the fields of land, sea, and air, are exposed to a number of environments, such as temperature, humidity, vibrations, static electricity, and lightning. We must prove that our products possess the durability as required by customers in such environments.

The Electronic Experiment Building has 16 physical environment-related facilities and 4 power/surge-related facilities, and we conduct thorough reliability evaluations in various stages of product development.

Photo 6 shows an environment testing room, and Photo 7 shows a scene from an ECU operation confirmation test under low temperatures.



Photo 6 Environment testing room



Photo 7 ECU operation confirmation test in low temperatures

5.4 Field test with actual vehicles

In addition to thorough bench tests in the Electronic Experiment Building, we have also been proactively participating in field tests using actual vehicles. Photos 8 and 9 are from our ECU operation reliability test with actual vehicles in extremely low temperatures in North America.



Photo 8 Operation reliability test with actual vehicles in extreme low temperatures

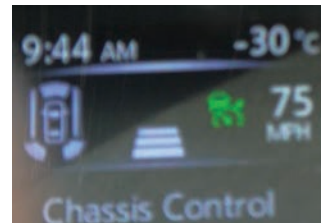


Photo 9 Recorded -30 degrees Celsius at 9:44 am during the test

6 In Closing

As represented by automatic driving of automobiles, promotion of electronics/control has been drastically accelerating in society. Improvement of the technical level in the Electronics Technology Center is urgently required, so we must not only establish the evaluation system but also improve skills and the number of qualification holders among members.

I would like to express my gratitude for relevant internal and external people who have provided great support for us to obtain the Radio Wave Test Engineer's Qualification "iNARTE-EMC". I would especially like to thank the members who have passed the extremely difficult test as a result of their diligent efforts.

Author



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Joined the company in 1983.
General Manager, Developmental Experiment Sect., Electronics Technology Center, Engineering Div.
Assumed present post after working in the Motorcycle Engineering Dept., in Germany/Italy, and in the Development/Experiment Dept.