Standardization Activities on EMC for Telecommunication in ITU-T SG5

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Abstract

The NTT Group participates in the development of international standards related to electromagnetic compatibility for telecommunication equipment as part of its effort to protect its telecommunication equipment from electromagnetic disturbances and lightning surges and to provide high-quality, high-reliability telecommunication services. This article reports on the standardization activities at the ITU-T SG5 (International Telecommunication Union - Telecommunication Standardization Sector, Study Group 5) meeting held in October 2015.

Keywords: EMC, ITU-T, standardization

1. Introduction

With a view to maintaining and enhancing the quality and reliability of its telecommunication services, the NTT Group defines standard specifications on electromagnetic compatibility (EMC) in the form of technical requirements, which must be met for development or procurement of telecommunication systems (**Fig. 1**). The basic global EMC specifications are created by the International Electrotechnical Commission (IEC) and Comité International Spécial des Perturbations Radioélectriques (CISPR). The requirements for telecommunication systems are developed by Study Group 5 (SG5) of the International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) in the form of ITU-T K series recommendations. NTT technical requirements conform to these international standards for the most part, and are instrumental in maintaining the quality and reliability of telecommunication services provided by the NTT Group. This article introduces the latest standardization activities of ITU-T SG5.

2. Overview of ITU-T SG5 WP1/WP2

Headquartered in Geneva, Switzerland, ITU-T issues ITU-T recommendations, which serve as international standards in the field of telecommunications. ITU-T consists of 11 Study Groups (SGs). Recommendations on EMC for telecommunication systems are developed by SG5 (Environment and climate change). SG5 consists of three Working Parties (WPs). Questions related to overvoltage, earthing (grounding), and safety for telecommunication systems are studied by WP1, and questions related to tolerable levels of electromagnetic disturbance emissions, immunity requirements, and human exposure to electromagnetic fields are studied in WP2.

WP1 and WP2 are addressing the questions indicated in **Fig. 2** in the current study period (2013–2016). This article reports on the content of discussions held at the SG5 meeting in Geneva October 12–23, 2015. Draft revisions to existing recommendations and new draft recommendations that were accepted in this meeting are listed in **Table 1**.

3. Discussions in WP1

WP1 studies how to protect telecommunication systems from overvoltage generated by lightning, and electromagnetic interference due to electromagnetic induction from power systems and electrified railway systems. The following discussions were held regarding

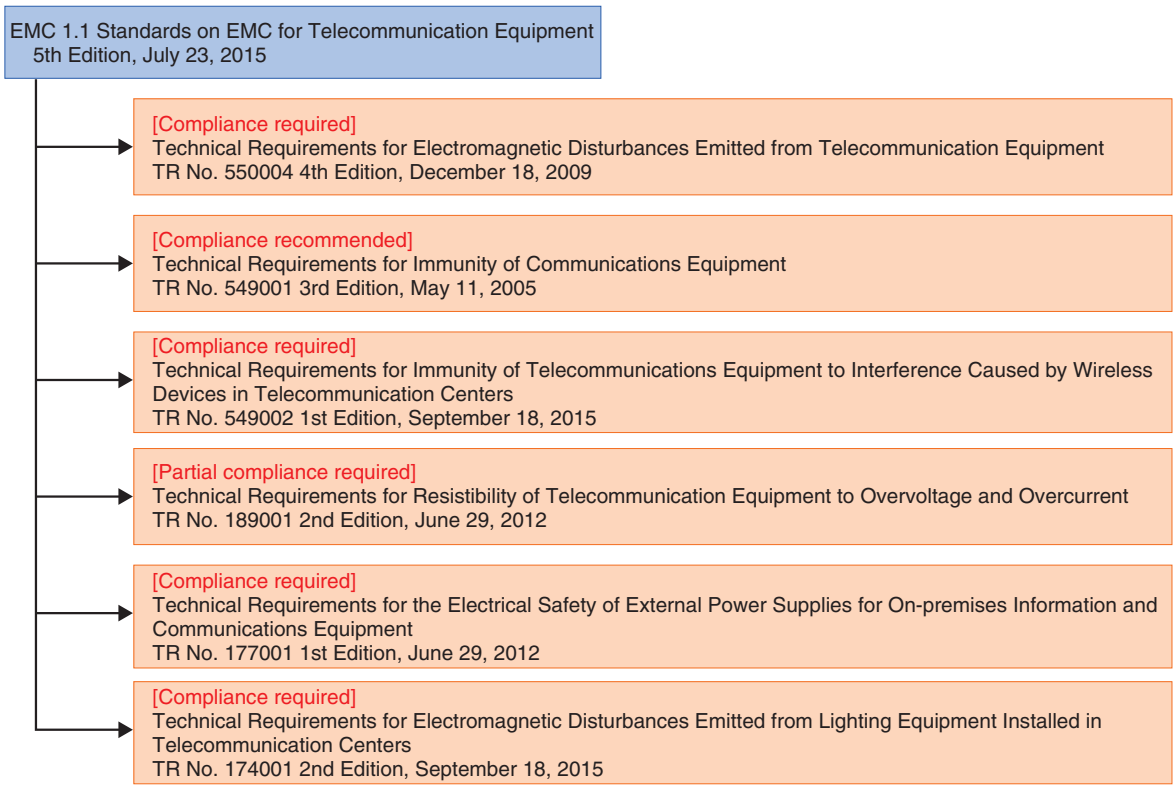


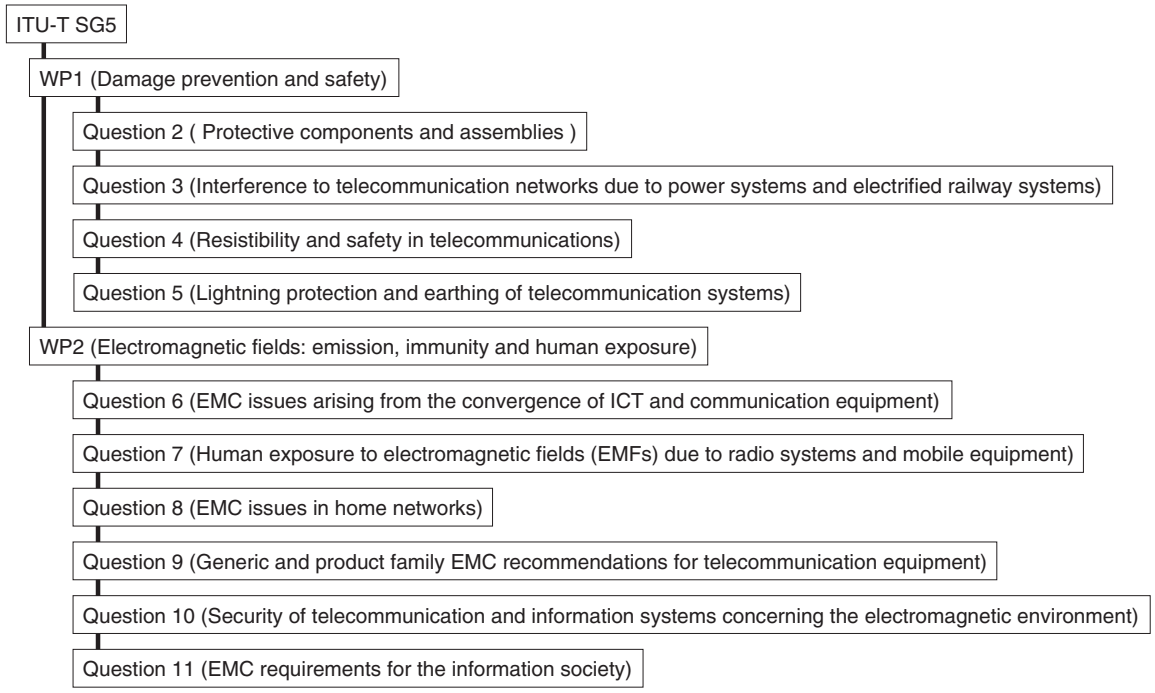
Fig. 1. NTT Group's standard and technical requirements related to EMC.

Questions 2 to 5.

Question 2 concerns test methods and requirements related to protective components and assemblies such as varistors and surge arresters against overvoltage. The UK and Germany submitted a contribution that pointed out the vulnerability of Ethernet ports of PoE (Power over Ethernet)-compatible devices to lightning surges in differential mode, and proposed a test method in which a 1500-V surge is applied between pair wires. Whether this test is needed will be discussed in the next and future meetings. A description of the problem of heat being generated when telecommunication cables come into contact with power cables was added to K.20, K.21, K.45, and K.82 as a supplement.

Question 3 relates to the issues of electromagnetic induction from power systems and electrified railway systems, and of the safety of workers in the event of ground faults. The meeting adopted the final draft of a new draft recommendation, K.hvps2, which defines the method of measuring ground impedance. The method takes into consideration a rise in the ground potential that occurs when a power substation suffers a ground fault. Consent was also given to a new draft recommendation, K.tup, which defines methods of protecting telecommunication devices installed on utility poles, and to another new draft recommendation, K.jup, which defines the method of protecting telecommunication cables from short-circuit accidents with power cables in cases where telecommunication cables and power cables share the same poles.

Question 4 addresses requirements for overvoltage resistibility at interfaces of telecommunication systems, methods of protecting against overvoltage, and electrical safety. NTT submitted a contribution that explained the problems with the method of testing lightning surge at Ethernet ports. It was agreed that these problems will be studied in the next and future meetings as draft revisions to the existing recommendations, K.20, K.21, K.44, and K.45. NTT also proposed a lightning protection method that bridges power and telecommunication lines. It was decided to begin studying this method in collaboration with IEC TC (Technical Committee) 108. The meeting accepted



ICT: information and communication technology

Fig. 2. Questions studied by ITU-T SG5 WP1/WP2.

Table 1. List of recommendations agreed on at the last meeting.

Work item	Recommendation name
K.44 (revision)	Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic Recommendation
K.59 (revision)	EMC, resistibility and safety requirements and procedures for connection to unbundled cables
K.60 (revision)	Emission levels and test methods for wireline telecommunication networks to minimize electromagnetic disturbance of radio services
K.67 (revision)	Expected surges on telecommunications and signalling networks due to lightning
K.hvps2 (new)	Method for determining the impedance to earth of earthing systems
K.tup (new)	Installation of telecommunication equipment on utility poles
K.jup (new)	Joint-use of poles by telecommunication and solidly earthed power lines
K.ldt (new)	Lightning protection of the dedicated transformer for radio base station
K.ntt (new)	Protection of surrounding structures of telecommunication towers against lightning
K.maps (new)	Generation of radiofrequency electromagnetic fields (RF-EMF) level maps
K.bts_emc (new)	Electromagnetic compatibility requirements and measurement methods for digital cellular mobile communication base station equipment
K.secmiti (new)	Mitigation methods against electromagnetic security threats
K.ter_emc (new)	EMC requirements and test methods for radio telecommunication terminal equipment

the draft revised K.44 version 2, which describes the configuration of the circuit that generates a surge waveform to be applied in an overvoltage test.

Question 5 concerns the earthing of telecommunication systems and risk management. The meeting adopted final drafts proposed by China for several

new draft recommendations: K.ldt, which concerns protection of power transformers for wireless base stations against lightning; K.tot, which specifies earthing and bonding of wireless base stations; and K.ntt, which specifies methods of protecting structures near wireless base stations against lightning. Brazil proposed a revision to K.67, which specifies the level and waveform of lightning surges that may arise in a telecommunication network. The meeting gave consent to it after a discussion was held on the calculation model for a direct lightning strike on telecommunication lines. In addition, the meeting agreed to create a new work item in order to develop a new recommendation, K.psp, which addresses lightning protection methods in the TT earthing and IT earthing systems.

4. Discussions in WP2

WP2 is studying emissions from telecommunication systems, immunity to such emissions, and how to protect the human body against potential harm from radio waves. The following discussions were held regarding Questions 6 to 11.

Question 6 concerns EMC problems that arise from the shared use of telecommunication networks by different providers, a situation brought about by the liberalization of telecommunications. A discussion was held on a draft revision to the existing recommendation, K.59, which specifies EMC, voltage resistibility, and safety requirements and countermeasures for cables. The final draft for this revision was accepted after the longitudinal conversion loss values specified in ITU-T Recommendation G.993.2 had been incorporated. The draft revision to the existing recommendation, K.60 (Emission levels and test methods for wireline telecommunication networks to minimize electromagnetic disturbance of radio services), received consent after a formula for conversion of tolerable emission levels for a variety of measurement distances was added.

Question 7 deals with human exposure to electromagnetic fields near radio system antennas. The meeting adopted a new draft recommendation, K.maps, which describes a method of mapping an electromagnetic field, after a discussion on it from a practical viewpoint was held. This discussion included issues such as the selection of colors to be used in electromagnetic distribution maps to indicate different levels of electric field strength. The National Institute of Information and Communications Technology and NTT DOCOMO jointly proposed to add a provision that the output measurement of mobile phone base stations be exempt from the application of the existing recommendation, K.52 (Guidance on complying with limits for human exposure to electromagnetic fields). It was agreed to study this proposal in the next and future meetings.

Question 8 covers EMC specifications for telecommunication devices that make up a home network. Since CISPR is planning to merge CISPR 20 (Sound and television broadcast receivers and associated equipment immunity standard) and CISPR 24 (Information technology equipment immunity standard) into the new CISPR 35 (Multimedia equipment immunity standard), the meeting started the study to revise the existing recommendation closely related to the above, K.93 (Immunity of home network devices to electromagnetic disturbances).

Question 9 relates to the study of EMC specifications for new telecommunication services, and to maintaining the existing recommendations. The meeting also discussed K.e_faci version 2, a new draft recommendation being studied at the initiative of NTT to specify the emission requirements for electronic equipment installed in telecommunication centers, and K.prox version 1, a new draft recommendation that specifies immunity requirements for radio systems located adjacent to telecommunication systems. In the discussion on K.e_faci, it was agreed to make the tolerable emission level of electric equipment equal to the level defined in CISPR 32 in order to maintain the existing electromagnetic environment of telecommunication centers. It was agreed to start the study of K.prox with the assumed radio systems limited to wireless LANs (local area networks) working in the 2.4/5.2/5.6 GHz band, and then gradually expand the scope of the frequency band of the assumed radio systems, taking the ongoing study at IEC 61000-4-39 (Radiated fields in close proximity - immunity test: being studied) into consideration. In addition, NTT's proposal to develop a draft recommendation for specifying EMC requirements for lighting devices installed in telecommunication centers was adopted as a new work item under the name of K.light.

Question 10 focuses on issues pertaining to the electromagnetic security of telecommunication systems. NTT submitted the final draft for the new draft recommendation, K.secmiti, which addresses measures to mitigate the effect of electromagnetic wave attacks. The draft was adopted after a modification was made to clarify the scope of its application. This adoption completes the standardization of a series of

recommendations related to electromagnetic field security, which has been studied at the initiative of NTT: K.78, K.81, K.84, K.87, and K.secmiti. A draft recommendation proposed by NTT to prevent cosmic radiation-caused soft error (phenomenon of malfunctions of LSIs (large-scale integrated circuits) and other semiconductors in electronic systems caused by neutron rays, etc. included in secondary cosmic rays) was approved. It was agreed to divide the proposed recommendation into four recommendations: overview (K.soft_ba), test method (K.soft_test), quality determination method (K.soft_mes), and design method (K.soft_des).

Question 11 addresses EMC issues related to radio systems. The meeting discussed the final draft of a new draft recommendation, K.ter_emc, which specifies EMC requirements for wireless terminals, and consent was granted after some modifications were made to the glossary. The next and future meetings will study a new draft recommendation, K.bwenv, which specifies the electromagnetic environment for wearable devices functioning in the 2.4-GHz band.

5. Conclusion

This article introduced the latest standardization activities in ITU-T SG5 WP1/WP2. The global penetration of telecommunication systems and mobile terminals has brought about dramatic changes in the electromagnetic environment surrounding telecommunication equipment. This has prompted the United States, European countries, Japan, and also developing countries to actively propose a wide range of new questions. ITU-T recommendations are international standards specifying test methods and requirements tuned to the characteristics of telecommunication equipment, and they are therefore directly linked to NTT technical requirements, which are used by the NTT Group as procurement standards. NTT will enhance the quality and reliability of telecommunication services by pursuing standardization activities in a way adapted to changes in the environment surrounding telecommunication equipment.

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