**Commission D (Electronics and Photonics) Activity Report**

March 2010-July 2010

August 4, 2010

Tadao Nagatsuma

**1) Commission Activities**

*AP-RASC2010:*

Thanks to the members of Commission D who are responsible for conveners and/or committee members in AP-RASC2010, 33 papers have been accepted for 5 oral sessions and 1 poster session;

D1: Advanced electronic devices and circuits for ubiquitous wireless (6 papers)

D2: Trends in electronic/photonic devices and circuits (5 papers)

DC1: Meta-materials and their applications (6 papers)

DC2: Microwave photonics technology (6 papers)

DC3: Terahertz-wave technology (5 papers)

DP: Poster Session for Commission D (Electronics and photonics) (5 papers)

2) **Domestic Activities Related to Areas Covered by Commission D**

*Light and radio-waves workshop (IEICE):*

July 29-30, 2010 at Hokkaido University (Sapporo)

3 invited and 3 contributed papers are presented in Microwave Photonics session. Invited papers are “Expectation on the future of Microwave Photonics (H. Ogawa: ARIB)”, “Trends in space optical communications (M. Toyoshima: NICT)”, and “Technology overview of next-generation inter-satellite communications (T. Ando: Mitsubishi Electric)”.

**Recent Status of Standardization and Allocation Issues on Frequencies above 275 GHz for Communications Applications**

Demand has been increasing for higher data rate in wireless access systems in order to keep up with the remarkable speed-up of fiber-optic networks. 10-Gbit/s data rate is an urgent need for the wireless transmission of 10-Gigabit Ethernet (10GbE) signals, and multiplexed uncompressed high-definition television (HDTV) signals. In the future, 20, 40, and 100 Gbit/s will be required for the wireless technologies, which can transmit Super Hi-Vision (SHV)/Ultra High Definition (UHD) TV data, having 16 times the resolution of HDTV (at least 24 Gbit/s),

OC-768/STM-256 data (43 Gbit/s), and 100GbE (100 Gbit/s). In addition to these access network applications, there has also been a need in close proximity wireless transfer of large amount of data, for example, between mobile terminals and storage devices. Such a near-field data transfer technology will possibly evolve to wireless interconnections in devices and equipments.

Towards 100-Gbit/s wireless, several promising approaches can be considered; 1) multi-value modulation with existing millimeter waves such as 60 GHz, 2) free-space optical link possibly with WDM technologies, and 3) use of terahertz carrier frequency with simple modulation format like ASK and PSK.

In particular, the use of millimeter and terahertz waves at frequencies above 275 GHz has attracted a great deal of interest for wireless communications. This is mainly because that these frequency spectra have not yet been allocated to specific applications and thus we can possibly make use of extreme bandwidth for high-speed communications.

In 2008, the IEEE 802.15 Terahertz Interest Group**, “IGThz”, has been chartered to explore the feasibility of the above frequencies for wireless communications. Many research groups all over the world, such as AT&T, Intel, Texas Instruments, Battelle, Tera-physics, NTT, NICT, MIT, TU Braunschweig, Korea University, and Osaka University, have recently initiated research activities in this emerging field. Apart the implementation aspects of THz communications, there are important regulatory aspects to be considered. For example, the allocation THz spectrum for passive services is on the agenda of the next WRC 2012; Agenda item 1.6 of WRC 2012 is to review No. 5.565 of the Radio Regulations in order to update the spectrum use by the passive services between 275 GHz and 3000 GHz.

In particular, frequency bands of from 275 GHz to 1000 GHz are considered to be most valuable for passive services such as radio astronomy and earth-exploration satellite services (EESS).

- Radio astronomy service:

  275-323 GHz, 327-371 GHz, 388-424 GHz, 426-442 GHz,
  453-510 GHz, 623-711 GHz, 795-909 GHz and 926-945 GHz;

- Earth exploration-satellite service (passive) and space research service (passive):

  275-277 GHz, 294-306 GHz, 316-334 GHz, 342-349 GHz, 363-365 GHz,
  371-389 GHz, 416-434 GHz, 442-444 GHz, 496-506 GHz, 546-568 GHz,
  624-629 GHz, 634-654 GHz, 659-661 GHz, 684-692 GHz, 730-732 GHz,
  851-853 GHz and 951-956 GHz.

Against the above background, IGThz will discuss agenda item for WRC 2015 (or 2016), identify overall spectrum demand for THz communications, and study interference studies

especially with EESS to share this frequency range with active services on the ground or in space due to the extremely strong atmospheric absorption and the very narrow antenna beam widths. Also in the APT (Asia-Pacific Telecommunity), similar discussion has started in Millimeter-wave Communication Systems Expert Group - MMCS-EG at 17th APT Standardization Program (ASTAP) Forum (5-9 July, 2010 in Pattaya, Thailand)***.

Members of Commission D will continue to pay attention to this hottest issue by attending related meetings or conferences as well as by watching related activities.

**http://www.ieee802.org/15/pub/IGthz.html

***http://www.apt.int/2010-ASTAP17