



TC124

Wearable electronic devices and technologies

WG4 Devices and Systems

2024-06-05

Convenor: Deok-kee KIM
Co-Convenor: Veronica Lancaster

- **WG4 (Devices and Systems)**

- ✓ **To develop measuring and evaluating methods for devices and packages including implantable, patchable, ingestible, excluding e-textiles**
- ✓ **To develop standards related with systems, applications, and services, all excluding e-textiles**
- ✓ **To develop standards related with power sources, all excluding e-textiles**
- ✓ **To develop standards related with interfaces and connectivity, all excluding e-textiles**

■ 1st WG4 meeting in Busan, Korea

■ Meeting place and date : BEXCO 317, 10/23/2018

■ Participants (35)

- Convenor (1): Deok-kee Kim (KR)

- Experts (14): Laurent Houillon (FR), Jitender Kumar (IN), Hirokazu SUGIHARA (JP), Satoshi Maeda (JP), Teiji YAMAMOTO (JP), Hideki OHMAE (JP), Mutsuo NISHI (JP), Shuji Hirakawa (JP), Koji SEINO (JP), Jae Yeong Park (KR), Hyun Min Cho (KR), Jonghong Jeon (KR), Kunnyun Kim (KR), Jungchul Lee (KR),

- Observers (20): Shin-ichi Uehara (JP), Catherine Grant (GB), Henry Yi Li (GB), Aranza OLIVARES MARTINEZ (Mexico), Xun GONG (CN), Yeonhwa Kwak (KR), Yun-Jae Won (KR), Diana Wyman (US), Sungin Lee (KR), Myung-chul Shin (KR), Sung Hoon CHOA (KR), Dae Hyun Sin (KR), Youngchol Park (KR), Veronica Lancaster (US), Raju Desai (US), Kerriane Haresign (US), Sofia Scataglini (BE), Hongzhi Tao (CN), Arni Alastalo (FI), Matti Mantysalo (FI)

■ 2nd WG4 meeting in San Francisco

■ Meeting place and date : The Marker Hotel 317, 15th May 2019

■ Participants (33)

Role	Name	NC	Role	Name	NC
Convenor	Mr Deok-kee Kim	KR	Member	Ms Ruobing Liu	CN
Assistant Secretary	Hyun-jin KOO	KR	Member	Mr Satoshi Maeda	JP
Member	Mr Seong-Deok Ahn	KR	Member	Mr Takeshi Nakagawa	JP
Member	Mr Kiyoharu AIZAWA	JP	Member	Mr Jae Yeong Park	KR
Member	Mr Hyun Min Cho	KR	Member	Ms Hyeri Park	KR
Member	Mr Sung-Hoon Choa	KR	Member	Mr Koji SEINO	JP
Member	Mr Raju P. Desai	US	Member	Mr Dae Hyun Sin	KR
Member	Mr Shuji Hirakawa	JP	Member	Mr Hirokazu SUGIHARA	JP
Member	Mr Laurent Houillon	FR	Member	Mr Hirokazu TANAKA	JP
Member	Mr Jonghong Jeon	KR	Member	Mr Teiji YAMAMOTO	JP
Member	Mr Kunnyun Kim	KR	Liaison	Ms. Kate GRANT	GB
Member	Mr Youngjin Kim	KR	Other	Yeonhwa KWAK	KR
Member	Mr Raymond Krasinski	US	Other	Hana Park	KR
Member	Ms Veronica A. Lancaster	US	Other	Hojun Ryu	KR
Member	Mrs Mijung Lee	KR	Other	Hongzhi Tao	CN
Member	Mr Jungchul Lee	KR	Other	Yun-Jae Won	KR
			Other	Diana Wyman	US

WG4

3rd WG4 meeting in Shanghai, China

Meeting place and date : Expo Center 407, 10/22/2019

Participants (37)

Role	Name	NC
Member	Mr Hongzhi Tao	CN
Member	Mr Joachim Zietlow	DE
Member	Mr Marc FROUIN	FR
Member	Mr Philippe GUERMONPREZ	FR
Member	Mr Laurent Houillon	FR
Member	Mr Leszek Artur Majewski	GB
Member	Mr Henry Yi Li	GB
Member	Mr Eiji AKIBA	JP
Member	Mr Shuji Hirakawa	JP
Member	Mr Tsutomu Ichikawa	JP
Member	Mr Satoshi Maeda	JP
Member	Mr hirohiko MATSUZAWA	JP
Member	Mr Mutsuo NISHI	JP
Member	Mr Hirokazu TANAKA	JP
Member	Mr Teiji YAMAMOTO	JP
Member	Mr Hyun Min Cho	KR
Member	Mr Sung-Hoon Choa	KR
Member	Mr Jonghong Jeon	KR

Role	Name	NC
Convenor	Mr Deok-kee Kim	KR
Member	Mr Jungchul Lee	KR
Member	Ms Mijung Lee	KR
Member	Mr Jae Yeong Park	KR
Member	Mr Dae Hyun Sin	KR
Member	Mr Yun-Jae Won	KR
Member	Mr Edwin Begemann	NL
Member	Mr Raju P. Desai	US
Member	Ms Veronica A. Lancaster	US
Observer	Shin-ichi Uehara	JP
Liaison	Catherine Grant	GB
Observer	Howard Choe	US
Observer	Kerriane Haresign	US
Assistant Secretary	Hyunjin Koo	KR
Observer	Hojun Ryu	KR
Observer	Lin Weiwei	CN
Observer	Yin Kuiying	CN
Observer	Alan Hodgson	GB
Observer	Felix Quintanar	GB

Role	Name	NC
Member	Mr Hai chen	CN
Member	Mrs Kai Jia	CN
Member	Ms Ruobing Liu	CN
Member	Ms Ruifen Mu	CN
Member	Mr Johannes Koch	DE
Member	Mr René Wagner	DE
Member	Mr Andy Weck	DE
Member	Mr Joachim Zietlow	DE
Member	Mr Ari Alastalo	FI
Member	Mr Marc FROUIN	FR
Member	Mr Philippe GUERMONPREZ	FR
Member	Mr Laurent Houillon	FR
Member	Mr Leszek Majewski	GB
Member	Mr Henry Yi Li	GB
Member	Ms Gargi Keeni	IN
Member	Mr Jitender Kumar	IN
Member	Mr Mohan Kumar R	IN
Member	Mr Kaushik Nanda	IN
Member	Mr Sumanth Naropanth	IN
Member	Mr Anupama P.	IN
Member	Mr Sanjeev Singh	IN
Member	Mr Kiyoharu AIZAWA	JP
Member	Mr Shuji Hirakawa	JP
Member	Mr Kogo IWABUCHI	JP
Member	Ms Yoko Komatsu	JP

Role	Name	NC
Member	Mr Satoshi Maeda	JP
Member	Mr Takeshi Nakagawa	JP
Member	Mr Mutsuo NISHI	JP
Member	Mr Hideki OHMAE	JP
Member	Mr Koji SEINO	JP
Member	Mr Hirokazu SUGIHARA	JP
Member	Mr Hirokazu TANAKA	JP
Member	Mr Teiji YAMAMOTO	JP
Member	Mr Seong-Deok Ahn	KR
Member	Mr Hyun Min Cho	KR
Member	Mr Sung-Hoon Choa	KR
Member	Mr Jonghong Jeon	KR
Member	Mr Kunnyun Kim	KR
Member	Mr Yong-Hoon Kim	KR
Convenor	Mr Deok-kee Kim	KR
Member	Mr Kyung-Keun Kim	KR
Member	Mr Seong-Hyok Kim	KR
Member	Mr Jae Bon Koo	KR
Member	Mr Jungchul Lee	KR
Member	Mr Jae Yeong Park	KR
Member	Mr Myungchul Shin	KR
Member	Mr Dae Hyun Sin	KR
Member	Mr Edwin Begemann	NL
Member	Mr Raju P. Desai	US
Member	Mr Raymond Krasinski	US
Member	Ms Veronica A. Lancaster	US

• **10 NCs & 51 members**

✓ **CN(4), DE(4), FI (1), FR(3), GB(2), IN(7), JP(12), KR(14), NL(1), US(3)**

Role	Name	NC
Member	Mrs Sofia Scataglini	BE
Member	Mr Hai chen	CN
Member	Mrs Kai Jia	CN
Member	Ms Ruobing Liu	CN
Member	Ms Ruifen Mu	CN
Member	Mr Hongzhi Tao	CN
Member	Mr Johannes Koch	DE
Member	Mr René Wagner	DE
Member	Mr Andy Weck	DE
Member	Mr Joachim Zietlow	DE
Member	Mr Ari Alastalo	FI
Member	Mr Marc FROUIN	FR
Member	Mr Philippe GUERMONPREZ	FR
Member	Mr Laurent Houillon	FR
Member	Mr Leszek Artur Majewski	GB
Member	Mr Henry Yi Li	GB
Member	Ms Gargi Keeni	IN
Member	Mr Jitender Kumar	IN
Member	Mr Mohan Kumar R	IN
Member	Mr Kaushik Nanda	IN
Member	Mr Sumanth Naropanth	IN
Member	Mr Anupama P.	IN
Member	Mr Sanjeev Singh	IN
Member	Mr Kiyoharu AIZAWA	JP
Member	Mr Eiji AKIBA	JP
Member	Mr Shuji Hirakawa	JP
Member	Mr Tsutomu Ichikawa	JP
Member	Mr Kogo IWABUCHI	JP
Member	Mr Satoru Kiuchi	JP
Member	Ms Yoko Komatsu	JP
Member	Mr Satoshi Maeda	JP
Member	Mr hirohiko MATSUZAWA	JP
Member	Mr HIDEYUKI MITERA	JP

Role	Name	NC
Member	Mr Takeshi Nakagawa	JP
Member	Mr Mutsuo NISHI	JP
Member	Mr Hideki OHMAE	JP
Member	Mr Koji SEINO	JP
Member	Mr Ryo SHINOZAKI	JP
Member	Mr Hirokazu SUGIHARA	JP
Member	Mr Hirokazu TANAKA	JP
Member	Mr Teiji YAMAMOTO	JP
Member	Mr Atsushi YASUDA	JP
Member	Mr Seong-Deok Ahn	KR
Member	Mr Hyun Min Cho	KR
Member	Mr Sung-Hoon Choa	KR
Member	Mr Jonghong Jeon	KR
Member	Mr Kyung-Keun Kim	KR
Member	Mr Yong-Hoon Kim	KR
Member	Mr Youngjin Kim	KR
Convenor	Mr Deok-kee Kim	KR
Member	Mr Seong-Hyok Kim	KR
Member	Mr Kunnyun Kim	KR
Member	Mr Jae Bon Koo	KR
Member	Mr Jungchul Lee	KR
Member	Ms Mijung Lee	KR
Member	Ms Hyeri Park	KR
Member	Mr Jae Yeong Park	KR
Member	Mr Myungchul Shin	KR
Member	Mr Dae Hyun Sin	KR
Member	Mr Yun-Jae Won	KR
Member	Mr Edwin Begemann	NL
Member	Mr Raju P. Desai	US
Member	Mr Raymond Krasinski	US
Member	Ms Veronica A. Lancaster	US
Member	Mr Michael Torres	US
Member	Ms Diana Wyman	US

- 11 NCs
- 66 members
- ✓ BE(1), CN(5), DE(4), FI (1), FR(3), GB(2), IN(7), JP(19), KR(18), NL(1), US(5)

Name	NC
Mrs Chelsea LIANG	BE
Mrs Sofia Scataglini	BE
Mr yu chao	CN
Mr Hai chen	CN
Mr Hao Gao	CN
Ms Guan HUANG	CN
Mrs Kai Jia	CN
Mrs yin kuiying	CN
Mr zhong li	CN
Ms Ruobing Liu	CN
Ms Ruifen Mu	CN
Mr Di Peng	CN
Mr Jiangbo PU	CN
Mr Hongzhi Tao	CN
Ms Shengli Zhou	CN
Mr Thomas Graßl	DE
Mr Marcin Meyer	DE
Mr Kay Ullrich	DE

Name	NC
Mr Mathieu DESTRIAN	FR
Mr Laurent Houillon	FR
Mr Leszek A. Majewski	GB
Mr Felix Clarence Quintanar	GB
Mr Henry Yi Li	GB
Ms ALISMITA KHAG	IN
Mr Suraj P Khanna	IN
Mr Bipin Kumar	IN
Mr Jitender Kumar	IN
Mr Mohan Kumar R	IN
Mr Oppili Prasad	IN
Mr Priyanshu Sharma	IN
Mr Sanjeev Singh	IN

Name	NC
Mr Kiyoharu AIZAWA	JP
Mr Eiji AKIBA	JP
Mr Shuji HIRAKAWA	JP
Mr Kei Hyodo	JP
Mr Tsutomu ICHIKAWA	JP
Mr Hiroyuki ISHII	JP
Mr MASAHIRO Mark KASUYA	JP
Mr Ikuro Kinno	JP
Mr Satoru Kiuchi	JP
Mr Euichul KWON	JP
Mr Satoshi MAEDA	JP
Mr Takaya MATSUNO	JP
Mr hirohiko MATSUZAWA	JP
Mr HIDEYUKI MITERA	JP
Mrs Sumiko MORITA	JP

Name	NC
Mr Yoshihiro MURAI	JP
Mr Takeshi Nakagawa	JP
Mr Kota Saikawa	JP
Mr Ryo SHINOZAKI	JP
Mr Go SODEYAMA	JP
Mr Yusuke TAKAHASHI	JP
Mr Hirokazu TANAKA	JP
Mr Noritaka Yamamoto	JP
Mr Atsushi YASUDA	JP

Member (2024.06)

Name	NC
Mr Seong-Deok Ahn	KR
Mr Hyun Min Cho	KR
Mr Sung-Hoon Choa	KR
Mr Jong Hong Jeon	KR
Ms JAE WON JEON G	KR
Ms Youngmin Jun	KR
Mr Taepyeong Kim	KR
Mr Youngjin Kim	KR
Mr Kyung-Keun Kim	KR
Mr Deok-kee Kim	KR
Mr Kunnyun Kim	KR
Mr Yong-Hoon Kim	KR
Mr Seong-Hyok Kim	KR
Mr Jae Bon Koo	KR
Mr Jongwon Kwon	KR
Ms Mijung Lee	KR

Name	NC
Mr Jungchul Lee	KR
Mr Sehyung Oh	KR
Mr Jae Yeong Park	KR
Ms Seohyun Park	KR
Mr Yun Jae Won	KR
Mr Donghyun Woo	KR
Mr Asrulnizam Abd Manaf	MY
Mr Zakaria Hussain	MY
Mr Edwin Begemann	NL
Mr Martin Ouwerkerk	NL
Mr Raju P. Desai	US
Ms Kerriane Haresign	US
Ms Emily Hoefler	US
Mr Raymond Krasinski	US
Ms Veronica A. Lancaster	US
Mr Michael Torres	US
Ms Diana Wyman	US

- **11 NCs**
- **88 members**
- ✓ **BE(2), CN(13), DE(3), FR(2), GB(3), IN(8), JP(24), KR(22), MY(2), NL(2), US(7)**

Program of work (5)

✓ PWI (4), CD (1), CDV (1)

IEC TC124/WG4

Project Reference	Title	Document Reference	Init. Date	Current Stage Date	Current Stage	Next Stage Date	Next Stage	Project Leader
PWI 124-9	Future IEC 63203-402-X: Wearable electronic devices and technologies - Part 402-X: Performance of stress measurements in wearables			2022-05	PWI	2024-05	prePNW	Veronica Lancaster
PWI 124-11	Future IEC 63203-402-X: Wearable electronic devices and technologies - Part 402-X: Performance Measurement of Fitness Wearables - Sleep Measurements			2023-08	PWI	2024-07	prePNW	Veronica Lancaster
PWI 124-12	Future IEC 63203-40X-X: Wearable electronic devices and technologies - Part 40X-X: Mobile wearable device data security			2023-08	PWI	2024-07	prePNW	Sanjeev Singh
PWI 124-13	Future IEC 63203-402-X: Wearable electronic devices and technologies - Part 402-X: Performance Measurement of Fitness Wearables - Test methods of glove-type motion sensing products			2023-08	PWI	2024-07	prePNW	Yun Jae Won
IEC 63203-401-1 ED 2	Wearable electronic devices and technologies - Part 401-1: Devices and systems: functional elements - Evaluation method of the stretchable resistive strain sensor	124/256A/R R	2023-11	2023-11	ACDV	2024-04	TCDV	Veronica Lancaster
IEC 63203-403-1 ED 1	Wearable electronic devices and technologies - Part 403-1: Test methods of surface electromyography sensors for wearable applications	124/258/CD	2022-08	2024-02	PCC	2024-03		yin kuiying

Reference	Edition	Date	Title
IEC 63203-401-1:2023	Edition 1.0	2023-10-09	Wearable electronic devices and technologies - Part 401-1: Devices and systems: functional elements - Evaluation method of the stretchable resistive strain sensor
IEC 63203-402-1:2022	Edition 1.0	2022-11-04	Wearable electronic devices and technologies - Part 402-1: Performance measurement of fitness wearables - Test methods of glove-type motion sensors for measuring finger movements
IEC 63203-402-2:2024	Edition 1.0	2024-01-31	Wearable electronic devices and technologies - Part 402-2: Performance measurement of fitness wearables - Step counting
IEC 63203-402-3:2024	Edition 1.0	2024-01-09	Wearable electronic devices and technologies - Part 402-3: Performance measurement of fitness wearables - Test methods for the determination of the accuracy of heart rate
IEC 63203-406-1:2021	Edition 1.0	2021-12-16	Wearable electronic devices and technologies - Part 406-1: Test method for measuring surface temperature of wrist-worn wearable electronic devices while in contact with human skin
IEC 63203-801-1:2022	Edition 1.0	2022-11-04	Wearable electronic devices and technologies - Part 801-1: Smart body area network (SmartBAN) - Enhanced ultra-low power physical layer
IEC 63203-801-2:2022	Edition 1.0	2022-11-04	Wearable electronic devices and technologies - Part 801-2: Smart body area network (SmartBAN) - Low complexity medium access control (MAC) for SmartBAN

Publications (7)

Ref	Title	Description
IEC 63203-401-1:2023	Wearable electronic devices and technologies - Part 401-1: Devices and systems: functional elements - Evaluation method of the stretchable resistive strain sensor	IEC 63203-401-1:2023 specifies a measurement method of tensile strain for stretchable, resistive strain sensors. This document describes characterization procedures for evaluation of the gauge factor, linearity, response characteristics, and hysteresis of unimodal tension sensors but is not appropriate for assessment of the physical properties of the sensor material such as the elastic modulus, elastic limit, and Poisson's ratio.
IEC 63203-402-1:2022	Wearable electronic devices and technologies - Part 402-1: Performance measurement of fitness wearables - Test methods of glove-type motion sensors for measuring finger movements	IEC 63203-402-1:2022 specifies test methods for wearable glove-type motion sensors to measure finger movements. The measurement methods include goniometric parameters related to the finger postures and flexion dynamics. Glove-type motion sensors are the type of gloves considered within the scope of this document for testing and measurement. This document describes direct and indirect measurement methods. In the direct measurement method, the angles of the joints of each finger are directly measured by a goniometer. The indirect method uses a measurement device such as a servomotor-based angle-measuring device. This document is applicable to angle measurement of all gloves with glove-type motion sensors without limitation of the device technology or size.
IEC 63203-402-2:2024	Wearable electronic devices and technologies - Part 402-2: Performance measurement of fitness wearables - Step counting	IEC 63203-402-2:2024 specifies test methods for measuring and evaluating the performance, reliability, and accuracy of the step counting feature in any wearable device that can count steps (e.g. activity and fitness trackers, smart bands, smart shoes, and smart insoles). These standard test methods exclude the evaluation of data associated with travel distance or ¹² calorie consumption.

Publications (7)

Reference	Title	Description
IEC 63203-402-3:2024	Wearable electronic devices and technologies - Part 402-3: Performance measurement of fitness wearables - Test methods for the determination of the accuracy of heart rate	IEC 63203-402-3:2024 specifies terms, a measurement protocol, and a test to evaluate the accuracy of wearables that measure heart rate with a photoplethysmography (PPG) sensor. While this document can be used to measure a variety of different devices claiming to report heart rate, care will be taken when testing in countries that differentiate between heart rate and pulse rate. This measurement protocol is not intended to evaluate medical devices associated with the IEC 60601 series or ISO 80601 series.
IEC 63203-406-1:2021	Wearable electronic devices and technologies - Part 406-1: Test method for measuring surface temperature of wrist-worn wearable electronic devices while in contact with human skin	IEC 63203-406-1:2021 defines the terms, definitions, symbols, configurations, and test methods to be used to specify the standard measurement conditions and methods for determining the contact-surface temperature of wrist-worn wearable electronic devices intended to be worn directly on a human wrist and that can be worn continuously during use. The conditions of the test do not consider perfusion and results are therefore considered conservatively. The temperature increase is induced by the thermal energy of wearable electronic devices during operation. This document gives the general procedure for the test method applicable to various wrist-worn wearable electronic devices for use by ordinary persons which in the context of this document is a healthy human adult.

Publications (7)

Reference	Title	Description
IEC 63203-801-1:2022	Wearable electronic devices and technologies - Part 801-1: Smart body area network (SmartBAN) - Enhanced ultra-low power physical layer	IEC 63203-801-1:2022 specifies the ultra-low power physical layer (PHY) of SmartBAN.
 As the use of wearables and connected body sensor devices grows rapidly in the Internet of Things (IoT), wireless body area networks (BANs) facilitate the sharing of data in smart environments such as smart homes, smart life, etc. In specific areas of digital healthcare, wireless connectivity between the edge computing device or hub coordinator and the sensing nodes requires a standardized communication interface and protocols.
 The present document describes the following physical layer (PHY) specifications:
 packet formats;
 modulation;
 forward error correction.
IEC 63203-801-2:2022	Wearable electronic devices and technologies - Part 801-2: Smart body area network (SmartBAN) - Low complexity medium access control (MAC) for SmartBAN	IEC 63203-801-2:2022 specifies low complexity medium access control (MAC) for SmartBAN.
 As the use of wearables and connected body sensor devices grows rapidly in the Internet of Things (IoT), wireless body area networks (BANs) facilitate the sharing of data in smart environments such as smart homes, smart life, etc. In specific areas of digital healthcare, wireless connectivity between the edge computing device or hub coordinator and the sensing nodes requires a standardized communication interface and protocols.
 The present document describes the following medium access control (MAC) specifications:
 channel structure;
 MAC frame formats;
 MAC functions.

Stability Date

Publication Number	Publication Date	Stability Date	Project in progress
IEC 63203-401-1:2023 ED1	2023-10-09	2024	IEC 63203-401-1 ED2 (ACDV)
IEC 63203-402-1:2022 ED1	2022-11-04	2027	
IEC 63203-402-2:2024 ED1	2024-01-31	2027	
IEC 63203-402-3:2024 ED1	2024-01-09	2028	
IEC 63203-406-1:2021 ED1	2021-12-16	2025	
IEC 63203-801-1:2022 ED1	2022-11-04	2027	
IEC 63203-801-2:2022 ED1	2022-11-04	2027	IEC 63203-801-2 ED2 (ACDV)

Liaison

Type Liaison	Committee	Description	Liaison Representative
Internal IEC Liaison	ISO/IEC JTC 1/SC 41	ISO/IEC JTC 1/SC 41	Mrs Catherine Rosemary Grant
Liaison ISO	ISO/TC 38	ISO/TC 38	Ms Karin Rachel Eufinger

Next Meetings

- **Next TC124/WG4 meetings**
 - **2024 TC124 Plenary meeting, Washington DC, USA, November, 2024**

Thank you!