International Electrotechnical Commission

메타버스 국제표준기술 워크숍

한국메타버스산업협회
KOREA METAVERSE INDUSTRY ASSOCIATION

IEC TC 100 메타버스 표준화 동향 및 주요 이슈

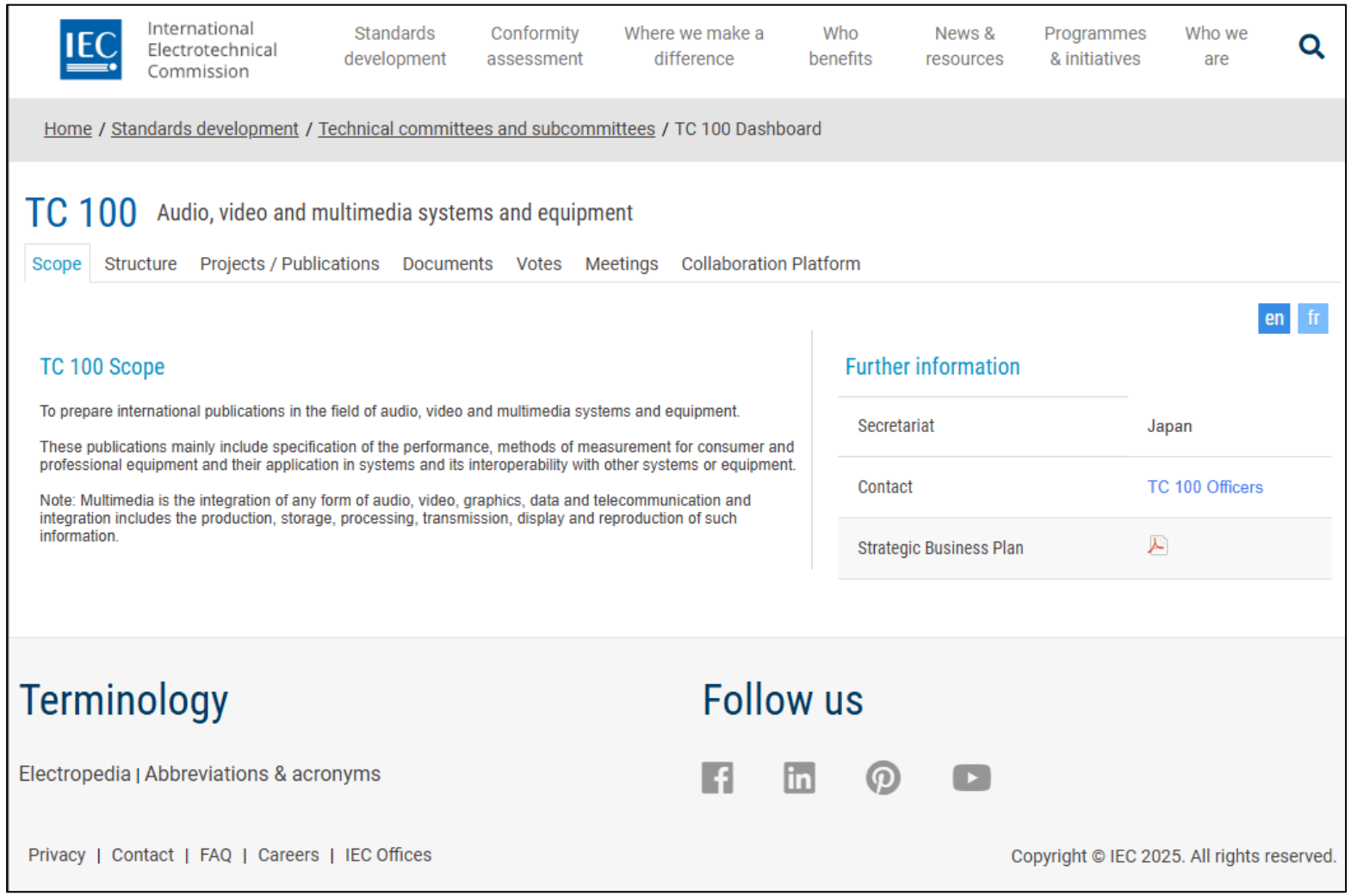
2025-09-16

FAM Tech
Factory Automation Machine

주식회사 팸텍 김지인

IEC TC 100

- IEC TC 100



- Audio, video and multimedia systems and equipment
- 간사국: 일본 (Mahiru Uehara)
- 의장국: 독일 (Ulrike Haltrich)
- 멀티미디어 시스템과 장비의 성능, 측정, 응용, 상호운영성 전반을 다루는 국제 표준 개발 위원회

IEC TC 100

- IEC TC 100

  - 오디오·비디오·멀티미디어 장비와 시스템에 대한 국제 표준 발간
  - 소비자용·전문가용 장비의 성능 규격과 시험 방법
  - 시스템 적용과 장비 간 상호운용성 보장

- IEC TC 100에서의 멀티미디어

  - 오디오, 비디오, 그래픽(표시/재생/연동), 데이터, 통신의 통합
  - 생산, 저장, 처리, 전송, 표시, 재생 전 과정을 포함

- IEC TC 100에서의 메타버스

1. XR 장치와 웨어러블

- 메타버스 경험은 HMD, XR, 글래스, 햅틱 장치 등 멀티미디어 장비 성능에 직접 의존 → TA 21 활동과 연결

2. 멀티미디어 콘텐츠와 시스템

- 메타버스는 실시간 오디오·비디오·3D 데이터 동기화와 전송이 핵심 → WG 12 활동과 연결

3. 상호운용성 (Interoperability)

- 다양한 장비와 플랫폼이 연결되어야 메타버스가 작동 가능 → TC 100의 본질적인 범위와 직결

"IEC TC 100은 메타버스의 기술 기반을 구성하는 핵심 분야와 직접적으로 맞닿아 있음"

IEC TC 100

- IEC TC 100 에서의 메타버스

TC 100 Subgroups

Label	Title
Technical Area	
TA 1	Terminals for audio, video and data services and content
TA 2	Colour measurement and management
TA 5	Cable networks for television signals, sound signals and interactive services
TA 6	Storage media, storage data structures, storage systems and equipment
TA 15	Wireless Power Transfer
TA 17	Multimedia systems and equipment for vehicles
TA 18	Multimedia home systems and applications for end-user networks
TA 19	Environmental and energy aspects for multimedia systems and equipment
TA 20	Analogue and digital audio
TA 21	Virtual (VR), Augmented (AR) and Mixed (MR) Reality systems and equipment
Working Groups	
WG 11	User's Quality of Experience (QoE) on Multimedia Conferencing Services
WG 12	Multimedia systems and equipment for metaverse

- TA21: VR/AR/MR systems and equipment (간사국: 한국)
- WG12: Multimedia systems and equipment for metaverse (컨비너: 한국)
- 간사국: 일본 (Mahiru Uehara)
- 의장국: 독일 (Ulrike Haltrich)
- 멀티디미어 시스템과 장비의 성능, 측정, 응용, 상호운영성 전반을 다루는 국제 표준 개발 위원회

IEC TC 100/WG 12

- IEC TC 100/WG 12

Virtual (VR), Augmented (AR), Mixed (MR) Reality systems and equipment

☑ Scope

- 미래 멀티미디어 시스템과 장비를 위한 메타버스를 기술적·표준화 관점에서 정의하고 분석하며, TC 100 범위 내에서 신규 표준화 과제 도출

☑ Officer

- 컨비너: 남옥우 (한국)
- 공동 컨비너: Veronica A. Lancaster (미국)

Standards in IEC TC 100/WG 12	
IEC TR 63614-1 (DTR)	Multimedia Systems and Equipment for Metaverse – Part 1: General
IEC TS 63614-2 (CD)	Multimedia Systems and Equipment for Metaverse – Part 2: Classification
IEC TR 63614-3 (DTR)	Multimedia Systems and Equipment for Metaverse – Part 3: Gap analysis
PWI 100-69	Requirements for Multilateral and Collaborative Metaverse (MCM) Systems
PWI 100-71	Measurement methods of colour accuracy under metaverse environments

IEC TC 100/WG 12

- Multimedia Systems and Equipment for Metaverse – Part 1: General (TR)

Multimedia Systems and Equipment for Metaverse – Part 1: General (TR)

☑ Scope

- C-P-N-D(Contents, Platform, Network, Device) 모델 기반으로 메타버스 기술 요소를 구조화

☑ 주요 내용

- Contents: 2D/3D 오브젝트, 실시간 데이터
- Platform: 저작 도구, 서비스 플랫폼
- Network: 5G/Edge 기반 저지연 통신
- Device: HMD, XR 디바이스, 센서·햅틱 기기

☑ 특이 사항

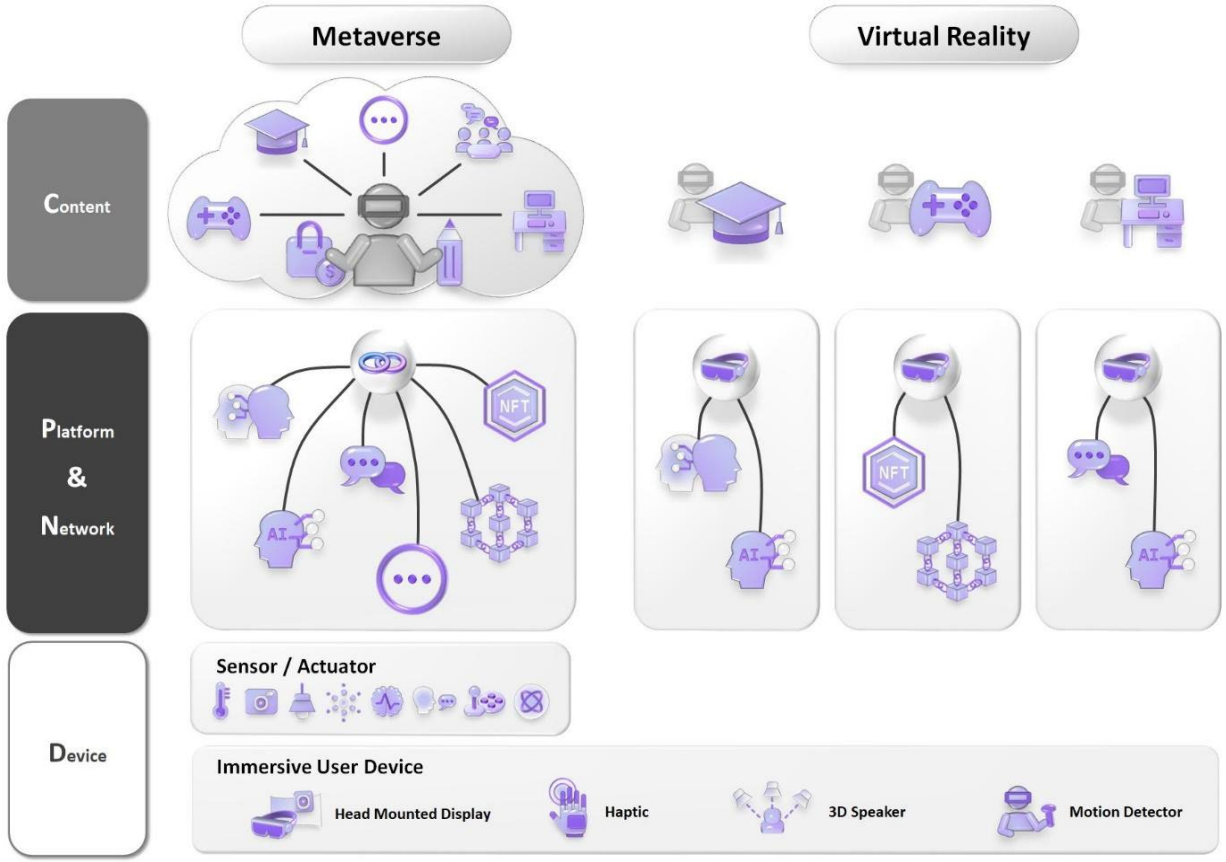
- 메타버스를 C-P-N-D 모델로 구조화 → TC 100 전반에 동일 프레임워크 적용 가능
- '메타버스는 기존 XR, 가상세계와 다르다'라는 차별화된 정의 시도

"IEC TC 100 메타버스 표준화의 출발점이자 기본 레퍼런스 문서"

IEC TC 100/WG 12

- Multimedia Systems and Equipment for Metaverse – Part 1: General (TR)

Multimedia Systems and Equipment for Metaverse – Part 1: General (TR)



IEC TC 100/WG 12

- Multimedia Systems and Equipment for Metaverse – Part 2: Classification (TS)

Multimedia Systems and Equipment for Metaverse – Part 2: Classification (TS)

☑ Scope

- 다양한 메타버스 구현 환경(AR, Virtual world 등)에 대한 분류 체계

☑ 주요 내용

- 구현 환경별 분류: AR, Mirror world, Virtual world, Lifelogging
- 각 영역의 기술적 요구사항 및 과제 도출

☑ 특이 사항

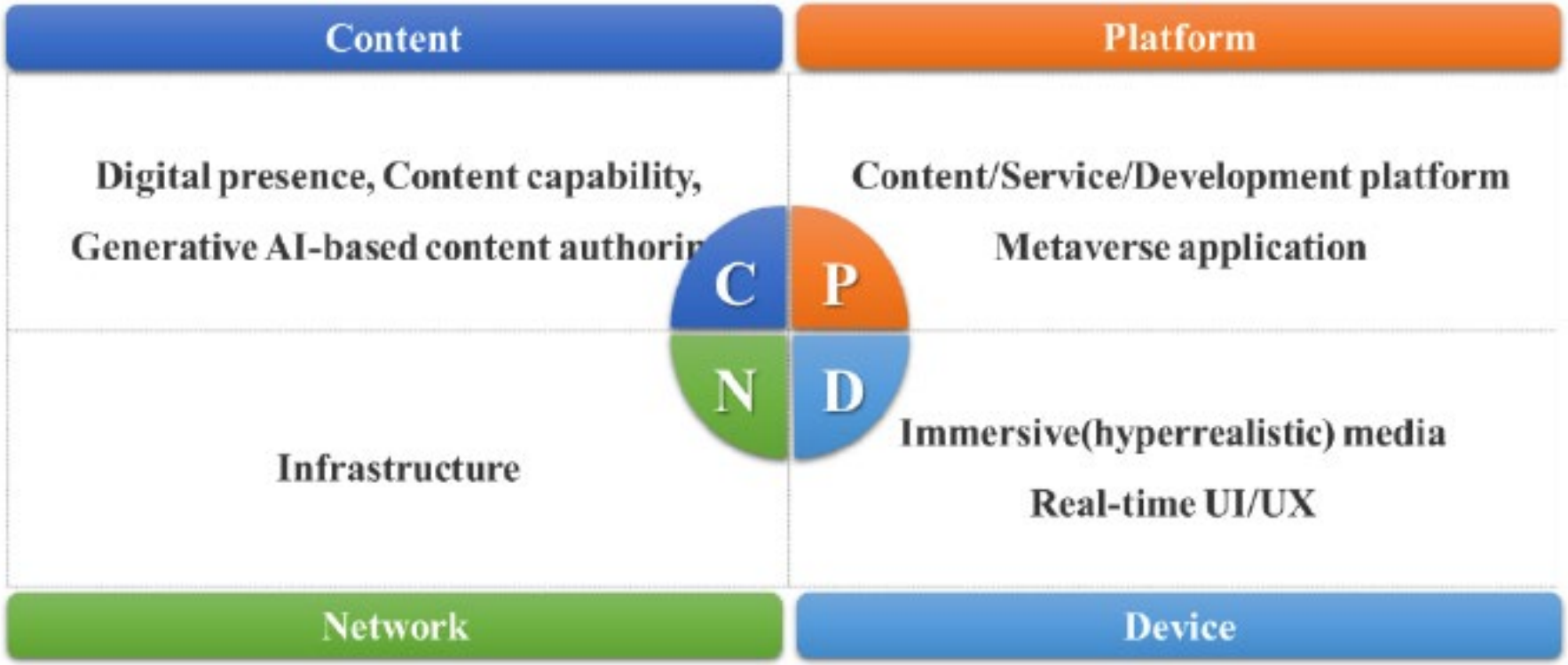
- Classification 결과가 후속 표준의 범위를 사전 결정하는 효과가 있어 중요

"메타버스 서비스 및 기술을 공통 분류 체계로 정의하는 첫 국제 표준"

IEC TC 100/WG 12

- Multimedia Systems and Equipment for Metaverse – Part 2: Classification (TS)

Multimedia Systems and Equipment for Metaverse – Part 2: Classification (TS)



IEC TC 100/WG 12

- Multimedia Systems and Equipment for Metaverse – Part 3: Gap analysis (TR)

Multimedia Systems and Equipment for Metaverse – Part 3: Gap analysis (TR)

☑ Scope

- IEC, ISO/IEC JTC 1, ITU-T FG-MV 등 타 표준화 활동과 비교

☑ 주요 내용

- 기존 표준과의 중복/차별성 분석
- Gap 영역 도출: 콘텐츠 메타데이터, 상호운용성, QoE 지표

☑ 특이 사항

- Gap Analysis를 통해 기존 표준에 대한 분석 및 TC 100에서 진행할 표준에 대한 선점
- QoE 평가, 메타베이터 상호운용, 보안·프라이버시 등 WG 12에 추가 검토 항목 제시

"IEC TC 100의 향후 신규 과제 발굴의 근거 문서"

IEC TC 100/WG 12

- Multimedia Systems and Equipment for Metaverse – Part 3: Gap analysis (TR)

Multimedia Systems and Equipment for Metaverse – Part 3: Gap analysis (TR)

Table 12 – Metaverse Device classification standards developed by IEC

No	WG	Standard No.	Title
1	TC 100/~~TA 1/WG 1~~	IEC TR 100-45	AR Technology
2	TC 100/~~TA 1/WG 1~~	PWI 100-56	Terminals for VR/AR/MR - Test method - Part 1: Durability test for AR devices
3	TC 100/~~TA 1/WG 1~~	PWI 100-57	Terminals for VR/AR/MR – Reference model – Part 1: Consumer VR/AR/MR devices
4	TC 110/~~WG 6~~	IEC 62629-62-12	3D displays - Part 62-12: Measurement methods for virtual-image type - Image Quality
5	TC 110/~~WG 12~~	PWI 110-48	Corrective lens for AR/VR
6	TC 110/~~WG 12~~	PWI 110-70	Optical components of AR eyewear display
7	TC 110	IEC 63145-1-1	Eyewear Display – Part 1-1: Generic Introduction
8	TC 110	IEC 63145-1-2	Eyewear Display – Part 1-2: Generic – Terminology
9	TC 110	IEC 63145-10	Eyewear Display – Part 10: Specification
10	TC 110	IEC 63145-20-10	Eyewear Display – Part 20-10: Fundamental measurement methods – Optical properties
11	TC 110	IEC 63145-20-20	Eyewear Display – Part 20-20: Fundamental measurement methods – Image quality
12	TC 110	IEC 63145-21-20	Eyewear Display – Part 21-20: Specific measurement methods for VR image quality – Screen door effect
13	TC 110	IEC 63145-22-10	Eyewear Display – Part 22-10: Specific measurement methods for AR – Optical properties
14	TC 110	IEC 63145-22-20	Eyewear Display – Part 22-20: Specific measurement methods for AR – Image quality

IEC TC 100/WG 12

- Requirements for Multilateral and Collaborative Metaverse (MCM)

Requirements for Multilateral and Collaborative Metaverse (MCM)

☑ Scope

- 교육, 엔터테인먼트, 헬스케어, 협업 환경 등 다양한 응용 도메인

☑ 주요 내용

- 서비스 요구사항: 가상 이벤트, 산업 협업, 교육, 게임.
- 기술 요구사항: AI, XR, Networking, Edge/Cloud 기반

☑ 특이 사항

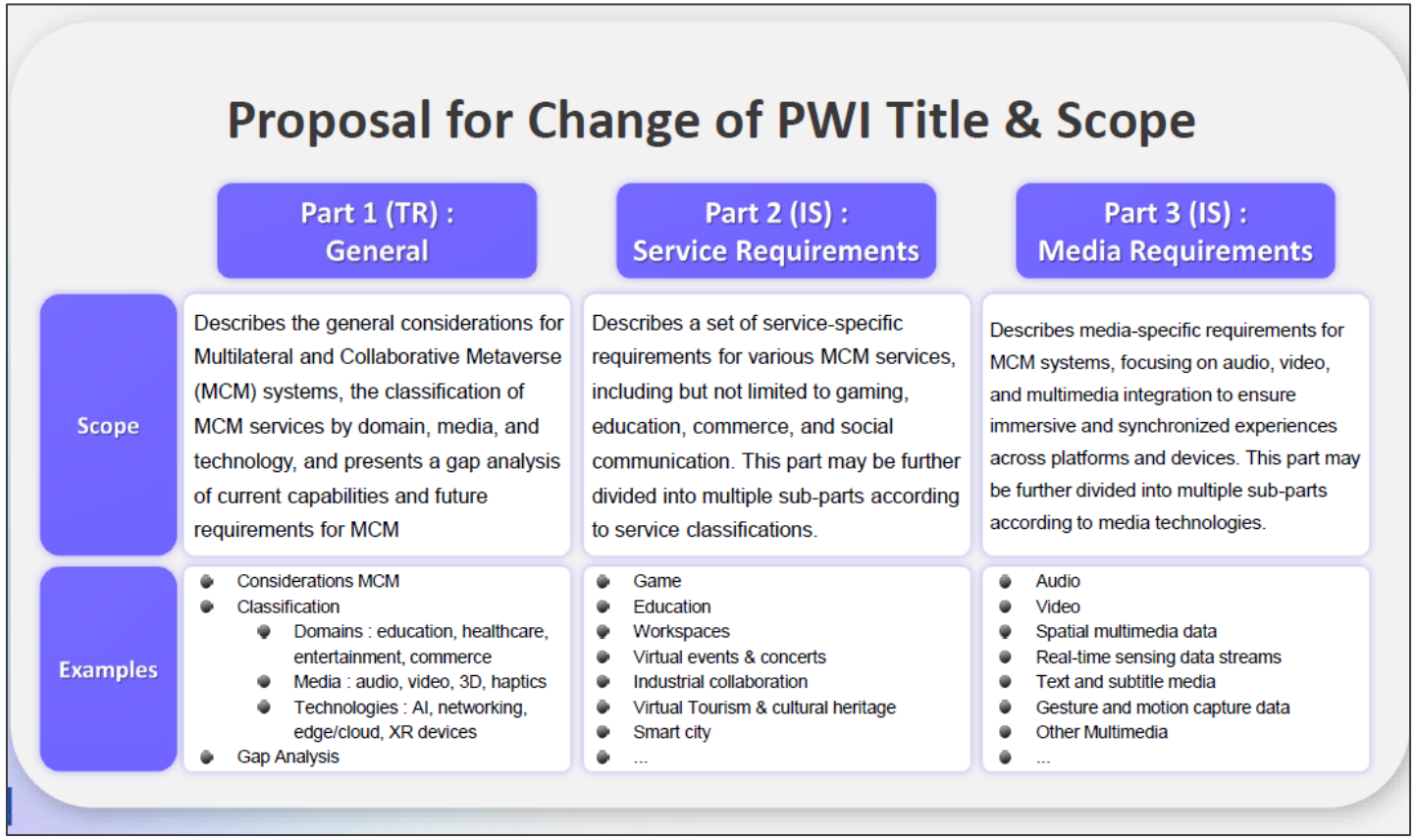
- 메타버스 환경에서의 다자간 협업 환경(교육, 헬스케어, 산업, 이벤트 등)을 포괄

"협업 환경에서의 상호 간의 '오디오 품질'을 넘어 멀티미디어 협업 메타버스 표준으로 확대"

IEC TC 100/WG 12

- Requirements for Multilateral and Collaborative Metaverse (MCM)

Requirements for Multilateral and Collaborative Metaverse (MCM)



IEC TC 100/WG 12

- Measurement methods of colour accuracy under metaverse environments

Measurement methods of colour accuracy under metaverse environments

☑ Scope

- 현실과 가상 객체 간 색상 불일치가 메타버스 몰입도 저하 요인 중 하나로 색상 불일치에 대한 측정 방법

☑ 주요 내용

- 현실 객체와 가상 객체 간 색상 정확도를 측정하는 방법
- 측정 장비: LMD, iLMD.
- 평가 지표: 톤 매핑 오류, 텍스처·색조·명암 대비

☑ 특이 사항

- 측정 장비(LMD, iLMD)를 구체적으로 제안
- "포토리얼 vs Stylized" 등 표현 유형별 색 기준 정의

"메타버스 시각 품질 보장을 위한 기초 시험 표준"

IEC TC 100/WG 12

- Measurement methods of colour accuracy under metaverse environments

Measurement methods of colour accuracy under metaverse environments

Measurement methods of colour accuracy between real and virtual objects

Colour tone and texture accuracy between real and virtual objects in the metaverse world

Unique colour of luxury brand between real and virtual world

IEC TC 100/WG 12

- AI use cases in metaverse (TR)

AI use cases in metaverse

☑ Scope

- 아바타, 디지털 휴먼, 절차적 콘텐츠 생성, NPC, 개인화 등 다양한 인공지능 활용 사례 분석

☑ 주요 내용

- Generative AI 기반 아바타, NeRF 기반 3D 공간 생성
- AI NPC, 대화형 에이전트, 렌더링 최적화

☑ 특이 사항

- 사례 중심 접근(TR) → 향후 Requirements → Framework 표준으로 확대 가능
- Generative AI, NeRF 등 최신 기술을 반영

"AI와 메타버스의 접목을 공식적으로 표준화 영역에 포함"

IEC TC 100/WG 12

- AI use cases in metaverse (TR)

AI use cases in metaverse

Use of AI Technology for Metaverse Systems

Use Case	AI Technology	Examples
Avatars & Digital Humans	Generative AI & GANs	Genies, AvatarOS, Nvidia Audio2Face
	Deep Learning-based Motion Synthesis	
Virtual World Building	Procedural AI	Meta AI World Builder, Niantic Scaniverse
	Neural Radiance Fields (NeRF)	Nvidia Omniverse & GANverse3D
AI NPC (Non-Player Characters) & AI Assistants	Natural Language Processing (NLP)	Horizon Worlds AI NPCs, ChatGPT NPCs in Roblox
	Reinforcement Learning (RL)	Horizon Worlds AI NPCs, AI-powered customer support
Personalization & Interaction	ML-based User Behavior Analysis	Decentraland, The Sandbox
	Speech Recognition & AI-based Translation	Ray-Ban Meta Smart Glasses
Rendering & Motion Capture	AI-based Super Resolution	Nvidia DLSS
	Pose Estimation & AI-based Motion Capture	Meta Motivo
TBD	....	....

IEC TC 100/WG 12

- Management on visual quality in metaverse (MVQM)

Management on visual quality in metaverse (MVQM)

☑ Scope

- QoE/QoS 기반 시각 품질 관리 프레임워크

☑ 주요 내용

- Usecase: scalable 3D 데이터, ROI 기반 자원 할당
- Gap 분석 대상 제시: ISO/IEC JTC1/SC24, SC29, SC36, TC 110 활동과의 차별화
- 표준화 로드맵: Part 1 TR(General) → Part 2 IS(Requirements) → Part 3 IS(Framework)

☑ 특이 사항

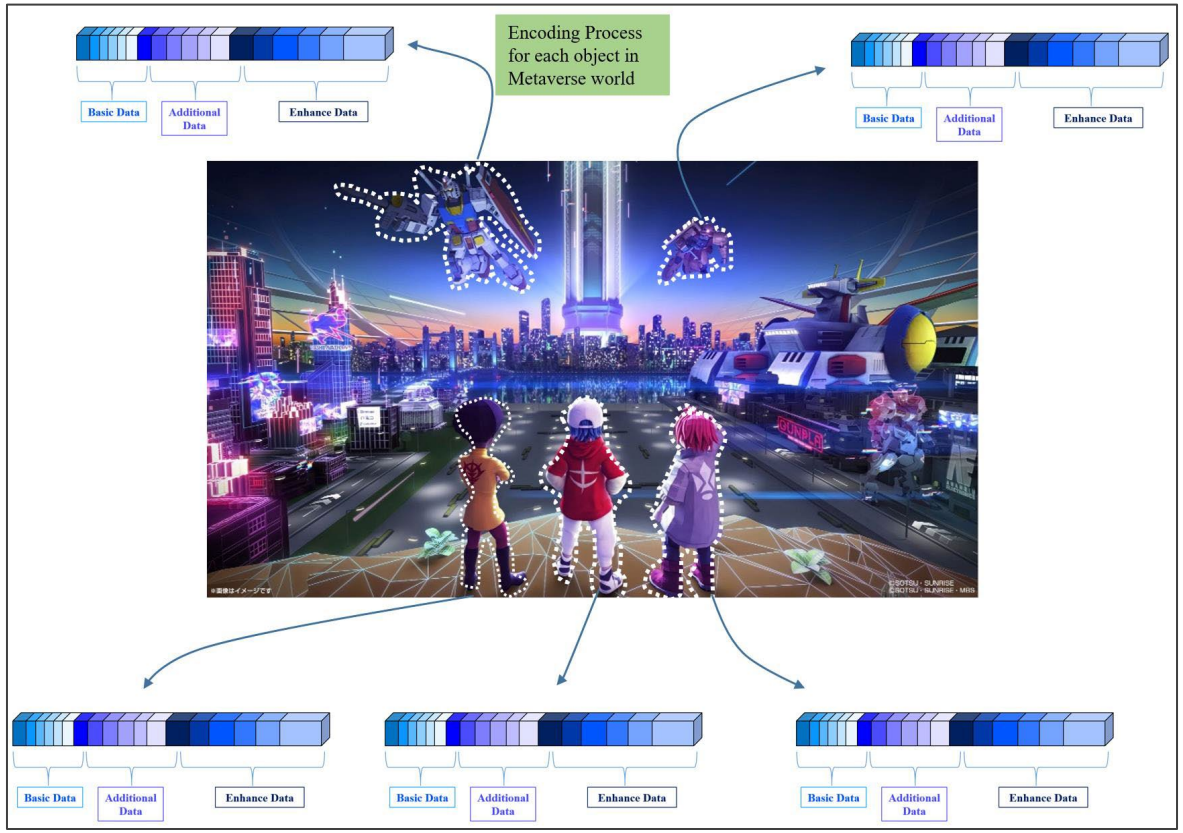
- 가변적인 시각 품질 제어를 통해 메타버스 서비스 품질 확보

"가변적 시각 품질을 제어하는 메타버스 전용 QoE 관리 표준"

IEC TC 100/WG 12

- Management on visual quality in metaverse (MVQM)

Management on visual quality in metaverse (MVQM)



IEC TC 100/WG 12

- Non-visual light effects in immersive metaverse

Non-visual light effects in immersive metaverse

☑ Scope

- C-P-N-D(Contents, Platform, Network, Device) 모델 기반으로 메타버스 기술 요소를 구조화

☑ 주요 내용

- immersive 환경에서의 빛 자극이 인간 생리에 미치는 효과를 측정·평가
- ipRGC 반응, flicker, pupil-centered light exposure.
- 3-part 구조: General, Measurement methods, Evaluation & Specification

☑ 특이 사항

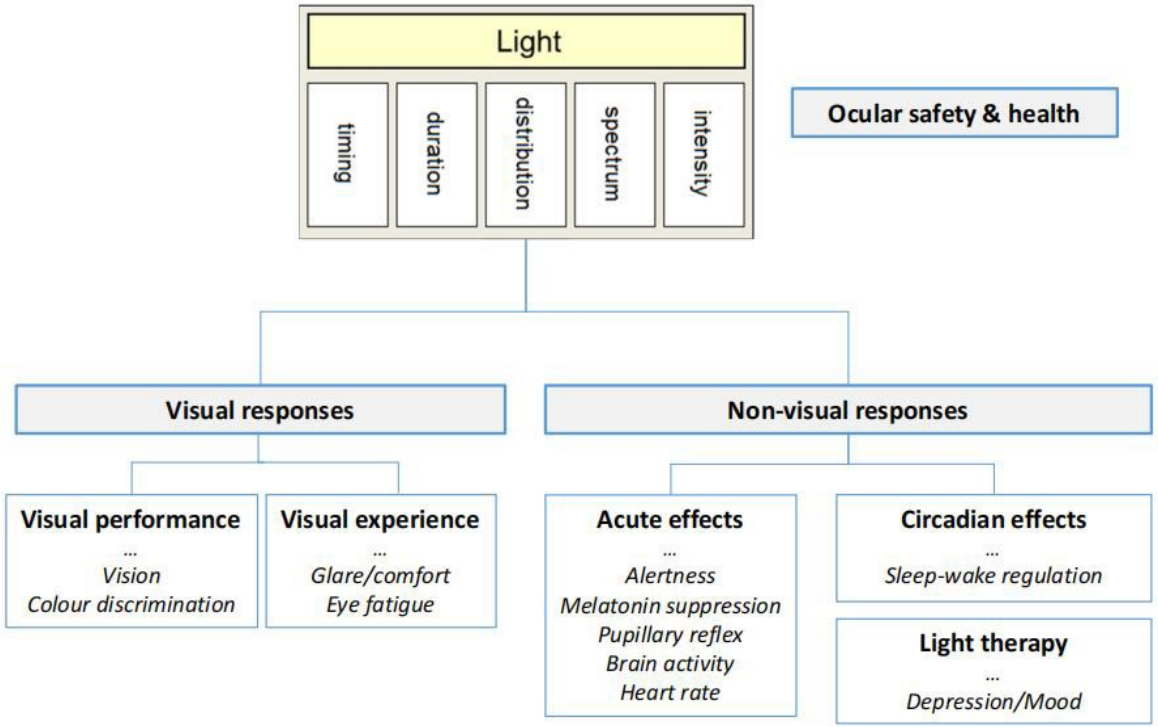
- 건강·생체 반응 영역이라는 점에서 이례적
- 메타버스 HMD가 시각 뿐만 아니라 생체리듬, 신경·호르몬 반응에도 영향을 줄 수 있음

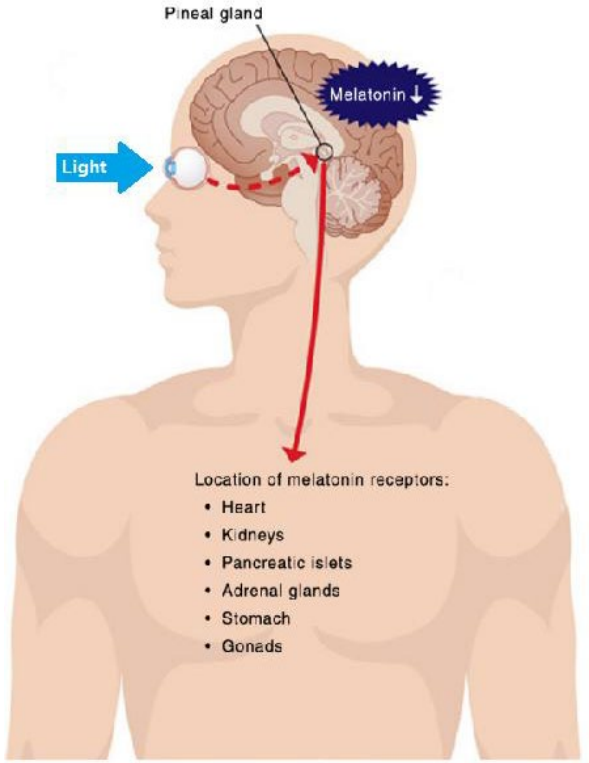
"인체 반응을 고려한 메타버스 HMD 조명·광학 설계 표준의 출발점"

IEC TC 100/WG 12

- Non-visual light effects in immersive metaverse

Non-visual light effects in immersive metaverse





IEC TC 100/TA 21

- IEC TC 100/TA 21

Virtual (VR), Augmented (AR), Mixed (MR) Reality systems and equipment

☑ Scope

- 소비자용 및 기업용 증강현실(AR), 가상현실(VR), 혼합현실(MR) 전자 장비와 시스템 관련 국제 표준 개발

☑ Officer

- 의장: Veronica A. Lancaster (미국)
- 간사: 최광순 (한국)

Standards in IEC TC 100/TA 21	
IEC TR 63610 (DTR)	Augmented and Mixed Reality equipment and systems – Technology and standards requirements
IEC 63611-1 (CD)	VR/AR/MR Systems and Equipment – Glossary of terms
IEC 63611-2-1 (CD)	VR/AR/MR Systems and Equipment – Consumer VR/AR/MR devices - Part 1: Reference model
PWI 100-56	VR/AR/MR Systems and Equipment – Test method – Part 1: Durability evaluation and test procedures for AR devices
PWI 100-70	VR/AR/MR Systems and Equipment – Measurement method – Part 1: Colour difference under ambient conditions for AR devices

IEC TC 100/TA 21

- Augmented and Mixed Reality equipment and systems – Technology and standards requirements (TR)

Augmented and Mixed Reality equipment and systems – Technology and standards requirements (TR)

☑ Scope

- AR/MR 장치를 C-P-N-D(Contents, Platform, Network, Device) 모델로 분석

☑ 주요 내용

- Contents: 2D/3D 객체, 엔지니어링 데이터, 센서 데이터
- Platform: 개발 플랫폼(API, 렌더링, 상호작용), 서비스 플랫폼 (콘텐츠 유통, ERP/MES 연계)
- Network: 5G 기반 실시간 데이터 업로드·분석·전송 구조
- Device: 글리스형·HMD형, 시뮬레이터, 햅틱 주변기기

☑ 표준화 대상

- 성능 요소: 정합 정확도, 렌더링 속도, 환경 인식(SLAM/occlusion), 착용성(FoV, 무게, 밝기, 투과율), Motion-to-Photon latency
- 표준화 Gap: 메타데이터, 성능 지표, 서비스 요건, 참조 모델, 시험/측정, 인터페이스

"XR 장치 전반을 아우르는 첫 종합 기술 보고서, TA 21 신규 표준 제안의 출발점"

IEC TC 100/TA 21

- Augmented and Mixed Reality equipment and systems – Technology and standards requirements (TR)

Augmented and Mixed Reality equipment and systems – Technology and standards requirements (TR)

CONTENTS

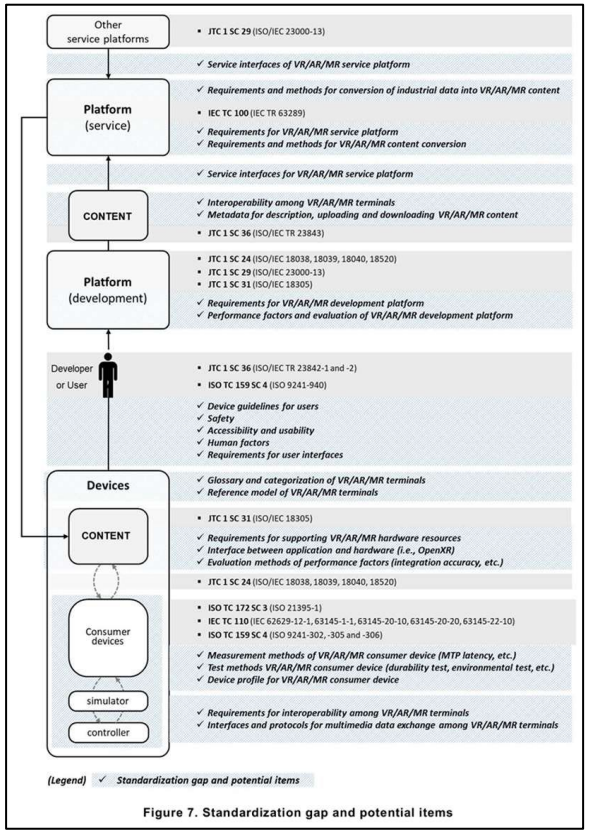


Figure 7. Standardization gap and potential items

IEC TC 100/TA 21

- VR/AR/MR Systems and Equipment – Glossary of terms (IS)

VR/AR/MR Systems and Equipment – Glossary of terms (IS)

☑ 배경 및 목적

- XR 관련 용어가 기업·학계·기관마다 달라 혼선을 유발
- 국제적으로 합의된 XR 용어집 제정 → 후속 표준들의 공통 언어 제공

☑ 주요 내용

- General term: XR, AR, VR, MR
- Device types: Standalone, Tethered, Smartphone-mounted
- Peripheral devices: XR 주변장치, CAVE
- Capturing devices: 360° 카메라, 모션 캡쳐, 포토그래메트리, NeRF
- Performance terms: tracking(inside-out / outside-in, gaze, hand, motion), FoV, latency, DoF, SLAM, occlusion, motion-to-photon

☑ 참조

- IEC 63145-1-2, ISO/IEC 18039, ISO/IEC TR 18121, ISO 9241 시리즈

"국제 표준 작성의 기초 언어 인프라 제공"

IEC TC 100/TA 21

- VR/AR/MR Systems and Equipment – Glossary of terms (IS)

VR/AR/MR Systems and Equipment – Glossary of terms (IS)

V3.1 (37 terms in total)		comparison with IEC 63145-1-2 (D) different definition → 9 (O) TC 100's new terms → 28		Related terms defined in the IEC 63145-1-2
3.3 general terms	3.3.1	virtual reality (VR)	D	different from each other
	3.3.2	augmented reality (AR)	D	different from each other
	3.3.3	mixed reality (AR)	D	different from each other
	3.3.4	XR	D	different from each other
	3.3.5	**XR terminal**	N	N/A
3.4 consumer VR/AR/MR devices	3.4.1	**closed-view**	N	N/A
	3.4.2	**optical see-through**	N	cf. optical see-through display
	3.4.3	**video see-through**	N	cf. video see-through display
	3.4.4	**pass-through**	N	N/A
	3.4.5	**VR device**	N	N/A
	3.4.6	**AR device**	N	N/A
	3.4.7	**MR device**	N	N/A
	3.4.8	**vision-based MR device**	N	N/A
	3.4.9	**optics-based MR device**	N	N/A
	3.4.10	**XR device**	N	N/A
	3.4.11	**tethered type**	N	N/A
	3.4.12	**untethered type**	N	N/A
	3.4.13	**standalone type**	N	N/A
	3.4.14	**smartphone-mounted type**	N	N/A

V3.1 (37 terms in total)		comparison with IEC 63145-1-2 (D) different definition → 9 (O) TC 100's new terms → 28		Related terms defined in the IEC 63145-1-2
3.5 Peripheral devices	3.5.1	**peripheral device**	N	N/A
	3.5.2	cave automatic virtual environment (CAVE)	N	N/A
3.6 Capturing devices	3.6.1	**capturing device**	N	N/A
	3.6.2	360-degree camera (omnidirectional camera)	N	cf. 360° video
	3.6.3	motion cature (MOCAP)	N	N/A
	3.6.4	photogrammetry	N	N/A
	3.6.5	**Neural Radiance Field (NeRF)**	N	N/A
3.7 Performance related terms	3.7.1	inside-out tracking	D	different from each other
	3.7.2	outside-in tracking	D	different from each other
	3.7.3	**gaze tracking**	D	different from each other
	3.7.4	hand tracking	N	N/A
	3.7.5	head tracking	D	different from each other
	3.7.6	motion tracking	N	N/A
	3.7.7	positional tracking	N	N/A
	3.7.8	degrees of freedom (DOF)	N	N/A
	3.7.9	simultaneous localization and mapping (SLAM)	D	different from each other
	3.7.10	occlusion	N	N/A
	3.7.11	**motion-to-photon latency (MTP latency)**	N	cf. motion-to-image latency

IEC TC 100/TA 21

- VR/AR/MR Systems and Equipment – Consumer VR/AR/MR devices - Part 1: Reference model (IS)

VR/AR/MR Systems and Equipment – Consumer VR/AR/MR devices - Part 1: Reference model (IS)

☑ Scope

- 소비자용 VR/AR/MR 장치의 유형 분류 및 공통 참조 모델 제시

☑ 주요 내용

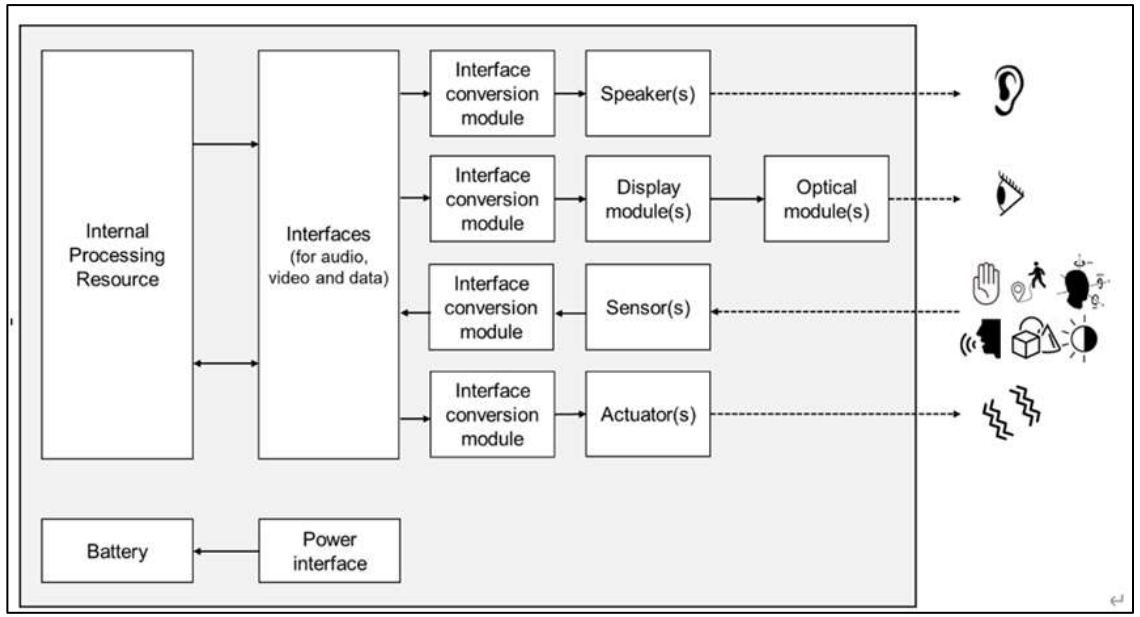
- 장치 유형 분류
  - ✓ VR devices: 완전 몰입형
  - ✓ AR devices: 현실 + 가상 중첩
  - ✓ MR devices: vision-based(pass-through), optics-based
- 기기 타입: Standalone, Tethered, Smartphone-mounted
- 참조 모델 모듈: Processing, Interface, Interface conversion, Display, Optical, Sensors, Speakers, Actuators, Battery

"상호운용성 · 성능 평가 · 호환성 확보의 기반 제공"

IEC TC 100/TA 21

- VR/AR/MR Systems and Equipment – Consumer VR/AR/MR devices - Part 1: Reference model (IS)

VR/AR/MR Systems and Equipment – Consumer VR/AR/MR devices - Part 1: Reference model (IS)



CONTENTS

IEC TC 100/TA 21

- VR/AR/MR Systems and Equipment – Test method – Part 1: Durability evaluation and test procedures for AR devices (IS)

VR/AR/MR Systems and Equipment – Test method – Part 1: Durability evaluation and test procedures for AR devices (IS)

☑ Scope

- 글라스형 AR 단말의 내구성 평가

☑ 주요 내용 (시험 항목)

- Engagement durability: 힌지 반복, 프레임 비트림/뒤틀림
- Impact test: 스틸볼 낙하 충격
- Abrasion-resistant test: 스크래치·마모 시험
- 안전성: 피부 접촉 소재의 생리적 안전성 요구

☑ 참조 규격

- IEC 60068 시리즈(내구성 시험 방법), ISO 12870(안경테 시험), ISO 1501(볼트)

"AR 글라스 신뢰성 보증을 위한 최초의 IEC 시험법 표준"

IEC TC 100/TA 21

- VR/AR/MR Systems and Equipment – Test method – Part 1: Durability evaluation and test procedures for AR devices (IS)

VR/AR/MR Systems and Equipment – Test method – Part 1: Durability evaluation and test procedures for AR devices (IS)

TERMINALS FOR VR/AR/MR – TEST METHOD

Part 1: Durability test for AR devices

1 Scope

This document specifies the fundamental requirements and test methods for assessir performance and durability of augmented reality (AR) devices, with a focus on glasses-ty devices intended for consumer and professional use. It covers aspects such as stru integrity, environmental resistance, and operational stability under specified conditions.

This document applies to AR devices including head-mounted devices and wearable gl but excludes contact lens types and handheld units. The durability tests include engag durability tests among parts, impact test, and scratch and wear durability tests, assessi robustness of glasses-type AR devices made from various materials, including plastic, displays, metal, and hybrid constructions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their c constitutes requirements of this document. For dated references, only the edition cited ap For undated references, the latest edition of the referenced document (including amendments) applies.

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, prima equipment-type specimens*

ISO 1501, *ISO miniature screw threads*

ISO 12870, *Ophthalmic optics — Spectacle frames — Requirements and test methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the foll addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
test
normally comprising the following operations, if required:
a) pre-conditioning;
b) initial examination and measurements;
c) testing;
d) recovery;
e) final examination and measurements.

* Inclusive values.

Variations in temperature and humidity should be kept to a minimum during a serie measurements carried out as a part of one test on one specimen.

NOTE 1 For large specimens or in test chambers where it is difficult to maintain the temperature within the limits sp above, the range may be extended beyond these limits either down to 10 °C or up to 40 °C, when allowed by the re specification. Absolute humidity should not exceed 22 g/m3.

NOTE 2 Where the relevant specification recognizes that it is impracticable to carry out measurements in standard atmos conditions, a note stating the actual conditions shall be added to the test report.

NOTE 3 The relative humidity may be disregarded when it does not influence the results of the test.

8 Test methods

8.1 Engagement durability tests among parts

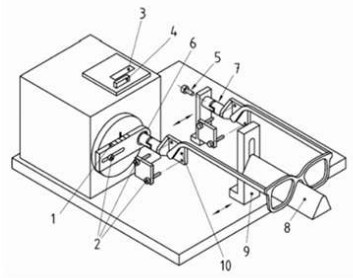
8.1.1 General

The method is to measure the durability and reliability of critical engagement parts i devices, such as hinges, lenses, screws, and the device frame. The engagement durabilit aims to assess the mechanical strength and wear resistance of parts that experience frec interaction or stress (e.g., hinges, screws), verify the long-term reliability of assen components under typical usage conditions and identify potential points of failure du mechanical fatigue or environmental exposure. Bolts should be checked for fastening to c the assembly status of the test product. Various bolts are used for fastening, and inform on small-sized bolts used in glasses and devices is briefly summarized in Annex A.

8.1.2 Hinge durability test

8.1.2.1 Test equipment

One leg should be fixed, and the right or left leg could be moved by test-setting condit Figure 1 shows an example of a frame holder described in ISO 12870 Annex B. The exa of the equipment test demonstration figure and description is shown in Annex B.



where

1 Displacement amplitude scale
2 Adjusting screw
3 Coefficient window
6 Ball bearing
7 All-round feldspars
8 Frame support

finely adjusted using adjustment screws or fixing clamps so that the frame standard. Vertical alignment is achieved by using a vertical laser or a vertica ensure that the centerline of the frame is correctly aligned with the vertical refere device. The frame's nose support and temple (leg) are symmetrically secured to force is evenly transferred during the test. If necessary, use the device's fixing pin to further adjust the position.

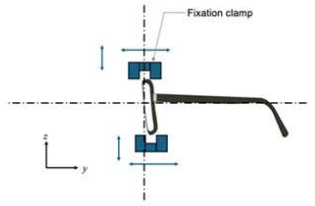


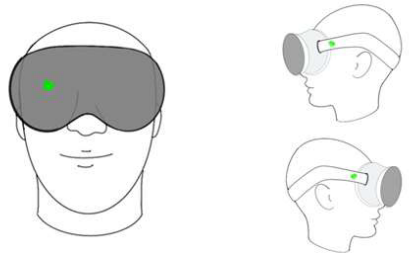
Figure 3 – Fixation clamp position (front view)

Visual inspection is also used as an aid. To do this, mark the base of the devic line or grid pattern, and make sure each part of the frame of glasses is aligned Working in an environment with sufficiently bright lighting can help to check th comparing the shadows to the baseline. The frame should be correctly mount and vertically, and the fixing clamp should be tightened to prevent movement.

8.1.3.2 Distortion direction

Distortion testing of specimen frames is the process of evaluating the durability of a frame when it is deformed in a specific direction by applying a rotational o to the opposite temple relative to a fixed temple. Distortion is performed in two n Forward and backward, and upward and downward.

For the forward and backward twist distortion test as shown in Figure 4, one temp is held firmly in place by a fixture, and then a force is applied to the oppo alternately twist it forward and backward. The forward twist pulls the tip of the the eyeglass lenses, causing the frame to undergo a deformation that constrict lenses. Backward twisting pushes the temple tips toward the wearer's ears, cau to undergo an expansion force in the opposite direction. During testing, the forc a constant rate, and an angle sensor is used to measure the angle at which the fi and its recovery in real time. This process evaluates whether the frame return shape after undergoing torsional deformation, or if permanent deformation occu



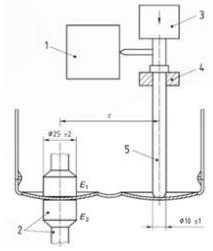
(a) Front impact point (b) side impact points

Figure 10 – Front and side (left and right) Impact points

8.3 Abrasion-resistant test

Figure 11 is a schematic diagram of a device that can fix the DUT and perform an abrasion test described and modified in ISO 12870 Clause 8. The test device features a vertically operating annular clamp to secure the DUT without twisting or slipping. The clamp has a 25 mm ± 2 mm diameter and includes E1, E2, and two contact surfaces made from rigid elastic materials, such as polyamide.

It also incorporates a pressure pusher (D) with a hemispherical contact surface measuring 10 mm ± 1 mm in diametre, which operates downward. The clamp surface can be separated by at least 10 mm from the horizontal axis of the device, and the pressure pusher can move at least 10 mm upward and 8 mm downward along the same horizontal plane. The distance between the clamp and the pressure pusher is adjustable. The device is also equipped with a length metre, offering a measurement accuracy greater than 0,1 mm.



where

IEC TC 100/TA 21

- VR/AR/MR Systems and Equipment – Measurement method – Part 1: Colour difference under ambient conditions for AR devices (IS)

VR/AR/MR Systems and Equipment – Measurement method – Part 1: Colour difference under ambient conditions for AR devices (IS)

☑ 배경 및 목적

- AR 디바이스의 색 재현이 주변 광 조건에 따라 달라짐
- 다양한 광원 환경에서 AR 디스플레이의 색 차이 측정 표준화

☑ 주요 내용

- 표준 광원(D65, A, F 계열) 조건에서 측정
- 색 좌표 변동 평가

"AR 디바이스의 색 차이 평가를 통한 품질 보증 기반 제공"

IEC TC 100/TA 21

- VR/AR/MR Systems and Equipment – Measurement method – Part 1: Colour difference under ambient conditions for AR devices (IS)

VR/AR/MR Systems and Equipment – Measurement method – Part 1: Colour difference under ambient conditions for AR devices (IS)

Example of colour shift with AR devices

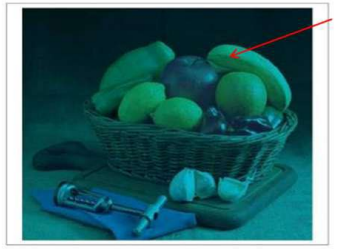
Original view

same ambient condition
Only banana colours are changed
from yellow to green.

(10, 97, 68)

A person could watch and perceive the green colour.

different ambient condition
All colours are changed to greenish.



(1, 89, 60)

The banana colours are well matched with others
A person could watch and perceive the yellow colour.

❖ **Table of contents**

IEC TC 100/TA 21

- New work item – MR-based driving simulator (IS)

MR-based driving simulator

☑ 배경 및 목적

- MR 기술을 활용한 운전 훈련·테스트 수요 증가
- MR 기반 운전 시뮬레이터 시스템 요구사항 정의

☑ 주요 내용

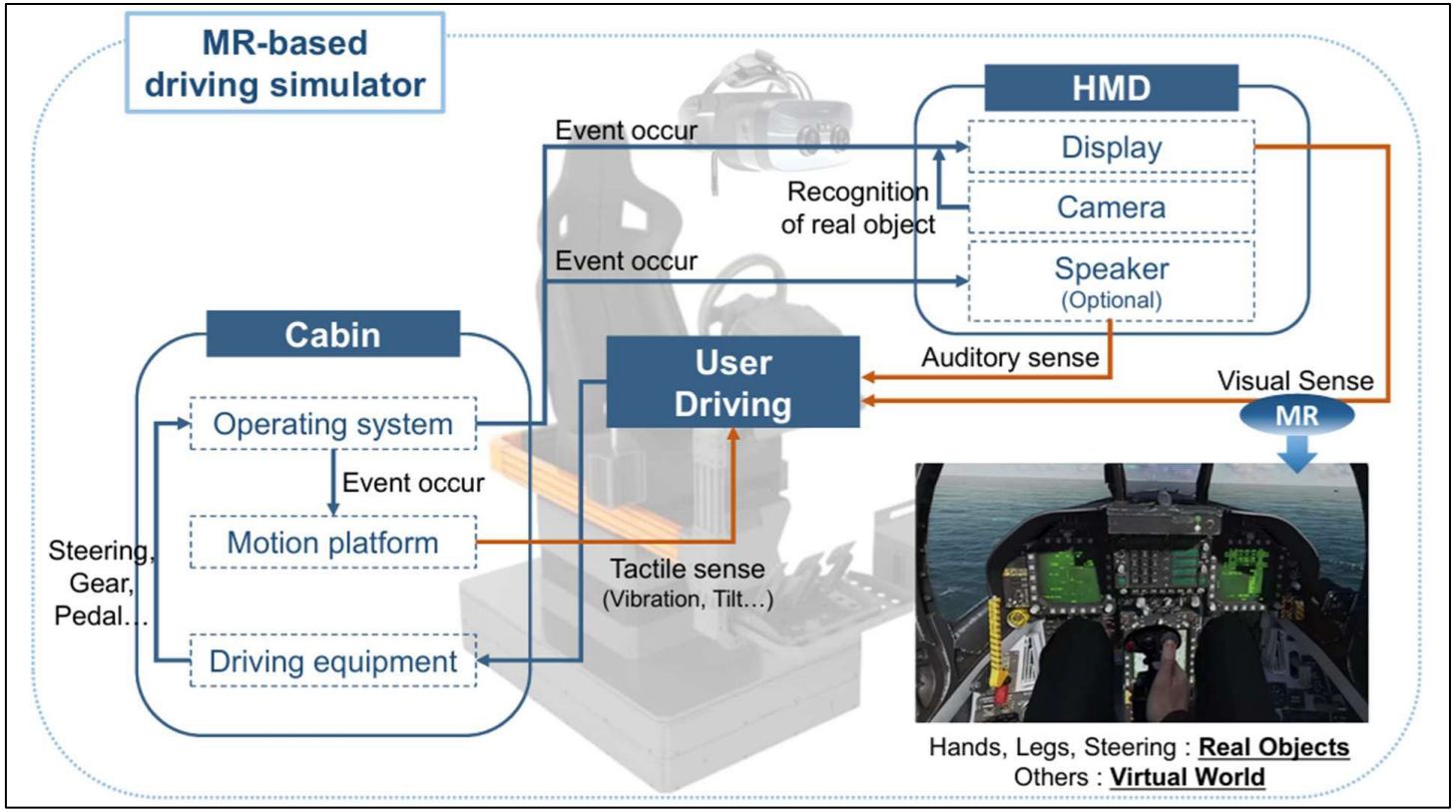
- 실물 조작계(핸들·페달) + 가상 환경 결합
- 기존 Compacting Driving Simulator와 차별화

"XR 응용을 자동차·교육 훈련 산업으로 확장"

IEC TC 100/TA 21

- New work item – MR-based driving simulator (IS)

MR-based driving simulator



IEC TC 100/TA 21

- New work item – Electrical stimulation device (TR & IS)

Electrical stimulation device

☑ 배경 및 목적

- XR 환경에서 햅틱 피드백을 제공하기 위해 EMS 디바이스(전기 근육 자극)가 확산되고 있음
- EMS 디바이스의 요구사항, 데이터 모델, 측정 방법 정의

☑ 주요 내용

- 자극 전류 강도, 안전 한계치
- 시험 프로토콜: 피부 반응, 장치 신뢰성
- 데이터 교환 인터페이스 모델

"새로운 형태의 XR 디바이스에 대한 IEC 국제 표준화"

IEC TC 100/TA 21

- New work item – Electrical stimulation device (TR & IS)

Electrical stimulation device

- Example of 'Electrical Stimulation Devices'

Prototype product in FAM Tech

IEC TC 100/TA 21

- New work item – Factors influencing immersive user experience (TR)

Factors influencing immersive user experience

☑ 배경 및 목적

- XR 디바이스 성능 평가는 하드웨어 스펙 뿐만 아니라 사용자의 몰입감·피로도까지 반영해야 함
- 몰입형 사용자 경험(QoE)에 영향을 주는 기술적 요인 분석

☑ 주요 내용

- 시야각(FoV), 해상도, 프레임율, 지연 시간
- 사운드, 햅틱 피드백
- 사용자 피로, 멀미 발생

"사용자 경험 중심의 성능 평가 프레임워크 구축"

IEC TC 100/TA 21

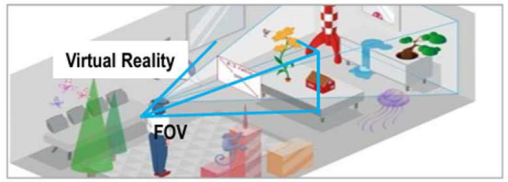
- New work item – Factors influencing immersive user experience (TR)

Factors influencing immersive user experience

Large Field of View (FOV) and high resolution are key factors to achieve hyper-immersive UX

FOV(Field Of View)[1)]

The size of the field of view where the virtual image is perceived



If the FOV is small, there is a problem of poor immersive due to the Tunnel Vision Effect effect.

High Resolution[2)]

Capability to express content in detail

If the contents (borders such as text and line) are not smooth, the immersive will be reduced.

When frame rate changes on an XR device

- FOV and horizontal resolution are decreasing, which hinders user's immersive experience

- **Immersiveness can be diminished by not only hardware condition but also software optimization for content characteristics**

Ex) Pimax 5K super

Refresh rate	90 / 120 / 160 / 180Hz
FOV	200˚ / 200˚ / 170˚ / 150˚
Hor. resolution	3080 / 3108 / 1712 / 1804

Factors	Description of components
Hardware	Display Panel (LCD,OLED, etc.), Display Driver IC, Interface (bandwidth)
Software	Input Lag Handling, Rendering Engine(Unity, Unreal Engine, etc.), Frame Interpolation algorithms, Eye/Head tracking algorithm
Contents	Graphic Frame Rate/ Resolution(films, animations, video games), Moving Speed

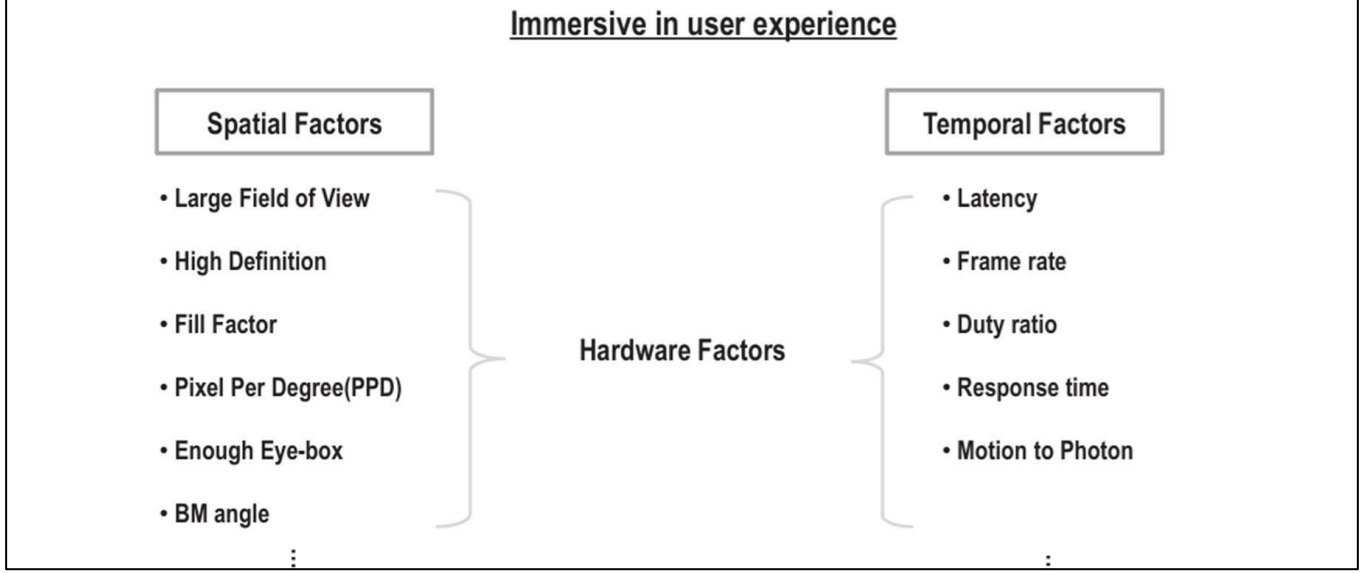
Focusing on the impact of hardware conditions considering the scope of TC100

IEC TC 100/TA 21

- New work item – Factors influencing immersive user experience (TR)

Factors influencing immersive user experience

- To propose TA 21 to initiate discussion on what influence users' XR experience
- And then, to develop a TR on "factors influencing users' XR experience" (tentative title)
- Then, to develop TS and/or IS further based on the TR



IEC TC 100/TA 21

- New work item - Measurement method for power consumption and/or battery life of consumer VR/AR/MR devices (IS)

Measurement method for power consumption and/or battery life of consumer VR/AR/MR devices

☑ 배경 및 목적

- XR 디바이스의 사용성은 배터리 지속 시간과 전력 효율성에 직접 의존
- 다양한 모드에서 전력 소모 및 배터리 수명을 측정하는 표준 방법 정의

☑ 주요 내용

- Standby, video, interactive 모드 구분
- Tethered vs Untethered 디바이스 고려

"에너지 효율과 사용성 검증의 핵심 표준"

IEC TC 100/TA 21

- New work item - Measurement method for power consumption and/or battery life of consumer VR/AR/MR devices (IS)

Measurement method for power consumption and/or battery life of consumer VR/AR/MR devices

❖ **Manufacturers of consumer XR devices provide users with information on power specifications of their devices.**

(examples)

Battery[2]	
	Up to 2 hours of general use
	Video watching up to 2.5 hours

[source: homepage of company A]

Power	
Battery Life	2-3 hours of active use. Up to two weeks of standby time.

[source: homepage of company M]

1) However, average experiential usage time < specification provided by manufacturers

2) Ambiguous definitions of operation modes
   - (ex) general use, active use, standby, etc.
   - In some cases, battery life is specified without mentioning any operation mode.

(note) **battery life**: refers to how long a device operates before needing to be recharged
battery lifespan: refers to how long the battery lasts until it needs to be replaced

❖ **Measuring battery life or power consumption ?**
- Tethered devices are usually powered from an external device (i.e., smart phone, etc).
- Untethered devices are self-powered.

- Better to mention **power consumption** for tethered devices
- While, **battery life** for untethered devices

❖ **How to measure ?**
- It should depend on device types. (i.e., tethered or untethered)

✓ Need to **define how to operate** the test device while measuring
✓ Need to **know when the test device shuts down**

Thank you!