WPTC Wireless Power Transfer Technology Center
무선전력전송기술센터

WPC(Qi) 국제규격

인증 획득 절차 및 지원방안

2017. 10. 24

경북TP 무선전력전송기술센터
김형준 선임

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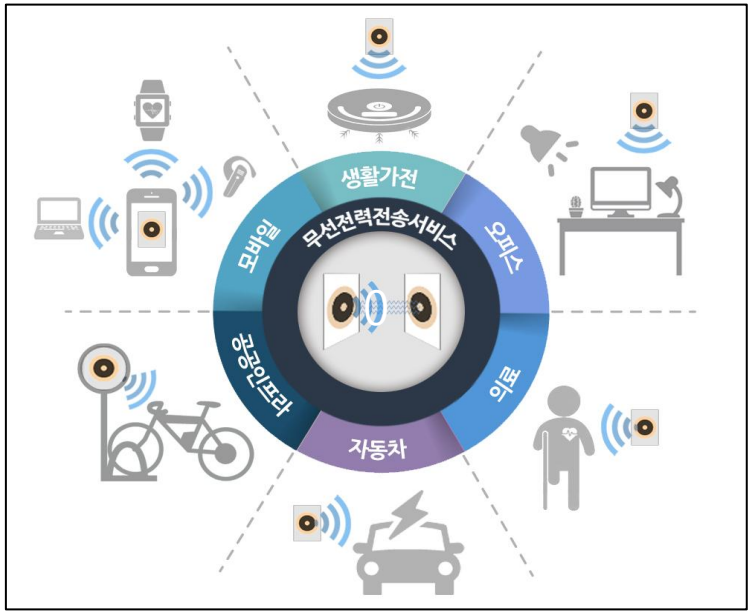
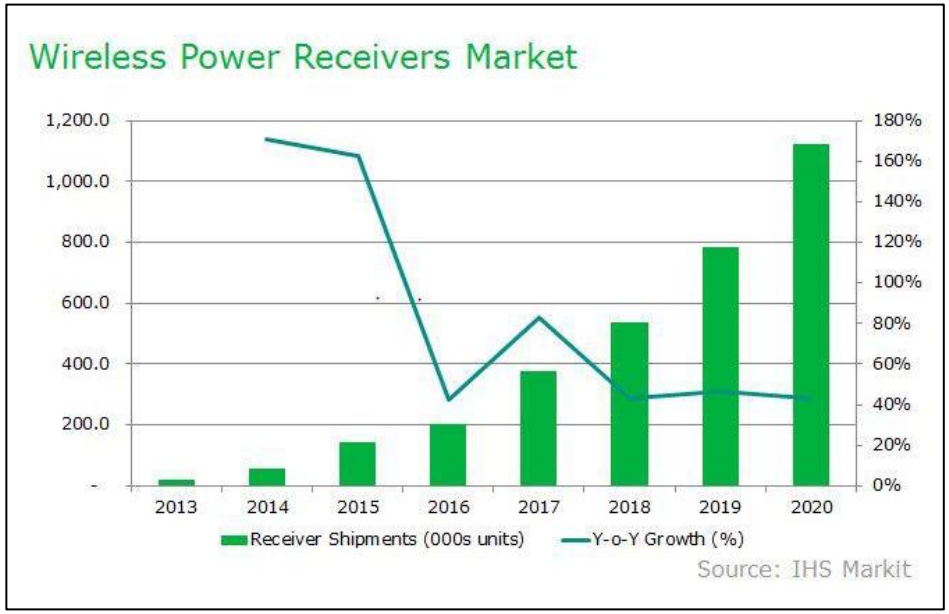
Wireless Power Transfer

WPTC Wireless Power Transfer Technology Center 무선전력전송기술센터

무선전력전송 기술은 다양한 분야에서 활용이 가능하며 4차 산업혁명에서 핵심기술로 평가되고 있음



무선전력전송 기술의 활용 시나리오



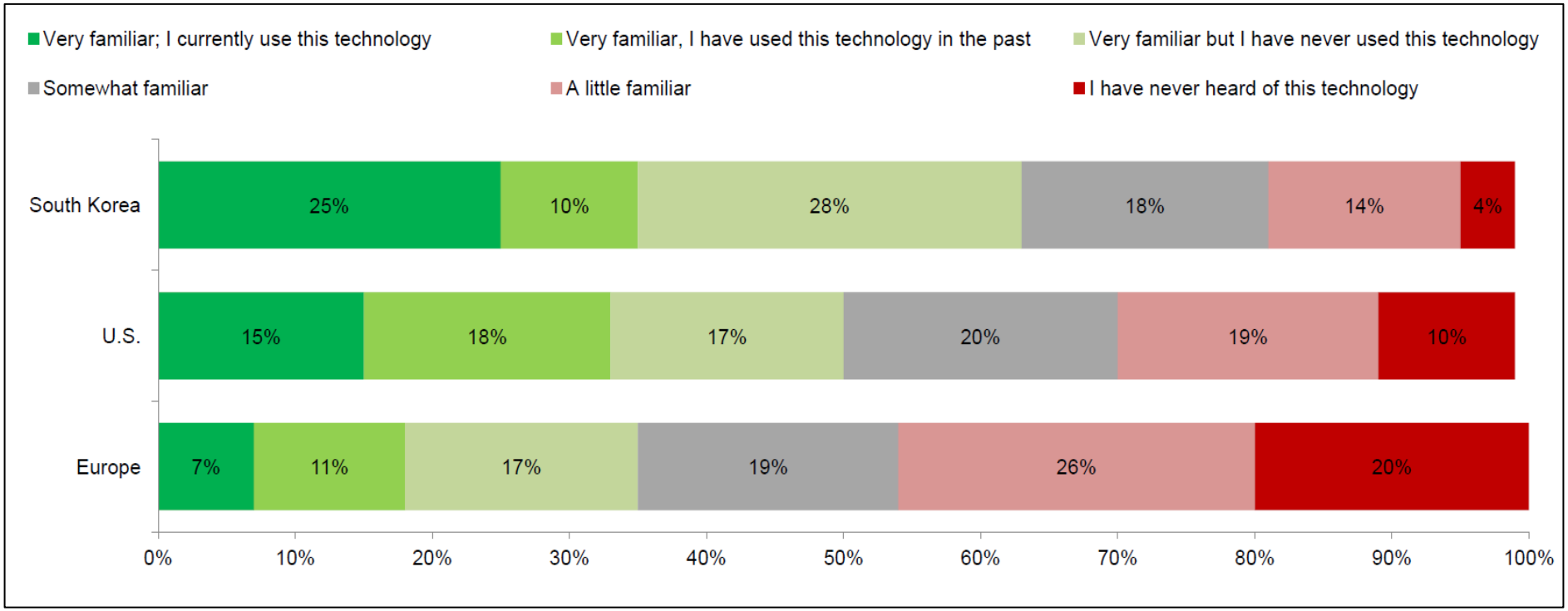
세계 무선전력전송 시장전망

2017: 400 million wireless power products

- 325 million mobile phones
- 75 million wireless phone chargers

Wireless Power Transfer

- ***Q: How familiar are you with the concept of wireless charging?***

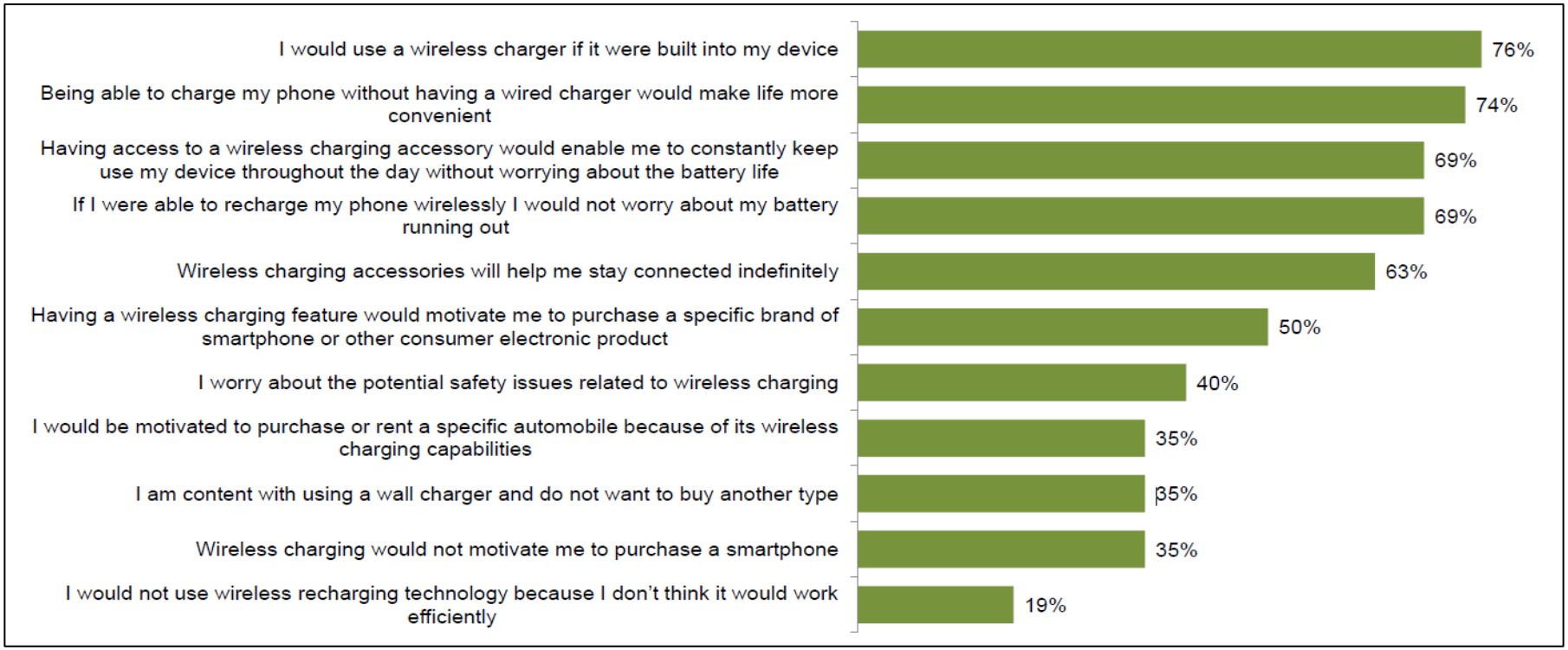


High familiarity

- 96% of consumers in South Korea and 90% in the U.S. are familiar with the concept of wireless charging, while in Europe 20% have never heard of it.

Wireless Power Transfer

- ***Q: Please indicate how strongly you agree or disagree with the following statements.***

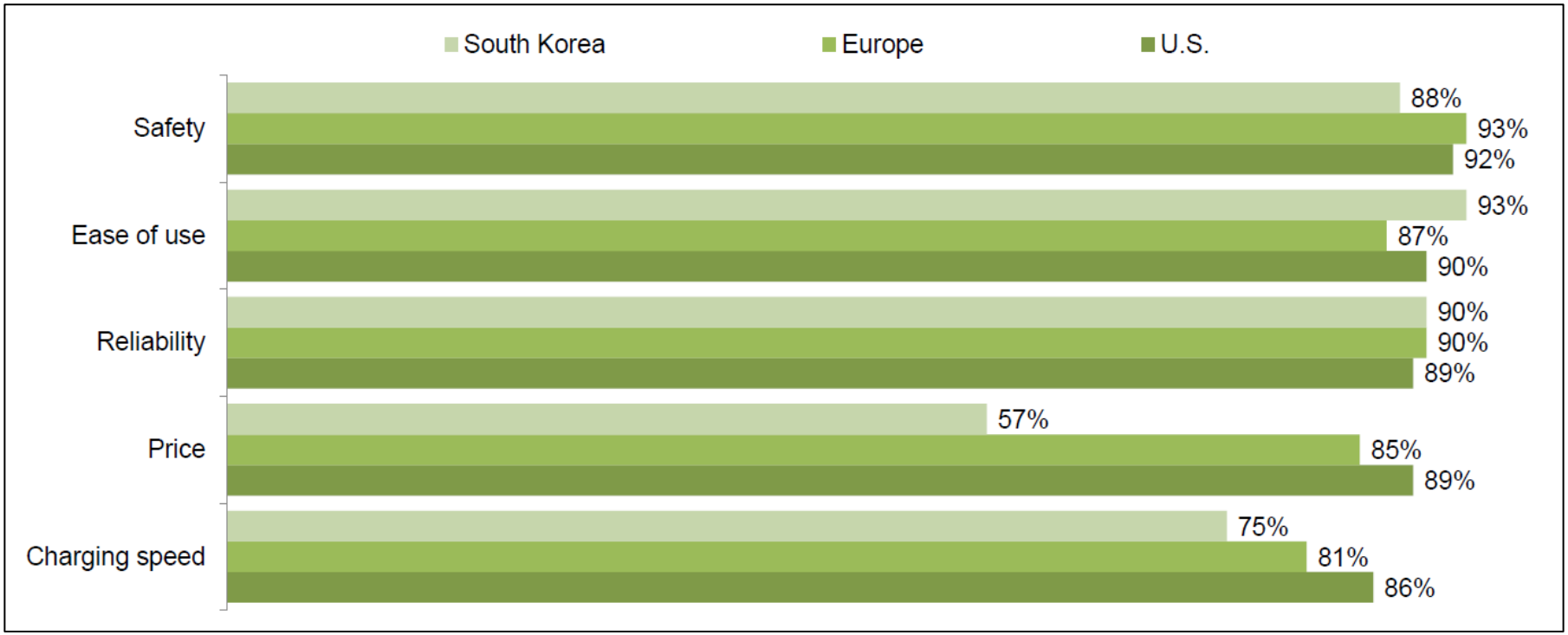


High demand for wireless charging in smart phones

- 76% report they would use wireless chargers if they were built in to their device, though concerns about security and **safety** will have to be addressed.

Wireless Power Transfer

- ***Q: Thinking about the different ways you have used your wireless charging accessories, how satisfied have you been with each of the following?***



High demand for wireless charging in smart phones

- Most consumers are more satisfied with **safety**, ease of use, reliability.

WPC(Qi) 국제규격

WPTC Wireless Power Transfer Technology Center 무선전력전송기술센터

- **Current version of the Qi specification**
  - ✓ The current version of the Qi specification has version number 1.2.3.
  - ✓ The Qi specification that is available for public download has version 1.2.2.
  - ✓ Version 1.2.3 is available only to members of the Wireless Power Consortium.
  - ✓ It will be made available for public download later in 2017.

- **History of the Qi specification**
  - ✓ Version 1.0
    - Qi transmitter delivers 5 Watt power into a Qi phone.
    - High flexibility in design of Qi receivers
    - Limited flexibility in the design of Qi transmitters
  - ✓ Version 1.1
    - Increased design freedom for transmitters.
    - ncreased sensitivity of "Foreign Object Detection".
    - The possibility to power a Qi transmitter with a USB charger.
  - ✓ Version 1.2
    - Fast charging.
    - The possibility for Tx/Rx up to 15 Watt power.
    - An improved thermal test for transmitters
    - Improved timing requirements
    - Changed limits for Foreign Object Detection improve the sensitivity.

WPC(Qi) 국제규격 인증 절차

WPTC Wireless Power Transfer Technology Center 무선전력전송기술센터

- **Process of Certification**

Compliance Test

Authorized Test Lab (ATL)

- BPP(5W) test
- EPP(15W) test

»

Interoperability Test

Interoperability Testing Center (IOC)

»

Qi Logo License

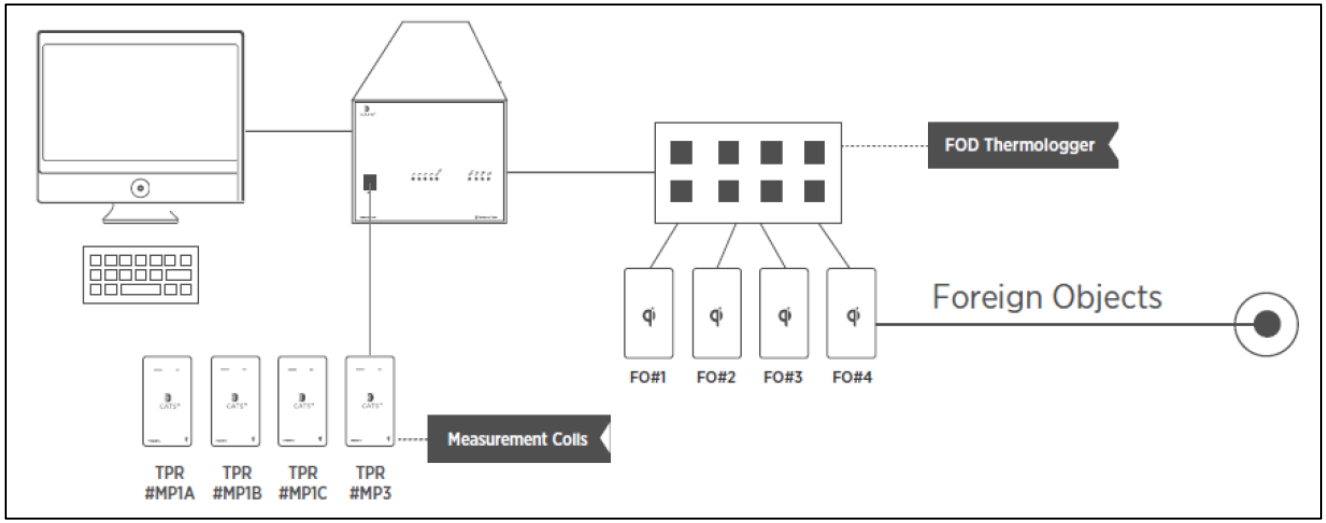
Logo License Agent (LLA)

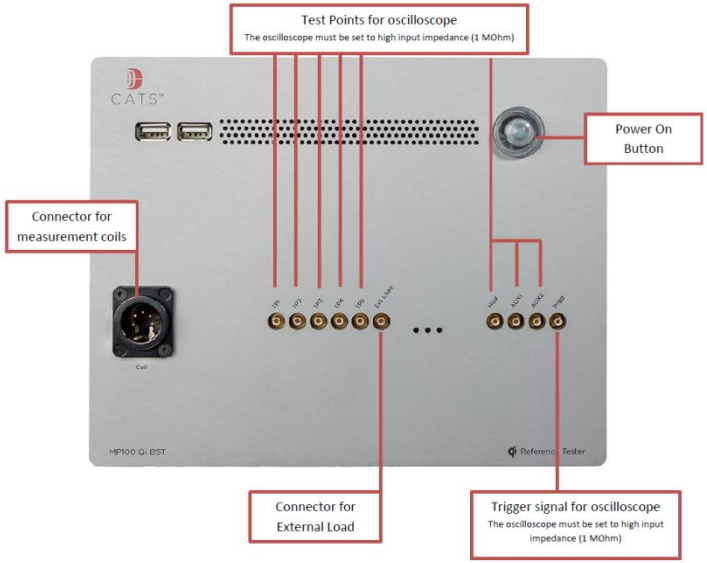
- **경북테크노파크 무선전력전송기술센터**

‘16/07/18	‘16/04/10	‘17/07/10	‘17/07/17~19	‘17/09/21~22
WPC Full Member 가입 /활동	Jan Willem 방문 센터계획 발표/ 실험여건 확인	CATS II 장비 교육이수 (스웨덴)	ATL 감독관 방문 인증시험 Training	ATL 감독관 방문 인증 심사 (Tx, Rx)

무선전력전송기술센터 인증 장비

- **CATS II – BST(Base Station Tester)**

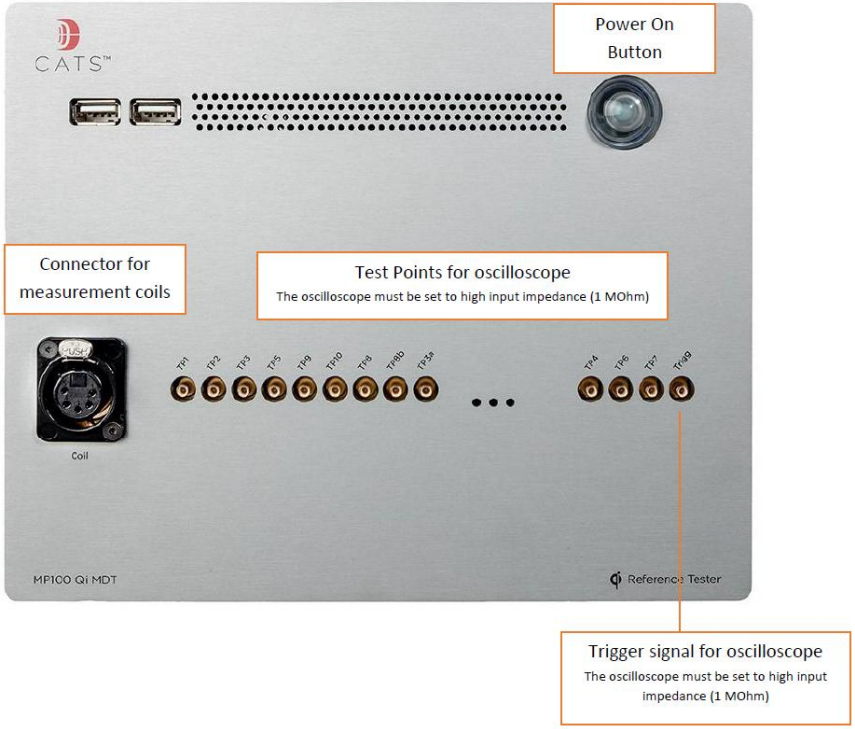




Reference Measurement Coil	Connector Color
TPR#1A (& TPR#3, TPR#4) *	Red
TPR#1B*	Yellow
TPR#1C*	White
TPR#1D*	Blue
TPR#1E*	Orange
TPR#5 (& TPR#6) * *	Purple
TPR#THERMAL**	Black
TPR#MP1A (8 W)	Brown
TPR#MP1B (15 W)	Green
TPR#MP1C (12 W)	Black
TPR#MP3 (15 W) *	Gray

무선전력전송기술센터 인증 장비

- **CATS II – MDT(Mobile Device Tester)**



Reference Measurement Coil	Connector color
TPT#2 *	Green
Coil TPT#MP1	Gray

무선전력전송기술센터 인증 장비

CATS II - BST

CATS II - MDT

TPR coil(5W)

TPR coil(15W)

TPT coil(15W)

사전성능시험 및 인증시험

WPTC Wireless Power Transfer Technology Center 무선전력전송기술센터

Brand Name

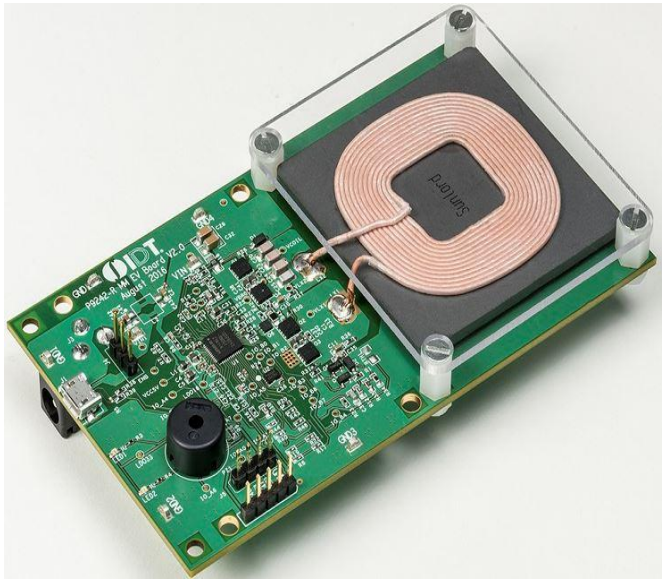
IDT Wireless Power

Type Number

P9242-R

Product Type

Power Class 0 Transmitter



Additional details

Qi Registration ID	2022
Version	1.2.3
Currently licensed	Yes
Power Profile	Extended Power Profile (15 Watt)
Transmitter design	MP-A2
Subsystem intended for integration into other products	No
Compliant with Automotive Guidelines	No
Automotive charger	No
Evaluation Module	Yes

사전성능시험 및 인증시험

WPTC Wireless Power Transfer Technology Center 무선전력전송기술센터

1. Modulation

- **[MP.TX.COM.MOD.TC1] Frequency Modulation**

The difference of the average cycle lengths: - 63.25 ns ≤ T1 – T2 ≤ -30.25 ns

Frequency Limits

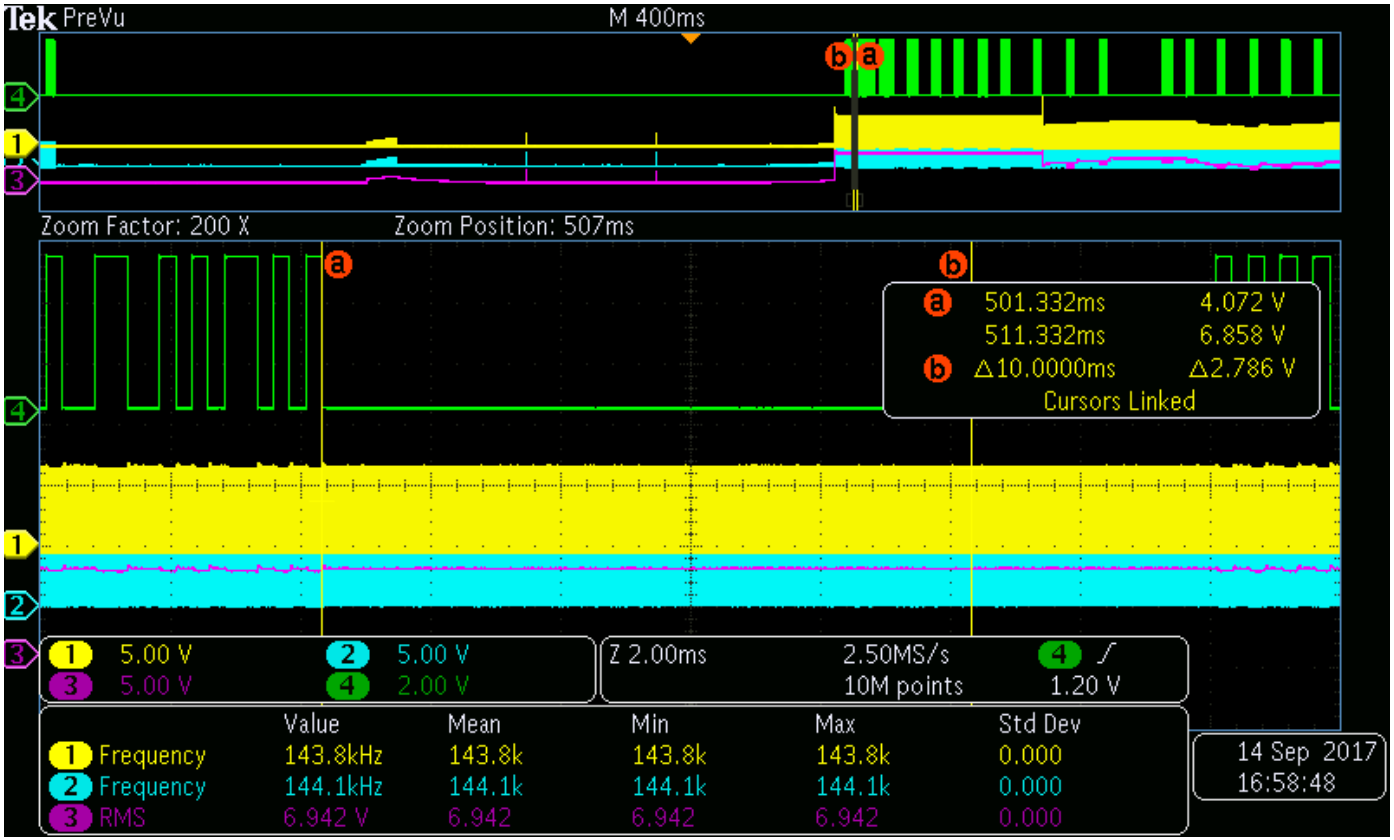
1/f_op [ns]:	6916.6	**FSK Limits**
σ_op [ns]:	4.5	Min: -63.25 ns Max: -30.25 ns
1/f_mod [ns]:	6884.8	-31.8 ns is within limits
σ_mod [ns]:	4.2	**Variation Limits**
FSK Depth [ns]:	-31.8	4.5 <= 8.0
FSK Polarity:	0	4.2 <= 8.0

Period statistics	Min	Max	Avg
Operational	-1	2	0.0
Modulation	-2	0	-1.0

사전성능시험 및 인증시험

2. Selection & Ping Phase
- [Test #5a] Digital Ping: Signal Strength

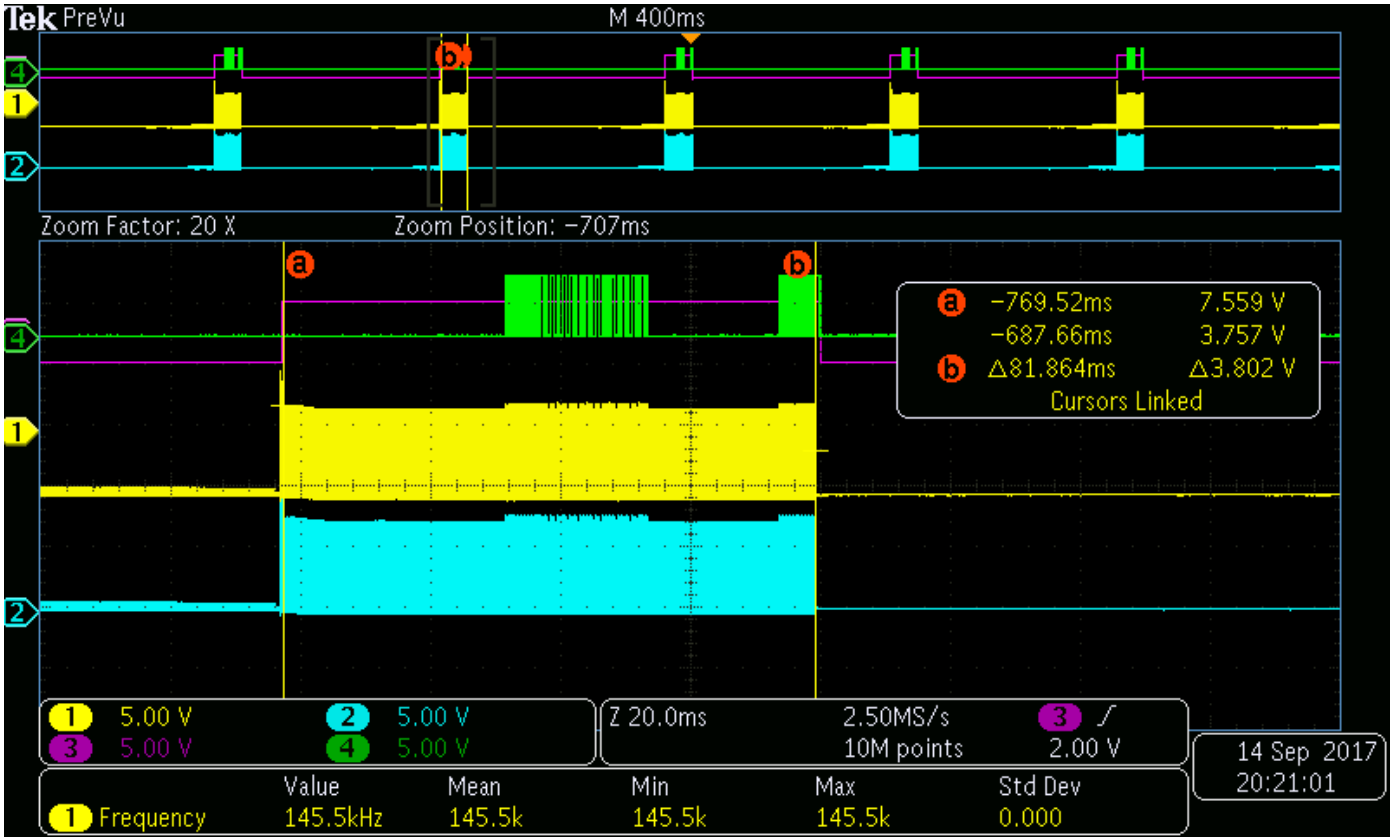
Parameter	Minimum	Target	Maximum	Result
V_r	3.0 V	6.0 V	9.0 V	6.942 V
f_{op}	135.0 KHz	140 KHz	145.0 KHz	143.8 KHz



사전성능시험 및 인증시험

3. Identification & Configuration Phase
- [Test #9] Packet Timing

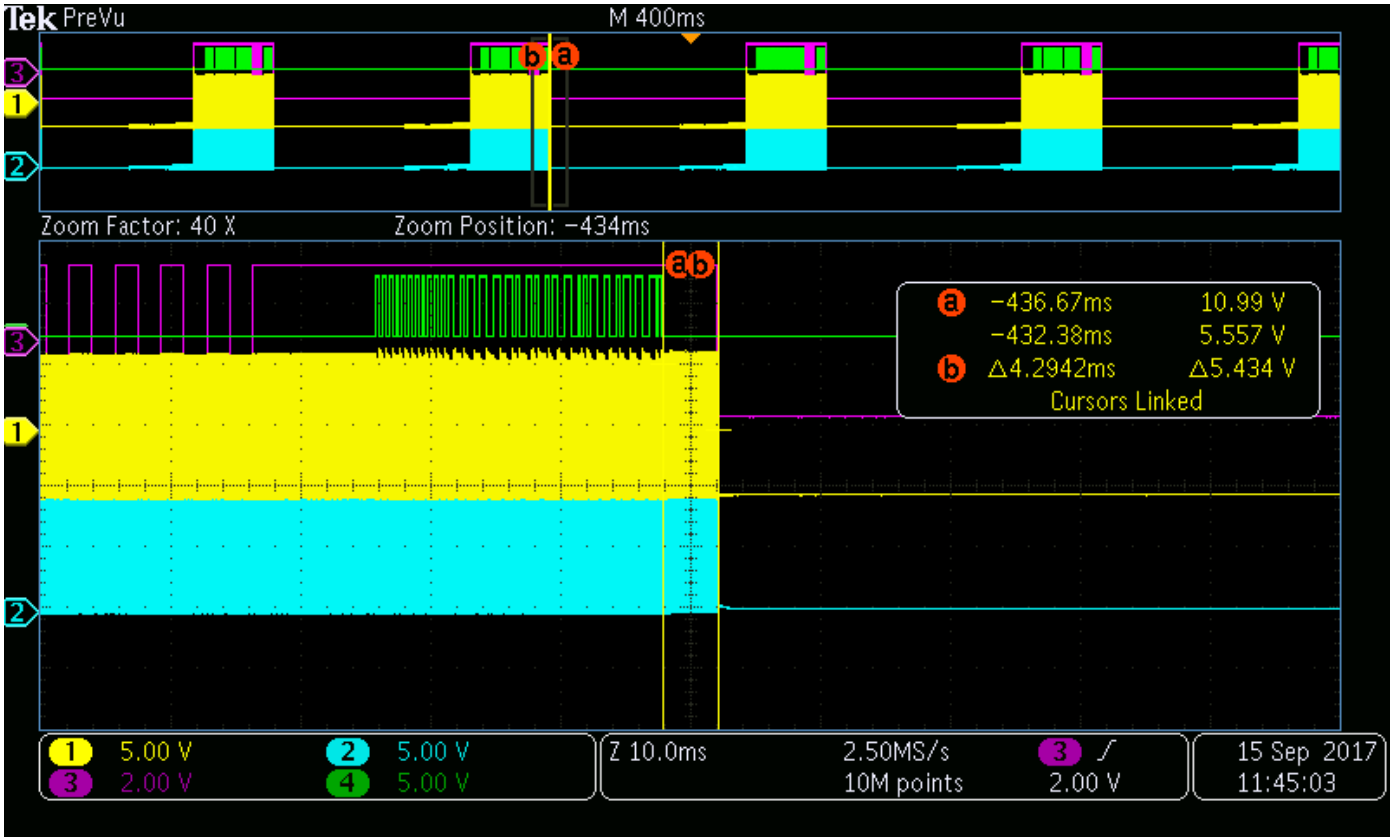
Minimum	Parameter	Maximum	Result
77.0 ms	$t_{packettiming}$	111.0 ms	81.864 ms



사전성능시험 및 인증시험

4. Negotiation Phase
- [MP.TX.SYSCTRL.NEG.RMPOW.TC2] Remove Power

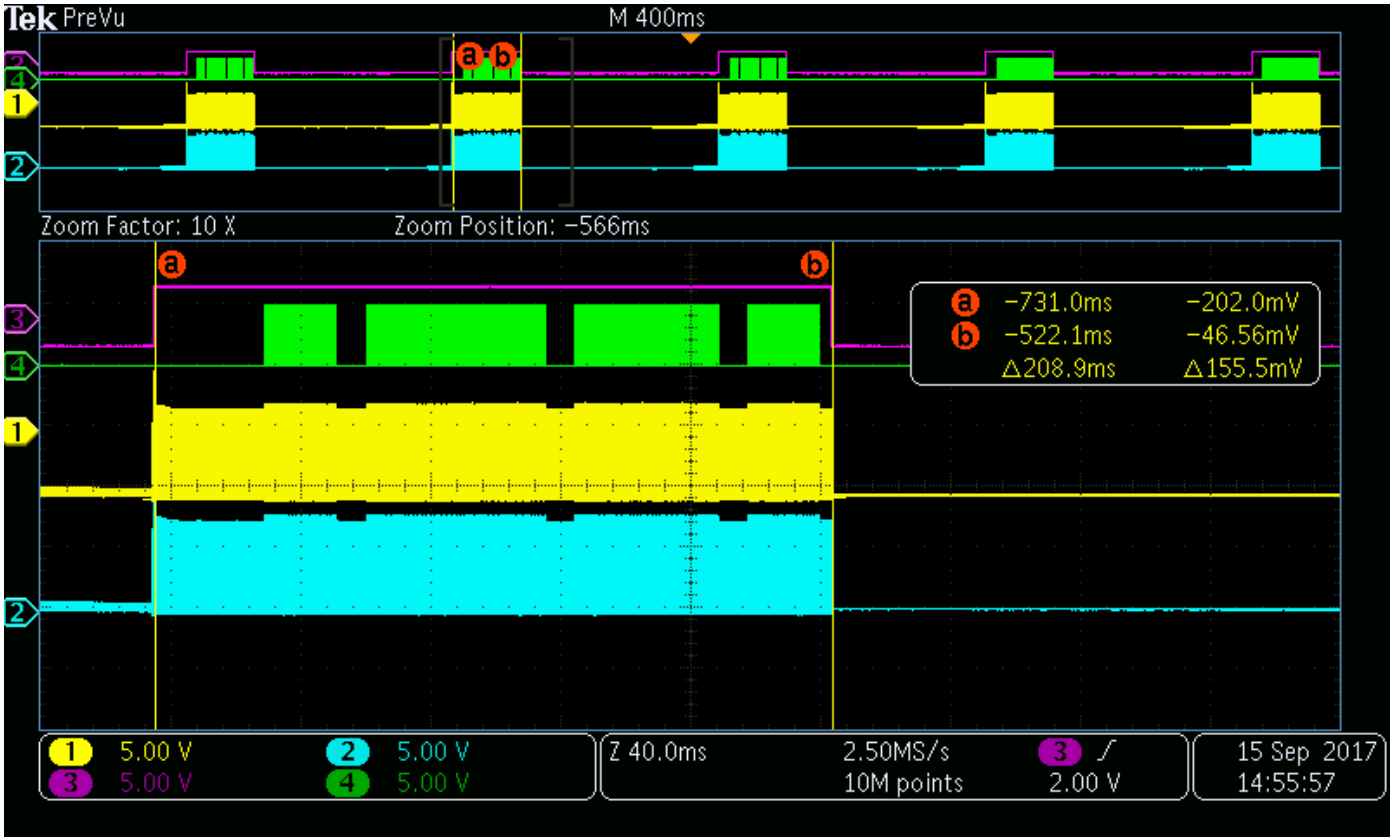
Parameter	Maximum	Result
$t_{terminate}$	28.0 ms	4.2942 ms



사전성능시험 및 인증시험

5. Power Transfer Phase
- [Test #16] Packet Sequence

Minimum	Parameter	Maximum	Result
201.0 ms	$t_{powerpacket}$	239.0 ms	208.9 ms



사전성능시험 및 인증시험

WPTC Wireless Power Transfer Technology Center 무선전력전송기술센터

6. Guaranteed Power

- **[MP.TX.PERF.POWGUARANT.15W.TC1] Guaranteed power**

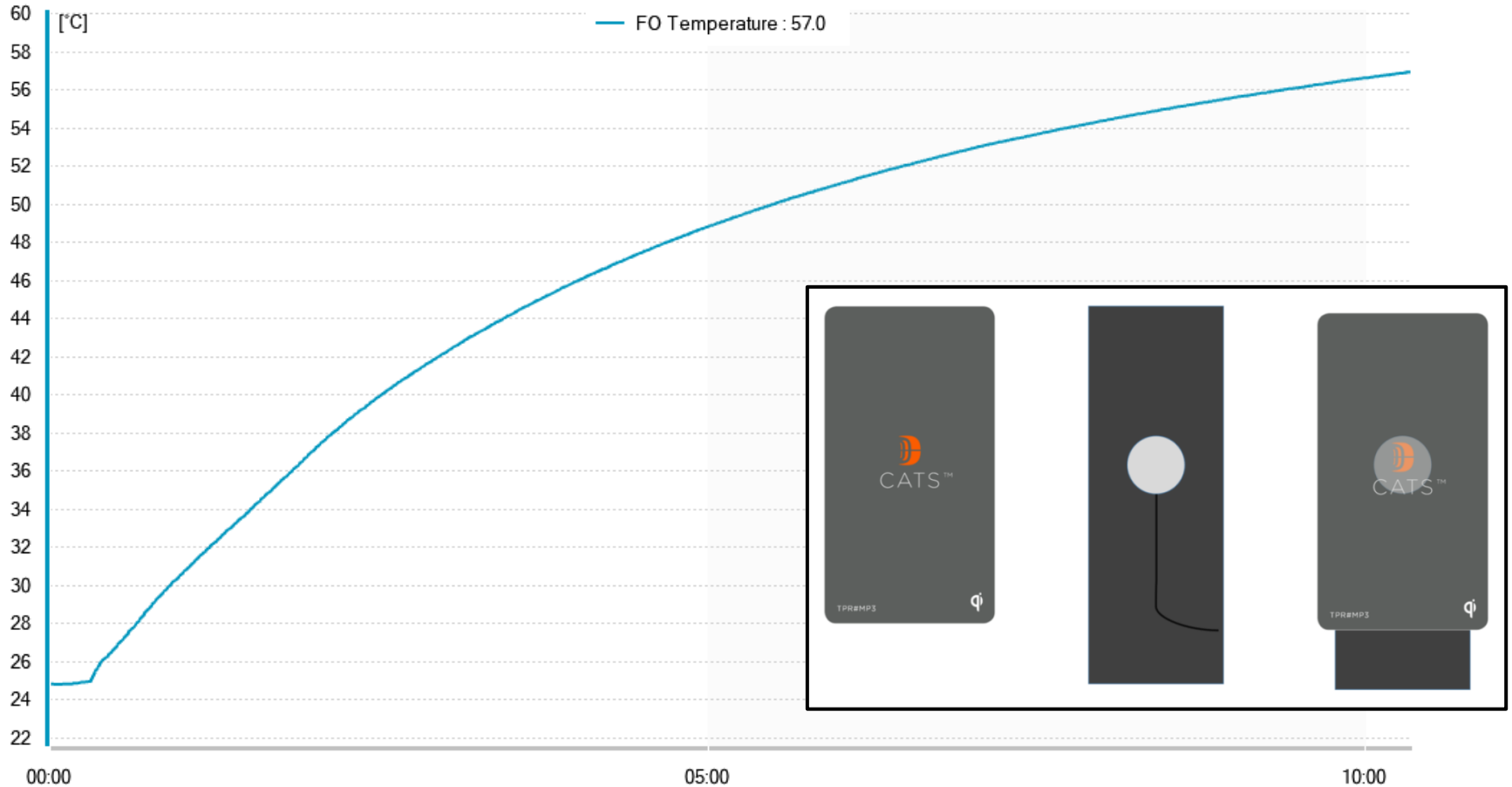
MP.TX.PERF.POWGUARANT.15W.TC1 passes
if the TPR eventually sends a sequence of at least ten Control Error Packets
that contain a Control Error Value of –1, 0, or 1 after stepping to the final load resistance.

```
15:15:22 Received Power (0x31), Mode 0: 16523 mW
15:15:22 FSK Word:ACK   f:6918 - 6886  s:4.0 - 3.8 po:1/0 pm:-1/-3
15:15:22 Sent Control Error: 0
15:15:23 Sent Control Error: 0
15:15:23 Sent Control Error: 0
15:15:23 Sent Control Error: 0
15:15:23 Sent Control Error: 0
15:15:24 Sent Control Error: 0
15:15:24 Sent Control Error: 0
15:15:24 Sent Control Error: 0
15:15:24 Received Power (0x31), Mode 0: 16528 mW
15:15:24 FSK Word:ACK   f:6917 - 6886  s:4.1 - 3.8 po:1/-1 pm:-1/-2
15:15:24 Sent Control Error: 0
15:15:25 Sent Control Error: 0
15:15:25 Sent Control Error: 0
15:15:25 Sent Control Error: 0
```

사전성능시험 및 인증시험

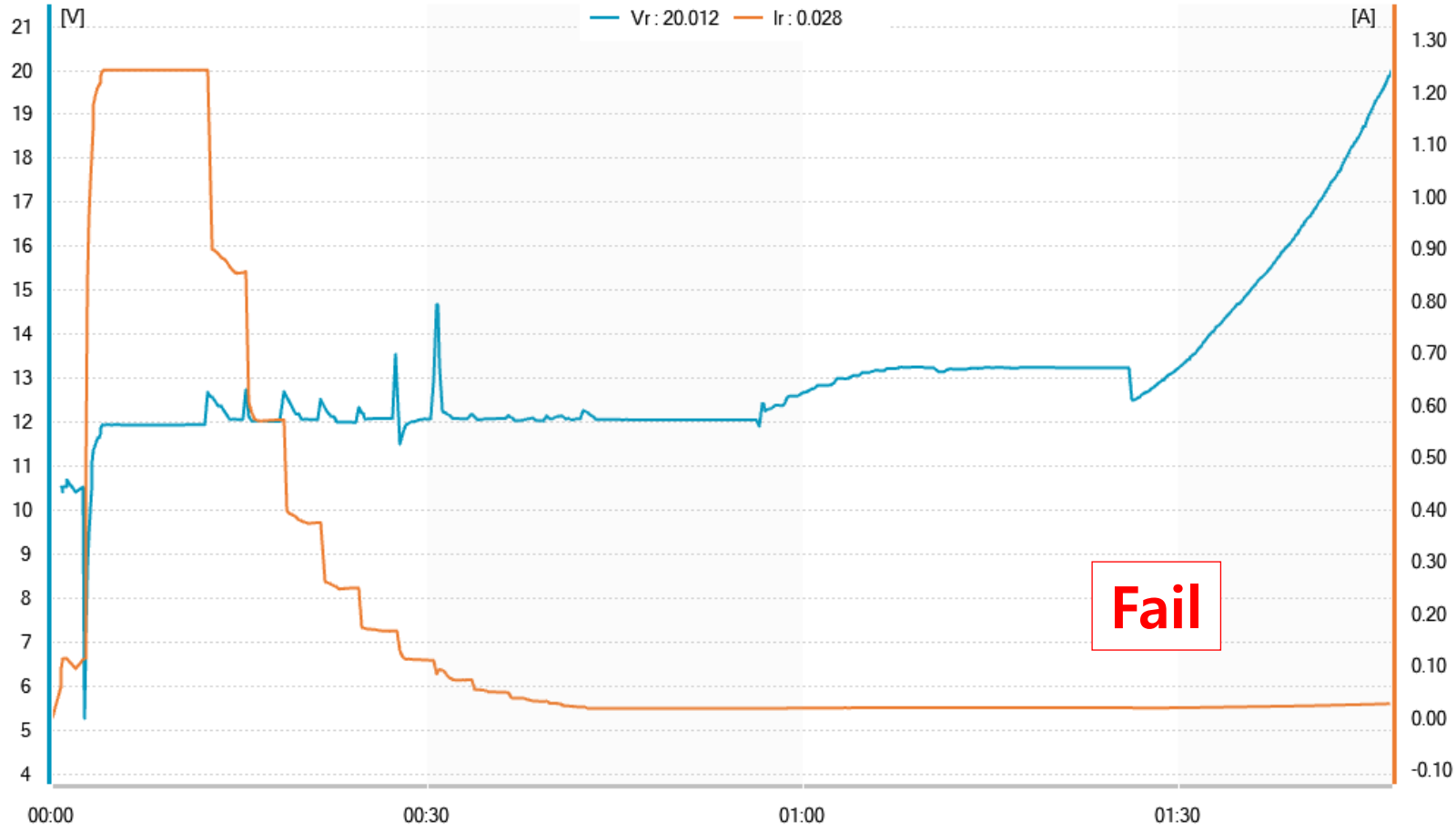
7. Foreign Object Detection
- [Test #25(a)] Heating Prevention

Test #25(a) pass if the temperature of representative Foreign Object #1 remains below 60°C throughout the test.



8. Maximum Voltage
- [ptx-pow-ovp-epp]

Test ptx-pow-ovp-epp passes
if the rectified voltage does not exceed 20 V in the final step of the test procedure.



사전성능시험 및 인증시험

WPTC Wireless Power Transfer Technology Center 무선전력전송기술센터

- **Test report**

CATS Reference Tester Rx Report

Test Name: BST_IDT#1_Test20171011

Information

Test Name	BST_IDT#1_Test20171011	**Spec. Version**	Version 1.2.3
Operator	John Kim	**Power Profile**	Extended (EPP)
Production Name		**Test started**	2017-10-11 09:59:17
Production Date	2017-10-17	**Test finished**	2017-10-17 21:26:20
Transmitter Design	MP A2		
Note			

Summary

PASSED (92%) | FAILED (3%) | NOT RUN (5%)

Modulation		
#1	Load Modulation	Passed
COM.MOD.TC1	Frequency Modulation	Passed
COM.MOD.TC2	Frequency Modulation	Passed
Selection & Ping Phase		
#2	Selection Phase	Not Run
#3a	Digital Ping: Power Signal Characteristics	Passed
#3b	Digital Ping: Power Signal Characteristics	Passed
#3c	Digital Ping: Power Signal Characteristics	Passed
#3d	Digital Ping: Power Signal Characteristics	Failed
#4	Digital Ping: No response	Passed
#5	Digital Ping: Signal Strength	Passed
#5a	Digital Ping: Signal Strength	Passed
#6	Digital Ping: Termination	Passed
#6a	Digital Ping: Termination	Passed
#7a	Digital Ping: Termination	Passed
#7b	Digital Ping: Termination	Failed
#7c	Digital Ping: Termination	Passed
Id & Configuration Phase		
#8a	Packet Sequence	Passed
#8b	Packet Sequence	Passed
#8c	Packet Sequence	Passed
#8d	Packet Sequence	Passed
#9	Packet Timing	Passed
#11	Communication Error	Passed
#13	Packet Content	Passed
#13a	Packet Content	Passed

CATS Reference Tester Rx Report

Test Name: BST_IDT#1_Test20171011

#13b	Packet Content	Passed
#13c	Packet Content	Passed
#14	Packet Content	Passed
IDCONFIG.ACK.TC1	ACK negotiation request	Passed
Negotiation Phase		
NEG.RESPCOR.TC1	Correct response	Passed
NEG.RESPCOR.TC2	Correct response	Passed
NEG.RESPTIME.TC1	Packet Response Timing	Passed
NEG.RMPOW.TC2	Remove Power	Passed
NEG.RMPOW.TC3	Remove Power	Passed
NEG.END.TC1	End Negotiation	Passed
NEG.WPID.TC1	Wireless Power ID	Passed
NEG.WPID.TC2	Wireless Power ID	Passed
NEG.WPID.TC3	Wireless Power ID	Passed
NEG.WPID.TC4	Wireless Power ID	Passed
NEG.WPID.TC5	Wireless Power ID	Passed
Power Transfer Phase		
#16	Packet Sequence	Passed
#16a	Packet Sequence	Passed
#16b	Packet Sequence	Passed
#17a	Packet Timing	Passed
#17b	Packet Timing	Passed
#18	Packet Timing	Passed
#20a	Power Control	Passed
#20b	Power Control	Passed
#21	Power Control	Passed
POW.XFER.LDSTP.TC1	Power Control	Passed
POW.XFER.LDSTP.TC2	Power Control	Passed
#22	Termination	Passed
POWXFER.RENEG.TC1	Renegotiation	Passed
Guaranteed Power		
#23a	Guaranteed Power	Passed
#23b	Guaranteed Power	Passed
#23c	Guaranteed Power	Passed
#23d	Guaranteed Power	Passed
#23e	Guaranteed Power	Passed
#23f	Guaranteed Power	Passed
POWGUARANT.8W.TC1	Guaranteed Power	Passed
POWGUARANT.15W.TC1	Guaranteed Power	Passed
POWGUARANT.12W.TC1	Guaranteed Power	Passed
POWGUARANT.15W.TC2	Guaranteed Power	Passed
Thermal Performance		
#24	Thermal Performance	Not Run
Foreign Object Detection		

인증 획득 지원방안

제품 설계 및
기술 지원

+

사전시험
및 인증시험
지원

=

WPC(Qi)
인증 획득

제품 설계 및 기술 지원

- 표준별, 전력별 공인인증 최신 정보 제공
- 기술세미나 및 전문 워크샵 개최
- 전문가 매칭(1:1 멘토링) 및 애로기술 지원

사전시험 및 인증시험 지원

- 사전성능평가시험 지원(디버깅 환경 제공)
- 무선충전 제품 개발 환경 지원(open lab 운영)
- 5W, 15W급 무선충전 인증시험 지원

WPTC Wireless Power Transfer Technology Center
무선전력전송기술센터

무선전력전송기술센터
김형준 선임
053-819-8161, jjunikim@gbtp.or.kr