

Report on business requirements

Your Spec No. 11575443
 NDK Model No. T01771
 NDK Spec No. ZT07S-012

- 1 Objective
 Verify business requirements.

2 Verification details

TVP Tag	TPRS Tag	Specification	Test Definition	Sample Size	Verification Method	Criterion
11.0.1	3.9.1.1-1	Sani-Cloth AF3	Duration: 168 hours at 20 °C (At room temperature)	n=1	Safety Appearance	1)Transducer shall pass safety testing of Hipot and Leakage Current Tests. Hipot (4 000 V [AC rms] / 50 Hz 60 seconds) : ≤ 2 mA Leakage Current (264 V [AC rms] / 60 Hz) : ≤ 0.05 mA 2)Mechanical damage to the plastic housing such as cracking etc.
	3.9.1.1-2	Super-Cloth HB	Duration: 168 hours at 20 °C	n=1		
	3.9.1.1-3	Super Sani-Cloth	Duration: 168 hours at 20 °C (At room temperature)	n=1		
	3.9.1.1-4	Enzol	Duration: 168 hours at 20 °C (At room temperature)	n=1		
	3.9.1.1-5	Transeptic	Duration: 168 hours at 20 °C (At room temperature)	n=1		
	3.9.1.1-6	Metrricide	Duration: 500 hours at 20 °C (At room temperature)	n=1		
	3.9.1.1-7	Dis OPA	Duration: 500 hours at 20 °C (At room temperature)	n=1		
	3.9.1.1-8	Gigasept FF (new)	Duration: 500 hours at 20 °C or 336 hours at 31 °C Submersion Level : Past the strain relief	n=1		
	3.9.1.1-9	Disinfectant : Trophon EPR	Total Cycle: 4,000 cycles	n=1		
	3.9.1.1-10	RESERT OX HLD	Duration: 168 hours at 30 °C (At room temperature)	n=1		
	3.9.1.1-11	Metrricide	Temperature : Room temperature (approx. 20 °C) Total Cycle : 20 cycles Soaking Time : 1 hour per one cycle	n=1		
	3.9.1.1-12	Dis OPA	Temperature : Room temperature (approx. 20 °C) Total Cycle : 20 cycles Soaking Time : 1 hour per one cycle	n=1		
	3.9.1.1-13	Gigasept FF (new)	Temperature : Room temperature (approx. 20 °C) Total Cycle : 20 cycles Soaking Time : 1 hour per one cycle	n=1		
	3.9.1.1-14	RESERT OX HLD	Temperature : Room temperature (approx. 20 °C) Total Cycle : 20 cycles Soaking Time : 1 hour per one cycle	n=1		
	3.9.2.1	Temperature Cycle	Temperature : -10 ~ 60°C Humidity : - Cycle : 20 Cycle Dwell time : 1 hour Ramp up time : - Ramp down Time : - Package : - Operation : -	n=3	Electrical characteristics Safety Appearance	1)No mechanical damage to the plastic housing such as cracking etc. 2)Average value of sensitivity :difference before and after the test ±30%(+2.27dB/-3.09dB) 3)Hipot (4 000 V [AC rms] / 50 Hz 60 seconds) : ≤ 2 mA
	3.9.2.2	WHTOL (Wet High Temperature Operating life Test)	Temperature : 60°C Humidity : 90%RH Cycle : N/A Dwell time : 168 hour Ramp up time : 50 min Ramp down Time : 50min Package : Unpacked Operation : Operation	n=3		
	3.9.2.3	ISTA 2A	Test Sequence 1) Pre-Humidity 2) Compression 3) 1st Vibration 4) Drop 5) 2nd Vibration Package : Packed Operation : non-Operation	n=3		

2 Verification details

TVP Tag	TPRS Tag	Specification	Test Definition	Sample Size	Verification Method	Criterion
11.0.1	3.9.2.4	RDT (Reliability Demonstration Test)	The Transducer population shall have a Reliability of at least 80% @ 80% Confidence Interval over 1,200 hours of operation @ 25 °C ambient	n=1	Electrical characteristics Safety Appearance	1)No mechanical damage to the plastic housing such as cracking etc. 2)Average value of sensitivity :difference before and after the test $\pm 30\%$ (+ 2.27dB/- 3.09dB) 3)Hipot (4 000 V [AC rms] / 50 Hz 60 seconds) : ≤ 2 mA
	3.9.2.5	4HT (High Heat High Humidity Test)	Temperature : 60°C Humidity : 95%RH Cycle : N/A Dwell time : 250 hour Ramp up time : 50 min Ramp down Time : 50min Package : Unpacked Operation : Non-Operation	n=3		
	3.9.2.6	OTHC (Operating Temperature & Humidity Cycle)	Temperature : +20 ~ +40°C Humidity : 15 ~ 80% RH Cycle : 10 cycle Dwell time : 1 hour Ramp up time : 50 min Ramp down time : 50 min Package : Unpacked Operation : Operation	n=3		
	3.9.2.7	STHC (Storage Temperature & Humidity Cycle)	Temperature: -40 ~ +60°C and then +10 to +60°C → -10 ~ +60°C and then +10 to +60°C Humidity: 10 % RH / 95 % RH Number of Cycles: Minimum of 4 cycles at each set of below Conditions* Dwell time: 1 hour Ramp up time: 50 min Ramp down time: 50 min Packaged: Packed Operation: Non-operating * conditions: (A) 10°C to 60°C at 95% RH & (B) -40°C to 60°C at 10% RH	n=3		
	3.9.2.8	Atmospheric Pressure	Up to 10,000 ft : Operating 10,000~36,000 ft : Non-Operating Package : Unpacked Operation : Operation and Non-Operation	n=3	Safety Appearance	No mechanical damage to the plastic housing such as cracking etc. Hipot (4 000 V [AC rms] / 50 Hz 60 seconds) : ≤ 2 mA
	3.9.2.9	Drop Test	Height : 1.22 m Drop : 9 drops(3 drops on of 3 main orientations) Package : Unpacked Operation : Non-Operation	n=3	Safety	Hipot (4 000 V [AC rms] / 50 Hz 60 seconds) : ≤ 2 mA
	3.9.2.10	Vibration	Vibration : Random 5 Hz : 0.012 G ² /Hz 50 Hz : 0.012 G ² /Hz 100 Hz : 0.0006 G ² /Hz Horizontal : 27 minutes, Vertical : 54 minutes	n=3	Safety Appearance	No mechanical damage to the plastic housing such as cracking etc. Average value of sensitivity :difference before and after the test $\pm 30\%$ (+ 2.27dB/-3.09dB) Hipot (4 000 V [AC rms] / 50 Hz 60 seconds) : ≤ 2 mA
	3.9.2.11	Transducer Assembly Reliability and Noise Test (Cable Bending)	Sample level : Transducer Angle : 90° in the initial direction, then 180° in the opposite direction, and then returning 90° to the starting position.(Clockwise and counterclockwise) Centerline of the transducer : 75mm from the point where the transducer strain relief ends on the cable Cycle rate : 20cycles / min. Weight load : 450g Weight location : weight shall be applied the end of the transducer Dwell cycle : 250 k cycles Package : Unpacked Operation : Non-operation Sample size : 3ea	n=3	Image	Evaluation with ultrasonic diagnostic system : There should be no missing images like black lines in the image in the air.

3 Criterion

Items		Measurement Condition	specification	Criterion
Electrical characteristics	Sensitivity	All elements	Average : -60.0±2.5dB Deviation : (max-min)5.6dB Max.	Average value of sensitivity : difference before and after the test ±30%(+2.2dB/-3.0dB)
	Hipot	All channels	AC4KV,cutoff current 2mA,1minite	≤2mA
Safety	Leakage Current	All channels	264V(AC)/60Hz ≤50μA	≤50μA
Appearance	Appearance	Appearance	Window,Housing, bush,Cable	Mechanical damage to the plastic housing such as cracking etc. No oil leaks.

4 Result

TVP Tag	TPRS Tag	Sample name	Verification Date	Used Equipment	Test Engineer	Result
11.0.1	3.9.1.1-1	ES1-07	Feb.25, 2022	Withstanding voltage tester : KIKUSUI TOS8650 Tester : sanwa PC7000/PC720M	K. Misuo	Pass
						Test omitted because it has the same composition as 3.9.1.1-1
	3.9.1.1-2					
	3.9.1.1-3	ES1-08	Feb.25, 2022		K. Misuo	Pass
	3.9.1.1-4	ES1-09	Feb.25, 2022		K. Misuo	Pass
	3.9.1.1-5	ES1-07	Mar.8, 2022		K. Misuo	Pass
	3.9.1.1-6	ES1-08	Mar.25, 2022		K. Misuo	Pass
	3.9.1.1-7	ES1-09	Mar.25, 2022		K. Misuo	Pass
	3.9.1.1-8	21-002	Jun.23, 2022	According to Siemens Report Technical report_NDK 9VC2, 9VE4 Transducer disinfection compatibility test.		Pass
	3.9.1.1-9	ES1-15	-	UnderTest		-
	3.9.1.1-10	ES1-07	Mar.16, 2022	Withstanding voltage tester : KIKUSUI TOS8650 Tester : sanwa PC7000/PC720M	K. Misuo	Pass
	3.9.1.1-11	ES1-07	Mar.31, 2022		K. Misuo	Pass
	3.9.1.1-12	ES1-08	Mar.31, 2022		K. Misuo	Pass
	3.9.1.1-13	ES1-14	-	Testing at Siemens		-
	3.9.1.1-14	ES1-09	Mar.31, 2022	Withstanding voltage tester : KIKUSUI TOS8650 Tester : sanwa PC7000/PC720M	K. Misuo	Pass
	3.9.2.1	ES1-01 ES1-02 ES1-03	Feb.21, 2022	Temperature Cycle chamber : ESPEC TSE-11-A Chamber : ESPEC SH-641	K. Misuo	Pass
		ES1-04 ES1-05 ES1-06		Pulsar : OLYMPUS 5800PR Digital oscilloscope : Tektronix DPO3032	K. Misuo	Pass
	3.9.2.2	ES1-01 ES1-02 ES1-03	Apr.2, 2022	Withstanding voltage tester : KIKUSUI TOS8650 Tester : sanwa PC7000/PC720M	K. Misuo	Pass
		ES1-10		Testing at Siemens		-
	3.9.2.5	ES1-01 ES1-02 ES1-03	Apr.22, 2022	Temperature Cycle chamber : ESPEC TSE-11-A Chamber : ESPEC SH-641	K. Misuo	Pass
		ES1-04 ES1-05 ES1-06		Pulsar : OLYMPUS 5800PR Digital oscilloscope : Tektronix DPO3032	K. Misuo	Pass
	3.9.2.7	ES1-07 ES1-08 ES1-09	May.23, 2022	Withstanding voltage tester : KIKUSUI TOS8650 Tester : sanwa PC7000/PC720M	K. Misuo	Pass
		22-002 22-007		According to Siemens Report SGS-R22-0871-EN00		Pass
	3.9.2.9	ES1-01 ES1-02 ES1-03	May.18.2022	Withstanding voltage tester : KIKUSUI TOS8650	K. Misuo	Pass
				Accoding to the result of 3.9.2.3		Pass
	3.9.2.10			Testing at Siemens		-
	3.9.2.11	ES1-11	-	Testing at Siemens		-

No abnormality under the above conditions for the items for which the test was completed.

4 Conclusion

Items that have completed the test have passed the criteria.
Items under test will be reported after the test is completed.

separate sheet1. 3.9.1.1-1 Sani-Cloth AF3
separate sheet2. 3.9.1.1-3 SuperSani-Cloth
separate sheet3. 3.9.1.1-4 Enzol
separate sheet4. 3.9.1.1-5 Transeptic
separate sheet5. 3.9.1.1-6 Metrricide
separate sheet6. 3.9.1.1-7 Dis OPA
separate sheet7. 3.9.1.1-10 RESERT OX HLD
separate sheet8. 3.9.1.1-11 Metrricide
separate sheet9. 3.9.1.1-12 Dis OPA
separate sheet10. 3.9.1.1-14 RESERT OX HLD
separate sheet11. 3.9.2.1 Temperature Cycle
separate sheet12. 3.9.2.2 WHTOL(Wet High Temperature Operating life Test)
separate sheet13. 3.9.2.3 ISTA 2A
separate sheet14. 3.9.2.5 4HT(High Heat High Humidity Test)
separate sheet15. 3.9.2.6 OTHC(Operating Temperature & Humidity Cycle)
separate sheet16. 3.9.2.7 STHC(Storage Temperature & Humidity Cycle)
separate sheet17. 3.9.2.9 Drop Test

TVP Tag 11.0.1
TPRS Tag 3.9.1.1-1

Confidential

Separate sheet 1

Specification Sani-Cloth AF3

Method Wrap the Sani-Cloth AF3 around the probe and leave it for 168 hours.
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment
Hipot	Pass
Leakage Current	15.70 μ A Pass
Appearance	Pass

Appearance



TVP Tag 11.0.1
TPRS Tag 3.9.1.1-3
Specification Super Sani-Cloth

Confidential

Separate sheet 2

Method Wrap the Super Sani-Cloth around the probe and leave it for 168 hours.
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment
Hipot	Pass
Leakage Current	15.10 μ A Pass
Appearance	Pass

Appearance



TVP Tag 11.0.1
TPRS Tag 3.9.1.1-4
Specification Enzol

Confidential

Separate sheet 3

Method Immerse the probe in Enzol and leave it for 168 hours,
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment
Hipot	Pass
Leakage Current	16.00 μ A Pass
Appearance	Pass

Appearance



Method Immerse the probe in Transeptic and leave it for 168 hours.
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment
Hipot	Pass
Leakage Current	15.80 μ A Pass
Appearance	Pass

Appearance



TVP Tag 11.0.1
TPRS Tag 3.9.1.1-6
Specification Metrricide

Confidential

Separate sheet 5

Method Immerse the probe in Metrricide and leave it for 336 hours.
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment
Hipot	Pass
Leakage Current	16.30 μ A Pass
Appearance	Pass

Appearance



TVP Tag 11.0.1
TPRS Tag 3.9.1.1-7
Specification Dis OPA

Confidential

Separate sheet 6

Method Immerse the probe in Dis OPA and leave it for 500 hours.
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



結果

Items	Results and judgment
Hipot	Pass
Leakage Current	16.90 μ A Pass
Appearance	Pass

Appearance



Specification RESERT OX HLD

Method Immerse the probe in RESERT OX HLD and leave it for 168 hours.
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment
Hipot	Pass
Leakage Current	16.30 μ A Pass
Appearance	Pass

Appearance



Method Immerse the probe in Mettricide and perform immersion 1h-5min / 20 cycles.
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment
Hipot	Pass
Leakage Current	16.40 μ A Pass
Appearance	Pass

Appearance



Method Immerse the probe in Dis OPA and perform immersion 1h-5min / 20cycles.
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment
Hipot	Pass
Leakage Current	14.90 μ A Pass
Appearance	Pass

Appearance



Specification RESERT OX HLD

Method Immerse the probe in RESERT OX HLD and perform immersion 1h-5min / 20cycles.
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment
Hipot	Pass
Leakage Current	15.70 μ A Pass
Appearance	Pass

Appearance



TVP Tag 11.0.1
TPRS Tag 3.9.2.1

Confidential

Separate sheet 11

Specification Temperature Cycle

Method -10°C/60°C、1h each、40cycles

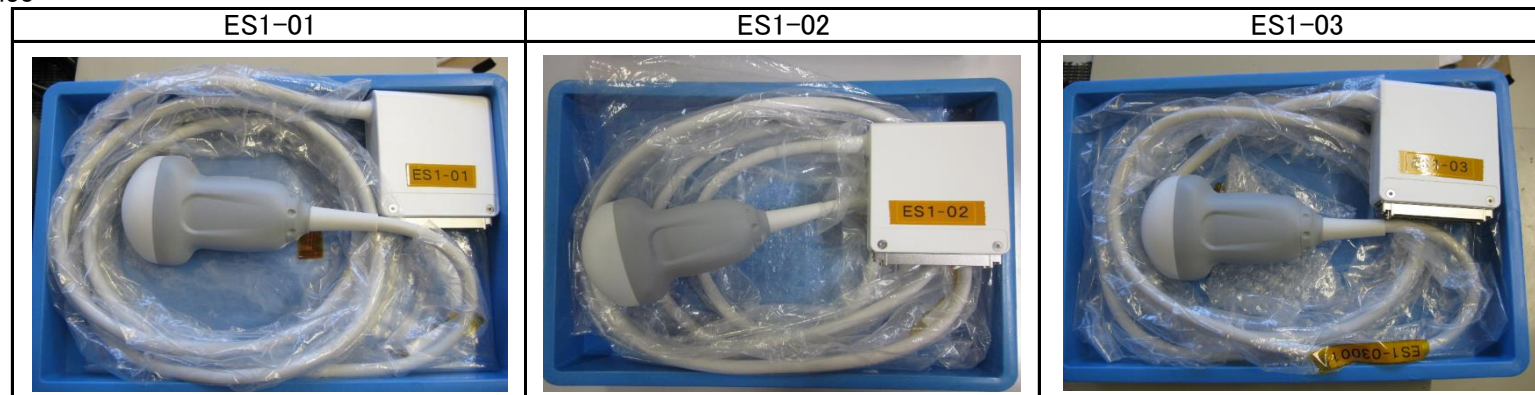
After that, check the Electrical characteristics, Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TSE-11-A	161000912	Nov.2022
5800PR	40081305	Jun.2022
DPO3032	C010119	Mar.2023
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023

Result

Items	Results and judgment		
	ES1-01	ES1-02	ES1-03
Electrical characteristics	Pass	Pass	Pass
Hipot	Pass	Pass	Pass
Leakage Current	15.00 μ A Pass	15.10 μ A Pass	15.70 μ A Pass
Appearance	Pass	Pass	Pass

Appearance



TVP Tag 11.0.1
TPRS Tag 3.9.2.2

Confidential

Separate sheet 12

Specification WHTOL(Wet High Temperature Operating life Test)

Method Temperature : +60°C

Humidity : 90%

Cycle :-

Dwell time : 168 hours (10080min)

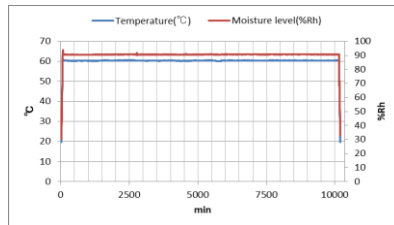
Ramp up time : 50min

Ramp down Time : 50min

Package : Unpacked、Operation : Operation

After that, check the Electrical characteristics, Hipot, Leakage current and Appearance.

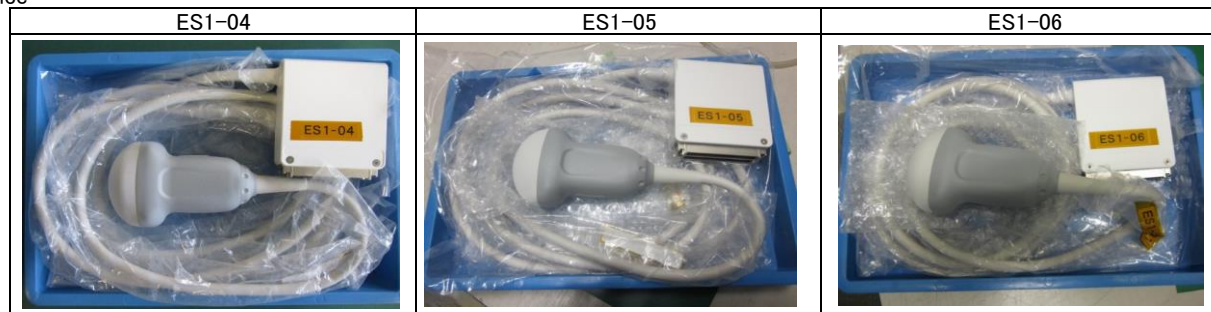
Used Equipment	Serial No.	Calibration Period
SH-641	92014497	Jun.2022
5800PR	40081305	Jun.2022
DPO3032	C010119	Mar.2023
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment		
	ES1-04	ES1-05	ES1-06
Electrical characteristics	Pass	Pass	Pass
Hipot	Pass	Pass	Pass
Leakage Current	14.30 μ A	16.10 μ A	15.50 μ A
Appearance	Pass	Pass	Pass

Appearance



TVP Tag 11.0.1
TPRS Tag 3.9.2.3
Specification ISTA 2A

Confidential

Separate sheet 13

Method 1)Pre-Humidity
2)Compression
3)1st Vibration
4)Drop
5)2nd Vibration

Package : Packed、Operation : non-Operation

After that, check the Electrical characteristics, Hipot, Leakage current and Appearance.

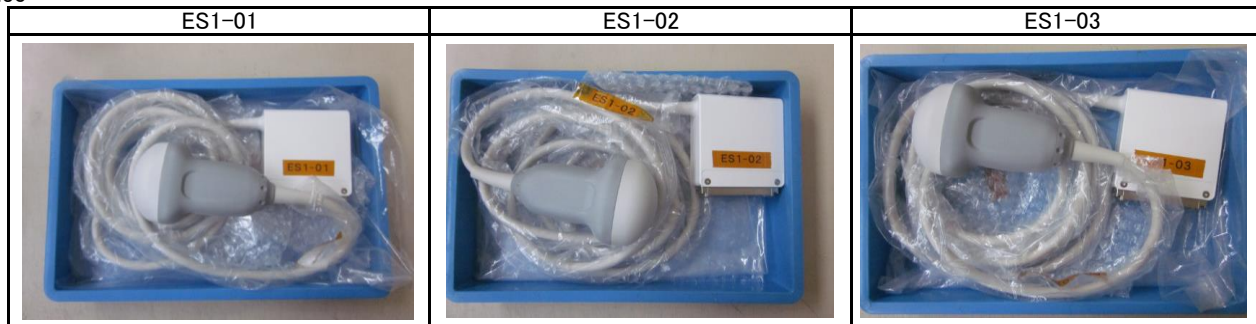
Used Equipment	Serial No.	Calibration Period
5800PR	40081305	Jun.2022
DPO3032	C010119	Mar.2023
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment		
	ES1-01	ES1-02	ES1-03
Electrical characteristics	Pass	Pass	Pass
Hipot	Pass	Pass	Pass
Leakage Current	15.30 μ A	15.30 μ A	15.40 μ A
Appearance	Pass	Pass	Pass

Appearance



TVP Tag 11.0.1
TPRS Tag 3.9.2.5

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Separate sheet 14

Specification 4HT(High Heat High Humidity Test)

Method Temperature : +60°C

Humidity : 95%

Cycle : -

Dwell time : 250h

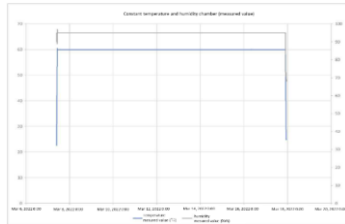
Ramp up time : 50min

Ramp down Time : 50min

Package : Unpacked, Operation : Non-Operation

After that, check the Electrical characteristics, Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
5800PR	40081305	Jun.2022
DPO3032	C010119	Mar.2023
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment		
	ES1-01	ES1-02	ES1-03
Electrical characteristics	Pass	Pass	Pass
Hipot	Pass	Pass	Pass
Leakage Current	15.10 μ A Pass	15.40 μ A Pass	15.40 μ A Pass
Appearance	Pass	Pass	Pass

Appearance



TVP Tag 11.0.1
TPRS Tag 3.9.2.6

Confidential

Separate sheet 15

Specification OTHC(Operating Temperature & Humidity Cycle)

Method Temperature : +20~+40°C

Humidity : 10~80%

Cycle : 10 cycle

Dwell time : 1h

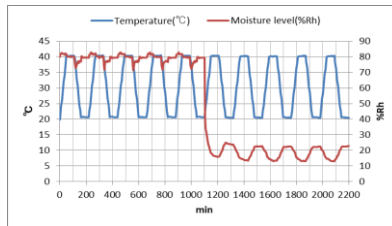
Ramp up time : 50min

Ramp down time : 50min

Package : Unpacked, Operation : Operation

After that, check the Electrical characteristics, Hipot, Leakage current and Appearance.

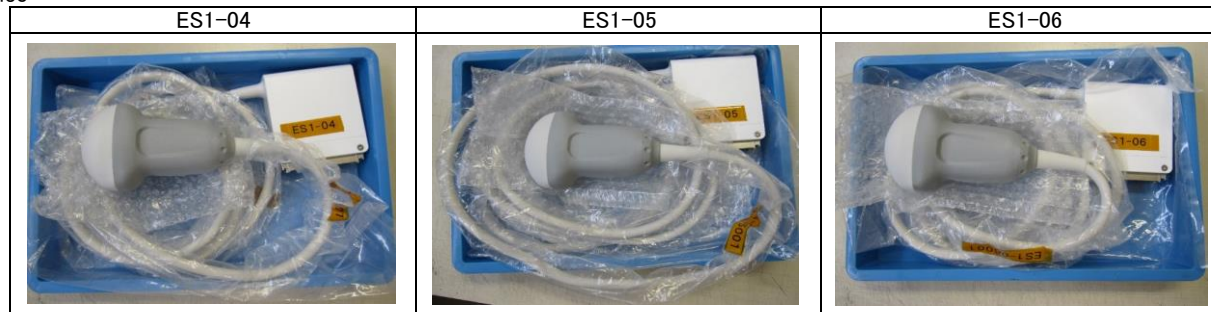
Used Equipment	Serial No.	Calibration Period
SH-641	92014497	Jun.2022
5800PR	40081305	Jun.2022
DPO3032	C010119	Mar.2023
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment		
	ES1-04	ES1-05	ES1-06
Electrical characteristics	Pass	Pass	Pass
Hipot	Pass	Pass	Pass
Leakage Current	14.10 μ A Pass	15.00 μ A Pass	15.10 μ A Pass
Appearance	Pass	Pass	Pass

Appearance



TVP Tag 11.0.1
TPRS Tag 3.9.2.7

Confidential

Separate sheet 16

Specification STHC(Storage Temperature & Humidity Cycle)

Method Temperature: -10°C to $+60^{\circ}\text{C}$ and then $+10^{\circ}\text{C}$ to $+60^{\circ}\text{C}$

Humidity: 10%/95%

Number of Cycles: Minimum of 4 cycles at each set of below Conditions

(A) $+10^{\circ}\text{C}$ to $+60^{\circ}\text{C}$ at 95% RH &

(B) -10°C to $+60^{\circ}\text{C}$ at 10% RH

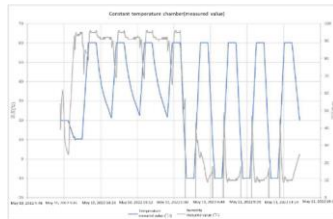
Dwell time: 1h

Ramp up time: 50min, Ramp down time: 50min

Packaged: Packed, Operation: Non-operating

After that, check the Electrical characteristics, Hipot, Leakage current, Appearance.

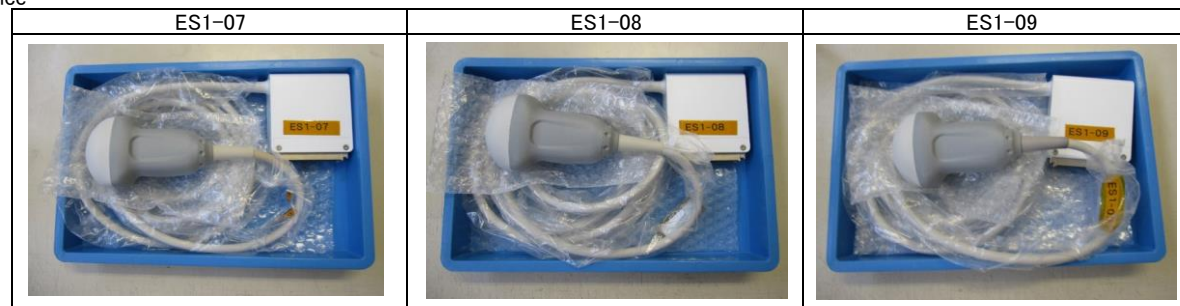
Used Equipment	Serial No.	Calibration Period
5800PR	40081305	Jun.2022
DPO3032	C010119	Mar.2023
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023



Result

Items	Results and judgment		
	ES1-07	ES1-08	ES1-09
Electrical characteristics	Pass	Pass	Pass
Hipot	Pass	Pass	Pass
Leakage Current	16.60 μA	15.10 μA	15.10 μA
Appearance	Pass	Pass	Pass

Appearance



TVP Tag 11.0.1

Verification Tag 3.9.2.9

Specification Drop Test

Method Height : 1.22 m
Drop : 9 drops(3 drops on of 3 main orientations)
Package : Unpacked
Operation : Non-Operation
After that, check the Hipot, Leakage current and Appearance.

Used Equipment	Serial No.	Calibration Period
TOS8650	12262118	Dec.2022
PC7000/PC720M	20025100350	Mar.2023

Temperature and humidity at the time of test

Temperature	Humidity
25.1°C	38.4%

Drop direction1



Drop direction2






Drop direction3



Result

Items	Result and judgement		
	ES1-01	ES1-02	ES1-03
Hipot	Pass	Pass	Pass
Leakage Current	15.30 μ A	15.10 μ A	15.70 μ A
Appearance	Pass	Pass	Pass

Appearance

ES1-01	ES1-02	ES1-03
		

Confidential

Separate sheet 17