

Prüfbericht-Nr.: <i>Test Report No.:</i>	50073102 001	Auftrags-Nr.: <i>Order No.:</i>	133049686	Seite 1 von 10 Page 1 of 10	
Kunden Referenz-Nr.: <i>Client Reference No.:</i>	637031	Auftragsdatum: <i>Order date:</i>	27-02-2017		
Auftraggeber: <i>Client:</i>	SoluM B-dong 3, 150, Maeyeong-ro, Yeongtong-gu 16674 Suwon-Si, Gyeonggi-do Rep. of Korea		Kyungah Cho +82-10-5295-0549 kacho@solu-m.com		
Prüfgegenstand: <i>Test item:</i>	SoluM LoRa Module				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	TLT04CS5				
Auftrags-Inhalt: <i>Order content:</i>	Test of Conformance to LoRaWAN™ Specification V1.0.1				
Prüfgrundlage: <i>Test specification:</i>	LoRa End Device Certification EU Version1.2				
Wareneingangsdatum: <i>Date of receipt:</i>	27-02-2017				
Prüfmuster-Nr.: <i>Test sample No.:</i>	001				
Prüfzeitraum: <i>Testing period:</i>	27-02-2017~28-02-2017				
Ort der Prüfung: <i>Place of testing:</i>	Seoul, Rep. of Korea				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Korea Ltd.				
Prüfergebnis: <i>Test results:</i>	PASS				
Geprüft von <i>Tested by:</i>	Jinah KIM / Engineer				
28-02-2017		28-02-2017			
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>
Sontiges / Other: -					
<p>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark</i></p>					

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Revisions Revisions			
Revision Revision	Datum Date	Anmerkung Remark	Verfasser Author

Note: Latest revision report will replace all previous reports

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1 PRODUCT INFORMATION

The device under test (DUT) is a wireless SoluM LoRa Module for LoRaWAN Certification testing

General information	
Product name:	SoluM LoRa Module
Model:	TLT04CS5
Description:	LoRa Alliance LoRaWAN compliance testing
Manufacturer SKU	-
Hardware version:	0.1
Software version:	1.2.0
Contact person:	Kyungah Cho
Phone number:	+82-10-5295-0549

LoRaWAN information	
Type of DUT	End Device
LoRa Device Class	A
Geographical area of operation	Europe
Operating frequency	868 MHz
Adaptive Data Rate (ADR) supported?	Yes
Optional data rates supported?	Not supported
Activation possibilities	Both Over the air and by personalization
Test According LoRaWAN™ Spec	v1.01
Output Power	Up to 14dBm
Number / Type of Antenna(s)	1
Antenna Gain	-
Test sample information	production unit

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For OTA activation:	
Serial No of Device with OTAA	CS3 6C09A(TLT04CS5)
End-device identifier (DevEUI)	BE7A0100000008A2
Application identifier (AppEUI)	0807060504030201
Application key (AppKey)	5FD4B41652A195BEA5C7D2E71EDA764F
For activation by personalization:	
Serial No of Device with ABP	CS3 6C09A(TLT04CS5)
End-device identifier (DevAddr)	A8891F72
Application identifier (AppSKey)	4993DD82BA49DB17306206297D6D61AF
Application key (NwkSKey)	05125B739814696B985F56267D238598
Default RX2 Window Frequency	869.525MHz
Default RX2 Window Data Rate	DR0 (SF12, 125kHz)
RECEIVE_DELAY1	1 s
RECEIVE_DELAY2	2 s (must be RECEIVE_DELAY1 + 1s)
JOIN_ACCEPT_DELAY1	5 s
JOIN_ACCEPT_DELAY2	6 s
MAX_FCNT_GAP	16384
ADR_ACK_LIMIT	63
ADR_ACK_DELAY	32
ACK_TIMEOUT	2 +/- 1 s (random delay between 1 and 3 seconds)

Submitted Documents:

LoRa Certification Customer Questionnaire document.
LoRa Test Environment log files.

Remarks:

All test cases are tested with Activation by Personalization (ABP) mode, else explicitly Over the Air (OTA) to be tested.

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2 TEST EQUIPMENT

Prüfmittel <i>Test equipment</i>	Marke <i>Brand</i>	Version <i>Version</i>
Comprehensive Testing Environment (CTE)	4ffCom AG	CTE - TMF V44.0 CTE - SIG - LoRaWAN V1.3
Semtech Development Kit (Semtech Gateway) for EU 863-870 Band	Semtech	SX1301-based concentrator reference design >=GW_V_3.1.0
Semtech Development Kit (Semtech Packet Forwarder) for EU 863-870 Band	Semtech	>= PF_V_2.2.0

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3 SUMMARY

Verdicts of functional requirements:	Verdict
Test Mode Activation (Activation by Personalization)	PASS
Test Mode Activation (Over the Air Activation)	PASS
Test Application Functionality	PASS
Packet Error Rate RX2 SF12	PASS
Cryptography	PASS
Downlink Window Timing	PASS
Frame Sequence Number	PASS
Device Status Request	PASS
Mac Commands	PASS
New Channel Request	PASS
Confirmed packets	PASS
RX Parameter Setup Request	PASS
RX Timing Setup Request	PASS
Link ADR Request	PASS
Packet Error Rate RX1 Window	PASS
Packet Error Rate RX2 Window	PASS

Supported optional features:	YES / No
Adaptive Data Rate (ADR)	YES
SF7BW250	No
FSK	No

Overall Test Result: PASS

4 TEST CASE VERIDCTS AS PER TEST SPECIFICATIONS

Test results per test case:

Test item	Description	Implementation	Result
EU863-870 1.0	Device Activation (Activation by Personalization)	Mandatory	PASS
EU863-870 1.0	Device Activation (Over the Air Activation)	Mandatory	PASS*
EU863-870 2.0	Test application functionality	Mandatory	PASS
EU863-870 3.0	Over the air Activation	Mandatory	PASS
EU863-870 4.0	Packet Error Rate Part 1	Mandatory	PASS
EU863-870 5.a.	AES encryption	Mandatory	PASS
EU863-870 5.b.	MIC	Mandatory	PASS
EU863-870 6.0	Downlink window timing	Mandatory	PASS
EU863-870 7.a.	Uplink sequence number	Mandatory	PASS
EU863-870 7.b.	Downlink sequence number	Mandatory	PASS
EU863-870 8.0	DevStatusReq MAC command	Mandatory	PASS
EU863-870 9.0.	MAC Commands	Mandatory	PASS
EU863-870 10.a.	Read-only default channels	Mandatory	PASS
EU863-870 10.b.	Addition and removal of multiple channels	Mandatory	PASS
EU863-870 10.c. & 10.d.	Addition and removal of a single channel	Mandatory	PASS
EU863-870 11.a.	Uplink confirmed packets	Mandatory	PASS
EU863-870 11.b.	Uplink retransmission	Mandatory	PASS
EU863-870 11.c.	Downlink confirmed packets	Mandatory	PASS
EU863-870 11.d.	Downlink retransmission	Mandatory	PASS
EU863-870 12.0	RXParamSetupReq MAC command	Mandatory	PASS
EU863-870 13.0	RXTimingSetupReq MAC command	Mandatory	PASS
EU863-870 14.a.	ADR bit	Optional	PASS
EU863-870 14.b.	TXPower	Optional	PASS
EU863-870 14.c.	Required DataRates	Optional	PASS
EU863-870 14.d.	Optional DataRates	Optional	N/A
EU863-870 14.e.	ChannelMask	Optional	PASS
EU863-870 14.f	Redundancy	Optional	PASS
EU863-870 14.g.	ADRACKReq bit	Optional	PASS
EU863-870 15.0	Packet Error Rate RX1	Optional	PASS
EU863-870 16.0	Packet Error Rate RX2	Optional	PASS

PASS*: Same sample was configured to Over the Air activation mode and particular test case was retested.

5 TEST RESULTS

Detailed test results (ABP):

Test item	Test Case Name	DataRate/ Timing	Limit	Results	Verdict
EU863-870 4.0	Packet Error Rate Part 1 (RX2)	SF12BW125	5%	0%	PASS
EU863-870 6.0	Downlink window timing	-20us	-	-	PASS
		+20us	-	-	PASS
EU863-870 15.0	Packet Error Rate RX1	SF12BW125	5%	0%	PASS
		SF11BW125	5%	3.33%	PASS
		SF10BW125	5%	5%	PASS
		SF9BW125	5%	1.66%	PASS
		SF8BW125	5%	1.66%	PASS
		SF7BW125	5%	1.66%	PASS
EU863-870 16.0	Packet Error Rate RX2	SF11BW125	5%	0%	PASS
		SF10BW125	5%	0%	PASS
		SF9BW125	5%	0%	PASS
		SF8BW125	5%	0%	PASS
		SF7BW125	5%	0%	PASS

6 PHOTO DOCUMENTATION



Photo 1: EUT front view

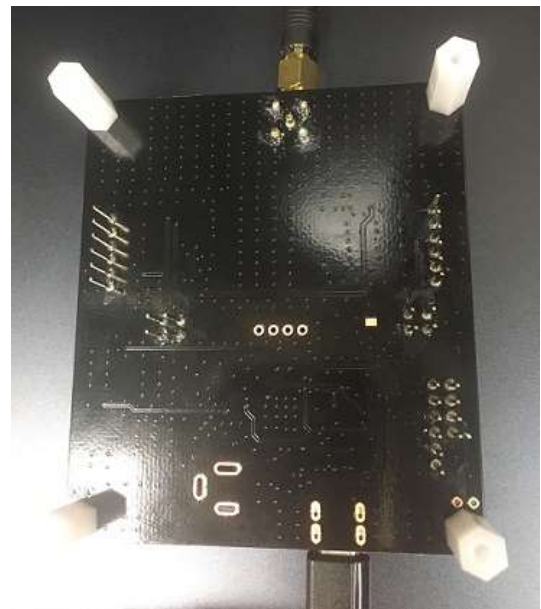


Photo 2: EUT rear view



Photo 3: Radio module top view



Photo 4: Radio module bottom view