

Prüfbericht - Nr.: 14049595 001		Seite 1 von 16 Page 1 of 16	
<i>Test Report No.:</i>			
Auftraggeber: <i>Client:</i>	TRONICO TECHNOLOGY COMPANY LIMITED Unit 213, 2/F., IC development Centre, No. 6, Science Park West Avenue, Hong Kong Science Park, Shatin, N.T.		
Gegenstand der Prüfung: <i>Test Item:</i>	Z-Wave Repeater		
Bezeichnung: <i>Identification:</i>	Please refer to "Models" on page 4	Serien-Nr.: <i>Serial No.:</i>	Engineering sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	A000560989 (001-002)	Eingangsdatum: <i>Date of Receipt:</i>	07.06.2017
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of test item at delivery:</i>	Test samples are not damaged and suitable for testing.		
Prüfört: <i>Testing Location:</i>	TÜV Rheinland Hong Kong Ltd. 3/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong Global United Technology Services Co., Ltd. 2nd Floor, Block No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, China		
Prüfgrundlage: <i>Test Specification:</i>	FCC Part 15 Subpart B FCC Part 15 Subpart C RSS-210 Issue 9 RSS-Gen Issue 4 RSS-102 Issue 5 ANSI C63.10-2013 ANSI C63.4-2014		
Prüfergebnis: <i>Test Results:</i>	Das vorstehend beschriebene Gerät wurde geprüft und entspricht oben genannter Prüfgrundlage. The above mentioned product was tested and passed .		
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland Hong Kong Ltd. 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong		
geprüft/ tested by:		kontrolliert/ reviewed by:	
12.07.2017	Joey Leung Project Manager	12.07.2017	Benny Lau Senior Project Manager
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>
	Unterschrift <i>Signature</i>		Unterschrift <i>Signature</i>
Sonstiges: Other Aspects		FCC ID: 2ADPENNG001 IC: 12524A-NNG001	
Abkürzungen:	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations:	P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested
<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.</p> <p><i>This test report 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 safety mark on this or similar products.</i></p>			

Table of Content

	Page
Cover Page	1
Table of Content	2
Product information.....	4
Manufacturers declarations	4
Product function and intended use	4
Submitted documents.....	4
Independent Operation Modes	4
Related Submittal(s) Grants	4
Remark	4
Test Set-up and Operation Mode.....	5
Principle of Configuration Selection	5
Test Operation and Test Software	5
Special Accessories and Auxiliary Equipment.....	5
Countermeasures to achieve EMC Compliance.....	5
Test Methodology	6
Radiated Emission	6
Field Strength Calculation.....	6
Test Setup Diagram	7
List of Test and Measurement Instruments.....	8
Measurement Uncertainty	9
Results FCC Part 15 – Subpart C, RSS-Gen Issue 4, RSS-210 Issue 9	10
FCC 15.203 – Antenna Requirement 1.....	Pass 10
FCC 15.204 – Antenna Requirement 2.....	Pass 10
RSS-Gen 6.3 – External Control.....	Pass 10
RSS-Gen 8.3 – Antenna Requirement	Pass 10
FCC 15.207 / RSS-Gen 8.8 – Conducted Emission on AC Mains.....	Pass 11
FCC 15.215 (c) – 20 dB Bandwidth	Pass 12
RSS-Gen 6.6 – Occupied Bandwidth.....	Pass 12
FCC 15.249 (a) / RSS-210 B.10 (a) – Field Strength of Fundamental and Harmonics.....	Pass 13
FCC 15.249 (d), 15.205 / RSS-210 B.10 (b) – Out Of Band Radiated Emission	Pass 14

Results FCC Part 15 – Subpart B, RSS-Gen Issue 4.....	15
FCC 15.107 / RSS-Gen 8.8 – Conducted Emission on AC Mains.....	Pass 15
FCC 15.109 / RSS-Gen 7.1 – Spurious Radiated Emissions	Pass 16
Appendix 1 – Test protocols	5 pages
Appendix 2 – Test setup	4 pages
Appendix 3 – EUT External Photos	3 pages
Appendix 4 – EUT Internal Photos	4 pages
Appendix 5 – RF exposure information.....	2 pages

Product information

Manufacturers declarations

	Transceiver
Operating frequency range	908.42MHz
Type of modulation	GFSK
Number of channels	1
Type of antenna	Integral
Power level	fix
Connection to public utility power line	No
Nominal voltage	V _{nom} : 120VAC

Product function and intended use

The equipment under test (EUT) is a Z-wave transceiver operating at 908.42MHz. It is powered by 120 VAC.

FCC ID: 2ADPENNG001 / IC: 12524A-NNG001

Models	Product description
F-BW8141US, ZRP-110NA, REZ1201, F-BW8142US, ZRP-120NA, REZ1301	Z-Wave Repeater

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
User manual
Label

Independent Operation Modes

The basic operation mode is:

- Z-wave communication link maintained with data transfer.

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the transmitter.
The receiving portion is authorized under the verification procedure.

Remark

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- There was no special software to exercise the device.

Special Accessories and Auxiliary Equipment

- None

Countermeasures to achieve EMC Compliance

- None

Test Methodology

Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013. The radiated emission measurements of the receiver part were performed according to the procedures in ANSI C63.4-2014.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

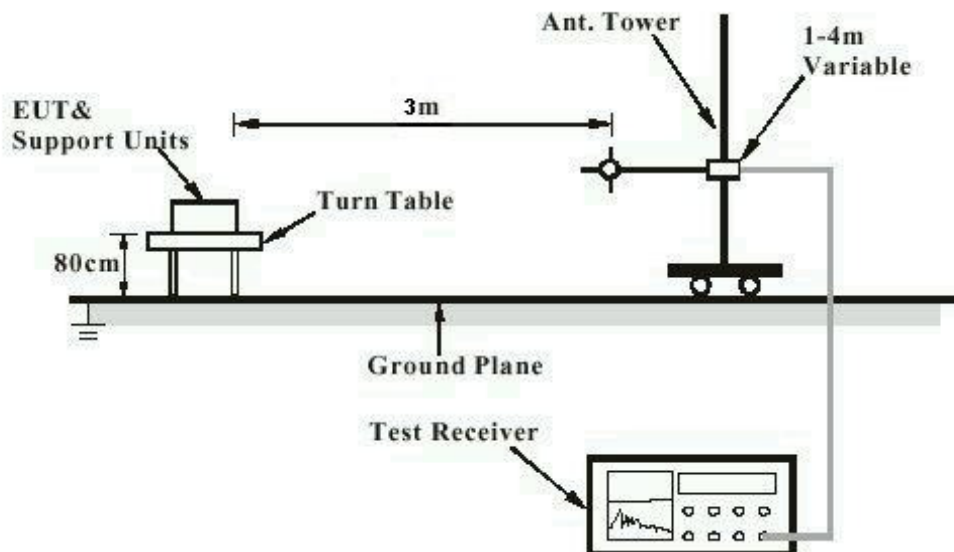
$$FS = R + AF + CF + FA - PA$$

Where FS = Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

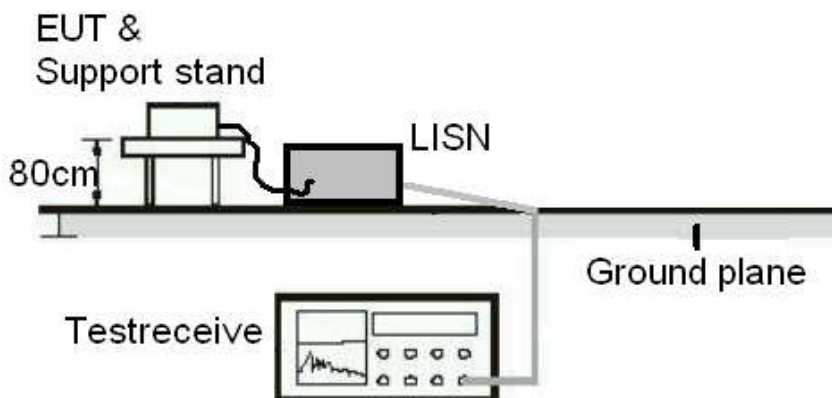
Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)



List of Test and Measurement Instruments

Global United Technology Services Co., Ltd. (FCC / IC Registration number: 600491 / 9079A-2)

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
3m Semi- Anechoic Chamber	ZhongYu Electron	9.0(L)*6.0(W)*6.0(H)	03 Jul 2017	03 Jul 2018
Control Room	ZhongYu Electron	6.2(L)*2.5(W)*2.4(H)	N/A	N/A
ESU EMI Test Receiver	R&S	ESU26	26 Jun 2017	25 Jun 2018
Loop Antenna	Zhinan	ZN30900A	26 Jun 2017	25 Jun 2018
BiConiLog Antenna	SCHWARZBECK	VULB9163	26 Jun 2017	25 Jun 2018
Double-ridged horn antenna	SCHWARZBECK	9120D	26 Jun 2017	25 Jun 2018
Horn Antenna	ETS-LINDGREN	3160-09	26 Jun 2017	25 Jun 2018
RF Amplifier	HP	8347A	26 Jun 2017	25 Jun 2018
RF Amplifier	HP	8349B	26 Jun 2017	25 Jun 2018
Broadband Preamplifier	SCHWARZBECK	BBV9718	26 Jun 2017	25 Jun 2018
EMI Test Software	AUDIX	E3	N/A	N/A
Coaxial cable	GTS	N/A	N/A	N/A
Coaxial Cable	GTS	N/A	N/A	N/A
Thermo meter	N/A	N/A	26 Jun 2017	25 Jun 2018

AC Mains Conducted Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	16 May 2017	15 May 2019
EMI Test Receiver	R&S	ESCI 7	26 Jun 2017	25 Jun 2018
Pulse Limiter	R&S	ESH3-Z2	26 Jun 2017	25 Jun 2018
Coaxial Switch	ANRITSU CORP	MP59B	26 Jun 2017	25 Jun 2018
Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	26 Jun 2017	25 Jun 2018
Coaxial Cable	GTS	N/A	N/A	N/A
EMI Test Software	AUDIX	E3	N/A	N/A
Thermo meter	KTJ	TA328	26 Jun 2017	25 Jun 2018

TÜV Rheinland Hong Kong Ltd

Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	16 Oct 2016	15 Oct 2017

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is $\pm 2.96\text{dB}$.

The estimated combined standard uncertainty for radiated emissions measurements is $\pm 3.70\text{dB}$ (9kHz to 30MHz) and $\pm 4.64\text{dB}$ (30MHz to 1000MHz) and $\pm 4.83\text{dB}$ (1GHz to 18GHz) and $\pm 5.20\text{dB}$ (18GHz to 25GHz).

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of $k=2$, which for the level of confidence is approximately 95%.

Results FCC Part 15 – Subpart C, RSS-Gen Issue 4, RSS-210 Issue 9

FCC 15.203 – Antenna Requirement 1		Pass
FCC Requirement: No antenna other than that furnished by the responsible party shall be used with the device		
Results:	a) Antenna type: Fixed Integral antenna b) Manufacturer and model no: N/A c) Peak Gain: N/A	
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2		Pass
FCC Requirement: An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.		
Results:	Only one integral antenna can be used.	
Verdict:	Pass	

RSS-Gen 6.3 – External Control		Pass
IC Requirement: The device shall not have any external controls accessible to the user that enable it to be adjusted, selected or programmed to operate in violation of the limits prescribed in the applicable RSS.		
Results:	The device does not have any transmitter external controls accessible to the user that can be adjusted and operated in violation of the limits of this standard.	
Verdict:	Pass	

RSS-Gen 8.3 – Antenna Requirement		Pass
IC Requirement: When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer.		
Results:	a) Antenna type: Fixed Integral antenna b) Manufacturer: N/A c) model no: N/A d) Gain with reference to an isotropic radiator: 0 dBi	
Verdict:	Pass	

FCC 15.207 / RSS-Gen 8.8 – Conducted Emission on AC Mains						Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : AC Mains input port of power supply Detector : Quasi-peak and Average Supply voltage : 120VAC 60Hz Temperature : 23°C Humidity : 50%						
Requirement: 15.207(a)						
Results: Pass						
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak (dBμV)	Average (dBμV)	Limit QP (dBμV)	Limit AV (dBμV)	Verdict
0.15 – 0.5	0.197	54.20	32.20	63.76	53.76	Pass
	0.249	53.95	31.95	61.78	51.78	Pass
	0.289	51.04	33.04	60.54	50.54	Pass
> 0.5 – 5	No peak found	---	---	56.00	46.00	Pass
> 5 – 30	No peak found	---	---	60.00	50.00	Pass
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak (dBμV)	Average (dBμV)	Limit QP (dBμV)	Limit AV (dBμV)	Verdict
0.15 – 0.5	0.197	57.00	27.00	63.76	53.76	Pass
	0.252	55.61	27.61	61.69	51.69	Pass
	0.296	54.18	25.18	60.37	50.37	Pass
> 0.5 – 5	No peak found	---	---	56.00	46.00	Pass
> 5 – 30	No peak found	---	---	60.00	50.00	Pass
Results: The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1.						

FCC 15.215 (c) – 20 dB Bandwidth				Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : TX mode Port of testing : Enclosure RBW/VBW : 3kHz / 10kHz Supply voltage : 120VAC Temperature : 23°C Humidity : 50%				
Requirement: The intentional radiators must be designed to ensure that the 20dB bandwidth of the emission, is contained within the frequency band designated in the rule section under which the equipment is operated.				
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. For test protocols refer to Appendix 1.				
Frequency (MHz)	20 dB left (MHz)	Limit (MHz)	20 dB right (MHz)	Limit (MHz)
908.420	908.379	> 902.000	908.467	< 928.000

RSS-Gen 6.6 – Occupied Bandwidth				Pass
Test Specification : RSS-Gen Mode of operation : TX mode Port of testing : Temporary antenna port Detector : Peak Supply voltage : 120VAC Temperature : 23°C Humidity : 50%				
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types. For test protocols refer to Appendix 1.				
Frequency (MHz)	Left (MHz)	Right (MHz)	99% bandwidth (MHz)	
908.420	908.328	908.536	0.208	

FCC 15.249 (a) / RSS-210 B.10 (a) – Field Strength of Fundamental and Harmonics			Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz RBW/VBW : 120 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Supply voltage : 120VAC Temperature : 23°C Humidity : 50%			
Requirement:			The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following limit.
Fundamental Frequency		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
908.420	92.79	94.0 / QP	
Fundamental Frequency		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
908.400	93.34	94.0 / QP	
Harmonics		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
1816.580	46.46	74.0 / PK	
2725.600	31.88	74.0 / PK	
Harmonics		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
1816.470	42.03	74.0 / PK	
2725.410	32.76	74.0 / PK	

FCC 15.249 (d), 15.205 / RSS-210 B.10 (b) – Out Of Band Radiated Emission		Pass
Test Specification : ANSI C63.10 – 2013 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz RBW/VBW : 120 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Supply voltage : 120VAC Temperature : 23°C Humidity : 50%		
Requirement: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.		
Results: Transmitting mode comply with the field strength limit of section 15.209. There is no spurious found below 30MHz.		
Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
50.764	20.24	40.0 / QP
102.011	17.66	43.5 / QP
155.910	19.80	43.5 / QP
243.377	21.62	46.0 / QP
902.000	31.48	46.0 / QP
928.000	31.75	46.0 / QP
Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
145.861	15.93	43.5 / QP
195.137	20.32	43.5 / QP
243.377	22.81	46.0 / QP
267.546	22.34	46.0 / QP
902.000	31.64	46.0 / QP
928.000	32.30	46.0 / QP

Results FCC Part 15 – Subpart B, RSS-Gen Issue 4

FCC 15.107 / RSS-Gen 8.8 – Conducted Emission on AC Mains						Pass
Test Specification : ANSI C63.4 – 2003 Mode of operation : RX mode Port of testing : AC Mains input port Detector : Quasi-peak and Average Supply voltage : 120VAC 60Hz Temperature : 23°C Humidity : 50%						
Requirement: 15.107(a)						
Results: Pass						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak (dBµV)	Average (dBµV)	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0.15 – 0.5	0.200	54.84	33.03	63.62	53.62	Pass
	0.256	52.76	31.31	61.56	51.56	Pass
	0.389	46.46	27.28	58.08	48.08	Pass
> 0.5 – 5	No peak found	---	---	56.00	46.00	Pass
> 5 – 30	No peak found	---	---	60.00	50.00	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak (dBµV)	Average (dBµV)	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0.15 – 0.5	0.202	53.98	30.13	63.54	53.54	Pass
	0.253	53.35	29.93	61.64	51.64	Pass
	0.348	46.73	25.97	49.00	49.00	Pass
> 0.5 – 5	No peak found	---	---	56.00	46.00	Pass
> 5 – 30	No peak found	---	---	60.00	50.00	Pass
Results: The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1.						

FCC 15.109 / RSS-Gen 7.1 – Spurious Radiated Emissions		Pass
Test Specification : ANSI C63.4 - 2003 Mode of operation : RX mode Port of testing : Enclosure Detector : Peak RBW/VBW : 120 kHz for f < 1 GHz 1 MHz / 3 MHz for f > 1 GHz Supply voltage : 120VAC Temperature : 23°C Humidity : 50%		
Requirement: 15.109(a)		
Results: Pass		
Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
51.481	10.27	40.0 / QP
201.393	9.72	43.5 / QP
299.316	13.34	46.0 / QP
1544.000	32.14	74.0 / PK
3184.000	35.51	74.0 / PK
4852.000	38.42	74.0 / PK
Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
99.180	8.45	43.5 / QP
210.048	9.96	43.5 / QP
294.114	11.25	46.0 / QP
1364.000	32.40	74.0 / PK
2696.000	34.95	74.0 / PK
4352.000	38.47	74.0 / PK