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Top Secret ☐ Secret ■ Unclassified ☐	Bluce ZHANG	Harris HE	2017-10-27

AG35-CE
Reliability Test Report

LTE Module Series

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Date: 2017-10-27

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1 Introduction

The document provides reliability test results of Quectel AG35-CE module.

2 Test Equipment and Tested Model

Table 1: Test Equipment

Index	Manufacturer	Description	Model
1	KSON	Temperature humidity test chamber	KTHA
2	ESPEC	Temperature humidity test chamber	SETH-A
3	R&S	Wideband radio communication tester	CMW500
4	Keysight	Power supply	E3640A
5	Agilent	Wireless communications tester	8960
6	Lite point	Wideband radio communication tester	IQxstrem
7	Whirltone	Micro-drop tester	WH-2018R
8	Whirltone	Tumbling Barrel tester	WH-2105
9	KSON	Shock Chamber	KSON KTCB-3TBS

Figure 1: Pictures of Tested Model

3 Test Period

Table 2: Test Period

Start Time	End Time	Tester
2017-8-10	2017-10-17	Reuben BAO&Emily CHU&Roger ZHAO

4 Test Results

Table 3: Test Results

No.	Test Item	Qty.	Test Result	Standard
1	High Temperature Performance	4	PASS	3GPP Test Specification
2	Low Temperature Performance	4	PASS	3GPP Test Specification
3	High Temperature Function	4	PASS	IEC 60068-2-2 Test Bb
4	Low Temperature Function	4	PASS	IEC 60068-2-1 Test Ab
5	High Temperature Storage	10	PASS	IEC 60068-2-2 Test Bb
6	Low Temperature Storage	10	PASS	IEC 60068-2-1 Test Ab
7	Humidity	5	PASS	IEC 60068-2-3
8	Moist Heat Cycling	5	PASS	IEC 60068-2-30 Db
9	Temperature Cycling	5	PASS	IEC 60068-2-14 Nb
10	High Temperature Operation	5	PASS	IEC 60068-2-2 Test Bb
11	Thermal Shock	3	PASS	IEC 60068-2-14
12	Sinusoidal Vibration	3	PASS	IEC 60068-2-6
13	Random Vibration	3	PASS	IEC 60068-2-64
14	Mechanical Shock	3	PASS	IEC 60068-2-27
15	Bump	3	PASS	IEC 60068-2-32
16	Free Fall	3	PASS	IEC 60068-2-32
17	Tumbling	3	PASS	IEC 60068-2-32
18	Micro-drop	3	PASS	IEC 60068-2-32

5 Test Items and Conditions

5.1. High Temperature Performance

Table 4: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-2, Bb	Tmax= +85°C	Reuben	2017.08.14	5 days	YES

5.1.1. GSM Test Report

Table 5: GSM Test Results

Band	Channel	PCL	Transmit Performance					Result
			Power (dBm)	PE (Deg)	FE (Hz)	PVT	Modulation& Switching	
GSM 900	1	5	32.6	0.9	39.9	OK	OK	PASS
	62		32.7	1.3	48.8	OK	OK	
	124		32.6	0.9	37.3	OK	OK	
DCS 1800	512	0	29.6	1.6	42.5	OK	OK	PASS
	698		29.2	1.6	54.3	OK	OK	
	885		28.8	1.7	46.2	OK	OK	

5.1.2. WCDMA Test Report

Table 6: WCDMA Test Results

Band	Channel	Transmit Performance						Result
		Power (dBm)	EVM (%)	PE (Deg)	FE (Hz)	PCDE (dB)	ACLR	
WB1	9612	23.5	3.56	1.75	1.41	-44.19	OK	PASS
	9750	23.46	3.37	1.56	1.7	-44.6	OK	PASS
	9888	23.48	3.17	1.49	0.78	-45.83	OK	PASS
WB8	2712	22.61	3.25	1.20	0.6	-47.66	OK	PASS
	2787	22.68	2.54	1.20	0.56	-48.22	OK	PASS
	2863	22.5	4.11	1.62	0.32	-45.24	OK	PASS

5.1.3. TD-SCDMA Test Report

Table 7: TD-SCDMA Test Results

Band	Channel	TD-SCDMA Transmit Performance						Result
		Power (dBm)	EVM (%)	FE (Hz)	PCDE (dB)	SEM	ACLR	
A	10054	23.35	6.55	33.6	-35.74	OK	OK	PASS
	10087	23.35	5.76	17.3	-35.65	OK	OK	PASS
	10121	23.53	4.23	17.7	-35.67	OK	OK	PASS
F	9404	23.33	4.23	6.54	-35.67	OK	OK	PASS
	9500	23.43	6.24	8.16	-32.37	OK	OK	PASS
	9596	23.20	6.27	8.58	-32.16	OK	OK	PASS

5.1.4. CDMA Test Report

Table 8: CDMA Test Results

Band	Channel	CDMA BC0 Transmit Performance				Result
		Max Power (dBm)	Min Power (dBm)	FE (Hz)	TE (μs)	
BC0	283	24.68	-58.75	0.29	0.12	PASS
	384	24.05	-59.11	1.75	0.17	PASS
	777	24.32	-59.58	1.54	0.23	PASS
	1013	24.38	-58.26	1.43	0.13	PASS

5.1.5. LTE Test Report

Table 9: LTE Test Results

Band	Band Width	Channel	LTE Transmit Performance					Result
			Power (dBm)	FE (Hz)	EVM (%)	SEM	ACLR	
1	10M	18050	21.65	2.23	2.76	OK	OK	PASS
		18300	21.74	3.03	2.04	OK	OK	PASS
		18550	21.58	3.60	1.59	OK	OK	PASS
3	10M	19250	22.61	1.02	1.60	OK	OK	PASS
		19575	22.39	2.36	2.38	OK	OK	PASS
		19900	22.45	2.32	1.69	OK	OK	PASS
5	10M	20450	22.01	1.10	1.57	OK	OK	PASS
		20525	21.92	0.21	1.52	OK	OK	PASS
		20600	21.83	0.73	1.43	OK	OK	PASS
8	10M	21500	21.97	0.14	2.38	OK	OK	PASS
		21625	21.86	0.93	1.58	OK	OK	PASS
		21750	21.95	0.60	3.18	OK	OK	PASS

		36250	23.87	2.49	7.44	OK	OK	PASS
34	10M	36275	23.78	5.56	5.83	OK	OK	PASS
		36300	23.88	1.40	6.42	OK	OK	PASS
		37800	23.15	0.94	3.81	OK	OK	PASS
38	10M	38000	23.22	1.53	3.56	OK	OK	PASS
		38200	23.19	15.9	3.97	OK	OK	PASS
		38300	24.21	1.03	1.87	OK	OK	PASS
39	10M	38450	24.13	2.85	2.07	OK	OK	PASS
		38600	24.02	1.79	1.54	OK	OK	PASS
		38700	21.14	2.88	3.94	OK	OK	PASS
40	10M	39150	21.27	2.40	3.15	OK	OK	PASS
		39600	21.47	1.34	3.91	OK	OK	PASS
		40290	22.95	4.32	3.73	OK	OK	PASS
41	10M	40740	22.92	2.35	3.96	OK	OK	PASS
		41190	22.84	2.16	3.62	OK	OK	PASS

5.2. Low Temperature Performance

Table 10: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-1, Ab	Tmin= –40°C	Reuben	2017.08.21	5 days	YES

5.2.1. GSM Test Report

Table 11: GSM Test Results

Band	Channel	PCL	Transmit Performance					Result
			Power (dBm)	PE (Deg)	FE (Hz)	PVT	Modulation& Switching	
GSM 900	1	5	32.9	0.5	13.7	OK	OK	PASS
	62		33	0.7	20.2	OK	OK	
	124		32.9	0.4	11.5	OK	OK	
DCS 1800	512	0	30.8	0.6	5.4	OK	OK	PASS
	698		30.3	0.5	5.0	OK	OK	
	885		30.0	0.6	5.6	OK	OK	

5.2.2. WCDMA Test Report

Table 12: WCDMA Test Results

Band	Channel	Transmit Performance						Result
		Power (dBm)	EVM (%)	PE (Deg)	FE (Hz)	PCDE (dB)	ACLR	
WB1	9612	22.47	3.08	1.32	18.3	-43.99	OK	PASS
	9750	22.26	3.39	1.48	1.57	-42.64	OK	PASS
	9888	22.35	2.93	1.34	16.9	-45.83	OK	PASS
WB8	2712	22.54	4.36	1.40	4.55	-44.95	OK	PASS
	2787	22.62	2.41	0.95	0.58	-49.91	OK	PASS
	2863	22.53	2.81	1.01	5.11	-48.15	OK	PASS

5.2.3. TD-SCDMA Test Report

Table 13: TD-SCDMA Test Results

Band	Channel	TD-SCDMA Transmit Performance						Result
		Power (dBm)	EVM (%)	FE (Hz)	PCDE (dB)	SEM	ACLR	
A	10054	23.84	5.46	0.40	-39.26	OK	OK	PASS
	10087	23.84	2.16	8.32	-38.69	OK	OK	PASS
	10121	23.71	3.15	0.51	-39.33	OK	OK	PASS
F	9404	23.86	2.34	2.40	-38.43	OK	OK	PASS
	9500	23.96	5.37	3.01	-33.23	OK	OK	PASS
	9596	23.65	5.38	14.9	-32.57	OK	OK	PASS

5.2.4. CDMA Test Report

Table 14: CDMA Test Results

Band	Channel	CDMA BC0 Transmit Performance				Result
		Max Power (dBm)	Min Power (dBm)	FE (Hz)	TE (μs)	
BC0	283	23.68	-62.18	2.34	0.04	PASS
	384	24.08	-62.49	5.65	0.23	PASS
	777	23.96	-62.22	8.02	0.06	PASS
	1013	23.46	-62.03	11.6	0.10	PASS

5.2.5. LTE Test Report

Table 15: LTE Test Results

Band	Band Width	Channel	LTE Transmit Performance					Result
			Power (dBm)	FE (Hz)	EVM (%)	SEM	ACLR	
1	10M	18050	21.38	4.01	2.32	OK	OK	PASS
		18300	22.17	1.34	1.98	OK	OK	PASS
		18550	21.56	1.13	2.18	OK	OK	PASS
3	10M	19250	21.98	3.39	1.57	OK	OK	PASS
		19575	22.03	1.63	1.33	OK	OK	PASS
		19900	21.95	1.99	1.25	OK	OK	PASS
5	10M	20450	21.46	2.15	1.12	OK	OK	PASS
		20525	21.66	2.07	1.13	OK	OK	PASS
		20600	21.58	1.12	1.98	OK	OK	PASS
8	10M	21500	21.97	0.21	2.38	OK	OK	PASS
		21625	21.85	0.57	2.05	OK	OK	PASS
		21750	21.87	1.86	2.25	OK	OK	PASS
34	10M	36250	23.31	2.54	2.65	OK	OK	PASS
		36275	23.17	1.12	2.44	OK	OK	PASS
		36300	23.41	1.23	1.26	OK	OK	PASS
38	10M	37800	22.28	4.72	7.24	OK	OK	PASS
		38000	22.66	5.81	7.61	OK	OK	PASS
		38200	22.49	1.62	7.30	OK	OK	PASS
39	10M	38300	22.97	1.12	4.93	OK	OK	PASS
		38450	22.90	4.03	5.06	OK	OK	PASS
		38600	22.95	2.03	4.85	OK	OK	PASS

40	10M	38700	20.96	6.14	5.61	OK	OK	PASS
		39150	21.15	2.53	6.13	OK	OK	PASS
		39600	21.21	3.43	5.56	OK	OK	PASS
41	10M	40290	22.49	0.20	6.91	OK	OK	PASS
		40740	22.55	0.74	7.37	OK	OK	PASS
		41190	22.75	2.33	7.09	OK	OK	PASS

5.3. High Temperature Function

Table 16: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-2, Bb	Tmax= +85°C	Reuben	2017.08.19	1 day	YES

Table 17: Test Results

Test Item	Description	Test Result
Network registration	Successfully registered on the network	PASS
Network connection	Connected to the network and can last for a long time without disconnection.	PASS
Power	3GPP compliant	PASS
Handover test	Handover smoothly without disconnection	PASS
Slow clock	Log out from slow clock mode successfully	PASS

5.4. Low Temperature Function

Table 18: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-1, Ab	Tmin= –40°C	Reuben	2017.08.26	1 day	YES

Table 19: Test Results

Test Item	Description	Test Result
Network registration	Successfully registered on the network	PASS
Network connection	Connected to the network and can last for a long time without disconnection.	PASS
Power	3GPP compliant	PASS
Handover test	Handover smoothly without disconnection	PASS
Slow clock	Log out from slow clock mode successfully	PASS

5.5. High Temperature Storage

Table 20: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-2, Bb	Tmax= +90°C	Reuben	2017.08.14	72 hours	No

Table 21: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation or component dropping.	PASS
Function	The module can register and connect to the network after return to normal temperature.	PASS
RF performance	When the temperature returns to the normal operating temperature levels, the RF indexes meet 3GPP specifications.	PASS
Power consumption	The current is normal under normal working conditions.	PASS

5.6. Low Temperature Storage

Table 22: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-1, Ab	Tmin= –45°C	Reuben	2017.08.14	72 hours	No

Table 23: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation or component dropping.	PASS
Function	The module can register and connect to the network after return to normal temperature.	PASS
RF performance	When the temperature returns to the normal operating temperature levels, the RF indexes meet 3GPP specifications.	PASS
Power consumption	The current is normal under normal working conditions.	PASS

5.7. Humidity

Table 24: Test Conditions

Standard	T(°C)&RH	Tester	Start Time	Duration	Monitoring
IEC 60068-2-3	65℃&95%RH	Roger	2017.08.21	10 days	Yes

Table 25: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation or component dropping.	PASS
Function	The module can register and connect to the network after return to normal temperature.	PASS
RF performance	When the temperature returns to the normal operating temperature levels, the RF indexes meet 3GPP specifications.	PASS
Power consumption	The current is normal under normal working conditions.	PASS

5.8. Moist Heat Cycling

Table 26: Test Conditions

Standard	T(°C)&RH	Tester	Start Time	Duration	Monitoring
IEC 60068-2-30,Db	Various	Roger	2017.08.22	21 days	No

Table 27: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation or component dropping.	PASS
Function	The module can register and connect to the network after return to normal temperature.	PASS
RF performance	When the temperature returns to the normal operating temperature levels, the RF indexes meet 3GPP specifications.	PASS
Power consumption	The current is normal under normal working conditions.	PASS

5.9. Temperature Cycling

Table 28: Test Conditions

Standard	T(°C)&RH	Tester	Start Time	Duration	Monitoring
IEC 60068-2-14,Nb	Various	Reuben	2017.09.15	30 cycles	Yes

Table 29: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation or component dropping.	PASS
Function	The module can register and connect to the network after return to normal temperature.	PASS
RF performance	When the temperature returns to the normal operating temperature levels, the RF indexes meet 3GPP specifications.	PASS
Power consumption	The current is normal under normal working conditions.	PASS

5.10. High Temperature Operation

Table 30: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-2,Bb	+85°C	Roger	2017.08.13	60 days	Yes

Table 31: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation or component dropping.	PASS
Function	The module can register and connect to the network after return to normal temperature.	PASS
RF performance	When the temperature returns to the normal operating temperature levels, the RF indexes meet 3GPP specifications.	PASS
Power consumption	The current is normal under normal working conditions.	PASS

5.11. Thermal Shock

Table 32: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-14	-40°C/+85°C	Emily	2017.08.29	500cycles	No

Table 33: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation and no obvious solder crack.	PASS
Function	The module can register and connect to the network after return to normal temperature.	PASS
RF performance	When the temperature returns to the normal operating temperature levels, the RF indexes meet 3GPP specifications.	PASS

5.12. Sinusoidal Vibration

Table 34: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-6	25℃	Emily	2017.08.29	6 Hours	No

Table 35: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation and no obvious solder crack.	PASS
Function	The module can register on and connect to the network.	PASS
RF performance	The RF indexes meet 3GPP specifications.	PASS
Dye pry	1. Dye pry type 1, 2, 3, 4, type A, B, C, D inspection. 2. Report type A, B, C, D failure. Normally only type A failure <25% dye-penetration is allowed.	PASS

5.13. Random Vibration

Table 36: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-64	25℃	Emily	2017.08.29	3 Hours	NO

Table 37: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation and no obvious solder crack.	PASS
Function	The module can register on and connect to the network.	PASS
RF performance	The RF indexes meet 3GPP specifications.	PASS

Dye pry	1. Dye pry type 1, 2, 3, 4, type A, B, C, D inspection. 2. Report type A, B, C, D failure. Normally only type A failure <25% dye-penetration is allowed.	PASS

5.14. Mechanical Shock

Table 38: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-27	25℃	Emily	2017.08.29	18Times	No

Table 39: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation and no obvious solder crack.	PASS
Function	The module can register on and connect to the network.	PASS
RF performance	The RF indexes meet 3GPP specifications.	PASS
Cross section	1. Line cut. 2. No delamination. 3. Allowable crack length: Max. 25% of pad diameter. 4. No crack on PP. 5. Void <25%. 6. IMC thickness > 1um. 7. No solder mask peel-off.	PASS

5.15. Bump

Table 40: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-32	25℃	Emily	2017.08.29	6000Times	No

Table 41: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation and no obvious solder crack.	PASS
Function	The module can register on and connect to the network.	PASS
RF performance	The RF indexes meet 3GPP specifications.	PASS
Dye pry	1. Dye pry type 1, 2, 3, 4, type A, B, C, D inspection. 2. Report type A, B, C, D failure. Normally only type A failure <25% dye-penetration is allowed.	PASS

5.16. Free Fall

Table 42: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-32	25℃	Emily	2017.08.29	18 Times	No

Table 43: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation and no obvious solder crack.	PASS
Function	The module can register on and connect to the network.	PASS
RF Performance	The RF indexes meet 3GPP specifications.	PASS
Dye pry	1. Dye pry type 1, 2, 3, 4, type A, B, C, D inspection. 2. Report type A, B, C, D failure. Normally only type A failure <25% dye-penetration is allowed.	PASS

5.17. Tumbling

Table 44: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-32	25℃	Emily	2017.08.29	100cycles	No

Table 45: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation and no obvious solder crack.	PASS
Function	The module can register on and connect to the network.	PASS
RF performance	The RF indexes meet 3GPP specifications.	PASS

5.18. Micro-drop

Table 46: Test Conditions

Standard	T°C	Tester	Start Time	Duration	Monitoring
IEC 60068-2-32	25℃	Emily	2017.08.29	10000 Times	No

Table 47: Test Results

Test Item	Description	Test Result
Visual inspection	No deformation and no obvious solder crack.	PASS
Function	The module can register on and connect to the network.	PASS
RF performance	The RF indexes meet 3GPP specifications.	PASS

6 Appendix A Reference

Table 48: Terms and Abbreviations

Abbreviation	Description
ACLR	Adjacent Channel Leakage Ratio
EVM	Error Vector Magnitude
FE	Frequency Error
PCDE	Peak Code Domain Error
PCL	Power Control Level
PE	Phase Error
PVT	Power Versus Time
RF	Radio Frequency
SEM	Spectrum Emission Mask
TE	Time Error