

# AH314-G/AH315-G QUALIFICATION REPORT

## I. SUMMARY

The AH314-G and AH315-G are new WiMax amplifier designs utilizing the standard qualified WJ 5V HBT process. The WJ 5V HBT process was qualified using the highest current and power density part designed into the process flow (AH312-S8G).

The AH314-G and AH315-G dies operate at slightly lower current and power densities than the AH312-S8G die. The die layout meets all Design Rules for the 5V HBT process. The AH312-S8G has successfully passed HTOL and HAST testing. Based on this, the AH314-G/AH315-G HTOL and HAST stress tests are qualified by similarity.

The AH314-G/AH315-G use a 5x5 mm 20pin QFN "green" package, which uses a molding compound and epoxy combination that has been qualified using the 6x6mm 40pin QFN "green" package (Test Vehicle A). The qualification was based on Temperature Cycling and MSL results. An additional MSL test was done on the AH314-G to confirm the results. The mold compound has also been qualified on the 4x4 16pin QFN (ECP050D-G). The AH314-G/AH315-G uses the same assembly subcontractor and plating as the 6x6mm 28pin QFN CV210-1F. Thus, the solderability is qualified by similarity.

Parameters monitored for the qualification tests were supply current, gain and IP3. Failures are defined as any variation of 10% or less for supply current, 1 dB or less for gain and 3dB or less for IP3 as compared to the initial pre-stressed testing.

## II. SCOPE

This report summarizes the reliability qualification of the AH314-G and AH315-G. The reliability data are obtained through the performance of the specified accelerated stress tests described in this document.

## III. APPLICABLE DOCUMENTS

All the test procedures and test methods are consistent with industry standards. The standards referenced in this document are JEDEC standard 22.



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## VI. PACKAGE QUALIFICATION TESTS

Stress or Test	Procedures/Conditions	Device Hours/ Cycles	Sample Size	Failed Units	Reference Document	Part Tested
Preconditioning Level 2 Lead Free	External visual 40x Temperature Cycle, -40 to 60°C, 5 cycles, High Temp. Storage Life 24 hrs @+125°C, Temp. & Humidity Test 168 hrs. @ +85°C/ 60% RH Convection Solder Reflow test 3 cycles, peak temperature 260°C	N/A	3 lots, a total of 500 parts	0	JESD22-A113E JESD22-A101-B JESD22-B101A JESD22-A103C J-STD-020C	AH312-S8G
Temperature Cycle	Test Condition B Temp. -55°C (+0°/-10°C) to +125°C (+10°/-0°C), Dwell time = 10 to 15 min.	1000 cycles	3 lots, a total of 135 parts	0	JESD22-A104-C	AH312-S8G
	Test Condition C Temp. -65°C (+0°/-10°C) to +150°C (+10°/-0°C), Dwell time = 15 min.	500 cycles	2 lots, a total of 90 parts	0		Test Vehicle A
Unbiased High Temperature Storage (HTB)	Temp. 150°C (+ 5°C, -0°C)	1000 hours	1 lot, a total of 45 parts	0	JESD22-A103-C	AH312-S8G
Unbiased Autoclave	Test Condition C Temp. 121°C (+/-1°C) Pressure = 15 +/-1psig Relative Humidity = 100%	96 (-1, +5) hours	3 lots, a total of 135 parts	0	JESD22-A102-C	AH312-S8G
			350 parts	0		ECP050D-G
Highly-Accelerated Temperature and Humidity Stress Test (HAST)	Test Condition A Temp. 130°C (+/- 2°C) Pressure = 33.3 +/-1psia Relative Humidity = 85%	96 (-0, +2) hours	3 lots, a total of 135 parts	0	JESD22-A110-B	AH312-S8G
Moisture/Reflow Sensitivity (MSL) MSL level 2 lead free	Electrical test, External Visual C-SAM Die, Paddle and leads Dry Bake 125°C, 24 hours 85°C/60 RH, 168 hours Convection reflow 260°C, 3X External Visual, Electrical test C-SAM Die, Paddle and leads	N/A	3 lot, a total of 405 parts	0	J-STD-20C & JESD47F	AH312-S8G
			1 lot, 111 parts	0	J-STD-20C & JESD47F	AH314-G
High Temp Op Life (HTOL)	Test Condition B Temp. 125°C (+5, -0°C)	1,000 (- 0, +10) hours	3 lots, a total of 135 parts	0	JESD22-A108C	AH312-S8G
ESD	Charged Device Model (CDM) Voltage Steps: 200, 500, 1000 Test Pulses: 5, Pulse Delay: 1 sec	N/A	1 lot, a total of 9 parts 3/voltage	0 failures through 1000 volts	JESD22-C101-A	AH314-G
ESD	Human Body Model (HBM) Voltage Steps: 250, 500, 1000, 2000 Test Pulses: 1 Pulse Delay: .5 sec	N/A	1 lot, a total of 84 parts 21/voltage	0 failures through 500 volts	JESD22-A114-B	AH314-G
Solderability Lead-Free solder	Lead-Free Solder: Sn96Ag4 Flux Type: R145 Solder Bath Requirements: 260°C	N/A	3 lots, a total of 30 parts, 840 pins	0	IPC/EIA/JEDEC J- STD-002B Method 2003)	CV210-1F



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## VII. DISCUSSION OF RESULTS

### 1. Testing procedures

The production test station was used for all of the testing. All of the qualification tests were performed using loose parts except HAST and HTOL, which were performed with parts mounted to a PCB. The PCB layout is the same as the application circuit published in the WJ Communications Data Sheet, including the recommended via pattern. The application circuit was duplicated 15 times on one large PCB for the qualification testing. A control board consisting of 15 devices was tested before and after HAST and HTOL tests, and 5 loose control units were tested before and after the other tests to ensure measurement accuracy and repeatability.

The Autoclave and HAST tests were performed at Viko Test Labs in Santa Clara California. The Temperature Cycling and HTOL test was performed at WJ Communications in San Jose California.

### 2. Pre-Conditioning

A total of 500 AH312-S8G devices completed pre-conditioning to MSL 2 with no electrical failures.

### 3. Temperature Cycle

AH312-S8G devices from three lots, 135 devices, completed 1000 temperature cycles with no failures. Test Vehicle A devices from two lots, 90 devices, completed 500 temperature cycles with no failures.

### 4. Unbiased Autoclave

AH312-S8G devices from three lots, 135 devices, completed Autoclave with no failures. ECP050D-G devices, 350 devices, completed Autoclave with no failures.

### 5. Highly Accelerated Temperature and Humidity (HAST)

AH312-S8G devices from three lots, 135 devices, completed HAST with no failures.

### 6. Moisture/Reflow Sensitivity Classification (MSL)

AH312-S8G devices from three lots, 405 devices, completed MSL 2 lead-free testing with no failures. AH314-G devices from one lot, 111 devices, completed MSL 2 lead-free testing with no failures.

### 7. High Temp Op Life (HTOL)

AH312-S8G devices from three lots, 135 devices, completed 1,000 hours of HTOL with no failures.

### 8. ESD Charge Device Model (CDM)

A total of 9 devices (3/voltage) passed the following CDM test voltages with no failures: 200, 500, 1000. The CDM rating is CLASS III.

### 9. ESD Human Body Model (HBM)

A total of 84 devices (21/voltage) passed the following HBM test voltages with no failures: 250, 500. The HBM rating is CLASS 1B.

### 10. Solderability

CV210-1F devices from three lots, a total of 30 parts, 840 pins completed Solderability with no failures.

## VI. CONCLUSIONS

The Reliability Qualification Data demonstrates that the AH314-G and AH315-G devices assembled in 5x 5mm 20pin QFN surface-mount package demonstrate high reliability and quality levels.



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