Test of Zebra Enterprise Solutions Corp. WLM54AG 802.11 b/g Wireless Module

To: FCC 47 CFR Part 15.247 & IC RSS-210

Test Report Serial No.: GBCC01-U2 Rev A



## **TEST REPORT**

From



Test of: Zebra Enterprise Solutions Corp. WLM54AG 802.11 b/g Wireless Module

To: FCC 47 CFR Part 15.247 & IC RSS-210

Test Report Serial No.: GBCC01-U2 Rev A

This report supersedes: None

Applicant:		Zebra Enterprise Solutions Corp 2940 N. First Street San Jose, CA 95134 USA		
Product Function:		802.11 b/g wireless module		
Сору No:	pdf	Issue Date:	9th December 2010	





Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 3 of 117

# TABLE OF CONTENTS

1	<b>ACC</b>	TESTING ACCREDITATION	<b>. 5</b>
	1.2		6
ſ			• •
2	TEO		.0
3	159		.9
4	KEF		10
	4.1	Test and Uncertainty Procedures	10
5	TEQ		11 12
5	IEJ		
6		DOUCT DETAILS AND TEST CONFIGURATIONS	14 14
	0.1 6.2		14
	6.3	Operational Power Range	16
	6.4	Types of Modulation Supported	16
	6.5	Antenna Details	16
	6.6	Cabling and I/O Ports	17
	6.7	EUT Configurations	17
	6.8	Equipment Details	18
	6.9	Test Configurations	18
	6.10	Dequipment Modifications	19
_	0.11		19
7	TES	T RESULTS	20
	7.1	6 dB and 99% Bandwidth	20
		7.1.1 0 0B and 99% Bandwidth Results: 802.11D	22
	72	Peak Output Power	20
	1.2	7.2.1 Measurement Results: 802.11 b	32
		7.2.2 Measurement Results: 802.11 g	33
	7.3	Peak Power Spectral Density	34
		7.3.1 Measurement results for 802.11 b	35
		7.3.2 Measurement results for 802.11 g	39
	7.4	Maximum Permissible Exposure	43
	1.5	Conducted Spurious	44
		7.5.1 Measurement Results for 802.11 b	40 52
	76	Radiated Spurious Emissions	52
	1.0	7.6.1 Measurement Results: Transmitter Radiated Spurious Emissions	64
		7.6.2 Measurement Results AIR-ANT1949: Transmitter Radiated Spurious	
		Emissions	65
		7.6.3 Measurement Results AIR-ANT1949: Band Edge	71
		7.6.4 Measurement Results AIR-ANT1949: Peak Emissions	75

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 4 of 117

	7.6.5	Measurement Results AIR-ANT2506: Transmitter Radiated Spuriou	IS
	Emissi	ons	81
	7.6.6	Measurement Results AIR-ANT2506: Band Edge	87
	7.6.7	Measurement Results AIR-ANT2506: Peak Emissions	91
	7.7 Receive	r Conducted Spurious Emissions	97
	7.8 Radiated	Spurious Emissions – Digital Apparatus	101
	7.8.1	Measurement Results for Radiated Spurious Emissions – Digital	
	Appara	atus	107
	7.9 Conduct	ed Disturbance at Mains Terminal (150 kHz – 30 MHz)	109
	Test not appl	icable - EUT Tested in host device Zebra Enterprise Solutions Corp.	
	WhereLAN III	LOCATION SENSOR	109
8	PHOTOGRA	PHS	113
	8.1 Test Set	up Photos	113
9	TEST FOUP	IMENT DETAILS	116



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 5 of 117

# **1** ACCREDITATION, LISTINGS & RECOGNITION

## 1.1 TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) <u>www.a2la.org</u> test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <u>http://www.a2la.org/scopepdf/2381-01.pdf</u>



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 6 of 117

## 1.2 RECOGNITION

MiCOM Labs, Inc has widely recognized Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA\*\* countries. Our test reports are widely accepted for global type approvals.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	ТСВ	-	Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	Listing #: 4143A
Japan	VCCI	-	-	No. 2959
	MIC	RCB	APEC MRA 2	
Europe	European Union	NB	N/A	]
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	US0159
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

\*\*APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.

Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.

Phase I - recognition for product testing

Phase II - recognition for both product testing and certification

N/A – Not Applicable



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 7 of 117

## **1.3 PRODUCT CERTIFICATION**

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard EN ISO/IEC Guide 65. The company is accredited by the American Association for Laboratory Accreditation (A2LA) <u>www.a2la.org</u> test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <u>http://www.a2la.org/scopepdf/2381-02.pdf</u>



### United States of America – Telecommunication Certification Body

TCB Identifier - US0159

### Industry Canada – Certification Body

CAB Identifier - US0159

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 8 of 117

# 2 DOCUMENT HISTORY

Document History				
Revision	Date	Comments		
Draft				
Rev A	9th December 2010	Initial Release		

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 9 of 117

# **3 TEST RESULT CERTIFICATE**

Applicant:	Zebra Enterprise Solutions Corp. 2940 N. First Street San Jose CA , 95134, USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
Product:	802.11 b/g Wireless Module	Telephone:	+1 925 462 0304
Model No.:	WLM54AG	Fax:	+1 925 462 0306
S/No's:	22523657		
Date(s) Tested:	25 <sup>th</sup> Oct to 2 <sup>nd</sup> November 2010	Website:	www.micomlabs.com

## STANDARD(S)

FCC 47 CFR Part 15.247 & IC RSS-210

TEST RESULTS

EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

### Notes:

- 1. This document reports conditions under which testing was conducted and the results of testing performed.
- 2. Details of test methods used have been recorded and kept on file by the laboratory.
- 3. Test results apply only to the item(s) tested.

## Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve Quality Manager MiCOM Labs, Inc.

ACCREDITED TESTING CERTIFICATE #2381.01

Gordon Hurst President & CEO MiCOM Labs, Inc.

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 10 of 117

## 4 REFERENCES AND MEASUREMENT UNCERTAINTY

### 4.1 Normative References

Ref.	Publication	Year	Title
i.	47 CFR Part 15, SubPart 15.247	2007	For Digitally Modulated Intentional Radiators
ii.	Industry Canada RSS- 210	Issue 7 June 2007	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands)
iii.	Industry Canada RSS- Gen	Issue 2 June 2007	General Requirements and Information for the Certification of Radiocommunication Equipment.
iv.	ANSI C63.4	2009	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low- Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
v.	CISPR 22/ EN 55022	2008 2006+A1:2007	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
vi.	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
vii.	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
viii.	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
ix.	A2LA	9 <sup>th</sup> June 2010	Reference to A2LA Accreditation Status – A2LA Advertising Policy

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 11 of 117

### 4.2 Test and Uncertainty Procedures

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 12 of 117

## 5 TEST SUMMARY

### List of Measurements:

The following table represents the list of measurements required under the FCC CFR47 Part 15.247 and Industry Canada RSS-210 and Industry Canada RSS-Gen.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(a)(2) A8.2(1) 4.4	6 dB and 99 % Bandwidths	≥500 kHz	Conducted	Complies	7.1
15.247(b)(3) 15.31(e) A8.4(4)	Peak Output Power Voltage Variation	Shall not exceed 1W Variation of supply voltage 85 % -115 %	Conducted	Complies	7.2
15.247(e) A8.2	Peak Power Spectral Density	Shall not be greater than +8 dBm in any 3 kHz band	Conducted	Complies	7.3
15.247(i) 5.5	Maximum Permissible Exposure	Exposure to radio frequency energy levels	Conducted	Complies	7.4
15.247(d) 15.205 / 15.209 A8.5 2.2 4.7	Spurious Emissions (30MHz - 26 GHz b/g and 30 MHz – 40 GHz a)	The radiated emission in any 100 kHz of out- band shall be at least 20 dB below the highest in- band spectral density	Conducted	Complies	7.5

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 13 of 117

### List of Measurements (continued)

The following table represents the list of measurements required under the FCC CFR47 Part 15.247, Industry Canada RSS-210, and Industry Canada RSS-Gen.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(d) 15.205 /	Radiated Emissions	Restricted Bands	Radiated	Complies	7.6
15.209 A8.5 2.2 2.6	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	
4.7	Radiated Band Edge	Band-edge results Peak Emissions		Complies	
Industry Canada only RSS-Gen §4.10, §6	Receiver Spurious Emissions	Emissions above 1 GHz	Conducted	Complies	7.7
15.205 / 15.209 2.2	Radiated Spurious Emissions	Emissions <1 GHz (30M- 1 GHz)	Radiated	Complies	7.8
15.207 7.2.2	AC Wireline Conducted Emissions 150 kHz– 30 MHz	Conducted Emissions	Conducted	Complies	7.9

Note 1: Test results reported in this document relate only to the items tested

**Note 2:** The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria

**Note 3:** Section 3.7 Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 14 of 117

# 6 PRODUCT DETAILS AND TEST CONFIGURATIONS

## 6.1 Test Program Scope

The scope of the test program was to test the Zebra Enterprise Solutions Corp. WLM54AG 802.11 b/g wireless module for compliance against FCC 47 CFR Part 15, SubPart 15.247 & IC RSS-210. The WLM54AG 802.11 b/g wireless module was tested in a host device, a Zebra Enterprise WhereLAN III Location Sensor wireless location system.

**APPLICANT:** Zebra Enterprise Solutions Corp.



PRODUCT: WLM54AG 802.11 b/g Wireless Card

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



## 6.2 EUT Details

Detail	Description
Purpose:	Test of the Zebra Enterprise Solutions Corp.
	WLM54AG 802.11 b/g wireless module for
	compliance against FCC 47 CFR Part 15, SubPart
	15.247 & IC RSS-210
Applicant:	Zebra Enterprise Solutions Corp.
Manufacturer:	Zebra Enterprise Solutions Corp.
Test Laboratory:	MiCOM Labs, Inc.
	440 Boulder Court, Suite 200
	Pleasanton, California 94566 USA
l est report reference number:	GBCC01-U2
Date EUT received:	25 <sup>dr</sup> October 2010
Dates of test (from - to):	25 <sup>ar</sup> October to 2 <sup>ard</sup> November 2010
No of Units Tested:	1
Product Name:	802.11 b/g wireless module
Manufacturers Trade Name:	Wireless Network Mini PC adapter
Model No.:	WLM54AG
Equipment Primary Function:	802.11 b/g wireless module
Equipment Secondary Function(s):	None
Type of Technology:	Wireless 802.11b/g
Installation type:	Fixed
Construction/Location for Use:	Indoor/Outdoor
Software/Firmware Release:	Rev B
Hardware Release:	Rev 01
Test Software Release:	Windows XP HyperTerminal and FEPdebugger.exe
	dated 1/13/2009
Transmit/Receive Operation:	Full Duplex
Output Power Type	Stepped fixed for ISO
AutomaticTransmit Power Control Available:	N/A
Remote Frequency Control Available:	N/A
Operating Frequency:	2,400 to 2483.5 MHz
Rated Input Voltage and Current DC:	5 Vdc, 0.35 (A)
Operating Temperature Range °C:	Min: -40 Max: +60°C
ITU Emission Designator(s):	802.11b/g
Long Term Frequency Stability:	20 ppm
Equipment Dimensions:	3 in X 2.25 in
Weight:	5 oz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



## 6.3 Operational Power Range

Declared O/P Power	Mode 1		Mode 2	
Range	Max	Max	Min	Min
EUT	10	10	0	0

## 6.4 Types of Modulation Supported

Modulation / Mode	BW 1
802.11b/g	22 MHz

## 6.5 Antenna Details

The following is a description of the EUT antennas.

Antenna Type:	Manufacturer	Model	Gain (dBi)	Frequency Range (MHz)
802.11, Dipole	Cisco	AIR-ANT4941	2	2402-2495
802.11, Dipole	Cisco	AIR-ANT2506	5.2	2400-2484
802.11 Yagi	Cisco	AIR-ANT1949	13.5	2400-2484

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 17 of 117

## 6.6 Cabling and I/O Ports

The following is a description of the cable and input, output ports available on the Support EUT.

Type of I/O Ports	Description	Screened (Y/N)	Qty
RJ-45	Eithernet	Ν	1
RJ-22	Timing Ports	Ν	3
DB-9 Male	Serial Port	Ν	1
MCX female	RF output ports for ISO24730	Y	2
SMB male	RF output port for WIFI	у	1

## 6.7 EUT Configurations

Band (GHz)	Mode	Freq Band (MHz)	Freq Range (MHz)	Low ch	Mid ch	High ch	# Ch	Ch Spacing (MHz)	ChBW (MHz)
2.4	802.11 b	2400 - 2483.5	2412 - 2462	2412	2437	2462	11	20	20
2.4	802.11 g	2400 - 2483.5	2412 - 2462	2412	2437	2462	11	20	20



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 18 of 117

### 6.8 Equipment Details

The following is a description of EUT and supporting equipment used during the test program.

Type (EUT/Support)	Equipment Description	Manufacturer	Model No.	Part No (s).
EUT	802.11 b/g wireless module	Zebra Enterprise Solutions Corp.	WLM54AG	
Support	Location Sensor	Zebra Enterprise Solutions Corp.	LOS-5000	LOS-5000-01AA
Support	Remote Telemetry Module	Zebra Enterprise Solutions Corp.	TFF-2225	TFF-2225-00AA
Support	Laptop PC	Dell	PP18L	72MUF A02
Support	Laptop PC	Dell	PPL	9172P

## 6.9 Test Configurations

Operational Mode(s)	Data Rate Tested	Duty Cycle
b	1 MBit/s	100
g	6 MBit/s	100



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 19 of 117

### 6.10 Equipment Modifications

The following modifications were required to bring the equipment into compliance:

• No modifications required.

### 6.11 Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

• No deviations required.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 20 of 117

# 7 TEST RESULTS

## 7.1 6 dB and 99% Bandwidth

### **Test Procedure**

The test methodology and conditions utilized for each measurement is referenced in the following test results matrix. 6 dB and 99% bandwidth were measured per the Test Configuration identified below.

Testing was restricted to a single port.

### **Test Configuration**



Test configuration for 6 dB & 99% Bandwidth

### Specification

### Limits

### §15.247 (a)(2) & RSS-210 §A8.2(1)

The minimum 6 dB bandwidth shall be at least 500 kHz.

§ IC RSS-Gen 4.4.1 Occupied Bandwidth When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

**§ IC RSS-Gen 4.4.2 6 dB Bandwidth** Where indicated, the 6 dB bandwidth is measured at the points when the spectral density of the signal is 6 dB down from the in –band spectral density of the modulated signal, with the transmitter modulated by a representative signal.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 21 of 117

Traceability

Method	Test Equipment Used
Measurements were made per work	0158, 0252, 0313, 0314, 0116, 0117, 0287, 0363
instruction WI-03 'Measurement of RF	
Spectrum Mask'	

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 22 of 117

### 7.1.1 6 dB and 99% Bandwidth Results: 802.11b

Test Conditions:	15.247 (a)(2)	Rel. Humidity (%):	35	to	42
Variant:	802.11 b	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.2	dBi	
Applied Voltage:	48.00 Vdc				
Notes 1:					
Notes 2:					

#### 6 dB Bandwidth

Test Frequency	6 dB Bandwidth MHz				Minimum Bandwidth	6dB Limit	Margin
MHz	а	b	С	d	kHz MHz		MHz
2412.000	12.104000						-11.604000
2437.000	11.142000				500	0.5	-10.642000
2462.000	12.104000						-11.604000

#### 99% Bandwidth

Test	99 % Bandwidth					
Frequency		:				
MHz	а	b	C	d		
2412.000	15.631000					
2437.000	15.471000					
2462.000	15.551000					
2462.000	15.551000					

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Span = 40.00MHz

Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 23 of 117



T2:2419.655311MHz:-11.499dBm

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title: Zebra Enterprise Solutions WLM54AG To: FCC 47 CFR Part 15.247 & IC RSS-210 Serial #: GBCC01-U2 Rev A Issue Date: 9th December 2010 Page: Page 24 of 117



T2:2444.815631MHz:-11.442dBm

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 25 of 117



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 26 of 117

### 7.1.2 6 dB and 99% Bandwidth Results: 802.11g

Test Conditions:	15.247 (a)(2)	Rel. Humidity (%):	35	to	42
Variant:	802.11 g	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.2	dBi	
Applied Voltage:	48.00 Vdc				
Notes 1:					
Notes 2:					

#### 6 dB Bandwidth

Test	6 dB Bandwidth				Minimum6dB		<b>N</b> <i>Amunim</i>
Frequency	MHz			Bandwidth	n Limit	iviargin	
MHz	а	b	С	d	kHz MHz		MHz
2412.000	16.433000		1				-15.933000
2437.000	16.433000	-	I		500	0.5	-15.933000
2462.000	16.433000	-	I				-15.933000

#### 99% Bandwidth

Test		99 % Bar	ndwidth			
Frequency	MHz					
MHz	а	b	С	d		
2412.000	16.673000		-	-		
2437.000	16.593000		1	-		
2462.000	16.673000					

Measurement uncertainty:

<u>+2.81 dB</u>

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Sweep time(s) = 20

RF Atten (dB) = 10

Span = 40.00MHz

Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 27 of 117



Delta: 2420.136273MHz: -3.207dBm

T1:2403.623246MHz:-7.407dBm

T2:2420.216433MHz:-7.921dBm

99% OBW(T2-T1) = 16.673347MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



VBW = 300.00KHz

Sweep time(s) = 20

RF Atten (dB) = 10

Span = 40.00MHz

Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 28 of 117



M2:2439.444890MHz:2.282dBm

Delta: 2445.136273MHz: -1.588dBm

T1:2428.703407MHz:-6.304dBm

T2:2445.216433MHz:-6.148dBm

6dB BW(Delta-M1) = 16.432866MHz 99% OBW(T2-T1) = 16.593186MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 29 of 117



Span = 40.00MHz

T2:2470.216433MHz:-6.093dBm

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 30 of 117

7.2 Peak Output Power

### **Test Procedure**

The test methodology and conditions utilized for each measurement is referenced in the test results matrix. The average output power was measured per the test configuration identified below.

Per the standard measurements were taken at ambient conditions, nominal voltage.

### **Test Configuration**



Measurement set-up for Peak Output Power

Total Power =  $A + G + Y + 10 \log (1/x) dBm$ 

A = Total Power [10 Log<sub>10</sub>  $(10^{a/10} + 10^{b/10} + 10^{c/10} + 10^{d/10})]$ , G = Antenna Gain,

Y = Beam Forming Gain, x = Duty Cycle

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 31 of 117

### Specification

Limits

**§15.247 (b)** The maximum peak output power of the intentional radiator shall not exceed the following:

**§15.247 (b) (3)** For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1.0 watt.

**15.247 (b) (4)** The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

15.247 (c) Operation with directional antenna gains greater than 6 dBi.

- (1) Fixed point-to-point operation:
- (i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.
- (ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

**§15.31 (e)** For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

§ RSS-210 A8.4(4) For systems employing digital modulation techniques operating in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands the maximum peak conducted power shall not exceed 1 watt.

### Traceability

Method	Test Equipment Used
Measurements were made per work	0158, 0252, 0313, 0314, 0223, 0116, 0117, 0287,
Output Power'	0363

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 32 of 117

### 7.2.1 Measurement Results: 802.11 b

Test Conditions:	15.247 (b)	Rel. Humidity (%):	35	to	42
Variant:	802.11 b	Ambient Temp. (ºC):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	100		
Beam Forming Gain	N/A dB	Antenna Gain:	5.2	dBi	
Applied Voltage:	48.00 Vdc				
Notes 1:					
Notes 2:					

Test Frequency	Measured Peak Power RF Port (dBm)				• Total Power (dBm)		Limit	Margin
MHz	а	b	с	d	Combined	Calculated	dBm	dB
2412	13.06				13.06		30.00	-16.94
2437	12.24				12.24		30.00	-17.76
2462	13.08				13.08		30.00	-16.92

Measurement uncertainty:	+1 33 dB
measurement anoertanity.	1100 dB

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 33 of 117

### 7.2.2 Measurement Results: 802.11 g

Test Conditions:	15.247 (b)	Rel. Humidity (%):	35	to	42
Variant:	802.11 g	Ambient Temp. (ºC):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	100		
Beam Forming	N/A dB	Antenna Gain:	5.2	dBi	
Applied Voltage:	48.00 Vdc				
Notes 1:					
Notes 2:					

Test	N	leasured Pe	eak Pow	/er	Total Day	uar (d D m)	Lingit	Morgin
Frequency	RF Port (dBm)				ncy RF Port (dBm)		Limit	wargin
MHz	а	b	С	d	Combined	Calculated	dBm	dB
2412	11.43				11.43		30.00	-18.57
2437	12.15				12.15		30.00	-17.85
2462	12.77				12.77		30.00	-17.23
			-		-			



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 34 of 117

### 7.3 Peak Power Spectral Density

#### **Test Procedure**

The test methodology and conditions utilized for each measurement is referenced in the following test results matrix. RF output power, transmit power control and power density were measured per the Test Configuration identified below.

Testing was performed on the highest and lowest power settings of the equipment.

Per the standard measurements were taken at ambient and extreme temperature conditions at nominal and extreme voltage levels.

### **Test Configuration**



Measurement set-up for Peak Power Spectral Density

### Specification

### **Peak Power Spectral Density Limits**

**§15.247 (e)** For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission

**RSS-210** §A8.2(2) The transmitter power spectral density (into the antenna) shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0 second duration.

#### Traceability

Method	Test Equipment Used
Measurements were made per work	0158, 0252, 0313, 0314, 0223, 0116, 0117, 0287,
Output Power'	0363

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 35 of 117

### 7.3.1 Measurement results for 802.11 b

Test Conditions:	15.247 (e)		Rel. Humidity (%):	35	to	42
Variant:	802.11 b		Ambient Temp. (ºC):	19	to	22
TPC:	HIGH		Pressure (mBars):	998	to	1003
Modulation:	ON		Duty Cycle (%):	100		
Beam Forming	N/A d	IB	Antenna Gain:	5.2	dBi	
Applied Voltage:	48.00 V	/dc				
Notes 1:						
Notes 2:						

Test Frequency	Measured Power Density RF Port (dBm)				Total Peak Power Spectral Density (dBm)		Limit	Margin
MHz	а	b	С	d	Combined	Calculated	dBm	dB
2412.000	-9.22				-9.22		8.00	-17.22
2437.000	-9.69				-9.69		8.00	-17.69
2462.000	-8.65				-8.65		8.00	-16.65

Measurement uncertainty:	± 1.33 dB
--------------------------	-----------



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 36 of 117



Span = 1.00MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.


Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 37 of 117



RBW = 3.00KHz VBW = 10.00KHz Sw eep time(s) = 350 RF Atten (dB) = 20 Span = 1.00MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 38 of 117

Center frequency = 2462MHz



M1: 2462.710421MHz: -8.649dBm

RBW = 3.00KHz VBW = 10.00KHz Sw eep time(s) = 350 RF Atten (dB) = 20 Span = 1.00MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 39 of 117

# 7.3.2 Measurement results for 802.11 g

Test Conditions:	15.247 (e)	Rel. Humidity (%):	35	to	42
Variant:	802.11 g	Ambient Temp. (ºC):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	100		
Beam Forming	N/A dB	Antenna Gain:	5.2	dBi	
Applied Voltage:	48.00 Vdc				
Notes 1:					
Notes 2:					

Test Frequency	Measured Power De RF Port (dBm)			nsity	Total Pe Spectral D	ak Power ensity (dBm)	Limit	Margin
MHz	а	b	С	d	Combined	Calculated	dBm	dB
2412.000	-11.19				-11.19		8.00	-19.19
2437.000	-9.80				-9.80		8.00	-17.80
2462.000	-9.28				-9.28		8.00	-17.28

Measurement uncertainty:	± 1.33 dB
--------------------------	-----------

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 40 of 117



Span = 1.00MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 41 of 117

Center frequency = 2437MHz



M1: 2440.710421MHz: -9.800dBm

RBW = 3.00KHz VBW = 10.00KHz Sw eep time(s) = 350 RF Atten (dB) = 20 Span = 1.00MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 42 of 117

Center frequency = 2462MHz



M1: 2465.085170MHz: -9.284dBm

RBW = 3.00KHz VBW = 10.00KHz Sw eep time(s) = 350 RF Atten (dB) = 20 Span = 1.00MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 43 of 117

# 7.4 Maximum Permissible Exposure

## FCC, Part 15 Subpart C §15.407(f) Industry Canada RSS-Gen §5.5

**Calculations for Maximum Permissible Exposure Levels** 

Power Density = Pd (mW/cm2) = EIRP/( $4\pi d2$ ) EIRP = P \* G P = Peak output power (mW) G = Antenna numeric gain (numeric) d = Separation distance (cm) Numeric Gain = 10 ^ (G (dBi)/10)

The peak power in the table below is calculated by assuming a worst case scenario where all of the EUT transmitters are operating simultaneously in the same band. The Peak Power in mW is the highest transmitter power measured and summed across all transmitters.

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm2

Freq. Band (MHz)	Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm <sup>2</sup> Limit(cm)	Minimum Separation Distance (cm)
2400 – 2500	13.5	22.39	13.24	21.09	6.2	20.00

\*Note: for mobile or fixed location transmitters the minimum separation distance is 20cm, even if calculations indicate the MPE distance to be less.

## Specification

#### Maximum Permissible Exposure Limits

§15.247(i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency levels in excess of the Commission's guidelines.

FCC §1.1310 Limit = 1mW / cm2 from 1.310 Table 1

**RSS-Gen §5.5** Before equipment certification is granted, the application requirements of RSS-102 shall be met.

## Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty

±1.33 dB

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 44 of 117

# 7.5 Conducted Spurious

#### **Test Procedure**

Conducted emissions were measured at a limit of 20 dB below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Emissions at the band edge were measured and recorded. Measurements were made while EUT was operating in transmit mode of operation at the appropriate center frequency.

Measurements were made using a combiner with the transmitter tuned to the channel closest to the band-edge being measured. All emissions were maximized during measurement. Limits which were derived from the peak emission.

## **Test Measurement Set up**



Conducted Spurious Emission measurement test configuration

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 45 of 117

# Specification

**Limits Band-Edge** 

Lower Limit Band-edge	Upper Limit Band-edge	Limit below highest level of desired power
2,400 MHz	2,483.5 MHz	20 dP
5725 MHz	5850 MHz	≥ 20 0B

**§15.247(d)** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

## §15.247(d)

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

**RSS-210 §A8.5** If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

# RSS-Gen §4.7

The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate of carrier frequency), or from 30 MHz, whichever is the lowest frequency, to the 5<sup>th</sup> harmonic of the highest frequency generated without exceeding 40 GHz.

## Traceability

Method	Test Equipment Used
Measurements were made per work	0158, 0252, 0313, 0314, 0223, 0116, 0117,
instruction WI-05 'Measurement of	0287, 0363.
Spurious Emissions'	

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title: Zebra Enterprise Solutions WLM54AG To: FCC 47 CFR Part 15.247 & IC RSS-210 Serial #: GBCC01-U2 Rev A Issue Date: 9th December 2010 Page: Page 46 of 117

# 7.5.1 Measurement Results for 802.11 b

Test Conditions:	15.247 (a)(2)	Rel. Humidity (%):	35	to	42
Variant:	802.11 b	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	100		
Beam Forming Gain	N/A dB	Antenna Gain:	N/A	dBi	
Applied Voltage:	48.00 Vdc				
Notes 1:					
Notes 2:					

#### **Conducted Spurious Measurment**

Test Frequency	Start Frequency	Stop Frequency	Maximum Observed Emission	Limit (20 dB below peak of fundamental)
MHz	MHz	MHz	dBm	dBm
2412.000	30.00	26000.00	-53.67	-17.31
2437.000	30.00	26000.00	-54.13	-18.13
2462.000	30.00	26000.00	-55.43	-17.67

#### Band-edge Measurment

Test Frequency	Band-edge Frequency	Emission Amplitude @ Band- edge	Limit (20 dB below peak of fundamental)	Margin
MHz	MHz	dBm	dBm	dB
2412.000	2400.00	-37.81	-16.85	-20.96
2462.000	2483.50	-55.02	-16.37	-38.65
Measurement uncertainty:			±2.8′	1 dB

Measurement uncertainty:	±2.81 dB

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 47 of 117



M2:4818.056112MHz:-53.666dBm

RBW = 100.00KHz VBW = 300.00KHz Sweep time(s) = 60 RF Atten (dB) = 10 Span = 25.97GHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 48 of 117

Center frequency = 2437MHz



M1: 2424.028056MHz: 1.871dBm

M2: 4870.100200MHz: -54.134dBm

RBW = 100.00KHz VBW = 300.00KHz Sw eep time(s) = 60 RF Atten (dB) = 10 Span = 25.97GHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 49 of 117

Center frequency = 2462MHz



M1:2424.028056MHz:2.331dBm

M2: 4922.144289MHz: -55.434dBm

RBW = 100.00KHz VBW = 300.00KHz Sw eep time(s) = 60 RF Atten (dB) = 10 Span = 25.97GHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 50 of 117



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 51 of 117



RBW = 100.00KHz VBW = 300.00KHz Sw eep time(s) = 20 RF Atten (dB) = 10 Span = 72.00MHz M1 : 2462.965932MHz : 3.626dBm M2 : 2471.046092MHz : -18.265dBm M3 : 2483.500000MHz : -55.023dBm Center frequency = 2462MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 52 of 117

# 7.5.2 Measurement Results for 802.11 g

Test Conditions:	15.247 (a)(2)	Rel. Humidity (%):	35	to	42
Variant:	802.11 g	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	100		
Beam Forming	N/A dB	Antenna Gain:	N/A	dBi	
Applied Voltage:	48.00 Vdc				
Notes 1:					
Notes 2:					

#### **Conducted Spurious Measurment**

Test Frequency	Start Frequency	Stop Frequency	Maximum Observed Emission	Limit (20 dB below peak of fundamental)
MHz	MHz	MHz	dBm	dBm
2412.000	30.00	26000.00	-56.26	-19.01
2437.000	30.00	26000.00	-56.75	-19.11
2462.000	30.00	26000.00	-55.99	-17.40

#### Band-edge Measurment

Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin		
MHz	MHz	dBm	dBm	dB		
2412.000	2400.00	-27.22	-18.36	-8.87		
2462.000	2483.50	-38.60	-17.04	-21.56		

Measurement uncertainty: ±2.81 dB

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 53 of 117



M2: 6951.863727MHz: -56.263dBm

RBW = 100.00KHz VBW = 300.00KHz Sw eep time(s) = 60 RF Atten (dB) = 10 Span = 25.97GHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 54 of 117

Center frequency = 2437MHz



M1: 2424.028056MHz: .891dBm

M2:6639.599198MHz:-56.747dBm

RBW = 100.00KHz VBW = 300.00KHz Sw eep time(s) = 60 RF Atten (dB) = 10 Span = 25.97GHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 55 of 117

Center frequency = 2462MHz



M1:2424.028056MHz:2.601dBm

M2:6899.819639MHz:-55.993dBm

RBW = 100.00KHz VBW = 300.00KHz Sw eep time(s) = 60 RF Atten (dB) = 10 Span = 25.97GHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 56 of 117



Span = 72.00MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 57 of 117



RBW = 100.00KHz VBW = 300.00KHz Sw eep time(s) = 20 RF Atten (dB) = 10 Span = 72.00MHz

M1 : 2463.254509MHz : 2.963dBm M2 : 2471.334669MHz : -18.456dBm M3 : 2483.500000MHz : -38.596dBm Center frequency = 2462MHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 58 of 117

# 7.6 Radiated Spurious Emissions

#### **Test Procedure**

Testing was performed in a 3-meter anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak hold mode.

Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR Compliant receiver. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz. Emissions from 30 MHz – 1000 MHz are measured utilizing a CISPR compliant quasi-peak detector with a tuned receiver, using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed.

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 59 of 117

#### Radiated Emission Measurement Setup – Above 1 GHz



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 60 of 117

#### Radiated Emission Measurement Setup – Below 1 GHz



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 61 of 117

# **Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

# FS = R + AF + CORR - FO

FS = Field Strength R = Measured Spectrum analyzer Input Amplitude AF = Antenna Factor

#### CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss AG = Amplifier Gain FO = Distance Falloff Factor NFL = Notch Filter Loss or Waveguide Loss

Field Strength Calculation Example:

Given receiver input reading of 51.5 dB $\mu$ V; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

 $FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 dB\mu V/m$ 

Conversion between dB $\mu$ V/m (or dB $\mu$ V) and  $\mu$ V/m (or  $\mu$ V) are done as:

Level (dB $\mu$ V/m) = 20 \* Log (level ( $\mu$ V/m))

40 dBμV/m = 100 μV/m 48 dBμV/m = 250 μV/m

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 62 of 117

# Specification

**FCC §15.247(d) and RSS-210 §A8.5** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

## FCC §15.247(d)

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

**IC RSS-210 §A8.5** If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

## IC RSS-Gen §4.7

The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate of carrier frequency), or from 30 MHz, whichever is the lowest frequency, to the 5<sup>th</sup> harmonic of the highest frequency generated without exceeding 40 GHz.

FCC §15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

**FCC §15.205 (a)** Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

**FCC §15.209 (a)** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



# Table 1: FCC 15.209 and RSS-Gen §6 Spurious Emissions Limits

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

### Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement Uncertainty	+5.6/ -4.5 dB

#### Traceability:

Method	Test Equipment Used
Work instruction WI-03	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 64 of 117

# 7.6.1 <u>Measurement Results: Transmitter Radiated Spurious Emissions</u>

Emissions profile from 1000 - 5000 MHz. These emissions were present from the device independent of the radio modulation, frequency of transmission, or antenna.

Test	Freq.	2412 N	1Hz					E	ngineer	SB		
V	ariant	802.11	b/g; 1/6	Mbs				Те	mp(⁰C)	22		
Freq. F	Range	1000 N	1Hz - 50	00 MHz				Rel. I	Hum .(%)	34		
Power Se	etting	max po	w er				Pi	ress.	(m Bars)	1005		
An	tenna	N/A - N	lo Radic	Emission	S			Duty C	Cycle (%)	100		
TestNo	otes 1	Ref Sc	an 1 to	5 GHz								
TestNo	otes 2											
WICCOME   29 Oct 10 11:35     Wiccome   Wasona by EMiSoft   29 Oct 10 11:35     Wiccome   Pice   Pice     Pice   Pice   Pice									 Ita I I I I			
Formally	mea	sure	d em	ission	peaks							
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV/m	M easurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	M argin dB	Pass /Fail	Comments
1220.879	67.1	2.2	-14.5	54.8	Peak	V	152	74	74.0	-19.2	Pass	
4883.517	57.4	4.5	03				102				1 4 3 3	
1375.130	52.8		-9.5	52.6	Peak	V	151	237	74.0	-21.4	Pass	
4700.000	52.0	2.3	-13.9	52.6 41.2	Peak Peak	V	151 98	237 274	74.0 74	-21.4 -32.8	Pass Pass	
1709.233	63.1	2.3 2.5	-9.3 -13.9 -13.4	52.6 41.2 52.3	Peak Peak Peak	> > >	151 98 98	237 274 337	74.0 74 74	-21.4 -32.8 -21.8	Pass Pass Pass	
1098.808	63.1 63.0	2.3 2.5 2.1	-9.3 -13.9 -13.4 -16.3	52.6 41.2 52.3 48.8	Peak Peak Peak Peak	> > > >	151 98 98 152	237 274 337 33	74.0 74 74 74	-21.4 -32.8 -21.8 -25.2	Pass Pass Pass Pass	
1709.233 1098.808 1587.126	63.1 63.0 61.1	2.3 2.5 2.1 2.4	- <u>9.3</u> -13.9 -13.4 -16.3 -14.5	52.6 41.2 52.3 48.8 49.0	Peak Peak Peak Peak Peak	> > > >	151 98 98 152 98	237 274 337 33 206	74.0 74 74 74 74 74.0	-21.4 -32.8 -21.8 -25.2 -25.0	Pass Pass Pass Pass Pass	
1709.233 1098.808 1587.126 1342.972	63.1 63.0 61.1 61.1	2.3 2.5 2.1 2.4 2.3	-9.3 -13.9 -13.4 -16.3 -14.5 -14.1	52.6 41.2 52.3 48.8 49.0 49.2	Peak Peak Peak Peak Peak Peak	> > > > >	151 98 98 152 98 202	237 274 337 33 206 223	74.0 74 74 74 74.0 74.0	-21.4 -32.8 -21.8 -25.2 -25.0 -24.8	Pass Pass Pass Pass Pass Pass	
1709.233 1098.808 1587.126 1342.972 1220.879	63.1 63.0 61.1 61.1 65.9	2.3 2.5 2.1 2.4 2.3 2.2	-9.3 -13.9 -13.4 -16.3 -14.5 -14.5 -14.1	52.6 41.2 52.3 48.8 49.0 49.2 53.5	Peak Peak Peak Peak Peak Peak Average	> > > > > > > > >	151       98       152       98       152       98       152       98       152       98       152       98       152       98       152       98       152	237 274 337 33 206 223 74	74.0 74 74 74 74.0 74.0 54	-21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5	Pass Pass Pass Pass Pass Pass Pass	
1709.233 1098.808 1587.126 1342.972 1220.879 4883.517	63.1 63.0 61.1 61.1 65.9 54.4	2.3 2.5 2.1 2.4 2.3 2.2 4.5	-9.3 -13.9 -13.4 -16.3 -14.5 -14.5 -14.5 -9.3	52.6 41.2 52.3 48.8 49.0 49.2 53.5 49.6	Peak Peak Peak Peak Peak Average Average	>   >   >   >   >   >   >   >   >	151       98       98       152       98       202       152       152	237 274 337 33 206 223 74 237	74.0 74 74 74 74.0 74.0 54 54	-21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -4.4	Pass Pass Pass Pass Pass Pass Pass Pass	
1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130	63.1     63.0     61.1     65.9     54.4     45.6	2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3	-9.3 -13.9 -13.4 -16.3 -14.5 -14.5 -14.1 -14.5 -9.3 -13.9	52.6 41.2 52.3 48.8 49.0 49.2 53.5 49.6 34.0	Peak Peak Peak Peak Peak Average Average Average	>   >   >   >   >   >   >   >   >   >   >   >	151       98       98       152       98       202       152       98       202       151       98	237 274 337 33 206 223 74 237 274	74.0 74 74 74 74.0 74.0 74.0 54 54 54	-21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -4.4 -20.0	Pass Pass Pass Pass Pass Pass Pass Pass	
1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130 1709.233	52.8     63.1     63.0     61.1     61.1     65.9     54.4     45.6     61.0	2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5	-9.3 -13.9 -13.4 -16.3 -14.5 -14.1 -14.5 -9.3 -13.9 -13.4	52.6 41.2 52.3 48.8 49.0 49.2 53.5 49.6 34.0 50.1	Peak Peak Peak Peak Peak Average Average Average	> > > > > > > > > > > > > > > > > > >	151 98 98 152 98 202 152 151 98 98 98	237 274 337 206 223 74 237 274 337	74.0 74 74 74 74.0 74.0 74.0 54 54 54 54	-21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -4.4 -20.0 -3.9	Pass Pass Pass Pass Pass Pass Pass Pass	
1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130 1709.233 1098.808	52.8       63.1       63.0       61.1       61.1       65.9       54.4       45.6       61.0       60.9	2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5 2.1	-9.3 -13.9 -13.4 -16.3 -14.5 -14.1 -14.5 -9.3 -13.9 -13.4 -16.3	52.6 41.2 52.3 48.8 49.0 49.2 53.5 49.6 34.0 50.1 46.6	Peak Peak Peak Peak Peak Average Average Average Average	> >   > >   > >   > >   > >	151 98 98 152 98 202 152 151 98 98 98 152	237 274 337 206 223 74 237 274 337 33	74.0 74 74 74 74.0 74.0 74.0 54 54 54 54 54	-21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -4.4 -20.0 -3.9 -7.4	Pass Pass Pass Pass Pass Pass Pass Pass	
1709.233     1098.808     1587.126     1342.972     1220.879     4883.517     1375.130     1709.233     1098.808     1587.126	63.1       63.0       61.1       61.1       65.9       54.4       45.6       61.0       60.9       58.6	2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5 2.1 2.4	-9.3 -13.9 -13.4 -16.3 -14.5 -14.1 -14.5 -9.3 -13.9 -13.4 -16.3 -14.5	52.6 41.2 52.3 48.8 49.0 49.2 53.5 49.6 34.0 50.1 46.6 46.6	Peak Peak Peak Peak Peak Average Average Average Average Average Average	> > > >   > > > >   > > > >	151 98 98 152 98 202 152 151 98 98 152 98	237 274 337 33 206 223 74 237 274 337 33 206	74.0 74 74 74 74.0 74.0 54 54 54 54 54 54 54	-21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -4.4 -20.0 -3.9 -7.4 -7.4	Pass Pass Pass Pass Pass Pass Pass Pass	
1709.233       1098.808       1587.126       1342.972       1220.879       4883.517       1375.130       1709.233       1098.808       1587.126       1342.972	63.1       63.0       61.1       61.1       65.9       54.4       45.6       61.0       60.9       58.6       59.1	2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5 2.1 2.4 2.3	-9.3 -13.9 -13.4 -16.3 -14.5 -14.1 -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.1	52.6 41.2 52.3 48.8 49.0 49.2 53.5 49.6 34.0 50.1 46.6 46.6 47.2	Peak Peak Peak Peak Peak Average Average Average Average Average Average	> > > > > > > > > > > > > > > > > > > >	151       98       98       152       98       202       152       98       202       152       98       152       98       152       98       202       152       98       202       98       202	237 274 337 206 223 74 237 274 337 33 206 223	74.0 74 74 74 74.0 74.0 54 54 54 54 54 54 54 54 54	-21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -4.4 -20.0 -3.9 -7.4 -7.4 -7.4 -6.8	Pass Pass Pass Pass Pass Pass Pass Pass	
1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1272.545	63.1       63.0       61.1       65.9       54.4       45.6       61.0       60.9       58.6       59.1       62.7	2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2	-9.3 -13.9 -13.4 -16.3 -14.5 -14.1 -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.1 -14.0	52.6 41.2 52.3 48.8 49.0 49.2 53.5 49.6 34.0 50.1 46.6 46.6 47.2 50.9	Peak Peak Peak Peak Peak Average Average Average Average Average Average Peak [Scan]	> > > > > > > > > > > > > > > > > > > >	151       98       152       98       202       151       98       202       152       98       98       98       98       9202       202       151       98       202       202       202       202       202       202       2002	237 274 337 206 223 74 237 274 337 274 337 206 223 0	74.0     74     74     74.0     74.0     54     54     54     54     54     54     54     54     54     54     54     54     54     54     54	-21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -4.4 -20.0 -3.9 -7.4 -7.4 -6.8 -3.1	Pass Pass Pass Pass Pass Pass Pass Pass	NRB

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 65 of 117

# 7.6.2 <u>Measurement Results AIR-ANT1949: Transmitter Radiated Spurious Emissions</u>

Test Fr	req.	2412 N	IHz					E	ngineer	SB		
Vari	iant	802.11	b; 1 Mbs	6				Те	mp(⁰C)	22		
Freq. Raı	nge	1000 N	IHz - 18	000 MHz				Rel. I	lum.(%)	34		
Power Sett	ting	max po	w er				Pi	ress. (	(m Bars)	1005		
Ante	nna	AIR-AN	AIR-ANT1949 Duty Cycle (%) 100									
TestNote	es 1	Please	lease See Ref Scan from 1-5GHz document for frequencies in the range 1 to 5 GHz									
TestNote	es 2											
MiCOMLab	DS	dBu√ 300 500 500 400 400 300 200 100 1000 Rad File	iated En	issions program\a	Vasona by E	Tem	plate: F		00 1-18GHz c 15.247 a	29 Oct 1 PK P, D D D D D D D D D D D D D	0 15:29 Vertical sak Limit verage Li ebug Straßm Dist 3m cy: MHz annex8\	 Itz It
Formally I	mea	sure	d em	ission	peaks							
Frequency R MHz di	Raw BuV	Cable Loss	A F dB	Level dBuV	M easurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	M argin dB	Pass /Fail	Comments
16458.116 4	41.9	8.8	0.1	50.8	Peak [Scan]	Н	150	0	54.0	-3.2	Pass	NRB
Legend: T	TX = T	ransmit	ter Emis	sions; DIC	G = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band Er	nission
R	RB = R	Restricte	ed Band	(15.209 L	_imits); NRB = N	on Res	stricted	d Band	, Limit is 2	0dB belov	v funda	mental peak

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 66 of 117

Test	Freq.	2437 N	1Hz					E	ngineer	SB			
Vá	ariant	802.11	b; 1 Mb:	5				Те	mp(⁰C)	22			
Freq. R	Range	1000 N	1Hz - 18	000 MHz				Rel. I	-um .(%)	34			
Power Se	etting	max po	w er				Pi	ess.	(m Bars)	1005			
Ant	tenna	AIR-AN	T1949					Duty Cycle (%) 100					
TestNo	otes 1	Please	ease See Ref Scan from 1-5GHz document for frequencies in the range 1 to 5 GHz										
TestNo	otes 2												
MiCem	abs	dBuV 800 600 600 400 700 300 200 100 100 8ad File	ated En	hissions program\g	Vasona by E	Tem	plate: F		00 1-18GHz c 15.247 a	29 Oct 1 PK PK P Au Spec Frequen 180000 nd rss 210	0 15:37 - ) Horizon ) Vertical eak Limit verage Li ebug bug bug bug bug bug bug bug	 t: t	
Formally	mea	sured	emiss	ion pea	ks								
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV	M easurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	M argin dB	Pass /Fail	Comments	
17931.864	40.9	8.8	1.4	51.0	Peak [Scan]	V	100	0	54.0	-3.0	Pass	Noise Floor	
Legend:	TX = T	ransmit	ter Emis	sions; DIC	6 = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band En	nission	
	RB = F	Restricte	ed Band	(15.209 L	.imits); NRB = N	on Res	stricted	Band	, Limit is 2	0dB belov	v funda	imental peak	

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 67 of 117

Test	Freq.	2462 N	1Hz					E	ngineer	SB		
Va	ariant	802.11	b; 1 Mb:	6				Те	mp(⁰C)	22		
Freq. R	Range	1000 N	1Hz - 18	000 MHz				Rel. I	Hum .(%)	34		
Power Se	etting	max po	w er				Pi	ress.	(m Bars)	1005		
Ant	tenna	AIR-AN	T1949					Duty C	Sycle (%)	100		
TestNo	otes 1	Please	ease See Ref Scan from 1-5GHz document for frequencies in the range 1 to 5 GHz									
TestNo	otes 2											
MiCOM	abs	dBu√ 80.0 80.0 80.0 40.0 40.0 30.0 20.0 10.0 10.0 10.0 80.0 7.0 80.0 80.0 80.0 80.0 80.0 80	iated Ern		Vasona by E	Tem	plate: F		00 1-18GHz 5c 15.247 a	29 Oct 1 PK P, D D D D D C PK P, D D D C C C C C C C C C C C C C	ID 15:43 - ) Horizon ) Vertical eak Limit verage Li ebug bits 3m Dist 3m cy: MHz annex8\	 fta t
Formally	mea	sured	emiss	ion pea	ks							
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV	M easurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
16258.116	40.7	8.9	1.0	50.7	Peak [Scan]	V	150	0	54.0	-3.3	Pass	NRB
Legend:	TX = T	ransmit	ter Emis	sions; DIC	G = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band En	nission
	RB = F	Restricte	ed Band	(15.209 L	_imits); NRB = N	on Res	stricted	d Band	, Limit is 2	0dB belov	w funda	imental peak

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 68 of 117

Test Fr	req.	2412 N	IHz					E	ngineer	SB		
Vari	iant	802.11	g; 6 Mbs	6				Те	mp(⁰C)	22		
Freq. Ran	nge	1000 N	IHz - 18	000 MHz				Rel. I	lum.(%)	34		
Power Sett	ting	max po	w er				Pr	ess.	(m Bars)	1005		
Anter	nna	AIR-AN	T1949				Duty Cycle (%) 100					
TestNote	es 1	Please	ease See Ref Scan from 1-5GHz document for frequencies in the range 1 to 5 GHz									
TestNote	es 2											
MiCOMLab	05	dBu√ 300 500 500 400 300 200 100 Rad File	iated Em	issions program \g	Vasona by E	Tem	plate: F		ניייקאינאיי אייקאינאיי ב 1-18GHz c 15.247 a	29 Oct 1 PK P D D D D D D D D D D D D D	0 15:23 - ) Vertical eak Limit verage Li ebug Shife Am Dist 3m cy: MHz annex8/	 fta t
Formally r	mea	sure	d em	ission	peaks							
Frequency MHz dE	≀aw BuV	Cable Loss	A F dB	Level dBuV	M easurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	M argin dB	Pass /Fail	Comments
18000.000 4	11.5	8.8	1.0	51.3	Peak [Scan]	V	200	0	54.0	-2.7	Pass	Noise Floor
Legend: T	X = T	ransmit	ter Emis	sions; DIC	6 = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band En	nission
R	RB = R	Restricte	d Band	(15.209 L	imits); NRB = N	on Res	stricted	Band	, Limit is 2	0dB belov	v funda	mental peak

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 69 of 117

Test	Freq.	2437 N	1Hz					E	ngineer	SB		
Vá	ariant	802.11	g; 6 Mb	6				Те	mp(⁰C)	22		
Freq. R	Range	1000 N	1Hz - 18	000 MHz				Rel. I	lum.(%)	34		
Power Se	etting	max po	w er				Pr	ess.	(m Bars)	1005		
Ant	tenna	AIR-AN	NT1949			Duty Cycle (%) 100						
TestNo	otes 1	Please	See Re	f Scan fro	om 1-5GHz docu	ment f	or free	quencie	es in the ra	ange 1 to	5 GHz	
TestNo	otes 2											
MiCOM	abs	dBu√ 80.0 80.0 80.0 80.0 80.0 30.0 20.0 10.0 10.0 10.0 80.0 File	iated En		Vasona by E	Tem	plate: F	1000 TCC RE Ingls If	0.0 1-18GHz c 15.247 a	29 Oot 1 PK P D D D D D D D D D D D D D	0 15:16 - ) Vertical eak Limit verage Li ebug String m Dist 3m cy: MHz annex8V	 fta t
Formally	mea	sured	emiss	ion pea	ks							
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
16615.230	41.9	8.7	0.9	51.6	Peak [Scan]	Н	200	0	54.0	-2.4	Pass	NRB
Legend:	TX = T	ransmit	ter Emis	sions; DIC	6 = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band En	nission
	RB = F	Restricte	ed Band	(15.209 L	.imits); NRB = N	on Res	stricted	Band	, Limit is 2	0dB belov	v funda	imental peak

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 70 of 117

Test F	Freq.	2462 M	IHz					E	ngineer	SB		
Va	riant	802.11	g; 6 Mbs	3				Те	mp(⁰C)	22		
Freq. Ra	ange	1000 M	IHz - 18	000 MHz				Rel. I	lum .(%)	34		
Power Se	tting	max po	w er				Pr	ess.	(m Bars)	1005		
Ante	enna	AIR-AN	T1949					Duty C	ycle (%)	100		
TestNot	tes 1	Please	ease See Ref Scan from 1-5GHz document for frequencies in the range 1 to 5 GHz									
TestNot	tes 2											
MiCOMLa	ibs	dBu√ 300 500 500 400 400 300 200 100 1000 Rad File	iated En		Vasona by E	Tem	plate: F		0.0 1-18GHz c 15.247 a	29 Oot 1 PK P D D D D PK P D D D D D D D D D D D D D	0 15:00 Vertical eak Limit yerage Li ebug Shraßm Dist 3m cy: MHz annex8V	 ta t
Formally	mea	sured	emiss	ion pea	ks							
Frequency MHz c	Raw dBuV	Cable Loss	A F dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	M argin dB	Pass /Fail	Comments
17523.046	40.5	8.8	1.3	50.6	Peak [Scan]	V	200	0	54.0	-3.4	Pass	NRB
Legend:	TX = T	ransmit	ter Emis	sions; DIC	6 = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band En	nission
	RB = F	Restricte	ed Band	(15.209 L	.imits); NRB = N	on Res	stricted	Band	, Limit is 20	0dB belov	v funda	mental peak

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



## 7.6.3 Measurement Results AIR-ANT1949: Band Edge

#### Band Edge 2200-2390MHz 802.11b ch1 h=100cm azt=359



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title: Zebra Enterprise Solutions WLM54AG To: FCC 47 CFR Part 15.247 & IC RSS-210 Serial #: GBCC01-U2 Rev A Issue Date: 9th December 2010 Page: Page 72 of 117

#### Band Edge 24835.5-2500MHz 802.11b ch11 h=100cm azt=180 30 dB Marker 1 [T1] RBW 1 MHz RF Att Ref Lvl 53.16 dB¥V VBW 1 MHz 100 db**y**V 2.48707114 GHz SWT 60 s dbyv Unit 100 -8.9 dB Offset **v**1 [T1] 53.16 dBy А 2.48707114 GHz 90 [T2] 35.80 dBy 2 SGL 2.48551703 GHz 80 -D1 74 dbNA 70 IN1 **1VIEW** 1MA **2VIEW** 2AV 60 <u>-</u>Д2 דע 54 db 50 MAA M the man and a share and make 40 2 ▼ 30 20 10 Start 2.4835 GHz

Date:

29.0CT.2010 15:59:45

1.65 MHz/

Stop 2.5 GHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.


Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 73 of 117

#### Band Edge 2200-2390MHz 802.11g ch1 h=100cm azt=264 Marker 1 [T1] 30 dB RBW 1 MHz RF Att Ref Lvl 59.29 dB¥V VBW 1 MHz 100 db**y**V 2.39000000 GHz SWT 60 s dbyv Unit 100 -9.2 dB Offset **v**1 [T1] 59.29 dBy 2.39000000 GHz 90 [T2] 36.26 dBM 2 2.38086172 GHz 80 -D1 74 dbNA 70 **1VIEW 2VIEW** 60 -D2 54 dbע 50 1.1. LA 1. 1.1 40 2 7 30 20 10

19 MHz/

Stop 2.39 GHz

А

SGL

IN1

1MA

2AV

Date:

Start 2.2 GHz

29.0CT.2010 16:22:02

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title: Zebra Enterprise Solutions WLM54AG To: FCC 47 CFR Part 15.247 & IC RSS-210 Serial #: GBCC01-U2 Rev A Issue Date: 9th December 2010 Page: Page 74 of 117

#### Band Edge 24835.5-2500MHz 802.11b ch11 h=100cm azt=180 30 dB Marker 1 [T1] RBW 1 MHz RF Att Ref Lvl 53.16 dB¥V VBW 1 MHz 100 db**y**V 2.48707114 GHz SWT 60 s dbyv Unit 100 -8.9 dB Offset **v**1 [T1] 53.16 dBy А 2.48707114 GHz 90 [T2] 35.80 dBy 2 SGL 2.48551703 GHz 80 -D1 74 dbNA 70 IN1 **1VIEW** 1MA **2VIEW** 2AV 60 <u>-</u>Д2 דע 54 db 50 the man and a share and make 40 2 ▼ 30 20 10 Start 2.4835 GHz

#### Date:

29.0CT.2010 15:59:45

1.65 MHz/

Stop 2.5 GHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 75 of 117

# 7.6.4 Measurement Results AIR-ANT1949: Peak Emissions

Test Freq.	2412 N	1Hz					E	ngineer	GMH		
Variant	802.11	b; 1 Mb	s				Те	mp(⁰C)	25		
Freq. Range	2400 -	2483.5	MHz				Rel. I	Hum .(%)	32		
Power Setting	Max. P	ow er				Pı	ress.	(m Bars)	1001		
Antenna	AIR AN	T1949					Duty (	Cycle (%)	100		
TestNotes 1											
TestNotes 2											
MiceMLabs	dBu/Vim 1200 1000 1000 900 2000 Rac File	D Siated En name: k	nissions torogram ta	Vasona by E	MiSot	plate: F	RSS-210	) PK 2400-2 be 15.247 a	29 Oct 1 (1 24 4 5 5 2483.5 10 10 10 10 10 10 10 10 10 10	10 19:52 ) Vertica verage L verage L bist 3m Dist 3m Dist 3m cy: MHz annex81	 itz i z
Formally me	asure	d em	ission	peaks							
Frequency Raw MHz dBuV	Cable Loss	A F dB	Level dBuV/m	M easurement Type	Pol	H gt c m	Azt Deg	Limit dBuV/m	M argin dB	Pass /Fail	Comments
2412.885 67.2	13.0	32.2	112.4	Peak [Scan]	V						PK
Legend: TX =	Transmit	ter Emis	sions; DIC	G = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band Er	mission
PK =	Peak em	issions	of Fundan	nental							

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 76 of 117

_	_							_				
Test	Freq.	2437 N	IHZ					E	ngineer	GMH		
V	ariant	802.11	b; 1 Mb	S				Те	mp(⁰C)	25		
Freq. F	Range	2400 -	2483.5	MHz				Rel.	Hum .(%)	32		
Power S	etting	Max. Po	ow er				Pi	ress.	(m Bars)	1001		
An	tenna	AIRAN	IT1949					Duty (	Cycle (%)	100		
TestNo	otes 1											
TestNo	otes 2											
MiC@M	abs	dBuV/im 1200 1100 1000 SOD 24000 Rad File	iated En name: k:	nissions program \go	Vasona by E	Tem	plate: F	RSS-210	0 PK 2400-2 cc 15.247 a	29 Oct 1 12 4 4 5 5 5 12 12 12 12 12 12 12 12 12 12	0 19:55 - Vertical verage L ebug Dist 3m Dist 3m	 t: t
Formally	/ mea	sured	emiss	ion pea	ks							
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
2436.144	66.9	13.0	32.2	112.1	Peak [Scan]	V						PK
Legend.	ТХ = Т	ransmit	ter Emis	sions: DIC	6 = Digital Emissi	ons: F	UND =	Funda	mental: W	B = Wide	band Fn	nission
Logona.		Poak omi		of Eundon								
	FN - P	earen	5510115		ICIIIdi							

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 77 of 117

	_							_				
Test	Freq.	2462 N	lHz					E	ngineer	GMH		
V	ariant	802.11	b; 1 Mb	s				Те	emp(⁰C)	25		
Freq. F	Range	2400 -	2483.5	MHz				Rel.	Hum .(%)	32		
Power S	etting	Max. P	ow er				Pi	ress.	(m Bars)	1001		
An	tenna	AIR AN	IT1949					Duty (	Cycle (%)	100		
TestNo	otes 1											
TestNo	otes 2											
MiCOM	abs	dBu√/m 1200 1000 1000 2000 800 24000 Rad File	iated En name: k:	hissions program\g	Vasona by E	MiSof	plate: F	SSS-210	D PK 2400-2 oc 15.247 a	29 Oct 1 (12 + 0 Meas Spec Frequen 2483.5 requen 2483.5 nd rss 210	10 19:57 - ) Vertical verage Li verage Li ebug Dist 3m Dist 3m cy: MHz annex8\	 fta t
Formally	/ mea	sured	emiss	sion pea	ks							
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV/m	M easurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	M argin dB	Pass /Fail	Comments
2462.918	67.6	13.0	32.3	112.8	Peak [Scan]	V						PK
Legend <sup>.</sup>	TX = T	ransmit	ter Emis	sions: DIC	6 = Digital Emissi	ons: F	UND =	Funda	mental: W	B = Wide	band En	nission
2090.10.		Doak omi	ssions	of Fundan		,.						
	' \ <b>-</b>	Car cill	3310113	or i unuali	iontai							

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 78 of 117

Test Fre	<b>a.</b> 2412	MHz					E	naineer	GMH		
Varia	<b>nt</b> 802.1	1a:6 Mb	s				Те		25		
Freg. Rand	<b>ae</b> 2400 ·	2483.5	MHz				Rel.	Hum .(%)	33		
Power Settin	ng Max.F	Pow er				P	ess.	(m Bars)	1001		
Anten	na AIRA	NT1949					Duty (	Cycle (%)	100		
TestNotes	; 1										
TestNotes	2										
MiC@MLabs	dBu\Vin 120.0 110.0 100.0 90.0 90.0 80.0 2400 R3 Fil	D diated En ename: k	hissions program/ge	Vasona by E	MiSof	plate: F	RSS-210	0 PK 2400-2 cc 15.247 a	29 Oct 1	10 19:49 Vertica verage L ebug Dist 3m Dist 3m cy: MHz annex8	 II I
Formally m	neasure	d em	ission	peaks							
Frequency Ra MHz dB	uv Cable uV Loss	A F dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	M argin dB	Pass /Fail	Comments
2415.562 64	.5 13.0	32.2	109.6	Peak [Scan]	V						PK
Legend: TX	= Transm	tter Emis	sions; DIC	6 = Digital Emissi	ons; F	UND =	Funda	imental; W	B = Wide	band Er	nission
PK	= Peak en	nissions	of Fundan	nental							

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 79 of 117

<b>T</b> = = 4	<b>F</b>	0407 1						-				
lest	Freq.	2437 10	IHZ					E	ngineer	GMH		
V	ariant	802.11	g; 6 Mb	S				Те	emp(⁰C)	25		
Freq. F	Range	2400 -	2483.5	MHz				Rel.	Hum .(%)	33		
Power Se	etting	Max. P	ow er				Pi	ress.	(m Bars)	1001		
An	tenna	AIRAN	IT1949					Duty (	Cycle (%)	100		
TestNo	otes 1											
TestNo	otes 2											
MiC@ML	abs	dBu\/im 1200 1100 1000 900 24000 Rad File	iated En name: k:	issions program/ge	Vasona by E	Tem	plate: F	RSS-210	0 PK 2400-2 oc 15.247 a	29 Oct 1 12 4 4 5 5 5 12 12 12 12 12 12 12 12 12 12	0 19:48 - ) Vertical verage Li ebug Dist 3m Dist 3m cy: MHz annex8V	 ft a t
Formally	/ mea	sured	emiss	ion pea	ks							
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV/m	M easurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	M argin dB	Pass /Fail	Comments
2443.340	65.2	13.0	32.3	110.4	Peak [Scan]	V						PK
Legend:	TX = T	ransmit	ter Emis	sions; DIC	6 = Digital Emissi	ons; F	UND =	Funda	mental; W	/B = Wide	band En	nission
U I	PK = F	eak emi	ssions	of Fundan	nental							
					-							

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 80 of 117

<b>—</b>	_	0.400 1						_				
lest	Freq.	2462 IV	IHZ					E	ngineer	GMH		
V	ariant	802.11	g; 6 Mb	S				Те	emp(⁰C)	25		
Freq. F	Range	2400 -	2483.5	MHz				Rel.	Hum .(%)	33		
Power S	etting	Max.P	ow er				Pi	ress.	(m Bars)	1001		
An	tenna	AIRAN	IT1949					Duty (	Cycle (%)	100		
TestNo	otes 1											
Test No	otes 2											
MiC	abs	dBu\Vim 1200 1000 900 2000 Rad File	iated En name: k:	hissions program/ge	Vasona by E	MiSof	plate: F	SS-210	0 PK 2400-2 oc 15.247 a	29 Oct 1 (1 2483 5 Frequen 2483.5 nd rss 210	10 19:41 ) Vertical verage Li ebug Dist 3m Dist 3m oy: MHz	 fta t t
Formally	/ mea	sured	emiss	sion pea	ks							
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	M argin dB	Pass /Fail	Comments
2465.595	64.9	13.0	32.3	110.2	Peak [Scan]	V						PK
Legend:	ТХ = Т	ransmit	ter Fmis	sions: DIC	a = Digital Emissi	ons <sup>.</sup> F	UND =	Funda	mental <sup>.</sup> W	/B = Wide	band Fr	nission
Legend.				of Funder		5115, 1	5.10 -			2 11100		
	PK = F	eak em	SSIONS	or Fundan	iemai							

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 81 of 117

# 7.6.5 <u>Measurement Results AIR-ANT2506: Transmitter Radiated Spurious Emissions</u>

Test	Freq.	2412 N	1Hz					E	ngineer	SB		
V	ariant	802.11	b; 1 Mb;	6				Те	mp (ºC)	22		
Freq. F	Range	1000 N	1Hz - 18	000 MHz				Rel. I	Hum .(%)	34		
Power So	etting	max po	w er				P	ress.	(m Bars)	1005		
An	tenna	AIR-AN	T2506					Duty (	Cycle (%)	100		
TestNo	otes 1	Please	See Re	f Scan fro	om 1-5GHz docu	iment f	or free	quencie	es in the ra	ange 1 to	5 GHz	
TestNo	otes 2											
MICCMLebs dBuv Vasona by EMiSoft 28 Oct 10 16:24 PK Peak Limit Average Li Debug Spec Dist 3m Spec Dist 3m Prequency: MHz Radiated Emissions Radiated Emissions Filename: k:program/go global consulting/gbcc01 - zebra ngls/foc 15:247 and rss 210 annex8/di												 Ita I I
Formaliy	Baw	Cable			Massurament		Hat	A -+	Limit	Margin	Page	
MHz	dBuV	Loss	dB	dBuV	Туре	Pol	cm	Deg	dBuV	dB	/Fail	Comments
1200.020	57.8	2.1	-14.9	45.0	Peak	V	98	222	74.0	-29.0	Pass	
1678.808	52.4	2.5	-13.6	41.2	Peak	V	98	332	74.0	-32.8	Pass	
4883.492	55.2	4.5	-9.3	50.4	Peak	V	151	288	74	-23.6	Pass	
1050.060	55.3	2.0	-16.1	41.3	Peak	V	98	7	74	-32.7	Pass	
1200.020	51.9	2.1	-14.9	39.2	Average	V	98	222	54	-14.8	Pass	
1678.808	45.0	2.5	-13.6	33.9	Average	V	98	332	54	-20.1	Pass	
4883.492	51.5	4.5	-9.3	46.7	Average	V	151	288	54	-7.3	Pass	
1050.060	42.8	2.0	-16.1	28.7	Average	V	98	7	54	-25.3	Pass	
17591.182	41.4	8.8	1.1	51.4	Peak [Scan]	V	200	0	54	-2.7	Pass	NRB
1272.545	61.0	2.2	-14.0	49.3	Peak [Scan]	V	100	0	54	-4.7	Pass	NRB
Legend:	TX = T RB = F	ransmit Restricte	ter Emis ed Band	sions; DK (15.209 L	G = Digital Emissi Limits); NRB = N	ions; F Ion Re	UND =	Funda d Band	mental; W , Limit is 2	B = Wide 0dB belov	band Er v funda	nission amental peak

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 82 of 117

Test	Freq.	2437 N	1Hz					E	ngineer	SB		
V	ariant	802.11	b; 1 Mb;	S				Те	mp (ºC)	22		
Freq. F	Range	1000 N	1Hz - 18	000 MHz				Rel. I	-um .(%)	34		
Power S	etting	max po	ow er				P	ress.	(m Bars)	1005		
An	tenna	AIR-AN	VT2506					Duty C	ycle (%)	100		
TestNo	otes 1	Please	See Re	f Scan fro	om 1-5GHz docu	ment f	or free	quencie	es in the ra	ange 1 to	5 GHz	
TestNo	otes 2											
MiCem	abs	dBu√ 80.0 70.0 80.0 80.0 80.0 80.0 30.0 20.0 10.0 10.0 80.0 710.0 80.0 710.0 80.0 70.0 80.0 80.0 80.0 80.0 80.0 8	29 Oct 1 PK P A D D PK P A A Spec Frequen 180000 nd rss 210	ID 11:13 ) Vertical eak Limit verage Li ebug officient Dist 3m Dist 3m cy: MHz annex8/	 ti t							
Formally	/ mea	sured	emiss	ion pea	ıks							
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
1587.126	61.1	2.4	-14.5	49.0	Peak	V	98	206	74.0	-25.0	Pass	
1342.972	61.1	2.3	-14.1	49.2	Peak	V	202	223	74.0	-24.8	Pass	
1587.126	58.6	2.4	-14.5	46.6	Average	V	98	206	54	-7.4	Pass	
1342.972	59.1	2.3	-14.1	47.2	Average	V	202	223	54	-6.8	Pass	
17523.046	41.0	8.8	1.3	51.0	Peak [Scan]	V	200	0	54	-3.0	Pass	NRB
Legend:	TX = T	ransmit	ter Emis	sions; DK	G = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band En	nission
	KB = F	Restricte	en paug	(15.2091	$_11111(S)$ , $NKB = N$	un Kes	sincie	a Band	, limitis 2		w runda	апента реак

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 83 of 117

Test	Freq.	2462 N	1Hz					E	ngineer	SB		
v	ariant	802.11	b; 1 Mb:	S				Те	mp(⁰C)	22		
Freq. F	Range	1000 N	1Hz - 18	000 MHz				Rel. I	Hum .(%)	34		
Power Se	etting	max po	w er				P	ress.	(m Bars)	1005		
An	tenna	AIR-AN	VT2506					Duty C	Sycle (%)	100		
TestNo	otes 1	Please	See Re	f Scan fro	om 1-5GHz docu	ment f	or free	quencie	es in the r	ange 1 to	5 GHz	
TestNo	otes 2											
MiC@M	Vasona by EMISoft										ID 08:58   Horizon Vertical eak Limit verage L oby offfen Dist 3m Dist 3m oy: MHz annex8\	 ti t
Formally	/ mea	sured	emiss	ion pea	iks							
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	M argin dB	Pass /Fail	Comments
1220.879	67.1	2.2	-14.5	54.8	Peak	V	152	74	74.0	-19.2	Pass	
4883.517	57.4	4.5	-9.3	52.6	Peak	V	151	237	74.0	-21.4	Pass	
1375.130	52.8	2.3	-13.9	41.2	Peak	V	98	274	74	-32.8	Pass	
1709.233	63.1	2.5	-13.4	52.3	Peak	V	98	337	74	-21.8	Pass	
1098.808	63.0	2.1	-16.3	48.8	Peak	V	152	33	74	-25.2	Pass	
1220.879	65.9	2.2	-14.5	53.5	Average	V	152	74	54	-0.5	Pass	
4883.517	54.4	4.5	-9.3	49.6	Average	V	151	237	54	-4.4	Pass	
1375.130	45.6	2.3	-13.9	34.0	Average	V	98	274	54	-20.0	Pass	
1709.233	61.0	2.5	-13.4	50.1	Average	V	98	337	54	-3.9	Pass	
1098.808	60.9	2.1	-16.3	46.6	Average	V	152	33	54	-7.4	Pass	
17523.046	40.9	8.8	1.3	50.9	Peak [Scan]	Н	150	0	54	-3.1	Pass	NRB
1272.545	62.7	2.2	-14.0	50.9	Peak [Scan]	V	200	0	54	-3.1	Pass	NRB
Legend:	TX = 1 RB = F	ransmit Restricte	ter Emis ed Band	sions; DK (15.209 l	G = Digital Emissi _imits); NRB = N	ons; F on Res	UND =	Funda d Band	mental; W , Limit is 2	B = Wide	band En w funda	nission amental peak

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 84 of 117

Test Fre	eq.	2412 M	IHz					E	ngineer	SB		
Varia	ant	802.11	g; 6 Mbs	6				Те	mp(⁰C)	22		
Freq. Ran	nge	1000 M	IHz - 18	000 MHz				Rel. I	-um .(%)	34		
Power Setti	ing	max po	w er				Pi	ess.	(m Bars)	1005		
Anten	nna	AIR-AI	NT2506					Duty C	Sycle (%)	100		
Test Note:	s 1	Please	See Re	f Scan fro	om 1-5GHz docu	ment f	or free	quencie	es in the ra	ange 1 to	5 GHz	
Test Note:	s 2											
MiC®MLab	S,	dBuV 30.0 50.0 50.0 40.0 30.0 20.0 10.0 80.0 10.0 80.0 7 10.0 80.0 7 10.0 80.0 7 10.0 80.0 7 10.0 80.0 7 10.0 80.0 7 10.0 80.0 80.0 80.0 80.0 80.0 80.0 80.0	iated Em	issions program g	Vasona by E	Tem	plate: F		00 11-18GHz to 15.247 a	29 Oct 1 PK 2 PK 2 PK 2 PK 2 PK 2 P PK 2 PK 2	ID 13:09 Vertical eak Limit verage Limit verage Limit verage Limit objection objection bist 3m Dist 3m cy: MHz annex8\	 fta t t
Formally n	nea	sure	d em	ission	peaks							
Frequency R MHz dB	aw BuV	Cable Loss	A F dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	M argin dB	Pass /Fail	Comments
16058.116 4	1.5	9.0	0.8	51.2	Peak [Scan]	V	200	0	54.0	-2.8	Pass	NRB
Legend: T>	X = Ti	ransmit	ter Emis	sions; DIC	G = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band Er	nission
RE	B = R	estricte	ed Band	(15.209 L	imits); NRB = N	on Res	stricted	l Band	, Limit is 2	0dB belov	w funda	imental peak

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 85 of 117

Test F	Freq.	2437 M	IHz					E	ngineer	SB			
Va	riant	802.11	g; 6 Mbs	6				Те	mp(⁰C)	22			
Freq. Ra	ange	1000 M	IHz - 18	000 MHz				Rel. H	lum.(%)	34			
Power Se	tting	max po	w er				Pi	ress.(	(m Bars)	1005			
Ante	enna	AIR-AN	T2506					Duty C	ycle (%)	100			
TestNot	tes 1	Please	See Re	f Scan fro	om 1-5GHz docu	ment f	or free	quencie	es in the ra	ange 1 to	5 GHz		
TestNot	tes 2												
MiCOMLa	abs	dBuV Vasona by EMiSoft 29 Oct 10 14:29 Pk (1) Horizont: Pk (2) Vertical Pk (2) Verti											
Formally	mea	sured	emiss	ion pea	ks								
Frequency MHz o	Raw dBuV	Cable Loss	A F dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dB uV	M argin dB	Pass /Fail	Comments	
16637.275	41.1	8.7	0.9	50.8	Peak [Scan]	V	100	0	54.0	-3.2	Pass	NRB	
Legend:	TX = T	ransmit	ter Emis	sions; DIC	G = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band En	nission	
F	RB = F	Restricte	ed Band	(15.209 L	.imits); NRB = N	on Res	stricted	Band	, Limit is 20	0dB belov	v funda	mental peak	

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 86 of 117

Test	Freq.	2462 N	1Hz					E	ngineer	SB		
Va	ariant	802.11	g; 6 Mb	S				Те	mp(⁰C)	22		
Freq. R	ange	1000 N	1Hz - 18	000 MHz				Rel. I	Hum .(%)	34		
Power Se	tting	max po	w er				Pr	ress.	(m Bars)	1005		
Ant	enna	AIR-AN	T2506					Duty C	Sycle (%)	100		
TestNo	tes 1	Please	See Re	f Scan fro	om 1-5GHz docu	ment f	or free	quencie	es in the ra	ange 1 to	5 GHz	
TestNo	tes 2											
MiC®M	abs	dBuv Vasona by EMiSoft 29 Oct 10 14:44 Predk Limit Debug Weat Altime Debug Weat Altime Debug Weat Altime Debug Weat Altime Spec Dist 3m Au Frequency: MHz Eadiated Emissions Eadiated Emissions Filename: k:\program\go global consulting\gbcc01 - 2ebra ngls\foc 15.247 and rss 210 annex8\da										
Formally	mea	sured	emiss	ion pea	ks							
Frequency MHz	Raw dBuV	Cable Loss	A F dB	Level dBuV	M easurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	M argin dB	Pass /Fail	Comments
16160.321	40.6	9.0	1.0	50.5	Peak [Scan]	Н	100	0	54.0	-3.5	Pass	NRB
Legend:	TX = T	ransmit	ter Emis	sions; DIC	G = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band En	nission
-	RB = F	Restricte	ed Band	(15.209 L	_imits); NRB = N	on Res	stricted	d Band	, Limit is 2	0dB belov	w funda	imental peak

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



## 7.6.6 Measurement Results AIR-ANT2506: Band Edge

### Band Edge 2200-2390MHz 802.11b ch1 h=100cm azt=157



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title: Zebra Enterprise Solutions WLM54AG To: FCC 47 CFR Part 15.247 & IC RSS-210 Serial #: GBCC01-U2 Rev A Issue Date: 9th December 2010 Page: Page 88 of 117

#### 30 dB Marker 1 [T1] RBW 1 MHz RF Att Ref Lvl 55.58 dB¥V VBW 1 MHz 100 db**y**V 2.48373146 GHz SWT 60 s dbyv Unit 100 -8.9 dB Offset **v**1 [T1] 55.58 dBy А 2.48373146 GHz 90 36.90 dBN [T2] 2 SGL 2.48350000 GHz 80 -D1 74 dB⊿v 70 IN1 **1VIEW** 1MA **2VIEW** 2AV 60 1 Labyv 50 maly minden where the hours marken on A And A 40 30 20 10 Start 2.4835 GHz 1.65 MHz/ Stop 2.5 GHz

### Band Edge 2483.5-2500MHz 802.11b ch11 h=100cm azt=337

Date:

29.OCT.2010 16:59:19

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 89 of 117

#### Band Edge 2200-2390MHz 802.11g ch1 h=100cm azt=157 Marker 1 [T1] 30 dB RBW 1 MHz RF Att Ref Lvl 61.95 dB¥V VBW 1 MHz 100 db**y**V 2.38961924 GHz SWT 60 s dbyv Unit 100 -9.2 dB Offset **v**1 [T1] 61.95 dBy А 2.38961924 GHz 90 [T2] 39.24 dBM 2 SGL 2.39000000 GHz 80 -D1 74 dB⊿v 70 IN1 **1VIEW** 1MA **2VIEW** 2AV 60 דע dB 54 -D2 Nelin 50 Marin 40 30 20 10 Start 2.2 GHz 19 MHz/ Stop 2.39 GHz

Date:

29.OCT.2010 16:46:56

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 90 of 117

#### Band Edge 2483.5-2500MHz 802.11g ch11 h=100cm azt=74 Marker 1 [T1] 30 dB RBW 1 MHz RF Att Ref Lvl 62.05 dB¥V VBW 1 MHz 100 db**y**V 2.48356613 GHz SWT 60 s dbyv Unit 100 -8.9 dB Offset **v**1 [T1] 62.05 dBy А 2.48356613 GHz 90 40.83 dBN [T2] 2 SGL 2.48350000 GHz 80 -D1 74 dbNA 70 IN1 1VIEW 1MA 2VIEW 2AV 60 1 54 dBע -D2 Manuful show the 50 4( 30 20 10 Start 2.4835 GHz 1.65 MHz/ Stop 2.5 GHz

Date:

29.OCT.2010 16:34:18

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 91 of 117

# 7.6.7 Measurement Results AIR-ANT2506: Peak Emissions

Test Freq.	2412 N	IHz					E	ngineer	SB		
Variant	802.11	b; 1 Mb	S				Те	mp(⁰C)	22		
Freq. Range	2400 -	2483.5	MHz				Rel. I	-um .(%)	34		
Power Setting	max po	ax pow er Press. (m Bars) 1005									
Antenna	AIR-AN	T2506					Duty (	Sycle (%)	100		
TestNotes 1											
TestNotes 2											
MiCOMLabs	d8u√/m 1200 1000 9000 24000 Rad File	liated En	hissions brogram a	Vasona by E	MiSof	plate: F	85-210 ng/s/fe	) PK 2400-2 be 15.247 a	29 Oct 1 [2] 4 5 12 12 12 12 12 12 12 12 12 12	10 17:44 ) Vertica verage L verage L obst 3m Dist 3m Dist 3m cy: MHz annex81	 Yt 2 I I I
Formally mea	asure	ured emission peaks									
Frequency Raw MHz dBuV	Cable Loss	able AF Level Measurement Pol Hgt cm Azt Limit Margin Pass / Fail Comments									
2412.885 61.9	13.0	32.2	107.0	Peak [Scan]	V						PK
Legend: TX =	Fransmit	ransmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission									
PK = 1	Peak emi	ak emissions of Fundamental									

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 92 of 117

_	_											
Test	Freq.	2437 N	1Hz					E	ngineer	SB		
V	ariant	802.11	b; 1 Mb	S				Те	emp(⁰C)	22		
Freq. F	Range	2400 -	2483.5	MHz				Rel.	Hum .(%)	34		
Power Se	etting	max po	w er				Pi	ress.	(m Bars)	1005		
An	tenna	AIR-AN	T2506					Duty (	Cycle (%)	100		
TestNo	otes 1											
TestNo	otes 2											
MiC@ML	abs	dBu\/im 1200 1100 1000 900 24000 Rad File	Vasona by EMiSoft									
Formally	/ mea	sured	ired emission peaks									
Frequency M Hz	Raw dBuV	Cable Loss	able AF Level Measurement Pol R Hgt C Hgt Deg dBuV/m Bass / Fail Comments									
2439.658	58.2	13.0	32.2	103.4	Peak [Scan]	V						PK
Legend:	TX = T	ransmit	ter Emis	sions: DIC	6 = Digital Emissi	ons: F	UND =	Funda	mental; W	B = Wide	band En	nission
_030.10.	PK = F	Peakemi	ssions	of Fundan	nental	· ·-, ·						
		can chi	0010110									

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 93 of 117

		r								-		
Test	Freq.	2462 N	1Hz					E	ngineer	SB		
V	ariant	802.11	.11b; 1 Mbs Temp (°C) 22									
Freq. F	Range	2400 -	0 - 2483.5 MHz Rel. Hum.(%) 34									
Power Se	etting	max po	pow er Press. (m Bars) 1005									
An	tenna	AIR-AN	T2506					Duty (	ycle (%)	100		
TestNo	otes 1											
TestNo	otes 2											
MiC@M	abs	dBuV/im 1200 1100 1000 500 800 2400 Rad File	Vasona by EMiSoft 29 Oct 10 17:05 (1) Horizont: (2) Vertical (2)									
Formally	/ mea	sured	red emission peaks									
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	M argin dB	Pass /Fail	Comments
2462.918	62.1	13.0	32.3	107.3	Peak [Scan]	V						PK
Legend:	TX = T	ransmit	ter Emis	sions; DIC	6 = Digital Emissi	ons; F	UND =	Funda	mental; W	B = Wide	band En	nission
- 0	PK = F	Peak emi	ssions	of Fundan	nental							

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 94 of 117

Variant 1902 11	INZ						numeer				
Voriont	0.14										
variant 802.11	g; 6 Mb	S				Te	mp(ºC)	25	25		
Freq. Range 2400 -	2483.5	MHz				Rel. I	Hum .(%)	32			
Power Setting max.p	ax. pow er Press. (m Bars)							1002			
Antenna AIR-AN	IR-ANT2506 Duty Cycle (%)							100	100		
TestNotes 1	·										
Test Notes 2											
MiC@MLabs 1200 1100 1000 500 2400 Ray File	29 Oct 10 19:25 29 Oct 10 19:25 (1) Horizonta (2) Vertical (2) Vertical (2) Vertical (2) Vertical (3) Meas Dist 3m Spec Dist 3m Spec Dist 3m (4) Frequency: MHz 24000 24035 Radiated Emissions Filename: k:\program\go global consulting\gbcc01 - zebra ngls\foc 15:247 and rss 210 annex8\di										
Formally measure	ured emission peaks										
Frequency Raw Cable MHz dBuV Loss	able AF Level Measurement Pol Hgt Azt Limit Deg dBuV/m Bass /Fail Comments										
2413.052 61.2 13.0	32.2	106.4	Peak [Scan]	V						PK	
	ransmitter Emissions: DIG = Digital Emissions: FUND = Fundamental: WB = Wideband Emission										
Legend: TX = Transmit	ter Emis	sions; Die	5 = Digitai Emissi	ons, r		i unua	mental, vv				

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 95 of 117

	_							_					
Test	Freq.	2437 N	lHz					E	ngineer	GMH			
V	ariant	802.11	g; 6 Mb	S				Те	mp(⁰C)	25			
Freq. F	Range	2400 -	2483.5	MHz				Rel.	Hum .(%)	32			
Power S	etting	max.p	ow er				Pi	ress.	(m Bars)	1002			
An	tenna	AIR-AN	T2506					Duty (	Cycle (%)	<b>)</b> 100			
TestNo	otes 1												
TestNo	otes 2												
MiC@M	abs	dBuV/im 1200 1100 1000 300 24000 Rad File	iated En name: k:	nissions program/g	Vasona by E	Tem	plate: F	RSS-210	0 PK 2400-2 oc 15.247 a	29 Oct 1 12 4 4 5 5 5 5 12 12 12 12 12 12 12 12 12 12	0 19:29 Vertical verage L ebug Dist 3m Dist 3m oy: MHz annex8V	 ft: t	
Formally	/ mea	sured	red emission peaks										
Frequency M Hz	Raw dBuV	Cable Loss	able AF Level Measurement Pol Hgt Azt Limit Deg dBuV/m Bass /Fail Comments										
2437.985	60.2	13.0	32.2	105.4	Peak [Scan]	V						PK	
Legend:	TX = T	ransmit	ter Emis	sions; DIC	6 = Digital Emissi	ons: F	UND =	Funda	mental; W	B = Wide	band En	nission	
2090.10.		Doak omi	ssions	of Fundan		,.							
	' \ <b>-</b>	Car cill	3310113	or i unuali	iontai								

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 96 of 117

_	_											
Test	Freq.	2462 N	lHz					E	ngineer	GMH		
v	ariant	802.11	.11g; 6 Mbs Temp (°C) 25									
Freq. F	Range	2400 -	0 - 2483.5 MHz Rel. Hum.(%) 32									
Power S	etting	max.p	ow er				Pi	ess.	(m Bars)	1002		
An	tenna	AIR-AN	T2506					Duty (	Cycle (%)	100		
TestNo	otes 1											
TestNo	otes 2											
MiC@M	abs	dBuV/im 1200 1000 900 2000 Rad File	iated En name: k:	hissions program/ge	Vasona by E	MiSof	plate: F	۲ <sup>4</sup> ۰۰۰۰۰ ۵۰۰۰۰ ۱ ngis Vi	D PK 2400-2 oc 15.247 a	29 Oct 1 12 + D Meas Spec Frequen 2483.5 nd rss 210	ID 19:34- ) Horizon ) Vertical verage Li ebug Dist 3m Dist 3m cy: MHz annex8V	 fta t
Formally	/ mea	sured	red emission peaks									
Frequency M Hz	Raw dBuV	Cable Loss	A F dB	Level dBuV/m	M easurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	M argin dB	Pass /Fail	Comments
2463.922	61.0	13.0	32.3	106.2	Peak [Scan]	V						PK
l egend:	TX = T	ransmit	ter Emis	sions: DIC	G = Digital Emissi	ons <sup>.</sup> F	UND =	Funda	mental <sup>.</sup> W	B = Wide	band Fn	nission
Logona.		Dook om	k amiasiana of Fundamental									
		ear ein	k emissions of Fundamental									

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



# 7.7 Receiver Conducted Spurious Emissions

Industry Canada RSS-Gen §4.10, §6

### **Test Procedure**

Conducted emissions were measured with a spectrum analyzer connected to the antenna terminal. Measurements were made while EUT was operating in receive mode.

### **Test Measurement Set up**



Receiver Conducted spurious emission measurement test configuration

## Specification

## **Receiver Radiated Spurious Emissions**

Industry Canada RSS-Gen §4.10,

The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

For emissions below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector with the same measurement bandwidth as that for CISPR quasi-peak measurements. Above 1 GHz, measurements shall be performed using an average detector and a resolution bandwidth of 300 kHz to 1 MHz.

## RSS-Gen §6 (b)

If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 98 of 117

# Traceability

Method	Test Equipment Used
Measurements were made per work	0287, 0158, 0252, 0223, 0116, 0117, 0287,
instruction WI-05 'Measurement of	0363.
Spurious Emissions'	

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



#### **Receiver Conducted Emissions 30 MHz to 1GHz** Marker 1 [T1] RBW 100 kHz RF Att 10 dB Ref Lvl -66.40 dBm VBW 30 kHz 0 dBm 990.28056112 MHz SWT 10 s Unit dBm Offset ▼1 [T1] 13 dB -66.40 dBn 990.28056112 MHz -10 -20 -30 TN1 1MA 1VIEW -40 -50 -D1 -54 dBm--60 -7 -80 -9( -100 Start 30 MHz 97 MHz/ Stop 1 GHz

Date: 29.0CT.2010 20:33:25

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.





This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 101 of 117

# 7.8 Radiated Spurious Emissions – Digital Apparatus

### **Standard Reference**

FCC, Part 15 Subpart B §15.109 Industry Canada ICES-003 §5

### **Test Procedure**

Testing was performed in a 3-meter semi-anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak hold mode.

Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR Compliant receiver. Emissions from 30 MHz – 1000 MHz are measured utilizing a CISPR compliant quasi-peak detector with a tuned receiver, using a bandwidth of 120 kHz. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz. Only the highest emissions relative to the limit are listed.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 102 of 117

### **Test Measurement Set up**



Measurement set up for Radiated Emission Test < 1 GHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Measurement set up for Radiated Emission Test > 1 GHz

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 104 of 117

# **Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

# FS = R + AF + CORR - FO

FS = Field Strength R = Measured Spectrum analyzer Input Amplitude AF = Antenna Factor

## CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss AG = Amplifier Gain FO = Distance Falloff Factor NFL = Notch Filter Loss or Waveguide Loss

Field Strength Calculation Example:

Given receiver input reading of 51.5 dB $\mu$ V; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

 $FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 dB\mu V/m$ 

Conversion between dB $\mu$ V/m (or dB $\mu$ V) and  $\mu$ V/m (or  $\mu$ V) are done as:

Level (dB $\mu$ V/m) = 20 \* Log (level ( $\mu$ V/m))

40 dBμV/m = 100 μV/m 48 dBμV/m = 250 μV/m

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 105 of 117

# Specification

# **Radiated Spurious Emissions – Digital Apparatus**

# FCC, Part 15 Subpart B §15.109

A representative type or model of each digital apparatus shall be tested in accordance with the measurement methods described in FCC Part 15; Subpart A - General and FCC Subpart B – Unintentional Radiators.

### Industry Canada ICES-003

A representative type or model of each digital apparatus shall be tested in accordance with the measurement method described in the publication referred to in Section 7.1 [Canadian Standards Association Standard CAN/CSA-CEI/IEC CISPR 22:02, "Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment."].

## FCC, Part 15 Subpart B §15.109 Spurious Emissions Limits

Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values.

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Field Strength of radiated emissions for a Class A digital device are as follows.

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	49.5	3
88-216	150	54.0	3
216-960	200	57.0	3
Above 960	500	60.0	3

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 106 of 117

# **ICES-003 §5 Spurious Emissions Limits**

**Class A Digital Device:** The field intensity of radio noise emissions that are radiated from a Class A digital apparatus shall not exceed the limits specified in Table 5 of the publication referred to in Section 7.1, within the indicated frequency range.

Frequency range	Quasi-peak limits dB(µV/m) @	Quasi-peak limits dB(µV/m) @					
MHz	10m	3m					
30 to 230	40	50.5					
230 to 1 000	47	57.5					
Note 1	The lower limit shall apply at the transition frequency.						
Noto 2	Additional provisions may be require	ed for cases where interference					
	occurs						

**Class B Digital Device:** The field intensity of radio noise emissions that are radiated from a Class B digital apparatus shall not exceed the limits specified in Table 6 of the publication referred to in Section 7.1, within the indicated frequency range.

Frequency range	Quasi-peak limits dB(µV/m) @	Quasi-peak limits dB(µV/m) @					
MHz	10m	3m					
30 to 230	30	40.5					
230 to 1 000	37	47.5					
Note 1	The lower limit shall apply at the transition frequency.						
Note 2	Additional provisions may be required for cases where interference						
	occurs						

Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement Uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Work instruction WI-03	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



## 7.8.1 <u>Measurement Results for Radiated Spurious Emissions – Digital Apparatus</u>

Please note: Radio emissions were investigated during digital emissions testing. No radio emissions were witnessed in the range 30 - 1000 MHz during testing.



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 108 of 117

lest	Freq.	2412 MHz					Engineer				SB		
v	ariant	802.11b/g; 1/6 Mbs				Temp (°C)				22			
Freq. I	Range	1000 MHz - 5000 MHz				Rel. Hum.(%)				34			
Power Setting max power				Press. (mBars)				1005					
Antenna NA - No Radio Emissions			s	Duty Cycle (%)			100						
Test No	otes 1	Ref Sc	Ref Scan 1 to 5 GHz										
Test Notes 2													
Vasona by EMISoft 29 Oct 10 11:35 29 Oct 10 11:35 29 Oct 10 11:35 20 Oct 10 Oc								 it t					
Formally measured emission peaks													
Frequency MHz	Raw	Cable	AF					1		1	-		
	abuv	Loss	dB	dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments	
1220.879	67.1	<b>Loss</b> 2.2	<b>dB</b> -14.5	dBuV/m 54.8	Type Peak	Pol V	Hgt cm 152	Azt Deg 74	Limit dBuV/m 74.0	Margin dB -19.2	Pass /Fail Pass	Comments	
1220.879 4883.517	67.1 57.4	Loss 2.2 4.5	dB -14.5 -9.3	<b>Level</b> dBuV/m 54.8 52.6	Peak	Pol V V	Hgt cm 152 151	Azt Deg 74 237	Limit dBuV/m 74.0 74.0	Margin dB -19.2 -21.4	Pass /Fail Pass Pass	Comments	
1220.879 4883.517 1375.130	67.1 57.4 52.8	Loss 2.2 4.5 2.3	dB -14.5 -9.3 -13.9	<b>dBuV/m</b> 54.8 52.6 41.2	Reasurement Type Peak Peak Peak	Pol V V V	Hgt cm 152 151 98	Azt Deg 74 237 274	Limit dBuV/m 74.0 74.0 74	Margin dB -19.2 -21.4 -32.8	Pass /Fail Pass Pass Pass	Comments	
1220.879 4883.517 1375.130 1709.233	67.1 57.4 52.8 63.1	2.2 4.5 2.3 2.5	dB -14.5 -9.3 -13.9 -13.4	<b>dBuV/m</b> 54.8 52.6 41.2 52.3	Reak Reak Reak Reak Reak Reak	Pol           V           V           V           V           V	Hgt cm 152 151 98 98	Azt Deg 74 237 274 337	Limit dBuV/m 74.0 74.0 74 74	Margin dB -19.2 -21.4 -32.8 -21.8	Pass /Fail Pass Pass Pass	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808	67.1 57.4 52.8 63.1 63.0	Loss 2.2 4.5 2.3 2.5 2.1	dB -14.5 -9.3 -13.9 -13.4 -16.3	<b>dBuV/m</b> 54.8 52.6 41.2 52.3 48.8	Type       Peak       Peak       Peak       Peak       Peak       Peak       Peak       Peak	Pol           >           >           >           >           >           >	Hgt           152           151           98           98           152	Azt Deg 74 237 274 337 33	Limit dBuV/m 74.0 74.0 74 74 74	Margin dB -19.2 -21.4 -32.8 -21.8 -25.2	Pass /Fail Pass Pass Pass Pass	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126	67.1 57.4 52.8 63.1 63.0 61.1	Loss 2.2 4.5 2.3 2.5 2.1 2.4	dB -14.5 -9.3 -13.9 -13.4 -16.3 -14.5	<b>dBuV/m</b> 54.8 52.6 41.2 52.3 48.8 49.0	Measurement Type Peak Peak Peak Peak Peak Peak	Pol > > > > > > > > > > > > > > > > > > >	Hgt cm           152           151           98           98           152           98           98           98           98           98           98           98	Azt Deg 74 237 274 337 33 206	Limit dBuV/m 74.0 74.0 74 74 74 74	Margin dB -19.2 -21.4 -32.8 -21.8 -25.2 -25.2	Pass /Fail Pass Pass Pass Pass Pass	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972	67.1 57.4 52.8 63.1 63.0 61.1 61.1	Loss 2.2 4.5 2.3 2.5 2.1 2.4 2.3	dB -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.5	Level           dBuV/m           54.8           52.6           41.2           52.3           48.8           49.0           49.2	Measurement Type Reak Reak Reak Reak Reak Reak Reak	Pol    >   >   >   >   >   >   >   >	Hgt cm           152           151           98           98           152           98           202	Azt Deg 74 237 274 337 33 206 223	Limit dBuV/m 74.0 74.0 74 74 74 74.0 74.0	Margin dB -19.2 -21.4 -32.8 -21.8 -25.2 -25.0 -24.8	Pass /Fail Pass Pass Pass Pass Pass	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1220.879	67.1 57.4 52.8 63.1 63.0 61.1 61.1 65.9	Loss 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2	dB -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.5 -14.1 -14.5	Level           dBuV/m           54.8           52.6           41.2           52.3           48.8           49.0           49.2           53.5	Measurement Type Peak Peak Peak Peak Peak Peak Peak Average	Pol	Hgt cm           152           151           98           98           152           98           152           98           152           98           152           98           152           98           152           98           152           98           152	Azt Deg 74 237 274 337 33 206 223 74	Limit dBuV/m 74.0 74.0 74 74 74 74.0 74.0 54	Margin dB -19.2 -21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5	Pass /Fail Pass Pass Pass Pass Pass Pass Pass	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1220.879 4883.517	67.1 57.4 52.8 63.1 63.0 61.1 61.1 65.9 54.4	Loss 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2 4.5	dB -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.5 -14.1 -14.5 -9.3	Level           dBuV/m           54.8           52.6           41.2           52.3           48.8           49.0           49.2           53.5           49.6	Measurement Type Peak Peak Peak Peak Peak Reak Reak Average Average	Pol         >         <	Hgt           152           151           98           152           98           152           98           152           98           152           98           152           98           152           151           152           152           152	Azt Deg 74 237 274 337 33 206 223 74 237	Limit dBuV/m 74.0 74.0 74 74 74 74.0 74.0 74.0 54	Margin dB -19.2 -21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -0.5 -4.4	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130	67.1 57.4 52.8 63.1 63.0 61.1 61.1 65.9 54.4 45.6	Loss 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3	dB -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.1 -14.5 -9.3 -13.9	Level           dBuV/m           54.8           52.6           41.2           52.3           48.8           49.0           49.2           53.5           49.6           34.0	Measurement Type Reak Reak Reak Reak Reak Reak Reak Average Average	Pol       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >	Hgt           152           151           98           152           98           152           98           152           98           152           98           152           98           202           152           152           98	Azt Deg 74 237 274 337 33 206 223 74 237 237	Limit dBuV/m 74.0 74.0 74 74 74 74.0 74.0 74.0 54 54	Margin dB -19.2 -21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -24.8 -0.5 -4.4 -20.0	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130 1709.233	67.1           57.4           52.8           63.1           63.0           61.1           65.9           54.4           45.6           61.0	Loss 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5	dB -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.5 -14.1 -14.5 -9.3 -13.9 -13.4	Level           dBuV/m           54.8           52.6           41.2           52.3           48.8           49.0           49.2           53.5           49.6           34.0           50.1	Measurement Type Peak Peak Peak Peak Peak Peak Reak Average Average Average	Pol       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >	Hgt cm           152           98           98           152           98           152           98           152           98           152           98           152           98           202           152           98           202           152           98	Azt Deg 74 237 274 337 33 206 223 74 237 237 237	Limit dBuV/m 74.0 74.0 74 74 74.0 74.0 74.0 54 54 54	Margin dB -19.2 -21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -24.8 -0.5 -4.4 -20.0 -3.9	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130 1709.233 1098.808	67.1           57.4           52.8           63.1           63.0           61.1           65.9           54.4           45.6           61.0           60.9	Loss 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5 2.1	dB -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.5 -14.1 -14.5 -9.3 -13.9 -13.4 -13.9 -13.4 -13.9	Level           dBuV/m           54.8           52.6           41.2           52.3           48.8           49.0           49.2           53.5           49.6           34.0	Measurement Type Peak Peak Peak Peak Peak Peak Average Average Average Average	Pol       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >	Hgt           152           151           98           152           98           152           98           152           98           202           151           98           202           152           98           98           98           98           98           98           98           98           98           98           98           98           98           98	Azt Deg 74 237 274 337 33 206 223 74 237 237 274 337 33	Limit dBuV/m 74.0 74.0 74 74 74.0 74.0 74.0 54 54 54 54	Margin dB -19.2 -21.4 -32.8 -25.2 -25.2 -25.0 -24.8 -0.5 -4.4 -20.0 -3.9 -3.9 -7.4	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130 1709.233 1098.808 1587.126	67.1 57.4 52.8 63.1 63.0 61.1 61.1 65.9 54.4 45.6 61.0 60.9 58.6	Loss 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5 2.1 2.4	dB -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.1 -14.5 -9.3 -13.9 -13.4 -16.3 -13.4 -16.3 -13.9 -13.4 -13.9	Level           dBuV/m           54.8           52.6           41.2           52.3           48.8           49.0           49.2           53.5           49.6           34.0           50.1           46.6           46.6	Measurement Type Reak Reak Reak Reak Reak Reak Average Average Average Average Average	Pol       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >       >	Hgt cm           152           151           98           98           152           98           152           98           152           98           152           98           152           98           152           98           152           98	Azt Deg 74 237 274 337 33 206 223 74 237 274 337 33 206	Limit dBuV/m 74.0 74.0 74 74 74 74.0 74.0 74.0 74.0	Margin dB -19.2 -21.4 -32.8 -21.8 -25.2 -25.0 -24.8 -0.5 -24.8 -0.5 -4.4 -20.0 -3.9 -7.4 -7.4	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972	67.1           57.4           52.8           63.1           63.0           61.1           65.9           54.4           45.6           61.0           60.9           58.6           59.1	Loss 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5 2.1 2.4 2.3	dB -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.1 -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -13.4 -16.3 -14.5 -14.5 -13.4	Level           dBuV/m           54.8           52.6           41.2           52.3           48.8           49.0           49.2           53.5           49.6           34.0           50.1           46.6           47.2	Measurement Type Reak Peak Peak Reak Reak Reak Average Average Average Average Average Average Average	Pol         >         <	Hgt cm           152           98           98           152           98           152           98           152           98           202           151           98           152           98           202           151           98           152           98           152           98           202           98           202	Azt Deg 74 237 274 337 33 206 223 74 237 274 337 33 206 223	Limit dBuV/m 74.0 74.0 74 74 74.0 74.0 74.0 54 54 54 54 54 54 54 54	Margin dB -19.2 -21.4 -32.8 -25.2 -25.0 -24.8 -0.5 -24.8 -0.5 -4.4 -20.0 -3.9 -7.4 -7.4 -7.4 -6.8	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1272.545	67.1           57.4           52.8           63.1           63.0           61.1           65.9           54.4           45.6           61.0           60.9           58.6           59.1           62.7	Loss 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2 2.1 2.4 2.3 2.2	dB -14.5 -9.3 -13.9 -13.4 -16.3 -14.5 -14.1 -14.5 -9.3 -13.9 -13.4 -16.3 -13.9 -13.4 -16.3 -14.5 -14.5 -13.9 -13.4 -14.5 -13.9 -13.4 -14.5 -9.3 -13.4 -14.5 -9.3 -14.5 -1	Level           dBuV/m           54.8           52.6           41.2           52.3           48.8           49.0           49.2           53.5           49.6           34.0           50.1           46.6           47.2           50.9	Measurement Type Reak Reak Reak Reak Reak Reak Reak Average Average Average Average Average Average Average Reak [Scan]	Pol         >         <	Hgt cm           152           151           98           152           98           152           98           202           151           98           152           98           152           98           152           98           152           98           202           203           204           202           202	Azt Deg 74 237 337 33 206 223 74 237 274 337 33 206 223 0	Limit dBuV/m 74.0 74.0 74 74 74 74.0 74.0 74.0 54 54 54 54 54 54 54 54 54 54	Margin dB -19.2 -21.4 -32.8 -25.2 -25.0 -24.8 -0.5 -24.8 -0.5 -4.4 -20.0 -3.9 -7.4 -7.4 -7.4 -6.8 -3.1	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments	
1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1220.879 4883.517 1375.130 1709.233 1098.808 1587.126 1342.972 1272.545 Legend:	67.1 57.4 52.8 63.1 63.0 61.1 61.1 65.9 54.4 45.6 61.0 60.9 58.6 59.1 62.7 TX=T	Loss 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.2 4.5 2.3 2.5 2.1 2.4 2.3 2.5 2.1 2.4 2.3 2.5 2.1 2.4 2.3 2.5 5 2.1 2.4 5 2.3 2.5 5 2.1 2.5 5 2.3 2.5 5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2	dB           -14.5           -9.3           -13.9           -13.4           -16.3           -14.5           -14.5           -14.5           -13.9           -13.4           -14.5           -14.5           -14.5           -14.5           -13.9           -13.4           -16.3           -14.5           -13.4           -16.3           -14.5           -14.1           -14.5           -14.1           -14.0	Level           dBuV/m           54.8           52.6           41.2           52.3           48.8           49.0           49.2           53.5           49.6           34.0           50.1           46.6           47.2           50.9           ssions; DK	Measurement Type Reak Peak Peak Reak Reak Reak Reak Average Average Average Average Average Average Reak [Scan] B = Digital Emissi	Pol           V	Hgt cm           152           151           98           152           98           152           98           152           98           202           151           98           152           98           152           98           152           98           152           98           152           98           202           98           202           98           202           98           202           98           202           98           202           98           202           98           200	Azt Deg 74 237 274 337 33 206 223 74 237 274 337 33 206 223 0 0	Limit dBuV/m 74.0 74.0 74 74 74 74 74.0 74.0 74.0 54 54 54 54 54 54 54 54 54 54	Margin dB -19.2 -21.4 -32.8 -25.2 -25.0 -24.8 -0.5 -4.4 -20.0 -3.9 -7.4 -7.4 -6.8 -3.1 B = Wide	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments	

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.


## 7.9 Conducted Disturbance at Mains Terminal (150 kHz – 30 MHz)

#### **Standard Reference**

FCC, Part 15 Subpart C §15.107 Industry Canada ICES-003 §5.3

### Test not applicable - EUT Tested in host device Zebra Enterprise Solutions Corp. WhereLAN III LOCATION SENSOR

#### **Test Procedure**

The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 110 of 117

#### Test Measurement Set up



Measurement set up for Conducted Disturbance at Mains Terminals

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 111 of 117

### Specification

#### **Conducted Disturbance at Mains Terminal – Digital Apparatus**

#### FCC, Part 15 Subpart B §15.107

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

(b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms LISN. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

#### **Industry Canada ICES-003**

The voltage of radio noise emissions that are conducted along the power supply lines of a Class A digital apparatus shall not exceed the limits specified in Table 1 of the publication referred to in Section 7.1 [Canadian Standards Association Standard CAN/CSA-CEI/IEC CISPR 22:02, "Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment."], within the indicated frequency range.

The voltage of radio noise emissions that are conducted along the power supply lines of a Class B digital apparatus shall not exceed the limits specified in Table 2 of the publication referred to in Section 7.1 [Canadian Standards Association Standard CAN/CSA-CEI/IEC CISPR 22:02, "Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment."], within the indicated frequency range.

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



## FCC, Part 15 Subpart B §15.107 & Industry Canada ICES-003 Limits

Limits for conducted disturbance at the mains ports of class B ITE

Frequency of emission	Quasi-peak	Average	
(MHz)	dBuV	dBuV	
0.15–0.5	66 to 56*	56 to 46*	
0.5–5	56	46	
5–30	60	50	
Note 1	* Decreases with the logarithm of the frequency		
Note 2	* The lower limit applies at the boundary between frequency		
	ranges		

Limits for conducted disturbance at the mains ports of class A ITE

Frequency of emission (MHz)	Quasi-peak dBuV	Average dBuV
0.15–0.5	79	66
0.5–30	73	60
Note 1	* The lower limit shall apply at the transition frequency.	

Laboratory Measurement Uncertainty for Conducted Emissions

Measurement uncertainty	±2.64 dB

Traceability

Method	Test Equipment Used
Work instruction WI-EMC-01	0158, 0184, 0193, 0190, 0293, 0307



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 113 of 117

# 8 PHOTOGRAPHS

## 8.1 Test Setup Photos



This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 114 of 117



WiFi Module WLM54AG with omni directional antenna AIR-ANT2506 (gain 5.2 dBi)

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 115 of 117



WiFi Module WLM54AG with yagi directional antenna AIR-ANT1949 (gain 13.5 dBi)

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



Title:Zebra Enterprise Solutions WLM54AGTo:FCC 47 CFR Part 15.247 & IC RSS-210Serial #:GBCC01-U2 Rev AIssue Date:9th December 2010Page:Page 116 of 117

# 9 TEST EQUPIMENT DETAILS

Asset #	Instrument	Manufacturer	Model #	Serial #
0072	Signal Generator	Hewlett Packard	HP 83640A	2927A00105
0075	Environmental Chamber	Thermatron	SE-300-2-2	27946
0338	Antenna (30M-3GHz)	Sunol Sciences	JB3	A052907
0083	Coupler	Hewlett Packard	HP 87301D	3116A00389
0287	EMI Receiver	Rhode & Schwartz	ESIB 40	100201
0335	Horn Antenna	The Electro-Mechanics Company	3117	00066580
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0134	Amplifier	ComPower	PA-122	181910
0158	Barometer /Thermometer	Control Co.	4196	E2844
0193	EMI Receiver	Rhode & Schwartz	ESI 7	838496/007
0223	Power Meter	Hewlett Packard	HP EPM-442A	US37480256
0252	K-Cable	Megaphase	Sucoflex 104	Unknown
0253	K-Cable	Megaphase	Sucoflex 104	Unknown
0256	K-Cable	Megaphase	Sucoflex 104	Unknown
0251	K-Cable	Megaphase	Sucoflex 104	Unknown
0305	20M-2GHz Amplifier	ML	ML001	001
0310	2m SMA Cable	Micro-Coax	UFA210A-0- 0787-3G03G0	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1- 1181-3G0300	209092-001
0313	Coupler	Hewlett Packard	86205A	3140A01285
0314	30 dB N-Type Attenuator	ARRA	N944-30	1623
Dipole	20MHz-1GHz Dipole Antennas	EMCO	3121C	9009-505

This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.



440 Boulder Court, Suite 200 Pleasanton, CA 94566, USA Tel: 1.925.462.0304 Fax: 1.925.462.0306 www.micomlabs.com