Certification Test Report

CFR 47 FCC Part 15, Subpart C Section 15.247
Industry Canada RSS 210, Issue 7

Rainforest Automation
RFA-Z105 EMU

FCC ID # YCXRFA-Z105
IC ID # 8919A-RFAZ105
Project Code CG-1465

(Report CG-1465-RA-1-1)
Revision: 1

September 16, 2010

Prepared for:	Rainforest Automation
Author:	Deniz Demirci Senior EMC / Wireless Technologist
Approved by:	Nick Kobrosly Director of Canadian Operations

Report Summary

Test Facility:	**National Technical Systems, Canada** Product Integrity Laboratory 5151-47th Street, N.E. Calgary Alberta T3J 3R2
Accreditation Numbers:	0214.22 Electrical 0214.23 Mechanical Accredited by A2LA The American Association for Laboratory Accreditation CLIENTS SERVED: All interested parties FIELDS OF TESTING: Electrical/Electronic, Mechanical/Physical ACCREDITATION DATE:: May 14, 2009 VALID TO: December 31, 2011
Applicant:	Rainforest Automation 34 W 7th Avenue V5Y 1L6 Vancouver, BC Canada
Customer Representative:	Name: Jacques Farges Phone #: 604-630-4287 Email Address: jfarges@rainforestautomation.com

Test Summary

Appendix	Test/Requirement Description	Deviations* from:			Pass / Fail	Applicable FCC Rule Parts	Applicable Industry Canada Rule Parts
		Base Standard	Test Basis	NTS Procedure			
A	6 dB Bandwidth	No	No	No	Pass	FCC Subpart C 15.247 (a) (2)	RSS 210 Issue 7 A8.2 (a)
B	Occupied Bandwidth (99% emission bandwidth)	No	No	No	N/A	N/A	RSS-Gen Issue 2 4.6.1
C	Peak Power Output	No	No	No	Pass	FCC Subpart C 15.247 (b) (3)	RSS 210 Issue 7 A8.4 (4)
D	Power Spectral Density	No	No	No	Pass	FCC Subpart C 15.247 (e)	RSS 210 Issue 7 A8.2 (b)
E	Conducted Spurious Emissions	No	No	No	Pass	FCC Subpart C 15.247 (d)	RSS 210 Issue 7 A8.5
F	Conducted Spurious Emissions Band Edge	No	No	No	Pass	FCC Subpart C 15.247 (d)	RSS 210 Issue 7 A8.5
G	Duty Cycle Correction factor	No	No	No	N/A	FCC Subpart C 15.35 (c)	RSS-Gen Issue 2 4.5
H	Radiated Spurious Emissions Band Edge	No	No	No	Pass	FCC Subpart C 15.247, 15.205	RSS 210 Issue 7 2.6, A8.5
I	Radiated Spurious Emissions (TX and RX)	No	No	No	Pass	FCC Subpart C 15.247, 15.205	RSS 210 Issue 7 2.6, A8.5

Test Result: The product presented for testing complied with test requirements as shown above.

Prepared By: Digitally signed by Deniz Demirci
Date: 2010.10.04 13:16:41 -06'00'
Deniz Demirci
Senior Wireless/EMC Technologist

Reviewed By: Glen Moore
Digitally signed by Glen Moore
DN: cn=Glen Moore, c=CA, o=NTS, email=glen.moore@ntscorp.com
Reason: I have reviewed this document
Date: 2010.10.04 13:40:17 -06'00'
Glen Moore
Wireless/EMC Manager

Approved By: Alex Mathews 2010.10.04 13:35:13 -06'00'
Alex Mathews
Quality Management Representative

Table of Contents

Register of revisions

Revision	Date	Description of Revisions
1	September 16, 2010	Final release

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Canada to demonstrate compliance of the RFA-Z105-RA EMU from Rainforest Automation to FCC Part 15 Subpart C section 15.247 for DTS transmitter and the equivalent sections of Industry Canada's RSS 210, Issue 7

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

Description of EUT

	Name	Model	Revision	Serial Number
EUT	RFA-Z105	RFA-Z105	N/A	N/A
Power Supply	N/A			
Classification	Mobile			
Antenna	Integral, PCB trace			
Modulation	0-QPSK			
EUT Size with Enclosure (H x W x D) (in mm)	140 x 100 x 30			
EUT Weight (in grams)	Less than 200 g (without batteries)			
Channels/Frequency Range	16 channels, 2405 MHz -2480 MHz			
Functional Description	The RFA-Z105 is an IEEE 802.15.4 compliant 2.4 GHz transceiver for Smart Meters See the Rainforest Automation EMU User Manual for details			

2.1.1 EUT POWERS

Voltage	4 x AA Battery operated
Number of Feeds	N/A

2.2 EUT CABLES

Quantity	Model/Type	Routing		Shielded / Unshielded	Description	Cable Length (m)
		From	To			
N/A						

2.3 MODE OF OPERATION DURING TESTS

The RFA-Z105 EMU was tested while Continuous Transmit and Receive modes. The EUT was tuned to a low, middle, and high channel to perform power, occupied bandwidth and spurious/harmonic tests.
While transmitting, the EUT was setup to operate at the intended maximum power output available to the end user.
Power level was reduced for Channel 26 (high channel) and set to "2" during the tests. This level will be implemented by Rainforest Automation in the production.

For all test cases pre-scans were completed in all modes to determine worst case levels.

3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION

Dell Vostro Laptop computer p/n: UW049A00 and the Rainforest Programming board were used for setting up the EUT.

Support equipments were used for configuring the EUT only, they were not connected during the tests.

3.2 TEST BED/PERIPHERAL CABLES

NA

4.0 TEST ENVIRONMENT

4.1 NORMAL TEST CONDITIONS

Temperature:	20 – 23 °C
Relative Humidity:	28 – 35 %
Atmospheric pressure:	883 – 890 mbar
Nominal test voltage:	4 x AA battery operated

The values are the limits registered during the test period.

APPENDICES

APPENDIX A: 6 DB BANDWIDTH

A.1. Base Standard & Test Basis

Base Standard	FCC PART 15.247 (a) (2) RSS 210 Issue 7 A8.2 (a)
Test Basis	ANSI C63.10: 2009 RSS-Gen Issue 2 4.6.2
Test Method	ANSI C63.10: 2009 RSS 210 Issue 7 A8.2 (a)

A.2. Specifications

15.247 2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

A.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
None						

A.4. Test Procedure

ANSI C63.10 and RSS 210.

A.5. Test Results

The EUT is in compliance with the requirement as specified above

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
11	2405	1.603
18	2440	1.643
26	2480	1.643

All final reported values are corrected values

A.6. Operating Mode During Test

The EUT was tuned to a low and middle channel, operating at maximum rated RF output power with maximum power Setting 3. For High channel; Power setting “2” was used in order to reduce power. (See CG-1465-NOD-01)

A.7. Tested By

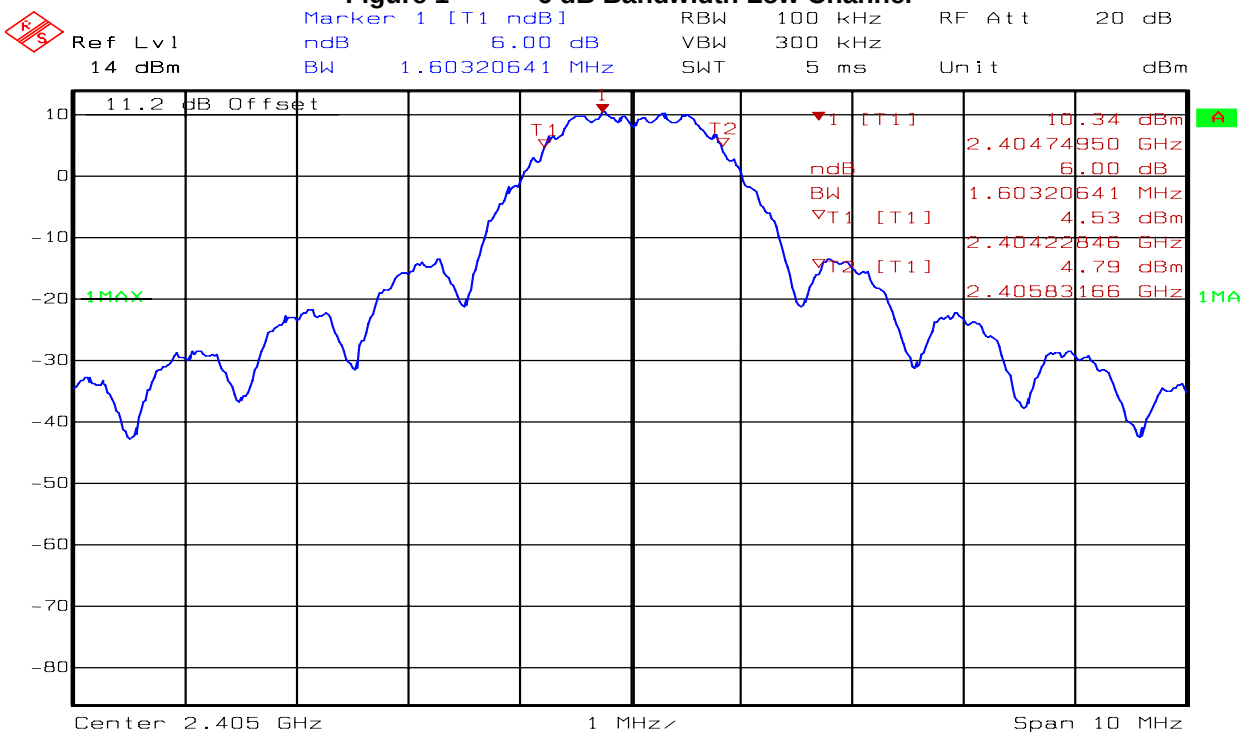
This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

A.8. Test date

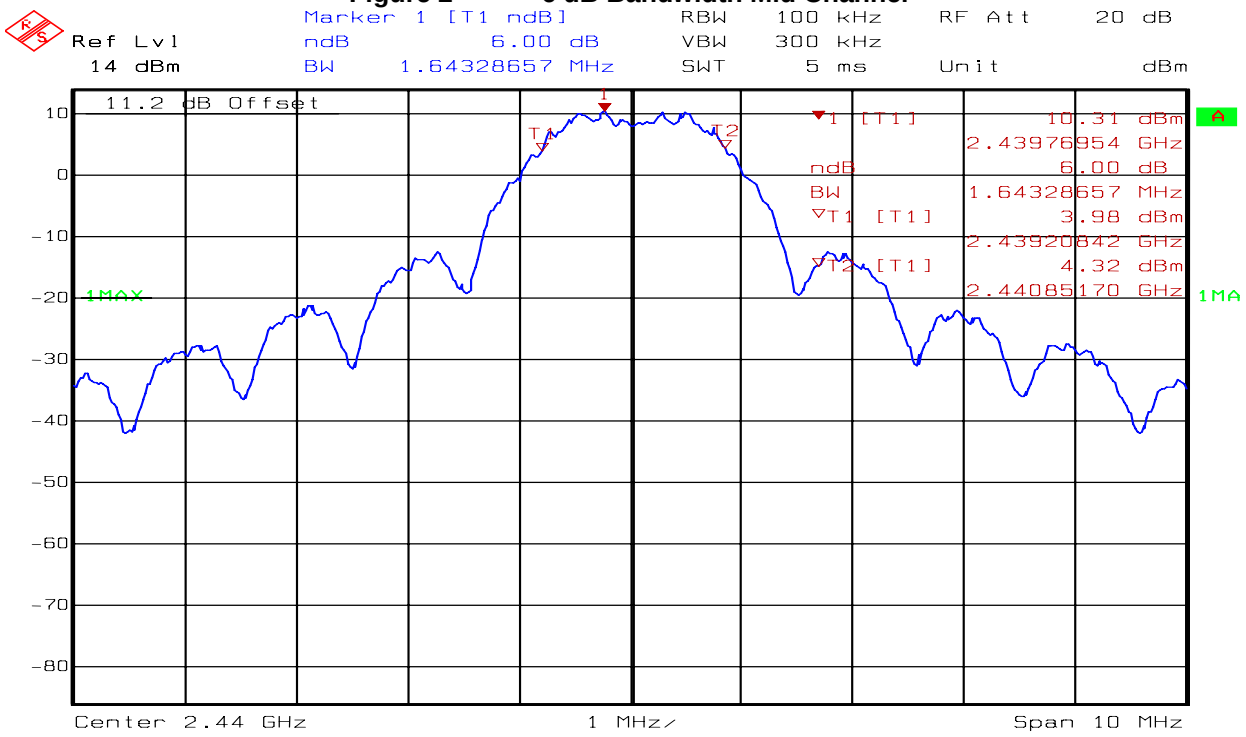
August 31, 2010

Figure 1 6 dB Bandwidth Low Channel



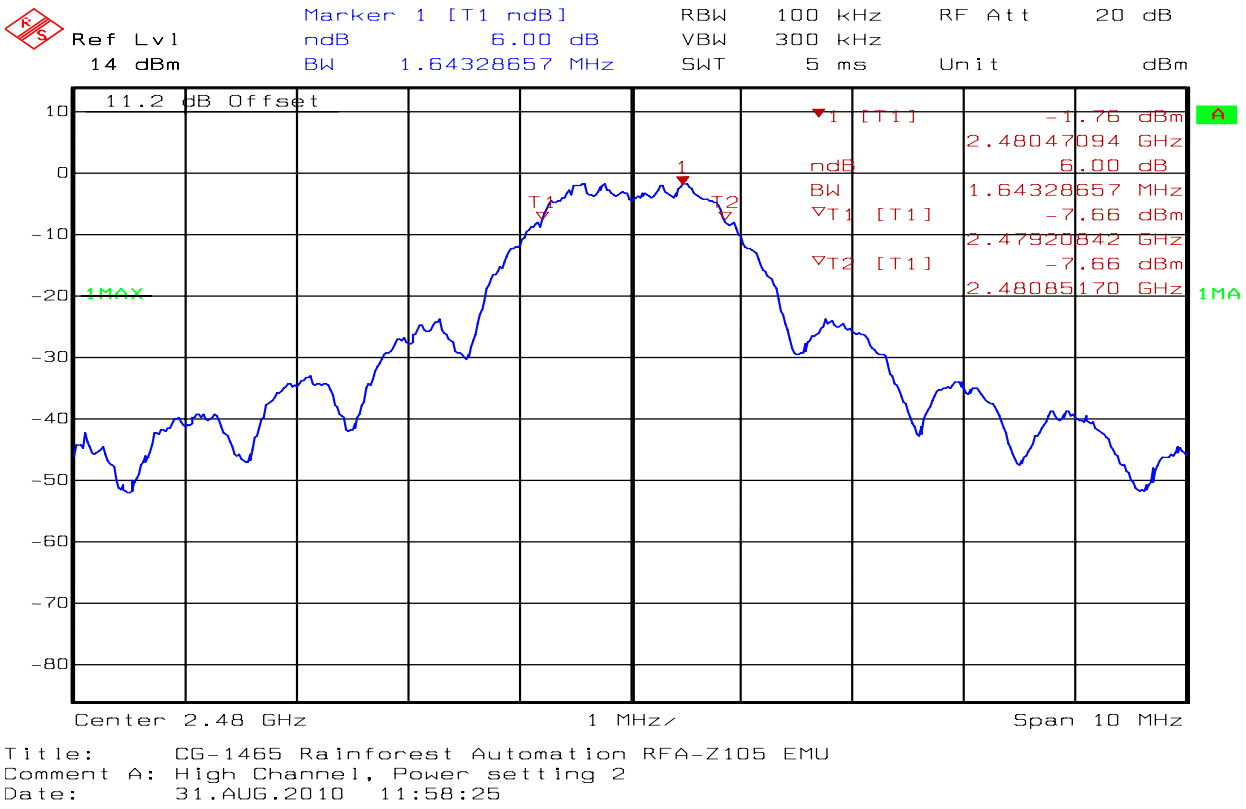
Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: Low Channel, Power setting max (3)
Date: 31.AUG.2010 11:45:52

Figure 2 6 dB Bandwidth Mid Channel



Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: Mid Channel, Power setting max (3)
Date: 31.AUG.2010 11:50:26

Figure 3 6 dB Bandwidth High Channel



APPENDIX B: OCCUPIED BANDWIDTH

B.1. Base Standard & Test Basis

Base Standard	RSS-Gen Issue 2 4.6.1
Test Basis	RSS-Gen Issue 2 4.6.1
Test Method	RSS-Gen Issue 2 4.6.1

B.2. Specifications

4.6.1 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.

B.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
None						

B.4. Test Procedure

RSS-Gen Issue 2

B.5. Test Results

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
11	2405	2.345
18	2440	2.425
26	2480	2.485

All final reported values are corrected values

B.6. Operating Mode During Test

The EUT was tuned to a low and middle channel, operating at maximum rated RF output power with maximum power Setting 3. For High channel; Power setting “2” was used in order to reduce power. (See CG-1465-NOD-01)

B.7. Sample Calculation

NA

B.8. Tested By

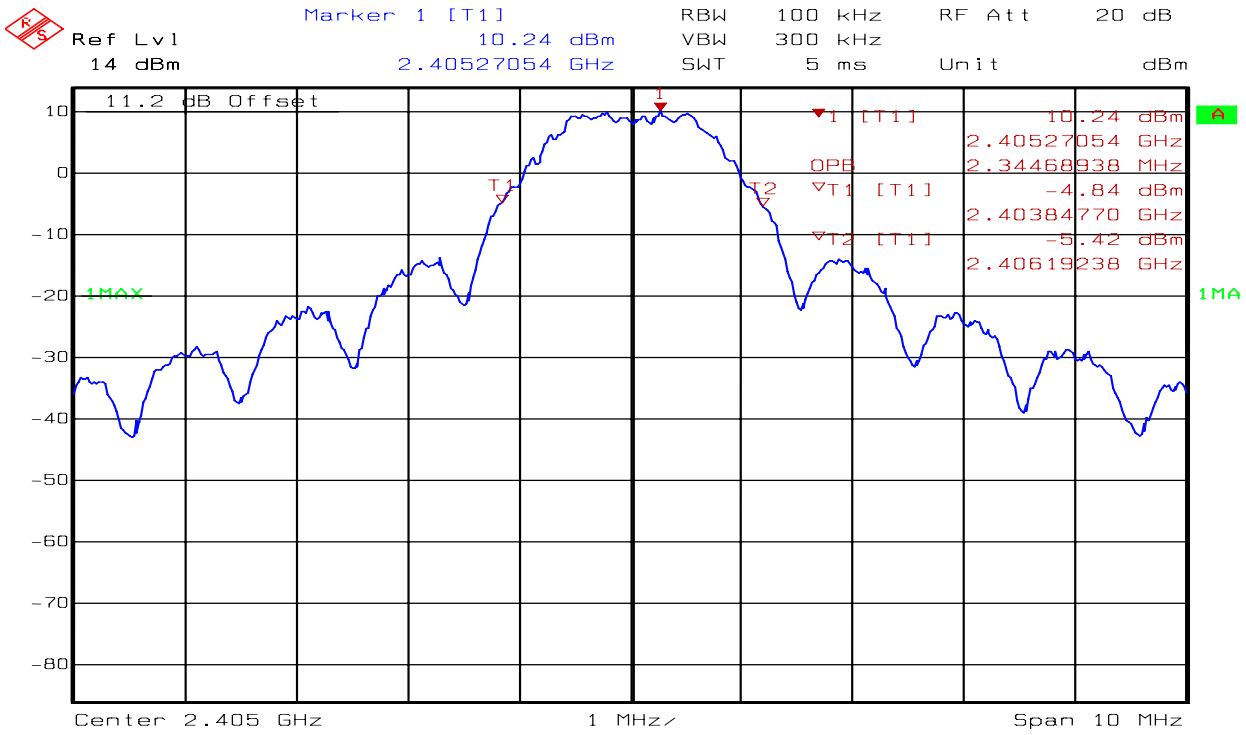
This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

B.9. Test date

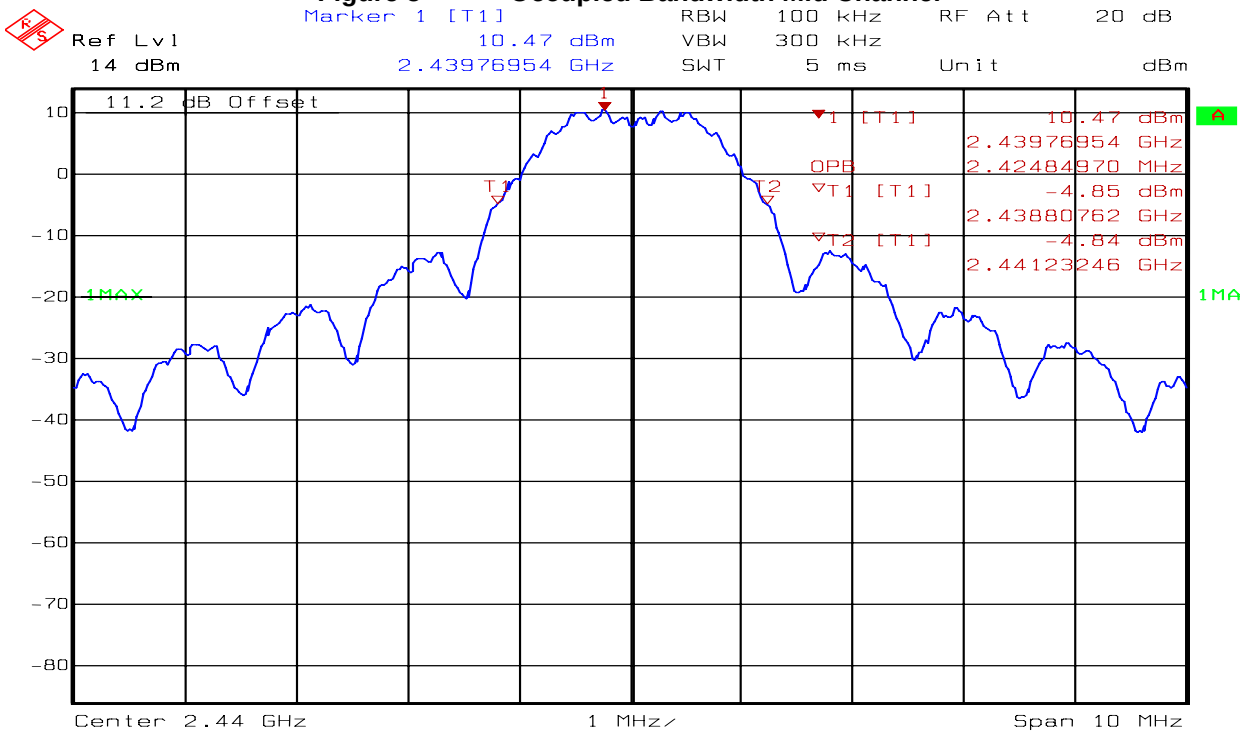
August 31, 2010

Figure 4 Occupied Bandwidth Low Channel



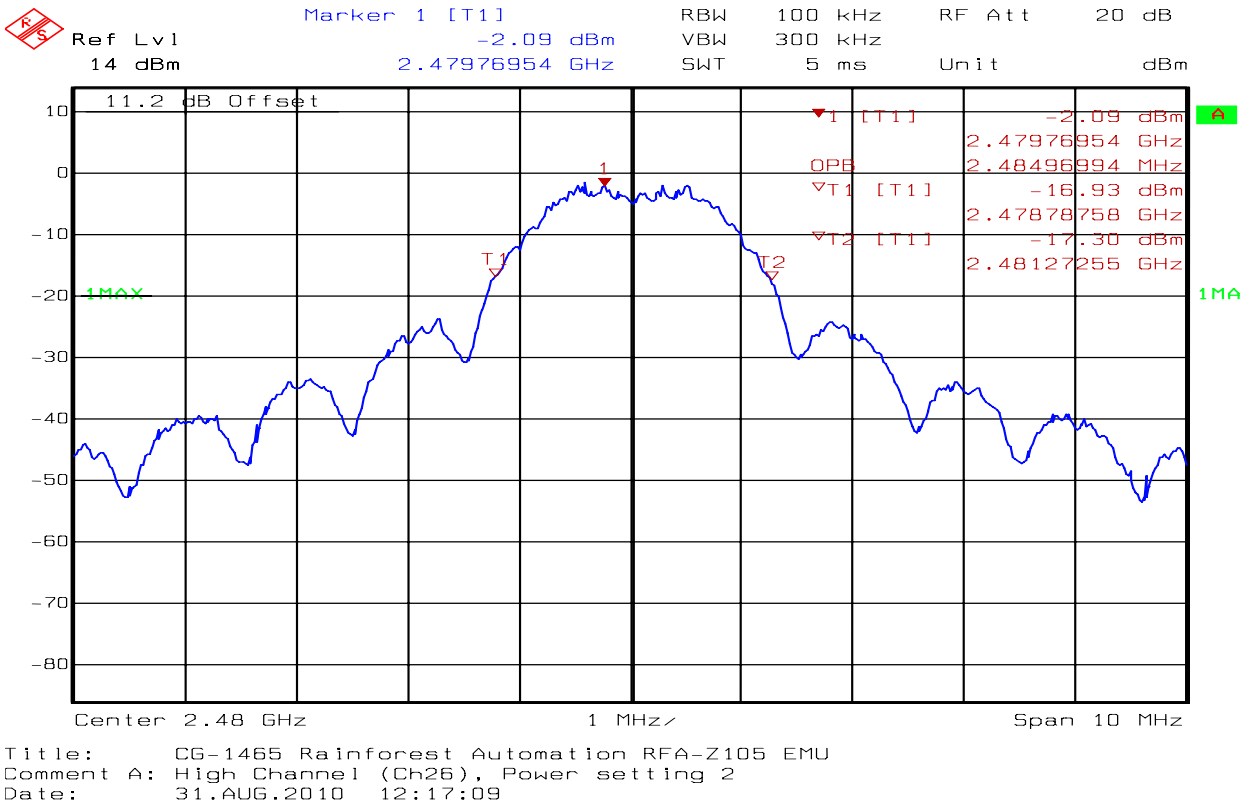
Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: Low Channel (Ch11), Power setting max (3)
Date: 31.AUG.2010 12:14:39

Figure 5 Occupied Bandwidth Mid Channel



Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: Mid Channel (Ch18), Power setting max (3)
Date: 31.AUG.2010 12:13:01

Figure 6 Occupied Bandwidth High Channel



APPENDIX C: PEAK POWER OUTPUT

C.1. Base Standard & Test Basis

Base Standard	FCC 15.247 RSS 210 Issue 7 A8.4 (4)
Test Basis	FCC 15.247 as per ANSI C63.10: 2009 RSS-Gen Issue 2 4.8
Test Method	ANSI C63.10: 2009 and RSS-Gen Issue 2 4.8

C.2. Specifications

The maximum peak output power shall not exceed 30 dBm in the 2400 MHz- 2483.5 MHz band

C.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

C.4. Test Procedure

ANSI C63.10 and RSS-Gen Issue 2 4.8

C.5. Operating Mode During Test

The EUT was tuned to a low and middle channel, operating at maximum rated RF output power with maximum power Setting 3. For High channel; Power setting “2” was used in order to reduce power. (See CG-1465-NOD-01)

C.6. Test Results

Compliant – The maximum peak power was 13.55 dBm

C.7. Sample Calculation

None

C.8. Test Data Summary

Channel	Frequency (MHz)	Peak RF power (dBm)
11	2404.899	13.55
18	2437.975	13.55
26	2478.939	1.63

All final reported values are corrected values

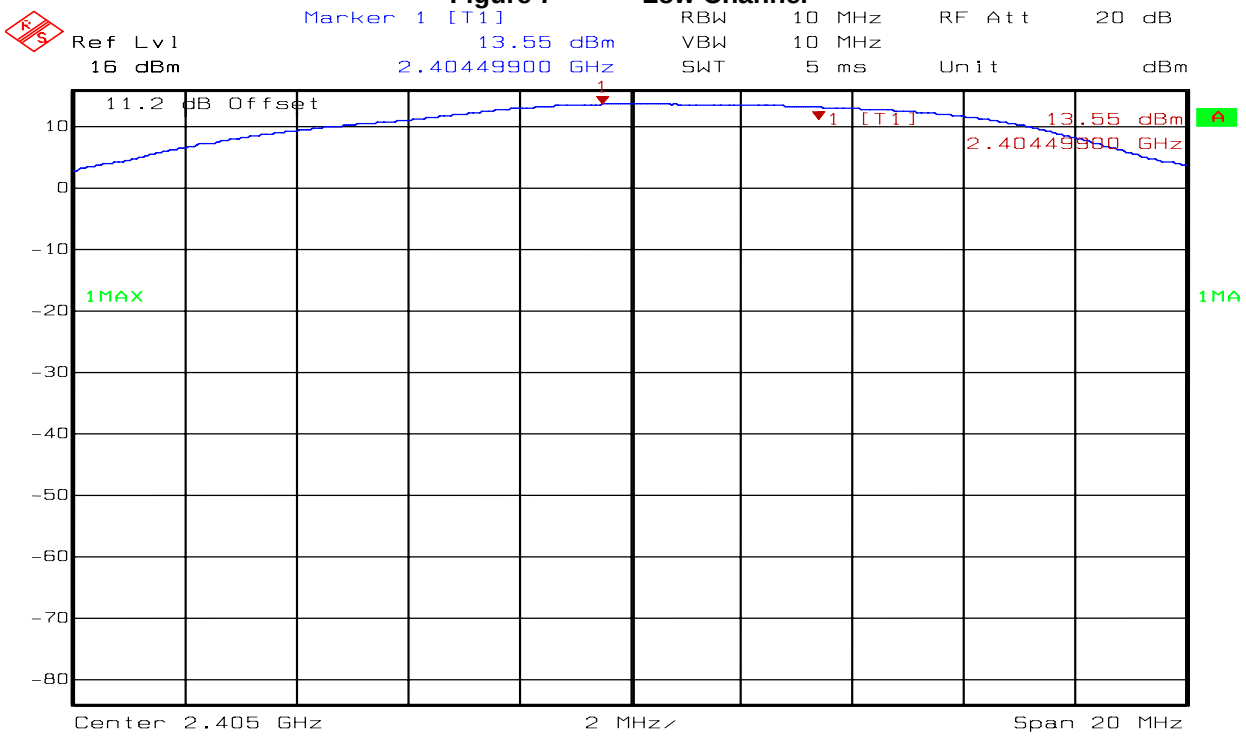
C.9. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

C.10. Test date

August 31, 2010

Figure 7 Low Channel

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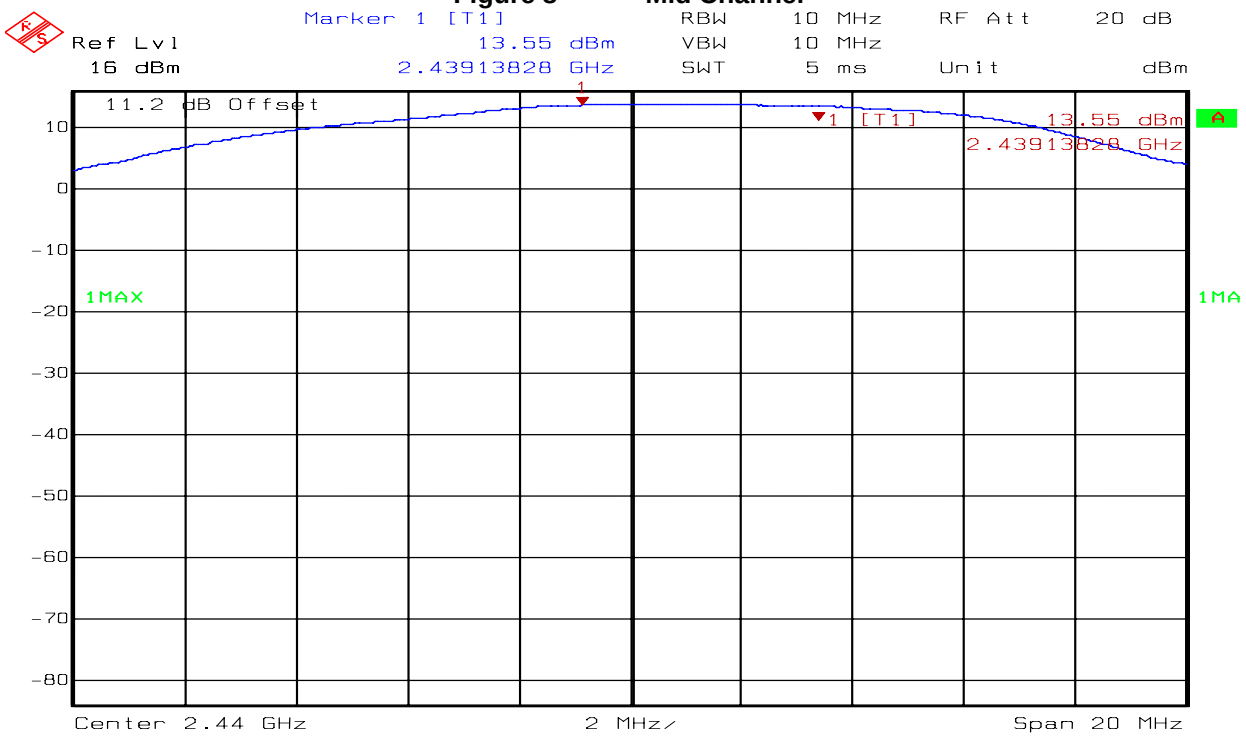
Title:      CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A:  Low Channel (Ch11), Power setting max (3)
Date:       31.AUG.2010  12:26:23
```

Figure 8 Mid Channel

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Title:      CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A:  Mid Channel (Ch18), Power setting max (3)
Date:       31.AUG.2010  12:27:38
```
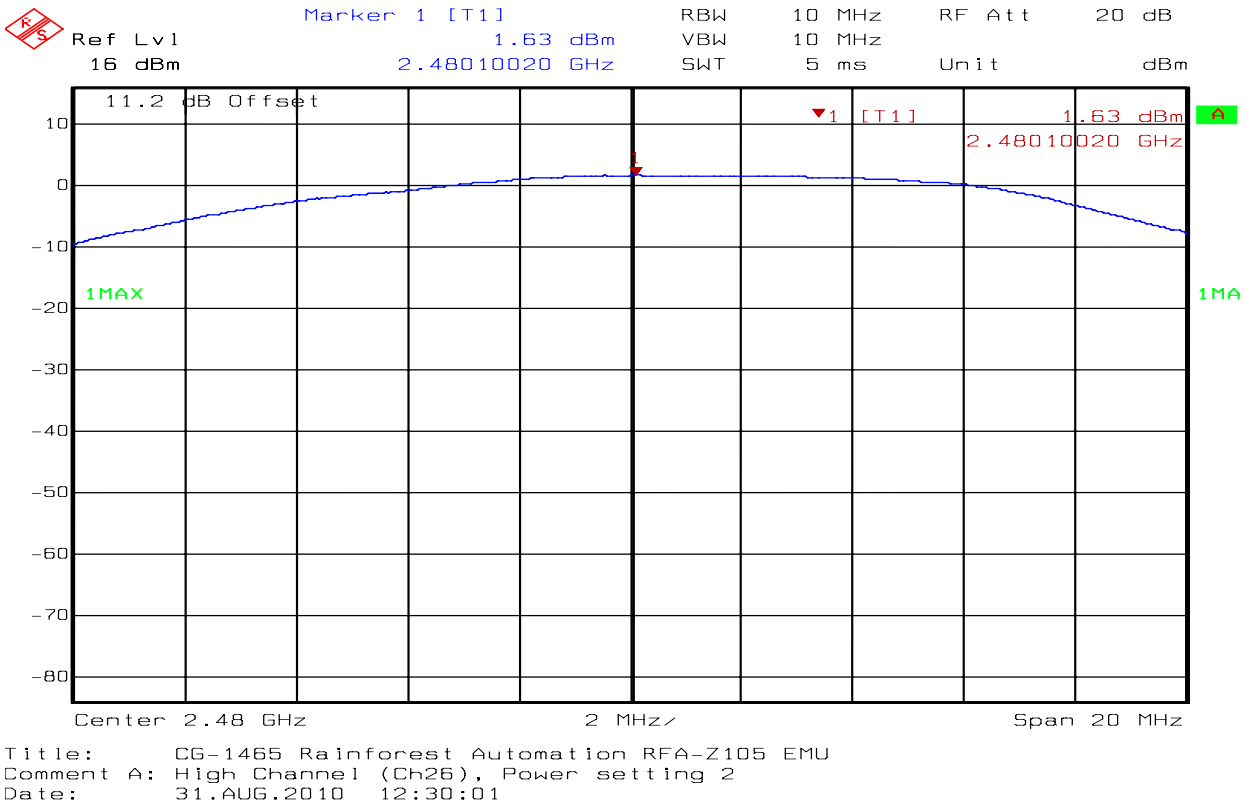

Figure 9 High Channel



APPENDIX D: POWER SPECTRAL DENSITY

D.1. Base Standard & Test Basis

Base Standard	FCC 15.247 (e) RSS 210 Issue 7 A8.2 (b)
Test Basis	FCC 15.247 as per ANSI C63.10: 2009 RSS 210 Issue 7 A8.2 (b)
Test Method	ANSI C63.10: 2009 and RSS 210 Issue 7 A8.2 (b)

D.2. Specifications

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.

D.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

D.4. Test Procedure

ANSI C63.10: 2009 and RSS 210 Issue 7 A8.2 (b)

D.5. Operating Mode During Test

The EUT was tuned to a low and middle channel, operating at maximum rated RF output power with maximum power Setting 3. For High channel; Power setting “2” was used in order to reduce power. (See CG-1465-NOD-01)

D.6. Test Results

Compliant. The maximum measured power spectral density was 1.12 dBm/3kHz

D.7. Sample Calculation

None

D.8. Test Data Summary

Channel	Frequency (MHz)	PSD (dBm)
11	2404.916	1.12
18	2439.571	0.27
26	2479.919	-11.55

All final reported values are corrected values

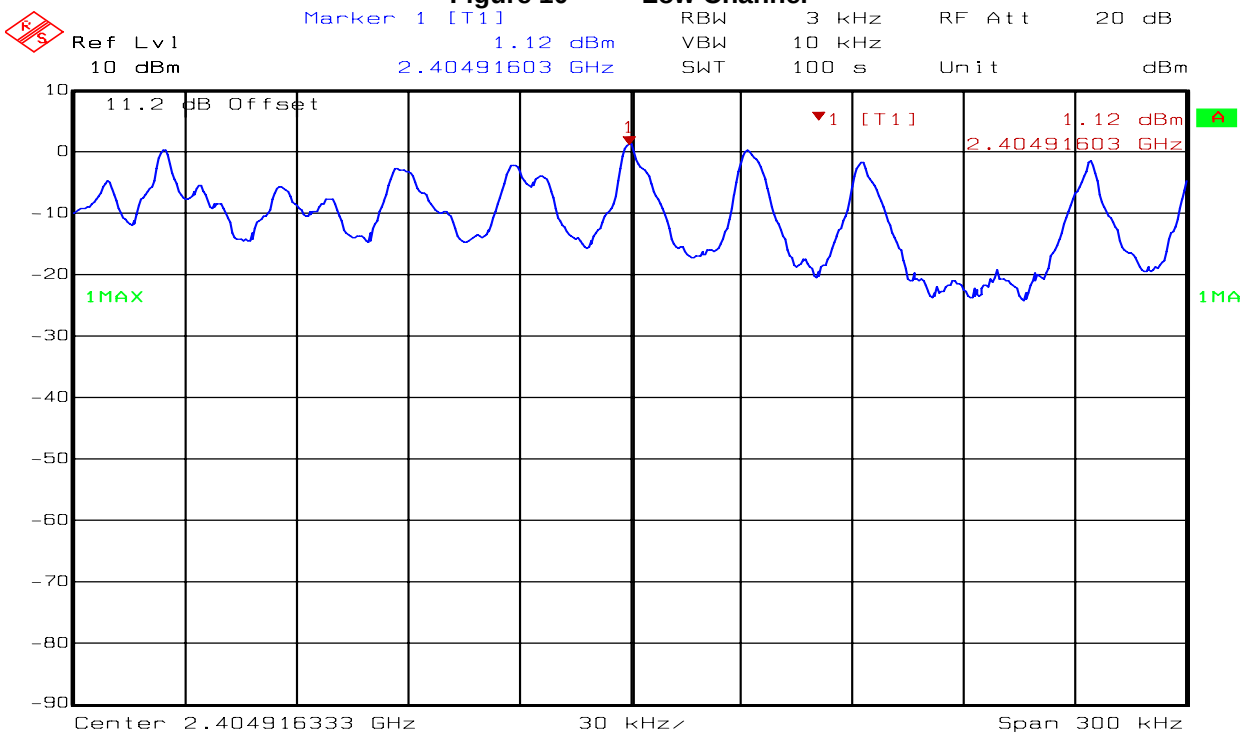
D.9. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

D.10. Test date

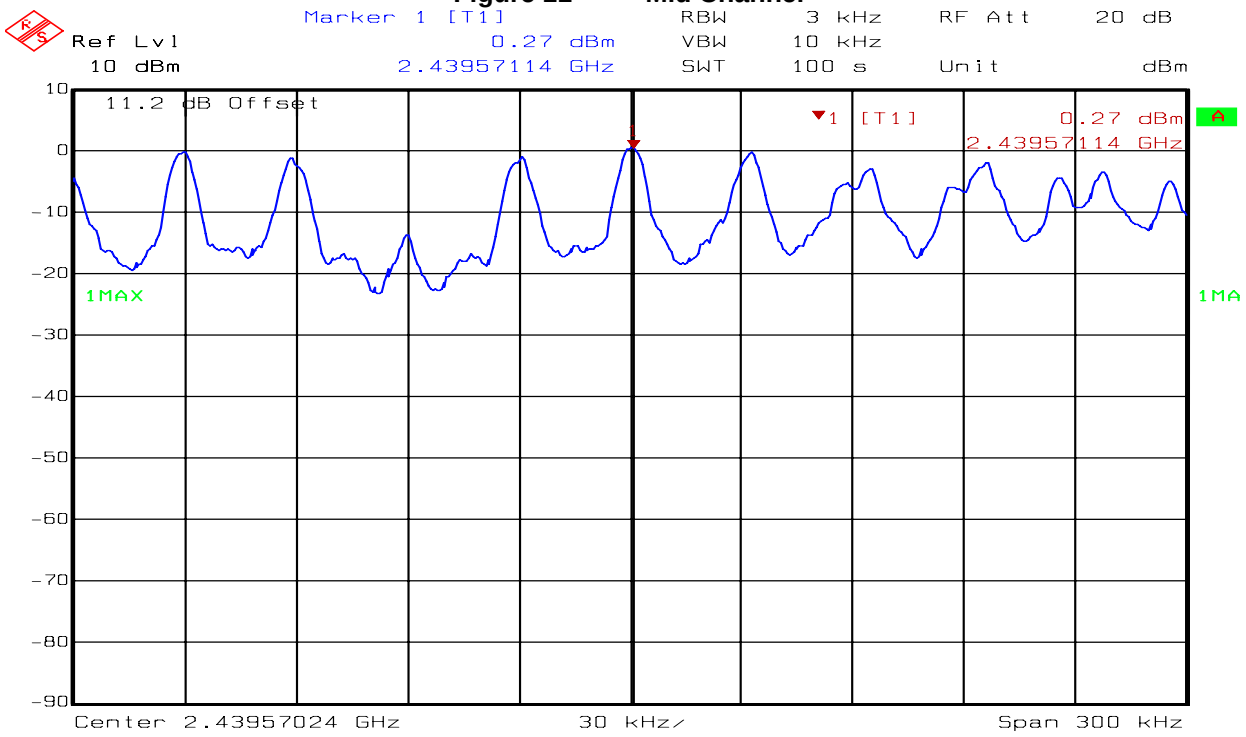
August 31, 2010

Figure 10 Low Channel



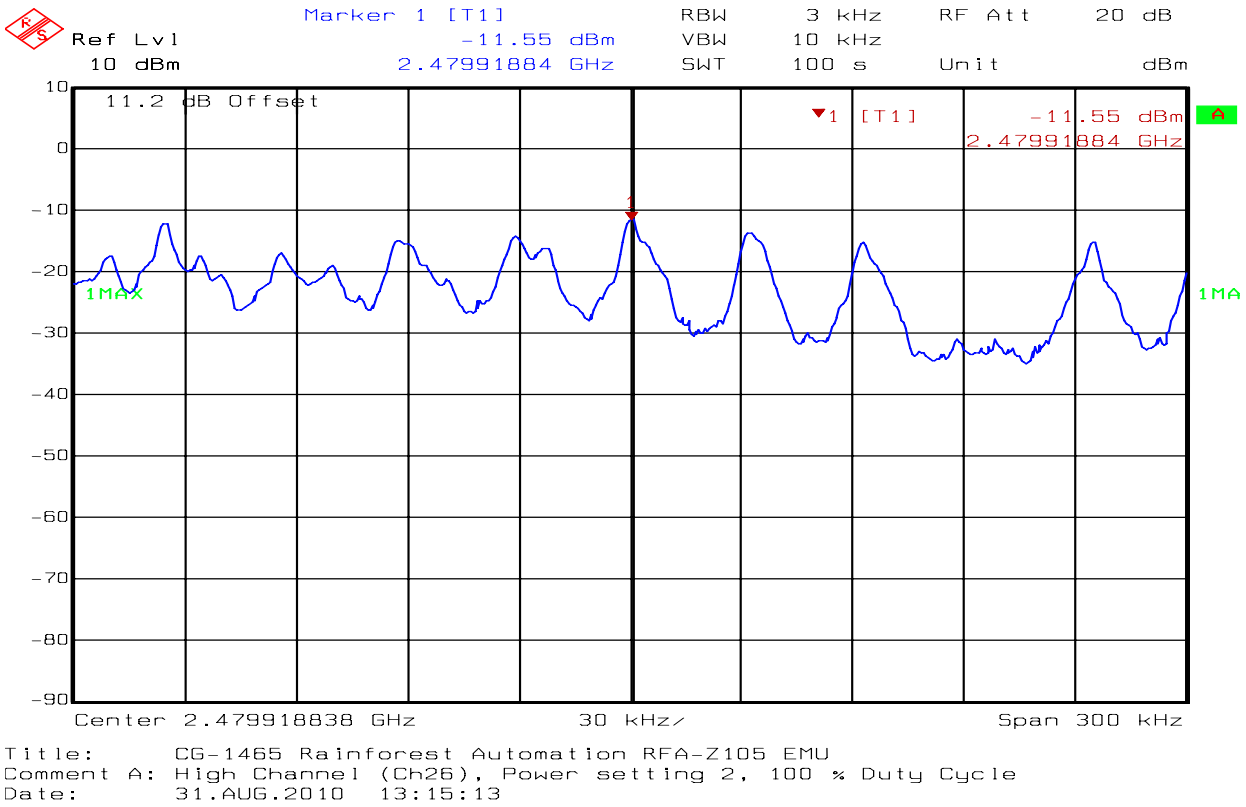
Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: Low Channel (Ch11), Power setting max (3),100 % Duty Cycle
Date: 31.AUG.2010 12:56:34

Figure 11 Mid Channel



Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: Mid Channel (Ch18), Power setting max (3),100 % Duty Cycle
Date: 31.AUG.2010 13:05:59

Figure 12 High Channel



Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: High Channel (Ch26), Power setting 2, 100 % Duty Cycle
Date: 31.AUG.2010 13:15:13

APPENDIX E: CONDUCTED SPURIOUS EMISSIONS

E.1. Base Standard & Test Basis

Base Standards	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.247 (d) RSS-210 Issue 7 A8.5
Test Basis	RF conducted as per ANSI C63.10: 2009 RSS-210 Issue 7 A8.5
Test Method	RF conducted as per ANSI C63.10: 2009 RSS-210 Issue 7 A8.5

E.2. Specifications

(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 a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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 in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

E.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

E.4. Test Procedure

ANSI C63.10

E.5. Operating Mode During Test

The EUT was tuned to a low and middle channel, operating at maximum rated RF output power with maximum power Setting 3. For High channel; Power setting “2” was used in order to reduce power. (See CG-1465-NOD-01)

E.6. Test Results

Compliant,
Worst case spurious emission was 48.86 dB below the carrier at Channel 11.

All final reported values are corrected values

E.7. Tested By

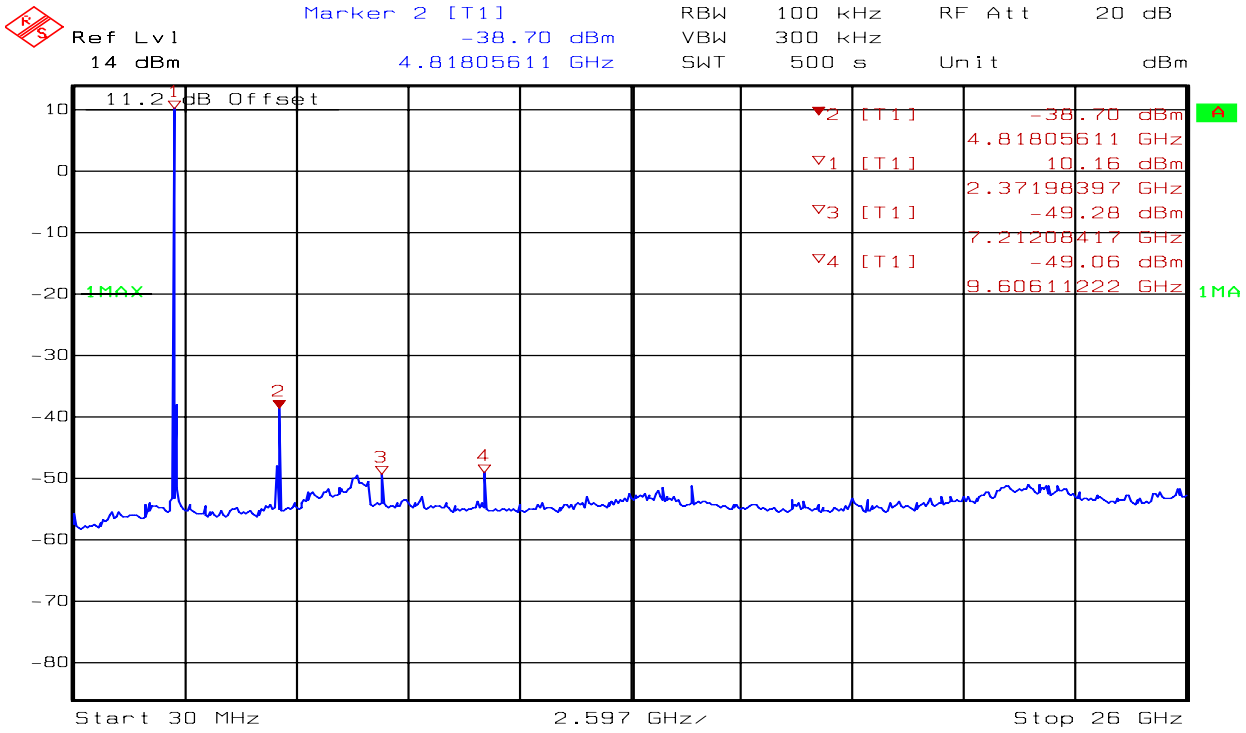
This testing was conducted in accordance with the ISO 17025: 2005 scope of accreditation, table 1; Quality Manual.

Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

E.8. Test date

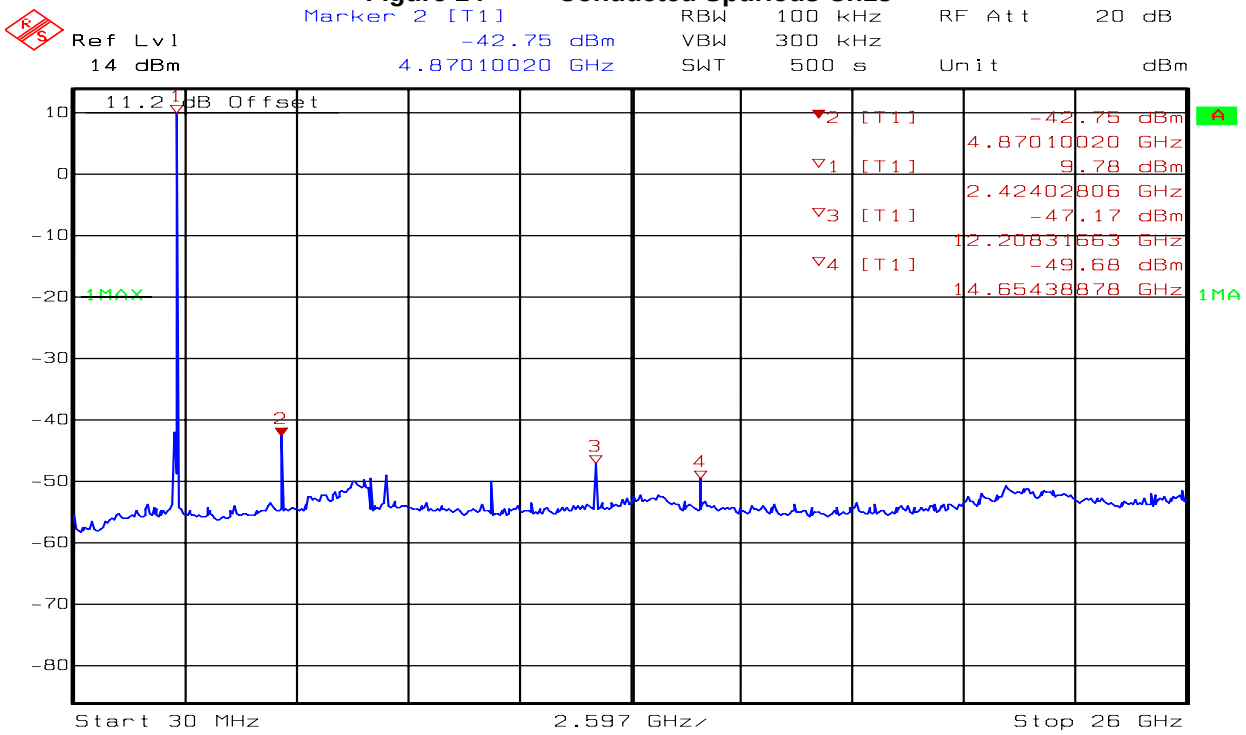
August 31, 2010

Figure 13 Conducted Spurious Ch11



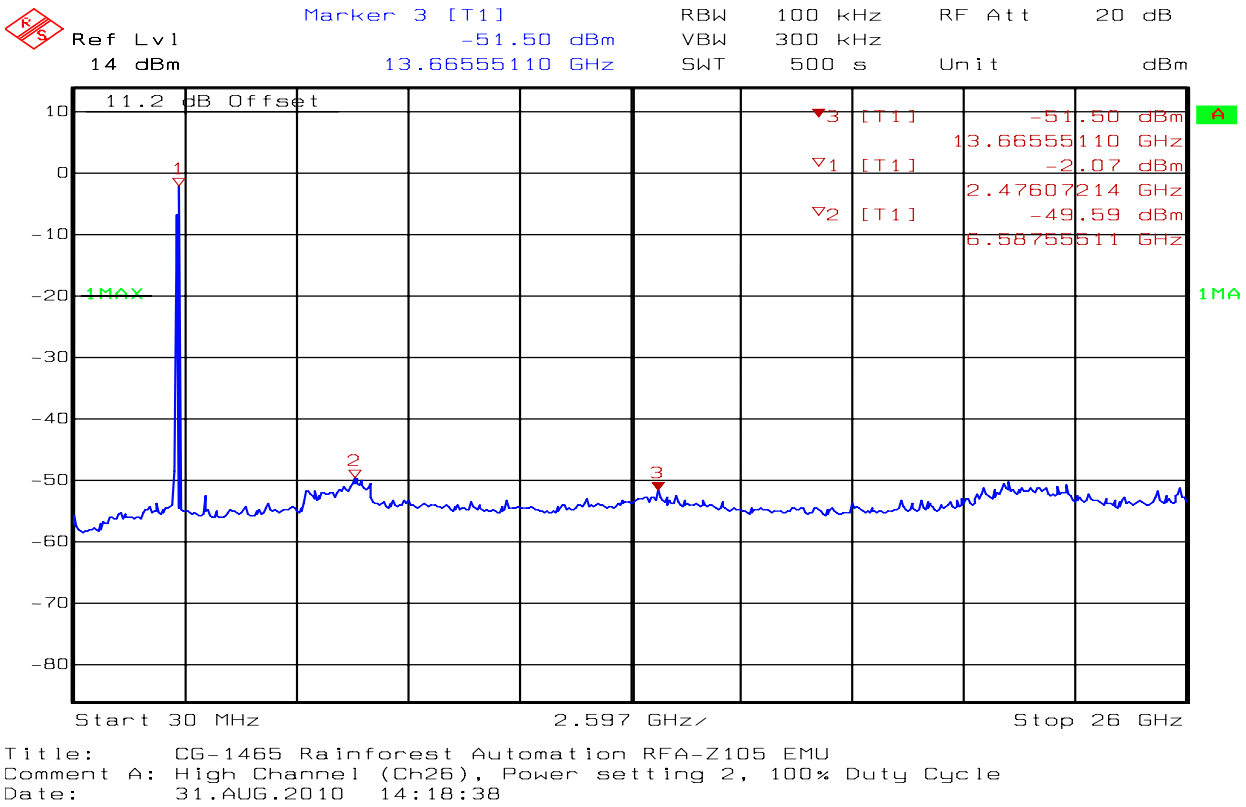
Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: Low Channel (Ch11), Power setting max (3), 100 % Duty Cycle
Date: 31.AUG.2010 13:38:16

Figure 14 Conducted Spurious Ch18



Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: Mid Channel (Ch18), Power setting max (3), 100 % Duty Cycle
Date: 31.AUG.2010 13:49:42

Figure 15 Conducted Spurious Ch26



Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: High Channel (Ch26), Power setting 2, 100% Duty Cycle
Date: 31.AUG.2010 14:18:38

APPENDIX F: CONDUCTED SPURIOUS EMISSIONS BAND EDGE

F.1. Base Standard & Test Basis

Base Standards	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.247 (d) RSS-210 Issue 7 A8.5
Test Basis	RF conducted as per ANSI C63.10: 2009 RSS-210 Issue 7 A8.5
Test Method	RF conducted as per ANSI C63.10: 2009 RSS-210 Issue 7 A8.5

F.2. Specifications

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 a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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 in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

F.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

F.4. Test Procedure

ANSI C63.10

F.5. Operating Mode During Test

The EUT was tuned to low channel, operating at maximum rated RF output power with maximum power Setting 3. For High channel; Power setting “2” was used in order to reduce power.
(See CG-1465-NOD-01)

F.6. Test Results

Compliant
Worst case spurious emission was 37.13 dB below the carrier at Channel 26 (High channel)

F.7. Tested By

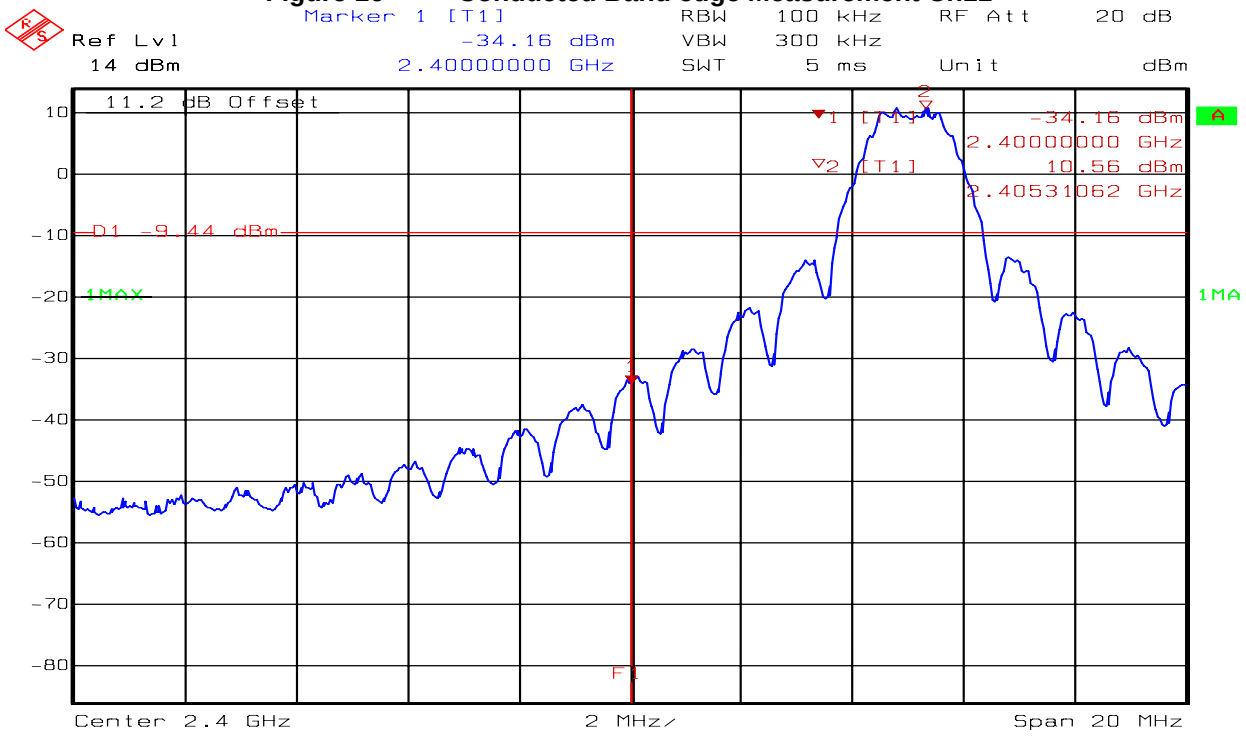
This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

F.8. Test date

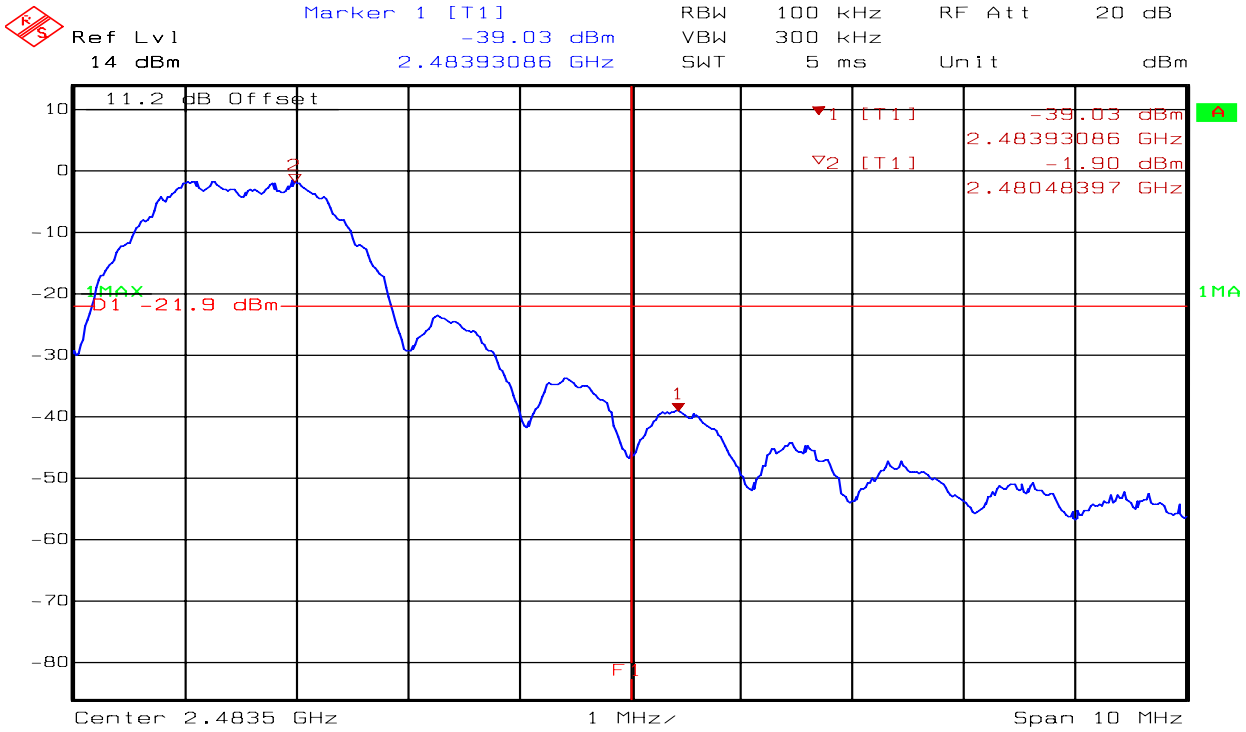
August 31, 2010

Figure 16 Conducted Band edge Measurement Ch11



Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: Low Channel (Ch11), Power setting max (3), 100% Duty Cycle
Date: 31.AUG.2010 14:42:28

Figure 17 Conducted Band edge Measurement Ch26



Title: CG-1465 Rainforest Automation RFA-Z105 EMU
Comment A: High Channel (Ch26), Power setting 2, 100% Duty Cycle
Date: 31.AUG.2010 14:39:39

APPENDIX G: DUTY CYCLE CORRECTION FACTOR

G.1. Base Standard & Test Basis

Base Standard	FCC 15.35 (c) RSS-Gen Issue 2 4.5
Test Basis	FCC 15.35 (c) as per ANSI C63.10: 2009 RSS-Gen Issue 2 4.5
Test Method	NTS Calgary SOP CAG EMC 02 Emission Test Methods and Zero span

G.2. Specifications

15.35 (c) Unless otherwise specified, e.g. §15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

G.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

G.4. Test Procedure

As per FCC 15.35 with spectrum analyzer in Zero span mode.

G.5. Operating Mode During Test

The EUT was tuned to Low channel (Ch11) with maximum duty cycle operating mode.

G.6. Test Results

Duty cycle correction factor = 20*log(0.175/8) = -33.20 dB
Therefore, maximum allowed duty cycle correction factor -20 dB can be used

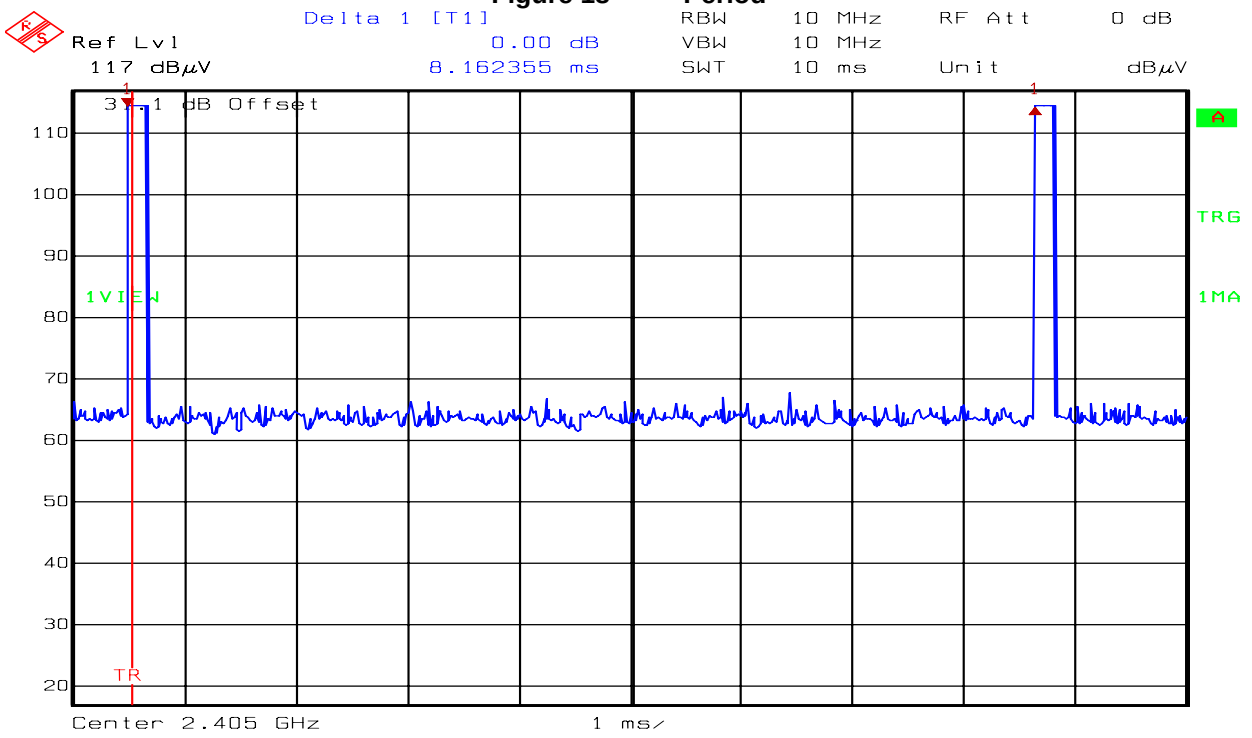
G.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

G.8. Test date

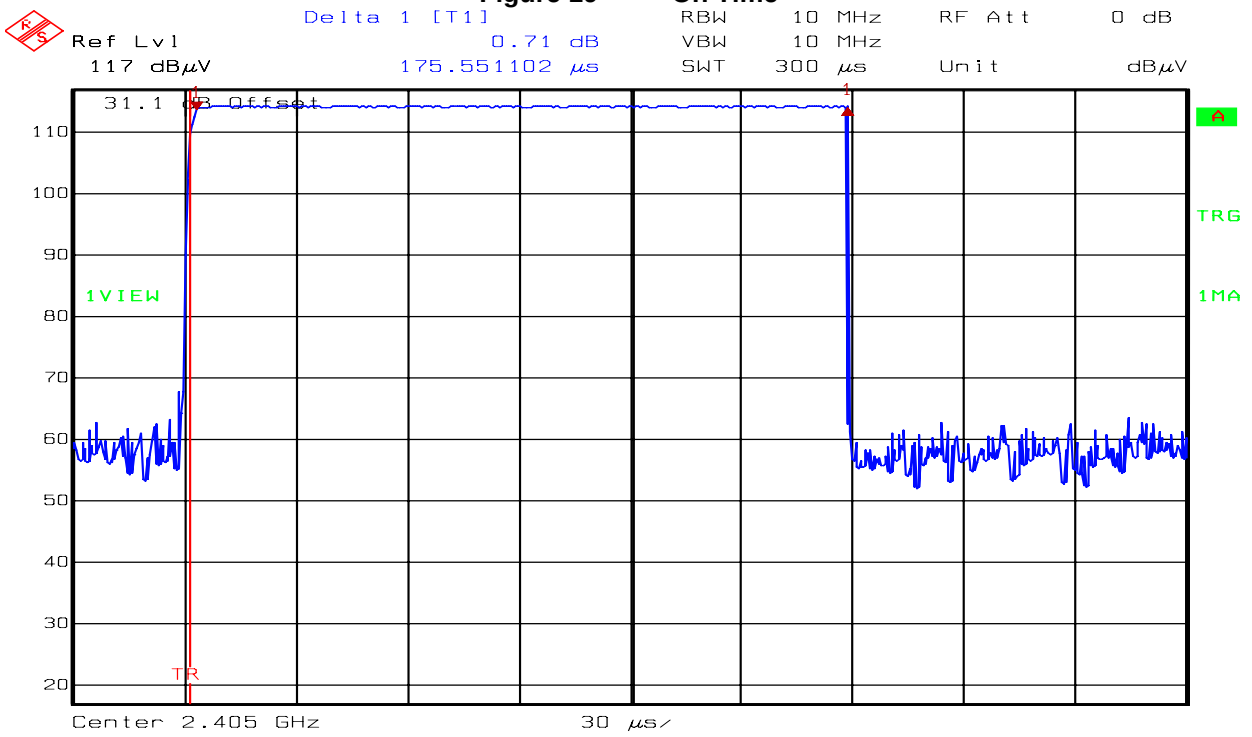
September 1, 2010

Figure 18 Period



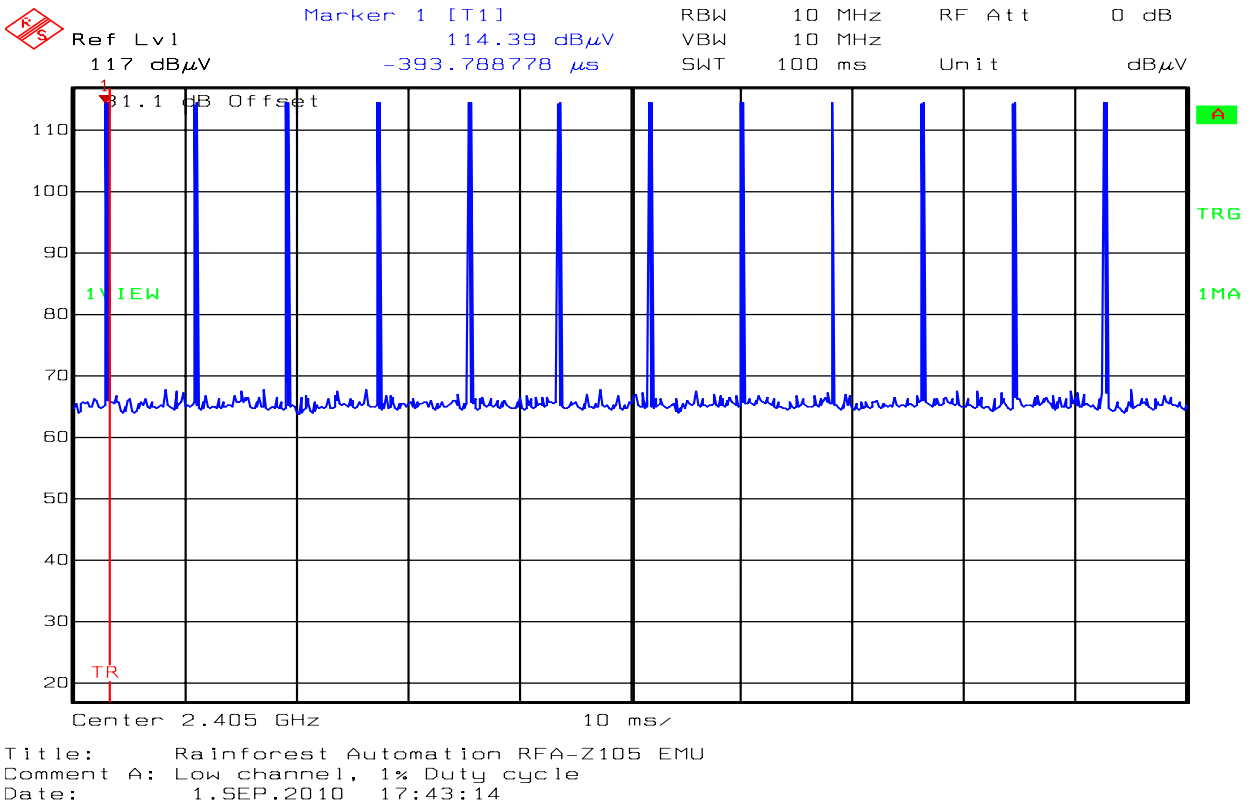
Title: Rainforest Automation RFA-Z105 EMU
Comment A: Low channel, 1% Duty cycle
Date: 1.SEP.2010 17:38:24

Figure 19 On Time



Title: Rainforest Automation RFA-Z105 EMU
Comment A: Low channel, 1% Duty cycle
Date: 1.SEP.2010 17:41:39

Figure 20 100 ms Time Slot



APPENDIX H: RADIATED SPURIOUS EMISSIONS BAND EDGE

H.1. Base Standard & Test Basis

Base Standard	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.209 – Radio Frequency Devices, Part 15.205 – Restricted bands of operation RSS 210 Issue 7 A8.5
Test Basis	ANSI C63.4: 2003 ANSI C63.10: 2009
Test Method	NTS Radiated Emissions Test Method SOP-CAG-EMC-01 FCC Publication 558074 and ANSI C63.10: 2009

H.2. Specifications: FCC 15.205 and RSS 210 Issue 7 2.2 Restricted bands of operation.

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1]0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	N/A
13.36–13.41	N/A	N/A	N/A

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

H.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

H.4. Test Procedure

RF radiated measurement at 3 meters distance per FCC Publication 558074 and ANSI C63.10: 2009 558074 (c) (2) Radiated emission test: Applies to harmonics/spurs that fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209. A pre-amp (and possibly a high-pass filter) is necessary for this measurement.
For measurements above 1 GHz, set RBW = 1 MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation, use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation.

EUT was tested in three orthogonal orientations

H.5. Operating Mode During Test

The EUT was tuned to low channel (Ch11) and high channel (Ch25), operating at maximum rated RF output power with maximum power Setting 3 at 100% duty cycle. For High channel (Ch26); Power setting 2 was used in order to reduce power.
(See CG-1465-NOD-01)

H.6. Test Results

Compliant

Channel	Frequency (MHz)	Detector	Radiated emission level (dBµV/m)	Duty cycle correction factor (dB)	Corrected value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
11	2388.91	PK	62.45	N/A	62.45	73.98	11.53
11	2389.16	AV	50.77	-20	30.77	53.98	23.21
25	2483.50	PK	65.34	N/A	65.34	73.98	8.64
25	2483.50	AV	53.16	-20	33.16	53.98	20.82
26	2483.50	PK	73.73	N/A	73.73	73.98	0.25
26	2483.50	AV	63.05	-20	43.05	53.98	10.93

Maximum peak measurement was 73.73 dBµV/m at 2483.50 MHz in channel 26. It has 0.25 dB margin to the 15.209 limits
All final reported values are corrected values. Worst case emissions presented

H.7. Sample Calculations

Part 15.209 Average Limit: 500 µV/m @ 3m = 20*Log (500) = 53.98 dBµV/m, Peak limit = 73.98 dBµV/m
Radiated emission level (dBµV/m) = Measured level (dBµV) + Receive antenna factor (dB) + Receive cable loss (dB) – LNA gain (dB)
Corrected value (dBµV/m) = Radiated emission level (dBµV/m) - Duty cycle correction factor (dB)

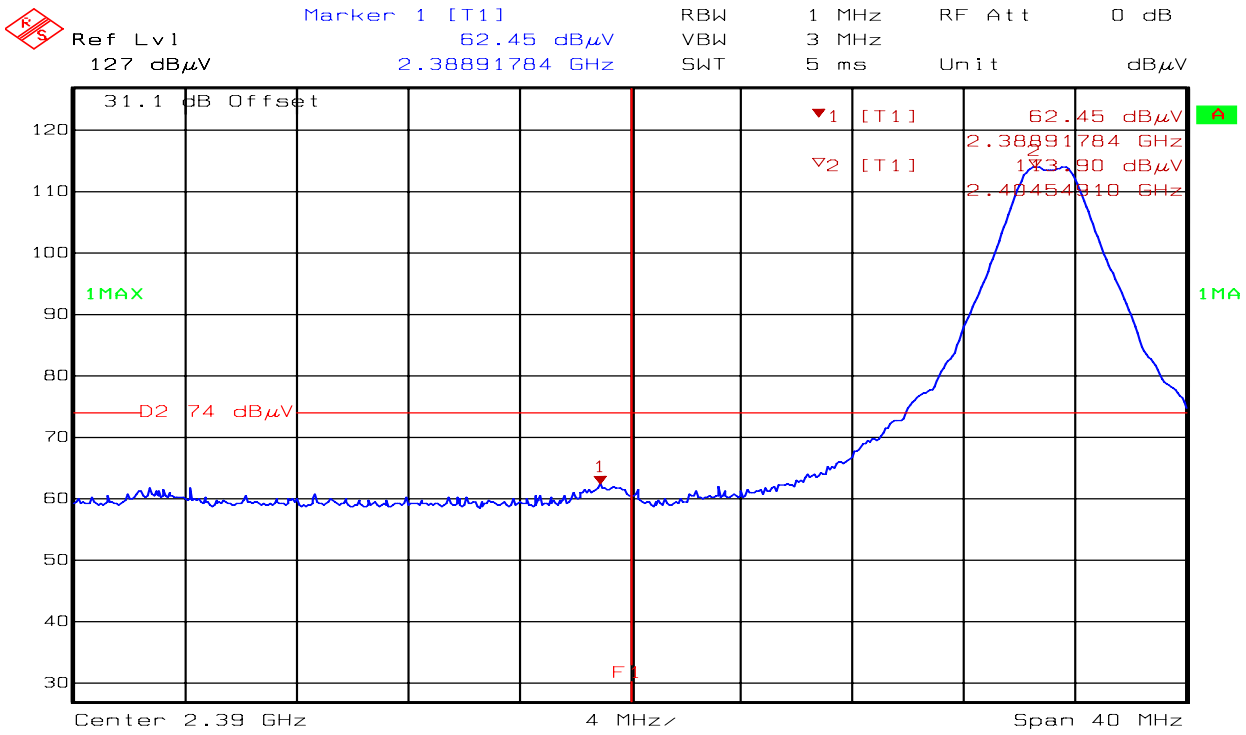
H.8. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

H.9. Test date

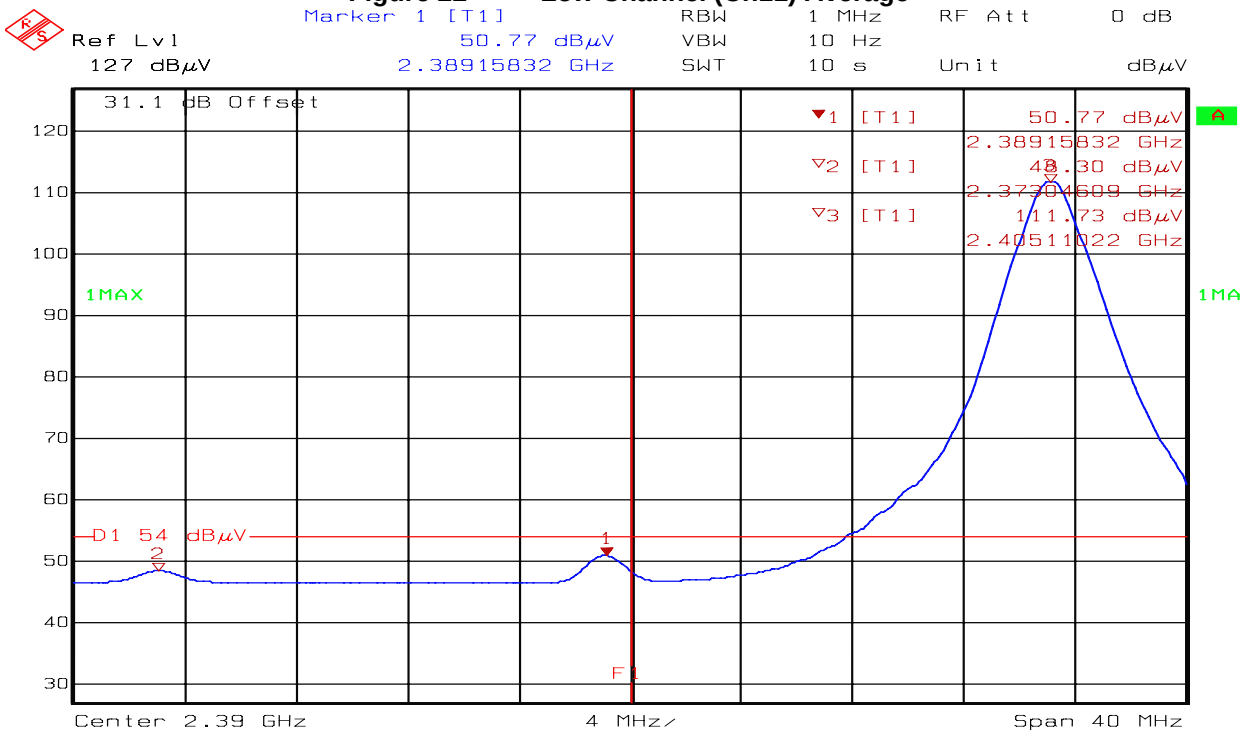
September 01, 2010

Figure 21 Low Channel (Ch11) Peak



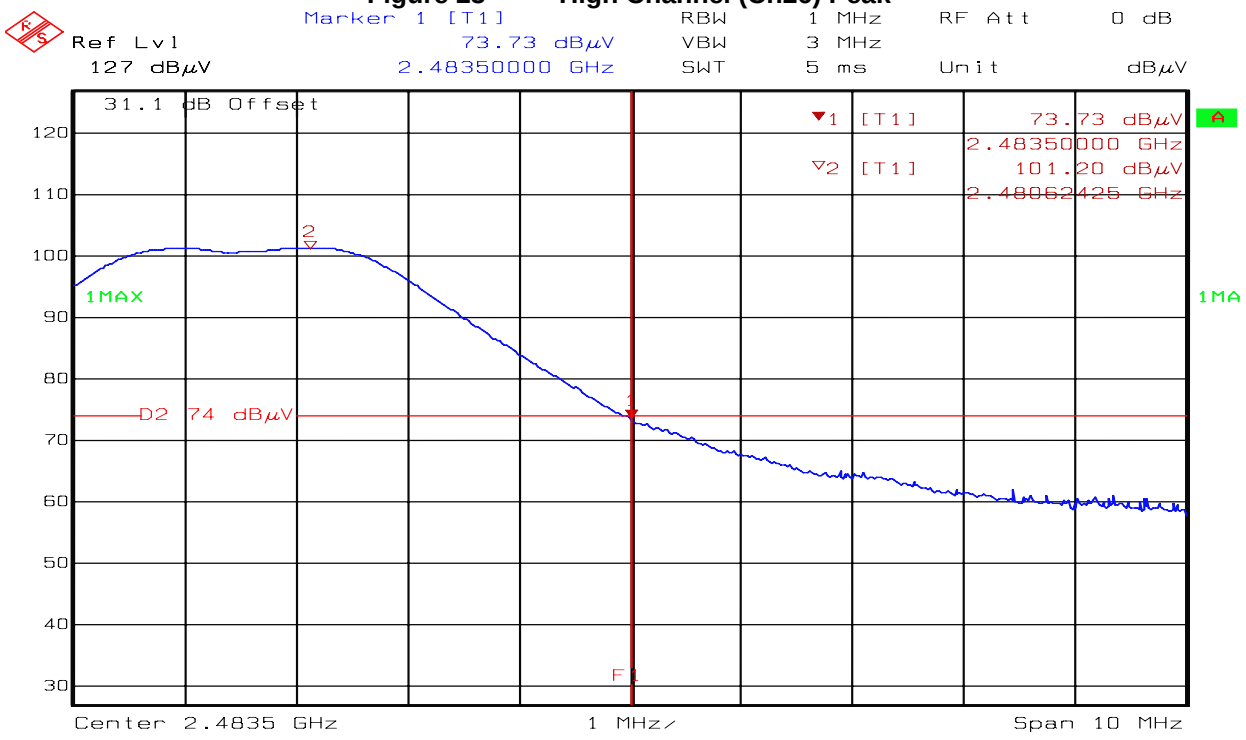
Title: Rainforest Automation RFA-Z105 EMU
Comment A: Low Channel (Ch11, 2405MHz) Power s.max (3) 100% duty cycle
Date: 1.SEP.2010 15:11:28

Figure 22 Low Channel (Ch11) Average



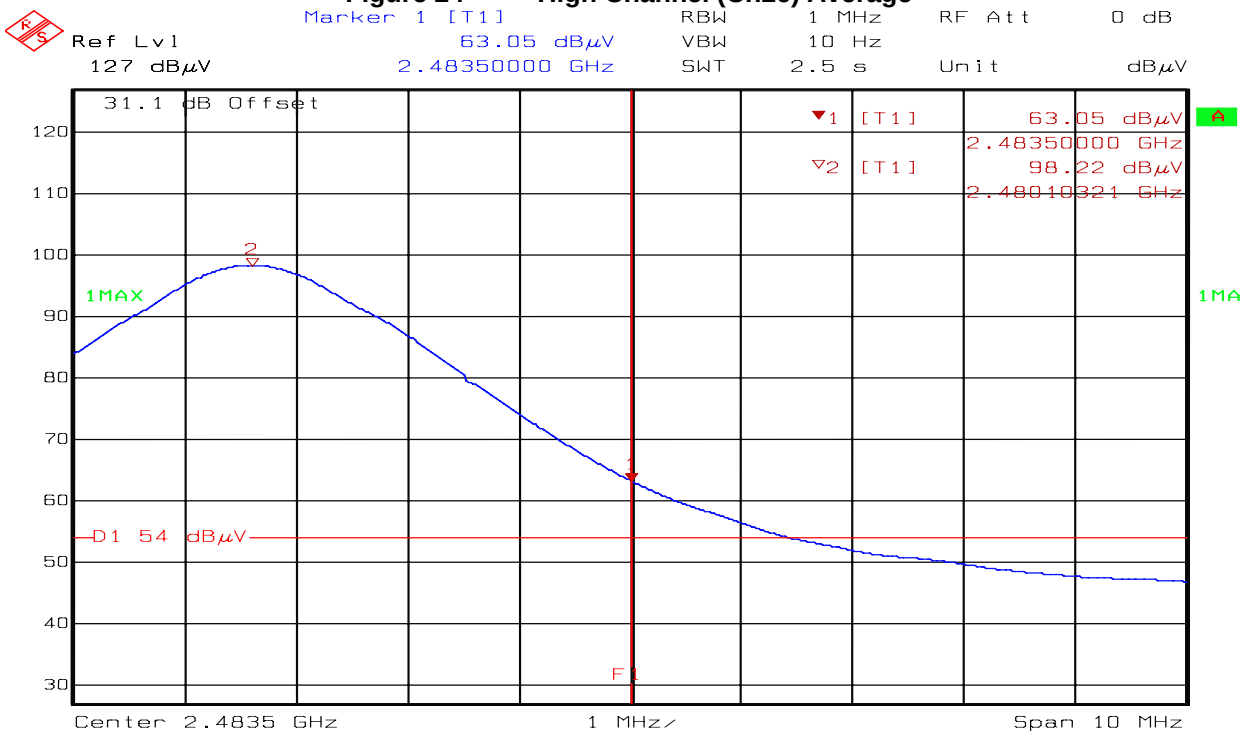
Title: Rainforest Automation RFA-Z105 EMU
Comment A: Low Channel (Ch11, 2405MHz) Power s.max (3) 100% duty cycle
Date: 1.SEP.2010 15:13:02

Figure 23 High Channel (Ch26) Peak



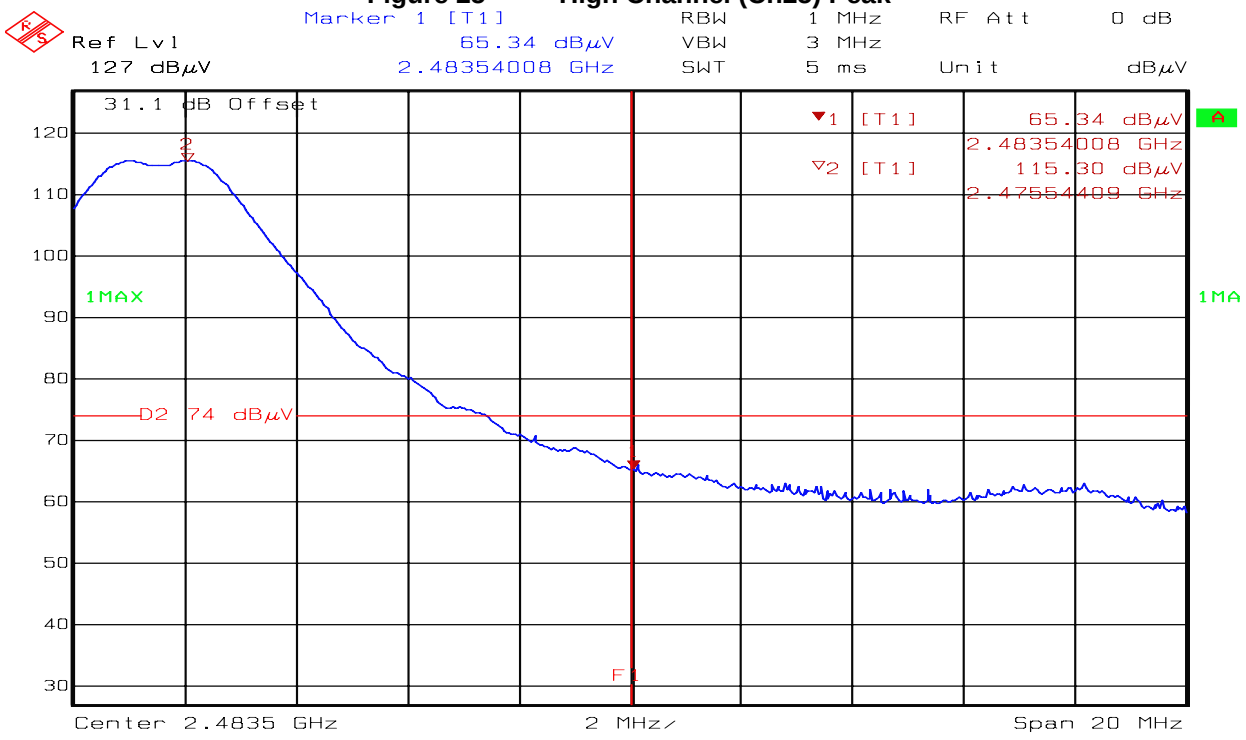
Title: Rainforest Automation RFA-Z105 EMU
Comment A: Ch26, 2480MHz, Power setting 2, 100% duty cycle
Date: 1.SEP.2010 13:18:48

Figure 24 High Channel (Ch26) Average



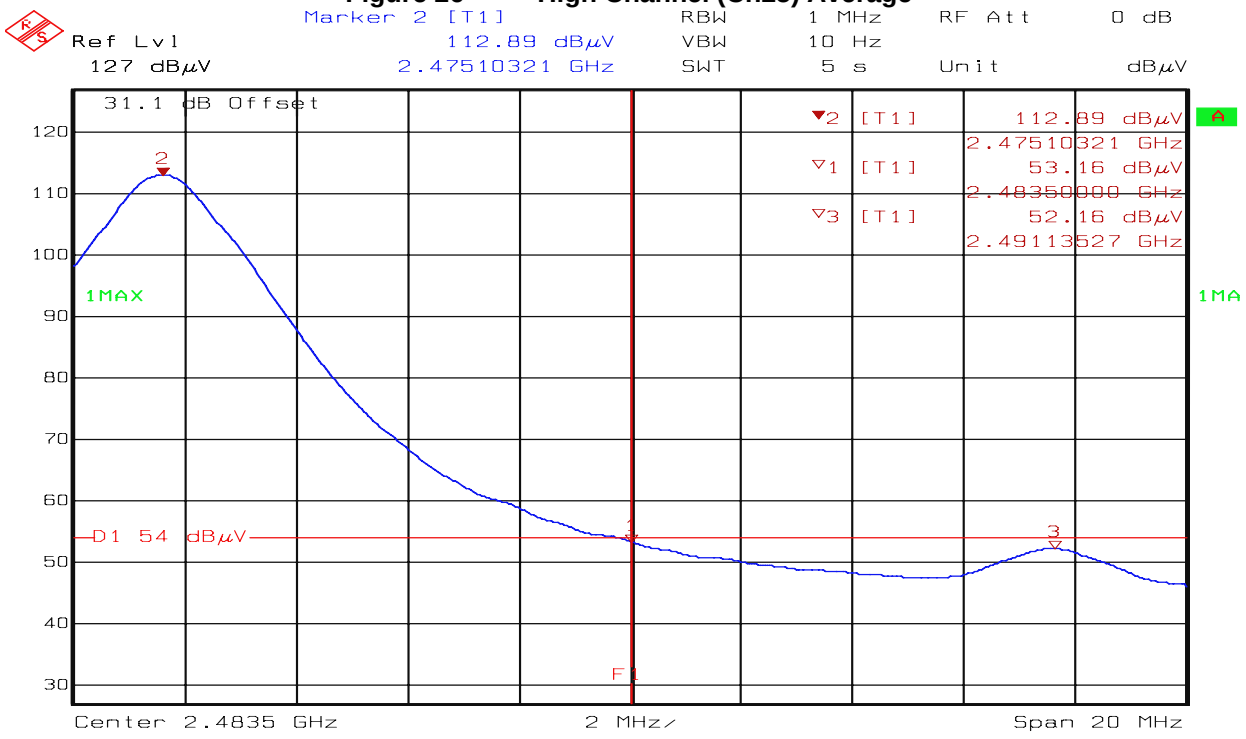
Title: Rainforest Automation RFA-Z105 EMU
Comment A: Ch26, 2480MHz, Power setting 2, 100% duty cycle
Date: 1.SEP.2010 13:20:04

Figure 25 High Channel (Ch25) Peak



Title: Rainforest Automation RFA-Z105 EMU
Comment A: Ch25, 2475MHz, Power setting max (3), 100% duty cycle
Date: 1.SEP.2010 14:15:34

Figure 26 High Channel (Ch25) Average



Title: Rainforest Automation RFA-Z105 EMU
Comment A: Ch25, 2475MHz, Power setting max (3), 100% duty cycle
Date: 1.SEP.2010 14:17:26

APPENDIX I: RADIATED SPURIOUS EMISSIONS (TX AND RX)

I.1. Base Standard & Test Basis

Base Standard	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.209 – Radio Frequency Devices, Part 15.205 – Restricted bands of operation RSS 210 Issue 7 2.6 and A8.5 RSS Gen Issue 2 4.10 and 7.2.3 Receiver Spurious Emission
Test Basis	ANSI C63.4: 2003 ANSI C63.10: 2009
Test Method	NTS Radiated Emissions Test Method SOP-CAG-EMC-02, RSS Gen Issue 2, ANSI C63.10: 2009

Specifications: FCC 15.205 and RSS 210 Issue 7 2.2 Restricted bands of operation.

(a) Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1]0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	N/A
13.36–13.41	N/A	N/A	N/A

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

I.2. Test Procedure

I.2.1 Tx Spurious measurements

RF radiated measurement at 3 meters distance.

For measurements above 1 GHz, RBW = 1 MHz, VBW = 3 MHz were used for peak measurements, RBW = 1 MHz, VBW = 10 Hz were used for average measurements

I.2.2 RSS Gen Issue 2, 4.10 Receiver Spurious Emission

The receiver shall be operated in the normal receive mode near the mid-point of the band over which the receiver is designed to operate.

Unless otherwise specified in the applicable RSS, the radiated emission measurement is the standard measurement method (with the device's antenna in place) to measure receiver spurious emissions.

Radiated emission measurements are to be performed using a calibrated open-area test site. As an alternative, the conducted measurement method may be used when the antenna is detachable. In such a case, the receiver spurious signal may be measured at the antenna port.

For either method, 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 tuneable 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.

Spurious Emission Limits for Receivers

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

EUT was tested in three orthogonal orientations

I.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

I.4. Operating Mode During Test

The EUT was tuned to a low and middle channel, operating at maximum rated RF output power with maximum power Setting 3. For High channel; Power setting 2 was used in order to reduce power. (See CG-1465-NOD-01)

The EUT was tuned to middle channel (Ch18) operating with receive mode

I.5. Sample Calculations

Part 15.209
Average Limit for above 960 MHz = 500 µV/m @ 3m = 20*Log (500) = 53.98 dBµV/m
Peak Limit for above 960 MHz = Average Limit + 20 (dB) = 73.98 dBµV/m

I.6. Test Results

Pass, Worst case results reported

I.6.1 Rx mode

There were no measurable emissions observed in Rx mode.

Maximum measured peak noise floor was 45.85 dBµV/m at 7395 MHz with RBW= 1 MHz, VBW= 3 MHz

Which has 8.13 dB margin to the RSS Gen Issue 2, 4.10 Receiver Spurious Emission Average limit

I.6.2 TX Mode

Channel	Frequency (MHz)	Polarization	Detector	Measured Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low	4809.17	Horizontal	Peak	48.06	73.98	25.92
	4810.21	Horizontal	Average	37.02	53.98	16.96
	4811.07	Vertical	Peak	49.57	73.98	24.41
	4810.15	Vertical	Average	39.03	53.98	14.95
Mid	4879.76	Horizontal	Peak	50.05	73.98	23.93
	4879.81	Horizontal	Average	39.75	53.98	14.23
	4879.76	Vertical	Peak	49.17	73.98	24.81
	4880.05	Vertical	Average	38.24	53.98	15.74
	7318.62	Horizontal	Peak	56.70	73.98	17.28
	7318.68	Horizontal	Average	45.54	53.98	8.44
	7321.80	Vertical	Peak	58.17	73.98	15.81
	7318.85	Vertical	Average	47.37	53.98	6.61
High	4960.77	Horizontal	Peak	43.85	73.98	30.13
	4959.23	Horizontal	Average	31.20	53.98	22.78
	4958.92	Vertical	Peak	43.07	73.98	30.91
	4959.23	Vertical	Average	30.68	53.98	23.30

Maximum measured average value was 47.37 dBµV/m at 7318.85 MHz. It has 6.61 dB margin to the FCC Part 15.247 and RSS 210 limits
All final reported values are corrected values. Worst case emissions presented
Plots were not provided in order to reduce file size

I.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

I.8. Test date

Test started: September 01, 2010 Completed: September 16, 2010

APPENDIX J: MEASUREMENT EQUIPMENT

Type	Manufacturer	Model	Asset #	Cal Due	Cal Date
Bilog Antenna	Teseq	CBL 6112B	CG0314	21SEP10	29OCT08
Horn Antenna (Rx) 1 GHz – 18 GHz	EMCO	3115	CG0368	08SEP11	08SEP09
Standard Gain Horn (Rx) 18 GHz – 26.5 GHz	EMCO	3160-09	CG0075	N/A (1)	27NOV01
LNA 1 GHz < f < 18 GHz	Miteq	JSD00121	CG0761	13NOV11	13NOV09
LNA 18GHz < f < 26.5GHz	Miteq	JSD00119	CG0482	02OCT11	02OCT09
High pass filter f > 1000 MHz	MicroTronics	HPM14576	CG0963	13NOV11	13NOV09
High pass filter f > 2800 MHz	MicroTronics	HPM50111	CG0964	N/A	N/A
Spectrum Analyzer 9 kHz – 40 GHz	Rohde & Schwarz	FSEK-20	CG0118	06SEP10 13SEP11	06AUG09 13SEP10 (2)
Test Receiver	Rohde & Schwarz	ESMI	CG0123 CG0434	04MAY11	04MAY09
HPIB Extender	HP	37204	CG0181	N/A	N/A
Mast Controller	EMCO	2090	CG0179	N/A	N/A
Turntable Controller	EMCO	2090	CG0178	N/A	N/A

(1): As per manufacturer recommend, this item does not require periodic calibration. Its electromagnetic performance is almost exclusively depended on the physical dimension of the horn. A thorough mechanical check is all that is needed to guarantee the antenna performance.

(2): New calibration date of the spectrum analyzer

END OF DOCUMENT