Nemko USA, Inc.
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CERTIFICATION TEST REPORT

Report Number:	2009 02112754 EMC
Project Number:	15751-1
Applicant:	Avaak 5405 Morehouse Dr. San Diego, CA 92121
Equipment Under Test (EUT): Model: FCC ID:	Wireless Repeater VUE Repeater WD9-VR110V
In Accordance With:	FCC Part 15 Subpart C, 15.247 RSS-210, Issue 7, June 2007
Tested By:	Nemko USA Inc. 11696 Sorrento Valley Road, Suite F San Diego, CA 92121
Authorized By:	Alan Laudani, Wireless/EMC Engineer
Date:	February 18, 2009
Total Number of Pages:	47

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Section 1. Summary of Test Results

General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C. Radiated tests were conducted is accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed: Wireless Repeater
Model VUE Repeater

Specification: FCC Part 15 Subpart C, 15.247

Date Received in Laboratory: September 25, 2008

Compliance Status: Complies

Exclusions: None

Non-compliances: None

Report Release History:

REVISION	DATE	COMMENTS
-	September 22, 2008	Prepared By: Ferdinand Custodio
-	February 18, 2009	Initial Release: Alan Laudani

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TESTED BY: _____ Date: September 22, 2008
Ferdinand Custodio, EMC Test Engineer

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Section 2: Equipment Under Test

2.1 Product Description

The VUE Repeater is a Wireless Repeater. The EUT is a wireless device that is attached to equipment so that the equipment may be located by a tracking system. The Tags transmit short messages periodically which are received by the tracking system receivers. The Receiver measures the signal strength of the pulse, and transmits this data (Tag ID and signal strength emitted from the Tag) to the Bridge via the mesh network created by the plurality of the Receivers. The Bridge communicates with the Tags on its wireless link via the Receivers. The Bridges communicate with the tracking system's Server over an Ethernet Interface. Tags, Receivers, and Bridges also periodically check the Server for updated configuration information or firmware updates.
The EUT was exercised by soldering a new fresh of battery for each test. The EUT will transmit every 5 seconds worst case but was modified to transmit continuously for the tests. Four (4) operating modes can be cycled using an external magnet to activate a Reed switch. These modes are Sleep (Stand-by), Low Channel transmit (2.404GHz), Mid Channel transmit (2.44GHz) and High Channel transmit (2.474GHz).

2.2 Technical Specifications of the EUT

Manufacturer:	Avaak
Operating Frequency:	2404 MHz to 2474 MHz in the 2400-2483.5 MHz Band
Rated Power:	104.7 mW
Modulation:	FSK
Antenna Connector/Data:	Integral/ -4.2 dBi Custom Monopole (gain calculated)
Power Source:	110 VAC, 60 Hz

Section 3: Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247
Operation within the bands 902-928 MHz, 2400-2483.5 MHz,
5725-5850 MHz and 24.0-24.25 GHz bands.

RSS-210, Issue 7, June 2007
Annex 8 - Frequency Hopping and Digital Modulation Systems Operating in the Bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

3.2 Deviations From Laboratory Test Procedures

No deviations from Laboratory Test Procedure

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	22 – 25 ^{o}C
Humidity range	:	42 - 76 %
Pressure range	:	87 - 105 kPa
Power supply range	:	+/- 1% of rated voltages

3.4 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
317	Preamplifier	HP	8449A	2749A00167	31-Mar-08	31-Mar-09
835	Spectrum Analyzer	Rohde & Schwarz	RHDFSEK	829058/005	27-Jun-08	27-Jun-09
946	Peak Power Sensor	Hewlett Packard	84815A	3318A01726	28-Aug-08	28-Aug-09
947	Peak Power Analyzer	Hewlett Packard	8991A	3621A00906	28-Aug-08	28-Aug-09
681	Transient Limiter	HP	11947A	3107A02634	12-Sep-08	12-Sep-09
564	High Pass Filter	Solar	7801-5.0	853130	17-Jul-08	17-Jul-09
114	Antenna, Bicon	EMCO	3104	2997	10-Jan-08	10-Jan-09
533	Quasi-Peak Adapter	HP	85650A	2043A00211	27-Jun-08	27-Jun-09
403	RF Preselector	HP	85685A	2648A00410	21-Aug-08	27-Jun-09
384	LISN	Solar	9348-50-R-24-BNC	941716	27-Aug-08	27-Aug-09
752	Antenna, DRWG	EMCO	3115	4943	31-Oct-07	31-Oct-08
111	Antenna, LPA	EMCO	3146	1382	03-Oct-07	03-Oct-08
N/A	2040B-1 OATS	SOATS IC Registration Number				

Section 4: Observations

4.1 Modifications Performed During Assessment

No modifications were performed during assessment.

4.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.4 Test Deleted

No Tests were deleted from this assessment.

Section 5: Results Summary

This section contains the following:

FCC Part 15 Subpart C: Test Results
§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

RSS-210, Issue 7, June 2007
Annex 8 - Frequency Hopping and Digital Modulation Systems Operating in the Bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

RSS-Gen Issue 2 June 2007
General Requirements and Information for the Certification of Radiocommunication Equipment

The column headed "Required" indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No: not applicable / not relevant
Y Yes: Mandatory i.e. the apparatus shall conform to these test.
N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

5.1 Test Results

Part 15C	RSS-210	Test Description	Required	Result
15.247 (a)(1)	RSS-210 A8.1 (a)	20 dB Bandwidth	Y	Pass
15.257 (b)(1)	A8.4(2)	Maximum peak output power	Y	Pass
15.247 (d)	RSS-210 2.2(b)	Radiated Emissions within Restricted Bands	Y	Pass
15.247(a)(1)	A8.1(b)	Carrier Frequency Separation	Y	Pass
15.247(d)	A8.5	Out-of-band Emissions	Y	Pass
15.247(a)(1)(iii)	A8.1(d)	Number of Hopping Frequencies	Y	Pass
15.207	RSS-GEN 7.2.2	Transmitter and Receiver AC Power Lines Conducted Emission Limit	Y	Pass
15.247(a)(1)(iii)	A8.1(d)	Time of Occupancy (Dwell Time)	Y	Pass
	RSS-GEN 4.8	Receiver Spurious Emissions	Y	Pass

Notes:

Spurious Emissions was measured when the unit is in "Stand By" mode to show compliance with IC RSS General Receiver requirements, however no emissions were detected.

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Appendix A: Test Results

Conducted Limits

15.207 (a)

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator 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 μH/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 boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

RSS-Gen 7.2.2
The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network. Except when the requirements applicable to a given device state otherwise, for any licence-exempt radio communication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2. The tighter limit applies at the frequency range boundaries.
The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network. A description of the method of measurement that is acceptable to Industry Canada is found in RSS-212.

Test Conditions:

Sample Number:	**VUE Repeater**	**Temperature:**	25
Date:	September 18,2008	**Humidity:**	76
Modification State:	Lo/Mid/High Channels	**Tester:**	FSCustodio
		Laboratory:	Shield Room 2

Test Results: See Attached Plots.

Additional Observations:

- Green limit line is Average limit and blue limit line is Quasi-peak limit.
- Instrumentation settings are 9kHz RBW/30kHz VBW for Average measurements and 100kHz RBW/100kHz VBW for Peak measurements.

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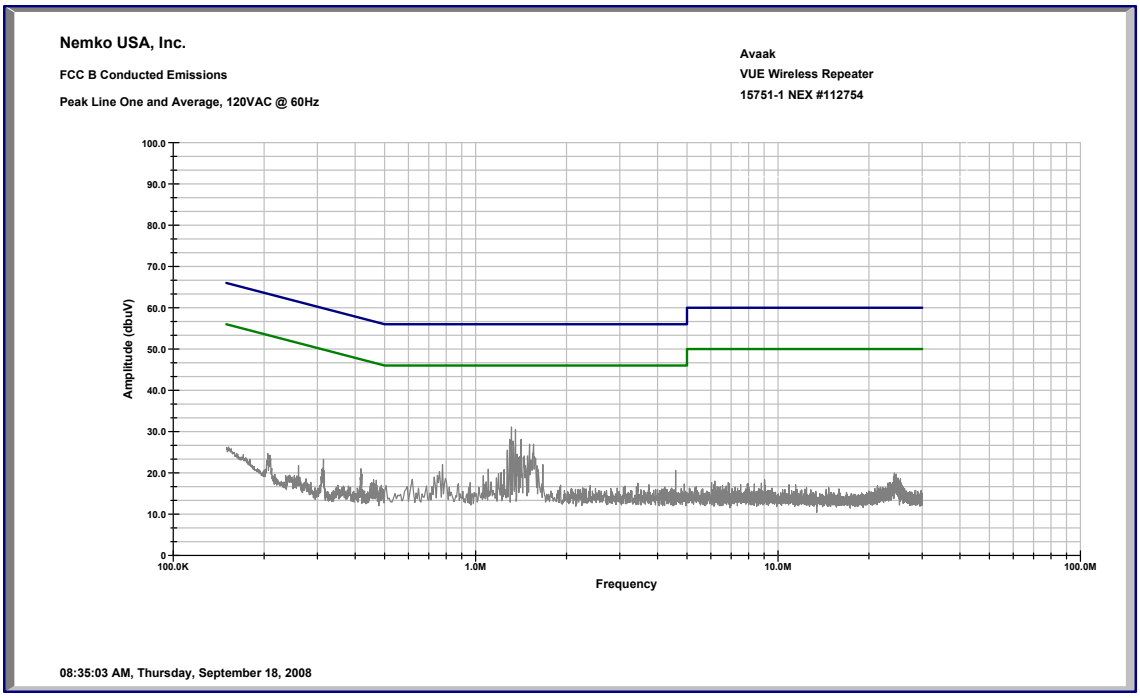
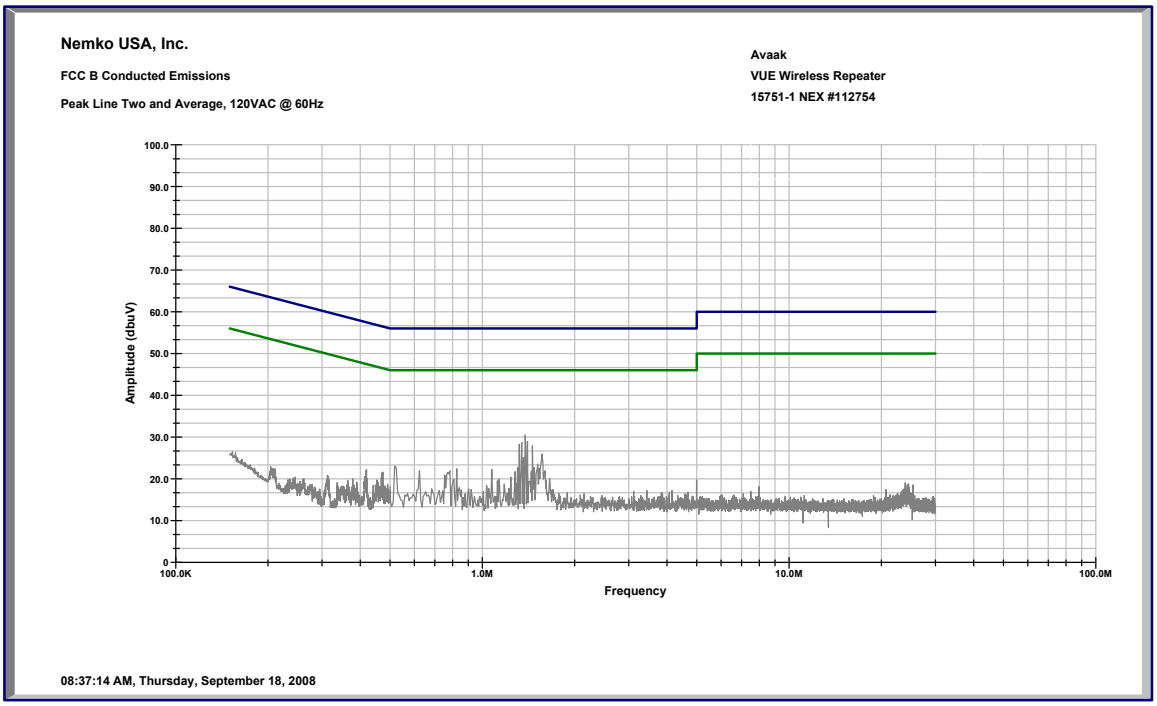

Nemko USA, Inc.
FCC B Conducted Emissions
Peak Line One and Average, 120VAC @ 60Hz
Avaak
VUE Wireless Repeater
15751-1 NEX #112754
Amplitude (dbuV)
Frequency
100.0K
1.0M
10.0M
100.0M
08:35:03 AM, Thursday, September 18, 2008


Nemko USA, Inc.
FCC B Conducted Emissions
Peak Line Two and Average, 120VAC @ 60Hz
Avaak
VUE Wireless Repeater
15751-1 NEX #112754
Amplitude (dbuV)
Frequency
100.0K
1.0M
10.0M
100.0M
08:37:14 AM, Thursday, September 18, 2008

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20dB Bandwidth

15.247 (a)(1)
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

RSS-210 A8.1 (a)
The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hop set. The hop set shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hop set while the long-term distribution appears evenly distributed.

Test Conditions:

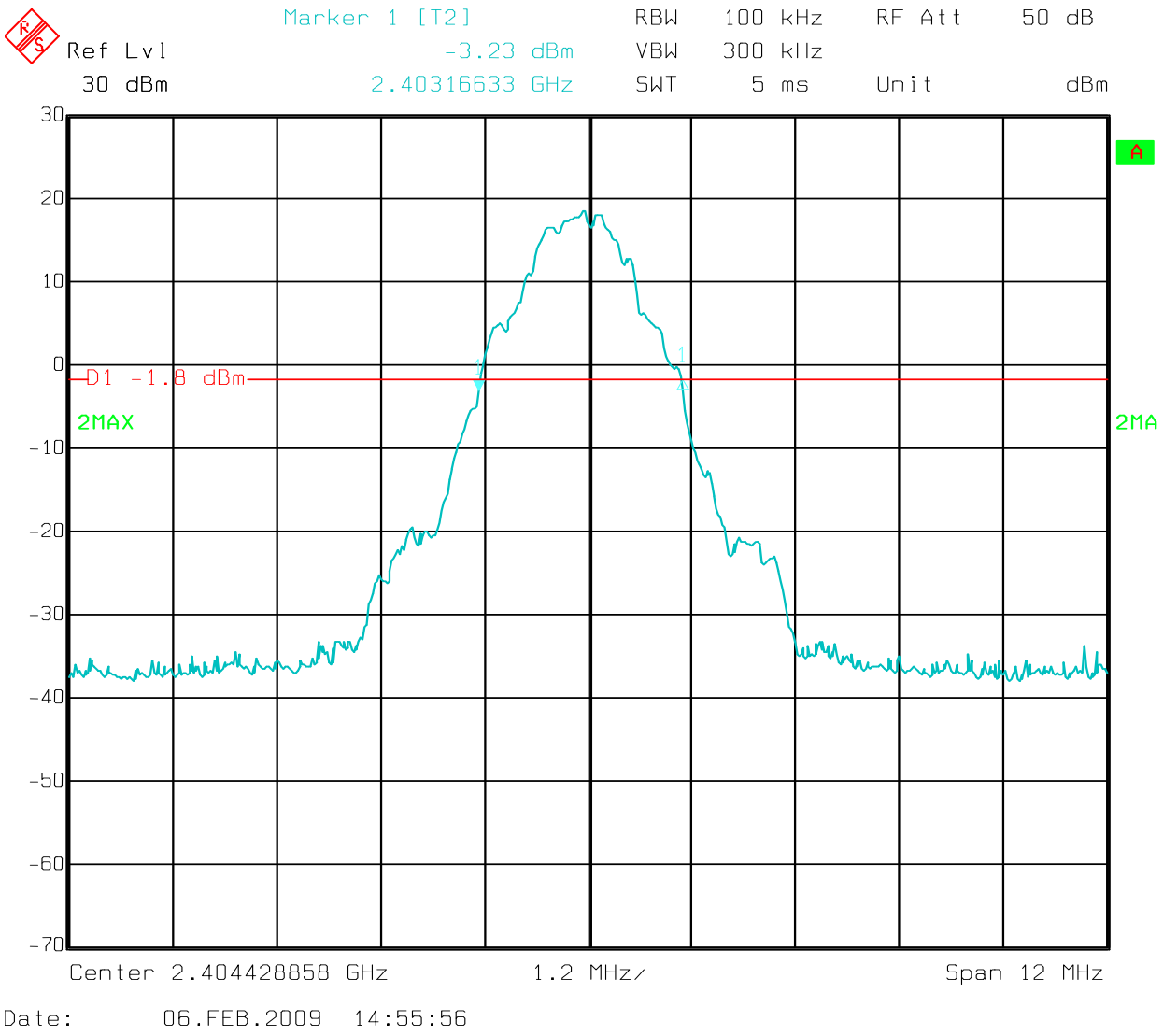
Sample Number:	**VUE Repeater**	**Temperature:**	25
Date:	September 18,2008	**Humidity:**	76
Modification State:	Lo/Mid/High Channels	**Tester:**	FSCustodio
		Laboratory:	Shield Room 2

Test Results:

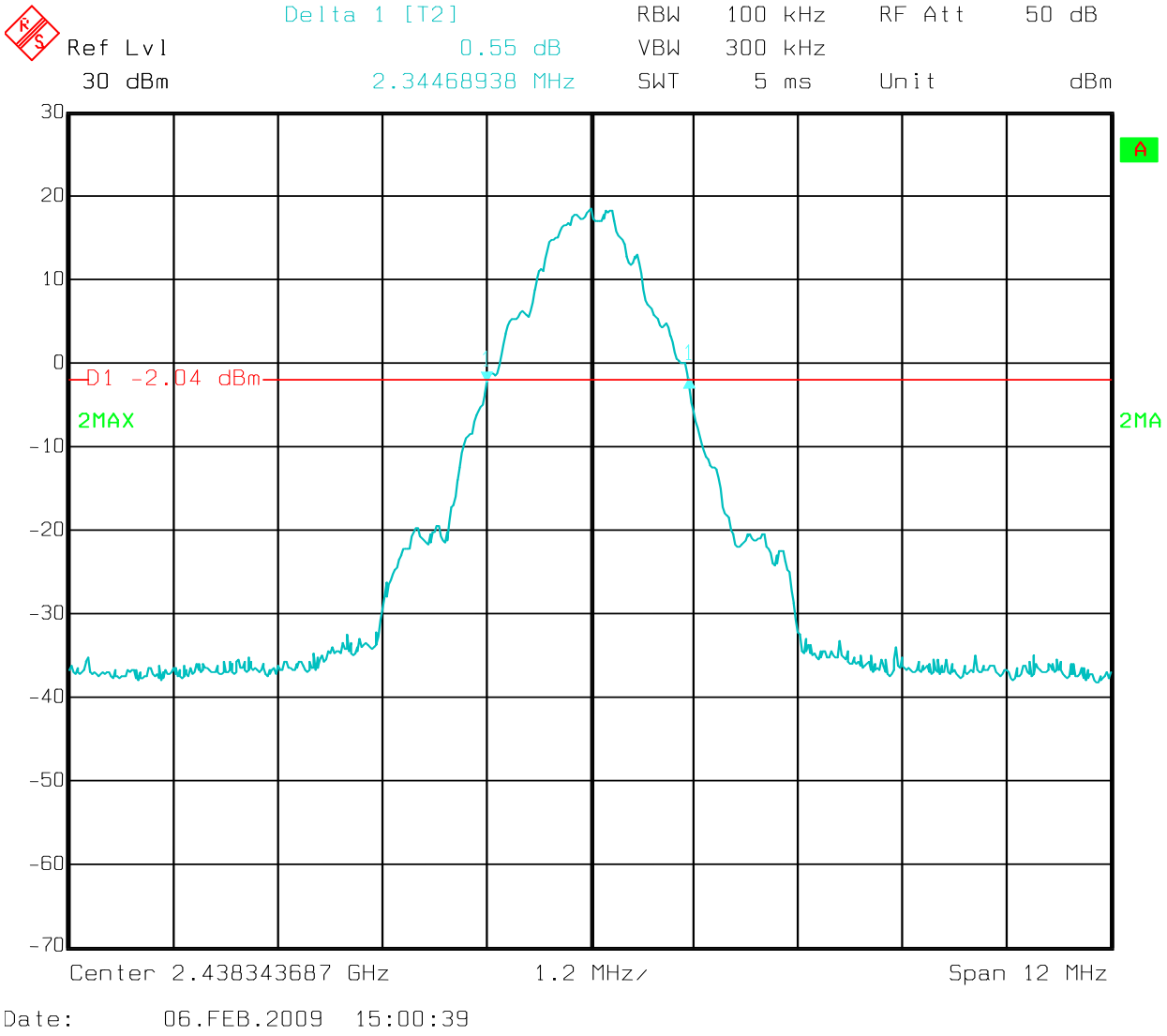
See Attached Plots.

Additional Observations:

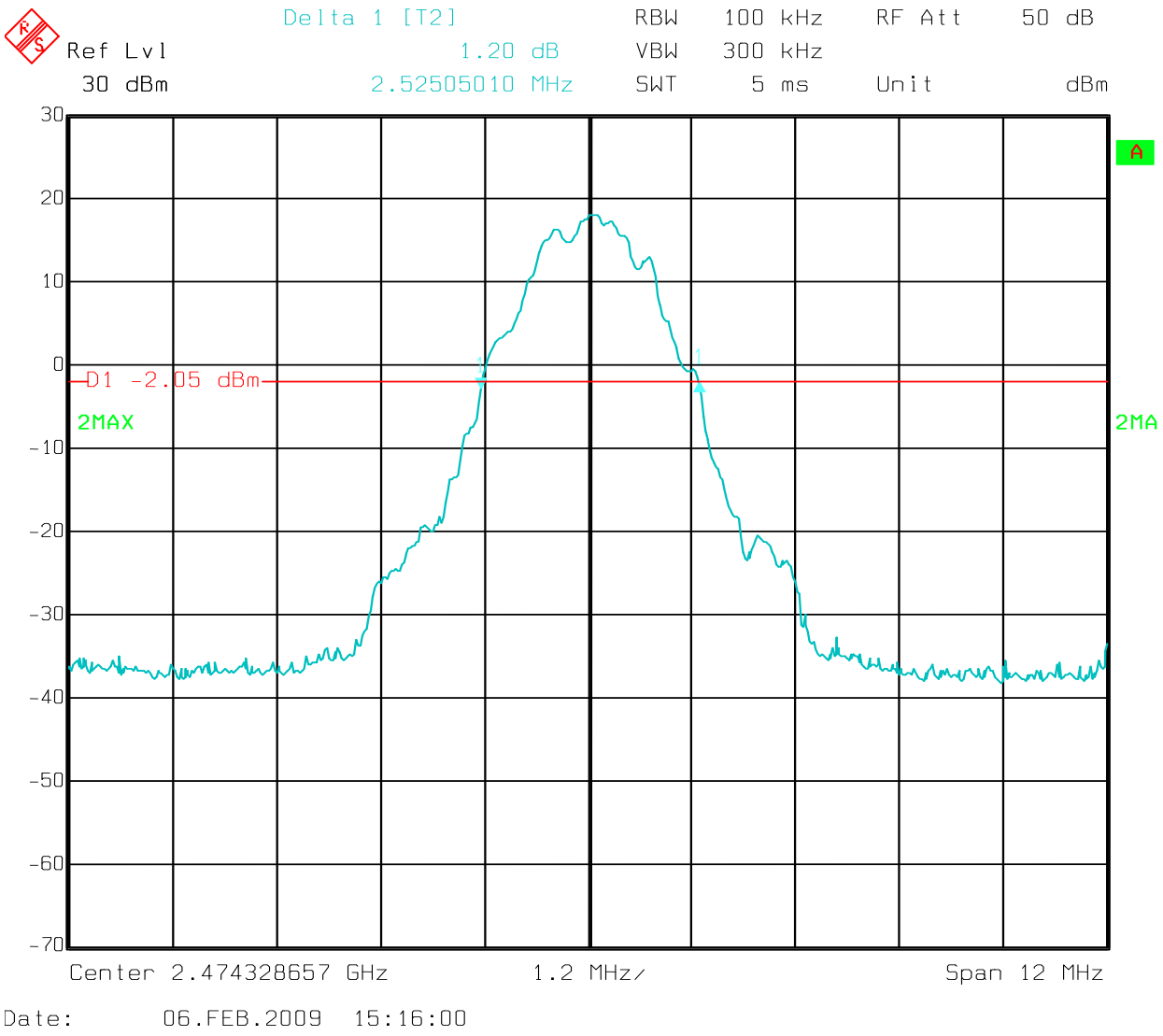
This is a conducted test. The EUT with the integral antenna removed and replaced with a SMA connector is connected directly to the input of the spectrum analyzer. RBW set to 100kHz and VBW to 300kHz. Detector function is set to Peak and the trace to Max Hold. While the EUT is transmitting at it's maximum data rate and allowed to stabilize, emission peak is determined. A display line is drawn 20dB from this point. The points where the line intersects the emission determined the bandwidth for each channel investigated.



LOW Channel 20dB bandwidth = 2.4 MHz



MID Channel 20dB bandwidth = 2.3MHz



HIGH Channel 20dB bandwidth = 2.5MHz

Spurious RF Conducted Emissions

15.247 (d) I
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 Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

A8.5 Out-of-band Emissions
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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 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.

Test Conditions:

Sample Number:	**VUE Repeater**	**Temperature:**	25 °C
Date:	September 19, 2008	**Humidity:**	76 %
Modification State:	Hopping	**Tester:**	FSCustodio
		Laboratory:	Shield Room 2

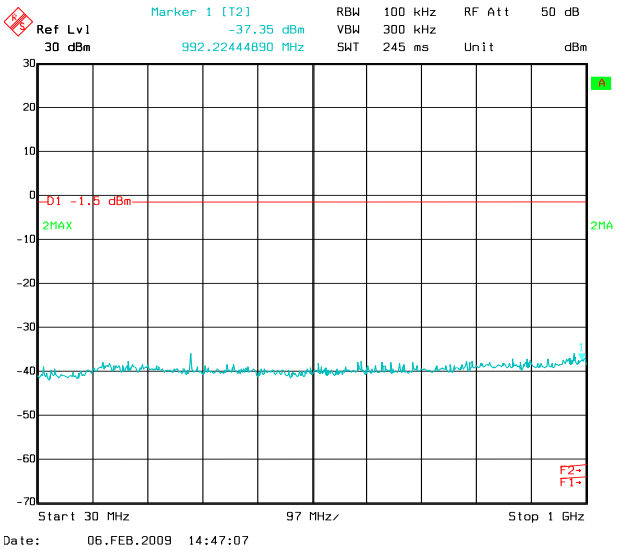
Test Results:

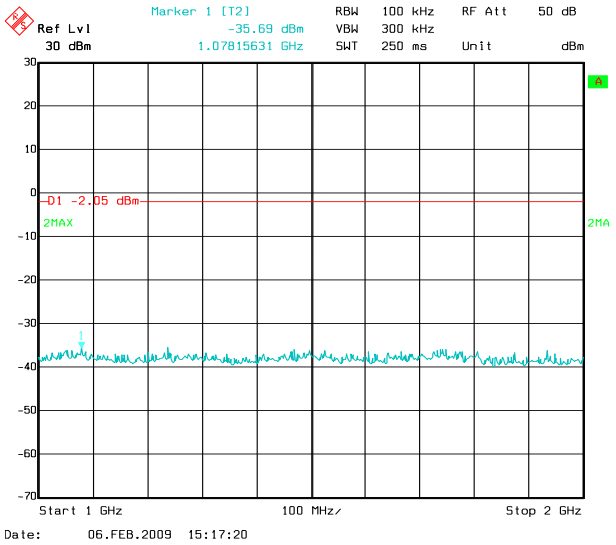
No emissions within 20 dB of the highest level desired power (fundamental). See attached plots.

Additional Observations:

- RBW =100kHz
- Sweep = Auto
- Detector function = peak.
- Trace = Max hold
- No offset used, EUT connected directly to the spectrum analyzer.

Low Channel:


Marker 1 [T2]
-37.35 dBm
992.22444890 MHz
RBW 100 kHz
VBW 300 kHz
SWT 245 ms
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -1.5 dBm
2MAX
2MA
Start 30 MHz
97 MHz/
Stop 1 GHz
Date: 06.FEB.2009 14:47:07


Marker 1 [T2]
-35.69 dBm
1.07815631 GHz
RBW 100 kHz
VBW 300 kHz
SWT 250 ms
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.05 dBm
2MAX
2MA
Start 1 GHz
100 MHz/
Stop 2 GHz
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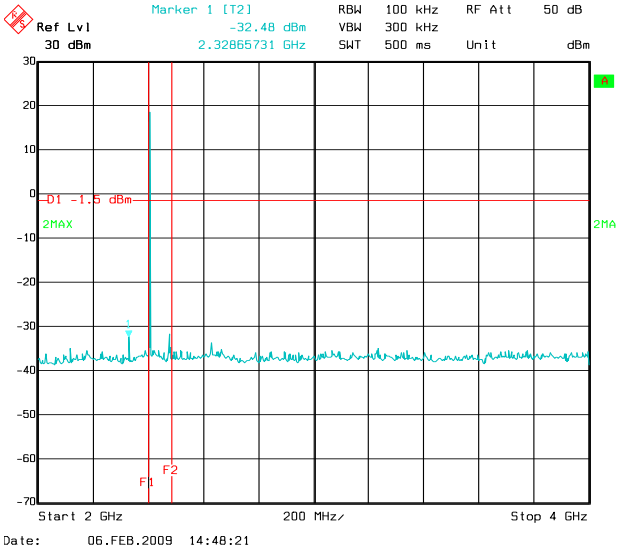
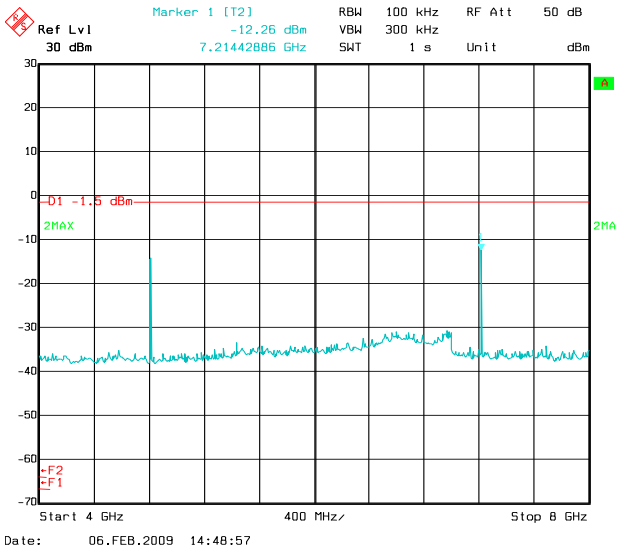

Marker 1 [T2]
-32.48 dBm
2.32865731 GHz
RBW 100 kHz
VBW 300 kHz
SWT 500 ms
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -1.5 dBm
2MAX
2MA
F1
F2
Start 2 GHz
200 MHz/
Stop 4 GHz
Date: 06.FEB.2009 14:48:21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-12.26 dBm
7.21442886 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -1.5 dBm
2MAX
2MA
F2
F1
Start 4 GHz
400 MHz/
Stop 8 GHz
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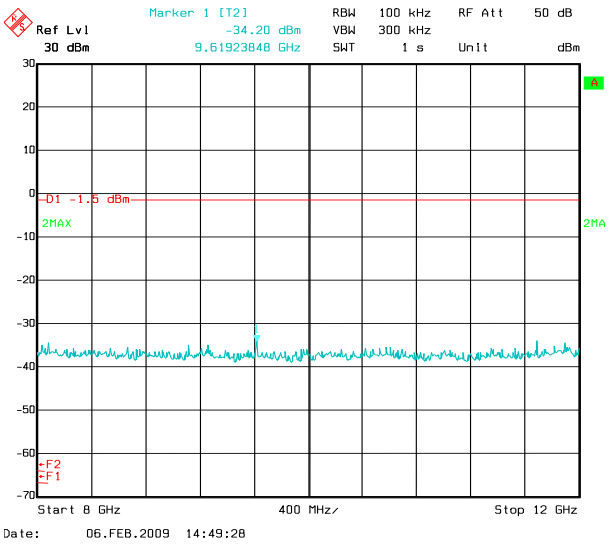
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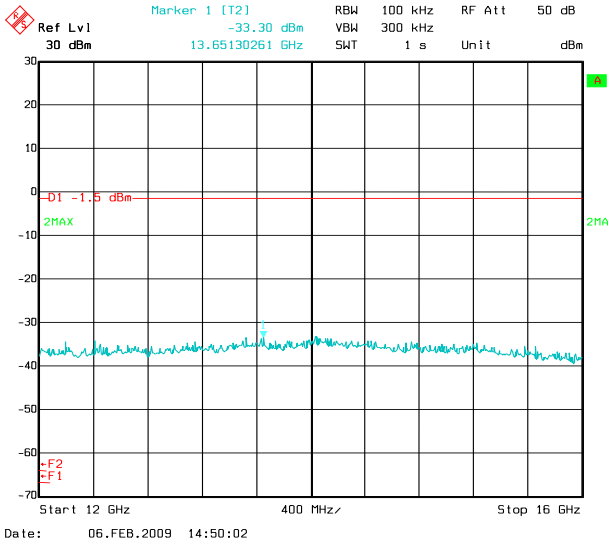
-34.20 dBm
9.61923848 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -1.5 dBm
2MAX
2MA
Start 8 GHz
400 MHz/
Stop 12 GHz
Date: 06.FEB.2009 14:49:28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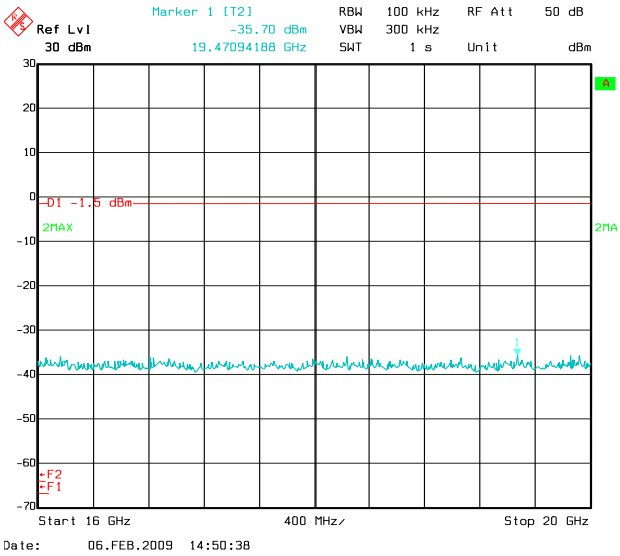
-33.30 dBm
13.65130261 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -1.5 dBm
2MAX
2MA
Start 12 GHz
400 MHz/
Stop 16 GHz
Date: 06.FEB.2009 14:50:02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-35.70 dBm
19.47094188 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1 s
RF Att 50 dB
Unit dBm
Ref Lvl
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D1 -1.5 dBm
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2MA
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400 MHz/
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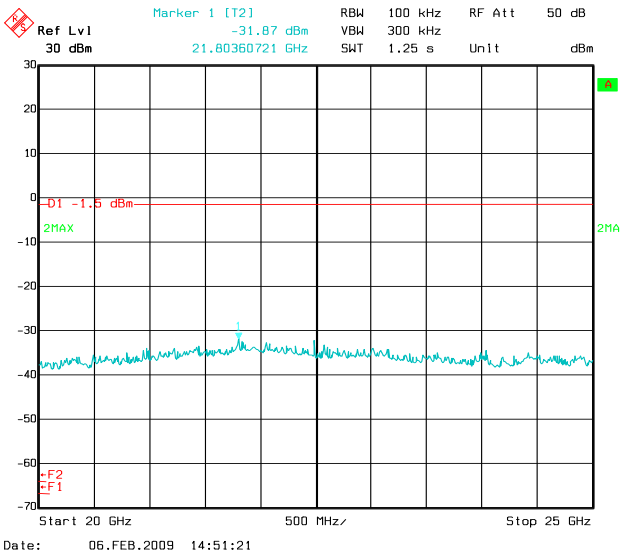
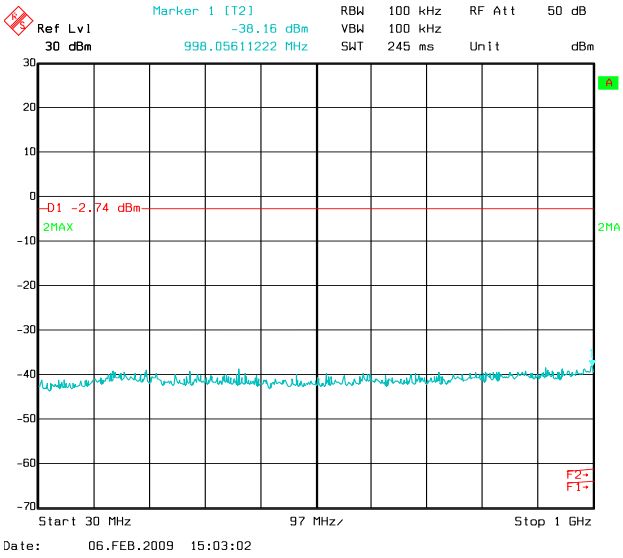

Marker 1 [T2]
-31.87 dBm
21.80360721 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1.25 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -1.5 dBm
2MAX
2MA
Start 20 GHz
500 MHz/
Stop 25 GHz
Date: 06.FEB.2009 14:51:21

Mid Channel: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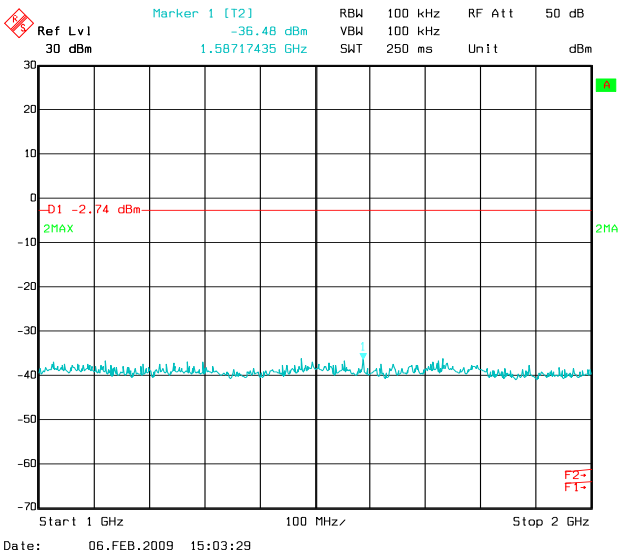
-38.16 dBm
998.05611222 MHz
RBW 100 kHz
VBW 100 kHz
SWT 245 ms
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.74 dBm
2MAX
2MA
F2
F1
Start 30 MHz
97 MHz/
Stop 1 GHz
Date: 06.FEB.2009 15:03:02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RBW 100 kHz
VBW 100 kHz
SWT 250 ms
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.74 dBm
2MAX
2MA
F2
F1
Start 1 GHz
100 MHz/
Stop 2 GHz
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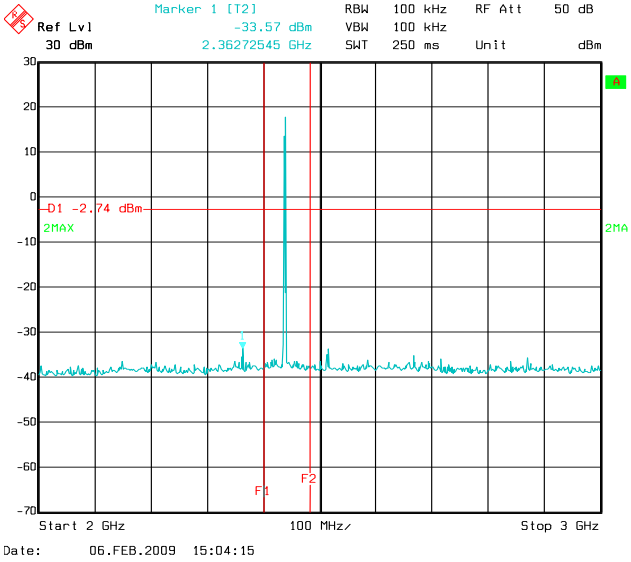
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2.36272545 GHz
RBW 100 kHz
VBW 100 kHz
SWT 250 ms
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.74 dBm
2MAX
2MA
F1
F2
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100 MHz/
Stop 3 GHz
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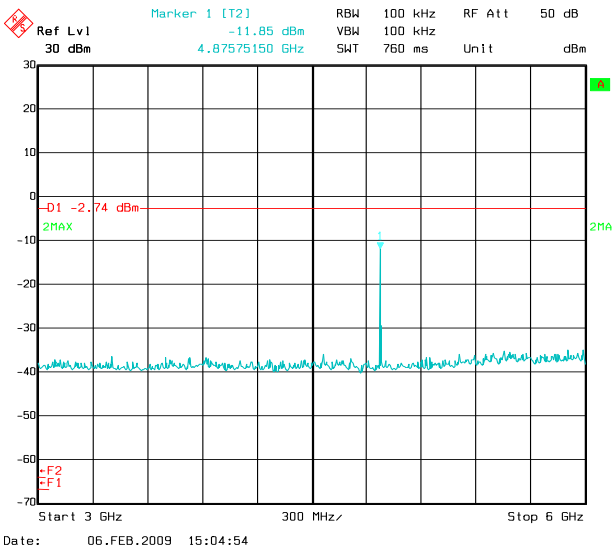
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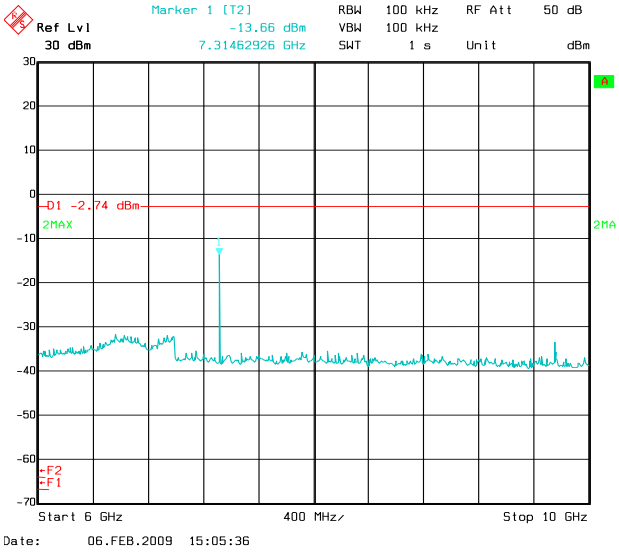
-11.85 dBm
4.87575150 GHz
RBW 100 kHz
VBW 100 kHz
SWT 760 ms
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.74 dBm
2MAX
2MA
F2
F1
Start 3 GHz
300 MHz/
Stop 6 GHz
Date: 06.FEB.2009 15:04:54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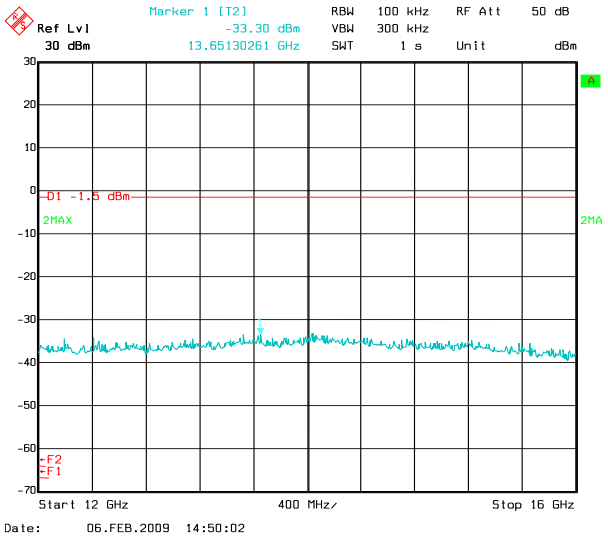
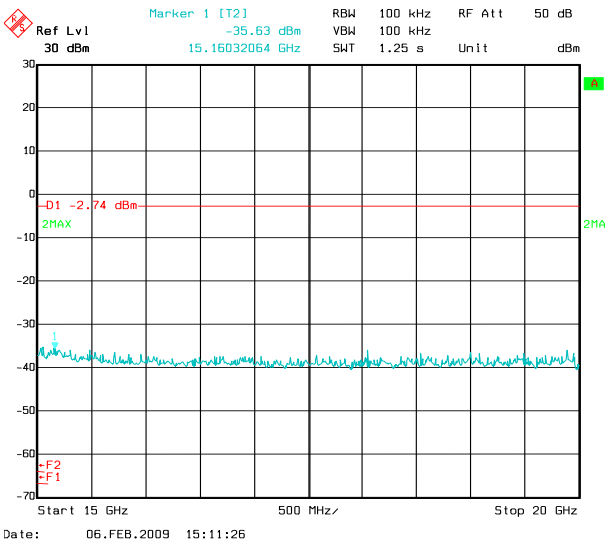
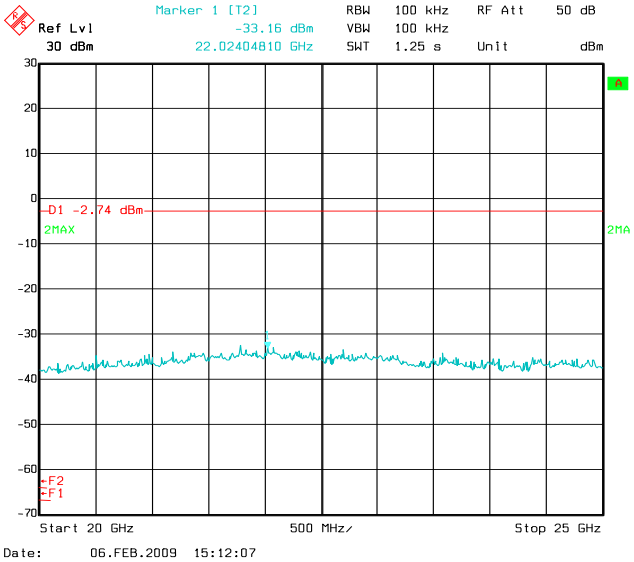
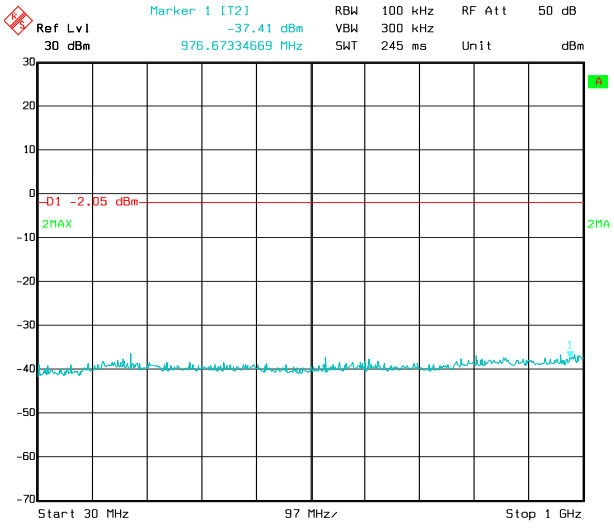
-13.66 dBm
7.31462926 GHz
RBW 100 kHz
VBW 100 kHz
SWT 1 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.74 dBm
2MAX
2MA
Start 6 GHz
400 MHz/
Stop 10 GHz
Date: 06.FEB.2009 15:05:36

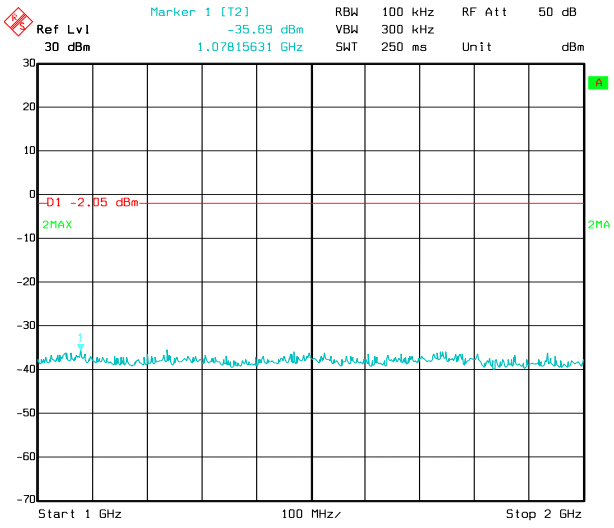

Marker 1 [T2]
-33.30 dBm
13.65130261 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -1.5 dBm
2MAX
2MA
Start 12 GHz
400 MHz/
Stop 16 GHz
Date: 06.FEB.2009 14:50:02

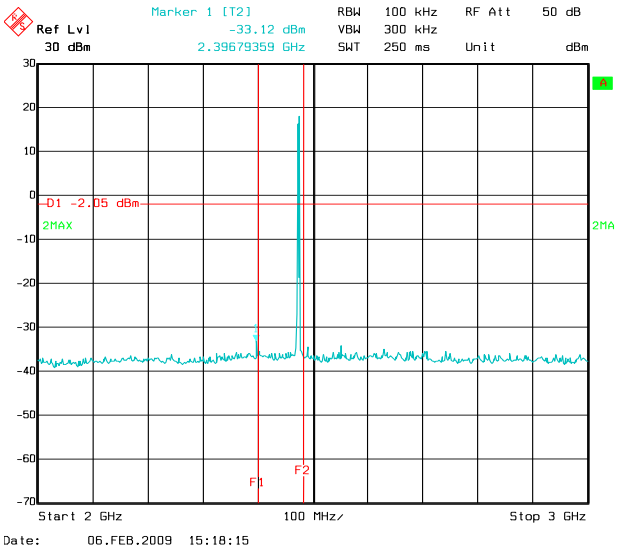

Marker 1 [T2]
-35.63 dBm
15.16032064 GHz
RBW 100 kHz
VBW 100 kHz
SWT 1.25 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.74 dBm
2MAX
2MA
Start 15 GHz
500 MHz/
Stop 20 GHz
Date: 06.FEB.2009 15:11:26

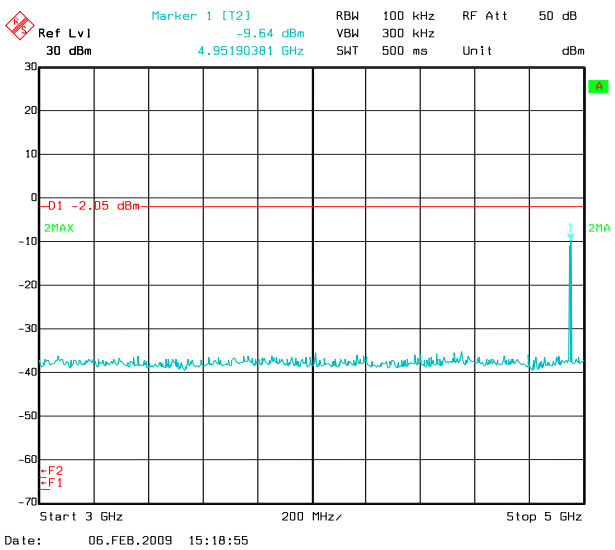

Marker 1 [T2]
-33.16 dBm
22.02404810 GHz
RBW 100 kHz
VBW 100 kHz
SWT 1.25 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.74 dBm
2MAX
2MA
Start 20 GHz
500 MHz/
Stop 25 GHz
Date: 06.FEB.2009 15:12:07

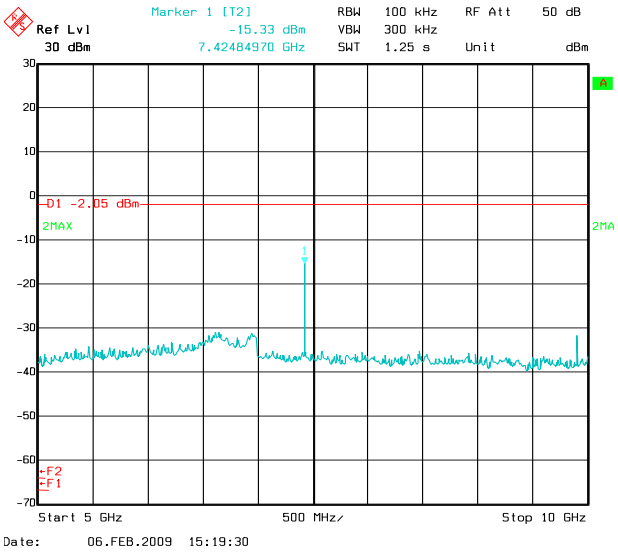
High Channel:

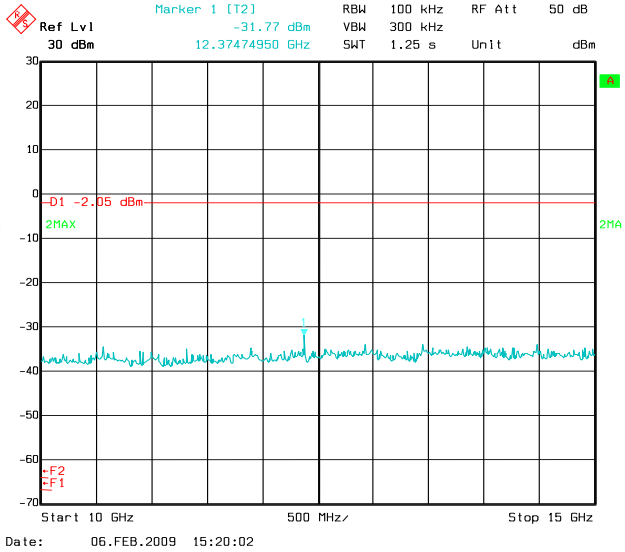


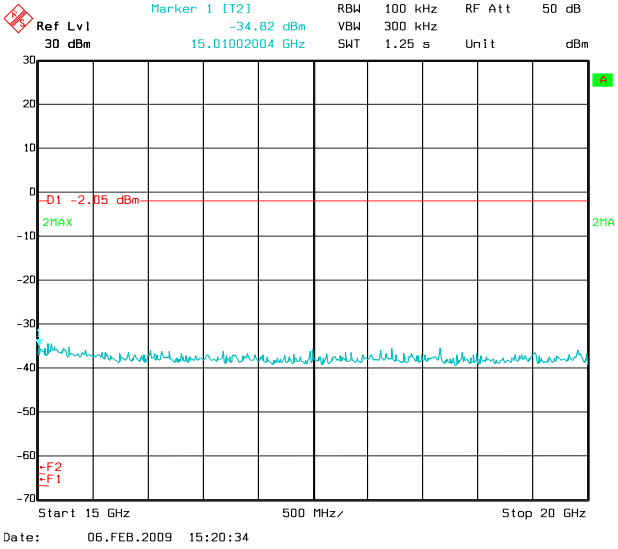


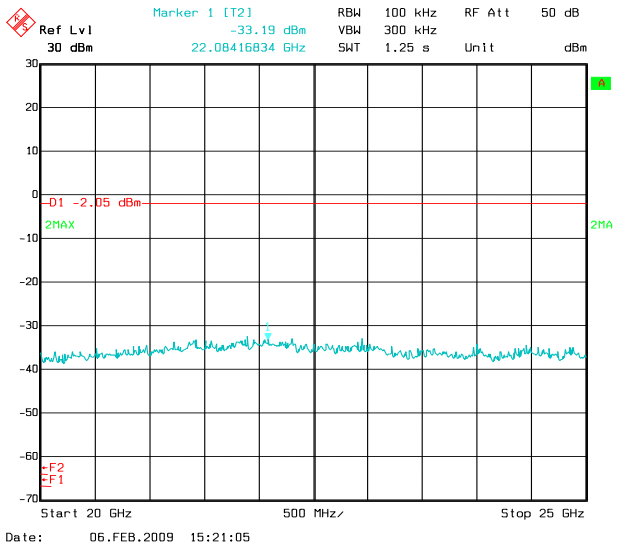





Marker 1 [T2]
-15.33 dBm
7.42484970 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1.25 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.05 dBm
2MAX
2MA
F2
F1
Start 5 GHz
500 MHz/
Stop 10 GHz
Date: 06.FEB.2009 15:19:30


Marker 1 [T2]
-31.77 dBm
12.37474950 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1.25 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.05 dBm
2MAX
2MA
F2
F1
Start 10 GHz
500 MHz/
Stop 15 GHz
Date: 06.FEB.2009 15:20:02


Marker 1 [T2]
-34.82 dBm
15.01002004 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1.25 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.05 dBm
2MAX
2MA
F2
F1
Start 15 GHz
500 MHz/
Stop 20 GHz
Date: 06.FEB.2009 15:20:34


Marker 1 [T2]
-33.19 dBm
22.08416834 GHz
RBW 100 kHz
VBW 300 kHz
SWT 1.25 s
RF Att 50 dB
Unit dBm
Ref Lvl
30 dBm
D1 -2.05 dBm
2MAX
2MA
F2
F1
Start 20 GHz
500 MHz/
Stop 25 GHz
Date: 06.FEB.2009 15:21:05

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Radiated Emissions within Restricted Bands

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)).***

RSS 210 2.2(b)
Unwanted emissions falling into restricted bands of Table 1 shall meet Tables 2 and 3 limits. It should also be noted that unwanted emissions falling in non-restricted bands do not need to be suppressed to a level lower than the Table 2 and 3 limits.

Test Conditions:

Sample Number:	**VUE Repeater**	**Temperature:**	24
Date:	September 18, 2008	**Humidity:**	66
Modification State:	Hopping	**Tester:**	FSCustodio
		Laboratory:	SOATS

Test Results:

See attached plots.

Additional Observations:

- Five (5) harmonics from the Low (2404MHz), Mid (2442MHz) and High (2474 MHz) channels were identified under the restricted bands.
- RBW/VBW =1MHz above 1GHz while RBW 120kHz/VBW 300kHz below 1GHz using Quasi-Peak detector.
- Sweep = Auto
- Detector function = peak.
- Trace = Max hold
- The Spectrum was searched from 30MHz to the 10^{th} Harmonic, 25000 MHz. There are no emissions found that do not comply to the restricted bands defined in FCC Part 15 Subpart C, 15.205 or Part 15.247(d).
- The EUT was measured on three orthogonal axes.

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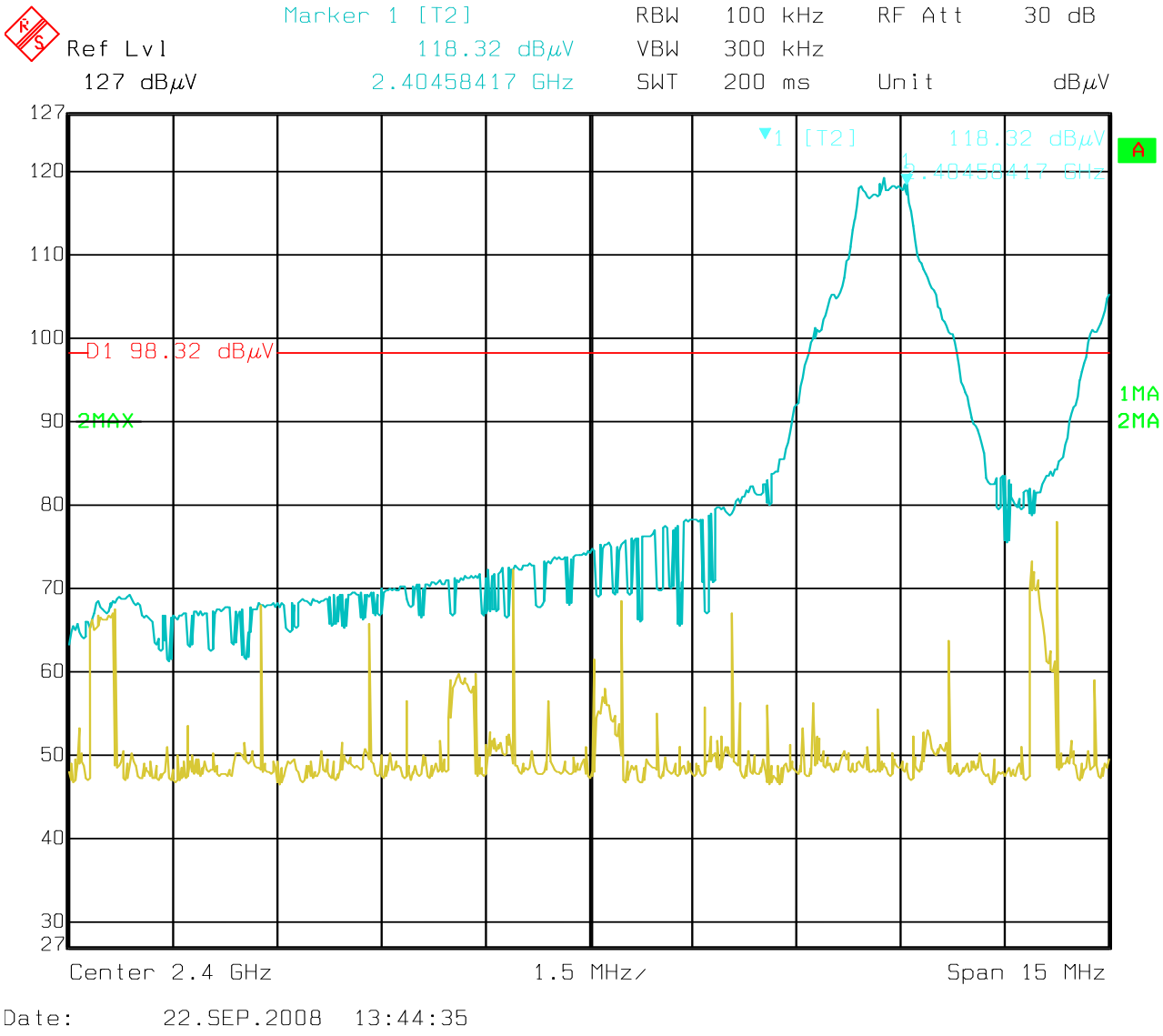
Radiated Emissions Data

Complete	YES			Job # : 15751-1	Test # : 1
Preliminary				Page 1	of 1
Client Name :	Avaak				
EUT Name :	Wireless Repeater				
EUT Model # :	VUE Repeater				
EUT ANTENNA Part # :					
EUT Serial # :					
EUT Config. :	Transmit				
	FCC Part 15.247				
Specification :	FCC Part 15.209 (a)				
Rod. Ant. #:	NA	Temp. (deg. C) :	24	Date :	9/18/2008
Bicon Ant.#:	NA	Humidity (%) :	66	Time :	9:30AM
Log Ant.#:	NA	EUT Voltage :	120	Staff :	FSC
DRG Ant. #	752	EUT Frequency :	60	Photo ID:	
Dipole Ant.#:	NA	Phase:	1	Peak Res Bandwidth:	1 MHz (Harmonics)
Cable#:	40ft	Location:	SOATS	Peak Video Bandwidth	1 MHz (Harmonics)
Preamp#:	317	Distance:	3 m		
Spec An.#:	835	Duty Cycle Factor	20		
QP #:	NA				

Meas. Freq. (MHz)	Vertical (dBuV) pk	Vertical (dBuV) av	Horizontal (dBuV) pk	Horizontal (dBuV) av	CF (db)	Max Level (dBuV/m) pk	Max Level (dBuV/m) av	Spec. Limit (dBuV/m) pk	Spec. Limit (dBuV/m) av	Margin dB pk	Margin dB av	EUT Rotation	Ant. Height	Pass Fail Unc.	Comment
4808.00	48.5	28.5	48.8	28.8	5.6	54.4	34.4	74.0	54.0	-19.6	-19.6			Pass	
4884.00	54.8	34.8	54.7	34.7	5.6	60.4	40.4	74.0	54.0	-13.6	-13.6			Pass	
7326.00	50.9	30.9	50.9	30.9	13.4	64.3	44.3	74.0	54.0	-9.7	-9.7				Noise Floor
4948.00	58.5	38.5	57.8	37.8	5.8	64.3	44.3	74.0	54.0	-9.7	-9.7			Pass	
7422.00	48.5	28.5	46.3	26.3	13.7	62.2	42.2	74.0	54.0	-11.8	-11.8			Pass	

Sample Computation: Correction Factor (CF) of **5.6 dB** (4808 MHz)
Antenna factor = 32.5
Cable Loss = 8.5
Preamplifier Gain =35.4
CF = 32.5 +8.5 -35.4

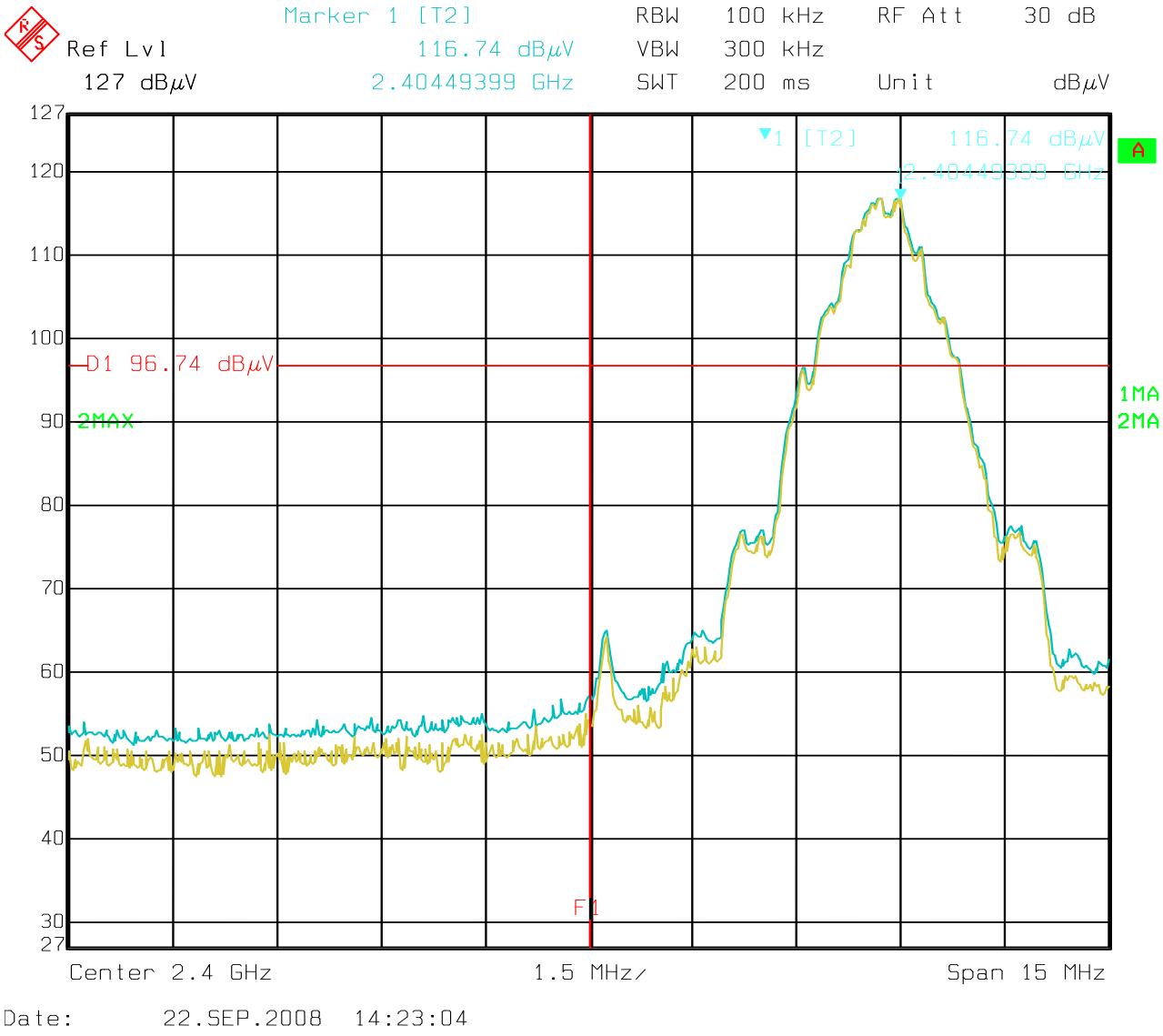
Bandedge Measurement (Low Channel Hopping)



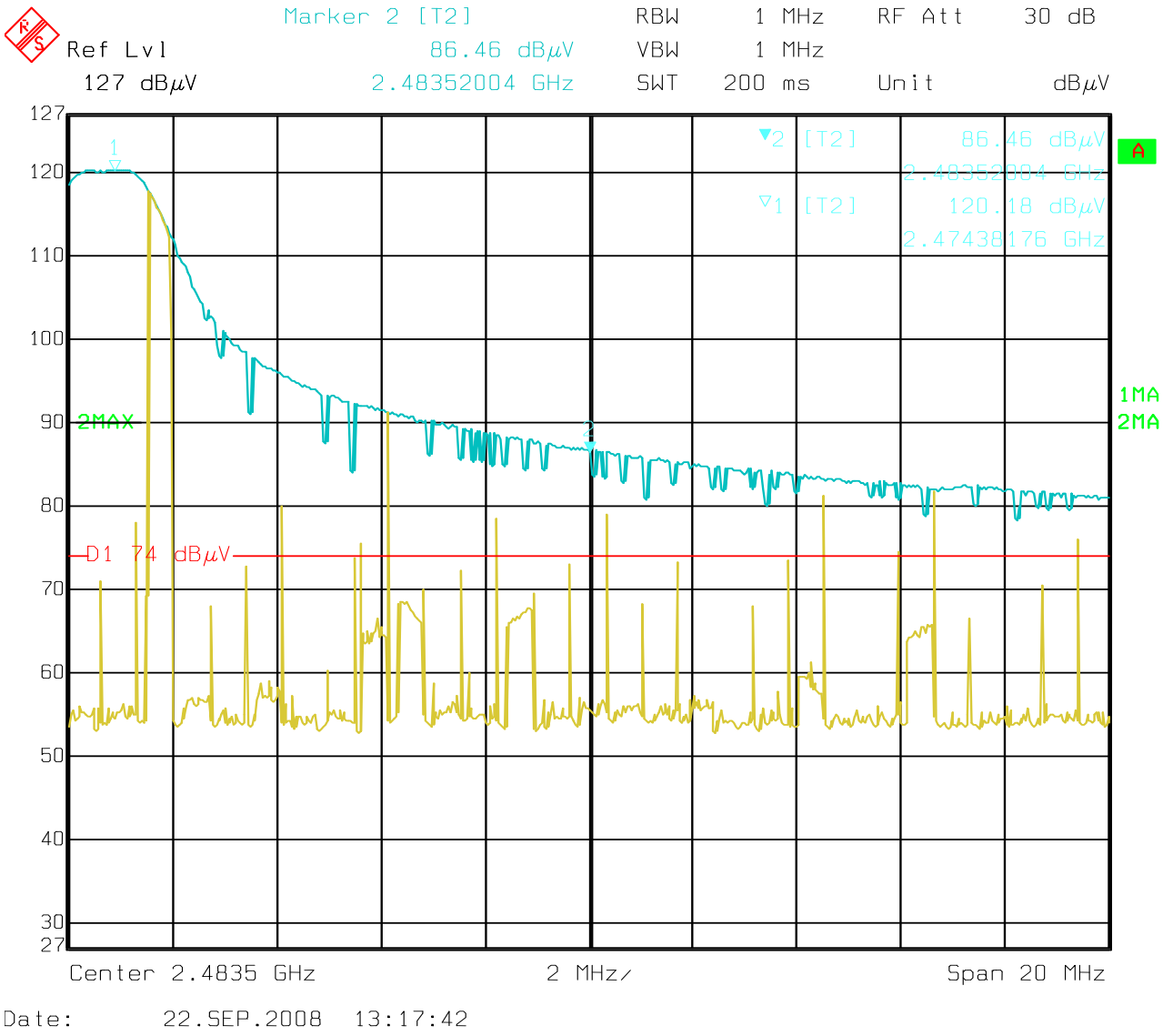
Low Channel 2404 MHz (Peak Measurement)

Center line is 2400MHz
Display/Limit line 98.32 dBµV is 20 dB from peak
Conducted measurement – EUT connected directly to the Spectrum Analyzer

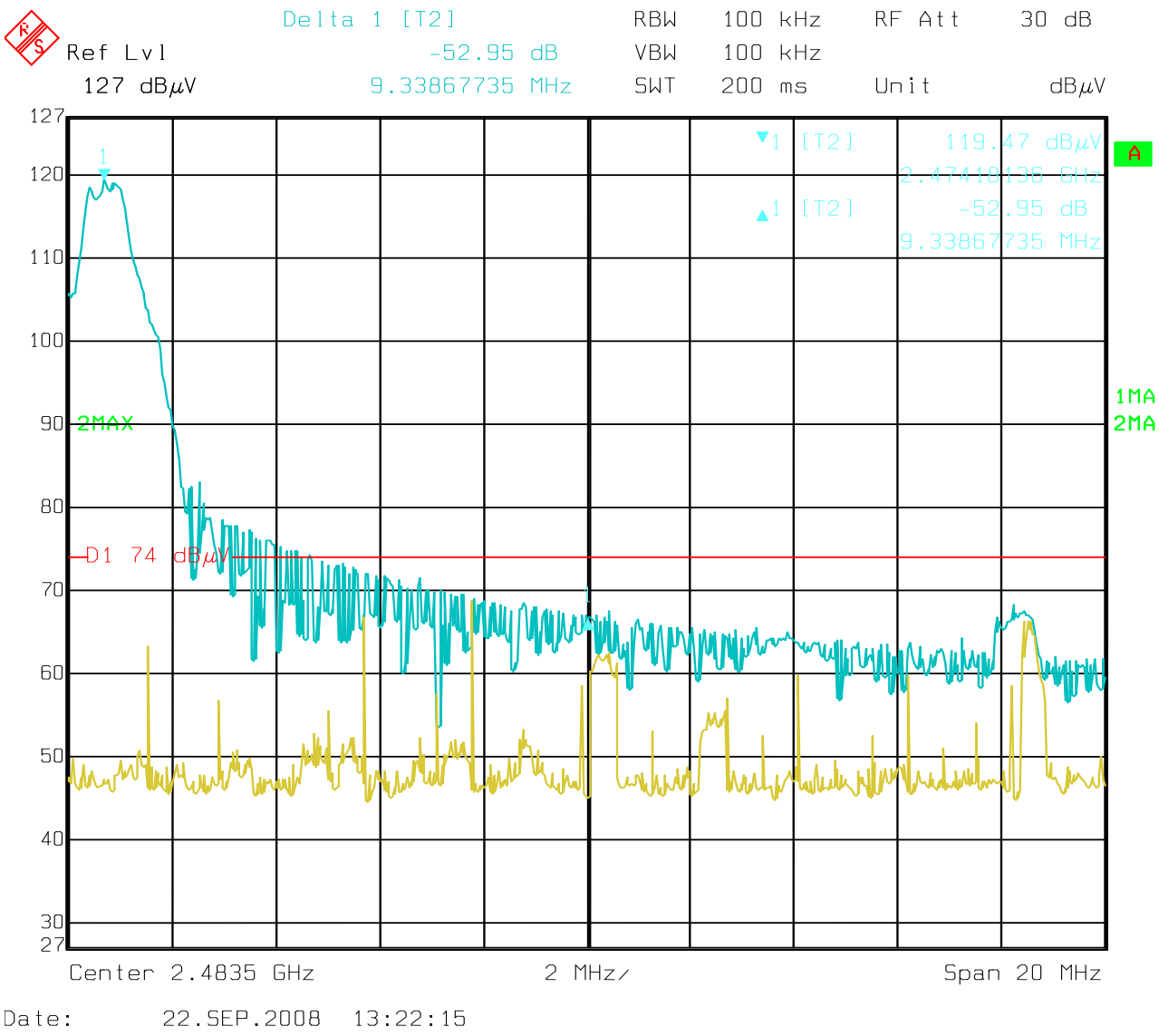
Bandedge Measurement (Low Channel Non-Hopping)



Bandedge Measurement (High Channel Hopping using Marker-Delta Method)



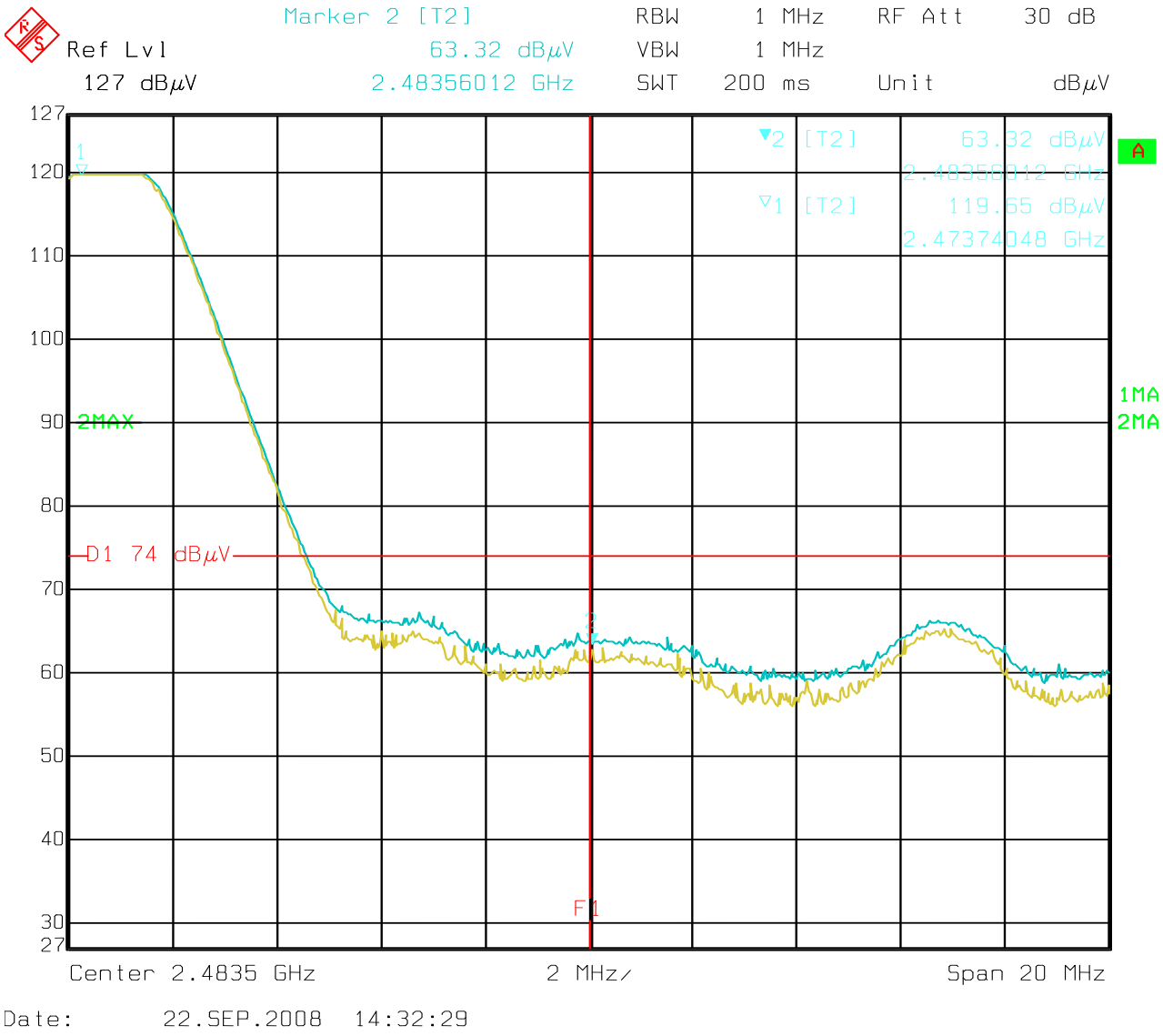
High Channel (2474MHz using 1MHz RBW/VBW)



High Channel (2474MHz using 100kHz RBW/VBW)

Band-Edge Computation: *Peak of fundamental @ 1MHz RBW/VBW – Delta of peak of fundamental and band-edge @ 100kHz RBW/VBW*
= 120.18 dBµV/m – 52.95 dBµV/m
= 67.23dBµV/m @ 2483.5MHZ

Bandedge Measurement (High Channel Non-Hopping)



High Channel (2474MHz using 1MHz RBW/VBW)

Maximum peak output power

15.257 (b)(1)
For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

A8.4(2)
For frequency hopping systems operating in the band 2400-2483.5 MHz employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4W.

Test Conditions:

Sample Number:	**VUE Repeater**	**Temperature:**	24 °C
Date:	September 18 and 19,2008	**Humidity:**	66 %
Modification State:	Lo/Mid/High Channels	**Tester:**	FS Custodio
		Laboratory:	SOATS

Additional Observations:

- Two (2) measurement methods were made: conducted and radiated. Radiated was done to demonstrate transmission characteristic of the integral antenna.
- For conducted measurement, a Peak Power Meter was used and the EUT connected directly to the input of the Peak Power Sensor (integral antenna replaced with a SMA connector – sensor head of meter with a 10dB attenuator).
- For radiated measurement, investigations were made at 3 meters. Each channel investigated was maximized at the OATS. Analyzer RES BW was set to 3 MHz and VBW to 3 MHz.
- The peak level measured was converted to V/m and Peak power computed using the formula :

$P = (E \times d)^2 / (30 \times G)$

Where: P = Power in watts
E = measured maximum field strength in V/m
d = distance in meters during measurement
G = numeric gain of the transmitting antenna over an isotropic radiator (assume 1 as antenna is trace in circuitry and cannot be determined.)

Test Results:

Channel	Frequency (MHz)	Measured Output Power Radiated mW	Measured Output Power Radiated dBm	Measured Output Power Conducted mW	Measured Output Power Conducted dBm	Gain, Calculated
Low	2404	33.4	15.2	**104.7**	20.2	-5.0
Mid	2442	30.4	14.8	89.1	19.5	-4.7
High	2474	34.2	15.3	89.1	19.5	-4.2

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Radiated Emissions Data

Complete	YES			Job # : 15751-1	Test # : 1
Preliminary				Page 1	of 1
Client Name :	Avaak				
EUT Name :	Wireless Repeater				
EUT Model # :	VUE Repeater				
EUT ANTENNA Part # :					
EUT Serial # :					
EUT Config. :	Transmit				
	FCC Part 15.247				
Specification :	FCC Part 15.209 (a)				
Rod. Ant. #:	NA	Temp. (deg. C) :	24	Date :	9/18/2008
Bicon Ant.#:	NA	Humidity (%) :	66	Time :	9:30AM
Log Ant.#:	NA	EUT Voltage :	120	Staff :	FSC
DRG Ant. #	752	EUT Frequency :	60	Photo ID:	
Dipole Ant.#:	NA	Phase:	1	Peak Res Bandwidth:	3 MHz (Fundamental)
Cable#:	40ft	Location:	SOATS	Peak Video Bandwidth	3 MHz (Fundamental)
Preamp#:	317	Distance:	3 m	Peak Res Bandwidth:	1 MHz (Harmonics)
Spec An.#:	835	Duty Cycle Factor	20	Peak Video Bandwidth:	1 MHz (Harmonics)
QP #:	NA				

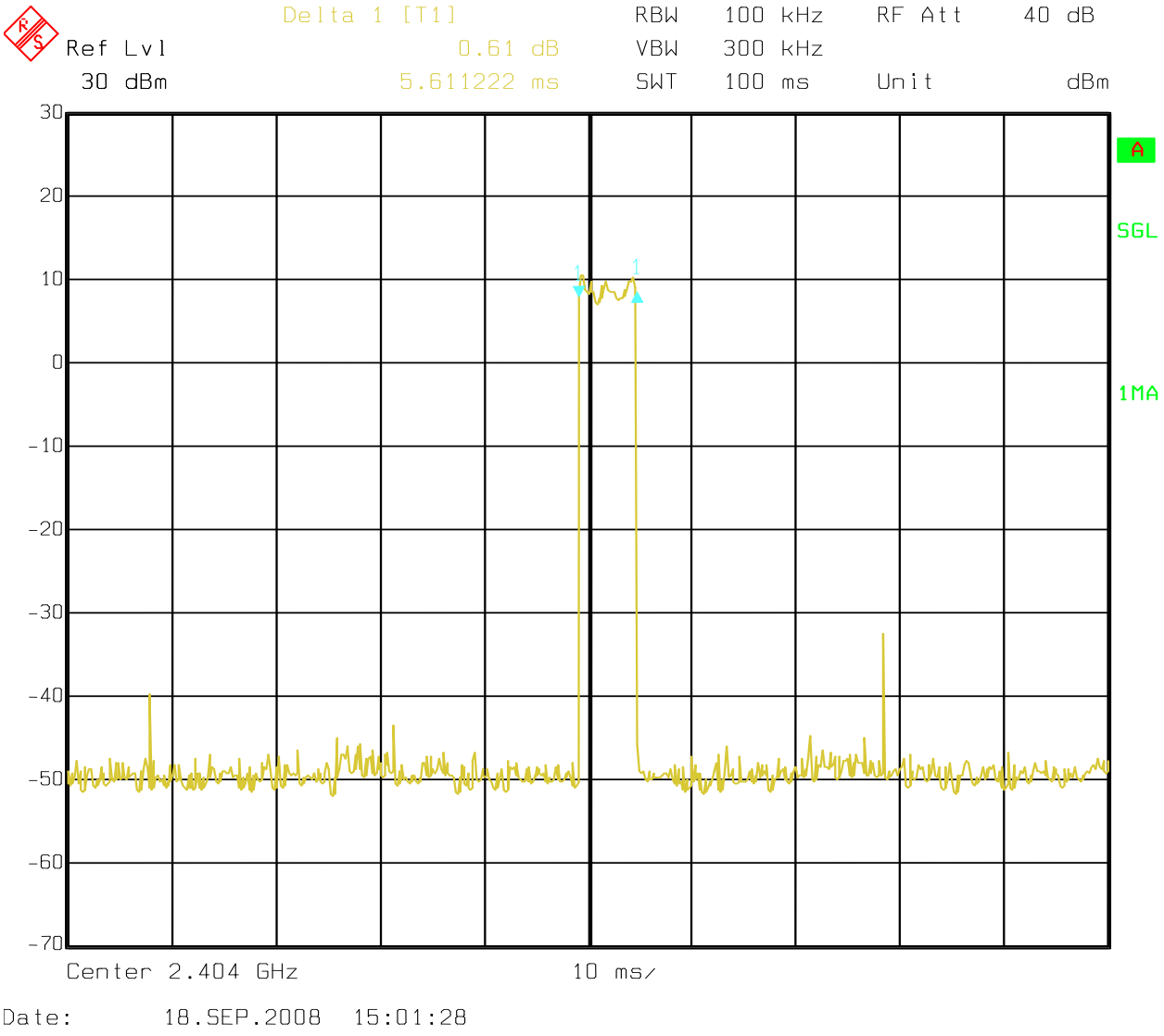
Meas. Freq. (MHz)	Vertical (dBuV) pk	Vertical (dBuV) av	Horizontal (dBuV) pk	Horizontal (dBuV) av	CF (db)	Max Level (dBuV/m) pk	Max Level (dBuV/m) av	Spec. Limit (dBuV/m) pk	Spec. Limit (dBuV/m) av	Margin dB pk	Margin dB av	EUT Rotation	Ant. Height	Pass Fail Unc.	Comment
2404.00	72.2	52.2	77.3	57.3	33.2	110.5	90.5	115.3	95.3	-4.8	-4.8	F	1.2	Pass	X Config
2404.00	74.2	54.2	72.2	52.2	33.2	107.4	87.4	115.3	95.3	-7.9	-7.9	F	1.0	Pass	Y Config
2404.00	70.8	50.8	75.1	55.1	33.2	108.3	88.3	115.3	95.3	-7.0	-7.0	T	1.0	Pass	Z Config
2442.00	73.2	53.2	76.9	56.9	33.2	110.1	90.1	115.3	95.3	-5.2	-5.2	F	1.2	Pass	X Config
2442.00	73.7	53.7	71.9	51.9	33.2	106.9	86.9	115.3	95.3	-8.4	-8.4	F	1.0	Pass	Y Config
2442.00	71.4	51.4	73.3	53.3	33.2	106.4	86.4	115.3	95.3	-8.8	-8.8	T	1.0	Pass	Z Config
2474.00	73.7	53.7	77.4	57.4	33.2	110.6	90.6	115.3	95.3	-4.7	-4.7	F	1.2	Pass	X Config
2474.00	74.4	54.4	72.9	52.9	33.2	107.6	87.6	115.3	95.3	-7.7	-7.7	F	1.0	Pass	Y Config
2474.00	71.9	51.9	73.5	53.5	33.2	106.7	86.7	115.3	95.3	-8.6	-8.6	T	1.0	Pass	Z Config

Sample Computation:

Correction Factor (CF) of 33.2 dB (2404 MHz)
Antenna factor = 27.3
Cable Loss = 5.9
Preamplifier Gain = 0
CF = 27.3+5.9-0

Max Level = Max Reading + CF
= 77.3 + 33.2
= 110.5dBµV/m

Duty Cycle Computation



Duty Cycle = 5.61ms/100ms
= 5.61%

Duty Cycle Factor = -20 since duty cycle is <10%

Carrier Frequency Separation

15.247(a)(1)
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

A8.1(b)
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Test Conditions:

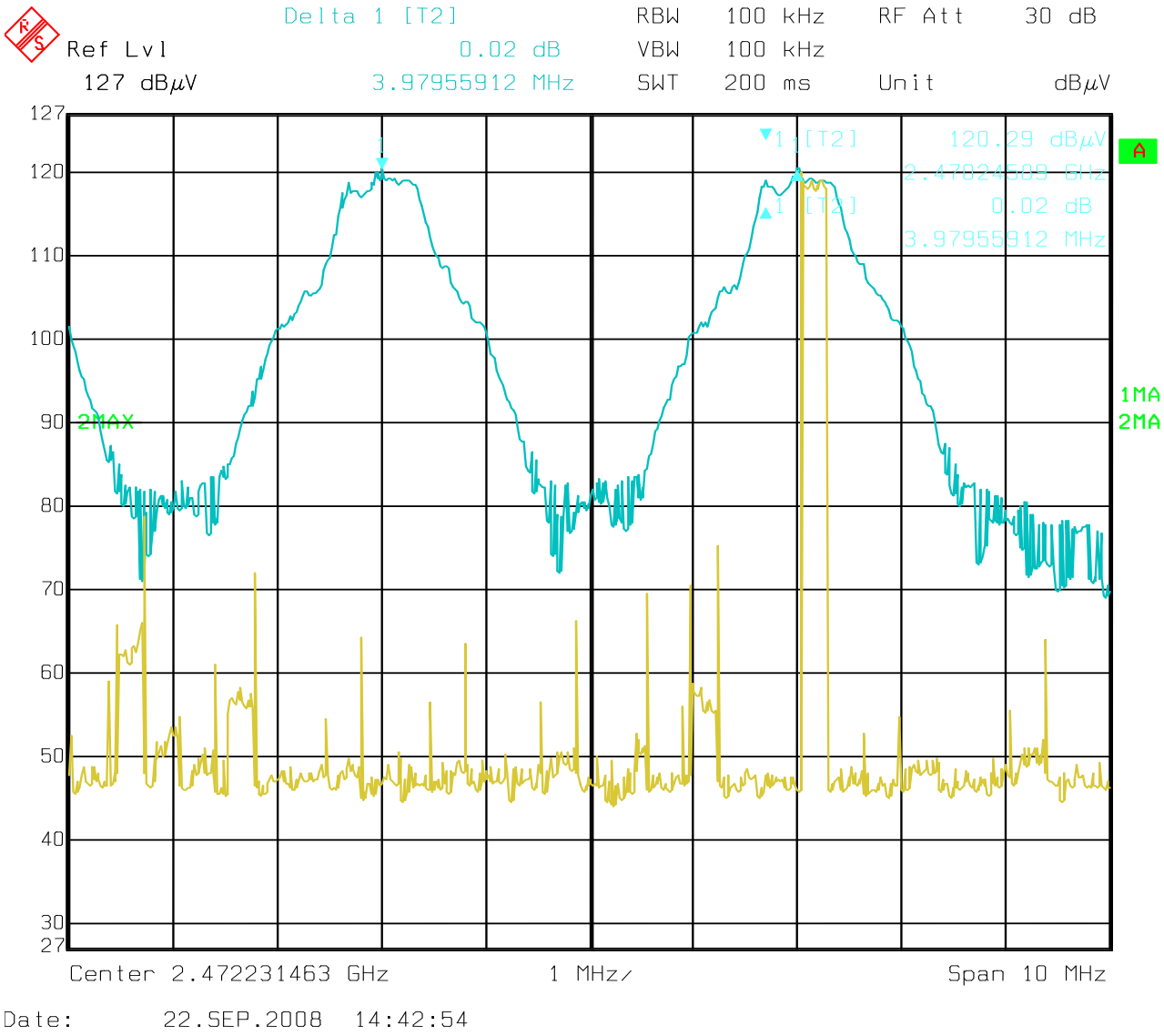
Sample Number:	**VUE Repeater**	Temperature:	25
Date:	September 22, 2008	Humidity:	42
Modification State:	Two adjacent channels	Tester:	FSCustodio
		Laboratory:	Shield Room 2

Test Results:

Passed - See attached plots.

Additional Observations:

- Span is set wide enough to capture the peaks of two adjacent channels.
- RBW is 1% of the span.
- Sweep = Auto
- Detector function = peak.
- Trace = Max hold
- Measured Carrier Frequency Separation should be greater than 1.4MHz (⅔ of 20dB Bandwidth)



Carrier Frequency Separation: 3.97MHz

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Number of Hopping Frequencies

15.247(a)(1)(iii) Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

A8.1(d) Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Test Conditions:

Sample Number:	**VUE Repeater**	Temperature:	22
Date:	February 17, 2009	Humidity:	42
Modification State:	Two adjacent channels	Tester:	A. Laudani
		Laboratory:	Shield Room 2

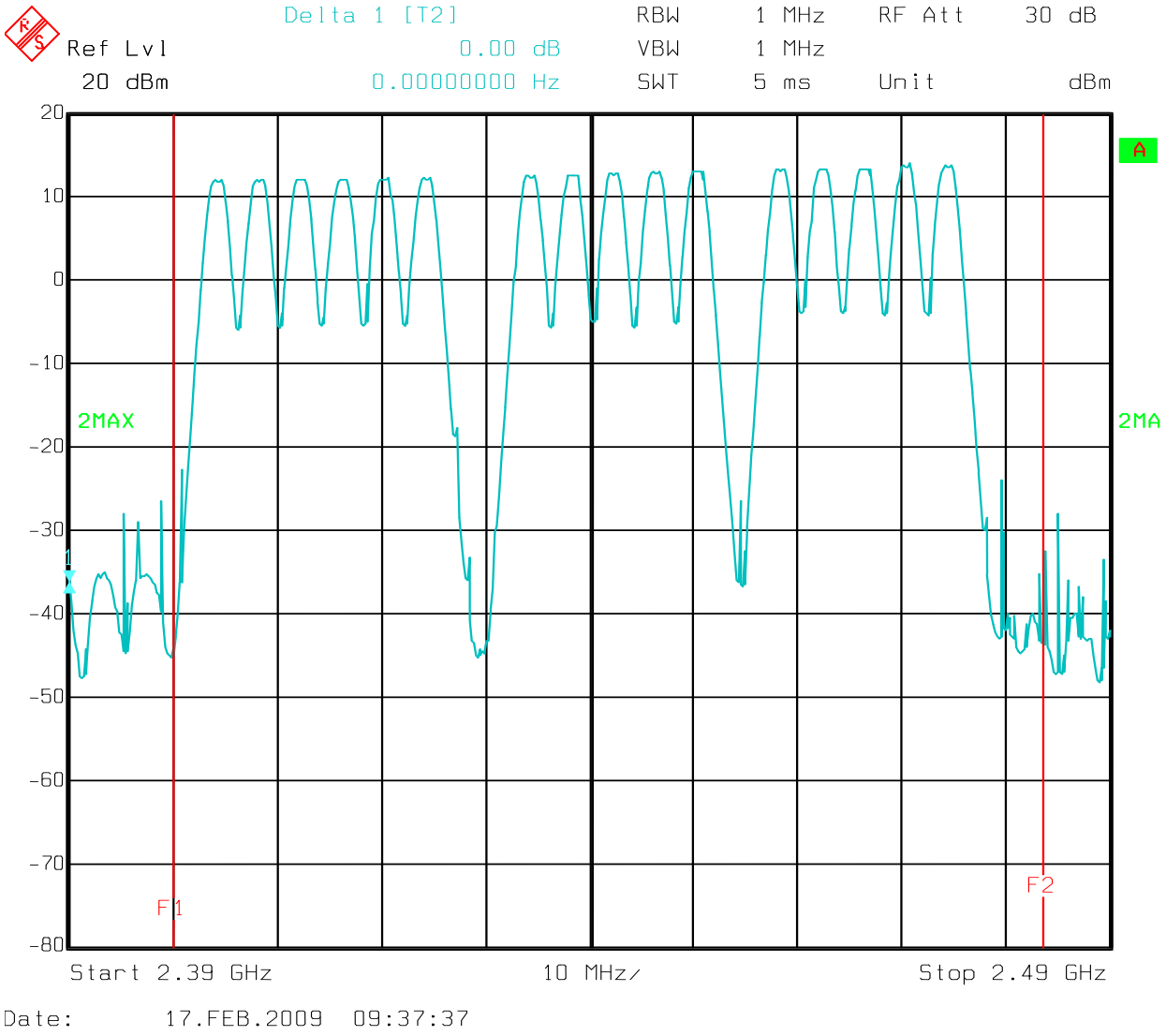
Test Results:

Passed - See attached plots.

Additional Observations:

- Span is set to the frequency band of operation.
- RBW is 1% of the span.
- Sweep = Auto
- Detector function = peak.
- Trace = Max hold

Number of Hopping Frequencies: 16



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Time of Occupancy (Dwell Time)

15.247(a)(1)(iii)
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

A8.1(d)
Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Test Conditions:

Sample Number:	**VUE Repeater**	Temperature:	22
Date:	February 17, 2009	Humidity:	42
Modification State:	Two adjacent channels	Tester:	A. Laudani
		Laboratory:	Shield Room 2

Test Results: 6.4 ms x 21 = 0.134s

Passed - See attached plots.

Additional Observations:

- Span is set to zero centered on a hopping channel.
- RBW is 1MHz.
- Sweep = 6.4 seconds (0.4second x 16 hopping channels)
- Detector function = peak.
- Trace = Max hold

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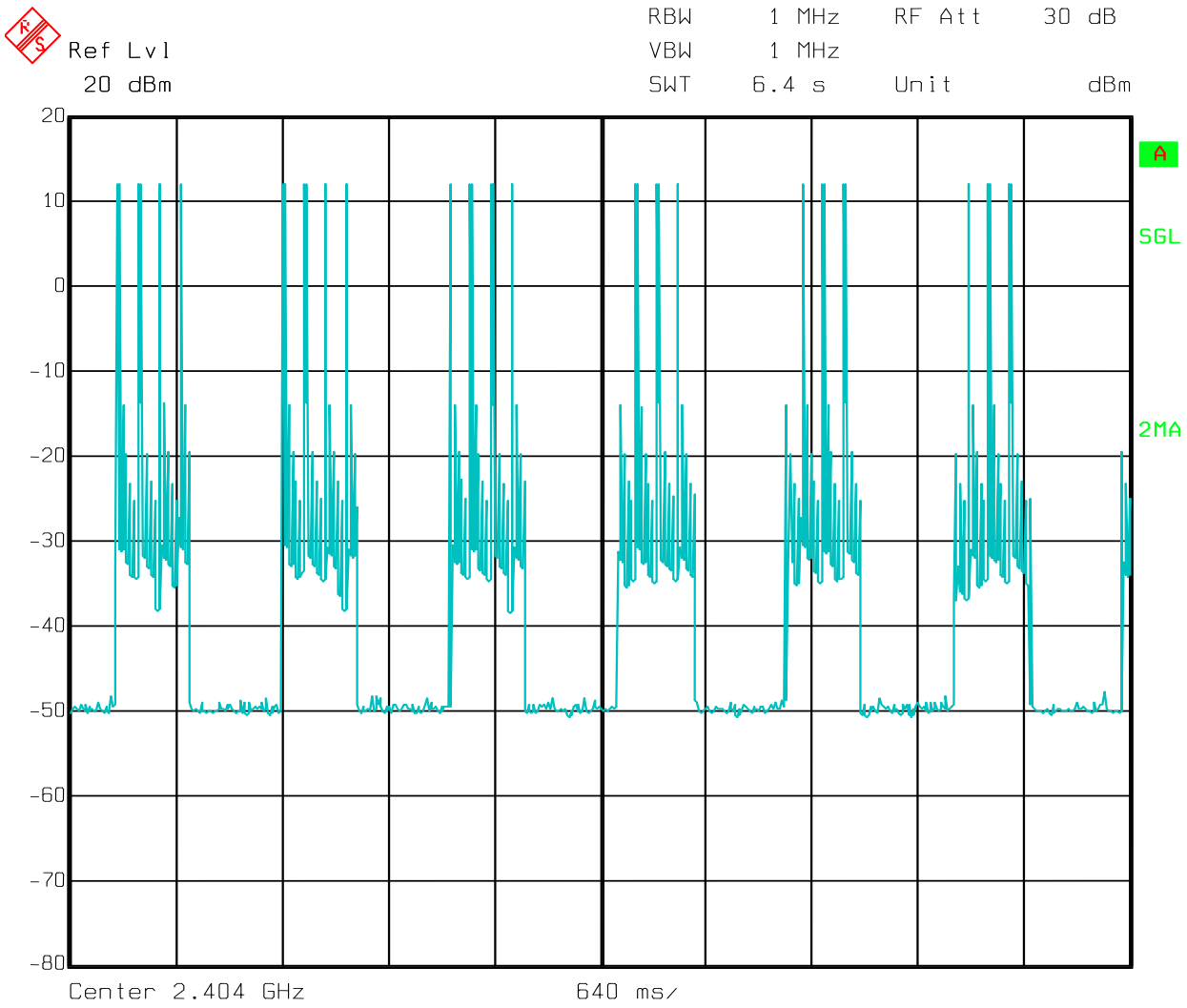
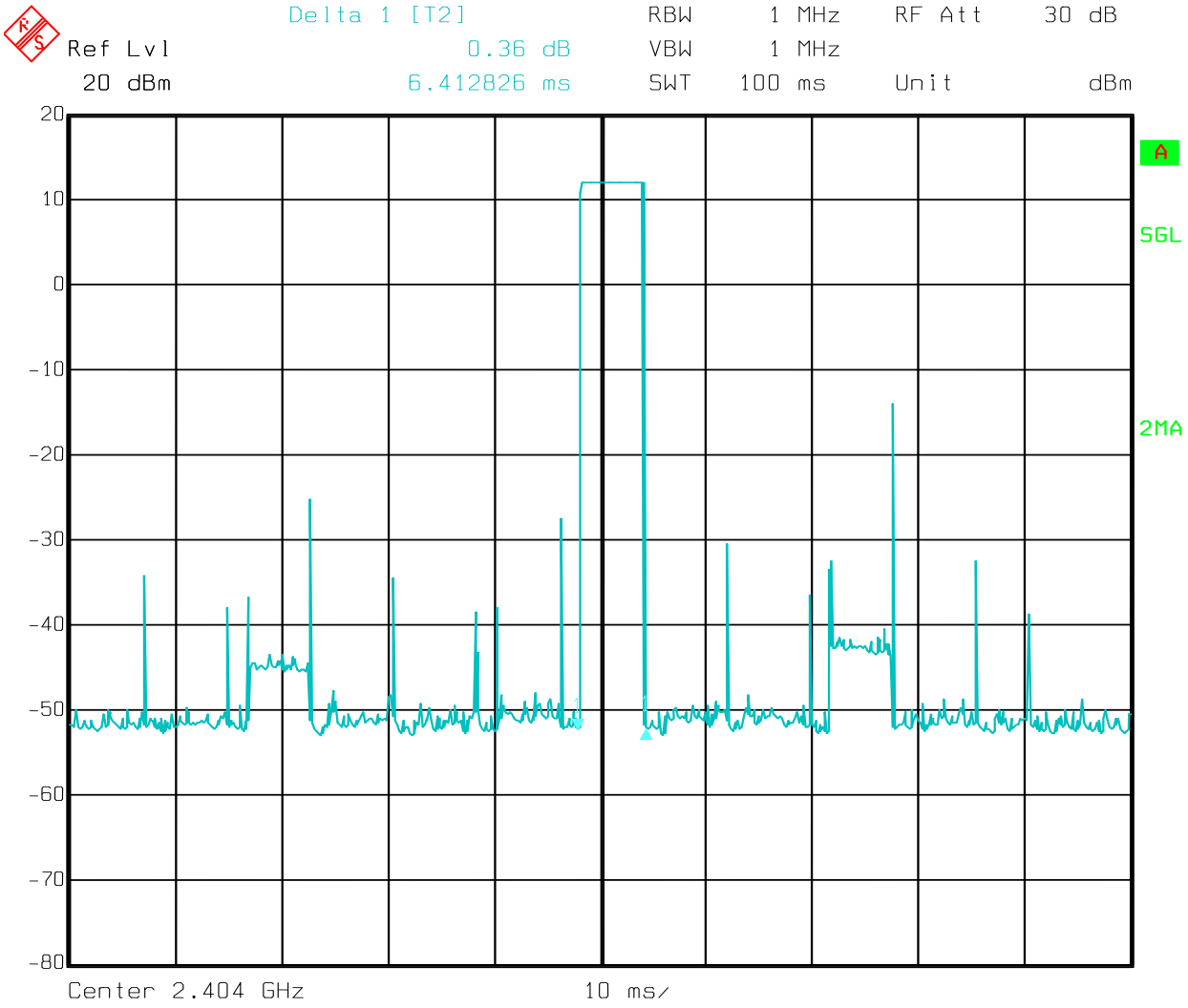
Phone (858) 755-5525 Fax (858) 452-1810

21transmissions in 6.4 seconds



6.4 ms


Delta 1 [T2]
RBW 1 MHz
RF Att 30 dB
Ref Lvl
0.36 dB
VBW 1 MHz
20 dBm
6.412826 ms
SWT 100 ms
Unit dBm
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
A
SGL
2MA
Center 2.404 GHz
10 ms/
Date: 17.FEB.2009 09:35:29