Product Integrity Laboratory

5151-47th Street, NE
Calgary, Alberta T3J 3R2
Tel: (403) 568-6605
Fax : (403) 568-6970

Supplemental Certification Test Report
CFR 47 FCC Part 15, Subpart C Section 15.247
Industry Canada RSS 210, Issue 6

OMNEX Controls LPD-24RC
FCC ID # IA9-LPD-24RC
Project Code CG-554

(Report CG-554-RA-1-2)
Revision: 2

April 27, 2007

Prepared for: Labtest Inc

Author: Glen Moore
EMC Manager

Approved by: Nick Kobrosly
Lab Manager

Report Summary

NTS Canada

Product Integrity Laboratory
5151-47th Street, N.E. Calgary Alberta T3J 3R2

Accreditation Numbers: FCC 101386
IC 46405-3978 File # IC3978-2
Standards Council of Canada Accredited Laboratory No. 440

Applicant: Omnex Controls

Customer Representative: Kavinder Dhillon, LabTest Inc

EUT Description:

EUT Description	Manufacturer	Model	Revision	Serial Number
2.4 GHz Frequency Hopping device	Omnex Controls Omnex Controls	LPD-24RC in T2300 R2160	NA	1066485 1066487

Test Summary

Appendix	Test/Requirement Description	Deviations* from:			Pass / Fail	Applicable Rule Parts
		Base Standard	Test Basis	NTS Procedure		
A	Dwell time/Time of Occupancy	No	No	No	PASS	FCC Subpart C 15.247(a)
B	20 dB Bandwidth	No	No	No	PASS	FCC Subpart C 15.247(a)
C	Peak Output Power	No	No	No	PASS	FCC Subpart C 15.247(b)
D	TX Conducted Spurious Emissions	No	No	No	PASS	FCC Subpart C 15.247(c)
E	TX Conducted Spurious Emissions Band edge	No	No	No	PASS	FCC Subpart C 15.247(c), 15.205
F	TX Radiated Spurious Emissions Band edge	No	No	No	PASS	FCC Subpart C 15.247(c), 15.205, RSS 210
G	Test Equipment List	No	No	No	PASS	NA

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

Prepared By: gmoore
Digitally signed by gmoore
DN: cn=gmoore, c=US, o=nts, email=glen.moore@ntscorp.com
Date: 2007.04.27 15:53:56 -06'00'

Glen Moore
EMC Manager

Reviewed By: Alex Mathews 2007.04.27 15:56:27 -06'00'

Alex Mathews
Compliance Specialist

Approved By: Alex Mathews Signed for Jennifer Hansen 2007.04.27 15:57:33 -06'00'

Jennifer Hansen
Quality Representative

Table of Contents

Register of revisions

Revision	Date	Description of Revisions
0	April 26, 2007	Draft release for Internal review
1	April 27, 2007	Release after internal review
2	April 27, 2007	Release after customer review

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to provide the supplemental test data as requested by Timco engineering (Re: Job 3434UT6) from the original filing to demonstrate compliance of the Omnex Controls LPD-24 C module.

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

Description of EUT

	Name	Model	Revision	Serial Number
EUT	2.4 GHz Frequency Hopping module	LPD-24 C	NA	1066487 1066485
Classification	Mobile			
Channels/Frequency Range	2403.1MHz -2478.6 MHz			
Functional Description	2.4 GHz Frequency Hopping module			

2.1.1 EUT POWER

Voltage	12 VDC
Number of Feeds	NA

2.2 EUT CABLES

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

2.3 MODE OF OPERATION DURING TESTS

The EUT was tested while in a continuous transmit mode, continuously hopping on the tested channel with the exception of Dwell time test where the eut was set to hopping mode. The EUT was tuned to a low, middle, and high channel to perform power, occupied bandwidth, and spurious/harmonic tests. For all test cases pre-scans were completed in all modes to determine worst case levels.

3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION

NA

3.2 TEST BED/PERIPHERAL CABLES

NA

APPENDICES

APPENDIX A: TIME OF OCCUPANCY DWELL TIME

A.1. Base Standard & Test Basis

Base Standard	FCC PART 15.247 (A)
Test Basis	As per FCC Publication DA-00-705
Test Method	As per FCC Publication DA-00-705

A.2. Specifications

15.247 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.

A.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
1.11/-1.22

A.4. Deviations

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

A.5. Test Procedure

RF conducted as per FCC Publication 558074

A.6. Test Results

The EUT is in compliance with the time of occupancy requirement. Maximum time of occupancy is 211.05 ms. See plots in section A.10.

A.7. Operating Mode During Test

The eut was in hopping mode for these tests

A.8. Calculation

The average time of occupancy is 23.45 ms x 9 = **211.05 ms**

A.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Glen Moore
Function: EMC Manager

A.10. Test Data

Figure 1 Dwell Time Plot (23.45 ms)

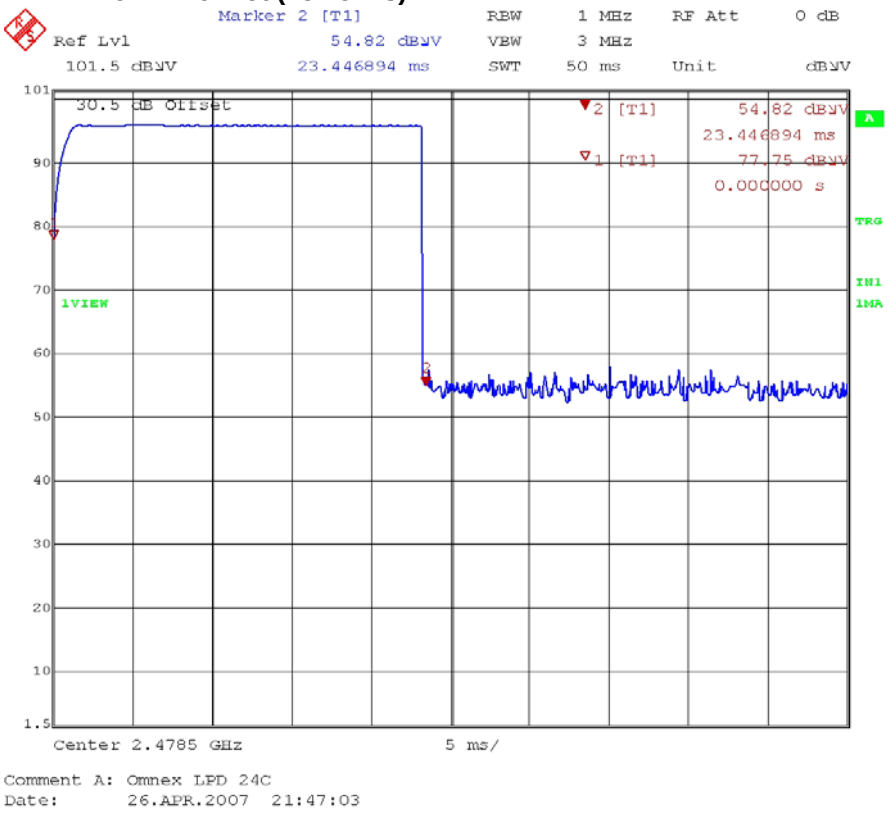
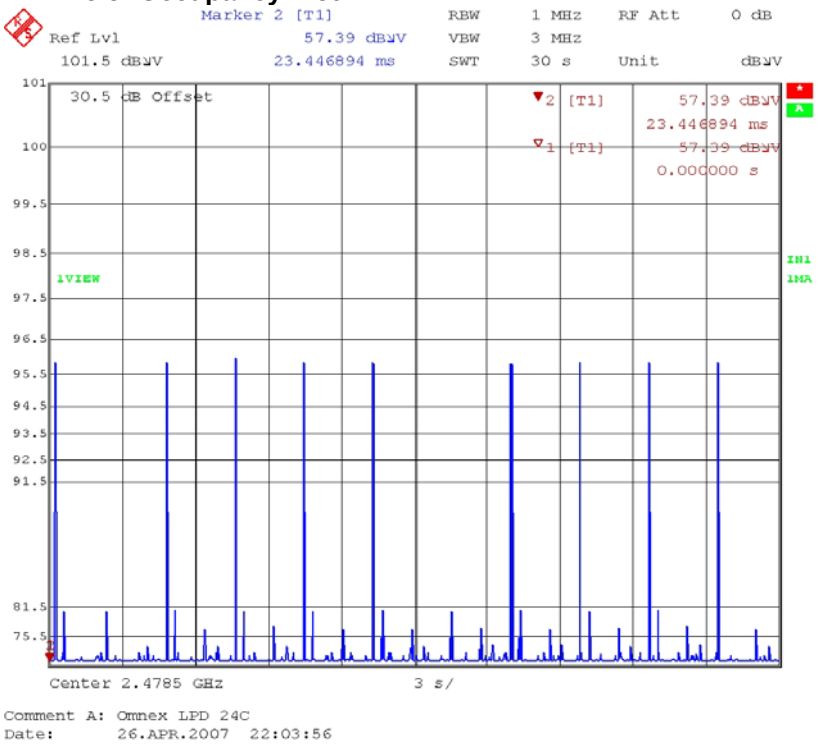


Figure 2 Time of Occupancy Plot



APPENDIX B: 20 DB BANDWIDTH

B.1. Base Standard & Test Basis

Base Standard	FCC PART 15.247 (A)
Test Basis	As per FCC Publication DA-00-705
Test Method	As per FCC Publication DA-00-705

B.2. Specifications

15.247 2) For systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, the maximum 20 dB bandwidth of the hopping channel is 1 MHz. Systems may utilize hopping channels whose 20 dB bandwidth is greater than 1 MHz provided the system use at least 15 non-overlapping channels.

B.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
1.11/-1.22

B.4. Deviations

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

B.5. Test Procedure

RF conducted as per FCC Publication DA 00-705

B.6. Test Results

The EUT is in compliance with the limits as specified above

Channel	20 dB Bandwidth (KHz)
2403.1 MHz	49.7
2441.7 MHz	46.5
2478.6 MHz	47.3

B.7. Operating Mode During Test

The EUT was tested while in a continuous transmit mode on each of the above channels with a worst case modulation. The EUT was tuned to channels low, middle, and high channel operating at maximum rated RF output power.

B.8. Sample Calculation

NA

B.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Glen Moore
Function: EMC Manager

B.10. Test Data

See plots on following pages

Figure 3 20 dB Bandwidth Low Channel

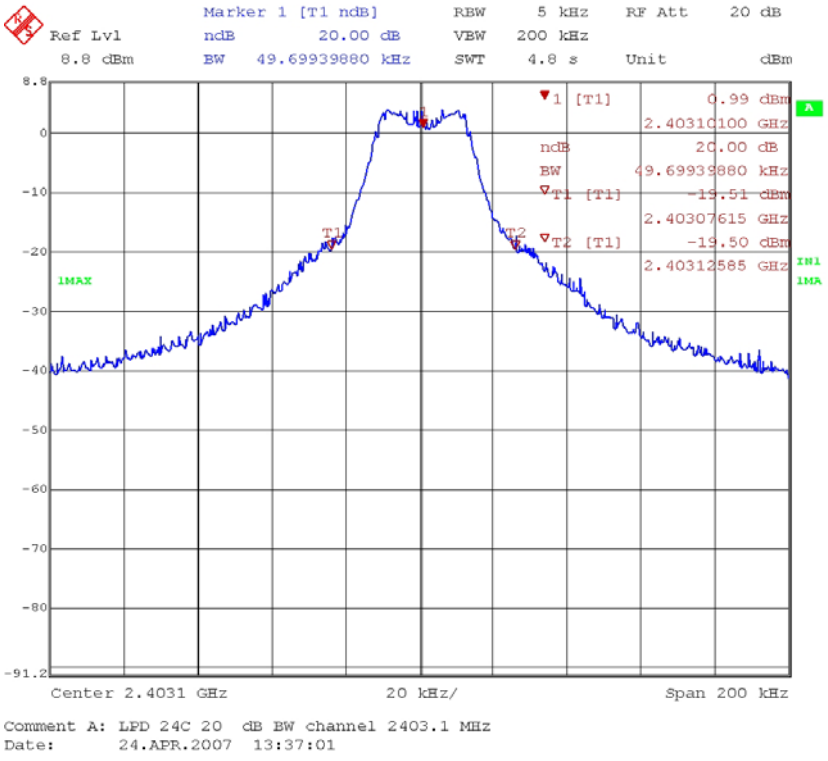


Figure 4 20 dB Bandwidth Mid Channel

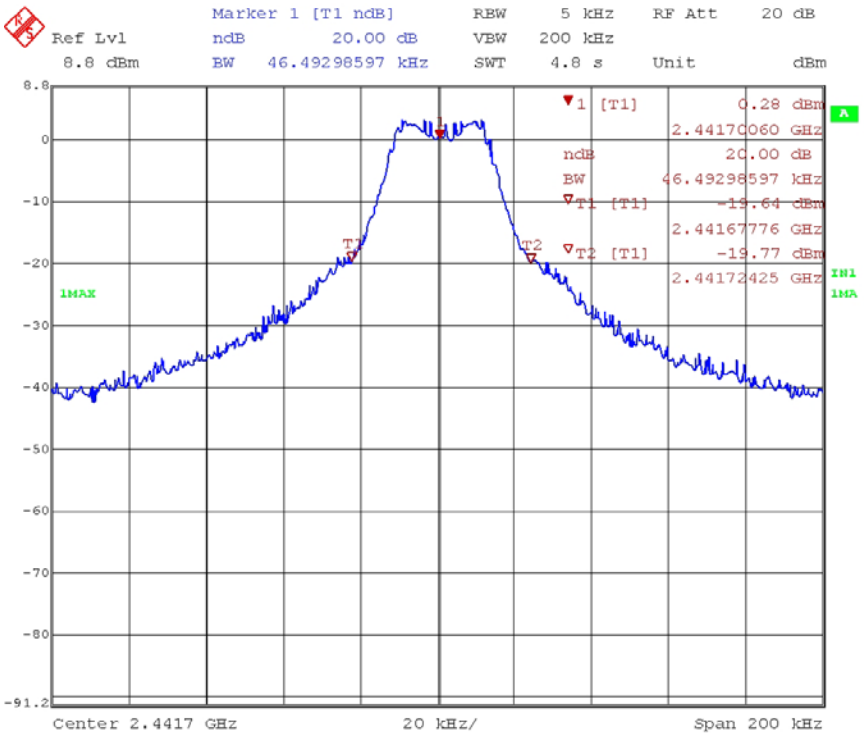
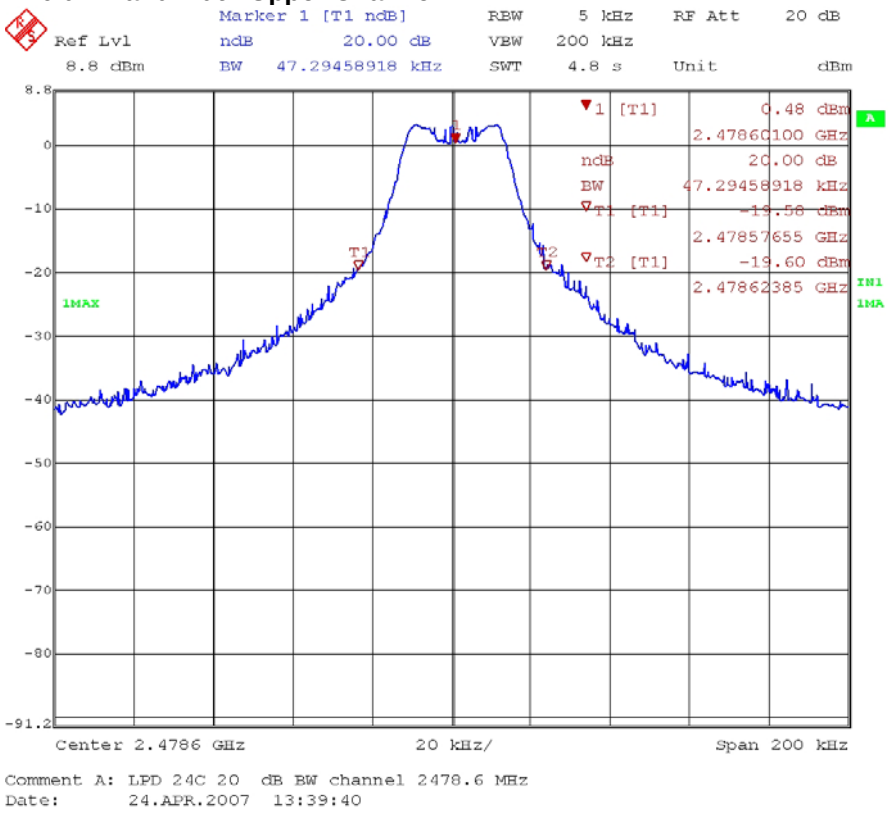


Figure 5 20 dB Bandwidth Upper Channel



APPENDIX C: PEAK POWER OUTPUT

C.1. Base Standard & Test Basis

Base Standard	FCC 15.247
Test Basis	As per FCC Publication DA-00-705
Test Method	As per FCC Publication DA-00-705

C.2. Specifications

For systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, the maximum peak output power is 1 watt (30 dBm), for all other systems – 0.125 W (21 dBm).

C.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
1.11/-1.22

C.4. Deviations

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

C.5. Test Method

As per FCC Publication DA-00-705

C.6. Test Results

Compliant. The worst case peak output power was 4.9 dBm at 2403.1 MHz

EUT Transmit Channel	Measured Output Power (dBm)
2403.1 MHz	4.9
2441.7 MHz	4.3
2478.6 MHz	4.38

C.7. Sample Calculation

None.

C.8. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Glen Moore
Function: EMC Manager

C.9. Test Data

See plots on following pages

Figure 6 2403.1 MHz

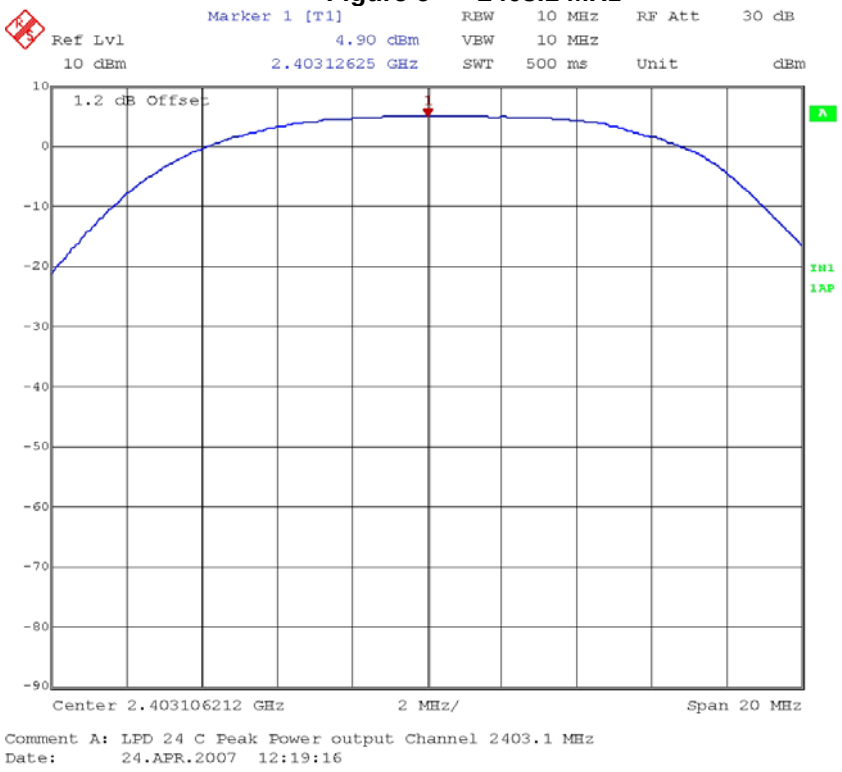


Figure 7 2441.7 MHz

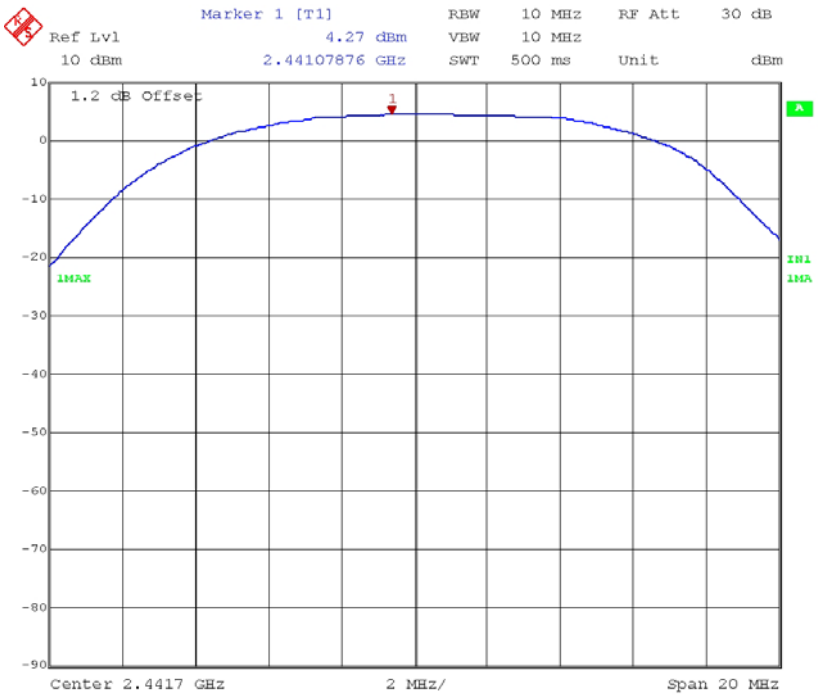
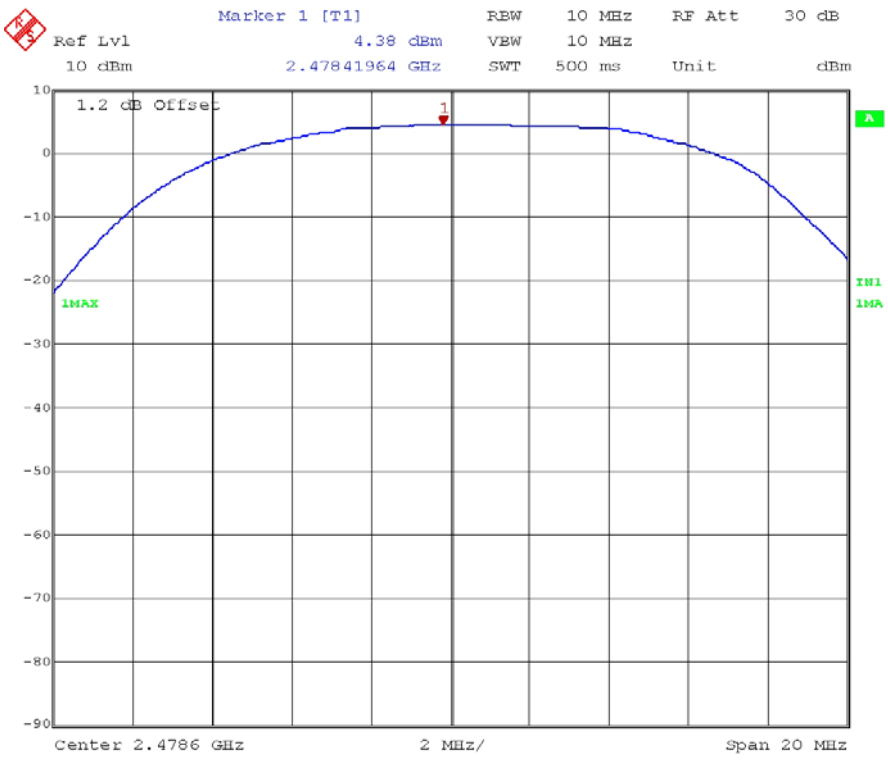


Figure 8 2478.6 MHz



APPENDIX D: TX CONDUCTED SPURIOUS EMISSIONS

D.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I – FCC Part 15.247 – Radio Frequency Devices - Subpart C– intentional Radiators FCC Part 15.205 Restricted Bands of Operation
Test Basis	RF conducted as per FCC Publication DA 00-705
Test Method	RF conducted as per FCC Publication DA 00-705

D.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)).

D.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
1.11/-1.22

D.4. Deviations

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

D.5. Test Results

Compliant, all peak emissions were more than 20 dB below the in band power. See plots below

D.6. Test Data & Photographs

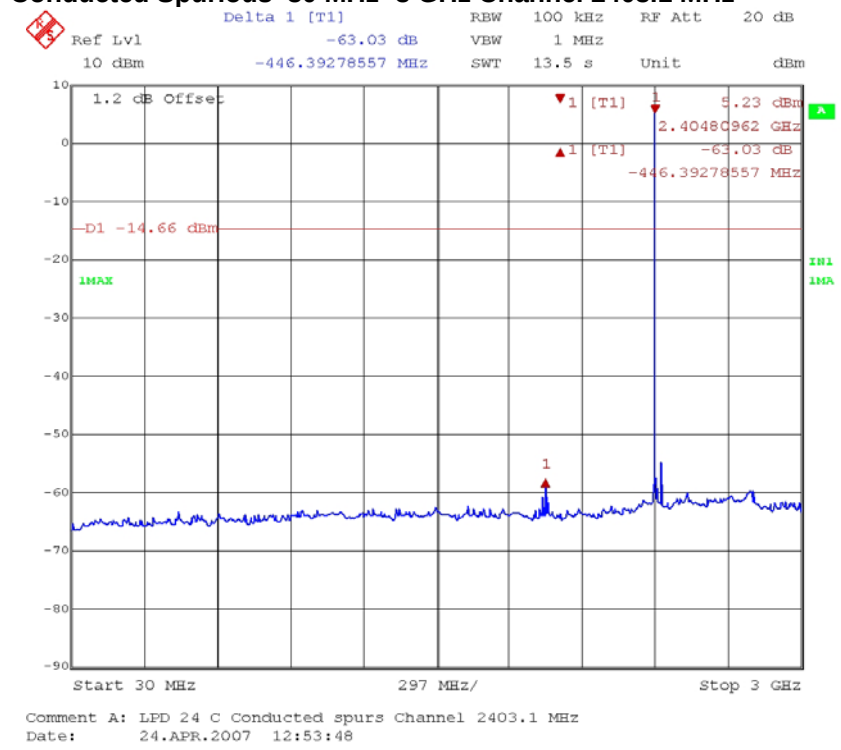
See following pages.

D.7. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

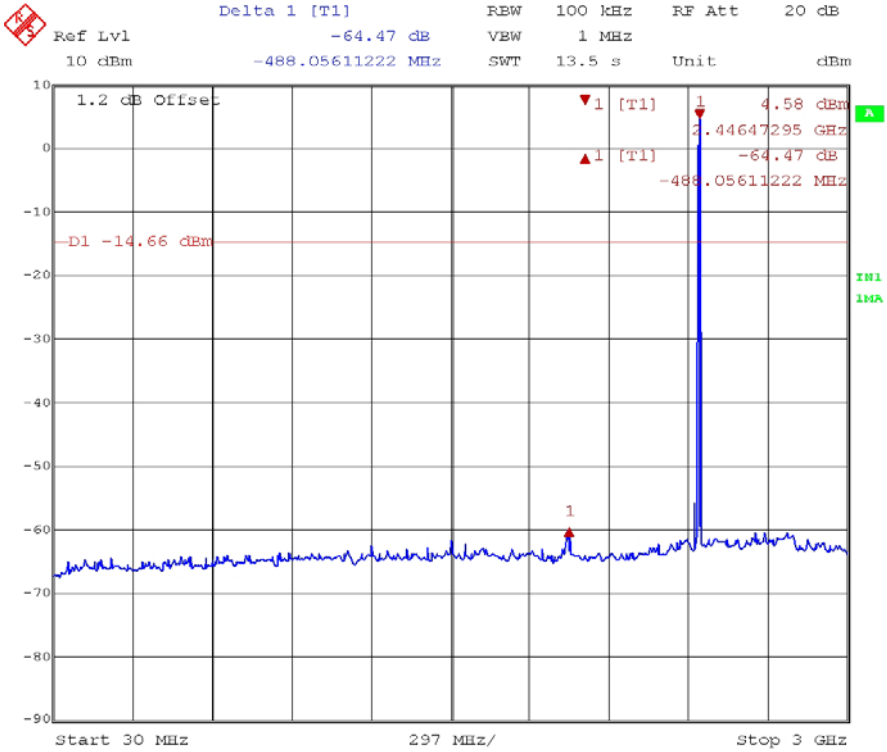
Name: Glen Moore
Function: EMC Manager

Figure 9 Conducted Spurious 30 MHz- 3 GHz Channel 2403.1 MHz



Comment A: LPD 24 C Conducted spurs Channel 2403.1 MHz
Date: 24.APR.2007 12:53:48

Figure 10 Conducted Spurious 30 MHz-3 GHz Channel 2441.7 MHz



Comment A: LPD 24 C Conducted Spurs Channel 2441.7 MHz
Date: 24.APR.2007 13:17:31

Figure 11 Conducted Spurious 2GHz-3 GHz Channel 2478.6 MHz

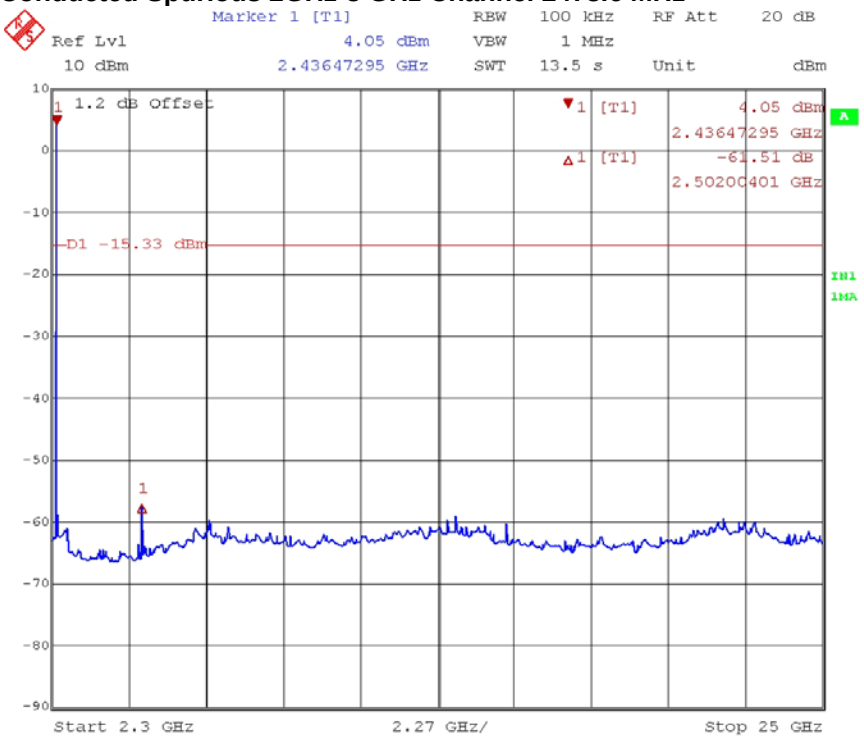


Figure 12 Conducted Spurious 2 GHz-25 GHz Channel 2403.1 MHz

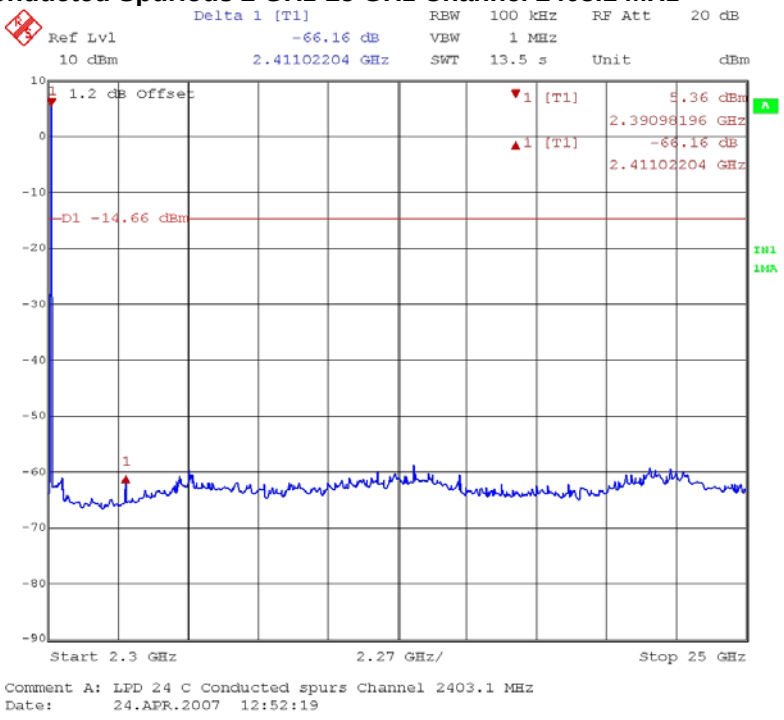


Figure 13 Conducted Spurious 2 GHz-25 GHz Channel 2441.7 MHz

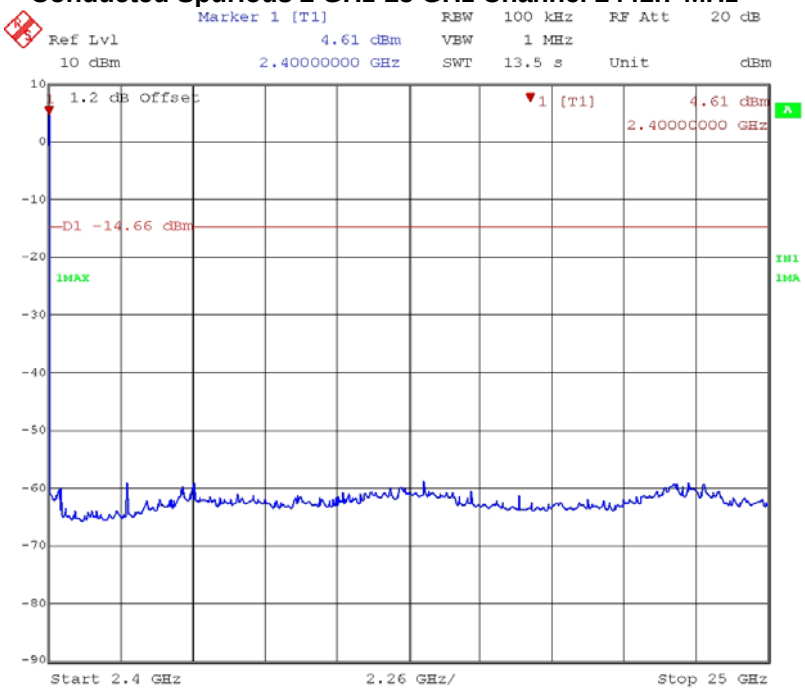
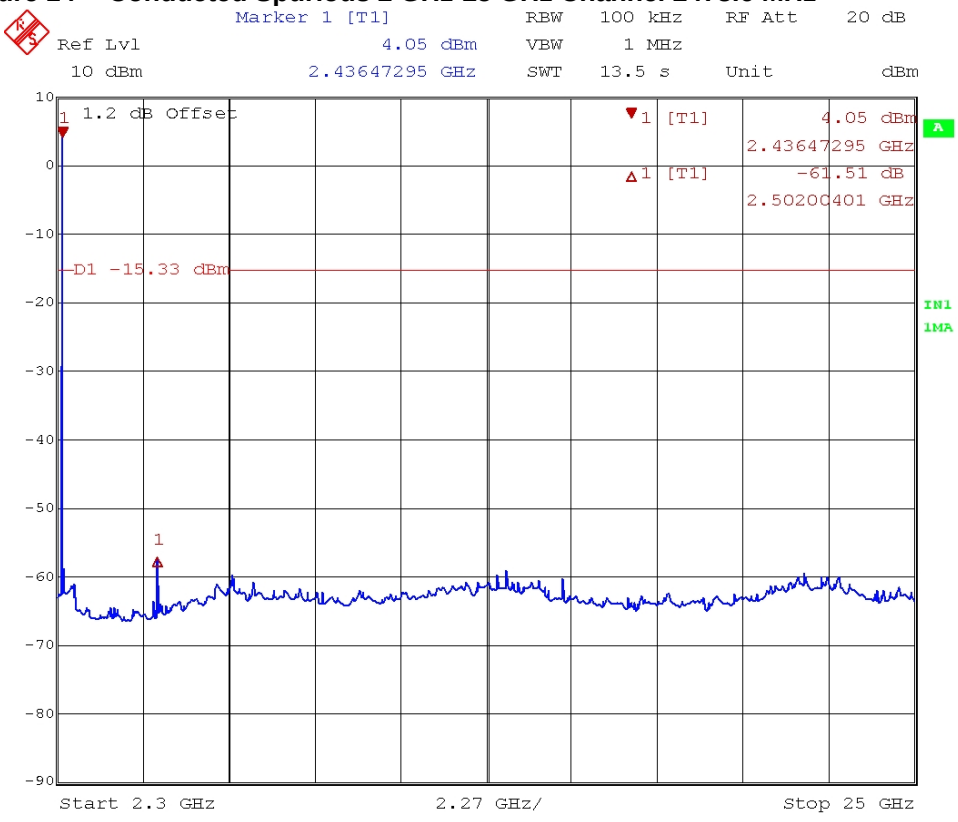


Figure 14 Conducted Spurious 2 GHz-25 GHz Channel 2478.6 MHz



APPENDIX E: CONDUCTED SPURIOUS EMISSIONS BAND EDGE MEASUREMENTS

E.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I – FCC Part 15.247 – Radio Frequency Devices - Subpart C– intentional Radiators.
Test Basis	RF conducted as per FCC Publication DA 00-705
Test Method	RF conducted as per FCC Publication DA 00-705

E.2. Limits

(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. Measurement Uncertainty

Expanded Uncertainty (K=2)
+1.11/-1.22

E.4. Test Results

Compliant. All out of band spurious emissions are more than 20 dB below the in band power of the fundamental. See plots below

E.5. Deviations from Normal Operating Mode During Test

None.

E.6. Sample Calculation

NA.

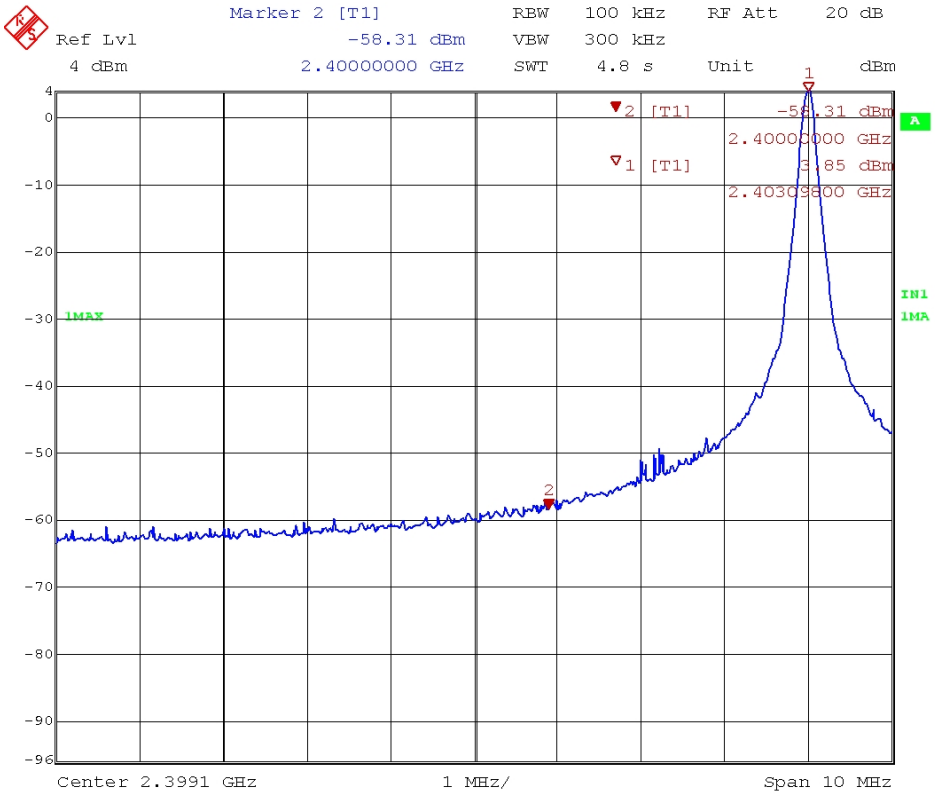
E.7. Test Data

See plots on following pages.

E.8. Tested By

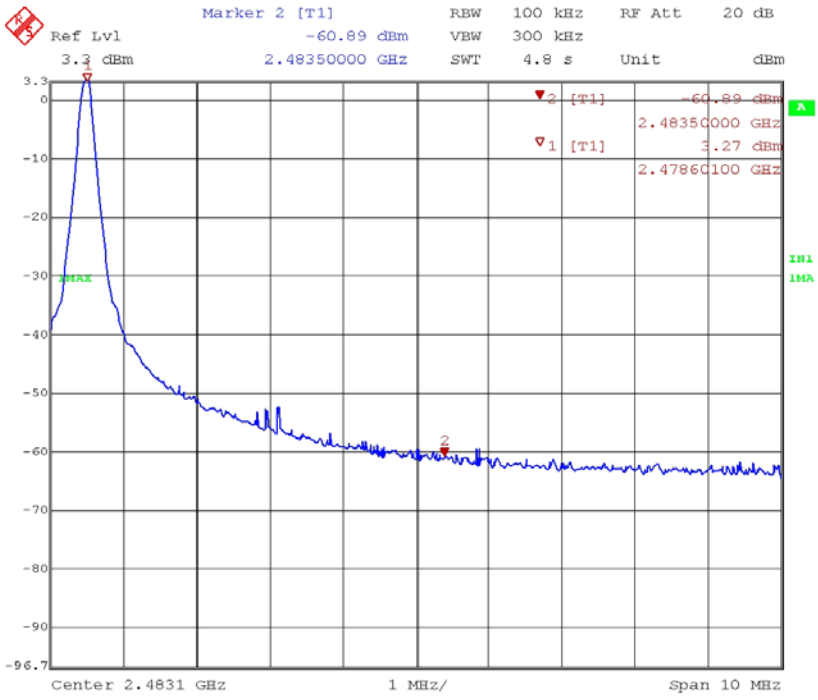
This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.
Name: Glen Moore
Function: EMC Manager

Figure 15 2400 MHz Conducted Lower Band edge Measurement



Comment A: LPD 24C Band Edge Conductes spurs channel 2403.1 MHz
Date: 24.APR.2007 13:46:58

Figure 16 2483.5 MHz Conducted Hi Band edge Measurement



Comment A: LPD 24C Band Edge Conductes spurs channel 2478.6 MHz
Date: 24.APR.2007 13:43:45

APPENDIX F: BAND EDGE RADIATED SPURIOUS EMISSIONS (RESTRICTED BAND CHECK USING MARKER DELTA METHOD)

F.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.209 – Radio Frequency Devices
Test Basis	ANSI C63.4-2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Test Method	RF conducted as per FCC Publication DA 00-705

Specifications

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	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
\2\ Above 38.6

(b) Except as provided 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 §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.

F.2. Measurement Uncertainty

Radiated Emissions	Measurement Uncertainty	Expanded Uncertainty (K=2)
30 MHz – 1 GHz	+2.32/-2.36	+4.65/-4.72
1 - 20 GHz	+3.48/-3.51	+6.96/-7.02

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 Results

The EUT is in compliance with FCC CFR47 Part 15.247/15.205/15.209 Radiated emission limits. The worst case band edge emission was 41.25 dBμV/m @ 3 meters, a pass margin of 12.8 dB.

F.5. Deviations from Normal Operating Mode During Test

None.

F.6. Sample Calculation

Peak field strength = Corrected Fundamental Rcvd Pk Field strength - Mkr Delta Level
Average field strength = Corrected Fundamental Rcvd Av Field strength - Mkr Delta Level

F.7. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.
Name: Glen Moore
Function: EMC/Wireless Manager

F.8. Test Data Summary

Antenna Polarity	Signal type	Emission frequency (MHz)	Detector (PK, AV)	Corrected Rcvd Level (dBuV/M)	Marker Delta Level (dB) (at highest emission freq – see plots)	Corrected Field Stregnth (dBuV/m @ 3 M)	Limit (dBuV/M)	Margin (dB)
H	Fundamental	2403.1	PK	98.92	45.5	53.42	74	20.6
H	Fundamental	2403.1	AV	98.75	57.5	41.25	54	12.8
H	Fundamental	2478.7	PK	97.31	43.88	53.43	74	20.57
H	Fundamental	2478.7	AV	97.0	57.5	39.5	54	14.5
V	Fundamental	2403.1	PK	95.80	42.15	53.65	74	20.35
V	Fundamental	2403.1	AV	95.44	54.31	41.13	54	12.9
V	Fundamental	2478.7	PK	96.15	42.3	53.85	74	20.2
V	Fundamental	2478.7	AV	95.99	55.75	40.24	54	13.8

Figure 17 Low Channel Peak Fundamental Measurement - Horizontal Polarity

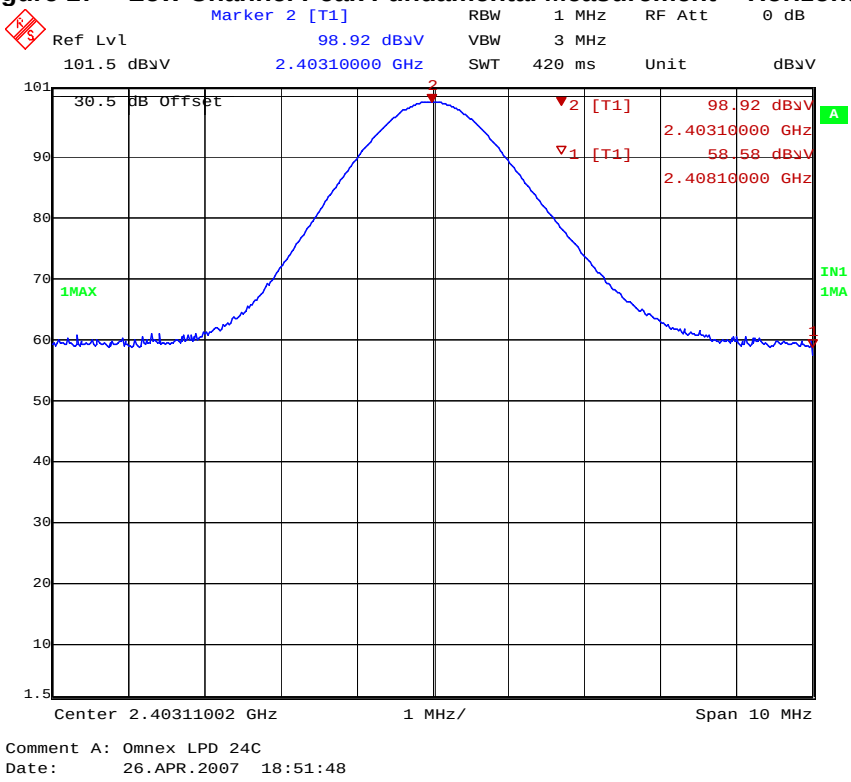


Figure 18 Low channel Average Fundamental Measurement - Horizontal Polarity

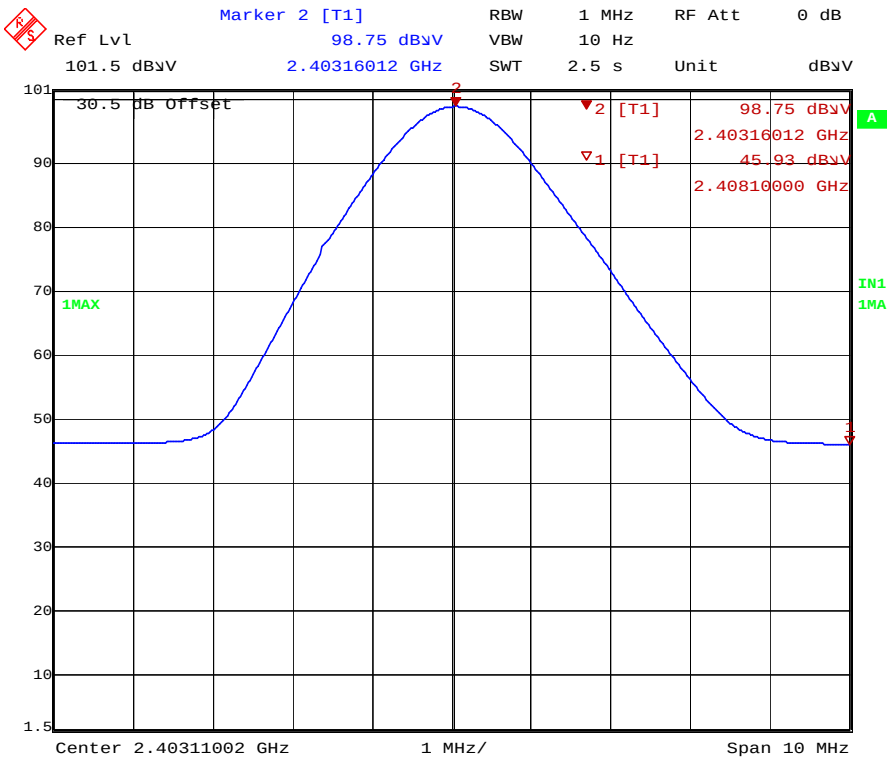
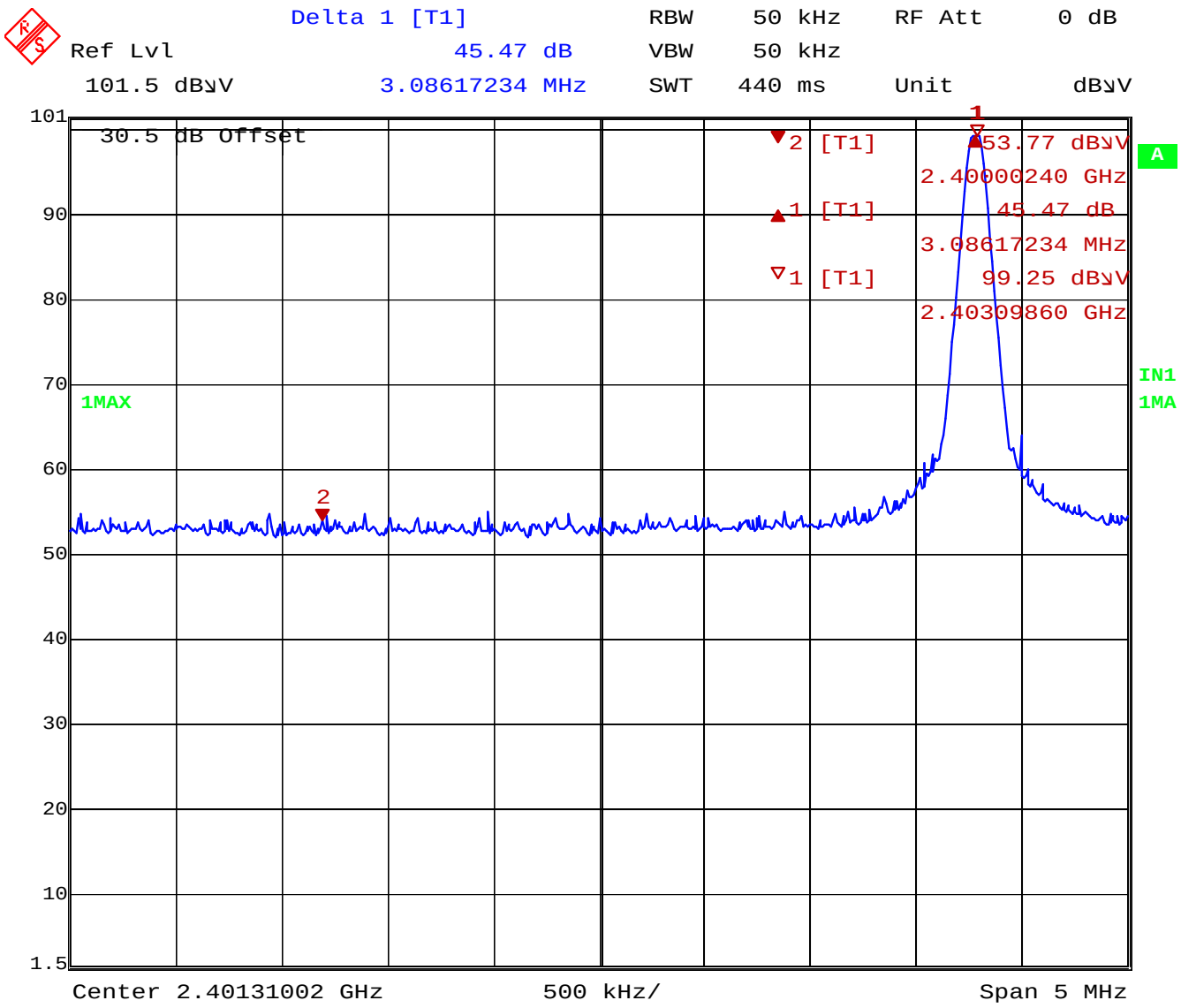
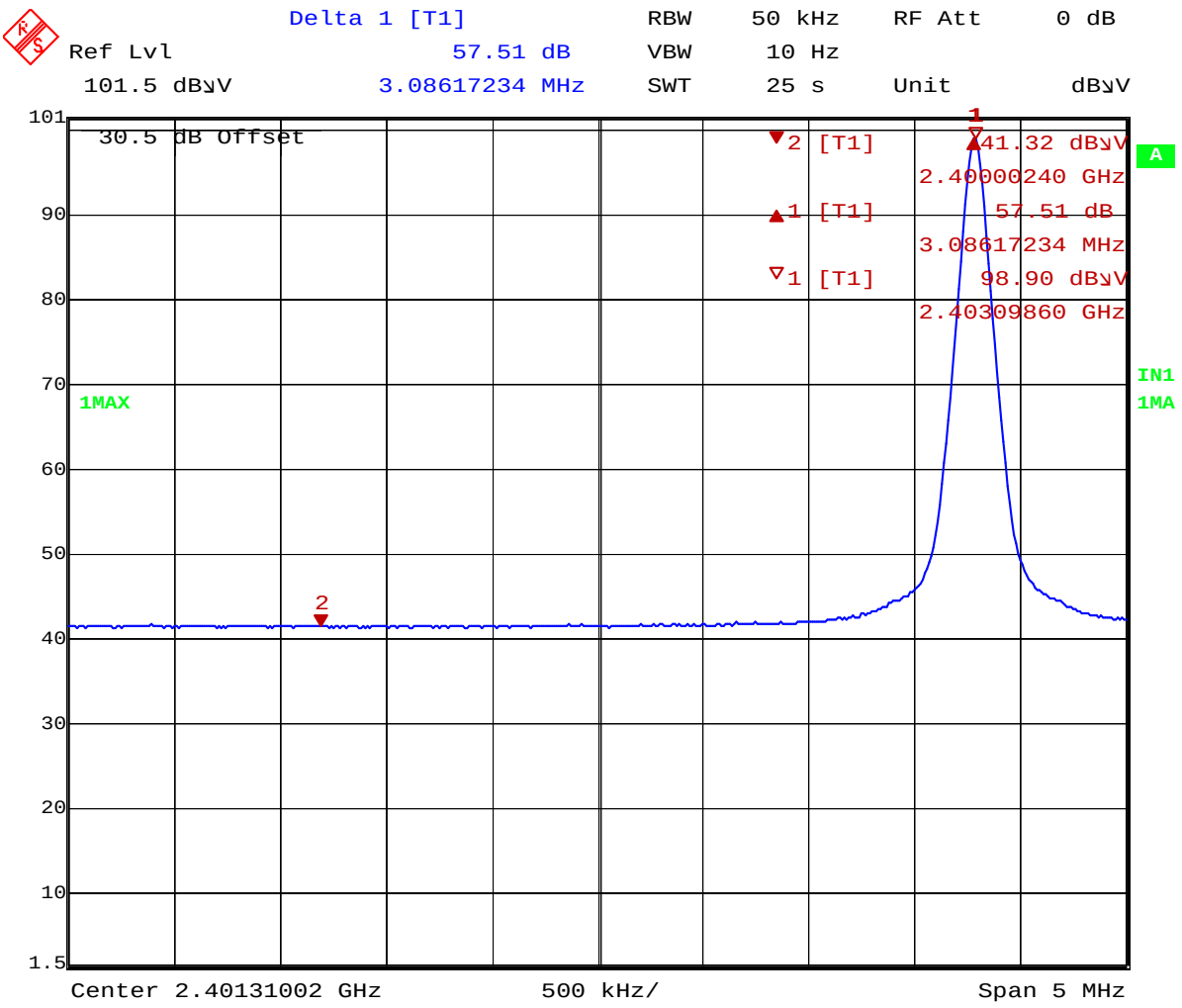


Figure 19 Lower Band edge Peak Marker-Delta Measurement - Horizontal Polarity



Comment A: Omnex LPD 24C
Date: 26.APR.2007 18:57:09

Figure 20 Lower Band edge Average Marker Delta Measurement - Horizontal Polarity



Comment A: Omnex LPD 24C
Date: 26.APR.2007 18:58:26

Figure 21 High Channel Peak Fundamental Measurement - Horizontal Polarity

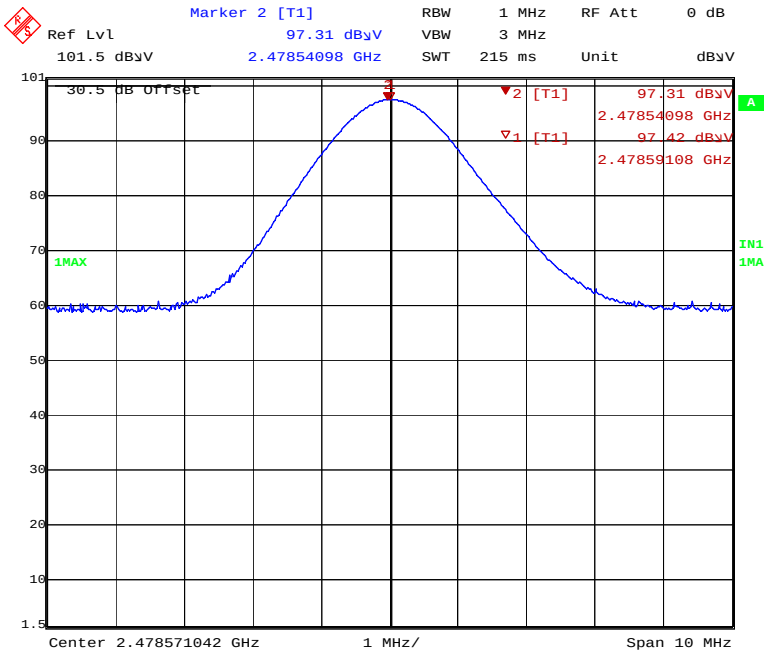


Figure 22 High Channel Average Fundamental Measurement - Horizontal Polarity

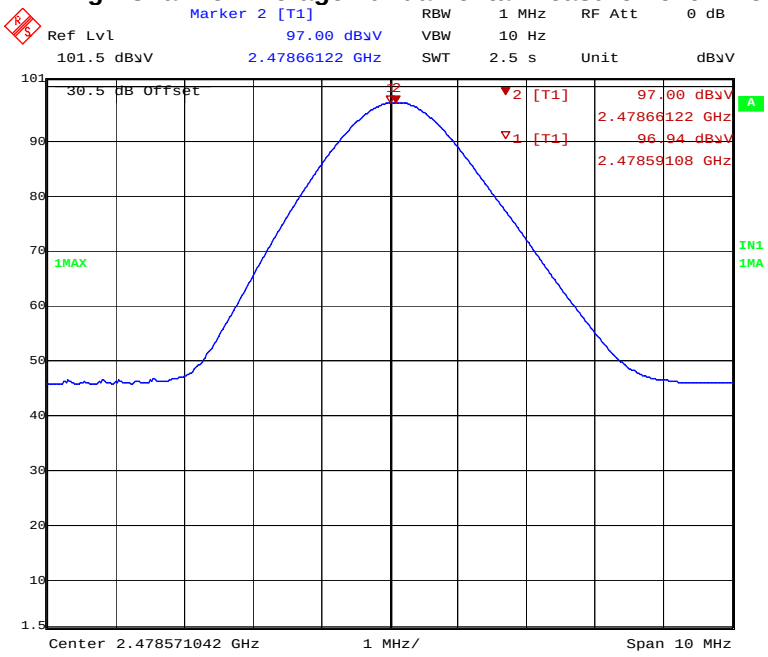
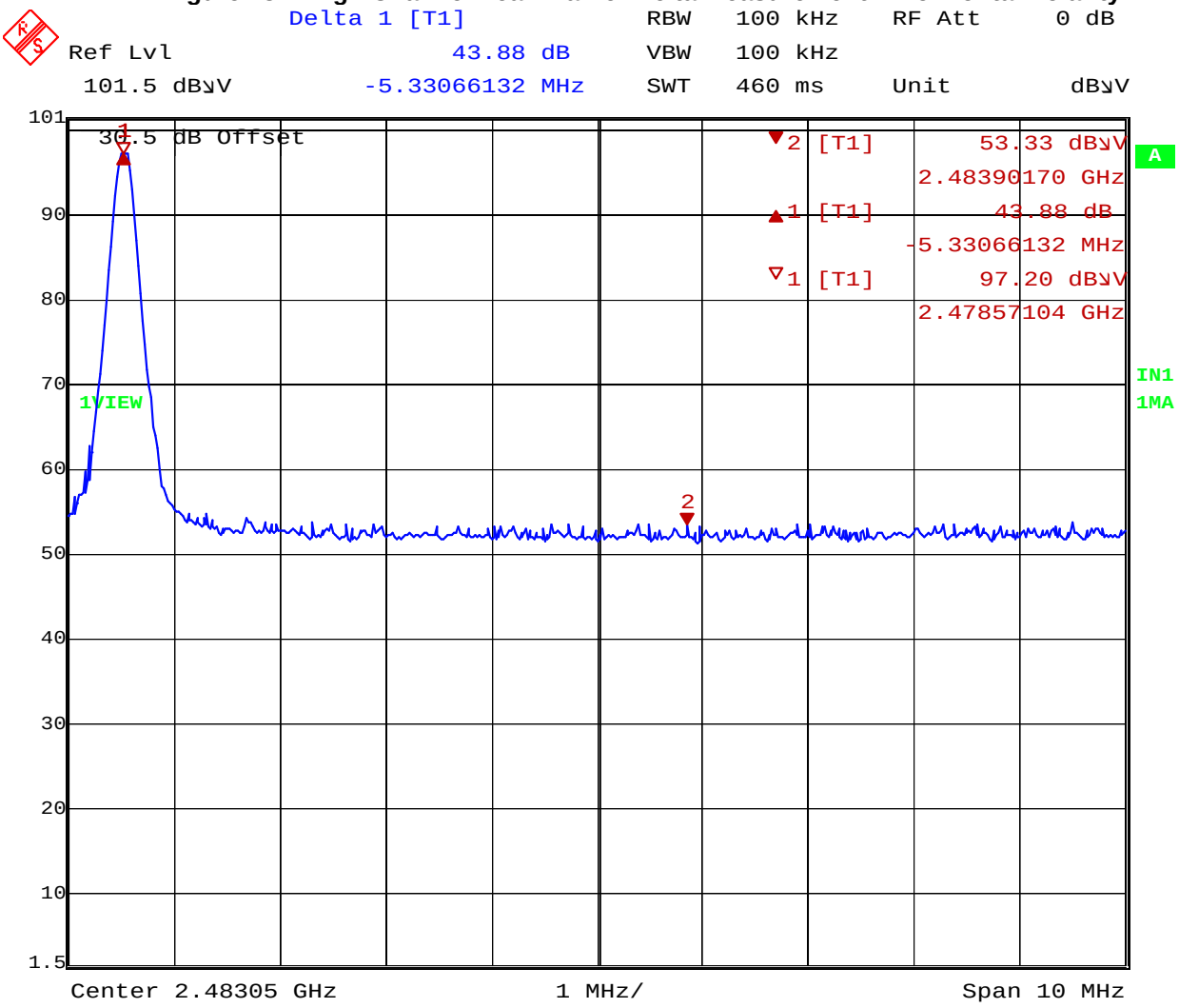
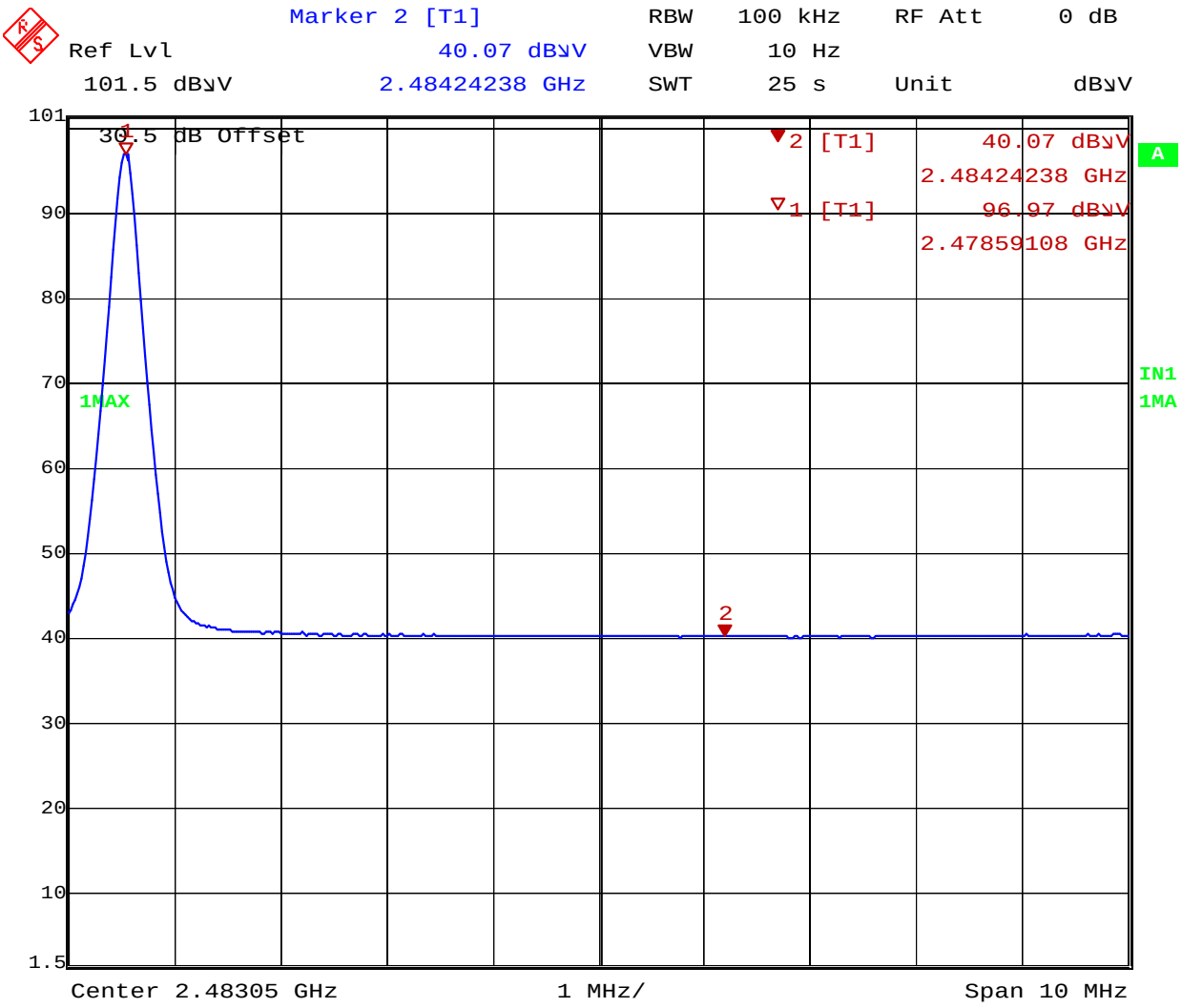


Figure 23 High Channel Peak Marker Delta Measurement - Horizontal Polarity



Comment A: Omnex LPD 24C
Date: 26.APR.2007 18:17:52

Figure 24 High Channel Average Marker Measurement - Horizontal Polarity



Comment A: Omnex LPD 24C
Date: 26.APR.2007 18:24:58

Figure 25 Low Channel Peak Fundamental Measurement - Vertical Polarity

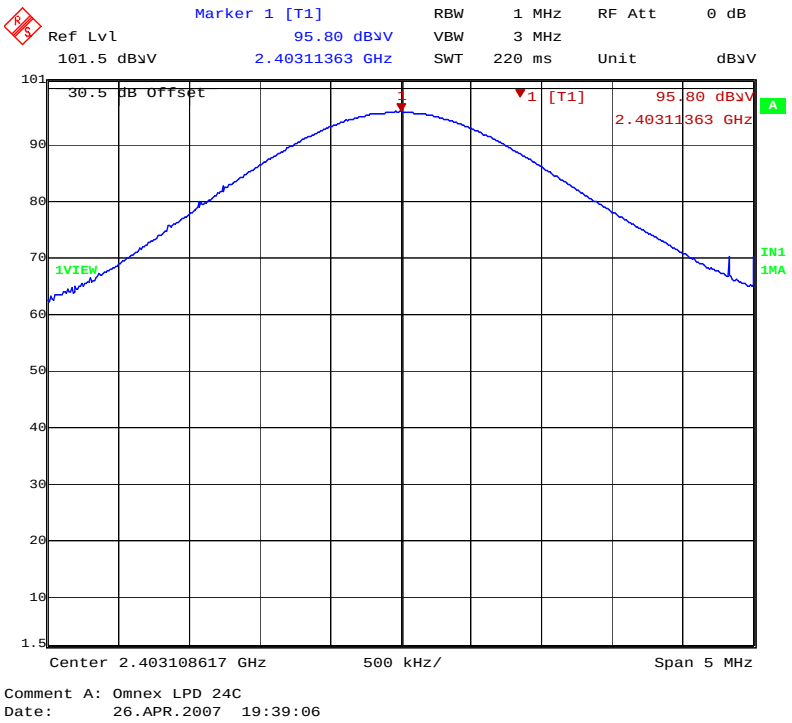


Figure 26 Low Channel Average Fundamental Measurement - Vertical Polarity

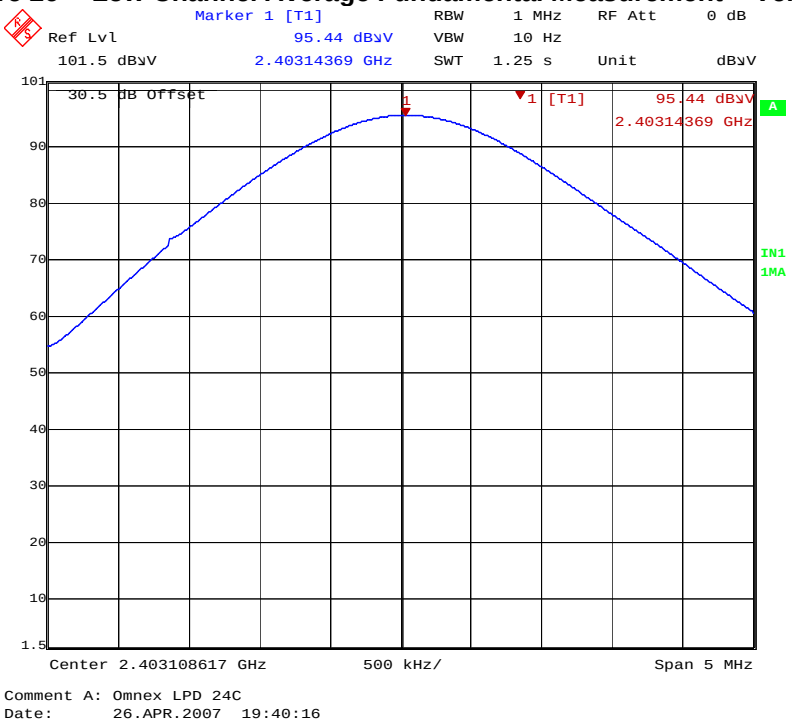
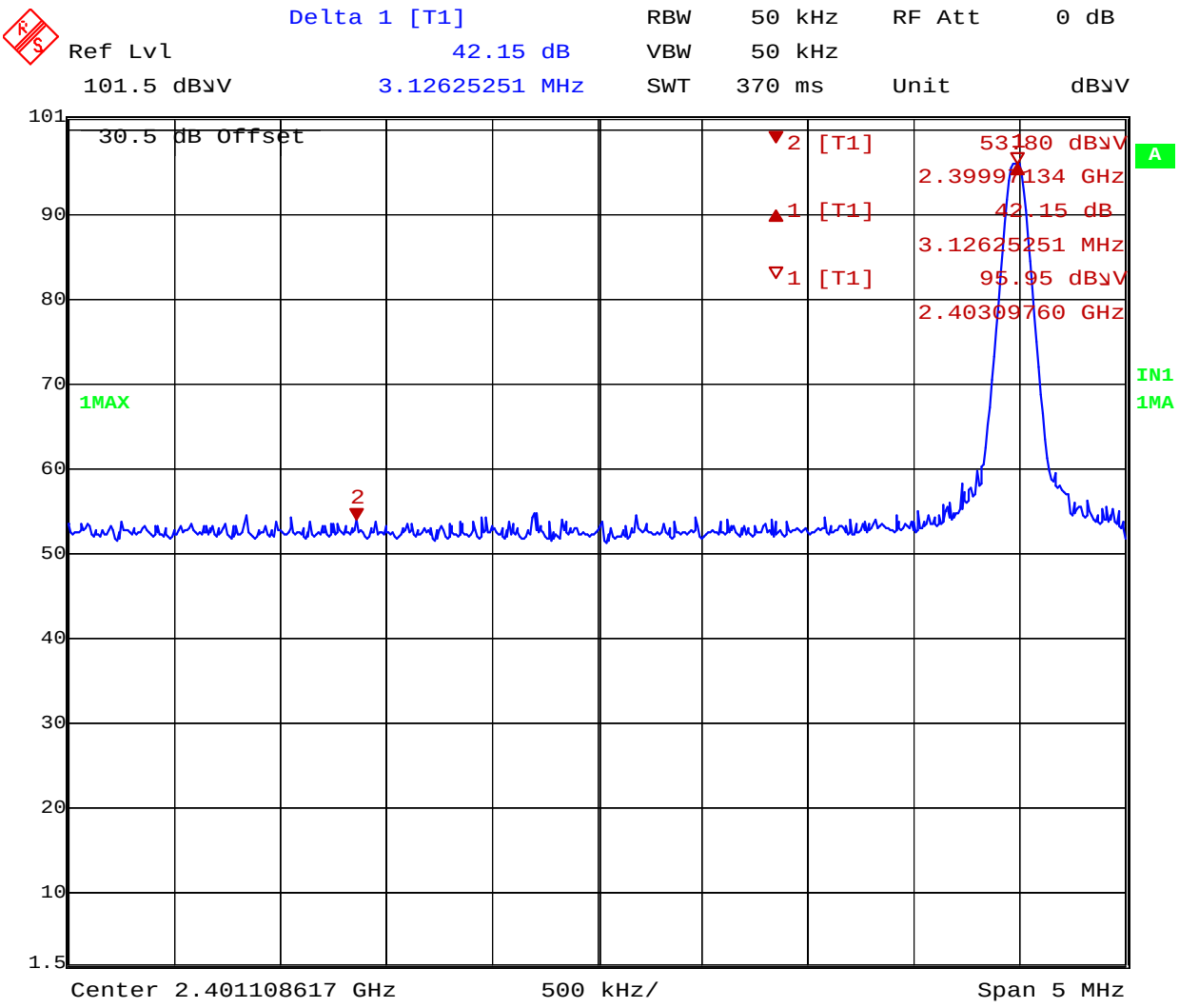
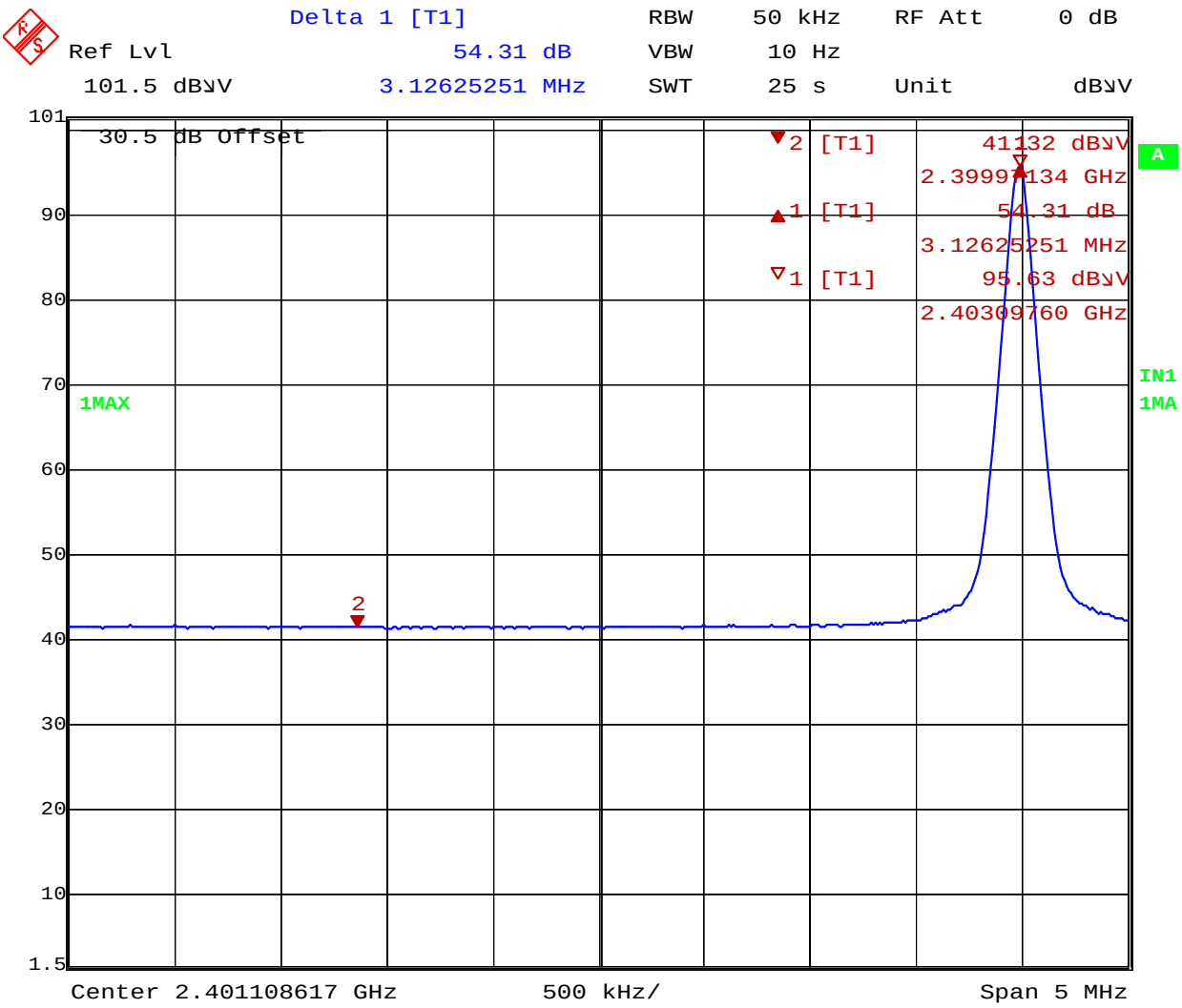


Figure 27 Low Channel Peak Mkr Delta Measurement - Vertical Polarity



Comment A: Omnex LPD 24C
Date: 26.APR.2007 19:42:40

Figure 28 Low Channel Average Mkr Delta Measurement - Vertical Polarity



Comment A: Omnex LPD 24C
Date: 26.APR.2007 19:43:50

Figure 29 High Channel Peak Fundamental Measurement - Vertical Polarity

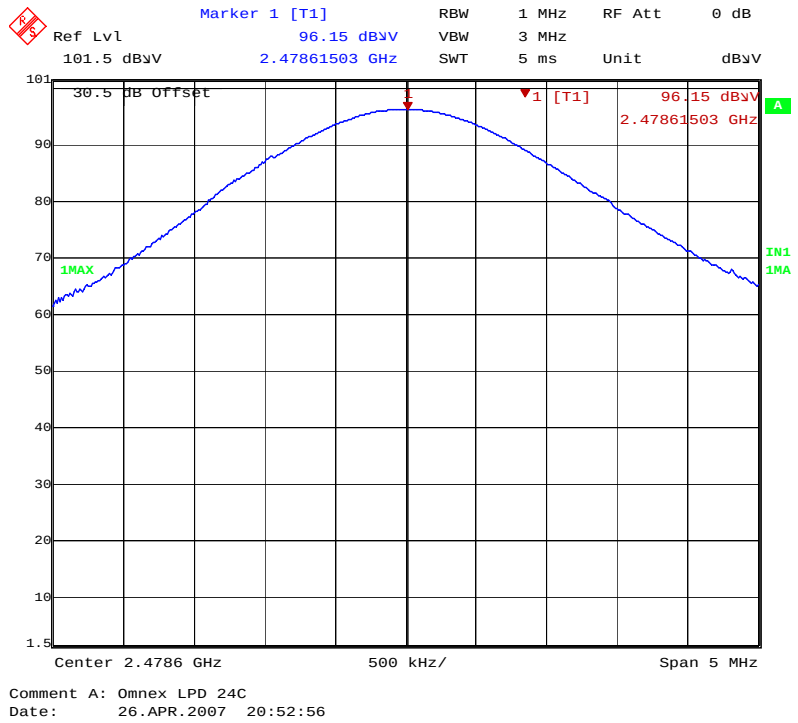


Figure 30 High Channel Average Fundamental Measurement - Vertical Polarity

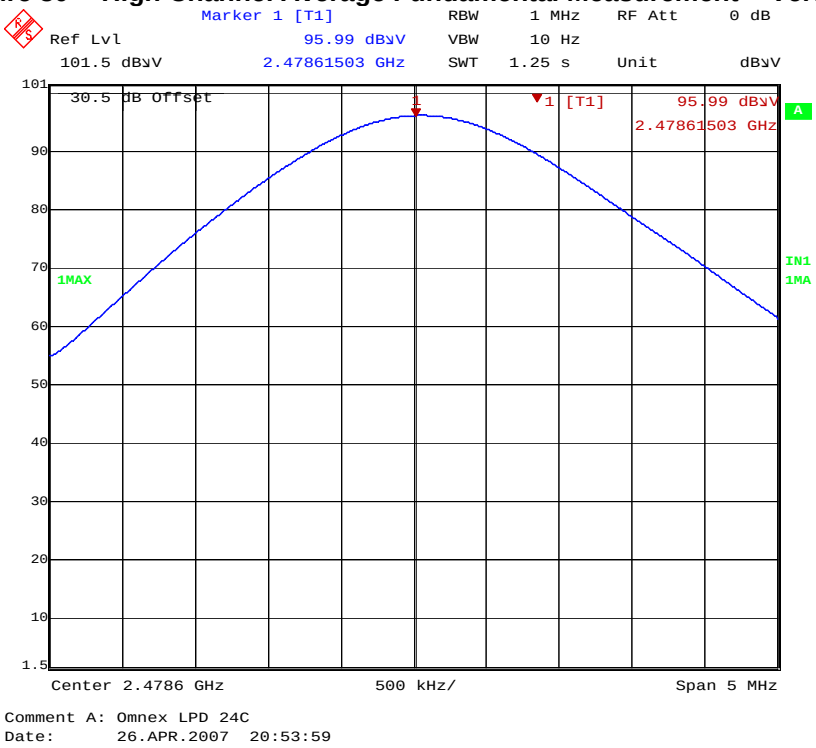


Figure 31 High Channel Peak Mkr Delta Measurement - Vertical Polarity

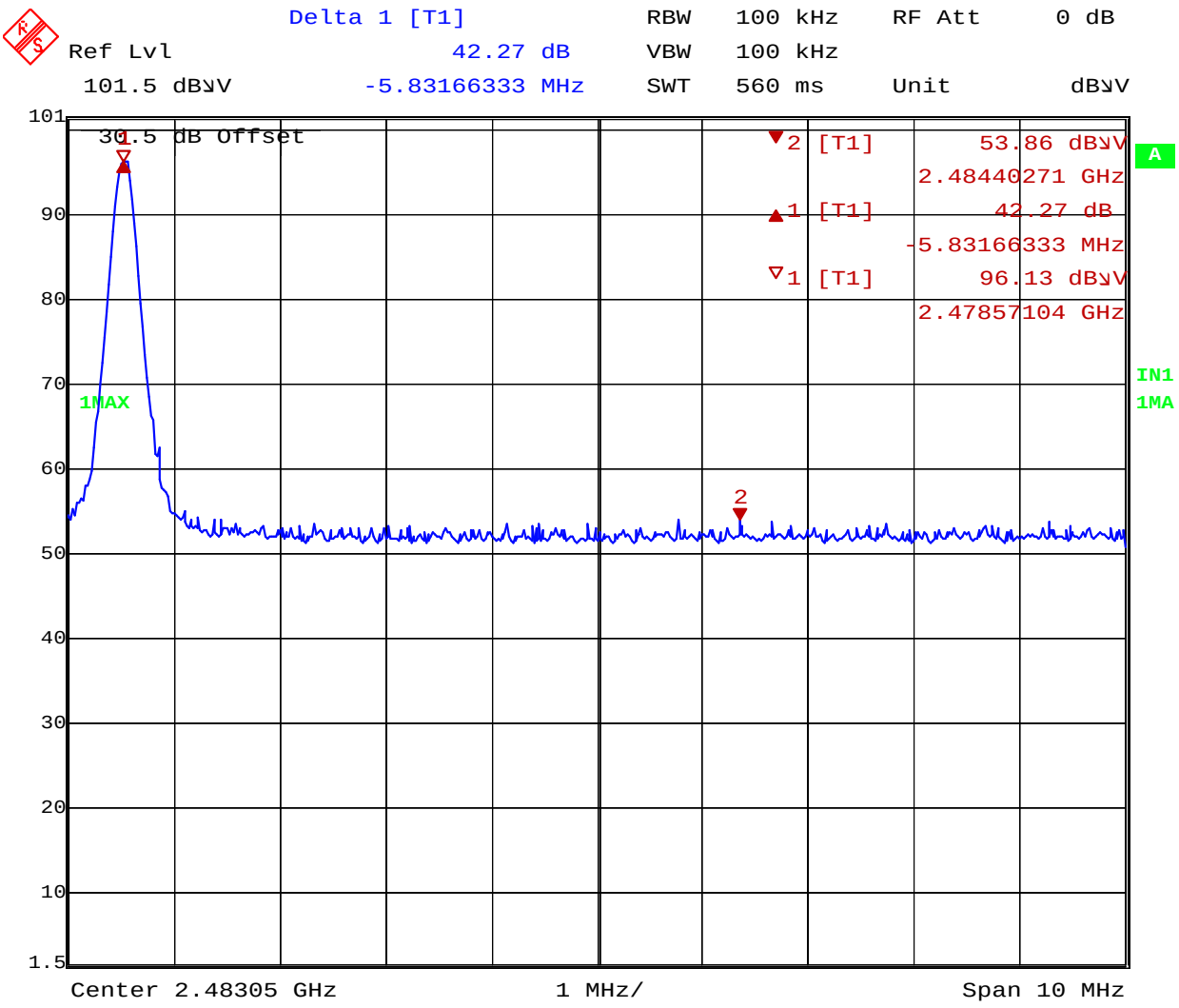
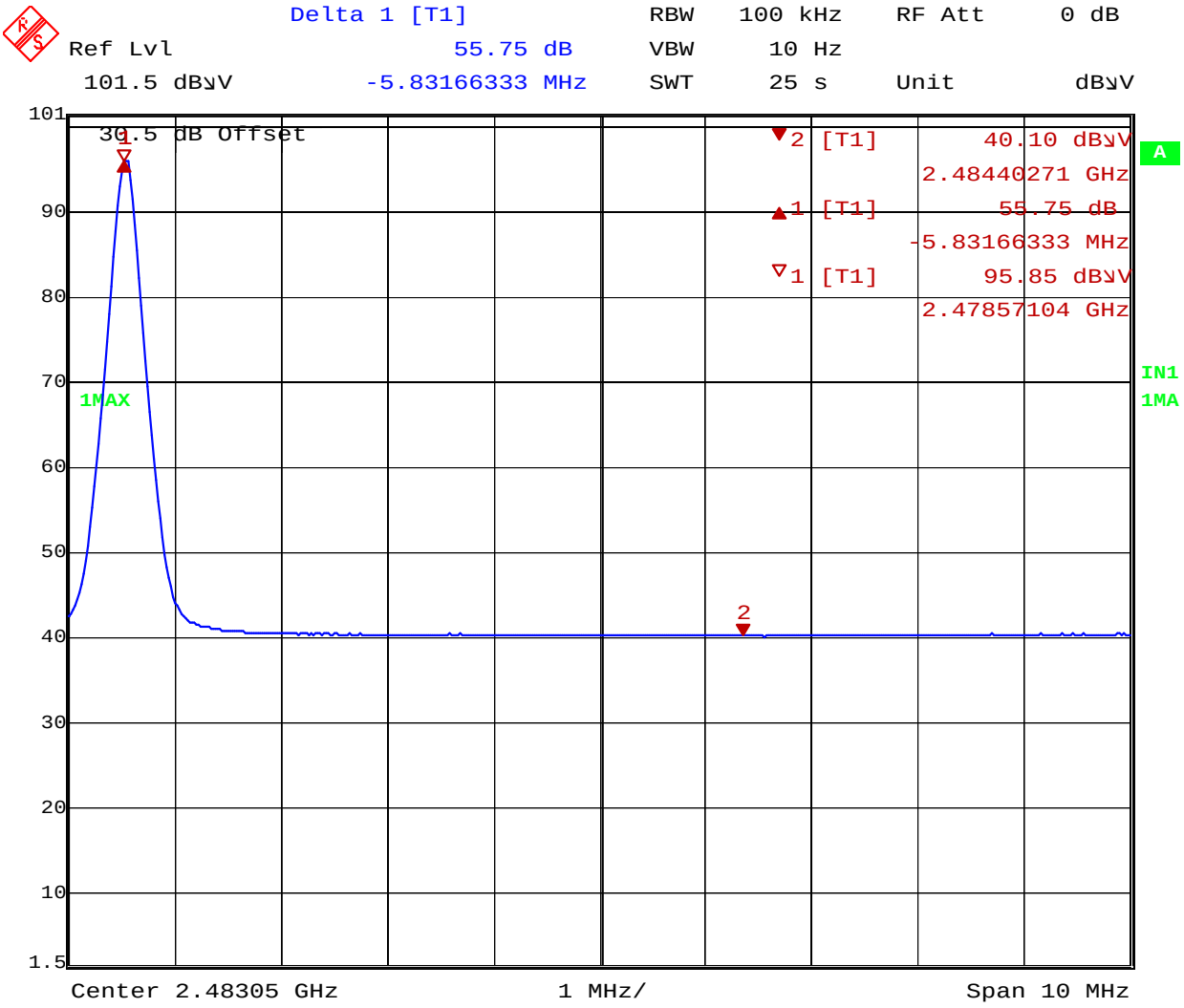


Figure 32 High Channel Average Mkr Delta Measurement - Vertical Polarity



Comment A: Omnex LPD 24C
Date: 26.APR.2007 21:01:48

APPENDIX G: MEASUREMENT EQUIPMENT

Description	Manufacturer	Type/Model	Asset #	Cal Due	Cal Date
Bilog Antenna	☒ Chase	CBL 6111B	260398	23APR07	23APR04
	☐ Chase	CBL 6112B	260301		
RF Cable	Suhner Sucoflex	Ferrite bead loaded cable	260388	13APR07	13APR06
Test Receiver	☐ Rohde & Schwarz	ESMI	260424 / 260423	02FEB08	02FEB05
	☒ Rohde & Schwarz	ESAI	260110 / 260111		
Mast Controller	EMCO	2090	260166	N/A	N/A
Multi Device Controller TT1 (Turntable)	EMCO	2090	260165	N/A	N/A
RF 10m East site Link				13APR07	13APR06
- Cable 1	Suhner Sucoflex	NA	263191		
- Cable 2	Suhner Sucoflex	NA	263135		
- Cable 3	Suhner Sucoflex	NA	263161		
- Cable 4	Suhner Sucoflex	NA	263162		
- Switch Matrix Controller	TDL	SMC-002	260162		
- Amplifier	Hewlett Packard	8447F	260164		
Horn Antenna (Rx) 1 GHz – 18 GHz	☒ EMCO	3115	260092	30AUG07	30AUG06
Standard Gain Horn (Rx) 18 GHz – 26.5 GHz	☒ EMCO	3160-09	260064	N/A	27NOV01
Standard Gain Horn (Rx) 26.5 GHz – 40 GHz	☒ EMCO	3160-10	260065	N/A	27NOV01
Test Receiver/Spectrum Analyzer	Rohde & Schwarz	ESI-40	CG0109	13SEP07	13SEP06
High pass filter	MicroTronics	HPM14576	CG963	10AUG07	10AUG06
LNA	Miteq	JSD00121	CG031	10AUG07	10AUG06
LNA	Miteq	JSD00119	513217	19JAN08	19JAN07
LNA	Miteq	JSD00120	513213	19JAN08	19JAN07
Cable from Antenna to LNA	Sucoflex 104	2422774A	263187	10AUG07	10AUG06
Cable from LNA to SA	Sucoflex 100	115757-4	263187	10AUG07	10AUG06
Spectrum Analyzer 9k-40GHz	Rohde & Schwarz	FSEK-20	260104	09MAY07	09MAY06
LNA DC Power Supply	Xantrex	LXO 30-2	260483	NA	NA
HPIB Extender	HP	37204	260096	N/A	N/A

HPIB Extender	HP	37204	260168	N/A	N/A
Mast Controller	EMCO	2090	260166	N/A	N/A
Multi Device Controller TT1	EMCO	2090	260165	N/A	N/A

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