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MPBT Report No.: w02e2348    Rev: 1    Date: 27 July 2001

Report for Emissions Testing of: AWE 120-24 rev 2  
Omni, TilTek Dish, and Sectoral Antennas

In accordance with: FCC Part 15, Subpart C (2000)

Test Personnel:    Quang Tan Nguyen

Prepared for:    Wi-LAN Inc.  
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Calgary, Alberta  
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Client Acceptance  
Authorized Signatory

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David Raynes  
Laboratory Supervisor  
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## **1.0 INTRODUCTION**

### **1.1 SCOPE**

The purpose of this report is to present the findings and results of compliance testing performed in accordance with CFR Title 47 FCC Part 15, Subpart C, Intentional Radiators.

### **1.2 APPLICANT**

This test report has been prepared for Wi-LAN Inc., located in Calgary, Alberta, Canada.

### **1.3 APPLICABILITY**

All test procedures, limits, and results defined in this document apply to the Wi-LAN Inc. AWE 120-24 rev 2 unit, referred to herein as the Equipment Under Test (EUT).

The results contained in this report relate only to the item tested.

This report does not imply product endorsement by NVLAP or the Canadian or US governments.

### **1.4 TEST SAMPLE DESCRIPTION**

The test sample provided for testing was an AWE 120-24 rev 2:

Product Type:	Information Technology
Model Number:	AWE 120-24 rev 2
Serial Number:	
Cables:	CAT 5, RS-232, antenna
Power Requirements:	120 to 230 VAC
Peripheral Equipment:	Omni, TiiTek Dish, and Sectoral Antenna
Brief Functional Description:	Wireless Communication Base Station

More detailed information is provided by Wi-LAN Inc. in Appendix A.

### **1.5 GENERAL TEST CONDITIONS AND ASSUMPTIONS**

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated.

Where relevant, the EUT was only tested using the monitoring methods and test criteria defined in this report.

All testing, unless otherwise noted, was performed under the following environmental conditions:

Temperature:	17 to 23 °C
Humidity:	45 to 75 %

## 1.6 SCOPE OF TESTING

Testing was performed in accordance with FCC Part 15 Subpart C (2000), and ANSI C63.4 (1992).

### 1.6.1 VARIATIONS IN TEST METHODS

The following variations in test methodology were noted during testing:

- a) At the client's request, only radiated and conducted emissions tests were performed at the Electronics Test Centre.
- b) In all cases of radiated emissions testing, the transmitting antenna was placed above the unit instead of at 80 cm.
- c) The radiated emissions above 18 GHz were performed using a down-converter with a shift of 17 GHz. All measurements between 18 and 25 GHz were shifted down by 17 GHz to the range 1 to 8 GHz in order to detect them on the test equipment that was available.

### 1.6.2 MARGINAL EMISSIONS MEASUREMENTS

None of the emissions was measured to be within -6 dB of the specified limit.

### 1.6.3 TEST SAMPLE MODIFICATIONS

There were no equipment modifications during test performance.

## **2.0 ABBREVIATIONS**

CE	-Conducted Emissions
E	-Field - Electric Field
H	-Field - Magnetic Field
N/T	-Not Tested
N/A	-Not Applicable
RBE	-Restricted Bands of Operation
RE	-Radiated Emissions

## **3.0 MEASUREMENT UNCERTAINTY**

For Radiated E-Field Emissions and Conducted Emissions, the uncertainties in the measurements were calculated using the methods outlined in the NAMAS document, NIS81: May 1984.

Frequency	= $\pm 1$ kHz
Amplitude (RE)	= $\pm 4.01$ dB
Amplitude (CE)	= $\pm 3.25$ dB

#### **4.0 TEST CONCLUSION**

The EUT was subjected to the following tests. Compliance status is indicated as **PASS** or **FAIL**.

The following table summarizes the test case (the section in this report containing the results), the type of test performed, the applicable sections of FCC Part 15, the antenna and channel configurations, and the results, PASS or FAIL.

Test Case	Test Type	Specification	Antenna	Channel	Result
§4.1	Conducted Emissions	FCC Part 15.207	N/A	N/A	PASS
§4.2	Radiated Emissions including Restricted Bands of Operation	FCC Part 15.209 and 15.205	Omni	Low	PASS
				Mid	PASS
				High	PASS
			Tiltek Dish	Low	PASS
				Mid	PASS
				High	PASS
			Sectoral	Low	PASS
				Mid	PASS
				High	PASS

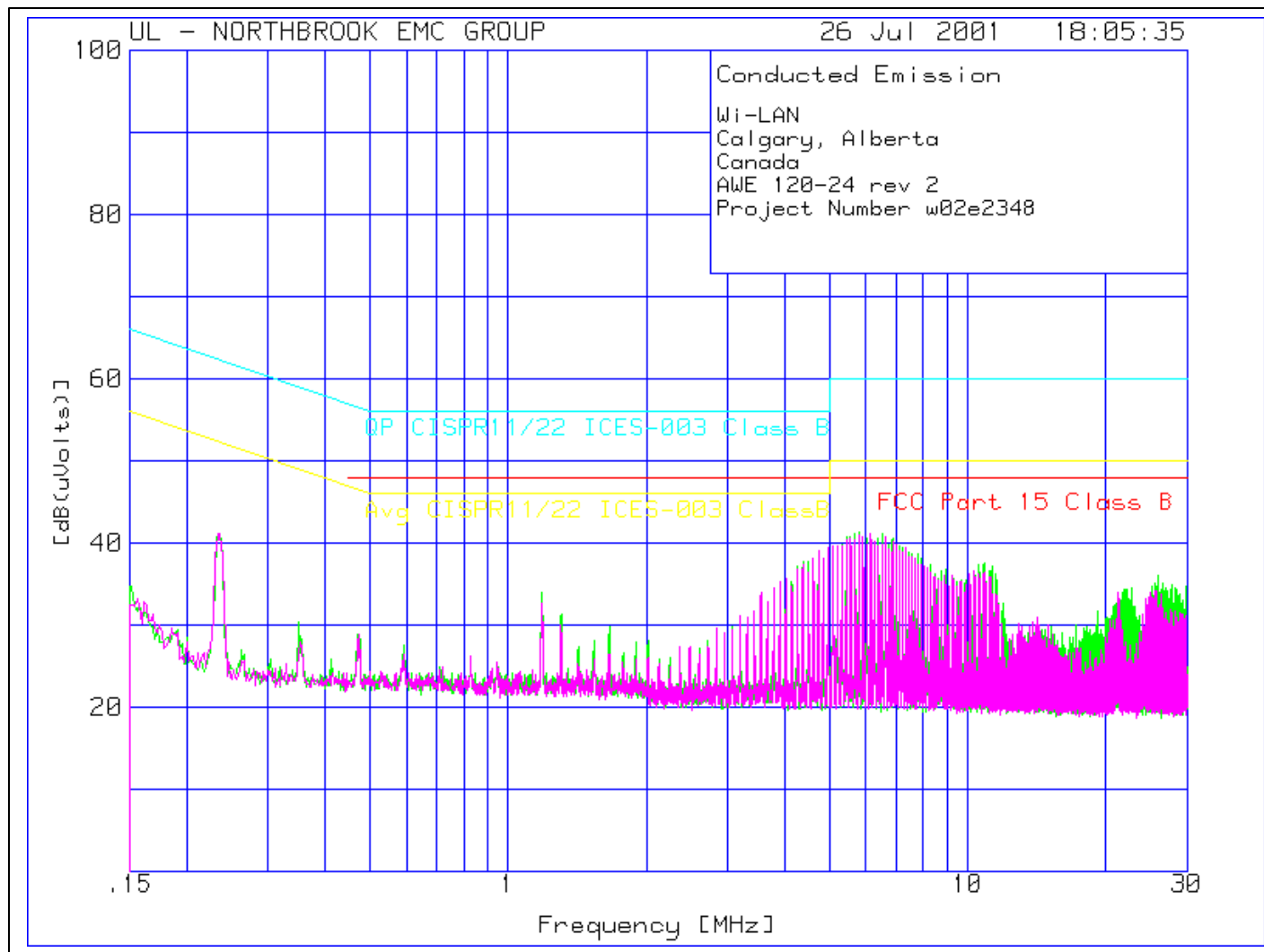
#### **STATEMENT OF COMPLIANCE**

The client equipment referred to in this report was found to comply with the requirements as stated above.

#### 4.15 CONDUCTED EMISSIONS ON AC POWER LINES

Test Lab: Electronics Test Centre (Airdrie)			Product:		
Test Personnel: Q. Nguyen			AWE 120-24 rev 2		
Test Date: 26 July 2001					
Test Result, AWE 120-24 rev 2: PASS					
Objectives/Criteria			Specifications		
The EUT was assessed against the requirements of FCC Part 15.207			FCC Part 15.207		
			Frequency	Limit (QP)	
			[MHz]	[dBµV]	
			0.45 – 30	47.96	
Line 1:			Line 2:		
Frequency [MHz]	RF Voltage [dBµV]	Delta [dB from limit]	Frequency [MHz]	RF Voltage [dBµV]	Delta [dB from limit]
There were no emissions within -6 dB of the limit. Please refer to Plot 1 for more detail.					

**Plot 1**  
**Conducted Emissions on AC Power Lines**  
**0.45-30 MHz**



## 4.2 RADIATED EMISSIONS INCLUDING RESTRICTED BANDS OF OPERATION

### 4.2.1 Omni Antenna

Test Lab: MPB Technologies Inc. Airdrie			Product:												
Test Personnel: Q. Nguyen, S. Tarkowski			AWE 120-24 rev 2												
Test Date: 27 June & 3, 4, 9, 10, 11 July 2001															
<p>Test Result, AWE 120-24 rev 2</p> <p>LOW Channel: <b>PASS</b></p> <p>MID Channel: <b>PASS</b></p> <p>HIGH Channel: <b>PASS</b></p>															
Objectives/Criteria			Specifications												
<p>The Radiated E-Field emissions produced by a system or sub-system, measured at a distance of 3m from the EUT, shall not exceed these limits for the specifications <i>within the restricted bands of operation (RBOs)</i>. Any emissions lying outside the RBOs shall not exceed the level of the fundamental transmission.</p> <p><b>Emission levels should meet the requirements with a margin of 6dB.</b></p>			<p>FCC Part 15.209 and 15.205</p> <table border="1"> <thead> <tr> <th>Frequency [MHz]</th> <th>Limit (QP @ 3m) [dBμV/m]</th> </tr> </thead> <tbody> <tr> <td>30 – 88</td> <td>40.00</td> </tr> <tr> <td>88 – 216</td> <td>43.52</td> </tr> <tr> <td>216 – 960</td> <td>46.02</td> </tr> <tr> <td>Above 960</td> <td>53.98</td> </tr> </tbody> </table>			Frequency [MHz]	Limit (QP @ 3m) [dBμV/m]	30 – 88	40.00	88 – 216	43.52	216 – 960	46.02	Above 960	53.98
Frequency [MHz]	Limit (QP @ 3m) [dBμV/m]														
30 – 88	40.00														
88 – 216	43.52														
216 – 960	46.02														
Above 960	53.98														
<b>Vertical:</b>			<b>Horizontal:</b>												
Frequency [MHz]	Field Strength [dBμV/m]	Delta [dB from limit]	Frequency [MHz]	Field Strength [dBμV/m]	Delta [dB from limit]										
LOW Channel:															
MID Channel:															
1111.288	23.81	-30.19	949,9699	34.21	-11.79										
HIGH Channel:															
There were no emissions measured within -6 dB of the specified limit. Please refer to the test data and plots (Plots 2 through 28) for more detail.															



Restricted Frequency Bands [MHz] FCC Part 15.205					
Start	End	Start	End	Start	End
4.17725	4.17775	123	138	3345.8	3358
4.20725	4.20775	149.9	150.05	3600	4400
6.215	6.218	156.52	156.53	4500	5150
6.26775	6.26825	156.7	156.9	5350	5460
6.31175	6.31225	162.01	167.17	7250	7750
8.291	8.294	167.72	173.2	8025	8500
8.362	8.366	240	285	9000	9200
8.37625	8.38675	322	335.4	9300	9500
8.41425	8.41475	399.9	410	10600	12700
12.29	12.293	608	614	13250	13400
12.51975	12.52025	960	1240	14470	14500
12.57675	12.57725	1300	1427	15350	16200
13.36	13.41	1435	1626.5	17700	21400
16.42	16.423	1645.5	1646.5	22010	23120
16.69475	16.69525	1660	1710	23600	24000
16.80425	16.80475	1718.8	1722.2	31200	31800
25.5	25.67	2200	2300	36430	36500
37.5	38.25	2310	2390		

**Test Data**  
**Radiated Emissions**  
**Omni Antenna**  
**Mid Channel**  
**AWE 20-24 REV-2 in Base mode**  
**30-1000 MHz**

Wi-LAN  
Mid channel  
Wi-LAN AWE 120-24 rev 2  
Project Number: w02e2348

Test	Meter	Gain/Loss	Transducer	Level	Limit:	1	2	3	4
Frequency	Reading	Factor	Factor	[dB(uVolts)]					
[MHz]	[dB(uV)]	[dB]		[dB]					
=====									
949.9669	4.41 qp	6.4		23.4	34.21	56.9	46		N/A
59.2									
Azimuth: 120	Height:101	Horz		Margin [dB]	-22.69	-11.79	N/A		-24.99

LIMIT 1: FCC Part 15 Class A 3m  
LIMIT 2: FCC Part 15 Class B 3m  
LIMIT 3: NONE  
LIMIT 4: AWE 120-24 REV 2I 300 328 TX

pk - Peak detector  
qp - Quasi-Peak detector  
av - Average detector

**Test Data**  
**Radiated Emissions**  
**Omni Antenna**  
**Mid Channel**  
**AWE 20-24 REV-2 in Base mode**  
**1-2 GHz**

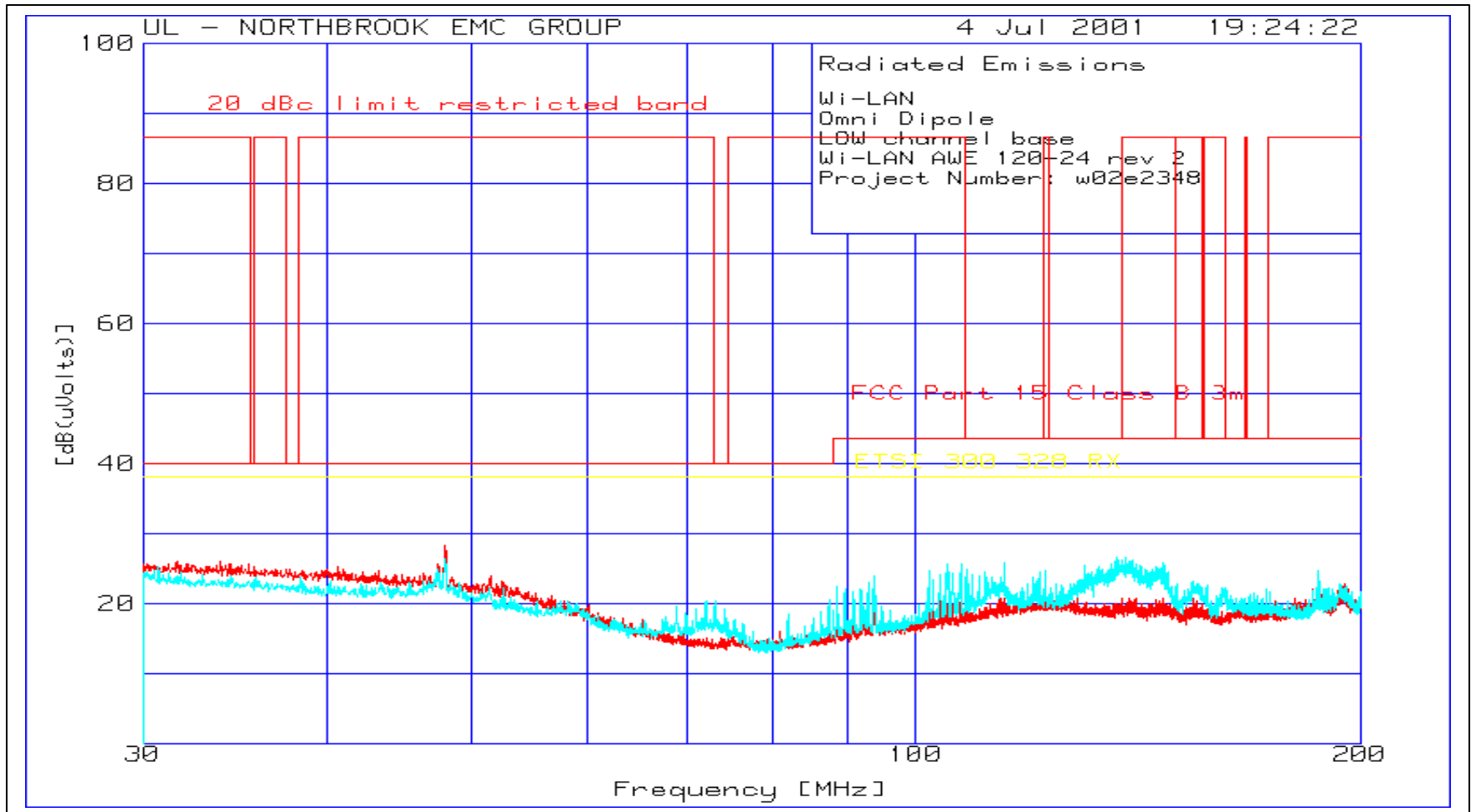
Wi-LAN  
Omni  
MID channel Base #58  
AWE 120-24 rev 2  
Project Number w02e2348

Test	Meter	Gain/Loss	Transducer	Level	Limit:1	2	3
4							
Frequency	Reading	Factor	Factor	[dB(uVolts)]			
[MHz]	[dB(uV)]	[dB]	[dB]				
=====							
1111.288	29.71 av	-31	25.1	23.81	57.7	54	
54	N/A						
Azimuth: 117	Height:320	Vert	Margin [dB]	-33.89	-30.19	-30.19	
N/A							

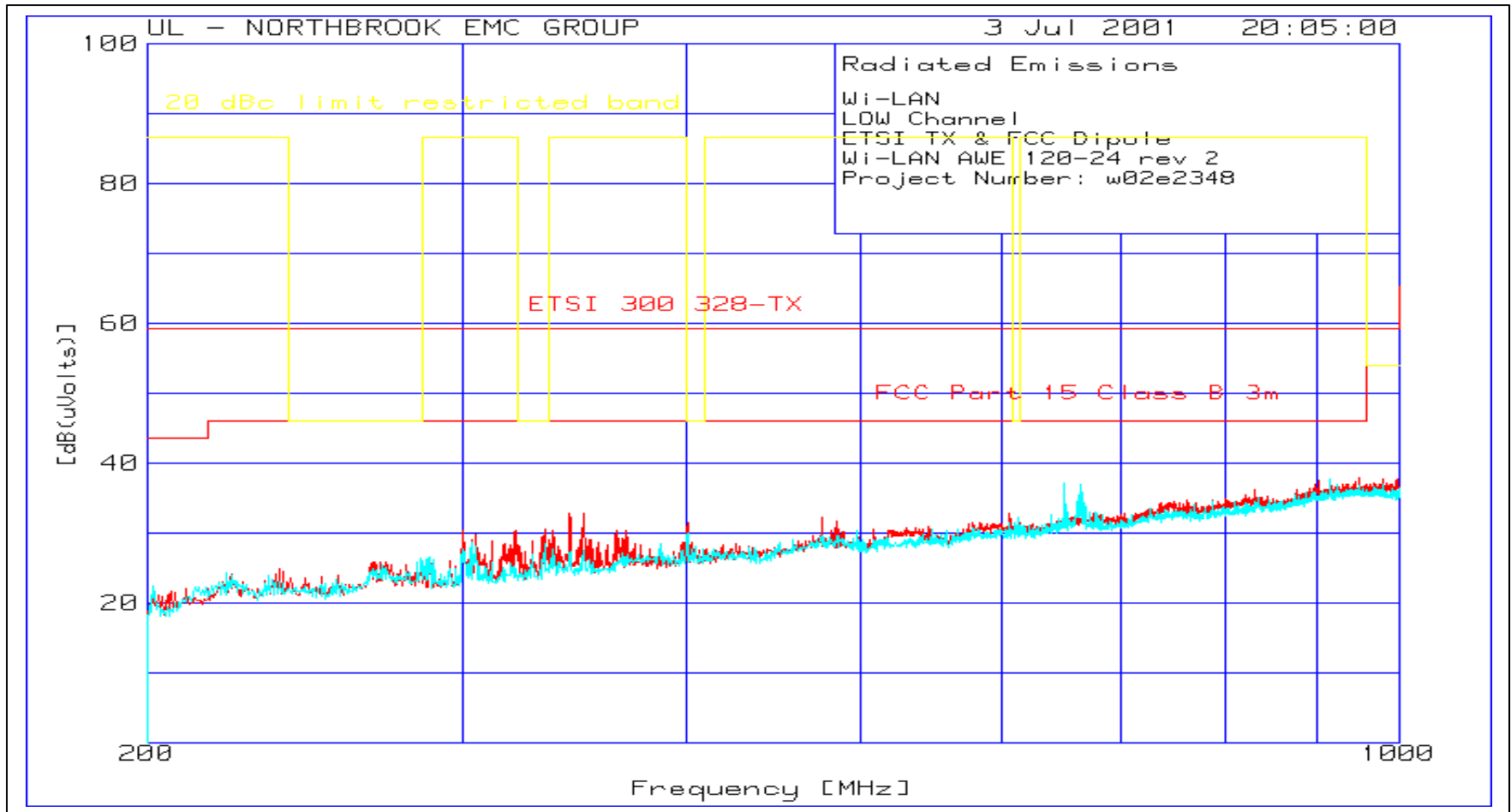
LIMIT 1: AWE 120-24 REV 2I 300 328 RX  
LIMIT 2: FCC Part 15 Subpart C 3m  
LIMIT 3: 20 dBc limit restricted band  
LIMIT 4: NONE

pk - Peak detector  
qp - Quasi-Peak detector  
av - Average detector

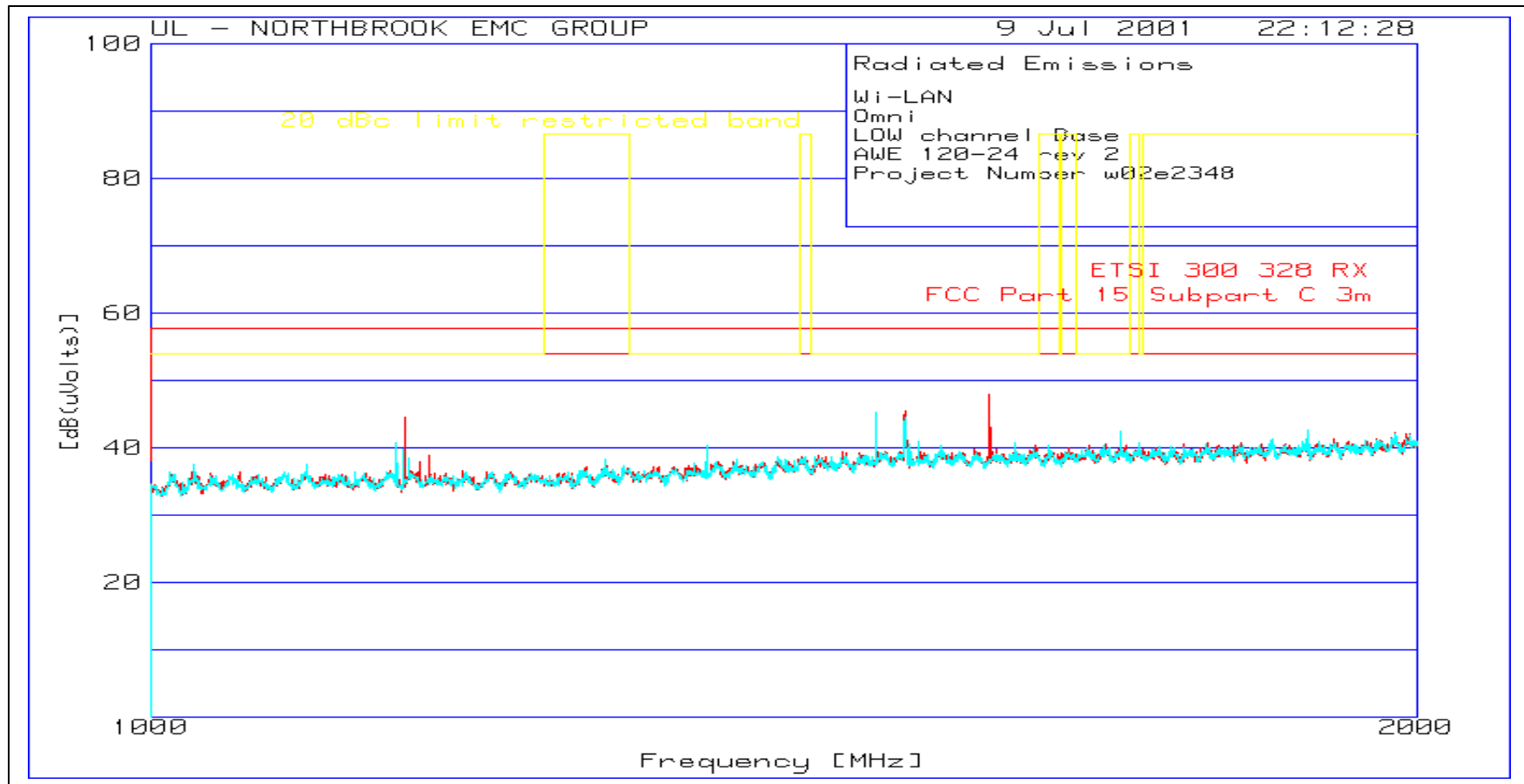
**Plot 2**  
**Radiated Emissions of Omni Antenna – Low Channel**  
**AWE 120-24 REV 2 in Base mode**  
**30-200 MHz**



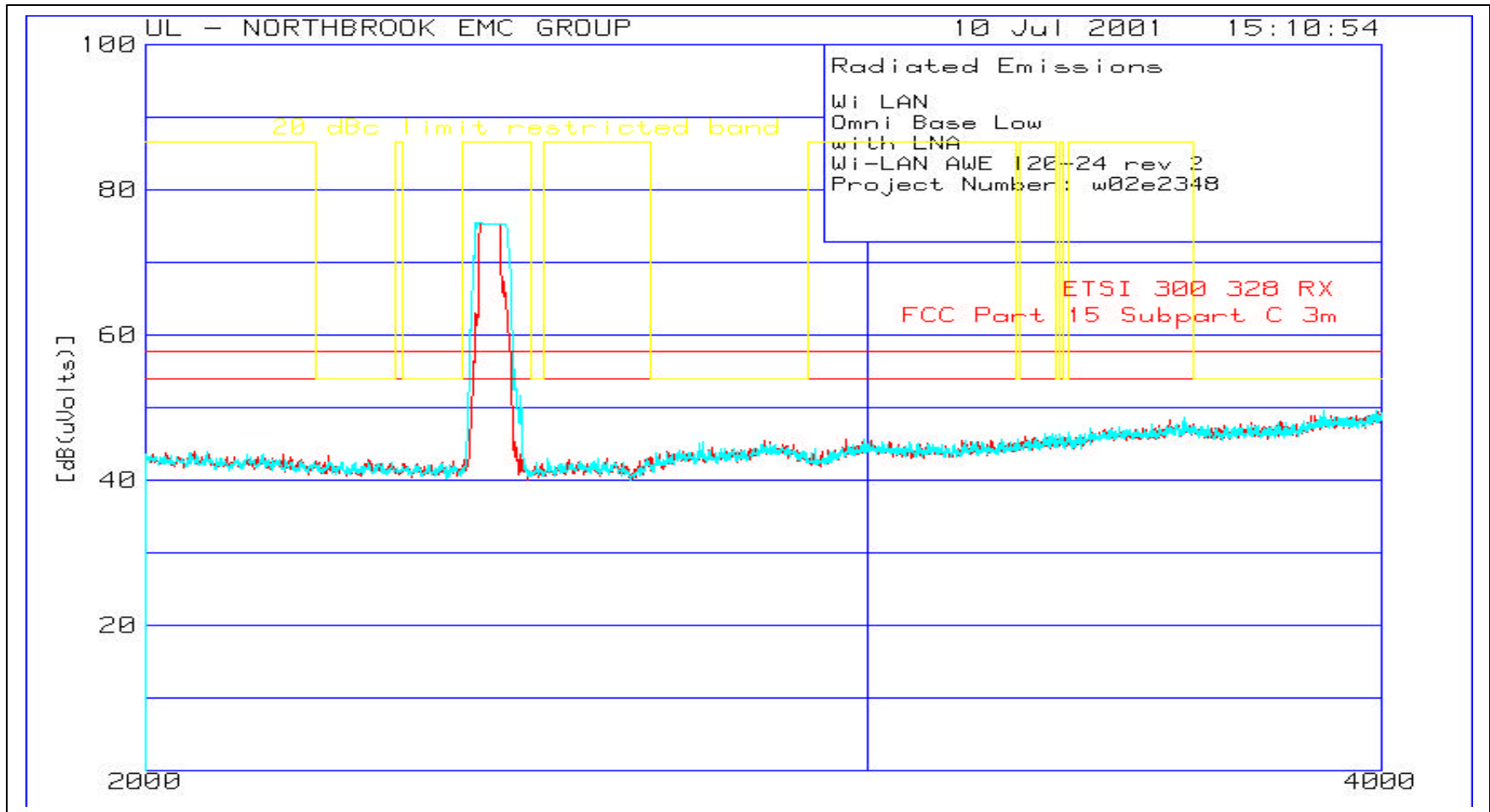
**Plot 3**  
**Radiated Emissions of Omni Antenna – Low Channel**  
**AWE 120-24 REV 2 in Base mode**  
**200-1000 MHz**



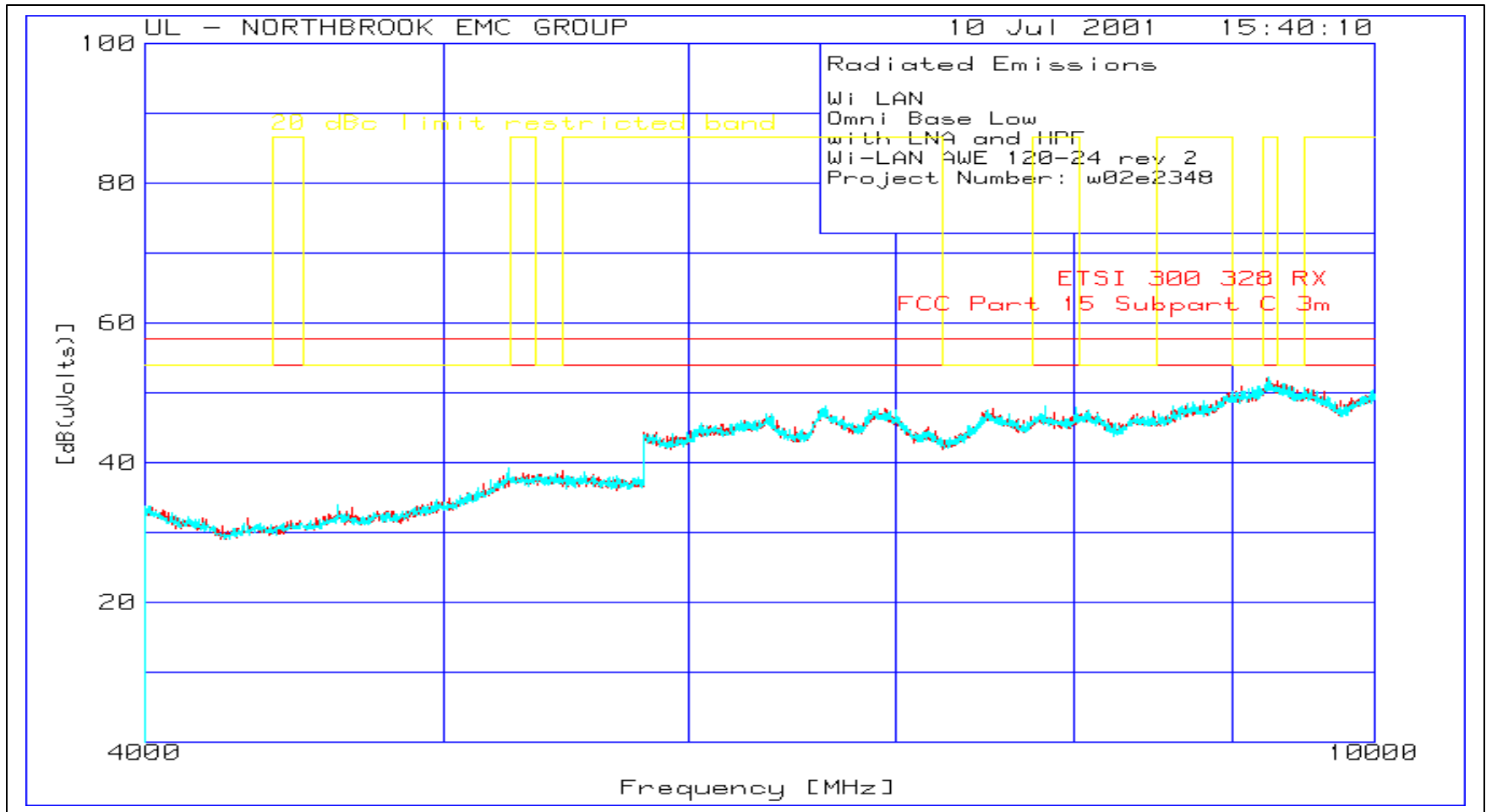
Plot 4  
Radiated Emissions of Omni Antenna – Low Channel  
AWE 120-24 REV 2 in Base mode  
1-2 GHz



**Plot 5**  
**Radiated Emissions of Omni Antenna – Low Channel**  
**AWE 120-24 REV 2 in Base mode**  
**2-4 GHz**

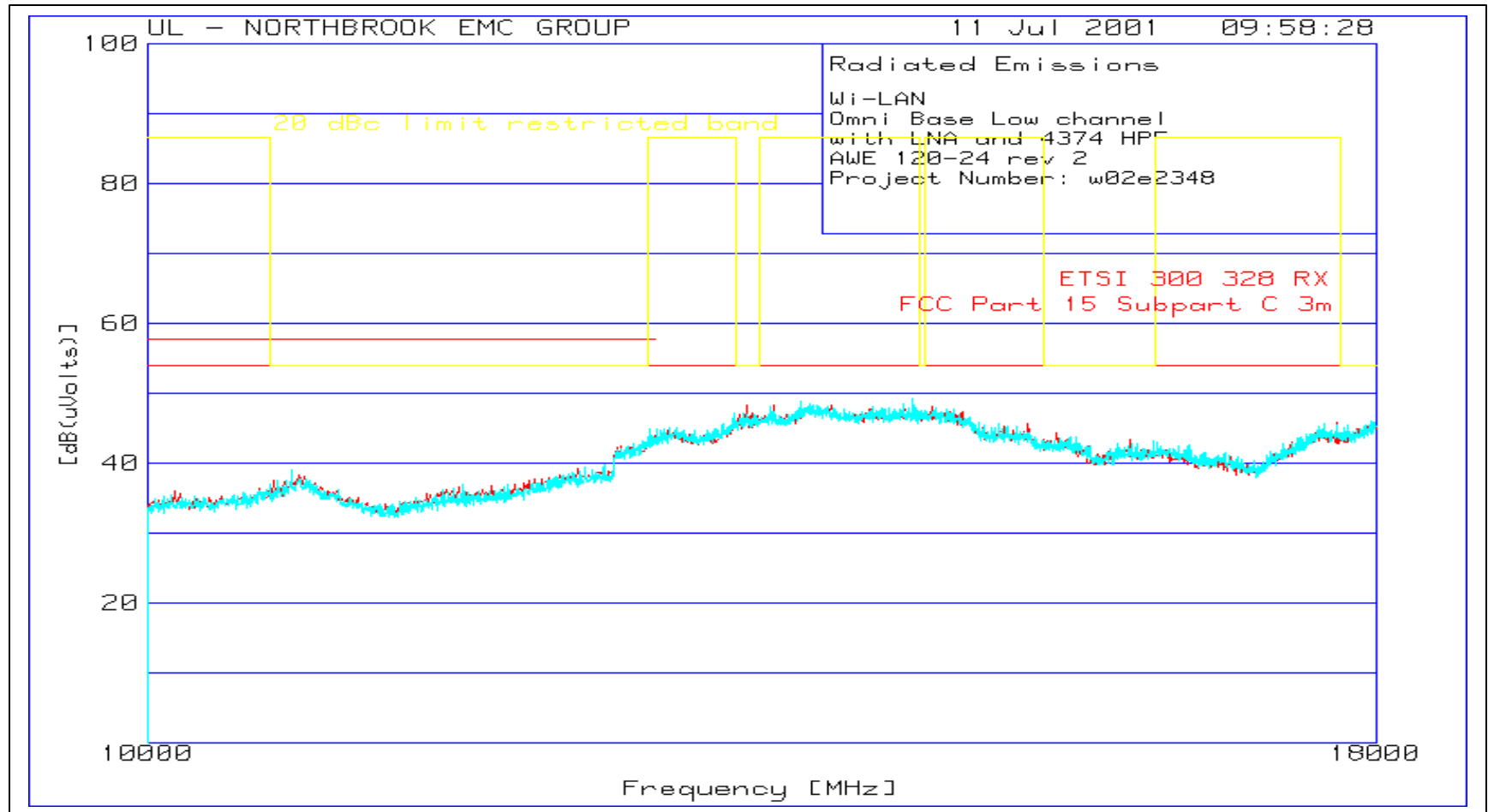


Plot 6  
Radiated Emissions of Omni Antenna – Low Channel  
AWE 120-24 REV 2 in Base mode  
4-10GHz

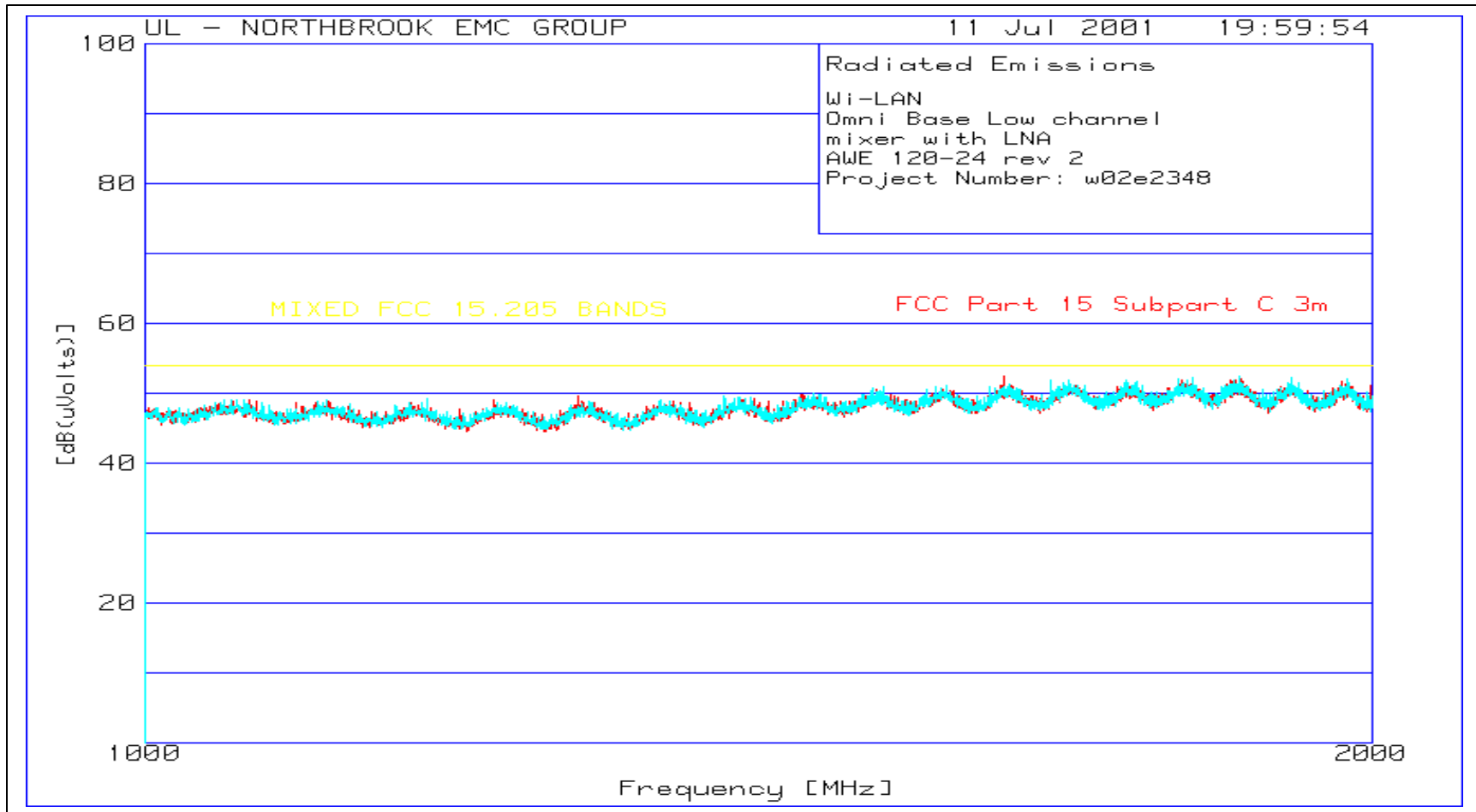




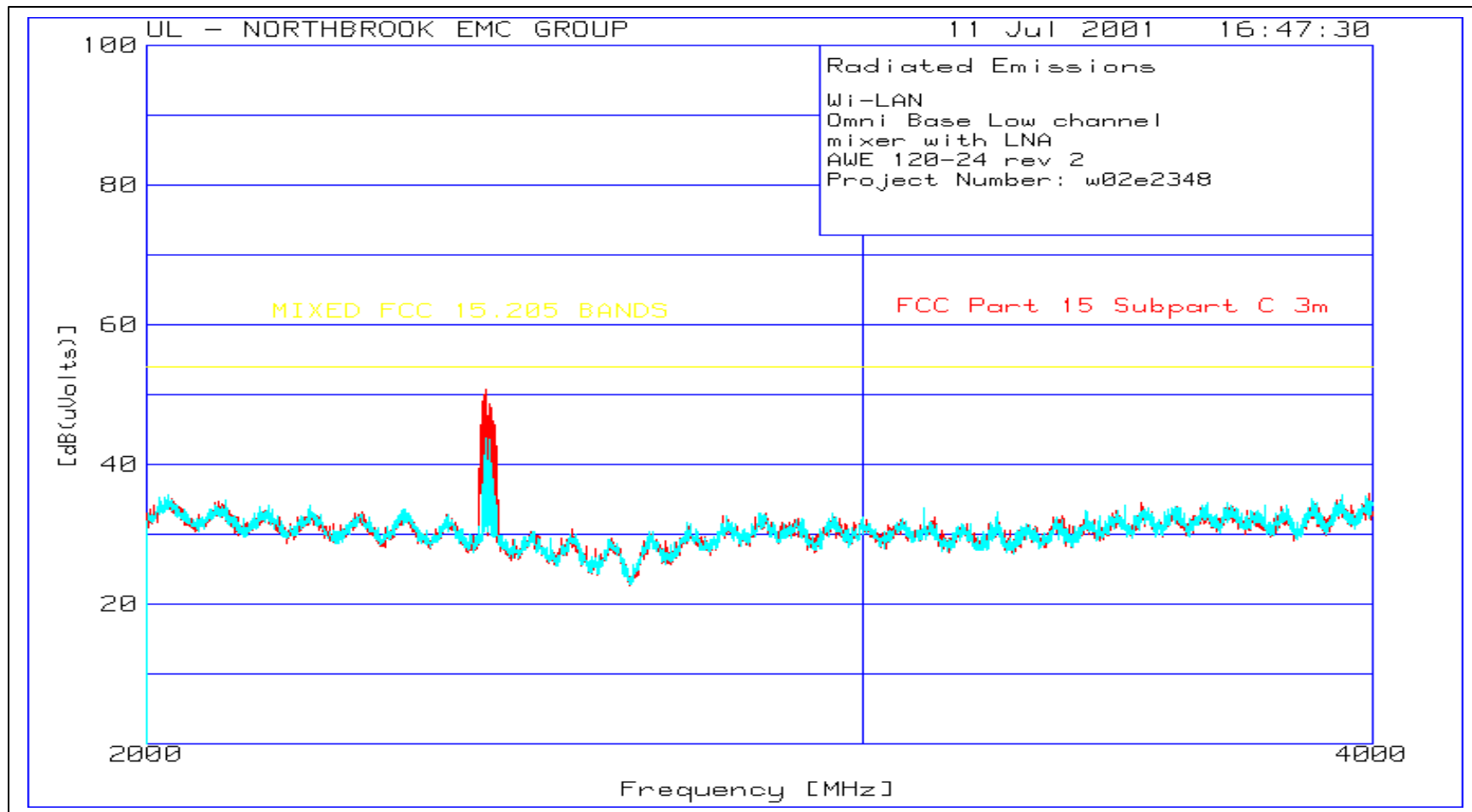
**Plot 7**  
**Radiated Emissions of Omni Antenna – Low Channel**  
**AWE 120-24 REV 2 in Base mode**  
**10-18 GHz**



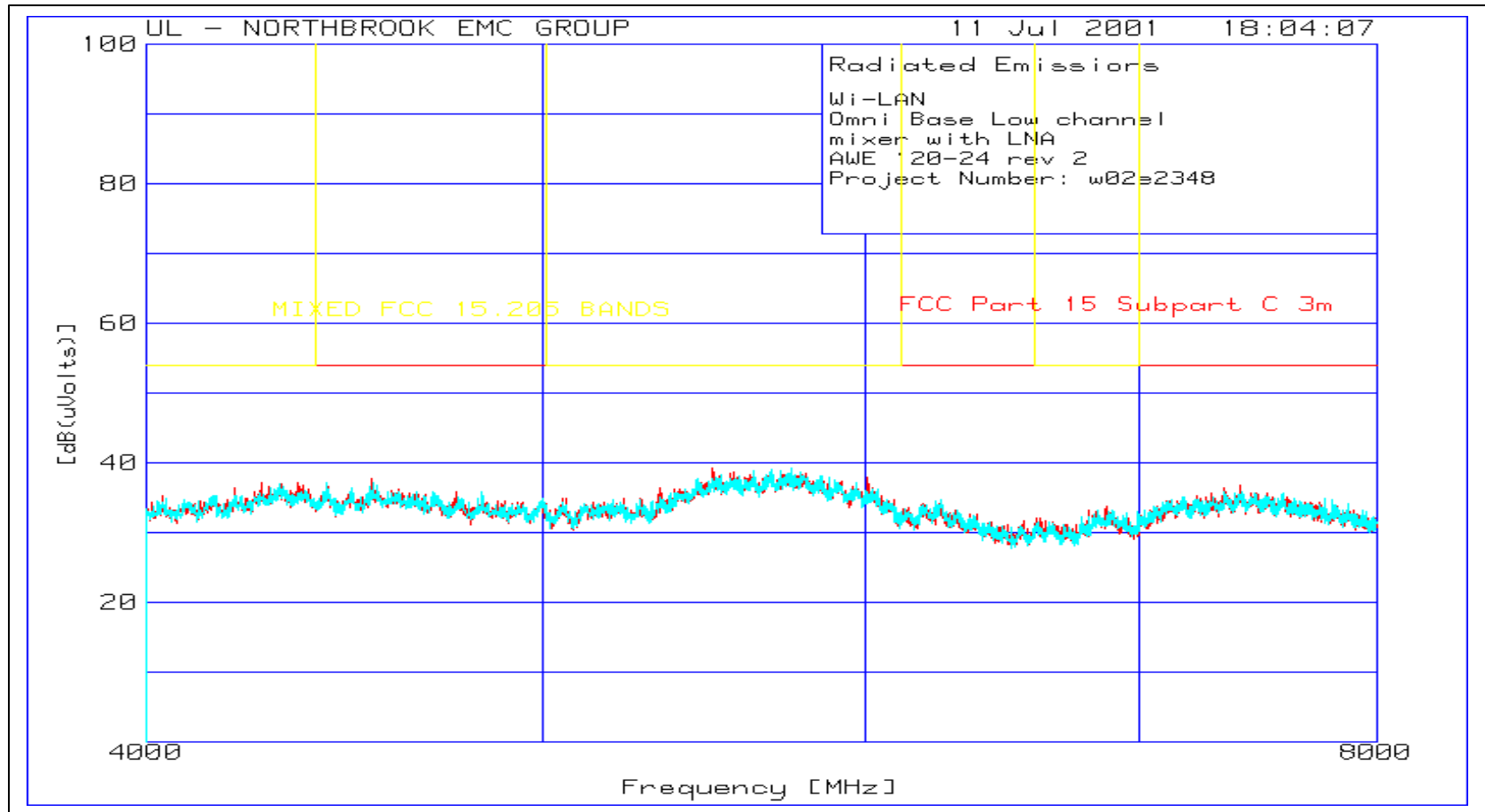
**Plot 8**  
**Radiated Emissions of Omni Antenna – Low Channel**  
**AWE 120-24 REV 2 in Base mode**  
**18-19 GHz**



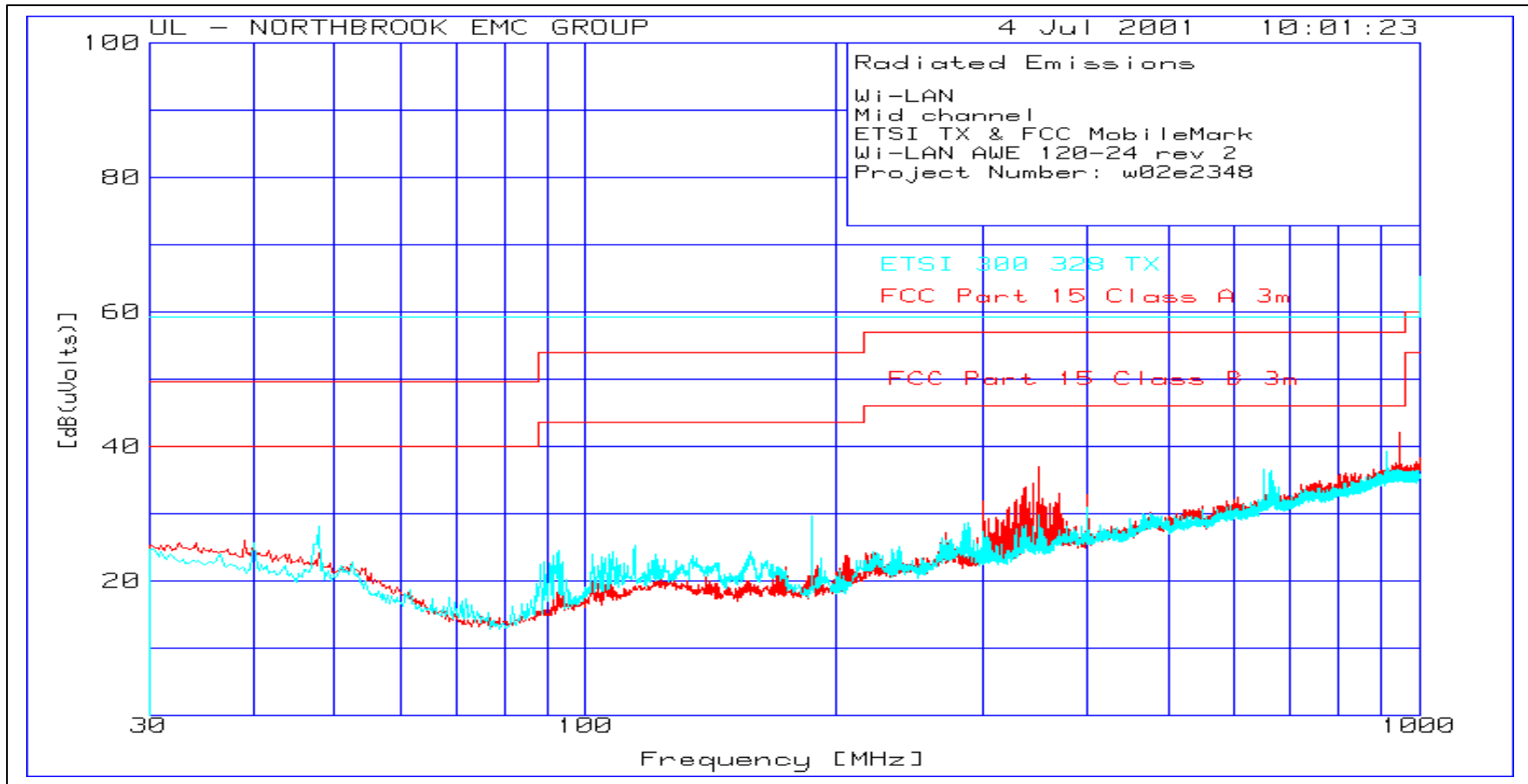
**Plot 9**  
**Radiated Emissions of Omni Antenna – Low Channel**  
**AWE 120-24 REV 2 in Base mode**  
**19-21 GHz**



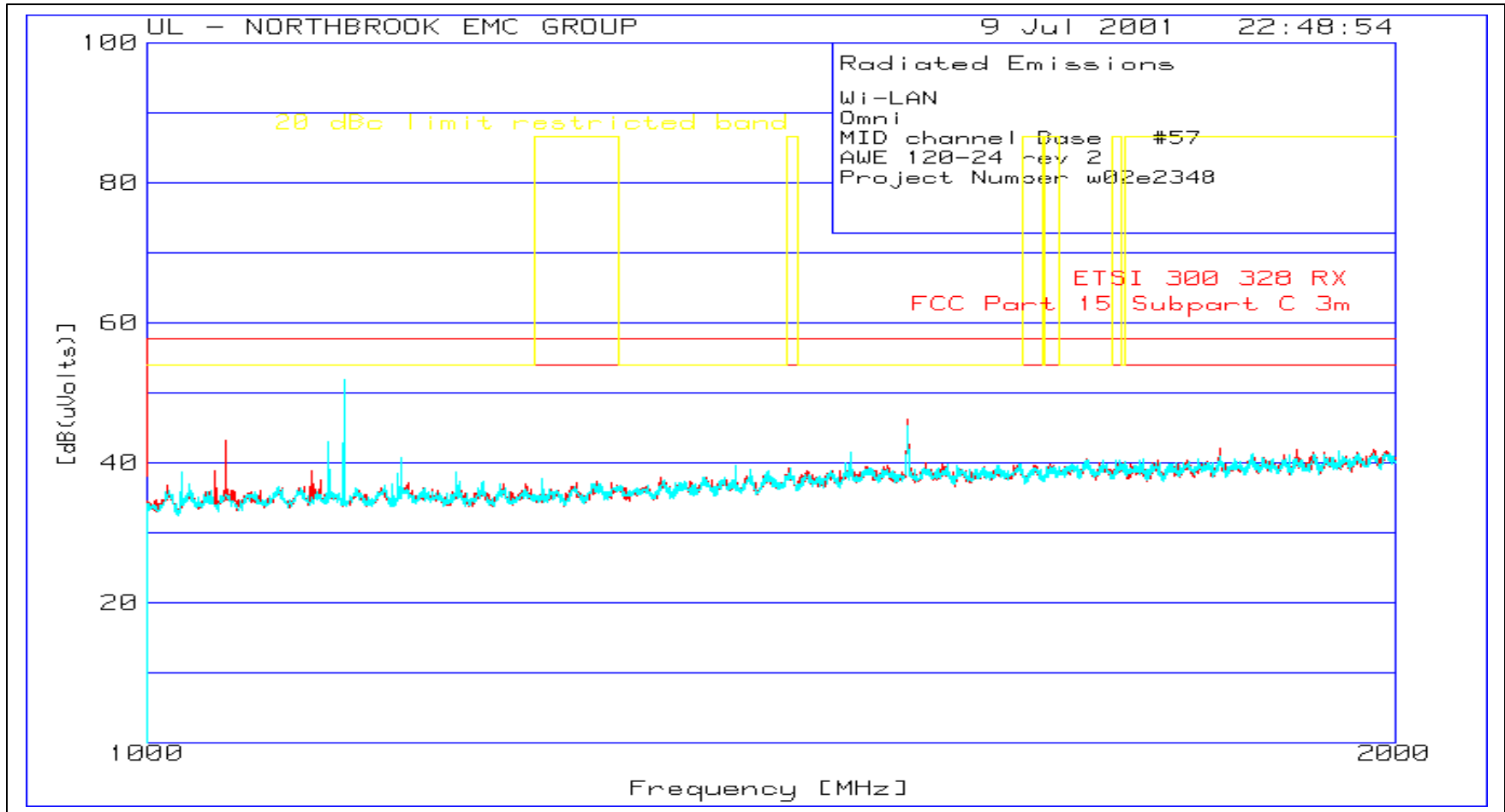
**Plot 10**  
**Radiated Emissions of Omni Antenna – Low Channel**  
**AWE 120-24 REV 2 in Base mode**  
**21-25GHz**



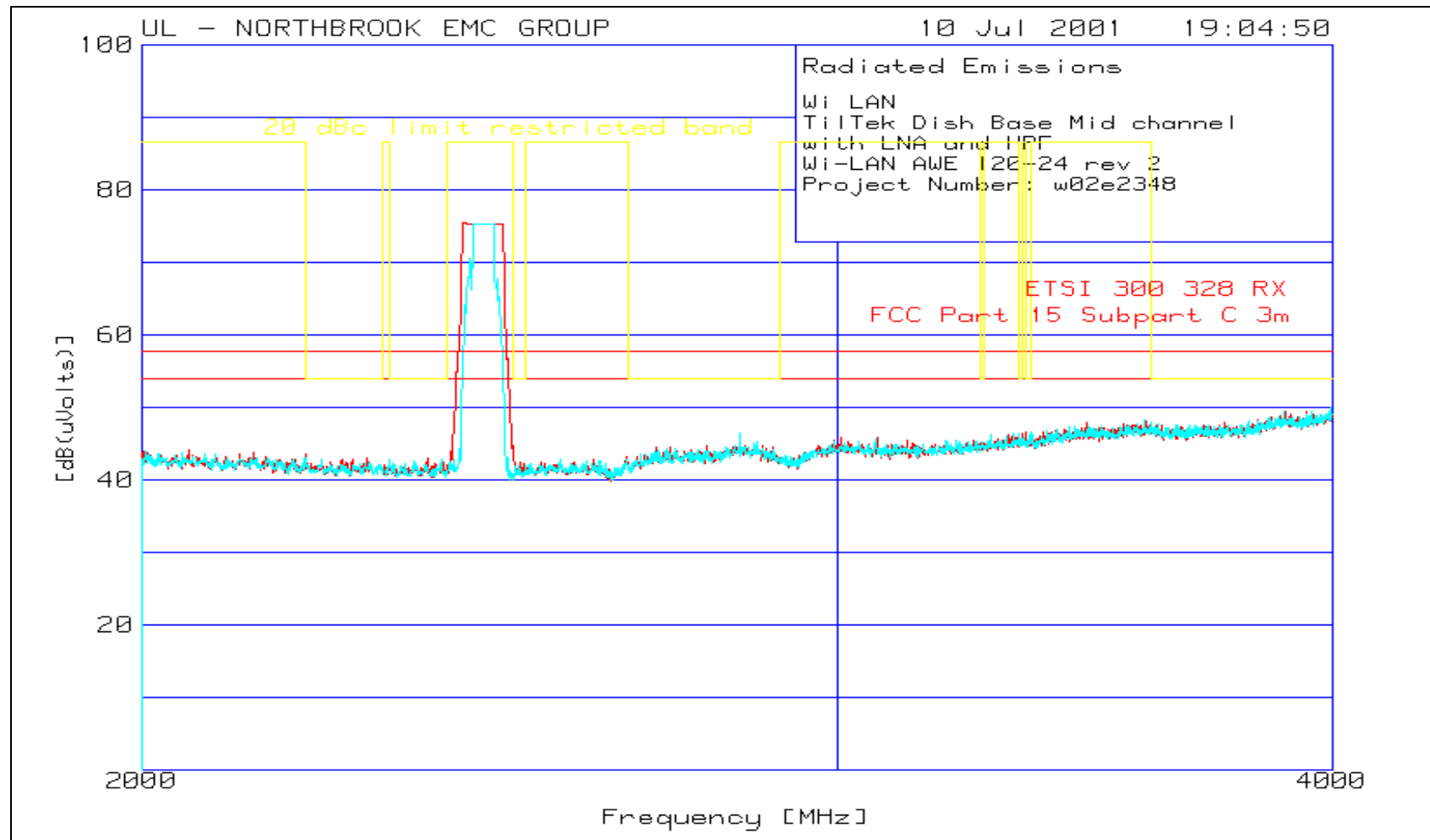
Plot 11  
Radiated Emissions of Omni Antenna – Mid Channel  
AWE 20-24 REV-2 in Remote mode  
30-1000 MHz



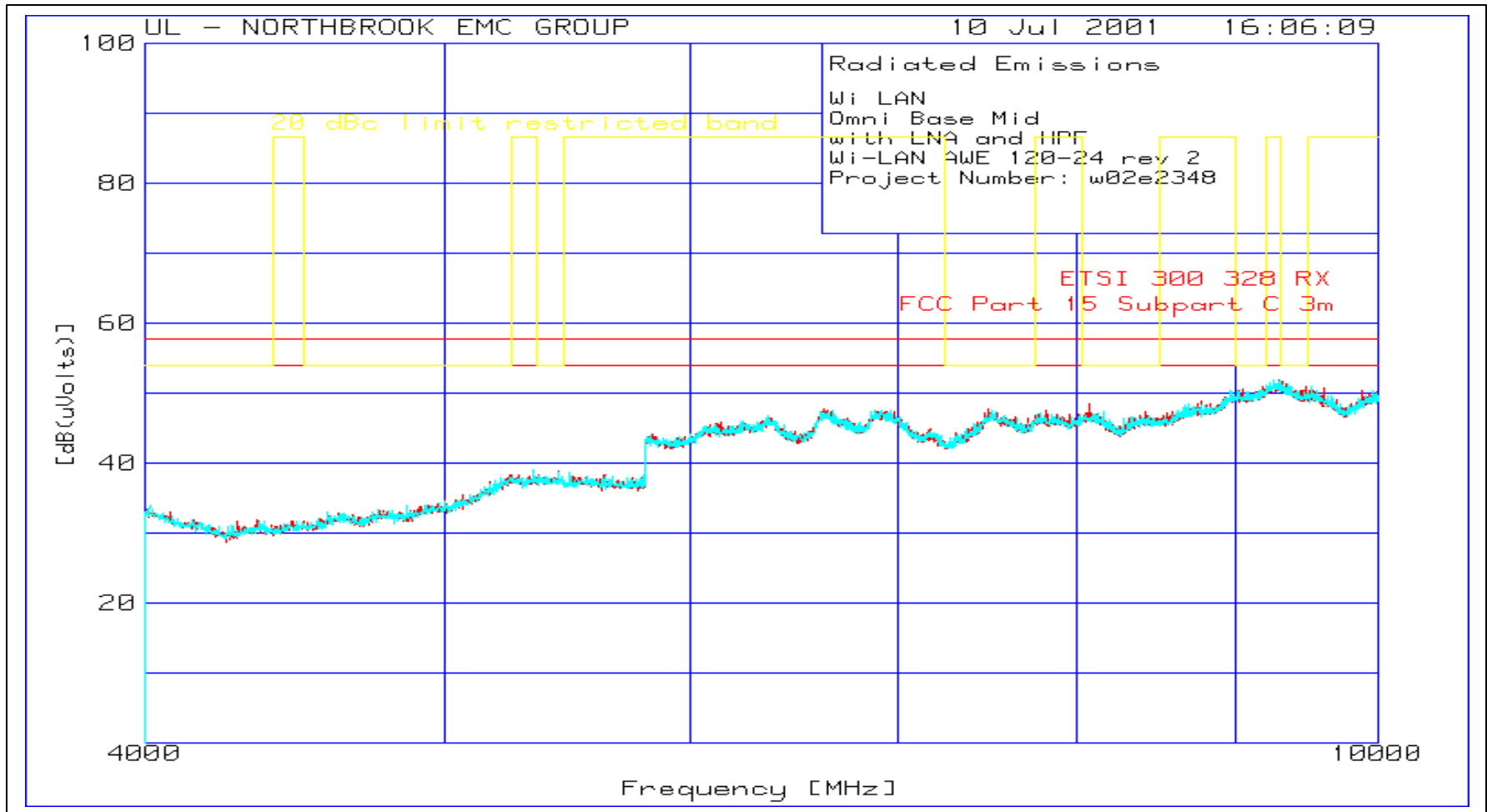
Plot 12  
Radiated Emissions of Omni Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
1-2 GHz



Plot 13  
Radiated Emissions of Omni Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
2-4 GHz

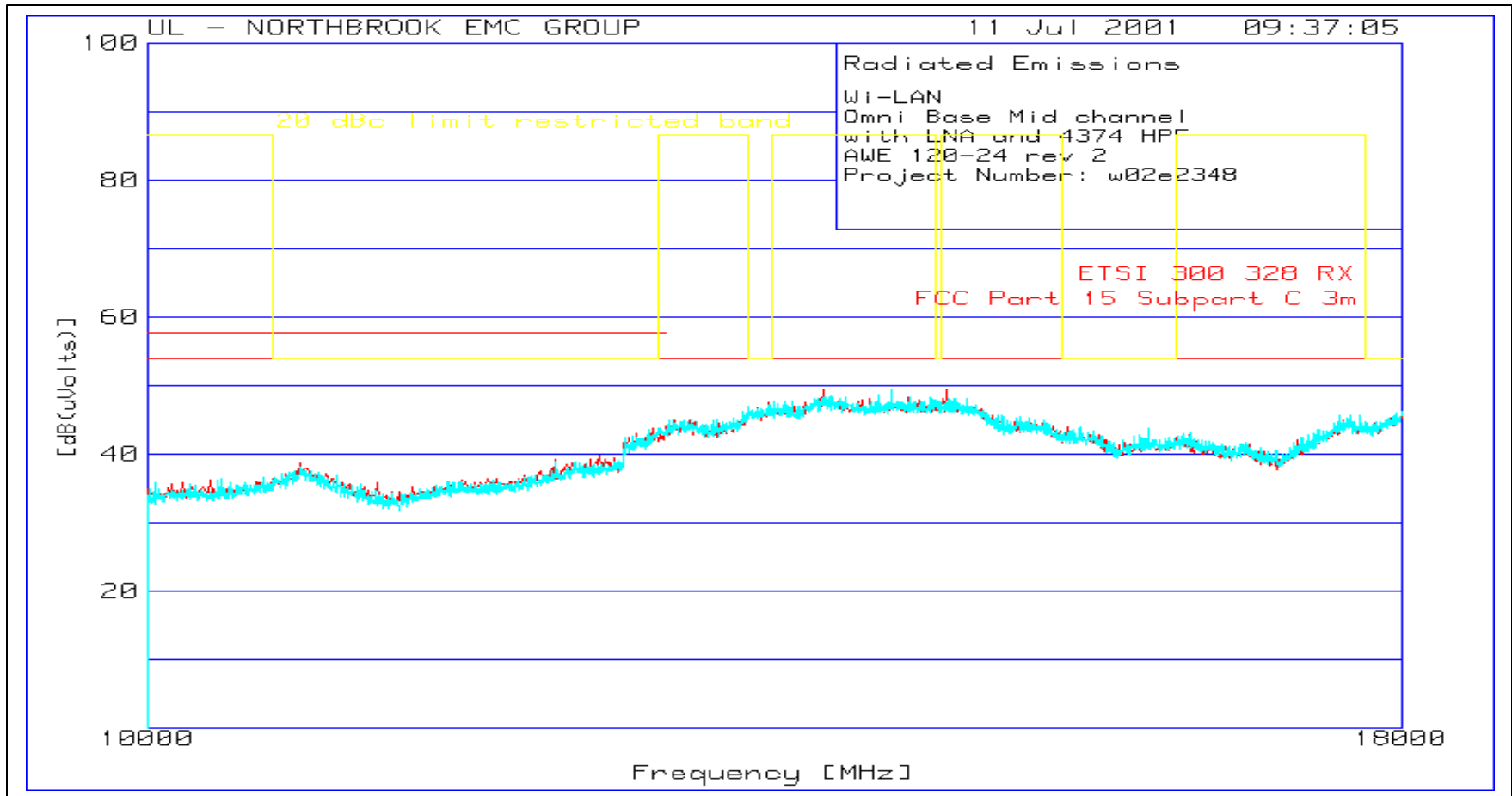


Plot 14  
Radiated Emissions of Omni Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
4-10GHz

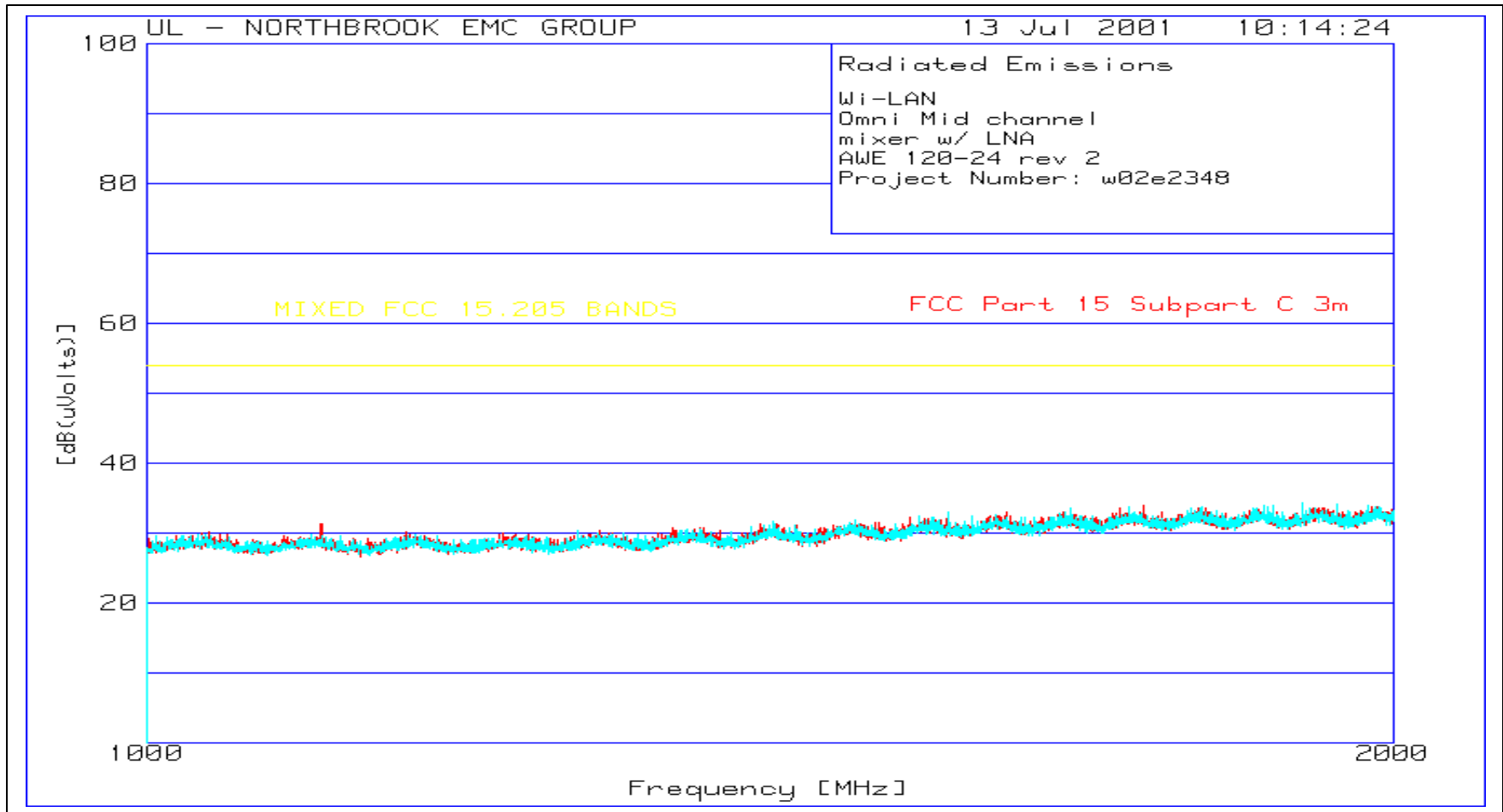




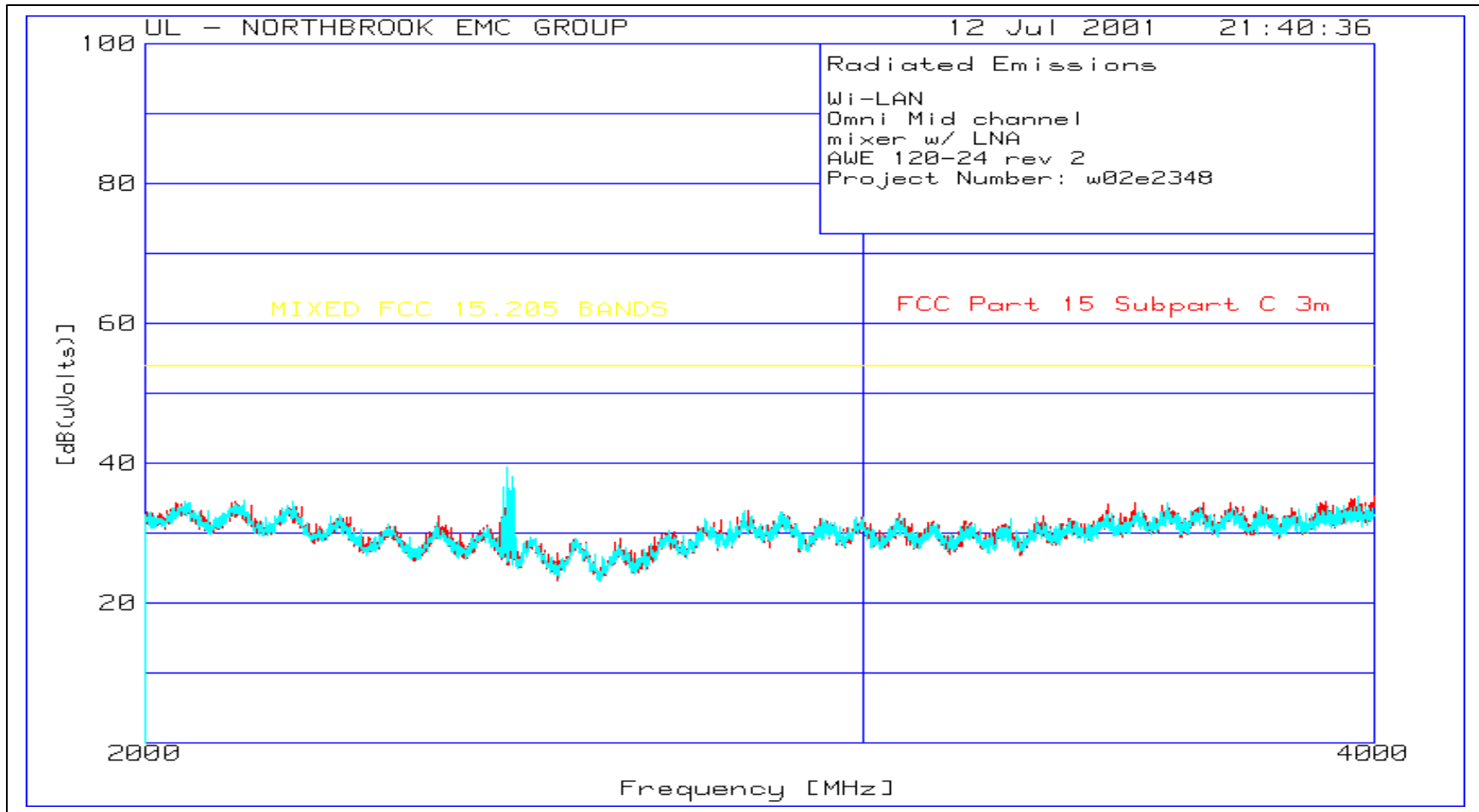
Plot 15  
Radiated Emissions of Omni Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
10-18 GHz



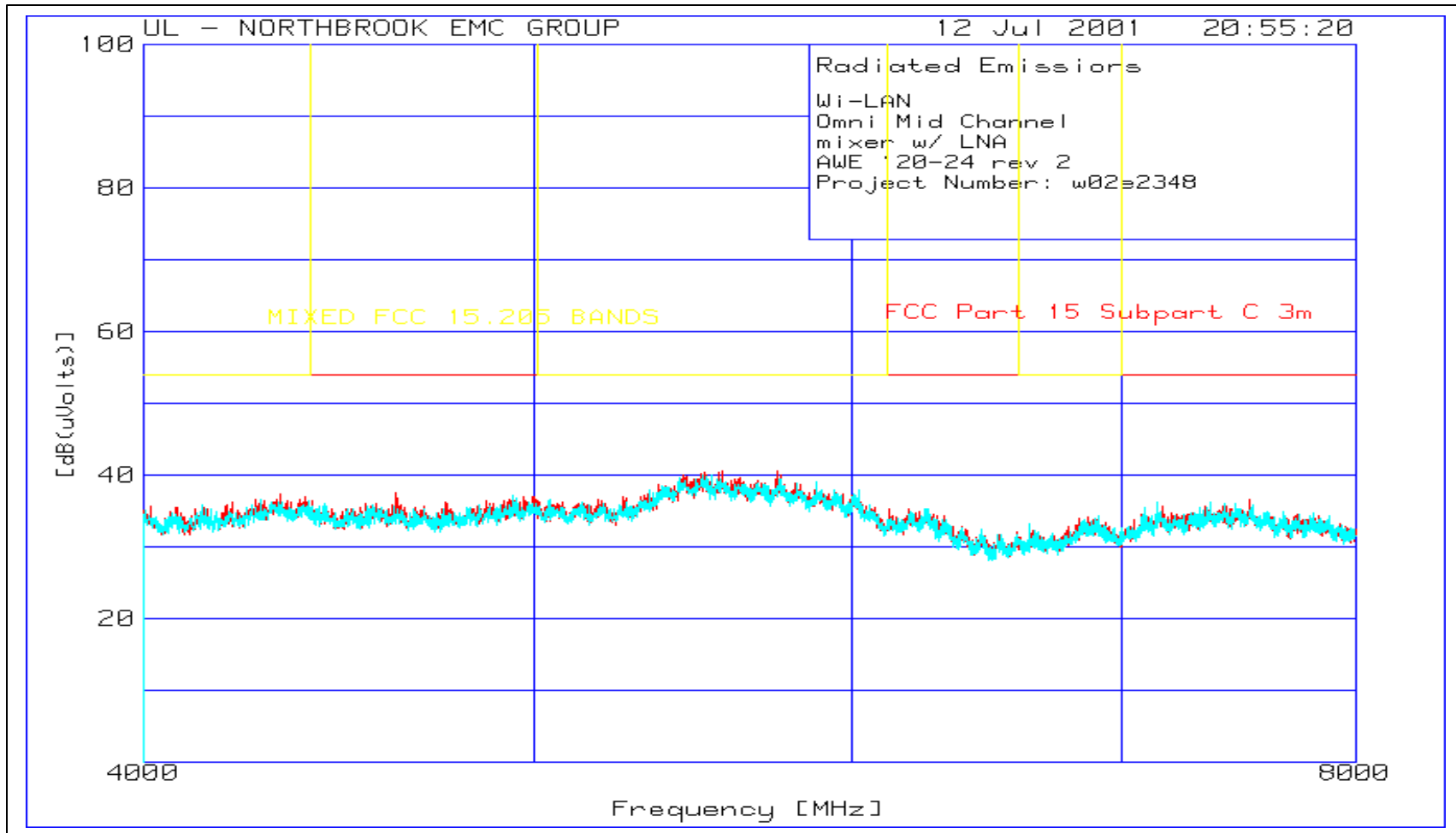
Plot 16  
Radiated Emissions of Omni Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
18-19 GHz



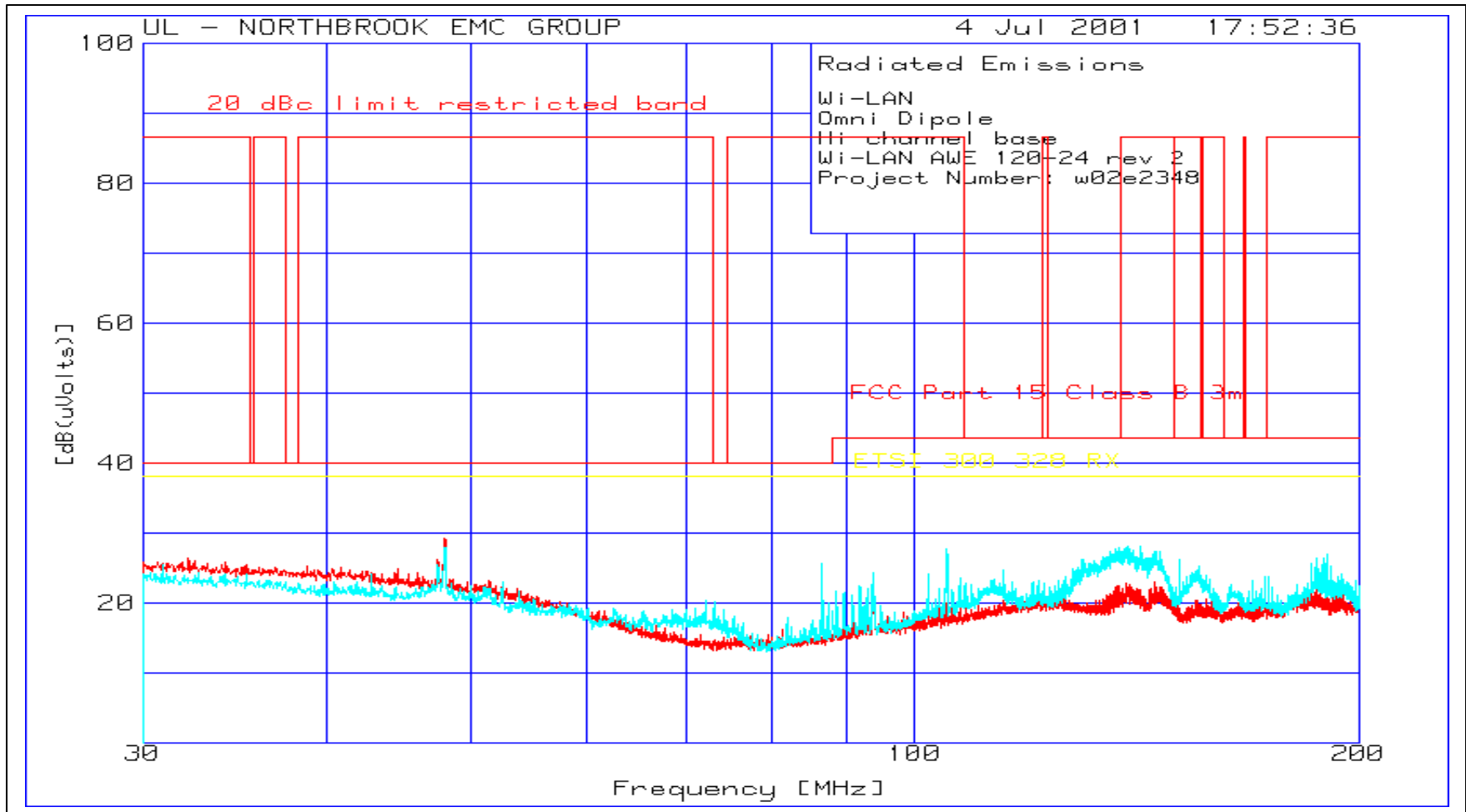
Plot 17  
Radiated Emissions of Omni Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
19-21 GHz



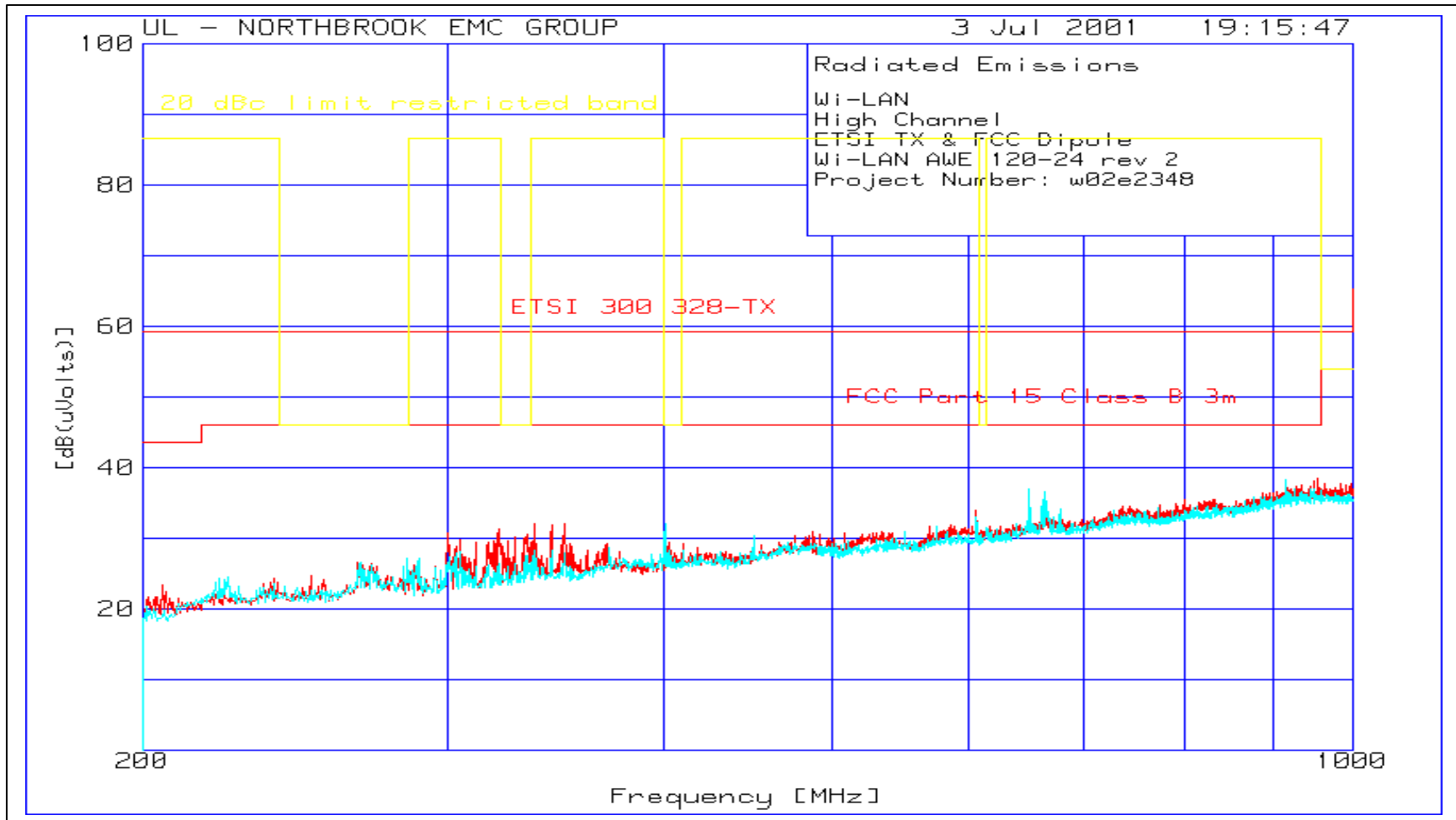
Plot 18  
Radiated Emissions of Omni Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
21-25 GHz



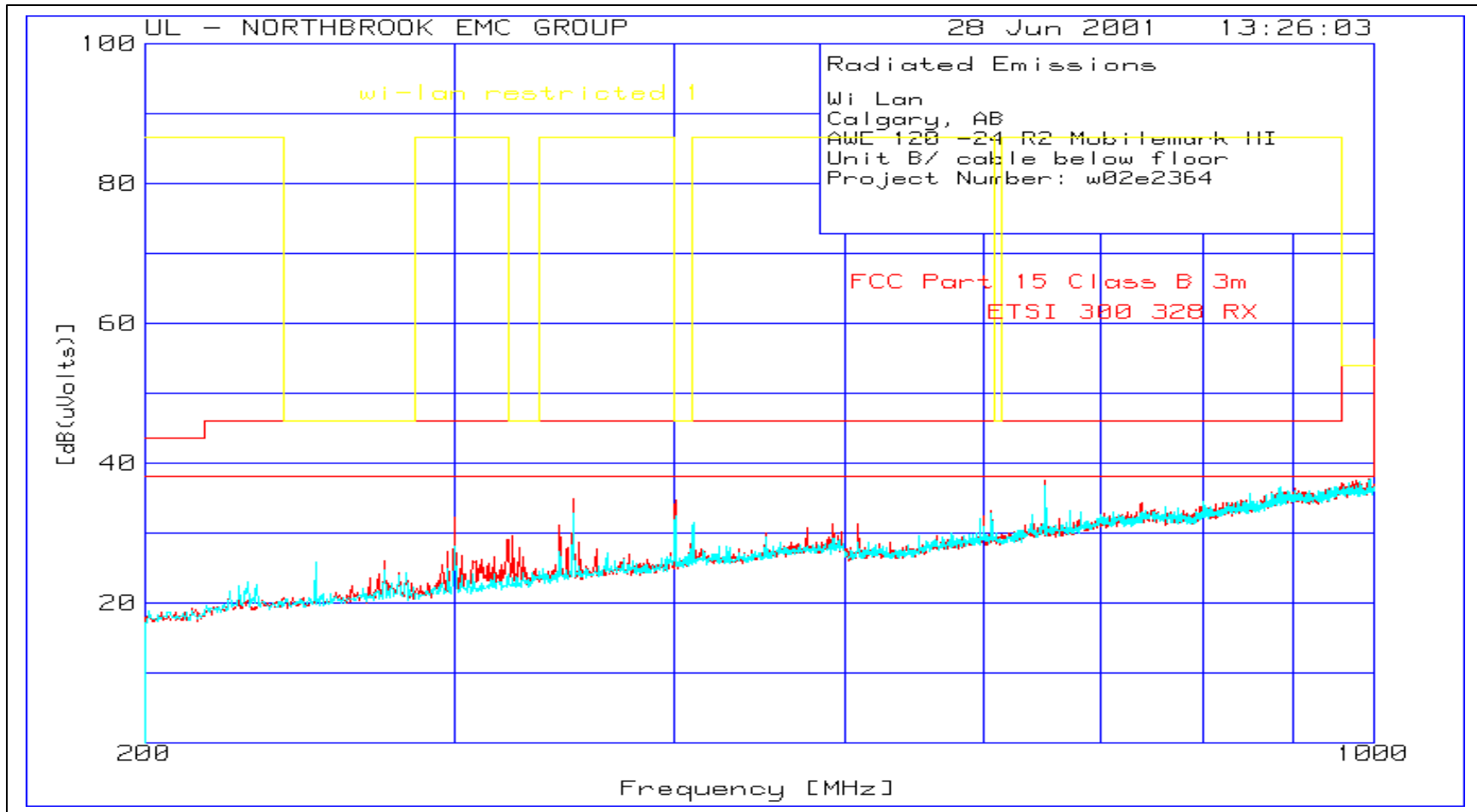
Plot 19  
Radiated Emissions of Omni Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
30-200 MHz



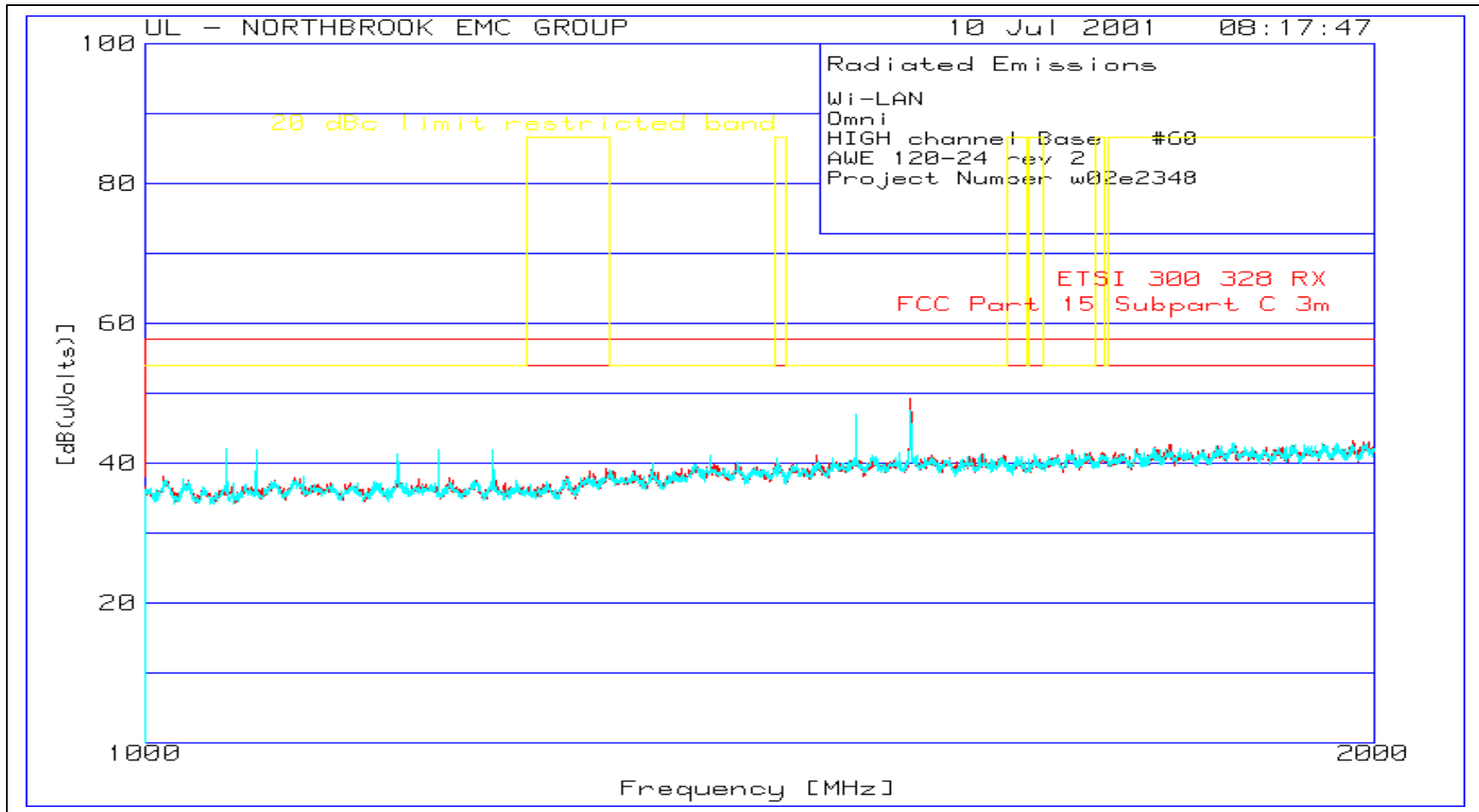
Plot 20  
Radiated Emissions of Omni Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
200-1000 MHz



Plot 21  
Radiated Emissions of Omni Antenna – High Channel  
AWE 20-24 REV-2 in Remote mode  
200-1000 MHz

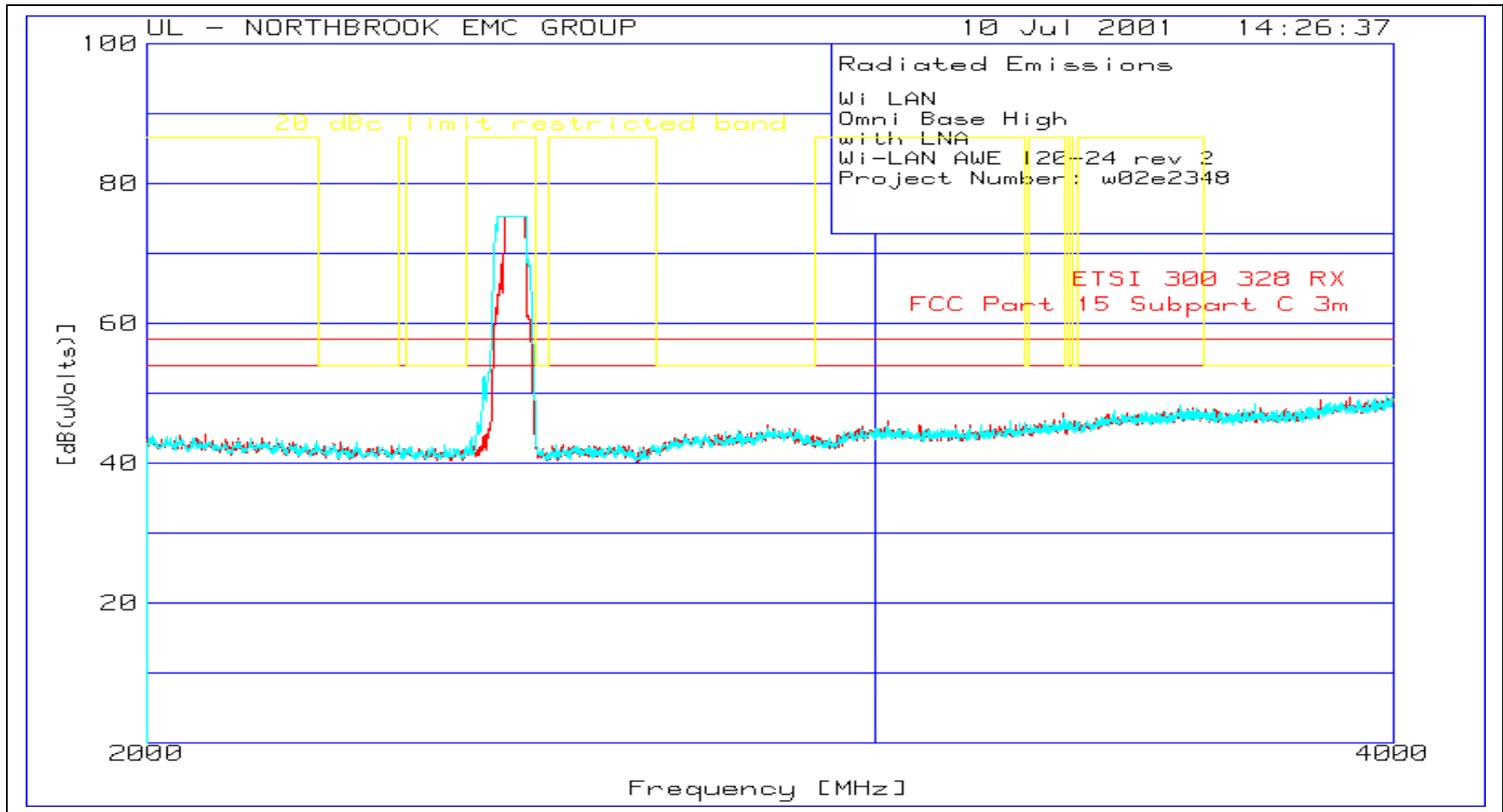


Plot 22  
Radiated Emissions of Omni Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
1-2 GHz

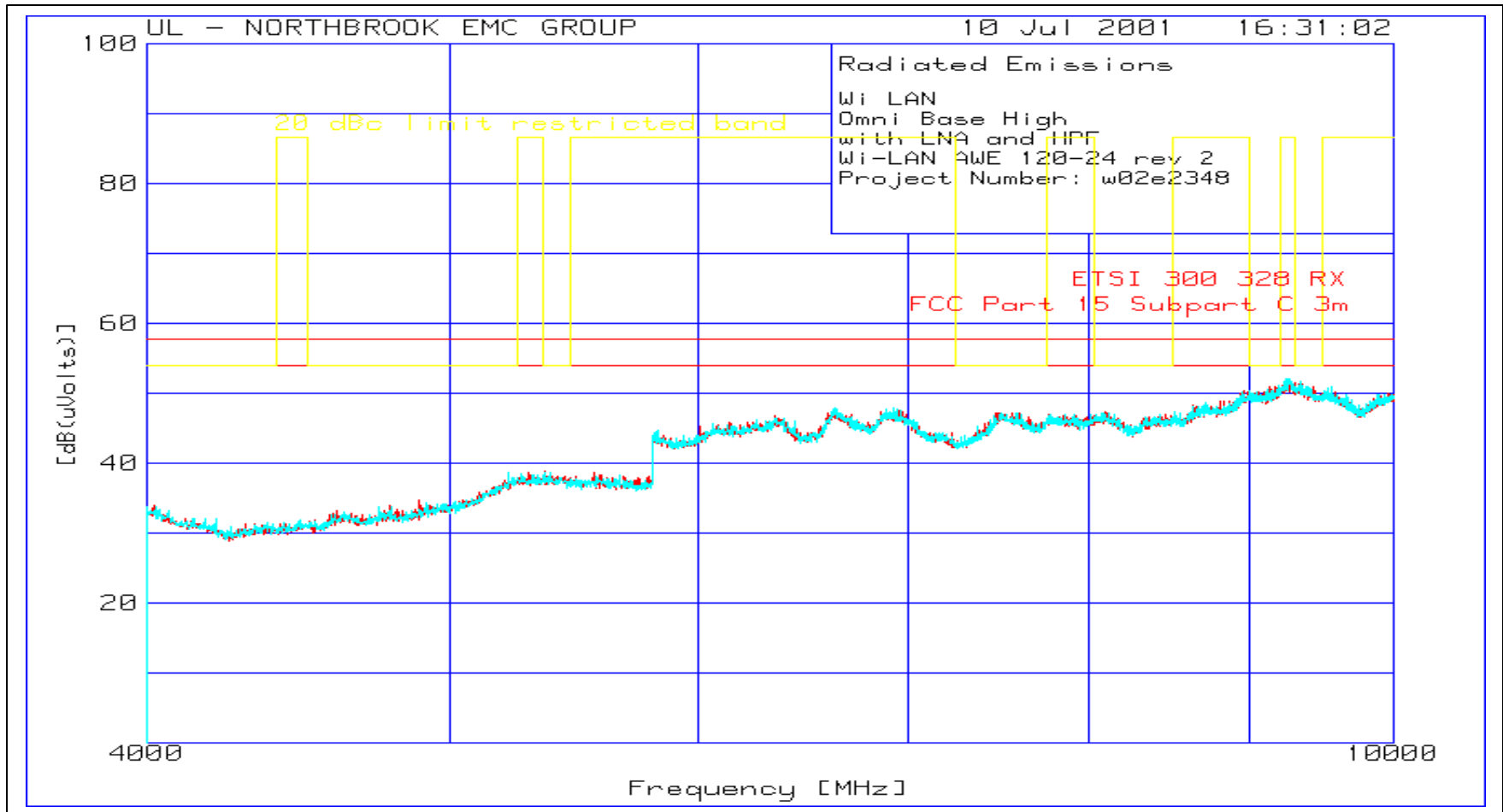




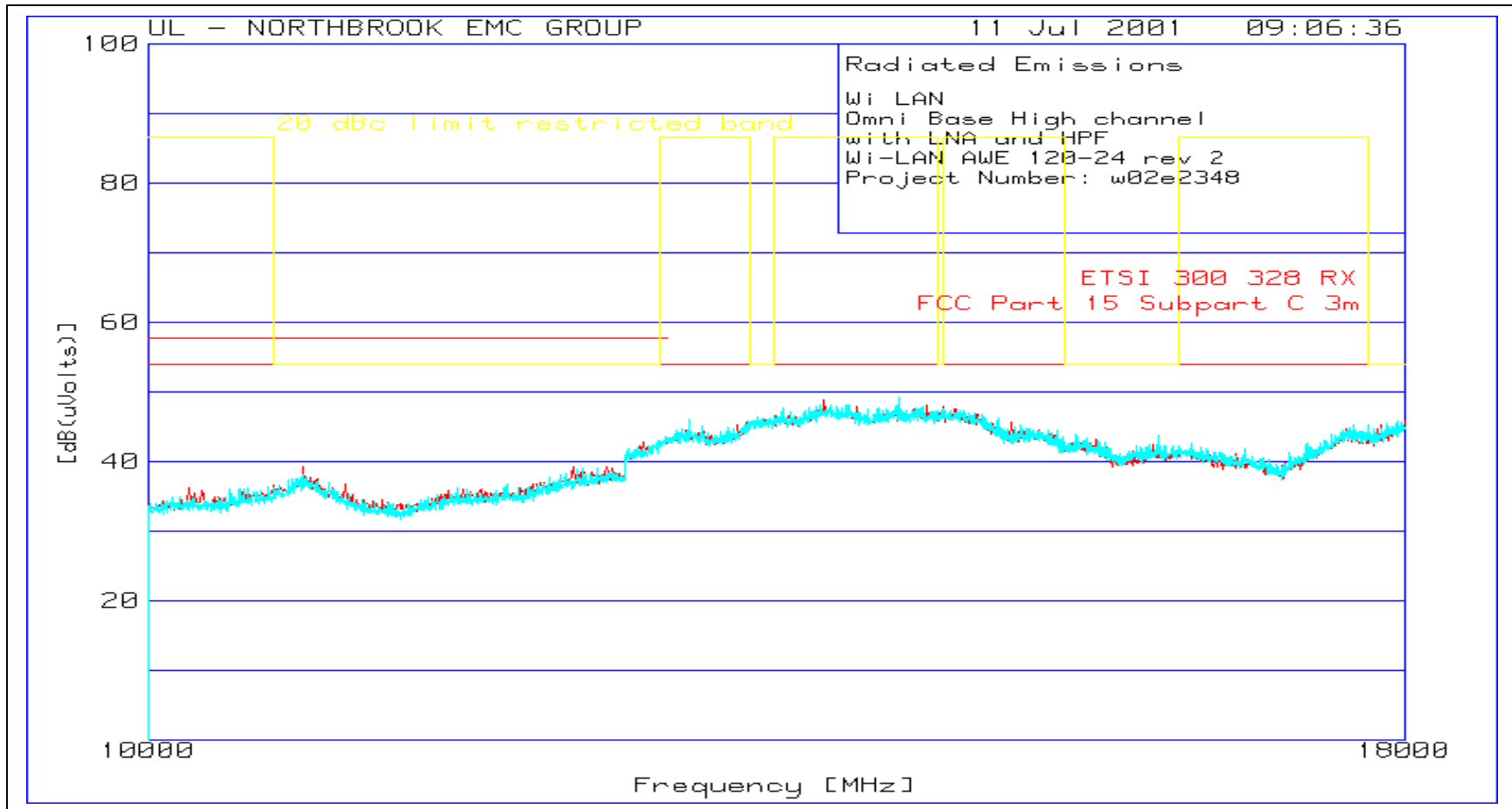
Plot 23  
Radiated Emissions of Omni Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
2-4 GHz



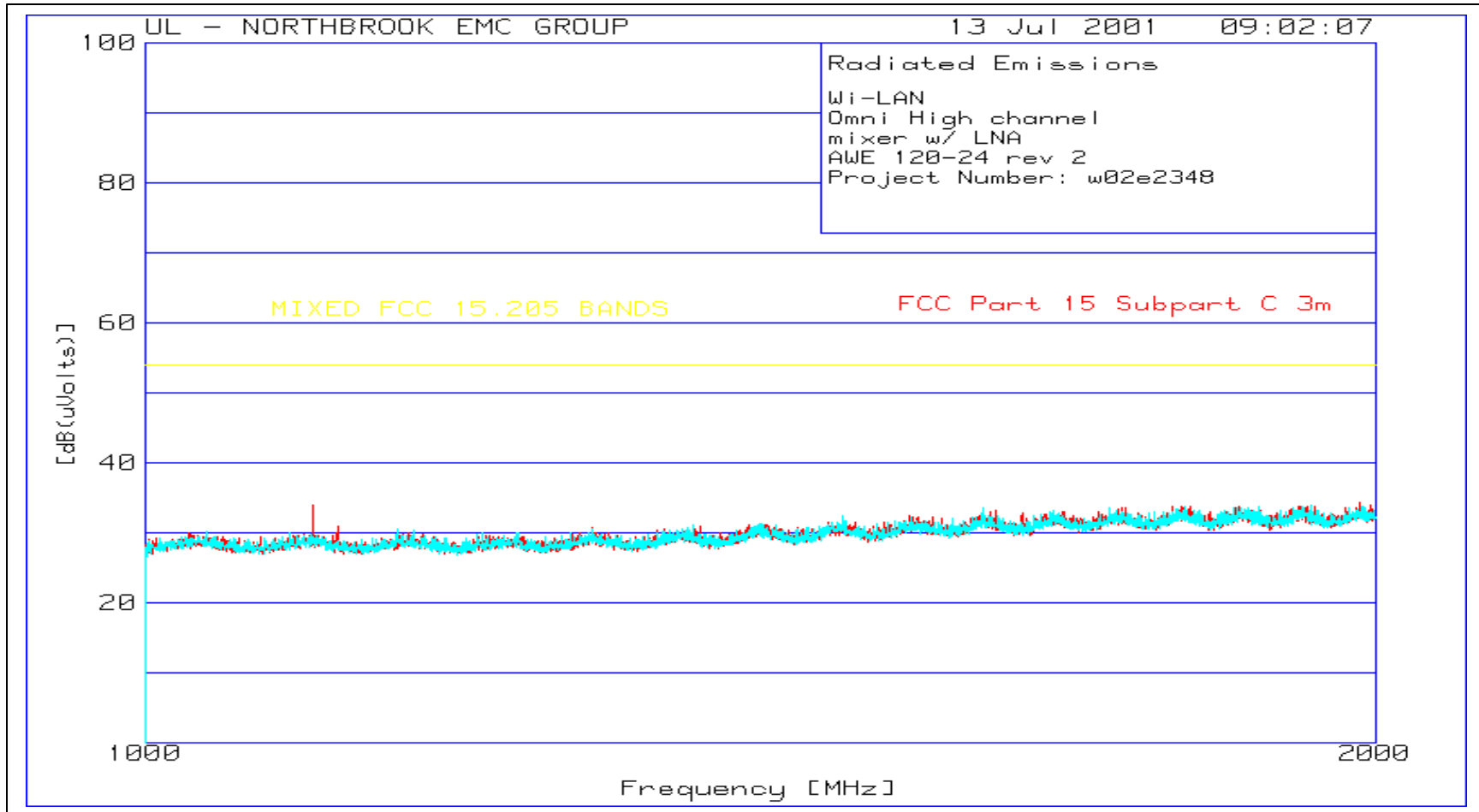
Plot 24  
Radiated Emissions of Omni Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
4-10GHz



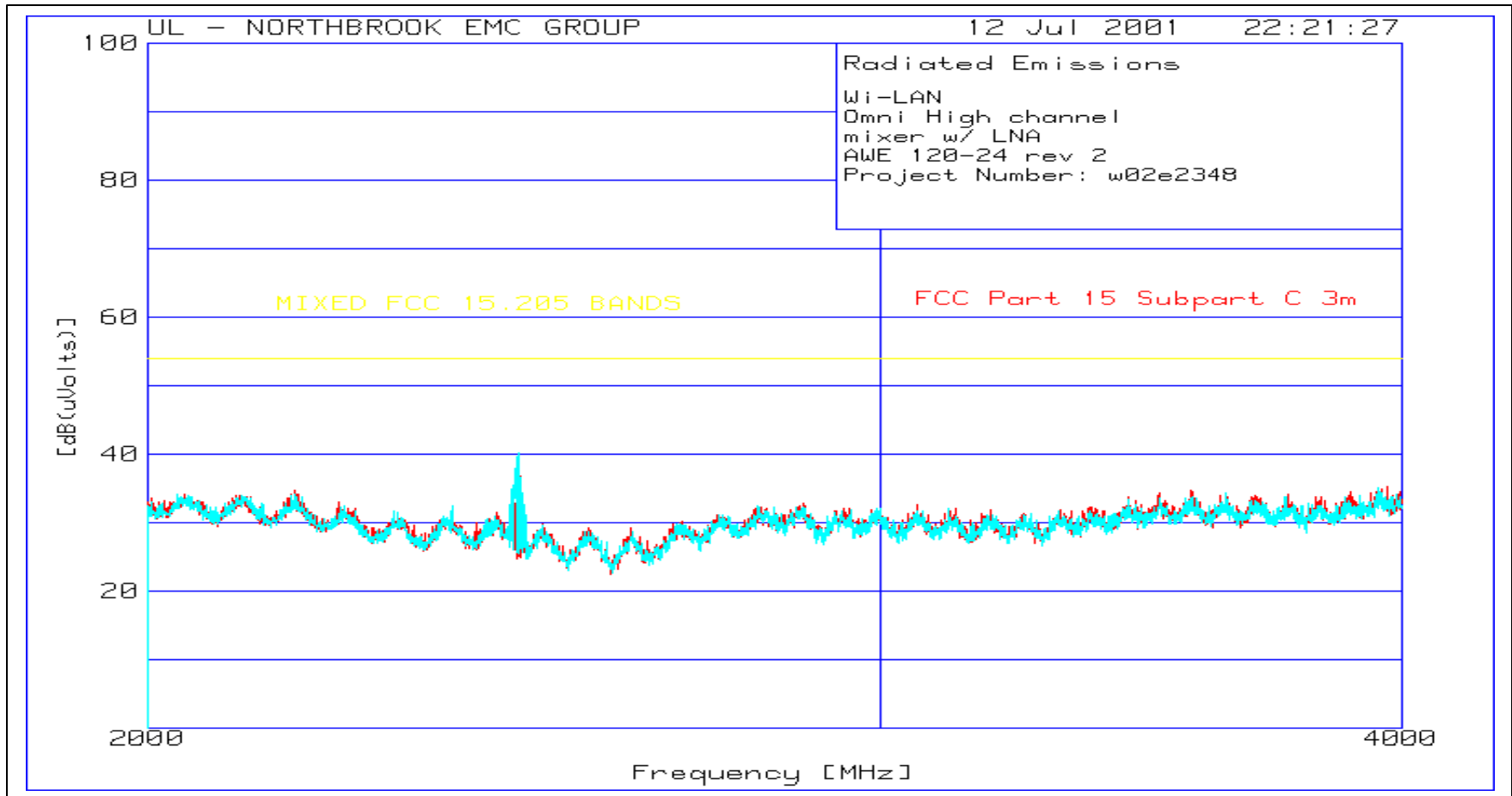
Plot 25  
Radiated Emissions of Omni Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
10-18 GHz



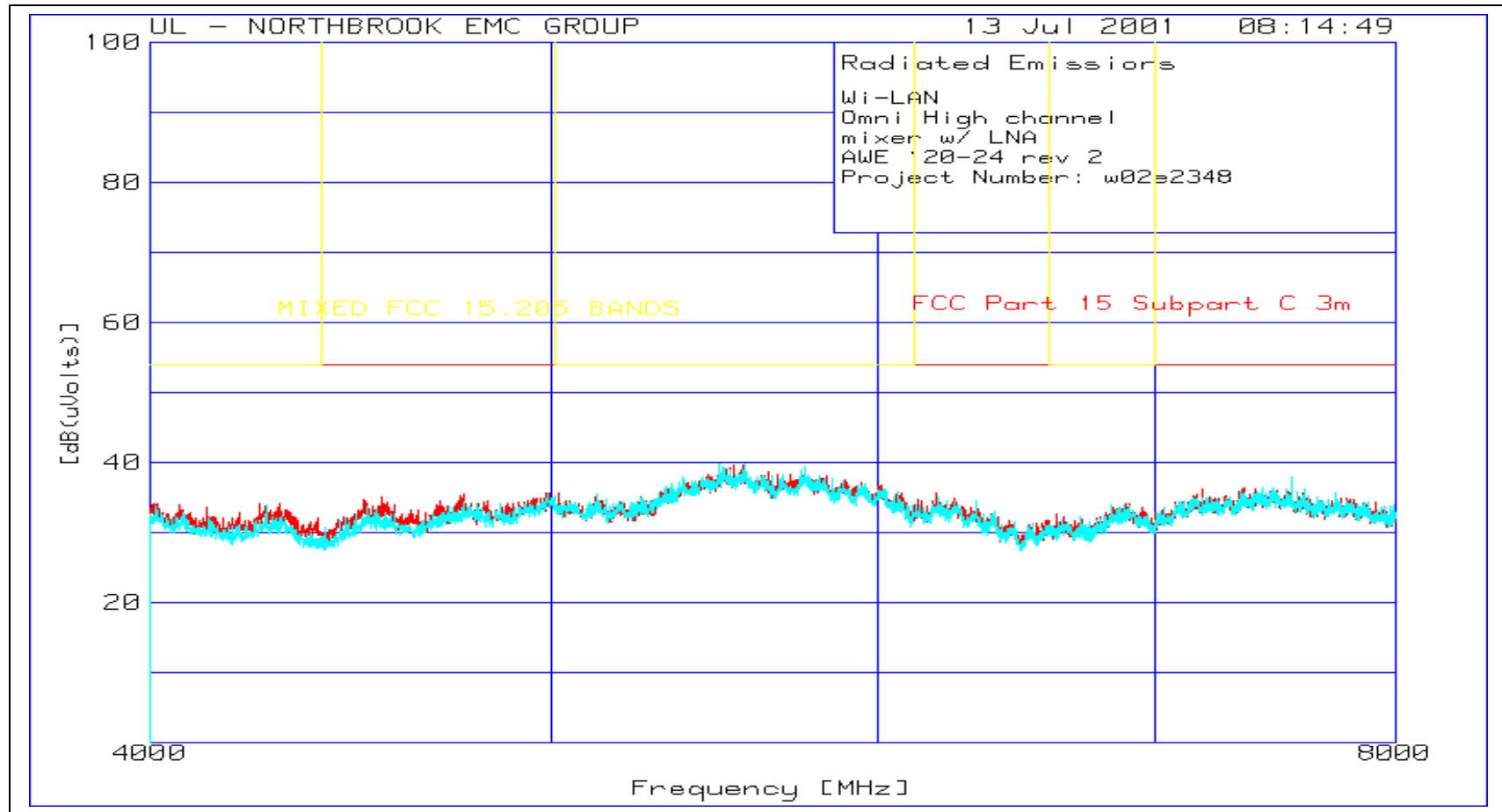
Plot 26  
Radiated Emissions of Omni Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
18-19 GHz



Plot 27  
Radiated Emissions of Omni Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
19-21 GHz



Plot 28  
Radiated Emissions of Omni Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
21-25 GHz



4.2.2 TilTek Dish Antenna

Test Lab: MPB Technologies Inc. Airdrie			Product:			
Test Personnel: Q. Nguyen, S. Tarkowski			AWE 120-24 rev 2			
Test Date: 27 June & 3, 4, 9, 10, 11 July 2001						
Test Result, AWE 120-24 rev 2						
LOW Channel: <b>PASS</b>						
MID Channel: <b>PASS</b>						
HIGH Channel: <b>PASS</b>						
Objectives/Criteria			Specifications			
<p>The Radiated E-Field emissions produced by a system or sub-system, measured at a distance of 3m from the EUT, shall not exceed these limits for the specifications <i>within the restricted bands of operation (RBOs)</i>. Any emissions lying outside the RBOs shall not exceed the level of the fundamental transmission.</p> <p><b>Emission levels should meet the requirements with a margin of 6dB.</b></p>			FCC Part 15.209 and 15.205			
			Frequency		Limit (QP @ 3m)	
			[MHz]		[dBμV/m]	
			30 – 88		40.00	
			88 – 216		43.52	
			216 – 960		46.02	
Above 960		53.98				
<b>Vertical:</b>			<b>Horizontal:</b>			
f (MHz)	Field Strength (dBμV/m)	Delta (dB from limit)	f (MHz)	Field Strength (dBμV/m)	Delta (dB from limit)	
LOW Channel:						
			39.4	18.3	-21.7	
			40	17.4	-20.8	
MID Channel:						
194.3955	54	-28.16	56.7745	49.5	-27.1	
HIGH Channel:						
There were no emissions measured within -6 dB of the specified limit. Please refer to the test data and plots (Plots 29 through 54) for more detail.						

**Test Data**  
**Radiated Emissions**  
**TiITek Dish Antenna**  
**LOW Channel**  
**AWE 20-24 REV-2 in Base mode**  
**30-200 MHz**

Wi-LAN  
Til Tek Dish  
Low channel base  
Wi-LAN AWE 120-24 rev 2  
Project Number: w02e2348

Test	Meter	Gain/Loss	Transducer	Level	Limit:1	2	3	4	
Frequency	Reading	Factor	Factor	[dB(uVolts)]					
[MHz]	[dB(uV)]		[dB]	[dB]					
=====									
39.4	-.4 qp	.9	17.8	18.3	86.6	40	38.2	N/A	
Azimuth: 125 Height:316 Horz					Margin [dB]	-68.3	-21.7	-19.9	N/A
40	-1.1 qp	.9	17.6	17.4	86.6	40	38.2	N/A	
Azimuth: 124 Height:360 Horz					Margin [dB]	-69.2	-22.6	-20.8	N/A

LIMIT 1: 20 dBc limit restricted band  
LIMIT 2: FCC Part 15 Class B 3m  
LIMIT 3: ETSI 300 328 RX  
LIMIT 4: NONE



**Test Data**  
**Radiated Emissions**  
**TiITek Dish Antenna**  
**Mid Channel**  
**AWE 20-24 REV-2 in Remote mode**  
**30-1000 MHz**

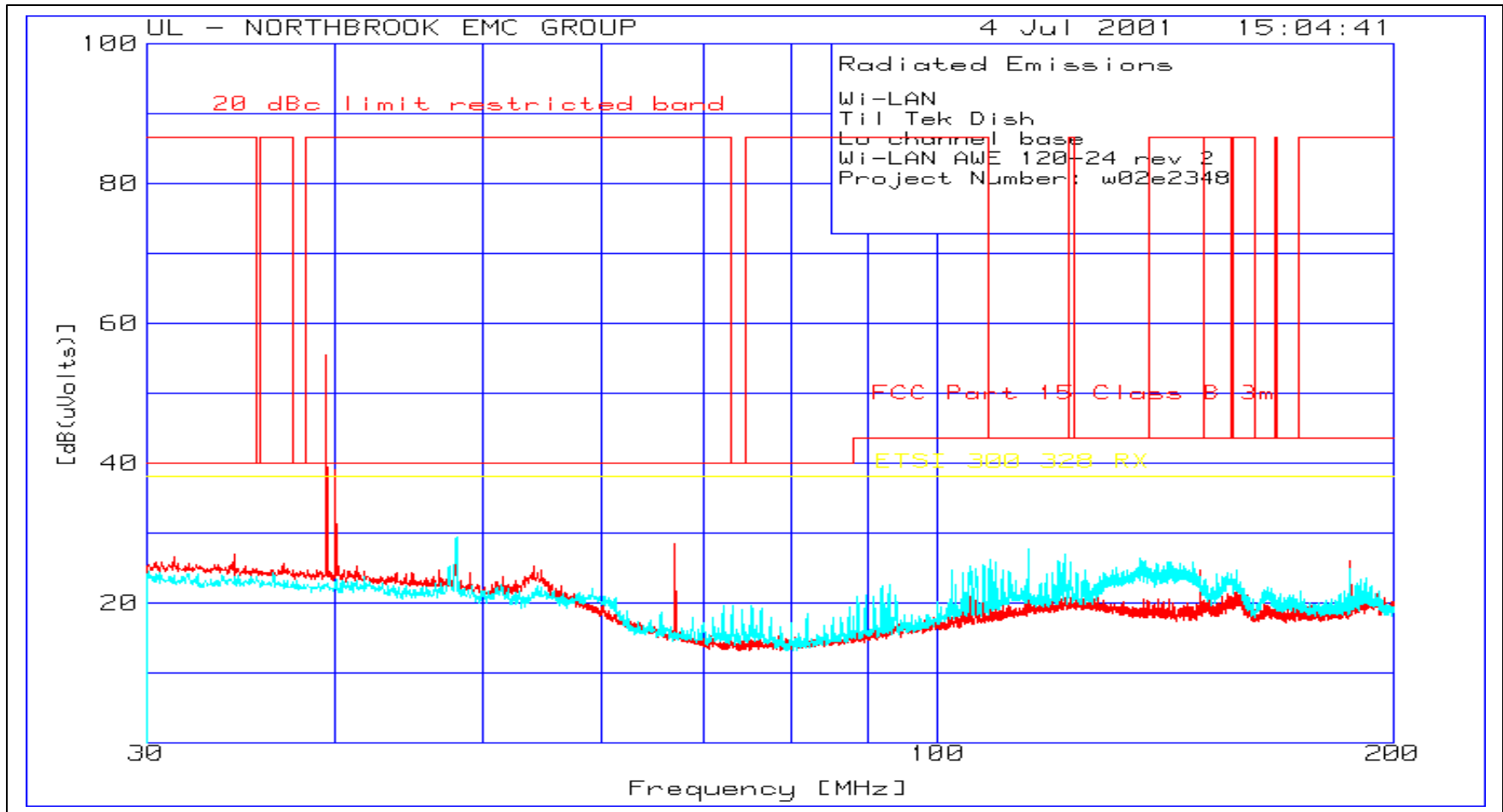
Wi-LAN  
Mid channel base  
FCC Tilttek Dish TX  
Wi-LAN AWE 120-24 rev 2  
Project Number: w02e2348

Test	Meter	Gain/Loss	Transducer	Level	Limit:1	2	3	4
Frequency	Reading	Factor	Factor	[dB(uVolts)]				
[MHz]	[dB(uV)]	[dB]	[dB]					
56.7745	-1.2 qp	1.1	13	12.9	49.5	40	86.6	59.2
Azimuth: 359	Height:100	Horz	Margin [dB]	-36.6	-27.1	-73.7	-46.3	
194.3955	2.44 qp	2.4	10.5	15.34	54	43.5	86.6	59.2
Azimuth: 125	Height:103	Vert	Margin [dB]	-38.66	-28.16	-71.26	-43.86	

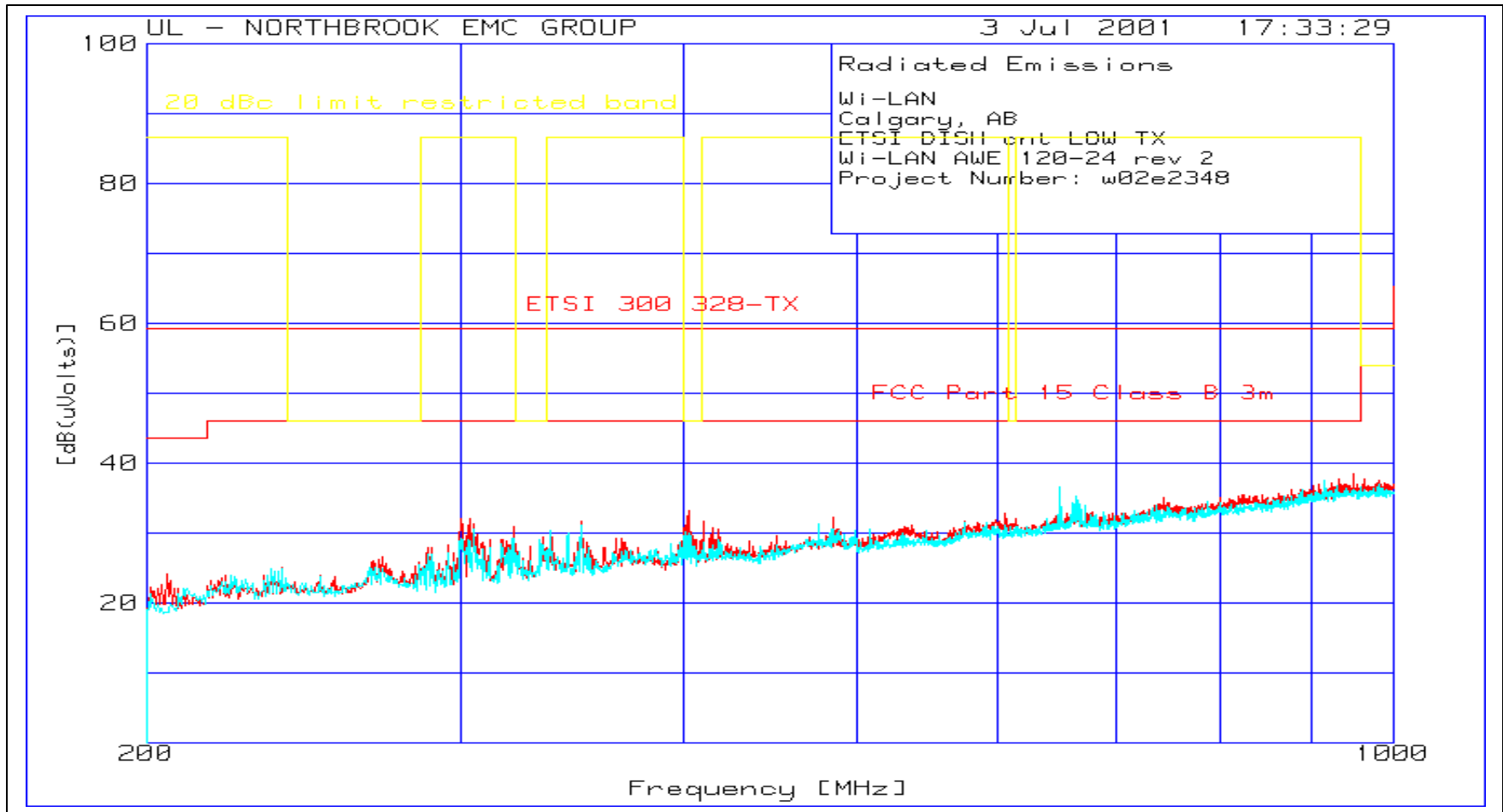
LIMIT 1: FCC Part 15 Class A 3m  
LIMIT 2: FCC Part 15 Class B 3m  
LIMIT 3: 20 dBc limit restricted band  
LIMIT 4: ETSI 300 328 TX

pk - Peak detector  
qp - Quasi-Peak detector  
av - Average detector

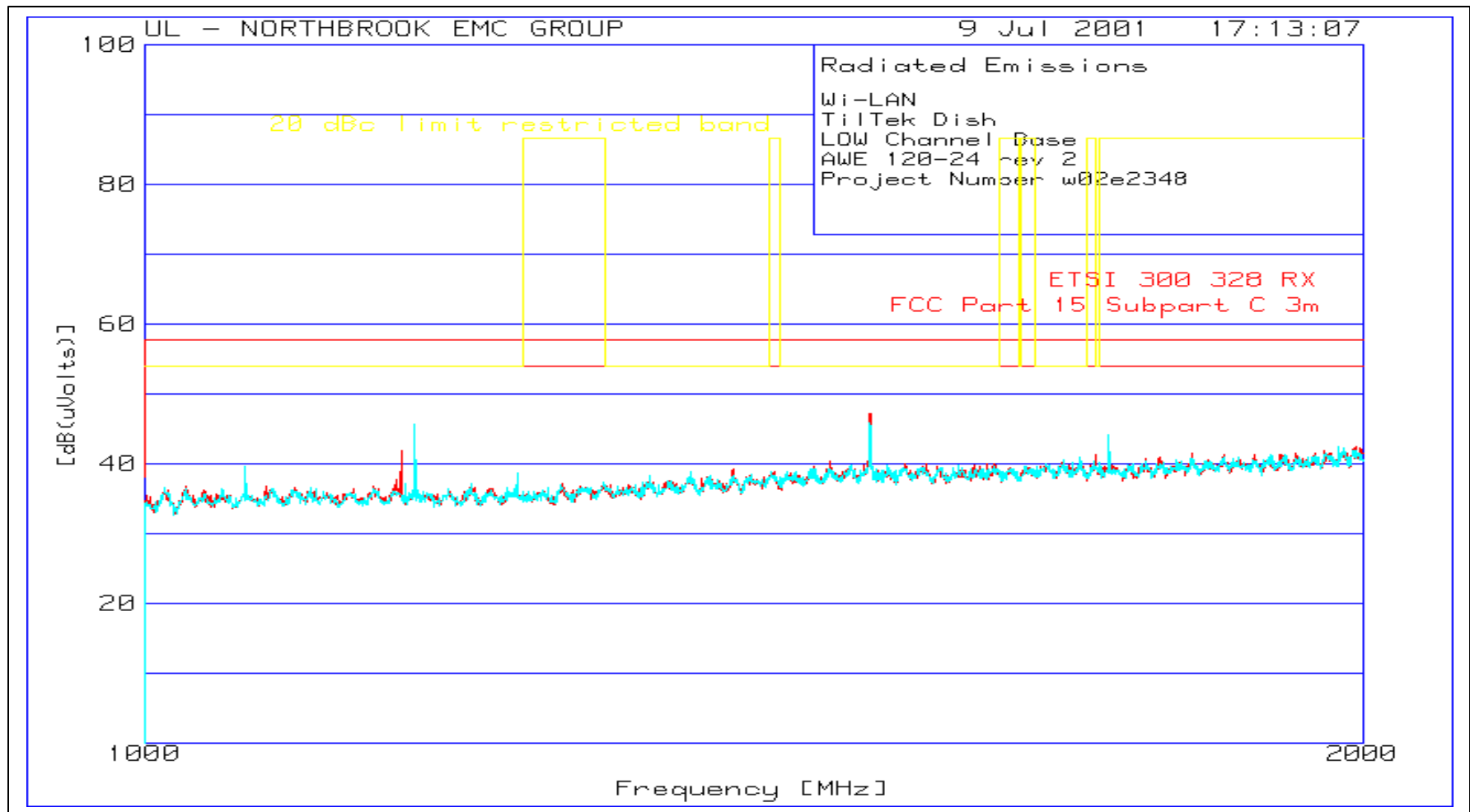
Plot 29  
Radiated Emissions of TilTek Dish Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
30-200 MHz



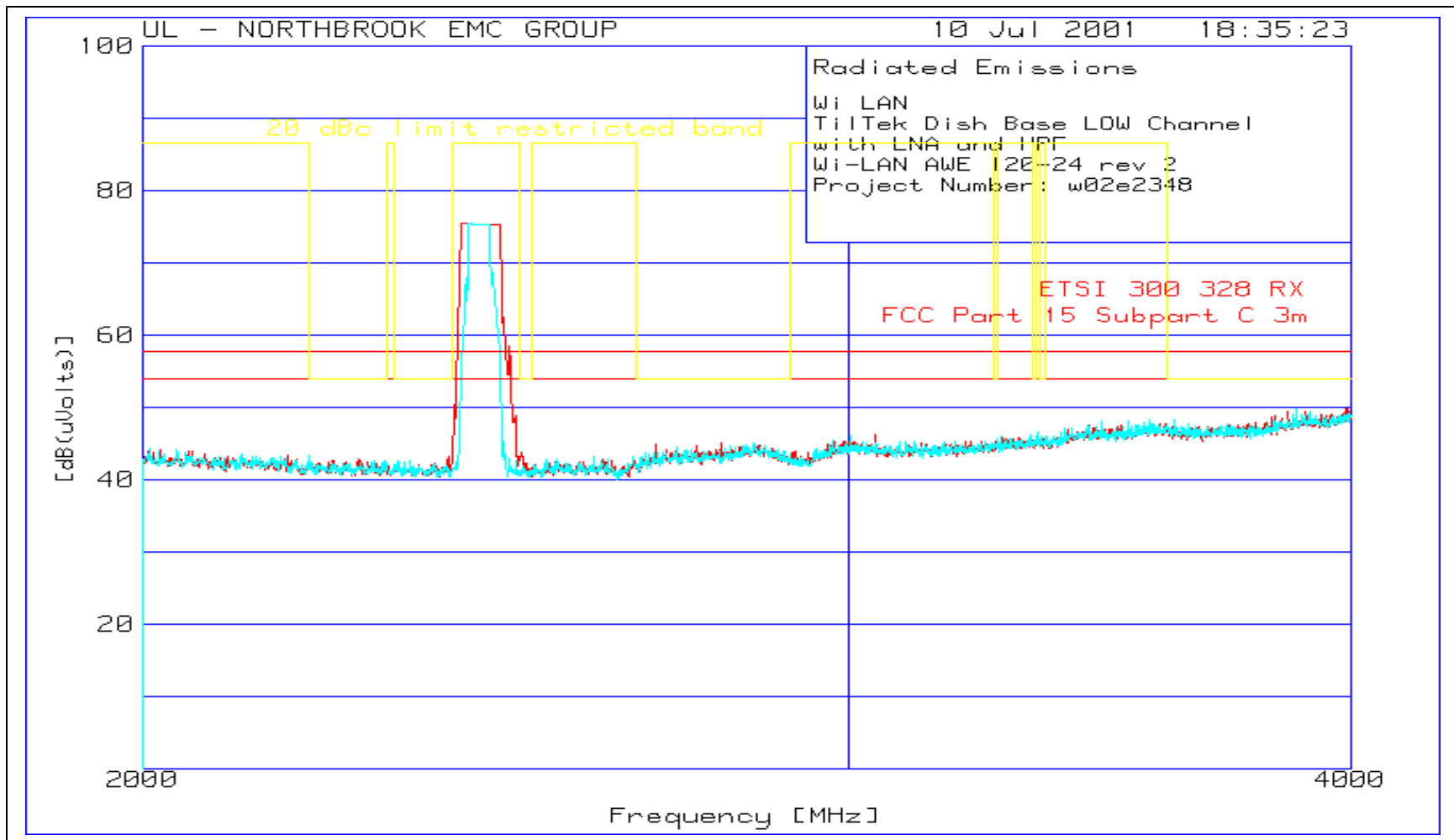
Plot 30  
Radiated Emissions of TilTek Dish Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
200-1000 MHz



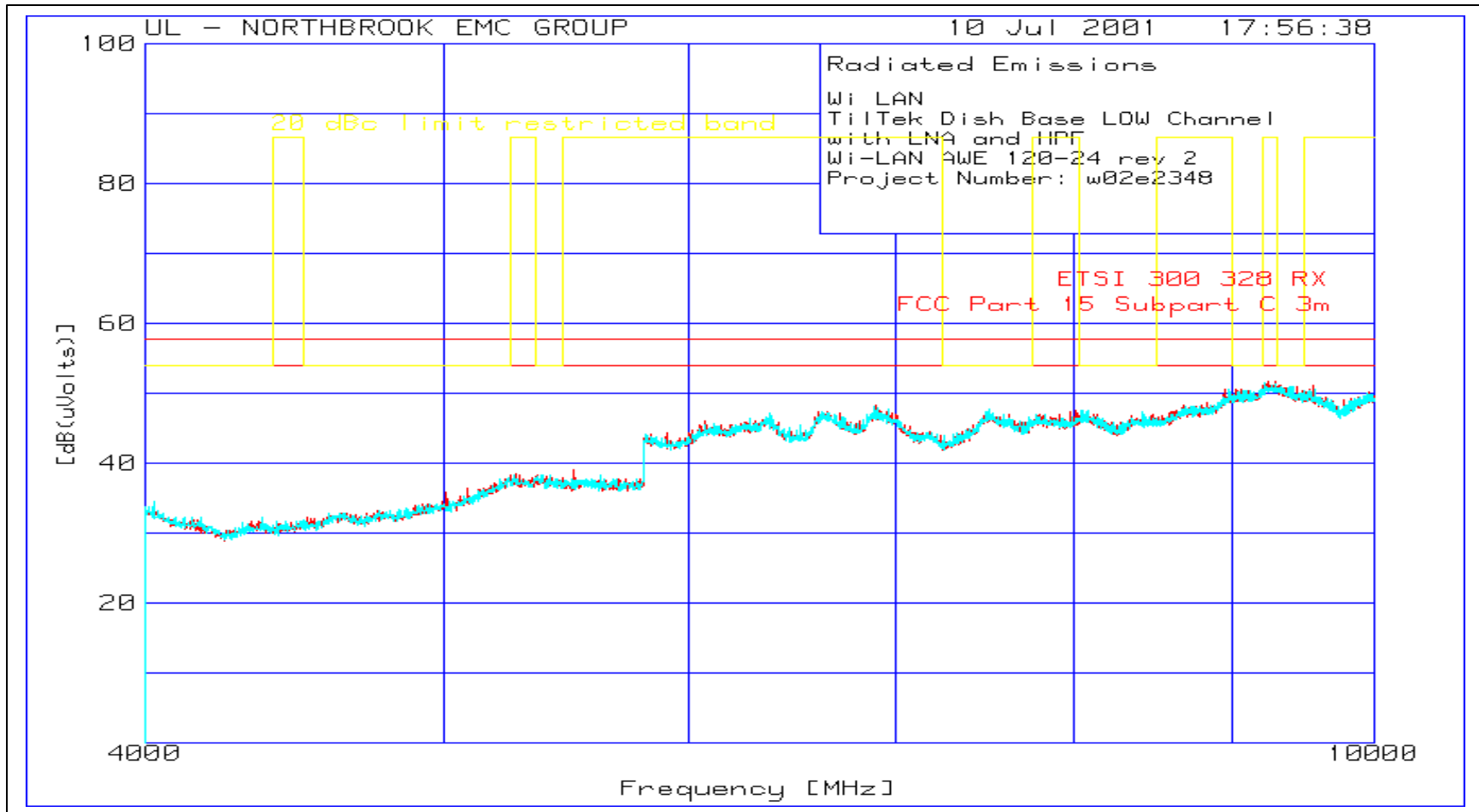
Plot 31  
Radiated Emissions of TilTek Dish Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
1-2 GHz



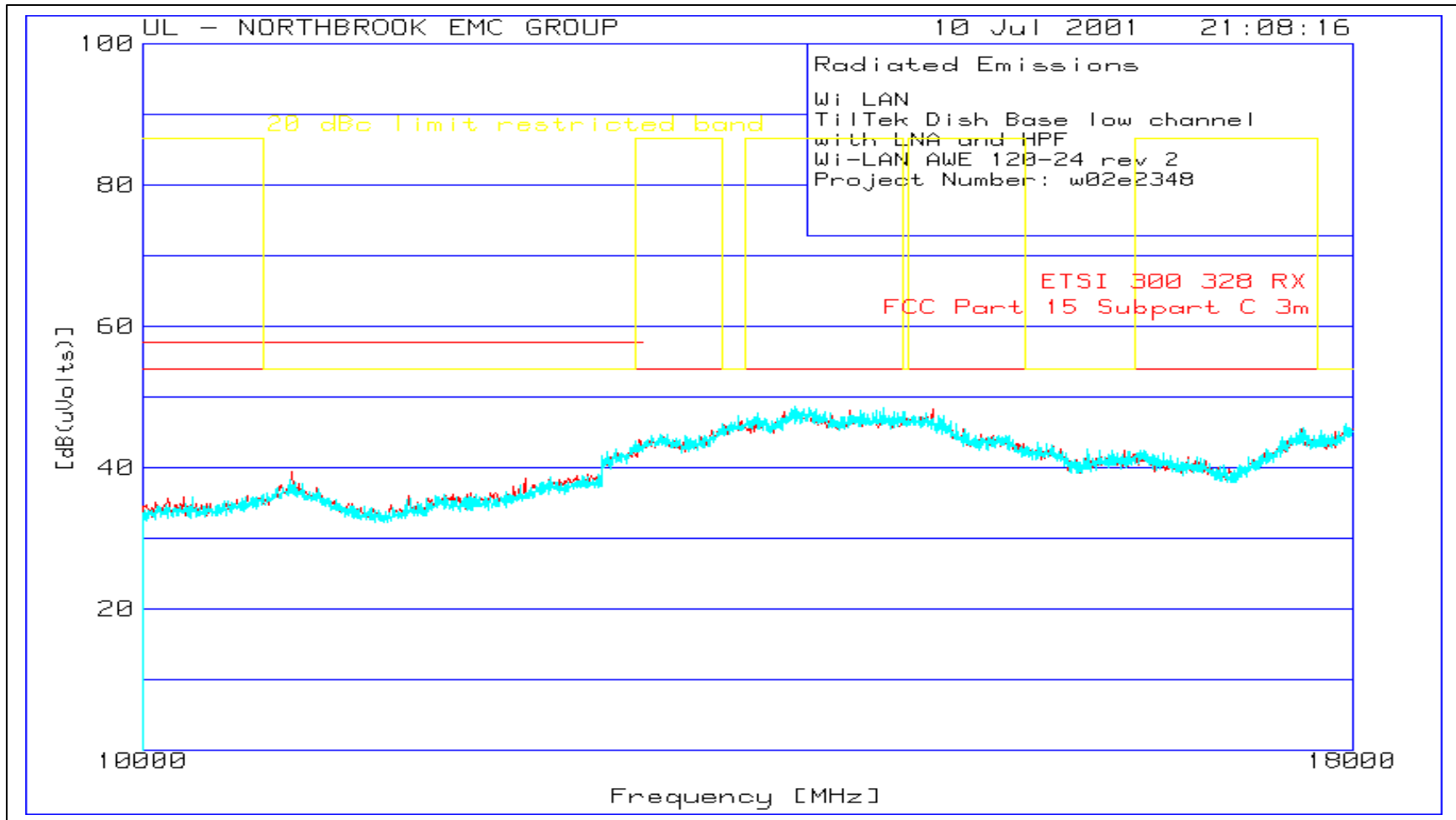
**Plot 32**  
**Radiated Emissions of TilTek Dish Antenna – Low Channel**  
**AWE 20-24 REV-2 in Base mode**  
**2-4 GHz**



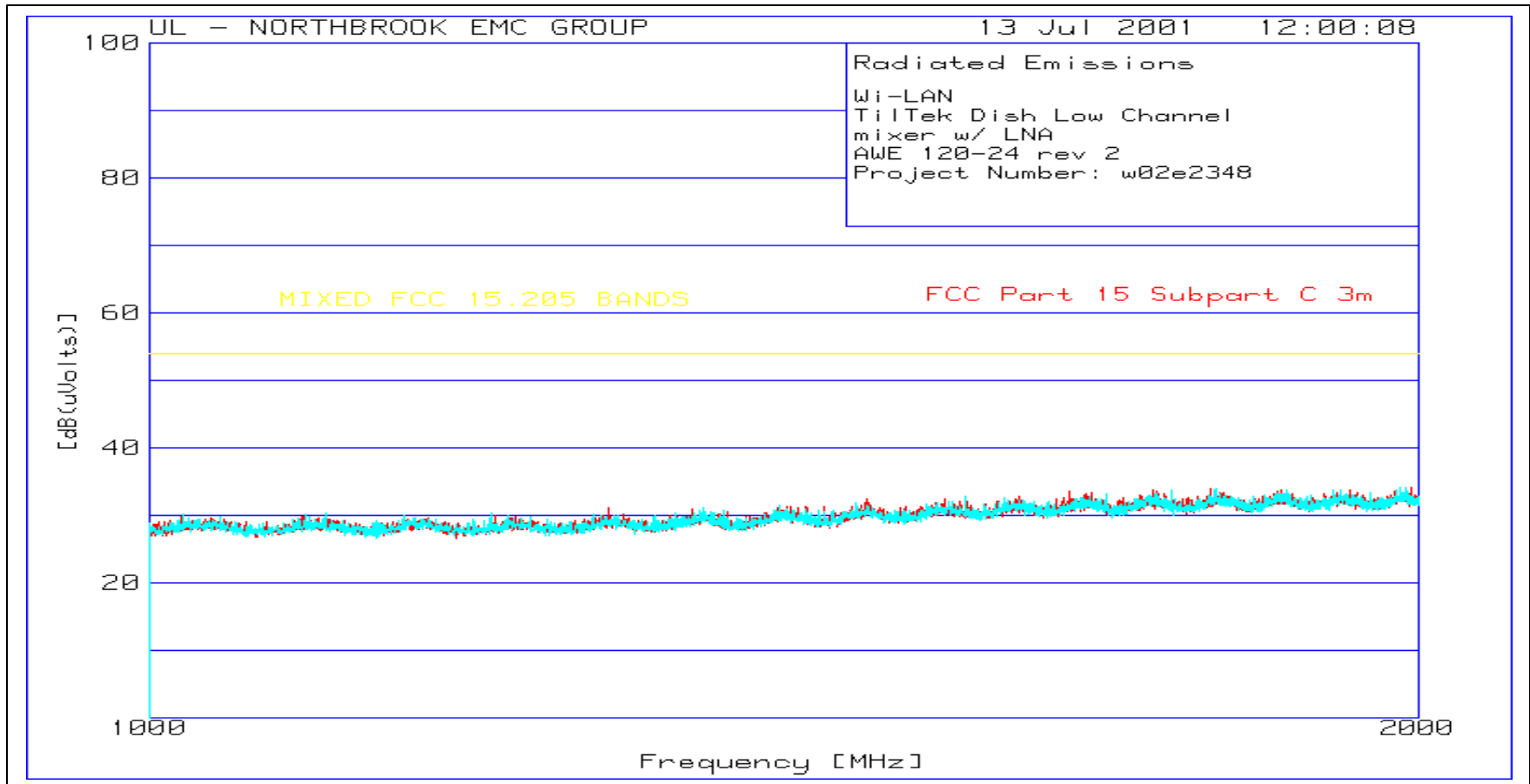
Plot 33  
Radiated Emissions of TilTek Dish Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
4-10GHz



Plot 34  
Radiated Emissions of TilTek Dish Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
10-18 GHz

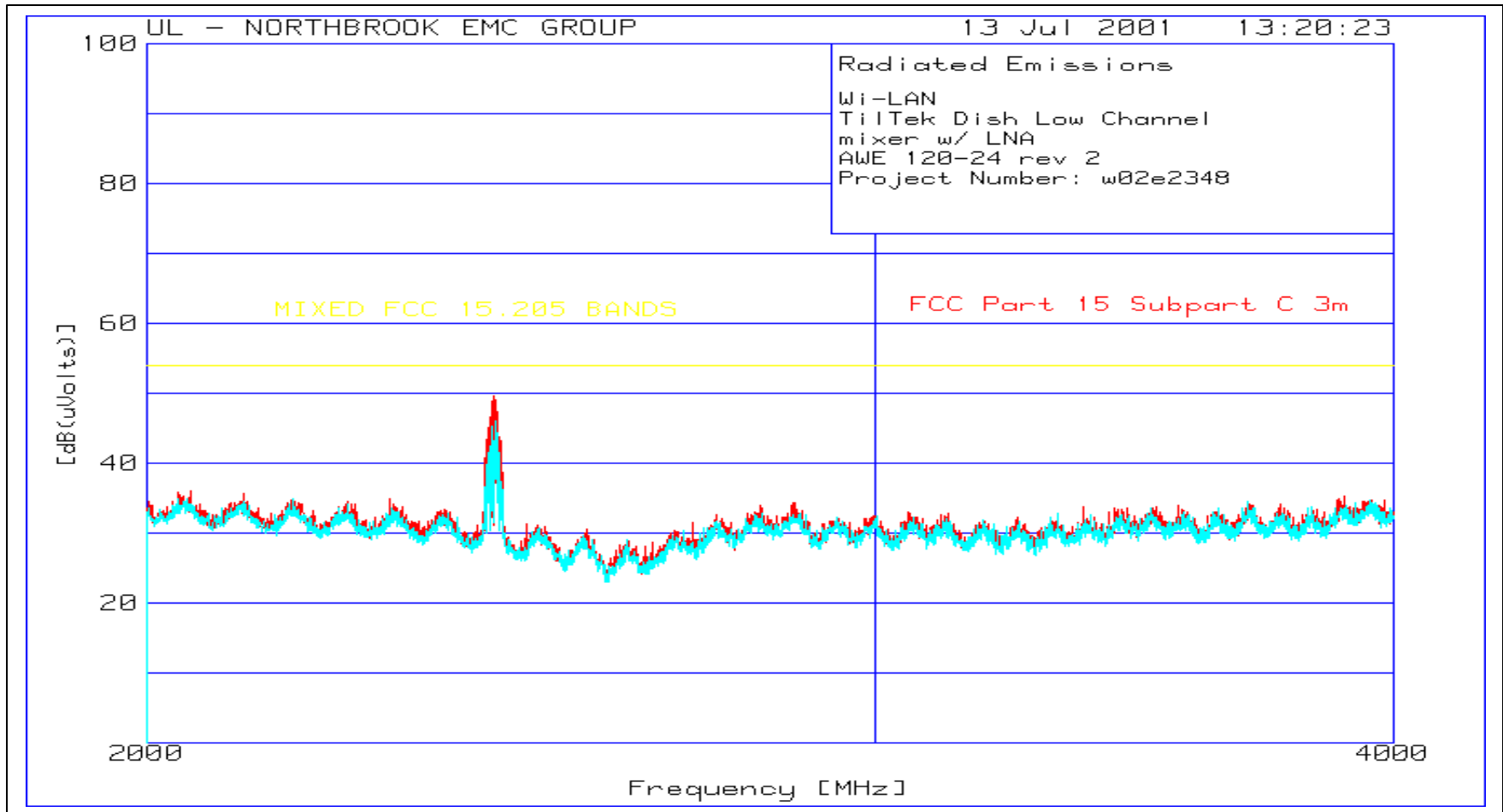


**Plot 35**  
**Radiated Emissions of TilTek Dish Antenna – Low Channel**  
**AWE 20-24 REV-2 in Base mode**  
**18-19 GHz**

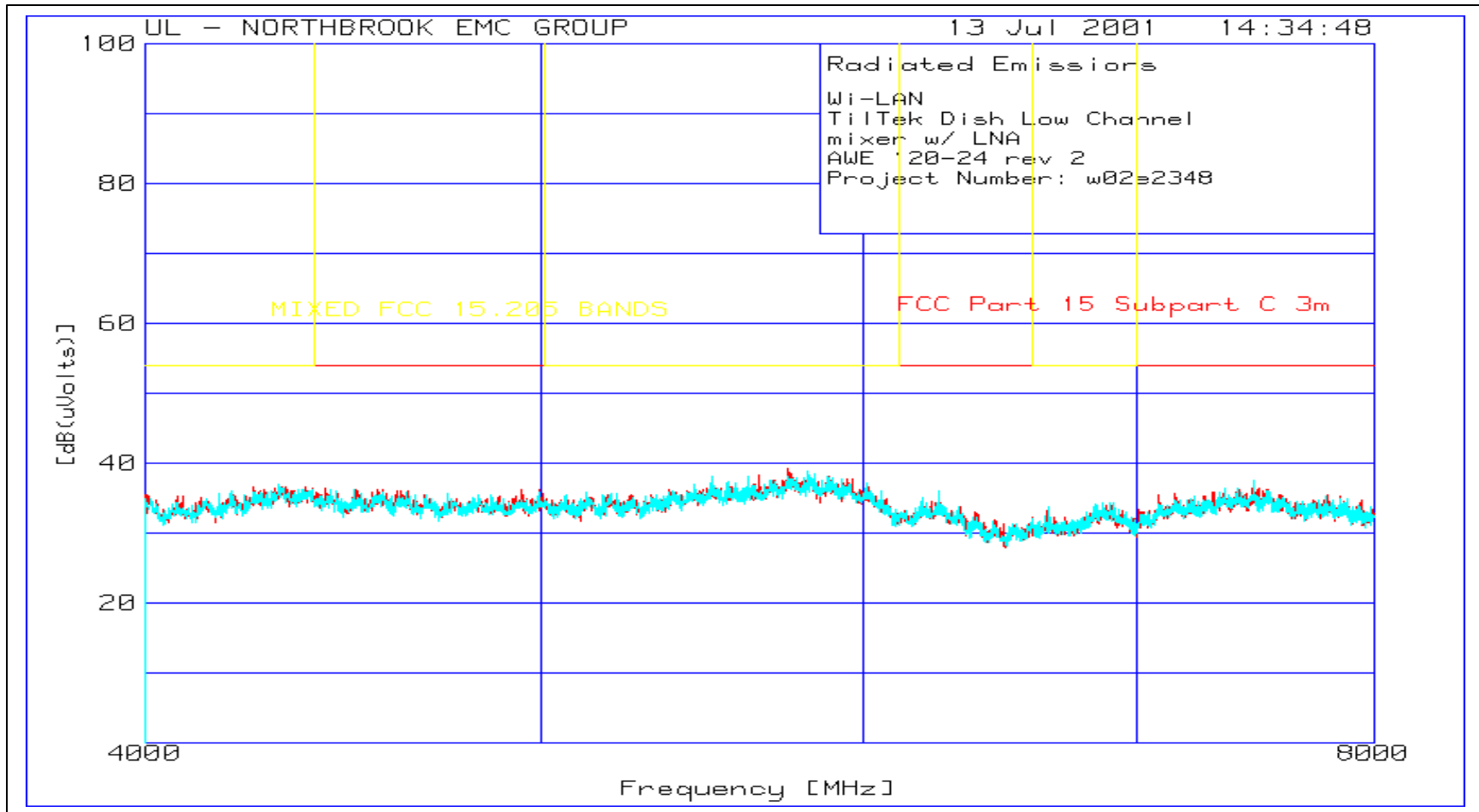




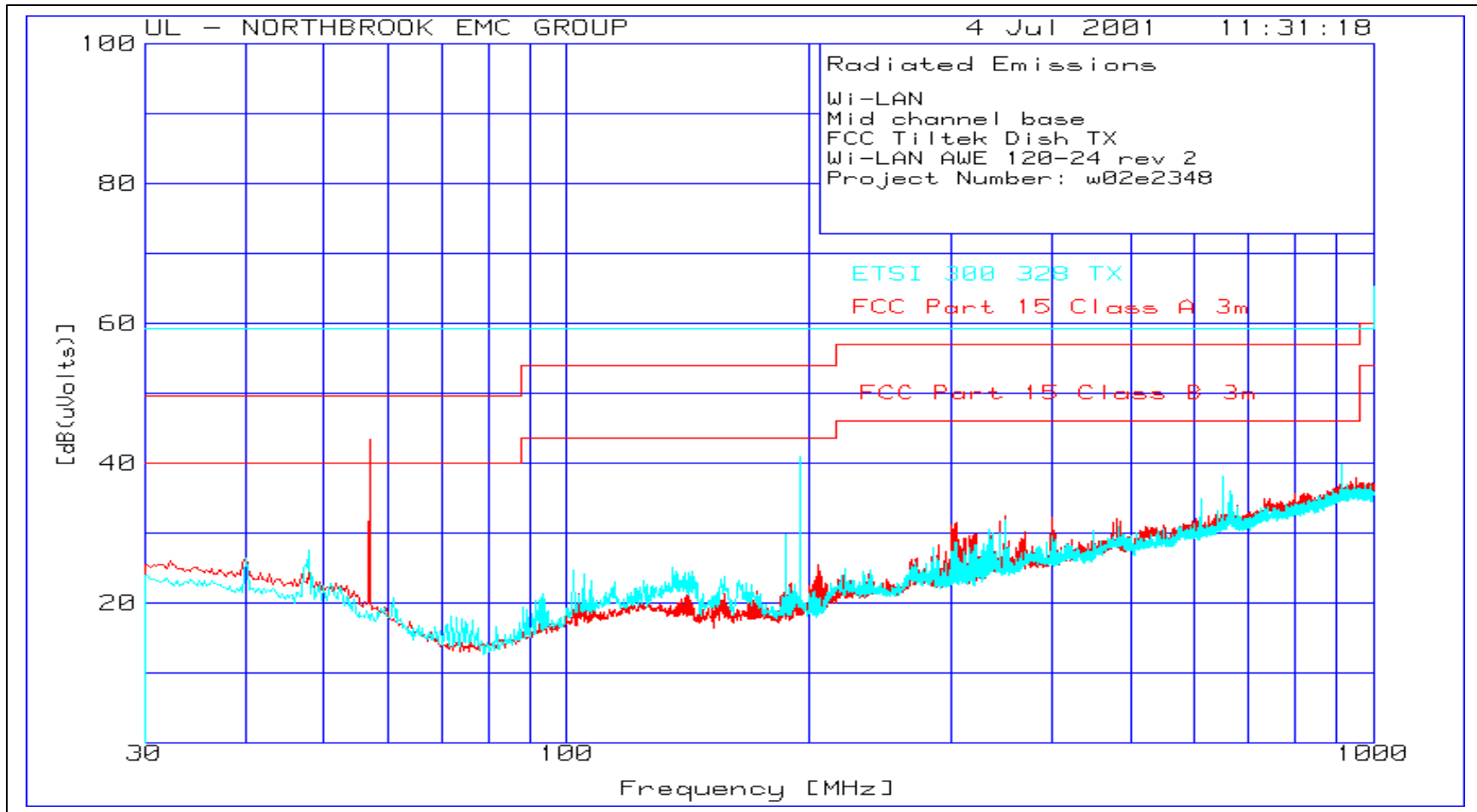
Plot 36  
Radiated Emissions of TilTek Dish Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
19-21 GHz



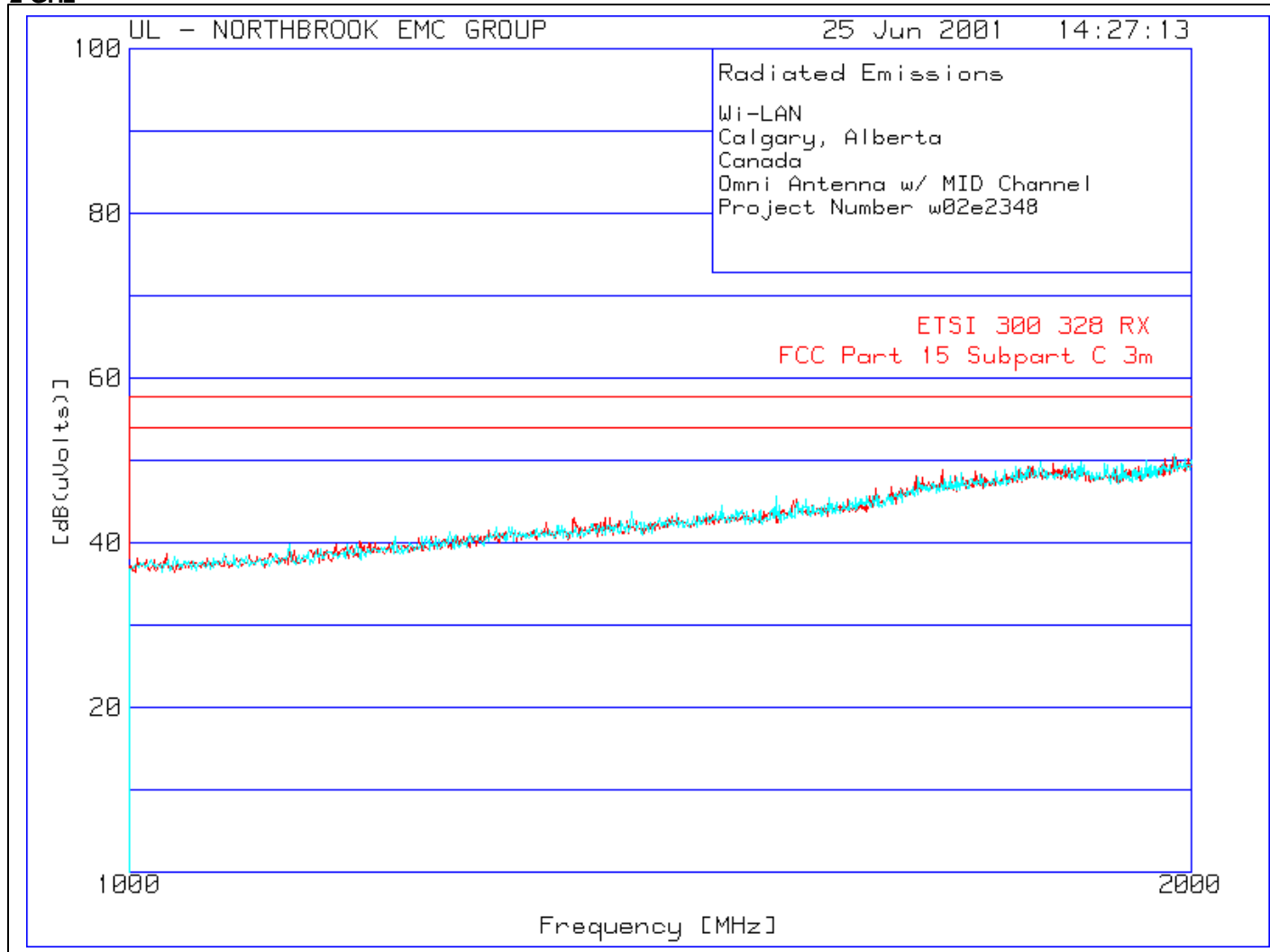
Plot 37  
Radiated Emissions of TilTek Dish Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
21-25 GHz



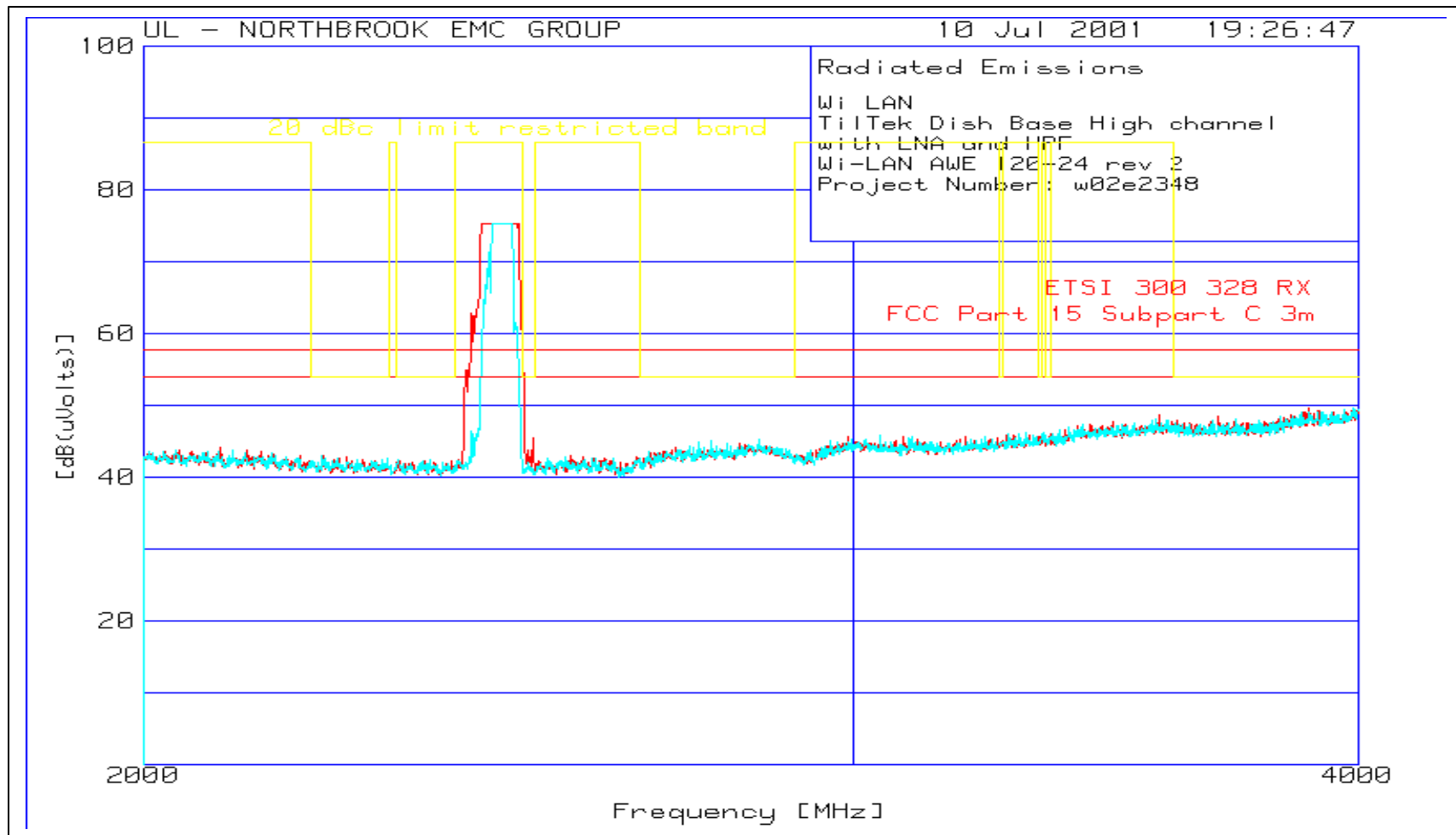
**Ploy 38**  
**Radiated Emissions of TilTek Dish Antenna – Mid Channel**  
**AWE 20-24 REV-2 in Base mode**  
**30-1000 MHz**



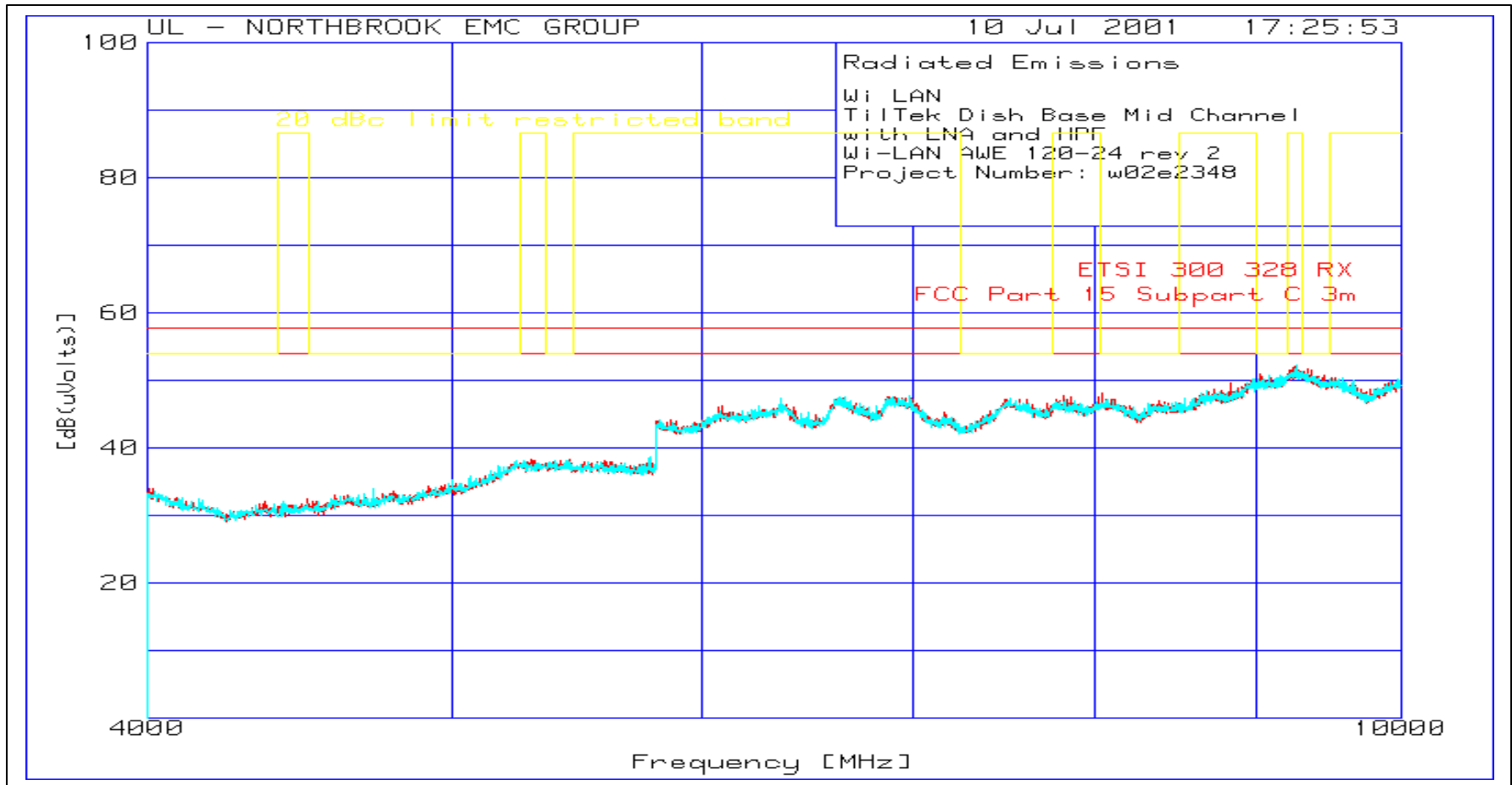
**Plot 39**  
**Radiated Emissions of TilTek Dish Antenna – Mid Channel**  
**AWE 20-24 REV-2 in Base mode**  
**1-2 GHz**



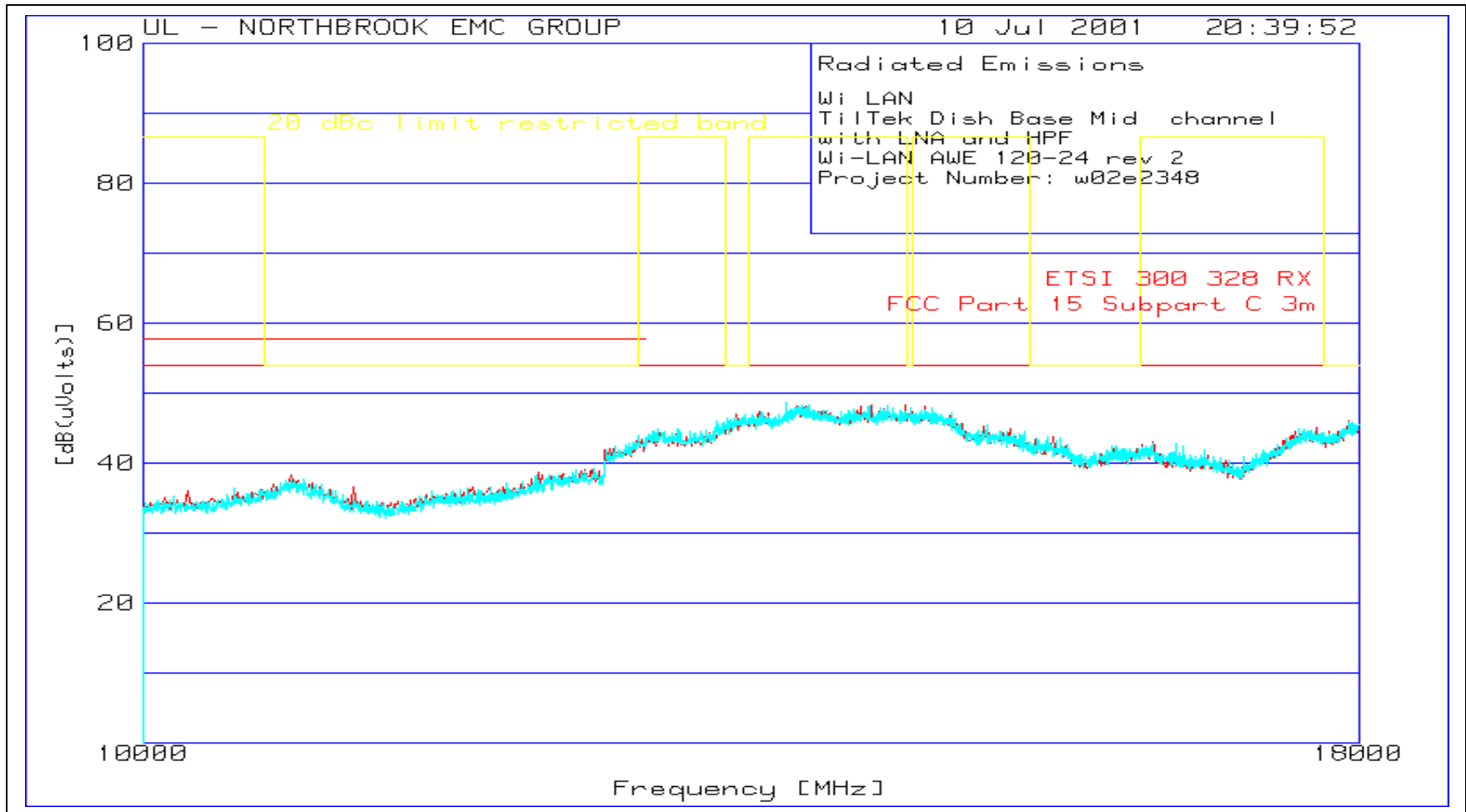
**Plot 40**  
**Radiated Emissions of TilTek Dish Antenna – Mid Channel**  
**AWE 20-24 REV-2 in Base mode**  
**2-4 GHz**



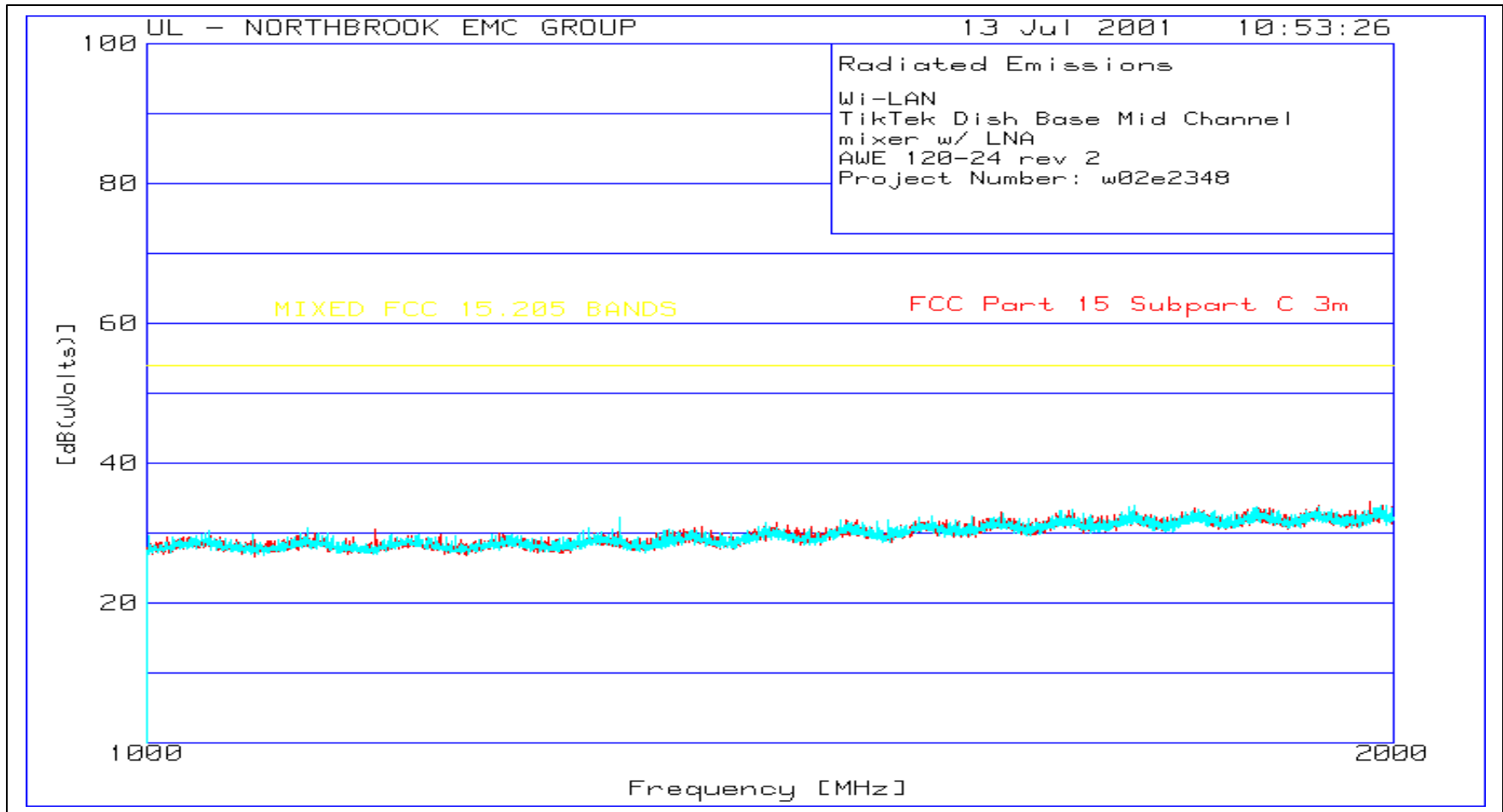
Plot 41  
Radiated Emissions of TilTek Dish Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
4-10GHz



Plot 42  
Radiated Emissions of TilTek Dish Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
10-18 GHz

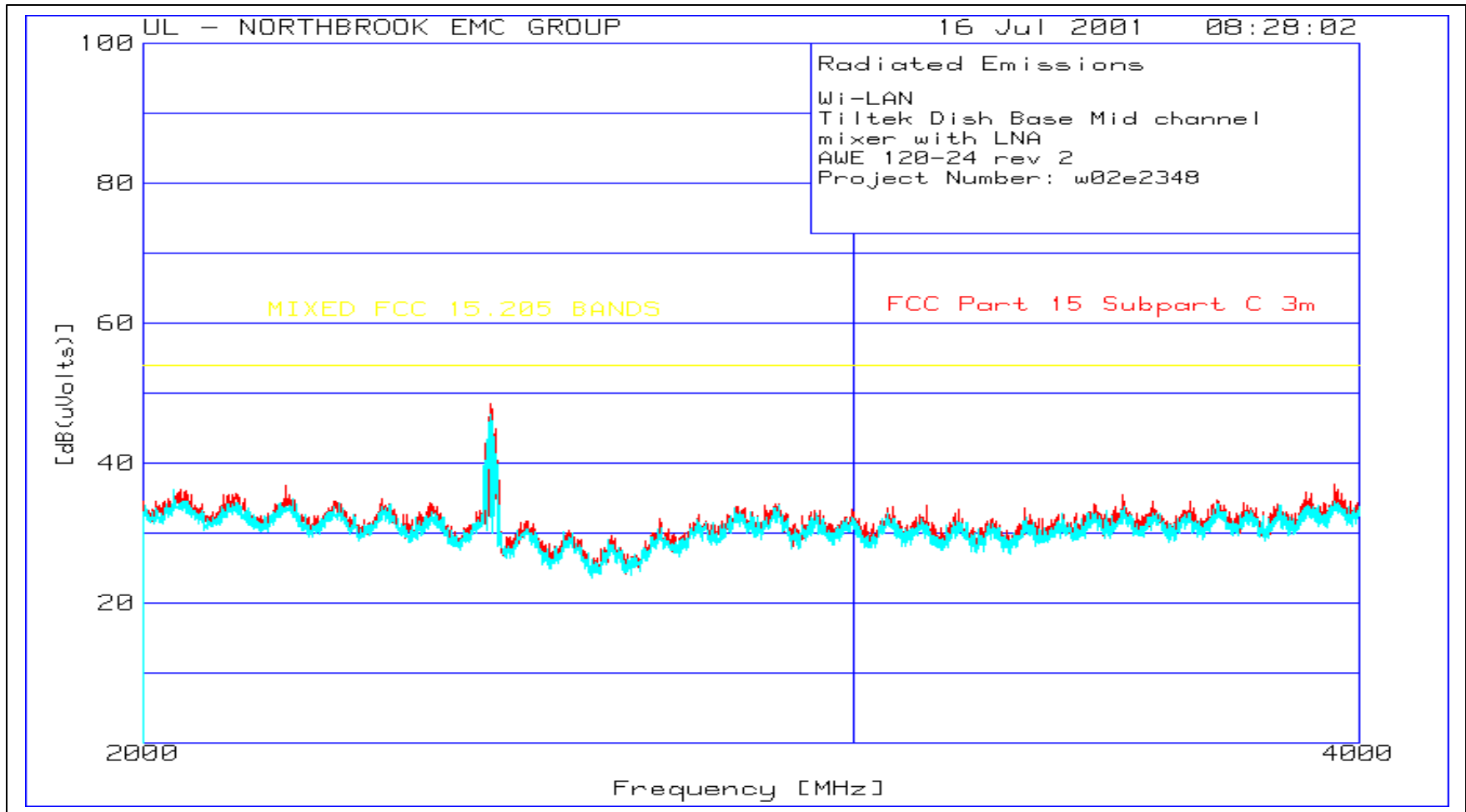


Plot 43  
Radiated Emissions of TilTek Dish Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
18-19 GHz

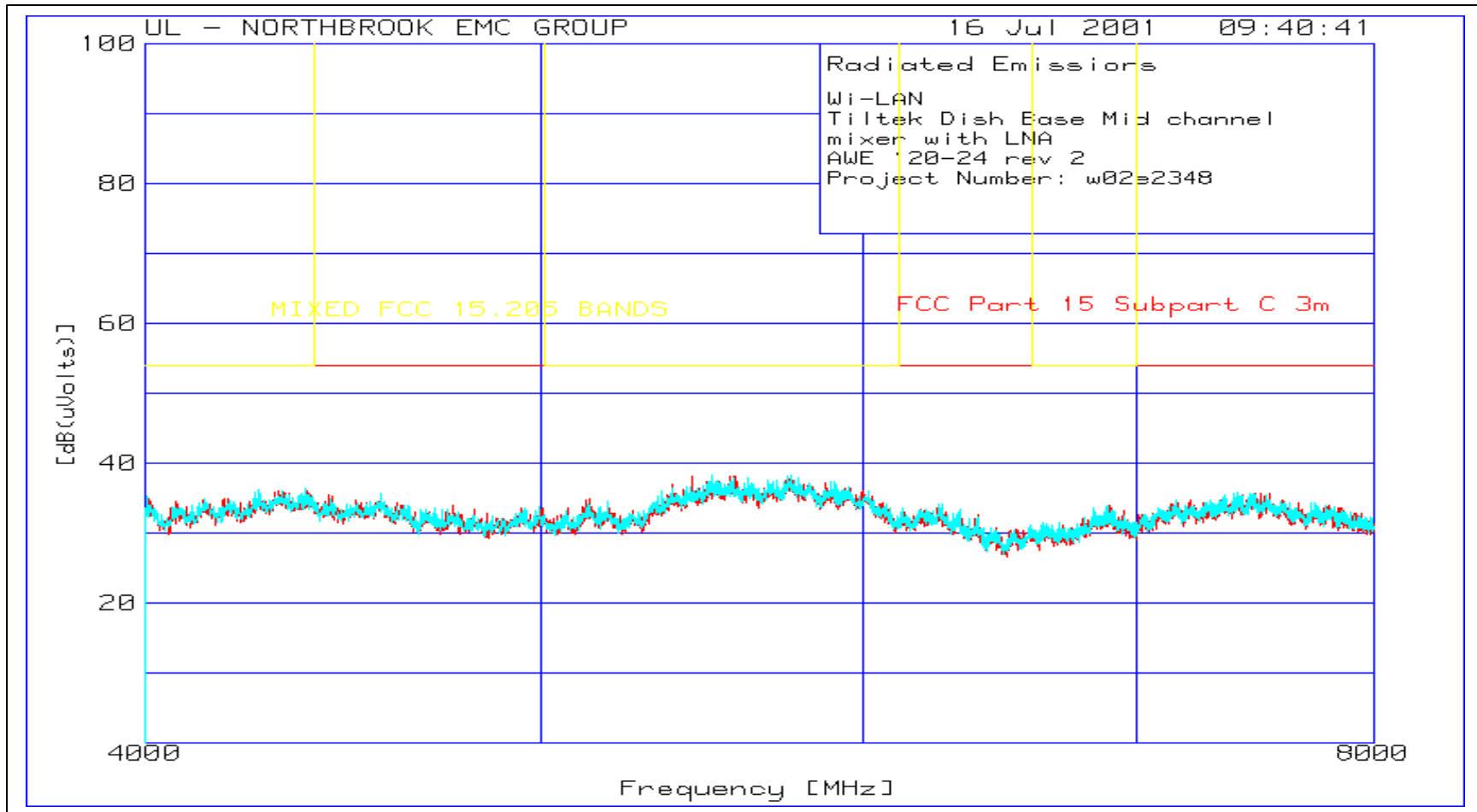




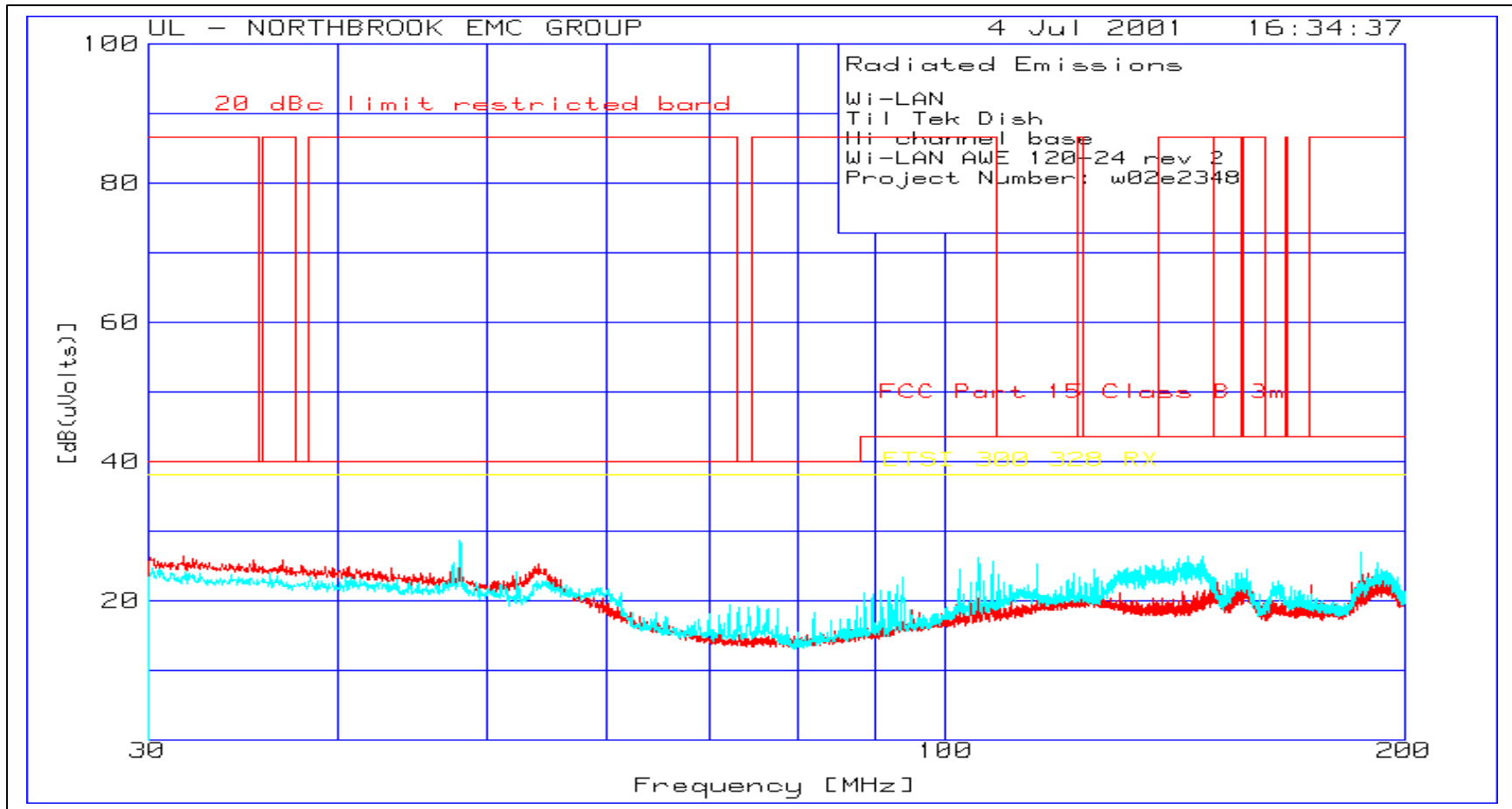
Plot 44  
Radiated Emissions of Tiltek Dish Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
19-21 GHz



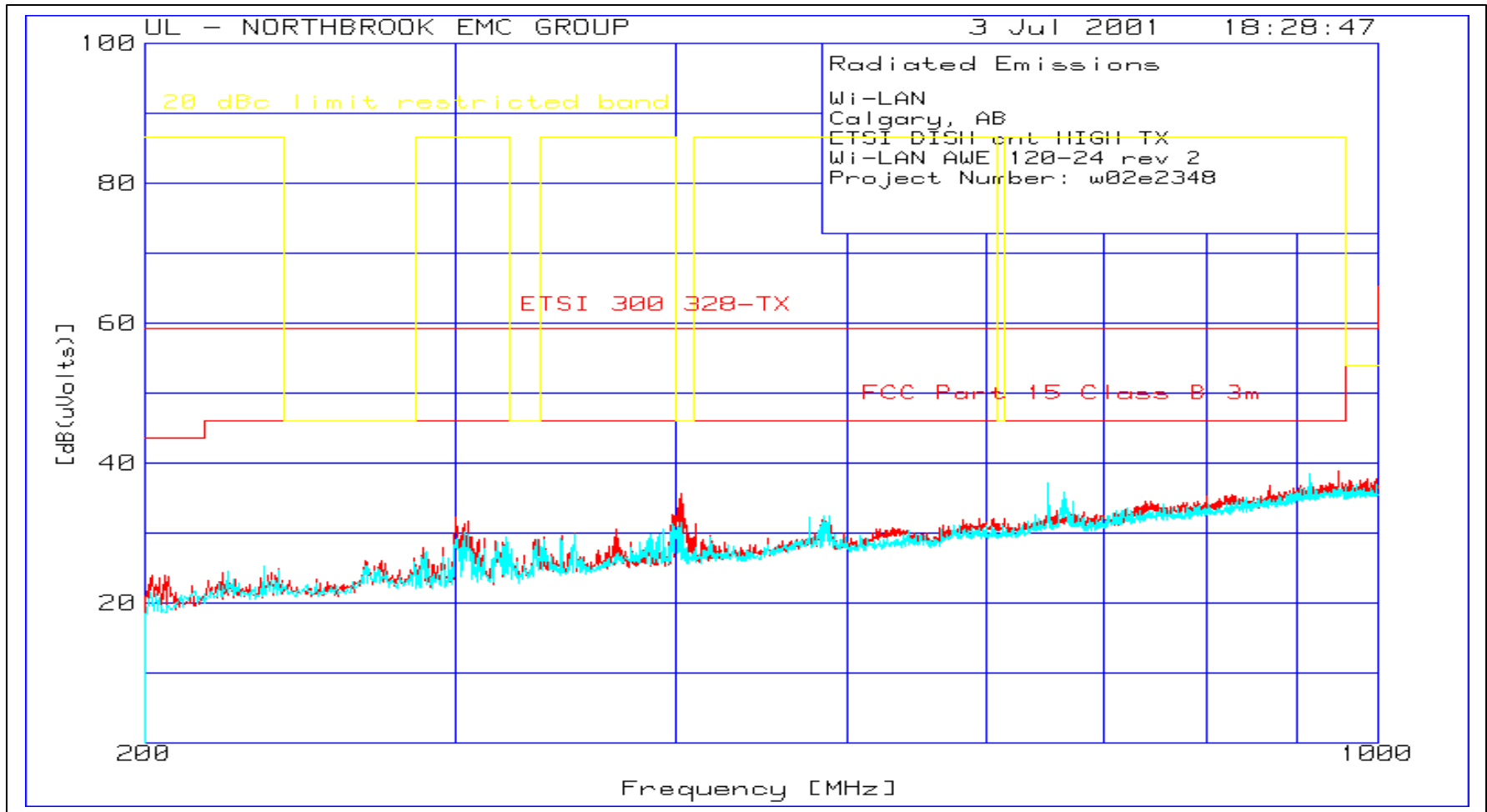
**Plot 45**  
**Radiated Emissions of TilTek Dish Antenna – Mid Channel**  
**AWE 20-24 REV-2 in Base mode**  
**21-25 GHz**



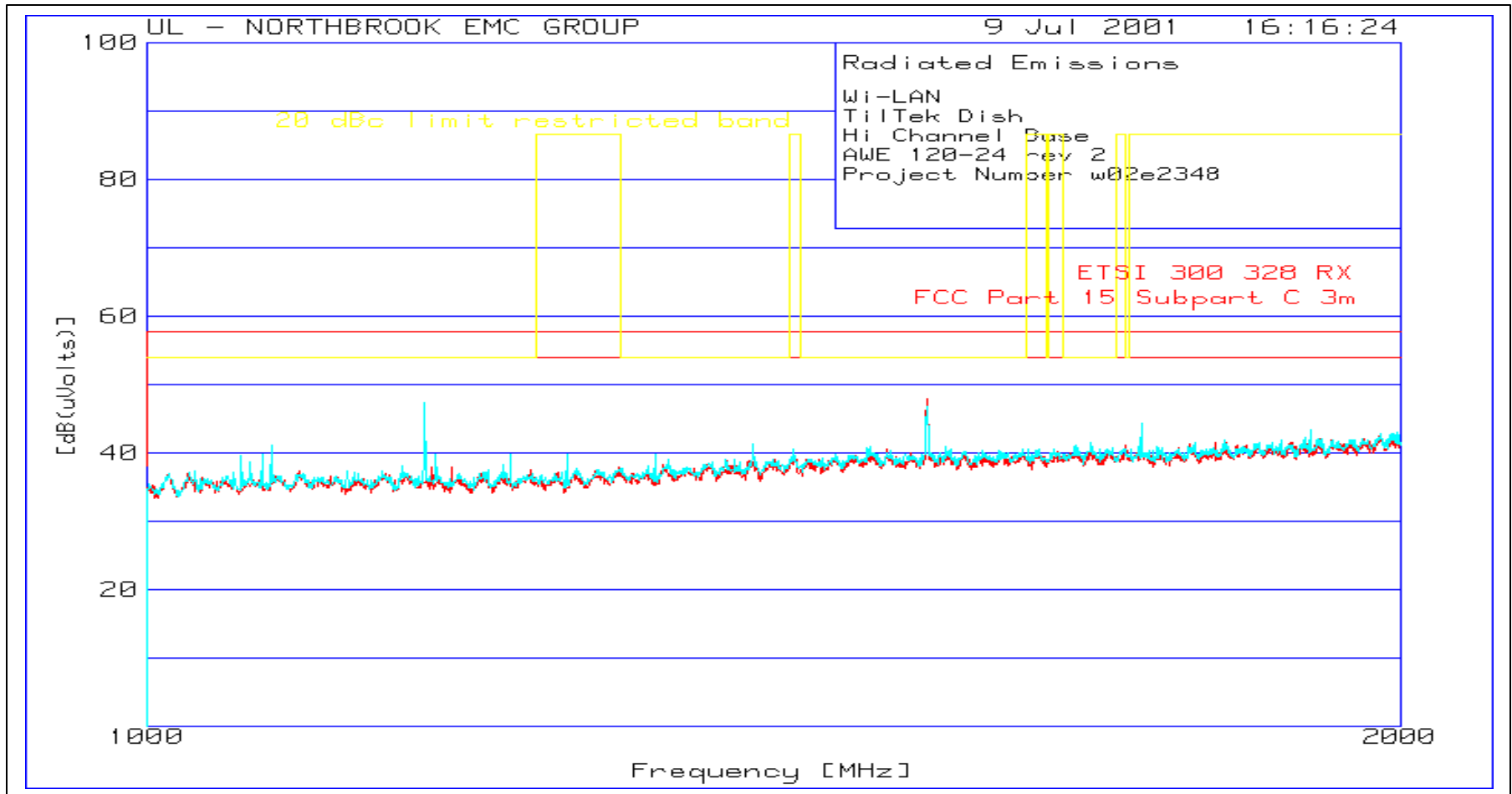
Plot 46  
Radiated Emissions of TilTek Dish Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
30-200 MHz



Plot 47  
Radiated Emissions of TilTek Dish Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
200-1000 MHz



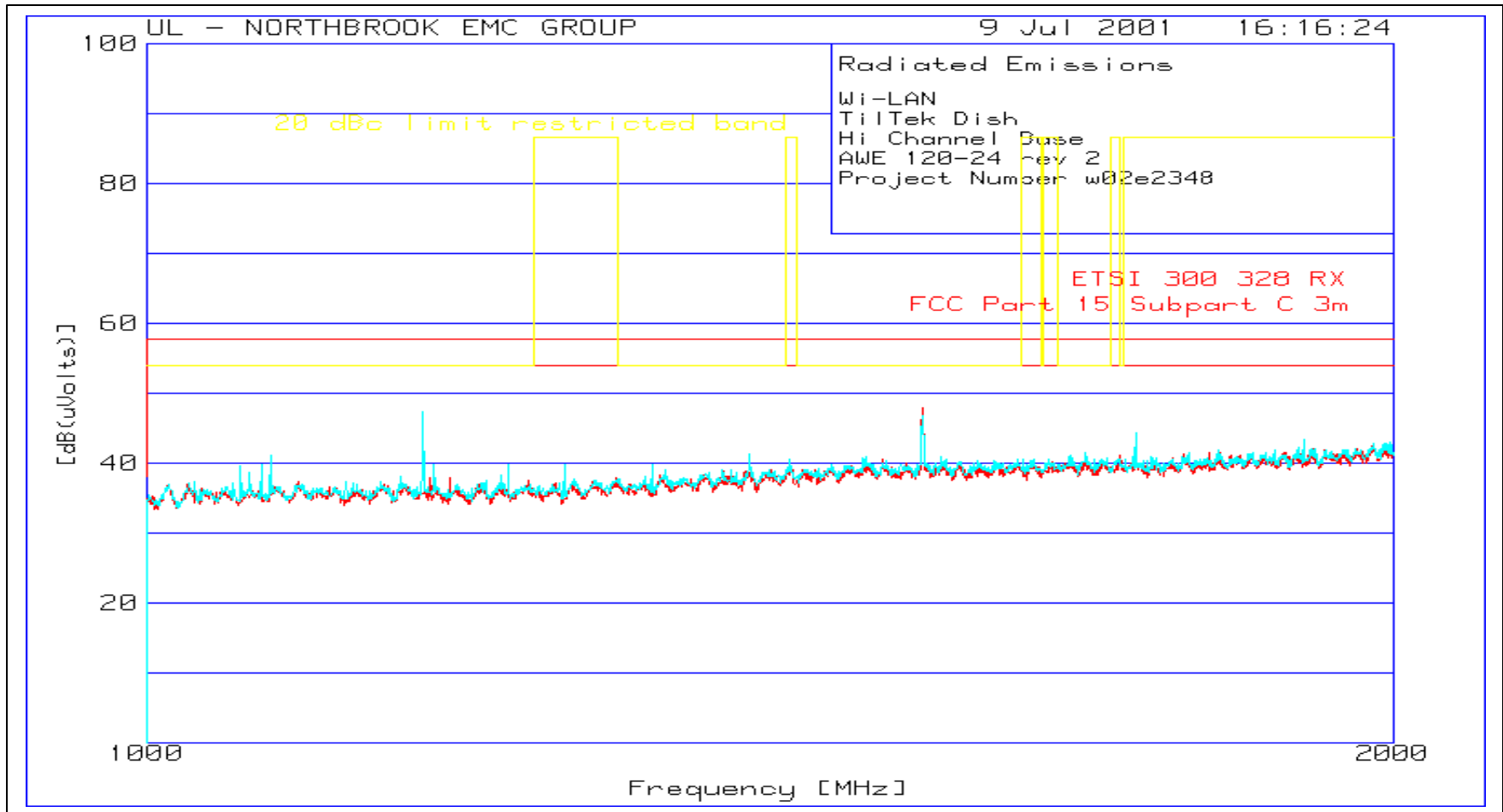
Plot 48  
Radiated Emissions of TilTek Dish Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
1-2 GHz



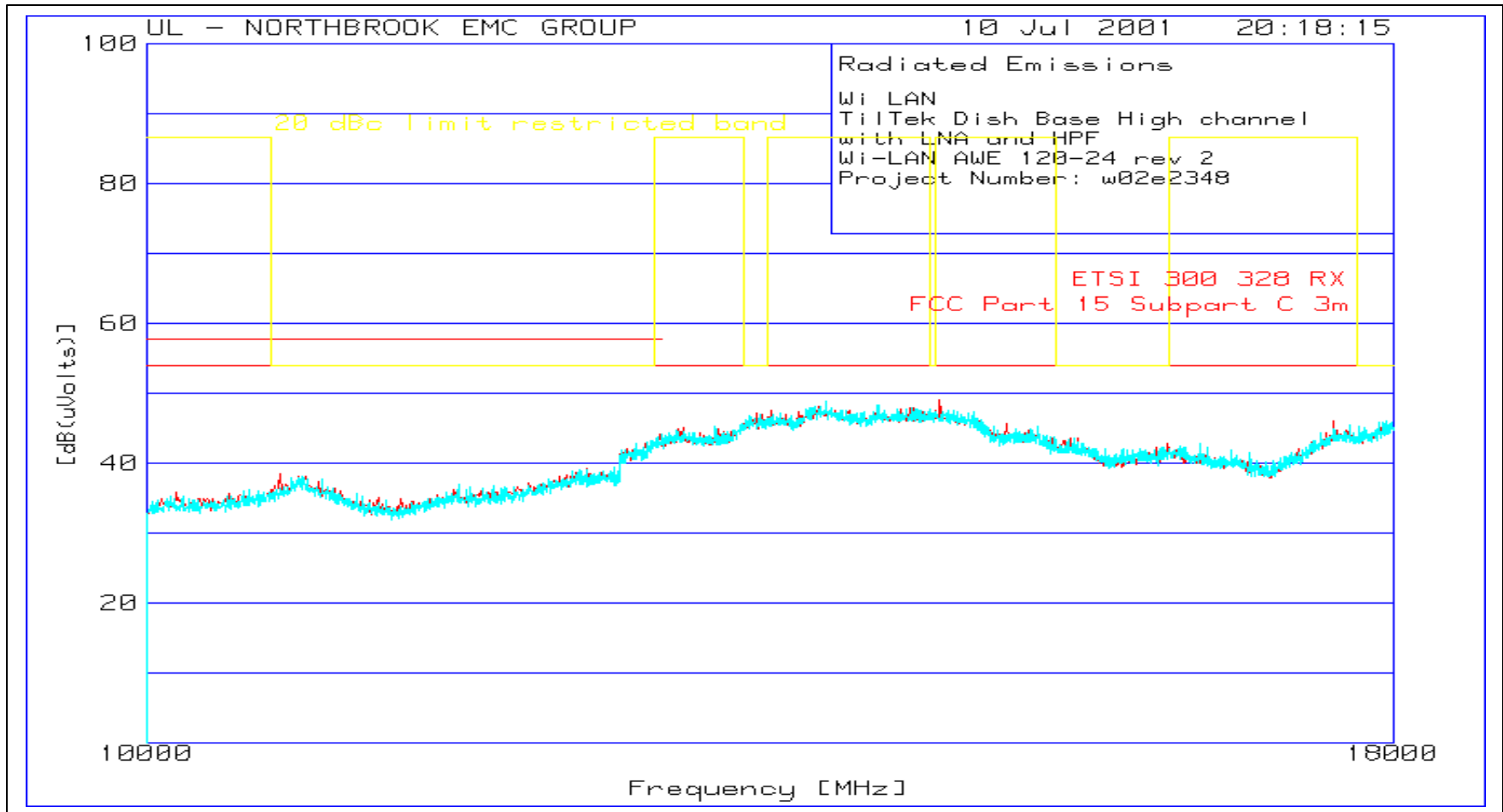
**Plot 49**  
**Radiated Emissions of TilTek Dish Antenna – High Channel**  
**AWE 20-24 REV-2 in Base mode**  
**2-4 GHz**



Plot 50  
Radiated Emissions of TilTek Dish Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
4-10GHz

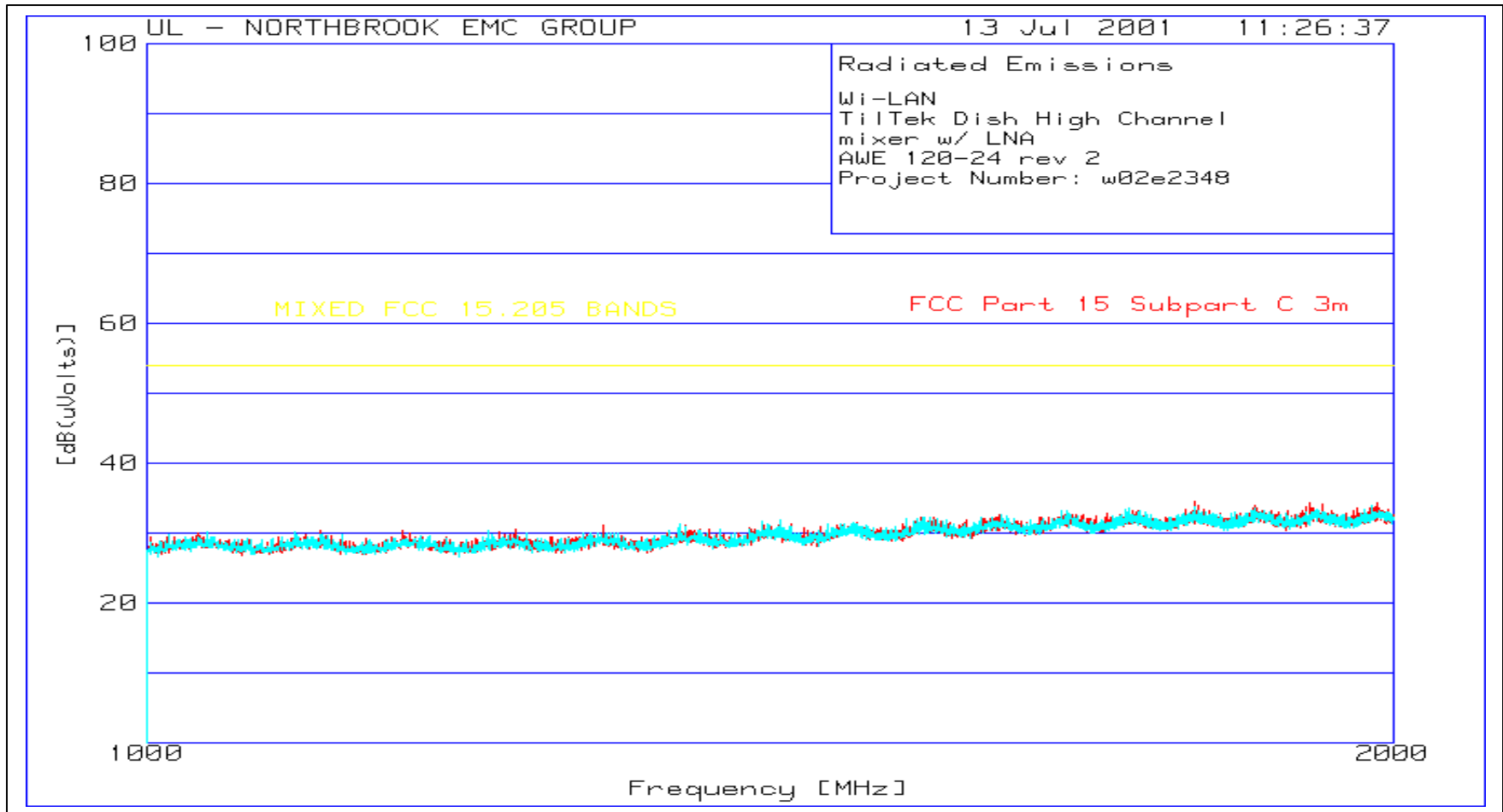


Plot 51  
Radiated Emissions of TilTek Dish Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
10-18 GHz

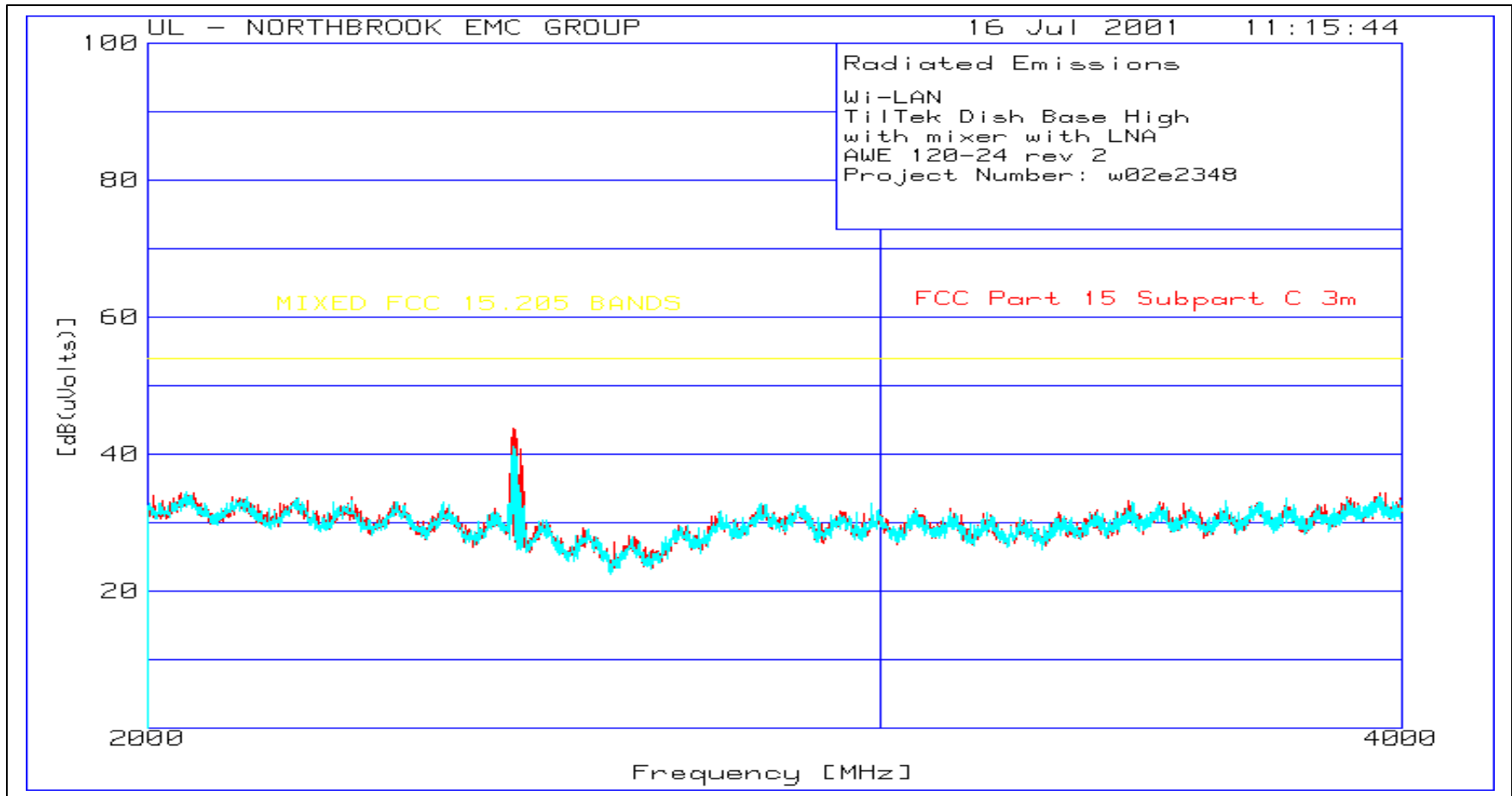




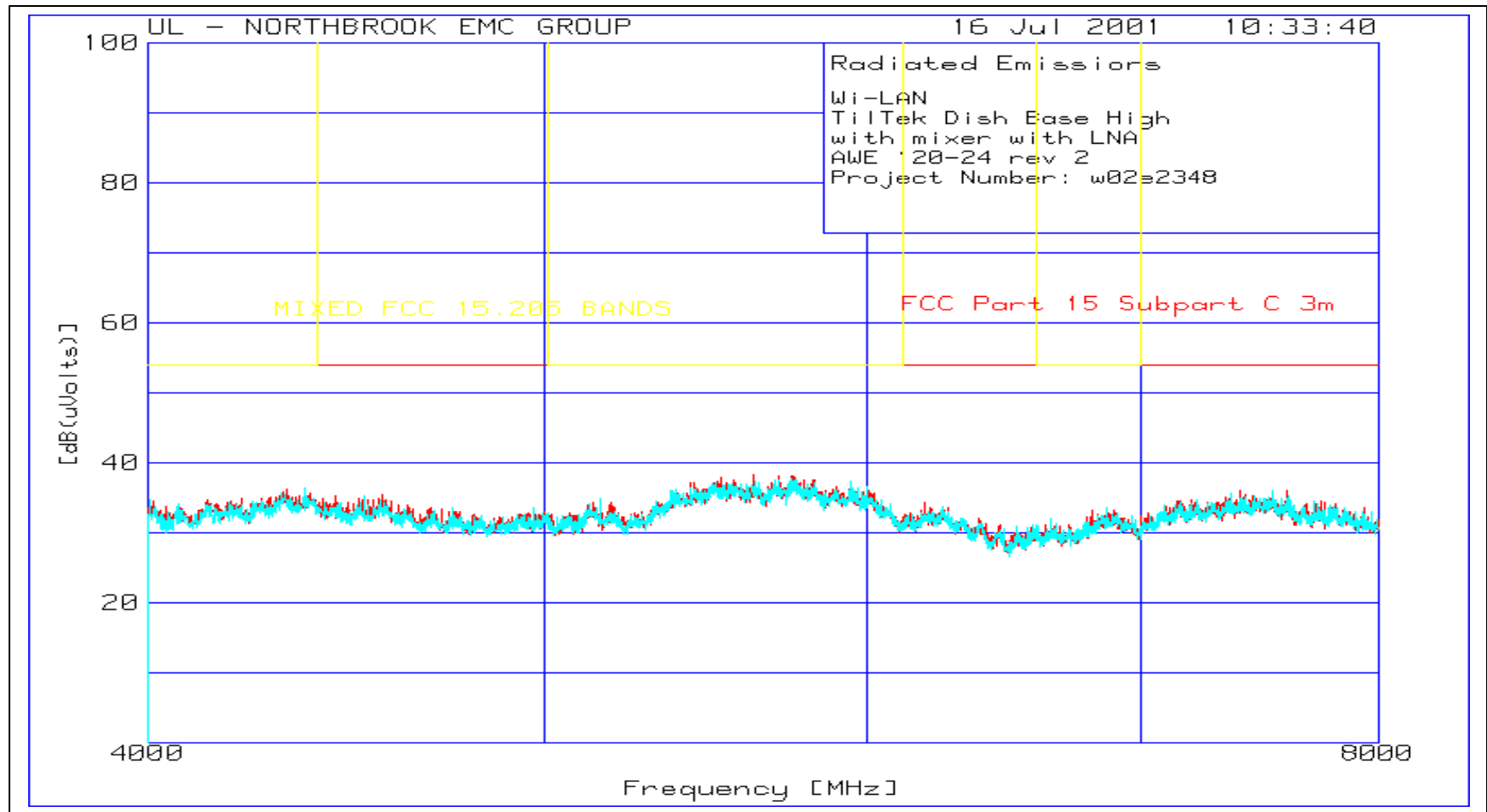
Plot 52  
Radiated Emissions of TilTek Dish Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
18-19 GHz



**Plot 53**  
**Radiated Emissions of TilTek Dish Antenna – High Channel**  
**AWE 20-24 REV-2 in Base mode**  
**19-21 GHz**



**Plot 54**  
**Radiated Emissions of TilTek Dish Antenna – High Channel**  
**AWE 20-24 REV-2 in Base mode**  
**21-25 GHz**



4.2.3 Sectoral Antenna

Test Lab: MPB Technologies Inc. Airdrie			Product:			
Test Personnel: Q. Nguyen, S. Tarkowski			AWE 120-24 rev 2			
Test Date: 27 June & 3, 4, 9, 10, 11 July 2001						
Test Result, AWE 120-24 rev 2						
LOW Channel: <b>PASS</b>						
MID Channel: <b>PASS</b>						
HIGH Channel: <b>PASS</b>						
Objectives/Criteria			Specifications			
<p>The Radiated E-Field emissions produced by a system or sub-system, measured at a distance of 3m from the EUT, shall not exceed these limits for the specifications <i>within the restricted bands of operation (RBOs)</i>. Any emissions lying outside the RBOs shall not exceed the level of the fundamental transmission.</p> <p><b>Emission levels should meet the requirements with a margin of 6dB.of 6dB.</b></p>			FCC Part 15.209 and 15.205			
			Frequency		Limit (QP @ 3m)	
			[MHz]		[dBµV/m]	
			30 – 88		40.00	
			88 – 216		43.52	
			216 – 960		46.02	
			Above 960		53.98	
<b>Vertical:</b>			<b>Horizontal:</b>			
f (MHz)	Field Strength (dBµV/m)	Delta (dB from limit)	f (MHz)	Field Strength (dBµV/m)	Delta (dB from limit)	
LOW Channel:						
1141.4695	24.46	-29.54				
MID Channel:						
HIGH Channel:						
1087.202	24.26	-29.74				
1203.292	24.21	-29.79				
There were no measured within -20 dB of the specified limit. Please refer to the test data and plots (Plots 55 through 80) for more detail.						

**Test Data**  
**Radiated Emissions**  
**Sectoral Antenna**  
**LOW Channel**  
**AWE 20-24 REV-2 in Remote mode**  
**30-1000 MHz**

Wi-LAN  
TilTek Sectoral  
LOW Channel Base  
AWE 120-24 rev 2  
Project Number w02e2348

Test	Meter	Gain/Loss	Transducer	Level	Limit:	1	2	3	4
Frequency	Reading	Factor	Factor		[dB(uVolts)]				
[MHz]	[dB(uV)]	[dB]	[dB]						
1141.4695	30.56	av	-31.4	25.3	24.46	57.7	54	54	N/A
Azimuth: 55	Height:133	Vert		Margin [dB]		-33.24	-29.54	-29.54	N/A

LIMIT 1: ETSI 300 328 RX  
LIMIT 2: FCC Part 15 Subpart C 3m  
LIMIT 3: 20 dBc limit restricted band  
LIMIT 4: NONE

**Test Data**  
**Radiated Emissions**  
**Sectoral Antenna**  
**HIGH Channel**  
**AWE 20-24 REV-2 in Remote mode**  
**1-2 GHz**

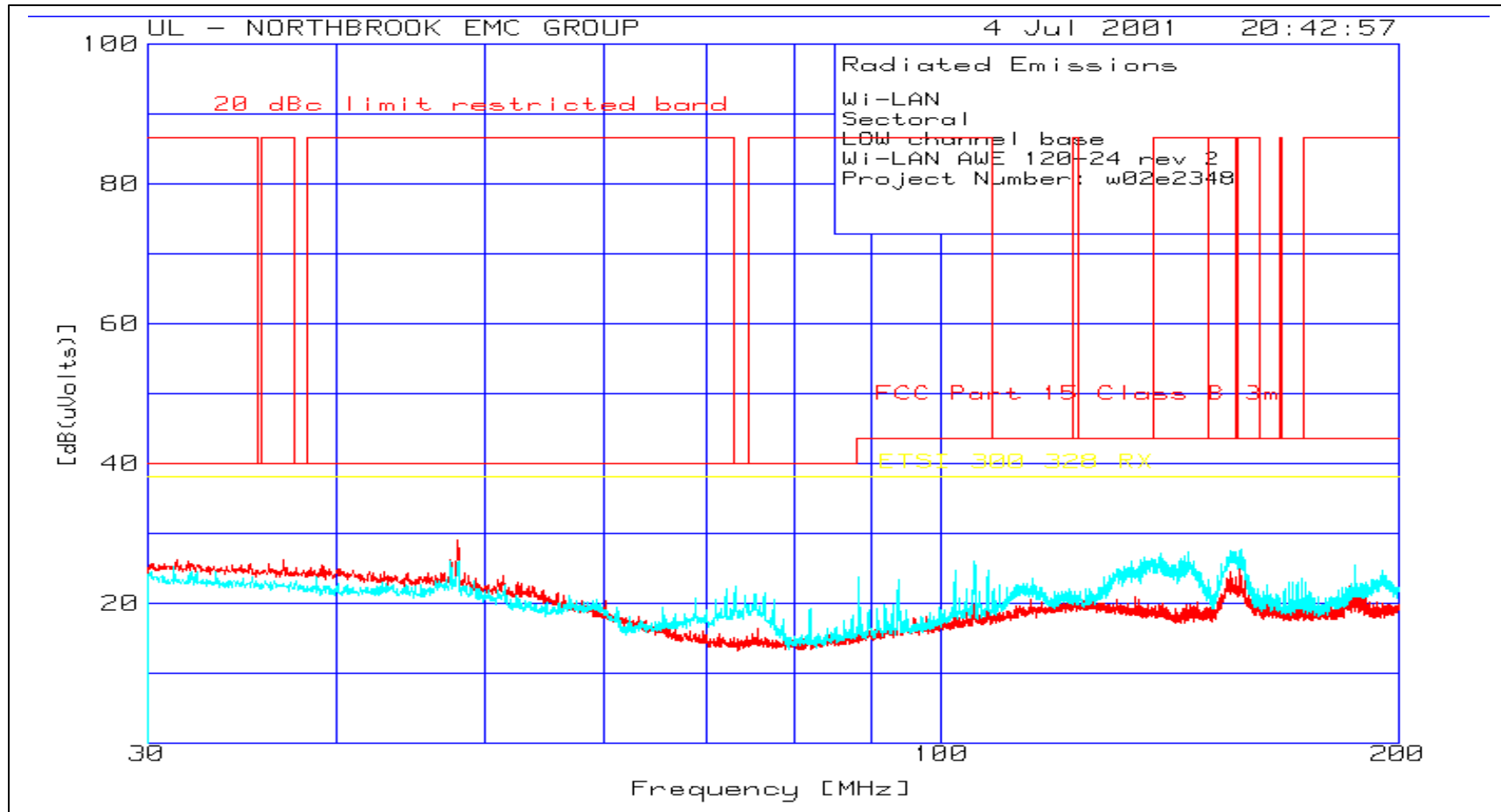
Wi-LAN  
TilTek Sectoral  
High channel Base  
AWE 120-24 rev 2  
Project Number w02e2348

Test	Meter	Gain/Loss	Transducer	Level	Limit:1	2	3	4
Frequency	Reading	Factor	Factor		[dB(uVolts)]			
[MHz]	[dB(uV)]	[dB]	[dB]					
1087.202	29.96 av	-30.7	25	24.26	57.7	54	54	N/A
Azimuth: 26 Height:370 Vert Margin [dB]					-33.44	-29.74	-29.74	N/A
1203.292	31.01 av	-32.3	25.5	24.21	57.7	54	54	N/A
Azimuth: 101 Height:369 Vert Margin [dB]					-33.49	-29.79	-29.79	N/A

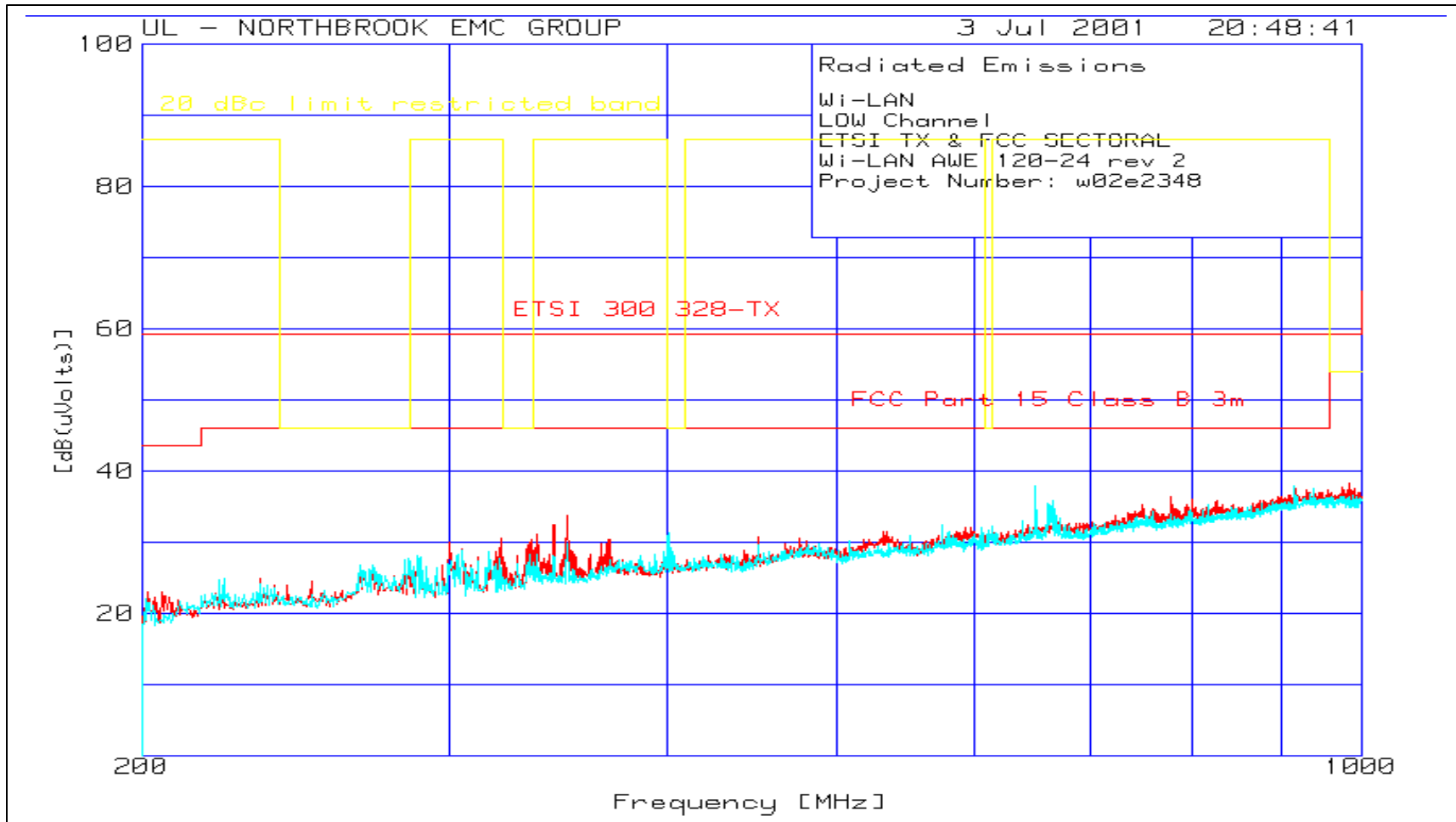
LIMIT 1: ETSI 300 328 RX  
LIMIT 2: FCC Part 15 Subpart C 3m  
LIMIT 3: 20 dBc limit restricted band  
LIMIT 4: NONE

pk - Peak detector  
qp - Quasi-Peak detector  
av - Average detector

Plot 55  
Radiated Emissions of Sectoral Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
30-200 MHz

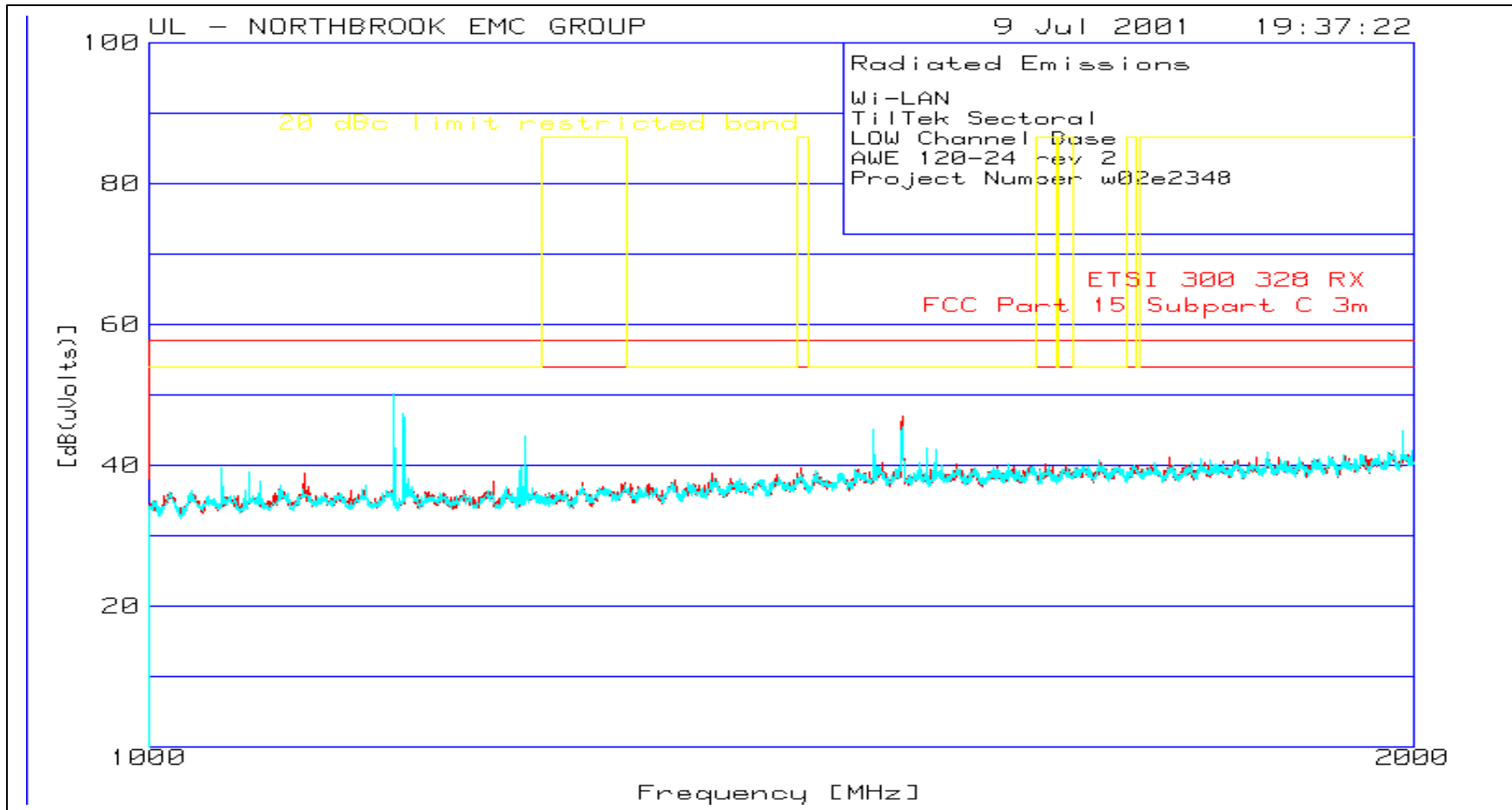


Plot 56  
Radiated Emissions of Sectoral Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
200-1000 MHz





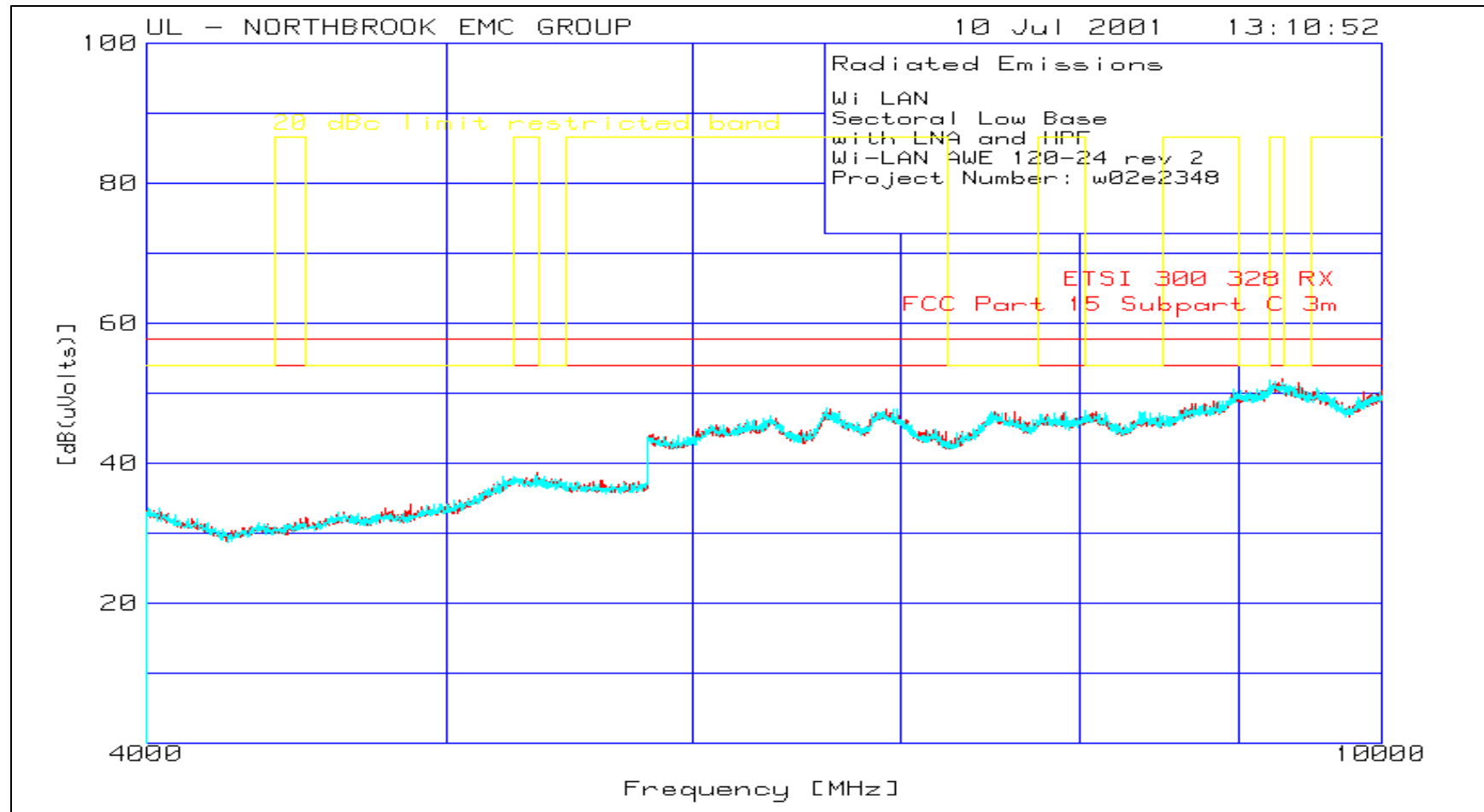
**Plot 57**  
**Radiated Emissions of Sectoral Antenna – Low Channel**  
**AWE 20-24 REV-2 in Base mode**  
**1-2 GHz**



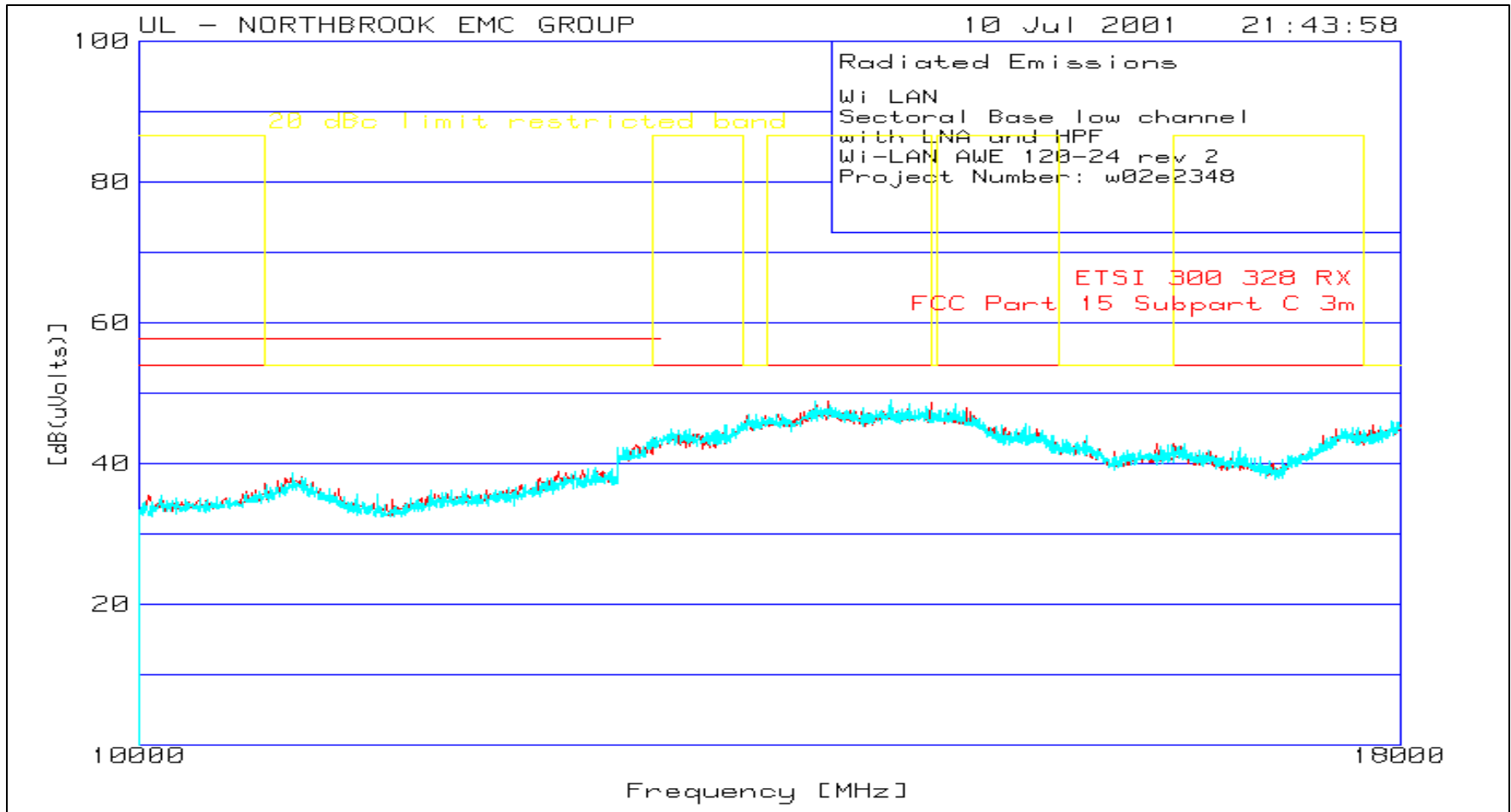
**Ploy 58**  
**Radiated Emissions of Sectoral Antenna – Low Channel**  
**AWE 20-24 REV-2 in Base mode**  
**2-4 GHz**



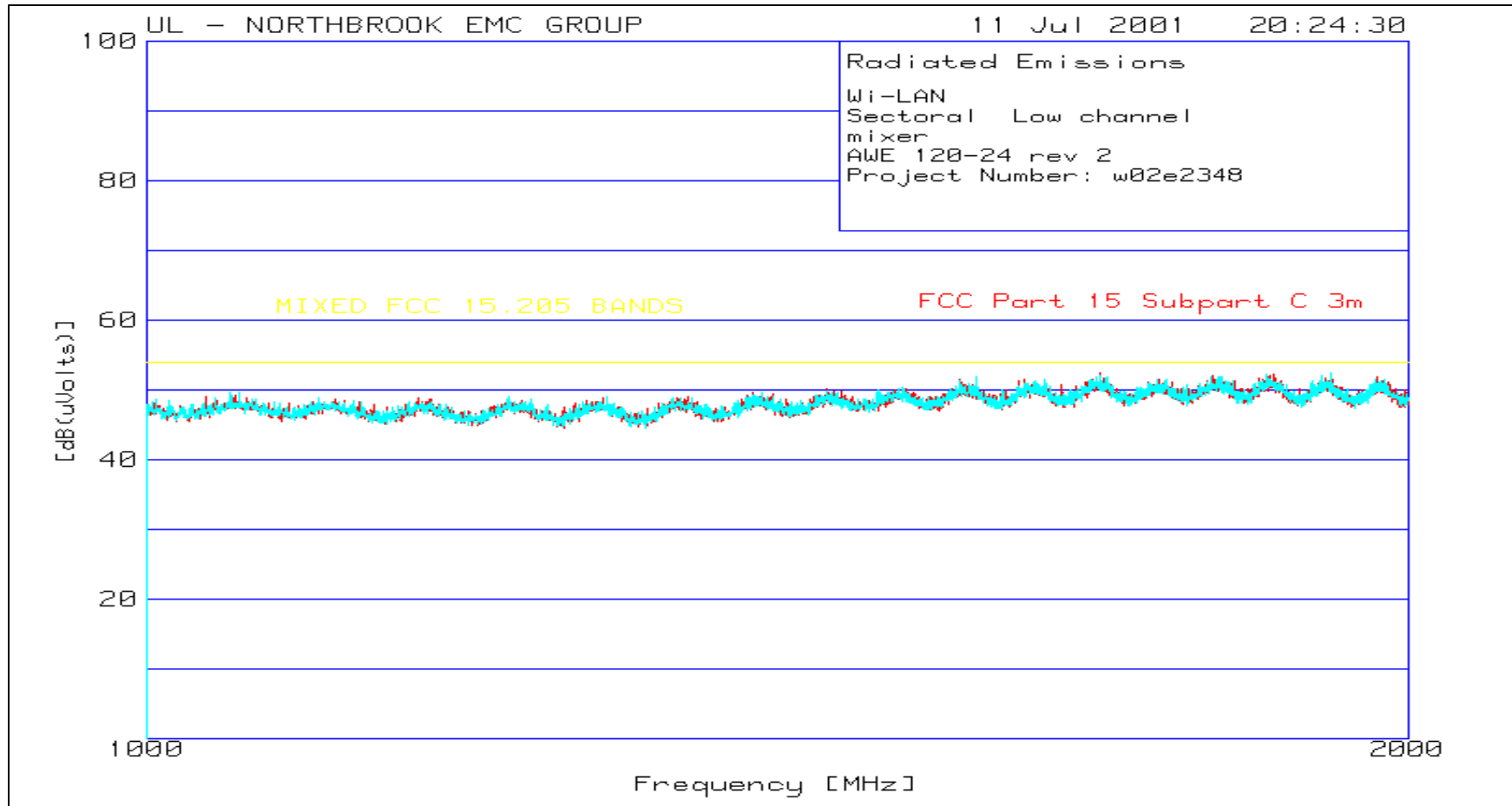
Plot 59  
Radiated Emissions of Sectoral Dish Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
4-10GHz



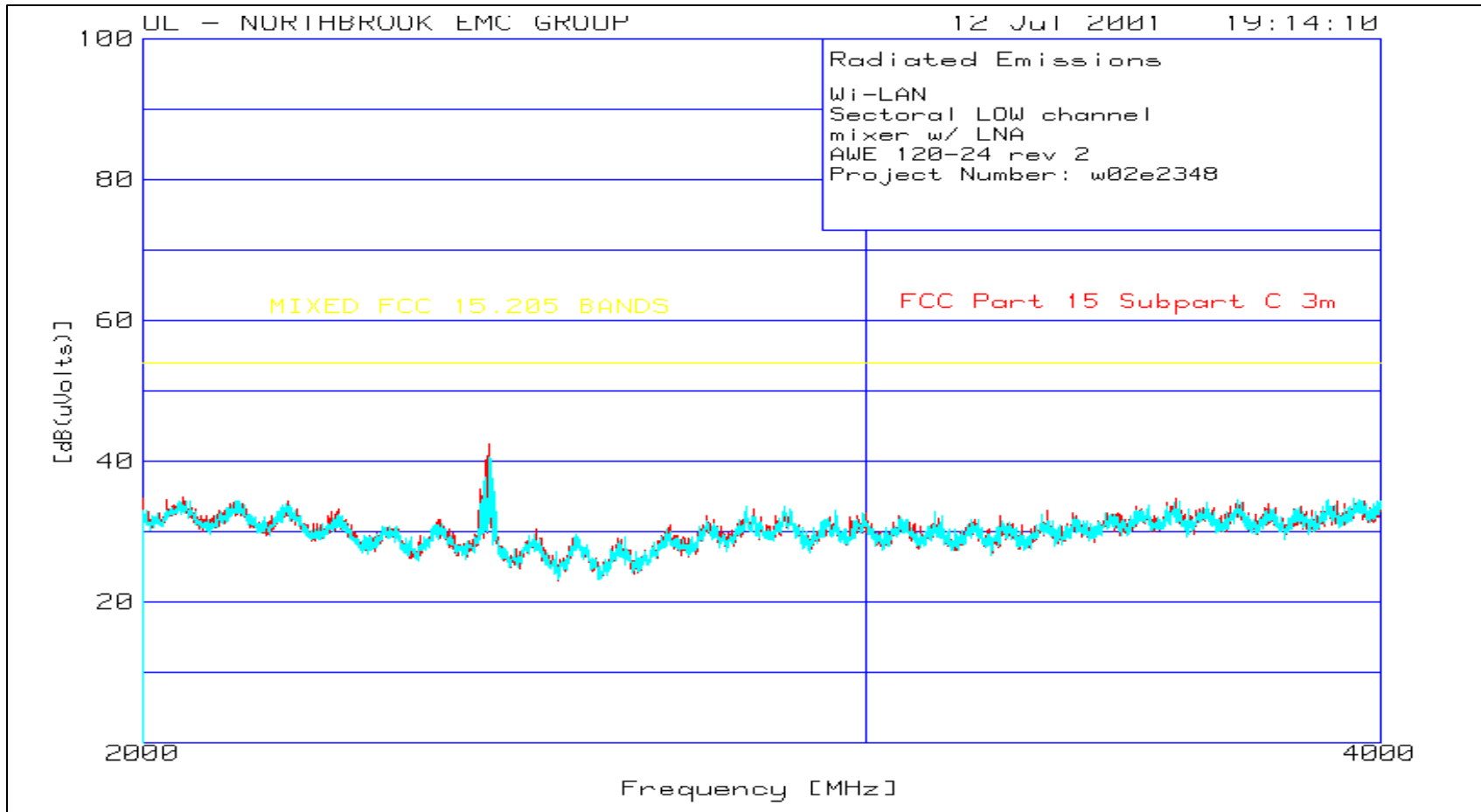
Plot 60  
Radiated Emissions of Sectoral Dish Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
10-18 GHz



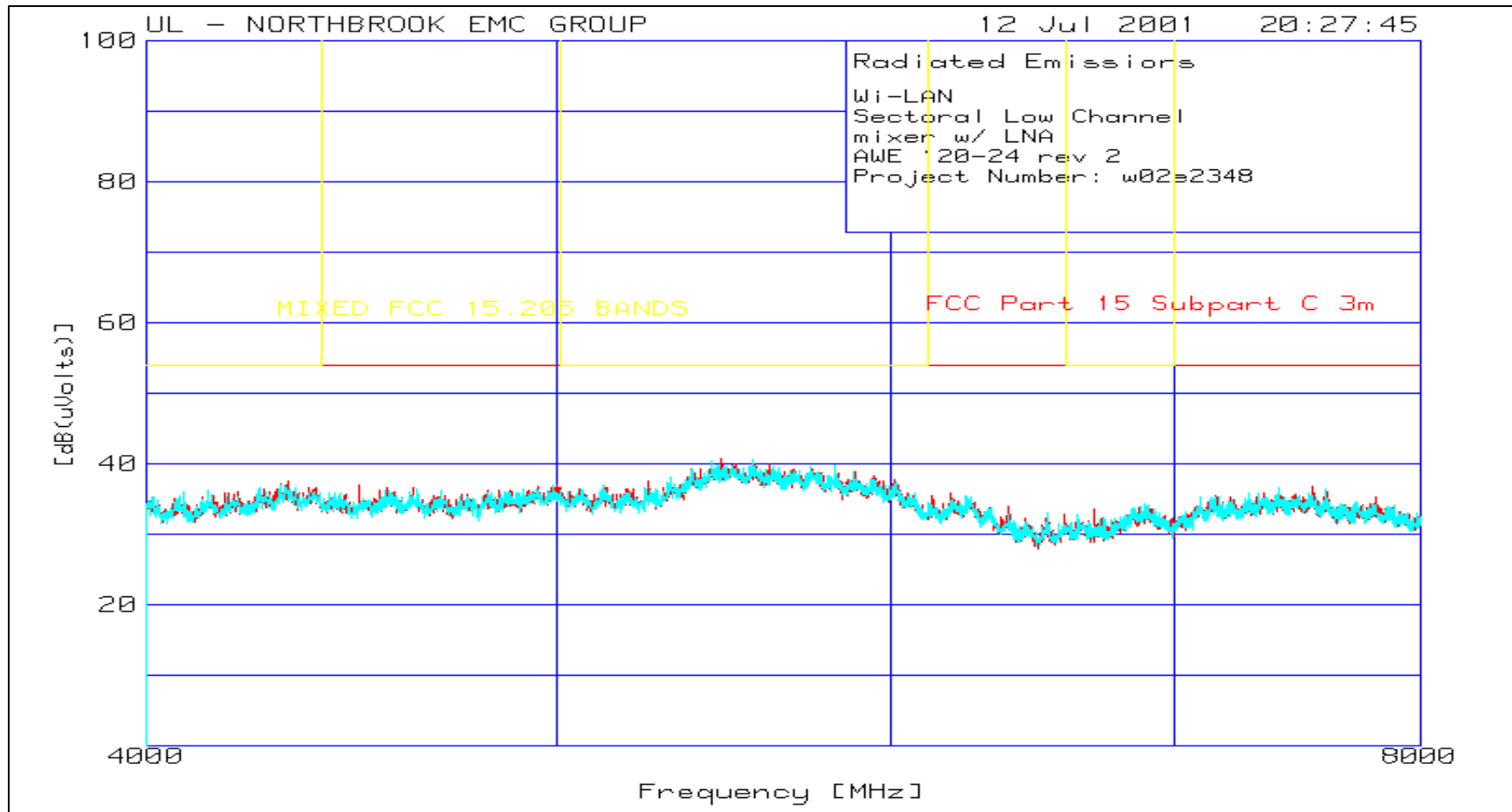
Plot 61  
Radiated Emissions of Sectoral Dish Antenna – Low Channel  
AWE 20-24 REV-2 in Base mode  
18-19 GHz



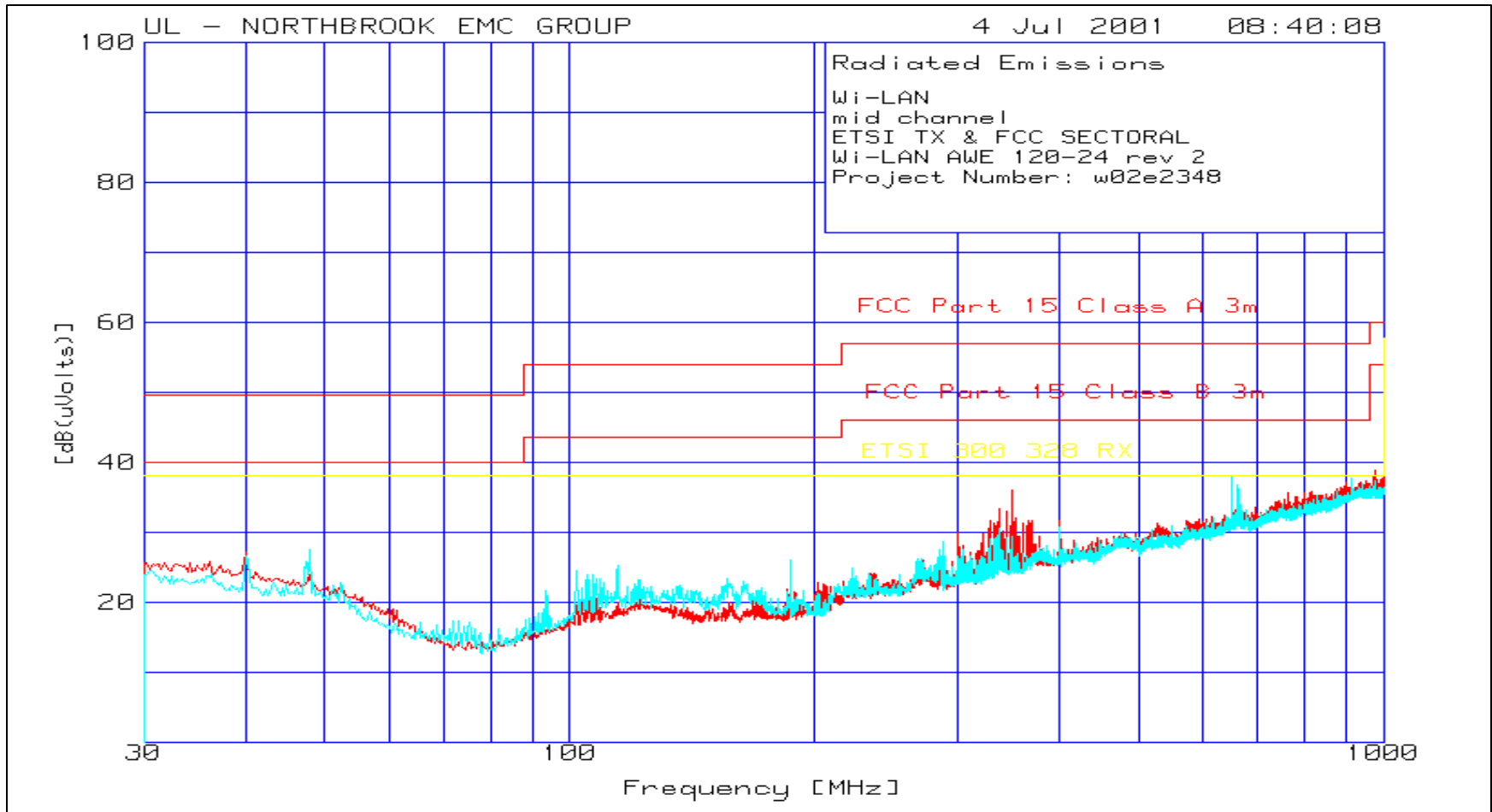
**Plot 62**  
**Radiated Emissions of Sectoral Antenna – Low Channel**  
**AWE 20-24 REV-2 in Base mode**  
**19-21 GHz**



**Plot 63**  
**Radiated Emissions of TilTek Dish Antenna – Low Channel**  
**AWE 20-24 REV-2 in Base mode**  
**21-25 GHz**

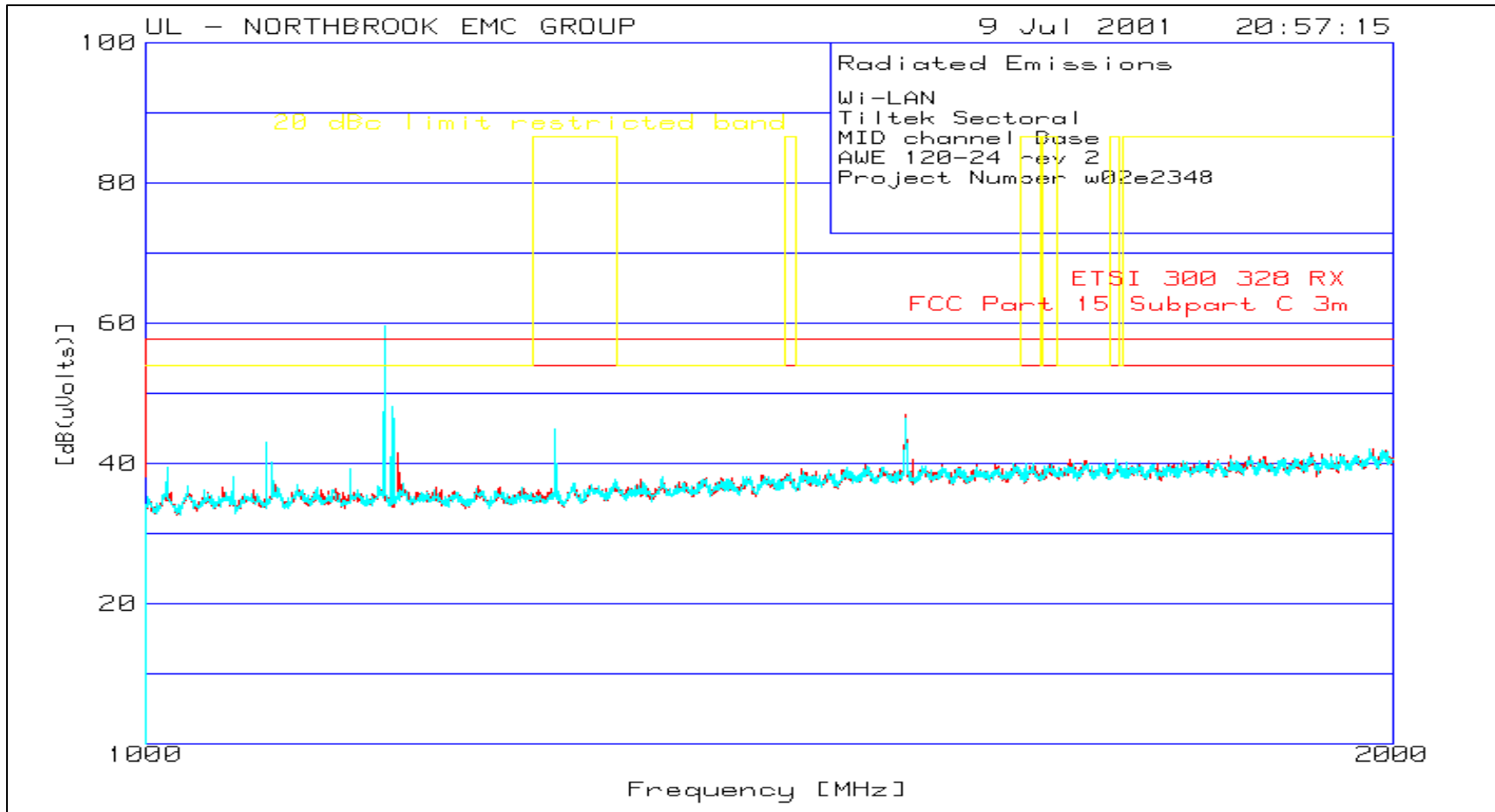


Plot 64  
Radiated Emissions of Sectoral Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
30-1000 MHz





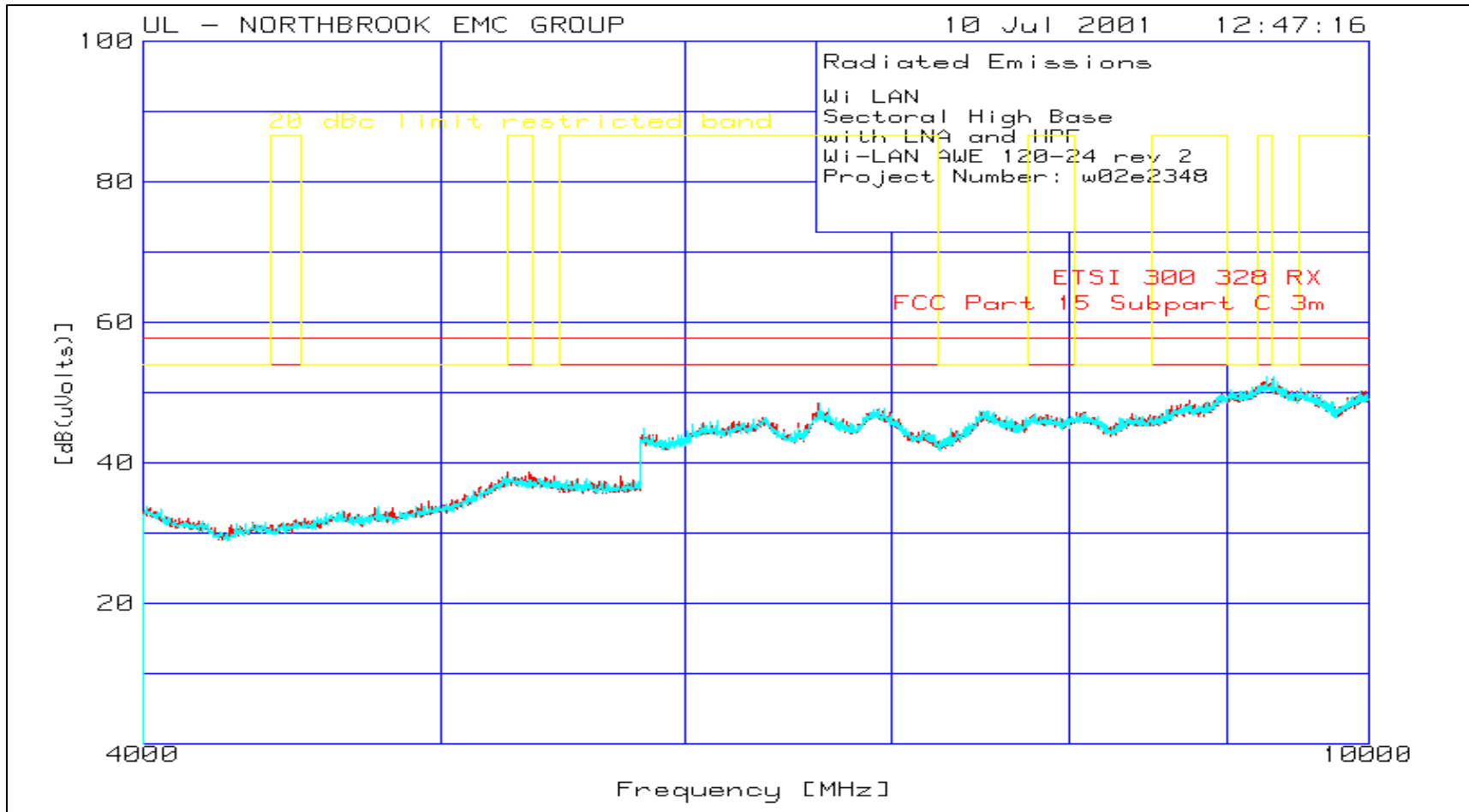
Plot 65  
Radiated Emissions of Sectoral Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
1-2 GHz



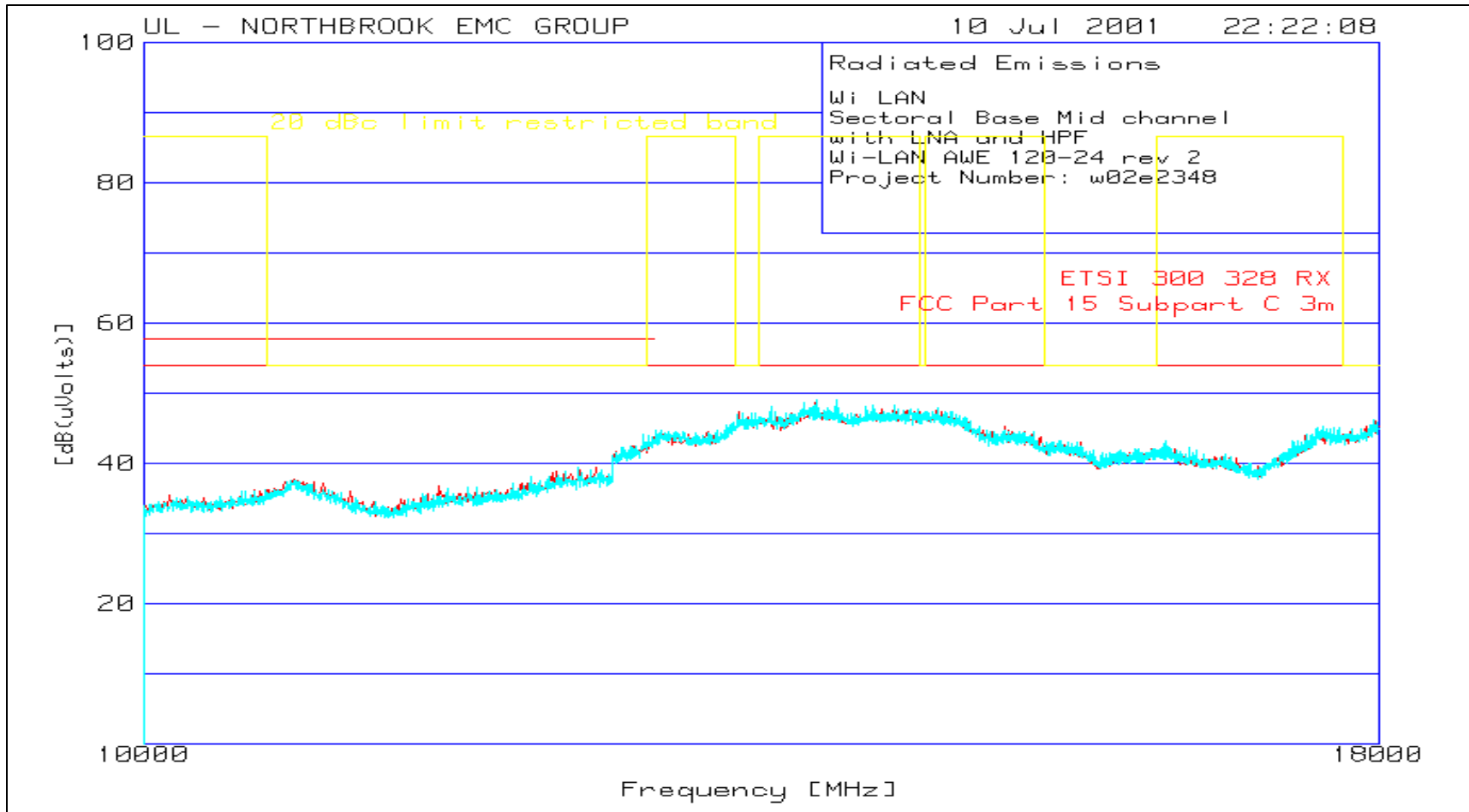
**Plot 66**  
**Radiated Emissions of Sectoral Antenna – Mid Channel**  
**AWE 20-24 REV-2 in Base mode**  
**2-4 GHz**



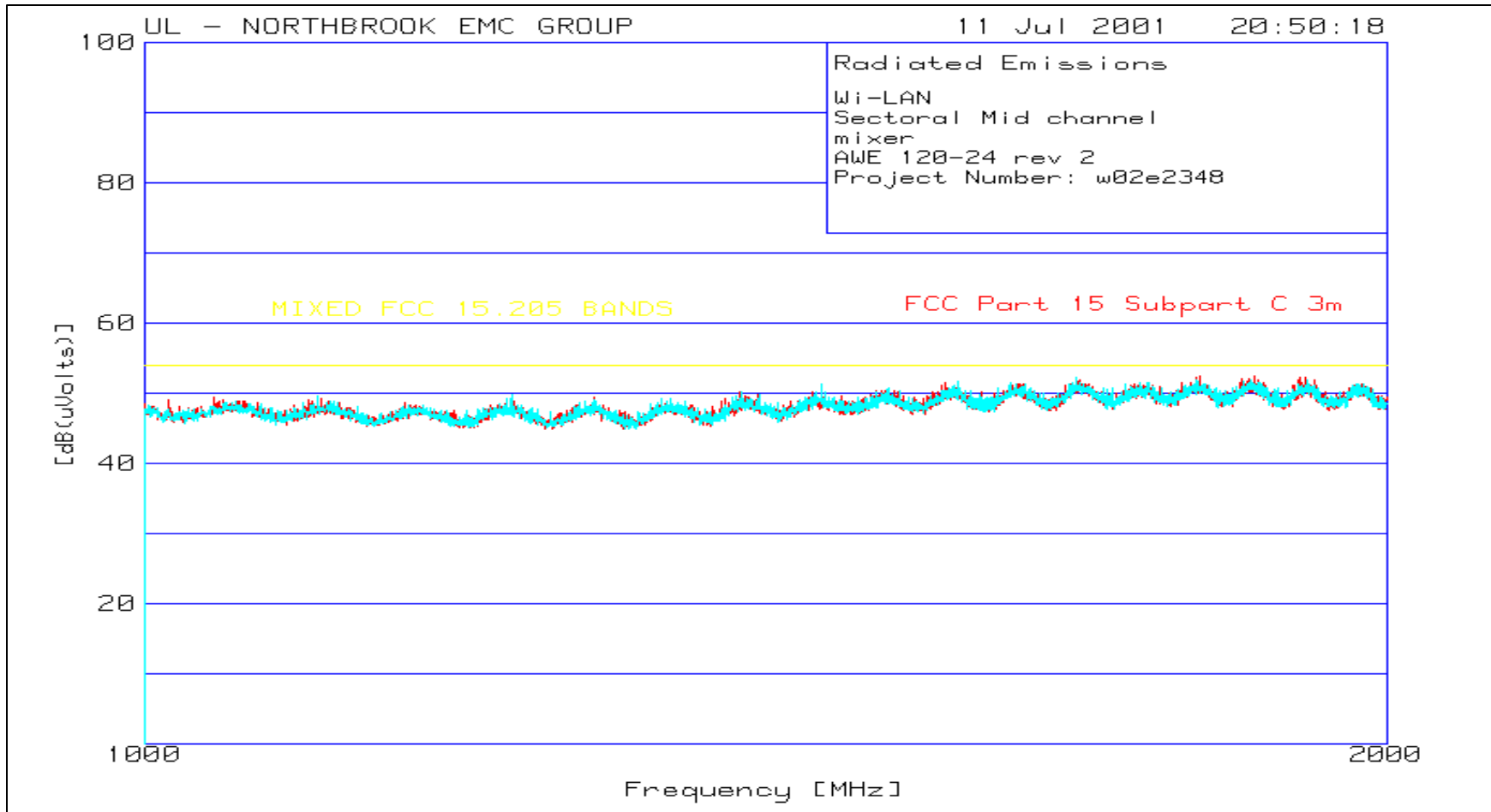
Plot 67  
Radiated Emissions of Sectoral Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
4-10GHz



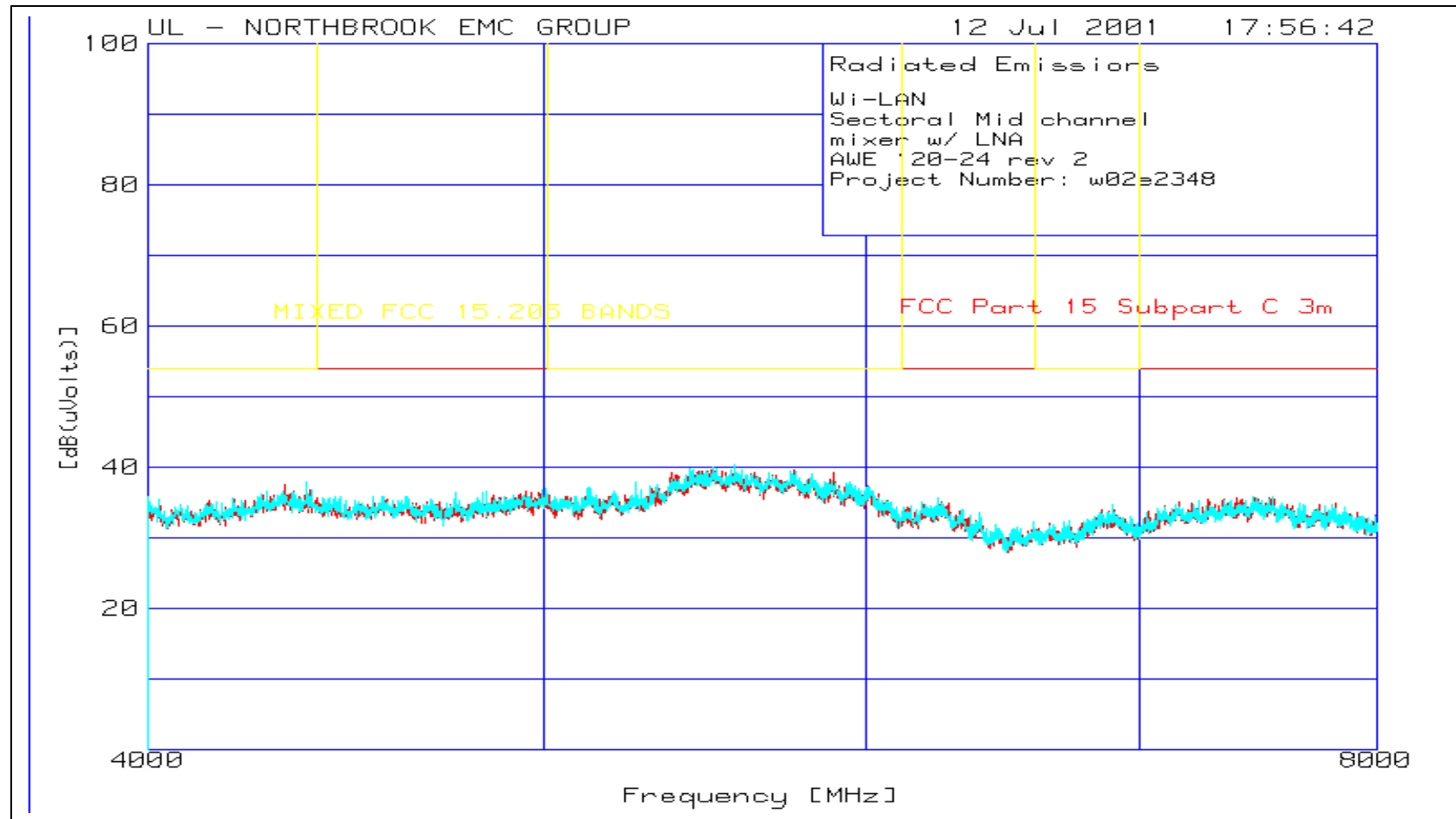
Plot 68  
Radiated Emissions of Sectoral Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
10-18 GHz



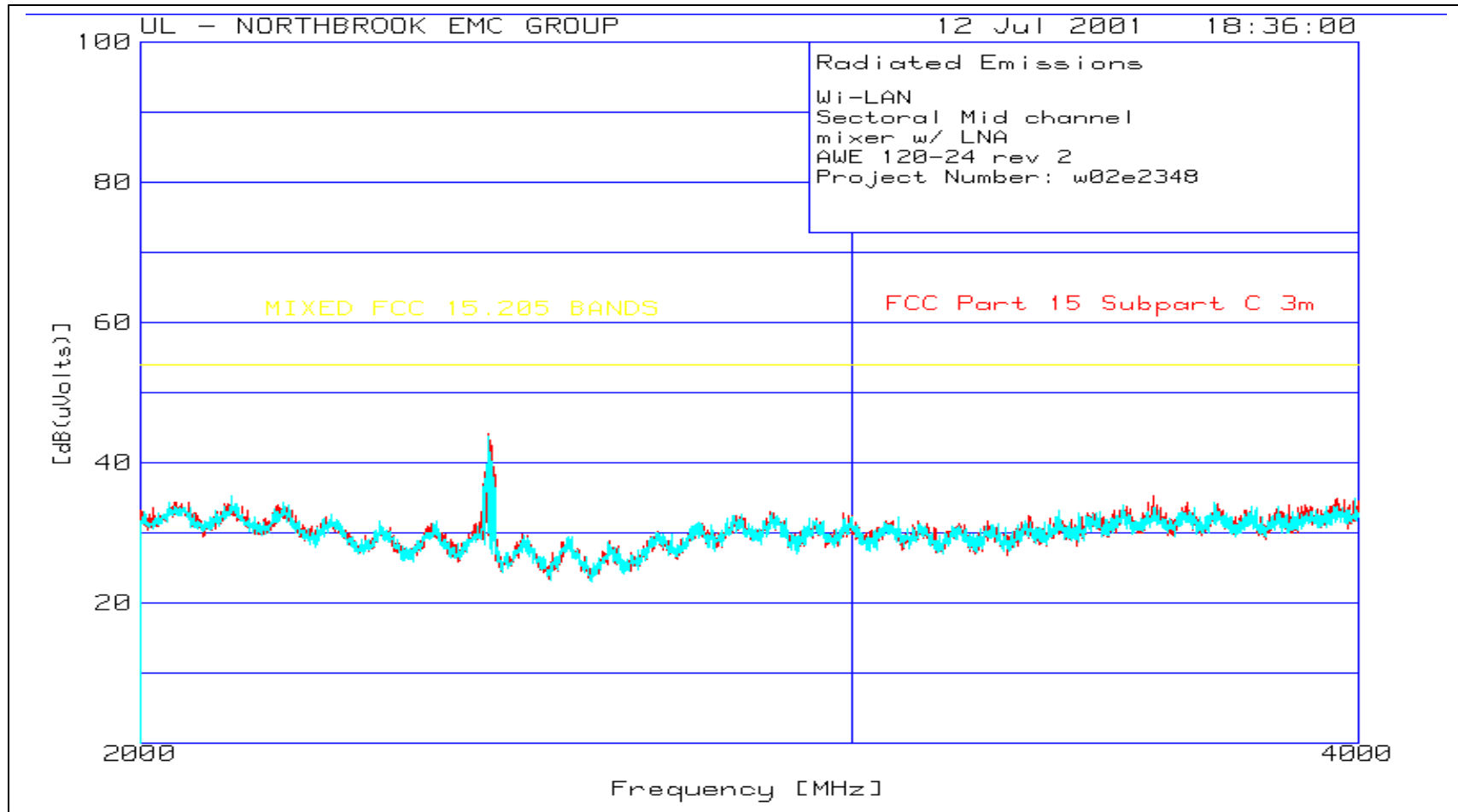
**Plot 69**  
**Radiated Emissions of Sectoral Antenna – Mid Channel**  
**AWE 20-24 REV-2 in Base mode**  
**18-19 GHz**



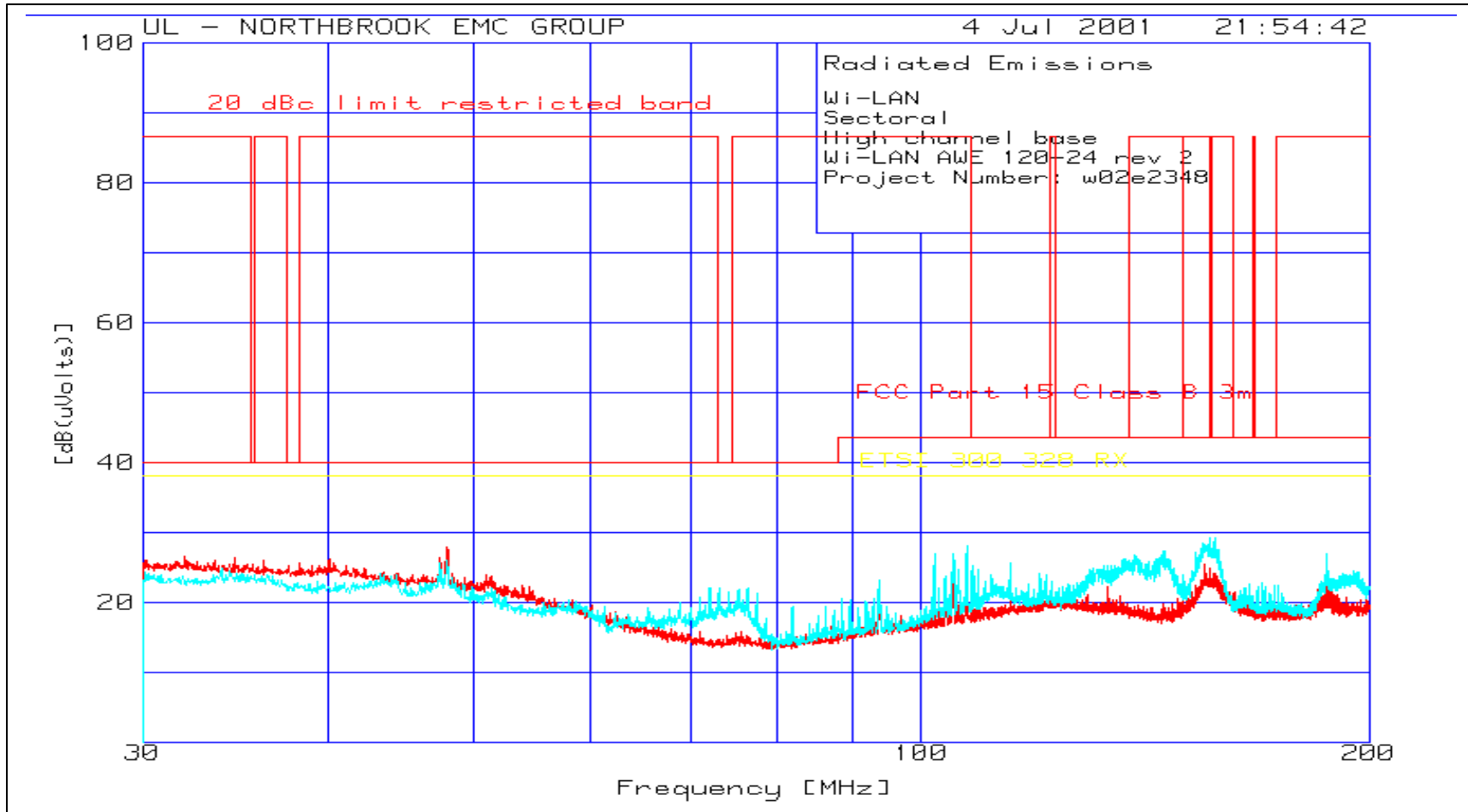
Plot 70  
Radiated Emissions of Sectoral Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
19-21 GHz



Plot 71  
Radiated Emissions of Sectoral Antenna – Mid Channel  
AWE 20-24 REV-2 in Base mode  
21-25 GHz

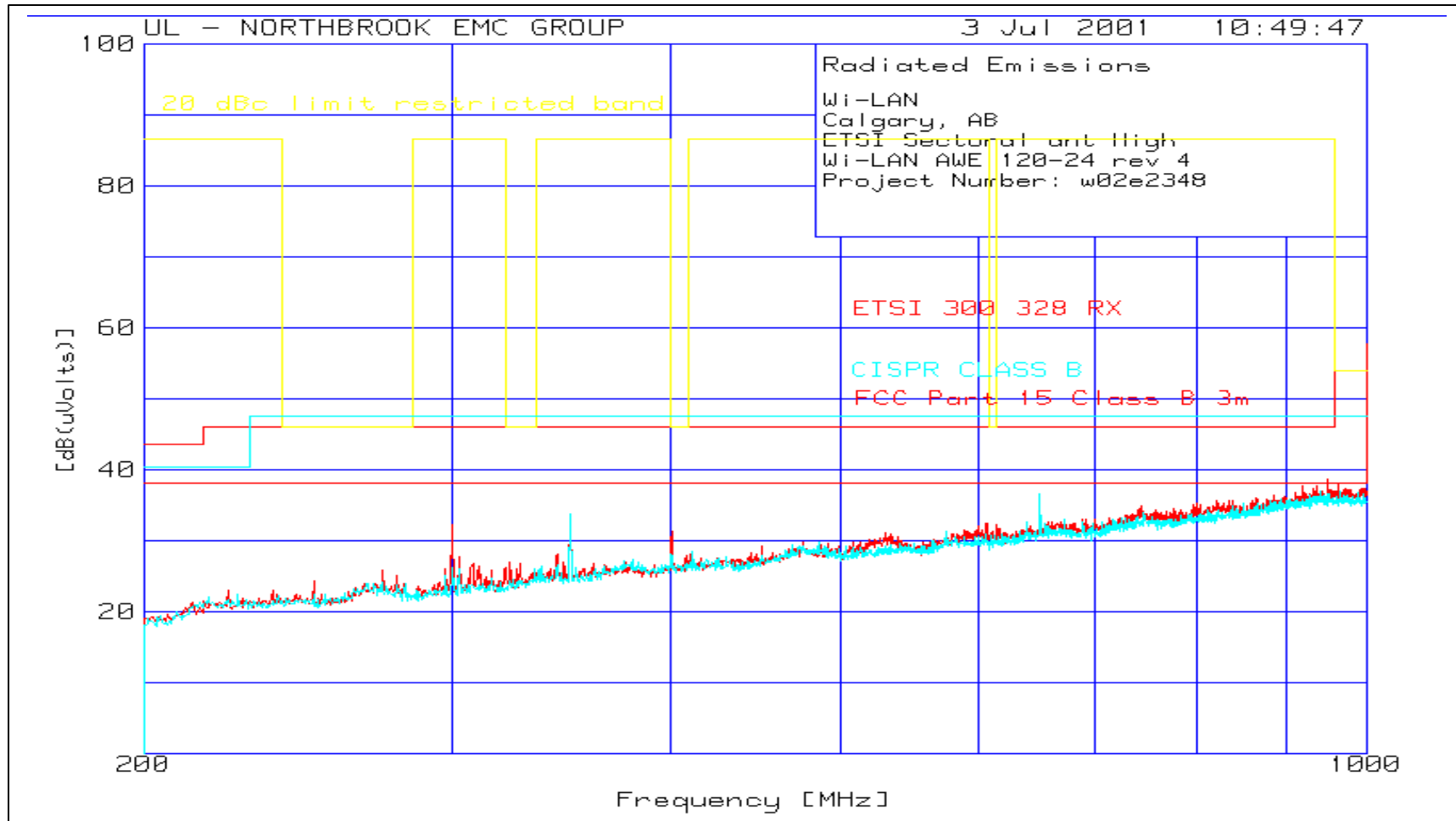


Plot 72  
Radiated Emissions of Sectoral Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
30-200 MHz

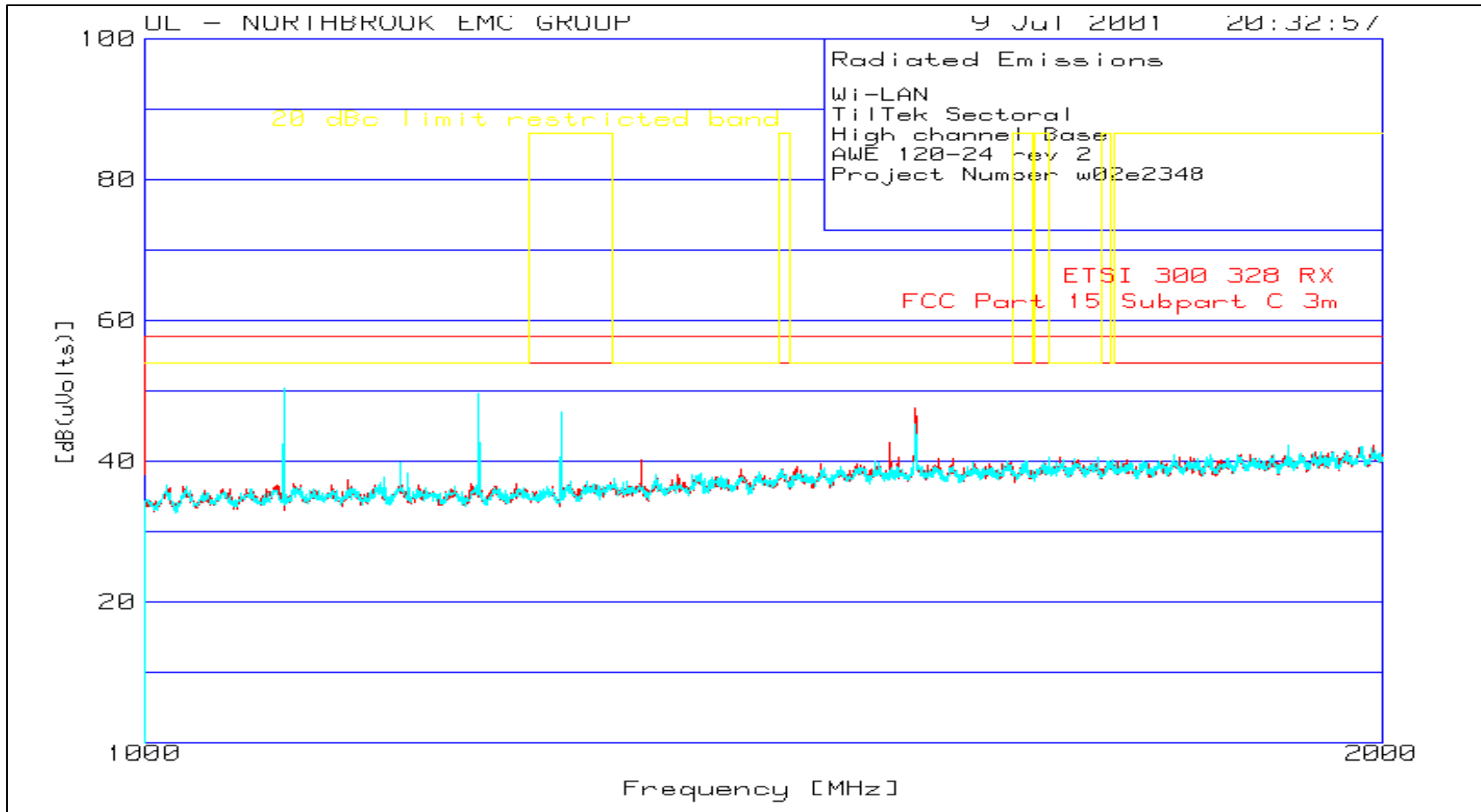




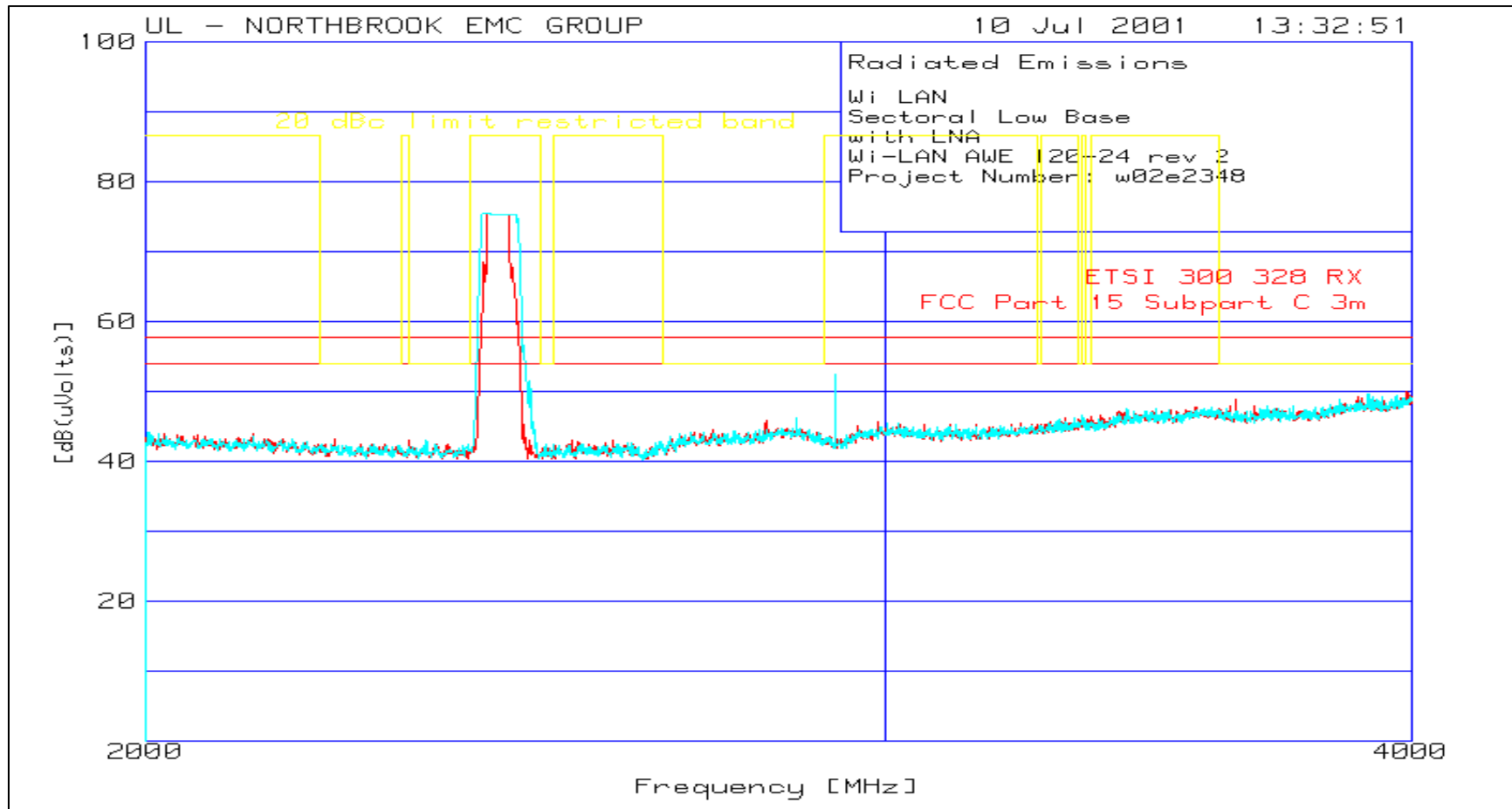
Plot 73  
Radiated Emissions of Sectoral Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
200-1000 MHz



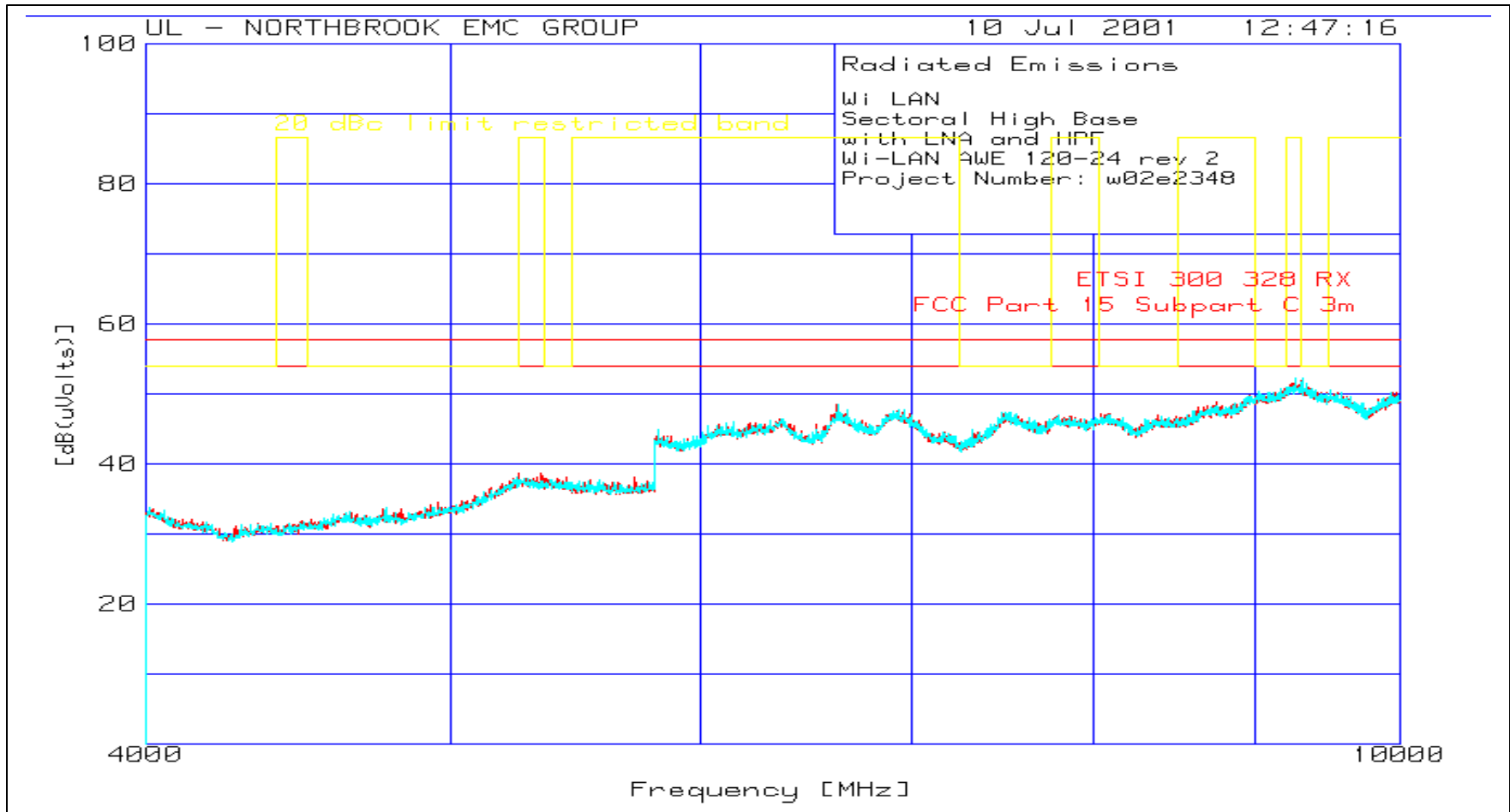
**Plot 74**  
**Radiated Emissions of Sectoral Antenna – High Channel**  
**AWE 20-24 REV-2 in Base mode**  
**1-2 GHz**



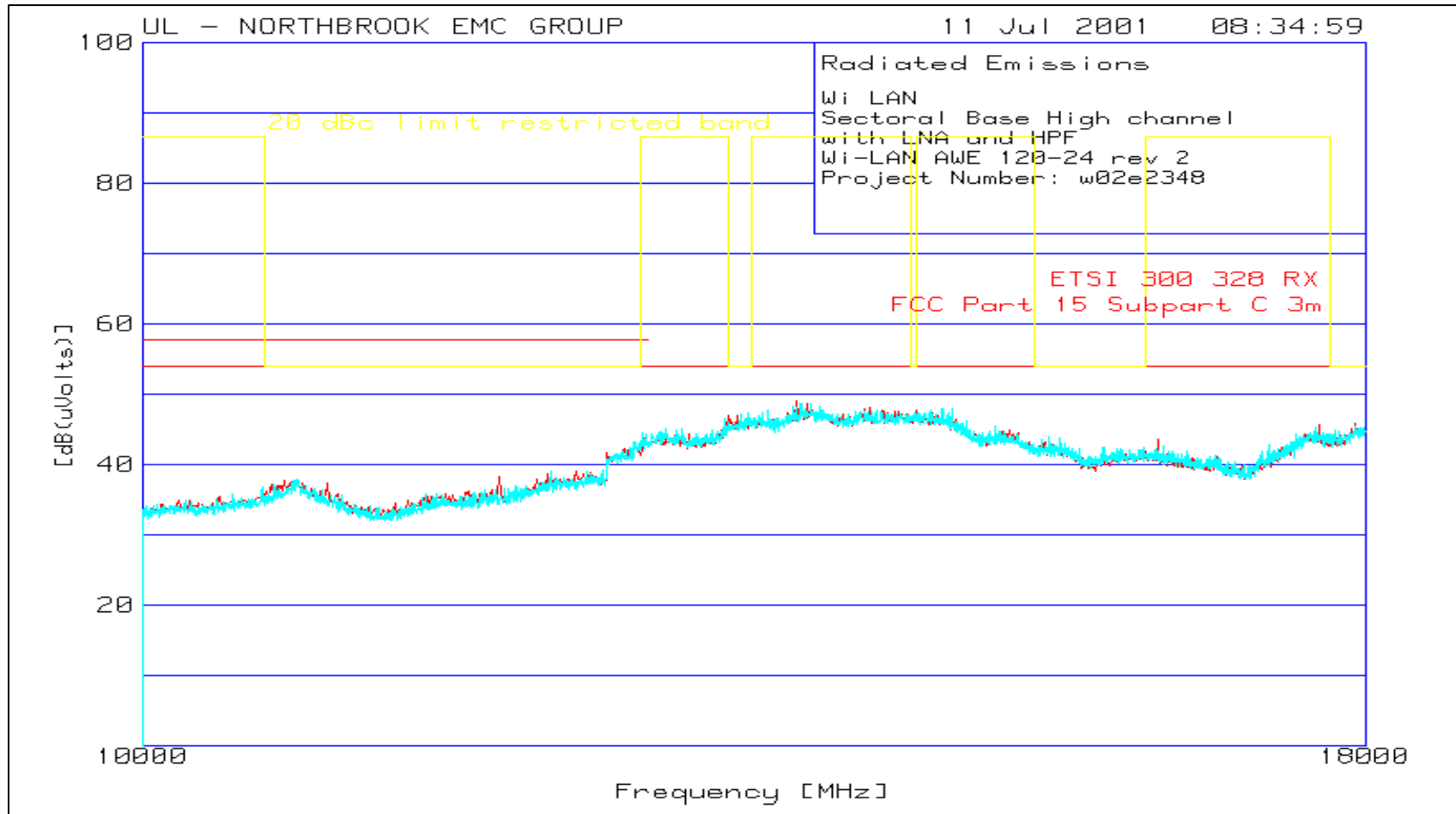
Plot 75  
Radiated Emissions of Sectoral Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
2-4 GHz



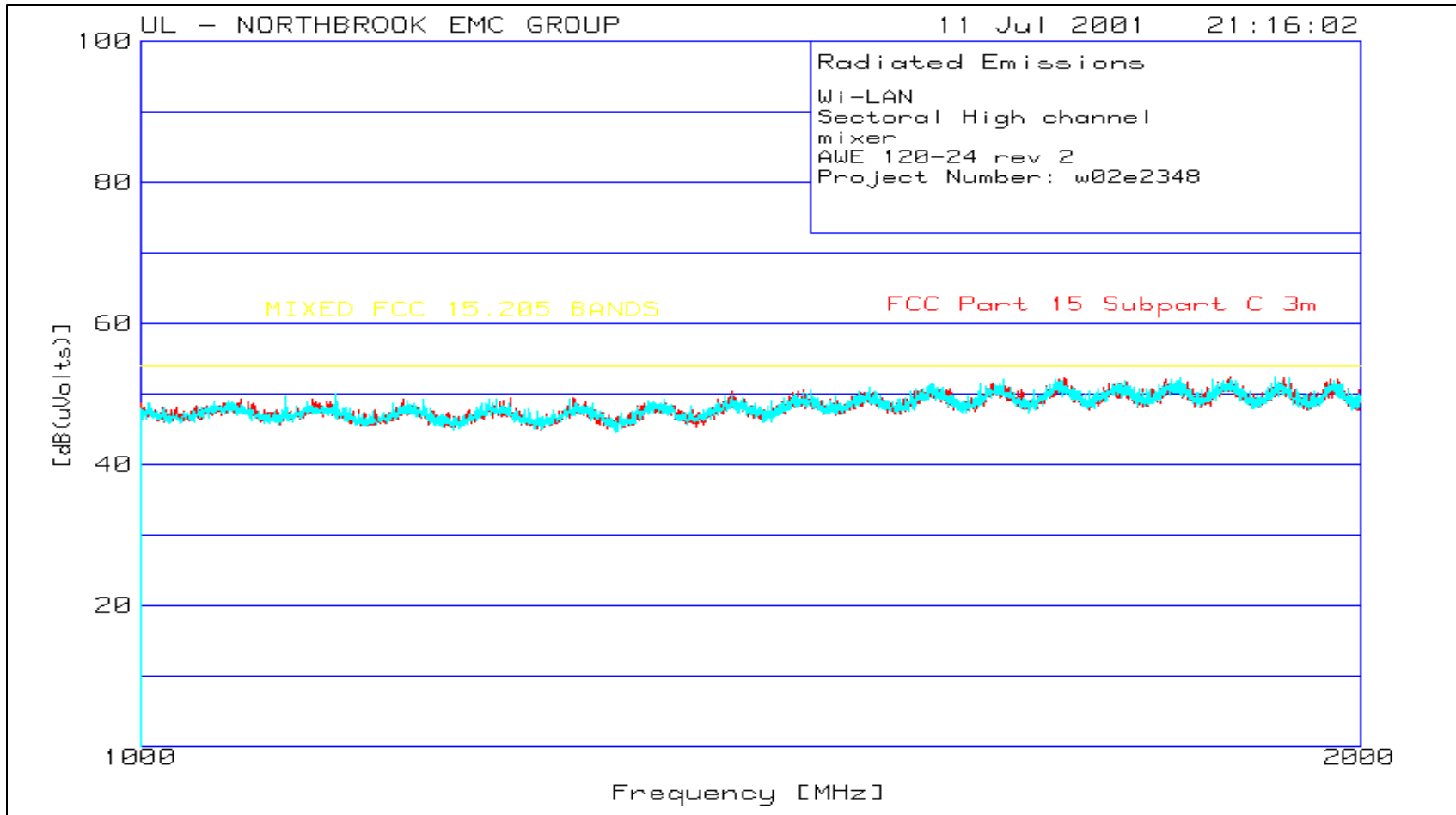
Plot 76  
Radiated Emissions of Sectoral Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
4-10GHz



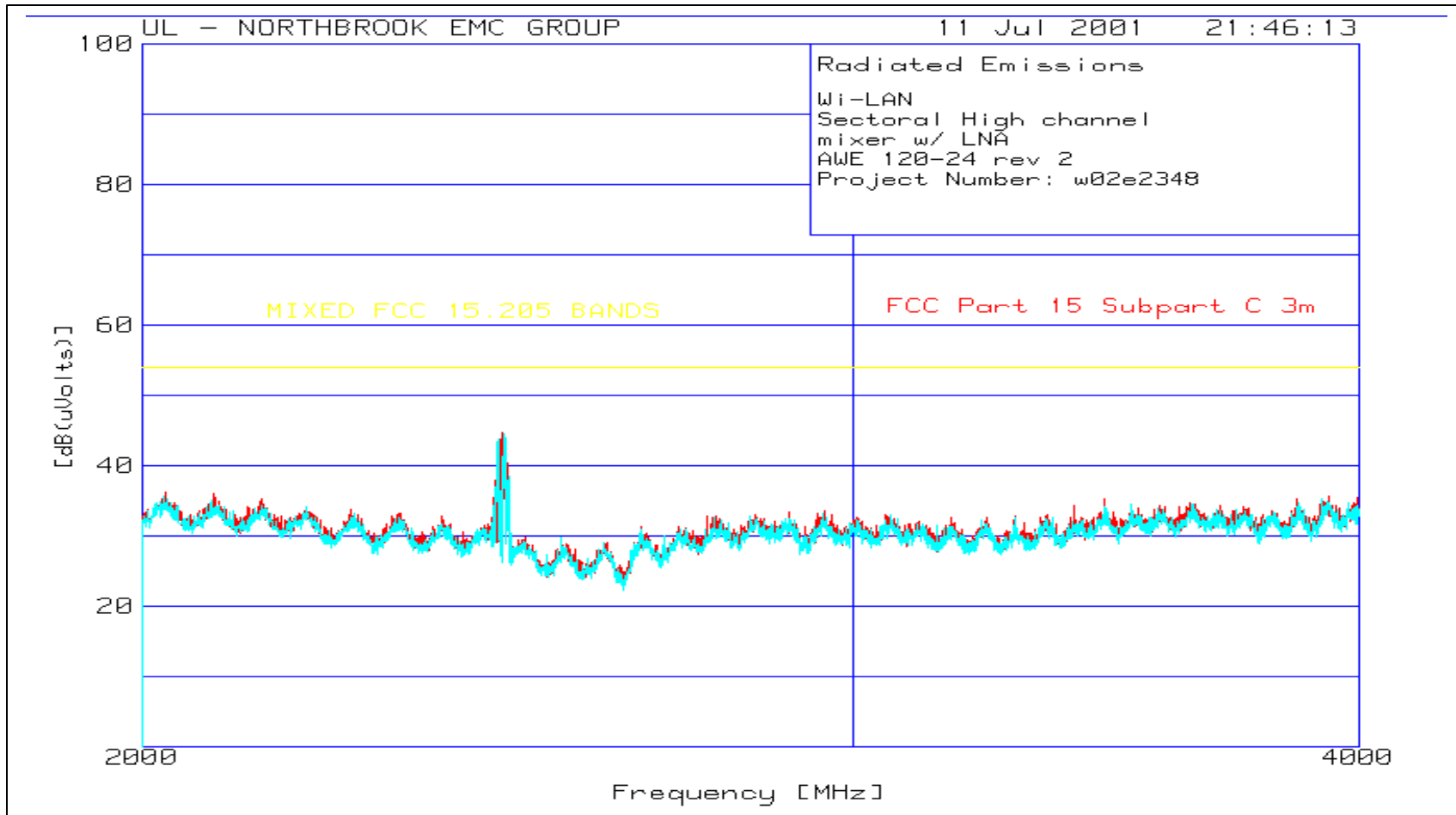
Plot 77  
Radiated Emissions of Sectoral Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
10-18 GHz



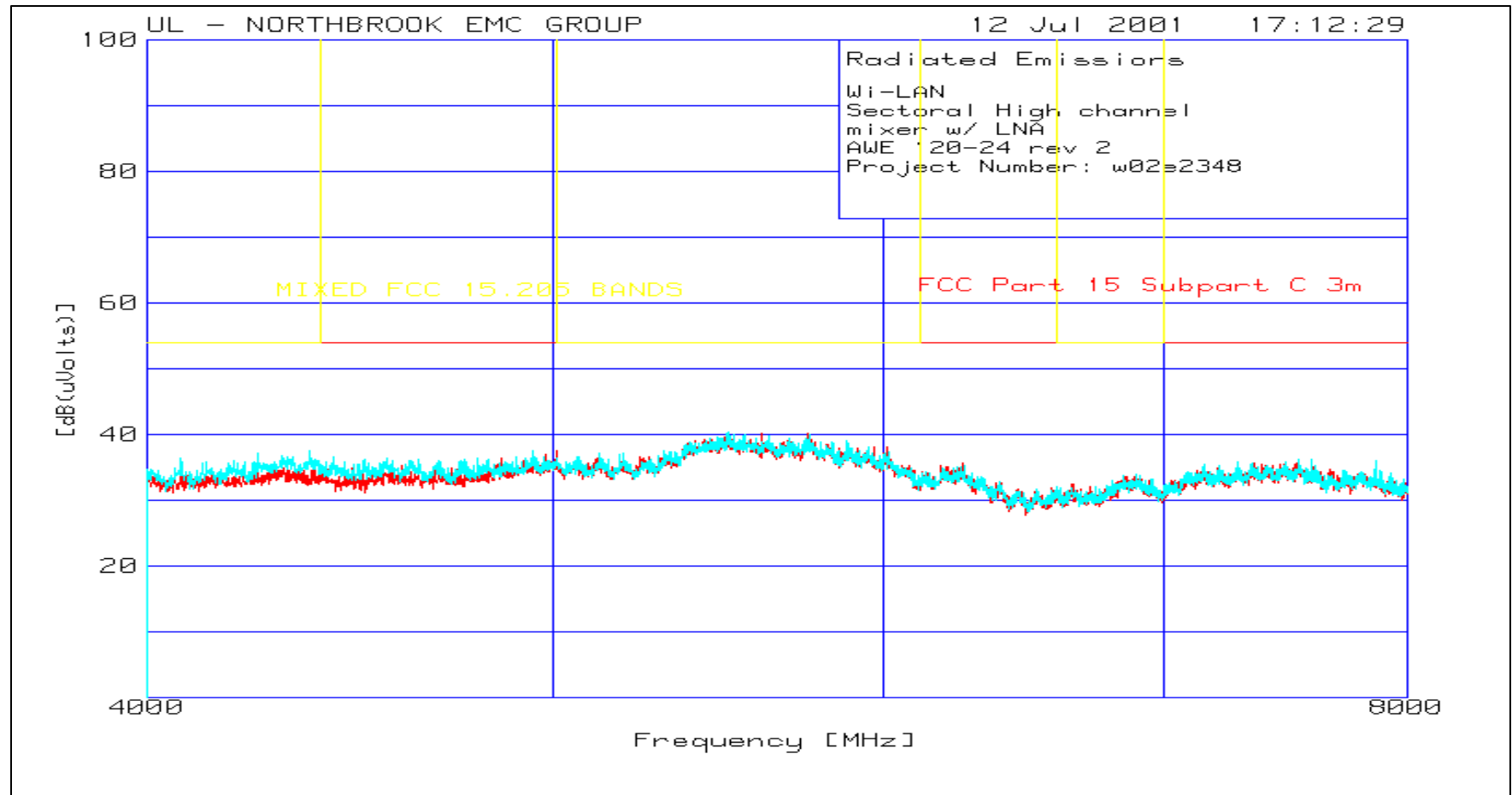
**Plot 78**  
**Radiated Emissions of Sectoral Antenna – High Channel**  
**AWE 20-24 REV-2 in Base mode**  
**18-19 GHz**



**Plot 79**  
**Radiated Emissions of Sectoral Antenna – High Channel**  
**AWE 20-24 REV-2 in Base mode**  
**19-21 GHz**



Plot 80  
Radiated Emissions of Sectoral Antenna – High Channel  
AWE 20-24 REV-2 in Base mode  
21-25 GHz





## **5.0 TEST FACILITY**

### **5.1 LOCATION**

The EUT was tested for Electromagnetic Compatibility at the Electronics Test Centre, located in Airdrie, Alberta, Canada.

The RF Anechoic Chamber (RFAC) is identified as Chamber 1, located in the main building complex at the Electronics Test Centre. Its usable working space measures 10.6 m long x 7.3 m wide x 6.5 m high.

This test site is listed with the FCC under Registration Number 99541. Measurements taken at this site are accepted by Industry Canada per file number IC 2046-1.

The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with ferrite tile, augmented by RF absorbant foam material on the end wall nearest the turntable, and on the adjacent walls and the ceiling. The chamber floor supports a 15 cm high internal floor, constructed of annealed steel panels, that forms the ground plane, and is bonded to the chamber walls.

The 3-m diameter turntable is flush-mounted with the floor. A sub-floor cable-way is provided to route cables between the turntable pit and EUT support equipment. Cables reach the EUT through an opening in the centre of the turntable.

Test instrumentation and EUT support equipment is located in two shielded vestibules located at the side of the main room. Cables are routed through bulkhead panels between the rooms as required. Power feeds are routed into the main room and vestibules through line filters providing at least 100 dB of attenuation between 10 kHz and 10 GHz.

### **5.2 GROUNDING PLAN**

The EUT was located on a wooden table 80 cm above the ground planes. The EUT was not grounded according to the client's specifications.

### **5.3 POWER**

AC power was supplied via an Underwriter's Laboratories ULW100-69, 100 dB, 100 Ampere wall mounted filter. Bonding to ground is implemented at the chamber wall.

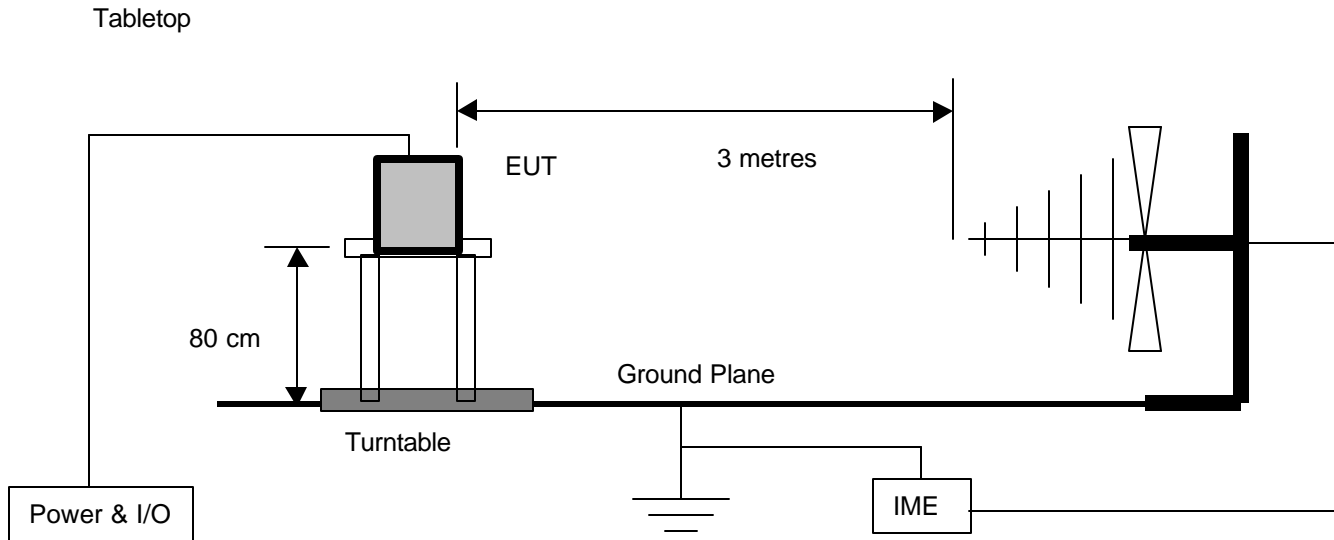
### **5.4 EMISSIONS PROFILE**

Ambient conducted and radiated electromagnetic emission profiles were generated throughout the tests and are included in the test data.

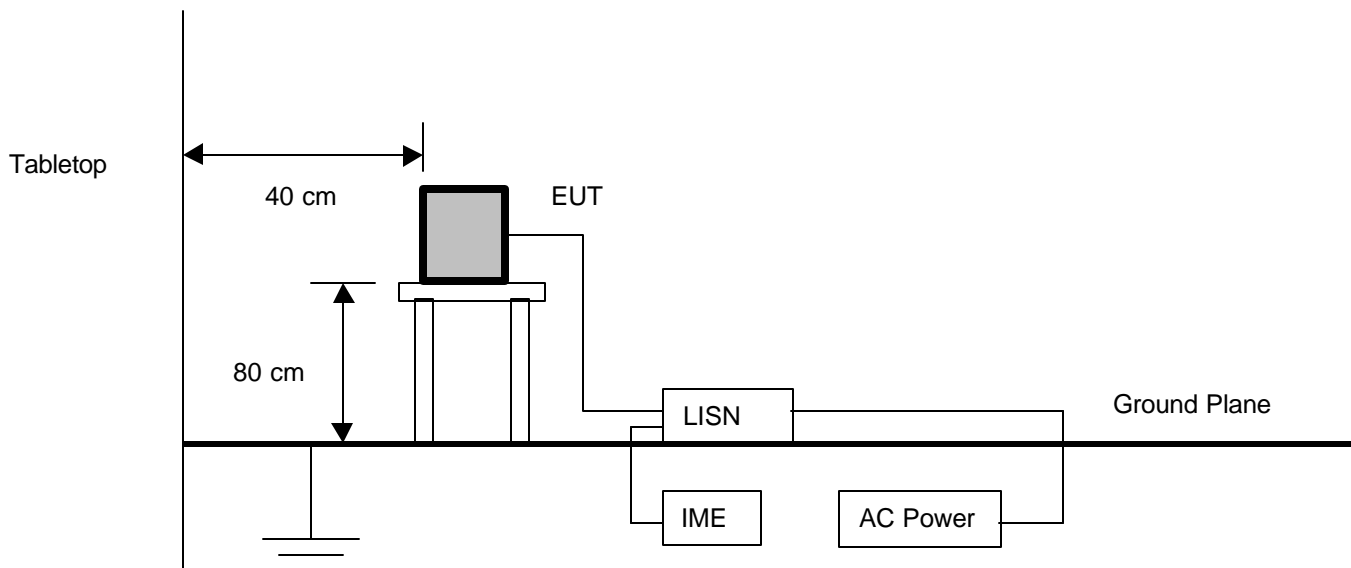
## 5.5 TEST CONFIGURATION

### 5.5.1 Tabletop Equipment

The following diagrams illustrate the configuration of the EUT test and measurement equipment for Radiated and Conducted Emissions Testing of tabletop equipment.



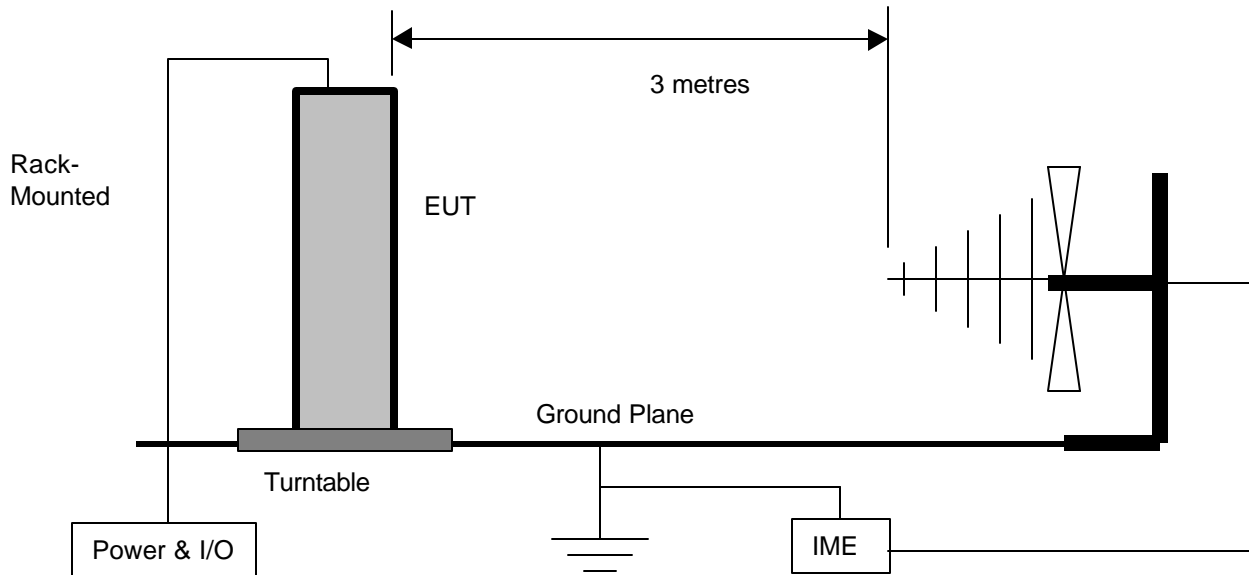
### Conducted Emissions



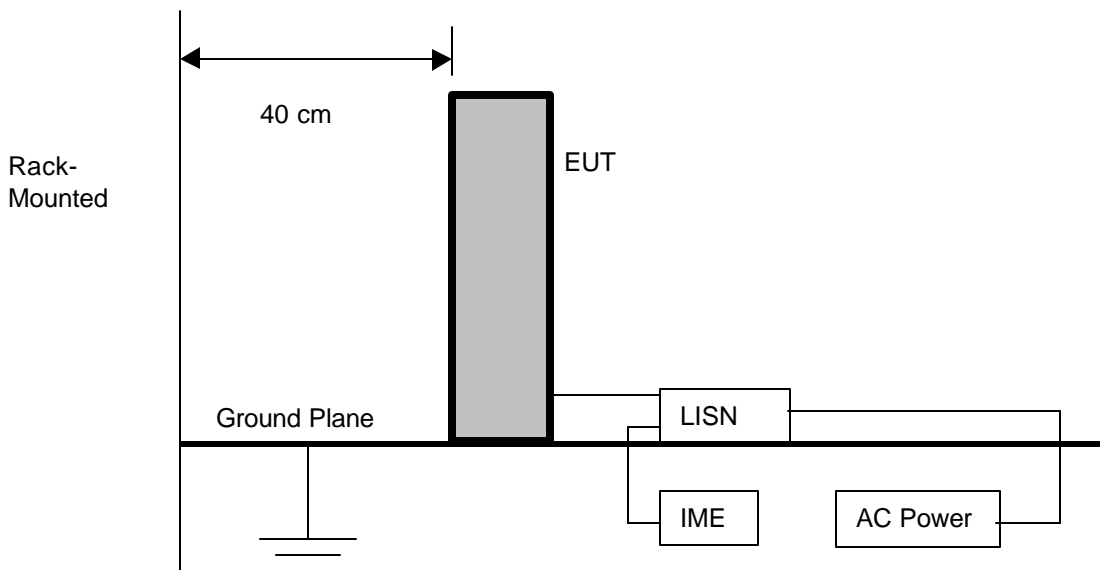
### 5.5.2 Rack Mount

The following diagrams illustrate the configuration of the EUT test and measurement equipment for Radiated and Conducted Emissions Testing of rack mounted equipment.

#### Radiated Emissions



#### Conducted Emissions



## **6.0 TEST EQUIPMENT**

The following equipment was used for this procedure. All measurement devices are calibrated annually, traceable to NIST.

### **6.1 RADIATED EMISSIONS**

- a) Spectrum Analyzer with RF Preselector
- b) CISPR Quasi-peak Adapter
- c) Power Isolation Transformers
- d) Biconilog antenna (20 MHz to 2 GHz)
- e) Antenna mast positioner, and controller
- f) Flush-mounted turntable, and controller
- g) Personal Computer and EMC software

### **6.2 CONDUCTED EMISSIONS**

- a) Spectrum Analyzer with RF Preselector
- b) Line Impedance Stabilization Network, 50  $\mu$ H
- c) CISPR Quasi-peak Adapter
- d) Isolation Transformer
- e) Personal Computer and EMC software

### **6.3 CALIBRATION**

All measurement instrumentation conforms to ANSI C63.2. Calibration is maintained in accordance with manufacturer recommendations. Each measurement device is labeled with its ETC asset number and calibration due date.

#### **6.3.1 CALIBRATION ACCURACY**

Test equipment used to provide quantitative measurements are calibrated with standards traceable to the National Research Council, National Institute of Standards and Technology or other national standards. Instrumentation systems for emissions measurements have the following accuracies:

Frequency =  $\pm 1$  kHz  
Amplitude (RE) =  $\pm 4.01$  dB  
Amplitude (CE) =  $\pm 3.25$  dB

### 6.3.2 TEST EQUIPMENT DESCRIPTION

The equipment used in the tests was selected from the following list.

Instrument	Manufacturer	Model No.	Asset No.	Calibration Due
Spectrum Analyzer	Hewlett Packard	8566B	9565	11 April 2002
Spectrum Analyzer	Hewlett Packard	8566B	9168	30 January 2002
RF Preselector	Hewlett Packard	85685A	9563	21 September 2001
RF Preselector	Hewlett Packard	85685A	9728	30 March 2002
Quasi-Peak Adapter	Hewlett Packard	85650A	9243	16 August 2001
Line Impedance Stabilization Network	EMCO	3825/2r	9331	2 November 2001
Line Impedance Stabilization Network	EMCO	3825/2r	9259	2 November 2001
Biconilog Antenna	ARA	Lpb-2520/A	4318	13 June 2002
Dual Ridged Guide Antenna	EMCO	3115	9588	6 August 2001
Low Noise Amplifier	MITEQ	JS43-01001800-21-5P	4354	14 February 2002
Power Meter	Hewlett Packard	436A	9061	3 August 2001
Power Sensor	Hewlett Packard	8482A	9758	3 August 2001
Down Converter (Mixer)	Quinstar		4381	11 July 2002

## Appendix A

### AWE 120-24 rev 2

#### Test Sample Description (from data provided by Wi-LAN)

Product Application	Product Category
Commercial <input checked="" type="checkbox"/> Military <input type="checkbox"/>	Telecommunications <input type="checkbox"/> Aerospace <input type="checkbox"/> Information Technology <input checked="" type="checkbox"/> Test & Measurement <input type="checkbox"/> Surface Transportation <input type="checkbox"/> Other <input type="checkbox"/> _____
<b>Product Name</b>	AWE 120-24 rev 2
<b>Part/Model No.</b>	AWE 120-24 rev 2
<b>Serial Number</b>	N/A
<b>Power Requirements:</b> (Voltage, AC/DC, Hz, Current)	120 to 230 VAC 50/60 Hz
<b>Typical Installation Instructions or Configuration</b>	N/A
<b>Ground Connection</b> (in addition to power cord)	N/A
<b>Internally Generated Frequencies</b>	2.400 to 2.485 GHz
<b>Peripheral Support Equipment</b>	Omni, TilTek Dish, and Sectoral Antennas
<b>Description and number of interconnecting Leads &amp; Cables</b>	CAT 5, RS-232, antenna cable
<b>Brief Functional Description</b>	Wireless communication base station