



Engineering and Testing for EMC and Safety Compliance

CERTIFICATION APPLICATION REPORT
FCC PART 15.247 CERTIFICATION & INDUSTRY CANADA CERTIFICATION

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FCC ID:	QLNVLJ24WFSW	GRANTEE FRN NUMBER:	0004-3370-93
PLAT FORM:	N/A	RTL WORK ORDER NUMBER:	2003034
MODEL(S):	Vivato 2.4 GHz Wi-Fi Switch	RTL QUOTE NUMBER:	QRTL03-768
DATE OF TEST REPORT:	April 15, 2003		
American National Standard Institute:	ANSI/TIA/EIA603 and ANSI/TIA/EIA 603-1		
FCC Classification:	DSS – Spread Spectrum Transmitter		
FCC Rule Part(s):	Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System		
Industry Canada Standard:	RSS-210: Low Power License-Exempt WLAN Communication Devices (All Frequency Bands)		
Digital Interface Information	Digital Interface was found to be compliant		
Receiver Information	Receiver was found to be compliant		
Frequency Range (MHz)	Conducted Output Power (W)	Frequency Tolerance	Emission Designator
2412-2462	0.118	N/A	N/A

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to, or exclusions from the FCC Part 2, FCC Part 15, Industry Canada RSS-210, ANSI C63.4, ANSI/TIA/EIA603, and ANSI/TIA/EIA 603-1.

Signature: 

Date: April 15, 2003

Typed/Printed Name: Desmond A. Fraser

Position: President

TABLE OF CONTENTS

1.	GENERAL INFORMATION.....	11
1.1.	SCOPE.....	11
1.2.	TEST FACILITY.....	11
1.3.	RELATED SUBMITTAL(S)/GRANT(S).....	11
2.	TEST INFORMATION.....	12
2.1.	TEST JUSTIFICATION.....	12
2.2.	EXERCISING THE EUT.....	13
2.3.	TEST RESULT SUMMARY.....	14
2.4.	TEST SYSTEM DETAILS.....	16
2.5.	CONFIGURATION OF TESTED SYSTEM.....	17
3.	COMPLIANCE WITH THE RESTRICTED BAND EDGE - §15.205.....	18
3.1.	TEST PROCEDURE.....	18
3.2.	COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN 13.....	20
3.3.	COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN 4.....	33
3.4.	COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN 8.....	46
3.5.	COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN'S 13, 6 AND 1.....	59
3.6.	COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN 13, 6 AND 1.....	72
3.7.	COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN 1, 6 AND 13.....	77
3.8.	COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN'S 6, 1 AND 13.....	82
3.9.	COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN'S 1, 13 AND 6.....	87
3.10.	COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN'S 6, 13 AND 1.....	92
4.	CONDUCTED LIMITS - §15.207.....	105
4.1	TEST METHODOLOGY FOR CONDUCTED EMISSIONS MEASUREMENTS.....	105
4.2	CONDUCTED EMISSION TEST.....	105
5.	RADIATED EMISSION LIMITS RECEIVER/DIGITAL INTERFACE - §15.209.....	116
5.1.	RADIATED EMISSION LIMITS TEST PROCEDURE.....	116
5.2.	RADIATED EMISSION LIMITS TEST DATA DIGITAL NOISE.....	116
5.3.	RADIATED EMISSION LIMITS TEST DATA RX MODE CH 1.....	117
5.4.	RADIATED EMISSION LIMITS TEST DATA RX MODE CH 6.....	117
5.5.	RADIATED EMISSION LIMITS TEST DATA RX MODE CH 11.....	118
6.	RADIATED EMISSION LIMITS RADIATED HARMONICS - §15.247.....	119
6.1.	RADIATED EMISSION LIMITS TEST PROCEDURE.....	119
6.2.	RADIATED EMISSION LIMITS TEST DATA FOR WLAN 13.....	120
6.3.	RADIATED EMISSION LIMITS TEST DATA FOR WLAN 8.....	126
6.4.	RADIATED EMISSION LIMITS TEST DATA FOR WLAN 4.....	132
6.5.	RADIATED EMISSION LIMITS TEST DATA FOR WLAN 13 (CH1), WLAN 1 (CH6) AND WLAN 6 (CH 11).....	138
6.6.	RADIATED EMISSION LIMITS TEST DATA FOR WLAN 1 (CH 1), WLAN 13 (CH 6) AND WLAN 6 (CH 11).....	144
6.7.	RADIATED EMISSION LIMITS TEST DATA FOR WLAN 6 (CH 1), WLAN 13 (CH 6) AND WLAN 1 (CH 11).....	152
6.8.	TEST EQUIPMENT USED FOR TESTING.....	161
7.	MODULATED BANDWIDTH - §15.247(A)(2).....	162
7.1.	MODULATED BANDWIDTH TEST PROCEDURE.....	162
7.2.	MODULATED BANDWIDTH TEST DATA WLAN 13.....	163
7.3.	MODULATED BANDWIDTH TEST PLOTS WLAN 13.....	164
7.4.	MODULATED BANDWIDTH TEST DATA WLAN 4.....	173
7.5.	MODULATED BANDWIDTH TEST PLOTS WLAN 4.....	174
7.6.	MODULATED BANDWIDTH TEST DATA WLAN 8.....	183
7.7.	MODULATED BANDWIDTH TEST PLOTS WLAN 8.....	184

8.	POWER OUTPUT - §15.247(B)	193
8.1.	POWER OUTPUT TEST PROCEDURE	193
8.2.	TEST EQUIPMENT USED FOR TESTING	196
8.3.	POWER OUTPUT TEST DATA - WLAN 13	197
8.4.	POWER OUTPUT TEST DATA - WLAN 1	198
8.5.	POWER OUTPUT TEST DATA - WLAN 6	199
8.6.	POWER OUTPUT TEST DATA- WLAN 4	200
8.7.	POWER OUTPUT TEST DATA - WLAN 8	201
8.8.	POWER OUTPUT TEST DATA - WLAN 10	202
9.	ANTENNA CONDUCTED SPURIOUS EMISSIONS - §15.247(C)	203
9.1.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST PROCEDURES	203
9.2.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13 CHANNEL 1 AT 1 MBPS	203
9.3.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13 CHANNEL 1 AT 2 MBPS	205
9.4.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13 CHANNEL 1 AT 11 MBPS	206
9.5.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13 CHANNEL 6 AT 1 MBPS	207
9.6.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13 CHANNEL 6 AT 2 MBPS	208
9.7.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13 CHANNEL 6 AT 11 MBPS	209
9.8.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13 CHANNEL 11 AT 1 MBPS	210
9.9.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13 CHANNEL 11 AT 2 MBPS	211
9.10.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13 CHANNEL 11 AT 11 MBPS	212
9.11.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 4 CHANNEL 1 AT 1 MBPS	213
9.12.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 4 CHANNEL 1 AT 2 MBPS	214
9.13.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 4 CHANNEL 1 AT 11 MBPS	215
9.14.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 4 CHANNEL 6 AT 1 MBPS	216
9.15.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 4 CHANNEL 6 AT 2 MBPS	217
9.16.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 4 CHANNEL 6 AT 11 MBPS	218
9.17.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 4 CHANNEL 11 AT 1 MBPS	219
9.18.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 4 CHANNEL 11 AT 2 MBPS	220
9.19.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 4 CHANNEL 11 AT 11 MBPS	221
9.20.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 8 CHANNEL 1 AT 1 MBPS	222
9.21.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 8 CHANNEL 1 AT 2 MBPS	223
9.22.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 8 CHANNEL 1 AT 11 MBPS	224
9.23.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 8 CHANNEL 6 AT 1 MBPS	225
9.24.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 8 CHANNEL 6 AT 2 MBPS	226
9.25.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 8 CHANNEL 6 AT 11 MBPS	227
9.26.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 8 CHANNEL 11 AT 1 MBPS	228
9.27.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 8 CHANNEL 11 AT 2 MBPS	229
9.28.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 8 CHANNEL 11 AT 11 MBPS	230
9.29.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13, 1 AND 6 ON CHANNEL 1, 6 AND 11 AT 1 MBPS	231
9.30.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA WLAN 13, 1 AND 6 ON CHANNEL 1, 6 AND 11 AT 2 MBPS	232
9.31.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 13, 1 AND 6 ON CHANNEL 1, 6 AND 11 AT 11 MBPS	233
9.32.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 1, 13 AND 6 ON CHANNEL 1, 6 AND 11 AT 1 MBPS	234
9.33.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA WLAN 1, 13 AND 6 ON CHANNEL 1, 6 AND 11 AT 2 MBPS	235
9.34.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 1, 13 AND 6 ON CHANNEL 1, 6 AND 11 AT 11 MBPS	236
9.35.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 6, 13 AND 1 ON CHANNEL 1, 6 AND 11 AT 1 MBPS	237
9.36.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA WLAN 6, 13 AND 1 ON CHANNEL 1, 6 AND 11 AT 2 MBPS	238
9.37.	ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST DATA, WLAN 1, 13 AND 6 ON CHANNEL 1, 6 AND 11 AT 11 MBPS	239

10.	POWER SPECTRAL DENSITY - §15.247(D)	240
10.1.	POWER SPECTRAL DENSITY TEST PROCEDURE	240
10.2.	TEST EQUIPMENT USED FOR TESTING	240
10.3.	POWER SPECTRAL DENSITY TEST DATA WLAN 13	240
10.4.	POWER SPECTRAL DENSITY TEST PLOTS WLAN 13	242
10.5.	POWER SPECTRAL DENSITY TEST DATA FOR WLAN 8	251
10.6.	POWER SPECTRAL DENSITY TEST PLOTS WLAN 8	252
10.7.	POWER SPECTRAL DENSITY TEST DATA FOR WLAN 4	261
10.8.	POWER SPECTRAL DENSITY TEST PLOTS WLAN 4	262
11.	CONCLUSION	271

TABLE INDEX

TABLE 2.3-1:	FCC PART 15.247 DIRECT SEQUENCE SPREAD SPECTRUM TEST RESULT SUMMARY	14
TABLE 2.3-2:	TEST RESULT SUMMARY WITH FCC RULES AND REGULATIONS	16
TABLE 2.4-1:	EQUIPMENT UNDER TEST (EUT).....	16
TABLE 2.4-2:	EXTERNAL COMPONENTS IN TEST CONFIGURATION	16
TABLE 3.2-1:	RESTRICTED BAND EDGE TEST DATA (1 MBPS).....	20
TABLE 3.2-2:	RESTRICTED BAND EDGE TEST DATA (2 MBPS).....	20
TABLE 3.2-3:	RESTRICTED BAND EDGE TEST DATA (11 MBPS).....	20
TABLE 3.3-1:	RESTRICTED BAND EDGE TEST DATA (1 MBPS).....	33
TABLE 3.3-2:	RESTRICTED BAND EDGE TEST DATA (2 MBPS).....	33
TABLE 3.3-3:	RESTRICTED BAND EDGE TEST DATA (11 MBPS).....	33
TABLE 3.4-1:	RESTRICTED BAND EDGE TEST DATA (1 MBPS).....	46
TABLE 3.4-2:	RESTRICTED BAND EDGE TEST DATA (2 MBPS).....	46
TABLE 3.4-3:	RESTRICTED BAND EDGE TEST DATA (11 MBPS).....	46
TABLE 3.5-1:	RESTRICTED BAND EDGE TEST DATA (1 MBPS).....	59
TABLE 3.5-2:	RESTRICTED BAND EDGE TEST DATA (2 MBPS).....	59
TABLE 3.5-3:	RESTRICTED BAND EDGE TEST DATA (11 MBPS).....	59
TABLE 3.6-1:	RESTRICTED BAND EDGE TEST DATA (1 MBPS).....	72
TABLE 3.7-1:	RESTRICTED BAND EDGE TEST DATA (1 MBPS).....	77
TABLE 3.8-1:	RESTRICTED BAND EDGE TEST DATA (1 MBPS).....	82
TABLE 3.9-1:	RESTRICTED BAND EDGE TEST DATA (1 MBPS).....	87
TABLE 3.10-1:	RESTRICTED BAND EDGE TEST DATA (1 MBPS)	92
TABLE 3.10-2:	RESTRICTED BAND EDGE TEST DATA (2 MBPS)	92
TABLE 3.10-3:	RESTRICTED BAND EDGE TEST DATA (11 MBPS).....	92
TABLE 4-1.2:	NEUTRAL SIDE TRANSMITTING ON CH 1 AT 1 MBPS RATE	106
TABLE 4-2.2:	PHASE SIDE TRANSMITTING ON CH 1 AT 1 MBPS RATE.....	106
TABLE 5.2-1:	RADIATED EMISSIONS LIMITS TEST DATA DIGITAL NOISE.....	116
TABLE 5.3-1:	RADIATED EMISSIONS TEST DATA RX MODE CH 1	117
TABLE 5.4-1:	RADIATED EMISSION LIMITS TEST DATA RX MODE CH 6.....	117
TABLE 5.5-1:	RADIATED EMISSION LIMITS TEST DATA RX MODE CH 11	118
TABLE 6.2-1:	HARMONICS/SPURIOUS (WLAN 13 CHANNEL 1) 1 MBPS.....	120
TABLE 6.2-2:	HARMONICS/SPURIOUS (WLAN 13 CHANNEL 1) 2 MBPS.....	120
TABLE 6.2-3:	HARMONICS/SPURIOUS (WLAN 13 CHANNEL 1) 11 MBPS	121
TABLE 6.2-4:	HARMONICS/SPURIOUS (WLAN 13 CHANNEL 6) 1 MBPS.....	122
TABLE 6.2-5:	HARMONICS/SPURIOUS (WLAN 13 CHANNEL 6) 2 MBPS.....	122
TABLE 6.2-6:	HARMONICS/SPURIOUS (WLAN 13 CHANNEL 6) 11 MBPS.....	123
TABLE 6.2-7:	HARMONICS/SPURIOUS (WLAN 13 CHANNEL 11) 1 MBPS	124
TABLE 6.2-8:	HARMONICS/SPURIOUS (WLAN 13 CHANNEL 11) 2 MBPS	124
TABLE 6.2-9:	HARMONICS/SPURIOUS (WLAN 13 CHANNEL 11) 11 MBPS	125
TABLE 6.3-1:	HARMONICS/SPURIOUS (WLAN 8 CHANNEL 1) 1 MBPS.....	126
TABLE 6.3-2:	HARMONICS/SPURIOUS (WLAN 8 CHANNEL 1) 2 MBPS.....	126
TABLE 6.3-3:	HARMONICS/SPURIOUS (WLAN 8 CHANNEL 1) 11 MBPS.....	127
TABLE 6.3-4:	HARMONICS/SPURIOUS (WLAN 8 CHANNEL 6) 1 MBPS.....	128
TABLE 6.3-5:	HARMONICS/SPURIOUS (WLAN 8 CHANNEL 6) 2 MBPS.....	128
TABLE 6.3-6:	HARMONICS/SPURIOUS (WLAN 8 CHANNEL 6) 11 MBPS.....	129
TABLE 6.3-7:	HARMONICS/SPURIOUS (WLAN 8 CHANNEL 11) 1 MBPS.....	130
TABLE 6.3-8:	HARMONICS/SPURIOUS (WLAN 8 CHANNEL 11) 2 MBPS.....	130
TABLE 6.3-9:	HARMONICS/SPURIOUS (WLAN 8 CHANNEL 11) 11 MBPS.....	131
TABLE 6.4-1:	HARMONICS/SPURIOUS (WLAN 4 CHANNEL 1) 1 MBPS.....	132
TABLE 6.4-2:	HARMONICS/SPURIOUS (WLAN 4 CHANNEL 1) 2 MBPS.....	132
TABLE 6.4-3:	HARMONICS/SPURIOUS (WLAN 4 CHANNEL 1) 11 MBPS.....	133
TABLE 6.4-4:	HARMONICS/SPURIOUS (WLAN 4 CHANNEL 6) 1 MBPS.....	134
TABLE 6.4-5:	HARMONICS/SPURIOUS ((WLAN 4 CHANNEL 6) 2 MBPS.....	134
TABLE 6.4-6:	HARMONICS/SPURIOUS (WLAN 4 CHANNEL 6) 11 MBPS.....	135
TABLE 6.4-7:	HARMONICS/SPURIOUS (WLAN 4 CHANNEL 11) 1 MBPS.....	136

TABLE 6.4-8:	HARMONICS/SPURIOUS (WLAN 4 CHANNEL 11) 2 MBPS.....	136
TABLE 6.4-9:	HARMONICS/SPURIOUS (WLAN 4 CHANNEL 11) 11 MBPS.....	137
TABLE 6.5-1:	HARMONICS/SPURIOUS (WLAN'S 13, 1 AND 6, CHANNEL 1) 1 MBPS.....	138
TABLE 6.5-2:	HARMONICS/SPURIOUS (WLAN 13, 1 AND 6, CHANNEL 1) 2 MBPS.....	138
TABLE 6.5-3:	HARMONICS/SPURIOUS (WLAN'S 13, 1 AND 6, CHANNEL 1) 11 MBPS.....	139
TABLE 6.5-4:	HARMONICS/SPURIOUS (WLAN'S 13, 1 AND 6, CHANNEL 6) 1 MBPS.....	140
TABLE 6.5-5:	HARMONICS/SPURIOUS (WLAN'S 13, 1 AND 6, CHANNEL 6) 2 MBPS.....	140
TABLE 6.5-6:	HARMONICS/SPURIOUS (WLAN'S 13, 1 AND 6, CHANNEL 6) 11 MBPS.....	141
TABLE 6.5-7:	HARMONICS/SPURIOUS (WLAN'S 13, 1 AND 6, CHANNEL 11) 1 MBPS.....	142
TABLE 6.5-8:	HARMONICS/SPURIOUS (WLAN'S 13, 1 AND 6, CHANNEL 11) 2 MBPS.....	142
TABLE 6.5-9:	HARMONICS/SPURIOUS (WLAN'S 13, 1 AND 6, CHANNEL 11) 11 MBPS.....	143
TABLE 6.6-1:	HARMONICS/SPURIOUS (WLAN'S 1, 13 AND 6, CHANNEL 1) 1 MBPS.....	144
TABLE 6.6-2:	HARMONICS/SPURIOUS (WLAN'S 1, 13 AND 6, CHANNEL 1) 2 MBPS.....	145
TABLE 6.6-3:	HARMONICS/SPURIOUS (WLAN'S 1, 13 AND 6, CHANNEL 1) 11 MBPS.....	146
TABLE 6.6-4:	HARMONICS/SPURIOUS (WLAN'S 1, 13 AND 6, CHANNEL 6) 1 MBPS.....	147
TABLE 6.6-5:	HARMONICS/SPURIOUS (WLAN 1, 13 AND 6, CHANNEL 6) 2 MBPS.....	148
TABLE 6.6-6:	HARMONICS/SPURIOUS (WLAN'S 1, 13 AND 6, CHANNEL 6) 11 MBPS.....	149
TABLE 6.6-7:	HARMONICS/SPURIOUS (WLAN'S 1, 13 AND 6, CHANNEL 11) 1 MBPS.....	150
TABLE 6.6-8:	HARMONICS/SPURIOUS (WLAN 1, 13 AND 6, CHANNEL 11) 2 MBPS.....	151
TABLE 6.6-9:	HARMONICS/SPURIOUS (WLAN'S 1, 13 AND 6, CHANNEL 11) 11 MBPS.....	151
TABLE 6.7-1:	HARMONICS/SPURIOUS (WLAN'S 6, 13 AND 1, CHANNEL 1) 1 MBPS.....	152
TABLE 6.7-2:	HARMONICS/SPURIOUS (WLAN'S 6, 13 AND 1, CHANNEL 1) 2 MBPS.....	153
TABLE 6.7-3:	HARMONICS/SPURIOUS (WLAN'S 6, 13 AND 1, CHANNEL 1) 11 MBPS.....	154
TABLE 6.7-4:	HARMONICS/SPURIOUS (WLAN 6, 13 AND 1, CHANNEL 6) 1 MBPS.....	155
TABLE 6.7-5:	HARMONICS/SPURIOUS (WLAN'S 6, 13 AND 1, CHANNEL 6) 2 MBPS.....	156
TABLE 6.7-6:	HARMONICS/SPURIOUS (WLAN'S 6, 13 AND 1, CHANNEL 6) 11 MBPS.....	157
TABLE 6.7-7:	HARMONICS/SPURIOUS (WLAN'S 6, 13 AND 1, CHANNEL 11) 1 MBPS.....	158
TABLE 6.7-8:	HARMONICS/SPURIOUS (WLAN 6, 13 AND 1, CHANNEL 11) 2 MBPS.....	159
TABLE 6.7-9:	HARMONICS/SPURIOUS (WLAN'S 6, 13 AND 1, CHANNEL 11) 11 MBPS.....	160
TABLE 6.8-1:	RADIATED SPURIOUS EMISSIONS TEST EQUIPMENT.....	161
TABLE 7.1-1:	TEST EQUIPMENT USED FOR TESTING MODULATED BANDWIDTH.....	162
TABLE 7.2-1:	MINIMUM 6 DB MODULATED BANDWIDTHS WLAN 13 CHANNEL 1.....	163
TABLE 7.3-1:	MINIMUM 6 DB MODULATED BANDWIDTHS WLAN 13 CHANNEL 6.....	167
TABLE 7.3-2:	MINIMUM 6 DB MODULATED BANDWIDTHS WLAN 13 CHANNEL 11.....	170
TABLE 7.4-1:	MINIMUM 6 DB MODULATED BANDWIDTHS WLAN 4 CHANNEL 1.....	173
TABLE 7.5-1:	MINIMUM 6 DB MODULATED BANDWIDTHS WLAN 4 CHANNEL 6.....	177
TABLE 7.5-2:	MINIMUM 6 DB MODULATED BANDWIDTHS WLAN 4 CHANNEL 11.....	180
TABLE 7.6-1:	MINIMUM 6 DB MODULATED BANDWIDTHS WLAN 8 CHANNEL 1.....	183
TABLE 7.7-1:	MINIMUM 6 DB MODULATED BANDWIDTHS WLAN 8 CHANNEL 6.....	187
TABLE 7.7-2:	MINIMUM 6 DB MODULATED BANDWIDTHS WLAN 8 CHANNEL 11.....	190
TABLE 8.3-1:	TEST EQUIPMENT USED FOR TESTING RADIATED RF OUTPUT.....	196
TABLE 8.4-1:	POWER OUTPUT TEST DATA WLAN 13.....	197
TABLE 8.5-1:	POWER OUTPUT TEST DATA WLAN 1.....	198
TABLE 8.6-1:	POWER OUTPUT TEST DATA WLAN 6.....	199
TABLE 8.7-1:	POWER OUTPUT TEST DATA WLAN 4.....	200
TABLE 8.8-1:	POWER OUTPUT TEST DATA WLAN 8.....	201
TABLE 8.9-1:	POWER OUTPUT TEST DATA WLAN 10.....	202
TABLE 9.2-1:	WLAN 13 CHANNEL 1 AT 1 MBPS.....	203
TABLE 9.3-1:	WLAN 13 CHANNEL 1 AT 2 MBPS.....	205
TABLE 9.4-1:	WLAN 13 CHANNEL 1 AT 11 MBPS.....	206
TABLE 9.5-1:	WLAN 13 CHANNEL 6 AT 1 MBPS.....	207
TABLE 9.6-1:	WLAN 13 CHANNEL 6 AT 2 MBPS.....	208
TABLE 9.7-1:	WLAN 13 CHANNEL 6 AT 11 MBPS.....	209
TABLE 9.8-1:	WLAN 13 CHANNEL 11 AT 1 MBPS.....	210
TABLE 9.9-1:	WLAN 13 CHANNEL 6 AT 2 MBPS.....	211

TABLE 9.10-1:	WLAN 13 CHANNEL 11 AT 11 MBPS	212
TABLE 9.11-1:	WLAN 4 CHANNEL 1 AT 1 MBPS.....	213
TABLE 9.12-1:	WLAN 4 CHANNEL 1 AT 2 MBPS.....	214
TABLE 9.13-1:	WLAN 4 CHANNEL 1 AT 11 MBPS.....	215
TABLE 9.14-1:	WLAN 4 CHANNEL 6 AT 1 MBPS.....	216
TABLE 9.15-1:	WLAN 4 CHANNEL 6 AT 1 MBPS.....	217
TABLE 9.16-1:	WLAN 4 CHANNEL 6 AT 11 MBPS.....	218
TABLE 9.17-1:	WLAN 4 CHANNEL 11 AT 1 MBPS.....	219
TABLE 9.18-1:	WLAN 4 CHANNEL 11 AT 2 MBPS.....	220
TABLE 9.19-1:	WLAN 4 CHANNEL 11 AT 11 MBPS.....	221
TABLE 9.20-1:	WLAN 8 CHANNEL 1 AT 1 MBPS.....	222
TABLE 9.21-1:	WLAN 8 CHANNEL 1 AT 2 MBPS.....	223
TABLE 9.22-1:	WLAN 8 CHANNEL 1 AT 11 MBPS.....	224
TABLE 9.23-1:	WLAN 8 CHANNEL 6 AT 1 MBPS.....	225
TABLE 9.24-1:	WLAN 8 CHANNEL 6 AT 2 MBPS.....	226
TABLE 9.25-1:	WLAN 8 CHANNEL 6 AT 11 MBPS.....	227
TABLE 9.26-1:	WLAN 8 CHANNEL 11 AT 1 MBPS.....	228
TABLE 9.27-1:	WLAN 8 CHANNEL 6 AT 2 MBPS.....	229
TABLE 9.28-1:	WLAN 8 CHANNEL 11 AT 11 MBPS.....	230
TABLE 9.29-1:	ANTENNA CONDUCTED SPURIOUS EMISSIONS AT 1 MBPS	231
TABLE 9.30-1:	ANTENNA CONDUCTED SPURIOUS EMISSIONS AT 2 MBPS	232
TABLE 9.31-1:	ANTENNA CONDUCTED SPURIOUS EMISSIONS AT 11 MBPS.....	233
TABLE 9.32-1:	ANTENNA CONDUCTED SPURIOUS EMISSIONS AT 1 MBPS	234
TABLE 9.33-1:	ANTENNA CONDUCTED SPURIOUS EMISSIONS AT 2 MBPS	235
TABLE 9.34-1:	ANTENNA CONDUCTED SPURIOUS EMISSIONS AT 11 MBPS.....	236
TABLE 9.35-1:	ANTENNA CONDUCTED SPURIOUS EMISSIONS AT 1 MBPS	237
TABLE 9.36-1:	ANTENNA CONDUCTED SPURIOUS EMISSIONS AT 2 MBPS	238
TABLE 9.37-1:	ANTENNA CONDUCTED SPURIOUS EMISSIONS AT 11 MBPS.....	239
TABLE 10.2-1:	TEST EQUIPMENT USED FOR TESTING POWER SPECTRAL DENSITY	240
TABLE 10.3-1:	POWER SPECTRAL DENSITY TEST DATA	240
TABLE 10.5-1:	POWER SPECTRAL DENSITY TEST DATA	251
TABLE 10.7-1:	POWER SPECTRAL DENSITY TEST DATA	261

PLOT INDEX

PLOT 3.1-1:	INSERTION LOSS OF FILTER	19
PLOT 3.2-1:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	21
PLOT 3.2-2:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	22
PLOT 3.2-3:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	23
PLOT 3.2-4:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	24
PLOT 3.2-5:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 2 MBPS	25
PLOT 3.2-6:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 2 MBPS	26
PLOT 3.2-7:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 2MBPS	27
PLOT 3.2-8:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 2 MBPS	28
PLOT 3.2-9:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 11 MBPS	29
PLOT 3.2-10:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 11 MBPS	30
PLOT 3.2-11:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 11 MBPS	31
PLOT 3.2-12:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 11 MBPS.....	32
PLOT 3.3-1:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS.....	34
PLOT 3.3-2:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	35
PLOT 3.3-3:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	36
PLOT 3.3-4:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	37
PLOT 3.3-5:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 2 MBPS.....	38
PLOT 3.3-6:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 2 MBPS	39
PLOT 3.3-7:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 2 MBPS	40
PLOT 3.3-8:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 2 MBPS	41
PLOT 3.3-9:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 11 MBPS	42
PLOT 3.3-10:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 11 MBPS	43
PLOT 3.3-11:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 11 MBPS	44
PLOT 3.3-12:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 11 MBPS.....	45
PLOT 3.4-1:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS.....	47
PLOT 3.4-2:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	48
PLOT 3.4-3:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	49
PLOT 3.4-4:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	50
PLOT 3.4-5:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 2 MBPS.....	51
PLOT 3.4-6:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 2 MBPS	52
PLOT 3.4-7:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 2 MBPS	53
PLOT 3.4-8:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 2 MBPS	54
PLOT 3.4-9:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 11 MBPS	55
PLOT 3.4-10:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 11 MBPS	56
PLOT 3.4-11:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 11 MBPS	57
PLOT 3.4-12:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 11 MBPS.....	58
PLOT 3.5-1:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS.....	60
PLOT 3.5-2:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	61
PLOT 3.5-3:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	62
PLOT 3.5-4:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	63
PLOT 3.5-5:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 2 MBPS.....	64
PLOT 3.5-6:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 2 MBPS	65
PLOT 3.5-7:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 2 MBPS	66
PLOT 3.5-8:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 2 MBPS	67
PLOT 3.5-9:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 11 MBPS	68
PLOT 3.5-10:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 11 MBPS	69
PLOT 3.5-11:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 11 MBPS	70
PLOT 3.5-12:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 11 MBPS.....	71
PLOT 3.6-1:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS.....	73
PLOT 3.6-2:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	74
PLOT 3.6-3:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	75

PLOT 3.6-4:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	76
PLOT 3.7-1:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	78
PLOT 3.7-2:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	79
PLOT 3.7-3:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	80
PLOT 3.7-4:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	81
PLOT 3.8-1:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	83
PLOT 3.8-2:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	84
PLOT 3.8-3:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	85
PLOT 3.8-4:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	86
PLOT 3.9-1:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	88
PLOT 3.9-2:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	89
PLOT 3.9-3:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	90
PLOT 3.9-4:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	91
PLOT 3.10-1:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	93
PLOT 3.10-2:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS	94
PLOT 3.10-3:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	95
PLOT 3.10-4:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS	96
PLOT 3.10-5:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 2 MBPS	97
PLOT 3.10-6:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 2 MBPS	98
PLOT 3.10-7:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 2 MBPS	99
PLOT 3.10-8:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 2 MBPS	100
PLOT 3.10-9:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 11 MBPS	101
PLOT 3.10-10:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 11 MBPS	102
PLOT 3.10-11:	BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 11 MBPS	103
PLOT 3.10-12:	BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 11 MBPS	104
PLOT 7.3-1:	6 DB BANDWIDTH: CHANNEL 1 SET FOR 1 MBPS	164
PLOT 7.3-2:	6 DB BANDWIDTH: CHANNEL 1 SET FOR 2 MBPS	165
PLOT 7.3-3:	6 DB BANDWIDTH: CHANNEL 1 SET FOR 11 MBPS	166
PLOT 7.3-4:	6 DB BANDWIDTH: CHANNEL 6 SET FOR 1 MBPS	167
PLOT 7.3-5:	6 DB BANDWIDTH: CHANNEL 6 SET FOR 2 MBPS	168
PLOT 7.3-6:	6 DB BANDWIDTH: CHANNEL 6 SET FOR 11 MBPS	169
PLOT 7.3-7:	6 DB BANDWIDTH: CHANNEL 11 SET FOR 1 MBPS	170
PLOT 7.3-8:	6 DB BANDWIDTH: CHANNEL 11 SET FOR 2 MBPS	171
PLOT 7.3-9:	6 DB BANDWIDTH: CHANNEL 11 SET FOR 11 MBPS	172
PLOT 7.5-1:	6 DB BANDWIDTH: CHANNEL 1 SET FOR 1 MBPS	174
PLOT 7.5-2:	6 DB BANDWIDTH: CHANNEL 1 SET FOR 2 MBPS	175
PLOT 7.5-3:	6 DB BANDWIDTH: CHANNEL 1 SET FOR 11 MBPS	176
PLOT 7.5-4:	6 DB BANDWIDTH: CHANNEL 6 SET FOR 1 MBPS	177
PLOT 7.5-5:	6 DB BANDWIDTH: CHANNEL 6 SET FOR 2 MBPS	178
PLOT 7.5-6:	6 DB BANDWIDTH: CHANNEL 6 SET FOR 11 MBPS	179
PLOT 7.5-7:	6 DB BANDWIDTH: CHANNEL 11 SET FOR 1 MBPS	180
PLOT 7.5-8:	6 DB BANDWIDTH: CHANNEL 11 SET FOR 2 MBPS	181
PLOT 7.5-9:	6 DB BANDWIDTH: CHANNEL 11 SET FOR 11 MBPS	182
PLOT 7.7-1:	6 DB BANDWIDTH: CHANNEL 1 SET FOR 1 MBPS	184
PLOT 7.7-2:	6 DB BANDWIDTH: CHANNEL 1 SET FOR 2 MBPS	185
PLOT 7.7-3:	6 DB BANDWIDTH: CHANNEL 1 SET FOR 11 MBPS	186
PLOT 7.7-4:	6 DB BANDWIDTH: CHANNEL 6 SET FOR 1 MBPS	187
PLOT 7.7-5:	6 DB BANDWIDTH: CHANNEL 6 SET FOR 2 MBPS	188
PLOT 7.7-6:	6 DB BANDWIDTH: CHANNEL 6 SET FOR 11 MBPS	189
PLOT 7.7-7:	6 DB BANDWIDTH: CHANNEL 11 SET FOR 1 MBPS	190
PLOT 7.7-8:	6 DB BANDWIDTH: CHANNEL 11 SET FOR 2 MBPS	191
PLOT 7.7-9:	6 DB BANDWIDTH: CHANNEL 11 SET FOR 11 MBPS	192
PLOT 10.4-1:	POWER SPECTRAL DENSITY: CHANNEL 1 AT 1 MBPS	242
PLOT 10.4-2:	POWER SPECTRAL DENSITY: CHANNEL 1 AT 2 MBPS	243
PLOT 10.4-3:	POWER SPECTRAL DENSITY: CHANNEL 1 AT 11 MBPS	244

PLOT 10.4-4:	POWER SPECTRAL DENSITY: CHANNEL 6 AT 1 MBPS	245
PLOT 10.4-5:	POWER SPECTRAL DENSITY: CHANNEL 6 AT 2 MBPS	246
PLOT 10.4-6:	POWER SPECTRAL DENSITY: CHANNEL 6 AT 11 MBPS.....	247
PLOT 10.4-7:	POWER SPECTRAL DENSITY: CHANNEL 11 AT 1 MBPS.....	248
PLOT 10.4-8:	POWER SPECTRAL DENSITY: CHANNEL 11 AT 2 MBPS.....	249
PLOT 10.4-9:	POWER SPECTRAL DENSITY: CHANNEL 11 AT 11 MBPS.....	250
PLOT 10.6-1:	POWER SPECTRAL DENSITY: CHANNEL 1 AT 1 MBPS	252
PLOT 10.6-2:	POWER SPECTRAL DENSITY: CHANNEL 1 AT 2 MBPS	253
PLOT 10.6-3:	POWER SPECTRAL DENSITY: CHANNEL 1 AT 11 MBPS.....	254
PLOT 10.6-4:	POWER SPECTRAL DENSITY: CHANNEL 6 AT 1 MBPS	255
PLOT 10.6-5:	POWER SPECTRAL DENSITY: CHANNEL 6 AT 2 MBPS	256
PLOT 10.6-6:	POWER SPECTRAL DENSITY: CHANNEL 6 AT 11 MBPS.....	257
PLOT 10.6-7:	POWER SPECTRAL DENSITY: CHANNEL 11 AT 1 MBPS.....	258
PLOT 10.6-8:	POWER SPECTRAL DENSITY: CHANNEL 11 AT 2 MBPS.....	259
PLOT 10.6-9:	POWER SPECTRAL DENSITY: CHANNEL 11 AT 11 MBPS.....	260
PLOT 10.8-1:	POWER SPECTRAL DENSITY: CHANNEL 1 AT 1 MBPS	262
PLOT 10.8-2:	POWER SPECTRAL DENSITY: CHANNEL 1 AT 2 MBPS	263
PLOT 10.8-3:	POWER SPECTRAL DENSITY: CHANNEL 1 AT 11 MBPS.....	264
PLOT 10.8-4:	POWER SPECTRAL DENSITY: CHANNEL 6 AT 1 MBPS	265
PLOT 10.8-5:	POWER SPECTRAL DENSITY: CHANNEL 6 AT 2 MBPS	266
PLOT 10.8-6:	POWER SPECTRAL DENSITY: CHANNEL 6 AT 11 MBPS.....	267
PLOT 10.8-7:	POWER SPECTRAL DENSITY: CHANNEL 11 AT 1 MBPS.....	268
PLOT 10.8-8:	POWER SPECTRAL DENSITY: CHANNEL 11 AT 2 MBPS.....	269
PLOT 10.8-9:	POWER SPECTRAL DENSITY: CHANNEL 11 AT 11 MBPS.....	270

APPENDIX INDEX

APPENDIX A:	RF EXPOSURE CALCULATIONS FOR HIGH GAIN ANTENNAS.....	272
APPENDIX B:	RESULTS POWER OUTPUT AT THE 16 PORTS AND WITH COMBINER.....	273
APPENDIX C:	ANTENNA SPECIFICATIONS.....	288
APPENDIX D:	AGENCY AUTHORIZATION LETTER.....	289
APPENDIX E:	CONFIDENTIALITY REQUEST LETTER.....	290
APPENDIX F:	ATTESTATION LETTER.....	291
APPENDIX G:	OPERATIONAL DESCRIPTION.....	292
APPENDIX H:	LABEL AND LABEL LOCATION.....	293
APPENDIX I:	SCHEMATICS	295
APPENDIX I:	BLOCK DIAGRAM.....	296
APPENDIX K:	MANUAL.....	297
APPENDIX L:	TEST PHOTOGRAPHS.....	298
APPENDIX M:	EXTERNAL PHOTOGRAPHS.....	302
APPENDIX N:	INTERNAL PHOTOGRAPHS.....	315

1. General Information

1.1. SCOPE

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

IC RSS-210 Section 6.2.2(o): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

A direct sequence (DS) system is a spread spectrum (SS) system in which the carrier has been modulated by a high speed spreading code and an information data stream. The high-speed code sequence dominates the “modulating function” and is the direct cause of the wide spreading of the transmitted signal.

1.2. TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

1.3. RELATED SUBMITTAL(S)/GRANT(S)

This is an original application for Certification for the Vivato, Inc. 2.4 GHz Wi-Fi Switch, FCC ID: QLNVLJ24WFSW. The IF, LO and up to the 2nd LO were investigated and tested.

2. Test Information

2.1. TEST JUSTIFICATION

The Vivato 2.4 GHz Wi-Fi Switch's design allows point-to-point packet transmission to client devices through an integrated high gain, electronically steered transmitting antenna. The same antenna also functions as a high gain receiving antenna, allowing the Wi-Fi switch to receive signals from standard 802.11b clients, even at long distances or with high signal attenuation.

The Vivato Wi-Fi switch uses a planar array of 128 slot antennas. The array is comprised of 16 vertical sub-arrays. Each sub-array is comprised of 8 slots, and each sub-array is fed with its own power amplifier (PA).

Each power amplifier is fed from a beam-forming network that provides the correct phase shift to each of the sub-arrays to create beams of RF that focus with high EIRP in the far field.

Power with nominally equal value is generated in each of the 16 power amplifiers. The power is radiated from the 16 sub-arrays and the signals are summed in space at distances far from the antenna array. All PA's generate signals of nominally equal value independent of the pointing direction of the beams. The relative phasing of the signals is what determines the pointing direction.

The EUT contains thirteen 802.11(b) WLAN circuits with modulated output signals, with eleven channels each. The EUT can communicate using the following:

- a) Simultaneously using up to three 802.11b channels at the same time, using different angles at different channels; firmware does not allow the transmission of two overlapping channels when 2 or 3 WLAN circuits with modulated outputs are on at the same time.
- b) Only one of the thirteen WLAN circuits with modulated outputs can be selected
As shown in the example diagram below, each WLAN circuit is allocated a different portion of the antenna's 100° radiation angle at which it transmits and receives.

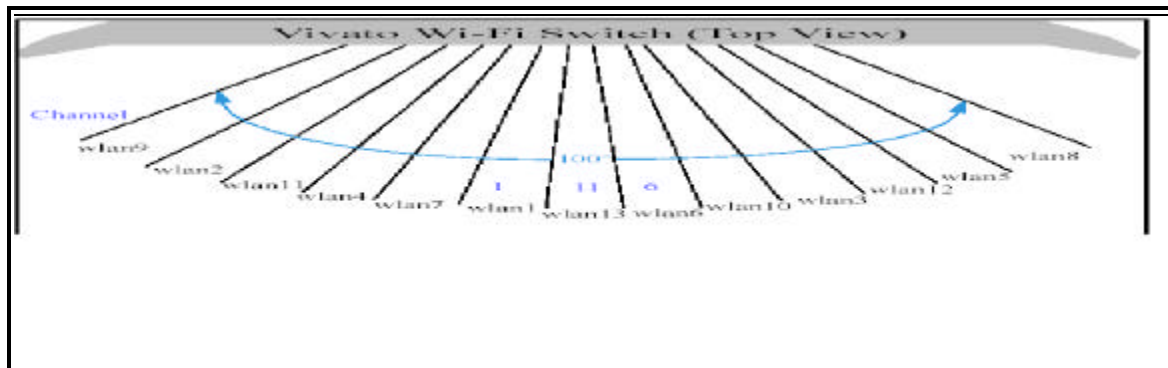


FIGURE 2.1-1: WLAN ANTENNA ALLOCATION

All of the conducted testing namely, **Conducted Power, Antenna Spurious, Bandwidth, and PSD**, were performed on the EUT by connecting a fixture at the WLAN circuit modulated antenna feeding port. This position was determined to be the point at which the antenna transmission line circuit connects with the antenna. The unit was modified for the purpose of performing all conducted tests. The attenuation that resulted in the use of the test fixture was accounted in all final measurement data. The product would be sold commercially with the antenna directly connected via the PCB transmission line circuit to the WLAN Circuit Modulated Outputs, and not with the test fixture. .

The EUT's worst case mode data throughout this report represents the highest, medium, and lowest power when one WLAN circuit with modulated output is selected. This should represent theoretically Bore-sight, +/- 25 degrees, and +/- 50 degrees within the 100 degree radiation angle. This finding is supported by the conducted power measurement performed within Section 8 'Power Output' in this report. Channel 1 at 2412 MHz, Channel 6 at 2437 MHz and Channel 11 at 2462 MHz were tested and investigated from 9 kHz to 24 GHz. Three types of modulations (DBPSK at 1 Mbps, DQPSK at 2 Mbps, and CCK at 11 Mbps) were also tested. Data for the three channels and the three modulation types are presented in this report. The data rate at 5.5 Mbps CCK modulations was not investigated because the 11 Mbps CCK modulations represent the worst case data rate for CCK type modulation.

Additionally, the unit was tested with three WLAN's circuits with modulated output signal simultaneously on, namely, WLAN13, WLAN6, and WLAN1, which have the highest power outputs. Channel 1 at 2412 MHz, Channel 6 at 2437 MHz and Channel 11 at 2462 MHz were tested and investigated from 9 kHz to 24 GHz. Three types of modulations (DBPSK at 1 Mbps, DQPSK at 2 Mbps, and CCK at 11 Mbps) were also tested. Data for the three channels and the three modulation types are presented in this report. The data rate at 5.5 Mbps CCK modulations was not investigated because the 11 Mbps CCK modulations represent the worst-case data rate for CCK type modulation.

Furthermore, different combinations of the three highest WLAN circuits with modulated output signal channels were investigated, and tested. Only the worst case configurations are listed in this report.

The EUT can receive transmission packets with all thirteen WLAN circuits enabled in the receiver mode. This mode was used for the receiver/digital interface testing in Section 5 of this report.

2.2. EXERCISING THE EUT

The EUT was provided with software to continuously transmit during testing, including the enabling of steering modes, data rates and 100% duty. The carrier was also checked to verify that information was being transmitted.

2.3. TEST RESULT SUMMARY

TABLE 2.3-1: FCC PART 15.247 DIRECT SEQUENCE SPREAD SPECTRUM TEST RESULT SUMMARY

SECTION	REQUIREMENT	2400-2483.5 MHz	SUMMARY
a) 2)	The minimum 6 dB bandwidth shall be at least 500 kHz.	Applicable	Results in this measurement report
b) 1)	The maximum peak output power shall not exceed 1 W.	Applicable	Conducted measurements
b) 3)	If transmitting antennas of directional gain greater than 6 dB are used, the peak output power stated in b) 1) shall be reduced by the amount of dB that the gain exceeds 6 dBi. Exceptions from this requirement are listed below in the b) 3) i, ii, iii.	Applicable	Results in this measurement report
b) 3) i)	Systems used exclusively for fixed, point-to-point operations may employ antennas with directional gain of more than 6 dBi. In this case, maximum peak output power of radiator must be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.	Applicable	Professional installation manual attached
b) 3) ii)	In the shown frequency range, systems used exclusively for fixed, point-to-point operations may employ antenna with gain more than 6 dBi without any corrections of transmitter output power.		Not applicable
b) 3) iii)	Exceptions from the b) 3) i and b) 3) ii) shall be made for: - point-to-multipoint systems, - omni directional applications, - multiple co-located intentional radiators. For these systems use requirement listed in Section b) 3).	Applicable	Professional installation manual attached

b) 4)	Systems shall be operated in a manner that ensures that the public is not exposed to RF energy levels more than are permitted via 47CFR paragraph 1.1307 (b)(1), (which refers to paragraph 1.1310).	Applicable	RF Exposure calculation attached
c)	In any 100 kHz bandwidths outside the frequency band in which the radiator is operating (and up to the tenth harmonic of the highest fundamental frequency, or to 40 GHz, whichever is lower – (see Section 15.33), the RF power that is produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency, shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the RF power produced by the radiator. - Attenuation below the general limits specified in 15.209(a) is not required. - Radiated emissions which fall in the restricted band specified in 15.205 (a), must comply with the radiated emission limits of 15.209(a) (up to the tenth harmonic of the highest fundamental frequency, or to 40 GHz, whichever is lower).	Applicable	Results in this measurement report
d)	The peak power spectral density conducted from the radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.	Applicable	Results in this measurement report
e)	The processing gain of this kind of system shall be at least 10 dB. (The processing gain shall be determined from the ratio in dB of the signal to noise ratio with the system spreading code turned off and the signal to noise ratio with the system spreading code turned on, as measured at the demodulated output of the receiver).	Applicable	Not applicable
f)	- Hybrid systems that employ a combination of both direct sequence and frequency hopping modulation techniques shall achieve a processing gain of at least 17 dB from the combined techniques. - The frequency hopping operation of the hybrid system, with the direct sequence operation turned off, shall have an average time of occupancy on any frequency less or equal to 0.4 sec within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. - The frequency hopping operation of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of 15.247.d	Applicable	Not applicable EUT is not a hybrid

TABLE 2.3-2: TEST RESULT SUMMARY WITH FCC RULES AND REGULATIONS

STANDARD	TEST	PASS/FAIL OR N/A
FCC 15.205	Compliance with the Restricted Band Edge	Pass
FCC 15.207	Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.247(a)(2)	Modulated Bandwidth	Pass
FCC 15.247(b)	Power Output	Pass
FCC 15.247(c)	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	Power Spectral Density	Pass

2.4. TEST SYSTEM DETAILS

The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system, are shown in Tables 2.4-1 and 2.4-2:

TABLE 2.4-1: EQUIPMENT UNDER TEST (EUT)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CONNECTORS	RTL BAR CODE
WI-FI SWITCH	VIVATO, INC.	VIVATO 2.4 GHz Wi-Fi SWITCH	N/A	QLNVLJ24 WFSW	ETHERNET PORTS (10 METER NON SHIELDED) POWER SUPPLY (2 METER SHILEDDED)	15070

TABLE 2.4-2: EXTERNAL COMPONENTS IN TEST CONFIGURATION

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
LAPTOP	IBM	NOTEBOOK	IQ20651279	DoC	ETHERNET/ POWER SUPPLY	N/A

2.5. CONFIGURATION OF TESTED SYSTEM

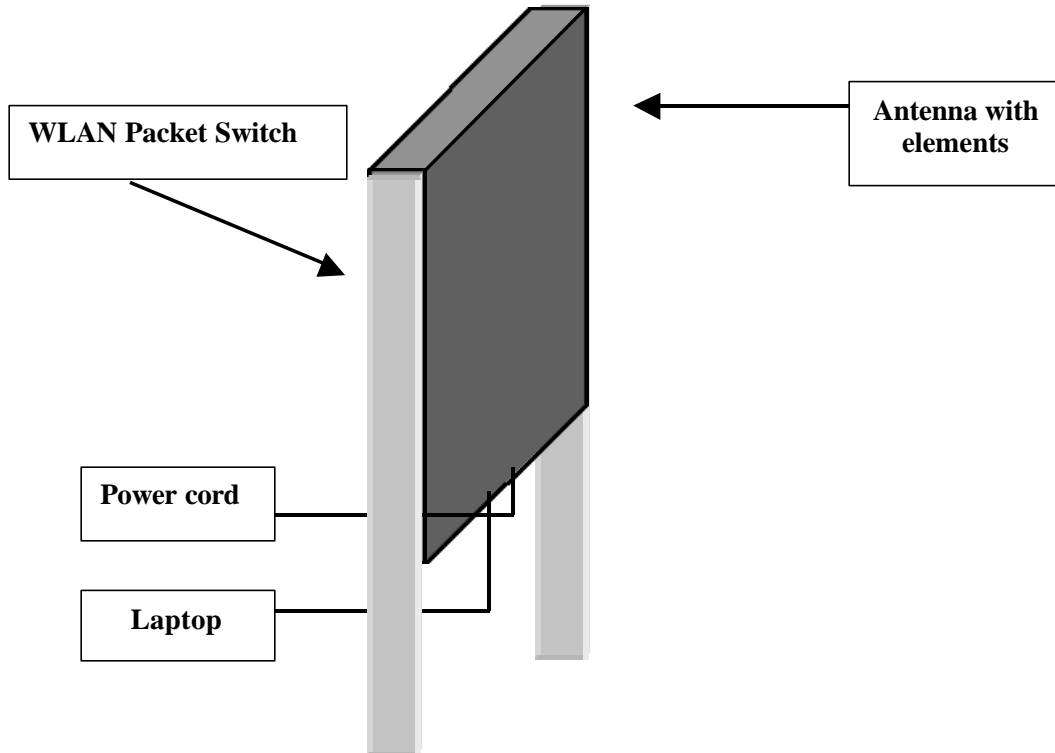


FIGURE 2.5-1: WORST CASE CONFIGURATION OF SYSTEM UNDER TEST

3. Compliance with the Restricted Band Edge - §15.205

3.1. TEST PROCEDURE

Compliance with the band edges was performed using the rules found in FCC parts 15.205 and 15.209. The final data derived below are from radiated measurements applying absolute detector values only. The data taken in this report represents the worst-case band edges at 11 Mbps, 2 Mbps and 1 Mbps. The unit was tested in the following modes:

Highest, Medium, and Lowest WLAN Circuit Modulated Output Signal:

WLAN 13 on Channels 1, 6 and 11 for the modulation rates 1, 2 and 11 Mbps

WLAN 4 on Channels 1, 6 and 11 for the modulation rates 1, 2 and 11 Mbps

WLAN 8 on Channels 1, 6 and 11 for the modulation rates 1, 2 and 11 Mbps

The following worst cases, those with the highest power output, were also tested:

Three Simultaneous Highest Power WLAN Circuits Modulated Output Signal:

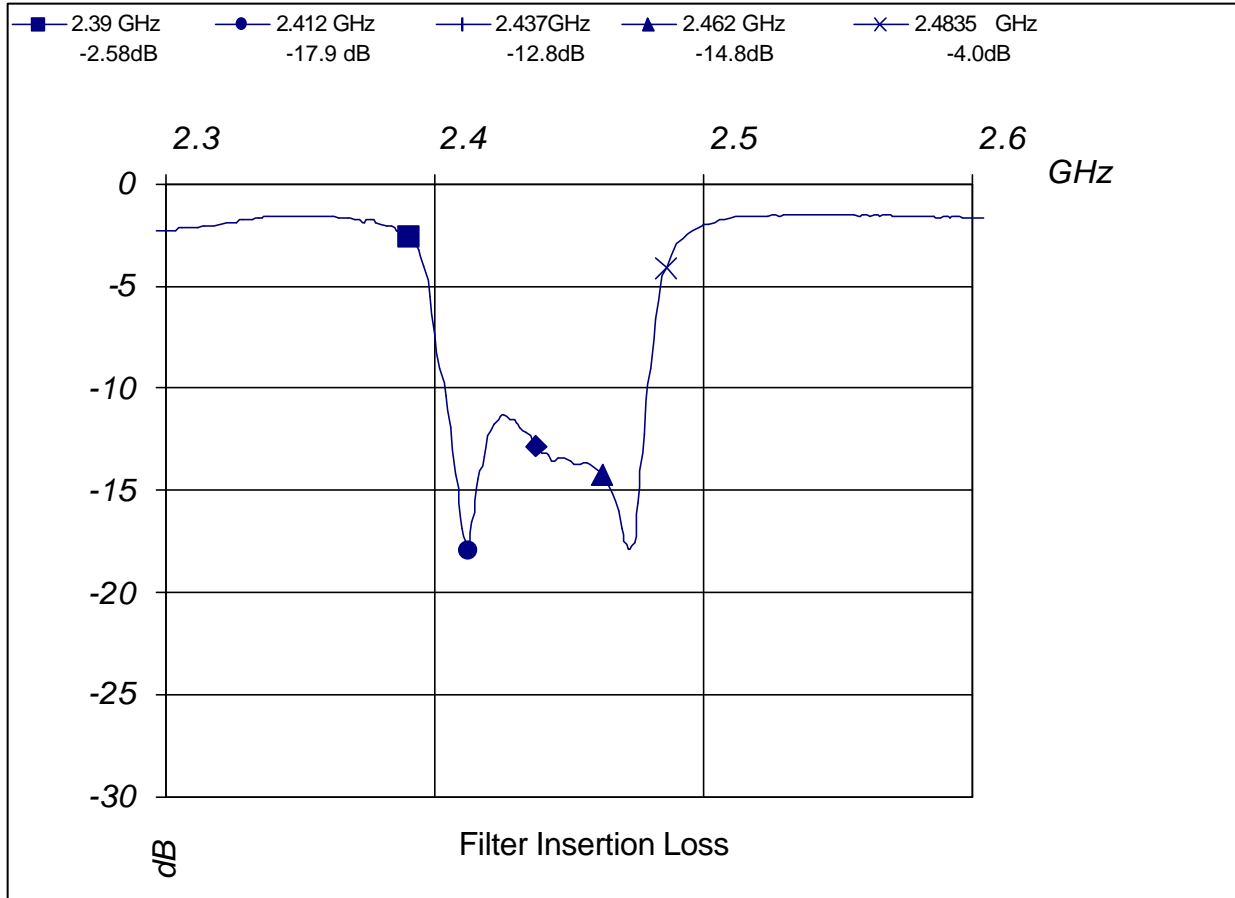
WLAN 13 on Channel 1, WLAN 1 on Channel 6, and WLAN 6 on Channel 11 for modulation rates 1, 2 and 11 Mbps

WLAN 1 on Channel 1, WLAN 13 on Channel 6, and WLAN 6 on Channel 11 for modulation rates 1, 2 and 11 Mbps

WLAN 6 on Channel 1, WLAN 13 on Channel 6, and WLAN 1 on Channel 11 for modulation rates 1, 2 and 11 Mbps

For these last three configurations, a cut band filter (band reject filter) was used to attenuate the signal of the carriers so that the measurement instruments would not be saturated. All effects of the filter use were accounted for in the final data. The characteristics of the filter can be found in Plot 3.1-1.

PLOT 3.1-1: INSERTION LOSS OF FILTER



3.2. COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN 13

WLAN On: 13
 Channels: 1 & 11
 Operating Frequency (MHz): 2412-2462
 Distance (m): 3
 Limit (dBuV/m): 54

TABLE 3.2-1: RESTRICTED BAND EDGE TEST DATA (1 MBPS)

Channel Set to	Frequency Tested (MHz)	Detector	Field Strength Level (dBmV/m)	Level Corrected (dBmV/m)	FCC Limit (dBmV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	22.7	49.07	54.0	-4.9
11	2483.5	Absolute measurement	24.8	51.18	54.0	-2.8

TABLE 3.2-2: RESTRICTED BAND EDGE TEST DATA (2 MBPS)


Channel Set to	Frequency Tested (MHz)	Detector	Field Strength Level (dBmV/m)	Level Corrected (dBmV/m)	FCC Limit (dBmV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	22.7	49.07	54.0	-4.9
11	2483.5	Absolute measurement	25.4	51.8	54.0	-2.2

TABLE 3.2-3: RESTRICTED BAND EDGE TEST DATA (11 MBPS)

Channel Set to	Frequency Tested (MHz)	Detector	Field Strength Level (dBmV/m)	Level Corrected (dBmV/m)	FCC Limit (dBmV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	22.6	49.0	54.0	-5.0
11	2483.5	Absolute measurement	23.9	50.3	54.0	-3.7

TEST PERSONNEL:

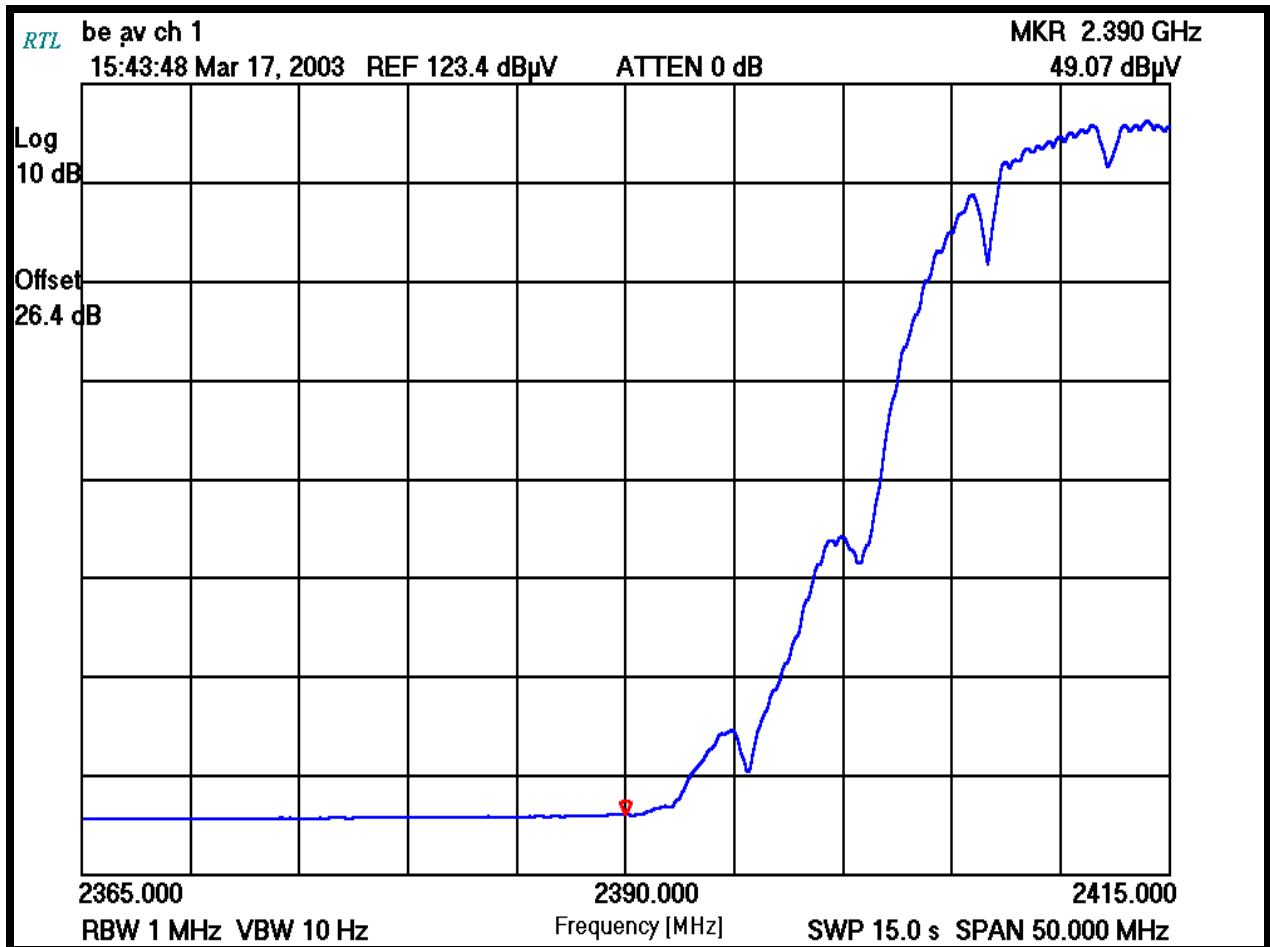
Rachid Sehb
 Test Technician/Engineer


 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 1
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.2-1: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS



TEST PERSONNEL:

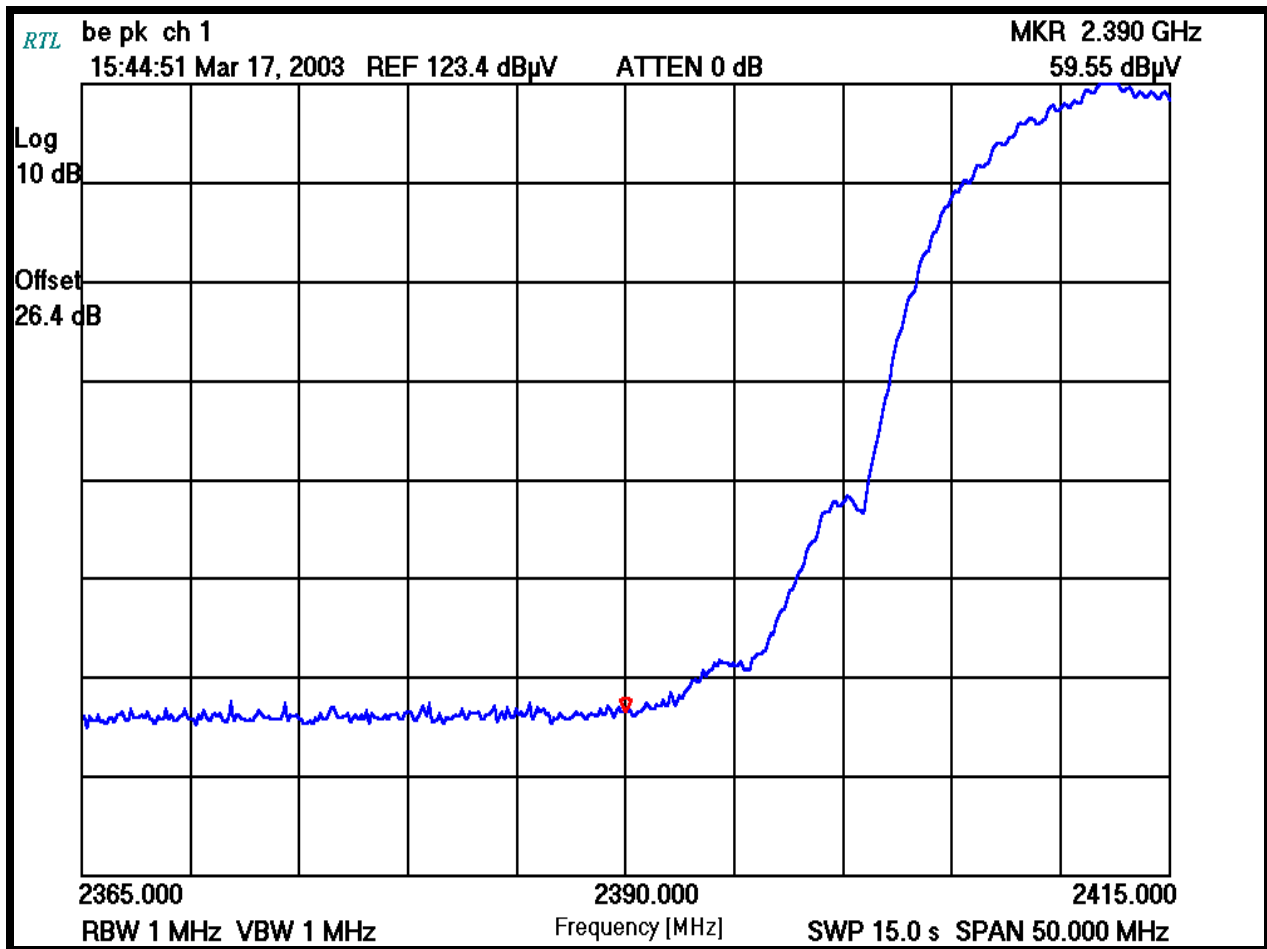
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 1
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (s): 15.0

PLOT 3.2-2: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS



TEST PERSONNEL:

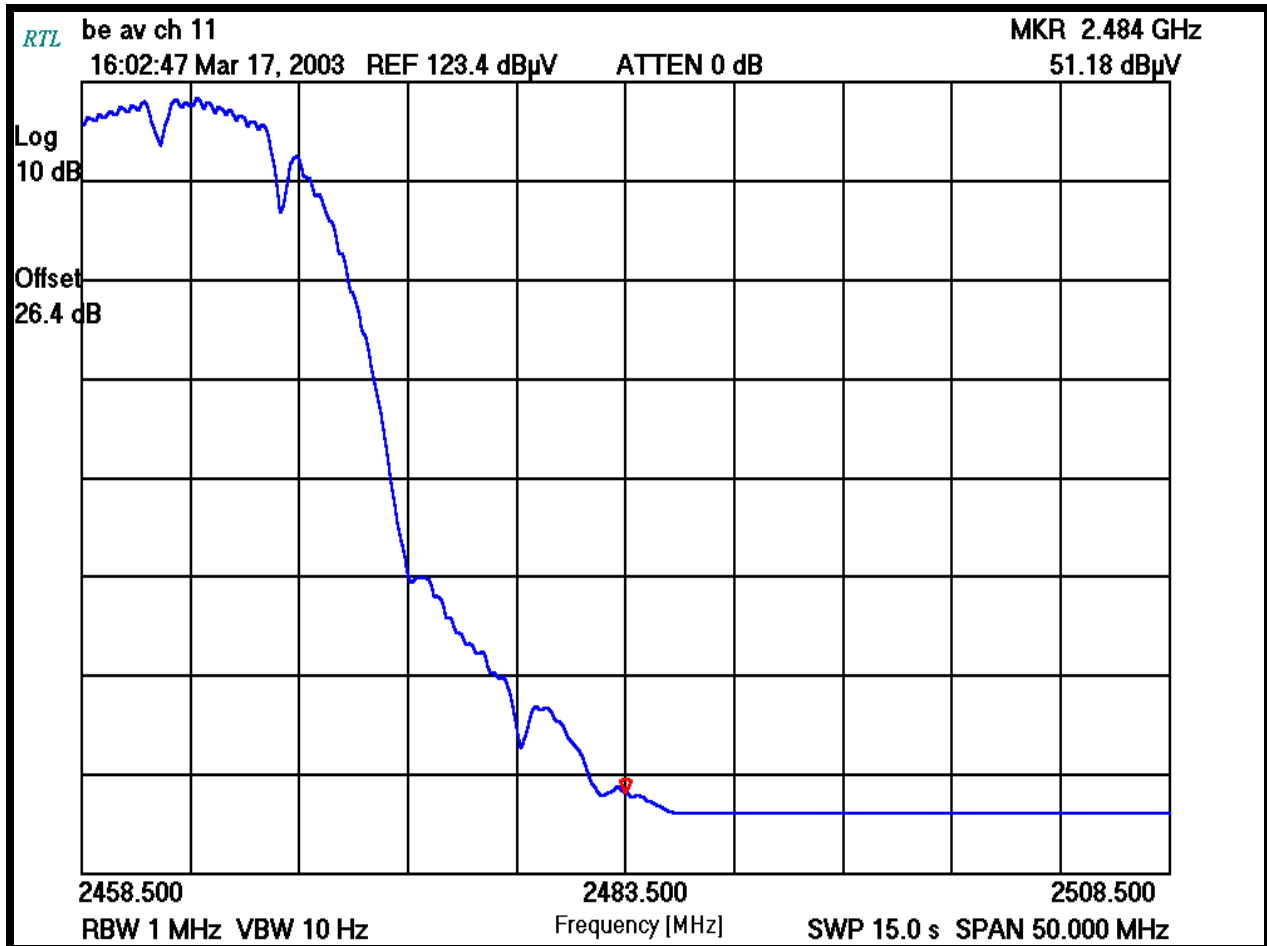
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test

Channel Number: 11
Frequency (MHz): 2462
Data Rate (Mbps): 1
Resolution Bandwidth (MHz): 1
Video Bandwidth (Hz): 10
Sweep Time (s): 15.0

PLOT 3.2-3: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS



TEST PERSONNEL:

Rachid Sehb
Test Technician/Engineer

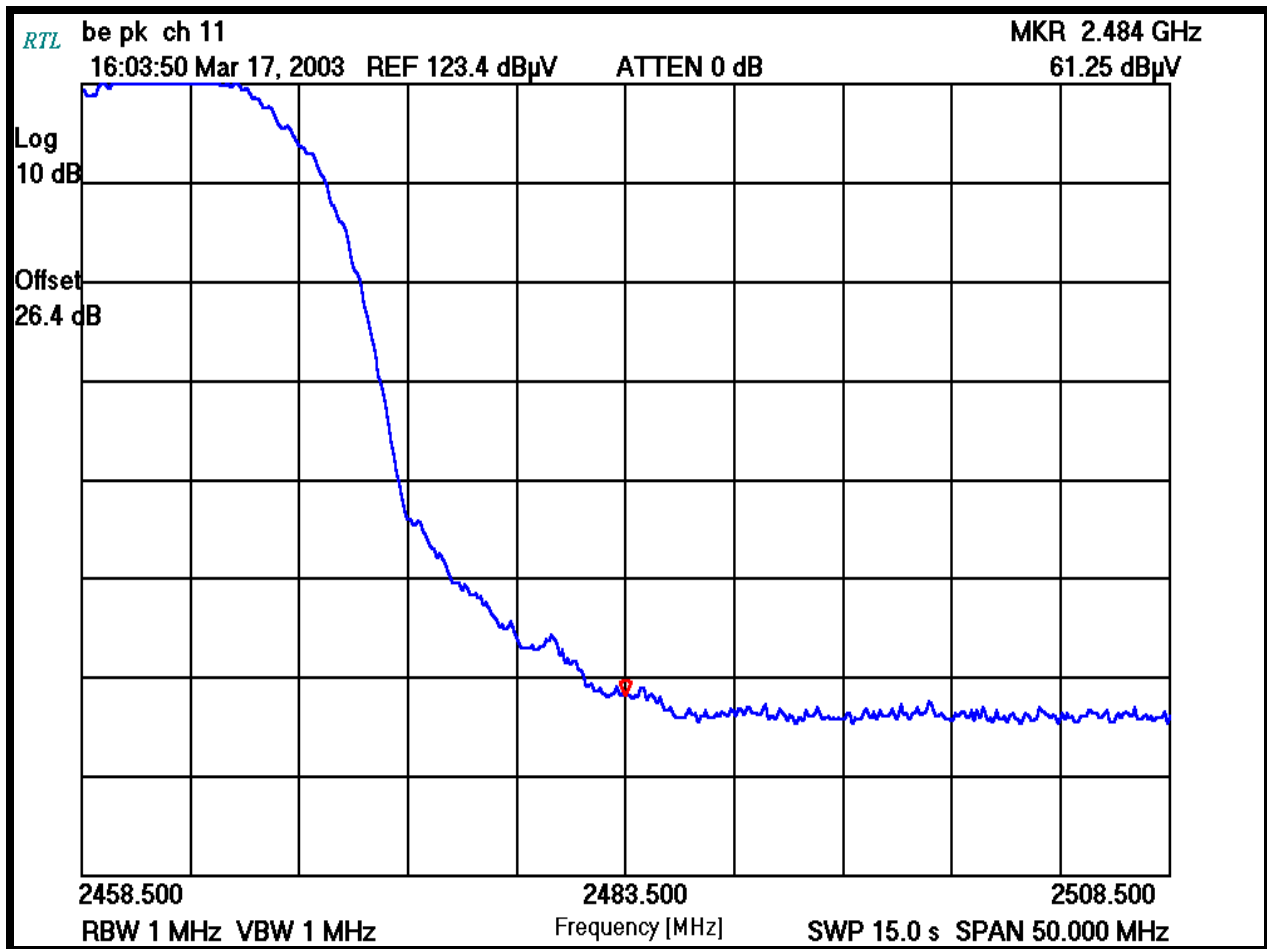
Signature

03/17/2003

Date Of Test


Channel Number: 11
Frequency (MHz): 2462
Data Rate (Mbps): 1
Resolution Bandwidth (MHz): 1
Video Bandwidth (MHz): 1
Sweep Time (s): 15.0

PLOT 3.2-4: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS



TEST PERSONNEL:

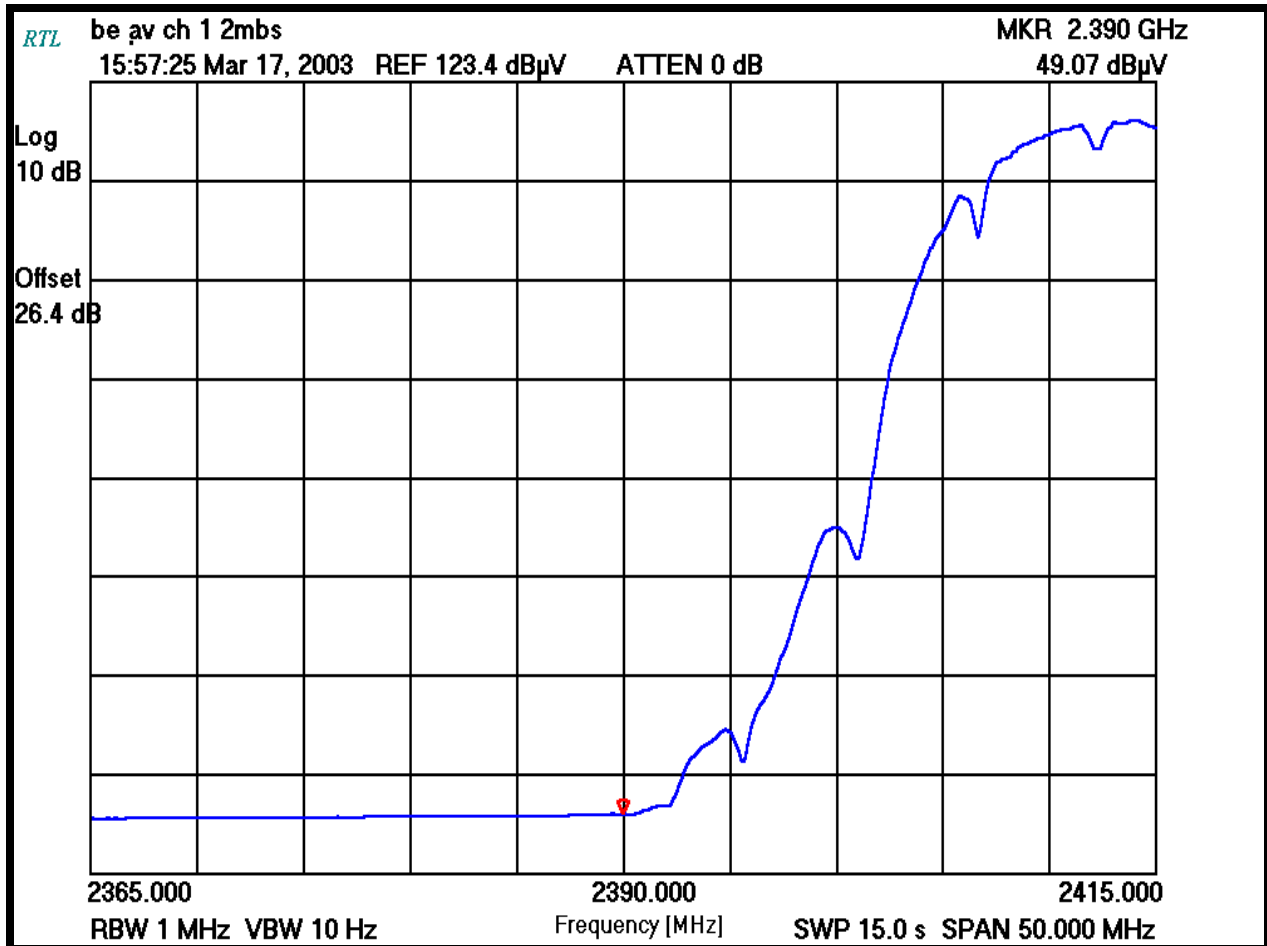
Rachid Sehb
Test Technician/Engineer


Signature

03/17/2003
Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 2
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.2-5: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 2 MBPS



TEST PERSONNEL:

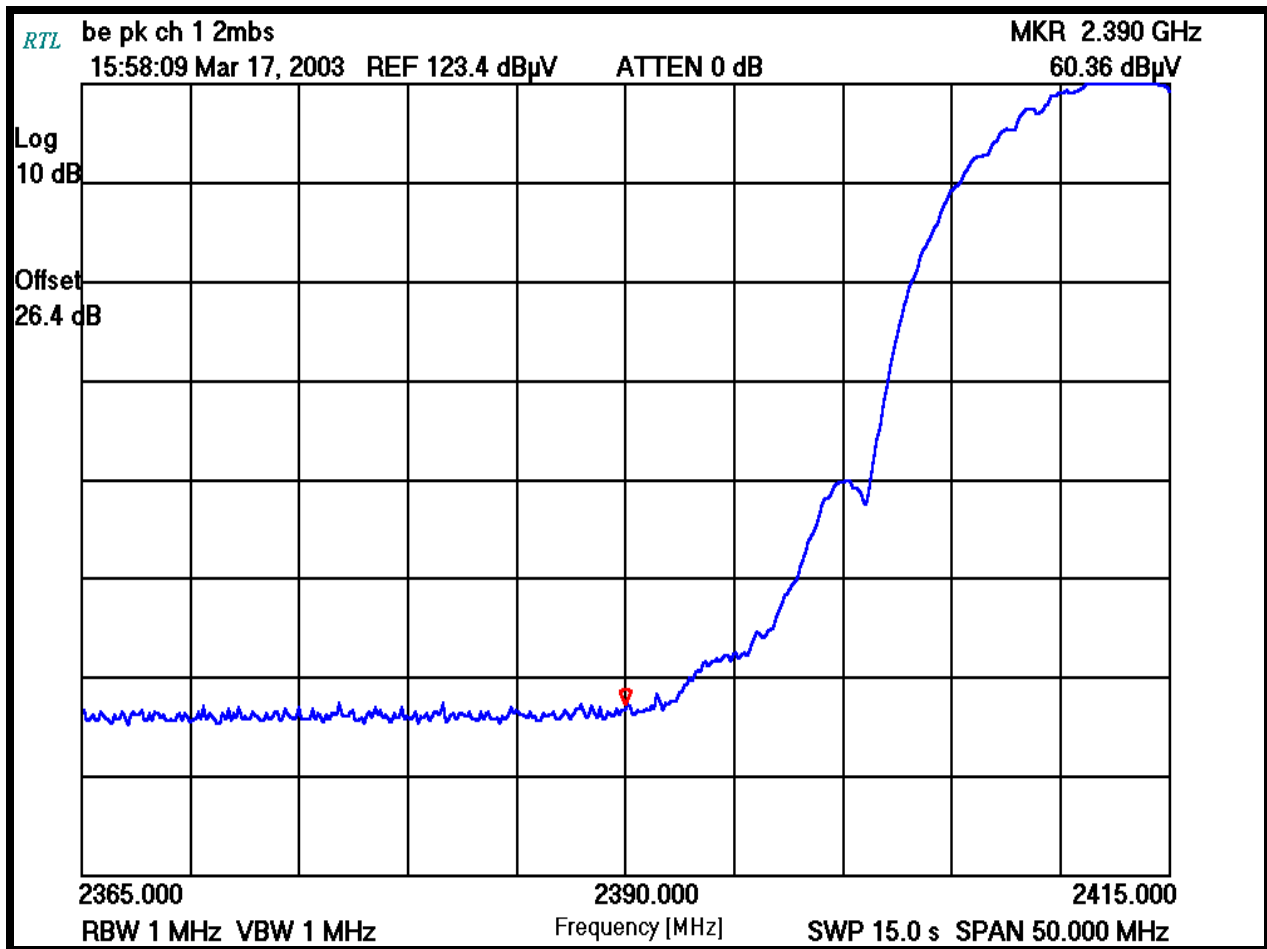
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test


Channel Number: 1
Frequency (MHz): 2412
Data Rate (Mbps): 2
Resolution Bandwidth (MHz): 1
Video Bandwidth (MHz): 1
Sweep Time (s): 15.0

PLOT 3.2-6: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 2 MBPS



TEST PERSONNEL:

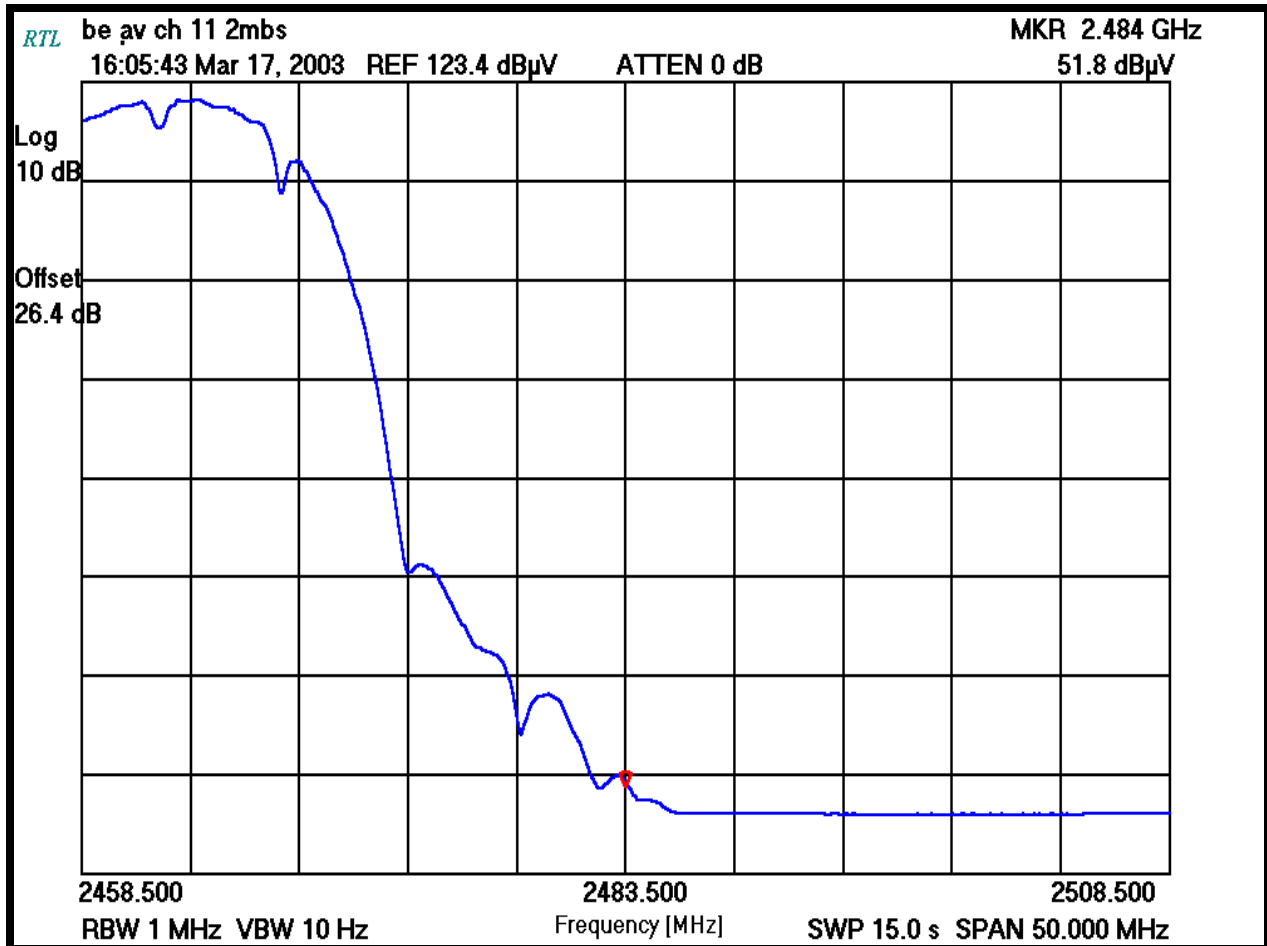
Rachid Sehb
Test Technician/Engineer


Signature

03/17/2003
Date Of Test

Channel Number: 11
 Frequency (MHz): 2462
 Data Rate (Mbps): 2
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.2-7: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 2MBPS



TEST PERSONNEL:

Rachid Sehb
 Test Technician/Engineer

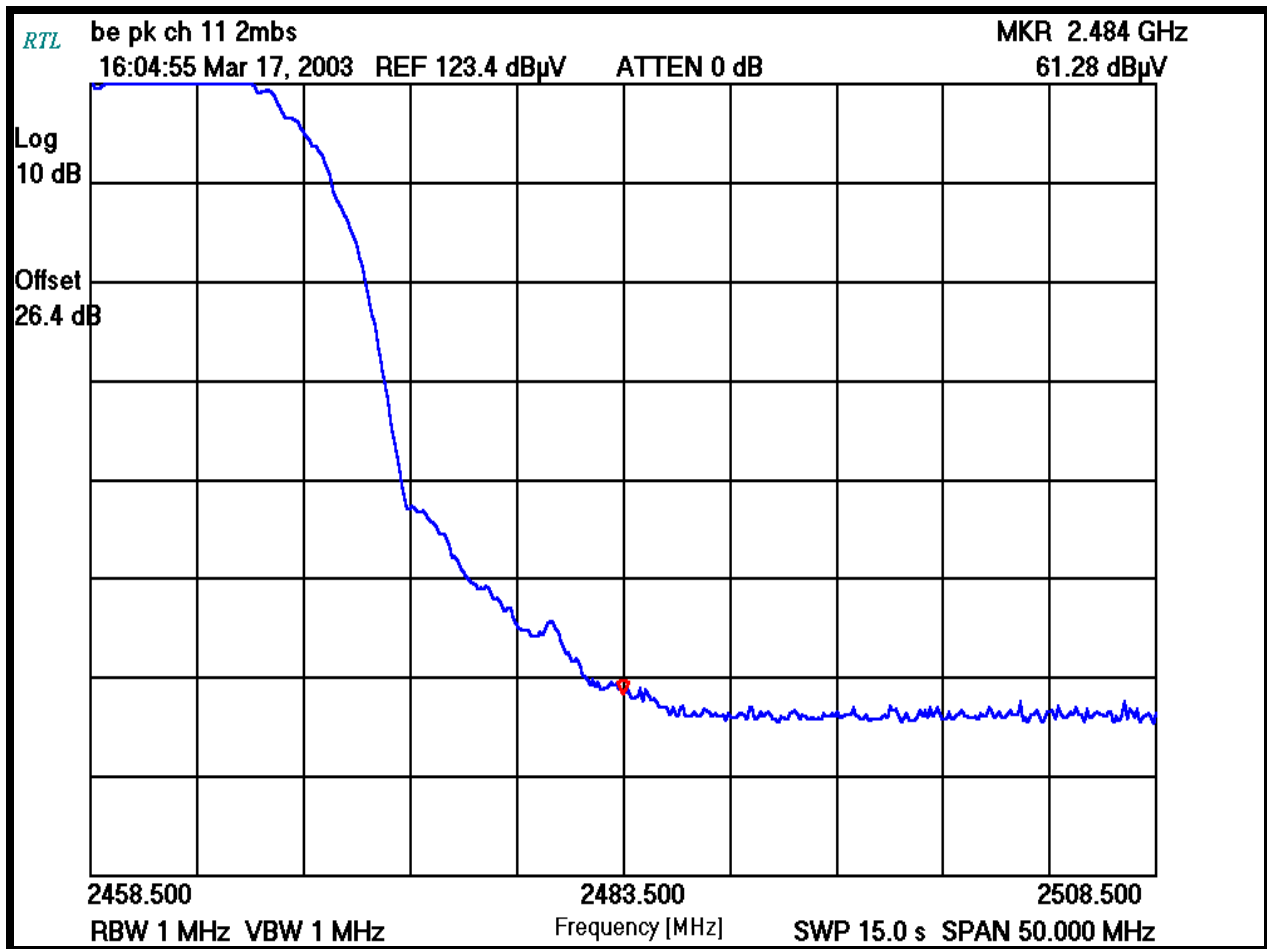
Signature

03/17/2003

Date Of Test


Channel Number: 11
Frequency (MHz): 2462
Data Rate (Mbps): 2
Resolution Bandwidth (MHz): 1
Video Bandwidth (MHz): 1
Sweep Time (s): 15.0

PLOT 3.2-8: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 2 MBPS



TEST PERSONNEL:

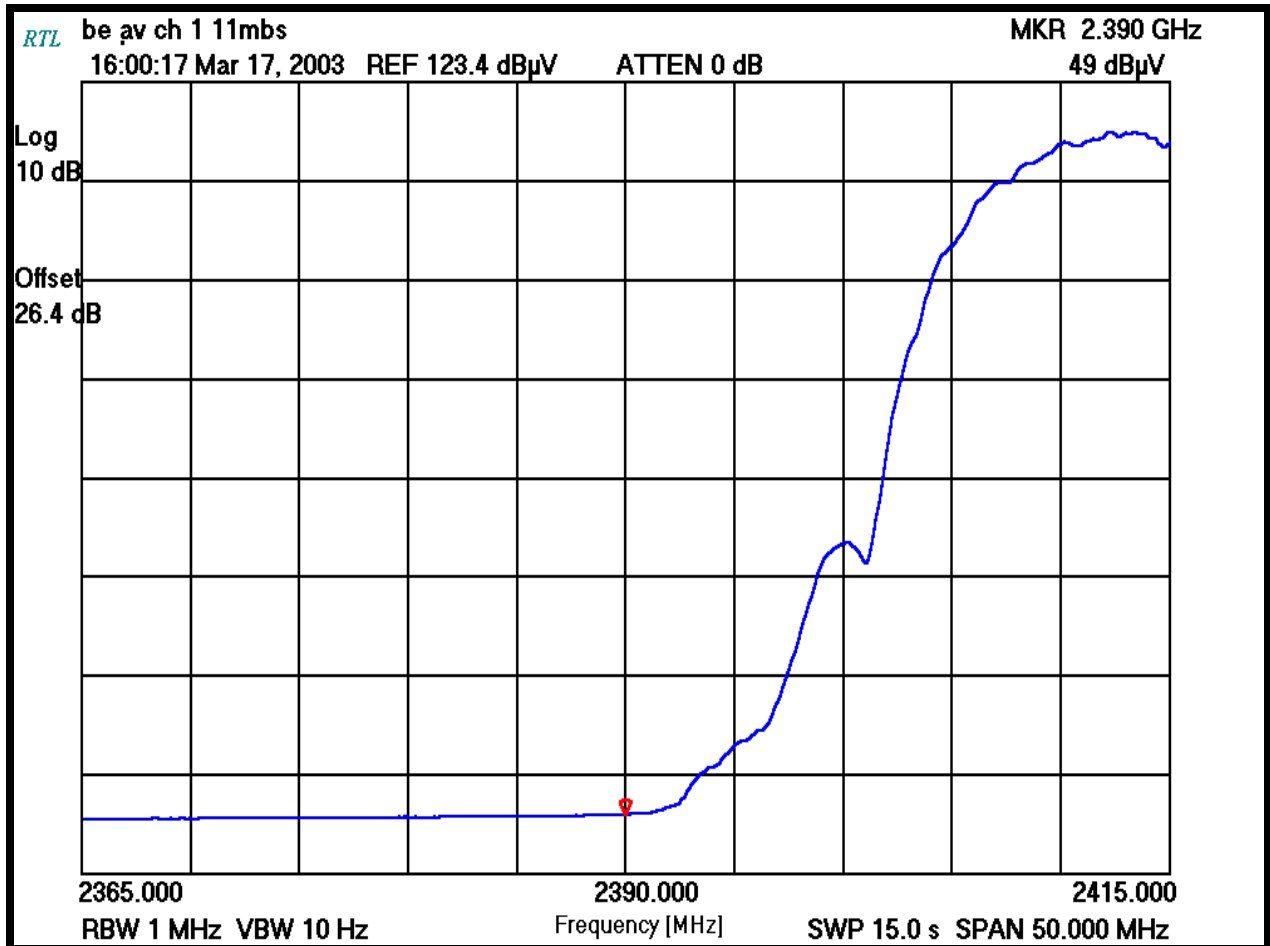
Rachid Sehb
Test Technician/Engineer


Signature

03/17/2003
Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 11
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.2-9: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 11 MBPS



TEST PERSONNEL:

Rachid Sehb
 Test Technician/Engineer

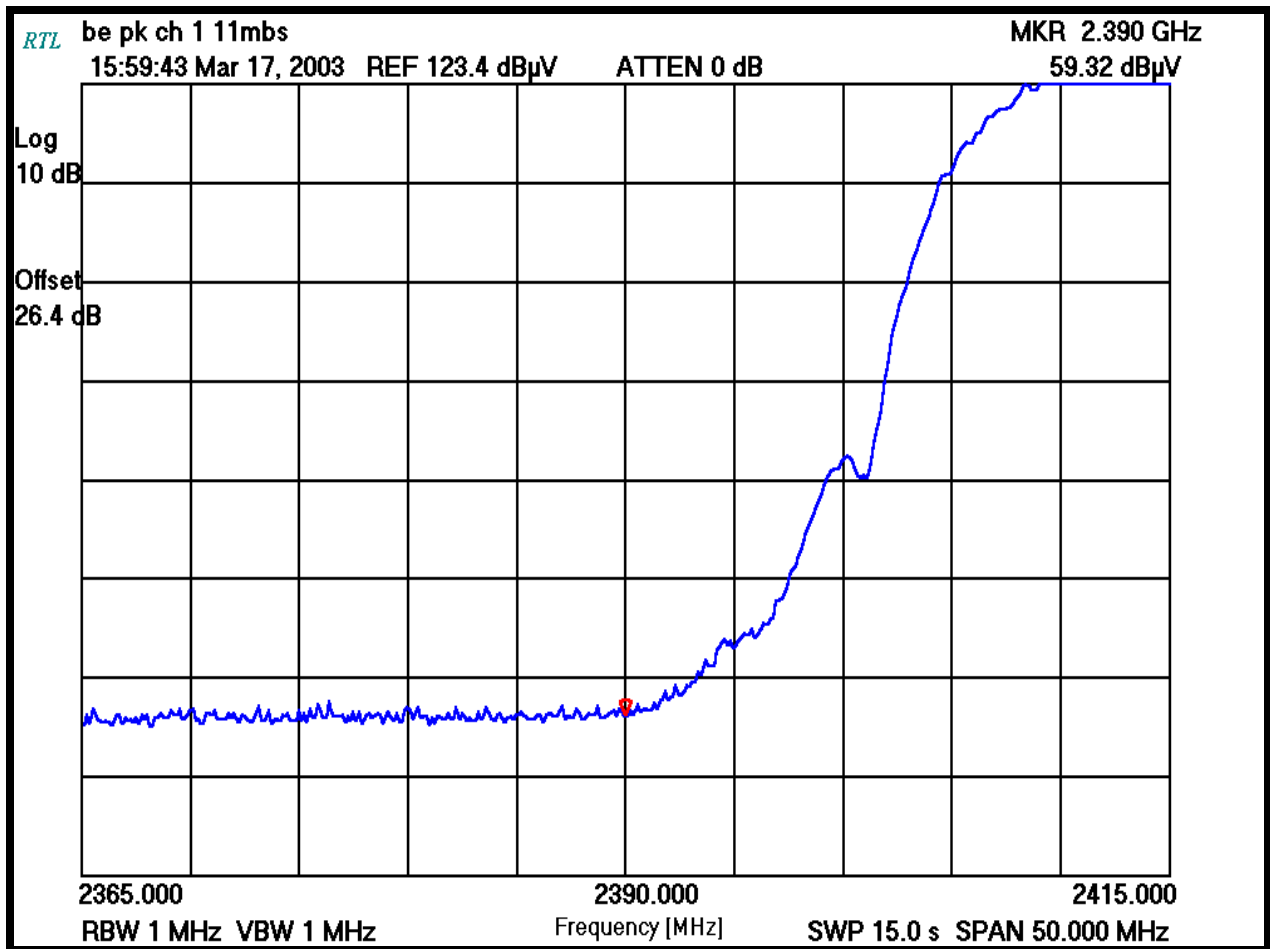
Signature

03/17/2003

Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 11
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (s): 15.0

PLOT 3.2-10: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 11 MBPS



TEST PERSONNEL:

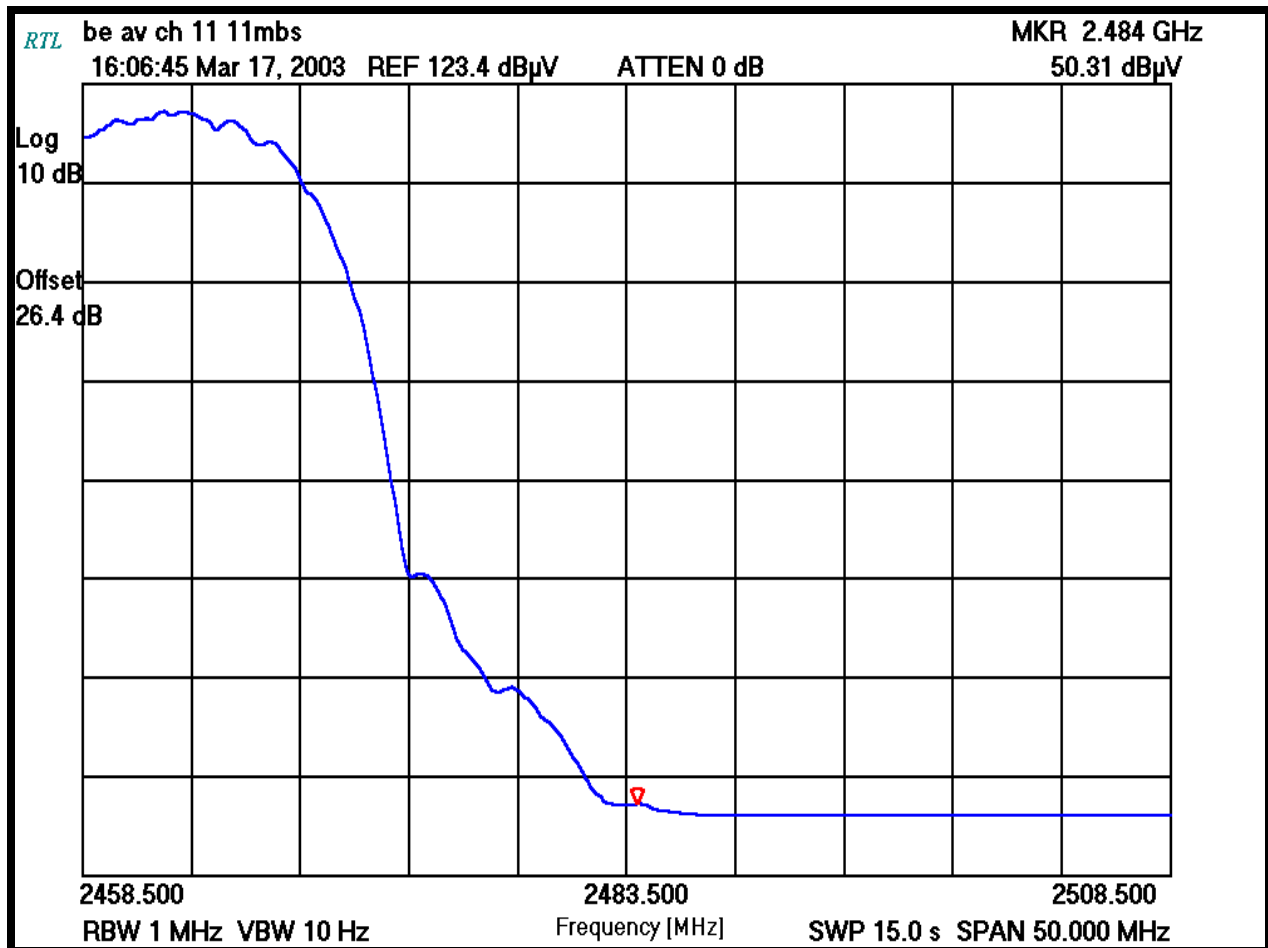
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test

Channel Number: 11
Frequency MHz: 2462
Data Rate (Mbps): 11
Resolution Bandwidth (MHz): 1
Video Bandwidth (Hz): 10
Sweep Time (s): 15.0

PLOT 3.2-11: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 11 MBPS



TEST PERSONNEL:

Rachid Sehb
Test Technician/Engineer

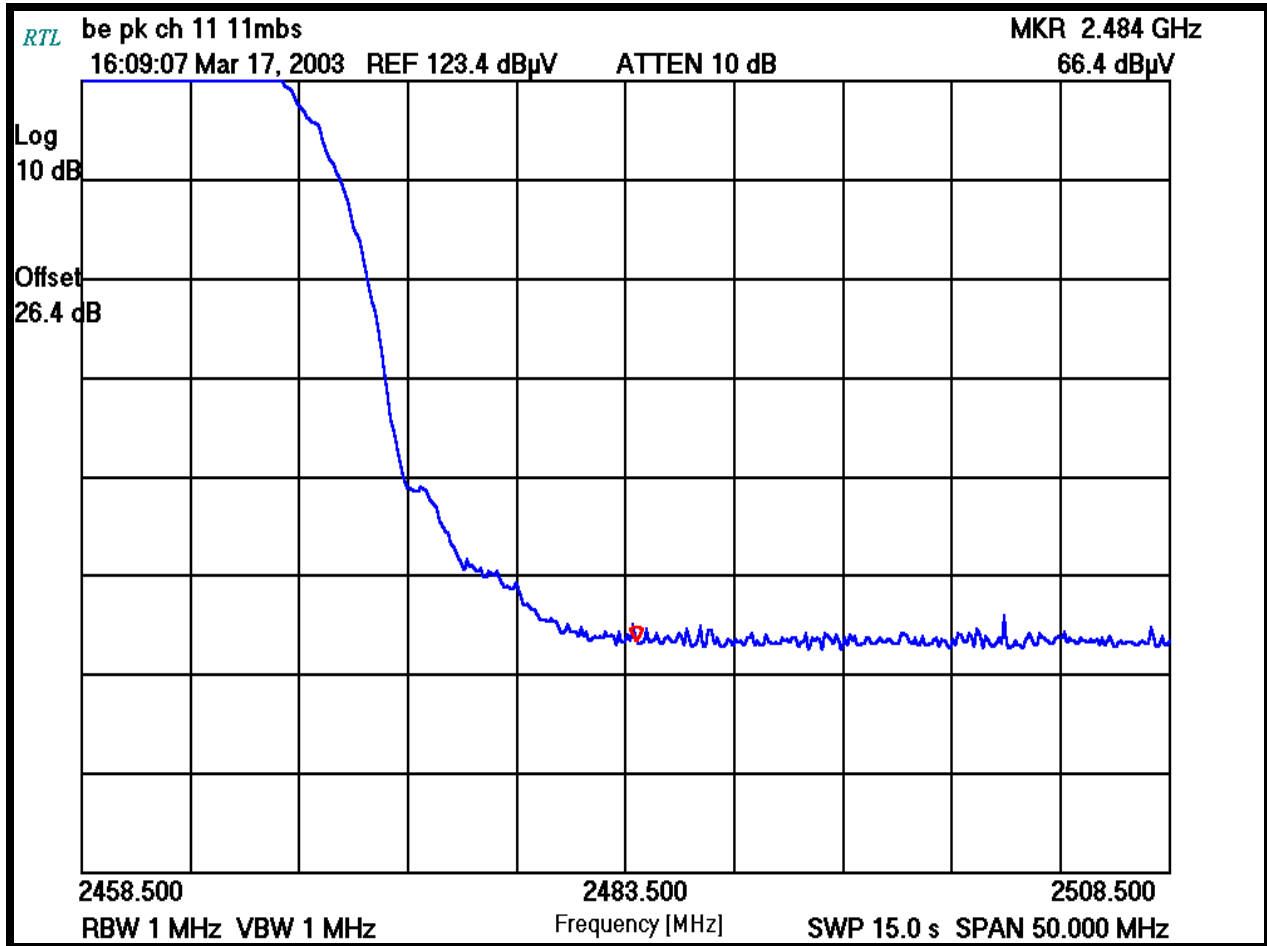
Signature

03/17/2003

Date Of Test

Channel Number: 11
 Frequency (MHz): 2462
 Data Rate (Mbps): 11
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (s): 15.0

PLOT 3.2-12: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 11 MBPS



TEST PERSONNEL:

Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test

3.3. COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN 4

WLAN On: 4
 Channels: 1 & 11
 Operating Frequency (MHz): 2412-2462
 Distance (m): 3
 Limit (dBuV/m): 54

TABLE 3.3-1: RESTRICTED BAND EDGE TEST DATA (1 MBPS)

Channel Set to	Frequency Tested (MHz)	Detector	Field Strength Level (dBmV/m)	Level Corrected (dBmV/m)	FCC Limit (dBmV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	22.5	48.9	54.0	-5.1
11	2483.5	Absolute measurement	23.2	49.6	54.0	-4.4

TABLE 3.3-2: RESTRICTED BAND EDGE TEST DATA (2 MBPS)


Channel Set to	Frequency Tested (MHz)	Detector	Field Strength Level (dBmV/m)	Level Corrected (dBmV/m)	FCC Limit (dBmV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	22.4	48.8	54.0	-5.2
11	2483.5	Absolute measurement	23.1	49.5	54.0	-4.5

TABLE 3.3-3: RESTRICTED BAND EDGE TEST DATA (11 MBPS)

Channel Set to	Frequency Tested (MHz)	Detector	Field Strength Level (dBmV/m)	Level Corrected (dBmV/m)	FCC Limit (dBmV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	22.5	48.9	54.0	-5.1
11	2483.5	Absolute measurement	22.8	49.2	54.0	-4.8

TEST PERSONNEL:

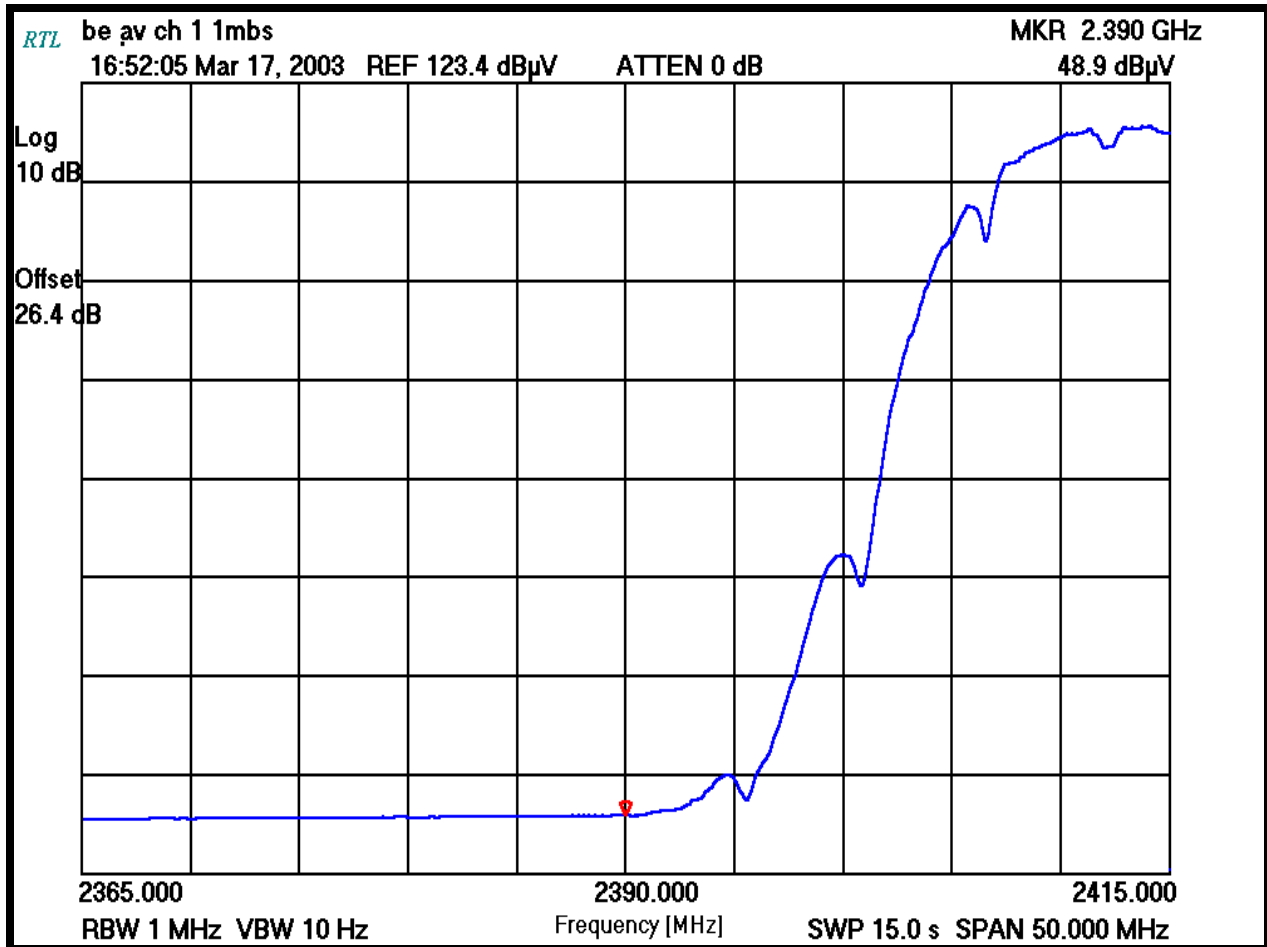
Rachid Sehb
 Test Technician/Engineer


 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 1
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.3-1: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS



TEST PERSONNEL:

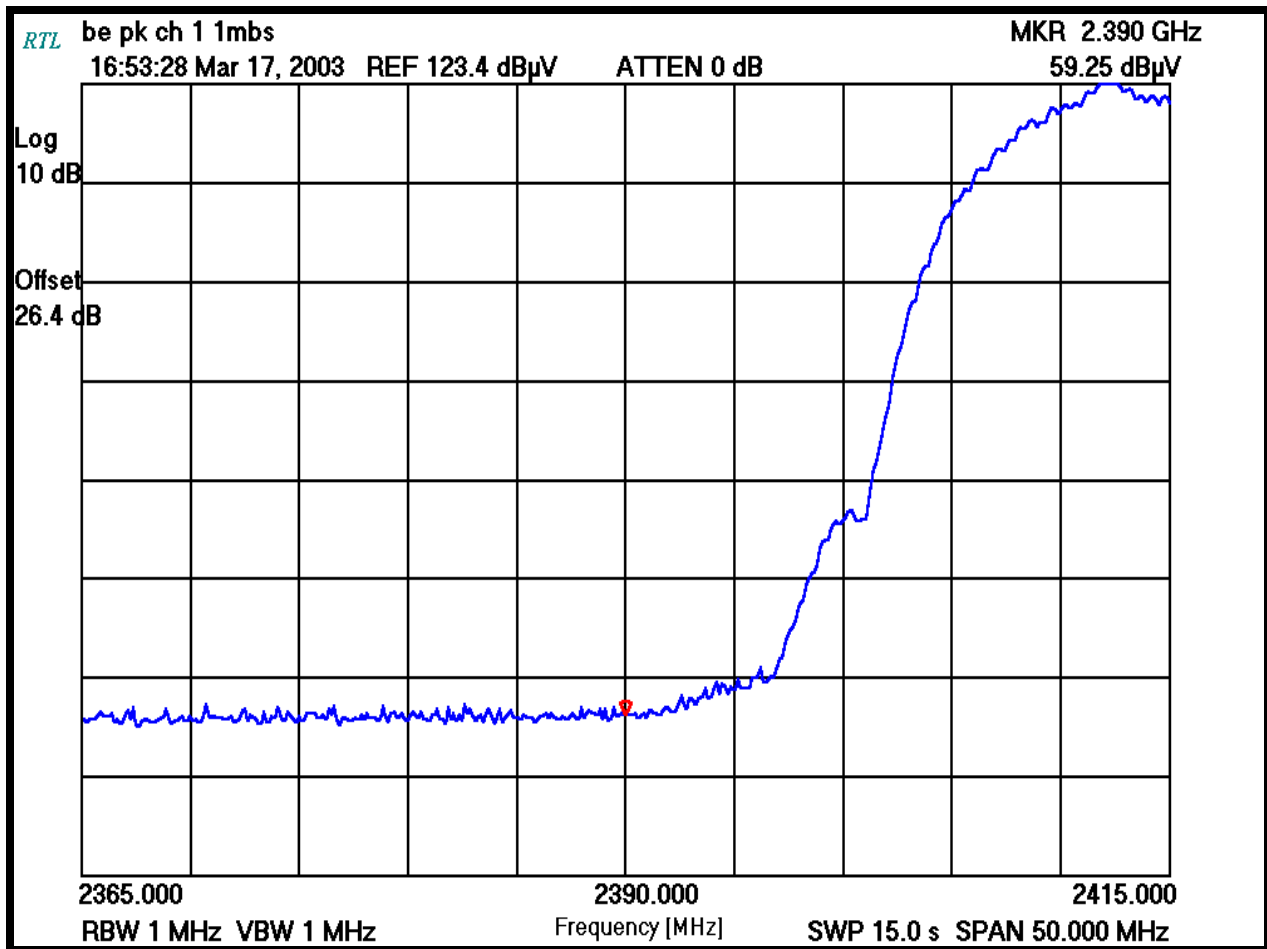
Rachid Sehb
 Test Technician/Engineer

See
 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 1
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (s): 15.0

PLOT 3.3-2: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS



TEST PERSONNEL:

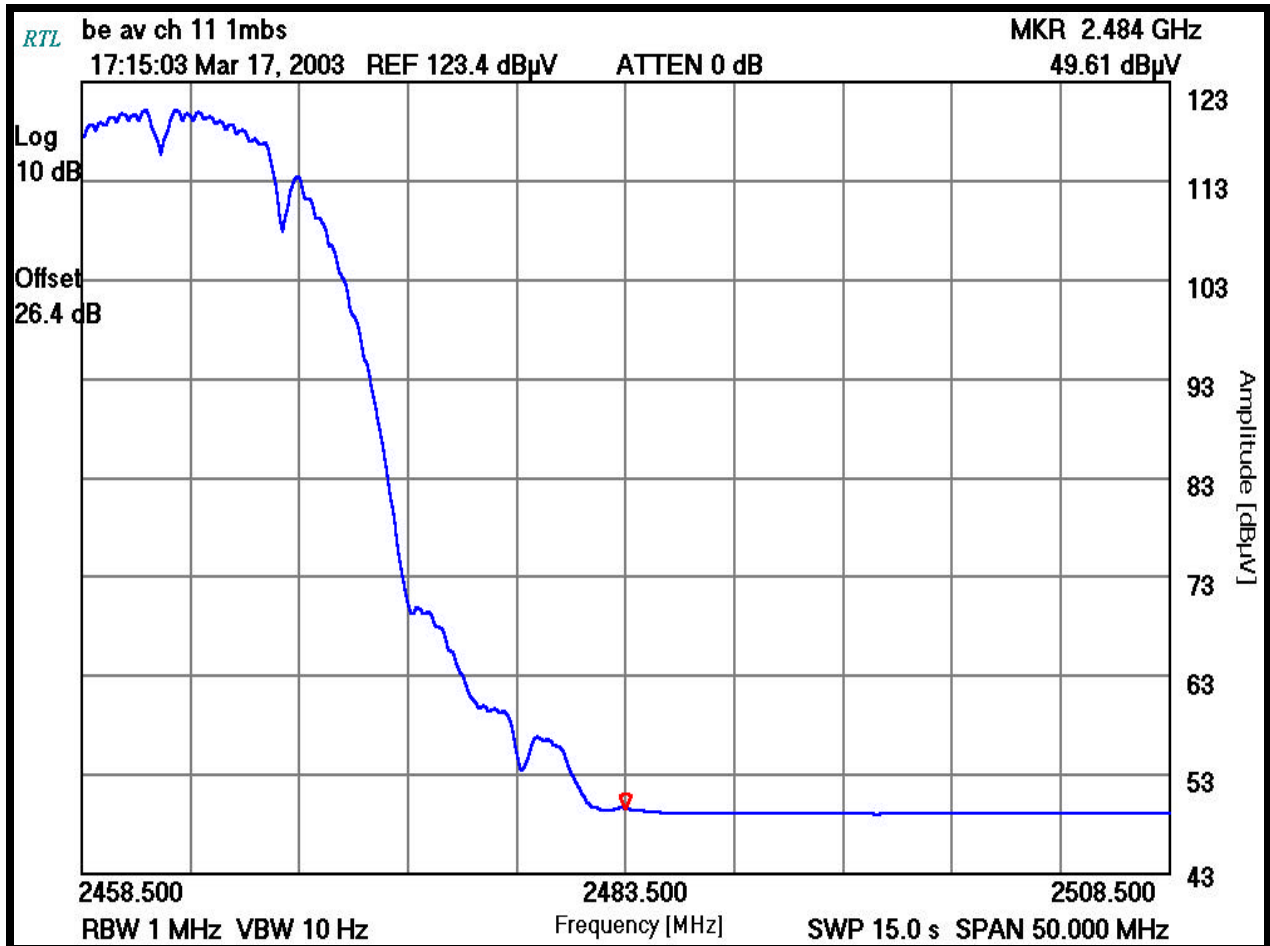
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test

Channel Number: 11
Frequency (MHz): 2462
Data Rate (Mbps): 1
Resolution Bandwidth (MHz): 1
Video Bandwidth (Hz): 10
Sweep Time (s): 15.0

PLOT 3.3-3: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS



TEST PERSONNEL:

Rachid Sehb
Test Technician/Engineer

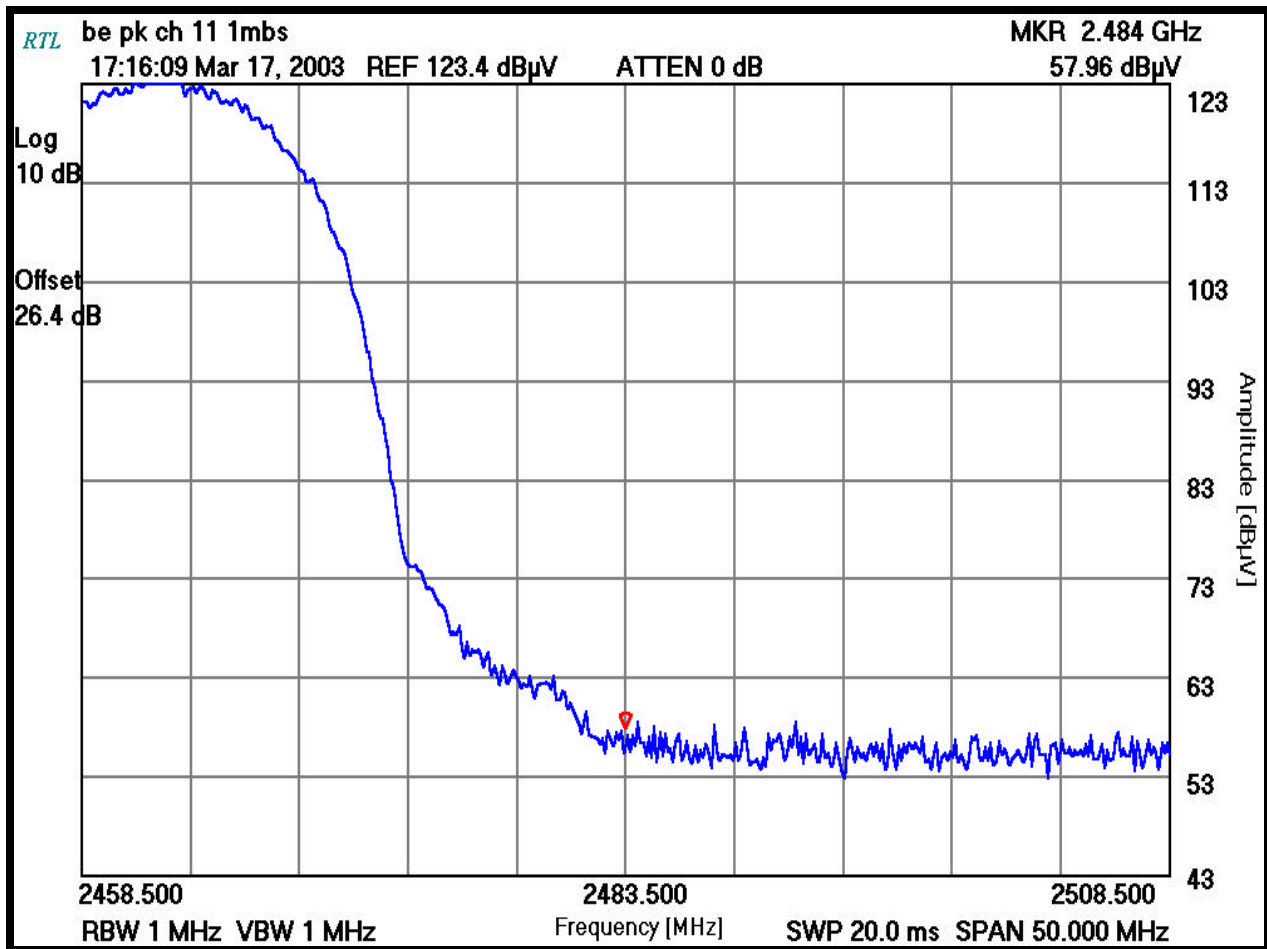
Signature

03/17/2003

Date Of Test

Channel Number: 11
 Frequency (MHz): 2462
 Data Rate (Mbps): 1
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (ms): 20.0

PLOT 3.3-4: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS



TEST PERSONNEL:

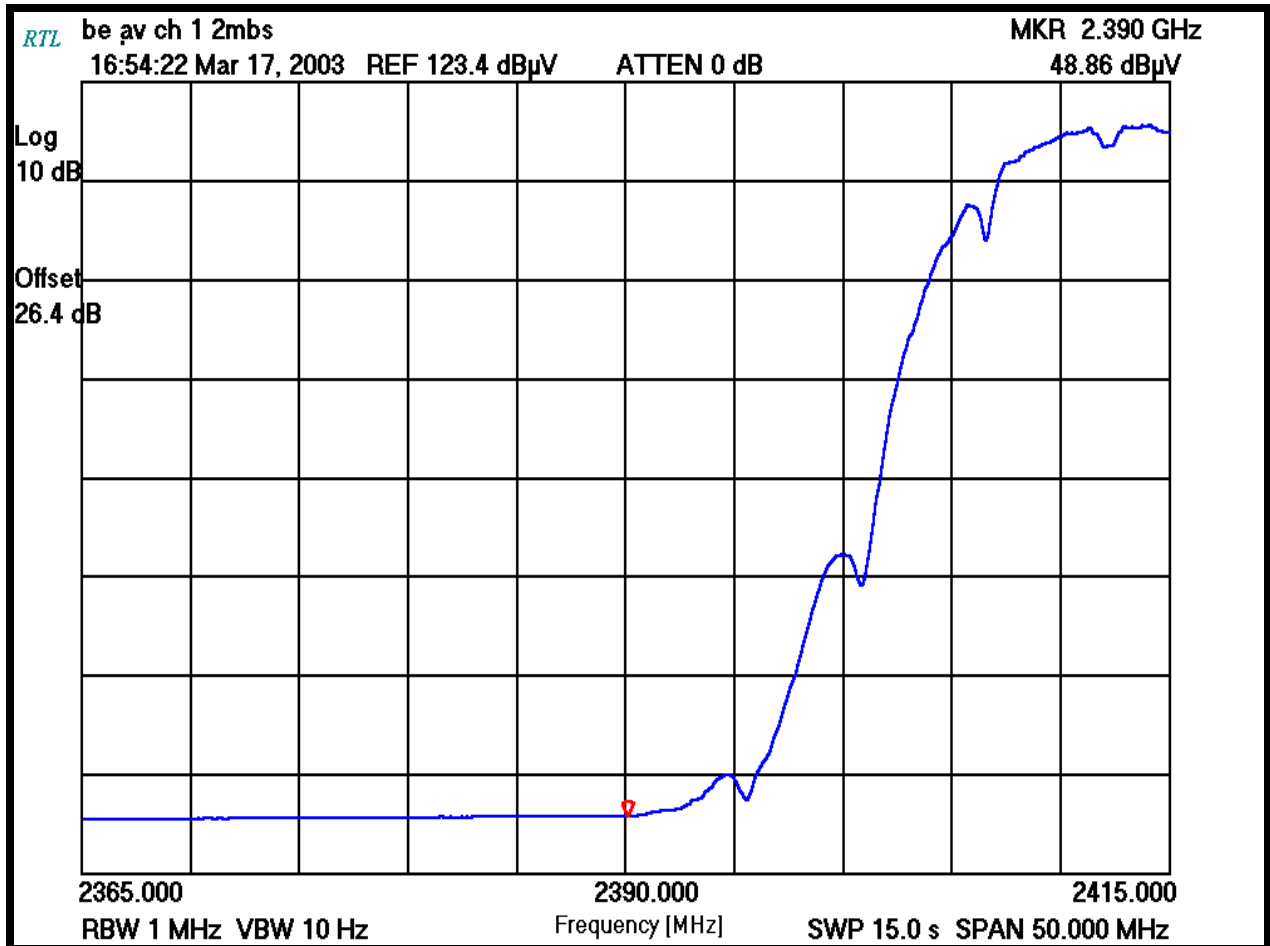
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 2
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.3-5: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 2 MBPS



TEST PERSONNEL:

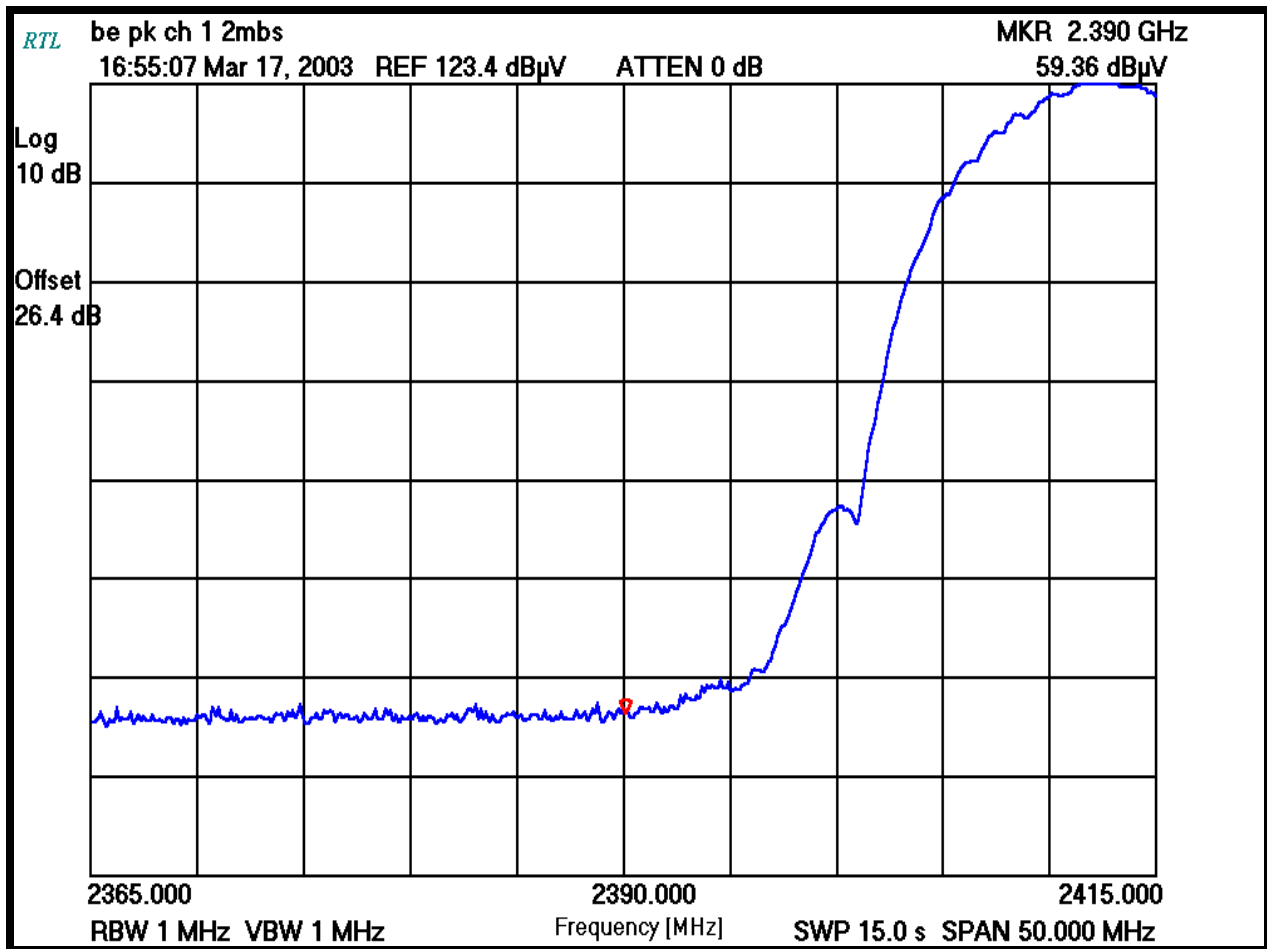
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test


Channel Number: 1
Frequency (MHz): 2412
Data Rate (Mbps): 2
Resolution Bandwidth (MHz): 1
Video Bandwidth (MHz): 1
Sweep Time (s): 15.0

PLOT 3.3-6: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 2 MBPS



TEST PERSONNEL:

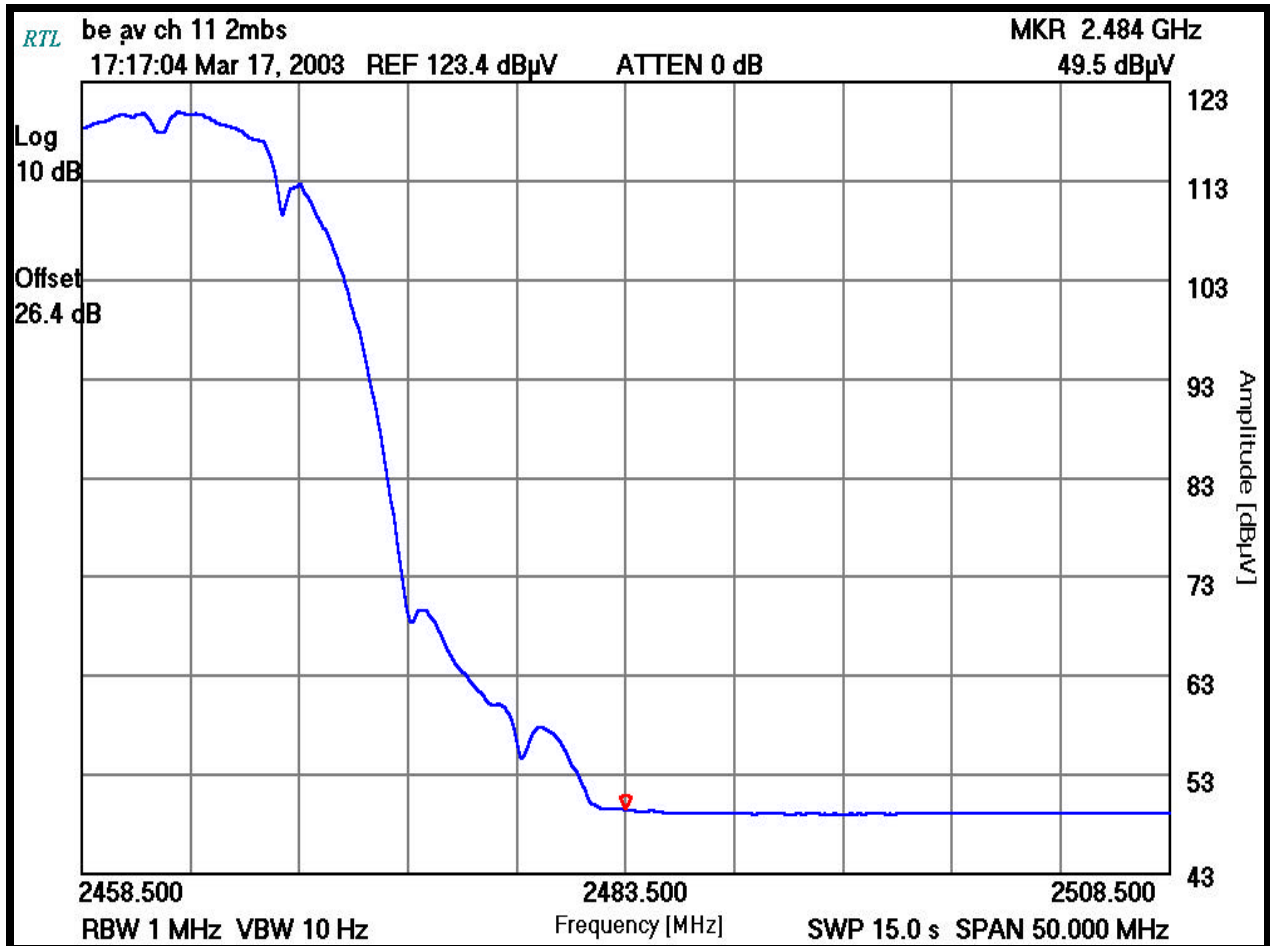
Rachid Sehb
Test Technician/Engineer


Signature

03/17/2003
Date Of Test

Channel Number: 11
 Frequency (MHz): 2462
 Data Rate (Mbps): 2
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.3-7: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 2 MBPS



TEST PERSONNEL:

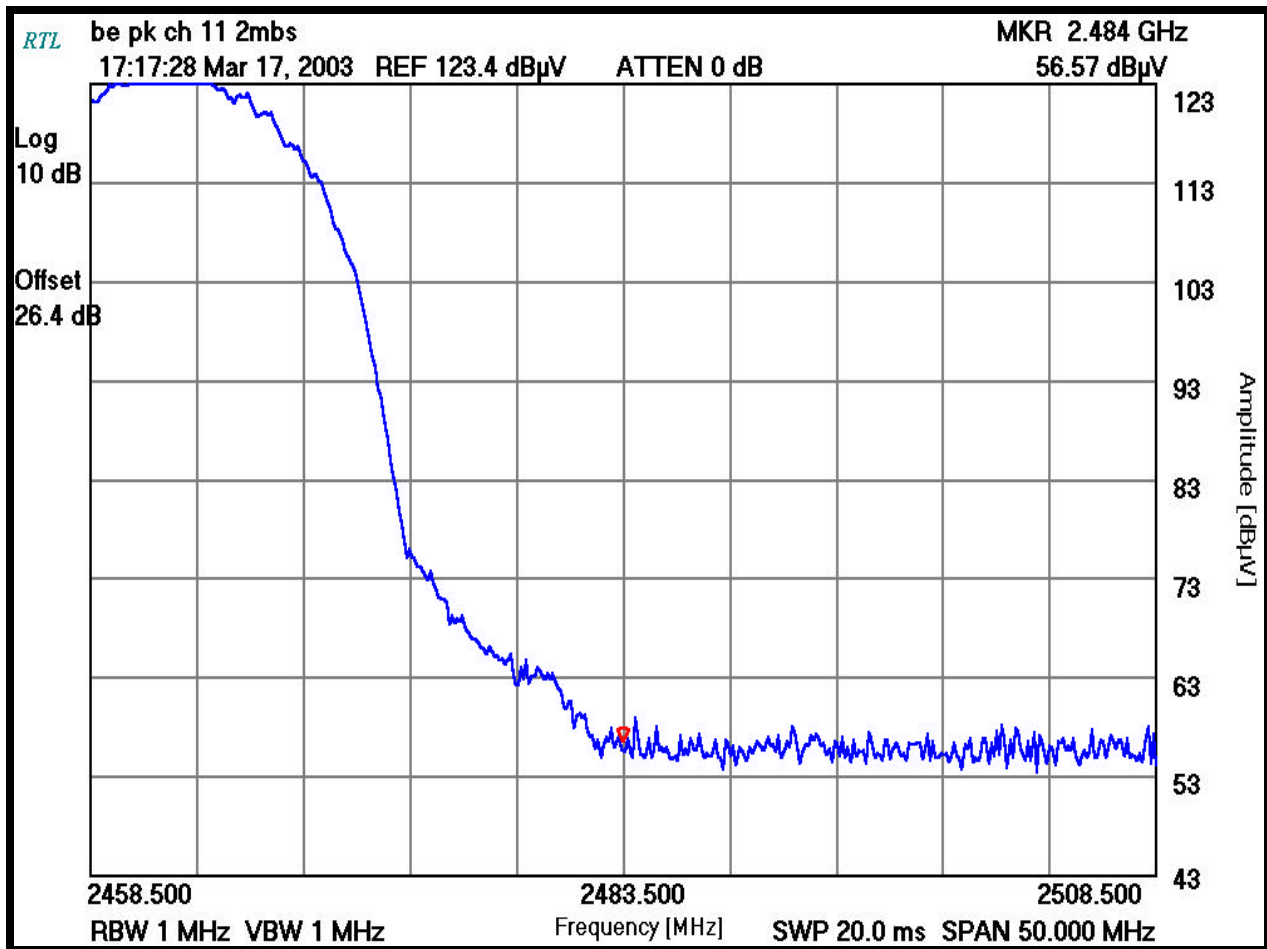
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test

Channel Number: 11
 Frequency (MHz): 2462
 Data Rate (Mbps): 2
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (ms): 20.0

PLOT 3.3-8: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 2 MBPS



TEST PERSONNEL:

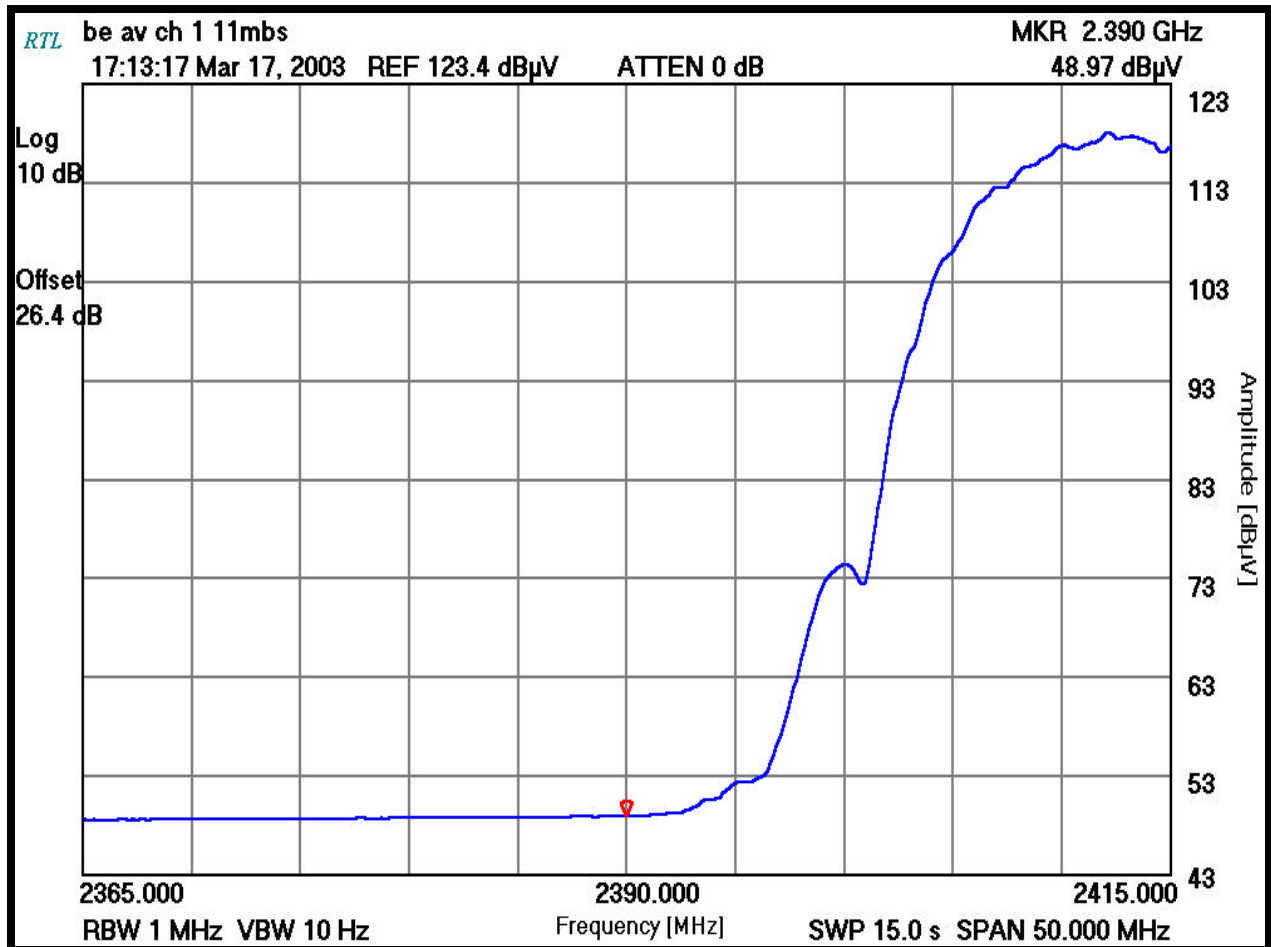
Rachid Sehb
 Test Technician/Engineer

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 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 11
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.3-9: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 11 MBPS



TEST PERSONNEL:

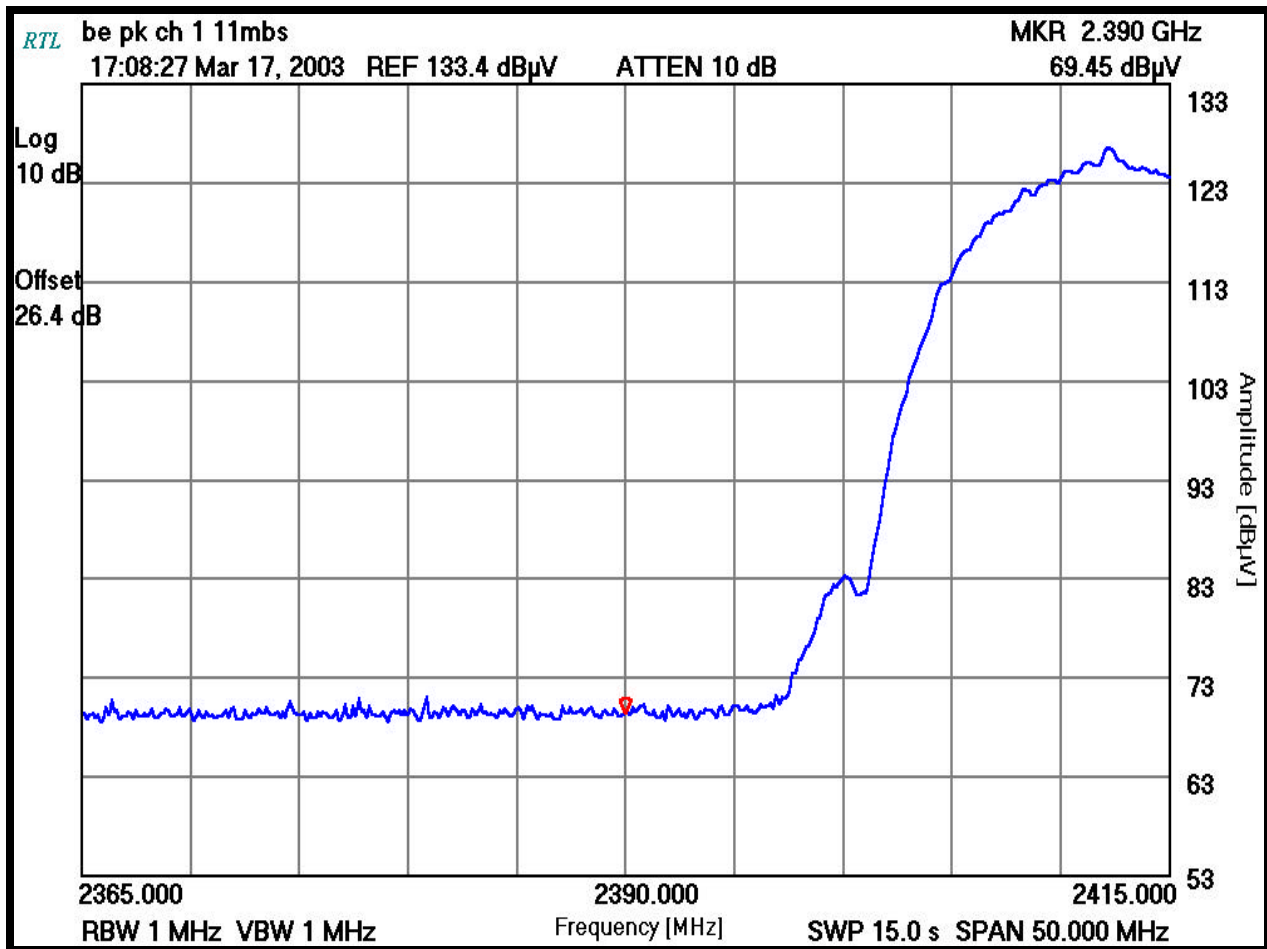
Rachid Sehb
 Test Technician/Engineer

See
 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 11
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (s): 15.0

PLOT 3.3-10: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 11 MBPS



TEST PERSONNEL:

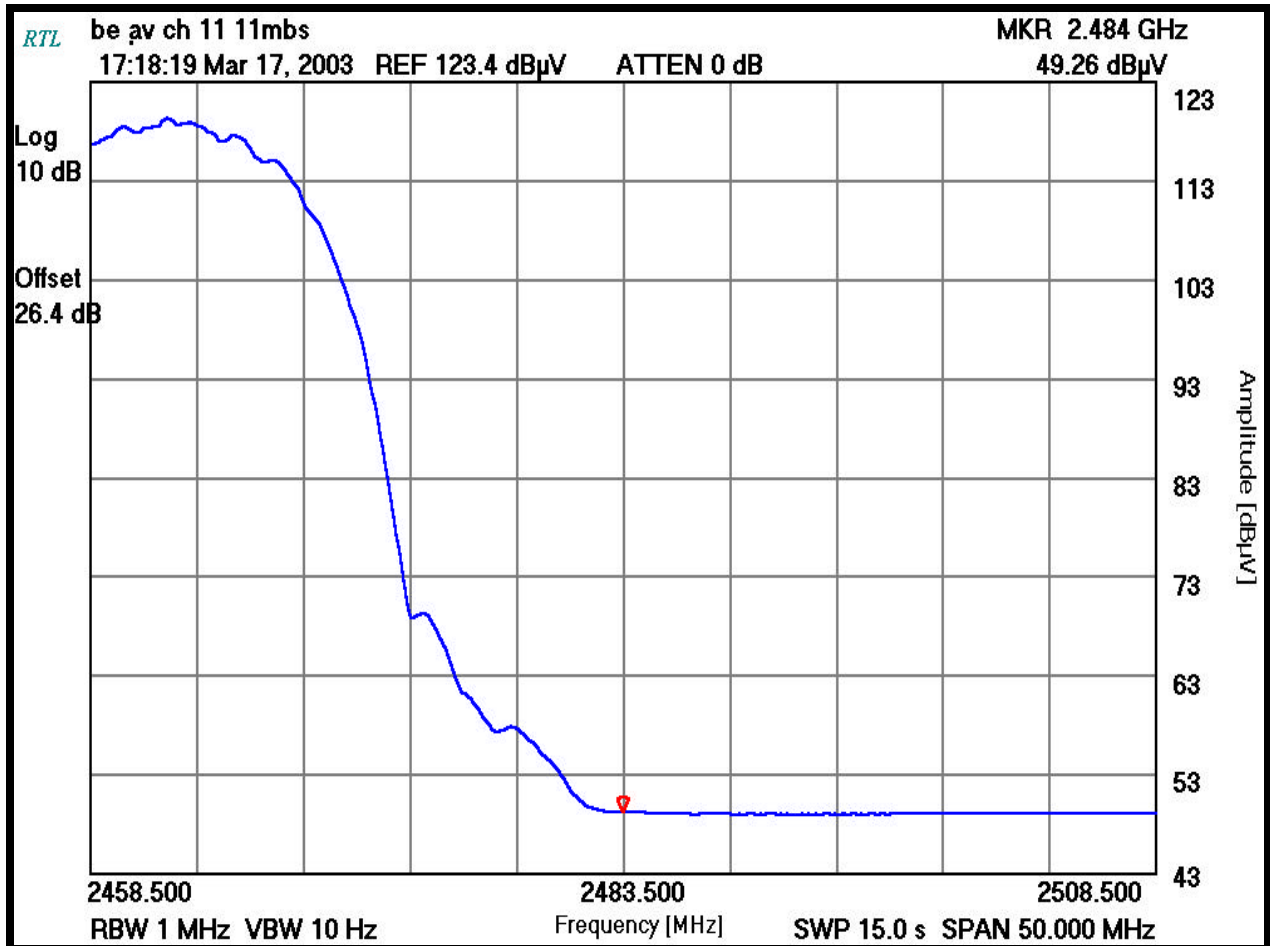
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test


Channel Number: 11
 Frequency (MHz): 2462
 Data Rate (Mbps): 11
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.3-11: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 11 MBPS



TEST PERSONNEL:

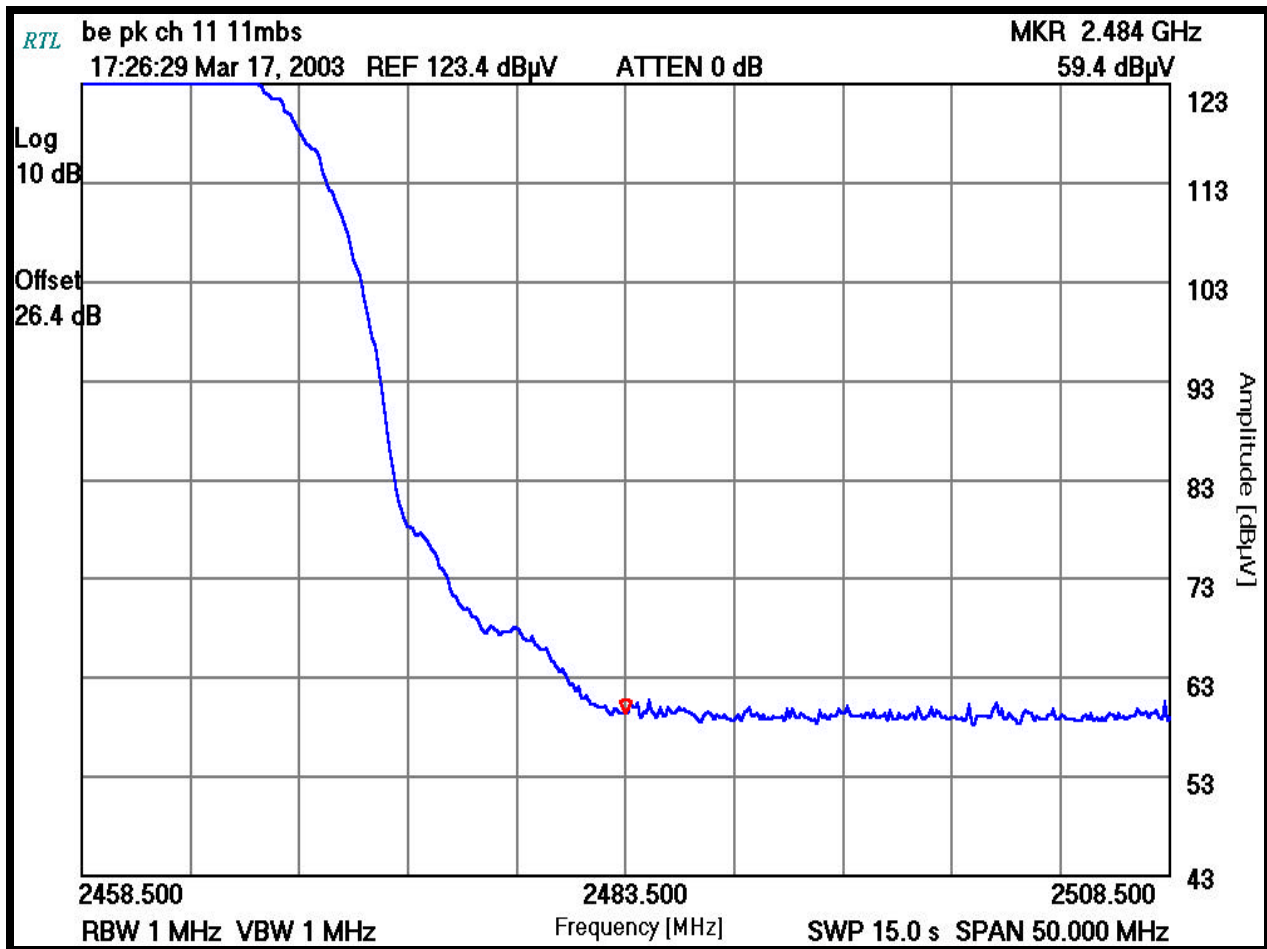
Rachid Sehb
 Test Technician/Engineer


 Signature

03/17/2003
 Date Of Test


Channel Number: 11
Frequency (MHz): 2462
Data Rate (Mbps): 11
Resolution Bandwidth (MHz): 1
Video Bandwidth (MHz): 1
Sweep Time (s): 15.0

PLOT 3.3-12: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 11 MBPS



TEST PERSONNEL:

Rachid Sehb
Test Technician/Engineer


Signature

03/17/2003
Date Of Test

3.4. COMPLIANCE WITH THE RESTRICTED BAND EDGE TEST DATA FOR WLAN 8

WLAN On: 8
 Channels: 1 & 11
 Operating Frequency (MHz): 2412-2462
 Distance (m): 3
 Limit (dBuV/m): 54

TABLE 3.4-1: RESTRICTED BAND EDGE TEST DATA (1 MBPS)

Channel Set to	Frequency Tested (MHz)	Detector	Field Strength Level (dBmV/m)	Level Corrected (dBmV/m)	FCC Limit (dBmV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	22.5	48.9	54.0	-5.1
11	2483.5	Absolute measurement	22.8	49.2	54.0	-4.8

TABLE 3.4-2: RESTRICTED BAND EDGE TEST DATA (2 MBPS)

Channel Set to	Frequency Tested (MHz)	Detector	Field Strength Level (dBmV/m)	Level Corrected (dBmV/m)	FCC Limit (dBmV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	22.4	48.8	54.0	-5.2
11	2483.5	Absolute measurement	22.7	49.1	54.0	-4.9

TABLE 3.4-3: RESTRICTED BAND EDGE TEST DATA (11 MBPS)

Channel Set to	Frequency Tested (MHz)	Detector	Field Strength Level (dBmV/m)	Level Corrected (dBmV/m)	FCC Limit (dBmV/m)	FCC Margin (dB)
1	2390.0	Absolute measurement	22.5	48.9	54.0	-5.1
11	2483.5	Absolute measurement	22.7	49.1	54.0	-4.9

TEST PERSONNEL:

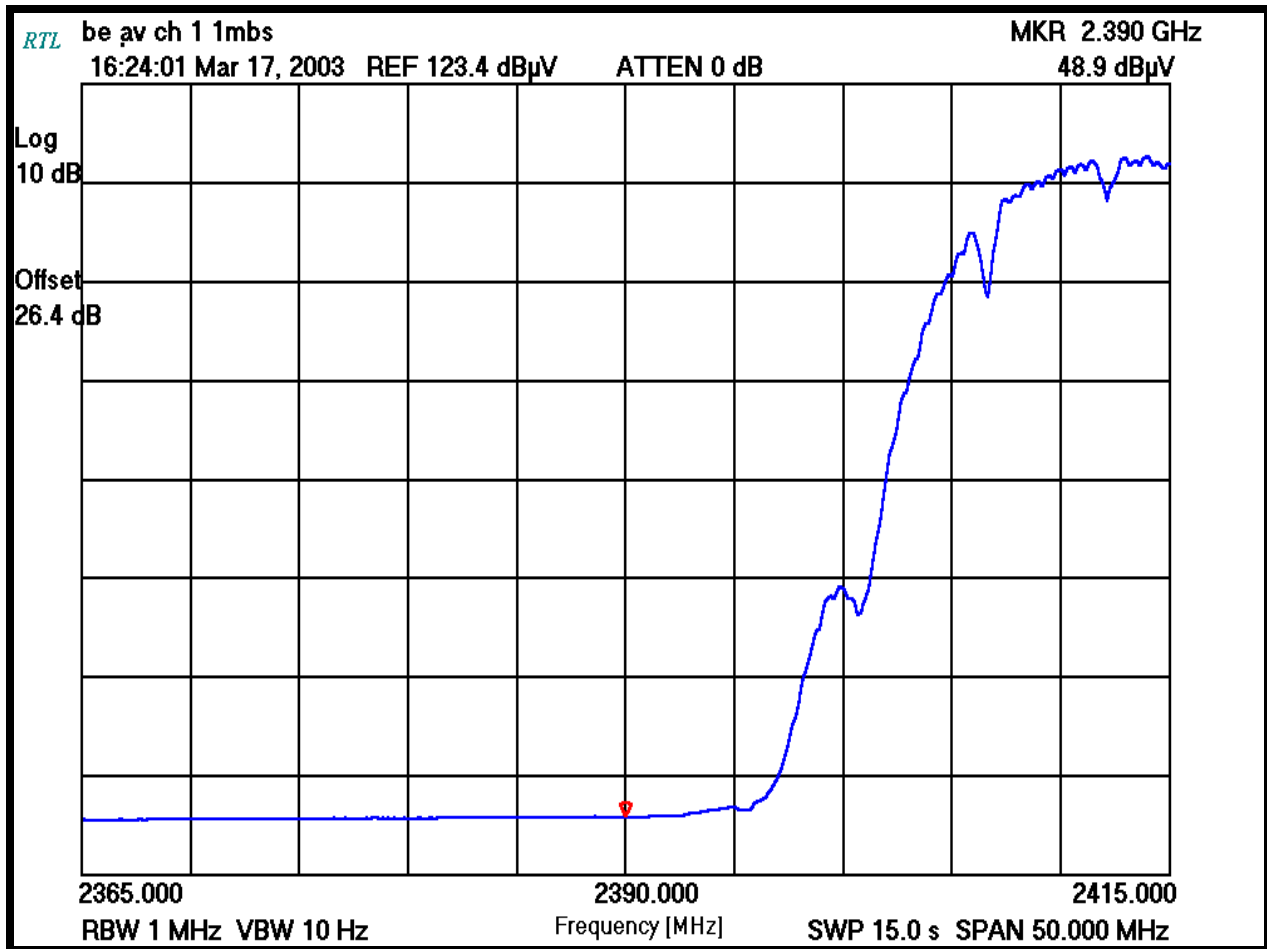
Rachid Sehb
 Test Technician/Engineer


 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 1
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.4-1: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 1 MBPS



TEST PERSONNEL:

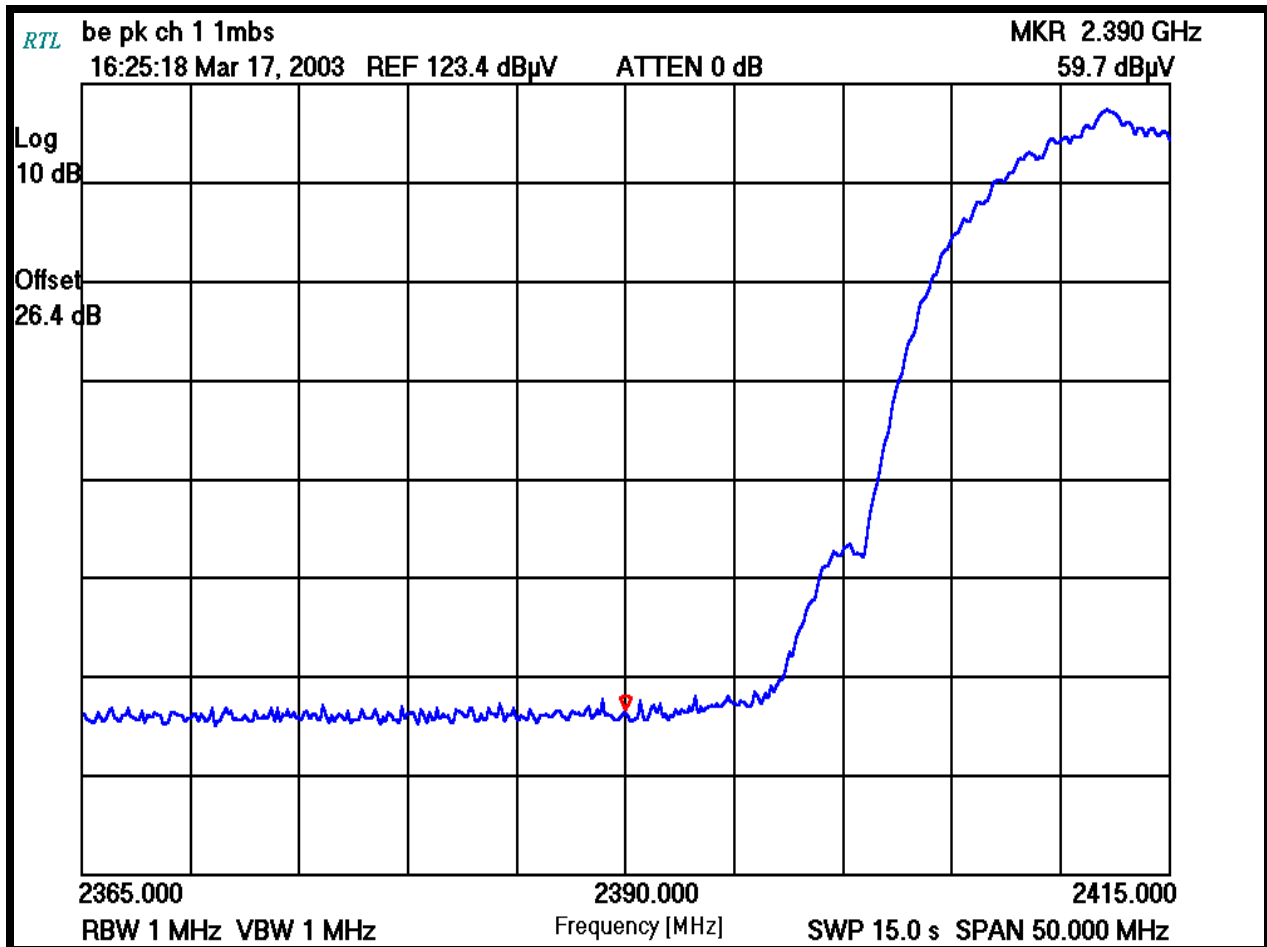
Rachid Sehb
 Test Technician/Engineer

See
 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 1
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (s): 15.0

PLOT 3.4-2: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 1 MBPS



TEST PERSONNEL:

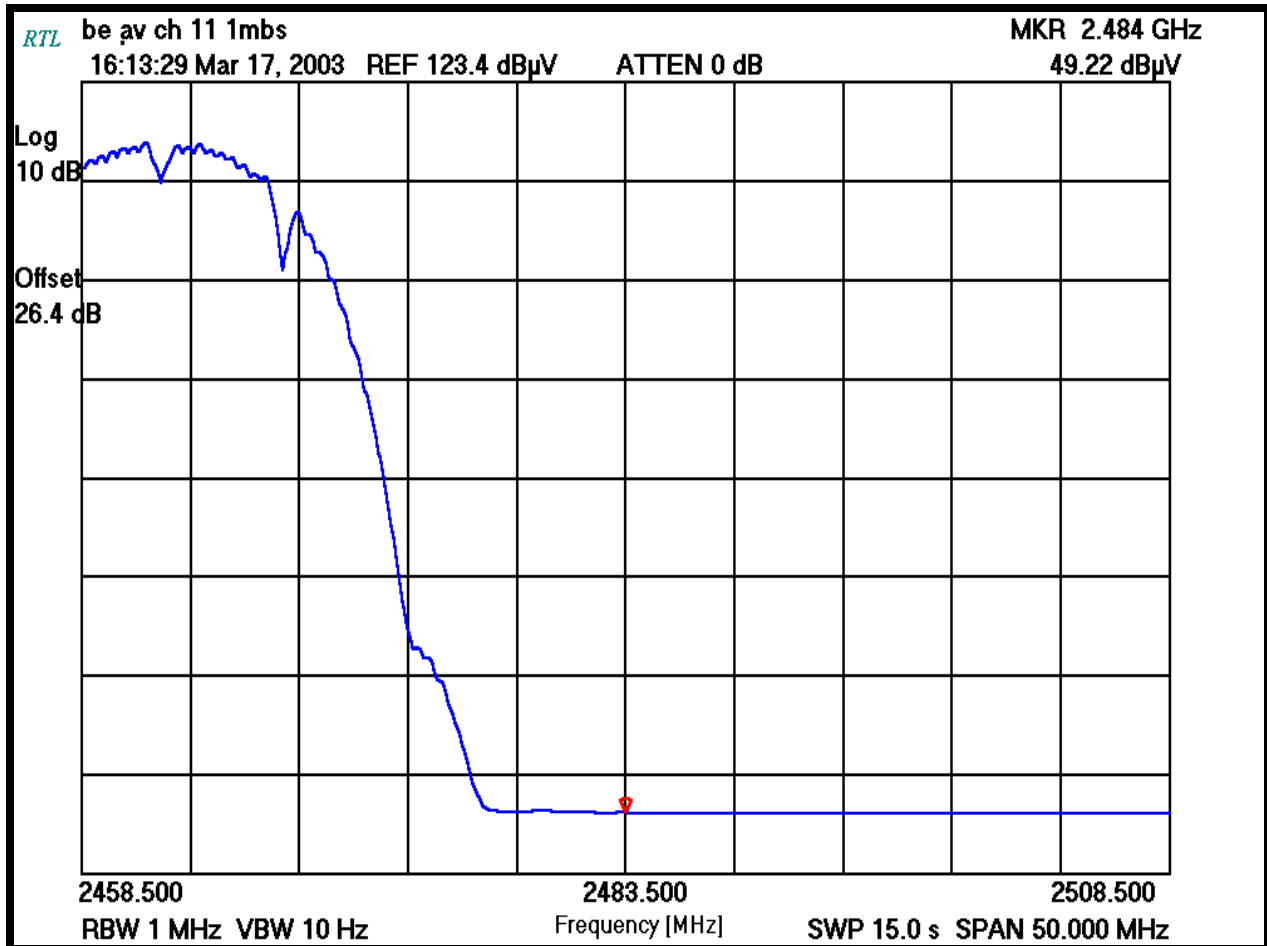
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test


Channel Number: 11
Frequency (MHz): 2462
Data Rate (Mbps): 1
Resolution Bandwidth (MHz): 1
Video Bandwidth (Hz): 10
Sweep Time (s): 15.0

PLOT 3.4-3: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 1 MBPS



TEST PERSONNEL:

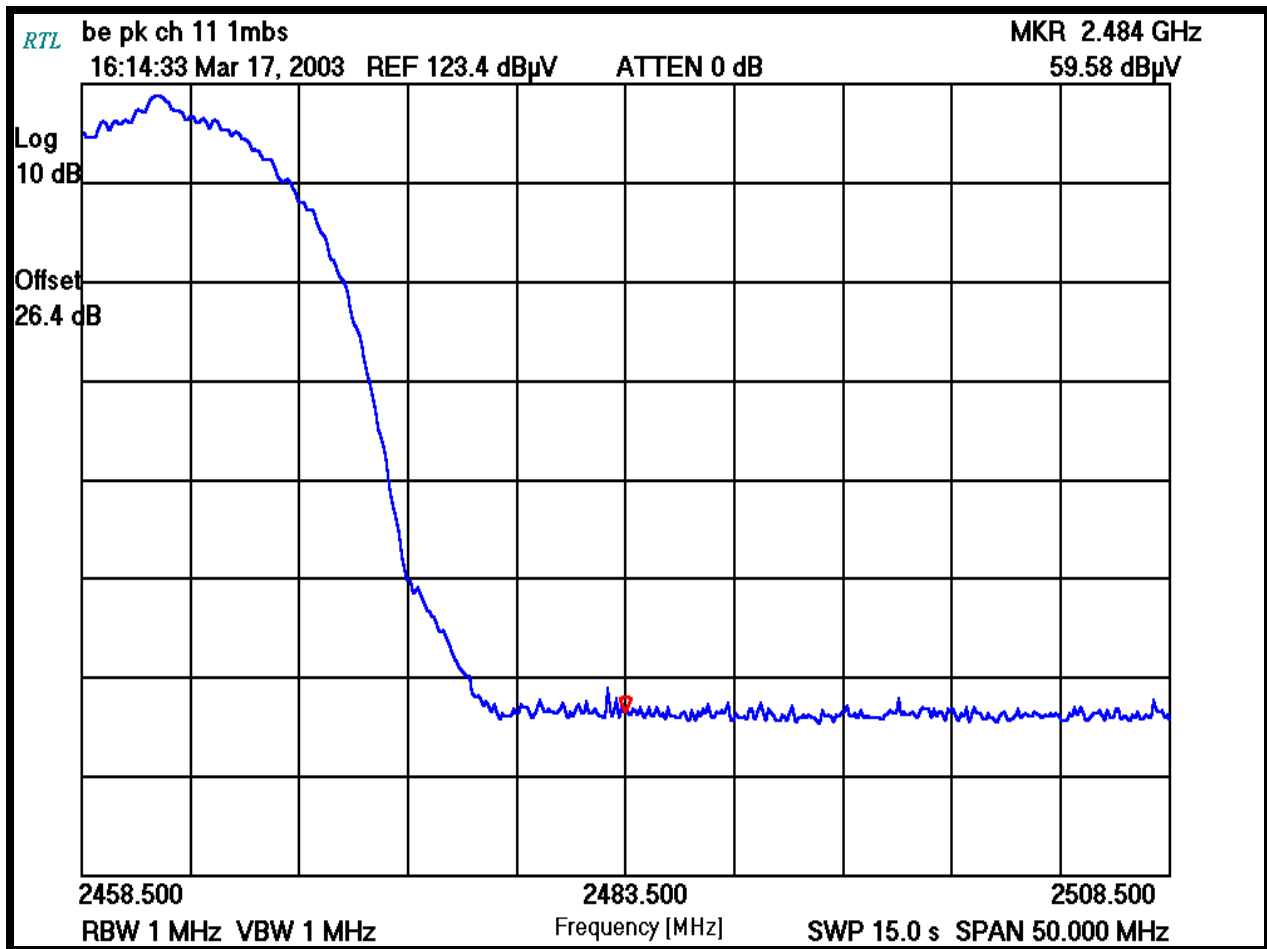
Rachid Sehb
Test Technician/Engineer


Signature

03/17/2003
Date Of Test

Channel Number: 11
 Frequency (MHz): 2462
 Data Rate (Mbps): 1
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (s): 15.0

PLOT 3.4-4: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 1 MBPS



TEST PERSONNEL:

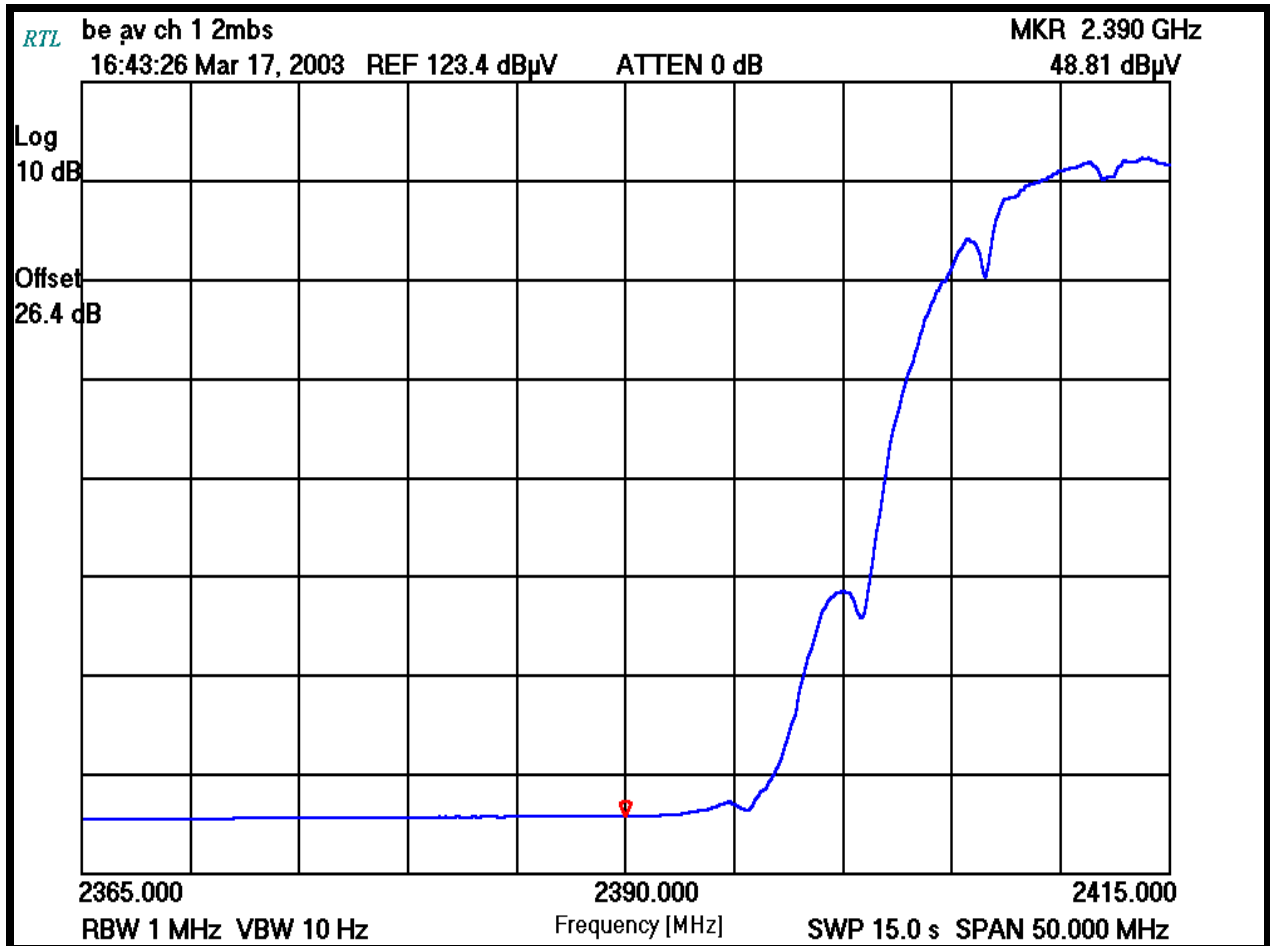
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 2
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (Hz): 10
 Sweep Time (s): 15.0

PLOT 3.4-5: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 2 MBPS



TEST PERSONNEL:

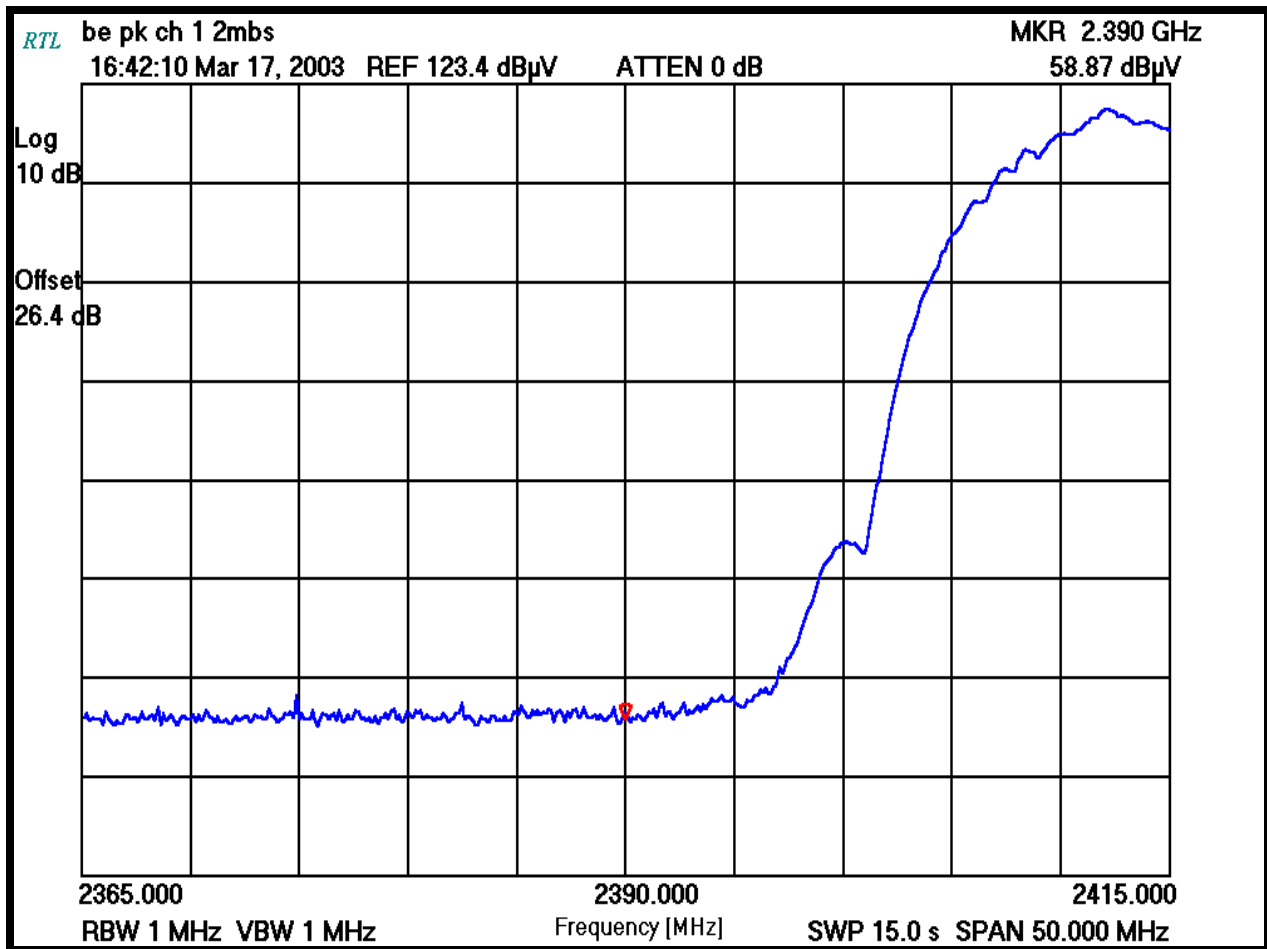
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 2
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (s): 15.0

PLOT 3.4-6: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 2 MBPS



TEST PERSONNEL:

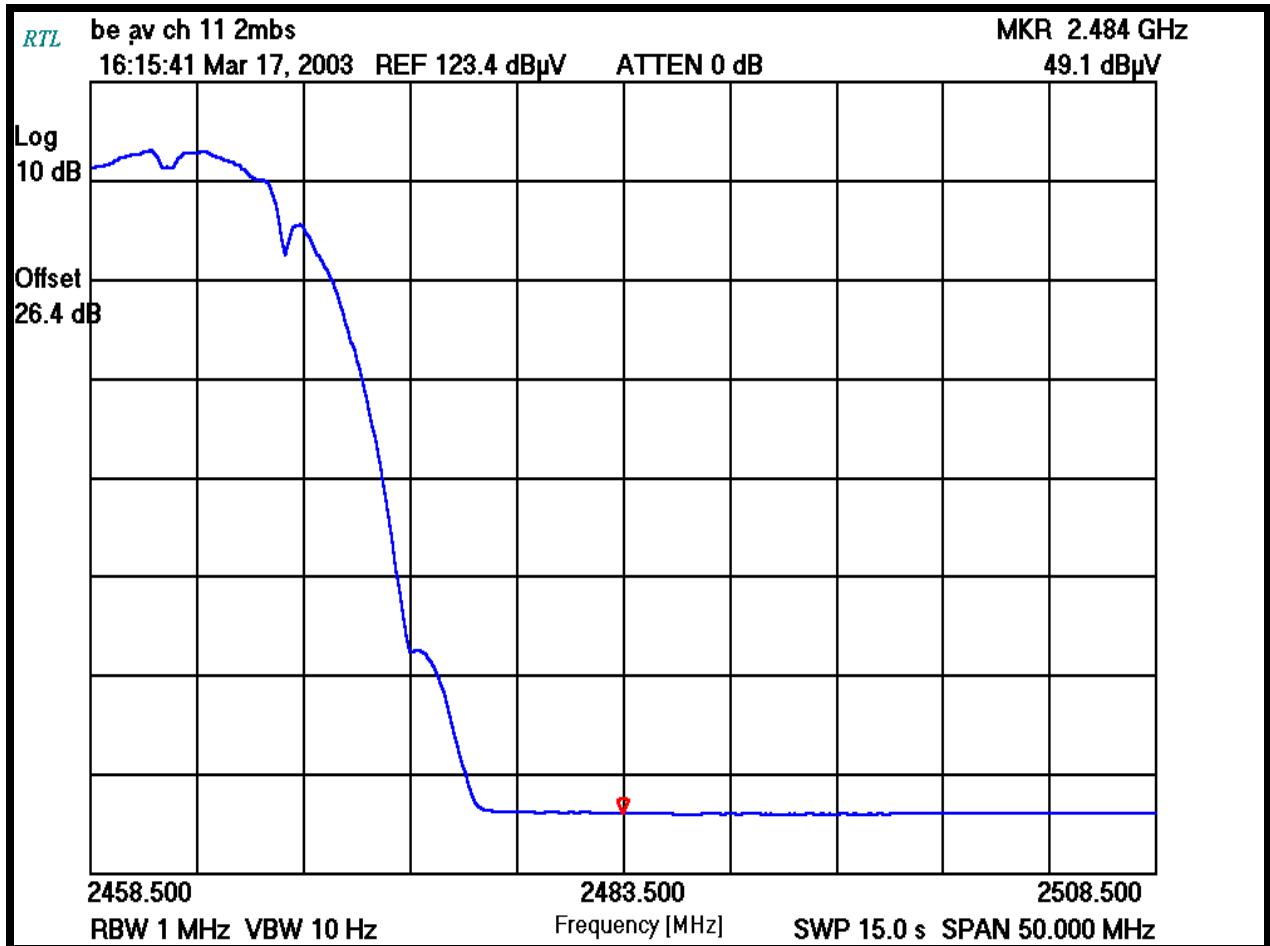
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test


Channel Number: 11
Frequency (MHz): 2462
Data Rate (Mbps): 2
Resolution Bandwidth (MHz): 1
Video Bandwidth (Hz): 10
Sweep Time (s): 15.0

PLOT 3.4-7: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 2 MBPS



TEST PERSONNEL:

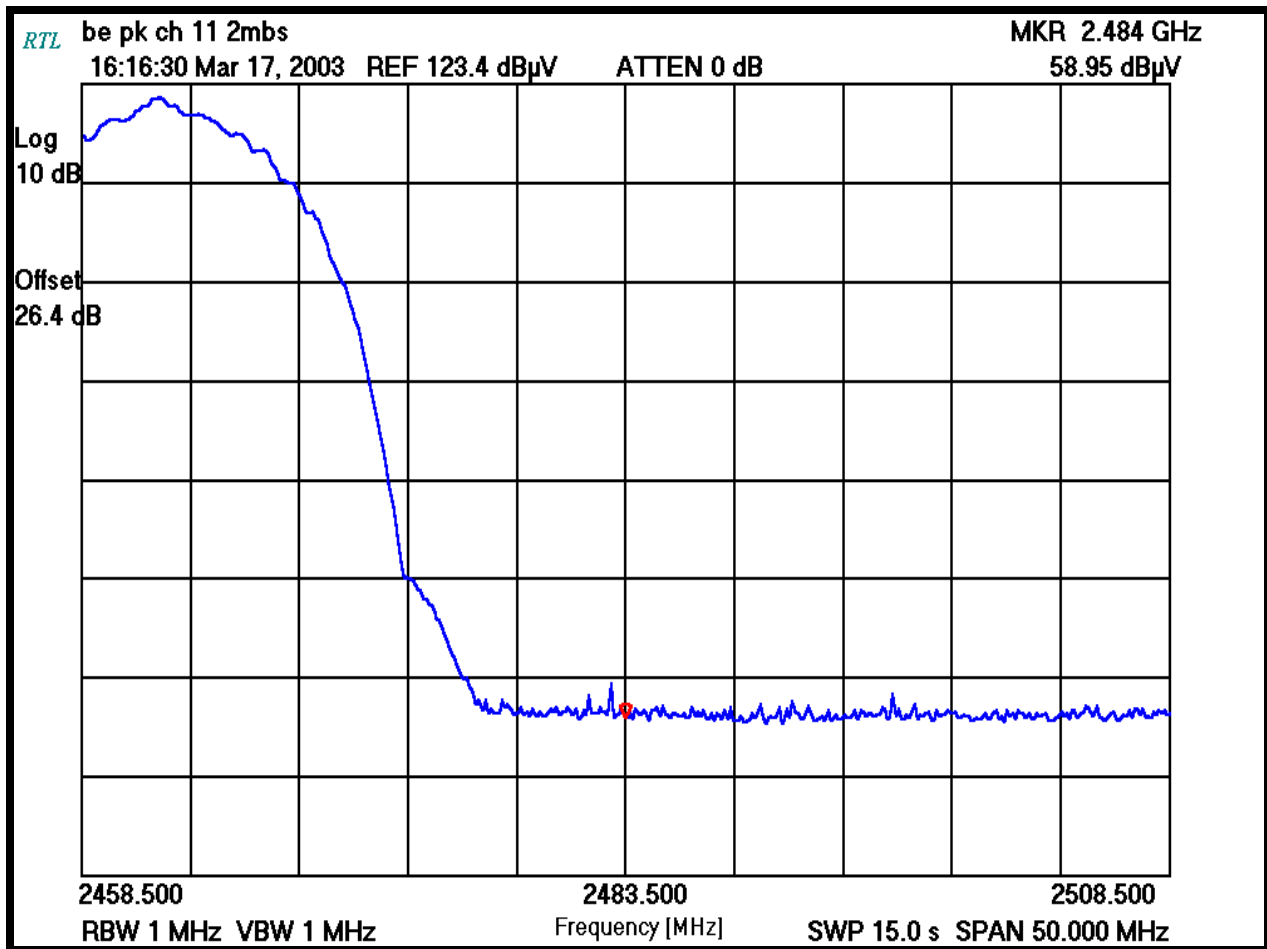
Rachid Sehb
Test Technician/Engineer


Signature

03/17/2003
Date Of Test

Channel Number: 11
 Frequency (MHz): 2462
 Data Rate (Mbps): 2
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (s): 15.0

PLOT 3.4-8: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 2 MBPS



TEST PERSONNEL:

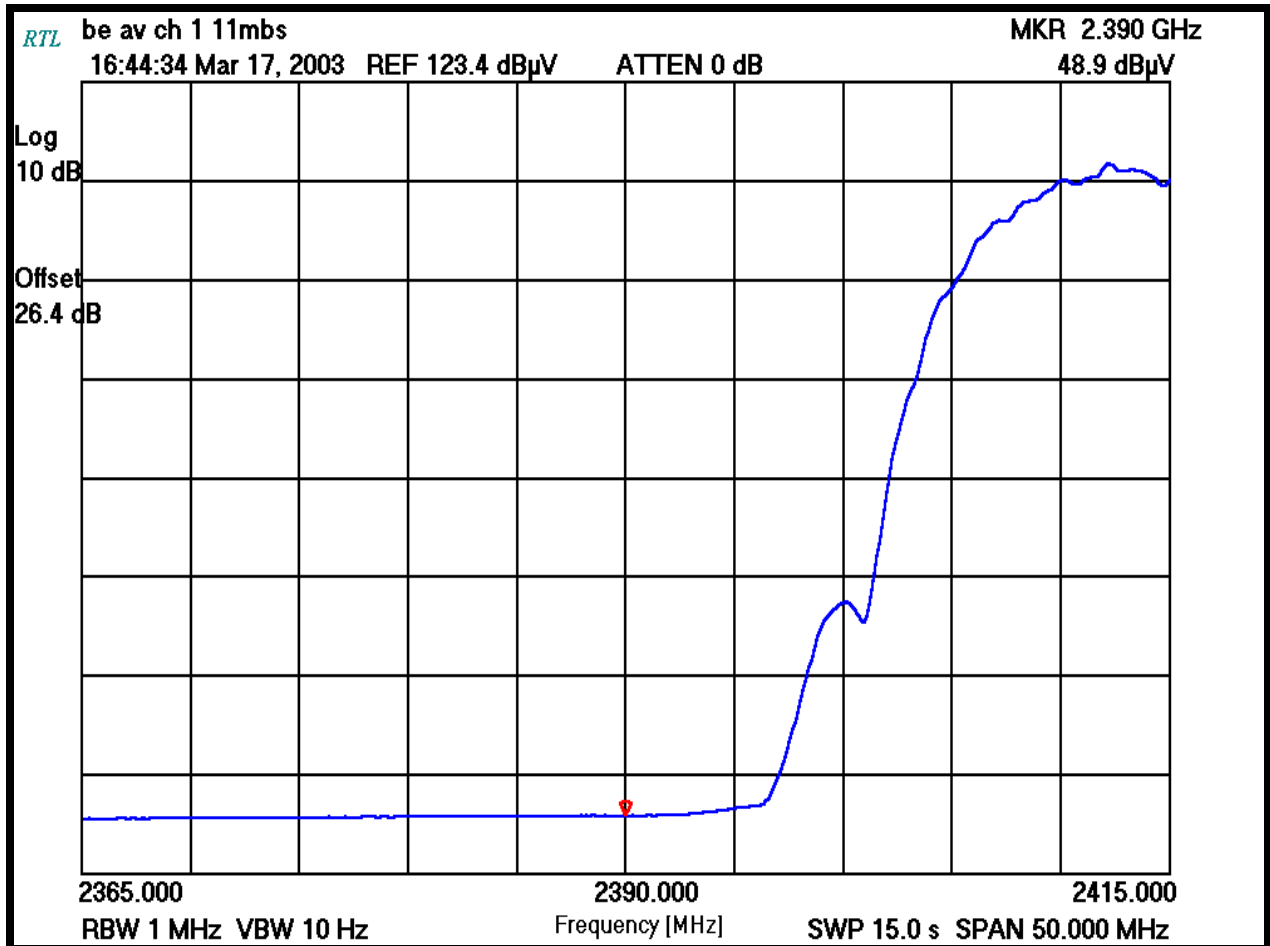
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test


Channel Number: 1
Frequency (MHz): 2412
Data Rate (Mbps): 11
Resolution Bandwidth (MHz): 1
Video Bandwidth (Hz): 10
Sweep Time (s): 15.0

PLOT 3.4-9: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 1 AT 11 MBPS



TEST PERSONNEL:

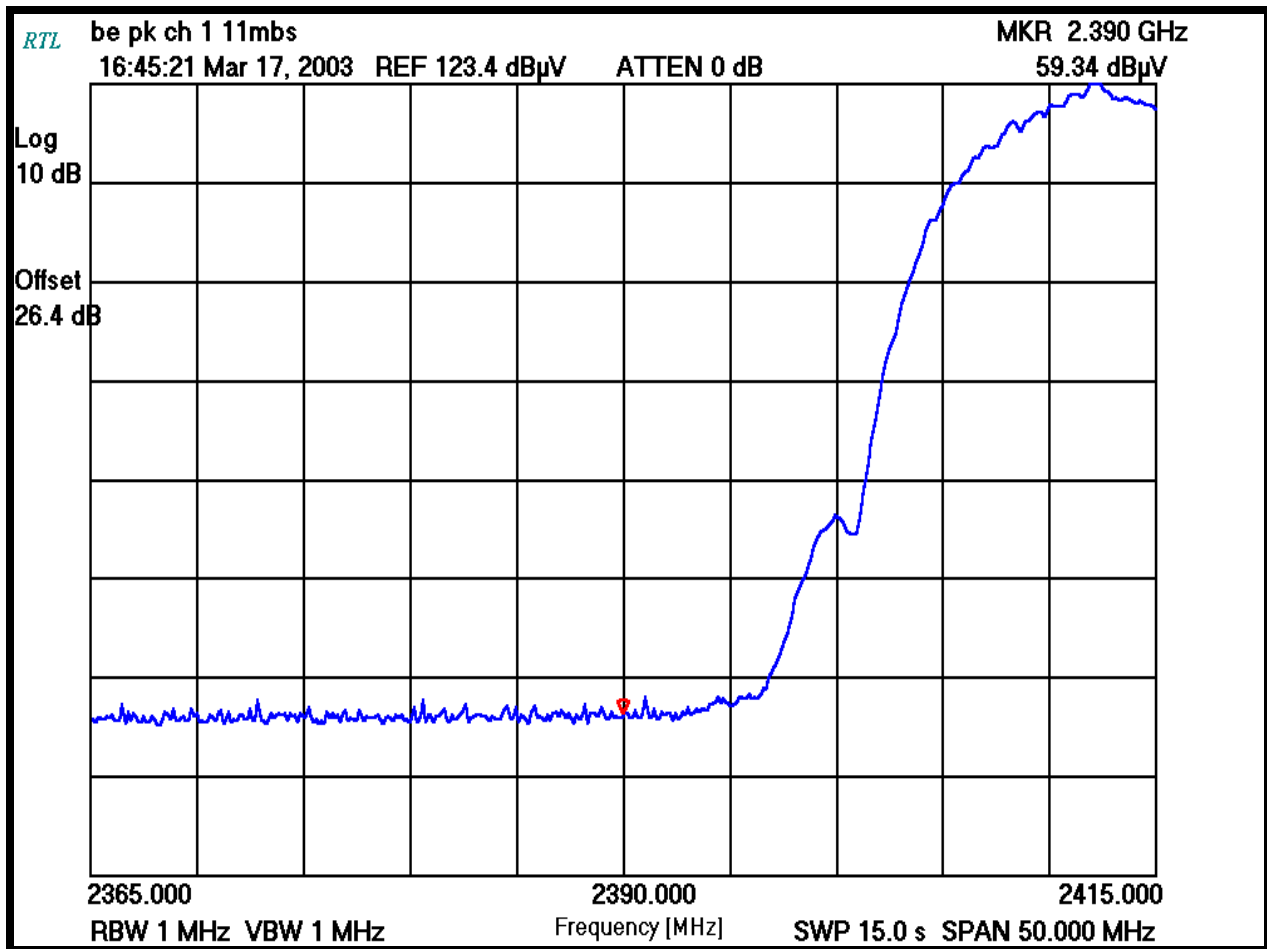
Rachid Sehb
Test Technician/Engineer


Signature

03/17/2003
Date Of Test

Channel Number: 1
 Frequency (MHz): 2412
 Data Rate (Mbps): 11
 Resolution Bandwidth (MHz): 1
 Video Bandwidth (MHz): 1
 Sweep Time (s): 15.0

PLOT 3.4-10: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 1 AT 11 MBPS



TEST PERSONNEL:

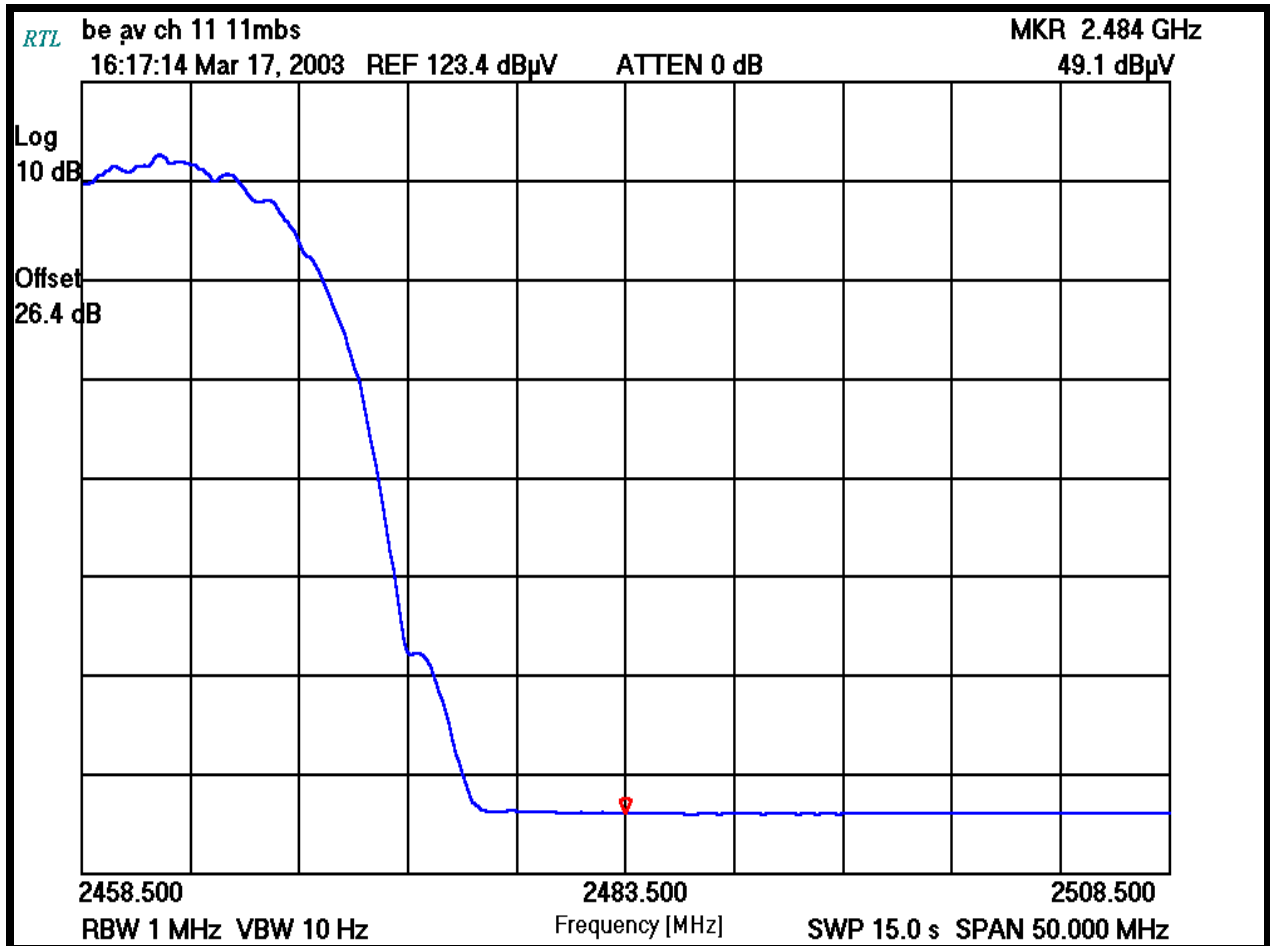
Rachid Sehb
 Test Technician/Engineer

Sehb
 Signature

03/17/2003
 Date Of Test


Channel Number: 11
Frequency (MHz): 2462
Data Rate (Mbps): 11
Resolution Bandwidth (MHz): 1
Video Bandwidth (Hz): 10
Sweep Time (s): 15.0

PLOT 3.4-11: BAND EDGE: AVERAGE MEASUREMENT FOR CHANNEL 11 AT 11 MBPS



TEST PERSONNEL:

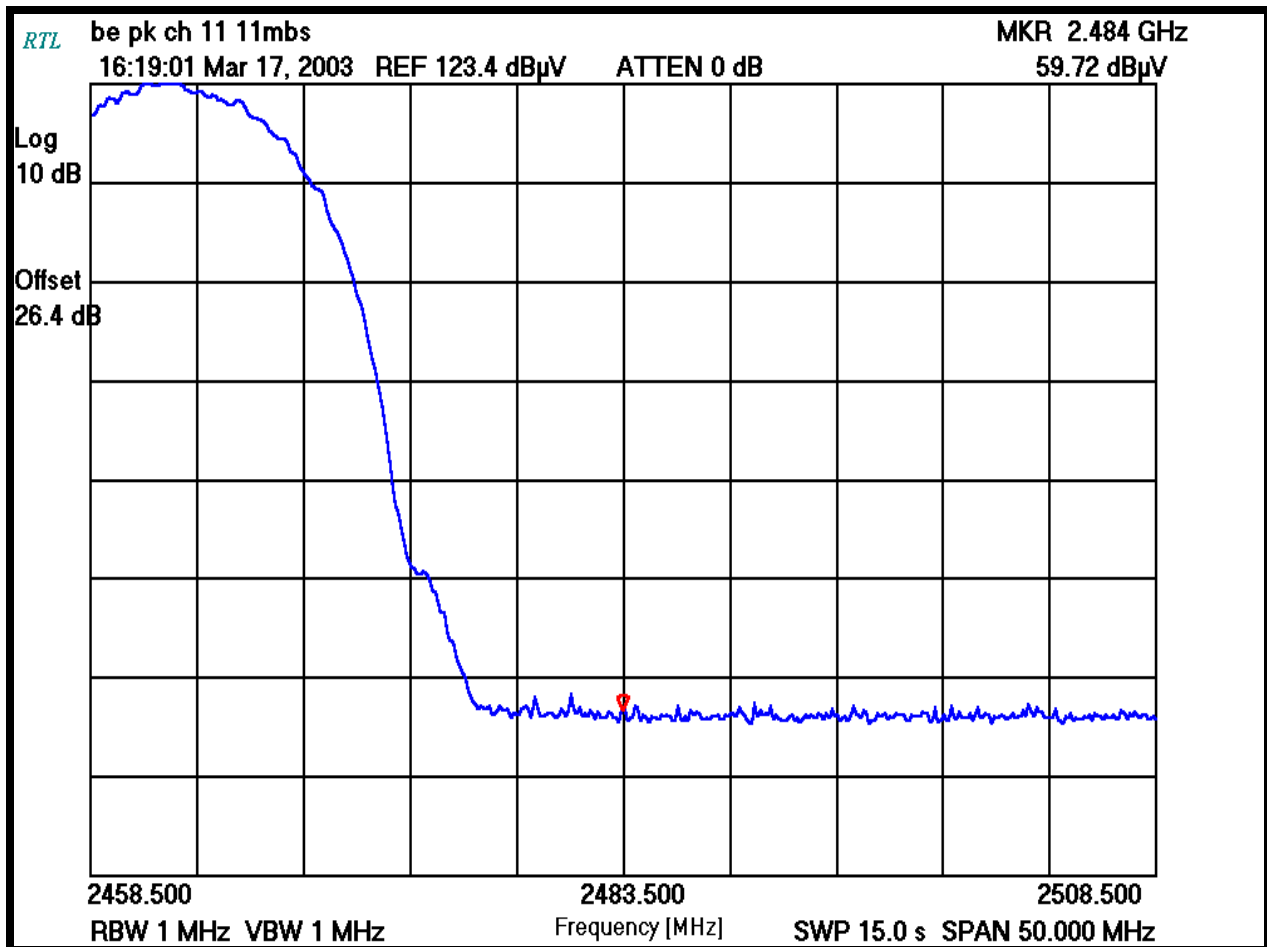
Rachid Sehb
Test Technician/Engineer


Signature

03/17/2003
Date Of Test

Channel Number: 11
Frequency (MHz): 2462
Data Rate (Mbps): 11
Resolution Bandwidth (MHz): 1
Video Bandwidth (MHz): 1
Sweep Time (s): 15.0

PLOT 3.4-12: BAND EDGE: PEAK MEASUREMENT FOR CHANNEL 11 AT 11 MBPS



TEST PERSONNEL:

Rachid Sehb
Test Technician/Engineer


Signature

03/17/2003
Date Of Test