Project:	**04CA21209**
File:	**MC1149**
Report:	**040126A**
Date:	**July 20, 2004** **(Modified August 24, 2004)**
Model:	**I-Class Alien** **Modular RFID reader**

Test Report

On

Electromagnetic Compatibility Testing

Datamax Corporation

Orlando, FL USA

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Test Report Details:

Tests Performed By:	**Underwriters Laboratories Inc.** **12 Laboratory Drive** **Research Triangle Park, NC 27709**
Tests Performed For:	**Datamax Corporation** **4501 Parkway Commerce Blvd.** **Orlando, FL 32808 USA**
Applicant Contact:	**Mr. Chuck Collins** **Compliance Engineer** **407-578-8007x4110** **407-578-8377 - FAX**
Test Report Number:	**040126A**
Test Report Date:	**July 20, 2004 (Revised August 24, 2004 - Modification page 3, remark 3)**
Product Type:	**Modular Radio Frequency ID reader**
Model Number:	**I-Class Alien**
Sample Serial Number:	**unserialized, preproduction sample**
Sample Tag Number:	**0579387-001**
EUT Category:	**Transmitter - Low Powered**
EUT Type:	**Component**
Sample Receive Date:	**May 12, 2004**
Testing Start Date:	**May 15, 2004**
Date Testing Complete:	**July 17, 2004**

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Summary of Testing:

Test #	Test Name Test Requirement/Specification	Comply	Does Not Comply	See Remark
1	Conducted Disturbance Emissions - Voltage 47 CFR Part 15, Subpart B / CISPR 22:1997 Class A	X	-	
2	Radiated Spurious Emissions / Unintentional Emissions - 30 to 1000 MHz 47 CFR Part 15.247 / ANSI C63.4:2001 47 CFR Part 15, Subpart B / 47 CFR Part 15, Subpart B, Class B	X	-	
3	Radiated Spurious Emissions - Above 1 GHz 47 CFR Part 15.247 / ANSI C63.42:2001	X	-	
4	Bandedge 47 CFR Part 15 Subpart C / 47 CFR Part 15.247	X	-	
5	Conducted Power and Occupied Bandwidth 47 CFR Part 15.247 / ANSI C63.4:2001	X	-	
6	Radiated Disturbance Emissions - Peak-to-Average Ratio 47 CFR Part 15, Subpart C / 47 CFR Part 15, Subpart C, Section 15.231	-	-	6
7	Frequency Hopping Channels, Channel Spacing, and Dwell Time 47 CFR Part 15.247 / ANSI C63.4:2001	X	-	
8	Maximum Permissible Exposure 47 CFR Part 1 Subpart I / 47 CFR Part 1.1307	X	-	

Remarks:

1) The transmitter is tested as a modular device. The transmitter was tested out on the table top connected to the printer by a cable. No shielding or ground bonding by the host is required. The transmitter contains its own voltage regulation.

2) This device is typically installed into the host device at the point of manufacture. This device, however, does not require professional installation and may be installed by the user.

3) The host device for this printer is not intended for residential environment. Class A limits apply for the digital portions of this device.

4) Antenna is attached with MMCX-type connector. This is regarded as "not readily available."

5) Ferrite is placed on the digital interface between the transceiver card and printer to comply with unintentional radiator FCC Class B limits. Steward P/N 28A2029-0B0 with one full turn was used. Radiated Power and Spurious emissions limits in Subpart C did not require the use of the ferrite.

6) There is no duty cycle limit, however results are applied to calculate average emissions from peak measurements.

Conclusion:

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by Underwriters Laboratories Inc. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

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Test Facilities:

Test Location A) 10-Meter Anechoic Chamber (Industry Canada - IC 2953, NVLAP - 200246-0, VCCI - R-722)

Constructed by Lindgren RF Enclosures, this room consists of a 17.9 by 12 by 8.3 m (inside clearance) shielded room lined with TDK absorber material. The walls, floor (conducting ground plane) and ceiling are constructed of double sided galvanized sheet steel supported by 19 mm thick particle board. The interior walls and ceiling are covered with 10 by 10 cm, 4.6 mm thick ferrite tiles and partially covered with polystyrene absorber cones. Removable floor tiles and cones covering the floor between the EUT and antenna are provided when RF immunity testing is performed.

Room is provided with a 4.0 m diameter embedded turntable and a 1.2 by 2.1 m and 2.4 by 2.4 m double knife edge doors for access. Also, the room is fed electrical EUT power via permanently installed filters and is provided with a permanently mounted video surveillance camera. A remotely controllable antenna mast is located in the room for positioning the measuring antenna from 1 to 4 m above the ground plane.

Test Location B) Compact Anechoic Chamber

Constructed by Lindgren RF Enclosures, this room consists of a 6 by 3 by 2.9 m (inside clearance) shielded room lined with TDK absorber material. The walls, floor, and ceiling are constructed of double sided galvanized sheet steel supported by 19 mm thick particle board. The interior walls and ceiling are covered with 10 by 10 cm, 4.6 mm thick ferrite tiles and partially covered with polystyrene absorber cones. Removable floor tiles and cones cover the floor between the EUT and antenna.

Room is provided with a 1.2 by 2.1 m double knife edge door for access. Also, the room is fed electrical EUT power via permanently installed filters and is provided with a video camera.

Test Location C) RF Shielded Room (VCCI - C-744, NVLAP - 200246-0)

Constructed by Lindgren RF Enclosures, this room consists of a 7.3 by 4.3 by 2.7 m (inside clearance) shielded room. The walls, floor (conducting ground plane) and ceiling are constructed of double sided galvanized sheet steel supported by 19 mm thick particle board. Room is provided with a 1.2 by 2.1m double knife edge door for access. Also, the room is fed electrical EUT power via permanently installed filters and is provided with a portable video surveillance camera.

Test Location D) Ground Reference Plane # 1 (VCCI - C-742, NVLAP - 200246-0)

Horizontal floor ground reference plane constructed of double sided galvanized sheet steel supported by 19 mm particle board and measures 3.6 by 3.0 m. It is located and bonded next to one vertical wall of the Control Room and is, therefore, provided with a 3.0 by 3.6 m vertical ground reference plane constructed of the same material. Power filters and LISNs, when required, are placed on top of and bonded to the horizontal floor ground reference plane.

Test Location E) Ground Reference Plane # 2 (VCCI - C-743, NVLAP - 200246-0)

Horizontal floor ground reference plane constructed of double sided galvanized sheet steel supported by 19 mm particle board and measures 4.3 by 5.2 m. It is located and bonded next to one vertical wall of the RFD Shielded Room and is, therefore, provided with a 4.3 by 2.8 m vertical ground reference plane constructed of the same material. Power filters and LISNs, when required, are placed on top of and bonded to the horizontal floor ground reference plane.

Test Location F) Ground Reference Plane # 3

Horizontal floor ground reference plane constructed of galvanized sheet steel measuring 3.0 by 3.6 m x 2.5mm thick.

Test Location G) Ground Reference Plane # 4 (Automotive)

Horizontal floor ground reference plane constructed of double-sided galvanized sheet steel supported by 19 mm particle board and measures 3.6 by 3.0 m.

Test Location I) Harmonic Current Test Area - Located in front of Standard Source Impedance Power Supply.

Test Location J) Magnetic Field Ground Reference Plane

Horizontal floor ground reference plane constructed of 1.5 mm thick aluminum measuring 3.6 by 2.4 m.

Test Location P) Ground Reference Plane # 5

Horizontal floor ground reference plane constructed of double-sided galvanized sheet steel supported by 19 mm particle board and measures 3.6 by 3.0 m.

Test Location R) Ground Reference Plane # 6

Ground reference plane constructed of galvanized sheet steel measuring 3.0 m x 3.6 m x 2.5 mm thick. CDNs, when required, are placed on top of and bonded to the horizontal floor ground reference plane.

Test Location Q) CISPR 12 Outdoor Site

30 meter diameter non-reflective area located behind the UL-RTP EMC Lab. Test area is used for CISPR 12 testing.

Test Location X) Other - As described in the Comments Section of Test Results.

EUT Information:

Equipment Used During Test:

Use*	Product Type	Manufacturer	Model	Comments
EUT	Modular RFID Transmitter	Alien Technologies	I-Class	Produced for Datamax
ACC	Printer	Datamax		
ACC	Laptop Computer	Datamax		Connected to printer via serial port
ACC	Antenna	Datamax		RFID antenna

* Use = EUT - Equipment Under Test, ACC - Accessory (Not Subjected to Test), or SIM - Simulator (Not Subjected to Test)

Input/Output Ports:

Port #	Name	Type*	Cable Max. >3m	Cable Shielded	Comments
0	Enclosure	N/E	No	No	
1	AC Mains	AC	No	No	
2	Antenna	N/E	No	No	Connects RFID module to antenna
3	Serial	I/O	No	Yes	Connects computer to printer

* AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
PMC = Process Measurement and Control Port

Product Description:

The device under test is a Radio Frequency Identification (RFID) reader designed to be used with Datamax printers. The RFID reader is designed such that it operates as a modular device with no dependencies on the host printer, therefore certification is sought as a modular device. The RFID reader contains onboard voltage regulation to minimize the effects of DC voltage variations supplied by the printer.

The RFID reader requires a 2.5 dBi gain antenna that is external to the RFID reader, however it is mounted within the printer and already installed at the factory. Therefore no installation is required beyond the normal installation of the printer.

The RFID reader operates in the 902-928 MHz band as a frequency hopping spread spectrum device. The hopping algorithm and other information regarding the operation of the device is located in the Operational Description exhibit.

EUT Internal Operating Frequencies:

Frequency (MHz)*	Description
902	Bandedge Left
928	Bandedge Right

Power Interface:

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	120	-	-	60	1	
1	120	-	-	60	1	

EUT Operation Modes:

Mode #	Description
1	RFID transmitter is transmitting on low channel.
2	RFID transmitter is transmitting on mid channel.
3	RFID transmitter is transmitting on high channel.
4	RFID transmitter is transmitting while hopping normally.
5	RFID transmitter is powered on, however the RF carrier is turned off.

EUT Configuration Modes:

Mode #	Description
1	RFID modular transmitter is located on a non-conductive table. The printer is connected to the RFID module (module interface/power) and laptop computer (serial port). The RFID antenna is located in worst-case orientation (pointed toward measurement ant)

Test 1: Conducted Disturbance Emissions - Voltage

Test Requirement: 47 CFR Part 15, Subpart B

Test Specification: CISPR 22:1997 Class A

Test Procedure:

The test was performed in accordance with the Test Requirement and Specification and configured as noted in the Test Setup. The EUT was connected to the proper supply source via a Line Impedance Stabilization Network (LISN). The Measuring Receiver was connected to the Port under test via the LISN. A peak measurement was first made at the test point across the test frequency range over a one minute test period. Then, Quasi-Peak or Average measurements were taken and recorded under Discrete Data. This was repeated for each conductor of the test port except for equipment grounding.

Conducted Disturbance Emission Limits For
Mains Terminals of Class A Equipment

Frequency (MHz)	Quasi-Peak Limit dB µV	Average Limit dB µV
0.15 to 0.50	79	66
0.50 to 5	73	60
5 to 30	73	60

Test Deviations:

None

Test Setup: Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	1	AC Mains	4 (hopping normally)	1	1

Test 1 - Results: Conducted Disturbance Emissions - Voltage

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (ºC)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	D	45	22	101	P	5/17/2004	1

The EUT was considered to **Pass** the Requirements.

Comments:

Comment #	Description
1	Note: This device complies with the latest FCC Part 15 conducted emissions limits that are identical to CISPR 22. This device may continue to be sold after the older limit expires on July 11, 2005.

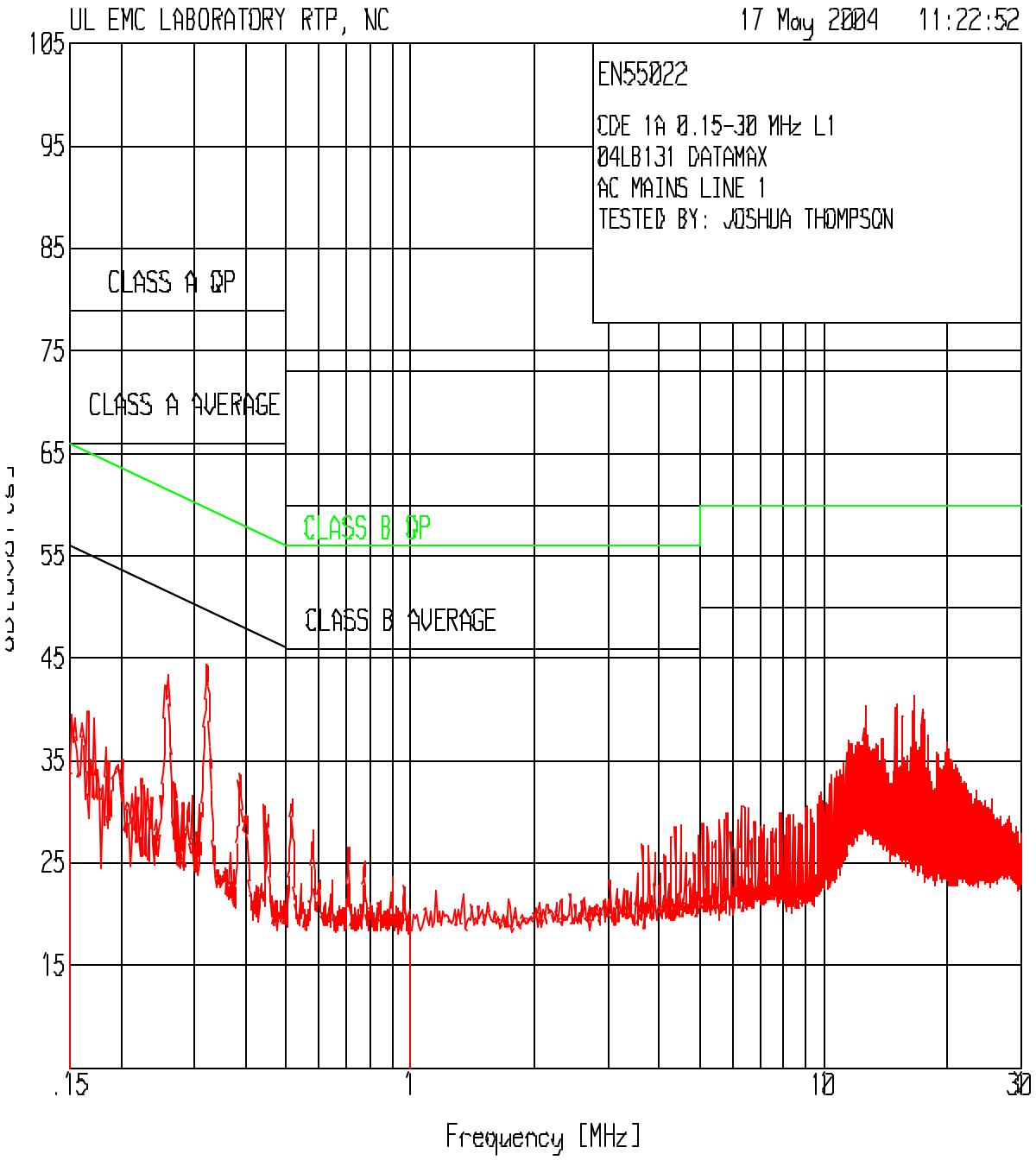
Test 1 - Test Equipment Used: Conducted Disturbance Emissions - Voltage

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
ATA013	20 ft Cable, BNC - BNC	UL	RG-223	2/18/04	2/28/05
ATA027	LISN, 150 kHz to 30 MHz	Solar Electronics	9629-50-TS-25	6/16/03	6/30/04
ATA028	LISN, 150 kHz to 30 MHz	Solar Electronics	9629-50-TS-25	6/16/03	6/30/04
ATA056	Transient Limiter, 0.009 to 100 MHz	Electro-Metrics	EM-7600	3/29/04	3/31/05
HI0040	Environmental Indicator	Cole-Palmer	99760-00	10/17/03	10/31/04
MG1131	Tape Measure, 15 m / 50 ft.	Lufkin	EL15CME	4/9/03	4/30/06
MM0132	Multimeter	Fluke	FLK-175/CWG	10/14/03	10/31/04
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	11/10/03	11/03/04

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

Test 1, Item A (Line) - Peak Plot (Amplitude in dBuV):

Conducted Disturbance Emissions - Voltage



Test 1, Item A (Line) - Discrete Data:

Conducted Disturbance Emissions - Voltage

CDE 1A 0.15-30 MHz L1
04LB131 DATAMAX
AC MAINS LINE 1
TESTED BY: JOSHUA THOMPSON

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uV)]	Limit:1	2	3	4
Range: 1 .15 - 1MHz									
1	.25891	32.54 pk	10.7	.1	43.34	79	66	51.5	61.5
				Margin [dB]		-35.66	-22.66	-8.16	-18.16
2	.32102	33.55 pk	10.7	.1	44.35	79	66	49.7	59.7
				Margin [dB]		-34.65	-21.65	-5.35	-15.35
3	.38739	22.88 pk	10.7	.1	33.68	79	66	48.1	58.1
				Margin [dB]		-45.32	-32.32	-14.42	-24.42
4	.51587	20.4 pk	10.7	.1	31.2	73	60	46	56
				Margin [dB]		-41.8	-28.8	-14.8	-24.8
Range: 2 1 - 30MHz									
5	12.68123	29.19 pk	11	.1	40.29	73	60	50	60
				Margin [dB]		-32.71	-19.71	-9.71	-19.71
6	14.99233	29.44 pk	11	.1	40.54	73	60	50	60
				Margin [dB]		-32.46	-19.46	-9.46	-19.46
7	16.53951	30.17 pk	11.1	.1	41.37	73	60	50	60
				Margin [dB]		-31.63	-18.63	-8.63	-18.63

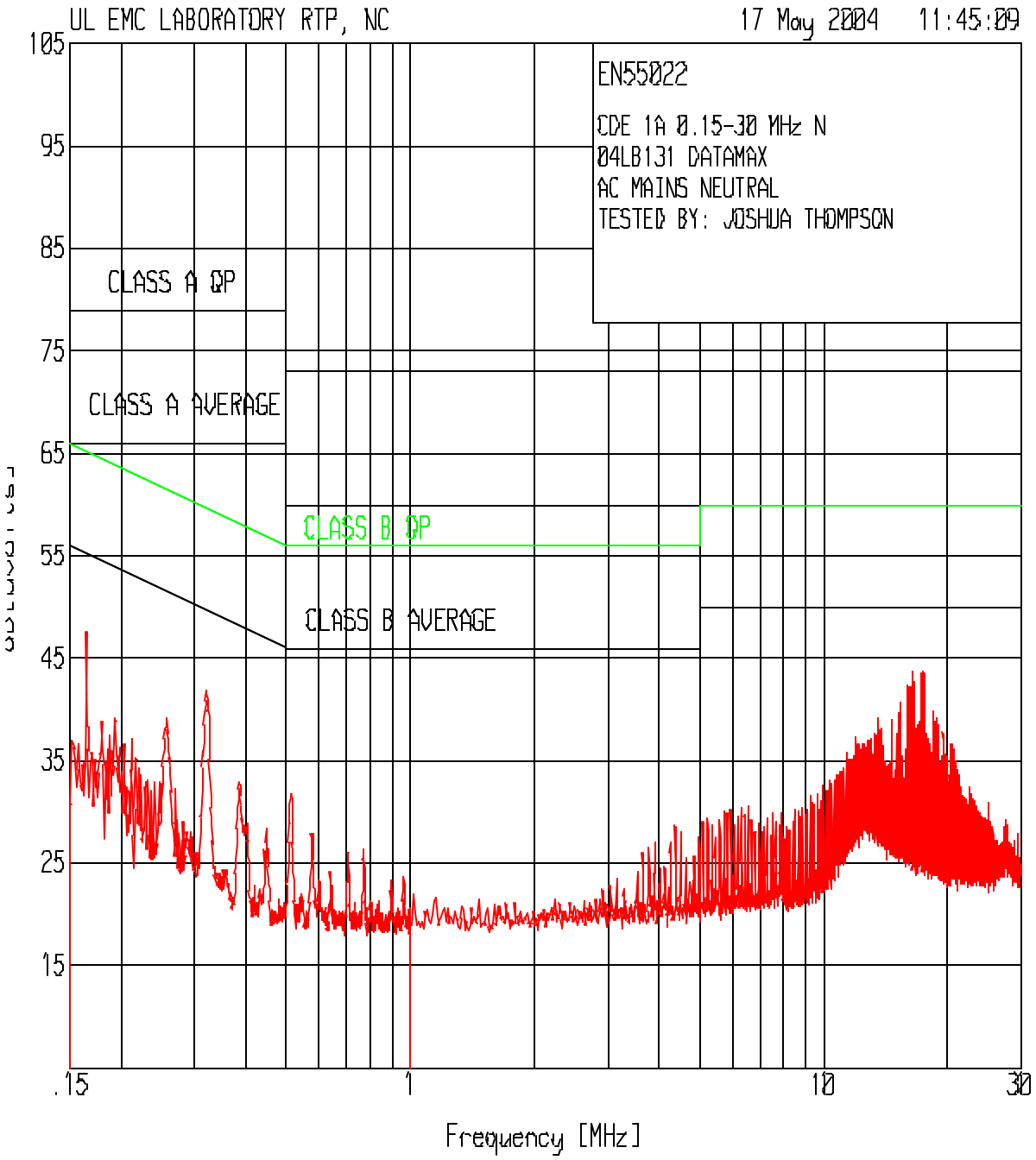
LIMIT 1: CLASS A QP
LIMIT 2: CLASS A AVERAGE
LIMIT 3: CLASS B AVERAGE
LIMIT 4: CLASS B QP

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

File: cde1.TXT

Test 1, Item A (Neutral) - Peak Plot (Amplitude in dBuV):

Conducted Disturbance Emissions - Voltage



Test 1, Item A (Neutral) - Discrete Data:

Conducted Disturbance Emissions - Voltage

CDE 1A 0.15-30 MHz N
04LB131 DATAMAX
AC MAINS NEUTRAL
TESTED BY: JOSHUA THOMPSON

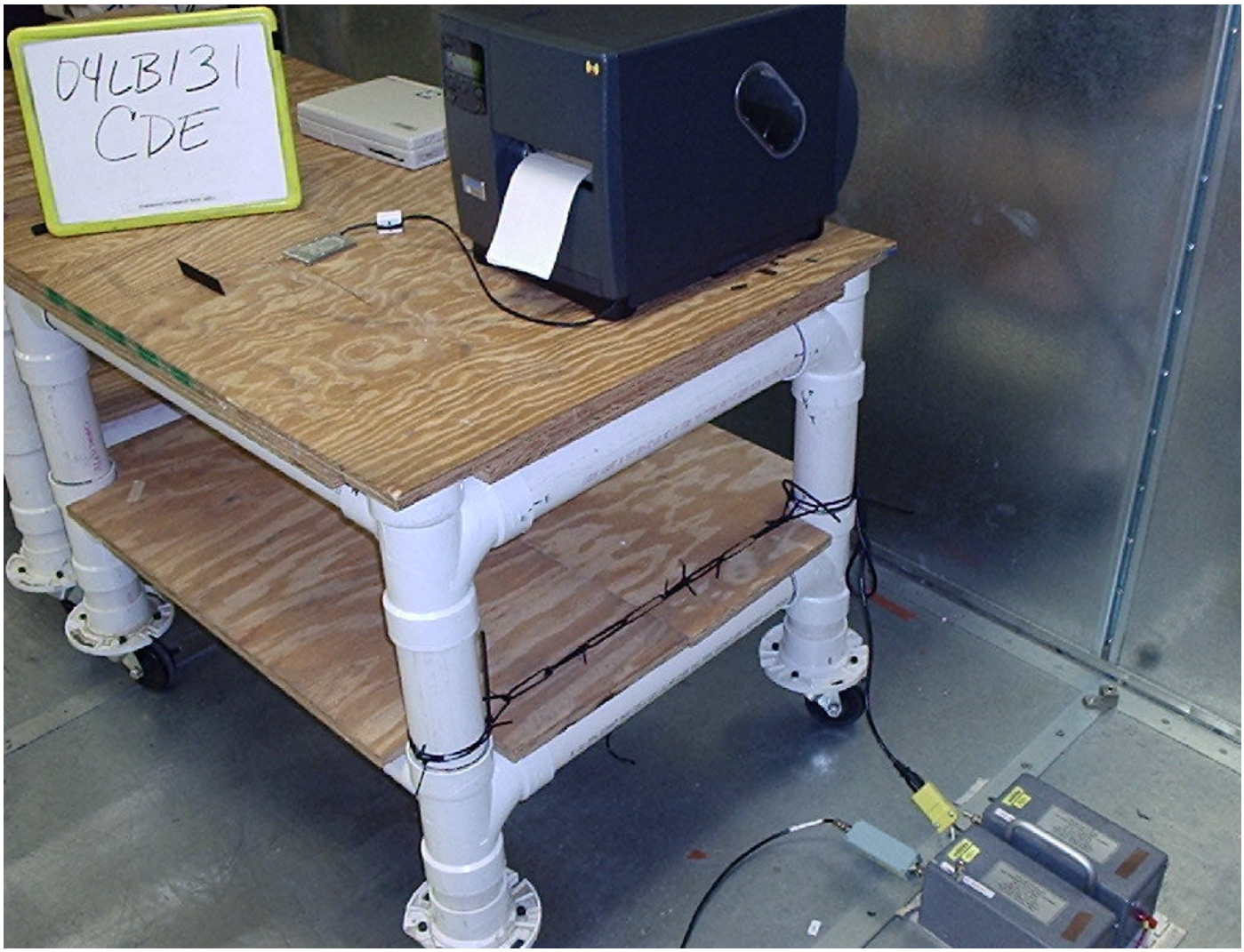
No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uV)]	Limit:1	2	3	4
Range: 1 .15 - 1MHz									
1	.16446	36.8 pk	10.7	.1	47.6	79	66	55.2	65.2
				Margin [dB]		-31.4	-18.4	-7.6	-17.6
2	.25721	28.33 pk	10.7	.1	39.13	79	66	51.5	61.5
				Margin [dB]		-39.87	-26.87	-12.37	-22.37
3	.32017	31.06 pk	10.7	.1	41.86	79	66	49.7	59.7
				Margin [dB]		-37.14	-24.14	-7.84	-17.84
4	.38484	22.03 pk	10.7	.1	32.83	79	66	48.2	58.2
				Margin [dB]		-46.17	-33.17	-15.37	-25.37
5	.51331	20.99 pk	10.7	.1	31.79	73	60	46	56
				Margin [dB]		-41.21	-28.21	-14.21	-24.21
Range: 2 1 - 30MHz									
6	13.51284	28.13 pk	11	.1	39.23	73	60	50	60
				Margin [dB]		-33.77	-20.77	-10.77	-20.77
7	16.39447	32.5 pk	11.1	.1	43.7	73	60	50	60
				Margin [dB]		-29.3	-16.3	-6.3	-16.3
8	17.42914	32.54 pk	11.1	.1	43.74	73	60	50	60
				Margin [dB]		-29.26	-16.26	-6.26	-16.26

LIMIT 1: CLASS A QP
LIMIT 2: CLASS A AVERAGE
LIMIT 3: CLASS B AVERAGE
LIMIT 4: CLASS B QP

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

Test 1, Item A - Test Set-Up Photo - Maximum Emissions Configuration:

Conducted Disturbance Emissions - Voltage



Test 1, Item A - Test Set-Up Photo - Maximum Emissions Configuration:

Conducted Disturbance Emissions - Voltage

Test 2: Radiated Spurious Emissions/Unintentional Emissions - 30 to 1000 MHz

Test Requirement: 47 CFR Part 15.247

Test Specification: ANSI C63.42:2001

Test Procedure:

The test was performed in accordance with the Test Requirement and Specification and configured as noted in the Test Setup. The EUT was placed inside the anechoic chamber on a non-conductive table with a fresh battery installed or operating at nominal voltage. The EUT was rotated from 0 to 360 degrees with the receive antenna scanned from 1 to 4 meters in height in vertical and horizontal polarities. All emissions close to the applicable limit were then measured with the appropriate detector (quasi-peak or average). All peak emissions were verified to be below the limits below.

Radiated Disturbance Limits for Spread Spectrum Transmitters - Section 15.247

Fundamental Frequency (MHz)	Hopping Channels	Permissible Output Power (milliwatts)	Permissible Output Power (dBm)	Permissible Spurious Emissions (milliwatts)	Permissible Spurious Emissions (dBm)
902 – 928	25 to 49	250	24	25	14
	50 or more	1000	30	100	20
	Digital Modulation	1000	30	100	20
2400 – 2483	15 to 74	125	21	12.5	11
	75 or more	1000	30	100	20
	Digital Modulation	1000	30	100	20
5725 – 5850	75 or more	1000	30	100	20
	Digital Modulation	1000	30	100	20

Other than fixed point-to-point applications, power adjustment for antenna gain are as follows:

Gain of 6 dBi or less	No reduction is required
Gain greater than 6 dBi	Reduce the maximum output power by 1 dB for each 1 dB of antenna gain above 6 dBi

Radiated Disturbance Limits for Class B Equipment
at a measuring distance of 3m.

Frequency Range MHz	Quasi-Peak Limits µV/m	Quasi-Peak Limits dBµV/m
30 to 88	100	40.00
88 to 216	150	43.52
216 to 960	200	46.02
Above 960	500	53.97

Test Deviations:

None

Test Setup: Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	0	Enclosure	1	1	1

Test 2 - Results: Radiated Spurious Emissions/Unintentional Emissions - 30 to 1000 MHz

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (ºC)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	A	45	23	101	P	7/14/2004	1

The EUT was considered to **Pass** the Requirements.

Comments:

Comment #	Description
1	Note: Emissions noted on plot above 750 MHz are a result of the mathematical correction for notch filter loss and intended emissions between 902 and 928 MHz. No significant emissions were observed between 750 and 1000 MHz with transmitter RF off.

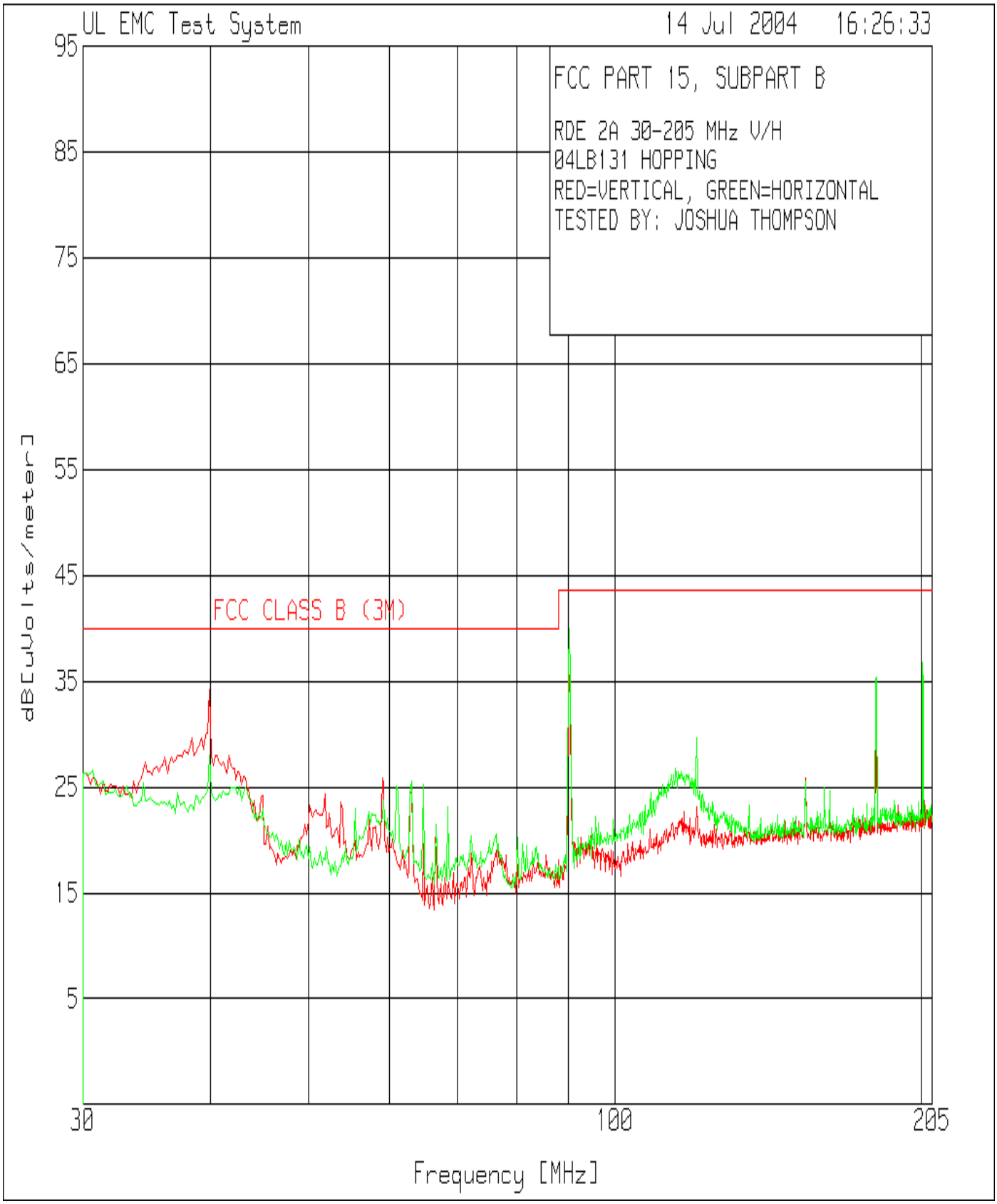
Test 2 - Test Equipment Used: Radiated Spurious Emissions/Unintentional Emissions - 30 to 1000 MHz

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0025	Biconical Antenna, 30 to 300 MHz	Schaffner, EMC	VBA6106A	3/22/04	3/31/05
AT0030	Log periodic Antenna, 200 MHz to 1000 MHz	Schaffner, EMC	3160-07	2/9/04	2/28/05
ATA084	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/11/04	3/31/05
ATA085	Attenuator 6 dB, 2 GHz	Pasternack	PE7002-6	3/11/04	3/31/05
ATA096	50 ft, N male - N male	Micro-Coax	Coaxial Cable	3/11/04	3/31/05
ATA124	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/11/04	3/31/05
ATA125	RF Amplifier, 1 to 1000 MHz	Miteq	AM-3A-000110-N	3/11/04	3/31/05
ATA140	RG214 Ferrite Cable	EMC Eupen	N/A	3/11/04	3/31/05
ATA143	Cable, 6ft., N-male to N-male	Micro-Coax	N/A	3/11/04	3/31/05
ATA167	RG214 Ferrite Cable	EMC Eupen	N/A	3/11/04	3/31/05
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/17/03	10/31/04
MG1131	Tape Measure, 15 m / 50 ft.	Lufkin	EL15CME	4/9/03	4/30/06
MM0132	Multimeter	Fluke	FLK-175/CWG	10/14/03	10/31/04
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	2/2/04	2/28/05

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

Test 2, Item A - Peak Plot (Amplitude in dBuV/m):

Radiated Spurious Emissions/Unintentional Emissions - 30 to 1000 MHz



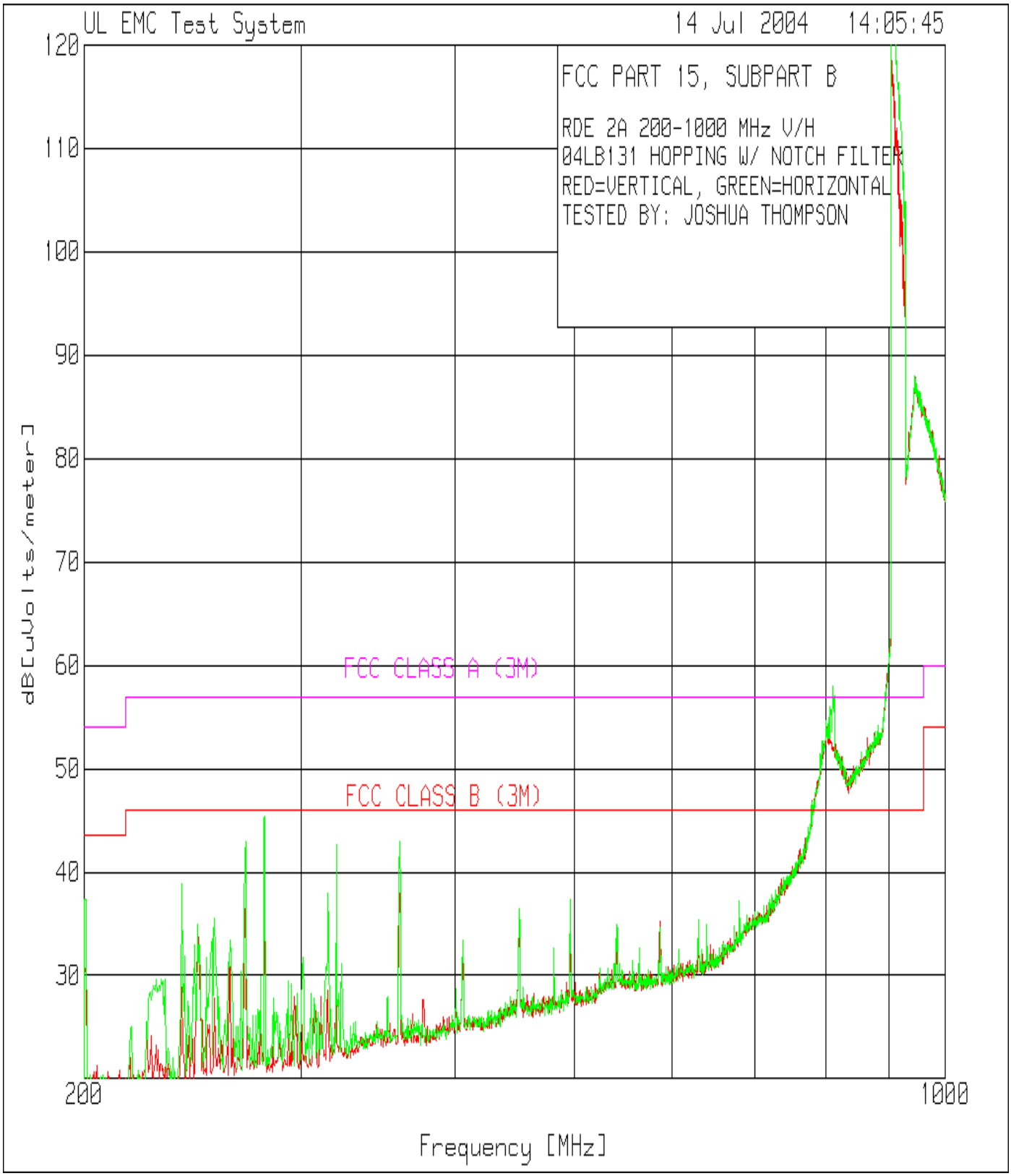
Test 2, Item A - Discrete Data:

Radiated Spurious Emissions/Unintentional Emissions - 30 to 1000 MHz

```
 RDE 2A 30-205 MHz V/H
 04LB131 HOPPING
 RED=VERTICAL, GREEN=HORIZONTAL
 TESTED BY: JOSHUA THOMPSON


      Test     Meter     Gain/Loss  Transducer  Level  Limit:1
No. Frequency  Reading    Factor     Factor  dB[uVolts/meter]
     [MHz]     [dB(uV)]     [dB]      [dB]
=================================================================
Range 4 30 - 205MHz ---------------------------------------------
1  39.975       48.8 pk      -28.7     14.1      34.2    40
                 Height:100 Vert     Margin [dB]         -5.8
2  51.875       43.7 pk      -28.6     9.2       24.3    40
                 Height:248 Vert     Margin [dB]         -15.7
3  59.05        47.6 pk      -28.5     6.7       25.8    40
                 Height:248 Vert     Margin [dB]         -14.2
4  90.2         55 pk        -28.5     9         35.5    43.5
                 Height:100 Vert     Margin [dB]         -8

Range 4 30 - 205MHz ---------------------------------------------
5  39.975       42.5 pk      -28.7     14.1      27.9    40
                 Height:248 Horz     Margin [dB]         -12.1
6  63.075       48.3 pk      -28.5     5.7       25.5    40
                 Height:248 Horz     Margin [dB]         -14.5
7  90.2         59.4 pk      -28.5     9         39.9    43.5
                 Height:248 Horz     Margin [dB]         -3.6

  Test     Meter     Gain/Loss  Transducer  Level  Limit:1
Frequency  Reading    Factor     Factor  dB[uVolts/meter]
 [MHz]     [dB(uV)]     [dB]      [dB]
=================================================================
Range 4 30 - 205MHz
89.9855    58.8 qp       -28.5     9         39.3    43.5
Azimuth: 289  Height:210 Horz         Margin [dB]:   -4.2


LIMIT 1: FCC CLASS B (3M)
```

Test 2, Item A - Peak Plot (Amplitude in dBuV/m):

Radiated Spurious Emissions/Unintentional Emissions - 30 to 1000 MHz



Note: Emissions between 750 MHz and 1000 MHz are due to mathematical correction for notch filter attenuation and the intended signal at 902-928 MHz. No significant emission was observed in this range other than the transmit signal.

Test 2, Item A - Discrete Data:

Radiated Spurious Emissions/Unintentional Emissions - 30 to 1000 MHz

RDE 2A 200-1000 MHz V/H
04LB131 HOPPING w/ NOTCH FILTER
RED=VERTICAL, GREEN=HORIZONTAL
TESTED BY: JOSHUA THOMPSON

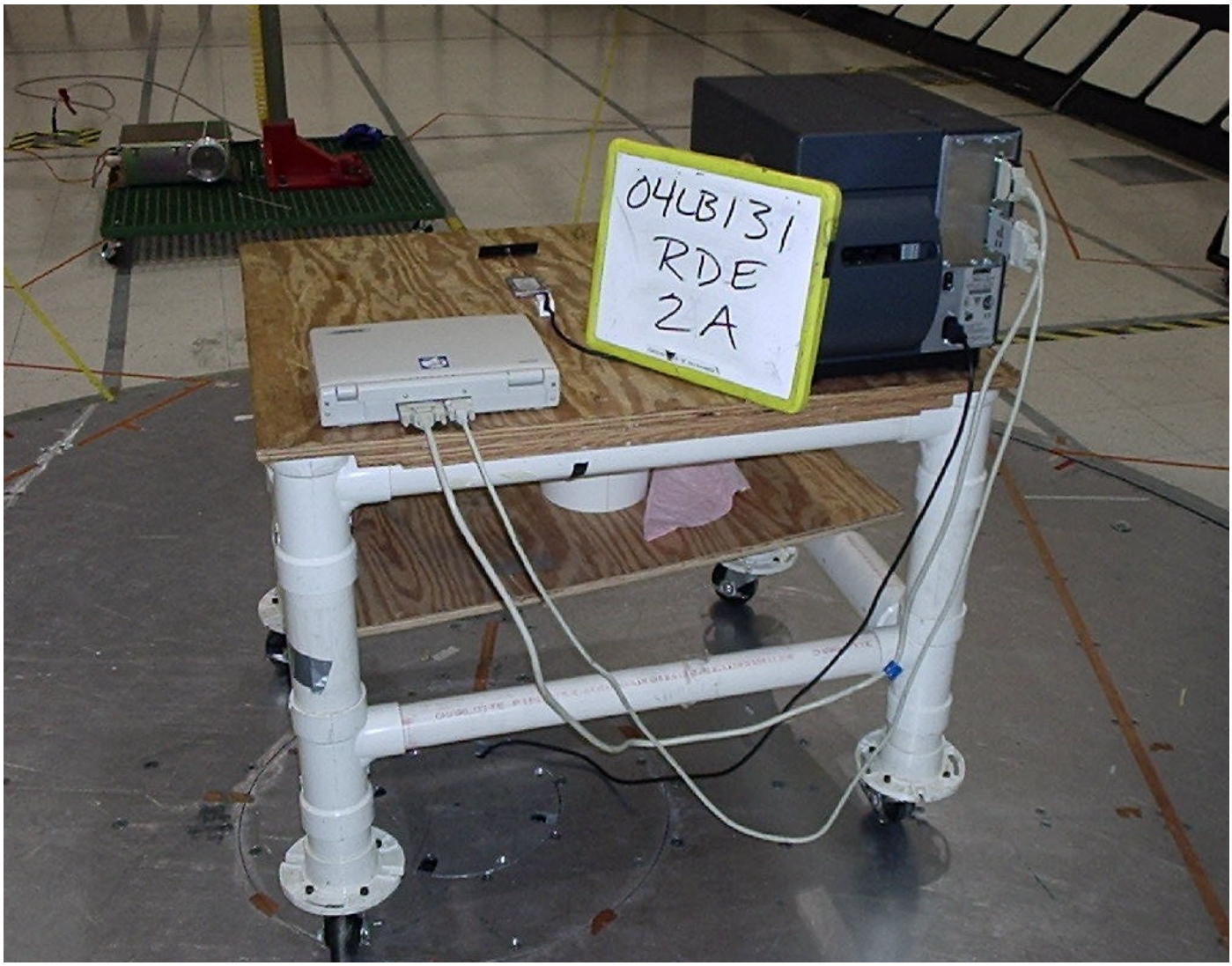
No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Antenna Factor [dB]	Field Stength [dB(uv/m)]	Limit:1	2
Range 4 200 - 1000MHz							
1	200.3998	46.1 pk	-28.0	12.6	30.7	43.5	54.0
	Height:247 Vert		Margin [dB]		-12.8	-23.3	
2	247.1764	49.5 pk	-27.5	12.8	34.8	46.0	56.5
	Height:101 Vert		Margin [dB]		-11.2	-21.7	
3	270.3648	51.3 pk	-27.4	13.5	37.4	46.0	56.5
	Height:101 Vert		Margin [dB]			-8.6	-19.1
4	280.1599	51.1 pk	-27.3	13.7	37.5	46.0	56.5
	Height:101 Vert		Margin [dB]			-8.5	-19.0
5	360.7196	48.9 pk	-26.5	15.6	38.0	46.0	56.5
	Height:101 Vert		Margin [dB]			-8.0	-18.5
Range 4 200 - 1000MHz							
6	200.7996	52.8 pk	-28.0	12.6	37.4	43.5	54.0
	Height:101 Horz		Margin [dB]			-6.1	-16.6
7	239.980	54.0 pk	-27.5	12.3	38.8	46.0	56.5
	Height:101 Horz		Margin [dB]			-7.2	-17.7
8	270.3648	56.8 pk	-27.4	13.5	42.9	46.0	56.5
	Height:101 Horz		Margin [dB]			-3.1	-13.6
9	280.3598	59.0 pk	-27.3	13.7	45.4	46.0	56.5
	Height:101 Horz		Margin [dB]			-0.6	-11.1
10	320.3398	55.1 pk	-27.0	14.6	42.7	46.0	56.5
	Height:101 Horz		Margin [dB]			-3.3	-13.8
11	360.7196	53.8 pk	-26.5	15.6	42.9	46.0	56.5
	Height:101 Horz		Margin [dB]			-3.1	-13.6
Range 4 200 - 1000MHz							
12	279.9788	58.7 qp	-27.3	13.7	45.1	46.0	56.5
	Azimuth: 92	Height:100 Horz		Margin [dB]:	-.9	-11.4	
13	360.1744	54.04 qp	-26.5	15.6	43.14	46.0	56.5
	Azimuth: 179	Height:100 Horz		Margin [dB]:	-2.86	-13.36	
14	319.9804	54.03 qp	-27.0	14.6	41.63	46.0	56.5
	Azimuth: 84	Height:100 Horz		Margin [dB]:	-4.37	-14.87	
15	270.1750	57.03 qp	-27.4	13.5	43.13	46.0	56.5
	Azimuth: 266	Height:100 Horz		Margin [dB]:	-2.87	-13.37	

LIMIT 1: FCC CLASS B (3M)
LIMIT 2: FCC CLASS A (3M)

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

Test 2, Item A - Test Set-Up Photo - Maximum Emissions Configuration:

Radiated Spurious Emissions/Unintentional Emissions - 30 to 1000 MHz



Test 2, Item A - Test Set-Up Photo - Maximum Emissions Configuration:

Radiated Spurious Emissions/Unintentional Emissions - 30 to 1000 MHz

Test 3: Radiated Spurious Emissions - Above 1 GHz

Test Requirement: 47 CFR Part 15.247

Test Specification: ANSI C63.42:2001

Test Procedure:

The test was performed in accordance with the Test Requirement and Specification and configured as noted in the Test Setup. The EUT was placed inside the anechoic chamber on a non-conductive table with a fresh battery installed or operating at nominal voltage. The EUT was rotated from 0 to 360 degrees with the receive antenna scanned from 1 to 4 meters in height in vertical and horizontal polarities. All emissions close to the applicable limit were then measured with the appropriate detector (quasi-peak or average). All peak emissions were verified to be below the limits below.

Radiated Disturbance Limits for Spread Spectrum Transmitters - Section 15.247

Fundamental Frequency (MHz)	Hopping Channels	Permissible Output Power (milliwatts)	Permissible Output Power (dBm)	Permissible Spurious Emissions (milliwatts)	Permissible Spurious Emissions (dBm)
902 – 928	25 to 49	250	24	25	14
	50 or more	1000	30	100	20
	Digital Modulation	1000	30	100	20
2400 – 2483	15 to 74	125	21	12.5	11
	75 or more	1000	30	100	20
	Digital Modulation	1000	30	100	20
5725 – 5850	75 or more	1000	30	100	20
	Digital Modulation	1000	30	100	20

Other than fixed point-to-point applications, power adjustment for antenna gain are as follows:

Gain of 6 dBi or less	No reduction is required
Gain greater than 6 dBi	Reduce the maximum output power by 1 dB for each 1 dB of antenna gain above 6 dBi

Test Deviations:

None

Test Setup: Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	0	Enclosure	1	1	1

Test 3 - Results: Radiated Spurious Emissions - Above 1 GHz

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (ºC)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	A	45	23	101	P	7/14/2004	

The EUT was considered to **Pass** the Requirements.

Comments:

Comment #	Description
1	Note: Emissions noted on plot between 1000 MHz and 1300 MHz are a result of the mathematical correction for notch filter. No significant emissions were observed between 1000 and 1300 MHz with transmitter RF off.

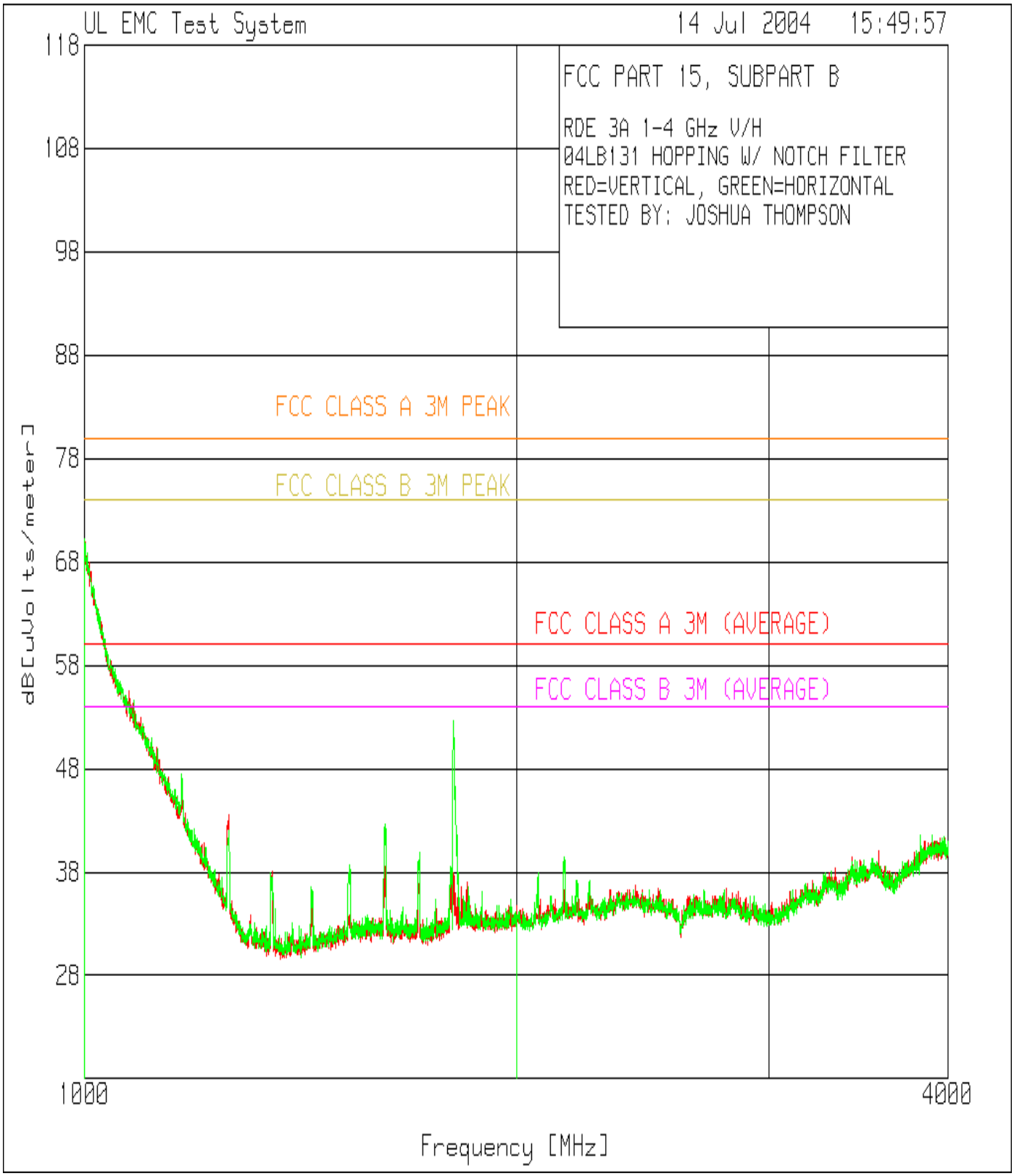
Test 3 - Test Equipment Used: Radiated Spurious Emissions - Above 1 GHz

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0026	Horn Antenna, 1 to 18 GHz	EMC Test Systems	3115	5/8/03	5/31/04
ATA096	50 ft, N male - N male	Micro-Coax	Coaxial Cable	3/11/04	3/31/05
ATA143	Cable, 6ft., N-male to N-male	Micro-Coax	N/A	3/11/04	3/31/05
ATA144	Amplifier, 0.1 to 18 GHz	Miteq	AFS42-00101800-2	3/11/04	3/31/05
ATA152	27 ft. N male - N male low loss cable	Micro-Coax	UFB293C-0-3149-50504	2/21/04	2/29/05
ATA163	High Pass Filter, 3.6 GHz cutoff frequency, N-male to N-female	UL	N/A	5/7/03	5/31/04
HI0034	Environmental Indicator	Cole-Palmer	99760-00	10/17/03	10/31/04
MG1131	Tape Measure, 15 m / 50 ft.	Lufkin	EL15CME	4/9/03	4/30/06
MM0132	Multimeter	Fluke	FLK-175/CWG	10/14/03	10/31/04
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	2/2/04	2/28/05
ZATA31	Attenuator, 6 dB, 50 W	Weinschel	24-6-34	N/A	N/A

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

Test 3, Item A - Peak Plot (Amplitude in dBuV/m):

Radiated Spurious Emissions - Above 1 GHz



Note: Broad emission from 1000 to 1400 MHz is due to mathematical correction for notch filter loss. No spurious emission was observed in this band.

Test 3, Item A - Discrete Data:

Radiated Spurious Emissions - Above 1 GHz

RDE 3A 1-4 GHz V/H
04LB131 HOPPING W/ NOTCH FILTER
RED=VERTICAL, GREEN=HORIZONTAL
TESTED BY: JOSHUA THOMPSON

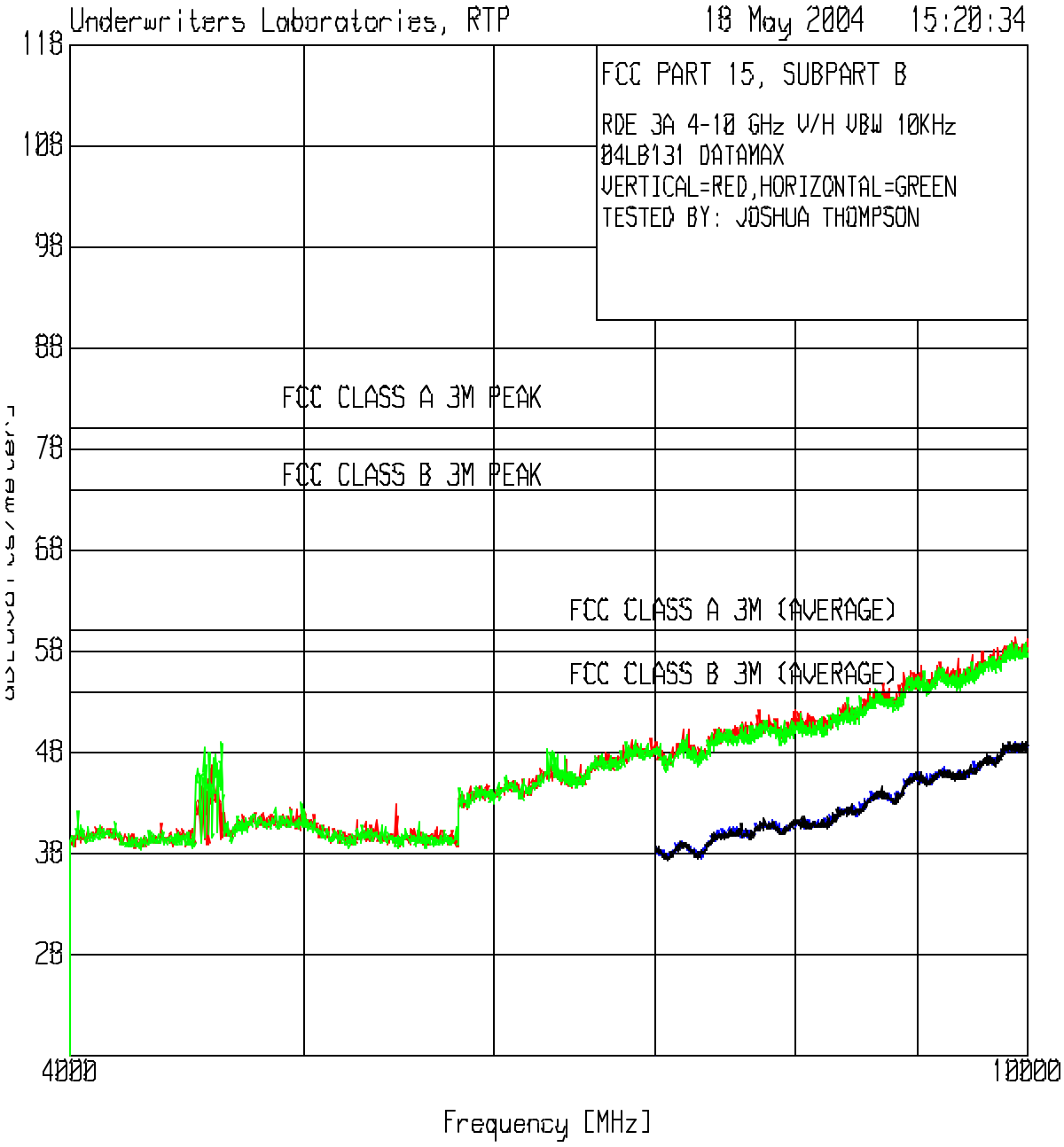
No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Cable/Amp Factors [dB]	Antenna Factor [dB]	Field Strength [dB(uV/m)]	Limit:1	2	3	4
Range 4 1000 - 2000MHz									
1	1168.416	38.5 pk	-17.8	25.6	46.3	60	54	80	74
		Height:100 Vert		Margin [dB]		-13.7	-7.7	-33.7	-27.7
2	1261.369	46.4 pk	-28.7	25.9	43.6	60	54	80	74
		Height:100 Vert		Margin [dB]		-16.4	-10.4	-36.4	-30.4
3	1620.69	42.3 pk	-31.3	27	38	60	54	80	74
		Height:150 Vert		Margin [dB]		-22	-16	-42	-36
4	1806.597	41.8 pk	-31.4	27.6	38	60	54	80	74
		Height:150 Vert		Margin [dB]		-22	-16	-42	-36
Range 4 1000 - 2000MHz									
7	1168.416	39.7 pk	-17.8	25.6	47.5	60	54	80	74
		Height:101 Horz		Margin [dB]		-12.5	-6.5	-32.5	-26.5
8	1260.87	44.8 pk	-28.6	25.9	42.1	60	54	80	74
		Height:101 Horz		Margin [dB]		-17.9	-11.9	-37.9	-31.9
9	1348.326	43.7 pk	-31.9	26.1	37.9	60	54	80	74
		Height:101 Horz		Margin [dB]		-22.1	-16.1	-42.1	-36.1
10	1621.689	46.9 pk	-31.3	27	42.6	60	54	80	74
		Height:101 Horz		Margin [dB]		-17.4	-11.4	-37.4	-31.4
11	1808.096	56.5 pk	-31.4	27.6	52.7	60	54	80	74
		Height:101 Horz		Margin [dB]		-7.3	-1.3	-27.3	-21.3
Range 4 2000 - 4000MHz									
5	2160.92	38.8 pk	-31.1	28.5	36.2	60	54	80	74
		Height:100 Vert		Margin [dB]		-23.8	-17.8	-43.8	-37.8
6	3577.211	37.3 pk	-28.7	31.4	40	60	54	80	74
		Height:150 Vert		Margin [dB]		-20	-14	-40	-34

LIMIT 1: FCC CLASS A 3M (AVERAGE)
LIMIT 2: FCC CLASS B 3M (AVERAGE)
LIMIT 3: FCC CLASS A 3M PEAK
LIMIT 4: FCC CLASS B 3M PEAK

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

Test 3, Item A - Peak Plot (Amplitude in dBuV/m):

Radiated Spurious Emissions - Above 1 GHz



Note: Upper trace represents peak sweep from 4000 to 10,000 MHz. Lower trace represents averaged sweep performed where margin to average limit was inadequate (from 7000 to 10,000 MHz).

Test 3, Item A - Discrete Data:

Radiated Spurious Emissions - Above 1 GHz

RDE 3A 4-10 GHz V/H VBW 10KHz
04LB131 DATAMAX
VERTICAL=RED,HORIZONTAL=GREEN
TESTED BY: JOSHUA THOMPSON

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3	4
Range: 1 4000 - 10000MHz									
1	4521.739	36.8 pk	-26.5	32.9	43.2	60	54	80	74
		Height:101 Vert		Margin [dB]		-16.8	-10.8	-36.8	-30
2	4605.697	38.3 pk	-26.3	33.1	45.1	60	54	80	74
		Height:149 Vert		Margin [dB]		-14.9	-8.9	-34.9	-28
5	5463.268	34.4 pk	-26	34.4	42.8	60	54	80	74
		Height:149 Vert		Margin [dB]		-17.2	-11.2	-37.2	-31
8	6335.832	36.1 pk	-24	34.7	46.8	60	54	80	74
		Height:101 Vert		Margin [dB]		-13.2	-7.2	-33.2	-27
9	7229.385	35.6 pk	-21.9	36.5	50.2	60	54	80	74
		Height:101 Vert		Margin [dB]		-9.8	-3.8	-29.8	-23
12	8230.885	33.8 pk	-20.7	38.3	51.4	60	54	80	74
		Height:101 Vert		Margin [dB]		-8.6	-2.6	-28.6	-22
13	9034.483	35.2 pk	-17.4	38.8	56.6	60	54	80	74
		Height:149 Vert		Margin [dB]		-3.4	2.6	-23.4	-17
Range: 3 4000 - 10000MHz									
3	4548.726	41.8 pk	-26.4	33	48.4	60	54	80	74
		Height:149 Horz		Margin [dB]		-11.6	-5.6	-31.6	-25
4	4623.688	42.1 pk	-26.4	33.2	48.9	60	54	80	74
		Height:149 Horz		Margin [dB]		-11.1	-5.1	-31.1	-25
6	5472.264	31.3 pk	-26	34.4	39.7	60	54	80	74
		Height:149 Horz		Margin [dB]		-20.3	-14.3	-40.3	-34
7	6314.843	37.6 pk	-24	34.7	48.3	60	54	80	74
		Height:149 Horz		Margin [dB]		-11.7	-5.7	-31.7	-25
10	7211.394	35 pk	-21.8	36.5	49.7	60	54	80	74
		Height:100 Horz		Margin [dB]		-10.3	-4.3	-30.3	-24
11	8182.909	33.5 pk	-20.8	38.4	51.1	60	54	80	74
		Height:149 Horz		Margin [dB]		-8.9	-2.9	-28.9	-22
14	9058.471	34.7 pk	-17.4	38.7	56	60	54	80	74
		Height:100 Horz		Margin [dB]		-4	2	-24	-18
Range: 4 7000 - 10000MHz									
15	9829	24.5 pk	-14.3	38.8	49	60	54	80	74
		Height:149 Horz		Margin [dB]		-11	-5	-31	-25

LIMIT 1: FCC CLASS A 3M (AVERAGE)
LIMIT 2: FCC CLASS B 3M (AVERAGE)
LIMIT 3: FCC CLASS A 3M PEAK
LIMIT 4: FCC CLASS B 3M PEAK

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

Test 4: Bandedge

Test Requirement: 47 CFR Part 15 Subpart C

Test Specification: 47 CFR Part 15.247

Test Procedure:

All testing was performed on an open test area covered by a ground plane. The spectrum analyzer Resolution Bandwidth and Video Bandwidth were set to 10 kHz for the measurement. A plot of the spectrum analyzer display screen is produced with marker points displaying the center frequency and the left and right side points that are 20 dB below the field strength at the center frequency.

The spectrum analyzer frequency is positioned such that the left or right bandedge frequency and the edge of the nearest channel are observed on the display. The device is considered to comply if all emissions at the bandedge and outside the

Limits - FCC Part 15.247

Bandedge	Frequency
Lower	902 MHz
Upper	928 MHz

Test Deviations:

None

Test Setup: Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	2	Antenna	4 (hopping normally)	1	1

Test 4 - Results: Bandedge

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (ºC)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	E	52	24	100	P	7/15/2004	

The EUT was considered to **Pass** the Requirements.

Comments:

Comment #	Description

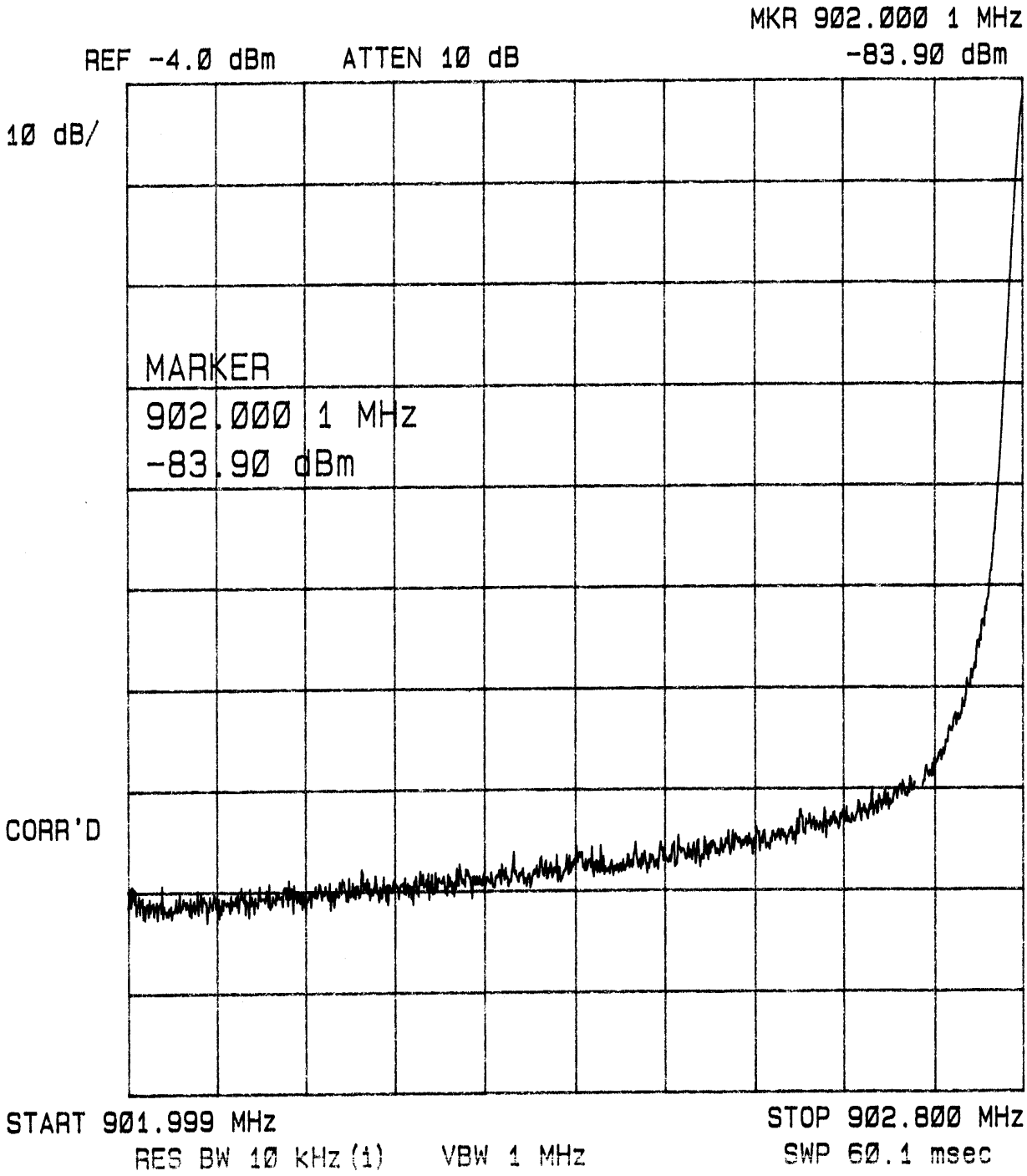
Test 4 - Test Equipment Used: Bandedge

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
ATA160	RF Attenuator, 30 dB	Weinshel	47-30-43	9/30/03	9/30/04
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	11/10/03	11/03/04

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

Test 4, Item A - Peak Plot (Amplitude in dBuV):

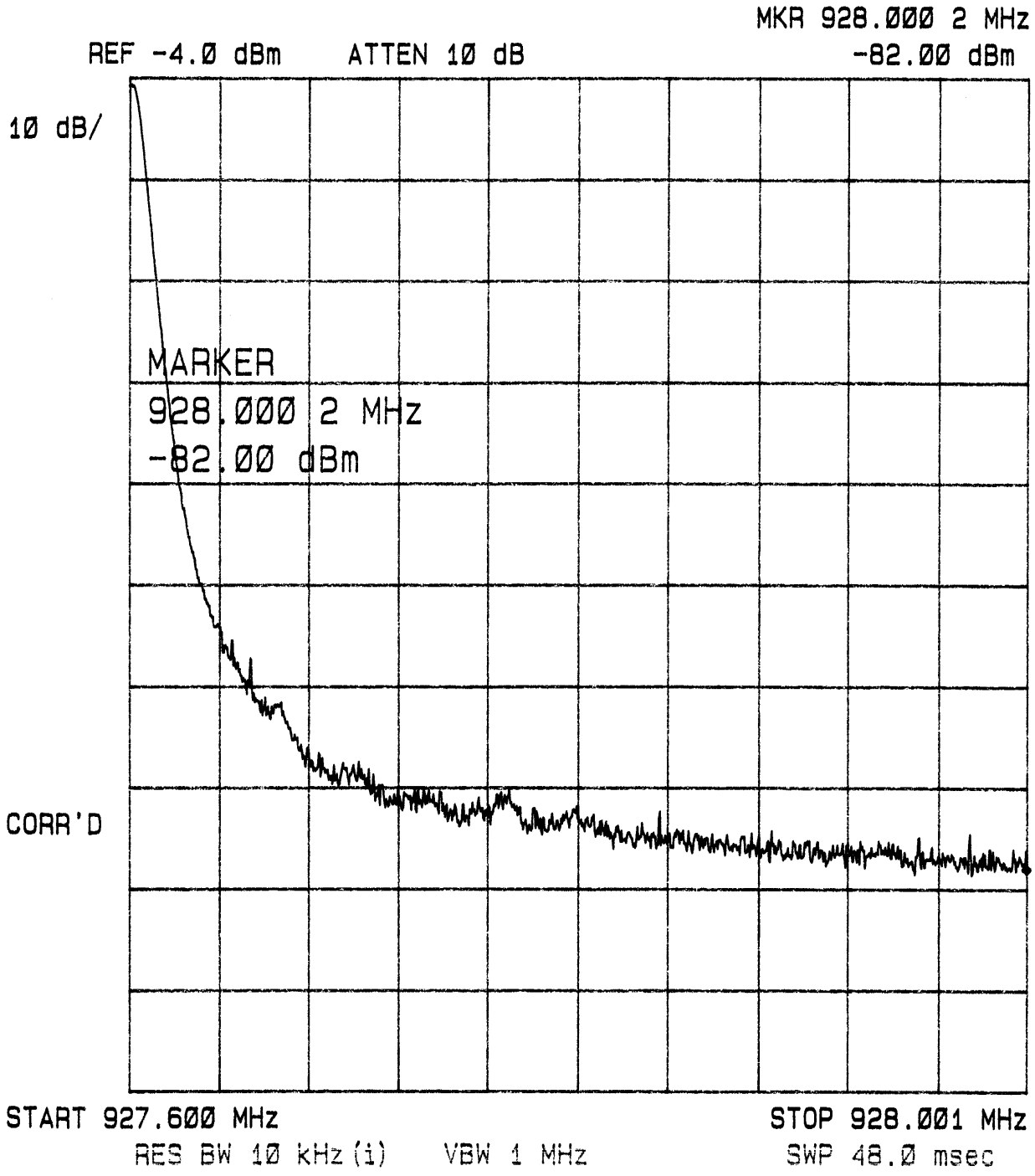
Bandedge



Left Bandedge at 902 MHz is shown to be >70 dB below lowest channel carrier. Requirement is >20 dB.

Test 4, Item A - Peak Plot (Amplitude in dBuV):

Bandedge



Right Bandedge at 928 MHz is shown to be >70 dB below lowest channel carrier. Requirement is >20 dB.

Test 5: Conducted Power and Occupied Bandwidth

Test Requirement: 47 CFR Part 15.247

Test Specification: ANSI C63.4:2001

Test Procedure:

All testing was performed in UL's 10 meter semi-anechoic chamber. The chamber meets the FCC's site attenuation criteria for use as an alternative measurement site. The EUT was tested per ANSI C63.4:2001 as a conducted measurement. The output of the transmitter was connected to the input of the measurement spectrum analyzer via a calibrated attenuator.

Conducted Power: The spectrum analyzer Resolution Bandwidth is set to 100 kHz and Video Bandwidth to 1 MHz or higher. The peak measurements for low, middle, and high channels are reported.

Occupied Bandwidth: The spectrum analyzer Resolution Bandwidth and Video Bandwidth were set to 10 kHz for the measurement. A plot of the spectrum analyzer display screen is produced with marker points displaying the center frequency and the left and right side points that are 20 dB below the field strength at the center frequency.

Limits - FCC Part 15.247 - Frequency Hopping

Frequency of Operation / Channels	Maximum Conducted Power	Maximum Bandwidth
902 - 928 MHz, >50 channels	1000 mW*	200 kHz

*for antenna with gain of 6 dBi or less

Test Deviations:

None

Test Setup: Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	2	Antenna	4 (hopping normally)	1	1

Test 5 - Results: Conducted Power and Occupied Bandwidth

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (ºC)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	E	52	24	100	P	7/15/2004	

The EUT was considered to **Pass** the Requirements.

Comments:

Comment #	Description
1	Intended antenna maximum gain is 2.5 dBi, therefore no conducted power reduction is required.

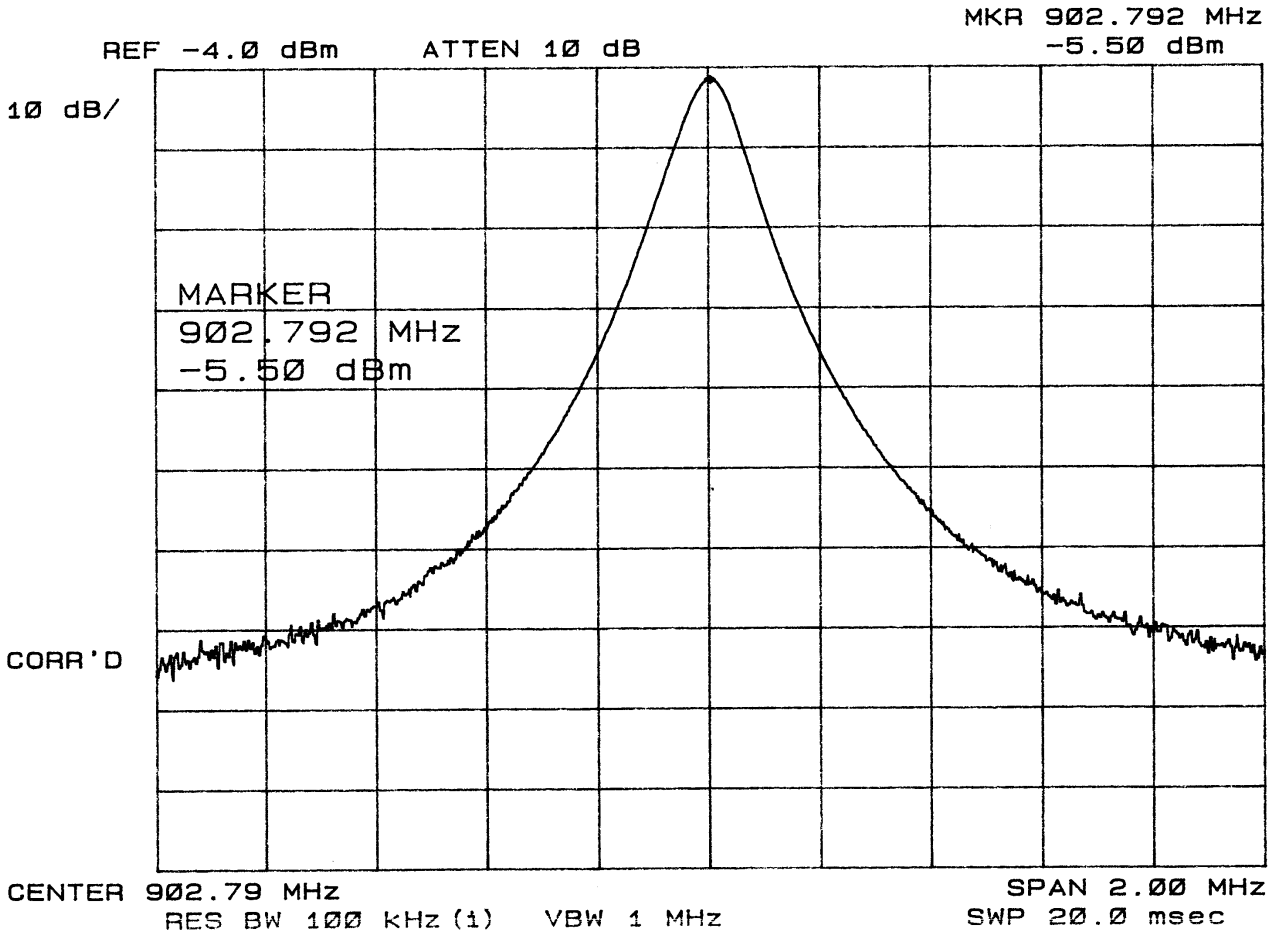
Test 5 - Test Equipment Used: Conducted Power and Occupied Bandwidth

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	2/2/04	2/28/05
ATA160	RF Attenuator, 30 dB	Weinshel	47-30-43	9/30/03	9/30/04

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

Test 5, Item A - Peak Plot (Amplitude in dBuV):

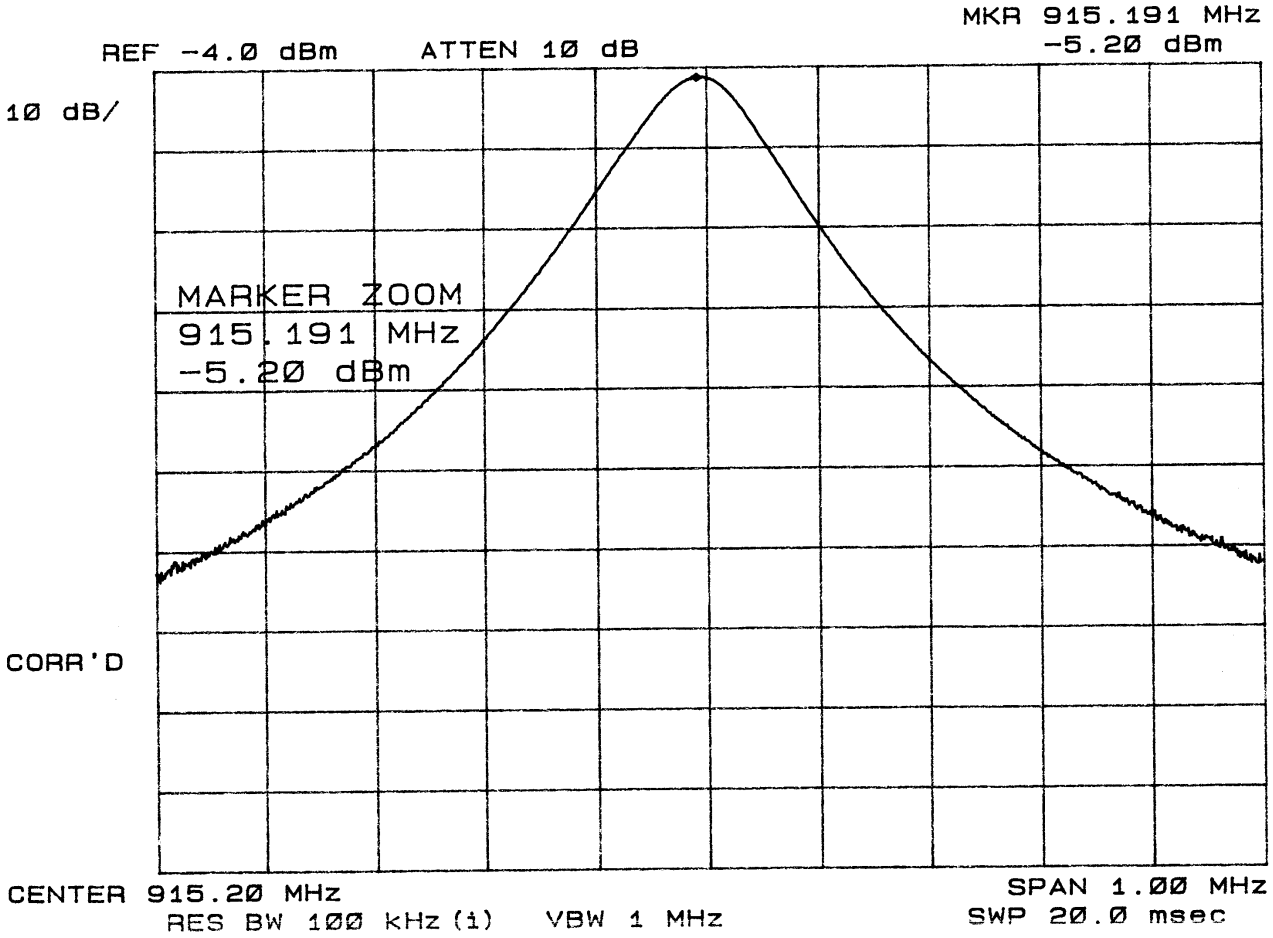
Conducted Power - Low channel



Measured Frequency (MHz)	Measured Power - Receiver (dBm)	Attenuator Loss (dB)	Corrected Power (dBm)	Corrected Power (mW)	Limit (mW)	Pass/Fail (P/F)	Comments (#)
902.792	-5.5	29.6	24.1	257.0	1000	P	

Test 5, Item A - Peak Plot (Amplitude in dBuV):

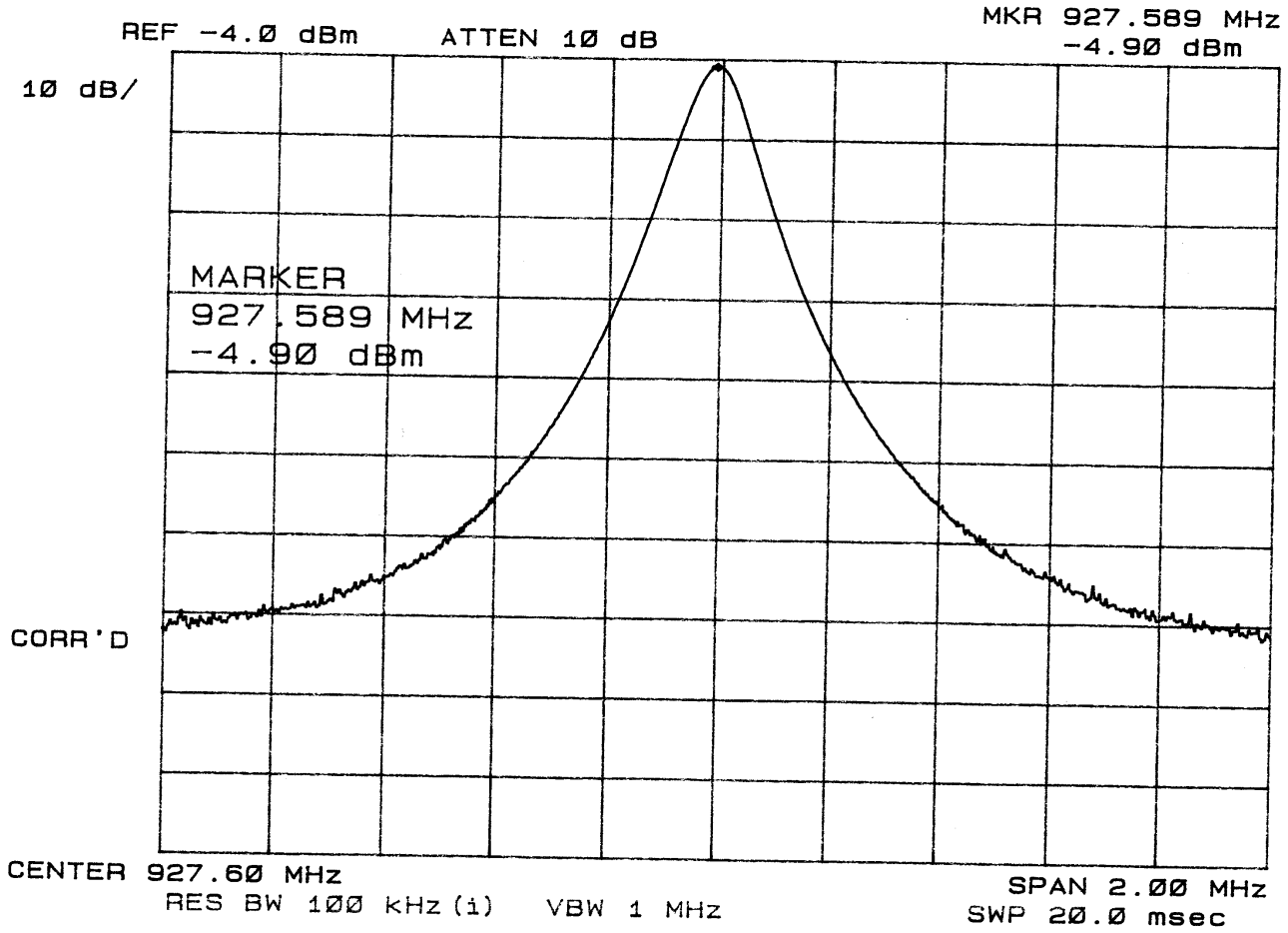
Conducted Power - Center Channel



Measured Frequency (MHz)	Measured Power - Receiver (dBm)	Attenuator Loss (dB)	Corrected Power (dBm)	Corrected Power (mW)	Limit (mW)	Pass/Fail (P/F)	Comments (#)
915.191	-5.2	29.6	24.4	275.4	1000	P	

Test 5, Item A - Peak Plot (Amplitude in dBuV):

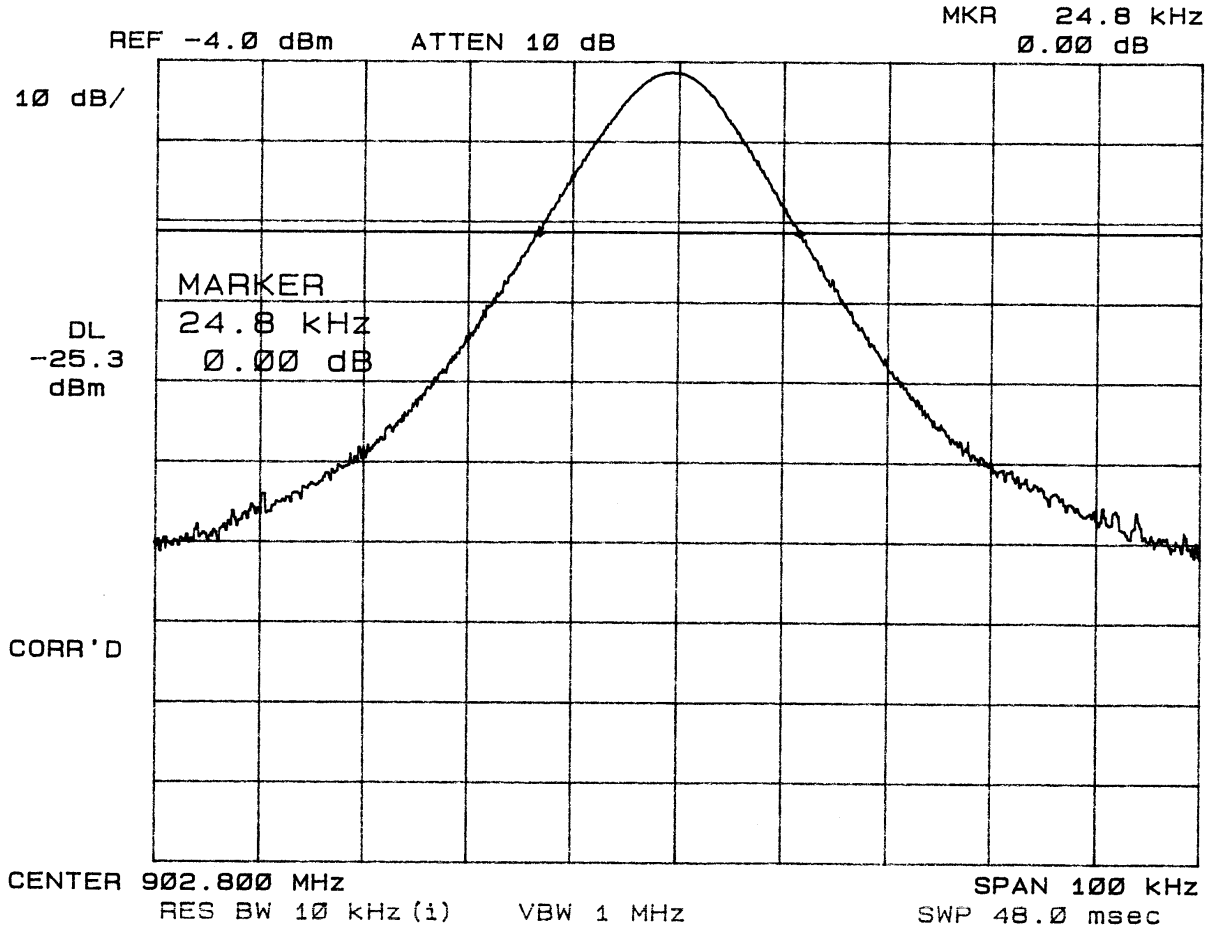
Conducted Power - High Channel



Measured Frequency (MHz)	Measured Power - Receiver (dBm)	Attenuator Loss (dB)	Corrected Power (dBm)	Corrected Power (mW)	Limit (mW)	Pass/Fail (P/F)	Comments (#)
927.589	-4.9	29.6	24.7	295.1	1000	P	

Test 5, Item A - Peak Plot (Amplitude in dBuV):

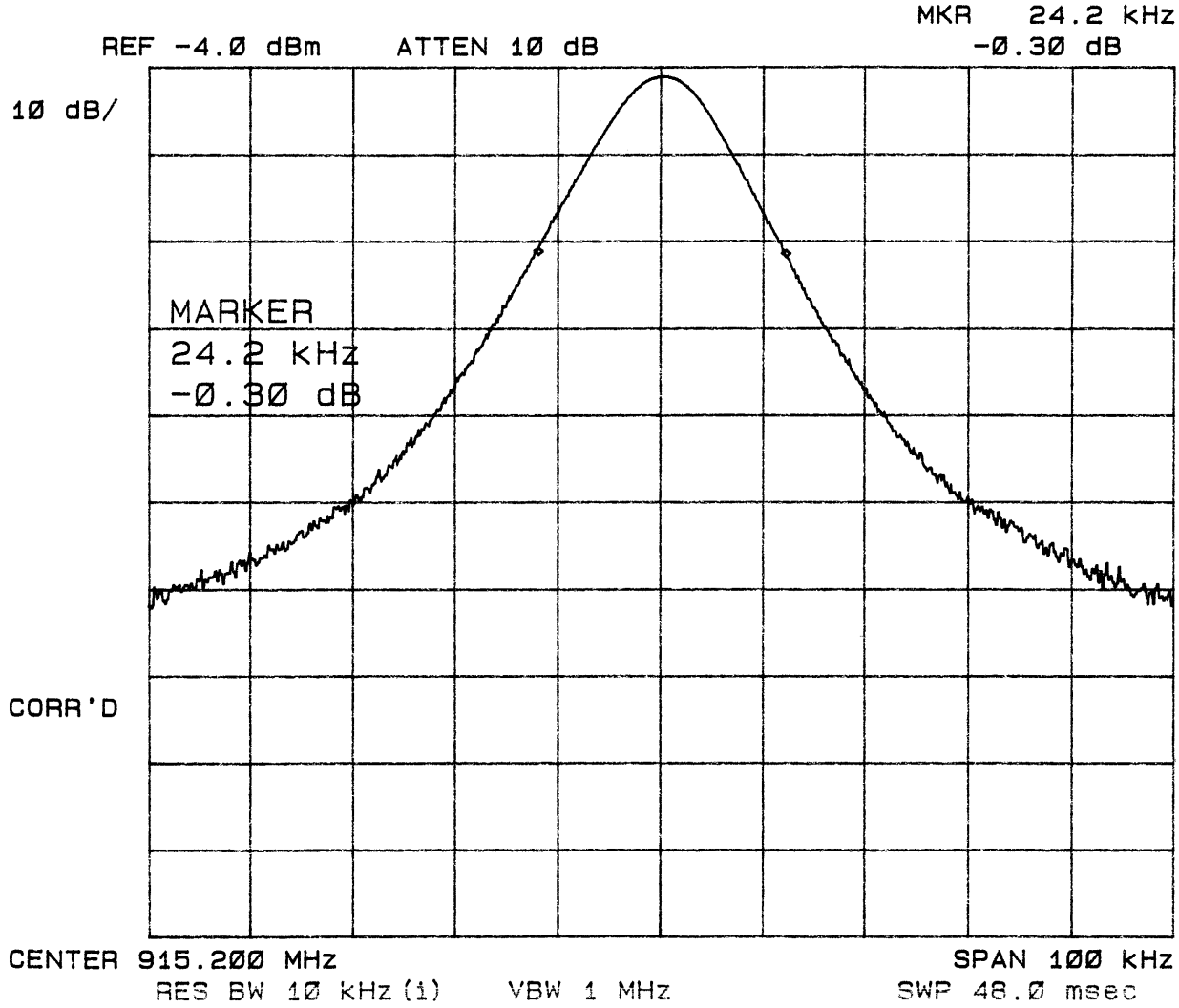
Occupied Bandwidth (Low channel)



Note: Maximum Occupied Bandwidth measured at low channel (24.8 kHz).

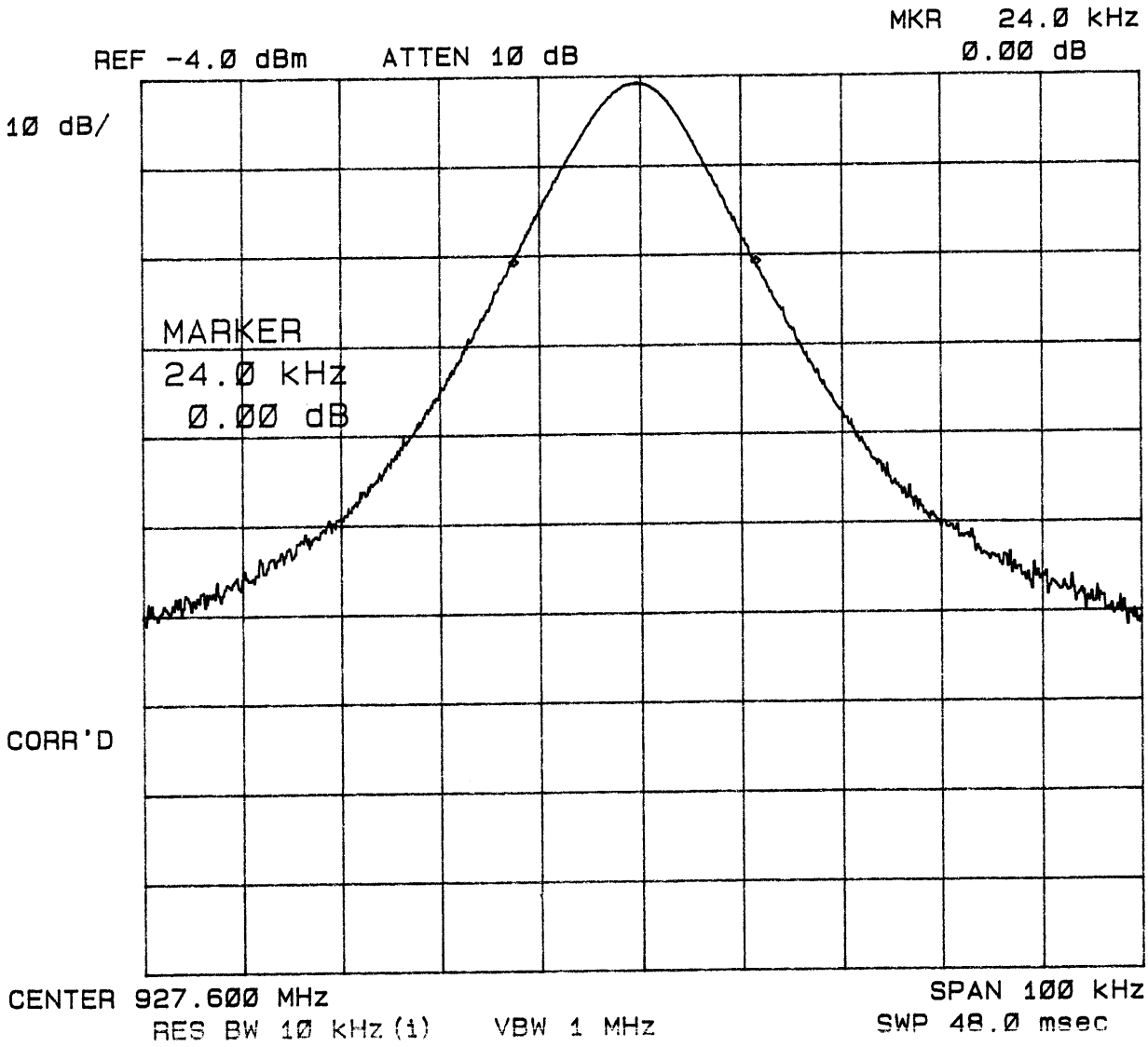
Test 5, Item A - Peak Plot (Amplitude in dBuV):

Occupied Bandwidth - Center Channel



Test 5, Item A - Peak Plot (Amplitude in dBuV):

Occupied Bandwidth - High Channel



Test 6: Radiated Disturbance Emissions - Peak-to-Average Ratio

Test Requirement: 47 CFR Part 15, Subpart C

Test Specification: 47 CFR Part 15, Subpart C, Section 15.231

Test Procedure:

The test was performed in accordance with the Test Requirement and Specification and configured as noted in the Test Setup. This test may be performed as a radiated or conducted measurement. This test was performed as a conducted measurement.

The measurement spectrum analyzer is centered on the EUT's transmit frequency and span is reduced to 0 Hz to obtain a time domain measurement. The period of one complete transmit cycle is recorded. Next each button on the transmitter is depressed in sequence to determine which button produces the largest duty cycle. The duration of each pulse in the cycle is recorded and the percentage of time the EUT is transmitting is calculated.

No limit is expressed in Section 15.247 for this test, however the result of this test is used to calculate average values for the remaining measurements.

Test Deviations:

None

Test Results:

As this RFID device transmits a CW nearly continuously, the peak-to-average ratio is assumed to be zero. No average reduction may be applied to peak measurements.

Test 7: Frequency Hopping Channels, Channel Spacing, and Dwell Time

Test Requirement: 47 CFR Part 15.247

Test Specification: ANSI C63.4:2001

Test Procedure:

Testing is performed with a measurement spectrum analyzer connected directly from the output stage of the antenna to the antenna. An impedance matching network is installed if needed.

Measurements are performed to document the number of hopping channels, the spacing (in kHz) of the channel centers, and the duration (in ms) of each channel occupied.

Duration on each hopping channel shall not exceed 0.4 seconds and be randomly (or pseudo-randomly) distributed.

Test Deviations:

None

Test Setup: Only the following ports were tested. See EUT Information for details.

Test Item	Port #	Port Name	EUT Operation Mode	EUT Configuration	Power Interface
A	2	Antenna	4 (hopping normally)	1	1

Test 7 - Results: Frequency Hopping Channels, Channel Spacing, and Dwell Time

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (ºC)	Pressure (kPa)	Pass/Fail (P/F)	Date Completed	Comment #
A	E	52	24	100	P	7/15/2004	

The EUT was considered to **Pass** the Requirements.

Comments:

Comment #	Description

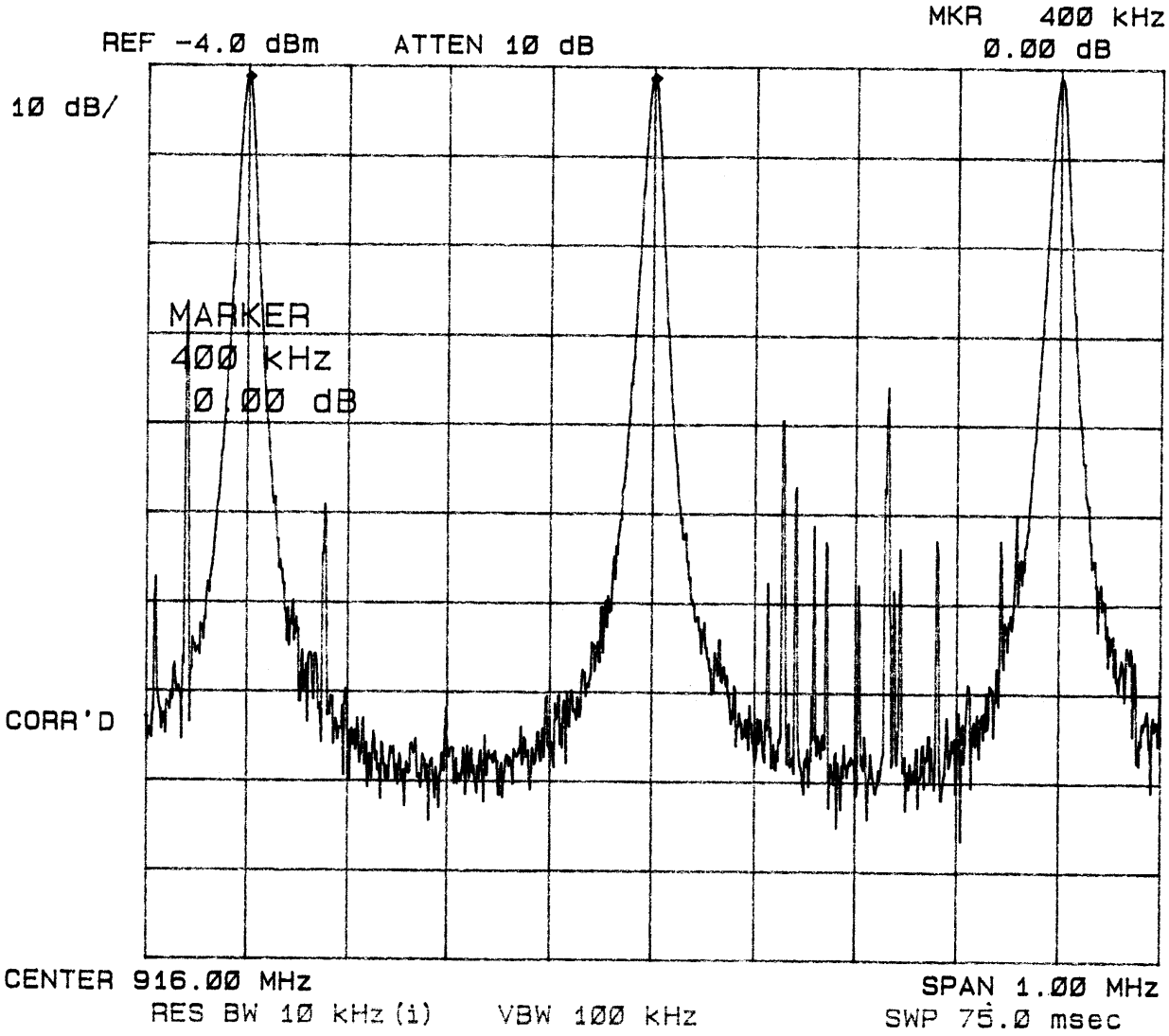
Test 7 - Test Equipment Used: Frequency Hopping Channels, Channel Spacing, and Dwell Time

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	11/10/03	11/03/04
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	2/2/04	2/28/05
ATA160	RF Attenuator, 30 dB	Weinshel	47-30-43	9/30/03	9/30/04

The above equipment has been calibrated and is within the manufacturer's published limit of error. Calibration is traceable to the National Institute of Standards & Technology(NIST) and conforms to ANSI/NCSL Z540-1-1994.

Test 7, Item A - Peak Plot (Amplitude in dBuV):

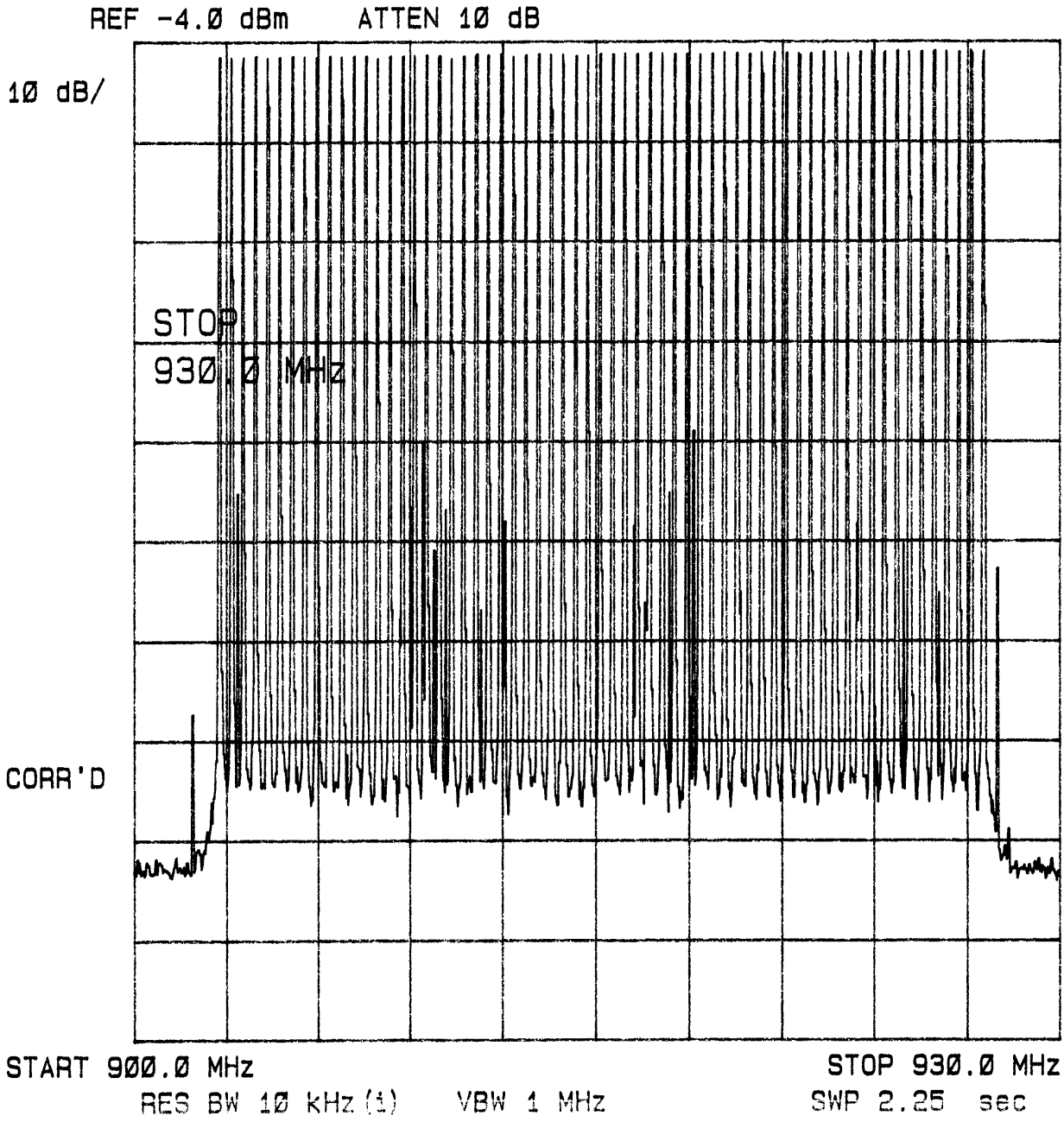
Channel Spacing



Channel spacing is 400 kHz center to center.

Test 7, Item A - Peak Plot (Amplitude in dBuV):

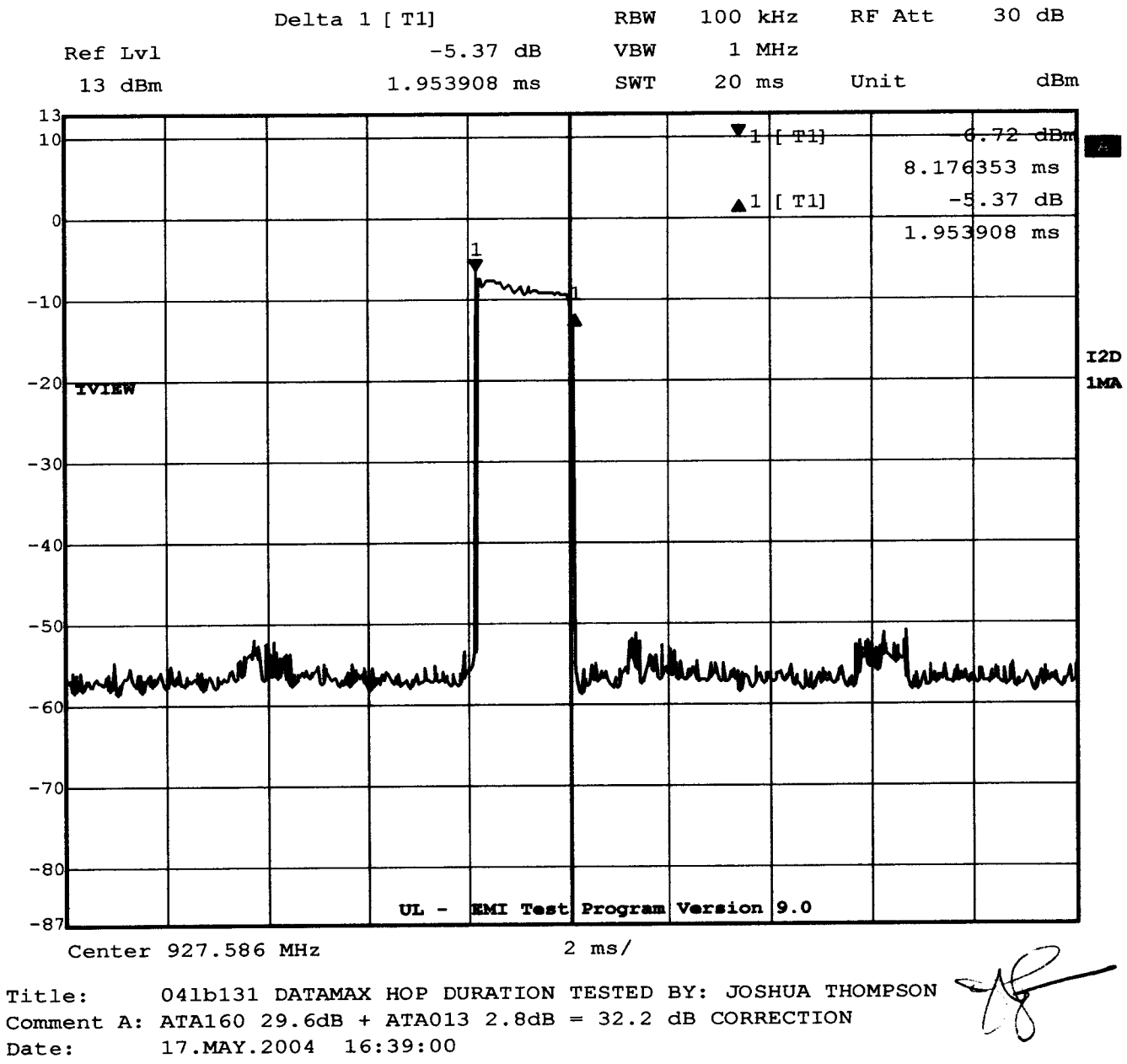
Number of Channels



The device is shown to have 63 hopping channels.

Test 7, Item A - Peak Plot (Amplitude in dBuV):

Hop Duration



Title: 04lb131 DATAMAX HOP DURATION TESTED BY: JOSHUA THOMPSON
Comment A: ATA160 29.6dB + ATA013 2.8dB = 32.2 dB CORRECTION
Date: 17.MAY.2004 16:39:00

Hop duration is 1.95 milliseconds. This is adjustable at the factory, but must not be set to more than 400 ms.

Test 8: Maximum Permissible Exposure

Test Requirement: 47 CFR Part 1

Test Specification: 47 CFR Part 1, Section 1.1307

Test Procedure:

Maximum Permissible Exposure limits are as follows:

FCC Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E^2\|$, $\|H^2\|$. or S (minutes)
0.3 – 3.0	614	1.63	(100)*	6
3.0 - 30	1824/f	4.89/f	($900/f^2$)*	6
30 - 300	61.4	0.163	1.0	6
300 – 1500	-	-	f/300	6
1500 – 100,000	-	-	5.0	6

* Plane-wave equivalent power density

FCC Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E^2\|$, $\|H^2\|$. or S (minutes)
0.3 - 1.34	614	1.63	(100)*	30
1.34 - 30	824/f	2.19/f	($180/f^2$)*	30
30 - 300	27.5	0.073	0.2	30
300 – 1500	-	-	f/1500	30
1500 – 100,000	-	-	1.0	30

*Plane-wave equivalent power density

Test Details: This device is considered to possibly be located in either environment. See calculation for assumptions.

Background: Per the following guidance from OET Bulletin 65 Supplement C required minimum spacings are provided to the professional installer.

Transmitter or Device Type[18]	Output[19]	Applicable Methods to Ensure Compliance[20]
Transmitters using indoor antennas that operate at 20 cm or more from nearby persons	>2.5 W at 915 MHz	If the MPE distance is greater than that required for normal operation of the device, operating instructions, warning instructions and/or warning labels may be used to ensure compliance by indicating the minimal separation distance to comply with MPE limits. If the antennas are professionally installed to ensure compliance, warning instructions and warning labels are not necessary.
	=< 2.5 W at 915 MHz or =< 4 W at 2450 MHz	Transmitters operating at 2.5 W EIRP (1.5 W ERP) or less at 915 MHz, or at 4 W EIRP (2.4 W ERP) or less at 2450 MHz, generally are not expected to exceed MPE limits when nearby persons are 20 cm or more from most antennas. Therefore, special instructions and warnings are normally not necessary to ensure compliance.

MPE Calculation with highest EIRP:

Assuming the highest gain antenna intended for use (2.5 dBi gain) and the device is outputting at highest measured power continuously, then the threshold for meeting MPE requirements in an uncontrolled environment is calculated to be 9 cm. The calculation for MPE at 20 cm is shown below. Because this device is less than 2.5 W EIRP, then no special cautions are required.

S = EIRP / (4 * Pi * R^2),

Power Density = EIRP / (4 * Pi * R^2),
where EIRP = Output Power * Antenna Gain

Limit for **Uncontrolled** Exposure at Operating Frequency	**6.1** W/m^2	- or -	**0.61** mW/cm^2

Uncontrolled/Occupational Exposure

Operating Frequency	915 MHz		
Output Power (Peak)	0.2951 Watts		
Antenna Gain	2.5 dB	or (linear)	1.778279 (unitless)
Separation Distance	0.2 m	-or-	7.874 inches

Peak Power Density	1.044 W/m^2	- or -	0.1044 mW/cm^2
Exposure % (over 6 min timespan for uncontrolled)	100%		
Transmit Duty Cycle (Peak-to-Average Ratio)	100%		
Average Power Density	**1.04399** W/m^2	- or -	**0.1044** mW/cm^2

Limit for **Uncontrolled** Exposure at Operating Frequency	**6.1** W/m^2	- or -	**0.61** mW/cm^2

Accreditation Certificates:

National Institute of Standards and Technology — NVLAP — National Voluntary Laboratory Accreditation Program

ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation

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ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS — **NVLAP LAB CODE 200246-0**

UNDERWRITERS LABORATORIES, INC.
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Research Triangle Park, NC 27709
Mr. Rick A. Titus
Phone: 847-272-8800 x43281 Fax: 847-509-6321
E-Mail: Rick.A.Titus@us.ul.com
URL: http://www.ul.com

NVLAP Code	*Designation / Description*
Emissions Test Methods:	
12/CIS14	CISPR 14-1 (March 30, 2000): Limits and Methods of Measurement of Radio interference Characteristics of Household Electrical Appliances, Portable Tools and Similiar Electrical Apparatus - Part 1: Emissions
12/CIS14a	EN 55014-1 (1993) with Amendments A1 (1997) & A2 (1999)
12/CIS14b	AS/NZS 1044 (1995)
12/CIS14c	CNS 13783-1
12/CIS22	IEC/CISPR 22 (1997) and EN 55022 (1998): Limits and methods of measurement of radio disturbance characteristics of information technology equipment
12/CIS22a	IEC/CISPR 22 (1993): Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1 (1995) and Amendment 2 (1996)

June 30, 2005
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National Institute of Standards and Technology — NVLAP — National Voluntary Laboratory Accreditation Program

ISO/IEC 17025:1999
ISO 9002:1994

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UNDERWRITERS LABORATORIES, INC.

NVLAP Code	*Designation / Description*
12/CIS22b	CNS 13438 (1997): Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment
12/EM02a	IEC 61000-3-2, Edition 2.1 (2001-10), EN 61000-3-2 (2000), and AS/NZS 2279.1 (2000): Electromagnetic compatibility (EMC) Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A)
12/EM03b	IEC 61000-3-3, Edition 1.1(2002-03) & EN 61000-3-3, A1(2001): EMC - Part 3-3: Limits - Limitations of voltage changes, voltage fluctuations and flicker, in public low-voltage supply-systems, for equipment with rated current <=16 A per phase and not subject to conditional connections
12/FCC15b	ANSI C63.4 (2001) with FCC Method - 47 CFR Part 15, Subpart B: Unintentional Radiators
12/T51	AS/NZS CISPR 22 (2002) and AS/NZS 3548 (1997): Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment
Immunity Test Methods:	
12/I01	IEC 61000-4-2, Edition 2.1 (2001) including Amds. 1 & 2 and EN 61000-4-2: Electrostatic Discharge Immunity Test
12/I02	IEC 61000-4-3, Edition 2.0 (2002-03) and EN 61000-4-3: Radiated Radio-Frequency Electromagnetic Field Immunity Test

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NVLAP Code	*Designation / Description*
12/I03	IEC 61000-4-4 (1995) + Amd. 1 (2000) & Amd. 2 (2001) and EN 61000-4-4: Electrical Fast Transient/Burst Immunity Test
12/I04	IEC 61000-4-5, Edition 1.1 (2001-04) and EN 61000-4-5: Surge Immunity Test
12/I05	IEC 61000-4-6, Edition 2.0 (2003-05) and EN 61000-4-6: Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields
12/I06	IEC 61000-4-8, Edition 1.1 (2001) and EN 61000-4-8: Power Frequency Magnetic Field Immunity Test
12/I07	IEC 61000-4-11, Edition 1.1 (2001-03) and EN 61000-4-11: Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests
Safety Test Methods:	
12/T41	AC/ACIF S001 (2001): Safety Requirements for Customer Equipment
12/T50	AS/NZS 3260 (1993) + Supplement 1 (1996): Safety of Information Technology Equipment Including Electrical Business Equipment
Telecommunications Test Methods:	
12/1089d	GR-1089-CORE, Issue 3 (April 2002): EMC and Electrical Safety - Generic Criteria for Network Telecommunications Equipment (sections: 2.1.2.1, 2.1.2.2, 2.1.4, 2.2, 3.2, 3.3, 4.6.2, 4.6.5, 4.6.7 - 4.6.17, 4.7, 5.2, 5.3.1, 5.4, 6, 7.2 - 7.7, 8, and 9.2 - 9.12)

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National Institute of Standards and Technology — NVLAP — National Voluntary Laboratory Accreditation Program

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NVLAP Code	*Designation / Description*
12/76200a	SBC-TP-76200, Issue 4 (May 2003): Network Equipment Power, Grounding, Environmental, and Physical Design Requirements (sections: 6.1B, 7.1, 7.2, 7.3, 7.4, and 10.1 - 10.4B)
12/GR63a	GR-63-CORE, Issue 2 (April 2002): NEBS (TM) Requirements: Physical Protection (sections: 2, 3, 4.1, 4.2.3, 4.3, 4.4.1, 4.4.3, 4.4.4, 4.5, 4.6, and 4.7)

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Measurement Uncertainty Statement

Test	Expanded Estimate of Uncertainty (k = 2, for 95% of a normal distribution)	Units
Radiated Disturbance Emissions:		
• 3 and 10 meter measurement distances	+/- 3.8 dB	Volts/meter
• 1 meter measurement distance	+/- 2.3 dB	Volts/meter
Conducted Disturbance Emissions (9 kHz – 30 MHz):	+/- 3.4 dB	Volts
Electrostatic Discharge	+/- 2.2 %	Volts
Radiated RF Immunity (Chamber):	+/- 2.7 dB	Volts/meter
Electrical Fast Transients/Bursts Immunity	+/- 4.6 %	Volts
Surge Immunity	+/- 4.6 %	Volts
Conducted RF Immunity	+/- 2.8 dB	Volts
Power Frequency Magnetic Field Immunity	+/-13.6 %	Amps/meter
Voltage Dips and Short Interrupts	+/-4.2 %	Volts
Radiated RF Immunity (Tri-plate)	+/-3.2 %	Volts/meter
Disturbance Power (30 – 300 MHz)	+/-3.5%	Volts

CISPR 16-4:2000 Statement

The UL-RTP estimate of expanded measurement uncertainty listed above for Conducted Disturbance (+/- 3.4 dB), Disturbance Power (+/- 3.5 dB), and Radiated Disturbance (+/-3.8 dB) are less than the Values of U_{cispr} as listed in Table 1 of CISPR 16-4. Therefore:

- Compliance is deemed to occur if no measured disturbance reported exceeds the disturbance limits.
- Non-compliance is deemed to occur if any measured disturbance reported exceeds the disturbance limits.