

Test 3 - Results: Conducted Disturbance Emissions - Voltage

Test Results Summary:

Test Item	Test Location	Humidity (%)	Temperature (°C)	Pass/Fail (P/F)	Date Completed	Comment #
A	A	53	23	P	10/14/05	

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

Comments:

Comment #	Description

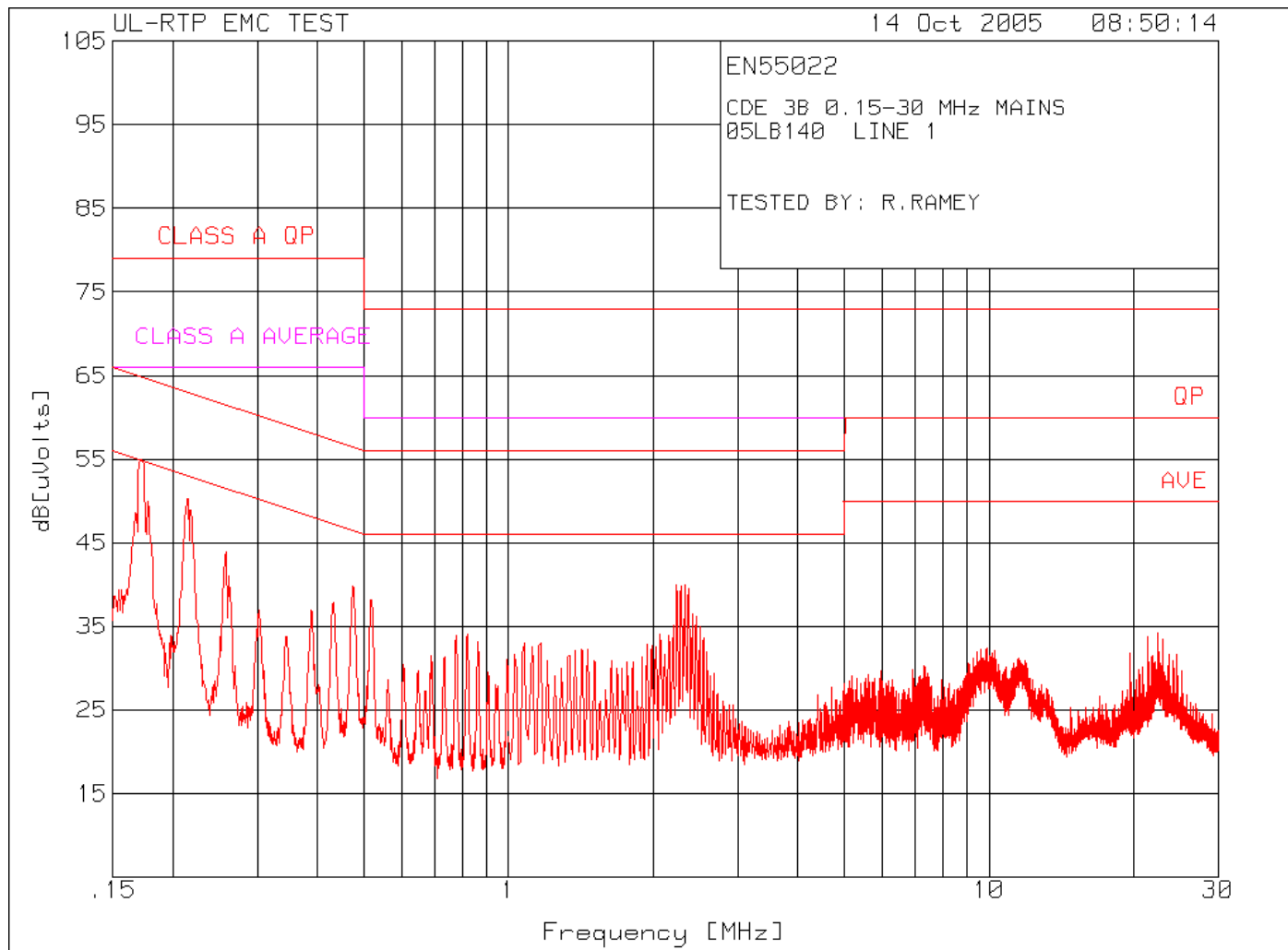
Test Equipment Used:

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
ATA027	LISN, 150 kHz to 30 MHz	Solar Electronics	9629-50-TS-25	4/21/05	4/30/06
ATA028	LISN, 150 kHz to 30 MHz	Solar Electronics	9629-50-TS-25	4/21/05	4/30/06
ATA030	25 ft Cable, N - N	UL	RG-223	7/14/05	7/31/06
ATA056	Transient Limiter, 0.009 to 100 MHz	Electro-Metrics	EM-7600	3/11/05	3/31/06
ATA096	50 ft, N male - N male	Micro-Coax	Coaxial Cable	8/31/05	2/28/06
ATA143	Cable, 6ft., N-male to N-male	Micro-Coax	N/A	8/10/05	2/28/06
SAR003	EMC Receiver	Rohde & Schwarz	1088.7490K40	12/02/04	12/31/05

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 ISO 17025:2005.

Test 3, Item A – Peak Plot (Line):

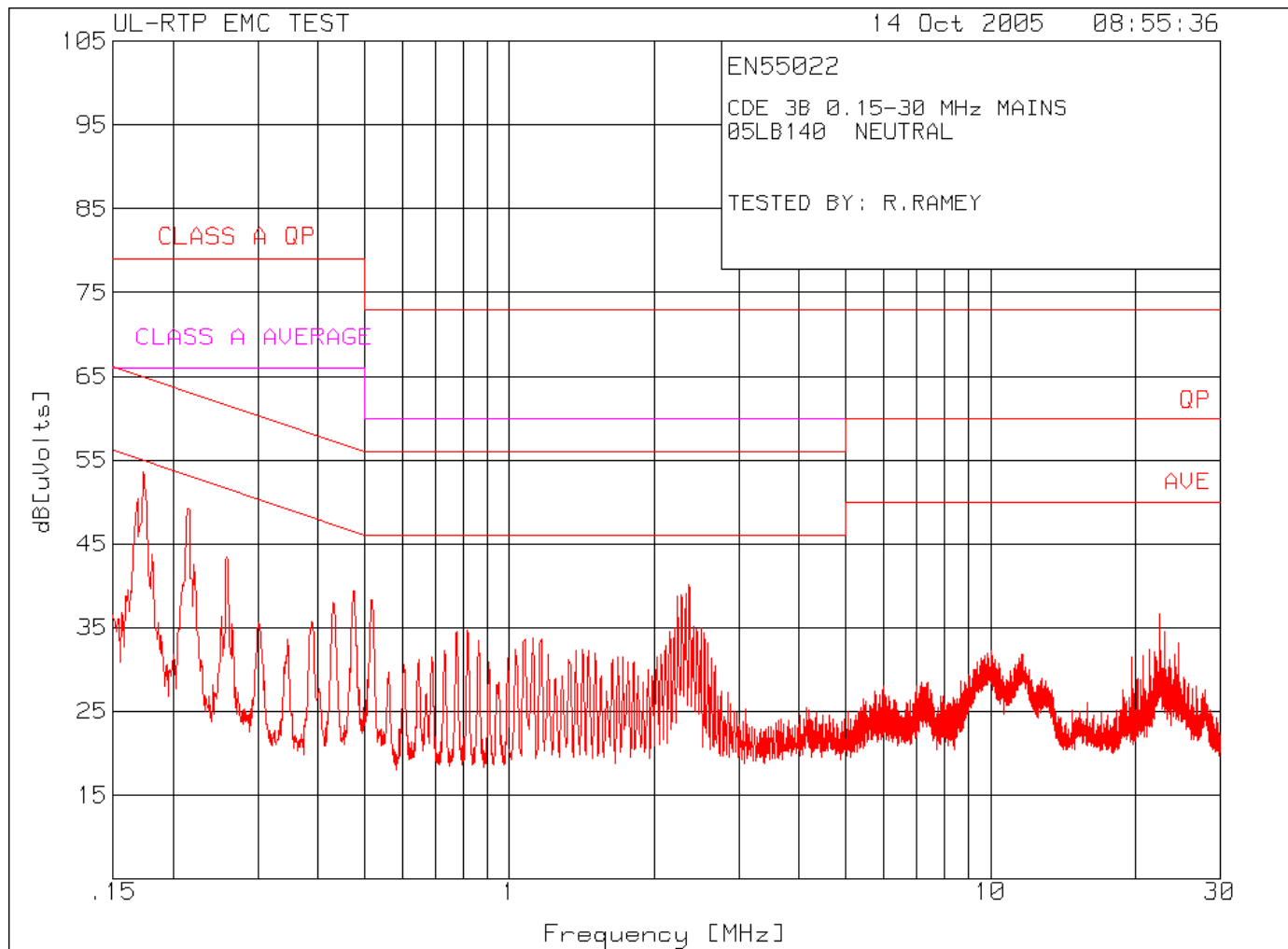
Conducted Disturbance Emissions - Voltage



Note: Both AC Conducted General Limits and Class A Unintentional Limits are displayed. Emissions observed below 3 MHz are sourced from the power supply switching circuit (approximately 42 kHz) and are regarded as unintentional emissions, therefore Class A unintentional limit is applied.

Test 3, Item A – Peak Plot (Neutral):

Conducted Disturbance Emissions - Voltage



Note: Both AC Conducted General Limits and Class A Unintentional Limits are displayed. Emissions observed below 3 MHz are sourced from the power supply switching circuit (approximately 42 kHz) and are regarded as unintentional emissions, therefore Class A unintentional limit is applied.

Test 3, Item A – Frequency Table: Conducted Disturbance Emissions – Voltage

Test Item (A-Z)	Detector Type* (P/Q/A)	Measured Conductor (Name)	Measured Frequency (MHz)	Measured Value (dBuV)	Equip Correction (dB)	Corrected Value (dBuV)	Quasi-Peak Limit (dBuV)	Spec Margin (dB)	Average Limit (dBuV)	Spec Margin (dB)	See Comment (#)**
A	P	Line	0.1721	44.4	10.6	55.0	79.0	-24.0	66.0	-11.0	1
A	P	Line	0.2155	39.7	10.6	50.3	79.0	-28.7	60.0	-9.7	1, 2
A	P	Line	0.2589	33.3	10.6	43.9	79.0	-35.1	60.0	-16.1	1
A	P	Line	2.3248	29.1	10.9	40.0	73.0	-33.0	60.0	-20.0	1
A	P	Line	9.8769	21.1	11.3	32.4	73.0	-40.6	50.0	-17.6	
A	P	Line	22.4382	22.6	11.6	34.2	73.0	-38.8	50.0	-15.8	
A	P	Neutral	0.1730	43.0	10.6	53.6	79.0	-25.4	66.0	-12.4	1
A	P	Neutral	0.2155	38.7	10.6	49.3	79.0	-29.7	60.0	-10.7	1
A	P	Neutral	0.2589	32.9	10.6	43.5	79.0	-35.5	60.0	-16.5	1
A	P	Neutral	2.3635	29.3	10.9	40.2	73.0	-32.8	60.0	-19.8	1
A	P	Neutral	9.8286	20.7	11.2	31.9	73.0	-41.1	50.0	-18.1	
A	P	Neutral	22.4188	25.1	11.6	36.7	73.0	-36.3	50.0	-13.3	

* P = Peak, Q = Quasi-Peak, A = Average.

** # = See Comment Below.

Sample Calculation: Corrected Value = Measured Value (dBuV) + Equip Correction (dB)

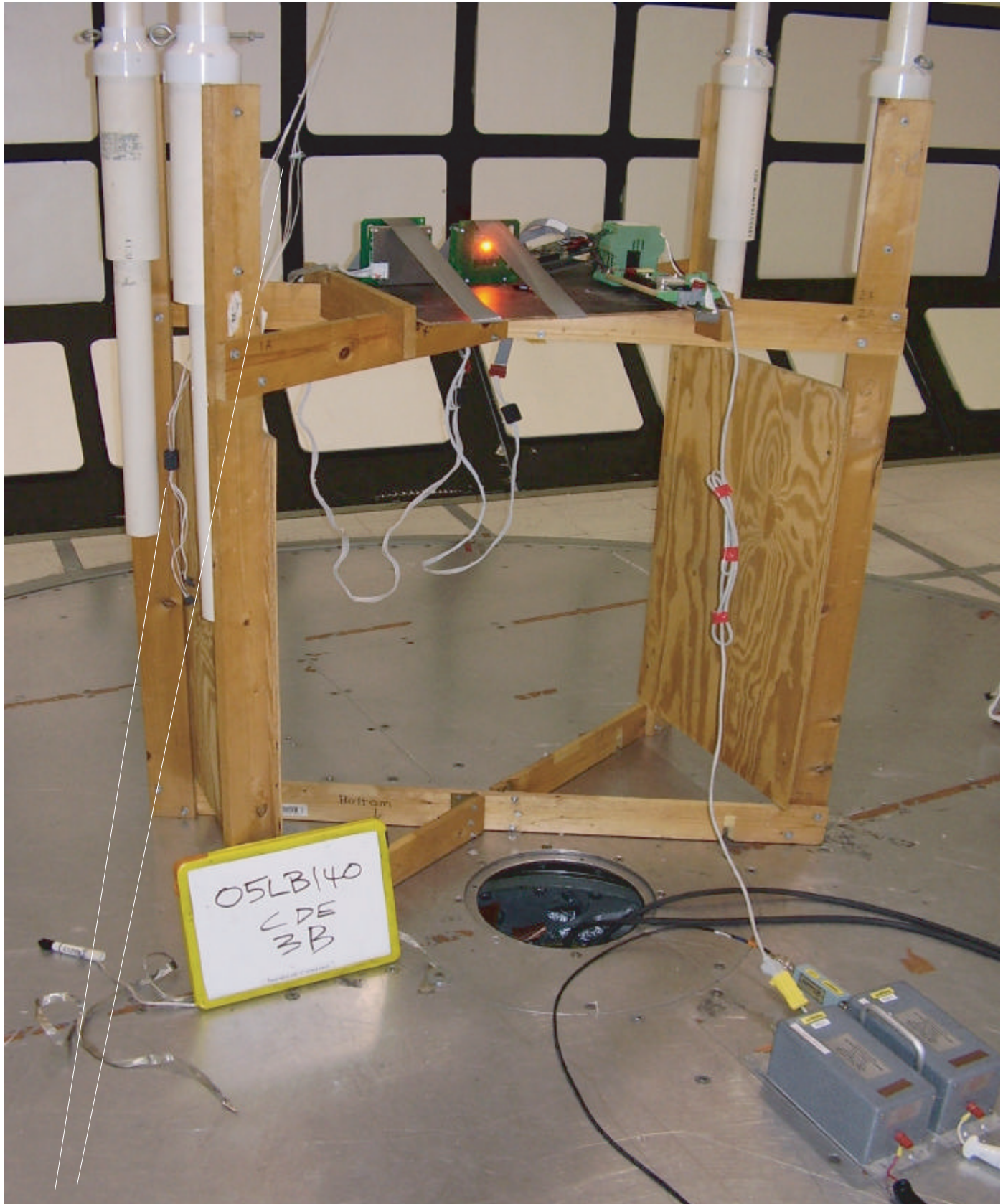
Sample Calculation: Equip Correction = LISN Factor (dB) + Cable Loss (dB) + Transient Limiter Loss (dB)

Comments:

Comment #	Description
1	Class A (unintentional) limits applied to power supply switching frequencies.
2	Highest Conducted Emission (unintentional) = 50.3 dBuV, or 327.3 uV, at 0.2155 MHz.
3	No conducted emissions were observed above measurement noise floor that could be attributed to the transmitter.

Test 3, Item A - Test Set-Up Photo:

Conducted Disturbance Emissions - Voltage



Overhead antenna configuration is not part of this grant application. Note cables with ferrites are visible for the overhead antenna configuration here.

Test 4: 99% Occupied Bandwidth

Test Requirement: 47 CFR Part 15, Subpart C

Test Specification: 47 CFR Part 15, Subpart C, Section 15.215

Test Procedure:

All testing was performed with a calibrated receiver and close field antenna located sufficiently close to the Equipment Under Test to receive a representative signal. The first measurement is performed at a sufficiently wide bandwidth to measure all, or nearly all, of the transmit power emitted. The reference line is placed 20 dB below the peak signal. The RBW is reduced until the observed signal is 1% to 3% of signal's 20 dB bandwidth, but not less than 100 Hz. Video Bandwidth is set to approximately 10 times the resolution bandwidth. The reference line is not readjusted. The left and right points on the signal that cross the reference line are marked and recorded as the 99% Occupied Bandwidth.

Occupied Bandwidth Limit - Section 15.209

Transmit Frequency MHz	Bandwidth Limit (% of fundamental)
All	Not Specified

Note: No limit for occupied bandwidth is specified for FCC Part 15.209, however the result is used to determine the emissions designator.

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 (Normal)	1 (Door Antenna)	1 (120V/60Hz)

Test 4 - Results:

99% Occupied Bandwidth

Test Results Summary:

Test Item	Test Location	Pass/Fail (P/F)	Date Completed	Comment #
A	E	N/A	10/14/05	

No Pass/Fail determination is required for this test.

Comments:

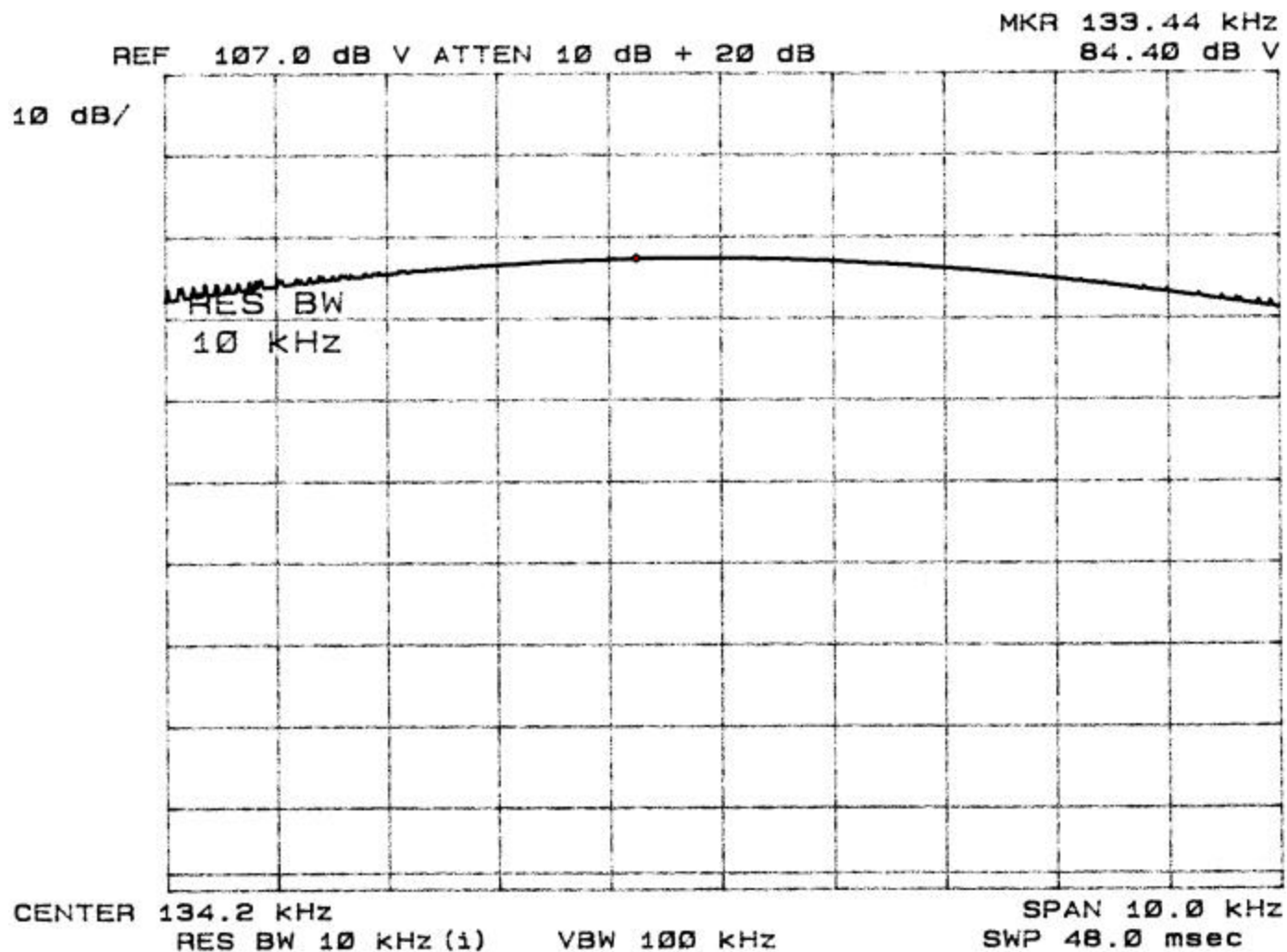
Comment #	Description

Test Equipment Used:

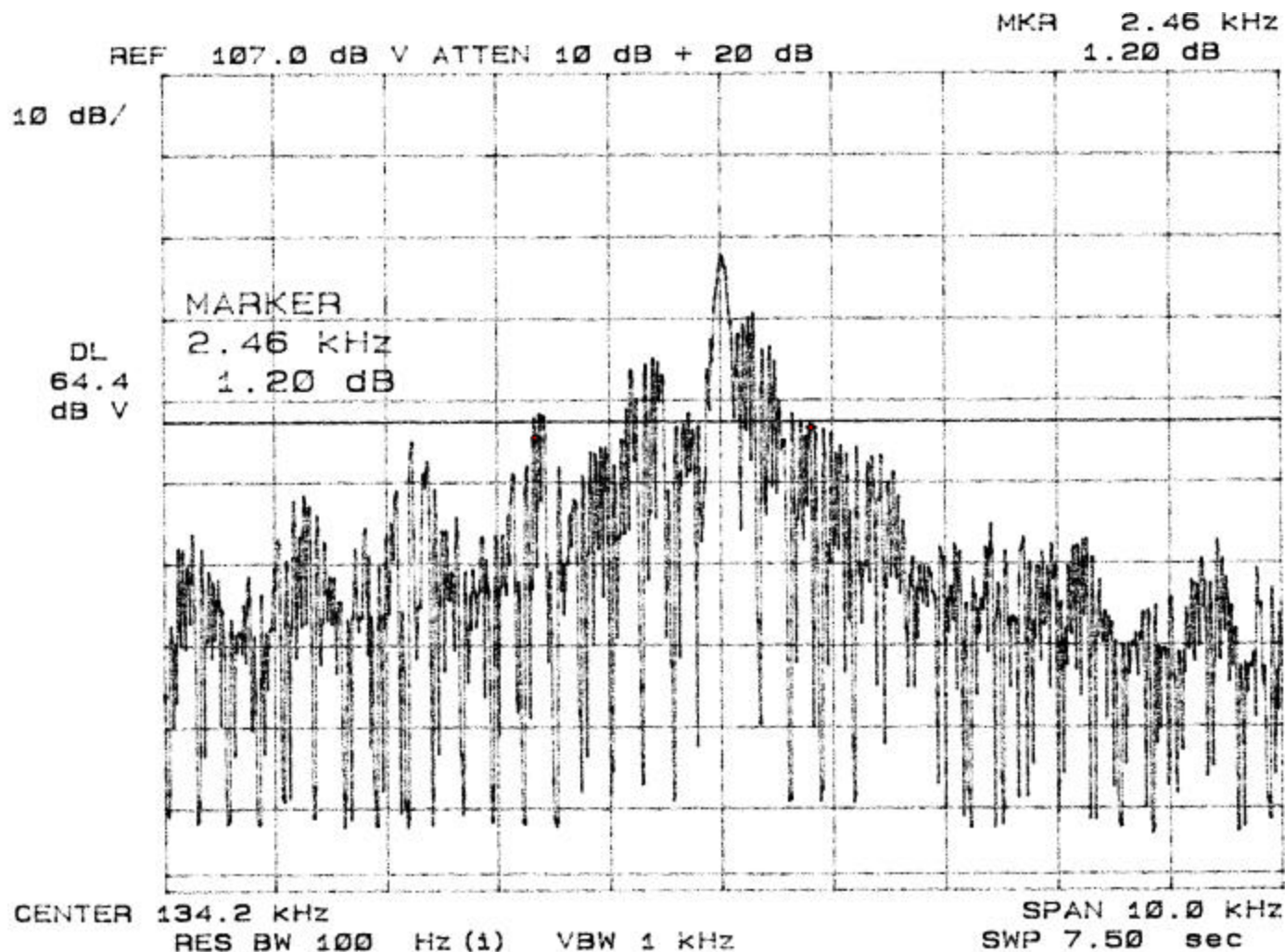
Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	2/12/05	2/28/06
-	Uncalibrated, 2-inch close-field loop antenna	EMCO	7405	N/A	N/A

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 ISO 17025:2005.

Test 4, Item A (Door Antenna, Wide Bandwidth Measurement):



Test 4, Item A (Door Antenna, 99% Occupied Bandwidth):



Discrete Data:

Occupied Bandwidth

Test Item (A-Z)	Center Frequency (kHz)	Measured Bandwidth (kHz)	Bandwidth (% of Center Frequency)	Maximum Permitted Bandwidth* (% of Center Frequency)	Pass/Fail (P/F)	See Comment (#)**
B	134.2	2.46	1.8358	N/A	P	

* No limit specified in 15.209, however bandwidth is needed for emissions designator

** # = See Comment Number Under This Test's Comments Section.

Test 5: Peak-to-Average Ratio

Test Requirement: 47 CFR Part 15, Subpart C

Test Specification: 47 CFR Part 15, Subpart C, Section 15.209

Test Procedure:

All testing was performed with a calibrated receiver and close field antenna located sufficiently close to the Equipment Under Test to receive a representative signal.

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 for this test, however the result of this test is used to calculate average values for the remaining measurements.

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 (Normal)	1 (Door Antenna)	1 (120V/60Hz)

Test 5 - Results:

Peak-to-Average Ratio

Test Results Summary:

Test Item	Test Location	Pass/Fail (P/F)	Date Completed	Comment #
A	E	N/A	10/14/05	

No Pass/Fail determination is required for this test.

Comments:

Comment #	Description

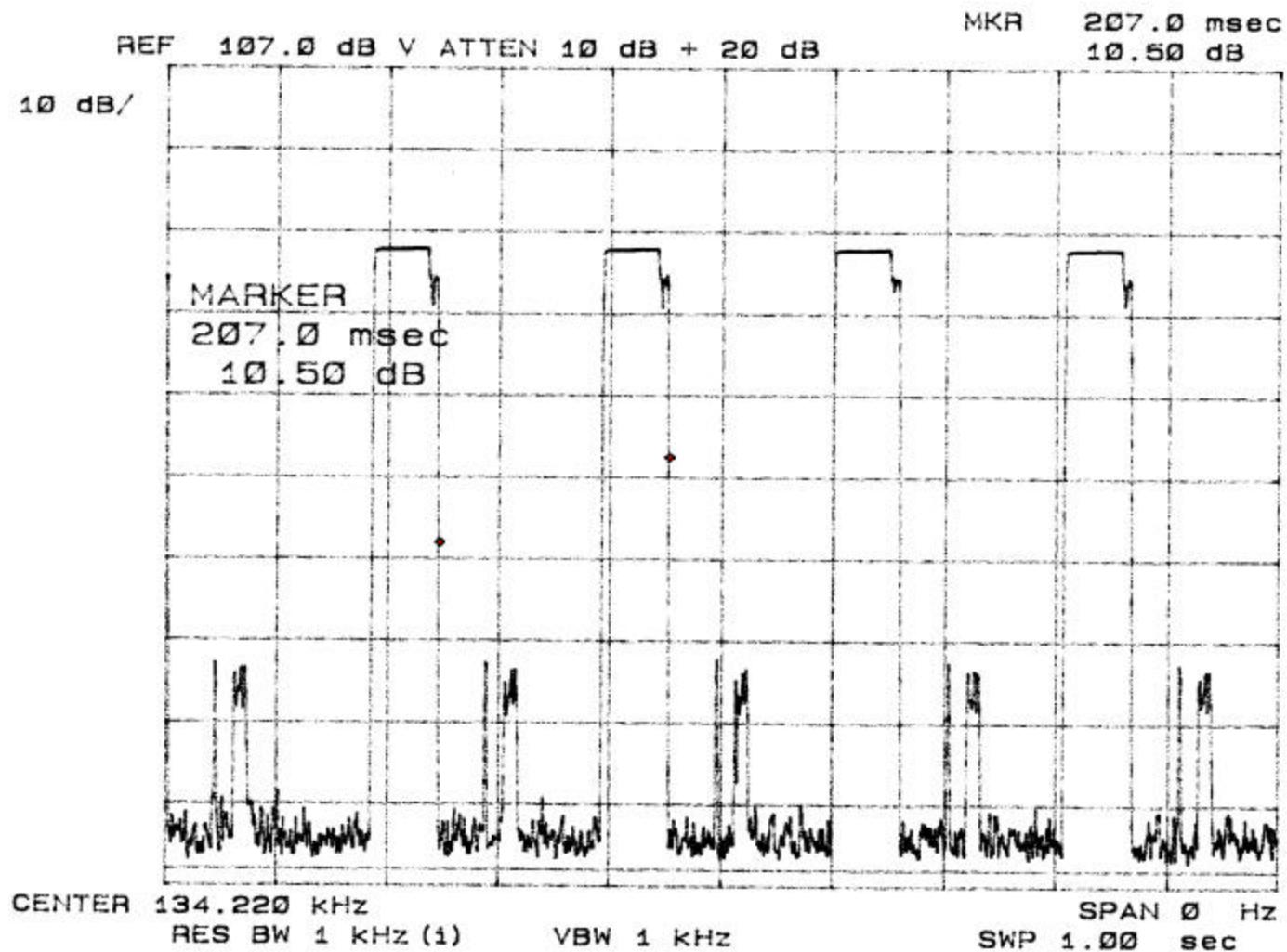
Test Equipment Used:

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SAR001	Spectrum Analyzer / Receiver	Hewlett-Packard	8572A	2/12/05	2/28/06
-	Uncalibrated, 2-inch close-field loop antenna	EMCO	7405	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 ISO 17025:2005.

Test 5, Item A (Door Antenna - Pulse Duration):

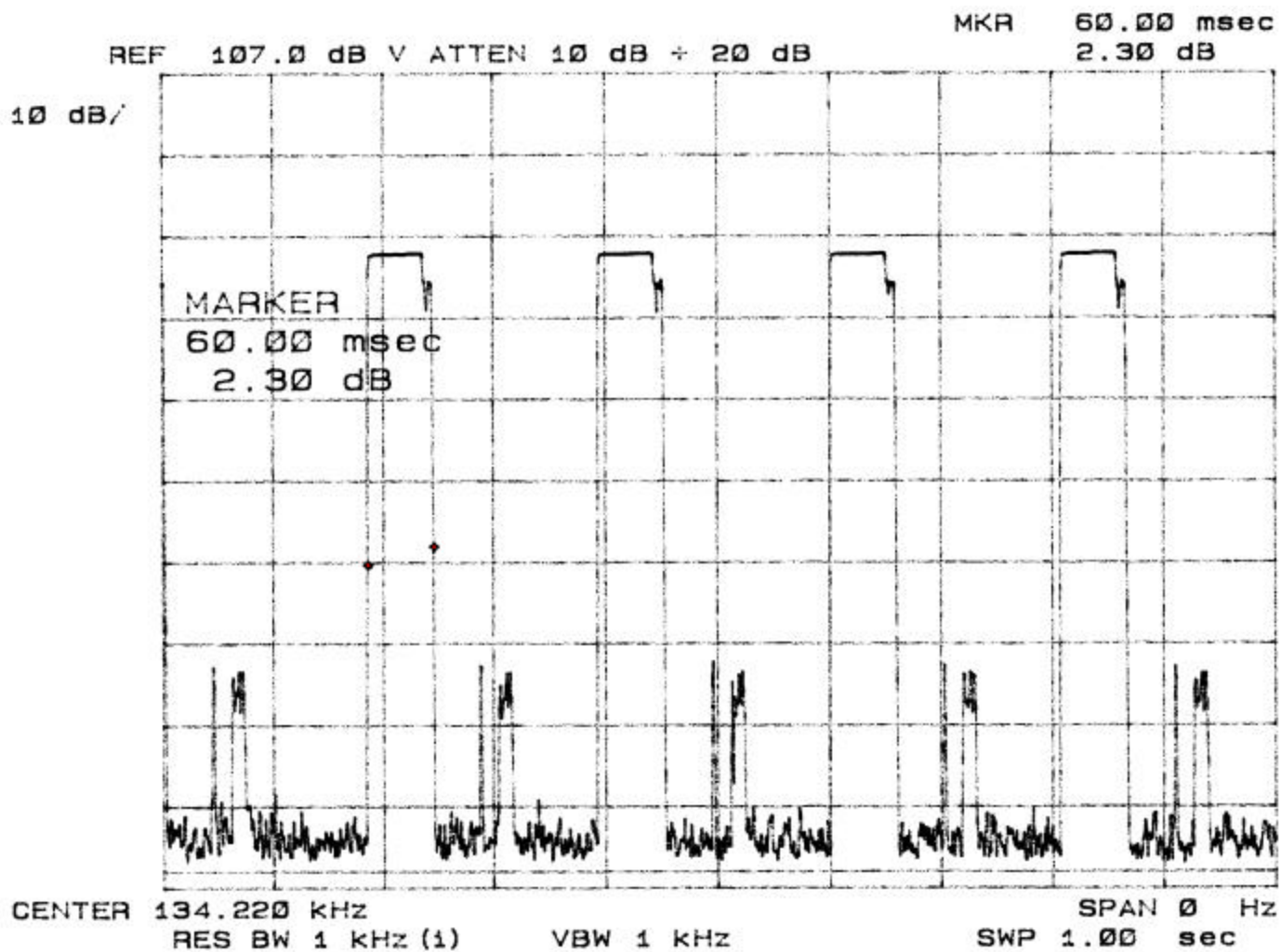
Peak-to-Average Ratio



Note: Lower amplitude signal is from "B" side of the pump. Reader alternates attempting to read each side of the pump for RFID tag.

Test 5, Item A (Door Antenna - Total Cycle Duration):

Peak-to-Average Ratio



Test 5, Item A (Door Antenna) – Calculation: Peak-to-Average Ratio

Test Item (A-Z)	Pulse Name	Pulses per Cycle	Duration per Pulse (ms)	Total Duration (Pulses times Duration)	See Comment (#)***
A	Pulse	1	60	60	
			Sum (ms)	60	

Test Item (A-Z)	Total ON time per transmission (mS)	Total Period of transmission (mS)*	Duty Cycle (ON time / total period)	Peak-to-Average Ratio (dB)**	See Comment (#)***
A	60	100 (actual is 207 ms)	0.6	-4.4	

* Or 100 milliseconds, whichever is less

** Peak-to-Average Ratio = $20 * \log(\text{Duty Cycle})$

*** # = See Comment Number Under The Preceding Test Comments Section.

Accreditation Certificates:



SCOPE OF ACCREDITATION TO ISO/IEC 17025:1999

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ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS NVLAP LAB CODE 200246-0

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 Similar Electrical Apparatus - Part 1: Emissions
12/CIS14a	EN 55014-1 (1993), A1 (1997), A2 (1999):
12/CIS14b	AS/NZS 1644 (1995):
12/CIS14c	CNS 13783-1: Electromagnetic Compatibility Requirements for household appliances, electric tools and similar apparatus - Part 1: Emissions
12/CIS22	IEC/CISPR 22 (1997) & EN 55022 (1996) + A1(2000): Limits and methods of measurement of radio disturbance characteristics of information technology equipment
12/CIS22a	IEC/CISPR 22 (1993) and EN 55022 (1994): Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1 (1995) and Amendment 2 (1996)
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)

2005-07-01 through 2006-06-30

Effective dates

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NVLAP Code Designation / Description

Safety Test Methods:

12/T41a	AS/NZS 60950 (2000): Safety of Information Technology Equipment (including Amendment 1)
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)
12/7620b	SBC-TP-76200, Issue 4 (May 2003): Network Equipment Power, Grounding, Environmental, and Physical Design Requirements (sections: 6.1B, 7.3, 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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NVLAP Code Designation / Description

12/EM03b	IEC 61000-3-3, Edition 1.1(2002-01) & 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(2003) 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, Ed. 1.2 (2001), A1, A2, EN 61000-4-2: Electrostatic Discharge Immunity Test
12/I02	IEC 61000-4-3, Ed. 2.0 (2002-05); EN 61000-4-3 (2002): Radiated Radio-Frequency Electromagnetic Field Immunity Test
12/I03	IEC 61000-4-4(1995), A1(2000), A2(2001), EN 61000-4-4: Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical Fast Transient/Burst Immunity Test
12/I04	IEC 61000-4-5, Ed. 1.1 (2001-04), EN 61000-4-5: Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
12/I05	IEC 61000-4-6, Ed. 2.0 (2003-05); EN 61000-4-6: Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
12/I06	IEC 61000-4-8, Ed. 1.1 (2001); EN 61000-4-8: Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test
12/I07	IEC 61000-4-11, Ed. 1.1 (2001-03); EN 61000-4-11: Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests

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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

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.