

15. Conducted Emissions Tests

Test Requirement: FCC Rules: 47CFR Part 15, Subpart B

Test Procedure: ANSI C63.4 - 1992

Date of Test: 24 December 2002

Laboratory: Test Site #2 (Acme, WA)

15.1 Test Equipment

- ⇒ Spectrum Analyzer (blue): Hewlett-Packard 8566B, Serial Number 2410A00168, Calibrated: 17 April 2002, Calibration Due Date: 17 April 2003
- ⇒ RF Preselector (blue): Hewlett-Packard 85685A, Serial Number 2648A00519, Calibrated: 17 April 2002, Calibration Due Date: 17 April 2003
- ⇒ Quasi Peak Adapter (blue): Hewlett-Packard 85650A, Serial Number 2043A00327, Calibrated: 17 April 2002, Calibration Due Date: 17 April 2003
- ⇒ Line Impedance Stabilization Networks: Solar Type 9408-50-R-24-BNC, Serial Number 941702, Calibrated: 08 November 2002, Calibration Due Date: 08 November 2003
- ⇒ Transient Limiter: Hewlett-Packard 11947A, Serial Number 3107A01879, Calibrated: 25 April 2002, Calibration Due Date: 25 April 2003
- ⇒ Line Conduction Test Site: Acme Testing Co., Test Site Number 2, Calibrated: 22 June 2002, Calibration Due Date: 22 June 2003

15.2 Purpose

The purpose of this test was to evaluate the level of conducted noise the EUT imposed on the AC Mains.

15.3 Test Procedures

The EUT was placed on a 1 meter long by 1.5 meters wide and 0.8 meter high nonconductive table that was placed directly on a flush-mounted turntable. The EUT was connected to its associated support equipment, with any excess I/O cabling bundled to approximately 1 meter. The EUT was connected to a dedicated LISN and all support equipment were connected to a second separate LISN circuit. The LISNs were bonded to the groundplane.

Prescan tests were performed to determine the “worst-case” mode of operation. With the EUT operating in “worst-case” mode, final conducted measurements were taken. Conducted measurements were made on each current carrying conductor with respect to ground.

Conducted Emissions Test Characteristics

| | |
|---|---------------------|
| Frequency range | 0.15 MHz - 30.0 MHz |
| Test instrumentation resolution bandwidth | 9 kHz |
| Lines Tested | Line 1/Line 2 |

15.4 Test Results

A summary of the highest amplitude conducted emissions is listed below.

FCC RULES: 47CFR PART 15, SUBPART B, SECTION 15.107,
CLASS B CONDUCTED EMISSIONS (CISPR LIMITS)
(0.15 MHz TO 30 MHz) 60 Hz/120 VAC

EUT IN RECEIVE MODE

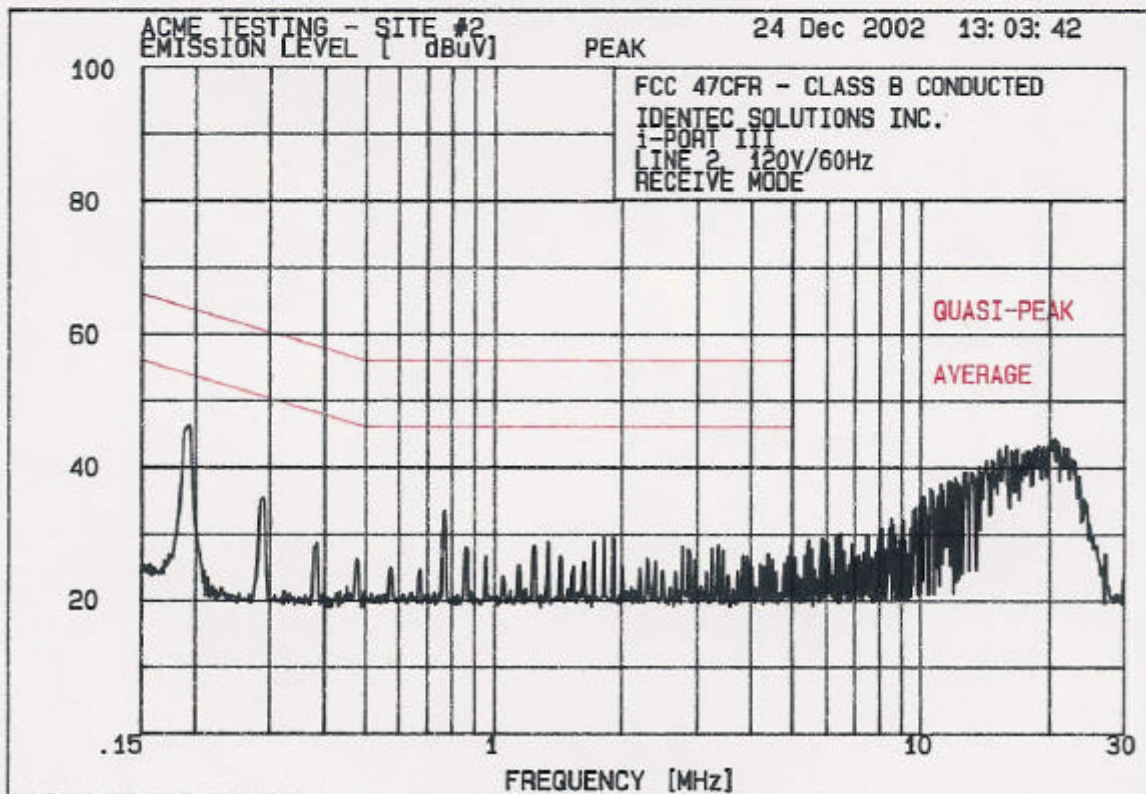
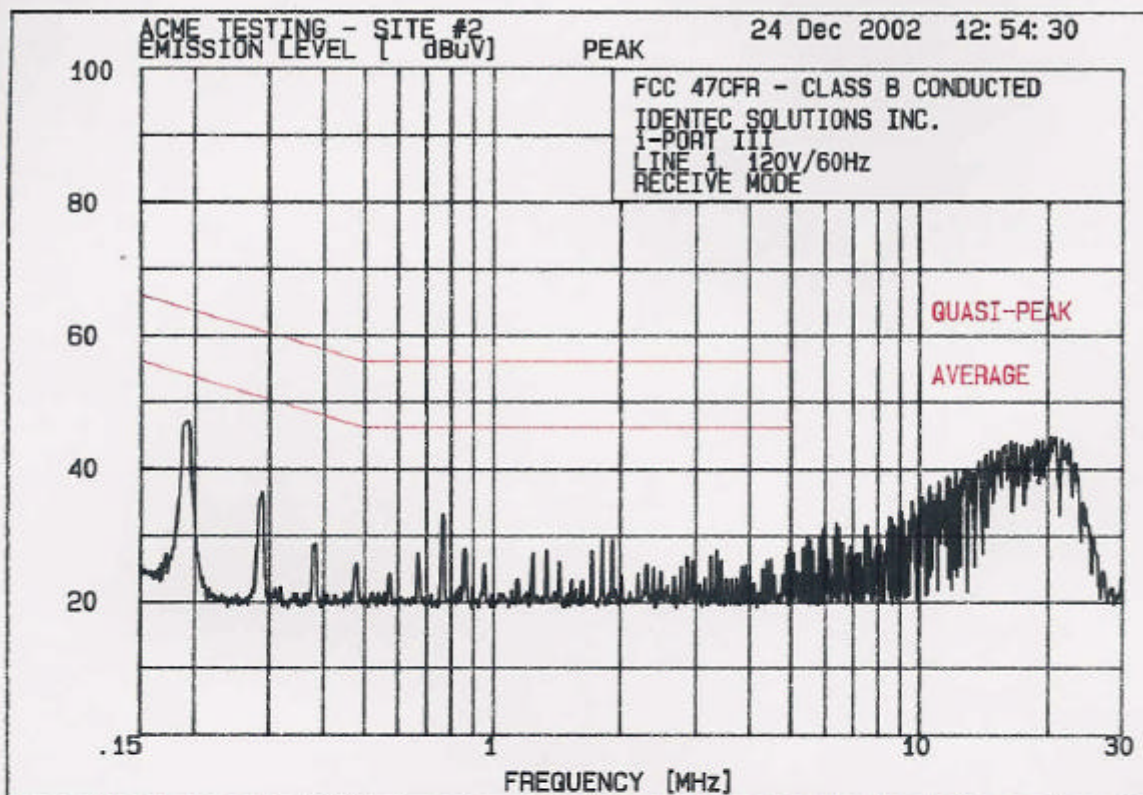
LINE 1 "HOT"

| PEAK # | FREQ. (MHz) | AMPL (dB μ V) |
|--------|-------------|-------------------|
| 1 | 0.1944 | 47.2 |
| 2 | 15.98 | 43.6 |
| 3 | 16.5 | 44.0 |
| 4 | 16.94 | 43.8 |
| 5 | 17.48 | 43.6 |
| 6 | 17.95 | 43.3 |
| 7 | 18.53 | 43.4 |
| 8 | 18.93 | 44.3 |
| 9 | 19.54 | 44.2 |
| 10 | 20.39 | 44.8 |
| 11 | 21.72 | 44.3 |

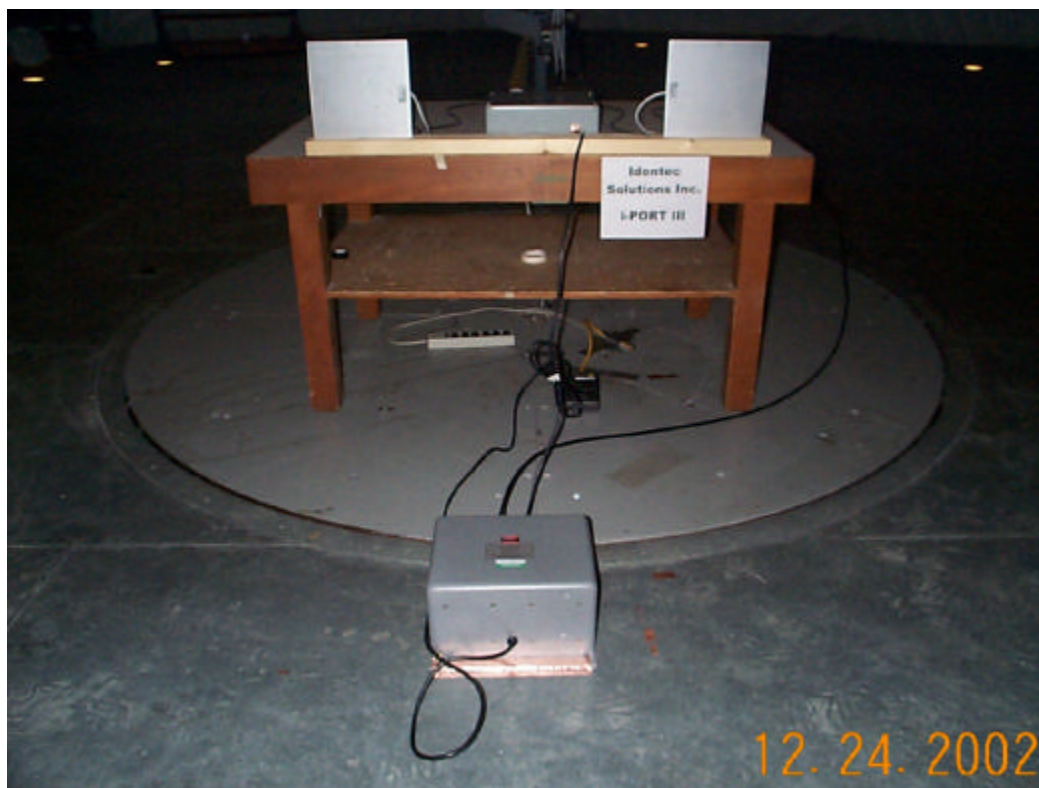
LINE 2 "NEUTRAL"

| PEAK # | FREQ. (MHz) | AMPL (dB μ V) |
|--------|-------------|-------------------|
| 1 | 0.1944 | 46.2 |
| 2 | 15.32 | 42.7 |
| 3 | 15.9 | 43.3 |
| 4 | 16.32 | 42.4 |
| 5 | 16.85 | 42.7 |
| 6 | 17.76 | 42.4 |
| 7 | 18.93 | 43.3 |
| 8 | 19.44 | 43.1 |
| 9 | 20.6 | 44.2 |
| 10 | 21.61 | 43.0 |

The EUT complied with the Class B Conducted Emissions Limits specified in 47CFR Part 15 Subpart B Section 15.107.



15.5 Test Setup Photographs



16. Radiated Emissions Tests

Test Requirement: FCC Rules: 47CFR Part 15, Subpart B

Test Procedure: ANSI C63.4 - 1992

Date of Test: 26 December 2002

Laboratory: Test Site #2 (Acme, WA)

16.1 Test Equipment

- ⇒ Spectrum Analyzer (blue): Hewlett-Packard 8566B, Serial Number 2410A00168, Calibrated: 17 April 2002, Calibration Due Date: 17 April 2003
- ⇒ RF Preselector (blue): Hewlett-Packard 85685A, Serial Number 2648A00519, Calibrated: 17 April 2002, Calibration Due Date: 17 April 2003
- ⇒ Quasi Peak Adapter (blue): Hewlett-Packard 85650A, Serial Number 2043A00327, Calibrated: 17 April 2002, Calibration Due Date: 17 April 2003
- ⇒ 1 GHz to 26 GHz Preamplifier: Hewlett Packard HP8449B/H02, Serial Number 2933A00198, Calibrated: 03 May 2001, Calibration Due Date: 03 May 2003
- ⇒ Loop Antenna (10 kHz – 30 MHz): EMCO 6502, Serial Number 2178 Calibrated: 26 December 2001, Calibration Due Date: 26 December 2002
- ⇒ Biconical Antenna (blue) (20 MHz to 200 MHz): EMCO 3110, Serial Number 1180, Calibrated: 14 June 2002, Calibration Due Date: 14 June 2003
- ⇒ Log Periodic Antenna (red) (200 MHz to 1000 MHz): EMCO 3146, Serial Number 9008-2853, Calibrated: 05 August 2002, Calibration Due Date: 05 August 2003
- ⇒ Double Ridge Guide Horn Antenna: (1 GHz to 18 GHz): EMCO 3115, Serial Number 9807-5534, Calibrated: 16 September 2002, Calibration Due Date: 16 September 2003
- ⇒ Turntable: Rothenbuhler Engineering, Custom, No Calibration Required
- ⇒ Turntable Position Controller: EMCO 1051, Serial Number 9002-1457, No Calibration Required
- ⇒ Antenna Mast and Controller: EMCO 1061, Serial Number 9003-1440, No Calibration Required
- ⇒ Open Area Test Site: Acme Testing Co., Test Site Number 2, Calibrated: 22 June 2002, Calibration Due Date: 22 June 2003

16.2 Purpose

The purpose of this test was to evaluate the radiated electromagnetic interference characteristics of the EUT.

16.3 Test Procedures

The EUT was placed on a 1 meter long by 1.5 meters wide by 0.8 meter high nonconductive table that was placed directly onto a flush mounted turn table. The EUT was connected to its associated peripherals with any excess I/O cabling bundled to approximately 1 meter.

With the EUT operating in “Receive” mode, emissions from the EUT were maximized by manipulating the cables, and by adjusting the polarization and height of the Detection System’s receive antenna and rotating the EUT on the turntable.

Note: During Testing, the EUT’s antennas were oriented in accordance with the manufacturer’s installation requirement.

Radiated Emissions Test Characteristics

| | |
|---|--|
| Frequency range | 30 MHz - 5000 MHz |
| Test distance | 3 m |
| Test instrumentation resolution bandwidth | 120 kHz (30 Mhz – 1 GHz); 1 MHz (1 GHz – 5 GHz) |
| Receive antenna scan height | 1 m - 4 m |
| Receive antenna polarization | Vertical/Horizontal |

16.4 Test Results

A summary of the highest amplitude Radiated Emission is listed below:

FCC RULES: 47CFR PART 15 SUBPART SECTION 15.109 CLASS B (CISPR LIMITS)
(30 MHz – 5000 MHz) 60 Hz/120 VAC

EUT IN RECEIVE MODE

| No | EMISSION FREQUENCY MHz | SPEC LIMIT dBuV/m | MEASUREMENTS ABS dB | dLIM dB | MODE | POL | SITE HGT cm | AZM deg | CORR FACTOR dB |
|----|------------------------------|-------------------------|---------------------------|------------|------|-----|-------------------|------------|----------------------|
| 1 | 133.734 | 43.5 | 35.4 | -8.1 | QP | V | 107 | 237 | 16.3 |
| 2 | 205.743 | 43.5 | 37.6 | -5.9 | QP | H | 144 | 100 | 14.3 |
| 3 | 212.385 | 43.5 | 40.6 | -2.9 | QP | H | 184 | 123 | 14.2 |
| 4 | 464.517 | 46.0 | 37.9 | -8.1 | QP | H | 100 | 285 | 22.3 |
| 5 | 497.709 | 46.0 | 38.7 | -7.3 | QP | H | 100 | 304 | 23.2 |
| 6 | 564.052 | 46.0 | 42.0 | -4.0 | QP | H | 185 | 153 | 24.5 |

Only the 6 (six) highest amplitude radiated emissions are listed above.

The EUT complied with the Class B Radiated Emissions Limits specified in 47CFR Part 15 Subpart B Section 15.109.

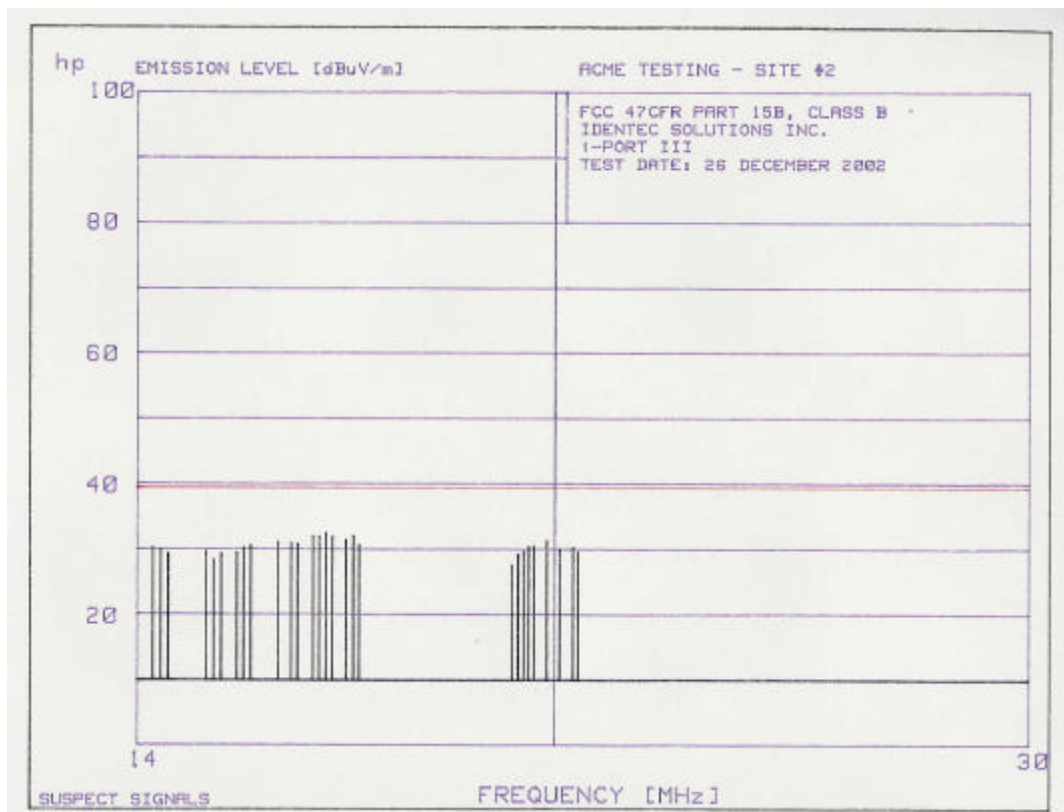
ACME TESTING - SITE #2
ALL SUSPECTS

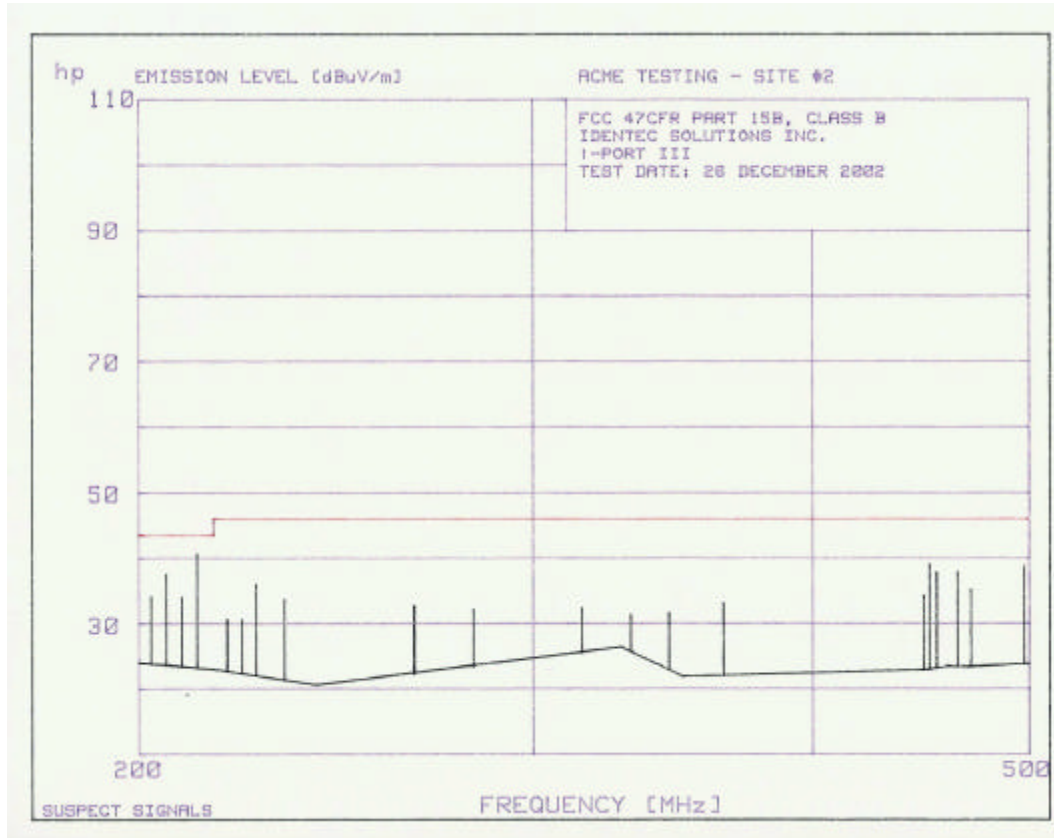
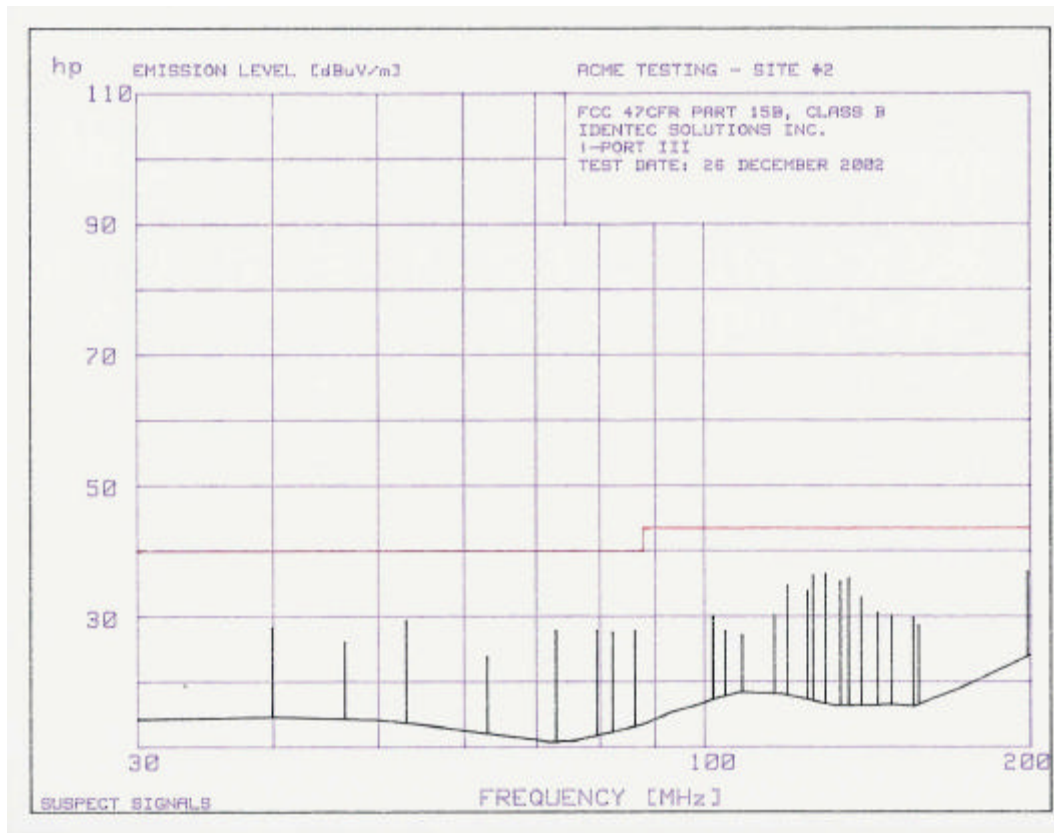
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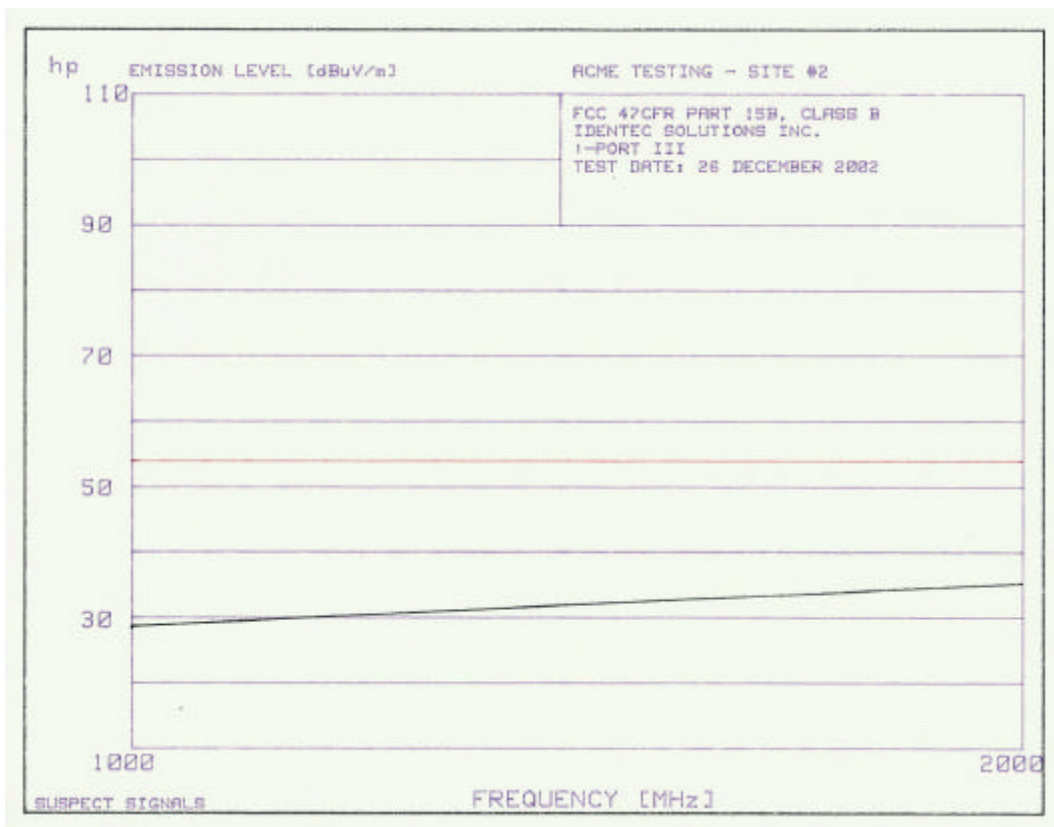
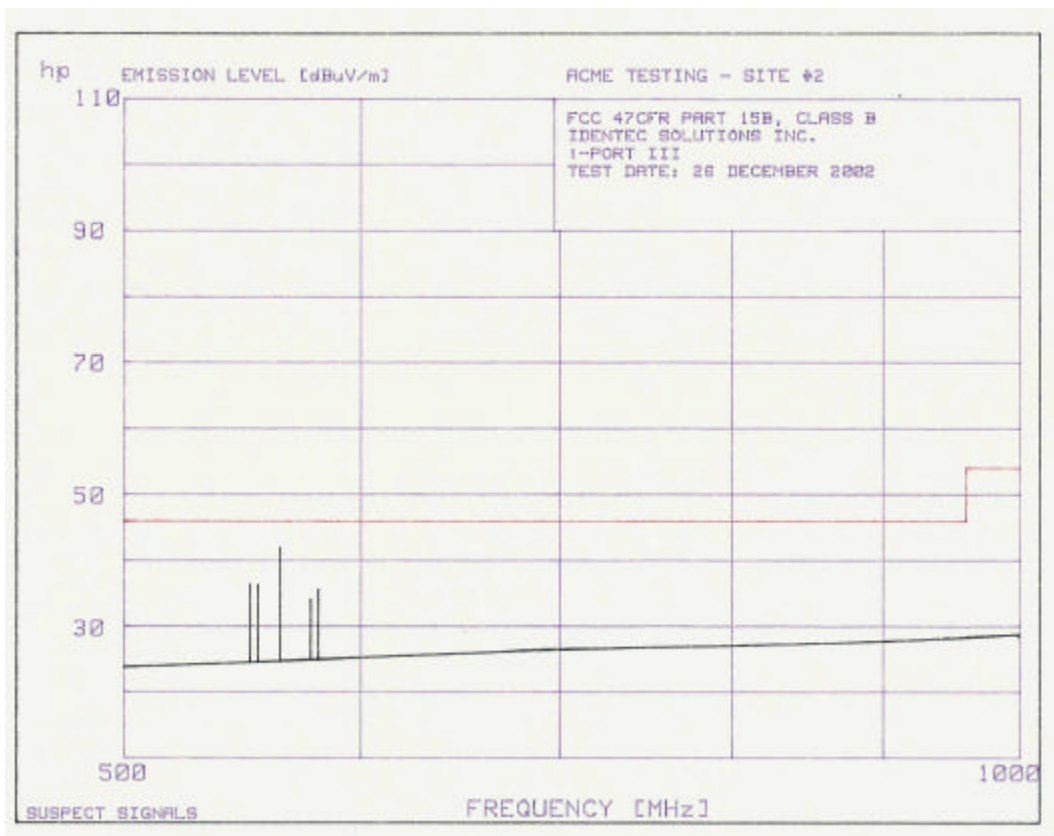
| No | FREQ MHz | BND | PEAK LIM | ABS | ANT P | AZ cm deg | COMMENTS |
|------|-------------|-----|-------------|------|----------|--------------|----------|
| 1 | 14.192 | 22 | -9 | 30.3 | V150 | 189 | |
| 2 | 14.287 | 22 | -9 | 30.0 | V150 | 189 | |
| 3 | 14.378 | 22 | -10 | 29.3 | V150 | 189 | |
| 4 | 14.858 | 22 | -10 | 29.7 | V150 | 189 | |
| 5 | 14.949 | 22 | -11 | 28.4 | V150 | 189 | |
| 6 | 15.043 | 23 | -10 | 29.3 | V150 | 189 | |
| 7 | 15.246 | 23 | -10 | 29.5 | V150 | 189 | |
| 8 | 15.340 | 23 | -9 | 30.3 | V150 | 189 | |
| 9 | 15.429 | 23 | -9 | 30.6 | V150 | 189 | |
| 10 | 15.796 | 24 | -8 | 31.1 | V150 | 189 | |
| 11 | 15.974 | 24 | -9 | 30.9 | V150 | 189 | |
| 12 | 16.064 | 24 | -9 | 30.7 | V150 | 189 | |
| 13 | 16.273 | 24 | -7 | 32.0 | V150 | 189 | |
| 14 | 16.364 | 24 | -8 | 31.9 | V150 | 189 | |
| 15 | 16.454 | 24 | -7 | 32.5 | V150 | 189 | |
| 16 | 16.551 | 24 | -8 | 31.9 | V150 | 189 | |
| 17 | 16.744 | 24 | -8 | 31.4 | V150 | 189 | |
| 18 | 16.844 | 24 | -7 | 32.1 | V150 | 189 | |
| 19 | 16.933 | 24 | -9 | 30.7 | V150 | 189 | |
| 20 | 19.293 | 25 | -12 | 27.5 | V150 | 189 | |
| 21 | 19.395 | 25 | -10 | 29.2 | V150 | 189 | |
| 22 | 19.487 | 25 | -10 | 29.7 | V150 | 189 | |
| 23 | 19.573 | 25 | -9 | 30.4 | V150 | 189 | |
| 24 | 19.659 | 25 | -9 | 30.5 | V150 | 189 | |
| 25 | 19.873 | 25 | -8 | 31.3 | V150 | 189 | |
| 26 | 20.09 | 26 | -9 | 30.1 | V150 | 189 | |
| 27 | 20.32 | 26 | -9 | 30.3 | V150 | 189 | |
| 28 | 20.41 | 26 | -10 | 29.6 | V150 | 189 | |
| 29 | 39.92 | 27 | -12 | 28.3 | V107 | 274 | |
| 30 | 46.60 | 27 | -14 | 26.1 | V107 | 272 | |
| 31 | 53.125 | 27 | -11 | 29.4 | V107 | 315 | |
| 32 | 63.16 | 27 | -16 | 23.9 | V107 | 278 | |
| 33 | 73.016 | 27 | -12 | 27.9 | V107 | 31 | |
| 34 | 79.64 | 27 | -12 | 27.9 | V107 | 246 | |
| 35 | 82.34 | 27 | -12 | 27.6 | V107 | 246 | |
| 36 | 86.30 | 27 | -12 | 27.8 | V107 | 246 | |
| 37 | 101.988 | 27 | -13 | 30.0 | V107 | 224 | |
| 38 | 104.719 | 27 | -16 | 27.8 | V107 | 245 | |
| 39 | 108.43 | 27 | -16 | 27.2 | V107 | 245 | |
| 40 | 116.20 | 27 | -13 | 30.2 | V107 | 245 | |
| 41 | 119.49 | 27 | -9 | 34.7 | V107 | 240 | |
| 42 | 124.64 | 27 | -10 | 34.0 | V107 | 240 | |
| 43 | 126.15 | 27 | -7 | 36.3 | V107 | 240 | |
| 44 | 129.54 | 27 | -7 | 36.6 | V107 | 240 | |
| * 45 | 133.734 | 27 | -5 | 38.1 | V107 | 237 | |
| 46 | 136.033 | 27 | -8 | 35.9 | V107 | 240 | |
| 47 | 139.684 | 27 | -11 | 33.0 | V107 | 240 | |
| 48 | 144.734 | 27 | -13 | 30.6 | V107 | 240 | |
| 49 | 149.022 | 27 | -13 | 30.1 | V107 | 209 | |
| 50 | 156.013 | 27 | -14 | 29.8 | V107 | 209 | |
| 51 | 157.89 | 27 | -15 | 28.7 | V107 | 217 | |
| 52 | 199.091 | 27 | -7 | 36.9 | V107 | 260 | |
| 53 | 202.46 | 28 | -9 | 34.1 | H142 | 100 | |
| * 54 | 205.743 | 28 | -3 | 40.0 | H144 | 100 | |

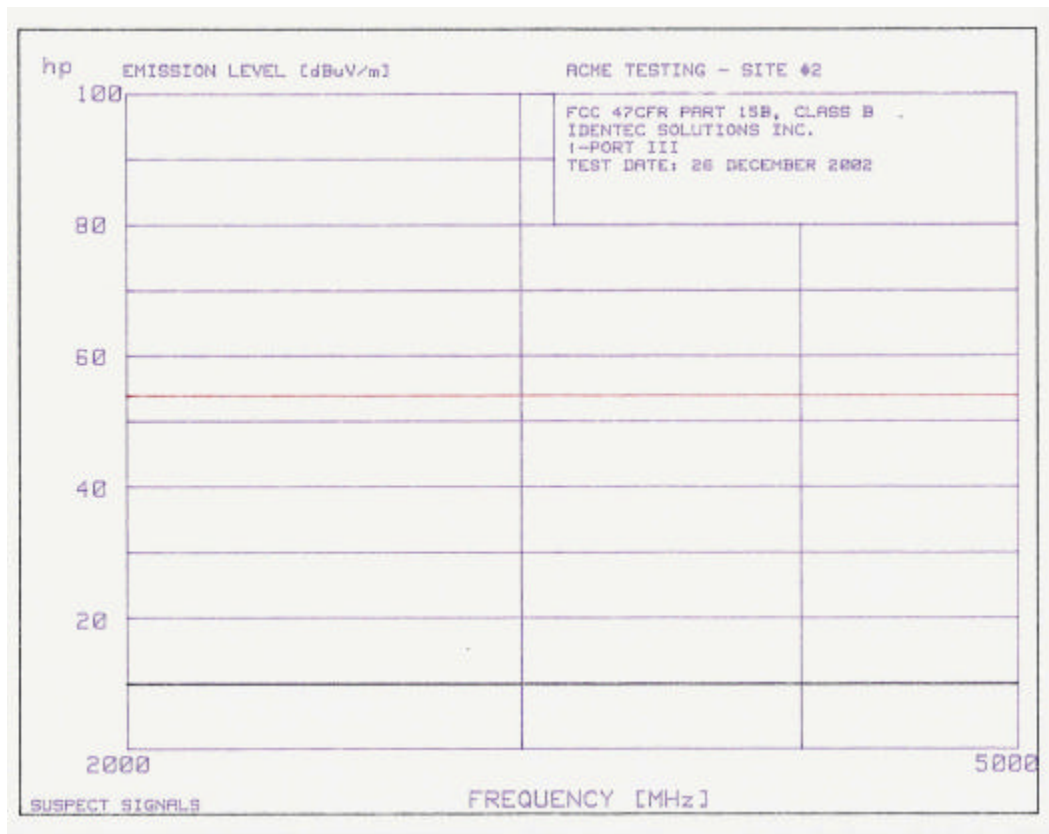
| | | | | | | |
|----|---------|---------|-----|------|------|----------|
| 55 | 209.10 | 28 | -9 | 34.0 | H142 | 100 |
| * | 56 | 212.385 | 28 | -2 | 41.4 | H184 123 |
| 57 | 219.05 | 28 | -15 | 30.7 | H143 | 98 |
| 58 | 222.37 | 28 | -15 | 30.6 | H143 | 98 |
| 59 | 225.66 | 28 | -10 | 36.1 | H143 | 98 |
| 60 | 232.35 | 28 | -12 | 33.7 | H143 | 98 |
| 61 | 265.51 | 28 | -13 | 32.7 | H118 | 93 |
| 62 | 282.25 | 28 | -14 | 32.2 | H118 | 93 |
| 63 | 315.63 | 28 | -14 | 32.4 | H100 | 145 |
| 64 | 331.82 | 28 | -15 | 31.4 | H100 | 150 |
| 65 | 345.19 | 28 | -14 | 31.7 | H100 | 150 |
| 66 | 365.0 | 28 | -13 | 33.2 | H100 | 153 |
| 67 | 448.5 | 28 | -12 | 34.3 | H100 | 72 |
| 68 | 451.277 | 28 | -7 | 39.0 | H100 | 284 |
| 69 | 454.60 | 28 | -8 | 37.9 | H100 | 284 |
| * | 70 | 464.517 | 28 | -6 | 39.8 | H100 285 |
| 71 | 471.0 | 28 | -11 | 35.2 | H100 | 285 |
| * | 72 | 497.709 | 28 | -6 | 40.0 | H100 304 |
| 73 | 551.1 | 28 | -10 | 36.4 | H100 | 285 |
| 74 | 554.4 | 28 | -10 | 36.3 | H100 | 285 |
| * | 75 | 564.052 | 28 | -3 | 43.0 | H185 153 |
| 76 | 577.8 | 28 | -12 | 34.1 | H100 | 150 |
| 77 | 581.2 | 28 | -10 | 35.6 | H100 | 150 |

* denotes a Final List signal









16.5 Test Setup Photographs



