

# EMC EMISSION - TEST REPORT

Test Report No. **B914901** Issue Date 30 April 1999

Model / Serial No. HG200A / SFA001

Product Type Ankle-Mount Low Power RF Transmitter

Client BI Inc.

Manufacturer BI Inc.

License holder BI Inc.

Address 6400 Lookout Road  
Boulder, CO 80301

Test Criteria Applied **FCC Part 15C 15.231**

Test Start Date: 26 April 1999

Test End Date: 26 April 1999

Test Result **■ PASS □ FAIL**

Test Report Project No. **BC1G914901**

Total Pages including  
Appendices **38**



Reviewed By : Felix J. Chavez



Reviewed By : Shawn Singh

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## DIRECTORY - EMISSIONS

| <b>Documentation</b>               | <b>Page(s)</b>  |
|------------------------------------|-----------------|
| Test report                        | <u>1 - 3</u>    |
| Directory                          | <u>2</u>        |
| Test Regulations                   | <u>3</u>        |
| General Remarks                    | <u>3</u>        |
| Test-setup Photographs             | <u>4-5</u>      |
| Test Equipment Used                | <u>6-8</u>      |
| <br><b>Appendix A</b>              |                 |
| Transmitter Data Sheets            | <u>A1 - A2</u>  |
| <br><b>Appendix B</b>              |                 |
| Detailed Test Data Sheets          | <u>B1 - B8</u>  |
| <br><b>Appendix C</b>              |                 |
| Plot of 20 dB bandwidth            | <u>C1 - C2</u>  |
| <br><b>Appendix D</b>              |                 |
| Plots of Calculated Duty Cycle     | <u>D1 - D3</u>  |
| <br><b>Appendix E</b>              |                 |
| Test Plan/Constructional Data Form | <u>E1 - E12</u> |
| <br><b>Appendix F</b>              |                 |
| Measurement of Protocol            | <u>F1 - F3</u>  |



## EMISSIONS TEST REGULATIONS :

The tests were performed according to following regulations :

- |   |  |   |
|---|--|---|
| <input checked="" type="checkbox"/> - Federal Communication Commission part 15            | <input type="checkbox"/> - Class A           | <input checked="" type="checkbox"/> - Class B |
| <input checked="" type="checkbox"/> - Federal Communication Commission part 15, Subpart C | <input checked="" type="checkbox"/> - 15.209 | <input checked="" type="checkbox"/> - 15.231  |

All tests performed according to ANSI C63.4.

## Emission Test Results:

### Conducted emissions 150 kHz - 30 MHz

Test Result ☒ - PASS ☐ - FAIL ☒ - Not Applicable

Passing Margin \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: EUT is battery operated.

### Radiated emissions (electric field) 30 MHz - 1000 MHz (Unintentional Radiator)

Test Result ☒ - PASS ☐ - FAIL ☐ - Not Applicable

Passing Margin 25.1 dB at 43.3 MHz

Remarks: \_\_\_\_\_

### Radiated emissions (electric field) 314.2 MHz - 3142 MHz (Intentional Radiator)

Test Result ☒ - PASS ☐ - FAIL ☐ - Not Applicable

Passing Margin 1.7 dB at 314.2 MHz

Remarks: \_\_\_\_\_

## GENERAL REMARKS:

Modifications required to pass: None

Test Specification Deviations: Additions to or Exclusions from: None



Test-setup photo(s)  
Radiated Emissions





Test-setup photo(s):  
Conducted Emissions



Test Not Applicable



Test Equipment Used





# Colorado Test Equipment

26-Apr-99

Report: B9149 Date: 26 APR 99 Signature: Shawn Singh

Temp: 20.8°C Rel. Humd.: 39% Atmo. Pressure: 79.5 kPa

| Location | Tests              | Manufacturer      | Model Number  | Serial Number | Description                              | Cal Date  | Cal Due   |
|----------|--------------------|-------------------|---------------|---------------|--|-----------|-----------|
| PW       |                    | A.H Systems       | SAS-200-510   | 116           | Log Periodic Antenna                     |           |           |
| PW       | R                  | AH Systems        | SAS-200/510   | 705           | Log Periodic Antenna (300-1800 MHz)      | 06-Jul-98 | 06-Jul-99 |
| PW       | (R)                | AH Systems        | SAS-200/512   | 104           | Log Periodic Antenna (200-1500 MHz)      | 13-Jul-98 | 13-Jul-99 |
| PW       | R                  | AvAntek           | AFT97-8434-10 | 1007          | RF Pre-Amplifier (4-8 GHz)               | 19-Nov-98 | 19-Nov-99 |
| PW       | R                  | Avantek           | AWT-18037     | 1002          | RF Pre-Amplifier (8-18 GHz)              | 19-Nov-98 | 19-Nov-99 |
| PW       | R C                | California Instr. | 850T-1        | 68458         | Oscillator (45-5000 Hz)                  |           |           |
| PW       | R C                | California Instr. | 9000TCA/3-1   | 50666+        | Power Source 9KVA (45-5000 Hz, 0-280VAC) |           |           |
| PW       | R C                | Compaq            | 470A          | 23605277B504  | Monitor - PW Testbed                     |           |           |
| PW       | R C                | Compaq            | DeskPro 575   | g545HSY20483  | Computer for PW Testbed                  |           |           |
| PW       | R                  | Compliance Desig  | none          | RD-1          | Roberts Dipole Ant. Set (30-1000 MHz)    | 03-Mar-97 | 02-Mar-00 |
| PW       |                    | Elgar             | 1751SX-14     | 8786          | AC power source                          |           |           |
| PW       |                    | Elgar             | 1751SX-15     | 9314          | AC Power Source                          |           |           |
| PW       |                    | EMCO              | 1070-4        | 9206-1681     | Antenna tower with manual polarization   |           |           |
| PW       |                    | EMCO              | 1080/1081     | 9206-1636     | 2 meter dia. wood turntable              |           |           |
| PW       |                    | EMCO              | 3104C         | 3519          | Biconical Antenna                        | 01-Feb-99 | 01-Feb-00 |
| PW       | R                  | EMCO              | 3104C         | 9203-4508     | Biconical antenna                        |           |           |
| PW       | R                  | EMCO              | 3104C         | 9203-4508     | Biconical antenna                        | 19-Jun-98 | 19-Jun-99 |
| PW       | (R)                | EMCO              | 3108          | 2149          | Biconical Dipole Antenna (30-300 MHz)    | 19-Jun-98 | 19-Jun-99 |
| PW       | R                  | EMCO              | 3108          | 7059203-2457  | Biconical Dipole Antenna (30-300 MHz)    | 06-Jul-98 | 06-Jul-99 |
| PW       | (R)                | EMCO              | 3115          | 9205-3886     | Dbi Ridged Horn Antenna (1-18 GHz)       | 05-Apr-99 | 04-Apr-00 |
| PW       | -3, R              | EMCO              | 3146          | 9203-3376     | Log Periodic Antenna                     | 18-Jun-98 | 18-Jun-99 |
| PW       | C                  | EMCO              | 3825/2        | 9202-1945     | LISN                                     | 15-Jul-98 | 15-Jul-99 |
| PW       | C                  | EMCO              | 3825/2        | 9202-1946     | LISN                                     |           |           |
| PW       | C                  | EMCO              | 3825/2        | 9202-1946     | LISN                                     | 23-Jul-98 | 23-Jul-99 |
| PW       | R                  | EMCO              | 4610          | 9205-1199     | Royce field site source                  |           |           |
| PW       | C                  | EMCO              | 4620          | 9110-1015     | Conducted noise source                   |           |           |
| PW       | R                  | EMCO              | 6502          | 9205-2738     | Magnetic loop                            | 30-Oct-97 | 29-Oct-00 |
| PW       | R                  | EMCO              | 7405          | 9203-2175     | Near field probe set                     |           |           |
| PW       | CISPR14            | Fischer           | F-201         | 141           | Absorbing Clamp (30-300 MHz)             | 23-Mar-99 | 22-Mar-00 |
| PW       | C                  | Fischer           | F-33-1        | 356           | Current Probe (10 kHz - 250 MHz)         | 04-May-98 | 04-May-99 |
| PW       | (R)                | Gishard           | 600-1040 mb   | 002           | Altimeter                                |           |           |
| PW       | R                  | Hewlett Packard   | 11940A        | 2650A04527    | Close field probe                        |           |           |
| PW       | R                  | Hewlett Packard   | 11940A        | 2650A04563    | Close field probe                        |           |           |
| PW       | R                  | Hewlett Packard   | 11941A        | 2807A02957    | Close field probe                        |           |           |
| PW       | C                  | Hewlett Packard   | 11947A        | 2820A00277    | Transient Limiter                        | 19-Nov-98 | 19-Nov-99 |
| PW       | C                  | Hewlett Packard   | 11947A        | 3107A01975    | Transient Limiter                        |           |           |
| PW       | C                  | Hewlett Packard   | 11947A        | 3107A01975    | Transient Limiter                        | 17-Jun-98 | 17-Jun-99 |
| PW       | R                  | Hewlett Packard   | 11970A        | 3003A07640    | Harmonic Mixer                           | 27-Feb-98 | 29-Mar-99 |
| PW       | R                  | Hewlett Packard   | 11970K        | 2332A01280    | Harmonic Mixer                           | 27-Feb-98 | 29-Mar-99 |
| PW       | R                  | Hewlett Packard   | 11975A        | 2738A01557    | Amplifier                                | 18-Mar-99 | 17-Mar-00 |
| PW       |                    | Hewlett Packard   | 8444A         | 2325A07899    | Tracking Generator (1-1200 MHz)          | 19-Nov-98 | 19-Nov-99 |
| PW       | R                  | Hewlett Packard   | 8445B         | 2034A03223    | Pre-Selector                             | 24-Jun-98 | 24-Jun-99 |
| PW       | R C                | Hewlett Packard   | 8447D         | 2727A05399    | Amplifier (30-1000 MHz)                  |           |           |
| PW       | R C                | Hewlett Packard   | 8447D         | 2727A05399    | Amplifier (30-1000 MHz)                  | 18-Nov-98 | 18-Nov-99 |
| PW       | (R) C, RE101, CISP | Hewlett Packard   | 85650A        | 2043A00256    | Quasi Peak Adapter (set 1)               | 17-Jun-98 | 17-Jun-99 |
| PW       | R, C, RE101, CISP  | Hewlett Packard   | 85650A        | 2811A01300    | Quasi Peak Adapter                       | 23-Nov-98 | 23-Nov-99 |
| PW       | R, C, RE101, CISP  | Hewlett Packard   | 85662A        | 2318A04983    | Display Section (set 1)                  |           |           |
| PW       | R, C, RE101, CISP  | Hewlett Packard   | 85662A        | 2318A04983    | Display Section (set 1)                  | 17-Jun-98 | 17-Jun-99 |
| PW       | (R) C,             | Hewlett Packard   | 85662A        | 2403A08749    | Display Section                          | 15-Apr-99 | 14-Apr-00 |
| PW       | R, C               | Hewlett Packard   | 8566B         | 2115A00853    | Spectrum Analyzer (dc-22 GHz)            |           |           |
| PW       | R, C               | Hewlett Packard   | 8566B         | 2115A00853    | Spectrum Analyzer (dc-22 GHz)            | 11-Mar-98 | 11-Mar-99 |
| PW       | (R) C, RE101, CISP | Hewlett Packard   | 8566B         | 2410A00154    | Spectrum Analyzer (dc-22 GHz)            | 15-Apr-99 | 14-Apr-00 |

1

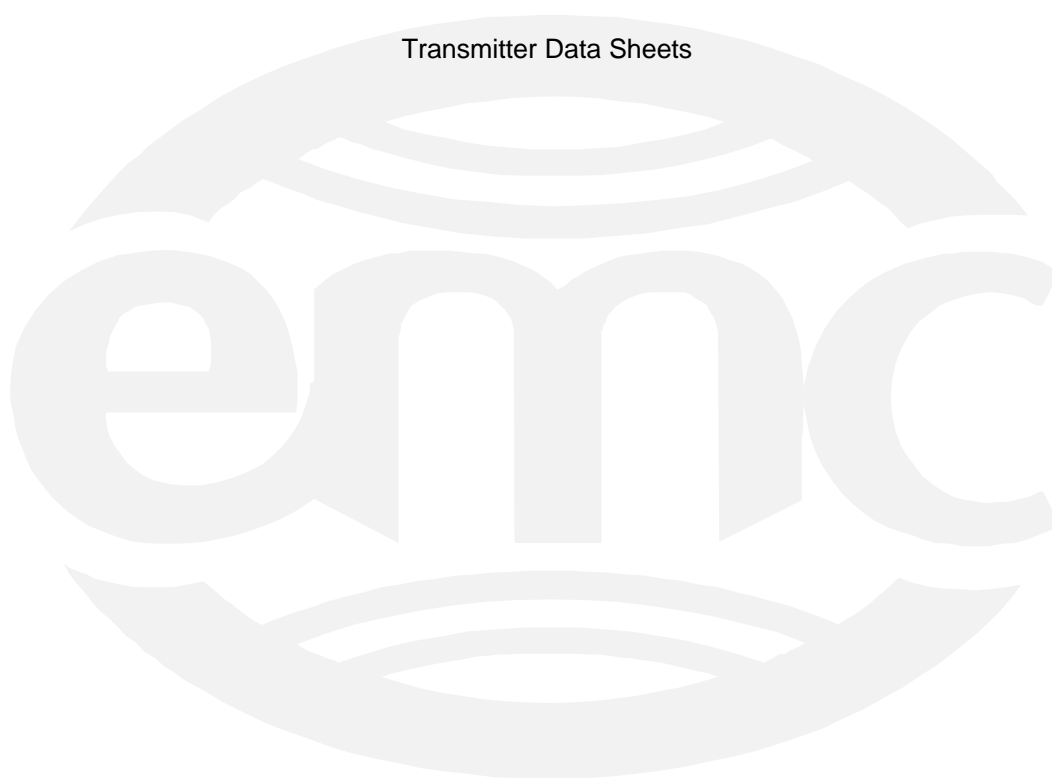


| Location | Tests              | Manufacturer        | Model Number   | Serial Number | Description                             | Cal Date  | Cal Due   |
|----------|--------------------|---------------------|----------------|---------------|---|-----------|-----------|
| PW       | R, C, RE101, CISP  | Hewlett Packard     | 8568B          | 2304A02508    | Spectrum Analyzer (set 1) (dc-1.8 Ghz)  |           |           |
| PW       | R, C, RE101, CISP  | Hewlett Packard     | 8568B          | 2304A02508    | Spectrum Analyzer (set 1) (dc-1.8 Ghz)  | 17-Jun-98 | 17-Jun-99 |
| PW       |                    | Hewlett Packard     | 8590           | 2722A02036    | Spectrum Analyzer                       |           |           |
| PW       | RE101, -8, -9, -11 | Hewlett Packard     | 8594E          | 3223A00145    | Spectrum Analyzer                       |           |           |
| PW       | RE101, -8, -9, -11 | Hewlett Packard     | 8594E          | 3223A00145    | Spectrum Analyzer                       | 03-Feb-99 | 03-Feb-00 |
| PW       | C                  | HP                  | 11947A         | 3107A01984    | Transient Limiter                       | 29-Oct-98 | 29-Oct-99 |
| PW       |                    | JFW                 | 50FH-003-100N  | 9825          | Attenuator                              |           |           |
| PW       |                    | JFW                 | 50FHB-003-5    | 00340         | Attenuator                              | 19-Nov-98 | 19-Nov-99 |
| PW       |                    | JFW                 | 50FHB-003-5    | 00363         | Attenuator                              | 19-Nov-98 | 19-Nov-99 |
| PW       |                    | JFW                 | 50FHB-006-5    | 00338         | Attenuator                              | 19-Nov-98 | 19-Nov-99 |
| PW       |                    | JFW                 | 50FHB-006-5    | 00339         | Attenuator                              | 19-Nov-98 | 19-Nov-99 |
| PW       | ✓ (2)              | Mini Circuits       | ZHL-1042J-SMA  | D020499-5     | Amplifier                               | 12-Feb-99 | 12-Feb-00 |
| PW       | -3                 | Mini-Circuits       | FK-3000        | 15542         | Doubler                                 |           |           |
| PW       | R                  | Mini-Circuits       | ZHL-1042J      | D020698-14    | RF Pre-Amplifier (10-4200 MHz)          | 13-Feb-98 | 13-Feb-99 |
| PW       |                    | Mini-Circuits       | ZHL-1042J(SMA) | D082098-3     | Amplifier                               | 23-Sep-98 | 23-Sep-99 |
| PW       | C                  | Polarad Electronics | ESH3-Z2        | 357.881J.32   | Transient Limiter                       |           |           |
| PW       | ✓                  | Radio Shack         | 63-867         | 005           | Temperature / Humidity Indicator        |           |           |
| PW       | C, R               | Rhode & Schwartz    | ESHS 30        | 842806/001    | EMI Test Receiver                       |           |           |
| PW       | C, R               | Rhode & Schwartz    | ESHS 30        | 842806/001    | EMI Test Receiver                       | 26-Oct-98 | 26-Oct-99 |
| PW       | C                  | Rhode & Schwarz     | ESH2-Z5        | 830364/002    | LISN 50 ohm/50uH 3 line (1kHz - 30 MHz) | 22-Mar-99 | 21-Mar-00 |
| PW       | C                  | Rhode & Schwarz     | ESH3           | 872318/036    | Low Frequency Receiver (9 kHz - 30 MHz) | 03-Sep-98 | 03-Sep-99 |
| PW       | R                  | Rhode & Schwarz     | HFH2-Z2        | 880665/042    | Loop Antenna (10 kHz - 30 MHz)          | 01-Apr-99 | 31-Mar-00 |
| PW       | C                  | Schwarzbeck         | NNLK 8129      | 8129126       | LISN                                    |           |           |
| PW       | C                  | Schwarzbeck         | NNLK 8129      | 8129126       | LISN                                    | 27-Oct-98 | 27-Oct-99 |
| PW       | C                  | Schwarzbeck         | TK 9416        | TUV-600       | Conducted Line Probe (150 kHz - 30 MHz) | 04-Apr-98 | 04-Apr-99 |
| PW       |                    | Shaffner            | NSG 431        | 1426          | ESD Tester                              |           |           |
| PW       | C                  | Solar               | 8028-50-TS-24- | 8305121       | LISN                                    | 19-Mar-99 | 18-Mar-00 |
| PW       | C                  | Solar               | 8028-50-TS-24- | 8305122       | LISN (10 kHz - 30 MHz)                  | 19-Mar-99 | 19-Mar-00 |
| PW       | R                  | Systron Donner      | DBD-520-15     | 1             | Antenna 18-26 ghz                       |           |           |
| PW       | R                  | Systron Donner      | DBE-520-15     | 2             | antenna-26 to 40 ghz                    |           |           |
| PW       |                    | Tensor              | 4105           | 2020          | Ridged Guide Antenna                    |           |           |
| PW       |                    | Tensor              | 4105           | 2020          | Ridged Guide Antenna                    | 11-Jun-98 | 11-Jun-99 |
| PW       |                    | Transjonic          | T-100          | 147           | Ion Meter                               |           |           |
| PW       |                    | TUV PS              | LPS-1          | 1             | P/S for Loop Antenna                    |           |           |
| PW       |                    | TUV PS              | TK1            | 01            | Voltage Probe                           | 06-Mar-98 | 06-Mar-99 |
| PW       |                    | WaveTek             | DM10XL         | 50313563      | multimeter                              | 17-Jun-98 | 17-Jun-99 |
| PW       |                    | WaveTek             | DM5XL          | 60206553      | Hand Held Multimeter                    |           |           |
| PW       |                    | Weinschel           | 2-3dB          | BC5530        | Attenuator                              | 19-Nov-98 | 19-Nov-99 |
| PW       |                    | Weinschel           | 2-3dB          | BC5539        | Attenuator                              | 19-Nov-98 | 19-Nov-99 |
| PW       |                    | Weinschel           | 2-6B           | BC6492        | Attenuator                              | 19-Nov-98 | 19-Nov-99 |
| PW       |                    | Weinschel           | 2-6dB          | BC6487        | Attenuator                              | 19-Nov-98 | 19-Nov-99 |



## Appendix A

Transmitter Data Sheets





B9149.XLS

## 15.231(e) PERIODIC OPERATION INTENTIONAL RADIATOR

**Date:** 26-Apr-99  
**EUT:** Ankle-Mount Low Power RF Transmitter  
**Manufacturer:** BI Inc.  
**Representative:** Don Melton

**Measured @**  
 314.2 MHz

**Miscellaneous Measurements:**

1) 20 dB Bandwidth 785 kHz

## Tx Mode: Radiated Measurements

**Calculated Averaging Factor:** -19.6 dB (20\*Log(duty cycle))  
**Averaging Factor Applied:** -19.6 dB

| Specification | Peak Measurement<br>dBuV/m @ MHz | Average Measurement<br>dBuV/m @ MHz | Delta<br>dB |
|---------------|----------------------------------|-------------------------------------|-------------|
| 67.6 dBuV/m   | 85.5                             | 65.9                                | -1.7        |

## Fundamental Field Strength:

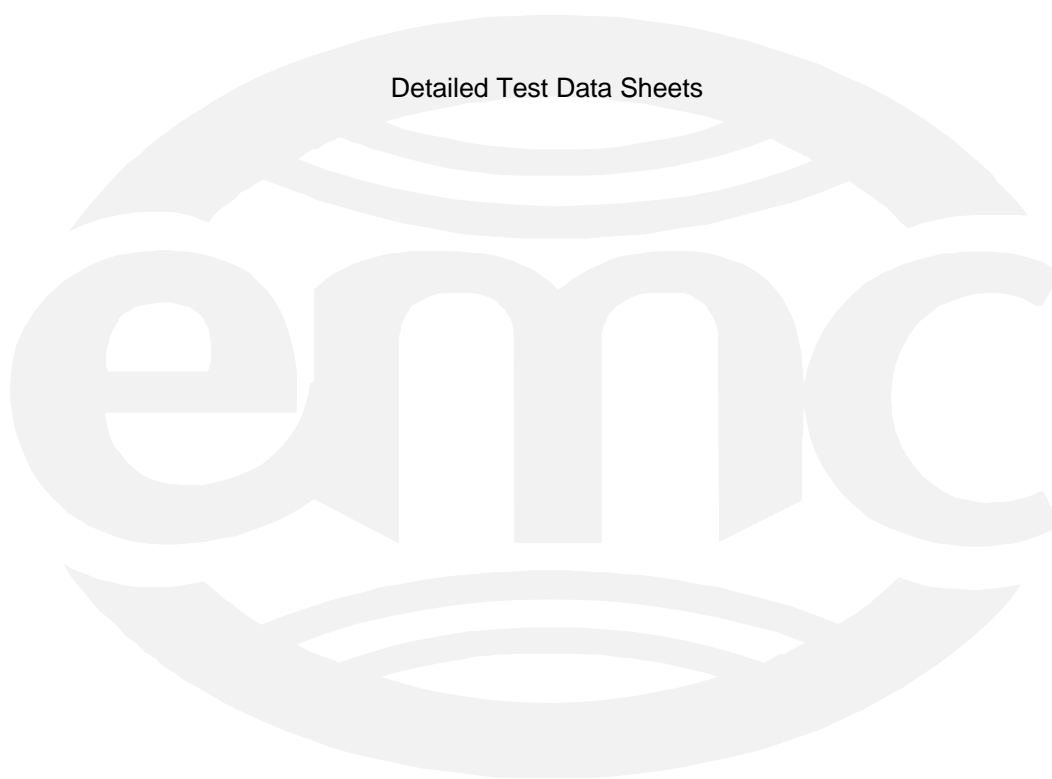
| Harmonics                 | Specification | Peak Measurement<br>dBuV/m @ MHz                         | Average Measurement<br>dBuV/m @ MHz | Delta<br>dB |
|---------------------------|---------------|--|-------------------------------------|-------------|
| 2nd harmonic (628.4 MHz)  | 47.6 dBuV/m   | 51.7   | 32.1                                | -15.5       |
| 3rd harmonic (942.6 MHz)  | 47.6 dBuV/m   | 50.6   | 31.0                                | -16.6       |
| 4th harmonic (1256.8 MHz) | 54 dBuV/m     | 50.7   | 31.1                                | -22.9       |
| 5th harmonic (1571 MHz)   | 54 dBuV/m     | 45.3   | 25.7                                | -28.3       |
| 6th harmonic (1885.2 MHz) | 54 dBuV/m     | 35.8   | 16.2                                | -37.8       |
| 7th harmonic (2199.4 MHz) | 54 dBuV/m     | No emissions were found above the receiver's noise floor |                                     |             |
| 8th harmonic (2513.6 MHz) | 54 dBuV/m     | 43.9   | 24.3                                | -29.7       |
| 9th harmonic (2827.8 MHz) | 54 dBuV/m     | 39.2   | 19.6                                | -34.4       |
| 10th harmonic (3142 MHz)  | 54 dBuV/m     | No emissions were found above the receiver's noise floor |                                     |             |

**Minimum Passing Margin:** -1.7 dB



## Appendix B

Detailed Test Data Sheets





# T U V P R O D U C T S E R V I C E

## RADIATED EMISSIONS

PW1 Test Site  
 3 Meter Antenna Distance  
 Equipment Under Test:  
 BI Inc., M/N: HG200A  
 FCC ID: CSQHG200A, S/N SFA001

Report B9149 Run 1  
 Date 04/26/99 Page 1

Engineer File 1x.  
 Tech: S S Shawn Singh  
 Requester \_\_\_\_\_

Notes: Ankle-Mount Low Power RF Transmitter, Fresh 3.6 Lithium Battery

| Frequency<br>MHz | Level<br>dBuV | Factor<br>dB | Cable<br>dB | Final<br>dBuV/m | Az<br>deg | Polar\<br>Height | Delta | Delta |
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|-------|-------|
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|-------|-------|

During the preliminary scan face down was found to be the worst case.  
 Peak readings. Average readings will be computed from duty cycle.

All frequencies are maximized.

Log periodic antenna, horizontal polarization.

112 deg/1.1 m  
 314.25 69.55 14.9 1 85.5 -- H --

Horizontal polarization.

Please disregard above note.

Vertical polarization.

112 deg/1.5 m  
 314.26 61.05 14.9 1 77 -- V --

0 deg/1 m

628.44 30.7 19.5 1.5 51.7 -- V --

942.62 16 23.5 2 41.5 -- V --

Horizontal polarization.

90 deg/1.2 m

628.42 30.25 19.5 1.5 51.3 -- H --

318 deg/1 m

942.62 25.05 23.5 2 50.6 -- H --

Horn antenna, horizontal polarization

62 deg/1.27 m

1256.8 19.5 25.6 2.3 47.4 -- H --



T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

PW1 Test Site  
3 Meter Antenna Distance  
Equipment Under Test:  
BI Inc., M/N: HG200A  
FCC ID: CSQHG200A, S/N SFA001

Report B9149 Run 1  
Date 04/26/99 Page 2  
Engineer FLA  
Tech: S S Shawn Singh  
Requester \_\_\_\_\_

Notes: Ankle-Mount Low Power RF Transmitter, Fresh 3.6 Lithium Battery

| Frequency<br>MHz | Level<br>dBuV | Factor<br>dB | Cable<br>dB | Final<br>dBuV/m | Az<br>deg | Polar\<br>Height | Delta | Delta |
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|-------|-------|
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|-------|-------|

|                |        |       |      |     |      |         |  |  |
|----------------|--------|-------|------|-----|------|---------|--|--|
| 54 deg, 1.05 M | 1570.9 | 15.75 | 26.9 | 2.6 | 45.3 | -- H -- |  |  |
|----------------|--------|-------|------|-----|------|---------|--|--|

|                |        |      |    |     |      |         |  |  |
|----------------|--------|------|----|-----|------|---------|--|--|
| 98 deg, 1.31 M | 1885.1 | 4.95 | 28 | 2.9 | 35.8 | -- H -- |  |  |
|----------------|--------|------|----|-----|------|---------|--|--|

No emission found above receivers noise floor at the 7th harmonic

|                 |        |     |      |     |      |         |  |  |
|-----------------|--------|-----|------|-----|------|---------|--|--|
| 182 Deg, 1.21 M | 2513.3 | 9.5 | 30.9 | 3.4 | 43.9 | -- H -- |  |  |
|-----------------|--------|-----|------|-----|------|---------|--|--|

No emissions were found above the receivers noise floor to 3142.2 MHz  
Horn antenna, vertical polarization

|              |        |       |      |     |      |         |  |  |
|--------------|--------|-------|------|-----|------|---------|--|--|
| 186 deg, 1 M | 1256.7 | 22.85 | 25.6 | 2.3 | 50.7 | -- V -- |  |  |
|--------------|--------|-------|------|-----|------|---------|--|--|

|                 |        |     |      |     |      |         |  |  |
|-----------------|--------|-----|------|-----|------|---------|--|--|
| 312 deg, 1.07 M | 1570.9 | 7.7 | 26.9 | 2.6 | 37.2 | -- V -- |  |  |
|-----------------|--------|-----|------|-----|------|---------|--|--|

|              |        |      |    |     |      |         |  |  |
|--------------|--------|------|----|-----|------|---------|--|--|
| 185 deg, 1 M | 1885.1 | 4.65 | 28 | 2.9 | 35.5 | -- V -- |  |  |
|--------------|--------|------|----|-----|------|---------|--|--|

No emission was found above the receivers noise floor at the 7th harmonic

|              |        |      |      |     |      |         |  |  |
|--------------|--------|------|------|-----|------|---------|--|--|
| 184 deg, 1 M | 2513.5 | 5.75 | 30.9 | 3.4 | 40.1 | -- V -- |  |  |
|--------------|--------|------|------|-----|------|---------|--|--|

|             |        |     |      |     |      |         |  |  |
|-------------|--------|-----|------|-----|------|---------|--|--|
| 52 deg, 1 M | 2827.7 | 3.6 | 31.9 | 3.7 | 39.2 | -- V -- |  |  |
|-------------|--------|-----|------|-----|------|---------|--|--|

No emission found above the receivers noise floor at the 10th harmonic



T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

|   |              |  |
|---|--------------|--|
| PW1 Test Site<br>3 Meter Antenna Distance<br>Equipment Under Test:<br>BI Inc., M/N: HG200A<br>FCC ID: CSQHG200A, S/N SFA001<br>Notes: Ankle-Mount Low Power RF Transmitter, Fresh 3.6 Lithium Battery | Figure _____ | Report B9149 Run 1<br>Date 04/26/99 Page 3<br>Engineer <u>DLA</u><br>Tech: S S <u>Simon Singh</u><br>Requester _____ |
|---|--------------|--|

-----  
Measurement Summary

| Frequency<br>MHz | ----- Final<br>dBuV/m | -----<br>uV/m | Azimuth<br>deg | Polar\<br>Height | Delta | Delta |
|------------------|-----------------------|---------------|----------------|------------------|-------|-------|
| -----            |                       |               |                |                  |       |       |
| 314.25           | 85.5                  | 18836.        | --             | H --             |       |       |
| 628.44           | 51.7                  | 384.59        | --             | V --             |       |       |
| 942.62           | 50.6                  | 338.84        | --             | H --             |       |       |
| 1256.7           | 50.7                  | 342.76        | --             | V --             |       |       |
| 1570.9           | 45.3                  | 184.07        | --             | H --             |       |       |
| 1885.1           | 35.8                  | 61.659        | --             | H --             |       |       |
| 2513.3           | 43.9                  | 156.67        | --             | H --             |       |       |
| 2513.5           | 40.1                  | 101.15        | --             | V --             |       |       |
| 2827.7           | 39.2                  | 91.201        | --             | V --             |       |       |

File B9149 Run 1



T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

PW1 Test Site  
3 Meter Antenna Distance  
Equipment Under Test:  
BI Inc., M/N: HG200A  
FCC ID: CSQHG200A, S/N SFA001

Report B9149 Run 2  
Date 04/26/99 Page 1  
Engineer File 3x  
Tech: DMD DMD  
Requester \_\_\_\_\_

Notes: Ankle-Mount Low Power RF Transmitter, Fresh 3.6 Lithium Battery

| Frequency<br>MHz | Level<br>dBuV | Factor<br>dB | Cable<br>dB | Final<br>dBuV/m | Az<br>deg | Polar\<br>Height | Delta<br>FCC B | Delta |
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|----------------|-------|
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|----------------|-------|

Bicon antenna, vertical polarization, 1 M initial height, 0 deg

30 - 200 MHz.

No emissions were found.

90 Deg

No emissions were found.

180 Deg

No emissions were found.

270 Deg

No emissions were found.

Below frequencies are noise floor measurements.

|        |       |      |    |      |    |   |    |       |
|--------|-------|------|----|------|----|---|----|-------|
| 30.552 | -2.7  | 14.4 | .4 | 12.1 | -- | V | -- | -27.9 |
| 43.291 | 1.7   | 12.8 | .4 | 14.9 | -- | V | -- | -25.1 |
| 62.319 | -2.4  | 10.7 | .5 | 8.7  | -- | V | -- | -31.3 |
| 111.35 | -4.15 | 11.1 | .6 | 7.6  | -- | V | -- | -35.9 |
| 169.55 | -6.35 | 13   | .7 | 7.4  | -- | V | -- | -36.1 |

Bicon antenna, horizontal polarization, initial height 2.5m.

0 Deg

No emissions were found.

90 Deg

No emissions were found.



# T U V P R O D U C T S E R V I C E

## RADIATED EMISSIONS

PW1 Test Site  
3 Meter Antenna Distance  
Equipment Under Test:  
BI Inc., M/N: HG200A  
FCC ID: CSQHG200A, S/N SFA001

Report B9149 Run 2  
Date 04/26/99 Page 2  
Engineer ELK  
Tech: DMD DMD  
Requester \_\_\_\_\_  
Notes: Ankle-Mount Low Power RF Transmitter, Fresh 3.6 Lithium Battery

| Frequency<br>MHz | Level<br>dBuV | Factor<br>dB | Cable<br>dB | Final<br>dBuV/m | Az<br>deg | Polar\<br>Height | Delta<br>FCC B | Delta |
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|----------------|-------|
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|----------------|-------|

180 Deg

No emissions were found.

270 Deg

No emissions were found.

Log antenna, vertical polarization initial height 1m.

0 Deg

No emissions were found.

90 Deg

No emissions were found.

180 Deg

No emissions were found.

270 Deg

No emissions were found.

The following are noise floor measurements.

|        |       |      |     |      |    |   |    |       |
|--------|-------|------|-----|------|----|---|----|-------|
| 200.34 | -6.75 | 11.5 | .8  | 5.5  | -- | V | -- | -38   |
| 306.17 | -6.85 | 14.8 | 1   | 8.9  | -- | V | -- | -37.1 |
| 402.32 | -7.3  | 15.4 | 1.2 | 9.2  | -- | V | -- | -36.8 |
| 603.02 | -7.55 | 19.1 | 1.5 | 13   | -- | V | -- | -33   |
| 755.04 | -7.5  | 21   | 1.7 | 15.3 | -- | V | -- | -30.7 |
| 971.88 | -8.1  | 23.5 | 2.1 | 17.5 | -- | V | -- | -36.5 |



# T U V P R O D U C T S E R V I C E

## RADIATED EMISSIONS

PW1 Test Site  
 3 Meter Antenna Distance  
 Equipment Under Test:  
 BI Inc., M/N: HG200A  
 FCC ID: CSQHG200A, S/N SFA001

Report B9149 Run 2  
 Date 04/26/99 Page 3  
 Engineer FLC Jx.  
 Tech: DMD DMD  
 Requester \_\_\_\_\_

Notes: Ankle-Mount Low Power RF Transmitter, Fresh 3.6 Lithium Battery

| Frequency<br>MHz | Level<br>dBuV | Factor<br>dB | Cable<br>dB | Final<br>dBuV/m | Az<br>deg | Polar\<br>Height | Delta<br>FCC B | Delta |
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|----------------|-------|
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|----------------|-------|

Log antenna, horizontal polarization, initial height 2.5m

0 Deg

No emissions were found.

90 Deg

No emissions were found.

180 Deg

No emissions were found.

270 Deg

No emissions were found.



# T U V P R O D U C T S E R V I C E

## RADIATED EMISSIONS

|   |              |   |
|---|--------------|---|
| PW1 Test Site<br>3 Meter Antenna Distance<br>Equipment Under Test:<br>BI Inc., M/N: HG200A<br>FCC ID: CSQHG200A, S/N SFA001<br>Notes: Ankle-Mount Low Power RF Transmitter, Fresh 3.6 Lithium Battery | Figure _____ | Report B9149 Run 2<br>Date 04/26/99 Page 4<br>Engineer <u>FL 1x.</u><br>Tech: DMD <u>DMD</u><br>Requester _____ |
|---|--------------|---|

### Measurement Summary

| Frequency<br>MHz | ----- Final<br>dBuV/m | -----<br>uV/m | Azimuth<br>deg | Polar\<br>Height | Delta<br>FCC B | Delta |
|------------------|-----------------------|---------------|----------------|------------------|----------------|-------|
| 30.552           | 12.1                  | 4.0271        | --             | V --             | -27.9          |       |
| 43.291           | 14.9                  | 5.5590        | --             | V --             | -25.1          |       |
| 62.319           | 8.7                   | 2.7227        | --             | V --             | -31.3          |       |
| 111.35           | 7.6                   | 2.3988        | --             | V --             | -35.9          |       |
| 169.55           | 7.4                   | 2.3442        | --             | V --             | -36.1          |       |
| 200.34           | 5.5                   | 1.8836        | --             | V --             | -38            |       |
| 306.17           | 8.9                   | 2.7861        | --             | V --             | -37.1          |       |
| 402.32           | 9.2                   | 2.8840        | --             | V --             | -36.8          |       |
| 603.02           | 13                    | 4.4668        | --             | V --             | -33            |       |
| 755.04           | 15.3                  | 5.8210        | --             | V --             | -30.7          |       |
| 971.88           | 17.5                  | 7.4989        | --             | V --             | -36.5          |       |

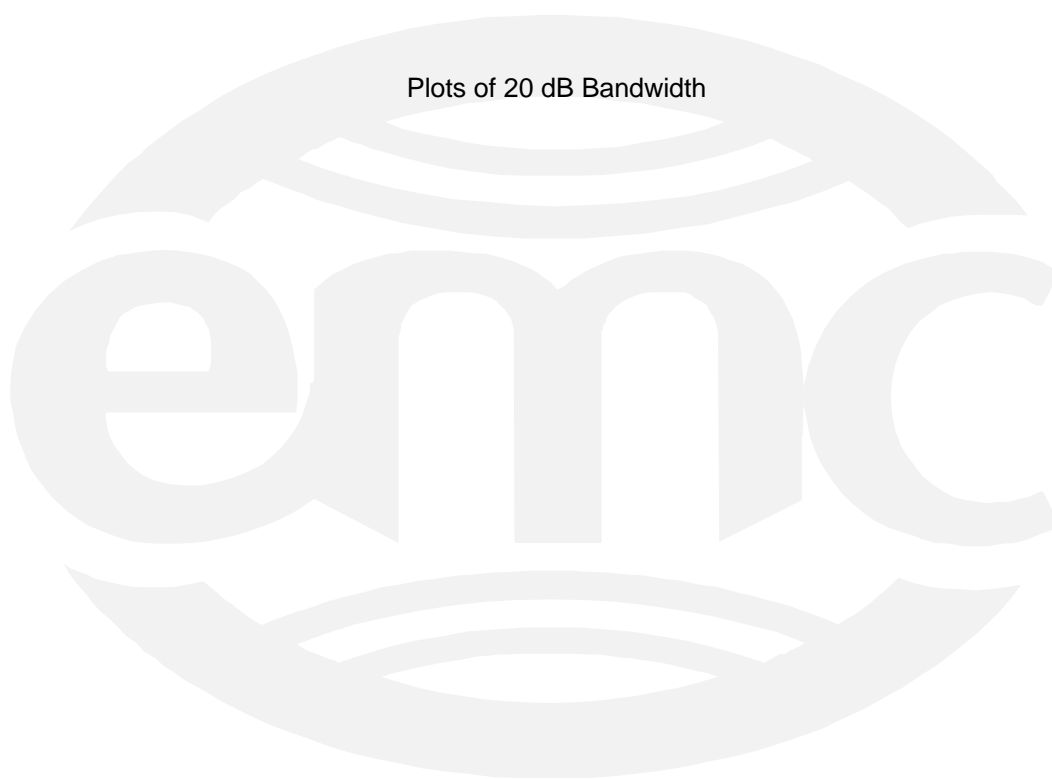
Minimum Passing Margin for FCC B is 25.1 dB at 43.291 MHz

File B9149 Run 2

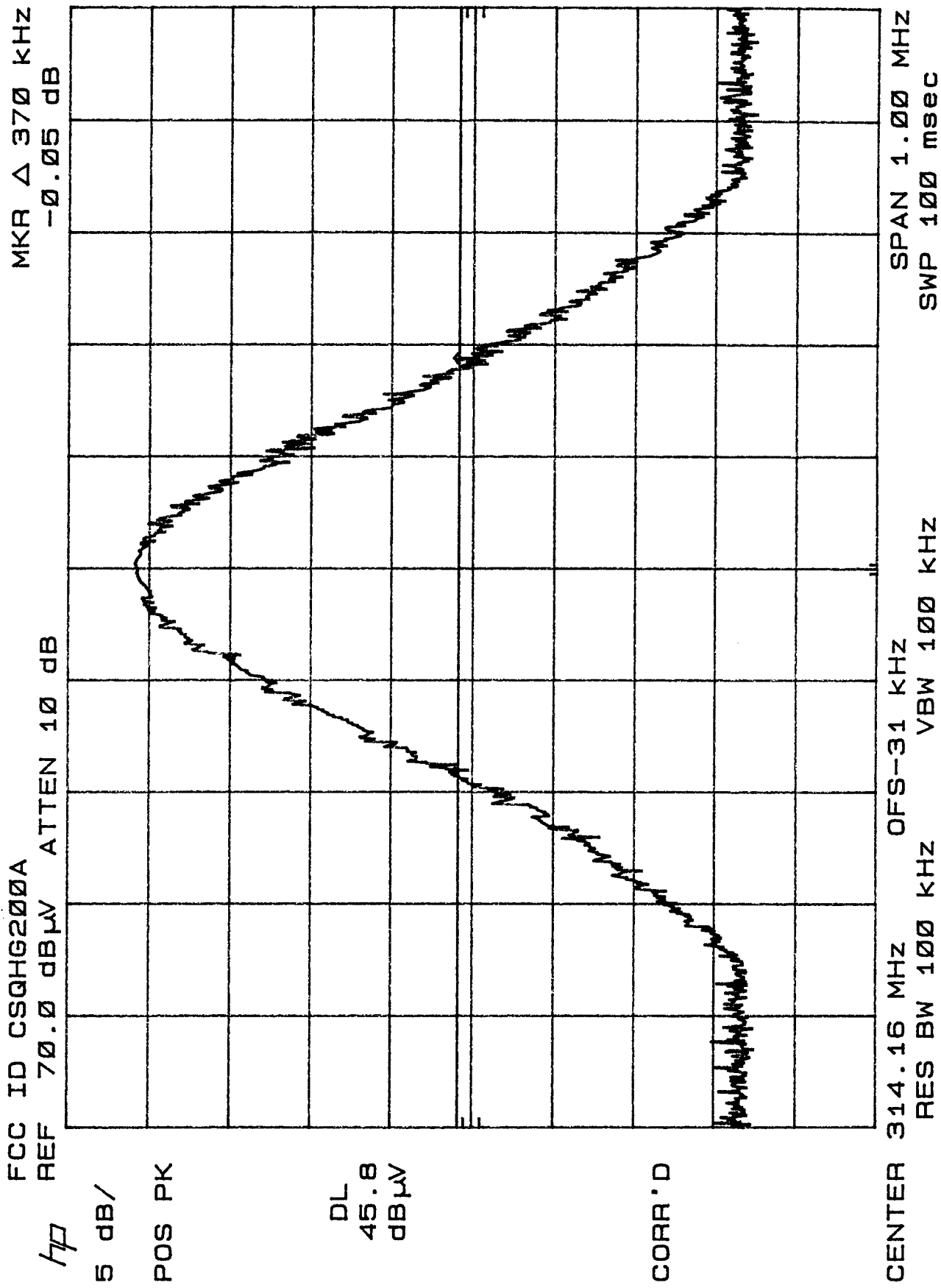


## Appendix C

Plots of 20 dB Bandwidth



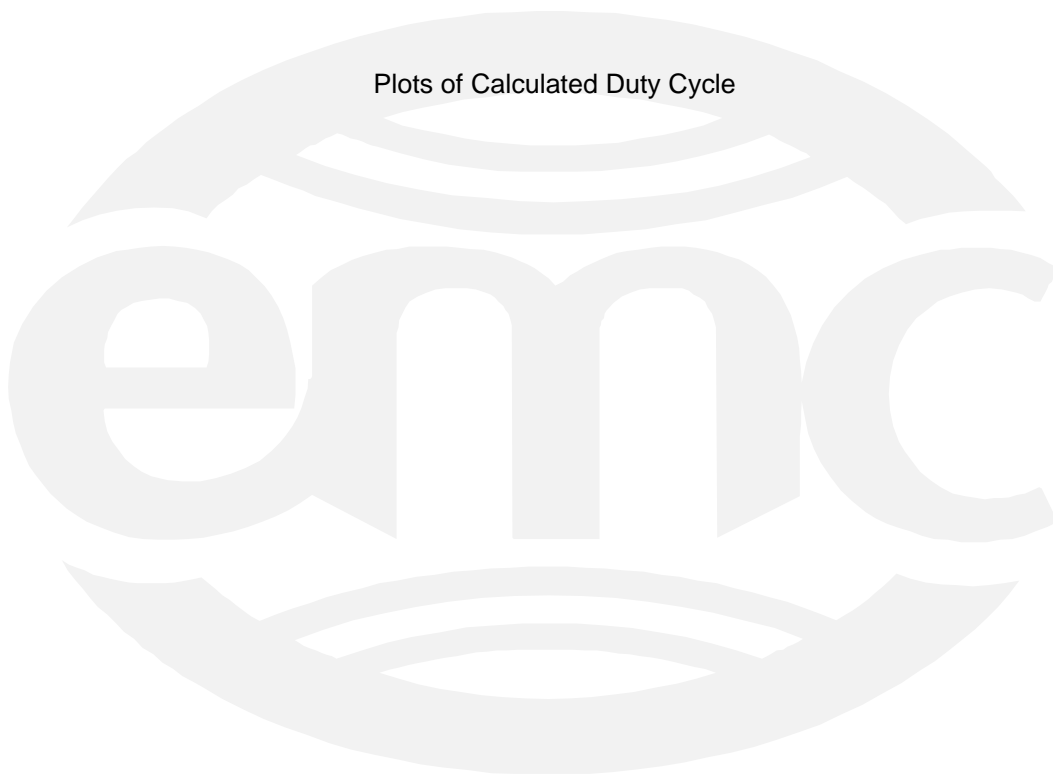






## Appendix D

Plots of Calculated Duty Cycle





$$\text{Duty Cycle} = \frac{10.4 \text{ ms}}{100 \text{ ms}} = -19.6 \text{ dB}$$

FCC ID CSQHG200A

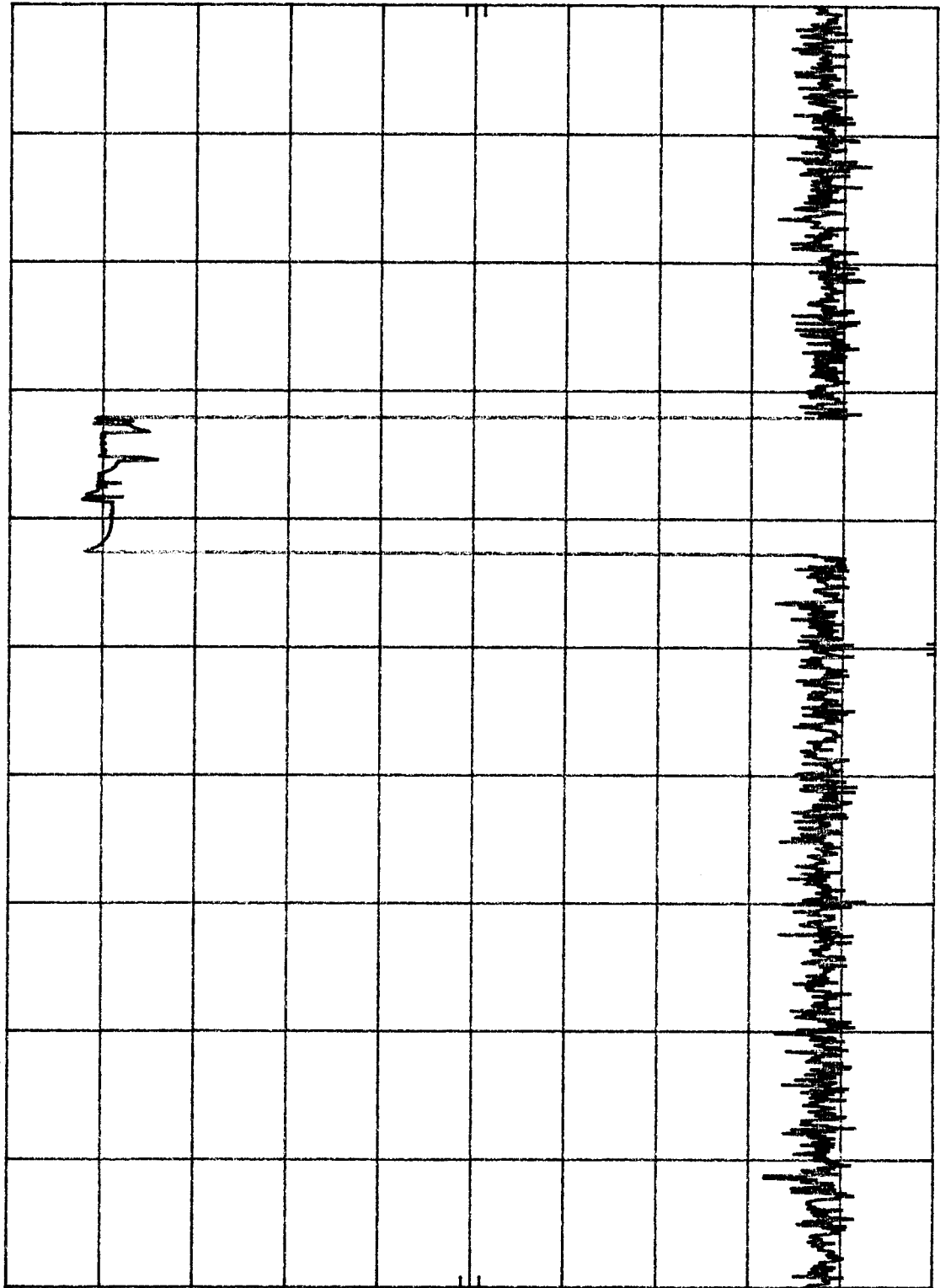
REF 70.0 dBμV ATTN 10 dB

hp

5 dB/

POS PK

CORR'D



CENTER 314.200 000 MHZ OFS -31.000 KHZ

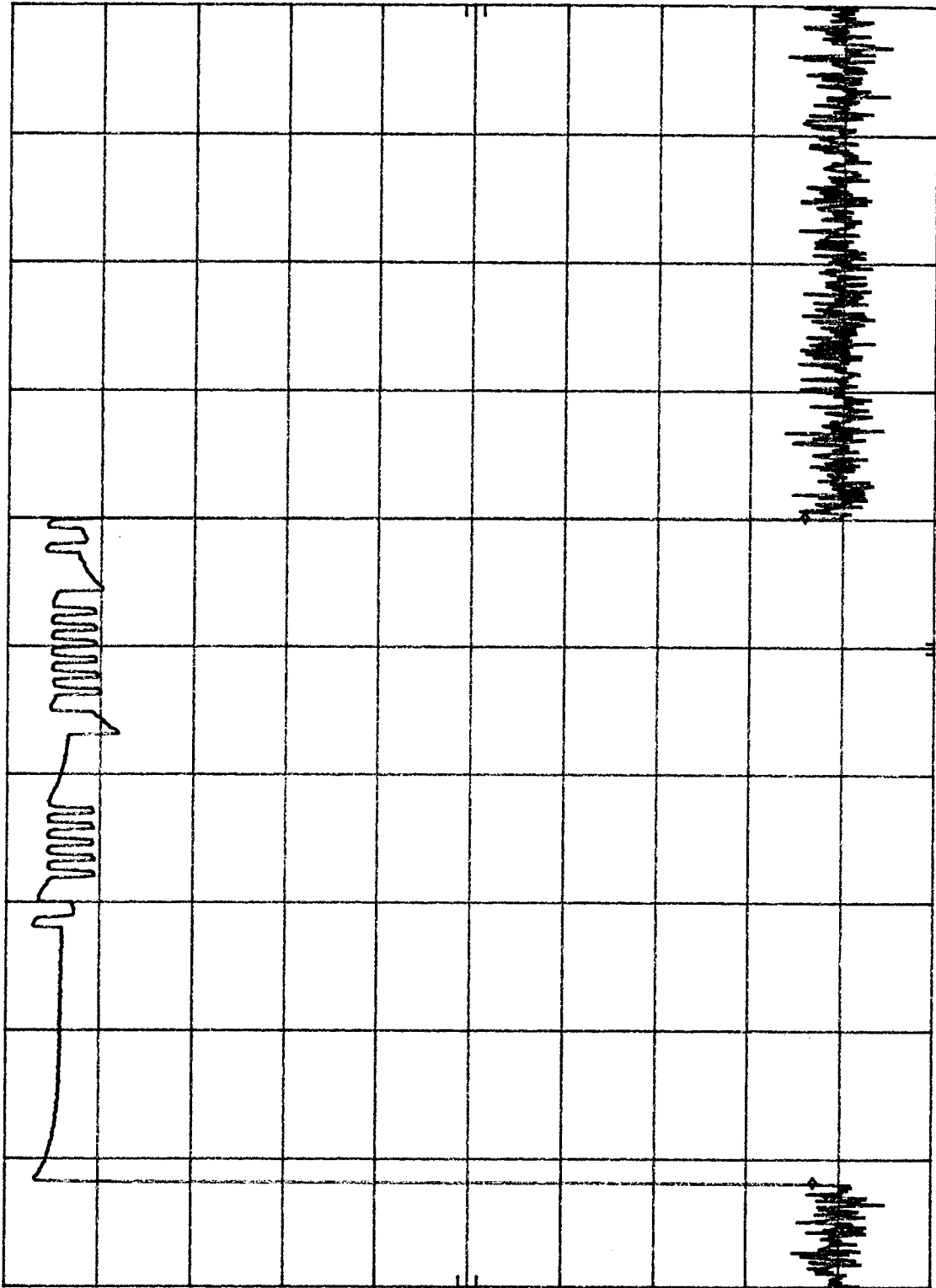
RES BW 100 KHZ VBW 100 KHZ

SPAN 0 HZ

SWP 100 msec



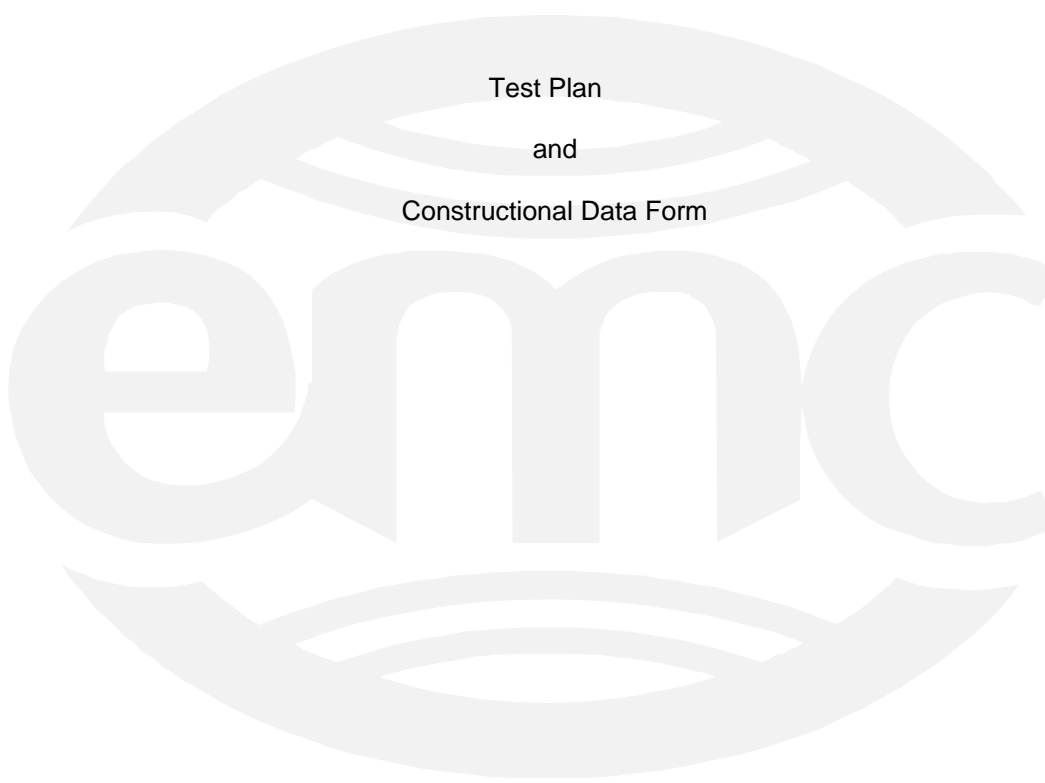
SPAN 0 Hz  
SWP 20.0 msec





## Appendix E

Test Plan  
and  
Constructional Data Form





# Test Plan for Electromagnetic Compatibility Testing



## General Information (if you need assistance completing this form contact your TÜV Product Service representative.)

Company: BI Inc. Quote Number: BI99301JM01  
Contact: Don Melton Phone: (business hrs) 303-218-1031  
E-mail Address: dmelton@bi.com Phone: (after hrs) PGR: 303-546-3821

## Product Description

Description: Ankle-Mount Low PowerRF Transmitter  
Model Number: HG200A Serial Number: SFAMT001

## Test Objective

- |   |   |
|---|---|
| <input type="checkbox"/> EMC Directive 89/336/EEC (EMC)           | <input type="checkbox"/> Vehicle Directive 72/245/EEC (EMC)   |
| <input type="checkbox"/> Machinery Directive 89/392/EEC (EMC)     | <input type="checkbox"/> FDA Reviewers Guidance for Premarket |
| <input type="checkbox"/> Medical Device Directive 93/42/EEC (EMC) | Notification Submissions (EMC)                                |
| <input checked="" type="checkbox"/> FCC Part <u>15.231</u> (list) | <input type="checkbox"/> Other _____ (list)                   |

## Attendance

Test will be: ☒ Attended by the customer ☐ Unattended by the customer

## Failure

If a failure occurs, TÜV Product Service should:

- ☒ Call contact listed above, if not available then stop testing.  
☐ Continue testing to complete test series.  
☐ Continue testing to define corrective action.  
☐ Stop testing.

## Authorization

Donald A. Melton

Customer authorization to perform tests according to  
this test plan.

22 Apr 99

Date

Don Melton

Test Plan Prepared By (please print)

22 Apr 99

Date

  
Reviewed by TÜV Product Service Associate

30 April 99

Date

UEMC0901.DOC, Revision 1.0  
Author: B. Dill  
Revised: 29 September 1998



# Test Plan for Electromagnetic Compatibility Testing



## Equipment Under Test Transportation

- ☒ Transportation between sites by customer.  
☐ Other (consult your TÜV Product Service representative)

## Dimensions and Weight

Length 2.8" Width 2.3"  
Height .9" Weight <4 oz.

## Facilities

### Power Requirements

- ☐ 230 VAC 50 Hz Single Phase \_\_\_\_\_ Amps  
☐ 400 VAC 50 Hz Three Phase \_\_\_\_\_ Amps per phase  
☐ 120 VAC 60 Hz Single Phase \_\_\_\_\_ Amps  
☐ 208 VAC 60 Hz Three Phase \_\_\_\_\_ Amps per phase  
☐ \_\_\_\_\_ VDC \_\_\_\_\_ Amps  
☒ Battery 3.6 VDC Expected life 8800 hours  
☐ Other \_\_\_\_\_

*Regulations require testing to be performed at typical power ratings in the countries of intended use. (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)*

### Other

- ☐ Air \_\_\_\_\_ cfm \_\_\_\_\_ psi ☐ Water \_\_\_\_\_ gpm \_\_\_\_\_ psi  
☐ Other \_\_\_\_\_ (describe)

## Test Plan Attachments

- ☒ Constructional Data Form (CDF) \* The CDF is required for all test plans.  
☒ Applicable (attached)
- Immunity Test Plan Details**  
☐ Applicable (attached) ☐ N/A
- Emissions Test Plan Details**  
☐ Applicable (attached) ☐ N/A
- On Site Test Plan Details**  
☐ Applicable (attached) ☐ N/A

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Author: B. Dill  
Revised: 29 September 1998

Page 2

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# FCC Emissions Test Plan Details (ATTACHMENT)



If testing levels other than those desired, then indicate the requested test levels under Engineering Justifications / Test Deviations.

| Standards to be Applied             |                                  |                    |                           |
|-------------------------------------|----------------------------------|--------------------|---------------------------|
| <input type="checkbox"/>            | CISPR 22                         |                    |                           |
|                                     | <input type="checkbox"/> Class A |                    |                           |
|                                     | <input type="checkbox"/> Class B |                    |                           |
| <input checked="" type="checkbox"/> | FCC Part                         | 15.231             | (list) Class _____ (list) |
| <input checked="" type="checkbox"/> | Other                            | Industry<br>Canada | (list)                    |

| Description                    | Basic Document | Requirement                                     |
|--------------------------------|----------------|---|
| Radiated & Conducted Emissions | ANSI 63.4      | Reference Basic Document or Applicable Standard |

| Engineering Justifications / Test Deviations |
|--|
|  |

UEMC0911.DOC, Revision 1.0  
Author: B. Dill  
Revised: 20 March 1997



# Constructional Data Form for Electromagnetic Compatibility Testing



A completed form helps ensure that product testing will go smoothly. Add attachments as necessary for additional documentation. For additional help, please contact your TÜV Product Service Representative.

Form No. 01-01-01-01-01-01

**Applicant** -- Enter company information pertaining to the location where the product is manufactured and for the manufacturer's contact soliciting the testing.

Company: BI Inc.

Address: 6400 Lookout Rd.  
Boulder CO 80301

Phone: 303-218-1031 Fax: 303-218-1250

Contact: Don Melton Position: Principal Engineer

**General Equipment Description** -- Indicate which attachments you are providing with this document. It is recommended that you provide those listed.

Type of  
Equipment: RF Transmitter Model No.: HG200A

Serial No.: N/A FCC ID No.: CSQHG200A

General description: **RF transmitter intended to be worn primarily on an ankle. Application is Electronic House Arrest Monitoring. A receiver, generally located in the home, keeps track of the presence or absence of the transmitter and reports changes to a host computer via a communication link. The transmitter is powered by a single 750 ma-hr lithium thionyl chloride cell.**

Product Variant/Options: N/A

Attachments: (only required for certification)

☒ External Photographs ☒ Product Literature ☒ High Level Bill of Materials

Form No. 01-01-01-01-01-01

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 4/22/99 Signature of Applicant: \_\_\_\_\_

UEMC0902.doc, Revision 2.0  
Author: B. Dill  
Revised: 29 September 1998

Page 1

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# Constructional Data Form for Electromagnetic Compatibility Testing



**Installation and Environmental Conditions (describe)** -- Describe the intended installation. Include details such as power connection and system grounding approaches. Describe the intended operating environment, include details such as humidity, cooling, heating and hazardous environments. Attaching a copy of an Installation manual is recommended for proper documentation of your system. Please indicate.

Intended installation is attached with a companion strap to the ankle of a person on Electronic House Arrest. Unit is waterproof and can operate between 0 and 50 degrees C.

☐ Installation manual/instructions (attached, only required for certification)

**Power Requirements** -- Indicate your system power requirements for the equipment to be tested.

Rated Voltage N/A Rated Input Power N/A

**Protection Class** -- Indicate your product's protection class. Contact your TÜV Product Service representative and is only required for certification.

Type: N/A Class: N/A

Printed on 10/10/99 Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 4/22/99 Signature of Applicant: \_\_\_\_\_

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Author: B. Dill  
Revised: 29 September 1998

Page 2

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# Constructional Data Form for Electromagnetic Compatibility Testing



## I/O Ports and Cables

Indicate all interface cables which can be attached to the equipment even if they are not sold as part of your system. Describe the port (e.g., Parallel, Serial, SCSI), list its type (e.g., AC, DC, Signal, Control) and number of ports/cables of type. Indicate if the I/O port is to be exercised during testing. List the type of transmission and if the cable is an EUT assembly-to-assembly interconnection cable (PC to printer, to modem). Indicate whether the cable is shielded or not, type of shield (e.g. Braid, Foil) and how terminated (e.g. 360 degree to conductive shell, pigtail) at both ends of the cable. If a cable can have a typical length of  $\geq 3.0$  meters, then it is required to test with a cable of at least 3.0 meters.

### I/O Ports and Cables

|  |                                 |                                  |                           |
|--|---------------------------------|----------------------------------|---------------------------|
| Description:                                     | N/A                             |                                  |                           |
| Type of Port:                                    |                                 |                                  |                           |
| Exercised during testing?                        | <input type="checkbox"/> Yes    | <input type="checkbox"/> No      | # of ports/cables of type |
| Assembly $\leftrightarrow$ Assembly Interconnect | <input type="checkbox"/> Yes    | <input type="checkbox"/> No      |                           |
| Cable shielded:                                  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No      |                           |
| Shield Type (describe)                           |                                 |                                  |                           |
| Termination: (describe)                          |                                 |                                  |                           |
| Transmission Type:                               | <input type="checkbox"/> Analog | <input type="checkbox"/> Digital |                           |
| Length of cable:                                 | Maximum:                        | Tested:                          |                           |

### I/O Ports and Cables

|  |                                 |                                  |                           |
|--|---------------------------------|----------------------------------|---------------------------|
| Description:                                     | N/A                             |                                  |                           |
| Type of Port:                                    |                                 |                                  |                           |
| Exercised during testing?                        | <input type="checkbox"/> Yes    | <input type="checkbox"/> No      | # of ports/cables of type |
| Assembly $\leftrightarrow$ Assembly Interconnect | <input type="checkbox"/> Yes    | <input type="checkbox"/> No      |                           |
| Cable shielded:                                  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No      |                           |
| Shield Type (describe)                           |                                 |                                  |                           |
| Termination: (describe)                          |                                 |                                  |                           |
| Transmission Type:                               | <input type="checkbox"/> Analog | <input type="checkbox"/> Digital |                           |
| Length of cable:                                 | Maximum:                        | Tested:                          |                           |

### I/O Ports and Cables

|  |                                 |                                  |                           |
|--|---------------------------------|----------------------------------|---------------------------|
| Description:                                     | N/A                             |                                  |                           |
| Type of Port:                                    |                                 |                                  |                           |
| Exercised during testing?                        | <input type="checkbox"/> Yes    | <input type="checkbox"/> No      | # of ports/cables of type |
| Assembly $\leftrightarrow$ Assembly Interconnect | <input type="checkbox"/> Yes    | <input type="checkbox"/> No      |                           |
| Cable shielded:                                  | <input type="checkbox"/> Yes    | <input type="checkbox"/> No      |                           |
| Shield Type (describe)                           |                                 |                                  |                           |
| Termination: (describe)                          |                                 |                                  |                           |
| Transmission Type:                               | <input type="checkbox"/> Analog | <input type="checkbox"/> Digital |                           |
| Length of cable:                                 | Maximum:                        | Tested:                          |                           |

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 4/22/99

Signature of Applicant:

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Author: B. Dill  
Revised: 29 September 1998



# Constructional Data Form for Electromagnetic Compatibility Testing



**EUT configurations** -- Provide a technical description of all possible EUT configurations. Specify if more than one configuration is to be tested.

Attached to an ankle with the companion strap and siderails, supplied by BI.

**EUT Software and Operation Modes to be Tested** -- list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. Consult with your TÜV Product Service Representative when typical operating modes are not practical. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. This pattern must be sent to the parallel port device, serial port device, and must be write/read/verified to each storage device. Monitors must display the H pattern, typically in white letters on a black background. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing.

General Description:  
(describe)

Normal mode includes transmission of a data packet in pseudorandom timing intervals of several seconds to tens of seconds. A special test mode is included to transmit every 0.5 second to facilitate testing.

Software Revision Level:  
(list and describe)

N/A

Operating modes to be  
tested: (list and describe)

Normal mode includes transmission of a data packet in pseudorandom timing intervals of several seconds to tens of seconds. A special test mode is included to transmit every 0.5 second to facilitate testing. A typical strap will be attached to the EUT.

☐ Operation manual/instructions (attached)

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 4/22/99

Signature of Applicant:

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Revised: 29 September 1998

Page 4

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# Constructional Data Form for Electromagnetic Compatibility Testing



**System, Subsystem, Major Subassemblies or Internal Peripherals** -- List and describe all system, subsystem, major subassemblies and all internal peripherals. This should include such things as an external monitor, parallel interface peripheral, serial interface peripheral, internal disk drives or internal circuit boards. It is recommended that circuit diagrams, assembly and subassembly drawings be attached. Please indicate.

| Description | Model # | Serial # | FCC ID # |
|-------------|---------|----------|----------|
| N/A         |         |          |          |
|             |         |          |          |
|             |         |          |          |
|             |         |          |          |
|             |         |          |          |
|             |         |          |          |
|             |         |          |          |
|             |         |          |          |

☐ Technical Drawings attached

**Interfacing Equipment and/or Simulators (which are not part of the EUT)** -- List and Describe all equipment or peripherals that will be connected to the EUT. For FCC testing a minimum configuration is required. If you have questions about this minimum configuration contact your TÜV Product Service representative.

| Description | Model # | Serial # | FCC ID # |
|-------------|---------|----------|----------|
| N/A         |         |          |          |
|             |         |          |          |
|             |         |          |          |
|             |         |          |          |
|             |         |          |          |
|             |         |          |          |
|             |         |          |          |
|             |         |          |          |

U.S. Patent 5,100,000

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 4/22/99 Signature of Applicant:

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Author: B. Dill  
Revised: 29 September 1998

Page 5

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# Constructional Data Form for Electromagnetic Compatibility Testing



**EMC System Details --** List all frequencies and sub-harmonics which are 10kHz or above for such things as oscillators, horizontal line rate of monitors, and clock rates of incorporated OEM assemblies. List all power supplies. Indicate switching frequencies. List power line filters and indicate the manufacturer, model and location on EUT. Indicate all components used for high frequency noise reduction. (e.g., ceramic capacitor, 0.01µF, 1 ea. at C12 - C20).

| Oscillator Frequencies |               |              |                               |
|------------------------|---------------|--------------|-------------------------------|
| Frequency              | Sub-harmonics | EUT Location | Description of Use            |
| 33.333kHz (Xtal)       | continuous    |              | .5sec wakeup; 120us bit width |
| 2.454688 MHz (Xtal)    | intermittent  |              | X128 to generate 314.2MHz     |
| 314.2 MHz (PLL)        | Intermittent  |              | Carrier; from 2.454MHz        |
| 2MHz (RC)              | Intermittent  |              | uP clock                      |
|                        |               |              |                               |

| Power Supply |              |         |          |                       |
|--------------|--------------|---------|----------|-----------------------|
| Frequency    | Manufacturer | Model # | Serial # | Type (list frequency) |
| N/A          |              |         |          |                       |
|              |              |         |          |                       |
|              |              |         |          |                       |

| Power Line Filters |         |     |                 |
|--------------------|---------|-----|-----------------|
| Manufacturer       | Model # | Qty | Location on EUT |
| N/A                |         |     |                 |
|                    |         |     |                 |
|                    |         |     |                 |

| Critical EMI Components (Capacitors, ferrites, etc.) |              |                 |     |                 |
|--|--------------|-----------------|-----|-----------------|
| Description  | Manufacturer | Part # or Value | Qty | Location on EUT |
| None   |              |                 |     |                 |
|  |              |                 |     |                 |
|  |              |                 |     |                 |
|  |              |                 |     |                 |

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 4/22/99 Signature of Applicant:

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Author: B. Dill  
Revised: 29 September 1998



# Constructional Data Form for Electromagnetic Compatibility Testing



**Other EMI Critical Construction Detail --** Indicate any other measures taken to reduce high frequency noise, (e.g., grounding the circuit board on the right rear corner with 0.25" braid, 3 inches long to the chassis).

**RF PLL IC and associated components are located inside a shield can to prevent feedback from the antennas to the low level control circuits.**

**Description of Enclosure --** Describe the principle materials of the enclosure (e.g., plastic, plastic with shielding material, metal, metal with specific shielding contact points, metal with paint on all surfaces).

**Plastic**

Date and sign each page of the CDF. Original signatures must be present on each page.

**Date:** 4/22/99 **Signature of Applicant:**

UEMC0902.doc, Revision 2.0  
Author: B. Dill  
Revised: 29 September 1998

Page 7

File s:\emc\forms\UEMC0902.doc, Revision 1.0



# Constructional Data Form for Electromagnetic Compatibility Testing



**System Configuration Block Diagram** -- Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, power cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside testing field.

A large, empty rectangular box with a thin black border, intended for a line drawing of the system configuration block diagram.

Date and sign each page of the CDF. Original signatures must be present on each page.

**Date:** **Signature of Applicant:**

UEMC0902.doc, Revision 2.0  
Author: B. Dill  
Revised: 29 September 1998

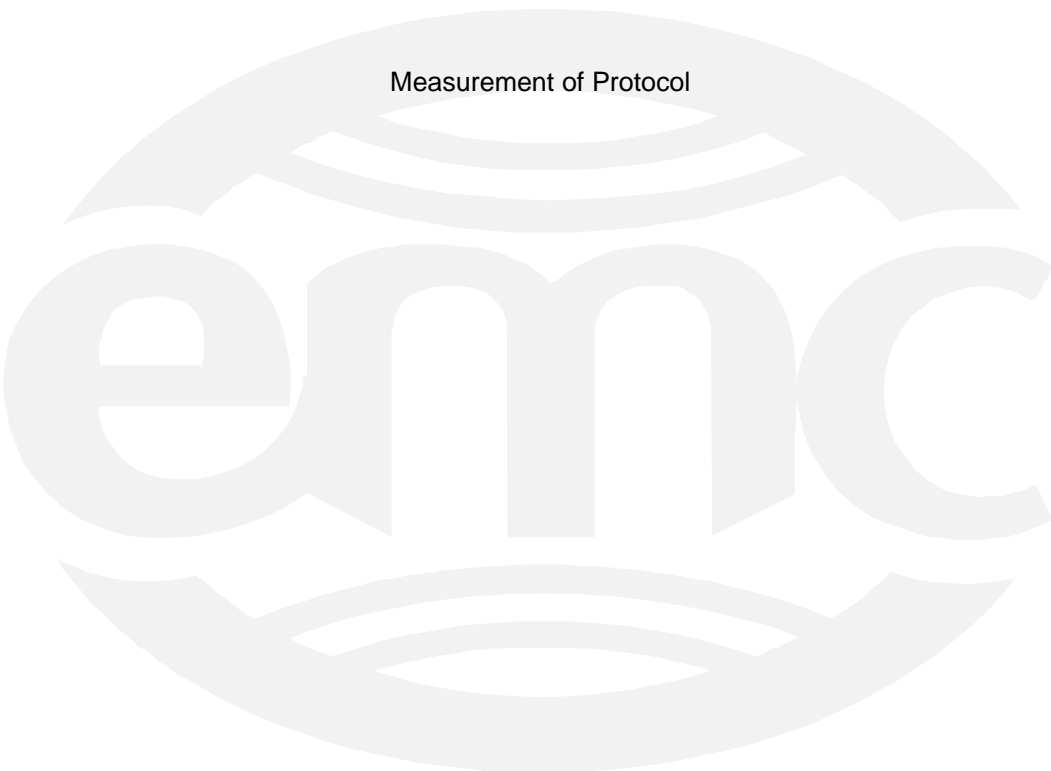
Page 8

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## Appendix F

Measurement of Protocol





# MEASUREMENT PROTOCOL FOR FCC

## GENERAL INFORMATION

### Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of  $\pm 4.5$  dB. The equipment comprising the test systems are calibrated on an annual basis.

### Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into it's characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

## CONDUCTED EMISSIONS

The final level, expressed in dB $\mu$ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between dB $\mu$ V and  $\mu$ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

## RADIATED EMISSIONS

The final level, expressed in dB $\mu$ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB $\mu$ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the FCC limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

Example:

| Frequency<br>(MHz) | Level<br>(dB $\mu$ V) | + | Factor &<br>Cable (dB) | = | Final<br>(dB $\mu$ V/m) | - | FCC B<br>Limit<br>(dB $\mu$ V/m) | = | Delta<br>FCC B<br>(dB) |
|--------------------|-----------------------|---|------------------------|---|-------------------------|---|----------------------------------|---|------------------------|
| 32.21              | 13.9                  | + | 16.3                   | = | 30.2                    | - | 40.0                             | = | -9.8                   |



## DETAILS OF TEST PROCEDURES

### General Standard Information

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

### Conducted Emissions

Conducted emissions on the 60 Hz power interface of the EUT are measured in the frequency range of 450 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50  $\Omega$ /50  $\mu$ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

### Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 3142 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and peak or quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Average field strength levels were computed from the peak readings and duty cycle of the transmitter. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees. Intentional radiators are rotated through three orthogonal axes to determine the attitude that maximizes the emissions.