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October 31, 2002

ATCB  
6731 Whittier Ave  
Suite C110  
McLean, Va. 22101

Gentlemen:

The enclosed documents constitute a formal submittal and application for a Grant of Equipment Authorization pursuant to Subpart C of Part 15 of FCC Rules (CFR 47) regarding intentional radiators. Data within this report demonstrates that the equipment tested complies with the FCC limits for intentional radiators.

Elliott Laboratories, as duly authorized agent prepared this submittal. A copy of the letter of our appointment as agent is enclosed.

If there are any questions or if further information is needed, please contact Elliott Laboratories for assistance.

Sincerely,

A handwritten signature in black ink that reads "Juan Martinez".

Juan Martinez  
Sr. EMC Engineer

JM/bab

Enclosures:   Application Fee  
                  FCC Form 731  
                  Agent Authorization Letter  
                  Emissions Test Report with Exhibits

***Electromagnetic Emissions Test Report  
and  
Application for Grant of Equipment Authorization  
pursuant to  
FCC Part 15, Subpart C Specifications for an  
Intentional Radiator on the  
ActionTec Electronics, Inc.  
Model: BMDC200***

FCC ID: LNQ-BMDC200

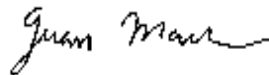
GRANTEE: ActionTec Electronics, Inc.  
760 North Mary Ave.  
Sunnyvale, CA 94087

TEST SITE: Elliott Laboratories, Inc.  
684 W. Maude Avenue  
Sunnyvale, CA 94086

REPORT DATE: October 31, 2002

FINAL TEST DATE: October 28, 2002

AUTHORIZED SIGNATORY: \_\_\_\_\_



Juan Martinez  
Sr. EMC Engineer

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## **SCOPE**

An electromagnetic emissions test has been performed on the ActionTec Electronics, Inc. model BMDC200 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the ActionTec Electronics, Inc. model BMDC200 and therefore apply only to the tested sample. The sample was selected and prepared by Angela Yao of ActionTec Electronics, Inc.

## **OBJECTIVE**

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

## **STATEMENT OF COMPLIANCE**

The tested sample of ActionTec Electronics, Inc. model BMDC200 complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any modification of the product, which may result in increased emissions, should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

**EMISSION TEST RESULTS**

The following emissions tests were performed on the ActionTec Electronics, Inc. model BMDC200. The actual test results are contained in an exhibit of this report.

**LIMITS OF CONDUCTED INTERFERENCE VOLTAGE**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.207.

The following measurement was extracted from the data recorded during the conducted emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

120V, 60Hz

| Frequency<br>MHz | Level<br>dBuV | Power<br>Lead | EN55022 B |        | Detector<br>QP/Ave | Comments |
|------------------|---------------|---------------|-----------|--------|--------------------|----------|
|                  |               |               | Limit     | Margin |                    |          |
| 0.150            | 54.0          | Line          | 66.0      | -12.0  | QP                 |          |

**LIMITS OF ANTENNA CONDUCTED POWER**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247.

The highest out-of-band (Un-restricted) emission recorded in any 100 kHz band was -50 dB below the in-band level at 1000 MHz. The actual test data and any correction factors are contained an exhibit of this report.

**LIMITS OF RADIATED INTERFERENCE FIELD STRENGTH**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247 and 15.209 in the case of emissions falling within the frequency bands specified in Section 15.205.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

| Frequency<br>MHz | Level<br>dBuV/m | Pol<br>v/h | 15.247(c) |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------|------------|-----------|--------|-----------------------|--------------------|------------------|----------|
|                  |                 |            | Limit     | Margin |                       |                    |                  |          |
| 4803.975         | 46.2            | V          | 54.0      | -7.8   | Avg                   | 0                  | 1.0              |          |

---

**LIMITS OF POWER AND BANDWIDTH**

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247.

The maximum power output was 3.74dBm on 2441 MHz. The minimum 20-dB bandwidth was .825 Megahertz on 2480. The actual test data and any correction factors are contained in an exhibit of this report.

**MEASUREMENT UNCERTAINTIES**

ISO Guide 25 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

| Measurement Type    | Frequency Range<br>(MHz) | Calculated Uncertainty<br>(dB) |
|---------------------|--------------------------|--------------------------------|
| Conducted Emissions | 0.15 to 30               | ± 2.4                          |
| Radiated Emissions  | 30 to 1000               | ± 3.2                          |

**EQUIPMENT UNDER TEST (EUT) DETAILS****GENERAL**

The ActionTec Electronics, Inc. model BMDC200 is a Bluetooth FHSS transmitter, which is designed to provide wireless networking for home or office environment use.

The sample was received on October 28, 2002 and tested on October 28, 2002.

The EUT consisted of the following component(s):

| Manufacturer/Model/Description     | Serial Number |
|------------------------------------|---------------|
| ActionTec/BMDC200/Bluetooth Module | N/A           |

**ENCLOSURE**

The EUT has no enclosure. It is designed to be installed within the enclosure of a host computer.

**MODIFICATIONS**

N/A

**SUPPORT EQUIPMENT**

The following equipment was used as local support equipment for emissions testing:

| Manufacturer/Model/Description | Serial Number | FCC ID Number |
|--------------------------------|---------------|---------------|
| IBM/Model ThinkPad R40/Laptop  | FX-00412      | DoC           |
| Logitec/N/A/Mouse              | LNA20956436   | DoC           |
| HP/2225C/Printer               | 2714S40166    |               |

No support equipment was used during emissions testing.

**EXTERNAL I/O CABLING**

The I/O cabling configuration during emissions testing was as follows:

| Cable Description | Length (m) | From Unit/Port | To Unit/Port |
|-------------------|------------|----------------|--------------|
| Parallel          | 2          | Printer        | Laptop       |
| USB               | 3          | Mouse          | Laptop       |

**TEST SOFTWARE**

During testing the EUT was continuously transmitting at full power on the channel(s) specified in the test data log.

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## TEST SITE

### GENERAL INFORMATION

Final test measurements were taken on October 28, 2002 at the Elliott Laboratories Open Area Test Site #4 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

### CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions' testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

### RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.



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**MEASUREMENT INSTRUMENTATION****RECEIVER SYSTEM**

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

**INSTRUMENT CONTROL COMPUTER**

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection program, which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

**LINE IMPEDANCE STABILIZATION NETWORK (LISN)**

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

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**POWER METER**

A power meter and thermister mount are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

**FILTERS/ATTENUATORS**

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

**ANTENNAS**

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz ranges for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers.

**ANTENNA MAST AND EQUIPMENT TURNTABLE**

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

**INSTRUMENT CALIBRATION**

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

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## **TEST PROCEDURES**

### **EUT AND CABLE PLACEMENT**

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst-case orientation is used for final measurements.

### **CONDUCTED EMISSIONS**

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

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**RADIATED EMISSIONS**

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions, which have values close to the specification limit, may also be measured with a tuned dipole antenna to determine compliance.

**CONDUCTED EMISSIONS FROM ANTENNA PORT**

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

**SPECIFICATION LIMITS AND SAMPLE CALCULATIONS**

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

**CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207**

| Frequency Range (MHz) | Limit (QP) (dBuV) | Limit (Avg) (dBuV) |
|-----------------------|-------------------|--------------------|
| .150 to .500          | 66 – 56           | 56 - 46            |
| .500 to 5             | 56                | 46                 |
| 5 to 30               | 60                | 50                 |

**RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209**

| Frequency Range (MHz) | Limit (uV/m @ 3m)                   | Limit (dBuV/m @ 3m)                               |
|-----------------------|-------------------------------------|---------------------------------------------------|
| 0.009-0.490           | $2400/F_{\text{KHz}} @ 300\text{m}$ | $67.6-20*\log_{10}(F_{\text{KHz}}) @ 300\text{m}$ |
| 0.490-1.705           | $24000/F_{\text{KHz}} @ 30\text{m}$ | $87.6-20*\log_{10}(F_{\text{KHz}}) @ 30\text{m}$  |
| 1.705 to 30           | 30 @ 30m                            | 29.5 @ 30m                                        |
| 30 to 88              | 100                                 | 40                                                |
| 88 to 216             | 150                                 | 43.5                                              |
| 216 to 960            | 200                                 | 46.0                                              |
| Above 960             | 500                                 | 54.0                                              |

**SAMPLE CALCULATIONS - CONDUCTED EMISSIONS**

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - B = C$$

and

$$C - S = M$$

where:

$R_r$  = Receiver Reading in dBuV

B = Broadband Correction Factor\*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

\* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

**SAMPLE CALCULATIONS - RADIATED EMISSIONS**

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20 * \text{LOG}_{10} (D_m/D_s)$$

where:

$$F_d = \text{Distance Factor in dB}$$

$$D_m = \text{Measurement Distance in meters}$$

$$D_s = \text{Specification Distance in meters}$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

$$R_r = \text{Receiver Reading in dBuV/m}$$

$$F_d = \text{Distance Factor in dB}$$

$$R_c = \text{Corrected Reading in dBuV/m}$$

$$L_s = \text{Specification Limit in dBuV/m}$$

$$M = \text{Margin in dB Relative to Spec}$$

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**EXHIBIT 1: Test Equipment Calibration Data**

1 Page



**Radiated Emissions, 1000 - 25,000 MHz, 29-Oct-02****Engineer: jmartinez**

| <u>Manufacturer</u> | <u>Description</u>                                      | <u>Model #</u> | <u>Asset #</u> | <u>Cal interval</u> | <u>Last Calibrated</u> | <u>Cal Due</u> |
|---------------------|---------------------------------------------------------|----------------|----------------|---------------------|------------------------|----------------|
| EMCO                | Horn Antenna, D. Ridge 1-18GHz                          | 3115           | 786            | 12                  | 3/2/2002               | 3/2/2003       |
| Hewlett Packard     | Microwave EMI test system (SA40, 9Hz - 40GHz), system 2 | 84125C         | 1410           | 12                  | 4/2/2002               | 4/2/2003       |
| Miteq               | Preamplifier, 1-18GHz                                   | AFS44          | 1346           | 12                  | 1/7/2002               | 1/7/2003       |

**Antenna Conducted Emissions, 29-Oct-02****Engineer: jmartinez**

| <u>Manufacturer</u> | <u>Description</u>                                      | <u>Model #</u> | <u>Asset #</u> | <u>Cal interval</u> | <u>Last Calibrated</u> | <u>Cal Due</u> |
|---------------------|---------------------------------------------------------|----------------|----------------|---------------------|------------------------|----------------|
| Hewlett Packard     | Microwave EMI test system (SA40, 9Hz - 40GHz), system 2 | 84125C         | 1410           | 12                  | 4/2/2002               | 4/2/2003       |

**Conducted and Radiated Emissions, 30-Oct-02****Engineer: Vishal**

| <u>Manufacturer</u>  | <u>Description</u>                              | <u>Model #</u>   | <u>Asset #</u> | <u>Cal interval</u> | <u>Last Calibrated</u> | <u>Cal Due</u> |
|----------------------|-------------------------------------------------|------------------|----------------|---------------------|------------------------|----------------|
| Elliott Laboratories | Biconical Antenna, 30-300 MHz                   | EL30.300         | 54             | 12                  | 1/4/2002               | 1/4/2003       |
| Hewlett Packard      | EMC Spectrum Analyzer, Opt. 026 ,9 KHz -26.5GHz | 8593EM           | 1141           | 12                  | 3/11/2002              | 3/11/2003      |
| Filtek               | High Pass Filter, 1GHz                          | HP12/1000-5BA    | 957            | 12                  | 3/25/2002              | 3/25/2003      |
| EMCO                 | LISN, 10kHz-100MHz                              | 3825/2           | 1293           | 12                  | 6/2/2002               | 6/2/2003       |
| EMCO                 | Log Periodic Antenna, 0.3-1 GHz                 | 3146A            | 364            | 12                  | 9/12/2002              | 9/12/2003      |
| Hewlett Packard      | Microwave Preamplifier, 1-26.5GHz               | 8449B            | 870            | 12                  | 1/15/2002              | 1/15/2003      |
| Rohde & Schwarz      | Pulse Limiter                                   | ESH3 Z2          | 1398           | 12                  | 2/7/2002               | 2/7/2003       |
| Solar Electronics    | Support Equipment LISN, 0.150-30.0 MHz          | 8012-50-R-24-BNC | 305            | 12                  | 8/20/2002              | 8/20/2003      |
| Rohde & Schwarz      | Test Receiver, 9kHz-2750MHz                     | ESCS 30          | 1337           | 12                  | 12/26/2001             | 12/26/2002     |

**Output Power, 15-Nov-02****Engineer: Mark**

| <u>Manufacturer</u> | <u>Description</u>           | <u>Model #</u> | <u>Asset #</u> | <u>Cal interval</u> | <u>Last Calibrated</u> | <u>Cal Due</u> |
|---------------------|------------------------------|----------------|----------------|---------------------|------------------------|----------------|
| Rohde & Schwarz     | Power Meter                  | NRVS           | 1422           | 12                  | 9/6/2002               | 9/6/2003       |
| Rohde & Schwarz     | Power Sensor 100uW - 2 Watts | NRV-Z32        | 1423           | 12                  | 9/6/2002               | 9/6/2003       |

## ***EXHIBIT 2: Test Data Log Sheets***

**ELECTROMAGNETIC EMISSIONS**

**TEST LOG SHEETS**

**AND**

**MEASUREMENT DATA**

T49181\_Radio 26 Pages



## EMC Test Data

|                                         |                       |
|-----------------------------------------|-----------------------|
| Client: ActionTec                       | Job Number: J49140    |
| Model: BMDC200                          | T-Log Number: T49181  |
|                                         | Proj Eng: Mark Briggs |
| Contact: Angela Yao                     |                       |
| Emissions Spec: FCC15.247(FHSS), 15.109 | Class: -              |
| Immunity Spec: -                        | Environment: -        |

# EMC Test Data

For The

**ActionTec**

Model

**BMDC200**



## EMC Test Data

|                                         |                       |
|-----------------------------------------|-----------------------|
| Client: ActionTec                       | Job Number: J49140    |
| Model: BMDC200                          | T-Log Number: T49181  |
| Contact: Angela Yao                     | Proj Eng: Mark Briggs |
| Emissions Spec: FCC15.247(FHSS), 15.109 | Class: -              |
| Immunity Spec: -                        | Environment: -        |

### EUT INFORMATION

#### General Description

The EUT is a Bluetooth FHSS transmitter, which is designed to provide wireless networking environment for home or office use. The device is designed to be installed into a laptop PC and connected to the internal USB interface bus. The USB bus of the host laptop provides both power and data/control signals to the EUT. The EUT's antenna is integrated into the enclosure for the laptop screen. For testing purposes the EUT was installed into an IBM laptop. Normally, the host system would be placed on a table top during operation. The host IBM laptop was, therefore, treated as table-top equipment during testing to simulate the end user environment. The electrical rating of the host system's external AC-DC adapter was 120/240 V, 50/60 Hz, 1 Amp.

#### Equipment Under Test

| Manufacturer | Model   | Description | Serial Number | FCC ID        |
|--------------|---------|-------------|---------------|---------------|
| Actiontec    | BMDC200 | MPCI card   | N/A           | LNQ-BMDC200   |
| Actiontec    | BMDC200 | MPCI card   | N/A           | 2496A-BMDC200 |

#### Antenna

The maximum gain of the antenna is approximately 1.5 dBi.

#### EUT Enclosure

The EUT does not have an enclosure as it is designed to be installed within the enclosure of a host computer.

#### Modification History

| Mod. # | Test | Date | Modification |
|--------|------|------|--------------|
| 1      | -    | -    | None         |



## EMC Test Data

|                                         |                       |
|-----------------------------------------|-----------------------|
| Client: ActionTec                       | Job Number: J49140    |
| Model: BMDC200                          | T-Log Number: T49181  |
| Contact: Angela Yao                     | Proj Eng: Mark Briggs |
| Emissions Spec: FCC15.247(FHSS), 15.109 | Class: -              |
| Immunity Spec: -                        | Environment: -        |

### Test Configuration #1

#### Local Support Equipment

| Manufacturer | Model            | Description | Serial Number | FCC ID |
|--------------|------------------|-------------|---------------|--------|
| IBM          | IBM ThinkPad R40 | Laptop      | FX-00412      | DoC    |
| Logitech     | N/A              | Mouse       | LNA20956436   | DoC    |
| HP           | 2225C            | Printer     | 2714S40166    |        |

#### Remote Support Equipment

| Manufacturer | Model | Description | Serial Number | FCC ID |
|--------------|-------|-------------|---------------|--------|
| None         |       |             |               |        |

#### Interface Cabling and Ports

| Port     | Connected To | Cable(s)       |                        |           |
|----------|--------------|----------------|------------------------|-----------|
|          |              | Description    | Shielded or Unshielded | Length(m) |
| Parallel | Printer      | Parallel Cable | Shielded               | 2         |
| USB      | Mouse        | USB Cable      | Shielded               | 3         |

Note: No external connections accessible.

#### EUT Operation During Emissions

The EUT was in a continuous transmit mode on the frequency specified in the 2400-2483.5 MHz band or set to hopping as required.



## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
|                               | Proj Eng: Mark Briggs |
| Contact: Angela Yao           |                       |
| Spec: FCC15.247(FHSS), 15.109 | Class: -              |

### Conducted Emissions - Power Ports

#### Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/29/2002  
Test Engineer: Vishal  
Test Location: SVOATS #1

Config. Used: 1  
Config Change: None  
EUT Voltage: 230V/50Hz and 120V/60Hz

#### General Test Configuration

For tabletop equipment, the EUT was located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment.

**Ambient Conditions:** Temperature: 12°C  
Rel. Humidity: 75%

#### Summary of Results

| Run # | Test Performed         | Limit        | Result | Margin             |
|-------|------------------------|--------------|--------|--------------------|
| 1     | CE, AC Power 230V/50Hz | EN 301 489-1 | Pass   | -10.0dB @ 0.150MHz |
| 2     | CE, AC Power 120V/60Hz | FCC B        | Pass   | -12.0dB @ 0.150MHz |

#### Modifications Made During Testing:

No modifications were made to the EUT during testing

#### Deviations From The Standard

No deviations were made from the requirements of the standard.



## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: -              |

### Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 230V/50Hz

| Frequency | Level      | AC      | EN55022 B |        | Detector | Comments |
|-----------|------------|---------|-----------|--------|----------|----------|
|           |            |         | Limit     | Margin |          |          |
| MHz       | dB $\mu$ V | Line    |           |        | QP/Ave   |          |
| 0.150     | 56.0       | Neutral | 66.0      | -10.0  | QP       |          |
| 0.327     | 38.7       | Neutral | 49.5      | -10.8  | Average  |          |
| 0.150     | 52.6       | Line    | 66.0      | -13.4  | QP       |          |
| 0.327     | 43.9       | Neutral | 59.5      | -15.6  | QP       |          |
| 8.650     | 39.5       | Line    | 60.0      | -20.5  | QP       |          |
| 8.6600    | 37.4       | Neutral | 60.0      | -22.6  | QP       |          |
| 0.740     | 29.1       | Line    | 56.0      | -26.9  | QP       |          |
| 0.740     | 16.5       | Line    | 46.0      | -29.5  | Average  |          |
| 0.150     | 26.4       | Neutral | 56.0      | -29.6  | Average  |          |
| 0.150     | 24.2       | Line    | 56.0      | -31.8  | Average  |          |
| 8.650     | 16.2       | Line    | 50.0      | -33.8  | Average  |          |
| 8.6600    | 13.5       | Neutral | 50.0      | -36.5  | Average  |          |

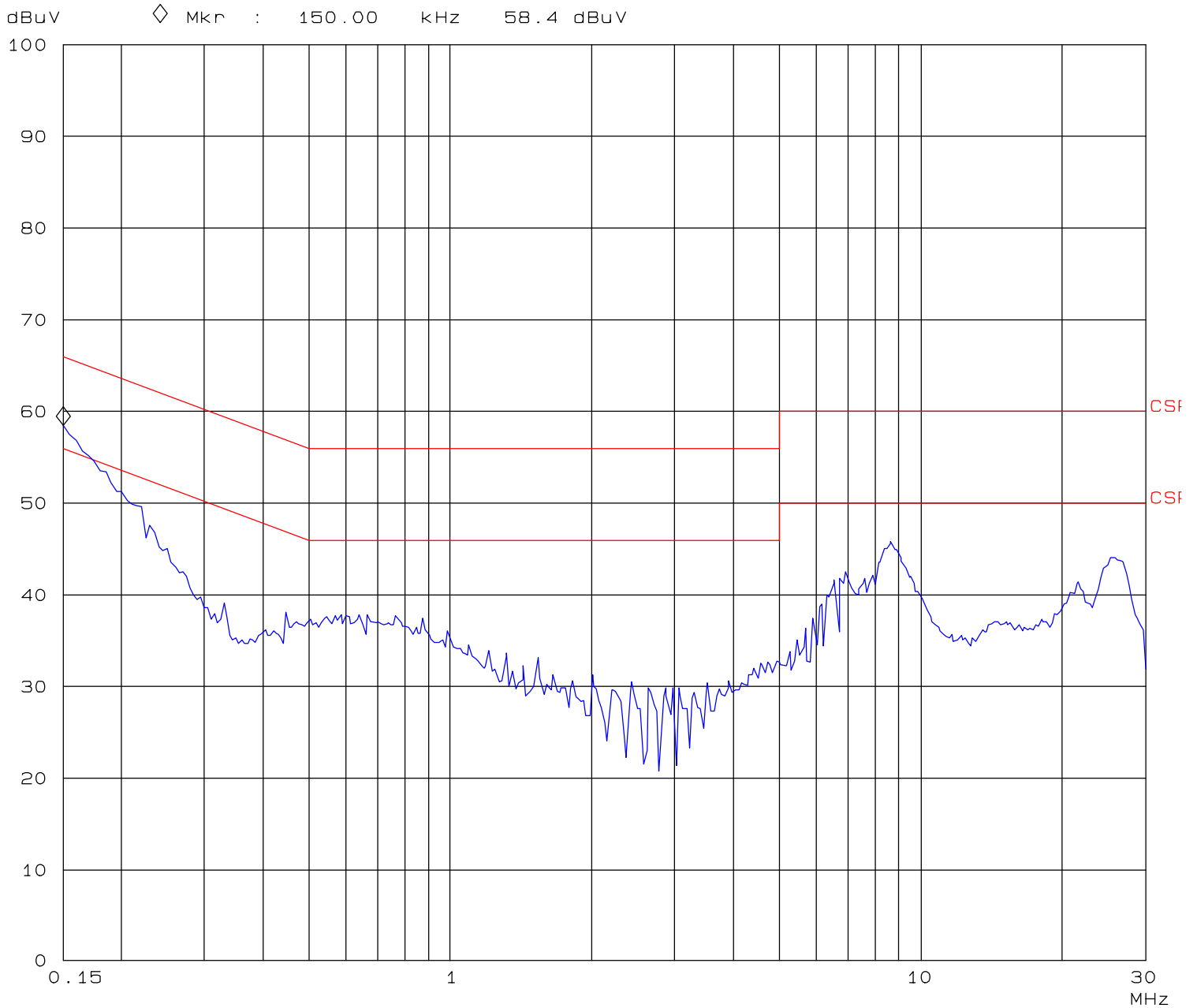
### Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

| Frequency | Level      | AC      | EN55022 B |        | Detector | Comments |
|-----------|------------|---------|-----------|--------|----------|----------|
|           |            |         | Limit     | Margin |          |          |
| MHz       | dB $\mu$ V | Line    |           |        | QP/Ave   |          |
| 0.150     | 54.0       | Line    | 66.0      | -12.0  | QP       |          |
| 0.190     | 50.0       | Line    | 64.0      | -14.0  | QP       |          |
| 0.190     | 33.9       | Line    | 54.0      | -20.1  | Average  |          |
| 0.190     | 33.7       | Neutral | 54.0      | -20.3  | Average  |          |
| 0.190     | 43.4       | Neutral | 64.0      | -20.6  | QP       |          |
| 8.2450    | 36.8       | Neutral | 60.0      | -23.2  | QP       |          |
| 0.585     | 30.6       | Neutral | 56.0      | -25.4  | QP       |          |
| 8.320     | 34.0       | Line    | 60.0      | -26.0  | QP       |          |
| 0.585     | 16.5       | Neutral | 46.0      | -29.5  | Average  |          |
| 0.150     | 24.0       | Line    | 56.0      | -32.0  | Average  |          |
| 8.2450    | 16.3       | Neutral | 50.0      | -33.7  | Average  |          |
| 8.320     | 12.6       | Line    | 50.0      | -37.4  | Average  |          |

# Elliott Laboratories Conducted Emissions

30. Oct 02 01:39

EUT: BMD C200  
Manuf: Action Tec  
Op Cond: Run 1 230V/50Hz Line  
Operator: Vishal Narayan  
Test Spec: EN55022 Class B  
Comment: J49140 / T49181  
File name: 120line.RES

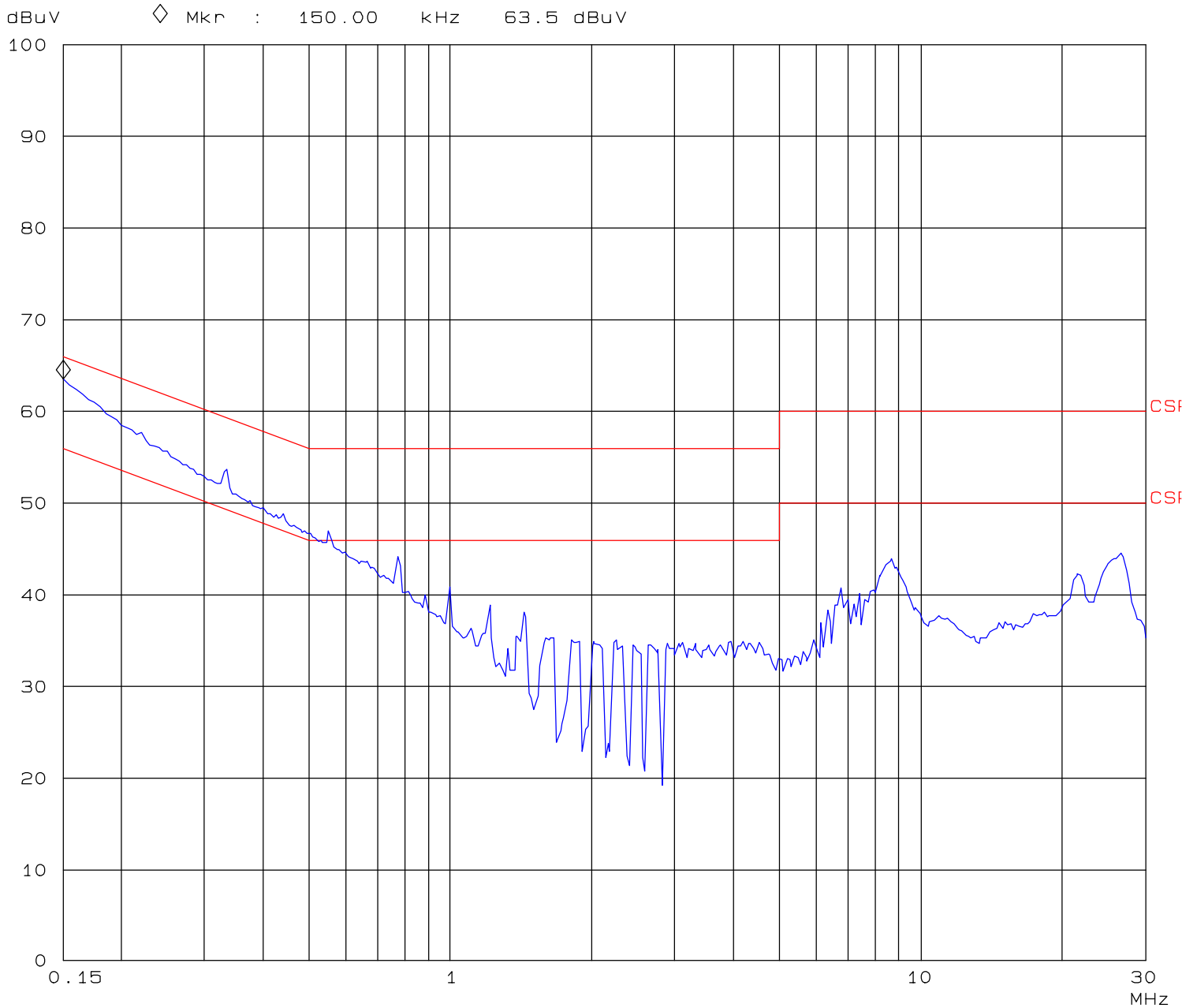




# Elliott Laboratories Conducted Emissions

30. Oct 02 01:55

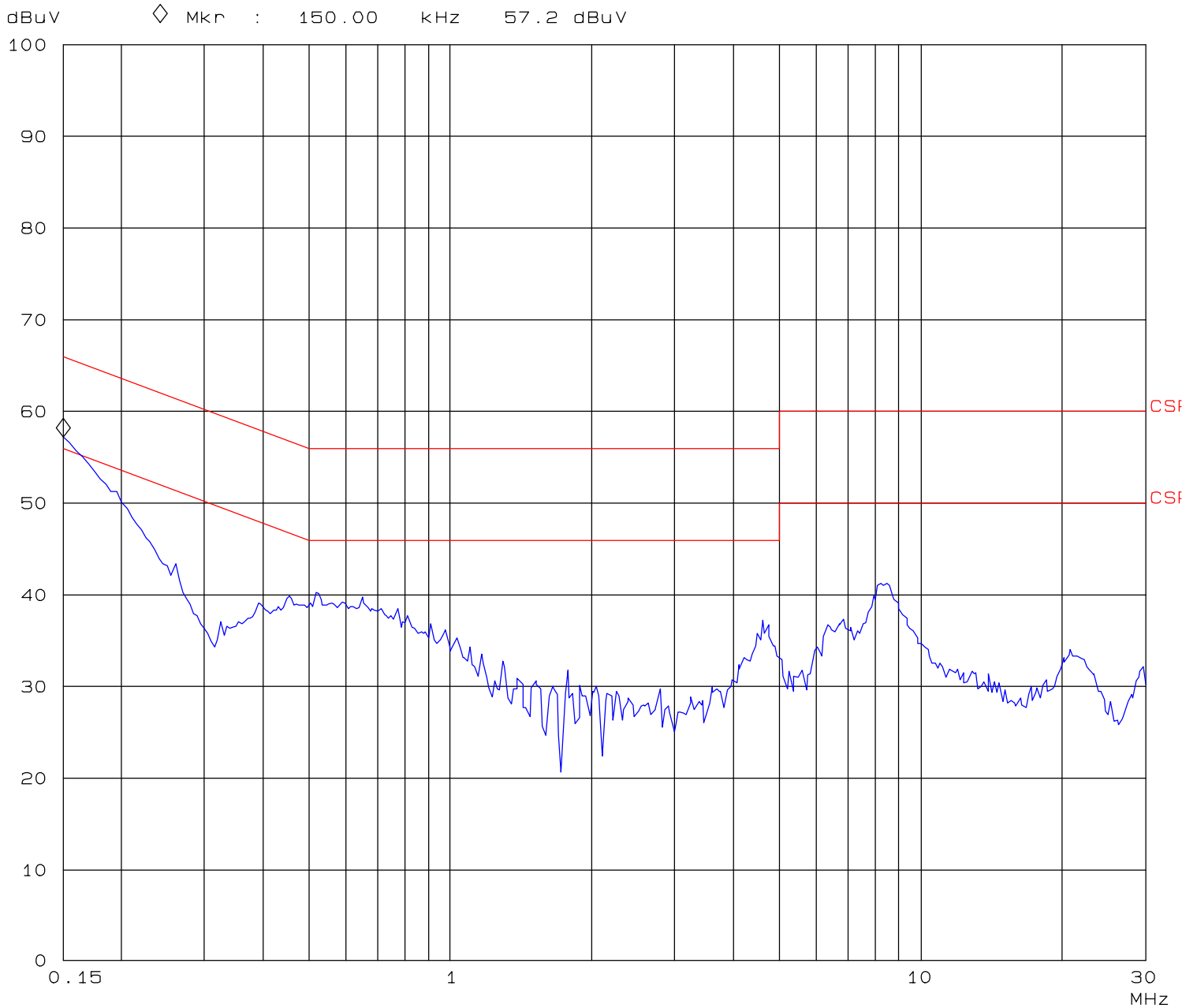
EUT: BMD C200  
Manuf: Action Tec  
Op Cond: Run 1 230V/50Hz Neutral  
Operator: Vishal Narayan  
Test Spec: EN55022 Class B  
Comment: J49140 / T49181  
File name: 120line.RES



# Elliott Laboratories Conducted Emissions

30. Oct 02 02: 23

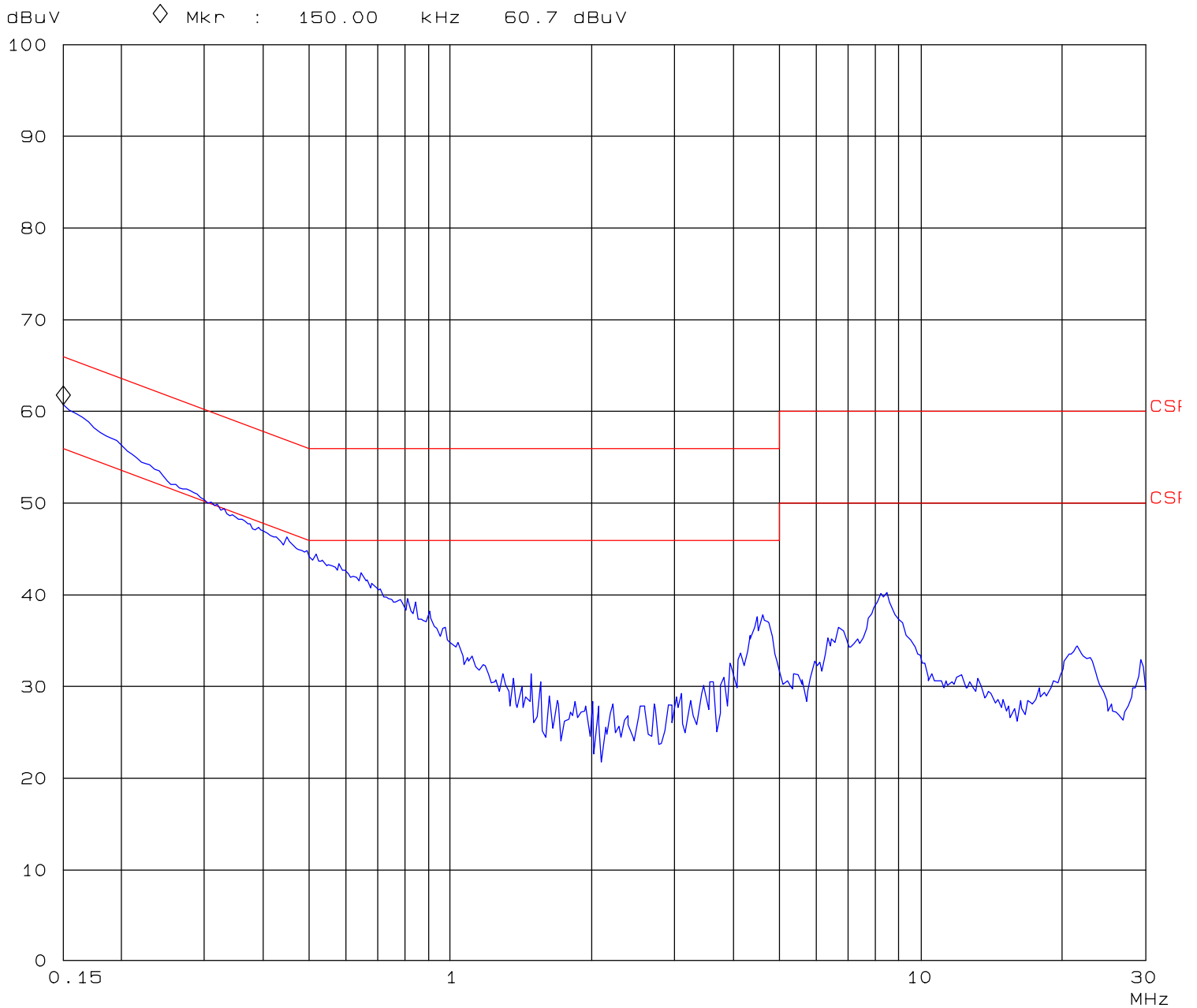
EUT: BMD C200  
Manuf: Action Tec  
Op Cond: Run 2 120V/60Hz Line  
Operator: Vishal Narayan  
Test Spec: EN55022 Class B  
Comment: J49140 / T49181  
File name: 120line.RES



# Elliott Laboratories Conducted Emissions

30. Oct 02 02: 12

EUT: BMD C200  
Manuf: Action Tec  
Op Cond: Run 2 120V/60Hz Neutral  
Operator: Vishal Narayan  
Test Spec: EN55022 Class B  
Comment: J49140 / T49181  
File name: 120line.RES





## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: -              |

### Radiated Emissions

#### Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/29/2002  
 Test Engineer: Vishal  
 Test Location: SVOATS #1

Config. Used: 1  
 Config Change: None  
 EUT Voltage: 230V/50Hz

#### General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

On the OATS, the measurement antenna was located 10 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 2 GHz.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

**Ambient Conditions:** Temperature: 12°C  
 Rel. Humidity: 75%

#### Summary of Results

| Run # | Test Performed                         | Limit                  | Result | Margin              |
|-------|----------------------------------------|------------------------|--------|---------------------|
| 1     | RE, Preliminary Scan 30 - 1000 MHz     | EN 55022 / FCC Class B | Pass   | -2.9dB @ 190.470MHz |
| 2     | RE, 30 - 1000MHz - Maximized Emissions | EN 55022 / FCC Class B | Pass   | -2.7dB @ 150.490MHz |
| 3     | RE, 1000 - 2000MHz Maximized Emissions | FCC B                  | Pass   | -18.3dB @ 1195.0MHz |

#### Modifications Made During Testing:

No modifications were made to the EUT during testing

#### Deviations From The Standard

No deviations were made from the requirements of the standard.



## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: -              |

### Run #1: Preliminary Radiated Emissions, 30-1000 MHz

| Frequency<br>MHz | Level<br>dB $\mu$ V/m | Pol<br>v/h | EN 55022 B / FCC B<br>Margin | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------------|------------|------------------------------|-----------------------|--------------------|------------------|----------|
| 190.470          | 27.1                  | V          | 30.0                         | -2.9                  | QP                 | 190              | 1.0      |
| 150.490          | 26.7                  | V          | 30.0                         | -3.3                  | QP                 | 30               | 1.0      |
| 256.000          | 33.1                  | V          | 37.0                         | -3.9                  | QP                 | 40               | 1.0      |
| 299.010          | 33.1                  | V          | 37.0                         | -3.9                  | QP                 | 200              | 1.0      |
| 223.240          | 25.6                  | H          | 30.0                         | -4.4                  | QP                 | 120              | 3.5      |
| 215.040          | 25.4                  | H          | 30.0                         | -4.6                  | QP                 | 110              | 4.0      |
| 210.000          | 25.3                  | V          | 30.0                         | -4.7                  | QP                 | 80               | 1.0      |
| 256.000          | 32.2                  | H          | 37.0                         | -4.8                  | QP                 | 120              | 3.5      |
| 198.660          | 25.2                  | V          | 30.0                         | -4.8                  | QP                 | 180              | 1.0      |
| 150.490          | 24.5                  | H          | 30.0                         | -5.5                  | QP                 | 130              | 4.0      |
| 432.070          | 31.1                  | H          | 37.0                         | -5.9                  | QP                 | 220              | 1.6      |
| 223.240          | 24.0                  | V          | 30.0                         | -6.0                  | QP                 | 180              | 1.0      |
| 198.660          | 24.0                  | H          | 30.0                         | -6.0                  | QP                 | 240              | 3.2      |
| 215.040          | 23.7                  | V          | 30.0                         | -6.3                  | QP                 | 180              | 1.3      |
| 364.325          | 30.1                  | V          | 37.0                         | -6.9                  | QP                 | 180              | 1.0      |
| 364.325          | 29.6                  | H          | 37.0                         | -7.4                  | QP                 | 230              | 3.5      |
| 243.720          | 29.5                  | H          | 37.0                         | -7.5                  | QP                 | 120              | 4.0      |
| 243.720          | 29.3                  | V          | 37.0                         | -7.7                  | QP                 | 190              | 1.0      |
| 165.140          | 21.9                  | V          | 30.0                         | -8.1                  | QP                 | 360              | 1.0      |
| 36.920           | 21.5                  | V          | 30.0                         | -8.5                  | QP                 | 280              | 1.0      |
| 299.010          | 28.3                  | H          | 37.0                         | -8.7                  | QP                 | 200              | 3.0      |
| 227.330          | 21.2                  | V          | 30.0                         | -8.8                  | QP                 | 330              | 1.0      |
| 162.530          | 20.7                  | V          | 30.0                         | -9.3                  | QP                 | 260              | 2.1      |
| 432.070          | 27.2                  | V          | 37.0                         | -9.8                  | QP                 | 320              | 1.0      |
| 210.000          | 20.0                  | H          | 30.0                         | -10.0                 | QP                 | 360              | 3.0      |
| 528.100          | 26.1                  | H          | 37.0                         | -10.9                 | QP                 | 320              | 1.8      |
| 528.100          | 25.5                  | V          | 37.0                         | -11.5                 | QP                 | 20               | 1.0      |
| 326.695          | 24.5                  | V          | 37.0                         | -12.5                 | QP                 | 260              | 1.0      |
| 380.755          | 24.4                  | V          | 37.0                         | -12.6                 | QP                 | 20               | 1.0      |
| 272.390          | 24.0                  | V          | 37.0                         | -13.0                 | QP                 | 360              | 1.0      |



## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: -              |

### Run #2: Maximized Readings From Run #1

| Frequency<br>MHz | Level<br>dB $\mu$ V/m | Pol<br>v/h | EN55022 B |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------------|------------|-----------|--------|-----------------------|--------------------|------------------|----------|
|                  |                       |            | Limit     | Margin |                       |                    |                  |          |
| 150.490          | 27.3                  | V          | 30.0      | -2.7   | QP                    | 30                 | 1.0              |          |
| 190.470          | 27.1                  | V          | 30.0      | -2.9   | QP                    | 190                | 1.0              |          |
| 256.000          | 33.1                  | V          | 37.0      | -3.9   | QP                    | 40                 | 1.0              |          |
| 299.010          | 33.1                  | V          | 37.0      | -3.9   | QP                    | 200                | 1.0              |          |
| 223.240          | 25.6                  | H          | 30.0      | -4.4   | QP                    | 120                | 3.5              |          |
| 215.040          | 25.4                  | H          | 30.0      | -4.6   | QP                    | 110                | 4.0              |          |

### Run #3: Maximized readings, 1000 - 2000 MHz

Measurements made at 3m per FCC requirements.

| Frequency<br>MHz | Level<br>dB $\mu$ V/m | Pol<br>v/h | FCC B |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------------|------------|-------|--------|-----------------------|--------------------|------------------|----------|
|                  |                       |            | Limit | Margin |                       |                    |                  |          |
| 1195.000         | 55.7                  | V          | 74.0  | -18.3  | Pk                    | 210                | 1.0              |          |
| 1097.000         | 33.0                  | V          | 54.0  | -21.0  | Avg                   | 230                | 1.0              |          |
| 1195.000         | 32.7                  | V          | 54.0  | -21.3  | Avg                   | 210                | 1.0              |          |
| 1198.000         | 30.7                  | H          | 54.0  | -23.3  | Avg                   | 360                | 3.5              |          |
| 1097.000         | 45.5                  | V          | 74.0  | -28.5  | Pk                    | 230                | 1.0              |          |
| 1198.000         | 44.4                  | H          | 74.0  | -29.6  | Pk                    | 360                | 3.5              |          |



## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
|                               | Proj Eng: Mark Briggs |
| Contact: Angela Yao           |                       |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

### Radiated Emissions

#### Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/28/2002  
Test Engineer: jmartinez  
Test Location: SVOATS #4

Config. Used: 1  
Config Change: None  
Host Unit Voltage 120V/60Hz

#### General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Unless stated otherwise the EUT was operating such that it constantly hopped on either the low, center or high channels.

#### Ambient Conditions:

Temperature: 13°C

Rel. Humidity: 72%



## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

### Summary of Results

| Run # | Test Performed                           | Limit                        | Result | Margin              |
|-------|------------------------------------------|------------------------------|--------|---------------------|
| 1a    | RE, 30 - 25,000 MHz - Spurious Emissions | FCC Part 15.209 / 15.247( c) | Pass   | -7.8dB @ 4804.0MHz  |
| 1b    | RE, 30 - 25,000 MHz - Spurious Emissions | FCC Part 15.209 / 15.247( c) | Pass   | -15.3dB @ 9764.0MHz |
| 1c    | RE, 30 - 25,000 MHz - Spurious Emissions | FCC Part 15.209 / 15.247( c) | Pass   | -10.9dB @ 7439.9MHz |
| 2     | 20dB Bandwidth                           | 15.247(a)                    | Pass   | .825 MHz            |
| 3     | Output Power                             | 15.247(b)                    | Pass   | 3.7 dBm             |
| 4     | Channel Occupancy                        | 15.247(a)                    | Pass   | 0.127 Sec           |
| 5     | Channel Separation                       | 15.247(a)                    | Pass   | 1.008 MHz           |
| 6     | Number of Channels                       | 15.247(a)                    | Pass   | 79 Channels         |
| 7     | Out-of-Band                              | 15.247(a)                    | Pass   | Refer to Plots      |
| 8     | Bandages                                 | 15.247(a)                    | Pass   | Refer to run        |

### Modifications Made During Testing:

No modifications were made to the EUT during testing

### Deviations From The Standard

No deviations were made from the requirements of the standard.





## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

### Run #1a: Radiated Spurious Emissions, 30-12,000 MHz. Low Channel @ 2402 MHz

|                                                  |                   |      |
|--------------------------------------------------|-------------------|------|
|                                                  | H                 | V    |
| Fundamental emission level @ 3m in 1 MHz RBW:    | 91.4              | 99.6 |
| Limit for emissions outside of restricted bands: | 79.6 dB $\mu$ V/m |      |

| Frequency<br>MHz | Level<br>dB $\mu$ V/m | Pol<br>v/h | 15.209 / 15.247 |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------------|------------|-----------------|--------|-----------------------|--------------------|------------------|----------|
|                  |                       |            | Limit           | Margin |                       |                    |                  |          |
| 4803.975         | 46.2                  | V          | 54.0            | -7.8   | Avg                   | 0                  | 1.0              |          |
| 7205.979         | 45.8                  | V          | 54.0            | -8.2   | Avg                   | 0                  | 1.2              |          |
| 12010.24         | 43.2                  | V          | 54.0            | -10.8  | Avg                   | 90                 | 1.2              |          |
| 7439.399         | 41.2                  | H          | 54.0            | -12.8  | Avg                   | 0                  | 1.0              |          |
| 12010.24         | 41.2                  | H          | 54.0            | -12.8  | Avg                   | 360                | 1.1              |          |
| 9608.491         | 41.1                  | V          | 54.0            | -12.9  | Avg                   | 319                | 1.2              |          |
| 9919.685         | 40.2                  | H          | 54.0            | -13.8  | Avg                   | 0                  | 1.0              |          |
| 9919.081         | 39.5                  | H          | 54.0            | -14.5  | Avg                   | 0                  | 1.0              |          |
| 7439.275         | 58.7                  | H          | 74.0            | -15.3  | Pk                    | 0                  | 1.0              |          |
| 12010.49         | 57.2                  | H          | 74.0            | -16.8  | Pk                    | 360                | 1.1              |          |
| 12010.49         | 56.5                  | V          | 74.0            | -17.5  | Pk                    | 90                 | 1.2              |          |
| 7205.952         | 55.8                  | V          | 74.0            | -18.2  | Pk                    | 0                  | 1.2              |          |
| 9608.719         | 55.2                  | V          | 74.0            | -18.8  | Pk                    | 319                | 1.2              |          |
| 9919.330         | 53.8                  | H          | 74.0            | -20.2  | Pk                    | 0                  | 1.0              |          |
| 9919.935         | 53.4                  | H          | 74.0            | -20.6  | Pk                    | 0                  | 1.0              |          |
| 4959.968         | 33.1                  | H          | 54.0            | -20.9  | Avg                   | 0                  | 1.3              |          |
| 4803.876         | 50.7                  | V          | 74.0            | -23.3  | Pk                    | 0                  | 1.0              |          |
| 4960.188         | 46.2                  | H          | 74.0            | -27.8  | Pk                    | 0                  | 1.3              |          |

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.



## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

### Run #1b: Radiated Spurious Emissions, 30-25,000 MHz. Center Channel @ 2441 MHz

|                                                  |                 |     |
|--------------------------------------------------|-----------------|-----|
|                                                  | H               | V   |
| Fundamental emission level @ 3m in 1 MHz RBW:    | 100             | 102 |
| Limit for emissions outside of restricted bands: | 82 dB $\mu$ V/m |     |

| Frequency<br>MHz | Level<br>dB $\mu$ V/m | Pol<br>v/h | 15.209 / 15.247 |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------------|------------|-----------------|--------|-----------------------|--------------------|------------------|----------|
|                  |                       |            | Limit           | Margin |                       |                    |                  |          |
| 9764.000         | 38.7                  | H          | 54.0            | -15.3  | Avg                   | 360                | 1.0              |          |
| 12205.00         | 42.2                  | V          | 54.0            | -11.8  | Avg                   | 0                  | 1.2              |          |
| 12205.00         | 42.1                  | H          | 54.0            | -11.9  | Avg                   | 293                | 1.0              |          |
| 7323.000         | 41.8                  | H          | 54.0            | -12.2  | Avg                   | 258                | 1.0              |          |
| 7323.000         | 41.8                  | V          | 54.0            | -12.2  | Avg                   | 130                | 1.0              |          |
| 9764.000         | 40.2                  | V          | 54.0            | -13.8  | Avg                   | 0                  | 1.1              |          |
| 4882.000         | 36.2                  | V          | 54.0            | -17.8  | Avg                   | 0                  | 1.0              |          |
| 7323.000         | 55.9                  | V          | 74.0            | -18.1  | Pk                    | 130                | 1.0              |          |
| 12205.00         | 55.7                  | H          | 74.0            | -18.3  | Pk                    | 293                | 1.0              |          |
| 12205.00         | 55.5                  | V          | 74.0            | -18.5  | Pk                    | 0                  | 1.2              |          |
| 9764.000         | 54.7                  | H          | 74.0            | -19.3  | Pk                    | 360                | 1.0              |          |
| 7323.000         | 54.5                  | H          | 74.0            | -19.5  | Pk                    | 258                | 1.0              |          |
| 9764.000         | 54.3                  | V          | 74.0            | -19.7  | Pk                    | 0                  | 1.1              |          |
| 4882.000         | 31.4                  | H          | 54.0            | -22.6  | Avg                   | 121                | 1.0              |          |
| 4882.000         | 46.2                  | V          | 74.0            | -27.8  | Pk                    | 0                  | 1.0              |          |
| 4882.000         | 45.7                  | H          | 74.0            | -28.3  | Pk                    | 121                | 1.0              |          |

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.



## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

### Run #1c: Radiated Spurious Emissions, 30-25,000 MHz. High Channel @ 2480 MHz

|                                                  |                 |    |
|--------------------------------------------------|-----------------|----|
|                                                  | H               | V  |
| Fundamental emission level @ 3m in 1 MHz RBW:    | 94.7            | 99 |
| Limit for emissions outside of restricted bands: | 79 dB $\mu$ V/m |    |

| Frequency<br>MHz | Level<br>dB $\mu$ V/m | Pol<br>v/h | 15.209 / 15.247 |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------------|------------|-----------------|--------|-----------------------|--------------------|------------------|----------|
|                  |                       |            | Limit           | Margin |                       |                    |                  |          |
| 7439.915         | 43.1                  | V          | 54.0            | -10.9  | Avg                   | 239                | 1.2              |          |
| 7439.399         | 43.1                  | H          | 54.0            | -10.9  | Avg                   | 0                  | 1.0              |          |
| 12399.65         | 42.3                  | V          | 54.0            | -11.7  | Avg                   | 360                | 1.2              |          |
| 9919.772         | 40.5                  | V          | 54.0            | -13.5  | Avg                   | 125                | 1.0              |          |
| 9919.081         | 40.4                  | H          | 54.0            | -13.6  | Avg                   | 0                  | 1.0              |          |
| 12399.65         | 40.4                  | H          | 54.0            | -13.6  | Avg                   | 0                  | 1.1              |          |
| 4959.933         | 39.8                  | V          | 54.0            | -14.2  | Avg                   | 242                | 1.4              |          |
| 7439.845         | 56.5                  | V          | 74.0            | -17.5  | Pk                    | 239                | 1.2              |          |
| 12399.89         | 55.8                  | V          | 74.0            | -18.2  | Pk                    | 360                | 1.2              |          |
| 7439.275         | 55.7                  | H          | 74.0            | -18.3  | Pk                    | 0                  | 1.0              |          |
| 12399.89         | 54.8                  | H          | 74.0            | -19.2  | Pk                    | 0                  | 1.1              |          |
| 9919.977         | 54.4                  | V          | 74.0            | -19.6  | Pk                    | 125                | 1.0              |          |
| 9919.330         | 54.3                  | H          | 74.0            | -19.7  | Pk                    | 0                  | 1.0              |          |
| 4959.968         | 32.7                  | H          | 54.0            | -21.3  | Avg                   | 0                  | 1.3              |          |
| 4959.707         | 48.2                  | V          | 74.0            | -25.8  | Pk                    | 242                | 1.4              |          |
| 4960.188         | 45.7                  | H          | 74.0            | -28.3  | Pk                    | 0                  | 1.3              |          |

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.



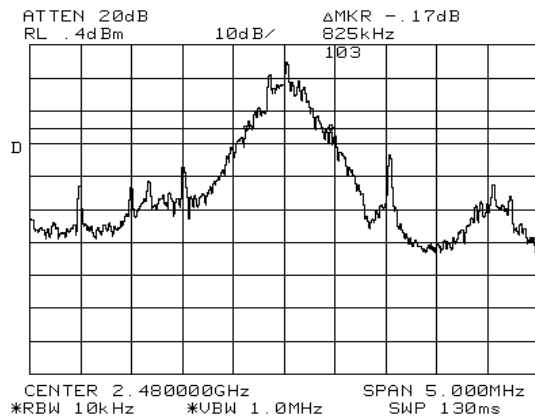
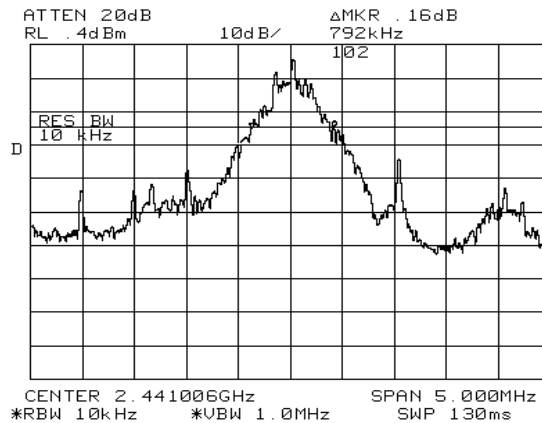
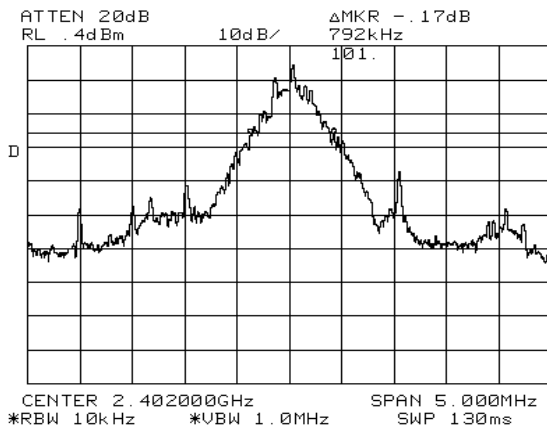
# EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

## Run #2: Signal Bandwidth

Bandwidth on all channels was less than 1MHz.

| Channel | Frequency (MHz) | Resolution Bandwidth | 20dB Signal Bandwidth | Graph reference # |
|---------|-----------------|----------------------|-----------------------|-------------------|
| Low     | 2402            | 30kHz                | .792 MHz              | 101               |
| Mid     | 2441            | 30kHz                | .792 MHz              | 102               |
| High    | 2480            | 30kHz                | .825 MHz              | 103               |





## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

### Run #3: Output Power (Peak Power Meter)

| Channel | Frequency (MHz) | Measured power | Cable Loss | Power Output (dBm) |
|---------|-----------------|----------------|------------|--------------------|
| Low     | 2402            | 2.4            | 0.6        | 3.0                |
| Mid     | 2441            | 3.1            | 0.6        | 3.7                |
| High    | 2480            | 2.5            | 0.6        | 3.1                |

- Note 1: Measured power was made using a peak power meter. Output power is measured power plus cable loss.
- Note 2: 3.7dBm is equivalent to an output power of 2.34mW. The antenna gain is approximately 2dBi. Maximum output power permitted under 15.247 is 1 Watt.



# EMC Test Data

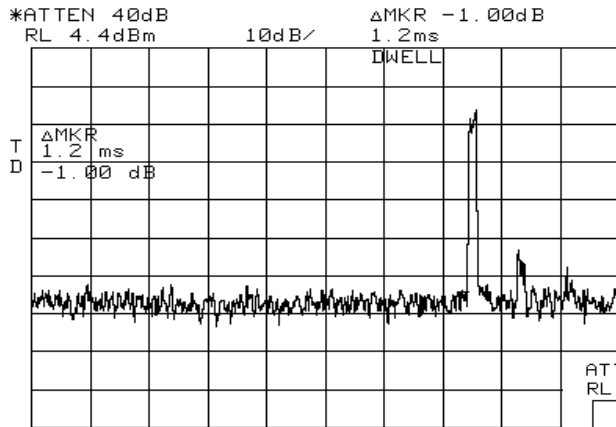
|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

## Run #4: Channel Occupancy

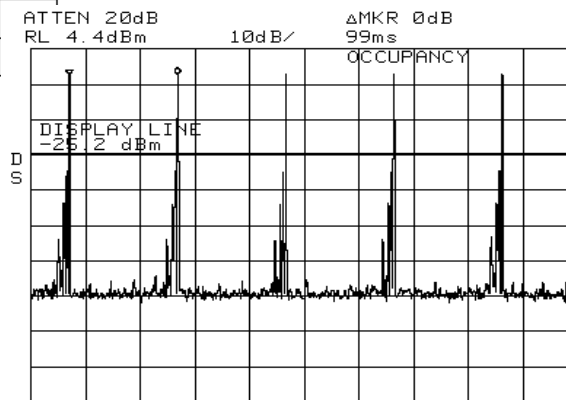
The channel occupancy was measured with the radio transmitting normally (i.e. In hopping mode)

|                                                      |                       |                       |
|------------------------------------------------------|-----------------------|-----------------------|
| The channel spacing was:                             | <u>1000</u> kHz       |                       |
| The minimum channel separation permitted is:         | <u>1000</u> kHz       |                       |
| The total number of channels (N) was:                | <u>79</u> channels    |                       |
| The dwell time (Dt) on the center channel was:       | <u>0.0012</u> Seconds |                       |
| Time between successive occupancy of a channel (Ot): | <u>0.099</u> Seconds  |                       |
| Time between successive occupancy of a channel:      | <u>0.095</u> Seconds  | Calculated (Dt * N)   |
| Dwell time calculated :                              | <u>0.0013</u> Seconds | Calculated (Ot / * N) |
| Average time per 10 seconds:                         | <u>0.127</u> Seconds  | Calculated (10 / N)   |
| Average time per 10 seconds:                         | <u>0.121</u> Seconds  | Measured (10/Ot * Dt) |

The maximum permitted dwell time in a 10 second period for FCC Part 15.247/RSS 210(o), based on a signal bandwidth >250kHz: 0.4 Seconds



CENTER 2.402000000GHz SPAN 0Hz  
\*RBW 30kHz \*UBW 3.0kHz \*SWP 30ms



CENTER 2.480000000GHz SPAN 0Hz  
\*RBW 100kHz \*UBW 1.0MHz \*SWP 500ms

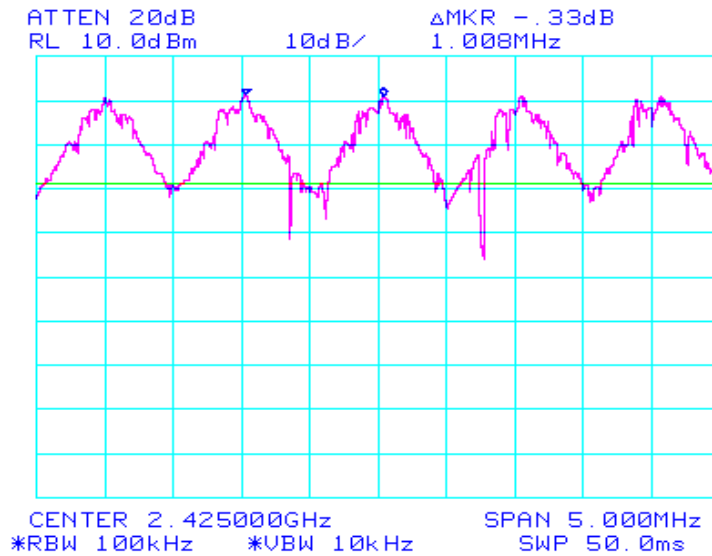
Note - theory of operations more fully discusses how the device, as a BlueTooth device, meets All occupancy requirements of 15.247 and RSS 210.

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

### Run #5: Channel Spacing

| Ch.    | Frequency (MHz) | Resolution Bandwidth | Channel Separation |
|--------|-----------------|----------------------|--------------------|
| Middle | 2441            | 100 kHz              | 1.008 MHz          |

### Channel Spacing

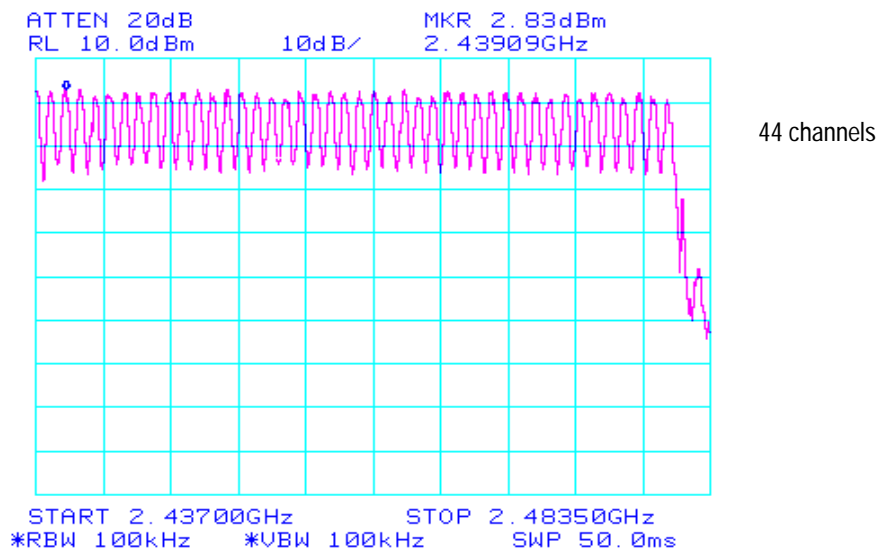
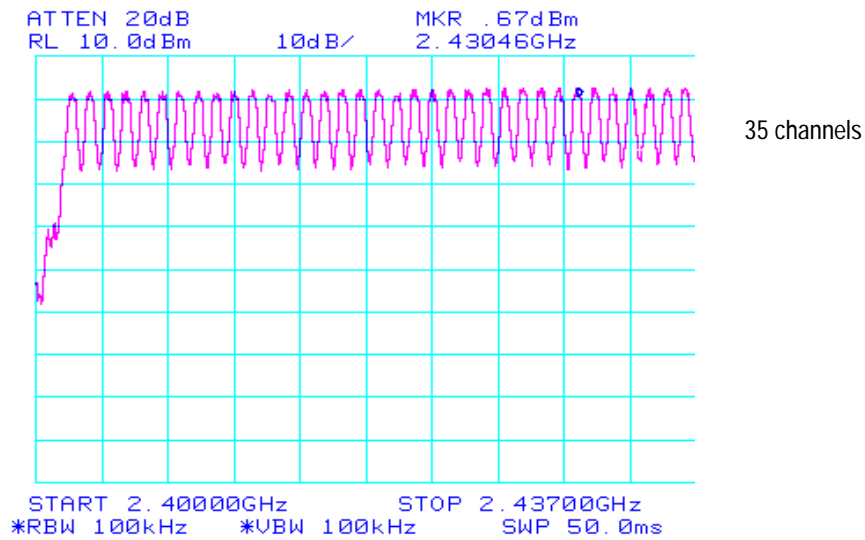


|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

### Run #6: Number of Channels

The number of channels was verified with the radio transmitting normally (i.e. In hopping mode)

The number of channels was: 79





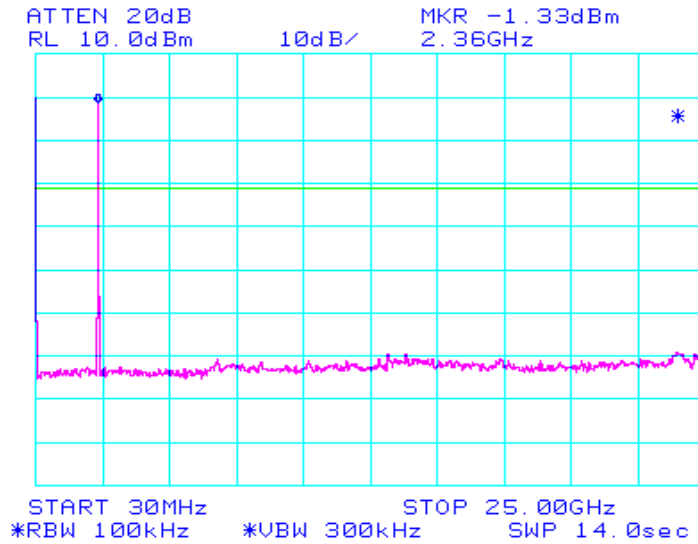


# EMC Test Data

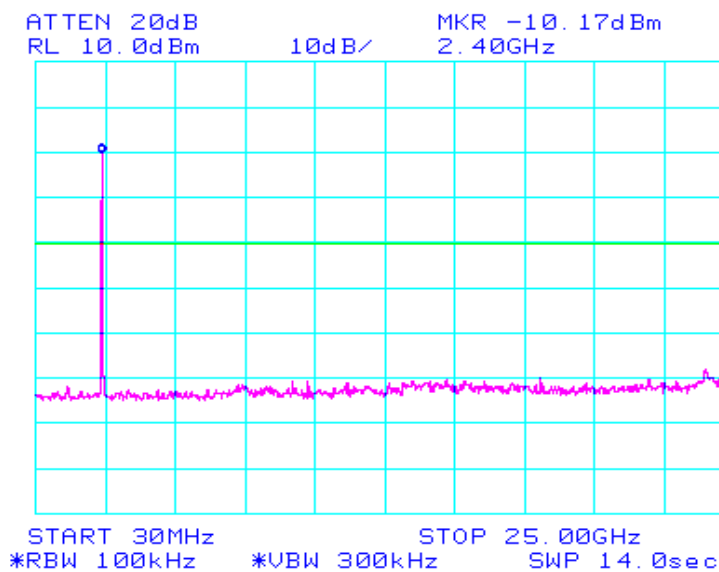
|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

## Run #7: Out of Band

2402 MHz



2441 MHz

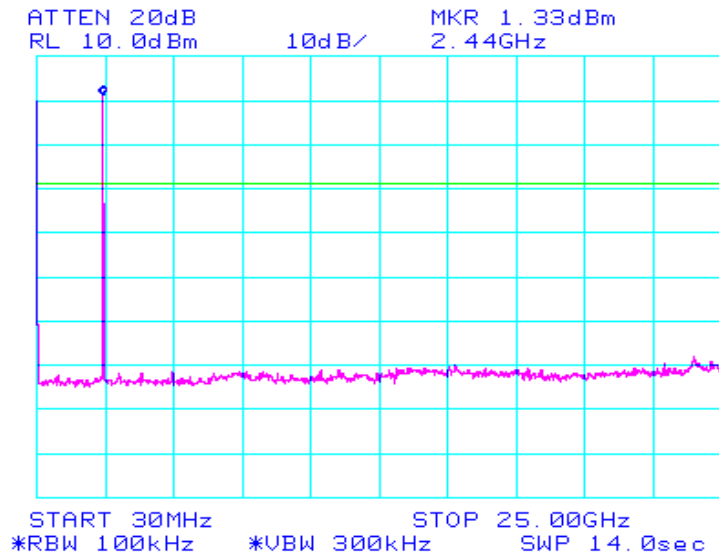




# EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

2480 MHz







## EMC Test Data

|                               |                       |
|-------------------------------|-----------------------|
| Client: ActionTec             | Job Number: J49140    |
| Model: BMDC200                | T-Log Number: T49181  |
| Contact: Angela Yao           | Proj Eng: Mark Briggs |
| Spec: FCC15.247(FHSS), 15.109 | Class: N/A            |

### Fundamental Frequency Measurements:

| Frequency<br>MHz | Level<br>dB $\mu$ V/m | Pol<br>v/h | 15.209 / 15.247 |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------------|------------|-----------------|--------|-----------------------|--------------------|------------------|----------|
|                  |                       |            | Limit           | Margin |                       |                    |                  |          |
| 2401.945         | 99.6                  | V          | -               | -      | Pk                    | 277                | 1.4              |          |
| 2401.999         | 99.4                  | V          | -               | -      | Avg                   | 277                | 1.4              |          |
| 2401.960         | 91.4                  | H          | -               | -      | Pk                    | 158                | 1.4              |          |
| 2401.965         | 90.3                  | H          | -               | -      | Avg                   | 158                | 1.4              |          |
| 2479.972         | 99.0                  | V          | -               | -      | Pk                    | 266                | 1.3              |          |
| 2479.989         | 98.4                  | V          | -               | -      | Avg                   | 266                | 1.3              |          |
| 2479.968         | 94.7                  | H          | -               | -      | Pk                    | 354                | 1.3              |          |
| 2479.992         | 94.0                  | H          | -               | -      | Avg                   | 354                | 1.3              |          |

### Bandedge Measurements

| Spurious Signal<br>MHz | Fundamental Level<br>(dB $\mu$ V/m @3m) | Detector<br>Pk/Avg | Spurious Level |              | Limit<br>dB $\mu$ V/m | Margin<br>dB | Polarization |
|------------------------|-----------------------------------------|--------------------|----------------|--------------|-----------------------|--------------|--------------|
|                        |                                         |                    | -dBc           | dB $\mu$ V/m |                       |              |              |
| 2385.98                | 99.6                                    | Pk                 | 61.5           | 38.1         | 74.0                  | -35.9        | v            |
| 2385.98                | 99.4                                    | Avg                | 61.5           | 37.9         | 54.0                  | -16.1        | v            |
| 2385.98                | 91.4                                    | Pk                 | 61.5           | 29.9         | 74.0                  | -44.1        | h            |
| 2385.98                | 90.3                                    | Avg                | 61.5           | 28.8         | 54.0                  | -25.2        | h            |
| 2484.04                | 99.0                                    | Pk                 | 65.2           | 33.8         | 74.0                  | -40.2        | v            |
| 2484.04                | 98.4                                    | Avg                | 65.2           | 33.2         | 54.0                  | -20.8        | v            |
| 2484.04                | 94.7                                    | Pk                 | 65.2           | 29.5         | 74.0                  | -44.5        | h            |
| 2484.04                | 94.0                                    | Avg                | 65.2           | 28.8         | 54.0                  | -25.2        | h            |

- Note 1: EUT operating on the lowest channel available in the 2390 - 2412 MHz band. Signal level calculated using the relative measurements in run #8, of CE spreadsheet (61.5 dBc) applied to the highest peak and average field strength measurements of the fundamental signal level.
- Note 2: EUT operating on highest channel available in the 2462 - 2483.5 MHz band. Signal level calculated using the relative measurements in run #8, of CE spreadsheet (65.2 dBc) applied to the highest peak and average field strength measurements of the fundamental signal level.

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**EXHIBIT 3: Photographs of Test Configurations**

Uploaded as a Separate File

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***EXHIBIT 4: Detailed Photographs of ActionTec Electronics, Inc.  
Model BMDC200 Construction***

Uploaded as a Separate File

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**EXHIBIT 5: Block Diagram of ActionTec Electronics, Inc. Model BMDC200**

Uploaded as a Separate File

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**EXHIBIT 6: Schematic Diagrams of ActionTec Electronics, Inc. Model BMDC200**

Uploaded as a Separate File



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**EXHIBIT 7: Theory of Operation for ActionTec Electronics, Inc. Model BMDC200**

Uploaded as a Separate File

**EXHIBIT 8: Operator's Manual**

Uploaded as a Separate File