INTERNATIONAL APPROVALS LABORATORIES

# EMC EMISSIONS - TEST REPORT (Full)

| | | | |
|---|---|---|---|
| Test Report No. | **BC400145-1** | Issue Date: | **Monday Nov 22, 2004** |
| Model / Serial No. | **Tag Trakker 2/ SN: TT2R000112** | | |
| Product Type | **Wireless RFID reader** | | |
| Client | **Morrison Engineering** | | |
| Manufacturer | **Infoclip LLC** | | |
| License holder | **Infoclip LLC** | | |
| Address | **1860 Lefthand Circle** | | |
| | **Longmont, CO 80534** | | |
| Test Criteria Applied | **FCC CFR47 Part 15.209** | | |
| Test Result | **PASS** | | |
| Test Project Number | **BC400145-1** | | RADIO FREQUENCY DEVICES |
| References | | | |
| Total Pages Including Appendices: | 25 | | |

Reviewed By : Todd Seeley

Approved By : Robert Cresswell



International Approval Laboratories and its professional staff hold government and professional organization certifications and are members of IEEE, NVLAP, and VCCI.

NVLAP Lab Code: 200624-0

Accredited

## STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty for Conducted Emissions in the frequency range of 150kHz – 30MHz is calculated to be ±2.30dB and for Radiated Emissions is calculated to be ±3.60dB in the frequency range of 30MHz – 200MHz and ±3.38dB in the frequency range of 200MHz – 1000MHz.

EUT Received Date: 3-May-2004

Testing Start Date: 3-May-2004

Testing End Date: 11-May-2004



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**The tests were performed according to following regulations :**

1. FCC CFR47 Part 15.205
2. FCC CFR47 Part 15.207
3. FCC CFR47 Part 15.209
4. ICES-003
5. RSS-210

**Emission Test Results:**

## Conducted Emissions, Powerline - Part 15.207 NA

**Test Result**

| | | | | | |
|---|---|---|---|---|---|
| Minimum limit margin | NA | dB | at | NA | MHz |
| Maximum limit exceeding | | dB | at | | MHz |

Remarks:

## Radiated Emissions (Electric Field) - Part 15.209 <30MHz

**Test Result**

| | | | | | |
|---|---|---|---|---|---|
| Minimum limit margin | -39.8 | dB | at | 0.134 | MHz |
| Maximum limit exceeding | | dB | at | | MHz |

Remarks: Testing was completed starting at 9kHz – lower than required

## Radiated Emissions (Electric Field) - Part 15.209 >30MHz

**Test Result**

| | | | | | |
|---|---|---|---|---|---|
| Minimum limit margin | -3.5 | dB | at | 414.75 | MHz |
| Maximum limit exceeding | | dB | at | | MHz |

Remarks: Testing was completed to 25GHz

**GENERAL REMARKS:**

**The following remarks are to be considered as "where applicable" and are taken into account while completing any FCC/IC/ETSI radio tests at International Approvals Laboratories, LLC.**

**Testing was performed in 3 different orthogonal axis to determine the worst case emissions from the device. The worst case emissions measurements are shown in this report.**

**FCC CFR47 Part 15.31: Measurement Standards: In any case where the device is powered off a battery, a fresh battery was used during test. In cases where the device is powered off an AC supply, voltage was varied per Part 15.31 to find worst case emissions.**

**FCC CFR47 Part 15.35: Measurement Detector Functions and Bandwidths: FCC Part 15.35 was utilized when performing the measurements within this report.**

**In any case where the device is powered off a battery, a fresh battery was used during test. In cases where the device is powered off an AC supply, voltage was varied per Part 15.31 to find worst case emissions.**



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**The actual test distance for the FCC Part 15.209 testing was conducted at 10m for the fact that the device was being tested to EN55022 Class B from 30 MHz to 1000 MHz (meets/exceeds the FCC Part 15.209 & 109B limits) The data is automatically extrapolated back to the FCC 3m limits and measurements are corrected to better show the compliance to FCC requirements and reduce confusion. A correction factor of 10.54dB is used in cases of 30MHz and up for a difference between 10m and 3m measurement distances. All measurements that are lesser than 30MHz where applicable are accompanied with the fall of measurements and calculations to support the interpolation.**

*****Specific Test Clarifications: The Tag Trakker 2 is a handheld RFID device that incorporates a low frequency passive tag reader and an Aerocomm RF Module for communications of the tag data to a base station. The unintentional emissions was completed with the Tag Trakker 2 fully functional and operational with all it's RF capability utilized. Please see the photos below to see the Blue Tag Trakker 2 and 2 base stations that it was communicating with during test. The base stations and computer within the field in this case are support equipment for the testing that allowed IALabs to verify the full functionality of the Tag Trakker 2 device.**

**Support Equipment Identification:**
**USB Connected Base Station Model Numbers: Tag Trakker 2 Serial Base Station**
**USB Connected Base Station Serial Numbers: TT2B0076**
**Remote Base Station Model Number: Tag Trakker 2 remote unit**
**Remote Base Station Serial Number: TT2P0011**
**Computer Model Number: PP01L**
**Computer Serial Number: TW-0791UH-12800-0CC-4067**
**Connections: Serial (USB) Connection from Computer to Base Station**

**Within the Tag Trakker 2 there was also another bluetooth module that was fully active. The manufacturer has decided not to implement the bluetooth module at this time to the final device.**

Modifications required to pass:

**NONE**

Test Specification Deviations: Additions to or Exclusions from



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Test-setup photo(s):
Conducted Emissions

**Not applicable Battery Powered Unit**



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Test-setup photo(s):
Unintentional Radiated Emissions


This photo shows 3 separate products within the test field simultaneously. The product covered by this report is the Blue RFID Reader shown on the table above.



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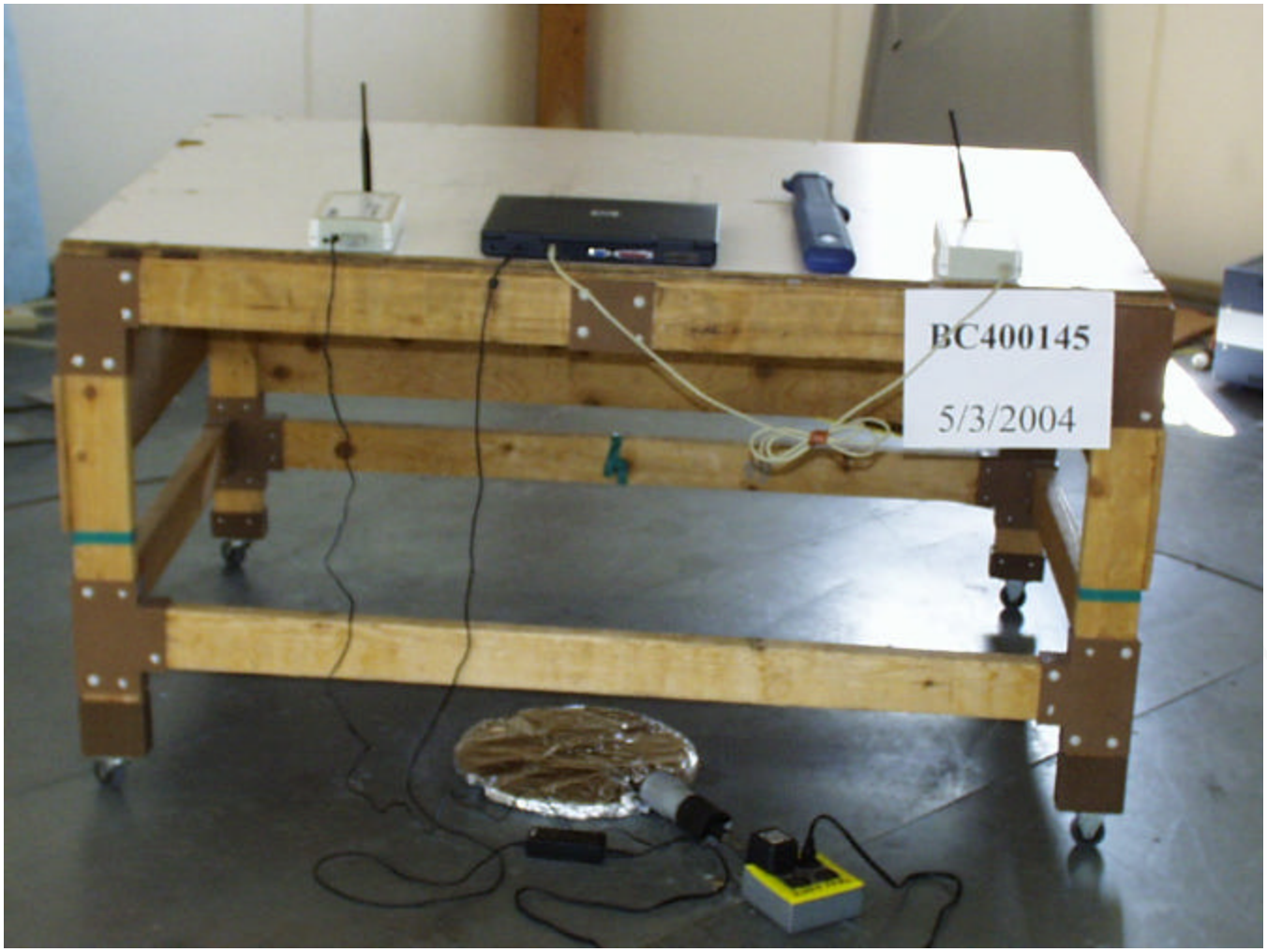
Test-setup photo(s):
Unintentional Radiated Emissions




This photo shows 3 separate products within the test field simultaneously. The product covered by this report is the Blue RFID Reader shown on the table above.



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Test-setup photo(s):
Intentional Radiated Emissions



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Test-setup photo(s):
Intentional Radiated Emissions




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**Appendix A**

Test Data Sheets

and

Test Equipment Used



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Unintentional Emission per FCC CFR47 Part 15.209



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# Radiated Electromagnetic Unintentional Emissions

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **BC400145 Run 01** | Test Area: | Pinewood Site 1 (3m) | Temperature: | 22 | °C |
| Test Method: | FCC Part 15.209 | Test Date: | 06-May-2004 | Relative Humidity: | 29 | % |
| EUT Model #: | Tag Trakker 2 Reader | EUT Power: | DC 9.6 V | Air Pressure: | 81 | kPa |
| EUT Serial #: | TT2R000112 | | | | | |
| Manufacturer: | InfoClip LLC | | | | | |
| EUT Description: | Tag Reading Data Handling System | | | | | |
| Notes: | | | | | | |

| Level Key | |
|---|---|
| Pk – Peak | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band |
| Av - Average | |

| FREQ | LEVEL | CABLE / ANT / PREAMP | FINAL | POL / HGT / AZ | DELTA1 (dB) | DELTA2 (dB) |
|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) (dB\m) (dB) | (dBuV/m) | (m) (DEG) | FCC Part 15.209 Qp | FCC Part 15.209 Av |
| Testing was completed from 9kHz to 25GHz | | | | | | |
| | | | | | | |
| No emissions found other than the following maximized emissions. | | | | | | |
| All the following signals are maximized | | | | | | |
| The following signals are the highest from a previous full baseline | | | | | | |
| horizontal and vertical were both checked, horizontal is worst case | | | | | | |
| 414.75 | 52.1 Qp | 2.2 / 15.5 / 28.0 | 41.9 | H / 1.0 / 43.0 | -4.1 | N/A |
| 414.75 | 52.7 Pk | 2.2 / 15.5 / 28.0 | 42.5 | H / 1.0 / 43.0 | -3.5 | N/A |
| 506.92 | 45.1 Qp | 2.3 / 18.1 / 28.4 | 37.2 | H / 1.7 / 51.0 | -8.8 | N/A |
| 506.92 | 45.7 Pk | 2.3 / 18.1 / 28.4 | 37.8 | H / 1.7 / 51.0 | -8.2 | N/A |
| 433.19 | 49.4 Qp | 2.2 / 16.3 / 28.1 | 39.8 | H / 1.0 / 61.0 | -6.2 | N/A |
| 433.19 | 51.0 Pk | 2.2 / 16.3 / 28.1 | 41.4 | H / 1.0 / 61.0 | -4.6 | N/A |
| 488.49 | 44.4 Qp | 2.3 / 17.5 / 28.4 | 35.8 | H / 1.0 / 55.0 | -10.2 | N/A |
| 488.49 | 45.2 Pk | 2.3 / 17.5 / 28.4 | 36.7 | H / 1.0 / 55.0 | -9.3 | N/A |
| 451.62 | 47.6 Qp | 2.3 / 16.5 / 28.2 | 38.2 | H / 1.0 / 80.0 | -7.8 | N/A |
| 451.62 | 48.0 Pk | 2.3 / 16.5 / 28.2 | 38.5 | H / 1.0 / 80.0 | -7.5 | N/A |
| 525.36 | 47.5 Qp | 2.3 / 17.9 / 28.4 | 39.3 | H / 2.0 / 47.0 | -6.7 | N/A |
| 525.36 | 49.2 Pk | 2.3 / 17.9 / 28.4 | 41.0 | H / 2.0 / 47.0 | -5.0 | N/A |
| | | | | | | |



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# Radiated Electromagnetic Unintentional Emissions

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **BC400145 Run 01** | Test Area: | Pinewood Site 1 (3m) | Temperature: | 22 | °C |
| Test Method: | FCC Part 15.209 | Test Date: | 06-May-2004 | Relative Humidity: | 29 | % |
| EUT Model #: | Tag Trakker 2 Reader | EUT Power: | DC 9.6 V | Air Pressure: | 81 | kPa |
| EUT Serial #: | TT2R000112 | | | | | |
| Manufacturer: | InfoClip LLC | | | | | |
| EUT Description: | Tag Reading Data Handling System | | | | | |
| Notes: | | | | | | |

| Level Key | |
|---|---|
| Pk – Peak | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band |
| Av - Average | |

| FREQ (MHz) | LEVEL (dBuV) | CABLE / ANT / PREAMP (dB) (dB\m) (dB) | FINAL (dBuV/m) | POL / HGT / AZ (m) (DEG) | DELTA1 (dB) FCC Part 15.209 Qp | DELTA2 (dB) FCC Part 15.209 Av |
|---|---|---|---|---|---|---|
| Changing to the Horn Antenna, Vertical | | | | | | |
| Checking from 1-4 GHz | | | | | | |
| 0 degrees | | | | | | |
| | | | | | | |
| no emissions detected | | | | | | |
| | | | | | | |
| 90 degrees | | | | | | |
| no emissions detected | | | | | | |
| | | | | | | |
| 180 degrees | | | | | | |
| no emissions detected | | | | | | |
| | | | | | | |
| 270 degrees | | | | | | |
| no emissions detected | | | | | | |
| | | | | | | |
| the following readings are noise floor measurements, for reference only | | | | | | |
| | | | | | | |
| 1000.00 | 33.2 Av | 2.2 / 24.9 / 37.1 | 23.2 | V / 1.0 / 0.0 | N/A | -30.8 |
| 4000.00 | 31.7 Av | 5.7 / 33.0 / 37.1 | 33.3 | V / 1.0 / 0.0 | N/A | -20.7 |
| | | | | | | |
| Changing to Horizontal polarization | | | | | | |
| 0 degrees | | | | | | |
| 2385.76 | 39.3 Av | 3.8 / 28.9 / 37.3 | 34.8 | H / 1.0 / 0.0 | N/A | -19.2 |
| 2476.90 | 38.6 Av | 4.0 / 29.1 / 36.9 | 34.8 | H / 1.0 / 0.0 | N/A | -19.2 |
| 2551.94 | 41.8 Av | 4.1 / 29.2 / 37.5 | 37.6 | H / 1.0 / 0.0 | N/A | -16.4 |
| | | | | | | |
| 90 degrees | | | | | | |
| 2626.90 | 41.2 Av | 4.2 / 29.4 / 36.9 | 37.9 | H / 1.0 / 0.0 | N/A | -16.1 |
| 2642.15 | 41.1 Av | 4.2 / 29.5 / 36.8 | 37.9 | H / 1.0 / 0.0 | N/A | -16.1 |



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# Radiated Electromagnetic Unintentional Emissions

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **BC400145 Run 01** | Test Area: | Pinewood Site 1 (3m) | Temperature: | 22 | °C |
| Test Method: | FCC Part 15.209 | Test Date: | 06-May-2004 | Relative Humidity: | 29 | % |
| EUT Model #: | Tag Trakker 2 Reader | EUT Power: | DC 9.6 V | Air Pressure: | 81 | kPa |
| EUT Serial #: | TT2R000112 | | | | | |
| Manufacturer: | InfoClip LLC | | | | | |
| EUT Description: | Tag Reading Data Handling System | | | | | |
| Notes: | | | | | | |

| Level Key | |
|---|---|
| Pk – Peak | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band |
| Av - Average | |

| FREQ (MHz) | LEVEL (dBuV) | CABLE / ANT / PREAMP (dB) (dB\m) (dB) | FINAL (dBuV/m) | POL / HGT / AZ (m) (DEG) | DELTA1 (dB) FCC Part 15.209 Qp | DELTA2 (dB) FCC Part 15.209 Av |
|---|---|---|---|---|---|---|
| 180 degrees | | | | | | |
| 2385.94 | 39.6 Av | 3.8 / 28.9 / 37.3 | 35.1 | H / 1.0 / 0.0 | N/A | -18.9 |
| 2551.91 | 43.9 Av | 4.1 / 29.2 / 37.4 | 39.8 | H / 1.0 / 0.0 | N/A | -14.2 |
| 2626.84 | 43.8 Av | 4.2 / 29.4 / 36.9 | 40.5 | H / 1.0 / 0.0 | N/A | -13.5 |
| 2642.13 | 41.2 Av | 4.2 / 29.5 / 36.8 | 38.1 | H / 1.0 / 0.0 | N/A | -15.9 |
| | | | | | | |
| 270 degrees | | | | | | |
| 2642.14 | 42.8 Av | 4.2 / 29.5 / 36.8 | 39.6 | H / 1.0 / 0.0 | N/A | -14.4 |
| | | | | | | |
| Maximized emissions, Horizontal, from 1-4 GHz | | | | | | |
| | | | | | | |
| 2626.95 | 47.1 Av | 4.2 / 29.4 / 36.9 | 43.8 | H / 1.1 / 256.0 | N/A | -10.2 |
| | | | | | | |
| Changing to the 4-8 GHz amp | | | | | | |
| | | | | | | |
| Horizontal | | | | | | |
| Full turntable rotation, horizontal, from 4-8 GHz | | | | | | |
| | | | | | | |
| no emissions detected other than the harmonics of the fundamental which will be measured | | | | | | |
| on a separate run. | | | | | | |
| | | | | | | |
| vertical | | | | | | |
| | | | | | | |
| no emissions detected, vertical, from 4-8 GHz | | | | | | |
| | | | | | | |
| Changing to the 8-18 GHz amp | | | | | | |
| | | | | | | |
| Vertical | | | | | | |
| Full turntable rotation 8-18 GHz, no emissions detected | | | | | | |



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# Radiated Electromagnetic Unintentional Emissions

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **BC400145 Run 01** | Test Area: | Pinewood Site 1 (3m) | Temperature: | 22 | °C |
| Test Method: | FCC Part 15.209 | Test Date: | 06-May-2004 | Relative Humidity: | 29 | % |
| EUT Model #: | Tag Trakker 2 Reader | EUT Power: | DC 9.6 V | Air Pressure: | 81 | kPa |
| EUT Serial #: | TT2R000112 | | | | | |
| Manufacturer: | InfoClip LLC | | | | | |
| EUT Description: | Tag Reading Data Handling Sysytem | | | | | |
| Notes: | | | | | | |

| Level Key | |
|---|---|
| Pk – Peak | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band |
| Av - Average | |

| FREQ (MHz) | LEVEL (dBuV) | CABLE / ANT / PREAMP (dB) (dB\m) (dB) | FINAL (dBuV/m) | POL / HGT / AZ (m) (DEG) | DELTA1 (dB) FCC Part 15.209 Qp | DELTA2 (dB) FCC Part 15.209 Av |
|---|---|---|---|---|---|---|
| Horizontal | | | | | | |
| Full turntable rotation, no emissions from 8-18 GHz | | | | | | |
| | | | | | | |
| Horizontal | | | | | | |
| Full turntable rotation, no emissions from 18-25 GHz | | | | | | |
| | | | | | | |
| Vertical | | | | | | |
| Full turntable rotation, no emissions from 18-25 GHz | | | | | | |



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|---|---|---|---|---|---|---|
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| Test Method: | FCC Part 15.209 | Test Date: | 06-May-2004 | Relative Humidity: | 29 | % |
| EUT Model #: | Tag Trakker 2 Reader | EUT Power: | DC 9.6 V | Air Pressure: | 81 | kPa |
| EUT Serial #: | TT2R000112 | | | | | |
| Manufacturer: | InfoClip LLC | | | | | |
| EUT Description: | Tag Reading Data Handling Sysytem | | | | | |
| Notes: | | | | | | |

| Level Key | |
|---|---|
| Pk – Peak | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band |
| Av - Average | |

| FREQ (MHz) | LEVEL (dBuV) | CABLE / ANT / PREAMP (dB) (dB\m) (dB) | FINAL (dBuV/m) | POL / HGT / AZ (m) (DEG) | DELTA1 (dB) FCC Part 15.209 Qp | DELTA2 (dB) FCC Part 15.209 Av |
|---|---|---|---|---|---|---|
| ********** **Measurement Summary** ********** | | | | | | |
| 414.75 | 52.7 Pk | 2.2 / 15.5 / 28.0 | 42.5 | H / 1.0 / 43.0 | -3.5 | N/A |
| 433.19 | 51.0 Pk | 2.2 / 16.3 / 28.1 | 41.4 | H / 1.0 / 61.0 | -4.6 | N/A |
| 525.36 | 49.2 Pk | 2.3 / 17.9 / 28.4 | 41.0 | H / 2.0 / 47.0 | -5.0 | N/A |
| 451.62 | 48.0 Pk | 2.3 / 16.5 / 28.2 | 38.5 | H / 1.0 / 80.0 | -7.5 | N/A |
| 506.92 | 45.7 Pk | 2.3 / 18.1 / 28.4 | 37.8 | H / 1.7 / 51.0 | -8.2 | N/A |
| 488.49 | 45.2 Pk | 2.3 / 17.5 / 28.4 | 36.7 | H / 1.0 / 55.0 | -9.3 | N/A |
| 2626.95 | 47.1 Av | 4.2 / 29.4 / 36.9 | 43.8 | H / 1.1 / 256.0 | N/A | -10.2 |
| 2551.91 | 43.9 Av | 4.1 / 29.2 / 37.4 | 39.8 | H / 1.0 / 0.0 | N/A | -14.2 |
| 2642.14 | 42.8 Av | 4.2 / 29.5 / 36.8 | 39.6 | H / 1.0 / 0.0 | N/A | -14.4 |
| 2385.94 | 39.6 Av | 3.8 / 28.9 / 37.3 | 35.1 | H / 1.0 / 0.0 | N/A | -18.9 |
| 2476.90 | 38.6 Av | 4.0 / 29.1 / 36.9 | 34.8 | H / 1.0 / 0.0 | N/A | -19.2 |
| 4000.00 | 31.7 Av | 5.7 / 33.0 / 37.1 | 33.3 | V / 1.0 / 0.0 | N/A | -20.7 |
| 1000.00 | 33.2 Av | 2.2 / 24.9 / 37.1 | 23.2 | V / 1.0 / 0.0 | N/A | -30.8 |



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Intentional Emission per FCC CFR47 Part 15.209<30MHz



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# Radiated Electromagnetic Intentional Emissions

| | | | | | | |
|---|---|---|---|---|---|---|
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| Test Method: | FCC Part 15.209 | Test Date: | 06-May-2004 | Relative Humidity: | 29 | % |
| EUT Model #: | Tag Trakker 2 Reader | EUT Power: | DC 9.6 V | Air Pressure: | 81 | kPa |
| EUT Serial #: | TT2R000112 | | | | | |
| Manufacturer: | InfoClip LLC | | | | | |
| EUT Description: | Wireless RFID reader | | | | | |
| Notes: | | | | | | |

| Level Key | |
|---|---|
| Pk – Peak | Nb – Narrow Band |
| Qp – QuasiPeak | Bb – Broad Band |
| Av - Average | |

| FREQ | LEVEL | CABLE / ANT / PREAMP | Final Corrected | POL / HGT / AZ | Measured Site Roll-off per Decade | Final | Limit @ applicable distance | DELTA 300m | DELTA 30m |
|---|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) (dB\m) (dB) | (dBuV) | (m) (DEG) | (dB) | (dBuV) | (dBuV) | (dB) | (dB) |
| 0.134 | 91.2 Pk | 0.0 / 10.5 / 0.0 | 101.7 | V / 1.0 / 17.0 | 116.4 | -14.7 | 25.1 | -39.8 | N/A |
| 0.134 | 90.1 Qp | 0.0 / 10.5 / 0.0 | 100.6 | V / 1.0 / 17.0 | 116.4 | -15.8 | 25.1 | -40.9 | N/A |
| | | | | | | | | | |
| 268.70 kHz, no emission detected | | | | | | | | | |
| 403.05 kHz, no emission detected | | | | | | | | | |
| 537.4 kHz no emission detected | | | | | | | | | |
| 671.75 kHz , no emission detected | | | | | | | | | |
| 806.1 kHz, no emission detected | | | | | | | | | |
| 940.45 kHz, no emission detected | | | | | | | | | |
| 1.0748 MHz, no emission detected | | | | | | | | | |
| 1.20915 MHz, no emission detected | | | | | | | | | |
| 1.34350 MHz, no emission detected | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Checking unintentional, from 17.1776 MHz, to 30 MHz | | | | | | | | | |
| | | | | | | | | | |
| no signal detected at 17.1776 MHz | | | | | | | | | |
| | | | | | | | | | |
| checked the 29.491 MHz clock, no emission detected | | | | | | | | | |
| | | | | | | | | | |
| no other emissions detected from 9 kHz to 30 MHz | | | | | | | | | |



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# Project Report

**Begin Date:** 5/3/2004 **End Date:** 5/12/2004

**Technician** Karen Parker **Project:** BC400145

| Capital Asset ID | Manufacturer | Model # | Serial # | Description | Test Performed | Service Type | Service Date | Service Due |
|---|---|---|---|---|---|---|---|---|
| 6 | Hewlett-Packard | 8594E | 3223A00145 | Spectrum Analyzer | R Radiated Emissions | For Cal | 1/16/2004 | 1/16/2005 |
| 106 | TENSOR | 4105 | 2020 | Ridged Guide Antenna 1-18GHz | R Radiated Emissions | For Cal | 7/11/2003 | 7/11/2004 |
| 135 | EMCO | 3146 | 9402-3775 | Log Periodic Antenna (200-1000MHz) | R Radiated Emissions | For Cal | 9/10/2003 | 9/10/2004 |
| 171 | Hewlett-Packard | 85662A | 1928A01169 | Spectrum Analyzer - Display Section | R Radiated Emissions | For Cal | 1/21/2004 | 1/21/2005 |
| 172 | Hewlett-Packard | 8566B | 2430A00759 | Spectrum Analyzer | R Radiated Emissions | For Cal | 1/21/2004 | 1/21/2005 |
| 189 | EMCO | 3109 | 9801-3142 | Bicon Antenna 30 - 300 MHz | R Radiated Emissions | For Cal | 9/9/2003 | 9/9/2004 |
| 201 | Hewlett-Packard | 11975A | 2738A01557 | Amplifier | R Radiated Emissions | For Cal | 10/3/2002 | 10/3/2004 |
| 202 | Avantek | AWT-18037 | 1002 | RF Pre-Amplifier (8-18 GHz) | R Radiated Emissions | For Ver | 4/7/2004 | 4/7/2005 |
| 203 | Avantek | AFT97-8434-10F | 1007 | RF Pre-Amplifier (4-8 GHz) | R Radiated Emissions | For Ver | 4/7/2004 | 4/7/2005 |
| 204 | Hewlett-Packard | 11970K | 2332A01280 | Harmonic Mixer | R Radiated Emissions | For Cal | 10/5/2002 | 10/5/2005 |
| 213 | Mini-Circuits Lab | ZHL-42 | N052792-2 | Amplifier | R Radiated Emissions | For Ver | 6/20/2003 | 6/20/2004 |
| 248 | Hewlett-Packard | 8447F | 3113A05545 | 9 kHz- 1.3GHz Pre Amp | R Radiated Emissions | For Ver | 6/5/2003 | 6/5/2004 |
| 195 | EMCO | 6502 | 9205-2738 | Magnetic loop | R Radiated Emissions | For Cal | 6/2/2003 | 6/2/2004 |



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**Appendix B**

Test Plan

and

Constructional Data Form



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**Appendix C**

Measurement Protocol

And

Test Procedures



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## MEASUREMENT PROTOCOL

## GENERAL INFORMATION

### Test Methodology

Conducted and radiated emission testing is performed according to the procedures in ANSI C63.4 & CNS13438.

**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 dBµV, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the applicable limit.

To convert between dBµV and µV, the following conversions apply:

- dBµV = 20(log µV)
- µV = Inverse log(dBµV/20)

### RADIATED EMISSIONS

The final level, expressed in dBµV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBµV) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the applicable 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: At a Test Frequency of 30 MHz, with a peak reading on the spectrum analyzer or measuring receiver of 14 dBmV:*

| Measured Level | + | Transducer & Cable Loss factor | = | Corrected Reading | Specification Limit | - | Corrected Reading | = | Delta Specification |
|---|---|---|---|---|---|---|---|---|---|
| (dBµV) | | (dB) | | (dBµV/m) | (dBµV/m) | | (dBµV/m) | | |
| **14.0** | | **14.9** | | **28.9** | **40.0** | | **28.9** | | **-11.1** |



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**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 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 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 Ω/50 µH (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 22GHz 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 quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. 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, 10 or 30 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.



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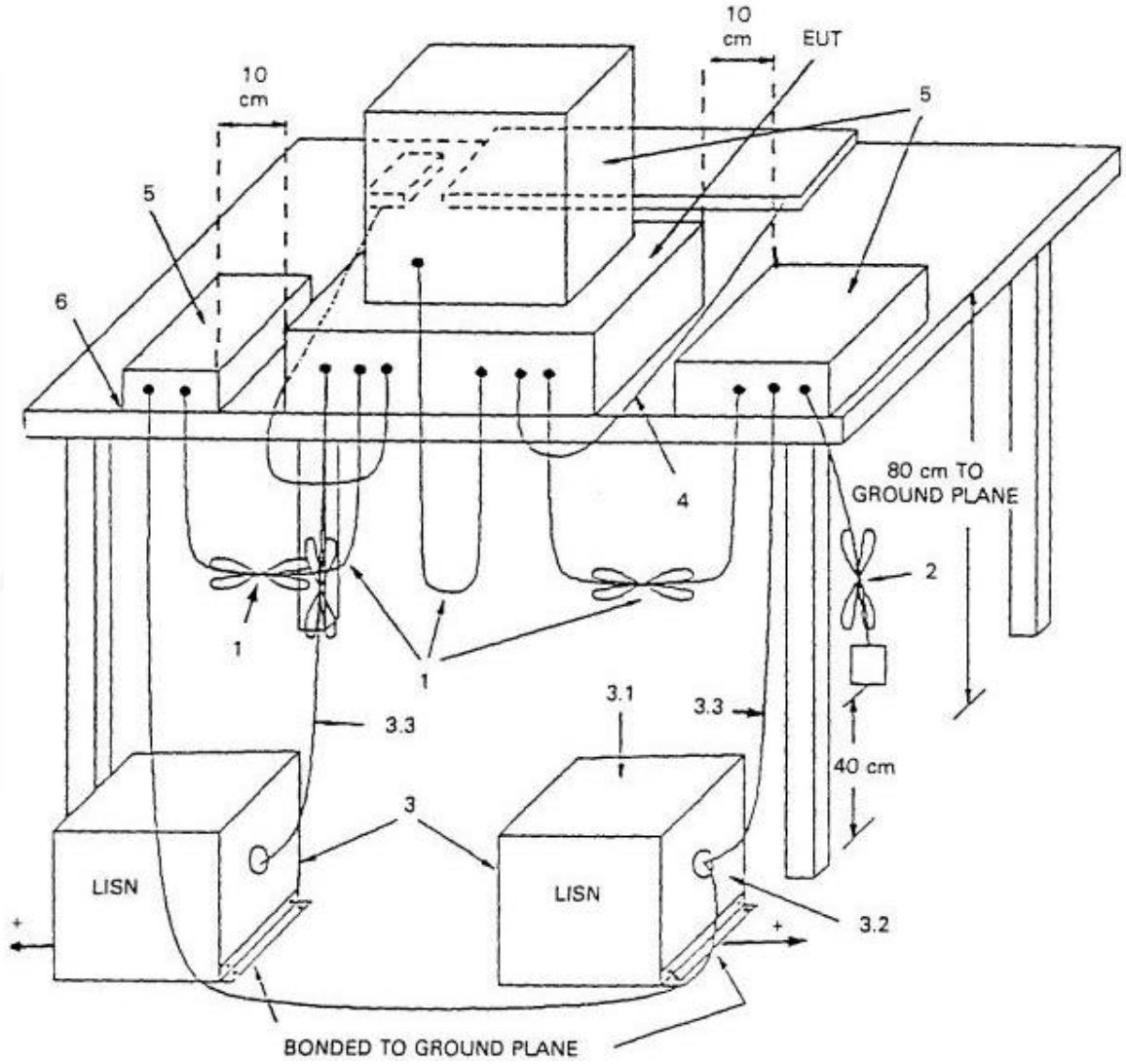
## Conducted Emissions Diagram:



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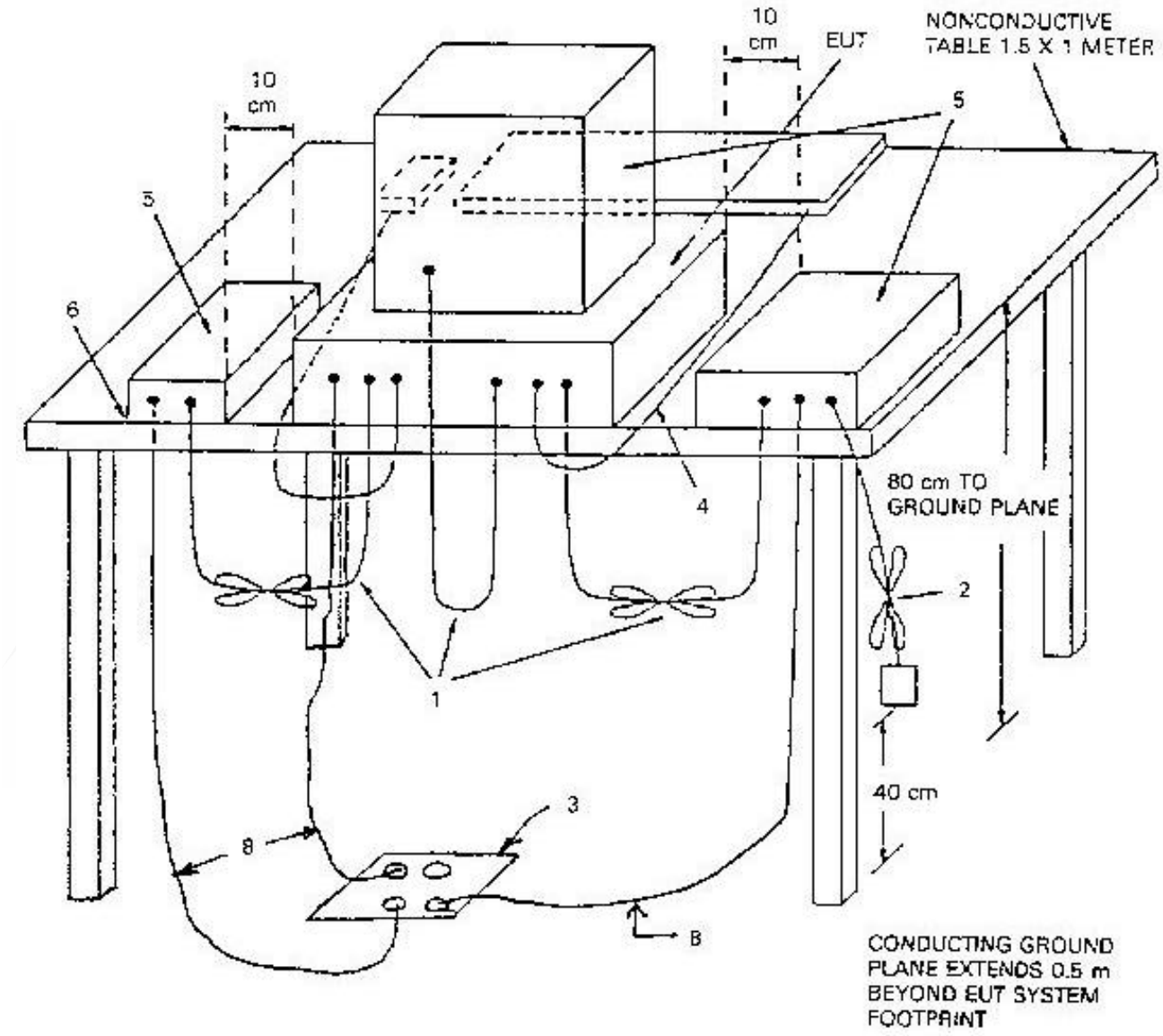
## Radiated Emissions Diagram:



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