Intertek ETL SEMKO

Successor in interest to International Approval Laboratories

# EMC EMISSIONS - TEST REPORT (Full)

| | | | |
|---|---|---|---|
| Test Report No. | **3126032DEN-002** | Issue Date: | **Thur 23/Aug/2007** |
| Model / Serial No. | **MN: M2 /SN: Unit4** | | |
| Product Type | **Utility \Meter Radio** | | |
| Client | **Transparent Technologies** | | |
| Manufacturer | **Transparent Technologies** | | |
| License holder | **Transparent Technologies** | | |
| Address | **5665 Airport Blvd.** | | |
| | **Boulder, CO 80303** | | |
| Test Criteria Applied | **FCC CFR47 Part 15.247**<br>**IC RSS-210 issue 7** | Title 47 CFR 15: RADIO FREQUENCY DEVICES | |
| Test Result | **PASS** | Low-power License-exempt Radio Communication Devices (All Frequency Bands): Category I Equipment | |
| Test Project Number | **3126032** | | |
| References | | | |
| Total Pages Including Appendices: | **32** | | |

Tested By : Mike Spataro

Reviewed By : Robert Cresswell



Lab Code:200264-0

The entity logos above are for reference only and may not apply to this test report.

# D I R E C T O R Y



## 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: 25-June-2007

Testing Start Date: 25-June-2007

Testing End Date: 13-Aug-2007




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

1. FCC CFR47 Part 15 subpart C
2. FCC CFR47 Part 15 subpart B
3. IC RSS-210e Issue 7 2007
4. IC RSS-GEN Issue 2 2007
5. ICES-003

**Emission Test Results:**

## Conducted Emissions, Powerline 15.207 - NA

**Test Result**

Minimum limit margin 0.0 dB at 0.0 MHz

Remarks: EUT is battery powered.

## Radiated Emissions 15.209/15.109 - PASS

**Test Result**

Minimum limit margin -13.8 dB at 8000.00 MHz

Remarks:

## 6dB Bandwidth 15.247 (a)(2) - PASS

Remarks:

## Peak Output Power 15.247 (b)(3) - PASS

**Test Result**

Minimum limit margin -12.5 dB at 919.74 MHz

Remarks: High Channel

## Radiated Emissions 15.205/15.247(d) - PASS

**Test Result**

Minimum limit margin -0.2 dB at 2759.14 MHz

Remarks: High Channel

## Power Spectral Density 15.247 (e) - PASS

**Test Result**

Minimum limit margin -2.04 dB at 909.86 MHz

Remarks: Mid Channel



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**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 Intertek, ETL Semko.**

**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.**

**Whenever possible the approved test procedures specified in FCC KDB 558074 for DTS devices was used for testing.**

**Limit Calculation:**
**At the time of testing, Intertek ETL Semko was unable to obtain the gain of the antenna for the EUT from the manufacture of the EUT or from the manufacture of the antenna. Therefore, the following calculation was used to determine the field strength limit for a test distance of 3m. This calculation assumes ideal isotropic radiation from the source.**

**P = 20*log(E)-95.2289**

**P is power in dBm**
**E is uV/m**

Sample:
☐Production ☒Prototype ☐See RFQ

Modifications required to pass: None

Test Specification Deviations: Additions to or Exclusions from: None



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## Required Information In Accordance to FCC CFR 47 Part 2.1033:

| *Rule Part 11, 15 & 18 Devices* | *Other Rule Part Devices* | *Description* | *Comments* |
|---|---|---|---|
| **2.1033(b)(1)** | **2.1033(c)(1)** | *Manu. Contact* | See Page 1 of this report |
| **2.1033(b)(2)** | **2.1033(c)(2)** | *FCC Identifier* | Attached as Exhibit |
| **2.1033(b)(3)** | **2.1033(c)(3)** | *Users Manual to include Operating, installation* | Attached as Exhibit |
| | **2.1033(c)(4)** | *Emissions Designator per 2.* | Attached as Exhibit |
| | **2.1033(c)(5)** | *Frequency Range* | Not Applicable to Part 15 Devcies |
| | **2.1033(c)(6)** | *Power range and controls* | Not Applicable to Part 15 Devcies |
| | **2.1033(c)(7)** | *Maximum power ouput rating* | Not Applicable to Part 15 Devcies |
| | **2.1033(c)(8)** | *DC Voltage and Current suplying final RF stages* | Not Applicable to Part 15 Devcies |
| **2.1033(b)(3)** | **2.1033(c)(9)** | *Tune –up procedure* | Please refer to the users manual for applicability |
| **2.1033(b)(4&5)** | **2.1033(c)(10)** | *Complete Circuit Diagrams and circuit operation description* | Attached as Exhibit |
| **2.1033(b)(7)** | **2.1033(c)(11)** | *Photographs/drawings of the identification label & its location on the device* | Attached as Exhibit |
| **2.1033(b)(7)** | **2.1033(c)(12)** | *Photographs of the external and internal surfaces, and construction* | Attached as Exhibit |
| | **2.1033(c)(13)** | *Digital Modulation* | Attached as Exhibit |
| **2.1033(b)(6)** | **2.1033(c)(14)** | *Report of Measurement Data Required by 2.1046 – 2.1057* | See Data |
| **2.1033(b)(8)** | | *Description of publicly available support equipment used during test* | Refer to Appendix B of this report (Client Test Plan) |
| **2.1033(b)(9)** | | *Statement of Autorization to Part 15.37 of CFR47* | The equipment herein is being authorized in accordance to 15.37 of the CFR47 Rules. |
| **2.1033(b)(10)** | | *Direct Sequence Spread Spectrum Devices (DSSS)* | NA |
| **2.1033(b)(10)** | | *Frequency Hopping Devices* | NA |
| **2.1033(b)(11)** | | *Scanning receiver construction* | Exhibit stating compliance to construction in accordance to 15.121. |
| **15.31** | **15.31** | *Transmitter Supply Voltage* | Testing herein was completed in accordance to FCC CFR47 Part 15.31 |



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Test-setup photo(s):
Conducted Emissions

Not Applicable



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Test-setup photo(s):
Radiated Emissions:




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Test-setup photo(s):
Radiated Emissions:




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**Appendix A**

Test Data Sheets

and

Test Equipment Used



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# Radiated Unintentional Emission
# 15.209

# And

# Spurious Emission
# 15.247 (d)



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# Radiated Electromagnetic Emissions

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **3126032 Run 03** | Test Area: | Pinewood Site 1 (10m) | Temperature: | 20.7 | °C |
| Test Method: | FCC CFR47 part 15 subpart C | Test Date: | 13-Jul-2007 | Relative Humidity: | 42 | % |
| EUT Model #: | M2 | EUT Power: | 3.3VDC Battery | Air Pressure: | 103.4 | kPa |
| EUT Serial #: | MOD4 | | | | | |
| Manufacturer: | Transparent Technologies | | | | | |
| EUT Description: | M2 Utility Radio | | | | | |
| Notes: | tested in Standby Mode | | | | | |

| Level Key | |
|---|---|
| Pk – Peak | Pk – Peak |
| Qp – QuasiPeak | Qp – QuasiPeak |
| Av - Average | |

| FREQ | LEVEL | CABLE / ANT / PREAMP | FINAL | POL / HGT / AZ | DELTA1 (dB) | DELTA2 (dB) |
|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) (dB\m) (dB) | (dBuV) | (m) (DEG) | 15.209 <1GHz | 15.209 >1GHz |
| Loop antenna is parallel. | | | | | | |
| No emissions found between 9kHz and 30MHz. | | | | | | |
| The following are noise floor. | | | | | | |
| 0.0100 | 41.7 Qp | 0.0 / 19.0 / 0.0 | 60.7 | V / 1.0 / 0.0 | -66.9 | N/A |
| 2.00 | 23.9 Qp | 0.1 / 10.7 / 0.0 | 34.7 | V / 1.0 / 0.0 | -34.8 | N/A |
| 25.00 | 9.4 Qp | 0.5 / 9.1 / 0.0 | 19.0 | V / 1.0 / 0.0 | -50.5 | N/A |
| | | | | | | |
| The loop antenna is perpendicular. | | | | | | |
| No emissions found between 9kHz and 30MHz. | | | | | | |
| The following are noise floor. | | | | | | |
| 4.00 | 17.8 Qp | 0.2 / 10.7 / 0.0 | 28.7 | H / 1.0 / 0.0 | -40.8 | N/A |
| 15.00 | 15.3 Qp | 0.3 / 10.8 / 0.0 | 26.4 | H / 1.0 / 0.0 | -43.1 | N/A |
| 20.00 | 12.7 Qp | 0.4 / 10.3 / 0.0 | 23.4 | H / 1.0 / 0.0 | -46.1 | N/A |
| | | | | | | |
| No emission found: Vertical 30MHz to 200MHz. | | | | | | |
| The following are noise floor. | | | | | | |
| 30.00 | 2.0 Qp | 0.5 / 13.4 / 28.1 | -12.2 | V / 1.0 / 0.0 | -52.2 | N/A |
| 80.00 | 35.1 Qp | 0.9 / 7.4 / 27.9 | 15.5 | V / 1.0 / 0.0 | -24.5 | N/A |
| 185.00 | 26.5 Qp | 1.4 / 13.1 / 27.4 | 13.7 | V / 1.0 / 0.0 | -29.8 | N/A |
| | | | | | | |
| No emissions found: Horizontal 30MHz to 200MHz. | | | | | | |
| The following are noise floor. | | | | | | |
| 32.00 | 24.3 Qp | 0.6 / 12.9 / 28.1 | 9.7 | H / 2.0 / 0.0 | -30.3 | N/A |
| 82.00 | 28.3 Qp | 0.9 / 7.2 / 27.8 | 8.6 | H / 2.0 / 0.0 | -31.4 | N/A |
| 195.00 | 28.1 Qp | 1.5 / 13.7 / 27.3 | 15.9 | H / 2.0 / 0.0 | -27.6 | N/A |
| | | | | | | |
| No emissions found: Vertical 200MHz to 1GHz. | | | | | | |
| The following are noise floor. | | | | | | |
| 200.00 | 22.5 Qp | 1.5 / 11.8 / 27.3 | 8.4 | V / 1.0 / 0.0 | -35.1 | N/A |
| 500.00 | 22.6 Qp | 2.6 / 19.4 / 28.2 | 16.4 | V / 1.0 / 0.0 | -29.6 | N/A |
| 900.00 | 21.9 Qp | 3.6 / 23.2 / 27.6 | 21.0 | V / 1.0 / 0.0 | -25.0 | N/A |
| | | | | | | |
| No emissions found: Horizontal 200MHz to 1GHz. | | | | | | |



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| FREQ | LEVEL | CABLE / ANT / PREAMP | FINAL | POL / HGT / AZ | DELTA1 (dB) | DELTA2 (dB) |
|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) (dB\m) (dB) | (dBuV) | (m) (DEG) | 15.209 <1GHz | 15.209 >1GHz |
| The following are noise floor. | | | | | | |
| 210.00 | 22.0 Qp | 1.5 / 11.5 / 27.3 | 7.8 | H / 2.0 / 0.0 | -35.7 | N/A |
| 505.00 | 23.6 Qp | 2.6 / 19.5 / 28.2 | 17.5 | H / 2.0 / 0.0 | -28.5 | N/A |
| 950.00 | 22.6 Qp | 3.7 / 23.2 / 27.4 | 22.2 | H / 2.0 / 0.0 | -23.8 | N/A |
| | | | | | | |
| No emissions found: Vertical 1 to 10GHz. | | | | | | |
| The following are noise floor. | | | | | | |
| 1000.00 | 35.0 Av | 3.7 / 24.1 / 37.5 | 25.3 | V / 1.0 / 0.0 | N/A | -28.7 |
| 4000.00 | 32.6 Av | 5.7 / 32.4 / 39.5 | 31.2 | V / 1.0 / 0.0 | N/A | -22.8 |
| 8000.00 | 42.0 Av | 8.3 / 37.1 / 47.3 | 40.2 | V / 1.0 / 0.0 | N/A | -13.8 |
| | | | | | | |
| No emissions found: 1 to 10GHz Horizontal. | | | | | | |
| 10000.0 | 41.6 Av | 9.5 / 38.1 / 49.2 | 40.0 | H / 1.0 / 0.0 | N/A | -14.0 |
| 7000.00 | 31.5 Av | 8.1 / 36.0 / 40.8 | 34.8 | H / 1.0 / 0.0 | N/A | -19.2 |
| 3000.00 | 33.6 Av | 4.6 / 30.9 / 37.8 | 31.3 | H / 1.0 / 0.0 | N/A | -22.7 |
| | | | | | | |



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| FREQ | LEVEL | CABLE / ANT / PREAMP | FINAL | POL / HGT / AZ | DELTA1 (dB) | DELTA2 (dB) |
|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) (dB\m) (dB) | (dBuV) | (m) (DEG) | 15.209 <1GHz | 15.209 >1GHz |
| ********** Measurement Summary ********** | | | | | | |
| 8000.00 | 42.0 Av | 8.3 / 37.1 / 47.3 | 40.2 | V / 1.0 / 0.0 | N/A | -13.8 |
| 10000.0 | 41.6 Av | 9.5 / 38.1 / 49.2 | 40.0 | H / 1.0 / 0.0 | N/A | -14.0 |
| 7000.00 | 31.5 Av | 8.1 / 36.0 / 40.8 | 34.8 | H / 1.0 / 0.0 | N/A | -19.2 |
| 3000.00 | 33.6 Av | 4.6 / 30.9 / 37.8 | 31.3 | H / 1.0 / 0.0 | N/A | -22.7 |
| 4000.00 | 32.6 Av | 5.7 / 32.4 / 39.5 | 31.2 | V / 1.0 / 0.0 | N/A | -22.8 |
| 950.00 | 22.6 Qp | 3.7 / 23.2 / 27.4 | 22.2 | H / 2.0 / 0.0 | -23.8 | N/A |
| 80.00 | 35.1 Qp | 0.9 / 7.4 / 27.9 | 15.5 | V / 1.0 / 0.0 | -24.5 | N/A |
| 900.00 | 21.9 Qp | 3.6 / 23.2 / 27.6 | 21.0 | V / 1.0 / 0.0 | -25.0 | N/A |
| 195.00 | 28.1 Qp | 1.5 / 13.7 / 27.3 | 15.9 | H / 2.0 / 0.0 | -27.6 | N/A |
| 505.00 | 23.6 Qp | 2.6 / 19.5 / 28.2 | 17.5 | H / 2.0 / 0.0 | -28.5 | N/A |
| 1000.00 | 35.0 Av | 3.7 / 24.1 / 37.5 | 25.3 | V / 1.0 / 0.0 | N/A | -28.7 |
| 500.00 | 22.6 Qp | 2.6 / 19.4 / 28.2 | 16.4 | V / 1.0 / 0.0 | -29.6 | N/A |
| 185.00 | 26.5 Qp | 1.4 / 13.1 / 27.4 | 13.7 | V / 1.0 / 0.0 | -29.8 | N/A |
| 32.00 | 24.3 Qp | 0.6 / 12.9 / 28.1 | 9.7 | H / 2.0 / 0.0 | -30.3 | N/A |
| 82.00 | 28.3 Qp | 0.9 / 7.2 / 27.8 | 8.6 | H / 2.0 / 0.0 | -31.4 | N/A |
| 2.00 | 23.9 Qp | 0.1 / 10.7 / 0.0 | 34.7 | V / 1.0 / 0.0 | -34.8 | N/A |
| 200.00 | 22.5 Qp | 1.5 / 11.8 / 27.3 | 8.4 | V / 1.0 / 0.0 | -35.1 | N/A |
| 210.00 | 22.0 Qp | 1.5 / 11.5 / 27.3 | 7.8 | H / 2.0 / 0.0 | -35.7 | N/A |
| 4.00 | 17.8 Qp | 0.2 / 10.7 / 0.0 | 28.7 | H / 1.0 / 0.0 | -40.8 | N/A |
| 15.00 | 15.3 Qp | 0.3 / 10.8 / 0.0 | 26.4 | H / 1.0 / 0.0 | -43.1 | N/A |
| 20.00 | 12.7 Qp | 0.4 / 10.3 / 0.0 | 23.4 | H / 1.0 / 0.0 | -46.1 | N/A |
| 25.00 | 9.4 Qp | 0.5 / 9.1 / 0.0 | 19.0 | V / 1.0 / 0.0 | -50.5 | N/A |
| 30.00 | 2.0 Qp | 0.5 / 13.4 / 28.1 | -12.2 | V / 1.0 / 0.0 | -52.2 | N/A |
| 0.0100 | 41.7 Qp | 0.0 / 19.0 / 0.0 | 60.7 | V / 1.0 / 0.0 | -66.9 | N/A |
| | | | | | | |



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# 6dB Bandwidth

# 15.247 (a)(2)



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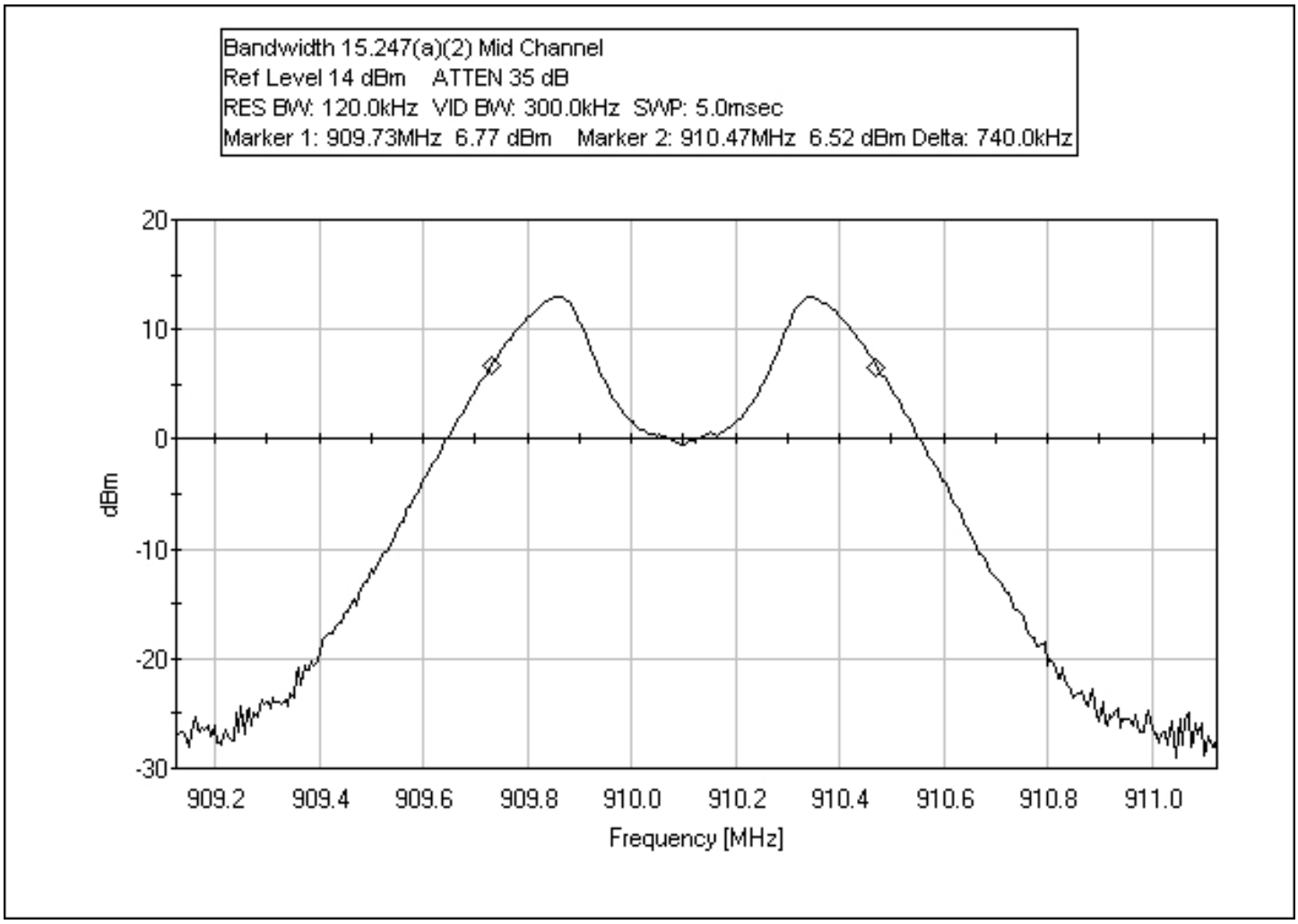
# Bandwidth

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **3126032** | Test Area: | PW1 | Temperature: | 23.5 | °C |
| Test Method: | FCC Part 15.247 | Test Date: | 13-Aug-2007 | Relative Humidity: | 20.6 | % |
| EUT Model #: | M2 | EUT Power: | 3.3VDC Battery | Air Pressure: | 101 | kPa |
| EUT Serial #: | Unti4 | | | | | |
| Manufacturer: | Transparent Technologies | | | | | |
| EUT Description: | Utility meter radio | | | | | |
| Notes: | | | | | | |

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



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# Fundamental field strength
# And
# Harmonics of the Fundamental

## 15.247 (b)(3), (d)/15.205



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# Field Strength Measurements
# Fundamental and Spurious of the Transmitter

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **3126032** | Test Area: | Pinewood Site 1 (3m) | Temperature: | 22.2 | °C |
| Test Method: | FCC CFR 47 part 15.247 | Test Date: | 13-Aug-2007 | Relative Humidity: | 35.5 | % |
| EUT Model #: | M2 | EUT Power: | 3.3VDC Battery | Air Pressure: | 101 | kPa |
| EUT Serial #: | Unit4 | | | Page: | | |
| Manufacturer: | Transparent Technologies | | | | | |
| EUT Description: | Utility meter radio | | | | | |
| Notes: | | | | | | |

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

| FREQ | LEVEL | CABLE / ANT / PREAMP | FINAL | POL / HGT / AZ | Duty Cycle Correction | Final Corrected | Limit | DELTA |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) (dB\m) (dB) | (dBuV) | (m) (DEG) | (dB) | (dBuV/m) | (dBuV/m) | (dB) |
| The following duty cycle was declared by the manufacturer. | | | | | | | | |
| 28% | | | | | | | | |
| **Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate field strength emissions.**<br>The testing performed in accordance to FCC CFR47 Part 15.205 (restricted bands of operation) and 15.247 emissions and delta limits were calculated as follows:<br>Final Corrected Peak Measurement – Duty Cycle Correction Factor* = Final Calculated Emission<br>The Final Calculated Emission was then compared to the Limits in CFR47 Part 15.209 and 15.247 and the emission/limit delta was calculated.<br>The DTCF is calculated as follows 20*$\log_{10}$(duty cycle in 100mS) “not to exceed 20dB” | | | | | | | | |
| Worst case axis was determined from previous testing. | | | | | | | | |
| Low Channel | | | | | | | | |
| 902.86 | 83.2 Pk | 3.6 / 23.1 / 0.0 | 109.9 | V / 1.0 / 221.2 | 0.0 | 109.9 | 125.0 | -15.1 |
| 902.86 | 81.0 Pk | 3.6 / 23.1 / 0.0 | 107.7 | H / 1.4 / 182.5 | 0.0 | 107.7 | 125.0 | -17.3 |
| 1805.69 | 74.0 Pk | 3.1 / 26.3 / 37.3 | 66.1 | V / 3.0 / 44.6 | -11.0 | 55.1 | 92.5 | -37.4 |
| 1805.71 | 74.2 Pk | 3.1 / 26.3 / 37.3 | 66.4 | H / 1.0 / 91.2 | -11.0 | 55.4 | 92.5 | -37.1 |
| 2708.52 | 61.5 Pk | 4.3 / 29.7 / 37.9 | 57.5 | V / 1.1 / 273.3 | -11.0 | 46.5 | 54.0 | -7.5 |
| 2708.56 | 61.1 Pk | 4.3 / 29.7 / 37.9 | 57.1 | H / 1.0 / 193.8 | -11.0 | 46.1 | 54.0 | -7.9 |
| 3611.38 | 45.3 Pk | 5.0 / 31.7 / 38.4 | 43.6 | H / 1.6 / 291.2 | -11.0 | 32.6 | 54.0 | -21.4 |
| 3611.42 | 47.4 Pk | 5.0 / 31.7 / 38.4 | 45.7 | V / 1.2 / 226.7 | -11.0 | 34.7 | 54.0 | -19.3 |
| 4514.24 | 43.1 Pk | 6.6 / 32.3 / 40.3 | 41.7 | V / 1.0 / 233.9 | -11.0 | 30.7 | 54.0 | -23.3 |
| 4514.25 | 46.6 Pk | 6.6 / 32.3 / 40.3 | 45.2 | H / 1.7 / 70.6 | -11.0 | 34.2 | 54.0 | -19.8 |
| 5417.08 | 43.6 Pk | 6.8 / 34.3 / 39.9 | 44.9 | H / 1.7 / 70.6 | -11.0 | 33.9 | 54.0 | -20.1 |
| 5417.09 | 41.6 Pk | 6.8 / 34.3 / 39.9 | 42.9 | V / 1.1 / 73.1 | -11.0 | 31.9 | 54.0 | -22.1 |
| 6319.95 | 41.8 Pk | 8.2 / 35.2 / 40.4 | 44.9 | H / 1.3 / 316.8 | -11.0 | 33.9 | 92.5 | -58.6 |
| 6319.95 | 38.8 Pk | 8.2 / 35.2 / 40.4 | 41.8 | V / 1.0 / 204.9 | -11.0 | 30.8 | 92.5 | -61.7 |
| No higher harmonics seen from the low channel. | | | | | | | | |
| Mid Channel | | | | | | | | |
| 909.82 | 82.5 Pk | 3.6 / 23.2 / 0.0 | 109.3 | H / 1.5 / 187.1 | 0.0 | 109.3 | 125.0 | -15.7 |
| 909.86 | 82.3 Pk | 3.6 / 23.2 / 0.0 | 109.1 | V / 1.0 / 272.2 | 0.0 | 109.1 | 125.0 | -15.9 |
| 1819.67 | 74.0 Pk | 3.1 / 26.4 / 37.3 | 66.2 | V / 1.0 / 43.1 | -11.0 | 55.2 | 92.5 | -37.3 |
| 1819.69 | 73.9 Pk | 3.1 / 26.4 / 37.3 | 66.1 | H / 1.0 / 336.3 | -11.0 | 55.1 | 92.5 | -37.4 |
| 2729.53 | 57.1 Pk | 4.3 / 29.8 / 37.9 | 53.2 | V / 1.1 / 315.0 | -11.0 | 42.2 | 54.0 | -11.8 |
| 2729.56 | 59.0 Pk | 4.3 / 29.8 / 37.9 | 55.1 | H / 1.0 / 190.9 | -11.0 | 44.1 | 54.0 | -9.9 |
| 3639.4 | 48.5 Pk | 5.1 / 31.7 / 38.4 | 46.9 | H / 1.8 / 62.1 | -11.0 | 35.9 | 54.0 | -18.1 |
| 3639.43 | 48.8 Pk | 5.1 / 31.7 / 38.4 | 47.1 | V / 1.2 / 226.5 | -11.0 | 36.1 | 54.0 | -17.9 |



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| FREQ | LEVEL | CABLE / ANT / PREAMP | FINAL | POL / HGT / AZ | Duty Cycle Correction | Final Corrected | Limit | DELTA |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuV) | (dB) (dB\m) (dB) | (dBuV) | (m) (DEG) | (dB) | (dBuV/m) | (dBuV/m) | (dB) |
| | | | | | | | | |
| 4549.22 | 45.7 Pk | 6.7 / 32.4 / 40.3 | 44.5 | V / 1.1 / 229.7 | -11.0 | 33.5 | 54.0 | -20.5 |
| 4549.22 | 49.1 Pk | 6.7 / 32.4 / 40.3 | 47.9 | H / 1.6 / 317.4 | -11.0 | 36.9 | 54.0 | -17.1 |
| 5459.09 | 42.0 Pk | 6.8 / 34.4 / 39.9 | 43.3 | V / 1.0 / 231.3 | -11.0 | 32.3 | 54.0 | -21.7 |
| 5459.09 | 42.8 Pk | 6.8 / 34.4 / 39.9 | 44.1 | H / 1.0 / 129.5 | -11.0 | 33.1 | 54.0 | -20.9 |
| 6368.92 | 38.0 Pk | 8.3 / 35.2 / 40.4 | 41.2 | V / 1.0 / 325.9 | -11.0 | 30.2 | 92.5 | -62.3 |
| 6368.95 | 40.5 Pk | 8.3 / 35.2 / 40.4 | 43.7 | H / 1.3 / 303.3 | -11.0 | 32.7 | 92.5 | -59.8 |
| No higher harmonics seen from the low channel. | | | | | | | | |
| High Channel | | | | | | | | |
| 919.73 | 84.0 Pk | 3.6 / 23.2 / 0.0 | 110.8 | H / 1.4 / 182.4 | 0.0 | 110.8 | 125.0 | -14.2 |
| 919.74 | 85.7 Pk | 3.6 / 23.2 / 0.0 | 112.5 | V / 1.0 / 355.9 | 0.0 | 112.5 | 125.0 | -12.5 |
| 1839.41 | 74.0 Pk | 3.1 / 26.5 / 37.4 | 66.3 | H / 1.0 / 266.2 | -11.0 | 55.3 | 92.5 | -37.2 |
| 1839.42 | 74.0 Pk | 3.1 / 26.5 / 37.4 | 66.2 | V / 1.0 / 170.3 | -11.0 | 55.2 | 92.5 | -37.3 |
| 2759.14 | 63.9 Pk | 4.3 / 29.9 / 37.9 | 60.2 | H / 1.0 / 175.9 | -11.0 | 49.2 | 54.0 | -4.8 |
| 2759.14 | 68.5 Pk | 4.3 / 29.9 / 37.9 | 64.8 | V / 1.1 / 314.6 | -11.0 | 53.8 | 54.0 | -0.2 |
| 3678.85 | 50.4 Pk | 5.1 / 31.8 / 38.5 | 48.8 | V / 1.1 / 314.0 | -11.0 | 37.8 | 54.0 | -16.2 |
| 3678.88 | 46.6 Pk | 5.1 / 31.8 / 38.5 | 45.1 | H / 1.0 / 160.2 | -11.0 | 34.1 | 54.0 | -19.9 |
| 4598.59 | 54.0 Pk | 6.8 / 32.5 / 40.3 | 52.9 | H / 1.6 / 64.5 | -11.0 | 41.9 | 54.0 | -12.1 |
| 4598.6 | 49.2 Pk | 6.8 / 32.5 / 40.3 | 48.2 | V / 1.4 / 230.5 | -11.0 | 37.2 | 54.0 | -16.8 |
| 5518.32 | 35.6 Pk | 6.7 / 34.5 / 39.8 | 37.1 | V / 1.4 / 85.7 | -11.0 | 26.1 | 92.5 | -66.4 |
| 5518.33 | 35.5 Pk | 6.7 / 34.5 / 39.8 | 36.9 | H / 1.3 / 77.7 | -11.0 | 25.9 | 92.5 | -66.6 |
| 6438.03 | 43.0 Pk | 8.4 / 35.3 / 40.3 | 46.4 | H / 1.3 / 314.4 | -11.0 | 35.4 | 92.5 | -57.1 |
| 6438.05 | 39.8 Pk | 8.4 / 35.3 / 40.3 | 43.1 | V / 1.0 / 208.6 | -11.0 | 32.1 | 92.5 | -60.4 |
| No higher harmonics seen from the low channel. | | | | | | | | |



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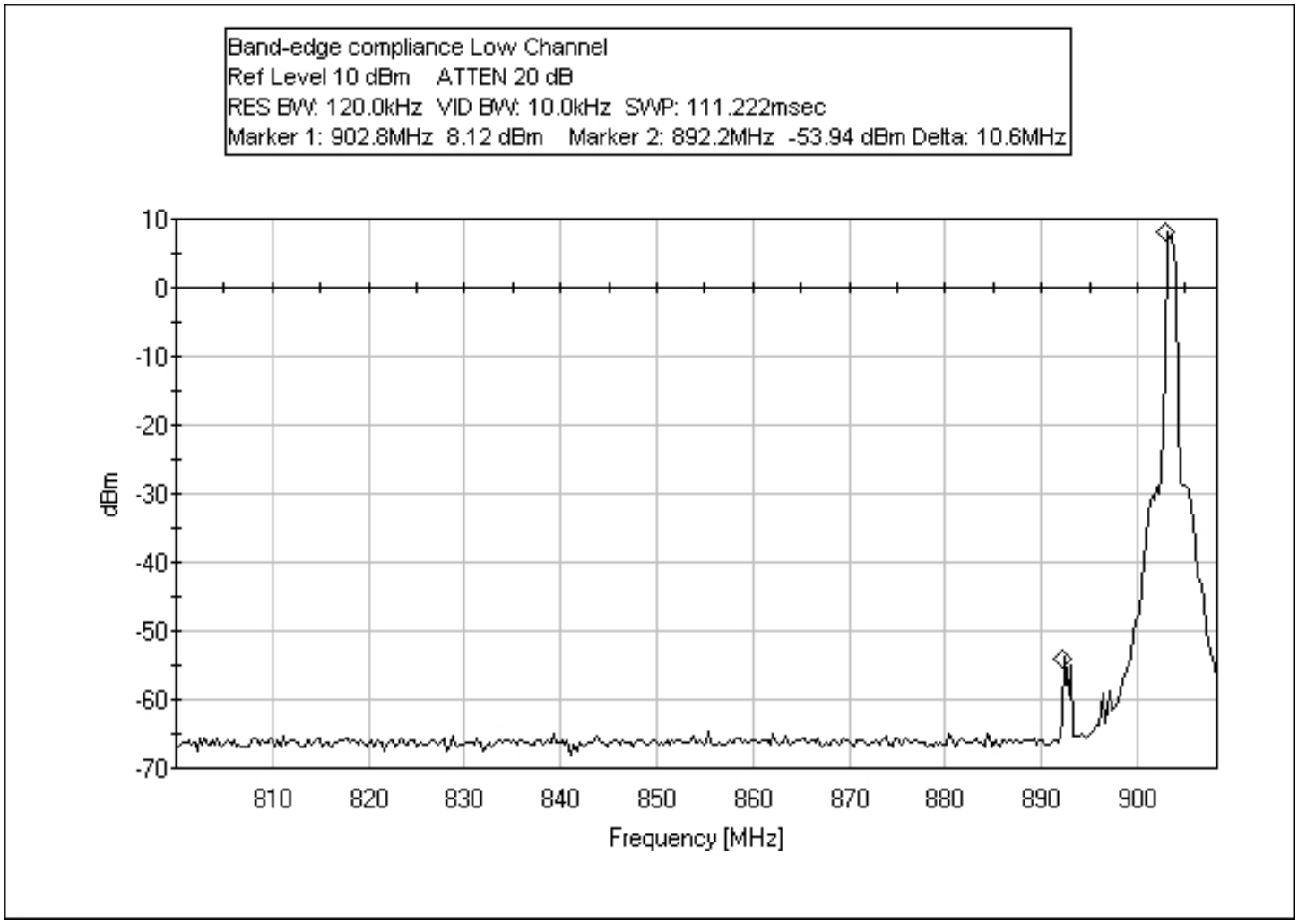
# Band-edge

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **3126032** | Test Area: | PW1 | Temperature: | 23.5 | °C |
| Test Method: | FCC Part 15.247 | Test Date: | 13-Aug-2007 | Relative Humidity: | 20.6 | % |
| EUT Model #: | M2 | EUT Power: | 3.3VDC Battery | Air Pressure: | 101 | kPa |
| EUT Serial #: | Unti4 | | | | | |
| Manufacturer: | Transparent Technologies | | | | | |
| EUT Description: | Utility meter radio | | | | | |
| Notes: | | | | | | |

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



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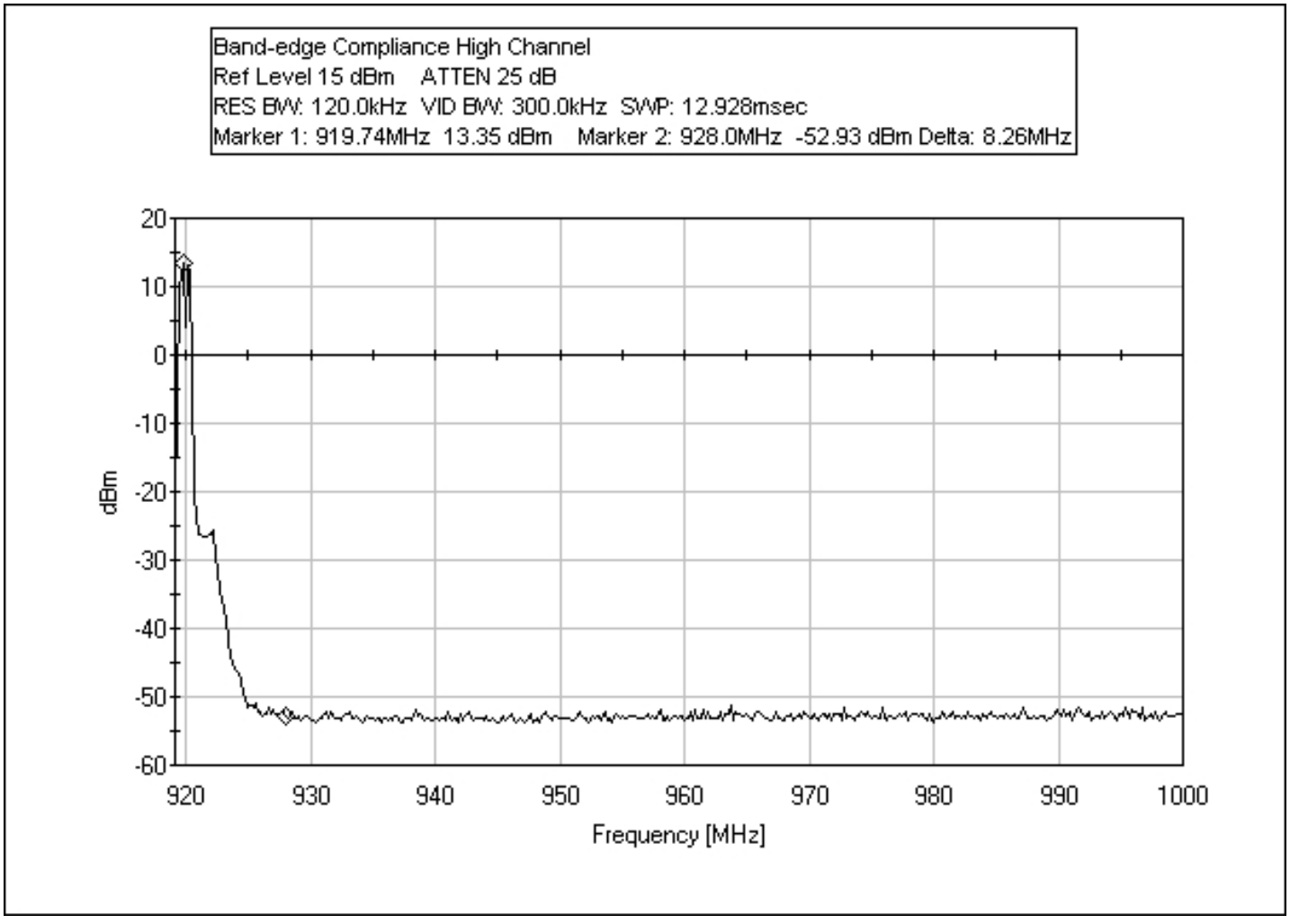
# Band-edge

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **3126032** | Test Area: | PW1 | Temperature: | 23.5 | °C |
| Test Method: | FCC Part 15.247 | Test Date: | 13-Aug-2007 | Relative Humidity: | 20.6 | % |
| EUT Model #: | M2 | EUT Power: | 3.3VDC Battery | Air Pressure: | 101 | kPa |
| EUT Serial #: | Unti4 | | | | | |
| Manufacturer: | Transparent Technologies | | | | | |
| EUT Description: | Utility meter radio | | | | | |
| Notes: | | | | | | |

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



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# Power Spectral Density

# 15.247 (e)



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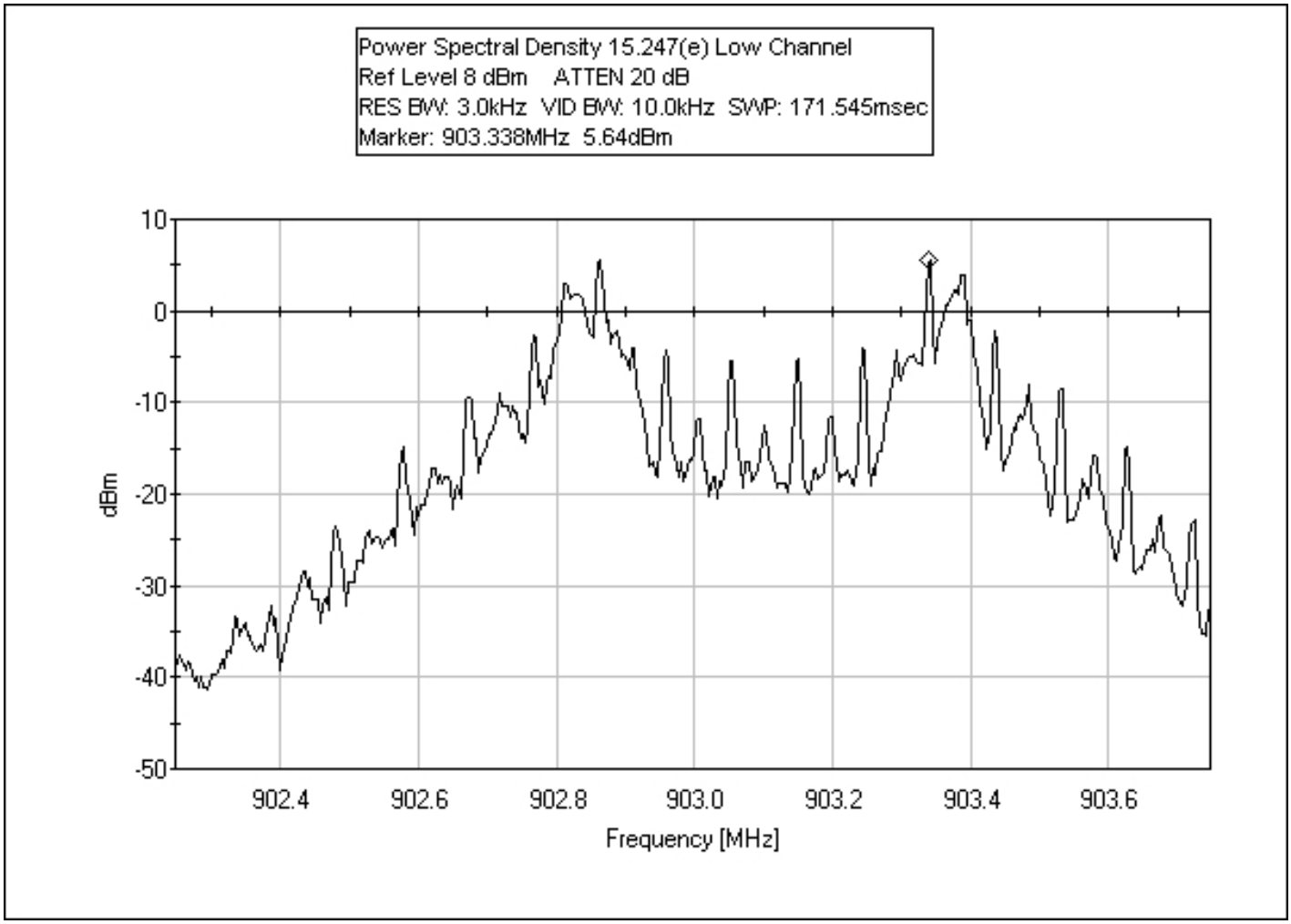
# Power Spectral Density

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **3126032** | Test Area: | PW1 | Temperature: | 23.5 | °C |
| Test Method: | FCC Part 15.247 | Test Date: | 13-Aug-2007 | Relative Humidity: | 20.6 | % |
| EUT Model #: | M2 | EUT Power: | 3.3VDC Battery | Air Pressure: | 101 | kPa |
| EUT Serial #: | Unti4 | | | | | |
| Manufacturer: | Transparent Technologies | | | | | |
| EUT Description: | Utility meter radio | | | | | |
| Notes: | Low channel | | | | | |

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



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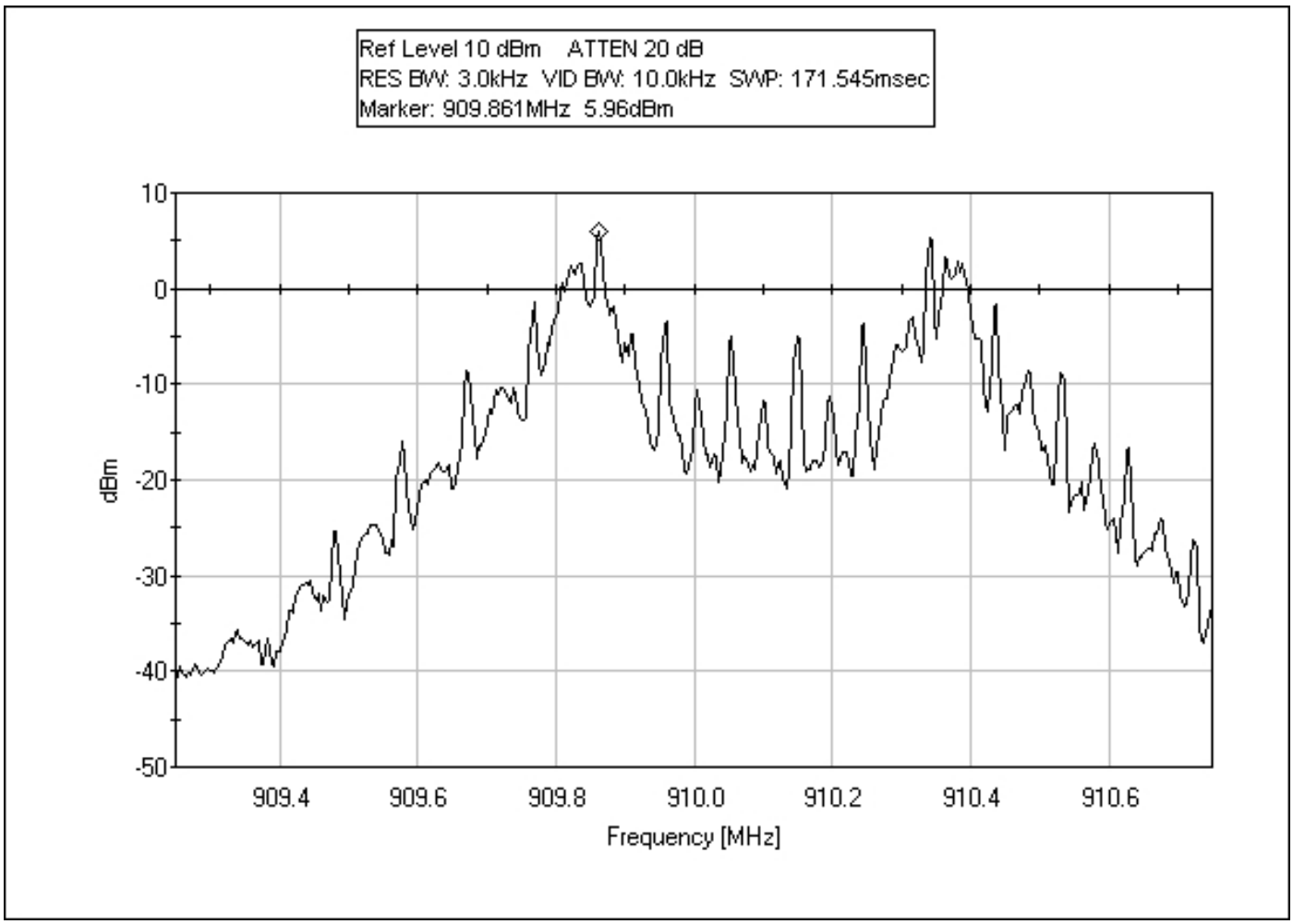
# Power Spectral Density

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **3126032** | Test Area: | PW1 | Temperature: | 23.5 | °C |
| Test Method: | FCC Part 15.247 | Test Date: | 13-Aug-2007 | Relative Humidity: | 20.6 | % |
| EUT Model #: | M2 | EUT Power: | 3.3VDC Battery | Air Pressure: | 101 | kPa |
| EUT Serial #: | Unti4 | | | | | |
| Manufacturer: | Transparent Technologies | | | | | |
| EUT Description: | Utility meter radio | | | | | |
| Notes: | Mid Channel | | | | | |

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



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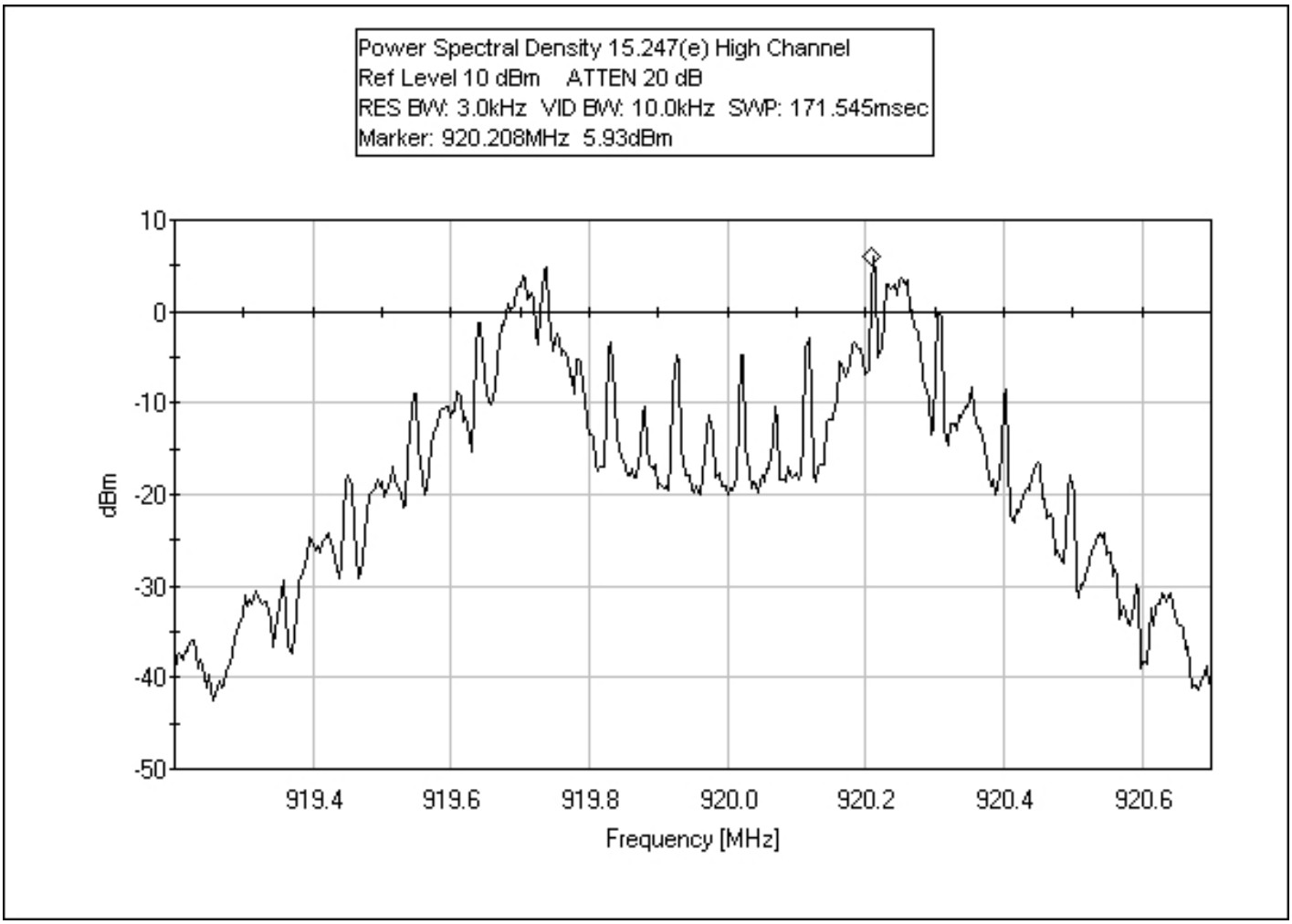
# Power Spectral Density

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Report #: | **3126032** | Test Area: | PW1 | Temperature: | 23.5 | °C |
| Test Method: | FCC Part 15.247 | Test Date: | 13-Aug-2007 | Relative Humidity: | 20.6 | % |
| EUT Model #: | M2 | EUT Power: | 3.3VDC Battery | Air Pressure: | 101 | kPa |
| EUT Serial #: | Unti4 | | | | | |
| Manufacturer: | Transparent Technologies | | | | | |
| EUT Description: | Utility meter radio | | | | | |
| Notes: | | | | | | |

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



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# List of Equipment Utilized for Final Test



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# Project Report

**Begin Date:** 6/25/2007 **End Date:** 8/13/2007

**Technician** Mike Spataro **Project** 3126032

| Capital Asset ID | Manufacturer | Model # | Serial # | Description | Test Performed | Service Type | Service Date | Service Due |
|---|---|---|---|---|---|---|---|---|
| 18880 | Hewlett-Packard | 85650A | 2811A01300 | Q.P Adapter | R Radiated Emissions | For Cal | 2/16/2007 | 2/16/2008 |
| 18882 | Hewlett-Packard | 8566B | 2410A00154 | Spectrum Analyzer (dc-22 GHz) | R Radiated Emissions | For Cal | 12/7/2006 | 12/7/2007 |
| 18887 | EMCO | 3115 | 9205-3886 | Horn Antenna 1-18GHz | R Radiated Emissions | For Cal | 3/6/2007 | 3/6/2008 |
| 18888 | EMCO | 3146 | 9402-3775 | Log Periodic Antenna (200-1000MHz) | R Radiated Emissions | For Cal | 10/31/2006 | 10/31/2007 |
| 18889 | EMC TEST SYSTEMS | 3109 | 3142 | Biconical Antenna 30-300MHz | R Radiated Emissions | For Cal | 10/31/2006 | 10/31/2007 |
| 18897 | EMCO | 6502 | 9205-2738 | Magnetic loop | R Radiated Emissions | For Cal | 8/8/2006 | 8/8/2007 |
| 18900 | Avantek | AFT97-8434-10F | 1007 | RF Pre-Amplifier (4-8 GHz) | R Radiated Emissions | For Ver | 5/1/2007 | 5/1/2008 |
| 18901 | Avantek | AWT-18037 | 1002 | RF Pre-Amplifier (8-18 GHz) | R Radiated Emissions | For Ver | 5/1/2007 | 5/1/2008 |
| 18906 | Mini-Circuits Lab | ZHL-42 | N052792-2 | Amplifier | R Radiated Emissions | For Ver | 5/1/2007 | 5/1/2008 |
| 18912 | Hewlett-Packard | 8447F | 3113A05545 | 9 kHz- 1.3GHz Pre Amp | R Radiated Emissions | For Ver | 5/1/2007 | 5/1/2008 |
| 18913 | Hewlett-Packard | E7405A | My44211889 | Spectrum Analyzer | R Radiated Emissions | For Cal | 2/23/2007 | 2/23/2008 |



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**Appendix B**

Test Plan

and

Constructional Data Form

## To be supplied by the customer



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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 dBμV:*

| 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 C63.4-2003 - "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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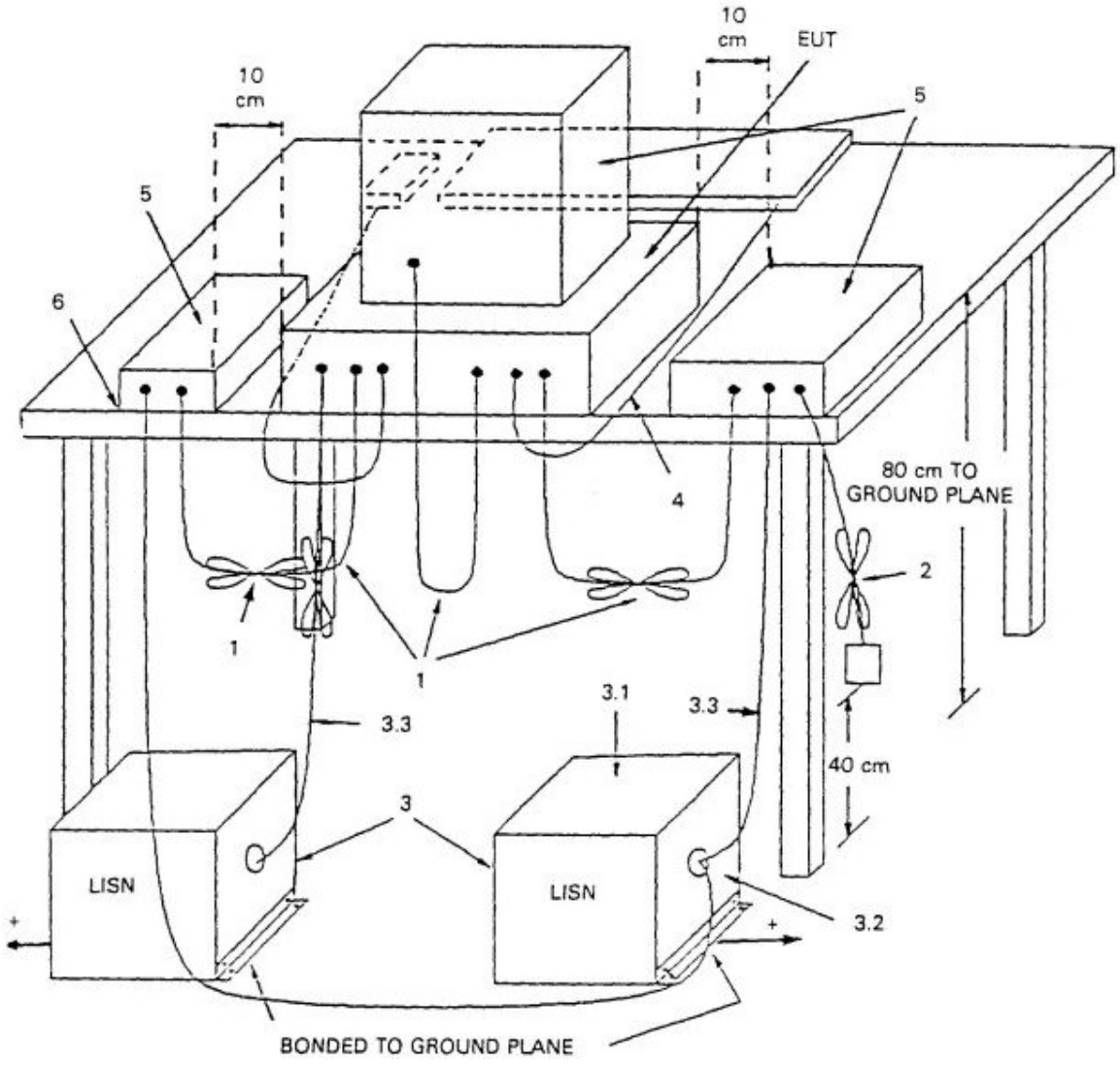
## Conducted Emissions Diagram:



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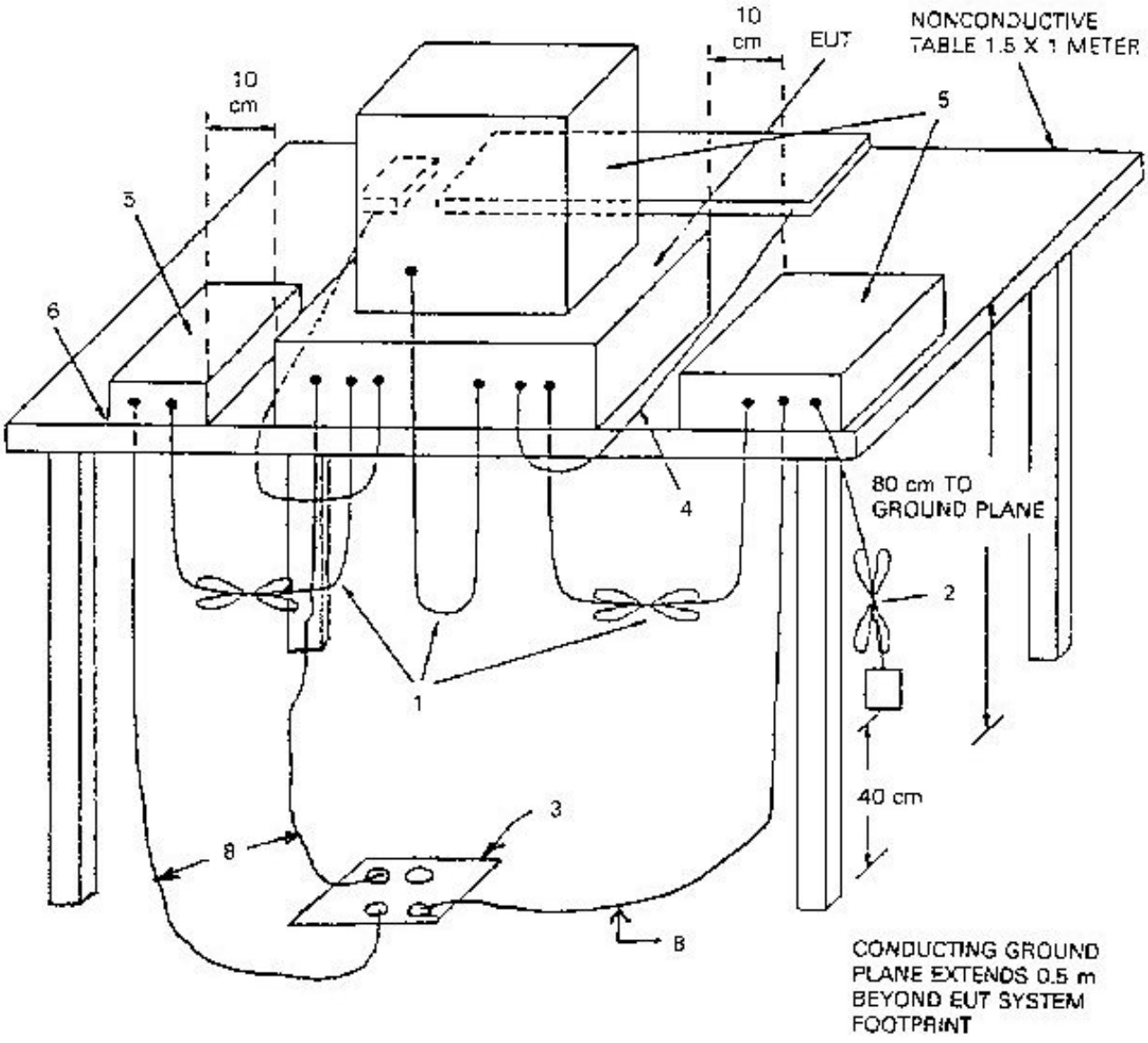
## Radiated Emissions Diagram:



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