# TEST REPORT

Report Number: 3064328.012
Project Number: 3064328
September 29, 2004

Evaluation of the
47550 DataDirect Remote Collector
FCC ID:

to
FCC Part 2
FCC Part 15, Subpart C, Section 15.247

For
Simpson Electric Company

Test Performed by:
Intertek
7250 Hudson Blvd. Suite 100
Oakdale, MN 55128

Test Authorized by:
Simpson Electric Company
853 Dundee Avenue
Elgin IL, 60120

Prepared by: _____ Date: September 29, 2004
Norman Shpilsher

Approved by: _____ Date: September 29, 2004
Troy Ihle

# CONTENTS

# 1.0 GENERAL DESCRIPTION

## 1.1 Related Submittals Grants

This is single application of the Simpson Electric Company *47550 DataDirect Remote Collector* for Certification under FCC Part 15, Subpart C.
The Receiver portion will be verified under Declaration of Conformity.

## 1.2 Product Description

*47550 DataDirect Remote Collector* is a RF Spread Spectrum Transmitter operating in frequency range 902.2 to 927.5MHz, which is using the AC4490 Spread Spectrum Transceiver manufactured by AeroComm Corporation and Maxrad 3dBi antennas. The intended use of the *47550 DataDirect Remote Collector* is to generate, transmit and receive a RF Spread Spectrum signal.
The AC4490 Spread Spectrum Transceiver manufactured by AeroComm Corporation has been previously approved under FCC ID: KQL-AC4490.
This is a new equipment certification to add the following antennas:

Antennas Description:

Two identical external 3dBi antennas BMMG9153 with different antenna cable length manufactured by MAXRAD Inc. can be used with the *47550 DataDirect Remote Collector*:

- Model No. BMMG9153PRMSMA, 18" cable length, reverse SMA connector
  or
- Model No. BMMG9153ML195//RPMSMA, 25' cable length, reverse SMA connector

Sample Submitted: September 6, 2004
Test Work Started: September 7, 2004
Test Work Completed: September 24, 2004

## 1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-2000. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in Appendices D and E were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

## 1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on March 2003 submitted to FCC. Please reference the site registration number: 90706, dated April 18, 2003.

## 2.0 SYSTEM TEST CONFIGURATION

### 2.1 Justification

The *47550 DataDirect Remote Collector* is using the previously certified AC4490 Spread Spectrum Transceiver manufactured by AeroComm Corporation under FCC ID: KQL-AC4490, therefore the Conducted Output Power (FCC 15.247) was verified and the Spurious Radiated Emissions (FCC 15.205 and 15.209) for both antennas was measured. The Conducted Emissions (FCC 15.207) was measured also.

### 2.2 EUT Setup

The EUT is a wall-mounted device and during Radiated Spurious Emissions and Conducted Emissions testing was setup as tabletop equipment and powered at 120VAC/60Hz. For simplicity of testing, the transmitter was set to test mode to transmit continuously.

### 2.3 EUT Exercising Software

N/A

### 2.4 Special Accessories

There are no special accessories necessary for compliance of these products.

### 2.5 Equipment Modification

No modifications were installed during the testing.

### 2.6 Support Equipment List and Description

N/A

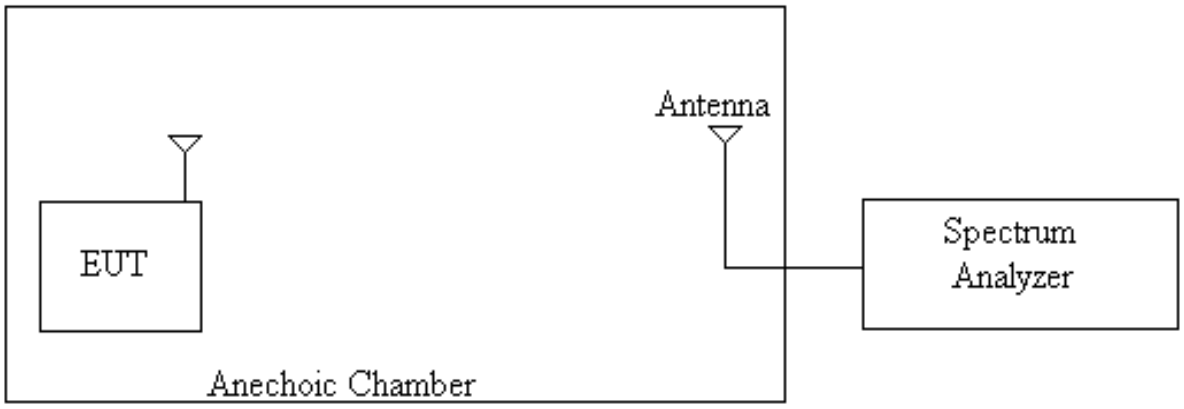
## 2.7 Test Configuration Block Diagrams

For Conducted Output Power measurements the EUT's antenna terminal was connected to a Spectrum Analyzer RF input via the RF cable with 0.3dB insertion loss.

During Radiated Spurious Emissions and Conducted Emissions testing the EUT was setup as tabletop equipment.

The EUT was powered at 120VAC/60Hz

Field Strength Measurements



## 3.0 TEST RESULTS

Data is included for the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements include the following:

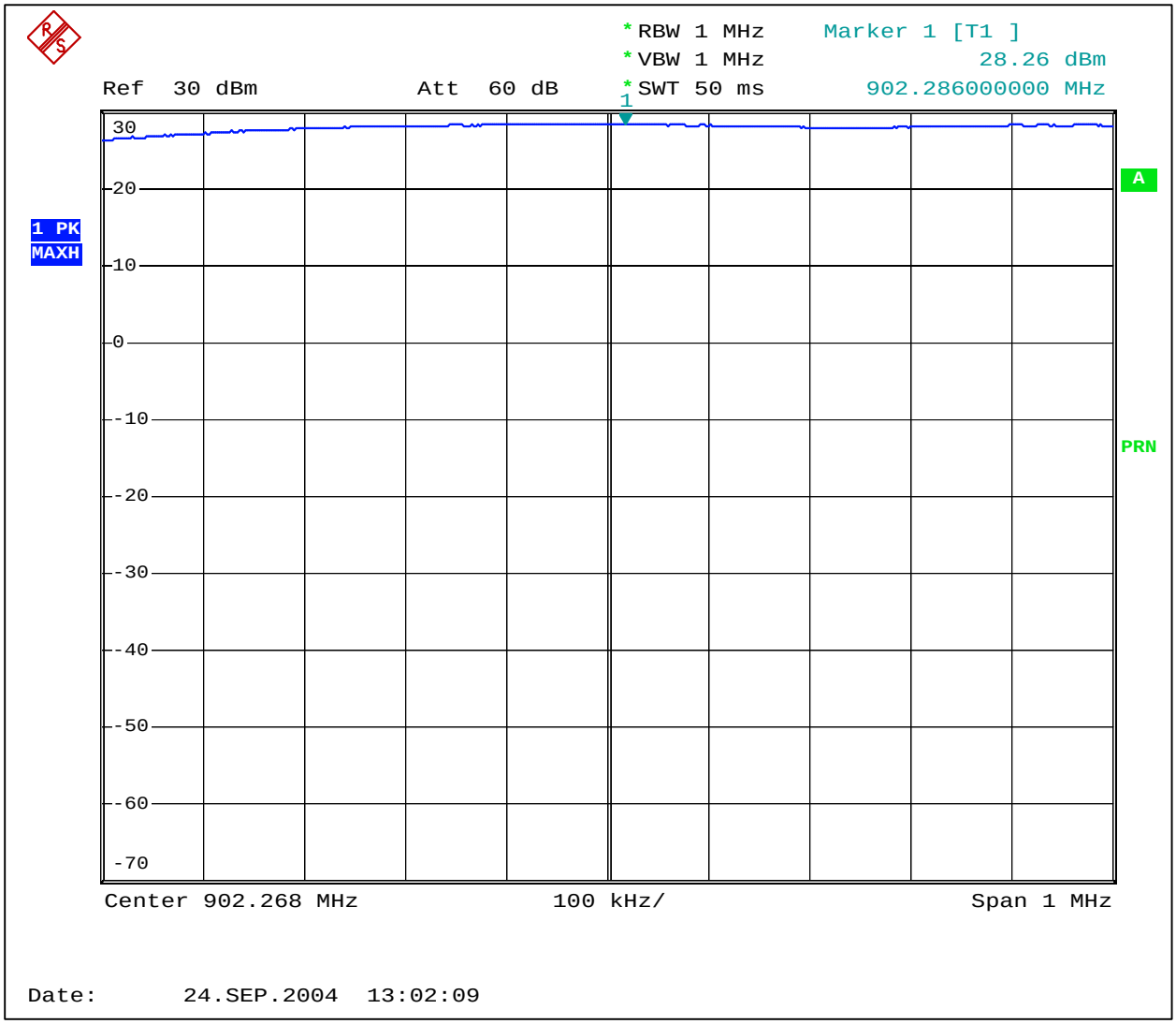
| | |
|---|---|
| 47 CFR 15.247(b)(2) | Maximum Peak Output Power |
| 47 CFR 15.247(c), 15.205, 15.209 | Field Strength of Spurious Emissions |
| 47 CFR 15.207 | Conducted Emissions |

## 3.1 Maximum Peak Output Power, FCC 15.247(b)(2)

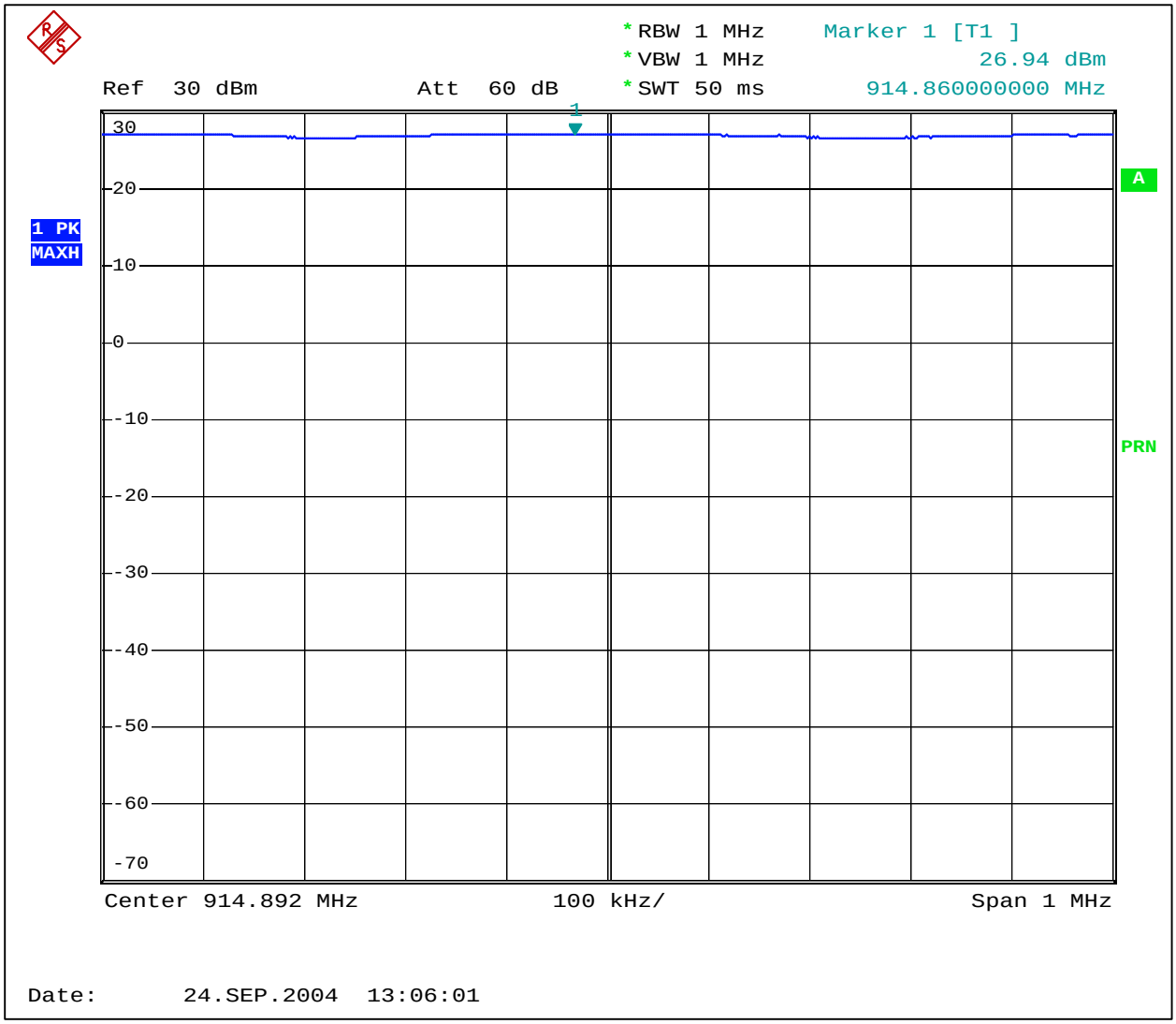
The Conducted Peak Output Power was measured at antenna terminal at channels 1, 25, and 50.
The Graphs 3-1-1, 3-1-2, and 3-1-3 show the Conducted Peak Output Power.

The maximum Conducted Peak Output Power measured at channel 1 is 28.26dBm, the total Peak Output Power (including the cable insertion loss of 0.3dB) is 28.56dBm, or 0.718W.
Note: The maximum Peak Output Power for AC4490 Spread Spectrum Transmitter manufactured by AeroComm Corporation under FCC ID: KQL-AC4490 is 0.743W, the difference in the power is 3.4%.

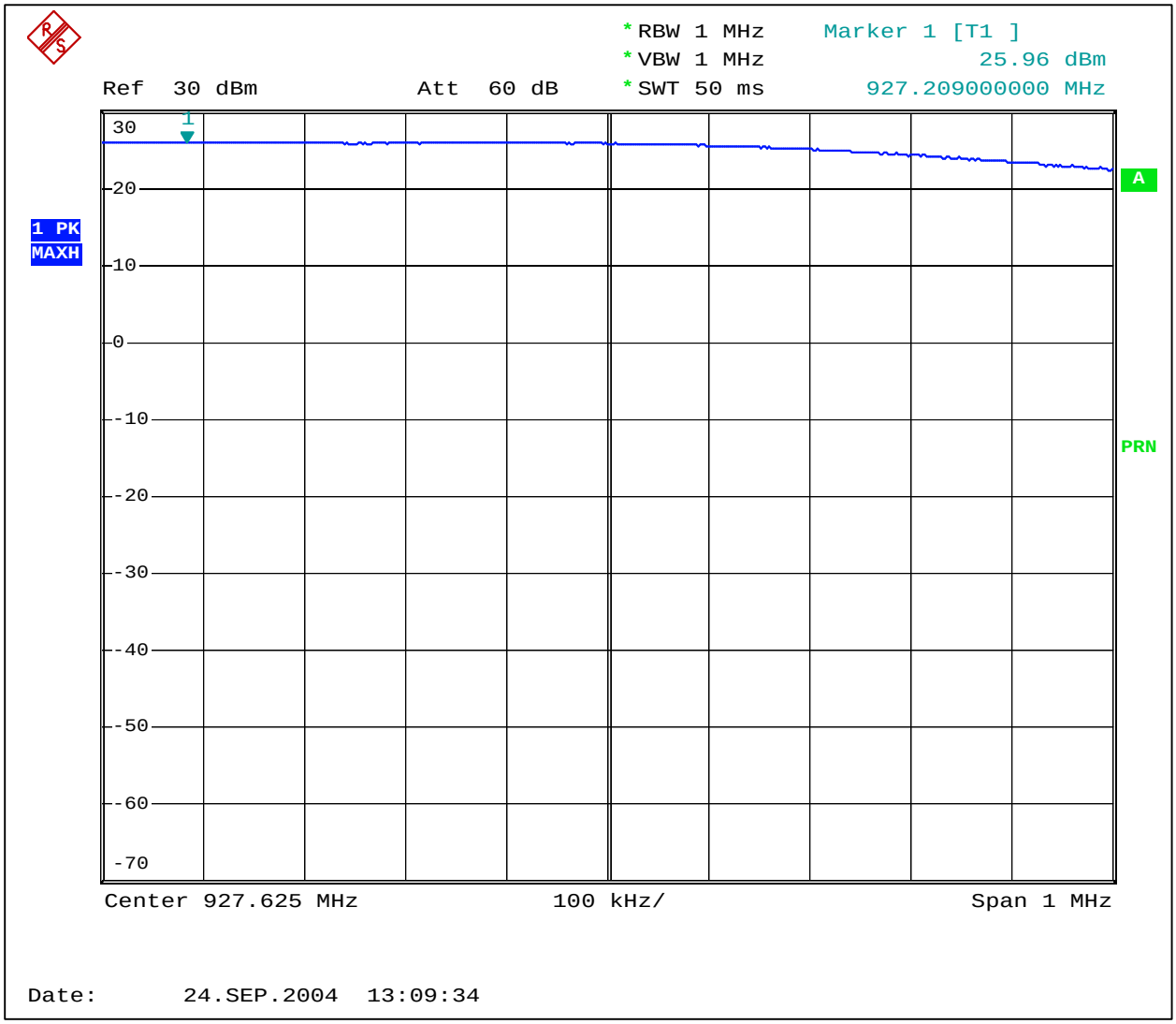
# Graph # 3-1-1
## Maximum Peak Output Power, Channel 1



# Graph # 3-1-2
## Maximum Peak Output Power, Channel 25



# Graph # 3-1-3
## Maximum Peak Output Power, Channel 50



### 3.1.1 RF Exposure, FCC 1.1307(b)(1)

The RF Exposure can be calculated according to equation from OET Bulletin 65, Edition 97-01:

$S = PG/4*pi*R^2$,

Where: S is Limits for Maximum Permissive Exposure (MPE) (mW/ $cm^2$),
P is Maximum Peak Power to Antenna (mW),
G is Antenna Gain (numerical gain),
R is Distance to the center of radiation of the antenna (cm)

Limits for Maximum Permissive Exposure (MPE) can be calculated as f/1500
Limits for Maximum Permissive Exposure (MPE) = 902/1500 = 0.601mW/ $cm^2$,
Maximum Peak Power to Antenna = 718mW,
Antenna Gain = 3dBi = 2 (numerical gain),

From calculation the Radius R = 13cm, within 20 cm.

## 3.2 Field Strength of Spurious Emissions, FCC 15.247(c), 15.205, 15.209

Field Strength of Spurious Emissions measurements were made up to 10th harmonic with Fundamental Frequencies from 902 to 928MHz.

The EUT complies with the Standard requirements for Harmonics Emissions with minimum margin 0.2dB.

The Table 3-2-1 and Graph 3-2-1 show the Field Strength Harmonics Emissions.
No emissions above ambient was found above 5th harmonics.

**Note:** The Antenna Factors in the Tables include the Antenna Factor and Cable Loss

**Spurious Radiated Emissions** **Date:** 09-22-2004

**Company:** Simpson Electric Company
**Model:** 47550 DDRC
**Test Engineer:** Norman Shpilsher
**Special Info:** 1W Radio with 18" antenna Cable
**Standard:** FCC Part 15.247(c), 15.205, 15.209
**Test Site:** 3m Anechoic Chamber, 3m measurement distance
**Note:** The table shows the worst case radiated emissions
Measurements below 1GHz were taken using a CISPR Quasi-peak detector
Measurements avobe 1GHz were taken using a peak detector with RBW 1MHz and VBW 1MHz or 10Hz (marked *)

**Table # 3-2-1**

| Frequency | Antenna | | Antenna CF | Pre-amp | Total Emissions | Limit | Margin | Comments |
|---|---|---|---|---|---|---|---|---|
| MHz | Polarity | Hts(cm) | dB1/m | Gain (dB) | at 3m (dBµV/m) | dBµV/m | dB | |
| 231.72 | V | 100 | 13.3 | 0.0 | 59.5 | 81.4 | -21.9 | |
| 231.72 | H | 120 | 13.3 | 0.0 | 55.7 | 81.1 | -25.4 | |
| 347.58 | V | 150 | 17.1 | 0.0 | 50.1 | 81.4 | -31.3 | |
| 569.45 | H | 166 | 21.4 | 0.0 | 53.2 | 81.1 | -27.9 | |
| 683.19 | V | 143 | 22.5 | 0.0 | 65.1 | 81.4 | -16.3 | |
| 683.19 | H | 124 | 22.5 | 0.0 | 65.3 | 81.1 | -15.8 | |
| 797.99 | V | 173 | 24.0 | 0.0 | 60.2 | 81.4 | -21.2 | |
| 797.99 | H | 100 | 24.0 | 0.0 | 63.8 | 81.1 | -17.3 | |
| 921.62 | V | 173 | 25.2 | 0.0 | 101.4 | N/A | N/A | 1 |
| 907.27 | H | 100 | 25.1 | 0.0 | 101.1 | N/A | N/A | 1 |
| 967.56 | V | 110 | 25.8 | 0.0 | 53.8 | 54.0 | -0.2 | 2 |
| 967.56 | H | 100 | 25.8 | 0.0 | 52.6 | 54.0 | -1.4 | 2 |
| 1002.51 * | H | 131 | 26.3 | 0.0 | 42.4 | 54.0 | -11.6 | 2 |
| 1015.15 * | V | 122 | 26.5 | 0.0 | 44.3 | 54.0 | -9.7 | 2 |
| 1026.50 * | V | 107 | 26.6 | 0.0 | 45.1 | 54.0 | -8.9 | 2 |
| 1130.21 * | V | 121 | 27.6 | 0.0 | 45.8 | 54.0 | -8.2 | 2 |
| 1842.39 | V | 119 | 31.2 | 36.0 | 65.4 | 81.4 | -16.0 | |
| 2733.07 * | H | 155 | 34.6 | 34.9 | 52.9 | 54.0 | -1.1 | 2 |
| 2755.25 * | V | 100 | 34.6 | 34.9 | 53.1 | 54.0 | -0.9 | 2 |
| 3682.88 | V | 118 | 37.7 | 34.3 | 49.8 | 54.0 | -4.2 | 2 |
| 4610.52 | V | 109 | 39.6 | 34.0 | 51.3 | 54.0 | -2.7 | 2 |
| 5464.24 | H | 122 | 41.6 | 33.9 | 50.1 | 54.0 | -3.9 | 2 |

**Comments:**
1. Maximum Field strenght at fundamental
2. Restricted Bands of Operation (FCC 15.205) with limits according to FCC 15.209;
limits for other emissions outside the frequency band is 20dB below emissions within the band

**Spurious Radiated Emissions** **Date:** 09-22-2004

**Company:** Simpson Electric Company
**Model:** 47550 DDRC
**Test Engineer:** Norman Shpilsher
**Special Info:** 1W Radio with 25' antenna Cable
**Standard:** FCC Part 15.247(c), 15.205, 15.209
**Test Site:** 3m Anechoic Chamber, 3m measurement distance
**Note:** The table shows the worst case radiated emissions
Measurements below 1GHz were taken using a CISPR Quasi-peak detector
Measurements avobe 1GHz were taken using a peak detector with RBW 1MHz and VBW 1MHz or 10Hz (marked *)

**Table # 3-2-2**

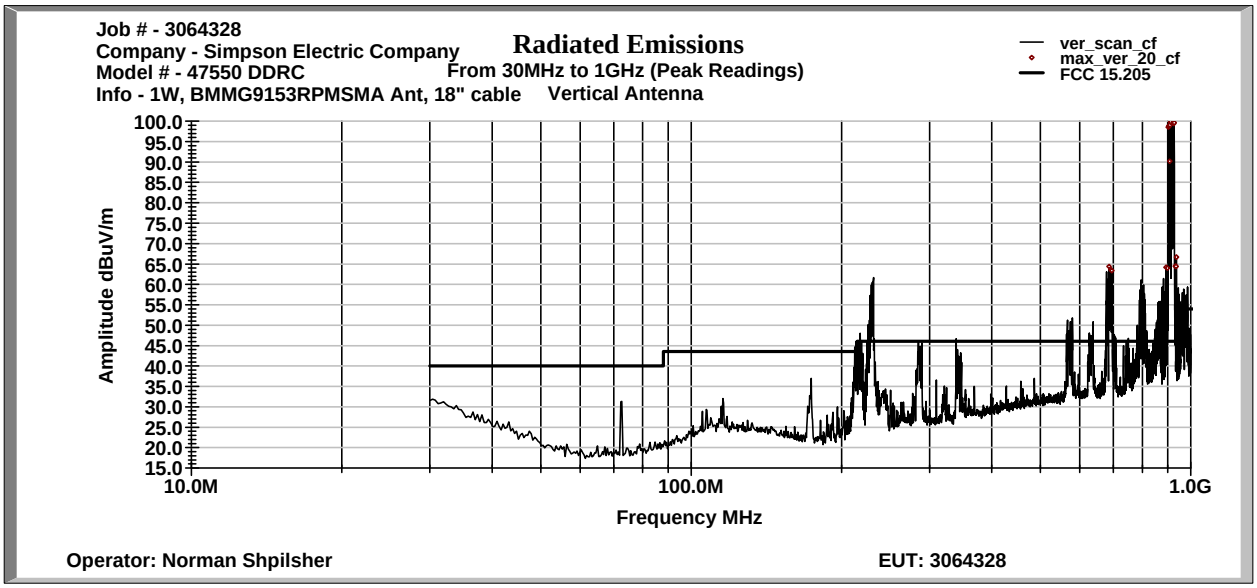
| Frequency | Antenna | | Antenna CF | Pre-amp | Total Emissions | Limit | Margin | Comments |
|---|---|---|---|---|---|---|---|---|
| MHz | Polarity | Hts(cm) | dB1/m | Gain (dB) | at 3m (dBµV/m) | dBµV/m | dB | |
| 231.73 | V | 100 | 13.3 | 0.0 | 59.0 | 80.5 | -21.5 | |
| 231.73 | H | 117 | 13.3 | 0.0 | 56.2 | 80.4 | -24.2 | |
| 346.12 | V | 122 | 17.1 | 0.0 | 51.1 | 80.5 | -29.4 | |
| 568.12 | H | 152 | 21.4 | 0.0 | 53.4 | 80.4 | -27.0 | |
| 683.22 | V | 131 | 22.5 | 0.0 | 65.3 | 80.5 | -15.2 | |
| 683.22 | H | 134 | 22.5 | 0.0 | 64.8 | 80.4 | -15.6 | |
| 797.97 | V | 166 | 24.0 | 0.0 | 59.3 | 80.5 | -21.2 | |
| 797.97 | H | 100 | 24.0 | 0.0 | 61.5 | 80.4 | -18.9 | |
| 918.52 | V | 119 | 25.2 | 0.0 | 100.5 | N/A | N/A | 1 |
| 913.48 | H | 103 | 25.1 | 0.0 | 100.4 | N/A | N/A | 1 |
| 967.55 | V | 113 | 25.8 | 0.0 | 53.6 | 54.0 | -0.4 | 2 |
| 967.55 | H | 108 | 25.8 | 0.0 | 52.5 | 54.0 | -1.5 | 2 |
| 1002.51 * | V | 115 | 26.3 | 0.0 | 49.4 | 54.0 | -4.6 | 2 |
| 1024.15 * | H | 117 | 26.5 | 0.0 | 39.9 | 54.0 | -14.1 | 2 |
| 1026.55 * | V | 116 | 26.6 | 0.0 | 50.3 | 54.0 | -3.7 | 2 |
| 1040.85 * | V | 100 | 26.7 | 0.0 | 44.2 | 54.0 | -9.8 | 2 |
| 1129.43 * | V | 115 | 27.6 | 0.0 | 40.9 | 54.0 | -13.1 | 2 |
| 1842.39 | V | 114 | 31.2 | 36.0 | 56.0 | 80.5 | -24.5 | |
| 1842.39 | H | 100 | 31.2 | 36.0 | 61.9 | 80.5 | -18.6 | |
| 2710.91 * | H | 142 | 34.5 | 34.9 | 52.7 | 54.0 | -1.3 | 2 |
| 2744.16 * | V | 105 | 34.6 | 34.9 | 52.5 | 54.0 | -1.5 | 2 |
| 3675.50 | H | 111 | 37.6 | 34.3 | 51.8 | 54.0 | -2.2 | 2 |
| 3682.88 | V | 118 | 37.7 | 34.3 | 49.8 | 54.0 | -4.2 | 2 |
| 4589.66 | V | 118 | 39.6 | 34.0 | 50.4 | 54.0 | -3.6 | 2 |
| 6432.52 | H | 100 | 42.4 | 34.1 | 51.2 | 80.4 | -29.2 | |

**Comments:**
1. Maximum Field strenght at fundamental
2. Restricted Bands of Operation (FCC 15.205) with limits according to FCC 15.209;
limits for other emissions outside the frequency band is 20dB below emissions within the band

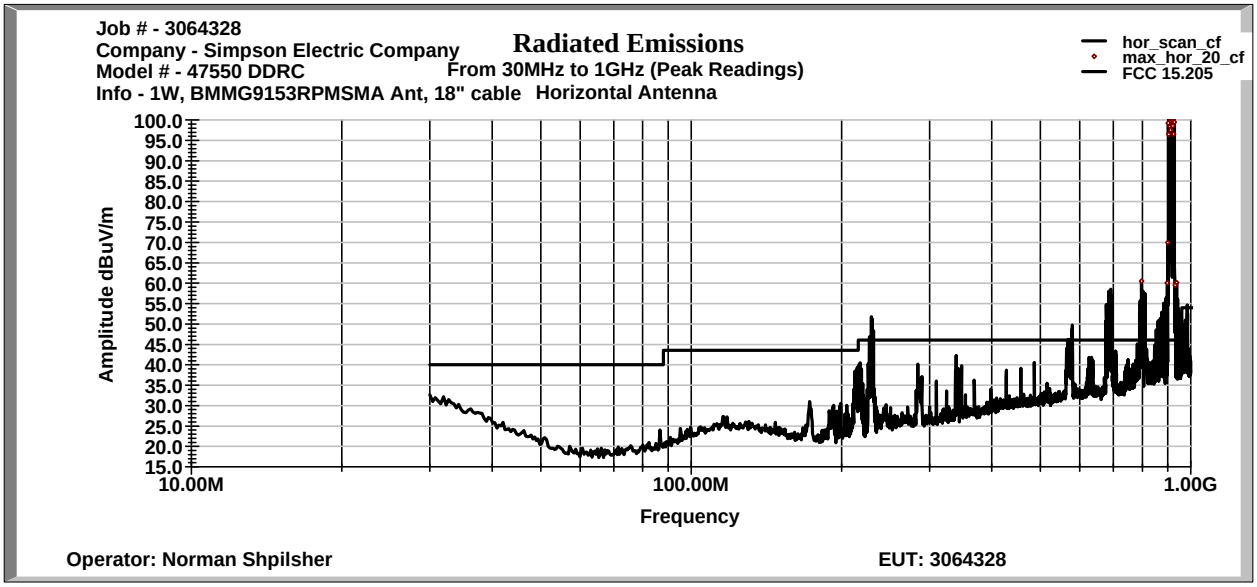
# Graph # 3-2-1

## Radiated Emissions from 30MHz to 1GHz, Antenna BMMG9153 with 18” cable

### Vertical Antenna Polarization

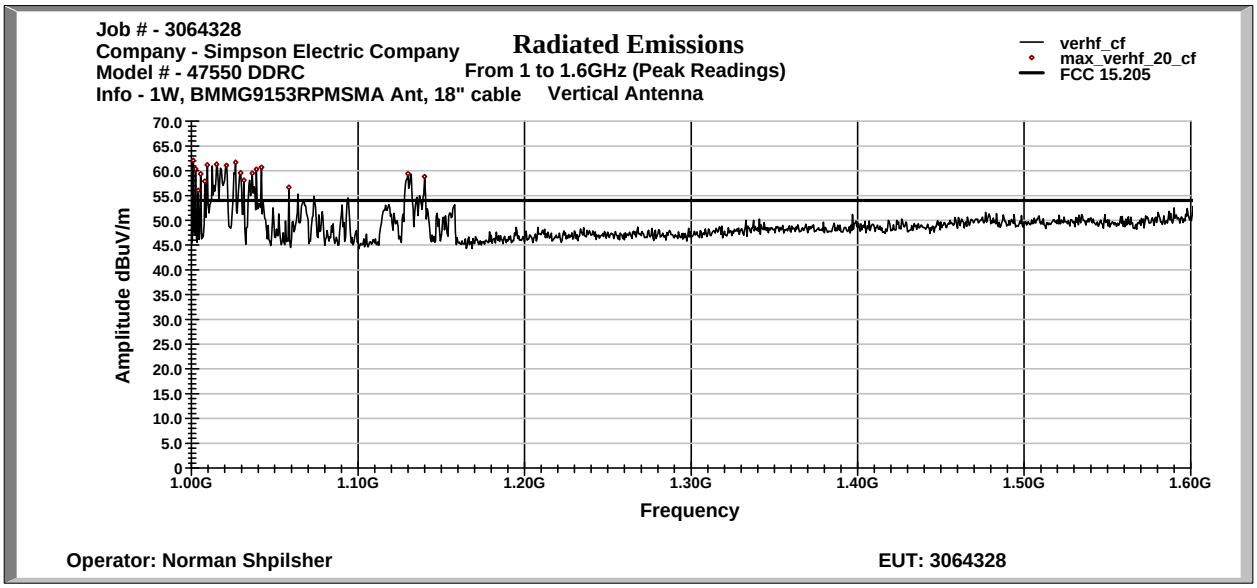



### Horizontal Antenna Polarization

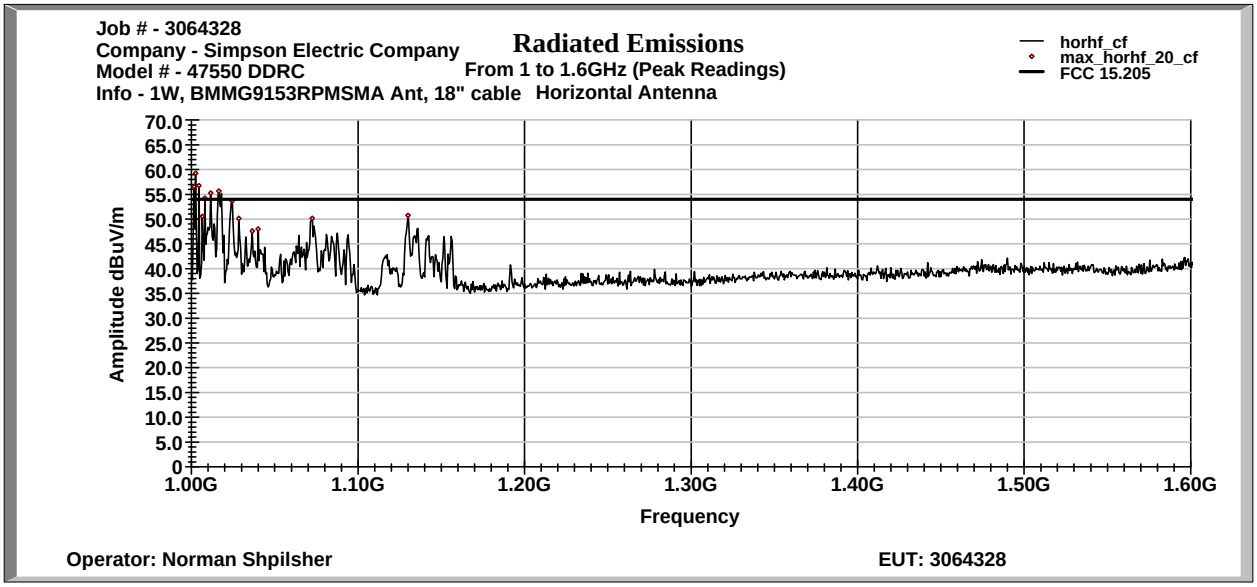


# Graph # 3-2-2
## Radiated Emissions from 1 to 1.6GHz, Antenna BMMG9153 with 18” cable

### Vertical Antenna Polarization

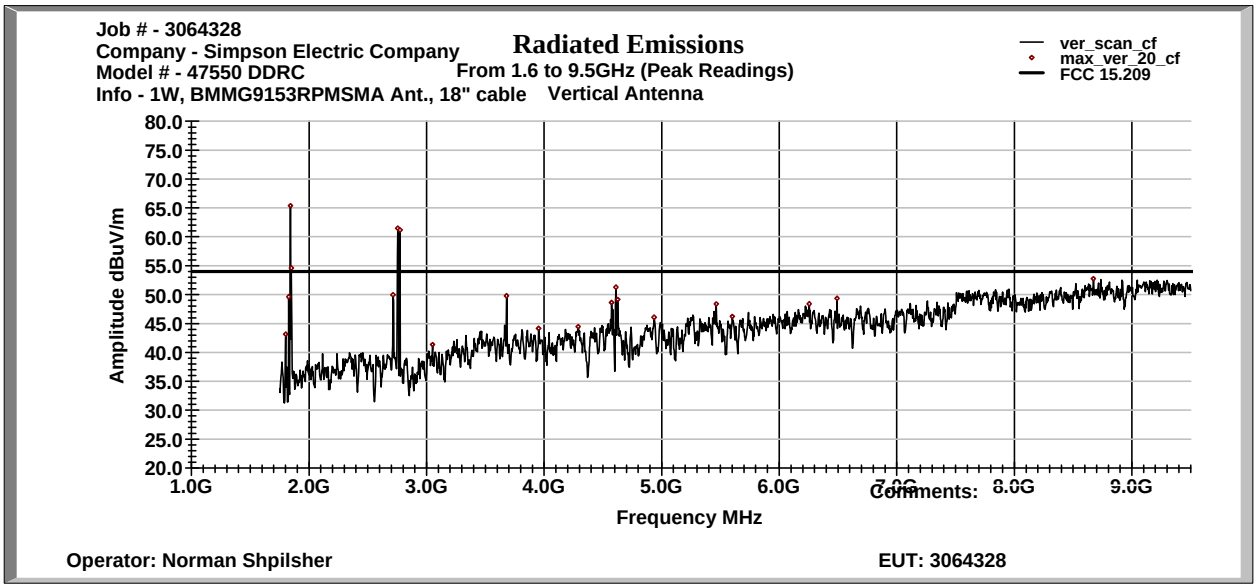



### Horizontal Antenna Polarization

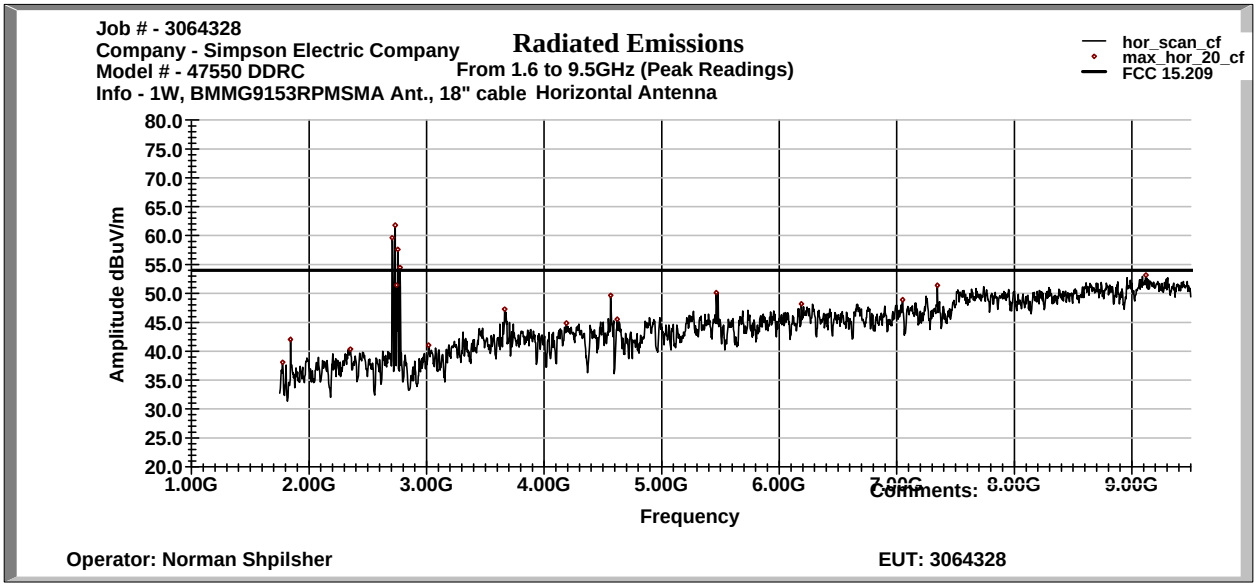


# Graph # 3-2-3
## Radiated Emissions from 1.6 to 9.5GHz, Antenna BMMG9153 with 18” cable

### Vertical Antenna Polarization



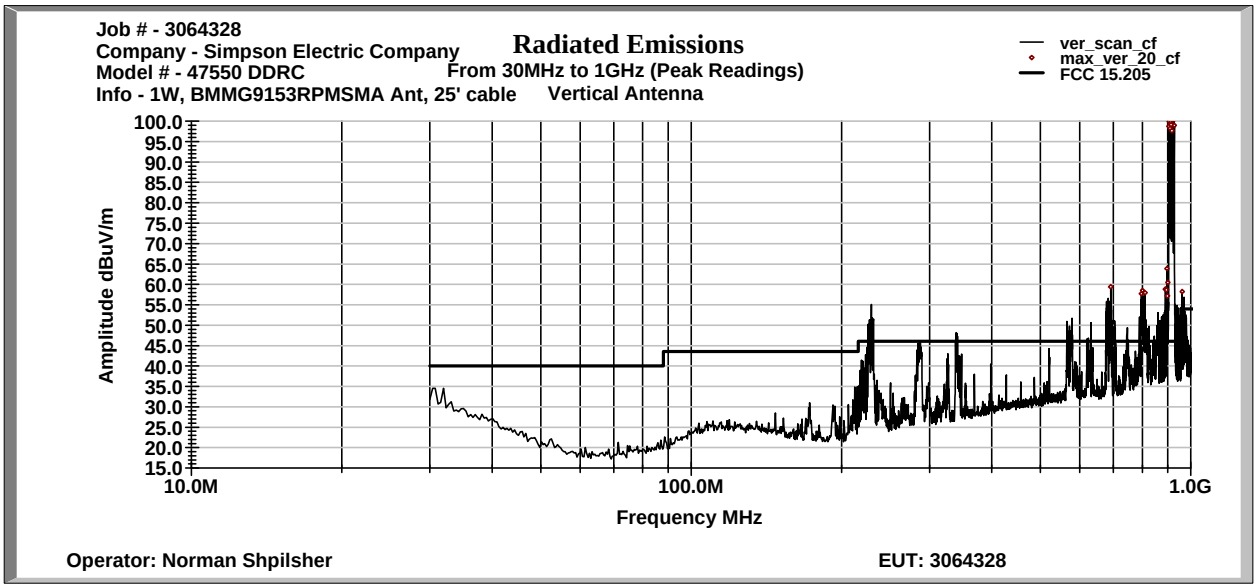

### Horizontal Antenna Polarization



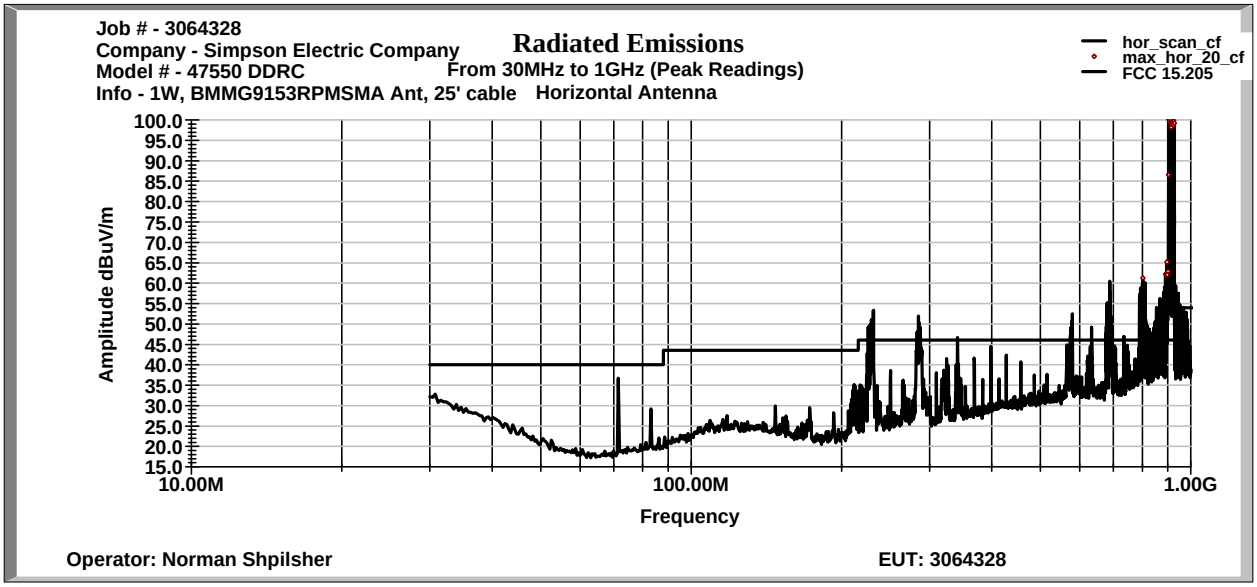
# Graph # 3-2-4

## Radiated Emissions from 30MHz to 1GHz, Antenna BMMG9153 with 25' cable

### Vertical Antenna Polarization

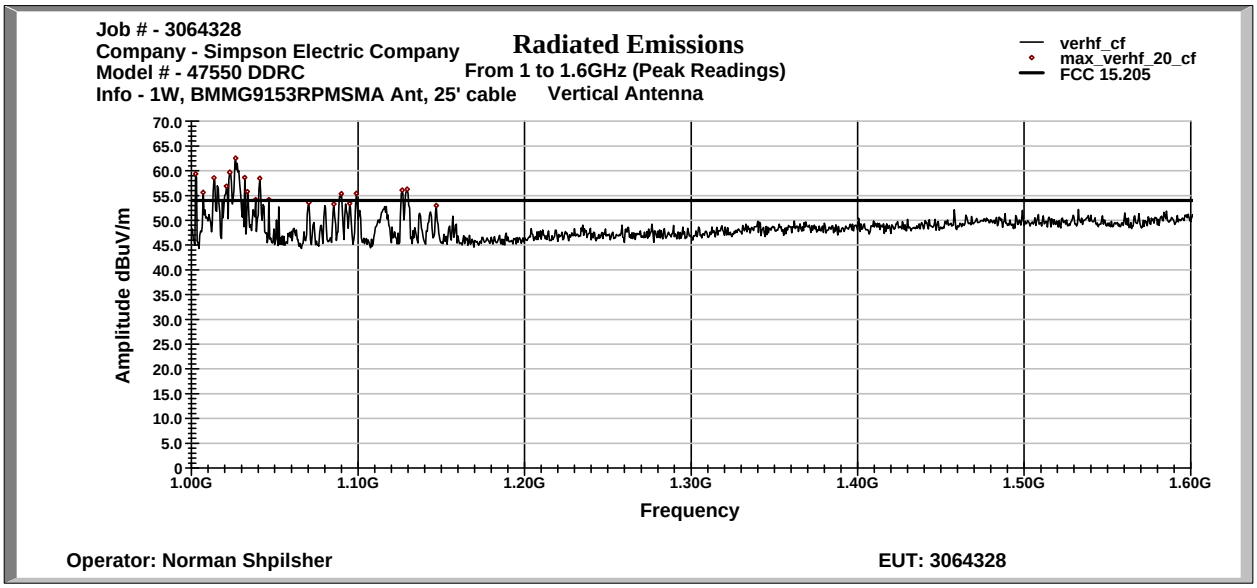



### Horizontal Antenna Polarization

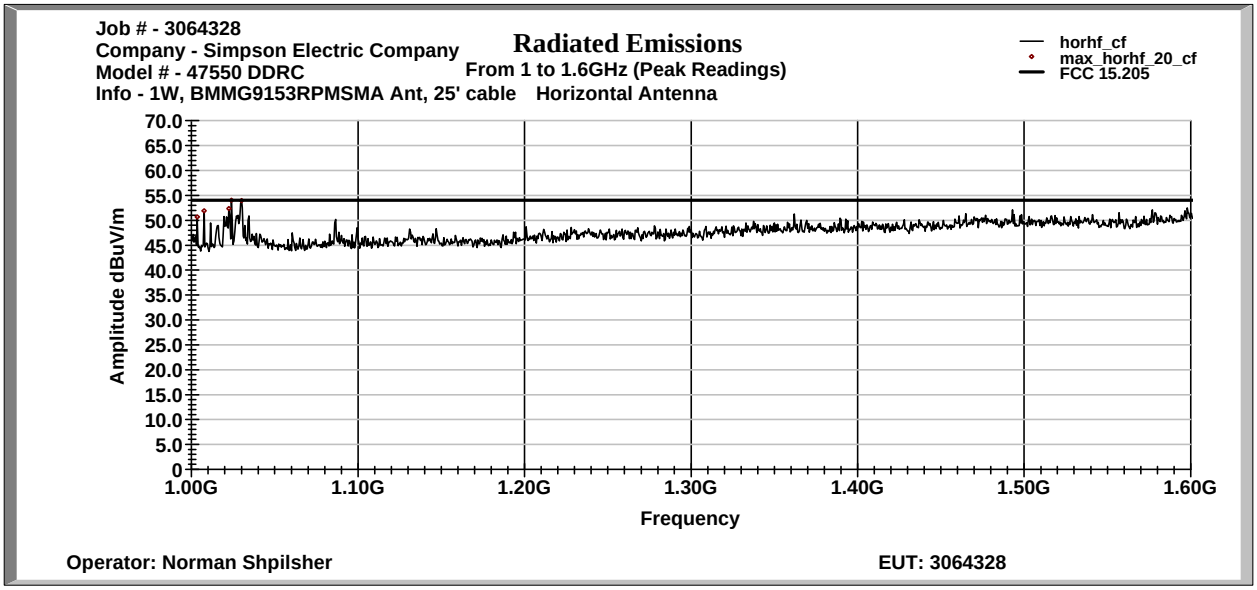


# Graph # 3-2-5
## Radiated Emissions from 1 to 1.6GHz, Antenna BMMG9153 with 25' cable

### Vertical Antenna Polarization



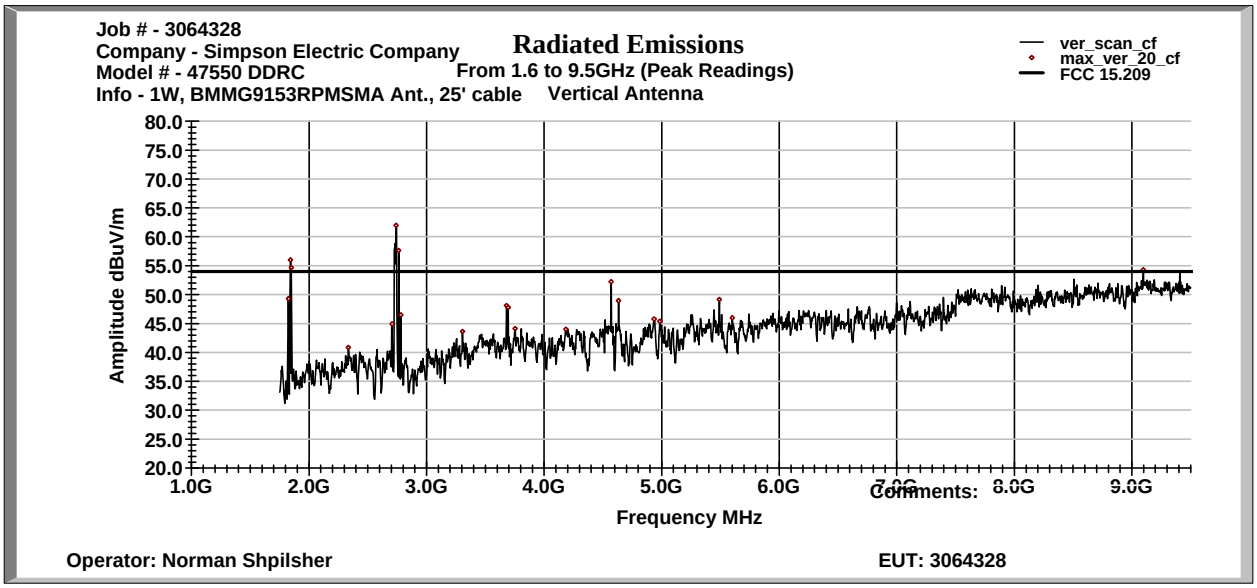

### Horizontal Antenna Polarization



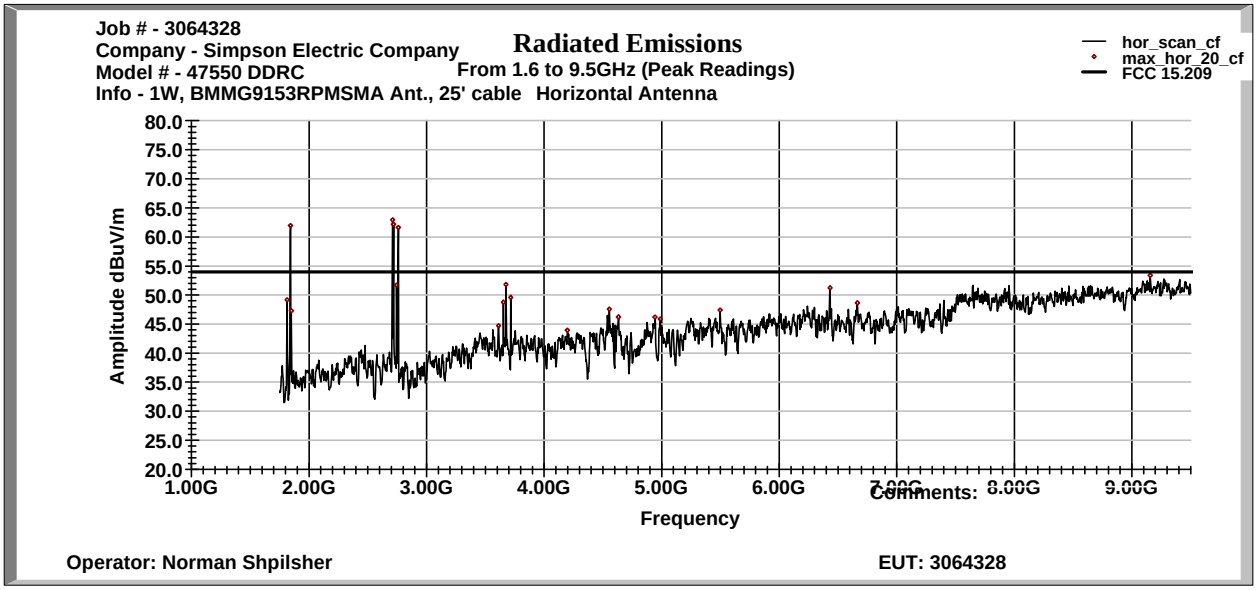
# Graph # 3-2-6

## Radiated Emissions from 1.6 to 9.5GHz, Antenna BMMG9153 with 25' cable

### Vertical Antenna Polarization




### Horizontal Antenna Polarization



### 3.3 Conducted Emissions, FCC 15.207

Conducted Emissions testing was performed in frequency range from 150kHz to 30MHz.

The Table 3-1-1 and Graph 3-5-1 show the Conducted Emissions.

*TILE Instrument Control System EMI Measurement Software*

**Conducted Emissions From 150kHz to 30MHz**
**Company:** Simpson Electric Company
**Model:** 47550
**Test Engineer:** Norman Shpilsher
**Special Info:**
**Standard:** FCC Part 15.207
**Note:** The table shows the worst case conducted emissions
Measurements were taken using a Peak detector

**Table # 3-3-1**

**Line 1**

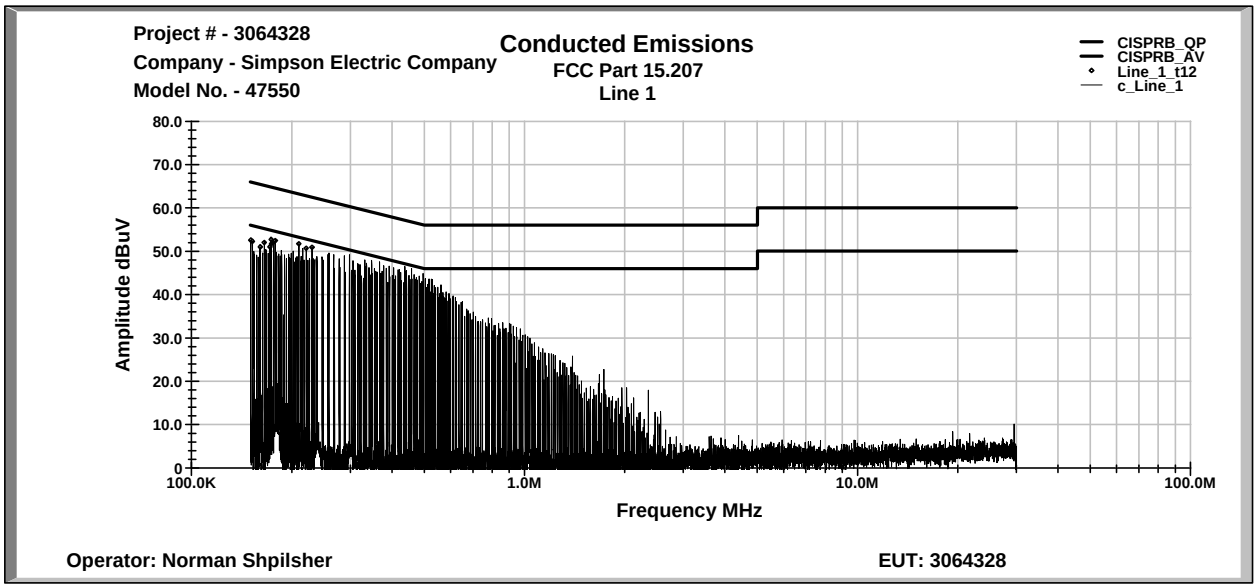
| Frequency | Peak dBµV | QP Limit dBµV | AVG Limit dBµV | QP Margin dB | AVG Margin dB |
|---|---|---|---|---|---|
| 150.68 KHz | 52.540 | 66.0 | 56.0 | -13.4 | -3.4 |
| 152.43 KHz | 52.260 | 65.9 | 55.9 | -13.6 | -3.6 |
| 160.87 KHz | 51.000 | 65.4 | 55.4 | -14.4 | -4.4 |
| 165.44 KHz | 51.990 | 65.2 | 55.2 | -13.2 | -3.2 |
| 171.94 KHz | 51.020 | 64.9 | 54.9 | -13.9 | -3.9 |
| 173.5 KHz | 52.720 | 64.8 | 54.8 | -12.1 | -2.1 |
| 173.89 KHz | 51.700 | 64.8 | 54.8 | -13.1 | -3.1 |
| 176.6 KHz | 52.150 | 64.6 | 54.6 | -12.5 | -2.5 |
| 178.45 KHz | 52.450 | 64.6 | 54.6 | -12.1 | -2.1 |
| 209.99 KHz | 51.700 | 63.2 | 53.2 | -11.5 | -1.5 |
| 220.99 KHz | 50.650 | 62.8 | 52.8 | -12.1 | -2.1 |
| 230.03 KHz | 50.910 | 62.5 | 52.5 | -11.5 | -1.5 |

**Line 2**

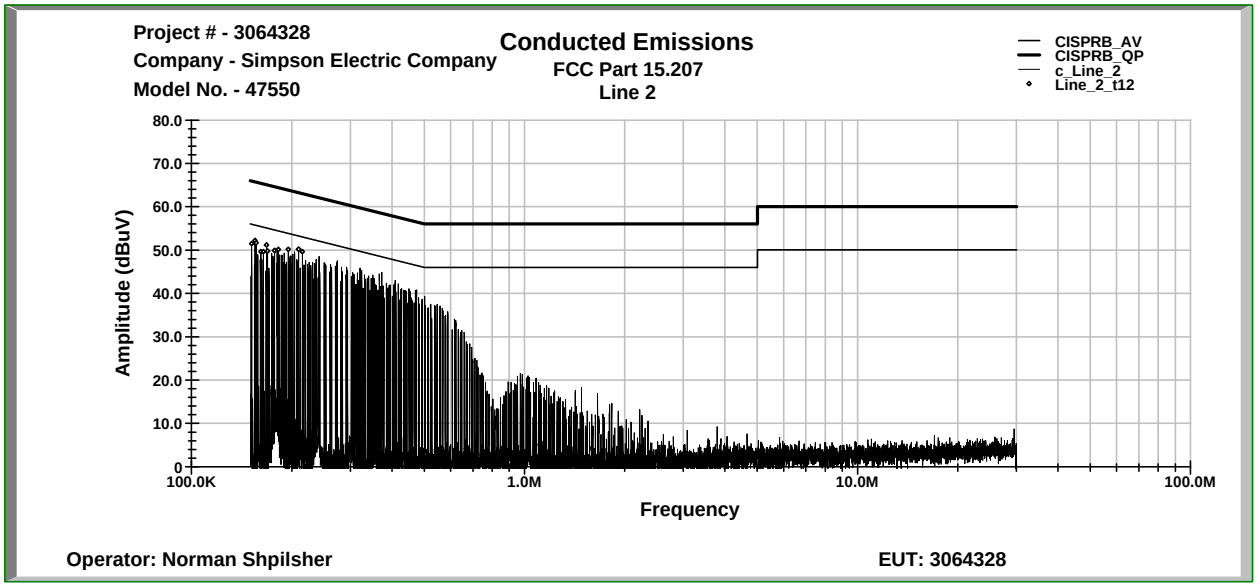
| Frequency | | QP Limit dBµV | AVG Limit dBµV | QP Margin dB | AVG Margin dB |
|---|---|---|---|---|---|
| 151.65 KHz | 51.460 | 65.9 | 55.9 | -14.5 | -4.5 |
| 155.05 KHz | 52.190 | 65.7 | 55.7 | -13.5 | -3.5 |
| 156.31 KHz | 51.630 | 65.7 | 55.7 | -14.0 | -4.0 |
| 161.55 KHz | 49.610 | 65.4 | 55.4 | -15.8 | -5.8 |
| 164.47 KHz | 49.590 | 65.2 | 55.2 | -15.6 | -5.6 |
| 167.96 KHz | 51.160 | 65.1 | 55.1 | -13.9 | -3.9 |
| 169.23 KHz | 49.750 | 65.0 | 55.0 | -15.3 | -5.3 |
| 177.48 KHz | 49.890 | 64.6 | 54.6 | -14.7 | -4.7 |
| 182.24 KHz | 50.120 | 64.4 | 54.4 | -14.3 | -4.3 |
| 195.32 KHz | 50.140 | 63.8 | 53.8 | -13.7 | -3.7 |
| 209.62 KHz | 50.170 | 63.2 | 53.2 | -13.1 | -3.1 |
| 215.12 KHz | 49.610 | 63.0 | 53.0 | -13.4 | -3.4 |

# Graph # 3-3-1
## Conducted Emissions from 150kHz to 30MHz

**Line 1**




**Line 2**



## 3.4 Test Procedure

Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at 3m distance. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz, and the Horn antenna was used in frequency range above 1GHz. The radiated emissions were maximized by configuring the EUT through its placement in three orthogonal axes, by rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m. Method of the direct Field Strength Calculation is shown in Section 3.5.

Conducted Emissions

For conducted emissions testing, the equipment is moved to an insulating platform over the ground plane, and the EUT is powered from a LISN. Both sides of the AC line are measured and the results are compared to the applicable limits. Measurements are taken using CISPR quasi-peak and average detectors when the peak readings approach or exceed the average limit. Only quasi-peak readings are taken when the emissions from the EUT meet the average limit as measured with the quasi-peak detector.

## 3.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB($m^{-1}$)
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB($m^{-1}$) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

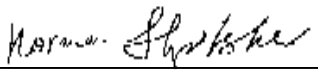
RA = 48.1 dB(µV)
AF = 7.4 dB($m^{-1}$)
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

In the tables the Cable correction factors are included to the Antenna Factors.

Tested by:

Norman Shpilsher
Sr. EMC Engineer
Intertek ETL SEMKO

Signature



Date: September 29, 2004

## 4.0 TEST EQUIPMENT

**Receivers/Spectrum Analyzers and Test Software**

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|---|---|---|---|
| HP85462A Receiver RF Section | 3549A00306 | 01/04 | 01/05 | X |
| HP85460A RF Filter Section | 3448A00276 | 01/04 | 01/05 | X |
| Rohde & Schwarz FSP 40 Spectrum Analyzer | 100024 | 03/04 | 03/05 | X |
| Advantest R3271A Spectrum Analyzer | 55050084 | 06/04 | 06/05 | X |
| TILE! Instrument Control System | ver. 3.4 | N/A | N/A | X |

**Antennas**

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|---|---|---|---|
| Schaffner-Chase Bicono-Log Antenna | 2468 | 01/04 | 01/05 | X |
| Schaffner-Chase Bicono-Log Antenna | 2630 | 06/03 | 06/04 | |
| EMCO Horn Antenna 3115 | 9507-4513 | 12/03 | 12/04 | |
| EMCO Horn Antenna 3115 | 6579 | 01/04 | 01/05 | X |

**Artificial Mains Networks/Pre-Amplifiers/Filters**

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|---|---|---|---|
| FCC LISN-2 | 316 | 04/04 | 04/05 | X |
| FCC-LISN-50-25-2 | 2014 | 05/04 | 05/05 | |
| HP83017A Pre-Amplifier | 3123A00475 | 09/03 | 9/29/04 | X |
| Reactel 7HS-4G-S12 Filter | 0223 | 01/04 | 01/05 | X |