

TEST REPORT

Report Number: 3064328.012

Project Number: 3064328

September 29, 2004

Evaluation of the
47550 DataDirect Remote Collector
FCC ID:

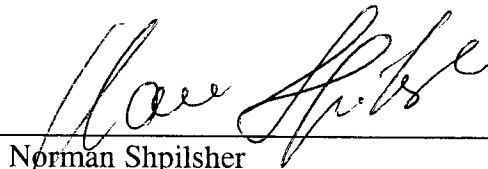
to
FCC Part 2
FCC Part 15, Subpart C, Section 15.247

For
Simpson Electric Company

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

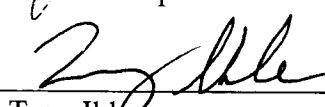
Test Authorized by:
Simpson Electric Company
853 Dundee Avenue
Elgin IL, 60120

Prepared by:


Norman Shpilsher

Date: September 29, 2004

Approved by:


Troy Ihle

Date: September 29, 2004

CONTENTS

1.0	GENERAL DESCRIPTION	1
1.1	Related Submittals Grants.....	1
1.2	Product Description	1
1.3	Test Methodology	1
1.4	Test Facility	1
2.0	SYSTEM TEST CONFIGURATION	2
2.1	Justification	2
2.2	EUT Setup	2
2.3	EUT Exercising Software.....	2
2.4	Special Accessories	2
2.5	Equipment Modification.....	2
2.6	Support Equipment List and Description	2
2.7	Test Configuration Block Diagrams.....	3
3.0	TEST RESULTS	4
3.1	Maximum Peak Output Power, FCC 15.247(b)(2)	5
3.1.1	RF Exposure, FCC 1.1307(b)(1)	9
3.2	Field Strength of Spurious Emissions, FCC 15.247(c), 15.205, 15.209	10
3.3	Conducted Emissions, FCC 15.207	19
3.4	Test Procedure	21
3.5	Field Strength Calculation	22
4.0	TEST EQUIPMENT	23

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

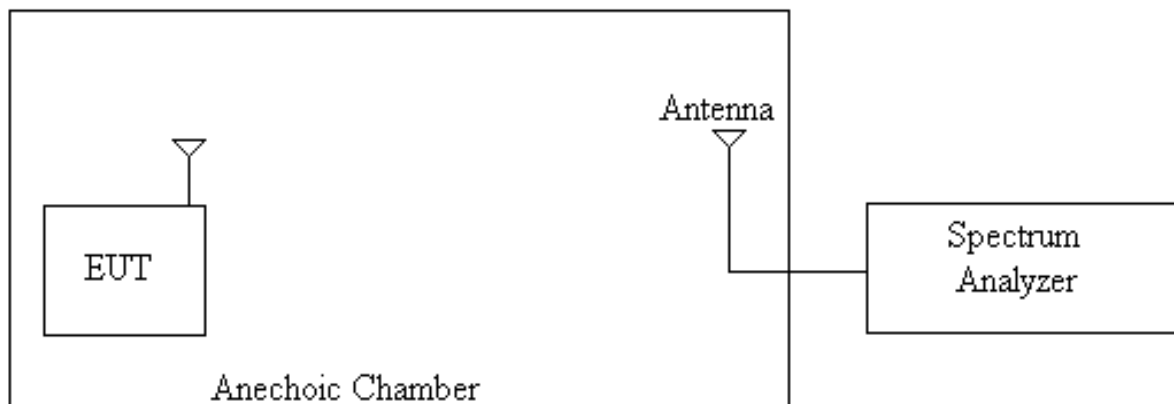
2.7 Test Configuration Block Diagrams

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

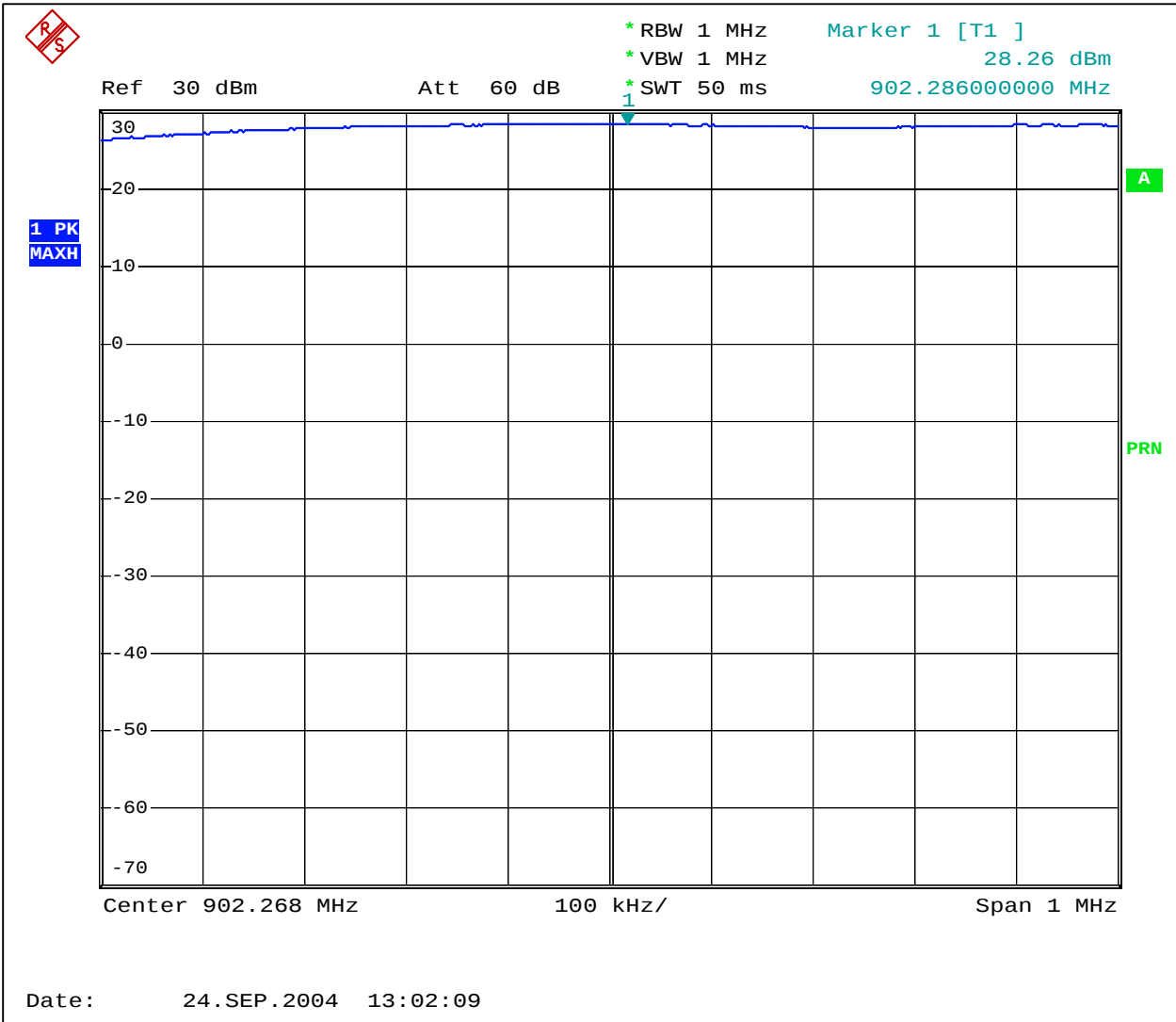
3.1 Maximum Peak Output Power, FCC 15.247(b)(2)

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.

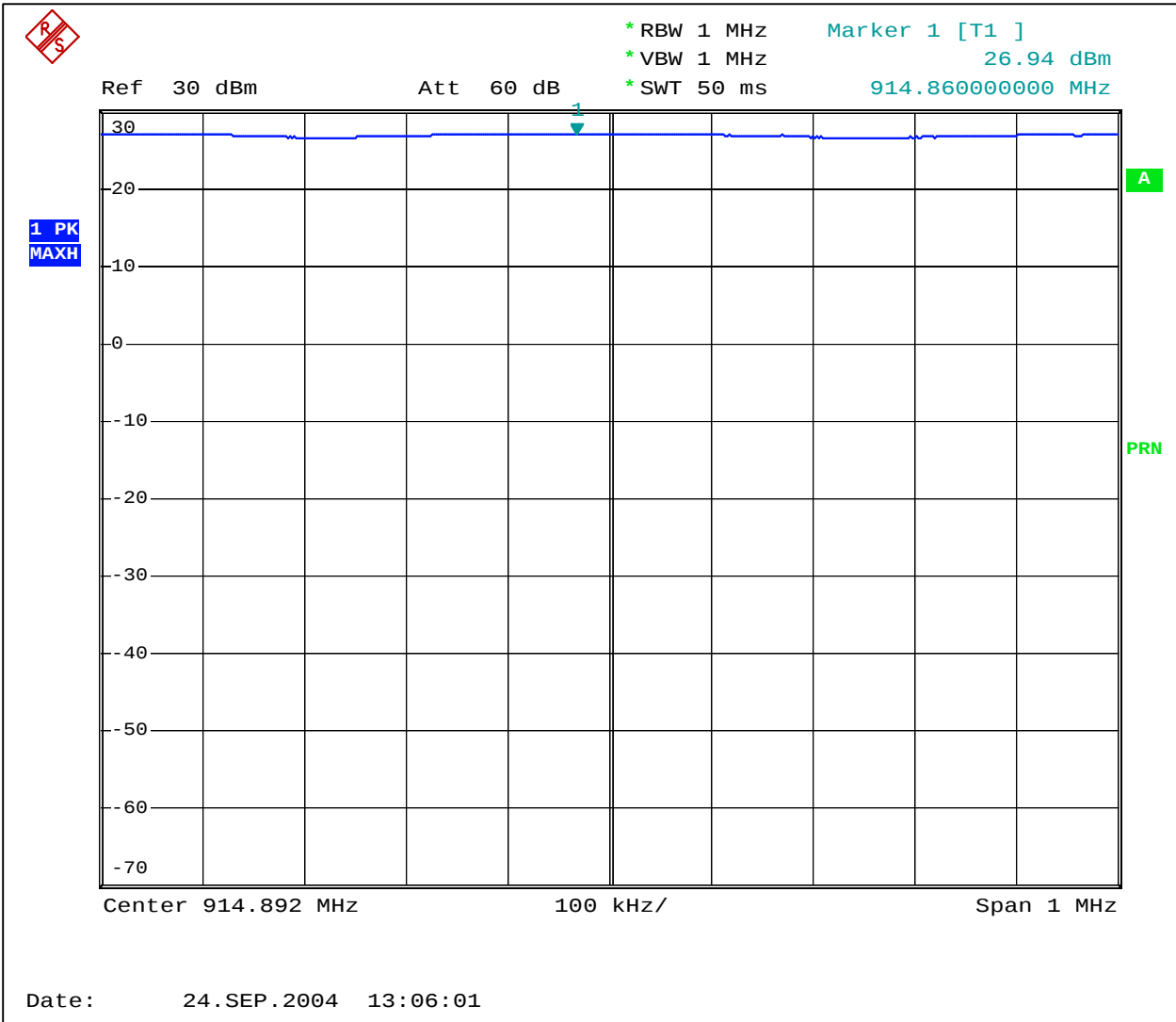
The maximum Conducted Peak Output Power measured at channel 1 is 28.26dBm, the total Peak Output Power (including the cable insertion loss of 0.3dB) is 28.56dBm, or 0.718W.

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%.

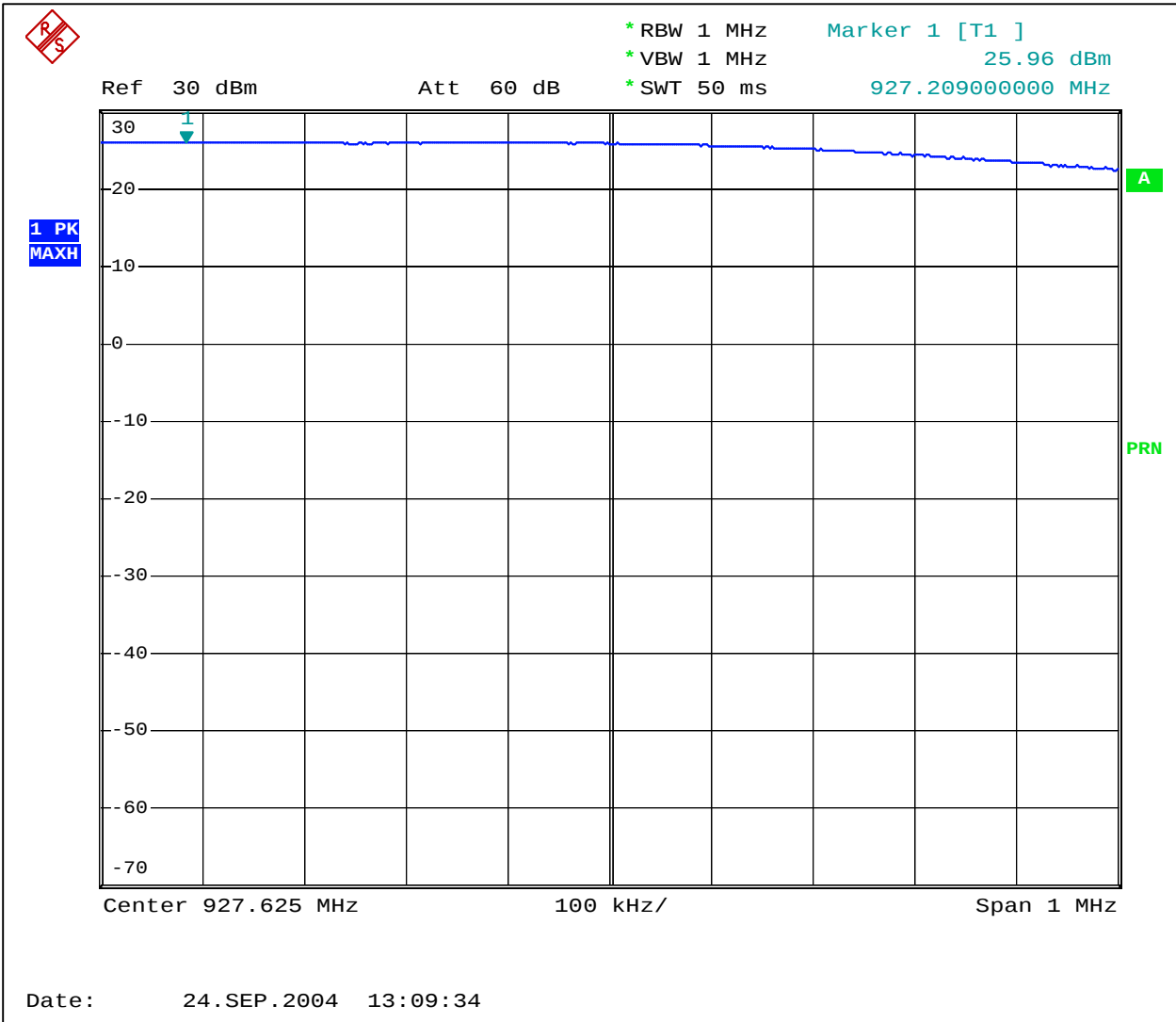
Graph # 3-1-1
Maximum Peak Output Power, Channel 1



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/ cm²),

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/ cm²,

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 above 1GHz were taken using a peak detector with RBW 1MHz and VBW 1MHz or 10Hz (marked *)

Table # 3-2-1

Frequency MHz	Antenna		Antenna CF dB1/m	Pre-amp Gain (dB)	Total Emissions at 3m (dBµV/m)	Limit dBµV/m	Margin dB	Comments
	Polarity	Hts(cm)						
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 strength 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 above 1GHz were taken using a peak detector with RBW 1MHz and VBW 1MHz or 10Hz (marked *)

Table # 3-2-2

Frequency MHz	Antenna		Antenna CF dB1/m	Pre-amp Gain (dB)	Total Emissions at 3m (dBμV/m)	Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)						
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	

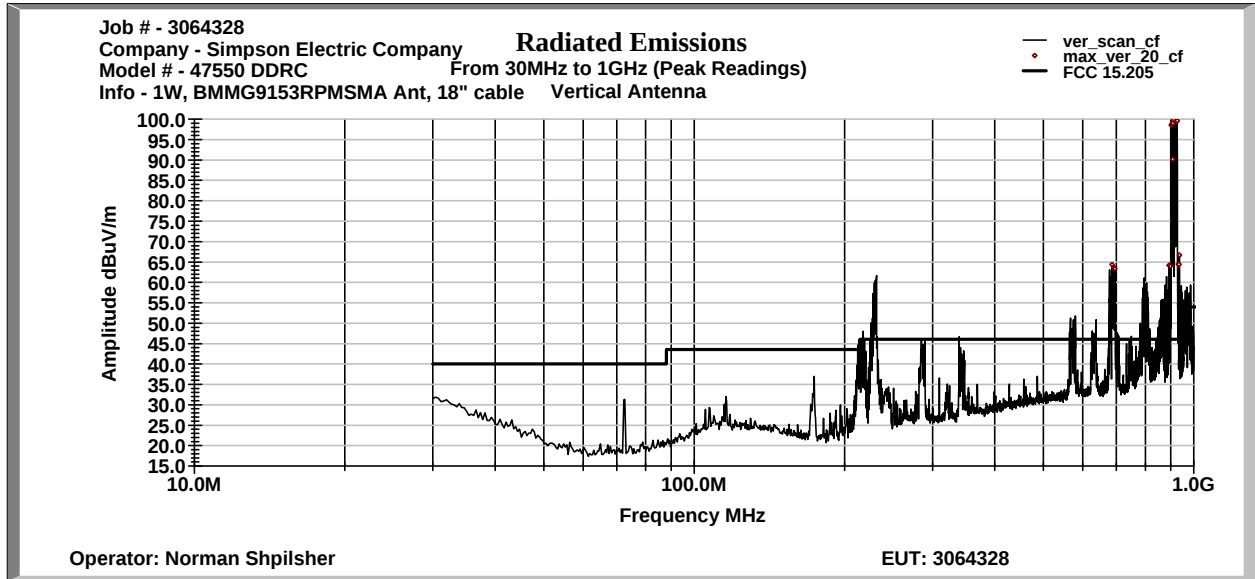
Comments:

1. Maximum Field strength 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

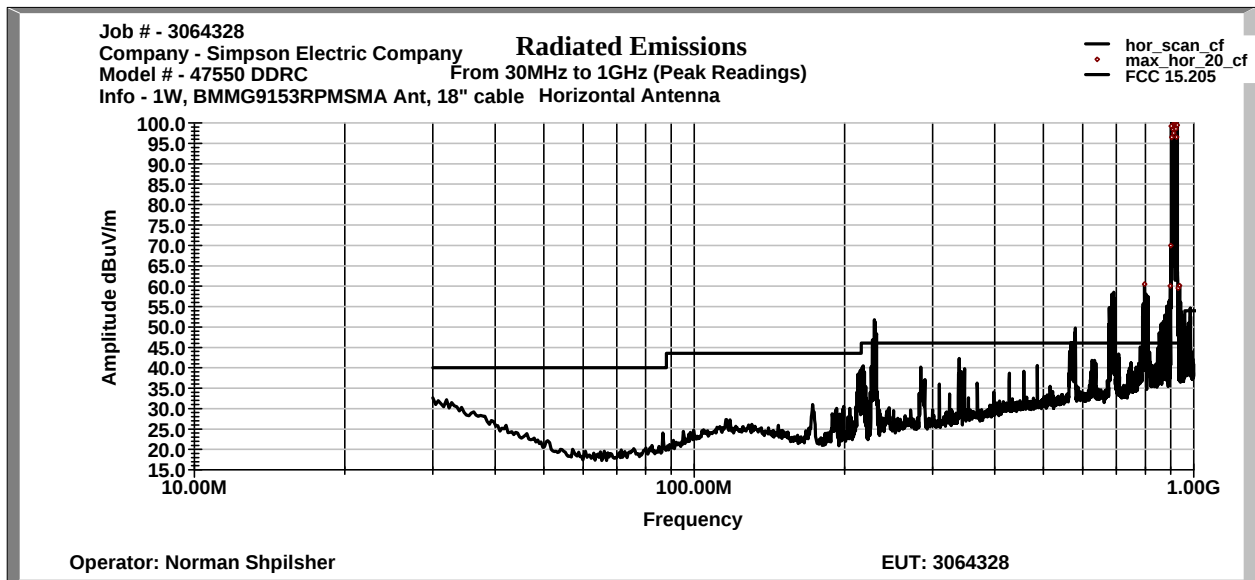
Graph # 3-2-1

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

Vertical Antenna Polarization



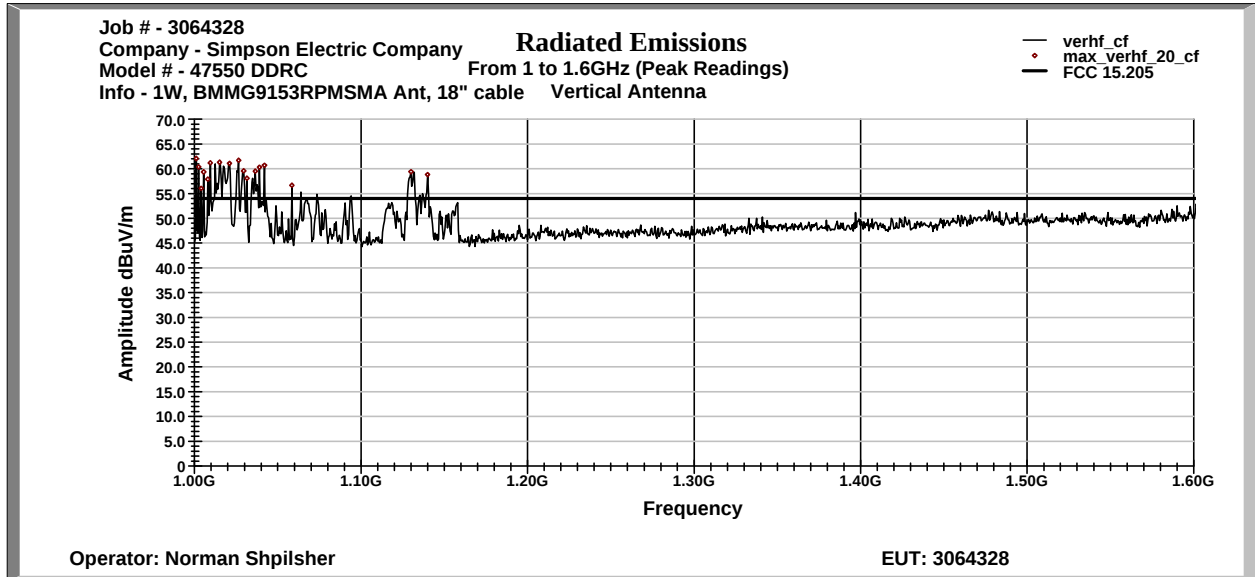
Horizontal Antenna Polarization



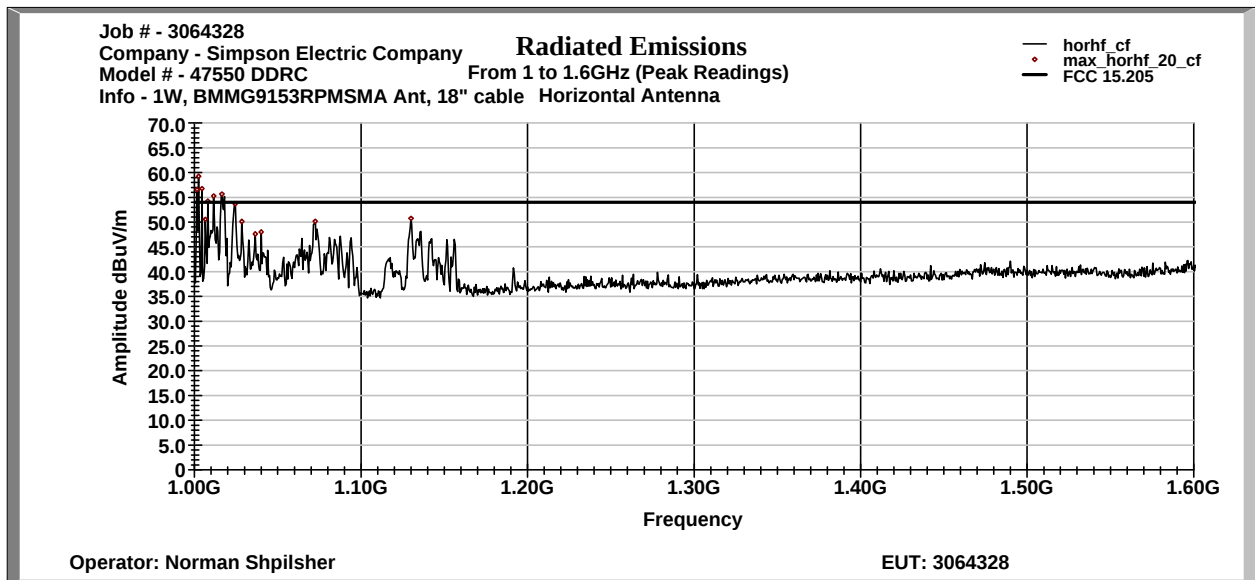
Graph # 3-2-2

Radiated Emissions from 1 to 1.6GHz, Antenna BMMG9153 with 18" cable

Vertical Antenna Polarization



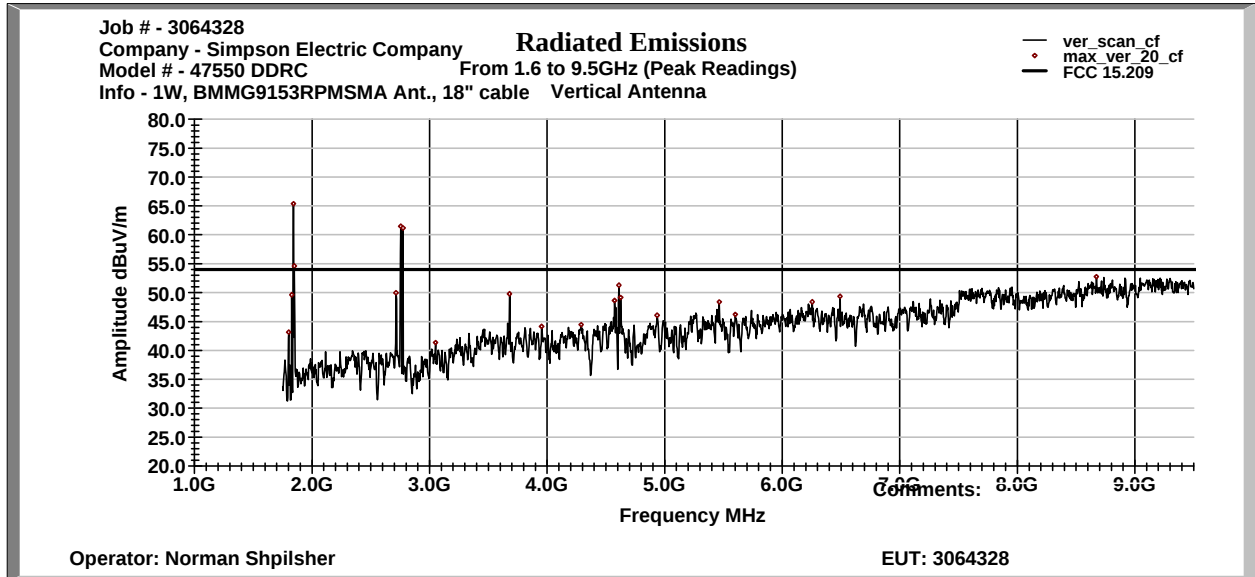
Horizontal Antenna Polarization



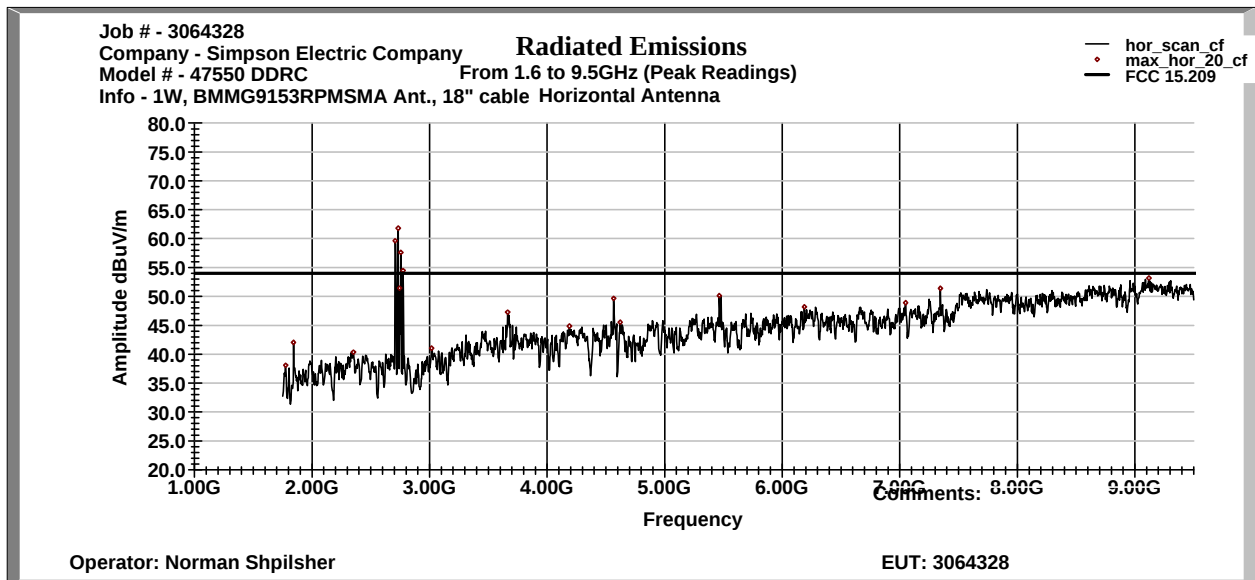
Graph # 3-2-3

Radiated Emissions from 1.6 to 9.5GHz, Antenna BMMG9153 with 18" cable

Vertical Antenna Polarization



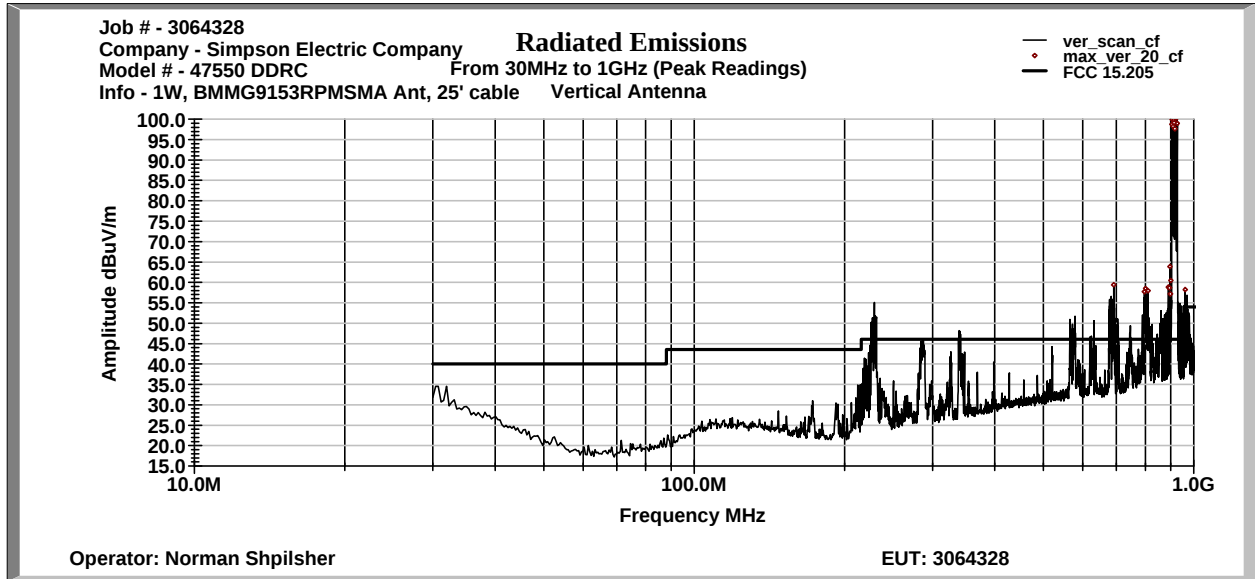
Horizontal Antenna Polarization



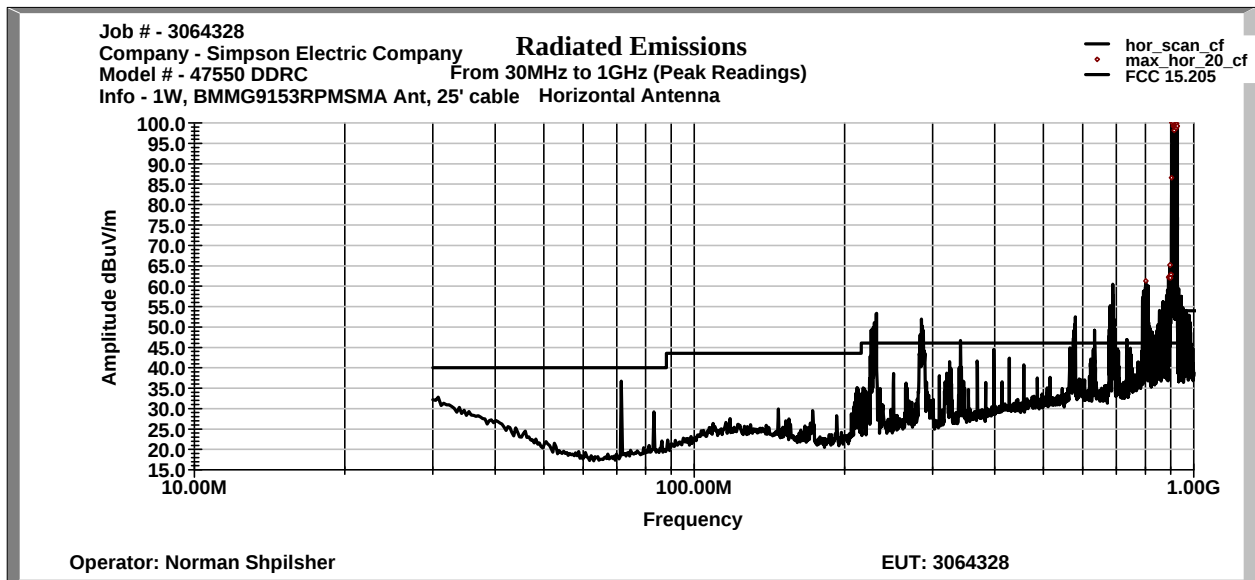
Graph # 3-2-4

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

Vertical Antenna Polarization



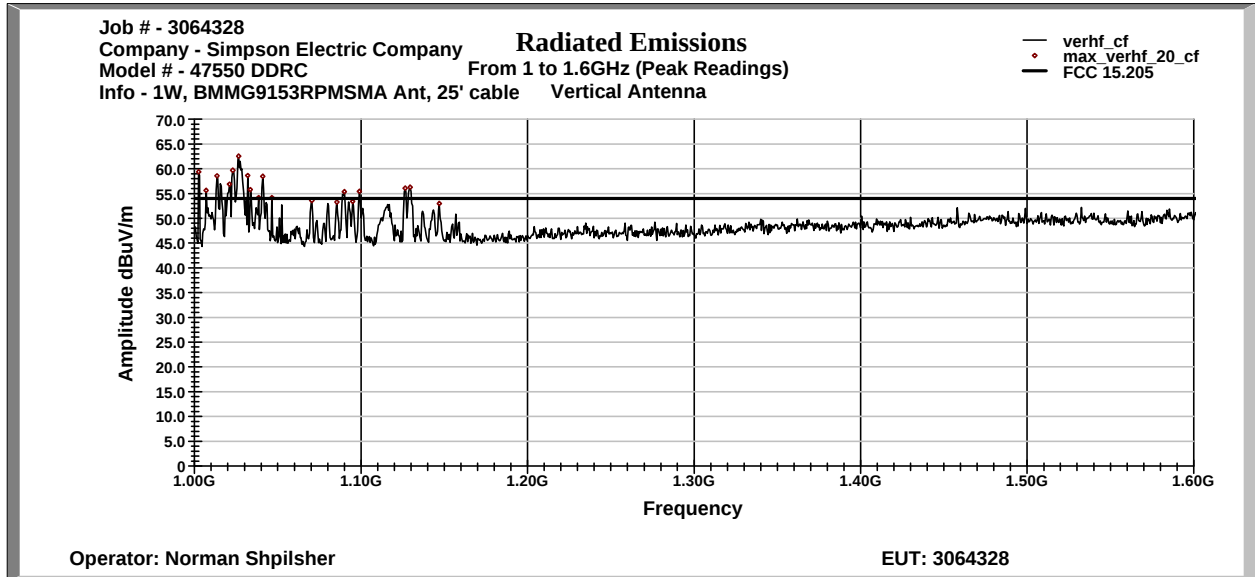
Horizontal Antenna Polarization



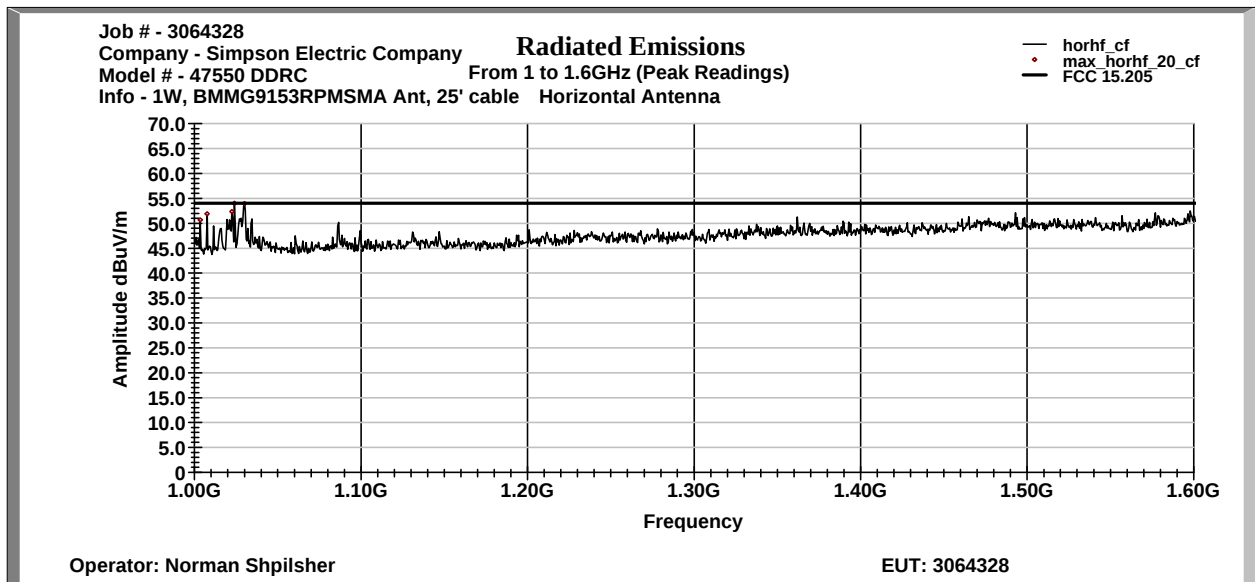
Graph # 3-2-5

Radiated Emissions from 1 to 1.6GHz, Antenna BMMG9153 with 25' cable

Vertical Antenna Polarization



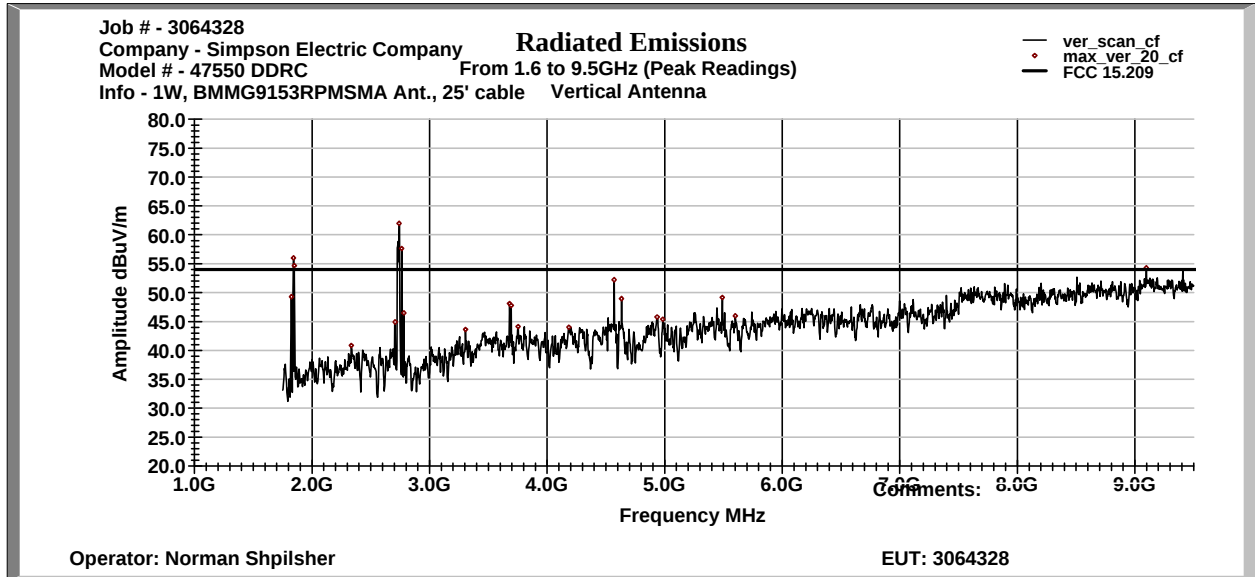
Horizontal Antenna Polarization



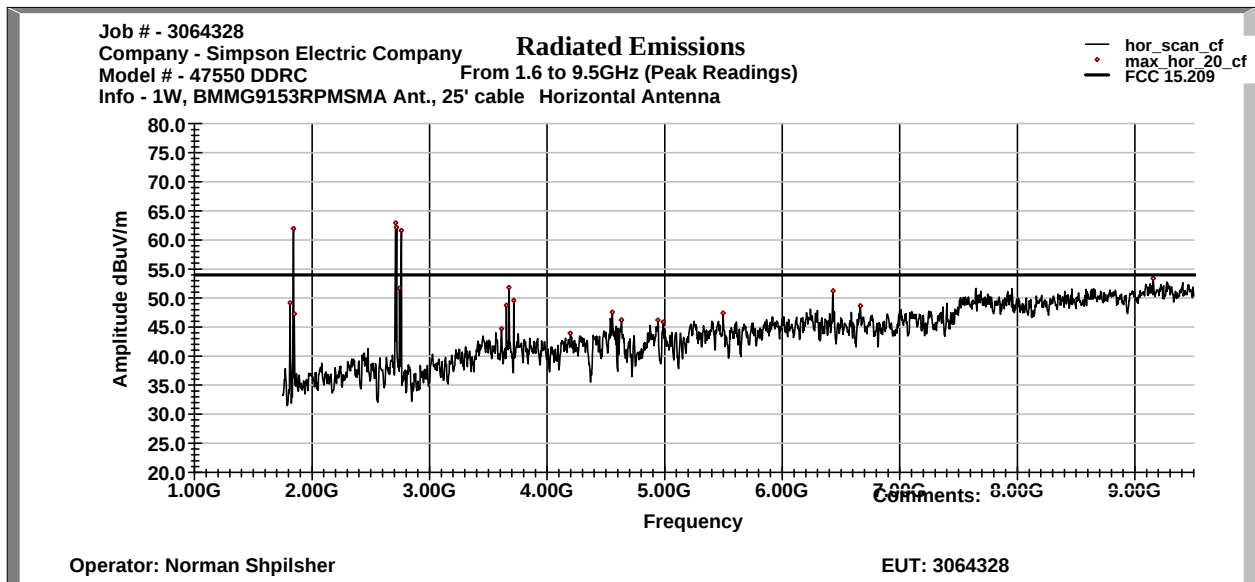
Graph # 3-2-6

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

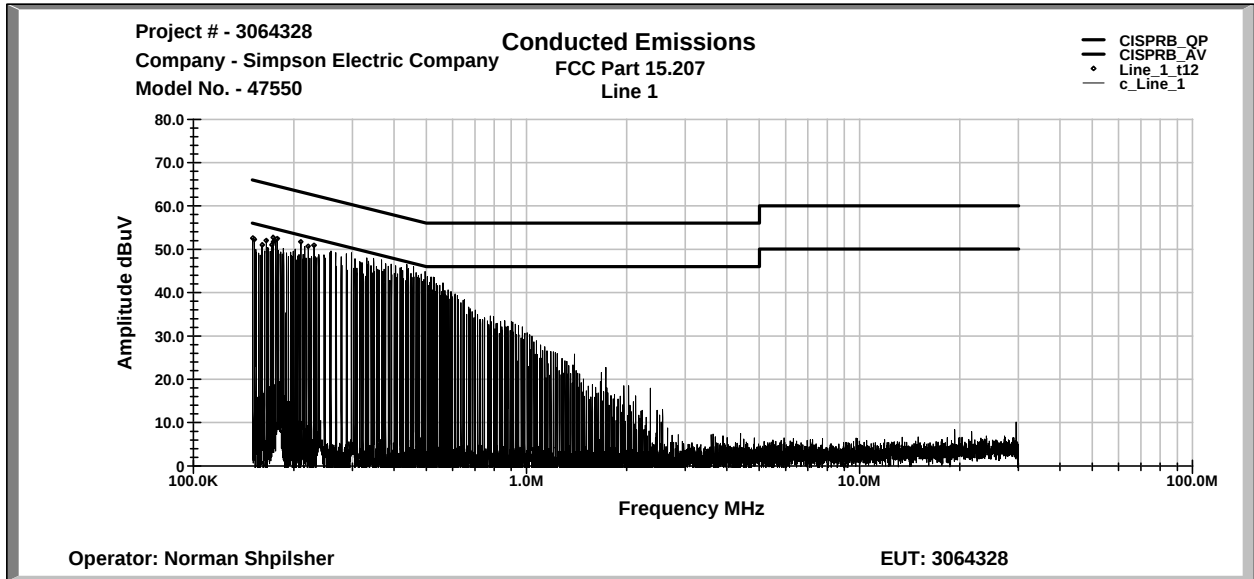
Frequency	Peak dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.68 KHz	52.540	66.0	56.0	-13.4	-3.4
152.43 KHz	52.260	65.9	55.9	-13.6	-3.6
160.87 KHz	51.000	65.4	55.4	-14.4	-4.4
165.44 KHz	51.990	65.2	55.2	-13.2	-3.2
171.94 KHz	51.020	64.9	54.9	-13.9	-3.9
173.5 KHz	52.720	64.8	54.8	-12.1	-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

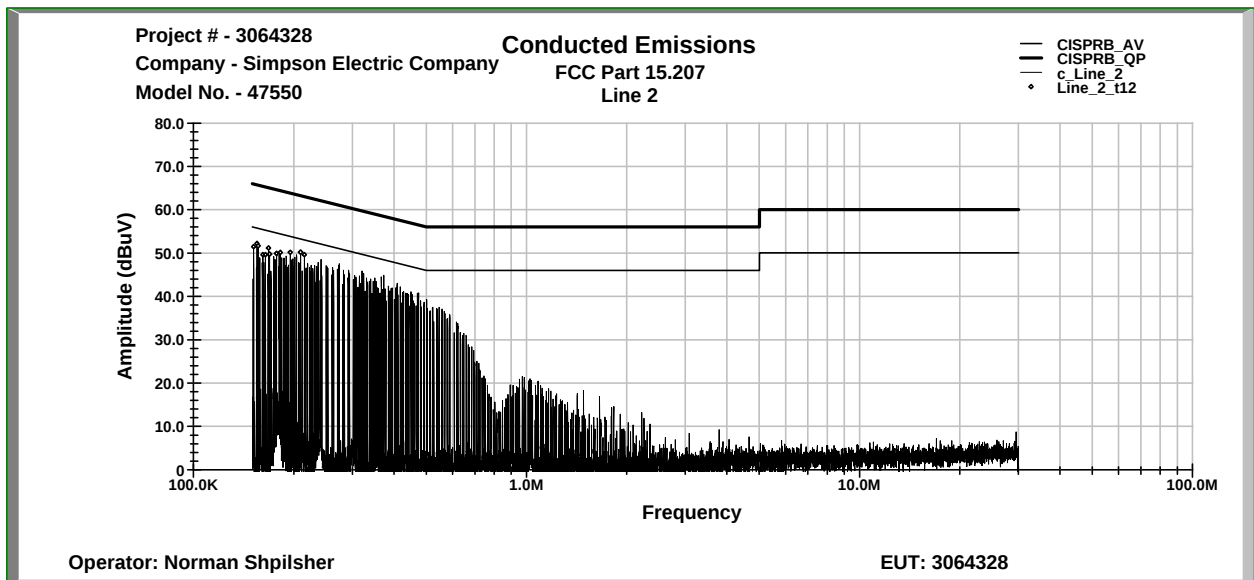
Frequency		QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
151.65 KHz	51.460	65.9	55.9	-14.5	-4.5
155.05 KHz	52.190	65.7	55.7	-13.5	-3.5
156.31 KHz	51.630	65.7	55.7	-14.0	-4.0
161.55 KHz	49.610	65.4	55.4	-15.8	-5.8
164.47 KHz	49.590	65.2	55.2	-15.6	-5.6
167.96 KHz	51.160	65.1	55.1	-13.9	-3.9
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(μ V/m)

RA = Receiver Amplitude in dB(μ V)

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(μ V) 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(μ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

$$FS = RA + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu\text{V}/m)$$

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

Tested by:

Norman Shpilsher
Sr. EMC Engineer
Intertek ETL SEMKO

Signature

A handwritten signature in black ink, appearing to read "Norman Shpilsher", written over a horizontal line.

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