Measurement of RF Emissions from a GM/Holden RFA System

For : Omron Electronics
3709 Ohio Avenue
St. Charles, IL 60174

P.O. No. : 57423N
Date Tested : March 13, 2008
Test Personnel : Richard King
Specification : FCC Part 15 Subpart C

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REVISION HISTORY

Revision	Date	Description
—	5/23/08	Initial release

Measurement of RF Emissions from a GM/Holden RFA System

1.0 INTRODUCTION:

1.1 Scope of Tests - This report presents the results of the RF emissions measurements performed on a GM/Holden RFA System, Serial No. none assigned, (hereinafter referred to as the test item). The test item was manufactured and submitted for testing by Omron Electronics located in St. Charles, IL.

1.2 Purpose - The test series was performed to determine if the test item meets the conducted and radiated RF emission requirements of the FCC Part 15, Subpart C for Intentional Radiators.

1.3 Deviations, Additions and Exclusions - There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4 EMC Laboratory Identification - This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

1.5 Laboratory Conditions - The temperature at the time of the test was 21.3^{o}C and the relative humidity was 30%.

2.0 APPLICABLE DOCUMENTS:

The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15C, for Intentional Radiators, dated 1 October 2007

3.0 TEST ITEM SET-UP AND OPERATION:

3.1 General Description - The test item is an Omron Electronics GM/Holden RFA System. A block diagram of the test item set-up is shown as Figure 1.

3.1.1 Power Input - The test item obtained 13.6VDC from a 2 foot long, unshielded three wire power harness. The power harness contained a battery, ignition and return lead.

3.1.2 Peripheral Equipment – The test item does not require peripheral

equipment to operate properly.

3.1.3 Signal Input/Output Leads – The test item does not require signal input or output leads to operate properly.

3.1.4 Grounding Considerations - The test item was grounded through the return lead of the power harness.

3.1.5 Frequency of Test Item -The test item was equipped with an RF transmitter that operated at a frequency of 125kHz. In accordance with 15.33 radiated emissions, measurements were made up to 30MHz.

3.2 Operational Mode - For all tests, the test item was placed on an 80cm high non-conductive stand. The test item was energized and set to continuously transmit at 125kHz.

3.3 Test Item Modifications - No modifications were required for compliance to the FCC 15C requirements.

4.0 TEST FACILITY AND TEST INSTRUMENTATION:

4.1 Shielded Enclosure - All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

4.2 Test Instrumentation - The test instrumentation and auxiliary equipment used during the tests are listed in Table 10-1. The test instrumentation was calibrated on a regular basis.

Conducted emission tests were performed with a spectrum analyzer in conjunction with a quasi-peak adapter.

Radiated emissions were performed with a spectrum analyzer. This receiver allows measurements with the bandwidths specified by the FCC and with the quasi-peak detector function.

4.3 Calibration Traceability Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

5.0 REQUIREMENTS, PROCEDURES AND RESULTS:

5.1 Powerline Conducted Emissions

5.1.1 Requirements –

Since the test item receives 13.6VDC from an automotive battery. No conducted emissions tests are required.

5.2 Radiated Measurements

5.2.1 Requirements - Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency MHz	Field strength (microvolts/meter)	Field Strength dBuV/m
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

5.2.2 Procedures - Final open field measurements were performed in an open area at the Elite Electronic Engineering Incorporated facility located in Downers Grove, Illinois at a test distance of 3 meters using a peak detector. Since the test distance was reduced from 300 meters and 30 meters to 3 meters, a correction factor was applied to the measurements. Radiation at the fundamental was measured at several distances and the levels plotted. A straight line was drawn through these points and the slope (which is the propagation loss constant) was calculated. Measurements and calculations are shown in Figure 4 on page 11. The factors to correct levels at 3 meters to levels at 300 meters and 30 meters are shown on the data pages.

The final open field emission tests were performed over the frequency range from the fundamental up to the 10th harmonic. An active loop antenna was used as the pick-up device.

The levels at harmonics up to the 10th were measured and tabulated.

To ensure that maximum emission levels were measured, the following steps were taken:

(a) The test item was rotated so that all of its sides were exposed to the receiving antenna.

(b) The measuring loop antenna was placed in both horizontal and vertical polarity.

5.2.3 Results - The preliminary plots are presented on pages 12 through 15. The plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels are presented on page 16. As can be seen from the data, all emissions measured from the test item were within the specification limits. Photographs of the test configuration for the radiated emissions are shown on Figure 2.

6.0 OTHER TEST CONDITIONS:

6.1 Test Personnel and Witnesses - All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated.

6.2 Disposition of the Test Item - The test item and all associated equipment were returned to Omron Electronics upon completion of the tests.

7.0 CONCLUSIONS:

It was determined that the Omron Electronics GM/Holden RFA System, Serial No. none assigned, did meet the conducted and radiated RF interference requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Paragraphs 15.207 and 15.209, for intentional radiators.

8.0 CERTIFICATION:

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the test item at the test date as operated by Omron Electronics personnel. Any electrical or mechanical modification made to the test item subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.

Table 0-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
CDS2	COMPUTER	GATEWAY	MFATXPNT NMZ 500L	0028483108	1.8GHZ	N/A	
NTA1	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL6112	2054	0.03-2GHZ	6/5/2007	6/5/2008
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	10/13/2007	10/13/2008
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	11/5/2007	11/5/2008
NLS1	24" ACTIVE LOOP ANTENNA	EMCO	6502	8903-2329	0.01-30MHZ	4/9/2008	4/9/2009

I/O: Initial Only; N/A: Not Applicable; Note 1 - For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument

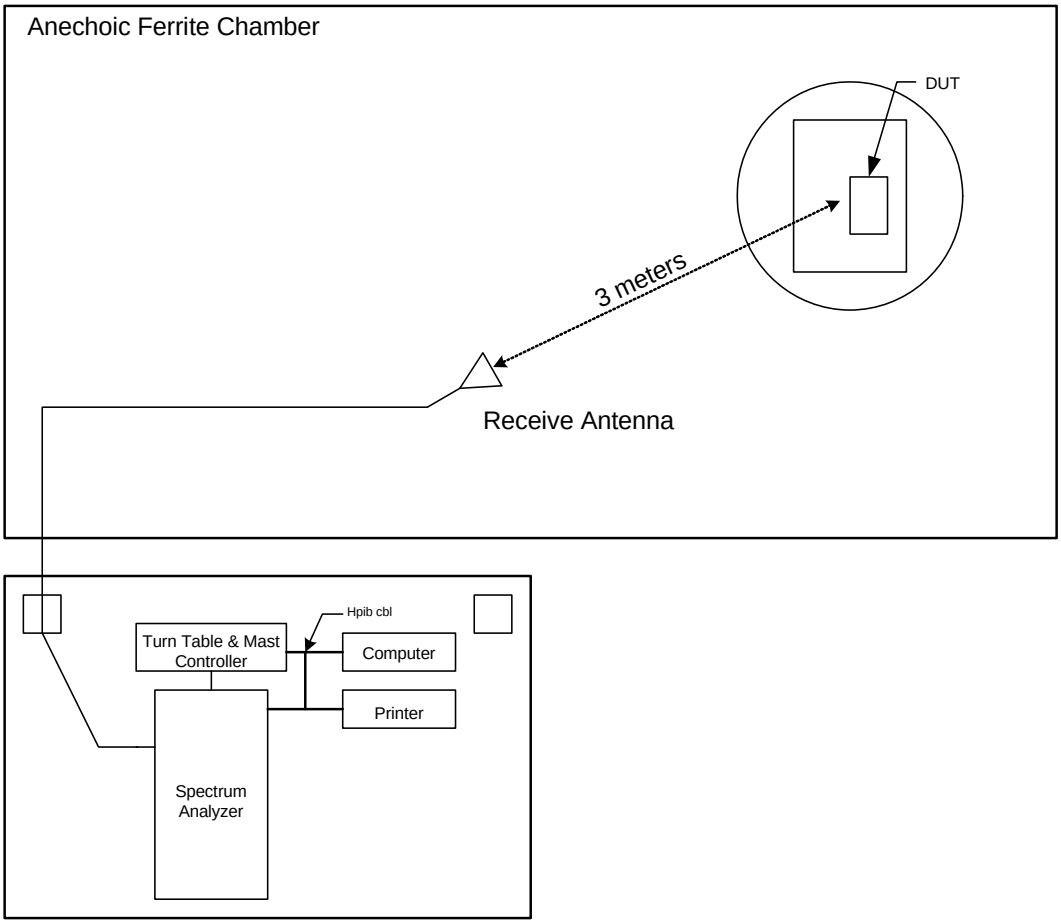
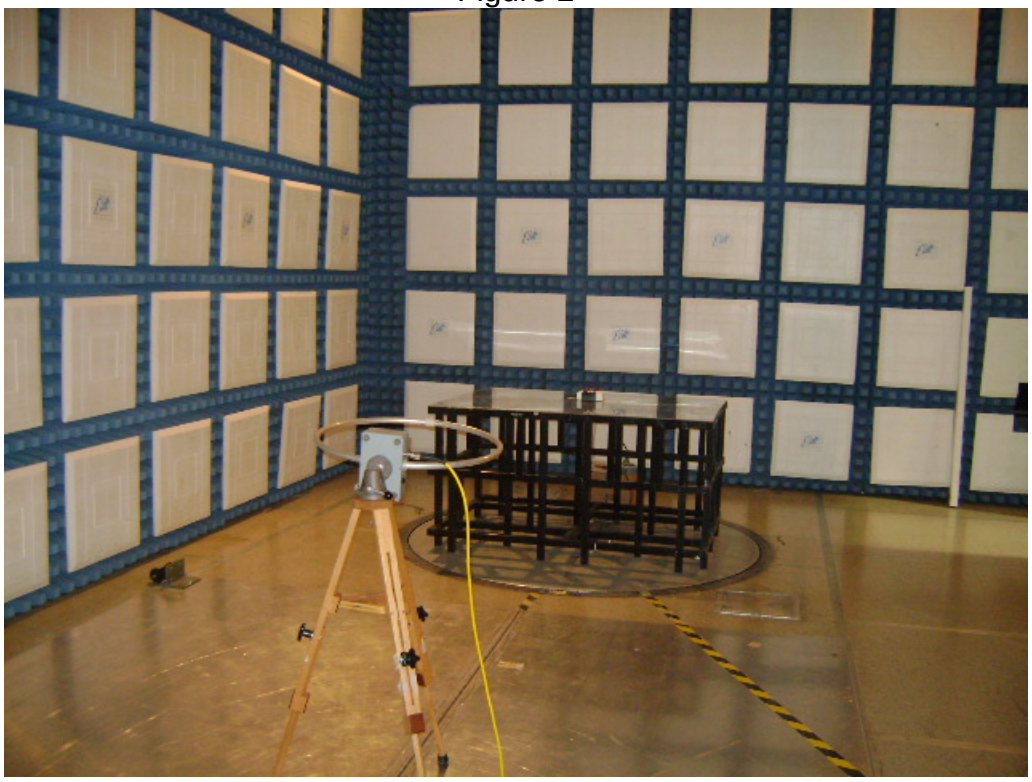
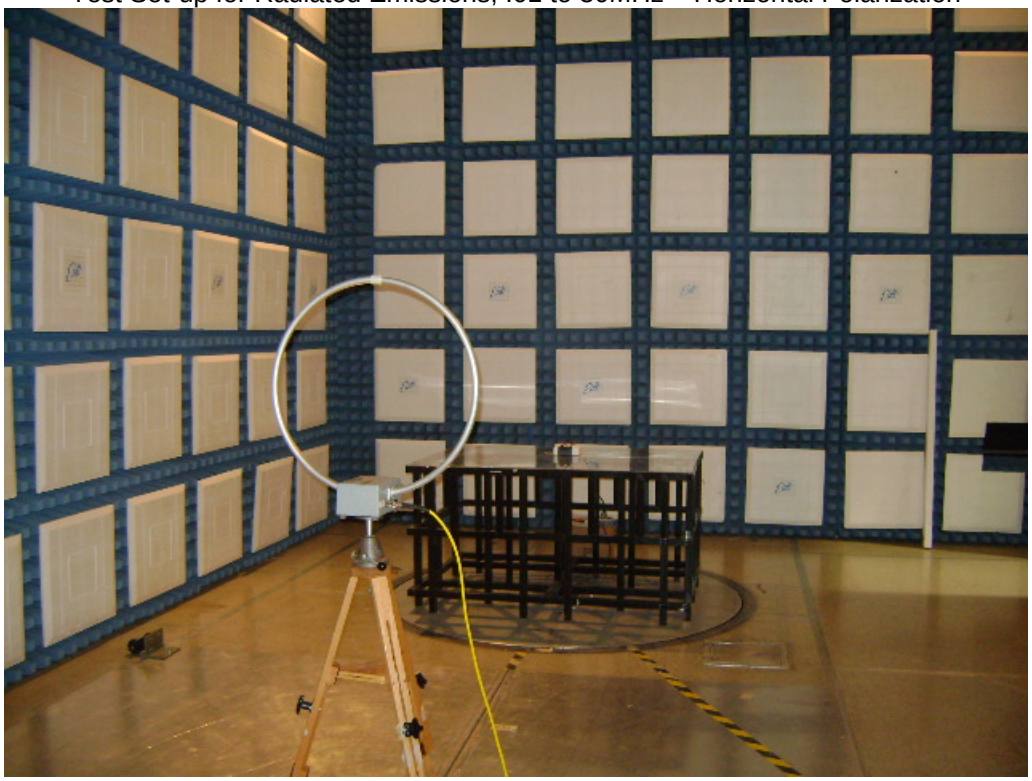


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2



Test Set-up for Radiated Emissions, .01 to 30MHz – Horizontal Polarization

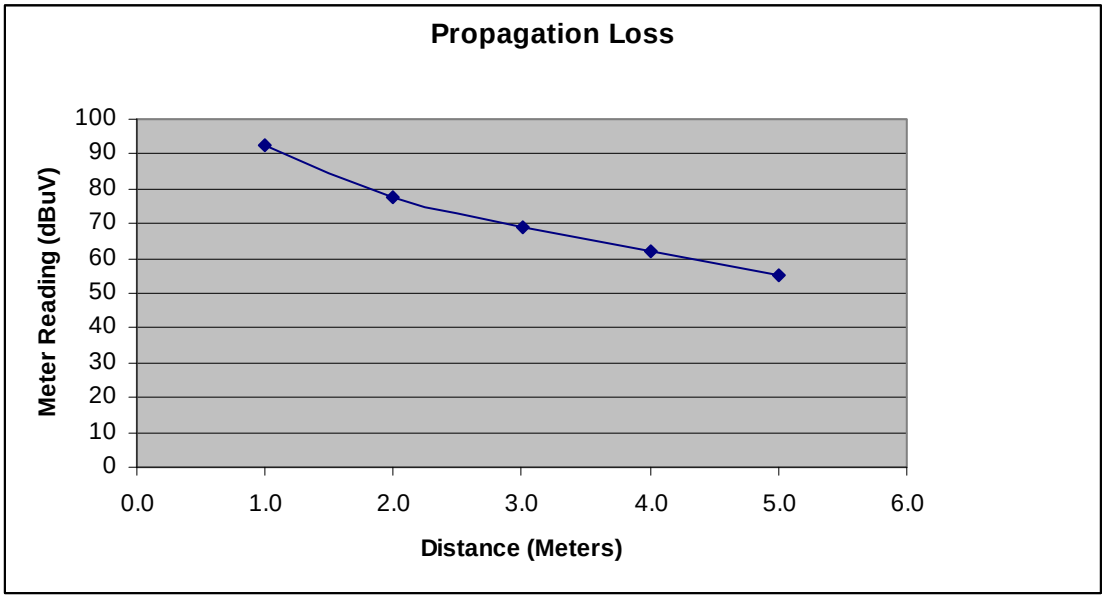


Test Set-up for Radiated Emissions, .01 to 30MHz – Vertical Polarization

Figure 4: PROPAGATION LOSS MEASUREMENTS AND CALCULATIONS

A. MEASUREMENTS

TEST DISTANCE (meters)	METER READING (dBuV)
1	92.6
2	77.8
3	69.2
4	61.9
5	55.0



B. CALCULATIONS:

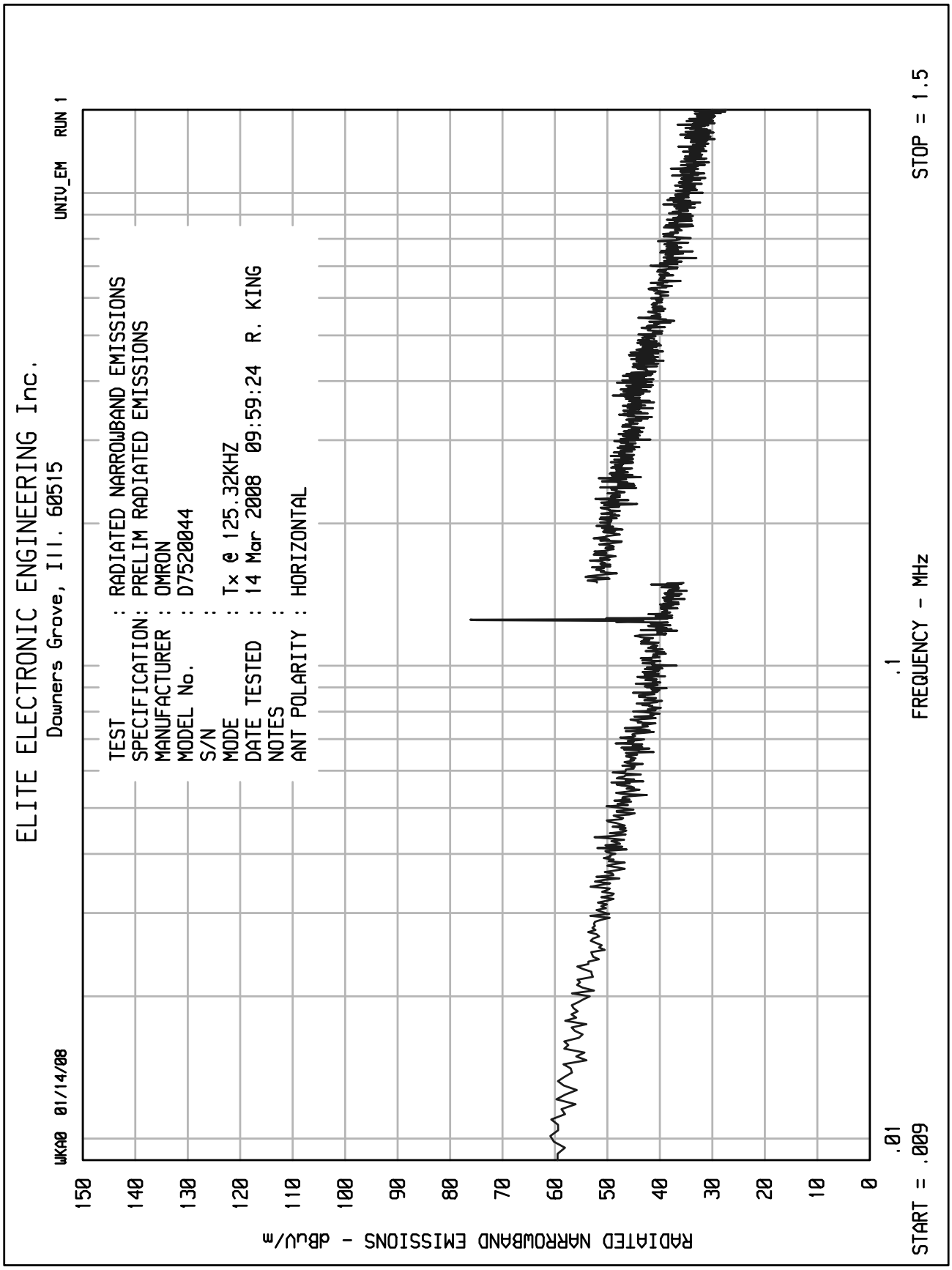
PROPAGATION LOSS = 20 * LOG (Dm/Dl)^N

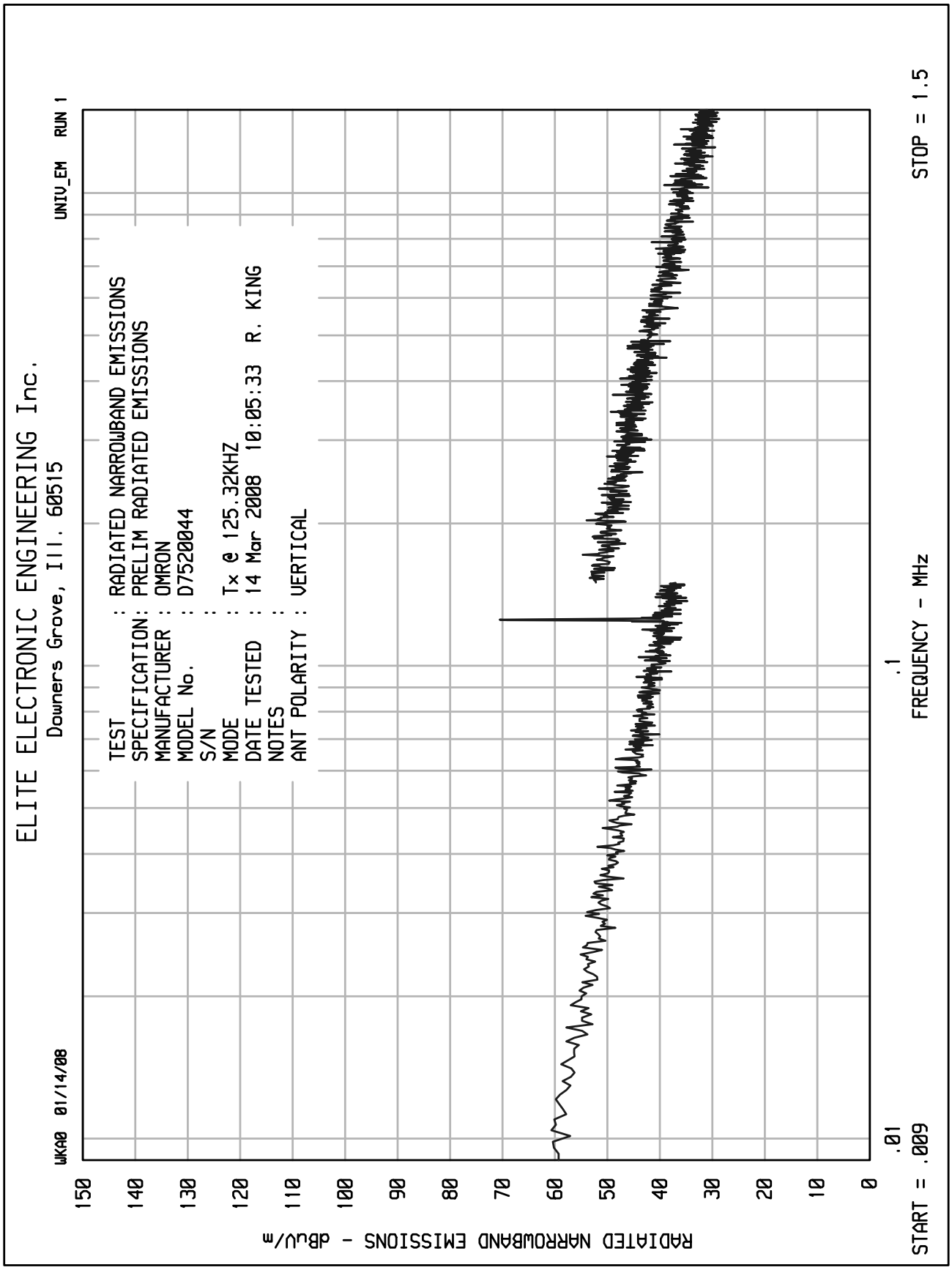
WHERE : Dm = DISTANCE OF MEASUREMENT
: Dl = LIMIT DISTANCE
: N = SLOPE OF THE LINE

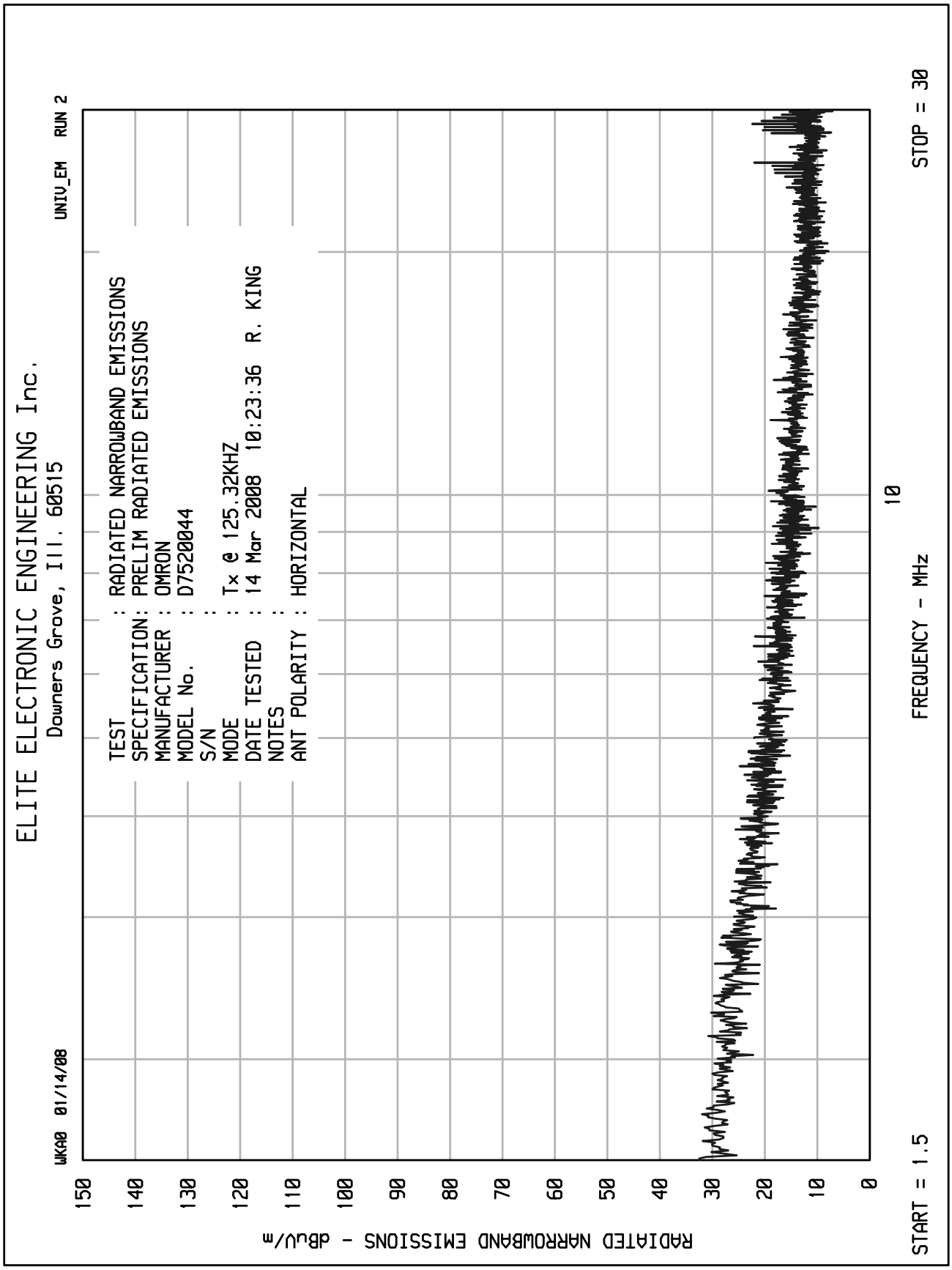
SOLVING FOR N USING READINGS AT 2 METERS AND 5 METERS:

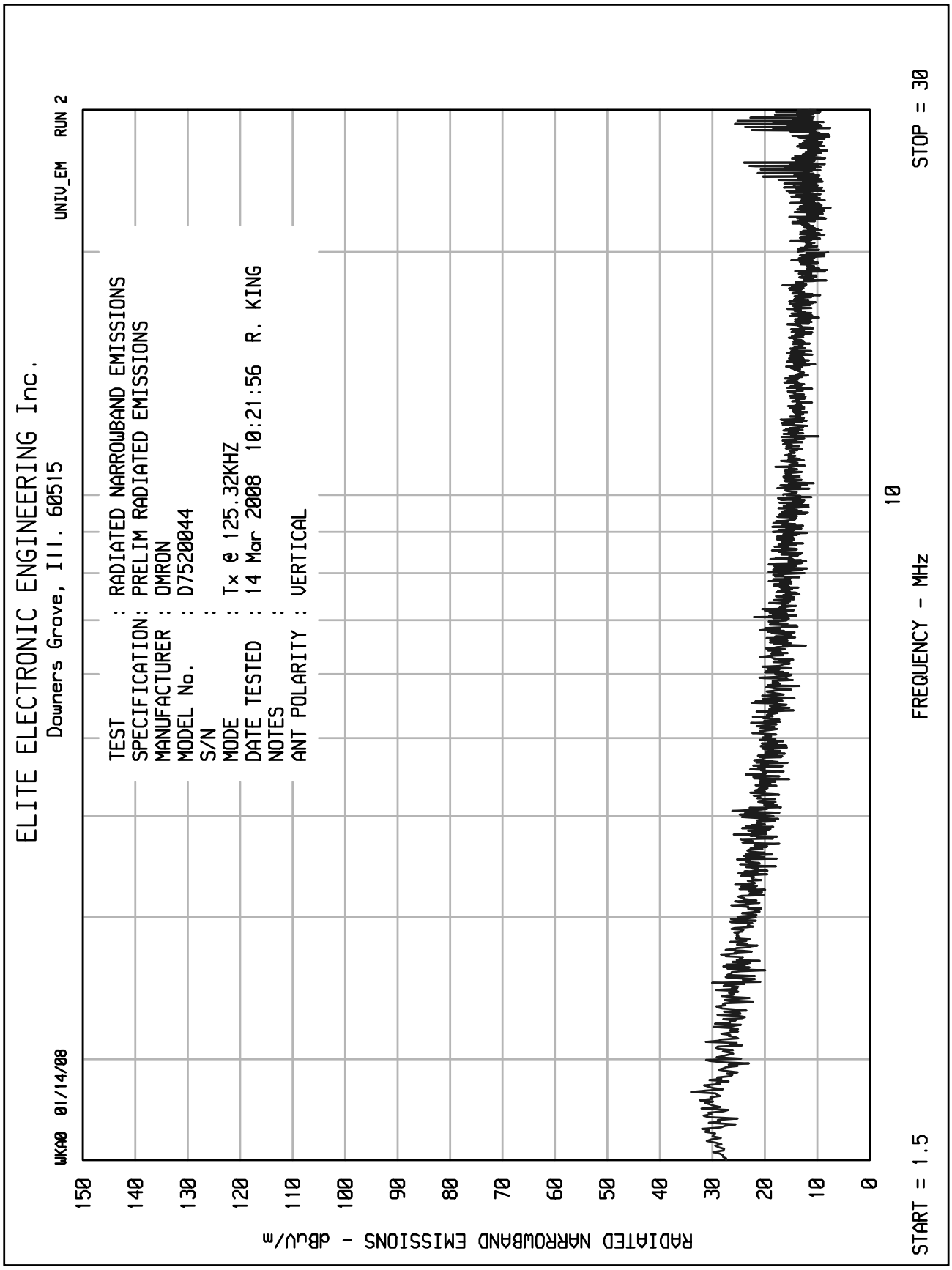
N = (dBV2 – dBV1)/(20*LOG(D2/D1))
N = (55.0 – 92.6)/(20 * LOG(5/1))
N = -2.7

FOR N= -2.7
PROPAGATION LOSS = -53.8dB TO CONVERT FROM 3 M TO 30 M
PROPAGATION LOSS = -107.6dB TO CONVERT FROM 3 M TO 300 M


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 01/14/08
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: PRELIM RADIATED EMISSIONS
MANUFACTURER : OMRON
MODEL No. : D7520044
S/N :
MODE : Tx @ 125.32KHZ
DATE TESTED : 14 Mar 2008 09:59:24 R. KING
NOTES :
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
START = .009
.01
.1
FREQUENCY - MHz
STOP = 1.5


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 1
WKA0 01/14/08
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: PRELIM RADIATED EMISSIONS
MANUFACTURER : OMRON
MODEL No. : D7520044
S/N :
MODE : Tx @ 125.32KHZ
DATE TESTED : 14 Mar 2008 10:05:33 R. KING
NOTES :
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
START = .009
.01
.1
FREQUENCY - MHz
STOP = 1.5


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 2
WKA0 01/14/08
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: PRELIM RADIATED EMISSIONS
MANUFACTURER : OMRON
MODEL No. : D7520044
S/N :
MODE : Tx @ 125.32KHZ
DATE TESTED : 14 Mar 2008 10:23:36 R. KING
NOTES :
ANT POLARITY : HORIZONTAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1.5
10
FREQUENCY - MHz
STOP = 30


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV_EM RUN 2
WKA0 01/14/08
TEST : RADIATED NARROWBAND EMISSIONS
SPECIFICATION: PRELIM RADIATED EMISSIONS
MANUFACTURER : OMRON
MODEL No. : D7520044
S/N :
MODE : Tx @ 125.32KHZ
DATE TESTED : 14 Mar 2008 10:21:56 R. KING
NOTES :
ANT POLARITY : VERTICAL
RADIATED NARROWBAND EMISSIONS - dBuV/m
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
START = 1.5
10
FREQUENCY - MHz
STOP = 30

DATA SHEET

MANUFACTURER : Omron Electronics
TEST ITEM : GM/Holden RFA System
MODEL NO. : D7520044
SERIAL NUMBER : None assigned
DOCUMENT : FCC "Code of Federal Regulation" Title 47 Part 15.209
TEST DESCRIPTION : Radiated Emissions
TEST DISTANCE : 3 Meters
TEST MODE : transmitting at 125kHz
DATE TESTED : March 14, 2008
NOTES : Distance correction factor based on a field decay exponent of -2.7

Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Dist. Corr. (dB)	Total dBuV/m at 300/30M	Total uV/m at 300/30M	Limits uV/m at 300/30M	Margin (dB)
0.125	H	65.3		0.0	10.7	0.0	-107.6	-31.5	0.0265	19.2	-57.2
0.125	V	69.2		0.0	10.7	0.0	-107.6	-27.7	0.0411	19.2	-53.4
0.251	H	42.9		0.0	10.4	0.0	-107.6	-54.3	0.002	9.6	-73.9
0.251	V	44.0		0.0	10.4	0.0	-107.6	-53.2	0.002	9.6	-72.8
0.376	H	41.8		0.0	10.4	0.0	-107.6	-55.4	0.002	6.4	-71.5
0.376	V	42.6		0.0	10.4	0.0	-107.6	-54.6	0.002	6.4	-70.7
0.501	H	36.9	*	0.0	10.4	0.0	-53.8	-6.5	0.472	47.9	-40.1
0.501	V	33.0	*	0.0	10.4	0.0	-53.8	-10.4	0.301	47.9	-44.0
0.627	H	36.0	*	0.0	10.5	0.0	-53.8	-7.3	0.432	38.3	-38.9
0.627	V	36.8	*	0.0	10.5	0.0	-53.8	-6.5	0.471	38.3	-38.2
0.752	H	34.1	*	0.0	10.5	0.0	-53.8	-9.2	0.346	31.9	-39.3
0.752	V	32.8	*	0.0	10.5	0.0	-53.8	-10.5	0.297	31.9	-40.6
0.877	H	32.3	*	0.0	10.6	0.0	-53.8	-11.0	0.283	27.4	-39.7
0.877	V	33.5	*	0.0	10.6	0.0	-53.8	-9.7	0.326	27.4	-38.5
1.003	H	30.1	*	0.0	10.6	0.0	-53.8	-13.1	0.222	23.9	-40.6
1.003	V	30.0	*	0.0	10.6	0.0	-53.8	-13.2	0.219	23.9	-40.8
1.128	H	30.2	*	0.0	10.6	0.0	-53.8	-13.0	0.224	21.3	-39.5
1.128	V	29.6	*	0.0	10.6	0.0	-53.8	-13.6	0.210	21.3	-40.1
1.253	H	27.6	*	0.0	10.6	0.0	-53.8	-15.6	0.166	19.2	-41.2
1.253	V	28.3	*	0.0	10.6	0.0	-53.8	-14.8	0.181	19.2	-40.5

Checked BY : Richard E. King

Richard E. King