



Measurement of RF Emissions from a Wireless Control Module with Embedded Transmitter, Model No. WCM

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

P.O. Number 71534N
Date Tested February 6 through 21, 2012
Test Personnel Daniel Crowder
Test Specification FCC "Code of Federal Regulations" Title 47, Part15
Industry Canada RSS-GEN

Test Report By:

A handwritten signature in black ink, appearing to read "D. Crowder".

Daniel Crowder
EMC Engineer

Requested By:

Matthew Colburn
Omron Electronics

Approved By:

A handwritten signature in black ink, appearing to read "Raymond J. Klouda".

Raymond J. Klouda
Registered Professional
Engineer of Illinois - 44894



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THIS REPORT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE WRITTEN APPROVAL OF ELITE ELECTRONIC ENGINEERING INCORPORATED.



REVISION HISTORY

Revision	Date	Description
—	7 June 2012	Initial release

Measurement of RF Emissions from a Wireless Control Module with Embedded Transmitter, Model No. WCM

1. INTRODUCTION

1.1. Scope of Tests

This report presents the results of the RF emissions measurements performed on a Wireless Control Module with Embedded Transmitter, Model No. WCM, Omron Part No. 1154564-0 and 1154307-8 with external P05026235AA 315MHz receiver antenna (hereinafter referred to as the Equipment Under Test (EUT)). No serial number was assigned to the EUT. The EUT was designed to transmit at 125 kHz using an internal loop antenna. The EUT 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 EUT meets the technical requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.209 for Intentional Radiators and Industry Canada RSS-GEN. Testing was performed in accordance with ANSI C63.4-2009.

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 American Association for Laboratory Accreditation (A2LA). A2LA Certificate Number: 1786.01.

1.5. Laboratory Conditions

The temperature at the time of the test was 23°C and the relative humidity was 37%.

2. 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 15, Subpart C, dated 1 October 2011
- ANSI C63.4-2009, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- Industry Canada Radio Standards Specification, RSS-Gen, "General Requirements and Information for the Certification of Radiocommunication Equipment", Issue 3, December 2010
- NOTICE 2012-DRS0126, Regulatory Standards Notice — Changes to RSS-Gen Issue 3 and RSS-310 Issue 3, January 2012

3. EUT SETUP AND OPERATION

3.1. General Description

The EUT is an Omron Electronics Wireless Control Module with Embedded Transmitter, Model No. WCM. A block diagram of the EUT setup is shown as Figure 1.



3.1.1.Power Input

The EUT obtained 13.6VDC from a power supply. The EUT will be powered from an automotive battery during normal use.

3.1.2.Peripheral Equipment

The EUT has connections for CAN bus monitoring. The CAN bus link was not connected during the tests.

3.1.3.Signal Input/Output Leads

The EUT has connections for CAN bus monitoring. 1 meter long unshielded leads were connected to the CAN bus port of the EUT.

3.1.4.Grounding

The EUT was ungrounded during the tests. The EUT was not grounded through the power supply.

3.2. Operational Mode

For all tests the EUT was placed on an 80cm high non-conductive stand. The unit was programmed to operate in the following mode:

- 1) Transmit at 125kHz

3.3. EUT Modifications

No modifications were required for compliance.

4. 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 C63.4-2009 for site attenuation.

4.2. Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1.

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).

4.4. Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

The measurement uncertainty for these tests is presented below:

Conducted Emissions Measurements		
Combined Standard Uncertainty	1.07	-1.07
Expanded Uncertainty (95% confidence)	2.1	-2.1

Radiated Emissions Measurements		
Combined Standard Uncertainty	2.26	-2.18
Expanded Uncertainty (95% confidence)	4.5	-4.4

5. TEST PROCEDURES

5.1. Radiated Measurements

5.1.1. Requirements

Per CFR 47, Part 15 section 209(a) and Industry Canada RSS-Gen Para. 7.2.5, all emanations from a transmitter shall be below the levels shown on the following table:

Frequency (MHz)	Field Intensity (uV/m)	Distance (Meters)
0.009–0.490	2,400/F (F in kHz)	300
0.490–1.705	24,000/F (F in kHz)	30
1.705–30.0	30	30

5.1.2. Procedures

All measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2009 for site attenuation.

A preliminary radiated emissions test was performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 10kHz to 30MHz was investigated using a peak detector function. The data was then processed by the computer to calculate equivalent field intensity.

The final emission tests were then manually performed over the frequency range of 10kHz to 30MHz. A loop antenna was used for the pick-up device. The measurement antenna was positioned three meters from the EUT. A distance correction factor of $40 * \log(3/D_m)$ where D_m is 300 or 30 Meter test distance was used to convert the measurements to be compared to the limit. All significant broadband and narrowband signals were measured and recorded.

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

- 1) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
- 2) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
- 3) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

5.1.3. 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 pages 16 and 17. All radiated emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figures 2 and 3.

6. OTHER TEST CONDITIONS

6.1. Test Personnel and Witnesses

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated. The test series was witnessed by Omron Electronics personnel.

6.2. Disposition of the EUT

The EUT and all associated equipment were returned to Omron Electronics upon completion of the tests.



7. CONCLUSIONS

It was determined that the Omron Electronics Wireless Control Module with Embedded Transmitter, Model No. WCM, Serial No. None Assigned, did fully meet the technical requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, for intentional radiators, when tested per ANSI C63.4-2009. In addition, the EUT meets the technical requirements of Industry Canada RSS-GEN.

8. 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 EUT at the test date as operated by Omron Electronics personnel. Any electrical or mechanical modification made to the EUT 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.



9. EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
CDY0	WORKSTATION	ELITE	WORKSTATION			N/A	
CMA1	Controllers	EMCO	2090	9701-1213	---	N/A	
NLS0	24" ACTIVE LOOP ANTENNA	EMCO	6502	89979	10KHZ-30MHZ	5/12/2011	6/12/2012
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/5/2012	3/5/2013
SRA7	DC POWER SUPPLY	TEKPOWER	HY3005D	23471		NOTE 1	

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.

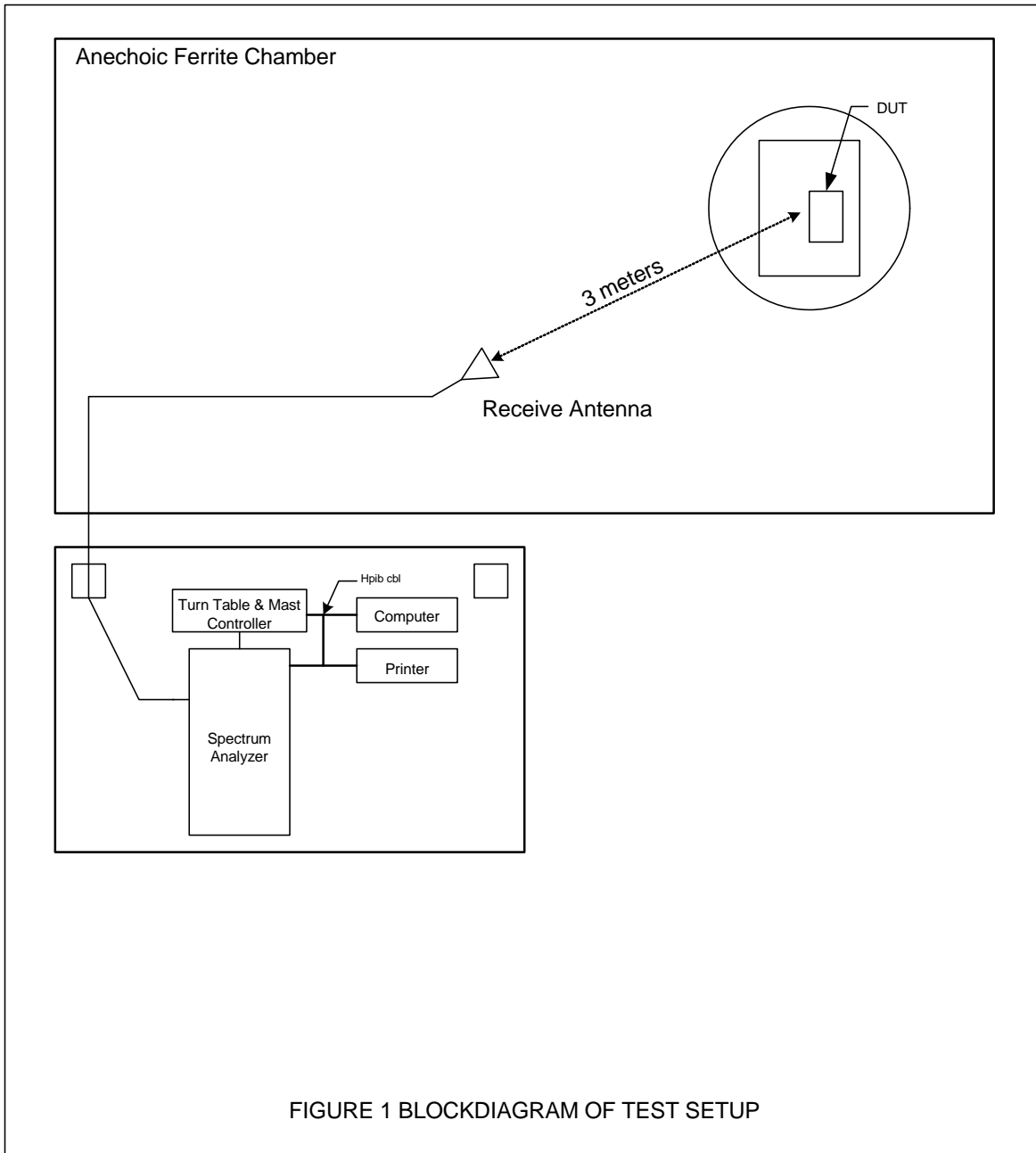


Figure 2



Test Setup



Figure 3



Test Setup for Radiated Emissions, Below 30MHz – Horizontal Polarization



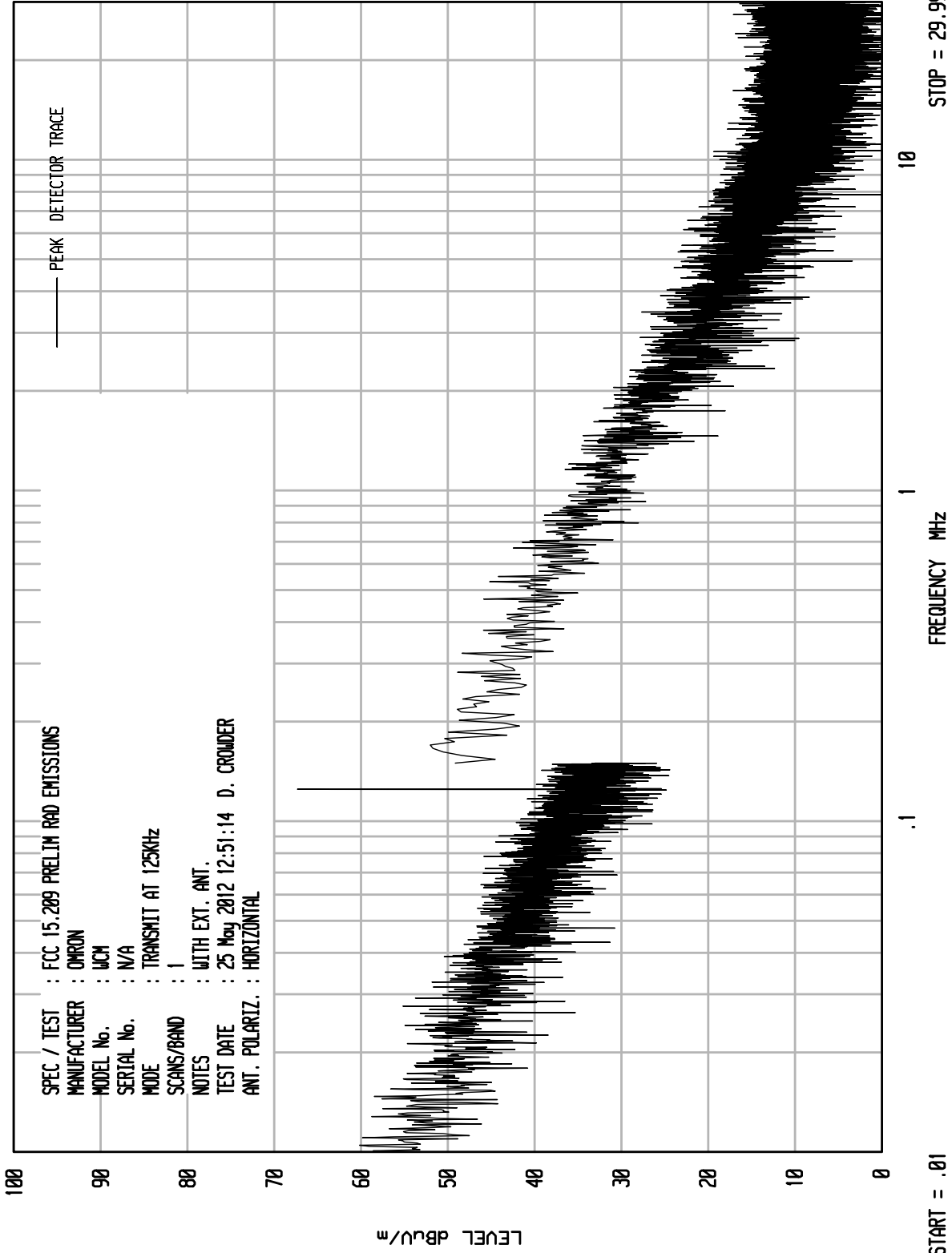
Test Setup for Radiated Emissions, Below 30MHz – Vertical Polarization

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Downers Grove, Ill. 60515

UNITU RCU EXT RUN 2

UKA1 04/26/11

SPEC / TEST : FCC 15.209 PRELIM RAD EMISSIONS
 MANUFACTURER : OMRON
 MODEL No. : UCH
 SERIAL No. : N/A
 MODE : TRANSMIT AT 125KHz
 SCANS/BAND : 1
 NOTES : WITH EXT. ANT.
 TEST DATE : 25 May 2012 12:51:14 D. CROWDER
 ANT. POLARIZ. : HORIZONTAL

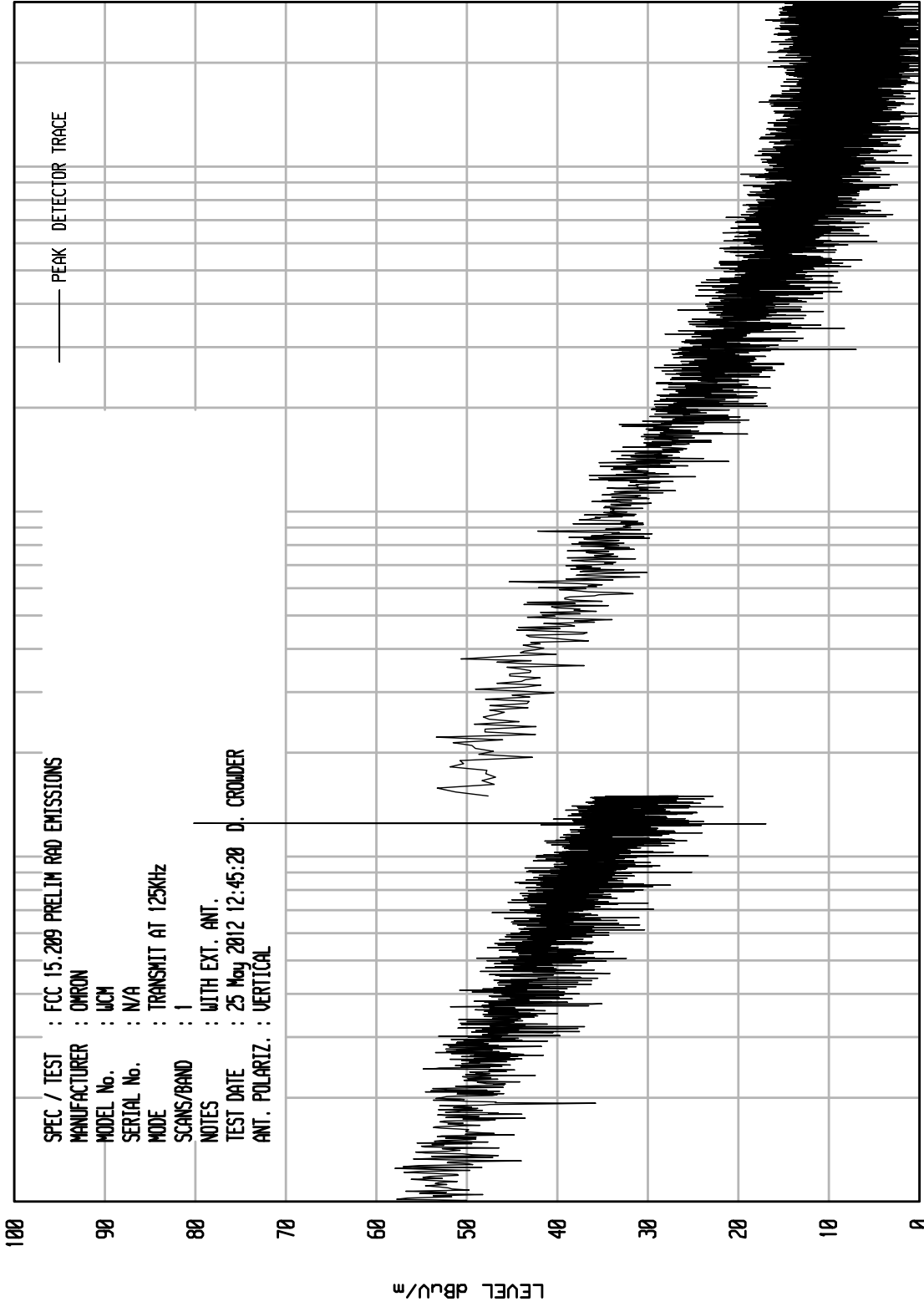


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNIU RCU EXT RUN 1

UKA1 04/26/11

SPEC / TEST : FCC 15.209 PRELIM RAD EMISSIONS
 MANUFACTURER : OMRON
 MODEL No. : UCH
 SERIAL No. : N/A
 MODE : TRANSMIT AT 125KHz
 SCANS/BAND : 1
 NOTES : WITH EXT. ANT.
 TEST DATE : 25 May 2012 12:45:20 D. CROWDER
 ANT. POLARIZ. : VERTICAL



START = .01

FREQUENCY MHz

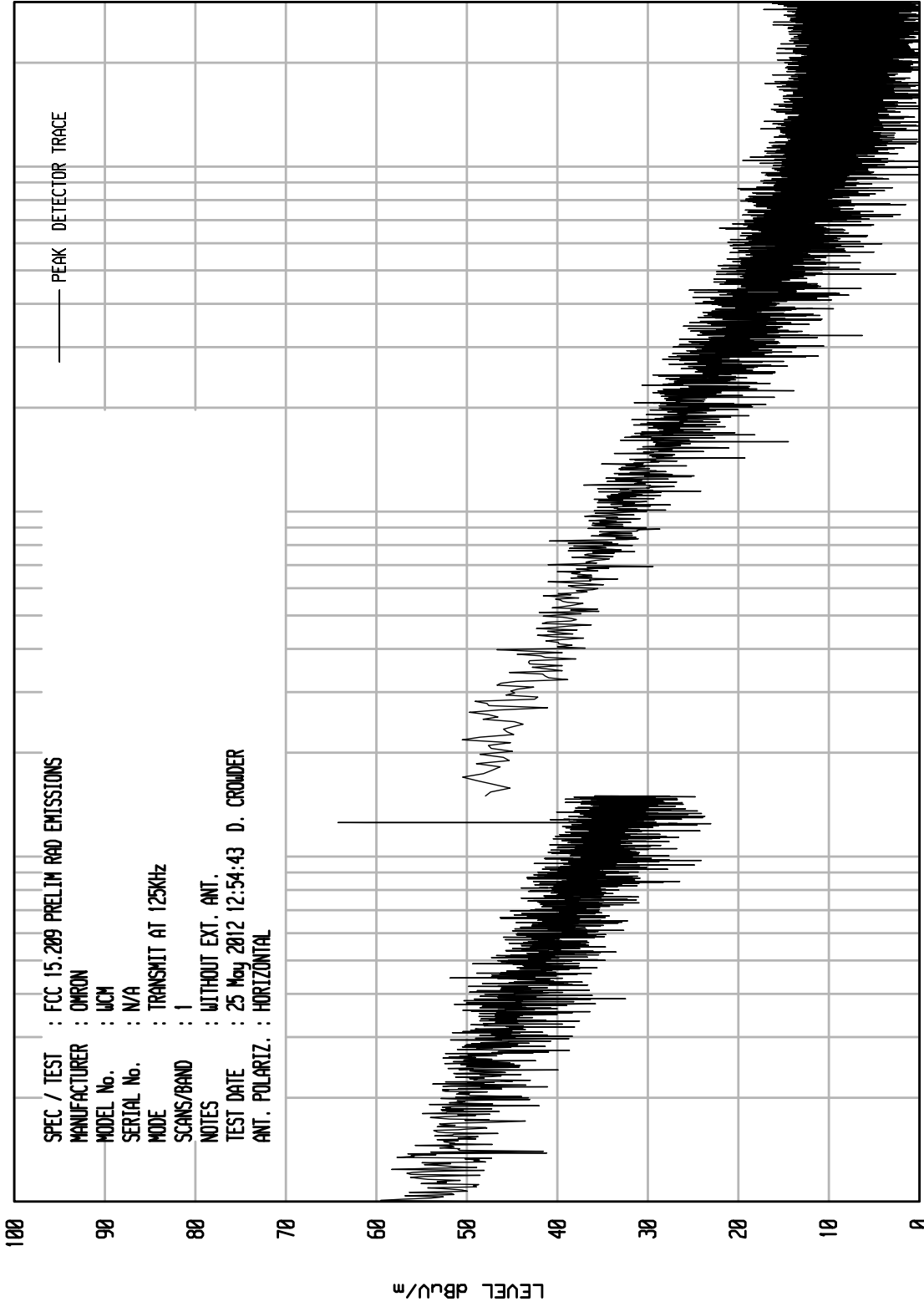
STOP = 29.999999

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNITU RCU EXT RUN 3

UKA1 04/26/11

SPEC / TEST : FCC 15.209 PRELIM RAD EMISSIONS
 MANUFACTURER : OMRON
 MODEL No. : UCH
 SERIAL No. : N/A
 MODE : TRANSMIT AT 125KHz
 SCANS/BAND : 1
 NOTES : WITHOUT EXT. ANT.
 TEST DATE : 25 May 2012 12:54:43 D. CROWDER
 ANT. POLARIZ. : HORIZONTAL



— PEAK DETECTOR TRACE

STOP = 29.999999

FREQUENCY MHz

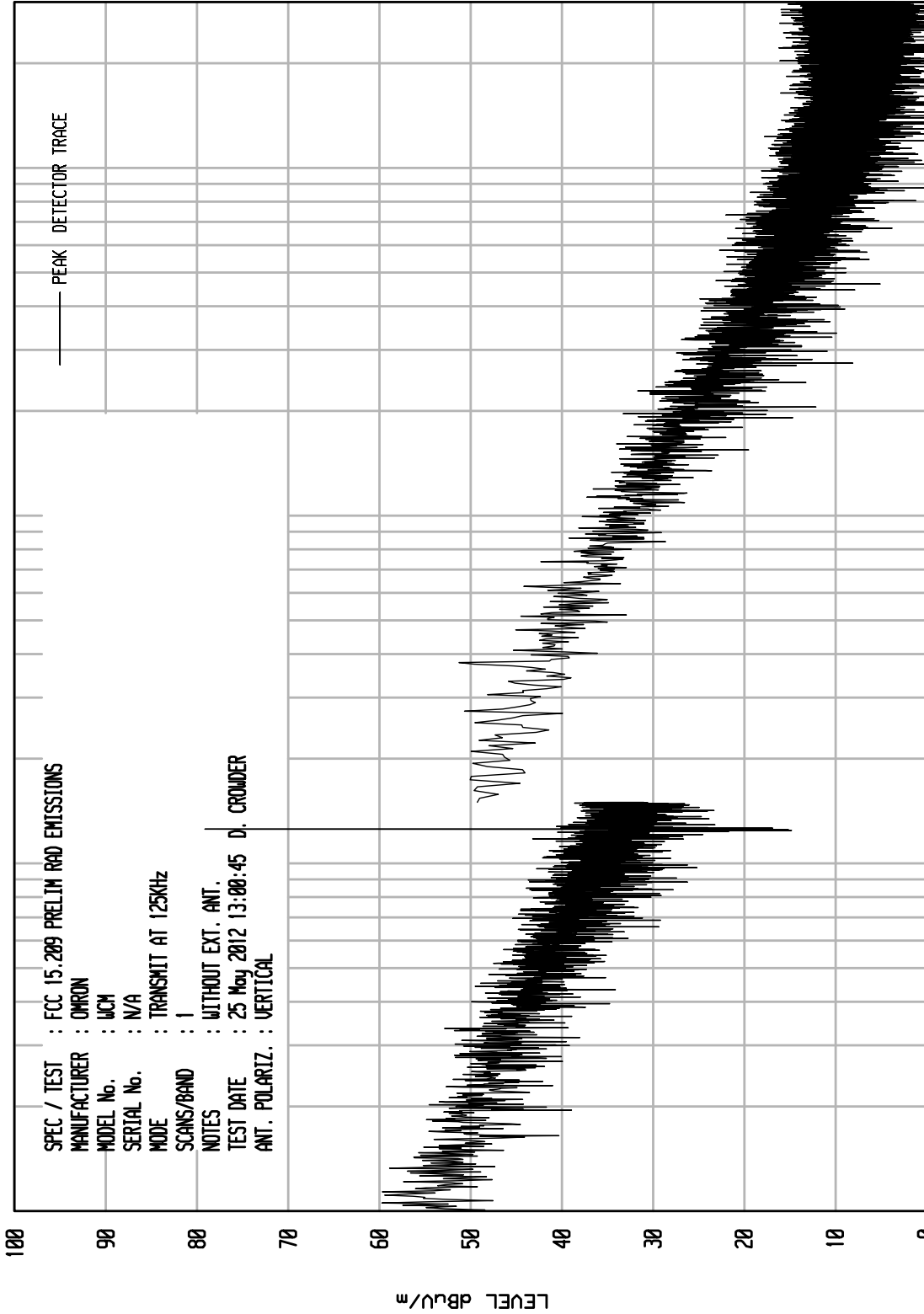
START = .01

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515

UNITU RCU EXT RUN 5

UKA1 04/26/11

SPEC / TEST : FCC 15.209 PRELIM RAD EMISSIONS
 MANUFACTURER : OMRON
 MODEL No. : UCH
 SERIAL No. : N/A
 MODE : TRANSMIT AT 125KHz
 SCANS/BAND : 1
 NOTES : WITHOUT EXT. ANT.
 TEST DATE : 25 May 2012 13:00:45 D. CROWDER
 ANT. POLARIZ. : VERTICAL



START = .01

FREQUENCY MHz

STOP = 29.999999



MANUFACTURER : Omron Electronics
 EUT : Wireless Control Module with Embedded Transmitter
 MODEL NO. : WCM
 TEST SPECIFICATION : FCC 15.209/RSS-Gen Radiated Emissions
 MODE : Transmit at 125kHz
 TEST DATE : May 25, 2012
 TEST DISTANCE : 3 meters
 NOTES : With External Antenna

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Dist Corr dB	Total dBuV/m	Total uV/m	Limit uV/m
0.125	H	60.8		0.0	11.3	-80.0	-7.9	0.4	19.2
0.125	V	69.2		0.0	11.3	-80.0	0.5	1.1	19.2
0.250	H	24.7	*	0.0	11.0	-80.0	-44.3	0.006	9.6
0.250	V	15.7	*	0.0	11.0	-80.0	-53.3	0.002	9.6
0.375	H	30.4		0.0	10.8	-80.0	-38.8	0.011	6.4
0.375	V	38.0		0.0	10.8	-80.0	-31.2	0.028	6.4
0.500	H	21.1	*	0.0	11.0	-40.0	-7.9	0.40	48.0
0.500	V	18.6	*	0.0	11.0	-40.0	-10.4	0.30	48.0
0.625	H	22.7		0.0	11.0	-40.0	-6.3	0.48	38.4
0.625	V	29.1		0.0	11.0	-40.0	0.1	1.01	38.4
0.750	H	15.1	*	0.0	11.0	-40.0	-13.9	0.20	32.0
0.750	V	15.0	*	0.0	11.0	-40.0	-14.0	0.20	32.0
0.875	H	17.3		0.0	10.9	-40.0	-11.8	0.26	27.4
0.875	V	23.5		0.0	10.9	-40.0	-5.6	0.53	27.4
1.000	H	12.7	*	0.0	11.3	-40.0	-16.0	0.16	24.0
1.000	V	10.6	*	0.0	11.3	-40.0	-18.1	0.12	24.0
1.125	H	13.7		0.0	11.3	-40.0	-15.0	0.18	21.3
1.125	V	19.7		0.0	11.3	-40.0	-9.0	0.36	21.3
1.250	H	9.7	*	0.0	11.3	-40.0	-19.0	0.11	19.2
1.250	V	8.7	*	0.0	11.3	-40.0	-20.0	0.10	19.2

H – Horizontal
 V = Vertical

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

tested by: 
 D. CROWDER



MANUFACTURER : Omron Electronics
 EUT : Wireless Control Module with Embedded Transmitter
 MODEL NO. : WCM
 TEST SPECIFICATION : FCC 15.209/RSS-Gen Radiated Emissions
 MODE : Transmit at 125kHz
 TEST DATE : May 25, 2012
 TEST DISTANCE : 3 meters
 NOTES : Without External Antenna

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Dist Corr dB	Total dBuV/m	Total uV/m	Limit uV/m
0.125	H	60.0		0.0	11.3	-80.0	-8.7	0.37	19.2
0.125	V	68.2		0.0	11.3	-80.0	-0.5	0.94	19.2
0.250	H	25.2	*	0.0	11.0	-80.0	-43.8	0.006	9.6
0.250	V	25.8	*	0.0	11.0	-80.0	-43.2	0.007	9.6
0.375	H	31.0		0.0	10.8	-80.0	-38.2	0.012	6.4
0.375	V	38.0		0.0	10.8	-80.0	-31.2	0.028	6.4
0.500	H	19.3		0.0	11.0	-40.0	-9.7	0.33	48.0
0.500	V	17.9	*	0.0	11.0	-40.0	-11.1	0.28	48.0
0.625	H	22.7		0.0	11.0	-40.0	-6.3	0.48	38.4
0.625	V	28.7		0.0	11.0	-40.0	-0.3	0.97	38.4
0.750	H	14.0	*	0.0	11.0	-40.0	-15.0	0.18	32.0
0.750	V	14.7	*	0.0	11.0	-40.0	-14.3	0.19	32.0
0.875	H	17.5		0.0	10.9	-40.0	-11.6	0.26	27.4
0.875	V	23.3		0.0	10.9	-40.0	-5.8	0.51	27.4
1.000	H	12.4	*	0.0	11.3	-40.0	-16.3	0.15	24.0
1.000	V	11.2	*	0.0	11.3	-40.0	-17.5	0.13	24.0
1.125	H	14.8		0.0	11.3	-40.0	-13.9	0.20	21.3
1.125	V	19.7		0.0	11.3	-40.0	-9.0	0.36	21.3
1.250	H	10.0	*	0.0	11.3	-40.0	-18.7	0.12	19.2
1.250	V	9.7	*	0.0	11.3	-40.0	-19.0	0.11	19.2

H – Horizontal
 V = Vertical

Total = Meter Reading + Cable Loss Factor + Antenna Factor – Distance Correction Factor

tested by: 
 D. CROWDER