



TEST SPECIFICATION:

FCC "Rules and Regulations", Part 15, Subpart C
Sections 15.225, 15.209 & 15.207

Intentional Radiators

Operation within the frequency range 13.553 MHz to 13.567 MHz

THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION

Formal Name:	Zebra R140
Kind of Equipment:	Bar Code Printer with RF ID Tag Reader (Transmitter/Receiver)
Test Configuration:	Parallel Data Cable to Laptop
Transmitter FCC ID:	OCTOEM-MSR2
Model Number:	R140
Serial Number:	NA
Dates of Test:	July 6 & August 16, 2000
Test Conducted For:	id Systems LTD
	Rutherford House, Manchester Science Park
	Manchester, United Kingdom M15 6SZ

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Report No. 8388
08/17/00

SIGNATURE PAGE

Report Written By:

Arnom C. Rowe

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Test Engineer
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Jack Prawica
Lab Manager

Report Approved by:

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Brian J. Mattson
General Manager

Company Official:

id Systems LTD

United States Department of Commerce
National Institute of Standards and Technology



ISO/IEC GUIDE 25:1990
ISO 9002:1987

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WHEELING, IL

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**ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS
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D.L.S. ELECTRONIC SYSTEMS, INC.

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NVLAP Code Designation / Description

International Special Committee on Radio Interference (CISPR) Methods

- | | |
|-----------|--|
| 12/CIS22 | IEC/CISPR 22:1993: Limits and methods of measurement of radio disturbance characteristics of information technology equipment |
| 12/CIS22a | IEC/CISPR 22:1993: Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1:1995, and Amendment 2:1996. |
| 12/CIS22b | CNS 13438:1997: Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment |

Federal Communications Commission (FCC) Methods

- | | |
|---------|---|
| 12/F01 | FCC Method - 47 CFR Part 15 - Digital Devices |
| 12/F01a | Conducted Emissions, Power Lines, 450 KHz to 30 MHz |
| 12/F01b | Radiated Emissions |

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**ELECTROMAGNETIC COMPATIBILITY
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NVLAP LAB CODE 100276-0

D.L.S. ELECTRONIC SYSTEMS, INC.

NVLAP Code Designation / Description

Australian Standards referred to by clauses in ACA Technical Standards

12/T51	AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment
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1.0 SUMMARY OF TEST REPORT

It was found that the Zebra R140 S/N NA meets the radio interference emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Sections 15.225, 15.209 and 15.207 for Intentional Radiators operating in the 13.553 MHz to 13.567 MHz Frequency Band.

2.0 INTRODUCTION

On July 6 & August 16, 2000, a series of radio frequency interference measurements were performed on Bar Code Printer with RF ID Tag Reader (Transmitter/Receiver), S/N NA. The tests were performed according to the procedures of FCC as stated in the "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" found in the American National Standards Institute, ANSI C63.4-1992 (Revision of ANSI C63.4-1988), by personnel of D.L.S. Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer.

3.0 OBJECT

The purpose of this series of tests was to determine if the test sample could meet the radio frequency emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Sections 15.225, 15.209 and 15.207 for Intentional Radiators operating in the 13.553 MHz to 13.567 MHz Frequency Band.

4.0 TEST SET-UP

All conducted emission tests were performed in a shield enclosure or lab at D.L.S. electronic Systems, Inc. The conducted tests were performed with the test item placed on a non-conductive table located in the Test Room. The power line supplied was connected to a dual line impedance stabilization network located on the floor, a ground plane. The networks were constructed per the requirements of the American National Standards Institute, ANSI C63.4-1992, Section 4, (Figure2). The only ground supplied to the unit was through the third wire of the standard power cord when supplied.

All radiated emission tests were performed at D.L.S. Electronic Systems, Inc. The radiated tests were made with the test item placed on a non-conductive turntable located in the Test Room with the receive antenna placed three meters from the device under test. The equipment under test was set up according to ANSI C63.4-1992, Section 8, (Figures 9c and 9d).

5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All preliminary data was automatically plotted using the Peak or CISPR Detector Functions. This information was then used to determine the frequencies of maximum emissions. Manual measurements were performed on these frequencies using a peak detector function of the Receiver with the bandwidths specified by the FCC.

The final data was taken using the fixed tuned receiver. Plots were made using the Peak Detector, with manual measurements made on the frequencies of interest, using the Peak, CISPR, and Average Detector Functions of the receiver. When average measurements were made using the fixed tuned receiver, the average was taken of a linear IF signal as specified by FCC and ANSI C63.4-1992.

The fundamental frequency was measured using the Average Detector and the CISPR Detector was used for measuring the Harmonics as stated in Section 15.209. From 10 kHz to 30 MHz a bandwidth of 9 kHz was used and from 30 MHz to 1000 MHz a bandwidth of 120 kHz was used to ensure proper measurement of the narrowband signal.

A list of the equipment used can be found in Table 1. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

6.0 CONDUCTED EMISSION MEASUREMENTS

The conducted emissions were measured over the frequency range from .45 MHz to 30 MHz in accordance with the power line measurements. As specified in ANSI C63.4-1992. Since the device is operated from the public utility lines, the 120 vac 60 Hz power leads, high and low sides, were measured by connecting the measuring equipment to the appropriate meter terminal of the LISN. All signals were then recorded. The allowed levels for Intentional Radiators can not exceed 250 uV (47.96 dBuV) at any frequency between 450 kHz and 30 MHz, as stated in Section 15.207a.



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CONDUCTED DATA TAKEN DURING TESTING

PART 15.207



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SUMMARY DATA SHEET OF CONDUCTED EMISSIONS

TEST DATE:----- August 16, 2000
MANUFACTURER:----- Zebra Technologies
MODEL NO:----- R140
S/N:----- NA
CONFIGURATION:----- **NA**
DETECTOR:----- **QUASI-PEAK**

TEST SPECIFICATION FCC "RULES AND REGULATION", PART 15
SUBPART C / SECTION 15.207

TEST EQUIPMENT: Spectrum Analyzer ----- HP 8566B
Quasi Peak Adapter ----- HP 85650A

TYPE OF TEST: CONDUCTED / / **LINE #1**

THE FOLLOWING ARE SIGNIFICANT CONDUCTED LEVELS FOUND:

FREQ IN MHz.	METER READING dBuV	CABLE LOSSES dB	TOTAL dBuV	LIMIT dBuV	MARGIN dB
0.4576	38.4000	0.05	38.45	47.96	9.51
0.4998	38.3000	0.05	38.35	47.96	9.61
14.4570	38.1000	0.05	38.15	47.96	9.81



SUMMARY DATA SHEET OF CONDUCTED EMISSIONS

TEST DATE:----- August 16, 2000
MANUFACTURER:----- Zebra Technologies
MODEL NO:----- R140
S/N:----- NA
CONFIGURATION:----- **NA**
DETECTOR:----- **QUASI-PEAK**

TEST SPECIFICATION: FCC "RULES AND REGULATION", PART 15
SUBPART C / SECTION 15.207

TEST EQUIPMENT: Spectrum Analyzer ----- HP 8566B
Quasi Peak Adapter ----- HP 85650A

TYPE OF TEST: CONDUCTED / / **LINE #2**

THE FOLLOWING ARE SIGNIFICANT CONDUCTED LEVELS FOUND:

FREQ IN MHz.	METER READING dBuV	CABLE LOSSES dB	TOTAL dBuV	LIMIT dBuV	MARGIN dB
0.4519	40.9000	0.05	40.95	47.96	7.01
0.5961	31.7000	0.05	31.75	47.96	16.21
0.8165	40.9000	0.05	40.95	47.96	7.01
1.1374	39.8000	0.05	39.85	47.96	8.11
13.2934	37.9000	0.05	37.95	47.96	10.01

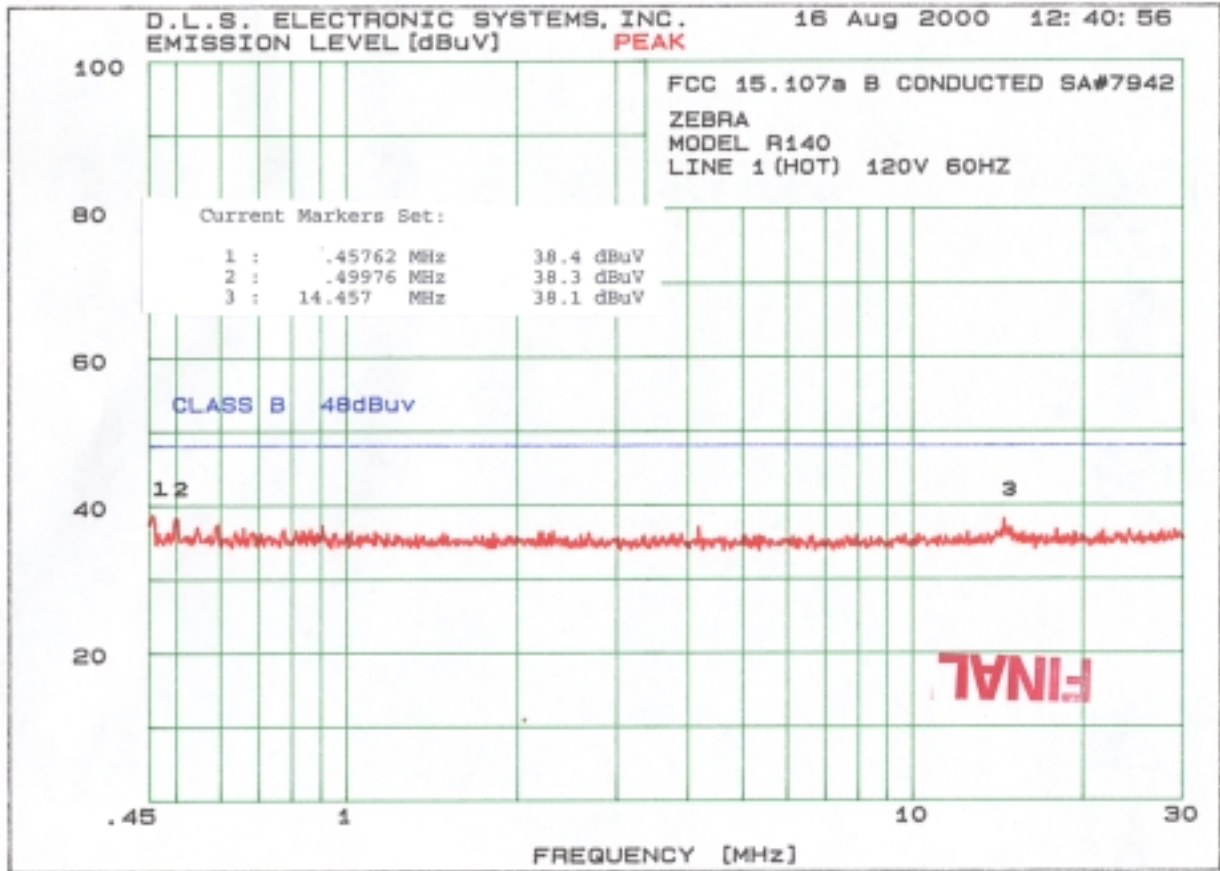


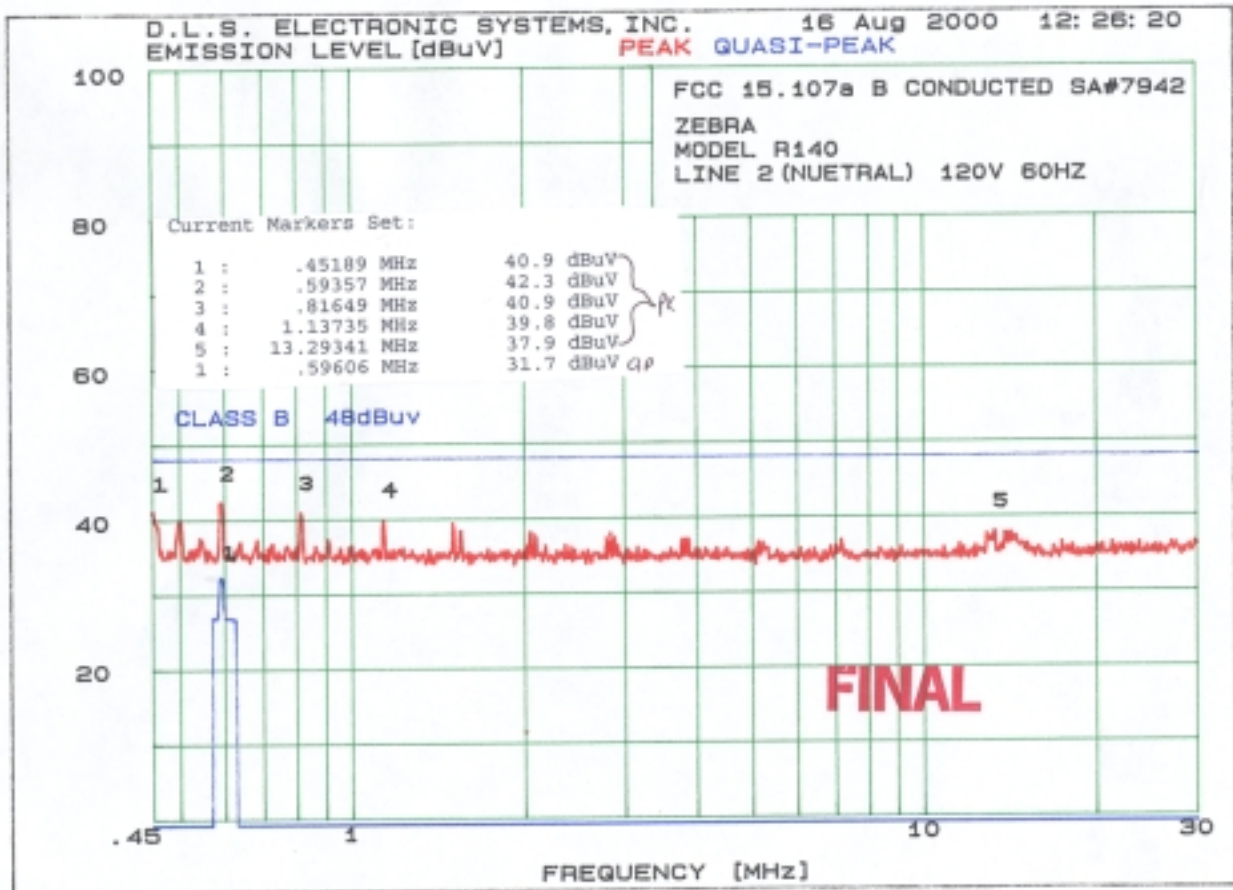
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CONDUCTED GRAPHS TAKEN DURING TESTING

PART 15.207





7.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS

The radiated measurements made at D.L.S. Electronic Systems, Inc., for the Zebra R140, Model Number R140, are shown in tabulated and graph form.

Preliminary radiation measurements were performed at a 3 meter test distance with the limits adjusted linearly when required. The frequency range from 9 kHz to over 960 MHz, depending upon the fundamental frequency as stated in Part 15.33a, was automatically scanned and plotted at various angles.

Measurements for the Zebra R140 were made up to 1000 MHz, in accordance with Section 15.33a for Intentional Radiators with a fundamental frequency of 13.56 MHz. For intentional radiators, the frequency range to be investigated is determined by the lowest radio frequency generated by the device without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or 1000 MHz, whichever is lower.

At those frequencies where significant signals were detected, measurements were made at an open field test site, located at Genoa City, Wisconsin, FCC file number 31040/SIT, to determine the actual radiation levels.

All signals in the frequency range of 9 kHz to 30 MHz were measured with a low frequency Loop Antenna as a pickup device. From 30 to 200 MHz, a Biconical Antenna or tuned dipoles were used and from 200 MHz to 1000 MHz, a Log Periodic or Tuned Dipoles were used. During the test the equipment was rotated and the antenna was raised and lowered from 1 meter to 4 meters to find the maximum level. In order to find maximum emissions, the cables were moved through all the positions the equipment would be expected to experience in the field. Tests were made in both the horizontal and vertical planes of polarization with the Loop (rotated 360° around its vertical axis), Biconical and Log Periodic. The table was rotated to find the maximum emissions.

When the equipment is out of limit at 3 meters, and the signals from the equipment at 30 meters cannot be recorded due to the background, a representative sample of these frequencies were remeasured at various distances such as 4, 5, 6, 8, 15 meters and the greatest distance that can be measured to demonstrate graphically that the emissions are dropping off and will be under the limit at the specified distance.

All signals were then recorded. The allowed levels for Intentional Radiators in the 13.553 MHz to 13.567 MHz band shall not exceed 10,000 uv measured at 30 meters. The field strength of any emissions appearing outside of this band shall not exceed the radiated emissions limits shown in Section 15.209.



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RADIATED DATA TAKEN FOR FUNDAMENTAL

EMISSION MEASUREMENTS

PART 15.225



SUMMARY DATA SHEET OF **RADIATED EMISSIONS <30 MHz**

TEST DATE:----- July 6, 2000
MANUFACTURER:----- Zebra Technologies
MODEL NO:----- R140
S/N:----- NA
CONFIGURATION:----- **NA**
RATED POWER:----- 0.065

TEST SPECIFICATION: FCC "RULES AND REGULATION", PART 15
SUBPART C / SECTION 15.225

TEST EQUIPMENT: Receiver --- EMC-30 -- SN 44168

Antennas: -- 6502 ---- SN143

TYPE OF TEST: **LOOP ANTENNA** MEASURED **AT 3 METERS**

THE FOLLOWING ARE SIGNIFICANT RADIATED LEVELS FOUND:

FREQ IN MHz.	METER READING dBuV	METER CORR dB	ANTENNA FACTOR dBuV	TOTAL dBuV	LIMIT dB	MARGIN dB
13.56	20.00	2.00	9.90	31.90	100.00	68.10

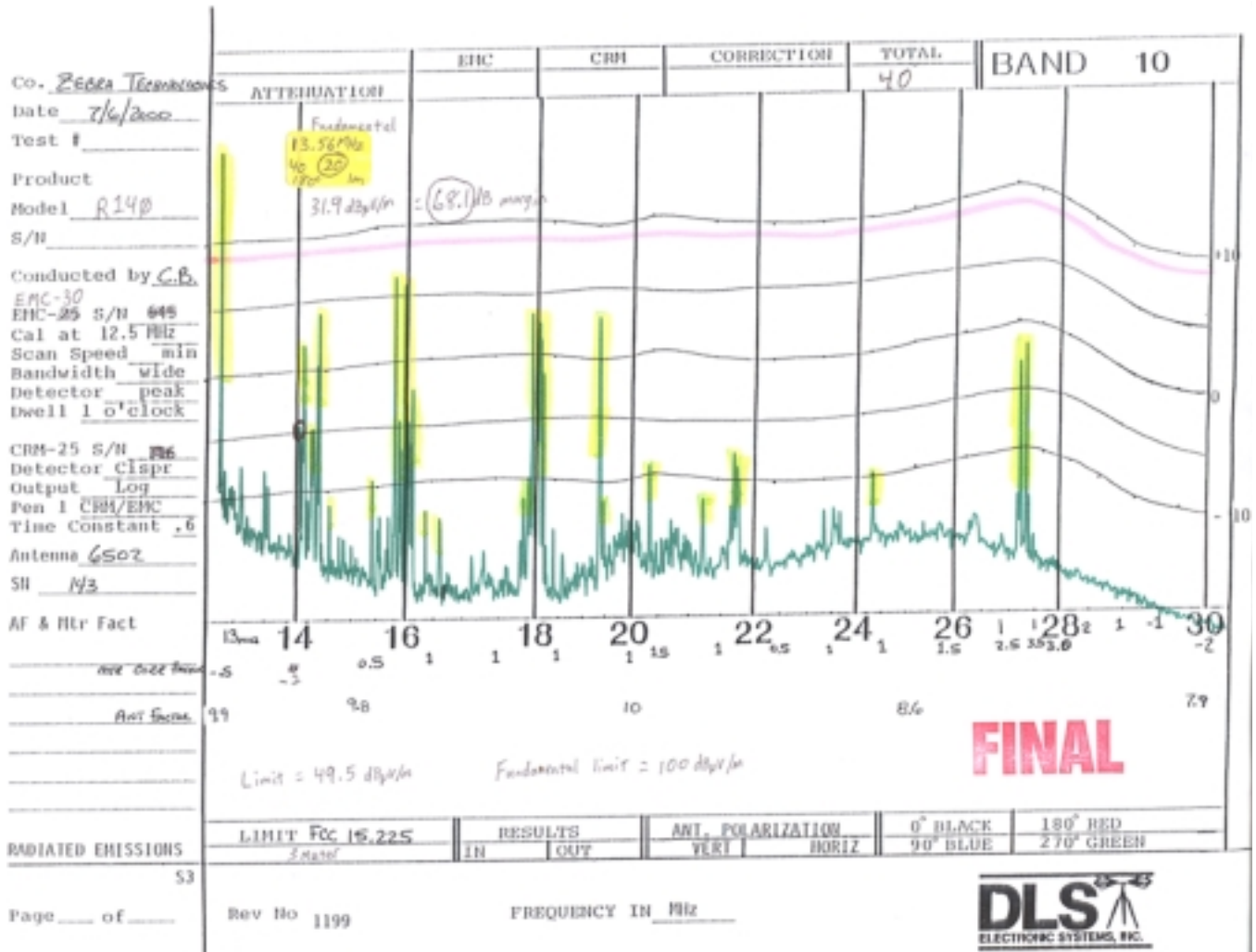


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RADIATED GRAPHS TAKEN FOR FUNDAMENTAL EMISSION MEASUREMENTS

PART 15.225





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RADIATED DATA TAKEN FOR

FIELD STRENGTH

SPURIOUS EMISSION MEASUREMENTS

PART 15.209



SUMMARY DATA SHEET OF **RADIATED EMISSIONS <1000 MHz**

TEST DATE:----- July 6, 2000
MANUFACTURER:----- Zebra Technologies
MODEL NO:----- R140
S/N:----- NA
CONFIGURATION:----- **NA**
RATED POWER:----- 0.065

TEST SPECIFICATION: FCC "RULES AND REGULATION", PART 15
SUBPART C / SECTION 15.225

TEST EQUIPMENT: Receiver --- EMC-30 -- SN 44168

Antennas --- BIA-25 --- SN 4785
LPA-25 --- SN 4895

TYPE OF TEST: **VERTICAL** MEASURED **AT 10 METERS**

THE FOLLOWING ARE SIGNIFICANT RADIATED LEVELS FOUND:

FREQ IN MHz.	METER READING dBuV	METER CORR dB	ANTENNA FACTOR dBuV	TOTAL dBuV	LIMIT dB	MARGIN dB
84.00	12.00	1.00	7.69	20.69	30.00	9.31
152.00	10.00	2.00	12.21	24.21	30.00	5.79
168.00	9.00	2.00	14.17	25.17	30.00	4.83
184.00	7.00	2.00	15.20	24.20	30.00	5.80
201.00	10.00	2.00	11.86	23.86	30.00	6.14
232.10	15.00	2.00	11.14	28.14	37.00	8.86
280.00	14.00	2.00	13.58	29.58	37.00	7.42



SUMMARY DATA SHEET OF **RADIATED EMISSIONS <1000 MHz**

TEST DATE:----- July 6, 2000
MANUFACTURER:----- Zebra Technologies
MODEL NO:----- R140
S/N:----- NA
CONFIGURATION:----- **NA**
RATED POWER:----- 0.065

TEST SPECIFICATION: FCC "RULES AND REGULATION", PART 15
SUBPART C / SECTION 15.225

TEST EQUIPMENT: Receiver --- EMC-30 -- SN 44168

Antennas --- BIA-25 --- SN 4785
LPA-25 --- SN 4895

TYPE OF TEST: **HORIZONTAL** MEASURED **AT 10 METERS**

THE FOLLOWING ARE SIGNIFICANT RADIATED LEVELS FOUND:

FREQ IN MHz.	METER READING dBuV	METER CORR dB	ANTENNA FACTOR dBuV	TOTAL dBuV	LIMIT dB	MARGIN dB
152.00	14.00	2.00	12.21	28.21	30.00	1.79
168.00	11.00	2.00	12.88	25.88	30.00	4.12
232.10	18.00	2.00	11.14	31.14	37.00	5.86
264.00	15.00	2.00	12.56	29.56	37.00	7.44
280.00	15.00	2.00	13.58	30.58	37.00	6.42
520.00	10.00	2.00	16.90	28.90	37.00	8.10



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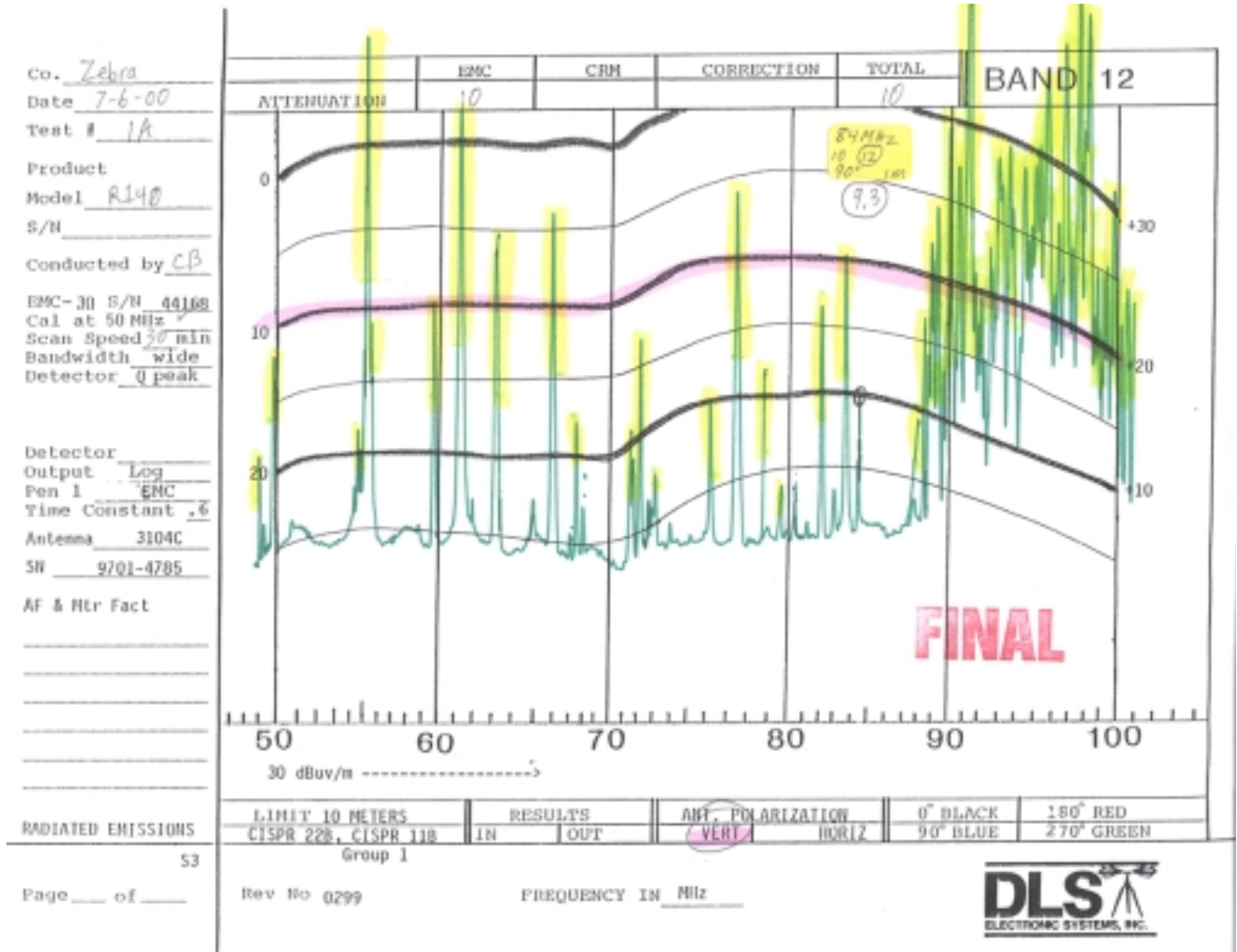
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RADIATED GRAPHS TAKEN FOR

FIELD STRENGTH

SPURIOUS EMISSION MEASUREMENTS

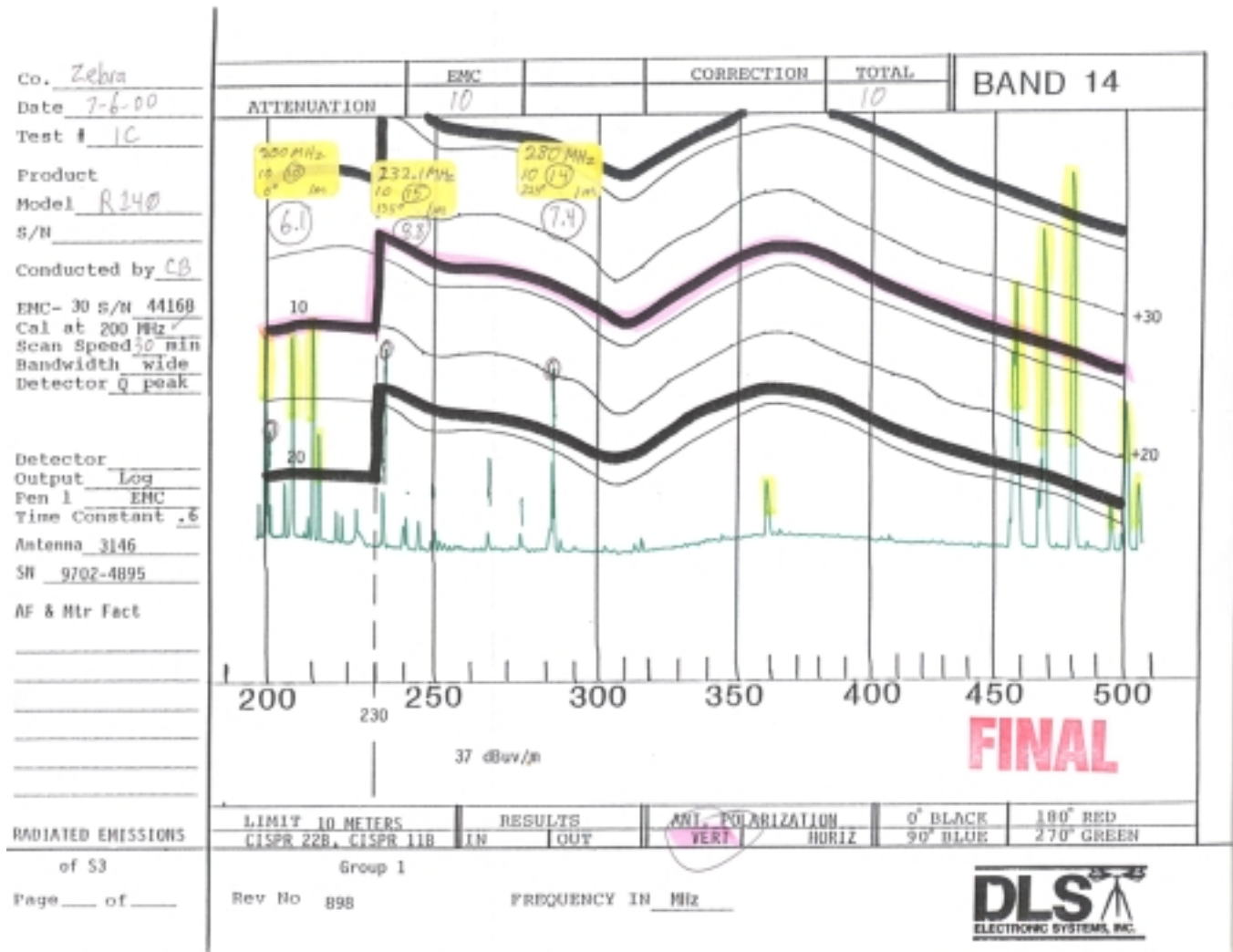
PART 15.209





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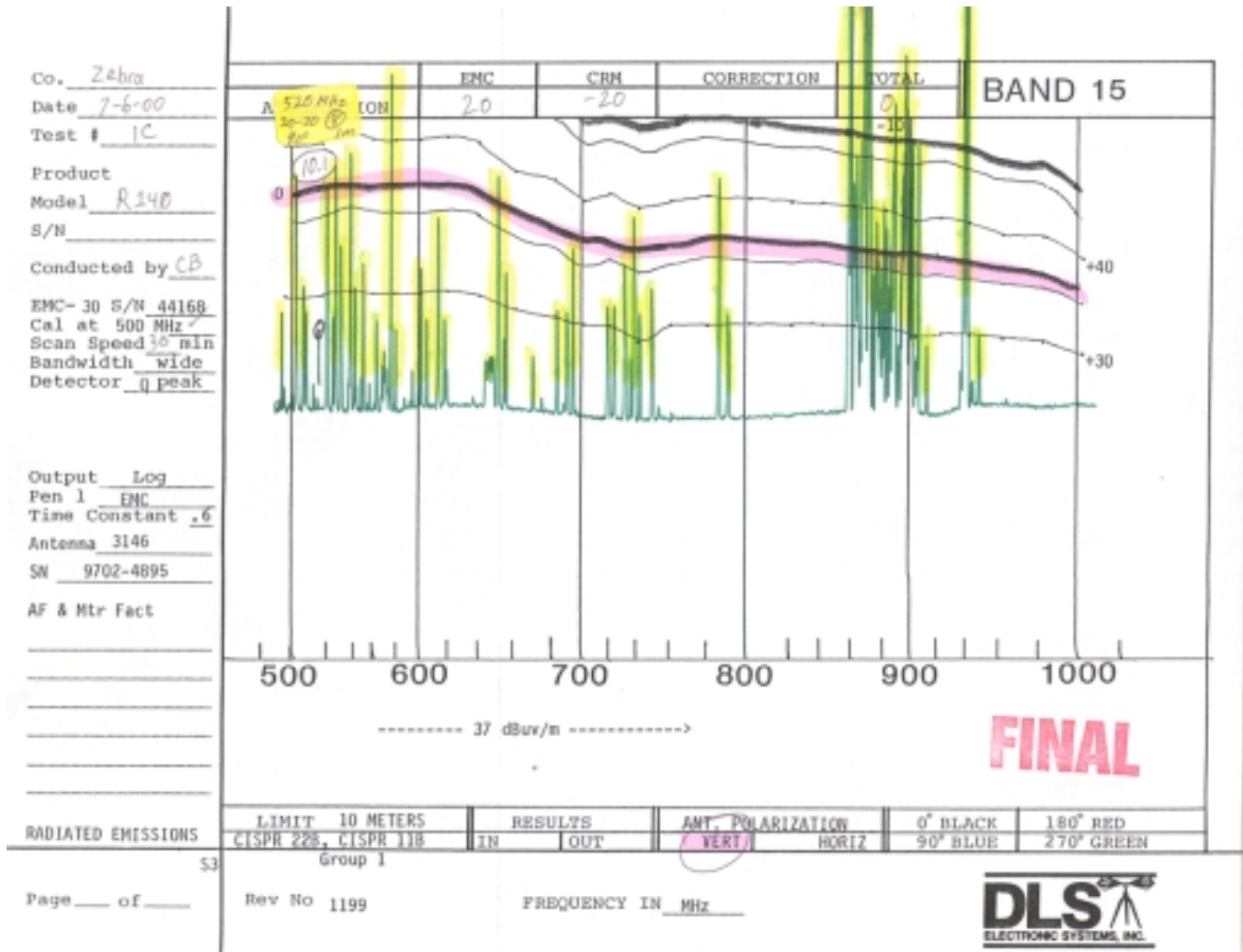
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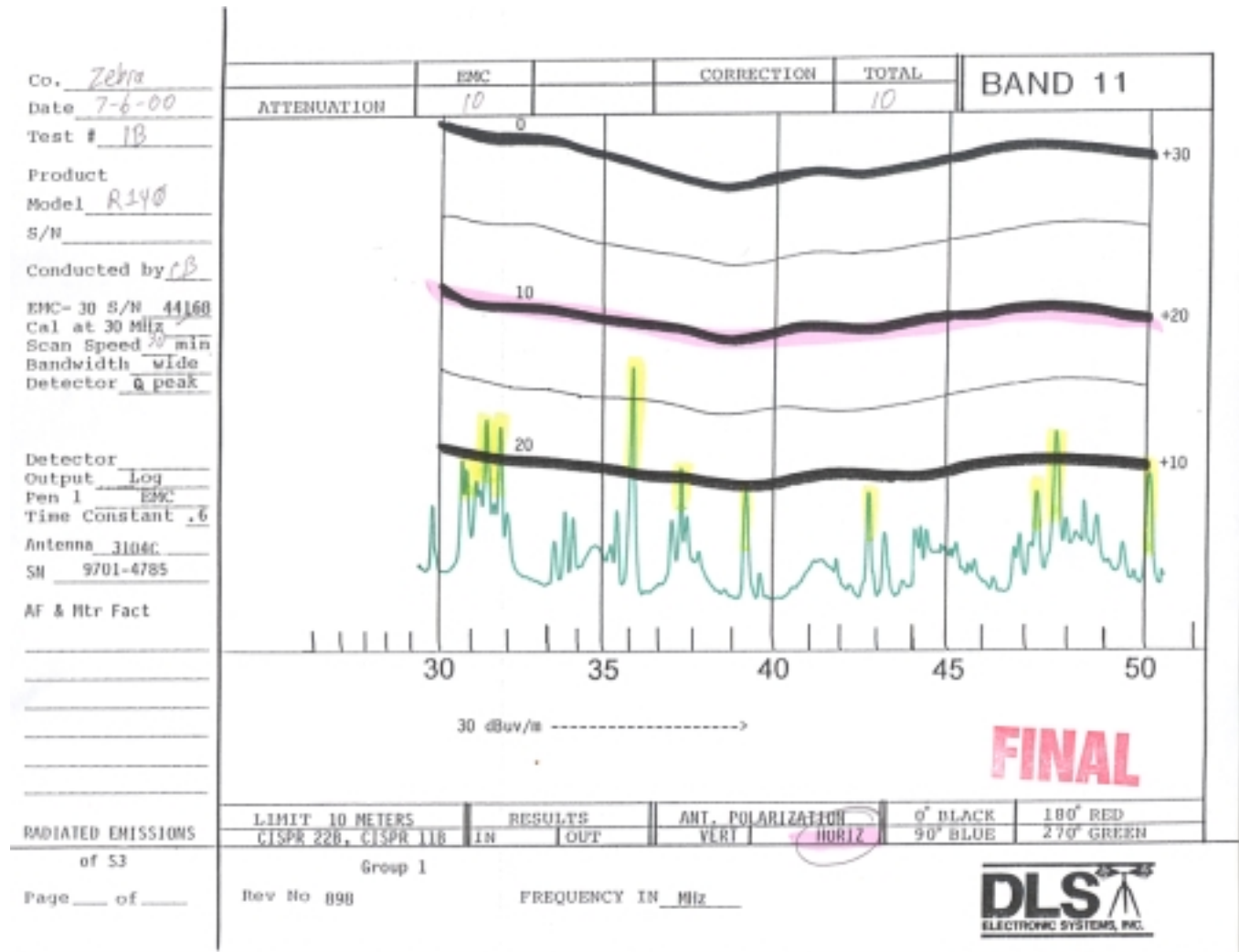
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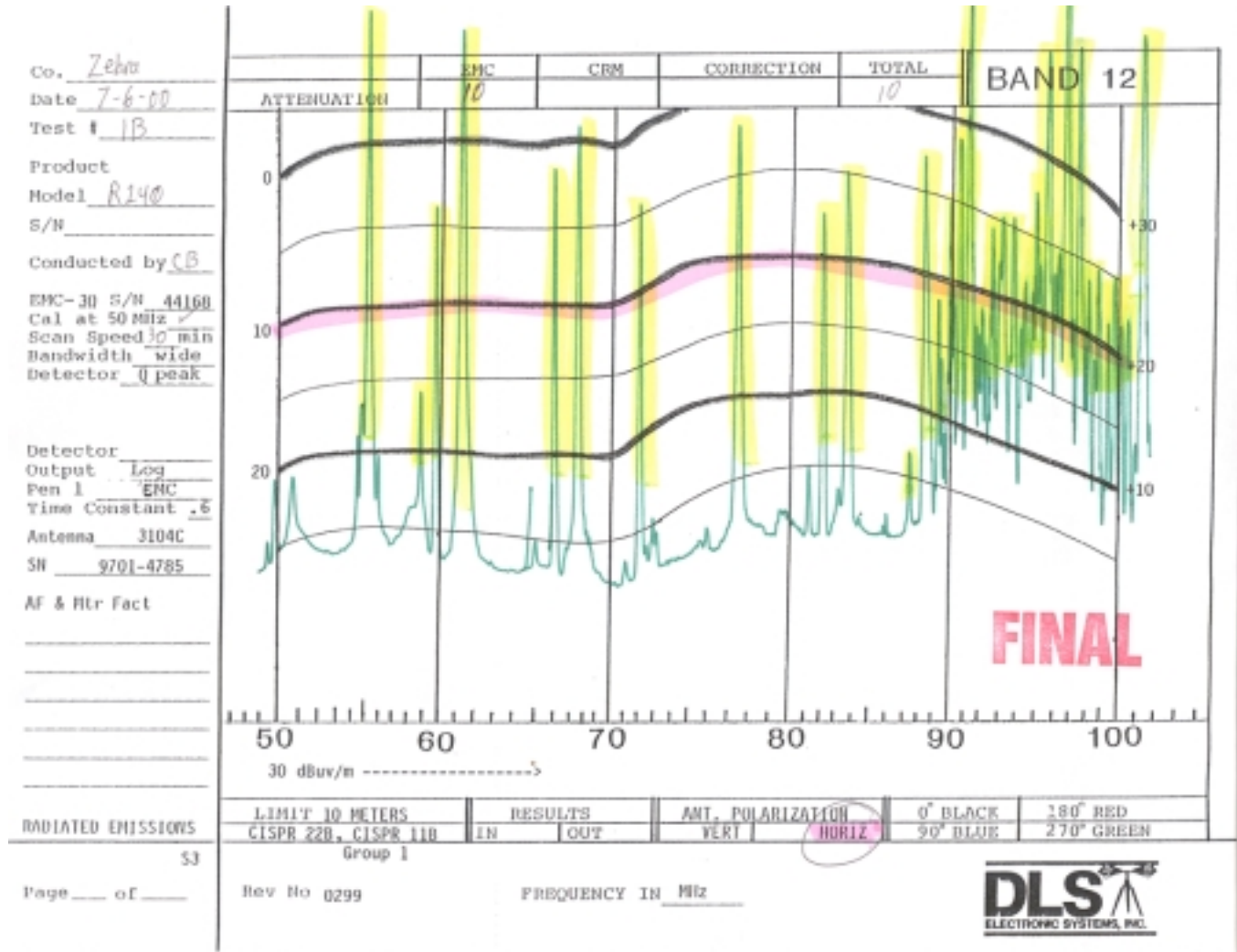
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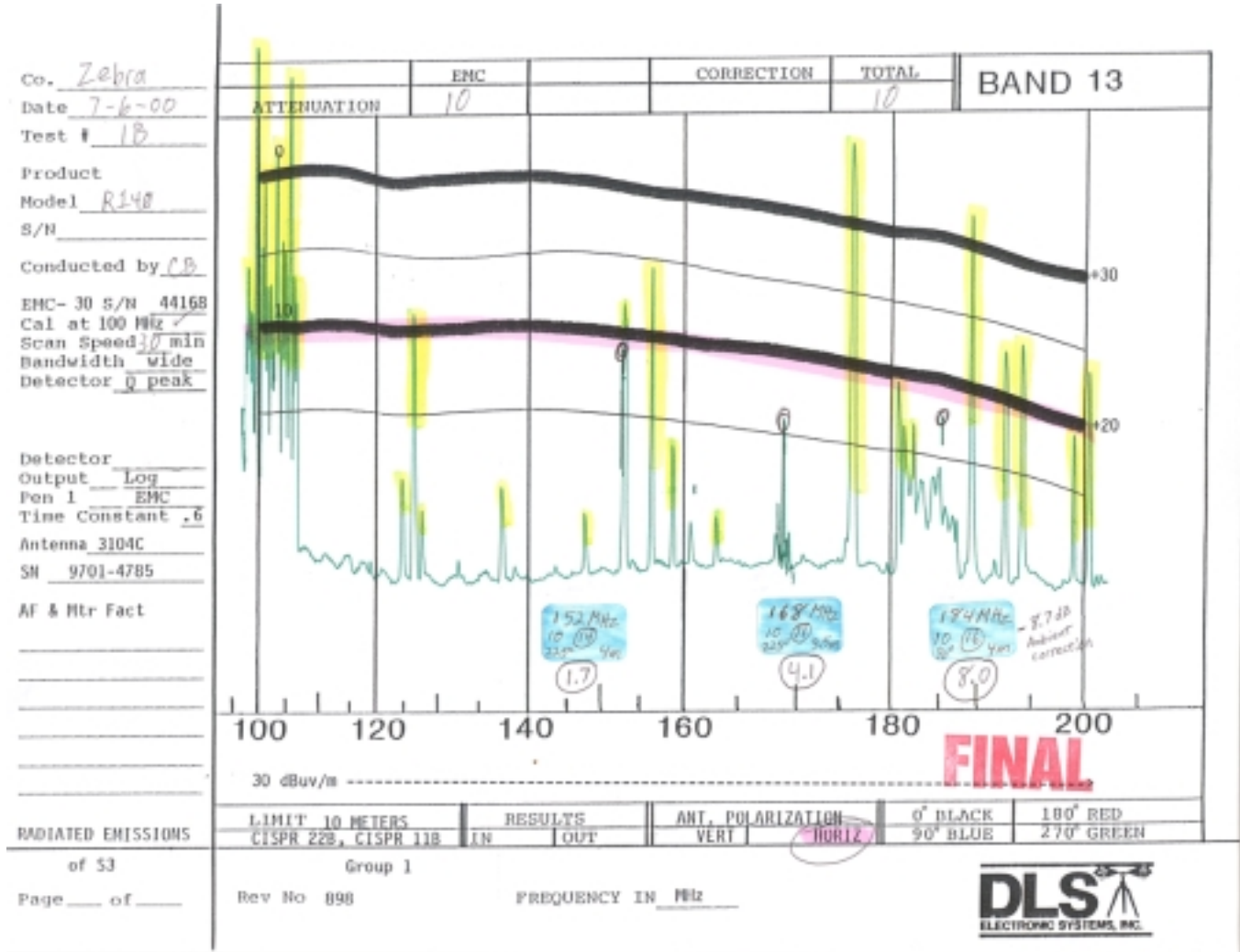




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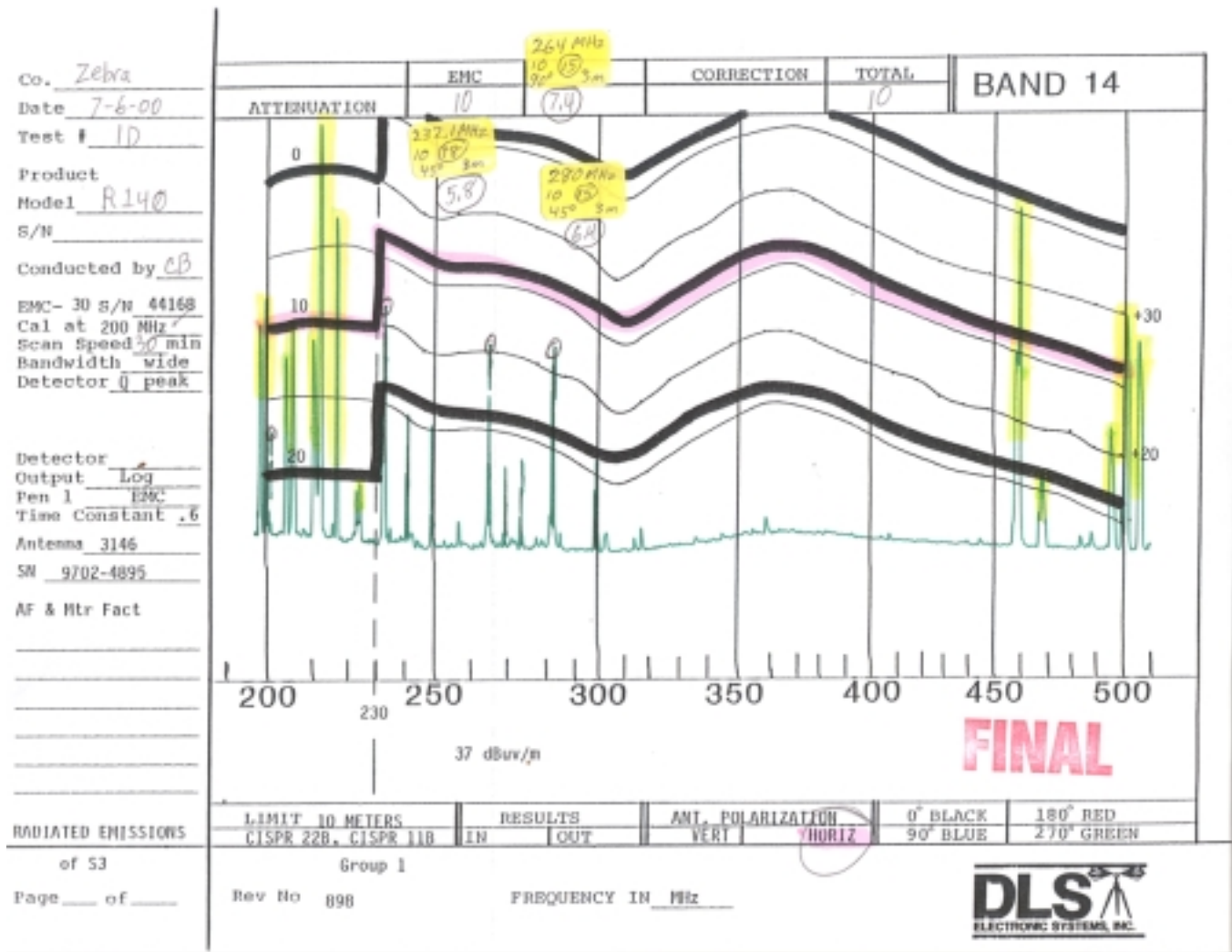






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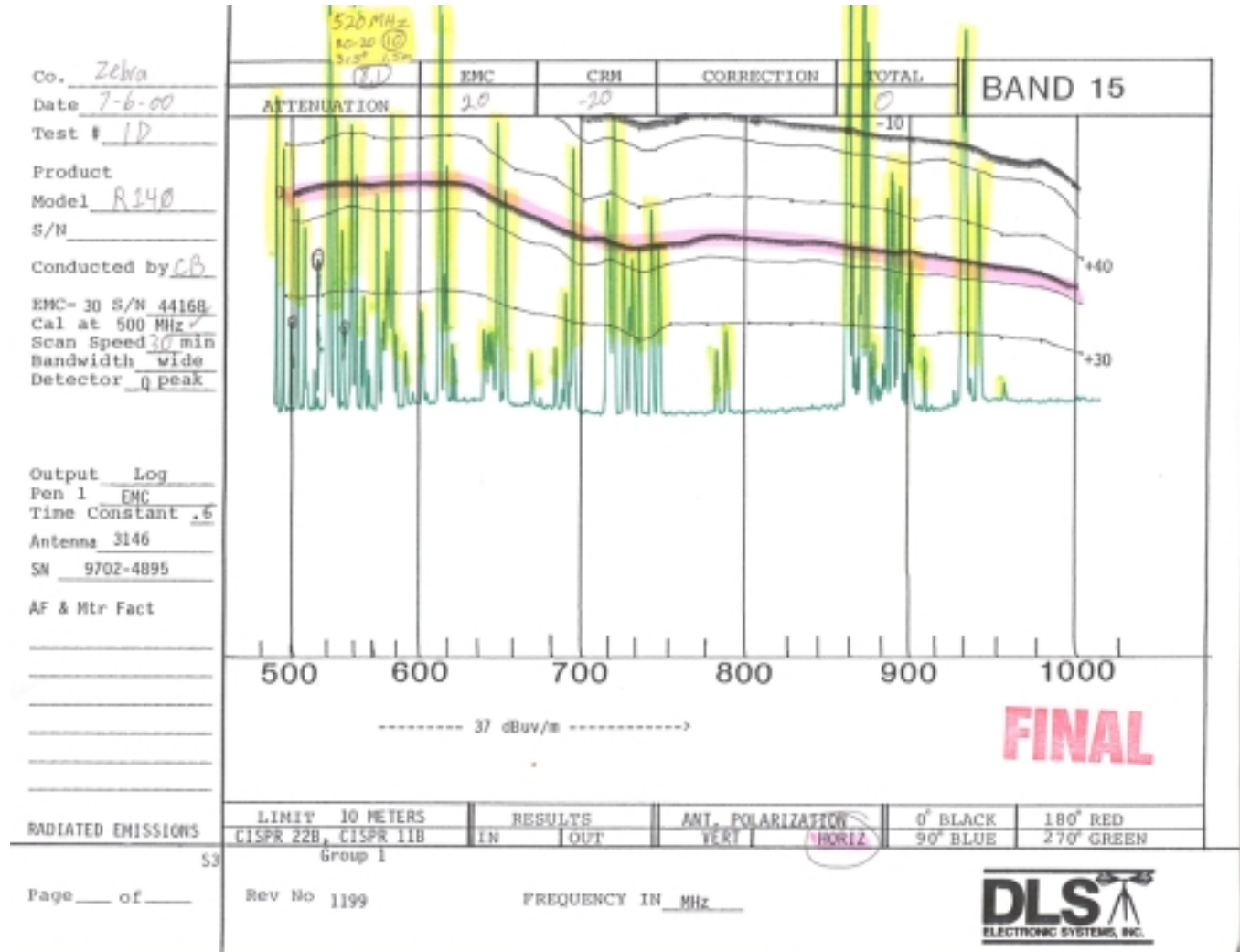
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8.0 FREQUENCY STABILITY - PART 2.1055a (Temperature)

The frequency stability was measured from -30° to +50° centigrade at intervals of 10° centigrade throughout the range. Prior to each frequency measurement, the equipment was left alone for a sufficient period of time (approximately 30 minutes or more) to allow the components of the Zebra R140 oscillator circuitry to stabilize. The following information was taken:

FREQUENCY STABILITY FOR TEMPERATURE VARIATION IN MHz:

-30°	0
-20°	0
-10°	0
0°	0
+10°	0
+20°	0
+30°	0
+40°	0
+50°	0

Worst Case Variance:

0 Hz

As stated in Part 74, Section 74.861 e-4 the Frequency Tolerance and Margin for this range are as follows:

Frequency Tolerance: = **0%**

Ambient Frequency: = **0**

0 * 0% = **0.00 Hz**

See FCC ID: OCTOEM-MSR2 for test data.



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GRAPHS TAKEN FOR FREQUENCY

STABILITY WHEN VARYING THE

TEMPERATURE

PART 2.1055A

See FCC ID: OCTOEM-MSR2 for test data.



9.0 FREQUENCY STABILITY - PART 2.1055d (Voltage)

The frequency stability of Zebra R140 was measured by varying the primary supply voltage from 85% to 115% of nominal value for all equipment other than hand carried battery equipment.

FREQUENCY STABILITY FOR VOLTAGE VARIATION:

85%	0
100%	0
115%	0

See FCC ID: OCTOEM-MSR2 for test data.

FREQUENCY STABILITY FOR HAND HELD DEVICES:

For hand carried, battery powered equipment, the supply voltage was reduced to the battery operating end point specified by the manufacturer. Readings were taken at the reduced end point and with a fresh battery:

Fresh Battery versus Battery end point:

Frequency #1 **0 Hz**
Frequency #2 **0 Hz**
Frequency #3 **0 Hz**
Frequency #4 **0 Hz**
Frequency #5 **0 Hz**
Frequency #6 **0 Hz**

As stated in Part 74, Section 74.861 e-4 the Frequency Tolerance and Margin for this range are as follows:

Frequency Tolerance: 0%

Limit: 0.00 Hz

See FCC ID: OCTOEM-MSR2 for test data.



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GRAPHS TAKEN FOR FREQUENCY

STABILITY WHEN VARYING THE

PRIMARY SUPPLY VOLTAGE

PART 2.1055d

See FCC ID: OCTOEM-MSR2 for test data.



10.0 PHOTO INFORMATION AND TEST SET-UP

The test set-up can be seen on the accompanying photo page.

Item 0 Zebra R140

FCC ID#: OCTOEM-MSR2 SN: NA

Item 1 Non-shielded AC Power Line. 1.5m

Item 2 Shielded Serial Cable with Metal Shells. 2m

Item 3 Shielded Parallel Cable with Metal Shells. 2m

Item 4

Item 5

Item 6

Item 7

Item 8

Item 9

Item 10

11.0 CONDUCTED PHOTOS TAKEN DURING TESTING.



12.0 RADIATED PHOTOS TAKEN DURING TESTING





13.0 CHANGE INFORMATION

The following changes were implemented during the testing and must be incorporated into the production units to ensure compliance.

Change 1. Improved connection between both side panels and bottom of chassis.

Change 2. Improved connection between left side panel and top of chassis.

Change 3.

Change 4.

Change 5.



13.0 CHANGE INFORMATION (CON'T)

Change 6.

Change 7.

Change 8.

Change 9.

Change 10.

The responsibility of implementing the changes listed in this report is accepted or I certify that no changes were made

by _____
Signature Title

for _____
Company Name Date



14.0 RESULTS OF TESTS

The emission test results can be seen on pages at the end of this report. Data sheets indicating the open field radiated measurements can also be found with this report. Those points on the radiated charts shown with a yellow mark are background frequencies that were verified during the test.

15.0 CONCLUSION

It was found that the Bar Code Printer with RF ID Tag Reader (Transmitter/Receiver), Model Number R140, S/N NA meets the radio interference emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Sections 15.225, 15.209 and 15.207 for Intentional Radiators operating in the 13.553 MHz to 13.567 MHz Frequency Band. This test report relates only to the items tested.

This report contains the following number of pages.

Text: 26 pages

Data Summary: 3 pages

Charts: 16 pages

TABLE 1 - EQUIPMENT LIST

Test Equipment	Manufacturer/Description	Model Number	Serial Number	Frequency Range	Cal Due Date
*Spectrum Analyzer	Hewlett/Packard	8566B	2240A 02041	25 Hz –22 GHz	4/01
Quasi-Peak Adapter	Hewlett/Packard	85650A	2043A 00121	10 kHz – 1 GHz	4/01
***Spectrum Analyzer	Hewlett/Packard	8591A	3009A 00700	9 kHz- 1.8 GHz	3/01
Receiver	Electrometrics	EMC-25 Mark-III	772	.01-1000 MHz	10/00
Meter Module	Electrometrics	CRM-25	162	.01-1000 MHz	10/00
Receiver	Electrometrics	EMC-25 Mark-III	804	.01-1000 MHz	10/00
Meter Module	Electrometrics	CRM-25	138	.01-1000 MHz	10/00
Receiver	Electrometrics	EMC-25 Mark-III	645	.01-1000 MHz	10/00
Meter Module	Electrometrics	CRM-25	116	.01-1000 MHz	10/00
Receiver	Electrometrics	EMC-30 Mark-III	44168	.01-1000 MHz	10/00
Antenna	Electrometrics	BIA-25	2453	20 - 200 MHz	10/00
Antenna	Electrometrics	LPA-25	1114	200 - 1000 MHz	10/00
Antenna	Electrometrics	BIA-25	2614	20 - 200 MHz	10/00
Antenna	Electrometrics	LPA-25	1205	200 - 1000 MHz	10/00
Antenna	Electrometrics	BIA-25	4785	20 - 200 MHz	10/00
Antenna	Electrometrics	LPA-25	4895	200 - 1000 MHz	10/00
Antenna	EMCO	6502	143	.01-30 MHz	10/00

*Firmware Version 29.9.86 Software Version 85864C Rev A

**Firmware Version 14.1.85 Software Version 85864C Rev A

***Firmware Version 5.1.3 Software Version 82301-12029 Rev C

I/O Initial Calibration Only