



***EMC Measurement / Technical Report***

***FCC Test Specification*** : Certification for FCC Part 15, Subpart C §15.249

***Manufacturer*** : Zebra Technologies Corporation

***Equipment Under Test*** : Wireless Printer  
Model No. P2222

***Test Report No.*** : FR1179

***Purchase Order No.*** : E51350

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## EMC Measurement / Technical Report

**Document No. FR1179**

**From**

**Garwood Laboratories, Inc.  
World Compliance Division**

**Test for**

**Zebra Technologies Corporation  
Wireless Printer  
Model No. P2222**

WRITTEN BY	REVIEWED BY	REVIEWED BY
<i>Arnulfo Tapia Sr. EMC Technician</i>	<i>Robert Lynch Quality Manager</i>	<i>Ed Nakauchi EMC Engineer NARTE, Certified</i>

<i>Test Personnel</i>	<i>Test Dates</i>
Arnulfo Tapia- Sr. EMC Technician	20 July 1999

<b>Test Facility</b> <b>Address</b> <b>City, State, Zip Code</b> <b>Phone</b> <b>Fax</b>	Garwood Laboratories, Inc.-OC 565 Porter Way Placentia, CA 92870 (714) 572-2027 (714) 572-2025
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## TABLE OF CONTENTS

<b>MEASUREMENT/TECHNICAL REPORT SUMMARY</b>	4
<b>1. GENERAL INFORMATION</b>	5
1.1 Product Description	5
1.2 Related Submittal(s)/ Grant(s)	5
1.3 Tested System Details	5
1.4 Test Methodology	6
1.5 Test Facility	7
<b>2. PRODUCT LABELING</b>	8
2.1 FCC ID Label	8
2.2 Location of Label on EUT	8
2.3 Information to User	8
<b>3. SYSTEM TEST CONFIGURATION</b>	9
3.1 Justification	9
3.2 EUT Exercise Software/Equipment	9
3.3 Special Accessories	9
3.4 Equipment Modifications	9
3.5 Configuration of Tested System	10
3.6 Details of Tested System	10
<b>4. BLOCK DIAGRAMS OF EUT</b>	11
<b>5. TEST MEASUREMENT PHOTOS</b>	12
<b>6. TEST DATA</b>	13
6.1 Conducted Emissions Limits	13
6.2 Conducted Emissions Results	13
6.3 Radiated Emissions Limits	14
6.4 Radiated Emissions Results	15
6.5 Field Strength Calculation	16
<b>APPENDIX A - TEST EQUIPMENT USED</b>	17
<b>APPENDIX B - SUPPLEMENTAL TEST DATA</b>	18
<b>ATTACHMENTS</b>	21



## MEASUREMENT / TECHNICAL REPORT SUMMARY

<b>Manufacturer Company</b> <b>Address</b> <b>City, State, Zip</b> <b>Country</b> <b>Contact Name</b> <b>Phone</b> <b>Fax</b>	Zebra Technologies 1001 Flynn Road Camarillo, CA 93012 USA Zaven Mangassarian 805-578-1247 805-581-7247
<b>Type of Authorization</b>	Certification for an Intentional Radiator
<b>Applicable FCC Rules</b>	Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 0 to 19 (10-1-98 Edition). The following subparts are applicable to the results in this test report:  Part 15, Subpart C – Intentional Radiators §15.249 Operation within the bands 902-928MHz, 2400-2483.5MHz, 5725-5875MHz, & 24.0-24.25GHz § 15.201 Equipment authorization requirement § 15.203 Antenna requirement § 15.207 Conducted limits § 15.209 Radiated emission limits; general requirements Part 2, Subpart J – Equipment Authorization Procedures Certification sections
<b>Equipment Under Test</b>	Wireless Printer Model No. P2222
<b>Summary of Data</b>	The EUT complied with all the applicable FCC rules as listed above. Note 1. The conducted emissions test was not performed and does not apply since the EUT derives its operating voltage from a rechargeable battery. 2. The EUT had previously been tested to and complied with the general radiated emission requirements.
<b>EMC Test Laboratory</b> <b>Facility</b> <b>Address</b> <b>City, State, Zip Code</b> <b>Country</b> <b>Contact Name</b> <b>Title</b> <b>Phone</b> <b>Fax</b>	Garwood Laboratories Incorporated World Compliance Division 565 Porter Way Placentia, CA 92870 USA Jason Armstrong General Manager (714) 572-2027 (714) 572-2025



## 1. General Information

### 1.1 Product Description

<b><i>Equipment Under Test</i></b>	Wireless Printer Model No. P2222
<b><i>Description</i></b>	The EUT is a portable direct thermal printer specifically designed for printing labels , tags, or continuous receipts from any DOS, Windows, or ASCII-based compatible computer. The EUT derives its operating voltage from a rechargeable battery. The antenna of the EUT is permanently installed.
<b><i>Clock Frequencies</i></b>	14.7456MHz, Transmitting Frequency - 916.5MHz

### 1.2 Related Submittal(s)/ Grant(s)

Peripherals tested with the EUT, which contain FCC ID numbers can be located in the table in Section 3.6 of this report.

### 1.3 Tested System Details

The Tested System was configured with all typical peripherals (or terminations) and operated to generate maximum emissions during the test. Refer to Section 3.5 for the Test Configuration and Section 3.6 the table lists all the details for Tested System components and cabling information. FCC ID numbers are included if available for a tested system component.



#### **1.4 Test Methodology**

The test for unwanted emissions was performed according to the general provisions of ANSI C63.4-1992 (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).

The EUT was setup on a non-conductive table, 1.0 x 1.5m, in the Open Area Test Site. The test for unwanted emissions was performed at an EUT to receiving antenna distance of 3 meters. The radiated emissions were maximized by rotating the turntable 360 degrees and varying the antenna height from 1 to 4 meters. The field strength of the fundamental frequency and harmonics, up to the 10<sup>th</sup> harmonic, were measured utilizing a BiLog and Double Ridge Guide Horn antenna. Measurements were made in both, vertical and horizontal antenna polarizations.



**Garwood Laboratories, Inc. - World Compliance Division**  
*Electromagnetic Compatibility*

## **1.5 Test Facility**

The open area test site (OATS) and measurement facilities used to collect the test data are located at Garwood Laboratories, Inc. World Compliance Division test facility in Placentia, CA. This facility has been fully described in a report submitted to the FCC and accepted in a letter dated 29 January 1999 (31040/SIT 1300F2) registration #90681.

**The test facility is also recognized and accredited from following accreditation organizations:**

<b>Acemark Europe, Ltd.</b>	Laboratory Number: 0007	Dated: 03/17/97
	<i>ISO Guide 25, EN45001, and relevant parts of ISO 9002</i>	

<b>Industry Canada</b>	Reference: IC 3298	Dated: 03/11/99
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<b>I<sup>2</sup>T</b>	Certificate Number: 99-051	Dated: 05/05/99
<i>(Interference Tech International)</i>	CE Mark for European Country	

<b>NVLAP</b>	NVLAP Lab Code: 200119-0	Effective Through
<i>(NIST)</i>	CISPR, FCC, AUSTEL	12/31/99

<b>VCCI</b>	Registration #'s C574, C575, C576, R561	Effective Through
		02/04/00
<i>(Voluntary Control Council for Interference by Information Technology Equipment)</i>		



## 2. Product Labeling

### 2.1 FCC ID Label

All devices authorized under the certification procedures are required to display an identification label showing the FCC Identifier (FCC ID) under which they are authorized.

Example:

<b>FCC ID: MX5-P2222</b>
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### 2.2 Location of Label on EUT

The label shall be located in a conspicuous place on the device consistent with the requirements of Section §15.19 of FCC CFR 47.

### 2.3 Information to user

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

- (a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

**NOTE:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

- (b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

**NOTE:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/ TV technician for help.





### **3. System Test Configuration**

#### **3.1 Justification**

The EUT was used in a system configured for testing in a typical fashion, as a customer would normally use it.

#### **3.2 EUT Exercise Software/Equipment**

The following operating mode was used to exercise the functions of the EUT.  
During testing, the wireless printer was continuously transmitting.

#### **3.3 Special Accessories**

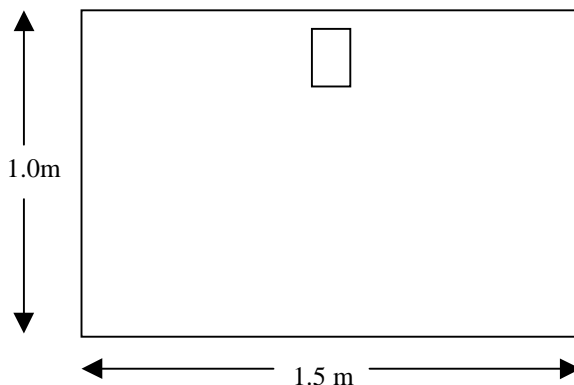
The EUT requires no special accessories to comply with the limits.

#### **3.4 Equipment Modifications**

No modifications were made to achieve the required specification limits.



### 3.5 Configuration of Tested System



The Equipment Under Test (EUT) was tested as a stand-alone unit. During the field strength measurements, the battery was fully charged.

### 3.6 Details of Tested System

The following table lists all of the components of the tested system. FCC ID numbers are included if available for a tested system component. Refer to the table following Tested System Details for cabling information.

<i>Item No.</i>	<i>Manufacturer</i>	<i>Description</i>	<i>Identification Numbers</i>
1	Zebra Technologies	Wireless Printer	Model No: P2222 Serial No.: 5900113

The following table lists all of the cabling details for the tested system. Refer to 3.5 configuration of tested system.

<i>Cabling of The Tested System</i>					
<i>Item No.</i>	<i>Description</i>	<i>Length (m)</i>	<i>Type Shielded-S Unshielded-US</i>	<i>Connected From</i>	<i>Connected To</i>
A	No interfacing cables are required during wireless operation.				



#### **4. BLOCK DIAGRAM(S) OF EUT**

Please refer to the Attachment Section of this report for a Block Diagram of the EUT.



## 5. TEST MEASUREMENT PHOTOS

5.1 Radiated Emissions (Front View)

5.2 Radiated Emissions (Rear View)



## 6. Test Data

### 6.1 Conducted Emissions Limits

<i>FCC Part 15, Subpart C, §15.207</i>	
<i>Frequency Range (MHz)</i>	<i>Class B Limit (dBμV)</i>
0.45 to 1.705	48
1.705 to 30.0	48

### 6.2 Conducted Emissions Results

The conducted emissions test was not performed and does not apply since the EUT derives its operating voltage from a rechargeable battery.



### 6.3 Radiated Emissions Limits

<i>FCC Part 15, Subpart C, § 15.249</i>		
<i>Fundamental frequency</i>	<i>Field Strength of Fundamental (millivolts/meter)</i>	<i>Field Strength of Harmonics (microvolts/meter)</i>
902 – 928 MHz	50	500
2400 – 2486.5 MHz	50	500
5725 – 5875 MHz	50	500
24.0 – 24.25 MHz	250	2500

The applicable limits for the wireless printer are those listed for fundamental frequencies falling within the band of 902 – 928 MHz.



## 6.4 Radiated Emissions Results

The following table lists the fundamental and harmonic emission frequencies, spectrum analyzer measured levels, correction factor (includes cable loss, preamplifier gain and antenna factor), the corrected reading, and the specification limit.

EUT Name: Wireless Printer Model No. P2222

Test Requirement: Field Strength of Emissions from Intentional Radiators

(Reference: FCC PT.15, Subpart C, §15.249)

Fundamental Frequency tuned at: 916.5 MHz

Antenna Polarity (V or H)	Frequency (MHz)	S.A. Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	FCC Limit 3 meters (μV/m)
V	916.5	82.4	6.8	89.2	28,840	50,000.0
H	916.5	81.0	6.8	87.8	24,547	50,000.0
V	1833	56.7	-3.51	Peak - 53.19 Avg. - 35.48	Peak - 456.6 Avg. - 59.4	500.0
H	1833	58.7	-3.51	Peak - 55.19 Avg. - 37.47	Peak - 574.8 Avg. - 74.7	500.0
V	2749	18.9	3.53	22.43	13.2	500.0
H	2749	21.4	3.53	24.93	17.6	500.0
V	3666	18.2	8.30	26.5	21.1	500.0
H	3666	18.8	8.30	27.1	22.6	500.0
V	4582	25.7	11.42	37.12	71.8	500.0
H	4582	22.8	11.42	34.22	51.4	500.0
V	5499	23.9	17.48	41.38	117.2	500.0
H	5499	20.9	17.48	38.38	83.0	500.0
V	6416	NDS	-	NDS	NDS	500.0
H	6416	NDS	-	NDS	NDS	500.0
V	7332	NDS	-	NDS	NDS	500.0
H	7332	NDS	-	NDS	NDS	500.0
V	8249	NDS	-	NDS	NDS	500.0
H	8249	NDS	-	NDS	NDS	500.0
V	9165	NDS	-	NDS	NDS	500.0
H	9165	NDS	-	NDS	NDS	500.0

- All readings are peak with the specified bandwidth unless otherwise stated.

- As per §15.249 (d) & as shown in §15.35 (b), for frequencies above 1000MHz, the field strength limits set forth in §15.249 (a) are based on average limits. However, the peak field strength of any emission should not exceed the maximum permitted average limits specified by more than 20dB under any condition of modulation.

- Average emission measurements were employed and the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions were followed.



## 6.5 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 reading. The basic equation with a sample calculation is as follows:

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

Where: FS = Field strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier gain

Example:

Assume a receiver reading of 52.5 dB $\mu$ V is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dB $\mu$ V/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dB}\mu\text{V/m}$$





## APPENDIX A - TEST EQUIPMENT USED

The absolute performance calibration of equipment requiring calibration is performed on an as needed basis in accordance with ANSI/NCSL Z540-1-1994, which supersedes MIL-STD 45662A. However, calibration periods do not exceed one (1) year. The test equipment is capable of making measurements within tolerances of at least +/- 2dB amplitude and +/- 2% frequency deviation. Equipment certifications showing traceability to NIST (National Institute of Standards and Technology) are maintained on file at Garwood Laboratories, Inc. offices in Placentia CA. All equipment is checked and verified for proper operation before and after each series of tests.

### A.1 Specific Equipment Used

<i>Test Instrument</i>	<i>Mfg / Model No.</i>	<i>Serial No.</i>	<i>Cal. Due Date</i>
<b>Radiated Emissions Test</b>			
Spectrum Analyzer	Hewlett Packard / 8566B	2848A17517	04/22/00
BiLog Antenna	Chase / CBL6111A	1823	07/09/00
Preamplifier (30-1000MHz)	ISCI / ZFL-2000	017	03/05/00
RF Coax Cable	Times Microwave / LMR-600	030	03/05/00
Preamplifier (Above 1000MHz)	Hewlett Packard / 8449B	0357	10/14/99
Double Ridge Guide Horn Antenna	Emco / 3115	3008A00357	01/27/00

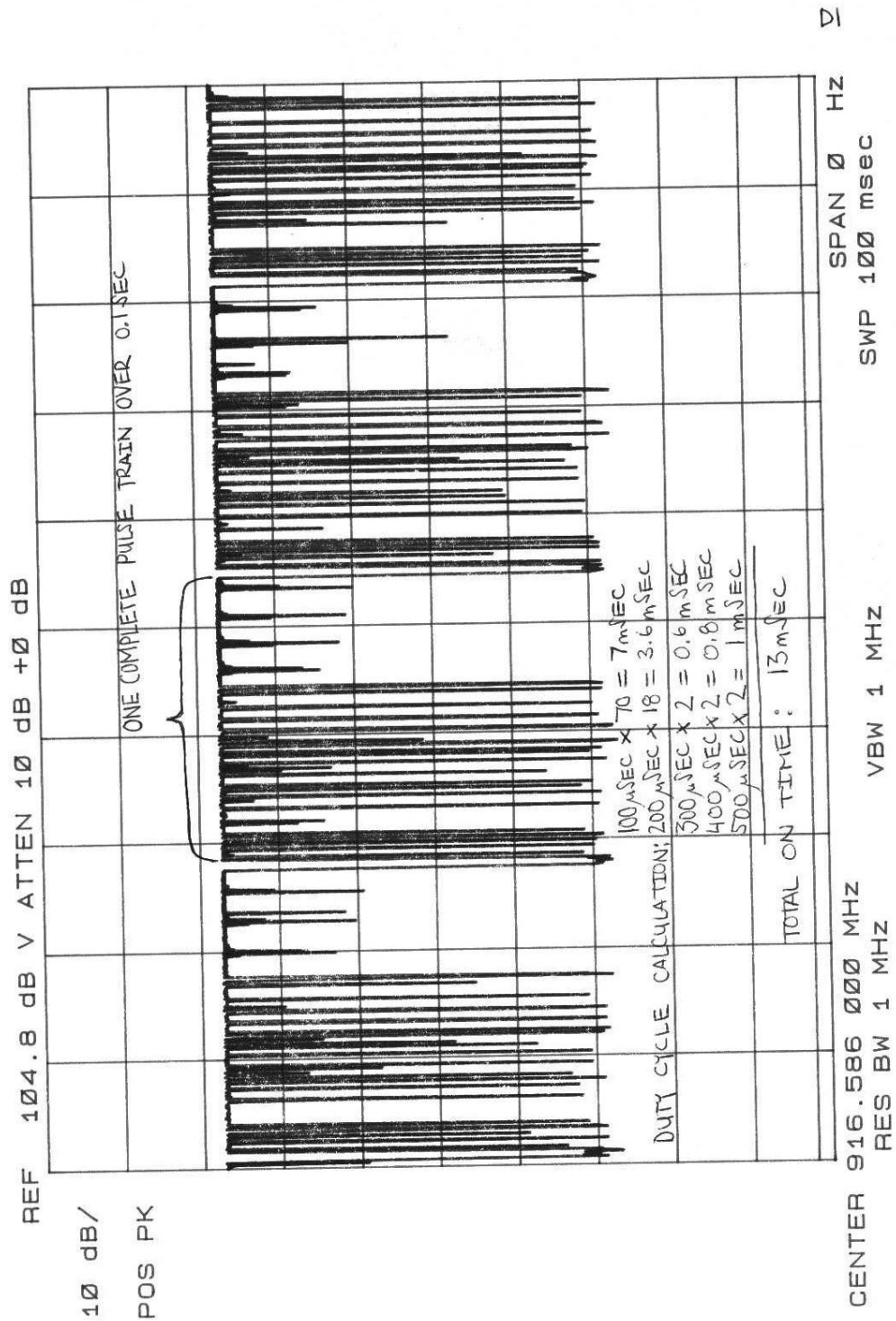


**APPENDIX B – SUPPLEMENTAL TEST DATA**

<i>Test Type</i>	<i>Basic Standard</i>	<i>Details</i>	<i>Data Format</i>	<i>Page No.</i>
Averaging Pulsed Emissions	FCC Pt.15 Subpart C §15.249 (d) Ref §15.35	Pulse Train over 100ms Pulse Train over 50ms	Plotted Plotted	D1 D2

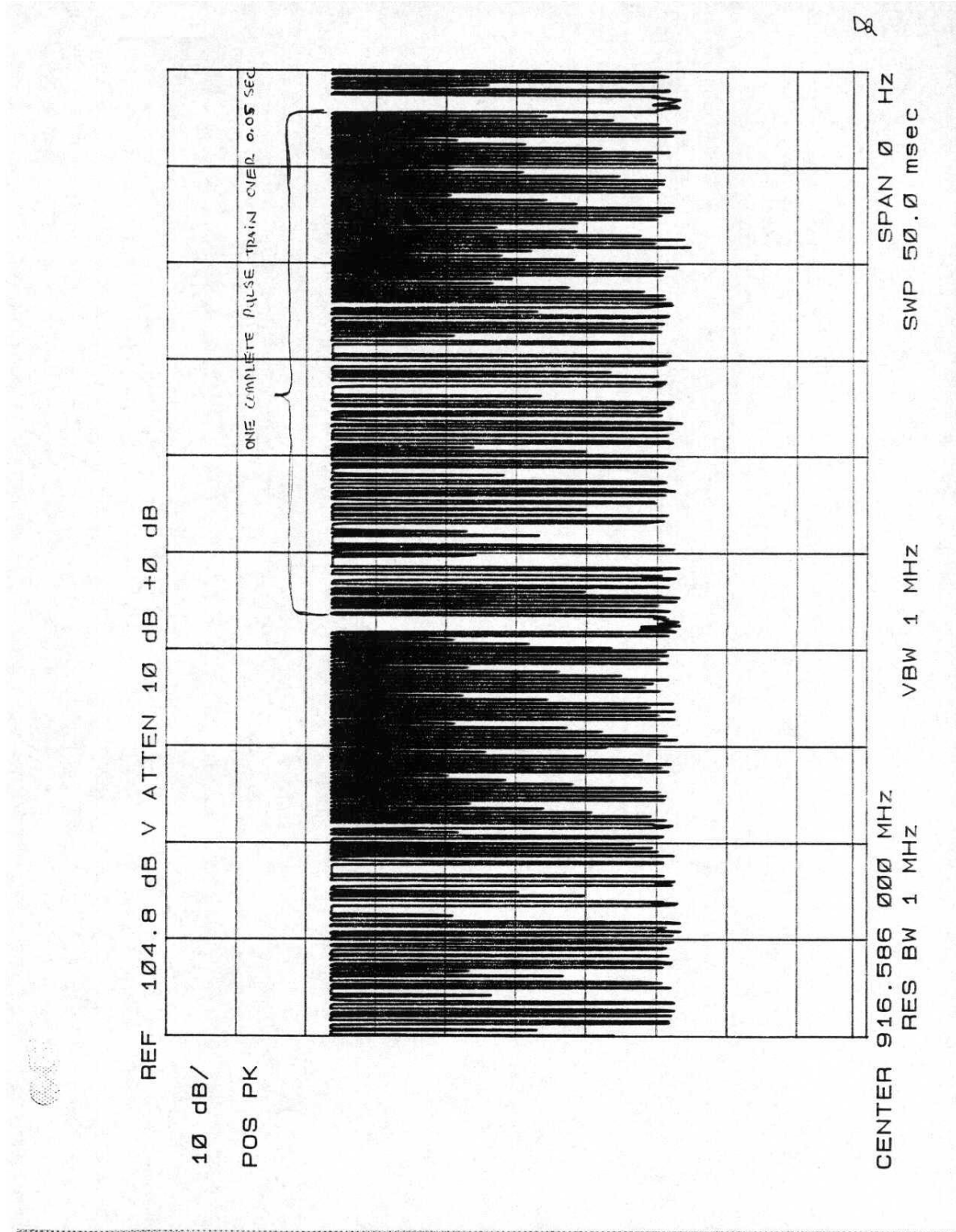


D1





D2





## ATTACHMENTS

### INDEX OF ATTACHMENTS

<i>Description of Contents</i>	<i>Page No.</i>
Block Diagram	Exhibit 1
Users Manual	Exhibit 2
Circuit Schematics	Exhibit 3