Exhibit N: Technical Report for MICN0042

FCC ID: QYT-4120

Measurement/Technical Report

Micron Communications, Inc.
Microstamp Interrogator

FCC ID: LC6-4120

April 20, 1999

This report concerns (check one): Original Grant___ Class II Change_X___

Equipment Type: Microstamp Interrogator/Intentional Radiator

Deferred grant requested per 47 CFR 0.457 (d)(1)(ii)? yes_____ no X

If yes, defer until: N/A
date

Micron Communications Inc. agrees to notify the Commission by: N/A
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37: yes_____ no_X_

If no, assumed Part 15, Subpart C for intentional radiators - new 47 CFR [10-1-02] provision.

Report prepared by:

Northwest EMC, Inc.
120 South Elliott Road, Suite 300
Newberg, OR 97132
(503) 537-0728
fax: (503) 537-0735

Table of Contents

1.0 General Information

1.1 Product Description

Manufactured By..... Micron Communications Inc.

Address.....3176 South Denver Way Boise, ID 83705

Test Requested By: .....Joe Hofstra

Model ..... Microstamp Interrogator Model 4120

FCC ID.....LC6-4120

Serial Number(s)..... Beta 26

Date of Test ..... April 20, 1999

Job Number MICN0042

EUT Description:

Class II Permissive Changes:
The EUT application for certification was originally granted on June 16, 1998. This is an application for authorization of the following Class II permissive changes:
Add the following antennas to the grant:

1. Antennas America Model M2.45FPT
2. Antennas America Model SPJ-M2.45SPT
3. Micron Model ANP-C-116/97/22
4. Shell RFID Upper Antenna Array

***Though the antennas are greater than 6dBi, these are only used in professional installations where cable (loss) is specified to work with the antennas and stay within the approved output power rating.**

1.2 Related Submittals/Grants

The EUT was originally certified on June 16, 1998. This is an application for authorization of Class II permissive changes.

1.3 Tested System Details

EUT and Peripherals
Setup #1

Item	FCC ID	Description and Serial No.
EUT	LC6-4120	Micron Communications Microstamp Interrogator Serial No. BETA26.
PC		Hewlett Packard Vectra 500 Series, Serial No. US71559022
Monitor		Gateway Model Crystal Scan 1024 NI, Serial No. 195B085643.
Keyboard		Dell Model SK-1000 REW, Serial No. M950977760
Mouse		Logitech Model M-S35, Serial No. LZA70901172.
Tx/Rx Controller		Micron, Serial No. S700307
Antenna		Shell RFID Upper Antenna Array M/A Com ANP-C-116*
DC Power Supply		Instek, Model PC3030D, Serial No. 9565963. *

*See Appendix II for additional information on antennas.

Cables:
Setup #1

Item	Descriptions
Mouse	1.6 meters in length. Unshielded and no ferrites attached. PS/2 style connectors. Permanently attached to the mouse and connected to the mouse port of the PC.
Keyboard	2.0 meters in length. Unshielded and no ferrites attached. PS/2 style connectors. Permanently attached to the keyboard and connected the keyboard port of the PC.
Video	1.1 meters in length. Unshielded and no ferrites attached. Plastic connector backshells. Permanently attached to the monitor and connected to the video port of the PC.
Serial Cable	1.5 meter in length. Shielded and no ferrites attached. Metal and Plastic connector backshells. Connected from the Tx/Rx Controller (metal) to the COM1 port of the PC(plastic).
PC Power	1.8 meters in length. Shielded and no ferrites attached. Plastic connector. Connected from the PC to the AC mains.
Monitor Power	1.6 meters in length. Shielded and no ferrites attached. Plastic connector. Connected from the Monitor to the AC mains.
Tx/Rx Controller Power	1.6 meters in length. Shielded and no ferrites attached. Plastic connector. Connected from the PC to the AC mains.
Antenna (2)	Twelve Times Microwave LMR-100A cables, 3.0 meters in length. Shielded and no ferrites attached. Metal connectors. Connected from the Tx/Rx Controller and receive ports on the EUT to the antennas.
Power Supply Power	2.2 meters in length. Unshielded and no ferrites attached. AC Connector. Connected from the Power Supply to the AC Mains.

EUT and Peripherals
Setup #2

Item	FCC ID	Description and Serial No.
EUT	LC6-4120	Micron Communications Microstamp Interrogator Serial No. BETA26.
PC		Hewlett Packard Vectra 500 Series, Serial No. US71559022
Monitor		Gateway Model Crystal Scan 1024 NI, Serial No. 195B085643.
Keyboard		Dell Model SK-1000 REW, Serial No. M950977760.
Mouse		Logitech Model M-S35, Serial No. LZA70901172.
Tx/Rx Controller		Micron, Serial No. S700307
Antenna (4)		Antennas America Model M2.45FPT. *
Antenna (2)		Antennas America Model SPJ-M2.45SPT *
DC Power Supply		Instek, Model PC3030D, Serial No. 9565963. *

*See Appendix if for additional information on antennas.

Cables:
Setup #2

Item	Descriptions
Mouse	1.6 meters in length. Unshielded and no ferrites attached. PS/2 style connectors. Permanently attached to the mouse and connected to the mouse port of the PC.
Keyboard	2.0 meters in length. Unshielded and no ferrites attached. PS/2 style connectors. Permanently attached to the keyboard and connected the keyboard port of the PC.
Video	1.1 meters in length. Unshielded and no ferrites attached. Plastic connector backshells. Permanently attached to the monitor and connected to the video port of the PC.
Serial Cable	1.5 meter in length. Shielded and no ferrites attached. Metal and Plastic connector backshells. Connected from the Tx/Rx Controller (metal) to the COM 1 port of the PC(plastic).
PC Power	1.8 meters in length. Shielded and no ferrites attached. AC Connector. Connected from the PC to the AC Mains.
Monitor Power	1.6 meters in length. Shielded and no ferrites attached. AC Connector Connected from the Monitor the AC Mains
Power Supply Power	2.2 meters in length. Unshielded and no ferrites attached. AC Connector. Connected from the Power Supply to the AC Mains.
Tx/Rx Controller Power	1.6 meters in length. Shielded and no ferrites attached. AC Connector. Connected from the Tx/Rx Controller to the AC Mains.
Antenna (4)	Eight Times Microwave LMR-100A cables, 3.0 meters in length. Shielded and no ferrites attached. Metal connectors. Connected from the Tx/Rx Controller and receive ports on the EUT to the antennas.
Antenna (2)	Four cables, 1.0 meters in length. Shielded and no ferrites attached. Metal connectors. Connected from the Tx/Rx Controller and receive ports on the EUT to the antennas.

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 (1992). Radiated testing was performed at an antenna to EUT distance of 3 meters. Please reference Appendix I for further detail on Test Methodology.

1.5 Test Facility

The Open Area Test Site and conducted measurement facility used to collect the radiated and conducted data is located at

Northwest EMC, Inc.
30475 NE Trails End Ln
Newberg, OR 97132
(503) 537-5566
Fax: 537-5562

The Open Area Test Site, and conducted measurement facility is located in Newberg, OR, at the address shown above. These sites have been fully described in reports filed with the FCC (Federal Communications Commission), and accepted by the FCC in letters maintained in our files.

Northwest EMC, Inc. is recognized under the United States Department of Commerce, National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. NVLAP Lab Code: 200059-0.

Northwest EMC, Inc. has been assessed and accredited by NEMKO (Norwegian testing and certification body) for European emissions and immunity testing. As a result of NEMKO's laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification (Authorization No. ELA 119).

2.0 Product Labeling

Figure 2.1 FCC ID Label

FCC ID Label has not changed from original grant

Figure 2.2 Location of Label on EUT

Location of Label has not changed from original grant

3.0 System Test Configuration

3.1 Justification

Data was taken with the EUT configured for low, mid, and high XMIT frequencies.

The EUT has six identical transmit ports and six identical receive ports. Only one transmit or one receive port can be active at a time. Port 6 and Port 1 exhibited the highest emission levels and were used for antenna measurements.

Since the only change was the antennas, only out of band radiated emissions testing was performed to validate the Class II Permissive Change.

Radiated emissions were measured with all the antenna ports connected to a coaxial cable and antenna.

3.2 EUT Exercise Software

A **Windows™** based program called *Microstamp Standard Assist V3.45 (3.4600)* was run off the hard-disk in the PC. It allows the EUT to be configured for hopping or no hopping (C/W) transmit modes. A typical frequency application is simulated by a routine called "Dots Animation".

3.3 Special Accessories

A power/serial test cable was used.

3.4 Equipment Modifications

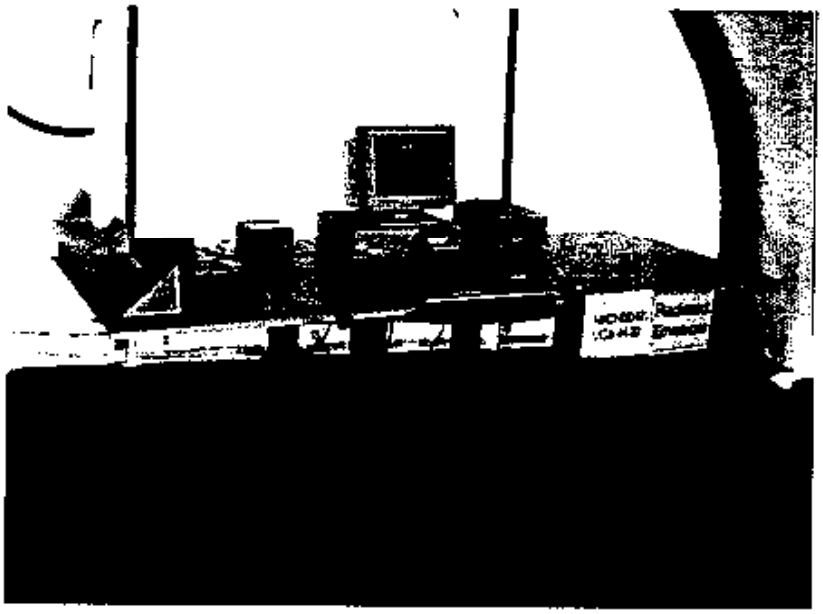
None.

4.0 Block Diagram of EUT

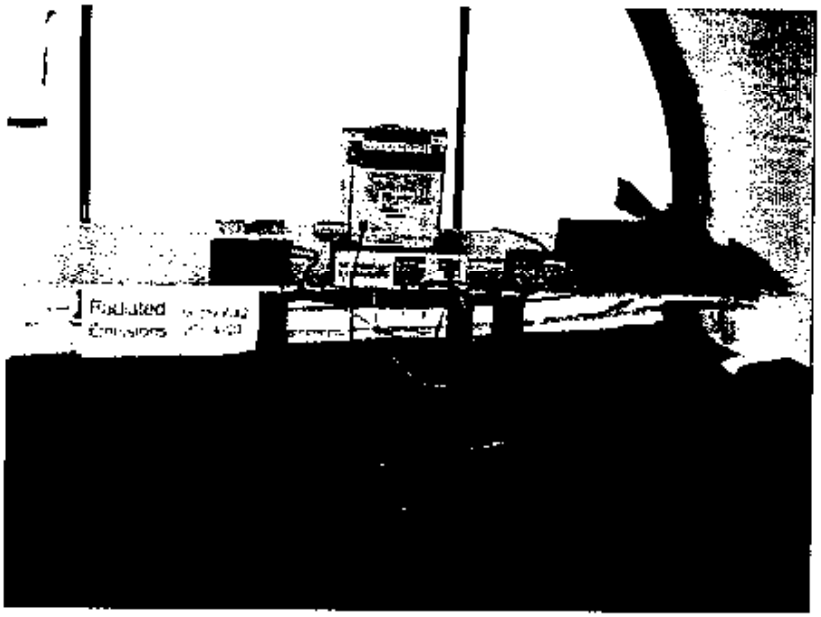
Block Diagram has not changed from original grant

5.0 Photographs

Radiated Emissions, Test Setup.

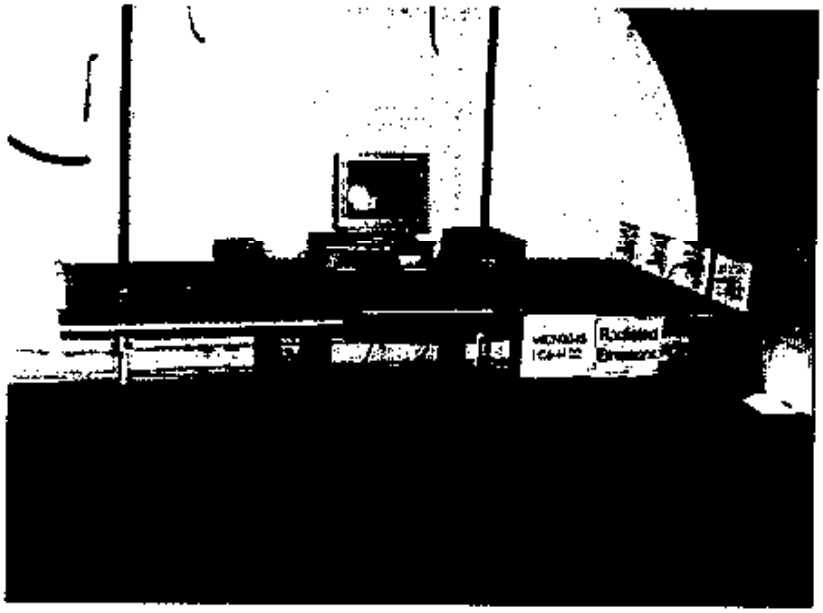


Radiated Emissions, Test Setup.

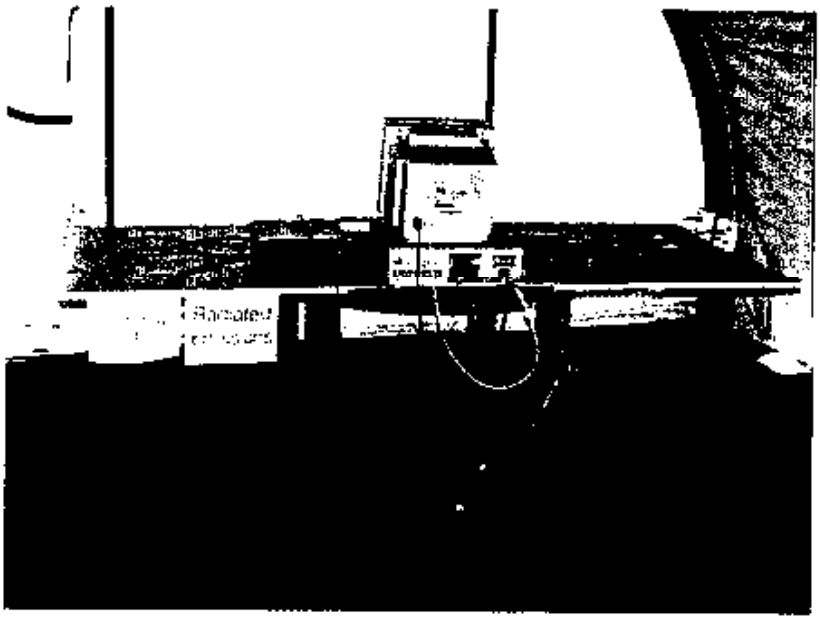


5.0 Photographs

Radiated Emissions Test Setup



Radiated Emissions Test Setup



6.0 Radiated Emissions Data

6.1 The following data lists the most significant emission frequencies, total (corrected) levels, and specification margins for each set of antennas tested. Correction factors, antenna height, table azimuth, etc., are contained in the data sheets immediately following. Explanation of the correction factors is given in paragraph 6.2 of this report. Complete graphs and data sheets may be referenced on the following pages. Minimum margins are listed below:

Micron Model ANP-C-116/97/22 (Setup #1) – Low Level

Frequency (MHz)	Detection	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)*	Polarization
12018.000	AV	44.5	54.0	9.5	Horizontal
12018.000	AV	44.4	54.0	9.6	Vertical
7210.000	AV	42.9	54.0	11.1	Vertical
9614.000	AV	38.9	54.0	15.1	Horizontal
9614.000	AV	38.8	54.0	15.2	Vertical
7210.000	AV	38.0	54.0	16.0	Horizontal

Judgment: Passed, minimum margin of 9.5 dB.

Micron Model ANP-C-116/97/22 (Setup #1) – Mid Level

Frequency (MHz)	Detection	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)*	Polarization
12209.000	AV	42.3	54.0	11.7	Horizontal
7326.000	AV	42.3	54.0	11.7	Vertical
12209.000	AV	42.1	54.0	11.9	Vertical
7326.000	AV	39.3	54.0	14.7	Horizontal
9768.000	AV	39.1	54.0	14.9	Vertical
9768.000	AV	39.0	54.0	15.0	Horizontal

Judgment: Passed, minimum margin of 11.7 dB.

Micron Model ANP-C-116/97/22 (Setup #1) – High Level

Frequency (MHz)	Detection	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)*	Polarization
7441.000	AV	43.4	54.0	10.6	Vertical
12402.000	AV	43.0	54.0	11.0	Horizontal
12402.000	AV	42.8	54.0	11.2	Vertical
7441.000	AV	41.1	54.0	12.9	Horizontal
9921.000	AV	39.2	54.0	14.8	Vertical
9921.000	AV	39.1	54.0	14.9	Horizontal

Judgment: Passed, minimum margin of 10.6 dB.

6.0 Radiated Emissions Data con't

Antennas America Model M2.45FPT (4) and Model SPJ-M2.45SPT (2) (Setup #2) – Low Level

Frequency (MHz)	Detection	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)*	Polarization
7210.000	AV	47.8	54.0	6.2	Horizontal
7210.000	AV	47.2	54.0	6.8	Vertical
12018.000	AV	43.5	54.0	10.5	Vertical
12018.000	AV	43.4	54.0	10.6	Horizontal
9614.000	AV	38.7	54.0	15.3	Vertical
9614.000	AV	38.5	54.0	15.5	Horizontal

Judgment: Passed, minimum margin of 6.2 dB.

Antennas America Model M2.45FPT (4) and Model SPJ-M2.45SPT (2) (Setup #2) – Mid Level

Frequency (MHz)	Detection	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)*	Polarization
7326.000	AV	43.7	54.0	10.3	Vertical
7326.000	AV	43.5	54.0	10.5	Horizontal
12210.000	AV	42.0	54.0	12.0	Horizontal
12210.000	AV	41.8	54.0	12.2	Vertical
9767.000	AV	38.9	54.0	15.1	Vertical
9767.000	AV	38.9	54.0	15.1	Horizontal

Judgment: Passed, minimum margin of 10.3 dB.

Antenna America Model M2.45FPT (4) and Model SPJ-M2.45SPT (2) (Setup #2) – High Level

Frequency (MHz)	Detection	Total Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)*	Polarization
7440.000	AV	43.2	54.0	10.8	Horizontal
12400.000	AV	42.8	54.0	11.2	Vertical
12400.000	AV	42.8	54.0	11.2	Horizontal
7440.000	AV	42.3	54.0	11.7	Vertical
9921.000	AV	39.2	54.0	14.8	Horizontal
9921.000	AV	39.0	54.0	15.0	Vertical

Judgment: Passed, minimum margin of 10.8 dB.

Test Personnel:

Tester Signature

Typed/Printed Name: Dan Haas

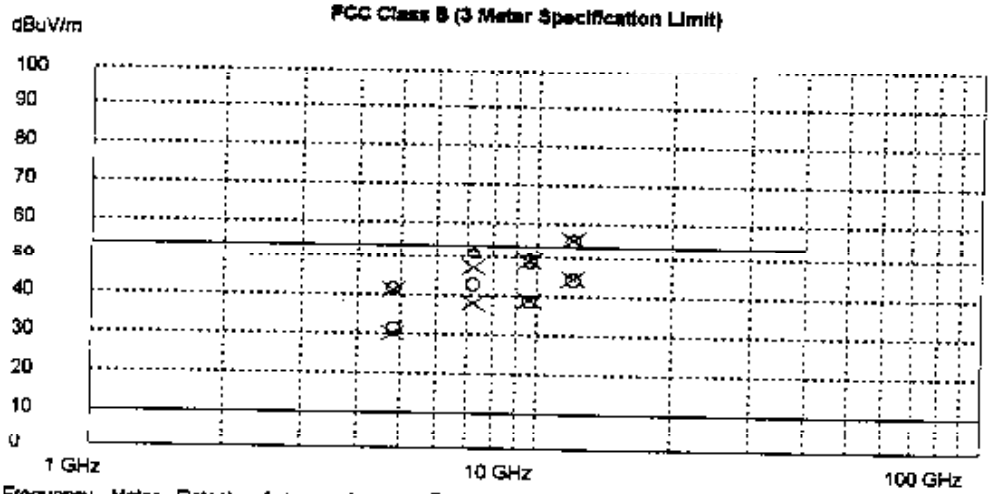
Northwest EMC, Inc.

Version 98.2, Mar. 1998

EUT Name:	LC6-4120 w/ new antenna
Serial Number:	
Manufacturer:	Micron Communications Inc.
Job Number:	MICN0042
Test Date:	04-20-1999
Tested By:	Dan Hess, TE-04
Test Distance:	3 meters.
Comments:	Run #1, Setup #1, Low level.

Horizontal= X
Vertical = O

FCC Class B (3 Meter Specification Limit)



Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Antenna Horizontal Vertical	Preamp Gain (dB)	Cable Loss (dB)	Adjusted Level (dBuV/m)	Spec Limit (dBuV/m)	Table Azimuth (degree)	Antenna Height (meters)	Compared (To Limit) (dB)
12018.000	41.3	PK	40.8	HHRN	33.6	7.4	55.9	54.0	0.0	1.0	1.9
12018.000	41.0	PK	40.8	VHRN	33.6	7.4	55.6	54.0	0.0	1.0	1.6
7210.000	42.8	PK	37.1	VHRN	32.8	4.6	51.5	54.0	45.0	1.5	-2.5
9614.000	38.7	PK	39.3	HHRN	34.8	5.8	49.0	54.0	0.0	1.0	-5.0
9614.000	38.7	PK	39.3	VHRN	34.8	5.8	49.0	54.0	0.0	1.0	-5.0
7210.000	36.3	PK	37.1	HHRN	32.8	4.6	47.2	54.0	45.0	1.0	-6.8
12018.000	29.9	AV	40.8	HHRN	33.6	7.4	44.5	54.0	0.0	1.0	-9.5
12018.000	29.8	AV	40.8	VHRN	33.6	7.4	44.4	54.0	0.0	1.0	-9.6
7210.000	34.0	AV	37.1	VHRN	32.8	4.6	42.9	54.0	45.0	1.5	-11.1
4807.000	38.6	PK	35.0	VHRN	35.0	3.0	41.6	54.0	180.0	1.0	-12.4
4807.000	38.3	PK	35.0	HHRN	35.0	3.0	41.3	54.0	45.0	1.0	-12.7
9614.000	28.6	AV	39.3	HHRN	34.8	5.8	38.9	54.0	0.0	1.0	-15.1
9614.000	28.5	AV	39.3	VHRN	34.8	5.8	38.8	54.0	0.0	1.0	-15.2
7210.000	29.1	AV	37.1	HHRN	32.8	4.6	38.0	54.0	45.0	1.0	-16.0
4807.000	28.5	AV	35.0	VHRN	35.0	3.0	31.5	54.0	180.0	1.0	-22.5
4807.000	27.2	AV	35.0	HHRN	35.0	3.0	30.2	54.0	45.0	1.0	-23.8

Temperature 70F 45% Humidity

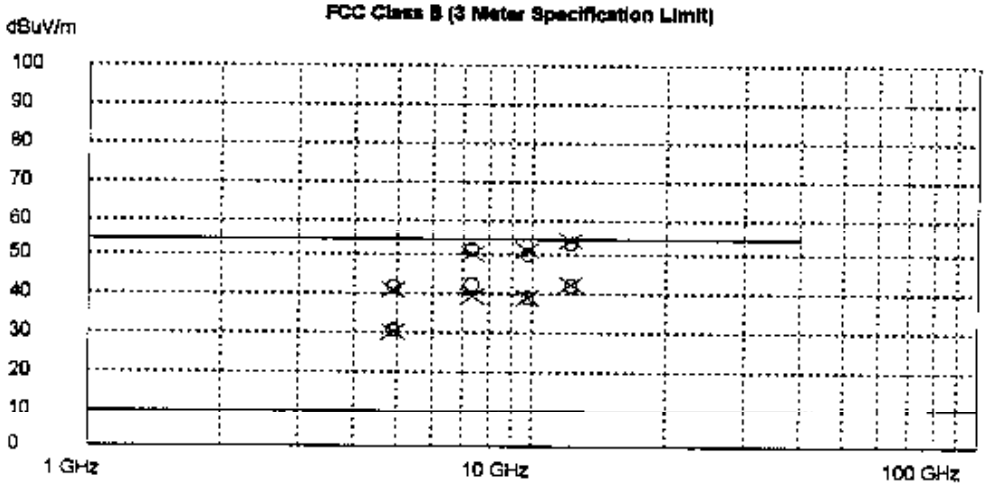
Northwest EMC, Inc.

Version 98.2. Mar. 1998

EUT Name:	**LC6-4120 w/ new antenna**
Serial Number:	
Manufacturer:	**Micron Communications,Inc.**
Job Number:	**MICN0042**
Test Date:	**04-20-1998**
Tested By:	**Dan Haas, TE-04**
Test Distance:	**3 meters.**
Comments:	**Run #1. Setup #1, Mid Level**

Horizontals X
Vertical = O

FCC Class B (3 Meter Specification Limit)



Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Antenna Horizontal Vertical	Preamp Gain (dB)	Cable Loss (dB)	Adjusted Level (dBuV/m)	Spec Limit (dBuV/m)	Table Azimuth (degree)	Antenna Height (meters)	Compared (To Limit) (dB)
12209.000	39.0	PK	40.7	HHRN	33.6	7.5	53.6	54.0	0.0	1.0	0.4
12209.000	38.3	PK	40.7	VHRN	33.6	7.5	52.9	54.0	0.0	1.0	-1.1
7326.000	42.2	PK	37.4	VHRN	33.0	4.7	51.3	54.0	0.0	1.5	-2.7
9768.000	40.4	PK	39.4	HHRN	34.6	5.9	51.1	54.0	0.0	1.0	-2.9
9768.000	39.4	PK	39.4	VHRN	34.6	5.9	50.1	54.0	0.0	1.0	-3.9
7326.000	41.0	PK	37.4	HHRN	33.0	4.7	50.1	54.0	45.0	1.0	-3.9
12209.000	27.7	AV	40.7	HHRN	33.6	7.5	42.3	54.0	0.0	1.0	-11.7
7326.000	33.2	AV	37.4	VHRN	33.0	4.7	42.3	54.0	0.0	1.5	-11.7
12209.000	27.5	AV	40.7	VHRN	33.6	7.5	42.1	54.0	0.0	1.0	-11.9
4884.000	38.6	PK	35.2	VHRN	35.0	3.0	41.8	54.0	10.0	1.0	-12.2
4884.000	37.7	PK	35.2	HHRN	35.0	3.0	40.9	54.0	10.0	1.0	-13.1
7326.000	30.2	AV	37.4	HHRN	33.0	4.7	39.3	54.0	45.0	1.0	-14.7
9768.000	28.4	AV	39.4	VHRN	34.6	5.9	39.1	54.0	0.0	1.0	-14.9
9768.000	28.3	AV	39.4	HHRN	34.6	5.9	39.0	54.0	0.0	1.0	-15.0
4884.000	27.5	AV	35.2	VHRN	35.0	3.0	30.7	54.0	10.0	1.0	-23.3
4884.000	26.9	AV	35.2	HHRN	35.0	3.0	30.1	54.0	10.0	1.0	-23.9

Temperature 70F 45% Humidity

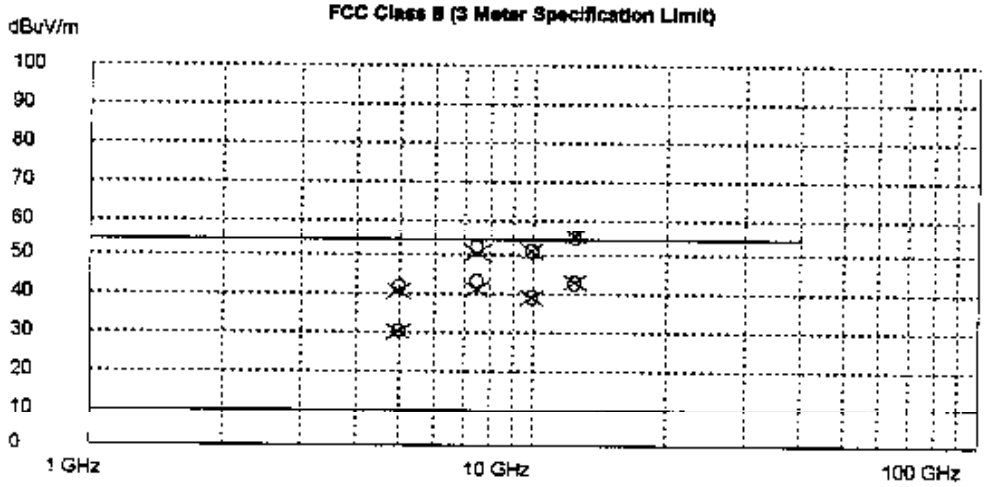
Northwest EMC, Inc.

Version 98.2, Mar. 1998

EUT Name:	**LC6-4120 w/ new antenna**
Serial Number:	
Manufacturer:	**Micron Communications,Inc.**
Job Number:	**MICN0042**
Test Date:	**04-20-1998**
Tested By:	**Dan Haas, TE-04**
Test Distance:	**3 meters,**
Comments:	**Run #1, Setup #1, High Level**

Horizontal= X
Vertical = O

FCC Class B (3 Meter Specification Limit)



Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Antenna Horizontal Vertical	Preamp Gain (dB)	Cable Loss (dB)	Adjusted Level (dBuV/m)	Spec Limit (dBuV/m)	Table Azimuth (degree)	Antenna Height (meters)	Compared (To Limit) (dB)
12402.000	40.3	PK	40.6	HHRN	33.6	7.6	54.9	54.0	0.0	1.0	0.9
12402.000	40.0	PK	40.6	VHRN	33.6	7.6	54.6	54.0	0.0	1.0	0.6
7441.000	42.7	PK	37.7	VHRN	33.2	4.7	51.9	54.0	135.0	1.1	-2.1
9921.000	40.0	PK	39.5	VHRN	34.5	6.0	51.0	54.0	0.0	1.0	-3.0
9921.000	40.0	PK	39.5	HHRN	34.5	6.0	51.0	54.0	0.0	1.0	-3.0
7441.000	41.3	PK	37.7	HHRN	33.2	4.7	50.5	54.0	45.0	1.0	-3.5
7441.000	34.2	AV	37.7	VHRN	33.2	4.7	43.4	54.0	135.0	1.1	-10.6
12402.000	28.4	AV	40.6	HHRN	33.6	7.6	43.0	54.0	0.0	1.0	-11.0
12402.000	28.2	AV	40.6	VHRN	33.6	7.6	42.8	54.0	0.0	1.0	-11.2
4960.000	38.6	PK	35.4	VHRN	35.0	3.0	42.0	54.0	140.0	1.0	-12.0
7441.000	31.9	AV	37.7	HHRN	33.2	4.7	41.1	54.0	45.0	1.0	-12.9
4960.000	37.3	PK	35.4	HHRN	35.0	3.0	40.7	54.0	135.0	1.0	-13.3
9921.000	28.2	AV	39.5	VHRN	34.5	6.0	39.2	54.0	0.0	1.0	-14.8
9921.000	28.1	AV	39.5	HHRN	34.5	6.0	39.1	54.0	0.0	1.0	-14.9
4960.000	27.1	AV	35.4	VHRN	35.0	3.0	30.5	54.0	140.0	1.0	-23.5
4960.000	26.8	AV	35.4	HHRN	35.0	3.0	30.2	54.0	135.0	1.0	-23.8

Temperature 70F 45% Humidity

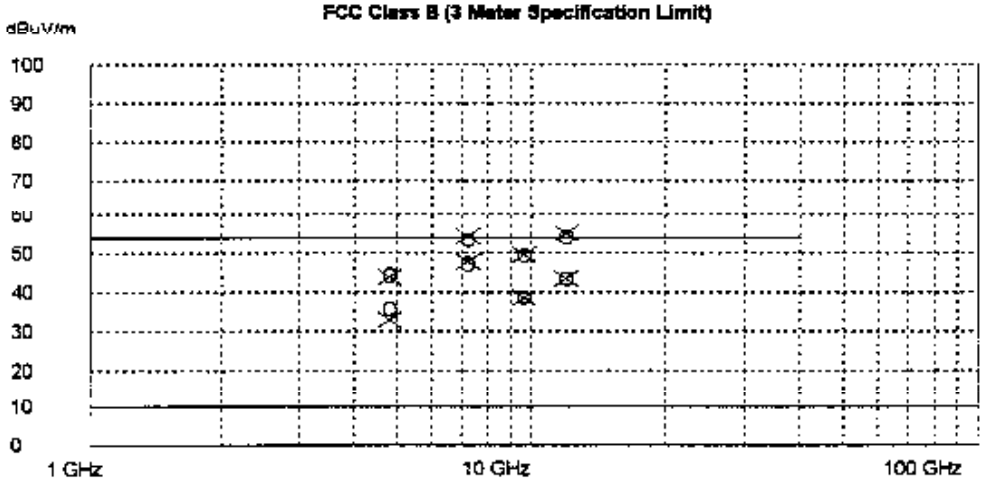
Northwest EMC, Inc.

Version 98.2, Mar. 1998

EUT Name:	**LC6-4120 w/ new antenna**
Serial Number:	
Manufacturer:	**Micron Communications,Inc.**
Job Number:	**MICN0042**
Test Date:	**04-20-1999**
Tested By:	**Dan Haas, TE-04**
Test Distance:	**3 meters.**
Comments:	**Run #1. Setup #2, Low Level**

Horizontal= X
Vertical = O

FCC Class B (3 Meter Specification Limit)



Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Antenna Horizontal Vertical	Preamp Gain (dB)	Cable Loss (dB)	Adjusted Level (dBuV/m)	Spec Limit (dBuV/m)	Table Azimuth (degree)	Antenna Height (meters)	Compared (To Limit) (dB)
12018.000	40.5	PK	40.8	HHRN	33.6	7.4	55.1	54.0	0.0	1.0	1.1
7210.000	45.4	PK	37.1	HHRN	32.8	4.6	54.3	54.0	260.0	1.0	0.3
12018.000	39.6	PK	40.8	VHRN	33.6	7.4	54.2	54.0	0.0	1.0	0.2
7210.000	44.5	PK	37.1	VHRN	32.8	4.6	53.4	54.0	260.0	1.1	-0.6
9614.000	39.3	PK	39.3	HHRN	34.8	5.8	49.6	54.0	0.0	1.0	-4.4
9614.000	39.2	PK	39.3	VHRN	34.8	5.8	49.5	54.0	0.0	1.0	-4.5
7210.000	38.9	AV	37.1	HHRN	32.8	4.6	47.8	54.0	260.0	1.0	-6.2
7210.000	38.3	AV	37.1	VHRN	32.8	4.6	47.2	54.0	260.0	1.1	-6.8
4807.000	41.3	PK	35.0	VHRN	35.0	3.0	44.3	54.0	260.0	1.1	-9.7
4807.000	40.8	PK	35.0	HHRN	35.0	3.0	43.8	54.0	270.0	1.1	-10.2
12018.000	28.9	AV	40.8	VHRN	33.6	7.4	43.5	54.0	0.0	1.0	-10.5
12018.000	28.8	AV	40.8	HHRN	33.6	7.4	43.4	54.0	0.0	1.0	-10.6
9614.000	28.4	AV	39.3	VHRN	34.8	5.8	38.7	54.0	0.0	1.0	-15.3
9614.000	28.2	AV	39.3	HHRN	34.8	5.8	38.5	54.0	0.0	1.0	-15.5
4807.000	32.8	AV	35.0	VHRN	35.0	3.0	35.8	54.0	260.0	1.1	-18.2
4807.000	29.9	AV	35.0	HHRN	35.0	3.0	32.9	54.0	270.0	1.1	-21.1

Temperature 70F 45% Humidity

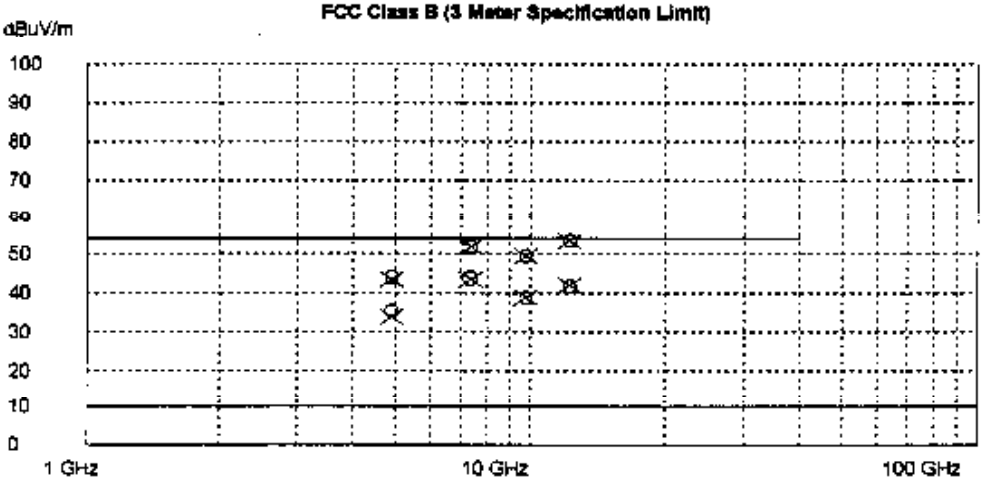
Northwest EMC, Inc.

Version 98.2. Mar. 1998

EUT Name:	**LC6-4120 w/ new antenna**
Serial Number:	
Manufacturer:	**Micron Communications,Inc.**
Job Number:	**MICN0042**
Test Date:	**04-20-1998**
Tested By:	**Dan Haas, TE-04**
Test Distance:	**3 meters.**
Comments:	**Run #1. Setup #2, Mid Level**

Horizontal= X
Vertical = O

FCC Class B (3 Meter Specification Limit)



Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Antenna Horizontal Vertical	Preamp Gain (dB)	Cable Loss (dB)	Adjusted Level (dBuV/m)	Spec Limit (dBuV/m)	Table Azimuth (degree)	Antenna Height (meters)	Compared (To Limit) (dB)
12210.000	38.8	PK	40.7	VHRN	33.6	7.5	53.4	54.0	0.0	1.0	-0.6
12210.000	38.7	PK	40.7	HHRN	33.6	7.5	53.3	54.0	0.0	1.0	-0.7
7326.000	42.7	PK	37.4	VHRN	33.0	4.7	51.8	54.0	270.0	1.4	-2.2
7326.000	42.7	PK	37.4	HHRN	33.0	4.7	51.8	54.0	310.0	1.4	-2.2
9767.000	39.0	PK	39.4	VHRN	34.6	5.9	49.7	54.0	0.0	1.0	-4.3
9767.000	38.7	PK	39.4	HHRN	34.6	5.9	49.4	54.0	0.0	1.0	-4.6
4884.000	41.0	PK	35.2	VHRN	35.0	3.0	44.2	54.0	260.0	1.1	-9.8
7326.000	34.6	AV	37.4	VHRN	33.0	4.7	43.7	54.0	270.0	1.4	-10.3
7326.000	34.4	AV	37.4	HHRN	33.0	4.7	43.5	54.0	310.0	1.4	-10.5
4884.000	40.3	PK	35.2	HHRN	35.0	3.0	43.5	54.0	260.0	1.2	-10.5
12210.000	27.4	AV	40.7	HHRN	33.6	7.5	42.0	54.0	0.0	1.0	-12.0
12210.000	27.2	AV	40.7	VHRN	33.6	7.5	41.8	54.0	0.0	1.0	-12.2
9767.000	28.2	AV	39.4	VHRN	34.6	5.9	38.9	54.0	0.0	1.0	-15.1
9767.000	28.2	AV	39.4	HHRN	34.6	5.9	38.9	54.0	0.0	1.0	-15.1
4884.000	32.2	AV	35.2	VHRN	35.0	3.0	35.4	54.0	260.0	1.1	-18.6
4884.000	30.6	AV	35.2	HHRN	35.0	3.0	33.8	54.0	260.0	1.2	-20.2

Temperature 70F 45% Humidity

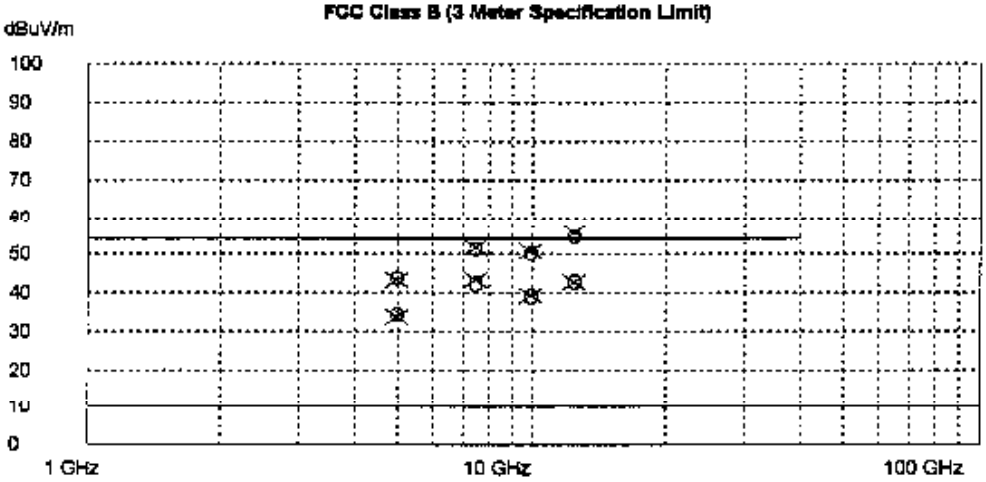
Northwest EMC, Inc.

Version 98.2, Mar. 1999

EUT Name:	LC6-4120 w/ new antenna
Serial Number:	
Manufacturer:	Micron Communications,Inc.
Job Number:	MICN0042
Test Date:	04-20-1999
Tested By:	Dan Haas, TE-04
Test Distance:	3 meters.
Comments:	Run #1. Setup #2, High Level

Horizontal= X
Vertical = O

FCC Class B (3 Meter Specification Limit)



Frequency (MHz)	Meter Reading (dBuV)	Detector	Antenna Factor (dB/m)	Antenna Horizontal Vertical	Preamp Gain (dB)	Cable Loss (dB)	Adjusted Level (dBuV/m)	Spec Limit (dBuV/m)	Table Azimuth (degree)	Antenna Height (meters)	Compared (To Limit) (dB)
12400.000	40.6	PK	40.6	HHRN	33.6	7.6	55.4	54.0	0.0	1.0	1.4
12400.000	39.9	PK	40.6	VHRN	33.6	7.6	54.5	54.0	0.0	1.0	0.5
7440.000	42.6	PK	37.6	HHRN	33.2	4.7	51.7	54.0	300.0	1.3	-2.3
7440.000	42.1	PK	37.6	VHRN	33.2	4.7	51.2	54.0	300.0	1.1	-2.8
9921.000	39.8	PK	39.5	HHRN	34.5	6.0	50.8	54.0	0.0	1.0	-3.2
9921.000	39.2	PK	39.5	VHRN	34.5	6.0	50.2	54.0	0.0	1.0	-3.8
4960.000	40.4	PK	35.4	VHRN	35.0	3.0	43.8	54.0	300.0	1.2	-10.2
4960.000	39.9	PK	35.4	HHRN	35.0	3.0	43.3	54.0	260.0	1.4	-10.7
7440.000	34.1	AV	37.6	HHRN	33.2	4.7	43.2	54.0	300.0	1.3	-10.8
12400.000	28.2	AV	40.6	VHRN	33.6	7.6	42.8	54.0	0.0	1.0	-11.2
12400.000	28.2	AV	40.6	HHRN	33.6	7.6	42.8	54.0	0.0	1.0	-11.2
7440.000	33.2	AV	37.6	VHRN	33.2	4.7	42.3	54.0	300.0	1.1	-11.7
9921.000	28.2	AV	39.5	HHRN	34.5	6.0	39.2	54.0	0.0	1.0	-14.8
9921.000	28.0	AV	39.5	VHRN	34.5	6.0	39.0	54.0	0.0	1.0	-15.0
4960.000	31.1	AV	35.4	VHRN	35.0	3.0	34.5	54.0	300.0	1.2	-19.5
4960.000	30.4	AV	35.4	HHRN	35.0	3.0	33.8	54.0	260.0	1.4	-20.2

Temperature 70F 45% Humidity

6.1 Field Strength Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured level. The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

where : FS = Field Strength

RA = Measured Level

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV 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 dBuV/meter.

FS = 52.5 + 7.4 + 1.1 - 29 = 32 dBuV/meter
Level in uV/m = Common Antilogarithm [(32 dBuV/m)/20] = 39.8 uV/m

6.2 Measurement Bandwidths

Peak Data

150 kHz - 30 MHz ..... 10 kHz
30 MHz - 1000 MHz ..... 100 kHz
1000 MHz - 10000 MHz ..... 1000 kHz

Quasi-peak Data

150 kHz - 30 MHz ..... 9 kHz
30 MHz - 1000 MHz ..... 120 kHz

Average Data

1000 MHz - 10000 MHz ..... 1000 MHz

Above 1 GHz, all peak radiated measurements used a video bandwidth set to 1 MHz.
Above 1 GHz, all average radiated measurements used a video bandwidth set to 10 Hz.

7.0 Measurement Equipment

Instrument	Model	Serial No.	Freq Range	Last Cal	Cal Due
Spectrum Analyzer	HP 8593E	3414U00634	9 kHz – 2.3 GHz	05/18/98	05/18/99
Horn Antenna	EMCO 3115	4074	1 GHz – 18 GHz	10/03/97	10/03/99
Pre-Amplifier	Miteq.	456374	1 GHz - 20 GHz	07/20/98	07/20/99
High Pass Filter	MicroLab FXRHD-40N	n/a	4 GHz High Pass Filter	NCR	NCR

Appendix I: Measurement Procedures

Each frequency was measured in both the horizontal and vertical antenna polarization's.

The EUT position was maximized for each frequency, for both the horizontal and vertical antenna polarization's, using a remotely controlled turntable.

The antenna height was varied from 1 - 4 meters at each frequency, for both the horizontal and vertical positions to maximize the emission level.

The cable and peripheral positions were manipulated to ensure maximum levels at each frequency for both horizontal and vertical antenna polarization's.

Measurements 30 MHz - 1000 MHz are made at an antenna to EUT distance of 3 meters.

Measurements 1000 MHz - 10 GHz are made at an antenna to EUT distance of 3 meters.

Appendix II: Antenna Information

Antennae: set up #1

Shell RFID Antenna Specification

1. Introduction

This specification details the requirements of the Upper Antenna Array Assemblies used by Shell Oil in retail automotive fueling. These antennas are to be used with a Micron Communications RFID system integrated into existing fuel dispensers. This includes fuel dispensers manufactured by Gilbarco, Schlumberger, Tokheim, and Wayne.

2. RFID System Description

The Micron/Shell dispenser RFID System is comprised of an interrogator (Micron Model 4120), an external power supply, a serial communications cable, antennas connected to the interrogator via coaxial cables, and the RFID tags (both key and car). Each fuel dispenser requires a single interrogator that will support the two fueling sides of the dispenser. Each dispenser side will have its own antenna subsystem. The antenna subsystem is comprised of four (4) antennas. Three antennas will be mounted near the top of the dispenser in it own housing and the fourth is to be mounted near the dispenser display panel (probably inside the dispenser). At the top of the dispenser there will be two transmit antennas and one receive antenna. The fourth antenna, near the display panel, will be a transmit antenna.

3. Electrical Specifications

3.1 Car Tag Antenna Assembly. The Car Tag Antenna Assembly shall consist of two transmit antennas and one receive antenna all in one assembly.

3.1.1 Transmit Left (Label - TX1) & Right (Label - TX2) The specifications for the two transmit antennas in the assembly are identical.

3.1.1.1 Center Frequency. The center frequency of the transmit antennas shall be 2.44 GHz.

3.1.1.2 Bandwidth. The bandwidth of the transmit antennas shall be no less than 150 MHz.

3.1.1.3 Antenna Gain. The antenna gain shall be 10 ± 1 dBi over the bandwidth specified in 3.1.1.2.

3.1.1.4 Pointing Angle. The beam pointing angle down from horizontal shall be 65 ± 1 degrees.

3.1.1.5 E-Plane Beamwidth. The E-Plane beamwidth (up & down) shall be 40 ± 5 Degrees.

3.1.1.6 H-Plane Beamwidth. The H-Plane beamwidth (side to side) shall be 50 ± 5 Degrees.

3.1.1.7 Impedance. The impedance of the antennas shall be 50 Ohms.

3.1.1.8 VSWR. The VSWR shall not exceed 2:1 over the bandwidth specified in 3.1.1.2.

3.1.1.9 Power Handling. The antennas shall be able to withstand a minimum input power level of 1 watt with no damage.

3.1.1.10 Polarization. The polarization of the antennas shall be linear in the vertical orientation.

3.1.1.11 Isolation. The isolation between either transmit antenna and the receive antenna in the same assembly shall be at least 40 dB.

3.1.1.12 2nd and 3rd Harmonic Suppression. The gain at the 2nd and 3rd harmonics will be less than 2 dBi.

3.1.1.13 Side Lobe Suppression. The side lobe suppression shall be more than 20 dB from main beam.

3.1.1.14 Connectors. The connectors shall be female TNC and located as shown in drawing 1.

3.1.2 Receive Center (Label - RX)

3.1.2.1 Center Frequency. The center frequency of the receive antenna shall be 2.44 GHz

3.1.2.2 Bandwidth. The bandwidth of the receive antenna shall be no less than 150 MHz.

3.1.2.3 Antenna Gain. The antenna gain shall be 5 ± 2 dBi over the bandwidth specified in 3.1.1.2.

3.1.2.4 Pointing Angle. The beam pointing angle down from horizontal shall be 65 ± 1 degrees.

3.1.2.5 E-Plane Beamwidth. The E-Plane beamwidth (up & down) shall be 50 ± 5 Degrees.

3.1.2.6 H-Plane Beamwidth. The H-Plane beamwidth (side to side) shall be 50 ± 5 Degrees.

3.1.2.7 Impedance. The impedance of the antenna shall be 50 Ohms.

3.1.2.8 VSWR. The VSWR shall not exceed 2:1 over the bandwidth specified in 3.1.1.2.

3.1.2.9 Power Handling. The antenna shall be able to withstand a minimum input power level of 1 watt with no damage.

3.1.2.10 Polarization. The polarization of the antenna shall be linear in the vertical orientation.

3.1.2.11 Isolation. The isolation between the receive antenna and either transmit antenna in the same assembly shall be at least 40 dB.

3.1.2.12 2nd and 3rd Harmonic Suppression. The gain at the 2nd and 3rd harmonics will be less than 2 dBi.

3.1.2.13 Connectors. The connector shall be female TNC and located as shown in drawing 1.

3.2 Key Tag Antenna (M/ACom ANP-C-116)

3.2.1.1 Center Frequency. The center frequency of the antenna shall be 2.44 GHz.

3.2.1.2 Bandwidth. The bandwidth of the antenna shall be no less than 150 MHz.

3.2.1.3 Antenna Gain. The antenna gain shall be 3 ± 1 dBi over the bandwidth specified in 3.2.1.2.

3.2.1.4 E-Plane Beamwidth. The E-Plane beamwidth (up & down) shall be 80 ± 10 Degrees.

3.2.1.5 H-Plane Beamwidth. The H-Plane beamwidth (side to side) shall be 80 ± 10 Degrees.

3.2.1.6 Impedance. The impedance of the antenna shall be 50 Ohms.

3.2.1.7 VSWR. The VSWR shall not exceed 1.5:1 over the bandwidth specified in 3.2.1.2.

3.2.1.8 Power Handling. The antenna shall be able to withstand a minimum input power level of 1 watt with no damage.

3.2.1.9 Polarization. The polarization of the antenna shall be right hand circular.

3.2.1.10 Axial Ratio. The axial ratio shall be less than 3 dB over the bandwidth specified in 3.2.1.2 and over a beam width of ± 20 degrees.

3.2.1.11 Connectors. The connectors shall be female SMA and located as shown in the attached data sheet.

4. Mechanical Specifications

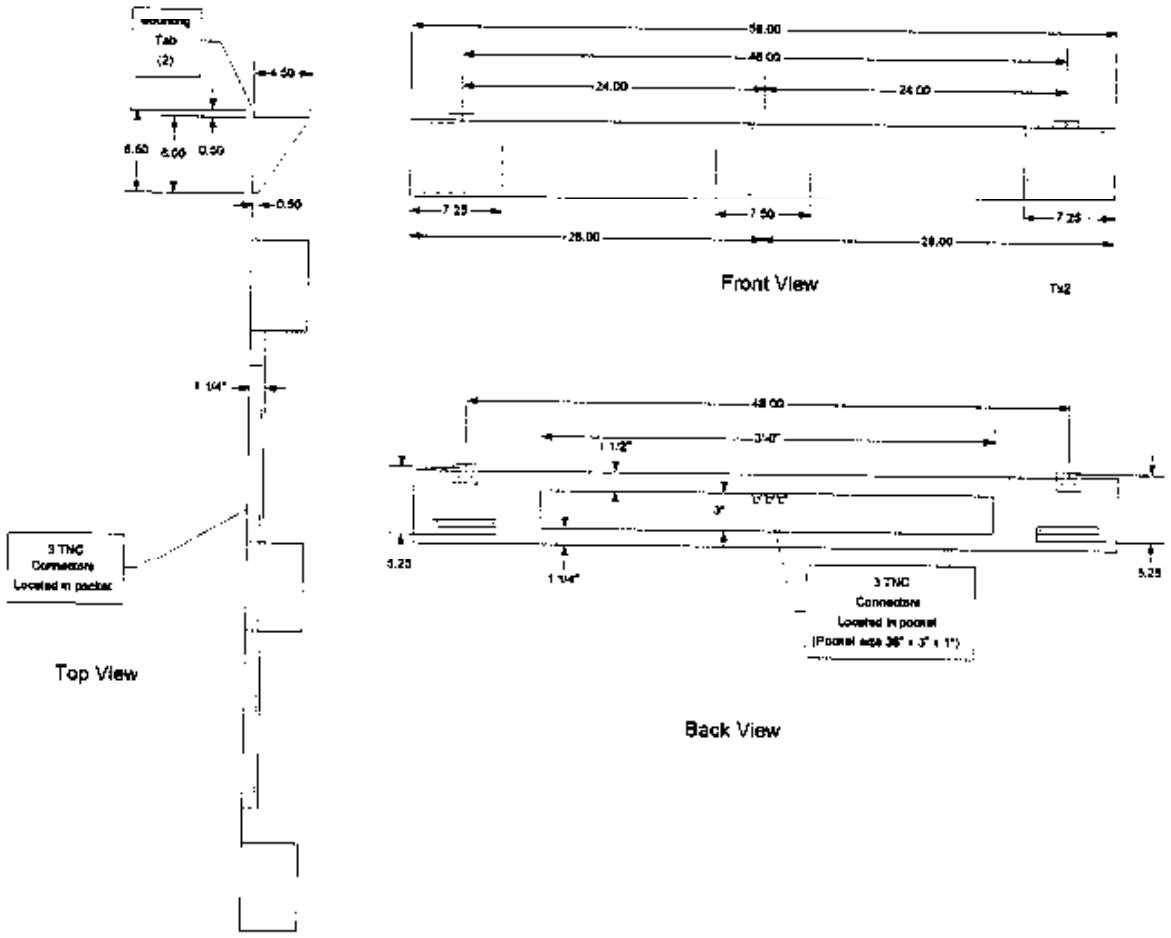
4.1 Car Tag Antenna Assembly.

4.1.1 Dimensions. The dimensions of the antenna array are shown in drawing 1.
4.1.2 Labeling. The antenna connectors will be labeled Tx1, Rx, & Tx2.
4.1.3 Antenna Housing and Radome.
4.1.3.1 Color. The Upper Antenna Array assembly will be enclosed in a radome that is of a specified color(s). The vertical mount shall be painted Shell yellow. The color shall not fade over the life expectancy of the antenna assembly listed in section 4.1.4.
4.1.3.2 Texture. The surface texture of the radome shall be TBD.
4.1.3.3 UV Resistance. The radome shall be UV resistant.
4.1.3.4 Oil & Gas Resistance. The radome shall be resistant to oil & gas.
4.1.3.5 Life Expectancy. The life expectancy for the Upper Antenna Arrays is 15 years. All electrical and mechanical specifications shall be met for this period of time.
4.1.4 Antenna Mounting. The antenna array will be mounted to the spandrel via a mounting plate attached to the spandrel. This plate will serve two purposes, it will provide a template as to where holes are required for mounting the array and it will provide mounting hooks for hanging the array.
4.1.5 Environmental. The antenna assembly shall withstand temperature variations between –40 and +85 degrees centigrade. The antenna assemblies shall also be waterproof.

4.2 Key Tag Antenna.

4.2.1 Dimensions. The dimensions of the Key Tag Antenna are shown in the attached M/Acom data sheet for the ANP-C-116.
4.2.2 Antenna Housing and Radome.
4.2.2.1 Oil & Gas Resistance. TBD
4.2.3 Life Expectancy. The life expectancy is 15 years. All electrical and mechanical specifications shall be met for this period of time.
4.2.4 Antenna Mounting. The Key Tag Antenna will be mounted on a PWB. The antenna should be designed to operate within specifications when spaced back 1 inch from a lexan or Plexiglas face plate.
4.2.5 Environmental. The Key Tag Antenna shall withstand temperature variations between -40 and +85 degrees centigrade. The antenna shall also be waterproof.

Drawing 1
Upper Antenna Array,



MACOM
an AMP company

2.4 GHz Patch Antenna for ISM Band

ANP-C-116

V2.01

Features

- Hemispherical/Omnidirectional
- Flat Configuration
- Rugged/Durable
- Low VSWR
- Circular Polarization Minimizes Multipath Effects
- Various Types of Input Connectors Available
- Variety of ISM Applications

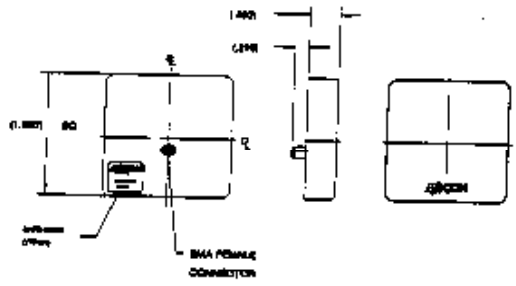
Description

The ANP-C-116 patch antenna is a hemispherical/omnidirectional antenna. It is circularly polarized to maximize immunity to fading in high multipath environments.

This durable antenna has a flat configuration that makes it suitable for surface mount applications. It can be used for a variety of ISM applications such as bar code scanning, auto toll collection, wireless LAN and medical monitoring devices.

Specifications

Frequency Range	2400-2485 MHz
Peak Gain	+4 dBic Min
Polarization	Right Hand Circular
Nominal Impedance	50 Ohms
VSWR	2.0:1 Max
R. F. Power Handling	1 W Avg. Max 3 W Peak Max
Connector Type	SMA Female
Weight	1.5 oz Max



Specifications Subject to Change Without Notice

M/A-COM Inc.

North America: Tel. (800) 366-2266 • Asia/Pacific: Tel. +85 2 2111 8088 • Europe: Tel. +44 (1344) 869-595
Fax (800) 618-8883 Fax +85 2 2111 8087 Fax +44 (1344) 300-020

Antennae: set up #2

SPJ-M2.45SP Antenna

Engineering Data

5. Electrical Specifications (Typical)

Frequency	2.45 GHz
Gain	8 dBi
Bandwidth – MHz for 2:1 VSWR	100 MHz
Horizontal Beamwidth	60°
Vertical Beamwidth	60°
Maximum Power input – Watts	100
Front – to – Back Ratio	>30 dB
Efficiency	85%
Connector	Various: TNC/TNC RP/SMA/N
Lightning Protection	Direct Ground
Polarization	Linear
Cross Polarization	>20dB

5.1 Mechanical Specification

Width – in. (mm)	4.25 (108)
Height – in. (mm)	4.25 (108)
Depth – in. (mm)	1.1 (28)
Case Material	High Impact UV Stabilized ABS Plastic
Wind/Ice Loading Area	16 in^2
Rated Wind Velocity 0 mph (km/hr)	150 (241.5)
Lateral Thrust @ 100 mph – lbs (kg)	4 (8.816)
Torsional Moment @ 100 mph with Std. Mounting – ft./lbs (m/kg)	.1 (.2204)

SPJ-M2.45FP Antenna

Engineering Data

6. Electrical Specifications (Typical)

Frequency	2.45 GHz
Gain	12 dBi
Bandwidth – MHz for 2:1 VSWR	100 MHz
Horizontal Beamwidth	30°
Vertical Beamwidth	30°
Maximum Power Input – Watts	100
Front – to – Back Ratio	>30 dB
Efficiency	75%
Connector	Various: TNC/TNC RP/SMA/N
Lightning Protection	Direct Ground
Polarization	Linear
Cross Polarization	>20dB

6.1 Mechanical Specification

Width – in. (mm)	7.125 (181)
Height – in. (mm)	7.125 (181)
Depth – in. (mm)	1.25 (31.75)
Case Material	High Impact UV Stabilized ABS Plastic
Wind/Ice Loading Area	49 in^2
Rated Wind Velocity - mph (km/hr)	150 (241.5)
Lateral Thrust @ 100 mph – lbs (kg)	10 (22.04)
Torsional Moment @ 100 mph with Std. Mounting – ft./lbs (m/kg)	.2 (.4408)