

FCC PART 15, SUBPART C
TEST METHOD: ANSI C63.4-1992

for

**TIRE PRESSURE MONITOR
TRANSMITTER**

MODEL: TPM-S2

Prepared for

**HCI CORPORATION
11245 EAST 183rd STREET
CERRITOS, CALIFORNIA 90703**

Prepared by:_____

KYLE FUJIMOTO

Approved by:_____

MICHAEL CHRISTENSEN

**COMPATIBLE ELECTRONICS INC.
114 OLINDA DRIVE
BREA, CALIFORNIA 92823
(714) 579-0500**

DATE: DECEMBER 14, 2001

	REPORT BODY	APPENDICES				TOTAL
		A	B	C	D	
PAGES	15	2	2	10	13	42

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TABLE OF CONTENTS

Section / Title	PAGE
GENERAL REPORT SUMMARY	4
SUMMARY OF TEST RESULTS	4
1. PURPOSE	5
2. ADMINISTRATIVE DATA	6
2.1 Location of Testing	6
2.2 Traceability Statement	6
2.3 Cognizant Personnel	6
2.4 Date Test Sample was Received	6
2.5 Disposition of the Test Sample	6
2.6 Abbreviations and Acronyms	6
3. APPLICABLE DOCUMENTS	7
4. Description of Test Configuration	8
4.1 Description of Test Configuration - EMI	8
5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT	10
5.1 EUT and Accessory List	10
5.2 EMI Test Equipment	11
6. TEST SITE DESCRIPTION	12
6.1 Test Facility Description	12
6.2 EUT Mounting, Bonding and Grounding	12
7. Test Procedures	13
7.1 Radiated Emissions (Spurious and Harmonics) Test	13
7.2 Bandwidth of the Fundamental	14
8. CONCLUSIONS	15



LIST OF APPENDICES

APPENDIX	TITLE
A	Modifications to the EUT
B	Additional Models Covered Under This Report
C	Diagrams, Charts and Photos <ul style="list-style-type: none">• Test Setup Diagrams• Radiated Emissions Photos• Antenna and Effective Gain Factors
D	Data Sheets

LIST OF FIGURES

FIGURE	TITLE
1	Plot Map And Layout of Test Site



GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced without the written permission of Compatible Electronics, unless done so in full.

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

Device Tested: Tire Pressure Monitor Transmitter
 Model: TPM-S2
 S/N: N/A

Product Description: See Expository Statement.

Modifications: The EUT was not modified during the testing.

Manufacturer: HCI Corporation
 11245 East 183rd Street
 Cerritos, California 90703

Test Date: December 7, 2001

Test Specifications: EMI requirements
 CFR Title 47, Part 15 Subpart C, Sections 15.205, 15.209, and 15.231

Test Procedure: ANSI C63.4: 1992

Test Deviations: The test procedure was not deviated from during the testing.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 450 kHz - 30 MHz	This test was not performed because the EUT operates on batteries only and cannot be powered by any device that runs off of the AC public mains.
2	Radiated RF Emissions, 10 kHz - 4500 MHz	Complies with the of CFR Title 47, Part 15 Subpart C, sections 15.205, 15.209, and 15.231



1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Tire Pressure Monitor Transmitter Model: TPM-S2. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 1992. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the specification limits defined by CFR Title 47, Part 15, Subpart C, sections 15.205, 15.209, and 15.231.



2. ADMINISTRATIVE DATA

2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

HCI Corporation

Steve Wong President

Compatible Electronics Inc.

Kyle Fujimoto Test Engineer
Michael Christensen Test Engineer

2.4 Date Test Sample was Received

The test sample was received on December 7, 2001.

2.5 Disposition of the Test Sample

The test sample has not been returned to HCI Corporation as of December 14, 2001.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network
CFR	Code of Federal Regulations



3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
CFR Title 47, Subpart C	FCC Rules – Radio frequency devices (including digital devices) – Intentional Radiators
ANSI C63.4 1992	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.



4. DESCRIPTION OF TEST CONFIGURATION

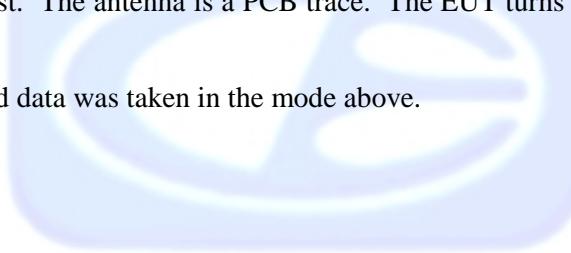
4.1 Description of Test Configuration - EMI

Setup and operation of the equipment under test.

Specifics of the EUT and Peripherals Tested

The Tire Pressure Monitor Transmitter Model: TPM-S2 (EUT) was tested as a stand alone unit and tested in three different orthogonal axis. The EUT was continuously transmitting during the test. The antenna is a PCB trace. The EUT turns immediately off after the button is released.

Final radiated data was taken in the mode above.



4.1.1 **Cable Construction and Termination**

There were no cables attached to the EUT.



5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT**5.1 EUT and Accessory List**

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
TIRE PRESSURE MONITOR TRANSMITTER (EUT)	HCI CORPORATION	TPM-S2	N/A	P2E01TPMS1S2



5.2 EMI Test Equipment

EQUIPMENT TYPE	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Radiated Emissions Manual Test – Radiated	Compatible Electronics	N/A	N/A	N/A	N/A
Spectrum Analyzer – Main Section	Hewlett Packard	8566B	3638A08768	June 15, 2001	June 15, 2002
Spectrum Analyzer – Display Section	Hewlett Packard	85662A	3701A22262	June 15, 2001	June 15, 2002
Spectrum Analyzer – Quasi-Peak Adapter	Hewlett Packard	85662A	2811A01363	June 15, 2001	June 15, 2002
Biconical Antenna	Com Power	AB-100	1548	Oct. 11, 2001	Oct. 11, 2002
Log Periodic Antenna	Com Power	AL-100	16089	Oct. 11, 2001	Oct. 11, 2002
Computer	Hewlett Packard	D5251A 888	US74458128	N/A	N/A
Printer	Hewlett Packard	C5886A	SG7CM1P090	N/A	N/A
Monitor	Hewlett Packard	D5258A	DK74889705	N/A	N/A
Horn Antenna	Antenna Research	DRG-118/A	1053	Dec. 8, 1995	N/A
Loop Antenna	Com-Power	AL-130	25309	May 21, 2001	May 21, 2002
Horn Antenna	Antenna Research	DRG-118/A	1053	Jan. 15, 2001	Jan. 15, 2002
Microwave Preamplifier	Com-Power	PA-122	25195	Jan. 9, 2001	Jan. 9, 2002



6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and 7.1 of this report for EMI test location.

6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was not grounded.



7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

7.1

Radiated Emissions (Spurious and Harmonics) Test

The spectrum analyzer was used as a measuring meter along with the quasi-peak adapter. Amplifiers were used to increase the sensitivity of the instrument. The Com Power Preamplifier Model: PA-102 was used for frequencies from 30 MHz to 1 GHz, and the Com Power PA-122 Microwave Preamplifier was used for frequencies above 1 GHz. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps. The quasi-peak adapter was used only for those readings which are marked accordingly on the data sheets. The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
10 kHz to 150 kHz	200 Hz	Active Loop Antenna
150 kHz to 30 MHz	9 kHz	Active Loop Antenna
30 MHz to 300 MHz	120 kHz	Biconical Antenna
300 MHz to 1 GHz	120 kHz	Log Periodic Antenna
1 GHz to 4.5 GHz	1 MHz	Horn Antenna

The open field test site of Compatible Electronics, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 1992. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results.

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 3 meter test distance to obtain final test data.



7.2

Bandwidth of the Fundamental

The -20 dB bandwidth was checked to see that it was within 0.25% of the fundamental frequency for the Tire Pressure Monitor Transmitter. A plot of the -20 dB bandwidth is in Appendix D.



8. CONCLUSIONS

The Tire Pressure Monitor Transmitter Model: TPM-S2 meets all of the specification limits defined in CFR Title 47, Part 15, Subpart C, sections 15.205, 15.209, and 15.231.



APPENDIX A

MODIFICATIONS TO THE EUT



MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC 15.231 specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

Modifications:

No modifications were made to the EUT.



APPENDIX B

***ADDITIONAL MODELS COVERED
UNDER THIS REPORT***



ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST

Tire Pressure Monitor Transmitter
Model: TPM-S2
S/N: N/A

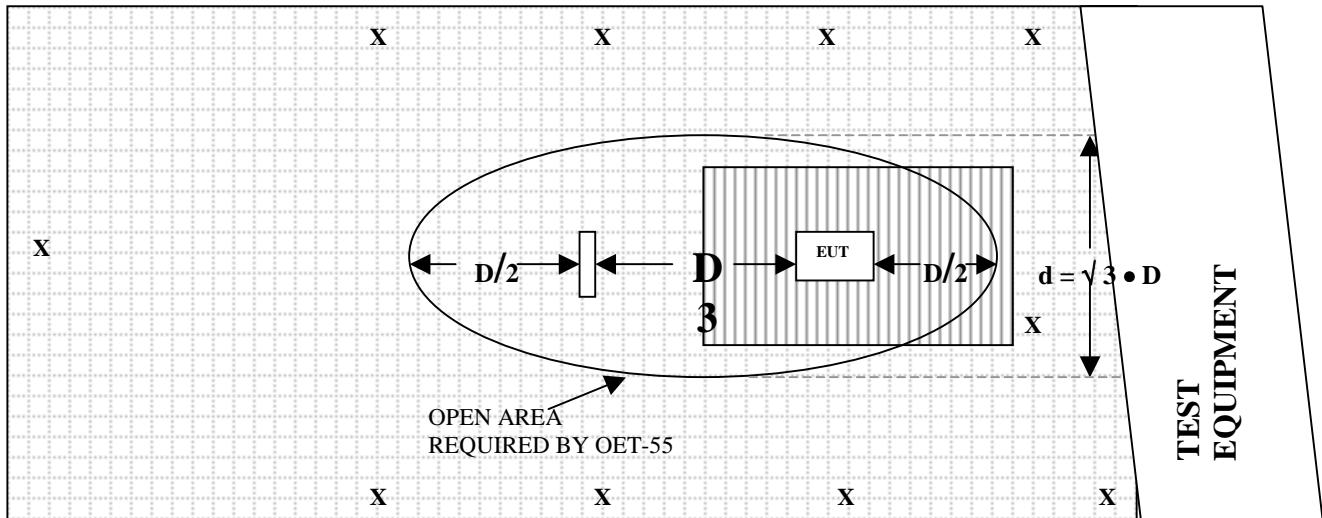
There were no additional models covered under this report.



APPENDIX C

DIAGRAMS, CHARTS AND PHOTOS



FIGURE 1: PLOT MAP AND LAYOUT OF RADIATED SITE**OPEN LAND > 15 METERS****OPEN LAND > 15 METERS****OPEN LAND > 15 METERS**

	= GROUND RODS		= GROUND SCREEN
	= TEST DISTANCE (meters)		= WOOD COVER



**FRONT VIEW**

HCI CORPORATION
TIRE PRESSURE MONITOR TRANSMITTER
MODEL: TPM-S2
FCC SUBPART C - RADIATED EMISSIONS – 12-7-01

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**





REAR VIEW

HCI CORPORATION
TIRE PRESSURE MONITOR TRANSMITTER
MODEL: TPM-S2
FCC SUBPART C - RADIATED EMISSIONS – 12-7-01

**PHOTOGRAPH SHOWING THE EUT CONFIGURATION
FOR MAXIMUM EMISSIONS**



COM-POWER AB-100

BICONICAL ANTENNA

S/N: 01548

CALIBRATION DATE: OCTOBER 11, 2001

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	13.70	120	11.00
35	13.70	125	11.20
40	11.80	140	12.50
45	12.30	150	13.20
50	11.00	160	13.50
60	10.40	175	14.60
70	8.60	180	14.40
80	8.30	200	15.90
90	8.30	250	17.60
100	8.80	300	19.90



COM-POWER AL-100

LOG PERIODIC ANTENNA

S/N: 16089

CALIBRATION DATE: OCTOBER 11, 2001

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
300	14.10	700	20.60
400	15.10	800	22.40
500	16.60	900	22.70
600	19.90	1000	26.50



COM-POWER PA-102

PREAMPLIFIER

S/N: 1017

CALIBRATION DATE: JANUARY 5, 2001

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	39.0	300	38.9
40	39.2	350	38.9
50	39.2	400	38.6
60	39.2	450	38.5
70	38.8	500	38.7
80	38.6	550	38.4
90	38.5	600	38.8
100	38.7	650	38.5
125	39.2	700	38.6
150	38.8	750	38.1
175	38.8	800	37.9
200	39.0	850	38.0
225	38.8	900	37.8
250	38.8	950	36.9
275	39.0	1000	38.2



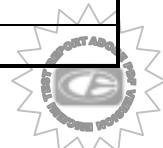
COM-POWER PA-122

MICROWAVE PREAMPLIFIER

S/N: 25195

CALIBRATION DATE: JANUARY 9, 2001

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	33.1	9.5	30.7
1.1	33.0	10.0	31.6
1.2	33.2	11.0	30.6
1.3	33.0	12.0	28.5
1.4	32.4	13.0	31.5
1.5	32.3	14.0	33.2
1.6	32.1	15.0	31.5
1.7	32.0	16.0	30.2
1.8	31.8	17.0	31.6
1.9	32.2	18.0	31.7
2.0	32.6		
2.5	31.9		
3.0	31.7		
3.5	31.7		
4.0	32.3		
4.5	31.5		
5.0	32.3		
5.5	34.2		
6.0	30.9		
6.5	32.0		
7.0	32.1		
7.5	33.0		
8.0	31.9		
8.5	31.9		
9.0	31.3		



ANTENNA RESEARCH DRG-118/A

HORN ANTENNA

S/N: 1053

CALIBRATION DATE: JANUARY 15, 2001

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	25.4	9.5	39.6
1.5	26.7	10.0	39.7
2.0	29.6	10.5	40.8
2.5	30.7	11.0	40.4
3.0	31.2	11.5	42.2
3.5	32.3	12.0	43.0
4.0	33.2	12.5	42.6
4.5	33.2	13.0	41.3
5.0	34.8	13.5	40.3
5.5	35.4	14.0	40.9
6.0	36.6	14.5	44.0
6.5	36.6	15.0	43.3
7.0	38.7	15.5	42.7
7.5	38.6	16.0	42.6
8.0	37.9	16.5	42.8
8.5	37.9	17.0	43.5
9.0	39.9	17.5	44.6
		18.0	42.2



Com-Power Corporation

(949) 587-9800

Antenna Calibration

Antenna Type:	Active Loop Antenna	
Model:	AL-130	
Serial Number:	25309	
Calibration Date:	(mm/dd/yy)	
Certificate Number:	05/21/01	
Certificate Number:	071014-R	
Frequency MHz	Magnetic (dB/m)	Electric dB/m
0.009	-40.2	11.3
0.01	-40.2	11.3
0.02	-40.9	10.6
0.03	-39.3	12.2
0.04	-39.7	11.8
0.05	-41.0	10.5
0.06	-40.6	10.9
0.07	-40.8	10.7
0.08	-41.1	10.4
0.09	-41.2	10.3
0.1	-41.2	10.3
0.2	-43.5	8.0
0.3	-41.1	10.4
0.4	-41.0	10.5
0.5	-41.0	10.5
0.6	-40.9	10.6
0.7	-40.8	10.7
0.8	-40.8	10.7
0.9	-40.8	10.7
1	-40.3	11.2
2	-39.7	11.8
3	-40.0	11.5
4	-40.2	11.3
5	-39.6	11.9
6	-39.6	11.9
7	-40.0	11.5
8	-40.3	11.2
9	-39.8	11.7
10	-40.6	10.9
12	-40.7	10.8
14	-40.6	10.9
15	-40.7	10.8
16	-40.7	10.8
18	-40.8	10.7
20	-41.6	9.9
25	-42.8	8.7
30	-43.3	8.2

Separation Distance:

1 meter

APPENDIX D

DATA SHEETS



RADIATED EMISSIONS SECTION 15.231

COMPANY	HCI CORPORATION	DATE	12/7/2001
EUT	TIRE PRESSURE MONITOR TRANSMITTER	DUTY CYCLE	50.00 %
MODEL	TPM-S2	PEAK TO AVG	-6.02 dB
S/N	N/A	TEST D ₁ DIST.	3 METERS
TEST ENGINEER	KYLE FUJIMOTO	LAB	D

PAGE 1

RADIATED EMISSIONS SECTION 15.231

COMPANY	HCI CORPORATION	DATE	12/7/2001
EUT	TIRE PRESSURE MONITOR TRANSMITTER	DUTY CYCLE	50.00 %
MODEL	TPM-S2	PEAK TO AVG	-6.02 dB
S/N	N/A	TEST D. DIST.	3 METERS
TEST ENGINEER	KYLE FUJIMOTO	LAB	D

PAGE 2

RADIATED EMISSIONS SECTION 15.231

COMPANY	HCI CORPORATION	DATE	12/7/2001
EUT	TIRE PRESSURE MONITOR TRANSMITTER	DUTY CYCLE	50.00 %
MODEL	TPM-S2	PEAK TO AVG	-6.02 dB
S/N	N/A	TEST D DIST.	3 METERS
TEST ENGINEER	KYLE FUJIMOTO	LAB	D

PAGE 3

RADIATED EMISSIONS SECTION 15.231

COMPANY	HCI CORPORATION	DATE	12/7/2001
EUT	TIRE PRESSURE MONITOR TRANSMITTER	DUTY CYCLE	50.00 %
MODEL	TPM-S2	PEAK TO AVG	-6.02 dB
S/N	N/A	TEST D. DIST.	3 METERS
TEST ENGINEER	KYLE FUJIMOTO	LAB	D

PAGE 4

RADIATED EMISSIONS SECTION 15.231

COMPANY	HCI CORPORATION	DATE	12/7/2001
EUT	TIRE PRESSURE MONITOR TRANSMITTER	DUTY CYCLE	50.00 %
MODEL	TPM-S2	PEAK TO AVG	-6.02 dB
S/N	N/A	TEST D DIST.	3 METERS
TEST ENGINEER	KYLE FUJIMOTO	LAB	D

PAGE 5

RADIATED EMISSIONS SECTION 15.231

COMPANY	HCI CORPORATION	DATE	12/7/2001	
EUT	TIRE PRESSURE MONITOR TRANSMITTER	DUTY CYCLE	50.00	%
MODEL	TPM-S2	PEAK TO AVG	-6.02	dB
S/N	N/A	TEST D. DIST.	3 METERS	
TEST ENGINEER	KYLE FUJIMOTO	LAB	D	

PAGE 6

RADIATED EMISSIONS SECTION 15.231

COMPANY	HCI CORPORATION	DATE	12/7/2001
EUT	TIRE PRESSURE MONITOR TRANSMITTER	DUTY CYCLE	50.00 %
MODEL	TPM-S2	PEAK TO AVG	-6.02 dB
S/N	N/A	TEST D. DIST.	3 METERS
TEST ENGINEER	KYLE FUJIMOTO	LAB	D

PAGE 7

RADIATED EMISSIONS SECTION 15.231

COMPANY	HCI CORPORATION	DATE	12/7/2001
EUT	TIRE PRESSURE MONITOR TRANSMITTER	DUTY CYCLE	50.00 %
MODEL	TPM-S2	PEAK TO AVG	-6.02 dB
S/N	N/A	TEST D. DIST.	3 METERS
TEST ENGINEER	KYLE FUJIMOTO	LAB	D

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = SPEC LIMIT - CORRECTED READING

PAGE 8

RADIATED EMISSIONS SECTION 15.231

COMPANY	HCI CORPORATION	DATE	12/7/2001	
EUT	TIRE PRESSURE MONITOR TRANSMITTER	DUTY CYCLE	50.00	%
MODEL	TPM-S2	PEAK TO AVG	-6.02	dB
S/N	N/A	TEST DIST.	3 METERS	
TEST ENGINEER	KYLE FUJIMOTO	LAB	D	

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = SPEC LIMIT - CORRECTED READING

PAGE 9

RADIATED EMISSIONS SECTION 15.231

COMPANY	HCI CORPORATION	DATE	12/7/2001	
EUT	TIRE PRESSURE MONITOR TRANSMITTER	DUTY CYCLE	50.00	%
MODEL	TPM-S2	PEAK TO AVG	-6.02	dB
S/N	N/A	TEST DIST.	3 METERS	
TEST ENGINEER	KYLE FUJIMOTO	LAB	D	

* CORRECTED READING = METER READING + ANTENNA FACTOR + CABLE LOSS - AMPLIFIER GAIN

** DELTA = SPEC LIMIT - CORRECTED READING

PAGE 10

BANDWIDTH OF FUNDAMENTAL
REF 97.0 dB μ V ATTEN 0 dB

MKR Δ 473 kHz
0.00 dB

hp

10 dB/

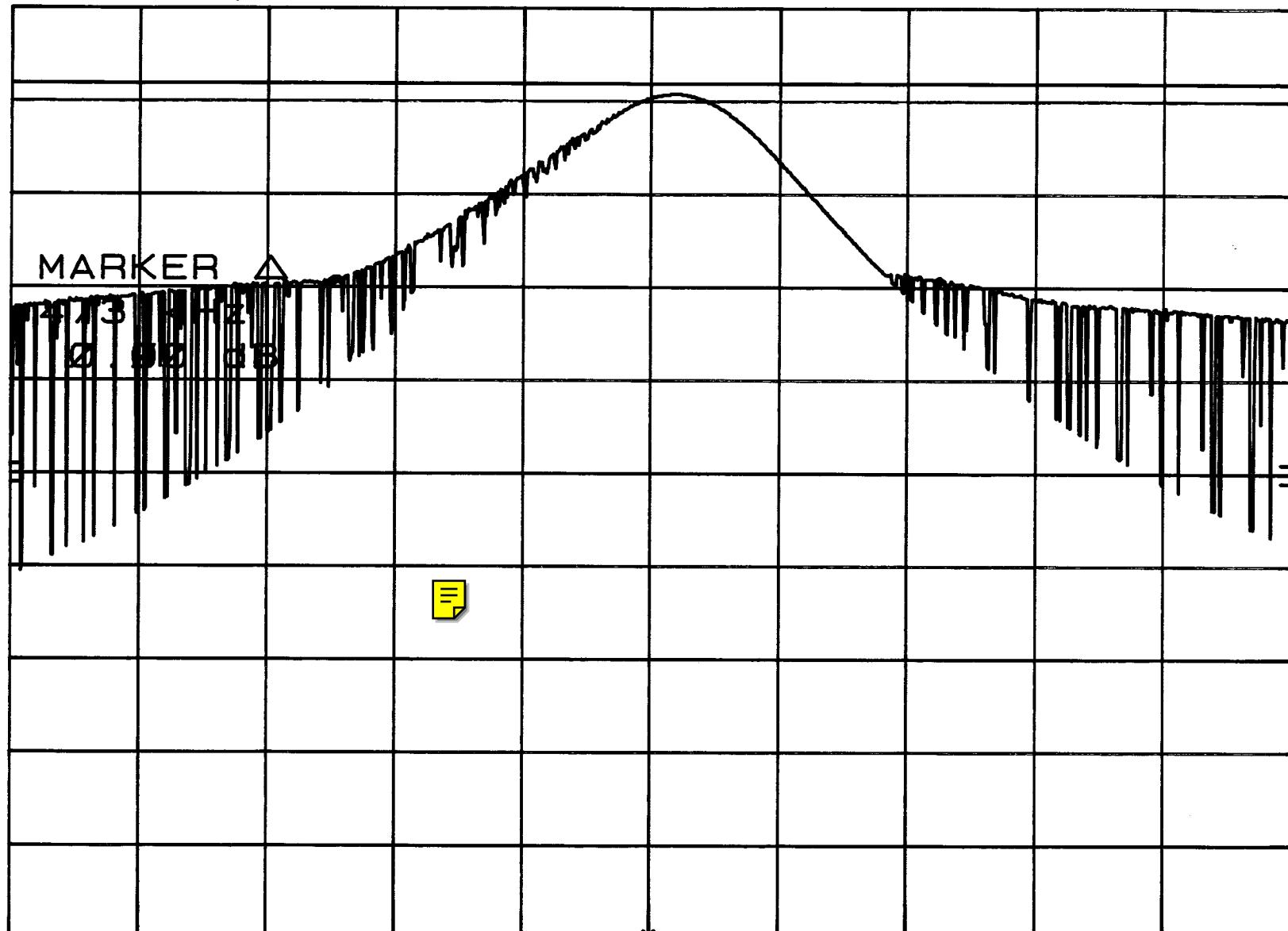
DL
88.9
dB μ V

CORR'D

CENTER 433.86 MHz
RES BW 100 kHz

VBW 100 kHz

SPAN 1.00 MHz
SWP 20.0 msec



Page: 1 of 1

Test location: Compatible Electronics
Customer : HCI CORPORATION

Date : 12/ 7/2001

Manufacturer : HCI CORPORATION Time : 16.56
EUT name : TIRE PRESSURE MONITOR TRANSMITTER Model: TPM-S2
Specification: Fcc_B Test distance: 3.0 mtrs Lab: D
Distance correction factor($20 * \log(\text{test}/\text{spec})$) : 0.00
Test Mode : SPRUIOUS EMISSIONS FROM THE EUT
TEMPERATURE 75 DEGREES F., RELATIVE HUMIDITY 45%
TESTED BY: KYLE FUJIMOTO

NO EMISSIONS FOUND FROM THE EUT FROM 10 kHz TO 4400 MHz
IN EITHER VERTICAL OR HORIZONTAL POLARIZATION