



**Compliance Report  
FCC 47 CFR PART 15, Sub-Class C  
For A  
Transcell TDMA 1900 System Consisting Of  
One Dual HUB And One Remote Unit**

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## REVISION PAGE

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## SIGNATURES

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## 1.0 Test Plan

NOTE: The Anechoic Room is calibrated with all internal cabling. All losses are recorded in memory and used as correction factors in the final data. All calibrations are periodically updated.

Test Standards	Test Requirements
<b>EMISSIONS</b>	
Radiated Emissions	FCC 47 CFR Part 15 Sub-Class C
Conducted Emissions	FCC 47 CFR Part 15 Sub-Class C

## 1.1 Test Procedure

Testing of the Transcell TDMA 1900 System Consisting Of One Dual HUB And One Remote Unit was performed in accordance with approved test procedures specified in the applicable standards. All test procedures can be found with their appropriate tests.

## 2.0 References

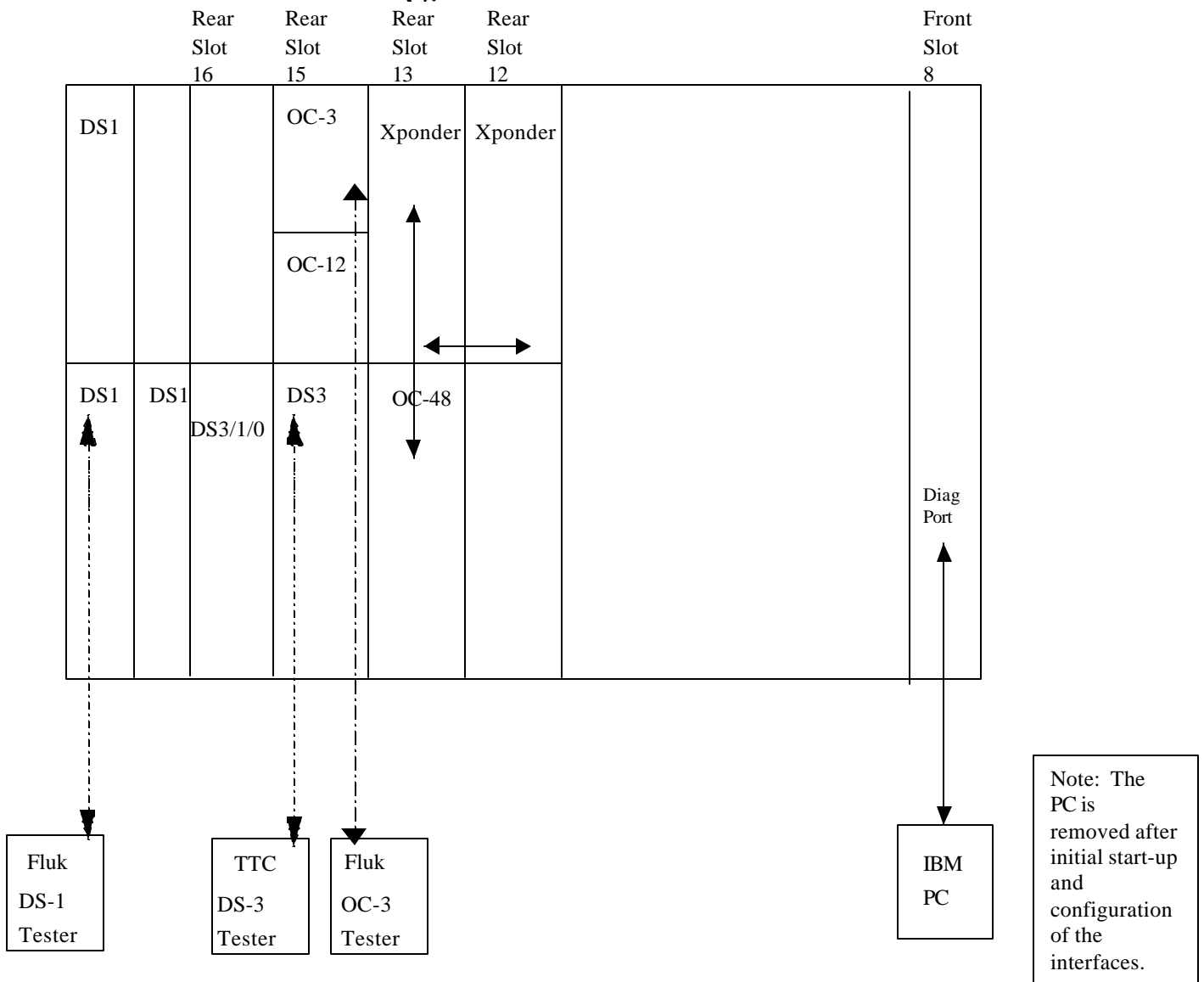
- 2.1 Transcept Purchase Order No. PO101696 dated September 28, 2000 and Purchase Order Rev dated October 6, 2000
- 2.2 NTS Quote No. 8-080C-809042-1 dated November 8, 2000
- 2.3 MIL-STD-462D Measurement of Electromagnetic Interference Characteristics
- 2.4 ANSI C63.4 1992 Method of Measurements of Radio Noise Emissions from Measurement of Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
- 2.5 ISO/IEC Guide 25, General Requirements of the Competence of Calibrating Test Laboratories, 1990
- 2.6 ANSI/NCSL Z540-1, 1994 CISPR 16 Calibration Laboratories and Measuring and Test Equipment – General Requirements
- 2.7 FCC 47 CFR Part 15

### 3.0 Description of Test Item

OneTranscell TDMA 1900 System consisting of (1) Dual HUB and (1) Remote Unit		
Part Description	Model No.	Serial No.
DUAL HUB	1000225G1	001200001000003
REMOTE UNIT	1000102G1	001200007000004

### 3.1 Test Item Configuration

Figure 2 - Tester



## 4.0 Test Information

### 4.1 Primary Power

The primary input power to the test sample shall be -48Vdc. The primary power inputs shall have an accuracy of  $\pm 5\%$ .

### 4.2 Mode of Operation and Synchronization

As per measurement procedures, the worst case test configuration and mode of operation was used for all testing. Unless otherwise noted elsewhere in this report, this selection will apply to all testing. The selection process was based on previous investigative testing of the Transcell TDMA 1900 System Consisting Of One Dual HUB And One Remote Unit.

Worst case operating mode is described as "Operate". Operating modes considered were all those available to the operator, including Standby.

### 4.3 Test Date and Location

Test Category	Location	Date
EMI	NTS/Boxborough, MA	December 18-22, 2000

### 4.4 Calibration Details

All test equipment used for this program were checked prior to testing to assure that they were in calibration and that the parameters being measured were appropriate for the range on the measuring instrument.

Calibration is performed and checked on a routine basis using standards traceable to the National Institute of Standards and Technology (NIST). Calibration of equipment is performed in accordance with the NTS quality program and satisfies the requirements of ISO 10012-1 and ISO/IEC Guide 25.

### 4.5 Equipment Modifications

No modifications were made to the unit during the performance of this test program.

### 4.6 Ambient Test Conditions

During testing contained in this test report, average ambient test conditions were as follows: Relative humidity between 30-70%, temperature 20-24°C, and barometric pressure between 990-995 kPa.

## 5.0 Radiated Emission Criteria (Electric Field)

### 5.1 Radiated E-Field Test Procedure

Radiated measurements were performed in a semi-anechoic chamber meeting the normalized site attenuation of ANSI C63.4 and listed with the FCC with an antenna to Transcell TDMA 1900 System Consisting Of One Dual HUB And One Remote Unit at a distance of 3m. The applicable frequency spectrum is scanned with a calibrated RF measuring system using an antenna and a spectrum analyzer and compared to the appropriate limits. "Maximization" of each suspect frequency is accomplished by a combination of a 360° azimuth search and varying the antenna to ground plane height from 1m to 4m. Also, both the vertical and horizontal polarization are scanned in the frequency range of 30 MHz to 12.5 GHz per ANSI C63.4. Final data was collected in the worst case configurations of the Transcell TDMA 1900 System Consisting Of One Dual HUB And One Remote Unit with the highest emission levels.

The test sample and necessary equipment was set-up in the semi anechoic chamber. The test sample was grounded with the grounding point used in the actual installation. All test sample cables were run at least 2 feet above the Transcell TDMA 1900 System Consisting Of One Dual HUB And One Remote Unit and then run across the horizontal and down. The cables were then draped back across the mounting rack to the other side. Power was supplied through a 50 iH LISN and connected as in the installation. The following procedure was used:

1. The test sample was operated in its normal, steady-state mode of operation. Sufficient time was allowed for stabilization.
2. The spectrum analyzer was set to "peak" mode from 30 MHz to 12.5 GHz. On any emission over the limit, the spectrum analyzer was set to "average" mode from 1 GHz to 12.5 GHz. The spectrum analyzer was set to quasi-peak mode between 30 MHz and 1 GHz.
3. The biconical antenna was positioned 3 meters from the closest point of any part of the test sample. The antenna was placed in the vertical position. Testing started at 30 MHz.
4. Amplitude versus frequency data was recorded using the spectrum analyzer until 200 MHz was reached.
5. The antenna was placed in the horizontal position.
6. Interference in the frequency range from 30 MHz to 200 MHz was recorded.
7. The biconical antenna was replaced with the log periodic antenna. The antenna was placed in the horizontal position.
8. Interference in the frequency range from 200 MHz to 1 GHz was recorded.
9. The log periodic antenna was placed in the vertical position and Step 8 was repeated.





10. The log periodic antenna was replaced with the double ridged horn antenna. The antenna was placed in the horizontal position one meter from the closest point of any part of the test sample. Emissions in the frequency range from 1 GHz to 12.5 GHz were recorded.
11. The horn antenna was placed in the vertical plane and Step 10 was repeated. The six highest field strength levels (and associated frequencies) were recorded.
12. Measurements at the six discrete frequencies established in Step 11 were performed. The measurement antennas used depended on the frequency tested. Antenna height was between 1 to 4 meters at the point of highest measured emissions. Further, the test sample was rotated horizontally on the rotary table a full 360 degrees to determine the orientation of greatest emissions. Antenna height and test sample orientation was recorded for inclusion in the test report.

#### Radiated Emissions Field Strength Calculations

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

where:

FS = field strength  
CF = cable attenuation factor  
RA = receiver amplitude  
AG = amplifier gain  
AF = antenna factor

The receiver used for radiated emissions measurements performed the field strength calculations automatically. The program has resident AF and CF figures for individual antennas and cables.

## Radiated Emissions Test Setup

Remote Unit



HUB



### Comments

The Transcell TDMA 1900 System Consisting Of One Dual HUB And One Remote Unit **conformed** to the requirements of FCC 47 CFR Part 15, Sub-Class C. Emissions were below the limit over the entire frequency range. Reference Appendix B for Radiated Emissions Plot Sheets.

## 6.0 Conducted Emissions (AC Power Leads Voltage)

### 6.1 Conducted Emissions (AC Power Leads Voltage) Test Procedure

Conducted measurements were made with power supplied to the Transcell TDMA 1900 System Consisting Of One Dual HUB And One Remote Unit; support equipment not part of the Transcell TDMA 1900 System was powered through a similar but separate LISN. Each of the Transcell TDMA 1900 System's input power leads were scanned first with a peak detector. The highest peak amplitudes relative to the appropriate limits were identified and re-measured using a quasipeak detector. At least six of all peaks closest to the respective limits were recorded in this report. The conducted emissions test was performed using NTS' automatic EMI test equipment. This equipment utilized HP EMI measurement software running on a HP computer that interfaced directly with GPIB (IEEE) compatible instruments with graphical displays presented on the spectrum analyzer's CRT, with hard copies of the data generated by a plotter. The program automatically selects the range of test frequencies or band, and sets the specification line limits to be used during the test. This equipment/software allows for real time data reduction and prints tabulated data on peak value or quasi-peak value measurements.



In the performance of this test, the LISNs were placed in series with the ac power lines. The test sample was grounded with the grounding point used in the actual installation. All test sample cables and power lines were elevated 3mm to 12mm above the ground plane (floor) for equipment floor stand model.

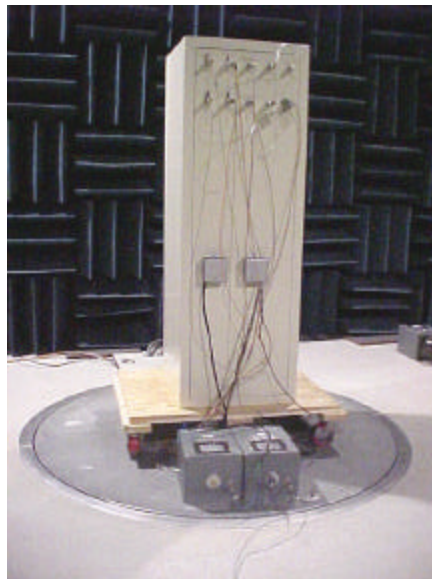
1. The spectrum analyzer was connected to a shielded 50-ohm coax cable.
2. The test sample was operated in its normal, steady-state mode of operation. Sufficient time was allowed for stabilization.
3. The spectrum analyzer cable was connected to the LISN.
4. Frequency scan was performed beginning at 450 kHz.
5. Amplitude versus frequency data was recorded using the spectrum analyzer until 30 MHz was reached.
6. Steps 3 through 5 were repeated for the remaining input power line.

## Conducted Emissions Test Setup

### Remote Unit



### HUB



### Comments

The Transcell TDMA 1900 System conformed to the requirements the Conducted Emission (AC Power Leads Voltage) Test. Emissions were below the limit over the entire frequency range. Reference Appendix C for Conducted Emissions Plot Sheets.



## **Appendix A**

### Test Equipment List



Inv. #	Description / Manufacturer	Model No. / Serial No.	Range / Accuracy	Cal Frequency / Cal Due Date	Cal Status
AM353	MICROWAVE AMPLIFIER HP	8349B 2644A01675	1 GHz TO 20 GHz, 15 dB +/-1.25dB		CBU
AM380	AMPLIFIER MITEQ	AM-1309-1179 708214	0.3 - 1000 MHz,GAIN:53dB N/A		CBU
AN339	BICONICAL ANTENNA EMCO	3104 3254	20 MHz TO 200MHz +/- 2DB	12 months 05/12/01	CAL
AN341	DOUB. RIDG. GUIDE ANT. ELECTROMETRICS	RGA-50/60 2661	1 TO 18 GHz +/-2dB	12 months 05/13/01	CAL
AN346	WAVEGUIDE HORN ANTENNA NARDA	638 8901	18 - 26.5 GHz, WITH MODEL +/-2dB		UWCE
AN347	WAVEGUIDE HORN ANTENNA NARDA	639 8805	12.4 - 18 GHz, WITH MODEL +/-2dB		UWCE
AN365	LOG PERIODIC DIPOLE ARRAY ANT. EMCO	3148 9707-1016	200 - 2000 MHz N/A	12 months 05/11/01	CAL
AN376	STANDARD GAIN HORN ANTENNA SCIENT.ATLANTA	12-26 62	26 - 40 GHz N/A		UWCE
AN378	ANTENNA SET EMCO	3301B 4240	30HZ-50MHz +/-0.3dB	36 months 06/14/03	CAL
WA419 A	SPECTRUM ANALYZER HEWLETT PACKARD	85660B 2637A03960	100 Hz TO 22 GHz SEE MFR SPEC	12 months 12/27/01	CAL
WA419B	DISPLAY HEWLETT PACKARD	85662A 2648A14030	100 Hz TO 22GHz SEE MFR SPEC	12 months 12/27/01	CAL
WA419C	QUASI-PEAK ADAPTER HEWLETT PACKARD	85650A 2521A00882	10 kHz TO 1 GHz SEE MFR SPEC	12 months 12/27/01	CAL
WA419 K	RF PRESELECTOR HP	85685A 2917A00736	20 Hz TO 2 GHz +/-2DB<1GHz +/- 3DB>1GHz	12 months 12/27/01	CAL



WA492	SPECTRUM ANALYZER TEKTRONIX	492 B054699	50 kHz – 21GHz SEE MFR SPEC	12 months 10/06/01	CAL
WA508	LINE IMPEDANCE STAB.NETWORK SOLAR	9331-50TS-200 005227	200 AMP,10 kHz - 30 MHz INSERT.LOSS:+/- .5dB	12 months 09/12/01	CAL
WA509	LINE IMPEDANCE STAB.NETWORK SOLAR	9331-50TS-200 005228	200 AMP,10 kHz - 30 MHz INSERT.LOSS:+/- .5dB	12 months 09/12/01	CAL
WA510	LINE IMPEDANCE STAB.NETWORK SOLAR	9331-50TS-200 005229	200 AMP,10 kHz - 30 MHz INSERT.LOSS:+/- .5dB	12 months 09/12/01	CAL

**Calibration Abbreviations**

**	rental/leased equipment
UWCE	use with calibrated equipment
CBU	calibrate before use
NQM	not used for quantitative measurement
CAL	calibrated
NCR	no calibration required



## **Appendix B**

### **Radiated Emissions Plot Sheets**



*Radiated Emissions*

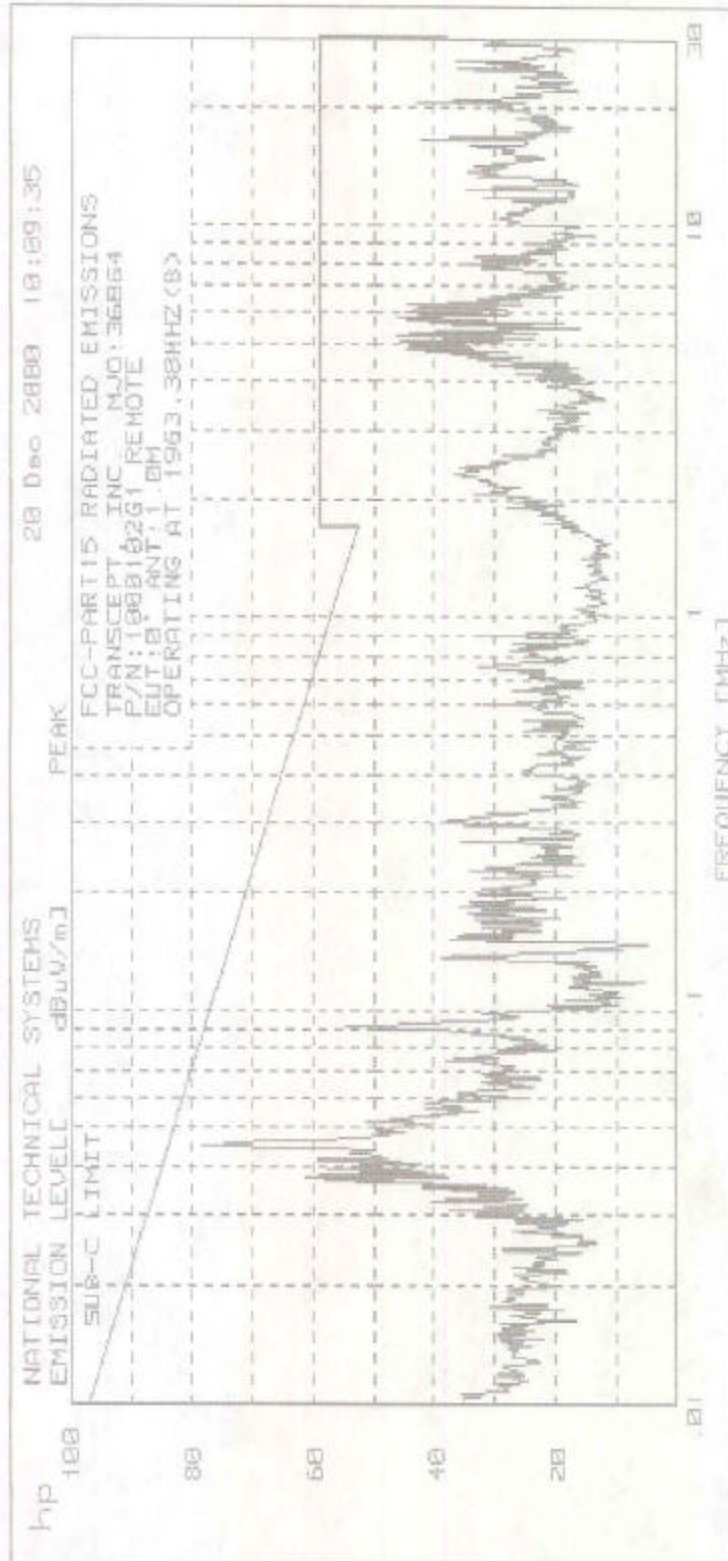
*FCC Part 15-Subpart C limits  
with exception of fundamental  
transmission frequency*

*FCC Part 24 limit =  
43 + 10 log P<sub>AB</sub>*

Point	Frequency (MHz)	Amplitude
1	.009	98
2	.49	63.3
3	1.705	52.5
4	1.705	59
5	30	59
6	30	40
7	88	40
8	88	43
9	216	43
10	216	45
11	960	45
12	960	53
13	1000	53
14	1000	62.5
15	10000	62.5

*1m* (points 1-3)  
*3m* (points 4-12)  
*1m* (points 13-15)

B 02



B 0.3

B-03



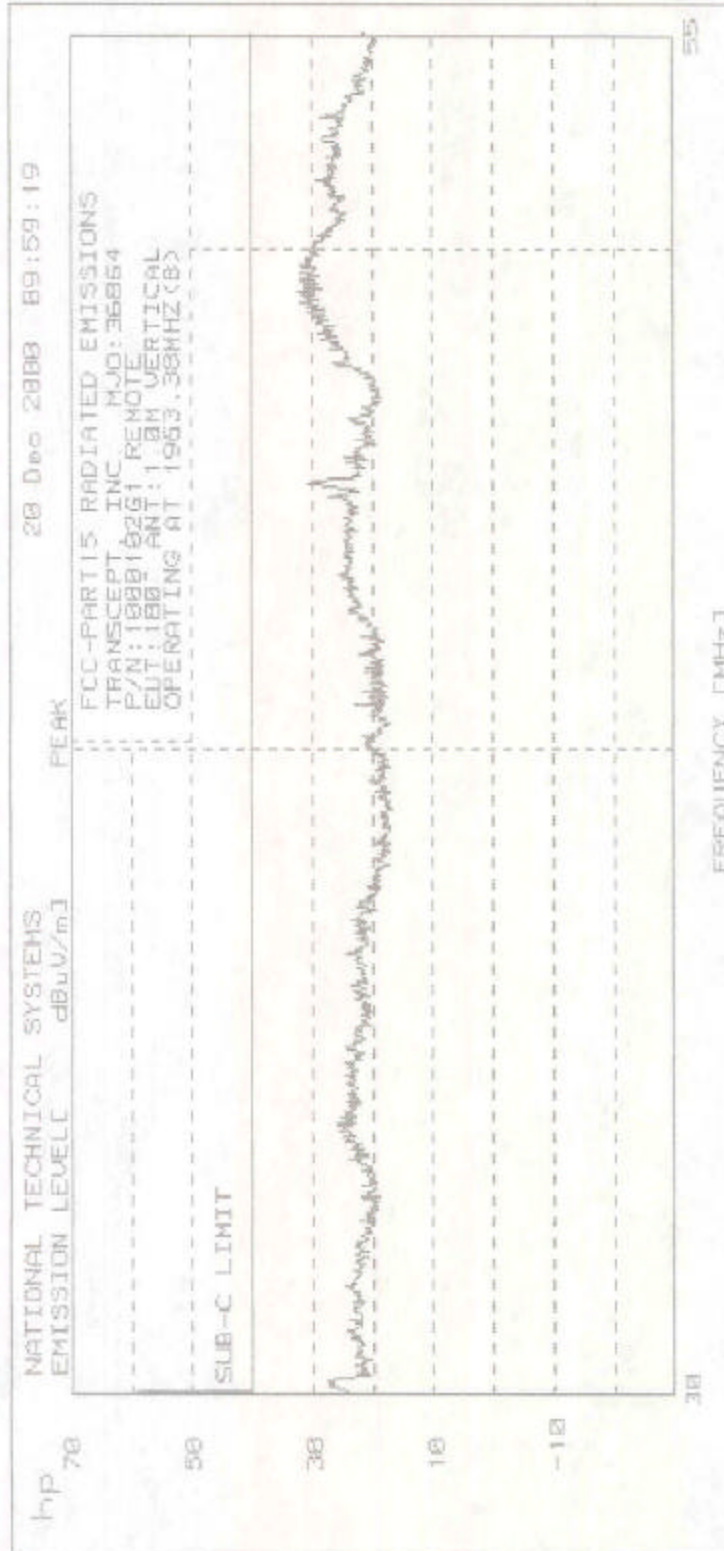
NATIONAL TECHNICAL SYSTEMS 20 Dec 2000 10:09:35

12. FCC P15 C RAD EMIS 12/18/00  
12.8 .01-30MHZ

20 highest Peaks above -30 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/m)	DELTA
1	.03713	57.8	-27.8
2	.03772	61.2	-24.3
3	.03833	59	-26.4
4	.03926	57.6	-27.6
5	.04119	59.3	-25.4
6	.04186	59.1	-25.5
7	.04534	78.3	-5.6
8	.09093	54.4	-23.5
9	4.843	44.4	-14.6
10	5.001	44.3	-14.7
11	5.081	45.4	-13.6
12	5.205	46.2	-12.8
13	5.331	44.1	-14.9
14	5.729	44.5	-14.5
15	5.821	46.1	-12.9
16	5.963	44.8	-14.2
17	6.059	43.3	-15.7
18	6.157	42.4	-16.6
19	6.256	44.6	-14.4
20	20.6	42.8	-16.2

B 01



B 0.5



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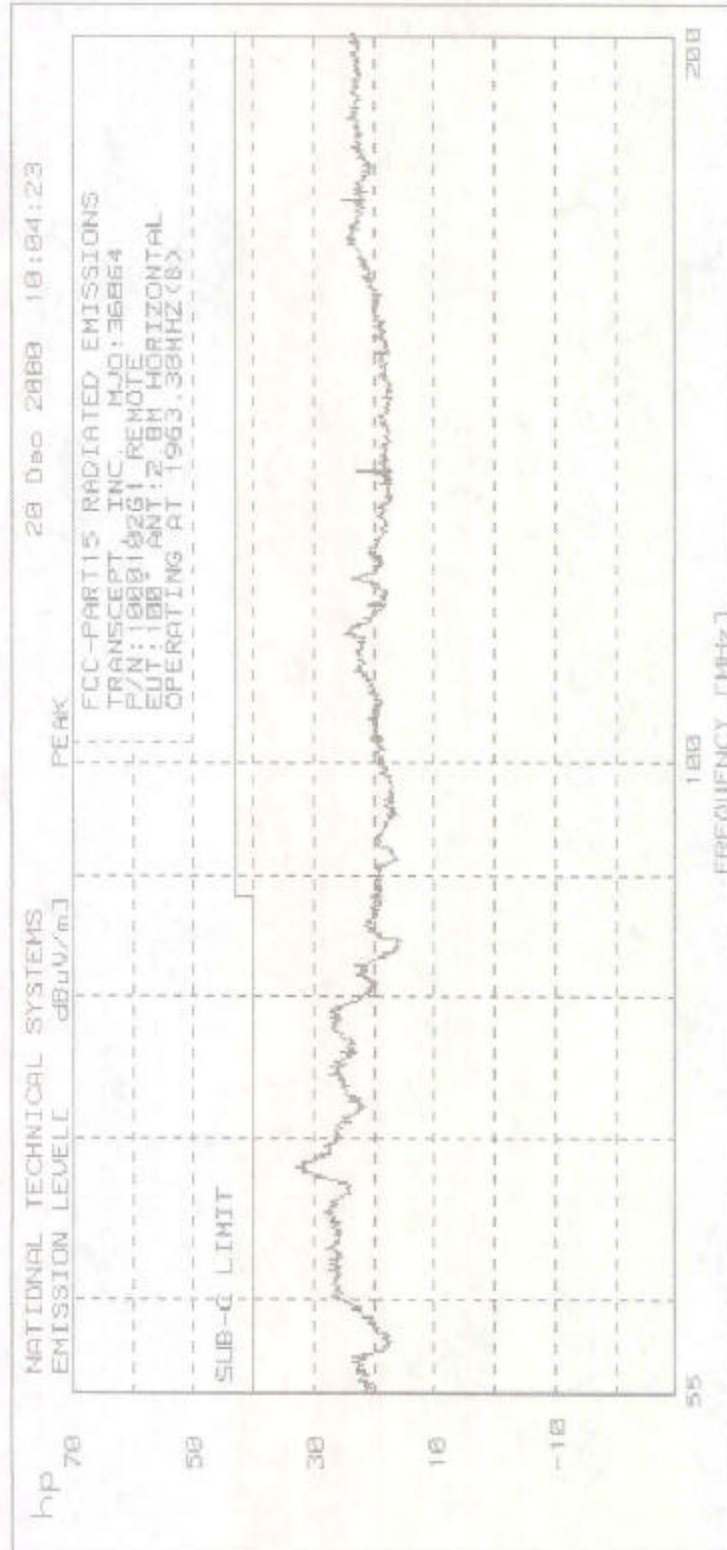
12. FCC P15 C RAD EMIS 12/19/00  
12.9 30-55MHZ

Peaks above -30 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/m)	DELTA
1	33.78	26	-14.0
2	45.01	30.6	-9.4
3	49.02	32.2	-7.8

B 06





B 07



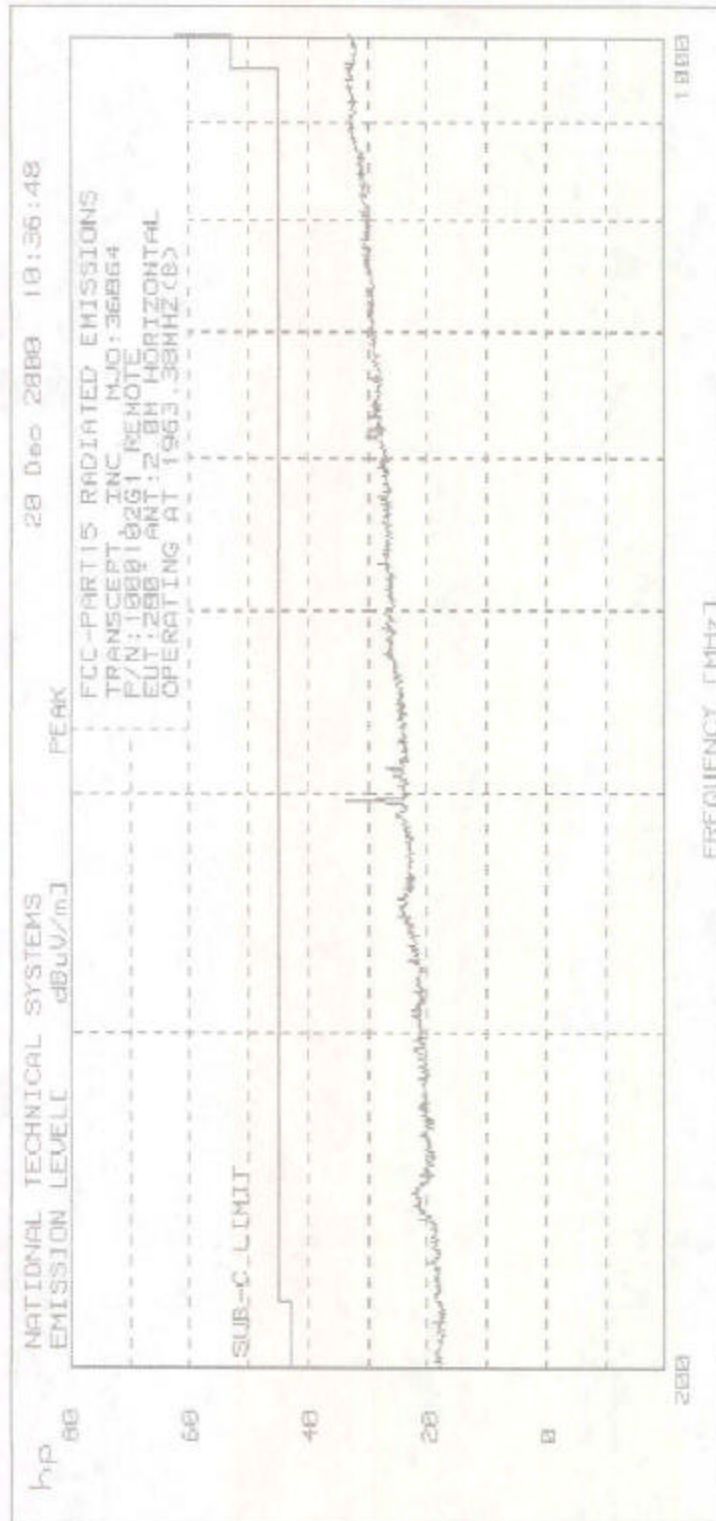
NATIONAL TECHNICAL SYSTEMS 20 Dec 2000 10:04:23

12. FCC P15 C RAD EMIS 12/18/00  
12.18 55-200MHZ

Peaks above -30 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/m)	DELTA
1	68.13	33.1	-6.9
2	113.25	24.8	-18.2

B 08



B 00

B-09





NATIONAL TECHNICAL SYSTEMS 20 Dec 2000 10:36:48

12. FCC P15 C RAD EMIS 12/18/00  
12.2 200-1000MHZ

20 highest Peaks above -30 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/m)	DELTA
1	396.73	33.7	-11.3

B 10



B 11



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12. FCC P15 C RAD EMIS 12/18/00

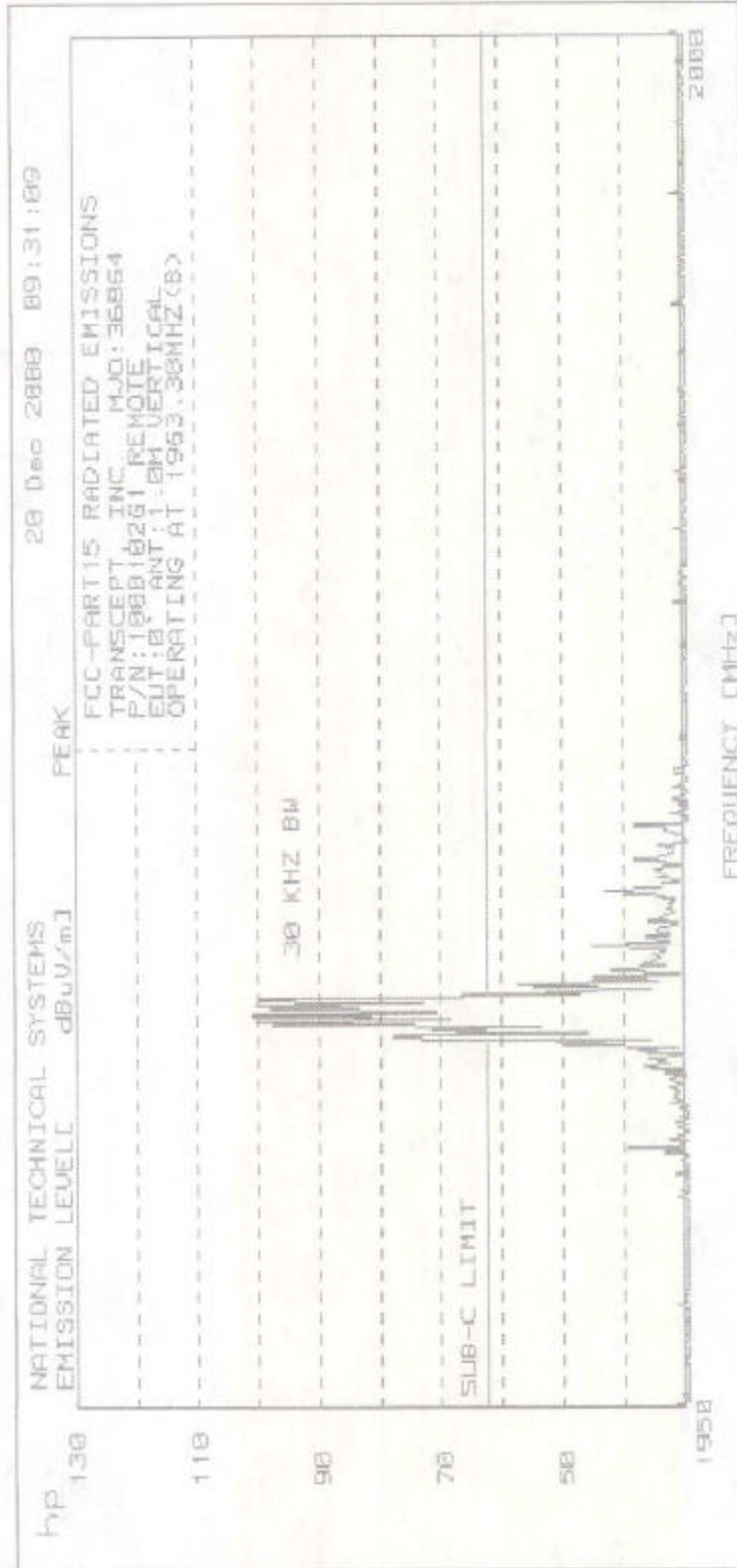
12.17 1-1.95GHZ \*

=====

No Peaks above -30 dB of Limit Line #1

=====

B 12



B 13

B-13



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NATIONAL TECHNICAL SYSTEMS      20 Dec 2000    09:31:09  
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12. FCC P15 C RAD EMIS 12/18/00

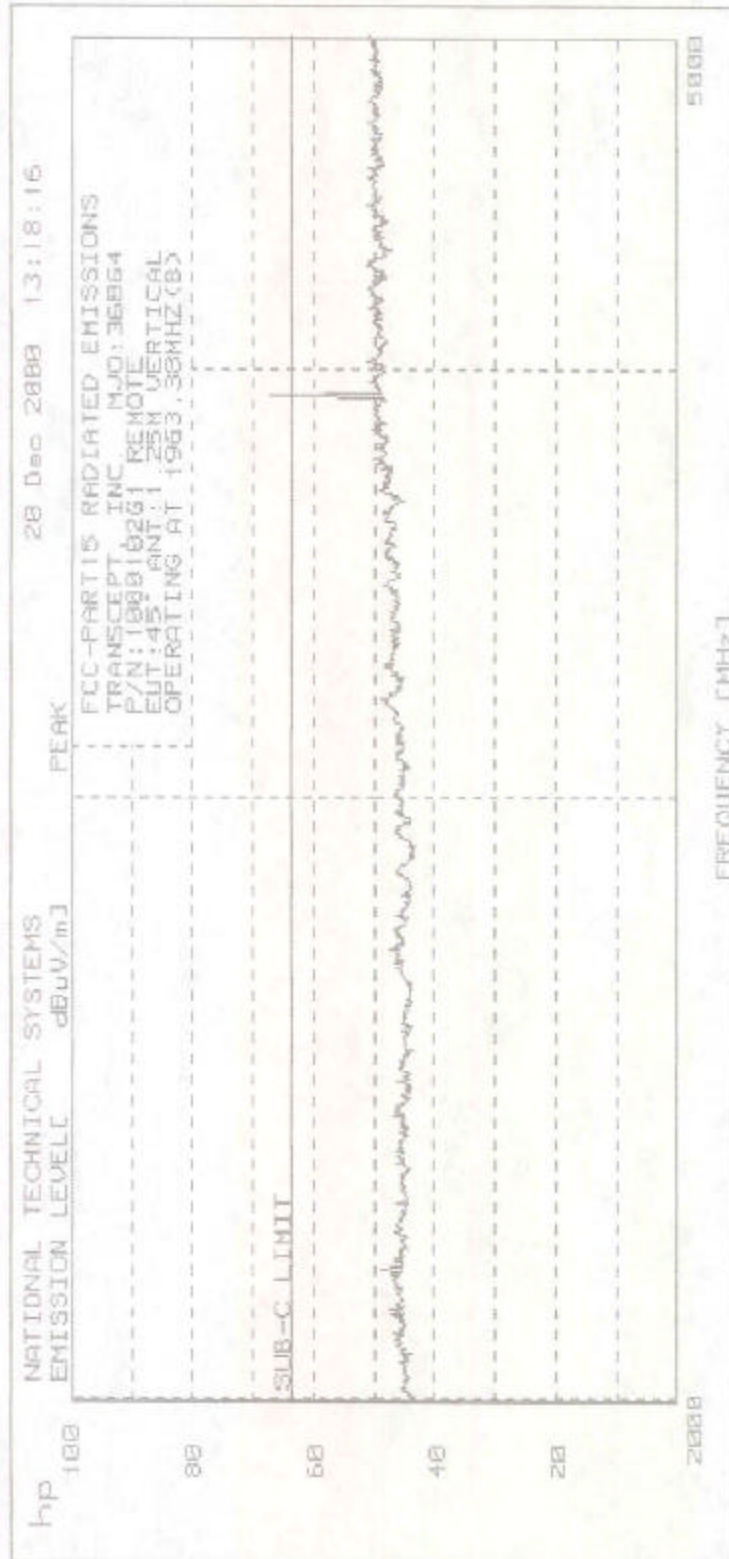
12.16 1.95-2.0GHZ \*

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Peaks above 62.5 dBuV/m  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/m)	DELTA
1	1963.3	77.7	15.2
2	1963.6	71.6	9.1
3	1963.9	100.2	37.7
4	1964.1	100.9	38.4
5	1964.4	100.5	38.0
6	1964.7	99.8	37.3





B 15



NATIONAL TECHNICAL SYSTEMS 20 Dec 2000 13:18:16

12. FCC P15 C RAD EMIS 12/18/00  
12.20 2-5GHZ

20 highest Peaks above -30 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/m)	DELTA
1	3930.2	67.4	3.9



B 17





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NATIONAL TECHNICAL SYSTEMS      20 Dec 2000    13:18:16

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12. FCC P15 C RAD EMIS 12/18/00

12.20    2-5GHZ

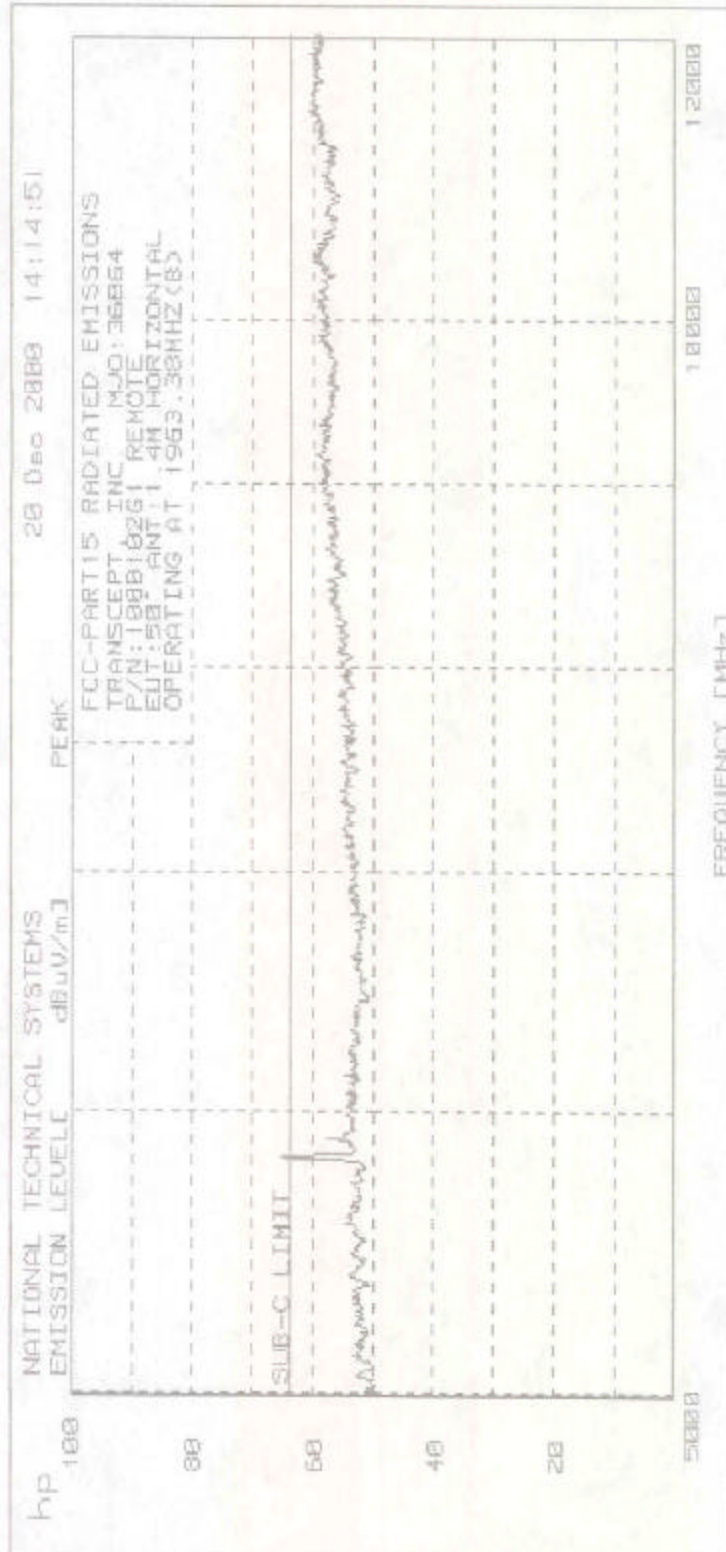
=====

20 highest Avg Peaks above -30 dB of Limit Line #1

peak criteria = 6 dB

=====

PEAK#	FREQ (MHz)	(dBuV/m)	DELTA
1	3930.2	52.8	-10.7



B 19



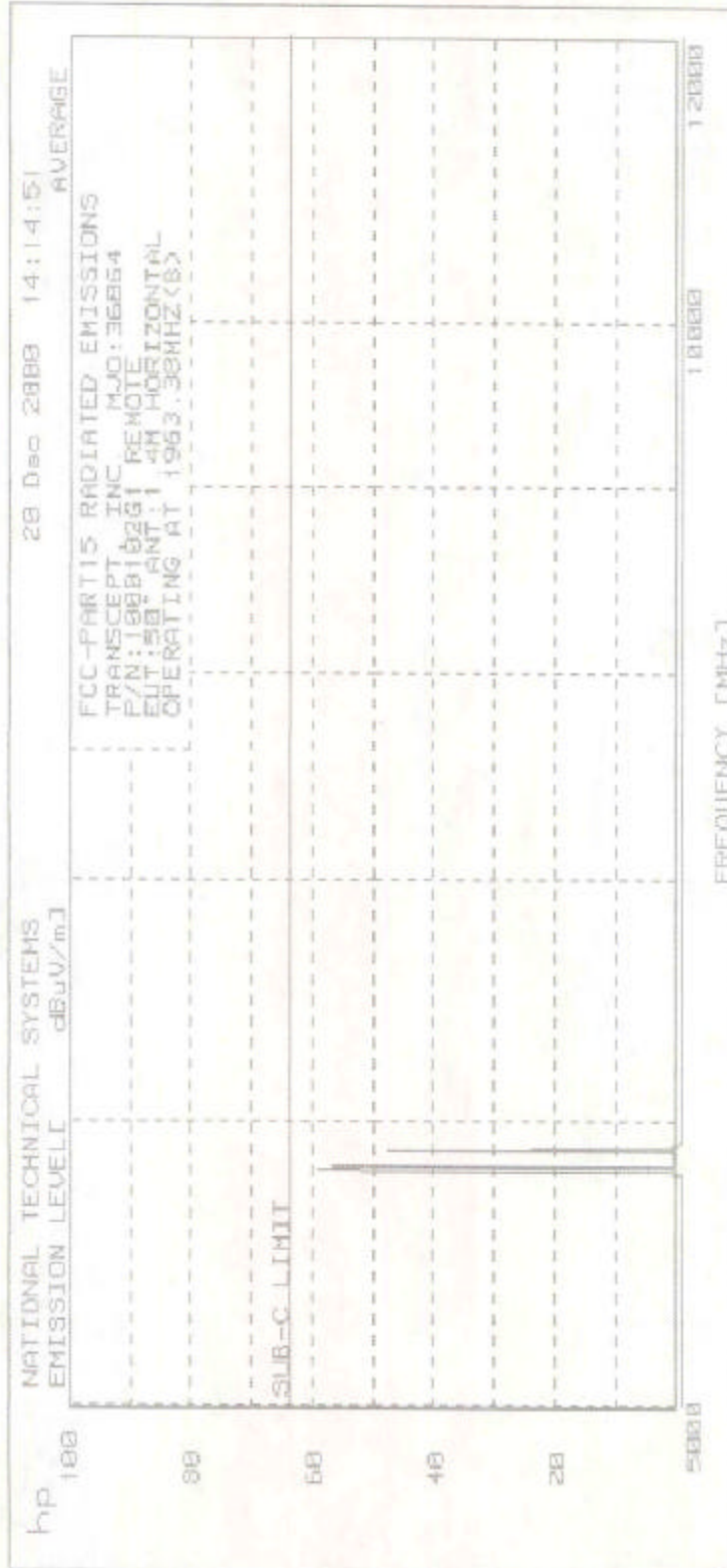
NATIONAL TECHNICAL SYSTEMS 20 Dec 2000 14:14:51

12. FCC P15 C RAD EMIS 12/18/00  
12.21 5-12GHZ

20 highest Peaks above -30 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/m)	DELTA
1	5826.9	65	1.5

B 20



B 21



NATIONAL TECHNICAL SYSTEMS 20 Dec 2000 14:14:51

12. FCC P15 C RAD EMIS 12/18/00

12.21 5-12GHZ

20 highest Avg Peaks above -30 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/m)	DELTA
1	5821.8	58.8	-4.7
2	5893.6	47.5	-16.0

B 22



B 23





NATIONAL TECHNICAL SYSTEMS 20 Dec 2000 15:12:20

12. FCC P15 C RAD EMIS 12/18/00  
12.6 12000-18000MHZ

20 highest Peaks above -30 dB of Limit Line #1  
peak criteria - 3 dB

PEAK#	FREQ (MHZ)	(dBuV/m)	DELTA
1	13996.	63.1	-.4
2	15067.	62.6	-.9
3	16233.	62.4	-1.1
4	16829.	63.8	.3

B 24

