September 7, 2000

Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

Attention: Applications Examiner

Applicant: Repeater Technologies
300 S. Harbor Blvd.
Suite 900
Anaheim, CA 92805

Equipment: OfficeCell PCS1900

FCC ID: EK2OC190002

Specification: 47 CFR 24 Licensed Certification

Dear Examiner:

The following application for Grant of Equipment Authorization is presented on behalf of Repeater Technologies for the Licensed Certification of their Model: OfficeCell PCS1900.

Enclosed, please find a complete data and documentation package demonstrating that this device complies with the technical requirements of 47 CFR, Part 24, for a PCS Repeater.

If you have any questions, please contact the undersigned, who is authorized to act as Agent.

Sincerely,

Chris Harvey
Director, EMC Laboratory

MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE ! BALTIMORE, MARYLAND 21230-3432 ! PHONE (410) 354-3300 ! FAX (410) 354-3313

ENGINEERING TEST REPORT

in support of the
Application for Grant of Equipment Authorization

EQUIPMENT:	OfficeCell PCS1900
FCC ID:	EK2OC190002
Specification:	47 CFR 24
On Behalf of the Applicant:	Repeater Technologies 300 S. Harbor Blvd. Suite 900 Anaheim, CA 92805
Manufacturer:	Repeater Technologies 300 S. Harbor Blvd. Suite 900 Anaheim, CA 92805
Manufacturer's Representative	Mr. Gary Grimes
Test Date(s):	August 10 thru September 5 , 2000

ENGINEERING STATEMENT

I ATTEST: the measurements shown in this report were made in accordance with the procedures indicated, and that the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements. On the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 24 of the FCC Rules under normal use and maintenance.

Liming Xu
EMC Engineer, MET Laboratories

1.0 INTRODUCTION

The following data is presented on behalf of the Applicant, Repeater Technologies, as verification of the compliance of the Repeater Technologies OfficeCell PCS1900 to the requirements of 47CFR 24.

2.0 TEST SITE

All testing was conducted at MET Laboratories, Inc., 914 West Patapsco Avenue, Baltimore, Maryland 21230-3493. Radiated emissions measurements were performed on a three-meter open area test site (OATS). A complete site description is on file with the FCC Laboratory Division as 31040/SIT/MET.

3.0 TEST EQUIPMENT USED

Manufacturer	Equipment	Calibration Due	Cal. Interval
Hewlett Packard	8563A Spectrum Analyzer	6/14/01	annual
EMCO	Biconical Antenna 3104	4/10/01	annual
EMCO	EMCO Log Periodic Antenna	4/10/01	annual
EMCO	Double Ridge Guided Horn	2/17/01	annual
Hewlett Packard	8594EM Analyzer	11/20/00	annual
Hewlett Packard	8591E Analyzer	8/12/00	annual
Solar	LISN	7/27/00	annual

4.0 EQUIPMENT UNDER TEST CONFIGURATION

The PCS Repeater was configured with AC power supply modules and a digital signal generator was used to simulate various CDMA (i.e. QPSK Modulation type),NADC (DAMPS) and GSM. cellular RF input signals to the EUT. The EUT with host external computer was configured for maximum signal gain and bandwidth. The EUT was operated in a manner representative of the typical usage of the equipment. During all testing, system components were manipulated within the confines of typical usage to maximize each emission.

5.0 TEST TYPE(S)

5.1 Radiated Emissions: 47 CFR 2.1053, 24.238

5.2 Occupied Bandwidth: 47 CFR 2.1049, Input vs. Output

5.3 RF Power Output: 47 CFR 2.1046, 24.132(b)(c)

5.4 Spurious Emission at Antenna Terminals (uplink & downlink): 47 CFR 2.1051, 24.238(a)

5.5 and Intermodulation Spurious Emissions-2 Tone Simultaneous RF Injection (uplink & downlink) at the lowest highest sides of the band: 47 CFR 2.1051.

5.6 AC Line Conducted Emissions: 47 CFR 15.107

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6.0 TEST RESULTS

6.1 TEST TYPE: Radiated Emissions

6.1.1 TECHNICAL SPECIFICATION: 47 CFR 2.1053; 24.238

6.1.2 TEST DATE(S): August 10, 2000

6.1.3 MEASUREMENT PROCEDURES:

As required by §2.1053, *field strength of spurious radiation measurements* were made in accordance with the general procedures of ANSI C63.4-1992 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz". Preliminary and final radiated emission measurements were performed inside a semi-anechoic chamber with all digital signal generators on and . The frequency list from the preliminary measurements was used as a guide for making final measurements in the semi-anechoic chamber. The unit was scanned over the frequency range of 30MHz to 20 GHz.
The Radiated Spurious Emissions *Limit* is obtained by the following:

Based on an output power (as measured at the output of the Amplifier) of 0.22 watts:

$$P_o = 0.22 \text{ W}$$

the radiated power level of all spurious emissions must be attenuated by at least 43 + 10log(Po) below Po, yielding:

$$Po - [43 + 10Log(0.22)] = -13dBm$$

All of the measurable radiated emissions are related to the digital device portion of the EUT, and thus are compared to the 47CFR 15 Class A field strength limit. Mathematical calculations indicate that these field strengths yield radiated power levels greater than 30 dB below the -13 dBm limit for spurious emissions from the transmitter portion of the EUT calculated above. There were no observable radiated emissions from the transmitter portion of the EUT.

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6.1.4 RESULTS:

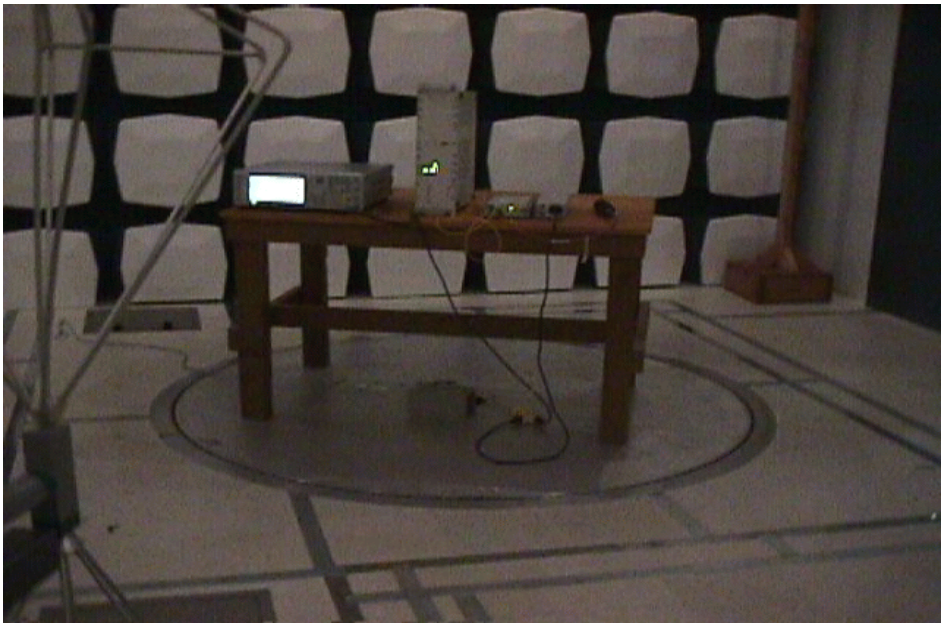
Carrier Emission: 0.22 Watts

Frequency (MHz)	Azimuth (ɛCCW-Oɛ=EUT facing ant.)	Pola-rity	Height (m)	Raw Amplitude (dBuV)	Ant.Cor. Factor (db)	Cable Loss (db)	Distance Corr. 3m to 10m	Corrected Amplitude (dBuV/m)
73.34	211	H	2.6	29.98	7.4312	1.55	0	38.96
73.34	220	V	1	17.77	7.2992	1.55	0	26.62
31.83	200	H	3.9	13.32	13.005	1.03	0	27.35
31.83	198	V	1	25.33	11.3144	1.03	0	37.67
263.6	200	H	3.6	14.2	18.232	3.14	0	35.57
263.6	200	V	1.3	16.62	18.26	3.14	0	38.02
401.2	200	H	2	14.21	16.736	3.95	0	34.90
401.2	200	V	1	14.24	16.46	3.95	0	34.65
625.0	200	H	1.5	13.27	20.05	5.155	0	38.48
625.0	200	V	1	13.22	19.5	5.155	0	37.88
740.0	200	H	1.8	13.9	21.4	5.74	0	41.04
740.0	200	V	1	13.92	20.9	5.74	0	40.56

(Radiated emissions from the digital device portion of the EUT)

All of the measurable radiated emissions are related to the digital device portion of the EUT, and thus are compared to the 47CFR 15 Class A field strength limit. Mathematical calculations indicate that these field strengths yield radiated power levels greater than 30 dB below the -13 dBm limit for spurious emissions from the transmitter portion of the EUT calculated above. There were no observable radiated emissions from the transmitter portion of the EUT. The EUT meets 47 CFR 24.238.

Photograph of Radiated Emissions Test Configuration



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6.2 TEST TYPE: Occupied Bandwidth (Input vs. Output)

6.2.1 TECHNICAL SPECIFICATION: 47 CFR 2.1049

6.2.2 TEST DATE(S): September 1 , 2000

6.2.3 MEASUREMENT PROCEDURES:

As required by §2.1049 of CFR 47, *occupied bandwidth measurements* were made on the PCS Repeater pre- and post- repeater. A digital signal generator was configured to transmit a modulated carrier signal. Using a bandwidth of 300Hz for NADC and 1-30 kHz for GSM and CDMA (digital).

6.2.4 RESULTS:

Equipment complies with Section 2.1049. Plots of the occupied bandwidth, as measured at the Repeater/Booster RF input port and at the antenna RF output port (post amplification) follow:

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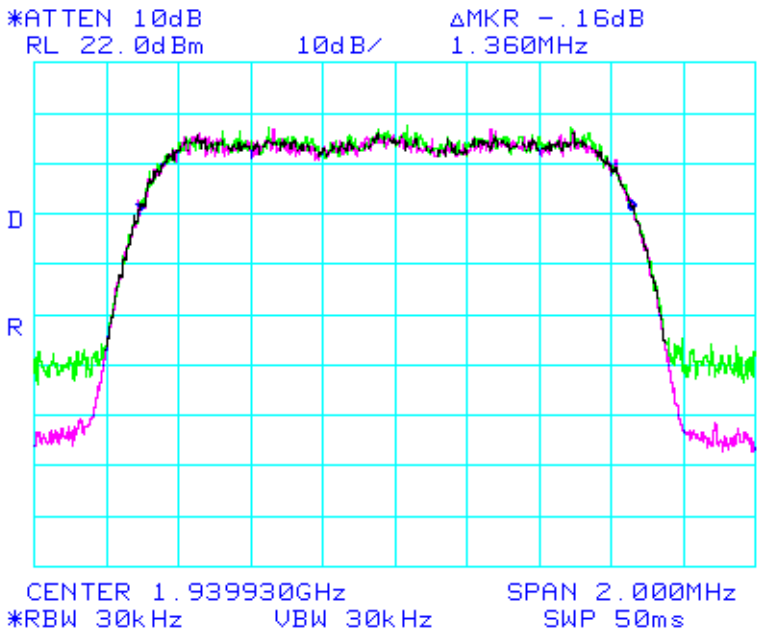
CDMA Occupied B/W Input vs Output Downlink
emc1367



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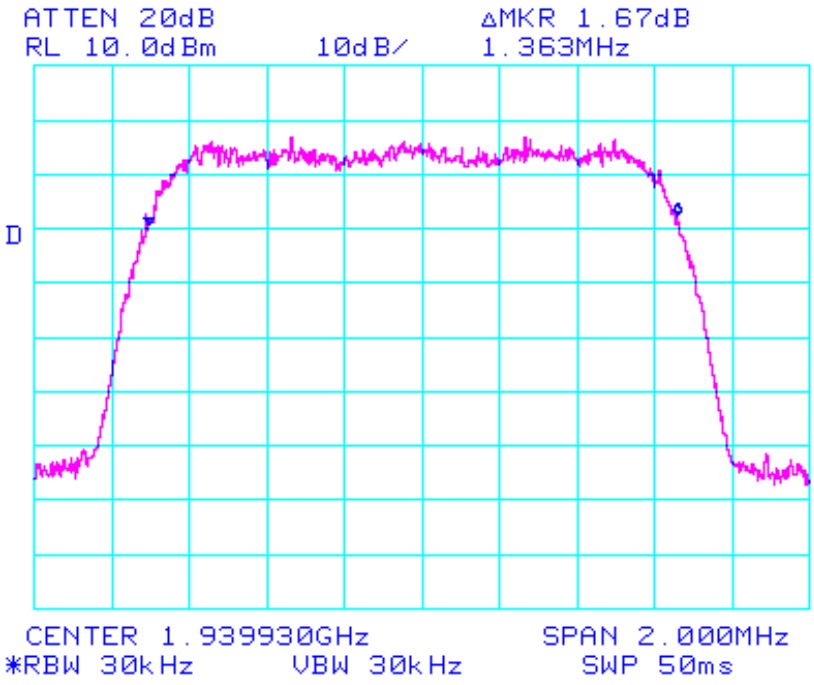
CDMA Occupied B/W at input side Downlink
emc1367



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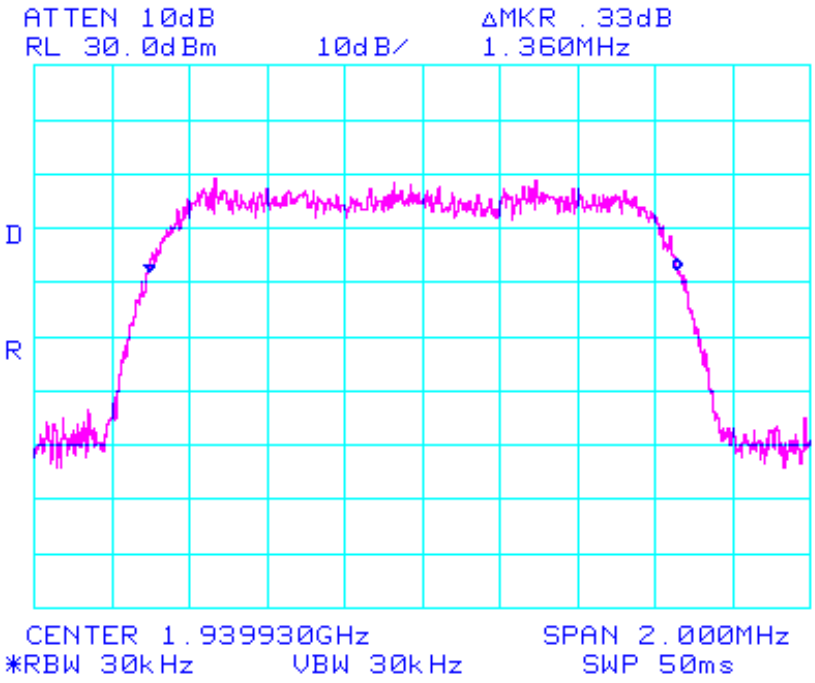
CDMA Occupied B/W at output side Downlink
emc1367



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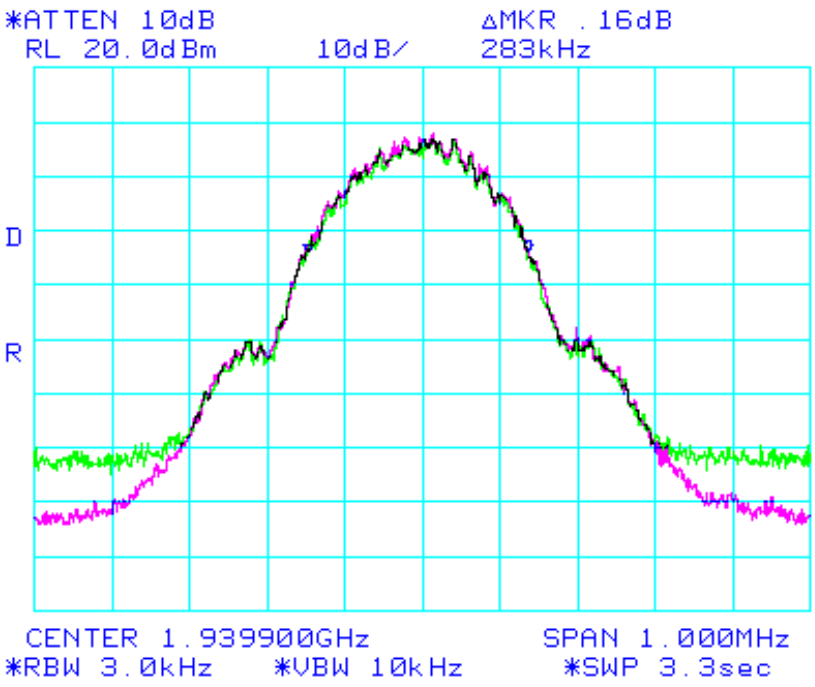
GSM Occupied B/W Input vs Output Downlink
emc1367



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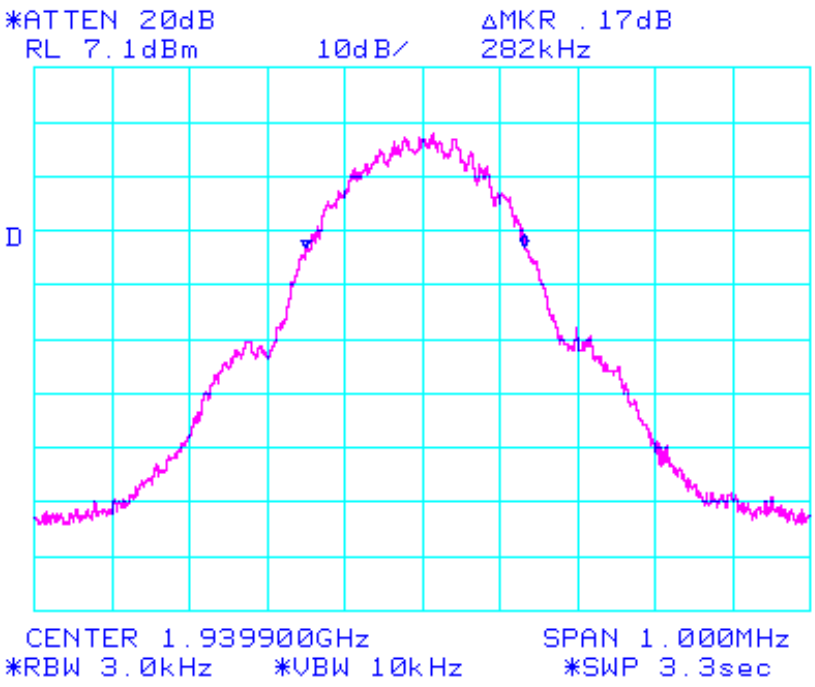
GSM Occupied B/W at Input side Downlink
emc1367



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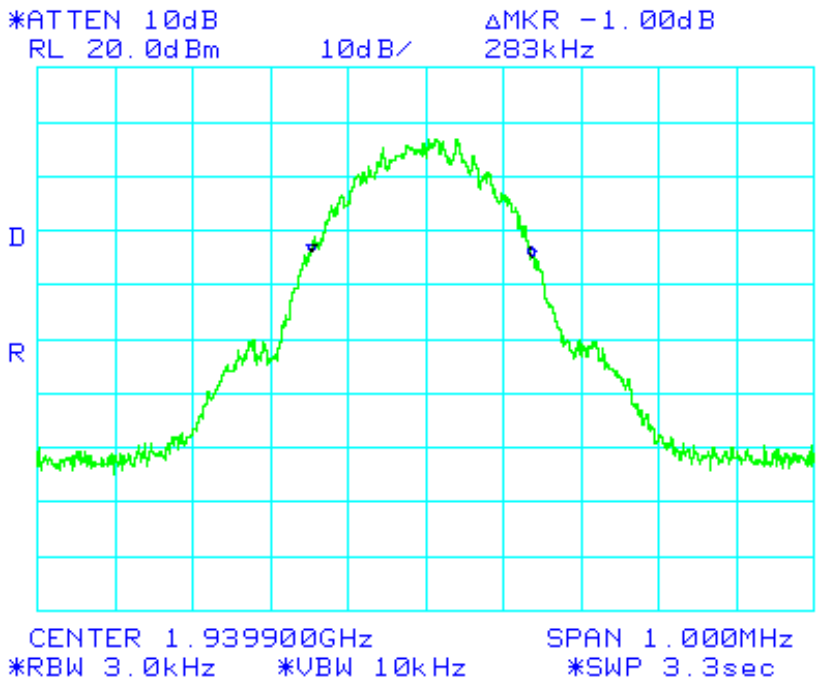
GSM Occupied B/W at Output side Downlink
emc1367



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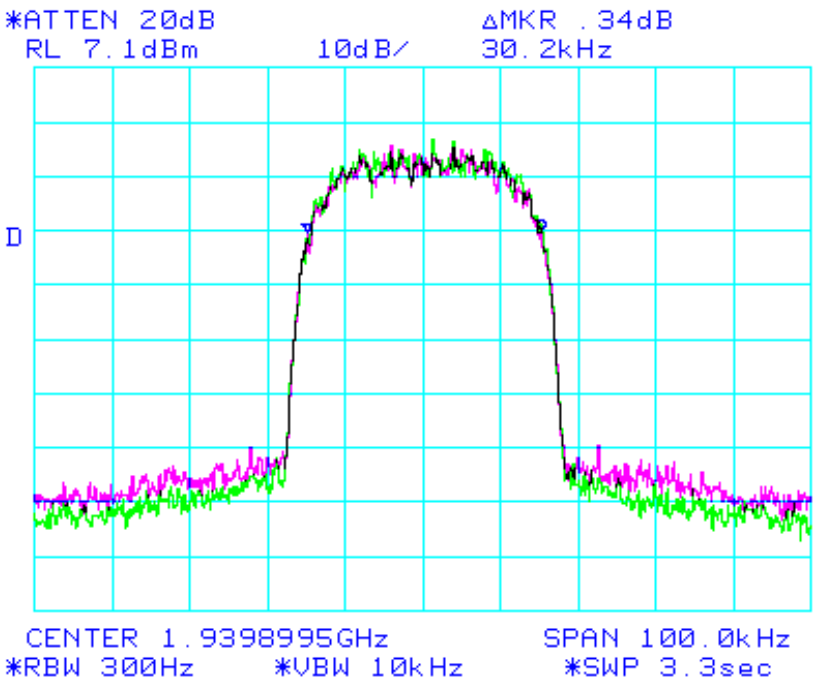
NADC Occupied B/W Input vs Output Downlink
emc1367



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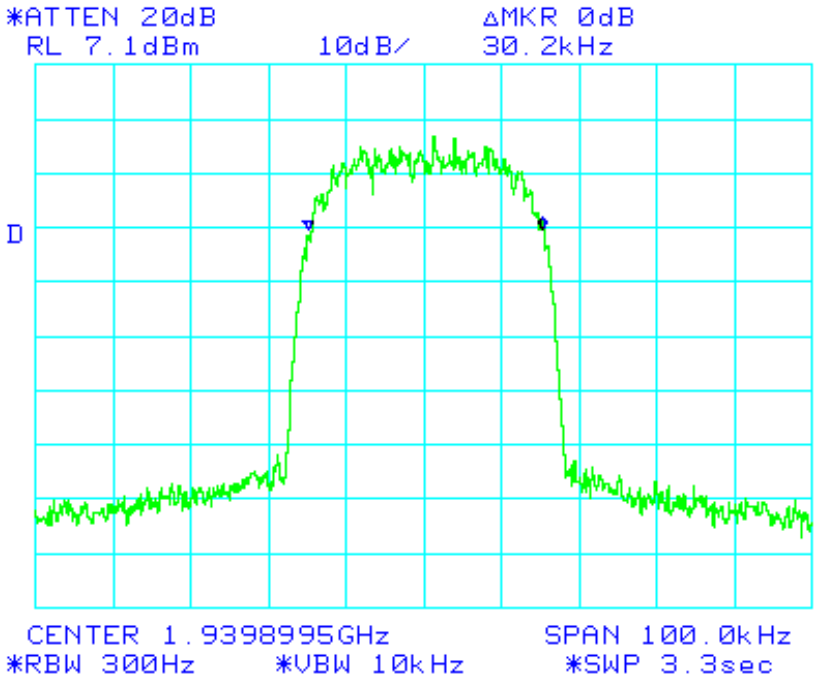
NADC Occupied B/W at Input side Downlink
emc1367



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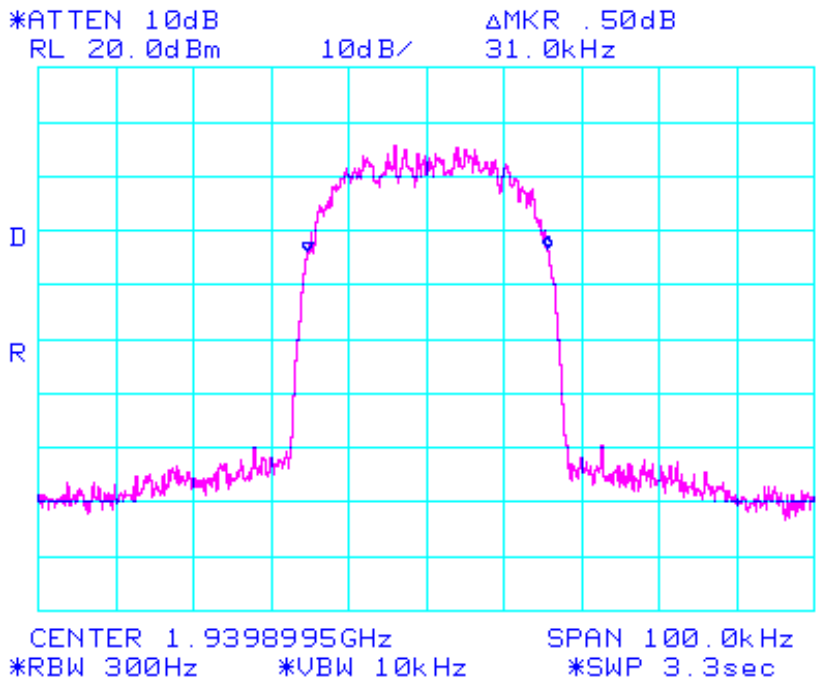
NADC Occupied B/W at output side Downlink
emc1367



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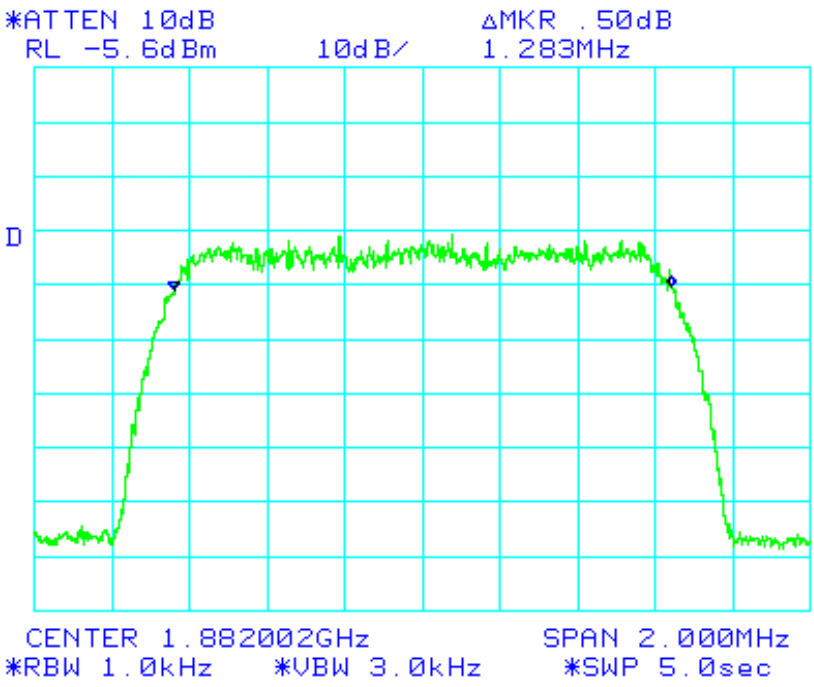
CDMA Occupied B/W at Input side Uplink emc1367



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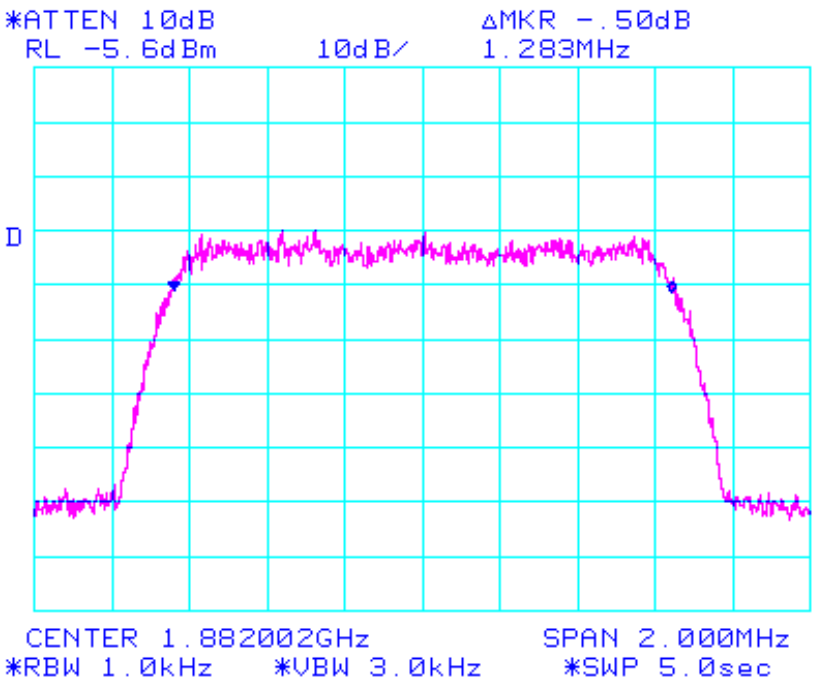
CDMA Occupied B/W at Output side Uplink emc1367



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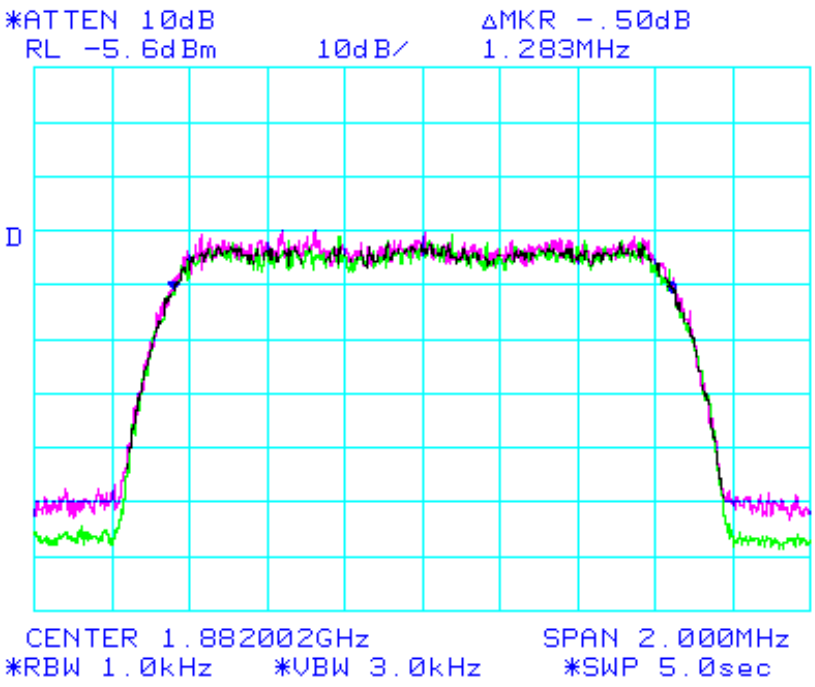
CDMA Occupied B/W Input vs Output Uplink emc1367



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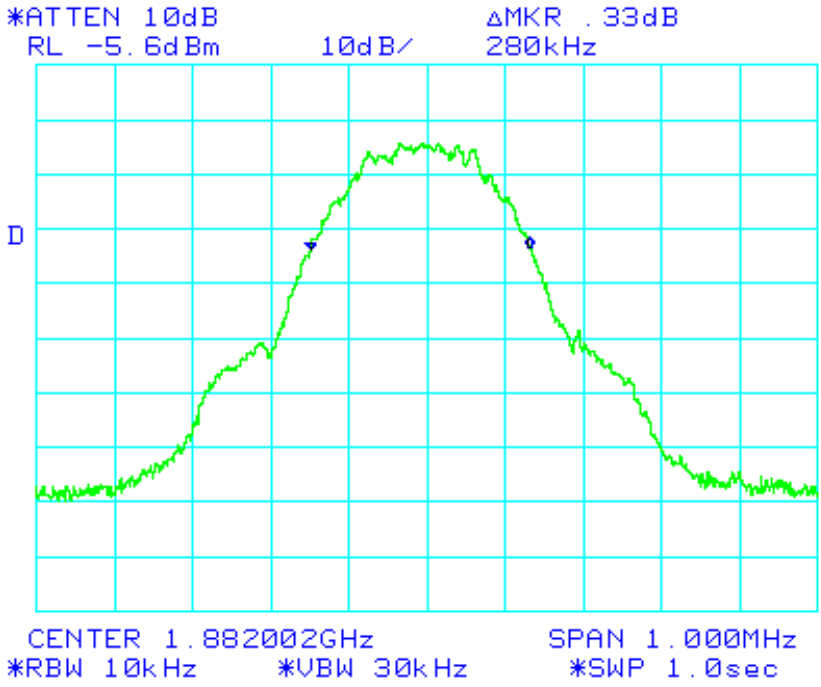
GSM Occupied B/W at Input side Uplink



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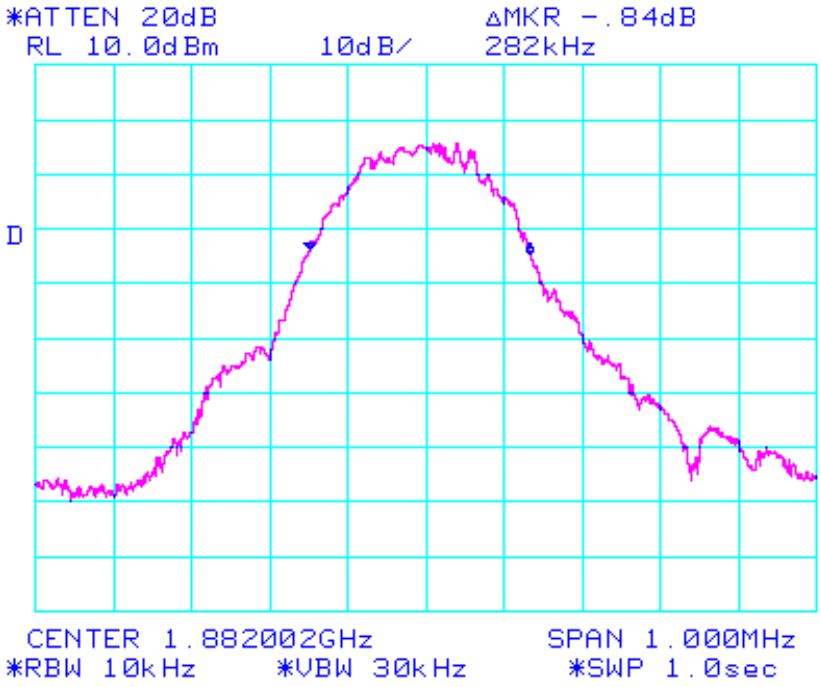
GSM Occupied B/W at output side Uplink



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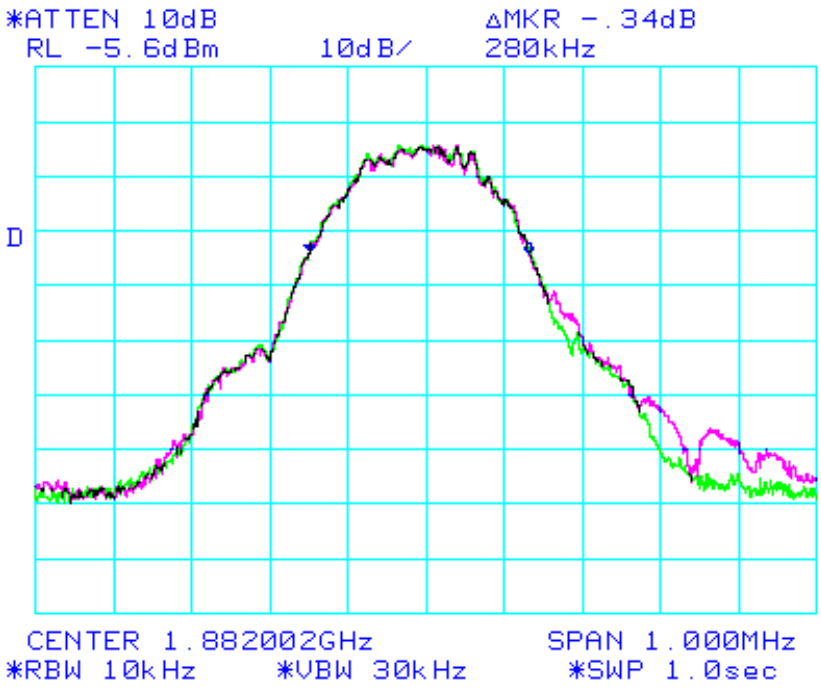
GSM Occupied B/W Input vs Output Uplink



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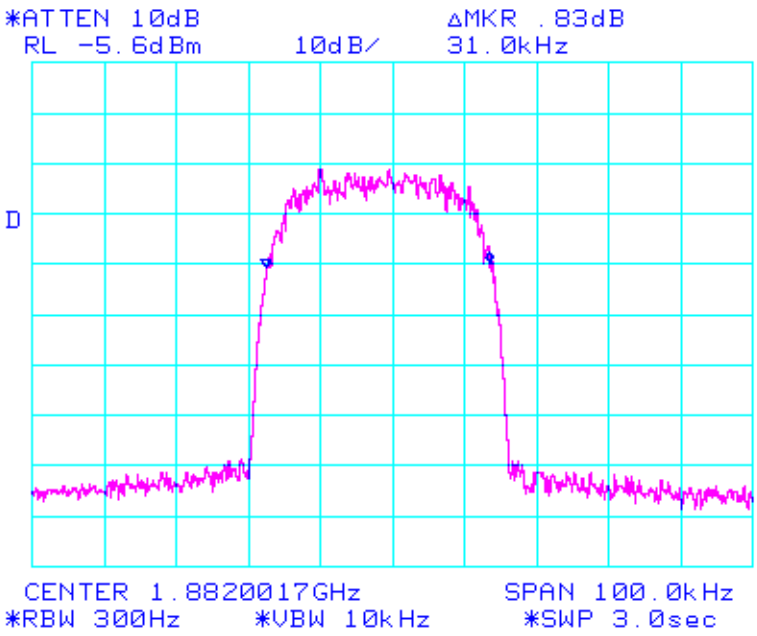
NADC Occupied B/W at input side Uplink emc1367



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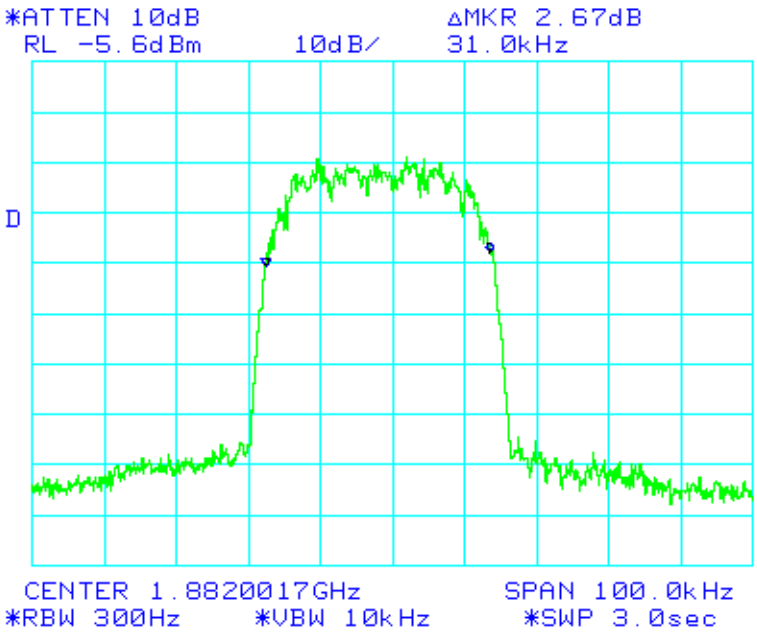
NADC Occupied B/W at Output side Uplink emc1367



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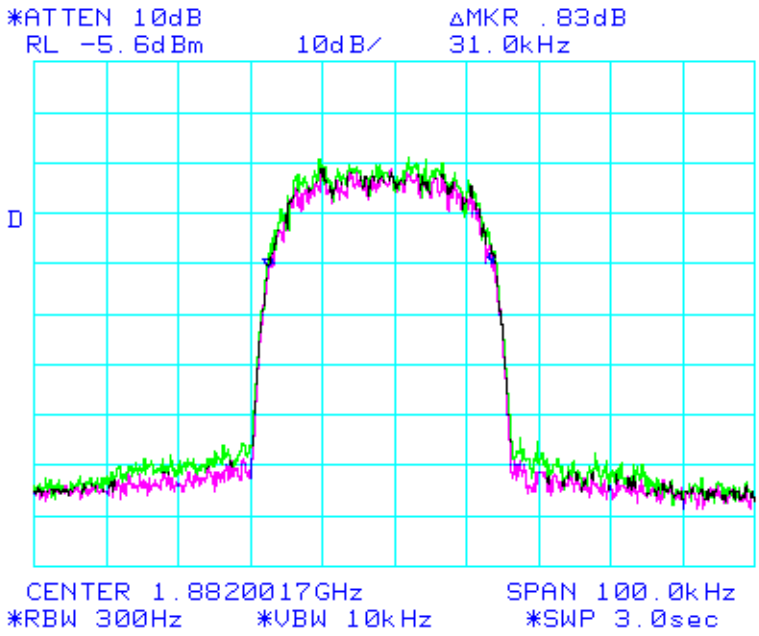
NADC Occupied B/W Input vs Output Uplink emc1367



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6.3 TEST TYPE: RF Power Output

6.3.1 TECHNICAL SPECIFICATION: 47 CFR 2.1046 and 24.132(b)(c)

6.3.2 TEST DATE(S): August 31, 2000

6.3.3 MEASUREMENT PROCEDURES:

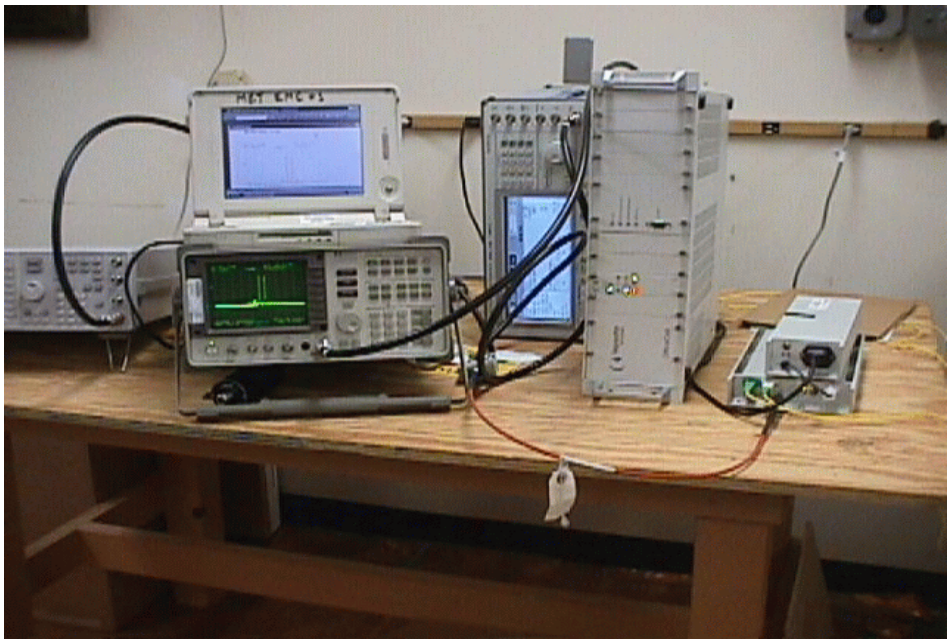
As required by 47 CFR 2.1046, *RF power output measurements* were made at the RF output terminals using an attenuator and spectrum analyzer.

Plots of the RF output Power level, as measured at the RF output of the signal generator and at the RF output terminals of the EUT are included in this application as file attachment

6.3.4 RESULTS:

Equipment complies with 47 CFR 2.1046 and 24.132(b)(c). The Cellular repeater/booster power does not exceed 500 W (57 dBm) at the carrier frequency.

Photograph of Antenna Conducted Spurious Emissions and
RF Power Output Test Configuration



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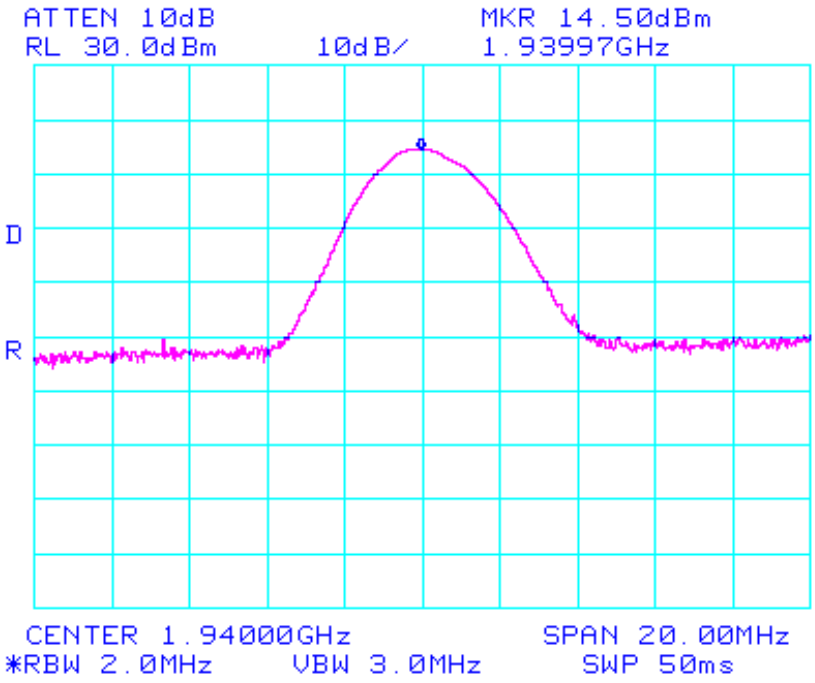
RF output power unmodulated Downlink
emc1367



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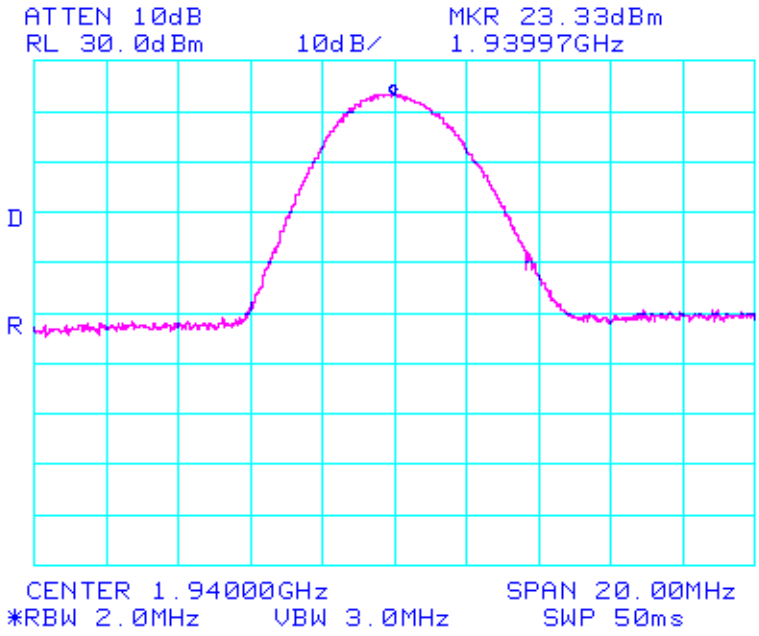
RF output power CDMA (IS-95) Downlink
emc1367



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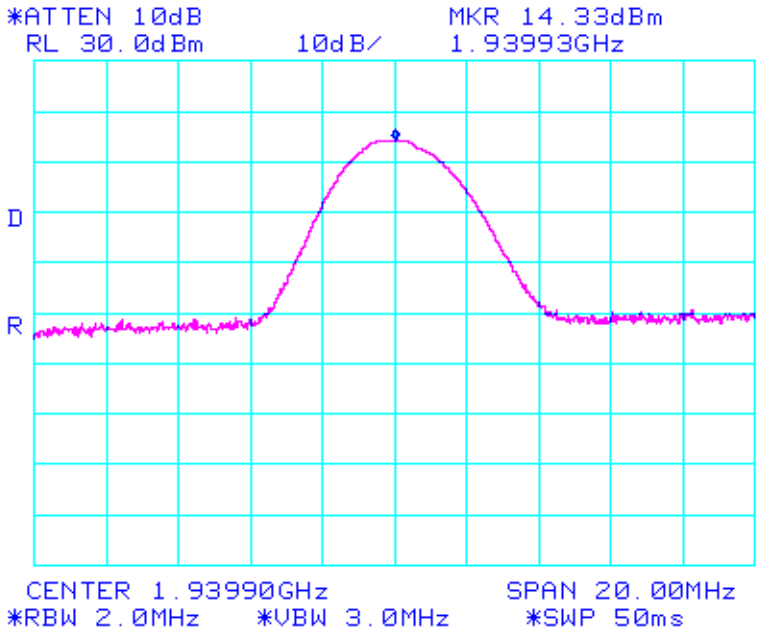
RF output power GSM Downlink
emc1367



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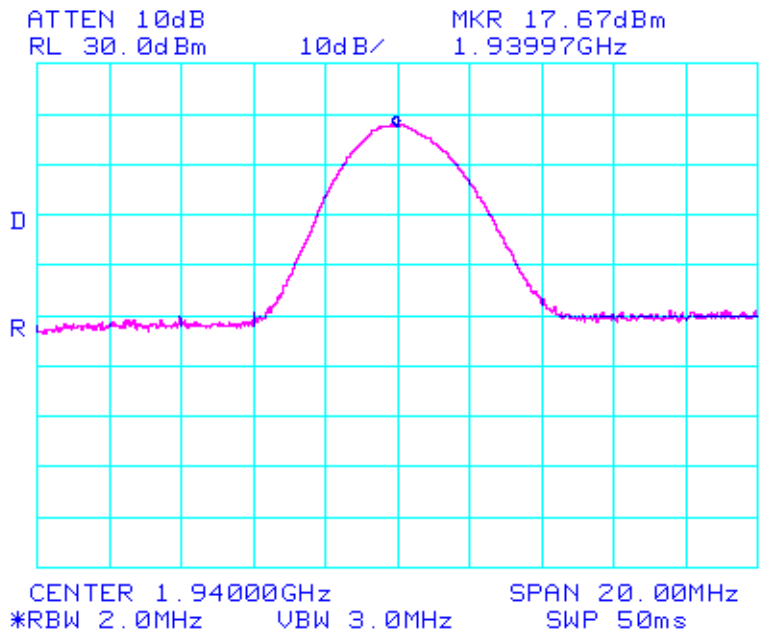
RF output power NADC (Damps) Downlink
emc1367



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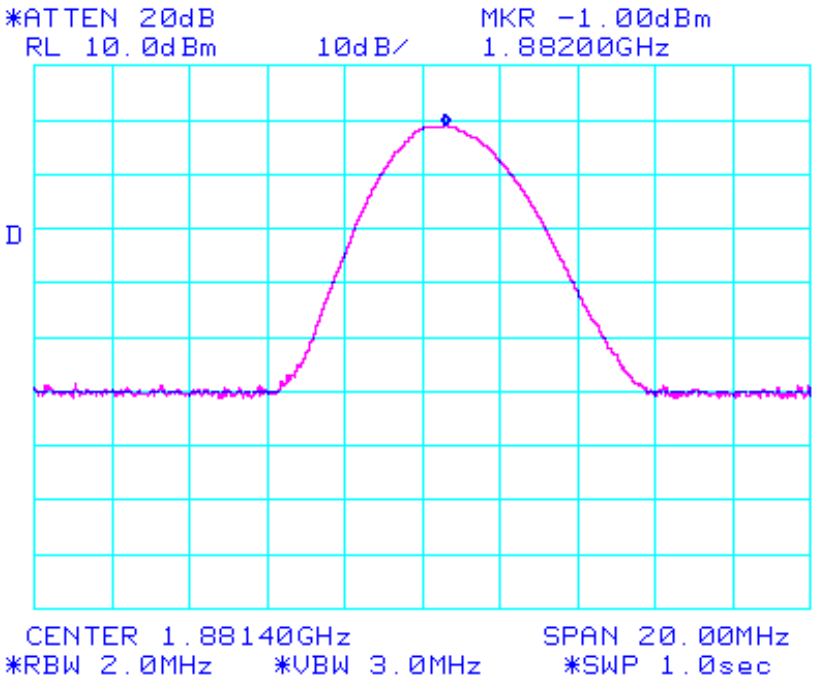
RF output power unmodulated Uplink emc1367



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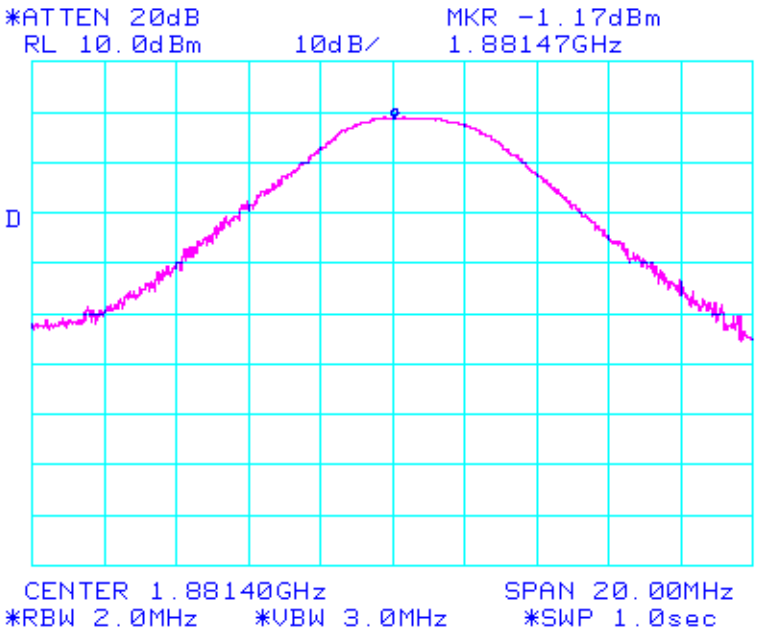
RF output power CDMA Uplink emc1367



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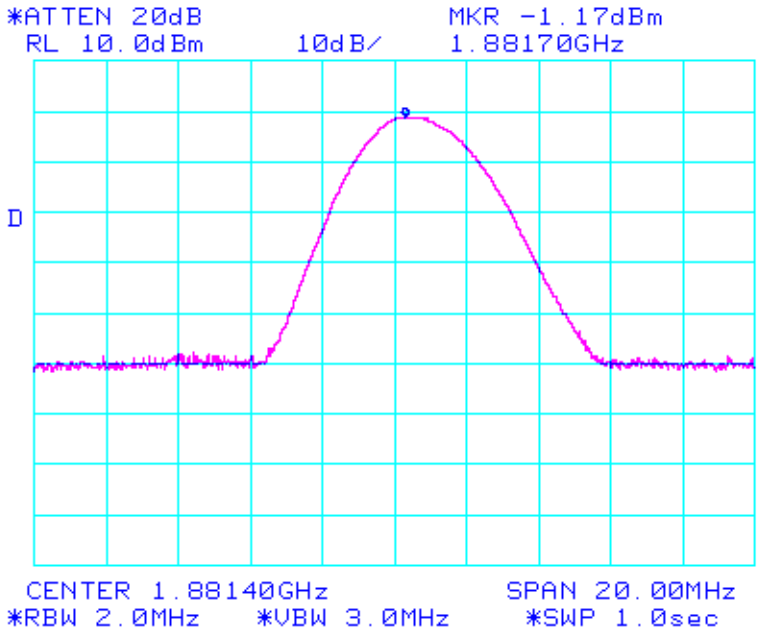
RF output power GSM Uplink emc1367



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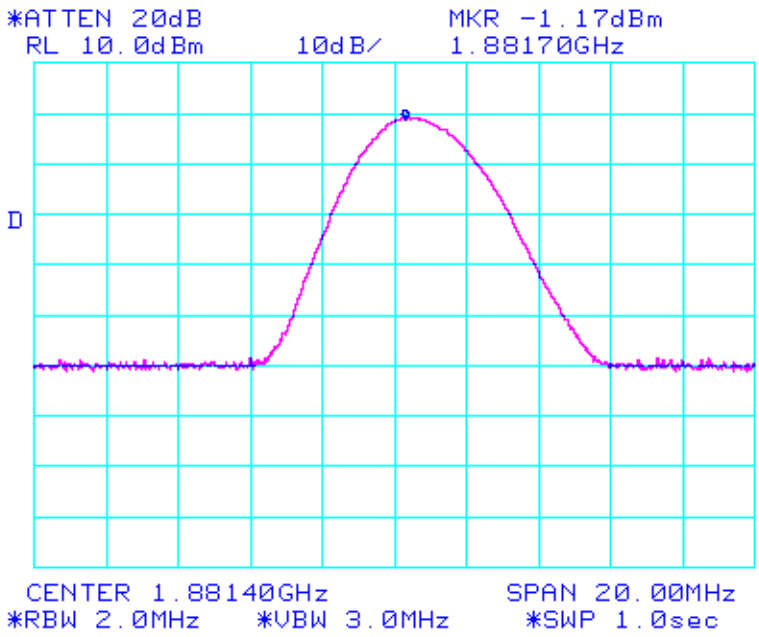
RF output power NADC Uplink emc1367



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6.4 TEST TYPE: Spurious Emissions at Antenna Terminals— Uplink Channels

6.4.1 TECHNICAL SPECIFICATION: 47 CFR 2.1051; 24.238(a)

6.4.2 TEST DATE(S): August 31, 2000

6.4.3 MEASUREMENT PROCEDURES:

As required by 47 CFR 2.1051, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a 50 S attenuator and spectrum analyzer set for a 100 kHz bandwidth. This test was performed with Digitally modulated carrier signals. The Digital signal generator was adjusted for continuous transmit on frequencies in both the uplink and down-link frequency bands. The frequency spectrum was investigated from 9.0 KHz to 20 GHz. For measuring emissions above 2 GHz, a high-pass filter was used to eliminate the fundamental transmit frequency to prevent possible saturation effects on the front end of the spectrum analyzer.

6.4.4 RESULTS:

Equipment complies with Sections 2.1051and 24.238(a)

As recommended in 47 CFR 24.238(a), a 100kHz bandwidth was chosen to measure the peak of any spurious emission. The unit was exercised using signal types required by 47 CFR 2.1051.

Spur limit = Po - (43 + 10logP) = 132.5 dBµV - (38.44 dB) = 94 dBµV = -13.1 dBm

SUMMARY OF SPURIOUS EMISSIONS AT ANTENNA TERMINALS - UpLink

Frequency Range	Emission Frequency	Emission Level (dBm)	Limit (dBm)
0 kHz - 2.9 GHz	1.774GHz	-50.0	-13.1
2.9GHz-9.0 GHz	5.664 GHz	-65.33	-13.1
9 GHz - 20.0 GHz	19.653 GHz	-57.00	-13.1

The following plots are included to illustrate compliance with the requirements of 47 CFR 24.238(a):

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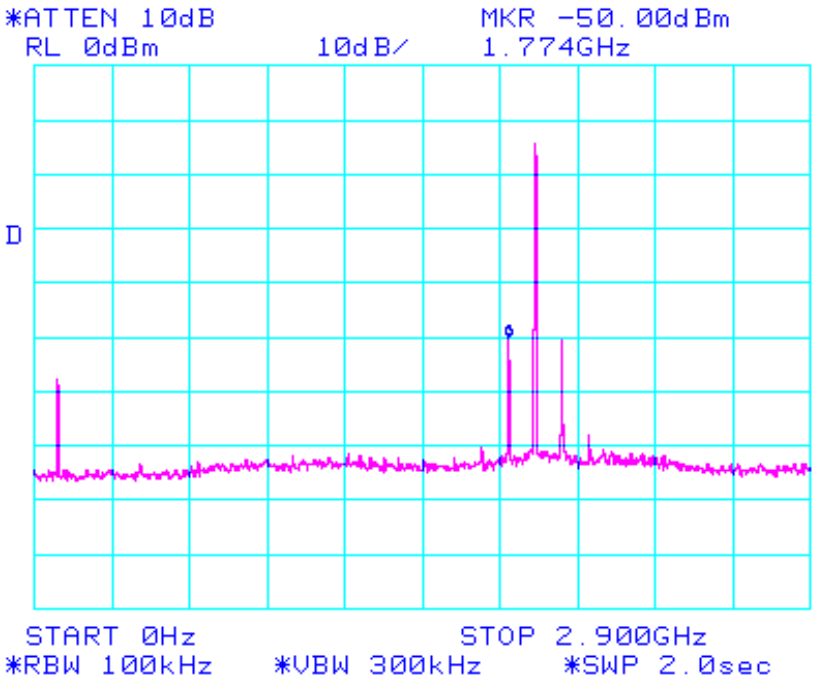
Spur emissions Uplink emc1367



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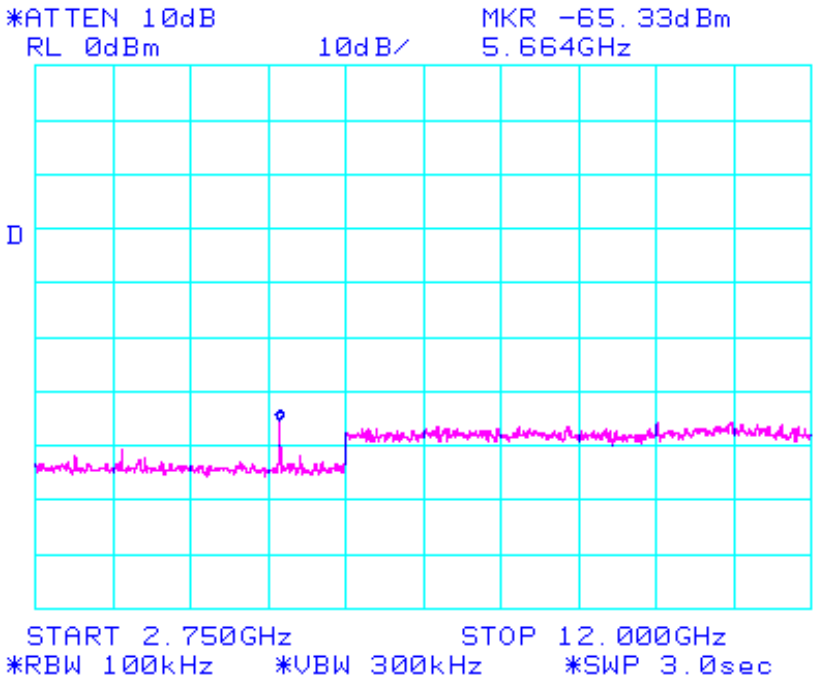
Spur emissions Uplink emc1367



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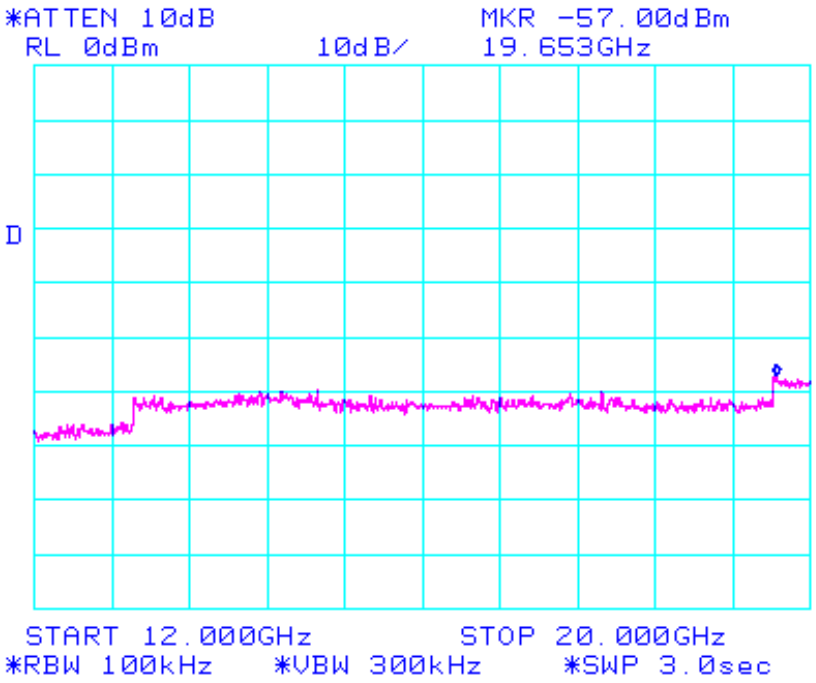
Spur emissions Uplink emc1367



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6.5 TEST TYPE: Spurious Emissions at Antenna Terminals— Downlink Channels

6.5.1 TECHNICAL SPECIFICATION: 47 CFR 2.1051; 24.238(a)

6.5.2 TEST DATE(S): August 31, 2000

6.5.3 MEASUREMENT PROCEDURES:

As required by 47 CFR 2.1051, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a 50 S attenuator and spectrum analyzer set for a 100 kHz bandwidth. This test was performed with Digitally modulated carrier signals. The Digital signal generator was adjusted for continuous transmit on frequencies in both the uplink and down-link frequency bands. The frequency spectrum was investigated from 9.0 KHz to 20 GHz. For measuring emissions above 2 GHz, a high-pass filter was used to eliminate the fundamental transmit frequency to prevent possible saturation effects on the front end of the spectrum analyzer.

6.5.4 RESULTS:

Equipment complies with Section 2.1051and 24.238(a).

As recommended in 47 CFR 24.238(a), a 100kHz bandwidth was chosen to measure the peak of any spurious emission. The unit was exercised using signal types required by 47 CFR 2.1051.

Spur limit = Po - (43 + 10logP) = 132.5 dBµV - (38.44 dB) = 94 dBµV = -13.1 dBm

SUMMARY OF SPURIOUS EMISSIONS AT ANTENNA TERMINALS - DownLink (Base)

Frequency Range	Emission Frequency	Emission Level (dBm)	Limit (dBm)
0 kHz - 1 GHZ	502.0 MHz	-45.67	-13.1
1 GHz - 2.9 GHZ	2.857 GHz	-42.33	-13.1
2.9 GHz - 20 GHZ	19.653 GHz	-28.00	-13.1

Plots on the following pages illustrate compliance to the required rule parts.

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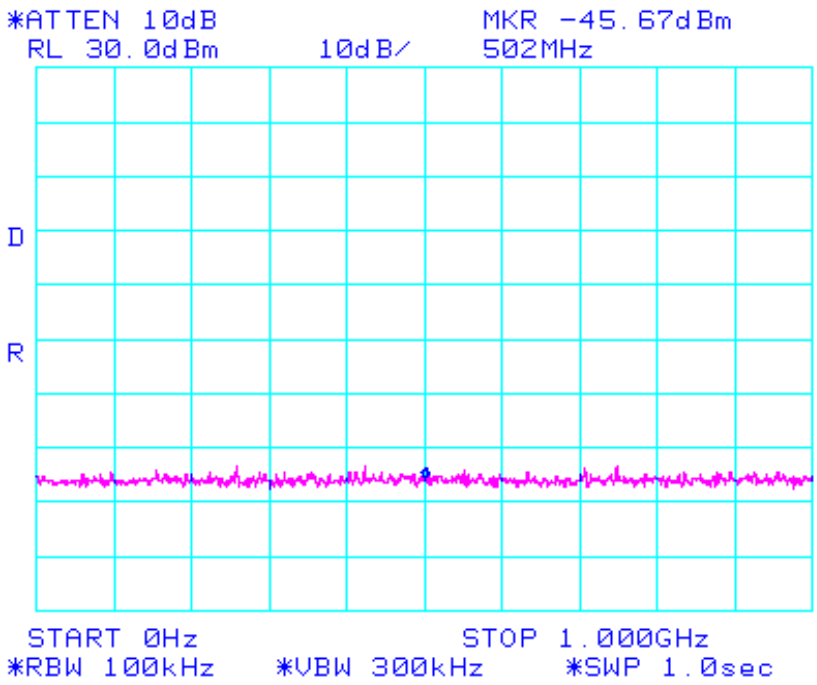
Spur emissions Downlink emc1367



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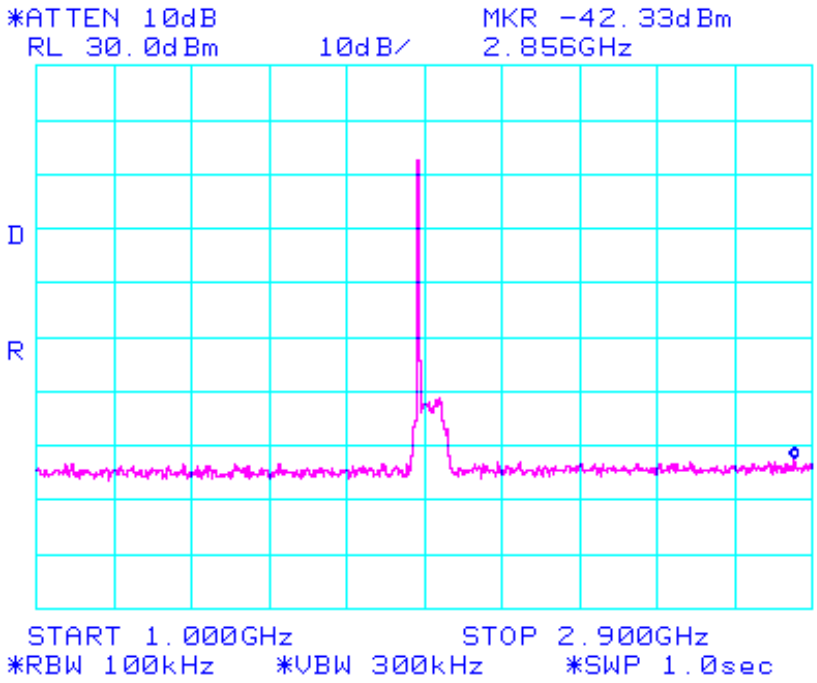
Spur emissions Downlink emc1367



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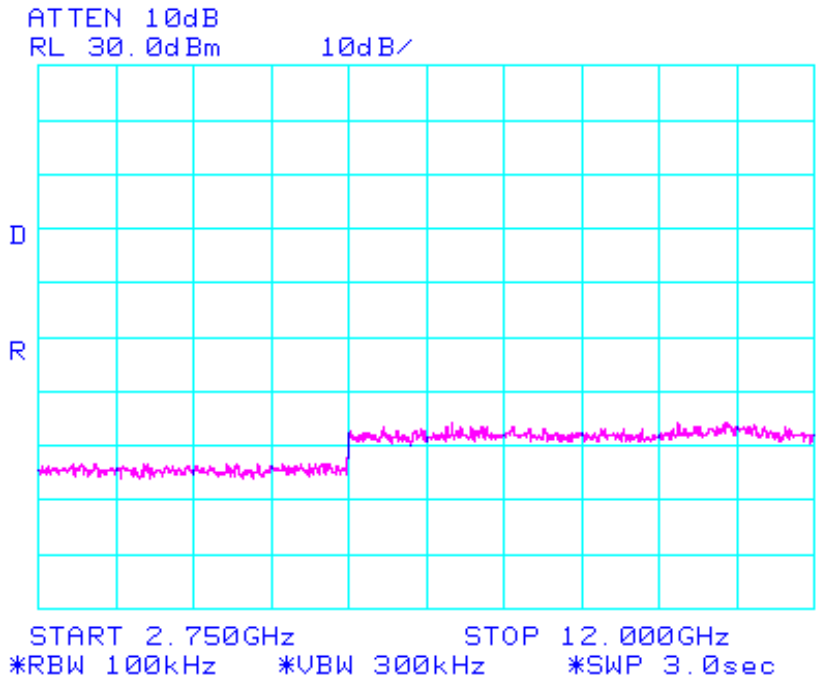
Spur emissions Downlink emc1367



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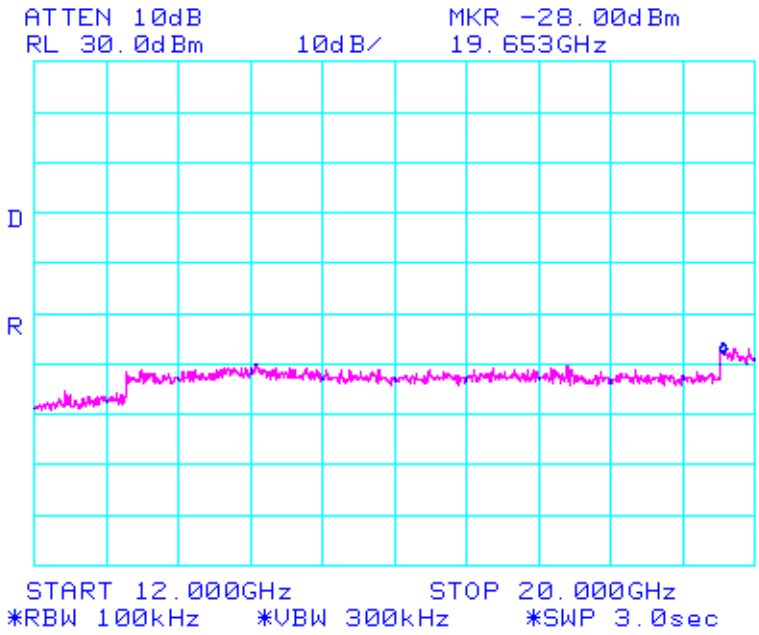
Spur emissions Downlink emc1367



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6.6 TEST TYPE: Intermodulation Spurious Emissions Antenna Terminals— Uplink

6.6.1 TECHNICAL SPECIFICATION: 47 CFR 2.1051.

6.6.2 TEST DATE(S): August 31, 2000

6.6.3 MEASUREMENT PROCEDURES: (UPLINK)

Spurious emissions were measured at the antenna terminal with the Digital signal generator tuned to transmit on a frequency in the uplink of its tuneable range.

6.6.4 RESULTS:

Equipment complies with 47CFR 2.1051. Plots of the spurious emissions as measured at the antenna port are included in this application as file attachment:

Intermodulation Spurious Products from 2-tone Simultaneous RF Injection At low side and high side of PCSr band. **Uplink**

Spur limit = Po - (43 + 10logP) = 132.5 dBµV - (38.44 dB) = 94 dBµV = -13.1 dBm

Uplink

modulation type	Intermodulation products (MHZ)	Emission Level (dBm)	Limit (dBm)
NADC (DAMPS)	1849.0 1902.0	-60.67 -66.67	-13.1

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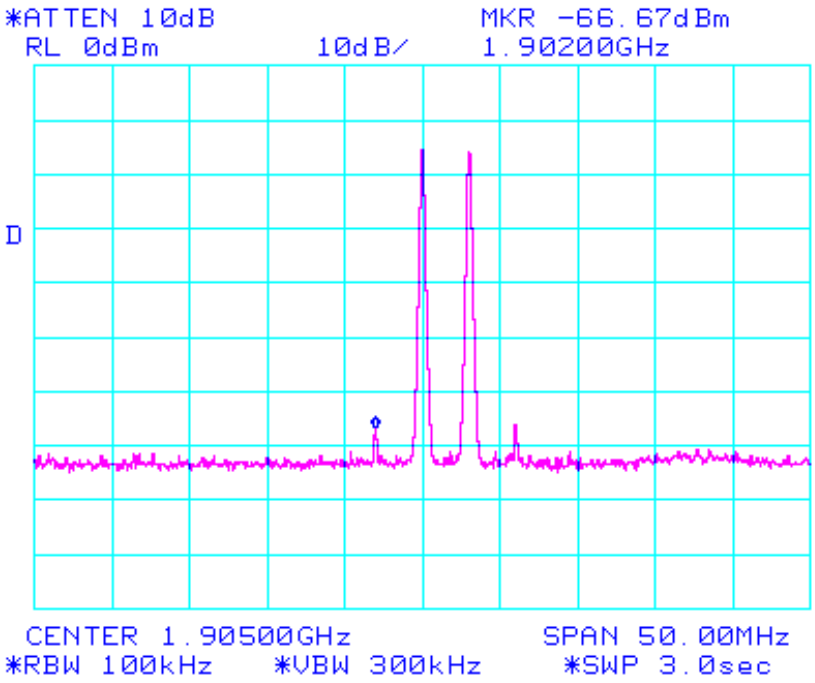
IMD NADC Uplink emc1367



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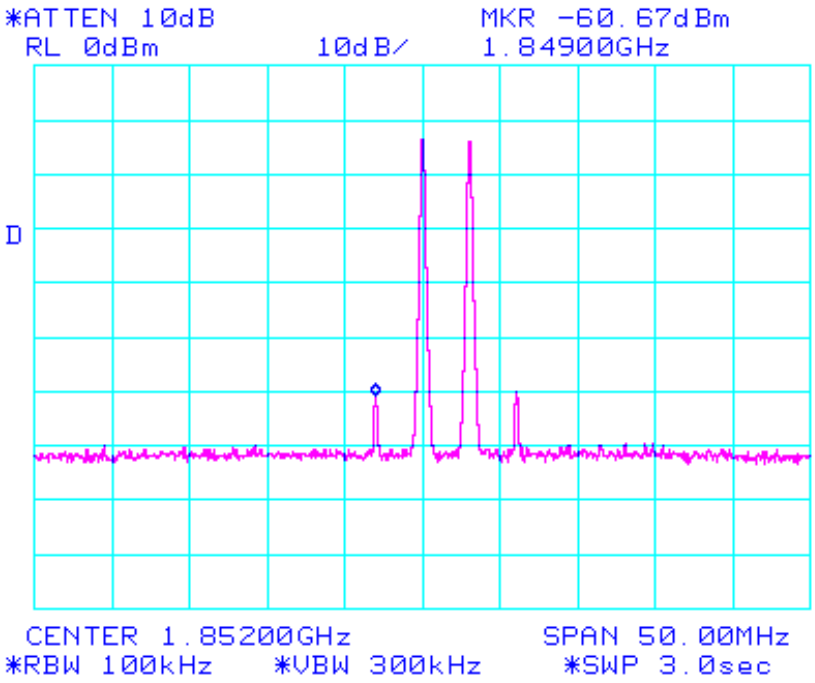
IMD NADC Uplink emc1367



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6.7 TEST TYPE: Intermodulation Spurious Emissions Antenna Terminals

6.7.1 TECHNICAL SPECIFICATION: 47 CFR 2.

6.7.2 TEST DATE(S): September 1, 2000

6.7.3 MEASUREMENT PROCEDURES: (DOWNLINK)

Modulation products outside of the authorized band are attenuated at least 43 + 10 Log (P) below the level of the modulated carrier.

6.7.4 RESULTS:

Equipment complies with 47CFR 2.1051. Plots of the spurious emissions as measured at the antenna port are included in this application as follows:

Intermodulation Spurious Products from 2-tone Simultaneous RF Injection At low side and high side of PCS band. **Downlink**

Spur limit = Po - (43 + 10logP) = 132.5 dBµV - (38.44 dB) = 94 dBµV = -13.1 dBm

modulation type	Intermodulation products (MHZ)	Emission Level (dBm)	Limit (dBm)
GSM	1954.3 1983.1	-31.17 -28.33	-13.1

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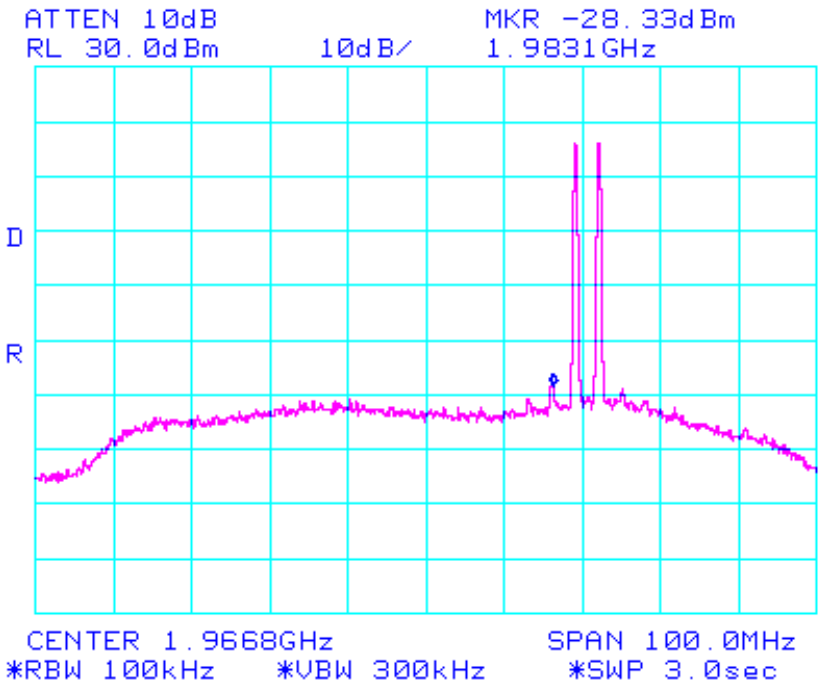
IMD (GSM) Downlink emc1367



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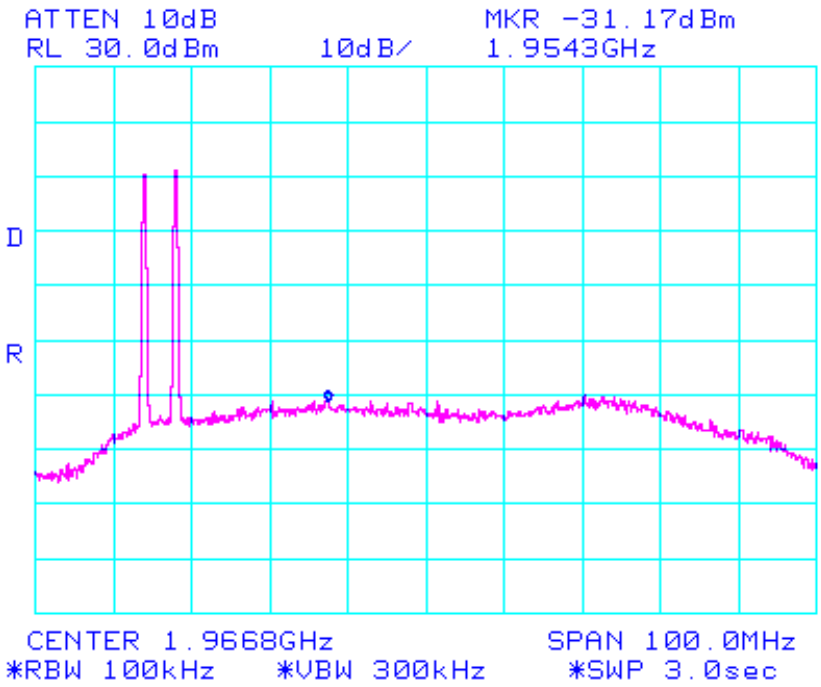
IMD (GSM) Downlink emc1367



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6.8 TEST TYPE: Line Conducted Emissions

6.8.1 TECHNICAL SPECIFICATION: 47 CFR 15.107(b)

6.8.2 TEST DATE(S): August 10, 2000

6.8.3 MEASUREMENT PROCEDURES:

The measurements were performed over the frequency range of 0.45 MHZ to 30 MHZ using a 50 Ω/50 µH LISN as the input transducer to an EMI/Field Intensity Meter. The measurements were made with the detector set for "peak" amplitude within an IF bandwidth of 10 kHz or for "quasi-peak" within a bandwidth of 9 kHz. The tests were conducted in a RF-shielded enclosure.

6.8.4 RESULTS:

Equipment complies with Section 15.107(b)

SUMMARY OF SPURIOUS EMISSIONS AT AC Mains Terminals - Phase

Frequency (MHZ)	EmissQuasi-Peak Leve(dBuV)	Limit (dBuV)
21.861	29.4	48.0
23.021	30.6	48.0
29.667	33.2	48.0

SUMMARY OF SPURIOUS EMISSIONS AT AC Mains Terminals - Neutral

Frequency (MHZ)	Emission Quasi-Peak Level (dBuv)	Limit (dBuV)
23.979	30.3	48.0
28.067	32.1	48.0
29.095	32.5	48.0

The following plots illustrate compliance with the applicable specification

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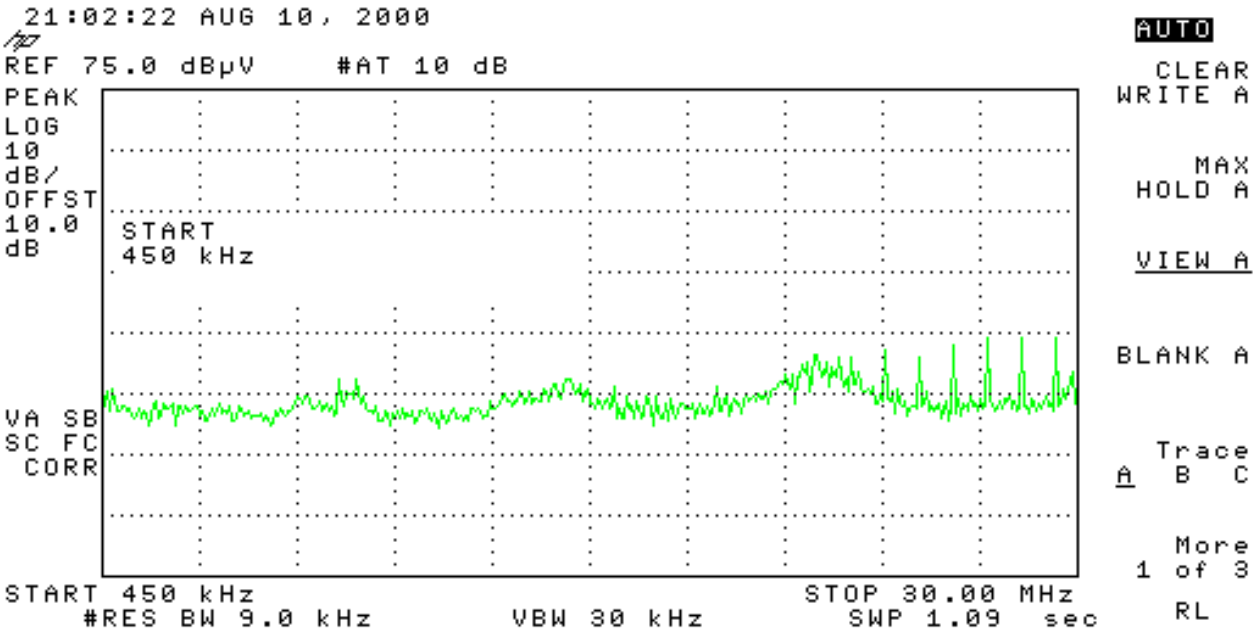
Neutral emc1367



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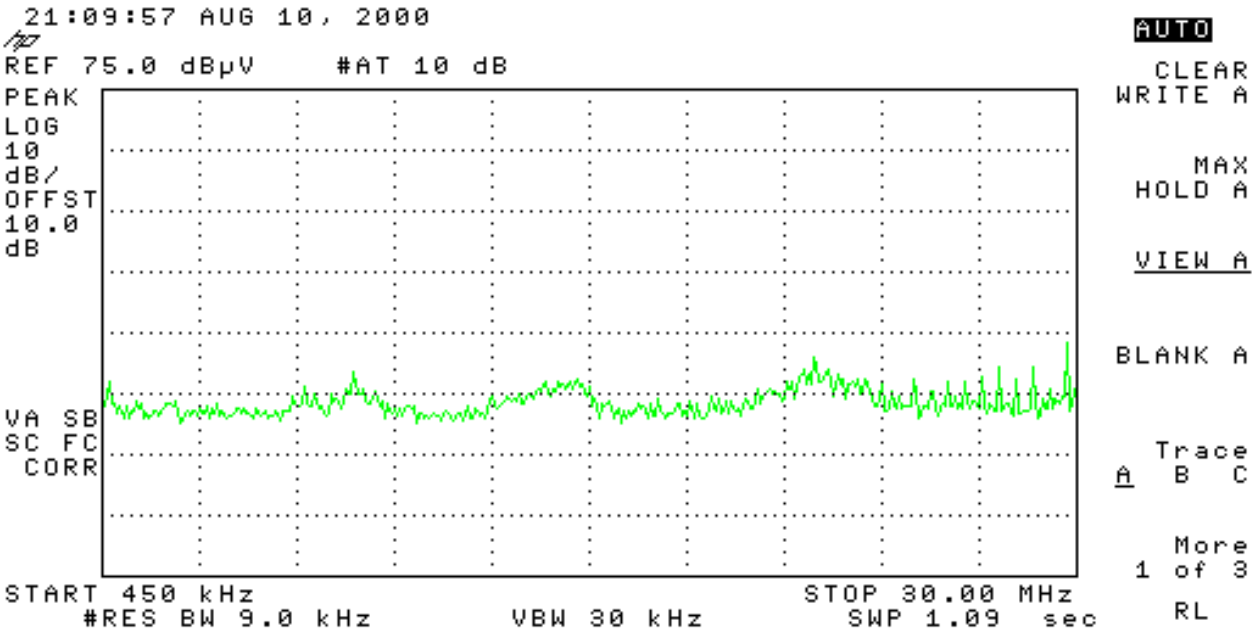
Phase emc1367



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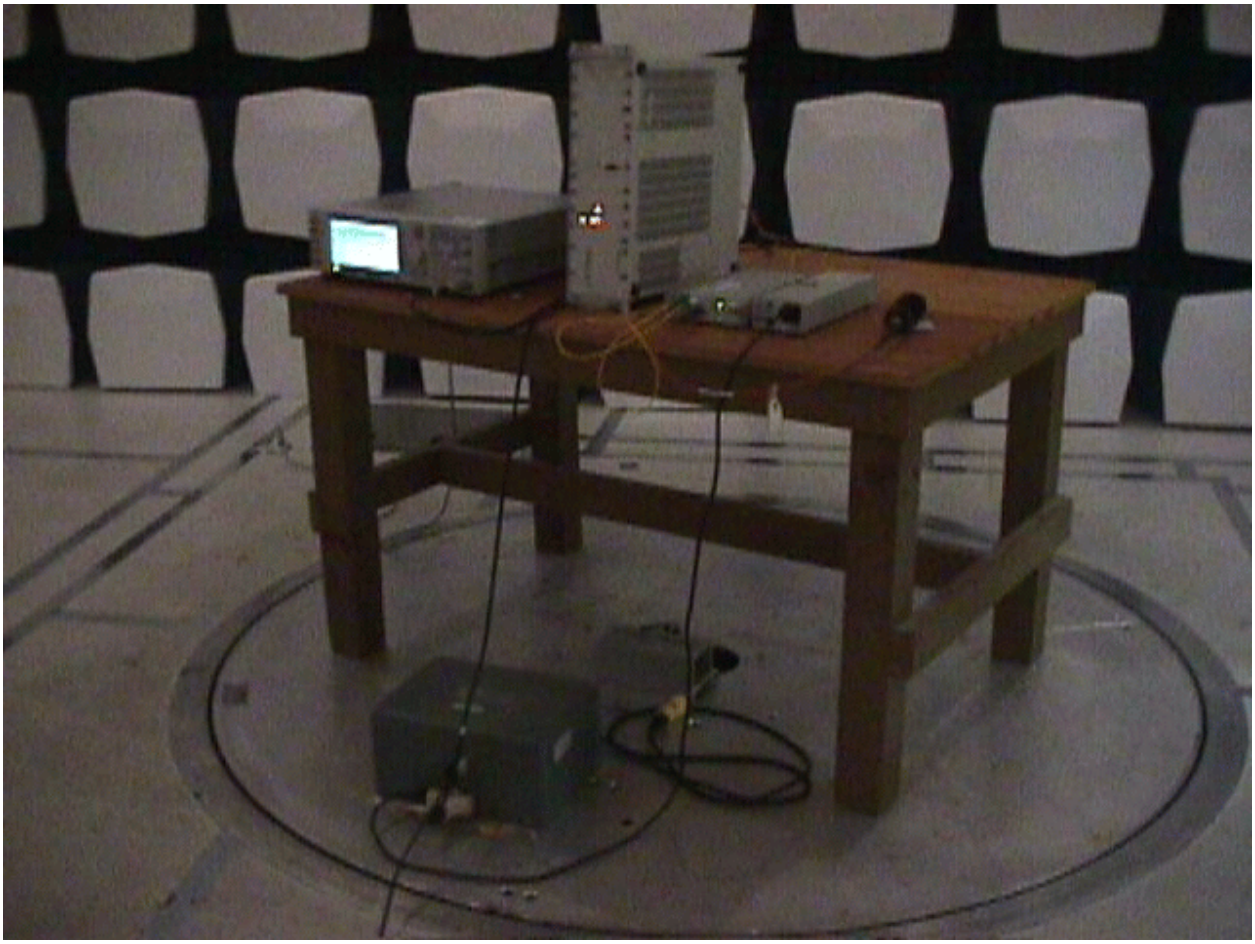
TEST SETUP OF LINE CONDUCTED EMISSIONS



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