



FCC ID: L6GAR4500

February 9, 1999

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

Attention: Applications Examiner

Applicant: Allgon Enterprises, Inc.
7317 Jack Newell Blvd. North Fort Worth, Texas 76118

Equipment: AMPS Cellular Repeater, Model: AR4500
FCC ID: L6GAR4500

Specification: 47 CFR 22 Licensed Certification

Dear Examiner:

The following application for Grant of Equipment Authorization is presented on behalf of Allgon Enterprises, Inc. for the Licensed Certification of their Model: AR4500, AMPS Cellular Repeater.

Enclosed, please find a complete data and documentation package demonstrating that this device complies with the technical requirements of 47 CFR, Part 22, for a Cellular 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: AMPS Cellular Repeater, Model 4500

FCC ID:: L6GAR4500

Specification: 47 CFR 22

On Behalf of the Applicant: Allgon Enterprises, Inc.
7317 Jack Newell Blvd. North
FortWorth, TX 76118

Manufacturer: Allgon Enterprises, Inc.
7317 Jack Newell Blvd. North
FortWorth, TX 76118

Manufacturer's Representative Mr. Tim Purvis

Test Date(s): Jan 22 thru Feb 1, 1999

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 22 of the FCC Rules under normal use and maintenance.

Kenneth Bass
EMI Engineer, MET Laboratories

1.0 INTRODUCTION



The following data is presented on behalf of the Applicant, Allgon Enterprises, Inc., as verification of the compliance of the Allgon AMPS Cellular Repeater, Model 4500 to the requirements of 47CFR 22.

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	1/29/99	annual
EMCO	Biconical Antenna 3104	2/9/99	annual
EMCO	EMCO Log Periodic Antenna	3/20/99	annual
EMCO	Double Ridge Guided Horn	3/20/99	annual
Hewlett Packard	8594EM Analyzer	11/19/98	annual
Rhode & Swartz (X3)	SMIQ 03 Digital Signal Gen.	N/A (Verified using HP8563A)	N/A
Solar	LISN	6/30/99	annual

4.0 EQUIPMENT UNDER TEST CONFIGURATION

The Cellular Repeater was configured with AC power supply modules and a digital signal generator was used to simulate various CDMA (i.e. QPSK Modulation type) 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: 47CFR2.993, **22.901(d)(2), 22.917(e)**
- 5.2 Occupied Bandwidth: 47CFR2.989, **Input vs. Output**
- 5.3 RF Power Output: 47CFR 2.985, **22.913(a)**
- 5.4 Spurious Emission at Antenna Terminals:(uplink & downlink) 47CFR 2.991, **22.917(e)**
- 5.5 Intermodulation Spurious Emissions-3 Tone Simultaneous RF Injection (uplink & downlink): 47CFR2.991, **22.917(e).**
- 5.6 AC Line Conducted Emissions: 47CFR 15.107



6.0 TEST RESULTS

6.1 TEST TYPE: Radiated Emissions

6.1.1 TECHNICAL SPECIFICATION: 2.993; 22.109(d); 22.917(e)

6.1.2 TEST DATE(S): 1 Feb 1999

6.1.3 MEASUREMENT PROCEDURES:

As required by §2.993, *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 radiated emission measurements were performed inside a shielded chamber with all digital signal generators on and terminated. The frequency list from the preliminary measurements was used as a guide for making final measurements on a 10 meter open area test site. The unit was scanned over the frequency range of 30MHz to 9 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 3 watts:

$$P_o = 3 \text{ W}$$

Install Equation Editor and double-
[click here to view equation.](#)

As per 2.993 (a), it is assumed this power is to be fed to a half-wave tuned dipole. Using a conversion formula for distance, the field strength at one meter can be derived:

Install Equation Editor and double-
[click here to view equation.](#)

Install Equation Editor and double-
[click here to view equation.](#)
Install Equation Editor and double-
[click here to view equation.](#)

As per 22.917(e), the spurious emissions must be attenuated by $43 + \log(P)$ which is:

Therefore, the limit for spurious emissions is:

At 3 meters measurement distance, the limit is:

According to 22.917(e), all signals must be attenuated by 47.77 dB. Therefore, the limit for spurious emissions for a test distance of 3 meters is:



Install Equation Editor and double-click here to view equation.

6.1.4 RESULTS:

Carrier Emission: 3 Watts

FREQUENCY (MHZ)	EUT AZIMUTH (Degrees)	ANTENNA		EUT RADIATION (dB μ V)	ANTENNA FACTOR (dB/m)	TEST DISTANCE (m)	CABLE LOSS (dB)	AMP GAIN MINUS FILTER LOSS (dB μ V)	FIELD STRENGTH (dB μ V/m)	LIMITS @ 3m (dB μ V/m)
		POL (H/V)	HGT (m)							
80.02	0	H	2.0	24.4	6.5	3	1.5	n/a	32.4	84.38
80.02	90	V	1.5	30.8	6.9	3	1.5	n/a	39.2	84.38
120.10	135	H	1.5	23.7	14.5	3	2.1	n/a	40.3	84.38
120.10	90	V	1.0	27.8	14.9	3	2.1	n/a	44.8	84.38
132.40	180	H	1.5	18.4	13.3	3	2.1	n/a	33.8	84.38
132.40	270	V	1.5	13.1	13.1	3	2.1	n/a	28.3	84.38
160.07	180	H	2.0	29.7	15.3	3	2.4	n/a	47.4	84.38
160.07	0	V	1.0	26.0	15.4	3	2.4	n/a	43.8	84.38
253.83	225	H	1.0	26.0	17.1	3	3.0	n/a	46.0	84.38
253.83	45	V	1.0	17.9	17.7	3	3.0	n/a	38.1	84.38
308.00	180	H	1.25	24.2	14.8	3	3.2	n/a	42.2	84.38
308.00	90	V	1.0	20.9	14.3	3	3.2	n/a	35.2	84.38

Equipment meets the specifications of 2.985; 2.993; 22.917(e)



FCC ID: L6GAR4500

Photograph of Radiated Emissions Test Configuration





6.2 TEST TYPE: Occupied Bandwidth

6.2.1 TECHNICAL SPECIFICATION: 47CFR2.989

6.2.2 TEST DATE(S): 22 Jan 1999

6.2.3 MEASUREMENT PROCEDURES:

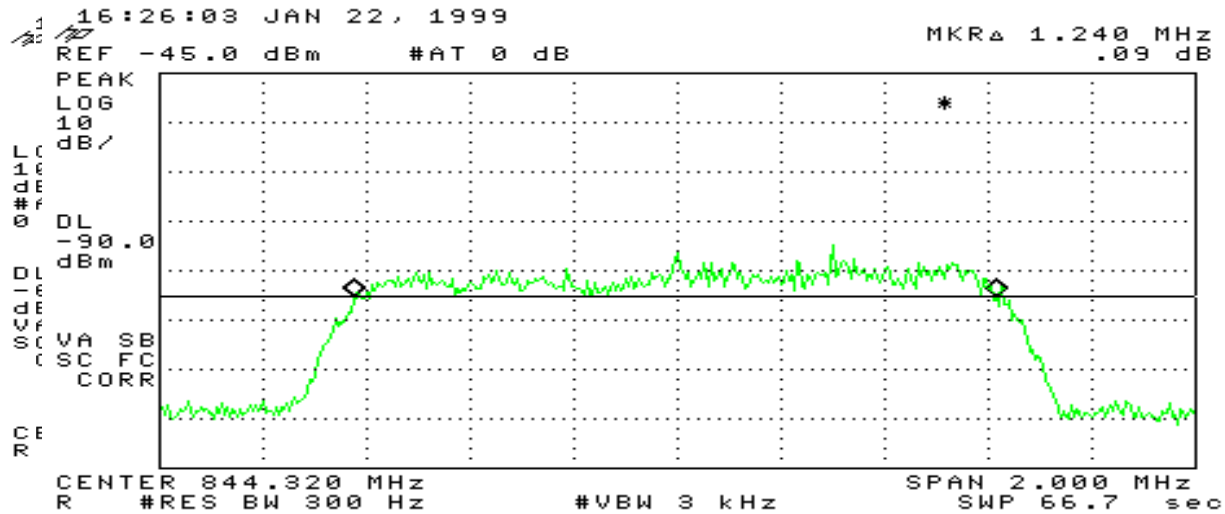
As required by §2.989 of CFR 47, *occupied bandwidth measurements* were made on the Cellular Repeater pre- and post- repeater. A digital signal generator was configured to transmit an AMPS QPSK modulated carrier signal. Using a bandwidth of 300Hz, we determined the occupied bandwidth of the emission at the lowest and highest selectable channel range was determined.

As recommended in §22.917(h)(ii), a 30kHz bandwidth was chosen to measure the peak of any spurious emission at 45 kHz removed from the carrier. The unit was exercised using signal types required by §2.989.

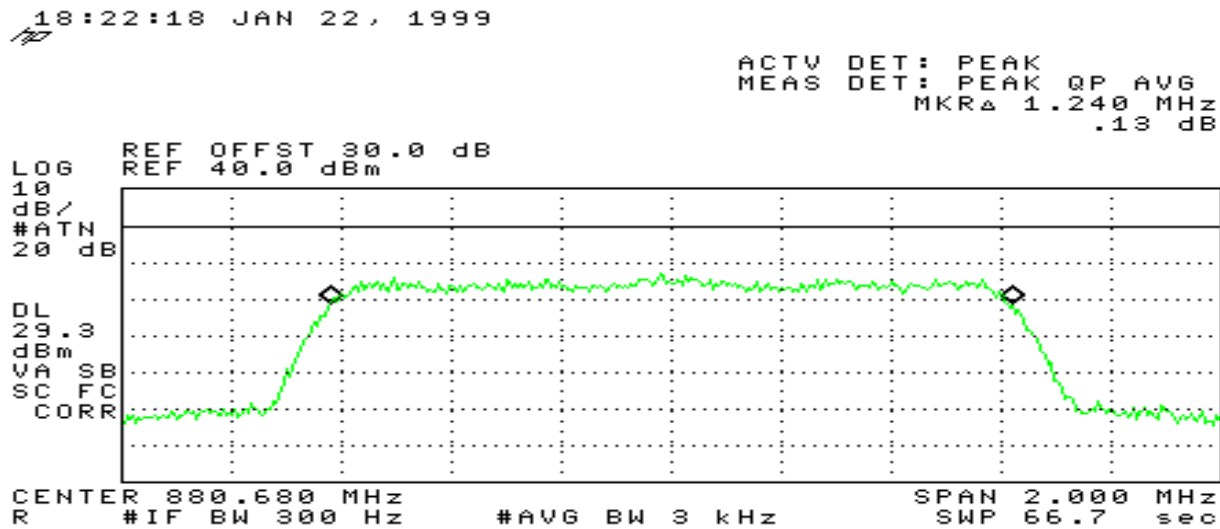
6.2.4 RESULTS:

Equipment complies with Section 2.989. Plots of the occupied bandwidth, as measured at the Repeater/Booster RF input port and at the antenna RF output port (post amplification) follow:

Occupied Bandwidth - from input source - Mobile Ch 644
emi1164a

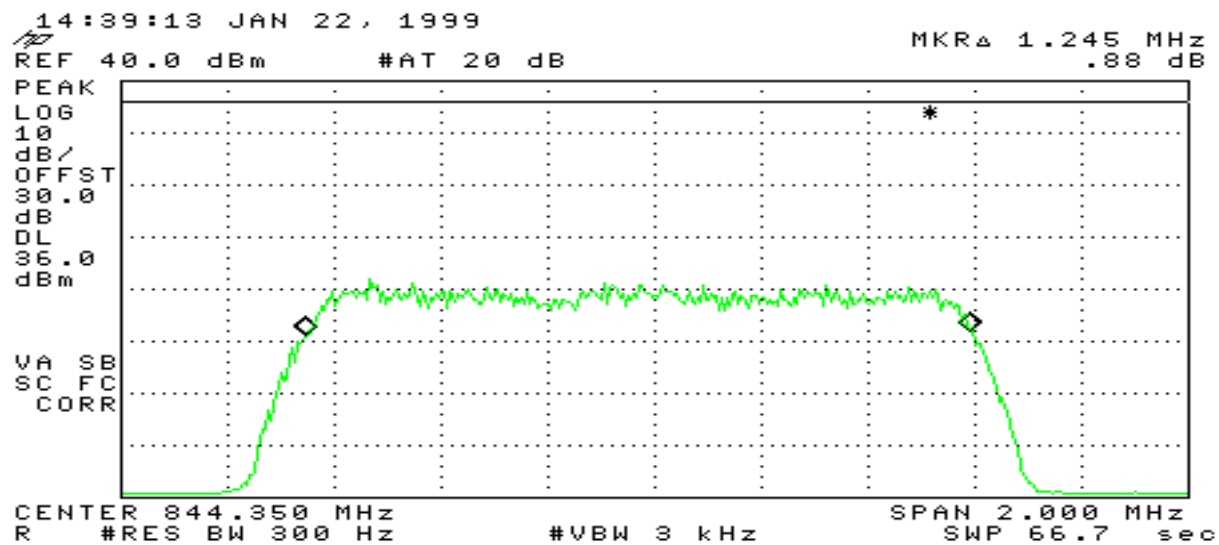


Occupied Bandwidth - Base Ch 356 - at Output side of AMP
emi1164a





**Occupied Bandwidth - output side - Mobile Tx frequency Ch 644
emi1164a**





6.3 TEST TYPE: RF Power Output

6.3.1 TECHNICAL SPECIFICATION: 47CFR2.985 and 22.913(a)

6.3.2 TEST DATE(S): 22 Jan 1999

6.3.3 MEASUREMENT PROCEDURES:

As required by §2.985 of CFR 47, *RF power output measurements* were made at the RF output terminals using an attenuator and spectrum analyzer. This test was performed with carrier modulated by an AMPS QPSK modulation signal.

Plots of the RF output Power level of the Digitally modulated carrier, 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 47CFR 2.985 and 22.913(a). The Cellular repeater/booster power does not exceed 500 W (57 dBm) at the carrier frequency.

Photograph of Antenna Conducted Spurious Emissions and

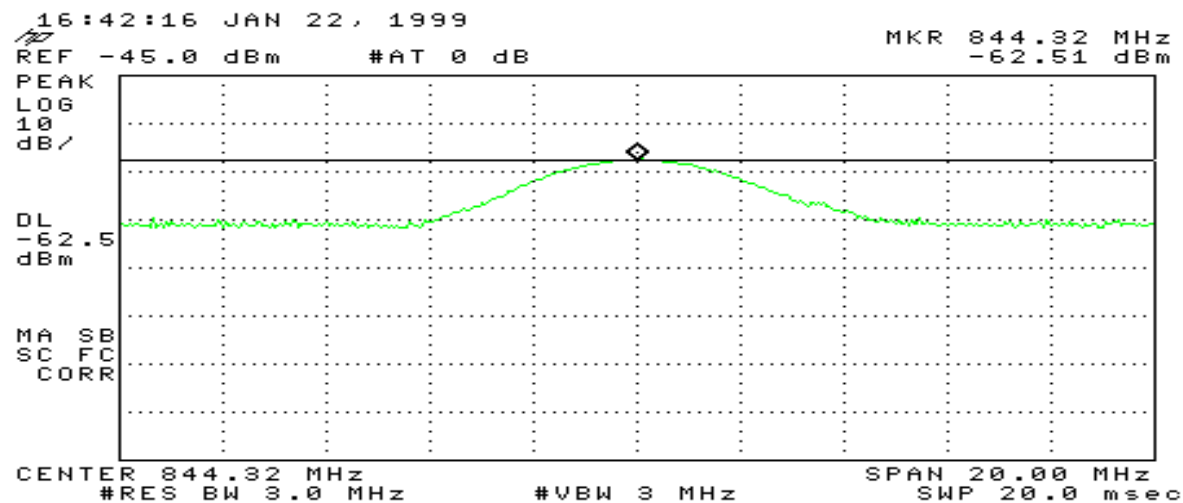


FCC ID: L6GAR4500

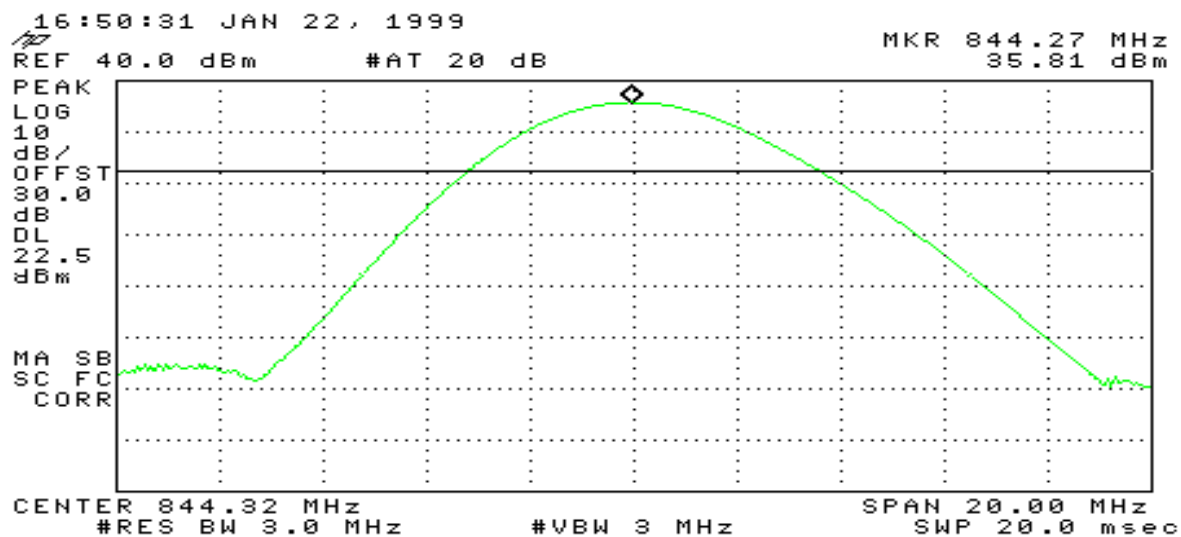
RF Power Output Test Configuration



**Power Output - Mobil Ch 644 - Input to Amp
emi1164a**



**Power Output - Mobil Ch 644 - Output side of AMP
emi114a**

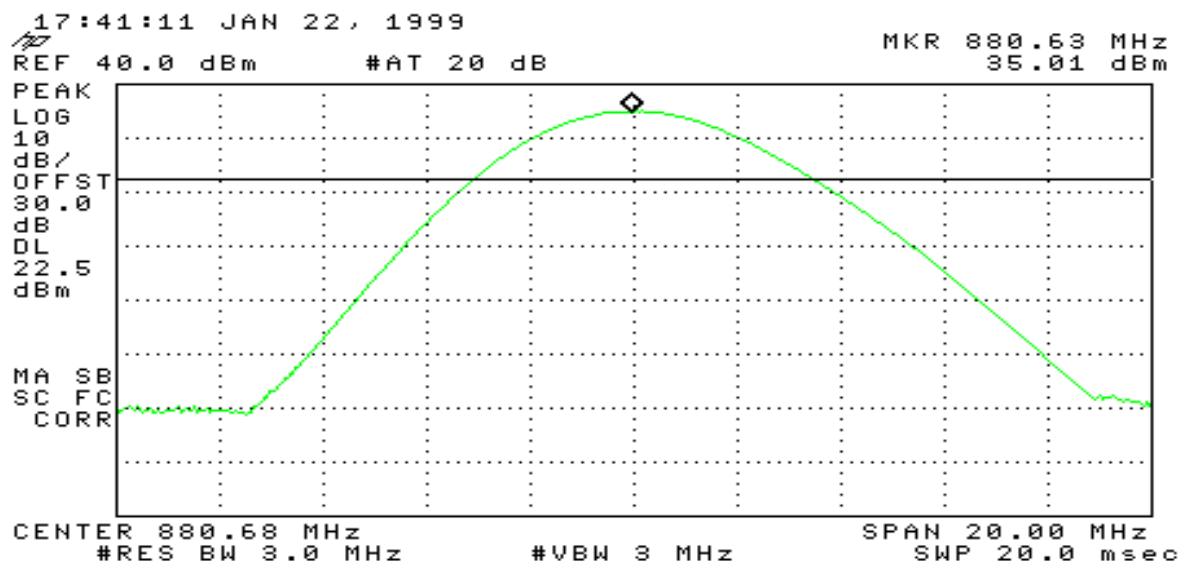




FCC ID: L6GAR4500



**Power Output - Base Ch 356 - output side of AMP
emi1164a**



6.4 TEST TYPE: Spurious Emissions at Antenna Terminals

6.4.1 TECHNICAL SPECIFICATION: 2.991

6.4.2 TEST DATE(S): 25 and 30 Jan 1999

6.4.3 MEASUREMENT PROCEDURES:

As required by §2.991 of CFR 47, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a 50 Ω attenuator and spectrum analyzer set for a 30 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 9.0 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 Section 2.991

SUMMARY OF SPURIOUS EMISSIONS AT ANTENNA TERMINALS - UpLink

	Emission	Emission	Limit
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Frequency Range	Frequency	Level (dBm)	(dBm)
9.0 kHz - 850 MHz	823.84	-45.0	-13.1
850.00 MHz - 1.5 GHz	1.417 GHz	-35.6	-13.1
2.9 - 9.0 GHz	7.973 GHz	-39.33	-13.1

The following plots are included to illustrate compliance with the requirements of 47 CFR Part 22.917:

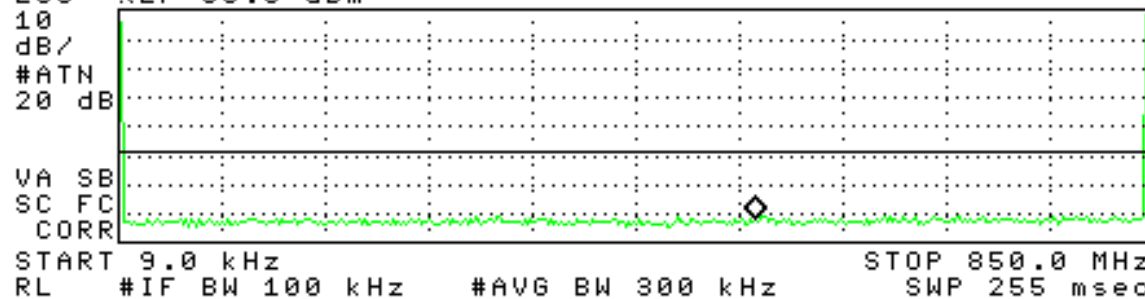
Antenna conducted Spurious Emissions - Uplink (mobile) emi1164a

14:30:11 JAN 25, 1999

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp
1	522.656921	-37.5	-43.5	-49.9

FREQ	522.7	MHz
PEAK	-37.6	dBm
QP	-43.6	dBm
AVG	-49.9	dBm

LOG REF 36.0 dBm

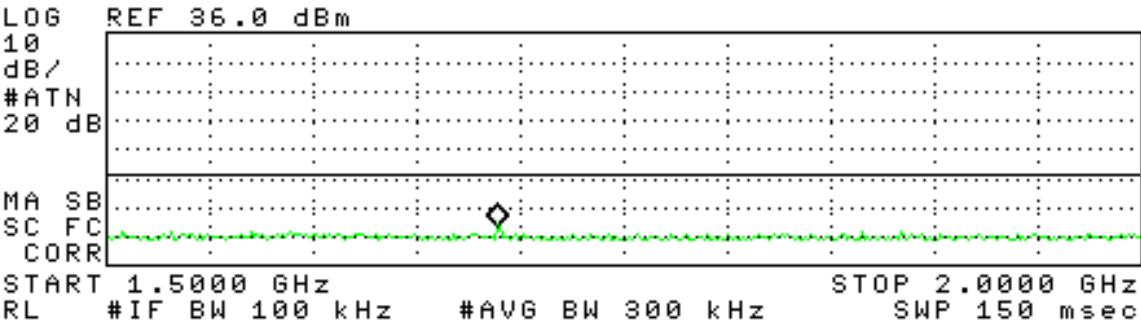


Antenna Conducted Spurious Emissions - uplink (mobile)
emi1164a

14:57:28 JAN 25, 1999

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp
1	1688.658438	-28.7	-31.9	-34.0

FREQ	1.689	GHz
PEAK	-28.7	dBm
QP	-31.9	dBm
AVG	-34.0	dBm

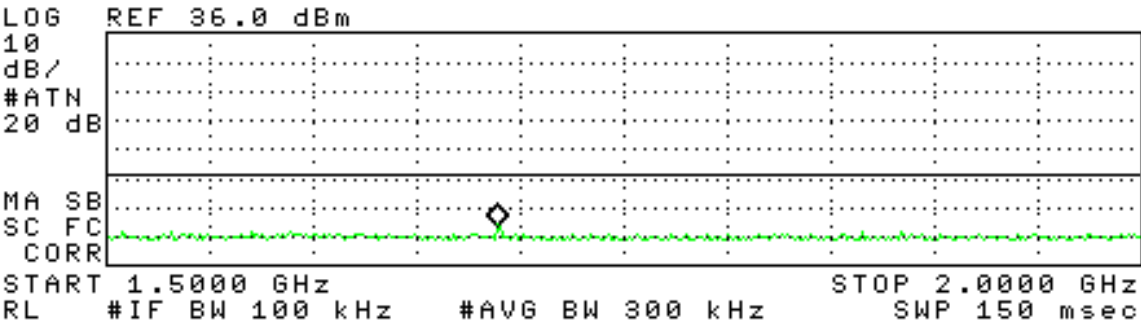


Antenna Conducted Spurious Emissions - uplink (mobile)
emi1164a

14:57:28 JAN 25, 1999

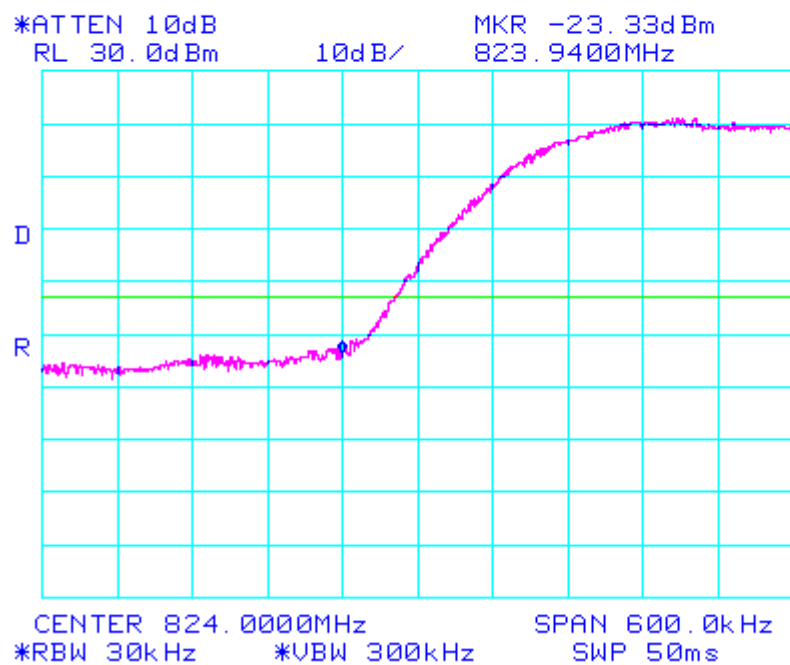
Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp
1	1688.658438	-28.7	-31.9	-34.0

FREQ	1.689	GHz
PEAK	-28.7	dBm
QP	-31.9	dBm
AVG	-34.0	dBm



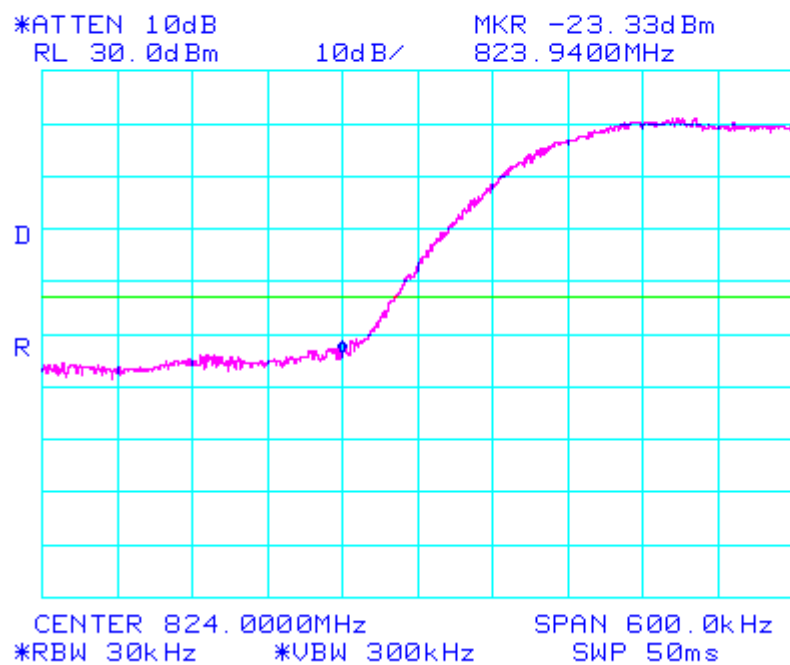
Antenna conducted spurious Emissions - Uplink (Mobile)
(@ 60 kHz removed from Fc)

emi1164



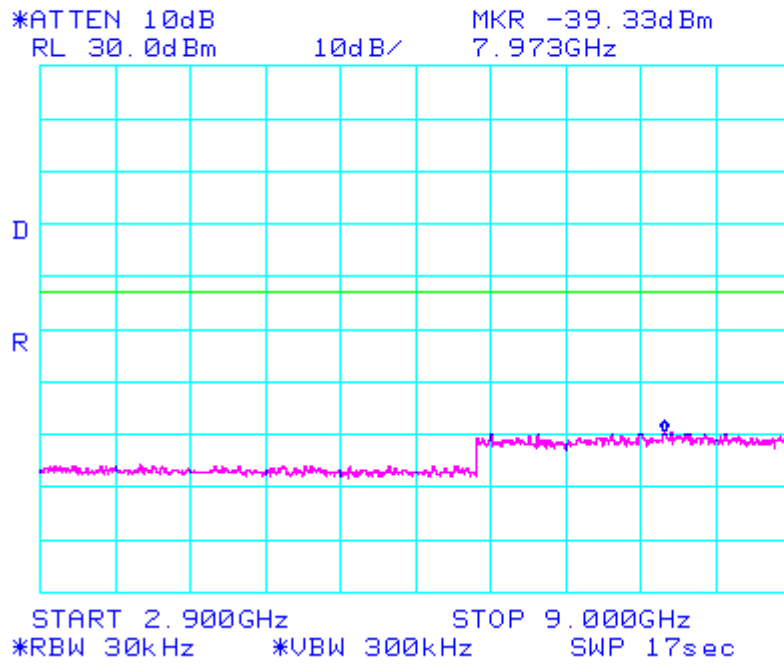
Antenna conducted spurious Emissions - Uplink (Mobile)
(@ 60 kHz removed from Fc)

emi1164



Antenna Conducted spurious Emissions - Uplink (Mobile)
(summary of emissions from 2.9-9GHz)

emi1164



**6.5 TEST TYPE:** Spurious Emissions at Antenna Terminals**6.5.1 TECHNICAL SPECIFICATION:** 2.991**6.5.2 TEST DATE(S):** 25 Jan 1999**6.5.3 MEASUREMENT PROCEDURES:**

As required by §2.991 of CFR 47, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a 50 Ω attenuator and spectrum analyzer set for a 30 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 9.0 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 2.991

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

Frequency Range	Emission Frequency (GHz)	Emission Level (dBm)	Limit (dBm)
9 kHz - 850 MHZ	0.24081	-43.00	-13.1
850 - 900 MHZ	0.86900	-15.00	-13.1
850 - 900 MHZ	0.80997	-37.90	-13.1
900 - 2.9 Ghz	2.642	-27.10	-13.1
2.9 - 9.0 Ghz	7.739	-25.33	-13.1

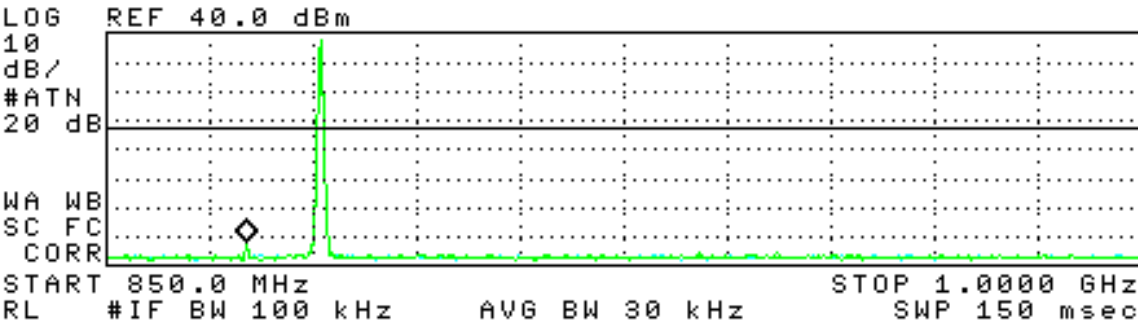
Plots on the following pages illustrate compliance to the required rule parts.

Antenna Conducted Spurious Emissions - Downlink/Base
emi1164a

12:54:02 JAN 25, 1999

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp
1	240.813025	-43.0	-49.0	-57.5
2	869.976988	-37.9	-42.5	-52.0

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 870.3 MHz
-31.81 dBm

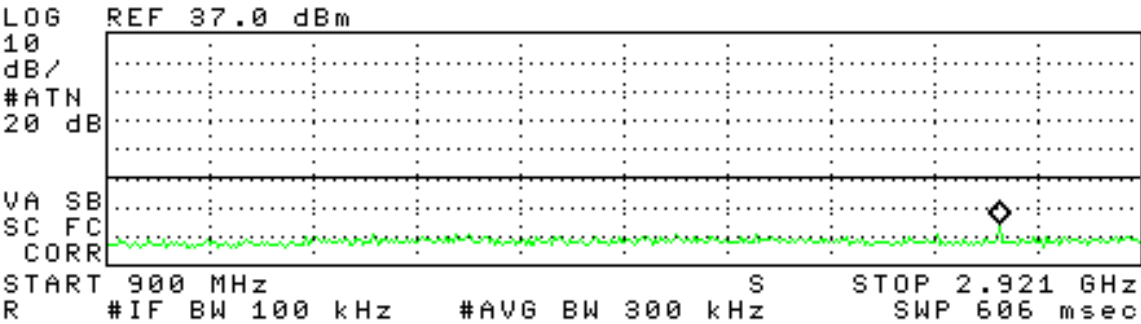


Antenna Conducted Spurious Emissions - Downlink/Base
emi1164a

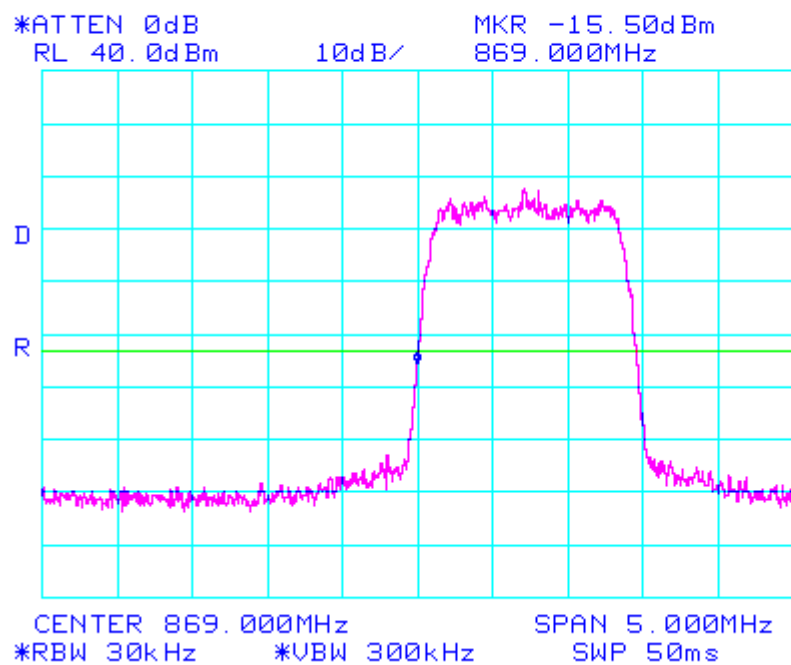
13:17:03 JAN 25, 1999

Signal Freq (MHz) PK Amp QP Amp AV Amp

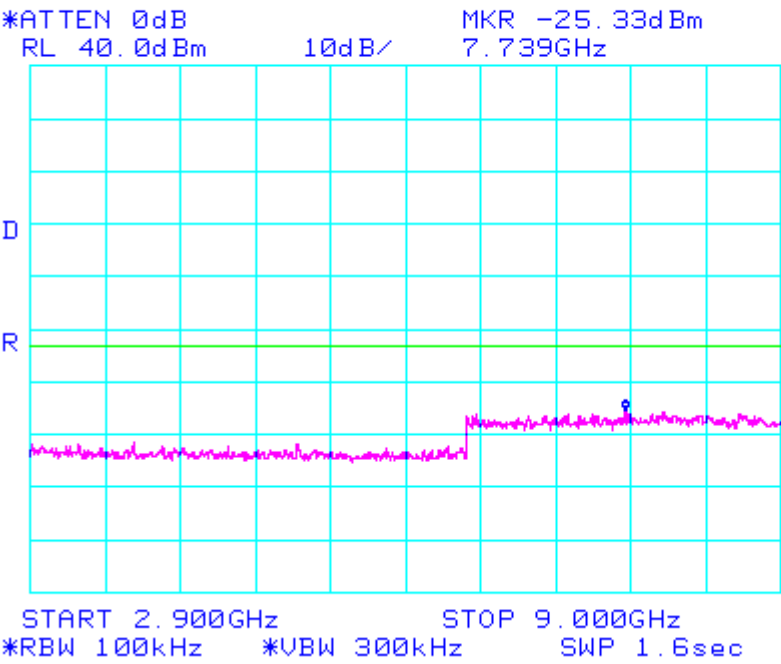
FREQ	2.642	GHz
PEAK	-27.1	dBm
QP	-29.6	dBm
AVG	-30.9	dBm



Antenna Conducted Spurious Emissions - Downlink (Base) (@ 500kHz removed from Fc)
emi1164a



Antenna conducted Spurious Emissions - Downlink (Base)
 (summary of spurious emissions). emi1164a



**6.6 TEST TYPE:** Intermodulation Spurious Emissions Antenna Terminals**6.6.1 TECHNICAL SPECIFICATION:** 47CFR2.991, 22.917(e)**6.6.2 TEST DATE(S):** 26 Jan 1999**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 2.991 and 22.917(e). Plots of the spurious emissions as measured at the antenna port are included in this application as file attachment:

Uplink - Input tone Frequencies : $F_1 = 825.0$ MHZ ; $F_2 = 824.68$ MHZ ; $F_3 = 848.28$ MHZ

modulation type	Intermodulation products (MHZ)	Emission Level (dBm)	Limit (dBm)
QPSK	none measurable	n/a	-13.1

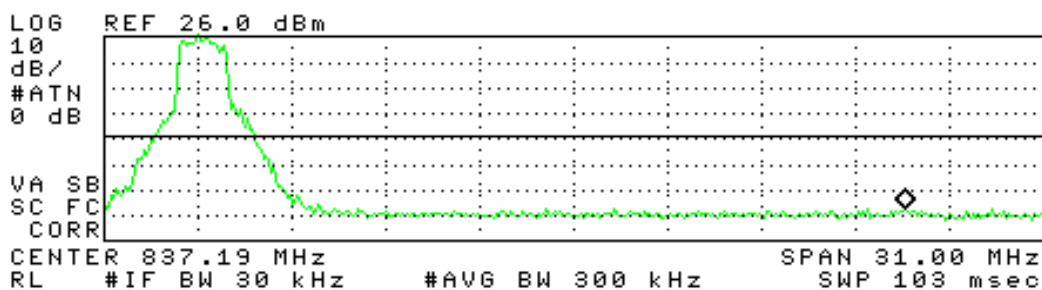


Intermodulation Distortion (IMD) - Uplink (Mobile) w/CDMA source
(Inputs : f1=824.70 ; f2=825 ; f3=848.31 MHz)
emi1164a

17:47:25 JAN 26, 1999

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp
1	848.288500	-42.5	-47.1	-54.2
2	824.687729	27.7	22.7	15.4
3	825.007838	27.4	23.2	16.2

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 848.12 MHz
-41.76 dBm



**6.7 TEST TYPE:** Intermodulation Spurious Emissions Antenna Terminals**6.7.1 TECHNICAL SPECIFICATION:** 2.991**6.7.2 TEST DATE(S):** 26 Jan 1999**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 2.991. Plots of the spurious emissions as measured at the antenna port are included in this application as follows:

Intermodulation Spurious Products from 3-tone Simultaneous RF Injection Downlink

Input tone Frequencies : $F_1 = 869.0 \text{ MHz}$; $F_2 = 870.0 \text{ MHz}$; $F_3 = 885.0 \text{ MHz}$

modulation type	Intermodulation products (MHz)	Emission Level (dBm)	Limit (dBm)
QPSK	888.96	-15.4	-13.1



Intermodulation Distortion (IMD) - Downlink (Base) w/CDMA source (Inputs : f1=869.70 , f2=879.33, f3=893.31 MHz) emi1164

18:25:37 JAN 26, 1999

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp
1	870.016744	24.3	18.9	11.5
2	879.078000	24.3	19.1	11.6
3	893.277483	-39.0	-44.5	-51.8
4	888.934858	-7.9	-15.1	-26.7
5	888.961508	-15.4	-22.3	-33.5

@100dB gain

@93dB gain

FREQ	889.0	MHz
PEAK	-15.4	dBm
QP	-22.3	dBm
AVG	-33.5	dBm

LOG REF 34.0 dBm

10
dB/
#ATN
0 dB

WA SB
SC FC
CORR

CENTER 888.927 MHz

#IF BW 30 kHz

#AVG BW 300 kHz

SPAN 5.000 MHz

SWP 20.0 msec



FCC ID: L6GAR4500

**Photograph of Antenna Conducted Intermodulation Distortion
Spurious Emissions Test Configuration**



FCC ID: L6GAR4500



**6.4 TEST TYPE:** Line Conducted Emissions**6.4.1 TECHNICAL SPECIFICATION:** 15.107(b)**6.4.2 TEST DATE(S):** 20 Oct 1998**6.4.3 MEASUREMENT PROCEDURES:**

The measurements were performed over the frequency range of 0.45 MHz to 30 MHz using a 50 Ω /50 μ H 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.

6.4.4 RESULTS:

Equipment complies with Section 15.107(b)

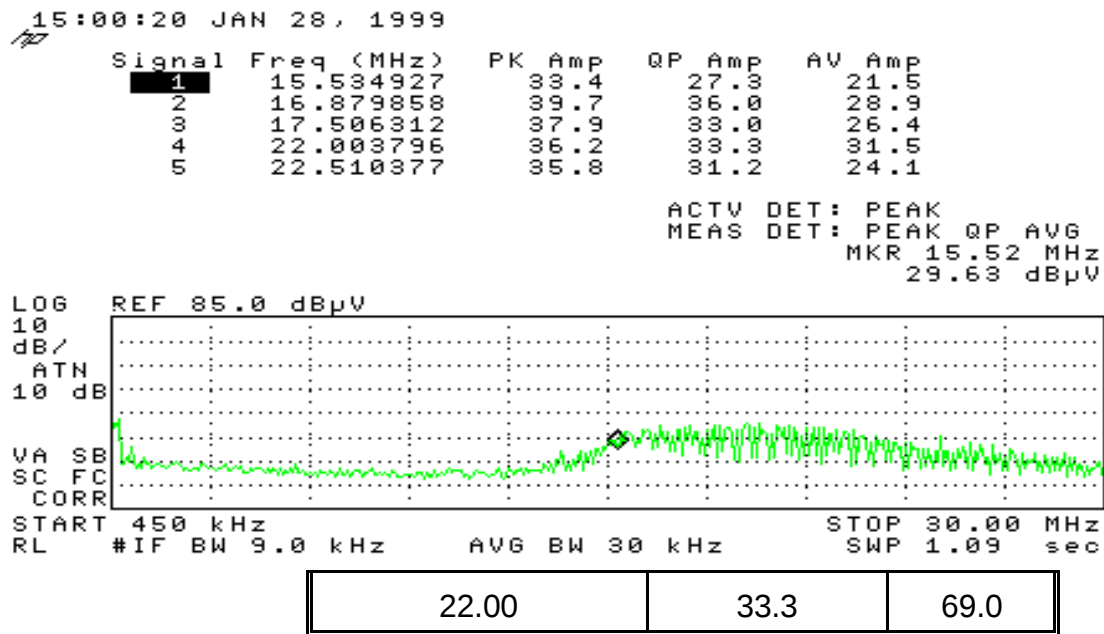
SUMMARY OF SPURIOUS EMISSIONS AT AC Mains Terminals - Phase

Frequency (MHz)	Emission Quasi-Peak Level (dBuV)	Limit (dBuV)
15.53	23.7	69.0
16.87	36.0	69.0
17.50	33.0	69.0

SUMMARY OF SPURIOUS EMISSIONS AT AC Mains Terminals - Neutral

Frequency (MHz)	Emission Quasi-Peak Level (dBuV)	Limit (dBuV)
16.87	36.0	69.0
17.50	33.0	69.0

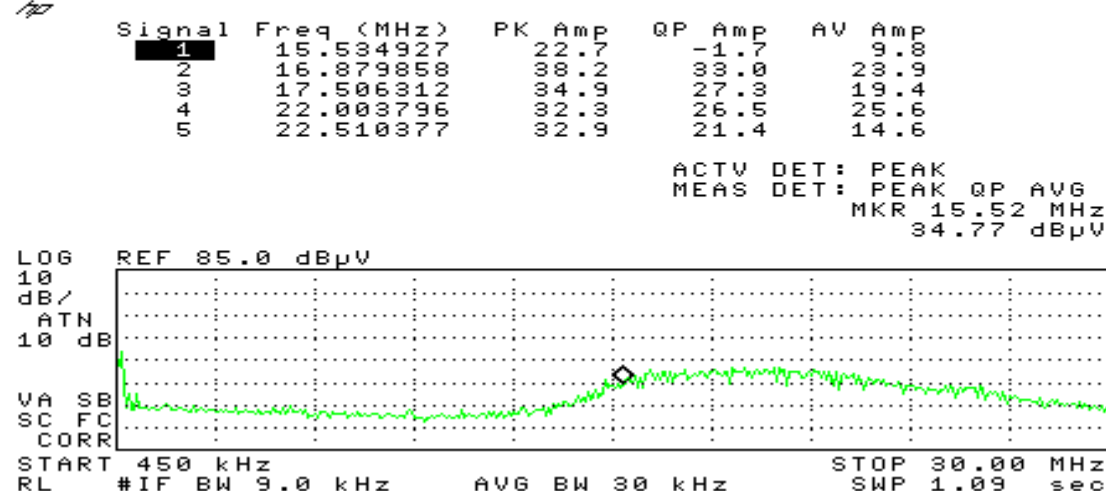
Line Conducted Emissions - Neutral (page 1 of 2)
emi1164



The following plots illustrate compliance with the applicable specification.

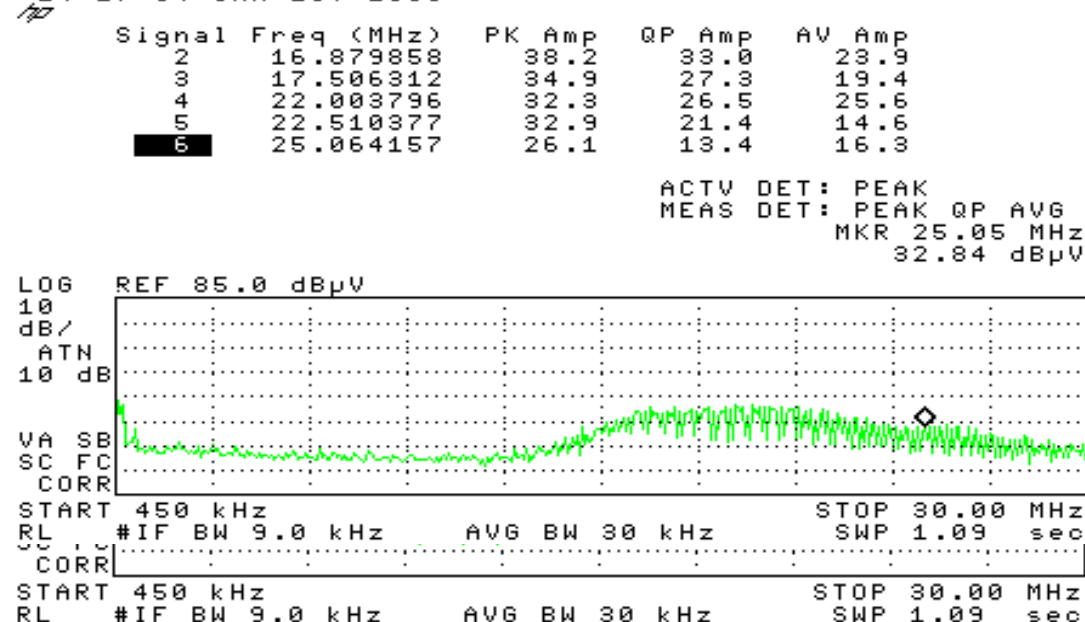
Line Conducted Emissions - Phase (page1 of 2) emi1164

14:24:00 JAN 28, 1999



Line Conducted Emissions - Phase (page 2 of 2) emi1164

14:27:34 JAN 28, 1999



more
1 of 4



FCC ID: L6GAR4500



TEST SETUP OF LINE CONDUCTED EMISSIONS