



September 13, 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: 9228.02
FCC ID: L6G922802

Specification: 47 CFR Part 24 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: 9228.02, PCS Cellular Repeater.

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 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: PCS Cellular Repeater, Model 9228.02

FCC ID:: L6G922802

Specification: 47 CFR 24

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): Aug. 16 thru Sept. 9, 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 24 of the FCC Rules under normal use and maintenance.

Kenneth Bass
Sr. 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 PCS Cellular Repeater, Model 9228.02 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	5/25/00	annual
EMCO	Biconical Antenna 3104	3/9/00	annual
EMCO	EMCO Log Periodic Antenna	2/16/00	annual
EMCO	Double Ridge Guided Horn	2/8/00	annual
Hewlett Packard	8594EM Analyzer	11/18/99	annual
Rhode & Swartz (X3)	SMIQ 03 Digital Signal Gen.	N/A (Verified using HP8563A)	N/A
Solar	LISN	7/26/00	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 PCS (i.e. GMSK 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, (with the exception of intermodulation tests), the EUT was configured for Stacked Channel operation which results in maximum possible output gain.

5.0 TEST TYPE(S)

- 5.1 Radiated Emissions: 47CFR2.993, **24.238(a)**
- 5.2 Occupied Bandwidth: 47CFR2.989, **Input vs. Output**
- 5.3 RF Power Output: 47CFR 2.985, **24.132(b),(c)**
- 5.4 Spurious Emission at Antenna Terminals: (downlink) 47CFR 2.991, **24.238(a)**
- 5.5 Intermodulation Spurious Emissions-2 Tone Simultaneous RF Injection (downlink): 47CFR2.991, **24.238(a)**
- 5.6 Spurious Emission at Antenna Terminals +/- 1MHz: 47CFR 2.991, **24.238(b)**
- 5.7 AC Line Conducted Emissions: 47CFR 15.107



6.0 TEST RESULTS

6.1 TEST TYPE: Radiated Emissions

6.1.1 TECHNICAL SPECIFICATION: 2.993; 24.238(a)

6.1.2 TEST DATE(S): 9 September 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 9 kHz 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 20 watts:

$$P_o = 20 \text{ W}$$

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:

$$E(V/m)_{1m} = \frac{\sqrt{49.2 \times 20}}{1}$$
$$E(V/m)_{1m} = 31.37 \text{ V/m or } 149.939 \text{ dB}\mu\text{V}$$

As per 24.238(a), the spurious emissions must be attenuated by $43 + \log(P)$ which is:

$$43 + 10\text{Log}(20) = 56.01 \text{ dB}$$

Therefore, the limit for spurious emissions is:

$$149.939 \text{ dB}\mu\text{V} - 56.01 \text{ dB} = 93.92 \text{ dB}\mu\text{V} @ 1m$$

At 3 meters measurement distance, the limit is;

$$E(V/m)_{3m} = \frac{\sqrt{49.2 \times 20}}{3}$$
$$E(V/m)_{3m} = 10.4563 \text{ V/m or } 140.39 \text{ dB}\mu\text{V}$$

According to 24.238(a), all signals must be attenuated by 56.01 dB. Therefore, the limit for spurious emissions for a test distance of 3 meters is:

$$140.39 - 56.01 = 84.38 \text{ dB}\mu\text{V} @ 3m$$



6.1.4 RESULTS:

Carrier Emission: 20 Watts

FREQUENCY (MHZ)	EUT AZIMUTH (Degrees)	ANTENNA		EUT RADIATION (dBµV)	ANTENNA FACTOR (dB/m)	TEST DISTANCE (m)	CABLE LOSS (dB)	FIELD STRENGTH (dBuV/m)	LIMITS @ 3m (dBuV/m)
		POL (H/V)	HGT (m)						
39.830	180	H	1.5	30.8	12.3	3	1.1	44.2	84.39
39.830	135	V	2	25.6	10.7	3	1.1	37.4	84.39
74.600	180	H	1.5	16.7	8.2	3	1.6	26.5	84.39
74.600	90	V	2	16.4	8.5	3	1.6	26.5	84.39
168.700	225	H	2.5	15.8	15.2	3	2.4	33.4	84.39
168.700	180	V	1.5	14.3	16.3	3	2.4	33.0	84.39
208.020	180	H	1.5	17.8	17.8	3	2.7	38.3	84.39
208.020	135	V	2.5	18.09	18.0	3	2.7	38.8	84.39
256.800	90	H	2	16.07	17.7	3	3.1	36.9	84.39
256.800	225	V	1.5	15.16	17.9	3	3.1	36.2	84.39
321.000	270	H	2	15.12	15.9	3	3.5	34.5	84.39
321.000	225	V	1	14.56	15.3	3	3.5	33.4	84.39

Equipment meets the specifications of 2.993; 24.238(a)

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): 25 Aug 1999

6.2.3 MEASUREMENT PROCEDURES:

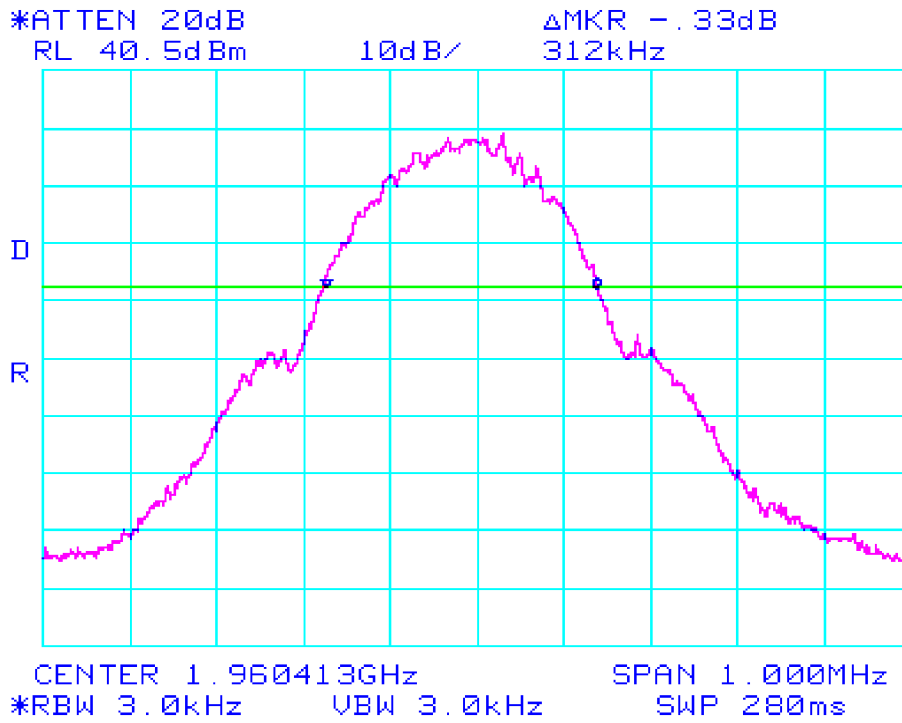
As required by §2.989 of CFR 47, *occupied bandwidth measurements* were made on the Cellular Repeater pre- and post- repeater. A digital signal generator was configured to transmit an PCS GMSK modulated carrier signal. Using an IF bandwidth of 300Hz, we determined the occupied bandwidth of the emission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

6.2.4 RESULTS:

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

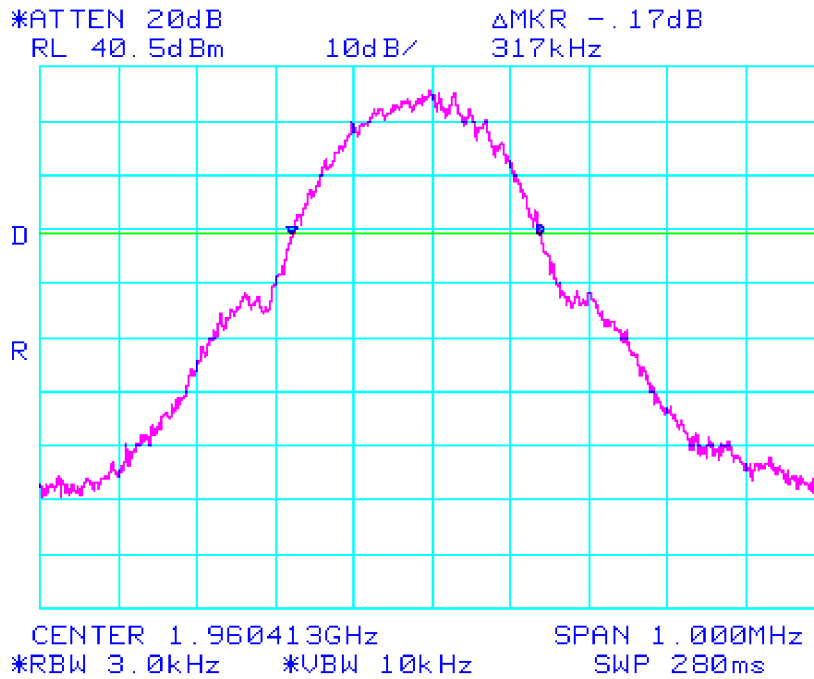


Occupied Bandwidth - (as measured at RF Input side of EUT)
emi1249





**Occupied Bandwidth - (as measured at the RF Output port of EUT)
emi1249**





6.3 TEST TYPE: RF Power Output

6.3.1 TECHNICAL SPECIFICATION: 47CFR2.985 and 24.132(b)(c)

6.3.2 TEST DATE(S): 06 AUG 1999

6.3.3 MEASUREMENT PROCEDURES:

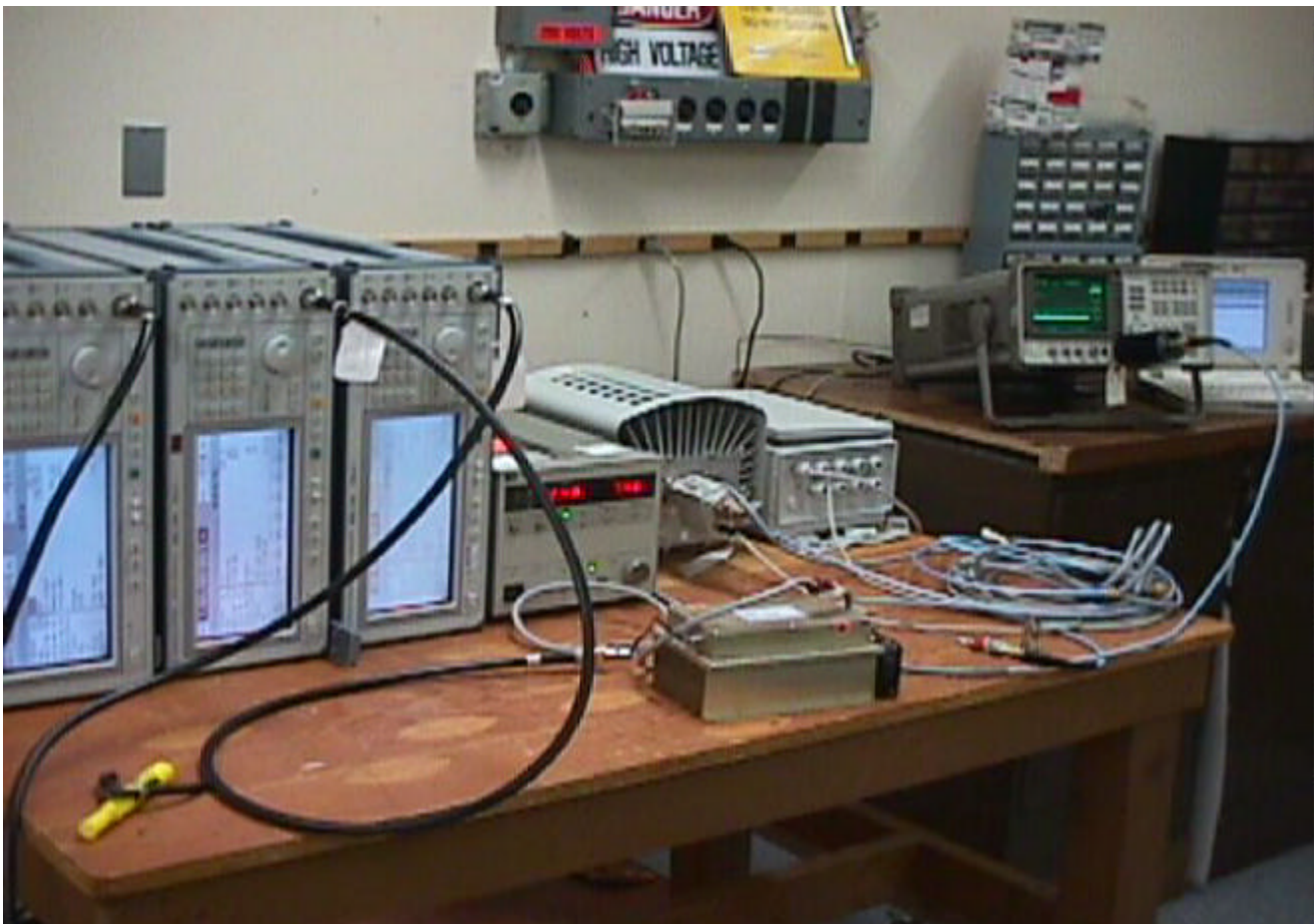
As required by §2.985 of CFR 47, *RF power output measurements* were made at the RF output terminals using an attenuator and spectrum analyzer. This test was performed with carrier modulated by an PCS GSMK modulation signal.

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 appear on the following pages:

6.3.4 RESULTS:

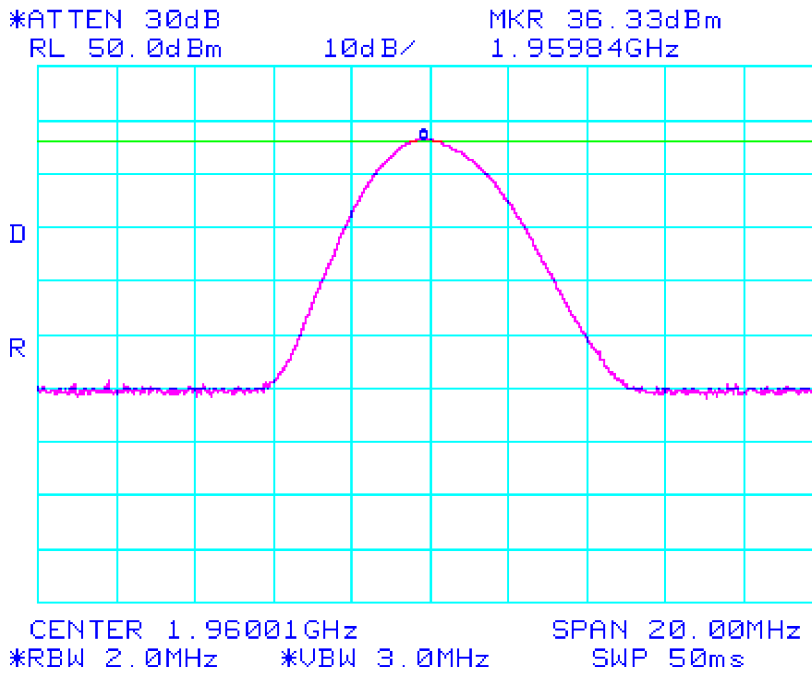
Equipment complies with 47CFR 2.985 and 24.132(b)(c). The PCS repeater power does not exceed 100 W (50 dBm) at the carrier frequency.

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



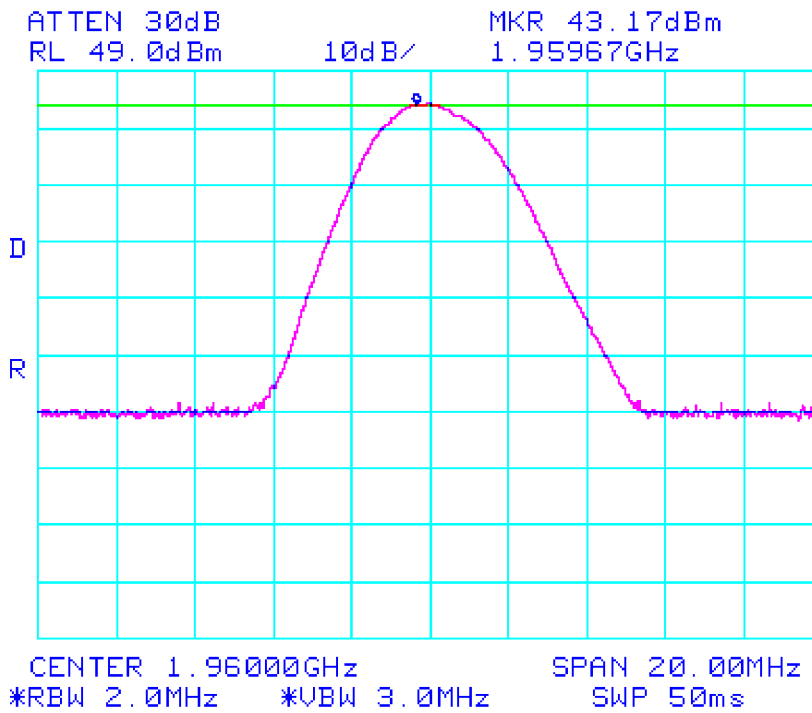


Power Output (in dBm) measured at input to TTPA (EUT)
EMI1249





**Power Output (in dBm) as measured at the RF Output/Antenna Port of the EUT
EMI1249**



**6.4 TEST TYPE:** Spurious Emissions at Antenna Terminals**6.4.1 TECHNICAL SPECIFICATION:** 2.991; 24.238(a)**6.4.2 TEST DATE(S):** 20 Aug 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 20.0 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 and 24.238(a)

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

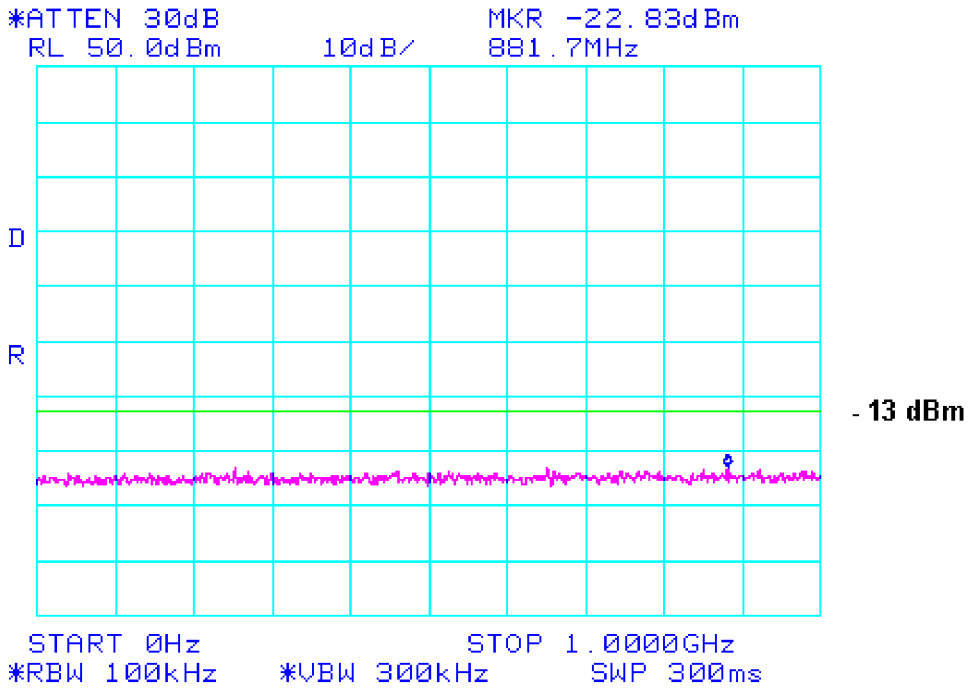
Frequency Range	Emission Frequency	Emission Level (dBm)	Limit (dBm)
0 - 1 GHz	881.7 MHz	-22.83	-13.1
1 - 2 GHz	1.400 GHz	-22.50	-13.1
2 - 2.90 GHz	2.861 GHz	-21.33	-13.1
2.90 - 5 GHz	3.912 GHz	-26.00	-13.1
5 - 9 GHz	5.887 GHz	-24.17	-13.1
9 - 20.0 Ghz	19.69 GHz	-37.83	-13.1

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



Conducted spurious emissions as measured at Antenna Terminals
EMI1249

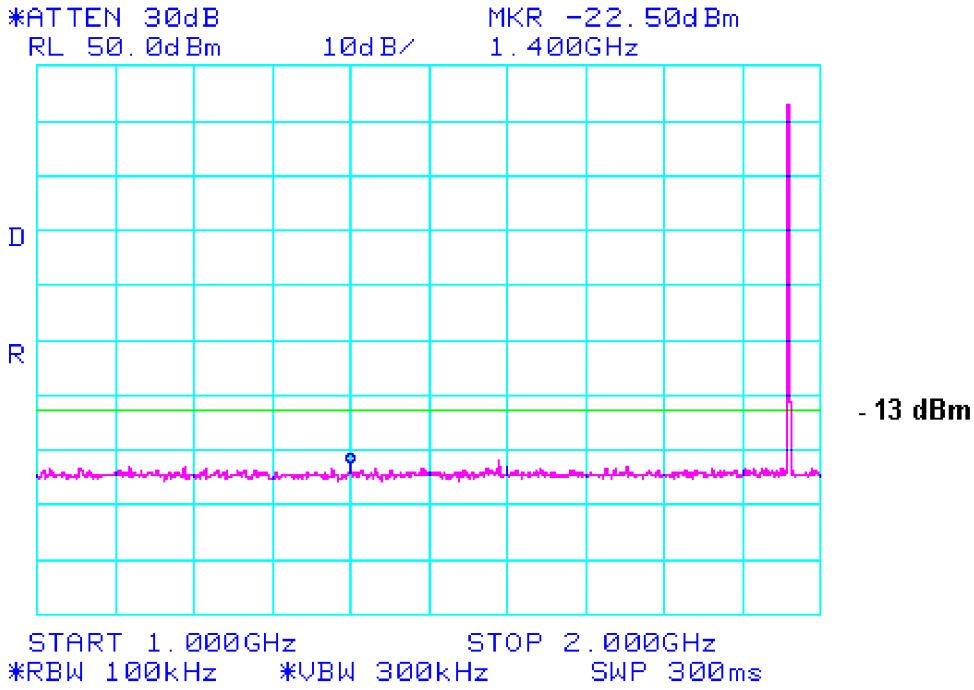
plot #0





Conducted Spurious emissions measured at Antenna Terminals
EMI1249

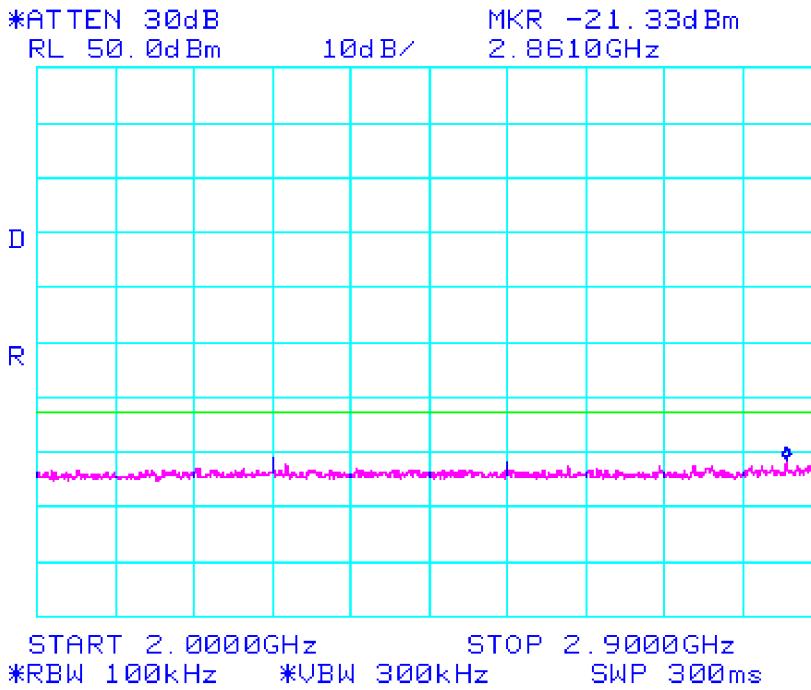
plot #1





Conducted Spurious emissions at Antenna Terminals
EMI1249

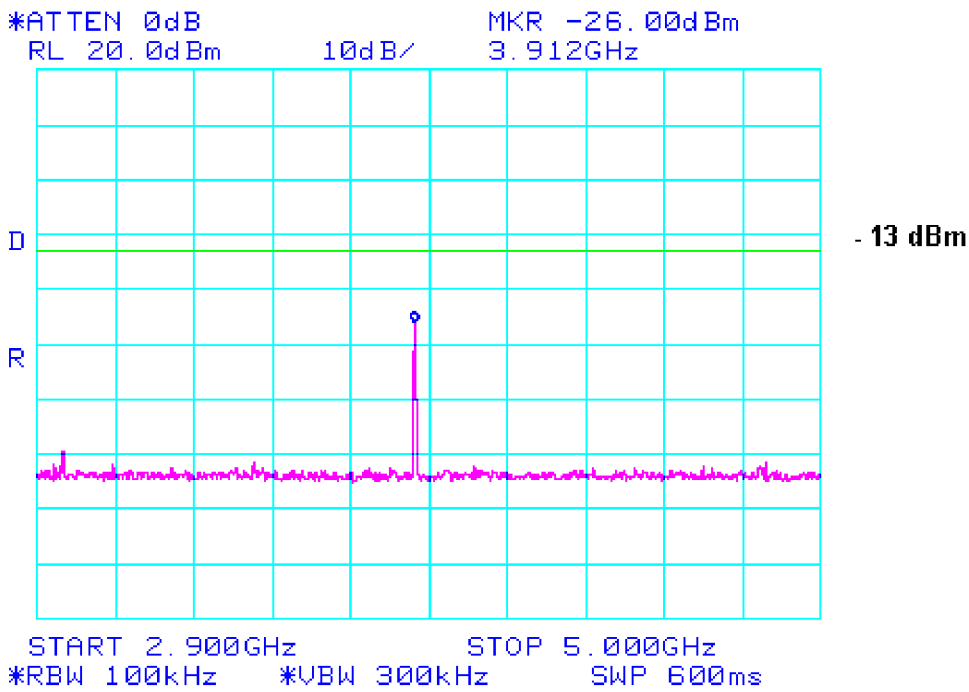
plot #2





**Conducted spurious emissions at Antenna Terminals
EMI1249**

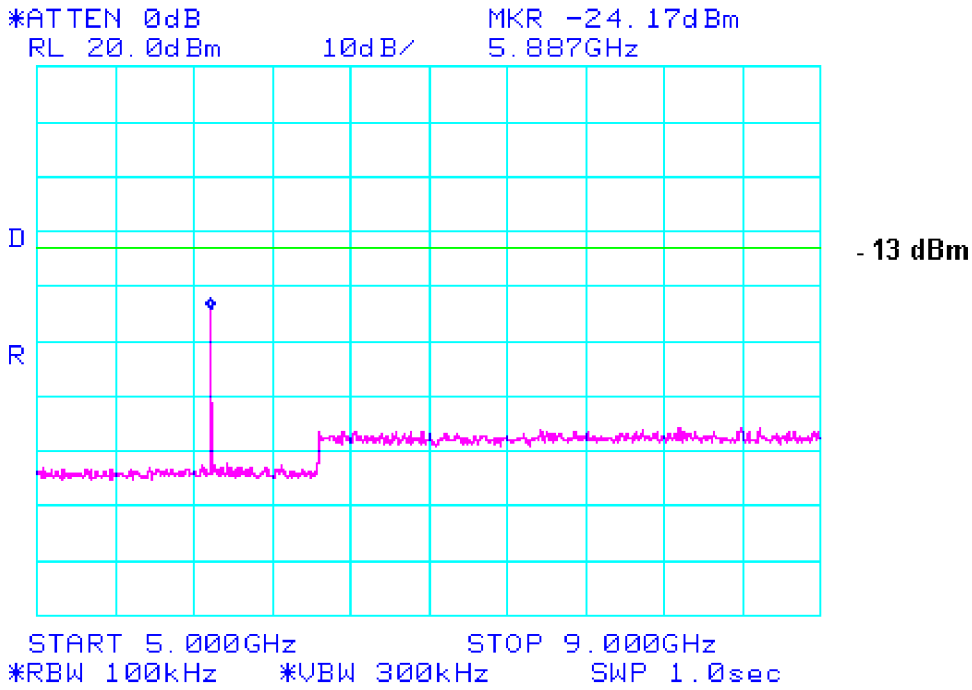
plot #3





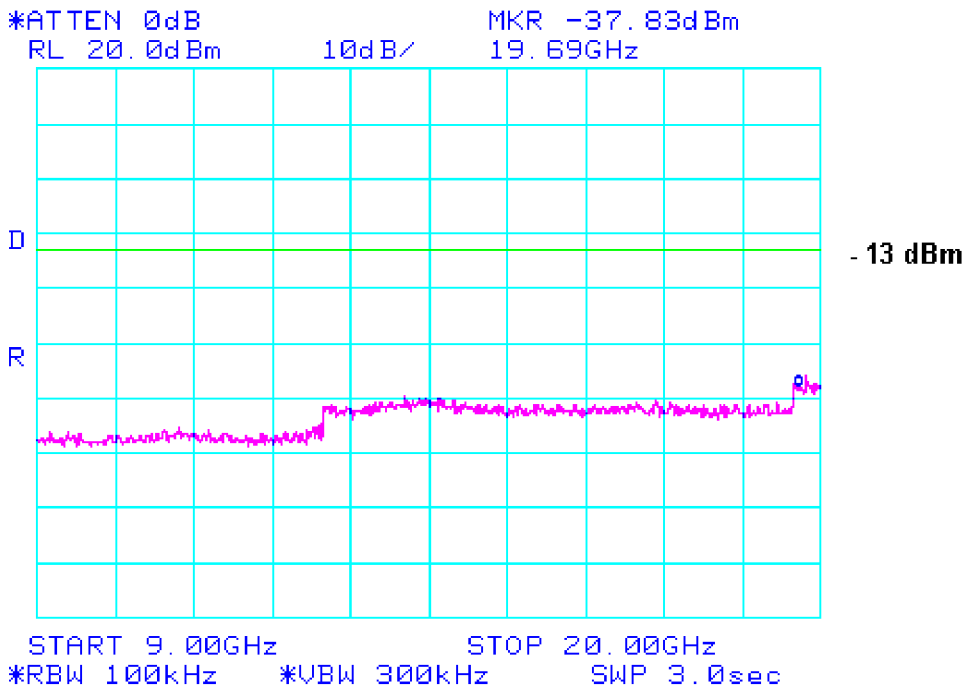
Conducted spurious emissions as measured at Antenna Terminals
EMI1249

plot #4





**Conducted Spurious emissions as measured at Antenna Terminals
EMI1249 port #5**





6.6 TEST TYPE: Spurious Emissions at Antenna Terminals @ Frequency Block Edge +/- 1MHz

6.6.1 TECHNICAL SPECIFICATION: 47CFR2.991;24.238(b)

6.6.2 TEST DATE(S): 16 Aug 1999

6.6.3 MEASUREMENT PROCEDURES: (Downlink) - PCS

Modulation products outside of this band are attenuated at least $43 + 10 \text{ Log (P)}$ below the level of the modulated carrier. A Plot of the spurious emissions at +/- 1 MHz around the transmit frequency, as measured at the antenna port, appear on the following pages.

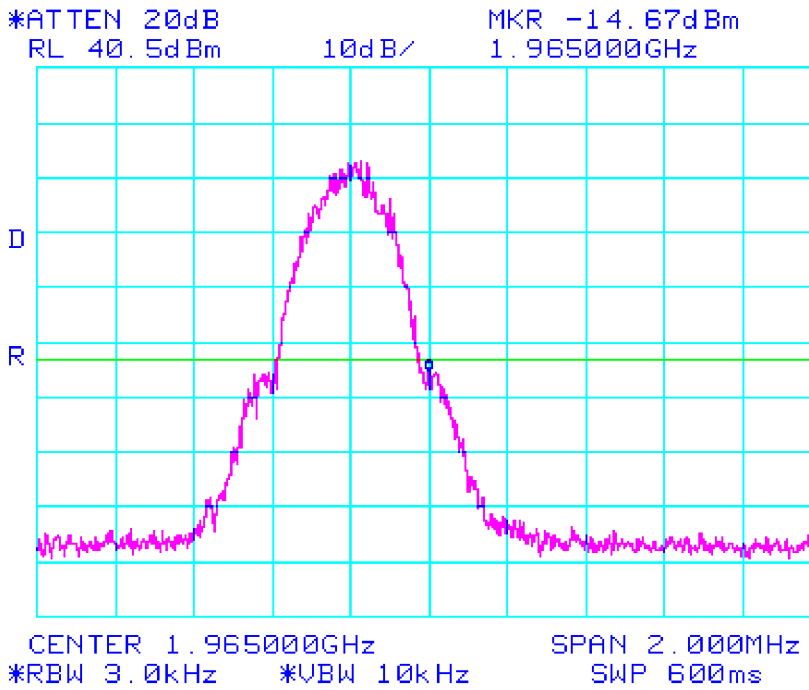
SPURIOUS EMISSION FREQUENCY BLOCKS

Frequency Block (MHz)	Low Frequency (MHz)	Hi Frequency (CH #)
B (1950-1965)	(1950.2)	(1964.8)
E (1965-1970)	(1965.2)	(1969.8)

Plots of the spurious emissions as measured at the extremes of each frequency block appear in the following plots:

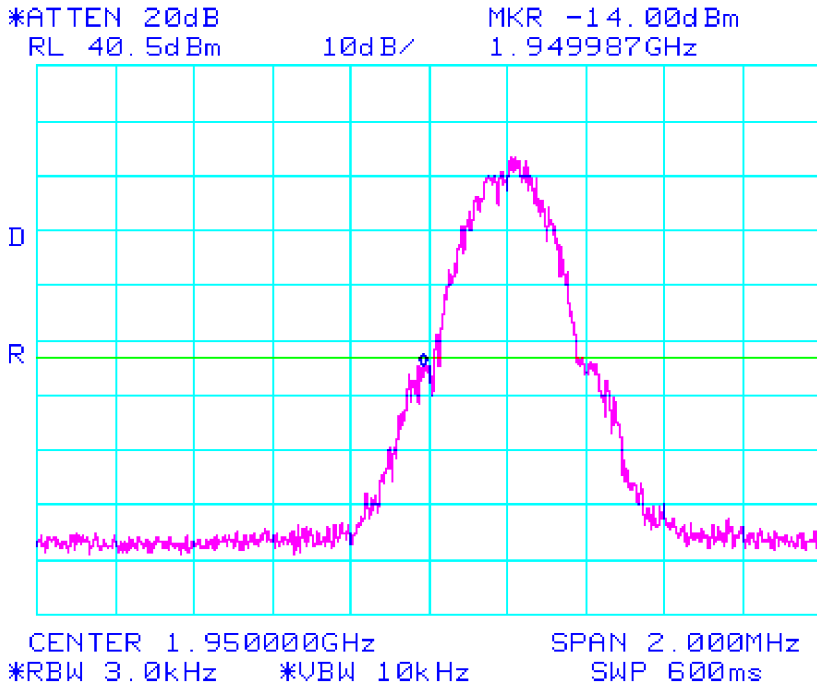


**Conducted Spurious emissions as measured at +/- 1 MHz of Frequency Block edge
Hi side of Block B
emi1249**



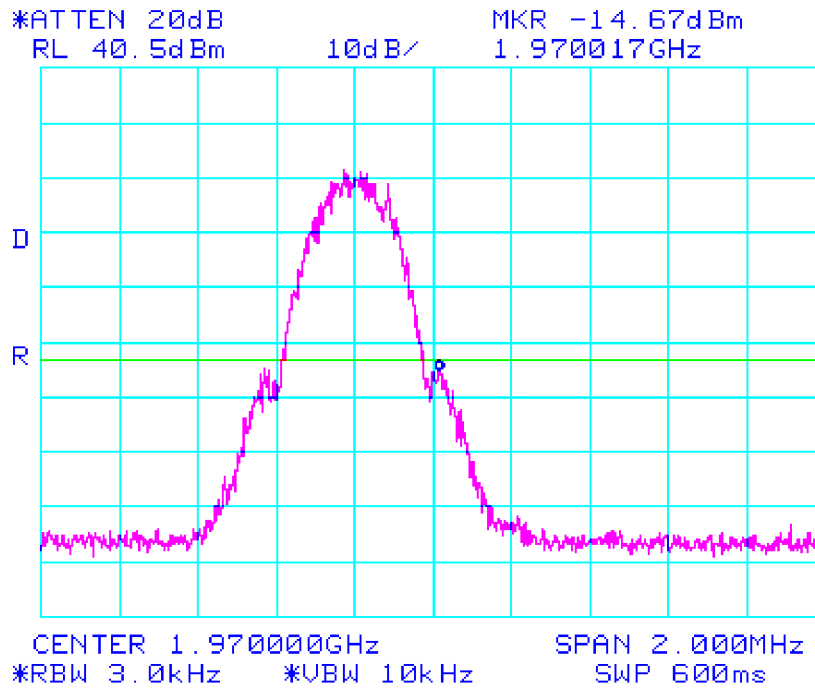


**Conducted Spurious Emissions at frequency Block edge +/- 1 MHz
Lo side of Block B
emi1249**



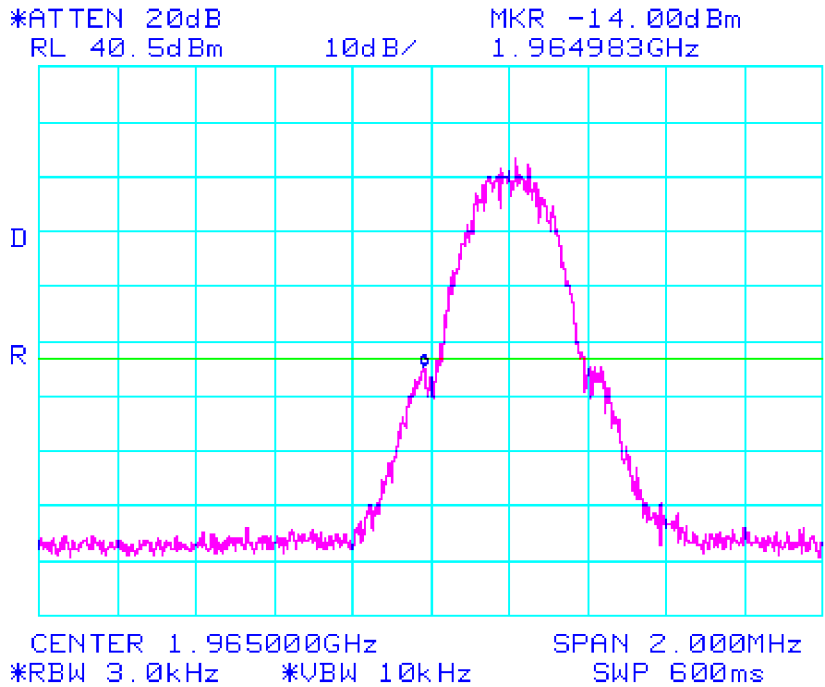


Spurious Emissions at the Frequency Block edge +/- 1 MHz
Hi side of Block E
emi1249





**Conducted Spurious Emissions as measured at Frequency Block edge +/- 1 MHz
Lo side of Block E
emi1249**





6.7 TEST TYPE: Intermodulation Spurious Emissions Antenna Terminals

6.7.1 TECHNICAL SPECIFICATION: 47CFR2.991, 24.238(a)

6.7.2 TEST DATE(S): Not Applicable

6.7.3 EXPLANATION OF APPLICABILITY: The Allgon Tower Top Power Amplifier (L6G922802) is intended for use in single carrier mode only. Due to the configuration of the technology in which the TTPA will be used, only one carrier will be possible per TTPA. The unit will be used with a single GMSK modulated carrier. See the attached attestation from Allgon for manufacturer's statement, submitted as the operational Description Document titled carrier.pdf.



6.9 TEST TYPE: Line Conducted Emissions

6.9.1 TECHNICAL SPECIFICATION: 15.107(b)

6.9.2 TEST DATE(S): 2 Sep 1999

6.9.3 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.

6.9.4 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)
1.442	40.0	60.0
0.962	51.3	60.0
3.531	24.1	69.0
8.016	26.24	69.0
9.123	26.35	69.0
24.047	54.16	69.0

SUMMARY OF SPURIOUS EMISSIONS AT AC Mains Terminals - Neutral

Frequency (MHZ)	Emission Quasi-Peak Level (dBuV)	Limit (dBuV)
0.4806	54.29	60.0
0.9612	51.13	60.0
1.442	39.60	60.0
3.541	23.86	69.0
24.050	31.45	69.0
23.634	21.60	69.0

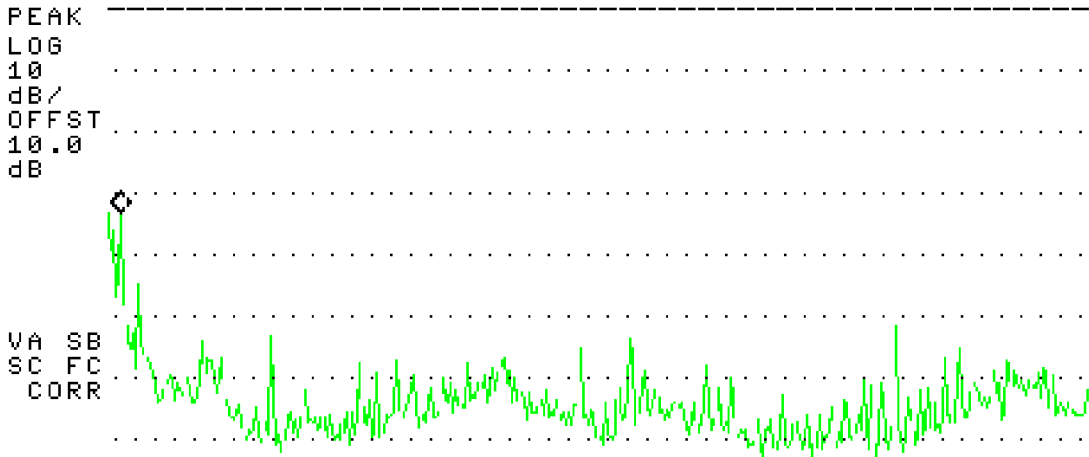
The following plots illustrate compliance with the applicable specification.



Line Conducted emissions - phase emi1249

20:37:47 SEP 02, 1999

REF 84.0 dB μ V #AT 0 dB MKR 890 kHz
50.99 dB μ V



START 450 kHz STOP 30.00 MHz RL
#RES BW 9.0 kHz VBW 30 kHz SMP 1.09 sec

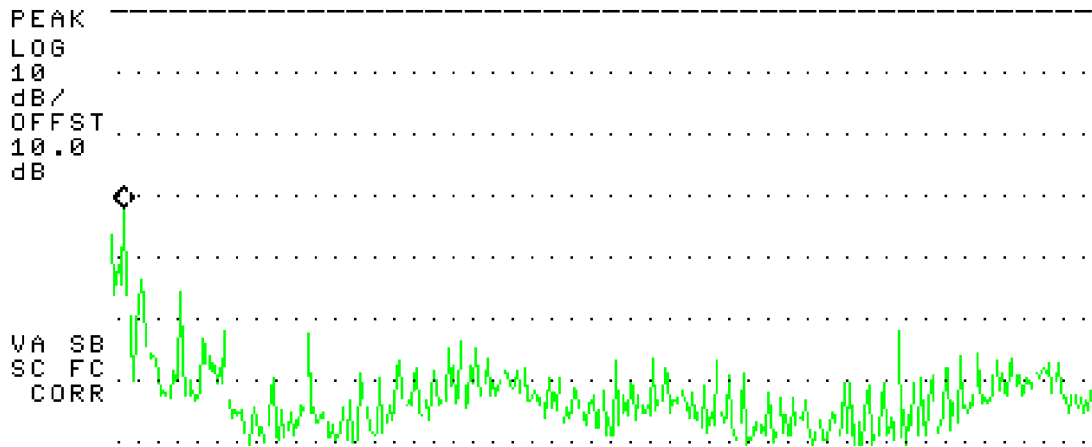


Line Conducted Emissions - Neutral emi1249

19:37:44 SEP 02, 1999

REF 83.0 dB μ V #AT 0 dB

MKR 890 kHz
50.96 dB μ V



CLEAR
WRITE B

MAX
HOLD B

VIEW B

BLANK B

Trace
A B C

More
1 of 3

START 450 kHz STOP 30.00 MHz
#RES BW 9.0 kHz VBW 30 kHz SWP 1.09 sec

RL



TEST SETUP OF LINE CONDUCTED EMISSIONS