



FCC ID: L6GAR3100A

April 19, 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: AR3100A
FCC ID: L6GAR3100A

Specification: 47 CFR 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: AR3100A, 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 3100A

FCC ID:: L6GAR3100A

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): Mar 8 thru April 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 24 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 PCS Cellular Repeater, Model 3100A 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	5/22/99	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	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 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:(uplink & downlink) 47CFR 2.991, **24.238(a)**
- 5.5 Intermodulation Spurious Emissions-2 Tone Simultaneous RF Injection (uplink & downlink): 47CFR2991, **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):** 1 April 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 3 watts:

$$P_o = 3 W$$

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 24.238(a), 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 24.238(a), 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 (dBμV)	ANTENNA FACTOR (dB/m)	TEST DISTANCE (m)	CABLE LOSS (dB)	distance Corr Factor (3m to 10m) (dB)	FIELD STRENGTH (dBuV/m)	LIMITS @ 10m (dBuV/m)
		POL (H/V)	HGT (m)							
80.040	135	H	1	31.1	7.20	3.0	1.7	10.46	29.5	84.38
80.040	0	V	2	29.5	8.80	3.0	1.7	10.46	29.5	84.38
78.780	0	H	2	27.7	7.42	3.0	1.6	10.46	26.3	84.38
78.780	270	V	1	24.9	8.73	3.0	1.6	10.46	24.8	84.38
50.130	90	H	1	28.2	10.69	3.0	1.3	10.46	29.7	84.38
50.130	90	V	2.5	29.6	10.88	3.0	1.3	10.46	31.3	84.38
110.050	135	H	3	19.7	12.61	3.0	2.0	10.46	23.8	84.38
110.050	0	V	1.5	16.5	13.81	3.0	2.0	10.46	21.8	84.38
160.100	180	H	2	27	14.70	3.0	2.4	10.46	33.6	84.38
160.100	45	V	1	25.8	15.51	3.0	2.4	10.46	33.3	84.38
255.100	315	H	1.5	11.7	17.51	3.0	3.1	10.46	21.9	84.38
255.100	13.9	V	1	13.9	17.80	3.0	3.1	10.46	24.4	84.38



1950.200	45	H	1	32.0	29.4	1.0	1.0	-9.54	52.96	84.38
1950.200	45	V	1	31.0	30.7	1.0	1.0	-9.54	52.46	84.38

Equipment meets the specifications of 2.993; 24.238(a)



FCC ID: L6GAR3100A

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): 8 Mar 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.

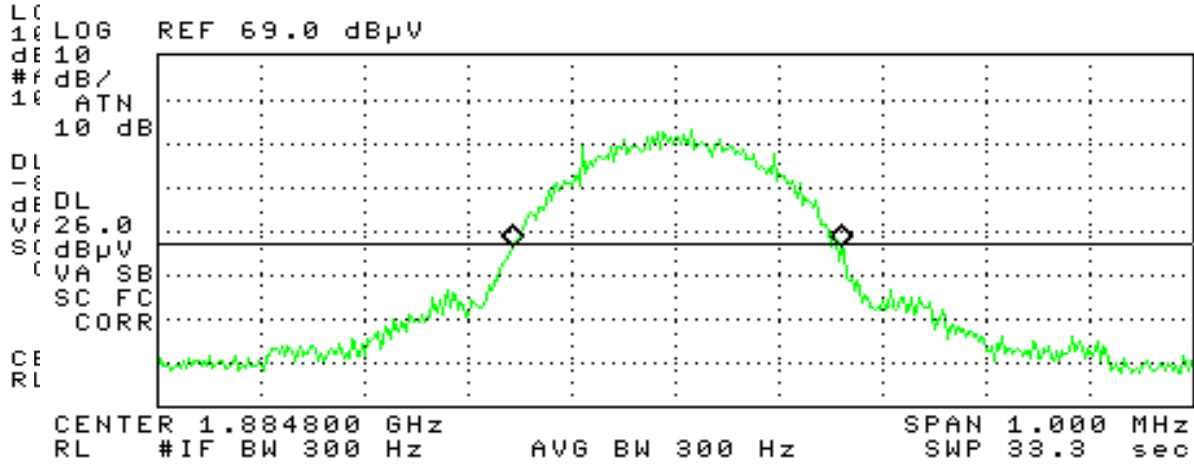
6.2.4 RESULTS:

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 - (@ Input side of repeater) Uplink
emi1186

10:44:13 MAR 09, 1999

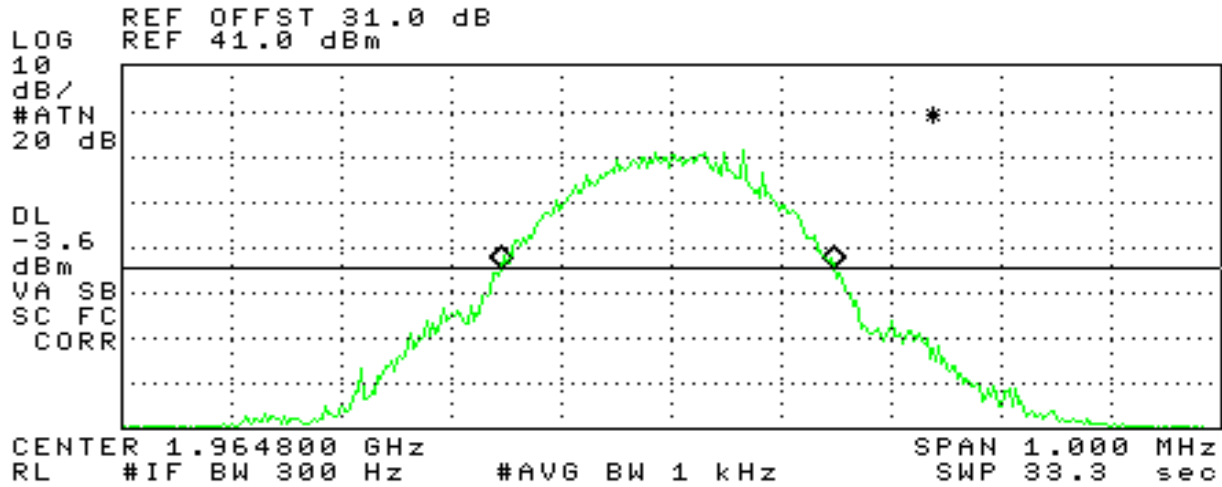
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 318 kHz
-.15 dB



Occupied Bandwidth (@ output side of repeater - Downlink)
EMI1186

17:43:27 MAR 08, 1999

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 303 kHz
-.33 dB

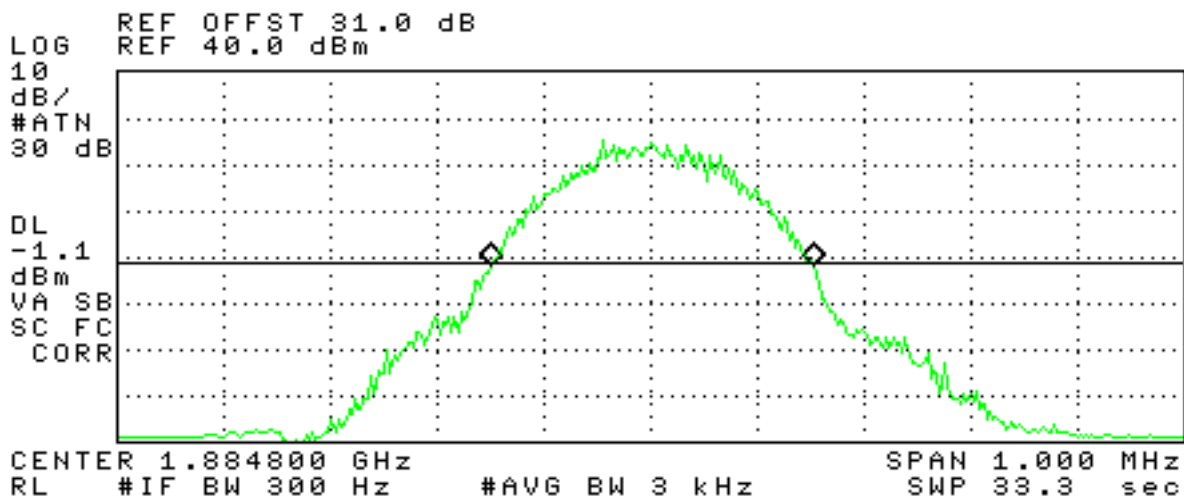




Occupied Bandwidth - (@ Output side of repeater) - Uplink
emi1186

11:09:56 MAR 09, 1999

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 303 kHz
-.54 dB





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): 8 Mar 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 GMSK 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

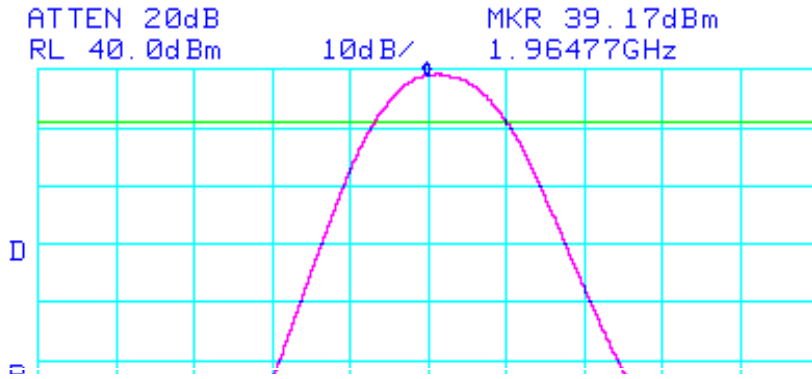


RF Power Output Test Configuration

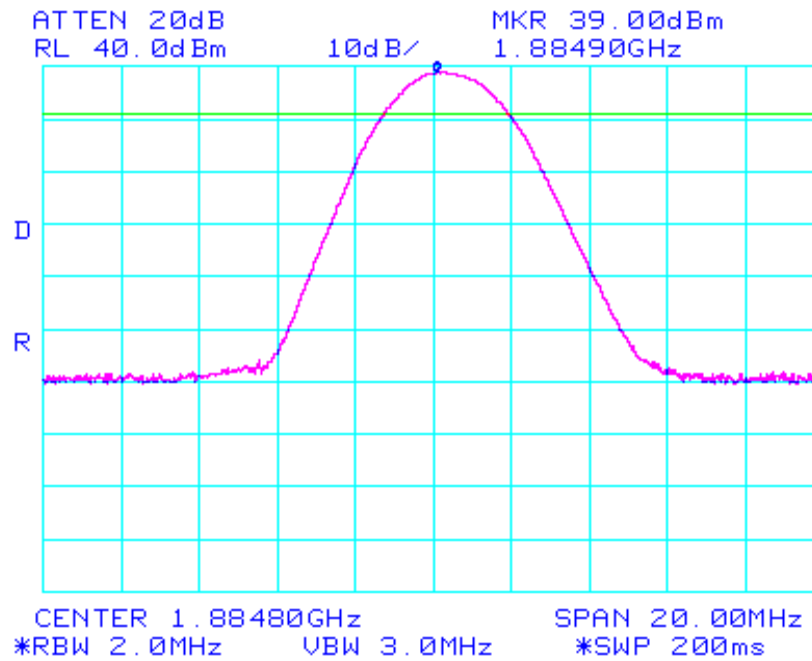




RF Power Output - Forward Midband
EMI1186



RF Power Output : PCS Band - Uplink/Reverse Channel output
emi1186





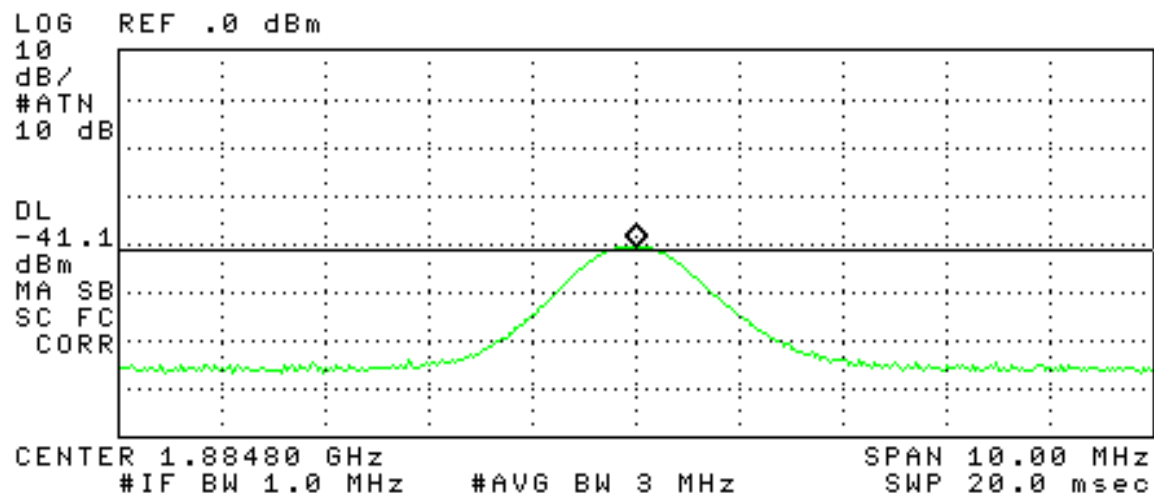
FCC ID: L6GAR3100A



Power Output - (Input Signl to repeater unit)
Reverse/Uplink. (Note: representative for Downlink/Forward direction).
emi1186

11:22:01 MAR 09, 1999

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 1.88480 GHz
-40.64 dBm



**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):** 19 Mar 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.

6.4.4 RESULTS:

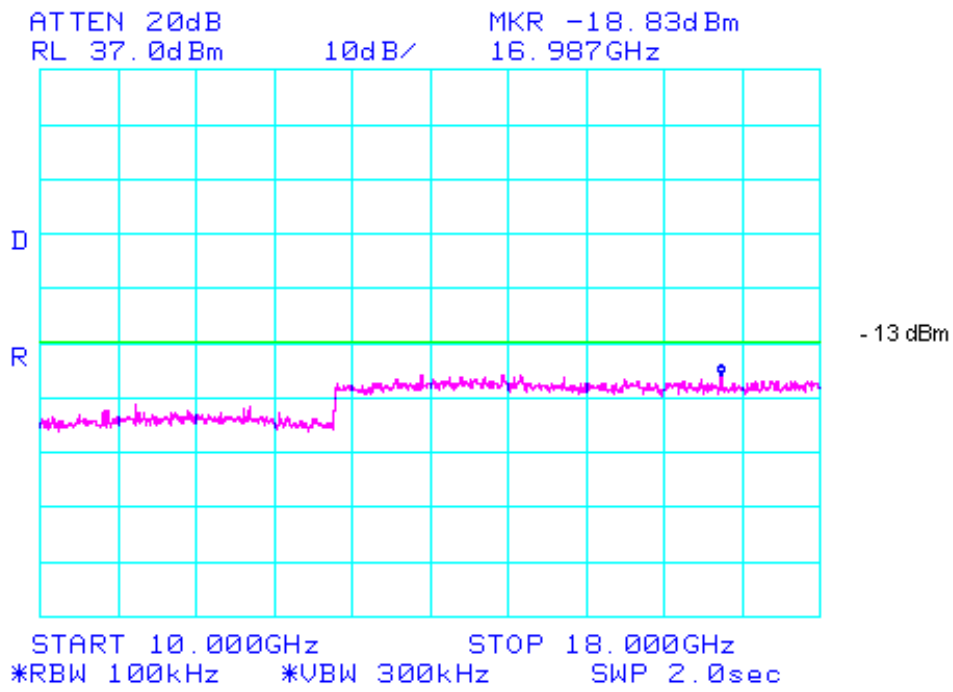
Equipment complies with Section 2.991 and 24.238(a)

SUMMARY OF SPURIOUS EMISSIONS AT ANTENNA TERMINALS - UpLink

Frequency Range	Emission Frequency	Emission Level (dBm)	Limit (dBm)
9.0 kHz - 500 MHz	251.0 MHz	-34.17	-13.1
500 MHz - 2.5 GHz	1.020 GHz	-30.67	-13.1
2.5 - 2.9 GHz	2.66 GHz	-41.00	-13.1
2.9 - 10.0 GHz	7.56 GHz	-25.50	-13.1
10 - 18 GHz	16.98 GHz	-18.83	-13.1
18.0 - 20.0 GHz	19.77 GHz	-22.83	-13.1

The following plots are included to illustrate compliance with the requirements of 47

Antenna Conducted Spurious Emissions - Uplink
EMI1186





6.5 TEST TYPE: Spurious Emissions at Antenna Terminals

6.5.1 TECHNICAL SPECIFICATION: 2.991; 24.238(a)

6.5.2 TEST DATE(S): 19 Mar 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 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)

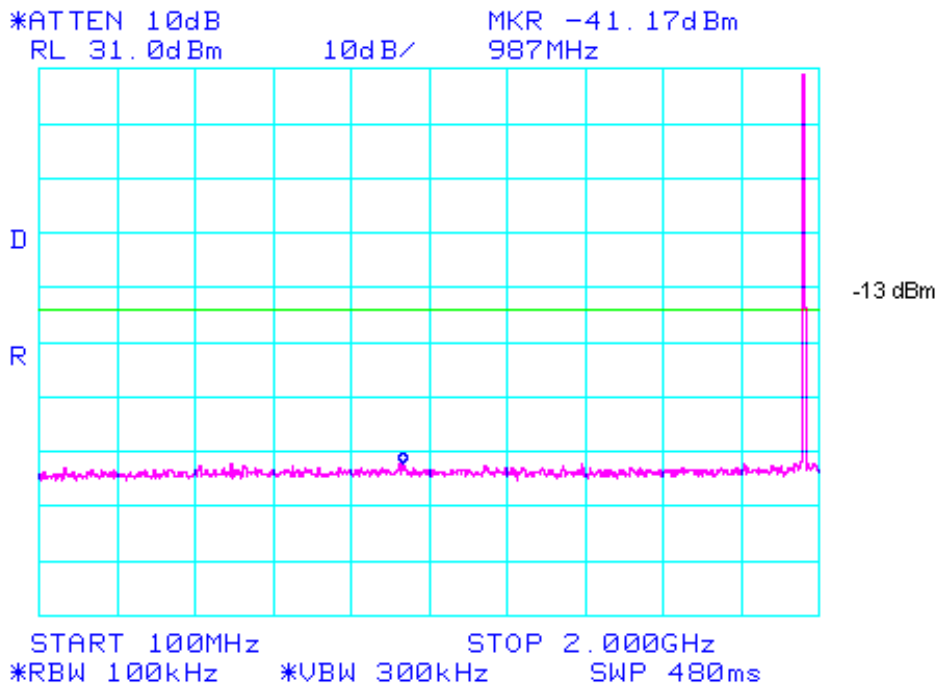
SUMMARY OF SPURIOUS EMISSIONS AT ANTENNA TERMINALS - DownLink (Base)

Frequency Range	Emission Frequency (GHz)	Emission Level (dBm)	Limit (dBm)
9 kHz - 100 MHz	0.00945	-26.33	-13.1
100 - 2 GHz	0.987	-41.17	-13.1
2 - 2.90 GHz	2.015	-40.33	-13.1
2.90 - 10 GHz	7.55	-32.67	-13.1
10 - 18.0 GHz	14.53	-27.67	-13.1
18.0 - 20.0 GHz	19.50	-29.17	-13.1

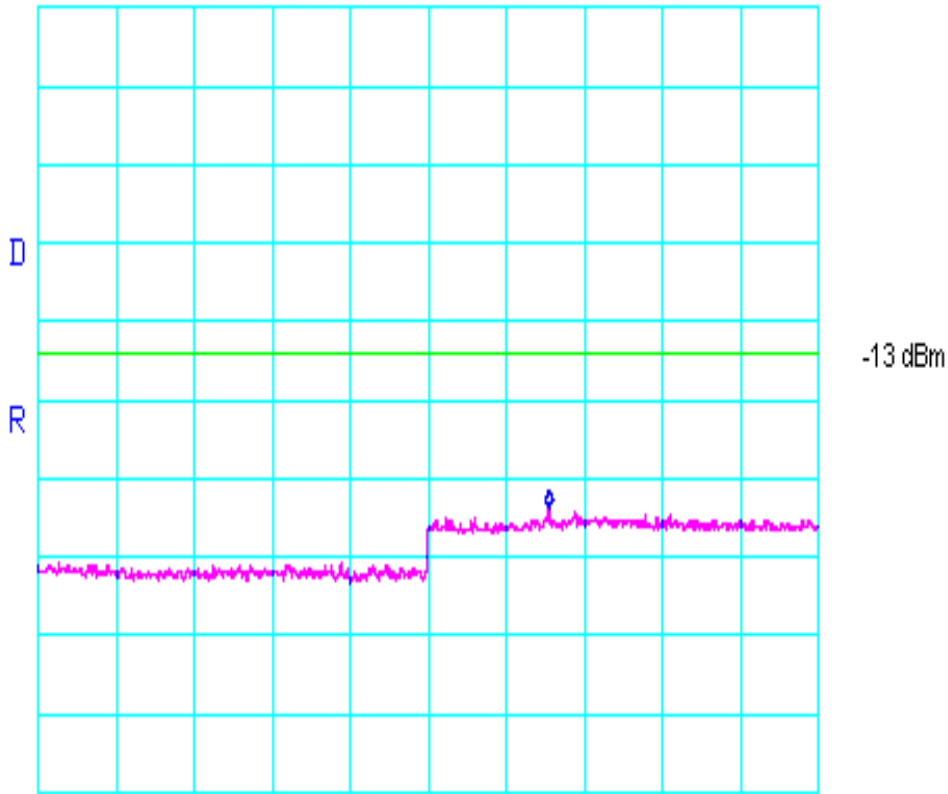
Plots on the following pages illustrate compliance to the required rule parts.

Antenna Conducted Spurious Emissions - Downlink
EMI1186

Antenna Conducted Spurious Emissions - Downlink
EMI1186



*ATTEN 10dB MKR -32.67dBm
RL 31.0dBm 10dB/ 7.551GHz



START 2.900GHz STOP 10.000GHz
*RBW 100kHz *VBW 300kHz SWP 1.8sec



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): 22 and 23 Mar 1999

6.6.3 MEASUREMENT PROCEDURES: (UPLINK) - 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 (CH #)	Hi Frequency (CH #)
A (1850 - 1865)	512 (1850.2)	585 (1864.8)
B (1870 - 1885)	612 (1870.2)	685 (1884.8)



C (1875 - 1910)	737 (1895.2)	810 (1909.8)
D (1865 - 1870)	587 (1865.2)	610 (1869.8)
E (1885 - 1890)	687 (1885.2)	710 (1889.8)
F (1890 - 1895)	712 (1890.2)	735 (1894.8)

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

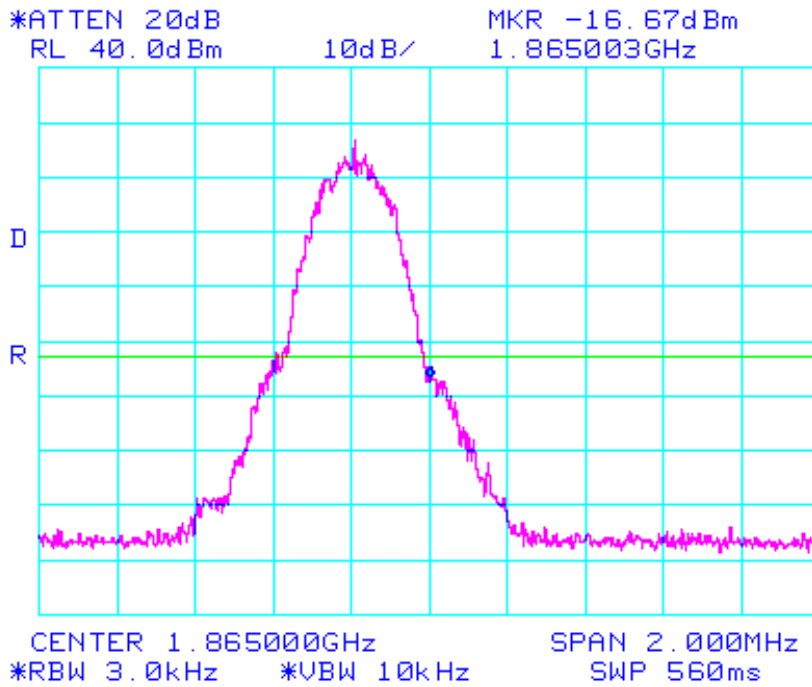


Spurious Emissions at frequency Block edges +/- 1 MHz

emi1186

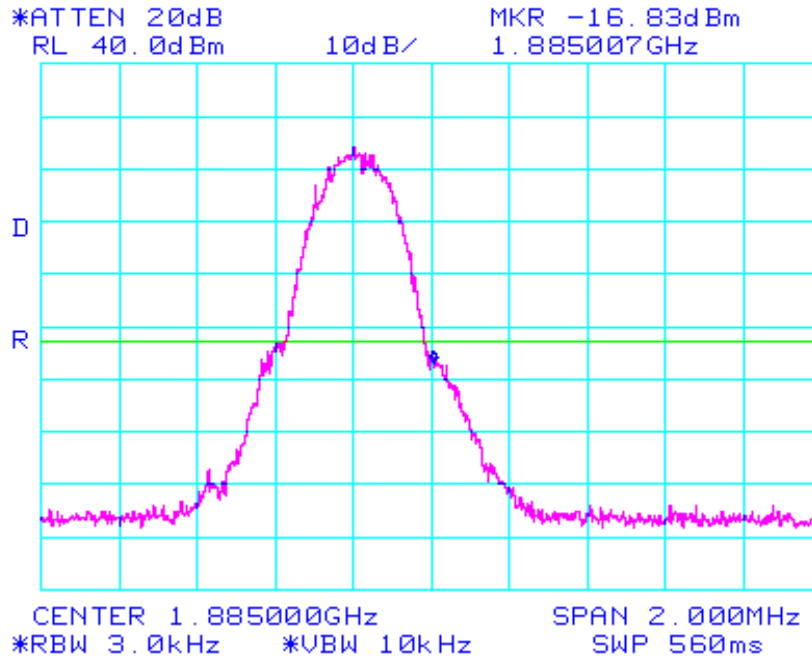
High side Block A

- uplink

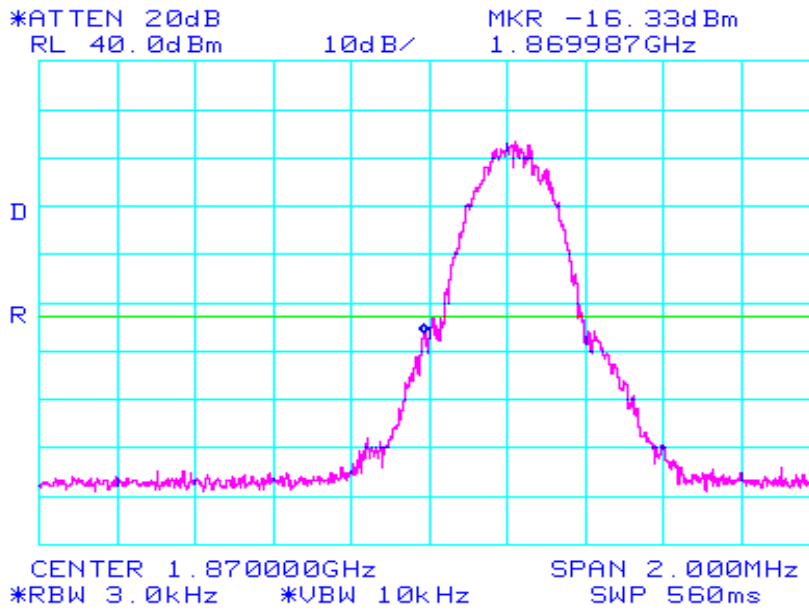




Spurious Emissions at frequency Block edges +/- 1 MHz - uplink
Hi side of Block B
emi1186



Spurious emissions at frequency block edges +/- 1 MHz
Lo side of Block B
emi1186 - uplink

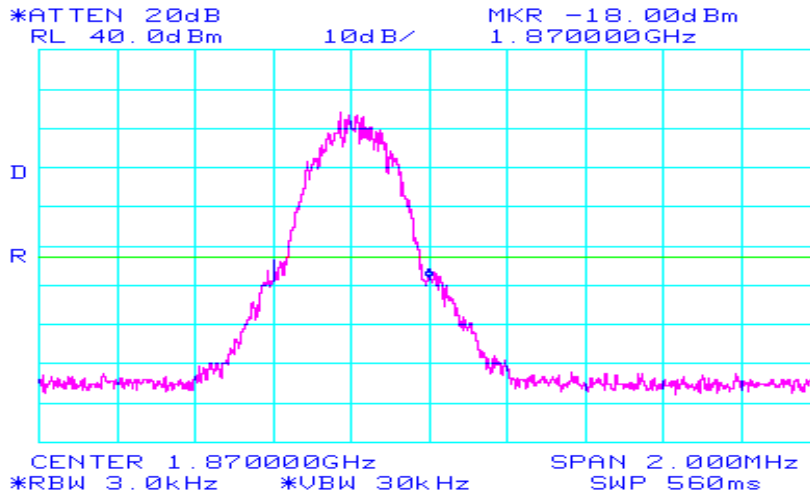


Spurious Emissions at frequency block edges +/- 1 MHz

Hi side of Block D

emi1186

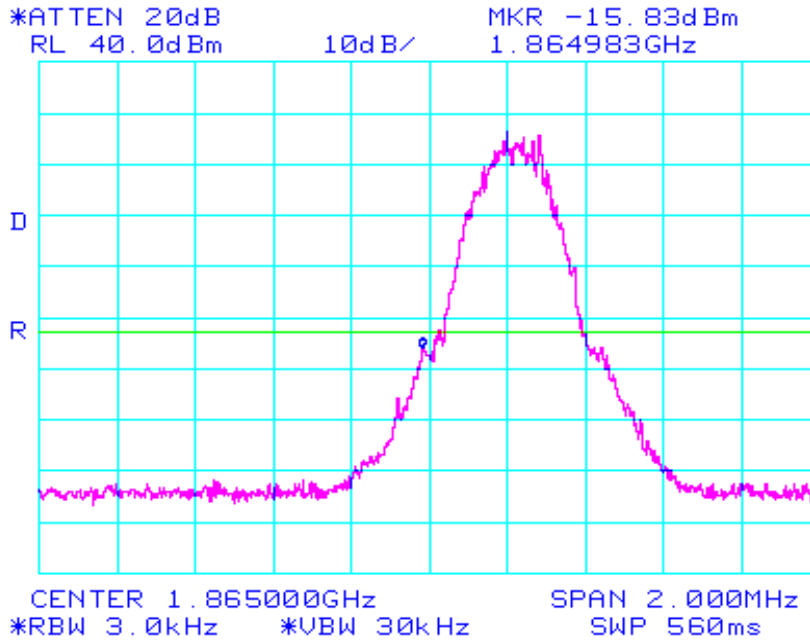
- uplink



Lo side of Block D

emi1186

- uplink



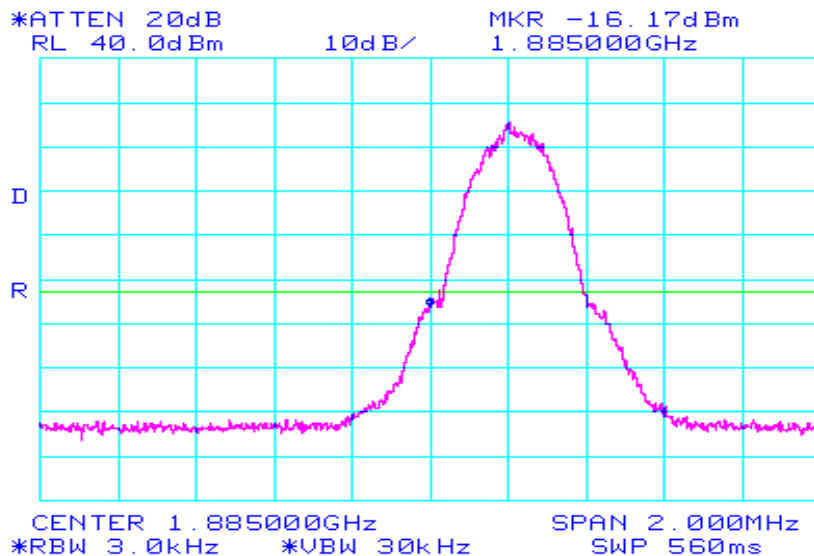


Spurious Emissions at frequency block edges +/- 1MHz

Lo side of Block E

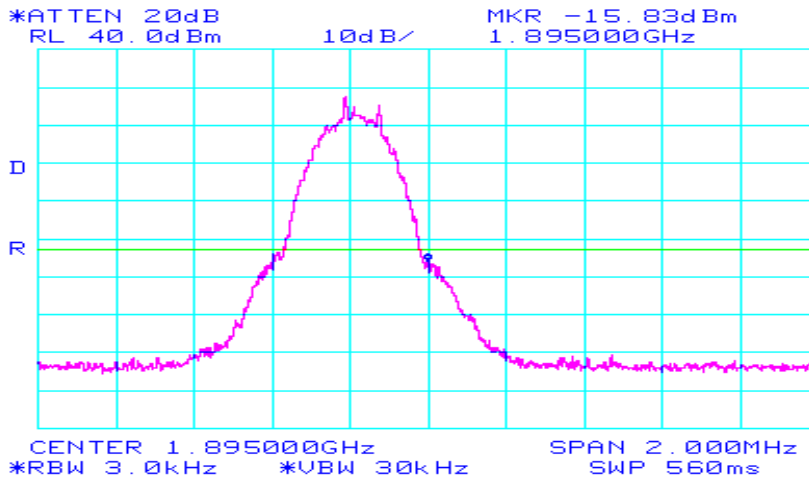
emi1186

- uplink



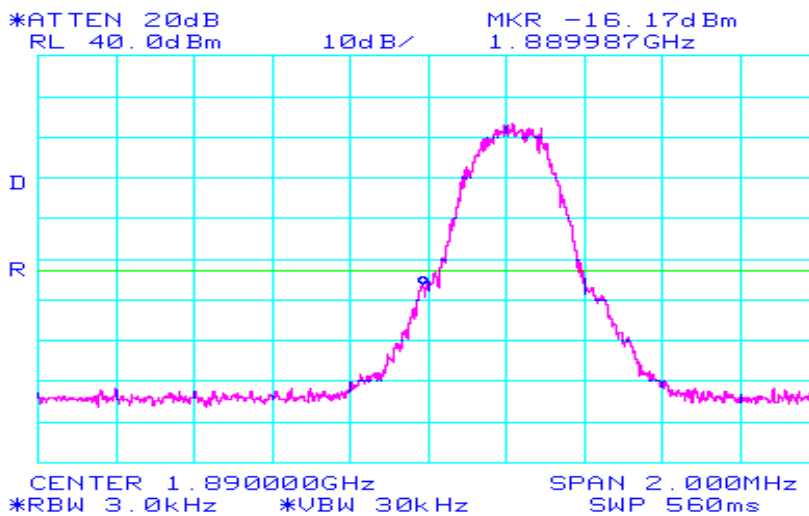
Spurious Emissions at frequency block edges +/- 1 MHz
Hi side of Block F
emi1186

- uplink



Spurious Emissions at frequency Block edges +/- 1 MHz
Lo side of Block F
emi1186

- uplink



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): 22 and 23 Mar 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 $\pm 1 \text{ MHz}$ around the transmit frequency, as measured at the antenna port, appear on the following pages.

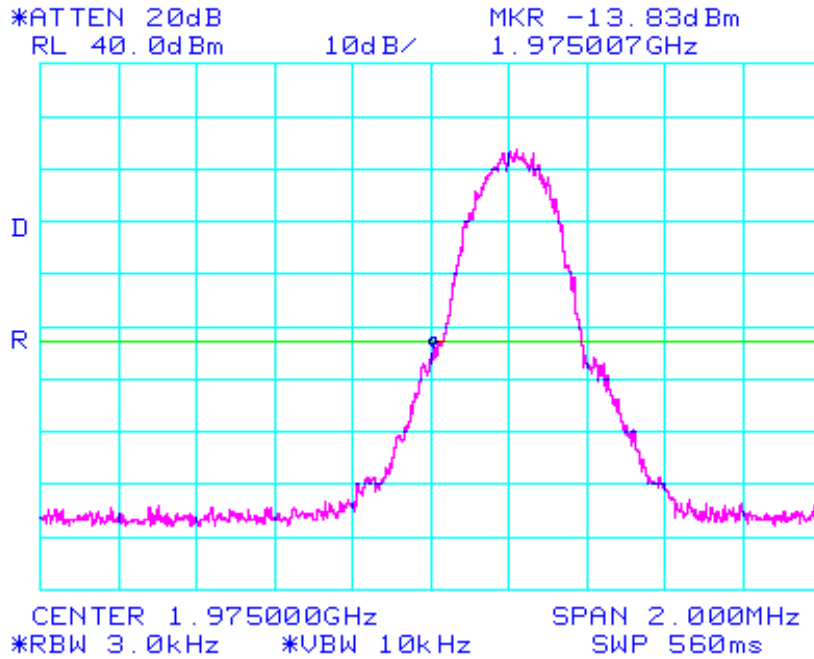
SPURIOUS EMISSION FREQUENCY BLOCKS

Frequency Block (MHZ)	Low Frequency (CH #)	Hi Frequency (CH #)
A (1930 - 1945)	513 (1930.2)	584 (1944.8)
B (1950 - 1965)	613 (1950.2)	684 (1964.8)
C (1975 - 1990)	738 (1975.2)	809 (1989.8)

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

Spurious Emissions at Frequency Block edges +/- 1 MHz
Lo side of Block C
emi1186

[downlink](#)

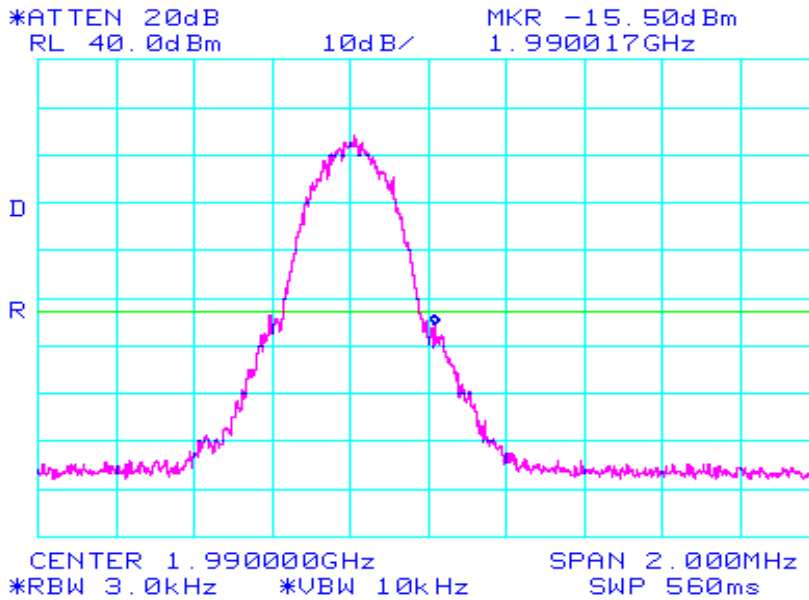


Spurious Emissions at Frequency Block edges +/- 1 MHz
Hi side of Block B

[downlink](#)

Spurious Emissions at Frequency Block edges +/- 1 MHz
Hi side of Block C
emi1186

[downlink](#)



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): 29 Mar 1999

6.7.3 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.

6.7.4 RESULTS:

Equipment complies with 47CFR 2.991 and 24.238(a). Plots of the spurious emissions as measured at the antenna port are included in this application as file attachment:

Uplink - Input tone Frequencies : $F_1 = 1850.2 \text{ MHz}$; $F_2 = 1889.8 \text{ MHz}$

modulation type	Intermodulation products (GHz)	Emission Level (dBm)	Limit (dBm)
GMSK	1.88077	-63.67	-13.1
GMSK	1.8988	-66.83	-13.1

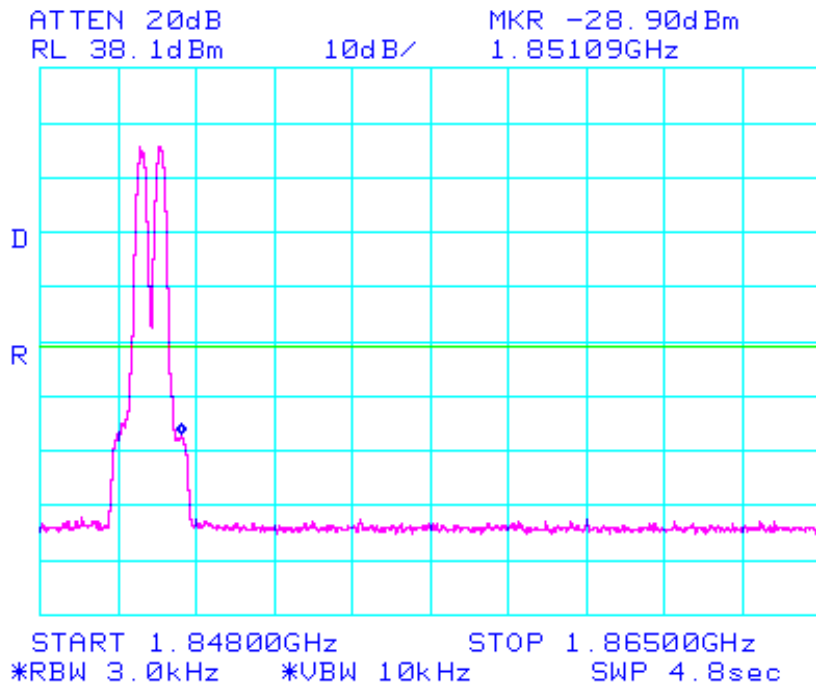
Note: The EUT is a 2 channel device and is capable of 2 channel amplification only. All other signals outside the Channel Passband are greatly attenuated.



FCC ID: L6GAR3100A

**Intermodulation Distortion (IMD) - Uplink
w/ 2 tone GMSK modulated input
Bottom of Block A**

emi1186



6.8 TEST TYPE: Intermodulation Spurious Emissions Antenna Terminals

6.8.1 TECHNICAL SPECIFICATION: 2.991; 24.238(a)

6.8.2 TEST DATE(S): 29 Mar 1999

**6.8.3 MEASUREMENT PROCEDURES: (DOWNLINK)**

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

6.8.4 RESULTS:

Equipment complies with 47CFR 2.991 and 24.238(a). 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 Downlink

Input tone Frequencies : $F_1 = 1989.4 \text{ MHz}$; $F_2 = 1989.8 \text{ MHz}$

modulation type	Intermodulation products (GHz)	Emission Level (dBm)	Limit (dBm)
GMSK	1.99022	-54.0	-13.1
GMSK	1.98900	-56.0	-13.1



FCC ID: L6GAR3100A

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



FCC ID: L6GAR3100A





6.9 TEST TYPE: Line Conducted Emissions

6.9.1 TECHNICAL SPECIFICATION: 15.107(b)

6.9.2 TEST DATE(S): 30 Mar 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)
21.893	39.1	69.0
22.511	41.5	69.0
21.261	40.4	69.0
25.012	39.1	69.0
21.893	39.1	69.0
27.536	37.4	69.0

SUMMARY OF SPURIOUS EMISSIONS AT AC Mains Terminals - Neutral

Frequency (MHZ)	Emission Quasi-Peak Level (dBuV)	Limit (dBuV)
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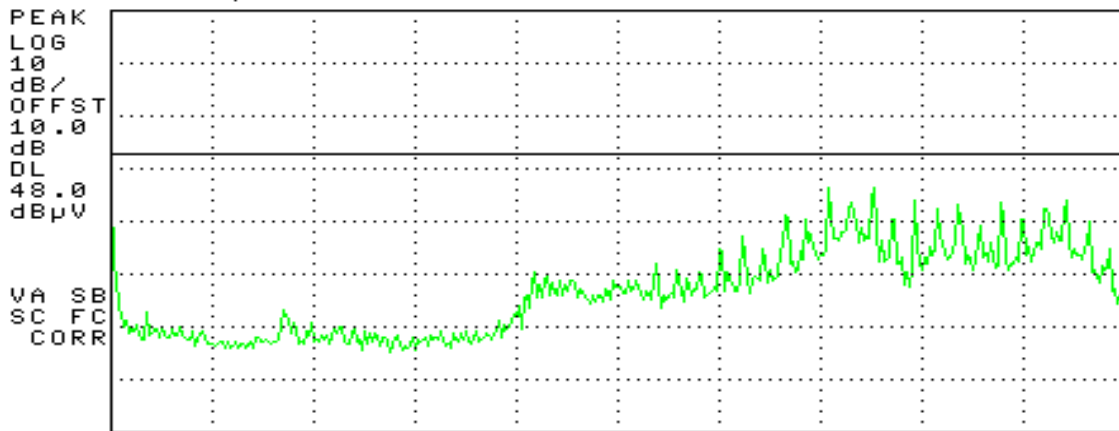


Line Conducted Emissions - Phase emi1186

14:16:31 MAR 30, 1999

AUTO

REF 75.0 dB μ V #ATTEN 0 dB



VA SB SC FC CORR RL

21.890	37.5	69.0
22.510	41.4	69.0
21.262	40.5	69.0
28.150	37.0	69.0
27.535	37.5	69.0
24.391	35.1	69.0

The following plots illustrate compliance with the applicable specification.



Line Conducted Emissions - Neutral emi1186

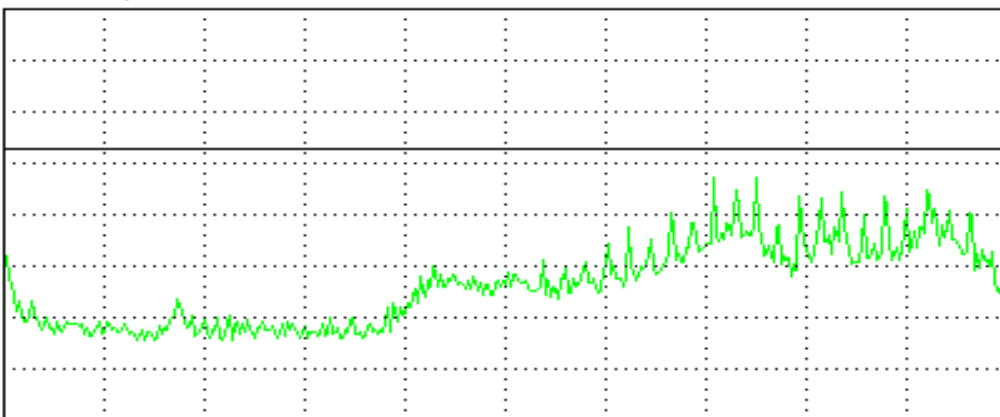
12:48:27 MAR 30, 1999

AUTO

REF 75.0 dB μ V #ATTEN 0 dB

PEAK
LOG
10
dB/
OFFST
10.0
dB
DL
48.0
dB μ V

VA SB
SC FC
CORR



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

RL



FCC ID: L6GAR3100A



TEST SETUP OF LINE CONDUCTED EMISSIONS