

October 31, 2000

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

Attention: Applications Examiner

Applicant: Allgon Telecom, Ltd.  
7317 Jack Newell Blvd. North Fort Worth, Texas 76118

Equipment: COMPACT repeater with adjustable bandwidth, Model ALR4600  
FCC ID: L6GALR4600

Specification: 47 CFR 90 Licensed Certification

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Dear Examiner:

The following application for Grant of Equipment Authorization is presented on behalf of Allgon Telecom Ltd.. for the Licensed Certification of their Model: ALR4600, Repeater.

Enclosed, please find a complete data and documentation package demonstrating that this device complies with the technical requirements of 47 CFR, Part 90, for a 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:** COMPACT Repeater, Model ALR4600

**FCC ID::** L6GALR4600

**Specification:** 47 CFR 90

**On Behalf of the Applicant:** Allgon Telecom Ltd.  
7317 Jack Newell Blvd. North  
FortWorth, TX 76118

**Manufacturer:** Allgon Telecom Ltd.  
7317 Jack Newell Blvd. North  
FortWorth, TX 76118


**Manufacturer's Representative** Mr. Tim Purvis

**Test Date(s):** September 20 thru 29 , 2000

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## 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 90 of the FCC Rules under normal use and maintenance.

  
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Liming Xu  
Project Engineer, MET Laboratories

## 1.0 INTRODUCTION

The following data is presented on behalf of the Applicant, Allgon Telecom Ltd. as verification of the compliance of the Allgon COMPACT Repeater, Model ALR4600 to the requirements of 47CFR 90.

## 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	5/26/01	annual
EMCO	Biconical Antenna 3104	03/06/01	annual
EMCO	EMCO Log Periodic Antenna	10/20/00	annual
EMCO	Double Ridge Guided Horn	2/27/01	annual
Hewlett Packard	8594EM Analyzer	11/20/00	annual
Rhode & Swartz	SMIQ03 SG	08/16/01	annual
Hewlett Packard	E4431B SG	8/29/01	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 RF (i.e. FM or iDEN type) 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 Single Channel operation which results in maximum possible output gain.

## 5.0 TEST TYPE(S)

- 5.1 Radiated Emissions: 47CFR2.1053, 90.210(h)/.691(a)
- 5.2 Occupied Bandwidth: 47CFR2.1049, Input vs. Output
- 5.3 RF Power Output: 47CFR 2.1046, 90.205(i), (90.635)
- 5.4 Spurious Emission at Antenna Terminals:(uplink & downlink) 47CFR 2.1051, 90.210(h)/.691(a)
- 5.5 Intermodulation Distortion

## 6.0 TEST RESULTS

### 6.1 TEST TYPE: Radiated Emissions

#### 6.1.1 TECHNICAL SPECIFICATION: 2.1053; 90.210(h), 90.691(a)

#### 6.1.2 TEST DATE(S): September 29, 2000

#### 6.1.3 MEASUREMENT PROCEDURES:

As required by 47 CFR 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 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 9 GHz.

The Radiated Spurious Emissions *Limit* is obtained by the following:  
Based on an output power (as measured at the output of the RF Amplifier) of 1 watts:

$$P_o = 1 \text{ W}$$

As per 2.1053, 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:

$$E(V/m)_{1m} = \frac{\sqrt{49.2 \times 1}}{1}$$

$$E(V/m)_{1m} = 7 \text{ V/m or } 137 \text{ dB}\mu\text{V}$$

As per 90.210(h), 90.691(a), the spurious emissions must be attenuated by  $43 + 10\log(P)$  which is:

$$43 + 10\text{Log}(1) = 43 \text{ dB}$$

Therefore, the limit for spurious emissions is:

$$137 \text{ dB}\mu\text{V} - 43 \text{ dB} = 94 \text{ dB}\mu\text{V} @ 1m$$

At 3 meters measurement distance, the limit is;

$$E(V/m)_{3m} = \frac{\sqrt{49.2 \times 1}}{3}$$

$$E(V/m)_{3m} = 2.333 \text{ V/m or } 127 \text{ dB}\mu\text{V}$$

According to 24.238(a), all signals must be attenuated by 46.08 dB. Therefore, the limit for spurious emissions for a test distance of 3 meters is:

$$127 - 43 = 84 \text{ dB}\mu\text{V} @ 3m$$

**6.1.4 RESULTS:**

Frequency (MHz)	Azimuth (Degrees)	Polarity	Height (Meters)	Raw Amplitude (dBuV)	A.C.F. (dB)	Cable loss (dB)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)
127.34	360	H	1.36	20.1	13.3	2.12	35.53	84.37
127.34	60	V	1	25.34	13.97	2.12	41.43	84.37
56.38	328	H	1.36	14.9	11.3	1.37	27.57	84.37
56.38	0	V	1	13.4	10.455	1.37	25.23	84.37
361.00	255	H	1	27.1	15.11	3.69	45.90	84.37
361.00	228	V	1	14.32	14.93	3.69	32.94	84.37
860.00	165	H	1.4	19.4	22.6	6.2	48.20	84.37
860.00	237	V	1.2	15.54	22	6.2	43.74	84.37
660.00	237	H	1	1	20.5	5.3	26.80	84.37
660.00	237	V	1.2	1	20.3	5.3	26.60	84.37
915.50	237	H	1	1	23.6	6.46	31.06	84.37
915.50	237	V	1.2	1	22.81	6.46	30.27	84.37

No Radiated Emissions was observed between 915.5 MhZ and 9GhZ.

The device complies with 47 CFR 2.1053; 90.210(h);90.691(a).



**6.2 TEST TYPE:** Occupied Bandwidth

**6.2.1 TECHNICAL SPECIFICATION:** 47 CFR 2.1046

**6.2.2 TEST DATE(S):** September 28, 2000

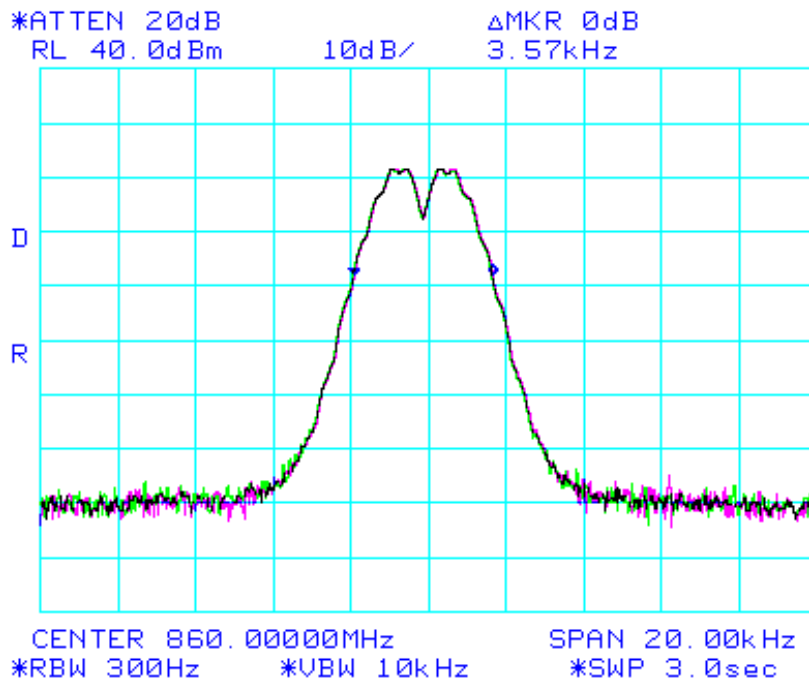
**6.2.3 MEASUREMENT PROCEDURES:**

As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made on the Repeater pre- and post-repeater. A digital signal generator was configured to transmit a modulated carrier signal. Using an IF bandwidth of 300Hz, we determined the occupied bandwidth of the emission at the Input vs Output.

**6.2.4 RESULTS:**

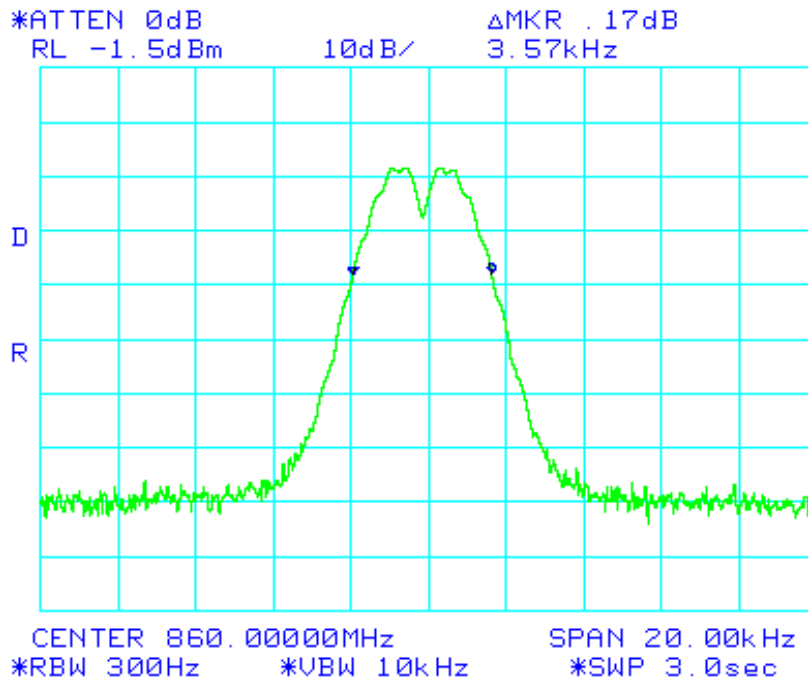
Equipment complies with Section 2.1049. Plots of the occupied bandwidth, as measured at the Repeater RF input port and at the antenna RF output port (post amplification) follow:

Occupied B/W (FM) Input vs. Output Downlink Met10023

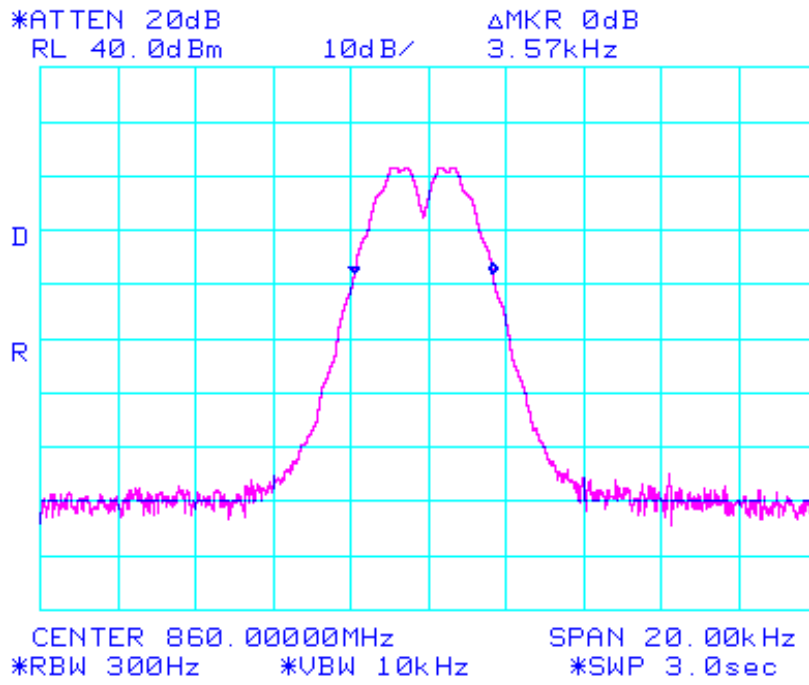




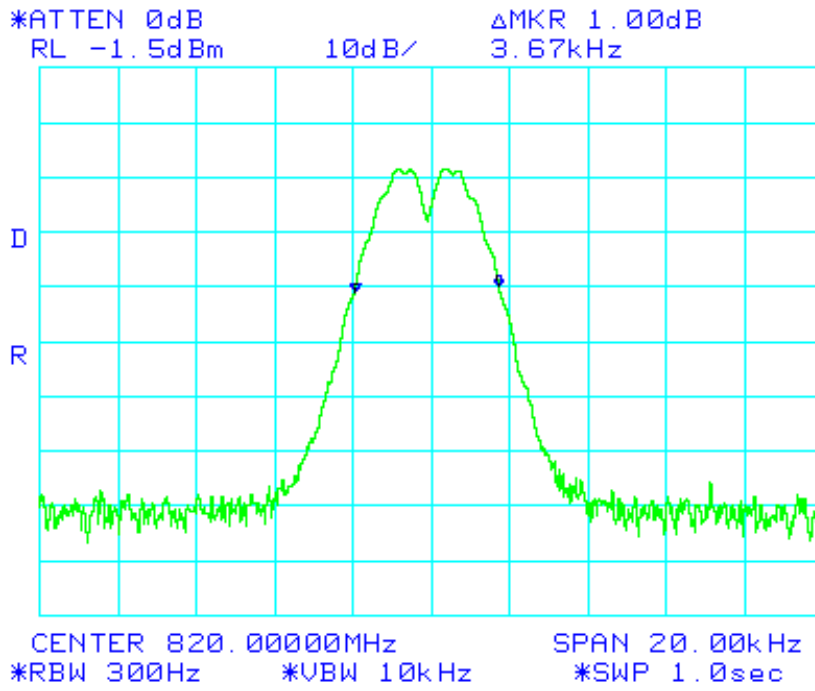
Occupied B/W (FM) at Input side Downlink Met10023



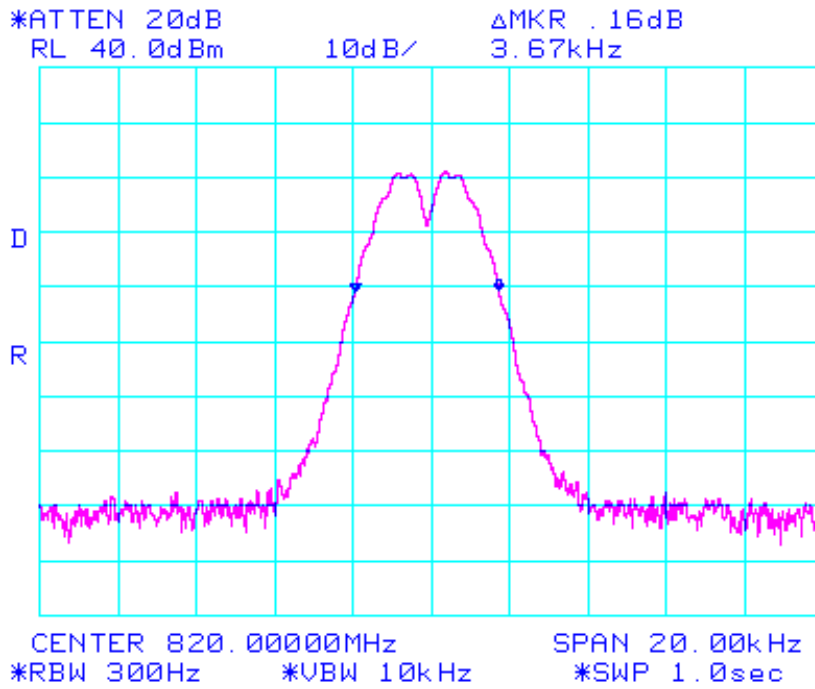
Occupied B/W (FM) at Output side Downlink Met10023



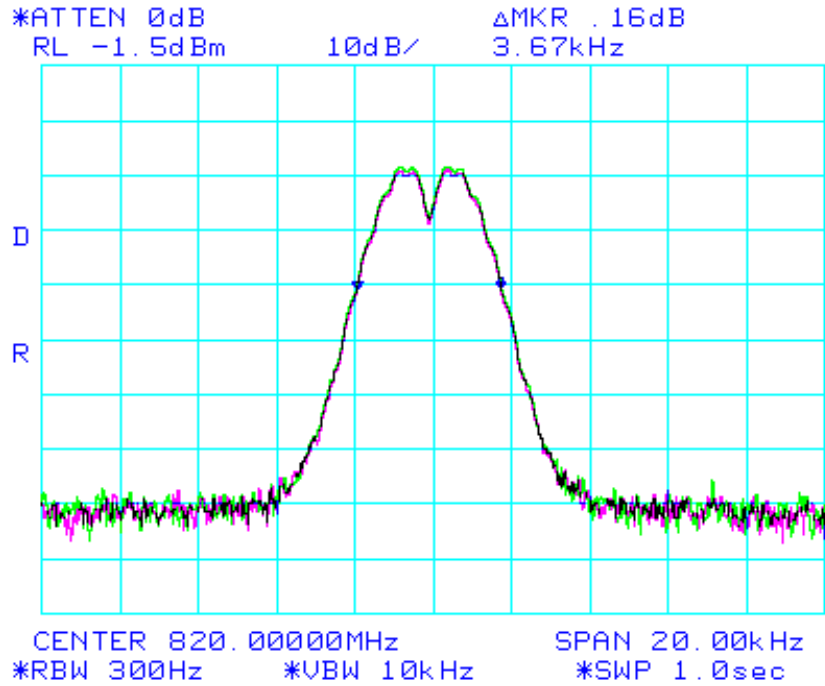
**Occupied B/W (FM) at input side Uplink Met10023**



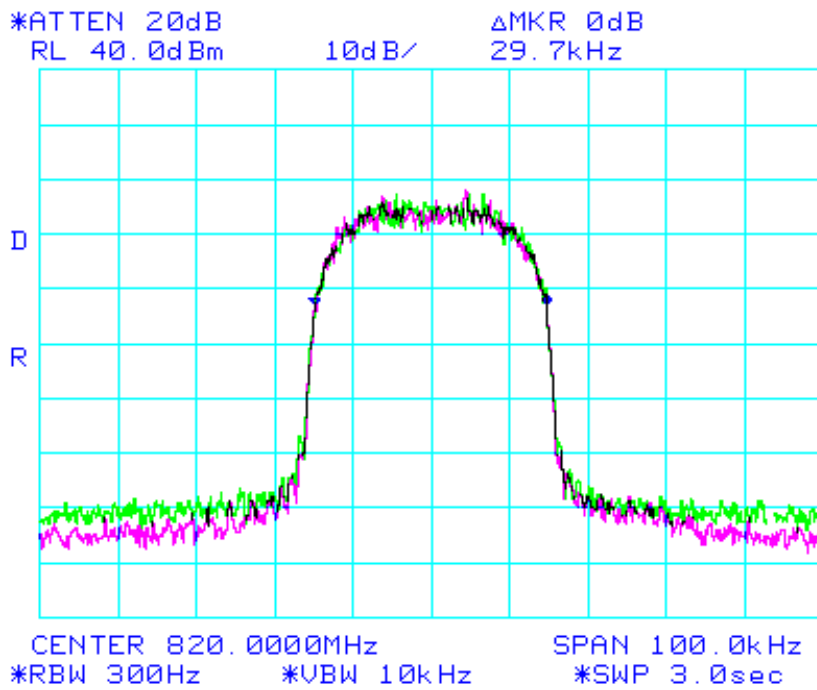
**Occupied B/W (FM) at output side Uplink Met.10023**



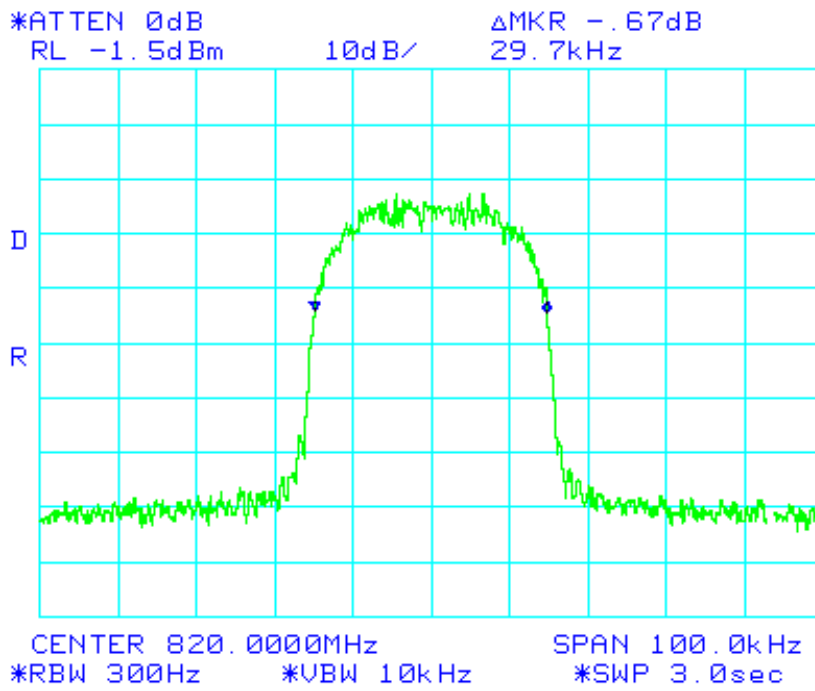
**Occupied B/W (FM) Input vs. Output Uplink Met10023**



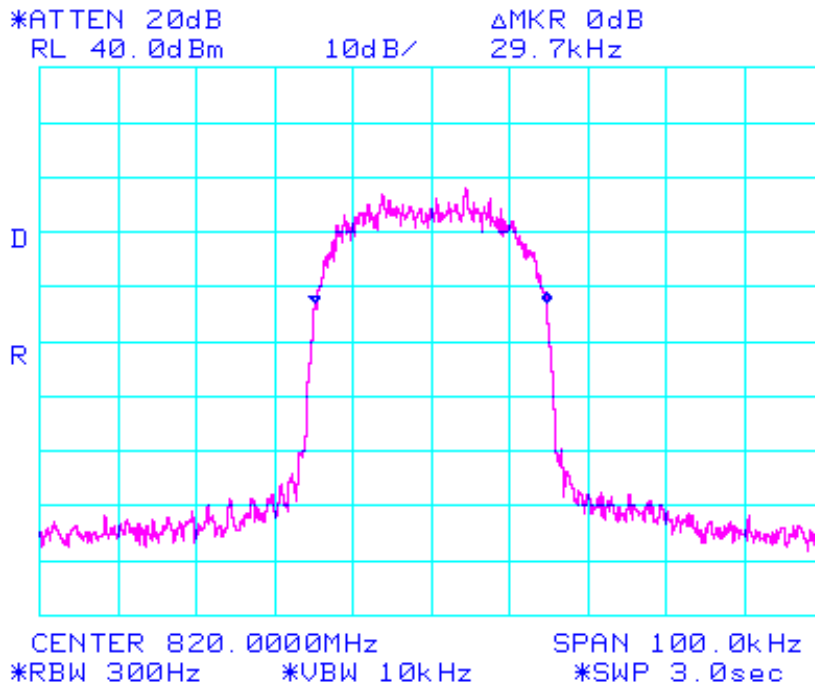
**Occupied B/W (iDEN) Input vs. Output Uplink Met.10023**



Occupied B/W (iDEN) at input side Uplink Met10023

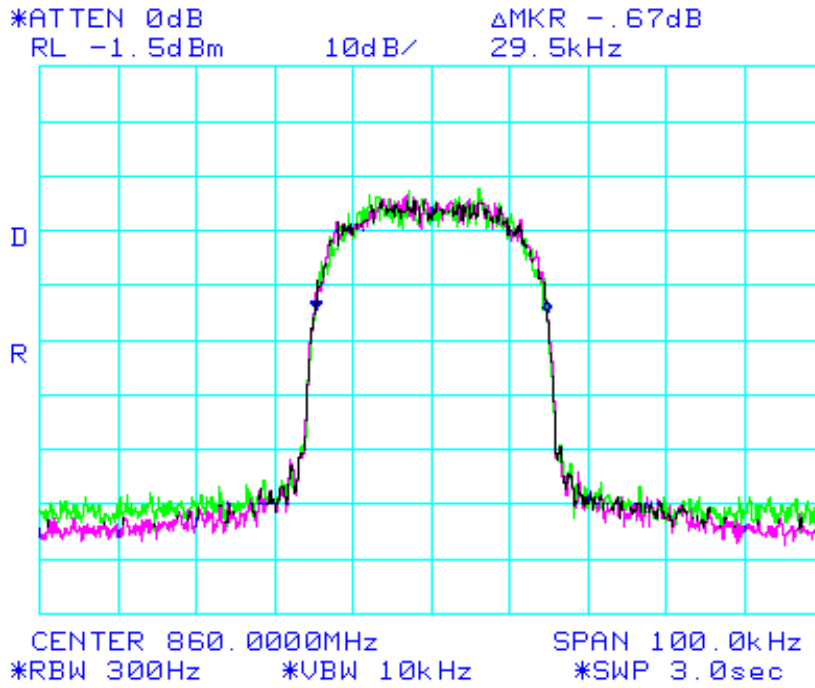


**Occupied B/W (iDEN) at output side    Uplink Met10023**



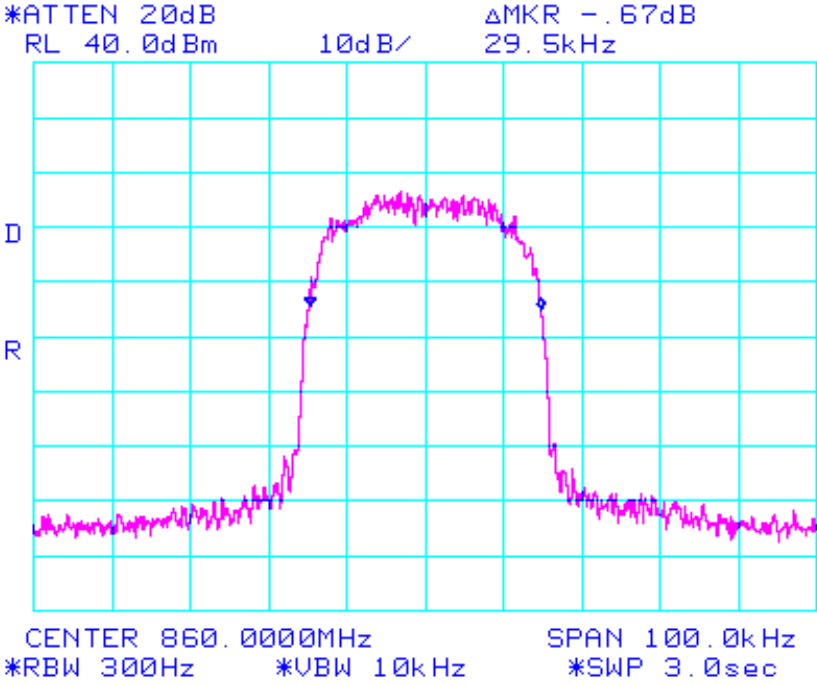


Occupied B/W (iDEN) Input vs. Output Downlink Met10023





Occupied B/W (iDEN) at output side Downlink Met10023



### **6.3 TEST TYPE: RF POWER OUTPUT**

**6.3.1 TECHNICAL SPECIFICATION:** 47 CFR 2.1046 and 90.205(i) (90.635)

**6.3.2 TEST DATE(S):** September 29, 2000

#### **6.3.3 MEASUREMENT PROCEDURES:**

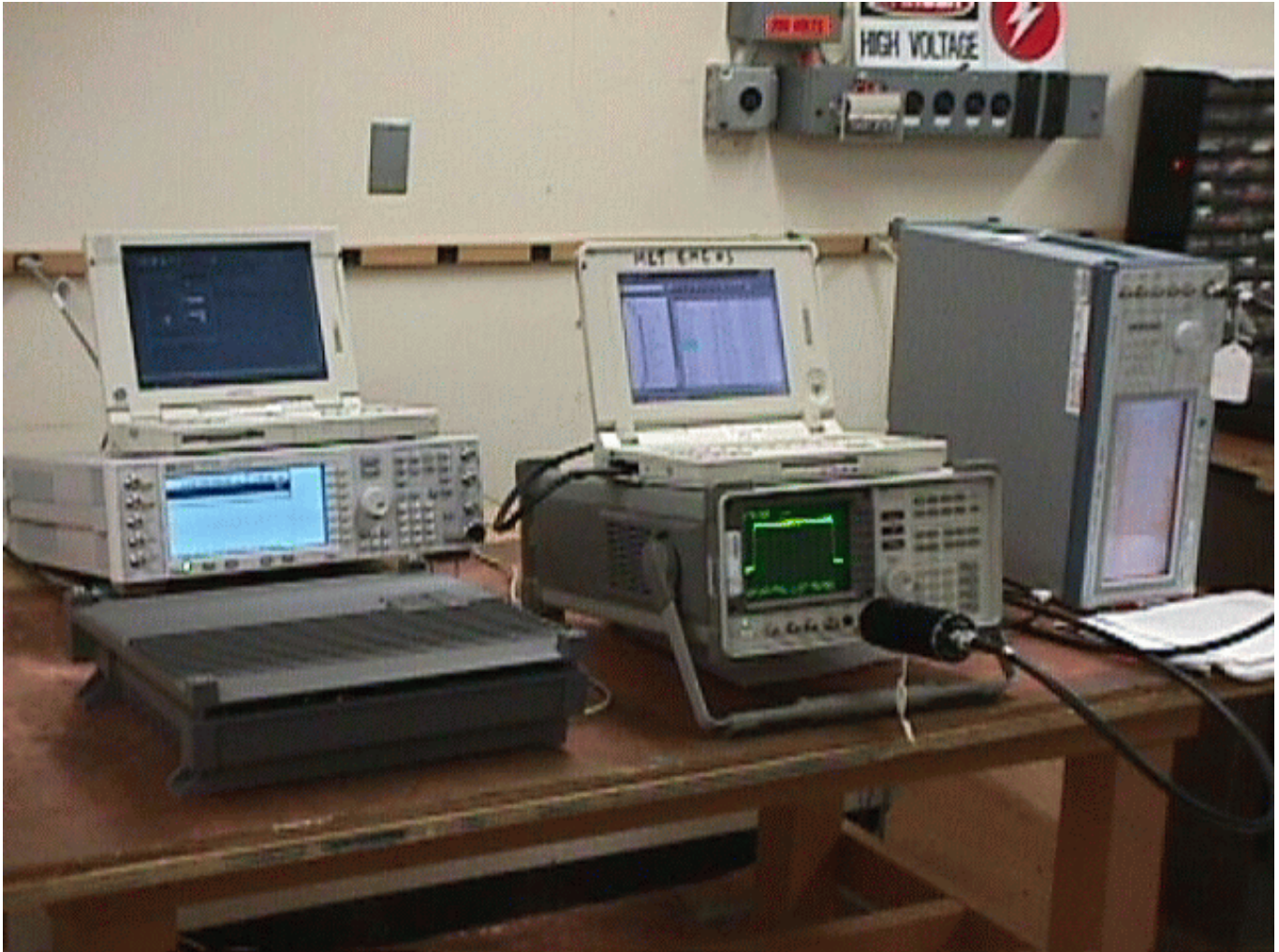
As required by 47 CFR 2.1046, *RF power output measurements* were made at the RF output terminals using an attenuator and spectrum analyzer. This test was performed with carrier modulated by a FM and iDEN(TDMA) modulated signal.

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:**

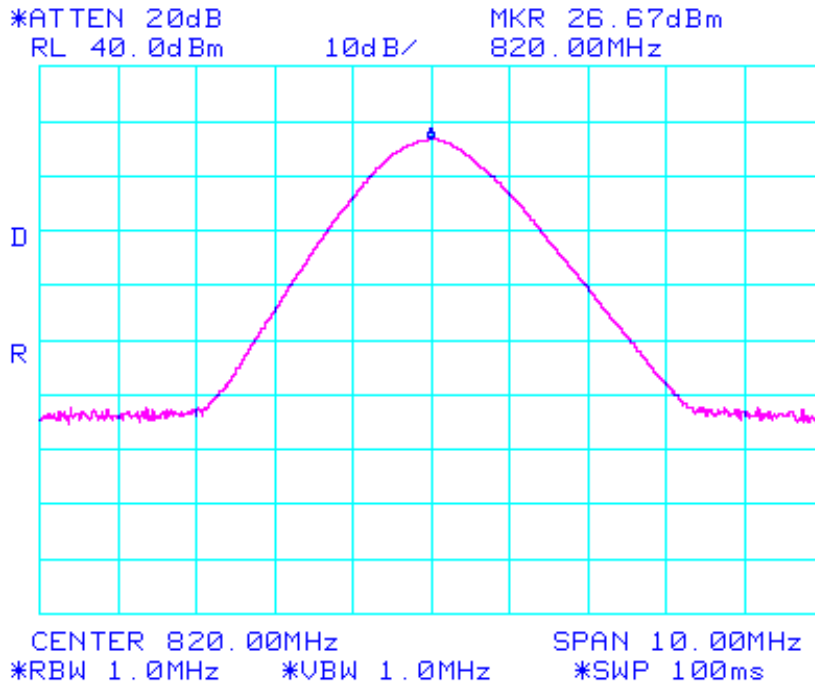
Equipment complies with 47CFR 2.1046 and 90.205(i) (90.635). The repeater power does not exceed downlink of 500 W, or uplink of 100 W, at the carrier frequency.

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

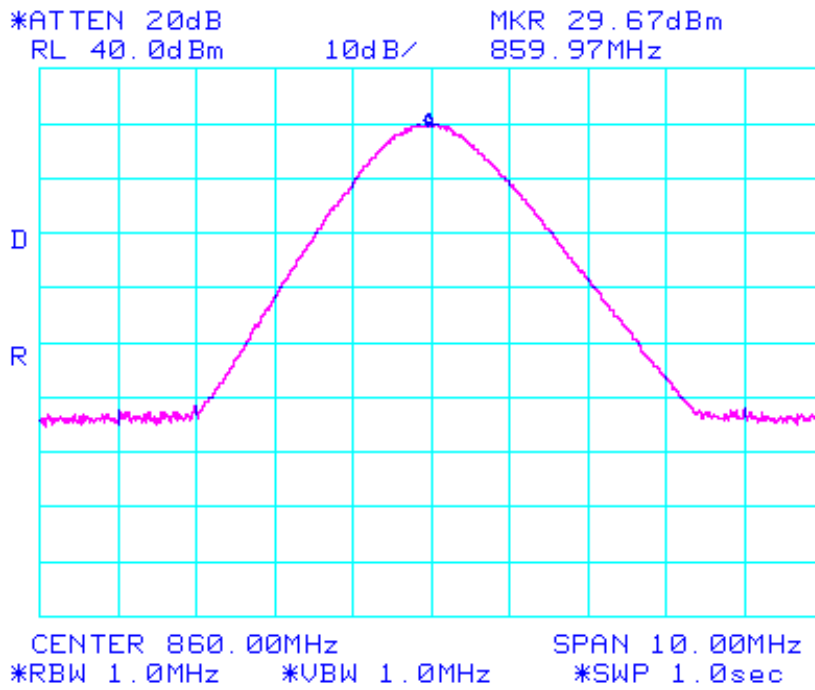




**RF Output power FM Uplink Met10023**

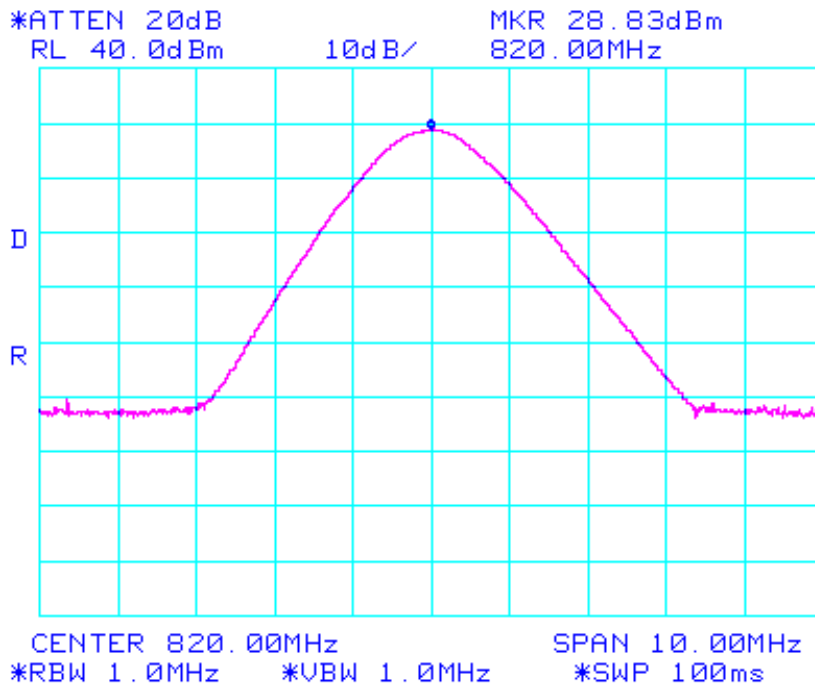


**RF Output power (iDEN) downlink Met10023**





**RF Output power TDMA (iDEN) Uplink Met10023**



**6.4 TEST TYPE:** Spurious Emissions at Antenna Terminals**6.4.1 TECHNICAL SPECIFICATION:** 2.1051; 90.691(a)(2)**6.4.2 TEST DATE(S):** September 29, 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  $\Omega$  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.

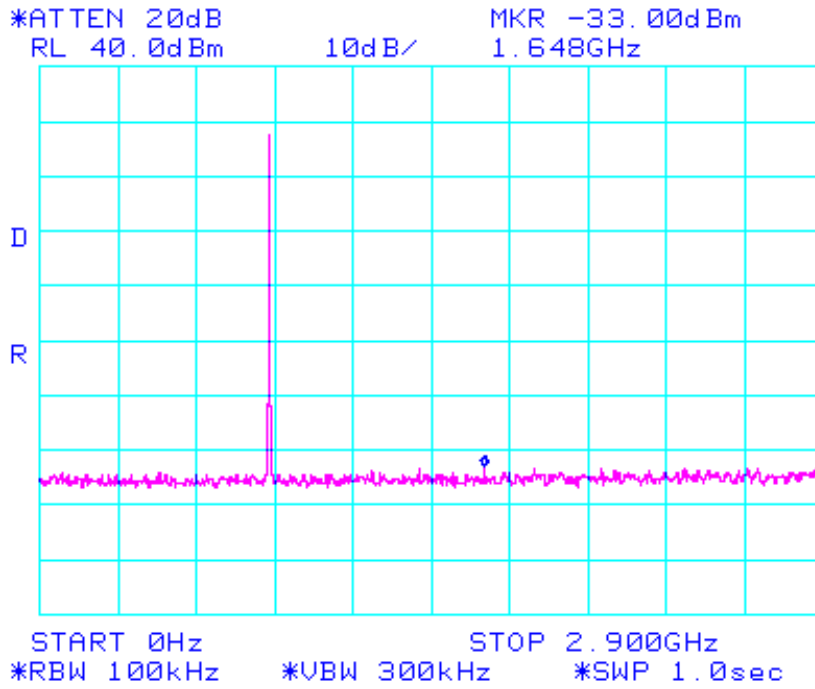
**6.4.4 RESULTS:**

Spur limit =  $P_o - (43 + 10\log P) = 143 \text{ dB}\mu\text{V} - (49 \text{ dB}) = 94 \text{ dB}\mu\text{V} = -13.1 \text{ dBm}$

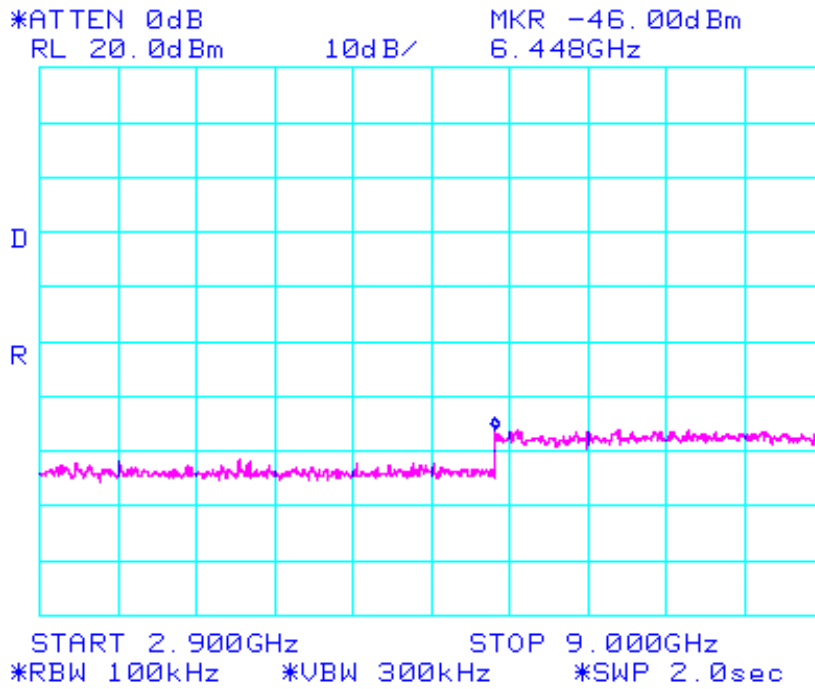
Equipment complies with Section 2.1051 and 90.691(a)(2)

**PLOTS OF SPURIOUS EMISSIONS AT ANTENNA TERMINALS** : on following pages

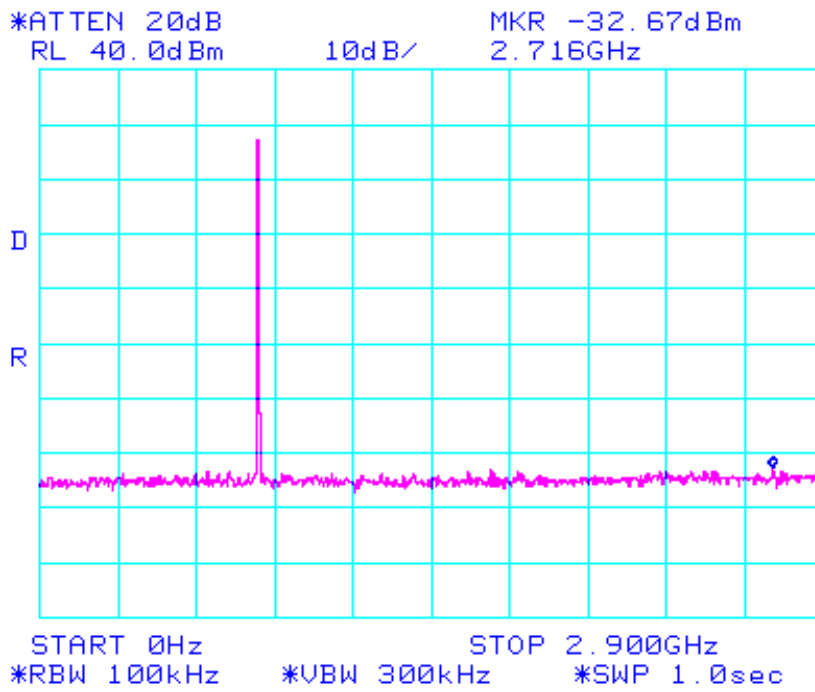
Spur emissions Downlink Met10023



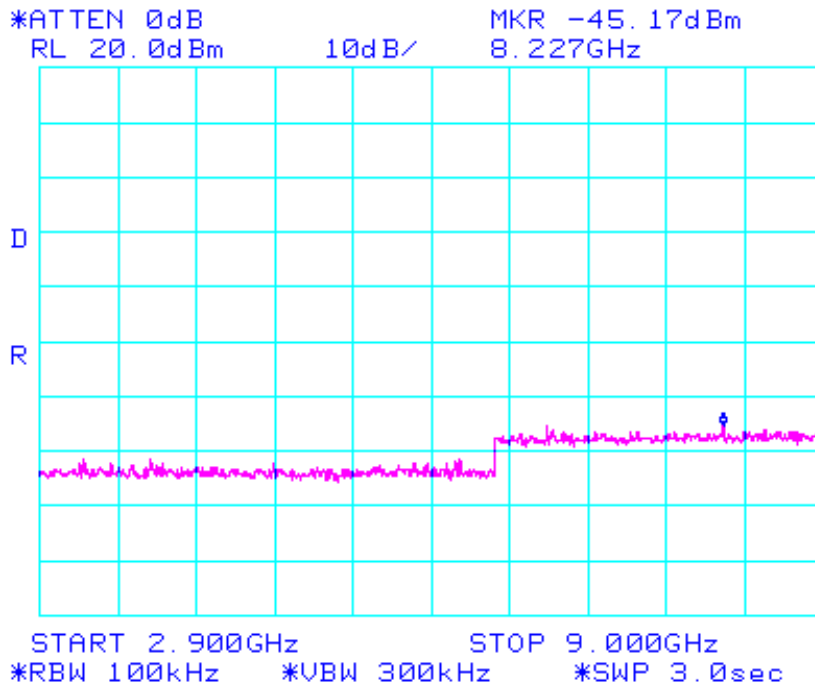
Spur emissions Downlink Met10023



**Spur emissions at antenna terminal Uplink Met.10023**



**Spur emissions at antenna terminal uplink Met.10023**



**6.6 TEST TYPE:** Intermodulation Spurious Emissions Antenna Terminals**6.6.1 TECHNICAL SPECIFICATION:** 47 CFR 2.1051.**6.6.2 TEST DATE(S):** September 28, 2000**6.6.3 MEASUREMENT PROCEDURES:** UPLINK and DOWNLINK

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

**6.6.4 RESULTS:**

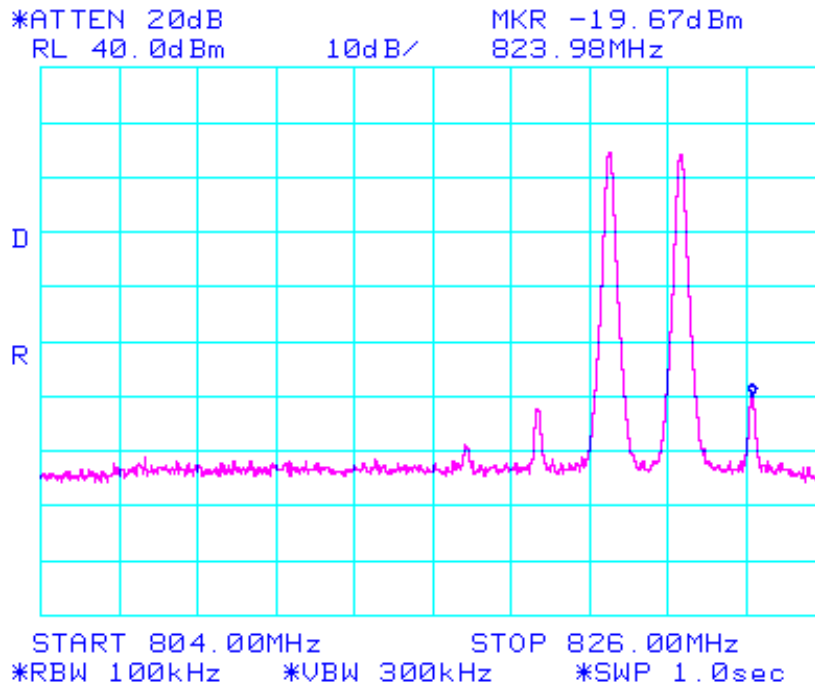
Equipment complies with 47CFR 2.1051. Plots of the spurious emissions as measured at the antenna ports are included in this application as file attachment:

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

$$\text{Spur limit} = P_o - (43 + 10\log P) = 132.5 \text{ dB}\mu\text{V} - (38.44 \text{ dB}) = 94 \text{ dB}\mu\text{V} = -13.1 \text{ dBm}$$

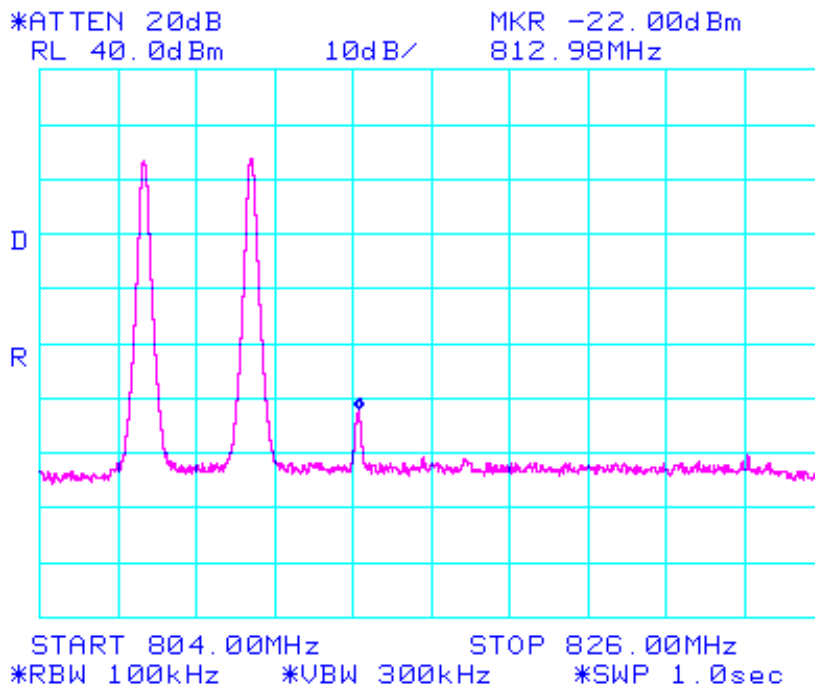
modulation type	Intermodulation products (MHZ)	Emission Level (dBm)	Limit (dBm)
TDMA(Downlink)	859.92	-20.17	-13.1
	868.92	-21.00	
TDMA(Uplink)	812.90	-22.00	-13.1
	823.98	-19.67	

**IMD Spur emissions at high side of uplink band Met.10023**





**IMD Spur emissions at low side of uplink band Met. 10023**



**IMD Spur emissions at high side of downlink band Met 10023**

