EXHIBIT 5
TESTS AND MEASUREMENTS

TESTS AND MEASUREMENTS

Product Description

The equipment under test (EUT) is a Kaval Telecom, Inc. Model OFR-P300F. This device is intended to filter, amplify and retransmit signals generated by transmitters manufactured by Motorola under Type Acceptance ABBZ89FC5778.

This device retransmits input signals at exactly the same frequency as received. In the signal processing chain, the RF signal is downconverted to an IF frequency of 21.4 MHz, and upconverted back to the same frequency by a single common oscillator.

This transmitter includes a power leveling system which maintains constant output power regardless of input level (within rated input dynamic range –90 to –20 dBm), and regardless of number of carriers processed within the passband. Nonidealities of this system result in total power being lower during multi-carrier operation.

Allowed Carrier Frequencies: 940.210, 940.220, 940.230, 940.240 MHz

Emission Designators:
38KOF2D (4 Carriers)
18KOF2D (2 Carriers)
8KOOFK1D (1Carrirer)

Standard Modulation: 2.4 kHz peak deviation with 3.2 kHz modulation frequency

All measurements were made with transmit power control set to maximum (+30 dBm nominal single carrier).

Test Methodology

Prepared in accordance with the requirements of FCC Rules and Regulations Part 2 Subpart F, Paragraphs 2.1046 through 2.1057 and applicable portions of Part 24. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1.

Test Facility

Radiated testing was performed at US Tech's measurement facility as described to the FCC and acknowledged in their letter marked 31040/SIT/US TECH. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

Test Equipment

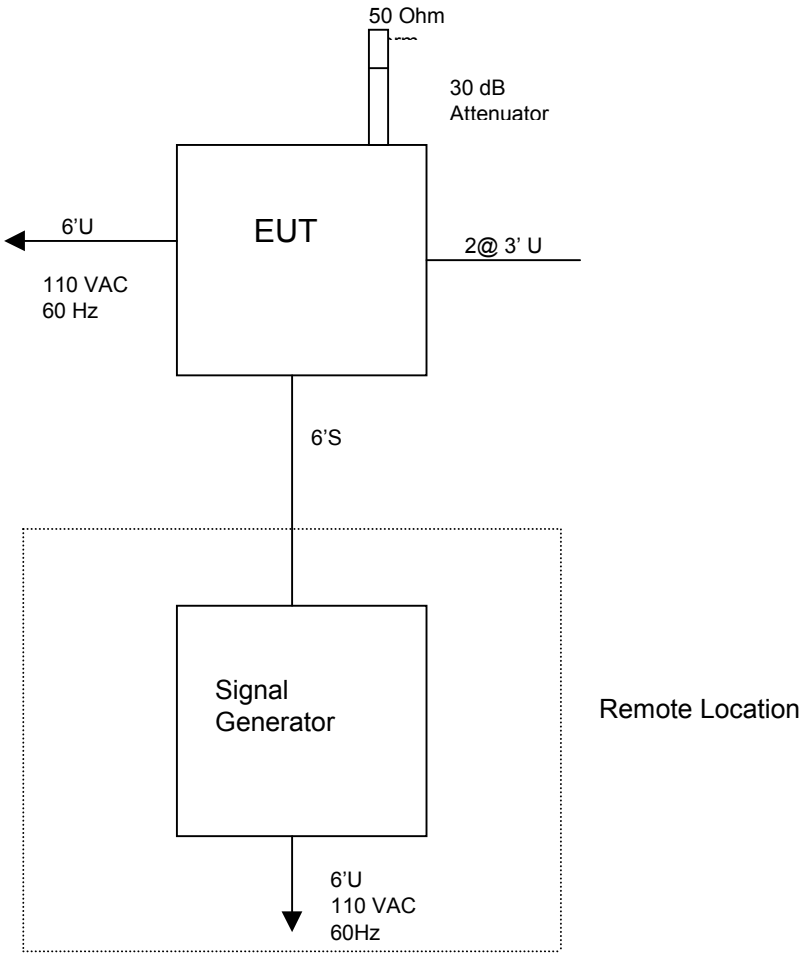
Table 1 describes test equipment used to evaluate this product.

Modifications

US Tech did not make any modifications to bring the EUT into compliance with the requirements of Part 24. The EUT did contain modifications which were required to meet the requirements of Part 15, Class A digital device emissions. Details of these modifications have been provided in a separate report.

Test Date: **January 8, 1999**
UST Project: **98-625**
Customer: **Kaval Telecom, Inc.**
Model: **OFR-P300F**

Figure 1
System Block Diagram



Test Date: **January 8, 1999**
UST Project: **98-625**
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Model: **OFR-P300F**

TABLE 1

EUT AND PERIPHERALS

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID	CABLES P/D
Repeater Kaval Telecom, Inc. (EUT)	OFR-P300F	None	H6M-OFRP300F (Pending)	2@ 3'U Unterm. 6'U 110 VAC 60 Hz
30 dB Attenuator Kaval Telecom, Inc.		None	None	50 Ohm Term.
Signal Generator Hewlett Packard	8648B	3642401679	None	6'S 6' U 110 VAC 60 Hz

Test Date: **January 8, 1999**
UST Project: **98-625**
Customer: **Kaval Telecom, Inc.**
Model: **OFR-P300F**

RADIATED EMISSION TEST SET-UP PHOTO(S)

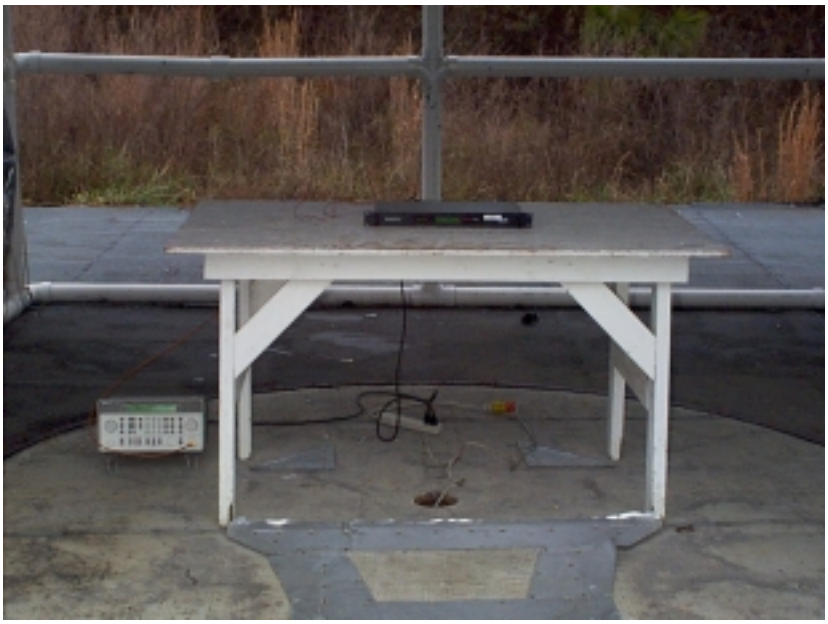


TABLE 2

TEST INSTRUMENTS

TYPE	MANUFACTURER	MODEL	SN.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
SPECTRUM ANALYZER	HEWLETT-PACKARD	8558B	2332A09900
S A DISPLAY	HEWLETT-PACKARD	853A	2404A02387
COMB GENERATOR	HEWLETT-PACKARD	8406A	1632A01519
RF PREAMP	HEWLETT-PACKARD	8447D	1937A03355
RF PREAMP	HEWLETT-PACKARD	8449B	3008A00480
BICONICAL ANTENNA	EMCO	3110	9307-1431
LOG PERIODIC ANTENNA	EMCO	3146	9110-3600
HORN ANTENNA	EMCO	3115	167
THERMOMETER	FLUKE	52	5215250
MULTIMETER	FLUKE	85	53710469
DUAL OUTPUT POWER SUPPLY	HEWLETT-PACKARD	E3620A	KR41200373
PLOTTER	HEWLETT-PACKARD	7475A	2325A65394

MEASUREMENT PROCEDURE

Subpart 2.1046 AND 24.232

RF Power Output

The following test was performed by Stephen Makk & Associates, Inc. The EUT was directly connected to a spectrum analyzer (Model 8595E) with the input resistance set to 50Ω. An external 20 dB attenuation was used during the test. The maximum RF output power was measured and compared to the manufacturer's rating. The connector and cable that was used to connect the EUT to the spectrum analyzer was compensated for. Information has been provided for one, two, & four unmodulated carriers.

All modulation tests were performed with a 2.4 kHz peak deviation with 3.2 kHz modulation frequency.

FCC Minimum Standard

Typically (+/-) 20 % of the manufacturer's rated output power & < 7 Watts

Mfg. Rated Power: +30.0 dBm/1.0 W across 50 Ω at output terminals

Power Measured (corrected)

	Power (dBm)	Power (mW)
Figure 2A. 1 Modulated Carrier (940.225 MHz)	29.75	944.1
Figure 2B. 2 Modulated Carrier (940.220 & 940.230 MHz)	26.28	424.6
Figure 2C. 4 Unmodulated Carrier (940.210, 940.220 MHz 940.230 & 940.240 MHz)	26.74	472.1

Example Calculation

Power in mW = antilog (29.75 /10) = 944.1

Results

Reviewed By: _____ Name: Tim R. Johnson _____

Figure 2A
RF Output Power with 1 Modulated Carrier

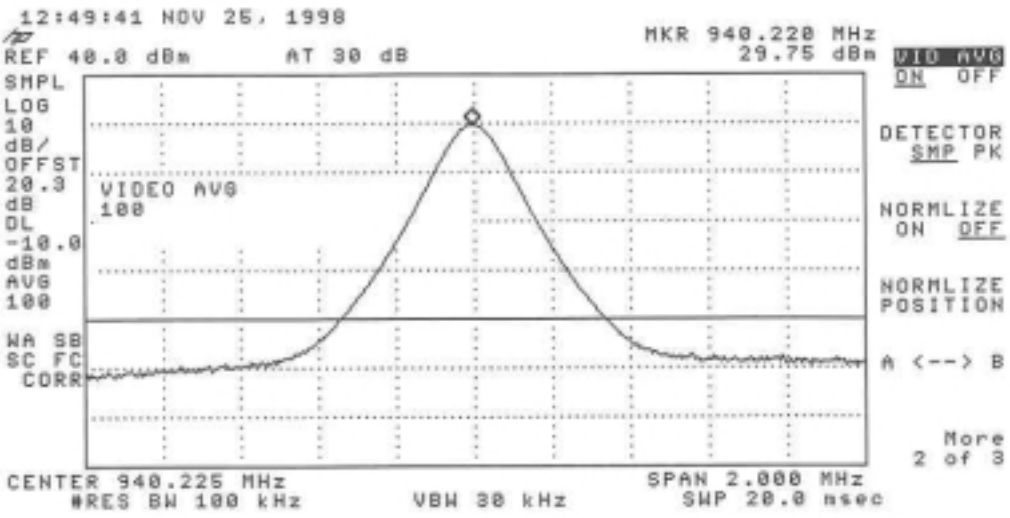


Figure 2B
RF Output Power with 2 Modulated Carriers

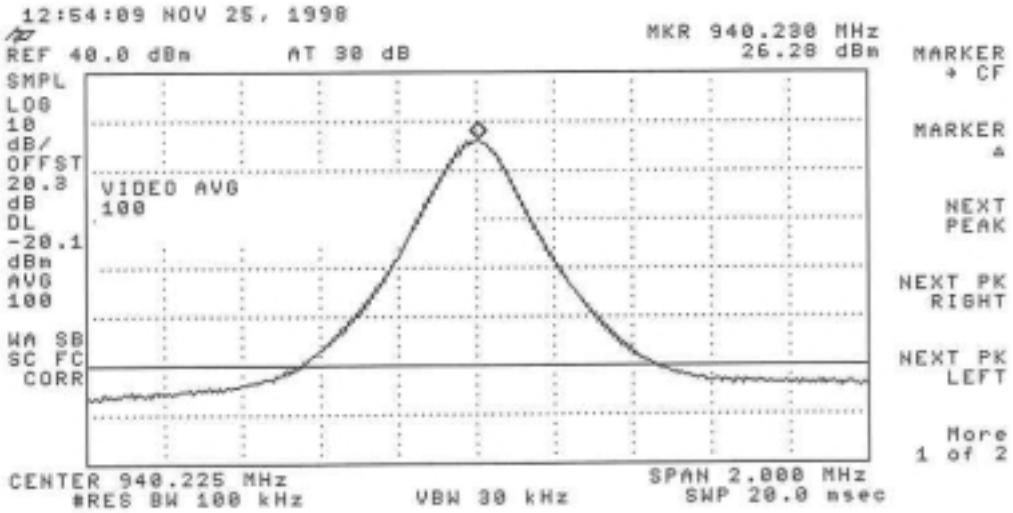
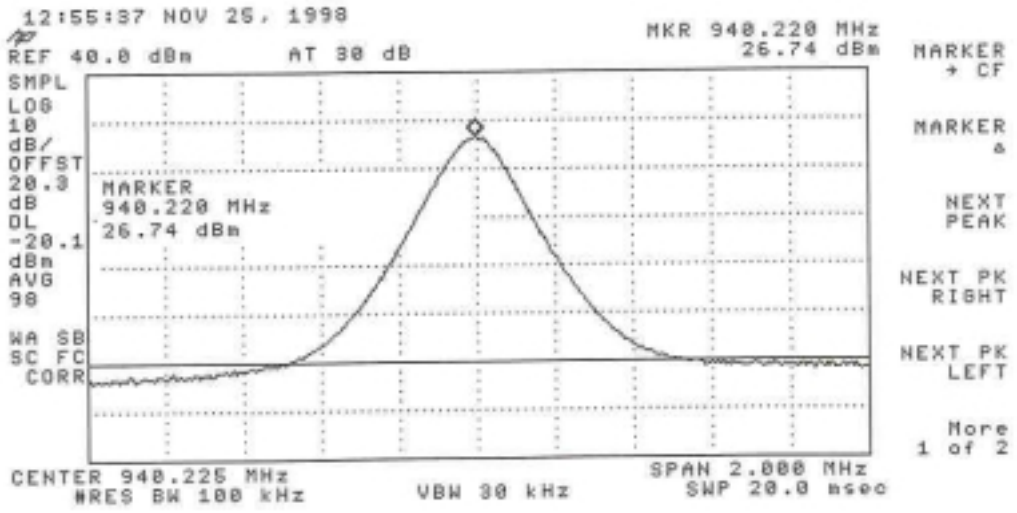


Figure 2C
RF Output Power with 4 Unmodulated Carriers



MEASUREMENT PROCEDURE

Subpart 2.1049 and 24.133

BANDWIDTH OF FUNDAMENTAL EMISSION UNDER MODULATION

The following test was performed by Stephen Makk & Associates, Inc. The EUT was modulated by a 2.4 kHz peak deviation with 3.2 kHz modulation frequency. The data for this measurement is shown in Figures 3A through 3L and the emission mask applied in 3M & 3N.

FCC Minimum Standard

From authorized bandwidth by a displacement frequency
(f_d in kHz) of up to and including 40 kHz

at least 116 Log $_{10}$ ((f_d + 10)/6.1) dB or 50 + 10 Log $_{10}$ (P) dB
or 70 dB whichever is lesser attenuation

> 40 kHz
43 + 10 Log $_{10}$ (P) dB
or 80 dB whichever is lesser attenuation

Figure 3A
Occupied Bandwidth Single Carrier (940.210 MHz)

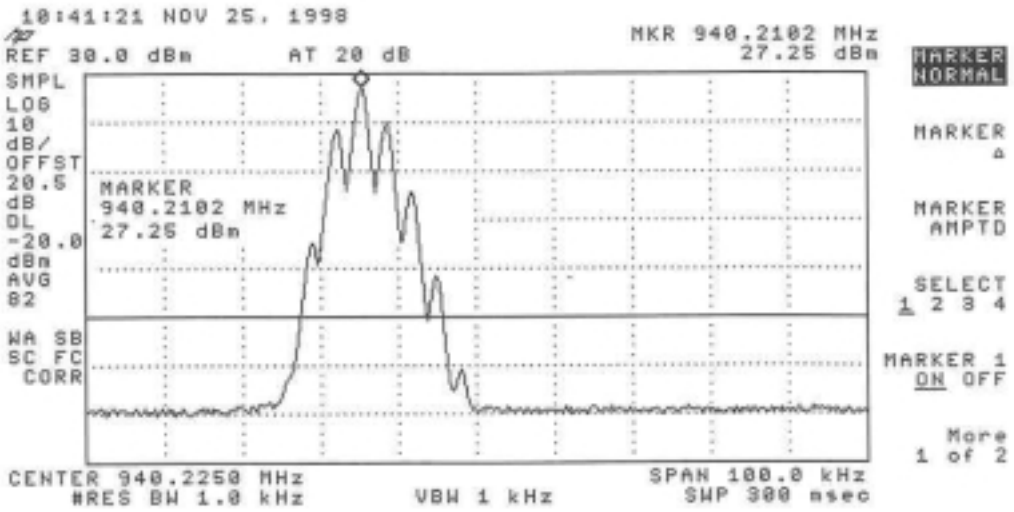


Figure 3B
Occupied Bandwidth Single Carrier (940.220 MHz)

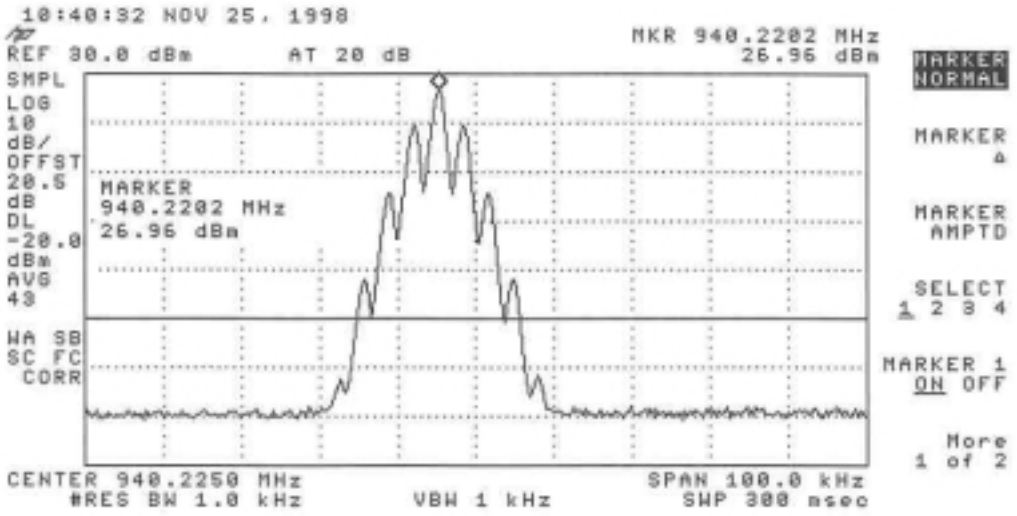


Figure 3C
Occupied Bandwidth Single Carrier (940.230 MHz)

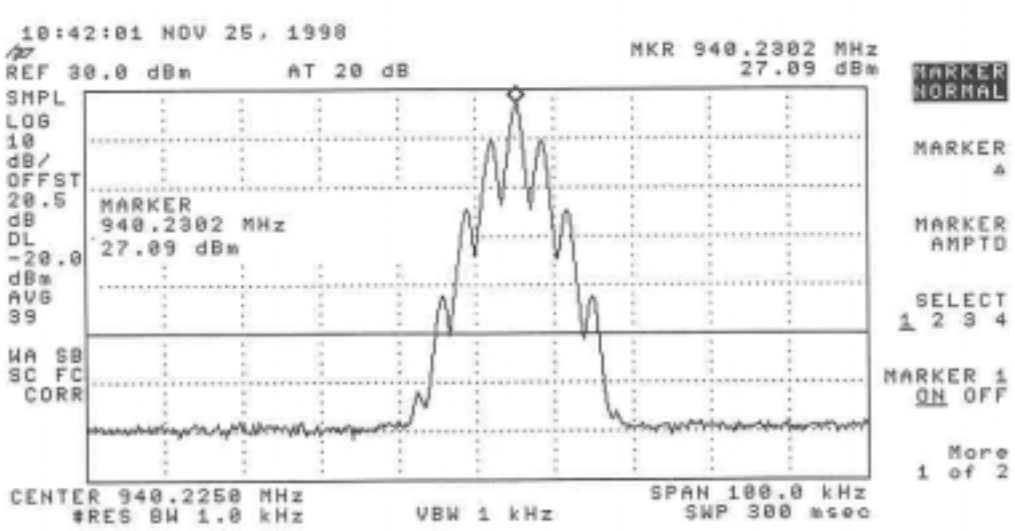


Figure 3D
Occupied Bandwidth Single Carrier (940.240 MHz)

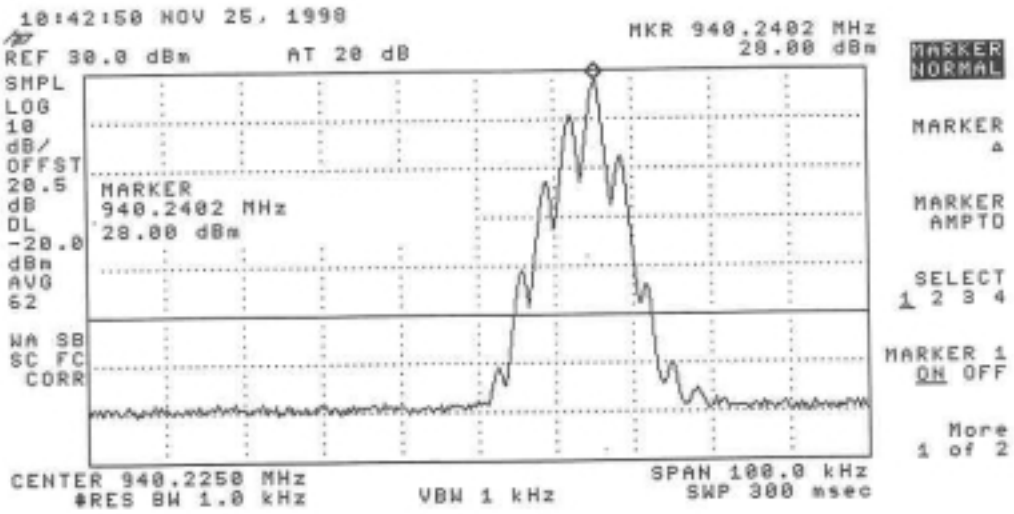


Figure 3E
Occupied Bandwidth Two Carriers (940.210 & 940.220 MHz)

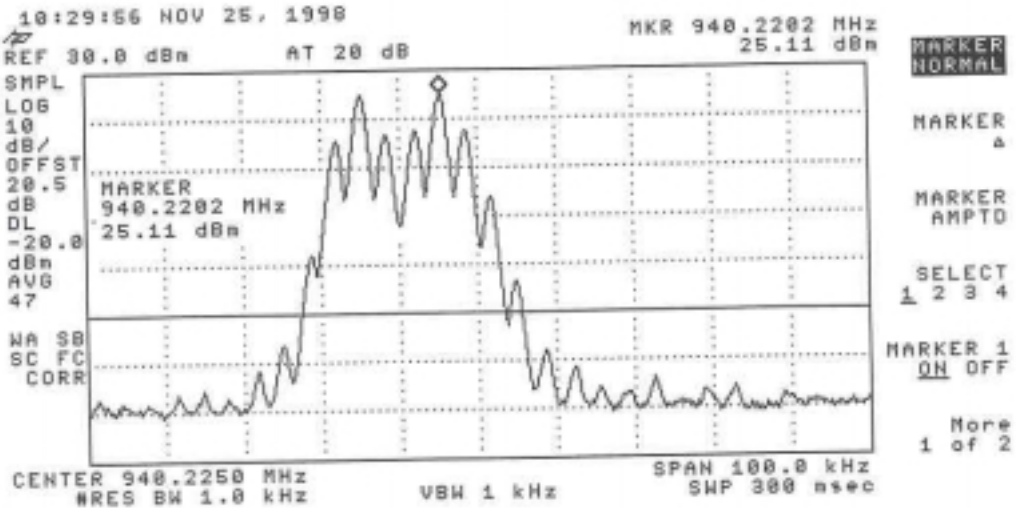


Figure 3F
Occupied Bandwidth Two Carriers (940.210 & 940.230 MHz)

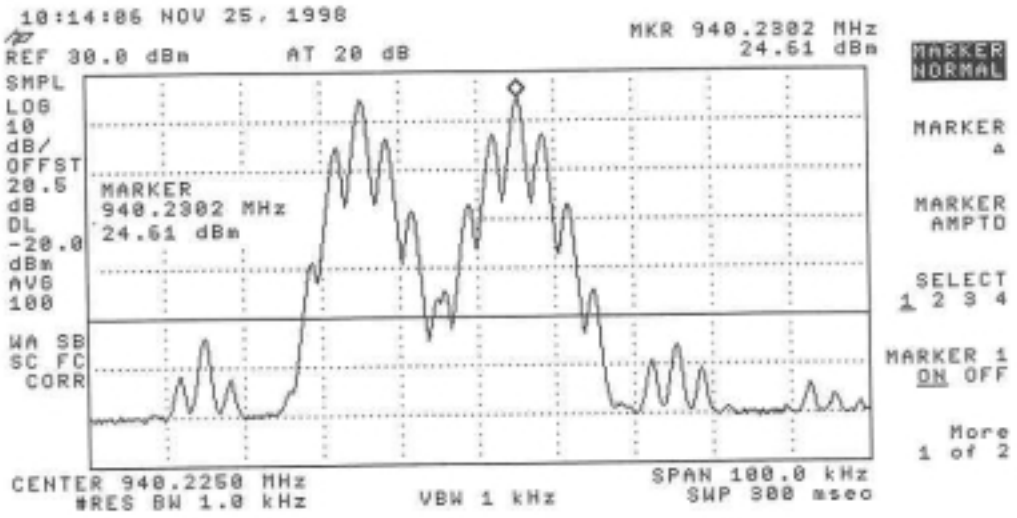


Figure 3G
Occupied Bandwidth Two Carriers (940.210 & 940.240 MHz)

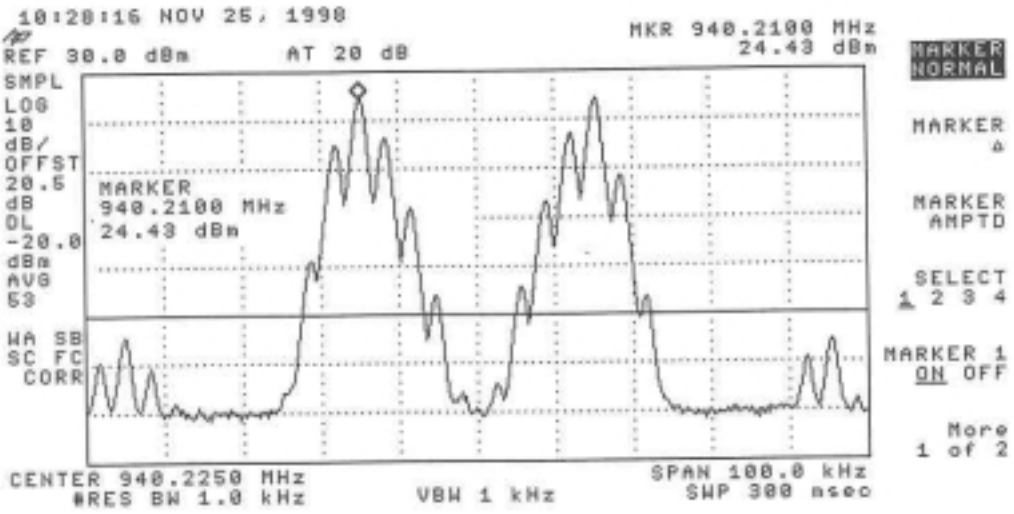


Figure 3H
Occupied Bandwidth Two Carriers (940.220 & 940.230 MHz)

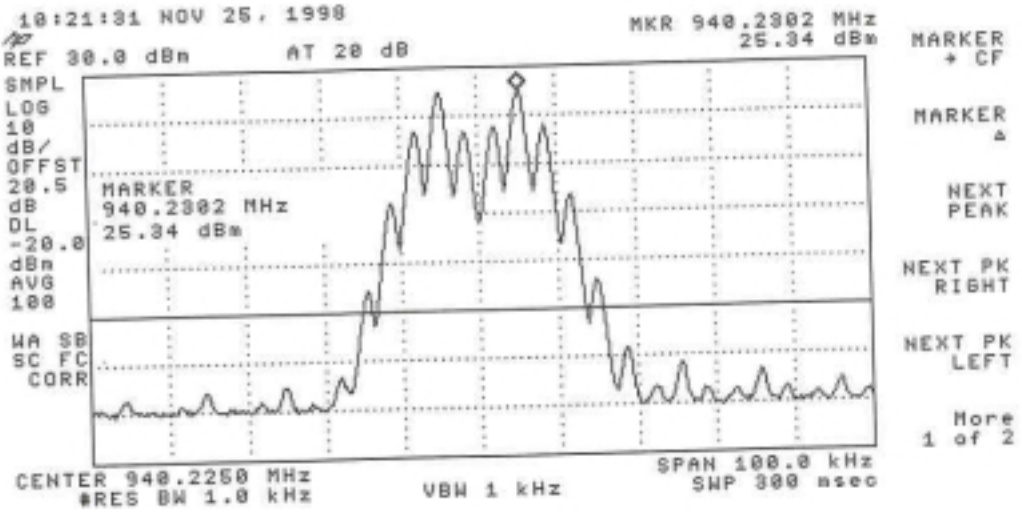


Figure 3I
Occupied Bandwidth Two Carriers (940.220 & 940.240 MHz)

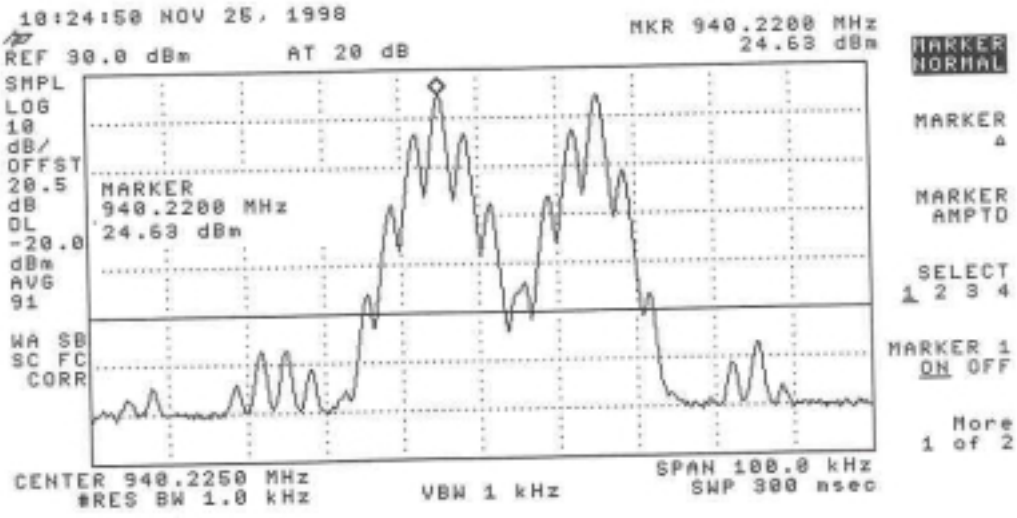


Figure 3J
Occupied Bandwidth Two Carriers (940.230 & 940.240 MHz)

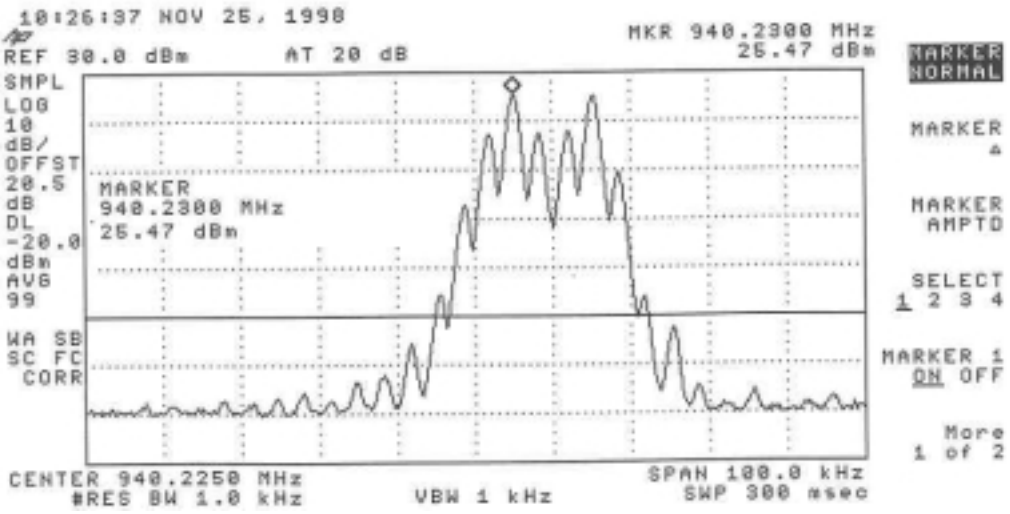


Figure 3K
Occupied Bandwidth Four Carriers (100 kHz span)

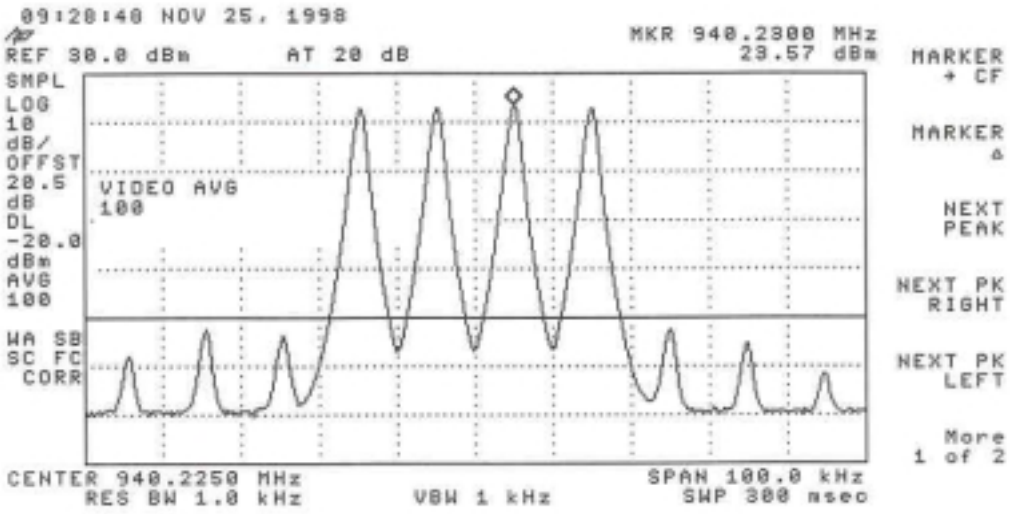


Figure 3L
Occupied Bandwidth Four Carriers (200 kHz span)

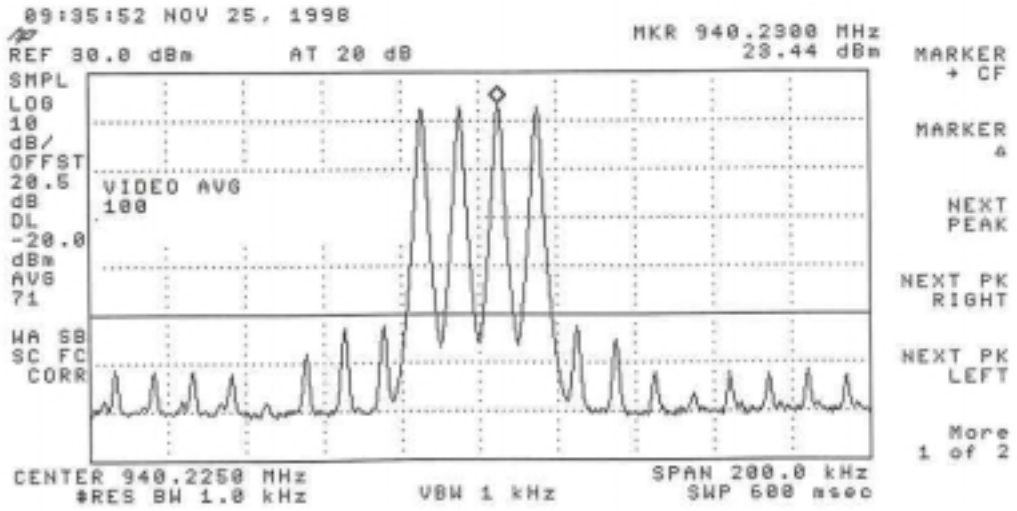


Figure 3M
Occupied Bandwidth Limits

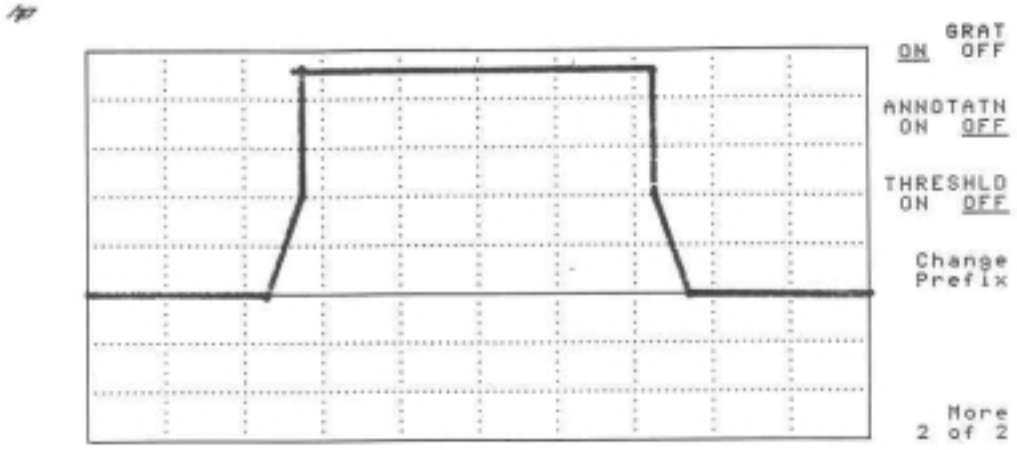
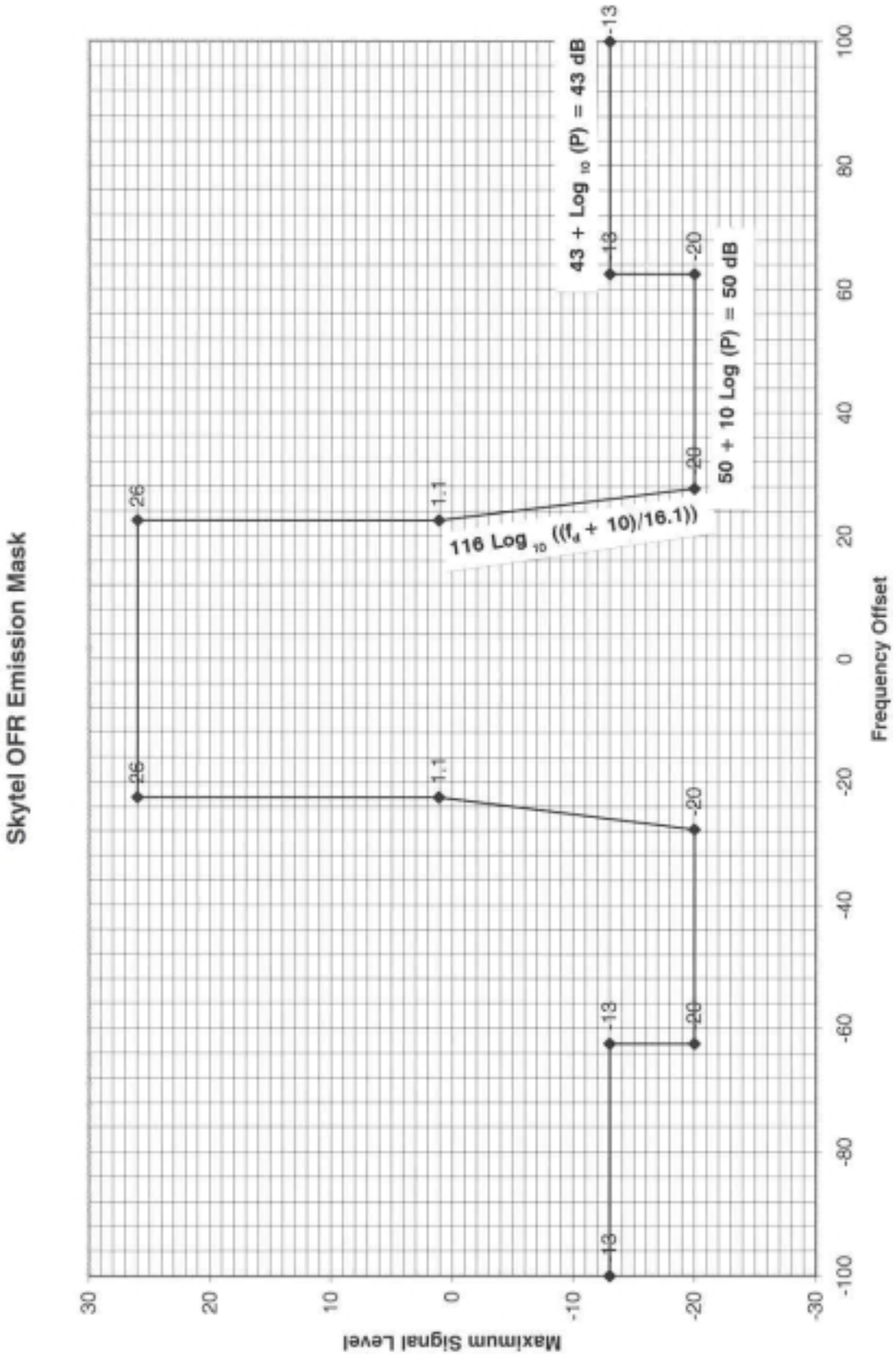


Figure 3N
Occupied Bandwidth Limits



MEASUREMENT PROCEDURE

Subpart 2.1051 and 24.133

Transmitter Spurious Emissions At Antenna Terminals

The following measurement was made by United States Technologies, Inc. The reference line is an indication of the FCC Limit with respect to the RF Output Power. The following table shows the level of each spurious emission with respect to the RF Output Power.

FCC Minimum Standard

From authorized bandwidth by a displacement frequency

(f_d in kHz) of up to and including 40 kHz

at least 116 Log $_{10}$ ((f_d + 10)/6.1) dB or 50 + 10 Log $_{10}$ (P) dB
or 70 dB whichever is lesser attenuation

> 40 kHz
43 + 10 Log $_{10}$ (P) dB
or 80 dB whichever is lesser attenuation

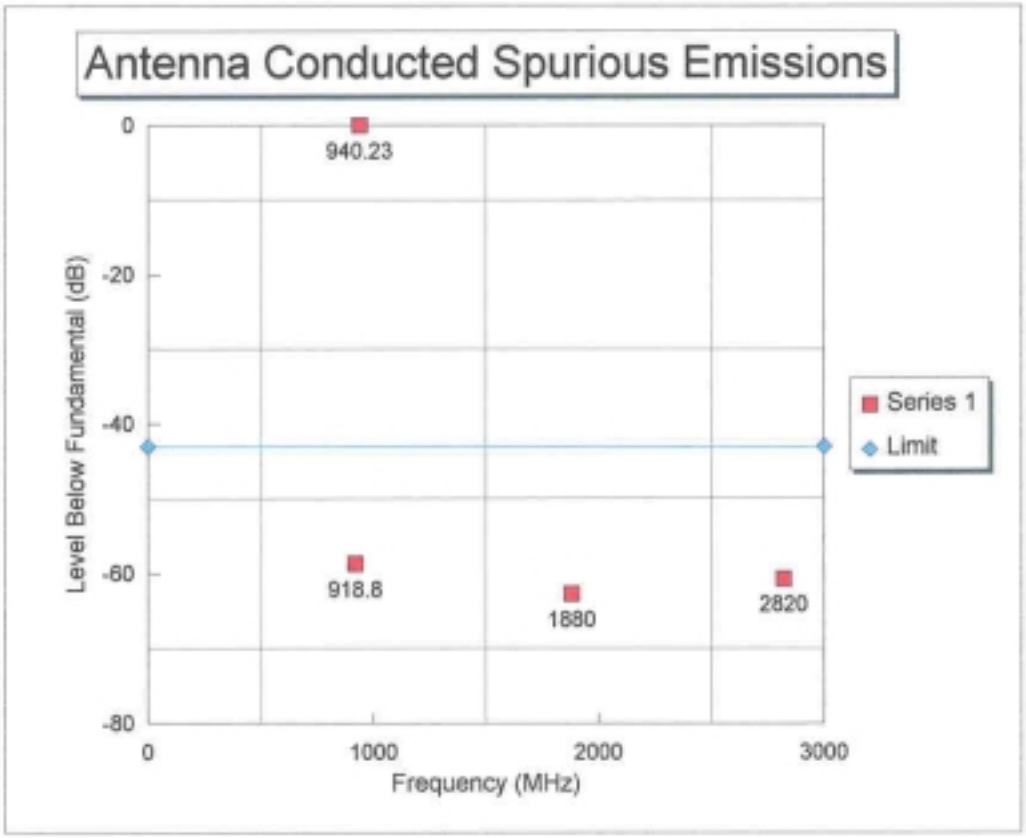
FCC Certification
Kaval OFR-P300F
Antenna Conducted Spurious Emissions

FCC ID: H6M-OFRP300F

Test Performed By:

Roger Bowen
Compliance Engineer

Frequency (MHz)	Raw Reading (dBm)	Level Below Fundamental (dB)
	(Fundamental)	
940.23	28.7	0
	(Data - Series 1)	
918.8	-30	-58.7
1880	-34	-62.7
2820	-32	-60.7



Limit (Over 40 kHz) = 43 + 10 Log (P) = 43 dB

FCC ID: H6M-OFRP300F

MEASUREMENT PROCEDURE

Subpart 2.1053 & 24.133

Field Strength of Spurious Radiation

Spurious emissions were evaluated from 30 MHz to 5.0 GHz at an EUT to antenna distance of 3 meters. Measurements for 30 to 1000 MHz were made with the analyzer's bandwidth set to 120 kHz. Measurements above 1000 MHz were made with the analyzer's bandwidth set to 1 MHz. This level is compared to the level a transmitter would produce at 3 meters if connected to a 1/2 wave dipole using:

$$E = \frac{(30\ Pt\ Gt)^{1/2}}{d} \text{ volts per meter}$$

E = Field intensity (volts per meter)

Pt = Power output of transmitter (watts)

Gt = Gain of antenna (1.64 for 1/2 wave dipole)

d = distance (meters)

Example: A 1 watt transmitter would produce

$$\frac{[(30)(1)(1.64)]^{1/2}}{3.0} \text{ volts per meter}$$

= 2,338,090 microvolts per meter @ 3 meters

FCC Minimum Standard
$43 + 10 \text{ Log}_{10} (P)$ = attenuation below carrier (dB)

FIELD STRENGTH OF SPURIOUS RADIATION

Test Date: January 8, 1999
UST Project: 98-625
Customer: Kaval Telecom, Inc.
Model: OFR-P300F

FCC Minimum Standard: 43 + 10 log (0.955) = 42.8 dB
Fundamental = Corrected Reading in Far Field (3m) = +20.2 dBm

TABLE 3

Freq. (GHz)	Test Data (dBm) @3m	AMP GAIN (dB)	Antenna Factor (dB)	Cable Loss (dB)	Results (uV/m) @ 3m	Attenuated Level Below Carrier Power (dB)
1.15	-52.0	35.8	27.0	2.4	-58.5	78.7
1.84	-61.0	35.1	28.5	3.0	-65.6	85.8
2.76	-56.0	34.6	31.5	3.8	-55.3	75.5
3.70	-56.0	34.4	33.3	4.5	-52.6	72.6
4.13	-58.0	34.4	34.3	4.6	-53.4	73.6

SAMPLE CALCULATION:
Results dBm @ 3 m:

-52.0 - 35.8 + 27.0 + 2.4 = -58.5 dBm

Results
Reviewed By: _____ Name: Tim R. Johnson

MEASUREMENT PROCEDURE

Frequency Stability

Subpart 2.1055 and 24.135

The frequency stability with respect to input voltage was performed by Stephen Makk & Associates, Inc. The EUT was operated with an applied unmodulated input carrier at 940.225 MHz and a level of – 50 dBm. Output frequency was observed using a HP53310A Modulation Domain Analyzer. Main supply voltage was adjusted using a variable isolation transformer. No variation of output frequency was observed (within measuring device resolution) over the range of 100 to 140 VAC. Frequency variation over voltage was less than 10 Hz (0.01 ppm). Absolute frequency accuracy was better than 100 Hz (0.12 ppm).

The frequency stability with respect to temperature was performed by U.S. Technologies. The frequency tolerance of the carrier signal was measured while ambient temperature was varied from -30 to 50 degrees centigrade. The frequency tolerance was verified at 10 degree increments. The basic procedures specified by TIA/EIA 603 were followed. The EUT was soaked at the specified temperature and enough time allowed for the components to stabilize. Power was applied to the EUT and 15 minutes allowed for the unit to stabilize prior to making measurements. The results of this test are shown in the following figure.

FCC Minimum Standard

< 1 ppm

FCC Certification
Kaval OFR-P300F
Frequency Stability Vs. Temperature

FCC ID: H6M-OFRP300F

Test Performed By:

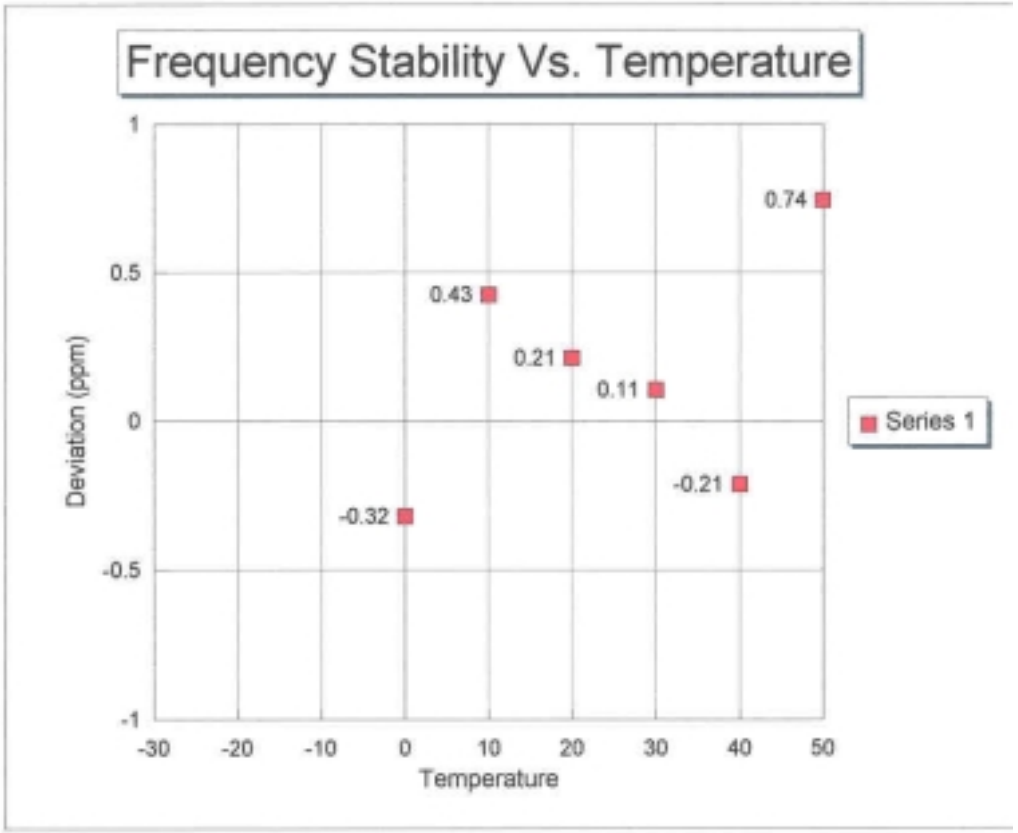
Tim Johnson
Compliance Engineer

Temperature (degrees C)	Measured Frequency (MHz)	Deviation (ppm)
-30	*	
-20	*	
-10	*	
0	940.2247	-0.32
10	940.2254	0.43
20	940.2252	0.21
30	940.2251	0.11
40	940.2248	-0.21
50	940.2257	0.74

Signal Generator input was: 940.2250 MHz

Maximum Deviation = 1 ppm

* NOTE: As temperature decreased, the minimum input signal level to trigger the output would increase. Points below 0 degrees C caused the following error "Foward Power Low & Excess Rev Power". Therefore the TX would not activate.



FCC ID: H6M-OFRP300F