

Alligator Communications
2888Transceiver

FCC ID: JIL2888
Model Nos: 2888A (analog), 2888D (digital)
FCC Rule Part: 101

General Overview

A description of the theory of operation and product configuration is found in an attachment to this application and report.

SPECIFICATIONS

Transmitter

TX operating frequency:	928-929 MHz (currently certified frequency range)
Additional operating frequencies	932-932.5 MHz 941-941.5 MHz 952-960 MHz
TX output power:	5 watts
Modulation:	FSK Modulation is internally generated and limited
Power requirements:	11-16.5 VDC, approx. 2 A maximum current draw
Antenna connector:	N- type
Frequency Tolerance	.00015% , ± 1392 Hz -30 to +50 C 85%-115% supply voltage at 20C
Test Dates:	5,12, 16 May 2006

Test Site

Radiated emissions tests, power output, and occupied bandwidth tests were performed at Compliance Certification Services. Output power and emissions masks tests were performed at Alligator Communications.

Conducted and radiated emissions were performed using test equipment with calibration traceable to NIST, and following test procedures accepted by the industry.



THOMAS N. COKENIAS
Consultant, EMC&Radio Type Approvals
Agent for Alligator Communications

FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part 2.

2.1033(c)1 Applicant: Alligator Communications Inc.
 317 Brokaw Road
 Santa Clara CA 95050

2.1033(c)2 FCC ID: JIL2888

2.1033(c)4,5 Emission type and Frequency range

Modulation: FSK from internal modem.

Emission designator:

928-929 MHz, 12.5 kHz bandwidth:	8K00F3D (analog) (original)
	9K64F1D (digital) (original)
928-929 MHz , 25 kHz bandwidth:	15K1F3D (analog) (original)
	13K7F1D (digital) (original)
932-932.5 MHz, 12.5 kHz bandwidth:	8K18F3D (analog)
	9K65F1D (digital)
932-932.5 MHz, 25 kHz bandwidth:	12KF3D (analog)
	14K3F1D (digital)
941-941.5 MHz, 12.5 kHz bandwidth:	8K01F3D (analog)
	9K72F1D (digital)
941-941.5 MHz, 25 kHz bandwidth:	11K1F3D (analog)
	12K0F1D (digital)
952-960 MHz, 12.5 kHz bandwidth:	7K95F3D (analog)
	9K74F1D (digital)
952-960 MHz, 25 kHz bandwidth:	11K1F3D (analog)
	14K6F1D (digital)

2.1033(c) 6 Range of Operating Power

5 watts nominal (37.0 dBm)

2.1033(c) 7 Maximum Power Rating

37.7 dBm measured = 5.89 watts

Maximum allowed per 101.113(a): 25 watts ERP (44 dBm ERP)

2.1033(c) 13 Description of Modulation System

1200 bps analog or 300-4800 bps FSK digital, from internal modems. Internal modem is analog (1200 baud Direct Interface, Asynchronous: RS-232), or digital (300-4800 baud

Direct Interface, Asynchronous: RS-232), depending on model.

2.1033(c) 14 Test Data per 2.1046 – 2.1057

CCS Test Equipment

TEST EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
Antenna, Horn 1 ~ 18 GHz	ETS	3117	35234	4/22/07
Preamplifier, 1 ~ 26.5 GHz	Miteq	924342	T87	9/9/06
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY45300064	12/19/06
EMI Receiver, 9 kHz ~ 2.9 GHz	Agilent / HP	8542E	3942A00286	2/4/07
RF Filter Section	Agilent / HP	85420E	3705A00256	2/4/07
Antenna, Bilog 30 MHz ~ 2 GHz	Sunol Sciences	JB1	A121003	9/3/06

Alligator Test Equipment

Mfr.	Model	Description	Cal Due
Hewlett Packard	HP 8648C	Signal Generator	15July2006
Hewlett Packard	HP 8920A	Service Monitor	
Hewlett Packard	HP 8561B	Spectrum Analyzer	
Tenney Engineering	Tenney Jr.	Temperature Chamber	

Note: Analyzer frequency and amplitude readings confirmed by signal substitution with calibrated signal generator

2.1046 RF Output Power Measurements

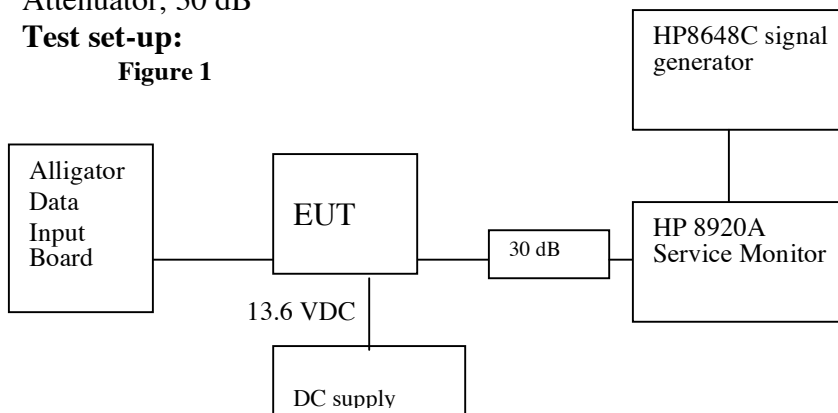
Measurement equipment used:

Spectrum Analyzer

Attenuator, 30 dB

Test set-up:

Figure 1



Test Procedures

1. Set the transmitter to produce maximum modulated power at the desired frequency
2. Set analyzer RBW and VBW to 100 kHz greater than 99% BW
3. Read PEAK output power

Test Results

F(MHz)	P, 12.5kHz analog	P, 12.5kHz digital	P, 25kHz analog	P, 25kHz digital
932	5.06 watts	5.18 watts	5.07 watts	5.11 watts
941	5.11	5.18	4.89	5.06
952	4.93	4.89	5.04	5.09
959	5.07	5.08	4.93	4.87

Section 2.1047 Modulation Characteristics

Requirement/Limit: 101.111(a)5

101.111 Emission limitations

(a) The mean power of emissions must be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(1) When using transmissions other than those employing digital modulation techniques:

(i) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 decibels;

(ii) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 decibels;

(iii) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log_{10}$ (mean output power in watts) decibels, or 80 decibels, whichever is the lesser attenuation.

(5) When using transmissions employing digital modulation techniques on the 900 MHz multiple address frequencies with a 12.5 KHz bandwidth, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 2.5 KHz up to and including 6.25 KHz: At least $53 \log_{10} (fd/2.5)$ decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 6.25 KHz up to and including 9.5 KHz: At least $103 \log_{10} (fd/3.9)$ decibels;

(iii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 9.5 KHz up to and including 15 KHz: At least $157 \log_{10} (fd/5.3)$ decibels; and

(iv) On any frequency removed from the center of the authorized bandwidth by a displacement frequency greater than 15 KHz: At least 50 plus $10 \log_{10}(P)$ or 70 decibels, whichever is the lesser attenuation.

(6) When using transmissions employing digital modulation techniques on the 900 MHz multiple address frequencies with a bandwidth greater than 12.5 KHz, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

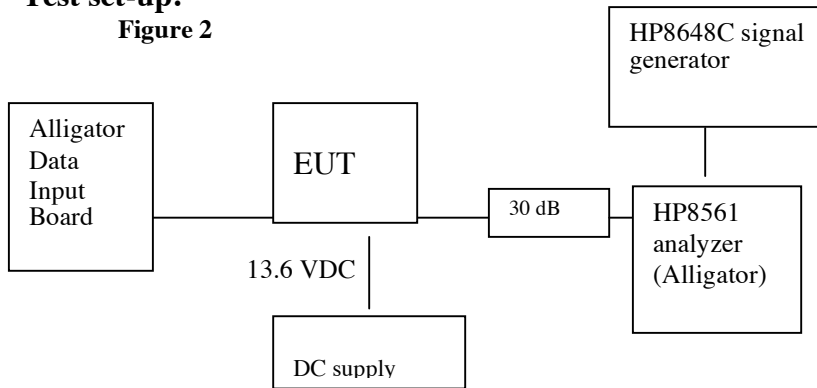
(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 5 KHz up to and including 10 KHz: At least $83 \log_{10} (fd/5)$ decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 10 KHz up to and including 250 percent of the authorized bandwidth: At least $116 \log_{10} (fd/6.1)$ decibels or 50 plus $10 \log_{10} (P)$ or 70 decibels, whichever is the lesser attenuation; and

(iii) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 plus $10 \log_{10}$ (output power in watts) decibels or 80 decibels, whichever is the lesser attenuation.

Test set-up:

Figure 2



Test Procedures

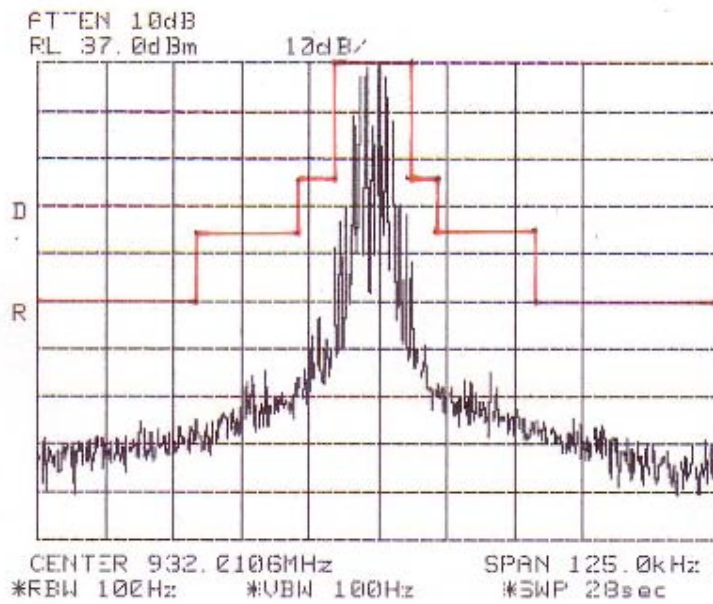
- a. Set the transmitter to produce maximum modulated power at the desired frequency
- b. Set RBW and VBW to required values and record emission masks.

Test Results

PASS. Refer to attached spectrum analyzer charts.

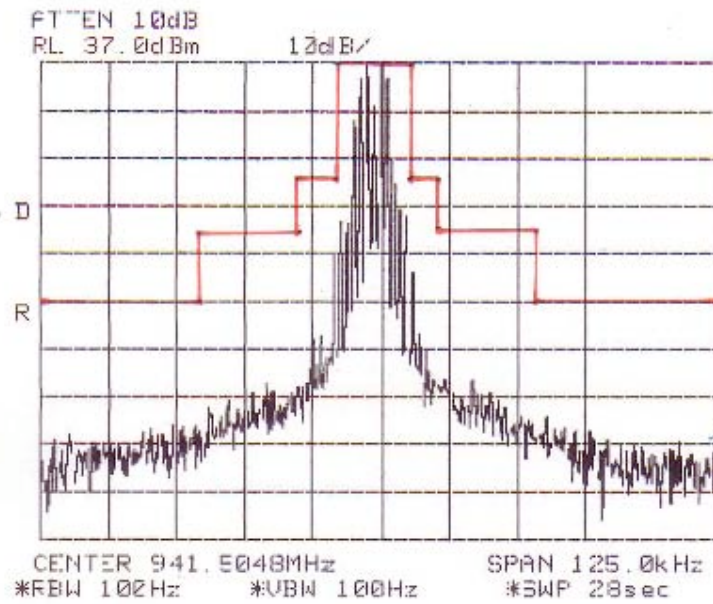
Emissions are shown with mask lines superimposed on spectrum analyzer charts.

Channel Mask for fo = 932.00625 MHz, 12.5 kHz Analog



12.5 KHz Analog 932.00625

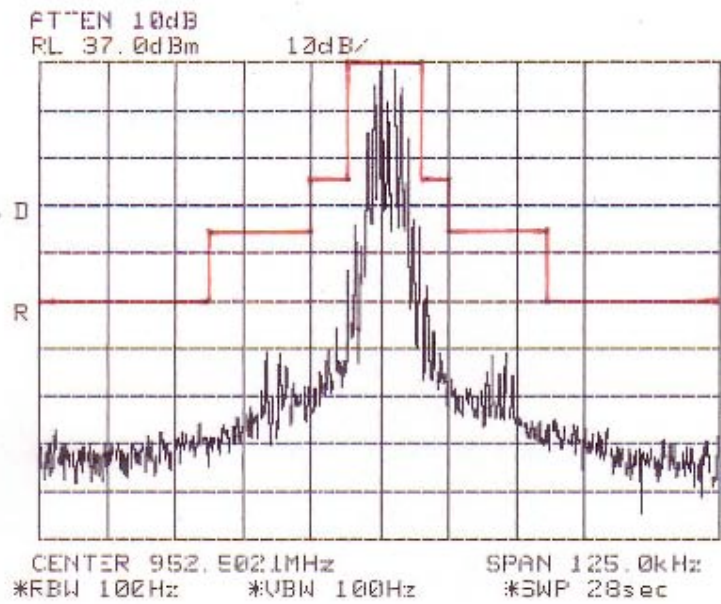
Channel Mask for fo = 941.5000 MHz, 12.5 kHz Analog



12.5 KHz Analog

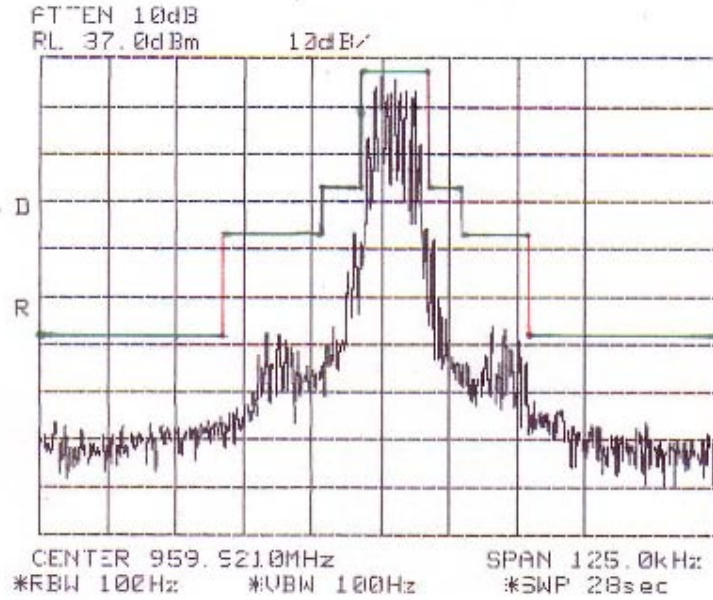
941.50000 MHz

Channel Mask for fo = 952.5000 MHz, 12.5 kHz Analog



12.5 KHz Analog 952.5000 MHz

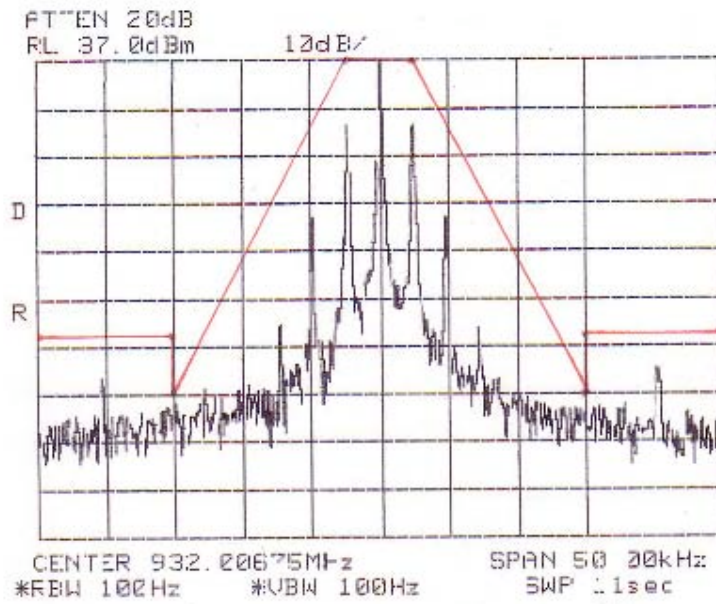
Channel Mask for $f_0 = 959.91875$ MHz, 12.5 kHz Analog



12.5 KHz Analog

959.91875 MHz

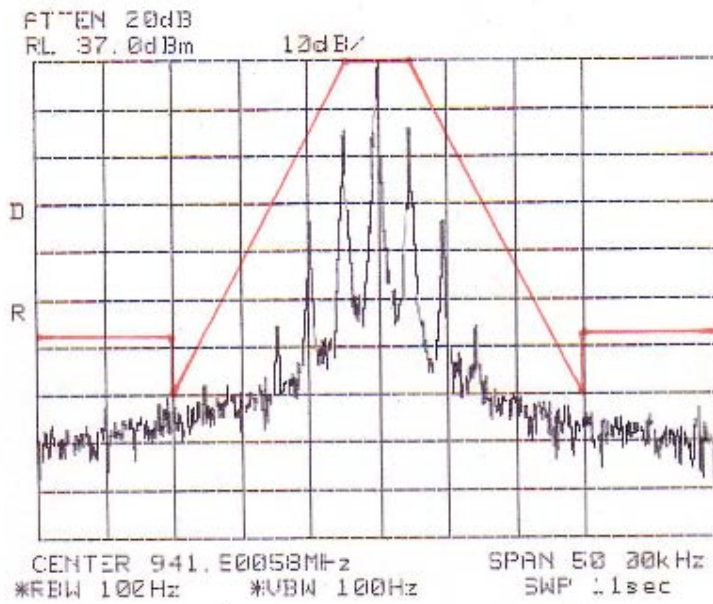
Channel mask for $f_0 = 932.00625$ MHz Digital 12.5 kHz channel



12.5 KHz Digital

932.00625

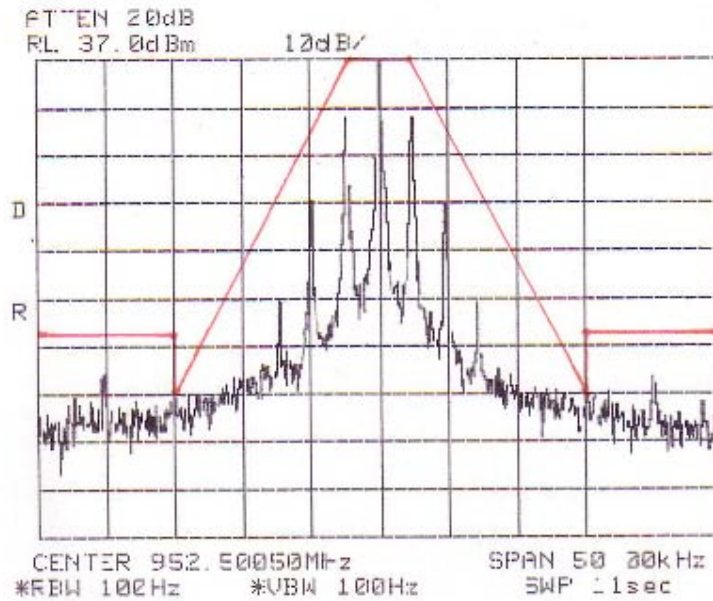
Channel mask for $f_0 = 941.5000$ MHz Digital 12.5 kHz channel



12.5 kHz Digital

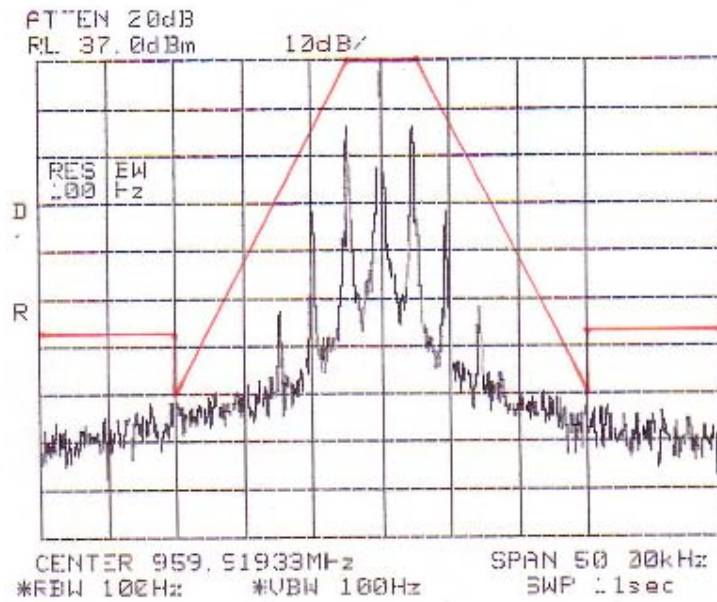
941.5000 MHz

Channel mask for $f_0 = 952.50000$ MHz Digital 12.5 kHz channel



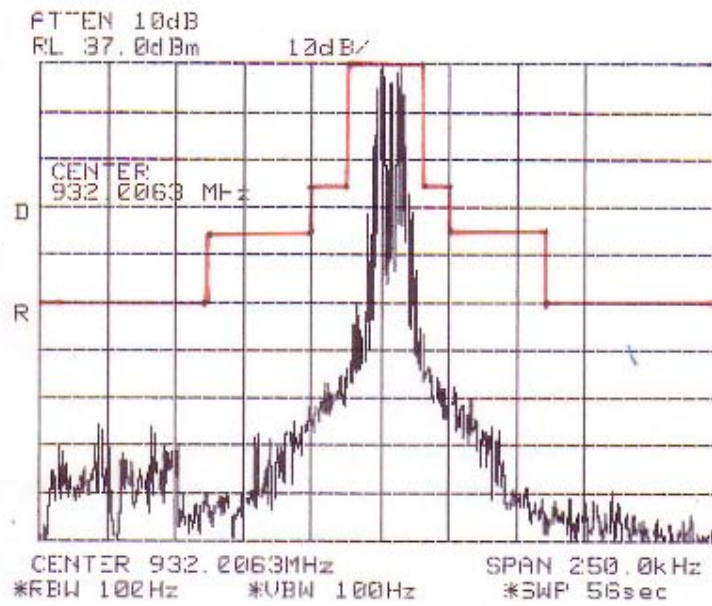
Digital 12.5 kHz 952.50000 MHz

Channel mask for $f_0 = 959.91875$ MHz Digital 12.5 kHz channel



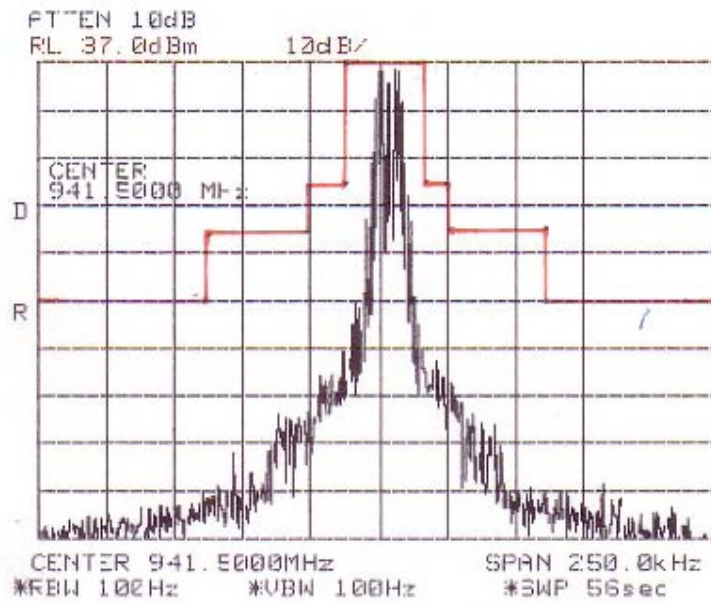
12.5 KHz Digital 959.91875 MHz

Channel Mask for fo = 932.00625 MHz, 25 kHz Analog



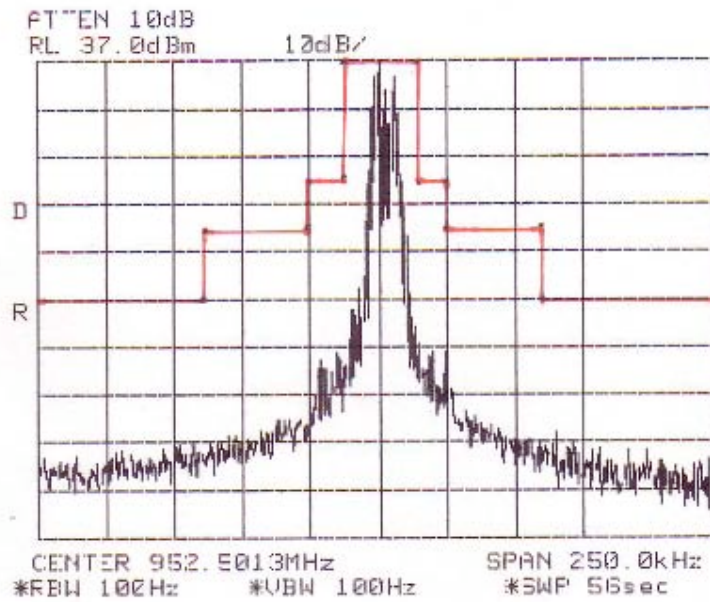
25 kHz Analog 932.00625

Channel Mask for fo = 941.5000 MHz, 25 kHz Analog



25 KHz Analog 941.50000 MHz

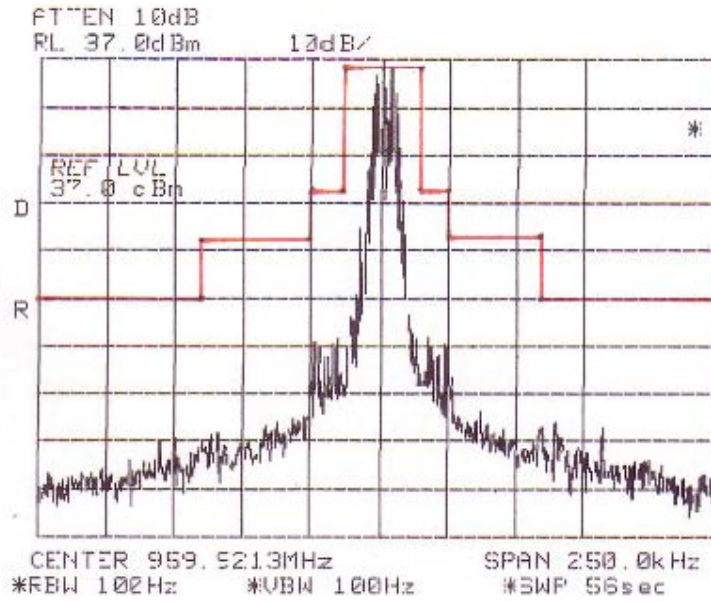
Channel Mask for $f_0 = 952.5000$ MHz, 25 kHz Analog



25 KHz Analog

952.50000 MHz

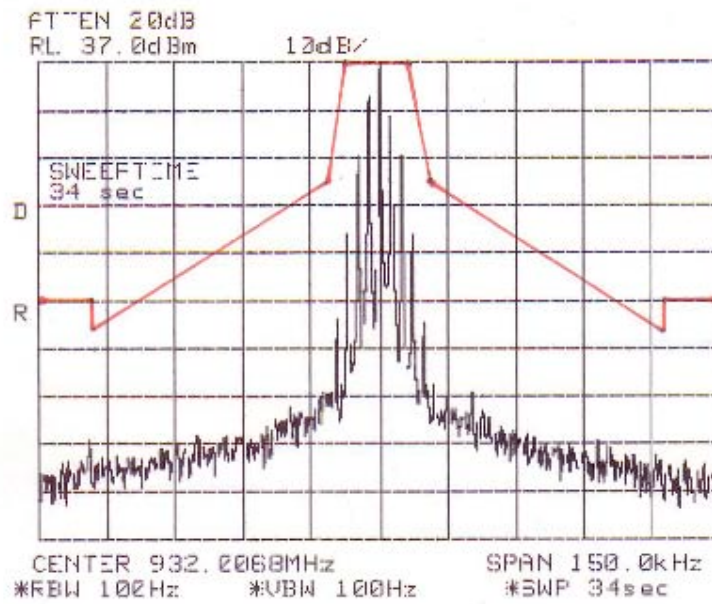
Channel Mask for $f_0 = 959.91875$ MHz, 25 kHz Analog



25 KHz Analog

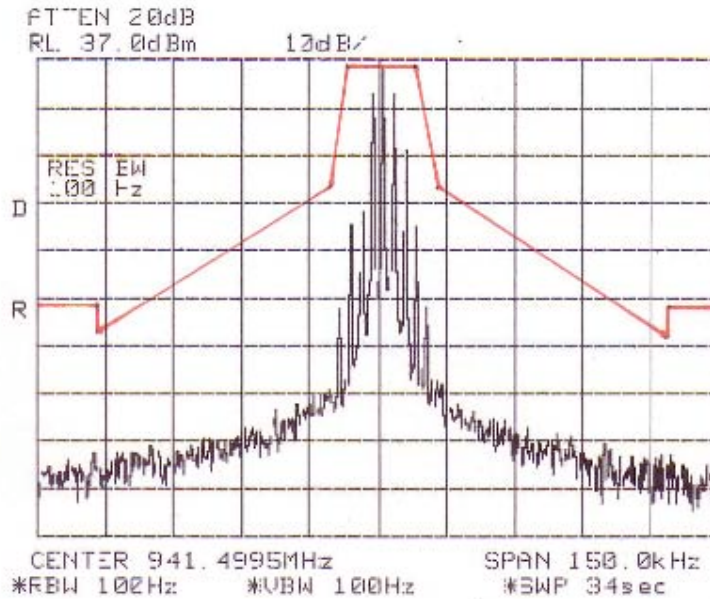
959.91875 MHz

Channel mask for $f_0 = 932.00625$ MHz Digital 25 kHz channel



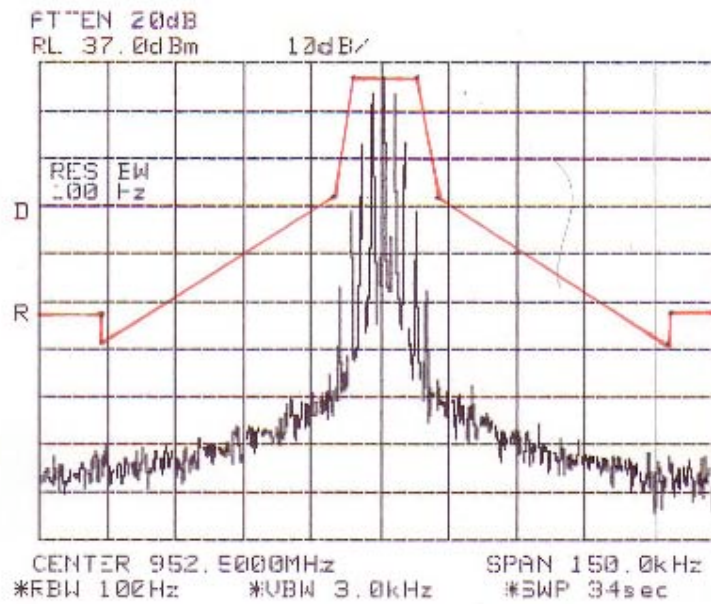
25 KHz Digital 932.00625

Channel mask for $f_0 = 941.5000$ MHz Digital 25 kHz channel



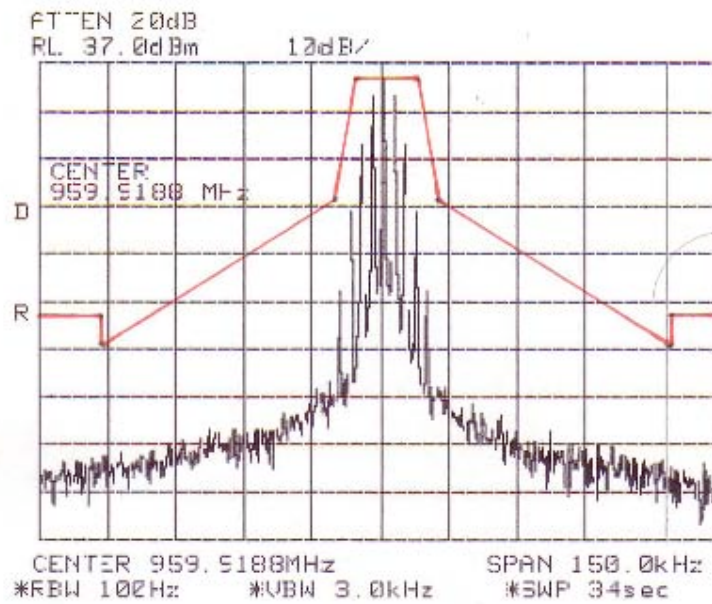
25KH Digital 941.50000 MHz

Channel mask for $f_0 = 952.50000$ MHz Digital 25 kHz channel



25 KHz Digital 952.50000 MHz

Channel mask for $f_0 = 959.91875$ MHz Digital 25 kHz channel



25 kHz Digital 959.91875 MHz

Section 2.1049 Occupied Bandwidth

Requirement/Limit: 101.109

(c) The maximum bandwidth which will be authorized per frequency assigned is set out in the table that follows. Regardless of the maximum authorized bandwidth specified for each frequency band, the Commission reserves the right to issue a license for less than the maximum bandwidth if it appears that a lesser bandwidth would be sufficient to support an applicant's intended communications

Frequency band (MHz)	Maximum authorized bandwidth
928 to 929.....	25 kHz 1 5 6
932 to 932.5, 941 to 941.5.....	12.5 kHz 1 5 6
952 to 960.....	200 KHz 1 5 6

\1\ The maximum bandwidth that will be authorized for each particular frequency in this band is detailed in the appropriate frequency table in § 101.147. If contiguous channels are aggregated in the 928-928.85/952-952.85/956.25-956.45 MHz, the 928.85-929/959.85-960 MHz, or the 932-932.5/941-941.5 MHz bands, then the bandwidth may exceed that which is listed in the table.

\5\ A 12.5 kHz bandwidth applies only to frequencies listed in § 101.147(b)(1) through (4).

\6\ For frequencies listed in § 101.147(b)(1) through (4), consideration will be given on a case-by-case basis to authorizing bandwidths up to 50 kHz.

Test set-up:

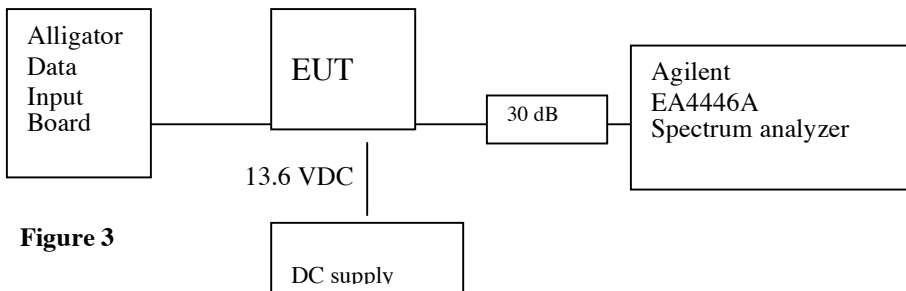


Figure 3

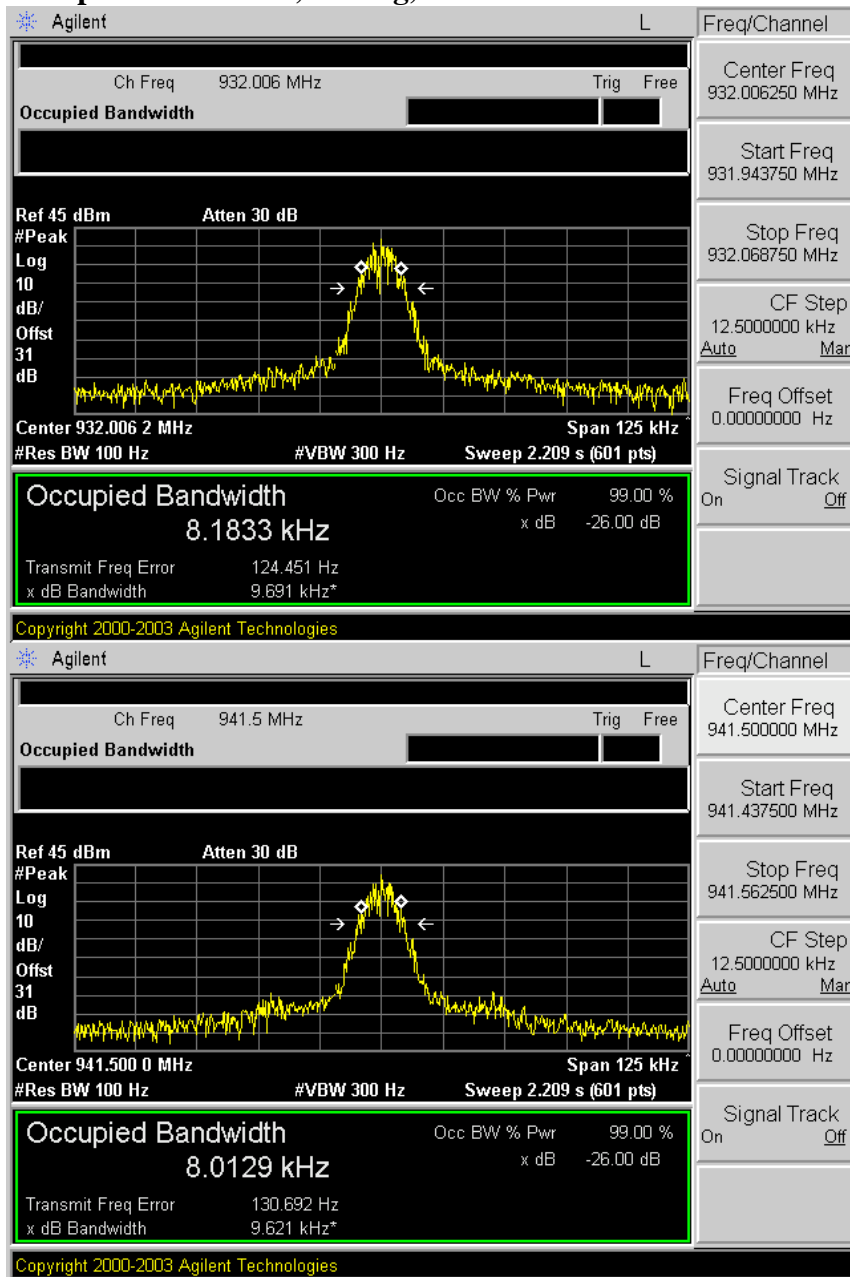
Test Procedures and Results:

Occupied bandwidth was measured manually using analyzer internal Occupied Bandwidth measurement function.

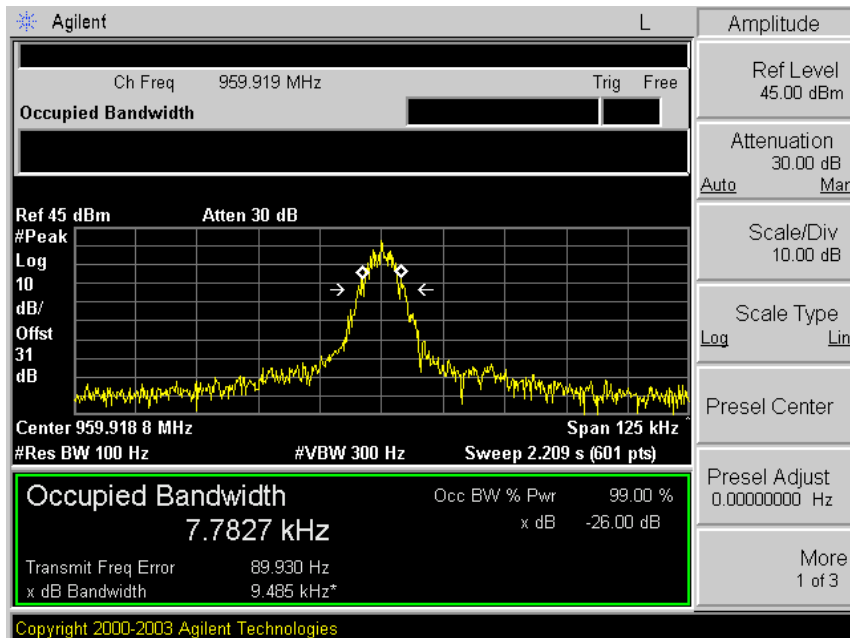
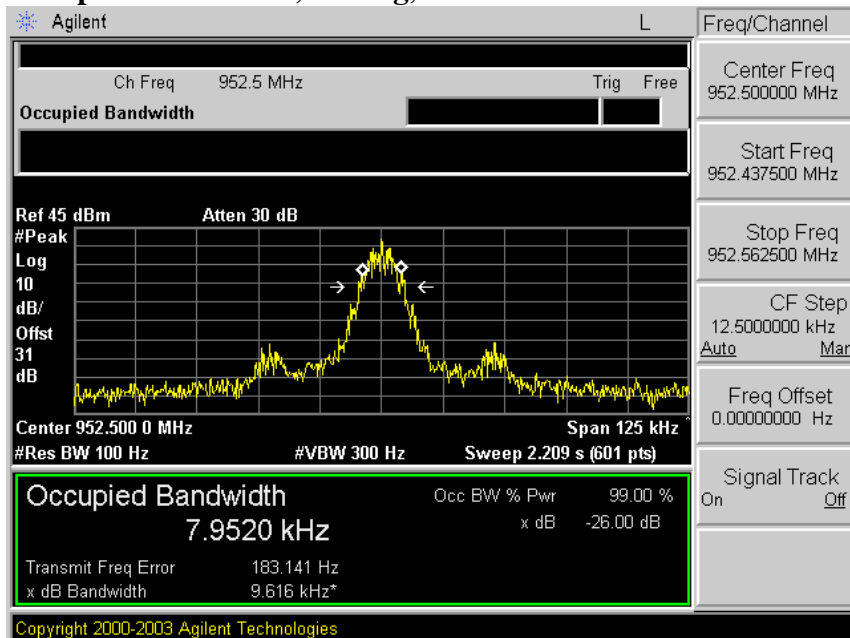
Test Results

Refer to spectrum analyzer plots below

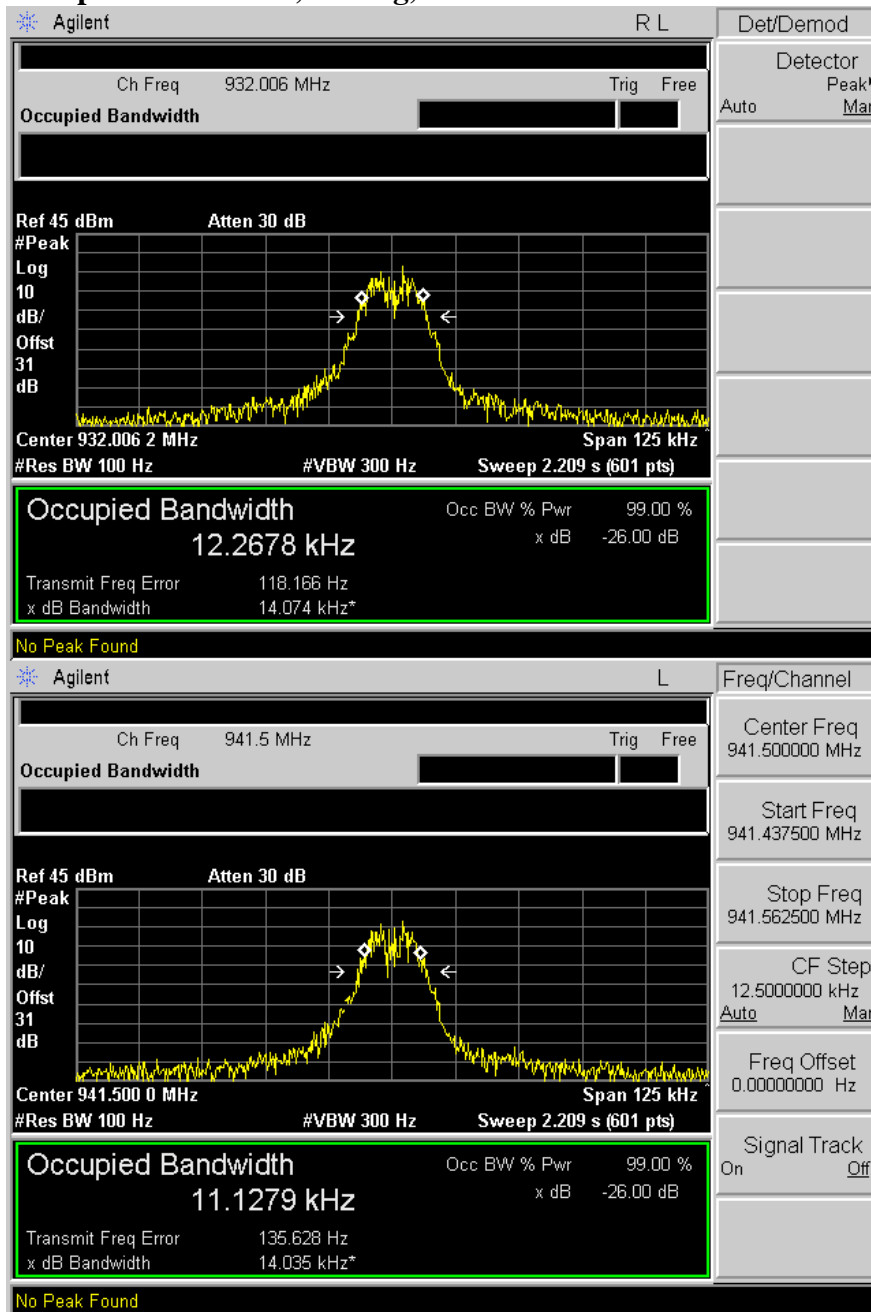
Occupied Bandwidth, Analog, 12.5 kHz channel



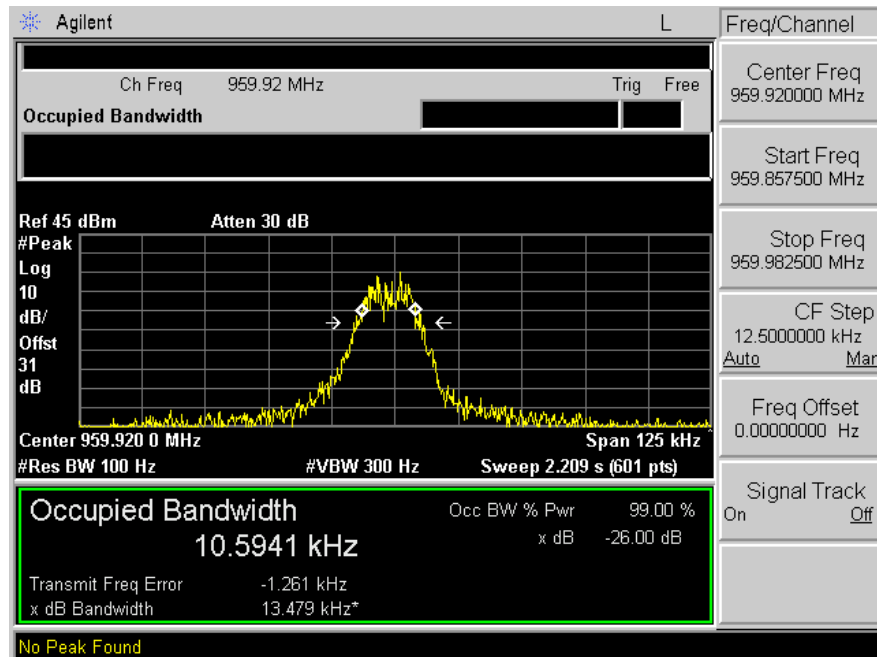
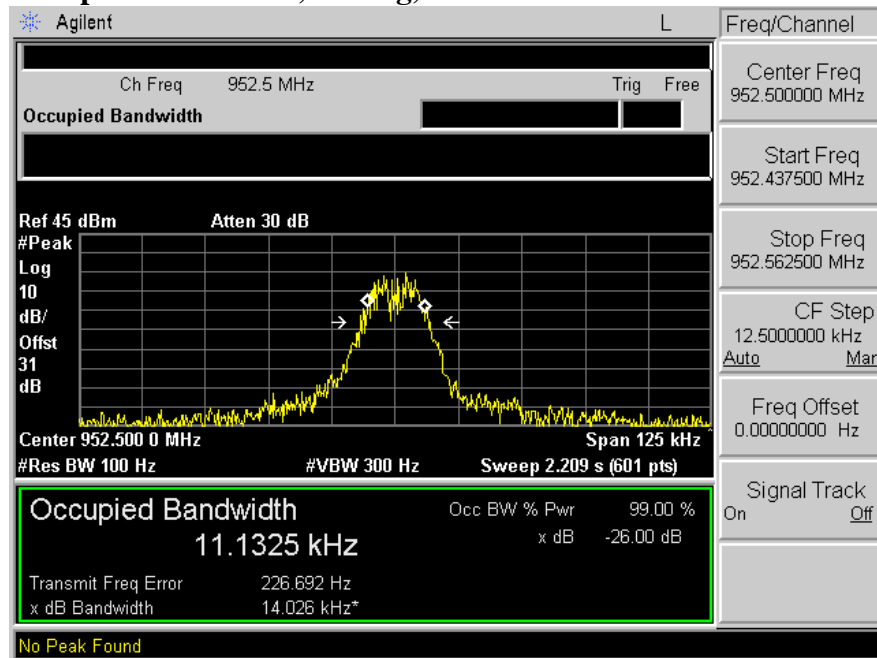
Occupied Bandwidth, Analog, 12.5 kHz channel



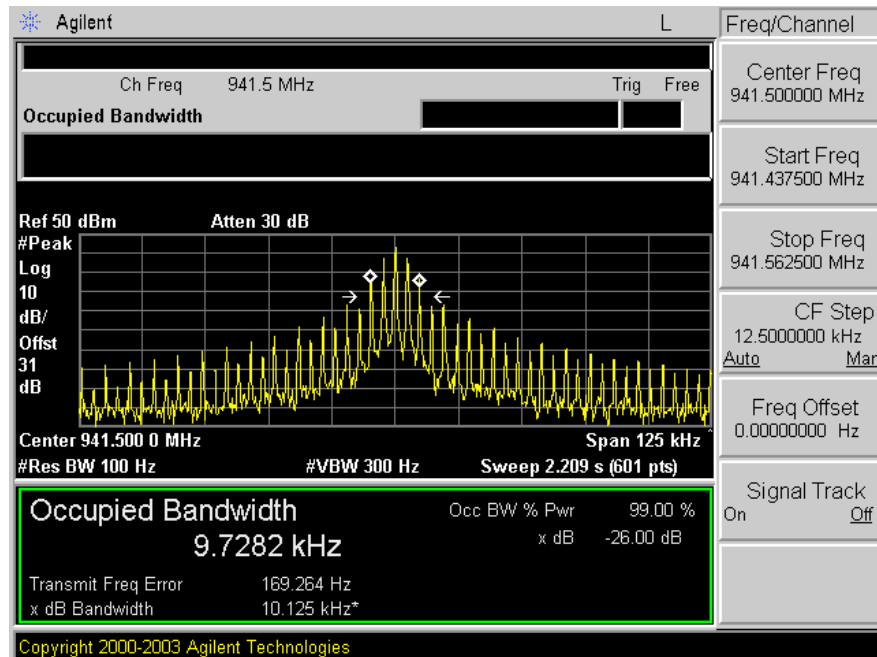
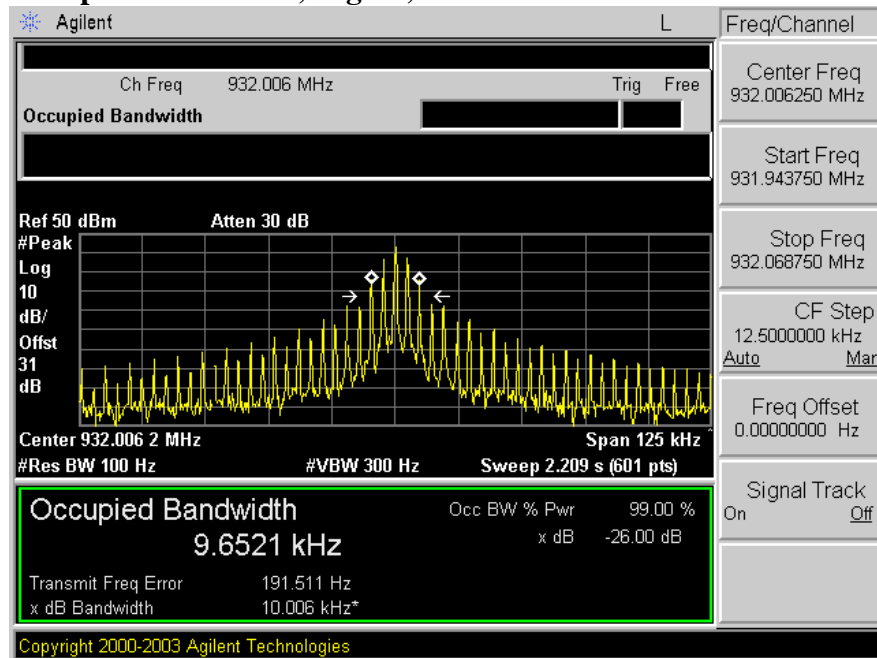
Occupied Bandwidth, Analog, 25 kHz channel



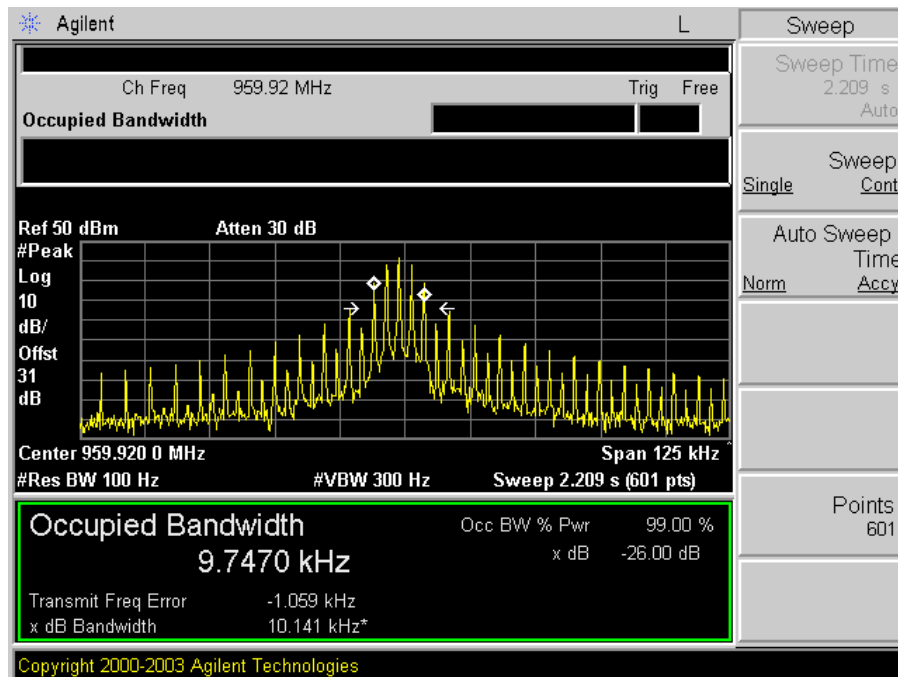
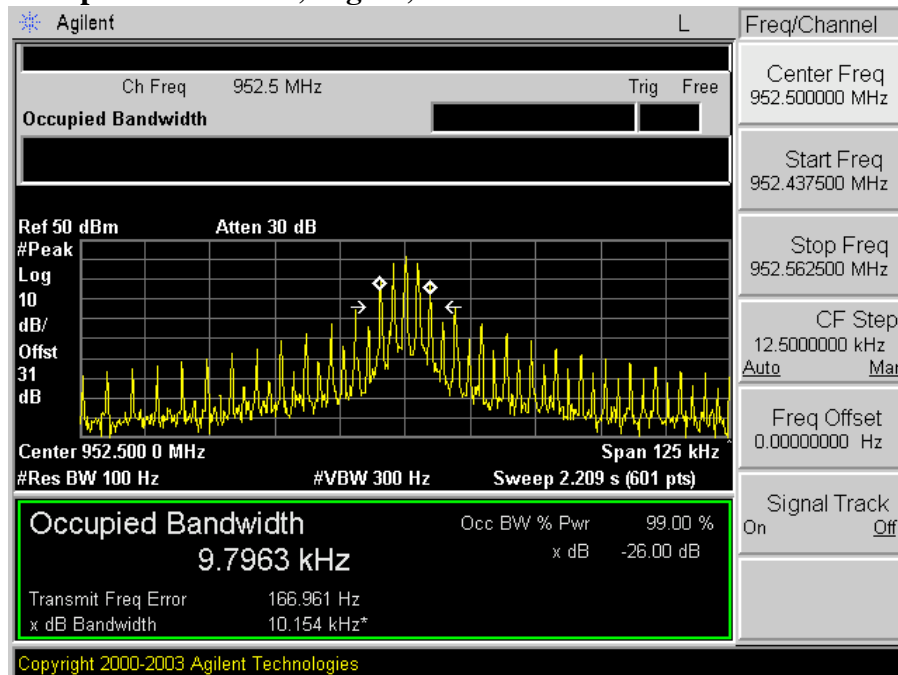
Occupied Bandwidth, Analog, 25 kHz channel



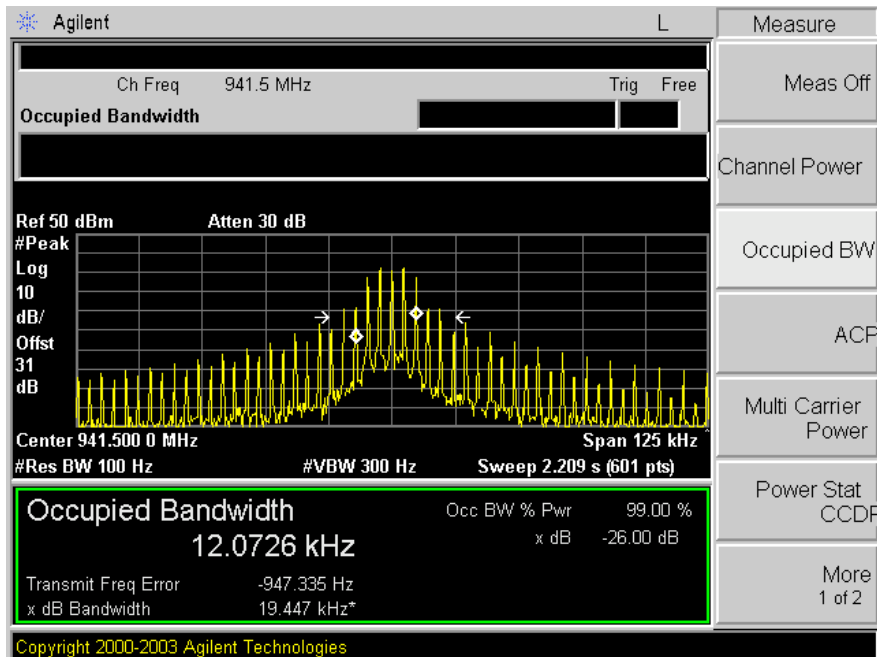
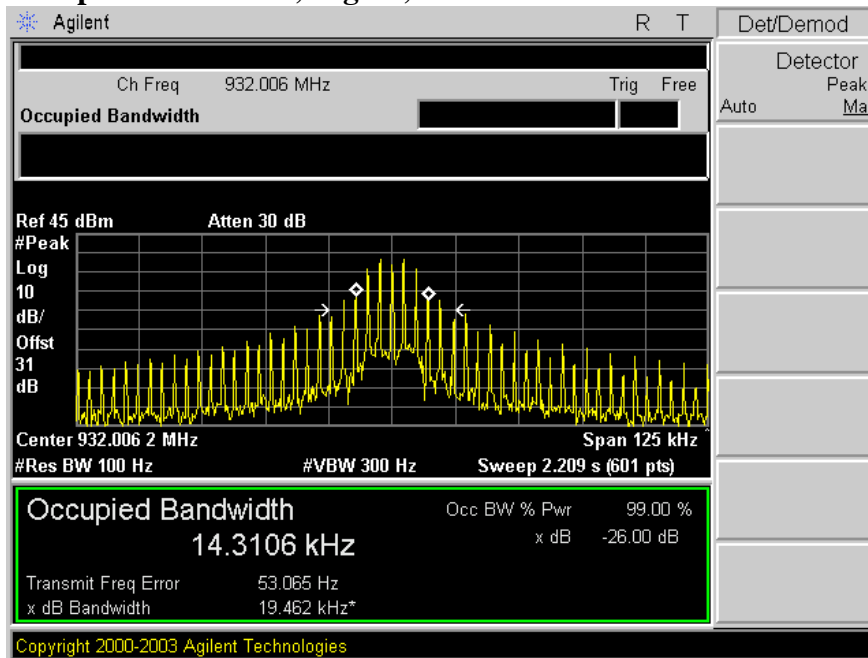
Occupied Bandwidth, Digital, 12.5 kHz channel



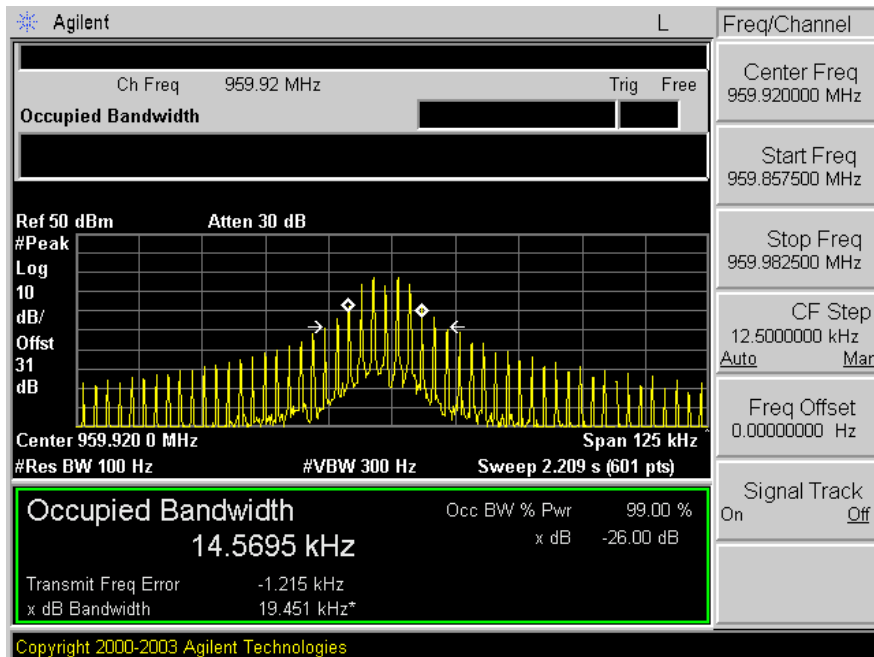
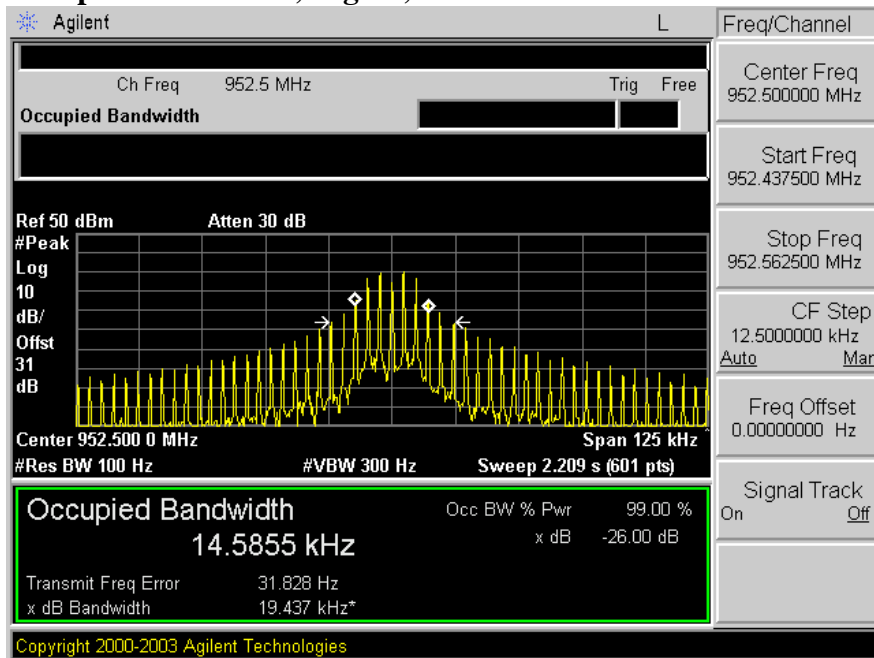
Occupied Bandwidth, Digital, 12.5 kHz channel



Occupied Bandwidth, Digital, 25 kHz channel



Occupied Bandwidth, Digital, 25 kHz channel



Section 2.1051 Spurious and Harmonic Emissions at Antenna Terminals Requirement/Limit: 101.111(a)5

101.111 Emission limitations

(a) The mean power of emissions must be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(1) When using transmissions other than those employing digital modulation techniques:

(i) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 decibels;

(ii) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 decibels;

(iii) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log_{10}$ (mean output power in watts) decibels, or 80 decibels, whichever is the lesser attenuation.

(5) When using transmissions employing digital modulation techniques on the 900 MHz multiple address frequencies with a 12.5 KHz bandwidth, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) of more than 2.5 KHz up to and including 6.25 KHz: At least $53 \log_{10} (f_d/2.5)$ decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) of more than 6.25 KHz up to and including 9.5 KHz: At least $103 \log_{10} (f_d/3.9)$ decibels;

(iii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) of more than 9.5 KHz up to and including 15 KHz: At least $157 \log_{10} (f_d/5.3)$ decibels; and

(iv) On any frequency removed from the center of the authorized bandwidth by a displacement frequency greater than 15 KHz: At least 50 plus $10 \log_{10}(P)$ or 70 decibels, whichever is the lesser attenuation.

(6) When using transmissions employing digital modulation techniques on the 900 MHz multiple address frequencies with a bandwidth greater than 12.5 KHz, the power of any emission must be attenuated below the unmodulated carrier power of the transmitter (P) in accordance with the following schedule:

(i) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) of more than 5 KHz up to and including 10 KHz: At least $83 \log_{10} (f_d/5)$ decibels;

(ii) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in KHz) of more than 10 KHz up to and including 250 percent of the authorized bandwidth: At least $116 \log_{10} (f_d/6.1)$ decibels or 50 plus $10 \log_{10} (P)$ or 70 decibels, whichever is the lesser attenuation; and

(iii) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 plus $10 \log_{10}$ (output power in watts) decibels or 80 decibels, whichever is the lesser attenuation.

Test set-up:

Refer to Figure 3 above

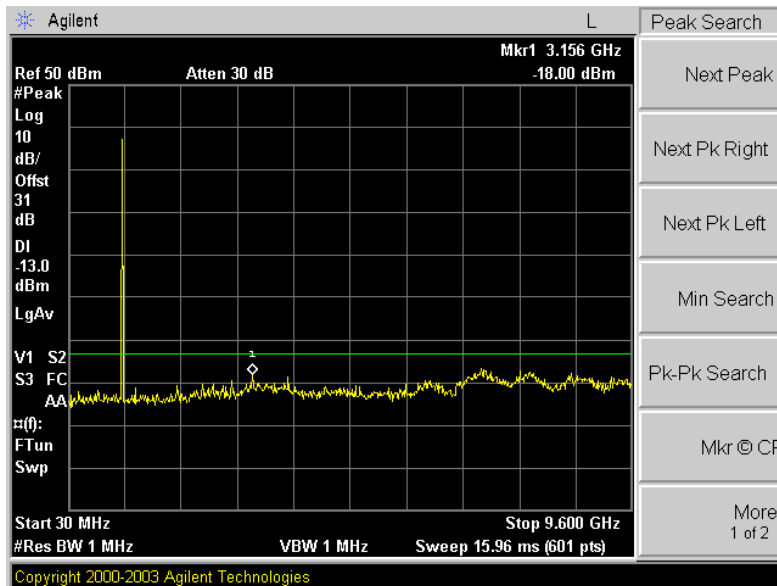
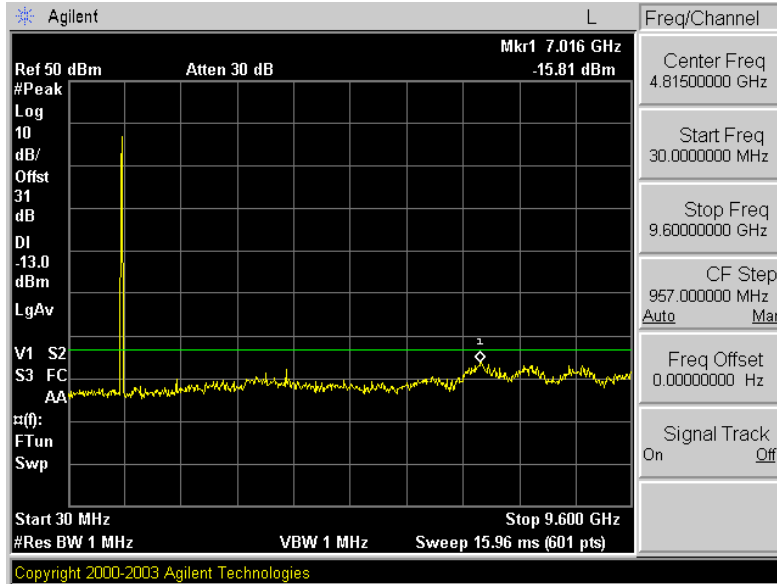
Test Procedures

1. Record transmitter output spectrum from 1 MHz to 10th harmonic of TX output frequency
2. Plot spectrum analyzer output traces.

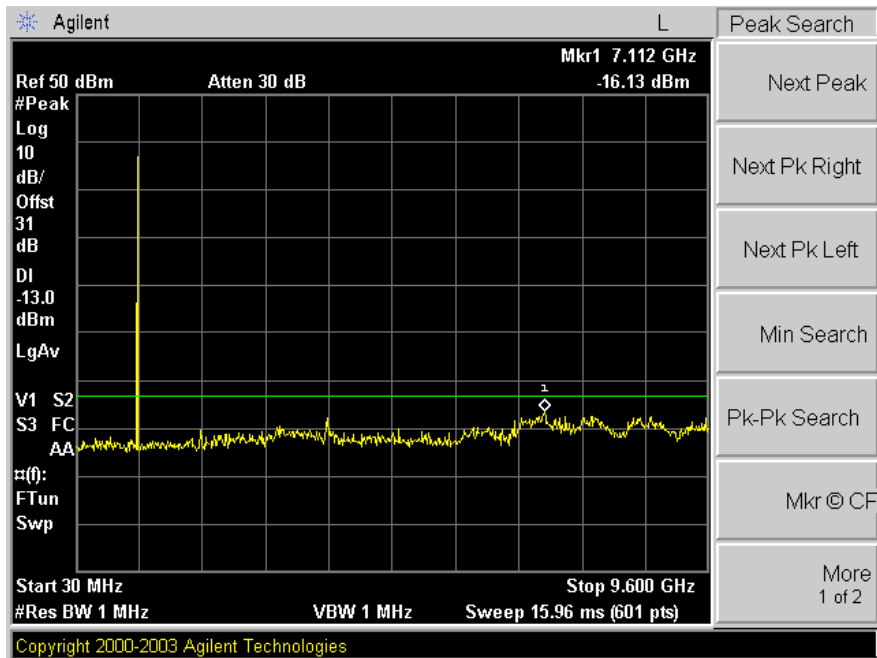
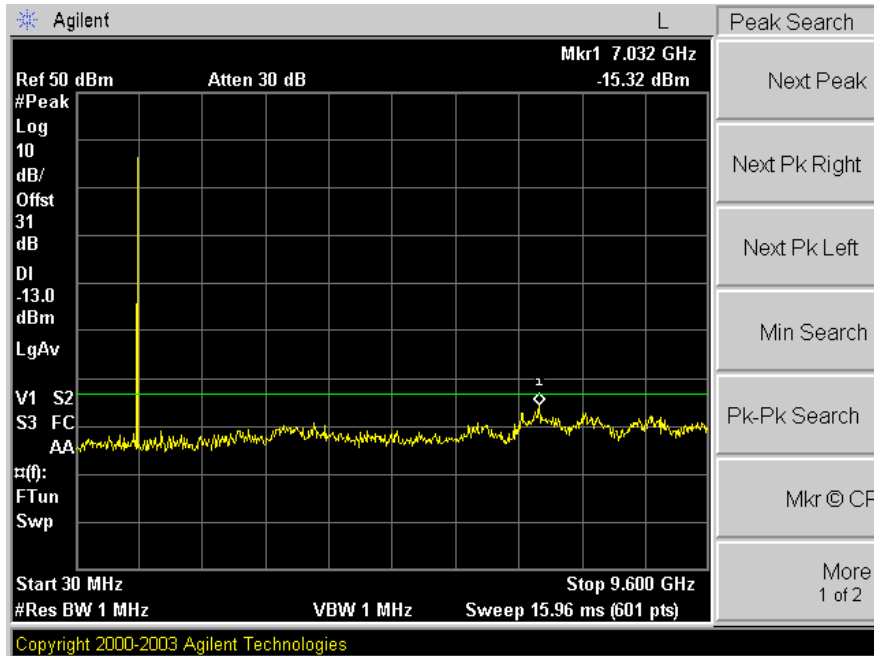
Test Results

PASS. Refer to data plots below.

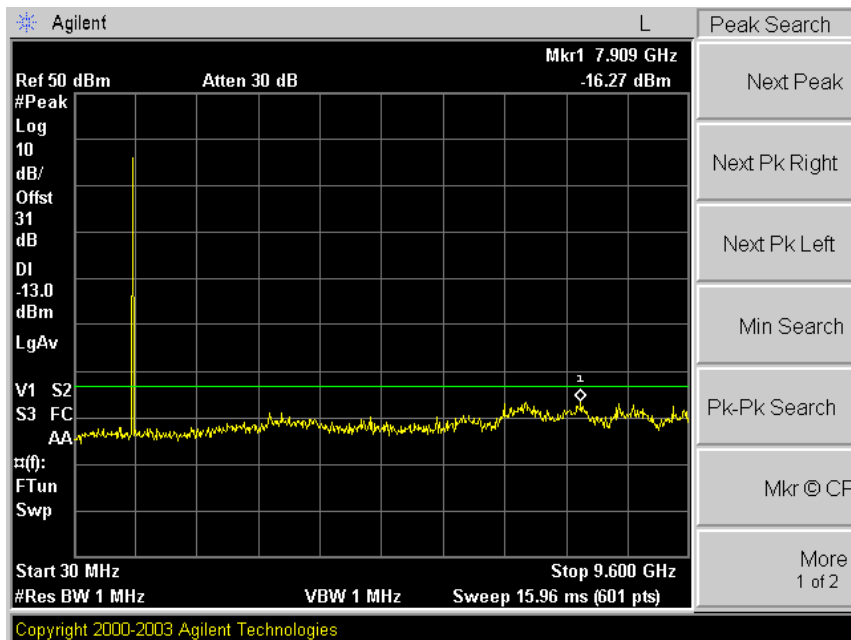
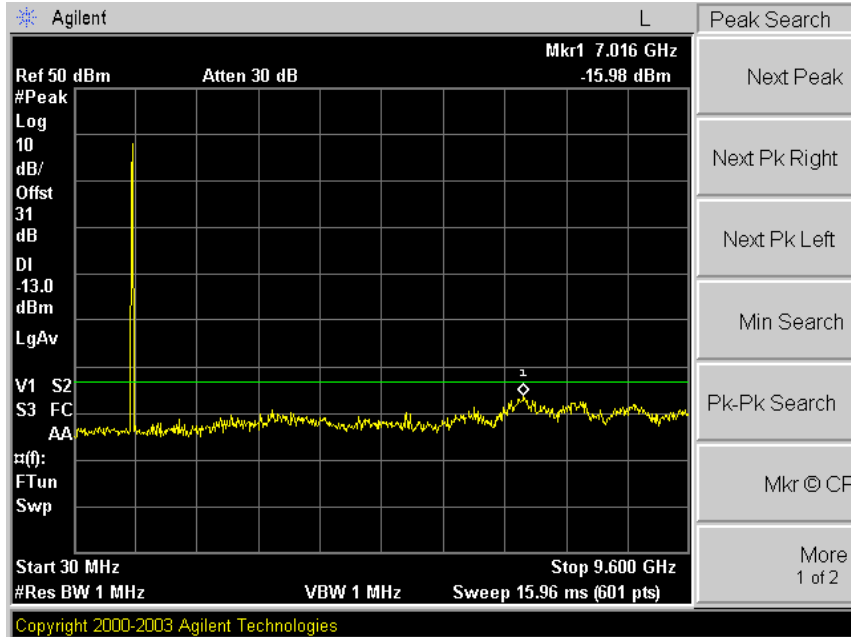
Spurious emissions, Analog, 12.5 kHz channel
932.00625 and 941.5000 MHz



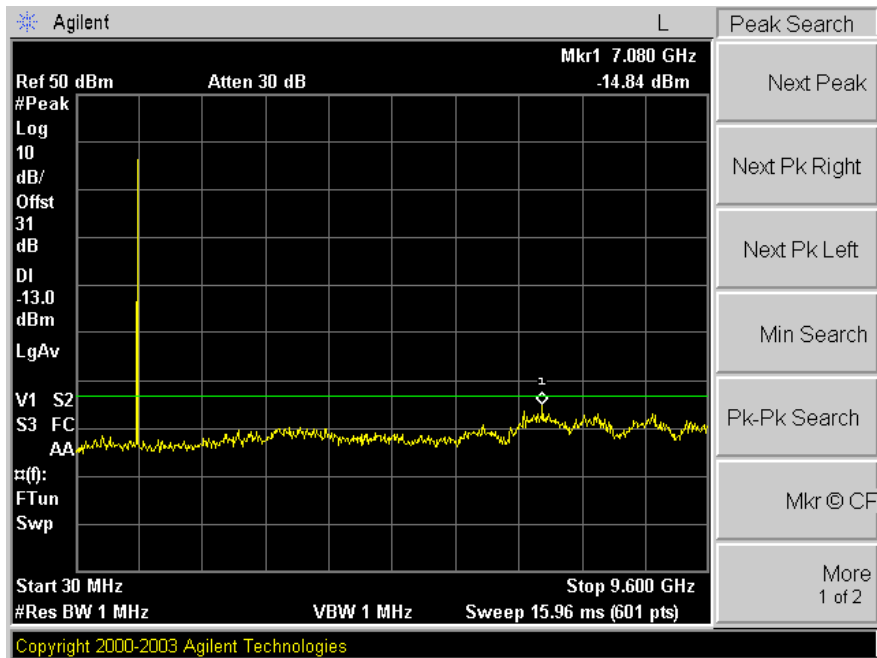
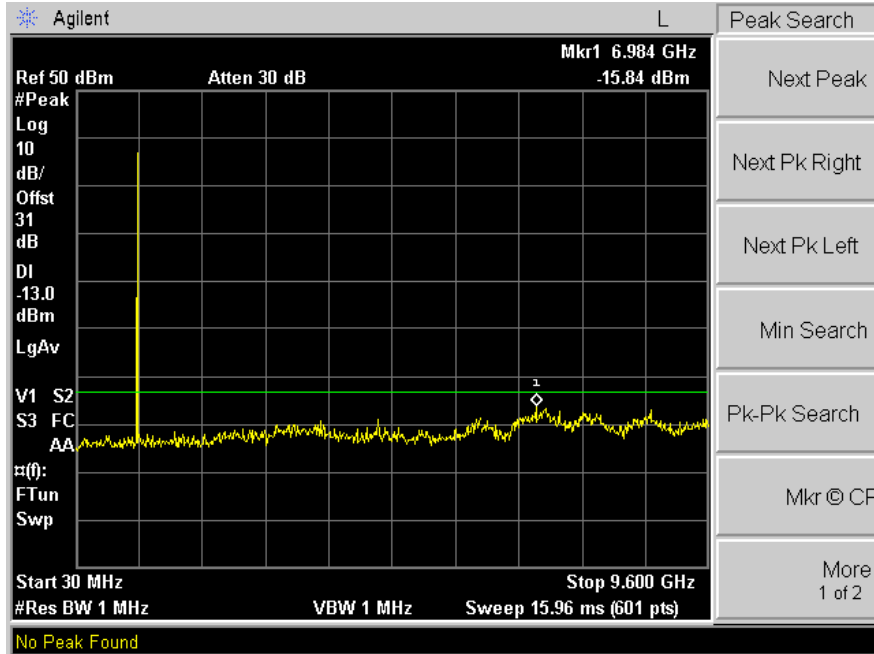
Spurious emissions, Analog, 12.5 kHz channel
952.5000 and 959.91875 MHz



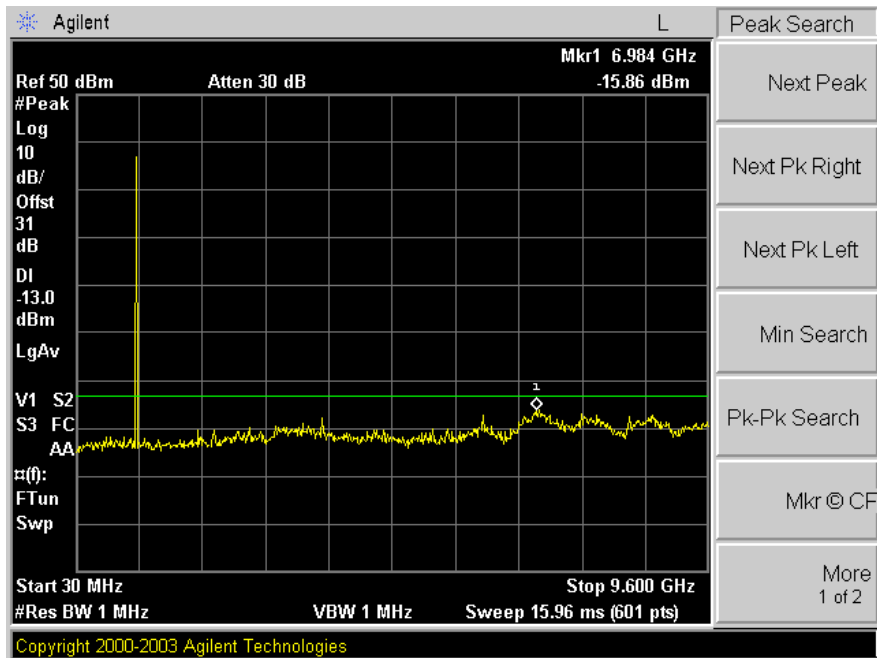
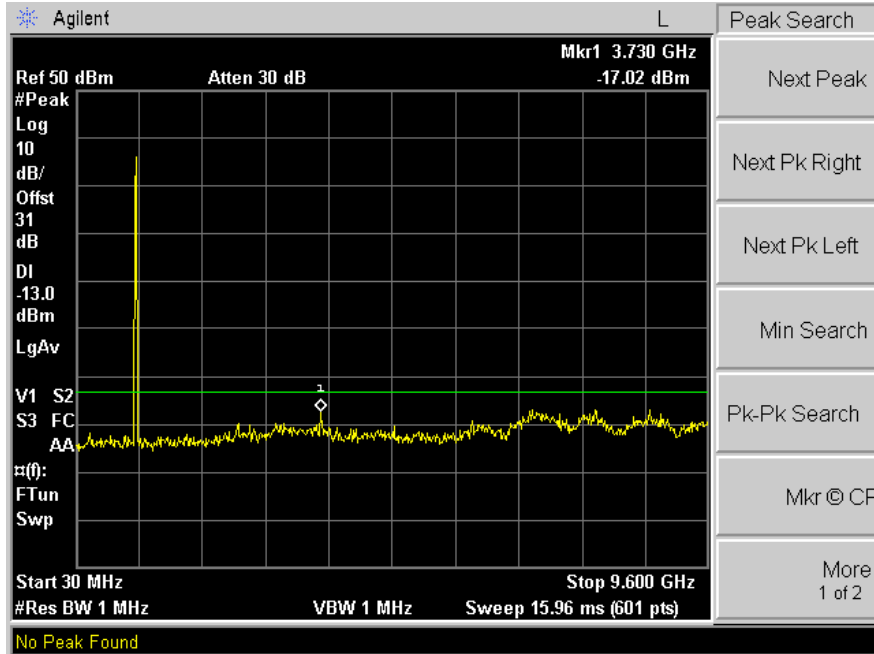
Spurious emissions, Digital, 12.5 kHz channel
932.00625 and 941.5000 MHz



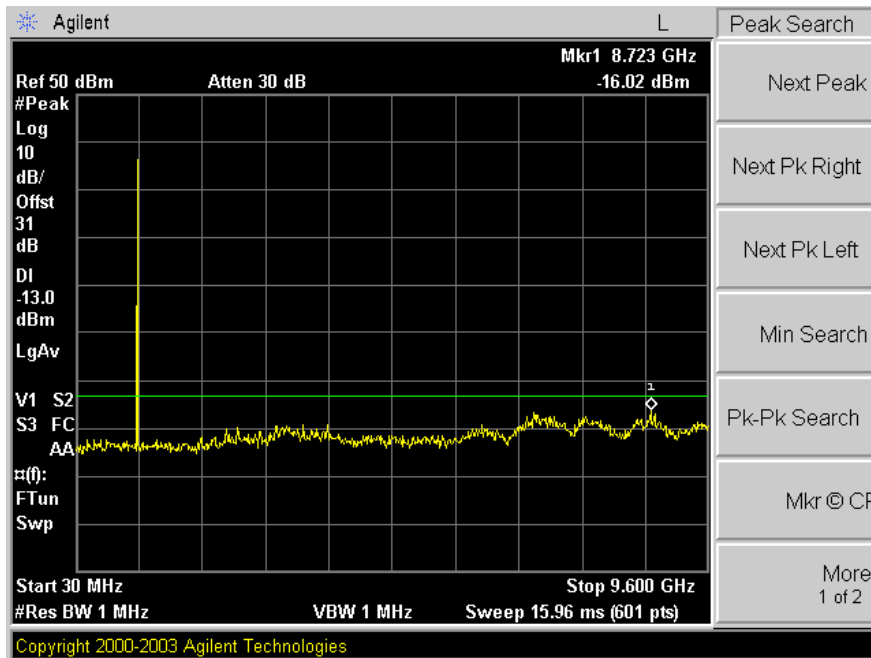
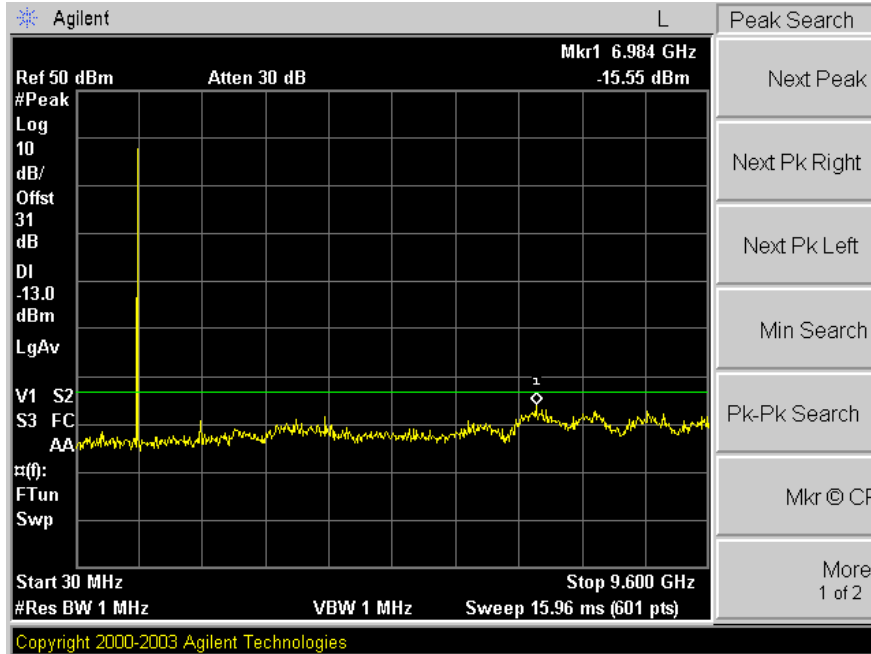
Spurious emissions, Digital, 12.5 kHz channel
952.5000 and 959.91875 MHz



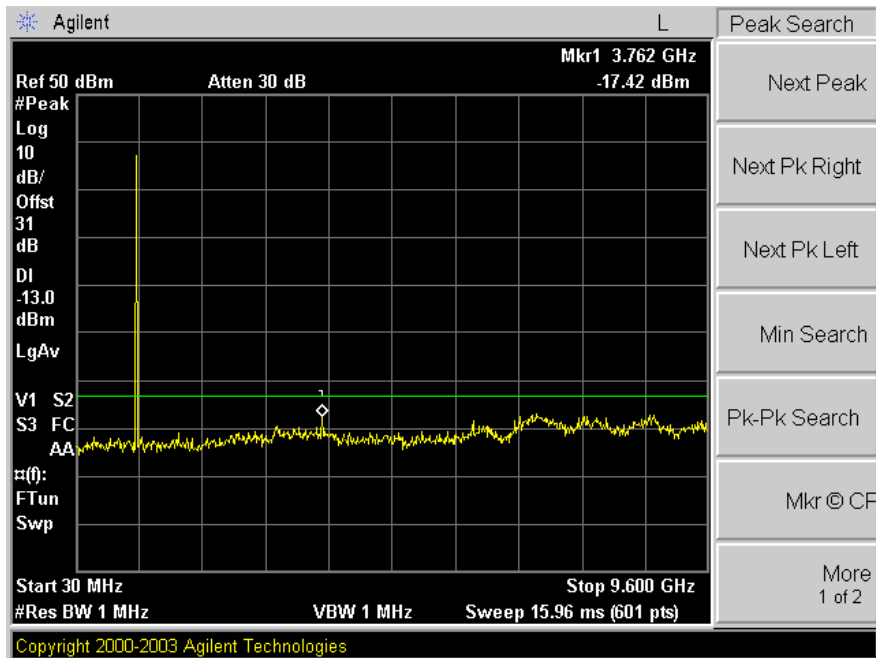
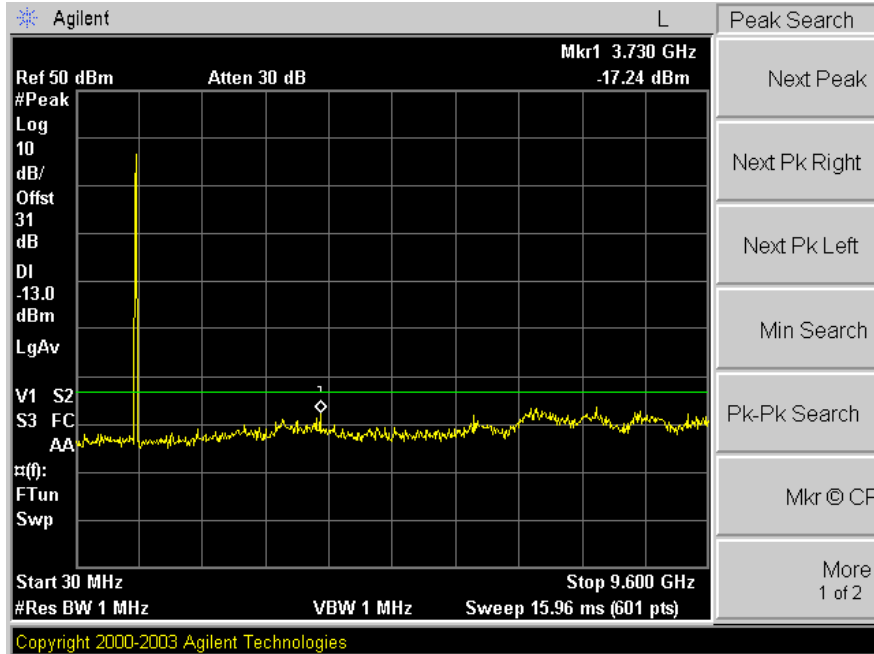
Spurious emissions, Analog, 25 kHz channel
932.00625 and 941.5000 MHz



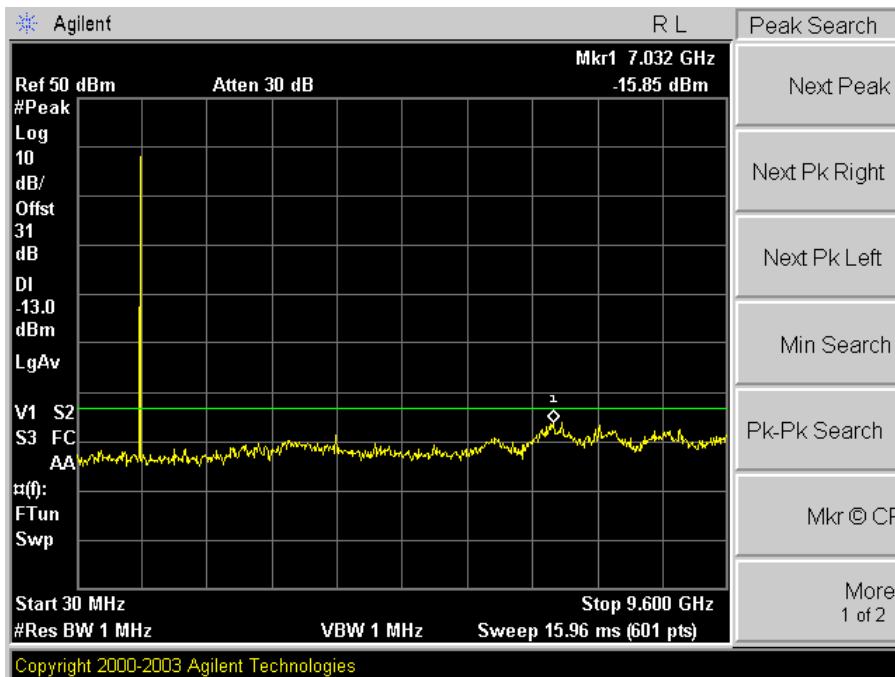
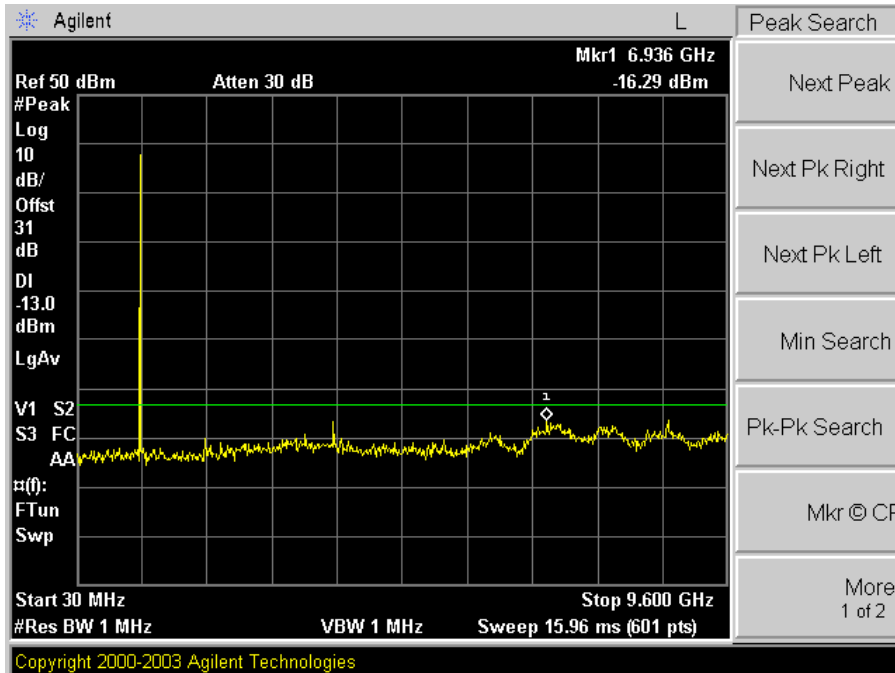
Spurious emissions, Analog, 25 kHz channel
952.5000 and 959.91875 MHz



Spurious emissions, Digital, 25 kHz channel
932.00625 and 941.5000 MHz



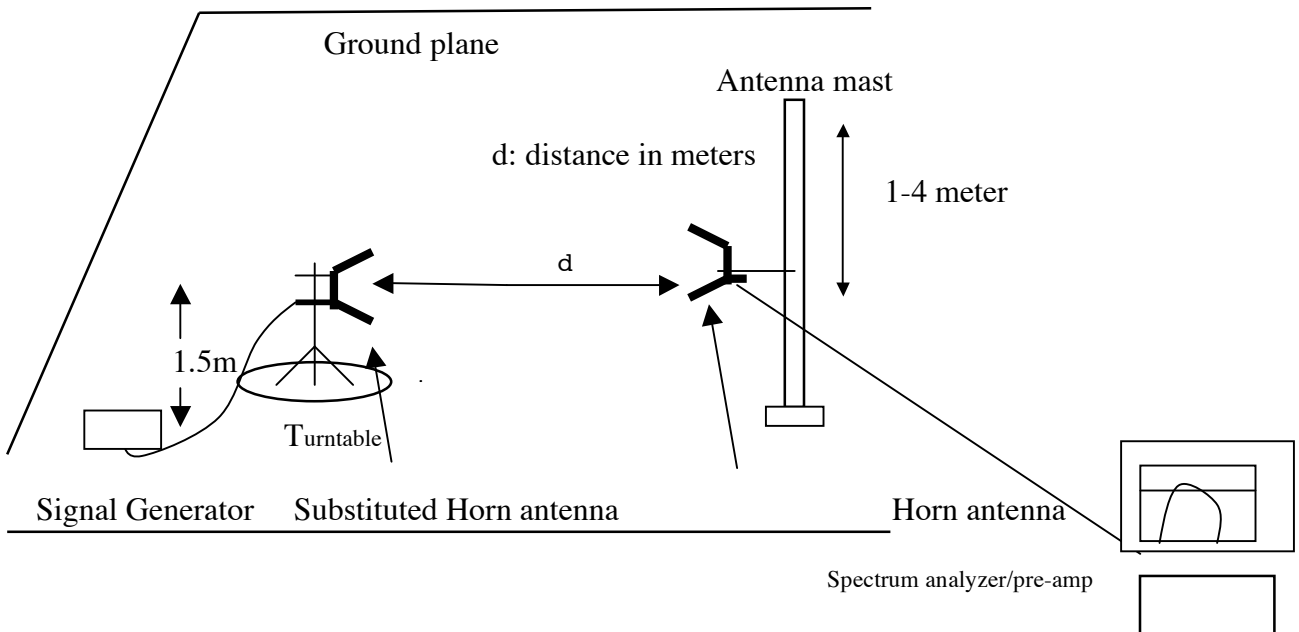
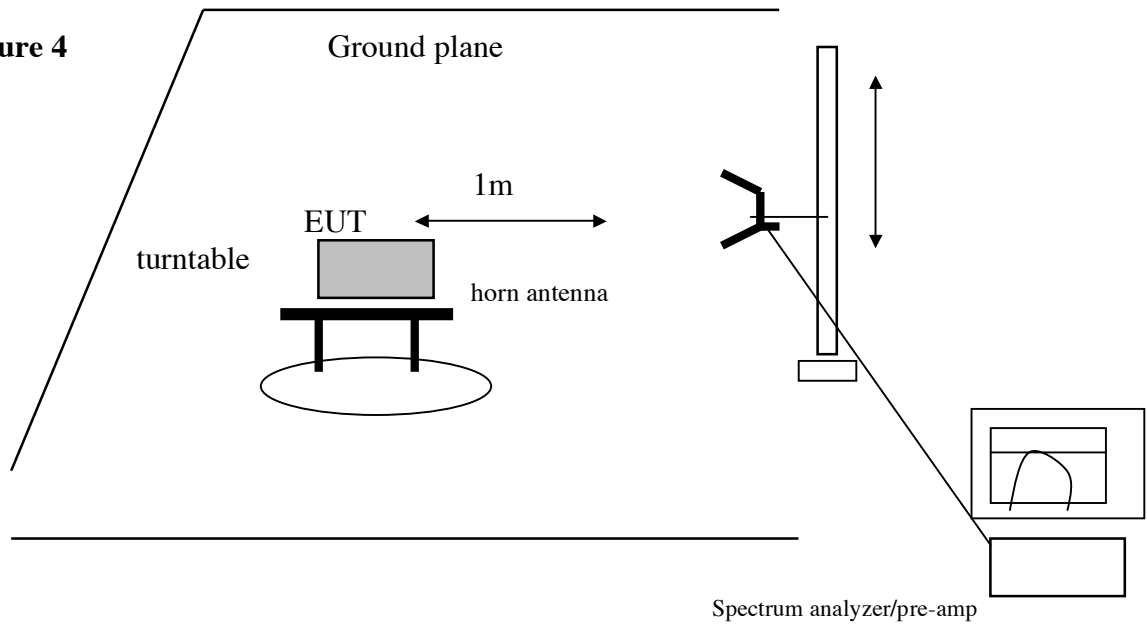
Spurious emissions, Analog, 25 kHz channel
952.5000 and 959.91875 MHz



Section 2.1053 Field Strength of Spurious and Harmonic Radiation
Requirement/Limit: 101.111(a)5

Test Set-Up

Figure 4



Minimum Requirement

-20 dBm ERP beyond 250% of authorized bandwidth

Test Method

The antenna output port of the EUT was terminated with a 50-ohm load. With the transmitter operating at full power, the EUT was rotated 360° and the search antenna was raised and lowered in both polarities, all in an attempt to maximize the levels of the received emission for each harmonic and spurious emission up to 10 fo.

The EUT was removed and was replaced by a substitution antenna connected via coax to a signal generator. The generator output was set to each emission frequency detected, the search antenna was raised and lowered, the turntable was rotated, and until the maximum emission level was obtained. The signal generator output level was adjusted to match the radiated emission level from the EUT. After correcting for substitution antenna factor and generator cable loss, output power level is compared to the limit.

Test Results

Pass. All emissions detected were at least 24.5 dB below limits. Refer to worst-case data below.

Company: Alligator / Tom Cokenias
Project #: 06U10295-1
Date: 05/12/06
Test Engineer: William Zhuang
Configuration: Analog Narrow Band
Mode: Tx On, 932.5MHz
Average Power Meter: Low = xx dBm, Mid = xx dBm, High = xx dBm

EMCO Horn 1-18GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m		ERP

Hi Frequency Cables

☒ (2 ft)	☐ (2 ~ 3 ft)	☐ (4 ~ 6 ft)	☒ (12 ft)
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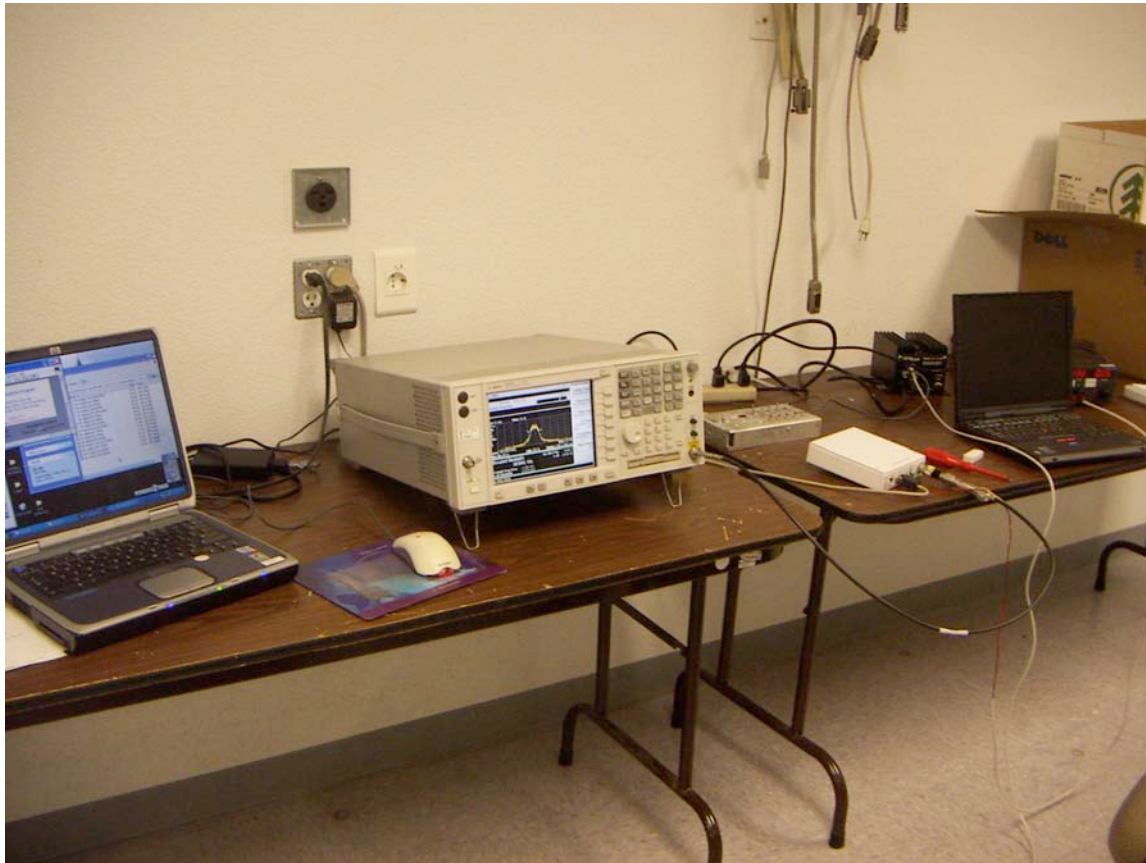
Pre-amplifier 1-26GHz	Pre-amplifier
T87 Miteq 924342	

[illegible]

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Test Set-up Photographs

Antenna port conducted emissions



Radiated emissions

