EXHIBITS

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EXHIBIT 1: Letter Requesting Confidentiality under Sec. 0.457(d)

Thomas N. Cokenias *EMC &Radio Approvals*
Test & Consulting Services for Commercial, Military, International Compliance
P.O. Box 1086
El Granada, CA 94018

12 August 1999

FCC Laboratory
7435 Oakland Mills Road
Columbia, MD 21046

Attention: Application Examiner
Reviewing Engineer

Re: Request for confidentiality per Section 0.459 of FCC Rules

Applicant: Watkins-Johnson Company

FCC ID: NTTSX1115

To whom it may concern,

Request is hereby submitted, on behalf of my client Watkins Johnson Co., to withhold from public review certain portions of the application for equipment certification for the referenced FCC identifier. In particular, the following sections of the application and report are requested to be kept confidential:

Schematics
Block diagrams
Theory of operation (P2P Architecture)

Rationale for request for confidentiality:

Watkins Johnson has invested considerable time and materials in research and development to produce the referenced product. Disclosure of the confidential portions of this application to competitors would give them competitive advantage in developing similar products.

The $135 fee for confidentiality has been submitted along with the fee for certification. If you have questions or need further information, please contact the undersigned.

Sincerely,

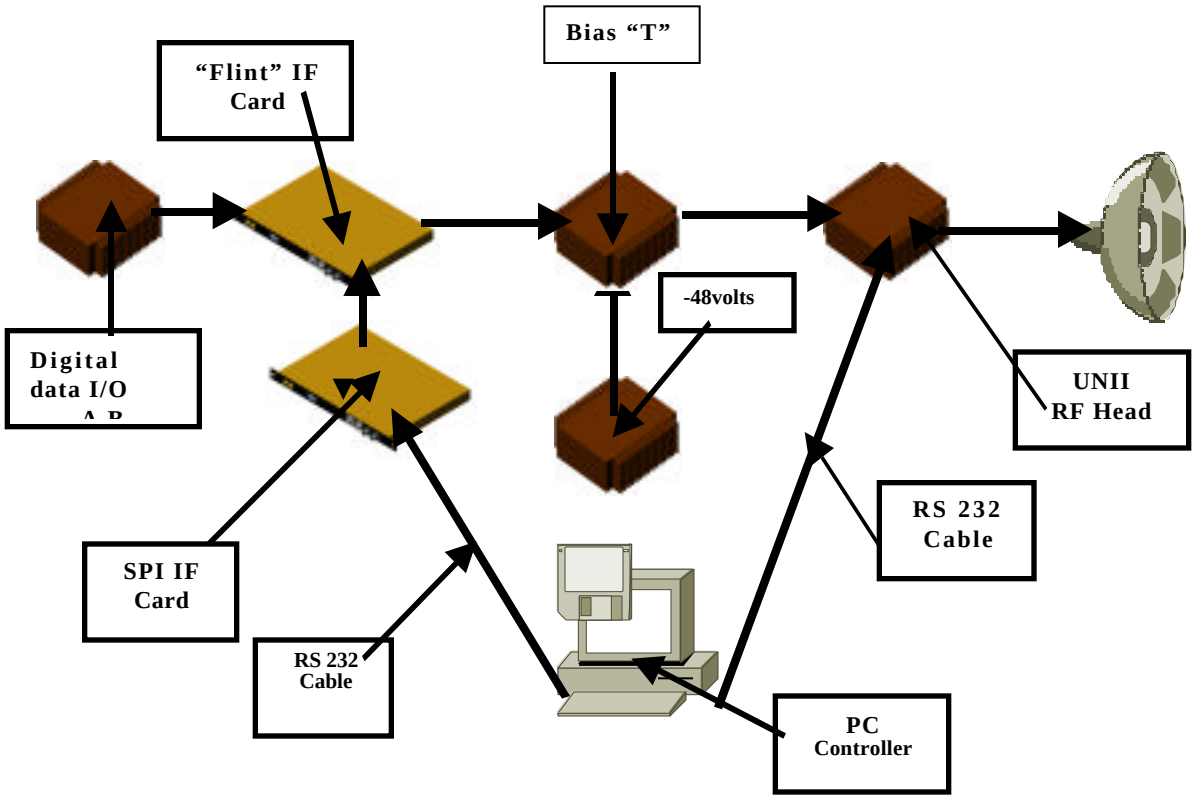
THOMAS N. COKENIAS
EMC Consultant/Agent for Watkins Johnson Co.

Tel 650 726 1263 *fax 650 726 1252* *trephonc@macconnect.com*

EXHIBIT 2: Product Description and Operation Overview

The Watkins Johnson FCC ID: NTTSX1115 is a UNII transceiver operating under the provisions of Part 15 of the Rules. The product functions as a point to point (P2P) wireless router.

Refer to the system module diagram below:



Product development strategy is to follow a modular approach.

Digital data I/O for the initial version of the system will be a line card that will fit into a standard router chassis. For test purposes, a Tektronix arbitrary waveform generator will simulate the signal output of the router/line card combination.

The **IF card** up-link performs the modulation functions of the system. A 324 MHz signal is modulated with the digital data stream using Orthogonal Frequency Division Multiplexing (OFDM) techniques. The system is capable of producing channel bandwidths in 6 MHz multiples. The system will be configurable for use with 6 MHz and 12 MHz channel bandwidths.

For the down-link signal, the IF card demodulates the receiver IF signal from the RF head and routes the demodulated digital information to the digital I/O card.

The **bias "T"** provides DC and the 324 MHz IF signal on a single coaxial cable for routing to the RF head.

The **RF head** produces the RF transmit link at 5.725 - 5.825 GHz , and houses the receiver LNAs, receiver local oscillator, and the receiver IF bandpass filters and IF amplifiers. The RF head also houses the TX-RX diplexer.

The **PC controller** and **RS 232 cables** are for system control and set-up for testing purposes.

The antenna shown in the diagram is specified but not supplied by Watkins-Johnson. The –48 VDC supply shown in the diagram is telephone central office (CO) power or a customer provided supply.

SPECIFICATIONS

RF Head

Frequency range:	5.725 - 5.825 GHz
Power output:	25 dBm maximum (5-25 dBm in 1 dB steps)
Channel Bandwidth:	6 MHz and 12 MHz, configurable

IF Head

Frequency range:	324 MHz 24 MHz clock	
Power output:	324 MHz: 24 MHz:	-13 dBm nominal (programmable) -12 dBm nominal
Data transfer rate, air link:	44 Mbs/sec (12 MHz channels)	
Modulation:	OFDM (Orthogonal Frequency Division Multiplexing)	
	6 MHz channel: 12 MHz channel:	512 tones, 64 QAM 1024 tones, 64 QAM

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

System Interconnection

- refer to attachment *fccbloc.pdf*

EXHIBIT 3: Information for which Confidentiality is Requested

Schematics
Block Diagrams
Theory of Operations

EXHIBIT 4: Product Photographs

refer to .jpg attachments

EXHIBIT 5: User Manual and FCC ID Label

-refer to separate attachments

EXHIBIT 6: RF Hazard Information Per Sec. 1.1307

For transmitters operating in the 5725-5825 MHz frequency range, paragraph 1.1310 limits maximum permissible exposure (MPE) to 1 mW/cm2 for uncontrolled environments, and 5 mW/cm2 for controlled environments.

The maximum distance from the antenna at which MPE is met or exceeded is calculated from the equation relating field strength in V/m, transmit power in watts, transmit antenna gain, and separation distance in meters:

E,V/m = (√(30*P*G))/d

Power density, mW/m2 = E^2/3770

E for MPE 1mW/m2 = 61.4 V/m E for MPE 5 mW/m2 = 136 V/m

Simplifying and rearranging terms:

d = (√(30*P*G))/61.4 Converting to decibels:

20 log d = 10 log 30 + 10 log P watts + G dBi -35.8 dB

20 log d = 14.77 + PdBm - 30 dB -35.8 + GdBi

20 log d = P dBm + G dBi -51 ; **d = 10^(PdBm+GdBi-51)/20**

Worst-case assumption is for 1.0 mW/cm2 uncontrolled environment:

Antenna	53 - G dBi	MPE distance, cm	Comments
34 dBi	19 dBm	1260	max EIRP per 15.407
26 dBi	24.8 dBm	977	max power for 17 dBm/MHz
22 dBi	24.8 dBm	617	max power for 17 dBm/MHz
14 dBi	24.8 dBm	245	max power for 17 dBm/MHz
8 dBi	24.8 dBm	123	max power for 17 dBm/MHz

Instructions will be placed in the user manual instructing installers and users to maintain the MPE distances during operation of the EUT.

EXHIBIT 7: Report of Measurements

FCC CERTIFICATION INFORMATION

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

2.1033(b)1 **Applicant:** Watkins Johnson
3333 Hillview Avenue
Palo Alto, CA 94304

2.1033(b)2 **FCC ID**: NTTSX115

2.1033(b)3 **Installation instructions** are found in attached document.

2.1033(b)4 A **brief description of the circuit functions** is found in attached document

2.1033(b)5 **Block diagram** is found in attached document

2.1033(b)6 **Report of measurements** is found below.

2.1033(b)7 **Product photographs** are attached in JPEG format.

2.1033(b)8 The EUT is operated with several **accessory devices** described below and in the attachments submitted.

2.1033(b) 9 The equipment for which certification is being sought **meet/does not require authorization under 15.37 transition provisions.**

2.1033(b)10 - 12 NOT APPLICABLE

15.203 The WJ UNII radio will be professionally installed. At present, there are five antennas specified for use with the radio:

34 dBi dish 26 dBi flat panel array 22 dBi dish

14 dBi corner reflector 8 dBi flat panel array

SUMMARY OF TEST RESULTS

15.407 General Technical Requirements

The UNII requirements for maximum power, peak power spectral density, minimum 26 dB emissions bandwidth, and maximum EIRP are interdependent variables. In addition, the level of transmitter spectral re-growth at the UNII band edges will limit the power output that may be transmitted into a particular antenna, since the emission limit is -17 or -25dBm/MHz EIRP, dependent on both antenna gain and power input.

The WJ UNII radio has user programmable output power levels from 5 - 25 dBm.

The 26 dB channel bandwidths, also user programmable, are either 6 MHz or 12 MHz .

A number of antennas can be used with the point-to-point UNII radio, with gains that vary between 8 dBi and 34 dBi.

15.407(a)3 Power limits

17 dBm + 10 log (6) = **24.8 dBm max. for 6 MHz channel**
17 dBm + 10log(12)= **27.8 dBm max. for 12 MHz channel**

As is demonstrated by attached spectrum analyzer plots, the spectral output of the OFDM modulation is flat over the emission bandwidth and then drops off vertically; as such, maximum power spectral density can be calculated:

Peak power spectral density: 24.8 dBm/6MHz -10 log (6) = **17 dBm/MHz**
27.8 dBm/12MHz - 10log(12) = **17 dBm/MHz**

For point-to-point transceivers:

Maximum EIRP: 1 watt (30dBm) + 23 dBi = **53 dBm EIRP**

Maximum Power, dBm, into antenna

	34 dBi 6MHz	34 dBi 12MHz	26 dBi 6 MHz	26dBi 12MHz	22 dBi 6MHz	22 dBi 12MHz	14 dBi 6MHz	14 dBi 12MHz	8 dBi 6MHz	8dBi 12MHz
fo MHz										
5739	19	19	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8
5736	19	18	24.8	24	24.8	24.8	24.8	24.8	24.8	24.8
5733	19	**	24.8	19	24.8	22	24.8	24.8	24.8	24.8
5730	**	**	15	**	18	**	24	**	24.8	**
5820	15	**	21	**	22	**	24.8	**	24.8	**
5817	18	17	24.8	23	24.8	24	24.8	24.8	24.8	24.8
5814	19	19	24.8	24	24.8	24.8	24.8	24.8	24.8	24.8
5811	19	19	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.8

**<15 dBm. Channel/antenna combination will not be used. 24.8dBm is power limit for staying below 17 dBm/MHz limit in 15.407

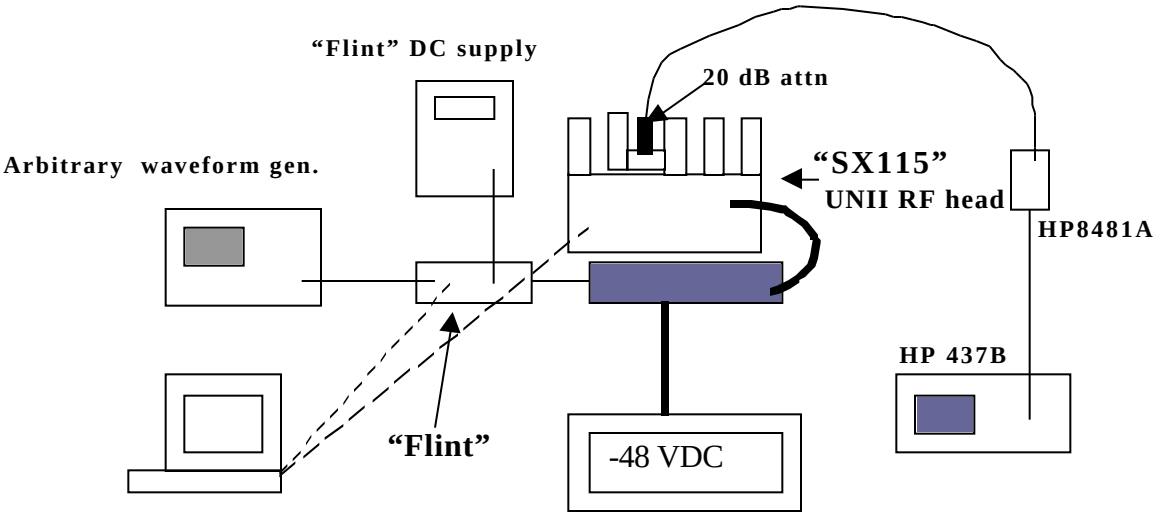
The tabulated results were determined from spectrum analyzer investigation of bandedge emissions. Sample spectrum analyzer plots are attached below.

15.407 RF Output Power Measurements

Measurement equipment used:

HP 437B Power meter
HP 8381A power sensor

Test set-up:



Test Procedures

1. Set the "Flint" channel bandwidth parameters and output level to desired values. Output level is chosen to maximize RF output level from SX115 UNII RF head while keeping spectral re-growth and spurious emissions from SX115 UNII RF at acceptably low levels.
2. Set SX115 UNII RF output power and channel bandwidth parameters as required.

Test Results: Power Output, Max

F(MHz)	Pout, 6 MHz Ch. BW	Pout, 12 MHz Ch BW
5730	25.2	NOT USED
5733	25.3	24.9
5736	25.1	25.0
5739	25.1	25.1
5775	25.1	25.3
5811	25.2	24.9
5814	25.6	25.0
5817	25.5	25.2
5820	25.5	NOT USED

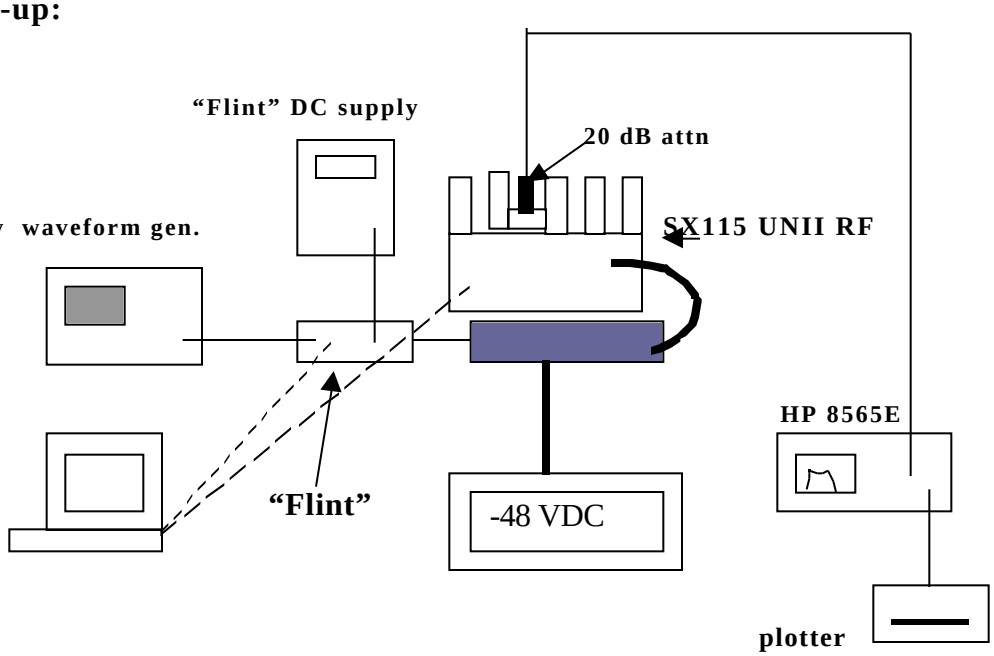
**NOTE: Above power levels were maximum achieved using software GUI. In actual use, maximum power levels chosen must meet power spectral density requirements of 15.407, as well as band edge undesired emissions levels of -17 dBm/MHz EIRP and -27 dBm/MHz EIRP. Refer to p. 14 above for limits.

Antenna Conducted Output (For determining bandedge EIRP)

Measurement equipment used:

HP 8565E spectrum analyzer

Test set-up:



Test Procedures

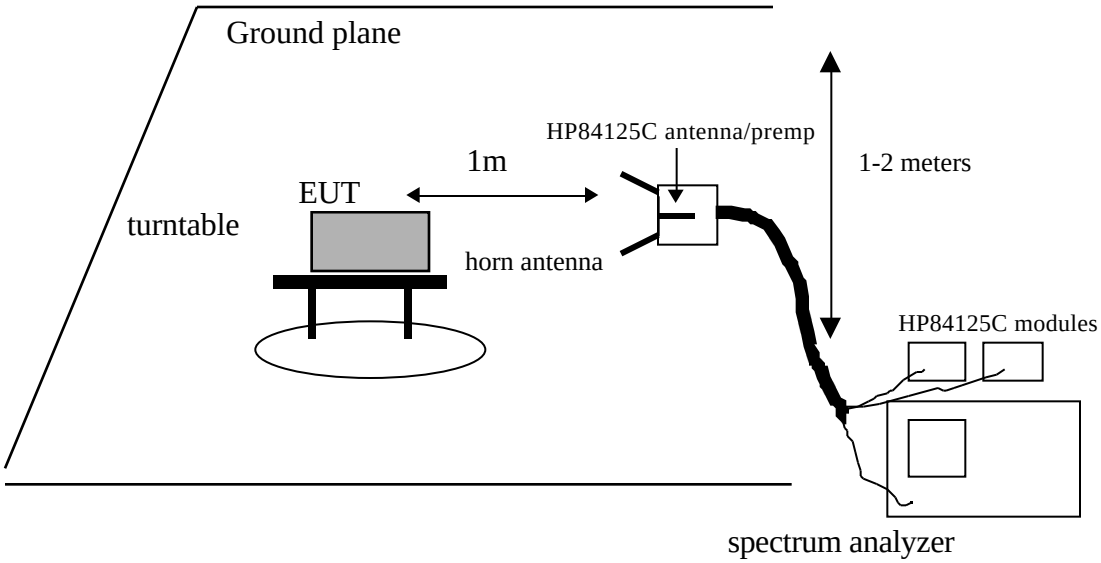
1. Set spectrum analyzer to TX output center frequency, RES BW = 100 kHz,
   VID BW = 300 Hz - 3 kHz.
3. Use analyzer MKR funtion to measure output at bandedge and 10 MHz from bandedge
4. Nomalize to 1 MHz: Reading, dBm + 10log(1MHz/meas BW)
5. Add antenna gain and compare to -17dBm/MHz and -27dBm/MHz
6. Plot spectrum analyzer data

15.407(c)6 Field Strength of Spurious and Harmonic Radiation

Measurement Equipment Used:

HP 8565E Spectrum Analyzer
HP 84125C Microwave EMI Measurement System

Test Set-Up



Minimum Requirement

For restricted band emissions listed in 15.205 that are above 1 GHz, the limit of each spurious and harmonic emission detected shall be no more than

54 dBuV/m at 3m separation, using an average detector

74 dBuV/m at 3m separation, using a peak detector

Test Method

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 40 GHz.

Test Results

No emissions above instrumentation noise floor were detected. Tests were repeated at 1m and at 1ft separations. It was determined that there were no emissions within 10-20 dB of the limit, even at 1 ft separation. Tests were performed for each of the 5 antennas at a LOW, MID, and HIGH channel:

15.205 Radiated Emissions at 1 ft separation, MID Channel

fo = 5775 MHz	34 dBi E, dBuV/m, 1ft	26 dBi E, dBuV/m, 1ft	22 dBi E, dBuV/m, 1ft	14 dBi E, dBuV/m, 1ft	8 dBi E, dBuV/m, 1ft
3.5-18 GHz	42-50 dBuV/m	42-50 dBuV/m	42-50 dBuV/m	42-50 dBuV/m	42-50 dBuV/m
18-26.5 GHz	50-55 dBuV/m	50-55 dBuV/m	50-55 dBuV/m	50-55 dBuV/m	50-55 dBuV/m
26.5-40 GHz	50-63 dBuV/m	50-63 dBuV/m	50-63 dBuV/m	50-63 dBuV/m	50-63 dBuV/m

15.205 Radiated Emissions at 1 ft separation, HIGH Channel

fo = 5820 MHz	34 dBi E, dBuV/m, 1ft	26 dBi E, dBuV/m, 1ft	22 dBi E, dBuV/m, 1ft	14 dBi E, dBuV/m, 1ft	8 dBi E, dBuV/m, 1ft
3.5-18 GHz	42-50 dBuV/m	42-50 dBuV/m	42-50 dBuV/m	42-50 dBuV/m	42-50 dBuV/m
18-26.5 GHz	50-55 dBuV/m	50-55 dBuV/m	50-55 dBuV/m	50-55 dBuV/m	50-55 dBuV/m
26.5-40 GHz	50-63 dBuV/m	50-63 dBuV/m	50-63 dBuV/m	50-63 dBuV/m	50-63 dBuV/m

15.205 Radiated Emissions at 1 ft separation, LOW Channel

fo = 5733 MHz	34 dBi E, dBuV/m, 1ft	26 dBi E, dBuV/m, 1ft	22 dBi E, dBuV/m, 1ft	14 dBi E, dBuV/m, 1ft	8 dBi E, dBuV/m, 1ft
3.5-18 GHz	42-50 dBuV/m	42-50 dBuV/m	42-50 dBuV/m	42-50 dBuV/m	42-50 dBuV/m
18-26.5 GHz	50-55 dBuV/m	50-55 dBuV/m	50-55 dBuV/m	50-55 dBuV/m	50-55 dBuV/m
26.5-40 GHz	50-63 dBuV/m	50-63 dBuV/m	50-63 dBuV/m	50-63 dBuV/m	50-63 dBuV/m

The HP84125C, when used with the memory card supplied with it, applies all corrections such as cable loss, antenna factor, and amplifier gains to the received signal and displays a corrected field strength level on the spectrum analyzer screen. System operation is verified per user manual by connecting a signal generator to where the antenna port would normally connect, and comparing the displayed emission level with the theoretical level calculated for the system loss/gain parameters.

When checked in this manner, the HP84125C system readings were within+/- 2 dB of calculated values.

Part 15 Digital Device Emissions

Tests were performed to measure radiated emissions per 15.109 of the Rules. A separate verification report is being held on file by the manufacturer.

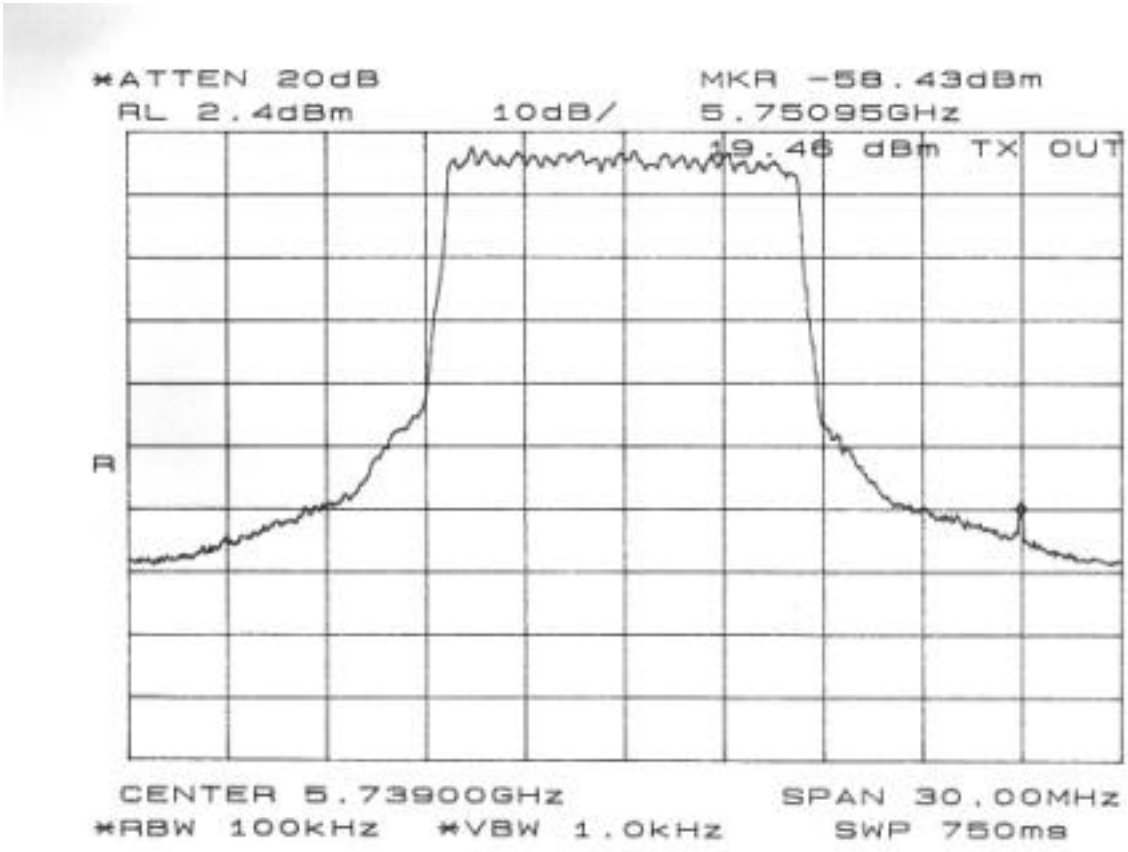
Test Site

All radiated testing was performed at Cisco Systems by me or under my supervision. Antenna conducted RF emissions were performed at Watkins Johnson and at Cisco. 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

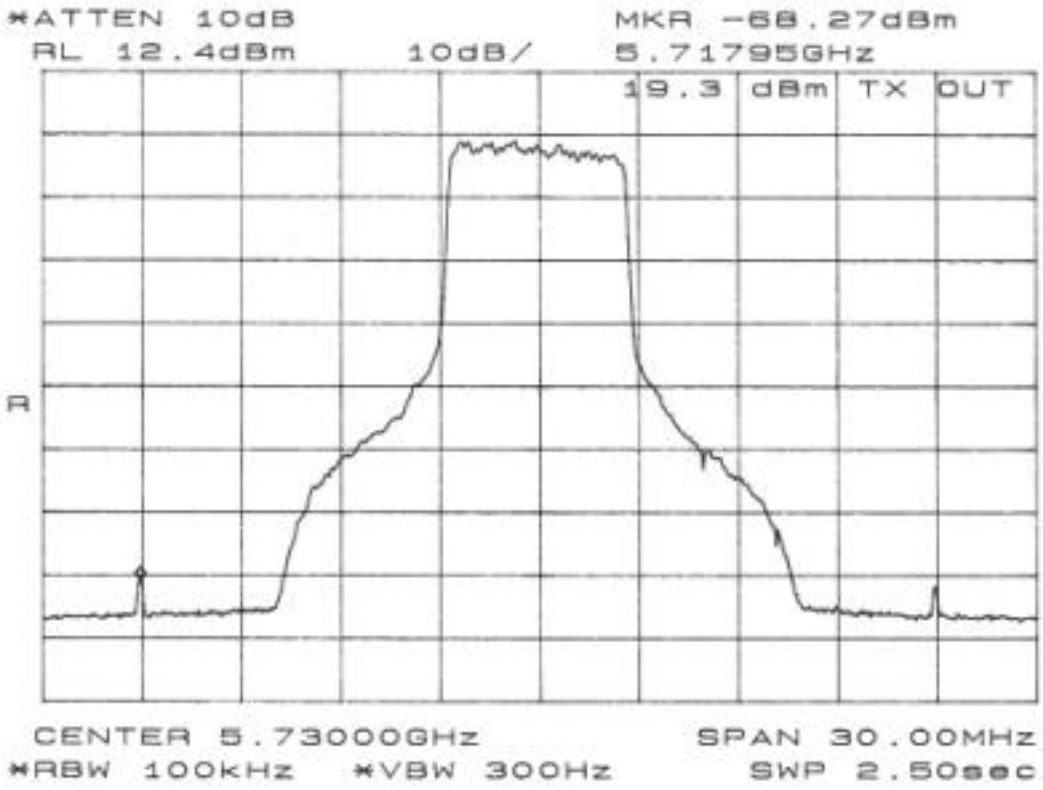
EXHIBIT 8: Data Graphs: Band Edge

12 MHz Channel, 5739 MHz Channel at 19.46 dBm out



12 MHz Channel, 5811 MHz Channel at 19.2 dBm out

6 MHz Channel, 5730 MHz Channel at 19.3 dBm out



6 MHz Channel, 5820 MHz Channel at 15.6 dBm out

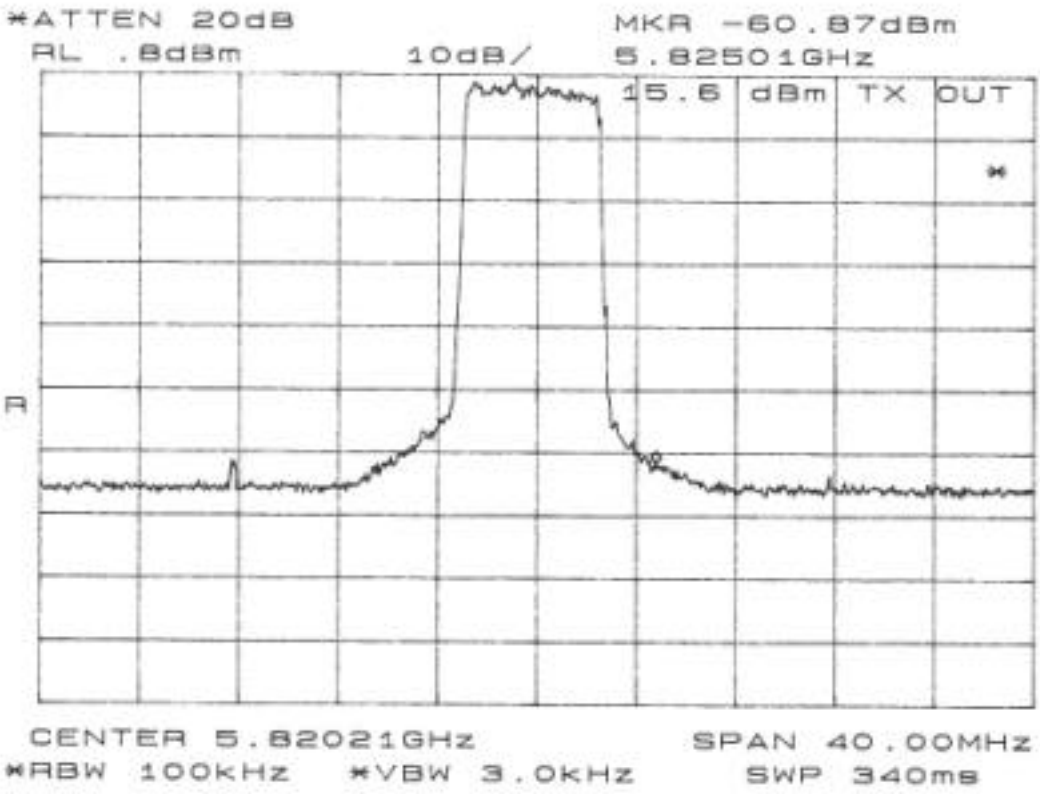
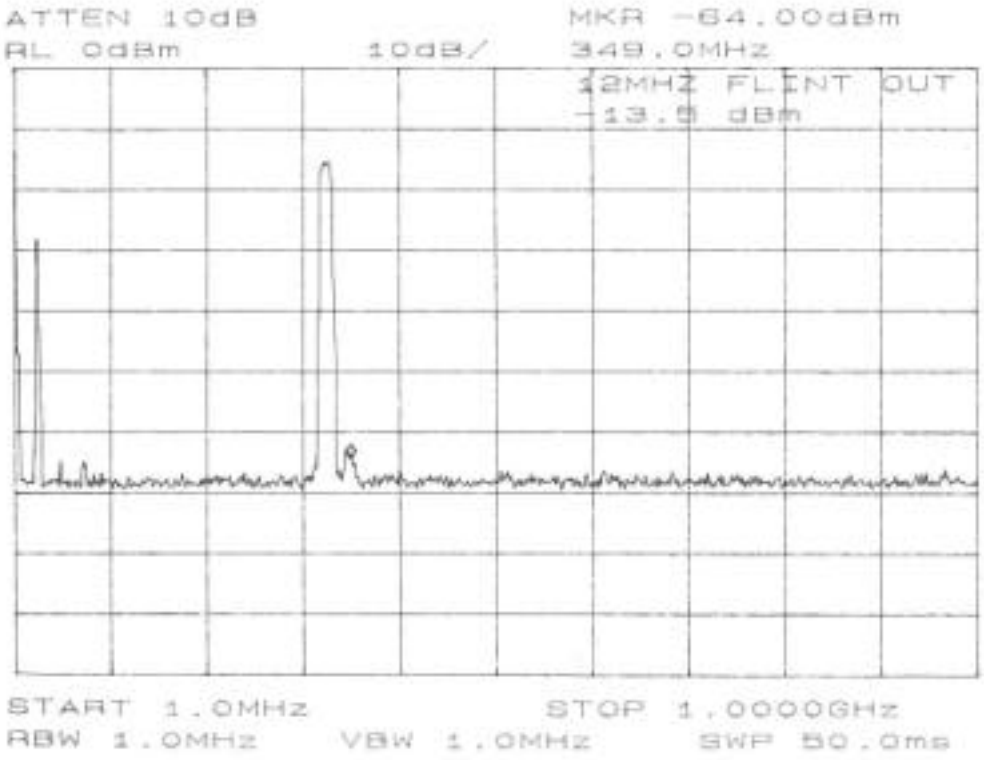


EXHIBIT 9 IF Card TX Signals to RF Module

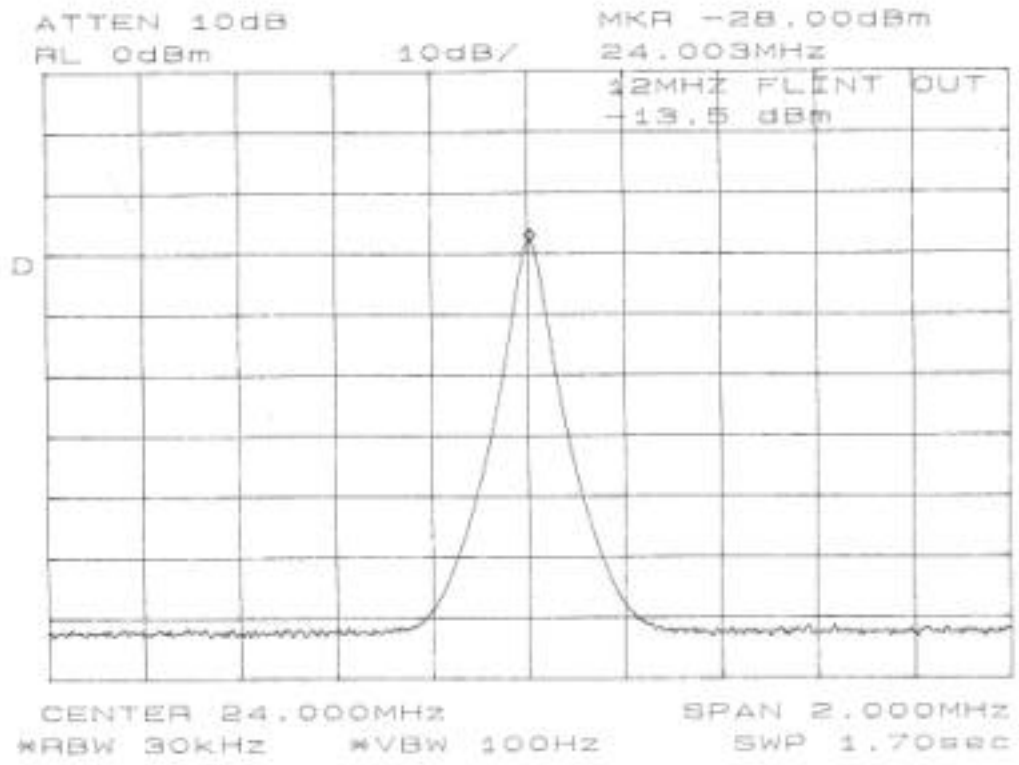
NOTE:

The graph labeled "12 MHz output, 3 of 3" shows a rounding at the edges that is characteristic of spectral re-growth for an over-driven spectrum analyzer, caused by incorrect attenuator settings. The settings were corrected for subsequent tests but in error the 12 MHz Flint output measurement was not plotted the second time. The actual signal has much steeper sides as can be deduced from the 12 MHz channel plots at the UNII frequency outputs.

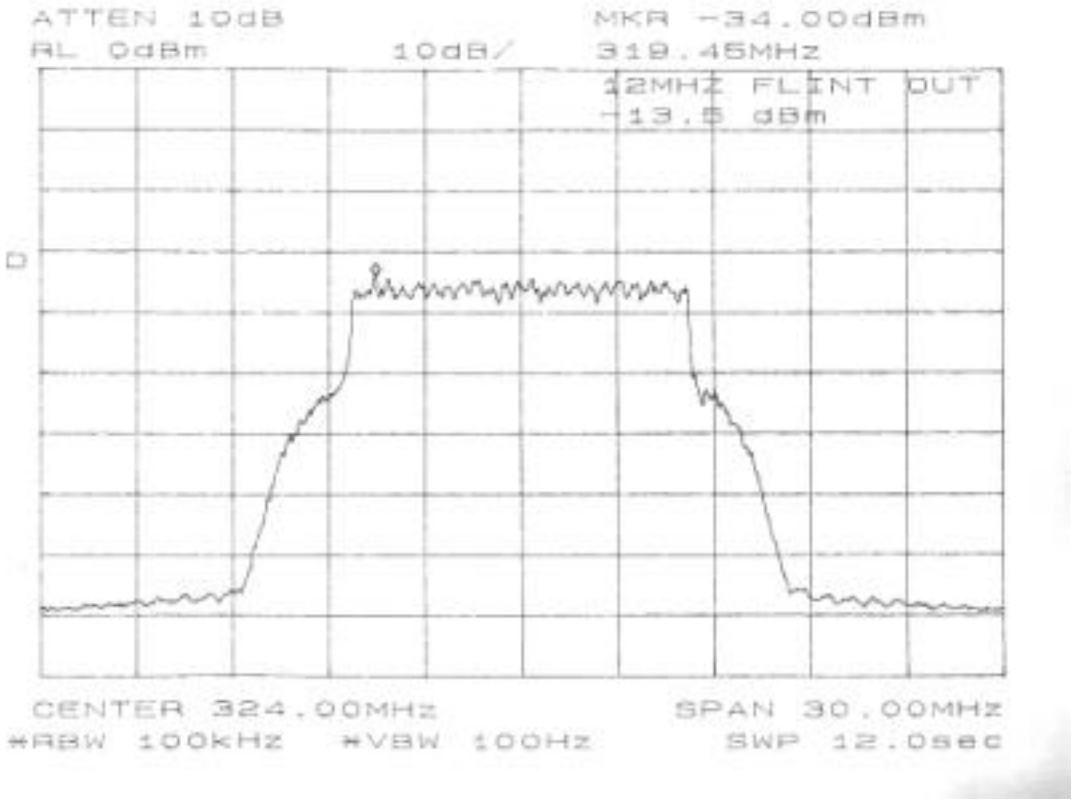
12 MHz output, 1 of 3



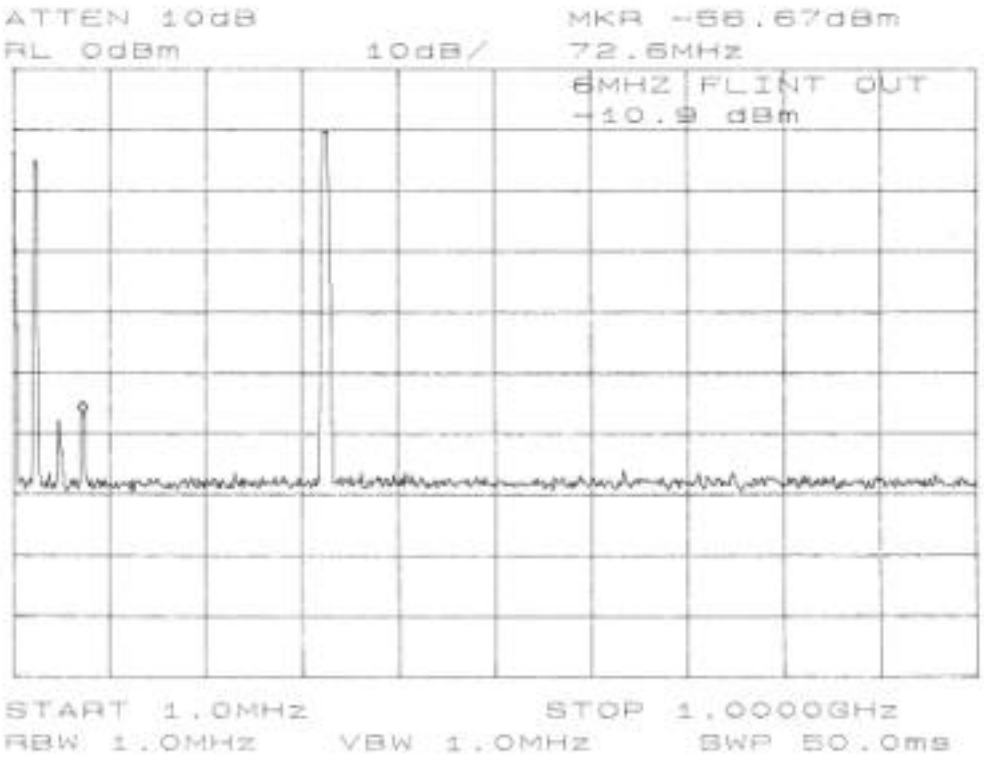
12 MHz output, 2 of 3



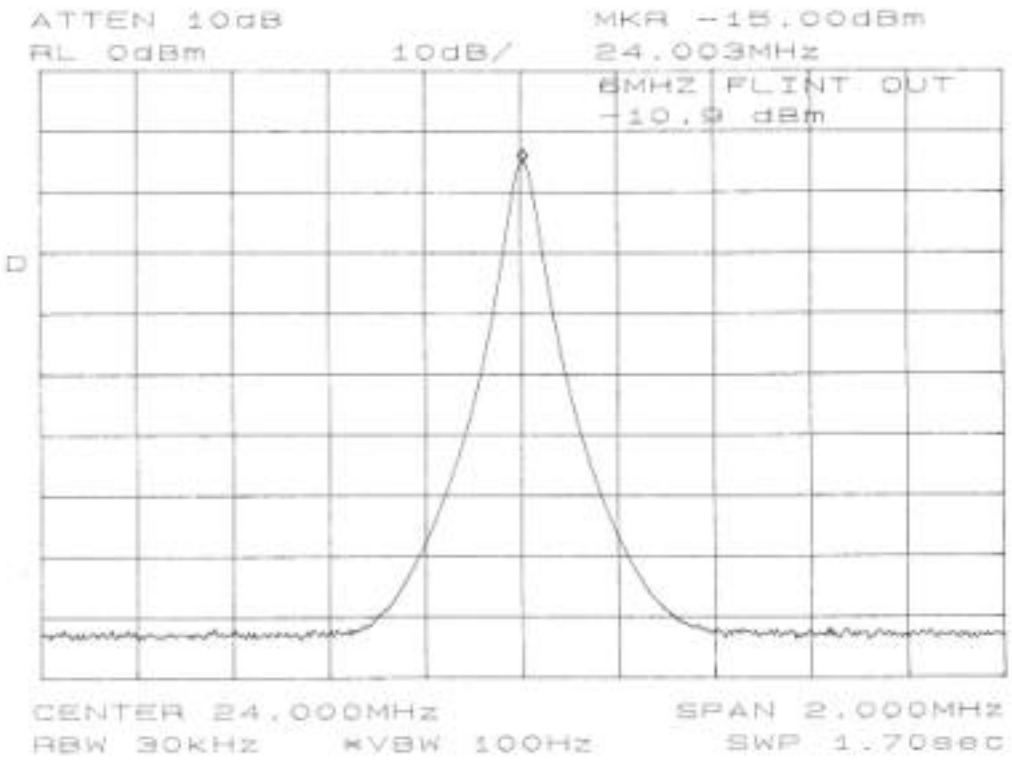
12 MHz output, 3 of 3



6 MHz output, 1 of 3



6 MHz output, 2 of 3



6 MHz output, 3 of 3

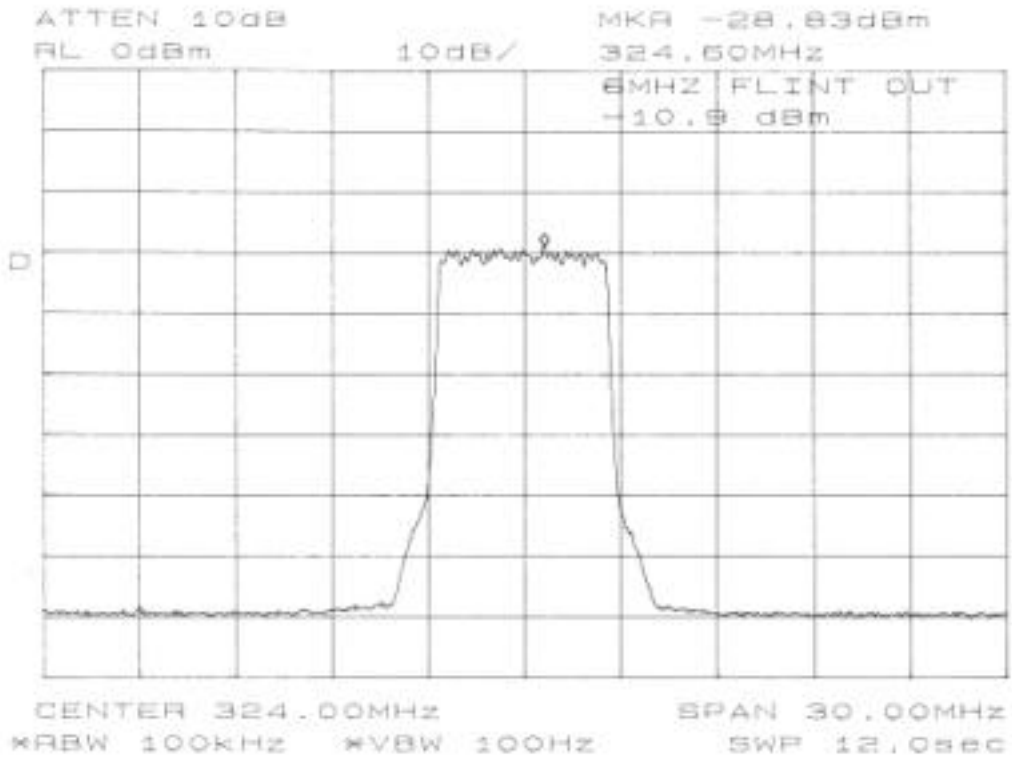


EXHIBIT 10:

HP84125C Output Display, Noise Floor