Pd-TX-100S TEST DATA

Pd-TX-100S RF Power Output:

Relevant FCC Chapter:

"§ 2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

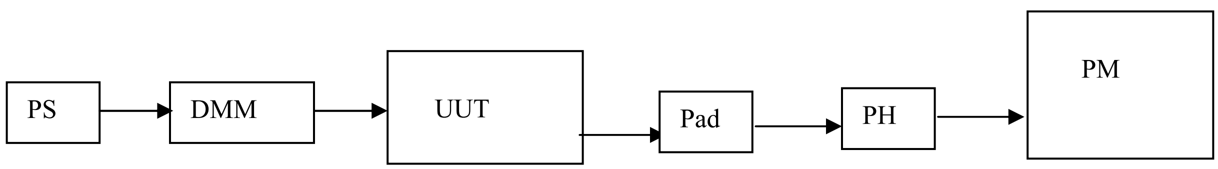
§ 2.1033 Application for certification.

(c) Applications for equipment other than that operating under parts 15 and 18 of the rules shall be accompanied by a technical report containing the following information:

(8) The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range."

Test Setup:

The setup for this test is shown below.



PS – Power Supply – Leader718-5D
DMM – Digital Multi-Meter – HP 3478A – 2619A31605
UUT – PD-TX-100
Pad – 20 dB Pad – Mini Circuits VAT20
PH – Power Head – HP 8481A – SN 2702A53289
PM – Power Meter - HP 435B - SN 2342A06959

Test Method:

The Unit Under Test (UUT) is powered up with a nominal 12.0 VDC power supply and swept across its frequency range with the internal attenuator set to 0dB via the manufacturing calibration software utility. The point on the band with the lowest output is selected and the internal attenuation is increased to set the output to just below 100mW. The calibration utility is limited to 1 dB resolution. Due to the integrated nature of the UUT, it is impractical to perform this test while monitoring the specific current draw to the final power amplifier. Therefore the amplifier was disabled to record the quiescent current consumption, then the difference calculated. The quiescent values proved to be frequency independent, and are noted in Figure 1.

The power output and current consumption are recorded as a function of output frequency and supply voltage. The results are presented in figures 1 and 2.

Supply Voltage (VDC)	Quiescent current	Frequency (GHz)					
		2.38		2.43		2.48	
	I (mA)	I (mA)	P(dBm)	I (mA)	P(dBm)	I (mA)	P(dBm)
10	314	408	20	405	19.8	415	20
11	298	345	20	345	19.8	352	20
12	277	313	20	312	19.8	317	20
13	259	284	20	287	19.8	291	20
14	245	261	20	264	19.8	267	20
15	231	243	20	246	19.8	249	20
16	218	229	20	231	19.8	235	20
17	206	216	20	221	19.8	223	20
18	197	204	20	209	19.8	211	20

Figure 1 – RF power output (dBm) and total current consumption as a function of frequency and supply voltage (Pursuant to FCC Requirement 2.1033(c)(8)) – Raw Data

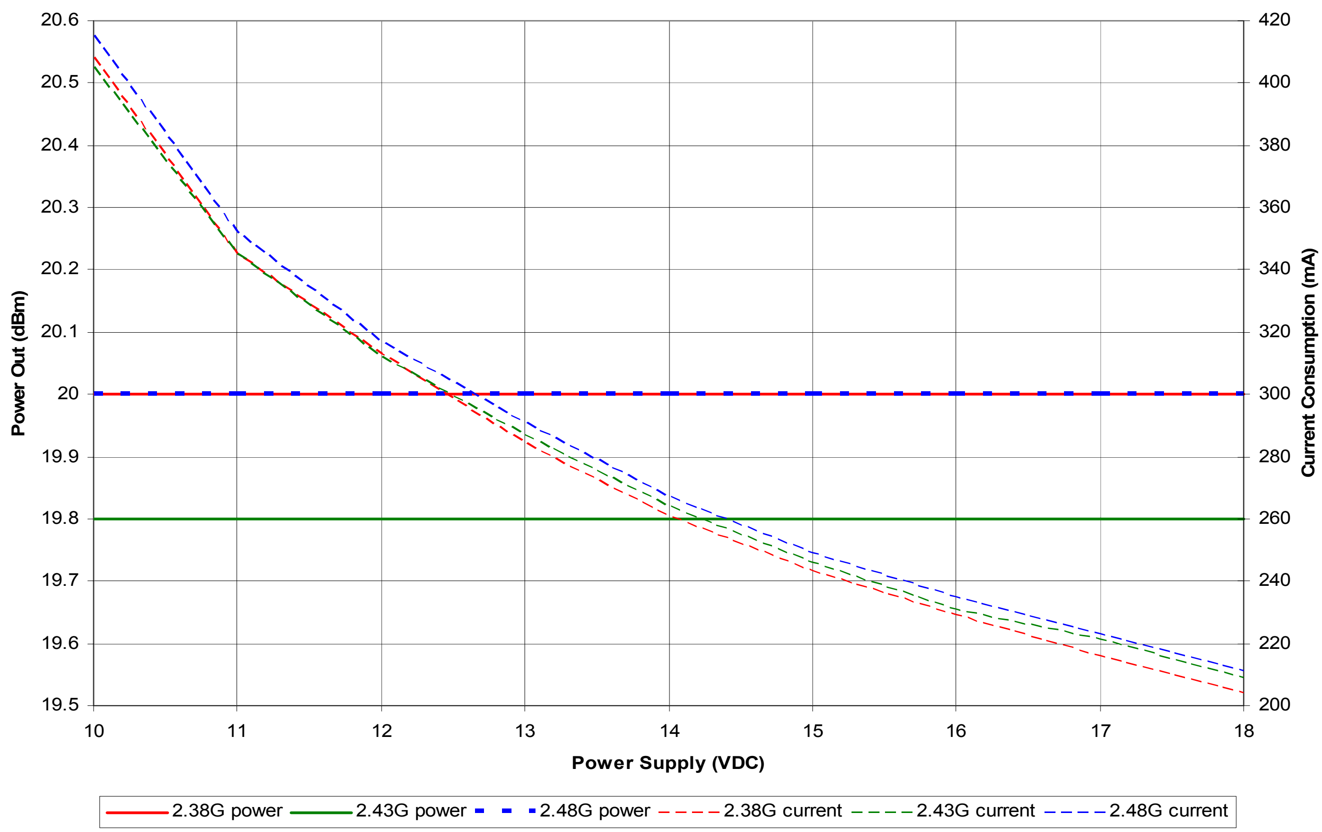


Figure 2 - RF power output (dBm) and total current consumption as a function of frequency and supply voltage (Pursuant to FCC Requirement 2.1033(c)(8))

Pd-TX-100S Modulation Characteristics
Deviation Frequency Response
And
Modulation Sensitivity

Relevant FCC Chapters:
"§ 2.1047 Measurements required: Modulation characteristics.
(d) *Other types of equipment.* A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

Test Method: See below

Test Results:
Since the nature of digital modulation is such that the input signal has no effect on the modulated carrier(s), typical analog audio and video signals will produce the same modulation characteristic as no input signal at all. Therefore, the modulation sensitivity is essentially flat with respect to the frequency and amplitude of the modulating signal. What follows is a brief description of the analog front end of the system:

Video is digitized and compressed using MPEG2 video compression. Two channels of Audio are compressed using a Nicam compression technique. The video, audio and forward error correction bits are multiplexed into one common serial data stream. This data stream is then parceled out to 400 separate carriers in an interlaced manner. The individual carriers are modulated using QPSK at a symbol rate that is approximately 1/(400 x (modulation bits/Hz)).

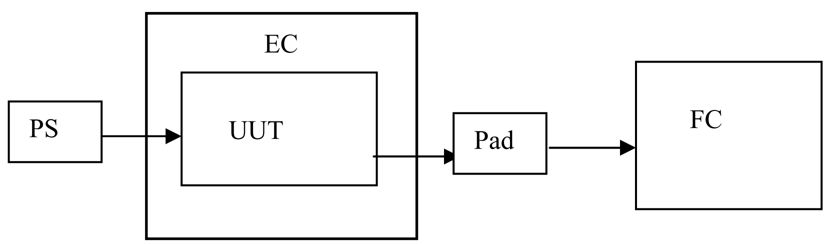
Pd-TX-100S Frequency Stability
Temperature Stability

Relevant FCC Chapter:
"§ 2.1055 Measurements required: Frequency Stability.
(a) The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From -30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

[The Pd-TX-100S does not qualify for exemption under part 90, chapter 2.1055 (a)(2) or (a)(3)]

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

Test Setup:
The setup for this test is shown below.



PS – Power Supply – Leader718-5D
EC – Environmental Chamber – Applied Systems BK-1101 – SN 8665
UUT – Pd-TX-100S
Pad – 20 dB Pad – Mini-Circuits VAT20
FC – Frequency Counter – HP 5351B – SN 3049A01169

Test Method:
The unit under test was powered at 12.0 VDC and set to a carrier frequency of 2.43 GHz. The modulation source was disabled in order to allow the unit to transmit a single CW center frequency carrier. The Environmental Chamber was set to 20°C where a reference was taken, then swept to -30°C in 10° steps. After soaking at -30°C the chamber was reset to 20°Cto verify the reference then swept to 50° in 10° steps. The unit was left at each temperature for 60 minutes before the measurement was made. Since there is no method of keying the transmitter or any form of heating element in the UUT, those results are not required.

Test Results:
The results of the test are shown in Figures 10 and 11.

Frequency Deviation (PPM) as a function of temperature

Temp (°C)	Fr Dev. (PPM)
-30	+.64
-20	+.51
-10	+.51
0	+.54
10	+.28
20	0
30	-.22
40	-.39
50	-.42

Figure 10 – Frequency Stability (Pursuant to FCC Requirement 2.1055a) – Raw Data

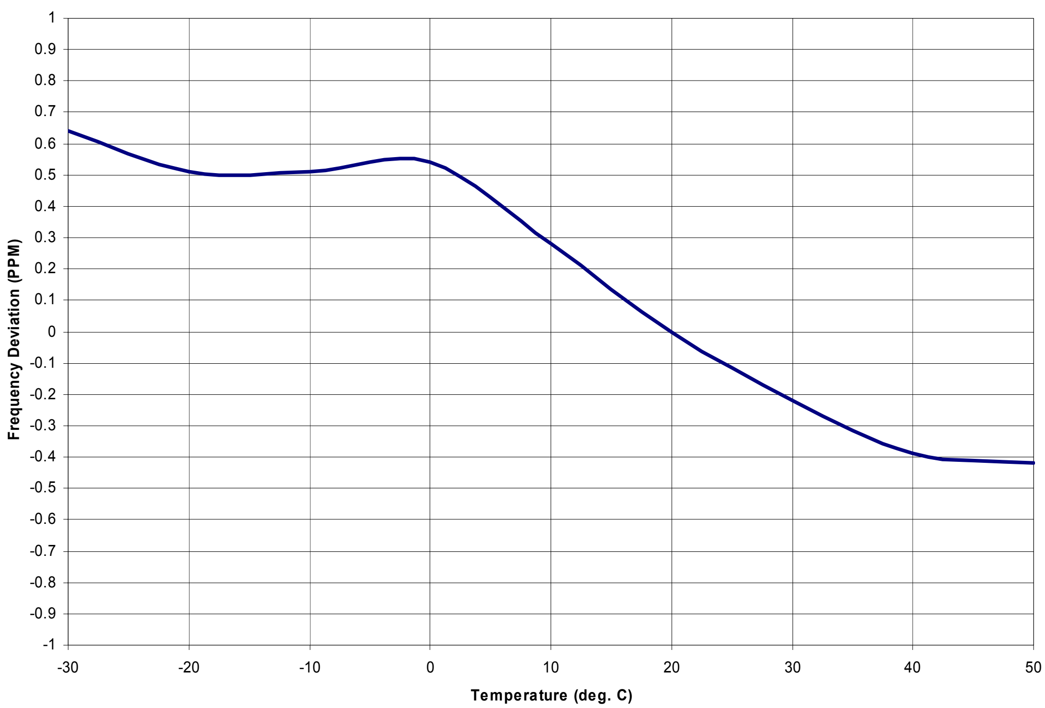
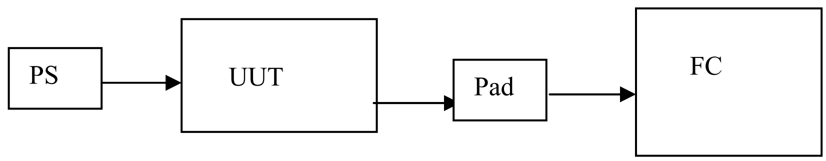


Figure 11 - Frequency Deviation (PPM) as a Function of Temperature (Pursuant to FCC Requirement 2.1055a)

Pd-TX-100S Frequency Stability
Power Supply Stability

Relevant FCC Chapter:
"§ 2.1055 Measurements required: Frequency Stability.
(d) The frequency stability shall be measured with variation of primary supply voltage as follows:
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

Test Setup:
The setup for this test is shown below.



PS – Power Supply – Leader718-5D
UUT – PD-TX-100S
Pad – 20 dB Pad – Mini Circuits VAT20
FC – Frequency Counter – HP 5351B – SN 3049A01169

Test Method:
The UUT was tuned to 2.430 GHz via the User Interface. The Frequency output of the unit under test was measured at supply voltages in 5 increments from 85% to 115% of the nominal 12 VDC.

Test Results: The results of the test are shown in Figures 8 and 9.

Frequency Deviation (PPM) as a function of supply voltage

Voltage (VDC)	Fr Dev. (PPM)
10.2	0
11.1	0
12.0	0
12.9	0
13.8	0

Figure 8 – Frequency Stability (Pursuant to FCC Requirement 2.1055d) – Raw Data

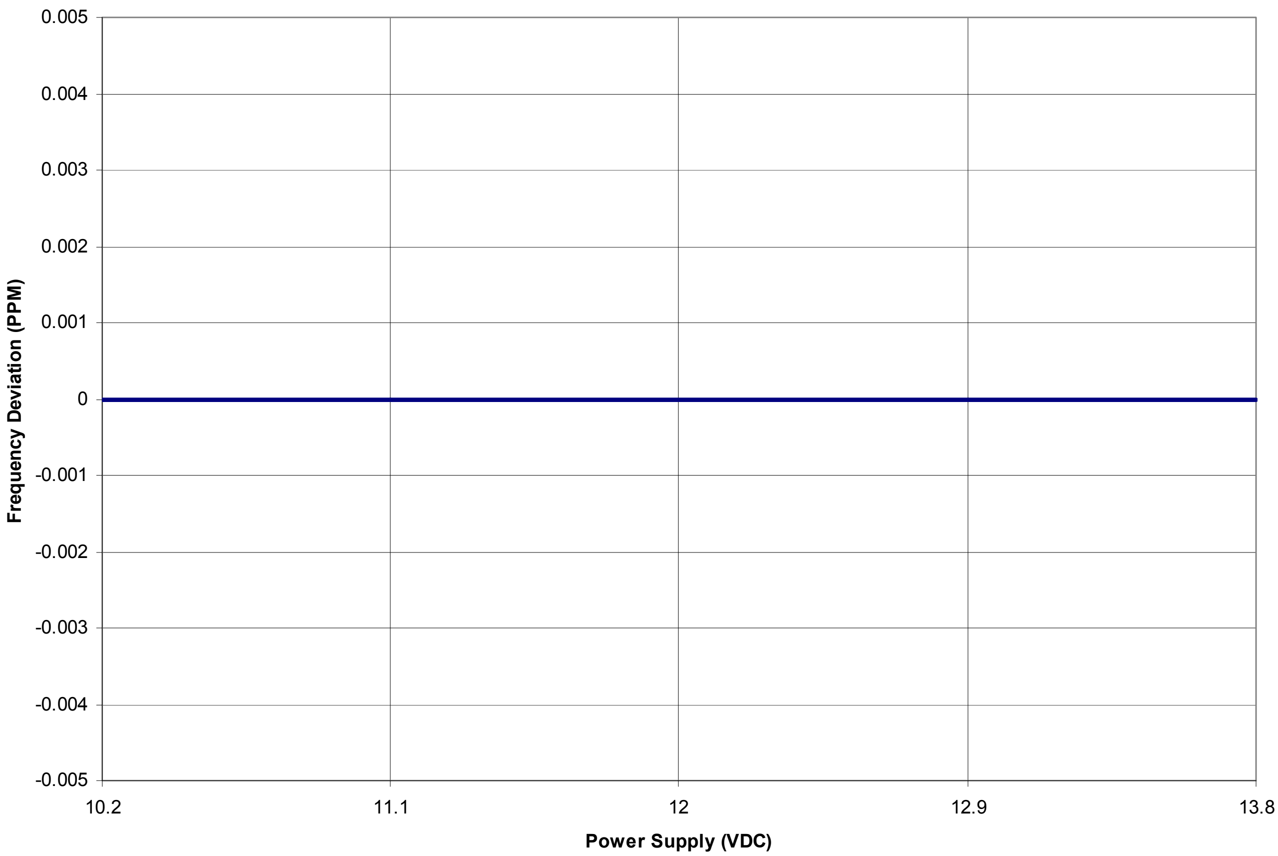


Figure 9 - Frequency Deviation (PPM) as a Function of Supply Voltage (Pursuant to FCC Requirement 2.1055d)

PD-TX-100S Occupied Bandwidth/Spurious Emissions

Relevant FCC Chapters:

§ 2.1049 Measurements required: Occupied bandwidth.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(h) Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

§ 2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

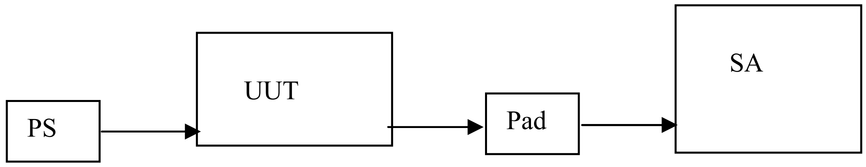
§ 90.210 Emission masks.

(Under Part 90 section 210, the masks for equipment designated to operate in the 2.38 to 2.48 MHz band are not specified in the Applicable Emission Masks Chart. Therefore, while the Pd-TX-1000-M-2.4 has no provision to inject an audio sub carrier into the transmitted RF signal, we have applied Mask B as noted for "All other bands". Although Mask B generally pertains to equipment with an audio low pass filter, Mask C is completely in appropriate in that it does not allow for spread spectrum carriers within the designated bandwidth.)

(b) *Emission Mask B* - For transmitters that are equipped with an audio lowpass filter pursuant to § 90.211(a), the power of any emission must be below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Test Setup:
The setup for this test is shown below.



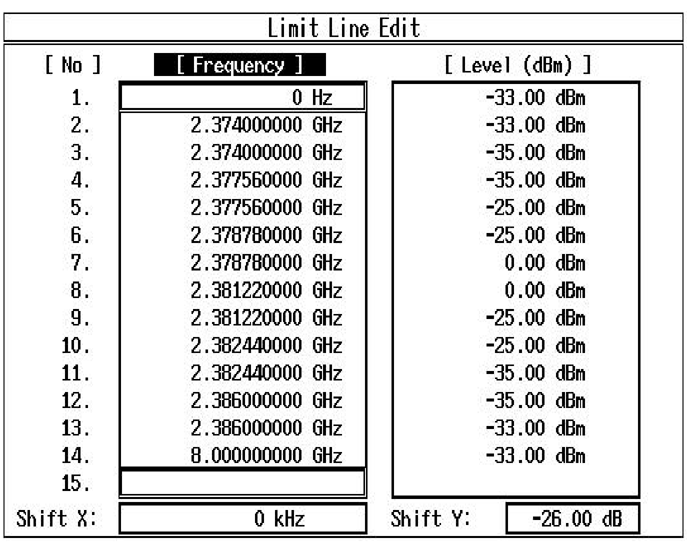
PS – Power Supply – Leader718-5D
UUT – PD-TX-100S
Pad – 20 dB Pad – Mini Circuits VAT30
SA – Spectrum Analyzer – Advantest R3131 – SN 120401992

Test Method:
The unit under test was calibrated as described in the Power Output section ("§ 2.1046) and tested at low, mid and high band frequencies.

For the purpose of calculating mask segments, the power of the unmodulated carrier was 100 mW, therefore the value calculated per 90.210 (b) (3): 43 + 10log(.10) = 33 dB

The mask was applied to the spectrum analyzer using the low band frequency of the Unit Under Test as the base point. The segment values are shown in Figure 3. The Advantest R3131 allows the X and Y offsets of the entire mask. For pragmatic and consistency purposes, the same mask was used for all three measurement points with the frequency offset of the mask adjusted to re-center over each of the three measurement points.

Test Results:
Figure 3 shows the mask segment values. Figure 4 is a Full Span display of the spectrum analyzer. Figures 5 – 10 show the results of the emissions mask.



Limit Line Edit

[No]	[Frequency]	[Level (dBm)]
1.	0 Hz	-33.00 dBm
2.	2.374000000 GHz	-33.00 dBm
3.	2.374000000 GHz	-35.00 dBm
4.	2.377560000 GHz	-35.00 dBm
5.	2.377560000 GHz	-25.00 dBm
6.	2.378780000 GHz	-25.00 dBm
7.	2.378780000 GHz	0.00 dBm
8.	2.381220000 GHz	0.00 dBm
9.	2.381220000 GHz	-25.00 dBm
10.	2.382440000 GHz	-25.00 dBm
11.	2.382440000 GHz	-35.00 dBm
12.	2.386000000 GHz	-35.00 dBm
13.	2.386000000 GHz	-33.00 dBm
14.	8.000000000 GHz	-33.00 dBm
15.		

Shift X: 0 kHz Shift Y: -26.00 dB

Figure 3

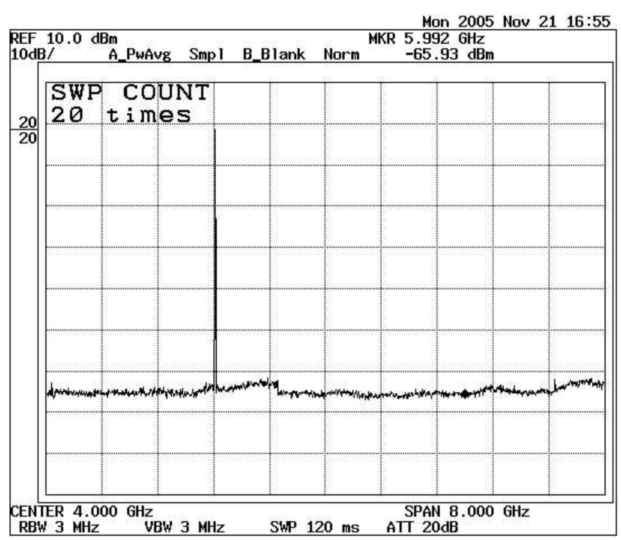


Figure 4

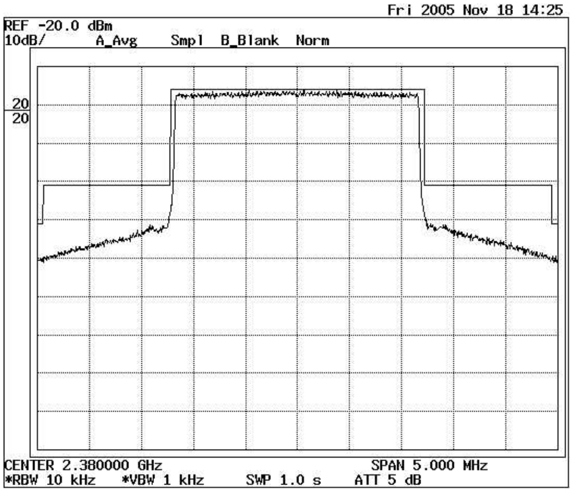


Figure 5

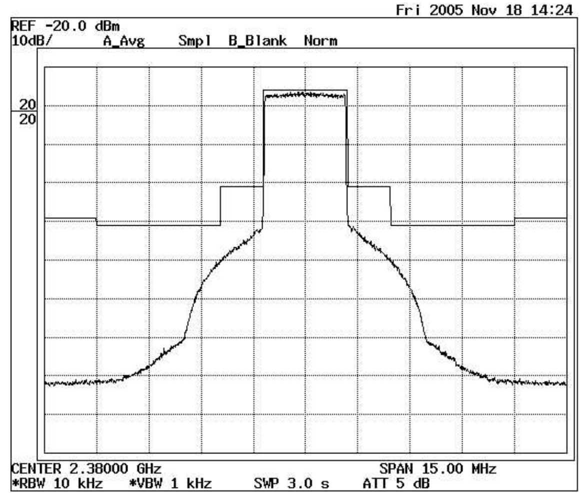


Figure 6

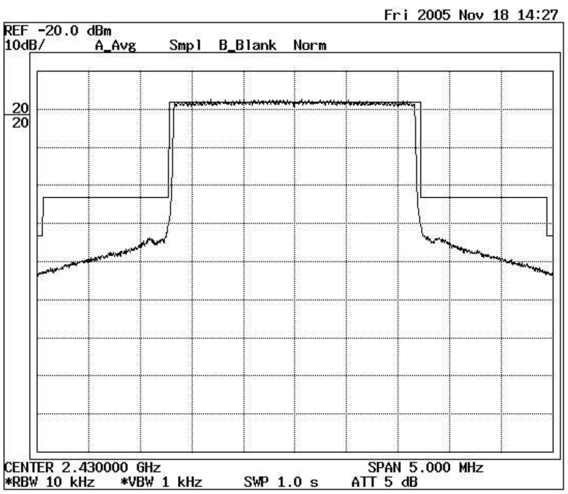


Figure 7

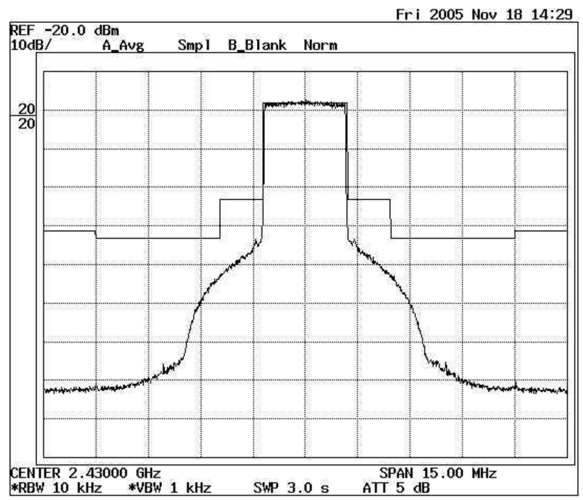


Figure 8

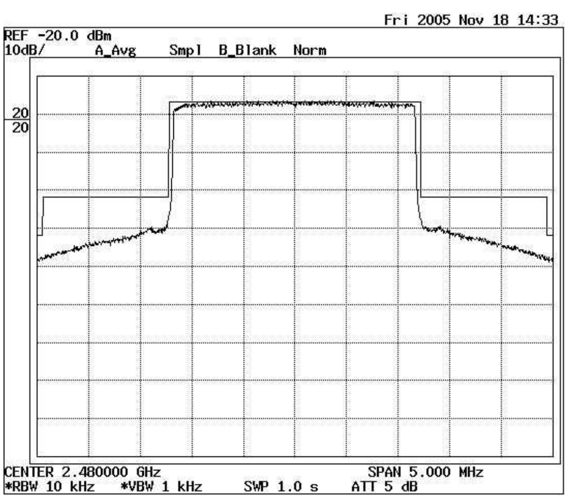


Figure 9

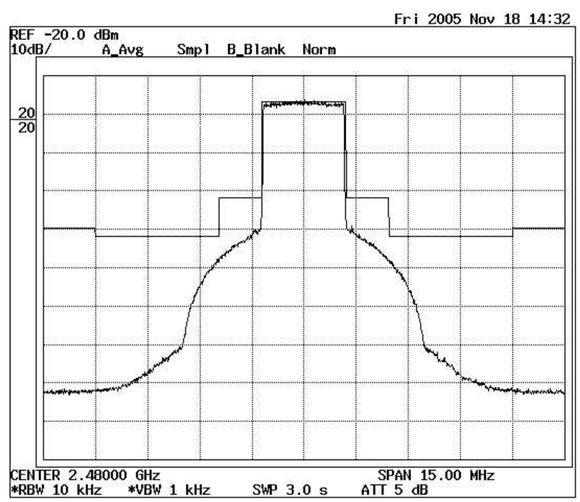


Figure 10