TEST REPORT LM04178A AMENDMENT

Reply to FCC Corespondence ID: 3047

Date: Tue 27 Oct, 1998

To: Rich Fabina, FCC lab.

Subject: Lab tests on modified NBI-PAD1000

This Report supplements the original Certification filing for Electronic Tracking Systems, Inc., subsidiary of PRONET, Inc. and addresses the compliance issues raised by your correspondence 3047.

The client has reworked the transmitter section and provided three test units that comply with the requirement to test low, mid and high operating frequency with the hopping stopped (he actually provided four units). The RF PC board is a different layout from the one pictured in Photo 6 through 8 of the original test report. New photographs of the PCB and the modifications made to bring the NBI-PAD1000 into compliance are provided herein.

I have included the spreadsheet that I used to calculate the 15.209 emission limit line for use in logging on the OATS. As you see the 2.4 dB pulse correction factor, antenna, and other conversions have been used to construct the three meter emission limit for this particular FHSS transmitter. This presentation shows radiated peak and average emissions for the fundamental as well as harmonics when measured at three meters for each of the four transmitters supplied. Each **EUT** now appears to meet the Commissions requirements for harmonic emissions.

Also included are the field notes using the calculated limits. The sa readings are raw (uncompensated for anything) which makes error analysis a bit easier for us. The antenna factors and amp gain were checked for minimum variation over each band. Low frequency emissions (10 KHz - 1GHz) were verified to be within the limits of 15.209 for the hopper and the high band CW **EUT**.

I believe that all other compliance issues have been satisfactorily answered in the original application or previous correspondence.

REPORT APPROVED 27 October, 1998 BY:

Ben Bibb, NARTE EMC-001970-NE,
President, **LambdaMetrics, Inc.**

Meas. Freq MHz	Meas At s/a dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	FCC Limit @ 3 mtrs	Prob. of Low error	Prob. of Hi error	R3265 noise floor
906.8		0.0	6.5	-	22.7	-				
1813.6	-53.0	32.6	6.6	0.8	27.6	2.4	54 dBuV/m	-54.8	-51.1	-81.0
2720.4	-57.1	30.5	6.7	0.7	29.6	2.4	54 dBuV/m	-59.0	-55.3	-80.7
3627.2	-60.1	29.9	6.8	0.7	31.9	2.4	54 dBuV/m	-62.0	-58.3	-81.0
4534.0	-58.4	31.8	7.0	0.6	32.0	2.4	54 dBuV/m	-60.3	-56.6	-80.0
5440.8	-60.6	32.3	7.1	0.6	34.6	2.4	54 dBuV/m	-62.5	-58.8	-79.5
6347.6	-61.1	32.0	7.2	0.7	34.6	2.4	54 dBuV/m	-63.0	-59.3	-79.2
7254.4	-63.3	32.1	7.4	0.6	36.8	2.4	54 dBuV/m	-65.2	-61.5	-82.0
8161.2	-63.2	32.4	7.5	0.7	36.8	2.4	54 dBuV/m	-65.1	-61.4	-84.0
9068.0	-65.1	31.6	7.7	0.7	37.7	2.4	54 dBuV/m	-67.0	-63.3	-78.0

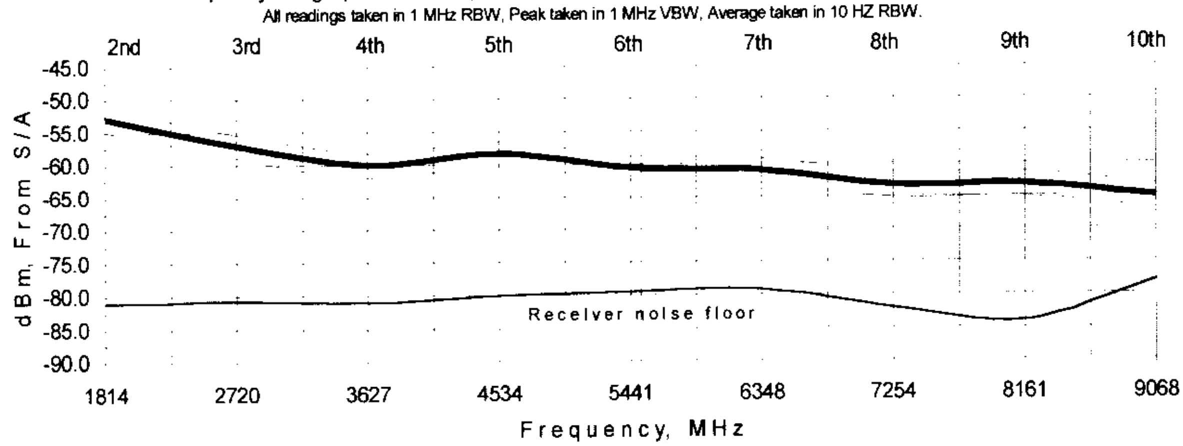
Valid only with the following configuration:

(a) Antenna, Horn, DRG, LM 1 - 18 GHz
(b) 6 dB Attenuator, 8491B-6
(c) N-m : SMA-f Adapt.
(d) SMT HPF, SMA-m-f
(e) SMA-f : N-f Adapt
(f) LM897-2 4 ft Cable, APC N-m
(g) UG-27D/U Adapt, right. angle
(h) MITEQ "30 dB" Amp, APC N-m
(I) Gore 16" Cable, APC N-m
(j) Advantest R3265 Spect. Ana. APC N-f

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

Low Frequency Range (906.800 MHz) PAD. The 2.4 dB duty factor correction is included in the limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ RBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Figure 1: EXCEL® Spreadsheet used to calculate emission limit

This sheet was duplicated for each **EUT** and used during testing on the OATS to manually document the emission levels.

MAXIMUM RADIATED EMISSIONS, NBI-PAD1000
- "LOW Frequency" EUT (906.8 MHz) Measured at 3.0 meters -

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
906.9	-27.4	-29.0	0.0	6.5	-	22.7	-	107.2	-	-
1813.7	-69.9	-69.1	32.6	6.6	0.8	27.6	2.4	37.9	54	16.2
2720.6	-72.8	-71.3	30.5	6.7	0.7	29.6	2.4	39.8	54	14.2
3627.4	-78.0	-76.0	29.9	6.8	0.7	31.9	2.4	38.1	54	15.9
4534.3	-74.5	-77.3	31.8	7.0	0.6	32.0	2.4	35.1	54	18.9
5441.1	-74.4	-75.0	32.3	7.1	0.6	34.6	2.4	39.6	54	14.4
6348.0	-	-80.0	32.0	7.2	0.7	34.6	2.4	35.1	54	18.9
7254.8	-83.0	-82	32.1	7.4	0.6	36.8	2.4	35.3	54	18.7
8161.7	-	-84	32.4	7.5	0.7	36.8	2.4	33.2	54	20.8
9068.5	-	-78	31.6	7.7	0.7	37.7	2.4	41.1	54	12.9

Maximum emissions were always vertical

Figure 2: OATS Measured Harmonic Emissions, Low-Band CW EUT

Emissions over the 100 KHz to 1000 MHz band were verified to be greater than 12 dB below the Commissions' limits.

MAXIMUM RADIATED EMISSIONS, NBI-PAD1000
- "MID Freq. Hopper" EUT (909.8 MHz) Measured at 3.0 meters -

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
909.8	-26.8	-28.1	0.0	6.5	-	22.7	-	**108.1**	-	-
1819.6	-71.7	-70.0	32.6	6.6	0.8	27.6	2.4	37.0	54	17.1
2729.4	-77.1	-75.0	30.5	6.7	0.7	29.6	2.4	36.1	54	17.9
3639.2	-77.8	-75.2	29.9	6.8	0.7	31.9	2.4	38.9	54	15.1
4549.0	-78.6	-77.6	31.8	7.0	0.6	32.0	2.4	34.8	54	19.2
5458.8	-78.0	-80.0	32.3	7.1	0.6	34.6	2.4	34.6	54	19.4
6368.6	-	-79.0	32.0	7.2	0.7	34.6	2.4	36.1	54	17.9
7278.4	-	-82	32.1	7.4	0.6	36.8	2.4	35.3	54	18.7
8188.2	-	-84	32.4	7.5	0.7	36.8	2.4	33.2	54	20.8
9098.0	-	-78	31.6	7.7	0.7	37.7	2.4	41.1	54	12.9

Maximum emissions were always vertical

Figure 3: OATS Measured Harmonic Emissions, Mid-Band Hopping EUT

MAXIMUM RADIATED EMISSIONS, NBI-PAD1000
- "MID Frequency" EUT (909.75 MHz) Measured at 3.0 meters -

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
909.8	-27.8	-28.5	0.0	6.5	-	22.7	-	107.7	-	-
1819.6	-62.5	-65.6	32.6	6.6	0.8	27.6	2.4	41.4	54	12.7
2729.4	-69.9	-76.3	30.5	6.7	0.7	29.6	2.4	34.9	54	19.2
3639.2	-65.6	-73.1	29.9	6.8	0.7	31.9	2.4	41.0	54	13.0
4549.0	-68.7	-75.3	31.8	7.0	0.6	32.0	2.4	37.2	54	16.9
5458.8	-70.0	-75.6	32.3	7.1	0.6	34.6	2.4	39.0	54	15.0
6368.6	-75.0	-79.0	32.0	7.2	0.7	34.6	2.4	36.1	54	17.9
7278.4	-	-82	32.1	7.4	0.6	36.8	2.4	35.3	54	18.7
8188.2	-	-84	32.4	7.5	0.7	36.8	2.4	33.2	54	20.8
9098.0	-	-78	31.6	7.7	0.7	37.7	2.4	41.1	54	12.9

Maximum emissions were always vertical

Figure 4: OATS Measured Harmonic Emissions, Mid-Band EUT

MAXIMUM RADIATED EMISSIONS, NBI-PAD1000
- "HIGH Frequency" EUT (914.750 MHz) Measured at 3.0 meters -

Meas. Freq MHz	Peak At s/a (1 MHz) dBm	"Avg." At s/a (10 Hz) dBm	Meas. Amp K Gain dB	Meas. Cab & Attn. Loss dB	Meas. HPF Loss, dB	Meas. Ant. Fact. dB 1/m	Calc. Pulse Cor. Fact. dB	Calc. Avg. 3 m Field dBuV/m	Avg. Limit dBuV/m	Limit Margin dB
914.8	25.5	-26.6	0.0	6.5	-	22.7	-	109.6	-	-
1829.5	-72.5	-71.0	32.6	6.6	0.8	27.6	2.4	36.0	54	18.1
2744.3	-76.9	-76.5	30.5	6.7	0.7	29.6	2.4	34.6	54	19.4
3659.0	-74.1	-72.0	29.9	6.8	0.7	31.9	2.4	42.1	54	11.9
4573.8	-78.5	-77.3	31.8	7.0	0.6	32.0	2.4	35.1	54	18.9
5488.5	-79.0	-78.2	32.3	7.1	0.6	34.6	2.4	36.4	54	17.6
6403.3	-79.0	-79.5	32.0	7.2	0.7	34.6	2.4	35.6	54	18.4
7318.0	-	-82	32.1	7.4	0.6	36.8	2.4	35.3	54	18.7
8232.8	-	-84	32.4	7.5	0.7	36.8	2.4	33.2	54	20.8
9147.5	-	-78	31.6	7.7	0.7	37.7	2.4	41.1	54	12.9

Maximum emissions were always vertical

Figure 5: OATS Measured Harmonic Emissions, High-Band EUT

MODIFICATIONS MADE TO THE PAD-1000

October 27, 1998

Ben Bibb, President
LambdaMetrics, Inc.
P.O. Box 1029
Cedar Park, TX 78630

Dear Ben,

The changes we made to the original PAD to address the out-of-spec harmonic emissions include:

1) moved the SAW filter, power amp, matching network and passive low-pass filter underneath a grounded metal shield can.

2) put an emi feedthrough filter on the power amp power supply line where it enters the can and ran the power supply to the amp through a ferrite Pi filter to prevent rf energy from being coupled back into the power supply traces

3) replaced discrete low-pass filter with monolithic low-pass filter having lower radiation and better harmonic suppression characteristics

4) increased voltage supply to transmit/receive switch from 3V to 4V to increase its headroom thus reducing its nonlinear distortion

5) adjusted power level ahead of power amp by means of a T-pad to ensure T/R switch is not in compression

6) poured ground plane on the top board layer under the power amp as much as possible

The two white wires on the pre-production units are incorporated in the artwork for the production boards.

Please let me know if you need any additional information or any elaboration on any of the above. Again, thanks for all of your help.

Sincerely,

Tom Boren
Sr. Project Engineer
ProNet Tracking Systems
6340 LBJ Freeway
Dallas, TX 75240
(972) 687-2188
tboren@pronettracking.com

Low BAND CW
CF = 906.8

NO AMP/HPF
Pk = -27.44 dBm
Avg = -29.0 dBm

LO -80dBm, 816.93MHz 861.8 -78.6dBm

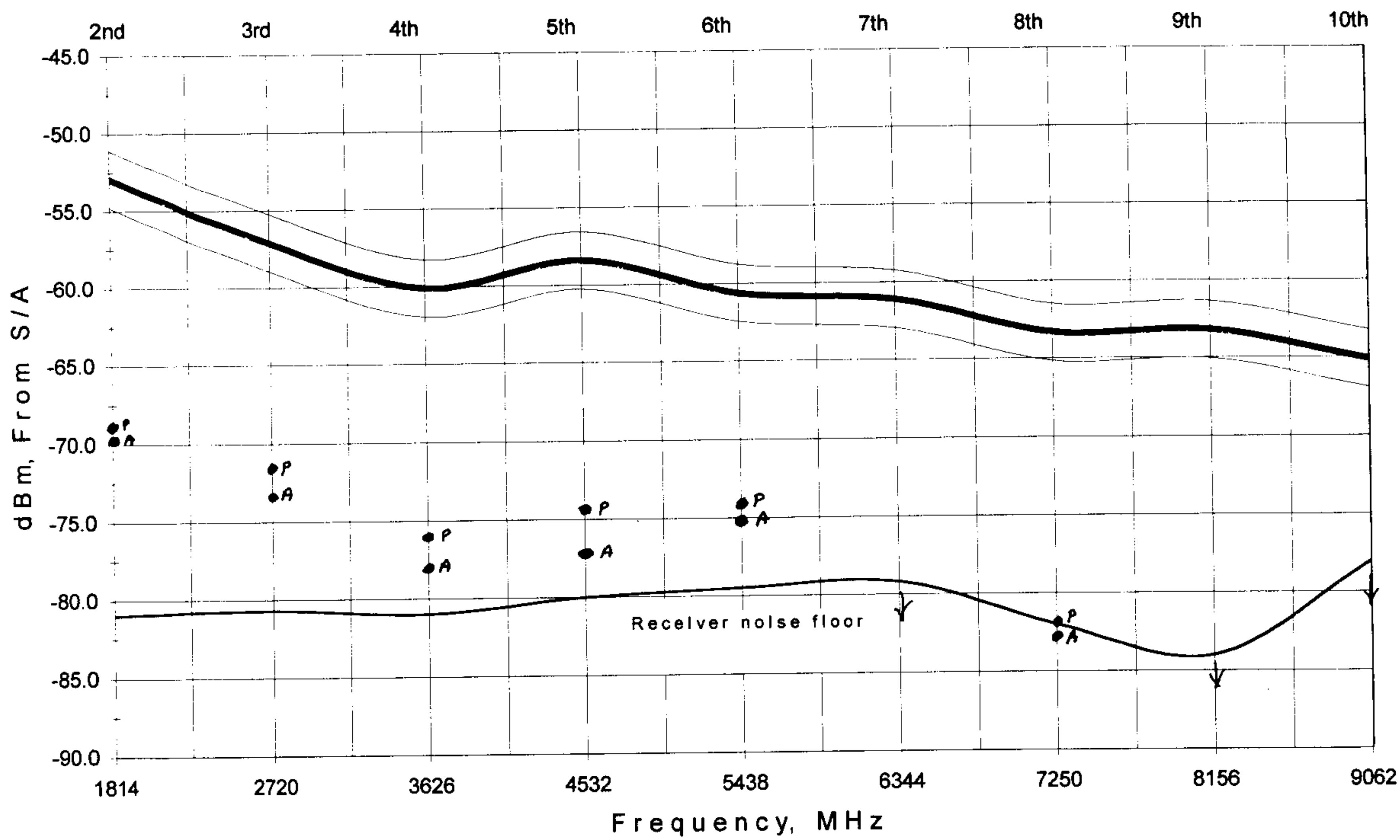
Engineer [signature] Date 27 Oct 1998

NBI-PAD1000

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

Low Frequency Range (906.8 MHz) PAD. The 2.4 dB duty factor correction is included in the limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ RBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

 Cedar Park, Tx. 78630-1029 (512) 219-8218

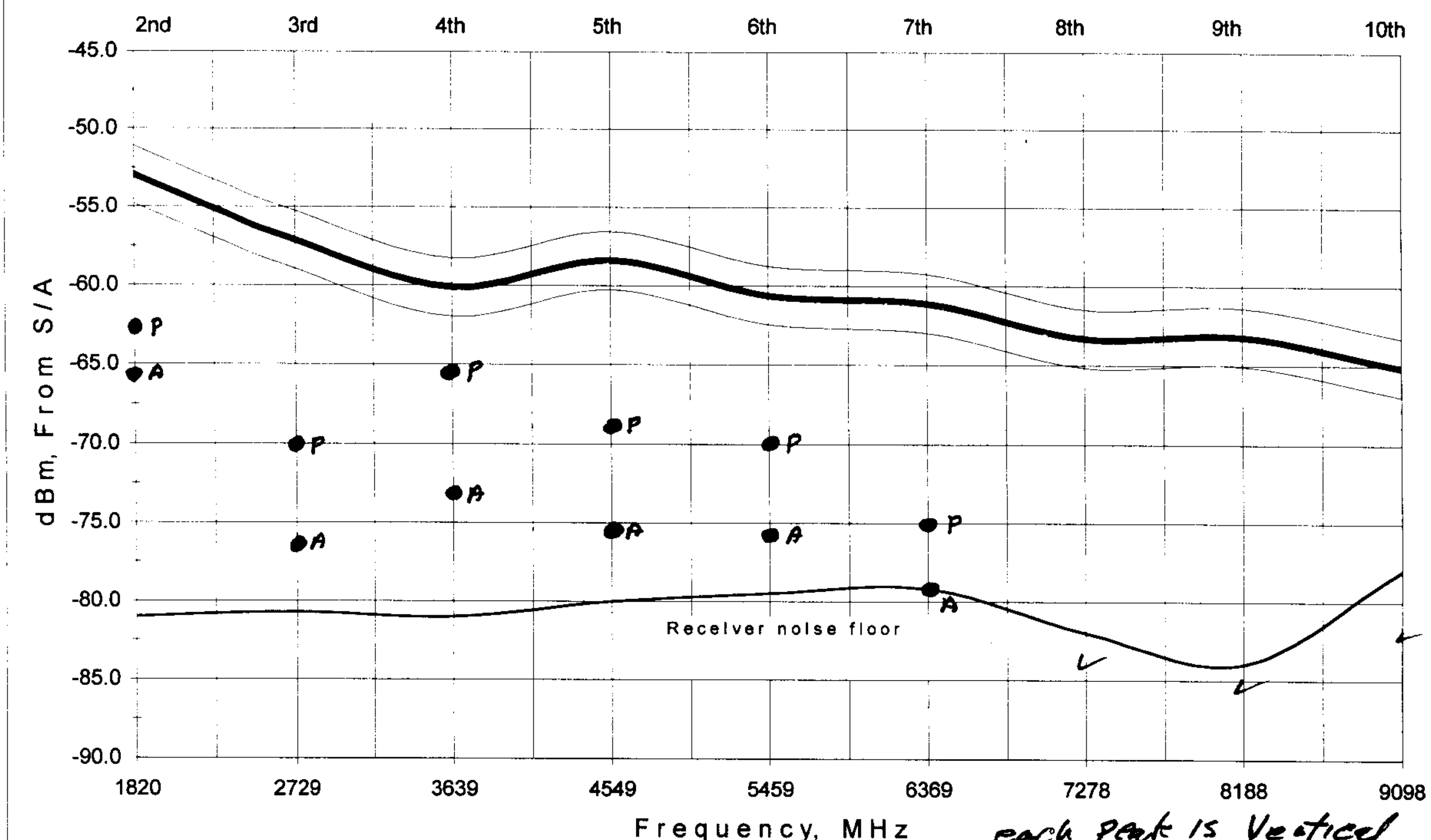
Band CW

CF = 909.750 MHz   Pk = -27.5 dBm (-27.25 dB)   Avg = -28.42 dBm   Engineer [illegible]   Date 28 Oct 1998

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

Mid Frequency Range (909.75 MHz) PAD. The 2.4 dB duty factor correction is included in the limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ RBW.



each peak is Vertical V:H ~3dB-10dB

Uncertainty limits are shown for substitution measurements. Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Cedar Park, Tx. 78630-1029 (512) 219-8218

26 Oct 1998: Failed to operate out of box. New bat No Help
Tom B. Took Back to DFW. FX WedsAM.

NBI-PAD1000

MID BAND HOPPER

CF= 909.8 MHz

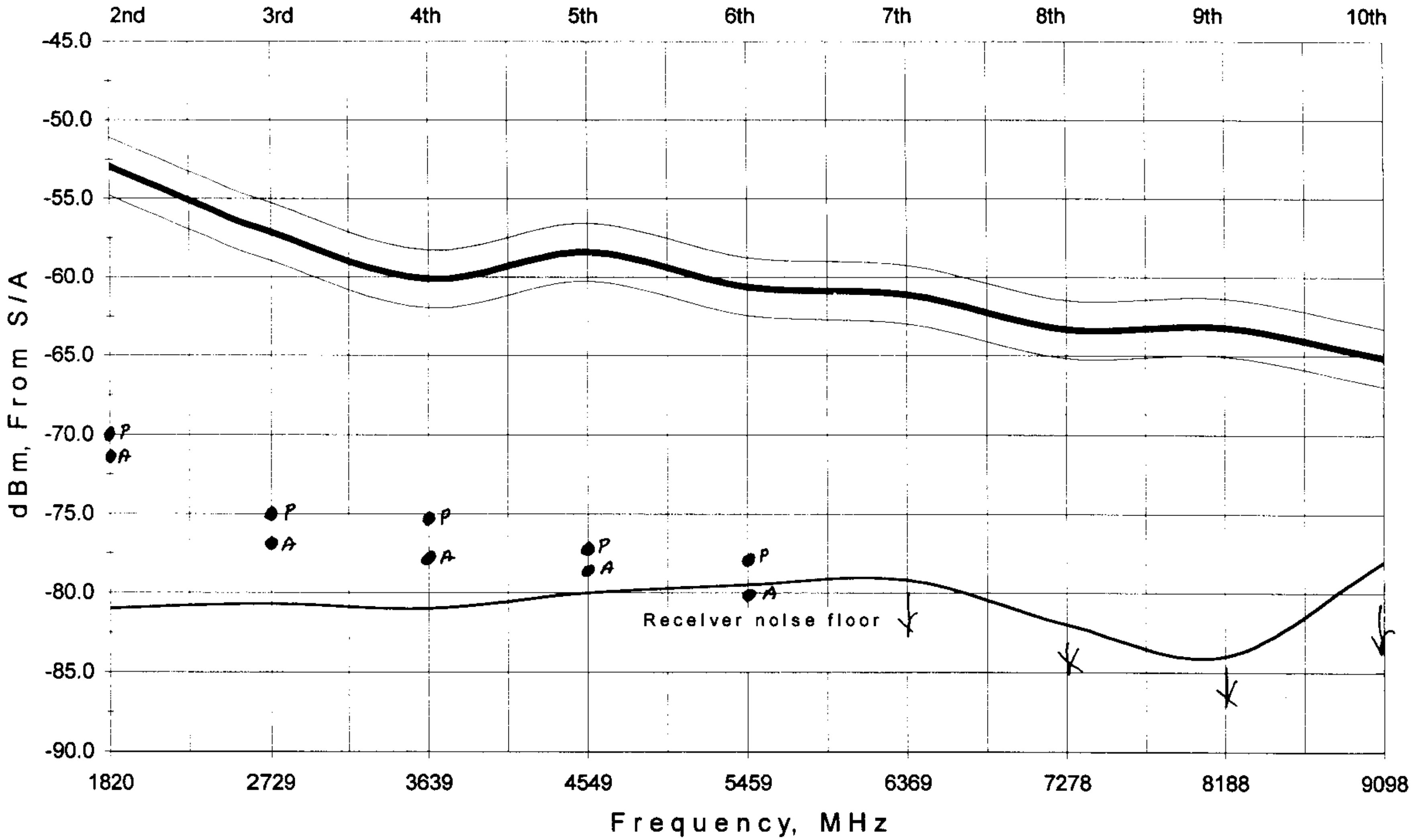
NO AMP HPF
PK= -26.81 dBm
Avg= -28.12 dBm

Engineer [signature]   Date 27 Oct 1998

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

Mid Freq. Hopper (909.8 MHz) PAD. The 2.4 dB duty factor correction is included in the limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ RBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

 Cedar Park, Tx. 78630-1029 (512) 219-8218

NBI-PAD1030

HIGH BAND - CW   LO - 78dBm, 869.75MHz

FC = 914.50MHZ

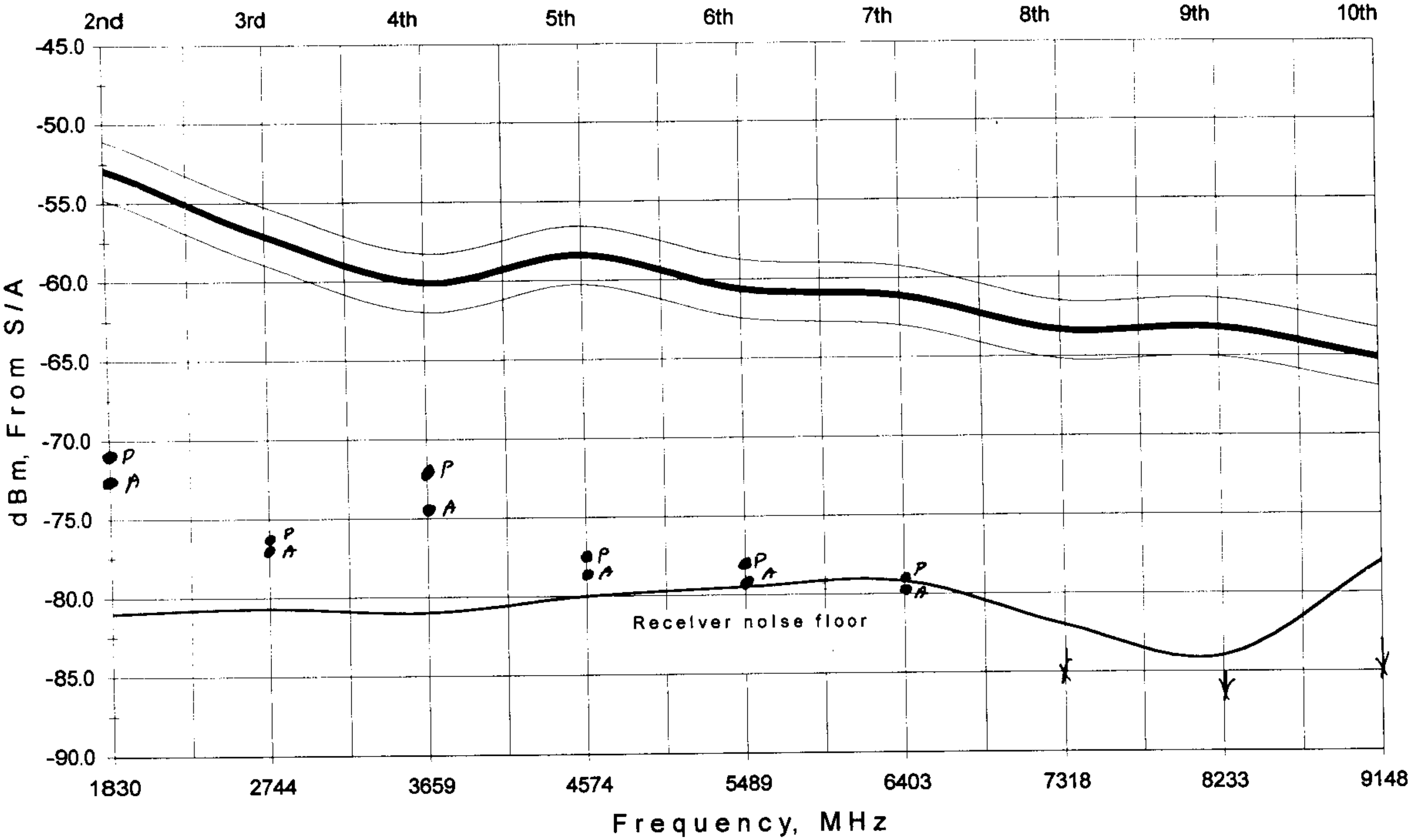
NO AMP/HPF
Pk = -25.53 dBm
Avg = - 26.56 dBm

Engineer B. B[illegible]   Date 27 Oct, 1998

Limit, s/a signal for 3 m OATS emissions, FCC 15.209, PEAK & Average

High Frequency Range (914.75 MHz) PAD. The 2.4 dB duty factor correction is included in the limit.

All readings taken in 1 MHz RBW, Peak taken in 1 MHz VBW, Average taken in 10 HZ RBW.



Uncertainty limits are shown for substitution measurements.
Traceable to NIST via HP 436A / 8481D.

FCC limit line, noise floor, and error limits include the effects of the attenuator, pre-amplifier, and receiver.

Cedar Park, Tx. 78630-1029   (512) 219-8218

NBI-PAD1000

Radiated Emissions Measurements at 3 meters

FCC §15.205 Restricted Bands of Operation shown in bold type

Operating Range			S/A Measured	Correction Factors used (Amp gain included in S/A reading)				Three meters
Har-monic	from 902 MHz	to 928 MHz	peak, 1 MHz RBW	G	AF	CL	CF	Peak Radiated
910 MHz	-	-	87.3 dBu	-	23.3	0.81	24.11	111.4 dBuV/m
2nd	1804	1856	34.2 dBu	(30.7)	26.5	1.09	27.6	61.8 dBuV/m
3rd	**2706**	**2784**	36.3 dBu	(29.8)	30.4	1.38	**31.8**	68.1 dBuV/m
4th	**3608**	**3712**	22.4 dBu	(29.8)	31.7	1.65	**33.4**	55.8 dBuV/m
5th	**4510**	**4640**	25.5 dBu	(30.3)	33.6	2.04	**35.6**	61.2 dBuV/m
6th	**5412**	**5568**	22.7 dBu	(30.5)	34.5	2.47	**37.0**	59.7 dBuV/m
7th	6314	6496	26.0 dBu	* (28.4)	34.9	3.10	38.0	64.0 dBuV/m
8th	# **7216**	**7424**	24.6 dBu	* (31.0)	36.3	3.80	**40.1**	64.7 dBuV/m
9th	# **8118**	**8352**	21.9 dBu	* (30.7)	37.3	4.59	**41.9**	63.8 dBuV/m
10th	# **9020**	**9280**	12.2 dBu	* (30.0)	37.9	5.70	**43.6**	55.8 dBuV/m

Amplifiers:	HPF:	Receiver(s)	Antenna(s)	Cable:
Miteq P58658 * Miteq 2-20AMPO-30	SMT950-HPF NARDA 2000HP #	Advantest R3265A Tek 492-BP	LM DRG 1-18 (#A) EMCO	3.4 m Gore

WORST CASE of the available frequencies, see EXHIBIT B, Table of frequencies

Table of Peak Detected Radiated Emissions at 3 meters

Freq. MHz	Radiated, Peak	10 HZ RBW	-2.4 dB	15.209
910	111 dBuV/m	110 dBuV/m	-	-
1820	62 dBuV/m	59 dBuV/m	57 dBuV/m	3 dB
RB **2730**	**68 dBuV/m**	**63 dBuV/m**	**61 dBuV/m**	7 dB ✓
RB **3640**	**56 dBuV/m**	**53 dBuV/m**	**51 dBuV/m**	-3 dB
RB **4550**	**61 dBuV/m**	**58 dBuV/m**	**56 dBuV/m**	2 dB ✓
RB **5460**	**60 dBuV/m**	**55 dBuV/m**	**53 dBuV/m**	-1 dB
6370	64 dBuV/m	57 dBuV/m	55 dBuV/m	1 dB
RB **7280**	**65 dBuV/m**	**58 dBuV/m**	**56 dBuV/m**	2 dB
RB **8190**	**64 dBuV/m**	**48 dBuV/m**	**46 dBuV/m**	-8 dB
RB **9100**	**56 dBuV/m**	**49 dBuV/m**	**47 dBuV/m**	-7 dB

RB => RESTRICTED BAND

ProNet Pk:Avg	Using ProNet formula 15.209 Margin
-	-
42 dBuV/m	-12 dBuV/m
49 dBuV/m	-5 dBuV/m
36 dBuV/m	-18 dBuV/m
42 dBuV/m	-12 dBuV/m
37 dBuV/m	-17 dBuV/m
42 dBuV/m	-12 dBuV/m
42 dBuV/m	-12 dBuV/m
41 dBuV/m	-13 dBuV/m
33 dBuV/m	-21 dBuV/m

Response to FCC Comments on NBI-PAD1000

The NBI-PAD1000 unit under test is a component of a frequency-hopped spread spectrum security system operating in the 902-928 MHz ISM Band. In its design we have attempted to make its operation interference free to other band users, including other nearby installations of the same or similar system, as possible, while keeping within the band-use requirements and intent set out by the FCC.

Short Recap on Spread Spectrum.

Spread spectrum systems have been allowed to develop because of their potential to dramatically increase the number of users that can simultaneously utilize the same spectrum. This potential arises out of two main features of spread spectrum modulation technology - lower average spectral energy density (obtained by "spectral spreading"), and higher tolerance to interference (obtained by coherent reception or "de-spreading").

Two main types of spectrum spreading are utilized, with some systems using hybrids of the two systems. They are direct sequence spreaders, and frequency hopped spreaders. They can each achieve significant interference reduction, but in uniquely different ways, and with very different characteristics.

Direct sequence[1] spreaders utilize the broad, flat spectral characteristic of white-noise to spread the message signal over a wider bandwidth than the message bandwidth, and then recover the signal by coherent demodulation using an a priori copy of the original spreading noise-like signal. In the recovery process, narrow-band interference signal are spread out by the demodulating noise, thereby creating a "process gain" - the increased tolerance to noise. The mean power spectral density of the transmitted signal is lowered by the ratio of the message-bandwidth to the spread-signal bandwidth. Furthermore, the mean power density of the transmitted signal is very nearly equal to the instantaneous power density.

Frequency hopped spreaders reduce their interference potential by transmitting their message signal at any one frequency in a burst of short duration, then "hopping" to a new frequency channel and continuing the transmission there for another burst of short duration, and so on. By using a large number of channels, selected in an essentially random fashion, the interference to any particular channel is small, and to another frequency hopper using its own random-order of hopping, very small.

However, the power spectral characteristic is quite different from the direct sequence approach. Here the instantaneous peak power density is equal to the message signal power density while on-channel, and near zero while off-channel. The average power spectral density is equal to the average message signal power (during transmission) times the sampling bandwidth divided by the total spread bandwidth times the number of hits in the sampling bandwidth per complete hopping cycle times the transmission duty cycle factor.

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[1] Direct sequence derived its name from certain mathematical sequences of numbers that have nearly random distribution characteristics - the longer the cycle the more nearly random, and hence noise-like, they are.

The NBI-PAD1000

The NBI-PAD1000 is an integral component of a Personal Security System. The device has two modes of operation, TEST mode and ALARM mode. The TEST mode allows the user to verify that the NBI-PAD1000 is operating properly. In normal conditions the device is tested once a day and the test transmission duration is on the order of 2-4 hops (TX ON time of 148 ms - 296 ms). In a life threatening or duress situation the user activates the NBI-PAD1000 in the ALARM mode. The operating parameters of the ALARM mode are fully presented in the following paragraphs. As mentioned earlier, the NBI-PAD1000 is an integral part of a Personal Security System and thus by its very nature should only be activated during life threatening or duressfull situations where emergency or police assistance is necessary. Thus the presence of the device's radio transmissions in the RF spectrum will be very infrequent.

The NBI-PAD1000 transmitter hops over 50 25 kHz channels with a transmission time of 74 ms/channel and an off period of 96 ms/channel. Additionally, there is an off period between each 5 hop sequence of 450 ms. The total duration of a complete hop cycle of 50 channels is thus ((0.074+0.096)*5 + 0.450) * 50 / 5 = 13s.

Therefore, from an energy perspective, the average power in any occupied 25 kHz channel is .074/13 => -22.4 dB of the peak power in the channel, and from a time perspective, each hop channel is occupied only 0.074/13*100% = 0.57% of the time.

The NBI-PAD1000 system uses 25 kHz channels spaced 200 kHz apart. When measuring the 3rd harmonic, the 200 kHz channels have 600 kHz (=3 * 200 kHz) spacing. This allows the possibility of at most 2 channels falling in any 1 MHz band. Therefore, from an energy perspective, the average power measured would be equal to the peak power less 22.4 + 3 dB or peak power - 19.4 dB. , and from a time perspective, each 1 MHz is occupied only 2*0.074/13*100% = 1.14% of the time

The measured emissions at the 3rd harmonic were 68.1 dBμV/m peak. Correcting for average power for the frequency hopped system results in 68.1 - 19.4 = 48.7 dBμV/m, well below the 54 dBμV/m limit. The harmonics higher than the 5th further spread the channel spacing such that only one channel will fall in any 1 MHz band and the 22.4 dB peak-to-average correction factor applies.

Further, the NBI-PAD1000 has no peak power component that exceeds the average power limit by more than 20 dB per §15.35(b).

The NBI-PAD1000 meets all other requirements specified for Part 15 frequency hopped spread spectrum systems including:

a) hop over minimum of 50 channels
b) never transmit on any one channel > 400 ms in any 20 s interval
c) hop in a pseudo-random manner
d) channels separated by minimum of 25 kHz
e) each channel used equally
f) receiver bandwidth matches that of the transmitter and is synchronized with the hopping sequence

The system is continuous, (table) sequential, frequency-hopping using FSK modulation. It transmits a complete data message during each frequency hop. It is *not* a pulsed transmitter and thus should *not* be subject to restrictions placed on pulsed transmitters such as the 0.1s pulse train duration. The transmitter is turned off for intervals between transmissions to conserve battery life.

Therefore, we submit that out-of-band emissions for the NBI-PAD1000 should be tested in the following manner:

According to §15.35(b), harmonics above 1000 MHz should be measured using a 1 MHz bandwidth and average power detection mode. If a peak detector is used then apply the following peak-to-average power conversion:

Average Power = Peak Power - 19.4 dB for the 3^{rd} , 4^{th}, and 5^{th} harmonics

and

Average Power = Peak Power - 22.4 dB for all higher harmonics.

The measured levels shall be compared to the maximum average power levels specified in §15.209.

The hop channel sequence is derived from the following equation:
XmtChannel = BandNumber + (49 - ChannelTable(ChannelIndex)) * ChannelSpacing

Where:
BandNumber is the frequency band number (112,114,116, or 118)

ChannelTable = {0, 25, 8, 33, 5, 38, 4, 42, 23, 31, 11, 27, 17, 39, 1, 29, 20, 44, 10, 48, 15, 41, 14, 43, 2, 35, 3, 36, 12, 46, 6, 40, 19, 34, 9, 45, 7, 26, 24, 49, 18, 47, 22, 28, 16, 37, 13, 32, 21, 30} is the pseudo-random hop sequence

ChannelSpacing = 8 (200kHz = 8 * 25kHz) and

ChannelIndex is incremented by 1 every hop. The transmission then is on the frequency determined by:

Transmission Frequency = 902 + XmtChannel * 0.025 MHz

The frequency hop sequences for the four bands used are then (in MHz):

Channel Table	Band 112	Band 114	Band 116	Band 118
	112	114	116	118
0	904.800	904.850	904.900	904.950
25	909.800	909.850	909.900	909.950
8	906.400	906.450	906.500	906.550
33	911.400	911.450	911.500	911.550
5	905.800	905.850	905.900	905.950
38	912.400	912.450	912.500	912.550
4	905.600	905.650	905.700	905.750
42	913.200	913.250	913.300	913.350
23	909.400	909.450	909.500	909.550
31	911.000	911.050	911.100	911.150
11	907.000	907.050	907.100	907.150
27	910.200	910.250	910.300	910.350
17	908.200	908.250	908.300	908.350
39	912.600	912.650	912.700	912.750
1	905.000	905.050	905.100	905.150
29	910.600	910.650	910.700	910.750
20	908.800	908.850	908.900	908.950
44	913.600	913.650	913.700	913.750
10	906.800	906.850	906.900	906.950
48	914.400	914.450	914.500	914.550
15	907.800	907.850	907.900	907.950
41	913.000	913.050	913.100	913.150
14	907.600	907.650	907.700	907.750
43	913.400	913.450	913.500	913.550
2	905.200	905.250	905.300	905.350
35	911.800	911.850	911.900	911.950
3	905.400	905.450	905.500	905.550
36	912.000	912.050	912.100	912.150
12	907.200	907.250	907.300	907.350
46	914.000	914.050	914.100	914.150
6	906.000	906.050	906.100	906.150
40	912.800	912.850	912.900	912.950
19	908.600	908.650	908.700	908.750
34	911.600	911.650	911.700	911.750
9	906.600	906.650	906.700	906.750
45	913.800	913.850	913.900	913.950
7	906.200	906.250	906.300	906.350
26	910.000	910.050	910.100	910.150
24	909.600	909.650	909.700	909.750
49	914.600	914.650	914.700	914.750
18	908.400	908.450	908.500	908.550
47	914.200	914.250	914.300	914.350
22	909.200	909.250	909.300	909.350
28	910.400	910.450	910.500	910.550
16	908.000	908.050	908.100	908.150
37	912.200	912.250	912.300	912.350
13	907.400	907.450	907.500	907.550
32	911.200	911.250	911.300	911.350
21	909.000	909.050	909.100	909.150
30	910.800	910.850	910.900	910.950

The last ChannelIndex is saved and the next hop sequence begins with ChannelIndex + 1. This ensures that all frequencies are visited with equal probability even in the event that a hop sequence is not completed before terminating a transmission.

The transmitter cycles through the ChannelTable from beginning to end before repeating and all transmissions of equal duration. This ensures that all frequencies are used equally.

The receivers have the same 25 kHz channel bandwidth as the transmitters. The receivers maintain sync with the transmitters by fast scanning to intercept the transmission on the next hop channel once it has received the information contained on the current channel.

The following information will appear in a prominent location in the My911 Users Manual.

FCC INFORMATION
This device complies with Part 15 of the FCC Rules. Operation is Subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

COPY

Date: Tue, 23 Jun 1998 15:32:43 -0400
From: oetech@fccsun07w.fcc.gov (OET)
To: benbibb@lambdametrics.com
Subject: ADDITIONAL INFORMATION ON FCC ID: NBI-PAD1000 [Correspondance ID: 1433]

1. Remeasure radiated emissions from this transmitter to show compliance with the limits of harmonic emissions (-20 dB below fundamental level) and restricted band frequencies (15.209 limits). Measurements were not made properly.

Three channels must be tested in accordance with Section 15.31(m) of the FCC Rules (one near the top, middle and bottom of the operating frequency range). The hopping must be stopped on one of these channels during measurements. For peak level radiated emissions, use a 1 MHz resolution bandwidth and a 1 MHz (or greater) video bandwidth with the analyzer in max hold function. Maximize the emission level by turntable rotation, EUT orientation, and antenna height adjustment, and record the highest level for your peak instrument reading. No contact with a human is permitted during radiated emissions testing. Compare the corrected instrument reading to the peak field strength level specified in Section 15.35(b) (20 dB above the average level in Section 15.209) for an emission listed in a restricted band in Section 15.205 or 20 dB below the level of the fundamental emission, not 20 dB below the maximum permitted level of the fundamental emission, (Section 15.247(c)) for harmoni!
c emissions not in a restricted
band. Change the video bandwidth to 10 Hz and record this level as the average level (you are doing video averaging). Make sure the sweep is slow enough to give a calibrated level. This is the average level of this emission.

Your transmitter is entitled to a duty cycle correction factor based upon Section 15.35(c). Based upon the test results, the pulse or hop is on one channel for 76 milliseconds. The silent time between hops is 88 milliseconds, so the period is 76+88 or 164 milliseconds.
Since 164 is greater than 100, we use 100 in calculating the duty cycle correction factor as follows:

duty cycle = 20*log(on time/100 milliseconds)

20*log(76/100) = -2.4 dB.

You may subtract an additional 2.4 dB from the average reading obtained using video averaging in the spectrum analyzer. That is your final average level which must comply with Section 15.209 average field strength limits. Repeat this process for the next channel, until 3 channels are measured. Report both peak and average radiated levels on all three channels.

2. Provide a list of the hop channel frequencies and sequences used by this transmitter and show its algorithm is pseudorandom in nature. The channel numbers must be incremented in a random nature, not in equal increments. Where does the next hop commence when the previous hop sequence isn't completed?

3. Provide statements confirming (a) that all frequencies are used equally on average in accordance with the third sentence in Section 15.247(a)(1), and (b) that the receiver
bandwidths match the hopping channel bandwidths and shift frequencies in sync with the transmitters in accordance with the last sentence of Section 15.247(a)(1).

4. Either submit an FCC ID label that agrees with the FCC ID listed on the application (731) form or submit an amended first page of the application form. The FCC ID listed on the form is NBINBI-PAD1000 but the FCC ID label shows NBI-PAD1000. What is correct?

1. Remeasure radiated emissions from this transmitter to show compliance with the limits of harmonic emissions (-20 dB below fundamental level) and restricted band frequencies (15.209 limits). Measurements were not made properly.

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2. Provide a list of the hop channel frequencies and sequences used by this transmitter and show its algorithm is pseudorandom in nature. The channel numbers must be incremented in a random nature, not in equal increments. Where does the next hop commence when the previous hop sequence isn't completed?

3. Provide statements confirming (a) that all frequencies are used equally on average in accordance with the third sentence in Section 15.247(a)(1), and (b) that the receiver bandwidths match the hopping channel bandwidths and shift frequencies in sync with the transmitters in accordance with the last sentence of Section 15.247(a)(1).

4. Either submit an FCC ID label that agrees with the FCC ID listed on the application (731) form or submit an amended first page of the application form. The FCC ID listed on the form is NBINBI-PAD1000 but the FCC ID label shows NBI-PAD1000. What is correct?

5. Provide a copy of the compliance statement that is required to be placed in the user's manual in accordance with Section 15.19(a)(5) and confirm that it will be placed in the final version of the user's manual. This statement was not on the FCC ID label or in the submitted user's manual as required by either Sections 15.19(a)(3) or (5), respectively.

DO NOT Reply to this email by using the 'Reply' button. In order for your response to be processed expeditiously, you must upload your response via the Internet at https://dettifoss.fcc.gov/beta/oet/index.html

Replies to this letter MUST contain the Reference Number: 1433

EXHIBIT B

ProNet, Inc. Band Plan

EXHIBIT B

Freq. (MHz)	Channel No.	CampusTrac™ Channel Identifier Set A	Set B	Set C	Set D	Notes
902.000	0					*Lower Edge of ISM Band*
▼						
904.800	112	A1				*First Set A Channel*
904.850	114		B1			*First Set B Channel*
904.900	116			C1		*First Set C Channel*
904.950	118				D1	*First Set D Channel*
905.000	120	A2				
905.050	122		B2			
905.100	124			C2		
905.150	126				D2	
905.200	128	A3				
905.250	130		B3			
905.300	132			C3		
905.350	134				D3	
905.400	136	A4				
905.450	138		B4			
905.500	140			C4		
905.550	142				D4	
905.600	144	A5				
905.650	146		B5			
905.700	148			C5		
905.750	150				D5	
905.800	152	A6				
905.850	154		B6			
905.900	156			C6		
905.950	158				D6	
906.000	160	A7				
906.050	162		B7			
906.100	164			C7		
906.150	166				D7	
906.200	168	A8				
906.250	170		B8			
906.300	172			C8		
906.350	174				D8	
906.400	176	A9				
906.450	178		B9			
906.500	180			C9		
906.550	182				D9	
906.600	184	A10				
906.650	186		B10			
906.700	188			C10		
906.750	190				D10	
906.800	192	A11				
906.850	194		B11			
906.900	196			C11		
906.950	198				D11	
907.000	200	A12				
907.050	202		B12			
907.100	204			C12		
907.150	206				D12	

EXHIBIT B

Freq.	Channel	Channel Identifier				
(MHz)	No.	Set A	Set B	Set C	Set D	Notes
907.200	208	A13				
907.250	210		B13			
907.300	212			C13		
907.350	214				D13	
907.400	216	A14				
907.450	218		B14			
907.500	220			C14		
907.550	222				D14	
907.600	224	A15				
907.650	226		B15			
907.700	228			C15		
907.750	230				D15	
907.800	232	A16				
907.850	234		B16			
907.900	236			C16		
907.950	238				D16	
908.000	240	A17				
908.050	242		B17			
908.100	244			C17		
908.150	246				D17	
908.200	248	A18				
908.250	250		B18			
908.300	252			C18		
908.350	254				D18	
908.400	256	A19				
908.450	258		B19			
908.500	260			C19		
908.550	262				D19	
908.600	264	A20				
908.650	266		B20			
908.700	268			C20		
908.750	270				D20	
908.800	272	A21				
908.850	274		B21			
908.900	276			C21		
908.950	278				D21	
909.000	280	A22				
909.050	282		B22			
909.100	284			C22		
909.150	286				D22	
909.200	288	A23				
909.250	290		B23			
909.300	292			C23		
909.350	294				D23	
909.400	296	A24				
909.450	298		B24			
909.500	300			C24		
909.550	302				D24	
909.600	304	A25				

EXHIBIT B

Freq. (MHz)	Channel No.	Channel Identifier Set A	Set B	Set C	Set D	Notes
909.650	306		B25			
909.700	308			C25		
909.750	310				D25	*Upper Edge of Lower LMS Band*
909.800	312	A26				
909.850	314		B26			
909.900	316			C26		
909.950	318				D26	
910.000	320	A27				
910.050	322		B27			
910.100	324			C27		
910.150	326				D27	
910.200	328	A28				
910.250	330		B28			
910.300	332			C28		
910.350	334				D28	
910.400	336	A29				
910.450	338		B29			
910.500	340			C29		
910.550	342				D29	
910.600	344	A30				
910.650	346		B30			
910.700	348			C30		
910.750	350				D30	
910.800	352	A31				
910.850	354		B31			
910.900	356			C31		
910.950	358				D31	
911.000	360	A32				
911.050	362		B32			
911.100	364			C32		
911.150	366				D32	
911.200	368	A33				
911.250	370		B33			
911.300	372			C33		
911.350	374				D33	
911.400	376	A34				
911.450	378		B34			
911.500	380			C34		
911.550	382				D34	
911.600	384	A35				
911.650	386		B35			
911.700	388			C35		
911.750	390				D35	
911.800	392	A36				
911.850	394		B36			
911.900	396			C36		
911.950	398				D36	
912.000	400	A37				
912.050	402		B37			
912.100	404			C37		
912.150	406				D37	
912.200	408	A38				
912.250	410		B38			
912.300	412			C38		
912.350	414				D38	
912.400	416	A39				
912.450	418		B39			

EXHIBIT B

Freq. (MHz)	Channel No.	Channel Identifier Set A	Set B	Set C	Set D	Notes
912.500	420			C39		
912.550	422				D39	
912.600	424	A40				
912.650	426		B40			
912.700	428			C40		
912.750	430				D40	
912.800	432	A41				
912.850	434		B41			
912.900	436			C41		
912.950	438				D41	
913.000	440	A42				
913.050	442		B42			
913.100	444			C42		
913.150	446				D42	
913.200	448	A43				
913.250	450		B43			
913.300	452			C43		
913.350	454				D43	
913.400	456	A44				
913.450	458		B44			
913.500	460			C44		
913.550	462				D44	
913.600	464	A45				
913.650	466		B45			
913.700	468			C45		
913.750	470				D45	
913.800	472	A46				
913.850	474		B46			
913.900	476			C46		
913.950	478				D46	
914.000	480	A47				
914.050	482		B47			
914.100	484			C47		
914.150	486				D47	
914.200	488	A48				
914.250	490		B48			
914.300	492			C48		
914.350	494				D48	
914.400	496	A49				
914.450	498		B49			
914.500	500			C49		
914.550	502				D49	
914.600	504	A50				
914.650	506		B50			
914.700	508			C50		
914.750	510				D50	
▼						
915.000	(520)					**Midpoint of ISM Band**
▼						
928.000	(1040)					**Upper Edge of ISM Band**

An alarm event causes the PAD-1000 to transmit on the next five channels chosen from this PR table, it listens at the end of each transmission for a reply from a master station, communication continues until help arrives or the battery depletes. Channels are 25 KHz in bandwidth. All transmissions are hopped over 50 channels chosen from this pseudo-random table. with equal transmission time on each channel. Transmissions are typically of 40 to 90 ms duration on a given channel, and never exceed 400 ms duration. The radio is half-duplex; meaning it is either receiving or transmitting at any given time, 15.247(f).