

**Engineering Exhibit in Support of
Class II Permissive Change Request
FCC Form 731**

for the

Tait's T85x -1 (400-440MHz) base station

modulated with

4 FSK digital modulation from Dataradio's Base Data Link Controller (BDLC)

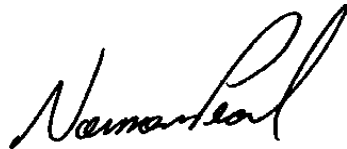
FCC ID: EOTBDD4T85-1

Trade Name: Paragon/PD

November 13, 2001

AFFIDAVIT

The technical data included in this report has been accumulated through tests that were performed by me or by engineers under my direction. To the best of my knowledge, all of the data is true and correct.

A handwritten signature in black ink, appearing to read "Norman Pearl". The signature is written in a cursive style with a large, prominent initial "N".

Norman D. Pearl
Vice-president Engineering, Dataradio Inc.

Dataradio Inc., Montreal, Canada

**ENGINEERING STATEMENT
OF CONSTANTIN PINTILEI**

The application consisting of the attached engineering exhibit and associated FCC form 731 has been prepared in support of a request for a Class II Permissive Change for EOTBDD4T85-1. All changes involved fall under Class II Permissive Change types and they are entirely detailed within the current report.

The certificate EOTBDD4T85-1 has been granted to Dataradio for the transmitter (Exciter+PA modules) part of its UHF base station. They both belong to the T85M-XY (see page 6 for part# description) UHF base station which is itself part of Paragon/PD, a wireless data base station. Dataradio Inc. buys this UHF base station from Tait Electronics, modifies the exciter for the proposed digital modulation scheme, does the final assembly and markets the Paragon/PD unit. The Paragon/PD data base station serves the Dataradio Gemini/PD mobile family.

One Class II Permissive type of change is demonstrated with this filing. The certificate EOTBDD4T85-1 is granted for the following list of emission designators 7K00, 7K50, 14K3 and 15K9F1D and 10K7 and 15K7 F3E. The change consists in the addition of a new emission designators for another 4-FSK digital modulation source for which the compliance has been demonstrated for mask 90.210C. For this modulation source the emission designators is 16K5F1D. This Class II permissive change involves the modulation source only and it is completely described in the current report.

EXISTING CONDITIONS

The unit utilized for these occupied bandwidth and mask-compliance measurements was a prototype built from pilot EOTBDD4T85-1 (in itself being a change in ID from production CASTEL0021) with beta-level firmware used to create the modulation scheme. The exciter operates on frequencies ranging from 400.000 MHz to 440.000 MHz. The frequency tolerance of the exciter is .0001% or 1.0 parts per million and the output power of the PA is 100W as granted in EOTBDD4T85-1.

PROPOSED CONDITIONS

It is proposed to accept the Class II permissive change request for the EOTBDD4T85-1 certificate for operation in the band of frequencies previously outlined. The applicant anticipates marketing the device for use in wireless transmission of data.

PERFORMANCE MEASUREMENTS

All measurements for Occupied Bandwidth and mask compliance as per 2.1043 (b)(2) were conducted in accordance with the Rules and Regulations Section 2.1041 and 2.1049 of Rules Service Co rev.2-154, Mar 15,2000. The measurements were made in the engineering laboratory located at 5500 Royalmount ave, Montreal, Canada. All measurements were made and recorded by myself or under my direction. The measurements were made between Oct 15, 2001 and Nov 12, 2001.

CONCLUSION

Given the results of the measurements contained herein, the applicant requests a Class II Permissive Change for the Certificate EOTBDD4T85-1 to add a new emission designators 16K5F1D to the existing list.

Constantin Pintilei

11/13/01

Constantin Pintilei
R&D Test Engineer, Dataradio Inc.

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ANNEXES:

Annex A: Instruction Manual

Qualifications of Engineering Personnel

NAME: Norman Pearl
TITLE: Vice-president Engineering
TECHNICAL EDUCATION: Bachelor of Engineering (Electrical)
(1979) McGill University, Montreal, Canada
TECHNICAL EXPERIENCE: Professional engineer since 1979
24 Years experience in radio communications

NAME: Constantin Pintilei
TITLE: R&D Test Engineer
TECHNICAL EDUCATION: Bachelor of Science Degree in Radiotechnique Electronic Engineering
(1993) Technical University of Iasi, Romania
TECHNICAL EXPERIENCE: Professional engineer since September 2001
7 Years experience in radio frequency measurements.

Class II Permissive Change Information - Rule part 2.1043 (b)(2)

The certificate EOTBDD4T85-1 has been granted to Dataradio Inc. following an ID change request from CASTEL0021. The certificate CASTEL0021 has been granted to Tait Electronics Ltd. for its transmitter comprised of T857 Exciter module and T859 PA module. It belongs to the T85M-XY (see page bottom for part# description) UHF base station. Dataradio Inc. buys this base station and uses it to build Paragon/PD, a base station for wireless data networks. In order to market it under Dataradio logo the change in ID was done.

Further, several data speeds using 4-FSK SRRC digital modulation were granted following two Class II permissive change requests. The emission designator list of the certificate granted on 05/29/2001 has the following values:

- 10K7 and 15K7F3E inherited from the original certificate CASTEL0021 granted on 01/19/1999
- 14K3 and 15K9F1D for 25.6kbps and 19.2 kbps 4-FSK SRRC digital modulation granted on 11/16/2000 following the ID change along with Class II permissive change request on 10/04/2000
- 7K50 and 7K00F1D, used for 16.0 and 14.4 kbps 4-FSK SRRC digital modulation granted on 07/12/2001 following a Class II permissive change request on 05/07/2001.

The current Class II permissive change request asks for the following value to be added to the emission designator list:

- 16K5F1D, used for 32.0 kbps 4-FSK RC digital modulation, whose compliance is demonstrated for mask 90.210(C).

The change above described involves the modulation source only therefore it fall under Class II Permissive Changes type as per 2.1043 (b)(2).

No other changes occur elsewhere in the circuitry of the exciter module or of the PA module.

The characteristics affected by the first modification of above are:

Digital Modulation Techniques - part 2.1033.(c)(13)
 Type of emission and Emission designators list - part 2.1033 (c)(4), 90.209
 Occupied bandwidth and mask compliance requirement - part 2.1049,90.210(c)

They are entirely documented with the current report.

All the original test results continue to be representative of and applicable to the exciter module. The compliance with Mask C for the new speed is further confirmed in this report.

All this Class II permissive change data as per 2.1043 are completely described with the current report.

Part Number of the Tait UHF base station T85M-XY

<u>M</u>	<u>Module Type</u>	<u>X</u>	<u>Freq Range</u>	<u>Y</u>	<u>Channel Bandwidth</u>
7	Exciter (1W)	1	400-440 MHz	0	25 kHz
5	Receiver	2	440-480 MHz	5	12.5 kHz
9	Power Amplifier	3	480-520 MHz		

Part Number of the Paragon/PD UHF data base station BDD4 -85XY PPPS

<u>X</u>	<u>Freq Range</u>	<u>Y</u>	<u>Channel Bandwidth</u>	<u>PPP</u>	<u>Transmitted Power</u>	<u>S</u>	<u>Supply</u>
1	400-440 MHz	0	25 KHz	100	100W	0	12VDC external
2	440-480 MHz	5	12.5 KHz			2	dual 120V AC
3	480-520 MHz						

EQUIPMENT IDENTIFICATION:

<u>TRADE NAME</u>	<u>DESCRIPTION</u>	<u>Dataradio Inc PART NUMBER</u>
T85x	UHF Base Station	T85M-XY
D212	Base Data Link Controller (BDLC)	050-03330-00x
Paragon/PD	Assembly	BDD4-88XY PPPS

General Information about the Grantee and Certified Equipment -2.1043 (B)(2)

(as per Rule Part Number: 2.1033 (c).(1),(2),(5),(6),(7))

APPLICANT: Dataradio Inc.,
5500 Royalmount Ave, suite 200,
Town of Mount Royal, Quebec, Canada, H4P 1H7

MANUFACTURER: Tait Electronics Ltd., Burnside Christchurch 5, New Zealand
(T85x UHF Base station)
DATARADIO Inc., Town of Mount Royal, Quebec, Canada, H4P 1H7
(D212 BDLC and Paragon/PD- final assembly)

MODEL NUMBER: Paragon/PD

PART NUMBER: BDD4-85XY PPPS

SERIAL NUMBER (S): D212 address 1.0 -prototype 4-level FSK BDLC
T857-16-0200 s.n 13007033 Exciter module
T859-10-0500 s.n 996041 PA module

FCC ID NUMBER: EOTBDD4T85-1 (following from a change in ID of CASTEL0021)

FCC RULES AND REGS: FCC Part (s) 22, 90

FREQUENCY RANGE: 400MHz -440 MHz as per EOTBDD4T85-1 certificate

MAXIMUM POWER RATING: 100Watts as per EOTBDD4T85-1 certificate.

NUMBER OF CHANNELS: 1 Channel selectable from 256 channels as per Tait's manual

OUTPUT IMPEDANCE: 50 ohms, Nominal

VOLTAGE REQUIREMENTS: 10.9-16.3VDC (13.6 VDC Nominal)

EQUIPMENT IDENTIFICATION:

<u>TRADE NAME</u>	<u>DESCRIPTION</u>	<u>DRI PART NUMBER</u>
T85x	UHF Base Station	T85M-XY
D212	Base Data Link Controller (BDLC)	050-03330-00x
Paragon/PD	Assembly	BDD4-85XY PPPS

Data And Characteristics Not Affected By The Change-Rule Part Number: 2.1033 (c)(8),(9),(10),(11),(12),(15),(16)

DC Voltages And Currents Into Final Amplifier (T881)	2.1033(c).(8)
Transmitter Tune Up Procedure	2.1033 (c) (9)
Description Of Circuitry, Schematics and Transistor, Diode, and IC Functions	2.1033 (C)(10)
FCC Label	2.1033 (c) (11)
Internal/External Photographs	2.1033 (c) (12)
Data addressing Rule Part Number	2.1033(c) (15),(16): this unit is not designed for the mentioned purposes
Test results not affected by the change	2.1033(c)(14), 2.1041
Test data according to:	
Part 2: 2.1046, 2.1051, 2.1053, and 2.1055	
Part 90, Subpart I: 90.213	
as follows:	
Transmitter Rated Power Output	2.1046
Transmitter Spurious and Harmonic Outputs	2.1051
Field Strength of Spurious Radiation	2.1053
Frequency Stability and Frequency Tolerance	2.1055,90.213

Data And Characteristics Affected By The Change - Rule Part Number: 2.1033(c) (3),(4),(13),(14)**INSTRUCTION BOOK**

2.1033 (c) (3)

Annex A . The attached Technical Manual for the Paragon/PD data base station using SRRC4FSK is a preliminary version.

TYPE OF EMISSION:

2.1033(c)(4)

For Class II Permissive Change 4levelFSK 25kHz ch. (16000baud, 4 FSK) **16K5F1D**Previously granted for EOTBDD4T885-3 25kHz ch. **15K7F3E**25kHz ch. (12800baud, 4 FSK) **14K3F1D**25kHz ch. (9600baud, 4 FSK) **15K9F1D**12.5kHz ch. **10K7F3E**12.5kHz ch. (8000baud, 4 FSK) **7K00F1D**12.5kHz ch. (7200baud, 4 FSK) **7K50F1D****SPECTRUM EFFICIENCY STANDARD DATA 90.203 (j)(3)**

The unit transmits 32000 bps in 25 kHz channel bandwidth.

This is more than $4800 \times 4 = 19200$ bps required for $6.25 \times 4 = 25$ kHz channel bandwidth**DIGITAL MODULATION TECHNIQUES**

2.1033 (c)(13)

The explanation provided with the previous Class II permissive change request (731 form number EA 100895) for 25.6kbps and 19.2 kbps 4-FSK SRRC digital modulation still applies.

The two differences refer to the speed, which is 32.0kbps and to the digital filter implemented, which is Raised Cosine $\alpha=0.4$. The cut-off frequencies of the RC digital filtering are provided on the next page (page 10).

TEST DATA Rule Part Number: 2.1033 (c)(14)

All applicable test data according to:

-Part 2: 2.1043 (b)(2), 2.1049

-Part 90, Subpart I: 90.209 and 90.210(h)

are provided in next section of this Engineering Report

Modulation Characteristic Part 2.1047 (d), 90.209 (b), 90.210(c): Other types of equipment: this equipment is not provided with hardware audio low-pass filters, the filtering is entirely the result of DSP firmware.

The following reports have been generated for Class II Permissive Change request for EOTBDD4T85-1 Transmitter. Paragon/PD is comprised of the Tait Electronics Ltd. T85M -1Y UHF Base station with the Dataradio Inc D212 Base Data Link Controller (BDLC). Dataradio Inc does the changes to fit the transmitter to digital modulation, does final assembly and markets the Paragon/PD unit

Unless otherwise noted, all of the measurements were conducted following the procedures set forth in the TIA/EIA-603 standards.

NAME OF TEST:

Transmitter Occupied Bandwidth

RULE PART NUMBER: 2.201, 2.202, 2.1033 c (14), 2.1049 (h), 2.1041

Emission Designator Determination

Necessary Bandwidth Measurement (90.209.(b))

This Exciter uses digital modulation signals, passing through a DSP implemented low-pass filter to an FM modulator. The necessary bandwidth calculation for this type of modulation (RC4FSK) is not covered by paragraphs (1), (2) or (3) from 2.202(c), the result exceeding by far the real necessary bandwidth obtained through simulations or measurement.

Therefore, the approach outlined in (2.202(c)(4)) is applicable in this case.

The results of 99% Occupied Bandwidth measurement are:

Bitrate	4-FSK Baud rate	SRRC filter 3dB cut-off	Deviation	Occupied Bandwidth	Emission designator
32000bps	16000 bauds	8000Hz	$\pm 4.38\text{kHz}$	16500 Hz	16K5

The measurement theory and set-up explanations follow.

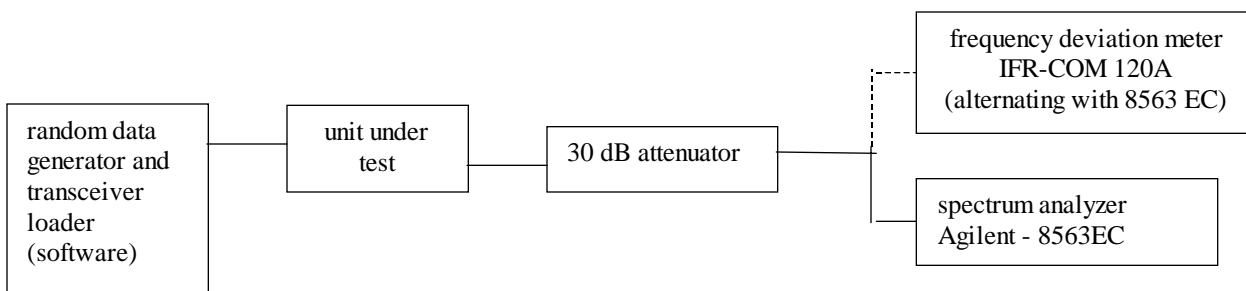
Occupied Bandwidth Measurement

The Occupied Bandwidth measurement option of the instrument (8563EC spectrum analyzer from Agilent) calculates and provides the values used above for the emission designator.

The percentage setting of the measurement has been set to 99% following the definition of the *Occupied Bandwidth* “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” (FCC 2.202)

The measurement has been performed preceding the tests for compliance with mask C, the resulting value was recorded as Occupied Bandwidth.

The measurement set-up is:



NAME OF TEST: Transmitter Occupied Bandwidth
Paragon/PD Modem at 16000 baud 4FSK

Mask compliance data in support of Emission Designator **16K5F1D**

RULE PART NUMBER: 2.201, 2.202, 2.1033 c (14), 2.1049 (h), 2.1041, 90.209 (b)(5), 90.210 (c)

MINIMUM STANDARD: Mask C
Sidebands and Spurious [Rule 90.210 (c)]
Authorized Bandwidth = 20 kHz [Rule 90.209(b) (5)]
Fo to 5.0 kHz Attenuation = 0 dB
>5.0 kHz to 10.0 kHz Attenuation = $83 * \log(f_d \text{ KHz} / 5)$ dB
>10.0 kHz to 250% Auth BW Attenuation = Lesser of: 50dB or $29 \log(f_d^2 / 11)$ dB
>250% Auth BW 43 + $10 * \log(P)$

Corner Points:

f₀ to 5.0 kHz Attenuation = 0 dB
>5.0 kHz to 10.0 kHz Attenuation = 0 dB to 25 dB
>10.0 kHz to 15.0 KHz Attenuation = 27.8 dB to 38 dB
>15.0 kHz to 20.0 KHz Attenuation = 38 dB to 45.3 dB
>20.0 kHz to 24.0 KHz Attenuation = 45.3 dB to 50 dB
>24.0 kHz to 50.0 KHz Attenuation = 50 dB
>250% Auth BW Attenuation = minimum 63 dB (100 W)

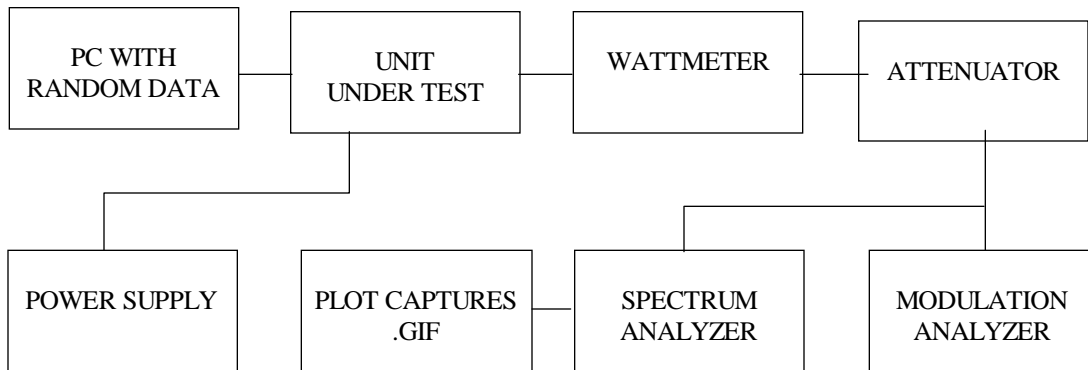
TEST RESULTS: Meets minimum standard (see data on the following pages)

TEST CONDITIONS: Standard Test Conditions, 25 C
TEST EQUIPMENT: Attenuator, BIRD Model / 150-A-MFN-30 / 30 dB / 150 Watt
Wattmeter Coaxial Dynamics model 81050
DC Power Source, Model Tait T808-10-00CA
Communication Analyzer, Model IFR COM120B for Modulation Analyzer
Spectrum Analyzer, Model HP E4401

Constantin Pintilei

PERFORMED BY: _____ DATE: 11/09/01
Constantin Pintilei

TEST SET-UP:



NAME OF TEST: Transmitter Occupied Bandwidth (Continued)
Paragon/PD Modem at 12800 baud 4FSK

MODULATION SOURCE DESCRIPTION:

TX Data Pattern:

The transmit data pattern is DBA protocol- type of "idle" packets data pattern as described in Annex E "Digital Modulation Techniques" of the application EA98949 granted on 11/16/2000. After this data follows the modulation process described, the resulting base band signal feed the modulator's input of the Exciter.

For 16000 baud rate, the deviation is set to 4.38kHz. For deviation readings an IF filter of 30kHz has been used.

NECESSARY BANDWIDTH (Bn) CALCULATION

See Page 11 for emission designator determination.

The corresponding emission designator prefix for necessary bandwidth
16K5F1D for 16000 baud rate, 4.38 kHz deviation

TEST DATA: Refer to the following graphs:

MASK: C, 16K5F1D, 100W

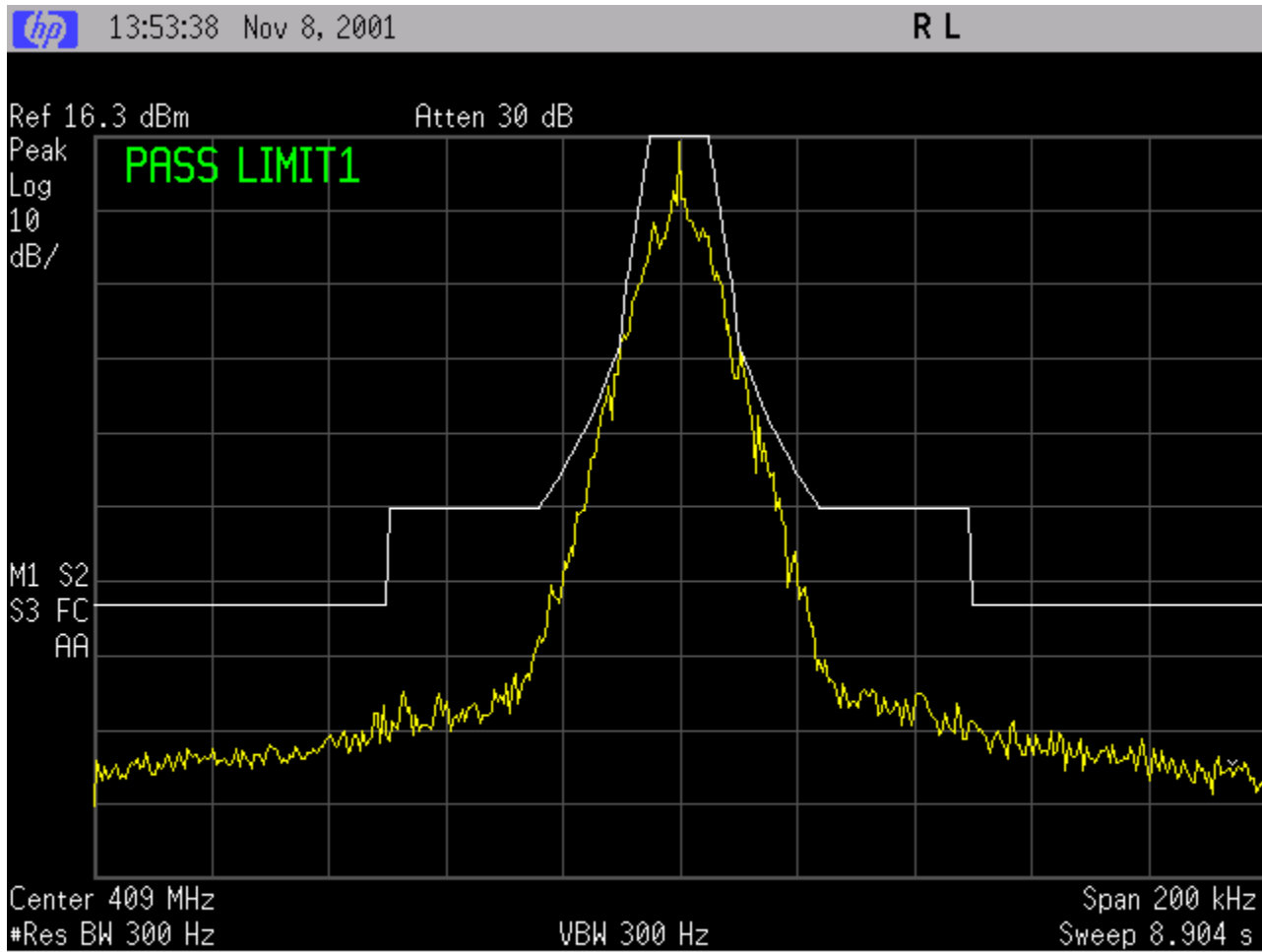
SPECTRUM FOR EMISSION 16K5F1D

OUTPUT POWER: 100 Watts

16000 bauds, 4 level FSK

PEAK DEVIATION = 4380 Hz

SPAN = 200 kHz



MASK: C, 16K5F1D, 20W

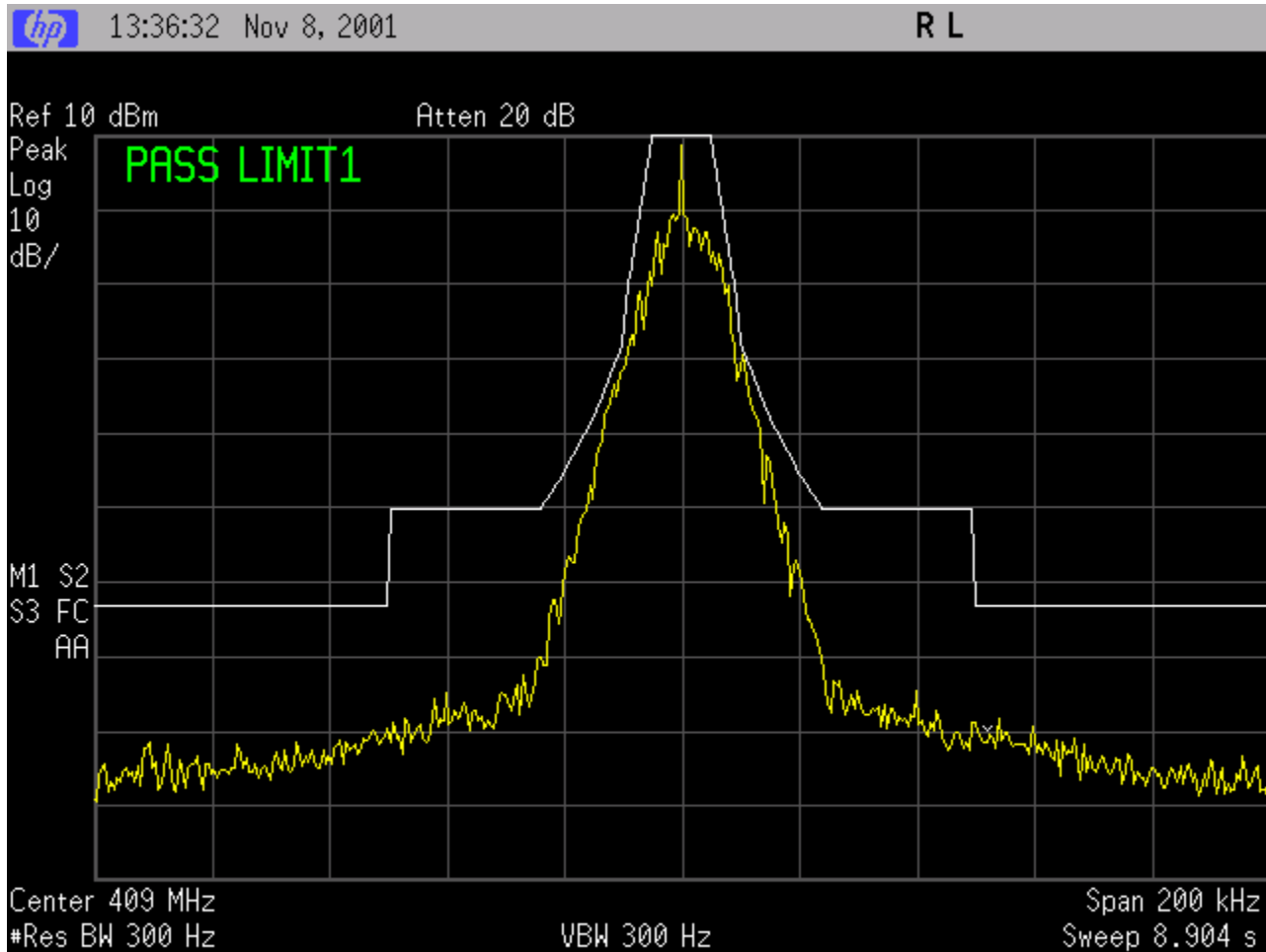
SPECTRUM FOR EMISSION 16K5F1D

OUTPUT POWER: 20 Watts

16000 bauds, 4 level FSK

PEAK DEVIATION = 4380 Hz

SPAN = 200 kHz



MASK: C, 16K5F1D, 1W _exciter output

SPECTRUM FOR EMISSION 16K5F1D

OUTPUT POWER: 1 Watt

16000 bauds, 4 level FSK

PEAK DEVIATION = 4380 Hz

SPAN = 200 kHz

