

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

for the

**Tait's T85x -2 (440-480MHz) base station**

modulated with

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

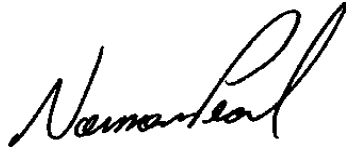
**FCC ID: EOTBDD4T85-2**

**Trade Name: Paragon/PD**

May 7, 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".

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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 EOTBDD4T85-2.

The certificate EOTBDD4T85-2 has been granted to Dataradio Inc 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 MHz base station built by Tait Electronics Ltd. Dataradio Inc. buys this base station and uses it to build Paragon/PD, a wireless data base station. Dataradio Inc. 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 genuine Dataradio Gemini/PD mobile family certified with the FCC ID EOTGPDA.

The certificate EOTBDD4T85-2 is granted for the following list of emission designators 14K3 and 15K9F1D and 10K7 and 15K7 F3E. The change consists in the addition of two new emission designators for the 4-FSK digital modulation source for which the compliance has been demonstrated for mask 90.210D. They accommodate two new speeds and their figures are 7K50 and 7K00 F1D. This Class II permissive change involves the two new speeds only and they are completely described with the current report.

EXISTING CONDITIONS

The unit utilized for these occupied bandwidth and mask-compliance measurements was a prototype built from current production transmitter EOTBDD4T85-2 (in itself being a change in ID from production CASTEL0023) with beta-level firmware used to create the modulation scheme. The exciter operates on frequencies ranging from 440.000 MHz to 480.000 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 EOTBDD4T85-2.

PROPOSED CONDITIONS

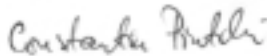
It is proposed to accept the Class II permissive change request for the EOTBDD4T85-2 certificate for operation in the band of frequencies previously outlined. The applicant anticipates marketing the device for use in wireless transmission of data.

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. Equipment performance 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 performance measurements were made between Apr 22, 2001 and May 2,2001.

CONCLUSION

Given the results of the measurements contained herein, the applicant requests to be applied a Class II Permissive Change for the Certificate EOTBDD4T85-2 to add the two new emission designators 7K50F1D and 7K00F1D to the existing list.



05/04/01

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  
25 Years experience in radio communications

**NAME:** Constantin Pintilei  
**TITLE:** R&D Test Engineer  
**TECHNICAL EDUCATION:** Bachelor of Science Degree in Electronic Engineering specialization  
Radiotechnique  
(1993) Technical University of Iasi, Romania  
**TECHNICAL EXPERIENCE:** 8 Years experience in radio frequency measurements.

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

The certificate EOTBDD4T85-2 has been granted to Dataradio Inc. following an ID change request from CASTEL0023. The certificate CASTEL0023 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 has been asked

Same time , 25.6kbps and 19.2 kbps speeds using 4-FSK SRRC digital modulation were granted following the supplementary data submitted in regards to Class II permissive change processed along with the change in ID.

The emission designator list of the certificate has the following values:

- 10K7 and 15K7F3E inherited from the original certificate CASTEL0023 granted on 01/19/1999
- 14K3 and 15K9F1D for 25.6kbps and 19.2 kbps 4-FSK SRRC digital modulation granted following the ID change along with Class II permissive change request on 11/07/2000

The current Class II permissive change request asks for following two new values in the emission designator list:

- 7K50 and 7K00F1D, used for 16.0 and 14.4 kbps 4-FSK SRRC digital modulation, and whose compliance is demonstrated for mask 90.210(D).

The change above described involves the modulation source only therefore it fall under Class II Permissive Changes type as per 2.1043 (b)(2). All modulator source signal-related issues as per 2.1033 (c) (4) and (13) are explained below on page 9. This Class II permissive change involves the code of the DSP-driven modulation source only, with no change occurring elsewhere in the logic or circuitry of the exciter module or of the PA module.

The characteristics affected 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(d)

They are entirely documented 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	6	US market only

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 Certificated Equipment -2.1043 (B)(2)**

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

APPLICANT and GRANTEE: 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 Base station for UHF frequencies)  
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 PPS

SERIAL NUMBER ( S ): D212 address 1.0 -prototype 4-level FSK BDLC  
T857-26-0020 s.n 13019666 Exciter module  
T859-20-0005 s.n 13015093 PA module

FCC ID NUMBER: EOTBDD4T85-2 (following from a change in ID of CASTEL0023)

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

FREQUENCY RANGE: 440MHz -480 MHz as per EOTBDD4T85-2 certificate

MAXIMUM POWER RATING: 100Watts as per EOTBDD4T85-2 certificate.

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

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 PPS

**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	12.5kHz ch. (8000baud, 4 FSK)	<b>7K00F1D</b>
	12.5kHz ch. (7200baud, 4 FSK)	<b>7K50F1D</b>
Previously granted for EOTBDD4T885-2	25kHz ch.	<b>15K7F3E</b>
	25kHz ch. ( 12800baud, 4 FSK)	<b>14K3F1D</b>
	25kHz ch. ( 9600baud, 4 FSK)	<b>15K9F1D</b>
	12.5kHz ch. sp.	<b>10K7F3E</b>

**SPECTRUM EFFICIENCY STANDARD DATA** 90.203 (j)(3)

The unit transmits 16000 bps in 12.5 kHz channel bandwidth.  
This is more than  $4800 \times 2 = 9600$  bps required for  $6.25 \times 2 = 12.5$  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 98946) for 25.6kbps and 19.2 kbps 4-FSK SRRC digital modulation still applies.  
The only difference refers to the speeds which are 16.0kbps and 14.4 kbps. The cut-off frequencies of the SRRC digital filtering are provided in 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(h):** 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 EOTBDD4T85-2 Transmitter. Paragon/PD is comprised of the Tait Electronics Ltd. T85M – 2Y 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 (SRRC4FSK) 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
16000bps	8000 bauds	4000 Hz	± 1.6 KHz	7000 Hz	7K00
14400bps	7200 bauds	3600 Hz	± 2.0 KHz	7500 Hz	7K50

The measurement theory and set-up explanations follow.

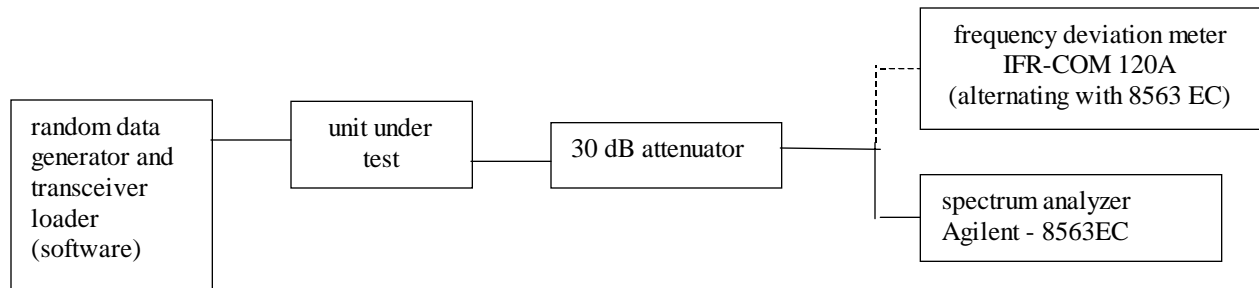
**Occupied Bandwidth Measurement**

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 during the tests for compliance with mask D, the resulting value was recorded as Occupied Bandwidth.

The measurement set-up is:



NAME OF TEST: Transmitter Occupied Bandwidth  
Paragon/PD Modem at 7200 and 8000 baud 4FSK

Mask compliance data in support of Emission Designator **7K00F1D and 7K50F1D**

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

MINIMUM STANDARD: Mask D  
Sidebands and Spurious [Rule 90.210 (d)]  
Authorized Bandwidth = 11.25 kHz [Rule 90.209(b) (5)]  
Fo to 5.625 kHz Attenuation = 0 dB  
>5.625 kHz to 12.5 kHz Attenuation= 7.27( $f_d - 2.88\text{kHz}$ ) dB  
>12.5kHz Lesser of 50 + 10\*log(P) dB or 70dB

**Corner Points:**  
Fo to 5.625 kHz Attenuation = 0 dB  
>5.625 kHz to 12.5 kHz Attenuation=20 dB to 70 dB  
>12.5 kHz Attenuation =60dB (10W)

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

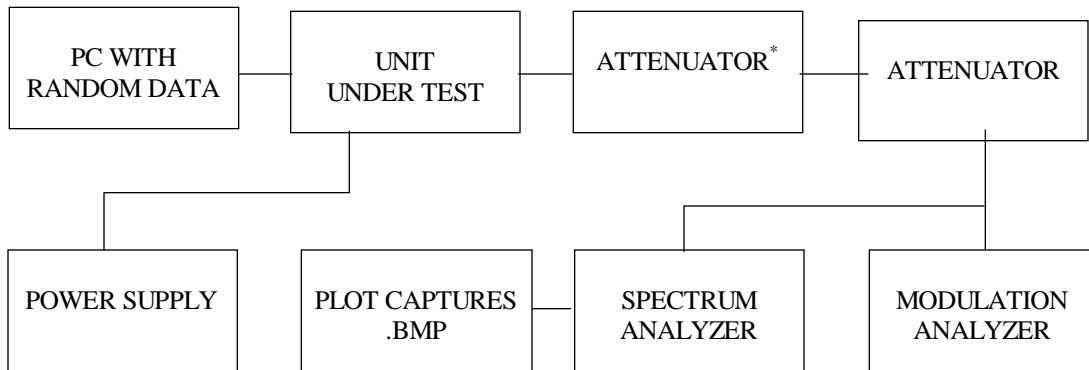
TEST CONDITIONS: Standard Test Conditions, 25 C

TEST EQUIPMENT: Attenuator, BIRD Model / 50-A-MFN-30 / 30 dB / 50 Watt  
Attenuator\*, BIRD Model / 150-A-MFN-30 / 30 dB / 100 Watt (not used for the captures at exciter output (1W))  
DC Power Source, Model Astron VS 20M  
Communication Analyzer, Model IFR COM120A (deviation meter)  
Spectrum Analyzer, Model Agilent (HP) 8563EC

*Constantin Pintilei*

PERFORMED BY: \_\_\_\_\_ DATE: 05/02/01  
Constantin Pintilei

TEST SET-UP:



NAME OF TEST: Transmitter Occupied Bandwidth (Continued)  
Paragon/PD Modem at 7200 and 8000 baud 4FSK  
In Support of Emission Designators **11K0F1D** and **9K50F1D**

**MODULATION SOURCE DESCRIPTION:**

TX Data Pattern:

The transmit data pattern is DBA protocol- type of "idle" packets data pattern remains as described in Annex E "Digital Modulation Techniques" submitted with the first Class II permissive Change request ( file EA 98946) . After this data follows the modulation process described, the resulting base band signal feed the modulator's input of the Exciter.

For 7200 baud rate, the deviation is set to 2.0 kHz. For 8000 baud rate, the deviation is set to 1.6 kHz. For deviation readings it has been used the IF filter of 30KHz

**NECESSARY BANDWIDTH (Bn) CALCULATION**

See Page 10 for emission designator determination.

The corresponding emission designator prefix for necessary bandwidth  
**7K50F1D** for 7200 baud rate , 2.0 kHz deviation  
**7K00F1D** for 8000 baud rate, 1.6 kHz deviation

**TEST DATA:** Refer to the following graphs:

**MASK: D, 7K00F1D, 100W**

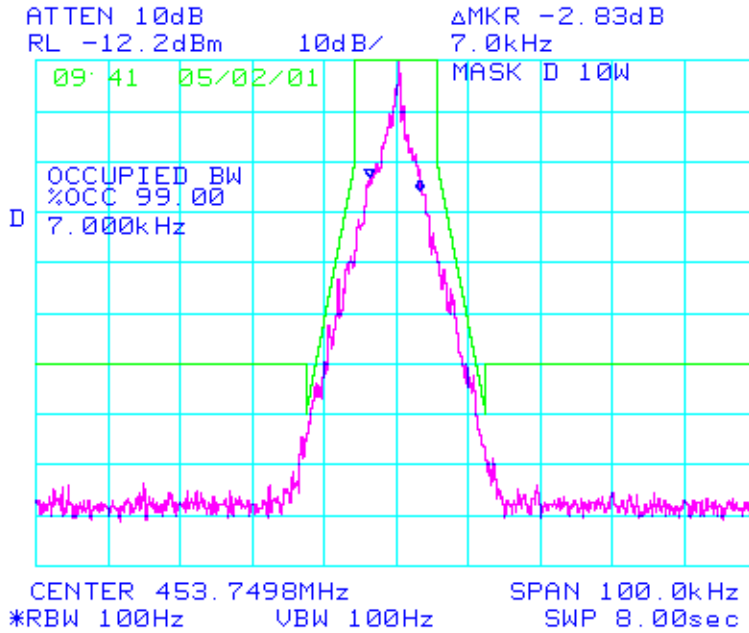
**SPECTRUM FOR EMISSION 7K00F1D**

OUTPUT POWER: 100 Watts

8000 bauds, 4 level FSK

PEAK DEVIATION = 1600 Hz

SPAN = 100 kHz



Note: For frequencies spaced more than 12.5kHz from the central frequency the required attenuation should read 70dBc at 100W. The plot above reads 60dBc as indicated in the description of the set-up. The measured emission bandwidth is within the actual requirement.

MASK: D, 7K00F1D, 20W

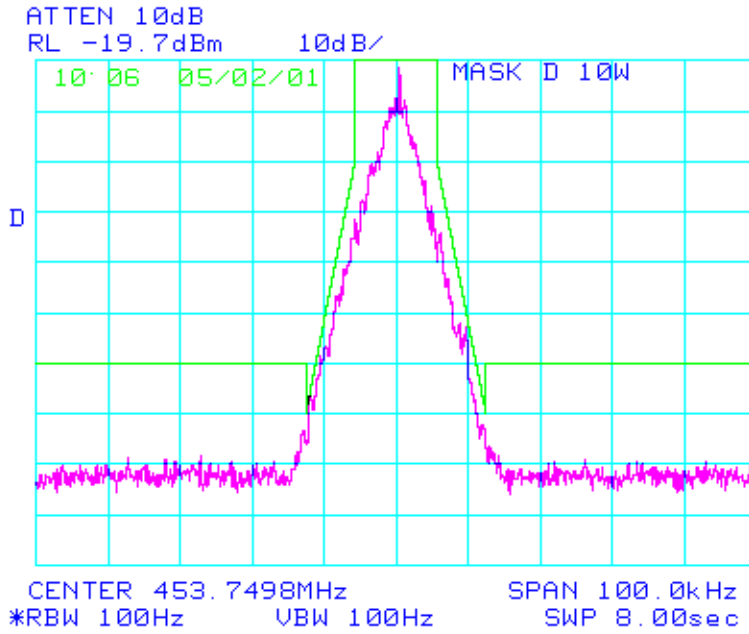
SPECTRUM FOR EMISSION 7K00F1D

OUTPUT POWER: 20 Watts

8000 bauds, 4 level FSK

PEAK DEVIATION = 1600 Hz

SPAN = 100 kHz



Note: For frequencies spaced more than 12.5kHz from the central frequency the required attenuation should read 63dBc at 20W. The plot above reads 60dBc as indicated in the description of the set-up. The measured emission bandwidth is within the actual requirement.

MASK: D, 7K00F1D, 1W Exciter output

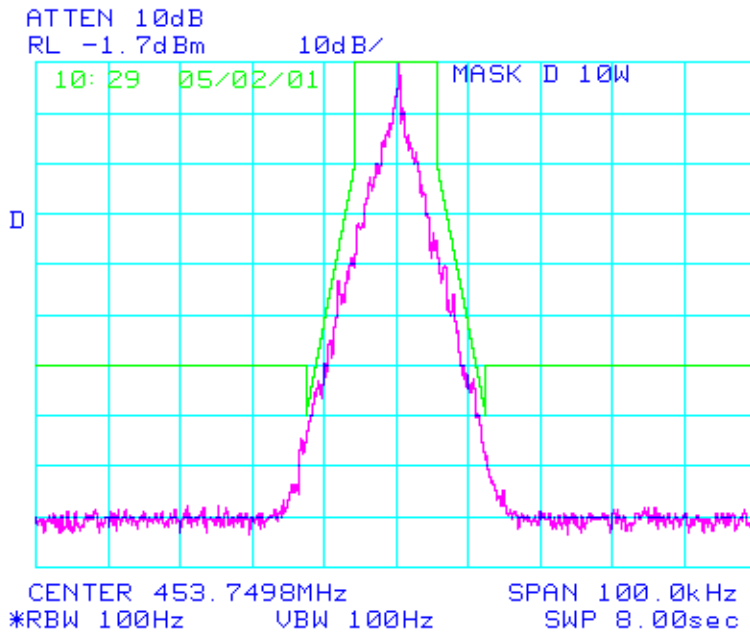
SPECTRUM FOR EMISSION 7K00F1D

OUTPUT POWER: 1 Watt

8000 bauds, 4 level FSK

PEAK DEVIATION = 1600 Hz

SPAN = 100 kHz



Note: For frequencies spaced more than 12.5kHz from the central frequency the required attenuation should read 50dBc at 1W. The plot above reads 60dBc as indicated in the description of the set-up. The measured emission bandwidth is within the actual requirement.

MASK: D, 7K50F1D, 100W

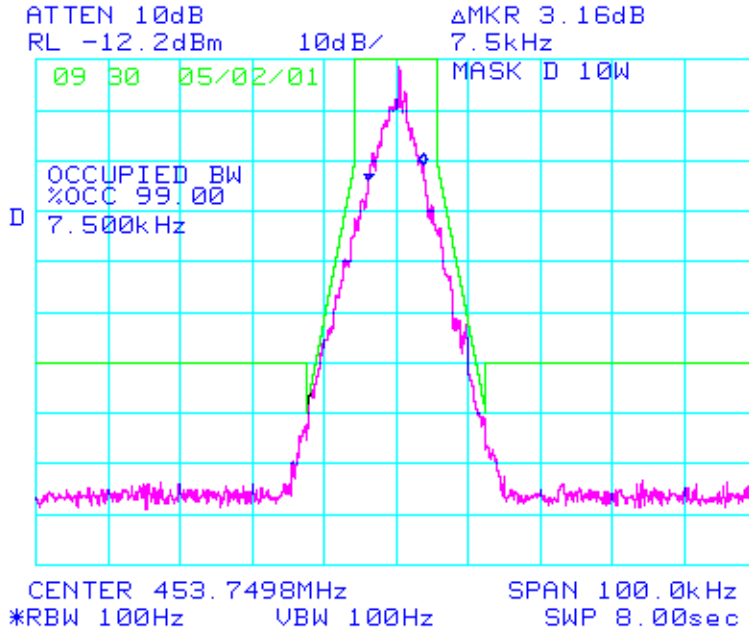
SPECTRUM FOR EMISSION 7K50F1D

OUTPUT POWER: 100 Watts

7200 bauds, 4 level FSK

PEAK DEVIATION = 2000 Hz

SPAN = 100 kHz



Note: For frequencies spaced more than 12.5kHz from the central frequency the required attenuation should read 70dBc at 100W. The plot above reads 60dBc as indicated in the description of the set-up. The measured emission bandwidth is within the actual requirement.



MASK: D, 7K50F1D, 20W

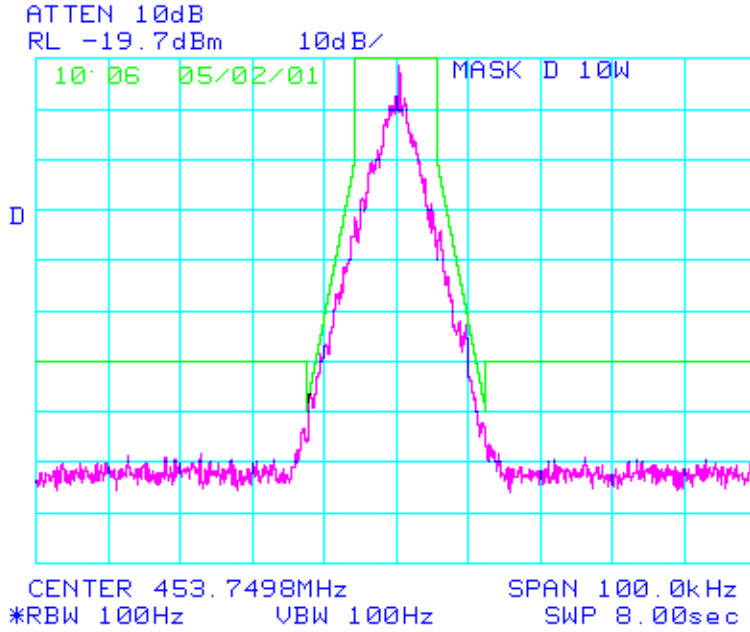
SPECTRUM FOR EMISSION 7K50F1D

OUTPUT POWER: 20 Watts

7200 bauds, 4 level FSK

PEAK DEVIATION = 2000 Hz

SPAN = 100 kHz



Note: For frequencies spaced more than 12.5kHz from the central frequency the required attenuation should read 63dBc at 20W. The plot above reads 60dBc as indicated in the description of the set-up. The measured emission bandwidth is within the actual requirement.

**MASK:** D, 7K50F1D, 1W Exciter output

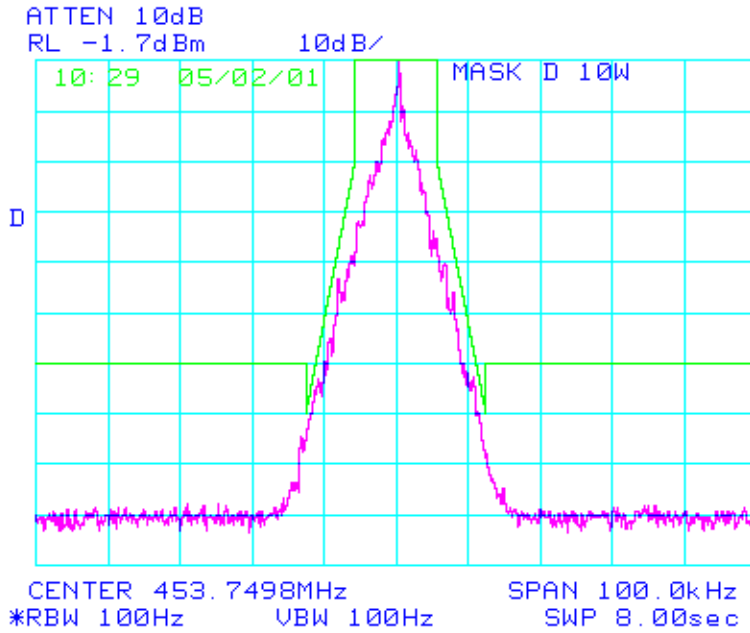
**SPECTRUM FOR EMISSION 7K50F1D**

OUTPUT POWER: 0.9 Watts

7200 bauds, 4 level FSK

PEAK DEVIATION = 2000 Hz

SPAN = 100 kHz



Note: For frequencies spaced more than 12.5kHz from the central frequency the required attenuation should read 50dBc at 1W. The plot above reads 60dBc as indicated in the description of the set-up. The measured emission bandwidth is within the actual requirement.