

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

for the

T881 Exciter module of Tait's T88x 800 MHz base station

modulated with

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

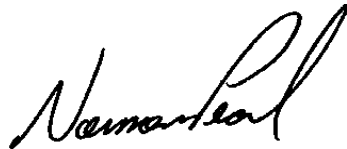
FCC ID: EOTBDD4T881S2

Trade Name: Paragon/PD

November 14, 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 fluid and cursive, with the first name "Norman" and last name "Pearl" clearly distinguishable.

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 EOTBDD4T881S2. All changes involved fall under Class II Permissive Change types and they are entirely detailed within the current report.

The certificate EOTBDD4T881S2 has been granted to Dataradio Inc. for the T881 Exciter module of the T88M-XY (see page 6 for part# description) 800 MHz base station manufactured 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 a new proposed digital modulation scheme, does the final assembly and markets the finished Paragon/PD unit.

One Class II Permissive type of change is demonstrated with this filing. The certificate EOTBDD4T881S2 is granted for the following list of emission designators: 9K50, 11K0, 14K3 and 15K9F1D and 16K0F3E. The change consists in the addition of a new speed capability for another 4-FSK digital modulation source for which the compliance has been demonstrated for mask 90.210G. For this modulation source the occupied bandwidth fell within the current emission designators of 15K9F1D. 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 EOTBDD4T881S2 (in itself being a change in ID from production CASTEL0043) with beta-level firmware used to create the modulation scheme. The Exciter operates on frequencies ranging from 800.000 MHz to 870.000 MHz. The frequency tolerance of the exciter is .0001% or 1 parts per million and the output power is 5W as granted in EOTBDD4T881s2.

PROPOSED CONDITIONS

It is proposed to accept the Class II permissive change request for the EOTBDD4T881S2 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 Nov 5, 2001 and Nov 14, 2001.

CONCLUSION

Given the results of the measurements contained herein, the applicant requests to be accepted the Class II Permissive Change for the Certificate EOTBDD4T881S2.



11/14/01

Constantin Pintilei
R&D Test Engineer, Dataradio Inc.

TABLE OF CONTENTS

AFFIDAVIT	2
ENGINEERING STATEMENT	3
TABLE OF CONTENTS.....	4
Qualifications of Engineering Personnel.....	5
Class II Permissive Change Information - Rule part 2.1043 (b)(2)	6
General Information about the Grantee and Certified Equipment -2.1043 (B)(2)	7
Data And Characteristics Not Affected By The Change-Rule Part Number: 2.1033 (c)(8),(9),(10),(11),(12),(15),(16)	8
Data And Characteristics Affected By The Change - Rule Part Number: 2.1033(c) (3),(4),(13),(14)	9
TEST DATA Rule Part Number: 2.1033 (c)(14)	9
Transmitter Occupied Bandwidth.....	10
Emission Designator Determination	10
Mask compliance data in support of 32kbps/16kbaud with RC4FSK modulation type.....	11
MASK: G, 5W.....	13
MASK: G, 1W.....	14

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 EOTBDD4T881S2 has been granted to Dataradio Inc. following an ID change request from CASTEL0043. The certificate CASTEL0043 has been granted to Tait Electronics Ltd. for its series II of T881 Exciter module. It belongs to the T88M-XY (see page bottom for part# description) 800 MHz 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:

- 16K0F3E inherited from the original certificate CASTEL0043 when the change in ID to EOTBDD4T881S2 was granted on 04/20/2001
- 14K3, 15K9, 9K50 and 11K0F1D for accordingly 25.6, 19.2, 16.0 and 14.4 kbps 4-FSK SRRC digital modulation granted on 05/30/2001 following a Class II permissive change request on 05/11/2001

The current Class II permissive change request demonstrates a Occupied Bandwidth of 15300Hz. The compliance of the proposed digital speed and filtering (32.0 kbps and 4-FSK RC digital modulation) is demonstrated for mask 90.210(G). Its emission designator, 15K3F1D does not need to be explicitly specified since a 15K9F1D occupied bandwidth/emission designator is already approved. Following the FCC part 2.1043(b)(2) rule, in order to market the proposed change the acknowledgment of the Commission that the change is acceptable must be obtained. Therefore a Class II Permissive Change request has been considered.

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. 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(g)

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 G 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 800 MHz base station T88M-XY

<u>M</u>	<u>Module Type</u>	<u>X</u>	<u>Freq Range</u>	<u>Y</u>	<u>Channel Bandwidth</u>
1	Exciter (5W)	1	800-870 MHz	0	25 kHz
5	Receiver	2	860-910 MHz	5	12.5 kHz
9	Power Amplifier	3	890-960 Mhz		

Part Number of the Paragon/PD 800 MHz data base station BDD4 -88XY 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	800-870 MHz	0	25 KHz	005	5W	0	12VDC external
2	860-960 MHz	5	12.5 KHz	070	70W	2	dual 120V AC

EQUIPMENT IDENTIFICATION:

<u>TRADE NAME</u>	<u>DESCRIPTION</u>	<u>Dataradio Inc PART NUMBER</u>
T88x	800 Mhz Base Station	T88M-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 and GRANTEE of ID EOTBDD4T881S2 Dataradio Inc.,
5500 Royalmount Ave, suite 200,
Town of Mount Royal, Quebec, Canada, H4P 1H7

MANUFACTURER: Tait Electronics Ltd., Burnside Christchurch 5, New Zealand
(T88x 800 MHz Base station, original FCC ID:CASTEL0043)
DATARADIO Inc., Town of Mount Royal, Quebec, Canada, H4P 1H7
(D212 BDLC and Paragon/PD- final assembly)

MODEL NUMBER: Paragon/PD
PART NUMBER: BDD4-88XY PPPS

SERIAL NUMBER (S): D212 address 1.0 -prototype 4-level FSK BDLC
T881-10-0200 s.n 13012185 Exciter module

FCC ID NUMBER: EOTBDD4T881s2

FCC RULES AND REGS: FCC Part (s) 90

FREQUENCY RANGE: 800 MHz -870 MHz as per EOTBDD4T881s2 certificate

MAXIMUM POWER RATING: 5Watts as per EOTBDD4T881s2 certificate.
The output power is adjustable down to 1W.

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:

TRADE NAME

T88x
D212
Paragon/PD

DESCRIPTION

800 MHz Base Station
Base Data Link Controller (BDLC)
Assembly

DRI PART NUMBER

T88M-XY
050-03330-00x
BDD4-88XY 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
MPE limits compliance	2.1091
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) **115K9F1D – not changed**

Previously granted for EOTBDD4T885-3	25kHz ch.	16K0F3E
	25kHz ch. (12800baud, 4 FSK)	14K3F1D
	25kHz ch. (9600baud, 4 FSK)	15K9F1D
	12.5kHz ch. (8000baud, 4 FSK)	9K50F1D
	12.5kHz ch. (7200baud, 4 FSK)	11K0F1D

DIGITAL MODULATION TECHNIQUES

2.1033 (c)(13)

The explanation provided with the previous Class II permissive change request (731 form number EA 100968) for the other speeds and 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 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(g): 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 EOTBDD4T881S2 Transmitter. Paragon/PD is comprised of the Tait Electronics Ltd. T88M 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	Authorized Bandwidth	Emission designator *
32000bps	16000 bauds	8000Hz	$\pm 3.63\text{kHz}$	15333 Hz	20000 Hz	15K9

* The Occupied Bandwidth being less than 15900, which is already approved with the 15K9F1D emission designators, there is no need to append a new emission designator to the list.

The measurement theory and set-up explanations follow.

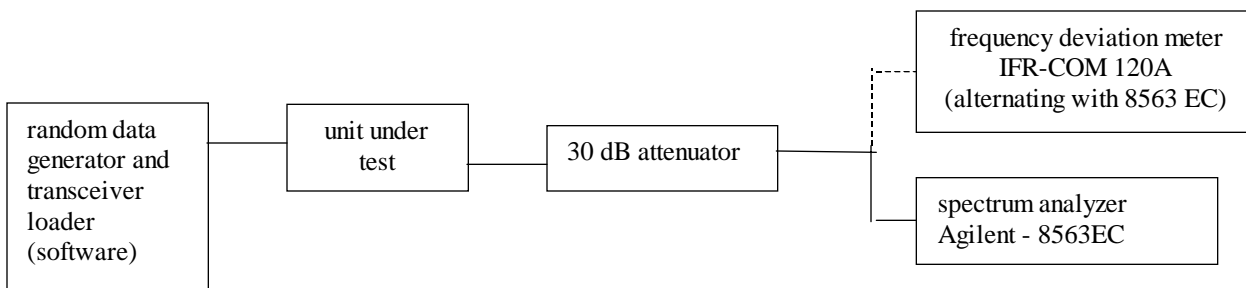
Occupied Bandwidth Measurement

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 32kbps/16kbaud with RC4FSK modulation type

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

MINIMUM STANDARD: Mask G
Sidebands and Spurious [Rule 90.210 (g)]
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:
 $116 * \log(f_d \text{ KHz} / 6.1)$ dB,
 $50 + 10 \log_{10}(P)$ OR
70 dB
>250% Auth BW $43 + 10 * \log(P)$
Corner Points:
 f_0 to 5.0 kHz Attenuation = 0 dB
>5.0 kHz to 10.0 kHz Attenuation = 0 dB to 25 dB
>10.0 kHz to 25.0 KHz Attenuation = 25 dB to 70 dB
>25.0 kHz to 50kHz Attenuation = 70dB (minimum 57dB -5W)
>250% Auth BW Attenuation = 50 dB (minimum 50 dB -5 W)
TEST RESULTS: Meets minimum standard (see data on the following pages)

TEST CONDITIONS: Standard Test Conditions, 25 C

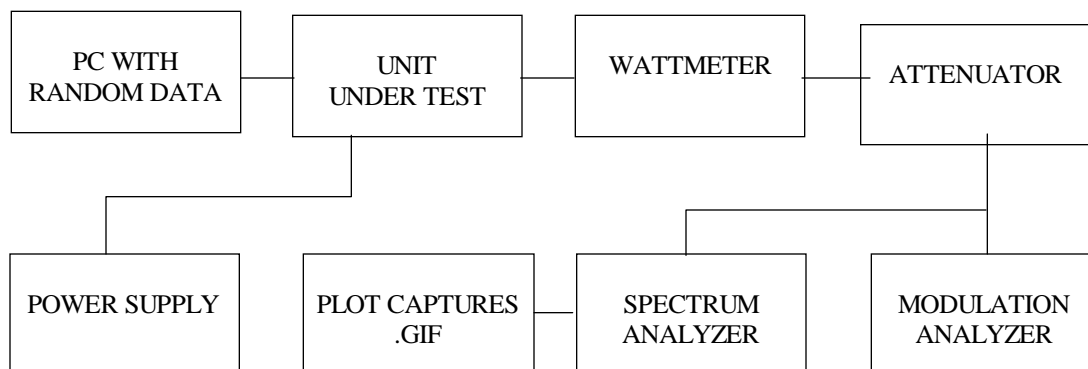
TEST EQUIPMENT: Attenuator, BIRD Model / 150-A-MFN-30 / 30 dB / 150 Watt
Wattmeter Coaxial Dynamics model 81050
DC Power Source, Model Tait T808-10-00CA
Communication Analyzer, Model IFR COM120B for Modulation Analyzer
Spectrum Analyzer, Model HP E4401

Constantin Pintilei

PERFORMED BY: _____ DATE: 11/13/00

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 EA100968 granted on 05/30/2001. 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 3.63 kHz. For deviation readings an IF filter of 30kHz has been used.

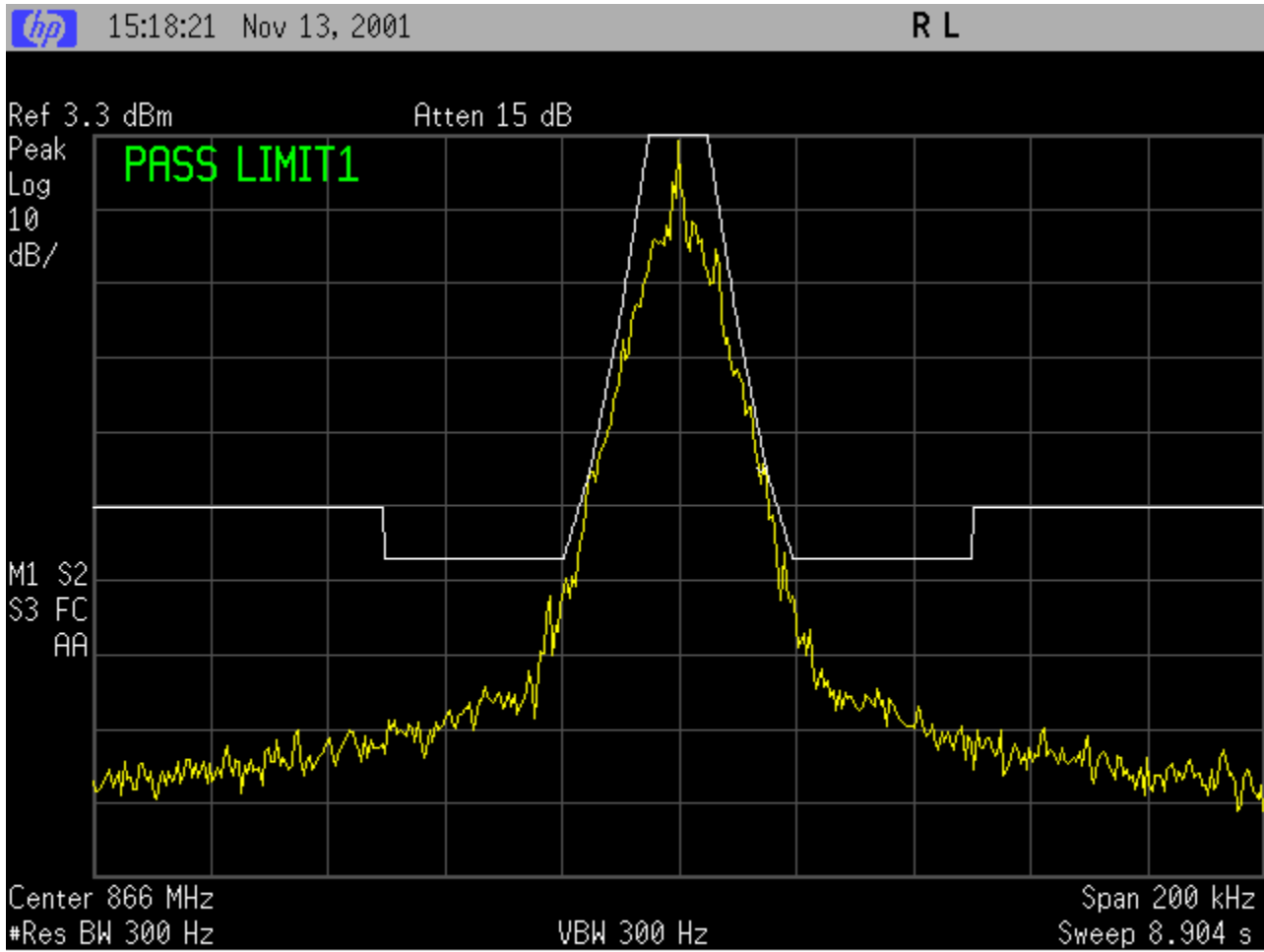
NECESSARY BANDWIDTH (B_n) CALCULATION

See Page 11 for emission designator determination.

The corresponding Necessary Bandwidth is 15333 Hz for 16000 baud rate, 3.63 kHz deviation and emission designator prefix for necessary bandwidth **15K9F1D**

TEST DATA: Refer to the following graphs:

MASK: G, 5W
OUTPUT POWER: 5 Watts
16000 bauds, 4 level FSK
PEAK DEVIATION = 3630 Hz
SPAN = 200 kHz



MASK: G, 1W
OUTPUT POWER: 1 Watt
16000 bauds, 4 level FSK
PEAK DEVIATION = 3630 Hz
SPAN = 200 kHz

