

June 23, 1998

FEDERAL COMMUNICATIONS COMMISSION

7435 Oakland Mills Road
Columbia, MD 21046
USA

Subject: Certification Application under FCC Part 15, Subpart C, Para. 15.247, Frequency Hopping Spread Spectrum Transmitters Operating in the Frequency Band 2402 - 2478 MHz.

Applicant: TELXON CORPORATION
Product: PTC-921 DOS
FCC ID: BC5-24-LP

Dear Sir/Madam,

The product sample, as provided by you, has been tested and found to comply with **FCC Part 15, Subpart C, Para. 15.247, Direct Sequence Spread Spectrum Transmitters operating in the Frequency Band 2402 - 2478 MHz.**

Please feel to contact us if you have any further questions.

Best Regards,

Tri M. Luu, P.Eng.
V.P. Engineering

June 23, 1998

TELXON CORPORATION
3330 West Market Street
Akron, OH
USA, 44313

Attn.: Mr. Dan Miller

Subject: Certification Application under FCC Part 15, Subpart C, Para. 15.247, Frequency Hopping Spread Spectrum Transmitters Operating in the Frequency Band 2402 - 2478 MHz.

Applicant: TELXON CORPORATION
Product: PTC-921 DOS
FCC ID: BC5-24-LP

Dear Mr. Miller,

The product sample, as provided by you, has been tested and found to comply with **FCC Part 15, Subpart C, Para. 15.247, Frequency Hopping Spread Spectrum Transmitters operating in the Frequency Band 2402 - 2478 MHz.**

We, UltraTech Engineering Labs Inc., as appointed agent for **TELXON CORPORATION**, will prepare the application to Federal Communications commission (FCC) for authorization of this equipment under Certification requirements of FCC Rules. The engineering report and required application documents have been submitted to FCC for inspection.

Enclosed you will find copies of the engineering report. If you have any queries, please do not hesitate to contact us.

Yours truly,

Tri Minh Luu, P. Eng.,
V.P., Engineering

Encl.

ENGINEERING TEST REPORT

PTC-921 DOS

FCC ID: BC5-24-LP

**FCC PART 15, SUBPART C, PARA. 15.247
FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTERS
OPERATING IN THE FREQUENCY BAND FROM 2402 - 2478 MHz**

UltraTech FILE NO.: BC5-015FTX

Tested for:

TELXON CORPORATION

3330 West Market Street
Akron, OH
USA, 44313

Tested by:

ULTRATECH GROUP OF LABS

4181 Sladeview Crescent, Unit 33
Mississauga, Ontario
Canada L5L 5R2

REPORT PREPARED BY: Tri M. Luu, P.Eng.

DATE: June 23, 1998

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1. EXHIBIT 1 - SUMMARY OF TEST RESULTS & GENERAL STATEMENT OF CERTIFICATION

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
15.247(a)(1) & 15.247(a)(1)(ii)	Hopping Channel Frequency Characteristics	Yes
15.247(b)(2) & 1.1310	Peak Output Power and RF Exposure Limit	Yes
15.247(c)	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Not conducted since the antenna is an internal integrated components.
15.247(c), 15.209 & 15.205	Transmitter Radiated Emissions	Yes
15.107	AC Power Conducted Emissions	Not applicable for battery operated equipment
1.1310	RF Safety Requirements/SAR	Note (2)

Note1: Telxon PTC-921 DOS has been tested and found to comply with FCC Part 15, Subpart B, Class A Digital Devices. The associated Radio Receiver operating in 2402 - 2478 MHz is exempted from FCC authorization .

Note 2: Since the EIRP power is too small and the calculated distance at the power density of 1 mW/cm² is less than the distance from the antenna to the plastic housing, the SAR tests and RF Safety requirements are not required.

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TESTIMONIAL AND STATEMENT OF CERTIFICATION

THIS IS TO CERTIFY:

- 1) *THAT the application was prepared either by, or under the direct supervision of the undersigned.*
- 2) *THAT the measurement data supplied with the application was taken under my direction and supervision.*
- 3) *THAT the data was obtained on representative production units, representative.*
- 4) *THAT, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.*

Certified by:

***Tri Minh Luu, P. Eng.
V.P., Engineering***

DATE: June 23, 1998

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1. EXHIBIT 2 - GENERAL INFORMATION

1.1. APPLICANT

TELXON CORPORATION
3330 West Market Street
Akron, OH
USA, 44313

Applicant's Representative: Mr. Dan Miller

1.2. MANUFACTURER

TELXON CORPORATION
8665 New Trails Drive
The Woodlands, Texas
USA, 77381

1.3. DESCRIPTION OF EQUIPMENT UNDER TEST

PRODUCT NAME:	PTC-921 DOS
SERIAL NUMBER:	Preproduction
TYPE OF EQUIPMENT:	Frequency Hopping Spread Spectrum Transmitters
OPERATING FREQ.:	2402 - 2478 MHz
NUMBER OF HOPPING FREQUENCY CHANNELS:	77
SEPERATION BETWEEN HOPPING FREQUENCY CHANNELS:	1 MHz
CHANNEL 20 dB BW:	682 kHz
CHANNEL OCCUPANCY TIME IN 30 SEC. PERIOD:	382 mS
POWER RATING:	2.0 mili-Watts max. EIRP

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EMISSION DESIGNATION:	682K0F1D
DUTY CYCLE:	50%
OSC. FREQUENCY(IES):	24 MHz (CPU), 2402 MHz (Radio low), 24077 MHz (Radio high)
INPUT SUPPLY:	Rechargeable battery
ANTENNA:	Internal integrated component antenna, antenna gain = 1.4 dBi
FCC ID:	BC5-24-LP
INTERFACE PORTS:	None

1.4. RELATED SUBMITTAL(S)/GRANT

Not applicable.

1.5. TEST METHODOLOGY

These tests were conducted on a sample of the equipment for the purpose of certification compliance with Code of Federal Regulations (CFR47-1991), Part 15, Subpart C, Para. 15.247, Frequency Hopping Spread Spectrum Transmitters operating in the Frequency Band 2402 - 2478 MHz.

Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4-1992 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz.

1.6. TEST FACILITY

AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

Radiated Emissions were performed at the UltraTech's 3-to-10 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: July 16, 1997.

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The above test site is also filed with Interference Technology International Ltd (ITI - An EC Directive on EMC).

1.7. UNITS OF MEASUREMENTS

Measurements of conducted emissions are reported in units of dB referenced to one microvolt [dB(uV)].

Measurements of radiated emissions are reported in units of dB referenced to one microvolt per meter [dB(uV)/m] at the distance specified in the report, wherever it is applicable.

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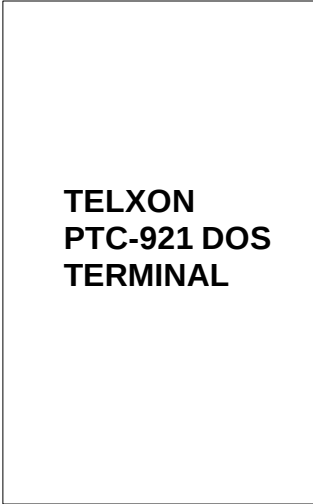
2. EXHIBIT 3 - SYSTEM TEST CONFIGURATION

2.1. TEST SYSTEM DETAILS

The following peripherals, FCC identifiers and types interconnecting cables were used with the EUT for testing:

- (1) **EUT:** TELXON CORPORATION, PTC-921 DOS, S/N: Preproduction, OSC. FREQ: 24 MHz (CPU), 2402 MHz (Radio low), 24077 MHz (Radio high).
I/O Cable: None
Power Supply Cable: None

2.2. BLOCK DIAGRAMS FOR CONDUCTED & RADIATED EMISSION MEASUREMENTS



TELXON
PTC-921 DOS
TERMINAL

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2.3. PHOTOGRAPH FOR RF EMISSION MEASUREMENTS



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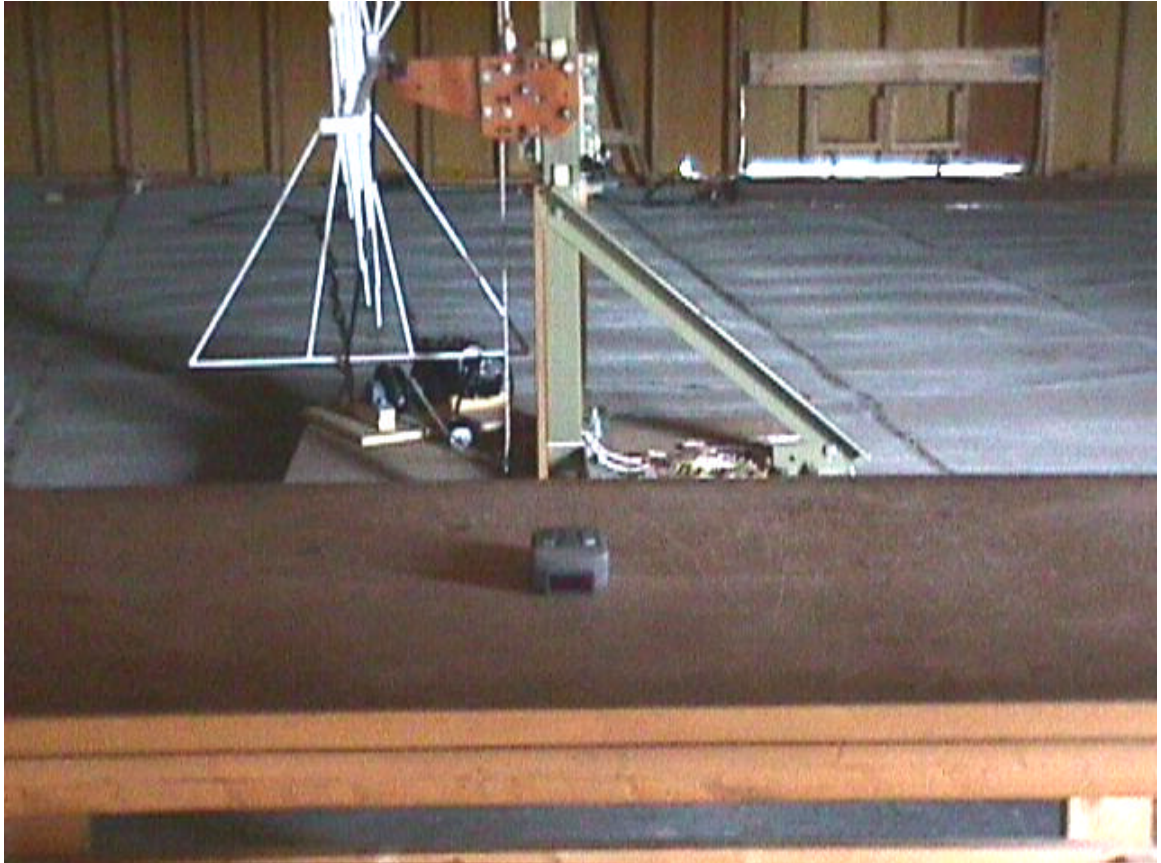


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2.4. JUSTIFICATION

No deviation, in both configuration and operation manners, different from normal operation were required.

2.5. EUT OPERATING CONDITION

The transmitter was specially set operated at lowest, middle and highest frequencies for testing.

2.6. SPECIAL ACCESSORIES

No special accessories were required.

2.7. EQUIPMENT MODIFICATIONS

Not required.

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3. EXHIBIT 4 - TEST DATA

3.1. HOPPING CHANNEL CARRIER FREQUENCY CHARACTERISTICS @ FCC CFR 47, PARA 15.247(A)(1) & (A)(1)(II)

PRODUCT NAME: PTC-921 DOS

FCC REQUIREMENTS:

@ FCC CFR 47, Para 15.247(a)(1):- Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

@ FCC CFR 47, Para 15.247(a)(1)(ii):- Frequency hopping systems operating in the 2402 - 2478 MHz and 5725-5850 MHz bands shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 23 °C
- Relative humidity: 43 %

POWER INPUT:

Rechargeable battery.

TEST EQUIPMENT:

- **Spectrum Analyzer**, Advantest, Model R3271, S/N: 15050203, 100 Hz to 32 GHz)
- **Microwave Amplifier**, HP, Model 83017A, Frequency Range 1 to 26.5 GHz, 34-38 dBdB gain nominal.
- **Log Periodic/Bow-Tie Antenna**, Emco, Model 3143, SN 1029, 20 - 1000 MHz, @ 50 ohms.
- **Horn Antenna**, Emco, Model 3115, SN 9701-5061, Frequency Range: 1 - 18 GHz, @ 50 Ohms.

METHOD OF MEASUREMENTS:

The measurements under this section will be performed at 3 meter distance.

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: May 10, 1998

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MEASUREMENT DATA:

Please refer of the attached plots for detailed measurements.

Test Description	FCC Specification	Measured Values	Comments
Channel Hopping Frequency Separation	minimum of 25 KHz or 20dB BW whichever is greater.	1 MHz	Pass
Channel frequency hopping method	See Note (1).	Please refer to the technical description provided by applicant.	Nil.
Number hopping frequencies	75 minimum	77	Pass
20 dB BW of the hopping channel	1 MHz maximum	682 kHz	Pass
Average Time of Occupancy	0.4 seconds max. within 30 seconds period	0.372 seconds within 30 seconds period	Pass

Note (1):- The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals

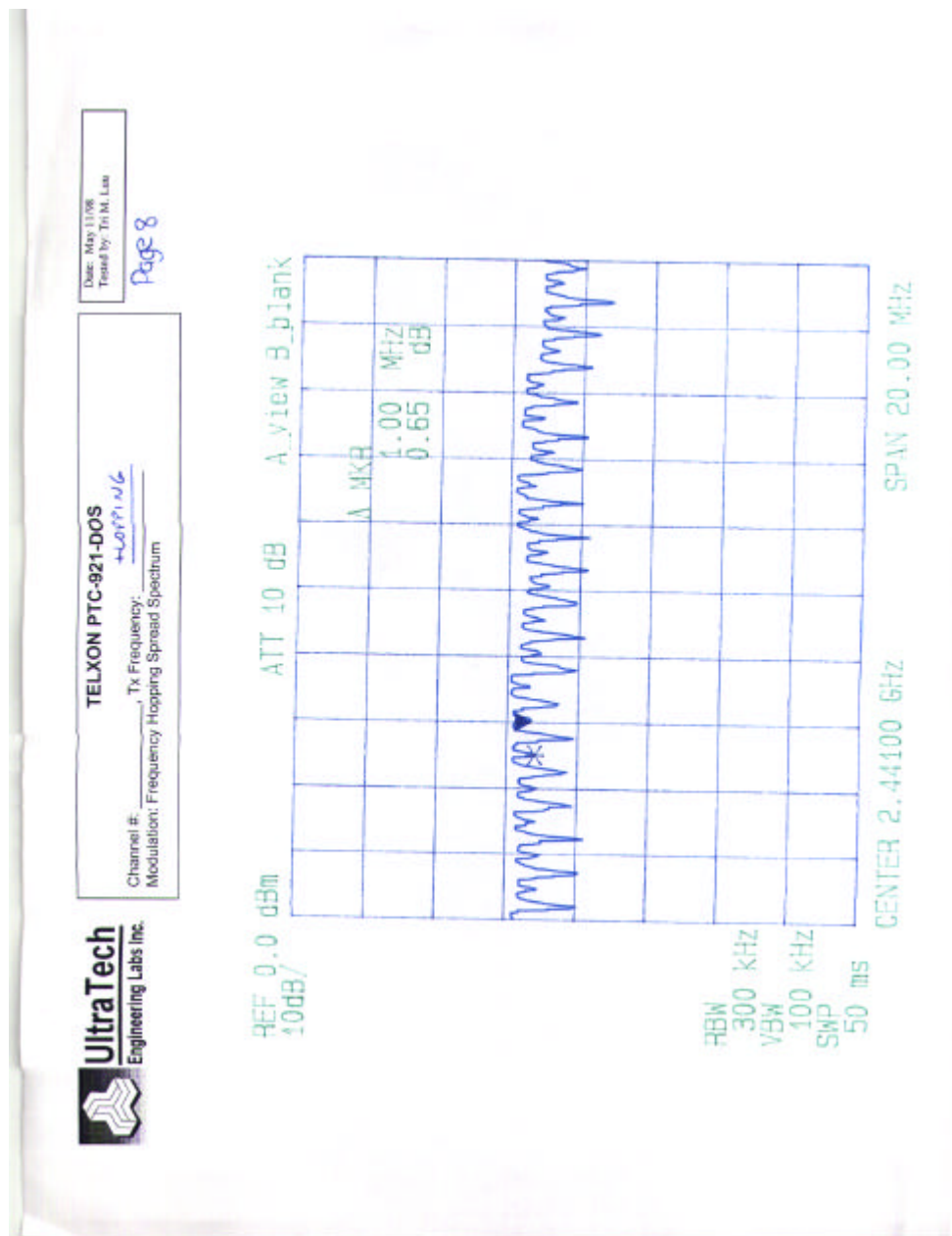
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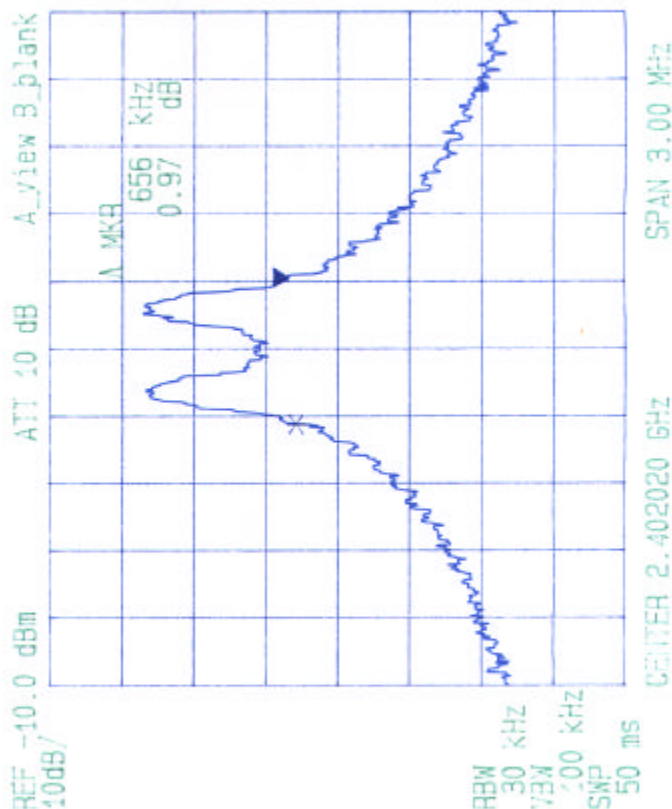
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Date: May 11/98
Tested by: T.M. Laro

Page 1

TELXON PTC-921-DOS

Channel #: 402020, Tx Frequency: 2.4020 GHz
Modulation: Frequency Hopping Spread Spectrum



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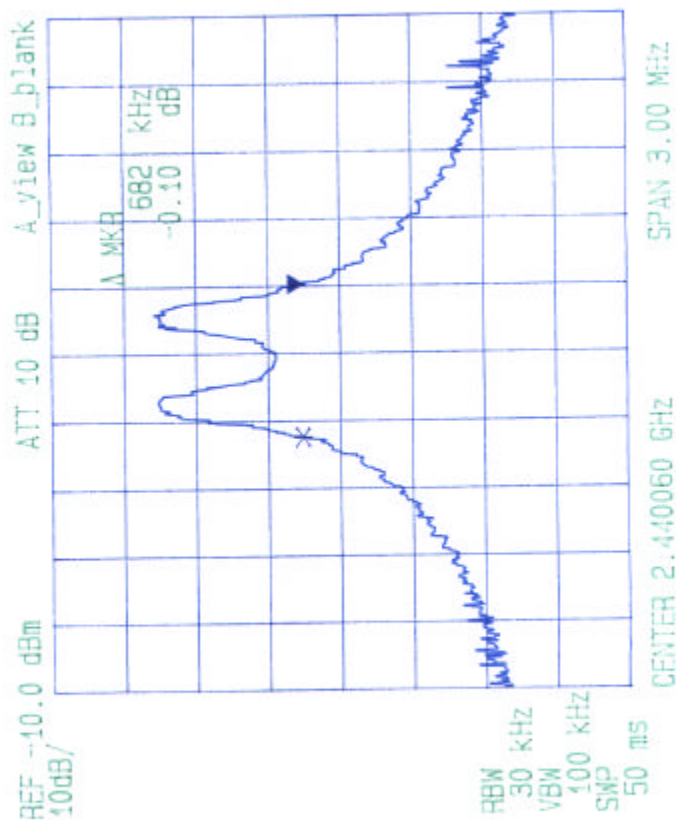
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Engineering Labs Inc.

TELXON PTC-921-DOS

Channel #: WLDLE, Tx Frequency: 2440 MHz
Modulation: Frequency Hopping Spread Spectrum

Date: May 11/98
Tested by: Tri M. Loo
Page 2

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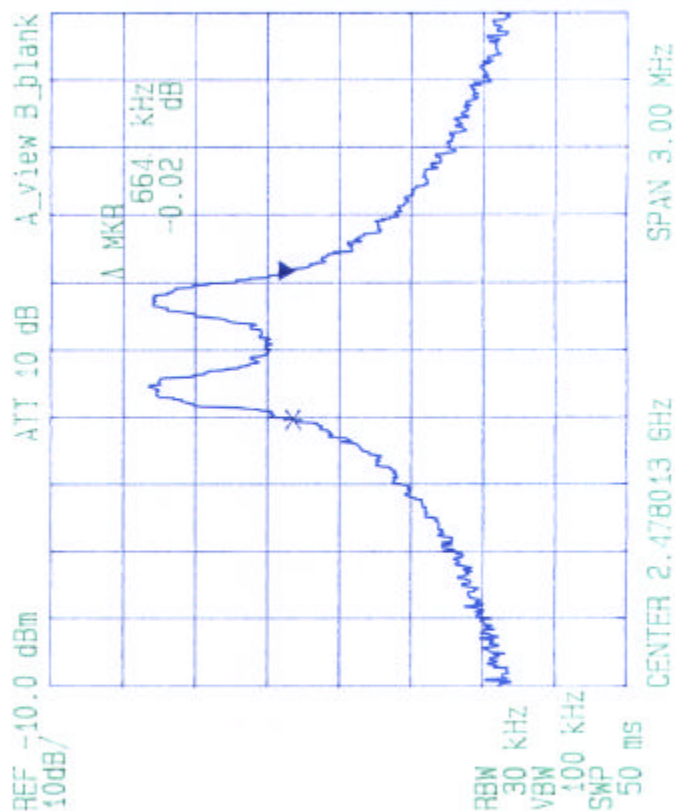
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Date: May 11/98
Tested by: Tri M. Lau

Page 3

TELXON PTC-921-DOS

Channel #: 416-635, Tx Frequency: 2478 MHz
Modulation: Frequency Hopping Spread Spectrum



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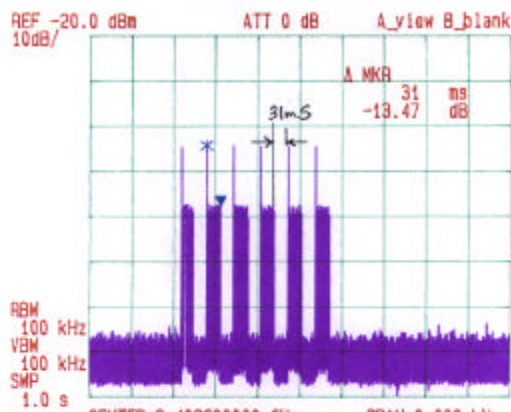
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Date: May 11/98
Tested by: Tim M. Liu

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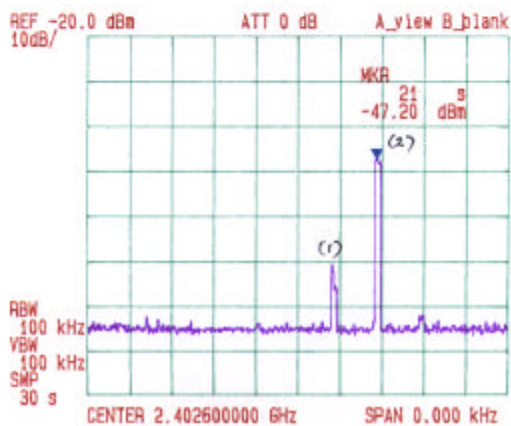
TELXON PTC-921-DOS

Channel #: / Tx Frequency: 2402
Modulation: Frequency Hopping Spread Spectrum



$$\text{OCCUPANCY TIME WITHIN 30S} = 31\text{ms} \times 6 \times 1 = 372\text{ms}$$

$$\text{DUTY CYCLE} = \frac{31\text{ms}}{31\text{ms} + 31\text{ms}} = 0.5$$



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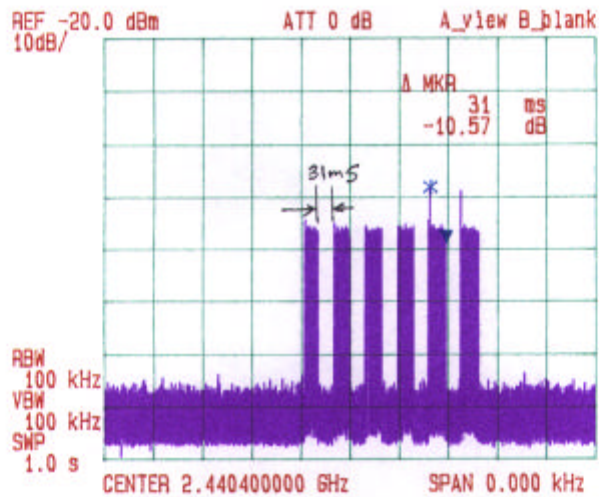
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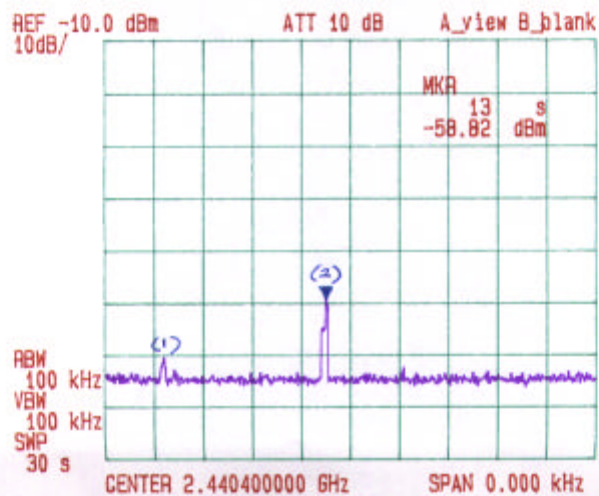
TELXON PTC-921-DOS

Channel #: 39, Tx Frequency: 2440
Modulation: Frequency Hopping Spread Spectrum



$$\text{OCCUPANCY TIME WITHIN 30SW} = 31\text{ms} \times 6 \times 2 = 372\text{ms}$$

$$\text{DUTY CYCLE WITHIN 100ms} = \frac{31\text{ms}}{31\text{ms} \times 2} = 0.5$$



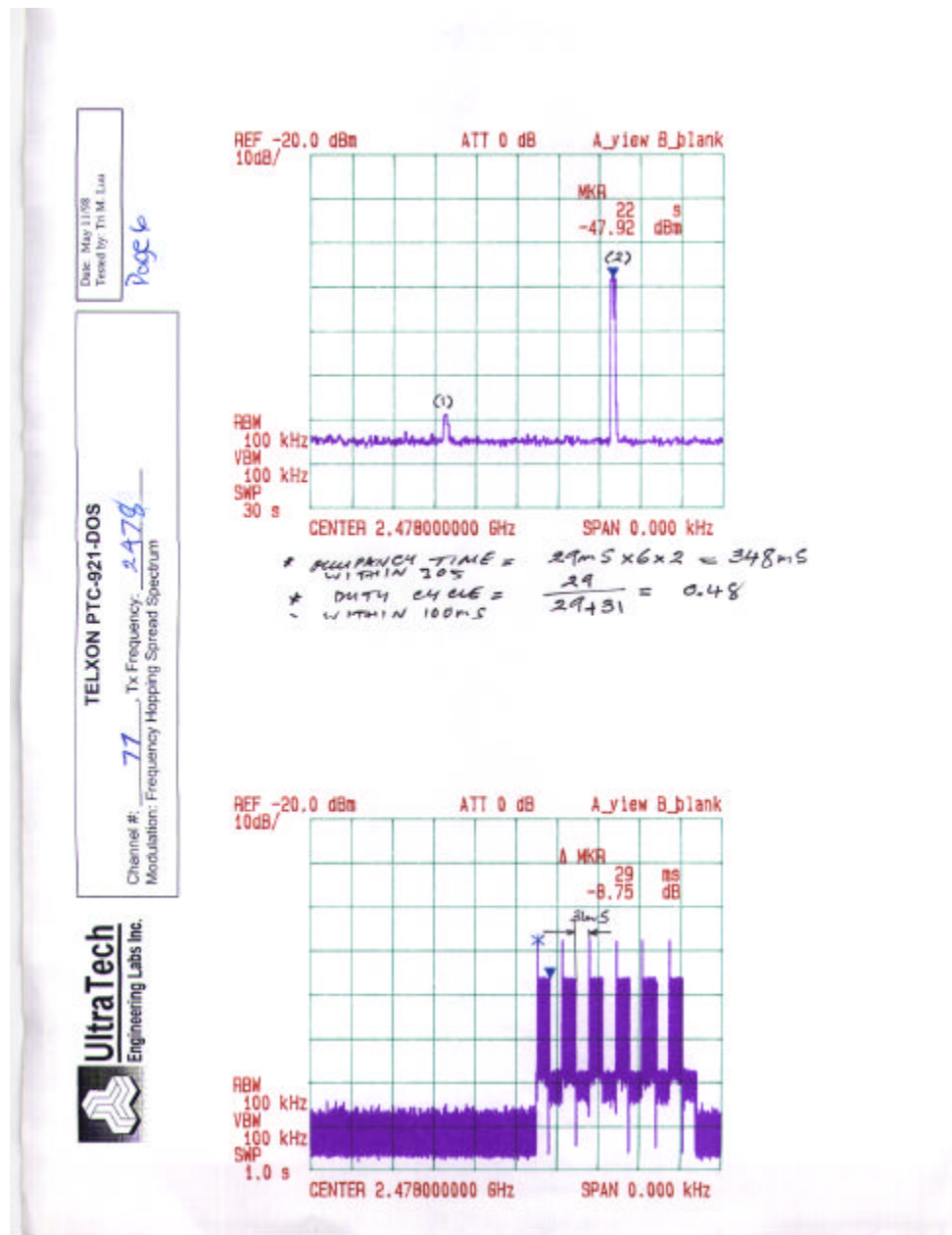
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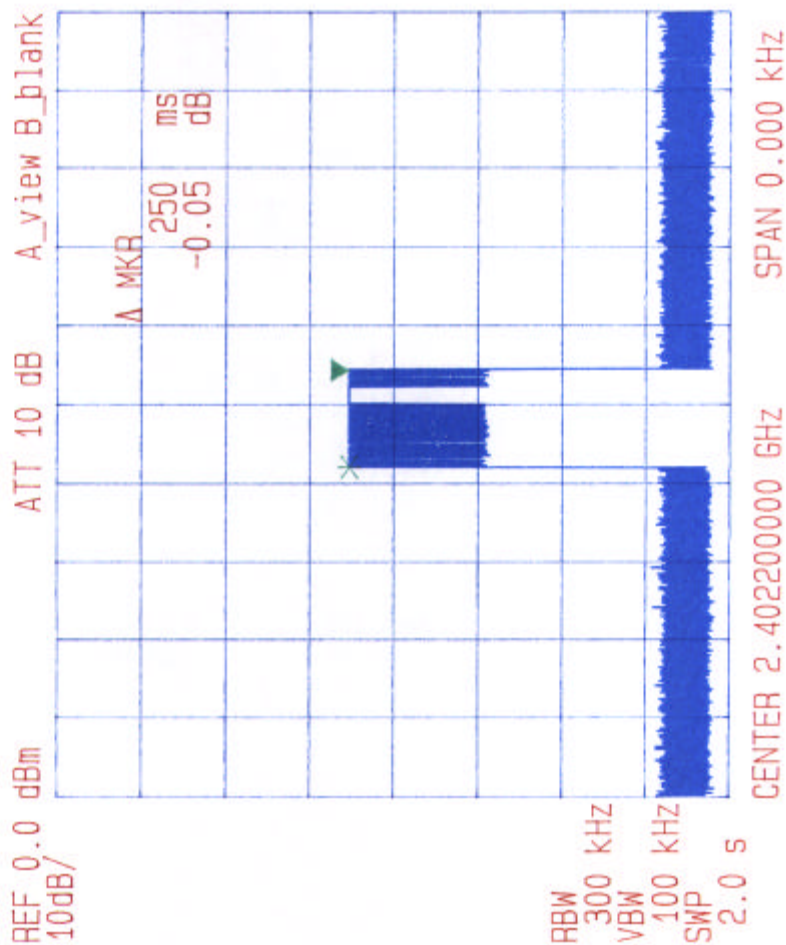
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Date: May 11/98
Tested by: Tri M. Lau

TELXON PTC-921-DOS
Channel #: 1, Tx Frequency: 2402
Modulation: Frequency Hopping Spread Spectrum



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3.2. MAXIMUM PEAK OUTPUT POWER @ FCC 15.247(B) AND RF EXPOSURE LIMIT FCC 1.1310

PRODUCT NAME: PTC-921 DOS

FCC REQUIREMENTS:

FCC 15.247(b):- Maximum peak output power of the transmitter shall not exceed 1 Watt. If the antenna of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

FCC 1.1310:- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
(B) Limits for General Population/Uncontrolled Exposure				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

F = Frequency in MHz

* = Plane-wave equivalent power density

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 23°C
- Relative humidity: 45 %

POWER INPUT:

Rechargeable battery.

TEST EQUIPMENT:

- **Spectrum Analyzer**, Advantest, Model R3271, S/N: 15050203, 100 Hz to 32 GHz)
- **Microwave Amplifier**, HP, Model 83017A, Frequency Range 1 to 26.5 GHz, 34-38 dBdB gain nominal.
- **Active Loop Antenna**, Emco, Model 6507, SN 8906-1167, Frequency Range 1 KHz - 30 MHz, @ 50 Ohms
- **Log Periodic/Bow-Tie Antenna**, Emco, Model 3143, SN 1029, 20 - 1000 MHz, @ 50 ohms.
- **Horn Antenna**, Emco, Model 3115, SN 9701-5061, Frequency Range: 1 - 18 GHz, @ 50 Ohms.

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METHOD OF MEASUREMENTS:

FCC @ 1.1310 & OST Bulletin No. 65-October 1985

$$S = PG/4\pi r^2 = EIRP/4\pi r^2$$

For a truly worst-case approximation, 100% ground reflection should be assumed, resulting in a potential doubling of predicted field strength and a four-fold increase in (far field equivalent) power density. The above equation then becomes:

$$S = PG/\pi r^2 = EIRP/\pi r^2$$

Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm²
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

$$r = \sqrt{PG/S}$$

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: May 11, 1998

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MEASUREMENT DATA:**EIRP PEAK POWER MEASUREMENT**

Antenna Gain G = 1.4 dBi or 1.38 numeric

TRANSMITTER CHANNEL OUTPUT	FUNDAMENTAL FREQUENCY (MHz)	MEASURED EIRP POWER (mWatts)	POWER LIMIT (Watts)
1	2403	1.0	1.0
39	2441	2.0	1.0
79	2479	1.1	1.0

$$\text{RF EXPOSURE DISTANCE LIMITS: } r = (PG/1P_d)^{1/2}$$

Where: r distance where the power density equals to 1 mW/cm²

P: EIRP power in mW

Pd: Power density limit 1mW/ cm²

TRANSMITTER CHANNEL OUTPUT	FUNDAMENTAL FREQUENCY (MHz)	MEASURED EIRP POWER (mWatts)	MINIMUM ALLOWABLE DISTANCE (r) FROM SKIN (Centi-Meter)
1	2403	1.0	0.1
39	2441	2.0	0.6
79	2479	1.1	0.2

Note: Since the EIRP power is too small and the calculated distance at the power density of 1 mW/cm² is less than the distance from the antenna to the plastic housing, the SAR tests and RF Safety requirements are not required.

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3.3. TRANSMITTER RADIATED EMISSIONS @ 3 METERS, FCC CFR 47, PARA. 15.247(C), 15.209 & 15.205

PRODUCT NAME: PTC-921 DOS

FCC REQUIREMENTS:

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in @ 15.209(a), which lesser attenuation.

All other emissions inside restricted bands specified in @ 15.205(a) shall not exceed the general radiated emission limits specified in @ 15.209(a)

Remarks:

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- **@ FCC CFR 47, Para. 15.237(c)** - The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in **@15.35** for limiting peak emissions apply.

FCC CFR 47, Part 15, Subpart C, Para. 15.205(a) - Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 - 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 - 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 - 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 - 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 - 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 - 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 - 156.9	2200 - 2300	9000 - 9200	

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FCC CFR 47, Part 15, Subpart C, Para. 15.209(a)
-- Field Strength Limits within Restricted Frequency Bands --

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

CLIMATE CONDITION:

Standard Temperature and Humidity:

- Ambient temperature: 23 °C
- Relative humidity: 43 %

POWER INPUT:

Rechargeable battery.

TEST EQUIPMENT:

- **Spectrum Analyzer**, Advantest, Model R3271, S/N: 15050203, 100 Hz to 32 GHz)
- **Microwave Amplifier**, HP, Model 83017A, Frequency Range 1 to 26.5 GHz, 34-38 dBdB gain nominal.
- **Active Loop Antenna**, Emco, Model 6507, SN 8906-1167, Frequency Range 1 KHz - 30 MHz, @ 50 Ohms
- **Log Periodic/Bow-Tie Antenna**, Emco, Model 3143, SN 1029, 20 - 1000 MHz, @ 50 ohms.
- **Horn Antenna**, Emco, Model 3115, SN 9701-5061, Frequency Range: 1 - 18 GHz, @ 50 Ohms.
- **Horn Antenna**, Emco, Model 3160-09, 18-26.5GHz
- **Horn Antenna**, Emco, Model 3160-09, 18-26.5GHz
- **Horn Antenna**, Emco, Model 3160-10, 26.5-40GHz
- **Mixer**, Tektronix, P/N 118-0098-00, 18-26.5GHz
- **Mixer**, Tektronix, P/N 119-0098-00, 26.5-40GHz

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METHOD OF MEASUREMENTS:

Refer to **ANSI 63.4-1992, Para. 8** for detailed radiated emissions measurement procedures.

Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.

For measurement below 1 GHz, set RBW = 100 KHz, VBW $\geq$ 100 KHz, SWEEP=AUTO.

For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz (Peak) & VBW = 10 Hz (Average), SWEEP=AUTO.

If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated

The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions

- (a) Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 1 GHz, an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

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- (b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:
- (1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
 - (2) All equipment operating on frequencies higher than 25 MHz
 - (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
 - (4) Other types of equipment as required, when deemed necessary by the commission.

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: May 11, 1998

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MEASUREMENT DATA**RADIATED EMISSIONS MEASUREMENTS @ 3 METERS****TEST CONFIGURATION**

- This lowest, middle and highest channels were established at its full rated output power. The emissions were investigated from the lowest frequency generated by the transmitter up to the 10th harmonic of the fundamental emissions in each case. the measured level of the carrier was recorded and compared to the level of the emissions as required in Parts 15.247(c) or 15.209(a) whichever was applicable.
- For measuring radiated emissions at frequencies below 1 GHz, the Spectrum Analyzer was set as 100 KHz RBW, VBW $\geq$ RBW, SWEEP TIME: AUTO, PEAK DETECTOR.
- For measuring radiated emissions at frequencies above 1 GHz, the Spectrum Analyzer was set as 1 MHz RBW, 1 MHz VBW, SWEEP TIME: AUTO for PEAK measurements and 1 MHz RBW, 10 Hz VBW, SWEEP TIME: AUTO for AVERAGE measurements.
- The following measurements were the worst cases when the radiating antenna was placed in both horizontal and vertical polarization.
- The following **AVERAGE** rf levels were obtained from either Peak or Average readings added by the duty cycle correction factor. **DUTY CYCLE FACTOR** = $20\text{LOG}_{10}(0.5) = -6 \text{ dB}$

CHANNEL FREQUENCY TESTED: 2402 MHz (Lowest)

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2402.00	96.3	90.3	V	--	--	--	--
2402.00	96.8	90.8	H	--	--	--	--
4804.00	50.1	35.0	V	54.0	76.8	-19.0	PASS
4804.00	53.2	42.3	H	54.0	76.8	-11.7	PASS
7206.00	49.9	26.2	V	54.0	76.8	-50.6	PASS
7206.00	52.0	38.3	H	54.0	76.8	-38.5	PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

**** Emission within the restricted band specified in @ 15.205(a)**

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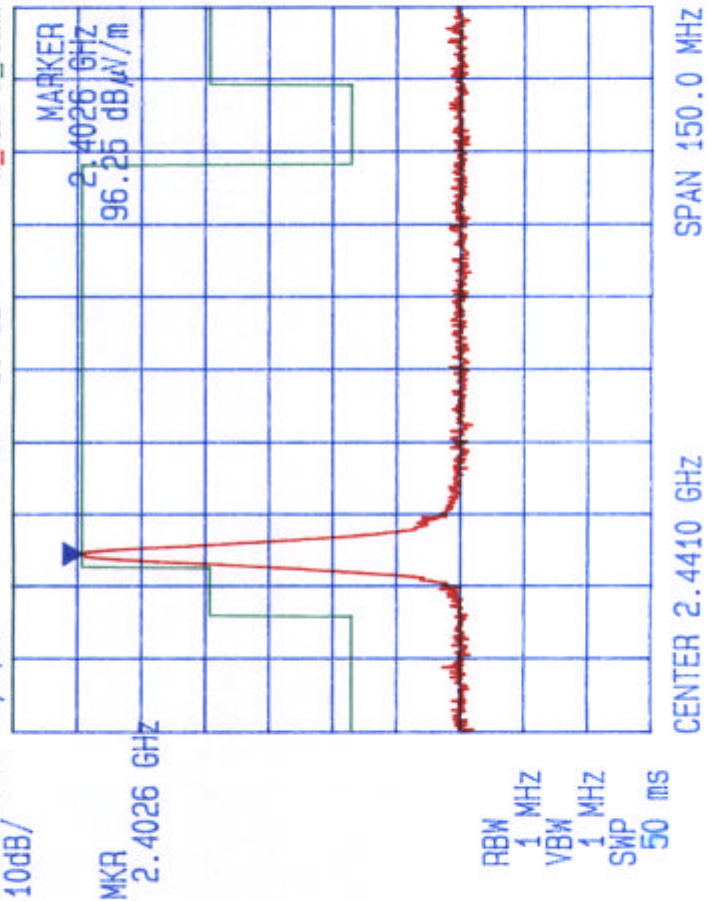
TELXON PTC-921 DOS
 FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
 Tx Frequency 2402 MHz
 Modulation: ON



Radiated Emissions Measurements at 3 Meters
 Antenna Polarization: Horizontal | Vertical | A

E3115+HP83017+SMA7
 REF 107.0 dB μ V/m
 10dB/

Fri May 8 15:55:23 1998
 ATT 10 dB
 A_view B_blank



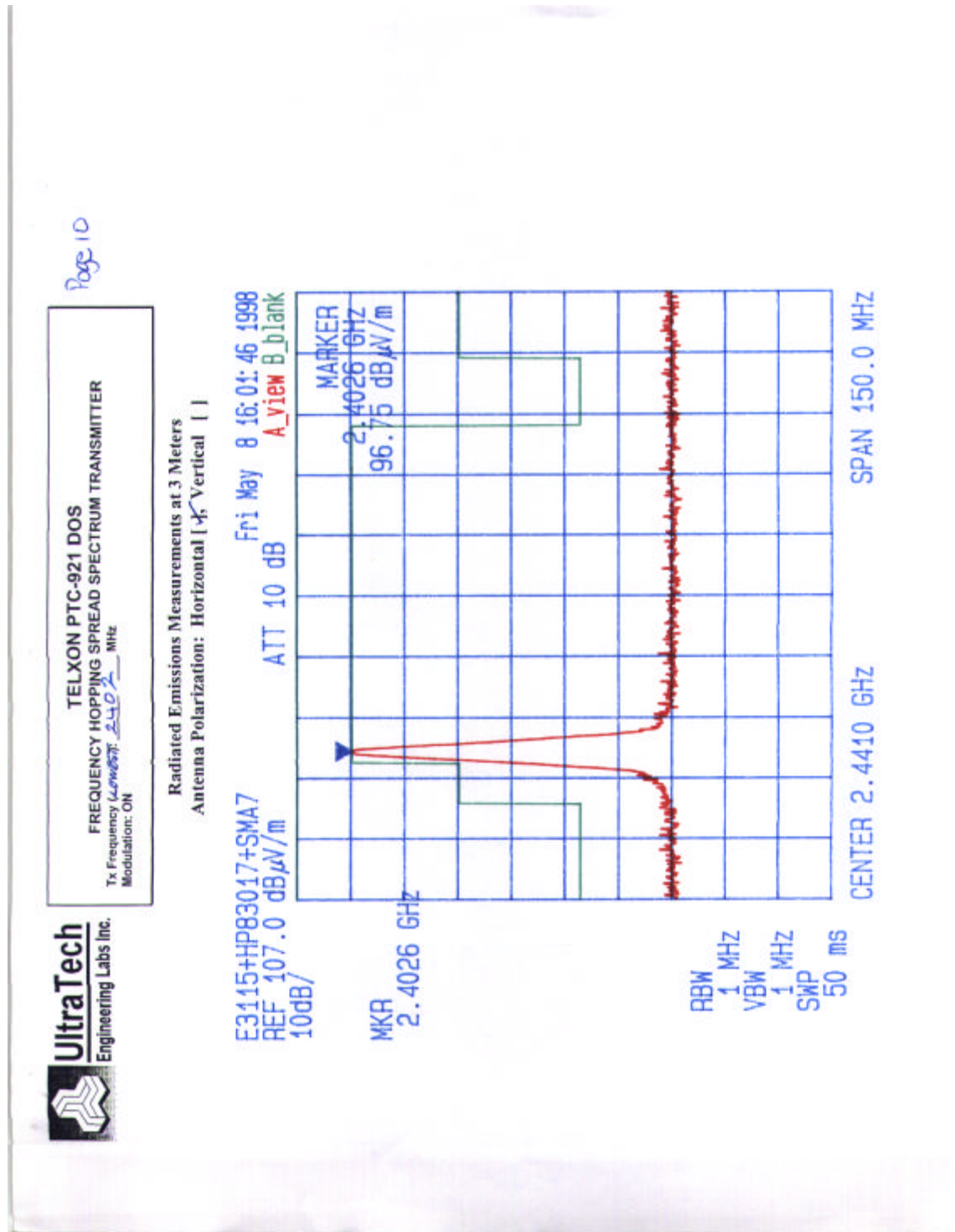
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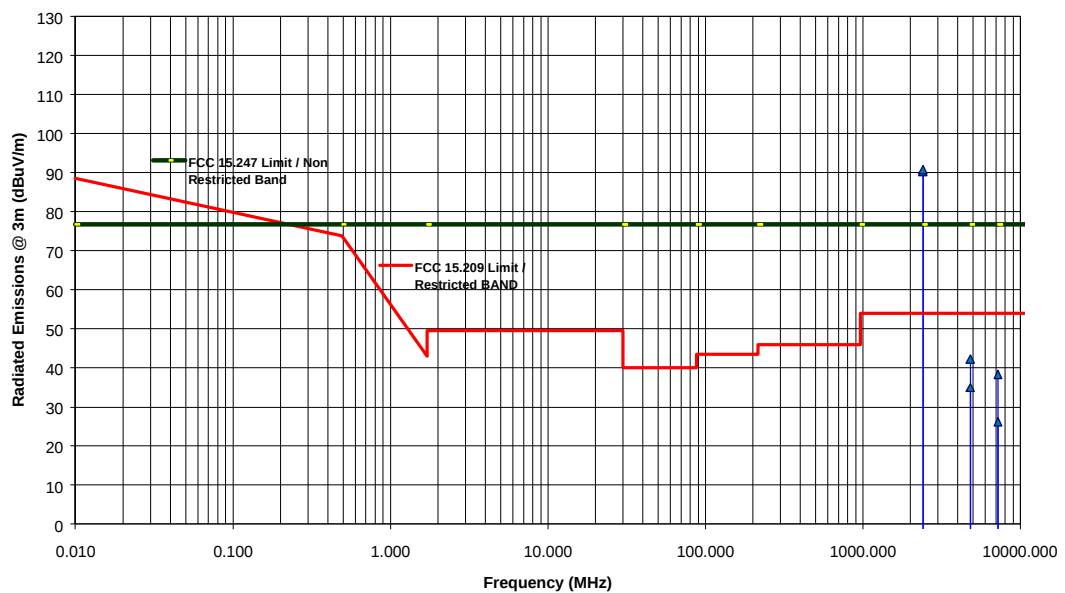
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Transmitter Radiated Emissions Measurements at 3 Meter OFTS
TELXON PTC-921 DOS
Lowest Frequency: 2402 MHz

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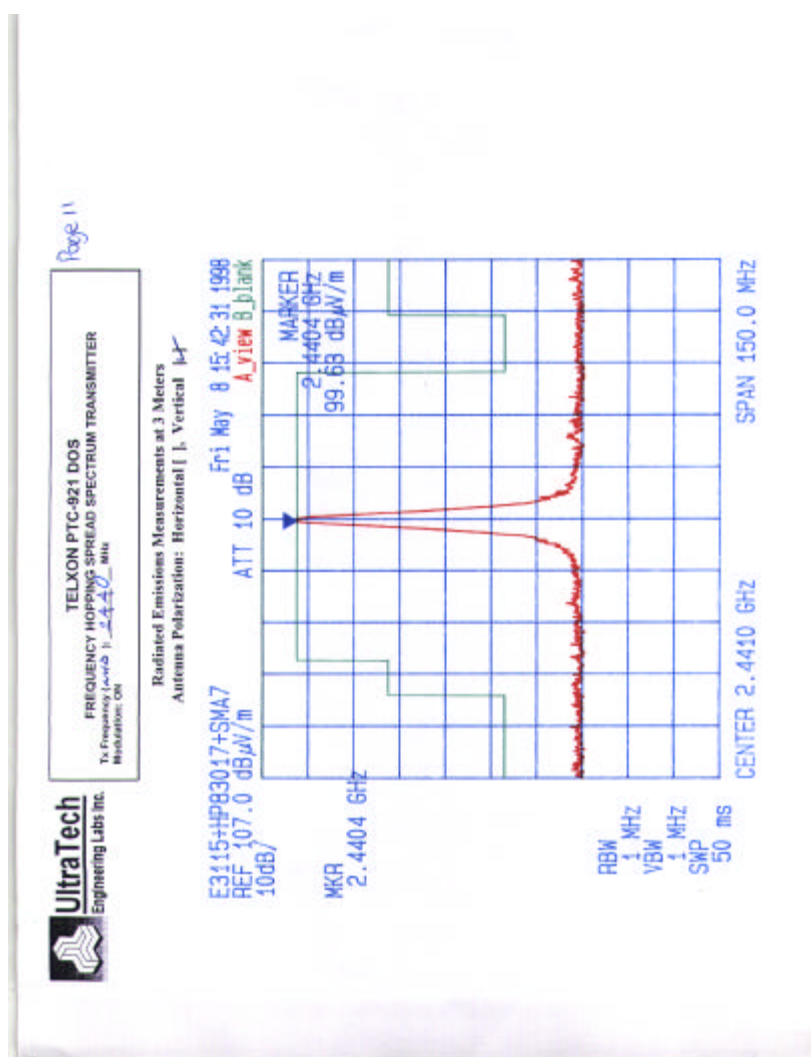
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CHANNEL FREQUENCY TESTED: 2440 MHz (Middle)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/FAIL
2440.00	99.6	93.6	V	--	--	--	--
2440.00	95.4	89.4	H	--	--	--	--
4880.00	49.6	36.4	V	54.0	79.6	-17.6	PASS
4880.00	52.9	42.7	H	54.0	79.6	-11.3	PASS
7320.00	50.3	34.2	V	54.0	79.6	-19.8	PASS
7320.00	52.8	40.2	H	54.0	79.6	-13.8	PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

**** Emission within the restricted band specified in @ 15.205(a)**



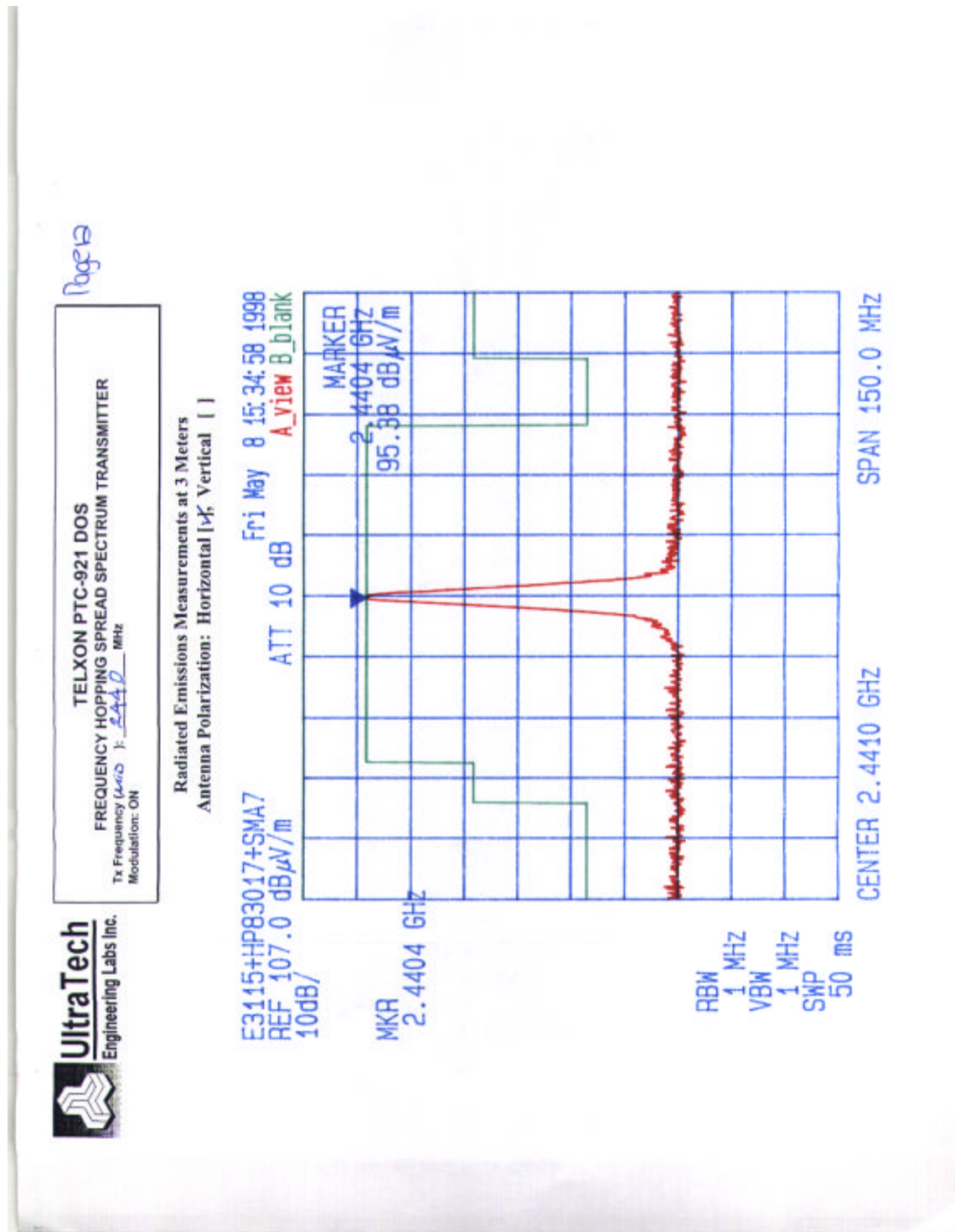
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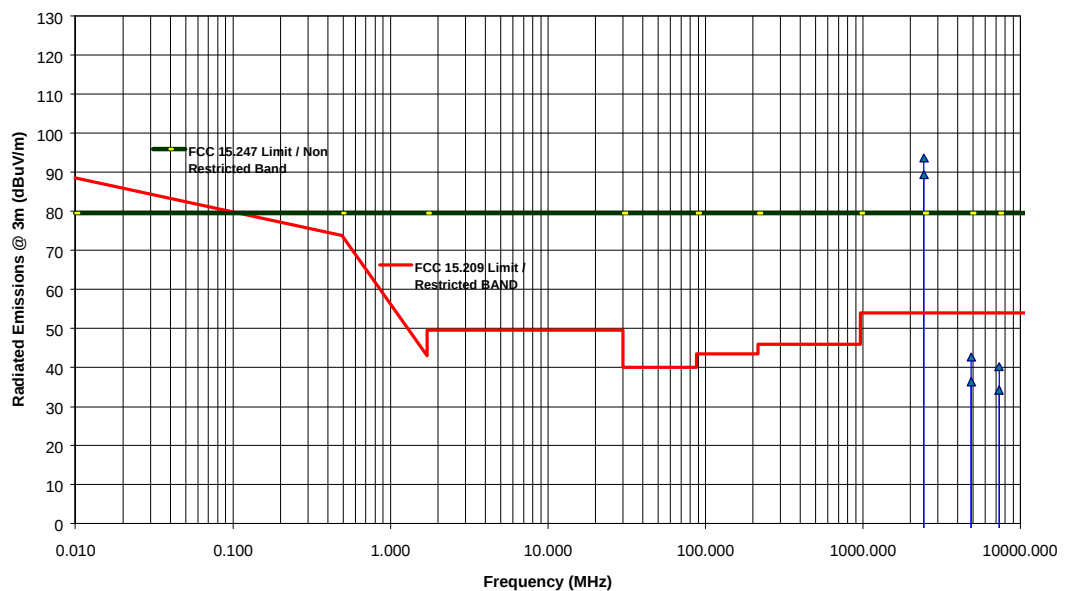
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Transmitter Radiated Emissions Measurements at 3 Meter OFTS
TELXON PTC-921 DOS
Lowest Frequency: 2440 MHz

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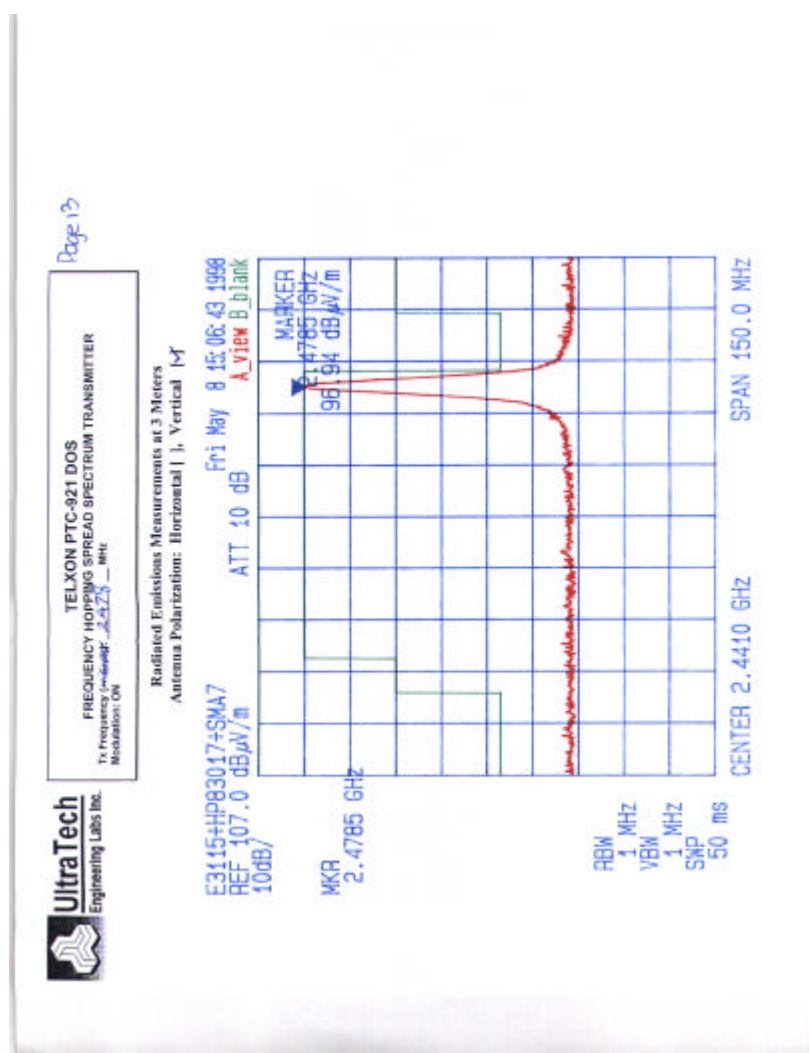
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CHANNEL FREQUENCY TESTED: 2478 MHz (Highest)							
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/FAIL
2478.00	96.9	90.9	V	--	--	--	--
2478.00	91.3	85.3	H	--	--	--	--
4956.00	53.8	41.5	V	54.0	79.6	-12.5	PASS
4956.00	55.9	46.4	H	54.0	79.6	-7.6	PASS
7434.00	50.1	33.1	V	54.0	79.6	-20.9	PASS
7434.00	52.2	36.1	H	54.0	79.6	-17.9	PASS

No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details

**** Emission within the restricted band specified in @ 15.205(a)**



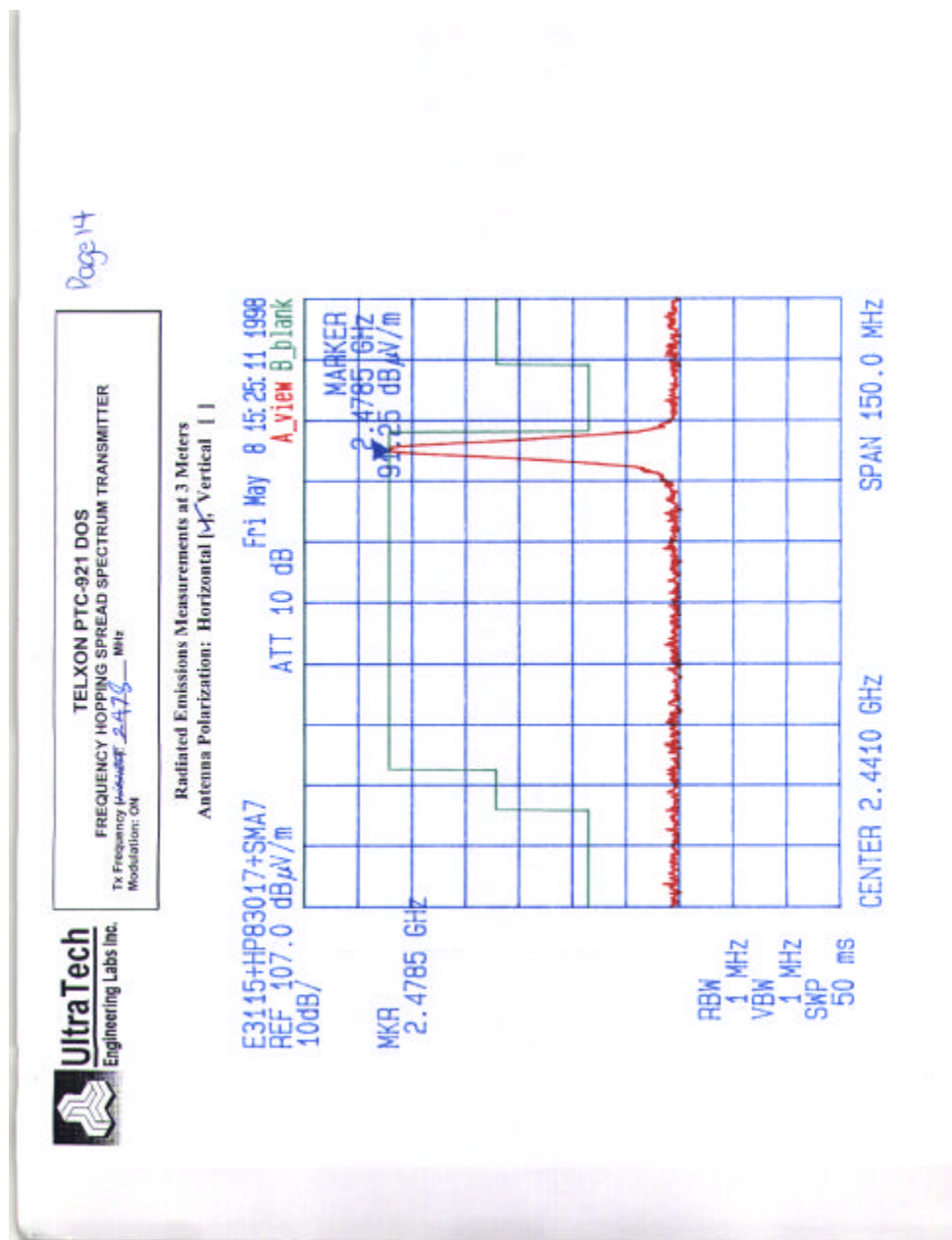
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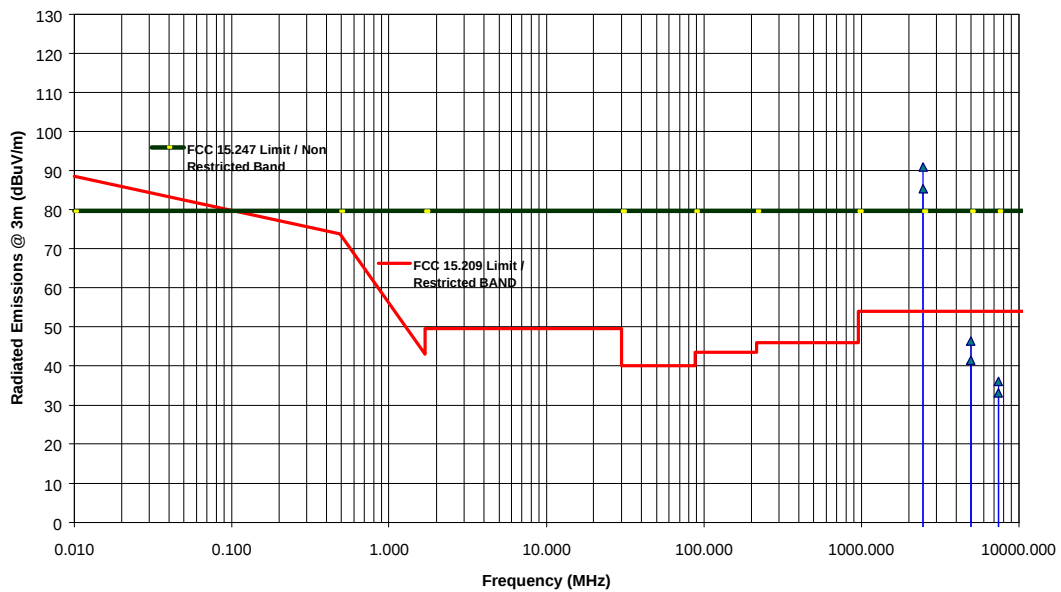
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Transmitter Radiated Emissions Measurements at 3 Meter OFTS
TELXON PTC-921 DOS
Lowest Frequency: 2478 MHz

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4. EXHIBIT 5 - GENERAL TEST PROCEDURES

4.1. ELECTRICAL FIELD RADIATED EMISSIONS MEASUREMENTS - GENERAL TEST METHOD

- The radiated emission measurements were performed at the UltraTech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC.
- Radiated emissions measurements were made using the following test instruments:
 - 1) Calibrated EMCO active loop antenna in the frequency range from 10 KHz to 1 MHz
 - 2) Calibrated EMCO biconilog antenna in the frequency range from 30 MHz to 2000 MHz.
 - 3) Horn Antennas:
 - a) Horn Antenna, Emco, Model 3115, 1 – 18 GHz
 - b) Horn Antenna, Emco, Model 3160-09, 18-26.5GHz
 - c) Horn Antenna, Emco, Model 3160-10, 26.5-40GHz
 - d) Mixer, Tektronix, P/N 118-0098-00, 18-26.5GHz
 - e) Mixer, Tektronix, P/N 119-0098-00, 26.5-40GHz
 - 4) Calibrated Advantest spectrum analyzer and pre-selector/pre-amplifier. In general, the spectrum analyzer would be used as follows:
 - The rf electric field levels were measured with the spectrum analyzer set to PEAK detector (1 KHz RBW and 1 KHz VBW for frequency below 30 MHz, 100 KHz RBW and VBW $\geq$ RBW for Frequency below 1 GHz and 1 MHz RBW and 1 MHz VBW for frequency greater than 1 GHz).
 - If any rf emission was observed to be a broadband noise, the spectrum analyzer's CISPR QUASI-PEAK detector (120 KHz RBW and 1MHz VBW) was then set to measure the signal level.
 - If the signal being measured was narrowband and the ambient field was broadband, the bandwidth of the spectrum analyzer was reduced.
- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.
- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement (each variable within bounds specified elsewhere) were explored to produce the highest amplitude signal relative to the limit.

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The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

- Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.
- Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.
- Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.
- Step4: Move the antenna over its full allowed range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.
- Step5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.
- Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.
- Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

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Calculation of Field Strength:

The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where	FS	=	Field Strength
	RA	=	Receiver/Analyzer Reading
	AF	=	Antenna Factor
	CF	=	Cable Attenuation Factor
	AG	=	Amplifier Gain

Example: If a receiver reading of 60.0 dBuV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:.

Field Level in dBuV/m = $60 + 7.0 + 1.0 - 30 = 38.0$ dBuV/m.

Field Level in uV/m = $10^{(38/20)} = 79.43$ uV/m.

Notes: The frequency and amplitude of at least six highest conducted emissions relative to the limit are recorded unless such emissions are more than 20 dB below the limit. If less than six emissions are within 20dB of the limit, the background or receiver noise level shall be reported at representative frequencies.

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5. EXHIBIT 6 - INFORMATION RELATED TO EQUIPMENT UNDER TESTS

5.1. FCC ID LABELING AND SKETCH OF FCC LABEL LOCATION

Refer to the attached sheets

5.2. PHOTOGRAPHS OF EQUIPMENT UNDER TEST

Refer to the attached photographs

5.3. SYSTEM BLOCK DIAGRAM(S)

Refer to the attached sheets

5.4. SCHEMATIC DIAGRAMS

Refer to the attached sheets

5.5. USER'S MANUAL WITH "FCC INFORMATION TO USER STATEMENTS"

Refer to the attached Users' manual

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