Intertek Testing Services
ETL SEMKO

FCC Parts 22 and 24 Test Report

For

Telson Electronics USA, Inc.

Performed on the

Dual Band Tri-mode CDMA Handset
Model: TDC-8200
FCC ID: MC6TDC8200

Report #: 30414482
Date of Report: April 26, 2003

Job #: 3041448
Date of Test: April 14 to 23, 2003

A2LA Certificate Number: 1755-01

Prepared by: David Chernomordik	David Chernomordik, EMC Technical Manager

All services undertaken are subject to the following general policy: Reports are submitted for exclusive use of the client to whom they are addressed. Their significance is subject to the adequacy and representative character of the samples and to the comprehensiveness of the tests, examinations or surveys made. This report shall not be reproduced except in full, without written consent of Intertek Testing Services, NA Inc.

Intertek Testing Services NA, Inc.
1365 Adams Court, Menlo Park, CA 94025
Telephone 650-463-2900 Fax 650-463-2910 Home Page www.etlsemko.com

Intertek Testing Services
ETL SEMKO

VERIFICATION OF COMPLIANCE
Report No. 30414482

Verification is hereby issued to the named APPLICANT and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below.

Equipment Under Test:	Dual Band Tri-mode CDMA Handset
Trade Name:	Telson Electronics
Model No.:	TDC-8200
Serial No.:	Not Labled
FCC ID:	MC6TDC8200
Applicant:	Telson Electronics USA, Inc.
Contact:	Mr. Young Kim
Address:	910 Sylvan Avenue, Suite 180 Englewood Cliffs, NJ 07632
Country	USA
Tel. number:	201/541-4005 ext. 120
Fax number:	201/541-0057
Manufacturer:	Telson Electronics CO., Ltd.
Contact:	Mr. Young-Man Kang
Address:	9949-3 Dogok-Dong, Kangnam-Gu Seoul 135-270
Country	Korea
Tel. number:	+82-2-2140-1330
Fax number:	+82-2-2140-1117
Applicable Regulation:	FCC Part 22, and FCC Part 24
Date of Test:	April 14 to 23, 2003

We attest to the accuracy of this report:

Arkadi Kaplan
Test Engineer

David Chernomordik
EMC Technical Manager

1.0 Introduction 5
1.1 Test Summary 5
1.2 Product Description 6
1.3 Test Configuration 6
1.4 Related Submittal(s) Grants 6

2.0 RF Power Output 7
2.1 Test Procedure 7
2.2 Test Equipment 7
2.3 Test Results 7

3.0 Radiated Power 16
3.1 Test Procedure 16
3.2 Test Equipment 16
3.3 Test Results 17

4.0 Occupied Bandwidth 18
4.1 Test Procedure 18
4.2 Test Equipment 18
4.3 Test Results 18

5.0 Emission Limitations 21
5.1 Test Procedure 21
5.2 Test Equipment 22
5.3 Test Results 22

6.0 Modulation Deviation Limiting 32
6.1 Test Procedure 32
6.2 Test Equipment 32
6.3 Test Results 32

7.0 Audio Filter Characteristics 34
7.1 Test Procedure 34
7.2 Test Equipment 35
7.3 Test Results 35

8.0 Out of Band Emissions at Antenna Terminals 36
8.1 Test Procedure 36
8.2 Test Equipment 36
8.3 Test Results 37

9.0 Field Strength of Spurious Radiation 38
9.1 Test Procedure 38
9.2 Test Equipment 38
9.3 Test Results 39

10.0 Frequency Stability vs Temperature and Voltage 40

10.1 Test Procedure 40
10.2 Test Equipment 40
10.3 Test Results 41

11.0 List of Test Equipment 42

12.0 Document History 43

Appendix A – Out-of-band conducted emission data 44

Appendix B – Radiated emission data 45

1.0 Introduction

1.1 Test Summary

FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
2.1046	RF Power Output	Complies	7
22.913, 24.232	ERP, EIRP	Complies	16
2.1047	Modulation Requirements	Complies	32, 34
2.1049	Occupied Bandwidth, Emission Designator	Complies	18
2.1049, 22.917(b)(d)	Emission Limitation	Complies	21
2.1051, 22.901(d) 22.917(f), 24.238(a)	Out of Band Emissions at Antenna Terminals Mobile Emissions In Base Frequency Range	Complies	Appendix A
2.1053	Field Strength of Spurious Radiation	Complies	38
2.1055	Frequency Stability vs. Temperature	Complies	40
2.1055	Frequency Stability vs. Voltage	Complies	40
2.1093	Specific Absorption Rate	Complies	*

* Separate Reports are issued

1.2 Product Description

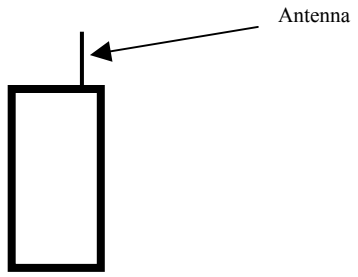
The TDC-8200 is a dual band tri-mode CDMA handset which operates in 800 MHz and 1900 MHz bands, provides 3 different modes (AMPS cellular, CDMA cellular, CDMA PCS), additionally supports GPS mode.

For more information, please refer to the attached product description.

Use of Product	Mobile Phone
Whether quantity (>1) production is planned	Yes
Cellular Phone standards	AMPS, CDMA
RF Output Power	27.1 dBm (Cell band, AMPS); 25.0 dBm (Cell band, CDMA) 24.5 dBm (PCS band, CDMA)
Frequency Range	824-849 MHz; 1850-1910 MHz
Antenna (e) & Gain	2dBi
Detachable antenna? **Receiver L.O. frequency** **External input**	No [X] Audio [ ] Digital Data

EUT receive date:	April 14, 2003
EUT receive condition:	The prototype version of the EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.
Test start date:	April 14, 2003
Test completion date:	April 23, 2003

1.3 Test Configuration



1.4 Related Submittal(s) Grants

None

2.0 RF Power Output
FCC 2.1046

2.1 Test Procedure

The transmitter output was connected a calibrated coaxial attenuator, the other end of which was connected to a spectrum analyzer. When measured the output power in AMPS mode, the resolution bandwidths of the spectrum analyzer was setup to 300 kHz and the power at the transmitter output was determined by adding the values of the attenuator and cable loss to the spectrum analyzer reading.

When measured the output power in CDMA mode, the resolution bandwidths of the spectrum analyzer was setup to 30 kHz and the video bandwidth was setup to 300 Hz. The power at the transmitter output was determined by adding the bandwidth correction factor [10 Log(1250/30)=16.2 dB] and the values of the attenuator and cable loss to the spectrum analyzer reading.

Tests were performed at three frequencies (low, middle, and high channels) in Cellular in PCS bands.

Note: The bandwidth of the CDMA signal is 1250 kHz.

2.2 Test Equipment

HP 8566B Spectrum Analyzer
10 dB Attenuator

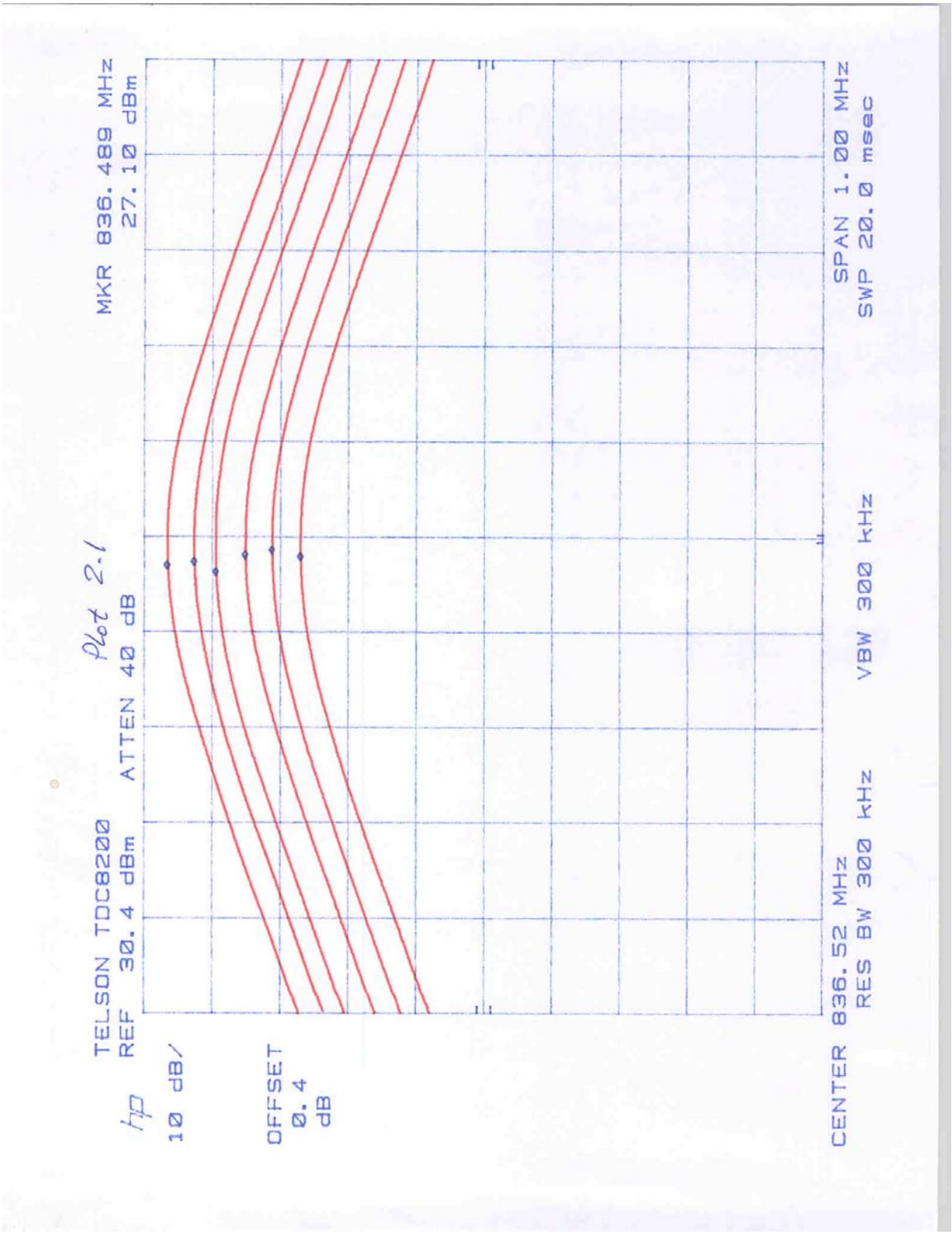
2.3 Test Results

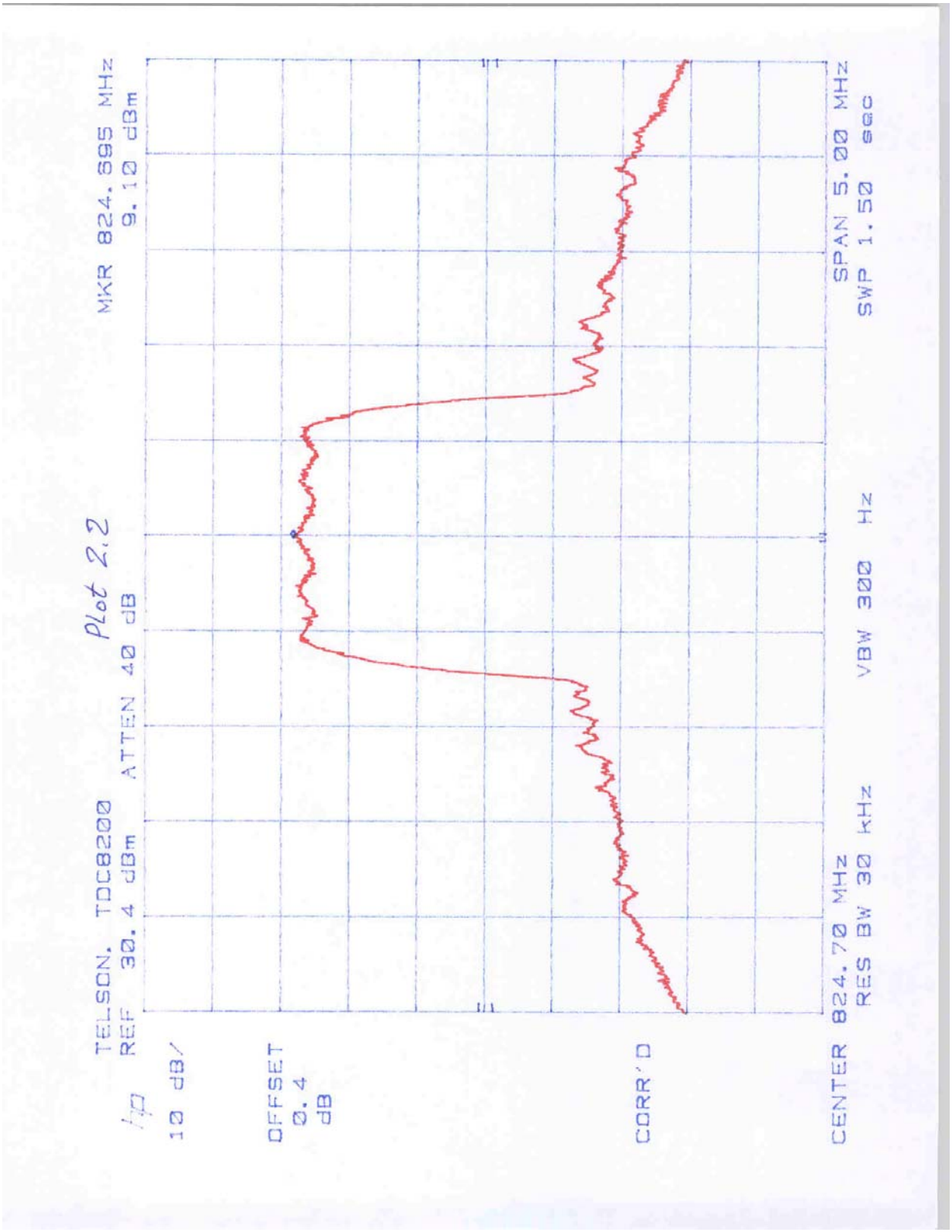
Frequency (MHz)	Mode	Measured Output Power (dBm)
825.25	AMPS	27.1
836.52	AMPS	27.1
847.75	AMPS	27.1
825.25	CDMA	25.3
836.52	CDMA	25.3
847.75	CDMA	25.4
1851.25	CDMA	24.8
1880.0	CDMA	24.7
1908.75	CDMA	24.7

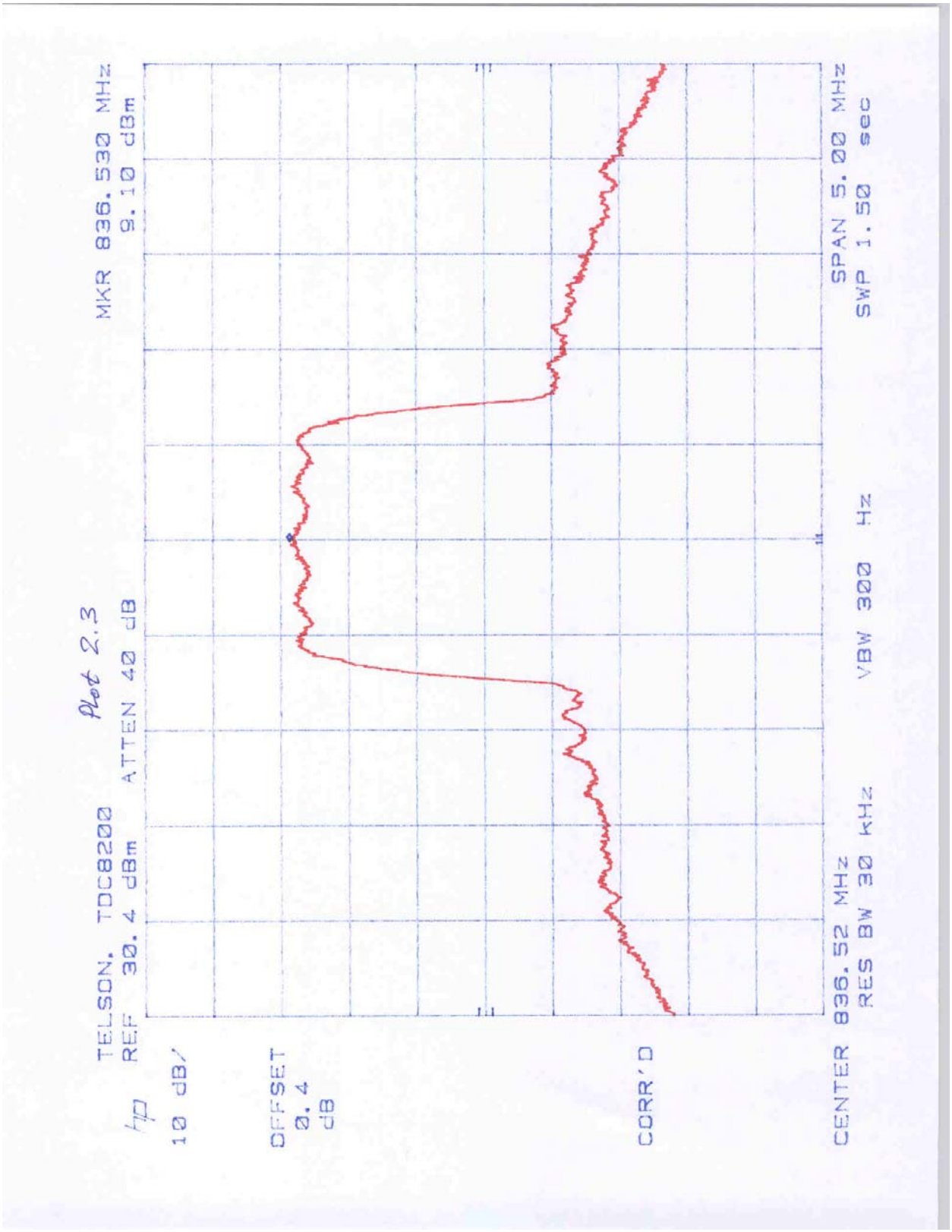
For more details refer to the attached plots:

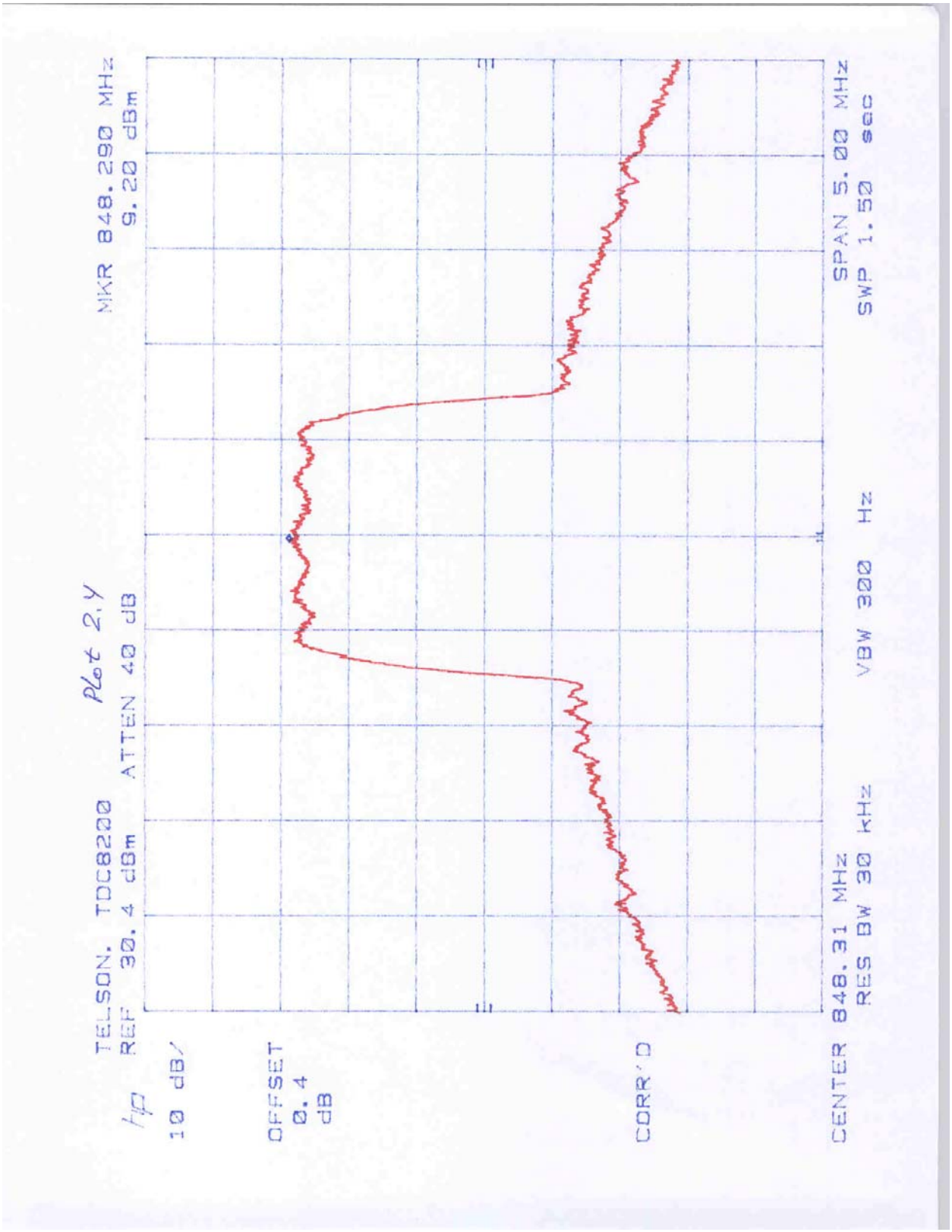
Cellular Band (AMPS Mode)	
Plot Number	**Description**
2.1	Middle Channel
Cellular Band (CDMA Mode)	
Plot Number	**Description**
2.2	Low Channel
2.3	Middle Channel
2.4	High Channel
PCS Band (CDMA Mode)	
Plot Number	**Description**
2.5	Low Channel
2.6	Middle Channel
2.7	High Channel

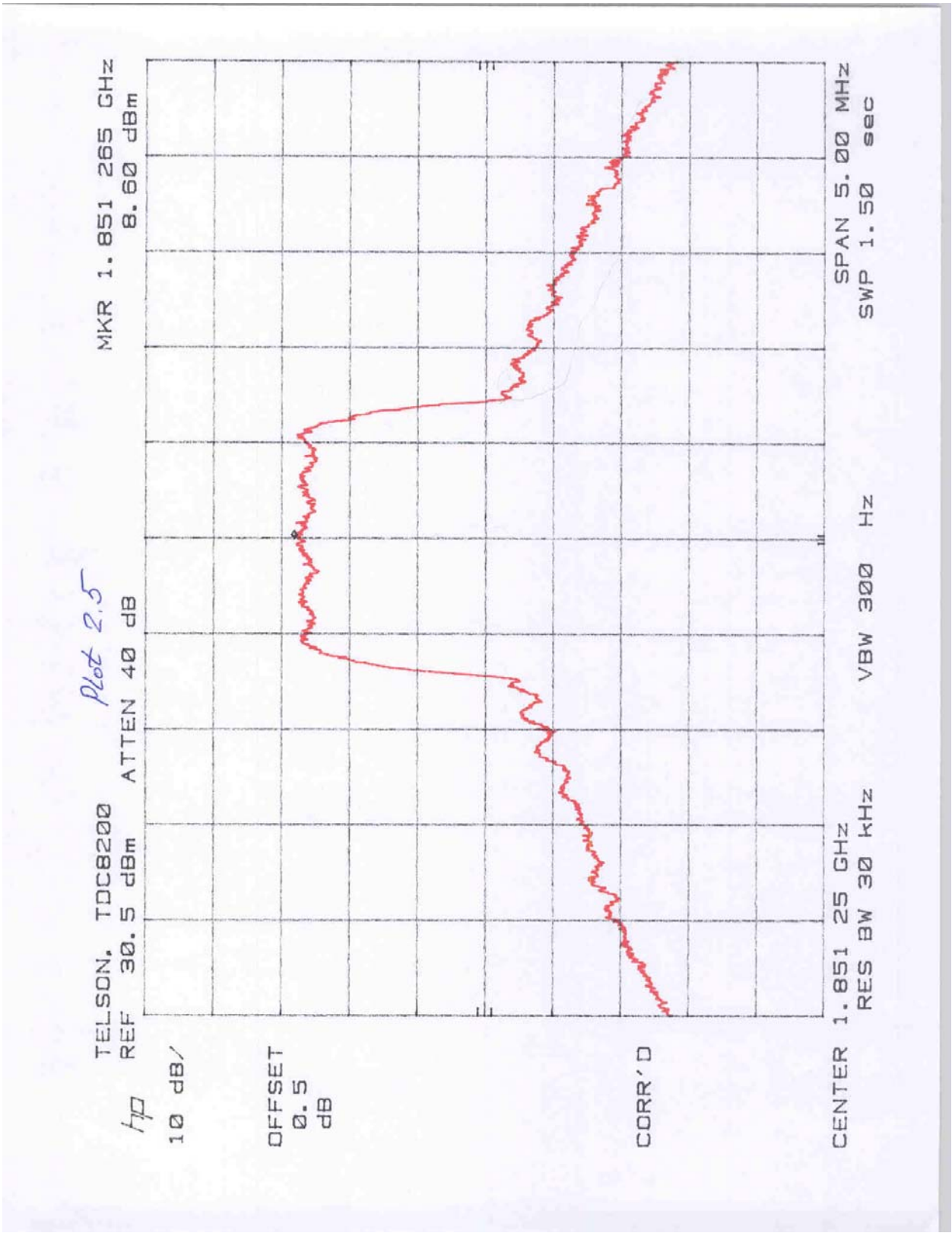
Note: To obtain the average power in CDMA mode, the bandwidth correction equals 10Log(1250/30) =16.2 dB should be added to the spectrum analyzer reading shown on the plots.

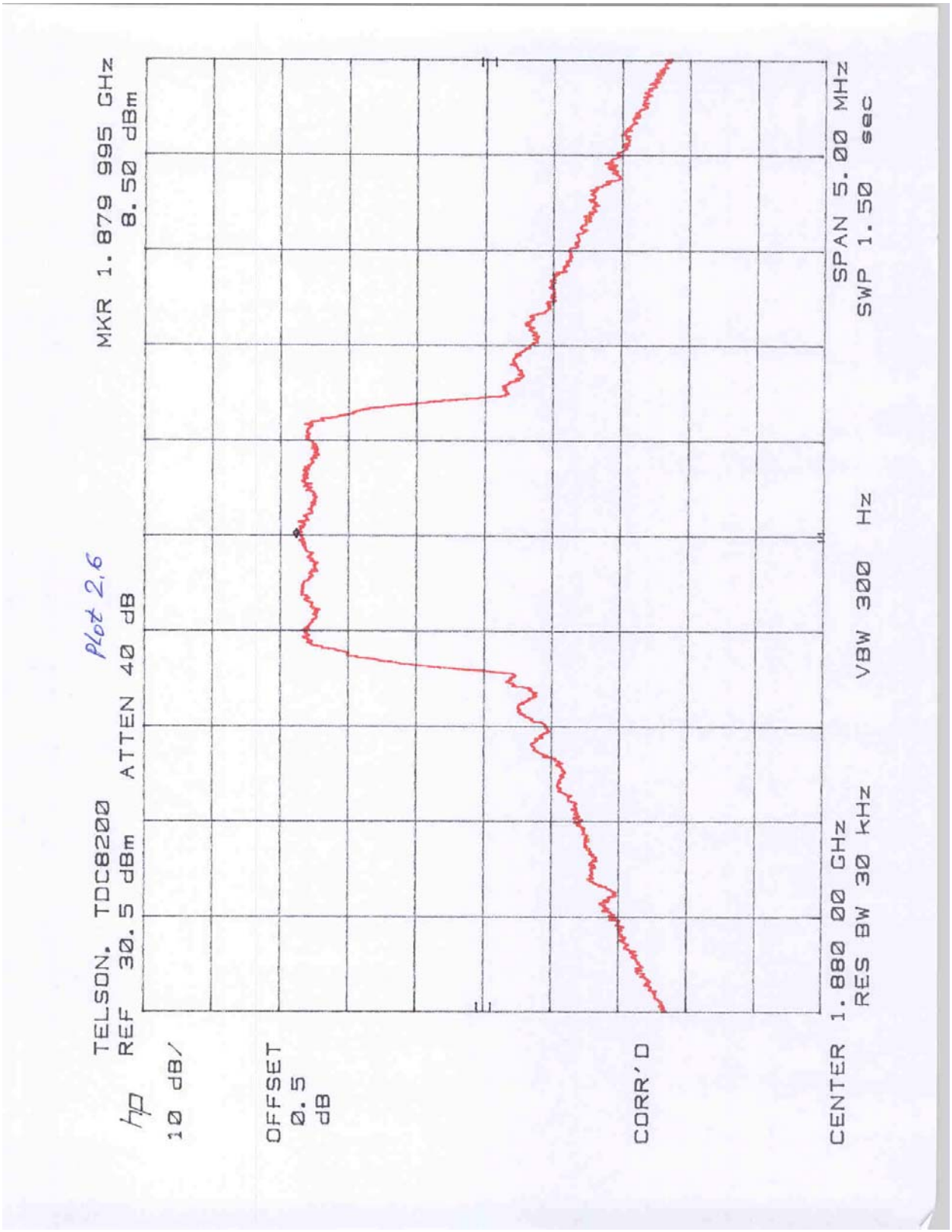

hp
10 dB/
TELSON TDC8200
REF 30.4 dBm
ATTEN 40 dB
Plot 2.1
OFFSET
0.4
dB
MKR 836.489 MHz
27.10 dBm
CENTER 836.52 MHz
RES BW 300 kHz
VBW 300 kHz
SPAN 1.00 MHz
SWP 20.0 msec

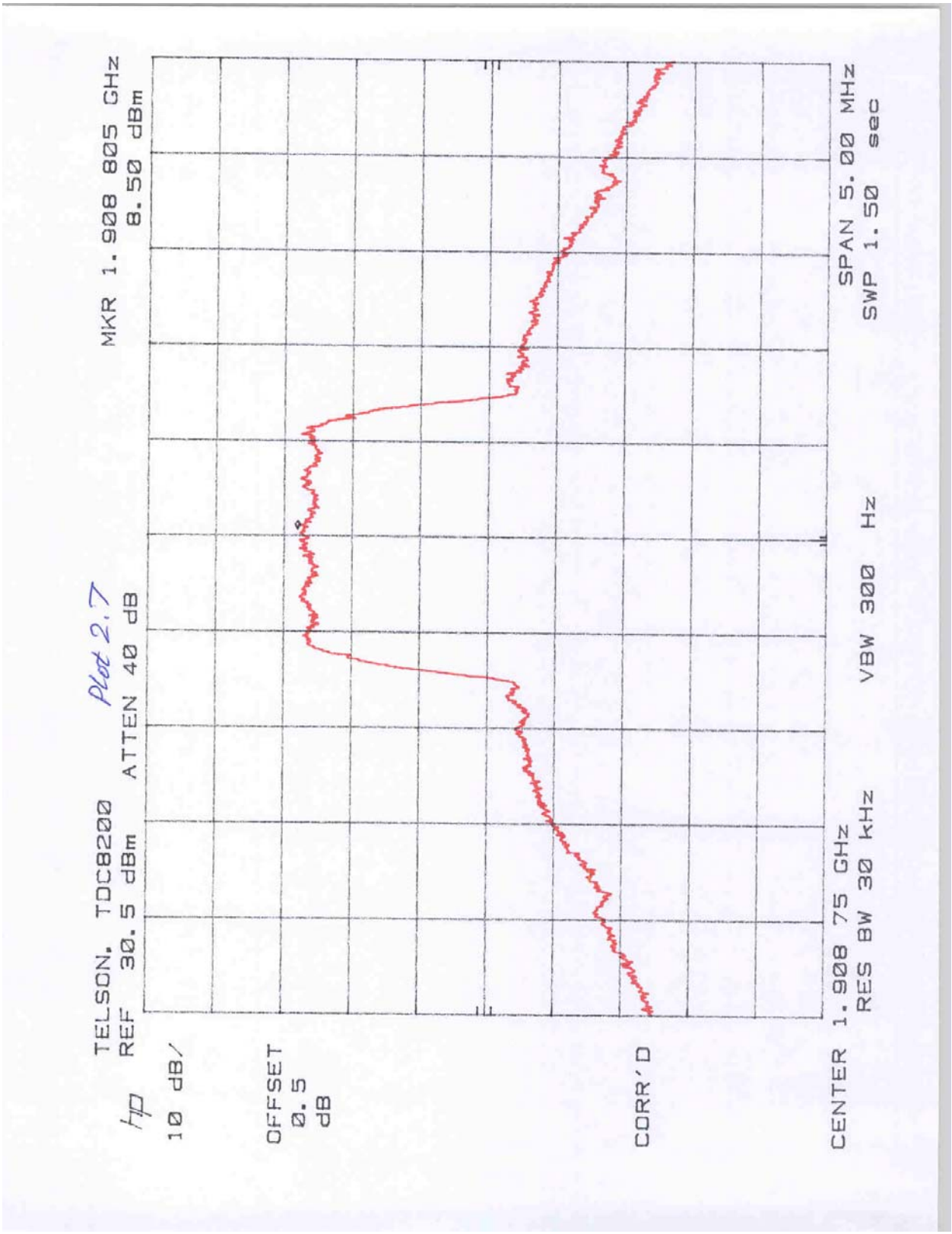

TELSON. TDC8200
REF 30.4 dBm
ATTEN 40 dB
Plot 2.2
MKR 824.895 MHz
9.10 dBm
10 dB/
OFFSET
0.4
dB
CORR'D
CENTER 824.70 MHz
RES BW 30 kHz
VBW 300 Hz
SPAN 5.00 MHz
SWP 1.50 sec


Plot 2.3
TELSON. TDC8200
REF 30.4 dBm
ATTEN 40 dB
MKR 836.530 MHz
9.10 dBm
10 dB/
OFFSET
0.4
dB
CORR'D
CENTER 836.52 MHz
RES BW 30 kHz
VBW 300 Hz
SPAN 5.00 MHz
SWP 1.50 sec


Plot 2.Y
TELSON. TDC8200
REF 30.4 dBm
ATTEN 40 dB
MKR 848.290 MHz
9.20 dBm
10 dB/
OFFSET
0.4
dB
CORR'D
CENTER 848.31 MHz
RES BW 30 kHz
VBW 300 Hz
SPAN 5.00 MHz
SWP 1.50 sec


Plot 2.5
TELSON. TDC8200
REF 30.5 dBm
ATTEN 40 dB
MKR 1.851 265 GHz
8.60 dBm
10 dB/
OFFSET
0.5
dB
CORR'D
CENTER 1.851 25 GHz
RES BW 30 kHz
VBW 300 Hz
SPAN 5.00 MHz
SWP 1.50 sec


Plot 2.6
TELSON. TDC8200
REF 30.5 dBm
ATTEN 40 dB
MKR 1.879 995 GHz
8.50 dBm
10 dB/
OFFSET
0.5
dB
CORR'D
CENTER 1.880 00 GHz
RES BW 30 kHz
VBW 300 Hz
SPAN 5.00 MHz
SWP 1.50 sec


Plot 2.7
TELSON. TDC8200
REF 30.5 dBm
ATTEN 40 dB
MKR 1.908 805 GHz
8.50 dBm
hp
10 dB/
OFFSET
0.5
dB
CORR'D
CENTER 1.908 75 GHz
RES BW 30 kHz
VBW 300 Hz
SPAN 5.00 MHz
SWP 1.50 sec

3.0 Radiated Power

FCC 22.913

The Effective Radiated Power (ERP) of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

FCC 24.232

The Equivalent Isotropic Radiated Power (EIRP) must not exceed 2 Watts.

3.1 Test Procedure

The EUT was positioned on a non-conductive turntable, 0.8m above the ground plane on an open test site. The radiated emission at the fundamental frequency was measured at 3m distance with a test antenna and spectrum analyzer. During the measurement, the resolution bandwidths of the spectrum analyzer was set to 300 kHz for AMPS mode, and 30 kHz (video bandwidth = 300 Hz) for CDMA mode.

The highest emission level was recorded with the rotation of the turntable and the raising and lowering of the test antenna. The spectrum analyzer reading was recorded

ERP in frequency band 824-849 MHz, and EIRP in frequency band 1851.25-1910 MHz were measured using a substitution method. The EUT was replaced by half-wave dipole (824-849 MHz) or horn antenna (1851.25-1908.75 MHz) connected to a signal generator. The spectrum analyzer reading was recorded and ERP/EIRP was calculated as follows:

$$ERP = U_1 - U_2 + V_g, ; \quad EIRP = U_1 - U_2 + V_g + G$$

Where U_1 & U_2 are spectrum analyzer readings in dBuV when measured field strength from EUT & generator accordingly; V_g is the generator output in dBm; G is the transmitting antenna gain.
Note: the bandwidth correction factor [10 Log(1250/30)=16.2 dB] was added to the reading in CDMA mode.

3.2 Test Equipment

EMCO 3148 Log Periodic Antenna
EMCO 3115 Horn Antenna
CDI Robert's Antenna
Hewlett Packard 8656A signal generator

3.3 Test Results

Complies	Refer to the data sheet below

Mode	Frequency MHz	Antenna Polarization H/V	SA Reading (EUT) dB(uV)	SA Reading (Signal Gen & Tuned Dipole) dB(uV)	Signal Generator Power dBm	Effective Radiated Power (EUT) dBm
Cellular Band						
AMPS	825.25	V	96.2	39.5	-30	26.7
	836.50	V	94.2	39.1	-30	25.1
	847.75	V	94.6	39.3	-30	25.3
CDMA	825.25	V	94.0	39.5	-30	24.5
	836.50	V	92.7	39.1	-30	23.4
	847.75	V	93.2	39.3	-30	23.9
PCS Band						
Mode	**Frequency MHz**	**Antenna Polarization H/V**	**SA Reading (EUT) dB(uV)**	**SA Reading (Signal Gen & Horn Antenna) dB(uV)**	**Signal Generator Power + Horn Antenna Gain dBm**	**Equivalent Isotropic Radiated Power (EUT) dBm**
CDMA	1851.25	V	84.8	41.5	-22.4	20.9
	1880.00	V	85.3	40.4	-22.4	22.5
	1908.75	V	84.8	39.0	-22.4	23.4

4.0 Occupied Bandwidth

FCC 2.1049

4.1 Test Procedure

The transmitter output was connected to a calibrated coaxial attenuator, the other end of which was connected to a spectrum analyzer. The Occupied Bandwidth (defined as the 99% Power Bandwidth) was measured with HP8546A Spectrum Analyzer.

4.2 Test Equipment

Hewlett Packard HP8546A Spectrum Analyzer

4.3 Test Results

See attached plots 4.1 and 4.2. The test result shows that the bandwidth is 1.285 MHz, which is 3% higher than the theoretical bandwidth for CDMA - 1.25 MHz. The Emission Designator was determined as 1M25F9W

Plot 4.1
MARKER Δ
1.275 MHz
.17 dB
REF OFFST 3.0 dB
REF 18.0 dBm
LOG
10
dB/
#ATN
40 dB
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 1.275 MHz
.17 dB
WA SB
SC FC
CORR
CENTER 836.500 MHz
#IF BW 30 kHz
#AVG BW 300 Hz
SPAN 2.000 MHz
SWP 667 msec
Last Hrd
Key Menu
SPAN
99%
PWR BW
%
AM
3rd ORD
MEAS
DELTA
MEAS
PK-PK
MEAS
More
2 of 2

Plot 4.2
MARKER Δ
1.285 MHz
-.75 dB
REF OFFST 3.0 dB
REF 18.0 dBm
LOG
10
dB/
#ATN
40 dB
WA SB
SC FC
CORR
CENTER 1.880000 GHz
#IF BW 30 kHz
#AVG BW 300 Hz
SPAN 2.000 MHz
SWP 667 msec
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 1.285 MHz
-.75 dB
Last Hrd
Key Menu
SPAN
99%
PWR BW
%
AM
3rd ORD
MEAS
DELTA
MEAS
PK-PK
MEAS
More
2 of 2

5.0 Emission Limitations
FCC 2.1049, 22.917(b)(d)

For F3E/F3D emission mask uses with audio filter, the mean power of emissions must be attenuated below the mean power of the unmodulated carrier wave (P) as follows:

(1) On any frequency removed from the carrier frequency by more than 20 kHz but not more than 45 kHz: at least 26 dB;

(2) On any frequency removed from the carrier frequency by more than 45 kHz, up to the first multiple of the carrier frequency: at least 60 dB or (43 + 10 log P) dB, whichever is the lesser attenuation.

For F1D emission mask, the mean power of emissions must be attenuated below the mean power of the unmodualted carrier (P) as follows:

(1) On any frequency removed from the carrier frequency by more than 20 kHz but no more than 45 kHz: at least 26 dB;

(2) On any frequency removed from the carrier frequency by more than 45 kHz but not more than 90 kHz: at least 45 dB;

(2) On any frequency removed from the carrier frequency by more than 90 kHz, up to the first multiple ofthe carrier frequency: at least 60 dB or (43 +10 log P) dB, whichever is the lesser attenuation.

5.1 Test Procedure

The RF output of the transceiver was connected to the input of the spectrum analyzer through sufficient attenuation. The audio generator was connected to the audio input of the transceiver.

The spectrum with no modulation was recorded. The audio input signal was adjusted to obtain the frequencies deviation equal 6 kHz at the audio frequency of maximum response which was determined measuring deviation versus frequency from 300 Hz to 3.5 kHz and was found about 2.5 kHz. The audio input level was increased by 16 dB. The audio frequency was set to the frequency 2.5 kHz.

The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the frequency band 50 kHz and 100 kHz from the carrier frequency. The same plots have been done for wideband emissions, SAT, ST, Voice, some of the combinations of these modulating signals.

5.2 Test Equipment

HP 8566B Spectrum Analyzer
Marconi 2955/2957 Radio Communication Test Set
HP 7470A Plotter

5.3 Test Results

Complies	Refer to the attached plots.

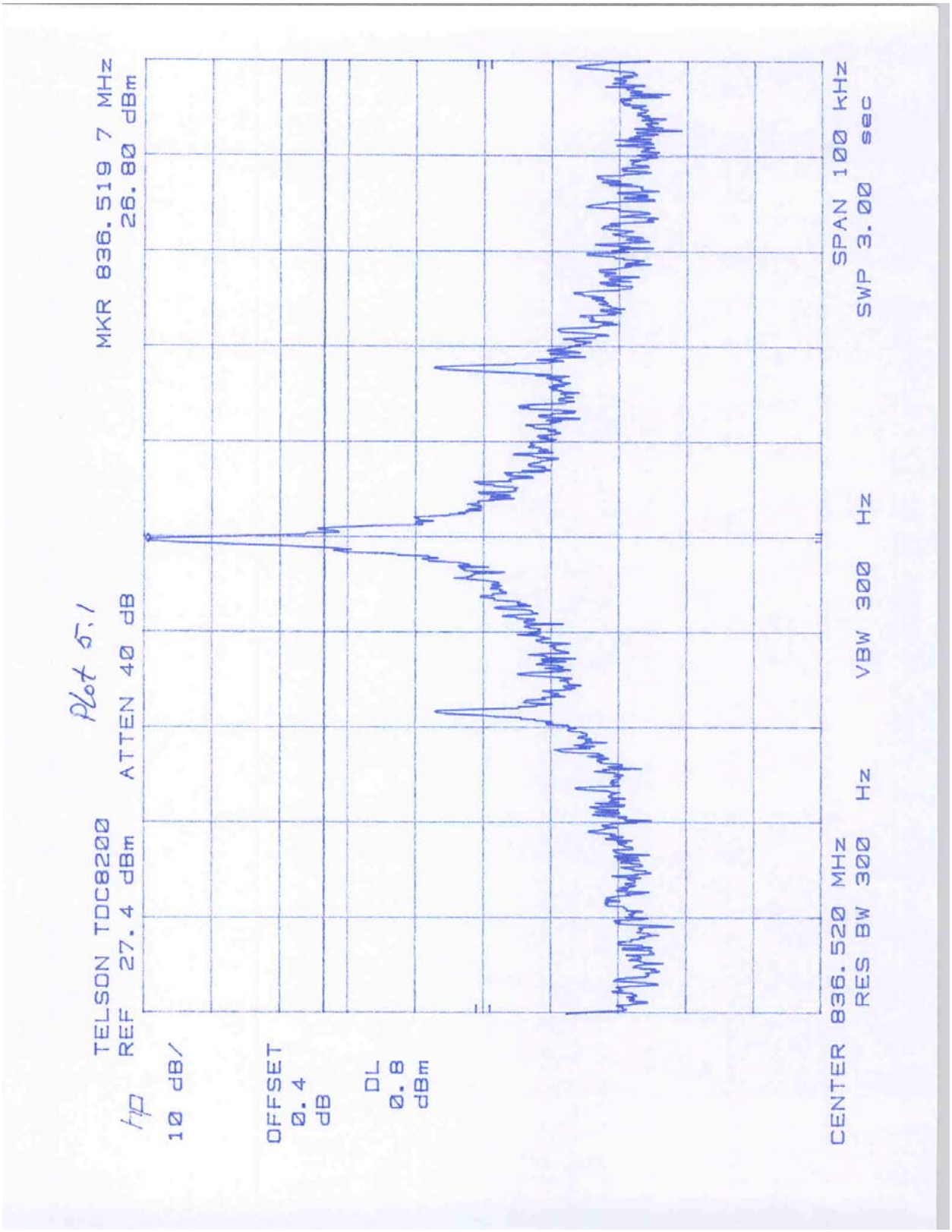
Plot Number	Description
5.1	Unmodulated carrier
5.2	Wideband emissions (0, 1, 0, 1), scan 100 kHz
5.3	SAT (6 kHz, 2 kHz deviation)
5.4	ST (10 kHz, 8 kHz deviation), scan 100 kHz
5.5	ST & SAT (6 kHz & 10 kHz), scan 100 kHz
5.6	Wideband emissions & SAT, scan 100 kHz
5.7	Wideband emissions & SAT, scan 200 kHz
5.8	Voice (2.5 kHz) & SAT (6 kHz), scan 100 kHz
5.9	Voice (2.5 kHz) & SAT (6 kHz), scan 200 kHz

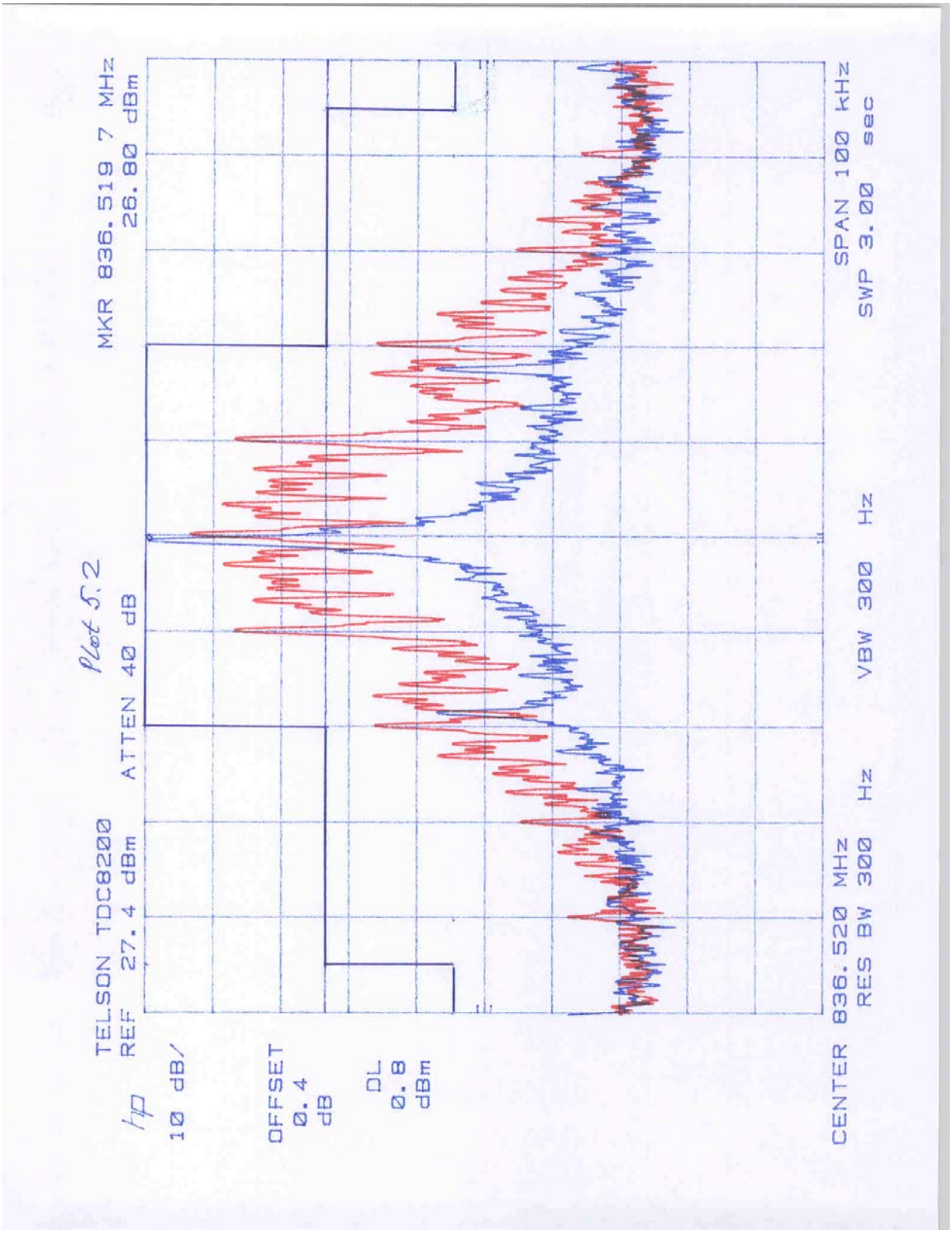
Calculation of the necessary bandwidth (Bn) using the Carson's Rule Bn = 2(M+D):

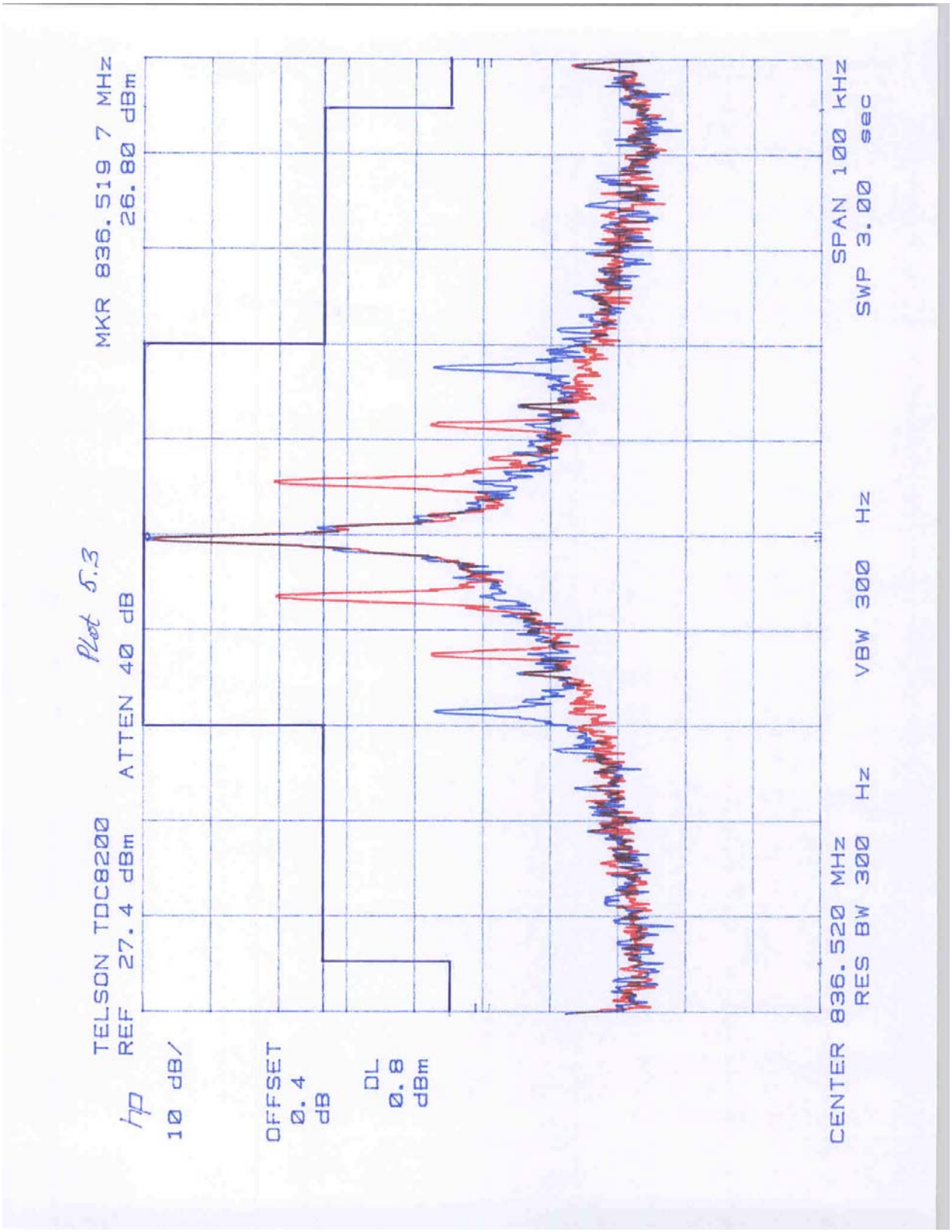
a) Voice and SAT signals:
Voice (M=2.5 kHz, D=12 kHz)
SAT (M=6 kHz, D=2 kHz)
Bn = 2(6+12+2) = 40 kHz
Emission Designator: 40K0F8W

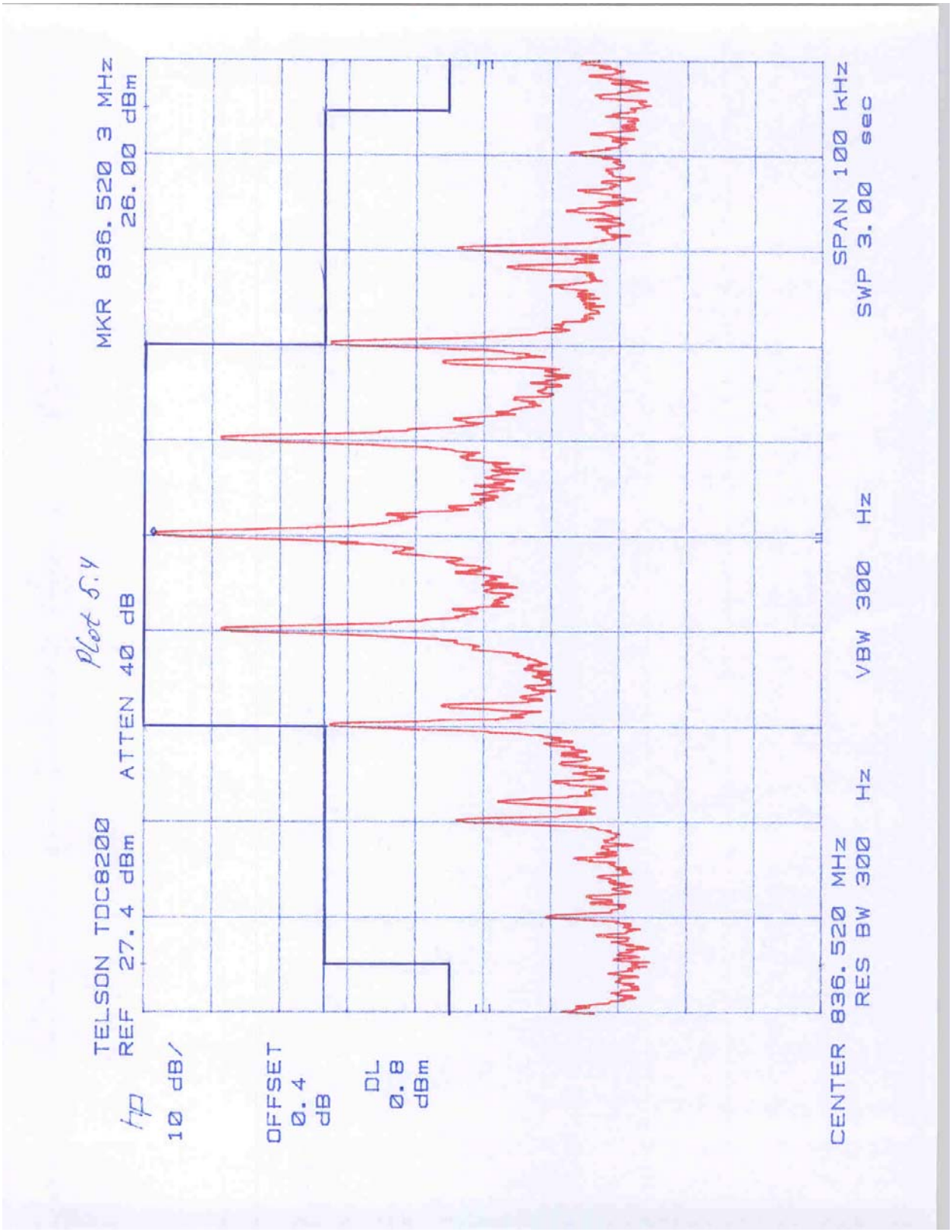
b) Wideband data:
Data (M=10 kHz, D=8 kHz)
SAT (M=6 kHz, D=2 kHz)
Bn = 2(10+8+2) = 40 kHz
Emission Designator: 40K0F1D

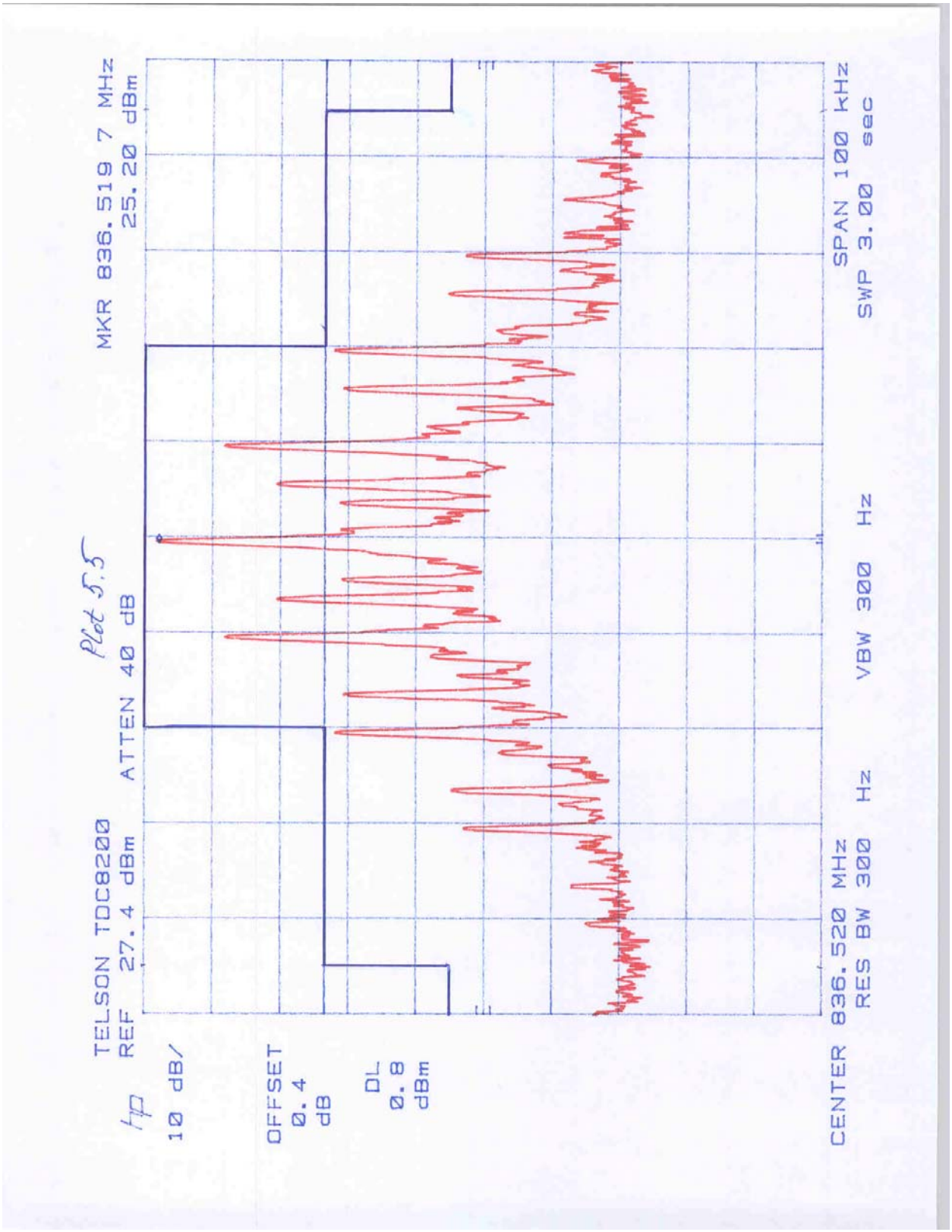
c) CDMA
Emission Designator: 1M25F9W

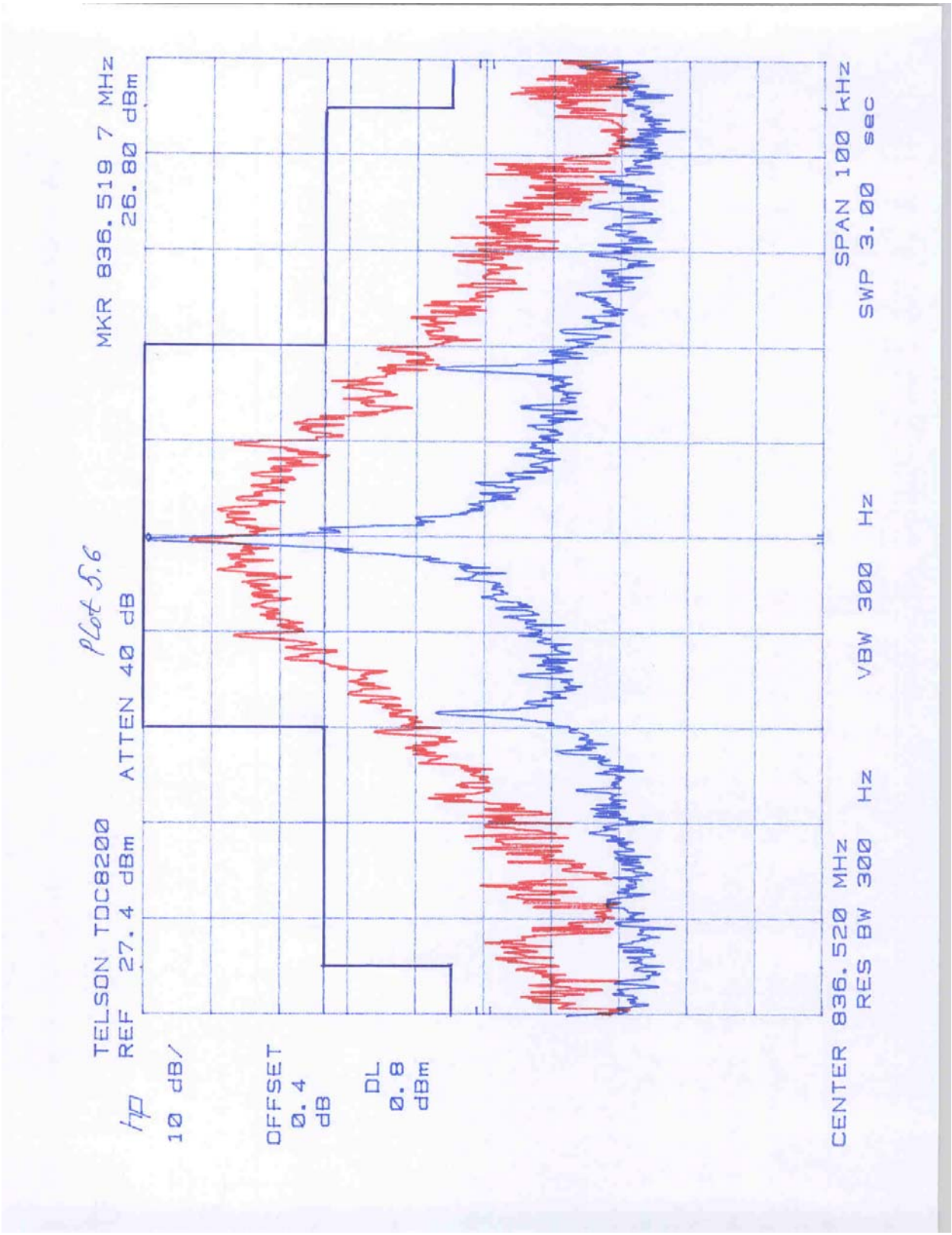

Plot 5.1
TELSON TDC8200
REF 27.4 dBm
ATTEN 40 dB
MKR 836.519 7 MHz
26.80 dBm
10 dB/
OFFSET
0.4
dB
DL
0.8
dBm
CENTER 836.520 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 100 kHz
SWP 3.00 sec

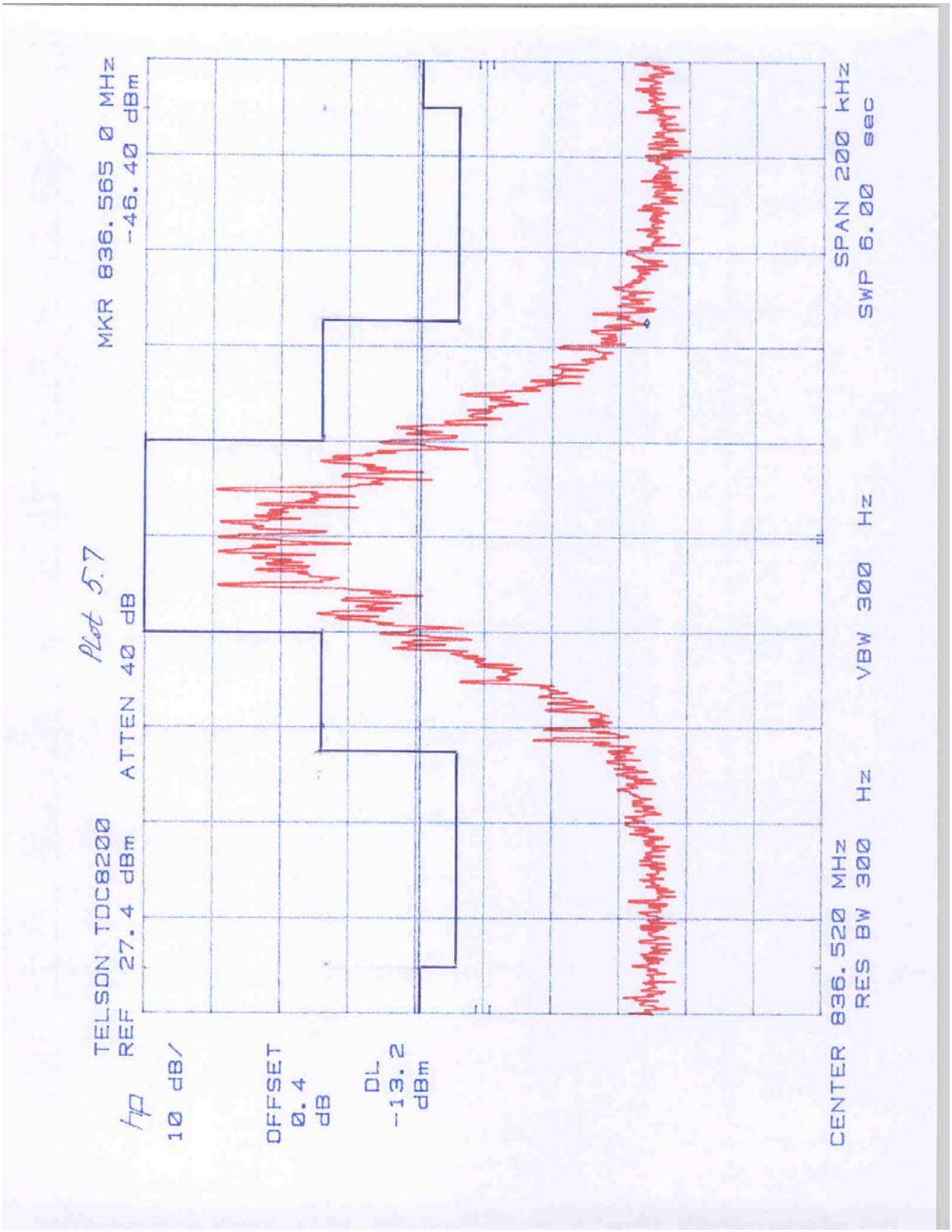

Plot 5.2
TELSON TDC8200
REF 27.4 dBm
ATTEN 40 dB
MKR 836.519 7 MHz
26.80 dBm
10 dB/
OFFSET
0.4
dB
DL
0.8
dBm
CENTER 836.520 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 100 kHz
SWP 3.00 sec

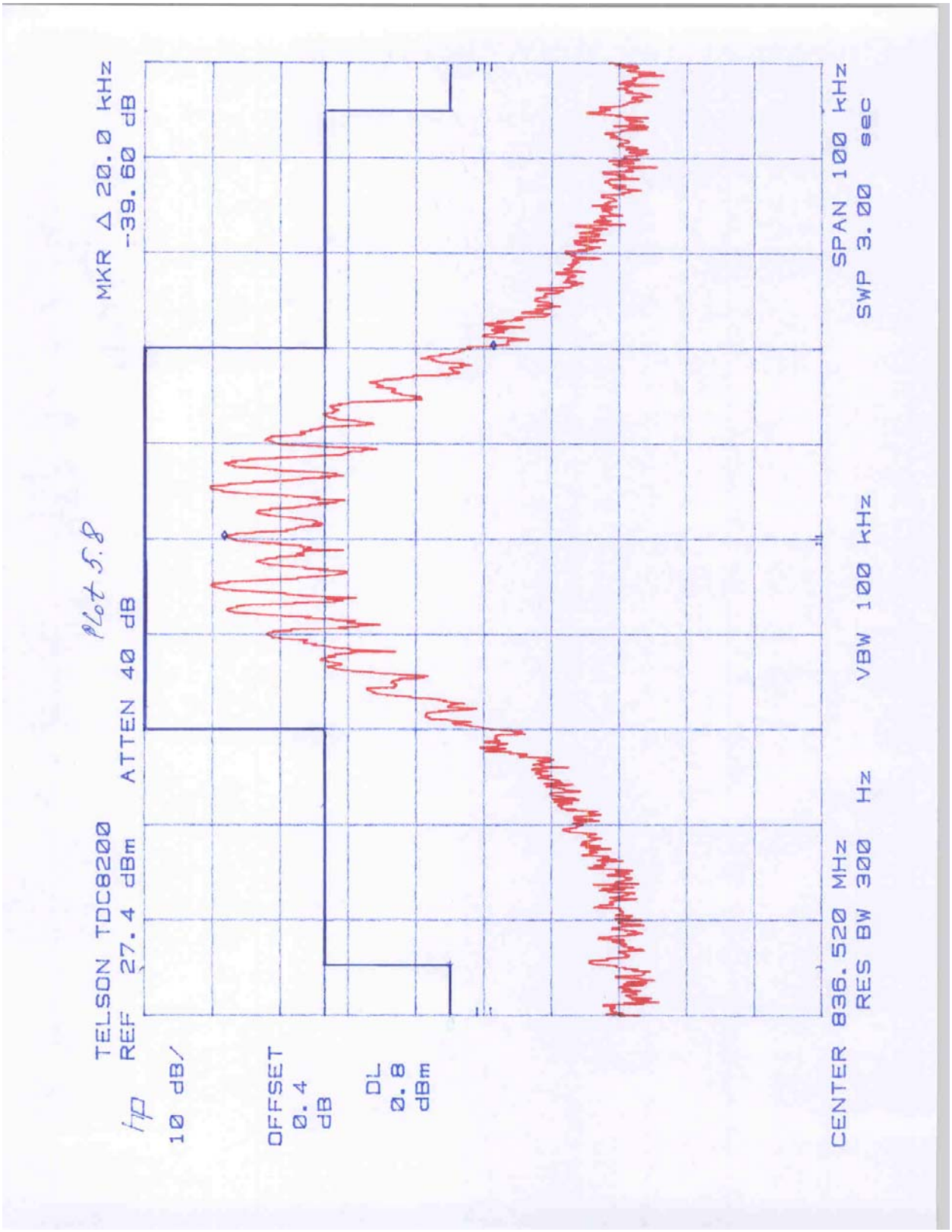

Plot 5.3
TELSON TDC8200
REF 27.4 dBm
ATTEN 40 dB
MKR 836.519 7 MHz
26.80 dBm
10 dB/
OFFSET
0.4
dB
DL
0.8
dBm
CENTER 836.520 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 100 kHz
SWP 3.00 sec

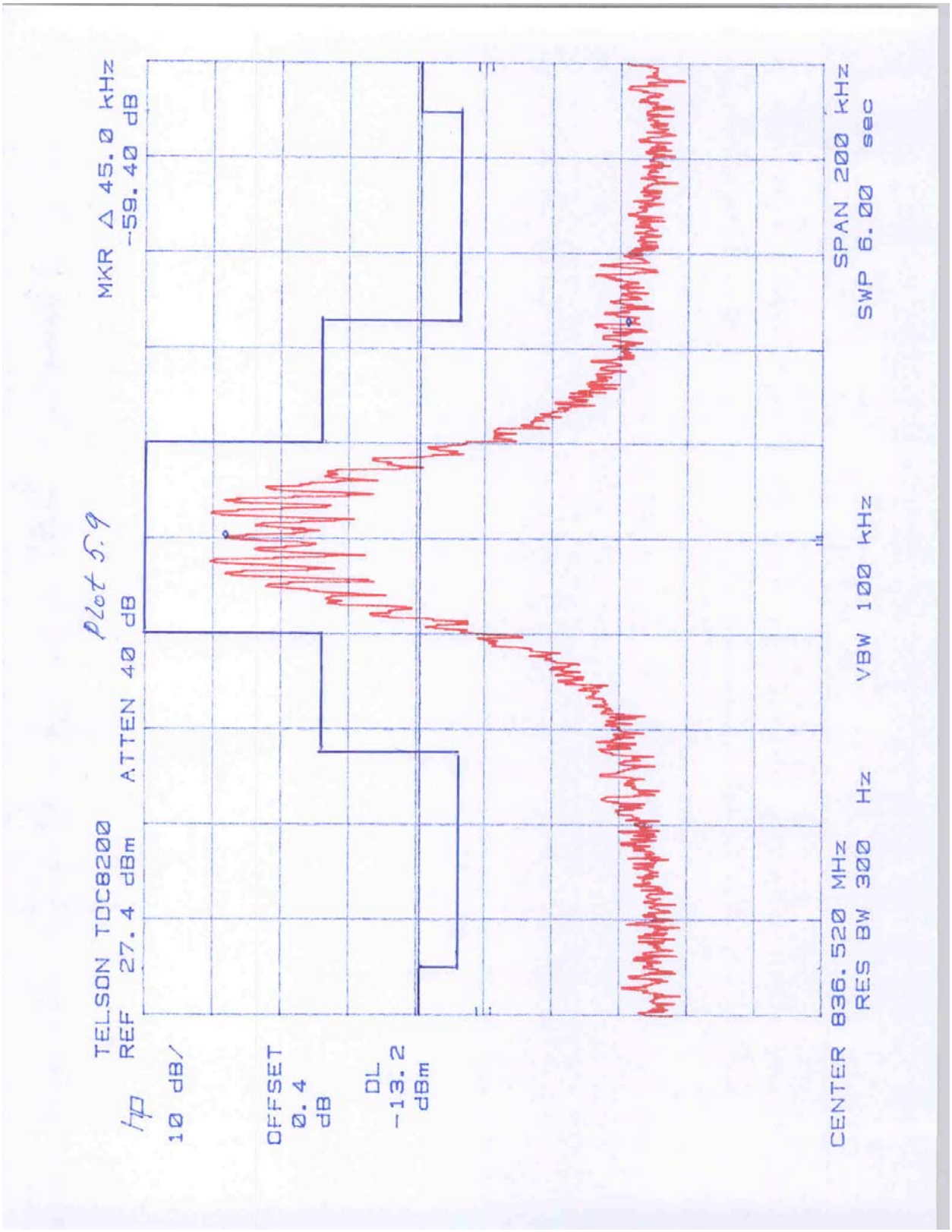

hp
TELSON TDC8200
REF 27.4 dBm
ATTEN 40 dB
Plot 5.4
MKR 836.520 3 MHz
26.00 dBm
10 dB/
OFFSET
0.4
dB
DL
0.8
dBm
CENTER 836.520 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 100 kHz
SWP 3.00 sec


Plot 5.5
TELSON TDC8200
REF 27.4 dBm
ATTEN 40 dB
MKR 836.519 7 MHz
25.20 dBm
10 dB/
OFFSET
0.4
dB
DL
0.8
dBm
CENTER 836.520 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 100 kHz
SWP 3.00 sec


Plot 5.6
TELSON TDC8200
REF 27.4 dBm
ATTEN 40 dB
MKR 836.519 7 MHz
26.80 dBm
10 dB/
OFFSET
0.4
dB
DL
0.8
dBm
CENTER 836.520 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 100 kHz
SWP 3.00 sec


TELSON TDC8200
REF 27.4 dBm
ATTEN 40 dB
MKR 836.565 0 MHz
-46.40 dBm
Plot 5.7
10 dB/
OFFSET
0.4
dB
DL
-13.2
dBm
CENTER 836.520 MHz
RES BW 300 Hz
VBW 300 Hz
SPAN 200 kHz
SWP 6.00 sec


TELSON TDC8200
REF 27.4 dBm
ATTEN 40 dB
MKR Δ 20.0 kHz
-39.60 dB
10 dB/
OFFSET
0.4
dB
DL
0.8
dBm
CENTER 836.520 MHz
RES BW 300 Hz
VBW 100 kHz
SPAN 100 kHz
SWP 3.00 sec
Plot 5.8


Plot 5.9
TELSON TDC8200
REF 27.4 dBm
ATTEN 40 dB
MKR Δ 45.0 kHz
-59.40 dB
10 dB/
OFFSET
0.4
dB
DL
-13.2
dBm
CENTER 836.520 MHz
RES BW 300 Hz
VBW 100 kHz
SPAN 200 kHz
SWP 6.00 sec

6.0 Modulation Deviation Limiting

FCC 2.1047, 22.915(b)(c)

6.1 Test Procedure

The RF output of the transceiver was connected to the input of an FM deviation meter through sufficient attenuation so as not to overload the meter or distort the readings. An audio signal generator with a variable attenuator on the output was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone wires by clip leads.

At three different modulating frequencies, the output level of the audio generator was varied and the FM deviation level was recorded (Table 4.1a).

6.2 Test Equipment

Marconi 2955A/2957 Radio Communication Test Set

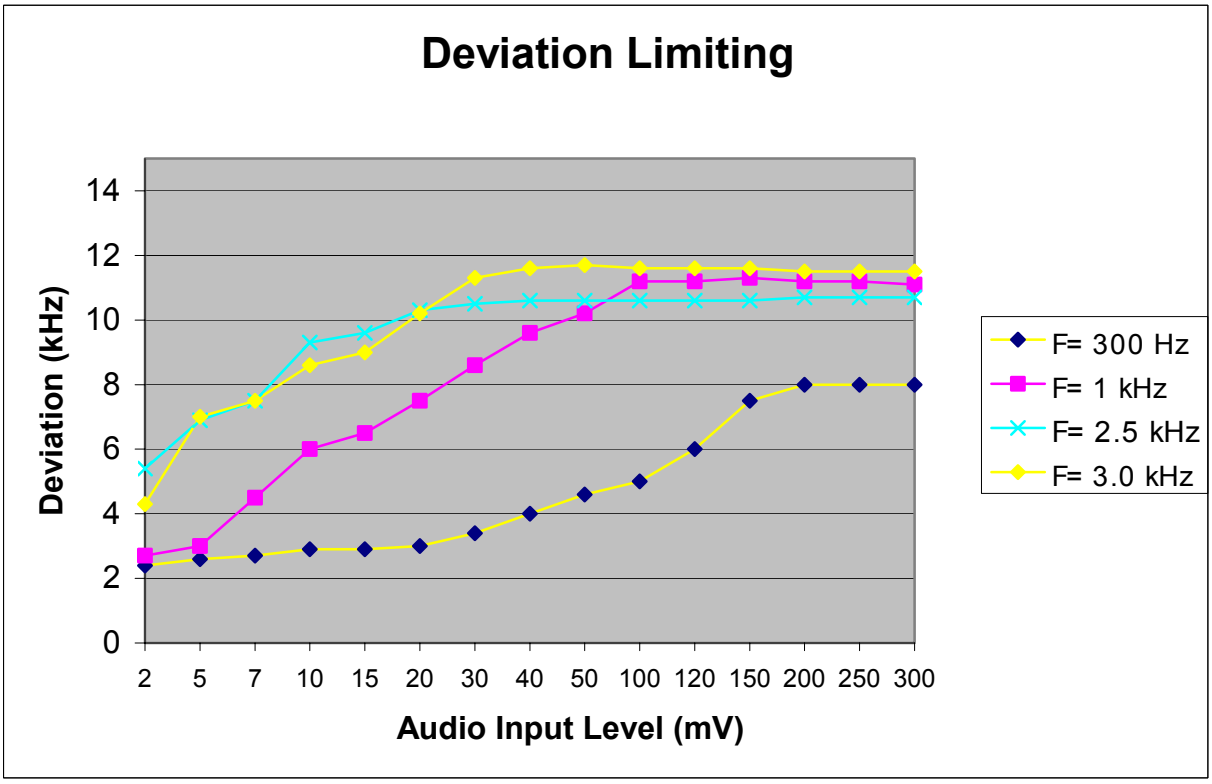
6.3 Test Results

The deviation did not exceed 13.2 kHz.
The EUT passed the test.
See test data in table 4.

Table 4 Modulation Deviation Limiting

Input Level (mV)	FM Deviation in kHz at Indicated Modulating Frequency			
	300 Hz	1 kHz	2.5 kHz	3 kHz
2	2.4	2.7	4.3	5.4
5	2.6	3.0	7.0	6.9
7	2.7	4.5	7.5	7.5
10	2.9	6.0	8.6	9.3
15	2.9	6.5	9.0	9.6
20	3.0	7.5	10.2	10.3
30	3.4	8.6	11.3	10.5
40	4.0	9.6	11.6	10.6
50	4.6	10.2	11.7	10.6
100	5.0	11.2	11.6	10.6
120	6.0	11.2	11.6	10.6
150	7.5	11.3	11.6	10.6
200	8.0	11.2	11.5	10.7
250	8.0	11.2	11.5	10.7
300	8.0	11.1	11.5	10.7

Middle Channel: 836.52 MHz


Deviation Limiting
Deviation (kHz)
0
2
4
6
8
10
12
14
2
5
7
10
15
20
30
40
50
100
120
150
200
250
300
Audio Input Level (mV)
F= 300 Hz
F= 1 kHz
F= 2.5 kHz
F= 3.0 kHz

7.0 Audio Filter Characteristics
FCC 22.915(d)

For mobile stations, these signals must be attenuated, relative to the level at 1 kHz, as follows:

(i) In the frequency ranges of 3.0 to 5.9 kHz and 6.1 to 15.0 kHz, signals must be attenuated by at least 40 log (f/3) dB, where f is the frequency of the signal in kHz.

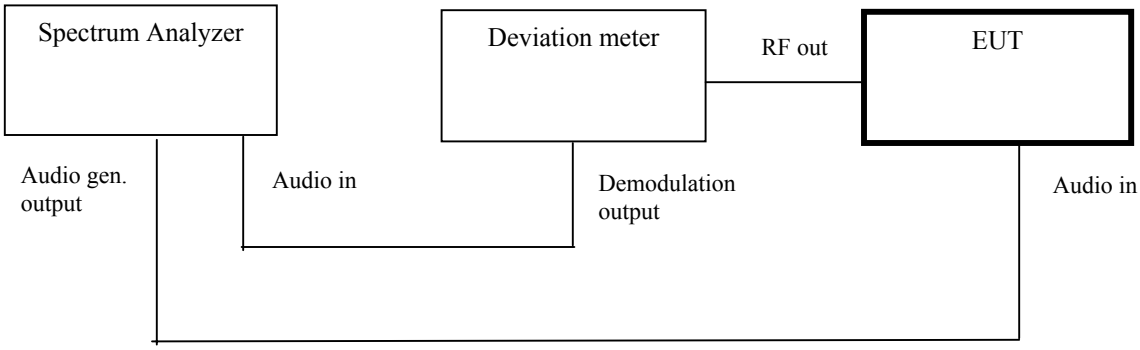
(ii) In the frequency range of 5.9 to 6.1 kHz, signals must be attenuated at least 35 dB.

(iii) In the frequency range above 15 kHz, signals must be attenuated at least 28 dB.

7.1 Test Procedure

The RF output of the transceiver was connected to the input of an FM deviation meter through sufficient attenuation so as not to overload the meter or distort the readings. An audio signal generator was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone wires by clip leads.

The test was performed according to the block diagram shown below.



On that block diagram, the HP 3885A spectrum analyzer having the tracing generator, and the Marconi 2955A Radio Communication Test Set having an output of a demodulator, are used. After the calibration was made (the -20 dBm reading of the spectrum analyzer corresponds to the 9 kHz deviation) the spectrum analyzer was set to scan the frequency from 300 Hz to 30 kHz, with the same audio input level as described above, and with compressor OFF and expander OFF.
The audio filter response was measured from the spectrum analyzer. Using the level measured at 1 kHz as a reference (0 dB), the audio filter response was calculated (See Table 7).

7.2 Test Equipment

Marconi Instruments 2955/2957 Radio Communications Test Set
HP 3588A Spectrum Analyzer
HP 7470A Plotter

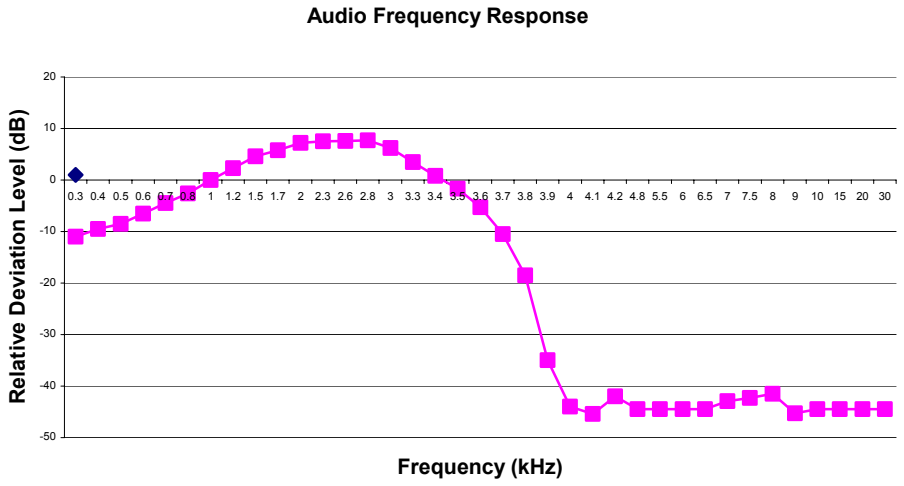
7.3 Test Results

Table 7 Audio Frequency Response

Freq., kHz	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.2	1.5	1.7	2.0	2.3	2.6	2.8	3.0
Level, dB	-11	-9.5	-8.5	-6.5	-4.5	-2.6	0	2.3	4.6	5.8	7.2	7.5	7.6	7.7	6.2

Freq., kHz	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.8	5.5	6.0
Level, dB	3.5	0.8	-1.7	-5.3	-10.5	-18.5	-35	-44	-45.4	-42	-44.5	-44.5	-44.5

Freq., kHz	6.5	7.0	7.5	8.0	9.0	10	15	20	30
Level, dB	-44.5	-42.9	-42.3	-41.5	-45.3	-44.5	-44.5	-44.5	-44.5



8.0 Out of Band Emissions at Antenna Terminals

FCC 22.901(d), 22.901(d), 22.917(f), 24.238(a)

Out of Band Emissions:

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least (43 + 10 log P) dB.

Mobile Emissions in Base Frequency Range:

The mean power of any emissions appearing in the base station frequency range from cellular mobile transmitters operated must be attenuated to a level not to exceed -80 dBm at the transmit antenna connector.

8.1 Test Procedure

The RF output of the transmitter was connected to a spectrum analyzer through appropriate attenuation. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic.

8.2 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer

8.3 Test Results

Complies	Refer to the plots in Appendix A.

Cellular Band, AMPS	
Plot Number	**Description**
7.1.1 – 7.1.3	Low Channel
7.2.1 – 7.2.3	Middle Channel
7.3.1 – 7.3.3	High Channel
7.4.1 – 7.4.3	Middle Channel, Low Power

Cellular Band, CDMA	
Plot Number	**Description**
7.5.1 – 7.5.6	Low Channel
7.6.1 – 7.6.4	Middle Channel
7.7.1 – 7.7.7	High Channel

PCS Band, CDMA	
Plot Number	**Description**
7.8.1 – 7.8.8	Low Channel
7.9.1 – 7.9.5	Middle Channel
7.10.1 – 7.10.7	High Channel

Emission in Base Frequency Range	
Plot Number	**Description**
7.11.1	Low Channel
7.11.2	Middle Channel
7.11.3	High Channel

9.0 Field Strength of Spurious Radiation

FCC 2.1053, 22.901(d), 24.238(a)

9.1 Test Procedure

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The EUT was powered from fully charged battery.

The frequency range up to tenth harmonic of each of the three fundamental frequency (low, middle, and high channels) for each band (cellular and PCS) was investigated. The tests were performed with the EUT placed on three orthogonal axes. The worst case of emissions was reported.

For spurious emissions attenuation, the substitution method was used. On each frequency where the Field Strength was found above 63.4 dBuV/m (which corresponds to ERP = -33 dBm), the EUT was substituted by a reference antenna (half-wave dipole - below 1 GHz, or Horn antenna - above 1GHz), connected to a signal generator. The signal generator output was adjusted to obtain the same reading as from EUT. The ERP/EIRP at the spurious emissions frequency was calculated as in section 3. The spurious emissions attenuation was calculated as the difference between ERP/EIRP at the fundamental frequency (see section 3) and at the spurious emissions frequency.

9.2 Test Equipment

EMCO 3115 Horn Antennas
Hewlett Packard HP8546A Spectrum Analyzer
Hewlett Packard HP 8566B Spectrum Analyzer
Low Pass Filter
Preamplifiers

9.3 Test Results

All spurious emissions are attenuated by more than 20 dB than the required attenuation limit. Therefore measurements by the substitution method were not performed.
Refer to the data sheets in Appendix B for radiated emissions data.

Test Result:	Complies

10.0 Frequency Stability vs Temperature and Voltage

FCC 2.1055

10.1 Test Procedure

The TDC-8200 was powered from AC/DC adapter and placed inside the temperature chamber. After the temperature stabilized for approximately 20 minutes, the transmitting frequency was recorded.

At the room temperature, the EUT was powered from DC power supply. The frequency was measured when it is powered with nominal battery voltage and with 85% and 115% of the nominal voltage. In addition, the frequency was measured when the EUT was powered with the minimum battery voltage

10.2 Test Equipment

Leader LDC-825 Digital Counter

10.3 Test Results

Test Result:	Complies. Emission attenuation on the band-edges frequencies of the frequency block is not affected by the measured frequency instability.

Transmitting Frequency: 836.52 MHz, channel 384

Temperature (°C)	**Frequency Hz**	**Difference ppm**
-30	836520165	0.20
-20	836520216	0.26
-10	836520270	0.32
0	836520315	0.38
10	836520355	0.42
20	836520380	0.45
30	836520475	0.57
40	836520513	0.61
50	836520564	0.67

Transmitting Frequency: 836.52 MHz, channel 384

Vcc, Volts	Frequency Hz	Difference ppm
4.83	836520380	0.45
3.57	836520380	0.45
2.8	836520380	0.45

Note: The measured frequency stability vs. temperature for the Cellular band is identical (% difference) to the above table since the transmitting frequency is locked to the same oscillator.

11.0 List of Test Equipment

Measurement equipment used for compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
Bi-Log Antenna	EMCO	3143	9509-1160	12	9/19/03
Pre-Amplifier	Sonoma Inst.	310	185634	12	4/30/03
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	7/16/03
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	7/16/03
Spectrum Analyzer w/85650 QP Adapter	Hewlett Packard	8566B	2416A00317 2043A00251	12	5/06/03
Signal Generator	Hewlett Packard	83732A	322A00119	12	3/04/03
Double-ridged Horn Antenna	EMCO	3115	9170-3712	12	6/02/03
Double-ridged Horn Antenna	EMCO	3115	8812-3049	12	4/03/03
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	4/05/03
Dipole Antenna	CDI	Roberts	331	12	9/10/03
Radio Communication Test Set	Marconi	2955/2957	N/A	12	12/13/03
Digital Counter	Leader Electronics	LDC-825	1010046	12	9/03/03

12.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3041448	SS	April 24, 2003	Original document

Appendix A – Out-of-band conducted emission data

See file "Appendix A"

Appendix B – Radiated emission data

FCC Part 22 Spurious Radiated Emission test data

Test Mode: Tx @ 824.04 MHz
Temperature: 20.5 C Company: Telson Corporation
Humidity: 51.5 % Model: MTD – 3500/3510

Frequency MHz.	Polarity	Mode	SA Reading dB(µV)	Cable Loss dB	Pre Amplif. dB	Ant. factor dB(1/m)	Ext. Atten. dB	FS Level dB(µV/m)	Calculated ERP dBm
1648.08	V	AMPS	26.8	4.2	-	27.4	3	61.4	-36.0
2472.12	V	AMPS	58.9	5.1	36.5	30.6	3	61.1	-36.3
3296.16	V	AMPS	52.5	6.0	36.4	32.3	3	57.4	-40.0
4120.20	V	AMPS	54.1	6.8	36.3	34.1	3	61.7	-35.7
4944.24	H	AMPS	45.7	9.5	35.8	35.2	3	57.6	-39.8
5768.28	H	AMPS	40.0	8.3	35.3	36.4	3	52.4	-45.0
6592.32	H / V	AMPS	32.3*	12.6	35.3	35.9	3	48.5	-48.9
7416.36	H / V	AMPS	32.3*	12.6	35.3	38.0	3	50.6	-46.8
8240.4	H / V	AMPS	32.3*	12.6	35.4	37.8	3	50.3	-47.1

FCC Part 22 Spurious Radiated Emission test data

Test Mode: Tx @ 836.52 MHz
Temperature: 20.5 C Company: Telson Corporation
Humidity: 51.5 % Model: MTD – 3500/3510

Frequency MHz.	Polarity	Mode	SA Reading dB(µV)	Cable Loss dB	Pre Amplif. dB	Ant. factor dB(1/m)	Ext. Atten. dB	FS Level dB(µV/m)	Calculated ERP dBm
1673.04	V	AMPS	26.3	4.2		27.4	3	60.9	-36.5
2509.56	V	AMPS	55.7	5.1	36.5	30.6	3	57.9	-39.5
3346.08	V	AMPS	56.6	6.0	36.4	32.3	3	61.5	-35.9
4182.26	H	AMPS	51.2	6.8	36.3	34.1	3	58.8	-38.6
5019.12	H	AMPS	45.1	9.5	35.8	35.2	3	57.0	-48.4
5855.64	H	AMPS	40.1	8.3	35.3	36.4	3	52.5	-44.9
6692.16	H / V	AMPS	33.2*	11.5	35.3	36.5	3	48.9	-48.5
7528.68	H / V	AMPS	33.2*	10.2	35.4	35.4	3	49.0	-48.4
8365.20	H / V	AMPS	33.2*	10.1	35.4	37.9	3	48.8	-48.6

FCC Part 22 Spurious Radiated Emission test data

Test Mode: Tx @ 848.97 MHz
Temperature: 20.5 C Company: Telson Corporation
Humidity: 51.5 % Model: MTD – 3500/3510

Frequency MHz.	Polarity	Mode	SA Reading dB(µV)	Cable Loss dB	Pre Amplif. dB	Ant. factor dB(1/m)	Ext. Atten. dB	FS Level dB(µV/m)	Calculated ERP dBm
1697.94	V	AMPS	21.7	4.2		27.4	3	56.3	-41.1
2546.91	H	AMPS	58.7	5.1	36.5	30.6	3	60.9	-36.5
3395.88	V	AMPS	52.3	6.0	36.4	32.3	3	57.2	-40.2
4244.85	V	AMPS	51.8	6.8	36.3	34.1	3	59.4	-38.0
5093.82	V	AMPS	43.8	9.5	35.8	35.2	3	55.7	-41.7
5942.79	H / V	AMPS	33.2*	8.3	35.3	36.4	3	45.6	-51.8
6791.79	H / V	AMPS	33.2*	10.5	35.3	36.7	3	48.1	-49.3
7640.73	H / V	AMPS	33.2*	10.4	35.4	37.9	3	49.1	-48.3
8489.70	H / V	AMPS	33.2*	10.4	35.4	37.9	3	49.1	-48.3

* Noise floor
** Test was performer at 1 m.
-

FCC Part 22 Spurious Radiated Emission test data

Test Mode: Tx, 1851.25 MHz.	FCC Part 24 (Radiated Emission, Harmonics)
Temperature: 21.0 C	Telson Electronics
Humidity: 51.0 %	Model: TDC-8200

Frequency MHz	Spectrum analyzer reading dB(uV)	Polarity	Cable loss (dB)	Pre-amplif. Gain dB	Ant.factor dB(1/m)	Distance Factor dB	FS Level dB(uV/m)	Calculated EIRP dBm
3702.5	7.2	V	6.4	0.0	32.5	0.0	46.1	-49.2
5553.8	38.2	V	8.3	36.7	36.1	0.0	45.9	-49.4
7405.0	34.7	V	10.2	36.0	38.0	0.0	46.9	-48.4
9256.3	24.5 *	V	10.9	37.2	40.2	0.0	38.4	-56.9
11107.5	37.0 **	V	7.2	36.3	40.7	-9.5	39.1	-56.2
12958.8	36.0 **	V	7.8	37.2	41.1	-9.5	38.2	-57.1
14810.0	36.5 **	V	8.4	36.1	41.1	-9.5	40.4	-54.9
16661.3	37.5 **	V	9.0	35.8	41.3	-9.5	42.5	-52.8
18512.5	343 **	V	9.6	35.6	40.2	-9.5	39.0	-56.3

FCC Part 22 Spurious Radiated Emission test data

Test Mode: Tx, 1880 MHz.	FCC Part 24 (Radiated Emission, Harmonics)
Temperature: 21.0 C	Telson Electronics
Humidity:51.0 %	Model: TDC-8200

Frequency MHz	Spectrum analyzer reading dB(uV)	Polarity	Cable loss (dB)	Pre-amplif. Gain dB	Ant.factor dB(1/m)	Distance Factor dB	FS Level dB(uV/m)	Calculated EIRP dBm
3760.0	8.9 **	V	6.4	0.0	32.5	0.0	47.8	-47.5
5640.0	38.8	V	8.3	36.9	36.1	0.0	46.3	-49.0
7520.0	34.8	V	10.2	36.0	37.8	0.0	46.8	-48.5
9400.0	24.8 *	V	10.9	37.2	40.2	0.0	38.7	-56.6
11280.0	37.0 **	V	7.2	36.3	40.7	-9.5	39.1	-56.2
13160.0	36.0 **	V	7.9	37.1	40.7	-9.5	38.0	-57.3
15040.0	36.0 **	V	8.5	35.7	42.5	-9.5	41.8	-53.5
16920.0	37.0 **	V	9.0	35.8	41.3	-9.5	42.0	-53.3
18800.0	34.0 **	V	9.6	35.6	40.2	-9.5	38.7	-56.6

* Noise floor
** Test was performer at 1 m.

FCC Part 22 Spurious Radiated Emission test data

Test Mode: Tx, 1908.75 MHz	FCC Part 24 (Radiated Emission, Harmonics)
Temperature: 21.0 C	Telson Electronics
Humidity:51.0 %	Model: TDC-8200

Frequency MHz	Spectrum analyzer reading dB(uV)	Polarity	Cable loss (dB)	Pre-amplif. Gain dB	Ant.factor dB(1/m)	Distance Factor dB	FS Level dB(uV/m)	Calculated EIRP dBm
3817.5	7.3 **	H	6.4	0.0	32.1	0.0	45.8	-49.5
5726.3	38.1	V	8.3	36.9	36.1	0.0	45.6	-49.7
7635.0	39.0	V	10.2	36.1	37.8	0.0	50.9	-44.4
9543.8	25.4 *	H	10.9	37.2	39.0	0.0	38.1	-57.2
11452.5	37.0 **	V	7.2	36.3	40.7	-9.5	39.1	-56.1
13361.3	36.0 **	V	7.9	37.1	40.7	-9.5	38.0	-57.3
15270.0	36.0 **	V	8.5	35.7	42.5	-9.5	41.8	-53.5
17178.8	37.0 **	H	9.2	36.1	43.0	-9.5	43.6	-51.7
19087.5	34.0 **	V	9.8	35.6	40.2	-9.5	38.9	-56.4

* Noise floor
** Test was performer at 1 m.
-