ITS Intertek Testing Services
ETL SEMKO

FCC Part 22 Test Report

Performed on the

Cellular Alarm Transmission System
Model: T100C001, T200C001, T300C001

For

Telular Corporation

FCC ID: MTF09000

Date of Test: August 20-29, 2000

Report #: 2016073
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FCC Parts 22 Certification, Ver 7/98

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Tested By: _____ 10/15/00
Suresh Kondapalli — Date

Approved By: David Chernomordik 10/15/00
David Chernomordik — Date

1.2 Product Description

The Telular Models T100C001, T200C001, T300C001 are Telguard DataBurst Models, used in Cellular Alarm Transmission Systems. All 3 models have identical electronics. The T100C001 is in flame-retardant plastic enclosure with spike antenna, the T200C001 is in metal enclosure (with lock and key) and used with Magnetic-mount antenna with 12 foot cable, the T300C001 is in attack resistance enclosure (with lock and key) and used with Magnetic-mount antenna with 12 foot cable.

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

Use of Product	Cellular Alarm System
Whether quantity (>1) production is planned	[X] Yes, [ ] No
Cellular Phone standards	AMPS
Type(s) of Emission	40K0F1D, 40K0F3E
Deviation	8 kHz ± 10% (wideband data signals)
RF Output	36 dBm
Frequency Range (transmitter)	824- 849 MHz
Number of Control Channels	42
Channel Spacing	30 kHz
Data Rate	10 kbs
Antenna(e) & Gain	1, 3, 5 dBi
Detachable antenna ? Receiver L.O. frequency	[X]Yes [ ] No 955.85 - 980.85 MHz

1.3 Related Submittal(s) Grants

[X] None

[ ] DOC for computer section, a separate DOC is prepared.

2.0 **RF Power Output**, FCC sec 2.1046

2.1 Test Procedure

The transmitter output was connected to a calibrated coaxial attenuator, the other end of which was connected to a spectrum analyzer. Transmitter output was read off the spectrum analyzer in dBm. The power output at the transmitter antenna port was determined by adding the value of the attenuator to the spectrum analyzer reading. An HP power meter was also used to measure the RF power.

Tests were performed at three frequencies (low, middle, and high channels) and on all power levels, which can be setup on the transmitters.

2.2 Test Equipment

Hewlett Packard 8481A Power Sensor, 435B Power Meter
Hewlett Packard HP8566B Spectrum Analyzer, 100 Hz - 22 GHz

2.3 Test Results

Frequency (MHz)	Measured Power (dBm)	Measured Power (Watt)
824.09	35.6	3.63
836.57	35.3	3.39
848.95	33.2	2.09

For more details refer to the attached plots:

Plot Number	Description
2.3.a	Low Channel
2.3.b	Middle Channel
2.3.c	High Channel

Pass

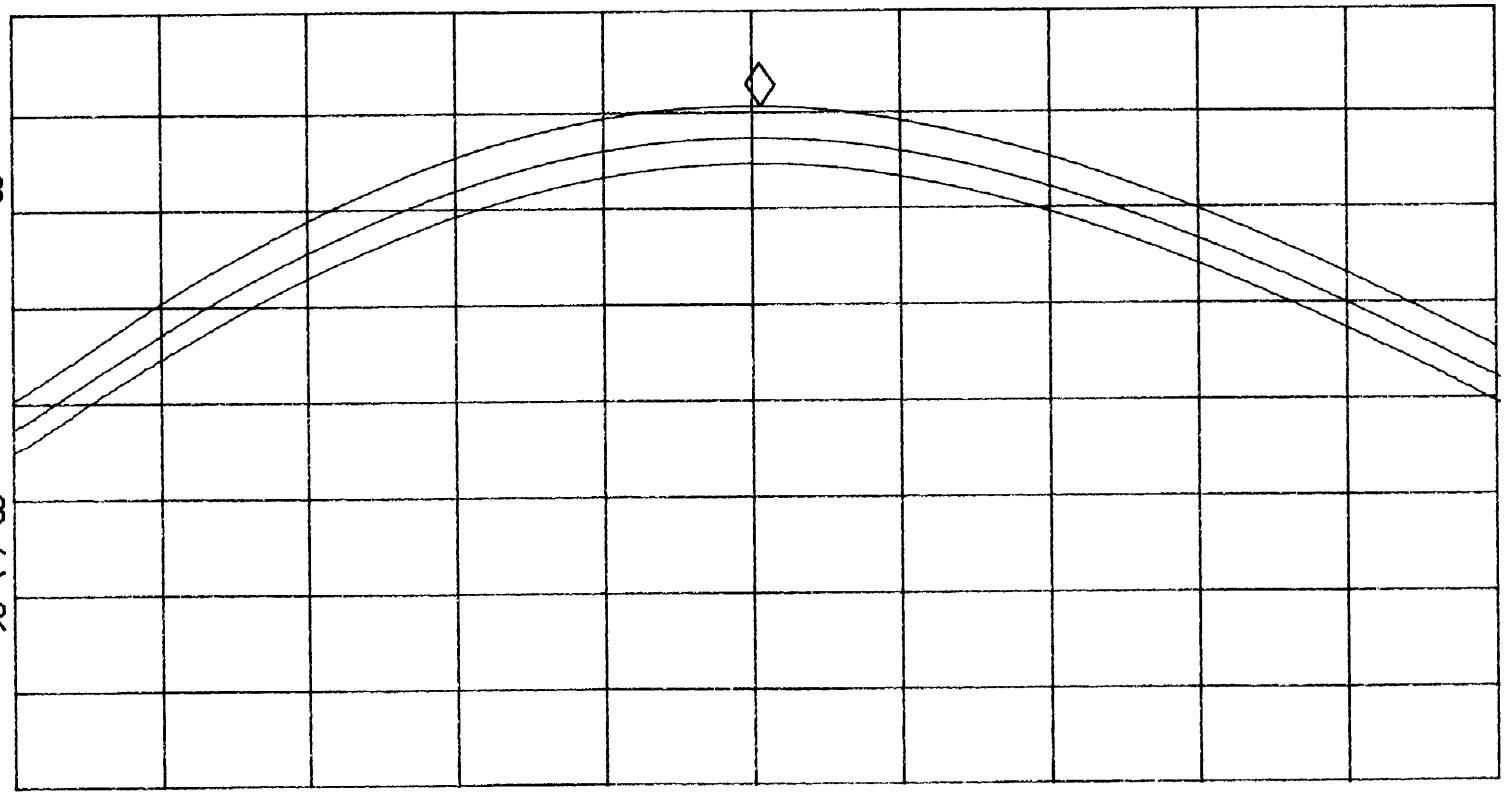
3.0 **Radiated Power,** FCC sec. 22.913

plot 2.3.a

12:36:08 JUL 21, 2000
TELULAR#2

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 824.09 MHz
35.61 dBm

REF OFFST 19.5 dB
LOG REF 45.5 dBm
10
dB/
ATN
40 dB



VA SB
SC FC
CORR

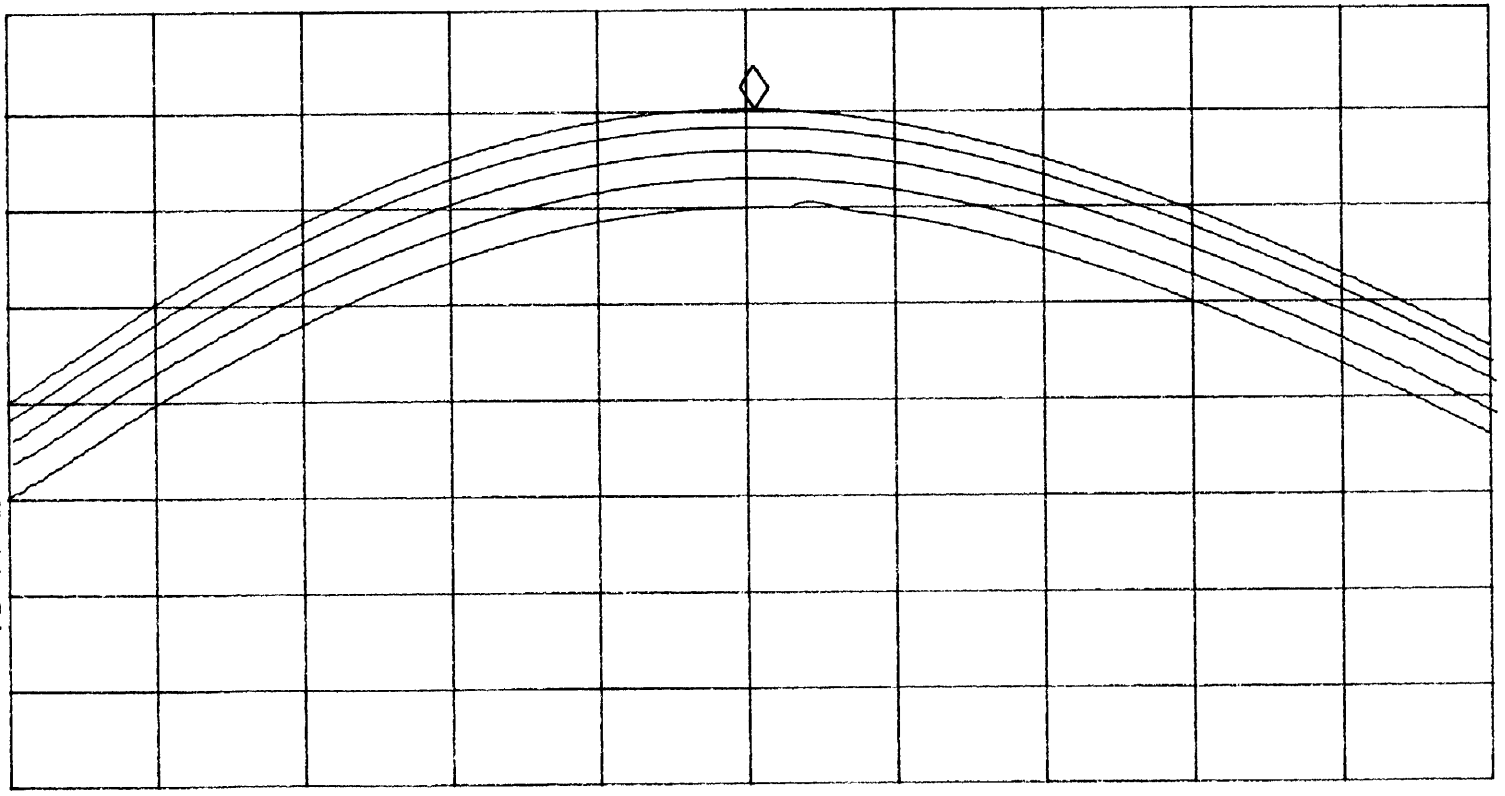
CENTER 824.04 MHz
#IF BW 3.0 MHz #AVG BW 3 MHz
SPAN 10.00 MHz
SWP 20.0 msec

Plot 2.3.b

12:09:04 JUL 21, 2000
TELULAR#2

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 836.57 MHz
35.25 dBm

REF OFFST 19.5 dB
LOG REF 45.5 dBm
10
dB/
ATN
40 dB



VA SB
SC FC
CORR

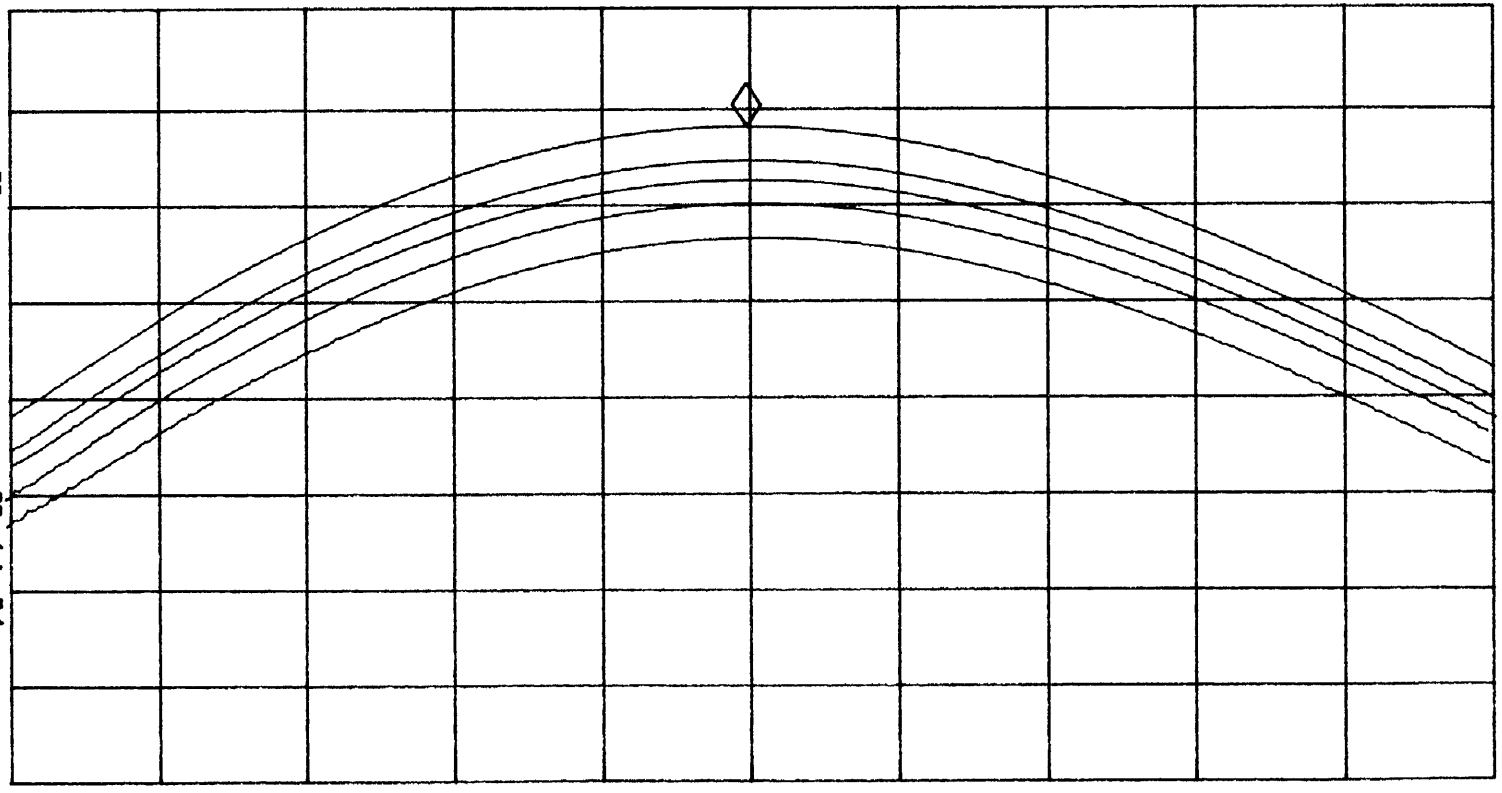
CENTER 836.52 MHz
SPAN 10.00 MHz
#IF BW 3.0 MHz #AVG BW 3 MHz
SWP 20.0 msec

Plot 2,3,C

13:05:08 JUL 21, 2000
TELULAR#2

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 848.95 MHz
33.20 dBm

REF OFFST 19.5 dB
LOG REF 45.5 dBm
10
dB/
ATN
40 dB



VA SB
SC FC
CORR

CENTER 848.97 MHz
SPAN 10.00 MHz
#IF BW 3.0 MHz #AVG BW 3 MHz
SWP 20.0 msec

Requirement

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

3.1 Test Procedure

ERP was calculated by adding an antenna gain (in dBd) to the maximum output power (in dBm). For antennas #2 and #3 used with 12 feet RG58 cable, a cable loss (cl) of 2 dB is taken into account.

For antenna #1 (G=1 dBi):	ERP = 35.6 -1.1=34.5 dBm (2.8 Watts)
For antenna #2 (G=3 dBi, cl=2 dB):	ERP = 35.6+0.9-2=34.5 dBm (2.8 Watts)
For antenna #3 (G=5 dBi, cl=2 dB):	ERP = 35.6+2.9-2=36.5 dBm (4.5 Watts)

3.2 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer

3.3 Test Results

Pass	The ERP does not exceed 4.5 Watts

4.0 **Modulation Deviation Limiting**, FCC sec. 2.1047, sec. 22.915(b)(c)

4.1 Test Procedure

The RF output of the transmitter was connected to the input of the Marconi Test Set through sufficient attenuation so as not to overload the meter or distort the readings. The transmitter was set up to transmit a modulated signal (Wideband data, SAT, ST). The deviation was read off from the instrument.

Note:

All transmitter modulation sources are integral to the terminal itself and are not accessible to the user.

4.2 Test Equipment

Marconi 2955A Radio Communication Test Set

4.3 Test Results

The test data is in the table below.

Type of modulation	Modulation frequency, kHz	Measured deviation, kHz	Deviation limit, kHz
Wideband data	10.0	7.82	8±10%
SAT	6.0	2.02	2±10%
ST	10.0	7.73	8±10%

Test Results	**Pass**

5.0 **Audio Filter Characteristics**, FCC sec. 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.

5.1 Test Procedure

The RF output of the transceiver was connected to the input of a 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.

The audio signal at the transceiver audio input was adjusted to obtain 8-9 kHz deviation at the more sensitive modulation frequency. The audio frequency was varied from 300 Hz to 30 kHz and the deviation was measured while maintaining a constant input level. Using the level measured at 1 kHz as a reference (0 dB), the audio filter response was calculated.

5.2 Test Equipment

Marconi Instruments 2955A Radio Communications Test Set
HP 3588A Spectrum Analyzer
HP 7470A Plotter
Leader LFG-1300S Function Generator
LMV-182 AC Millivoltmeter

5.3 Test Results

Not Applicable	All transmitter modulation sources are integral to the terminal itself and are not accessible to the user

6.0 **Emission Limitations, Occupied Bandwidth**, FCC sec. 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 of the carrier frequency: at least 60 dB or [43 +10 log P(W)} dB, whichever is the lesser attenuation.

6.1 Test Procedure

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

The EUT was set up to transmit wideband data signal, which is generated internally by EUT.

The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the frequency band plus/minus 50 kHz and plus/minus 100 kHz from the carrier frequency. The same plots have been done for SAT, ST.

6.2 Test Equipment

HP 8566B Spectrum Analyzer
Leader LFG-1300S Function Generator
Leader LMV-182 AC Millivoltmeter
Marconi 2955A Radio Communication Test Set
HP 7470A Plotter

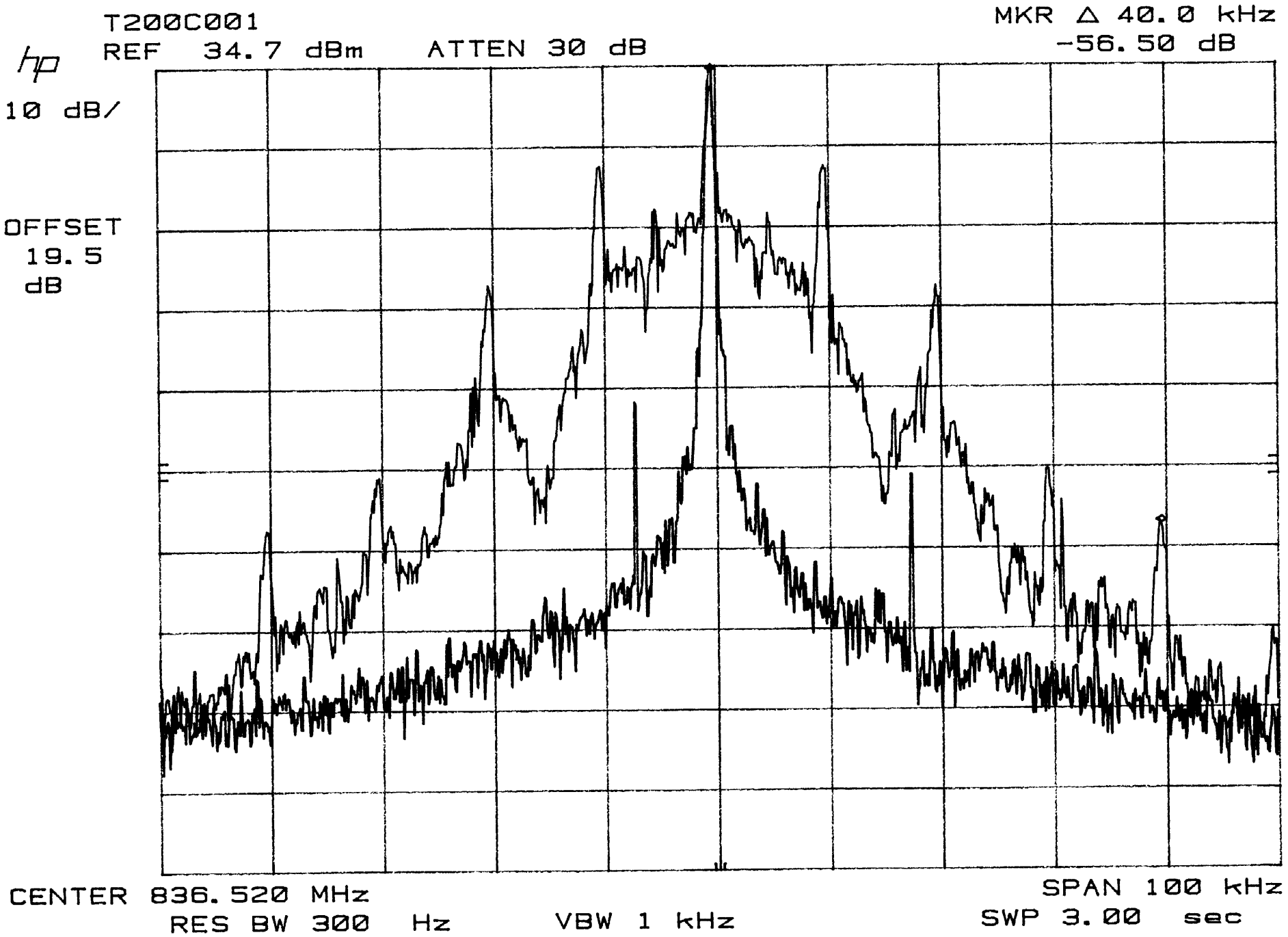
6.3 Test Results

Test Results	**Passes.** Refer to the attached plots.

Plot Number	Description
6.3.a	Wideband data modulation, 100 kHz Span
6.3.b	Wideband data modulation, 200 kHz Span
6.3.c	Signalling Tone modulation, 50 kHz Span
6.3.d	Signaling Tone modulation, 100 kHz Span
6.3.e	Signaling Tone modulation, 200 kHz Span
6.3.f	Supervisory Audio Tone modulation, 100 kHz Span 1
6.3.g	Supervisory Audio Tone modulation, 100 kHz Span 2

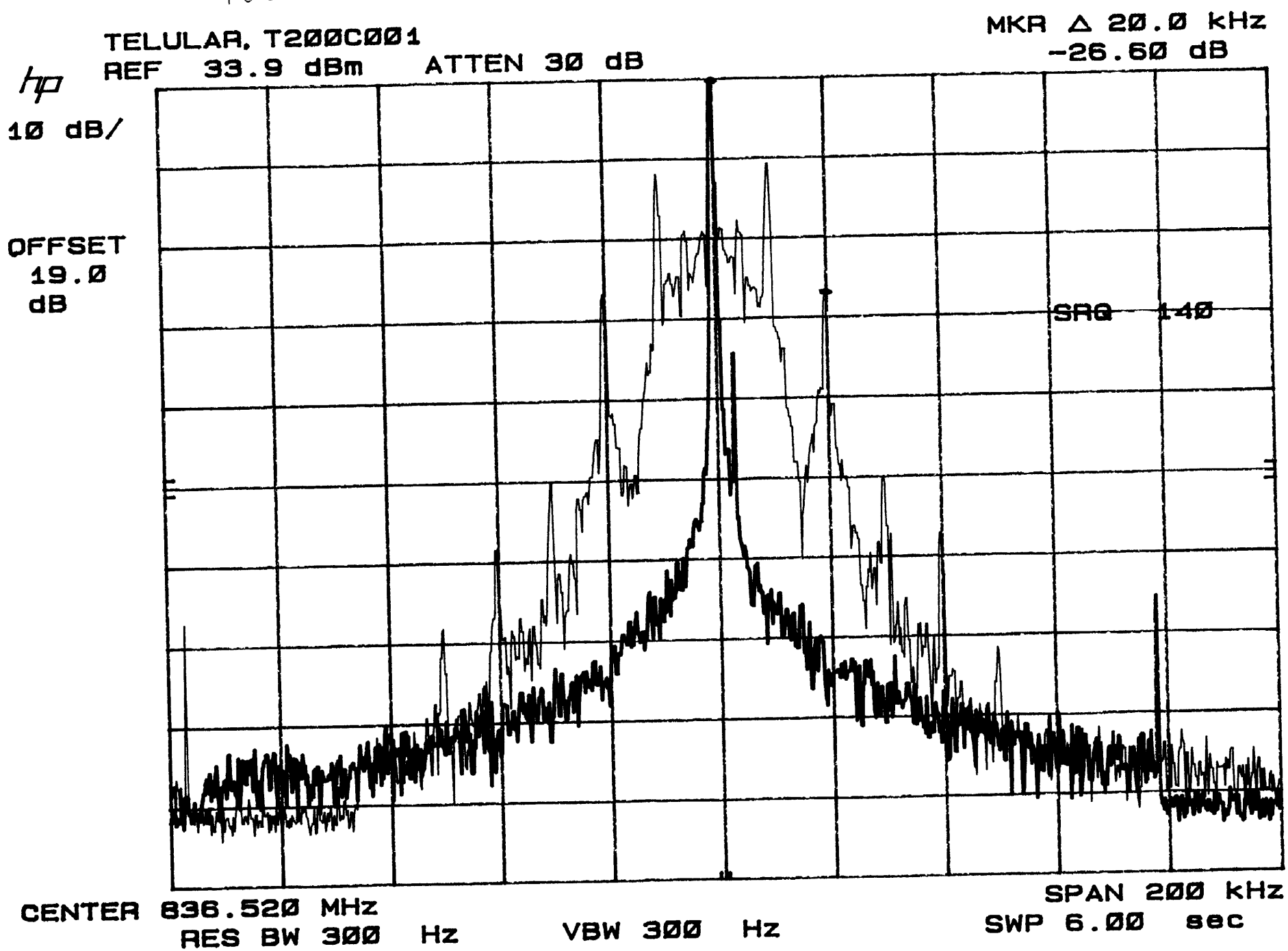
Plot 6.3.a

Wide Band Modulation

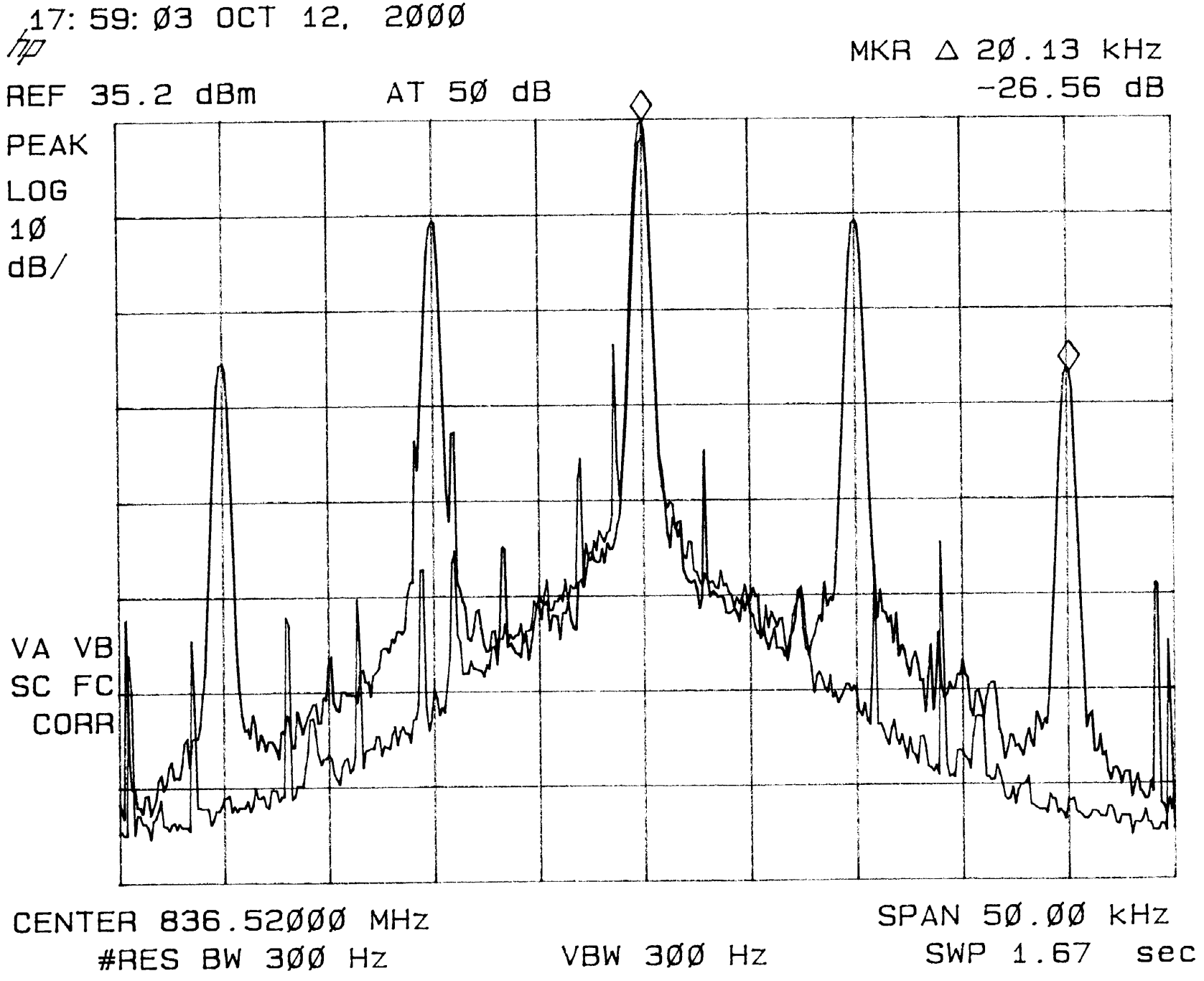


Plot 6.3.b

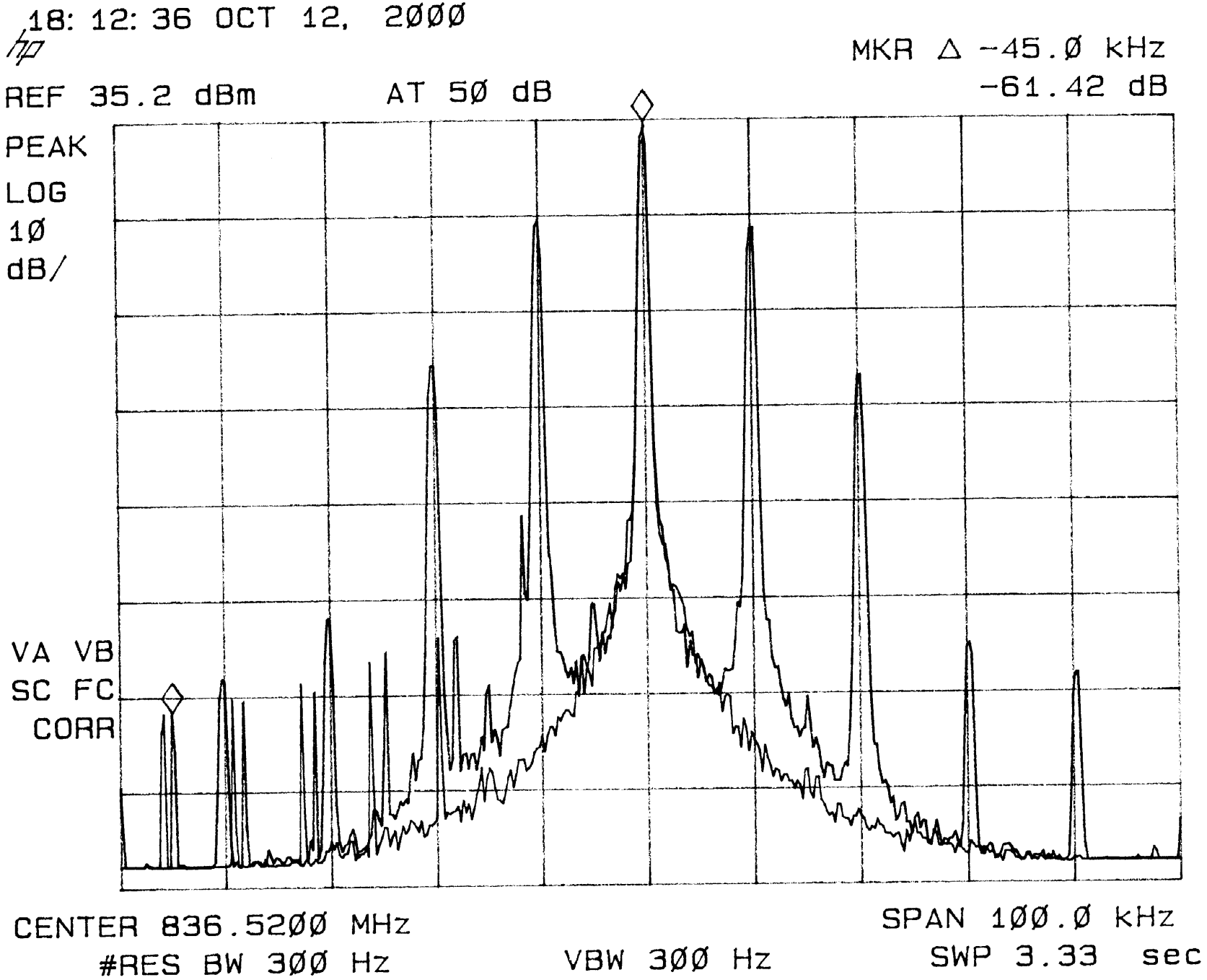
wide Data Modulation



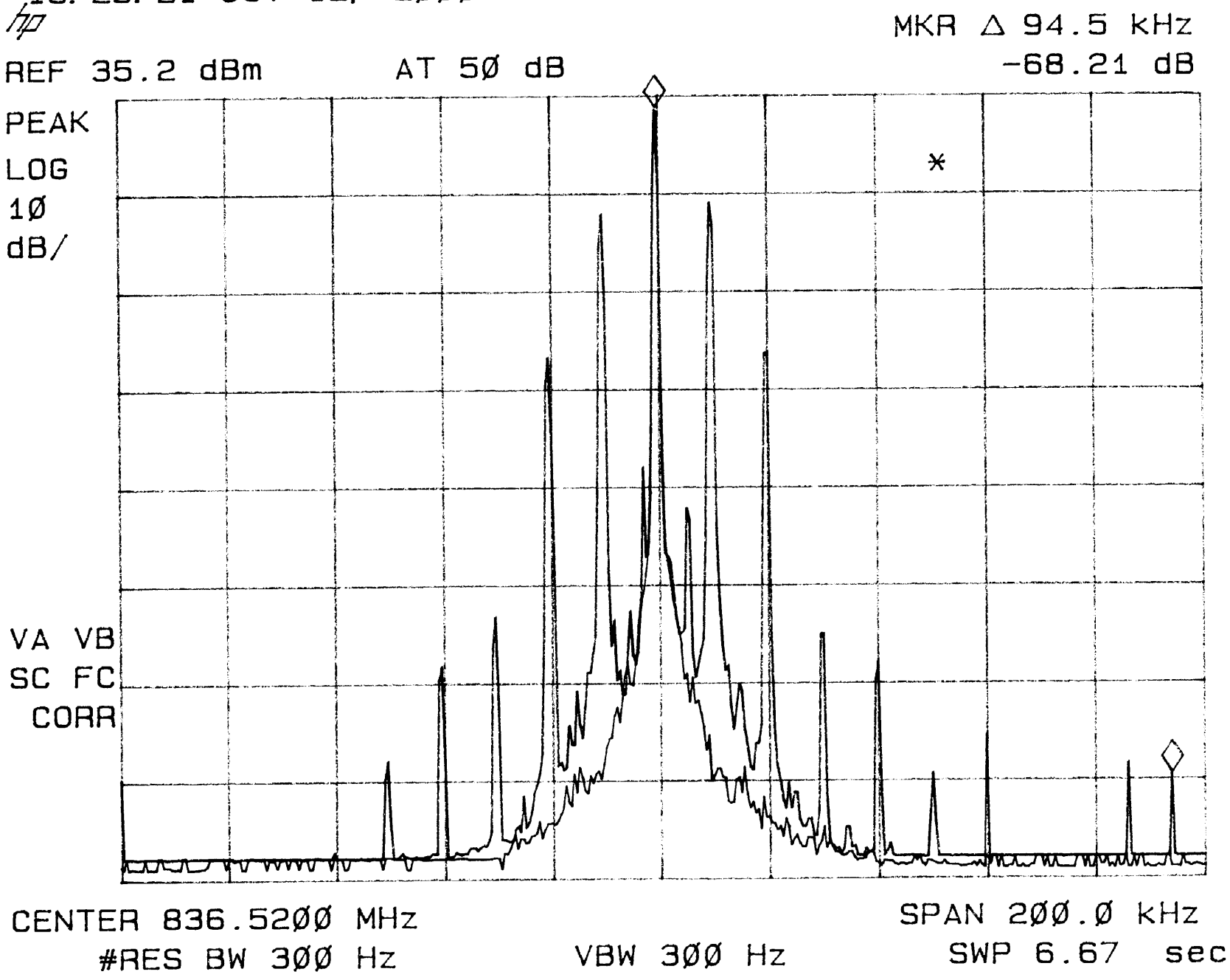
Plot 6.3.c


17: 59: Ø3 OCT 12, 2ØØØ
hp
MKR Δ 2Ø.13 kHz
-26.56 dB
REF 35.2 dBm
AT 5Ø dB
PEAK
LOG
1Ø
dB/
VA VB
SC FC
CORR
CENTER 836.52ØØØ MHz
#RES BW 3ØØ Hz
VBW 3ØØ Hz
SPAN 5Ø.ØØ kHz
SWP 1.67 sec

Plot 6.3d

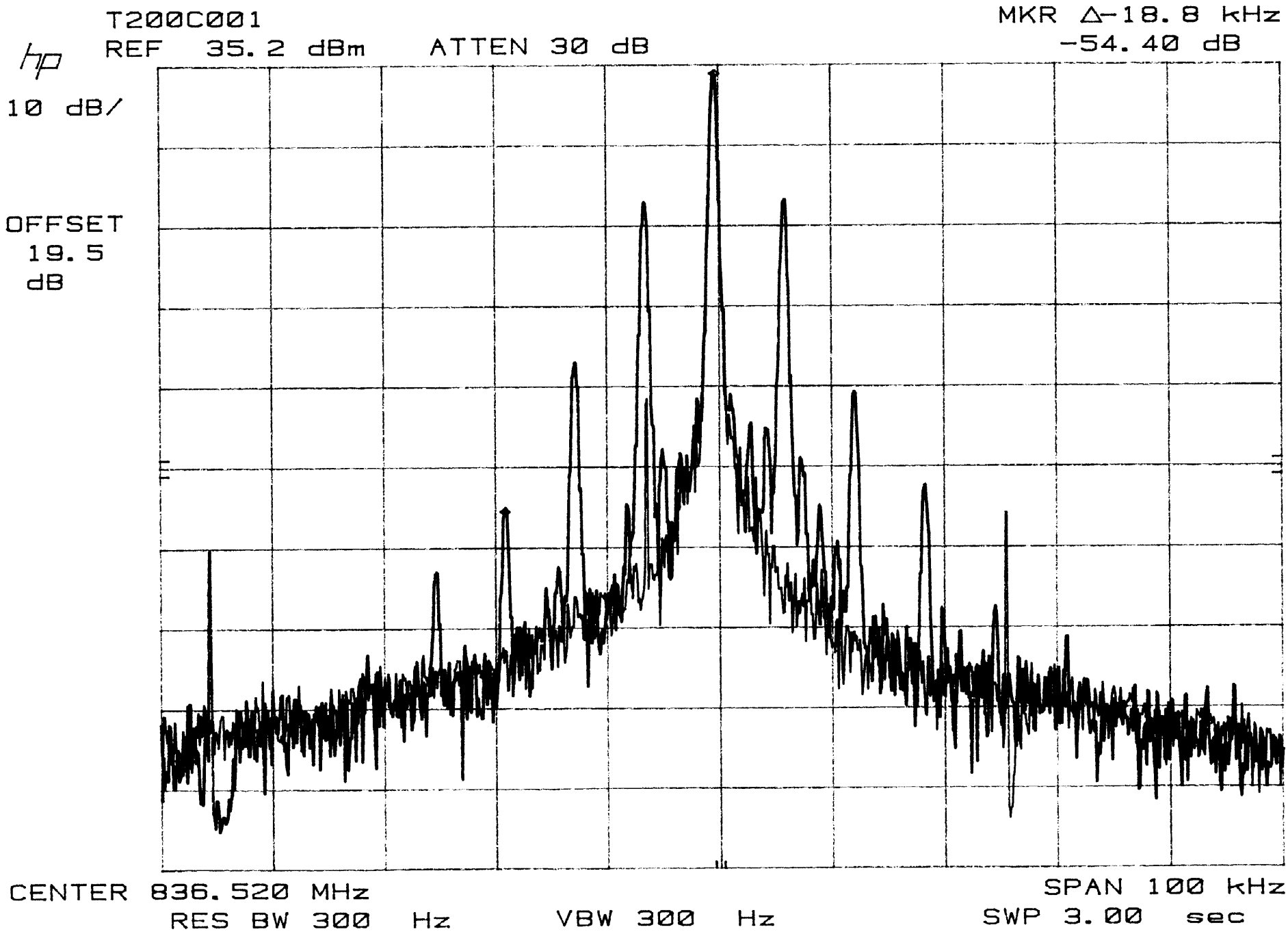

18: 12: 36 OCT 12, 2000
MKR Δ -45.0 kHz
-61.42 dB
REF 35.2 dBm
AT 50 dB
PEAK
LOG
10
dB/
VA VB
SC FC
CORR
CENTER 836.5200 MHz
#RES BW 300 Hz
VBW 300 Hz
SPAN 100.0 kHz
SWP 3.33 sec

Plot 6.3e


18: 29: 21 OCT 12, 2000
hp
MKR Δ 94.5 kHz
REF 35.2 dBm
AT 50 dB
-68.21 dB
PEAK
LOG
10
dB/
VA VB
SC FC
CORR
CENTER 836.5200 MHz
#RES BW 300 Hz
VBW 300 Hz
SPAN 200.0 kHz
SWP 6.67 sec

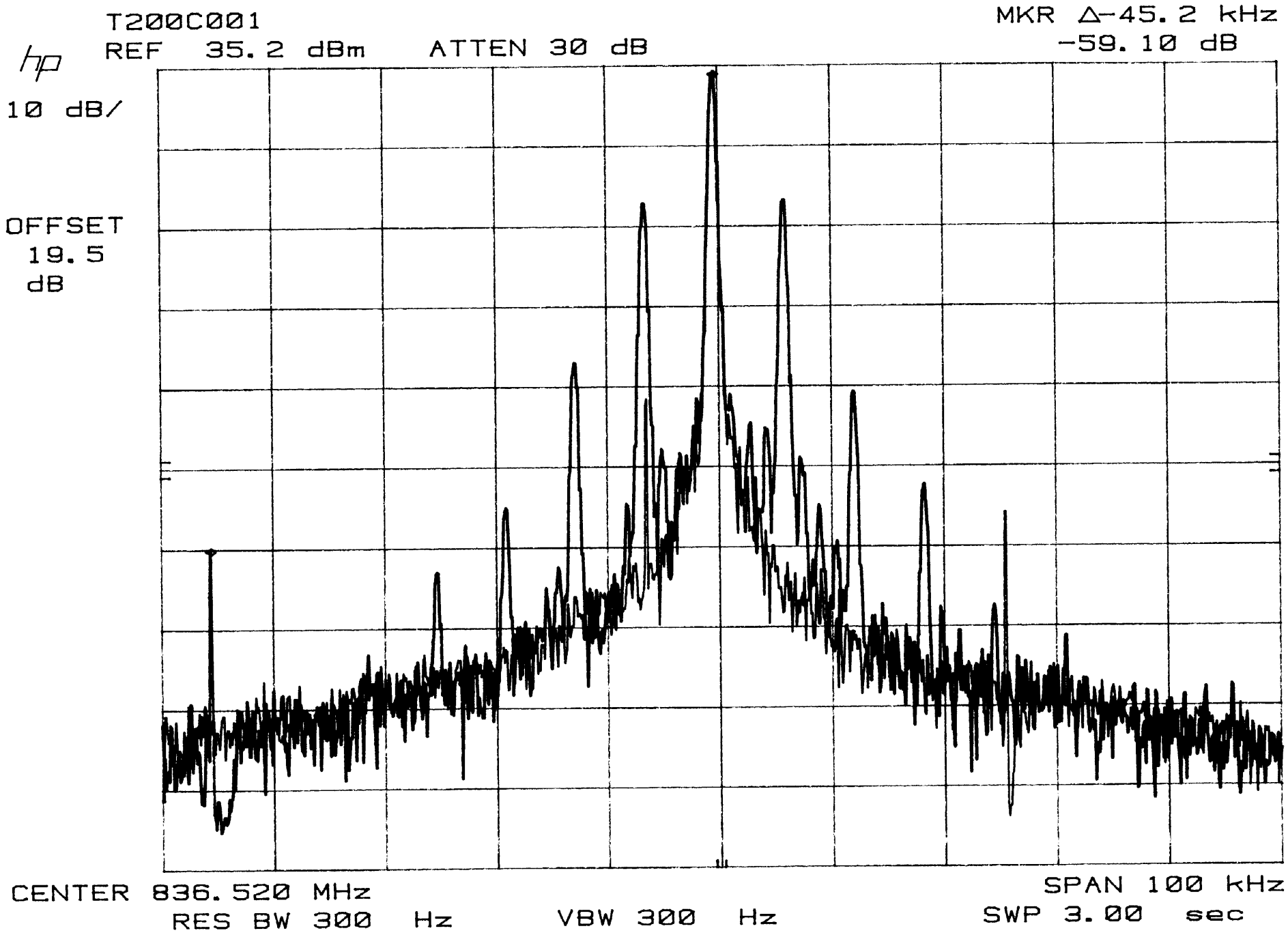
Plot 6.3.f

SAT ①



Plot 6.3.9

SAT ②



7.0 **Out of Band Emissions at Antenna Terminals** , FCC sec. 22.917(e), 22.917(f),

Out of Band Emissions:

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency twice or more than twice the fundamental frequency 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.

7.1 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 30 kHz. The audio modulating signal was adjusted like it is described in Section 6.1 of this report. Sufficient scans were taken to show the out-of-band emissions if any up to 10th harmonic.

7.2 Test Equipment

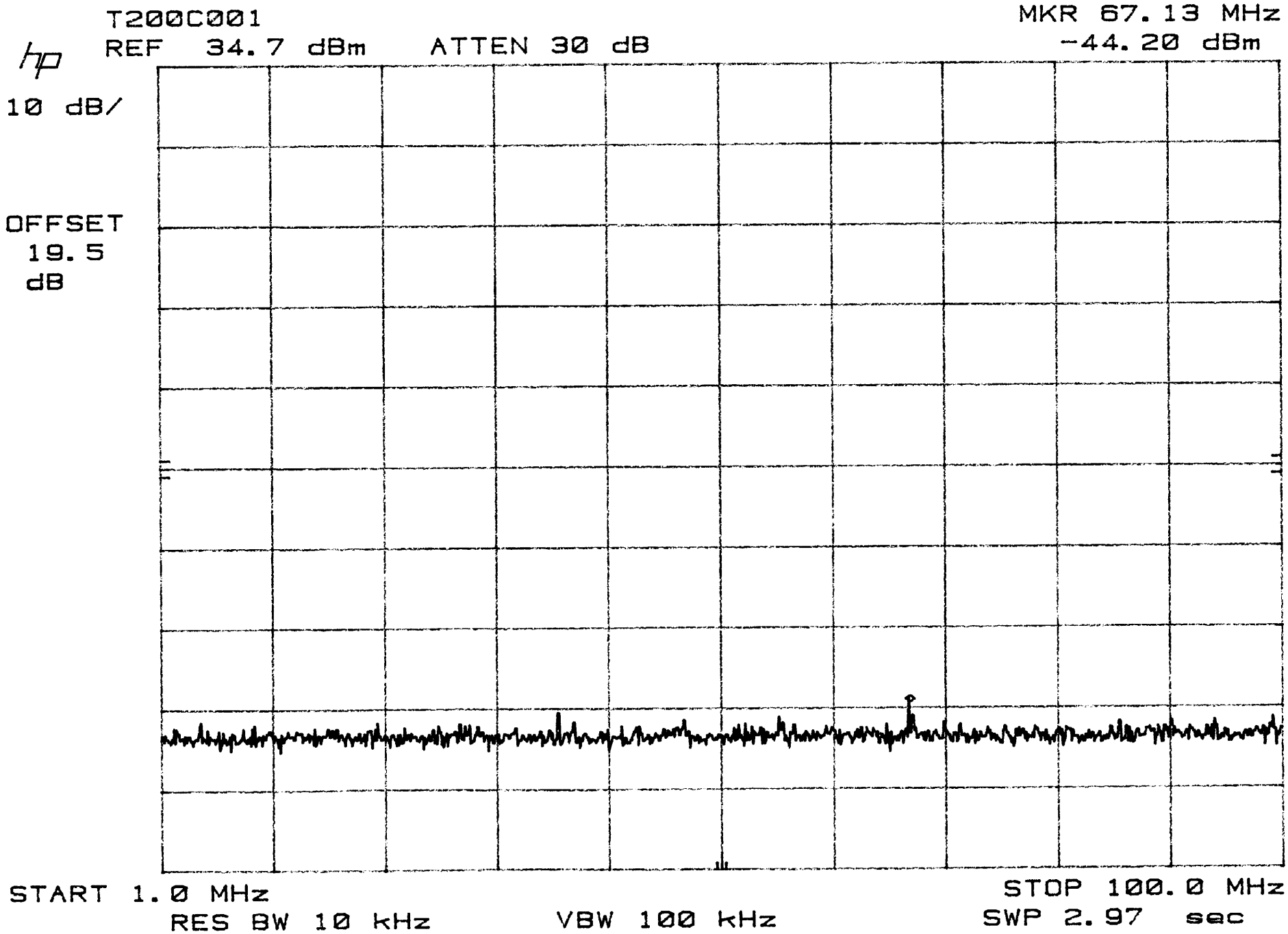
HP 8566B Spectrum Analyzer
Attenuators

7.3 Test Results

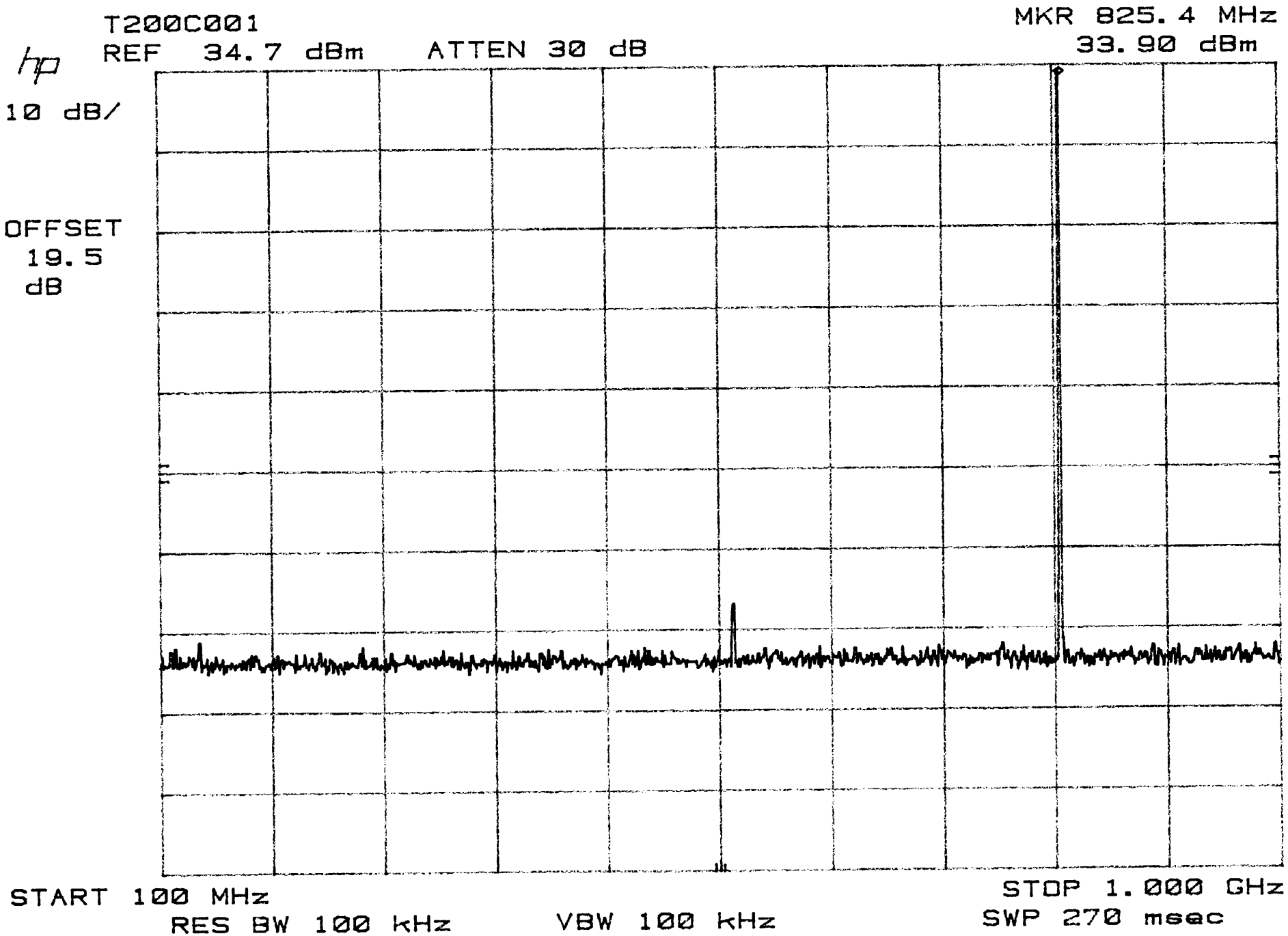
Test Results	**Pass.** Refer to the attached plots.

Plot Number	Description
7.3.1.a - 7.3.1.d	Low Channel
7.3.2.a - 7.3.2.d	Middle Channel
7.3.3.a - 7.3.3.d	High Channel
7.3.4.a	Low Channel, emission in receiving band
7.3.4.b	Middle Channel, emission in receiving band
7.3.4.c	High Channel, emission in receiving band

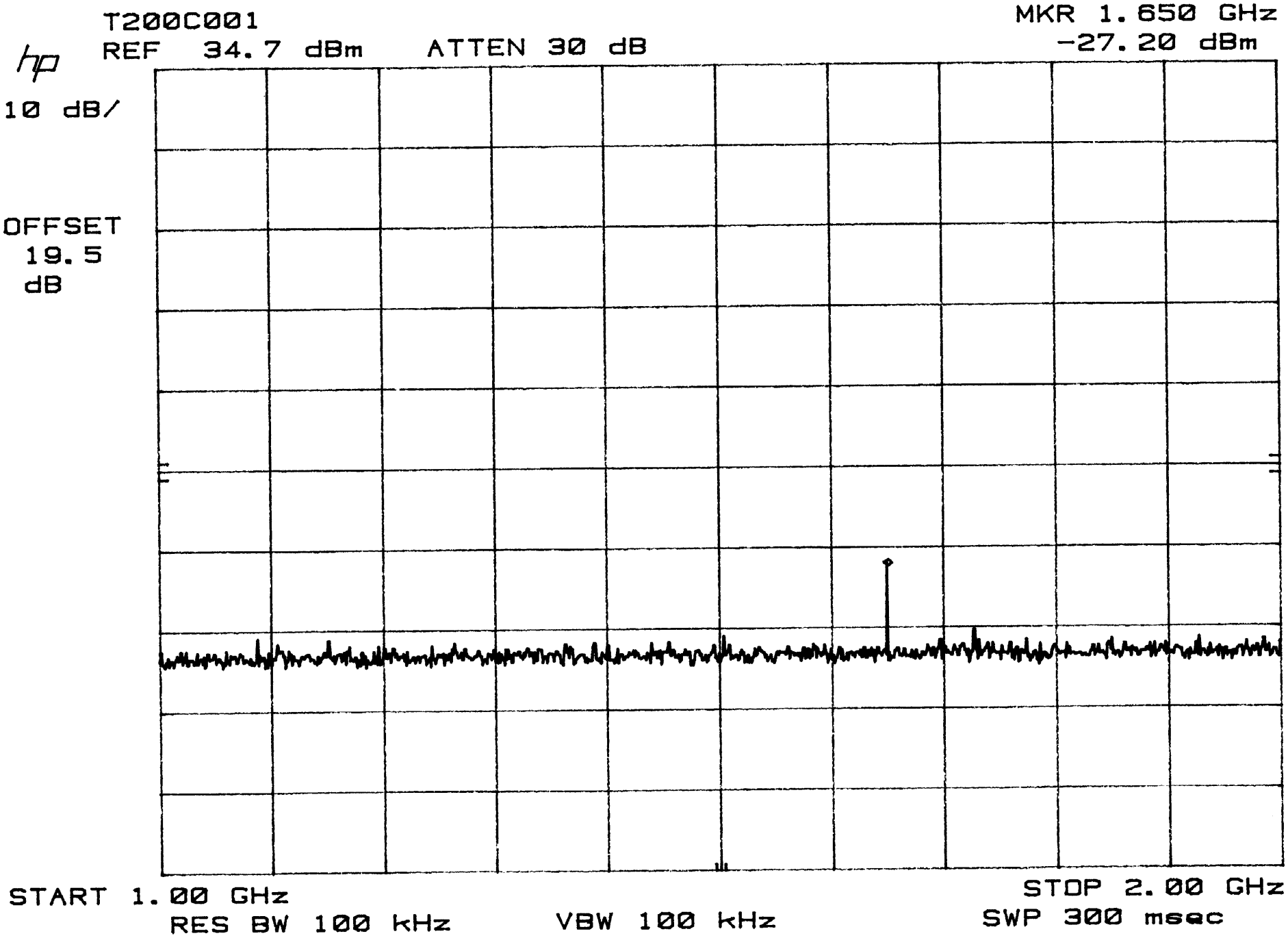
7.3.1.a


T200C001
MKR 67.13 MHz
REF 34.7 dBm
ATTEN 30 dB
-44.20 dBm
10 dB/
OFFSET
19.5
dB
START 1.0 MHz
STOP 100.0 MHz
RES BW 10 kHz
VBW 100 kHz
SWP 2.97 sec

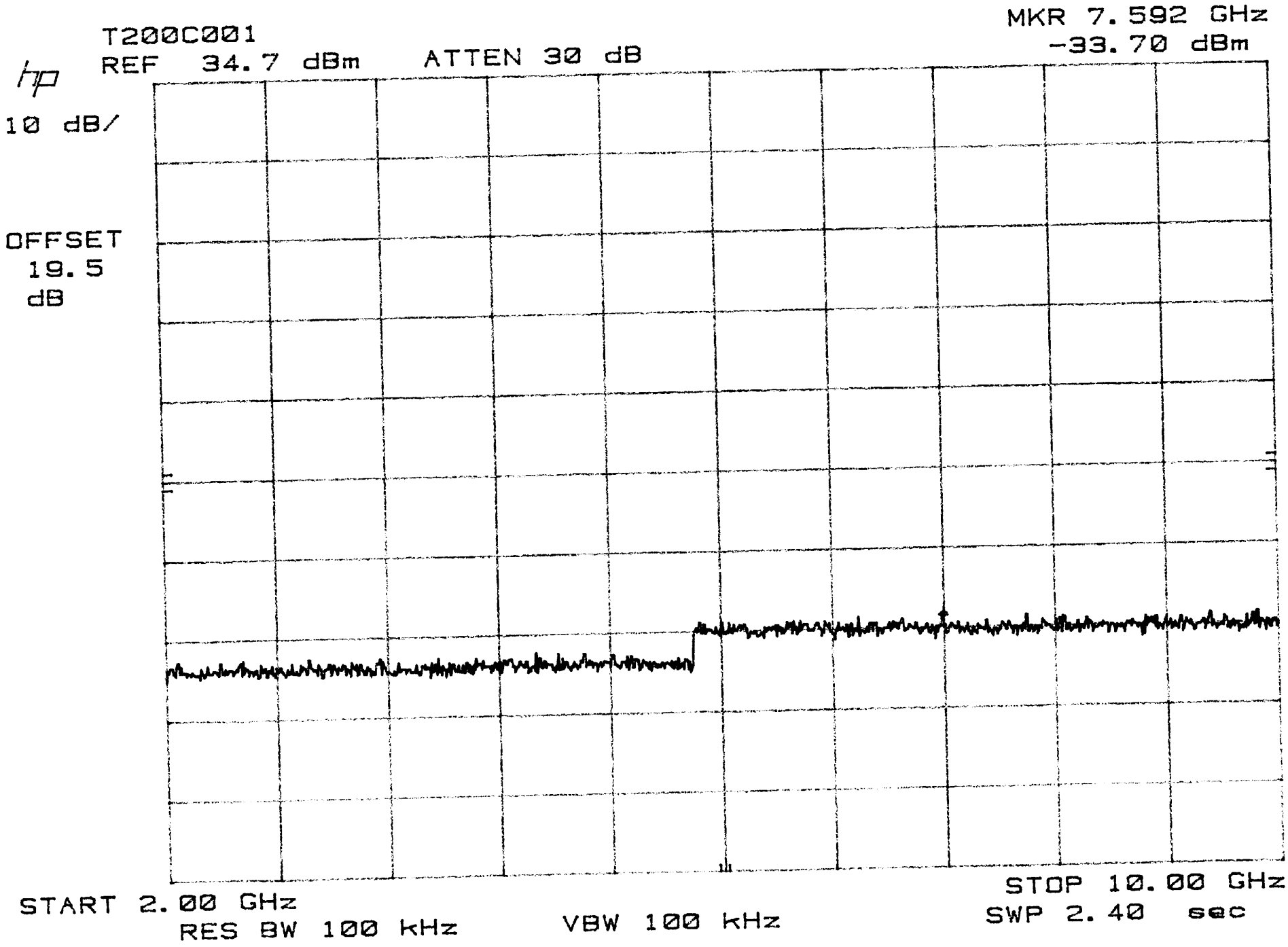
7.3.1.b


T200C001
MKR 825.4 MHz
REF 34.7 dBm
ATTEN 30 dB
33.90 dBm
10 dB/
OFFSET
19.5
dB
START 100 MHz
STOP 1.000 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 270 msec

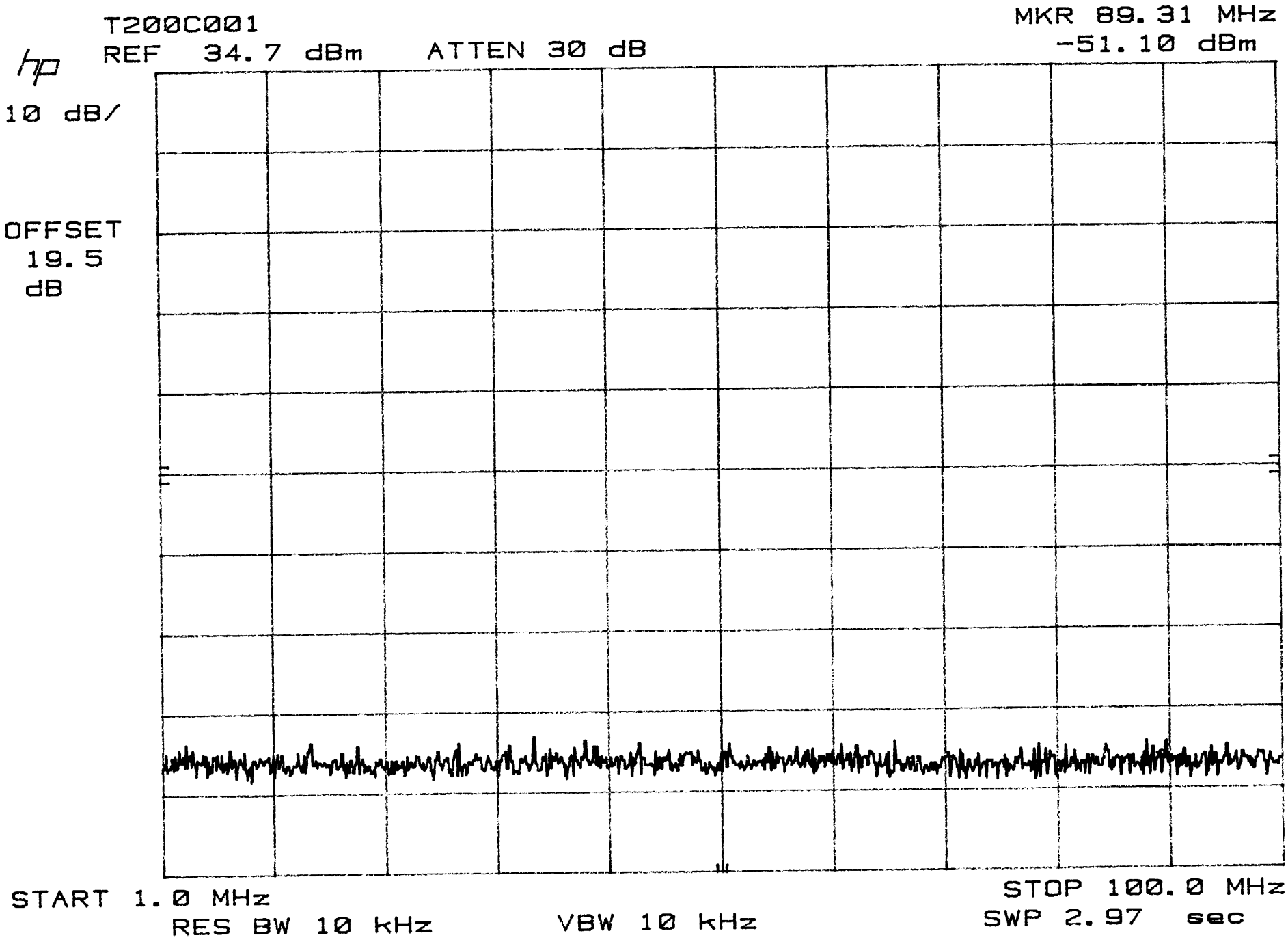
7.3.1.C


T200C001
REF 34.7 dBm
ATTEN 30 dB
MKR 1.650 GHz
-27.20 dBm
10 dB/
OFFSET
19.5
dB
START 1.00 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 2.00 GHz
SWP 300 msec

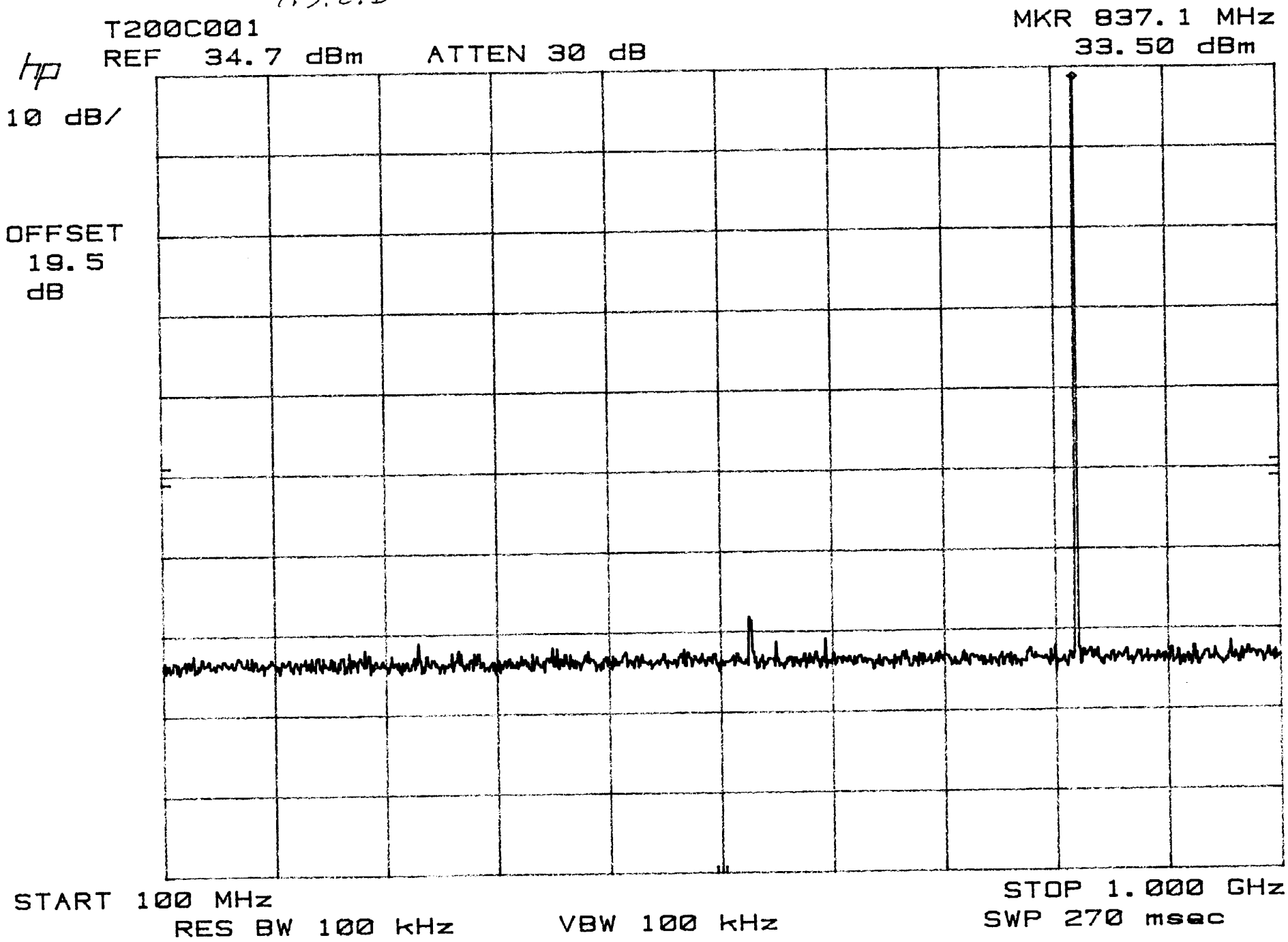
7.3.1.d


T200C001
REF 34.7 dBm
ATTEN 30 dB
MKR 7.592 GHz
-33.70 dBm
10 dB/
OFFSET
19.5
dB
START 2.00 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 10.00 GHz
SWP 2.40 sec

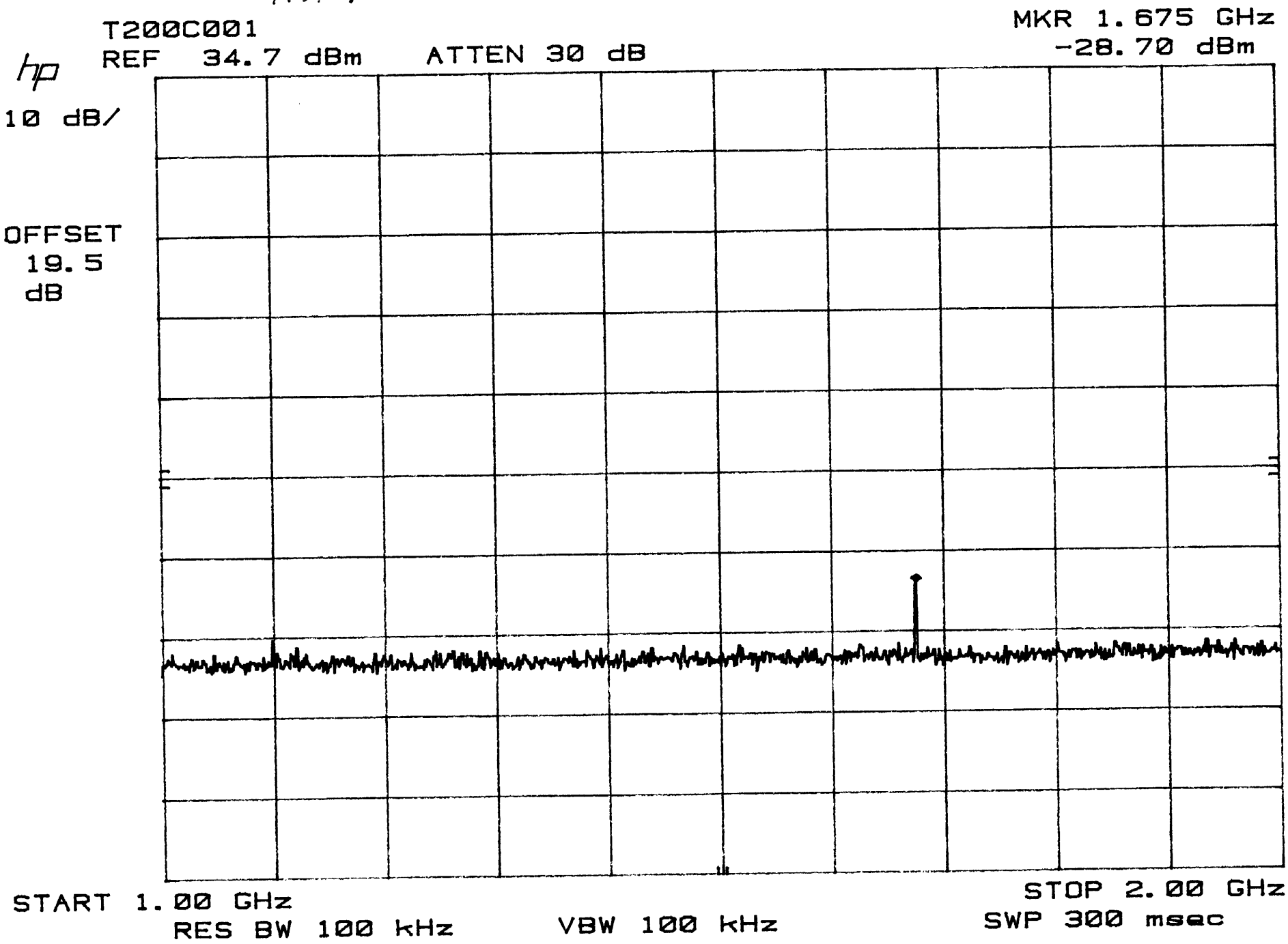
7.3.2.9


T200C001
MKR 89.31 MHz
REF 34.7 dBm
ATTEN 30 dB
-51.10 dBm
10 dB/
OFFSET
19.5
dB
START 1.0 MHz
STOP 100.0 MHz
RES BW 10 kHz
VBW 10 kHz
SWP 2.97 sec

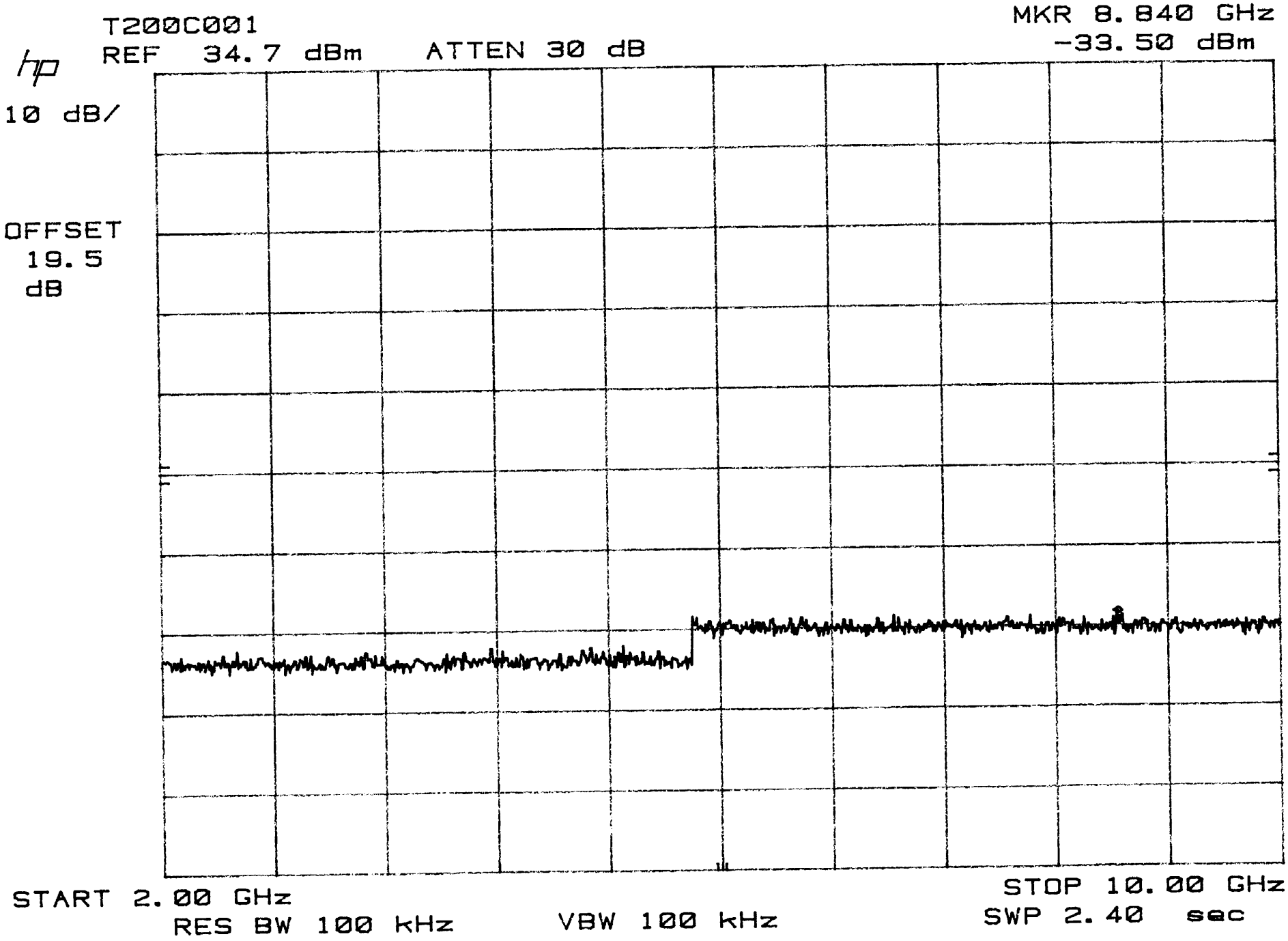
7.3.2.b


T200C001
MKR 837.1 MHz
REF 34.7 dBm
ATTEN 30 dB
33.50 dBm
10 dB/
OFFSET
19.5
dB
START 100 MHz
STOP 1.000 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 270 msec

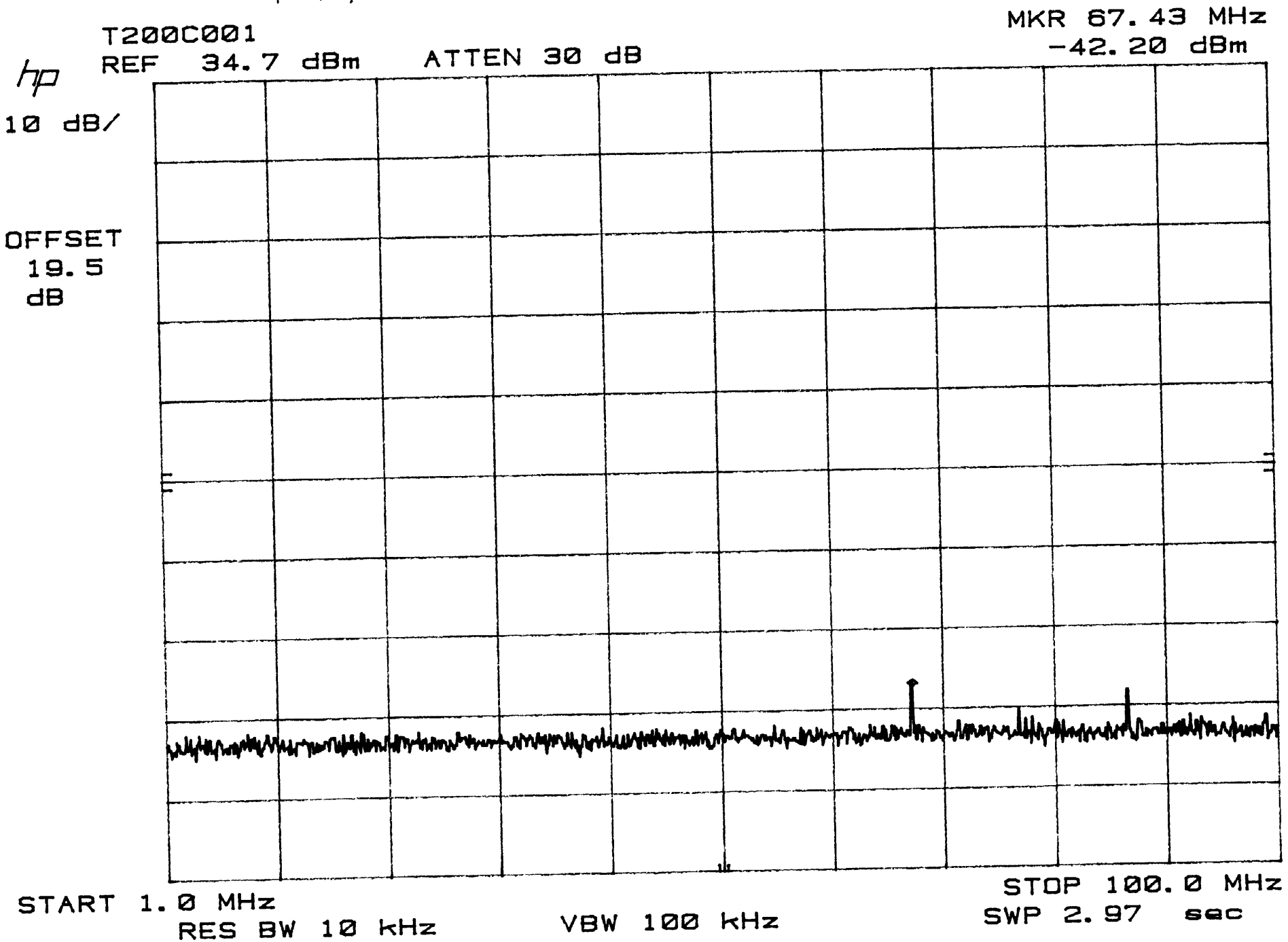
7.3.2.C


T200C001
REF 34.7 dBm
ATTEN 30 dB
MKR 1.675 GHz
-28.70 dBm
10 dB/
OFFSET
19.5
dB
START 1.00 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 2.00 GHz
SWP 300 msec

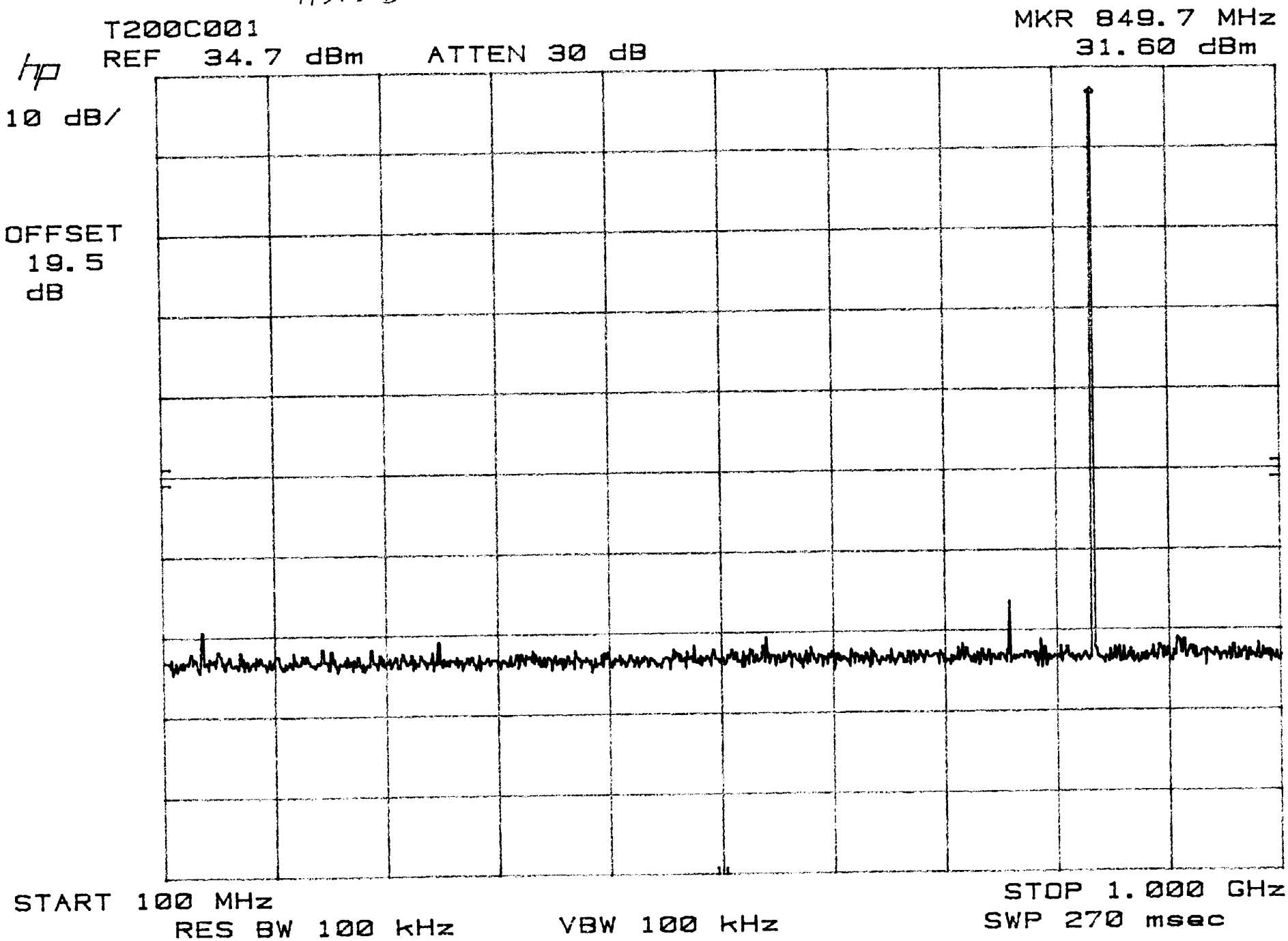
7.3.2.d


T200C001
MKR 8.840 GHz
REF 34.7 dBm
ATTEN 30 dB
-33.50 dBm
hp
10 dB/
OFFSET
19.5
dB
START 2.00 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 10.00 GHz
SWP 2.40 sec

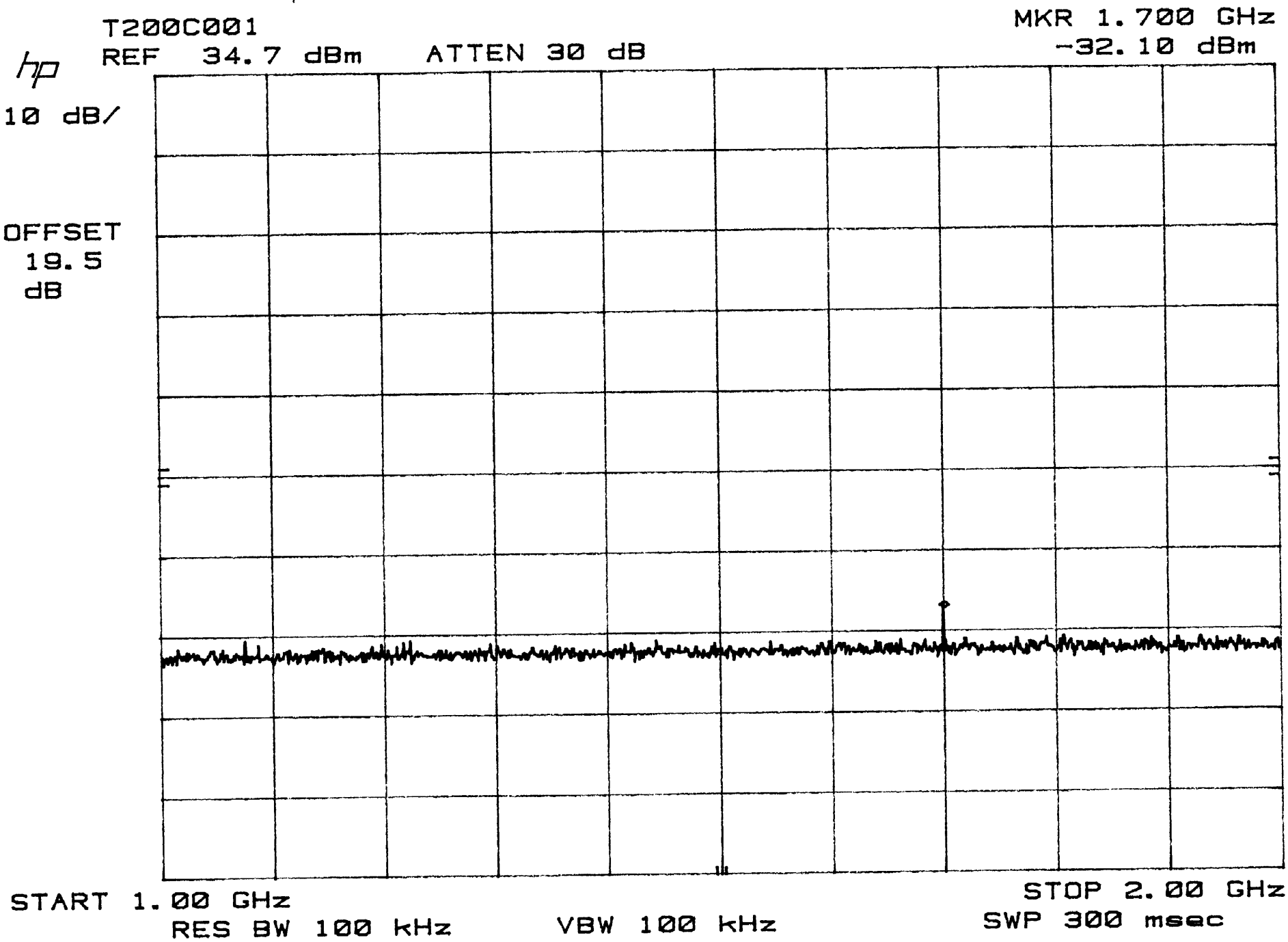
7.3.3.a


T200C001
REF 34.7 dBm
ATTEN 30 dB
MKR 67.43 MHz
-42.20 dBm
10 dB/
OFFSET
19.5
dB
START 1.0 MHz
RES BW 10 kHz
VBW 100 kHz
STOP 100.0 MHz
SWP 2.97 sec

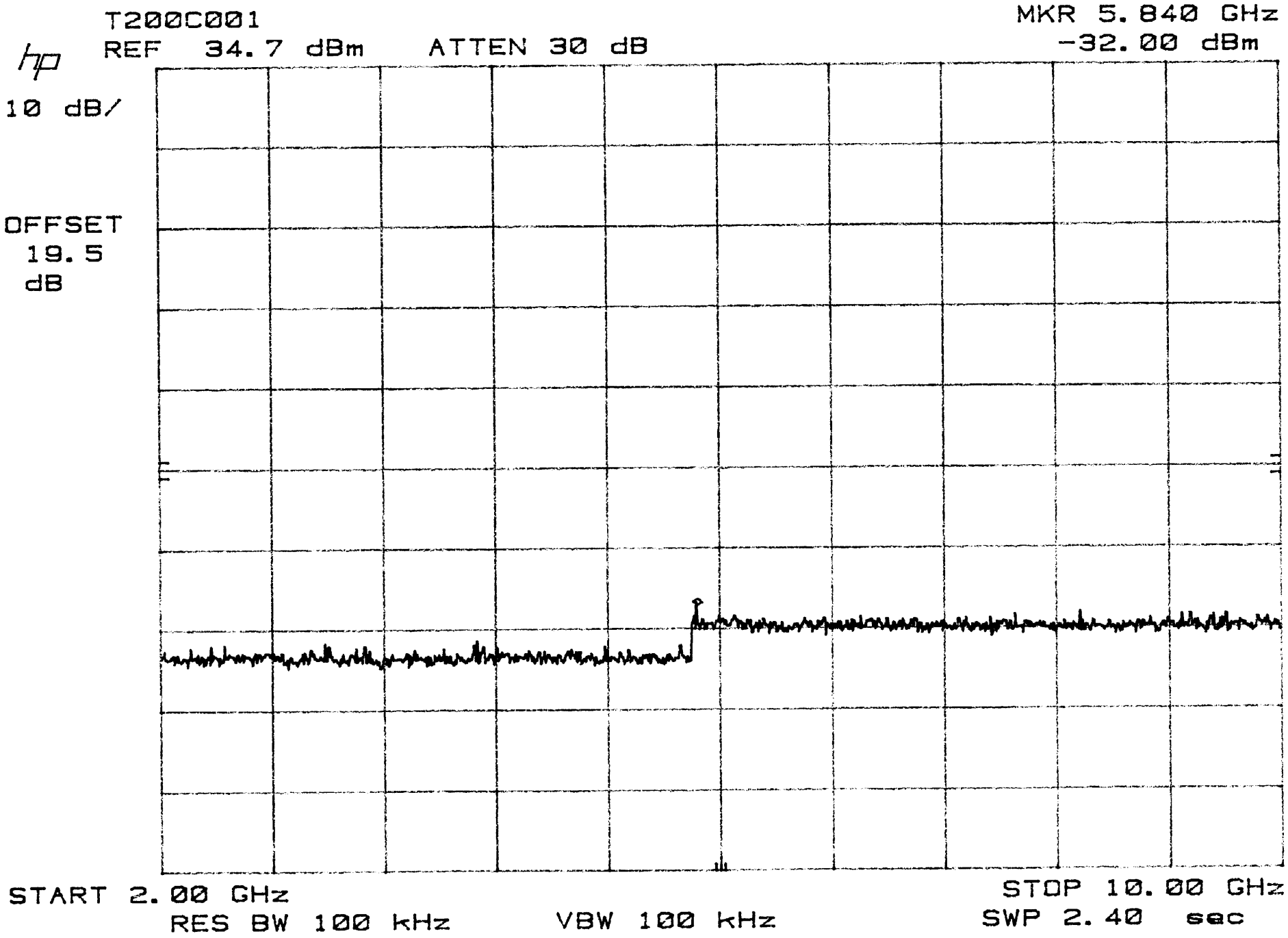
7.3.3.b


T200C001
MKR 849.7 MHz
31.60 dBm
hp
REF 34.7 dBm
ATTEN 30 dB
10 dB/
OFFSET
19.5
dB
START 100 MHz
RES BW 100 kHz
VBW 100 kHz
STOP 1.000 GHz
SWP 270 msec

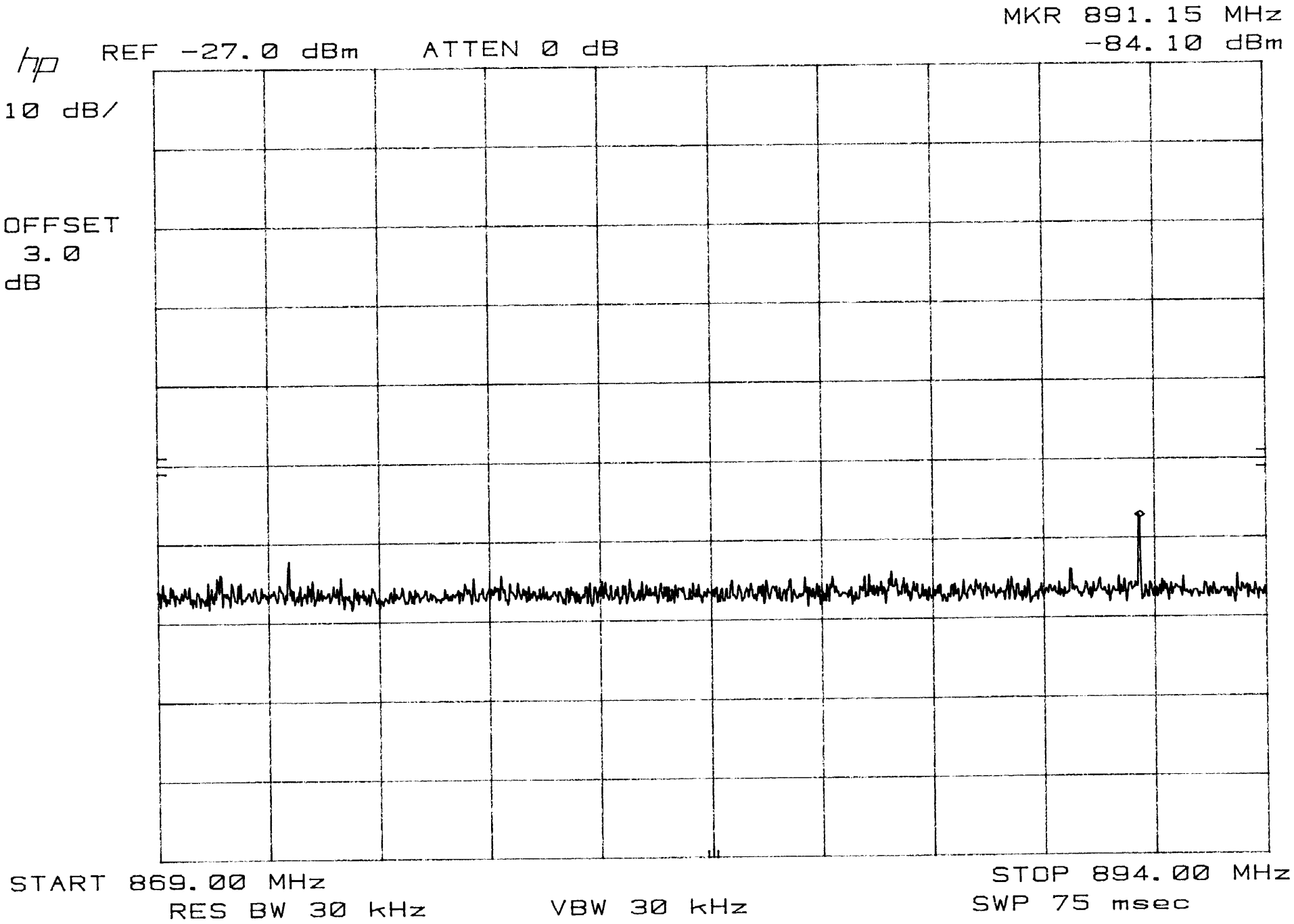
7.3.3.C


T200C001
REF 34.7 dBm
ATTEN 30 dB
MKR 1.700 GHz
-32.10 dBm
10 dB/
OFFSET
19.5
dB
START 1.00 GHz
RES BW 100 kHz
VBW 100 kHz
STOP 2.00 GHz
SWP 300 msec

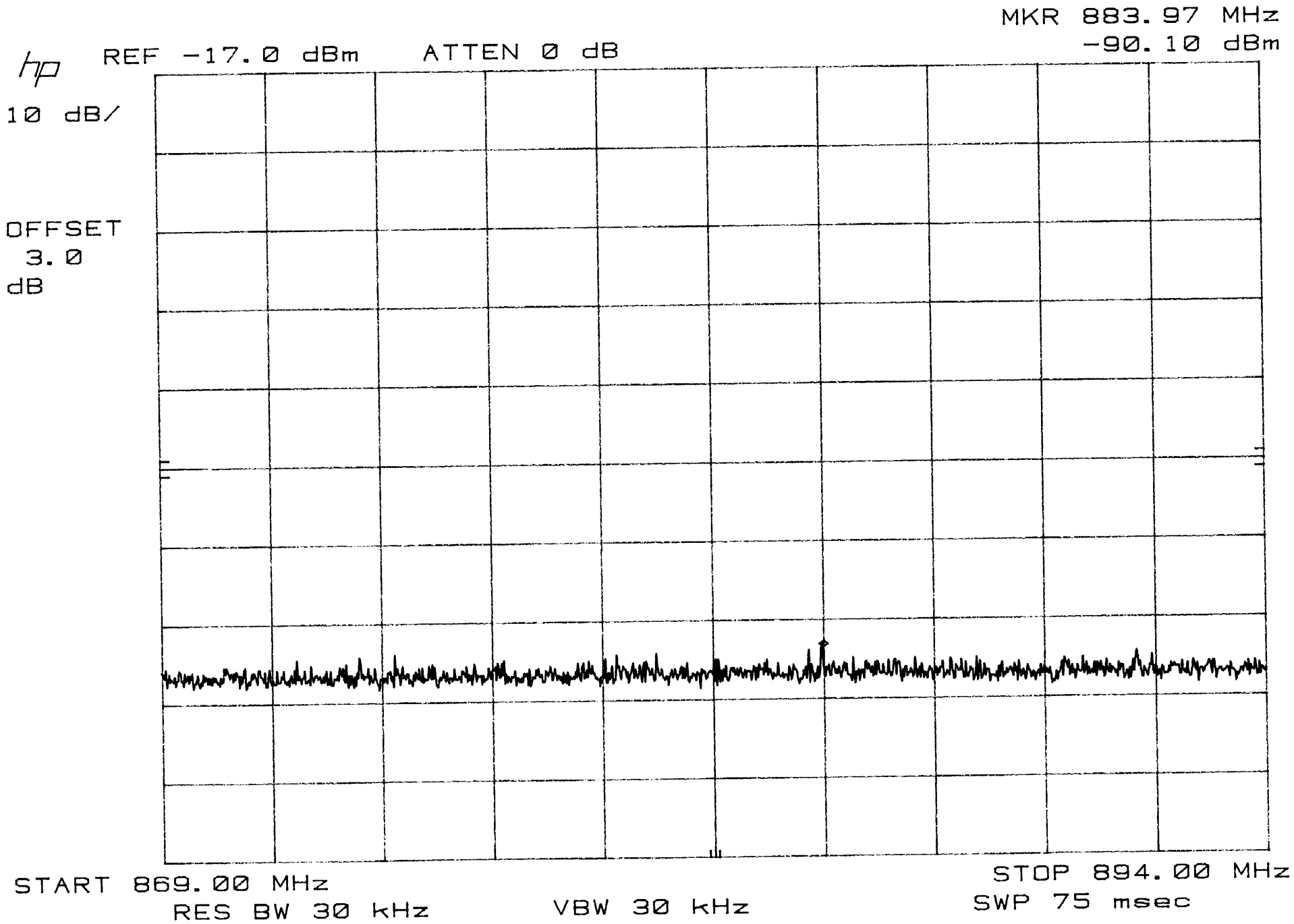
7.3.3.d


T200C001
MKR 5.840 GHz
REF 34.7 dBm
ATTEN 30 dB
-32.00 dBm
hp
10 dB/
OFFSET
19.5
dB
START 2.00 GHz
STOP 10.00 GHz
RES BW 100 kHz
VBW 100 kHz
SWP 2.40 sec

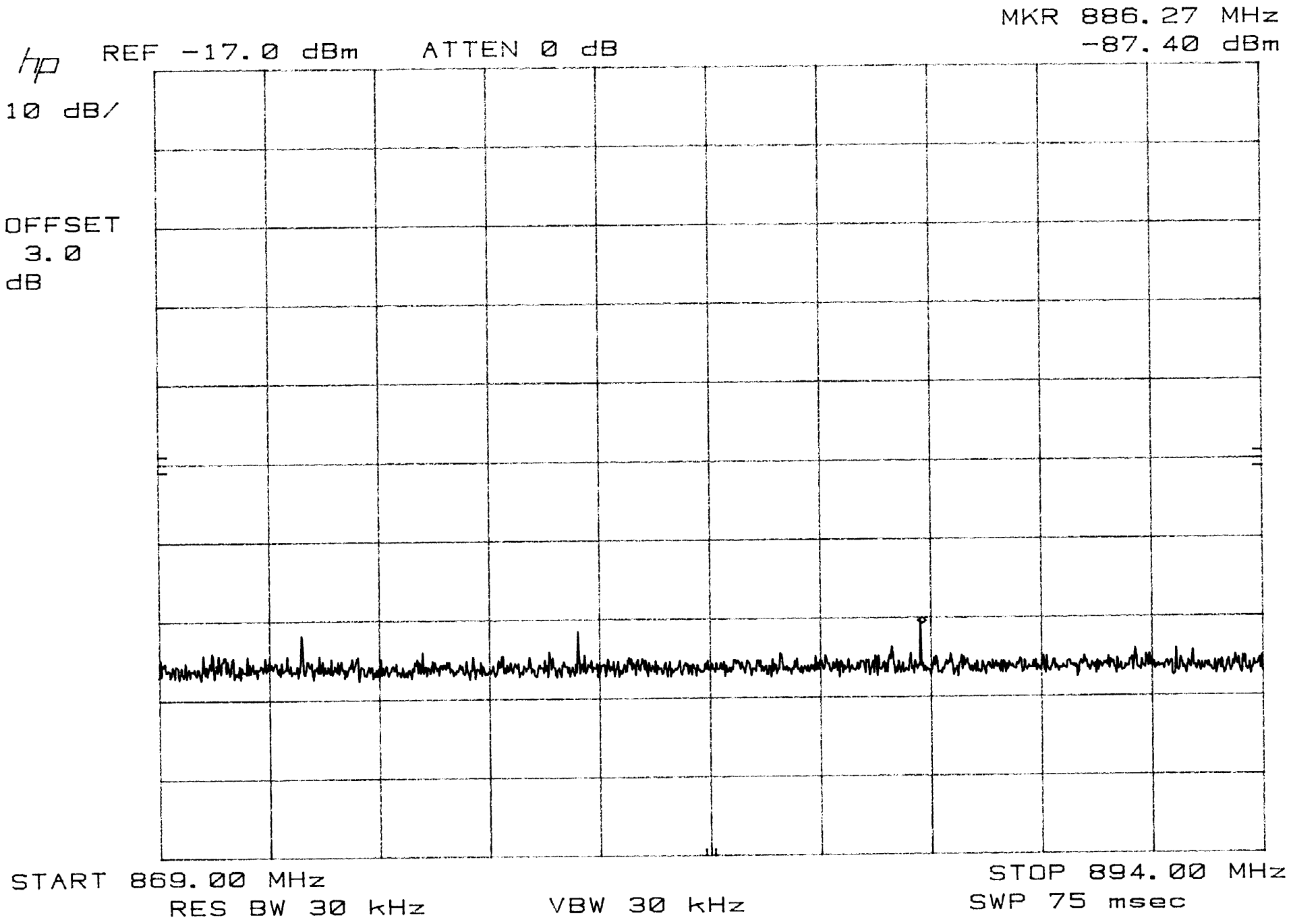
7.3.4.a


MKR 891.15 MHz
-84.10 dBm
hp
REF -27.0 dBm
ATTEN 0 dB
10 dB/
OFFSET
3.0
dB
START 869.00 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 894.00 MHz
SWP 75 msec

7.3.4.b


MKR 883.97 MHz
-90.10 dBm
REF -17.0 dBm
ATTEN 0 dB
10 dB/
OFFSET
3.0
dB
START 869.00 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 894.00 MHz
SWP 75 msec

7.3.4.C


MKR 886.27 MHz
-87.40 dBm
REF -17.0 dBm
ATTEN 0 dB
10 dB/
OFFSET
3.0
dB
START 869.00 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 894.00 MHz
SWP 75 msec

8.0 **Field Strength of Spurious Radiation**, FCC sec. 2.1053

8.1 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 frequency range up to tenth harmonic of each of the three fundamental frequency (low, middle, and high channels) was investigated.

The spurious emissions attenuation was calculated as the difference between Field strength in dBuV/m at the fundamental frequency and at the spurious emissions frequency.

The Field strength at the fundamental frequency was calculated as following.

$E = \sqrt{(30 \times EIRP)} / D$
EIRP (in dBm) equal P + G – cl

At 824.0 MHz EIRP=35.6 +1=36.6 dBm or 4.57 W
At 836.5 MHz EIRP=35.3 +3–2=36.3 dBm or 4.27 W
At 848.9 MHz EIRP=33.2 +5–2=36.2 dBm or 4.17 W

At 824.0 MHz E= 3.9 V/m or 131.8 dBuV/m
At 836.5 MHz E= 3.8 V/m or 131.6 dBuV/m
At 848.9 MHz E= 3.7 V/m or 131.4 dBuV/m

8.2 Test Equipment

EMCO 3115 Horn Antenna
HP 8566B Spectrum Analyzer
High Pass Filter
Preamplifier

8.3 Test Results

Test Result:	**Pass**. Refer to the attached data sheets

Data Sheet Number	Description
8.3.a	Low Channel
8.3.b	Middle Channel
8.3.c	High Channel
8.3.d	Radiated Emissions 15.109
8.3.e	Plot of Local Oscillator conducted Emissions
8.3.f	Local Oscillator Radiated Emissions

Radiated Emissions Test Data

Company:	Telular	**Model #:**	T200C001		**Req.**	FCC 2.993	
EUT:	Telgurad	**FCC #:** MTF0900			**Test Dist.**	3	meters
Project #:	J20016073	**Test Date:**	Aug 29, 2000		**TP**	3.00	Watt
Test Mode:	Low Channel with Dipole Antenna	**Engineer:**	Suresh		**Min. Attn**	47.77	dBc

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	8	18	12	0	3	13	21	0	0	0
Model:	EMCO 3115	0	EMCO 3104	None	MC 15642	ACO/400	Gm_M+L	None	None	None

Frequency	Reading	Detector	Ant. #	Amp. #	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	Net	ERP	Attn.	Margin
MHz	dB(µV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(µV/m)	mW	dBc	dB
824.00	-	-	-	-	-	-	-	-	131.9	2.83E+03	-	-
1648.00	40.2	Peak	8	0	V	26.7	0.0	3.0	69.9	1.79E-03	62.0	-14.2
2472.00	36.1	Peak	8	0	V	29.1	0.0	2.3	67.5	1.03E-03	64.4	-16.6
3296.00	37.5	Peak	8	0	V	31.3	0.0	2.5	71.3	2.47E-03	60.6	-12.8
4120.00	27.7	Peak	8	0	V	34.5	0.0	2.9	65.1	5.92E-04	66.8	-19.0
3345.80	27.7	Peak	8	0	V	31.3	0.0	2.5	61.5	2.58E-04	70.4	-22.6
4944.00	32.5	Peak	8	0	V	34.0	0.0	3.2	69.7	1.71E-03	62.2	-14.4
5768.00	18.8	Peak	8	0	V	36.6	0.0	3.7	59.1	1.49E-04	72.8	-25.0
6592.00	25.1	Peak	8	0	V	36.4	0.0	4.2	65.7	6.80E-04	66.2	-18.4
7416.00	23.8	Peak	8	0	V	37.0	0.0	4.3	65.1	5.92E-04	66.8	-19.0
8240.00	22.8	Peak	8	0	V	37.5	0.0	4.8	65.1	5.92E-04	66.8	-19.0

Notes:

a) O.C.F.:Other Correction Factor

b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.

c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.

d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).

e) Negative signs (-) in Margin column signify levels below the limits.

8-3.b

Radiated Emissions Test Data

Company :	Telular Corporation	**Model #:**	T200C001		**Req.**	FCC 2.993	
EUT:	Telgurard	**FCC #:** MTF0900			**Test Dist.**	3	meter
Project #:	J20016073	**Test Date:**	Aug29, 2000		**TP**	3.00	Watt
Test Mode:	Mid Channel with Dipole Antenna	**Engineer:**	Suresh		**Min. Attn.**	47.77	dBc

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	18	8	12	0	3	13	21	0	0	0
Model:	0	EMCO 3115	EMCO 3104	None	MC 15542	ACO/400	Gm_M+L	None	None	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	Net	ERP	Attn.	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(μV/m)	mW	dBc	dB
836.47	-	-	-	-	-	-	-	-	131.9	2.83E+03	-	N/A
1673.00	36.6	Peak	8	0	V	26.7	0.0	3.0	66.3	7.80E-04	65.6	-17.8
2509.40	28.4	Peak	8	0	V	30.6	0.0	2.3	61.3	2.47E-04	70.6	-22.8
3345.80	27.7	Peak	8	0	V	31.3	0.0	2.5	61.5	2.58E-04	70.4	-22.6
4182.25	29.1	Peak	8	0	V	34.5	0.0	2.9	66.5	8.17E-04	65.4	-17.6
5018.70	25.8	Peak	8	0	V	35.4	0.0	3.5	64.7	5.40E-04	67.2	-19.4
5855.15	25.5	Peak	8	0	V	36.6	0.0	3.7	65.8	6.95E-04	66.1	-18.3
6691.60	25.2	Peak	8	0	V	36.4	0.0	4.2	65.8	6.95E-04	66.1	-18.3
7528.00	25.4	Peak	8	0	V	37.8	0.0	4.6	67.8	1.10E-03	64.1	-16.3
8364.70	23.9	Peak	8	0	V	37.5	0.0	4.8	66.2	7.63E-04	65.7	-17.9

Notes:

a) O.C.F.:Other Correction Factor

b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.

c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.

d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).

e) Negative signs (-) in Margin column signify levels below the limits.

Radiated Emissions Test Data

Company:	Telular	**Model #:**	T200C001		**Req.**	FCC 2.993	
EUT:	Telguard Celluar Alarm System	**FCC #:**	MTF09000		**Test Dist.**	3	meters
Project #:	J20016073	**Test Date:**	Aug 30,2000		**TP**	3.00	Watt
Test Mode:	High Channel with Dipole Antenna	**Engineer:**	Suresh		**Min Attn**	47.77	dBc

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	8	18	0	0	3	13	21	0	0	0
Model:	EMCO 3115	0	None	None	MC 15642	ACO/400	Gm_M+L	None	None	None

Frequency	Reading	Detector	Ant	Amp	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	Net	ERP	Attn.	Margin
MHz	dB(µV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB(µV/m)	mW	dBc	dB
848.97	106.6	Peak	18	0	V	23.3	0.0	2.0	131.9	2.83E+03	0.0	N/A
1697.94	35.6	Peak	8	0	V	26.7	0.0	3.0	65.3	6.20E-04	66.6	-18.8
2546.90	29.0	Peak	8	0	V	30.6	0.0	2.3	61.9	2.83E-04	70.0	-22.2
3395.88	28.7	Peak	8	0	V	31.3	0.0	2.5	62.5	3.25E-04	69.4	-21.6
4244.80	31.5	Peak	8	0	V	34.5	0.0	2.9	68.9	1.42E-03	63.0	-15.2
5093.80	21.5	Peak	8	0	V	35.4	0.0	3.5	60.4	2.01E-04	71.5	-23.7
5942.80	25.3	Peak	8	0	V	36.6	0.0	3.7	65.6	6.64E-04	66.3	-18.5
6791.76	24.5	Peak	8	0	V	36.4	0.0	4.2	65.1	5.92E-04	66.8	-19.0
7640.93	24.1	Peak	8	0	V	37.8	0.0	4.6	66.5	8.17E-04	65.4	-17.6
8489.70	24.1	Peak	8	0	V	37.5	0.0	4.8	66.4	7.99E-04	65.5	-17.7

Notes:

a) O.C.F.:Other Correction Factor

b) Insert. Loss = Cable A + Cable B + Cable C + Transducer.

c) Net = Reading + Antenna Factor - Pre-Amp + Insert. Loss.

d) Attn. = Field Strength (Fundamental) - Field Strength (Harmonics).

e) Negative signs (-) in Margin column signify levels below the limits.

8.3.d

Radiated Emissions Test Data

Company:	Telular Corporation	**Model #:**	T200C001	**Standard**	**FCC § 15B**
EUT:	Telguard	**FCC ID #:**	MTF09000	**Limits**	2
Project #:	J20016073	**Test Date:**	July 25,2000	**Test Distance**	3 meters
Test Mode:	Normal	**Engineer:**	Suresh	**Duty Relaxation**	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	1	0	0	7	1	0	2	7	13	0
Model:	EMCO 3143	None	None	CPPA_10 2	HP 8447D	None	Site 2 10m	NPS120 -1	NPS256-3	None

Frequency	Reading	Detector	Ant	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
38.55	9.2	Peak	1	0	V	7.7	0.0	1.4	0.0	18.3	40.0	-21.7
42.78	44.6	Peak	1	1	V	8.4	27.4	1.5	0.0	27.1	40.0	-12.9
86.70	44.9	Peak	1	1	V	7.1	27.8	2.6	0.0	26.8	40.0	-13.2
115.35	12.9	Peak	1	0	H	6.8	0.0	3.0	0.0	22.7	43.5	-20.8
163.10	38.2	Peak	1	1	H	9.0	27.4	3.8	0.0	23.6	43.5	-19.9
211.26	17.1	Peak	1	0	H	10.8	0.0	3.8	0.0	31.7	43.5	-11.8
221.50	39.1	Peak	1	1	V	11.4	29.4	3.8	0.0	24.9	46.0	-21.1
240.50	39.5	Peak	1	1	H	11.7	29.6	3.9	0.0	25.5	46.0	-20.5

Notes:

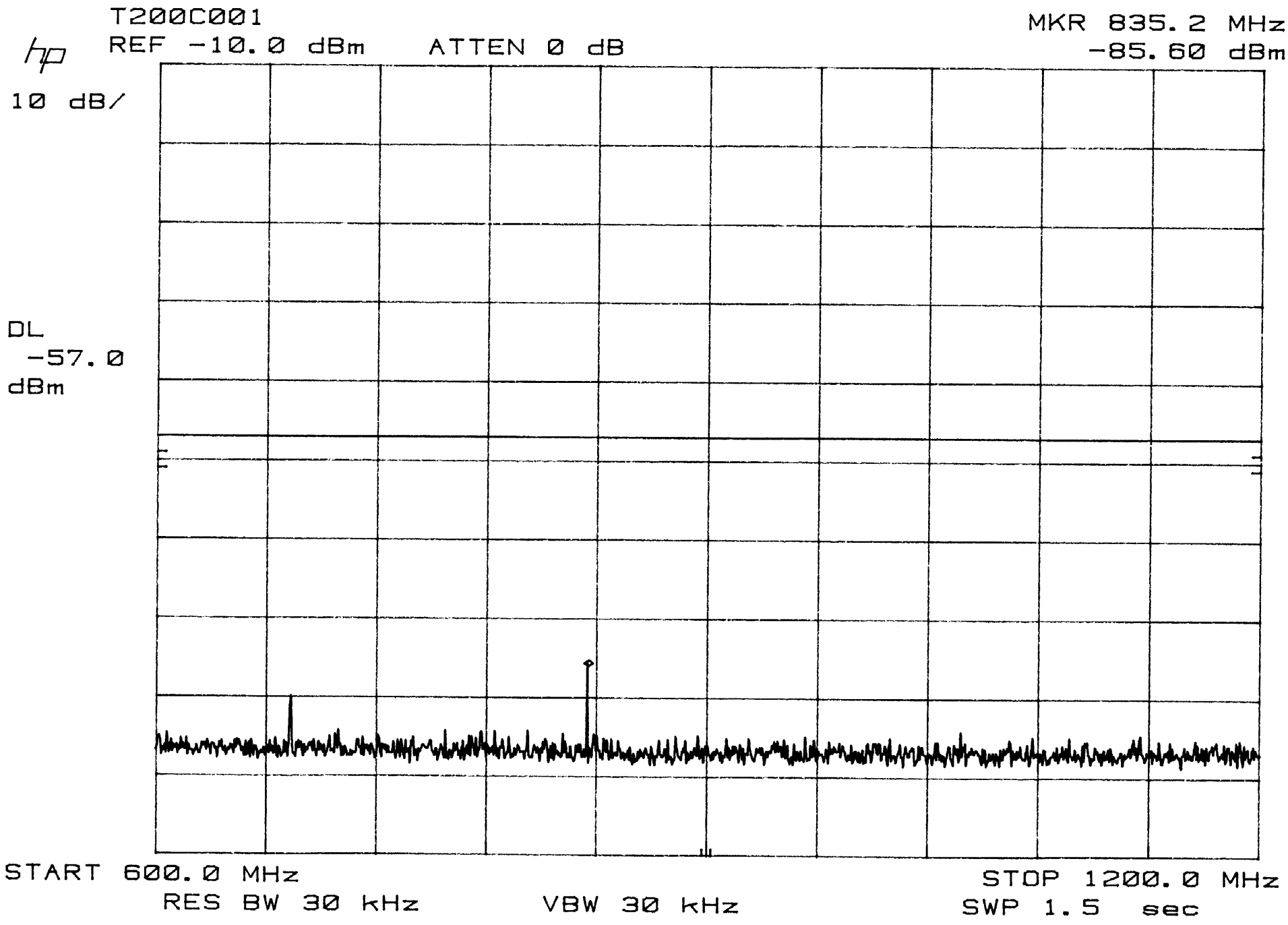
a) D.C.F.:Distance Correction Factor

b) Insert. Loss (dB) = Cable A + Cable B + Cable C .

c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).

d) Negative signs (-) in Margin column signify levels below the limits.

e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.


T200C001
REF -10.0 dBm
ATTEN 0 dB
MKR 835.2 MHz
-85.60 dBm
10 dB/
DL
-57.0
dBm
START 600.0 MHz
RES BW 30 kHz
VBW 30 kHz
STOP 1200.0 MHz
SWP 1.5 sec

Radiated Emissions Test Data

Company:	Telular	**Model #:**	T200C001	**Standard_**	**FCC § 15B**	
EUT:	Telguard	**FCC ID:**	MTF09000	**Limits_**	2	
Project #:	J20016073	**Test Date:**	Aug30, 2000	**Test Distance_**	3	meters
Test Mode:	Normal	**Engineer:**	Suresh	**Duty Relaxation**	0	dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Use
Number:	18	8	0	5	0	0	21	0	0	0
Model:	0	EMCO 3115	None	CDI_P9 50	None	None	Grn_M+L	None	None	None

Frequency	Reading	Detector	Ant.	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(μV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
967.60	22.9	Peak	18	5	V	24.0	9.4	2.3	0.0	39.8	54.0	-14.2
1935.68	20.6	Peak	8	0	V	26.7	0.0	2.2	0.0	49.5	54.0	-4.5
956.42	26.5	Peak	18	5	V	24.0	9.4	2.3	0.0	43.4	46.0	-2.6
980.86	22.0	Peak	18	5	V	23.8	9.4	2.3	0.0	38.7	54.0	-15.3
1960.66	18.1	Peak	8	0	V	26.7	0.0	2.2	0.0	47.0	54.0	-7.0
1910.72	18.2	Peak	18	0	V	28.8	0.0	2.2	0.0	49.2	54.0	-4.8

Notes:

a) D.C.F.:Distance Correction Factor

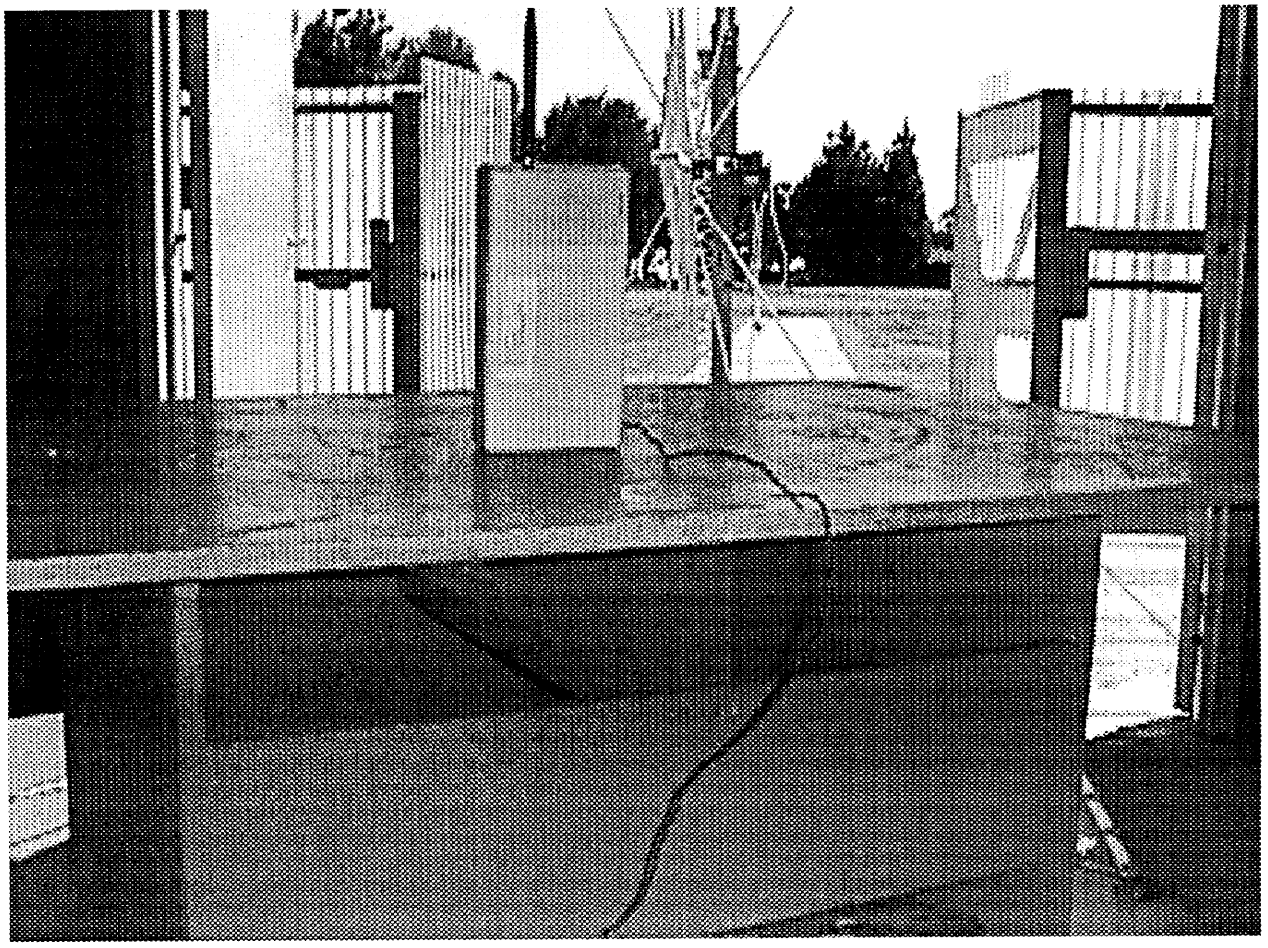
b) Insert. Loss (dB) = Cable A + Cable B + Cable C .

c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).

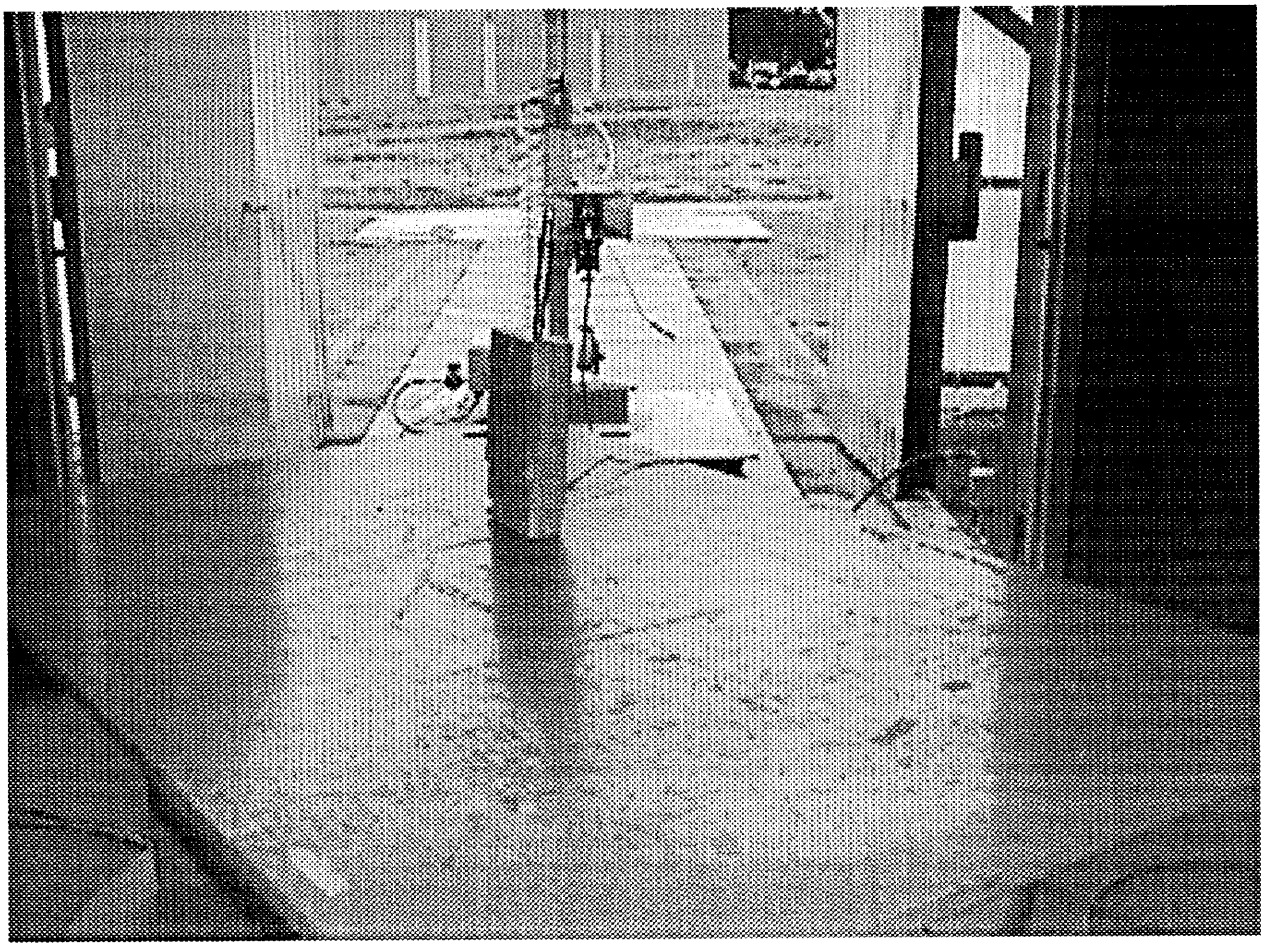
d) Negative signs (-) in Margin column signify levels below the limits.

e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

Radiated Emission Test – Configuration Photograph



Radiated Emission Test - Configuration Photograph



9.0 **Line Conducted Emissions**, FCC sec. 15.107

9.1 Test Procedure

Test procedure described in the ANSI C63.4 Standard was employed.

The EUT was connected to the AC line through the LISNs.

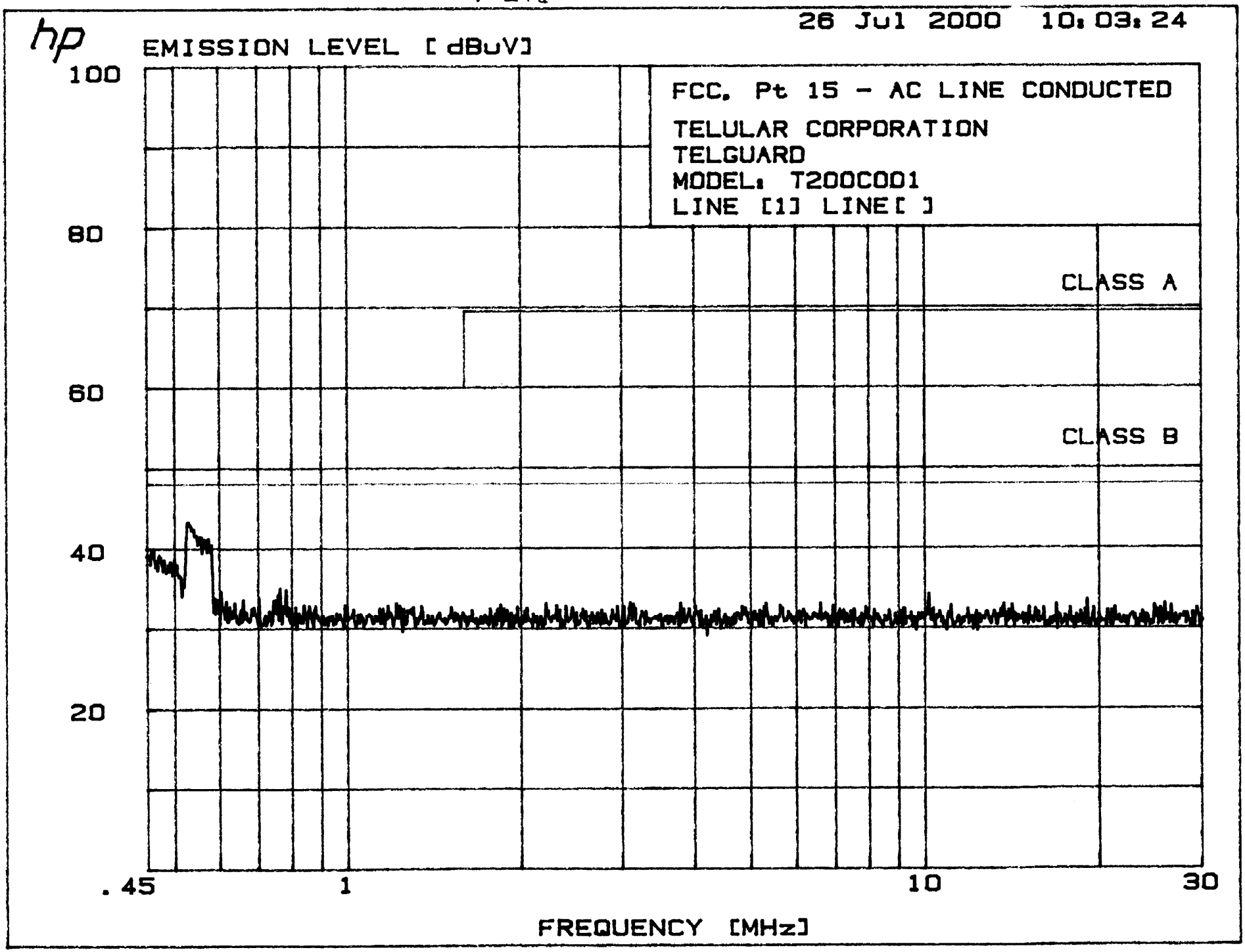
Both HOT and NEUTRAL leads were tested.

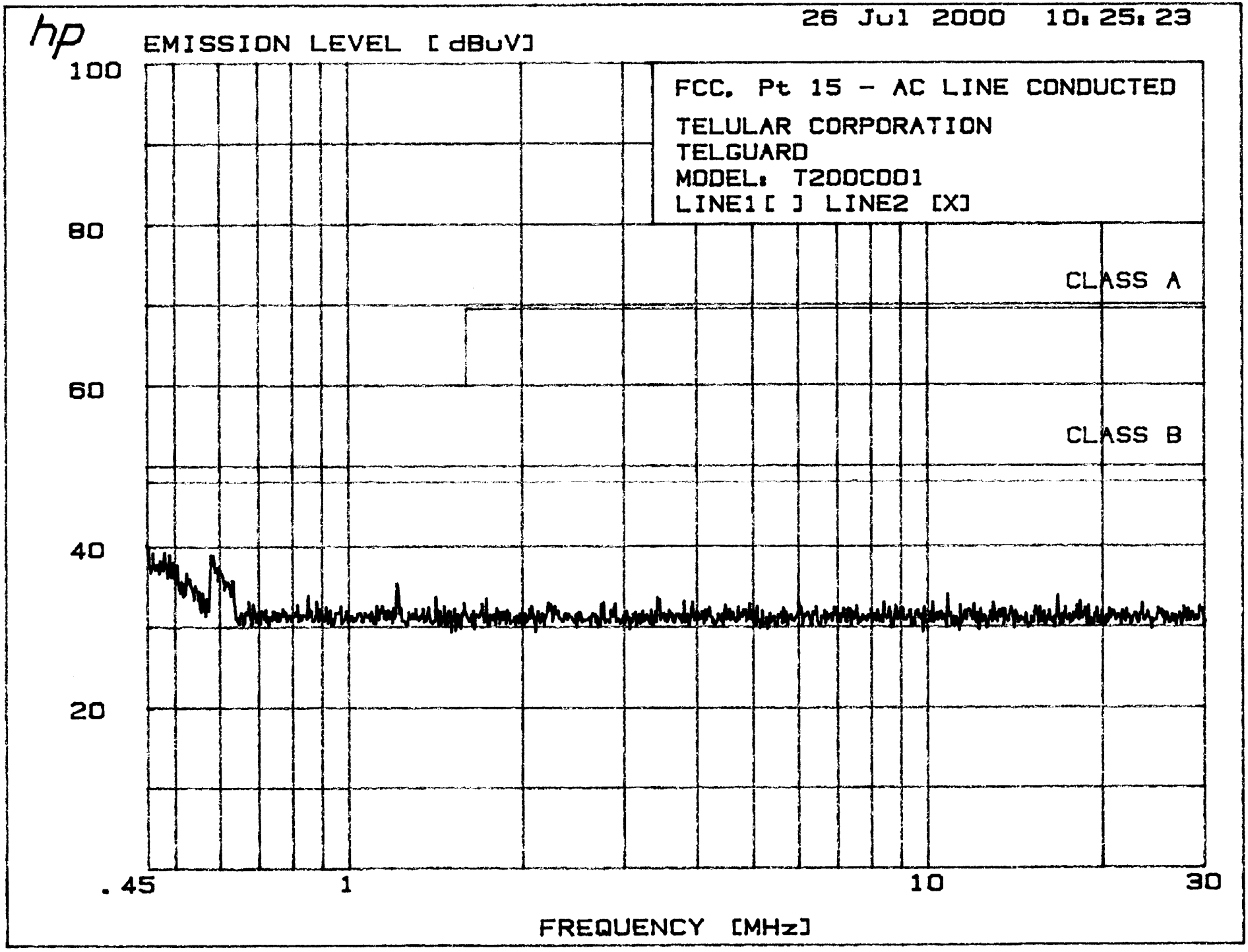
9.2 Test Results

Test Result:	Passed by 5 dB. Refer to the attached plots

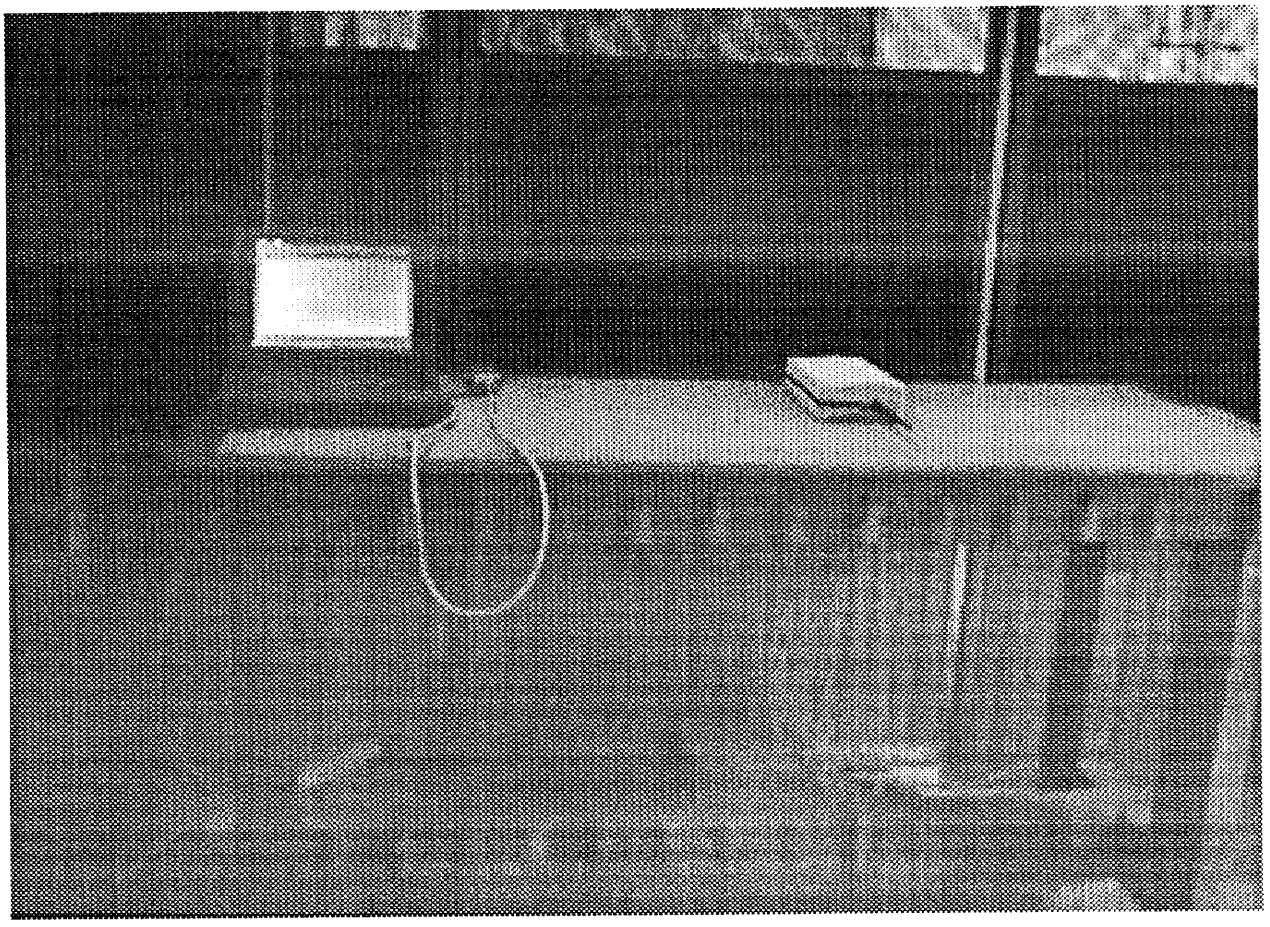
Plot Number	Description
9.2.a	Line1 (HOT)
9.2.b	Line2 (NEUTRAL)

9.2.8


hp
26 Jul 2000 10:03:24
EMISSION LEVEL [dBuV]
FCC. Pt 15 - AC LINE CONDUCTED
TELULAR CORPORATION
TELGUARD
MODEL: T200C001
LINE [1] LINE[ ]
CLASS A
CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]


hp
26 Jul 2000 10:25:23
EMISSION LEVEL [dBuV]
100
80
60
40
20
FCC. Pt 15 - AC LINE CONDUCTED
TELULAR CORPORATION
TELGUARD
MODEL: T200C001
LINE1 [ ] LINE2 [X]
CLASS A
CLASS B
.45
1
10
30
FREQUENCY [MHz]

AC Line Conducted Emission Test - Configuration Photograph



10.0 **Frequency Stability vs Temperature**, FCC sec. 2.1055, 22.355
Frequency Tolerance: ±2.5 ppm

10.1 Test Procedure

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber. The DC leads, RF output cable, and external PTT cable exited the chamber through an opening made for that purpose.

After the temperature stabilized for approximately 20 minutes, the external PTT switch was activated, and the frequency output was recorded from the counter.

10.2 Test Equipment

Temperature Chamber, -50C to +100C
Hewlett Packard 5383A Frequency Counter
Goldstar DC Power Supply, GR303
Rohde & Schwarz ESVP Test Receiver

10.3 Test Results

Test Result:	Passed. The maximum deviation is 1.2 ppm

Frequency: 836.52 MHz (Middle Channel)		
Temperature, C	Frequency (MHz)	Difference (Hz)
50	836,518,975	1025
40	836,519,400	600
30	836,519,763	237
20	836,520,563	563
10	836,520,588	588
0	836,520,025	025
-10	836,519,813	087
-20	836,519,500	500
-30	836,519,250	750

11.0 **Frequency Stability vs Voltage**, FCC sec. 2.1055, 22.355
Frequency Tolerance: ±2.5 ppm

11.1 Test Procedure

An autotransformer was connected to power terminals of the EUT. The voltage was set to the nominal voltage, 115% of the nominal voltage, and 85% of normal voltage. The output frequency was recorded for each voltage. The test also was performed when the EUT was powered from a DC power supply. The DC voltage was set the nominal voltage (12.4 V), 115% of the nominal voltage, 85% of the normal voltage, and to the lowest level of the battery (according to the specification of the battery used in the EUT). The output frequency was recorded for each voltage.

11.2 Test Equipment

Hewlett Packard 5383A Frequency Counter
Goldstar DC Power Supply, GR303
Rohde & Schwarz ESVP Test Receiver

11.3 Test Results.

Test Result:	Passed. The maximum deviation is 0.6 ppm

Frequency: 836.52 MHz (Middle Channel)		
A.C. Volt (60Hz)	Frequency (MHz)	Difference (Hz)
120	836.519934	66
138	836.519670	330
102	836.519670	330

Frequency: 836.52 MHz (Middle Channel)		
D.C. Volt	Frequency (MHz)	Difference (Hz)
12.4	836.519574	426
14.26	836.519532	468
10.54	836.519514	486
10.50	836.519514	486

RF Exposure Requirements

The EUT is considered as a mobile device. Therefore the Electromagnetic Field Strength (E) was calculated and compared with FCC Maximum Permissive Exposure (MPE) limit. The Power Density (S) can be calculated using the formula

$$S = (30 \times EIRP) / (120 \times \pi) / D^2 \quad (W/m^2)$$

The maximum EIRP in dBm equal P + G –cl= 35.6 + 5 –2=38.6 dBm or 7.24 W.

Therefore, $S = 0.576/ D^2 \ (W/m^2)$

The Duty Cycle can be taking into account.

$$S = 0.576 \times DC/ D^2$$

According Microburst protocol, the worst case of Duty Cycle (DC) is 16.7%, (e.g. the transmitter in ON for 3 s, and OFF for 15 s). However, in practice in back-up mode, once an hour the resulting transmitter DC would be approximately 0.08%.

In the Table below is shown the MPE calculated data for different distances, for DC=0.167, DC=0.0008, and the FCC Limit, which for uncontrolled environment equal F/1500 (mW/cm^2) or F/150 (W/m^2) where F is a frequency in MHz.

F=836.5 MHz

Distance. m	Calculated S, W/ m^2 DC=0.167	Calculated S, W/ m^2 DC=0.0008	MPE Limit W/ m^2
0.1	9.62	0.046	5.58
0.2	2.40	0.012	5.58
0.3	1.07	0.005	5.58
0.4	0.60	0.003	5.58
0.5	0.38	0.002	5.58

As can be seen, at 0.2 m the Power Density is well below the Limit.