RADIO TEST REPORT

No. 0034096R1

EQUIPMENT UNDER TEST

Equipment :	GSM Base Station
Type /Model:	InSite BTS GSM 1900
Manufacturer :	Nokia
Tested by request of :	Nokia

SUMMARY

The equipment complies with the conducted and radiated emission requirements according to the following standard.

FCC part 15 subpart C (1999) Intentional radiators, Class B
FCC part 24 subpart E (1999) Broadband PCS

Date of issue: March 3, 2001

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CONTENTS

Charts

1. CLIENT INFORMATION

The EUT has been tested by request of

Company:	NOKIA SVENSKA AB Nokia Networks Box 1070 164 25 KISTA
Name of contact:	Stefan Hübbert

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment:	GSM Base Station
Type/Model:	InSite BTS GSM 1900
Brand name:	Nokia
Manufacturer:	Nokia
Rating:	240/100 VAC, 50/60 Hz BTS 16 W, Power supply 4 W
Transmitting frequency range:	1930 – 1990
Receiving frequency range:	1850 – 1910
Rated RF power output:	-0,2 – 22 dBm
Type of modulation :	GMSK, Gaussian Minimum Shift Keying

2.2 Additional information about the EUT

The EUT consists of the two following units:

-InSite BTS GSM 1900 (Base Station)
-Power supply

The EUT was tested with the following connections and cables:

Cable/Connection	Type	Length
DC power	Two wire	1 m
HDSL 1 and 2	2 x four wire	6 m
E1	Ethernet cable	6 m
13 MHz oscillator output	Not used	
Antenna	RG-223	6 m
LMP computer connection	Ethernet cable	6 m

2.3 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not included as part of the testing and evaluation of the EUT.

Power supply unit (230 VAC, 50 Hz / 115 VAC, 60 Hz) with 7,2 V DC battery.

3. TEST SPECIFICATIONS

3.1 Standards

FCC part 15, subpart C (1999): Intentional radiators. Class B
Conducted limits according to 15.207
Radiated limits according to 15.209

Conducted emission:	0,45 – 30 MHz	47.9 dBµV
Radiated emission		
Limits 3 m distance:	30 – 88 MHz	40.0 dBµV/m
	88 –216 MHz	43.5 dBµV/m
	216 – 960 MHz	46.0 dBµV/m
	960 MHz -	54.0 dBµV/m

FCC part 24, subpart E (1999): Broadband PCS.

Frequency stability:	The RF carrier frequency shall not depart from the reference frequency by more then ± 1 ppm.
RF Output power:	The output power from the base station shall not exceed more then 100 W.
Spurious conducted: Antenna emission	On any frequency outside a licensee's frequency block, the power of any spurious emission shall be attenuated below the transmitter power (P) by least 43 + 10 log (P) dB.
Occupied bandwidth:	The emission outside the occupied bandwidth shall be attenuated at least 26 dB below the transmitter power.

3.2 Additions, deviations and exclusions from standards

No additions, deviations or exclusions have been made from the standards.

3.3 Purpose of the test

Purpose of test: To determine whether the equipment under test fulfils the EMC-emission requirements of the standards stated in section 3.1 and also the Radio requirements of the standard stated above.

3.4 Mode of operation during the test

The EUT was operated in transmit mode. Radiated and conducted measurements were performed with the EUT adjusted to the upper, middle and lower channels. The highest output power from the EUT was used. A computer was connected to the EUT to make it send at test data sequence on all timeslots to emit worst case.

4. TEST SUMMARY

The results in this report apply only to the tested sample:

	Test	Result	Note
Emission	Conducted emission, 0,45 – 30 MHz	Pass	
Emission	Radiated electromagnetic field, 30 MHz – 20 GHz	Pass	
Radio	Frequency stability	Pass	
Radio	Output power conducted	Pass	
Radio	Occupied bandwidth	Pass	
Radio	Field strength of spurious emission, 30 MHz – 20 GHz	Pass	
Radio	Spurious conducted antenna emission	Pass	
Radio	Modulation characteristics		NA

NA = Not Applicable

5. MAINS TERMINAL CONTINUOS DISTURBANCE VOLTAGE, 0,45 – 30 MHZ

5.1 Operating environment

Temperature: 21 °C
Relative Humidity: 36 %

5.2 Test set-up and test procedure

The mains terminal disturbance voltage was measured with the equipment under test (EUT) 0,8 m above the ground plane and 0,4 m from the vertical ground plane. The EUT was connected to an artificial mains network (AMN). The AMN was placed on a metallic, grounded floor. Amplitude measurements were performed with a quasi-peak detector.
The two HDSL output ports were connected in a loop whit a 6 m long cable and the base station was powered from the power supply. The E1 cable was also connected to the EUT.

5.3 Measurement uncertainty

Mains terminal disturbance voltage, quasi-peak detection: ±2,0 dB
Mains terminal disturbance voltage, average detection: ±2,0 dB

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT in the above mentioned way.

Measurement uncertainty is calculated in accordance with WECC 19-1990.
The measurement uncertainty is given with a confidence of 95%.

5.4 Test equipment

Test site: Shielded room

Equipment	Manufacturer	Type	SEMKO No.
Measurement receiver	Rohde & Schwarz	ESHS 30	4946
Artificial mains network	Rohde & Schwarz	ESH3-Z5	2260

5.5 Test protocol

Date of test: October 19, 2000
An overview sweep performed with a peak detector is included in the test report as chart A.

Frequency /MHz	Quasi-Peak Disturbance level /dB(µV)	limit /dB(µV)
0,57	39,0	47,9
0,76	37,0	47,9
2,86	37,0	47,9
3,13	42,0	47,9
3,46	43,0	47,9
20,70	38,0	47,9

Note 1. All the other emissions in the measured frequency range were more then 10 dB below the limit.

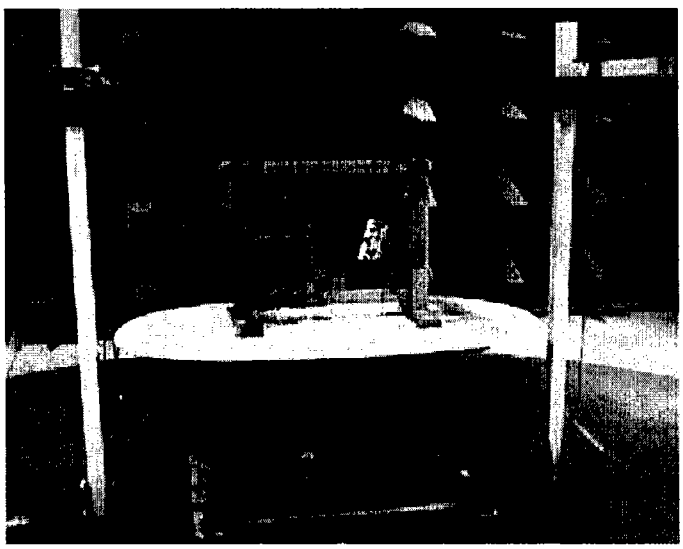
6. RADIATED ELECTROMAGNETIC FIELD, 30 MHZ – 20 GHZ

6.1 Operating environment

The measurements were performed in a semi-anechoic chamber.

Temperature: 22 °C
Relative Humidity: 46 %

6.2 Test set-up and test procedure



The EUT was placed on the Reference Ground Plane, (RGP). An overview sweep with peak detection of the electric field intensity was performed. The overview sweep was performed with the measurement receiver in max-hold mode. The antenna height was varied in steps from 1 to 4 m with the antenna in both horizontal and vertical polarisation. The measurements were repeated with the EUT rotated in steps of 90 degrees. From the overview sweep, frequencies with high disturbance level were selected. The EUT was put in the predefined angle and the antenna in the corresponding polarisation and height. First, the antenna height was varied up and down to find max emission. Then with the antenna in this new position the angle between the EUT and the antenna was varied back and forth to find max emission. The final measurements were performed with a quasi-peak detector with the antenna and EUT in the max emission position. The measurement distance was 3 m.

6.3 Measurement uncertainty

Radiated disturbance electric field intensity, 30-200 MHz:	±3,0 dB
Radiated disturbance electric field intensity, 200-1000 MHz:	±2,5 dB
Radiated disturbance electric field intensity, 1 - 20 GHz:	±3 dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT in the above mentioned way.
Measurement uncertainty is calculated in accordance with WECC 19-1990.
The measurement uncertainty is given with a confidence of 95%

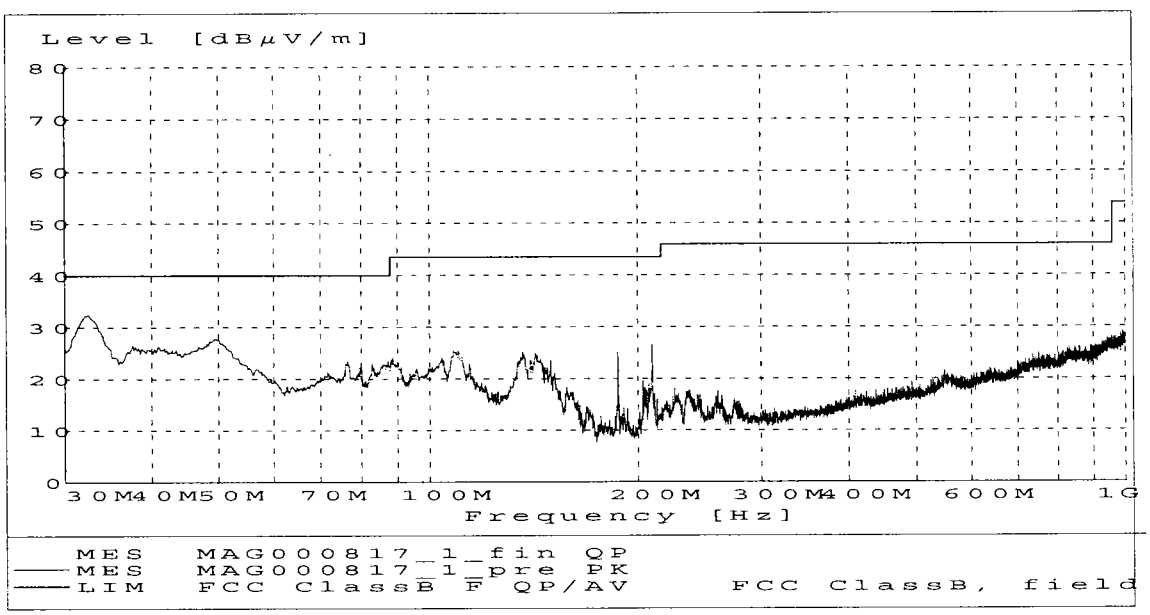
6.4 Test instrumentation

Equipment	Manufacturer	Type	Semko No.
30 – 1000 MHz:			
Software	ES.K1 V1.60		
Measurement receiver	R&S	ESAI	2973/2974
Amplifier	Semko		7992/7993
Antenna, bilog	Chase	CBL6111A	1550
1 – 20 GHz			
Software	Remi	2,019	
Spectrum analyser	HP	8566B	7091
Amplifier	HP	8449B	6685
Antenna, horn	EMCO	3115	3006

R&S = Rohde & Schwarz; HP = Hewlett-Packard

6.5 Test protocol

Date of test: August 17, 2000

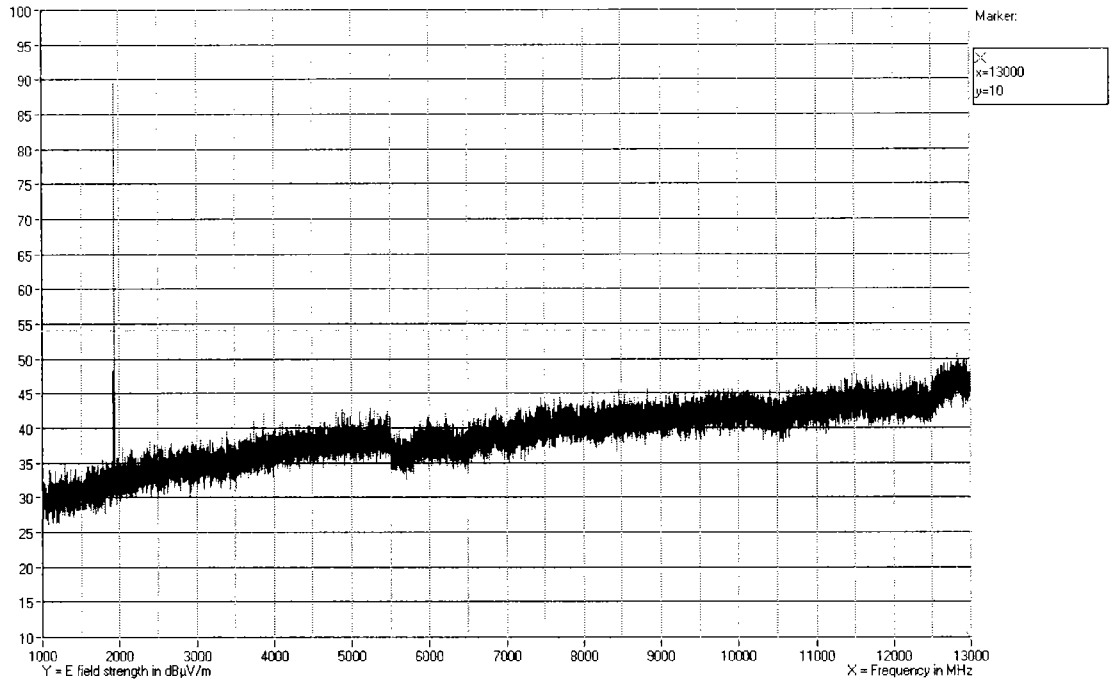


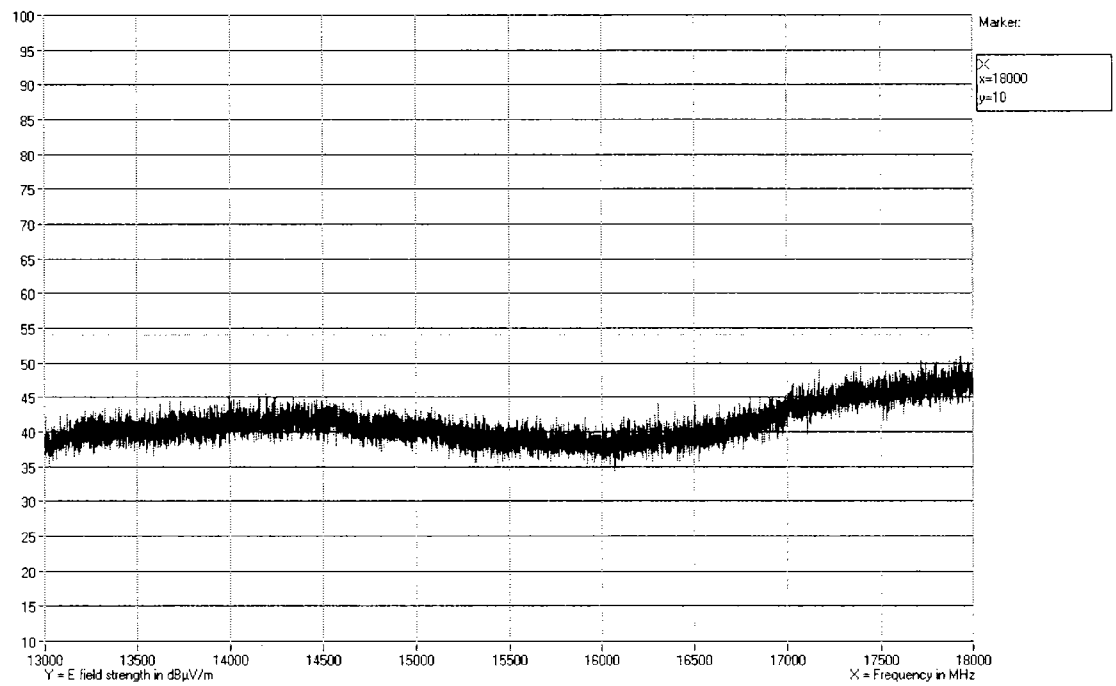
Overview sweep with peak detector measured at 3 m distance. Class B limit.

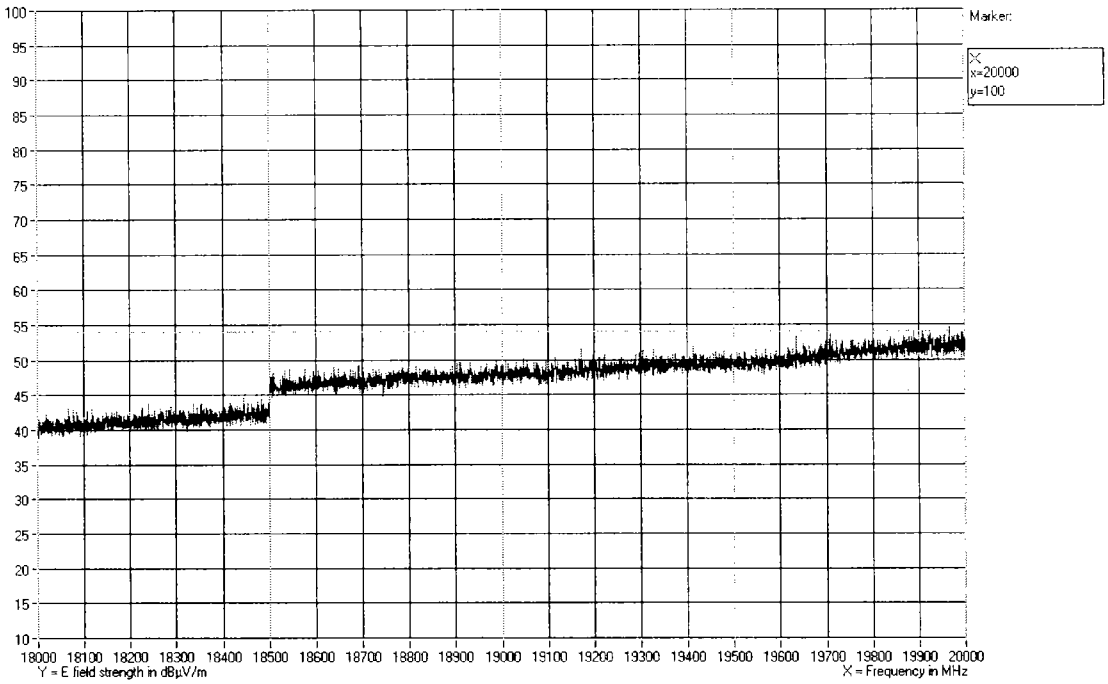
Frequency /MHz	Measurement BW kHz	Quasi-Peak Disturbance Level /dB(µV/m)	Limit FCC class B, 3 m. /dB(µV/m)
32,24	120	33,3	40,0
87,84	120	21,9	40,0
108,96	120	24,6	43,5
137,12	120	22,3	43,5
209,28	120	19,2	43,5

The EUT complies with the Class B requirements

Radiated electromagnetic field, 30 MHz – 20 GHz, overall profile







Frequency	Measurement BW	Quasi-Peak Disturbance Level	Limit FCC class B, 3 m.
/GHz	kHz	/dB(µV/m)	/dB(µV/m)
1 – 20	1000	< 40	54.0

No disturbances above 40 dB(µV/m) were found in the frequency range 1 – 20 GHz.

7. FREQUENCY STABILITY

7.1 Operating environment

The measurements were performed in a climate chamber.

Temperature: 22 °C
Relative Humidity: 28 %

7.2 Test set-up and test procedure

The EUT was placed in a climate chamber and the frequency error was measured at –30, -20, -10, 0, 10, 20, 30, 40, 50 and 60°C. The frequency error was measured at the nominal supply voltage and also at 85% and 115% of the manufacturer's rated supply voltage.

7.3 Measurement uncertainty

The measurement uncertainty: ± 1 %

7.4 Test instrumentation

Equipment	Manufacturer	Type	Semko No.
Frequency counter	PHILIPS	PM6685R	5616
Climate chamber	Heraeus Vötsch		7024

7.5 Test protocol

Date of test: December 15, 2000

Frequency Error (Hz)				
	AC input voltage (V)			
Temperature (°C)	U_{nom}(115)V	U_{min}(97)V	U_{max}(132)V	Specification (Hz)
-30	No signal	No signal	No signal	±1960
-20	500	400	500	±1960
-10	300	400	400	±1960
0	300	400	300	±1960
10	200	100	200	±1960
20	0	0	100	±1960
30	0	100	100	±1960
40	0	100	0	±1960
50	-100	-100	0	±1960
60	-100	-200	-100	±1960

The table above shows the frequency deviation from the carrier frequency 1960,0079 MHz, channel 611.
Limit: The RF carrier frequency shall not depart from the reference frequency by more then ± 1 ppm.

8. OUTPUT POWER, CONDUCTED

8.1 Operating environment

The measurements were performed in a climate chamber.

Temperature: 22 °C
Relative Humidity: 28 %

8.2 Test set-up and test procedure

The measurement was made from the antenna terminal of the EUT. A spectrum analyser was used to determine the output power. The EUT was transmitting an unmodulated carrier on channel 512, 661 and 810, during the test.

8.3 Measurement uncertainty

The measurement uncertainty: +/- 0,7 dB

8.4 Test instrumentation

Equipment	Manufacturer	Type	Semko No.
Spectrum analyser	HP	8593E	6661

HP = Hewlett-Packard

8.5 Test protocol

Date of test: December 14, 2000

Conducted RF power output (W)			
Channel	Carrier frequency (MHz)	Measurement BW (kHz)	RF power (W)
512	1930,2	10	0,141
661	1960	10	0,158
810	1989,8	10	0,126

Output power limit: 50 dBm

9. FIELD STRENGTH OF SPURIOUS EMISSIONS, 30 MHZ – 20 GHZ

9.1 Operating environment

The measurements were performed in a semi-anechoic chamber.

Temperature: 22 °C
Relative Humidity: 46 %

9.2 Test procedure

The EUT was transmitting a test sequence through the HDSL cable during the test.

9.3 Measurement uncertainty

Radiated disturbance electric field intensity, 30-200 MHz: ±3,0 dB
Radiated disturbance electric field intensity, 200-1000 MHz: ±2,5 dB
Radiated disturbance electric field intensity, 1 - 20 GHz: ±3 dB
The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT in the above mentioned way.
Measurement uncertainty is calculated in accordance with WECC 19-1990.
The measurement uncertainty is given with a confidence of 95%

9.4 Test instrumentation

Equipment	Manufacturer	Type	Semko No.
30 – 1000 MHz:			
Software	ES.K1 V1.60		
Measurement receiver	R&S	ESAI	2973/2974
Amplifier	Semko		7992/7993
Antenna, bilog	Chase	CBL6111A	1550
1 – 20 GHz			
Software	Remi	2,019	
Spectrum analyser	HP	8566B	7091
Amplifier	HP	8449B	6685
Antenna, horn	EMCO	3115	3006

R&S = Rohde & Schwarz; HP = Hewlett-Packard

9.5 Test protocol

Date of test: August 17, 2000

Spurious emission, radiated			
Frequency [MHz]	Measurement bandwidth [kHz]	Disturbance level [dBm]	Comments
30-1000	120	<-60	Se note 1
1000-20000	1000	<-55	Se note 1

Note 1. Emission measurements were performed in the frequency range 30 MHz - 20 GHz, in the actual band and out of band, to see if the equipment generated any spurious emission. No spurious emission were found above the noise floor (<-55 dBm). No substitution measurements were performed.

Limit: -13 dBm => 43 + 10 log(P); P = 22 dBm ≈ - 8 dB => 43 – 8 = 35 dB
FCC part 24.238 => 22 – 35 = -13dBm

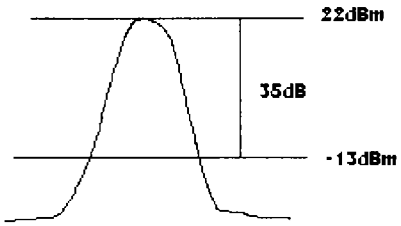


Figure 9.1. Drawing of the limit line calculated from the maximum signal power of the EUT.

10. OCCUPIED BANDWIDTH

10.1 Operating environment

Temperature: 20 °C
Relative Humidity: 13 %

10.2 Measurement uncertainty

The measurement uncertainty: ±3,0 dB

10.3 Test instrumentation

Equipment	Manufacturer	Type	Serial No.
Spectrum analyser	HP	8593E	6661

HP = Hewlett-Packard

10.4 Test protocol

Date of test: February 26, 2001

Rated output power level (maximum): 22 dBm

The EUT was transmitting a modulated signal during the measurements.

Occupied bandwidth (kHz)		
Channel	Carrier frequency (MHz)	Occupied bandwidth (kHz)
512	1930,2	340
661	1960,0	340
810	1989,8	340

11. SPURIOUS CONDUCTED ANTENNA EMISSION

11.1 Operating environment

Temperature: 22 °C
Relative Humidity: 28 %

11.2 Measurement uncertainty

The measurement uncertainty: ±3,0 dB

11.3 Test instrumentation

Equipment	Manufacturer	Type	Serial No.
Spectrum analyser	HP	8566B	7091
Attenuator	Spinner	10 dB	7988
Softaware	Remi	2,019	
Spectrum analyser	HP	8593E	6661

HP = Hewlett-Packard

11.4 Test protocol

Date of test: August 29 and December 14, 2000

Rated output power level (maximum): 22 dBm

The EUT was transmitting a modulated signal during the measurements.

Conducted spurious emission at low band, channel 512			
Frequency (MHz)	Measurement BW (kHz)	Measured level (dBm)	Limit (dBm)
0,009 – 1000	100	<-44	-13
1930,2	1000	21,2	In band
1000 – 20000	1000	<-40	-13

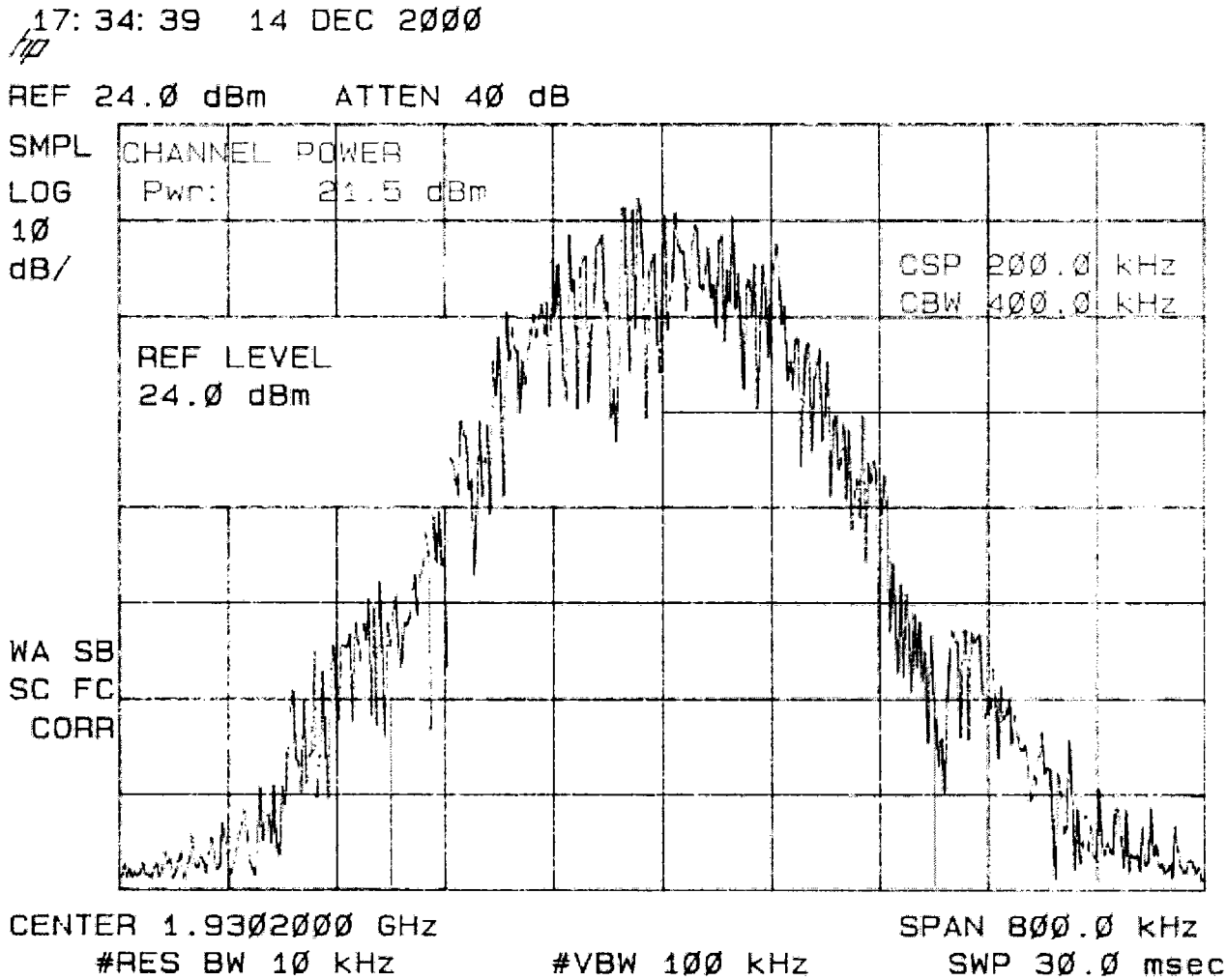
Conducted spurious emission at low band, channel 661			
Frequency (MHz)	Measurement BW (kHz)	Measured level (dBm)	Limit (dBm)
0,009 – 1000	100	<-44	-13
1960,0	1000	21,2	In band
1000 – 20000	1000	<-40	-13

Conducted spurious emission at low band, channel 810			
Frequency (MHz)	Measurement BW (kHz)	Measured level (dBm)	Limit (dBm)
0,009 – 1000	100	<-44	-13
1989,8	1000	20,9	In band
1000 – 20000	1000	<-40	-13

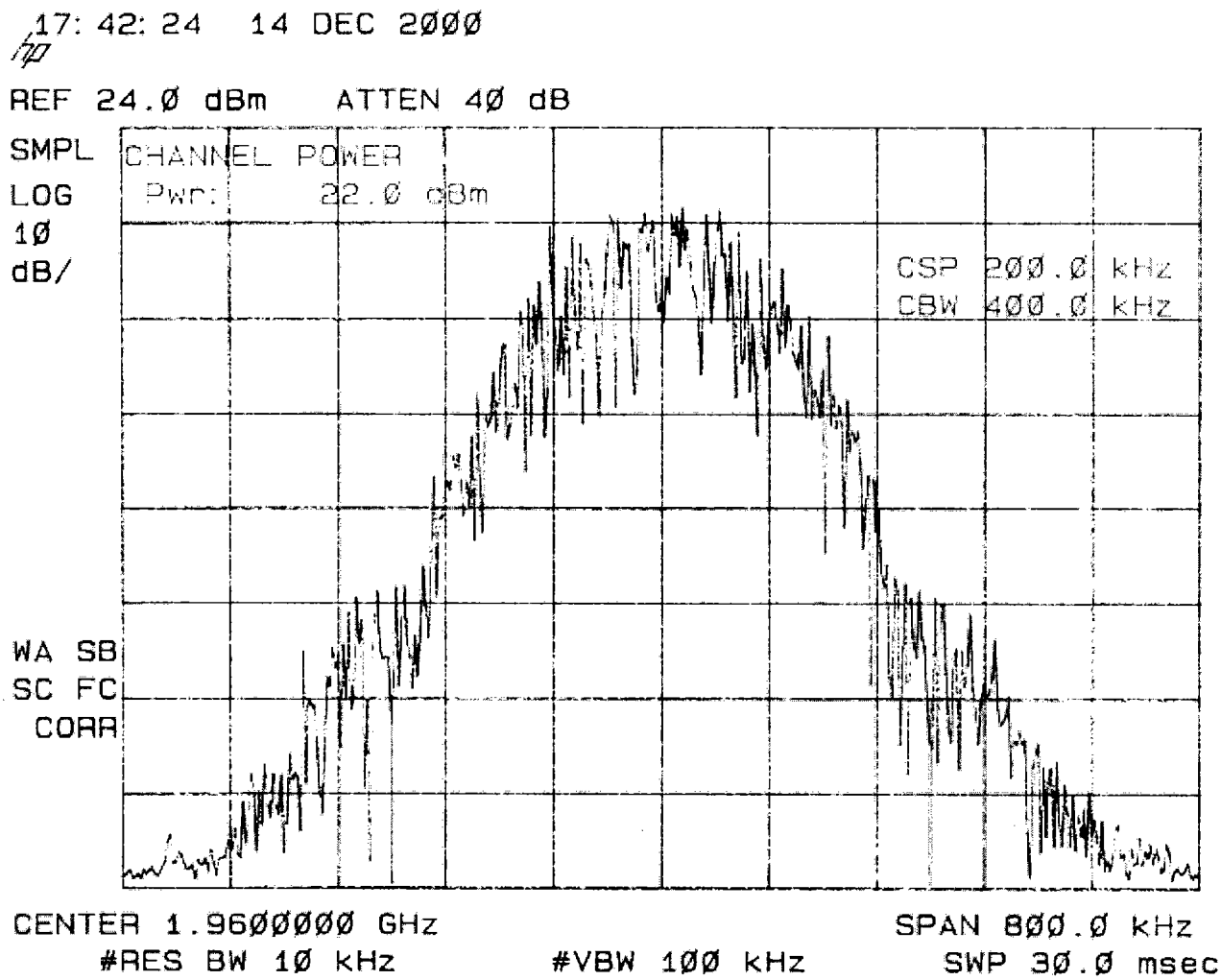
Note 1. No spurious emission were detected above the noise floor.

Appendix I - Channel power, Occupied bandwidth and Conducted spurious emission

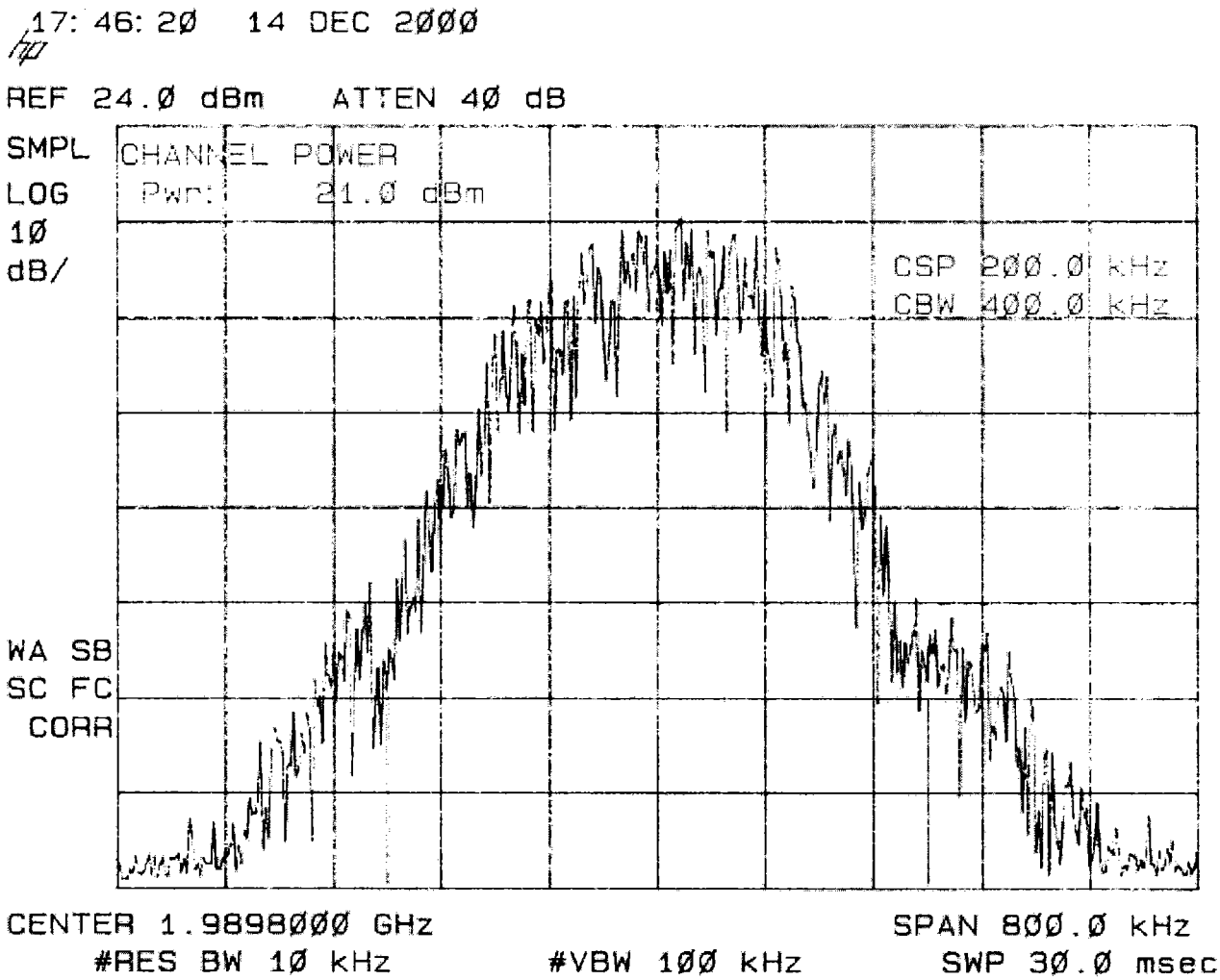
Power level on channel 512, 1930,2 MHz



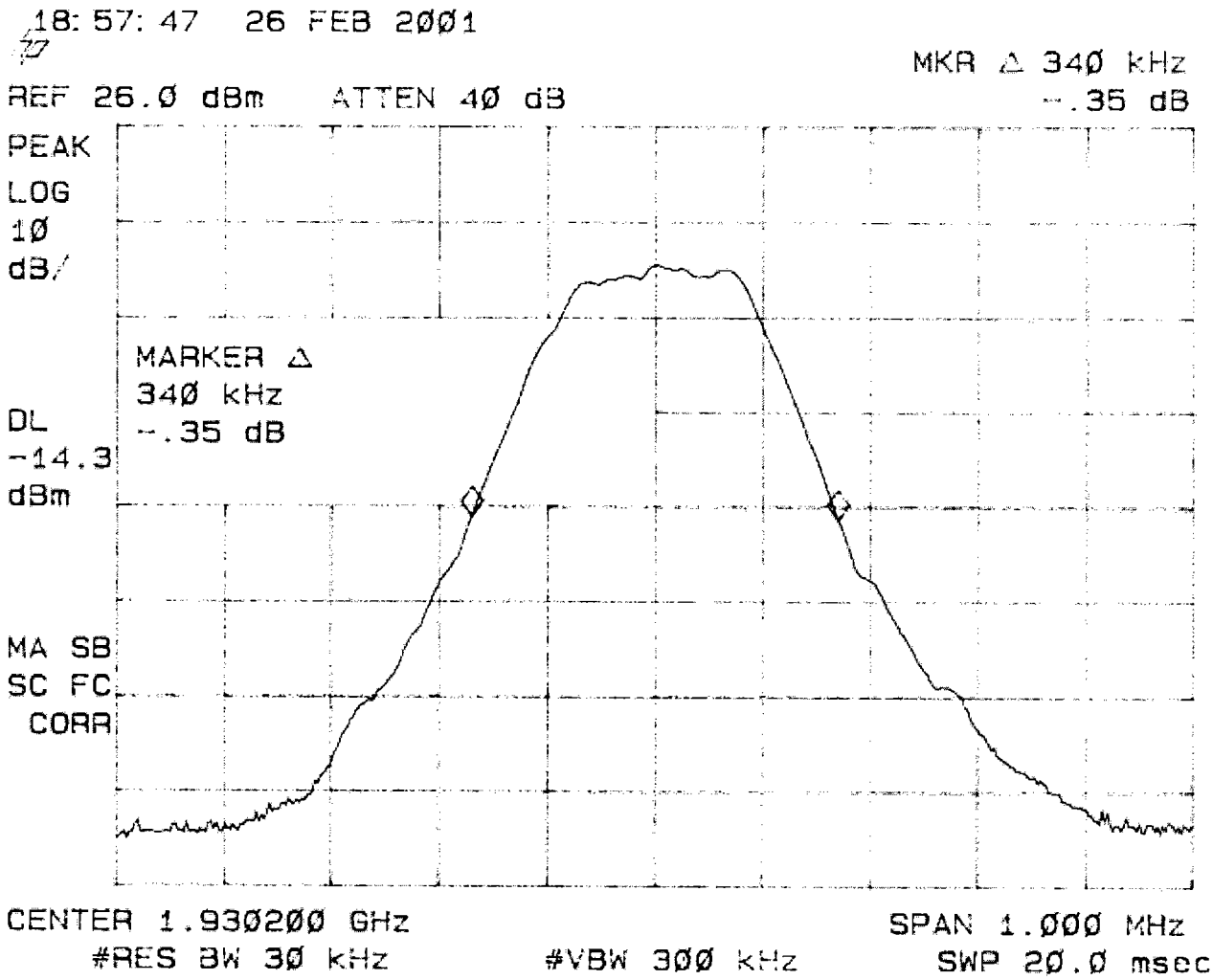
Power level on channel 661, 1960,0 MHz



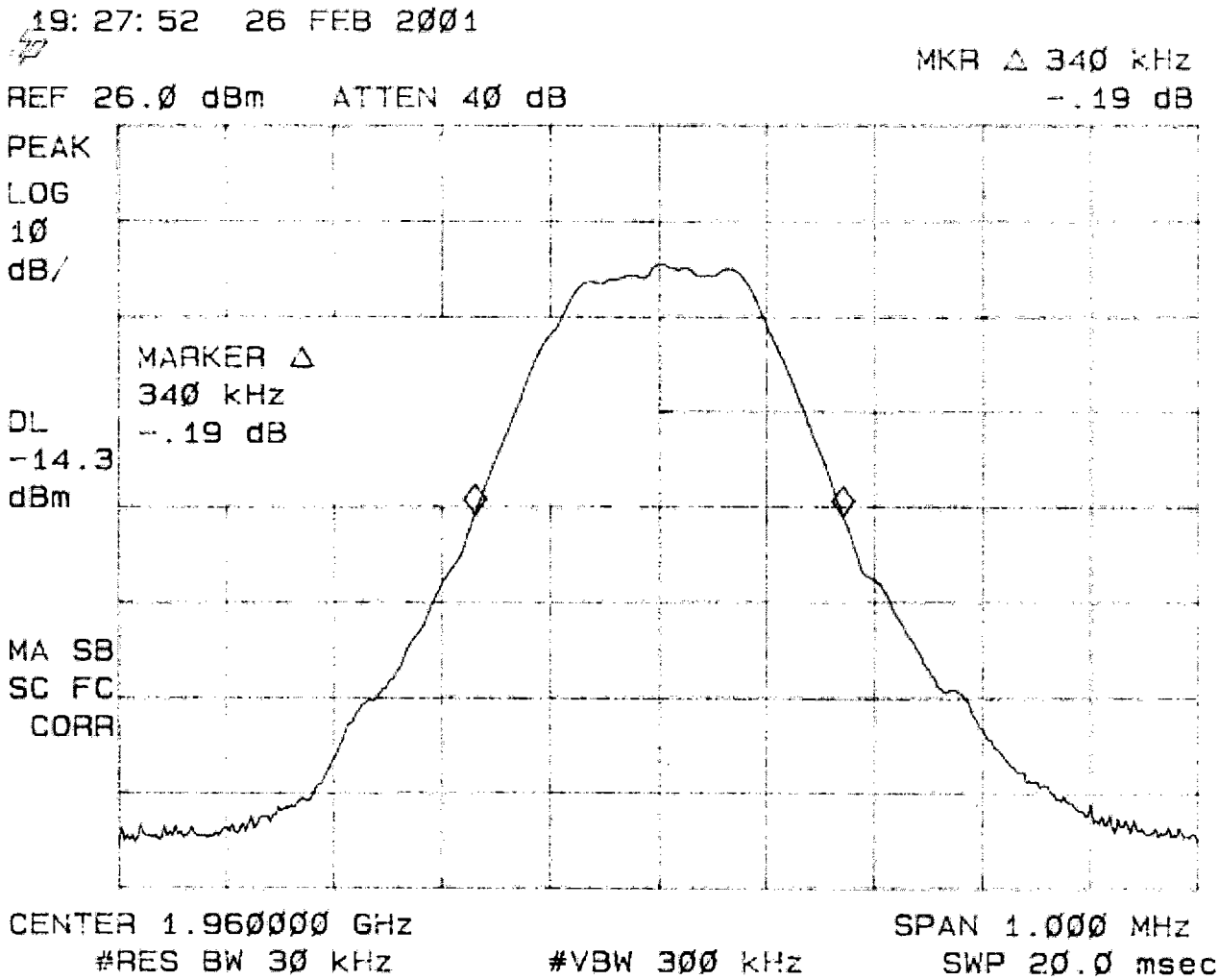
Power level on channel 810, 1989,8 MHz



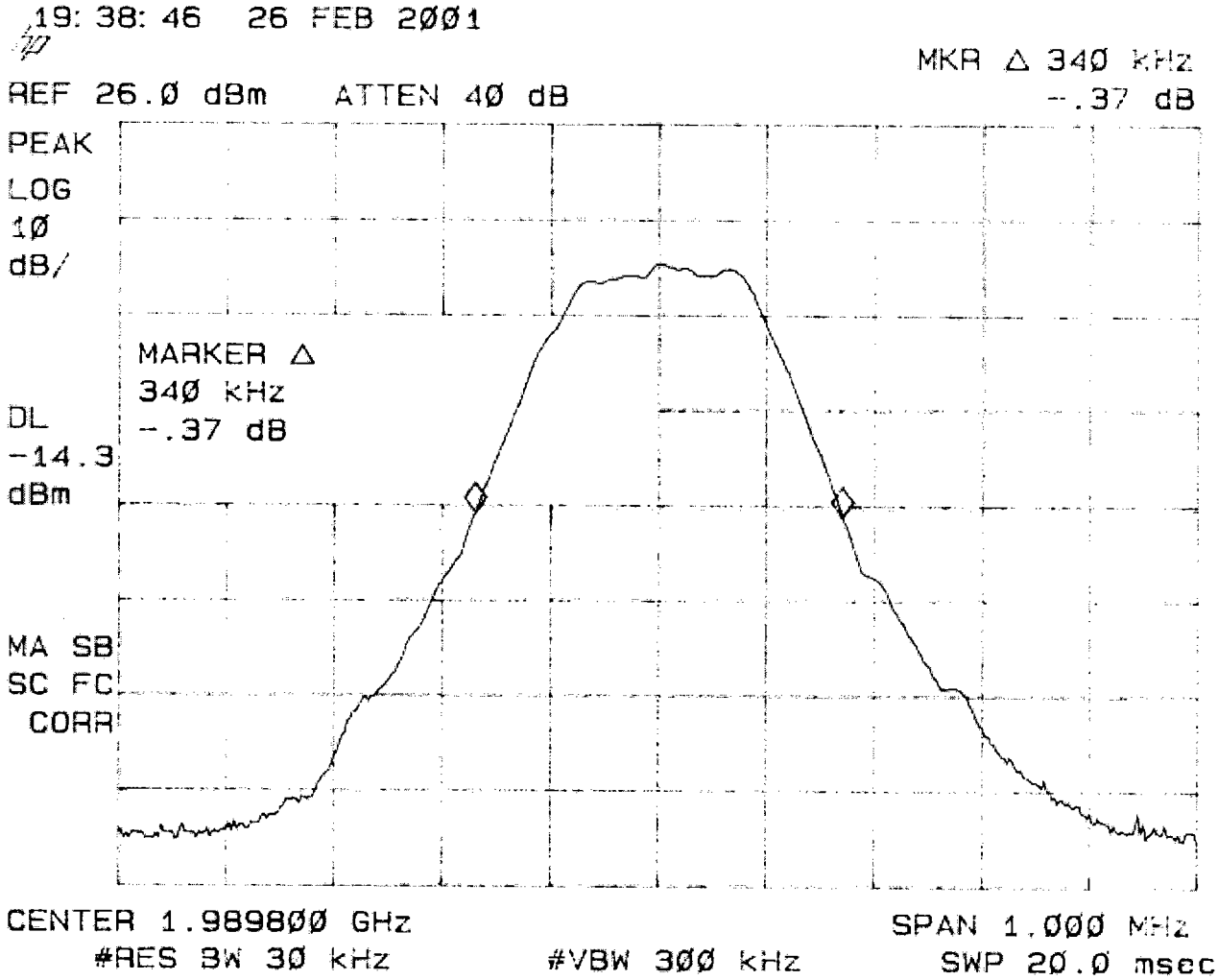
Occupied bandwidth on channel 512, 1930,2 MHz



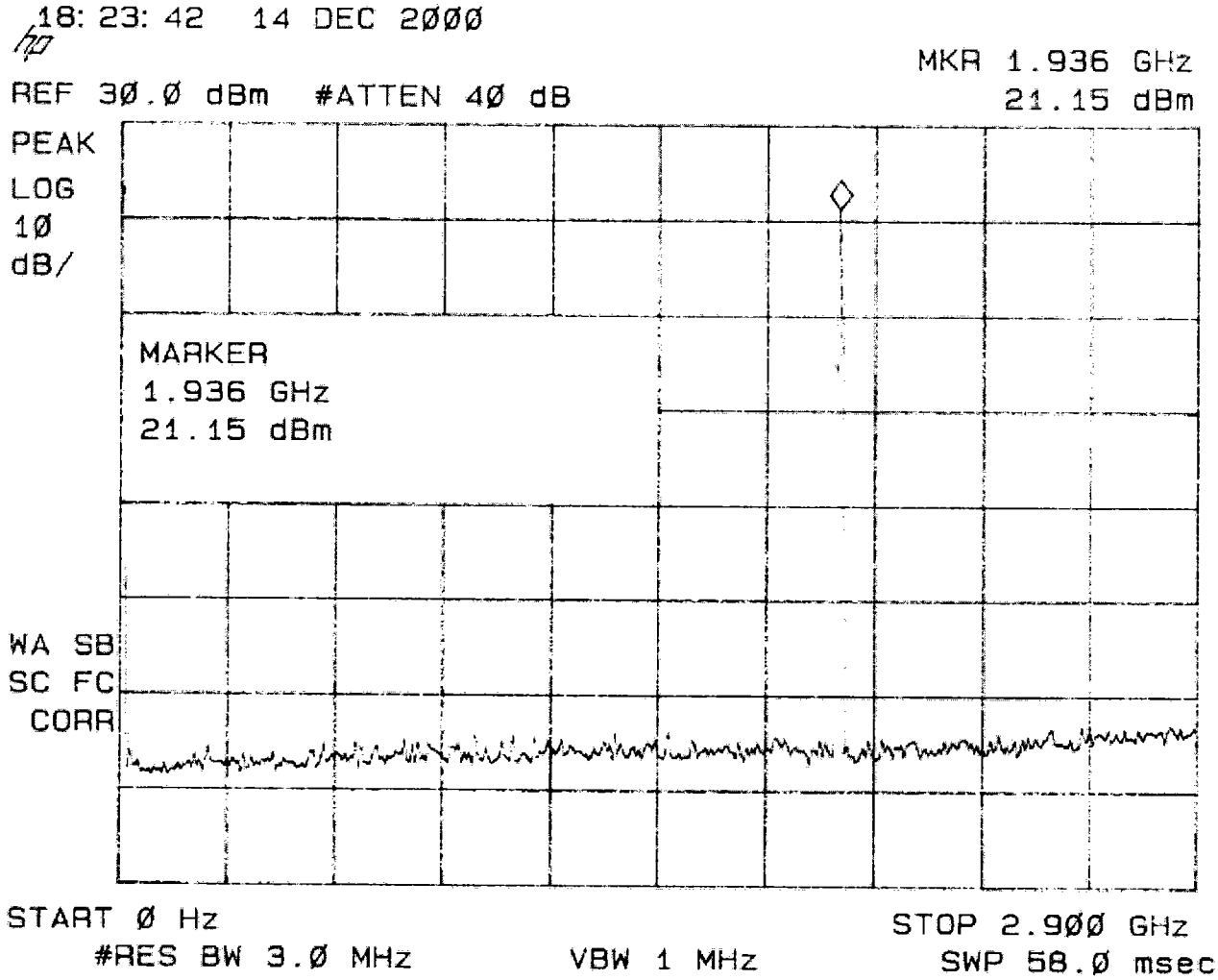
Occupied bandwidth on channel 661, 1960,0 MHz



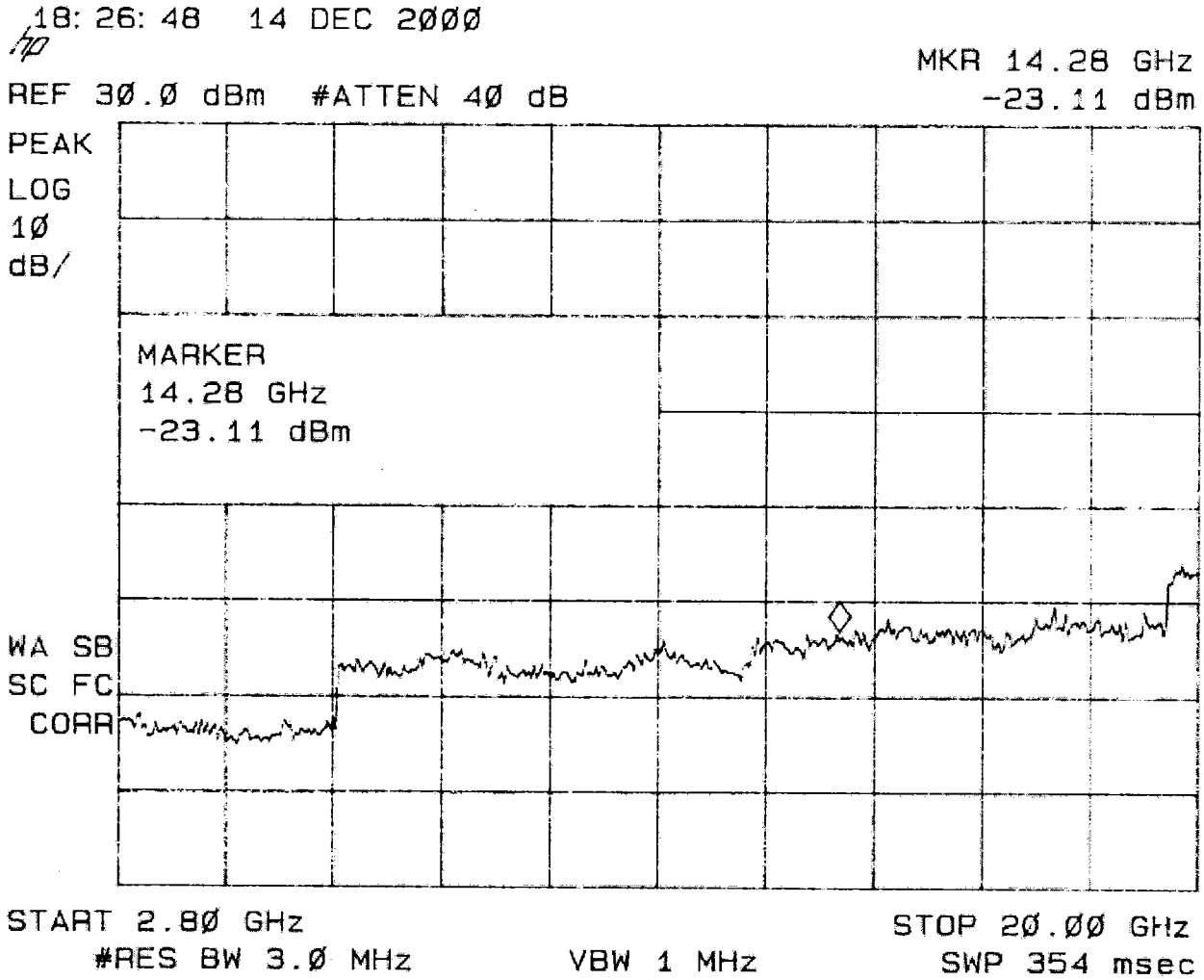
Occupied bandwidth on channel 810, 1989,8 MHz



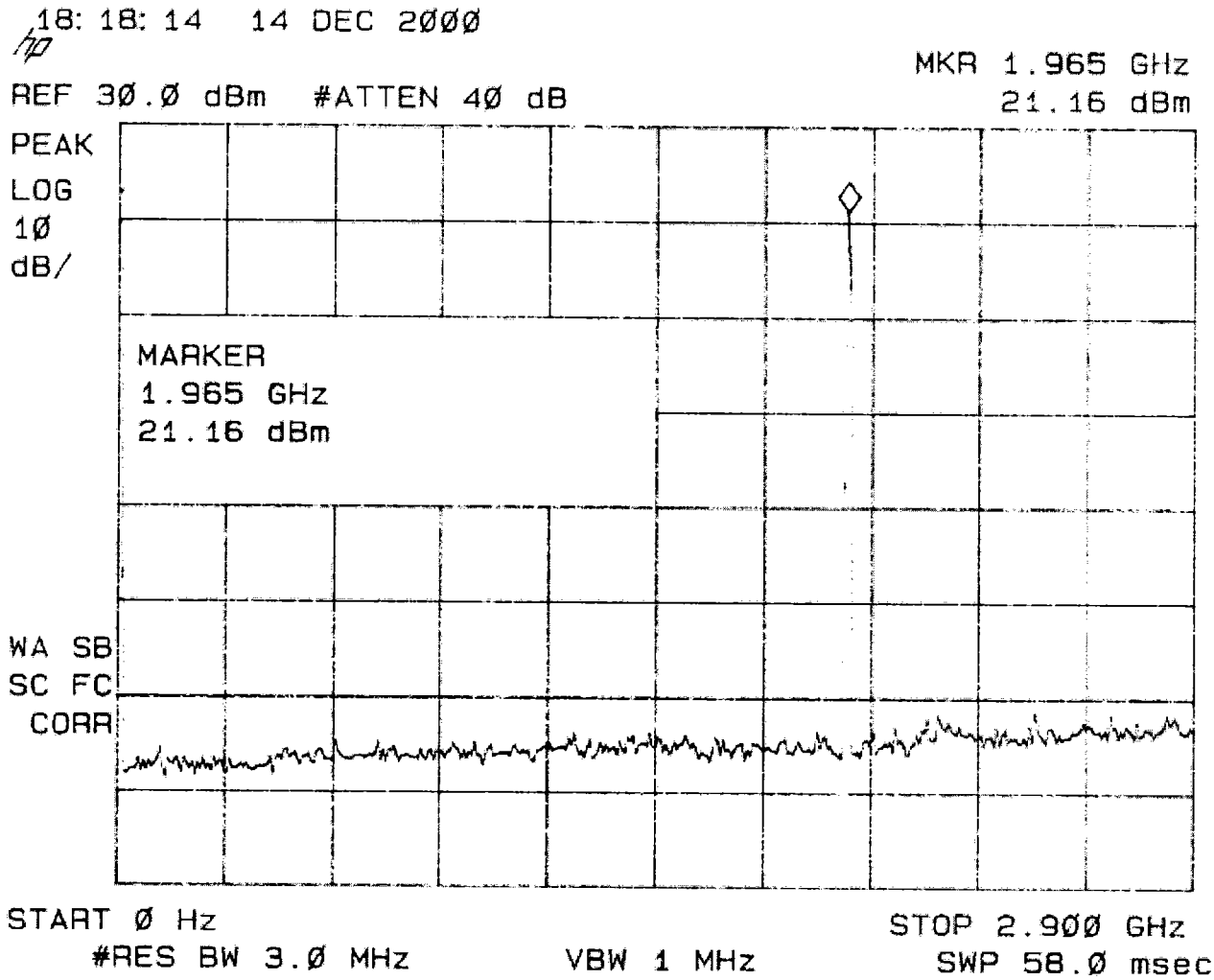
Spurious emission conducted, overall profile under channel 512 (0-2,9GHz)



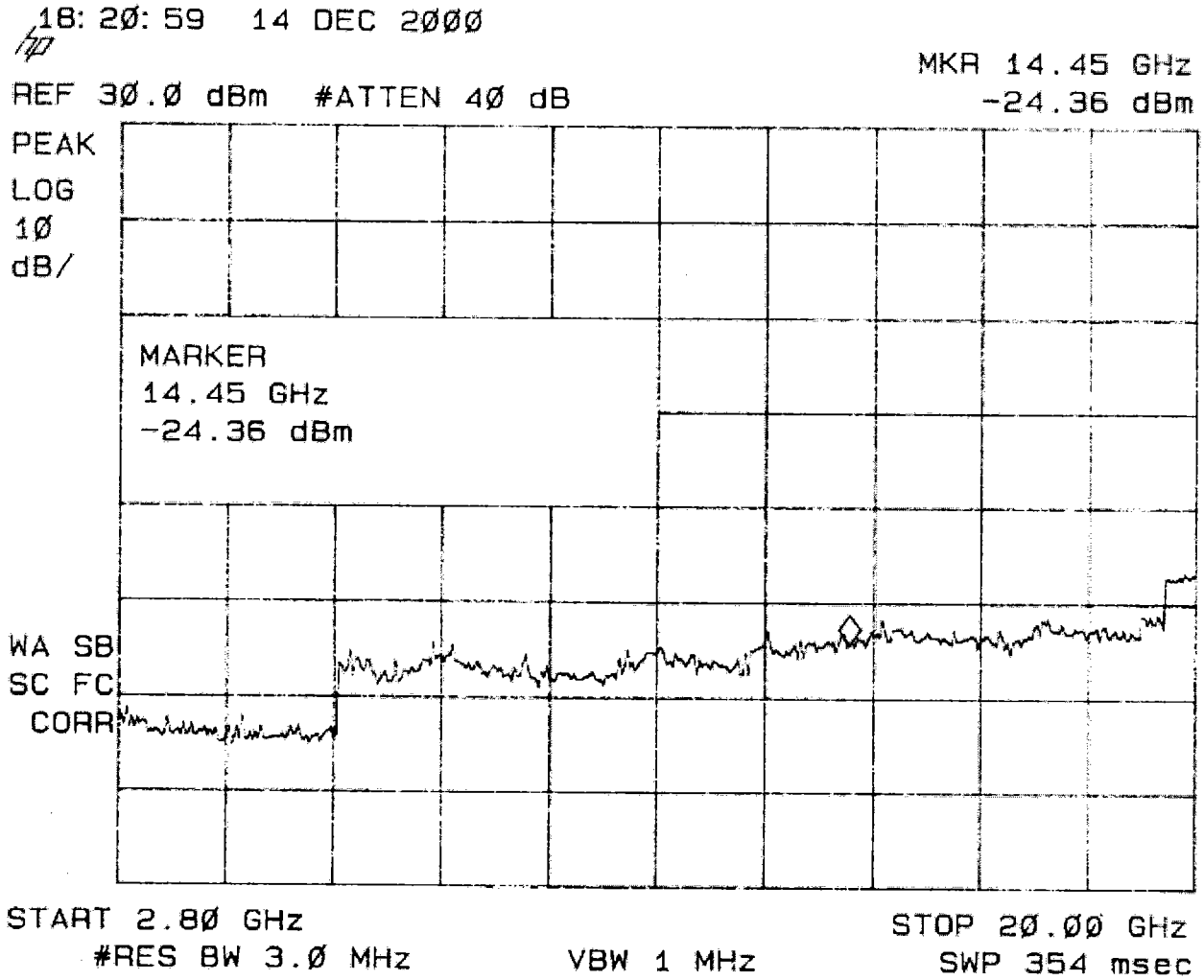
Spurious emission conducted, overall profile under channel 512 (2,8-20GHz)



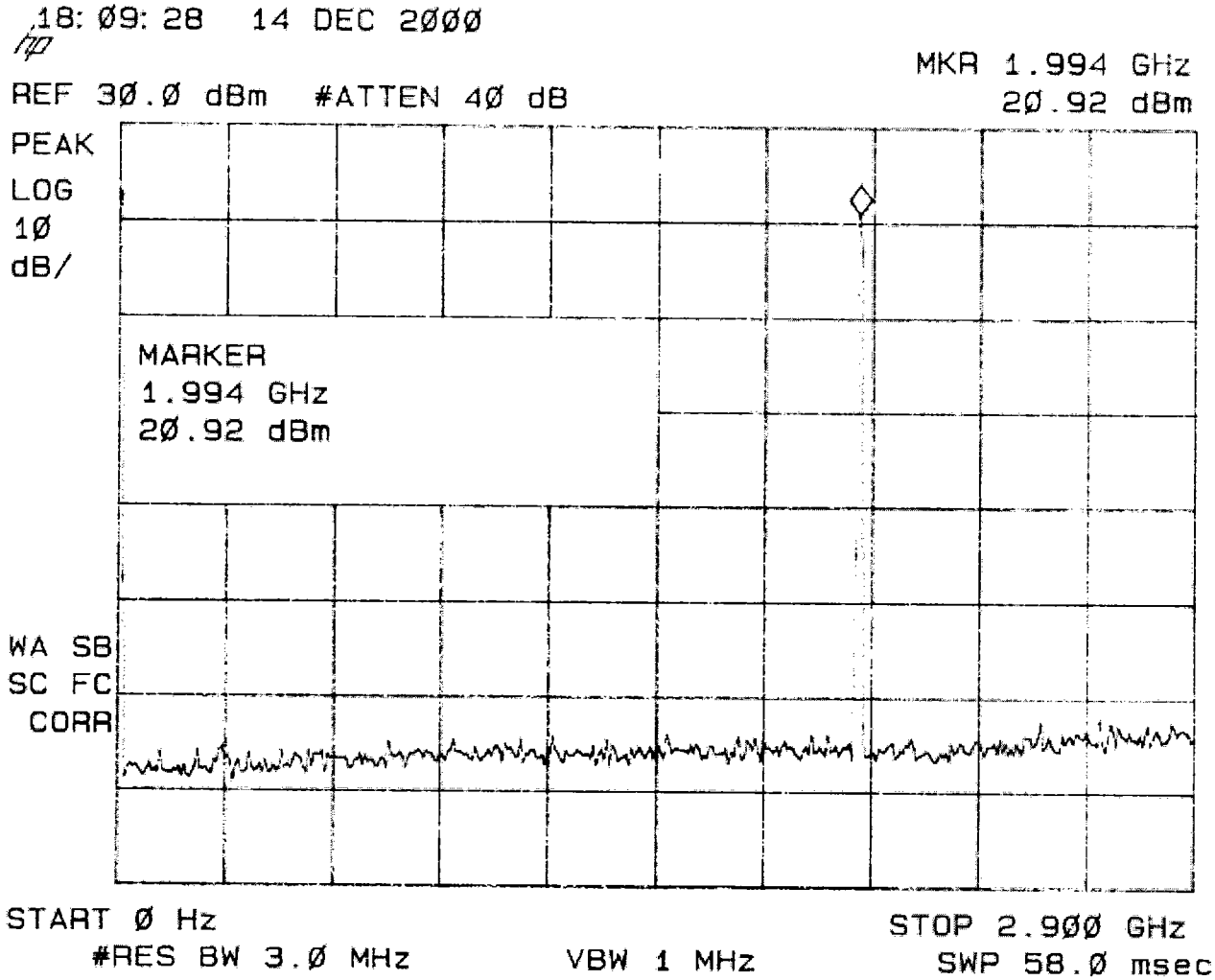
Spurious emission conducted, overall profile under channel 661 (0-2,9GHz)



Spurious emission conducted, overall profile under channel 661 (2,8-20GHz)



Spurious emission conducted, overall profile under channel 810 (0-2,9GHz)



Spurious emission conducted, overall profile under channel 810 (2,8-20GHz)

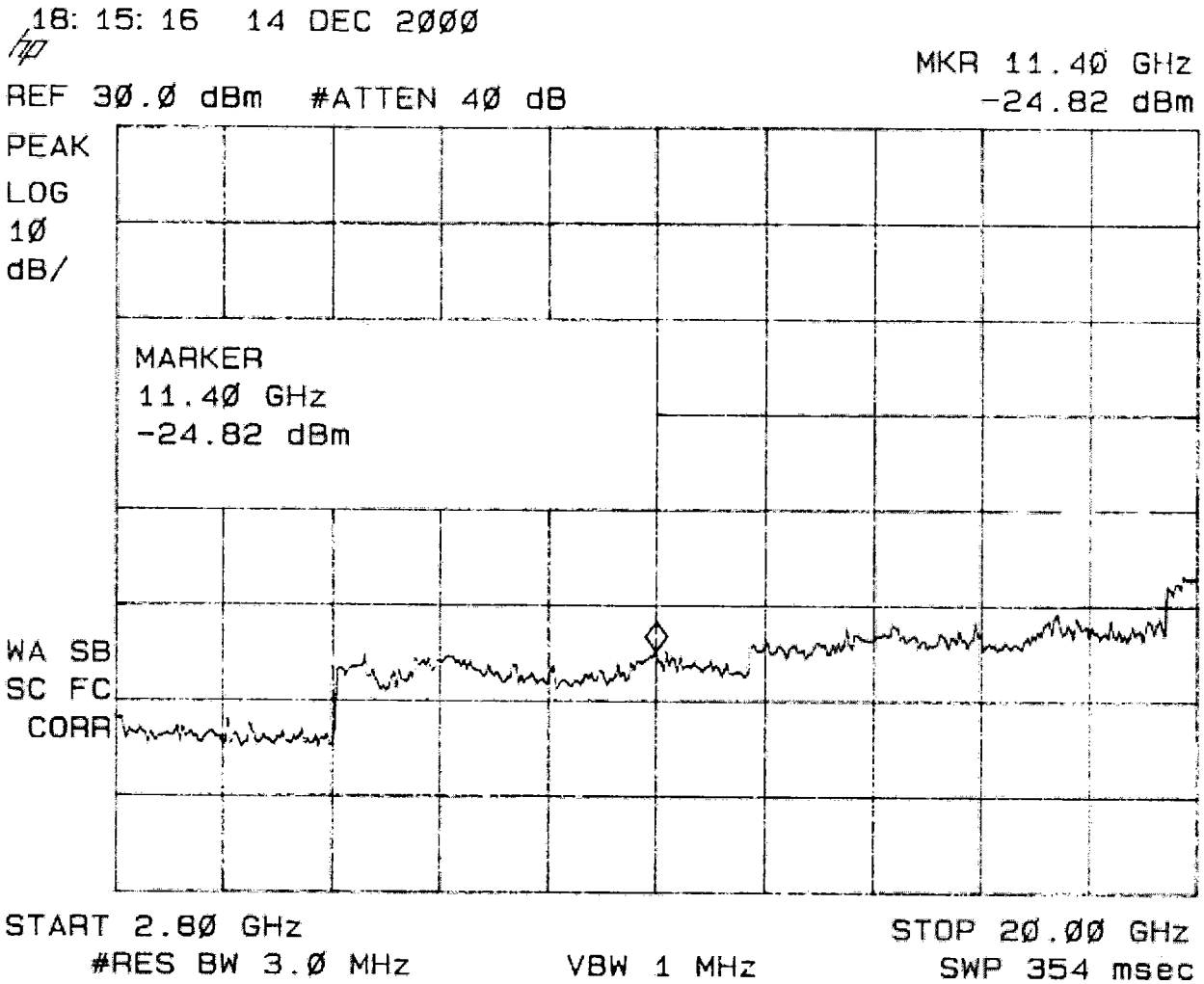


Chart A

MAG

EMC-CENTER

19. Oct 00 10: 12

FCC Part 15 class B

EUT: InSite 1900
Manuf: Nokia
Op Cond: Test Loop max power
Operator: LGH

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	30M	7k	10k	PK	20ms	AUTO	LN OFF	60dB