7. STATEMENT OF COMPLIANCE WITH HUMAN EXPOSURE TO RADIOFREQUENCY ELECTROMAGNETIC FIELDS (ETH ZÜRICH).

See attach letter and ETH report.

SAGEM

SAGEM SA

ETABLISSEMENT DE RECHERCHE
ET DÉVELOPPEMENT DE SAINT-CHRISTOPHE

2, rue du Petit Albi
95800 CERGY SAINT-CHRISTOPHE
B.P. 8250 - 95801 CERGY PONTOISE CEDEX
FRANCE

Tél. (33) 01 30 73 70 70
Télex 609600
Fax (33) 01 30 73 16 60

SPECIFIC ABSORPTION RATE (SAR)
COMPLIANCE STATEMENT

OK

I, hereby undersigned André SEVENS - Chief Design Engineer - Mobile Phones R&D Unit, attest that the SAGEM SA P21 V70 mobile PCS phone complies with the requirements of FCC Report and Order (ET Docket 93-62, August 1st 1997, ANSI/IEEE C95.1-1992).

The tests were performed at the facilities of ETH Zürich, SWITZERLAND. The results of the SAGEM P21 V70 phone and the measurements conditions are given in the attached report of April 2nd 1998.

André SEVENS
Chief Design Engineer
Mobile Phones R&D Unit

Eidgenössische Technische Hochschule Zürich
Ecole polytechnique fédérale de Zurich
Politecnico federale di Zurigo
Swiss Federal Institute of Technology Zurich

Prof. Dr. Niels Kuster
Tel: +41 1 632 2737, Fax: +41 1 632 1057

Dosimetric Evaluation of the Cellular Phone

Sagem P21V70

in accordance with the requirements of

FCC Report and Order: ET Docket 93-62, August 1, 1997, and the interim Guidelines of RSS-102 Draft of Industry Canada of March 10, 1998

Zurich, April 2, 1998

Executive Summary

The PCS1900 Sagem P21V70 device was evaluated in accordance with the FCC report and order ET Docket No. 93-62 [1] (called in the following FCC 93-62) which was complimented with the Supplement C to OET Bulletin 65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", in December, 1997 [2] as well as in accordance with the interim Guidelines of RSS-102 Draft of Industry Canada of March 10, 1998 [3].

The dosimetric tests were performed at the Swiss Federal Institute of Technology in Zurich under supervision of Sagem. For the evaluation, the dosimetric assessment system DASY3 was used, which is currently the most accurate system for dosimetric studies [4], [5]. The phantom employed was the recently developed "Generic Twin Phantom", the first phantom satisfying the worst-case criteria of the CENELEC document [6]. The total uncertainty for the evaluation of the spatial peak SAR values averaged over a cube of 1 g tissue mass has been assessed for this system to be ±23.5%. This uncertainty includes probe, calibration, positioning and evaluation errors as well as errors in assessing the correct dielectric parameters for the brain simulating liquid, etc.

The Sagem P21V70 device, provided by Sagem, was evaluated for right-hand and left-hand usage in the intended use position. The device was tested at the maximum power level defined by the PCS1900 system (Power Class 1 = 30dBm). The output power was controlled by a Rhode&Schwarz Radio Communication Tester CTS55. At each configuration, the spatial peak SAR values were assessed for the traffic channels 512, 661 and 810 which are the lowest, the middle and the highest channel of the PCS1900 system. The output power was monitored before and after each evaluation in order to determine any power drop compared to operation with a fully charged battery. In addition, the antenna input power was measured after the evaluation and found to be well within the system specifications. According to the Canadian standards the values around the eye were assessed and found to be below the required 0.2W/kg.

In summary, the maximum spatial peak SAR value averaged over 1 g of tissue found in all tested configurations was:

Device	SAR_{1g} [mW/g]
Sagem P21V70	1.0 ± 23.5%*

*worst case uncertainty of the system

In conclusion, the tested Sagem P21V70 device **was found to be** in compliance with the requirements of the document FCC 93-62 [1] and the document RSS-102 [3] even if the worst case uncertainty of the system has to be added to the assessed value.

Contents

1 Requirements for Compliance Testing Defined by the FCC and by Industry Canada

The US Federal Communications Commission has released the report and order "Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996 [1]. The order requires routine SAR evaluation prior to equipment authorization of portable telephones, including PCS telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [7] for an uncontrolled environment (Paragraph 65).

According to the Supplement C to OET Bulletin 65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", drafted in December, 1997 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This also holds for the "Compliance Criteria of Mobile Transmitters with Respect to Exposure of Humans to Radio Frequency Fields" drafted on March 10, 1998 by Industry Canada. There, in addition, the SAR averaged for the eye should not exceed 0.2 mW/g. However if the SAR for a single point in the front portion of each eye region of the head phantom does not exceed 0.2 mW/g, then detailed averaging for the eye is not required.

2 Dosimetric Assessment Setup

These measurements were performed with the automated near-field scanning system DASY3 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9 m) which positions the probes with a positional repeatability of better than ±0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines (length ≈ 300 mm) to the data acquisition unit. The system is described in detail in [4].

The SAR measurements were conducted with the dosimetric probe ET3DV5 SN:1302 (manufactured by SPEAG), designed in the classical triangular configuration [4] and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [10] with an accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in [11] and found to be better than ±0.25 dB.

The phantom used was the "Generic Twin Phantom" described in [5]. The ear was simulated as a spacer of 4 mm thickness between the ear piece of the phone and the tissue simulating liquid.

The liquid used for the frequency range of 1750-1950 MHz consisted of 45.0% water, 53.9% sugar and 1% HEC (Hydroxyethylcellulasis WP-40). The liquid has previously been proven to be suited for worst-case assessments [12] and [13].

3 Device and Test Conditions

The sample device was provided by Sagem for this evaluation. The device was put in operation using the Rhode & Schwarz, Digital Radio Tester CTS55. Communication between device and tester was established by air-link in order to simulate the actual usage as close as possible. The spatial peak SAR values were assessed for the lowest, middle and highest channels defined by a

PCS1900 system (i.e., #512 = 1850.2 MHz, #661 = 1880 MHz and #810 = 1909.8 MHz). The RF level at which the device transmitted was set to maximum power; Level 0 = 30 dBm.

The device was placed in the intended use position. This position is defined by a reference plane and a line. The reference plane of the head is given by three points, the auditory canal openings of both ears and the center of the closed mouth. The reference line of the phone is defined by the line which connects the center of the ear piece with the center of the bottom of the case and lies on the surface of the case facing the phantom. With these definitions the positions of the phone are characterized as follows:

- The reference line of the phone lies in the reference plane of the head. The center of the ear piece of the phone is placed at the entry of the auditory canal. The angle between the reference line of the phone and the line connecting both auditory canal openings is 80°.

Tests were conducted for right-hand and left-hand usage. The distances between the antenna axis at the joint and the liquid surface were:

position	left-hand [mm]	right-hand [mm]
intended use	21.5	17

The device has a non-extendable helix antenna. After the evaluation, the actual antenna input power of the device was measured in order to ensure that the device operated at highest power level. A standard low loss cable (< 0.3 dB loss) was connected to the 50 ohm point below the antenna and its matching network. Using the setup shown in Figure 1, the device was set to exactly the same operational conditions as during the tests and the antenna input power was measured with the power meter HP437B.

The assessed power for the lowest (512), the middle (698) and the highest (885) channel was 30.8 ± 0.1 dBm. Hence, the power at the car adapter port was within the specifications of the maximum power level for the PCS1900 system.

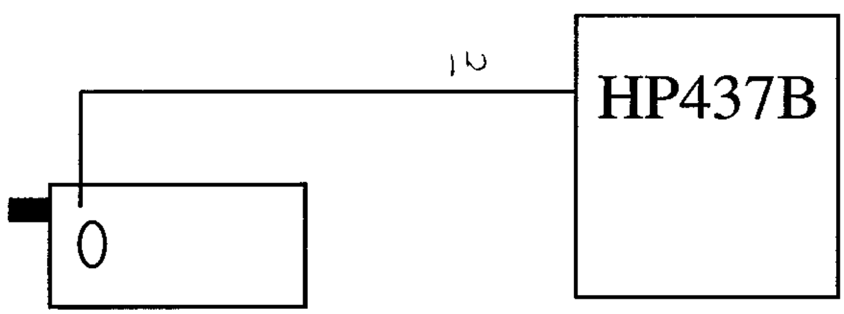

Figure 1: Setup used for assessment of the antenna input power.

4 Evaluation Procedure

The dielectric parameters were controlled prior to assessment using the HP85070A dielectric probe kit. The dielectric parameters were:

frequency	ϵ_r^*	σ^*	ρ^{**}
1800 MHz	41.0 ±5%	1.72 ±10% mho/m	1000 kg/m^3
1900 MHz	40.5 ±5%	1.84 ±10% mho/m	1000 kg/m^3

*worst case uncertainty of the HP85070A dielectric probe kit

**worst case assumption

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±5%. The validation was performed at 1800 MHz.

validation kit	SAR_{1g} [mW/g] targeted	SAR_{1g} [mW/g] measured
D900V2 SN:201	39.2	39.1

The evaluation was performed the with following procedure:

- **Step 1:** Measurement of the SAR value at a fixed location above the ear point was used as a reference value for assessing the power drop.
- **Step 2:** The SAR distribution at the exposed side of the head was measured at a distance of 3.9 mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 20 mm x 20 mm. Based on this data, the area of the maximum absorption was determined by spline interpolation.
- **Step 3:** Around this point, a volume of 32 mm x 32 mm x 34 mm was assessed by measuring 5 x 5 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure:
  1. The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm [14]. A polynomial of the fourth order was calculated hrough the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
  2. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the "Not a knot"-condition (in x, y and z-directions) [14], [15]. The volume was integrated with the trapezoidal - algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
  3. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
- **Step 4:** Remeasurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

5 Measurement Uncertainty

The uncertainty budget has been determined for the DASY3 measurement system according to the NIS81 [8] and the NIST1297 [9] documents and is given in the following Table 1. The extended uncertainty ($K = 2$) was assessed to be ±23.5 %.

Uncertainty Description	Error	Distrib.	Weight	Std. Dev.	Offset
Probe Uncertainty					
axial isotropy	±0.2 dB	U-shape	0.5	±2.4 %	
spherical isotropy	±0.4 dB	U-shape	0.5	±4.8 %	
Isotropy from gradient	±0.5 dB	U-shape	0		
Spatial resolution	±0.5 %	normal	1	±0.5 %	
Linearity error	±0.2 dB	rectang.	1	±2.7 %	
Calibration error	±3.3 %	normal	1	±3.3 %	
SAR Evaluation Uncertainty					
Data acquisition error	±1 %	rectang.	1	±0.6 %	
ELF and RF disturbances	±0.25 %	normal	1	±0.25 %	
Conductivity assessment	±10 %	rectang.	1	±5.8 %	
Spatial Peak SAR Evaluation Uncertainty					
Extrapol boundary effect	±3 %	normal	1	±3 %	±5 %
Probe positioning error	±0.1 mm	normal	1	±1 %	
Integrat. and cube orient	±3 %	normal	1	±3 %	
Cube shape inaccuracies	±2 %	rectang.	1	±1.2 %	
Device positioning	±6 %	normal	1	±6 %	
Combined Uncertainties				**±11.7 %**	**±5 %**

Table 1: Uncertainty budget of DASY3

6 Results

Table 2 summarizes the results of the performed dosimetric evaluation. The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the device, are added in the Appendix.

The location of the virtual eye point of the head phantom was found to be outside the region where the SAR values are higher or equal to 0.1 mW/g, which takes into account the increased absorption due to the higher conductivity of the eye tissue.

7 Compliance with FCC Requirements and the Requirements of RSS-102 Draft of Industry Canada

The maximum spatial peak SAR value averaged over 1 g assessed in normal or intended use position was 1.0 mW/g ± 23.5% for the Sagem P21V70 device, which is in compliance with the requirements of the document FCC 93-62 [1] even if the worst case uncertainty of the system

Sagem P21V70 Device		
	left-hand usage	right-hand usage
Channel	SAR_{1g} [mW/g]	SAR_{1g} [mW/g]
512 (1850.2 MHz)	0.67	0.96
661 (1880 MHz)	0.7	1.0
810 (1909.8 MHz)	0.65	0.91

Table 2: Summary of the dosimetric evaluation. The power drop during measurements compared to power with fully charged battery was less than 2%. **Note:** The uncertainty of the system (±23.5%) is not included.

has to be added to the assessed value. In addition it is also found to be in compliance with the requirements of the RSS-102 Draft of Industry Canada [3].

Jürg Fröhlich, March 1998

References

[1] Federal Communications Commission, "Report and order: Guidelines for evaluating the environmental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.

[2] David L. Means Kwok Chan, Robert F. Cleveland, "Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commision, Office of Engineering & Technology, Washington, DC, 1997.

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[4] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", *IEEE Transactions on Microwave Theory and Techniques*, vol. 44, pp. 105–113, Jan. 1996.

[5] Niels Kuster, Ralph Kästle, and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with known precision", *IEICE Transactions on Communications*, vol. E80-B, no. 5, pp. 645–652, May 1997.

[6] CENELEC, "Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz - 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.

[7] ANSI, *ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.

[8] NIS81 NAMAS, "The treatment of uncertainity in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.

[9] Barry N. Taylor and Christ E. Kuyatt, "Guidelines for evaluating and expressing the uncertainity of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994.

[10] Katja Poković, Thomas Schmid, and Niels Kuster, "Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies", in *ICECOM97*, Dubrovnik, October 15–17, 1997, pp. 120–124.

[11] Katja Poković, Thomas Schmid, and Niels Kuster, "E-field probe with improved isotropy in brain simulating liquids", in *Proceedings of the ELMAR*, Zadar, Croatia, 23–25 June, 1996, pp. 172–175.

[12] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard Kühn, and Niels Kuster, "The dependence of EM energy absorption upon human head modeling at 900 MHz", *IEEE Transactions on Microwave Theory and Techniques*, vol. 44, no. 10, pp. 1865–1873, Oct. 1996.

[13] Klaus Meier, Ralf Kästle, Volker Hombach, Roger Tay, and Niels Kuster, "The dependence of EM energy absorption upon human head modeling at 1800 MHz", *IEEE Transactions on Microwave Theory and Techniques*, Oct. 1997, in press.

[14] W. Gander, *Computermathematik*, Birkhaeuser, Basel, 1992.

[15] W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery, *Numerical Recepies in C, The Art of Scientific Computing, Second Edition*, Cambridge University Press, 1992.

8 Appendix

Plots of the measured SAR distributions inside the phantom are given in this Appendix for the tested configurations. The spatial peak SAR values were assessed with the procedure described in the report.

Please be aware that the graphical visualization of the phone position onto the SAR distribution gives only limited information on the current distribution of the device, since the curvature of the head results in graphical distortion. Full information can only be obtained either by H-field scans in free space or SAR evaluations with a flat phantom.

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17.9 FILE

SAGEM

SAGEM Inc.

Terminals and Telecommunications Division

P.O Box 5755
5150 Pelham Road
Greenville, SC 29606
USA
Phone 864/ 297 1700
Fax 864/ 297 9156

7-24-98

GI

FCC ID: M9H95380002

TELECOPIE / FACSIMILE

Date : 08/06/98 Heure : 2:37 PM N° :
Date : Time : N° :

DE / *FROM* : Mr O. CHARLANES	**A / *TO* : Mr Greg Czumak**	**COPIE (S) / *COPY (IES)* :**
Service : **R&D** *Dept.* : **MOBILE PHONE**	Société : FCC *Firm :*	
Tél. / *Tel. : (864) 297 1709 - 251*	Service / *Dept.*	
Fax (B.A.L.) : (864) 297 91 56 *Fax (M.BOX) :*	Fax (B.A.L.) : 301/ 344-2050 *Fax (M.BOX) :*	

This message contains 11 *page (s) including this one.* *Confidential* ☒ *Urgent* ☒

Dear Greg Czumak,

I tried to contact Charlie Cobbs but he doesn't seem to be here.
So, please find attached the documents relative ti the P21 variants :

-1- a description of the differences between the variants P21 L, P21 F and P21 OL and the already certified P21 S,

-2- a "Mobile Phone Versions - Compliance Statement",

-3- the drawings of the P21 variants.

Moreover, we have received the notification from CETECOM that the P21 variants have succesfully completed testing.
So, could you update our FCC file with these variants ?

Thank you in advance.

Best regards

Olivier Charlanes

SAGEM

SAGEM Inc.

Terminals and Telecommunications Division

P.O Box 5755
5150 Pelham Road
Greenville, SC 29606
USA
Phone 864/ 297 1700
Fax 864/ 297 9156

Description of the SAGEM terminal equipment variants

1. Equality

The basic hardware (PCB Board, Layout, mounted components) of the SAGEM terminal equipement variants P21 L, P21 F and P21 OL is identical with the harware of the already certified MS type P21 S.

2. Differences

In comparaison with the P21 S, the P21 OL has the following differences:
* a different front cover design
* a another ear piece
* different shapes of the keypad buttons
* a different shape for the display
* a changed shape of the plastic casing on the reverse side, so that a big battery type fits into this shape.

In comparaison with the P21 S, the P21 L has the following differences :
*a changed shape of the plastic casing on the reverse side, so that a big battery type fits into this shape.

In comparaison with the P21 S, the P21 F has the following differences:
* a different front cover design
* a another ear and mouthpiece
* different shapes of the keypad buttons
* a different shape for the display
* a movable flap which covers the most of the keypad buttons when it is closed.

All the mobile stations types have got minor mechanical differences only.

Best regards,

Olivier Charlanes

SAGEM

SAGEM SA

ETABLISSEMENT DE RECHERCHE
ET DEVELOPPEMENT DE SAINT-CHRISTOPHE

2, rue du Petit Albi
95800 CERGY SAINT-CHRISTOPHE
B.P. 8250 - 95801 CERGY PONTOISE CEDEX
FRANCE

Tél. (33) 01 30 73 70 70
Télex 609600
Fax (33) 01 30 73 16 60

Cergy, July 8th 1998.

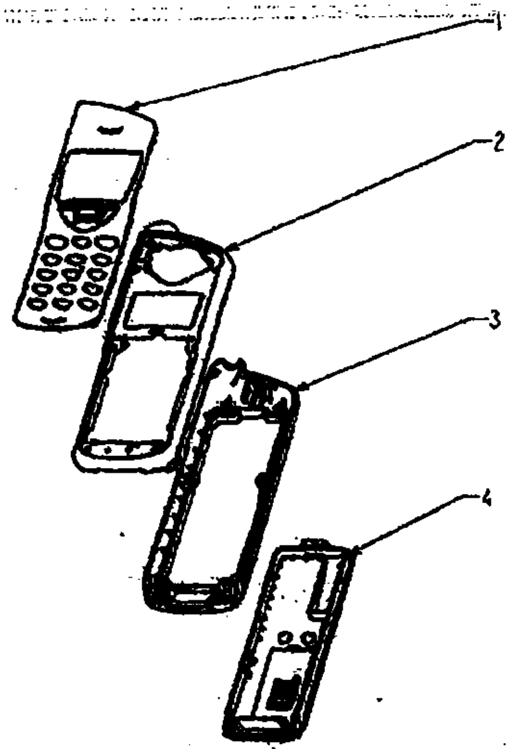
Mobile Phone Versions
COMPLIANCE STATEMENT

I, hereby undersigned André SEVENS - Chief Design Engineer - Mobile Phones R&D Unit, attest that :

- the mobile SAGEM GSM 1900 MHz P21S,
- the mobile SAGEM GSM 1900 MHz P21L,
- the mobile SAGEM GSM 1900 MHz P21F,
- and the mobile SAGEM GSM 1900 MHz P21OL

are using the same PCB with the same mounted components.

André SEVENS
Chief Design Engineer
Mobile Phones R&D Unit



1 : PLASTRON G21L
2 : COQUE SUP SANS FLAP
3 : COQUE INF DOS ROND
4 : BATTERIE DOS ROND

LIBELLE: P21 L

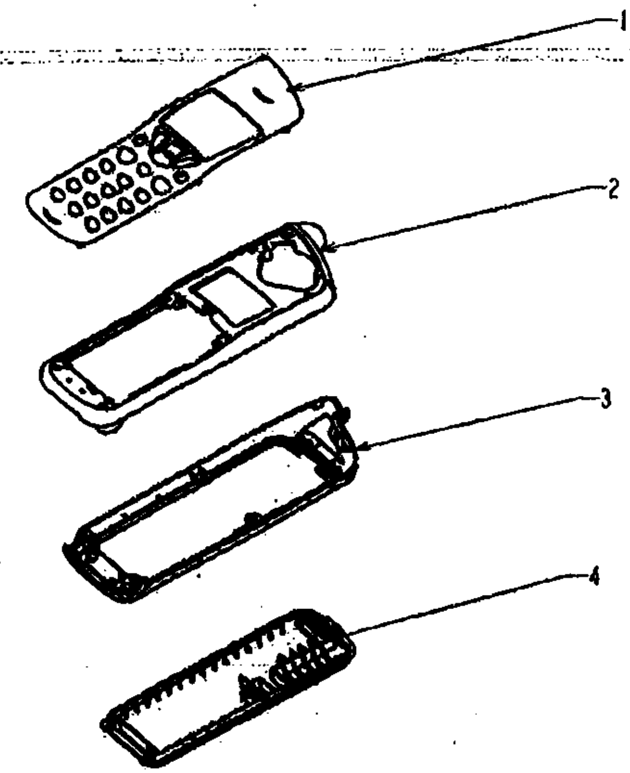
SAGEM

FEUILLE/SHEET 1/1

ECHELLE/SCALE 0.5

FORMAT/SIZE A3

SAGEM SA F6151



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2 : COQUE SUP SANS FLAP
3 : COQUE INF DOS PLAT
4 : BATTERIE DOS PLAT

CAO/CAD : PRO/ENGINEER (PTC)

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ETABLI / DRAWN | NOM/NAME | DATE | VERIFIE / CHECKED | NOM/NAME | DATE

LIBELLE: P21 S

DENOMINATION

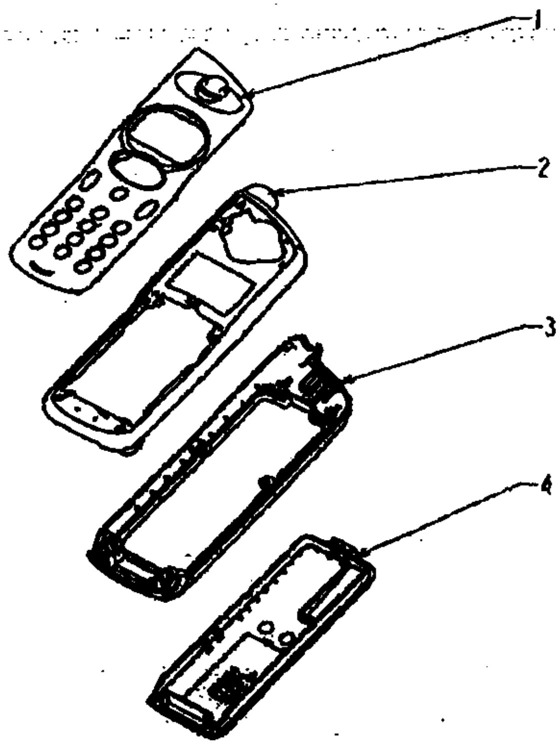
SAGEM

FEUILLE/SHEET 1/1

R.FAB/P.N.

SAGEM SA

FORMAT / SIZE A3



1 : PLASTRON ZAPPING
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3 : COQUE INF DOS ROND
4 : BATTERIE DOS ROND

CAO/CAD : PRO/ENGINEER (PEC)				
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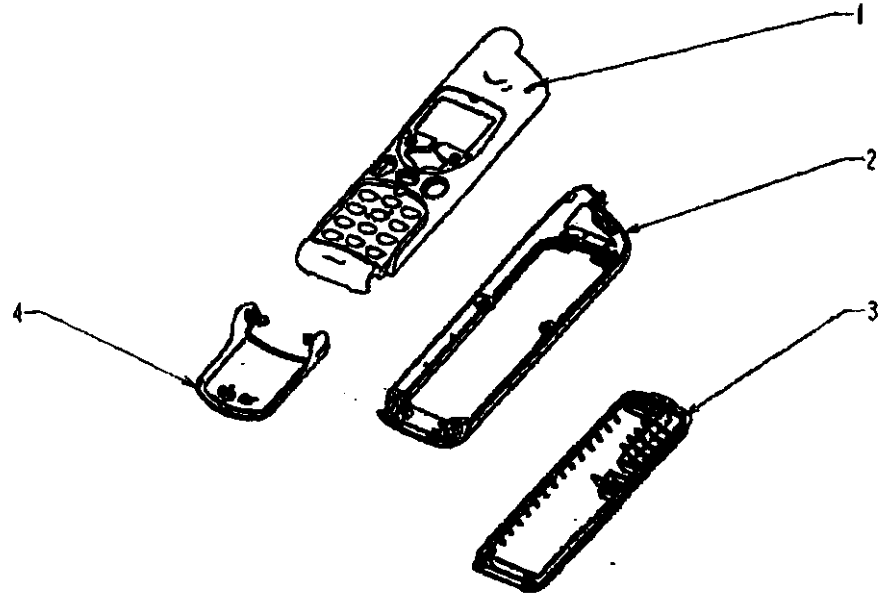
R. FAB/P. U,		FORMAT/SIZE A3		
SAGEM SA				



1 : COQUE SUP FLAP
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3 : BATTERIE DOS PLAT
4 : FLAP

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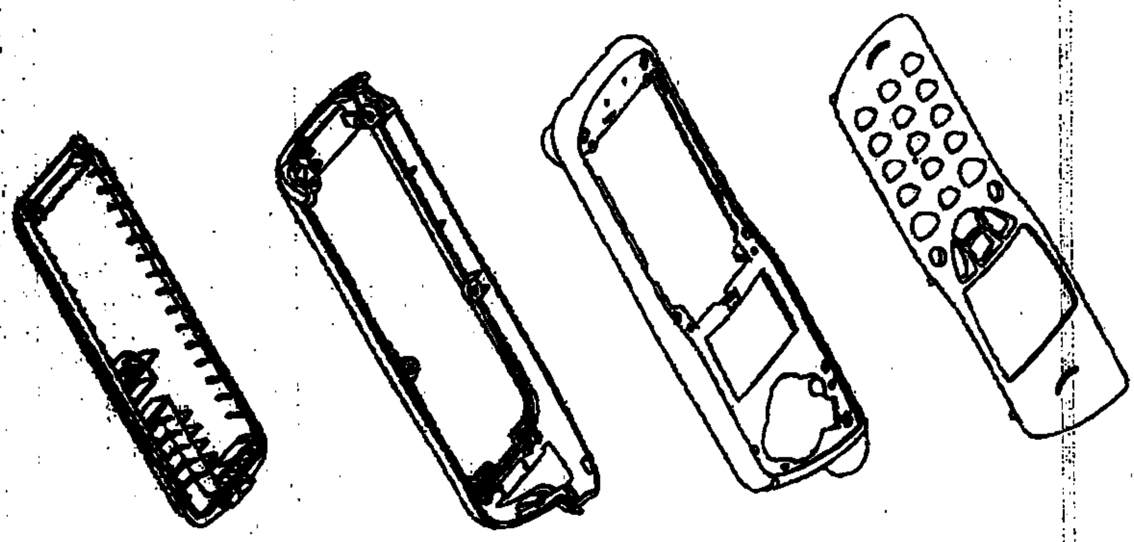
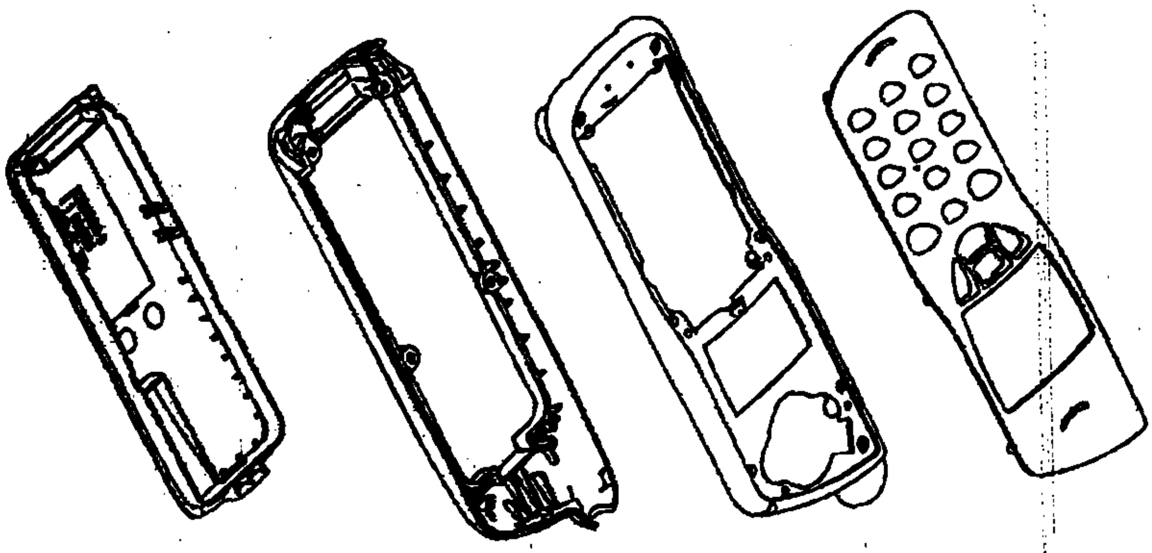
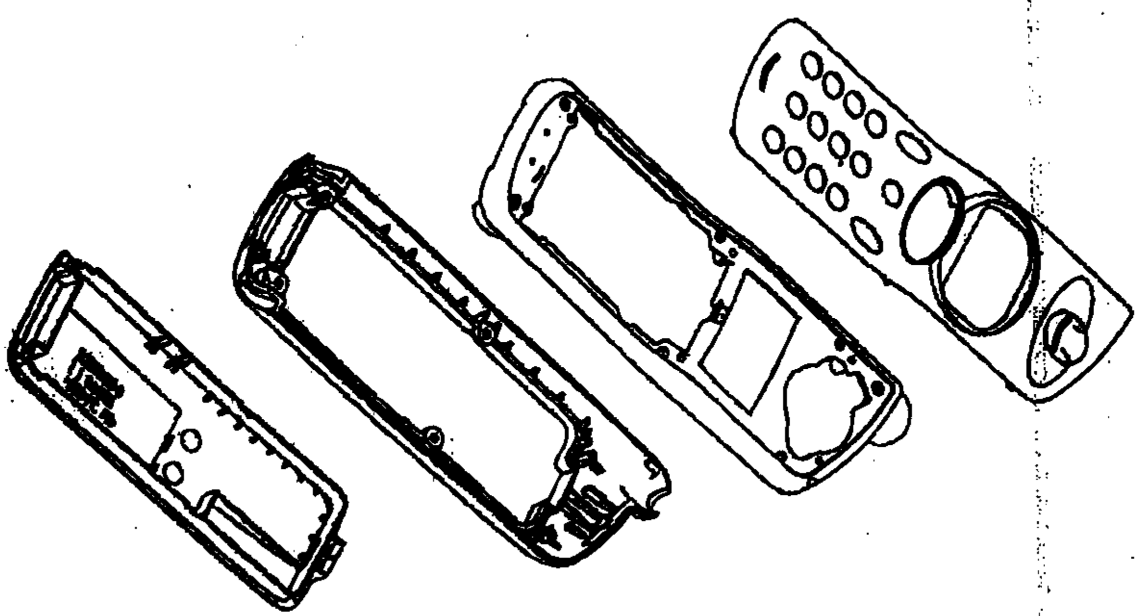
DENOMINATION			FEUILLE/SHEET 1/1	
R.FAB/P.N.		FORMAT A?		

SAGEM SA







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