Test Report

DANAK
Reg. no. 19

Emission tests to FCC requirements of Precise Miranda

Performed for Precise Biometrics AB

DANAK-196071
Project no.: K222371-6
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5 annexes

2002-03-05

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Title	Emission tests to FCC requirements of Precise Miranda
Test object	Precise Miranda with Mifare contactless smart card
Report no.	DANAK-196071
Project no.	K222371-6
Test period	November 2001 - February 2002
Client	Precise Biometrics AB Dag Hammerskjöldsväg S-224 64 Lund Sweden Telephone: +46 46 311100 Fax: +46 46 311101
Contact person	Mr. Håkan Lohmander
Manufacturer	Precise Biometrics AB
Specifications	47 CFR Part 15, Subpart B - Unintentional Radiators 47 CFR Part 15, Subpart C - Intentional Radiators
Results	The equipment under test was in compliance with the requirements
Test personnel	Jesper Nielsen Vagn Sylvest
Date	2002-03-05
Responsible	 Vagn Sylvest B.Sc.E.E., EMC DELTA

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1. Summaries

1.1 Technical Report Summary

The tests reported in this document have been performed to demonstrate compliance with the requirements of FCC for Information Technology Digital Equipment and for intentional transmitters, operating within the band 13.553 - 13.567 MHz.

This report contains measurement data from tests performed at DELTA, Denmark, a FCC listed and DANAK accredited test laboratory.

1.1.1 Applicable FCC Rules for test

47 CFR Part 15, Subpart B – Unintentional Radiators

§15.107 Conducted limits
§15.109 Radiated emission limits, general requirements

47 CFR Part 15, Subpart C – Intentional Radiators

§15.207 Conducted limits
§15.209 Radiated emission limits, general requirements
§15.225 Operation within the band 13.553 - 13.567 MHz

The methods and procedures have been applied as specified in:

ANSI C63.4:1992 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.2 Summary of tests

The results of the emission tests can be summarised as follows:

Tests of Unintentional Radiator	**Key references to requirement**	**FCC Part 15, Subpart B, Class B**
Conducted emission, AC mains	§ 15.107	Passed
Radiated electromagnetic field emission	§ 15.109	Passed

Tests of Intentional Radiator	**Key references to requirement**	**FCC Part 15 Subpart C**
Conducted emission, AC mains	§ 15.207	Passed
Radiated electromagnetic field emission	§15.209	Passed
Peak Field Strength	§ 15.225(a)	Passed
Occupied Bandwidth	§ 15.225(b)	Passed
Frequency tolerance over temperature	§ 15.225(c)	Passed
Frequency tolerance over supply voltage range	§ 15.225(c)	Passed

Abbreviations

Passed	:	The requirements are met.
Not done	:	No test was performed.
N/A	:	Not applicable.
Not relevant	:	The test was not relevant for the test object.

The test results relate only to the specimen tested.

2. Test specimen(s)

The test object consists

2.1 Test object - Precise Miranda

Category	Information Technology Equipment with intentional radiator
Manufacturer	Precise Biometrics AB
Model / type	Precise Miranda
Part no.	MS 010 040
Serial no.	-
FCC ID	-
Supply voltage	7-12 VAC
Operational mode	Reading contactless smart card

2.2 Test object- -AC Adapter

Category	AC adapter
Manufacturer	Nordic Power AB
Model / type	A20960C 9 VAC
Part no.	-
Serial no.	-
FCC ID	-
Supply voltage	120 VAC
Operational mode	Normal, 120 VAC

2.3 AUX equipment - Precise Fingerprint reader

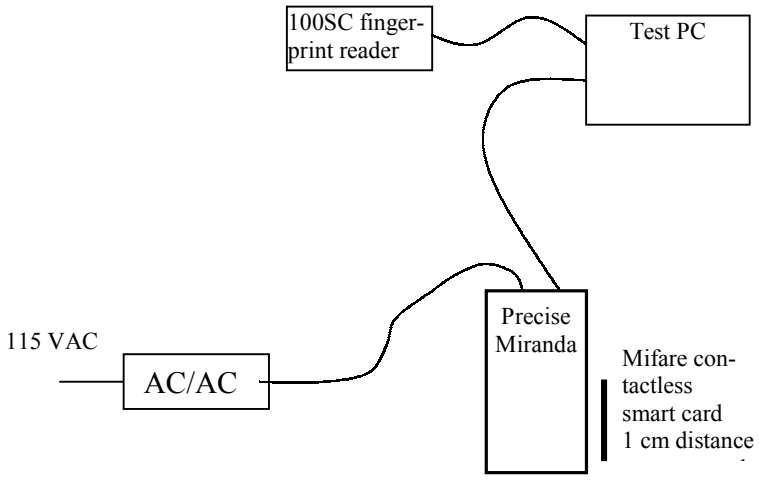
Manufacturer	Precise Biometrics AB
Model / type	100SC
Part no.	MS 010 004
Serial no.	0001
FCC ID	PBKMS010004

2.4 AUX equipment - Test PC

Manufacturer	IBM
Model / type	ThinkPad 600E/2645-3AQ
Part no.	-
Serial no.	5502ZP2-02/99
FCC ID	4U6JPN-32476-DT-E

3. General test conditions

3.1 Test set-up



Precise Miranda is a programming unit to programme standard Mifare contactless smart cards.

During test a DOS programme in the test PC can constantly read a Mifare card mounted on the Precise Miranda unit.

When the card is removed a carrier modulated five times a second by a request command (duration below 100 µs) is transmitted continuously. This mode was used for most tests.

During conducted emission tests a shorted ring was placed in the card position. This has the consequence that the transmitter is loaded and that the radiated part of the field is reduced.

The power adapter / EUT was powered from 115 VAC 50 Hz during tests.

4. Test and results

4.1 Conducted emission, AC mains (FCC Part 15, Subpart B, Class B and FCC Part 15, Subpart C)

	Requirements
Specification 1	FCC Rules and Regulations Part 15, Subpart B, Class B
Specification 2	FCC Rules and Regulations Part 15, Subpart C
Test set-up	ANSI C63.4:1992
Frequency range	0.45 - 30 MHz
Limit: (quasi-peak) As specified in 15.107(a) 15.207(a)	0.45 - 30 MHz: 48 dBµV
Test record sheets	*Annex 3*

Results:

The emission was within the specified limits.

Comments:

Supply voltage: 115 VAC.

During conducted emission tests a shorted ring was placed in the card position. This has the consequence that the transmitter is loaded and that the radiated part of the field is reduced. It this way the directly conducted emission can be measured without being overlaid with a strong portion of radiated field, picked up by the power conductor.

4.2 Radiated electromagnetic field (FCC Part 15, Subpart B, Class B and FCC Part 15, Subpart C)

	Requirements	
Specification 1	FCC Rules and Regulations Part 15, Subpart B, class B	
Specification 2	FCC Rules and Regulations Part 15, Subpart C	
Test set-up	ANSI C63.4:1992	
Measuring distance	3 m, except 13 to 30 MHz band which is measured at 30 m	
Frequency range	13 - 30 and 30 - 1.000 MHz	
Limits: As specified in 15.109(a) 15.209(a) and 15.225(a)	13 - 30 MHz 13.553 - 13.567 MHz 30 - 88 MHz: 88 - 216 MHz: 216 - 960 MHz: Above 960 MHz:	29.5 dBµV/m 80 dBµV/m 40 dBµV/m 43.5 dBµV/m 46 dBµV/m 54 dBµV/m
Measurement uncertainty (2 σ) <1 GHz Measurement uncertainty (2 σ) >1 GHz		2.6 dB 4.9 dB
Test record sheets *Note*: The transducer values have been calculated/corrected for in the level shown in the 2nd column of the test record sheet.		*Annex 4*

Measurement results in tabular form

Frequency MHz	**Polarity**	**Measured dBµV/m**	**dB to limit**	**Notes**
13.56	Vertical	41.3	38.7	No harmonics or other spurious emissions were detected in the band 13 MHz to 30 MHz
162.0	Vertical	36.2	7.3	
162.2	Vertical	36.9	6.6	
326.11	Horizontal	37.1	8.9	
456.3	Vertical	37.4	8.6	

Result

The emission was within the specified limits.

Comments

Because the transmitter is operating on 13.56 MHz, radiated emission measurements have been performed from 13 MHz and up.

Measurements were performed with the card removed enabling the transmitter to send constant carrier.

Measurements were performed also when the system was communicating with card enabling observation of modulation products. The survey of the content of modulation products was performed using relative measurements on a distance of 9 m using a rod antenna. For plot of this survey measurement, see *annex 4*.

Measurements using a magnetic loop antenna from 13 to 30 MHz were performed on a 30 m OATS.

4.3 Peak field strength

§ 15.225(a) specifies the peak field strength within the band 13.553 - 13.567 MHz to be maximum 10.000 microvolts/meter at 30 meters, or 80 dBµV/m.

The maximum field strength measured at a distance of 30 m was 41.3 dBµV/m, 38.7 dB below the limit.

The carrier is 11.8 dB above the spurious limit.

Result

The EUT is in compliance with the requirement(s).

4.4 Occupied bandwidth

§ 15.225(b) specifies that emission outside the band 13.553 - 13.567 MHz shall be in compliance with the requirements of 15.209.

Using a spectrum analyser with RBW=VBW=100 Hz, the 20 dB bandwidth was measured to 349 Hz with the transmitter constantly transmitting (no card detected). The 20 dB level is lower than the spurious limit. The carrier bandwidth is expected to be less if measured using a narrower bandwidth.

The limits of the transmission band are reached when only spurious emission can be measured.

Based on the frequency measurements to be presented in *section 4.5 and 4.6*, it can be calculated that the carrier will come no closer to the lower frequency limit than 13559617 - (349/2 + 13553000) = 6442.5 Hz and no closer to the upper frequency limit than 13567000 - (349/2 + 13560771) = 6054.5 Hz.

Result

The EUT is in compliance with the requirement(s).

4.5 Frequency tolerance over temperature

§ 15.225(c) specifies that the frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of -20°C to +50°C at normal supply voltage.

Temperature	Minutes after switch ON	Frequency Hz	% from frequency measured at 20°C	Result
20°C	10	13559617	0	Reference
+50°C	0	13560571	0.007	Passed
+50°C	2	13560571	0.007	Passed
+50°C	5	13560571	0.007	Passed
+50°C	10	13560571	0.007	Passed
-20°C	0	13560771	0.0085	Passed
-20°C	2	13560771	0.0085	Passed
-20°C	5	13560771	0.0085	Passed
-20°C	10	13560771	0.0085	Passed

Result

The EUT is in compliance with the requirement(s).

Comments/procedure

During temperature transitions the carrier was left on and the spectrum analyser set in max-hold showing the carrier. In this way it can be observed that the carrier frequency stays within limits on all temperatures between extreme temperature limits.

The EUT was switched off for 10 min before measurements on the carrier frequency at the temperatures -20°C, +20°C and +50°C using a spectrum analyser and a marker generator. Therefore, double traces can be observed on the test record sheets. This method enables frequency measurements with the accuracy of the marker generator.

4.6 Frequency tolerance over supply voltage range

§ 15.225(c) specifies that the frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C.

Supply voltage (actual)	% from nominal (target voltage)	Frequency Hz	% from frequency measured at 120 VAC	Temperature °C
101.9 VAC	85% of 120 VAC	13559617	0	20°C
120 VAC	100%	13559617	0	20°C
138.1 VAC	115% of 120 VAC	13559617	0	20°C

Result

The EUT is in compliance with the requirement(s).

Comments

The carrier frequency was measured during the tests using a spectrum analyser and a marker generator. Therefore, double traces can be observed on the test record sheet. Using this method it is possible to measure the frequency with the accuracy of the marker generator, which is very high.

Annex 1

List of instruments

(1 page)

LIST OF INSTRUMENTS

NO.	DESCRIPTION	MANUFACTURER	TYPE NO.	CAL. EXPIRES
29224	BROADBAND ROD ANTENNA	SINGER	95010-1	2003-01-08
29300	MEASURING RECEIVER	ROHDE & SCHWARZ	ESH3, 335.8017.52	2003-01-03
29332	ACTIVE LOOP ANTENNA	ROHDE & SCHWARZ	HFH-Z2	2002-04-20
29433	SPECTRUM ANALYZER	HEWLETT-PACKARD	8566 B	2002-05-06
29439	ARTIFICIAL MAINS NETWORK	EMCO	3825/2	2002-07-17
29680	IMPULSE VOLTAGE LIMITER	ROHDE & SCHWARZ	ESH3/Z2	2003-01-02
29797	BILOG ANTENNA, 30-1000 MHz	CHASE ELECTRICS LTD	CBL 6111A	2003-07-27
29861	EMI-SOFTWARE Ver. 1.60	ROHDE & SCHWARZ	ES-K1, PART: 1026.6790.02	ONLY CAL. IF REQUIRED
29916	AUTOMATIC TEST RECEIVER, 9 kHz-2.75 GHz	ROHDE & SCHWARZ	ESCS 30 1102.4500.30	2003-01-02

Annex 2

Photos

(3 pages)

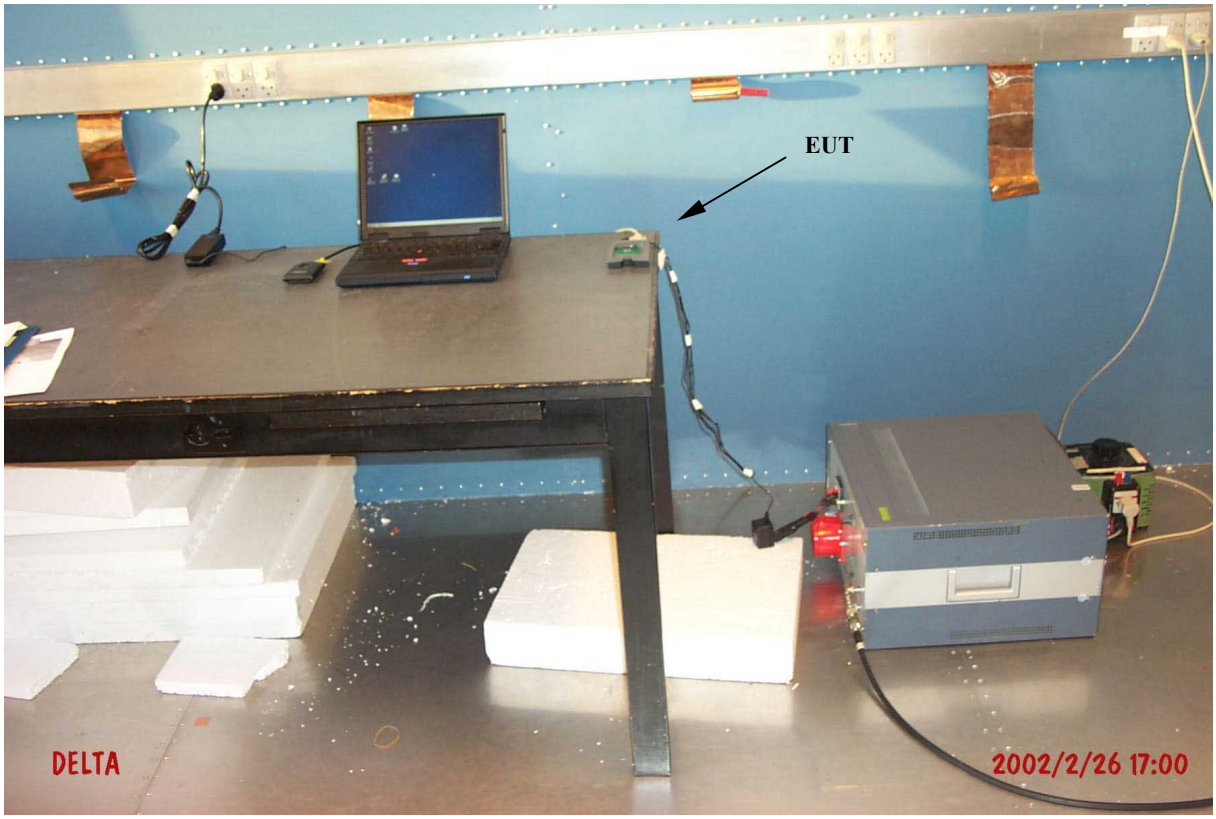


Photo 1 FCC Conducted emission on AC mains port.

Photo 2 EUT with card.

Photo 3 FCC Radiated emission 30 - 1000 MHz.

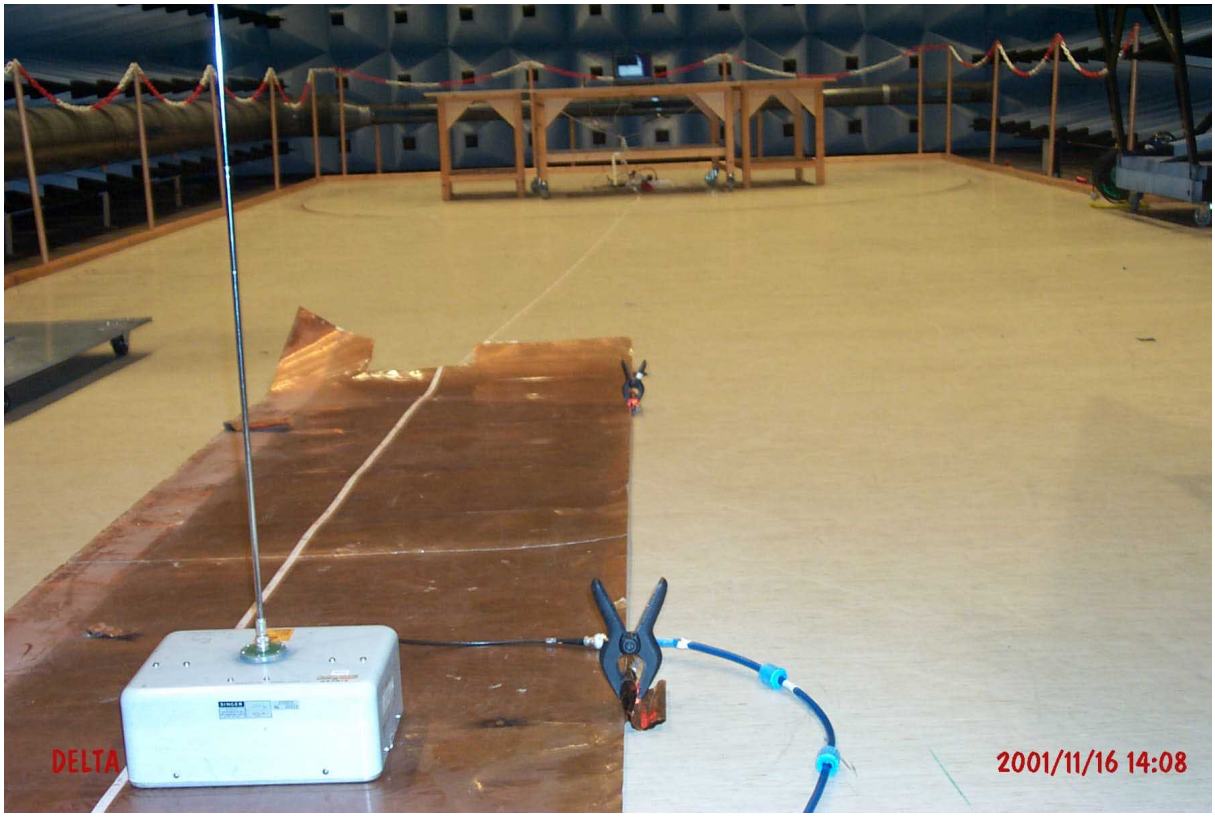


Photo 4 Measurements of modulation products at a distance of 9 m. Survey only.

Photo 5 Radiated measurements using magnetic loop. 13 MHz to 30 MHz on 30 m OATS. EUT shown in position with maximum radiation.

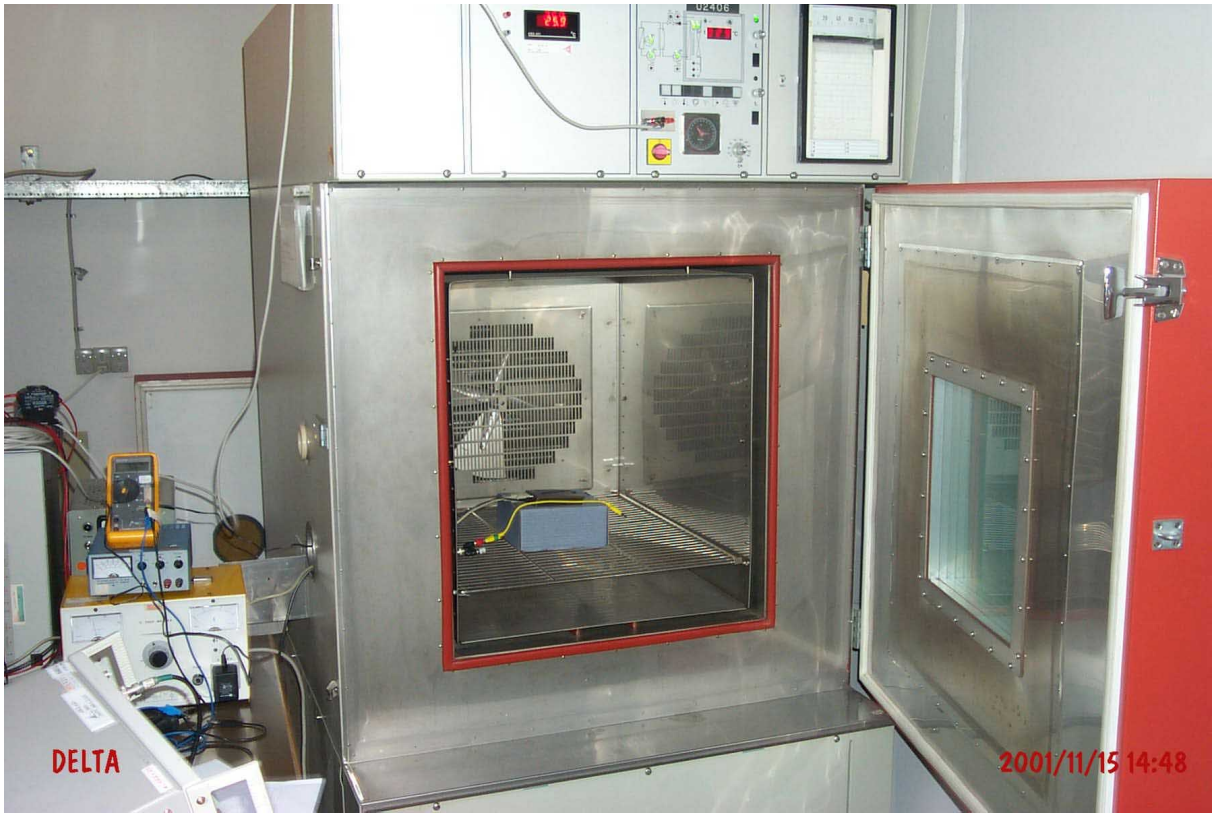
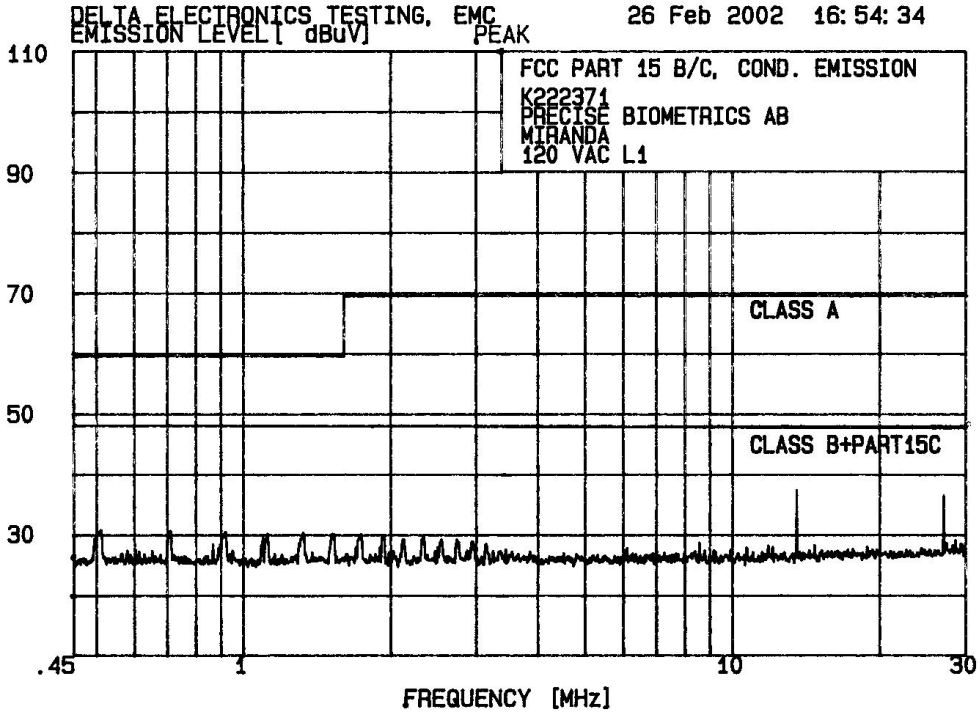


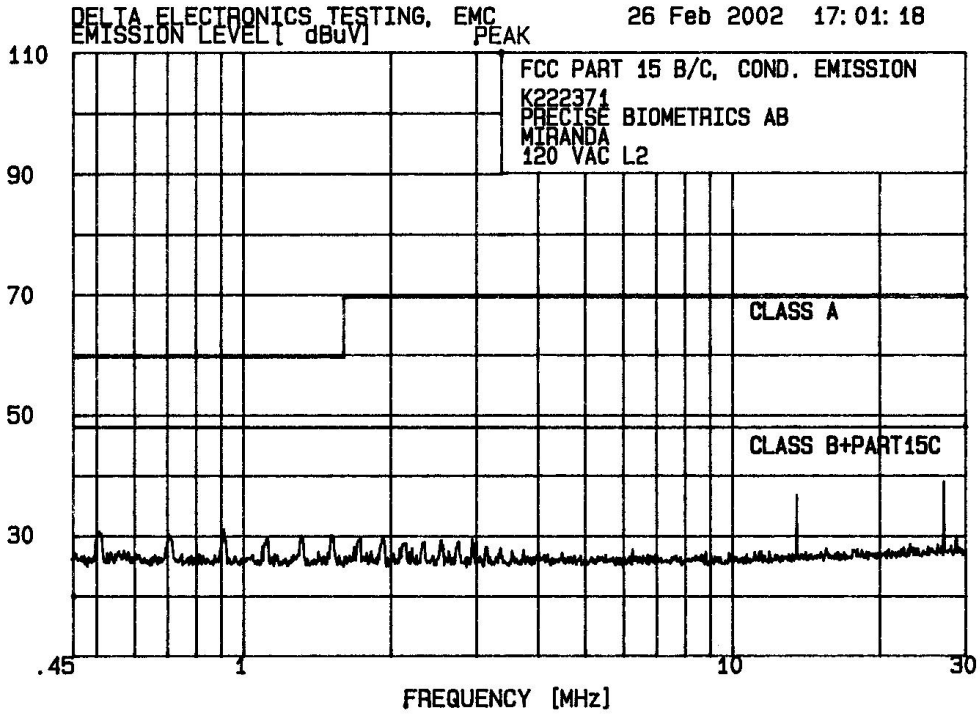
Photo 6 Measurements in climatic chamber.

Annex 3

Test record sheet regarding conducted emission on power port

(1 page)


DELTA ELECTRONICS TESTING, EMC 26 Feb 2002 16:54:34
EMISSION LEVEL[dBuV] PEAK
FCC PART 15 B/C, COND. EMISSION
K222371
PRECISE BIOMETRICS AB
MIRANDA
120 VAC L1
CLASS A
CLASS B+PART15C
110
90
70
50
30
.45
1
10
30
FREQUENCY [MHz]


DELTA ELECTRONICS TESTING, EMC 26 Feb 2002 17:01:18
EMISSION LEVEL[dBuV] PEAK
FCC PART 15 B/C, COND. EMISSION
K222371
PRECISE BIOMETRICS AB
MIRANDA
120 VAC L2
CLASS A
CLASS B+PART15C
110
90
70
50
30
.45
1
10
30
FREQUENCY [MHz]

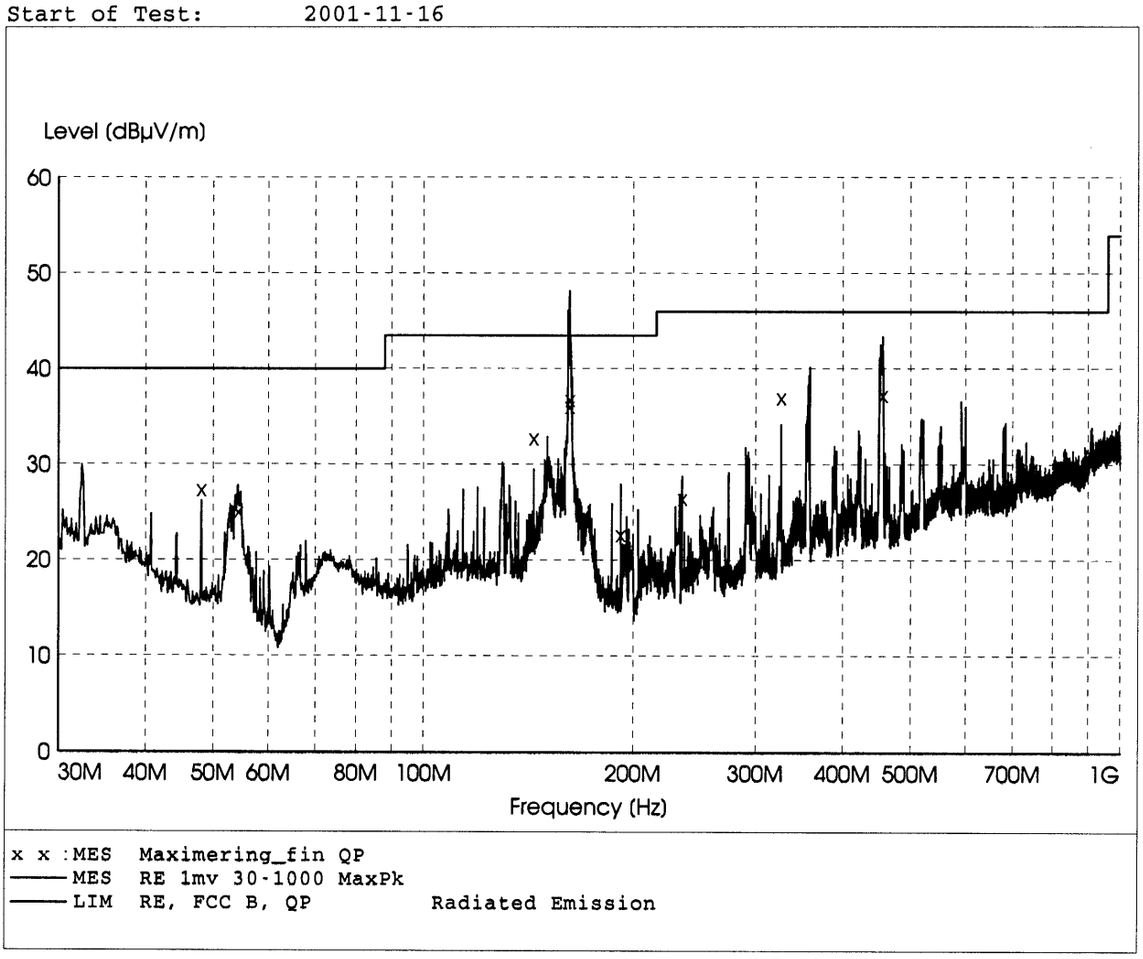
Annex 4

Test record sheets regarding radiated emission

(2 page)

DELTA Electronics Testing. EMC section

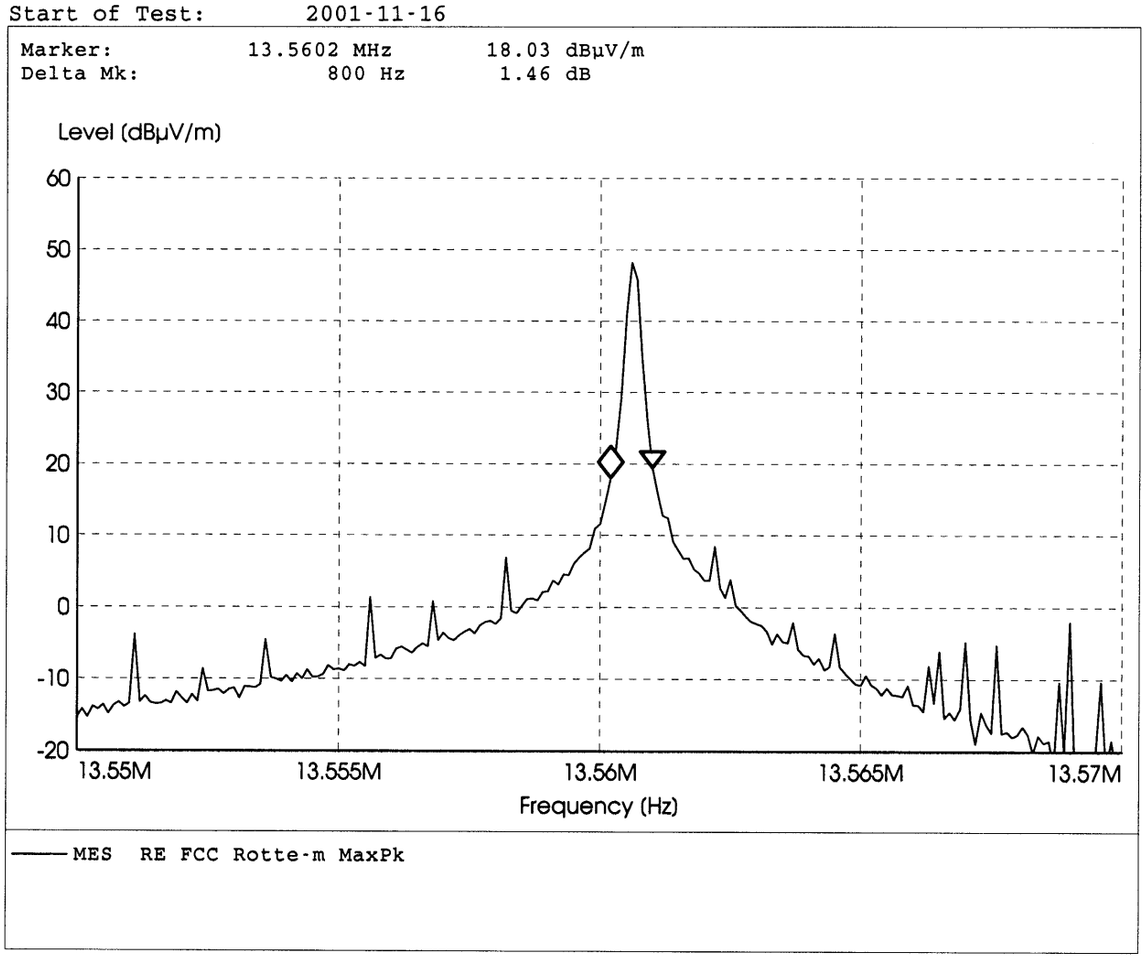
EUT: Miranda
Manufacturer: Precise Biometrics
Operating Condition: Ant. 1 meter vertical. 115 VAC
Test Site: EMC-5
Operator: JN - K222371-2
Test Specification: FCC class B
Comment: Sheet 4
Start of Test: 2001-11-16



MEASUREMENT RESULT: "Maximering_fin QP"
11/16/2001 11:48

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
48.000000	27.50	10.5	40.0	12.5	101.0	132.00	VERTICAL
54.240000	25.20	7.9	40.0	14.8	101.0	154.00	VERTICAL
144.000000	32.90	14.1	43.5	10.6	101.0	131.00	VERTICAL
162.000000	36.20	12.9	43.5	7.3	102.0	90.00	VERTICAL
162.200000	36.90	12.9	43.5	6.6	102.0	80.00	VERTICAL
191.690000	22.80	11.7	43.5	20.7	111.0	173.00	VERTICAL
234.970000	26.60	13.7	46.0	19.4	184.0	0.00	VERTICAL
326.110000	37.10	16.6	46.0	8.9	248.0	321.00	HORIZONTAL
456.300000	37.40	20.2	46.0	8.6	134.0	0.00	VERTICAL

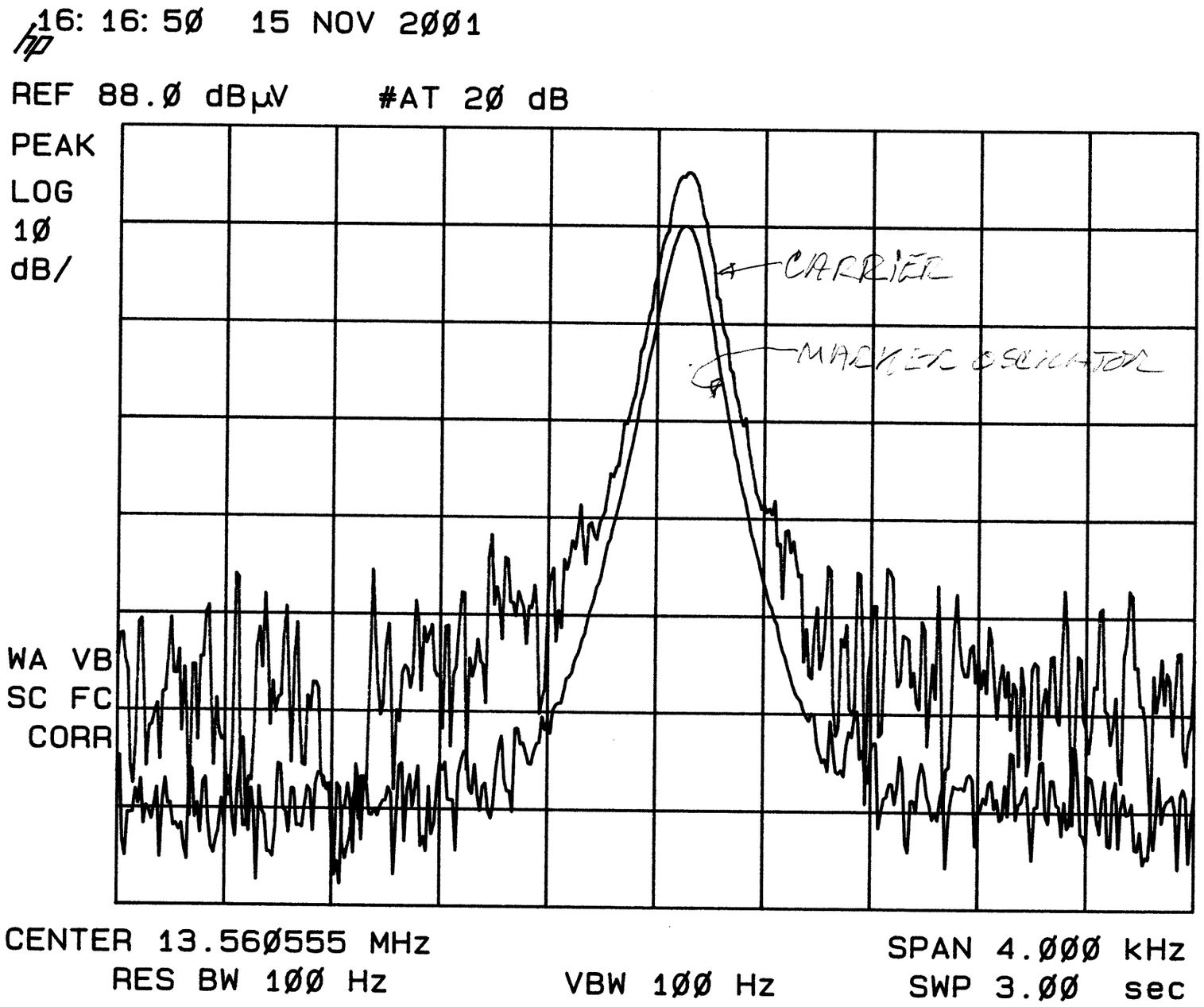
EUT: Precise Biometrics
Manufacturer: Miranda
Operating Condition: Ant. Singer Rod. dist. 9 meter.
Test Site: EMC-5
Operator: JN - K222371-2
Test Specification: FCC 13.56 MHz radiator
Comment: Sheet 8
Start of Test: 2001-11-16



Annex 5

Plot of relative measurement in climatic chamber

(1 page)



MIRANDA
−20 °C
10 MIN AFTER ON