Nemko TEST REPORT

Date:	**ESPOO 11.10.2004**	Page:	**1 (24)**
		Appendices	–

Number: No. 1 / 1

1032443

Date of handing in: 27.09.2004

Tested by:

Timo Hietala, Test Engineer

Reviewed by:

Timo Leismala, Test Manager

SORT OF EQUIPMENT:	**Triple band (900/1800/1900) E-GPRS GSM mobile phone**
MARKETING NAME:	***Nokia 9300***
TYPE:	***RAE-6***
MANUFACTURER:	***Nokia Corporation***
CLIENT:	**Nokia Corporation**
ADDRESS:	**Joensuunkatu 7 H, FIN-24100 SALO, Finland**
TELEPHONE:	**+358 400 815 340, Timo Seppälä**
TEST LABORATORY:	**Nemko Oy**
FCC REG. NO.	**91087 August 24, 2004**
IC FILE NO.	**IC 4627 July 2, 2003**

SUMMARY:

In regard to the performed tests the equipment under test fulfils the requirements defined in the test specifications, see page 2 for details

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Summary of performed tests and test results

Section in CFR 47	*Section in RSS-133*		*Result*
24.232, (b)	6.2	Radiated RF output	**PASS**
2.1049, (h)	5.6	99% occupied bandwidth	**X**
24.238 (a)	6.3	Band-edge compliance	**PASS**
24.238 (a), 2.1053	6.3	Spurious radiated emissions	**PASS**
24.235, 2.1055 (a)(1)(b)	7	Frequency stability, temperature variation	**PASS**
24.235, 2.1055 (d)(1)(2)	7	Frequency stability, voltage variation	**PASS**

Explanations:

PASS The EUT passed that particular test.
FAIL The EUT failed that particular test.
X The measurement was done, but there is no applicable performance criteria.

Contents

1. EUT and Accessory Information

1.1 EUT description

The EUT is a Triple band (900/1800/1900) E-GPRS GSM mobile phone with Bluetooth.

1.2 EUT and accessories

	unit	*type*	*S/N*
EUT1	**Mobile phone**	**RAE-6**	**004400/57/160212/5 HW: 4001, SW: 4.37(0)**
EUT2	**Mobile phone**	**RAE-6**	**004400/57/160206/7 HW: 4001, SW: 4.37(0)**
EUT3	**Mobile phone**	**RAE-6**	**004400/57/160215/8 HW: 4001, SW: 4.37(0)**
Accessories	**Battery, EUT 1**	**BP-6M**	**PROTO80670467VVV VVVL222110000106**
	Battery, EUT 2	**BP-6M**	**PROTO80670467VVV VVVL222110000648**
	Battery, EUT 3	**BP-6M**	**PROTO80670467VVV VVVL222110000243**
	Memory Card, EUT1	**HB28D032MM2**	**DUT10102**
	Memory Card, EUT2	**Toshiba 128MB**	**-**
	Memory Card, EUT3	**Toshiba 128MB**	**-**
	Dummy Battery	**SF-24DLIGHT v.3 042**	**05.04.2004/03618**
	Antenna adapter	**Special fixed, EUT3**	**-**

2. Standards and measurement methods

The test were performed in guidance of the CFR 47 part 24, part 2, ANSI/TIA/EIA-603-A and RSS-133 (Issue 2 Rev 1 1999).

3. Test results

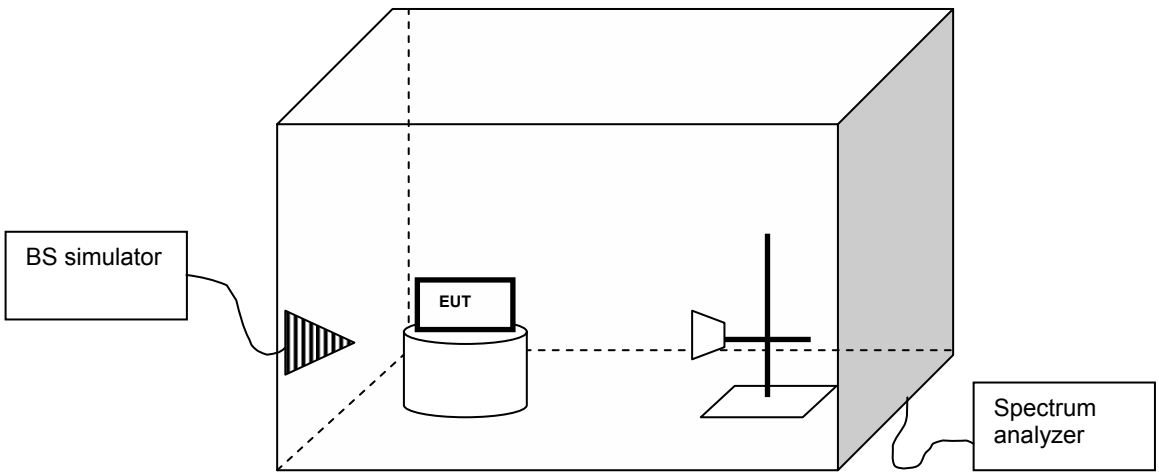
3.1 Radiated RF output power

The test was performed as a compliance test. The test parameters concerned were as follows:

EUT	EUT1
Site name	Nemko Oy / Perkkaa
Section in CRF 47	§ 24.232 (b)
Section in RSS-133	6.2
Date of testing	06.10.2004
Test equipment	42, 351, 319, 350, 184, 545, X3
Test conditions	22 °C, 35 % RH
Test result	**PASS**

3.1.1 Test method and limit

The test was performed inside a semi anechoic shielded room. For the duration of the test the EUT was placed on a non-conductive support 0.8 m high standing on the turntable. In the corner of the chamber there was a communication antenna, which was connected to the BS simulator located outside the room. The radiated power from the EUT was measured with an antenna fixed to a antenna tower. The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to the spectrum analyzer. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.



a) The maximum power level was searched at each frequency by rotating the turntable and adjusting the measuring antenna polarization and height (from 1- 4 m). This level (PEUT) was recorded. The measurements were performed the EUT at all three orthogonal planes and with flip closed and open.
b) The EUT was replaced with a substituting antenna.
c) The substituting antenna was fed with the power (P_{Gen}) giving a convenient reading on the spectrum analyzer and the measuring antenna height was adjusted to obtain a maximum reading at spectrum analyzer. That reading (P_{Subst}) on spectrum analyzer was recorded.

The formula below was used to calculate the EIRP of the EUT.

$$P_{EIRP[dbm]} = P_{Measured[dB]} – P_{Subst[dB]} - L_{Cable[dB]} + G_{Antenna[dBi]} + P_{Gen[dBm]}$$

Where

$P_{Measured[dBm]}$ measured power level from the EUT

$P_{Subst[dBm]}$ measured emission level from substitutive antenna

$L_{Cable[dB]}$ loss of the cable between substitutive antenna and signal generator

$G_{Antenna[dBi]}$ gain of the substitutive antenna

$P_{Gen[dBm]}$ signal generator power fed to the substitutive antenna

3.1.2 Limit

Power level	*EIRP power (dBm)*	*EIRP power (W)*
0	**≤ 33**	**≤ 2**

3.1.3 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 1 time slot transmission, audio PRBS 2E9-1 modulation, GMSK modulation***
EUT channel	**512, 661, 810**
EUT power level	**0 (+ 30 dBm)**

3.1.4 Test results

The maximum power level was measured at flip open

EUT Channel	***$P_{Measured}$ [dBm]***	***P_{Gen} [dBm]***	***P_{Subst} [dBm]***	***L_{Cable} [dBm]***	***$G_{Antenna}$ [dBd]***	***EIRP [dBm]***	***EIRP [W]***
512	-19.2	10	-40.7	1.8	-0.7	29.0	0.794
661	-19.3	10	-40.3	1.8	-1.0	28.2	0.661
810	-20.0	10	-40.1	1.8	-1.4	26.9	0.490

3.1.5 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 1 time slot transmission, audio PRBS 2E9-1 modulation, 8PSK (edge) modulation***
EUT channel	**512, 661, 810**
EUT power level	**0 (+ 30 dBm)**

3.1.6 Test results

EUT Channel	$P_{Measured}$ ***[dBm]***	P_{Gen} ***[dBm]***	P_{Subst} ***[dBm]***	L_{Cable} ***[dBm]***	$G_{Antenna}$ ***[dBd]***	***EIRP [dBm]***	***EIRP [W]***
512	-20.2	10	-40.7	1.8	-0.7	28.0	0.631
661	-21.2	10	-40.3	1.8	-1.0	26.3	0.427
810	-21.9	10	-40.1	1.8	-1.4	25.0	0.316

3.1.7 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 2 time slot GPRS transmission, audio PRBS 2E9-1 modulation, GMSK modulation***
EUT channel	**512, 661, 810**
EUT power level	**0 (+ 30 dBm)**

3.1.8 Test results

EUT Channel	$P_{Measured}$ ***[dBm]***	P_{Gen} ***[dBm]***	P_{Subst} ***[dBm]***	L_{Cable} ***[dBm]***	$G_{Antenna}$ ***[dBd]***	***EIRP [dBm]***	***EIRP [W]***
512	-20.2	10	-40.7	1.8	-0.7	28.0	0.631
661	-20.1	10	-40.3	1.8	-1.0	27.4	0.550
810	-20.7	10	-40.1	1.8	-1.4	26.2	0.417

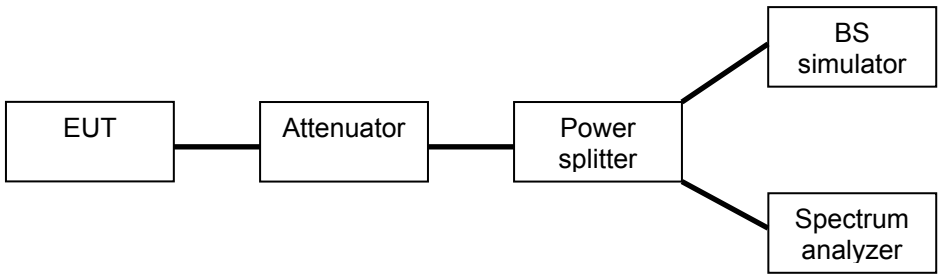
3.2 99% occupied bandwidth

The test was performed as a compliance test. The test parameters concerned were as follows:

EUT	EUT3
Site name	Nemko Oy / Perkkaa
Section in CRF 47	§ 2.1049, (h)
Section in RSS-133	5.6
Date of testing	05.10.2004
Test equipment	42, 519, 545, X2
Test conditions	22 °C, 35 % RH
Test result	**PASS**

3.2.1 Test method and limit

The test was performed inside a shielded room. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.



3.2.2 Limit

Power level	*99% occupied bandwidth*
0	**--**

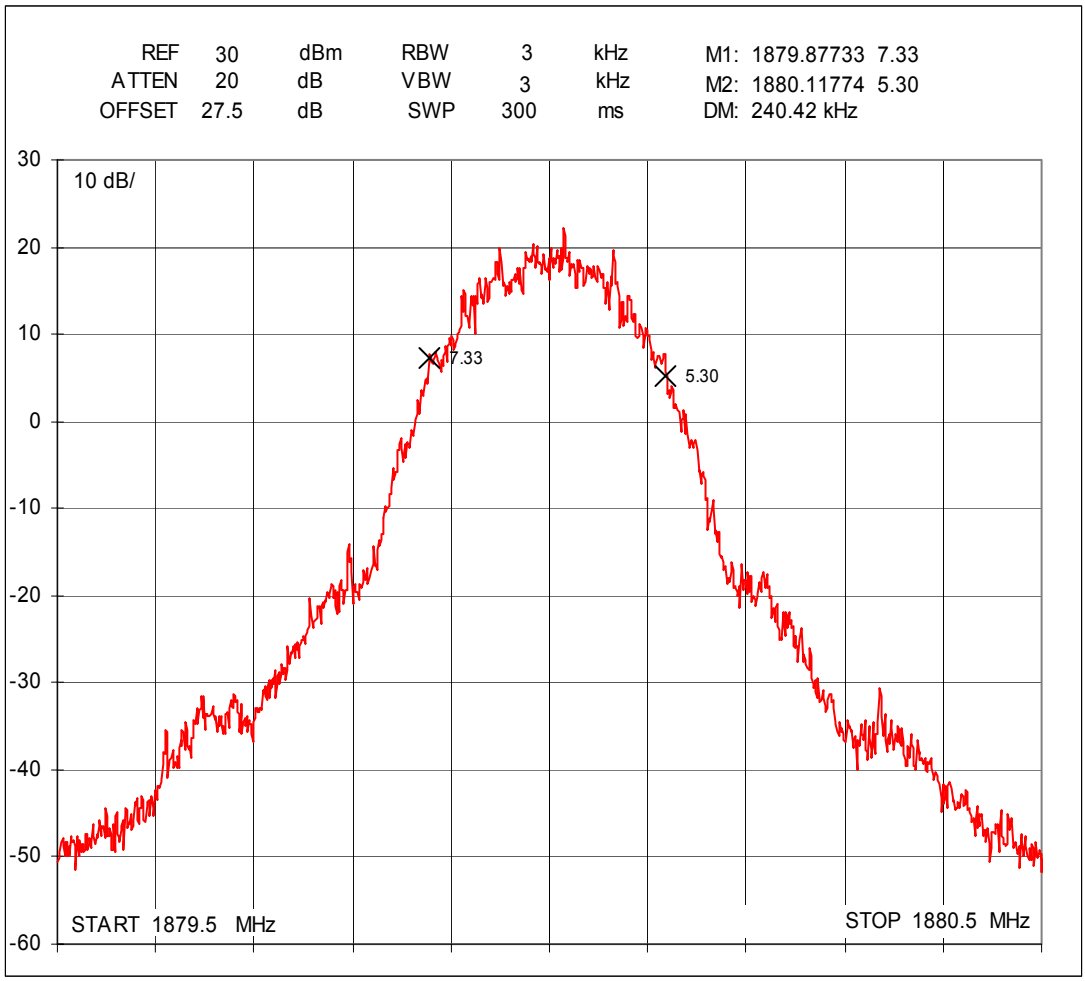
3.2.3 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 1 time slot transmission, audio PRBS 2E9-1 modulation, GMSK modulation***
EUT channel	**661**
EUT power level	**0 (+ 30 dBm)**

3.2.4 Test results

Channel	*99% occupied bandwidth kHz*
661	**240.4**

The 99% occupied bandwidth was calculated from the trace data of the spectrum analyzer.



Spectrum analyzer plot channel 661, GMSK modulation

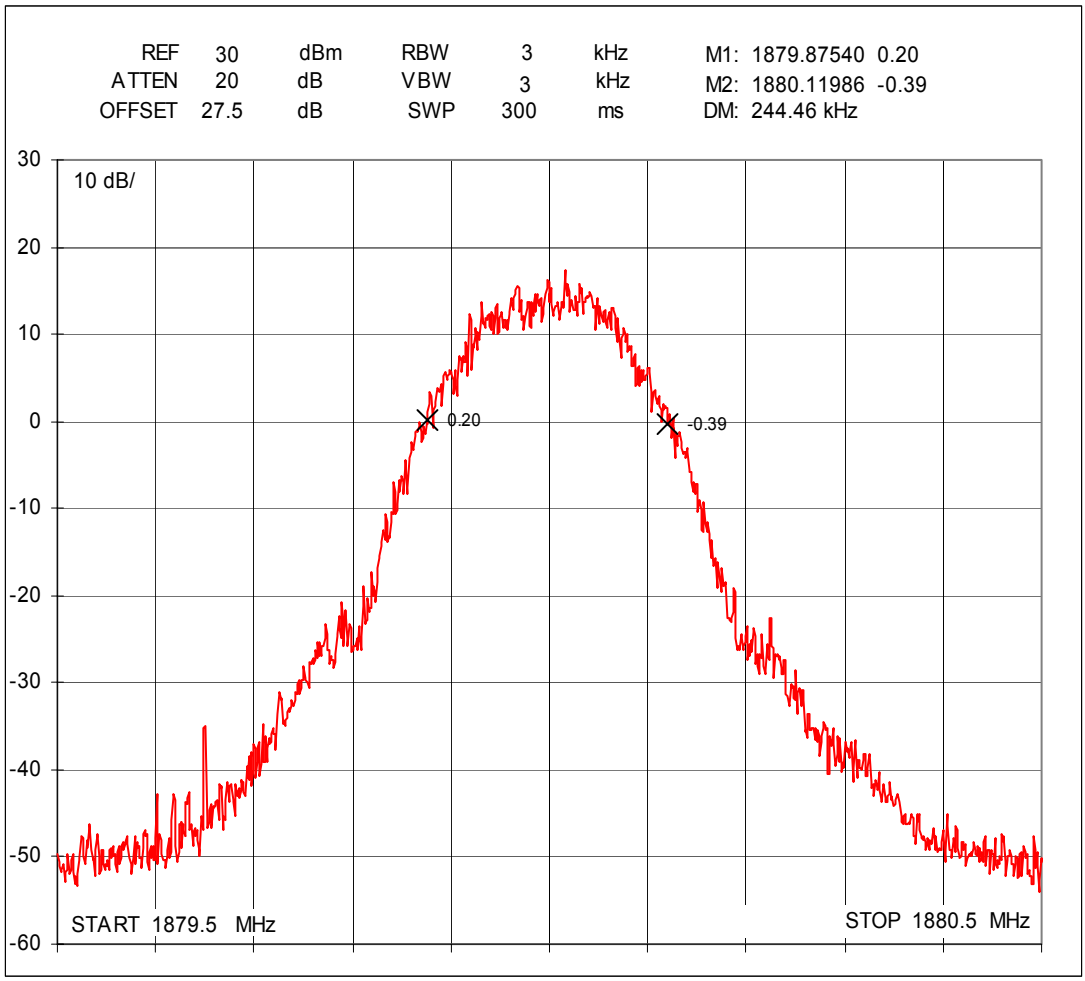
3.2.5 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 1 time slot transmission, audio PRBS 2E9-1 modulation, 8PSK modulation (edge)***
EUT channel	**661**
EUT power level	**0 (+ 30 dBm)**

3.2.6 Test results

Channel	*99% occupied bandwidth kHz*
661	**244.5**

The 99% occupied bandwidth was calculated from the trace data of the spectrum analyzer.



Spectrum analyzer plot channel 661, 8PSK modulation (edge)

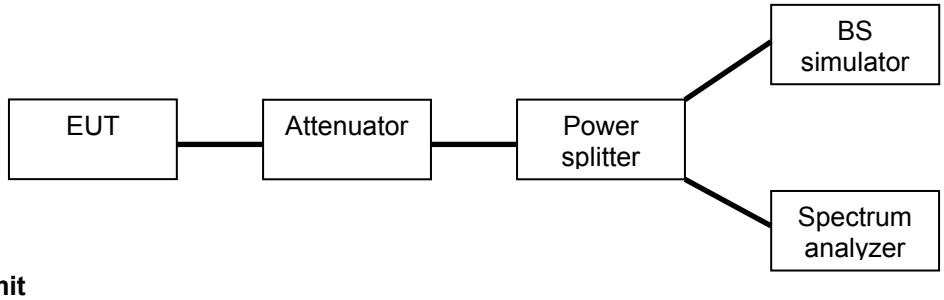
3.3 Band-edge compliance

The test was performed as a compliance test. The test parameters concerned were as follows:

EUT	EUT3
Site name	Nemko Oy / Perkkaa
Section in CRF 47	§ 24.238 (a)
Section in RSS-133	6.3
Date of testing	05.10.2004
Test equipment	42, 519, 545, X2
Test conditions	22 °C, 35 % RH
Test result	**PASS**

3.3.1 Test method and limit

The test was performed inside a shielded room. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.



3.3.2 Limit

Frequency MHz	*Band-edge compliance dBm*
< 1850 or 1910 <	**≤ -13**

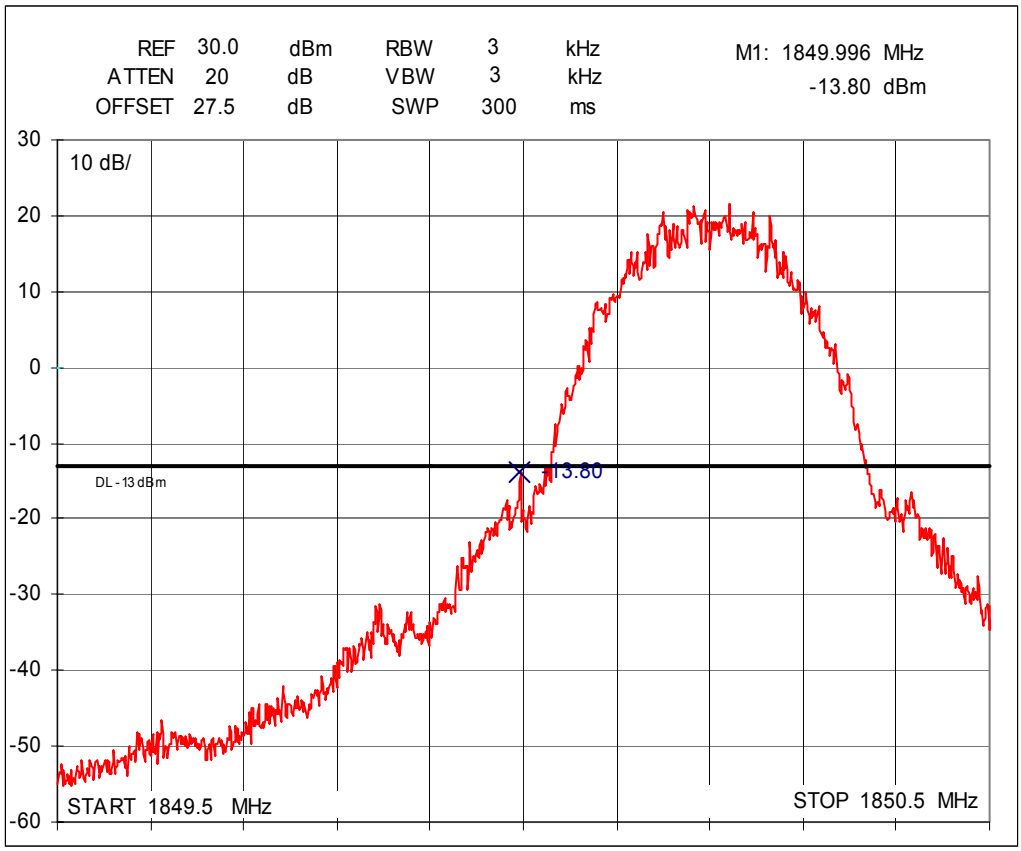
3.3.3 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 1 time slot transmission, audio PRBS 2E9-1 modulation, GMSK modulation***
EUT channel	**512, 810**
EUT power level	**0 (+ 30 dBm)**

3.3.4 Test results

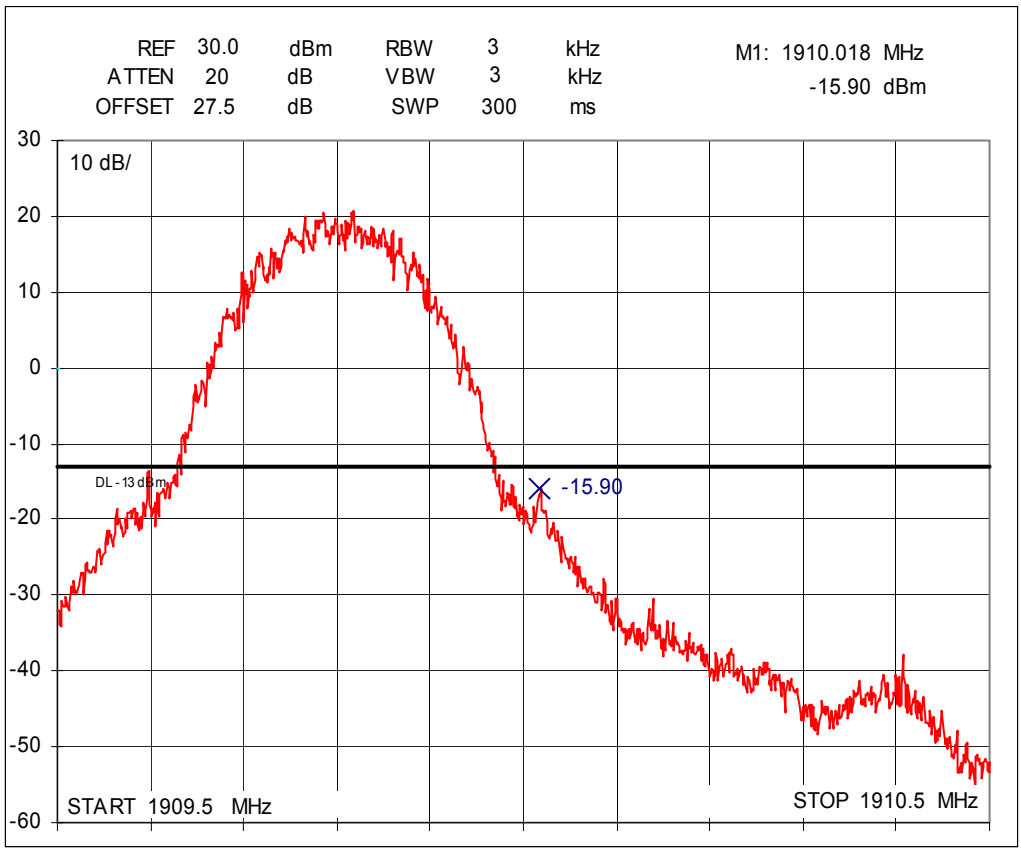
The line in the spectrum analyzer plot is the -13dBm limit line. The band edge is at the middle of the screen. The results were corrected with combined attenuation of the cables, attenuator and power divider set as "offset" in the spectrum analyzer.

Channel	*Band-edge compliance MHz / dBm*	*Limit Frequency MHz / dBm*
512	**1849.996 / -13.8**	**< 1850 or 1910 < / ≤ -13**



Spectrum analyzer plot channel 512, GMSK modulation

Channel	*Band-edge compliance MHz / dBm*	*Limit Frequency MHz / dBm*
810	**1910.018 / -15.9**	**< 1850 or 1910 < / ≤ -13**



Spectrum analyzer plot channel 810, GMSK modulation

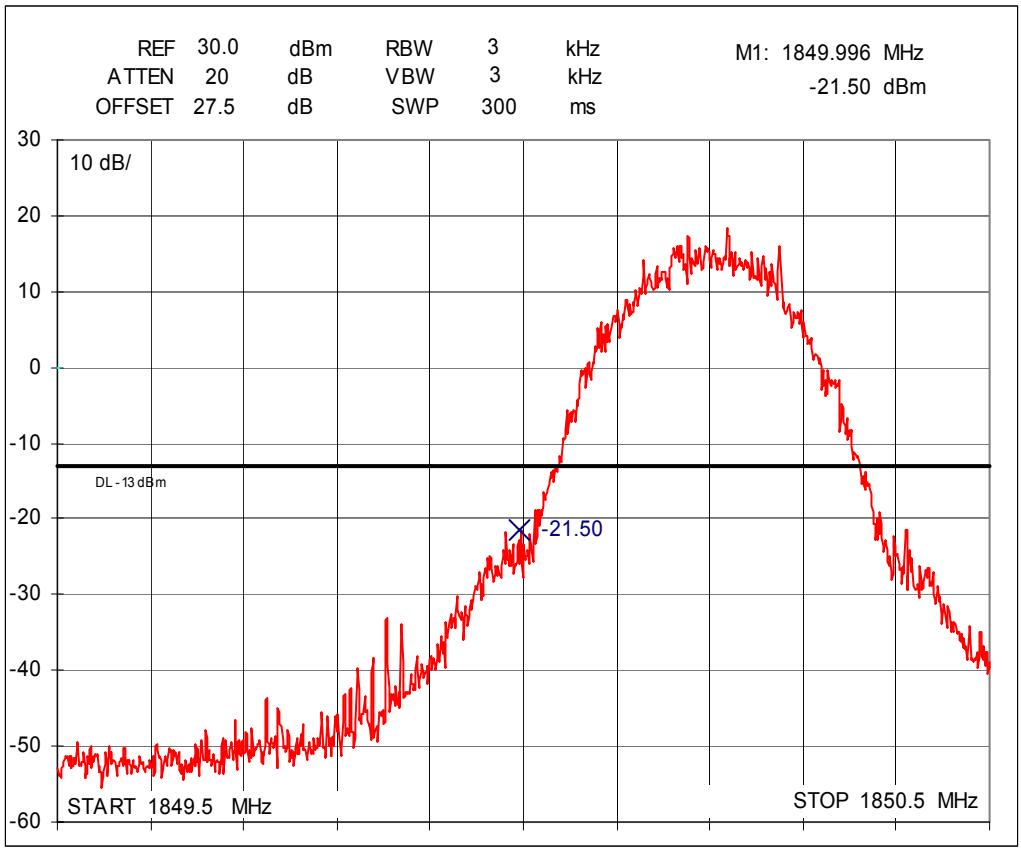
3.3.1 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 1 time slot transmission, audio PRBS 2E9-1 modulation, 8PSK modulation (edge)***
EUT channel	**512, 810**
EUT power level	**0 (+ 30 dBm)**

3.3.2 Test results

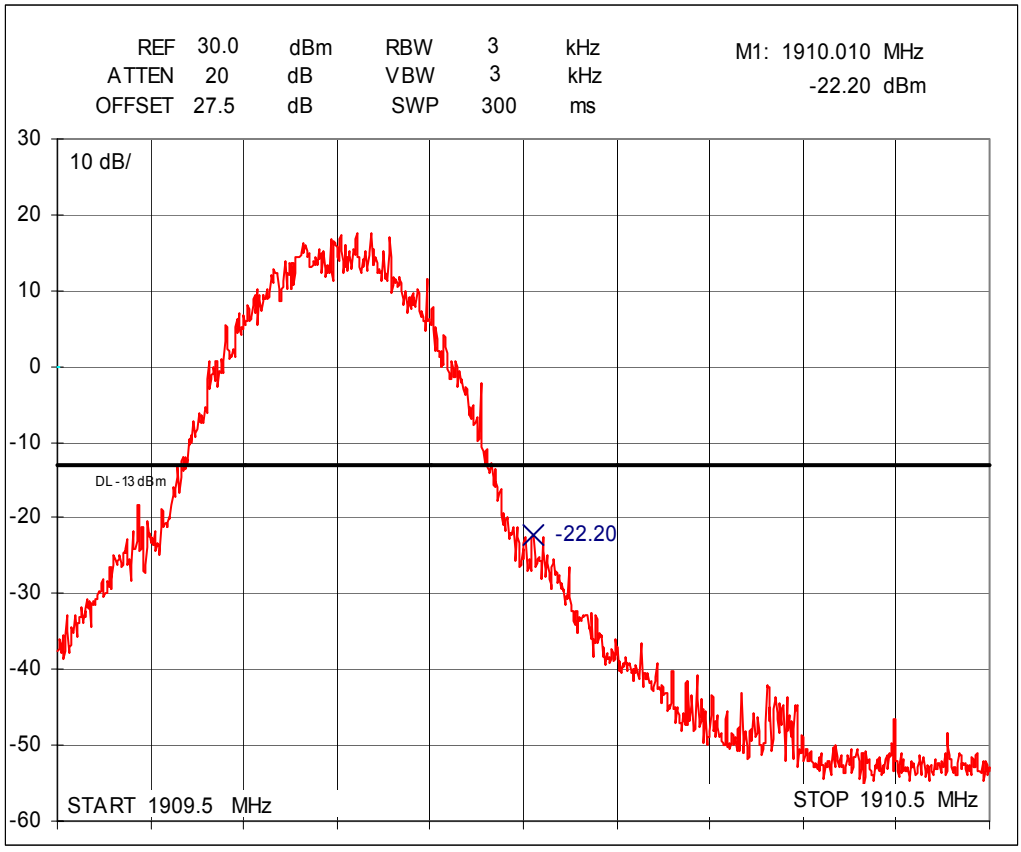
The line in the spectrum analyzer plot is the -13dBm limit line. The band edge is at the middle of the screen. The results were corrected with combined attenuation of the cables, attenuator and power divider set as “offset” in the spectrum analyzer.

Channel	*Band-edge compliance MHz / dBm*	*Limit Frequency MHz / dBm*
512	**1849.996 / -21.5**	**< 1850 or 1910 < / ≤ -13**



Spectrum analyzer plot channel 512, 8PSK modulation (edge)

Channel	*Band-edge compliance MHz / dBm*	*Limit Frequency MHz / dBm*
810	**1910.010 / -22.2**	**< 1850 or 1910 < / ≤ -13**



Spectrum analyzer plot channel 810, 8PSK modulation (edge)

3.4 Spurious radiated emission

EUT	EUT2
Site name	Nemko Oy / Perkkaa
Section in CRF 47	§ 24.238 (a), § 2.1053
Section in RSS-133	6.3
Date of testing	04.10.2004
Test equipment	350, 42, 525, 319, 544, 184, 542, 543, 545, 550, 552, X1
Test conditions	22 °C, 35 % RH
Test Result	**PASS**

3.4.1 Test method and limit

The test was performed inside a semi anechoic shielded room. For the duration of the test the EUT was placed on a non-conductive support 0.8 m high standing on the turntable. In the corner of the chamber there was a communication antenna, which was connected to the BS simulator located outside the room. The radiated power from the EUT was measured with an antenna fixed to a antenna tower. The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to the spectrum analyzer. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.

a) The maximum power level was searched at each frequency by rotating the turntable and adjusting the measuring antenna polarization and height (from 1- 4 m). This level (PEUT) was recorded. The measurements were performed the EUT at all three orthogonal planes and with flip closed and open.

b) The EUT was replaced with a substituting antenna.

c) The substituting antenna was fed with the power (P_{Gen}) giving a convenient reading on the spectrum analyzer and the measuring antenna height was adjusted to obtain a maximum reading at spectrum analyzer. That reading (P_{Subst}) on spectrum analyzer was recorded.

3.4.2 Limit

Frequency MHz	*Level dBm*
30 - 19100	**- 13**

3.4.3 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 1 time slot transmission, audio PRBS 2E9-1 modulation, GMSK modulation***
EUT channel	**661**
EUT power level	**0 (+ 30 dBm)**

3.4.4 Test results

The formula below was used to calculate the EIRP of the spurious emissions. If there were no emissions closer than 20 dB below the limit line, then the emission levels were measured at the transmitter's harmonics.

$$P_{Emission[dbm]} = P_{Measured[dB]} - P_{Subst[dB]} - L_{Cable[dB]} + G_{Antenna[dBi]} + P_{Gen[dBm]}$$

Where

$P_{Measured[dBm]}$ measured emission level

$P_{Subst[dBm]}$ measured emission level from substitutive antenna

$L_{Cable[dB]}$ loss of the cable between substitutive antenna and signal generator

$G_{Antenna[dBi]}$ gain of the substitutive antenna

$P_{Gen[dBm]}$ signal generator power fed to the substitutive antenna

Calculation example:

$$P_{3760[dbm]} = -36.2_{Measured[dB]} - (-21.0)_{Subst[dB]} - 2.6_{Cable[dB]} + 9.1_{Antenna[dBi]} + (-30)_{Gen[dBm]}$$

$$= -38.7_{dBm]}$$

TX GSM 1900 (ch 661)

Frequency MHz	*Result dBm*	*Result µW*	*Limit dBm*	*Margin dB*
3760.0	**-38.7**	**0.136**	**-13.0**	**25.7**
5640.0	**-41.8**	**0.067**	**-13.0**	**28.8**
7520.0	**-46.0**	**0.025**	**-13.0**	**33.0**
9400.0	**-41.4**	**0.073**	**-13.0**	**28.4**
11280.0	**-41.7**	**0.068**	**-13.0**	**28.7**
13160.0	**-33.0**	**0.496**	**-13.0**	**20.0**

3.4.5 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 1 time slot transmission, audio PRBS 2E9-1 modulation, 8PSK modulation (edge)***
EUT channel	**661**
EUT power level	**0 (+ 30 dBm)**

3.4.6 Test results

The formula below was used to calculate the EIRP of the spurious emissions. If there were no emissions closer than 20 dB below the limit line, then the emission levels were measured at the transmitter's harmonics.

$$P_{Emission[dbm]} = P_{Measured[dB]} - P_{Subst[dB]} - L_{Cable[dB]} + G_{Antenna[dBi]} + P_{Gen[dBm]}$$

Where

$P_{Measured[dBm]}$ measured emission level

$P_{Subst[dBm]}$ measured emission level from substitutive antenna

$L_{Cable[dB]}$ loss of the cable between substitutive antenna and signal generator

$G_{Antenna[dBi]}$ gain of the substitutive antenna

$P_{Gen[dBm]}$ signal generator power fed to the substitutive antenna

Calculation example:

$$P_{3760[dbm]} = -34.8_{Measured[dB]} - (-21.0)_{Subst[dB]} - 2.6_{Cable[dB]} + 9.1_{Antenna[dBi]} + (-30)_{Gen[dBm]}$$

$$= -37.3_{dBm]}$$

TX GSM 1900 (ch 661), 8PSK modulation

Frequency MHz	*Result dBm*	*Result µW*	*Limit dBm*	*Margin dB*
3760.0	**-37.3**	**0.188**	**-13.0**	**24.3**
5640.0	**-40.8**	**0.083**	**-13.0**	**27.8**
7520.0	**-46.2**	**0.024**	**-13.0**	**33.2**
9400.0	**-43.3**	**0.047**	**-13.0**	**30.3**
11280.0	**-42.6**	**0.055**	**-13.0**	**29.6**
13160.0	**-33.7**	**0.423**	**-13.0**	**20.7**

3.5 Frequency stability, temperature variation

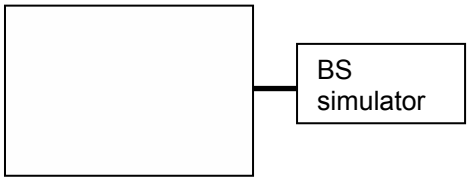
The test was performed as a compliance test. The test parameters concerned were as follows:

EUT	EUT3
Site name	Nemko Oy / Perkkaa
Section in CRF 47	24.235, 2.1055 (a)(1)(b)
Section in RSS-133	7
Date of testing	7 and 8.10.2004
Test equipment	545, 157
Test conditions	22 °C, 38 % RH
Test result	**PASS**

3.5.1 Test method and limit

The test was performed EUT placed inside a temperature chamber. The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.

a) The climate chamber temperature was set to the minimum value and the temperature was allowed to stabilize.
b) The EUT was placed in the chamber
c) The EUT was set in idle mode for 60 minutes.
d) The EUT was set to transmit.
e) The transmit frequency error was measured immediately
f) The steps c - e were repeated for each temperature



3.5.2 Limit

Frequency error ppm
± 2.5

3.5.3 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 1 time slot transmission, audio PRBS 2E9-1 modulation, GMSK modulation***
EUT channel	**661**
EUT power level	**0 (+ 30 dBm)**

3.5.4 Test results

Temperature [ºC]	*Deviation [Hz]*	*Deviation [ppm]*
-30	**-49**	**-0.026**
-20	**-46**	**-0.024**
-10	**-45**	**-0.024**
0	**-26**	**-0.014**
10	**-25**	**-0.013**
20	**-30**	**-0.016**
30	**-29**	**-0.015**
40	**-25**	**-0.013**
50	**-26**	**-0.014**

Frequency deviation, temperature variation

3.6 Frequency stability, voltage variation

The test was performed as a compliance test. The test parameters concerned were as follows:

EUT	EUT3
Site name	Nemko Oy / Perkkaa
Section in CRF 47	24.235, 2.1055 (d)(1)(2)
Section in RSS-133	7
Date of testing	07.10.2004
Test equipment	545, 76
Test conditions	22 °C, 38 % RH
Test result	**PASS**

3.6.1 Test method and limit

The BS simulator was used to set the TX channel and power level and modulate the TX signal with different bit patterns.

The EUT battery was replaced with an adjustable power supply. The frequency stability was measured at nominal voltage and in 0.1V increments the battery cut-off point.

3.6.2 Limit

Frequency error ppm
± 2.5

3.6.3 EUT operation mode

EUT operation mode	***GSM 1900, TX ON, 1 time slot transmission, audio PRBS 2E9-1 modulation, GMSK modulation***
EUT channel	**661**
EUT power level	**0 (+ 30 dBm)**

3.6.4 Test results

Battery level	*Voltage [V]*	*Deviation [Hz]*	*Deviation [ppm]*
Nominal	**4.1**	**-26**	**-0.014**
Cut off-point	**3.3**	**-20**	**-0.011**

Frequency deviation, voltage variation

4. List of test equipment

Each active test equipment is calibrated once a year, antennas every 18 months and other passive equipment every 24 months.

Nr.	Equipment	Type	Manufacturer	Serial number
42	Spectrum analyzer	8566B	Hewlett Packard	2637A04102
76	Power supply	B32-30R	Oltronix	537
157	Temp. test chamber	VMT 04/240	Vötsch	31884
184	Temp. & humidity meter	H MI 32	Vaisala	63837
319	Antenna	CBL6112	Chase	2018
348	Shielded room	RFSD-100	Euroshield Oy	1320
350	Semianechoic shielded room	RFD-F-100	Euroshield Oy	1327
351	RF generator	SMT 06	Rohde & Schwarz	845715/001
519	RF High-Power Attenuator	765-20	Narda	
525	Double-Ridged Horn	3115	Emco	6691
542	Double-Ridged Horn	3115	Emco	00023905
543	RF-amplifier	JCA018-501	JCA Technologies	103
544	RF-amplifier	ZFL-2000VH2	Mini-Circuits	D01080
545	GSM MS Test System	CMU	Rohde & Schwarz	836536/049
552	Highpass Filter	WHK2.3/18G-10SS	Wainwright Instruments	1
550	Notch Filter	WRCD1800/2000-0.2/40-5SSSD	Wainwright Instruments	1
X1	RF-Generator	8341B	Hewlett Packard	2802A01090
X2	Power splitter	1870A	Weinschel	1798
X3	Antenna	3125-1880	ETS	00028029

5. Photographs

See "1032443_test_setup_photographs"