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Nokia

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T117 (EN ISO/IEC 17025)

GSM 1900 Test Report for RM - 47

Test Report no.:	DTX10434-EN	**Date of Report:**	28-10-2004
Number of pages:	18	**Customer's Contact person:**	Niko Balabanis
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Testing laboratory:	TCC Copenhagen Nokia Danmark A/S Frederikskaj DK-1790 Copenhagen V Denmark Tel. +45 33 29 29 29 Fax. +45 33 29 20 01 FCC Reg. # 99059, June 2003 IC File # 4820, January 2004 IC File # 4820-1, February 2004	**Client:**	Nokia Corporation P.O. Box 50 Elektroniikkatie 10 FIN-90571 OULU, FINLAND Tel. +358 (0) 7180 08000 Fax. +358 (0) 7180 47222
Tested devices/ accessories:	**Phone RM – 47, battery BL – 4C**		
Supplement reports:			
Testing has been carried out in accordance with:	The tests listed in this report have been done to demonstrate compliance with the applicable requirements in FCC rules Part 24 and IC standard RSS-133.		
Documentation:	The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 15 years at TCC Copenhagen.		
Test Results:	**The EUT complies with the requirements in respect of all parameters subject to the test.** The test results relate only to devices specified in this document		
Date and signatures for the contents:	28-10-2004		

Allan Franch Henriksen

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Test engineer

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1. Summary of test results

Section in CFR 47	Section in RSS-133		Result
§2.1046 (a)	6.2	Conducted RF output	NA
§24.232 (b)	6.2	Radiated RF output	-
§2.1049 (h)	5.6	99% occupied bandwidth	X
§24.238 (a)	6.3	Bandedge compliance	PASS
§24.238 (a), §2.1051	6.3	Spurious emissions at antenna terminals	NA
§24.238 (a), §2.1053	6.3	Spurious radiated emission	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

PASS Pass
FAIL Fail
X Measured, but there is no applicable performance criteria
NA Not Applicable
- Not Measured

2. EUT Information

Product	Type	SN	HW	MV	SW	DUT
Phone	RM-47	004400/55/155652/1	1005-1500		3.121	234763
Phone	RM-47	004400/55/165649/7	1005-1500		3.121	234764
Battery	BL–4C	0670386417535 L353A20105398				234766
Battery	BL-4C	0670386417535 L353A20105567				234765

2.1. EUT description

The EUT is a dual band (900MHz/1800MHz/1900MHz) GSM and E-GPRS mobile phone with a camera.
The EUT was not modified during the tests.

3. EUT Test Setup

For each test the EUT was exercised to find the worst case of operation modes and device configuration.
The test setup photographs are in an Appendix to this Test Report.

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4. Applicable Standards

The tests were performed in guidance of CFR 47, part 24 and part 2, ANSI/TIA/EIA-603-A and RSS-133. Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under “Test method” for each test case.

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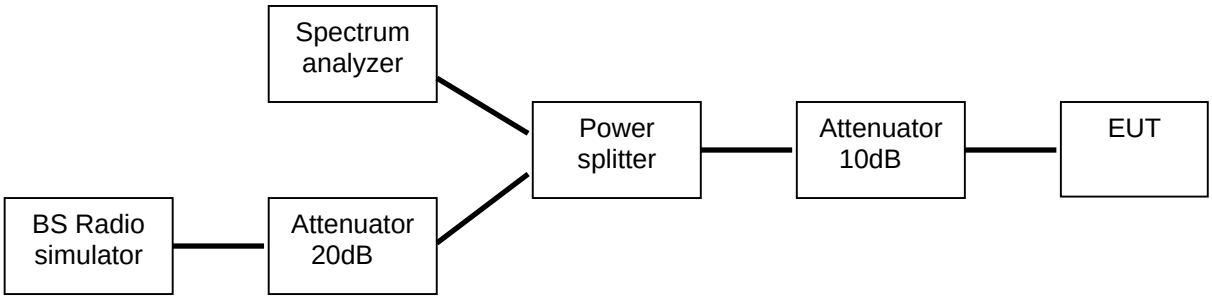
5. 99% occupied bandwidth

EUT	RM-47 dut 244763, BL-4C dut 244766		
Accessories	none		
Temp, Humidity, Air Pressure	20.6 ºC	43.0 RH%	992.8 mbar
Date of measurement	10-19-2004		
FCC rule part	§2.1049 (h)		
RSS-133 section	5.6		
Measured by	Jan Engelbrechtsen		

5.1. Test setup

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



5.2. EUT operation mode

EUT operation mode GSM	TX on, 1 time slot transmission, PRBS 2E9-1
EUT operation mode E-GPRS	TX on, 2 time slot transmission
EUT channel	661
EUT TX power level	Maximum

5.3. Results

The 99% occupied bandwidth was measured using the in-built function of the spectrum analyzer.

EUT Channel	99% occupied bandwidth [kHz]
661 GSM	243.0
661 EGPRS	241.5

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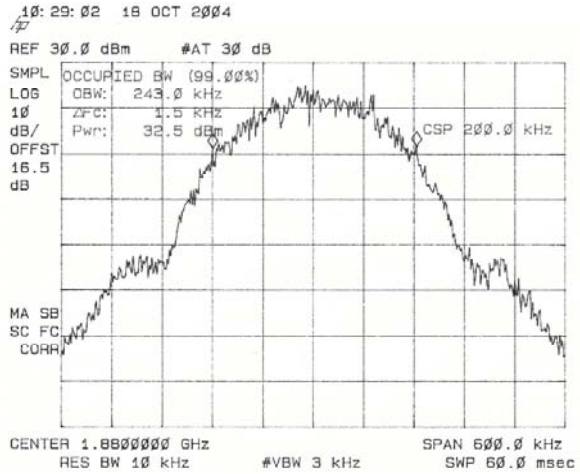
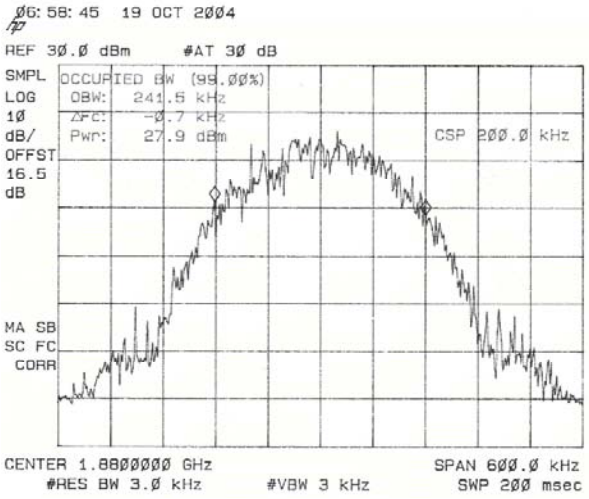
5.4. Screen shots



Picture 4. 99% occupied bandwidth GSM, channel 661



Picture 5. 99% occupied bandwidth EGPRS, channel 661

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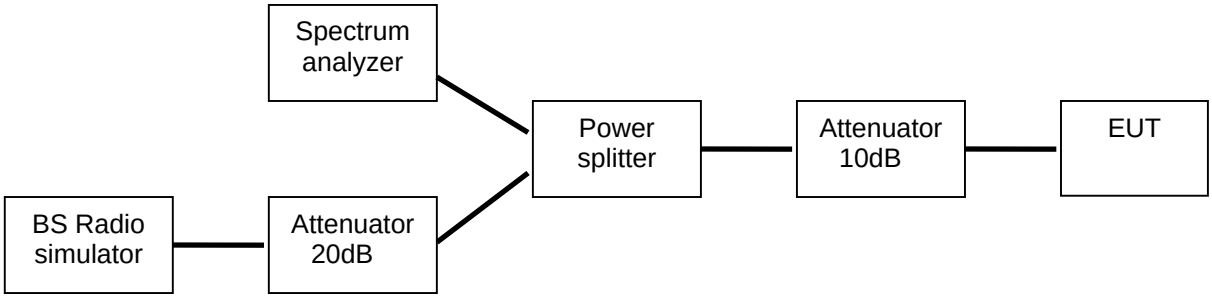
6. Band edge compliance

EUT	RM-47 dut 234463, BL-4C dut 234466		
Accessories	none		
Temp, Humidity, Air Pressure	20.6 ºC	43.0 RH%	992.8 mbar
Date of measurement	10-19 2004		
FCC rule part	§24.238 (a)		
RSS-133 section	6.3		
Measured by	Jan Engelbrechtsen		
Result	Passed		

6.1. Test setup

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



6.2. EUT operation mode

EUT operation mode GSM	TX on, 1 time slot transmission, PRBS 2E9-1
EUT operation mode E-GPRS	TX on, 2 time slot transmission
EUT channel	See section 7.4
EUT TX power level	Maximum

6.3. Limit

Frequency [MHz]	Level [dBm]
<1850 or 1910<	-13

6.4. Results

The line in the screen shots is the -13dBm limit line. The results were corrected with measurement path loss set as “offset” in the spectrum analyzer.

EUT Channel	Level [dBm]
512 GSM	-15.4
810 GSM	-15.13
512 EGPRS	-27.34
810 EGPRS	-27.71

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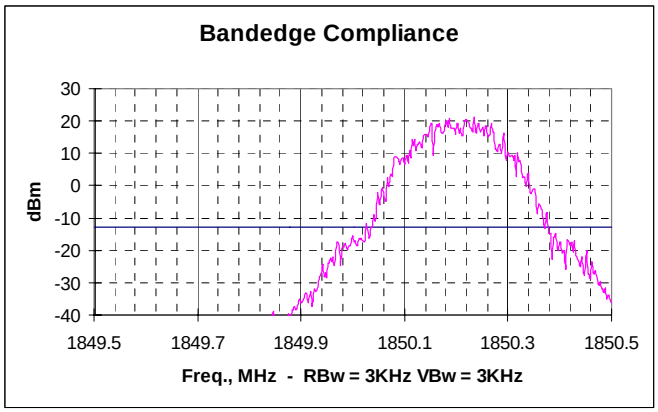
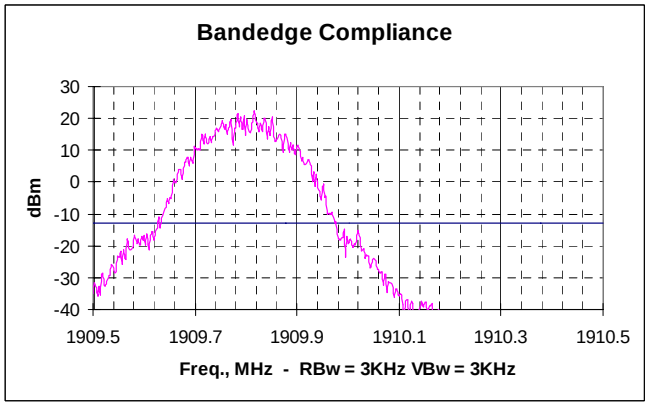
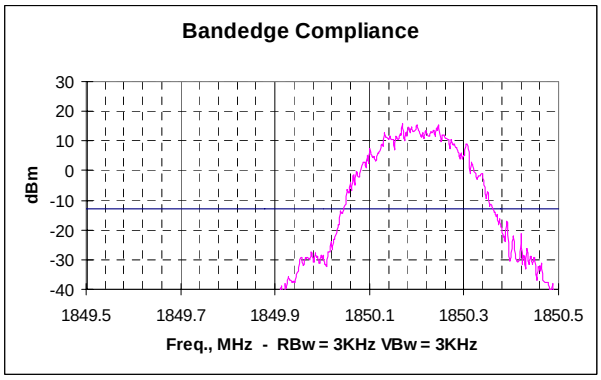
6.5. Screen shots



Picture 6. Lower bandedge, channel 512 GSM



Picture 7. Upper bandedge, channel 810 GSM



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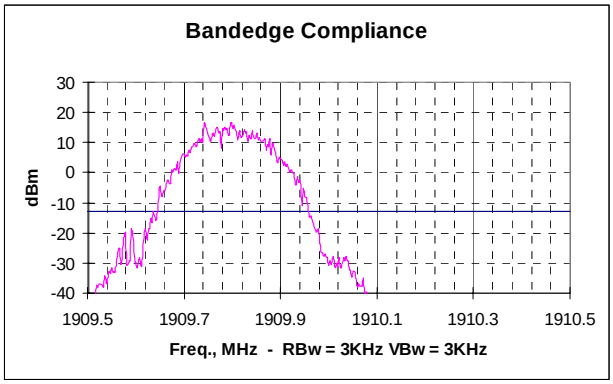
Picture 6. Lower bandedge, channel 512 EGPRS



Picture 7. Upper bandedge, channel 810 EGPRS

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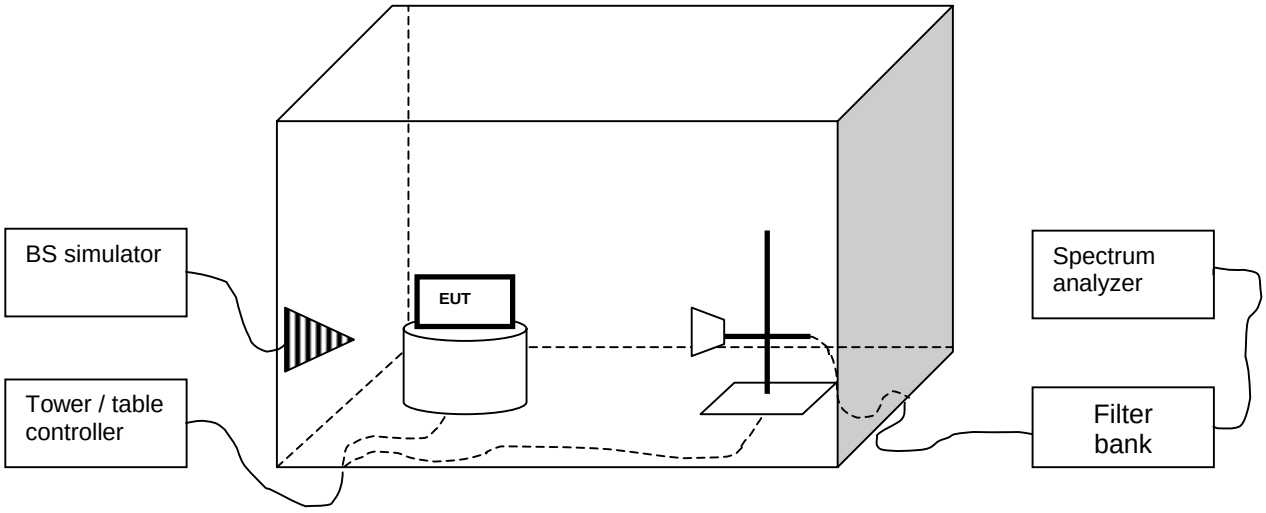
7. Spurious radiated emission

EUT	RM-47 dut#234764		
Accessories	BL-4C dut#234765		
Temp, Humidity, Air Pressure	20.5 ºC	47.0 RH%	1010 mbar
Date of measurement	10-22-2004		
FCC rule part	§24.238 (a), §2.1053		
RSS-133 section	6.3		
Measured by	Jesper Nielsen		
Result	Passed		

7.1. Test setup

A set of LP/HP/BS filters was used to prevent overloading 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. The test was done manually.



7.2. Test method

a) The emissions were searched and maximized by moving the turn table and measuring antenna and manipulating the EUT.

b) All suspicious frequencies with emission levels were recorded.

c) The EUT was replaced with a substituting antenna.

d) For each frequency recorded, the substituting antenna was fed with the power (from signal generator) giving the same reading as in (b). These power levels were reported.

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7.3. EUT operation mode

	GSM	EGPRS
EUT operation mode	TX on, 1 time slot transmission,	TX on, 2 time slot transmission,
EUT channel	661	661
EUT TX power level	Maximum	Maximum

7.4. Limit

Frequency [MHz]	Level [dBm]
30 – 19100	-13

7.5. Results

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

$$P_{Emission[dBm]} = P_{SubstTX[dBm]} - L_{Cable[dB]} + G_{Antenna[dBi]}$$

where the variables are as follows:

$P_{Measured\ [dBm]}$ Measured emission level (from step b in 8.2)

$P_{Subst_TX\ [dBm]}$ Signal generator power (from step d in 8.2) fed to the substituting antenna

$L_{Cable\ [dB]}$ Loss of the cable between antenna and signal generator (from step d in 8.2)

$G_{Antenna\ [dBi]}$ Gain of the substitutive antenna over isotropic radiator

Emission levels, channel 661, GSM/GPRS

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Frequency [MHz]	$P_{Measured}$ [dBm]	$P_{Subst\ TX}$ [dBm]	L_{Cable} [dB]	$G_{Antenna}$ [dBi]	$P_{Emission}$ [dBm]
3760,00	-55.03	-43.8	8.73	15.80	-36.73
5640,00	-65.72	-54.6	11.53	18.03	-48.10

Emission levels, channel 661, EGPRS

Frequency [MHz]	$P_{Measured}$ [dBm]	$P_{Subst\ TX}$ [dBm]	L_{Cable} [dB]	$G_{Antenna}$ [dBi]	$P_{Emission}$ [dBm]
3760,00	-56.48	-45.3	8.73	15.80	-38.23
5640,00	-65.32	-54.2	11.53	18.03	-47.70

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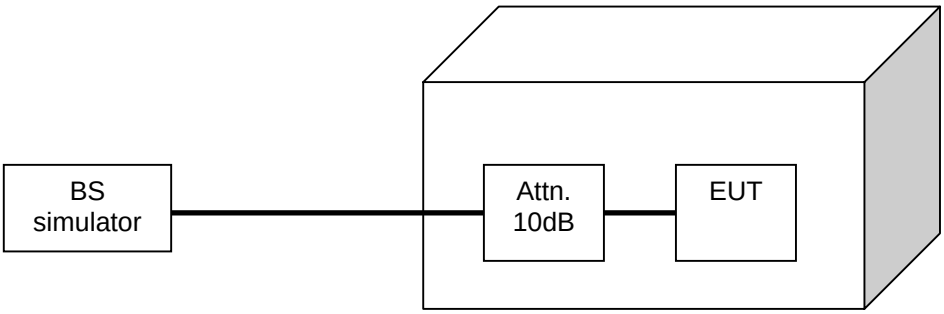
8. Frequency stability, temperature variation

EUT	RM-47 dut 234463, BL-4C dut 234466		
Accessories	none		
Temp, Humidity, Air Pressure	20.6 ºC	43.0 RH%	992.8 mbar
Date of measurement	10-19-2004		
FCC rule part	§24.235, §2.1055 (a)(1)(b)		
RSS-133 section	7		
Measured by	Jan Engelbrechtsen		
Result	Passed		

8.1. Test setup

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



8.2. EUT operation mode

EUT operation mode	TX on, 1 time slot transmission, PRBS 2E9-1
EUT channel	661
EUT TX power level	Maximum

8.3. Limit

Frequency deviation [ppm]
± 2.5

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8.4. Test method

a) The EUT was placed in the chamber

b) The climate chamber temperature was set to the maximum value (50ºC) and the temperature was allowed to stabilize.for 45 minutes

c) .The EUT was set to transmit.

d) The transmit frequency error was measured after 1 minute

e) The call was released

f) Temperature decreased 10 ºC and allowed to stabilize for 45 minutes after set temperature was reached

g) The steps c – f were repeated

8.5. Results

Temperature [ºC]	Deviation [Hz]	Deviation [ppm]
+50	-18.29	-0.01
+40	-18.43	-0.01
+30	-23.87	-0-013
+20	-17.42	-0.01
+10	-26.48	-0.014
0	-11.03	-0.06
-10	-31.69	-0.017
-20	-13.4	-0.007
-30	-20.62	-0.011

Table 15. Frequency deviation, temperature variation

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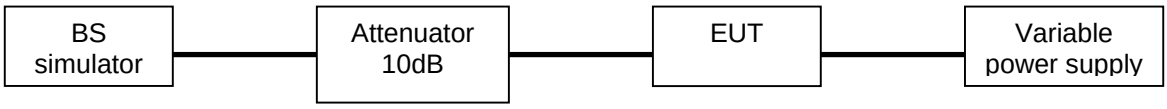
9. Frequency stability, voltage variation

EUT	RM-47 dut 234463		
Accessories	Dummy battery BTD-8		
Temp, Humidity, Air Pressure	20.6 ºC	43.0 RH%	992.8 mbar
Date of measurement	10-19-2004		
FCC rule part	§24.235, §2.1055 (d)(1)(2)		
RSS-133 section	7		
Measured by	Jan Engelbrechtsen		
Result	Passed		

9.1. Test setup

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



9.2. EUT operation mode

EUT operation mode	TX on, 1 time slot transmission, PRBS 2E9-1
EUT channel	661
EUT TX power level	Maximum

9.3. Limit

Frequency deviation [ppm]
± 2.5

9.4. Test method

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

9.5. Results

Level	Voltage [V]	Deviation [Hz]	Deviation [ppm]
Nominal	3.7	19	0.01
Battery cut-off point	3.36	48	0.03

Table 16. Frequency deviation, voltage variation

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10. Test equipment

Each test equipment is calibrated once a year, except antennas which are calibrated every second year.

10.1. Conducted measurements

Equipment #	Equipment	Type	Serial #	Manufacturer
13357	Signal Generator	SMP 02		Rohde & Schwarz
13302	Spectrum Analyzer	8596E		Hewlet Packard
13524	BS Simulator	CMD-55		Rohde & Schwartz
17277	Multimeter	34401A		Agilent
15761	DC Power Supply	E3632A		Hewlet Packard
13371	Temperature chamber	2800		Thermotron
-	RF Attenuator	23-10-34		Weinchel
-	Power Divider	-		Suhner
17796	BS Simulator	4400M		Wavetek
-	Antenna Mast	-		Deisel
14900	Antenna Mast Controller	HD-100		Deisel
15191	Turn Table	G-800SDX		Yaesu
13668	Antenna	CBL6112A		Chase
13935	Two Line Artificial Mains Network	ESH-3-Z5		Rohde & Schwarz
13666	EMI Test Receiver	ESPC		Rohde & Schwarz

10.2. Radiated measurements

Equipment #	Equipment	Type	Serial #	Manufacturer
14993	EMI Test Receiver 9KHz-2750MHz	ESCS30	847124/001	Rohde&Schwarz
15191	Turntable Contoller Unit	G-800SDX	ONO10000	YAESU
14900	Antenna Controller	HD100	100\552	HD GmbH
18792	Multi Device Controller	2090	1606	ETS-EMCO
13829	Turntable Controller	4630-100	100/510	Comtest
14963	RF Preamplifier 100MHz-4GHz (Metal Chassis)	AFS3-00100400	571131	Miteq/NMP Cph
13668	BiLog Antenna 30-2000MHz	BiLog-CBL6112A	2259	Chase

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18861	EMI Test Receiver 20Hz-26,5GHz	ESI	833362/004	Rohde&Schwarz
12679	Dual Log Periodic Antenna 1-26.5 GHz	HL025	----------	Rohde&Schwarz
18860	Ultra Broadband Antenna Ultralog 30-3000MHz	HL562	100154	Rohde&Schwarz
18773	Shielded Chamber	RFD-100	2420	ETS-Lindgren
18774	Shielded Chamber	RFSD-F/A-100	2425	ETS-Lindgren
18324	High Pass Filter 3GHz SMA f Conn	WHJS3000-10SS	1	Wainwright
14114	Highpass Filter 1000MHz-4500MHz	WHK1000-12SS	1	Wainwright
13918	Highpass Filter 2000-4000MHz 50OHM SMA Conn	WHKS2000-10SS		Wainwright Instruments
13937	Ultra Stable Notch Filter 902,4MHz	WRCA902.4-0.2/40-6SS		Wainwright Instruments
13936	Ultra Stable Notch Filter 1747,5MHz	WRCD1747.5-0.2/40-10SS		Wainwright Instruments
16633	Ultra Stable Notch Filter 1880,0MHz	WRCD1880.0-0.2/40-10SS		Wainwright Instruments

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