REPORT

issued by an FCC listed Laboratory Reg. no. 93866.
The test site complies with RSS-Gen, Issue 2, file no: IC 3482A-2.

Date	Reference	Page
2009-01-19	F810819-A	1 (1)

1002
ISO/IEC 17025

Handled by, department
Jonas Bremholt
Electronics
+46 10 516 54 38, jonas.bremholt@sp.se

Best Teleprodukter AB
Mikael Blom
Uggledalsvägen 19
427 40 Billdal

Equipment Authorization measurements on 902.4 MHz Transceiver unit with digital modulation and no FHSS with FCC ID: WUP-BEST-9616

(7 appendices)

Test object

Proactive Receiver Best-9616 "FCC R".

The test object was powered by a DC power supply, the DC power supply was not a part of the test object.

Summary

See appendix 1 for general information and appendix 7 for photo.
Emission measurements as specified below have been performed.

Standard	Compliant	Appendix	Remarks
FCC 47 CFR Part 15 C (07-10-08) §15.249 Operation within the band 902 - 928 MHz	**Yes**		
§15.249 (a) Field strength of fundamental	Yes	2	
§15.249 (d) Band edge	Yes	3	
§15.249 (d, e) Emission outside the frequency band	Yes	4	
§15.215 (c) 20 dB bandwidth	Yes	5	
§15.207 Conducted emission limits	Yes	6	

SP Technical Research Institute of Sweden
Electronics - EMC

Christer Karlsson
Technical Manager

Jonas Bremholt
Technical Officer

Performance test and requirements

The tests were performed to verify that the electromagnetic compatibility of the test object meets the requirements of FCC 47 CFR part 15 C.

Test facility

The used test site (SP 504 114) is compliant with the requirements of section 2.948 of the FCC rules and listed, registration number 96866, as a facility accepted for certification under parts 15 and 18. The site complies with RSS-Gen, Issue 2 and is accepted by Industry Canada for the performance of radiated measurements, file no: IC 3482A-2.

Test object

Transceiver:	Proactive Receiver Best-9616
Antenna	Integral
Frequency band:	902-928 MHz
Frequency range:	902.4 MHz (one frequency)
Frequency used during test:	902.4 MHz
Modulation:	Gaussian Frequency Shift Keying (GFSK)
Duty Cycle:	4/100 ms
Supply voltage:	12 V DC

Operational test mode

The tests were performed with the integral antenna, continuous transmission with the highest possible duty cycle and with modulation activated.

Cabling during emission test:

I/O port	Cable type	Cable length	Termination
DC port	2 wire unshielded	1.0 m	Connected to DC power supply

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”EL-QD 8.3”.

Reservation

The test results in this report apply only to the particular test object as declared in the report.

Delivery of test object

The client delivered the test object at the date of the test.

Test engineer

Jonas Bremholt

Maximum radiated output power measurements according to FCC 47 CFR part 15.249 (a)

Date	Temperature	Humidity
2008-10-17	22 °C ± 3 °C	38 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003.
The test was performed with the integral antenna, continuous transmission with the highest possible duty cycle and with modulation activated at maximum output power.

The radiated maximum radiated output power measurements were performed in the semi-anechoic chamber.
The fundamental was scanned with PEAK-detector with the antenna height 1-4 m and the turntable was varied between 0-360 degrees for maximum response. The output power was then measured with the Quasi-Peak detector activated. The antenna distance during the measurements was 3.0 m

Test set-up during the test can be found in appendix 7.

Measurement equipment	Calibration Due	SP number
Semi anechoic chamber, Edison	2009-04	504 114
Spectrum analyzer R&S ESI 26	2009-07	503 885
Antenna Schaffner CBL 6143	2010-03	504 079
Control computer, Fujitsu Siemens	-	-
Software: R&S EMC32, ver. 6.10.10	-	503 745
Temperature and humidity meter Testo 625	2009-08	504 117

Measurement uncertainty: 5.1 dB

Results

		Max output power Quasi-Peak
		902.4 MHz
	Antenna height	1.83 m
	Azimuth	0 deg
	Polarization	Horizontal
	RBW	120 kHz
T_{nom} 22°C	V_{nom} 12 V DC	70.8 dBµV/m
T_{nom} 22°C	V_{min} 10.2 V DC Note 1	70.8 dBµV/m
T_{nom} 22°C	V_{max} 13.8 V DC Note 1	70.8 dBµV/m

Note 1: According 47CFR 15.31(e), For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

Limits

47CFR 15.249(a), The field strength of fundamental emissions from intentional radiators operated in the frequency band 902 to 928 MHz shall not exceed 50 mV/m (94 dBuV/m).

Complies?	Yes

Band edge measurements according to 47CFR 15.249 (d)

Date	Temperature	Humidity
2008-10-17	22 °C ± 3 °C	26 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003 and the Marker-delta method.

The test was performed with the integral antenna, continuous transmission with the highest possible duty cycle and with modulation activated.

The radiated measurements were performed in a semi anechoic chamber. The measurements were performed with the antenna at the position and polarization and the turntable with the highest level of the fundamental The antenna distance was 3.0 m.

Test set-up during the test can be found in appendix 6.

Measurement equipment	Calibration Due	SP number
Semi anechoic chamber, Edison	2009-04	504 114
Spectrum analyzer R&S ESI 26	2009-07	503 885
Antenna Schaffner CBL 6143	2010-03	504 079
Control computer, Fujitsu Siemens	-	-
Software: R&S EMC32, ver. 6.10.10	-	503 745
Temperature and humidity meter Testo 625	2009-08	504 117

Measurement uncertainty: 5.1 dB

Results

The diagram can be found in the appendix 3.1.

Diagram 1 902.4 MHz Marker-delta method, step 1:
Peak level at fundamental =70.8 dBµV/m

Step 2:
Delta between fundamental and 902 MHz = 44.1 dB.

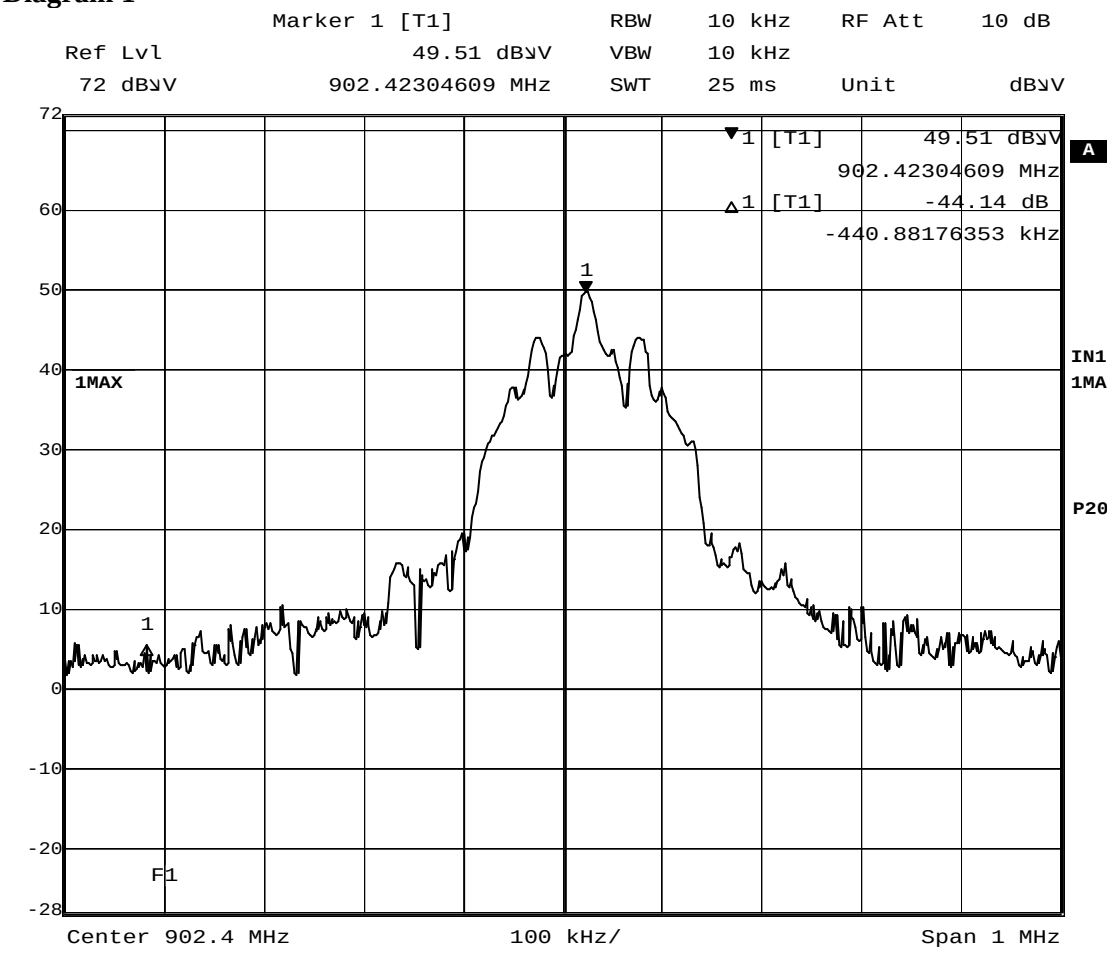
Step 3:
Decrease the measured peak level in step 1: 70.8-44.1 = 26.7 dBµV/m @ 902 MHz

Limits

47CFR 15.249(d)
Emissions radiated outside the specified frequency band , except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209, whichever is the lesser attenuation.

Complies?	Yes

Diagram 1


Marker 1 [T1]
RBW 10 kHz
RF Att 10 dB
Ref Lvl
49.51 dBµV
VBW 10 kHz
72 dBµV
902.42304609 MHz
SWT 25 ms
Unit dBµV
1 [T1] 49.51 dBµV
902.42304609 MHz
Δ1 [T1] -44.14 dB
-440.88176353 kHz
A
IN1
1MA
P20
1MAX
F1
Center 902.4 MHz
100 kHz/
Span 1 MHz
Date: 17.OCT.2008 11:07:58

Emissions radiated outside the specified band, measurements according to FCC 47 CFR part 15.249 (d, e)

Date	Temperature	Humidity
2008-10-17	22 °C ± 3 °C	26 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003.

The test of radiated emission was performed in a semi anechoic chamber. The measurements were performed with both horizontal and vertical polarizations of the antenna. The antenna distance was 3 m.

The measurement procedure is as the following:

1. A pre-measurement is performed with peak detector. The test object is measured in eight directions with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m.
2. If the emission is close or above the limit during the pre-measurement, the test object is scanned 360 degrees and the antenna height scanned from 1 to 4 m for maximum response. Then the emission is measured with the quasi-peak detector on frequencies below 1 GHz and with the average detector above 1 GHz. The used resolution band width is 120 kHz blow 1 GHz and 1 MHz above 1 GHz.

Test set-up during the test can be found in appendix 7.

Measurement equipment	Calibration Due	SP number
Semi anechoic chamber, Edison	2009-04	504 114
Spectrum analyzer R&S ESI 26	2009-07	503 885
Antenna Schaffner CBL 6143	2010-03	504 079
Horn antenna EMCO 3115	2011-01	502 175
Miteq Low Noise Amplifier	2009-08	504 160
High pass filter	2010-06	502 758
Control computer, Fujitsu Siemens	-	-
Software: R&S EMC32, ver. 6.10.10	-	503 745
Temperature and humidity meter Testo 625	2009-08	504 117

Measurement uncertainty: 5.1 dB

Results

The highest detected levels in the frequency range 30 MHz-10 GHz are listed in the table below.

902.4 MHz

Frequency (MHz)	QP level (dBµV/m)	AV level (dBµV/m)	Peak level (dBµV/m)	Limit (dBµV/m)	Height (m)	Azimuth (deg)	Polarization
2706.863728	N/A	29.9	55.1	53.9/ 73.9	1.00	240	Vertical

All other emission > 20 dB below limit.

Limits

47CFR 15.249(d)
Emissions radiated outside the specified frequency band , except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209, whichever is the lesser attenuation.

Complies?	Yes

20 dB bandwidth measurements according to 47CFR 15.215 (c)

Date	Temperature	Humidity
2008-10-17	22 °C ± 3 °C	26 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003.
The test was performed with the integral antenna, continuous transmission with the highest possible duty cycle and with modulation activated.

The radiated measurements were performed in a semi anechoic chamber. The measurements were performed with the antenna at the position and polarization and the turntable with the highest level of the fundamental The antenna distance was 3.0 m.

Test set-up during the test can be found in appendix 7.

Measurement equipment	Calibration Due	SP number
Semi anechoic chamber, Edison	2009-04	504 114
Spectrum analyzer R&S ESI 26	2009-07	503 885
Antenna Schaffner CBL 6143	2010-03	504 079
Temperature and humidity meter Testo 625	2009-08	504 117

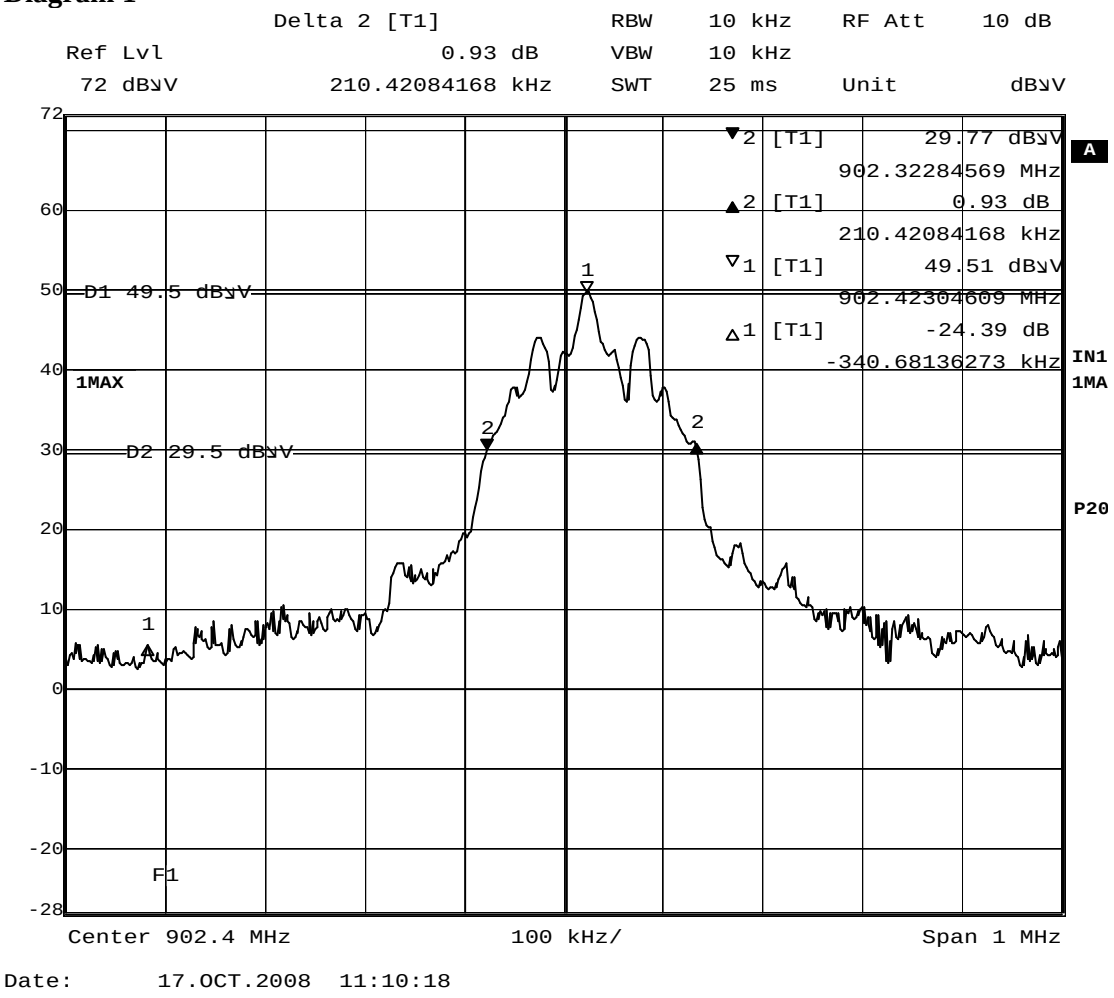
Measurement uncertainty: 2.6 %

Results

The diagram can be found in the appendix 5.1.

Diagram 1 902.4 MHz 210 kHz

Diagram 1


Delta 2 [T1]
RBW 10 kHz
RF Att 10 dB
Ref Lvl 0.93 dB
VBW 10 kHz
72 dBµV 210.42084168 kHz
SWT 25 ms
Unit dBµV
2 [T1] 29.77 dBµV
902.32284569 MHz
2 [T1] 0.93 dB
210.42084168 kHz
1 [T1] 49.51 dBµV
902.42304609 MHz
1 [T1] -24.39 dB
-340.68136273 kHz
D1 49.5 dBµV
D2 29.5 dBµV
1MAX
A
IN1
1MA
P20
F1
Center 902.4 MHz
100 kHz/
Span 1 MHz
Date: 17.OCT.2008 11:10:18

Conducted emission measurements according to FCC 47 CFR part 15.207

Date	Temperature	Humidity
2008-06-24	22 °C ± 3 °C	41 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.4-2003.
The test was performed with the integral antenna ,continuous transmission (100% duty cycle) and with modulation.

The measurements were performed with a typical AC/DC adapter, (Mean Well DR-75-12).
The measurements were performed on the 120 V AC/60 Hz, phase and neutral conductors.

Measurement equipment	Calibration Due	SP number
Semi anechoic chamber, Tesla	-	15:115
Spectrum analyzer R&S ESI 26	2008-07	503 292
Control computer, Fujitsu Siemens	-	-
Software: R&S ES-K1, ver. 1.60	-	-
LISN Schwartzbeck NNLK 8121	2008-10	502 112
Temperature and humidity meter Testo 615	2009-11	503 505

Measurement uncertainty: 3.5 dB

Result

The conducted emission spectra can be found in appendix 6.1:

Diagram 1: 120 V AC, neutral conductor
Diagram 2: 120 V AC, phase conductor

The limit lines indicated as EN 55022 in the diagrams are the same limit lines of FCC part 15.

Complies?	Yes

Diagram 1

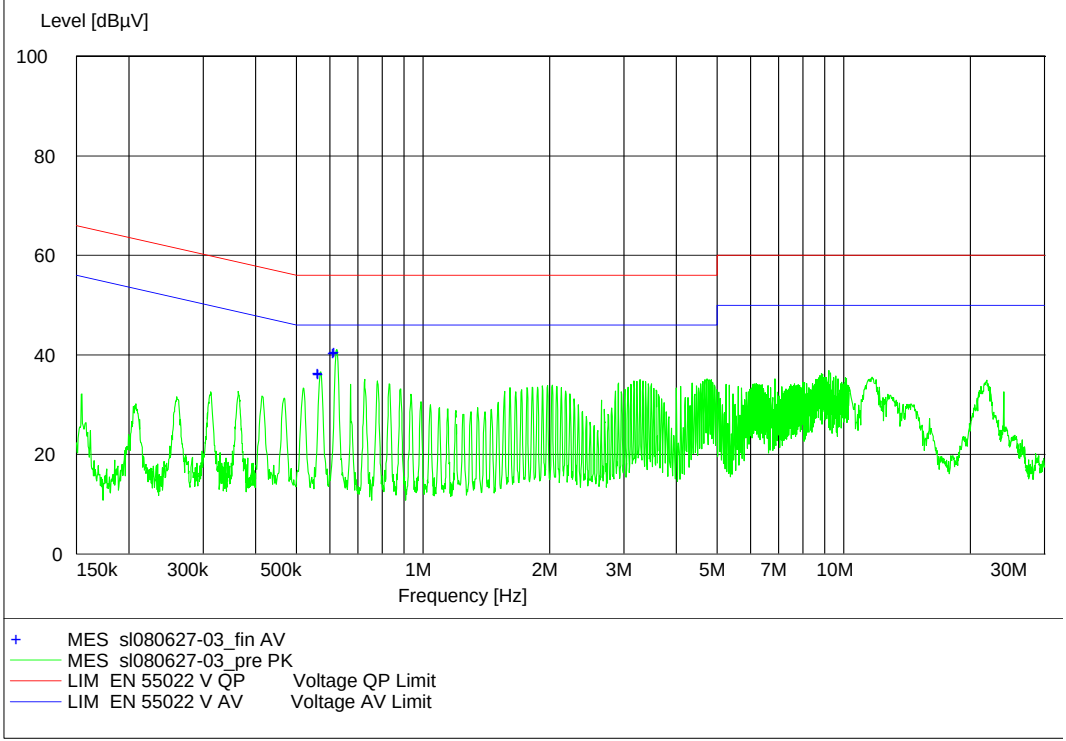
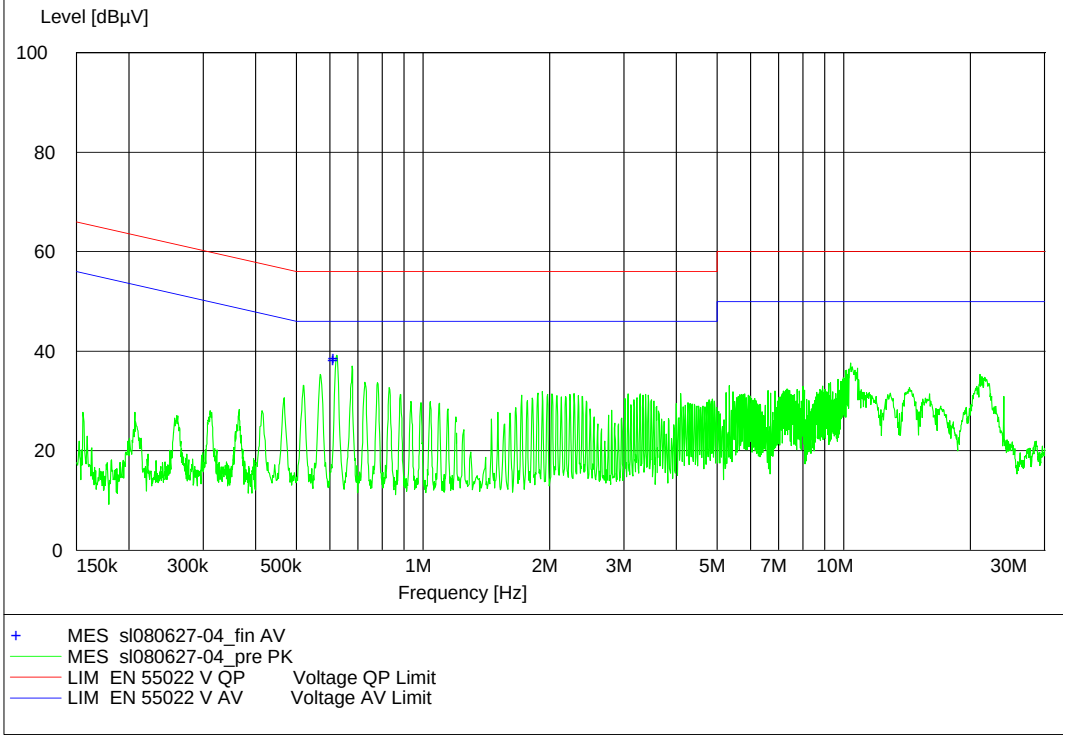


Diagram 2



Photo

The test set-up during all the radiated tests can be seen in the picture below.