Nemko TEST REPORT

Date: **ESPOO 05.10.2010** Page: **1 (10)**

Appendices **-**

Number: **157439**
No. 1 / 1

Date of handing in: **17.09.2010**

Tested by:

Timo Hietala, Test Engineer

Reviewed by:

Timo Leismala, Test Manager

SORT OF EQUIPMENT:	**Transceiver**
MARKETING NAME:	***SATELLINE-EASy Pro 35W***
TYPE:	***SATEL-TA18***
MANUFACTURER:	***SATEL Oy, Finland***
SERIAL NUMBER:	**-**
CLIENT:	**SATEL Oy**
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TEST LABORATORY	**Nemko Oy**
FCC REG. NO.	**359859 November 26, 2008**
IC FILE NO.	**2040F-1 December 15, 2008**

REMARKS:

Tested to FCC Part 90 and RSS-119 Issue 9.

The test results are valid for the tested unit only. Without a written permission of Nemko Oy it is allowed to copy this report as a whole, but not partially.

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Contents

1. General

Type:	**SATEL-TA18**
Alignment range:	**403.0 – 473.0 MHz**
Switching range:	**403.0 – 473.0 MHz**

Measurement	Equipment 1	Equipment 2	Equipment 3
	Serial no. -	Serial no. -	Serial no.
Frequencies:	1) **406.1 MHz** 2) **428.0 MHz** 3) **468.0 MHz**	4) 5) 6)	)

	Normal	Minimum	Maximum
Voltages:	**13.2 VDC**	**11.2 VDC**	**15.2 VDC**
Temperatures:	**+23,0°C**	**-30,0°C**	**+60,0°C**
Humidity:	**35 %**		

Effective radiated power:	**35 W**	Antenna:	**50 ohm**
		Production model:	**Pre-production model**
Number of channels:		Modulation:	**Multilevel State FM (4FSK)**
Channel separation:	**12.5 and 25 kHz**		**(12,5 kHz: 9600 bps** **25 kHz: 19200 bps)**

The transmitter was tested in a standalone configuration.

2. Summary of performed tests and test results

(This interpretation of the test report's results does not belong to the scope of our accreditation.)

Section in CFR 47	*Section in RSS-119, Issue 9*		*Result*
90.205 & 2.1046	*5.4*	*Transmitter power (conducted)*	**NT**
90.210, 2.1057 & 2.1051	*5.8*	*Spurious emissions (conducted)*	**NT**
90.210, 2.1057 & 2.1053	*5.8*	*Spurious emissions (radiated)*	**PASS**
90.213 & 2.1055	*5.3*	*Frequency stability*	**NT**
90.210 & 2.1049	*5.5*	*99% Occupied bandwidth*	**NT**
90.210 & 2.1049	*5.5*	*Spectrum emission mask*	**NT**
90.214	*5.9*	*Transient frequency behavior*	**NT**
15.107 (a)	*RSS-Gen 7.2.2*	*Conducted emissions at mains ports*	**N.A.**
15.109 (a)	*RSS-Gen 6*	*Spurious radiations (radiated)*	**PASS**

According to the standard the measurement results have been compared directly with the limits without considering measurement uncertainties.

Explanations:

PASS The EUT passed that particular test.
FAIL The EUT failed that particular test.
NT Not tested
NA Not applicable

3. Transmitter Spurious Emissions (Radiated)

NAME OF TEST: Field Strength of Spurious Emissions	PARA.NO.:, 2.1053 RSS119: 5.8
TESTED BY: Timo Hietala DATE: 29/09/2010	

Test Results: Complies.

Requirement: 43 + 10 log (P) dB, (-13 dBm)

Transmitter tuned at 406.1, 428 and 468 MHz

Test Data:

Channel 406.1 MHz		Channel 428.0 MHz		Channel 468.0 MHz	
Frequency (MHz)	Level (dBm)	Frequency (MHz)	Level (dBm)	Frequency (MHz)	Level (dBm)
812.2	-47.1	856.0	-51.2	936.0	-43.7
1218.3	-46.9	1284.0	-56.8	1404.0	-56.2
1624.4	-50.7	1712.0	-56.6	1872.0	-57.0
2030.5	-49.4	2140.0	-54.2	2340.0	-59.3
2436.6	-54.4	2568.0	-48.6	2808.0	-53.4
2842.7	-46.5	2996.0	-41.2	3276.0	-38.2
3248.8	-45.1	3424.0	-42.2	3744.0	-36.4
3654.9	-44.4	3852.0	-46.6	4212.0	-42.8
4061	-45.2	4280.0	-46.8	4680.0	-41.5
4467.1	-48.5	4708.0	-43.7	5148.0	-43.7
4873.2	-42.0				

Equipment used: 566, 564, 571, 525, 417, 544, 145

Measurement Uncertainty: ± 5.2 dB.

Temperature: 22 °C.

Relative Humidity: 35 %.

The spectrum was searched from 30 MHz to the 10th harmonic of the carrier (5GHz).

The test was performed in a semi-anechoic shielded room. The EUT was placed on a non-conductive 0.8 m high table standing on the turntable. During the test in the frequency range 30-5000 MHz the distance from the EUT to the measuring antenna was 3 m. In order to find the maximum levels of the disturbance radiation the angle of the turntable, the height of the measuring antenna were varied during the tests. The test was performed with the measuring antenna being both in horizontal and vertical polarizations. Spectrum analyzer settings were: 30MHz-1000MHz RBW 100kHz,VBW 1MHz, 1000-5000MHz RBW 1MHz, VBW 3MHz.

Vertical and horizontal polarizations in the frequency range 30 – 5000 MHz was first measured by using the peak detector. During the peak detector scan the turntable was rotated from 0° to 360° with 30° steps with the antenna heights 1.0 m and 2.5 m.

The limit of -13 dBm has been calculated to correspond 84.4 dB(µV/m).
Spurious emissions closer than 20 dB to the limit were measured with average detector.

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The EUT was replaced with a reference substitution antenna with a known gain referenced to an isotropic radiator $G_{Antenna[dBi]}$. This antenna was fed with a signal at the spurious frequency $P_{Gen[dBm]}$. The level of the signal was adjusted to repeat the previously measured level. The resulting EIRP is the signal level fed to the reference antenna corrected for gain referenced to an isotropic.
The formula below was used to calculate the EIRP of the EUT.

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

4. Receiver Spurious Emissions (Radiated)

NAME OF TEST: Radiated disturbance emission test		**PARA.NO.:, 15.109 RSS-Gen: 6**
TESTED BY: Timo Hietala	**DATE: 29/09/2010**	

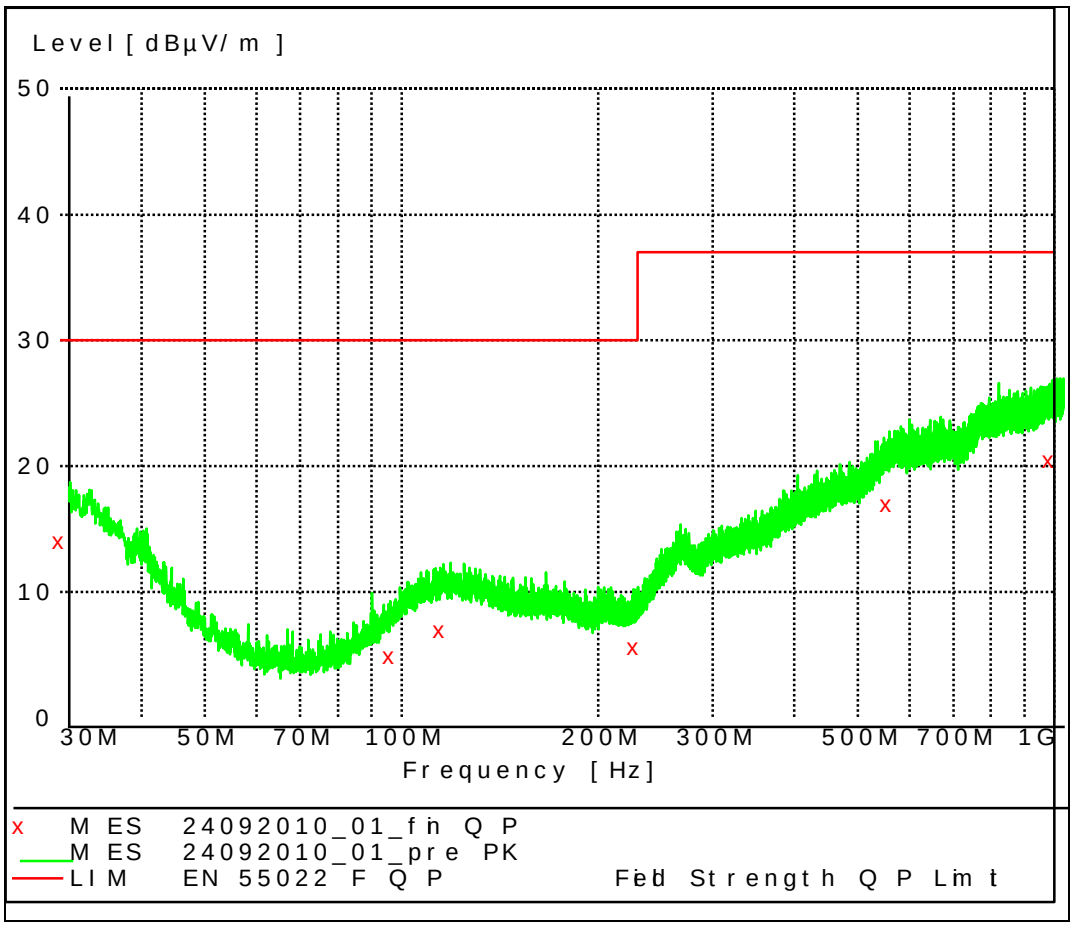
Test Results: Complies.

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

Parameter	Specification
Test method	CISPR 22, ANSI C63.4 (2009)
Frequency range	30 – 2000 MHz
Site name	Nemko Oy / Perkkaa
Test equipment	319, 350, 544, 525, 566, 564
Test uncertainty U95	±4.6 dB
Test conditions	22 °C, 35 % RH

The test was performed in a semi-anechoic shielded room. For the duration of the test the EUT was placed on a non-conductive support 0.8 m above the metallic ground plane (see photograph 1). During the test the distance from the EUT to the measuring antenna was 3 meters. In order to find the maximum levels of the disturbance radiation the angle of the turntable, the height of the measuring antenna and the lay-out of the EUT cables were varied during the tests. The test was performed with the measuring antenna being both in horizontal and vertical polarizations. Spectrum was searched from 30MHz to 2GHz. Spectrum analyzer settings were: 30MHz-1000MHz RBW 100kHz, VBW 1MHz, 1000-2000MHz RBW 1MHz, VBW 1MHz.

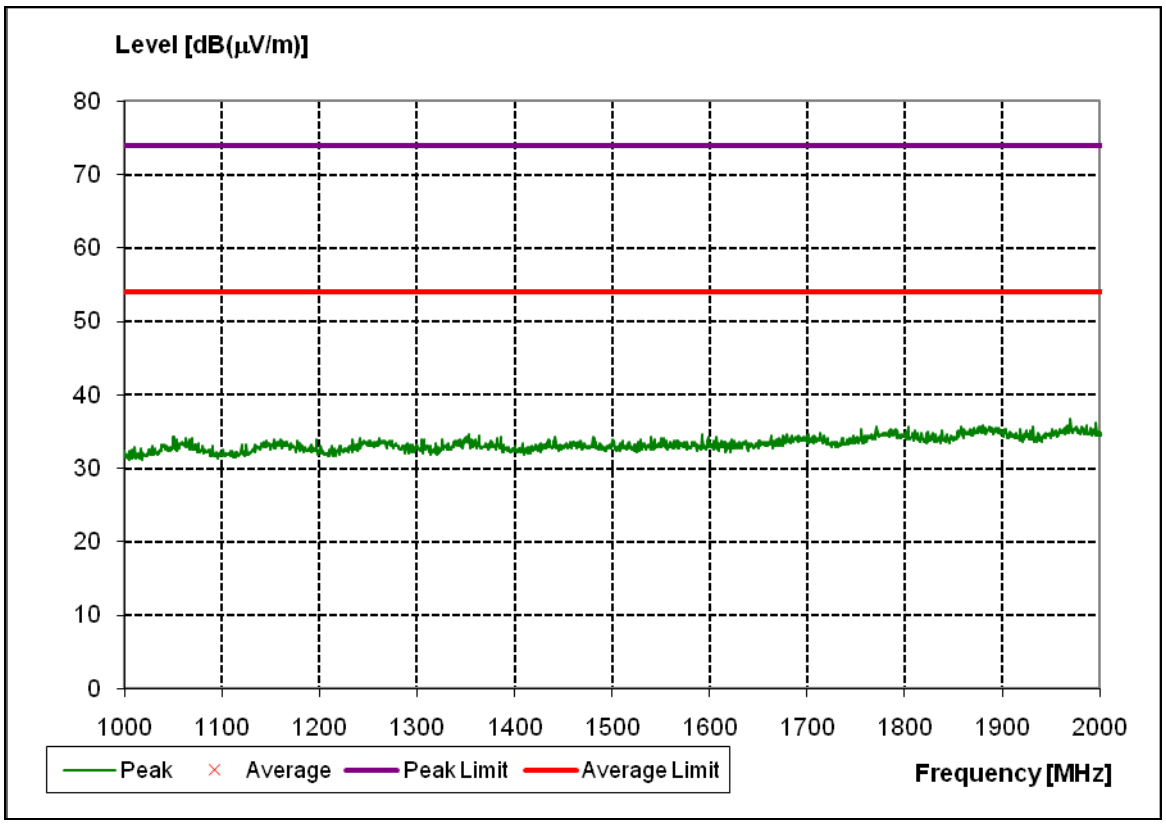
Test results radiated disturbance emission test



Horizontal and vertical polarisations in the frequency range 30 – 1000 MHz measured by using the peak detector. During the peak detector scan, the turntable was rotated from 0° to 360° with 30° steps with the antenna heights 1.0 m and 3.0 m. The highest levels of the radiated interference field strength measured by using the quasi-peak detector were recorded.

Measurement results (QP):

Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Exceed
30.12	14.1	30	15.9	–
96.36	4.9	30	25.1	–
115.28	7.0	30	23.0	–
228.76	5.6	30	24.4	–
557.32	17.0	37	20.0	–
988.44	20.5	37	16.5	–



Horizontal and vertical polarizations in the frequency range 1000 – 2000 MHz measured by using the peak detector. During the peak detector scan, the turntable was rotated from 0° to 360° with 15° steps with the antenna heights 1.0, 1.5m, 2.0m, 2.5m and 3.0m. The highest levels of the radiated interference field strength measured by using the peak and average detectors were recorded.

The FCC 47 CFR Part 15, Subpart B, Class B limit of 500 µV/m has been calculated to correspond 54.0 dB(µV/m) as follows: [dB(µV/m)]=20log[µV/m].

5. List of measuring equipment:

No.	Equipment	Type	Manufacturer	Serial Number
5	Test receiver	ESH-3	Rohde & Schwarz	894718/01510
10	Oscilloscope	9400A	LeCroy	8878
42	Spectrum analyzer	8566B	Hewlett Packard	2637A04102
43	Spectrum analyzer	8568B	Hewlett Packard	2039A01256
62	Audio amplifier	PRL x	Self made	
89	Antenna	3147	EMCO	9202-1078
102	Hybrid	H 9	Anzac	
133	Termination 50	370 BNM	Narda	
145	Notch Filter	TTR - 375 - 3EE	Telonic	3062 - 1
146	Dual directional coupler	778D	Hewlett Packard	1144A02333
157	Temp. test chamber	VMT 04/240	Vötch	31884
168	Artificial Mains	NSLK 8127	Schwartzbeck	8127162
176	Anechoic chamber	888 cm x 585 cm x 416 cm	length of absorber 66 cm	
185	Antenna	PRL LogPer	Self made	1A93
201	RF-Generator	2042	Marconi	119571/062
205	RF-Amplifier	ZHL-1042J	Mini-Circuits	012288-11
316	Power supply	HP 6032A	Hewlett Packard	2517A-00654
319	Antenna	CBL6112	Chase	2018
328	Power attenuator	765-20	Narda	-
332	IF-filter	10.7MHz/25kHz	Ultracom Oy	-
334	IF-filter	10.7MHz/12.5kHz	Ultracom Oy	-
335	Mixer	ZFM-150	Mini-Circuits	-
337	Modulation analyzer	HP 8901B	Hewlett Packard	3538A05622
341	Multimeter	Fluke 87	Fluke	593100386
350	Semianechoic shielded room	RFD-F-100	Euroshield Oy	1327
386	RF attenuator PAD	WA2-3	Weinschel	3780
390	RF attenuator PAD	WA2-10	Weinschel	3784
392	RF attenuator PAD	1A (6dB)	Weinschel	
394	RF attenuator PAD	1A (20dB)	Weinschel	
417	Antenna, bilog	CBL 6141	Chase	4028
525	Double-Ridged Horn	3115	Emco	6691
544	RF-amplifier	ZFL-1000VH2	Mini-Circuits	D01080
563	Thermometer	52 II	Fluke	81210080
564	RF amplifier	CA018-4010	CIAO Wireless	101
566	Spectrum analyzer	E4448A	Agilent	US42510236
567	RF generator	E8257C	Agilent	MY43320736
571	High Pass Filter	WHK0.6/13G-10SS	Wainwright Instruments	1
2039	Power sensor	8482A	Hewlett Packard	1925A03475
2040	Power meter	438A	Hewlett Packard	2517U00427
2046	Counter	5351B	Hewlett Packard	2844U00220

Photograph 1, Radiated spurious emissions test.