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Tested by:



Pekka Kälviäinen, Test Engineer



Reviewed by:



Timo Leismala, Test Manager

SORT OF EQUIPMENT:

SATELLAR product family Radio Unit

MARKETING NAME:

SATELLAR RU

TYPE:

SATEL-TA12

MANUFACTURER:

SATEL Oy, Finland

SERIAL NUMBER:

01, 02, 03 and 04

CLIENT:

SATEL Oy

ADDRESS:

Meriniitynkatu 17, FI-24100 Salo, Finland

TELEPHONE:

+358 50 5998411 / Marita Latovehmas

TEST SPECIFICATION:

IEC 61000-6-2 (2005), EN 301 489-1, v.1.8.1, EN 301 489-3, v.1.4.1**SUMMARY:**

In regard to the performed tests the EUT fulfils the requirements defined in the test specifications IEC 61000-6-2 (2005), EN 301 489-1, v.1.8.1, EN 301 489-3, v.1.4.1, see page 2 for details.

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.

Summary of performed tests and test results

Immunity tests according to the test specifications IEC 61000-6-2 (2005), EN 301 489-1, v.1.8.1 and EN 301 489-3, v.1.4.1:

Immunity test	Test method	Conclusion
Radiated radio-frequency electromagnetic field	EN 61000-4-3	Pass
Conducted radio-frequency common mode	EN 61000-4-6	Pass

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1. General

The equipment under test (EUT) was a SATELLAR product family Radio Unit. The purpose of the performed tests was to see if in regard to these tests the EUT fulfils the EMC requirements defined in the Commission Directives 2004/108/EC and 1999/5/EC. The tests were performed according to the test specifications IEC 61000-6-2 (2005), EN 301 489-1, v.1.8.1, EN 301 489-3, v.1.4.1 by using accredited test methods.

2. System Configuration

2.1 Test set-up

Equipment under test (EUT):

unit	S/N
SATEL-TA12 (360 - 405 MHz)	03 and 04 *)
SATEL-TA12 (400 - 445 MHz)	01 and 02 **)

*) 04 in TX-mode and 03 in RX-mode

**) 02 in TX-mode and 01 in RX-mode

Peripheral devices:

unit	type	S/N
Data cable (2)	-	-
Power cable (2)	-	-
Computer 1 *)	Compaq Admada, 1540D	0509Q114
Computer 2 *)	Fujitsu LifeBook, 555T	R6Y00015
20 dB 50W attenuator	Narda, 765-20	9605 (328)
Variable attenuator	R&S, DPU-BN 18043/50	2519/1 (155)

*) located outside of the test area

Cables:

from	to	type	length [m]
SATEL-TA12 (TX) serial port	Computer 1	unshielded	10
SATEL-TA12 (TX) antenna port	Attenuator (328+155)	coaxial	1 or 3
Attenuator (328+155)	SATEL-TA12 (RX) Antenna port	coaxial	1 or 3
SATEL-TA12 (RX) serial port	Computer 2	unshielded	10
SATEL-TA12 (TX)	DC power source	unshielded	1
SATEL-TA12 (RX)	DC power source	unshielded	1

Operating voltage of the EUT:

- 12 VDC

2.2 Operating conditions and monitoring of the EUT

The radio units were connected to the computers. The antenna ports of the radio units were connected together via the attenuators. One computer was set to send a data pack. That data pack was received with the second computer. Quality of the data transfer was monitored. TX/RX frequency was 380 MHz and 420 MHz.

2.3 Performance criteria for immunity tests

Equipment type: III

Class of SRD equipment: 1

Criteria A

During test:

Operate as intended. No loss of function. No unintentional responses.

After test:

Operate as intended. No loss of function. No degradation of performance. No loss of stored data or user programmable functions.

Criteria B

During test:

May be loss of function (one or more). No unintentional responses.

After test:

Operate as intended. Lost function(s) shall be self-recoverable. No degradation of performance. No loss of stored data or user programmable functions.

3. Test procedures

3.1 Immunity tests

3.1.1 Radiated radio-frequency electromagnetic field immunity test

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

Parameter	Specification
Test method	EN 61000-4-3
Frequency range	80 – 1000 and 1400 – 2700 MHz
Modulation	AM 80% 1 kHz
Sweep	Step: 1 %, Time/step: 1 s
Test level	80 – 1000 MHz, 10 V/m 1400 – 2700 MHz, 3 V/m
Performance criterion	A
Site name	Nemko Oy / Perkkää
Date of testing	12.05.2010
Test equipment	176, 201, 354, 417, 525, 534
Test conditions	21 °C, 35-37 % RH
Tested operation states	TX and RX

The test was carried out in an absorber lined anechoic shielded room. The EUT was placed on a non-conductive turntable 1 m above the floor absorbers (see photograph 1). The distance between the transmitting bilog antenna (80 – 1000 MHz) and the EUT was 2.2 m measured from the antenna tip. The distance between the transmitting horn antenna (1400 – 2700 MHz) and the EUT was 3.0 m. The test was performed with the field generating antenna facing each of the four sides of the EUT. Both vertical and horizontal polarizations were tested. The field strength was checked with a calibrated field sensor. The uniformity of field has been calibrated. The cables were oriented in a position anticipated to be the worst-case.

3.1.2 Conducted radio-frequency common mode immunity test

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

Parameter	Specification
Test method	EN 61000-4-6
Frequency range	0.150 – 80 MHz
Modulation	AM 80% 1 kHz
Sweep	Step: 1 %, Time/step: 1 s
Test level	0.15 – 47 MHz: 10 V _{emf} 47 – 68 MHz: 3 V _{emf} 68 – 80 MHz: 10 V _{emf}
Performance criterion	A
Site name	Nemko Oy / Perkkää
Date of testing	21.06.2010
Test equipment	351, 348, 418, 299, 363, 339, 560
Test conditions	22 °C, 38 % RH
Tested operation states	TX and RX

The test was carried out inside a shielded room. The EUT was placed on a non-conductive support 0.1 m above the reference ground plane (RGP). Coupling/decoupling networks (CDNs) were used to realize a defined impedance for the test signal and to prevent the test signal from reaching the assisting equipment (see photograph 2). The EUT cables were placed 30 - 50 mm above the RGP. The distance between the CDNs and the EUT was 0.3 m.

4. Test results

4.1 Immunity tests

4.1.1 Radiated radio-frequency electromagnetic field immunity test

TX and RX 380 MHz

Polarisation	Frequency MHz	Test level V/m	Remarks	Conclusion Pass/Fail
Vertical	80 – 1000	10	–	Pass
Horizontal	80 – 1000	10	–	Pass

Polarisation	Frequency MHz	Test level V/m	Remarks	Conclusion Pass/Fail
Vertical	1400 – 2700	3	–	Pass
Horizontal	1400 – 2700	3	–	Pass

TX and RX 420 MHz

Polarisation	Frequency MHz	Test level V/m	Remarks	Conclusion Pass/Fail
Vertical	80 – 1000	10	–	Pass
Horizontal	80 – 1000	10	–	Pass

Polarisation	Frequency MHz	Test level V/m	Remarks	Conclusion Pass/Fail
Vertical	1400 – 2700	3	–	Pass
Horizontal	1400 – 2700	3	–	Pass

4.1.2 Conducted radio-frequency common mode immunity test*TX and RX 380 MHz*

Port	Frequency MHz	Test level Vemf	Remarks	Conclusion Pass/Fail
DC power input	0.150 – 47	10	–	Pass
	47 – 68	3	–	Pass
	68 – 80	10	–	Pass
Serial port	0.150 – 47	10	–	Pass
	47 – 68	3	–	Pass
	68 – 80	10	–	Pass
Antenna port	0.150 – 47	10	–	Pass
	47 – 68	3	–	Pass
	68 – 80	10	–	Pass

TX and RX 420 MHz

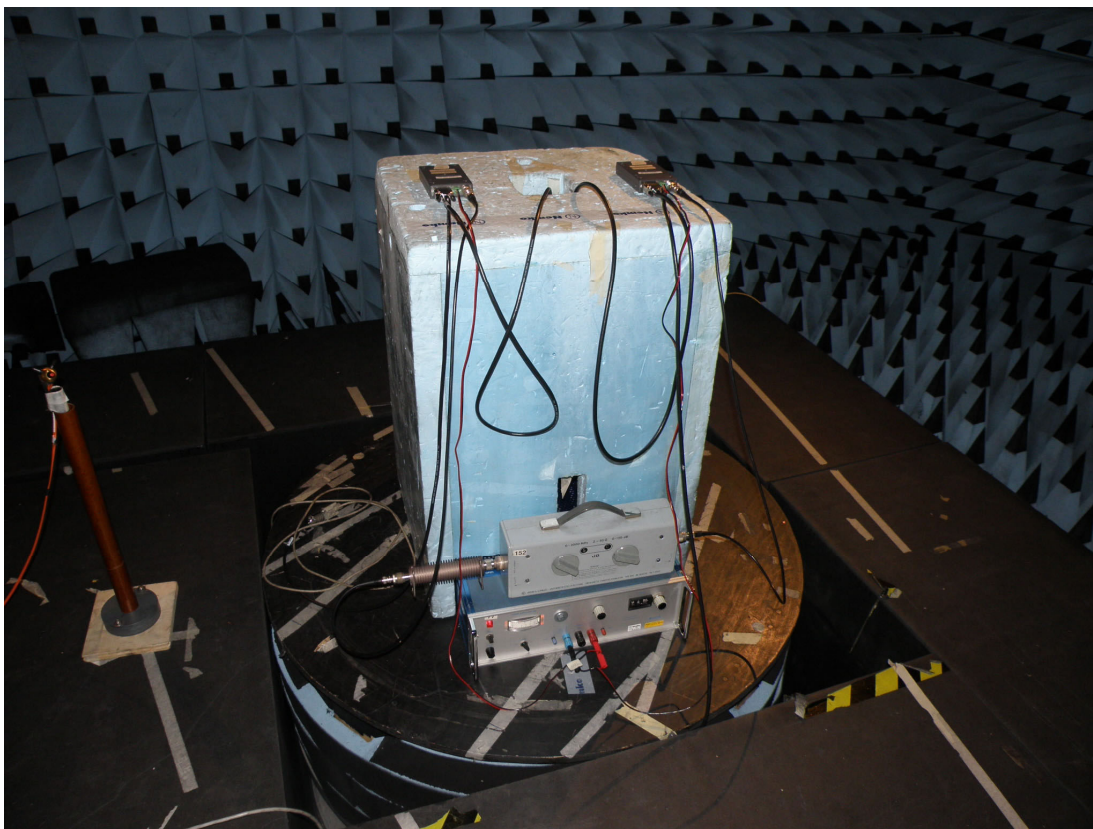
Port	Frequency MHz	Test level Vemf	Remarks	Conclusion Pass/Fail
DC power input	0.150 – 47	10	–	Pass
	47 – 68	3	–	Pass
	68 – 80	10	–	Pass
Serial port	0.150 – 47	10	–	Pass
	47 – 68	3	–	Pass
	68 – 80	10	–	Pass
Antenna port	0.150 – 47	10	–	Pass
	47 – 68	3	–	Pass
	68 – 80	10	–	Pass

5. List of test equipment

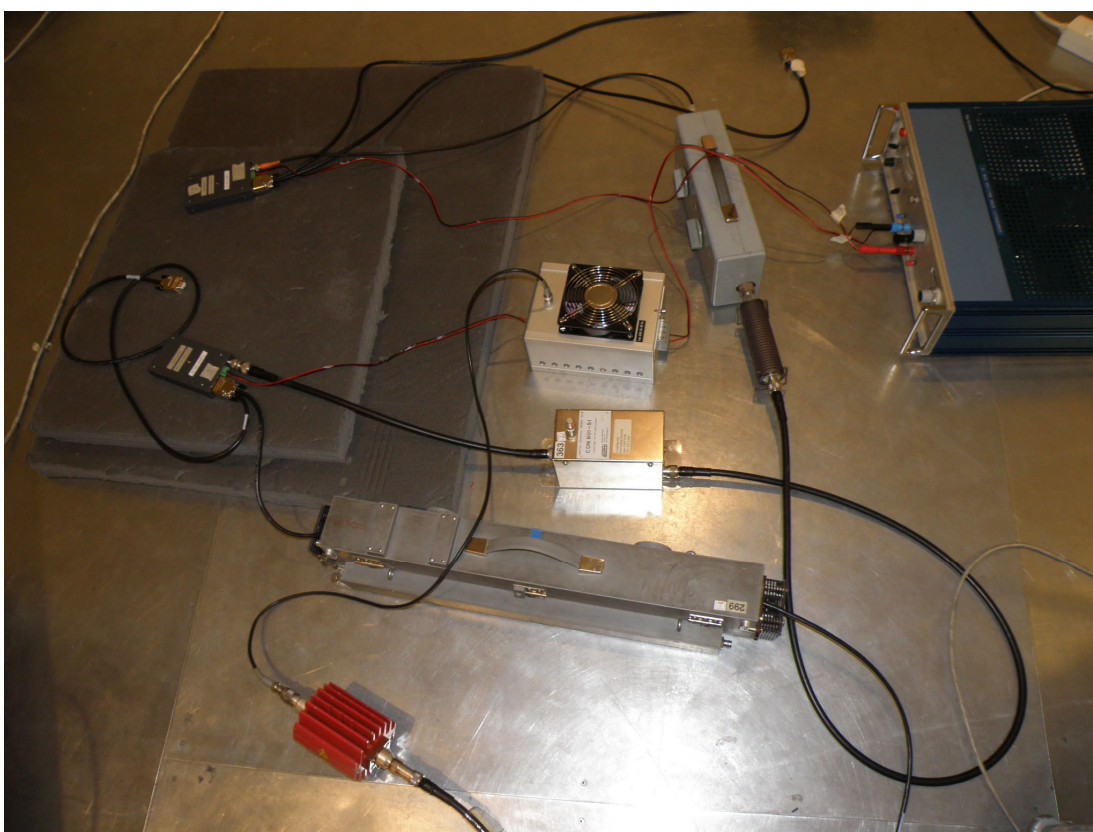
Nr.	Equipment	Type	Manufacturer	Serial number
234	Measuring amplifier	2636	Brüel & Kjær	1601424
235	Band pass filter	1617	Brüel & Kjær	1375358
574	Microphone	4192-B-001	Brüel & Kjær	1536771
9	Modulation analyzer	8901B	Hewlett Packard	2718A01220
233	Measuring amplifier	2636	Brüel & Kjær	1601422
315	RF generator	8656B	Hewlett Packard	2530A02373
42	Spectrum analyzer	8566B	Hewlett Packard	2637A04102
5	Test receiver	ESH-3	Rohde & Schwarz	894718/015
38	RF generator	SMG	Rohde & Schwarz	883590/035
55	Power meter	NAUS	Rohde & Schwarz	2177/064
362	Power supply	B32-20R	Oltronix	653
167	Artificial Mains	NSLK 8126	Schwartzbeck	8126101
168	Artificial Mains	NSLK 8127	Schwartzbeck	8127162
176	Anechoic chamber	RFD-60	Euroshield	509
184	Temp. & humidity meter	H MI 32	Vaisala	63837
188	Antenna	CBL6111	Chase	1028
190	Shielded room	L3000	Belling-Lee	S4566
193	ESD generator	NSG435	Schaffner	316
201	RF-Generator	2042	Marconi	119571/062
222	Impulse tester	PSURGE4	Haefely	083070-10
223	Coupling network	IP6.2	Haefely	083038-20
224	EFT/Burst generator	PEFT JUNIOR	Haefely	083180-46
225	HF coupling clamp	IP4A	Haefely	083078-008
289	Universal power analyzer	PM 3000A	Voltech	8448
290	Ref. impedance network	IEC555	Voltech	8448
291	Field sensor	BA05		
292	Optical repeater	ORO1		
293	Isotropic field meter	PMM 8051		
294	DCN-network	801-M2/M3	Lüthi GmbH	
299	RF injection clamp	EM 100	Lüthi GmbH	-
300	Coupling network	CDN 801-AF2	Self made	-
316	Power supply	HP 6032A	Hewlett Packard	2517A-00654
317	RF generator	2052	Marconi	119754/058
319	Antenna	CBL6112	Chase	2018
320	Voltage dip tester	PLINE 1610	Haefely Trench AG	083690-22
321	Coupling network	FP-EFT 32.1	Haefely Trench	083590-08
322	Coupling network	HV-SURGE 63.3	EMCEC OY	011996
323	T-network	EZ-10	Rohde & Schwarz	843074/005
324	T-network	ESH3-Z4	Rohde & Schwarz	842929/012
325	T-network	ESH3-Z4	Rohde & Schwarz	842929/010
336	Magnetic field tester	MAG 100.1	Haefely Trench AG	080015-9
338	Test receiver	ESS	Rohde & Schwarz	847151/009
339	RF-power amplifier	116FC-CE	Kalmus	7583A-1
340	RF-power amplifier	7100LC-CE	Kalmus	7583B1
341	Multimeter	Fluke 87	Fluke	593100386
342	Multimeter	Fluke 12	Fluke	58720270
343	Artificial Mains Network	NSLK8128	Schwartzbeck	8128177
344	mV-meter	URV4	Rohde & Schwarz	879747/013
347	Automotive test system	NSG5000	Shaffner	EK3396-021
348	Shielded room	RFSD-100	Euroshield Oy	1320
349	Shielded room	RFSD-100	Euroshield Oy	1319
350	Semianechoic shielded room	RFD-F-100	Euroshield Oy	1327
351	RF generator	SMT 06	Rohde & Schwarz	845715/001
352	Antenna	3142	EMCO	9701-1122
353	RF power amplifier	AR 10S1G4	Amplifier Research	20156
354	RF power amplifier	AR 500W1000M7	Amplifier Research	20487
355	RF power amplifier	LA100V - CE	Kalmus	7809-1
359	E-field probe	HI-4422	Holaday	95835
360	Antenna	3303	Emco	9702-2978
361	Current probe	CIP 9136	Chase	1043
363	Coupling/decoupling dev.	CDN 801-S1	Robert Lüthi GmbH	554
364	Coupling/decoupling dev.	CDN 801-M4/63A	MEB	12998

365	Coupling/decoupling dev.	CDN 801-M5/25A	MEB	11514
366	RF-amplifier	AR15A25	Amplifier Research	10783
367	LISN	NNB-4/200	Rolf Heine	4/200X-96009
369	Discont.Interf.analyzer	DIA 1512A	Chase	5115
370	AC Power source	15003i-400/3	California Instr.	
371	AC Power source	500i-400	California Instr.	HK 52064
372	AC Power source	500i-400	California Instr.	HK 52065
373	AC Power source	500i-400	California Instr.	HK 52063
374	Impedance network	OMNI 3-18i	California Instr.	X71344
403	Processmeter	787	Fluke	6975028
404	Processmeter	787	Fluke	7005196
405	Horizontal coupling plane	HCP1	Self made	-
406	Vertical coupling plate	VCP1	Self made	-
409	ESD generator	NSG435	Schaffner	2288
410	ELF Survey meter	HI-3604	Holaday	91604
411	E-field probe	HI-4433-GRE	Holaday	96730
412	Decoupling clamp	FGZ 40X15 C	Lüthi	4561
413	Decoupling clamp	FGZ 40X15 C	Lüthi	4562
414	Decoupling network	DEC1A	Haefely	080 641-04
416	RF High-Power Attenuator	765-6	Narda	9708
417	Antenna, bilog	CBL 6141	Chase	4028
418	Coupling network	CDN L801 M2/50	Luthi	1655
419	Audio power amplifier	S900	Dynacord	9815010364
421	Hand simulator	-	Oma valmiste	021996
427	Directional coupler	DC2500	Amplifier Research	24148
428	Directional coupler	RK 100	MEB	13703
429	Directional coupler	DC6280	Amplifier Research	24067
430	Directional coupler	DC7144	Amplifier Research	24230
431	Power meter	NRVD	Rohde & Schwarz	826224/047
432	Voltage probe	URV5-Z2	Rohde & Schwarz	826853/030
433	Voltage probe	UVR5-Z2	Rohde & Schwarz	826853/029
485	Horizontal coupling plane	HCP2	Self made	992
506	4 wire ISN	ENY41	Rohde & Schwarz	866824/029
507	2 x 2 wire ISN	ENY22	Rohde & Schwarz	833823/017
510	Audio isolation transformer	6220-1A	Solar Electronics Co.	
519	RF High-Power Attenuator	765-20	Narda	
520	Injection clamp	EM101	Robert Lüthi GmbH	903557
524	Active Rod Antenna	3301B	Emco	4432
525	Double-Ridged Horn	3115	Emco	6691
528	Matching device	CN-DC1	Emcec Oy	01
529	Matching device	CN-DC1	Emcec Oy	02
534	RF-amplifier	25S1G4A	Amplifier Research	303881
535	True RMS Multimeter	189	Fluke	80350519
542	Double-Ridged Horn	3115	Emco	00023905
544	RF-amplifier	ZFL-2000VH2	Mini-Circuits	D01080
560	Power attenuator 6 dB	BN 74 53 52	Spinner	-
561	Power attenuator 6 dB	BN 74 53 52	Spinner	-
564	RF-amplifier	CA018-4010	CIAO Wireless	101
582	Automotive electronic switch	SWE-25A	AFJ International	499
581	Automotive pulse generator	ZCP40-1000	AFJ International	502

6. Photographs



Photograph 1. Radiated radio-frequency electromagnetic field immunity test.



Photograph 2. Conducted radio-frequency common mode immunity test.