

Date: **ESPOO** **07 / 10** **1998**

Page: **1 (25)**

Number: **TL 980212**

Date of handing in: **24.06.1998**

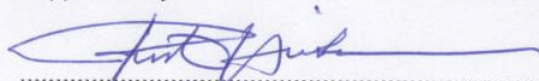
Measured by:



Pekka Kälviäinen

B.Sc.(Eng)

Approved by:



Risto Hietanen

Product Manager



T017 (EN 45001)

SORT OF EQUIPMENT: Radio Modem

MARKETING NAME:

SATELLINE

TYPE:

3ASd

MANUFACTURER:

SATEL OY

SERIAL NUMBER:

98260001, 98260002, 98260003, 98260004

CUSTOMER:

SATEL Oy

ADDRESS:

Meriniitynkatu 17, FIN-24100 Salo

TELEPHONE:

+358 2 777 7800 / Tapio Malmivaara

TESTSPESIFICATION:

EN 300 220-1

REMARKS:

Five original identical test reports have been prepared.
All have been delivered to the client. This test report is No. 1 (of 5).

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

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Type:	3ASd		Category: AR3
Alignment range:	90 MHz		
Switching range:	One channel		
Measurement	Equipment 1 and 4	Equipment 2	Equipment 3
Frequencies Tx/Rx:	Serial no. 98260001 / 98260004 1) 380.000 MHz 4) 470.000 MHz	Serial no. 98260002 2) 410.000 MHz	Serial no. 98260003 3) 440.000 MHz
Voltages:	Normal 13.5 VDC	Minimum 9.0 VDC	Maximum 30.0 VDC
Temperatures:	23.2 to 25.8 °C	- 20 °C (Category: I)	+ 55 °C
Humidity:	36.5 to 56.5 %		
Carrier power:	0.4 mW (Class: 12)	Antenna:	TNC-connector (50 Ω)
Class of emission:	F1D	If frequencies:	77 550 khz, 455 kHz
Number of channels:	1	Production model:	No
Channel separation:	25 kHz	Mode of DATA	FSK, 19200 bps, direct

The following measurements according to EN 300 220-1 standard have been performed:

Eq. 2 Ch. 2)	Eq. 1 and 4 Channels 1) 4)	Eq. 3 Ch. 3)	
x	x	x	8. Transmitter
x	x	x	8.1 Frequency error
na	na	na	8.2 Carrier power (conducted)
na	na	na	8.3 Effective radiated power (radiated)
na	na	na	8.4.1.2 Analogue signals within the audio bandwidth (FM)
na	na	na	8.4.1.3 Analogue signals above the audio bandwidth (FM)
na	na	na	8.4.2.2 Analogue signals within the audio bandwidth (AM)
na	na	na	8.4.2.3 Analogue signals above the audio bandwidth (AM)
na	x	na	8.5 Adjacent channel power
na	na	na	8.6 Range of modulation bandwidth for wide band equipment (>25 kHz)
na	x	na	8.7.2 Conducted spurious emissions / 8.7.1 a) i)
na	x	na	8.7.3 Spurious emissions (cabinet radiation) / 8.7.1 a) ii)
na	na	na	8.7.4 Spurious emissions (cabinet radiation) / 8.7.1 b)
na	x	na	8.8 Frequency stability under low voltage conditions
na	na	na	8.9 Duty Cycle (*)
			9. Receiver
na	x	na	9.1.2 Conducted spurious emissions / 9.7.1 a) i)
na	x	na	9.1.3 Spurious emissions (cabinet radiation) / 9.7.1 a) ii)
na	na	na	9.1.4 Spurious emissions (cabinet radiation) / 9.7.1 b)
na	x	na	9.2 Spurious response rejection and blocking / desensitization

REMARKS

na: no applicable

*) See the application form (Appendix)

Ambient temperature: 23.3 °C Relative humidity: 46.8 % Date: 10.09.1998

TRANSMITTER FREQUENCY ERROR CLAUSE 8.1

TEST CONDITIONS		FREQUENCY ERROR (Hz)			
Channel		1	2	3	4
Tnom	Vnom	+ 224	+ 378	+ 555	+ 752
Tmin	Vmin	+ 1286	+ 1218	+ 1497	+ 1563
	Vmax	+ 1387	+ 1222	+ 1589	+ 1577
Tmax	Vmin	- 271	- 776	+ 198	- 242
	Vmax	- 230	- 745	+ 218	- 226
Maximum freq. error. (Hz)					
Measurement uncertainty (U95)		6.1×10^{-8}	6.1×10^{-8}	6.1×10^{-8}	6.1×10^{-8}

LIMITS CLAUSE 8.1.3

CHANNEL SPACING kHz	FREQUENCY RANGES				
	Below 47MHz	Above 47 to 137MHz	Above 137 to 300MHz	Above 300 to 500MHz	Above 500 to 1000MHz
	LIMITS kHz				
10.0 / 12.5	± 0.60	± 1.00	± 1.00 (b) ± 1.50 (m) ± 2.00 (p)	± 1.00 (b) ± 1.50 (m) ± 2.50 (p)	No value specified
20.0 / 25.0	± 0.60	± 1.35	± 2.00	± 2.00 (mb) ± 2.50 (p)	± 2.50 (mb) ± 3.00 (p)

b = fixed station (base)

m = mobile station

p = portable station

TEST EQUIPMENT USED: 53, 394, 157, 230, 362, 195

Ambient temperature: 23.3 °C Relative humidity: 46.8 % Date: 10.09.1998

CARRIER POWER (CONDUCTED) CLAUSE 8.2

Rated output power: 0.4 W.

TEST CONDITIONS		TRANSMITTER POWER (Watts)			
Channel		1	2	3	4
Tnom	Vnom	0.36	0.42	0.37	0.29
Tmin	Vmin	0.48	0.53	0.49	0.32
	Vmax	0.48	0.53	0.49	0.32
Tmax	Vmin	0.32	0.40	0.34	0.25
	Vmax	0.32	0.40	0.34	0.25
Variation in output power under normal test conditions					
Variation in output power under extreme test conditions					
Measurement uncertainty		± 0.75 dB	± 0.75 dB	± 0.75 dB	± 0.75 dB

LIMITS CLAUSE 8.2.3

CLASS	POWER LEVEL mW
7a	5
8	10
9	25
11	100
12	500

TEST EQUIPMENT USED: 59, 218, 394, 157, 230, 362, 195

Ambient temperature: 23.7 °C Relative humidity: 52.6 % Date: 01.07.1998

ADJACENT CHANNEL POWER CLAUSE 8.5

MEASUREMENT	BELOW CARRIER POWER (dBc)			
	1	2	3	4
Equipment				
+ 25.0 kHz	74.5	72.5	73.5	72.0
- 25.0 kHz	71.5	73.5	70.5	71.5
Measurement uncertainty (U95)	± 1.6 dB			

LIMITS: CLAUSE 8.5.3 TABLE 11

	Channel separation < 20 kHz	Channel separation ≥ 20 kHz
Normal test conditions	10 µW	200 nW
Extreme test conditions	32 µW	640 nW

TEST EQUIPMENT USED: 9, 33, 394, 390, 362, 195

Ambient temperature: 23.7 °C Relative humidity: 52.6 % Date: 01.07.1998 (channel 1)
Ambient temperature: 23.3 °C Relative humidity: 52.7 % Date: 11.09.1998 (channel 4)

TRANSMITTER SPURIOUS EMISSIONS CONDUCTED CLAUSE 8.7.2 / 8.7.1 a) i)

FREQUENCY (MHz)	CHANNEL 1	FREQUENCY (MHz)	CHANNEL 4	Remarks
Tx operating		Tx operating		
372.20	11.8 nW	472.33	1.7 nW	
527.30	0.24 nW	471.90	2.9 nW	
760.00	2.2 nW	1880.00	250 nW	
1520.00	1.7 nW	2820.00	0.50 nW	
2280.00	4.9 nW	3760.00	0.74 nW	
2660.00	6.2 nW	others 25 MHz to 4 GHz	< 0.2 nW	
3040.00	5.8 nW			
all 1 GHz to 4 GHz	< 5.0 nW			
Tx on standby				
				see clause 9.1.2
				page 8
Measurement uncertainty	± 1.8 dB			

LIMITS: CLAUSE 8.7.5 TABLE 12

State	47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies below 1000 MHz	Frequencies above 1000 MHz
Operating	4 nW	250 nW	1 µW
Standby	2 nW	2 nW	20 nW

TEST EQUIPMENT USED: 41, 211, 212, 145, 120, 201, 390, 394, 262, 195

Ambient temperature: 25.8 °C Relative humidity: 36.5 % Date: 03.07.1998

TRANSMITTER SPURIOUS EMISSIONS RADIATED CLAUSE 8.7.3 / 8.7.1 a) ii)

FREQUENCY (MHz)	CHANNEL 1	FREQUENCY (MHz)	CHANNEL 4	Remarks
Tx operating		Tx operating		
760.00	0.45 nW	940.00	0.96 nW	
1140.00	5.3 nW	1410.00	12.9 nW	
1520.00	28.8 nW	1880.00	60.3 nW	
1900.00	2.9 nW	2350.00	1.1 nW	
3040.00	1.6 nW	2820.00	2.0 nW	
		3290.00	1.2 nW	
		3760.00	5.6 nW	
Tx on standby				
				See clause 9.1.3
				page 9
Measurement uncertainty	+ 3.4 dB - 4.4 dB			

LIMITS: **CLAUSE 8.7.5 TABLE 12**

State	47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies below 1000 MHz	Frequencies above 1000 MHz
Operating	4 nW	250 nW	1 µW
Standby	2 nW	2 nW	20 nW

TEST EQUIPMENT USED: 45, 176, 89, 185, 91, 205, 119, 135, 362, 195

Ambient temperature: 24.4 °C Relative humidity: 47.6 % Date: 21.08.1998

FREQUENCY STABILITY UNDER LOW VOLTAGE CONDITIONS CLAUSE 8.8

VOLTAGE (V)	FREQUENCY / POWER Hz / mW		
	1	4	REMARKS
9	+ 260 / 360	+ 720 / 280	
8	+ 220 / 360	+ 720 / 280	
7.7	/	- 640 / 280	the equipment "4" ceases to function below this point
7.8	- 960 / 360	/	the equipment "1" ceases to function below this point
	/	/	
	/	/	
	/	/	
	/	/	
	/	/	
	/	/	
Measurement uncertainty	P: ± 1.8 dB F: 6.1×10^{-8}		

LIMITS: CLAUSE 8.8.3

The equipment shall either:

- remain on the operating frequency, within the limits stated in subclause 8.1.3 whilst the radiated or or conducted power is greater than the spurious emission limits; or
- the equipment ceases to function below the applicants declared operating voltage.

TEST EQUIPMENT USED: 33, 43, 102, 131, 119, 120, 362, 195

Ambient temperature: 24.0 °C Relative humidity: 56.5 % Date: 13.07.1998 (channel 1)
Ambient temperature: 23.3 °C Relative humidity: 52.7 % Date: 11.09.1998 (channel 4)

RECEIVER SPURIOUS EMISSIONS CONDUCTED CLAUSE 9.1.2 / 9.1.1 a) i)

FREQUENCY (MHz)	CHANNEL 1	FREQUENCY (MHz)	CHANNEL 4	Remarks
2722.00	0.53 nW	392.44	0.071 nW	
3025.00	14.1 nW	2747.10	1.4 nW	
others 9 kHz to 4 GHz	< 0.05 nW	3139.60	0.20 nW	
		others 9 kHz to 4 GHz	< 0.04 nW	
Measurement uncertainty	± 1.8 dB			

LIMITS: CLAUSE 9.7.5

- 2 nW below 1000 MHz
- 20 nW above 1000 MHz

TEST EQUIPMENT USED: 42, 362,195

Ambient temperature: 24.0 °C Relative humidity: 56.5 % Date: 13.07.1998

RECEIVER SPURIOUS EMISSIONS RADIATED CLAUSE 9.1.3 / 9.1.1 a) ii)

FREQUENCY (MHz)	CHANNEL 1	FREQUENCY (MHz)	CHANNEL 4	Remarks
all 25 MHz to 1 GHz	< 0.01 nW	784.90	1.4 nW	
3024.50	5.9 nW	2747.15	16.6 nW	
others 1 GHz to 4 GHz	< 1.0 nW	3139.60	17.8 nW	
		3532.05	1.7 nW	
		3924.50	43.7 nW	
Measurement uncertainty	+ 3.4 dB - 4.4 dB			

LIMITS: CLAUSE 9.7.5

- 2 nW below 1000 MHz
- 20 nW above 1000 MHz

TEST EQUIPMENT USED: 45, 176, 89, 185, 205, 119, 135, 362, 195

Ambient temperature: 23.2 °C Relative humidity: 46.8 % Date: 22.07.1998 (channel 1)
Ambient temperature: 23.8 °C Relative humidity: 46.7 % Date: 10.08.1998 (channel 4)

SPURIOUS RESPONSE REJECTION AND BLOCKING / DESENSITISATION CLAUSE 9.2

FREQUENCY OF WANTED SIGNAL	CHANNEL		
	RATIO (dB)		
	1	4	
f+10MHz	87.0 dB	85.5 dB	
f+5MHz	87.5 dB	88.5 dB	
f+2MHz	85.6 dB	91.2 dB	
f+1MHz	88.8 dB	89.7 dB	
f-1MHz	84.7 dB	85.3 dB	
f-2MHz	86.2 dB	86.5 dB	
f-5MHz	86.4 dB	85.8 dB	
f-10MHz	85.7 dB	84.4 dB	
Measurement uncertainty	+ 2.4 dB, - 3.0 dB		

LIMIT: CLAUSE 4.2.8 (ETS 300 113)

(The blocking ratio, for any frequency within the specified ranges shall not be less than 84dB, except at frequencies on which spurious responses are found, clause 8.6 refers.)

TEST EQUIPMENT USED: 314, 33, 99, 132, 9, 62, 10, 362, 195

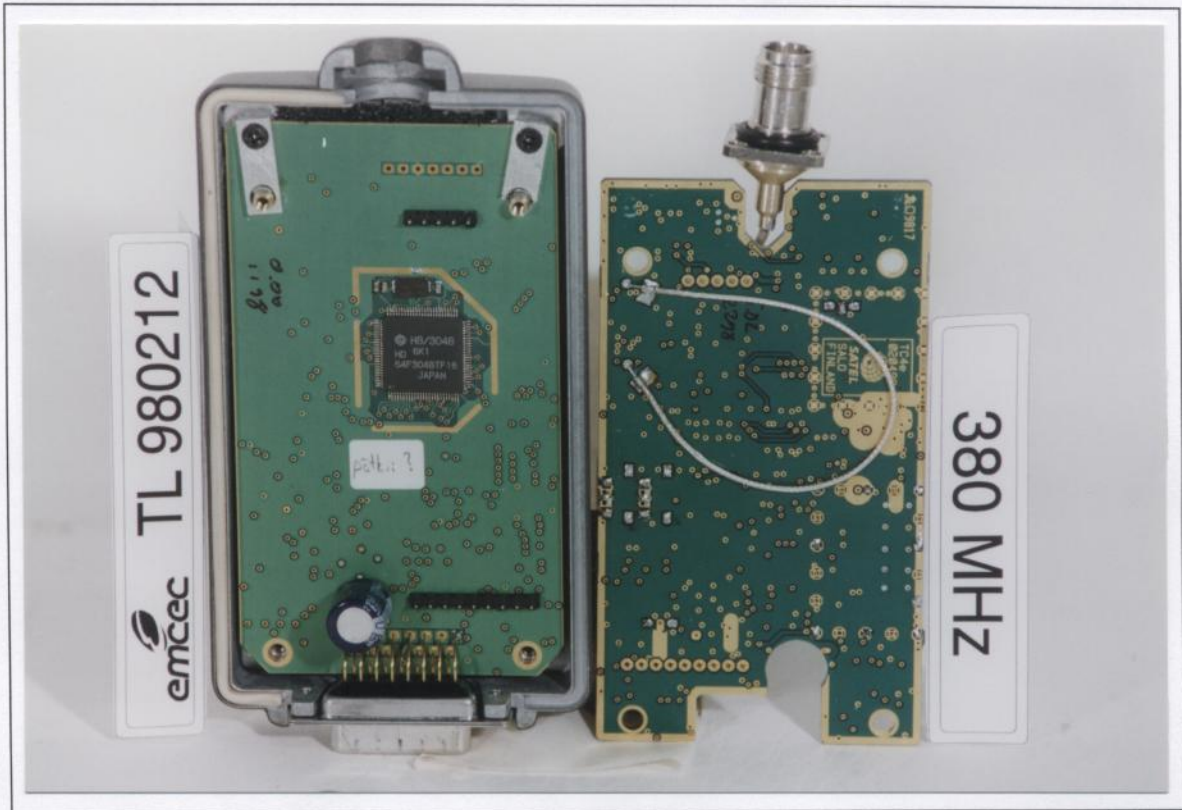




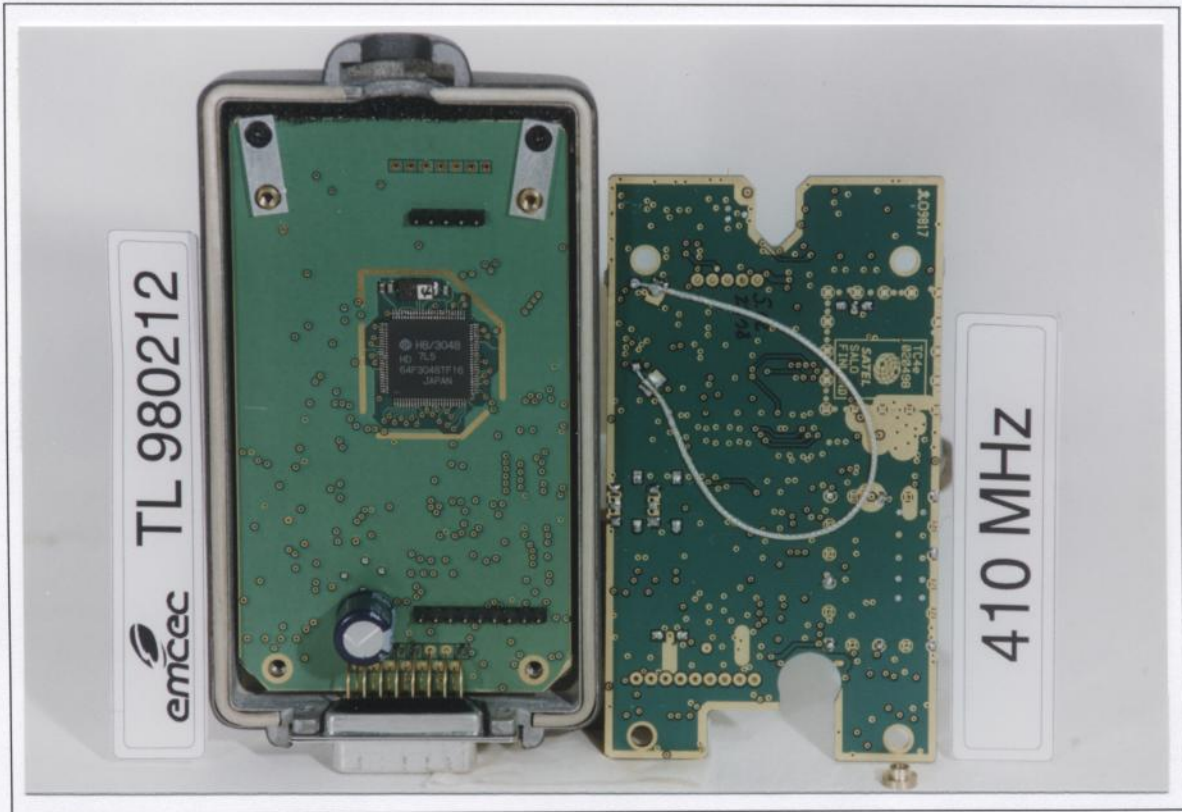


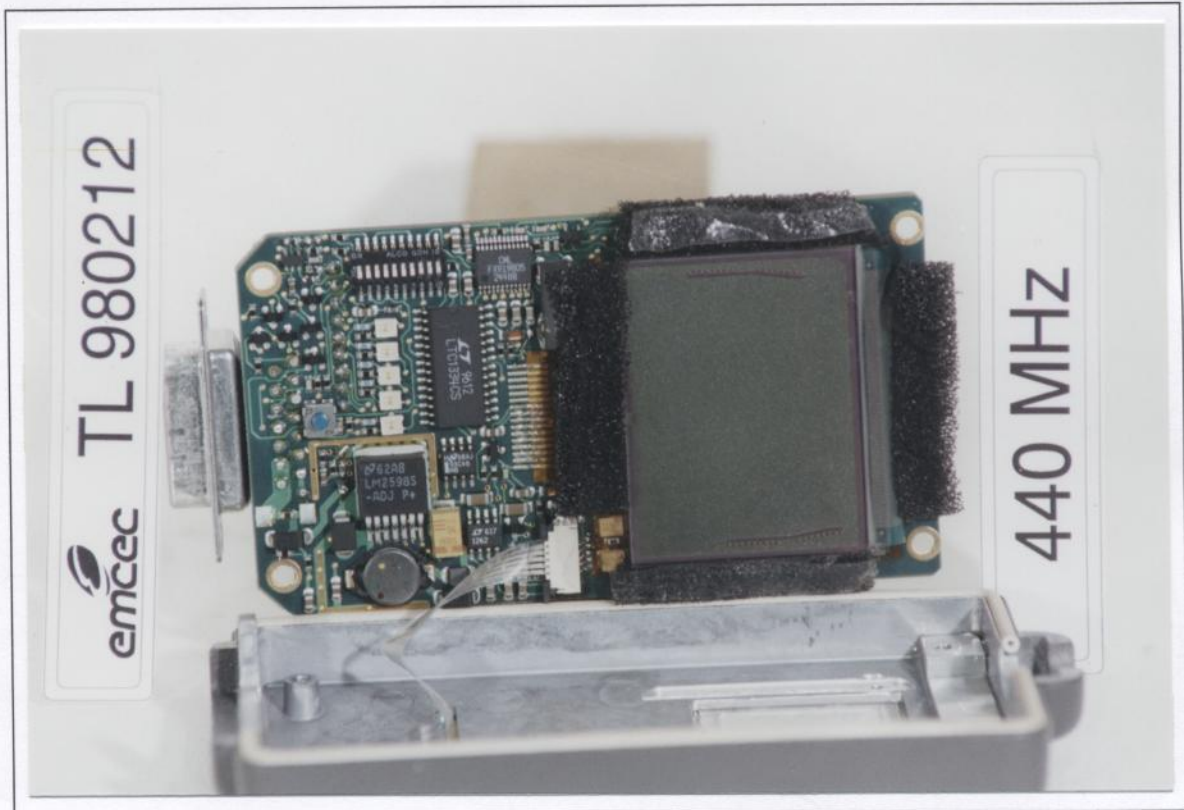


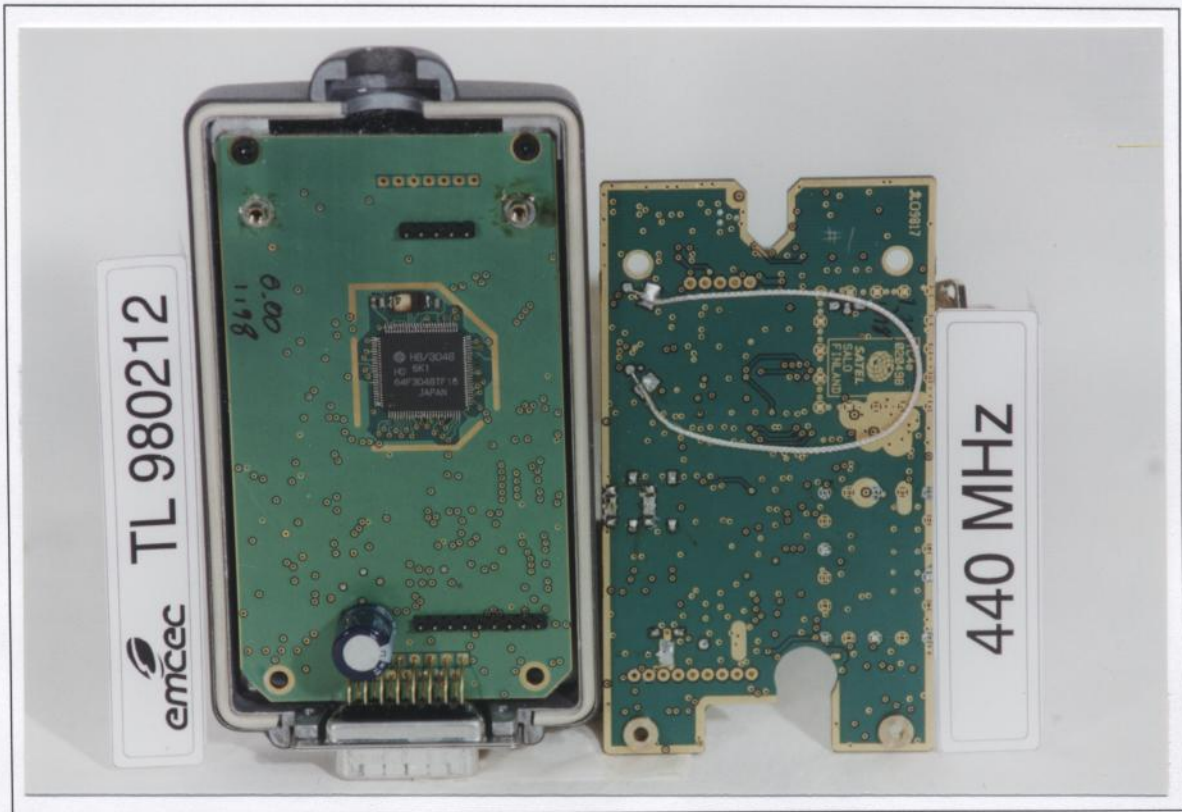




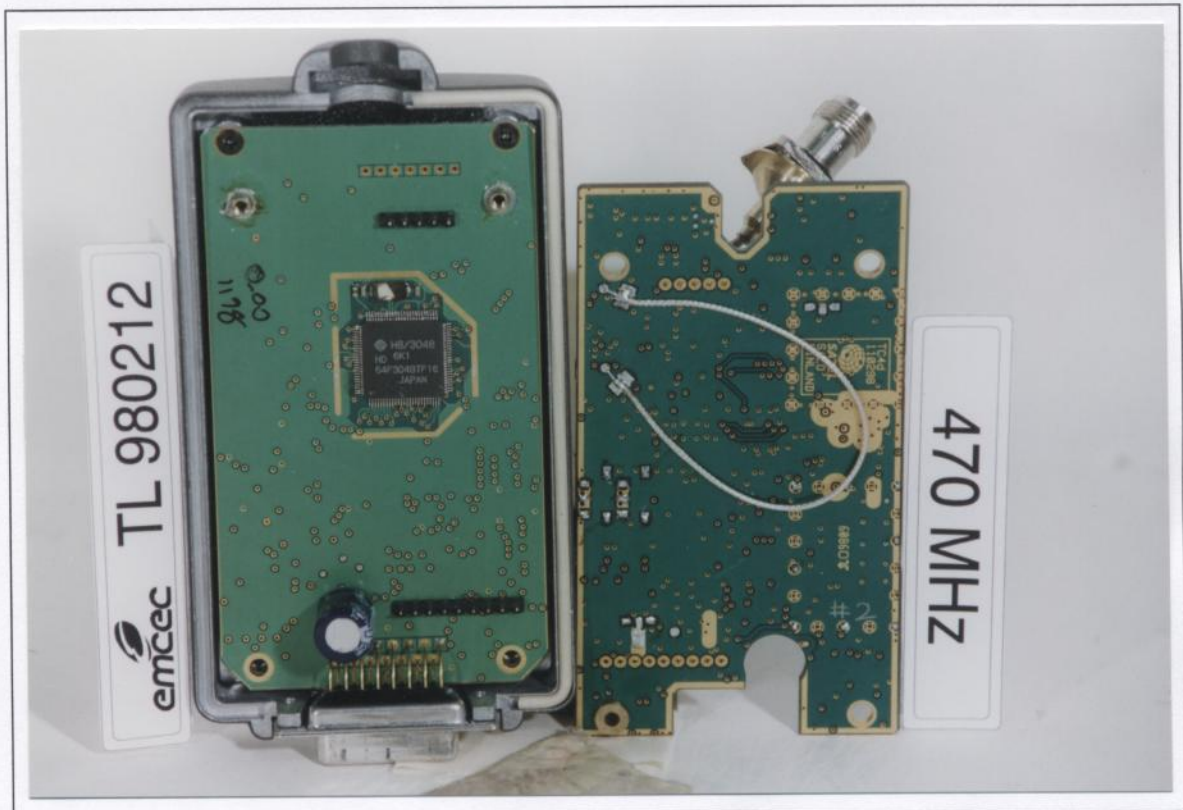
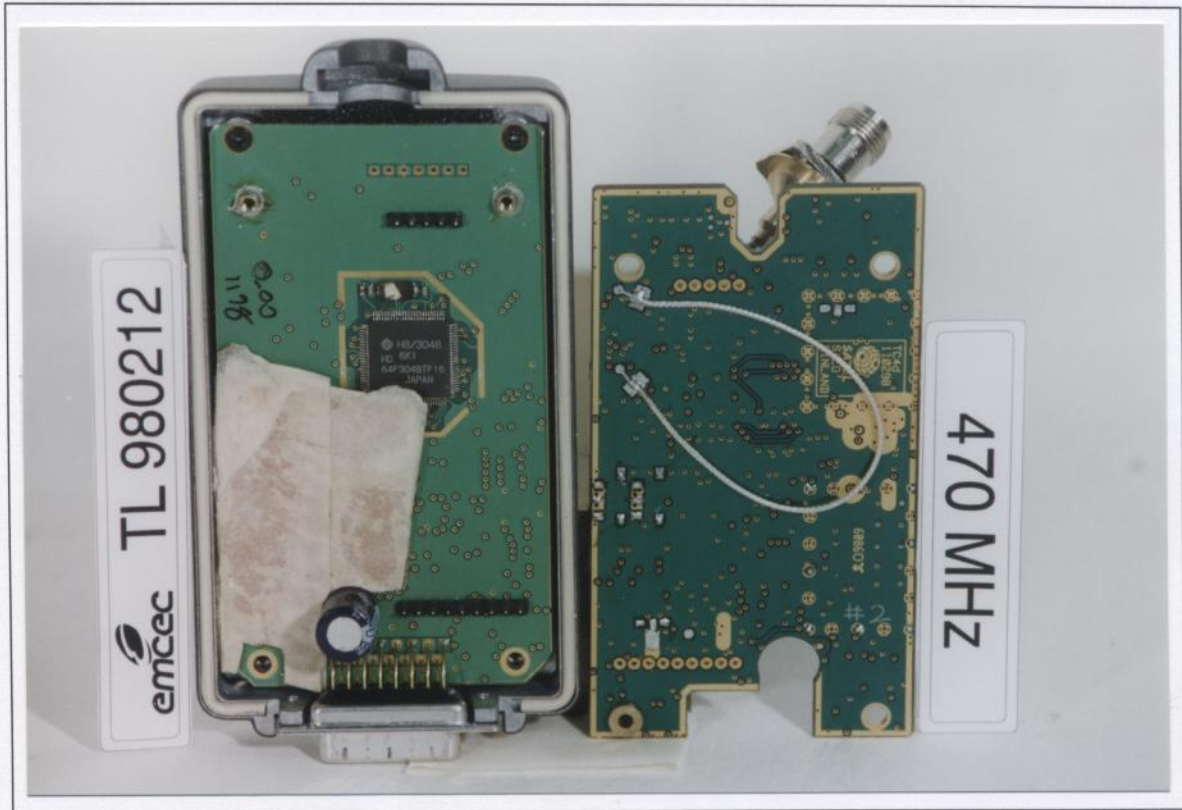












List of measuring equipment:

No.	Equipment	Type	Manufacturer	Serial Number
1	Audio analyzer	8903A	Hewlett Packard	2016A00211
9	Modulation analyzer	8901B	Hewlett Packard	2718A01220
10	Oscilloscope	9400A	LeCroy	8878
30	RF generator	8642A	Hewlett Packard	2644A00601
31	RF generator	8642B	Hewlett Packard	2427A00131
32	RF generator	8642B	Hewlett Packard	2521A00226
33	RF generator	8642B	Hewlett Packard	2521A00232
35	RF generator	8656B	Hewlett Packard	2506A00751
41	Spectrum analyzer	8566B	Hewlett Packard	2005A01452
42	Spectrum analyzer	8568B	Hewlett Packard	2039A01256
43	Spectrum analyzer	8568B	Hewlett Packard	2039A01256
45	Spectrum analyzer	FSBS	Rohde & Schwarz	862563/010
48	Counter	351DCCN150	EiP Incorporated	00369
53	Counter	1999	Racal-Dana	1321
59	Power meter	435A	Hewlett Packard	1430000505
61	Audio amplifier	PRL 737	Self made	
62	Audio amplifier	PRL ?	Self made	
70	RF amplifier	510L	EIN	
71	RF amplifier	25W1000M7	Amplifier Research	11128
79	Power supply	B60-15R	Oltronix	512
89	Antenna	3147	EMCO	9202-1078
91	Antenna	VHA 9103 BBA 9106	Schwarzbeck	
92	Antenna	VHA 9103 BBA 9106	Schwarzbeck	
99	Hybrid	H 9	Anzac	
100	Hybrid	H 9	Anzac	
101	Hybrid	H 9	Anzac	
102	Hybrid	H 9	Anzac	
109	Audio load	1840-A	General Radio	4749
117	RF High-Power Attenuator	RBU	Rohde & Schwarz	300741/13
119	RF High-Power Attenuator	765	Narda	
120	RF High-Power Attenuator	765	Narda	
131	Termination 50Ω	908A	Hewlett Packard	
132	Termination 50Ω	908A	Hewlett Packard	
133	Termination 50W	370 BNM	Narda	
134	Termination 50W	370 BNM	Narda	
135	Termination 50W	370 BNM	Narda	
145	Notch Filter	TTR - 375 - 3EE	Telonic	3062 - 1
146	Dual directional coupler	778D	Hewlett Packard	1144A02333
156	Temp. test chamber	VMT 04/140	Vöth	17031
157	Temp. test chamber	VMT 04/240	Vöth	31884
158	Temp. test chamber	VKT 08/130	Vöth	17984
159	Temp. test chamber	VMT 04/140	Vöth	16227
165	Spectrum monitor	EZM	Rohde & Schwartz	862065/011
176	Anechoic chamber	888 cm x 585 cm x 416 cm	length of absorber 66 cm	
177	Keimola	Open area radiation measurement site		
185	Antenna	PRL LogPer	Self made	1A93
188	Antenna	CBL6111	Chase	1028
195	Calibrator	Fluke 515A	Fluke	18522
201	RF-Generator	2042	Marconi	119571/062
205	RF- Amplifier	ZHL-1042J	Mini-Circuits	012288-11
211	Bandpass Filter	TTF 1500-5-5EE	Telonic Berkeley Inc	93037-3
212	Bandpass Filter	TTF 3000-5-5EE	Telonic Berkeley Inc	93039-1
218	Power sensor	HP 8485A	Hewlett Packard	2942A08711
230	Thermometer	MT 120 KC	Eirelec Ltd.	0894/83
246	Notch filter 900 MHz	-	Self made	-
279	Lowpass filter	874-F185	General Radio Co.	-

280	Lowpass filte	874-F500	General Radio Co.	-
281	Attenuator 20dB/600Ω	-	Self made	-
307	Temp. test chamber	VMT 04/140	Heraeus VÖTCH GmbH	27045
308	Internet advisor	J2300A	Hewlett Packard	3530A00685
314	RF generator	HP 8642B	Hewlett Packard	2535A00464
317	RF generator	2052	Marconi	119754/058
318	Power supply	B 603D/F	Oltronix	416
319	Antenna	CBL6112	Chase	2018
326	Power attenuator	765-6	Narda	-
327	Power attenuator	765-20	Narda	-
328	Power attenuator	765-20	Narda	-
329	Power attenuator	BN 745392	Spinner12/93	
330	Power attenuator	BN 745394	Spinner	36009
332	IF-filter	10.7MHz/25kHz	Ultracom Oy	-
333	IF-filter	10.7MHz/20kHz	Ultracom Oy	-
334	IF-filter	10.7MHz/12.5kHz	Ultracom Oy	-
335	Mixer	ZFM-150	Mini-Circuits	-
338	Test receiver	ESS	Rohde & Schwarz	847151/009
350	Semiunechoic shielded room, 10 m test site, hybrid absorber			
362	Power supply	B32-20R	Oltronix	653
381	Audio load	1840-A	General Radio	4752
386	RF attenuator PAD	WA2-3	Weinschel	3780
387	RF attenuator PAD	WA2-6	Weinschel	3781
388	RF attenuator PAD	WA2-6	Weinschel	3782
389	RF attenuator PAD	WA2-10	Weinschel	3783
390	RF attenuator PAD	WA2-10	Weinschel	3784
391	RF attenuator PAD	1A (3dB)	Weinschel	
392	RF attenuator PAD	1A (6dB)	Weinschel	
393	RF attenuator PAD	1A (10dB)	Weinschel	
394	RF attenuator PAD	1A (20dB)	Weinschel	
395	RF attenuator PAD	757 C - 10 dB	Narda	
396	Termination 50W	370 BNM	Narda	
397	RF-amplifier	ZFL-2000	Mini-Circuits	
402	Power supply	B60-10R	Oltronix	508