

Date: ESPOO 27.08.2009Page: 1 (26)Appendices -Number:
No. 1 / 1**131691A**Date of handing in: 03.08.2009

Tested by:


Risto Hietanen, Test Engineer

Reviewed by:


Janne Nyman, Compliance Specialist

SORT OF EQUIPMENT:

Radio modem (PCB-unit)

MODEL:

SATELLINE-M3-TR1

TYPE:

SATEL-TA13 (*)

MANUFACTURER:

Satel Oy, Finland

SERIAL NUMBER:

0926 21

CLIENT:

Satel Oy

ADDRESS:

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TEST SPECIFICATION

EN 300 113-2 V1.4.1 (2007-07)

REMARKS:

***) This test report includes the results of the version of the supply voltage 12 VDC.**

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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1. General

Type:	SATEL-TA13		
Alignment range:	403 – 473 MHz		
Switching range:	One channel		Category: AR3

Measurement	Equipment 1 Serial no. 7 0926 21	Equipment 1 Serial no. 7 0926 21	Equipment 1 Serial no. 7 0926 21
Frequencies:	1) 403,000 MHz 4) 470,000 MHz	2) 426,350 MHz	3) 449,650 MHz

Voltages: Temperatures: Humidity:	Normal 12,0 VDC 23,0° ± 1,5°C 30 % ± 8 %	Minimum 6,5 VDC -20, 0°	Maximum 28,0 VDC +55, 0°
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Effective radiated power:	1 W / 100 mW	Antenna:	50 ohm (two SMA-connector)
Number of channels:	1	Production model:	Pre-production model
Channel separation:	12,5, 20,0 and 25,0 kHz	Modulation:	Multilevel State FM (12,5 kHz: 9600 bps and 25 kHz: 19200 bps)

The following measurements been performed according to ETS EN 300 113-1 V1.6.1 (2007-07) standard:

Eq 1	Eq. 1 and 1	Eq. 1	
Freq 2)	Freq 1) 4)	Freq 3)	
☒	☒ ☒	☒	7.1 Frequency error
☒	☒ ☒	☒	7.2 Transmitter power (conducted)
☐	☐ ☐	☐	7.3 Maximum Effective radiated power
☒	☒ ☒	☒	7.4 Adjacent channel power
☐	☒ ☒	☐	7.5.1 a Spurious emissions (conducted)
☐	☒ ☒	☐	7.5.1 b Spurious emissions (radiated)
☐	☐ ☐	☐	7.5 Intermodulation attenuation
☐	☒ ☒	☐	7.7 Transmitter attack time
☐	☒ ☒	☐	7.8 Transmitter release time
☐	☒ ☒	☐	7.9.3.1 Time domain analysis of power and frequency
☐	☒ ☒	☐	7.9.3.3 Adjacent and alternate channel transient power
☐	☐ ☐	☐	8.1 Maximum useable sensitivity (digital, conducted)
☐	☐ ☐	☐	8.2 Average usable sensitivity (digital, field strength)
☐	☐ ☐	☐	8.3 Level of the wanted signal for the degradation measurements
☐	☐ ☐	☐	8.4 Error behaviour at high input levels
☐	☐ ☐	☐	8.5 Co-channel rejection
☐	☐ ☐	☐	8.6 Adjacent channel selectivity
☐	☐ ☐	☐	8.7 Spurious response rejection
☐	☐ ☐	☐	8.8 Intermodulation response rejection
☐	☐ ☐	☐	8.9 Blocking or desensitization
☐	☐ ☐	☐	8.10.1 a Spurious radiations (conducted)
☐	☐ ☐	☐	8.10.1 b Spurious radiations (radiated)
☐	☐ ☐	☐	Duplex operation
☐	☐ ☐	☐	9.1 Receiver desensitization
☐	☐ ☐	☐	9.2 Receiver spurious response rejection

REMARKS:

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.)

<i>ETSI EN 300 113-1 V1.6.1 (2007-07)</i>		<i>Result</i>
7.1	<i>Frequency error</i>	PASS
7.2	<i>Transmitter power (conducted)</i>	PASS
7.4	<i>Adjacent channel power</i>	PASS
7.5.1 a	<i>Spurious emissions (conducted)</i>	PASS
7.5.1 b	<i>Spurious emissions (radiated)</i>	PASS
7.7	<i>Transmitter attack time</i>	PASS
7.8	<i>Transmitter release time</i>	PASS
7.9.3.1	<i>Time domain analysis of power and frequency</i>	PASS
7.9.3.3	<i>Adjacent channel transient power</i>	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.

3. Test results

3.1 Frequency error Clause 7.1

Date: 20.08.2009

Method of measurement: Clause 7.1.2

Test conditions		Frequency error (kHz)				
		Freq.1	Freq.2	Freq.3	Freq.4	
Tnom	Vnom	+0,52	+0,38	+0,29	+0,25	
Tmin	Vmin	+0,31	+0,26	+0,28	+0,20	
	Vmax	+0,28	+0,22	+0,20	+0,21	
Tmax	Vmin	+0,57	+0,52	+0,63	+0,39	
	Vmax	+0,48	+0,37	+0,45	+0,37	
Maximum freq. error. (Hz)		+0,57	+0,52	+0,63	+0,39	
Measurement uncertainty (U95)		$6,1 \times 10^{-8}$				

LIMITS Clause 7.1.3

Table 2: Frequency error

Channel separation (kHz)	Frequency error limit (kHz)				
	Below 47MHz	Above 47 to 137MHz	Above 137 to 300MHz	Above 300 to 500MHz	Above 500 to 1000MHz
12,5	± 0,60	± 1,00	± 1,00 (B) ± 1,50 (M)	± 1,00 (B) ± 1,50 (M) (note 2)	No value specified
20,0 / 25,0	± 0,60	± 1,35	± 2,00	± 2,00 (note)	± 2,50 (note 2)

NOTE 1: For handportable stations having integral power supplies, these limits only apply to the reduced extreme temperature range 0 °C to + 40 °C.

NOTE 2: However for the full extreme temperature conditions (subclause 5.4.1), exceeding the reduced extreme temperature range above, the following frequency error limits apply:

± 2,50 kHz between 300 MHz and 500 MHz;

± 3,50 kHz between 500 MHz and 1000 MHz.

NOTE 3: (B) = BASE STATION

NOTE 4: (M) = MOBILE STATION

TEST EQUIPMENT USED: 2046, 328, 390, 394, 316, 341, 157, 563

3.2 Transmitter power (conducted) Clause 7.2

Date: 20.08.2009

Method of measurement: Clause 7.2.2

Rated output power: Low: 100 mW and high: 1W

Test conditions		Transmitter power (mW)							
		Freq. 1		Freq. 2		Freq. 3		Freq. 4	
		P: low	P: high	P: low	P: high	P: low	P: high	P: low	P: high
Tnom	Vnom	97	945	106	980	109	1000	104	940
Tmin	Vmin	88	960	99	1020	118	1080	114	1060
	Vmax	88	960	99	1020	118	1080	114	1060
Tmax	Vmin	100	900	100	905	103	900	102	880
	Vmax	100	900	100	910	103	930	102	880
Variation in output power under normal test conditions		-0,13 dB	-0,25 dB	+0,25 dB	- 0,09 dB	+0,37 dB	± 0,0 dB	+0,17 dB	-0,27 dB
Variation in output power under extreme test conditions		-0,56 to ±0,0 dB	-0,46 to -0,18 dB	-0,04 to ±0,0 dB	-0,43 to +0,09 dB	+0,13 to +0,72 dB	-0,46 to +0,33 dB	+0,09 to +0,57 dB	-0,56 to +0,25 dB
Measurement uncertainty (U95)		± 0.75 dB							

LIMITS Clause 7.2.3

Under normal test conditions	± 1.5 (dB)
Under extreme test conditions	+ 2.0 (dB), - 3.0 (dB)

TEST EQUIPMENT USED: 2039, 2040, 328, 390, 394, 316, 341, 157, 563

3.3 Adjacent channel power Clause 7.4

Date: 19.08.2009

Method of measurement: Clause 7.4.2

Rated output power: Low: 100 mW and high: 1W

Channel separation $\pm 12,5$ kHz

Adjacent channel	Below carrier power (dBc)							
	Freq. 1		Freq. 2		Freq. 3		Freq. 4	
	P: low	P: high	P: low	P: high	P: low	P: high	P: low	P: high
- 12,5 kHz	-66,4	-66,5	-64,8	-64,4	-65,1	-65,0	-64,8	-65,2
+ 12,5 kHz	-66,7	-66,7	-65,7	-65,3	-66,4	-66,0	-65,9	-65,3
Measurement uncertainty (U95)	± 1.6 dB							

Channel separation $\pm 20,0$ kHz

Adjacent channel	Below carrier power (dBc)							
	Freq. 1		Freq. 2		Freq. 3		Freq. 4	
	P: low	P: high	P: low	P: high	P: low	P: high	P: low	P: high
- 20,0 kHz	-72,7	-74,1	-71,8	-73,0	-71,3	-72,3	-70,6	-71,9
+ 20,0 kHz	-72,4	-74,1	-71,7	-72,7	-71,0	-72,2	-70,6	-72,0
Measurement uncertainty (U95)	± 1.6 dB							

Channel separation $\pm 25,0$ kHz

Adjacent channel	Below carrier power (dBc)							
	Freq. 1		Freq. 2		Freq. 3		Freq. 4	
	P: low	P: high	P: low	P: high	P: low	P: high	P: low	P: high
- 25,0 kHz	-73,4	-75,6	-73,0	-73,7	-72,4	-73,7	-71,8	-72,9
+ 25,0kHz	-73,2	-74,7	-72,7	-74,0	-72,5	-73,9	-71,9	-72,7
Measurement uncertainty (U95)	± 1.6 dB							

LIMIT Clause 7.4.3	12,5 kHz, 20,0 kHz & 25,0 kHz channel spacing: 60dB below carrier power (without the need to be below 0,2 μ W (-37dBm))
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TEST EQUIPMENT USED: 337, 201, 328, 390, 394, 316, 341

3.4 Unwanted emissions in the spurious domain Clause 7.5

Transmitter Spurious Emissions (Conducted) 7.5.1 a

Date: 19.08.2009

Method of measurement: Clause 7.5.2

Rated output power: Low: 100 mW and high: 1W

Frequency 1			Frequency 4		
Frequency (MHz)	Results / dBm (P: low)	Results / dBm (P: high)	Frequency (MHz)	Results / dBm (P: low)	Results / dBm (P: high)
Tx operating			Tx operating		
806,000	-64,8	-63,2	All	< -70,0	
Others	< -70,0	< -70,0			
			3784,000		-65,6
			Others		< -70,0
Tx on standby			Tx on standby		
183,145	-76,9		183,145	-76,9	
others 9 kHz to 4.0 GHz	< -80,0		others 9 kHz to 12,75 GHz	< -80,0	
Measurement uncertainty	± 1.8 dB				

LIMITS Clause 7.5.4

Table 4: Conducted emissions

Frequency range	Tx operating	Tx standby
9 kHz to 1 GHz	0.25 μ W (- 36.0 dBm)	2.0 nW (- 57.0 dBm)
above 1 to 4 GHz or above 1 to 12.75 GHz,	1.00 μ W (- 30.0 dBm)	20.0 nW (- 47.0 dBm)

TEST EQUIPMENT USED: 566, 328, 390, 394, 571, 145, 316, 341

3.5 Unwanted emissions in the spurious domain Clause 7.5

Transmitter Spurious Emissions (Radiated) 7.5.1 b

Date: 12.08.2009 (Frequency 1)
26.08.2009 (Frequency 4)
27.08.2009 (Frequency 4 Standby)

Method of measurement: Clause 7.5.3

Rated output power: Low: 100 mW and high: 1W

Frequency 1			Frequency 4		
Frequency (MHz)	Results / dBm (P: low)	Results / dBm (P: high)	Frequency (MHz)	Results / dBm (P: low)	Results / dBm (P: high)
Tx operating			Tx operating		
All 30 MHz to 4.0 GHz	< -60,0	< -60,0	1892,0	< -60,0	-59,1
			2365,0	- 58,6	-57,9
			Others 30 MHz to 4.0 GHz	< -60,0	< -60,0
			All 4 GHz to 12,75 GHz	< -50,0	< -50,0
Tx on standby			Tx on standby		
All 30 MHz to 1.0 GHz	< - 70,0		656,6		-65,8
All 1 GHz to 4.0 GHz	< - 65,0		others 30 MHz to 1.0 GHz	< - 70,0	
			all 1 GHz to 12.75 GHz	< - 65,0	
Measurement uncertainty	- 4.4 dB / +3.4 dB				

LIMITS Clause 7.5.4

Table 4: Radiated emissions

Frequency range	Tx operating	Tx standby
30 MHz to 1 GHz	0.25 μ W (- 36.0 dBm)	2.0 nW (- 57.0 dBm)
above 1 to 4 GHz or above 1 to 12.75 GHz,	1.00 μ W (- 30.0 dBm)	20.0 nW (- 47.0 dBm)

TEST EQUIPMENT USED: 176, 566, 201, 205, 89, 185, 417, 525, 542, 328, 133, 571, 316, 341

3.6 Transmitter attack time Clause 7.7

Date: 18.08.2009

Method of measurement: Clause 7.7.2

Rated output power: Low: 100 mW and high: 1W

Measured the time after the carrier power exceeds – 50 dBc to the power – 1 dBc

Time characteristic	Attack time			
	Frequency 1		Frequency 2	
	P: low	P: high	P: low	P: high
Time relative to the power rise	3,32 ms	3,04 ms	3,26 ms	3,09 ms
Time relative to the frequency behaviour	< above	< above	< above	< above
Maximum of these times, i.e. attack time	3,32 ms	3,04 ms	3,26 ms	3,09 ms
Measurement uncertainty	± 3.0 ms			

See clause 7.7.1 (ETS 300 113) for the definition and clause 7.9.1 (ETS 300 113), figures 11 and 12 for the graphs of transmitter attack time.

The plots of frequency and power versus time can be found in the test report sheets corresponding to clause 7.9.1.
See pages 14, 16, 18 and 20

LIMIT Clause 7.7.3

The transmitter attack time shall not exceed: 25 ms

TEST EQUIPMENT USED: 337, 201, 567, 43, 10, 133, 102, 328, 390, 394, 62, 316, 341

3.7 Transmitter release time Clause 7.8**Date:** 18.08.2009**Method of measurement:** Clause 7.8.2**Rated output power:** Low: 100 mW and high: 1W**The release time was measured between the power levels from - 3 dBc to - 50 dBc.**

Time characteristic	Release time			
	Frequency 1		Frequency 2	
	P: low	P: high	P: low	P: high
Transmitter release time	1,88	1,93	1,63	1,68
Measurement uncertainty	± 3.0 ms			

See clause 7.8.1 (ETS 300 113) for the definition and clause 7.9.1 (ETS 300 113), figure 13 for the graphs of transmitter release time.

The plots of frequency and power versus time can be found in the test report sheets corresponding to clause 7.9.1. See pages 15, 17, 19 and 21

LIMIT Clause 7.8.3**The transmitter release time shall not exceed:** 20 ms**TEST EQUIPMENT USED:** 337, 201, 567, 43, 10, 133, 102, 328, 390, 394, 62, 316, 341

3.8 Transient behaviour of the transmitter Clause 7.9 (Time domain analysis of power and frequency 7.9.3.1)

Date: 18.08.2009

Method of measurement: Clause 7.9.3.1

Power level at which the measurement has been performed: Low: 100 mW and high: 1W

Measurement	Time (tp and td)			
	Frequency 1		Frequency 2	
	P: low	P: high	P: low	P: high
tp	0,23	0,42	0,23	0,41
td	-0,31	-0,44	-0,35	-0,44
Measurement uncertainty	± 3.0 ms			

See pages 14 to 21

LIMIT Clause 7.9.4.1

In case of equipment operating with channel separation of 12,5 kHz, the slopes of the plots "power as a function of time" corresponding to both attack and release times, shall be such that:

- tp: $\geq 0,10$ ms, td: $\geq 0,10$ ms, for attack and release time;
- between the Pc - 30 dB point and the Pc - 6 dB point, both in the case of attack and release time, the sign of the slope shall not change.

In case of equipment operating with channel separation of 20 kHz or 25 kHz, the slopes of the plots "power as a function of time" corresponding to both attack and release times, shall be such that:

- tp: $\geq 0,05$ ms, td: $\geq 0,05$ ms, for attack and release time;
- between the Pc - 30 dB point and the Pc - 6 dB point, both in the case of attack and release time, the sign of the slope shall not change.

TEST EQUIPMENT USED: 337, 201, 567, 43, 10, 133, 102, 328, 390, 394, 62, 316, 341

3.9 Transient behaviour of the transmitter Clause 7.9 (Adjacent channel transient power 7.9.3.3.2)

Date: 19.08.2009

Method of measurement: Clause 7.9.3.3.2 (constant envelope angle modulation equipment)

Rated output power: Low: 100 mW and high: 1W

Adjacent channel	Below carrier power (dBc)							
	Frequency 1				Frequency 2			
	P: low		P: high		P: low		P: high	
	TX: on	TX: off	TX: on	TX: off	TX: on	TX: off	TX: on	TX: off
- 12,5 kHz	≤ -48,5 (*)	≤ -54,0	≤ -57,5	≤ -59,5	≤ -50,0	< -53,5	< -55,5	< -56,5
+ 12,5 kHz	≤ -48,5 (*)	≤ -54,0	≤ -55,5	≤ -60,0	≤ -48,0 (*)	≤ -53,5	≤ -55,0	≤ -56,5
- 20,0 kHz	≤ -53,0 (*)	≤ -54,5 (*)	≤ -58,5 (*)	≤ -58,5 (*)	≤ -54,0 (*)	≤ -53,5 (*)	≤ -58,0 (*)	≤ -58,0 (*)
+ 20,0kHz	≤ -51,5 (*)	≤ -54,0 (*)	≤ -58,5 (*)	≤ -59,0 (*)	≤ -52,5 (*)	≤ -53,5 (*)	≤ -57,5 (*)	≤ -58,5 (*)
- 25,0 kHz	≤ 55,0 (*)	≤ -56,0 (*)	≤ -59,5 (*)	≤ -60,5	≤ -54,5 (*)	≤ -55,0 (*)	≤ -59,0 (*)	≤ -60,0
+ 25,0kHz	≤ -55,0 (*)	≤ -55,0 (*)	≤ -59,5 (*)	≤ -59,5 (*)	≤ -54,0 (*)	≤ -54,0 (*)	≤ -58,5 (*)	≤ -59,0 (*)
Measurement uncertainty	+ 1.4 dB, -1.6 dB							

*) ≤ 2 µW

LIMITS:

7.9.4.2.1 Equipment measured as constant envelope angle modulation equipment

The transient power, in the adjacent channels shall not exceed a value of:

- 60,0 dB below the transmitter power (conducted) of the transmitter in decibels relative to the carrier power (dBc) without the need to be below 2 µW (-27,0 dBm), for channel separations of 20 kHz and 25 kHz;
- 50,0 dB below the transmitter power (conducted) of the transmitter (in dBc) without the need to be below 2 µW (-27,0 dBm), for a channel separation of 12,5 kHz.

7.9.4.2.2 Equipment measured as non-constant envelope modulation equipment

The transient power, in the adjacent channels shall not exceed a value of:

- 60,0 dB below the transmitter power (conducted) of the transmitter in decibels relative to the carrier power (dBc) without the need to be below 2 µW (-27,0 dBm), for channel separations of 20 kHz and 25 kHz;
- 50,0 dB below the transmitter power (conducted) of the transmitter (in dBc) without the need to be below 2 µW (-27,0 dBm), for a channel separation of 12,5 kHz.

The transient power, in the alternate channels shall not exceed a value of:

- 65,0 dB below the transmitter power (conducted) of the transmitter in decibels relative to the carrier power (dBc) without the need to be below 2 µW (-27,0 dBm), for channel separations of 20 kHz and 25 kHz;
- 60,0 dB below the transmitter power (conducted) of the transmitter (in dBc) without the need to be below 2 µW (-27,0 dBm), for a channel separation of 12,5 kHz.

For measurements at 100 kHz and 1 MHz (from the wanted channel), the transient power shall not exceed a value:

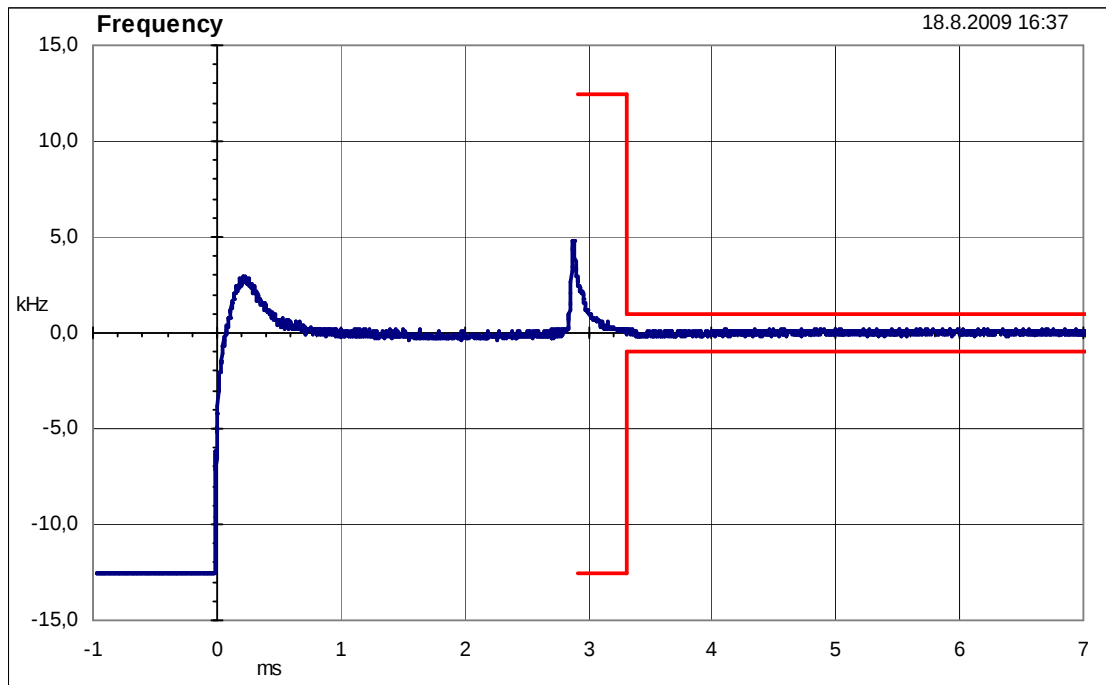
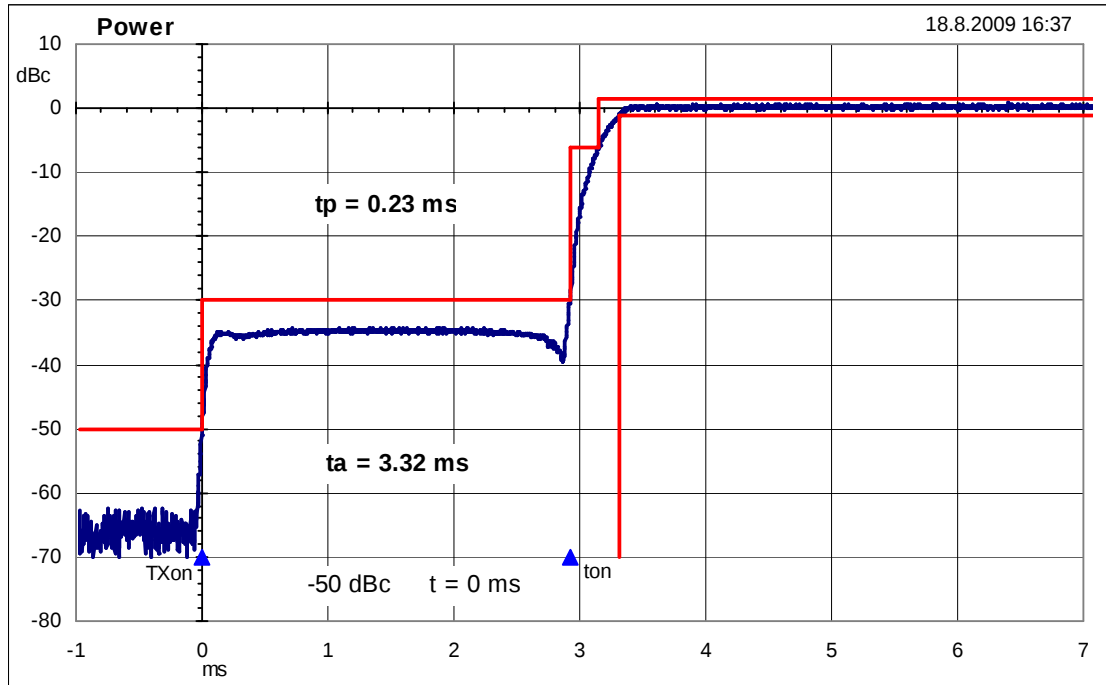
- 65,0 dB below the transmitter power (conducted) of the transmitter in decibels relative to the carrier power (dBc) without the need to be below 2 µW (-27,0 dBm), for channel separations of 20 kHz and 25 kHz;
- 60,0 dB below the transmitter power (conducted) of the transmitter (in dBc) without the need to be below 2 µW (-27,0 dBm), for a channel separation of 12,5 kHz.

TEST EQUIPMENT USED: 335, 332, 334, 43, 42, 10, 201, 133, 146, 328, 386, 390, 392, 394, 316, 341

3.10 Graphs of the attack time and release measurements Rated output power 100 mW

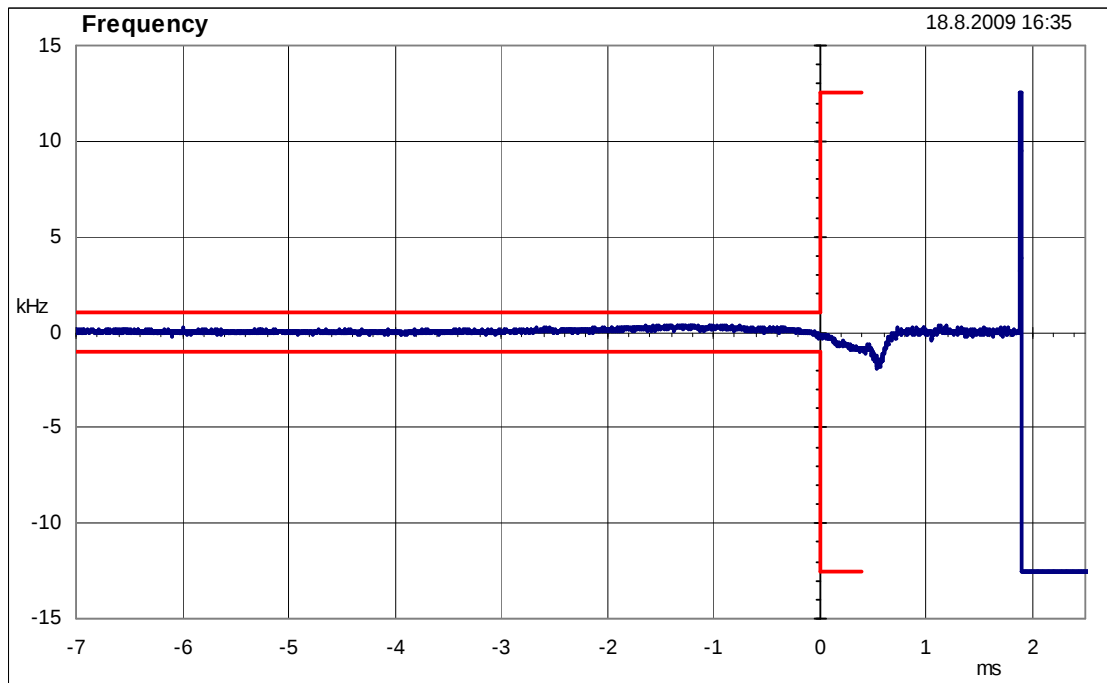
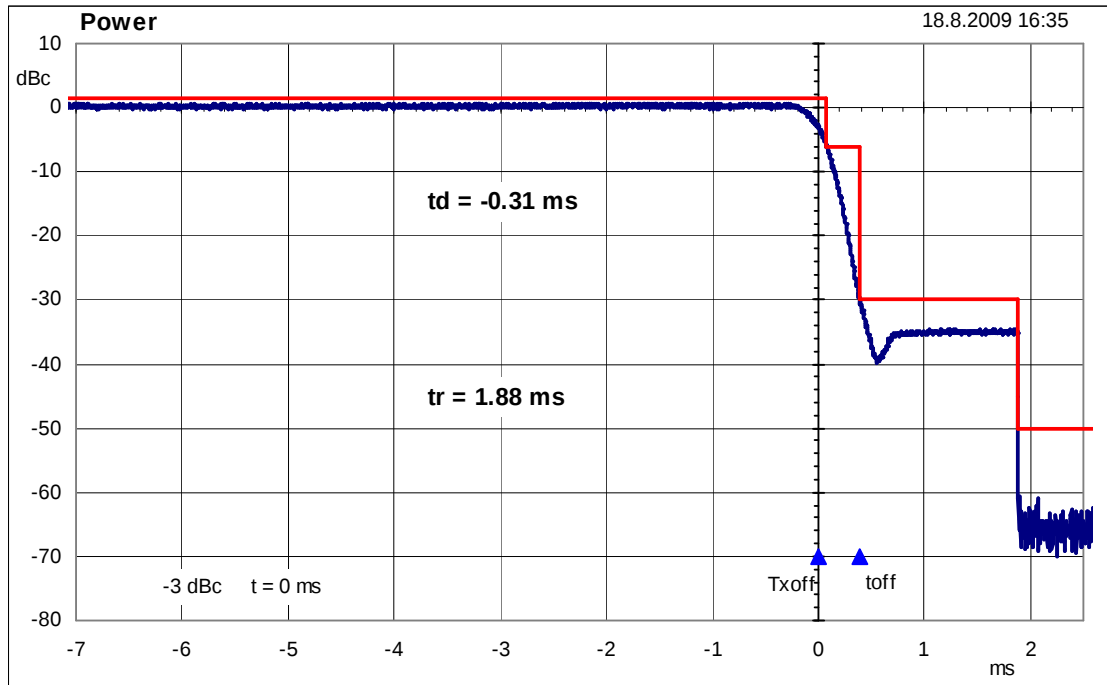
Transmitter attack time (403 MHz)
(Transient behaviour of the transmitter switch-on)

Output power: 100 mW.



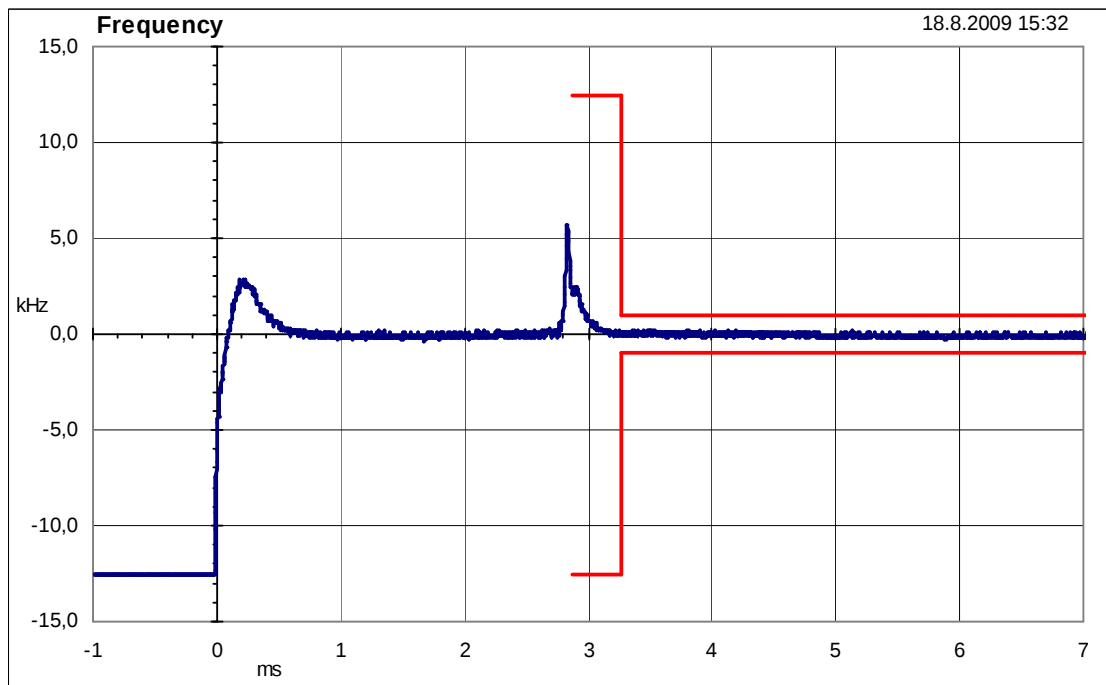
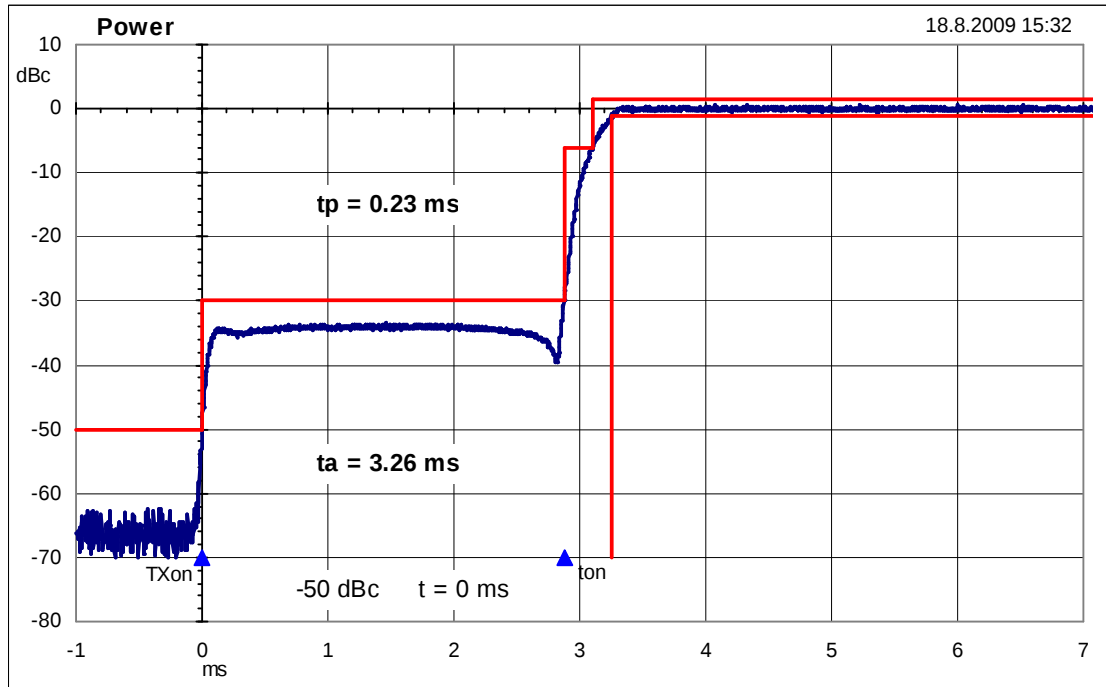
Transmitter release time (403 MHz)
(Transient behaviour of the transmitter switch-off)

Output power: 100 mW.



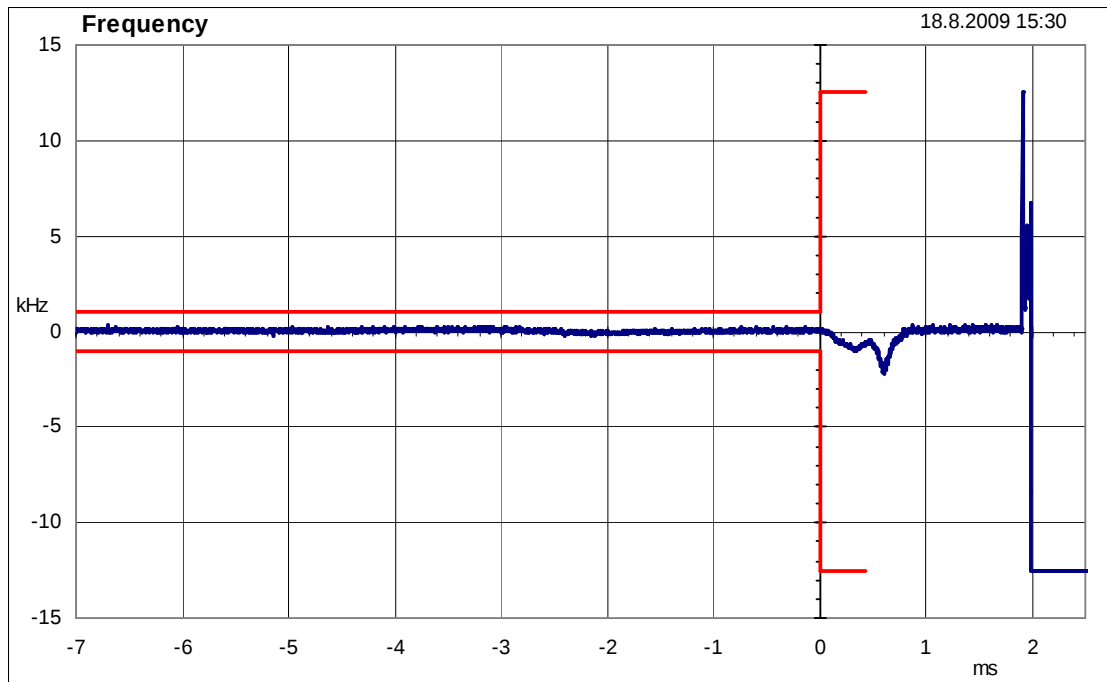
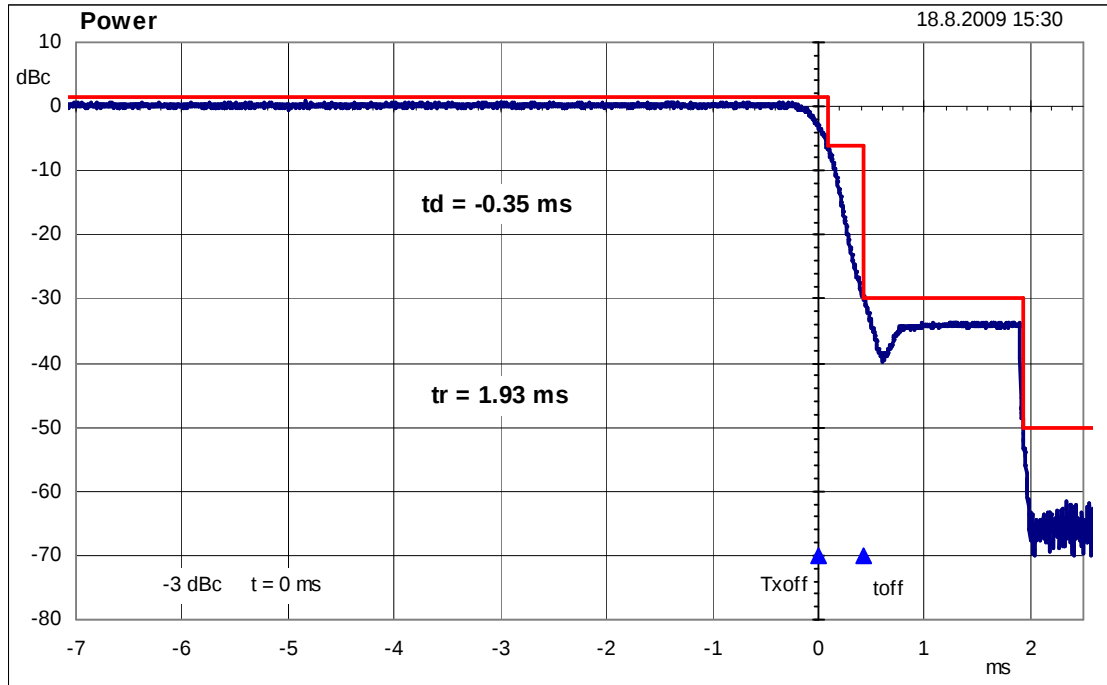
Transmitter attack time (473 MHz)
(Transient behaviour of the transmitter switch-on)

Output power: 100 mW.



Transmitter release time (473 MHz)
(Transient behaviour of the transmitter switch-off)

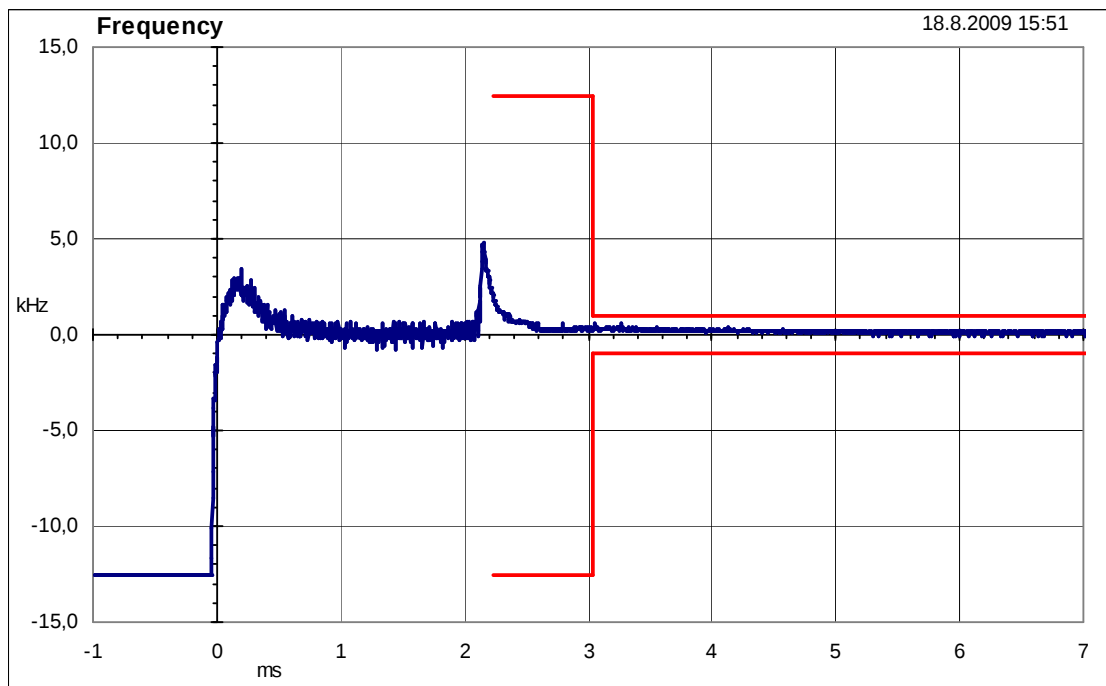
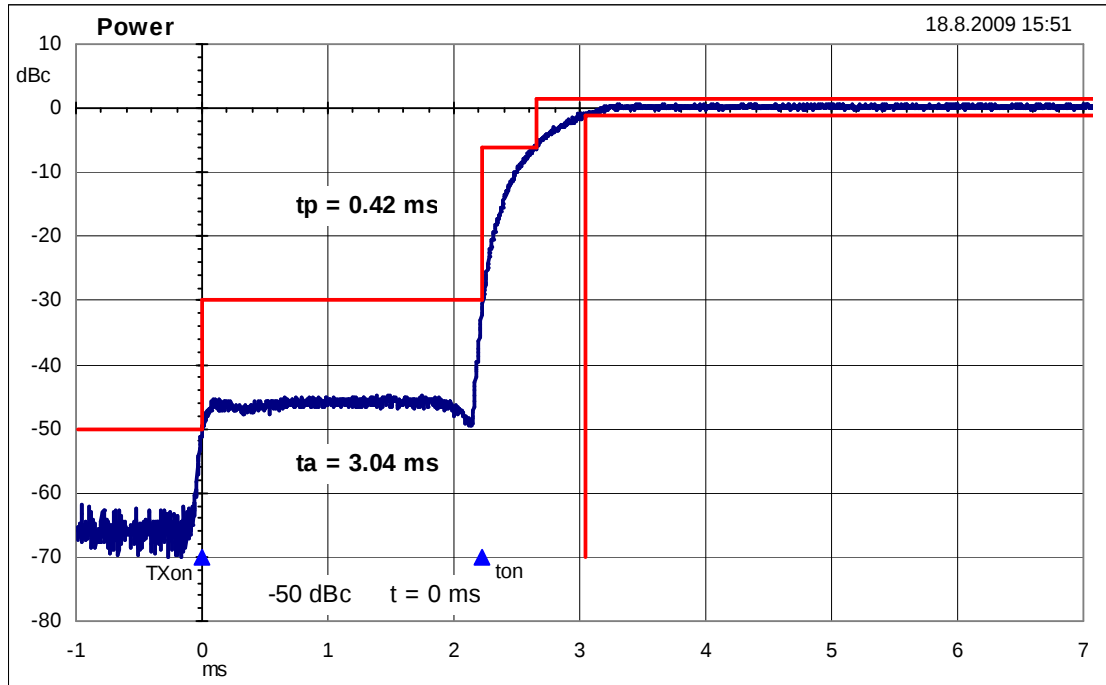
Output power: 100 mW.



3.11 Graphs of the attack time and release measurements Rated output power 1 W

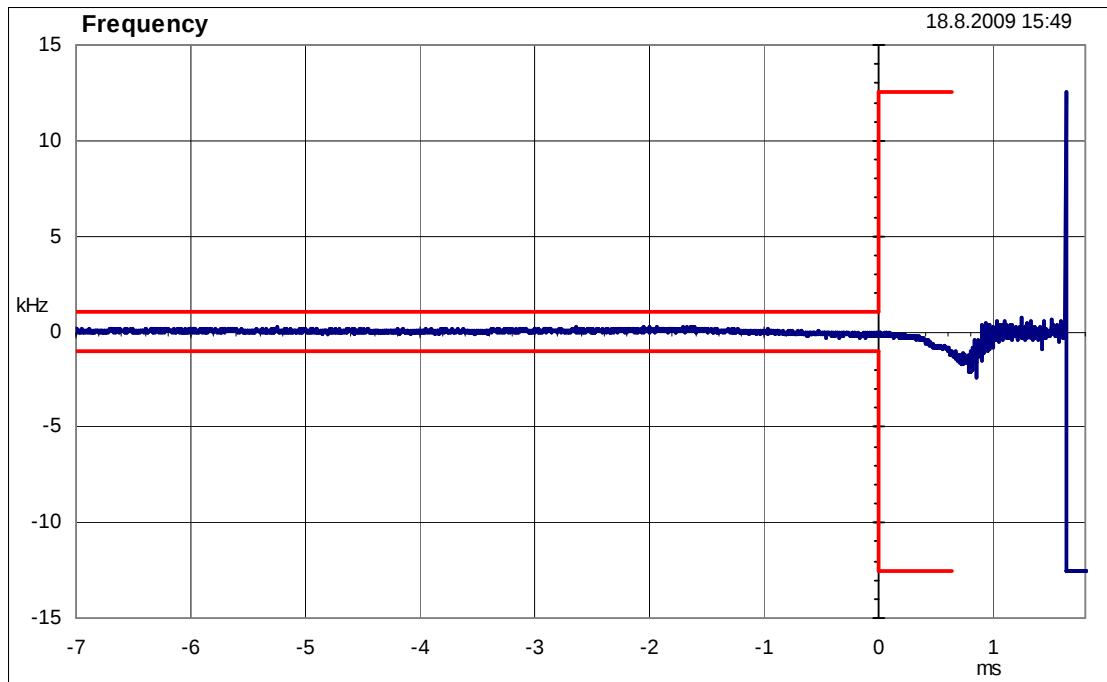
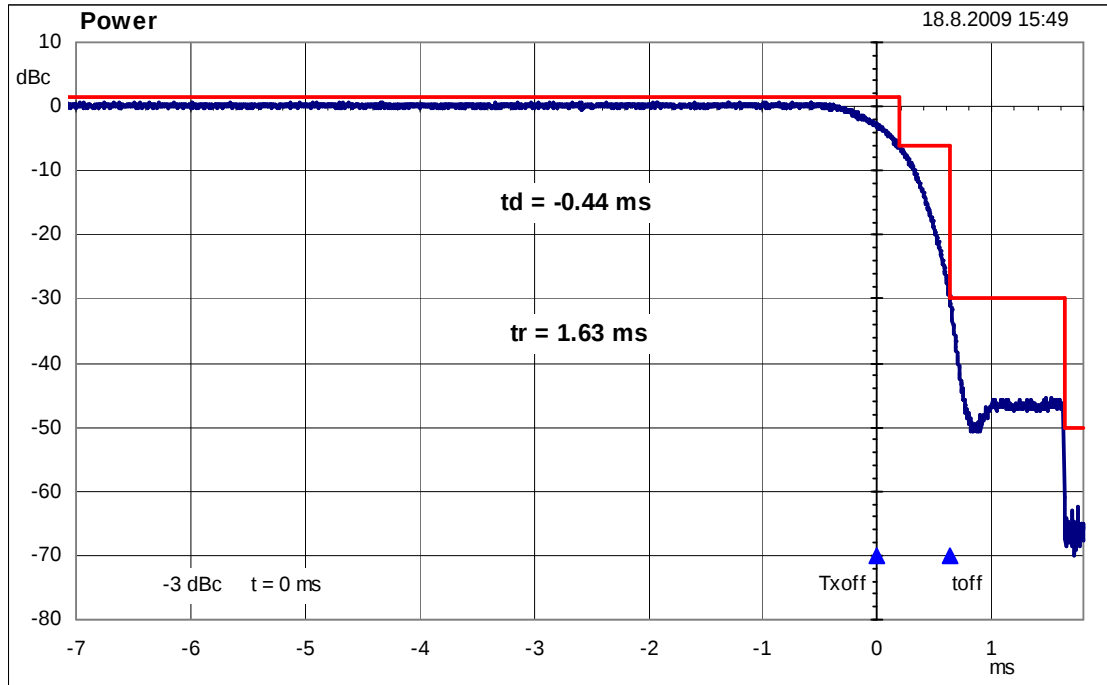
Transmitter attack time (403 MHz)
(Transient behaviour of the transmitter switch-on)

Output power: 1 W.



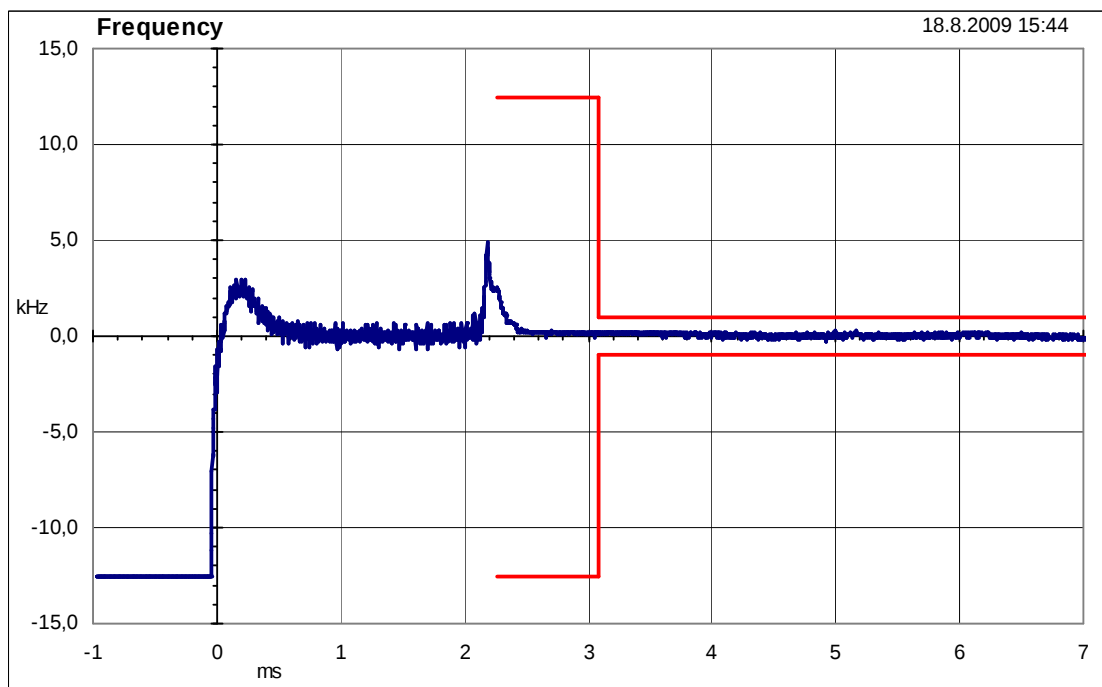
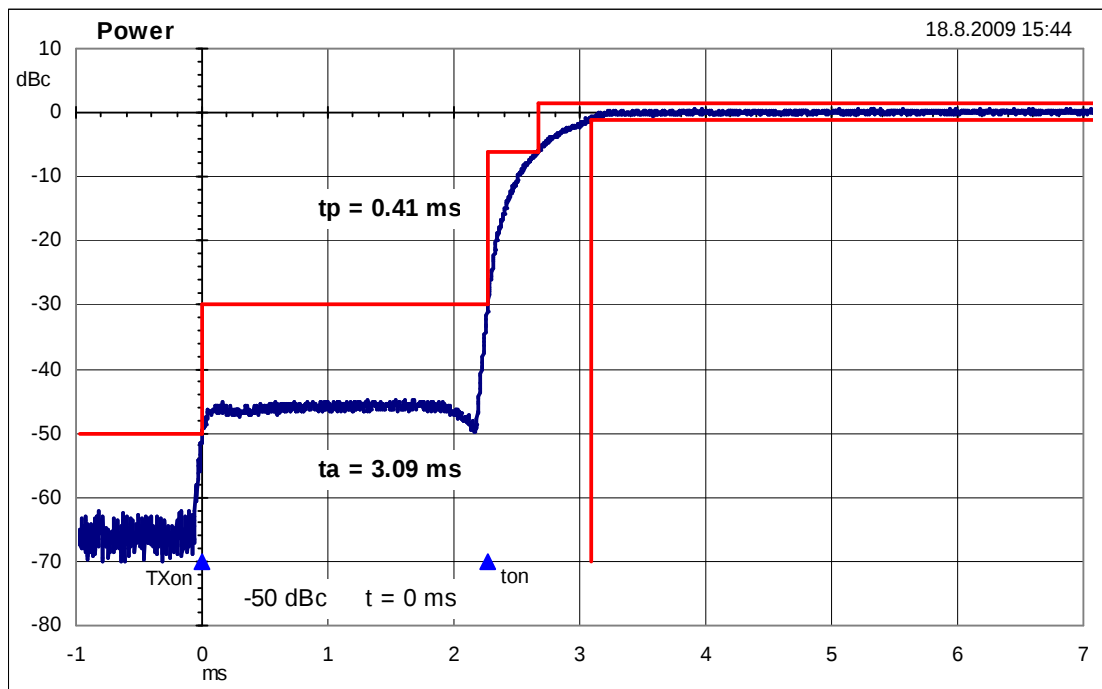
Transmitter release time (403 MHz)
(Transient behaviour of the transmitter switch-off)

Output power: 1 W.



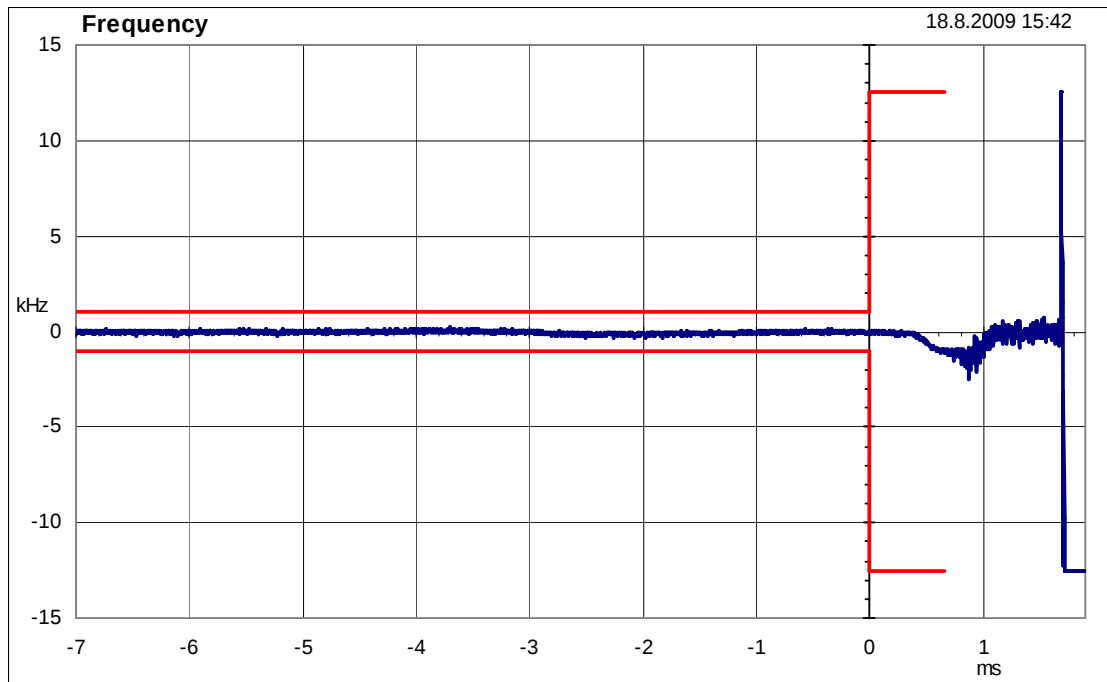
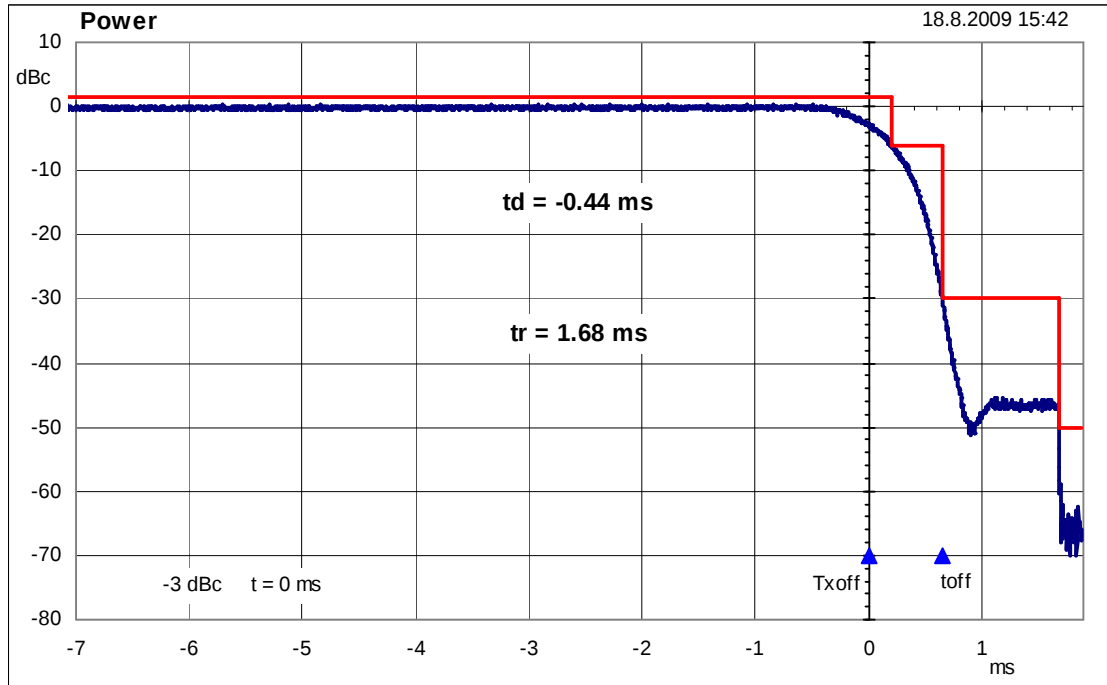
Transmitter attack time (473 MHz)
(Transient behaviour of the transmitter switch-on)

Output power: 1 W.



Transmitter release time (473 MHz)
(Transient behaviour of the transmitter switch-off)

Output power: 1 W.



3.12 Receiver spurious radiation Clause 8.10

Conducted Clause 8.10.1 a)

Date: 19.08.2009

Measurement method: Clause 8.10.2

Frequency 1		Frequency 4		Remarks
Frequency (MHz)	Level (dBm)	Frequency (MHz)	Level (dBm)	
183,145	-76,9	183,145	-76,9	
others 9 kHz to 4.0 GHz	< -80,0	others 9 kHz to 4.0 GHz	< -80,0	
Measurement uncertainty	- 4.4 dB / +3.4 dB			

LIMITS: Clause 8.10.4

Table 9: Conducted components

Frequency range	Limit
9 kHz to 1 GHz	2,0 nW (-57 dBm)
Above 1 GHz to 4 GHz, or above 1 GHz to 12,75 GHz	20,0 nW (-47 dBm)

TEST EQUIPMENT USED: 566, 389, 316, 404

3.13 Receiver spurious radiation Clause 9.7

Radiated Clause 7.5.1 b)

Date: 12.08.2009 (Frequency 1)
27.08.2009 (Frequency 4)

Measurement method: Clause 8.10.3

Frequency 1		Frequency 4		Remarks
Frequency (MHz)	Level (dBm)	Frequency (MHz)	Level (dBm)	
Tx operating		Tx operating		
All 30 MHz to 1.0 GHz	< - 70,0	656,6	-65,8	
All 1 GHz to 4.0 GHz	< - 65,0	others 30 MHz to 1.0 GHz	< - 70,0	
		all 1 GHz to 4.0 GHz	< - 65,0	
Measurement uncertainty	- 4.4 dB / +3.4 dB			

LIMITS: Clause 8.10.4

Table 10a: Radiated components

Frequency range	Limit
30 MHz to 1 GHz	2,0 nW (-57 dBm)
Above 1 GHz to 4 GHz	20,0 nW (-47 dBm)

TEST EQUIPMENT USED: 566, 201, 205, 133, 89, 176, 185, 417, 316, 404

4. Photographs



Photograph 1.



Photograph 2.

5. List of measuring equipment:

No.	Equipment	Type	Manufacturer	Serial Number
10	Oscilloscope	9400A	LeCroy	8878
42	Spectrum analyzer	8566B	Hewlett Packard	2637A04102
43	Spectrum analyzer	8568B	Hewlett Packard	2039A01256
62	Audio amplifier	PRL ?	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	Vötsch	31884
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
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
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
542	Double-Ridged Horn	3115	Emco	00023905
563	Thermometer	52 II	Fluke	81210080
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