

TEST REPORT

REPORT CERTIFICATE issued by a FCC listed Test Laboratory

**CUSTOMER AND
MANUFACTURER:**

Q-Matic Sweden AB
Neongatan 8
SE-413 53 Mölndal
Sweden

Project No: 04220

**EQUIPMENT UNDER
TEST (EUT):**

Remote Control Transmitter, "Wireless Terminal 433.92 MHz".
S/n: 31126-040. Nominal Center frequency: 433.92 MHz.

TEST SPEC.:

47 Cfr Ch. 1 (10-1-02 Edition):
Part 15, Subpart C.
Applicable Section: 15.231(a – d). Periodic operation in the
band 40.66 – 40.70 and above 70 MHz.

DATE OF TEST:

February 5 - 6, 2004

TEST SITE:

Svenska EMC Lab AB, Karlskrona, Sweden.
FCC registration number: 90967.
Industry Canada registration number: IC 4328.

TEST RESULT:

The EUT (Equipment Under Test) did pass the above mentioned test.

Approved, Karlskrona February 19, 2004



Hans Östergren
Manager Svenska EMC Lab AB

DATE OF RECEIPT: February 5, 2004

CONDITION OF EUT: No remarks. Operates as intended.

TEST PERSONNEL: Svenska EMC Lab AB: Bo Gidlöw, Hans Östergren.

DESCRIPTION OF THE EUT:

The EUT is a hand held Short range remote control, used to "Call forward" a new customer in a Queue System. With integral Antenna and without any Antenna contact. Powered from build-in batteries. No cables could be connected to the EUT.
EUT dimension: Approx. 20 mm thick and approx. diameter of 70 mm.

CALIBRATION DECLARATION:

The test equipment is calibrated as the calibration information in the Test Equipment list. Before starting of the tests the check points in the applicable Checklists were confirmed.

ESTIMATED UNCERTAINTY:

Expanded uncertainty ($k = 2$), Field Strength, emission 9 kHz – 1000 MHz: ± 2.4 dB
Expanded uncertainty ($k = 2$), Field Strength, emission 1 to 5 GHz: ± 3 dB
Frequency, 0.09 – 1000 MHz: ± 10 Hz
Frequency, 1 – 5 GHz: ± 10 kHz
The uncertainties are for a confidence level of not less than 95 %.

TEST EQUIPMENT:

Type/Manufacturer/Bandwidth	s/n	Calibration information	
		Date	Interval
EMI Test System, Monitor EZM,	860157/014	0308	12 months
Rohde & Schwarz EP-6, 20 Hz - 1300 MHz			
Test Receiver, Rohde & Schwarz ESH-3,	894979/013	0308	12 months
9 kHz - 30 MHz			
Test Receiver, Rohde & Schwarz ESVP,	893497/006	0308	12 months
20 - 1300 MHz			
Plotter, Rohde & Schwarz DOP 2	893117/0008	0308	12 months
Biconical Antenna, Schwarzbeck BBA9106	93-92196.1	0308	12 months
30 - 300 MHz			
Log-periodic Antenna, Schwarzbeck UHALP9107,	91071205	0308	12 months
300 - 1000 MHz			
Double Ridged Guide Antenna, EMCO 3115,	2338	0308	36 months
1 - 18 GHz			
Signal Amplifier, Mini-Circuits, ZHL-42	8607 01	0402	12 months
0.7 - 4.6 GHz			
Spectrum Analyzer Tektronix 2712,	B023361	0401	12 months
10 kHz - 1,8 GHz			
Spectrum Analyzer Tektronix 2755AP	B010111	0307	12 months
10 kHz - 21 GHz			
Plotter, Tektronix HC-100	JP05851	NA	NA
Coaxial Cable, Sucoflex 104, l = 5 m	171288/4	0309	12 months
Coaxial Cable, Sucoflex 104, l = 0.5 m	180067/4	0309	12 months
Coaxial cable, Suhner RG214	93-1217	0309	12 months
Antenna Mast System, Jyske EMC, h = 1 - 4 m	93-90172	NA	NA
Turn Table, Jyske EMC	93-90171	NA	NA
Anechoic Chamber, 8 x 4.5 x 3 m	93-87151	0304	36 months
Open Area Test Site for 3 m antenna distance	-	0312	36 months
Oscilloscope, Tektronix 2230	B011088	0301	24 months
Digital Multimeter, Fluke 77	63430754R	0302	24 months

TEST SET-UP AND PROCEDURE:

As laid out in ANSI C.63.4:2001 Document.
Tested as hand-held equipment in 3 orthogonal directions.
See Appendix 1.

TEST CONDITIONS:

Rating: 6 VDC. (4 x 1.5 V batteries).

Voltage at test: 6.3 VDC.

Peripherals: No peripherals.

Cables: Not possible to connect any cable.

Configuration: See photos in Appendix 2 to 4. . Resistor R1 = 4.7 kilo-ohm.

Operating Frequency: 433.92 MHz nominal.

Effective radiated power: Less than 1 mW.

Modulation: No external modulation possible. The manufacturers normal modulation was used.

Modulation data: See Appendix 5 and 6.

Modifications: No modifications.

Operating Condition: The normal operating mode with deactivation time of 60 seconds was disabled. The transmitter switch was mechanical looked to get continuously transmitting at 100 % duty cycle. The normal operating mode is a short activation of the transmitter. An auto-shutoff function automatically stops the device from transmitting after 60 seconds if a button inadvertently gets pressed for a long period of time.

Ambient Humidity: 49 % RH

Ambient temperature: 21 °C.

DESENSITIZATION FACTOR:

Not applicable.

TEST PERFORMANCE:

Section 15.231.

Applicable items:

15.231(a)(1). Deactivation time.

After releasing the manual switch the transmitter was automatic deactivated in less than 0.1 seconds.
Test instrument: Oscilloscope Tektronix 2230.

15.231(b). Field strength of emission.

Pre-test: A pretest was performed in the Anechoic Chamber to determine the radiated frequencies. Measured frequency range 30 – 1000 MHz. The EUT was measured at an Antenna distance of 3 m. The antenna polarization was both vertical and horizontal during the test. The EUT was fixed in position by a wooden fixture and measured in 3 orthogonal directions to find the direction generating the highest emission. This position was then used at the final measurements. The only emission from EUT was from the fundamental and its harmonics. No sub harmonics or spurious emission was found. The emission was checked with a Peak detector. See Appendix 7.

Final Test:

Measured on the open area test site with EUT - Antenna distance of 3 m. The EUT was in the fixture and positioned to give maximum emission. on a wooden table at 0.8 m height. The emission was maximized by varying the antenna height and the antenna polarization. Sec. 15.213(b)(2) specifies an Average detector (or as an alternative a Quasi-peak detector). Sec. 15.35(a) specifies a peak detector if the repetition frequency is lower than 20 Hz. Peak limit is in this case the same as the Av.limit.

1. Fundamental (f_0) and harmonic $2 \times f_0$. < 1000 MHz.

The emission was measured with a Peak detector and also with an Average detector (RBW = 120 kHz, Av. time = 100 ms). The limit in 15.231(b) is compared to the measured level with a Peak detector in accordance with 15.35(a). See Appendix 11. Test instruments: Test Receiver, Rohde & Schwarz ESVP, 30 MHz - 1300 MHz. Antenna, Schwarzbeck UHALP9107, 300 - 1000 MHz.

2. Harmonics, (3 to 10) $\times f_0$. > 1000 MHz.

The emission was measured with the Spectrum Analyzer in max. hold and with a Peak Detector (RBW = 1 MHz, VBW = 1 MHz). The limit at 3 m distance is in this case the same as the Av.limit. See Appendix 11. Test instruments: S/A Tektronix 2755AP, 10 kHz – 21 GHz. Signal Amplifier, Mini-Circuits, ZHL-42, 0.8 – 4.5 GHz. Antenna: Double Ridged Guide, EMCO 3115, 1 – 18 GHz.

15.231(c). Bandwidth.

The bandwidth was measured as dBc at the points carrier minus 20 dB. (The available frequency range is 420 – 450 MHz). Spectrum Analyzer in max. hold and with Peak Detector (RBW = 120 kHz, VBW = 300 kHz). See Appendix 10. Test instruments: Spectrum Analyzer Tektronix 2712, 10 kHz – 1.8 GHz. Antenna: Double Ridged Guide Antenna, EMCO 3115, 1 – 18 GHz.

Section 2.1049

2.1049(i). Occupied bandwidth.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. Spectrum Analyzer in max. hold and with Peak Detector (RBW = 120 kHz, VBW = 300 kHz). The bandwidth was measured at ± 0.5 % points (= 99 % power as shown in diagram). See Appendix 10. Test instruments: Spectrum Analyzer Tektronix 2712, 10 kHz – 1.8 GHz. Antenna: Double Ridged Guide Antenna, EMCO 3115, 1 – 18 GHz.

TEST RESULTS:

15.231(a)(1). Deactivation time.

The limit is 5 seconds and the measured deactivation time is less than 0.1 second.

15.231(b). Field strength of emission.

Fundamental:

Margin to limit was with peak detector – 3.6 dB as worst case.

See Appendix 11.

Harmonics:

Margin to limit were with peak detector – 11.1 dB at 867.490 MHz as worst case.

See Appendix 11.

15.231(c). Bandwidth.

The bandwidth was 384 kHz at – 20 dBc.

See Appendix 9.

2.1049(i). Occupied bandwidth.

The occupied bandwidth was 896 kHz.

See Appendix 10.

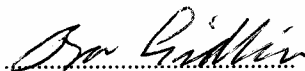
CONCLUSION:

The Remote Control Transmitter, “Wireless Terminal 433.92 MHz”, s/n: 31126-040 with nominal Center frequency of 433.92 MHz, did pass the above mentioned tests in Part 15, Subpart C.

Karlskrona February 19, 2004



Hans Östergren
Manager Svenska EMC Lab AB
Sr. EMC Engineer



Bo Gidlöw
Test Engineer

List over Appendixes.

Appendix No	Note
1	Test set-up, photo
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5	Modulation data
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7	Pre-test radiated emission
8	Pre-test radiated emission
9	Bandwidth
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11	Calculation of field strength

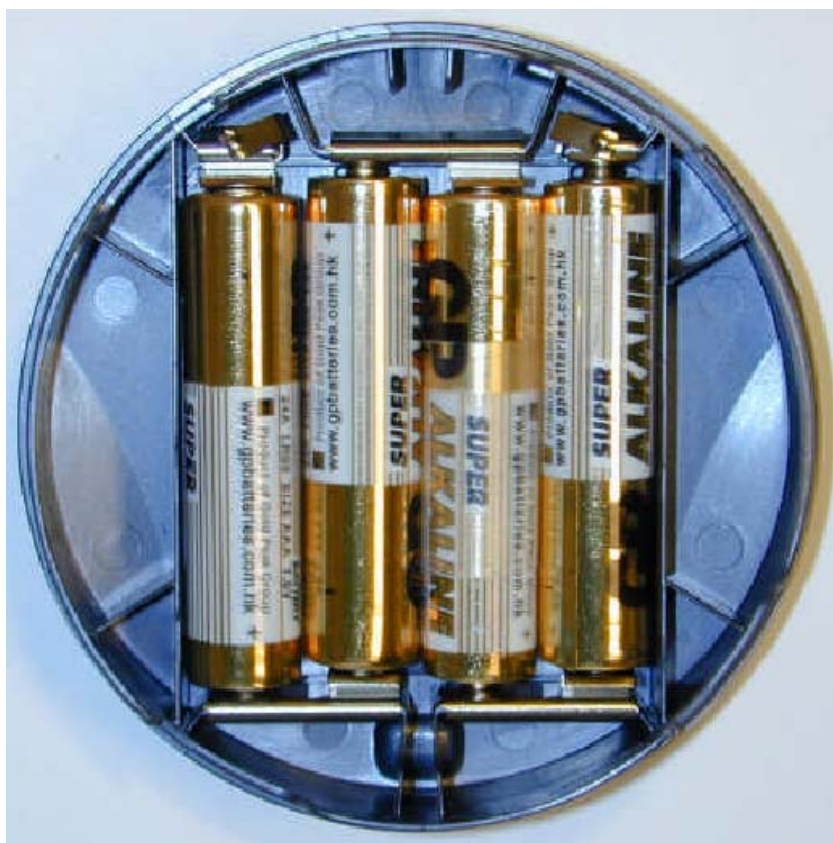
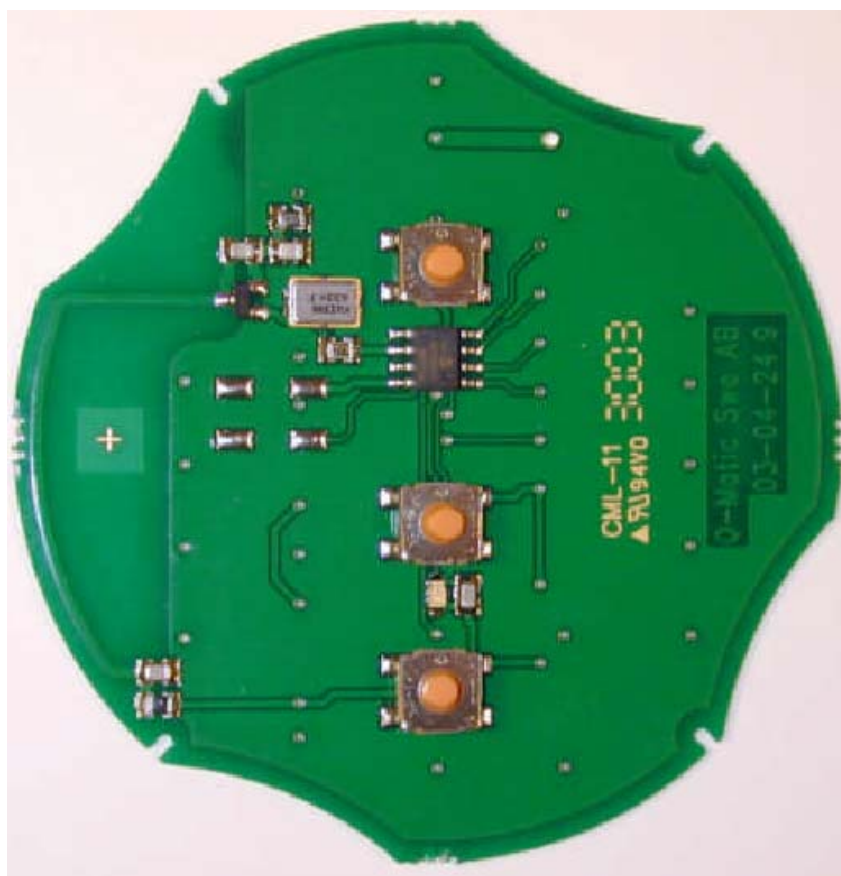
Test set-up, EUT with wooden fixture



Configuration



Configuration

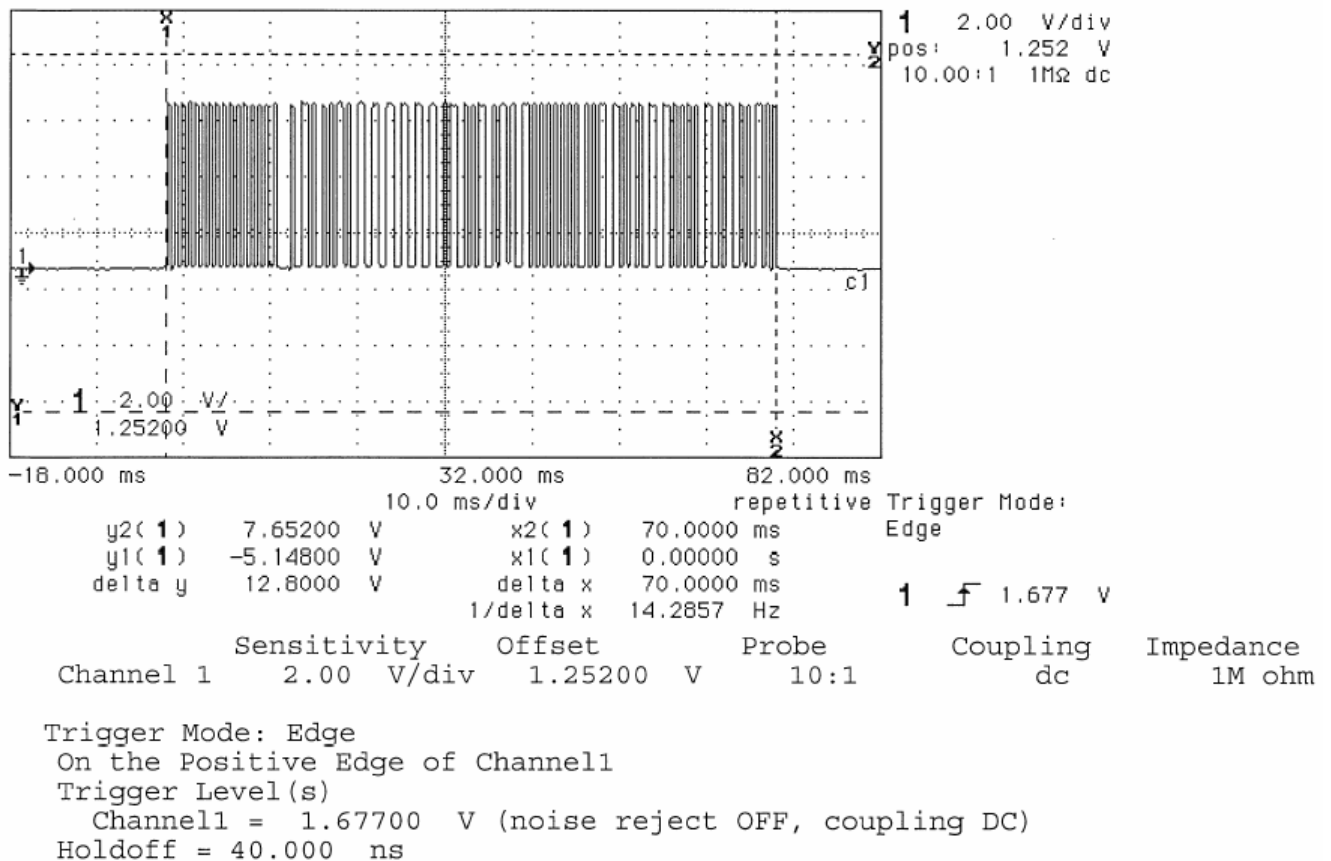


Configuration



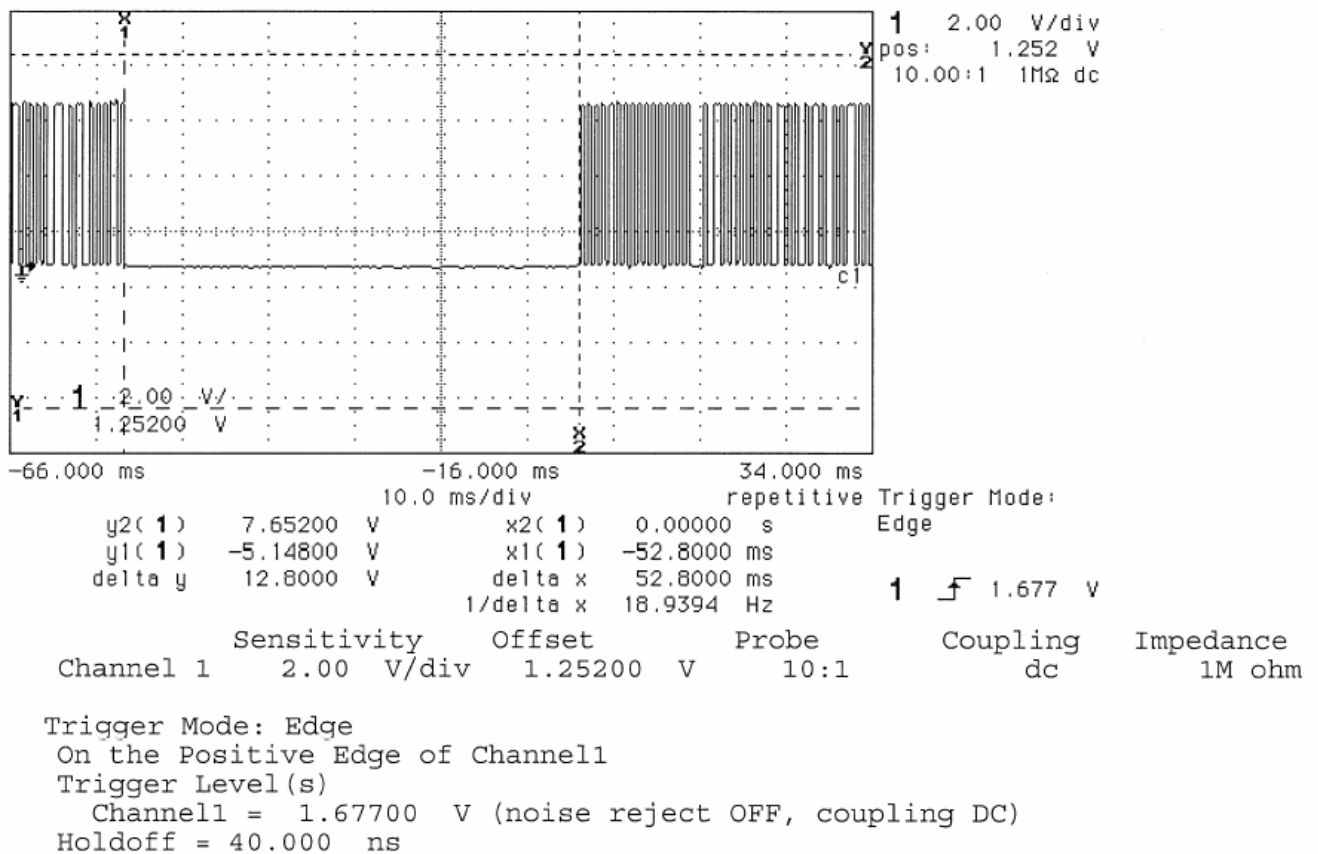
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hp running-awaiting trigger



Printed: 26 JAN 2004 at 11:48:48

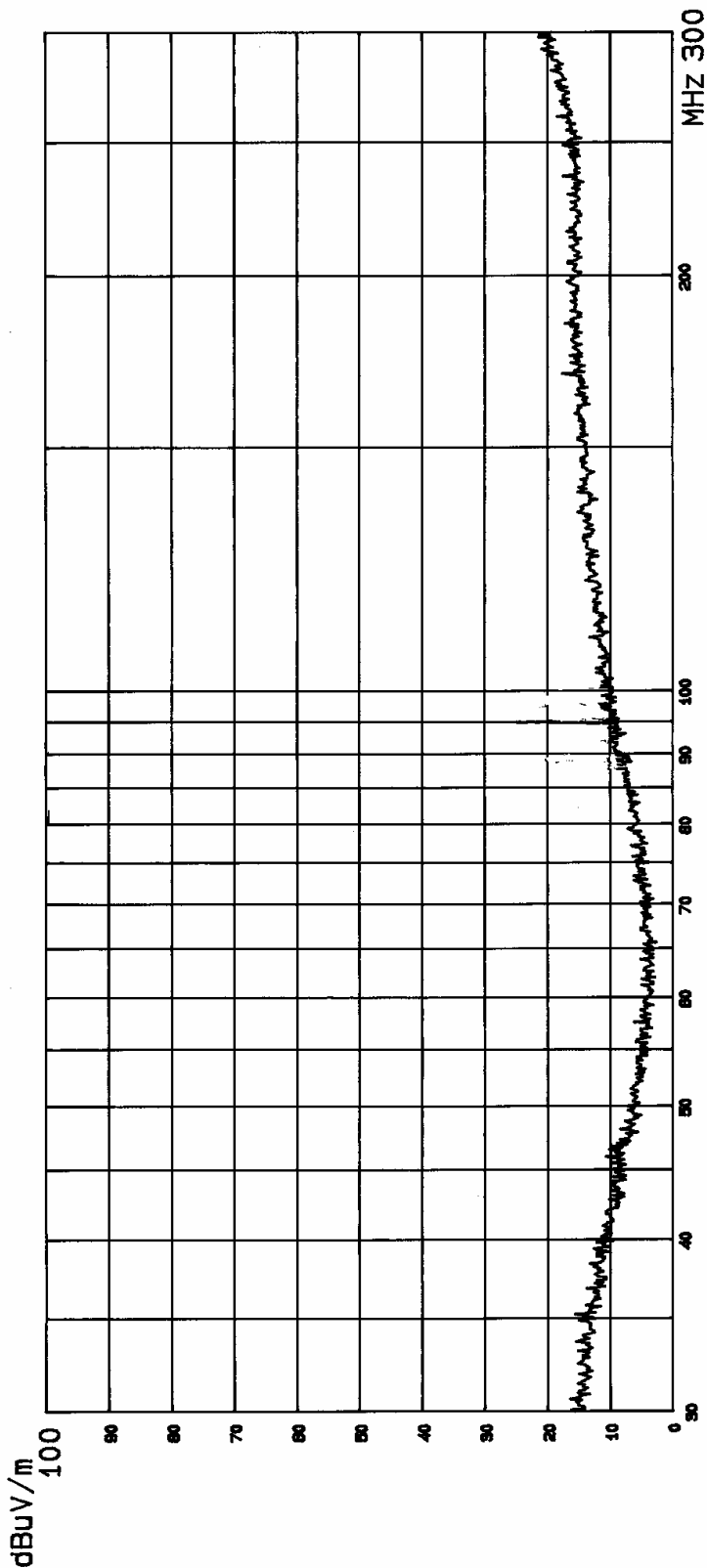
hp running-awaiting trigger



Pre-test, radiated emission

Q-Matic AB
Pretest (RE) in shielded chamber
Start of Test: 05.FEB'84 . 10:48
E.U.T.: Wireless Remote 3+1 Btn
Oper. Condition: Transm. 433.92 MHz
Operator: BO BIDLOEW
Test Spec:
Pretest executed with EM-ant.in anechoic chamber, 30-300 MHz

Start Fr. 30.0000 MHz Stop Fr. 299.9999 MHz IF-BW 120 kHz Detec. Peak Att. dB LN 0.020 Meas.T. type BICON

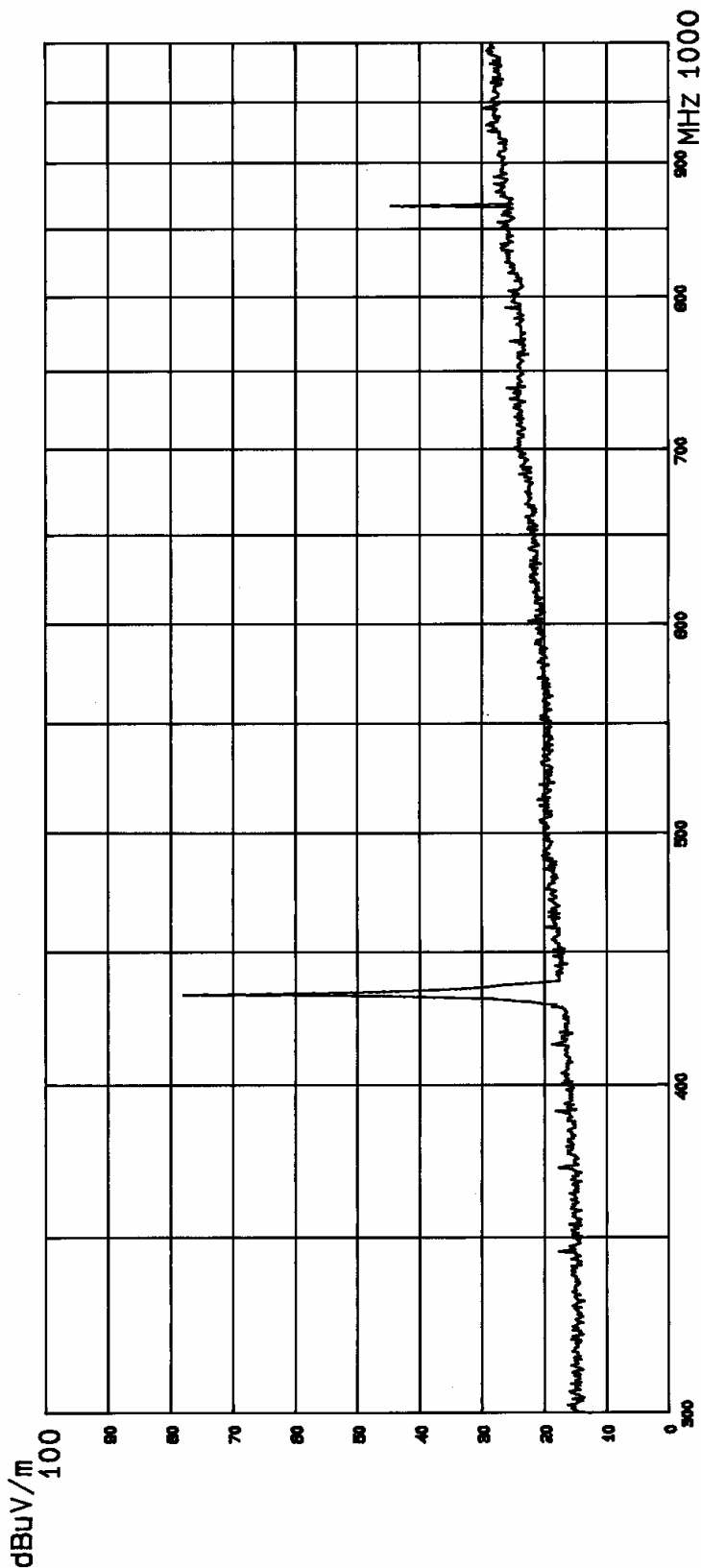


PREVIEW AT LOW RANGE VP (PREAMP. ON)

Pre-test, radiated emission

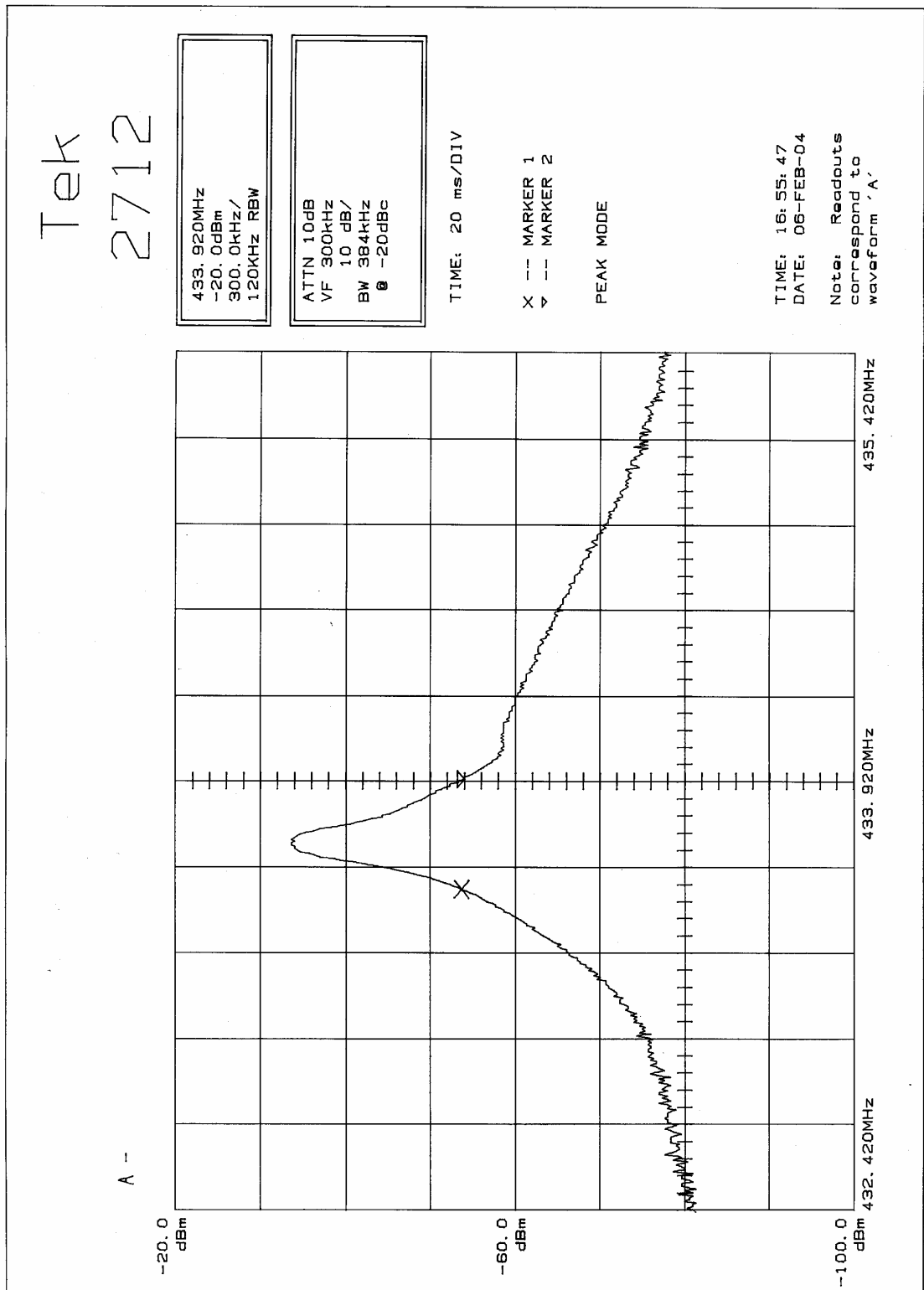
Q-Matic AB
Pretest (RE) in shielded chamber
Start of Test: 05.FEB'84, 12:00
E.U.T.: Wireless Remote 3+1 Btn
Oper. Condition: Transm. 433.92 MHz
Operator: BO BIDLOEW
Test Spec:
Pretest executed with EM-ant.in anechoic chamber, 0.3-1 GHz

Start Fr. 300.0000 MHz Stop Fr. 1000.0000 MHz IF-BW 120 kHz Datec 0.020 Peak LN 0.020 Meas. T. type L08.PEA

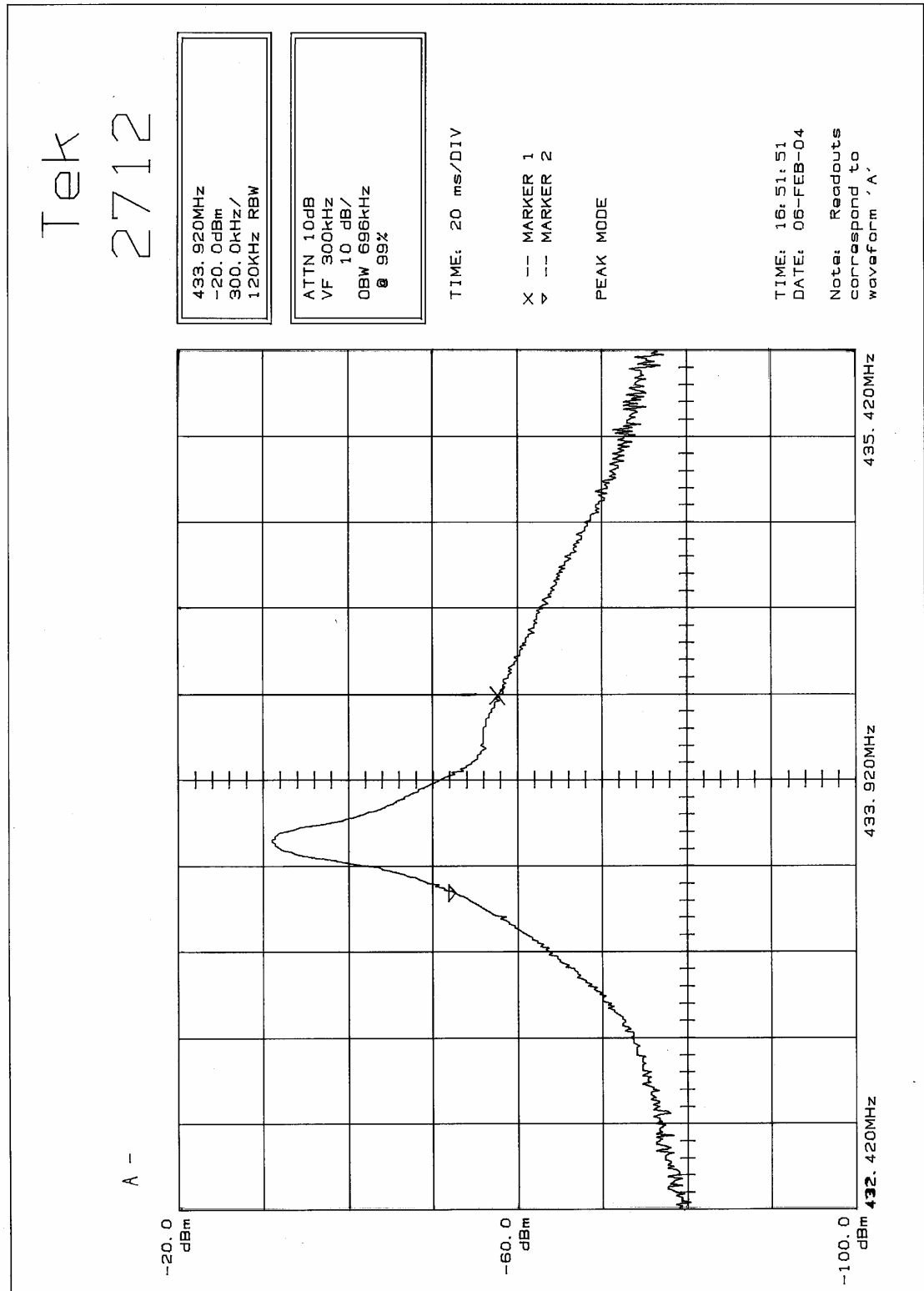


PREVIEW AT HIGH RANGE HP

Bandwidth



Occupied bandwidth



Radiated Fieldstrength Test. Calculation of Final Emission Levels.

EUT: Control Transmitter, "Wireless Terminal 433.92 MHz".
S/n: 31126-040. Nominal Center frequency: 433.92 MHz.

Test spec.: 47 Cfr Ch. 1 (10-1-02 Edition):
Part 15, Subpart C.
§ 15.231(b): Field strength of emission.
Open Area Test Site, 3 m antenna distance.

Date of Test: February 5 - 6, 2004

Operation: The EUT was configured to continuously transmit at 100% duty cycle.

Field strength (dBμV/m) = Amplitude (dBμV) + Antenna factor (dB/m) + cable loss (dB) + Gain (dB)

Tested frequency range: 300 - 4400 MHz
Measured maximum values.

Frequency MHz	Amplitude Peak dBμV	Amplitude Average dBμV	Antenna factor dB/m	Preamplifier Gain dB	<u>Cable Loss</u> dB	Field Strength dBμV/m	Limit dBμV/m	Margin to limit dB	Detector type
433.745 (f0)	-	27.6	17.6	-	0.5	45.7	80.7	- 35.0	AV.
433.745 (f0)	59.0		17.6	-	0.5	77.1	80.7	- 3.6	P
867.490		14.0	24.0	-	0.9	38.9	62	- 23.1	AV.
867.490	26.0		24.0	-	0.9	50.9	62	- 11.1	P
1301.235	- 11.2		25.9	30.0	1.3	46.0	62	- 16.0	P
1734.980	- 14.8	-	27.7	30.0	1.3	44.2	62	- 17.8	P
2168.725	- 25.2	-	28.6	31.0	1.4	35.8	62	- 26.2	P
2602.470	- 24.4	-	29.8	31.0	1.4	37.8	62	- 24.2	P
3036.215	- 23.2	-	30.4	30.5	1.5	39.2	62	- 22.8	P
3469.960	- 24.0	-	31.6	29.5	1.6	38.7	62	- 23.3	P
3903.705	- 21.6	-	32.9	31.0	1.7	44.0	62	- 18.0	P
4337.450	- 22.8	-	33.0	30.5	1.8	42.5	62	- 19.5	P