CETECOM ICT Services GmbH

Radio Satellite Communication
Untertürkheimer Straße 6–10, D-66117 Saarbrücken,
Telephone +49 (0) 681 598- 0, Fax +49 (0) 598 9075

Recognized by the
Federal Communications Commission
FCC–Identification Number
TCB ID: DE 0001

Federal Communications Commission

Accredited by the
German Accreditation Council
DAR–Registration Number
TTI–P–G 166/98

Deutscher Akkreditierungs Rat
DAR

Independent ETSI
Compliance test house

ETSI

Accredited Bluetooth™ Test Facility (BQTF)

Test report No. : 2-3253-01-01/03
Applicant : Mandolyn Int. Ltd.
Type : RT601
FCC–ID No : PLJRT601

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1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5.
The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.

Test laboratory manager:

2003-05-23	RSC - 8431	Gillmann D.	
Date	Section	Name	Signature

Technical responsibility for area of testing:

2003-05-23	RS - 8412	Hausknecht D.	
Date	Section	Name	Signature

1.2 Testing laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6 - 10
66117 Saarbrücken
Germany
Telephone : + 49 681 598 - 0
Telefax : + 49 681 598 - 9075
E-mail : info@ict.cetecom.de
Internet : www.cetecom-ict.de

Accredited testing laboratory
Accredited by : Regulierungsbehörde für Telekommunikation und Post (RegTP)
Listed by : Federal Communications Commission (FCC)

Authority	Identification/Registration No.
RegTP	TTI-P-G 166/98-30
FCC	90462

1.3 Details of applicant

Name : W.H. Mandolyn International Ltd.
Street : Unit 1003-8 Landmark North
39 Lung Sum Avenue;
Sheung Shui
City : N.T. Hong Kong
Country : N.T. Hong Kong
Telephone: (852) 2670 9733
Telefax : (852) 2673 0337
E-mail : Shirleyc@upm-products.com.hk

Contact person:
Name : Shirley
Telephone : + 852 2670 9733
Telefax : + 852 2673 0337
E-mail : Shirleyc@upm-products.com.hk

1.4 Application details

Date of receipt of test item : 2003-05-09
Date of test : 2003-05-22

1.5 Test item

Type of equipment	:	Remote control transmitter
Type designation	:	Model RT601
Manufacturer	:	see applicant
Street	:	
City	:	
Country	:	
Serial number	:	- / -

Additional information	**:**	
Frequency	:	433.92 MHz
Type of modulation	:	10K0A1D
Channel spacing	:	>25 kHz
Number of channels	:	1
Antenna	:	Integral antenna
Power supply (DC)		3.0V
FCC ID	:	PLJRT601

1.6 Test specifications:

Test standard :

Code of Federal Regulations (CFR 47)

FCC Part 15 Section 15.31
Measurement standards

FCC Part 15 Section 15.209
Radiation emission limits, general requirements

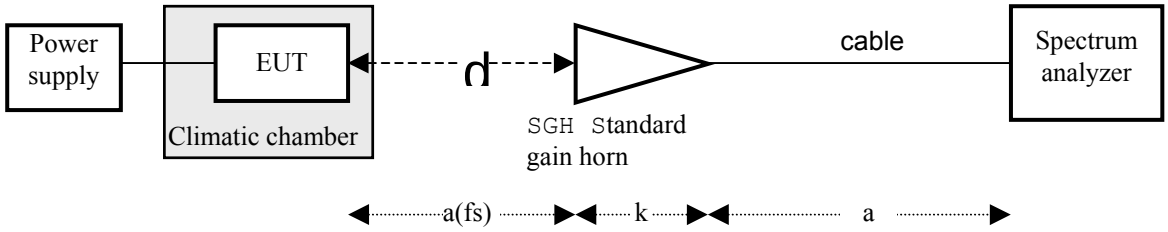
FCC Part 15 Section 15.231 (a)(1)
Periodic operation in the band 40.66 – 40.70 MHz
and above 70 MHz (timing of the Transmitter)

FCC Part 15 Section 15.231 (c)(1)
Periodic operation in the band 40.66 – 40.70 MHz
and above 70 MHz (Occupied bandwith)

CANADA RSS-210

1.7 Test equipment utilized and test set-up

1.7.1 Field strength and spurious radiation in the frequency range 4 GHz to 40 GHz



Frequency f [GHz]	Distance d [m]	Standard gain Horn ant. (SGH)	Dist. correction dc (3 m/X m) [dB]	Antenna factor k [dB 1/m]	Cable loss a [dB]
3.8 ... 6.0	1.0	narda 643	-9.54	27.22	1.8
5.3 ... 8.2	0.5	narda 642	-15.56	29.94	2.0
8.2 ... 12.4	0.5	narda 640	-15.56	33.64	2.5
12.4 ... 18.0	0.25	narda 639	-21.58	36.88	2.9
18 ... 26	0.25	narda 638	-21.58	40.36	4.5
26 ... 40	0.25	narda V637	-21.58	43.94	4.8
24.125	3.0	narda 640	n.a.	33.64	4.8

Calculation : Field strength = Analyser reading + Cable loss + Antenna factor + Distance correction

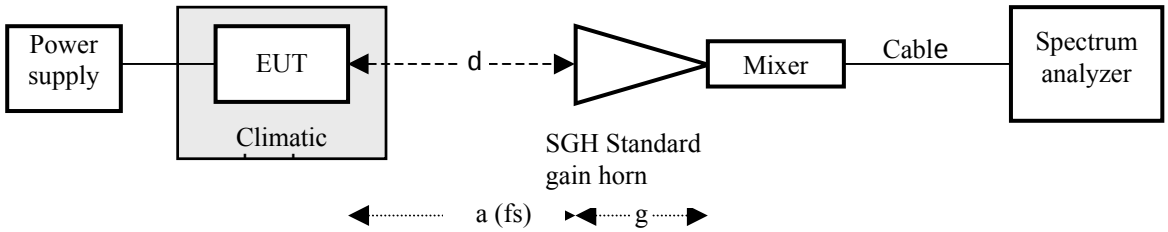
e = u + a + k + dc

Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300001665
SGH 3.8 ... 6.0 GHz	narda	643	300002447
SGH 5.3 ... 8.2 GHz	narda	642	300000767
SGH 8.2 ... 12.4 GHz	narda	640	300002213
SGH 12.4 ... 18.0 GHz	narda	639	300000786
SGH 18 ... 27 GHz	narda	638	300002442
SGH 27 ... 40 GHz	narda	V637	300000510
SGH 27 ... 40 GHz	Thomson	COR 27_40	300000797a
Power supply	HP	6032A	300002115
RF-cable	HP	5061-5359	300002033

Measurement uncertainty

Test parameter	Measurement uncertainty
Power supply	±0.1 VDC
Temperature	±0.2 °C
Frequency	±0.01 ppm
eirp	±1.4 dB

1.7.2 Field strength and spurious radiation in the frequency range 33 GHz to 110 GHz



Frequency	Distance	Distance correction	Antenna factor
f [GHz]	d [m]	dc (3 m/Xm) [dB]	k [dB 1/m]
42.0	1.0	-9.54	38.98
52.5	1.0	-9.54	39.66
63.0	0.5	-15.56	45.5
73.5	0.5	-15.56	41.5
84.0	0.5	-15.56	40.0

Calculation : Field strength = Analyser reading + Cable loss + Antenna factor + Distance correction

$$e = u + a + k + dc$$

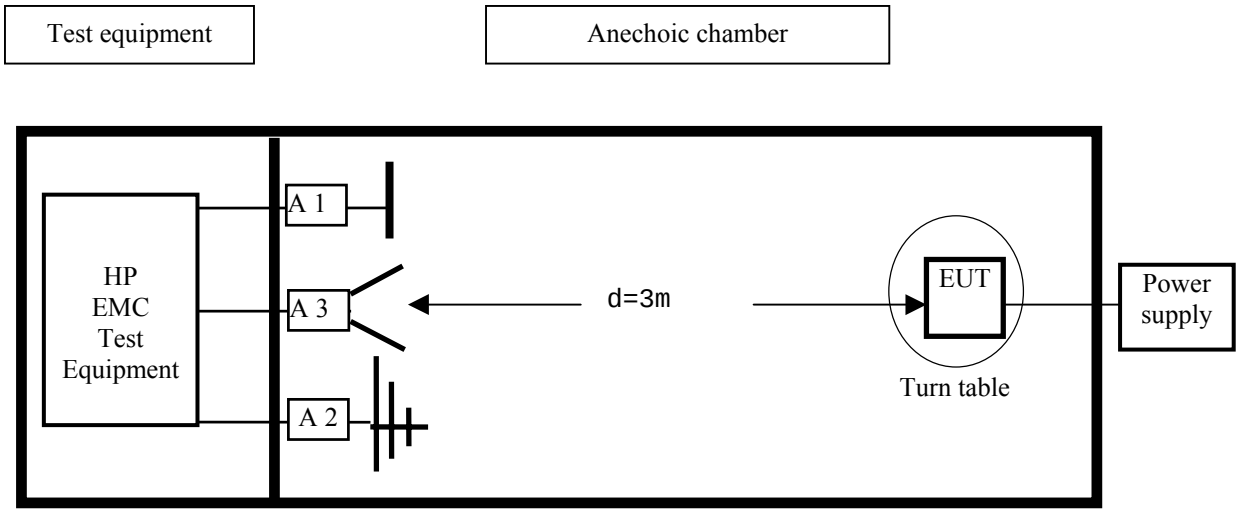
Test equipment	Manufacturer	Type	CETECOM reference
Spectrum Analyser	HP	HP 8565E	300001665
Power supply	HP	6032A	300002115
SGH 33 ... 50 GHz	Thomson	COR 33_50	300000812
Mixer 33 ... 50 GHz	HP	11970Q	300000781i
SGH 50 ... 75 GHz	Thomson	COR 50_75	300000789k
Mixer 50 ... 75 GHz	HP	11970V	300000871o
SGH 75 ... 110 GHz	Thomson	COR 75_110	300000789m
Mixer 50 ... 110 GHz	HP	11970W	300000871v

Measurement uncertainty

Test parameter	Measurement uncertainty
Power supply	±0.1 VDC
Temperature	±0.2 °C
Frequency	±0.01 ppm
eirp	±1.0 dB

1.7.3 Field strength and spurious radiation in the frequency range 9 kHz to 4 GHz

Set-up for radiated measurements



Test equipment	Manufacturer	Type	Serial No.
Spectrum analyser	HP	HP 85660B	2478A05306
Analyser display	HP	HP 85662A	2816A16541
Quasi peak adapter	HP	HP 85650A	2811A01131
RF-preselector	HP	HP 85685A	2833A00768
Biconical antenna A 1	Emco	3104	3758
Log.-per.-antenna A 2	Emco	3146	2304
Double ridge horn ant. A 3	Emco	3115	3007
Relay switch	R&S	RSU	375 339/002
High pass filter	FSY Microwave	HM 985955	001
Amplifier	Tron-Tech	P42-GA29	B2302
Power supply	HP	HP 6038A	2848A07027
RF-cable	HP	5061-5359	P36303

Measurement uncertainties

Performance	Measurement uncertainty
Input power (DC)	±0.1 V
Temperature	±0.2 °C
Frequency	±0.01 ppm
RF-power	±1.5 dB

1.8 Test results

Test results overview

This test was performed :

☐ in addition to the test report no.

Verification of EUT :

☒ EUT is in accordance with the technical description

☐ EUT is not in accordance with the technical description

☒ The equipment is compliant to FCC requirement

2 Technical test

2.1 Summary of test results

The radiated measurements were performed vertical and horizontal over the whole frequency range. We start at 1 m high with vertical receiving antenna and rotate the dish continuously. During rotation we use the antenna lift system to vary the high from 1 to 4 m. So we find maximum radiation output. At this points we do manual re-measurements. After this we do the same measurements in horizontal position of the receiving antenna. This (horizontal and vertical) is made for all the three planes of the test sample. We use the maximum received results.
The detector function and selection of bandwidth are according ANSI C63.2-1996 item 8.2.1 and ANSI C63.4-1992 Item 4.2.
Antennas are conform with ANSI C63.2-1996 item 15.
9 kHz - 30 MHz: Quasi Peak measurement, 200Hz Bandwidth, passive loop antenna.
30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna
200MHz - 1GHz: Quasi Peak measurement, 120KHz Bandwidth, log periodic antenna
1GHz: Average, RBW 1MHz, VBW 10 MHz, waveguide horn

All measurement settings are according to FCC 15.35, 15.205 and 15.209.

The product fulfills also the requirements for CANADA RSS-210

No deviations from the technical specification(s) were ascertained in the course of the tests performed.

2.2 Test report

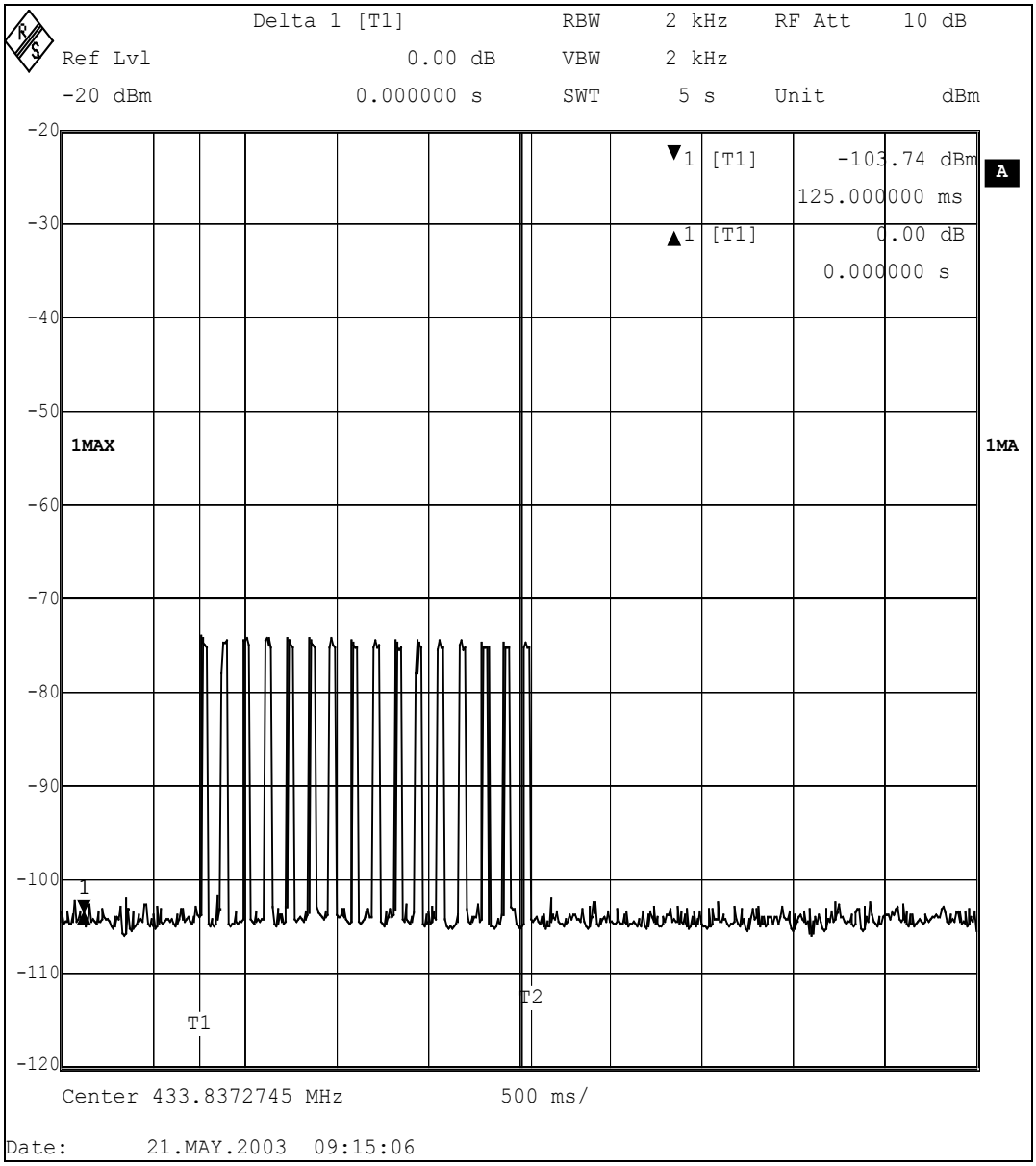
TEST REPORT

Test report no. : 2-3253-01-01/03

TEST REPORT REFERENCE

LIST OF MEASUREMENTS

Section 15.231 (a) (1) Periodic operation in the band ..above 70 MHz
Timing of the transmitter

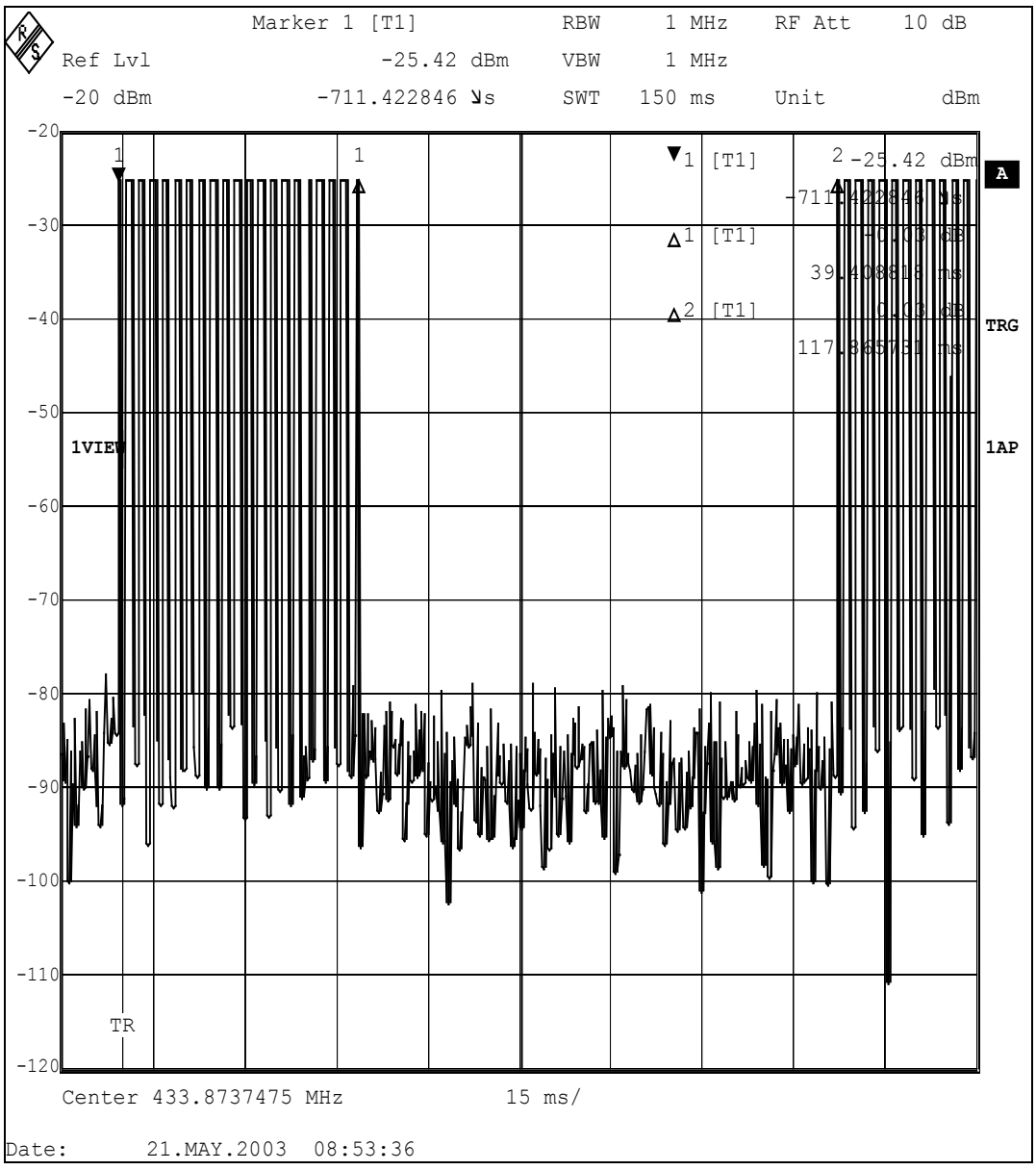


Vertical line Marker T1↓ : Press button
Vertical line Marker T2↑ : Release button

Tx stop immediately after releasing the button

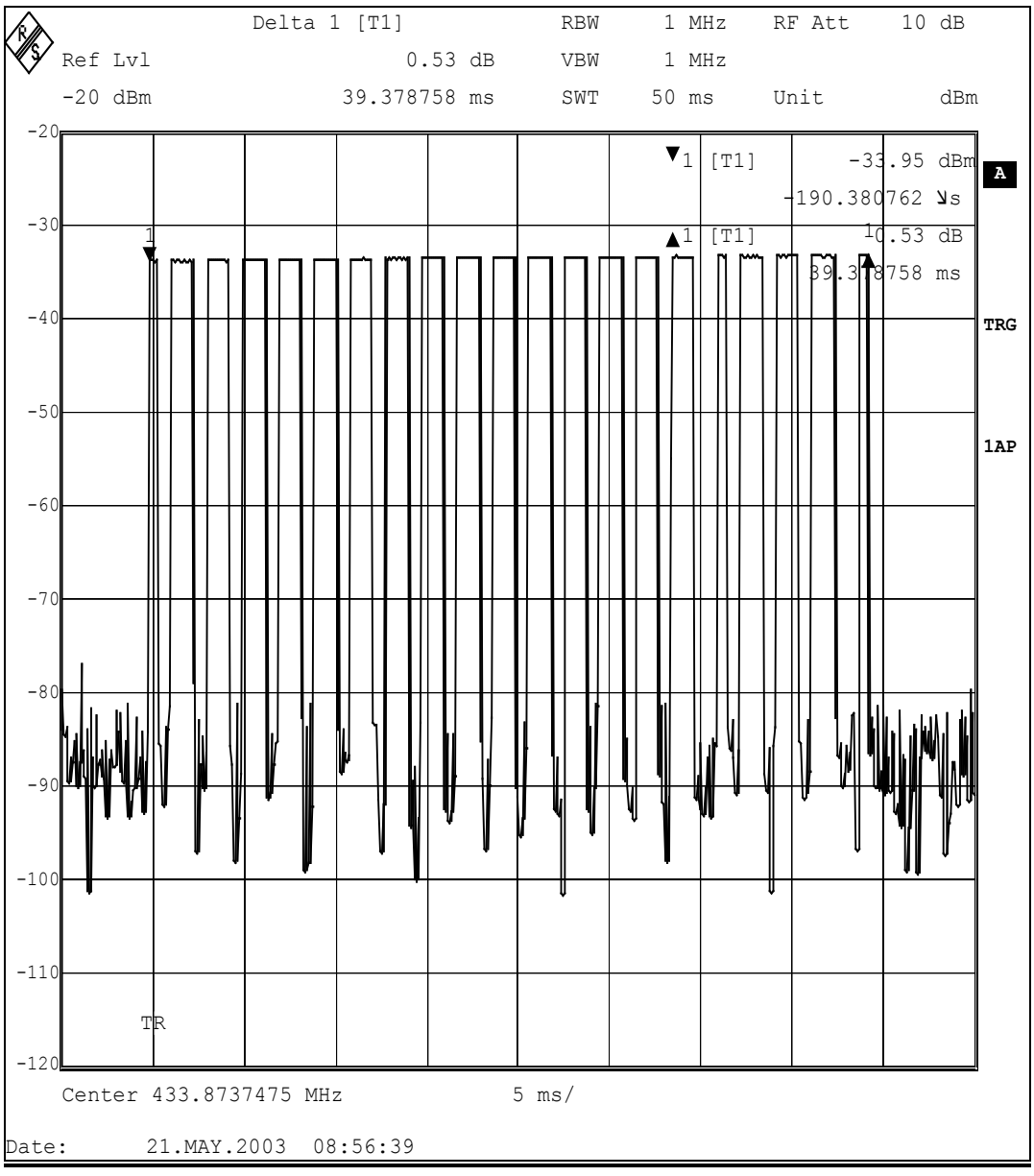
<u>So the product complies with the FCC requirements.</u>

Section 15.231 (a) (1) Periodic operation in the band ..above 70 MHz
Timing of the transmitter



Remark: The pulse train repetition is 125 ms.
The ON – time of transmitter pulsing is 39.4 ms.
The OFF- time is 100ms – 39.4 ms = ~ 60.6 ms
(according to the time requirements of FCC)
It is not possible to send more than 40 ms per 100 ms interval

Section 15.231 (a) (1) Periodic operation in the band ..above 70 MHz
Timing of the transmitter / Pulse time of the signal



Remarks: Marker 1 : Start signal
Marker 2 : Stop transmitting (Delta t = ~ 39.4 ms)

Calculation on Page 16

Section 15.231 (a) (1) Periodic operation in the band ..above 70 MHz
Timing of the transmitter / Pulse time of the signal

Calculation:

During transmission: ON – time is 24 ms

Average calculation(AV) $U_{av} = U_{peak} + 20\lg t_{on} : t_{ges}$

$U_{av} =$ 65.5 dBµV/m + 20lg (24ms:100ms)

$U_{av} =$ 65.5 dBµV/m – 12.4dB

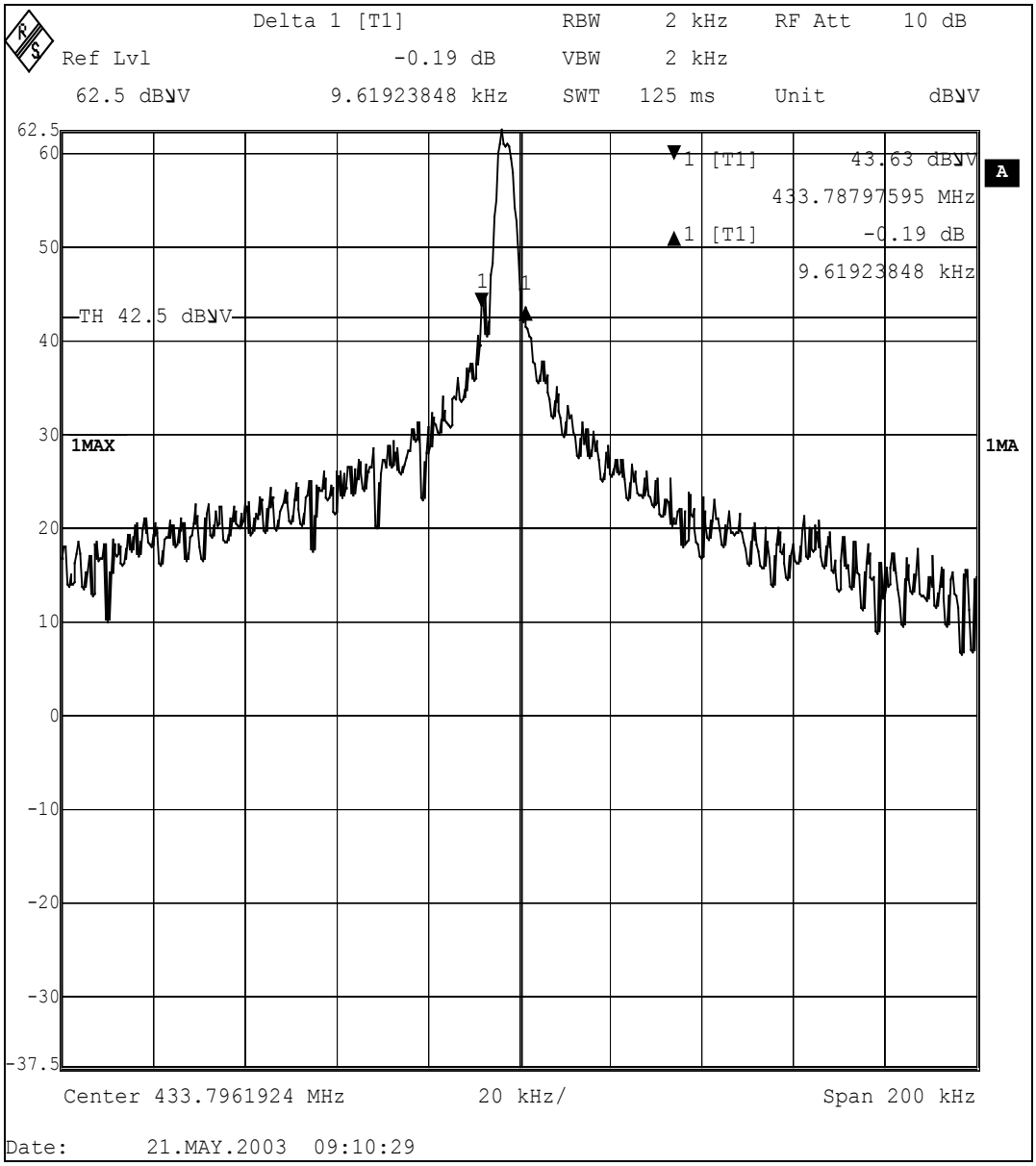
$U_{av} =$ 50.1 dBµV/m

AV = 319.9 µV/m

Limit: AV: 11 000µV/m = 80.8 dBµV/m

So the product complies with the FCC requirements.

Section 15.231 (c) Periodic operation in the band ..above 70 MHz
Occupied bandwidth



The occupied bandwidth is 9.62 kHz at –20 dB points.

Limit: 0.25 % of carrier frequency; here 1.085 MHz

So the product complies with the FCC requirements.

Section 15.209(b)(2) Spurious emission > 30 MHz (Tx radiated)

	TRANSMITTER SPURIOUS FIELD STRENGTH			
Frequency range [GHz]	Spurious frequencies [MHz]	S A u [dBmV]	E [µV/m]	See plot on page
0.009 – 30.000 MHz	Noise	-	-	19
30.000 – 4.000	Tx (433 MHz)	-	-	20
4.000 – 12.000 (h + v)	Noise	-	-	21
12.000 – 18.000 (h + v)	Noise	-	-	-
18.000 – 26.500 (h + v)	Noise	-	-	-
18.000 – 26.500 (h + v)	Noise	-	-	-
26.500 – 40.000 (h + v)	Noise	-	-	-
40.000 – 60.000 (h + v)	Noise	-	-	-
50.000 – 75.000 (h + v)	Noise	-	-	-
75.000 – 110.000 (h + v)	Noise	-	-	-

LIMITS: SECTION 15.245 / 15.205 / 15.209

Frequency range (MHz)	Measurement distance [m]	Field strength e [dBµV/m] @ 3 m	Field strength E [µV/m]
0.009 – 0.490	300	88.5 ... 53.8	2400/F(kHz)
0.490 – 1.705	30	53.8 ... 43.0	24000/F(kHz)
1.705 – 30.0	30	49.5	30
30.0 – 88.0	3	40.0	100
88.0 – 216.0	3	43.5	150
216.0 – 960.0	3	46.0	200
> 960.0	3	54.0	500
Harmonics	3	67.9 = 7.9 dBmV/m	2,500

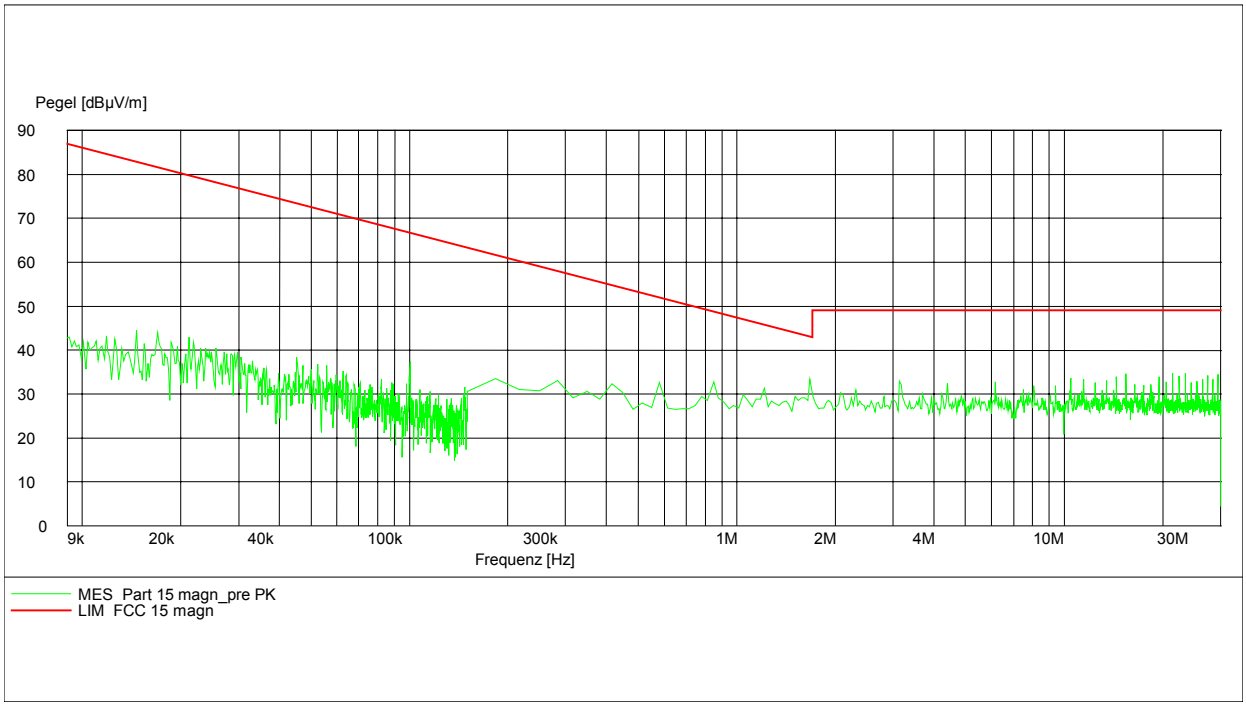
REFERENCE OF TEST EQUIPMENT USED : see test set-up on pages 6,7 and 8

Verdict :	Spurious limits are kept

Section 15.209(b)(2) Spurious emission < 30 MHz (Tx radiated)
§ 15.231 (b) (1)

Plot No.: 07

All limits are recalculated to 10m with 40 db/decade according to FCC part 15.31 (f)(2)

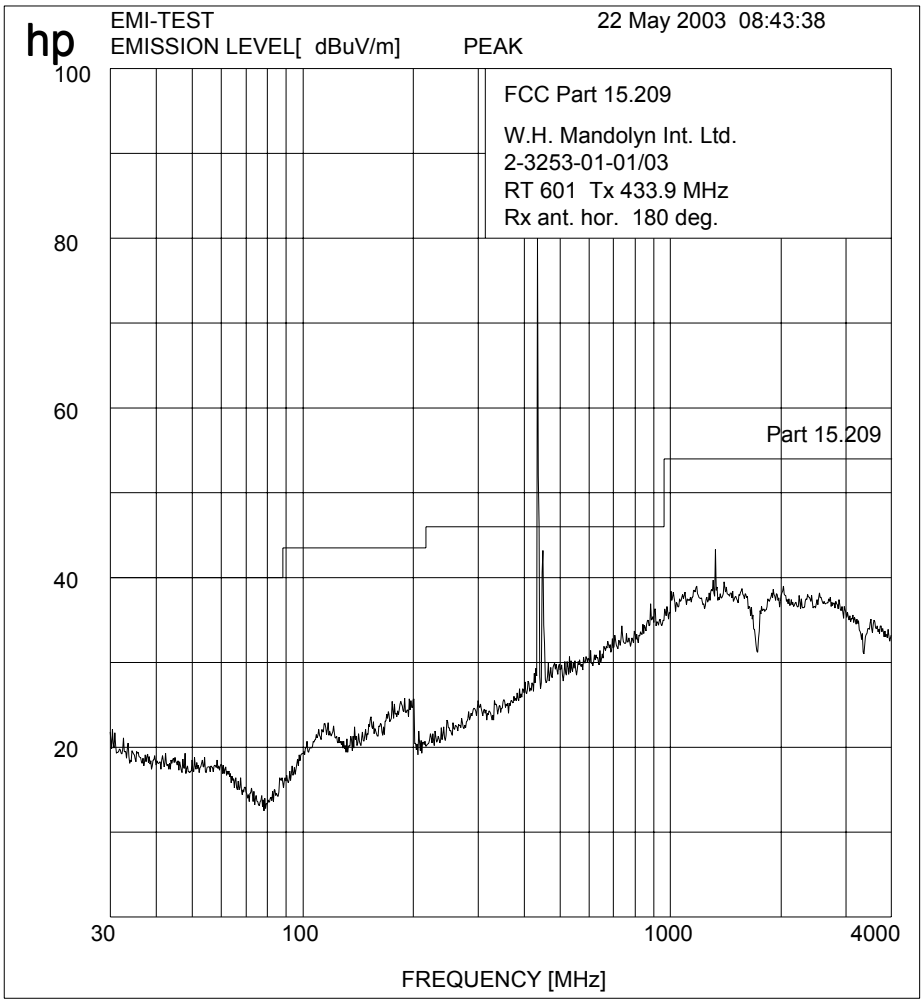


The green line shows a peak scan over the range.
The peaks between 10 MHz and 30 MHz have been remeasured withCISPR QP detector.
All values are more than 25 dB below limit.

So the product complies with the FCC requirements.

Section 15.209(b)(2) Spurious emission > 30 MHz (Tx radiated)

Plot No.: 06



Section 15.209(b)(2) Spurious emission > 4.0 GHz (Tx radiated)

Plot No.: 07

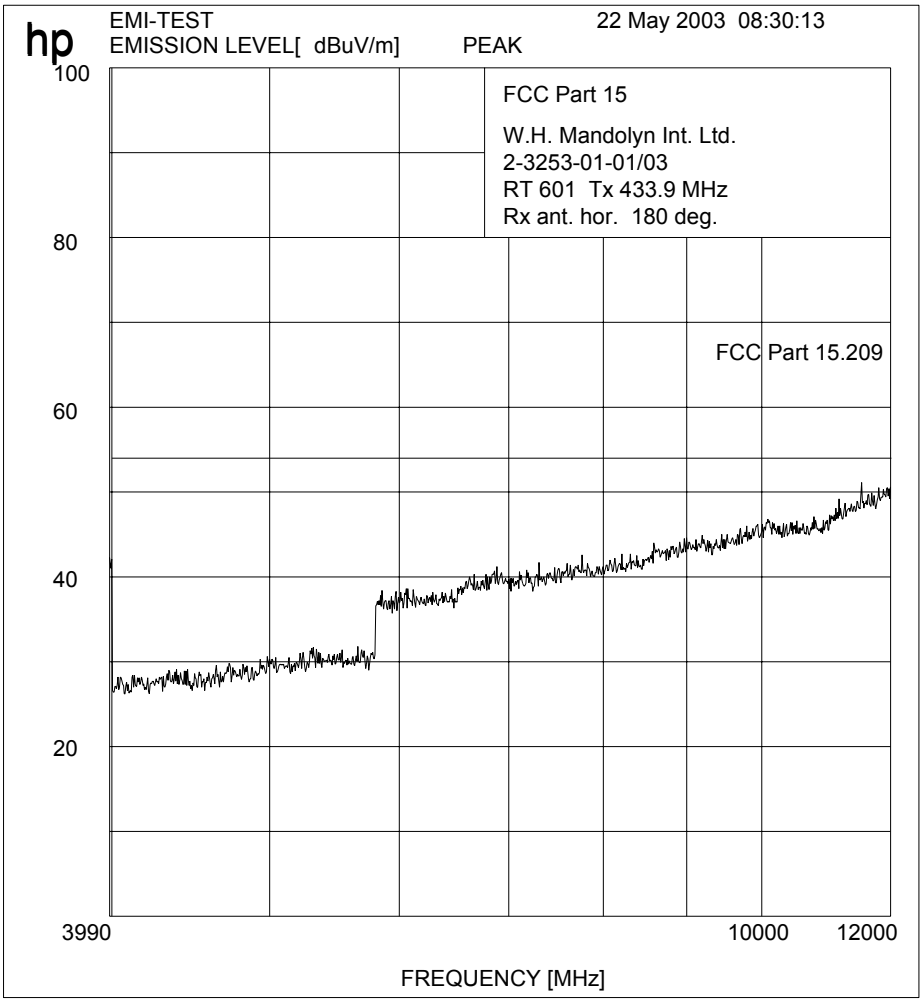


Photo No.: 01

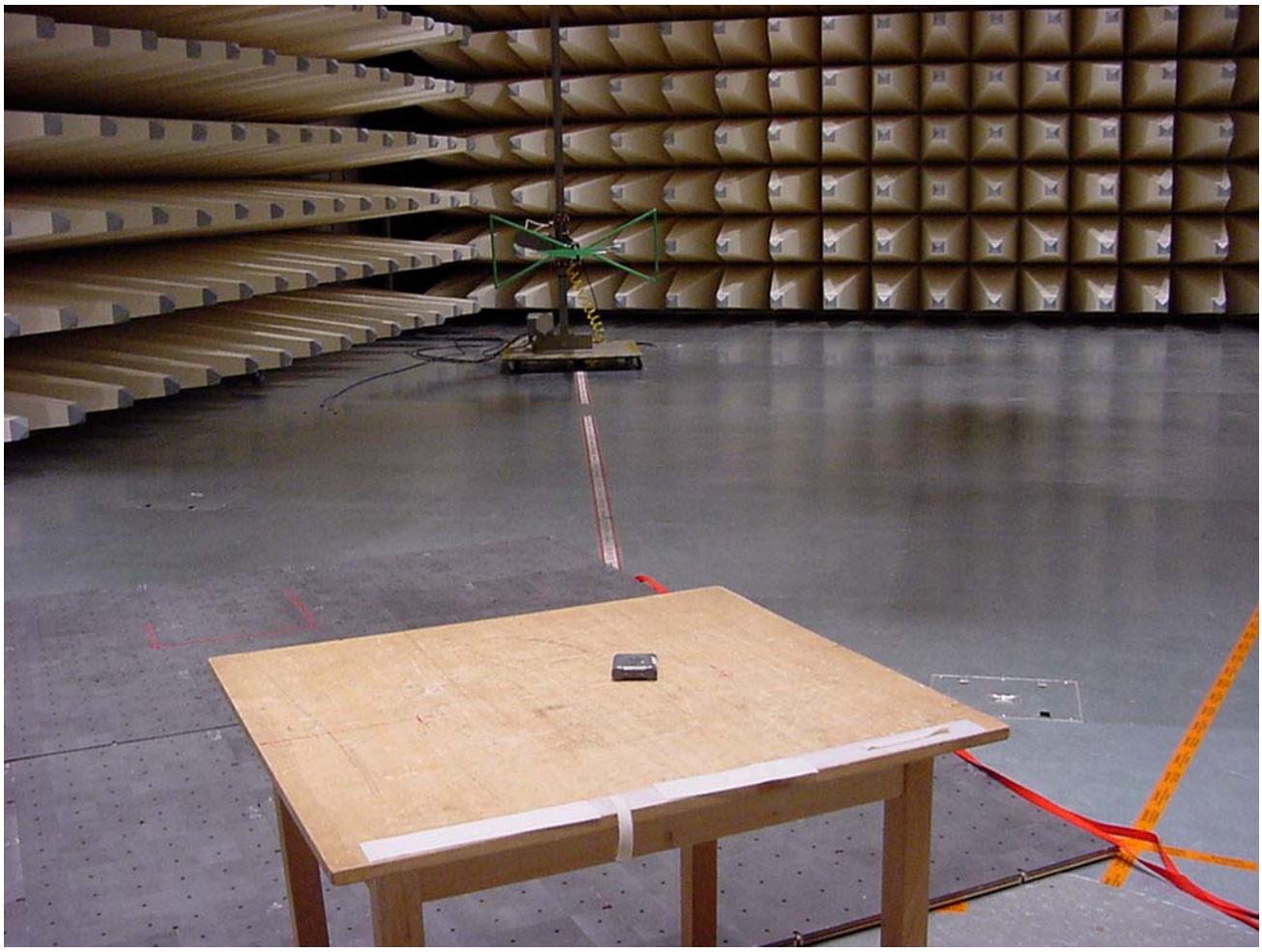


Photo No.: 02

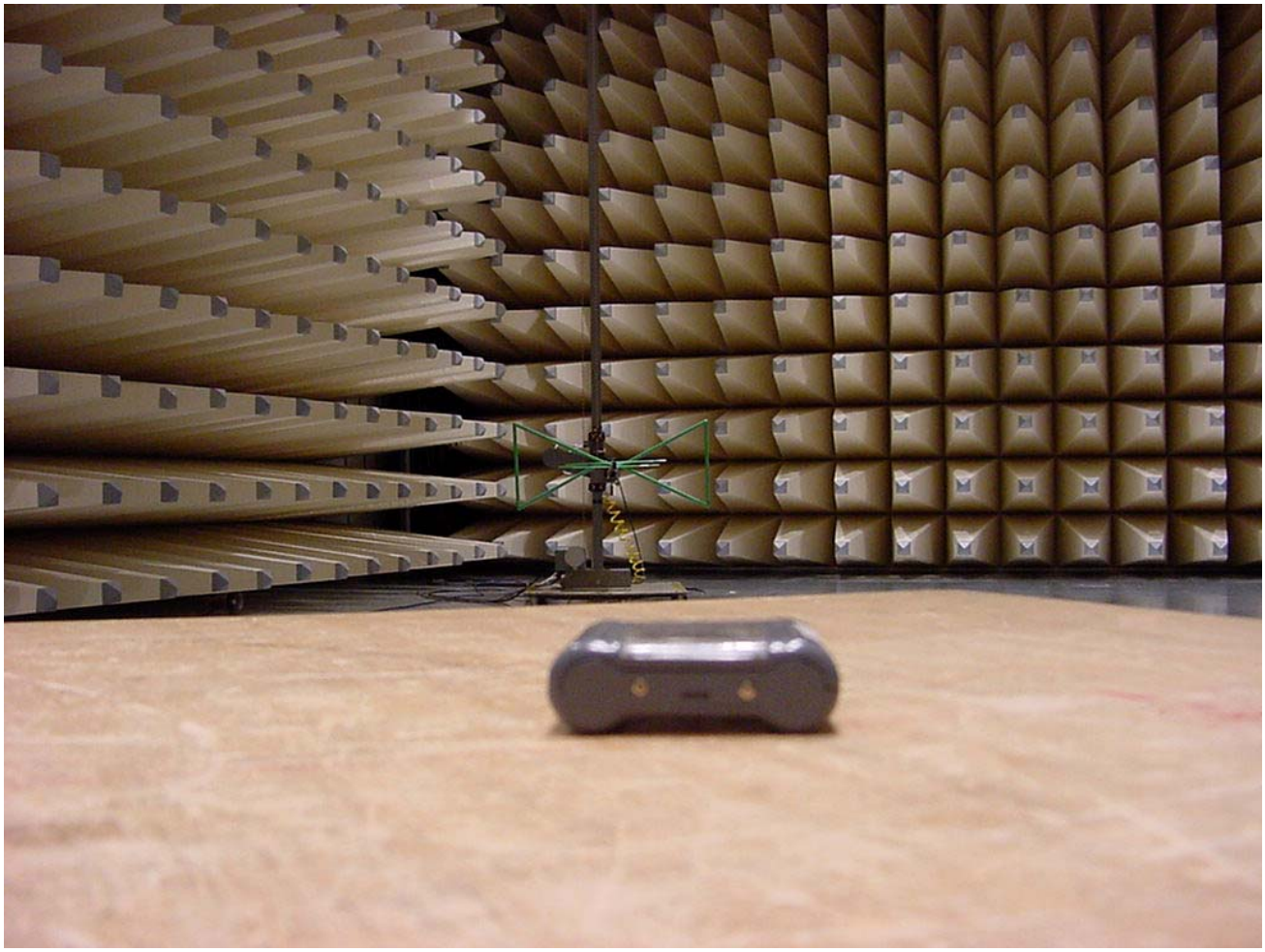


Photo No.: 03

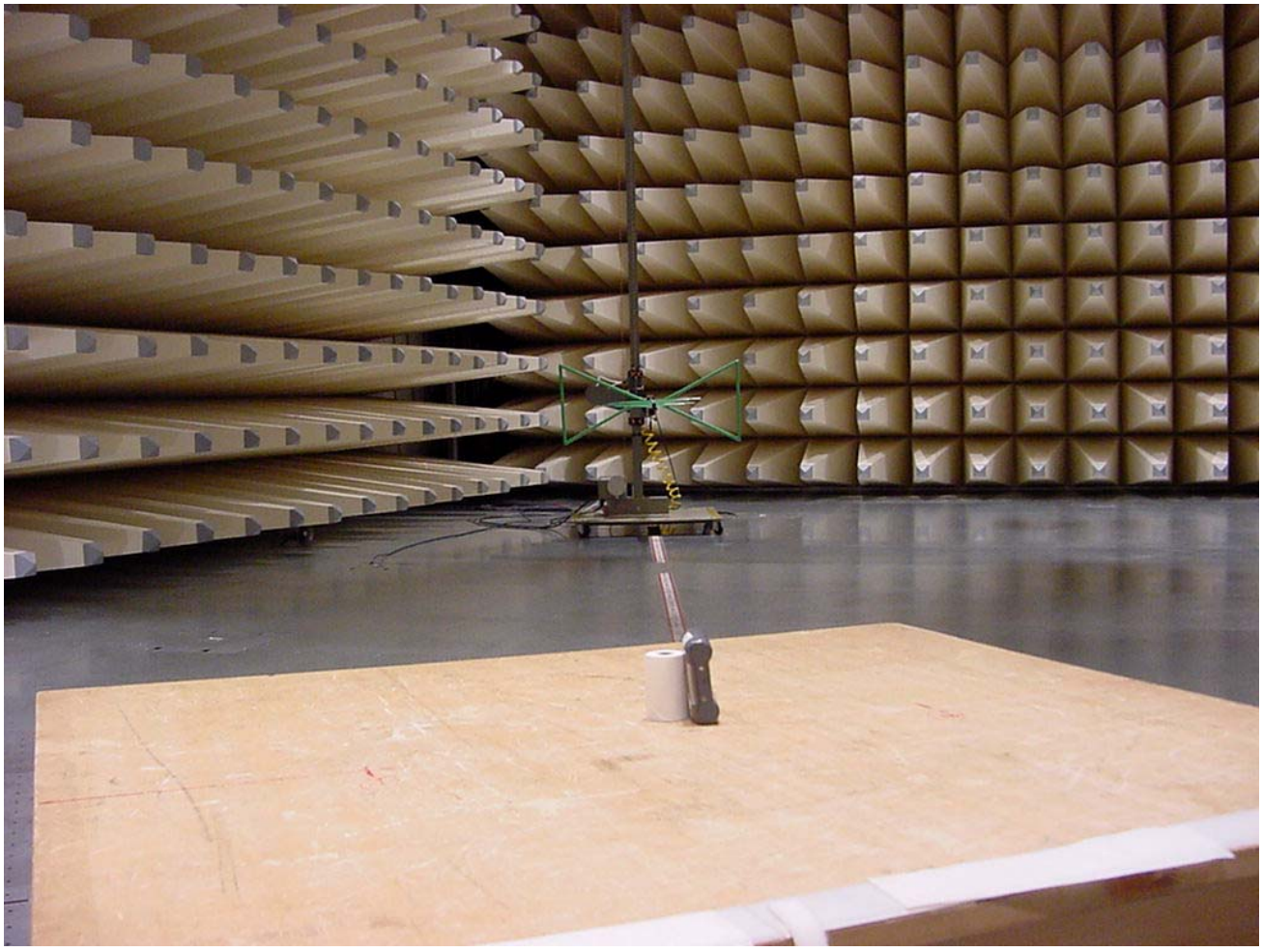


Photo No.: 04

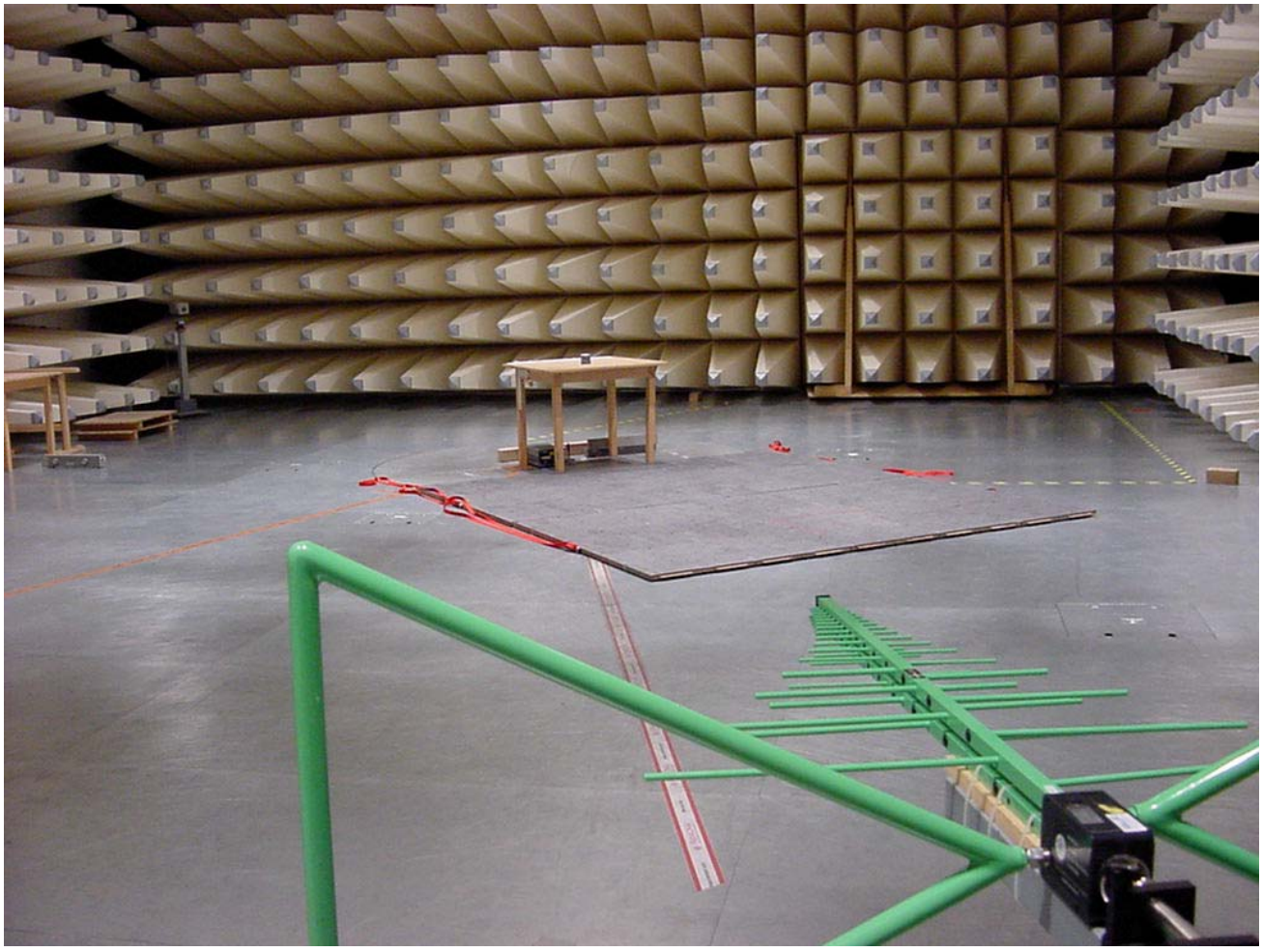


Photo No.: 05

Photo No.: 06

Photo No.: 07

Photo No.: 08

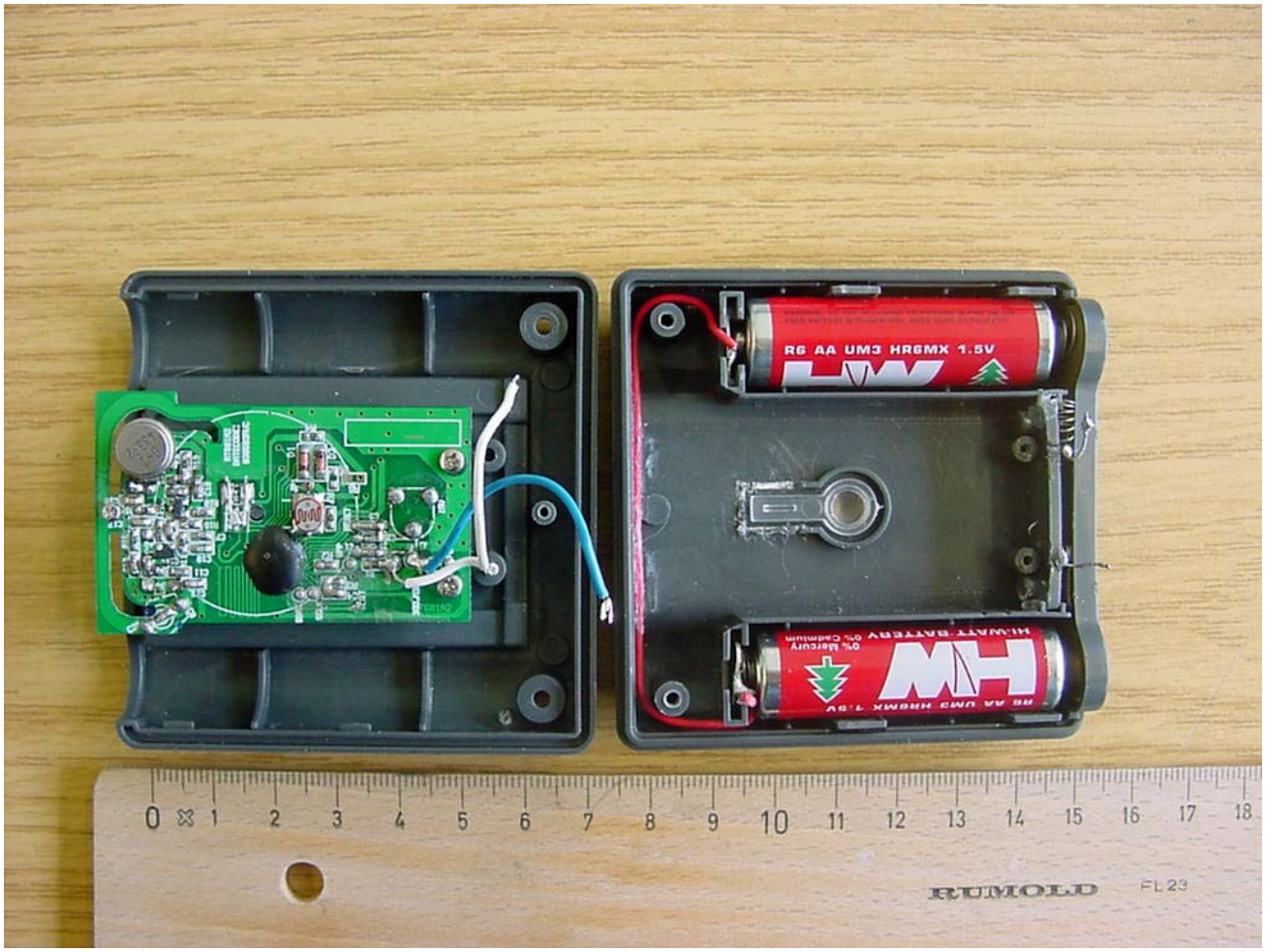


Photo No.: 09

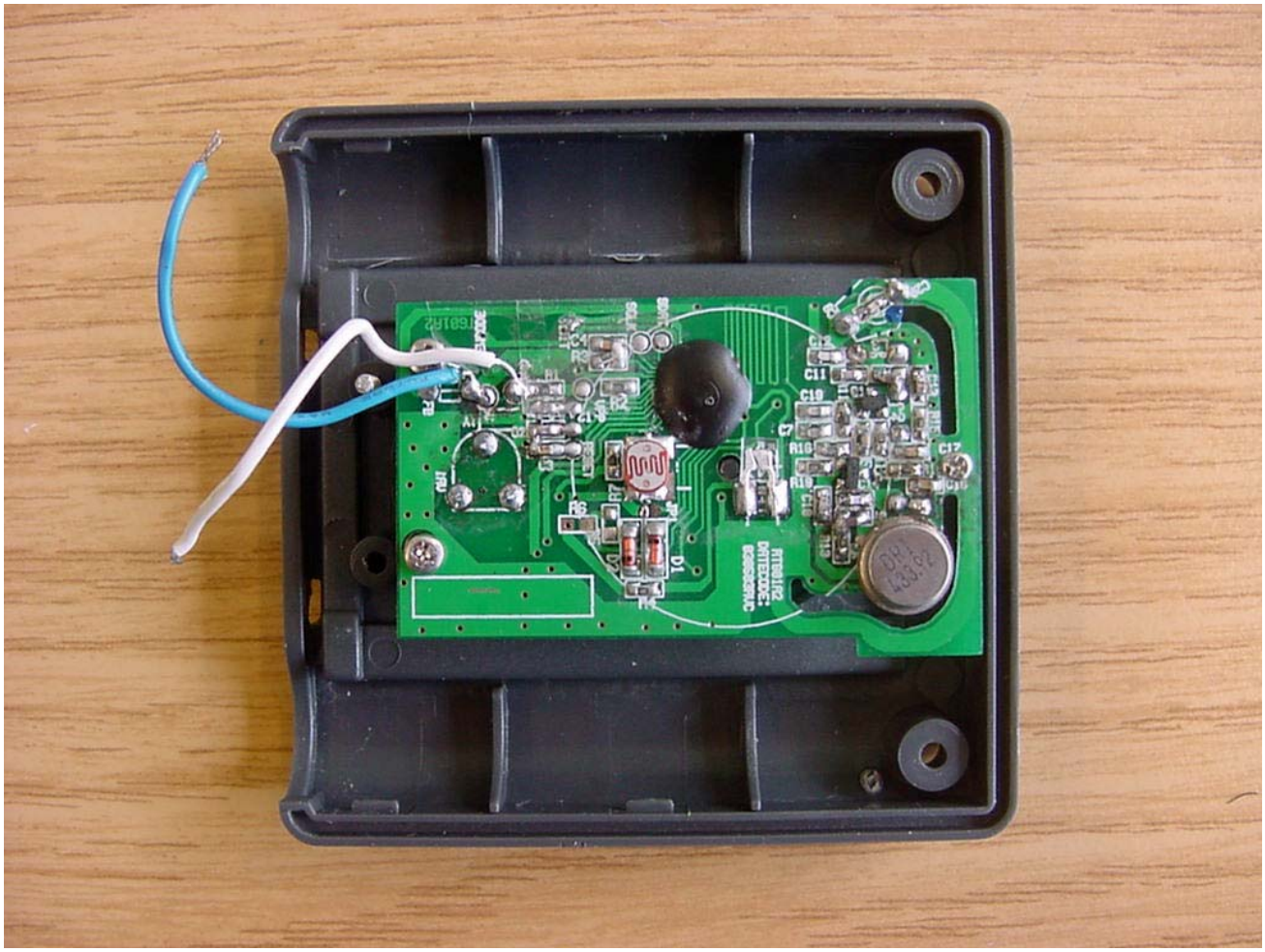


Photo No.: 10