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EMC Test Report

Company:	Holtzbrinck Publishers 41 Madison Ave. New York, NY 10010
Contact:	Lawrence Jankovic
Product:	i>clicker remote
FCC ID:	T24-RLR13
IC:	6495A-RLR13
Test Report No:	R032806-01-01
APPROVED BY:	Doug Kramer Senior Test Engineer
DATE:	19 May 2006
Total Pages:	45

ACCREDITED
Certificate Number 1953-01

1.0 Summary of test results

1.1 Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARDS: FCC Part 15, Subpart C			
Standard Section	**Test Type and Limit**	**Result**	**Remark**
15.203	Unique Antenna Requirement	Pass	PCB Antenna
15.209	Radiated Emission	Pass	Meets the requirement of the limit.
15.247(a)(2)	Spectrum Bandwidth of a Direct Sequence Spread Spectrum System, Limit: Min. 500kHz	Pass	Meets the requirement of the limit.
15.247(b)	Maximum Peak Output Power, Limit: Max. 30dBm	Pass	Meets the requirement of the limit.
15.247(c)	Transmitter Radiated Emissions, Limit: Table 15.209	Pass	Meets the requirement of the limit.
15.247(d)	Power Spectral Density, Limit: Max. 8dBm	Pass	Meets the requirement of the limit.
15.247(c)	Band Edge Measurement, Limit: 20dB less than the peak value of fundamental frequency	Pass	Meets the requirement of the limit.

1.2 Test Methods

1.2.1 Conducted Emissions

The EUT was powered by 3 AAA batteries and had no connection to the public mains. Conducted emissions measurements were therefore not required on the EUT.

1.2.2 Radiated Emissions

Compliance to CFR 47 Parts 15.209 and 15.247 was tested in accordance with the methods of ANSI/IEEE C63.4: 2003. Several configurations were examined and the results presented represent a worst-case scenario. The EUT was placed on a wooden table approximately 80cm high and centered on a 4m diameter turntable. The table was rotated to find the angles of maximum emissions and the receiving antenna was moved from 1m to 4m in both vertical and horizontal positions. The EUT was tested while sitting both vertically and horizontally. The horizontal configuration produced the highest emissions, and that position was used for all radiated testing. All measurements were taken at a distance of 3m from the EUT for Part 15.209 intentional radiator measurements, and 3m for 15.247 measurements of the fundamental frequency in the 902MHz to 928MHz band and subsequent harmonics.

2.0 Description

2.1 Equipment under test

The Equipment Under Test (EUT) was a i>clicker remote, which is designed to communicate directly with the i>clicker base. The device allows students in a classroom to select an answer to multiple-choice questions and have their selected answer sent over a 900MHz wireless link to the i>clicker base located within the classroom.

EUT Received Date: 26 April 2006
EUT Tested Date: 1 - 5 May, 2006

PRODUCT	i>clicker Remote
MODEL	RLR13
POWER SUPPLY	3 AAA Batteries
MODULATION TYPE	FSK, 240 kHz peak deviation
RADIO TECHNOLOGY	Half-duplex RF Link
TRANSFER RATE	152.34kb/s modulation rate 750 packets per second, maximum 0.4ms packet length
FREQUENCY RANGE	905.5 MHz – 923 MHz
NUMBER OF CHANNELS	16
MAXIMUM OUTPUT POWER	15 dBm,
ANTENNA TYPE	Internal, PCB mounted, ¼ wave 0 dBi gain
DATA CABLE	N/A
I/O PORTS	N/A
ASSOCIATED DEVICES	N/A

NOTE:
1. For more detailed features description, please refer to the manufacturer's specifications or User's Manual.

2.2 Laboratory description

All testing was performed at the NCEE Lincoln facility, which is a FCC and IC registered lab. This site has been fully described in previously submitted reports. Laboratory environmental conditions varied slightly throughout the tests:

Relative humidity of 45 ± 4%
Temperature of 20 ± 3° Celsius

2.3 Description of test modes

Channel	Frequency	Channel	Frequency
AA	917.0 MHz	CA	922.0 MHz
AB	913.0 MHz	CB	923.0 MHz
AC	914.0 MHz	CC	907.0 MHz
AD	915.0 MHz	CD	908.0 MHz
BA	916.0 MHz	DA	905.5 MHz
BB	919.0 MHz	DB	909.0 MHz
BC	920.0 MHz	DC	911.0 MHz
BD	921.0 MHz	DD	910.0 MHz

NOTE:
1. Channel DA, AC and CB were chosen to represent frequencies at the lowest, middle and highest possible transmitting frequencies, respectively.
1. Below 1 GHz, channels DA, AC, and CB were tested individually
2. Above 1 GHz, channels DA, AC, and CB were tested individually.

2.4 Applied standards

The EUT is a digital transmission device operating between 902 MHz and 928 MHz. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C. (15.247) using ANSI/IEEE C63.4: 2003
Industry Canada, RSS 210, Issue 6, Category I Equipment

All test items have been performed and recorded as per the above standards.

2.5 Description of support units

None

2.6 Configuration of system under test

The EUT required no auxiliary power and had no auxiliary devices, so it was tested by itself. The EUT was programmed by the manufacturer to transmit continually for testing purposes only.

3.0 Test equipment used

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE
Rohde & Schwarz Test Receiver	ESIB26	100037	10-Aug-05
Rohde & Schwarz Test Receiver	ESIB7	100007	28-Dec-05
EMCO Biconilog Antenna	3142B	1654	13-Mar-06
EMCO Horn Antenna	3115	6416	12-Oct-05
EMCO Horn Antenna	3116	2576	12-Oct-05

4.0 Detailed results

4.1 Unique antenna requirement

4.1.1 Standard applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

4.1.2 Antenna description

The antenna supplied with the EUT is internal to the device and not interchangeable.

4.2 Radiated emissions

4.2.1 Limits for radiated emissions measurements

Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

FREQUENCIES (MHz)	FIELD STRENGTH (μV/m)	MEASUREMENT DISTANCE (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 * log * Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.

4.2.2 Test procedures

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground plane in a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.

d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4 meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.

e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.

2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for peak and average detectors at frequencies above 1GHz.

4.2.3 Deviations from test standard

No deviation.

4.2.4 Test setup

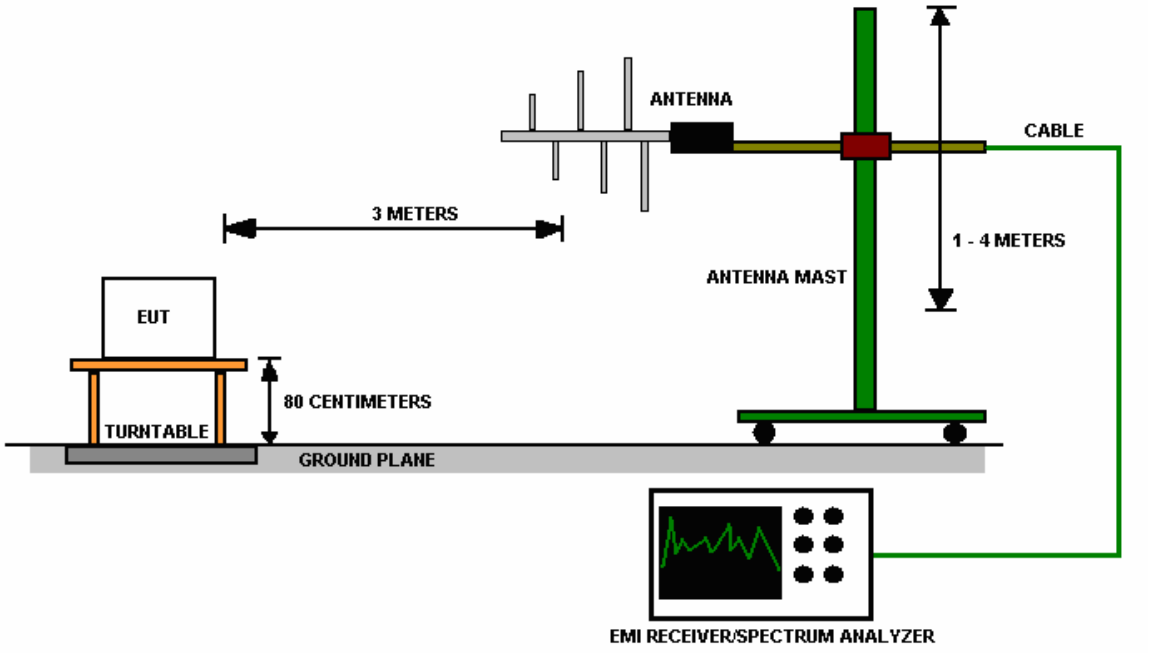


Figure 1 - Radiated Emissions Test Setup

For the actual test configuration, please refer to Appendix A for photographs of the test configuration.

4.2.5 EUT operating conditions

The EUT required no auxiliary power and had no auxiliary devices, so it was tested by itself. The EUT was programmed by the manufacturer to transmit continually for testing purposes only.

4.2.6 Test results

EUT	i>clicker Remote	Model	RLR13
MODE	Channel AA	FREQUENCY RANGE	30MHz – 1GHz
INPUT POWER (SYSTEM)	3 AAA Batteries, 4.5VDC	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

REMARKS:
1. Emission level (dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. "* ": Fundamental frequency

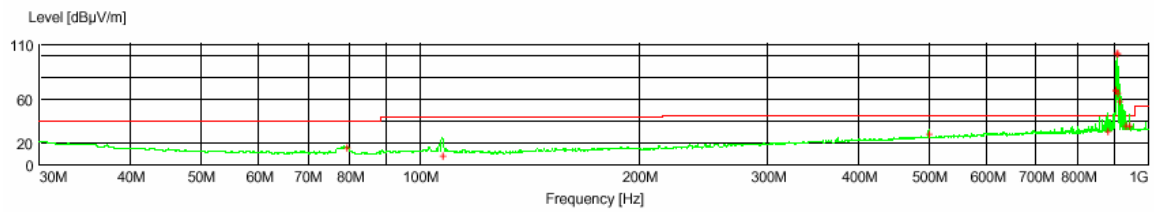


Figure 2 - Radiated Emissions Plot, 30MHz – 1GHz, Channel DA

EUT	i>clicker Remote	Model	RLR13
MODE	Channel AC	FREQUENCY RANGE	30MHz – 1GHz
INPUT POWER (SYSTEM)	3 AAA Batteries, 4.5VDC	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Frequency	**Level**	**Limit**	**Margin**	**Height**	**Angle**	**Pol.**
MHz	**dBµV/m**	**dBµV/m**	**dB**	**cm**	**deg**	
79.140000	13.07	40.0	26.9	249.0	311	VERT
107.400000	7.81	43.5	35.7	350.0	30	HORI
499.980000	28.88	46.0	17.1	101.0	153	VERT
883.320000	37.89	46.0	8.1	100.0	264	HORI
900.180000	29.16	46.0	16.8	99.0	264	HORI
912.780000	61.37	46.0	-15.4	400.0	281	HORI
913.740000*	101.24	46.0	-55.2	250.0	312	HORI
914.220000	96.53	46.0	-50.5	249.0	319	HORI
914.880000	74.45	46.0	-28.4	256.0	96	HORI
927.300000	52.04	46.0	-6.0	150.0	161	VERT
928.320000	52.26	46.0	-6.3	150.0	180	VERT
938.280000	30.06	46.0	15.9	141.0	85	VERT
938.940000	32.33	46.0	13.7	145.0	60	VERT
967.080000	31.96	53.9	21.9	100.0	258	HORI

REMARKS:
1. Emission level (dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. “* “: Fundamental frequency
6. Radiated limits do not apply within the 002MHz to 928MHz band.

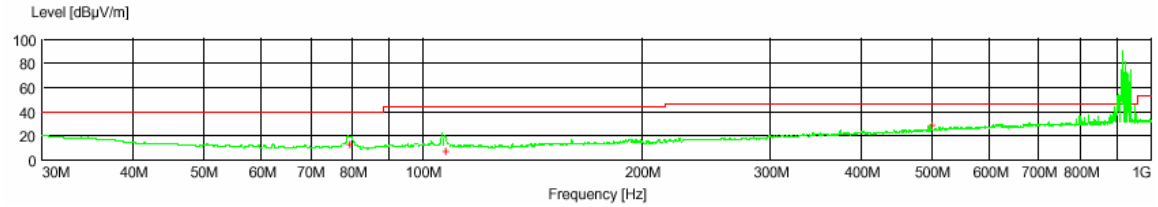


Figure 3 - Radiated Emissions Plot, 30MHz – 1GHz, Channel AC

EUT	i>clicker Remote	Model	RLR13
MODE	Channel CB	FREQUENCY RANGE	30MHz – 1GHz
INPUT POWER (SYSTEM)	3 AAA Batteries, 4.5VDC	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Frequency	Level	Limit	Margin	Height	Angle	Pol.
MHz	dBµV/m	dBµV/m	dB	cm	deg	
79.200000	12.84	40.0	27.2	249.0	153	VERT
106.560000	7.80	43.5	35.7	250.0	86	VERT
499.980000	28.78	46.0	17.2	100.0	153	VERT
902.400000	31.67	46.0	14.3	399.0	250	HORI
915.840000	55.35	46.0	-9.3	401.0	348	HORI
922.740000	92.25	46.0	-46.3	394.0	117	HORI
923.280000*	99.56	46.0	-53.6	268.0	173	VERT
924.840000	81.82	46.0	-35.8	99.0	103	HORI
925.860000	68.96	46.0	-23.0	101.0	105	HORI
927.300000	55.46	46.0	-9.5	150.0	165	VERT
959.940000	27.14	46.0	18.9	148.0	22	VERT

REMARKS:
1. Emission level (dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. "* ": Fundamental frequency

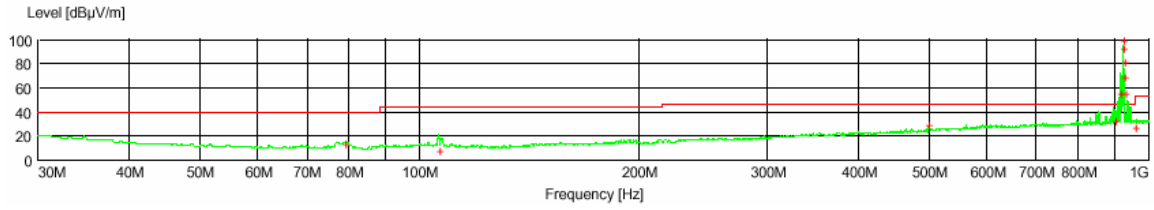


Figure 4 - Radiated Emissions Plot, 30MHz – 1GHz, Channel CB

EUT	i>clicker Remote	Model	RLR13
MODE	Channel DA	FREQUENCY RANGE	Above 1000MHz
INPUT POWER (SYSTEM)	3 AAA Batteries, 4.5VDC	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Frequency	Average Level	Average Limit	Average Margin	Peak Level	Peak Limit	Peak Margin	Height	Angle	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV/m	dBµV/m	dB	cm	deg	
1800.000000	34.68	53.9	19.2	48.21	73.9	25.7	349.0	353	HORI
1810.500000	35.38	53.9	18.5	56.89	73.9	17.0	150.0	33	VERT
1811.500000	35.40	53.9	18.5	60.88	73.9	13.0	201.0	29	VERT
2715.500000	39.58	53.9	14.3	58.71	73.9	15.2	119.0	3	VERT
2740.500000	38.96	53.9	14.9	51.94	73.9	22.0	337.0	245	VERT
3618.000000	42.31	53.9	11.6	55.47	73.9	18.4	192.0	76	VERT
4514.000000	49.10	53.9	4.8	57.76	73.9	16.1	150.0	185	VERT
5429.000000	49.09	53.9	4.8	62.36	73.9	11.5	350.0	261	HORI
6385.000000	51.52	53.9	2.4	64.77	73.9	9.1	249.0	254	HORI
7262.500000	31.49	53.9	16.4	43.77	73.9	30.1	256.0	299	HORI
8134.500000	33.08	53.9	20.8	46.30	73.9	27.6	349.0	359	HORI
9053.000000	35.13	53.9	18.8	49.54	73.9	24.36	249.0	321	HORI

REMARKS:
1. Emission level (dBuV/m)= Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

EUT	i>clicker Remote	Model	RLR13
MODE	Channel AC	FREQUENCY RANGE	Above 1000MHz
INPUT POWER (SYSTEM)	3 AAA Batteries, 4.5VDC	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Frequency	Average Level	Average Limit	Average Margin	Peak Level	Peak Limit	Peak Margin	Height	Angle	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV/m	dBµV/m	dB	cm	deg	
1827.500000	37.10	53.9	16.8	66.12	73.9	7.8	106.0	103	HORI
1828.500000	35.13	53.9	18.8	55.53	73.9	18.4	349.0	358	VERT
2741.000000	39.44	53.9	14.5	59.63	73.9	14.3	105.0	355	HORI
2768.500000	39.17	53.9	14.7	52.45	73.9	21.4	394.0	77	HORI
3654.000000	42.84	53.9	11.1	57.55	73.9	16.3	129.0	252	HORI
4564.500000	44.58	53.9	9.3	58.19	73.9	15.7	375.0	359	HORI
5487.000000	49.56	53.9	4.3	63.21	73.9	10.7	301.0	165	HORI
6396.000000	51.65	53.9	2.2	65.04	73.9	8.0	349.0	101	VERT
7336.500000	30.94	53.9	23.0	44.53	73.9	29.4	178.0	149	VERT
8226.000000	32.86	53.9	21.0	46.37	73.9	27.5	101.0	247	HORI
9150.000000	34.55	53.9	19.4	48.50	73.9	25.4	350.0	286	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

EUT	i>clicker Remote	Model	RLR13
MODE	Channel CB	FREQUENCY RANGE	Above 1000MHz
INPUT POWER (SYSTEM)	3 AAA Batteries, 4.5VDC	ORIENTATION	Vertical/Horizontal
ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC	TECHNICIAN	NJohnson

Frequency	Average Level	Average Limit	Average Margin	Peak Level	Peak Limit	Peak Margin	Height	Angle	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV/m	dBµV/m	dB	cm	deg	
1837.500000	35.09	53.9	18.8	49.08	53.9	4.8	191.0	344	HORI
1845.500000	35.91	53.9	18.0	57.86	53.9	-4.0	191.0	29	VERT
1854.500000	35.38	53.9	18.5	48.40	53.9	5.5	388.0	216	VERT
2761.000000	39.23	53.9	14.7	52.44	53.9	1.5	191.0	80	VERT
2769.000000	39.23	53.9	14.7	52.71	53.9	1.2	388.0	178	HORI
2770.000000	39.48	53.9	14.4	59.99	53.9	-6.1	101.0	113	HORI
3704.000000	43.12	53.9	10.8	56.51	53.9	-2.6	394.0	224	VERT
4620.500000	44.94	53.9	9.0	58.37	53.9	-4.5	314.0	157	VERT
5521.500000	50.03	53.9	3.9	63.63	53.9	-9.7	117.0	193	HORI
6456.000000	53.61	53.9	0.3	64.90	53.9	-11.0	149.0	16	HORI
7372.500000	31.29	53.9	22.6	45.72	53.9	8.2	227.0	60	VERT
8321.500000	32.90	53.9	21.0	46.24	53.9	7.7	352.0	204	VERT
9219.500000	34.23	53.9	19.7	47.64	53.9	6.3	227.0	149	HORI

REMARKS:
1. Emission level (dBuV/m) = Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

4.3 Bandwidth

4.3.1 Limits of bandwidth measurements

The 6dB bandwidth of the signal needs to be greater than 0.5MHz

4.3.2 Test procedures

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 kHz RBW and 100 kHz VBW. The 6 dB bandwidth is defined as the bandwidth of which is higher than peak power minus 6dB.

The 99% occupied is defined as the bandwidth at which 99% of the signal power is found. This corresponds to 20dB down from the maximum power level. The maximum power was measured with the largest resolution bandwidth possible (10MHz) and it was found that this power level was equal to that with a 100kHz bandwidth. For this EUT, the 20dB bandwidth of the signal at 100kHz resolution bandwidth is used as the measurement of the 99% occupied bandwidth.

4.3.3 Deviations from test standard

No deviation.

4.3.4 Test setup

4.3.5 EUT operating conditions

The EUT required no auxiliary power and had no auxiliary devices, so it was tested by itself. The EUT was programmed by the manufacturer to transmit continually for testing purposes only.

4.3.6 Test results

EUT	i>clicker Remote	MODEL	RLR13
INPUT POWER (SYSTEM)	3 AAA Batteries, 4.5VDC	ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC
TECHNICIAN	NJohnson	MODE	Continuous Transmit

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (kHz)	99% OCCUPIED BANDWIDTH (kHz)	MINIMUM LIMIT (MHz)	RESULT
1	905.5	757.51	1148	0.500	Pass
6	914.0	751.50	1112	0.500	Pass
11	923.0	781.56	1142	0.500	Pass

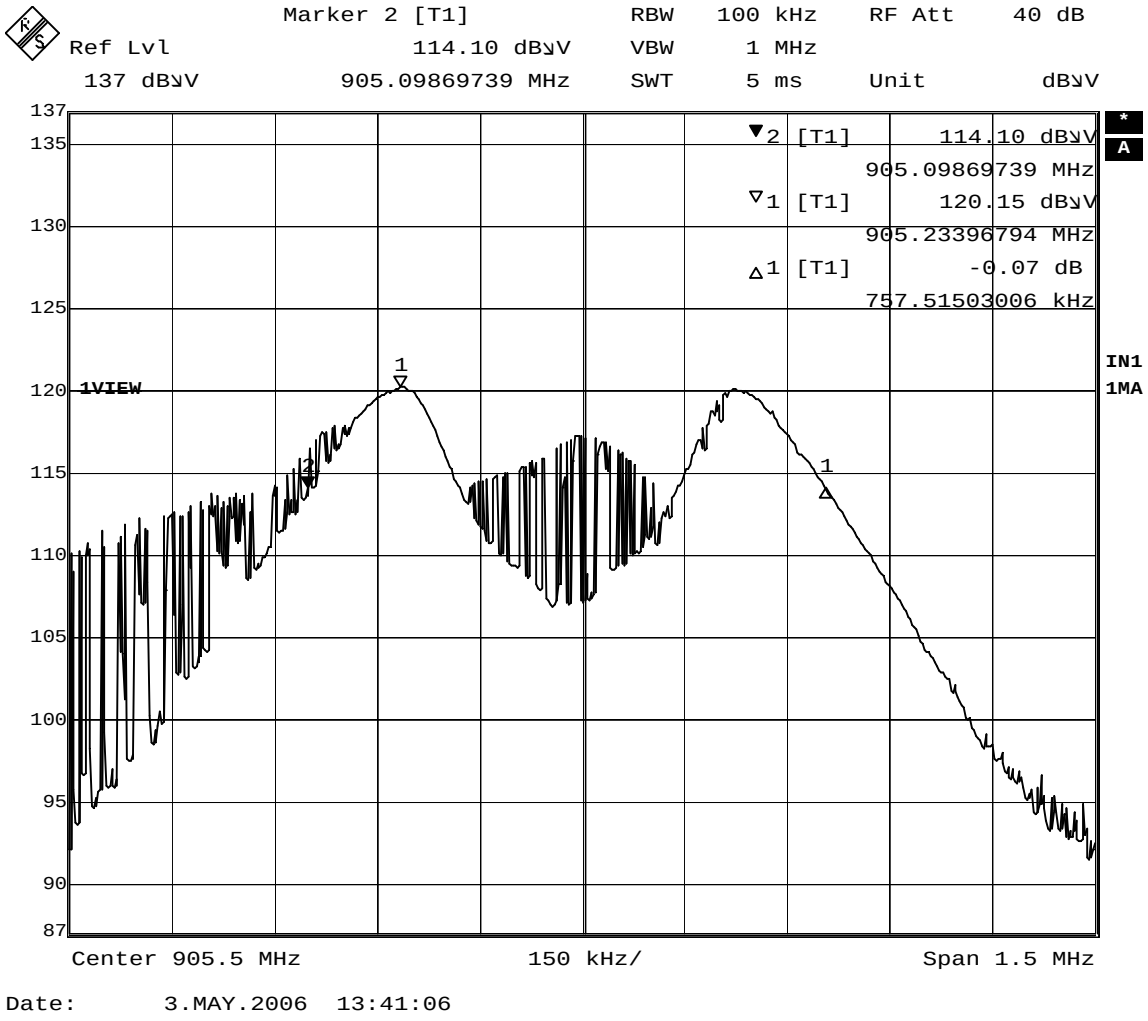


Figure 5 - 6dB Bandwidth, Channel DA, 757.31kHz

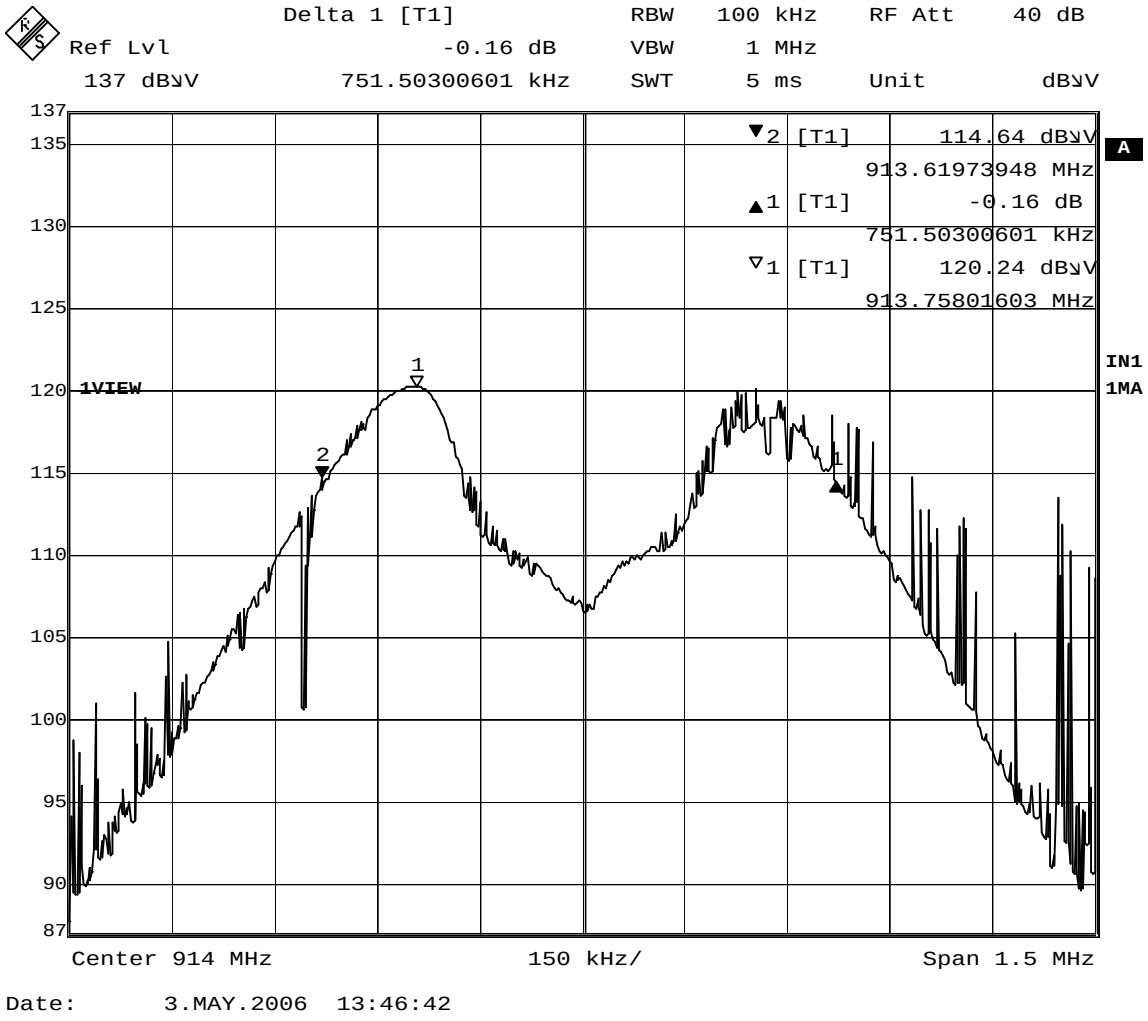


Figure 6 - 6dB Bandwidth, Channel AC, 751.30kHz

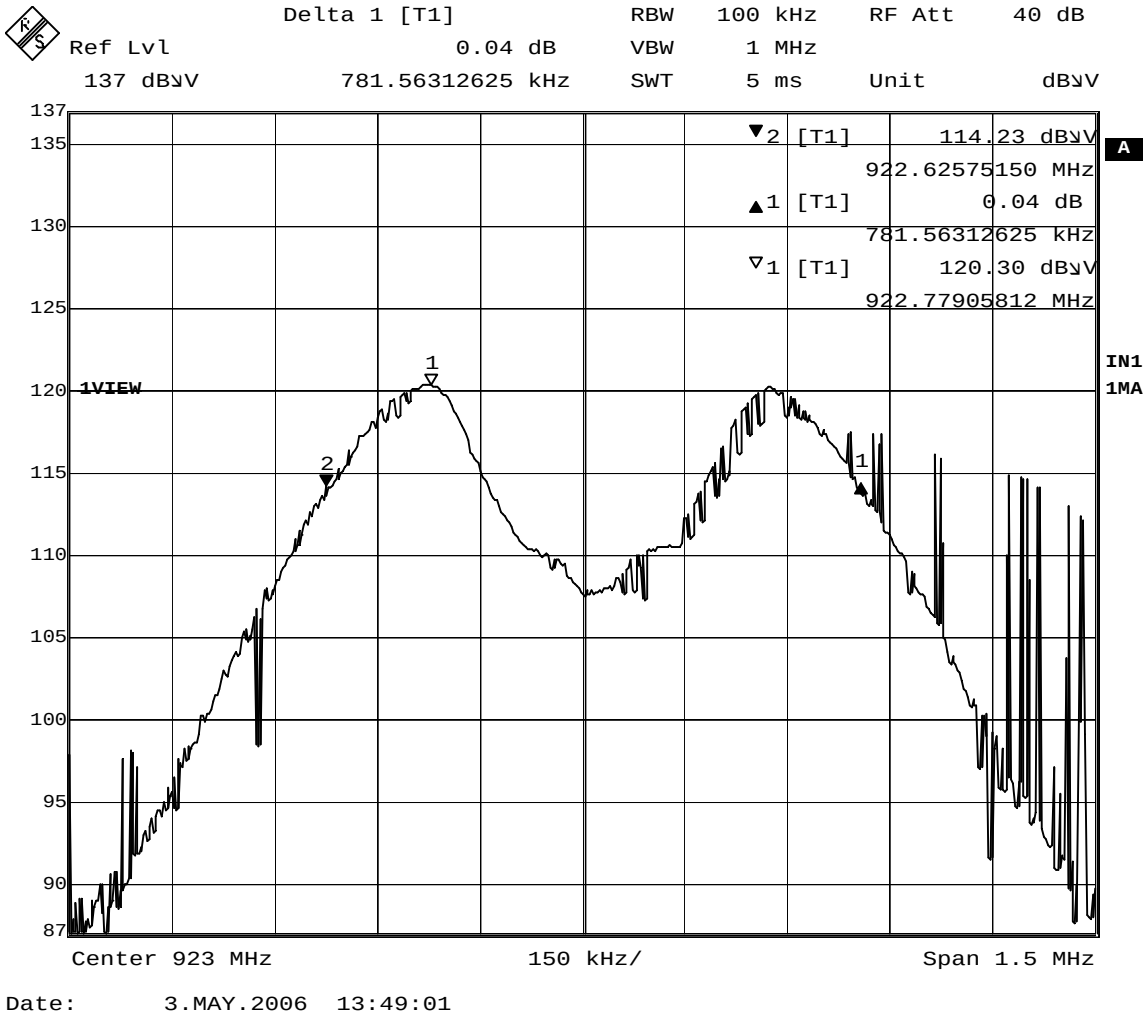


Figure 7 - 6dB Bandwidth, Channel CD, 781.56MHz

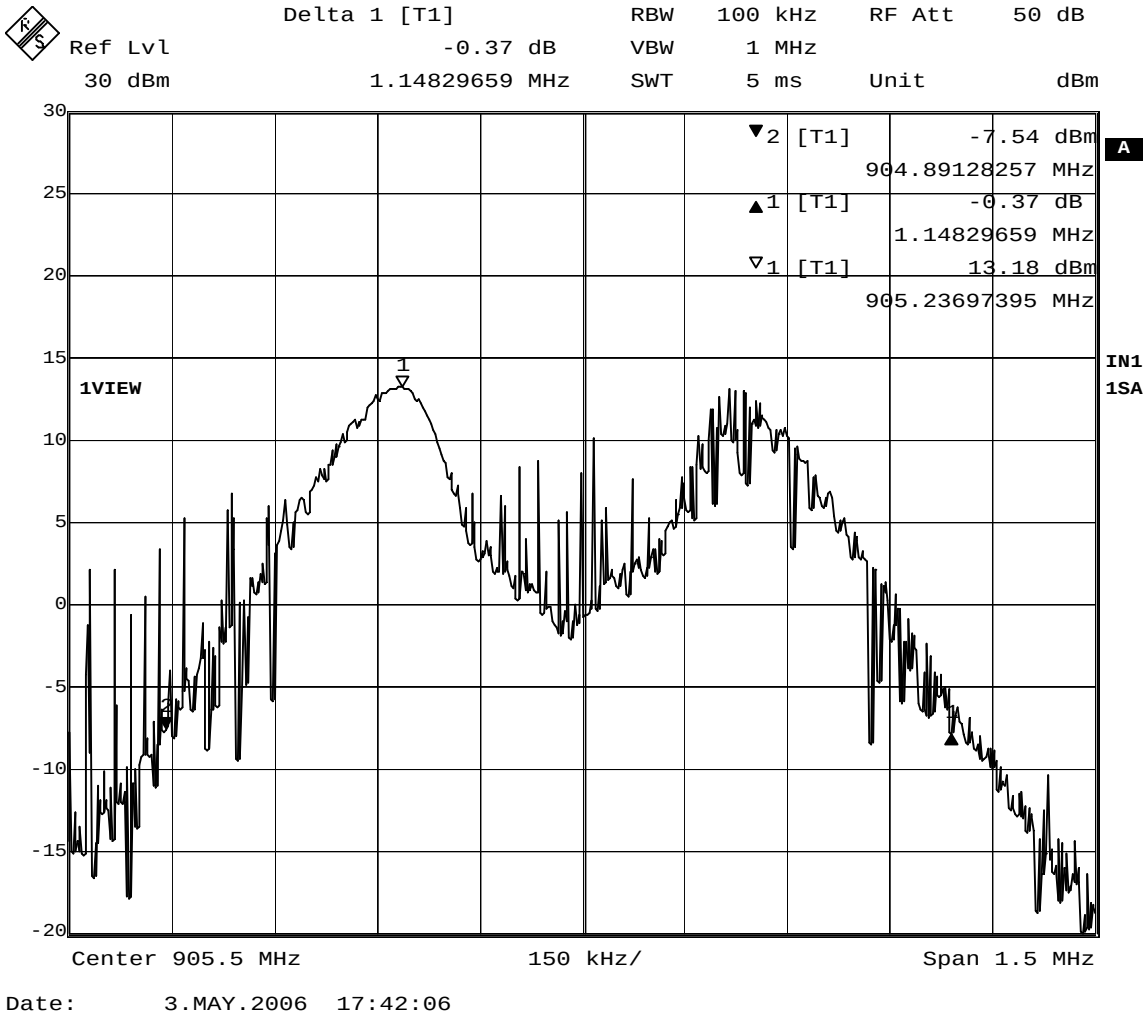


Figure 8 - 99% Occupied Bandwidth, Channel DA, 1148kHz

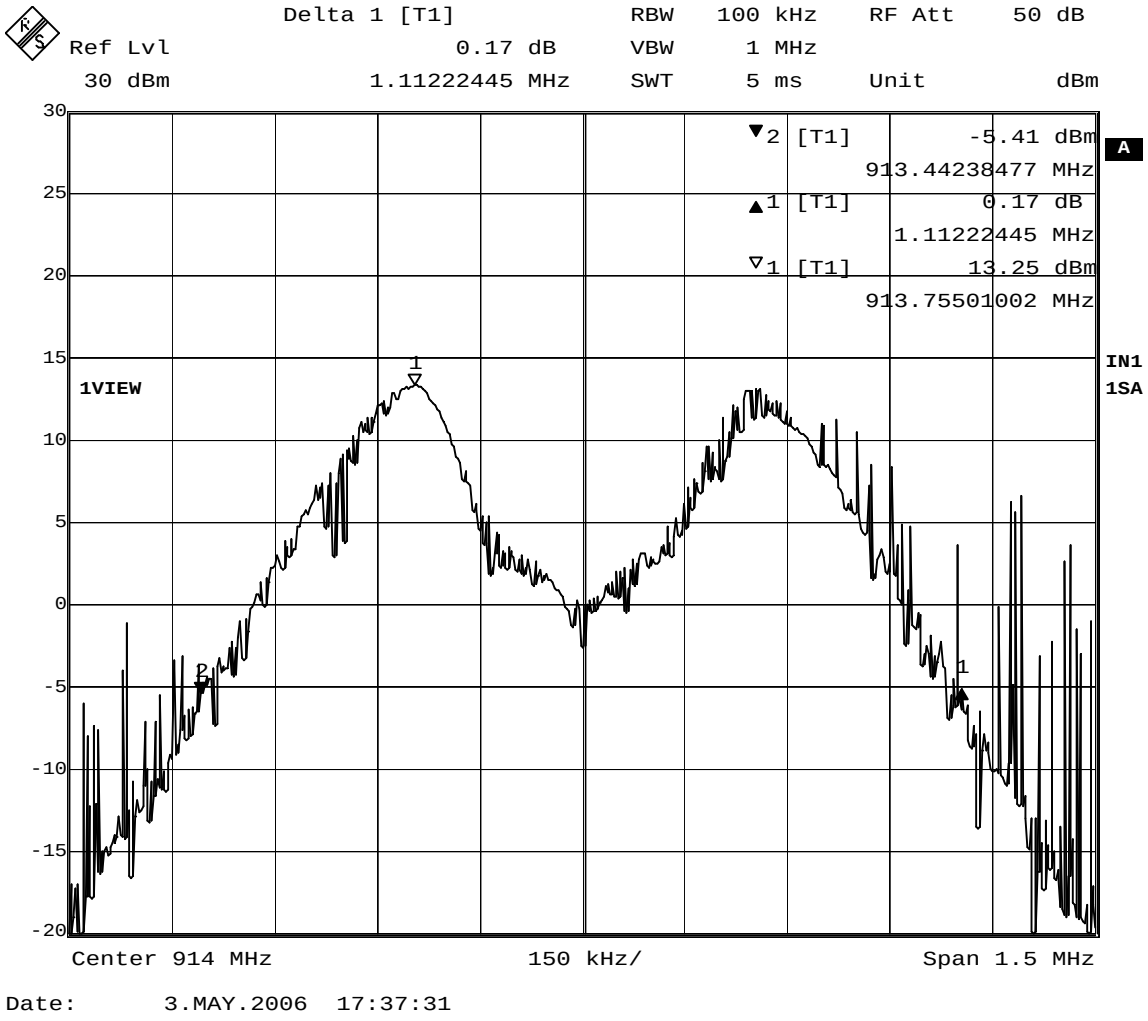


Figure 9 - 99% Occupied Bandwidth, Channel AC, 1112kHz

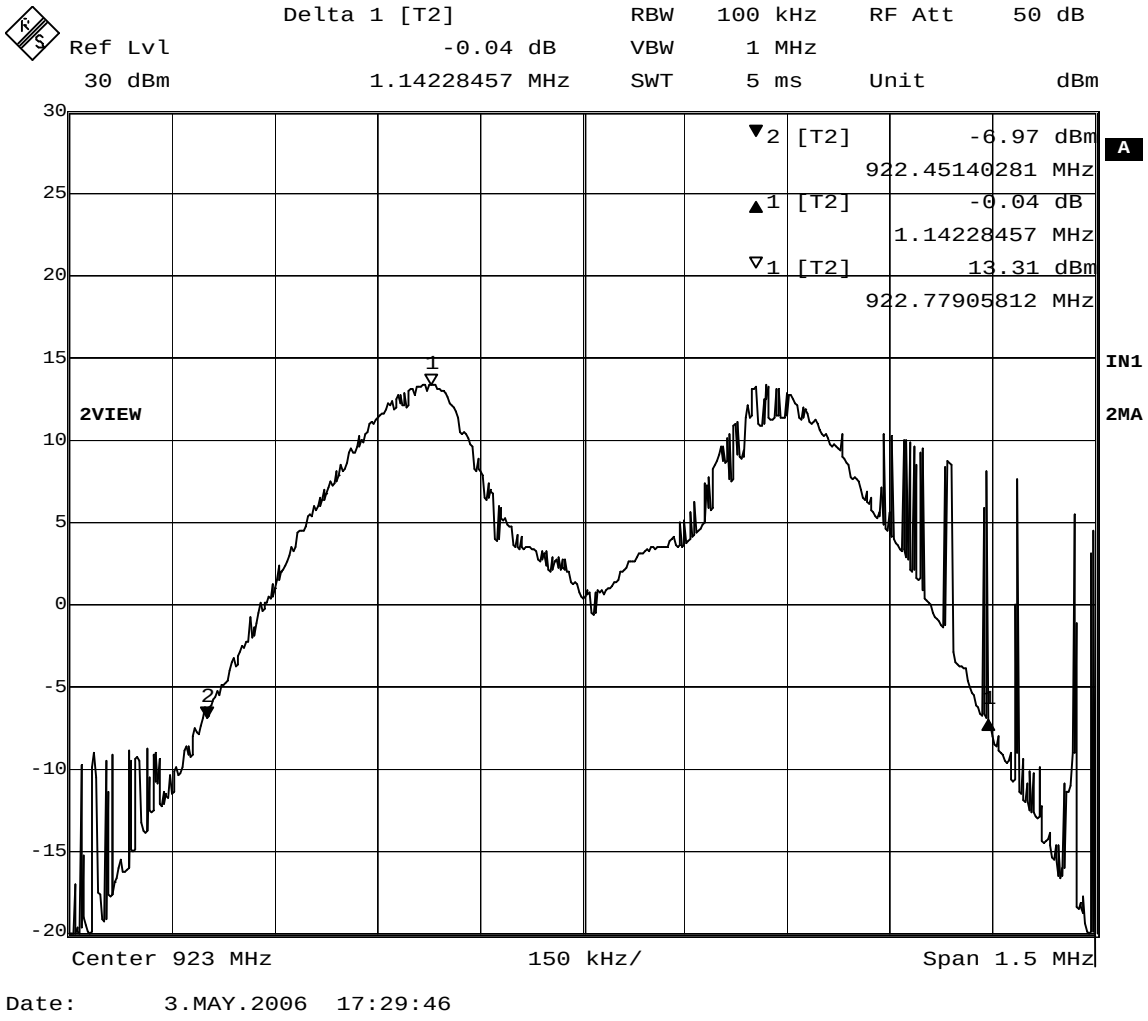


Figure 10 – 99% Occupied Bandwidth, Channel CD, 1142kHz

4.4 Maximum peak output power

4.4.1 Limits of bandwidth measurements

The maximum peak output allowed is 30dBm

4.4.2 Test procedures

1. The EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable.

2. The channel power function of the spectrum analyzer was used to calculate the cumulative power output per MHz over the range of the set channel bandwidth. The channel bandwidth was set to 30MHz.

3. The resolution bandwidth was set to 10MHz and the video bandwidth was set to 10MHz to capture the maximum amount of signal. The analyzer used a peak detector in max hold mode. This represented the maximum output power.

4.4.3 Deviations from test standard

No deviation.

4.4.5 Test setup

4.4.5 EUT operating conditions

The EUT required no auxiliary power and had no auxiliary devices, so it was tested by itself. The EUT was programmed by the manufacturer to transmit continually for testing purposes only.

4.4.6 Test results

Maximum peak output power

EUT	i>clicker Remote	MODEL	RLR13
INPUT POWER (SYSTEM)	3 AAA Batteries, 4.5VDC	ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC
TECHNICIAN	NJohnson	MODE	Continuous transmit

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	RESULT
1	905.5	14.46	30	Pass
6	914	14.51	30	Pass
11	923	14.60	30	Pass

4.5 Power spectral density

4.5.1 Limits of bandwidth measurements

The maximum power spectral density allowed is 8dBm.

4.5.2 Test procedures

The transmitter output was connected directly to the spectrum analyzer. the bandwidth of the fundamental frequency was measured with the spectrum analyzer using 3 kHz RBW and 30 kHz VBW, the sweep time was 500s. The power spectral density was measured and recorded at the frequency with the highest emission. The sweep time is allowed to be longer than span/3KHz for a full response of the mixer in the spectrum analyzer.

4.5.3 Deviations from test standard

No deviation.

4.5.4 Test setup

4.5.5 EUT operating conditions

The EUT required no auxiliary power and had no auxiliary devices, so it was tested by itself. The EUT was programmed by the manufacturer to transmit continually for testing purposes only.

4.5.6 Test results

Power Spectral Density

EUT	i>clicker Remote	MODEL	RLR13
INPUT POWER (SYSTEM)	3 AAA Batteries, 4.5VDC	ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC
TECHNICIAN	NJohnson	MODE	Continuous transmit

CHANNEL	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN # KHz BW (dBm)	MAXIMUM POWER LIMIT (dBm)	RESULT
DA	905.5	3.53	8	Pass
AC	914.0	-2.03	8	Pass
CB	923.0	4.45	8	Pass

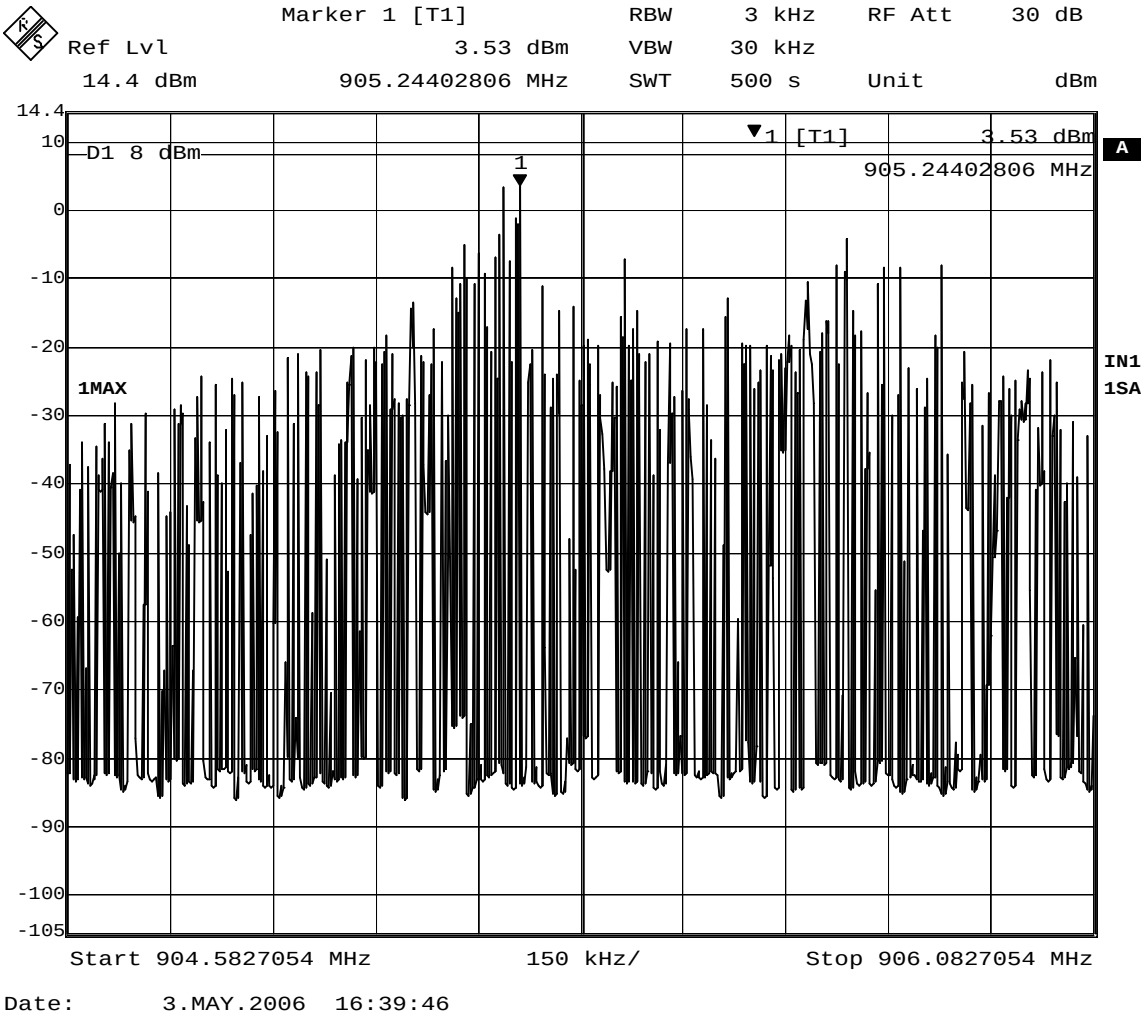


Figure 11 - PSD Measurement, Channel DA, 3.53dBm

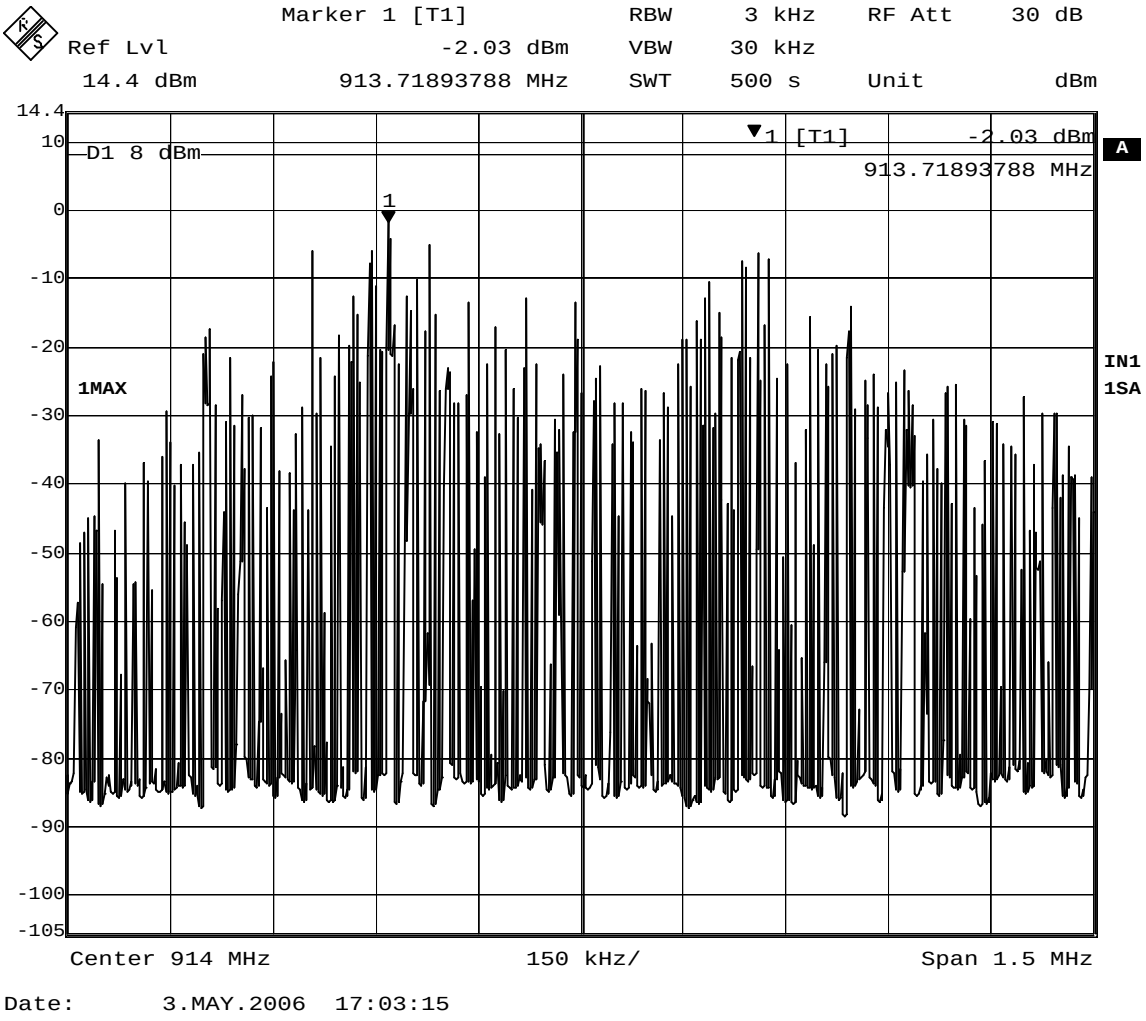


Figure 12 - PSD Measurement, Channel AC, -2.03dBm

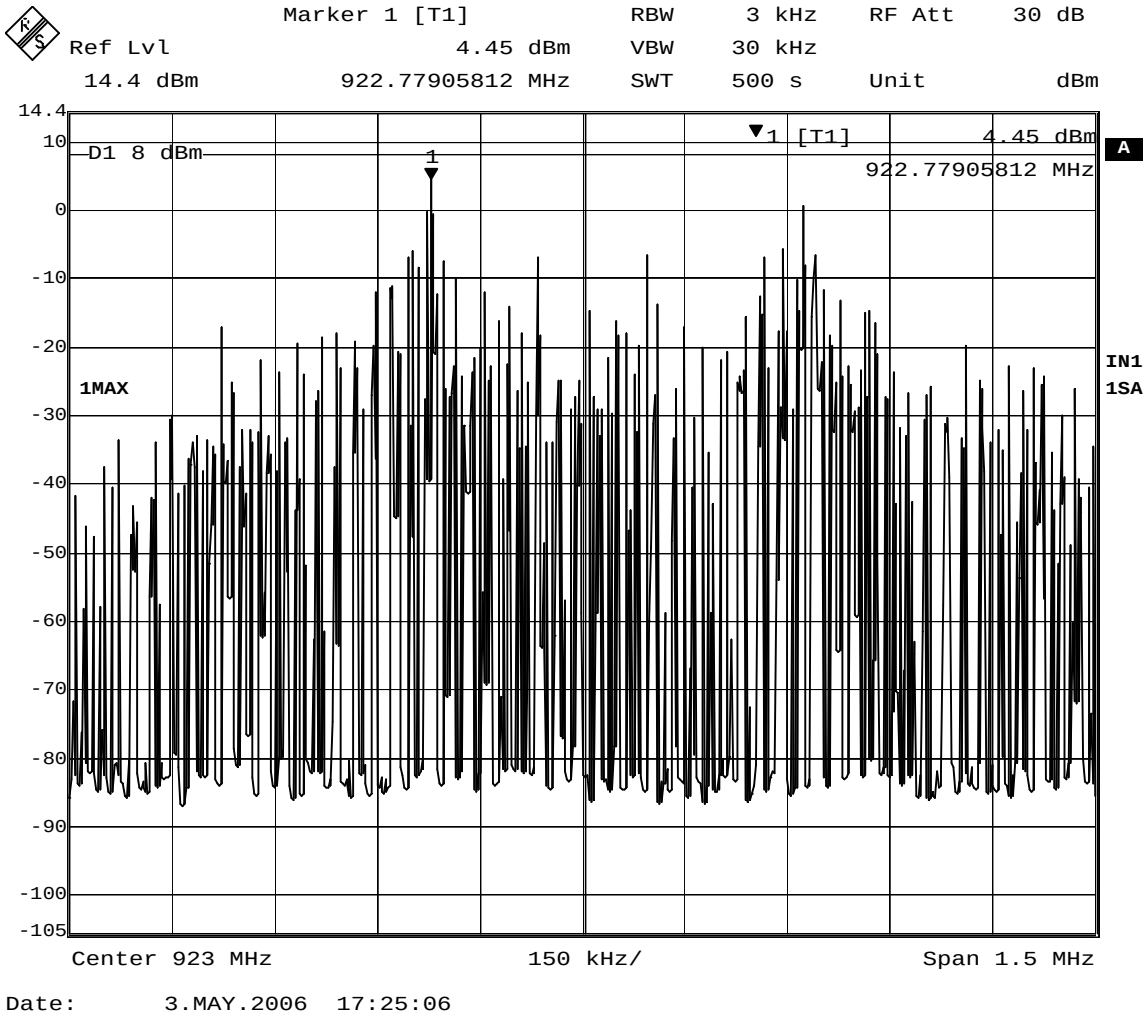


Figure 13 - PSD Measurement, Channel CB, 4.45dBm

4.6 Bandedges

4.6.1 Limits of bandedge measurements

For emissions outside of the allowed band of operation (902MHz – 928MHz), the emission level needs to be 20dB under the maximum fundamental field strength. However, if the emissions fall within one of the restricted bands from 15.205 the field strength levels need to be under that of the limits in 15.209.

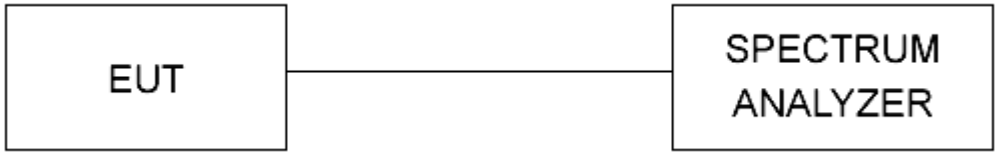
4.6.2 Test procedures

The EUT was tested in the same method as described in section *4.2 - Radiated emissions*. The EUT was oriented as to produce the maximum emission levels. The resolution bandwidth was set to 120kHz and the EMI receiver was used to scan from the bandedge to the fundamental frequency with a quasi-peak detector. The highest emissions level beyond the bandedge was measured and recorded. If the out of band emissions do not fall within a restricted band from 15.205, then it is required that the out of band emission be 20dB below that of the fundamental emission level. If the out of band emission falls with a restricted band from 15.205, then it is required that the emission be below the limits from 15.209.

4.6.3 Deviations from test standard

No deviation.

4.6.4 Test setup



4.6.5 EUT operating conditions

The EUT required no auxiliary power and had no auxiliary devices, so it was tested by itself. The EUT was programmed by the manufacturer to transmit continually for testing purposes only.

4.6.6 Test results

EUT	i>clicker Remote	MODEL	RLR13
INPUT POWER (SYSTEM)	3 AAA Batteries, 4.5VDC	ENVIRONMENTAL CONDITIONS	45% ± 5% RH 20 ± 3ºC
TECHNICIAN	NJohnson	MODE	Continuous transmit

Highest Out of Band Emissions

CHANNEL	Bandedge/Measurement Frequency (MHz)	QP Level (dBµV/m)	Fund. QP Level	Delta
DA	902 MHz	68.15	101.06	32.91
CB	928 MHz	67.20	99.67	32.47

The spectrum plots can be seen in Figures 11 and 12 on the following page. The lowest frequency channel, channel DA, was tested at the low end of the frequency band (902MHz) and the highest channel, channel CB, was tested at the upper end of the frequency band (928MHz). The quasi-peak measurements are shown in the plots and markers were placed on the fundamental frequency emission, the band edge frequency. The markers reflect the quasi-peak measurements.

NOTE:
The plots show corrected measurements. All values listed include all transducer and cable loss factors and reflect actual field strength levels.

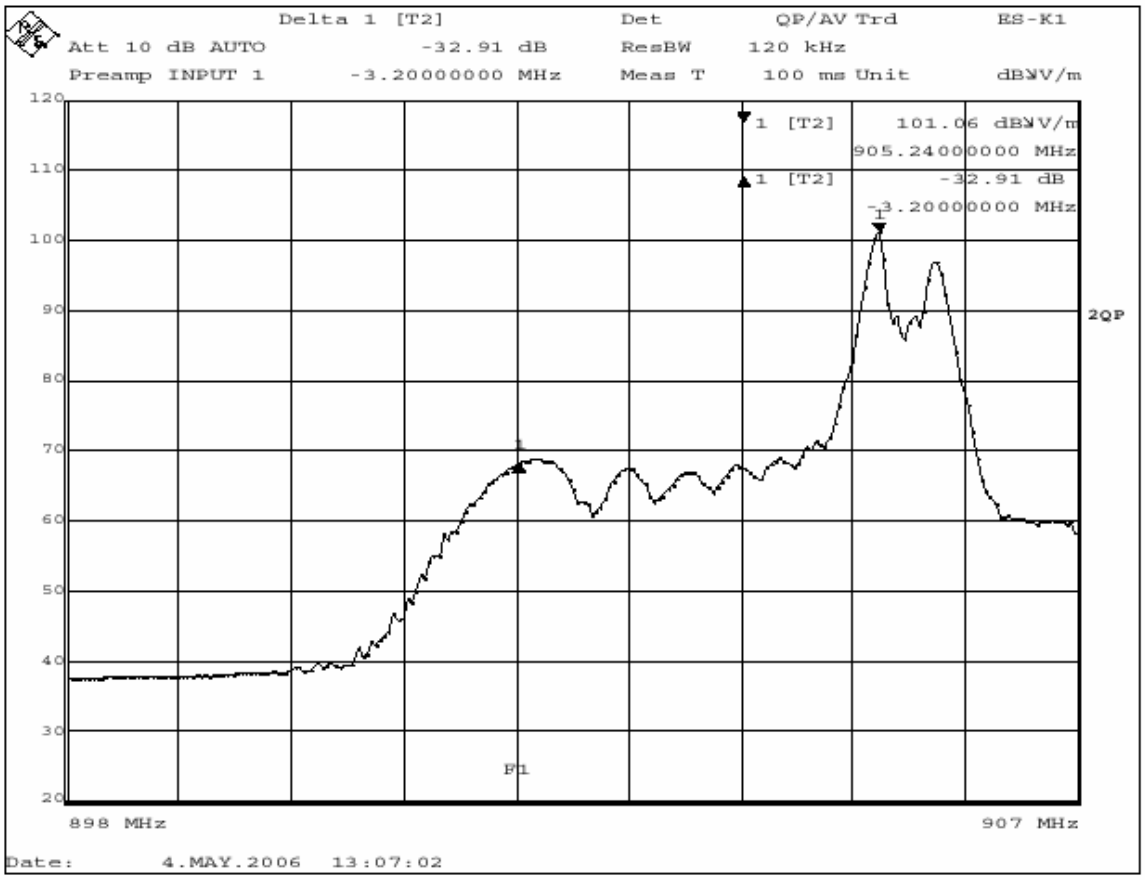


Figure 14 - Radiated Bandedge Scan, Channel DA, 32.91 Peak to Bandedge Delta

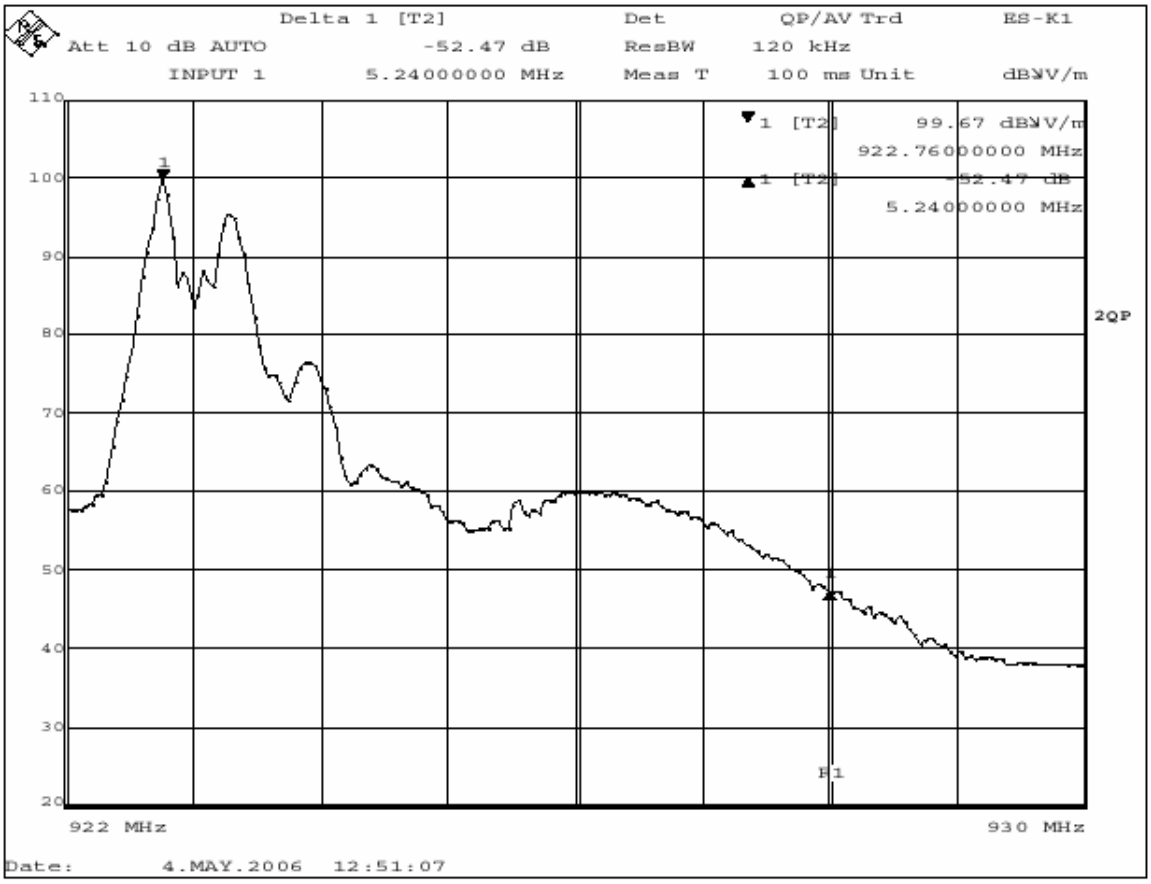


Figure 15 - Radiated Bandedge Scan, Channel CB, 32.47 Peak to Bandedge Delta

Appendix A: Test Photos

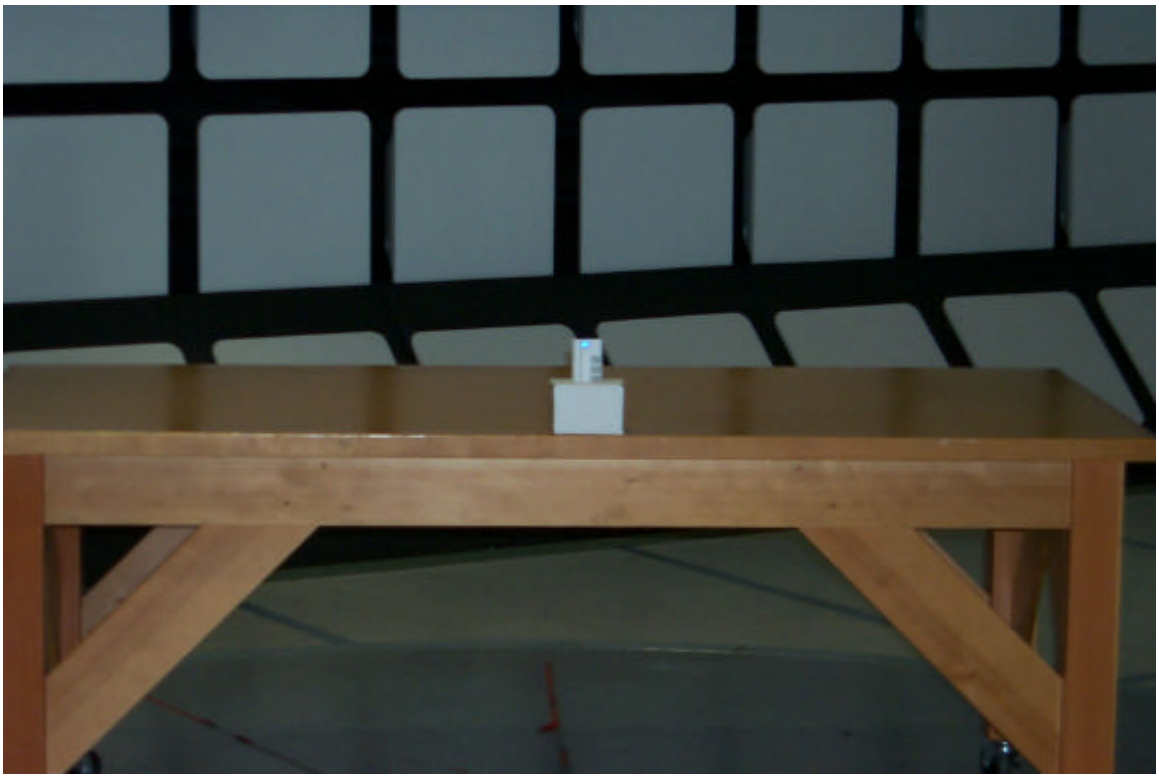


Figure 16 - Radiated Emissions Test Setup, EUT Vertical

Figure 17 - Radiated Emissions Test Setup, EUT Horizontal (worst-case)

Figure 18 - Radiated Emissions Test Setup, EUT Horizontal (worst-case)

Appendix B: Sample Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:
FS = RA + AF – (-CF + AG) + AV

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dBµV is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBµV/m.

FS = 55 + 12 – (-1.1 + 20) + 0 = 48.1 dBµV/m

The 48.1 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm [(48.1 dBµV/m)/20]= 254.1 µV/m

AV is calculated by the taking the 20*log(T_{on}/100) where T_{on} is the maximum transmission time in any 100ms window.

Appendix C: RF Exposure Evaluation

FCC ID: T24-RLR13
RF Exposure Statement for i>clicker Remote:

Notice in Installation Manual:
FCC Radiation Exposure Statement
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 1.75cm (0.7 inches) between the radiator and your body.

RF Exposure Calculations:

The following information provides the minimum separation distances for the two major antenna types used in this system.

Directional Antenna:
The 0 dBi antenna is the maximum gain antenna certified for use with the product. The minimum separation distance is calculated from **FCC OET 65 Appendix B, Table 1B** Guidelines for General Population/Uncontrolled Exposure. This calculation is based on the highest EIRP possible from the system, considering maximum power and antenna gain. The exposure limit for a transmitter operating at 905.5MHz is found in mW/cm^2 using the equations f/1200. Since the operating frequency in channel DA produced the lowest limit, that limit will be used in calculation. (905.5/1200 = 0.75mW/cm^2)

S = (Po * G) / (4 * Pi * r^2) or r = SQRT [(Po * G) / (4 * Pi * S)]

Where S = 0.75 mW/cm^2 for 905.5 MHz
Where Po = 28.84 mW (Peak RF, 14.60dBm)
Where G = 1 (numeric equivalent to 0dBi antenna gain with 0.0 dB cable loss)
Where r = Minimum Safe Distance from antenna (cm)

For Po = 28.84mW, r = 1.75cm (0.7 inches)

For a distance [r] of 20cm from this antenna, the field density S = 0.0057 mW/cm^2

Notes:

1. The minimum safe distance is based on a conservative “worse case” prediction, i.e. using the formula shown above and no duty factor. In practice the minimum distance will be much shorter. (Ref. 2)
2. The minimum safe distance has been calculated for the maximum allowed Power Density (S) limit of 0.75 mW/cm^2 for the frequency 905.5 MHz for uncontrolled environments (Ref. 2).

References:

1. FCC Part 15, sub-clause 15.247 (b) (4) (i)
2. FCC OET Bulletin 65, Edition 97-01
3. FCC Supplement C to OET Bulletin 65, edition 01-01

Appendix D: Table of Figures

Figure **Page Number**