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Nemko Canada Inc., 303 River Road, R.R. 5, Ottawa, Ontario, Canada, K1V 1H2

Report number: 160429-1TRFWL
Apparatus: Push Button Transmitter
Applicant: Bellman & Symfon AB
Sodra Langebergsgatan 30
Vastra Frolunda
421 32, Sweden
FCC ID: WMSBETX2

Test specification:

Title 47-Telecommunication

Chapter I - Federal Communications Commission
Subchapter A - General
Part 15 - Radio Frequency Devices
Subpart C - Intentional Radiators

§15.231- Periodic operation in the band 40.66–40.70 MHz and above 70 MHz

Reviewed by: 
Signature _____ January 5, 2011
Richard Brazeau, Laboratory Manager Date

Tested by: Kevin Ma, Technical Assessor

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Section 1: Report summary

Report Number: 160429-1TRFWL

Specification: FCC 15.231

Section 1: Report summary

This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Canada Inc.

Test specification:

FCC Part 15 Subpart C, 15.231

Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

Compliance status:	Complies
Exclusions:	None
Non-compliances:	None
Report release history:	Original release
Test location:	Nemko Canada Inc. 303 River Road, R.R. 5, Ottawa, Ontario, Canada, K1V 1H2
Registration number:	176392 (3 m Semi anechoic chamber)

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 2: Equipment under test

2.1 Identification of equipment under test (EUT)

The following information identifies the EUT under test:

Type of equipment:	Push button transmitter
Brand name:	Bellman
Model number:	BE1240
Serial number:	None
Nemko sample number:	1
FCC ID:	WMSBETX2
Date of receipt:	November 4, 2010

2.2 Accessories and support equipment

The following information identifies accessories used to exercise the EUT during testing:

None.

2.3 EUT description

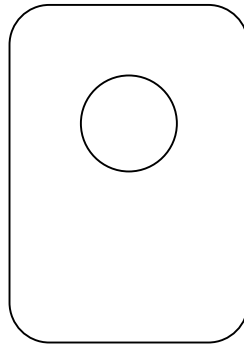
The BE1240 is a Push Button Transmitter to be used with 433.92 MHz B&S Visit System.

2.4 Technical specifications of the EUT

Operating frequency:	433.92 MHz
Modulation type:	On-off keying
Occupied bandwidth:	59.4 kHz
Emission designator:	L1D
Antenna data and type:	Integral Helical Coil, -15.85 dBi Permanent fixed antenna, which may be built-in, (Equipment does not have an external 50 Ω RF connector)
Power source:	6 VDC Battery powered

Section 2: Equipment under test, continued

2.5 EUT setup diagram



2.6 Operation of the EUT during testing

A modified sample was provided for continues transmission to complete radiated measurements and a normal sample for occupied bandwidth and timing requirements.

2.7 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

Section 3: Test conditions

3.1 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

3.2 Test conditions, power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 °C Relative humidity: 20–75 % Air pressure: 86–106 kPa When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.
Power supply range:	The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$, for which the equipment was designed.



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Section 3: Test conditions

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Section 3: Test conditions, continued

3.3 Measurement uncertainty

Nemko Canada measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95 % and can be found in Nemko Canada document MU-003.

3.4 Test equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
Bilog	Sunol	JB3	FA002108	Jan. 27/11
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Dec. 16/10
Horn Antenna #2	EMCO	3115	FA000825	Jan. 21/11
50 Coax cable	HUBER + SUHNER	None	FA002013	Sep. 02/11
50 Coax cable	HUBER + SUHNER	None	FA002074	July 07/11
1 – 18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct. 2/11
Spectrum Analyzer	Rohde & Schwarz	FSP 40	FA001920	May 17/11

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use

Section 4: Result summary

4.1 FCC Part 15 Subpart C, 15.231: Test results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N	No : not applicable / not relevant.
Y	Yes : Mandatory i.e. the apparatus shall conform to these tests.
N/T	Not Tested, mandatory but not assessed. (See report summary)

Part	Test description	Required	Result
General requirements for FCC Part 15			
§15.31(e)	Variation of power source	Y	Pass
§15.203	Antenna requirement	Y	Pass
§15.207(a)	Conducted limits	N	---
Specific requirements for FCC Part 15 Subpart C, 15.231			
§15.231(a)	Conditions for intentional radiators to comply with periodic operation	---	---
§15.231(a)(1)	Manually operated transmitter	Y	Pass
§15.231(a)(2)	Automatically activated transmitter	N	---
§15.231(a)(3)	Periodic transmissions at regular predetermined intervals	N	---
§15.231(a)(4)	Radiators used in cases of emergency	N	---
§15.231(a)(5)	Set-up information transmission for security systems	N	---
§15.231(b)	Field strength of emissions	Y	Pass
§15.231(c)	Emission bandwidth	Y	Pass
§15.231(d)	Requirements for devices operating within 40.66–40.70 MHz band	N	---
§15.231(e)	Field strength of emissions for periodic radiators	N	---
Notes: None			



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Appendix A: Test results

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Appendix A: Test results

Clause 15.31(e) Variation of the power source

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.

Test date: December 13, 2010

Test results: Pass

Test data

– A new battery was used for fundamental field strength measurement.



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Appendix A: Test results

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Specification: FCC 15.231

Clause 15.203 Antenna requirement

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Test date: December 13, 2010

Test results: Pass

Test data

The EUT uses an integral antenna.

Clause 15.231(a) Conditions for intentional radiators to comply with periodic operation

The provisions of this section are restricted to periodic operation within the band 40.66–40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test date: December 13, 2010

Test results: Pass

Special notes

The EUT is a manually operated transmitter.

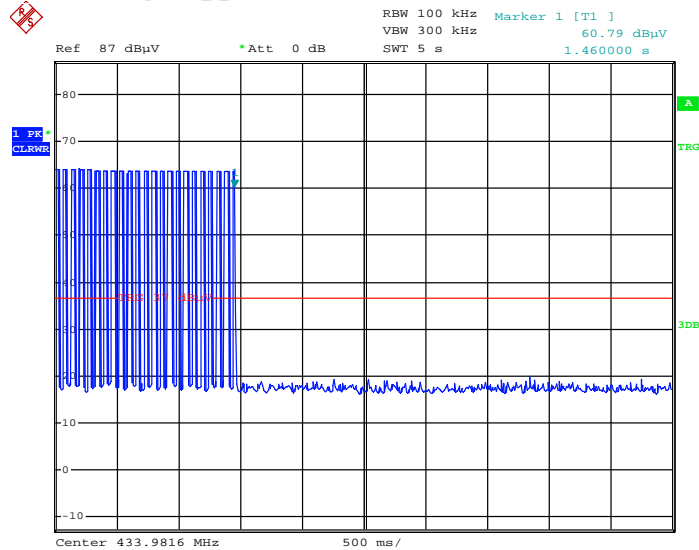


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Clause 15.231(a) Conditions for intentional radiators to comply with periodic operation

Test data

Plot of the timing of a manually trigger event.



Date: 14.DEC.2010 09:36:31

Manually operated transmitter, automatically deactivate the transmitter within not more than 5 seconds of being released.

Clause 15.231(b) Field strength of emissions

In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental		Field strength of spurious emissions	
	($\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)	($\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)
40.66–40.70	2,250	67	225	47
70–130	1,250	61.9	125	41.9
130–174	1,250 to 3,750*	61.9 to 71.5*	125 to 375*	41.9 to 51.5*
174–260	3,750	71.5	375	51.5
260–470	3,750 to 12,500*	71.5 to 81.9*	375 to 1,250*	51.5 to 61.9*
Above 470	12,500	81.9	1,250	61.9

*-Linear interpolations.

The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

The field strength of emissions appearing within restricted bands (as specified in §15.205) shall not exceed the limits from §15.209:

Frequency (MHz)	Field strength		Measurement distance (m)
	($\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)	
0.009–0.490	2400/F	67.6–20log(F)	300
0.490–1.705	24000/F	87.6–20log(F)	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes:

- F = fundamental frequency in kHz
- In the emission table above, the tighter limit applies at the band edges.
- For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

Test date: December 14, 2010

Test results: Pass

Clause 15.231(b) Field strength of emissions, continued

Special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:
 - within 30–1000 MHz range: using a peak detector with 100 kHz/300 kHz RBW/VBW,
 - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results
 - using a duty cycle/average factor for average results calculations.
- The EUT was measured positioned vertically and horizontally to obtain maximum emissions.
- Only the worst data presented in the test report.

§ 15.205 Restricted bands of operation.

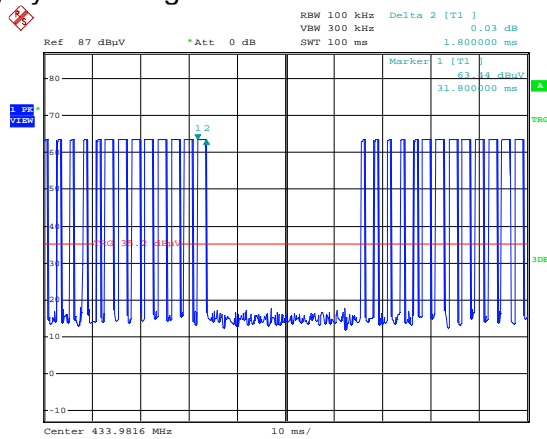
MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

Clause 15.231(b) Field strength of emissions, continued

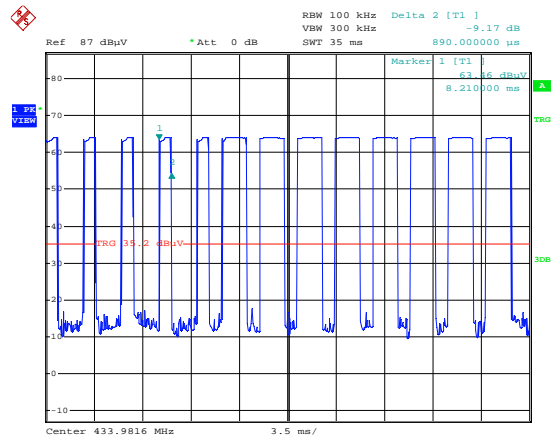
Test Data

§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Duty cycle/average factor calculations:



Date: 14.DEC.2010 09:38:35



Date: 14.DEC.2010 09:39:24

$$\text{Duty cycle / average factor} = 20 \times \log_{10} \left(\frac{T_{x100ms}}{100ms} \right)$$

$T_x = 1.8 \times 16 + 10 \times 0.89 = 37.7$ ms within 100 ms

Average factor: $20 \times \log(0.377) = -8.47$ dB



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Appendix A: Test results

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Specification: FCC 15.231

Clause 15.231(b) Field strength of emissions, continued

Tabular data (15.231(b) emissions limit)

Freq. (MHz)	Pol. V/H	Peak field strength (dB μ V/m)	Peak limit (dB μ V/m)	Peak margin (dB)	Duty cycle corr. (dB)	Avg field strength (dB μ V/m)	Avg limit (dB μ V/m)	Avg margin (dB)
Fundamental								
433.92	H	85.10	100.83	15.73	-8.47	76.63	80.83	4.20
433.92	V	75.67	100.83	25.16	-8.47	67.20	80.83	13.63
Harmonics								
867.94	H	62.53	80.83	18.30	-8.47	54.06	60.83	6.77
1215.20	H	55.63	80.83	25.20	-8.47	47.16	60.83	13.67
1649.12	H	50.27	80.83	30.56	-8.47	41.80	60.83	19.03
1909.31	H	51.83	80.83	29.00	-8.47	43.36	60.83	17.47

Notes: using peak detector with 1 MHz/3 MHz RBW/VBW for fundamental measurement, and 100 kHz/300 kHz RBW/VBW for below 1 GHz harmonics peak result, and 1 MHz/3 MHz RBW/VBW for above 1 GHz harmonics peak results.
Both Vertical and Horizontal polarizations were measured; only worst-case data were reported.

Clause 15.231(b) Field strength of emissions, continued

Setup photos





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Clause 15.231(c) Emission bandwidth

The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test date: December 14, 2010

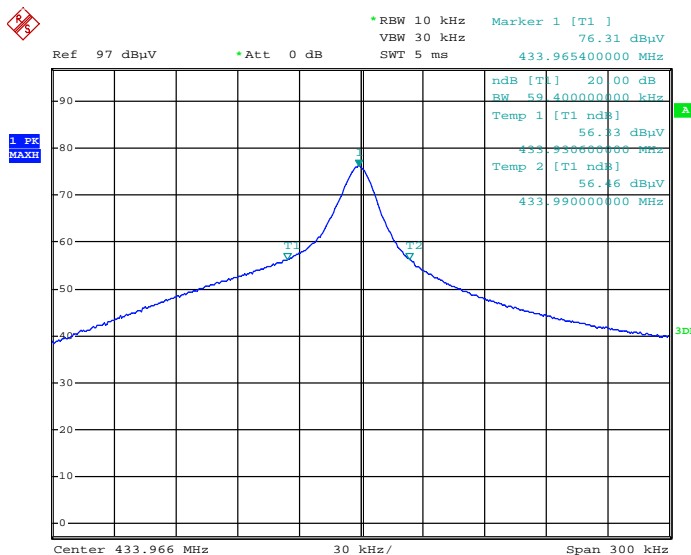
Test results: Pass

Special notes

- The test was performed using peak detector of the spectrum analyzer with RBW no narrower than 1 % of the emission bandwidth.

Test data

Calculated limit: $0.25\% \times 433.92 \text{ MHz} = 1084.8 \text{ kHz}$



Date: 14.DEC.2010 09:32:04

20 dB bandwidth, kHz	Limit, kHz	Margin, kHz
59.4	1084.8	1025.4

Appendix B: Block diagrams of test set-ups

Radiated emissions set-up

