

DATE: 29 June 2009

I.T.L. (PRODUCT TESTING) LTD.
FCC Radio Test Report
for
The Sapling Company Inc.

Equipment under test:

SAL-2 Series Wireless Clock

SAL-2BS-12R-0

Written by:

E. Ever

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E. Ever, Test Engineer

Approved by:

I. Raz

I. Raz, EMC Laboratory Manager

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This report relates only to items tested.

**Measurement/Technical Report for
The Sapling Company Inc.
SAL-2 Series Wireless Clock**

SAL-2BS-12R-0

FCC ID: R73SAL002

29 June 2009

This report concerns:	Original Grant: <input checked="" type="checkbox"/>
	Class I Change: <input type="checkbox"/>
	Class II Change: <input type="checkbox"/>
Equipment type:	Frequency Hopping Spread Spectrum Transmitter
Limits used:	47CFR15 Section 15.247

Measurement procedure used is ANSI C63.4-2003.

Application for Certification prepared by:	Applicant for this device: (different from "prepared by")
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1. General Information

1.1 Administrative Information

Manufacturer: The Sapling Company Inc.

Manufacturer's Address: 65 Weizman St.
Givatayim
Israel 53468
Tel: +972-3-573-1801
Fax: +972- 3-573-1807

Manufacturer's Representative: Rafy Regev

Equipment Under Test (E.U.T): SAL-2 Series Wireless Clock

Equipment Model No.: SAL-2BS-12R-0

Equipment Serial No.: Not Designated

Date of Receipt of E.U.T: 26/04/2009

Start of Test: 26/04/2009

End of Test: 10/05/2009

Test Laboratory Location: I.T.L (Product Testing) Ltd.
Kfar Bin Nun,
ISRAEL 99780

Test Specifications: FCC Part 15 Sub-part C



1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

Sapling's revolutionary SAL-2 Series wireless clocks incorporate multi-function software. Every clock is capable of receiving and transmitting a signal. This type of system provides significant advantages because it is not limited to the distance between the slave clock and the master. The important factor is the distance between one clock and another. The innovative 915-928MHz frequency hopping technology guarantees a better signal even if there is interference in one of the frequencies.

The clocks transmit in the frequency range 914.85-927.65MHz.

The SAL-2 Series wireless clock transmits a stream of data every 4 hours (battery operated model only), and every minute (24VAC and 110VAC models) that constantly checks and corrects every clock in the system. Each clock communicates with each other simultaneously.

The SAL-2 Series wireless clocks are compact, energy efficient, and reliable. The clocks are available in 12" and 16" round cases. The ABS cases eliminate the need for custom back boxes. By using electronic components, The sapling wireless Clocks have much less chance of mechanical failure.

1.4 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing August 22, 2006).

I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ± 4 dB Normalized Site Attenuation requirements of ANSI C63.4-2003. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. Product Labeling



Figure 1. FCC Label



Figure 2. Location of Label on EUT

3. System Test Configuration

3.1 *Justification*

Radiated emission screening was performed in a wall mount position since the unit is normally positioned in this way.

3.2 *EUT Exercise Software*

Manufacturing software was used for the tests.

3.3 *Special Accessories*

No special accessories were needed.

3.4 *Equipment Modifications*

No modifications were needed in order to achieve compliance

3.5 *Configuration of Tested System*

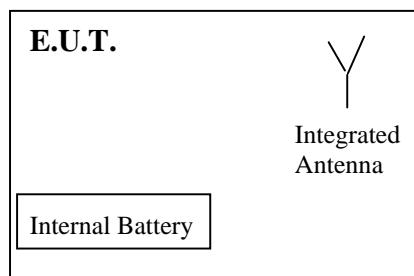


Figure 3. Configuration of Tested System

4. Theory of Operation

4.1 Theory of Operation

The E.U.T. is a fixed wall mounted installation, mounted in the vertical position.

Since the clock transmits only every one minute, a special software was used for testing the clock. This software allows the user to select one of 10 modes by pushing the push button. The modes are:

1. Continuous transmission at lowest frequency (without modulation)
2. Continuous transmission at middle frequency (without modulation)
3. Continuous transmission at highest frequency (without modulation)
4. Continuous transmission at middle frequency (with modulation)
5. Continuous transmission at lowest frequency (with modulation)
6. Continuous transmission at highest frequency (with modulation)
7. Continuous reception at lowest frequency
8. Continuous reception at middle frequency
9. Continuous reception at highest frequency
10. Normal frequency hopping with modulation

The modulation was done with time message.



Figure 4. Radiated Emissions



Figure 5. Table Top Testing

5. 20 dB Minimum Bandwidth

5.1 *Test Specification*

F.C.C. Part 15, Subpart C: 15.247(a)(1)

5.2 *Test procedure*

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (10 dB) and an appropriate coaxial cable (cable loss = 1.2 dB). The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded.

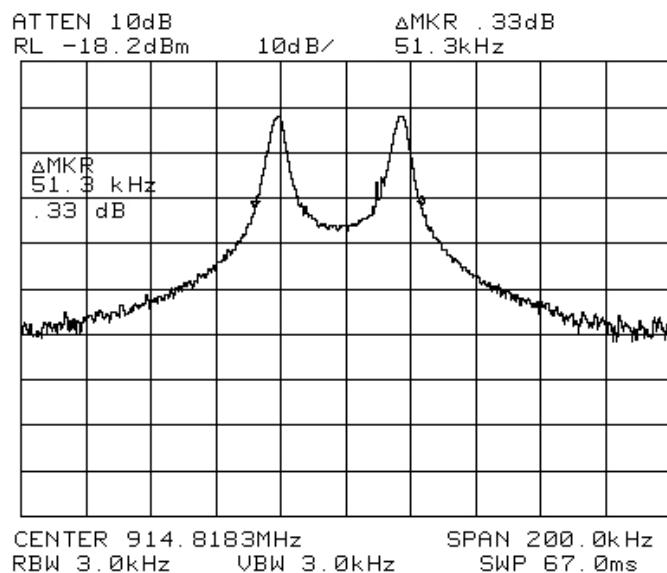


Figure 6. 914.82 MHz

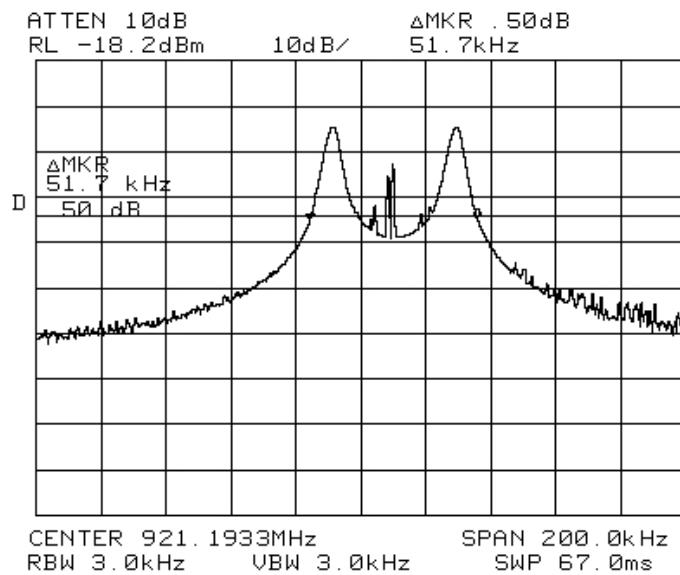


Figure 7. 921.19 MHz

5.3 Test Results

E.U.T Description: SAL-2 Series Wireless Clock

Model: SAL-2BS-12R-0

Serial Number: Not Designated

Operation Frequency (MHz)	Bandwidth Reading (MHz)	Specification (MHz)
914.82	0.052	>0.025
921.19	0.052	>0.025

Figure 8 Test Results

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: Evan Ever

Date: 21/06/2009

Typed/Printed Name: E. Ever

5.4 **Test Equipment Used.**

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April, 19, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 19, 2009	1 year

6. Dwell Time on Each Channel

Section 15.247(a)(1)(iii)

6.1 Test procedure

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

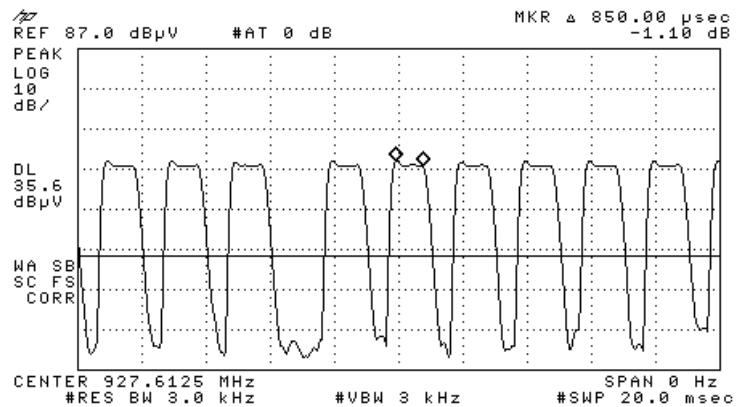


Figure 9. Emission Width 0.850 msec.

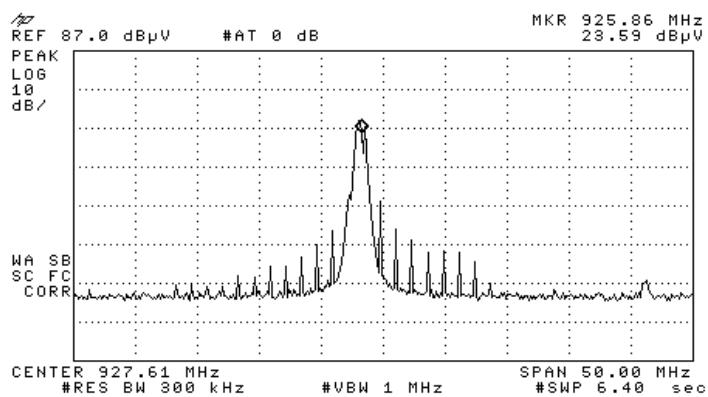


Figure 10. No. of Hops in 6.4 seconds,
 average time of occupancy = $20 \times 0.85 = 0.017 < 0.4$ Sec, total number of hops 20

6.2 **Results table**

E.U.T. Description: SAL-2 Series Wireless Clock

Model No.: SAL-2BS-12R-0

Serial Number: Not Designated

Specification: FCC Part 15, Subpart C, 15.247(a)(1)(iii)

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: Evan Ever Date: 21/06/2009

Typed/Printed Name: E. Ever

6.3 **Test Instrumentation Used.**

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 19, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 19, 2009	1 year

7. Number of Hopping Frequencies

7.1 Test procedure

The E.U.T. was set to hopping mode.

The E.U.T. antenna terminal was connected to the spectrum analyzer through a 24 dB attenuator ($3 \times 8\text{dB}$) and an appropriate coaxial cable.

The spectrum analyzer was set to the following parameters:

Span: Every 2.8 MHz Frequency

Band of Operation: 914-928 MHz

RBW: 30kHz

VBW: 30kHz

Detector Function: Peak

Trace: Maximum Hold

The number of hopping frequencies is $8+11+11+11+10=51$ (See plots).

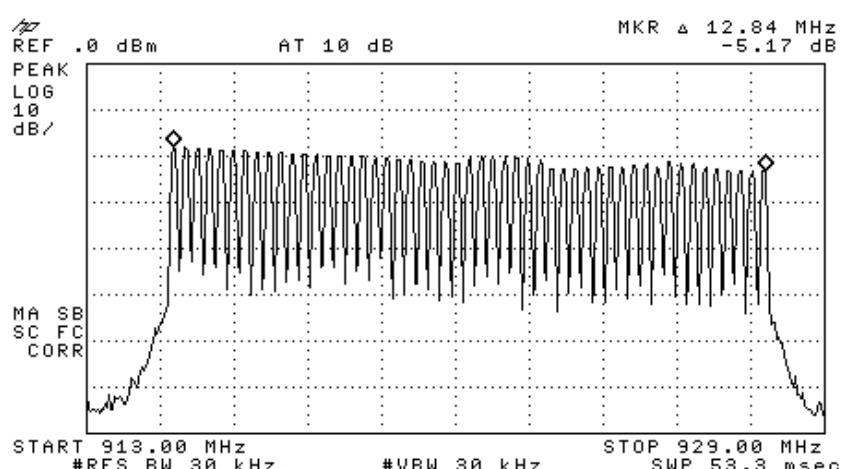


Figure 11.— 914.0-916.8 MHz

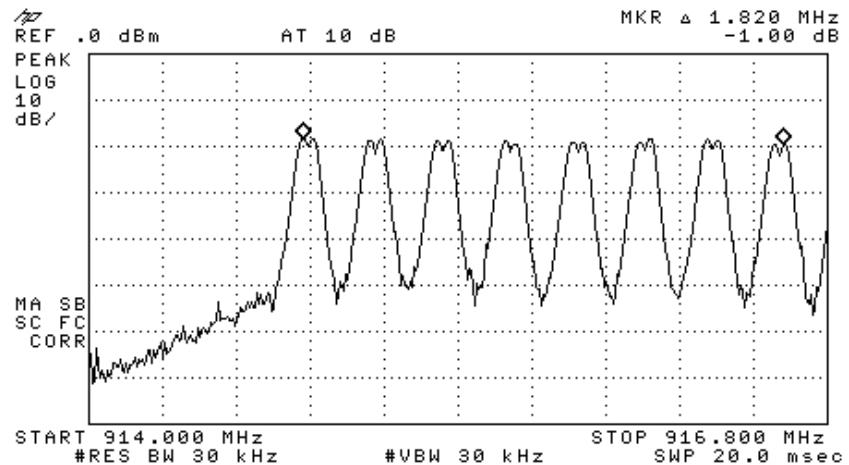


Figure 12.— 914.0-916.8 MHz

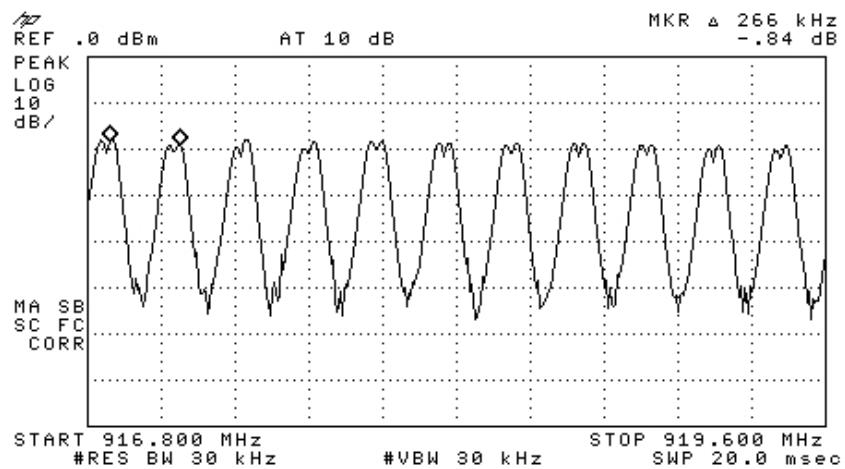


Figure 13.— 916.8-919.6 MHz

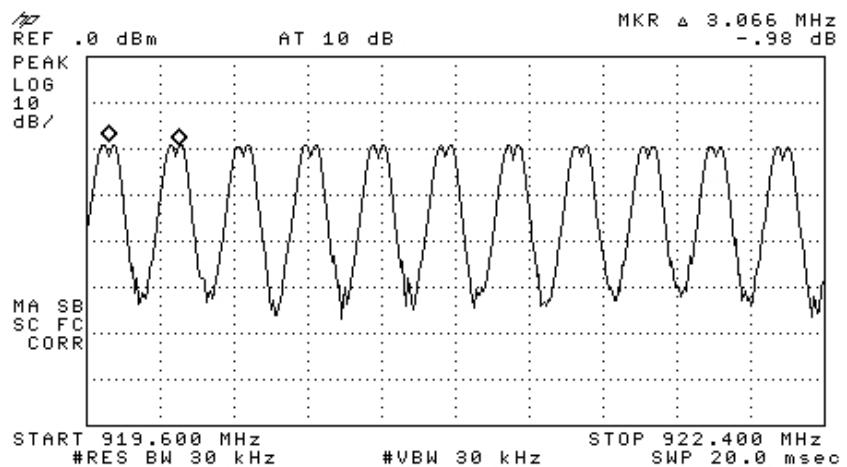


Figure 14.— 919.6-922.4 MHz

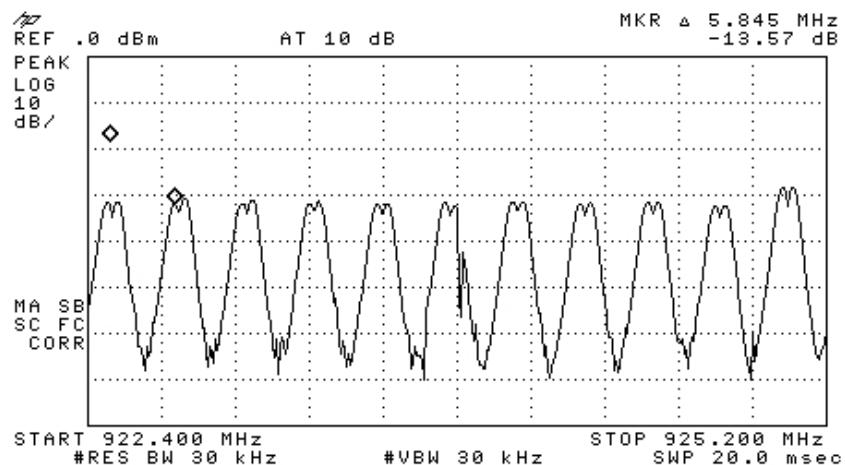


Figure 15.— 922.4-925.2 MHz

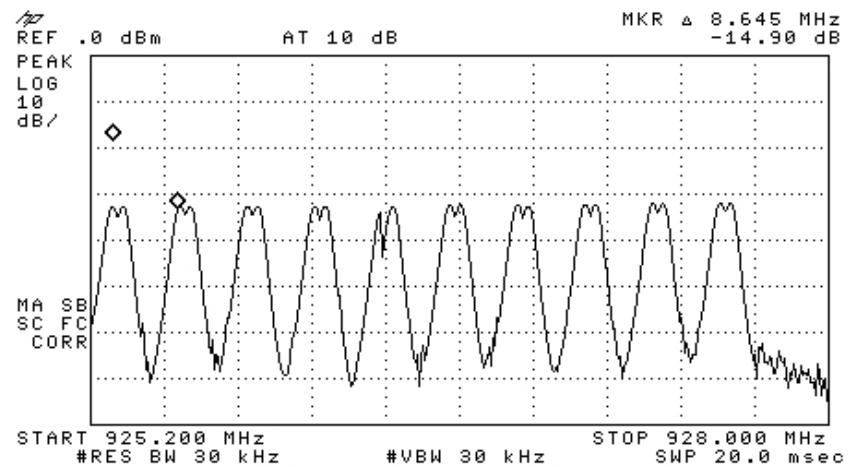


Figure 16.— 925.2-928.0 MHz

7.2 Results table

E.U.T. Description: SAL-2 Series Wireless Clock

Model No.: SAL-2BS-12R-0

Serial Number: Not Designated

Specification: FCC Part 15, Subpart C (15.247(a) (1)

Number of Hopping Frequencies	Specification
51	>50

Figure 17 Number of Hopping Frequencies

TEST PERSONNEL:

Tester Signature: Evan Ever

Date: 21/06/2009

Typed/Printed Name: E. Ever

7.3 **Test Equipment Used.**

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 19, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 19, 2009	1 year

8. Channel Frequency Separation

8.1 Test procedure

The E.U.T. was set to hopping mode.

The spectrum analyzer was set to the following parameters:

Span: 0.5 MHz
 RBW: 10kHz
 VBW: 10kHz
 Detector Function: Peak
 Trace: Maximum Hold

The marker delta function to determine the separation between the peaks of the adjacent channels was used.

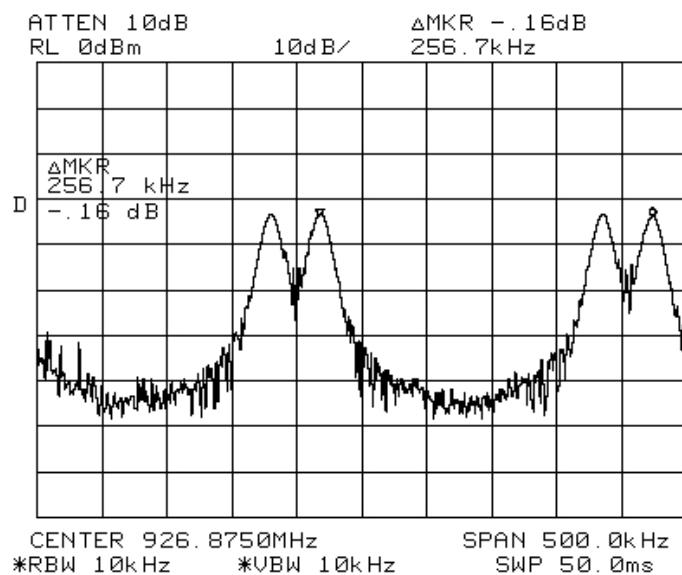


Figure 18.— 926.8-927.0 MHz

8.2 Results table

E.U.T. Description: SAL-2 Series Wireless Clock

Model No.: SAL-2BS-12R-0

Serial Number: Not Designated

Specification: FCC Part 15, Subpart C (15.247(a) (1)

Channel Frequency Separation (kHz)	Specification (kHz)	Margin (kHz)
256.7	>165	91.7

Figure 19 Channel Frequency Separation

JUDGEMENT: Passed by 91.7 kHz

TEST PERSONNEL:

Tester Signature: Evan Ever Date: 21/06/2009

Typed/Printed Name: E. Ever

8.3 **Test Equipment Used.**

Instrument	Manufacturer	Model	Serial/Part Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 year
Attenuator	Jyebao	-	FAT-AM5AF5G6G2W20	April 19, 2009	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	April 19, 2009	1 year

9. Radiated Power Output

9.1 ***Test Specification***

F.C.C. Part 15, Subpart C: 15.247(b)

9.2 ***Test procedure***

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 1 MHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

The E.U.T. was tested in three operating channels and frequencies (1 (914.8 MHz); 3 (921.2 MHz); 3 (927.6 MHz)) with modulation.

Radiated output power levels were measured at selected operation frequencies and the results were converted to power level according to the formula as shown below:

$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} [\text{W}]$$

d: Test distance, 3 meters

G: EUT antenna gain, 0 dBi = 1 (numerical value)

E: Measured field strength, (dBuV/m)

P: Calculated output power

bp

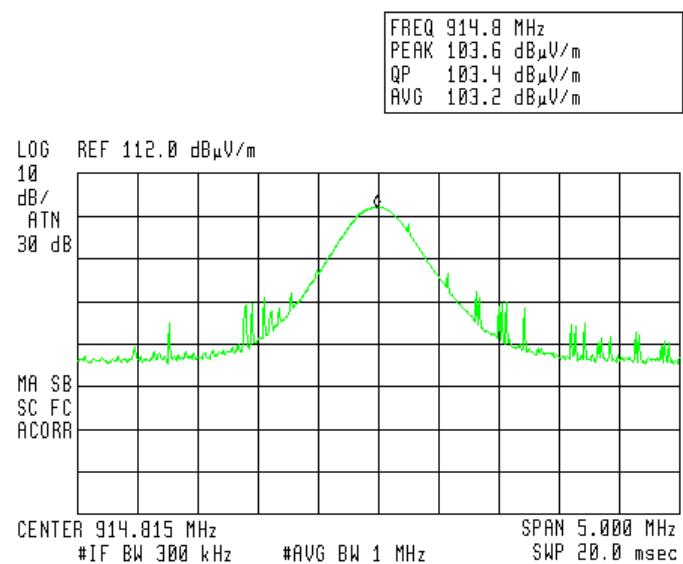


Figure 20 914.8 MHz

bp

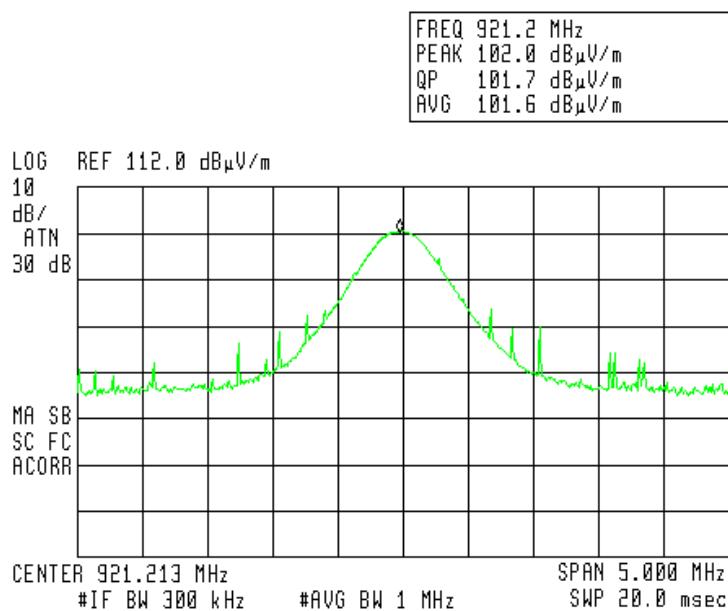


Figure 21 921.2 MHz

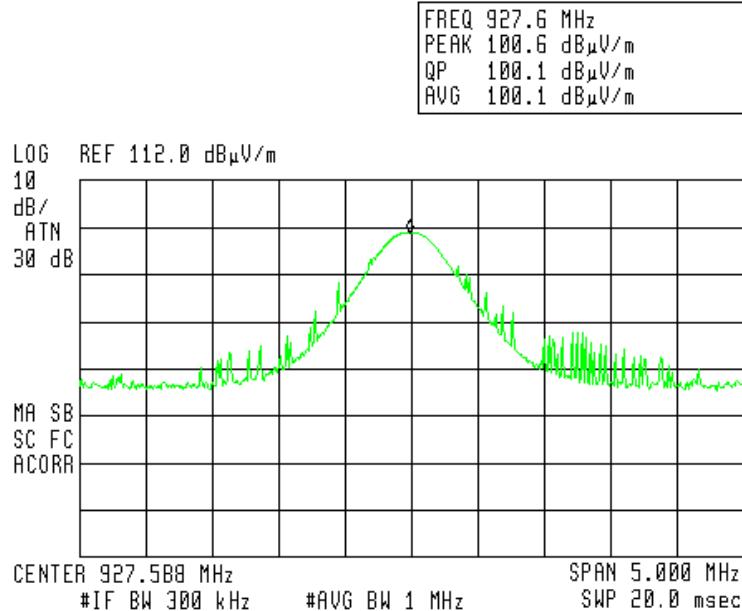


Figure 22 927.6 MHz

9.3 Results Calculation

E.U.T. Description: SAL-2 Series Wireless Clock

Model No.: SAL-2BS-12R-0

Serial Number: Not Designated

Specification: F.C.C. Part 15, Subpart C

The following calculations were used to determine maximum radiated power output.

$$P = \frac{(E \times d)^2}{(30 \times G)} \text{ [W]}$$

914.8 MHz

$$E = 10^{-6} \times 10^{\left(\frac{103.6}{20}\right)} = 0.15V/m$$

$$P = \frac{(0.15 \times 3)^2}{(30 \times 1)} = 6.75mW$$

921.2 MHz

$$E = 10^{-6} \times 10^{\left(\frac{102.0}{20}\right)} = 0.12V/m$$

$$P = \frac{(0.12 \times 3)^2}{(30 \times 1)} = 4.32mW$$

927.6 MHz

$$E(V/m) = 10^{-6} \times 10^{\left(\frac{100.6}{20}\right)} = 0.10V/m$$

$$P = \frac{(0.10 \times 3)^2}{(30 \times 1)} = 3mW$$

Operation Frequency (MHz)	Power (mW)	Specification (mW)	Margin (mW)
914.8	6.8	1000	-993.2
921.2	4.3	1000	-995.7
927.6	3.0	1000	-997.0

JUDGEMENT: Passed by 993.2 mW

TEST PERSONNEL:

Tester Signature: Evan Ever

Date: 21/06/2009

Typed/Printed Name: E. Ever

9.4 **Test Equipment Used.**

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 06, 2008	1 year

10. Band Edge

[In Accordance with section 15.247(d)]

10.1 Test procedure

The E.U.T was placed on a non-metallic table, 0.8 meters above the ground plane, on a remote-controlled turntable in the OATS. The test distance was 3 meters.

The transmitter unit operated with normal modulation. The EMI receiver was set to 120 kHz resolution BW. The EUT was set up as shown in Figure 3, and its proper operation was checked.

The EMI receiver was adjusted to the transmission channel at the maximum radiated level. The display line was set to 20 dBc and the EMI receiver was set to the band edge frequencies.

Maximum power level below 914 MHz and above 928 MHz was measured relative to power level at 914.85 MHz, and 927.65 MHz correspondingly.

The E.U.T. was tested in 2 operating channels and frequencies (1 (914.85 MHz); 3 (927.65 MHz)).

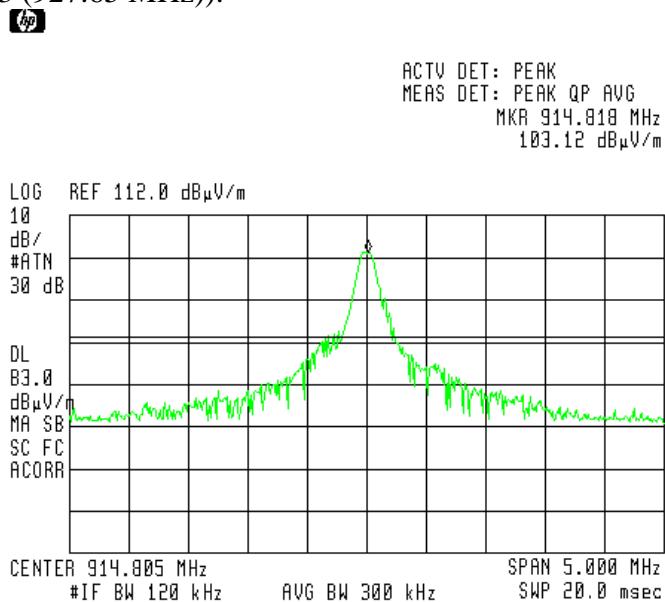


Figure 23 — 914.818 MHz

hp

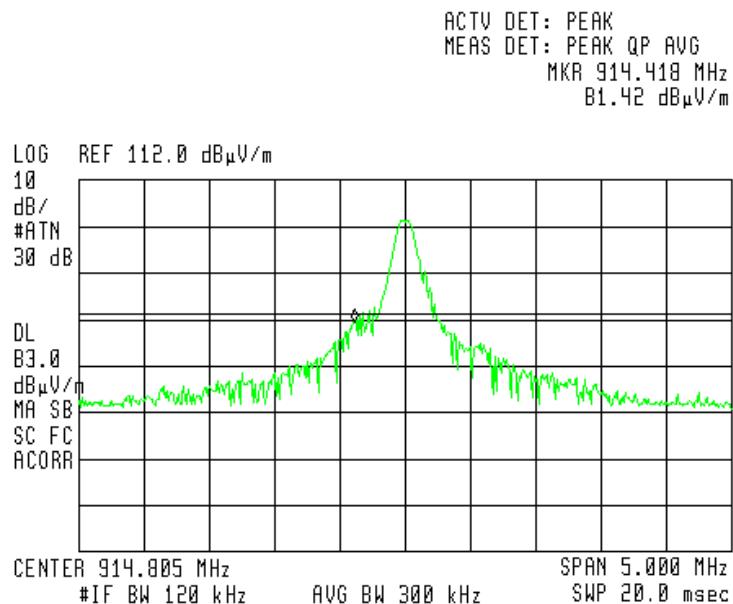


Figure 24 — Fmin (914.418 MHz)

hp

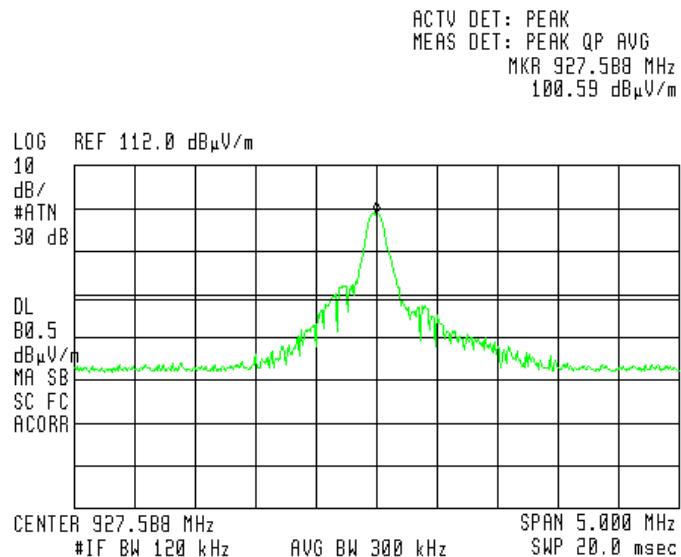


Figure 25 — 927.65 MHz

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 927.825 MHz
79.01 dB μ V/m

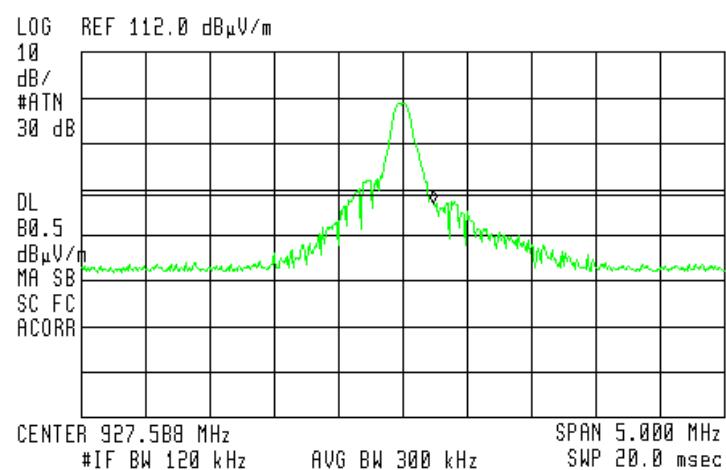


Figure 26 — Fmax (927.825 MHz)

10.2 Results table

E.U.T. Description: SAL-2 Series Wireless Clock

Model No.: SAL-2BS-12R-0

Serial Number: Not Designated

Specification: F.C.C. Part 15, Subpart C (15.247 (d))

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBuV/m)	Specification (dBuV/m)	Margin (dB)
914.85	914.42	81.4	95.8	-14.4
927.65	927.825	79.0	93.9	-14.9

Figure 27 Band Edge

JUDGEMENT: Passed by 14.4 dB

TEST PERSONNEL:

Tester Signature: Evan Ever

Date: 21/06/2009

Typed/Printed Name: E. Ever

10.3 Test Equipment Used.

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Antenna Bioconical	ARA	BCD 235/B	1041	March 25, 2009	1 year

11. Radiated Emission, 9 kHz – 30 MHz

11.1 *Test Specification*

9 kHz-30 MHz, FCC, Part 15, Subpart C, Section 209

11.2 *Test Procedure*

The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-30 MHz was scanned.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter at a distance of 3 meters.

The E.U.T. was tested in three operating channels and frequencies (1 (914.8 MHz); 3 (921.2 MHz); 3 (927.6 MHz)).

11.3 *Measured Data*

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 209 specification.

The results for all three channels were the same.

No signals were detected in the frequency range of 9 kHz – 30 MHz.

TEST PERSONNEL:

TEST PERSONNEL:

Date: 21/06/2009

Typed/Printed Name: E. Ever

11.4 **Test Instrumentation Used, Radiated Measurements**

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 15, 2008	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A

11.5 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$FS = RA + AF + CF$$

FS: Field Strength [dB μ V/m]

RA: Receiver Amplitude [dB μ V]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

Example: $FS = 30.7 \text{ dB}\mu\text{V (RA)} + 14.0 \text{ dB (AF)} + 0.9 \text{ dB (CF)} = 45.6 \text{ dB}\mu\text{V}$

No external pre-amplifiers are used.

12. Spurious Radiated Emission 30 – 1000 MHz

12.1 ***Test Specification***

30 MHz-1000 MHz, F.C.C., Part 15, Subpart C

12.2 ***Test Procedure***

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground..

The frequency range 30 MHz-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 30-1000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.

Using a frequency span less than 10 MHz.

Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The E.U.T. was tested in three operating channels and frequencies (1 (914.8 MHz); 3 (921.2 MHz); 3 (927.6 MHz)).

12.3 **Test Data**

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.
The results for all three operation channels were the same.

The signals in the band 30 MHz – 1.0 GHz were below the spectrum analyzer noise level.

TEST PERSONNEL:

Tester Signature: Evan Ever Date: 21/06/2009

Typed/Printed Name: E. Ever

12.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 year
RF Section	HP	85420E	3705A00248	November 16, 2008	1 year
Antenna Bi-conical	ARA	BCD 235/B	1041	March 25, 2009	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 06, 2008	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

12.5 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[\text{dB}\mu\text{v}/\text{m}] \text{ FS} = \text{RA} + \text{AF} + \text{CF}$$

FS: Field Strength [dB μ v/m]

RA: Receiver Amplitude [dB μ v]

AF: Receiving Antenna Correction Factor [dB/m]

CF: Cable Attenuation Factor [dB]

Example: FS = 30.7 dB μ V (RA) + 14.0 dB (AF) + 0.9 dB (CF) = 45.6 dB μ V

No external pre-amplifiers are used.

13. Spurious Radiated Emission Above 1 GHz

13.1 Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.

In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

The test distance was 3 meters.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

The E.U.T. was tested in three operating channels and frequencies (1 (914.8 MHz); 3 (921.2 MHz); 3 (927.6 MHz)).

13.2 Test Data

JUDGEMENT: Passed by 9.9 dB

For the operation channel 1 (914.85 MHz), the margin between the emission level and the specification limit is 9.9 in the worst case at the frequency of 4574.25 MHz, horizontal polarization.

For the operation channel 2 (921.25 MHz), the margin between the emission level and the specification limit is 12.4 in the worst case at the frequency of 5527.36 MHz, horizontal polarization.

For the operation channel 3 (927.65 MHz), the margin between the emission level and the specification limit is 14.5 in the worst case at the frequency of 5527.36 MHz, vertical polarizations.

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification.

The details of the highest emissions are given in *Figure 28* to *Figure 39*.

TEST PERSONNEL:

Tester Signature: Evan Ever

Date: 21/06/2009

Typed/Printed Name: E. Ever

Radiated Emission Above 1 GHz

E.U.T Description SAL-2 Series Wireless Clock
 Type SAL-2BS-12R-0
 Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C - 914.85 MHz

Antenna Polarization: Horizontal Frequency range: 1.0 GHz to 9.5 GHz
 Test Distance: 3 meters Detector: Peak

Freq. (MHz)	Peak Result (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
3659.38	49.1**	74.0	-24.9
4574.25	51.6**	74.0	-22.4
5489.10	43.6**	74.0	-30.4
6403.95	42.6**	74.0	-31.4

Figure 28 914.85 MHz Peak Readings (Horizontal)

Test Distance: 3 meters Detector: Average

Freq. (MHz)	Average Result (dB μ V/m)	Average Specification (dB μ V/m)	Avg. Margin (dB)
3659.40	43.1**	54.0	-10.9
4574.25	44.1**	54.0	-9.9
5489.10	38.2**	54.0	-15.8
6403.95	34.9**	54.0	-19.1

Figure 29 914.85 MHz Average Readings (Horizontal)

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

** “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter

Radiated Emission Above 1 GHz

E.U.T Description SAL-2 Series Wireless Clock
Type SAL-2BS-12R-0
Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C – 914.85 MHz

Antenna Polarization: Vertical Frequency range: 1.0 GHz to 9.5 GHz
Test Distance: 3 meters Detector: Peak
Operating Frequency: 914.85 MHz

Freq. (MHz)	Peak Result (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
3659.40	48.7**	74.0	-25.3
4574.25	51.0**	74.0	-23.0
5489.10	43.7**	74.0	-30.3
6403.95	46.0**	74.0	-28.0

Figure 30 914.85 MHz Peak Readings (Vertical)

Test Distance: 3 meters

Detector: Average

Freq. (MHz)	Average Result (dB μ V/m)	Average Specification (dB μ V/m)	Avg. Margin (dB)
3659.40	42.7**	54.0	-11.3
4574.25	43.3**	54.0	-10.7
5489.10	38.9**	54.0	-15.1
6403.95	41.0**	54.0	-13.0

Figure 31 914.85 MHz Average Readings (Vertical)

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter

Radiated Emission Above 1 GHz

E.U.T Description: SAL-2 Series Wireless Clock
 Type: SAL-2BS-12R-0
 Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C – 921.25 MHz

Antenna Polarization: Horizontal Frequency range: 1.0 GHz to 9.5 GHz
 Test Distance: 3 meters Detector: Peak
 Operating Frequency: 921.25 MHz

Freq. (MHz)	Peak Result (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
3684.41	43.4**	74.0	-30.6
4606.25	41.7**	74.0	-32.3
5527.36	43.2**	74.0	-12.4
6448.66	41.5**	74.0	-32.5

Figure 32 921.25 MHz Peak Readings (Horizontal)

Test Distance: 3 meters Detector: Average

Freq. (MHz)	Average Result (dB μ V/m)	Average Specification (dB μ V/m)	Avg. Margin (dB)
3684.41	37.4**	54.0	-16.6
4606.25	34.0**	54.0	-20.0
5527.36	38.4**	54.0	-15.6
6448.66	33.3**	54.0	-20.7

Figure 33 921.25 MHz Average Readings (Horizontal)

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

** “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter

Radiated Emission Above 1 GHz

E.U.T Description SAL-2 Series Wireless Clock
 Type SAL-2BS-12R-0
 Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C – 921.25 MHz

Antenna Polarization: Vertical Frequency range: 1.0 GHz to 9.5 GHz
 Test Distance: 3 meters Detector: Peak
 Operating Frequency: 921.25 MHz

Freq.	Peak Result	Peak. Specification	Peak. Margin
(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)
3684.41	43.7**	74.0	-30.3
4606.25	42.0**	74.0	-32.0
5527.36	43.1**	74.0	-30.9
6448.66	43.7**	74.0	-30.3

Figure 34 921.25 MHz Peak Readings (Vertical)

Test Distance: 3 meters Detector: Average

Freq.	Average Result	Average Specification	Avg. Margin
(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)
3684.41	37.4**	54.0	-16.6
4606.25	34.2**	54.0	-19.8
5527.36	36.8**	54.0	-17.2
6448.66	39.3**	54.0	-14.7

Figure 35 921.25 MHz Average Readings (Vertical)

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

** “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter

Radiated Emission Above 1 GHz

E.U.T Description: SAL-2 Series Wireless Clock
 Type: SAL-2BS-12R-0
 Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C – 927.65 MHz

Antenna Polarization: Horizontal Frequency range: 1.0 GHz to 9.5 GHz
 Test Distance: 3 meters Detector: Peak
 Operating Frequency: 927.65 MHz

Freq.	Peak Result	Peak Specification	Peak Margin
(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)
3710.36	42.9**	74.0	-31.1
4637.91	41.5**	74.0	-32.5
5527.36	42.2**	74.0	-31.8
6493.21	42.0**	74.0	-32.0

Figure 36 927.65 MHz Peak Readings (Horizontal)

Test Distance: 3 meters Detector: Average

Freq.	Average Result	Average Specification	Avg. Margin
(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)
3710.36	37.9**	54.0	-21.8
4637.91	31.3**	54.0	-22.7
5527.36	36.3**	54.0	-17.7
6493.21	33.5**	54.0	-20.5

Figure 37 927.65 MHz Average Readings (Horizontal)

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

** “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter

Radiated Emission Above 1 GHz

E.U.T Description: SAL-2 Series Wireless Clock
 Type: SAL-2BS-12R-0
 Serial Number: Not Designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical Frequency range: 1.0 GHz to 9.5 GHz
 Test Distance: 3 meters Detector: Peak
 Operating Frequency: 927.65 MHz

Freq. (MHz)	Peak Result (dB μ V/m)	Peak. Specification (dB μ V/m)	Peak. Margin (dB)
3710.36	43.5**	74.0	-30.5
4637.91	41.2**	74.0	-32.8
5565.71	44.2**	74.0	-29.8
6493.21	43.8**	74.0	-30.2

Figure 38 927.65 MHz Peak Readings (Vertical)

Test Distance: 3 meters Detector: Average

Freq. (MHz)	Average Result (dB μ V/m)	Average Specification (dB μ V/m)	Avg. Margin (dB)
3710.36	37.1**	54.0	-16.9
4637.91	33.0**	54.0	-21.0
5527.36	39.5**	54.0	-14.5
6493.21	38.8**	54.0	-15.2

Figure 39 927.65 MHz Average Readings (Vertical)

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Average Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

** “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain + Band Pass Filter

13.3 Test Instrumentation Used

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	November 17, 2008	1 Year
RF Filter Section	HP	85420E	3705A00248	November 16, 2008	1 Year
Antenna Biconical	ARA	BCD 235/B	1041	March 25, 2009	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	November 06, 2008	1 Year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 29, 2009	2 Years
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 16, 2008	2 Years
Horn Antenna	ARA	SWH-28	1008	December 23, 2008	2 Years
Horn Antenna	Narda	V637	0410	December 23, 2008	2 Years
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 3, 2008	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 9, 2009	1 Year
Low Noise Amplifier	MK Milliwave	MKT6-3000 4000-30-13P	A0399	January 15, 2009	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	March 17, 2009	1 Year
Spectrum Analyzer	HP	8546E	3442A00275	December 15, 2008	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

14. R.F Exposure/Safety

Typical use of the E.U.T. is . The typical placement of the E.U.T. is wall or ceiling mounted. The typical distance between the E.U.T. and the user in the worst case application, is <10 cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 914 MHz is: $1 \frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t- Transmitted Power 6.75 mw (Peak) = 8.29 dBm

G_T- Antenna Gain, 0 dBi =

R- Distance from Transmitter using 1 cm worst case

(c) The peak power density is :

$$S_p = \frac{6.75}{4\pi(1)^2} = 0.529 \frac{mW}{cm^2}$$

(d) The duty cycle of transmission in actual worst case is 8 %.

The average power source is:

$$P_{AV} = \frac{6.75 \times 1.08}{100} = 0.0729mW$$

(e) The averaged power density of the E.U.T. is:

$$S_{AV} = \frac{0.0729}{4\pi(1)^2} = 0.0058 \frac{mW}{cm^2}$$

APPENDIX B - CORRECTION FACTORS

14.1 Correction factors for **CABLE**

**from EMI receiver
to test antenna
at 3 meter range.**

FREQUENCY CORRECTION FACTOR		FREQUENCY CORRECTION FACTOR	
(MHz)	(dB)	(MHz)	(dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
90.0	1.6		
100.0	1.7		
150.0	2.0		
200.0	2.3		
250.0	2.7		
300.0	3.1		
350.0	3.4		
400.0	3.7		
450.0	4.0		
500.0	4.3		
600.0	4.7		
700.0	5.3		
800.0	5.9		
900.0	6.3		
1000.0	6.7		

NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 27 meters.
3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

14.2 Correction factors for CABLE

from EMI receiver
to test antenna
at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.
2. The overall length of the cable is 10 meters.

14.3 Correction factors for CABLE

from spectrum analyzer
to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.
2. The cable is used for measurements above 2.9 GHz.
3. The overall length of the cable is 10 meters.

14.4 Correction factors for CABLE

from EMI receiver
to test antenna
at 10 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	9.8
20.0	0.8	1400.0	10.0
30.0	0.9	1600.0	11.3
40.0	1.2	1800.0	12.2
50.0	1.4	2000.0	13.1
60.0	1.6	2300.0	14.5
70.0	1.8	2600.0	15.9
80.0	1.9	2900.0	16.4
90.0	2.0		
100.0	2.1		
150.0	2.6		
200.0	3.2		
250.0	3.8		
300.0	4.2		
350.0	4.6		
400.0	5.1		
450.0	5.3		
500.0	5.6		
600.0	6.3		
700.0	7.0		
800.0	7.6		
900.0	8.0		
1000.0	8.7		

NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 34 meters.
3. The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".

12.6 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

NOTES:

1. Antenna serial number is 1038.
2. The above lists are located in file number 38M30.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.
3. The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".

14.5 Correction factors for LOG PERIODIC ANTENNA
Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. Antenna serial number is 253.
2. The above lists are located in file number SAS3M0.ANT for a 3 meter range.
3. The files mentioned above are located on the disk marked "Antenna Factors".

14.6 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.
2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

14.7 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
10 meter range

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. Antenna serial number is 1041.
2. The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

14.8 Correction factors for Double-Ridged Waveguide Horn

**Model: 3115, S/N 29845
at 3 meter range.**

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENN A Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			

14.9 Correction factors for

Horn Antenna

**Model: SWH-28
at 1 meter range.**

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

14.10 Correction factors for

**Horn Antenna
Model: V637**

FREQUENCY (GHz)	AFE (dB /m)	Gain (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0

14.11 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2