Cert. No. 1152.01
Electrical (EMC)

DATE: 12 October 2004

I.T.L. (PRODUCT TESTING) LTD.

FCC EMC/Radio Test

for

The Sapling Company Inc.

Equipment under test:

RF Clock

(Transmitter Section)

SAL-1BS-12R-1 *

* See customer's declaration on page 6 and Appendices B; C.

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
E. Pitt, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

Cert. No. 1152.01
Electrical (EMC)

Measurement/Technical Report for

The Sapling Company Inc.

RF Clock

(For Transmitter Section)

SAL-1BS-12R-1

FCC ID:R73 SAL001

12 October 2004

This report concerns: Original Grant x Class II change

Class B verification ___ Class A verification_____Class I change

Equipment type: Radio Telemetry Transmitter

Request Issue of Grant:

__**x**__Immediately upon completion of review

Limits used:

CISPR 22 _____ Part 15 __x__

Measurement procedure used is ANSI C63.4-2001.

Application for Certification
prepared by:
Ishaishou Raz
ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel
e-mail Sraz@itl.co.il

Applicant for this device:
(different from "prepared by")
Ilan Shemesh
The Sapling Company
451 Veit Road
Huntington Valley, PA 19006
U.S.A.
Tel: +1-215-322-6063
Fax: +1-215-322-8498
e-mail: Ilan@Sapling-Inc.com

TABLE OF CONTENTS

1. General Information

1.1 Administrative Information

Manufacturer:	The Sapling Company Inc.
Manufacturer's Address:	451 Veit Road Huntington Valley, PA 19006 U.S.A. Tel: +1-215-322-6063 Fax: +1-215-322-8498
Manufacturer's Representative:	Lior Yehoshua
Equipment Under Test (E.U.T):	RF Clock
Equipment Model No.:	SAL-1BS-12R-1 (See customer's declaration on following page).
Equipment Serial No.:	001
Date of Receipt of E.U.T:	31.05.04
Start of Test:	31.05.04
End of Test:	14.06.04
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Part 15, Sub-part C

The Sapling Company, Inc.
451 Veit Road
Huntingdon Valley, PA. 19006
P: 215.322.6063
F: 215.322.8498
W: www.sapling-inc.com

DECLARATION

October 28, 2004

I HEREBY DECLARE THAT THE FOLLOWING PRODUCT:

SAL-1BS-12R-1

IS IDENTICAL ELECTRONICALLY, PHYSICALLY, AND MECHANICALLY TO:

AMR

Please relate to them all (from an EMC point of view) as the same product.

Thank you,

Ilan Shemesh
President

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), File No. IC 4025.
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 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 and receive in the frequency range 925.55-938.35MHz.

The SAL 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 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

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2001. 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 December 12, 2003).
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 C63.4-2001. 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

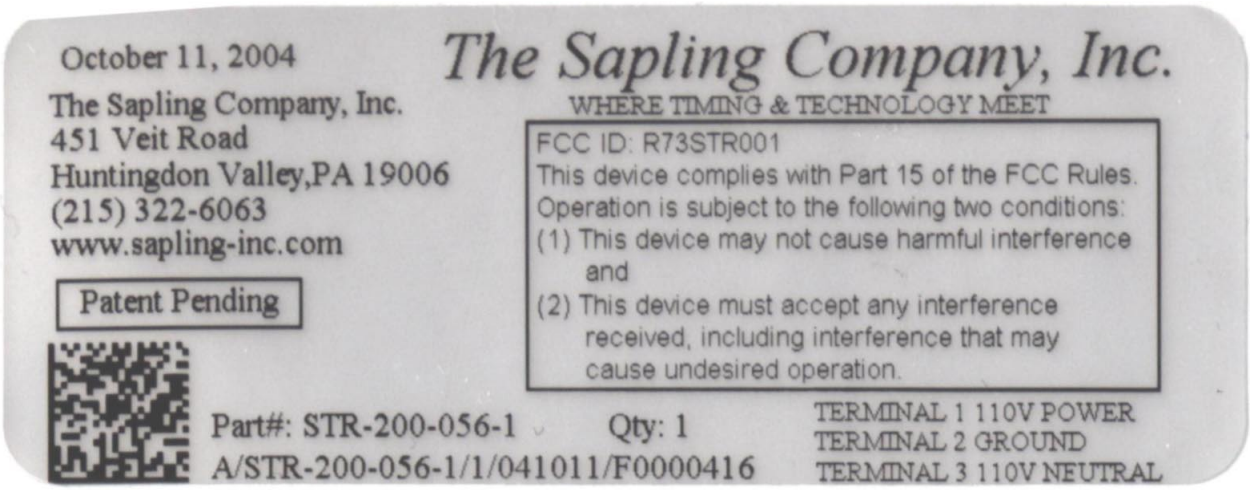


Figure 1. FCC Label

Figure 2. Location of Label on EUT

3. System Test Configuration

3.1 Justification

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

3.2 EUT Exercise Software

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.

3.3 Special Accessories

No special accessories were needed to achieve compliance.

3.4 Equipment Modifications

No equipment modifications are required and none have been made.

3.5 Configuration of Tested System

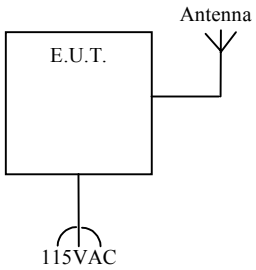
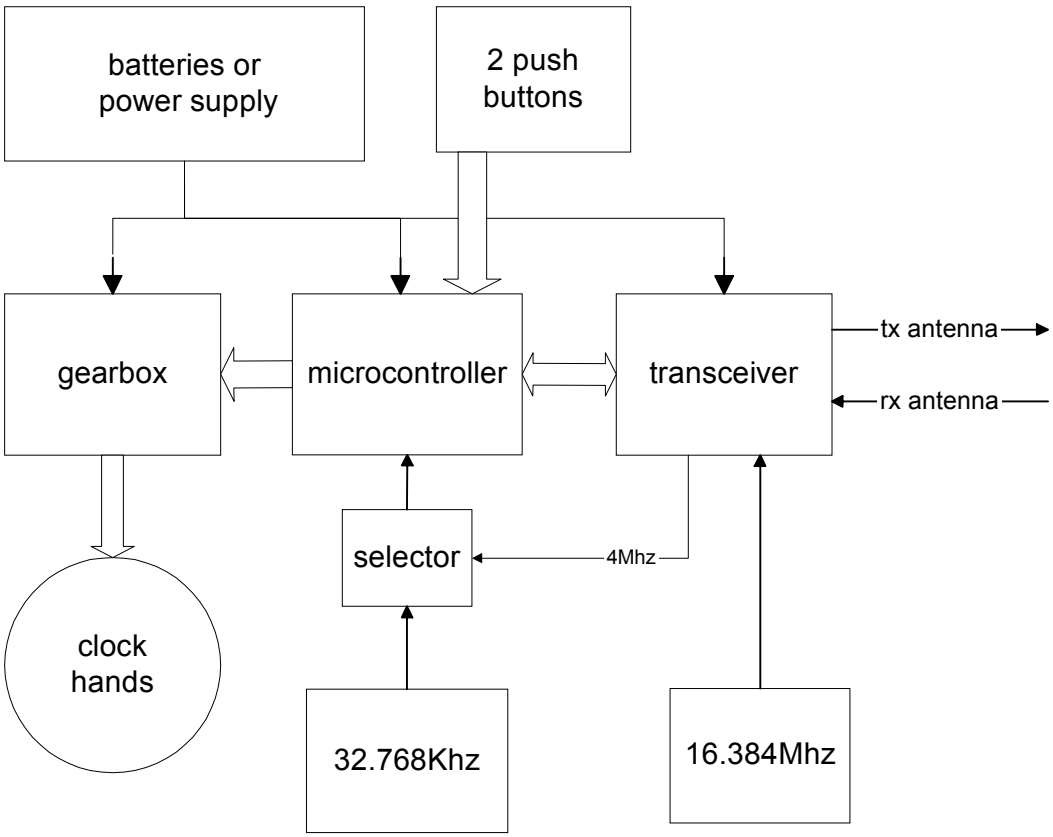


Figure 3. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram



4.2 Theory of Operation

The wireless clock is based on micro-controller. The micro-controller controls the movement of the hands of the clock through a gear box.
The gearbox outputs a signal of the hands position to the micro-controller. The micro-controller uses this signal to make sure it displays the correct time.

The clock receives the correct time through RF communication. Any time it receives time, it also transmits the correct time to other clocks. For that purpose the clock includes a transceiver. The micro-controller uses this transceiver to receive and transmit messages in frequency hopping technology in the 915-928 MHz frequency range. The transceiver is connected to 2 antennas, one for transmit and one for receive. These are internal antennas printed on the print.

The clock transmits the same time message in 51 different frequencies. It stays 10 mili-seconds in every channel before it hops to the next channel but it transmits only 6.64 mili-seconds during this time. After 51 different frequencies it transmits another 9 messages starting at the first frequency.

In worst case the clock transmits the time message every 1 minute. The all transmission endure 600 mili-seconds. Which mean, in worst case it stays 13.3 mili-seconds at the same frequency during 1 minute.

The clock is available in battery operated,110V or 24V power input. The 110V and 24V wireless analog series receives and transmits time every minute, as opposed to the battery-operated version which receives and transmits time every four (4) hours. The clock is designed to consume very little energy. For that the microcontroller controls the frequency of its operation by a selector which gives the option to select 32.768 khz (low frequency) or 4 Mhz (high frequency).

The clock includes 2 push buttons. One of them allows the user to drive the clock into receive or transmit mode (since most of the time the clock is not open for communication). The other one allows the user to drive the clock into debug mode.

5. Customer's Declaration

The Sapling Company, Inc.
451 Veit Road
Huntingdon Valley, PA. 19006
P: 215.322.6063
F: 215.322.8498
W: www.sapling-inc.com

Date: September 27, 2004

DECLARATION

To Whom It May Concern,

I hereby declare that the product, SAL Series wireless clock, complies with the following requirements of Part 15, Sub-part C, Section 15.247:

1. Channel average time occupancy, Section 15.247 (a) (1).
2. Receiver B.W. matching to transmitter B.W. and frequencies in synchronization with the transmitted signals, Section 15.247 (a) (1).
3. Non-coordination requirement, Section 15.247 (h).

Thank you,

Ilan Shemesh
President

6. Conducted Emission Data

6.1 Test Specification

F.C.C., Part 15, Subpart B: Class B

6.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 3.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room (see section 3), with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

The E.U.T was powered from 115 V AC / 60 Hz via 50 Ohm / 50 μHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, and using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

The E.U.T. was operated in the frequency of 921.25 MHz.

6.3 Measured Data

JUDGEMENT: Passed by 11.8 dB

The margin between the emission levels and the specification limit is, in the worst case, 12.3 dB for the phase line at 28.68 MHz and 11.8 dB at 28.68 MHz for the neutral line.

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

The details of the highest emissions are given in Figure 4 to Figure 7.

TEST PERSONNEL:

Tester Signature:  Date: 07.11.04

Typed/Printed Name: E. Pitt

Conducted Emission

E.U.T Description	RF Clock
Type	SAL-1BS-12R-1
Serial Number:	001

Specification:	F.C.C., Part 15, Subpart B: Class B
Lead:	Phase
Detectors:	Peak, Quasi-peak, Average

Frequency (MHz)	Peak Amplitude (dBµV)	Quasi-peak Amplitude (dBµV)	Specification (dB µV)	Pass/Fail	Margin (dB)
4.09	14.1	13.4	56.0	Pass	-42.6
12.29	21.8	21.1	60.0	Pass	-38.9
20.48	8.2	7.0	60.0	Pass	-53.0
28.68	38.3	37.6	60.0	Pass	-22.4

Figure 4. Detectors: Peak, QUASI-PEAK

Frequency (MHz)	Peak Amplitude (dBµV)	Average Amplitude (dBµV)	Specification (dB µV)	Pass/Fail	Margin (dB)
4.09	14.1	13.2	46.0	Pass	-32.8
12.29	21.8	20.6	50.0	Pass	-29.4
20.48	8.2	6.3	50.0	Pass	-43.7
28.68	38.3	37.7	50.0	Pass	-12.3

Figure 5. Detectors: Peak, AVERAGE .

Conducted Emission

E.U.T Description	RF Clock
Type	SAL-1BS-12R-1
Serial Number:	001

Specification:	F.C.C., Part 15, Subpart B: Class B
Lead:	Neutral
Detectors:	Peak, Quasi-peak

Frequency (MHz)	Peak Amplitude (dB µV)	Quasi-peak Amplitude (dB µV)	Specification (dB µV)	Pass/Fail	Margin (dB)
4.10	18.3	17.8	56.0	Pass	-38.2
12.29	21.2	20.8	60.0	Pass	-39.2
28.68	39.9	39.1	60.0	Pass	-20.9

Figure 6. Detectors: Peak, QUASI-PEAK

Frequency (MHz)	Peak Amplitude (dBµV)	Average Amplitude (dBµV)	Specification (dB µV)	Pass/Fail	Margin (dB)
4.10	18.3	17.4	46.0	Pass	-28.6
12.29	21.2	20.5	50.0	Pass	-29.5
28.68	39.9	38.2	50.0	Pass	-11.8

Figure 7. Detectors: Peak, AVERAGE

6.4 Test Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Calibration	Period
LISN	Fischer	FCC-LISN-2A	127	April 1, 2004	1 year
LISN	Fischer	FCC-LISN-2A	128	April 1, 2004	1 year
Receiver	HP	85420E/85422E	3427A00103/34	February 28, 2004	1 year
Printer	HP	ThinkJet2225	2738508357	N/A	N/A

7. Spurious Radiated Emission, Below 1 GHz

7.1 Test Specification

30kHz-1000 MHz, FCC, Part 15, Subpart C

7.2 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 30kHz-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 kHz-30MHz, the loop antenna was rotated on its vertical axis. The antenna height (center of loop) was 1 meter.
In the frequency range 30-1000MHz, 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 operated at the frequencies of 914.85, 921.25, and 927.65 MHz

7.3 Measured Data

The signals in the band 30 kHz – 1.0 GHz were below the spectrum analyzer noise level which is at least 6dB below the specification limit.

The results for all three operating frequencies were the same.

TEST PERSONNEL:

Tester Signature: _____ Date: 07.11.04

Typed/Printed Name: E. Pitt

7.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	February 28, 2004	1 year
RF Section	HP	85420E	3427A00103	February 28, 2004	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	April 11, 2004	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 21, 2004	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 17, 2003	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	ThinkJet 2225	2738508357.0	N/A	N/A

7.5 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 [dBµv/m]
RA:	Receiver Amplitude [dBµv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

8. Spurious Radiated Emission Above 1 GHz

8.1 Radiated Emission Above 1 GHz

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, 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. The test distance was 3 meters.
In the frequency range 2.9-9.5 GHz, a spectrum analyzer including a low noise amplifier was used. The test distance was 3 meters. During peak measurements, the I.F. bandwidth was 1 MHz, and video bandwidth 3 MHz. During average measurements, the I.F. bandwidth was 1 MHz and video bandwidth was 100 Hz. 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 operated in continuous mode.

8.2 Test Data

JUDGEMENT: Passed by 12.5 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification. The worst cases were:

for 914.85 MHz, 12.5 dB margin at 2744.55 MHz frequency, vertical polarization.

for 921.25 MHz, 14.7 dB margin at 2763.75 MHz frequency, vertical polarization

for 927.65 MHz, 15.5 dB margin at 2782.95 MHz frequency, vertical polarization

The details of the highest emissions are given in Figure 8 to Figure 19.

TEST PERSONNEL:

Tester Signature: _____ Date: 07.11.04

Typed/Printed Name: E. Pitt

Radiated Emission Above 1 GHz

E.U.T Description	RF Clock
Type	SAL-1BS-12R-1
Serial Number:	001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 914.85 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq.	Peak Result	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB µV/m)	(dB)
2744.55	60.3**	74.0	-13.7
3659.40	41.5*	74.0	-32.5
4574.25	42.1*	74.0	-31.9

Figure 8. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

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.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description RF Clock
Type SAL-1BS-12R-1
Serial Number: 001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 914.85 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Average

Freq. (MHz)	Average Result (dBμV/m)	Average Specification (dB μV/m)	Avg. Margin (dB)
2744.55	31.3**	54.0	-22.7
3659.40	11.1*	54.0	-42.9
4574.25	13.3*	54.0	-40.7

Figure 9. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

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 Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

** Correction Factor = Antenna Factor + Cable Loss + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{6.64}{100} = -23.6dB$

The maximum transmission "ON" time is 6.64 msec. within a 100 msec. window.

Radiated Emission Above 1 GHz

E.U.T Description	RF Clock
Type	SAL-1BS-12R-1
Serial Number:	001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 914.85 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq. (MHz)	Peak Result (dBμV/m)	Peak. Specification (dB μV/m)	Peak. Margin (dB)
2744.55	61.5**	74.0	-12.5
3659.40	40.1*	74.0	-33.9
4574.25	41.2*	74.0	-32.8

Figure 10. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

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.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description RF Clock
Type SAL-1BS-12R-1
Serial Number: 001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 914.85 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Average

Freq. (MHz)	Average Result (dBμV/m)	Average Specification (dB μV/m)	Avg. Margin (dB)
2744.55	32.9**	54.0	-21.1
3659.40	9.1*	54.0	-44.9
4574.25	11.9*	54.0	-42.1

Figure 11. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

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 Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

** Correction Factor = Antenna Factor + Cable Loss + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{6.64}{100} = -23.6dB$

The maximum transmission "ON" time is 6.64 msec. within a 100 msec. window.

Radiated Emission Above 1 GHz

E.U.T Description	RF Clock
Type	SAL-1BS-12R-1
Serial Number:	001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 921.25 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq.	Peak Result	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB µV/m)	(dB)
2763.75	58.6**	74.0	-15.4
3685.00	44.1*	74.0	-29.9
4606.25	47.4*	74.0	-26.6

Figure 12. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

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.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description RF Clock
Type SAL-1BS-12R-1
Serial Number: 001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 921.25 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Average

Freq. (MHz)	Average Result (dBμV/m)	Average Specification (dB μV/m)	Avg. Margin (dB)
2763.75	28.6**	54.0	-25.4
3685.00	14.1*	54.0	-39.9
4606.25	11.7*	54.0	-42.3

Figure 13. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

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 Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

** Correction Factor = Antenna Factor + Cable Loss + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{6.64}{100} = -23.6dB$

The maximum transmission "ON" time is 6.64 msec. within a 100 msec. window.

Radiated Emission Above 1 GHz

E.U.T Description	RF Clock
Type	SAL-1BS-12R-1
Serial Number:	001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 921.25 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq. (MHz)	Peak Result (dBμV/m)	Peak. Specification (dB μV/m)	Peak. Margin (dB)
2763.75	59.3**	74.0	-14.7
3685.00	41.3*	74.0	-32.7
4606.25	43.3*	74.0	-30.7

Figure 14. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

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.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description RF Clock
Type SAL-1BS-12R-1
Serial Number: 001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 921.25 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Average

Freq. (MHz)	Average Result (dBμV/m)	Average Specification (dB μV/m)	Avg. Margin (dB)
2763.75	31.2**	54.0	-22.8
3685.00	12.6*	54.0	-41.4
4606.25	12.3*	54.0	-41.7

Figure 15. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

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 Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

** Correction Factor = Antenna Factor + Cable Loss + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{6.64}{100} = -23.6dB$

The maximum transmission "ON" time is 6.64 msec. within a 100 msec. window.

Radiated Emission Above 1 GHz

E.U.T Description	RF Clock
Type	SAL-1BS-12R-1
Serial Number:	001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 927.65 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq.	Peak Result	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB µV/m)	(dB)
2782.95	56.2**	74.0	-17.8
3710.60	42.3*	74.0	-31.7
4638.25	48.3*	74.0	-25.7

Figure 16. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

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.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description RF Clock
Type SAL-1BS-12R-1
Serial Number: 001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 927.65 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Average

Freq. (MHz)	Average Result (dBμV/m)	Average Specification (dB μV/m)	Avg. Margin (dB)
2782.95	24.3**	54.0	-29.7
3710.60	11.9*	54.0	-42.1
4638.25	20.5*	54.0	-33.5

Figure 17. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

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 Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

** Correction Factor = Antenna Factor + Cable Loss + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{6.64}{100} = -23.6dB$

The maximum transmission "ON" time is 6.64 msec. within a 100 msec. window.

Radiated Emission Above 1 GHz

E.U.T Description	RF Clock
Type	SAL-1BS-12R-1
Serial Number:	001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 927.65 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Peak

Freq. (MHz)	Peak Result (dBμV/m)	Peak. Specification (dB μV/m)	Peak. Margin (dB)
2782.95	58.5**	74.0	-15.5
3710.60	40.0*	74.0	-34.0
4638.25	43.9*	74.0	-30.1

Figure 18. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

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.

"Peak Result" includes correction factor.

* "Correction Factor" = Antenna Factor + Cable Loss- Preamplifier Gain

** "Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description RF Clock
Type SAL-1BS-12R-1
Serial Number: 001

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 927.65 MHz

Frequency range: 1.0 GHz to 9.5 GHz
Detector: Average

Freq. (MHz)	Average Result (dBμV/m)	Average Specification (dB μV/m)	Avg. Margin (dB)
2782.95	27.8**	54.0	-26.2
3710.60	11.6*	54.0	-42.4
4638.25	13.0*	54.0	-41.0

Figure 19. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

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 Result" includes correction factor.

* Correction Factor = Antenna Factor + Cable Loss- Preamplifier Gain + Duty Cycle Factor

** Correction Factor = Antenna Factor + Cable Loss + Duty Cycle Factor

Duty Cycle Factor = $20\log\frac{6.64}{100} = -23.6dB$

The maximum transmission "ON" time is 6.64 msec. within a 100 msec. window.

8.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	February 28, 2004	1 year
RF Section	HP	85420E	3427A00103	February 28, 2004	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	ThinkJet2225	2738508357	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 31,2003	2 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 17, 2004	1 year
Horn Antenna	ARA	SWH-28	1007	October 28, 2003	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	October 14, 2003	1 year
Spectrum Analyzer	HP	8592L	3926A01204	February 28, 2004	1 year

9. Number of Hopping Frequencies

9.1 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 × 8dB) 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).

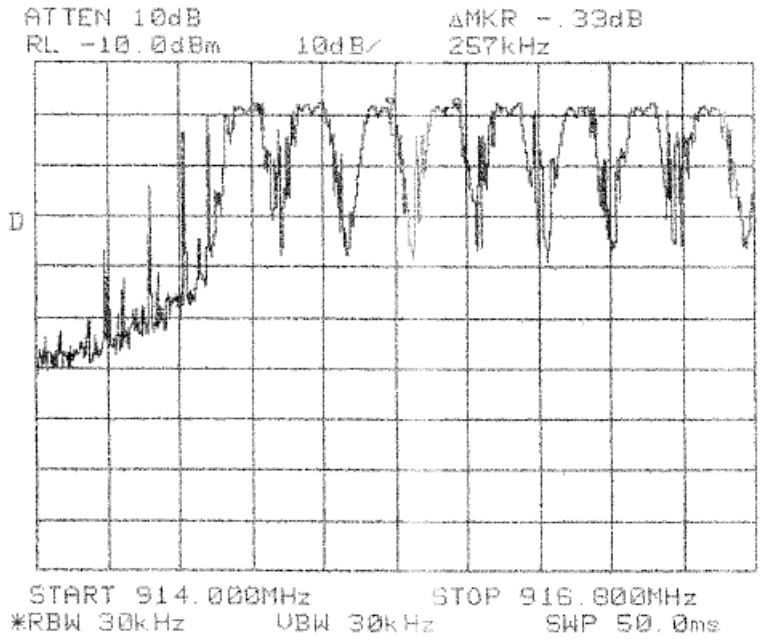


Figure 20.— 914.0-916.8 MHz

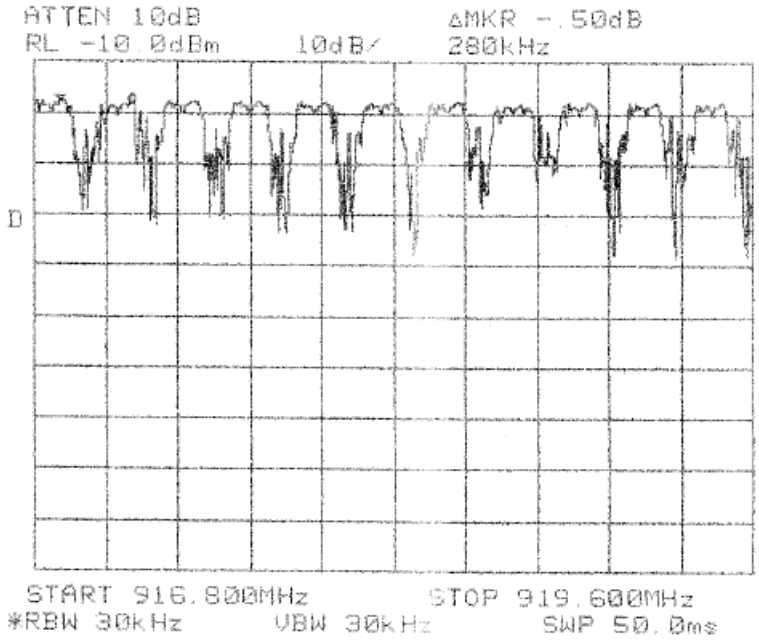


Figure 21.— 916.8-919.6 MHz

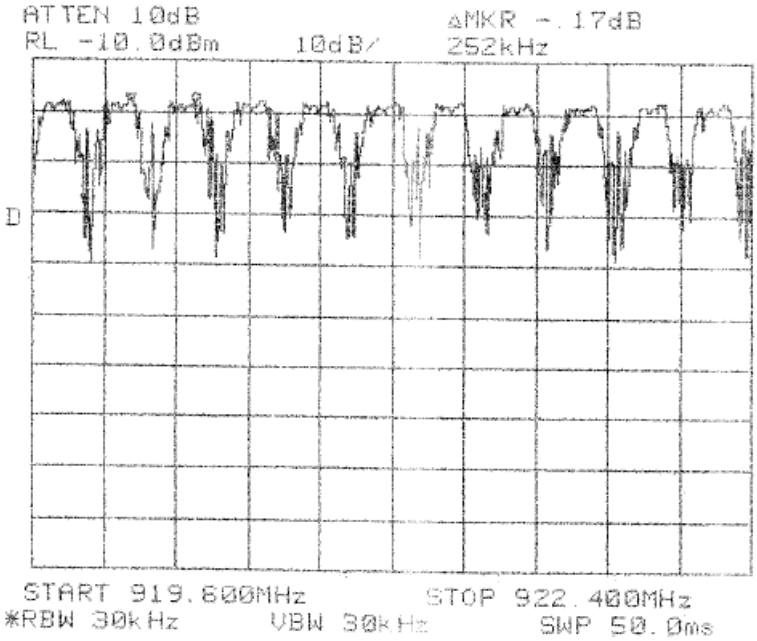


Figure 22.— 919.6-922.4 MHz

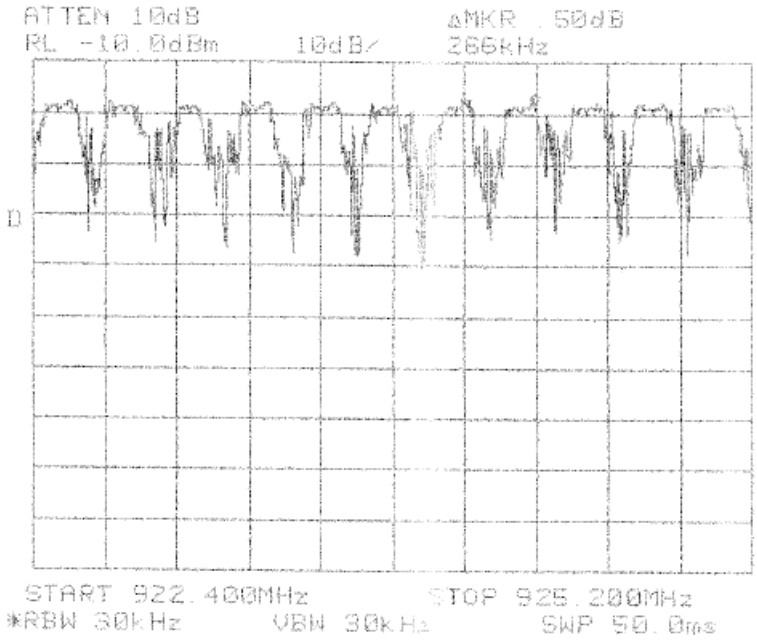


Figure 23.— 922.4-925.2 MHz

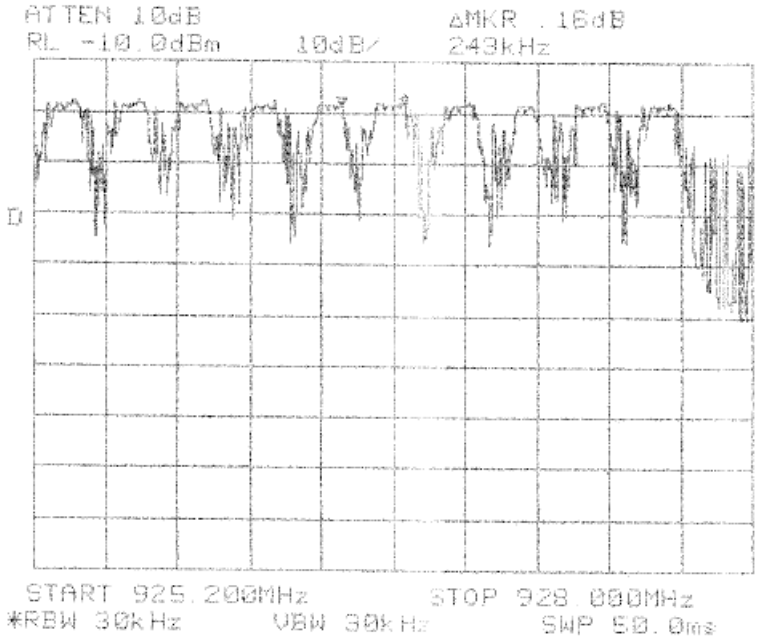


Figure 24.— 925.2-928.0 MHz

9.2 Results table

E.U.T. Description: RF Clock
Model No.: SAL-1BS-12R-1
Serial Number: 001
Specification: FCC Part 15, Subpart C (15.247(a) (1)

Number of Hopping Frequencies	Specification
51	>50

Figure 25 Number of Hopping Frequencies

TEST PERSONNEL:
Tester Signature: _____ Date: 07.11.04
Typed/Printed Name: E. Pitt

9.3 Test Equipment Used.

Number of Hopping Frequencies

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2004	1 year
Cable	Avnet	MTS	N/A	September 9, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 26 Test Equipment Used

10. Channel Frequency Separation

10.1 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 × 8dB) and an appropriate coaxial cable.
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.

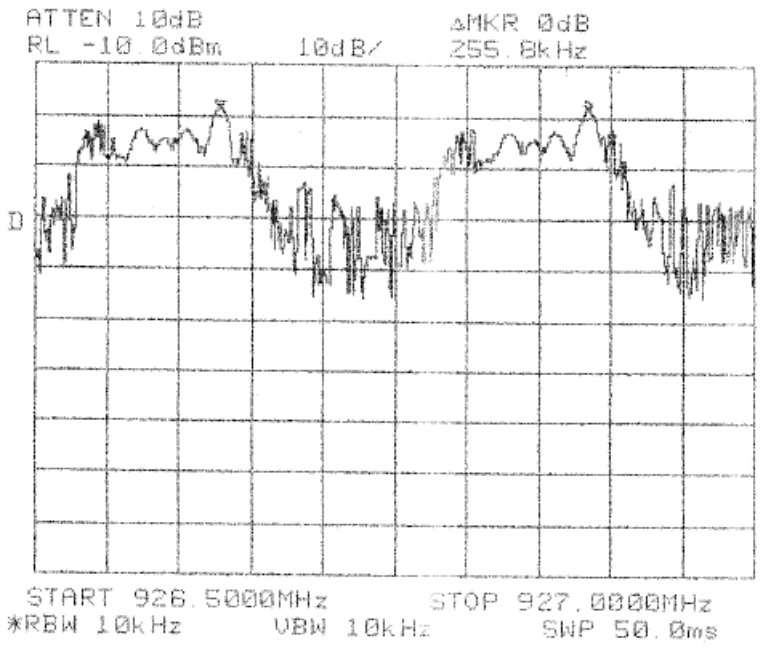


Figure 27.— 926.5-927.0 MHz

10.2 Results table

E.U.T. Description: RF Clock
Model No.: SAL-1BS-12R-1
Serial Number: 001
Specification: FCC Part 15, Subpart C (15.247(a) (1)

Channel Frequency Separation (kHz)	Specification (kHz)	Margin (kHz)
255.8	>165	90.8

Figure 28 Channel Frequency Separation

JUDGEMENT: Passed by 90.8 kHz

TEST PERSONNEL:
Tester Signature: _____ Date: 07.11.04
Typed/Printed Name: E. Pitt

10.3 Test Equipment Used.

Channel Frequency Separation

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2004	1 year
Cable	Avnet	MTS	N/A	September 9, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 29 Test Equipment Used

11. Maximum Transmitted Peak Power Output

11.1 Test procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through EXT ATTT=24dB (3 × 8dB) and an appropriate coaxial cable=1dB. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 300 MHz RBW. Peak power level was measured at selected operation frequencies.

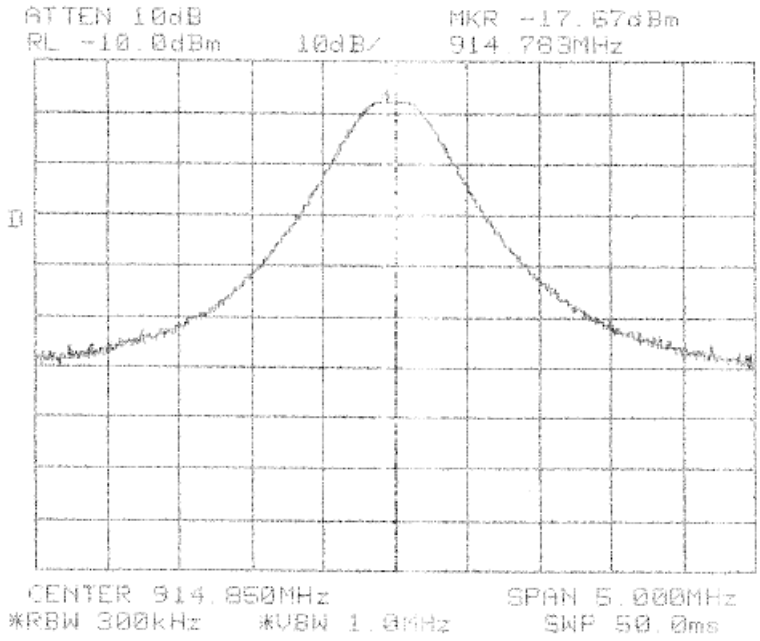


Figure 30.— 914.85 MHz

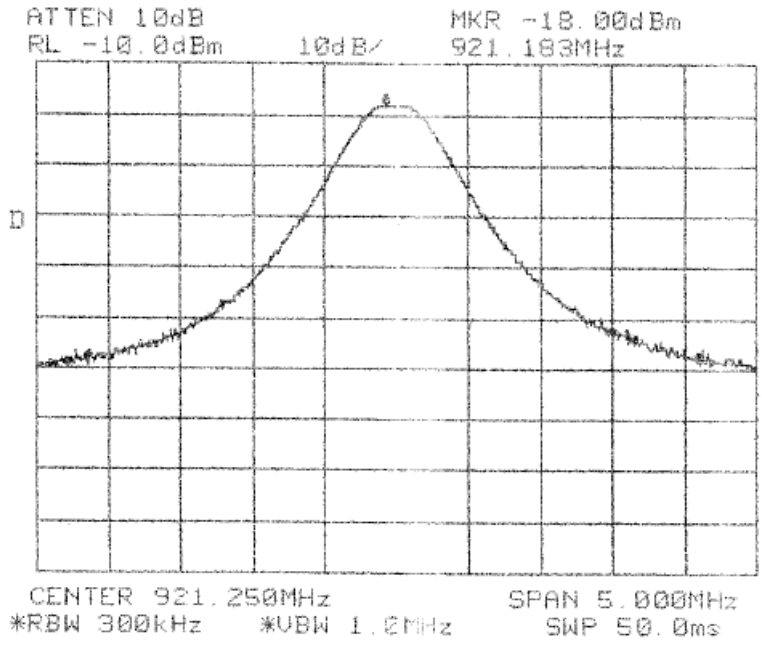


Figure 31.— 921.25 MHz

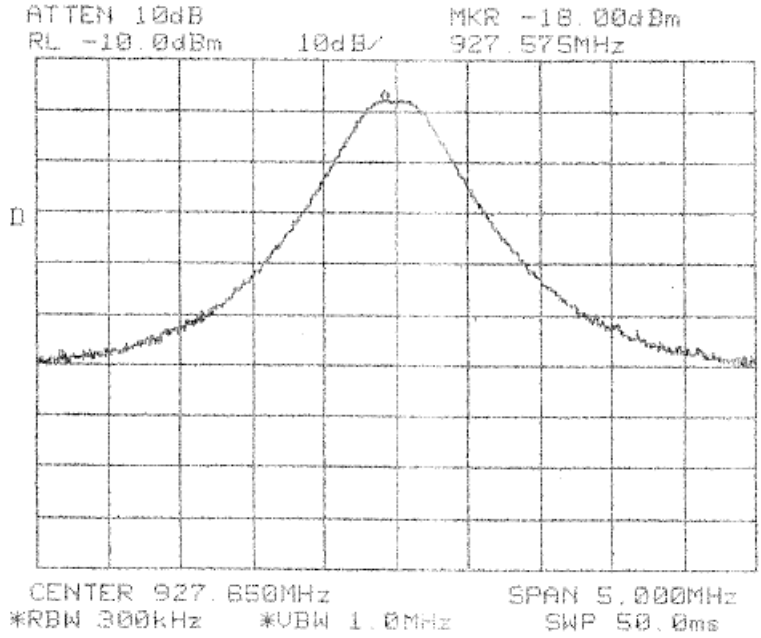


Figure 32.— 927.85 MHz

11.2 Results table

E.U.T. Description: RF Clock
Model No.: SAL-1BS-12R-1
Serial Number: 001
Specification: FCC Part 15, Subpart C

Operation Frequency (MHz)	Peak Power Reading at Spectrum Analyzer (dBm)	External Attenuator + Cable Loss (dB)	Peak Power Output (dBm)	Specification (dBm)	Margin (dB)
914.85	-17.87	25.0	7.33	30.0	-22.7
921.25	-18.0	25.0	7.0	30.0	-23.0
927.85	-18.0	25.0	7.0	30.0	-23.0

Figure 33 Maximum Power Output

JUDGEMENT: Passed by 22.7 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 07.11.04

Typed/Printed Name: E. Pitt

11.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2004	1 year
Cable	Avnet	MTS	N/A	September 9, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 34 Test Equipment Used

12. Peak Power Output Out of 902-928 MHz Band

12.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through a 24dB attenuator (3 × 8 dB) and an appropriate coaxial cable. The spectrum analyzer was set to 3 kHz RBW for the frequency range 30 kHz to 150 kHz, 30 kHz RBW for the frequency range 150 kHz to 1.0 MHz, and 100 kHz RBW for the frequency range 1.0 MHz to 9.5 GHz. The frequency range from 30 kHz to 9.5 GHz was scanned. Level of spectrum components out of the 902-928 MHz was measured at the selected operation frequencies.

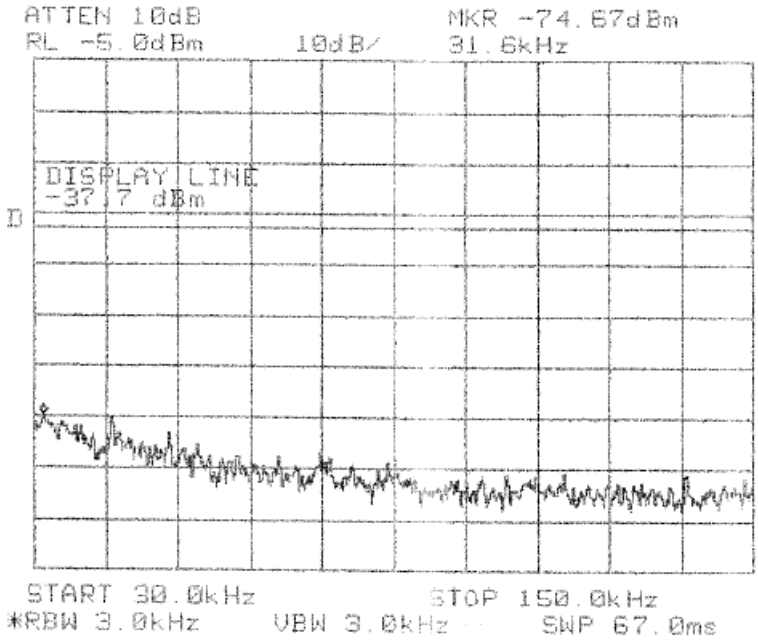


Figure 35.— 914.85 MHz

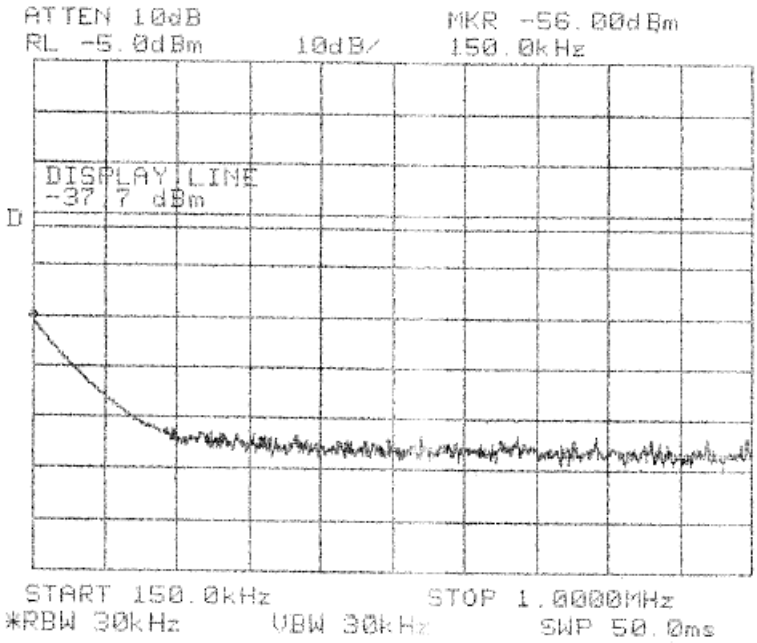


Figure 36.— 914.85 MHz

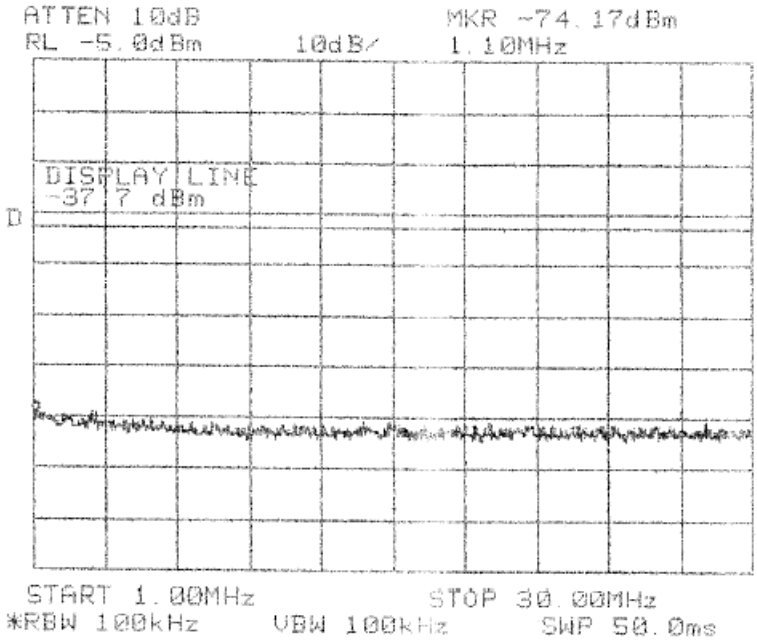


Figure 37.— 914.85 MHz

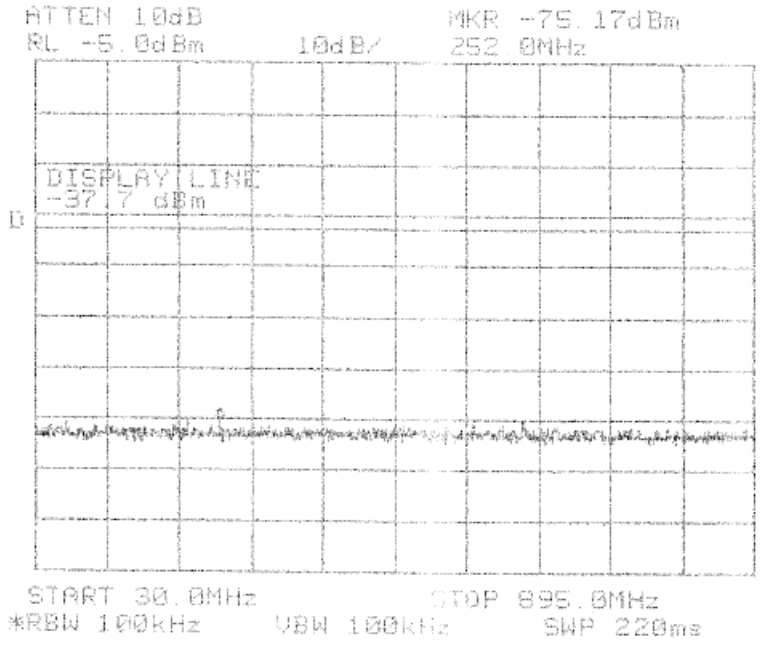


Figure 38.— 914.85 MHz

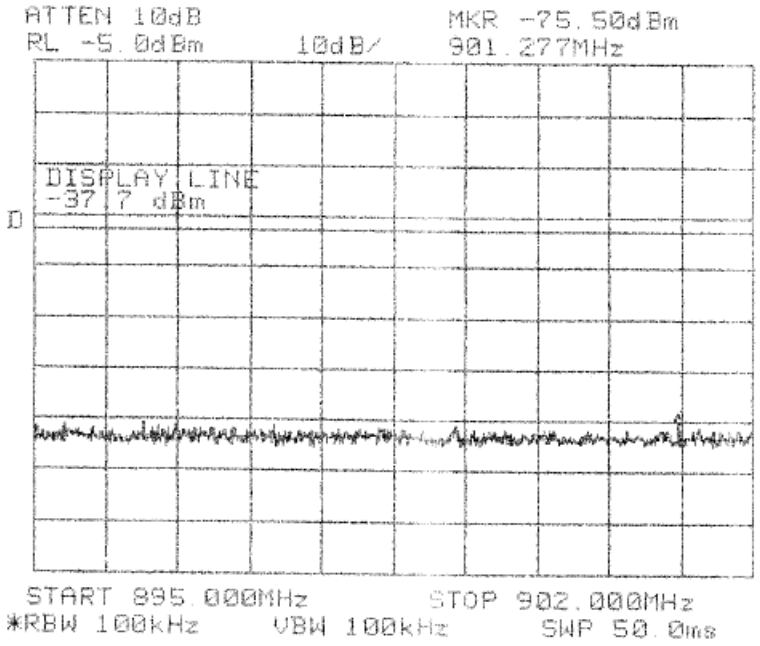


Figure 39.— 914.85 MHz

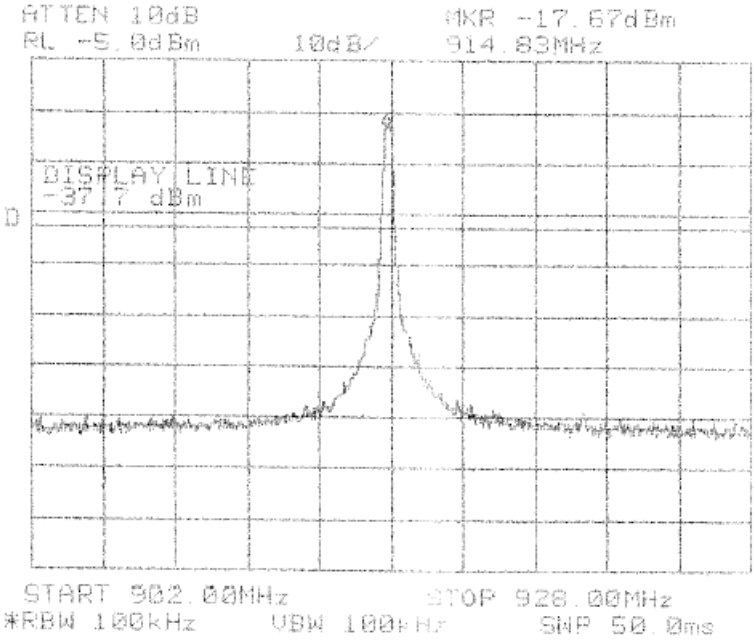


Figure 40.— 914.85 MHz

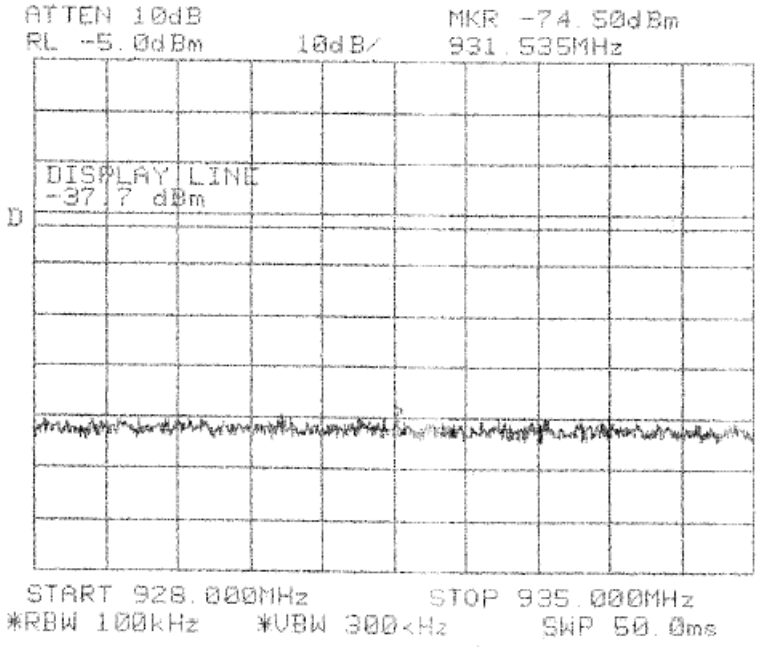


Figure 41.— 914.85 MHz

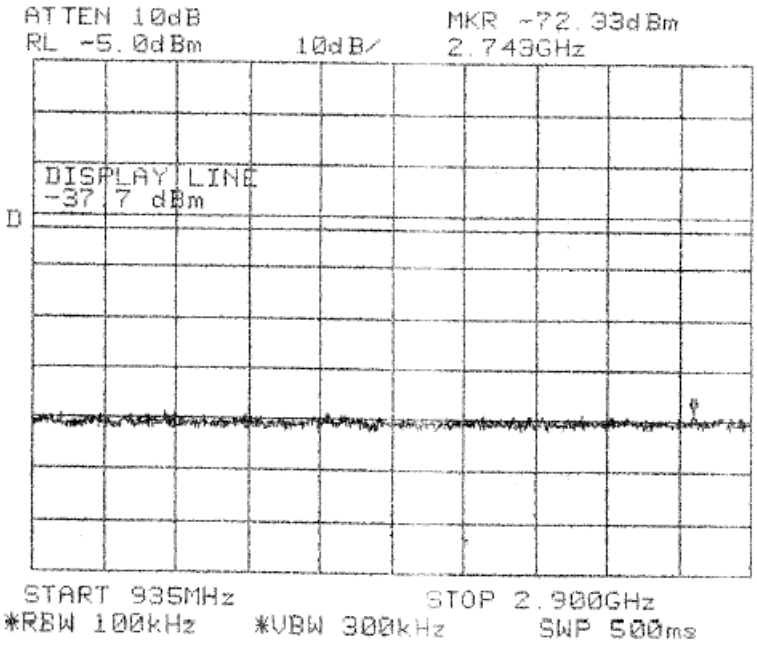


Figure 42.— 914.85 MHz

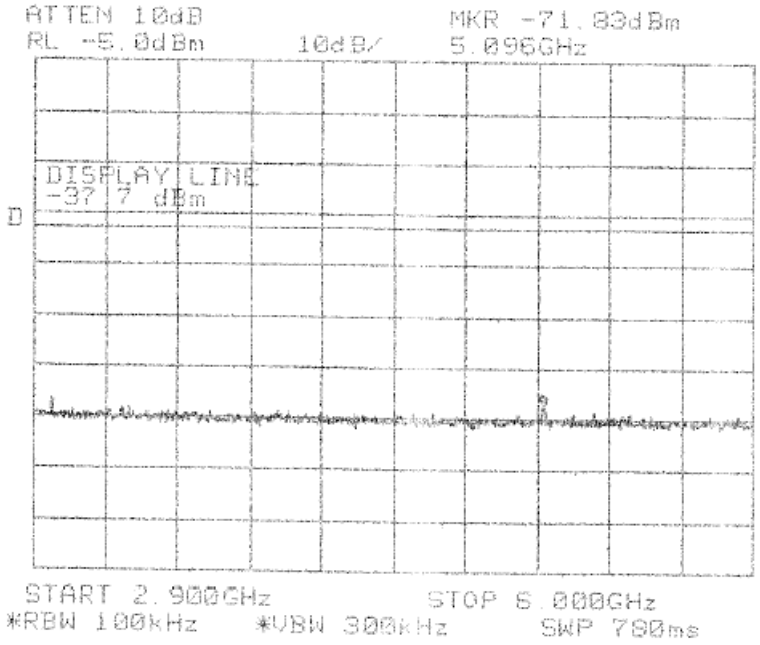


Figure 43.— 914.85 MHz

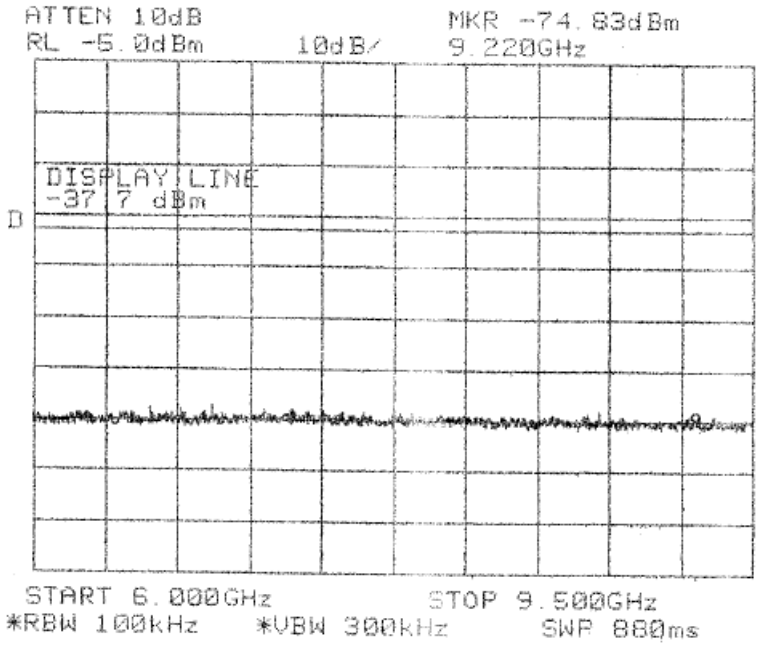


Figure 44.— 914.85 MHz

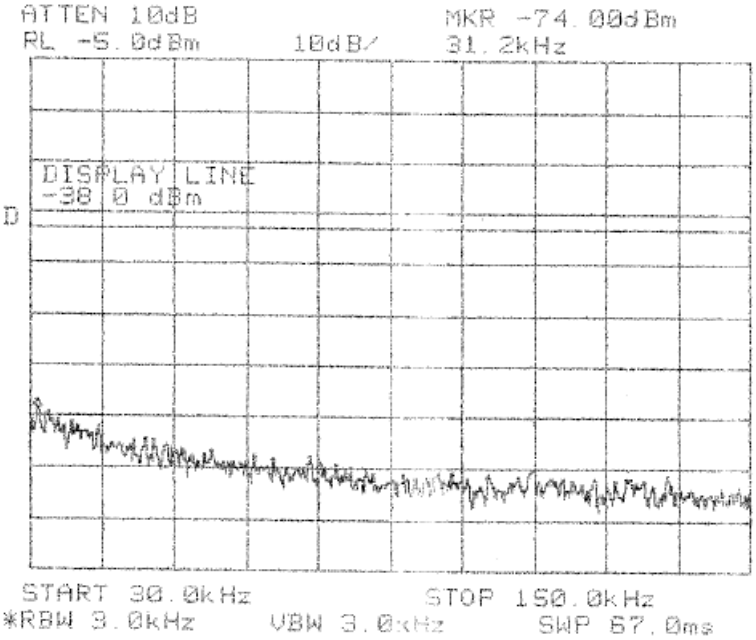


Figure 45.— 921.25 MHz

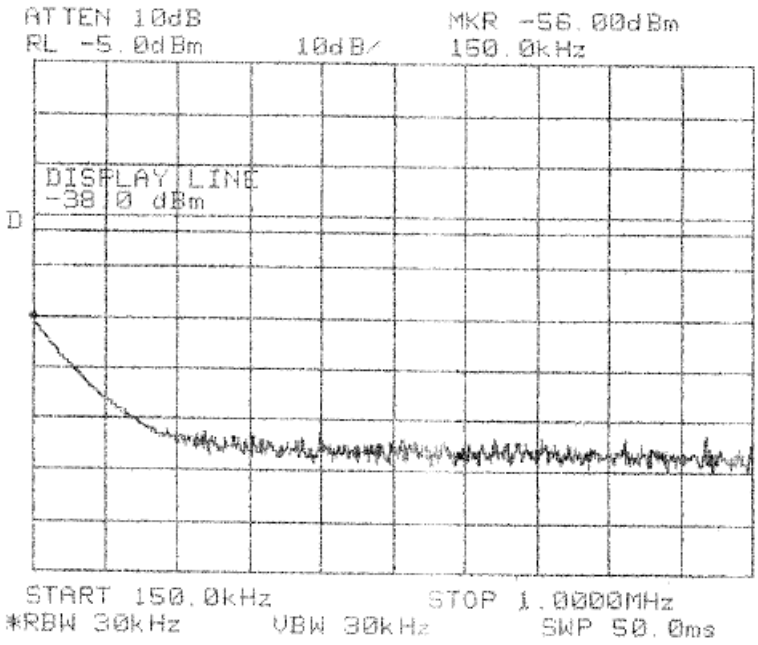


Figure 46.— 921.25 MHz

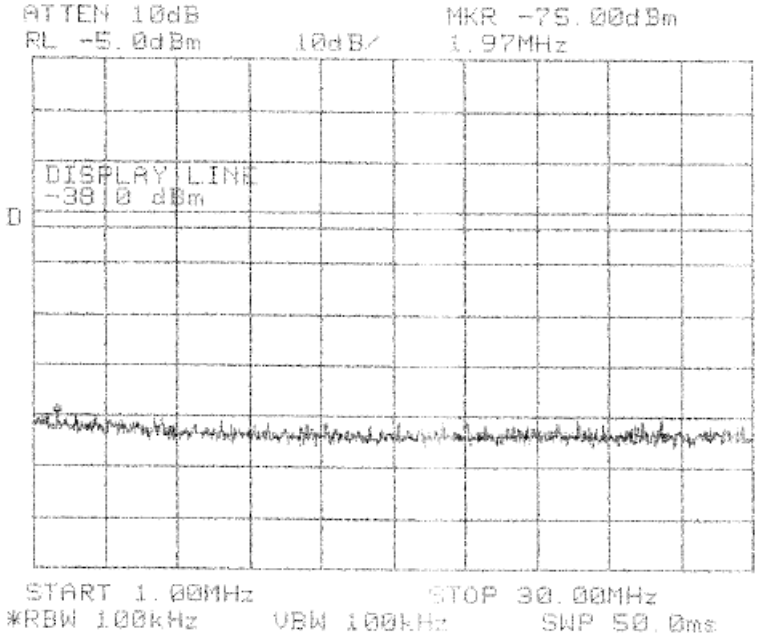


Figure 47.— 921.25 MHz

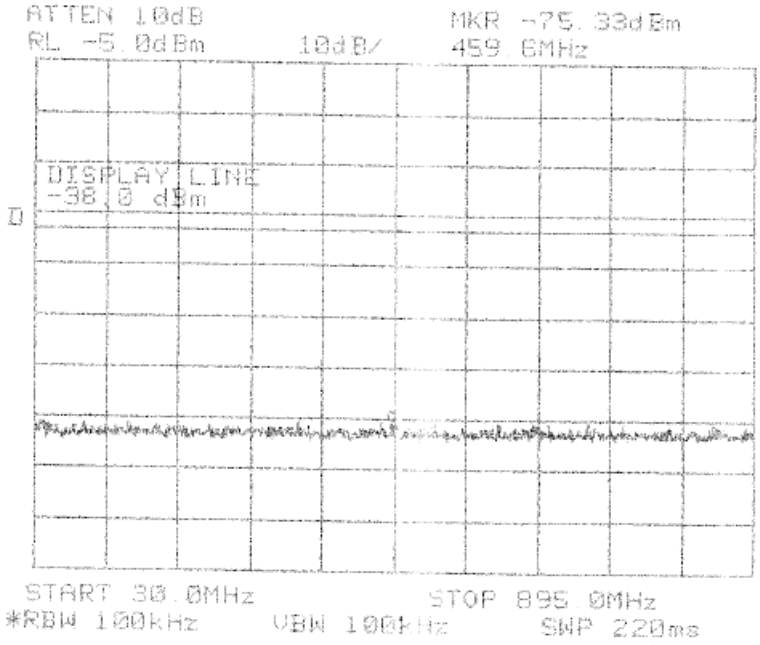


Figure 48.— 921.25 MHz

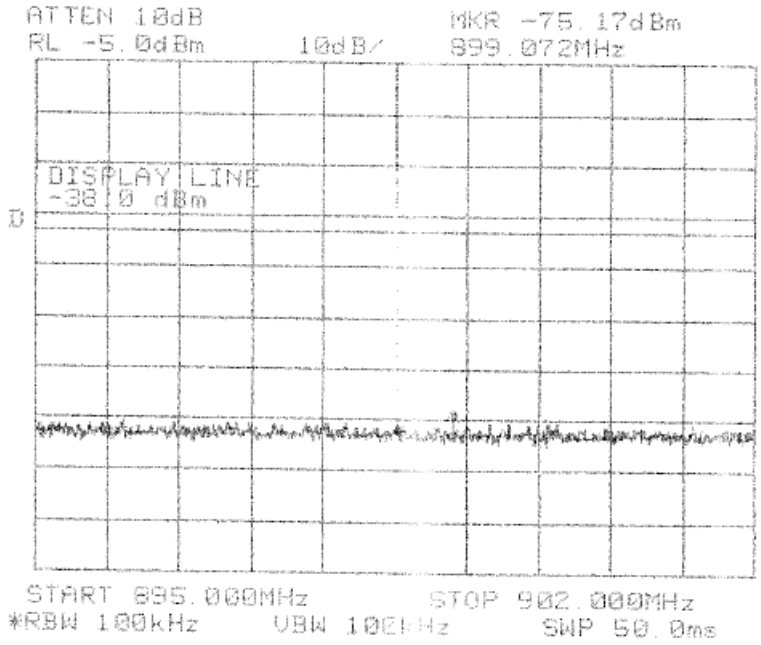


Figure 49.— 921.25 MHz

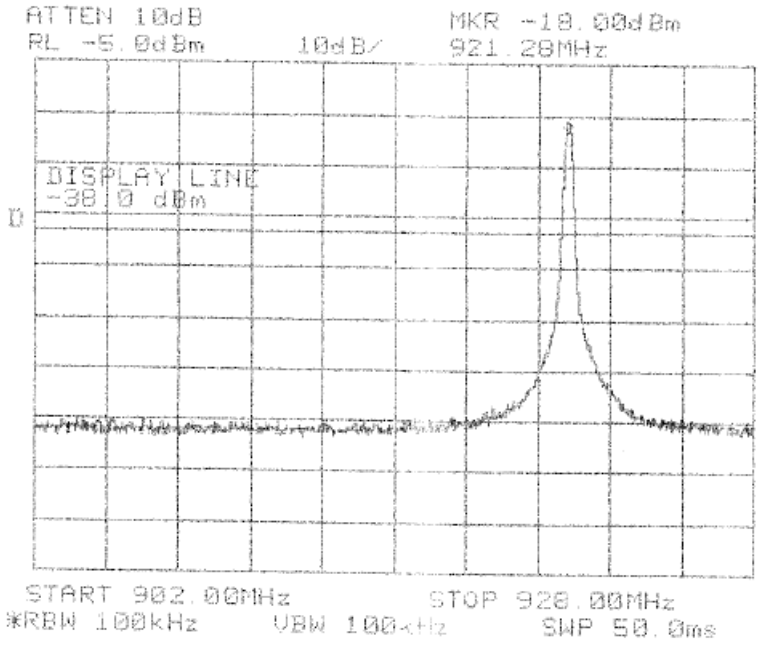


Figure 50.— 921.25 MHz

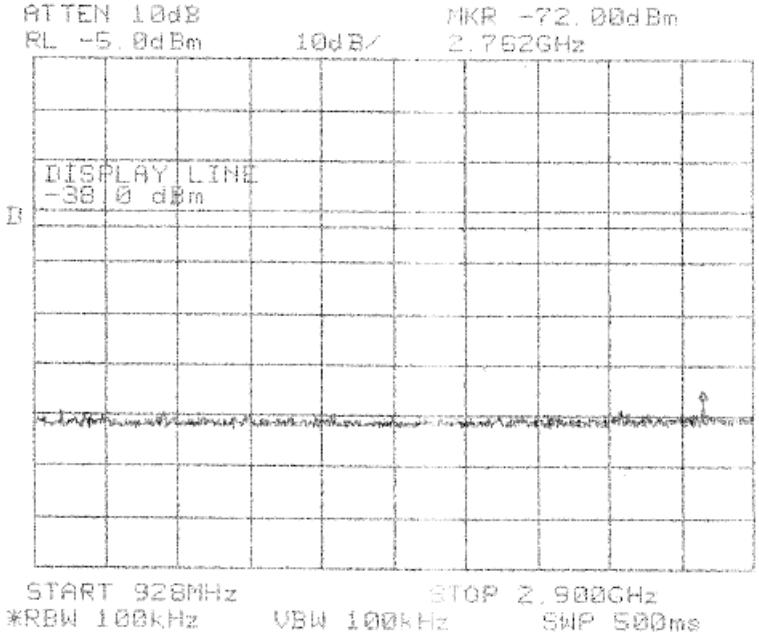


Figure 51.— 921.25 MHz

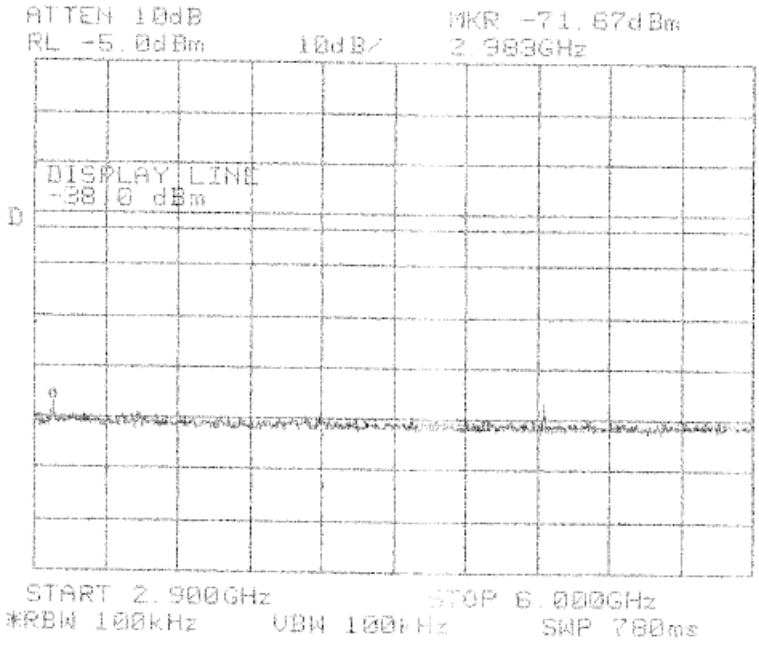


Figure 52.— 921.25 MHz

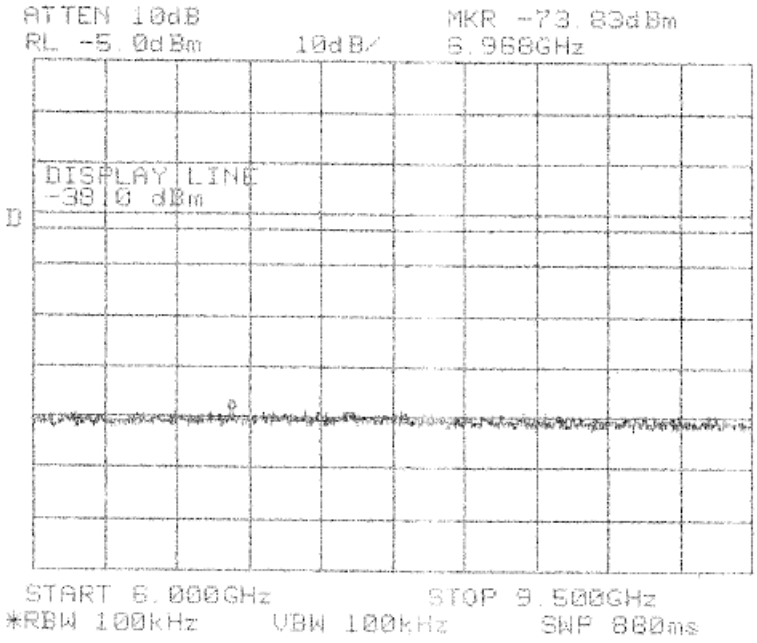


Figure 53.— 921.25 MHz

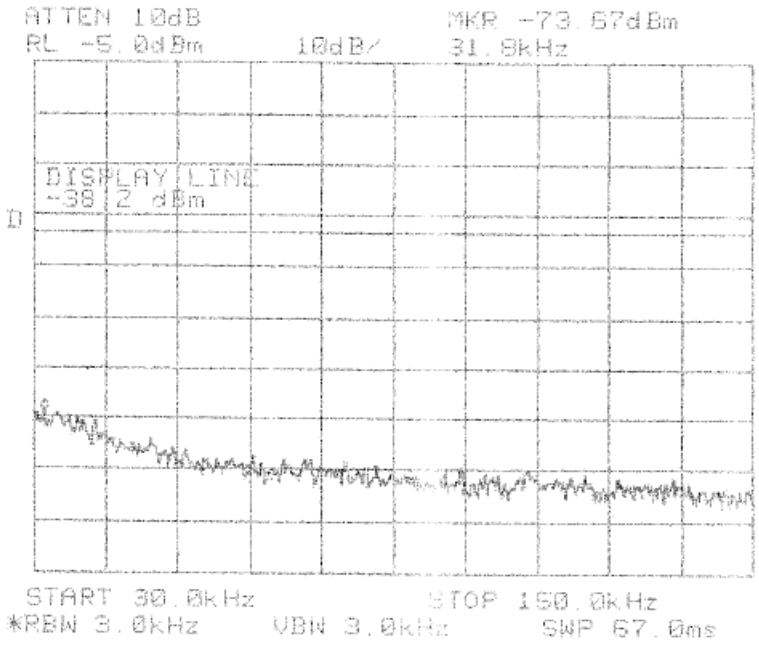


Figure 54.— 927.65 MHz

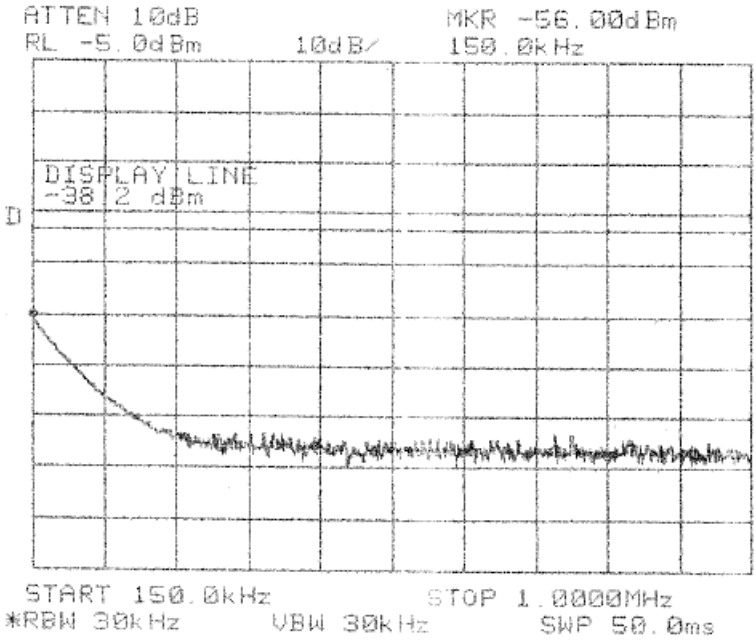


Figure 55.— 927.65 MHz

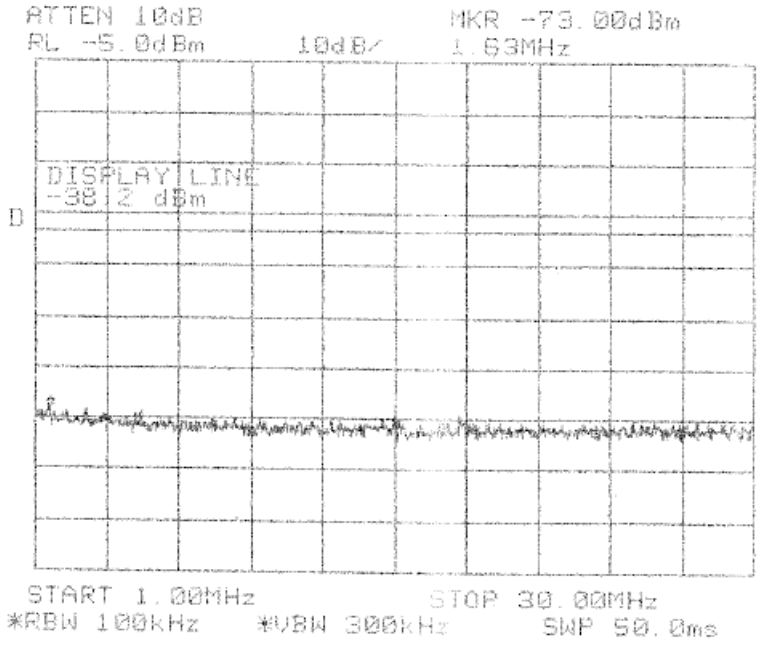


Figure 56.— 927.65 MHz

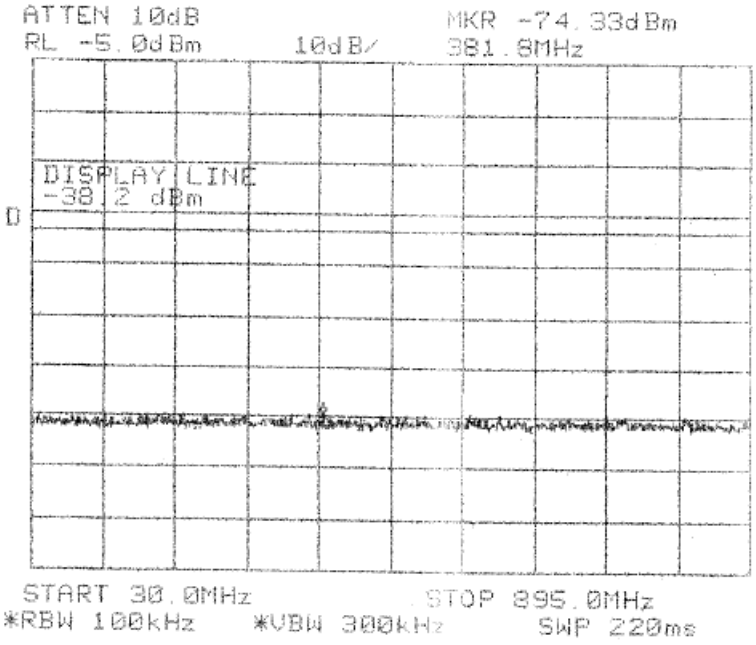


Figure 57.— 927.65 MHz

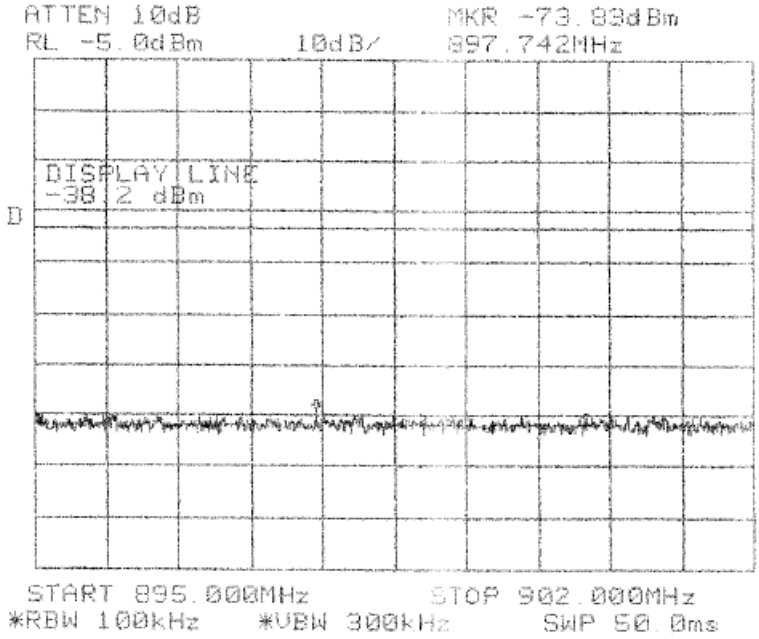


Figure 58.— 927.65 MHz

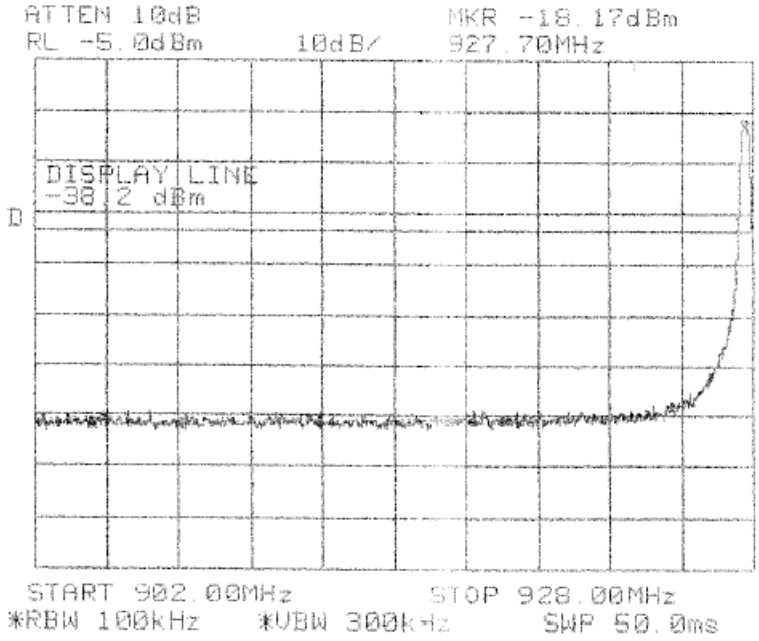


Figure 59.— 927.65 MHz

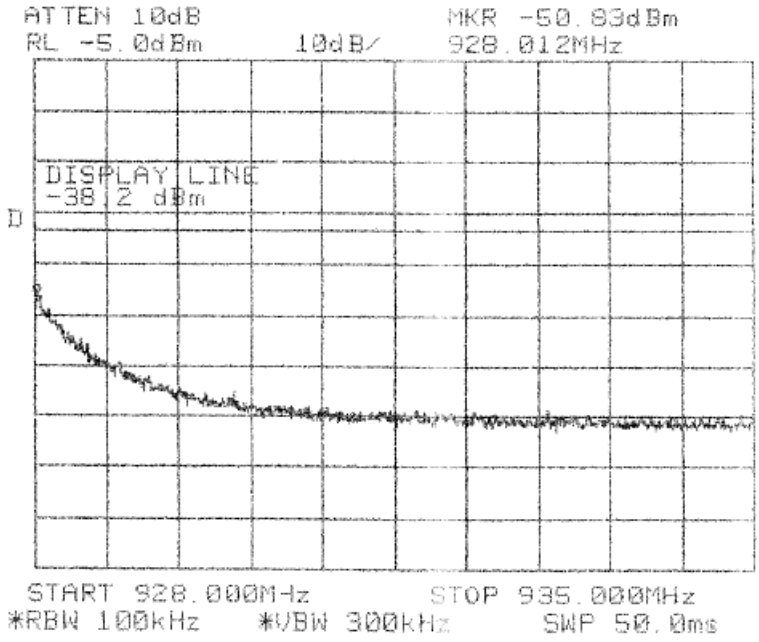


Figure 60.— 927.65 MHz

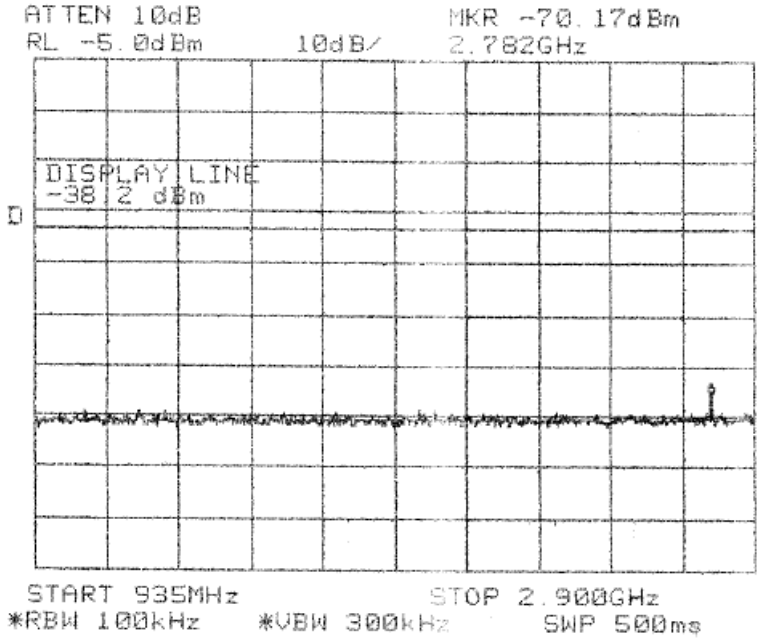


Figure 61.— 927.65 MHz

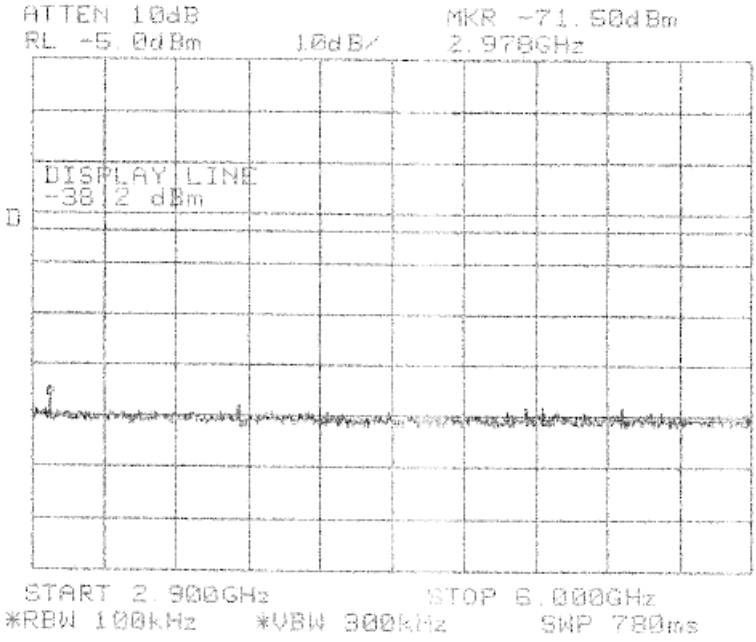


Figure 62.— 927.65 MHz

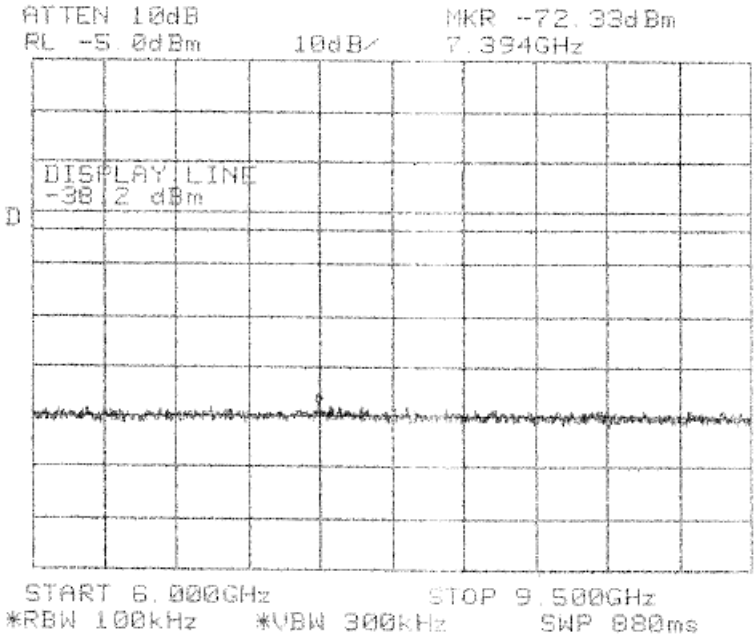


Figure 63.— 927.65 MHz

12.2 Results table

E.U.T. Description: RF Clock
Model No.: SAL-1BS-12R-1
Serial Number: 001
Specification: FCC Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading (dBc)	Specification (dBc)	Margin (dB)
914.85	38.30	20.0	18.30
921.25	38.00	20.0	18.00
927.65	32.63	20.0	12.63

Figure 64 Peak Power Output of 902-928 MHz Band

JUDGEMENT: Passed by 12.63 dB

TEST PERSONNEL:
Tester Signature: _____ Date: 07.11.04
Typed/Printed Name: E. Pitt

12.3 Test Equipment Used.

Peak Power Output Out of 902-928 MHz Band

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2004	1 year
Cable	Avnet	MTS	N/A	September 20, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 65 Test Equipment Used

13. 20 dB Bandwidth

13.1 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 a 24dB attenuator and an appropriate coaxial cable. The spectrum analyzer was set to 3 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 20 dB below maximum peak power was measured and recorded.

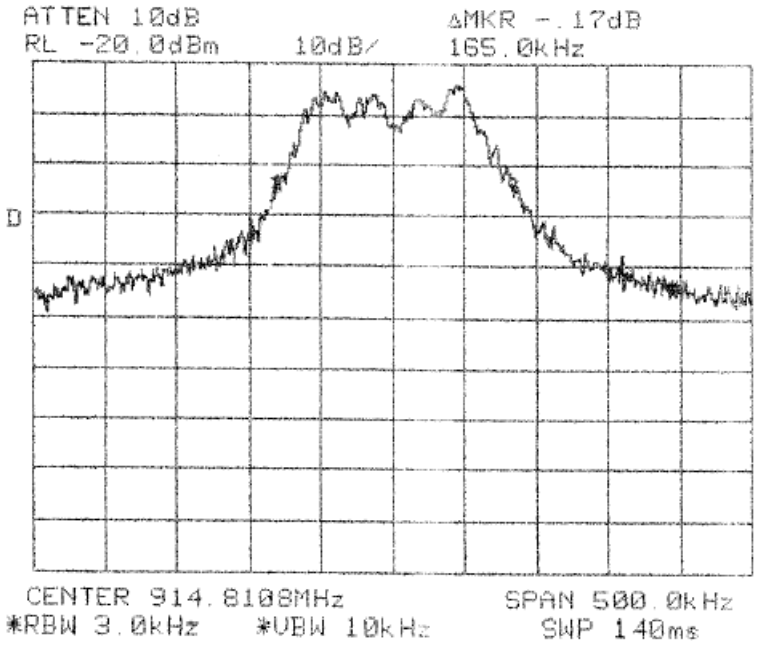


Figure 66 — 914.85 MHz

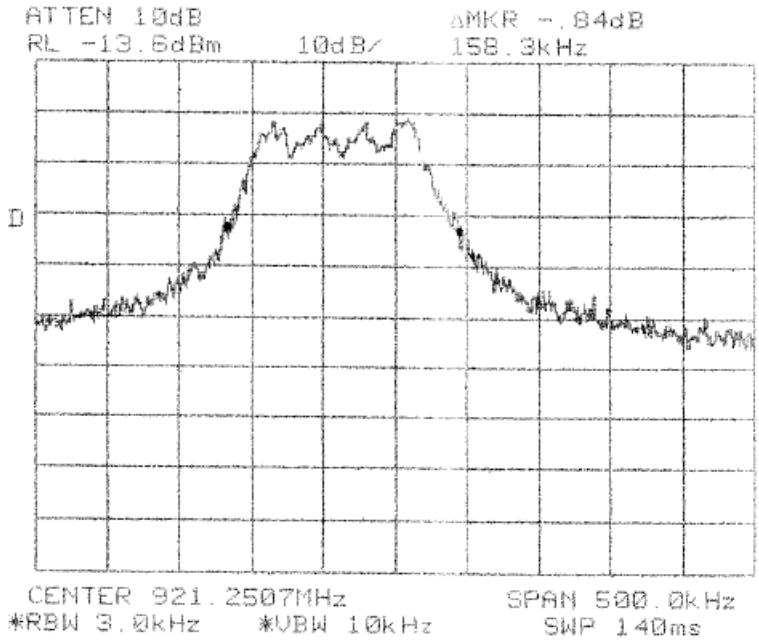


Figure 67 — 921.25 MHz

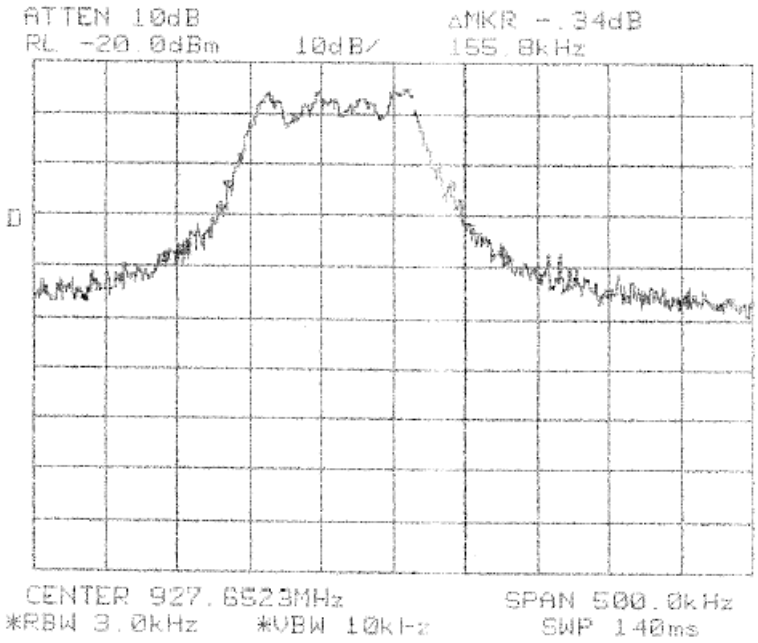


Figure 68 — 927.65 MHz

13.2 Results table

E.U.T. Description: RF Clock
Model No.: SAL-1BS-12R-1
Serial Number: 001
Specification: FCC Part 15, Subpart C (15.247-a2)

Operation Frequency (MHz)	Reading (kHz)	Specification (kHz)	Margin (kHz)
914.85	165.0	500	335.0
921.25	158.3	500	341.7
927.65	155.8	500	344.2

Figure 69 20 dB Bandwidth

JUDGEMENT: Passed by 335.0 kHz

TEST PERSONNEL:
Tester Signature: _____ Date: 07.11.04
Typed/Printed Name: E. Pitt

13.3 Test Equipment Used.

6 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2004	1 year
Cable	Avnet	MTS	N/A	September 20, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 70 Test Equipment Used

14. Antenna Gain

The gain of the antenna is +2 dBi.

15. R.F Exposure/Safety

The E.U.T. is a wall mounted, fixed installation. The typical distance between the E.U.T. and the general population in normal use is at least 0.5m.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) Considering the worst case FCC limit at the operating frequency of 921.25 MHz the FCC limit is:

$$S = \frac{921.25}{1500} = 0.61 \frac{mW}{cm^2}$$

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 given by:

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

P_t- Transmitted Power: +7.33dBm =5.4mW (max. measured power)

G_T- Antenna Gain: +2dBi = 1.6

R- Distance from Transmitter using 20cm worst case

(c) The peak power density is :

$$S_p = \frac{5.4x1.6}{4\pi(20)^2} = 1.7x10^{-3} \frac{mW}{cm^2}$$

(d) The duty cycle of transmission in actual worst case is 13.3msec within each 1min. (See Section 4.2 Theory of Operation).

The average power over 30 minutes is:

$$P_{AV} = \frac{5.4 \times 13.3}{1000} = 0.07mW$$

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

$$S_{AV} = \frac{0.07 \times 1.6}{4\pi(20)^2} = 2.2X10^{-5} \frac{mW}{cm^2}$$

(f) This is more than 5 orders of magnitude below the FCC limit.

16. APPENDIX A - CORRECTION FACTORS

16.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.5
20.0	0.7
30.0	1.0
40.0	1.2
50.0	1.3
60.0	1.5
70.0	1.6
80.0	1.7
90.0	1.8
100.0	1.9
150.0	2.4
200.0	2.7
250.0	3.0
300.0	3.3
350.0	3.7
400.0	4.0
450.0	4.3
500.0	4.7
600.0	4.9
700.0	5.4
800.0	5.8
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.5
1400.0	8.2
1600.0	9.0
1800.0	9.6
2000.0	10.7
2300.0	11.1
2600.0	11.8
2900.0	12.8

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".

16.2 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.

16.3 Correction factors for CABLE

from EMI receiver to test antenna

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.1
20.0	0.1
30.0	0.2
40.0	0.2
50.0	0.2
60.0	0.2
70.0	0.3
80.0	0.3
90.0	0.3
100.0	0.3
150.0	0.4
200.0	0.4
250.0	0.4
300.0	0.5
350.0	0.6
400.0	0.6
450.0	0.6
500.0	0.7
600.0	0.8
700.0	0.8
800.0	1.0
900.0	1.1
1000.0	1.1

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	1.4
1400.0	1.5
1600.0	1.5
1800.0	1.7
2000.0	1.7
2300.0	2.0
2600.0	2.1
2900.0	2.2

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 5.5 meters.

16.4 Correction factors for CABLE

from EMI receiver
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.

16.5 Correction factors for CABLE

from EMI receiver to test antenna at 10 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.6
20.0	1.1
30.0	1.3
40.0	1.6
50.0	1.7
60.0	1.9
70.0	2.0
80.0	2.2
90.0	2.3
100.0	2.4
150.0	3.1
200.0	3.6
250.0	4.2
300.0	4.5
350.0	4.8
400.0	5.2
450.0	5.5
500.0	6.2
600.0	6.4
700.0	7.0
800.0	7.5
900.0	8.1
1000.0	8.6

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	9.7
1400.0	10.5
1600.0	11.5
1800.0	12.6
2000.0	13.5
2300.0	14.3
2600.0	15.5
2900.0	16.4

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".

16.6 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	11.4
400.0	14.5
500.0	15.2
600.0	17.3
700.0	19.0
850.0	20.1
1000.0	22.2

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.2
400.0	14.4
500.0	15.2
600.0	17.2
700.0	19.0
850.0	20.1
1000.0	22.1

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.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".*

16.7 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".*

16.8 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".

16.9 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".*

16.10 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(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

17.11 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 29845
at 1 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.5	5.8	10.0	37.9	12.3
1.5	25.8	8.0	10.5	38.0	12.6
2.0	27.8	8.5	11.0	38.2	12.8
2.5	28.5	9.7	11.5	38.8	12.6
3.0	30.1	9.6	12.0	38.7	13.1
3.5	31.3	9.8	12.5	38.7	13.5
4.0	32.8	9.5	13.0	39.7	12.8
4.5	32.4	10.8	13.5	40.0	12.8
5.0	33.8	10.4	14.0	40.8	12.4
5.5	34.3	10.8	14.5	40.3	13.1
6.0	34.6	11.1	15.0	39.0	14.8
6.5	34.9	11.5	15.5	37.4	16.6
7.0	35.9	11.2	16.0	37.6	16.7
7.5	37.0	10.7	16.5	39.0	15.5
8.0	36.9	11.3	17.0	41.3	13.5
8.5	37.3	11.5	17.5	44.3	10.8
9.0	37.5	11.8	18.0	46.7	8.6
9.5	37.4	12.3			

17.12 Correction factors for Double-Ridged Waveguide Horn

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

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA 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			

17.13 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

17.14 Correction factors for BICONICAL ANTENNA

Type 3109,
1.0 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	11.1
30.0	12.0
40.0	12.0
50.0	11.4
60.0	10.3
70.0	10.7
80.0	8.3
90.0	9.0
100.0	10.0
110.0	11.6
120.0	13.6
130.0	14.2
140.0	13.5
150.0	12.7
160.0	12.7
170.0	13.6
180.0	15.3
190.0	14.6
200.0	14.7
210.0	15.3
220.0	15.8
230.0	17.0
240.0	18.0
250.0	18.1
260.0	18.0
270.0	17.5
280.0	18.2
290.0	19.7
300.0	21.8

NOTES:

1. Antenna serial number is 3244.

2. The above list is located in file 44BIC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver"

17.15. Correction factors for BICONICAL ANTENNA

Type 3109,
3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	18.4
30.0	14.0
40.0	12.3
50.0	10.6
60.0	8.3
70.0	8.7
80.0	7.2
90.0	8.6
100.0	10.1
110.0	11.2
120.0	11.8
130.0	12.3
140.0	12.7
150.0	12.5
160.0	12.4
170.0	12.1
180.0	12.2
190.0	12.8
200.0	13.7
210.0	14.5
220.0	15.4
230.0	15.9
240.0	16.3
250.0	16.7
260.0	17.1
270.0	17.2
280.0	17.5
290.0	18.1
300.0	18.9

NOTES:

1. Antenna serial number is 3244.

2. The above list is located in file 44BIC3M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver"

17. APPENDIX B – Additional Models

In addition to the AC Model SAL-1BS-12R-1 which was fully tested, the additional AC model and DC models to be covered under this application (by agreement with the FCC and the TCB, (See Appendix C correspondence)) are:

Model: SAL-1BS-16R-1 (AC) 16”

This clock is the same as SAL-1BS-12R-1 except the size of the case is 16" instead 12".

Model: SAL-1BS-12R-0 (DC) 12”

Model: SAL-1BS-16R-0 (DC) 16”

The difference between the: SAL Series, 16” Battery Operated, Part # SAL-1BS-16R-0 and the: SAL Series, 12” Battery Operated, Part # SAL-1BS-12R-0 is the size of the case and crystal and hands of the clock.
It is either 12" or 16" diameter.

The case is made of Smooth surface ABS. The crystal is made of side molded polycarbonate.

All models use the same schematics.

18. APPENDIX C - Correspondence

Date: 03/06/04
From: Lior [lior@roseman.co.il]
To: EMC
Subject: Fw: question about spurious emmision
Shalom,
Attached the answer from fcc.
As you can see, we have to test the power supply version only.
regards
Lior Yehoshua
Chief Engineer
Roseman Engineering Ltd.
Tel : 972-3-5731801
Fax : 972-3-5731807

----- Original Message ----- **From:** LabHelp
To: Lior
Sent: Wednesday, June 02, 2004 5:55 PM
Subject: RE: question about spurious emmision

QUESTION:
We have a frequency hopping, spread spectrum transmitter operating in the 915-928MHz range, 10dBm power output. The transmitter has two configurations that differ only by the operating voltage source:
One is battery operated and the other is operated via an AC/DC adapter. All other electronics/RF/Digital Circuitry is the same (same PCB). Could the spurious radiated emission testing be done only for the AC/DC version ? (Under the assumption that the battery operated version does not produce more emmision than the AC/DC version)

ANSWER:
Yes, the spurious radiated emissions testing may be done only with the AC/DC version of the transmitter since this is the fully configured system, and theoretically, may be the worse case scenario since conducting wires are connected that may act as an antenna.

Date: 21/10/04
From: Lior [lior@roseman.co.il]
To: EMC
Subject: Re: FCC ID # Certification for RF Clock
David,
The model number are:

SAL Series, 16" Battery Operated ,Part # SAL-1BS-16R-0

SAL Series, 12" Battery Operated Part # SAL-1BS-12R-0

Battery Type:

(2) D cell batteries (recommended battery type: Duracell PROCELL; can be purchased through Sapling (Part # SBATT-100-000-0).

lior

----- Original Message ----- **From:** Emc
To: Lior Yehoshua (E-mail)
Sent: Thursday, October 21, 2004 10:24 AM
Subject: FW: FCC ID # Certification for RF Clock
Lior shalom,
As you can see from the TCB reply I need to include details of the battery configuration in the test report.
Please send A.S.A.P.
Is there a different label? The FCC Identifier can remain the same but I certainly need the model no. etc.
Regards
David Shidlowsky
Technical Writer
EMC Laboratory
ITL (Product Testing) Ltd.
Kfar Bin Nun
Israel
Tel: +972-8-9797799
Fax: +972-8-9797702
Email: davids@itl.co.il/emc@itl.co.il
http://www.itl.co.il
http://www.i-spec.com

-----Original Message-----
From: Sid Sanders [mailto:sid@timco.cc]
Sent: Thursday, October 21, 2004 12:33 AM
To: Emc
Cc: Gretchen Torres
Subject: RE: FCC ID # Certification for RF Clock

21 Oct 2004

David,

If both products are going to be sold then yes include both products & both products will have to be labeled with the FCC Identifier. Include them in the Test report.

Regards,

Sid

-----Original Message-----
From: Emc [mailto:emc@itl.co.il]
Sent: Wednesday, October 20, 2004 6:12 AM
To: Sid Sanders (E-mail)
Subject: FW: FCC ID # Certification for RF Clock
-----Original Message-----

From: Emc
Sent: Wednesday, October 20, 2004 10:10 AM
To: Sid Sanders (E-mail)
Subject: FCC ID # Certification for RF Clock

Dear Mr. Sanders,

Due to minor problems with our customer understanding fully our requests for certain documents, we are finally almost ready to submit his first application via TIMCO.

The subject RF clock's transmitter has 2 configurations, 1 powered from a battery, and the other from an AC/DC adapter.

According to correspondence with the FCC (attached) <<Fw: question about spurious emmision>> , only the configuration using the AC/DC adapter was tested.

Should we include details of the battery operated configuration in the test report (model name, battery type etc) or just include them in a separate document.

Please detail what other information you need for the battery configuration.

We understand from the FCC correspondence that both configurations can use the same FCC ID #.

Regards
David Shidlowsky
Technical Writer
EMC Laboratory
ITL (Product Testing) Ltd.
Kfar Bin Nun
Israel
Tel: +972-8-9797799
Fax: +972-8-9797702
Email: davids@itl.co.il/emc@itl.co.il

http://www.itl.co.il
http://www.i-spec.com

From: Lior [mailto:lior@roseman.co.il]
Sent: Monday, October 25, 2004 3:49 PM
To: Emc
Subject: sal series, difference between 12" and 16"

Shalom,
The difference between the: SAL Series, 16” Battery Operated,
Part # SAL-1BS-16R-0 and the: SAL Series, 12” Battery Operated,
Part # SAL-1BS-12R-0 is the size of the case and cristal and hands of the clock.
It is either 12" or 16" diameter.
The case is made of Smooth surface ABS. The cristal is made of side molded polycarbonate.
Lior Yehoshua
Chief Engineer
Roseman Engineering Ltd.
Tel : 972-3-5731801
Fax : 972-3-5731807

From: Sid Sanders [sid@timco.cc]
Sent: Thursday, October 26, 2004
To: EMC
Subject: RE: sal series, difference between 12" and 16"

26 October 2004

David,

Can you send me photo of pbth units?

Thanks,

Sid

-----Original Message-----

From: Emc [mailto:emc@itl.co.il]
Sent: Tuesday, October 26, 2004 3:15 AM
To: Sid Sanders (E-mail)
Subject: FW: sal series, difference between 12" and 16"

Ref: Your email from 21 October 2004

Hi Sid,

Our customer "woke up" and decided to mention to us that the battery operated configuration also has a 16" clock face and body in addition to the 12" unit that was proposed to include in the FCC ID # Certification along with the AC version.

Will you accept also the 16" version under this FCC ID # Certification application or do I need to refer this question to LabHelp.

Regards

David Shidlowsky
Technical Writer
EMC Laboratory
ITL (Product Testing) Ltd.
Kfar Bin Nun
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Fax: +972-8-9797702
Email: davids@itl.co.il/emc@itl.co.il

http://www.itl.co.il
http://www.i-spec.com

From: Sid Sanders [sid@timco.cc]
Sent: Thursday, October 26, 2004
To: EMC
Subject: RE: sal series, difference between 12" and 16"

26 October 2004

David,

If the schematics are the same & only difference is the size of the clock face, then they can be approved under a single FCCID.

Regards,

Sid

-----Original Message-----
From: Emc [mailto:emc@itl.co.il]
Sent: Tuesday, October 26, 2004 3:15 AM
To: Sid Sanders (E-mail)
Subject: FW: sal series, difference between 12" and 16"

Ref: Your email from 21 October 2004

Hi Sid,

Our customer "woke up" and decided to mention to us that the battery operated configuration also has a 16" clock face and body in addition to the 12" unit that was proposed to include in the FCC ID # Certification along with the AC version.

Will you accept also the 16" version under this FCC ID # Certification application or do I need to refer this question to LabHelp.

Regards

David Shidlowsky
Technical Writer
EMC Laboratory
ITL (Product Testing) Ltd.
Kfar Bin Nun
Israel
Tel: +972-8-9797799
Fax: +972-8-9797702
Email: davids@itl.co.il/emc@itl.co.il

http://www.itl.co.il
http://www.i-spec.com

Date: 31/10/04
From: Lior [lior@roseman.co.il]
To: EMC
Subject: Fw: Corrected Names Declaration
Shalom David,
Attached the photos of the 16" ac clock, SAL-1BS-16R-1.
This clock is the same as SAL-1BS-12R-1 exept the size of the case is 16" instead 12".
lior

From: Emc
Sent: 03/11/04 16:20
To: Sid Sanders
Subject: SAL Series AC/DC 12" and 16" Clocks-Part 3
Hi Sid,
1. We were informed late Thursday (here in Israel our work week is Sunday-Thursday) before leaving for the weekend that the AC model is also made in 16" clock face.
2. All models use the same electrical schematics.
3. I apologize for all of this but we were informed of the 16" models at the last minute so I couldn't send the application last week. I hope that this is the last of any unforeseen items.
Regards
David Shidlowsky
Technical Writer
EMC Laboratory
ITL (Product Testing) Ltd.
Kfar Bin Nun
Israel
Tel: +972-8-9797799
Fax: +972-8-9797702
Email: davids@itl.co.il/emc@itl.co.il

http://www.itl.co.il
http://www.i-spec.com

From: Sid Sanders
Sent: 03/11/04 17:25
To: EMC
Subject: RE: SAL Series AC/DC 12" and 16" Clocks-Part 3
3 November 2004

David,

They can both be certified on one grant of certification with both models being listed on the grant. It is no problem because It is better to get it correct before we issue the grant.

FYI, we are starting a customer service Instant Messenger on MSN & the contact name is “TEICUSTSERVICE”.

Regards,

Sid