

Radio Test Report: 99393321

Applicant: Samsung Electro-Mechanics Co., LTD.
314, Maetan 3-Dong, Paldal-Gu, Suwon, Gyunggi-Do
Suwon
Korea

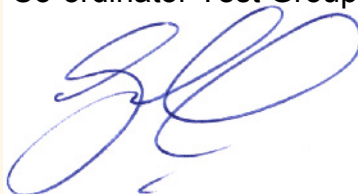
Equipment Under Test: SWL-2300U Direct Sequence Spread Spectrum
(E.U.T.) Transceiver

FCC ID: E2XSWL-2300U

In Accordance With: **FCC Part 15, Subpart C (10-1-02 Edition)**
Direct Sequence Transmitters
2400 - 2483.5 MHz

Tested By: Telefication bv
Edisonstraat 12A
6902 PK Zevenaar

Authorized By: J.P. van de Poll
Co-ordinator Test Group



Date: 15 July 2003

Total Number of Pages: 43

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EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 1 Summary of Test Results

Manufacturer: Samsung Electro-Mechanics Co.,LTD
Model No.: SWL-2300U
Serial No.: Not applicable
Date Received In Laboratory: 5 June 2003

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.247 for Direct Sequence Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-1992

<input checked="" type="checkbox"/>	New Submission	<input checked="" type="checkbox"/>	Production Unit			
<input type="checkbox"/>	Class II Permissive Change	<input type="checkbox"/>	Pre-Production Unit			
<table border="1"><tr><td>D</td><td>T</td><td>S</td></tr></table>	D	T	S	Equipment Code	<input type="checkbox"/>	Family Listing
D	T	S				


THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE
TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".



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TESTED BY:  DATE: 15 July 2003
ing. P.A. Suringa, Senior engineer Radio/EMC

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EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
Powerline conducted emissions	15.207(a)	64 dB μ V	40.7 dB μ V	Complies
Minimum 6 dB bandwidth	15.247(a)(2)	500 kHz	12.7 MHz	Complies
Maximum Peak Power Output	15.247(b) (3)	1 Watt	20.3 dBm E.I.R.P.	Complies
Peak Power Spectral Density	15.247(d)	8 dBm/3 kHz	-19 dBm	Complies
Spurious Emissions (Radiated)	15.247(c)	> 20 dB below fundamental	> 20 dB	Complies

Test Conditions:**Indoor**

Temperature: 22 °C
Humidity: 45 %

EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 2 Equipment Under Test (E.U.T.)

General Equipment Information

Equipment class	Class B digital device (computer peripheral)
Type of equipment	Data transmission equipment in the 2.4 GHz ISM band using spread spectrum techniques
Frequency Range:	2412 – 2462 MHz
Number of Channels:	11
Emissions Designator:	22M0G1D

EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver

FCC ID: E2XSWL-2300U

Description of Modification for Modification Filing

Not applicable

Family List Rationale

Not applicable

EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver

FCC ID: E2XSWL-2300U

Theory of Operation

The SWL-2300U is a spread spectrum direct sequence transceiver and is designated for operation in the frequency band of 2412 – 2462 MHz.

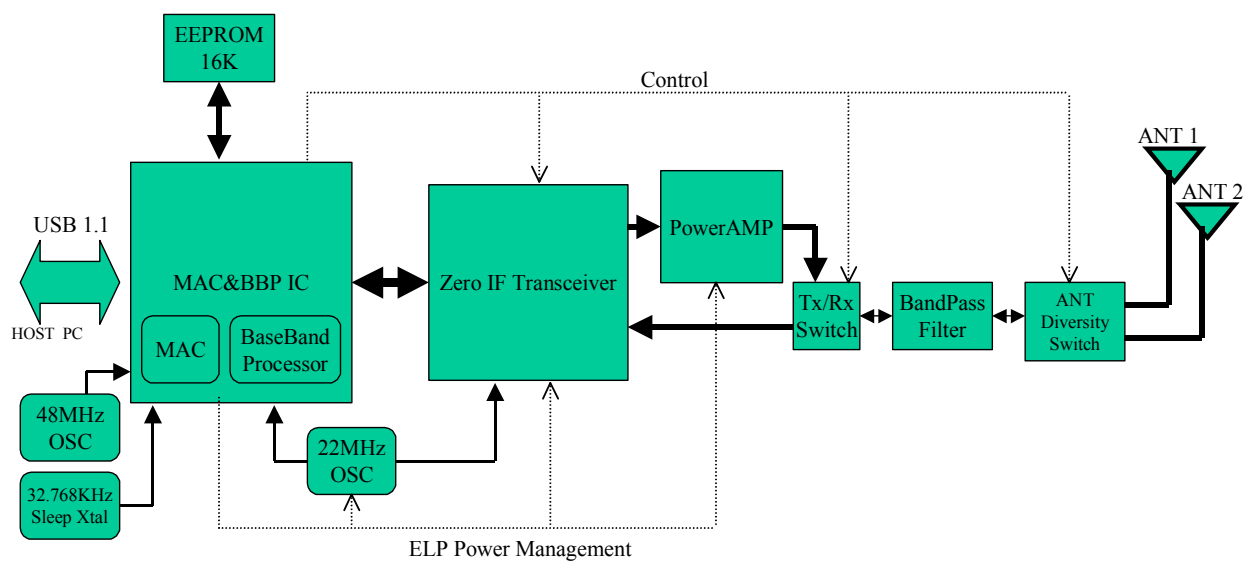
The equipment is a computer peripheral intended to be connected to the PC's USB port.

The equipment is provided with an integral antenna.

EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Block diagram

SWL-2300U Samsung MagicLAN USB Adapter Block Diagram



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 3 Powerline conducted emissions

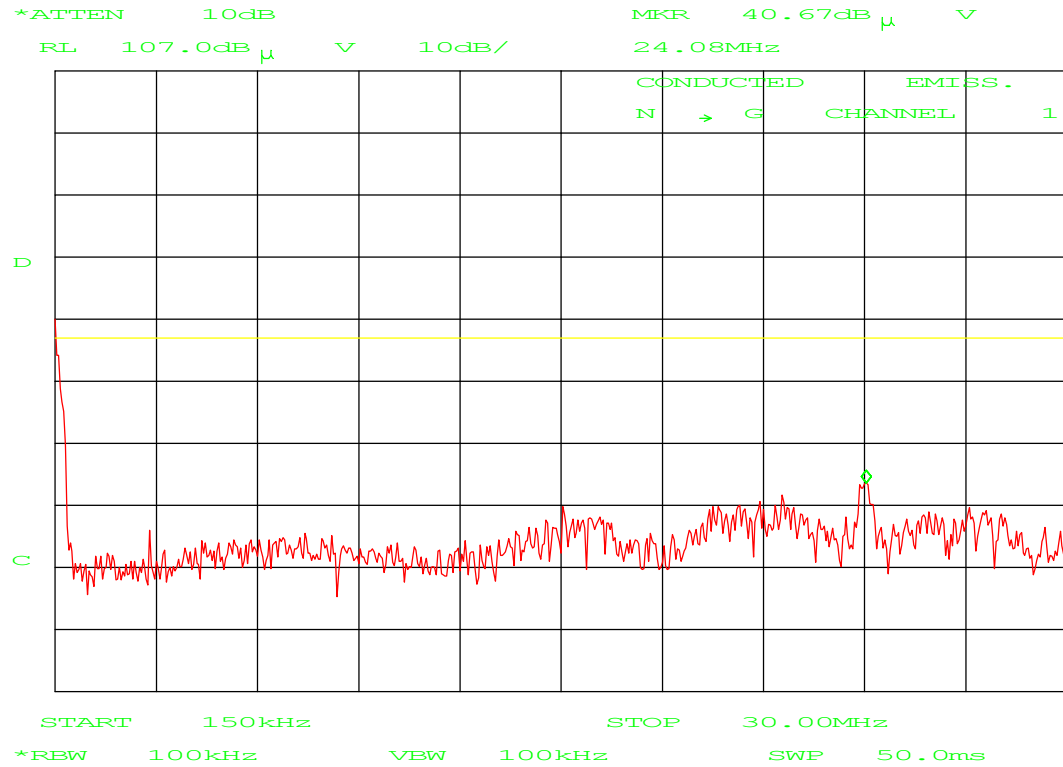
Test Results: Complies.

Measurement Data: See attached graphs

Equipment used: Toshiba notebook computer model satellite 4070 CDT with AC adaptor model PA 2450U

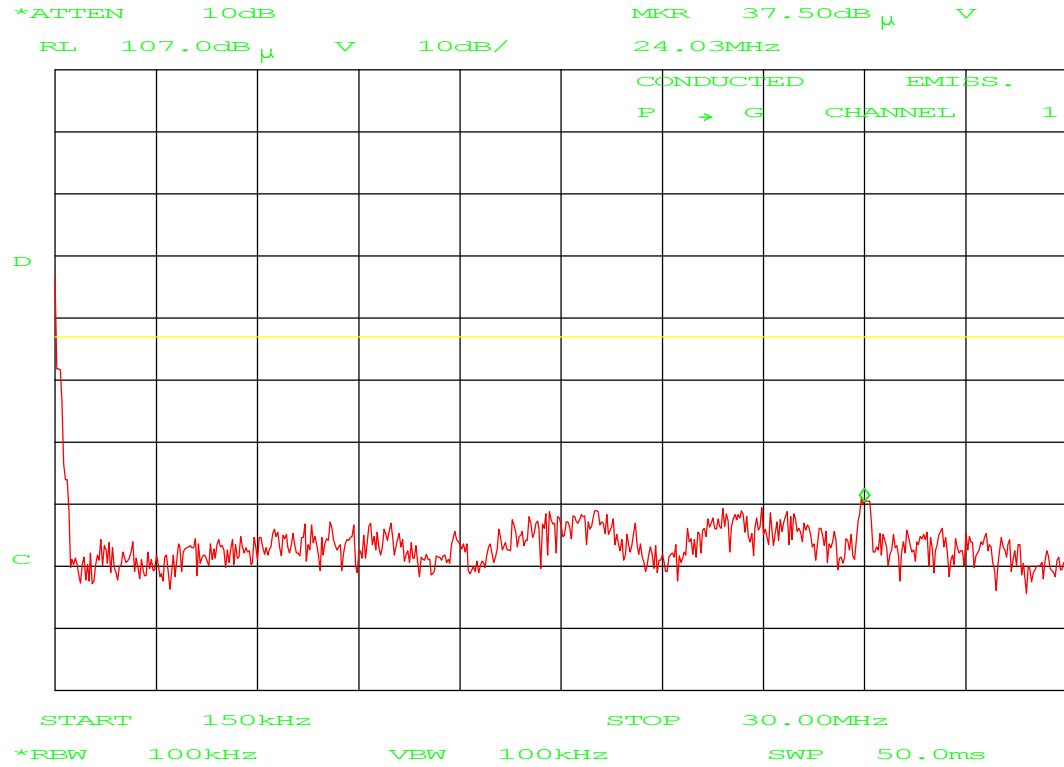
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 1: Neutral to ground



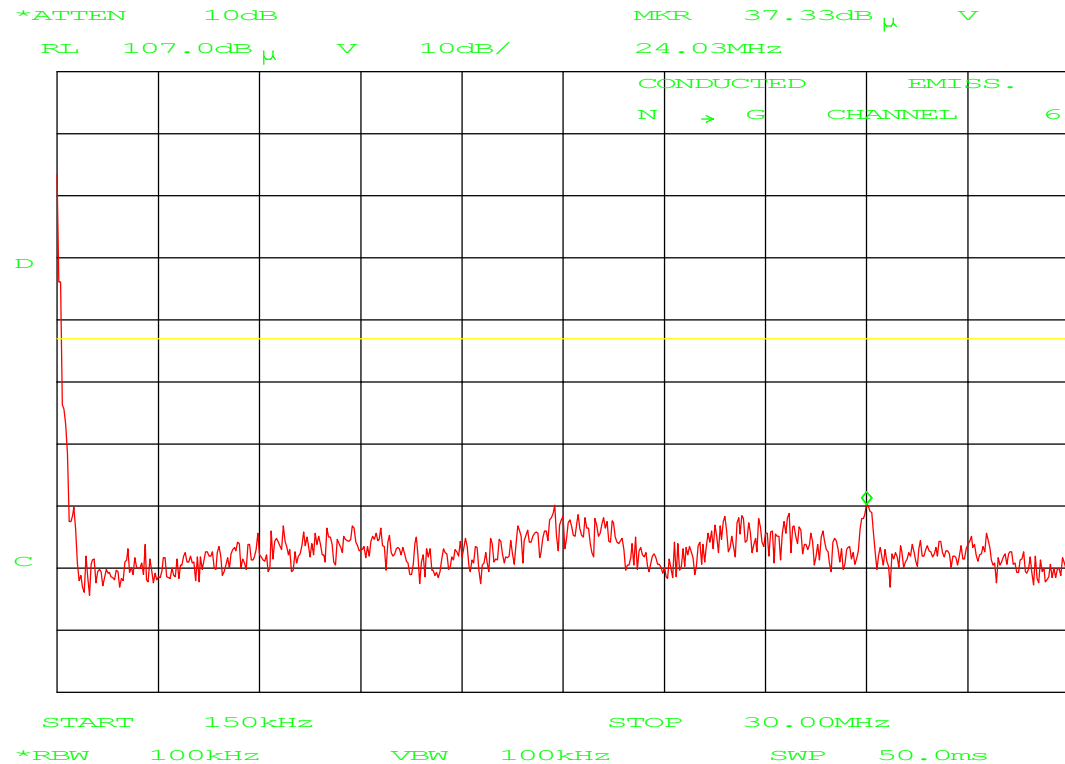
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 1: Phase to ground



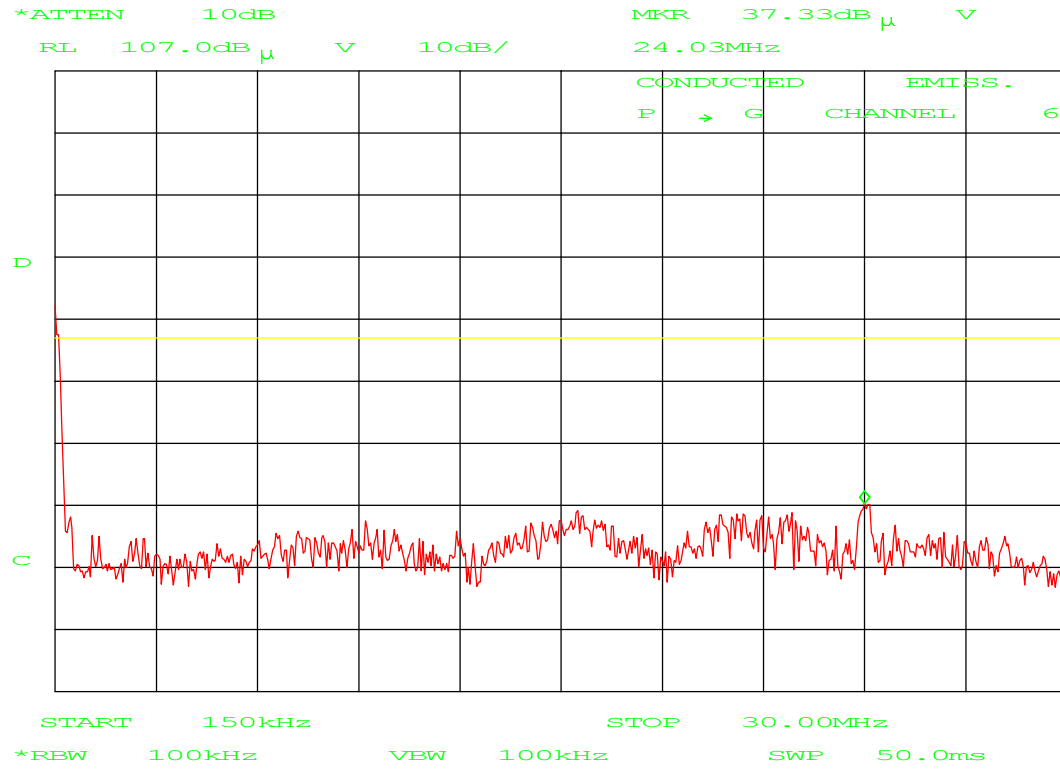
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 6: Neutral to ground



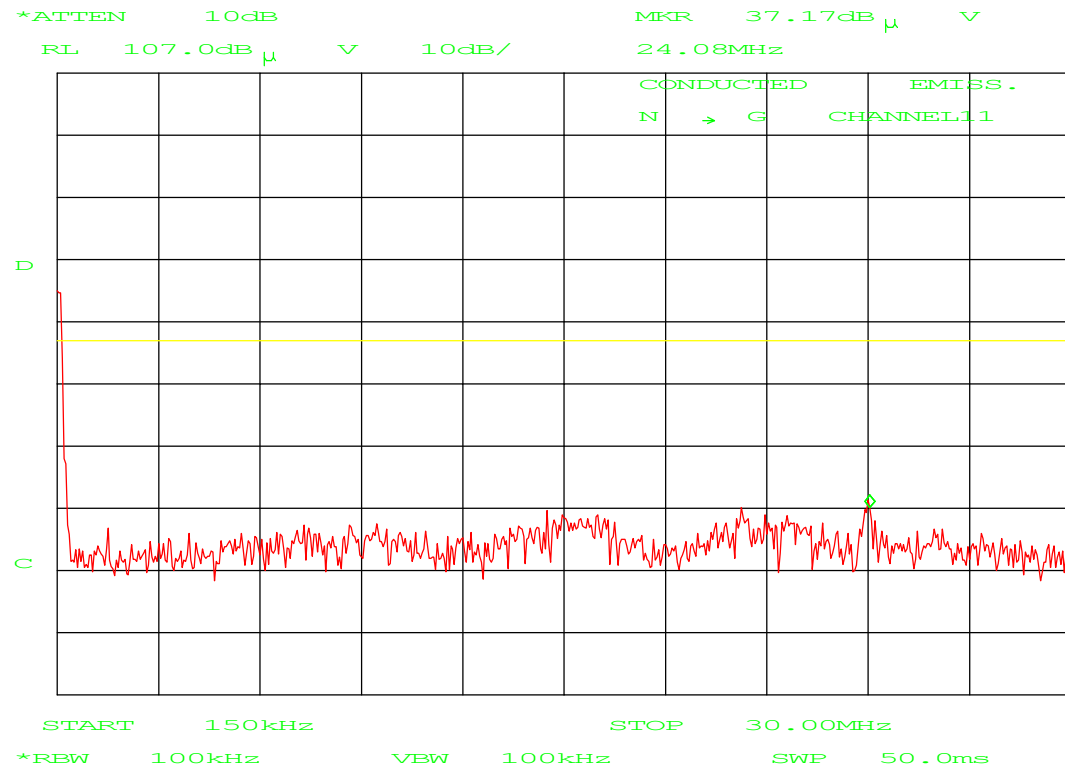
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 6: Phase to ground



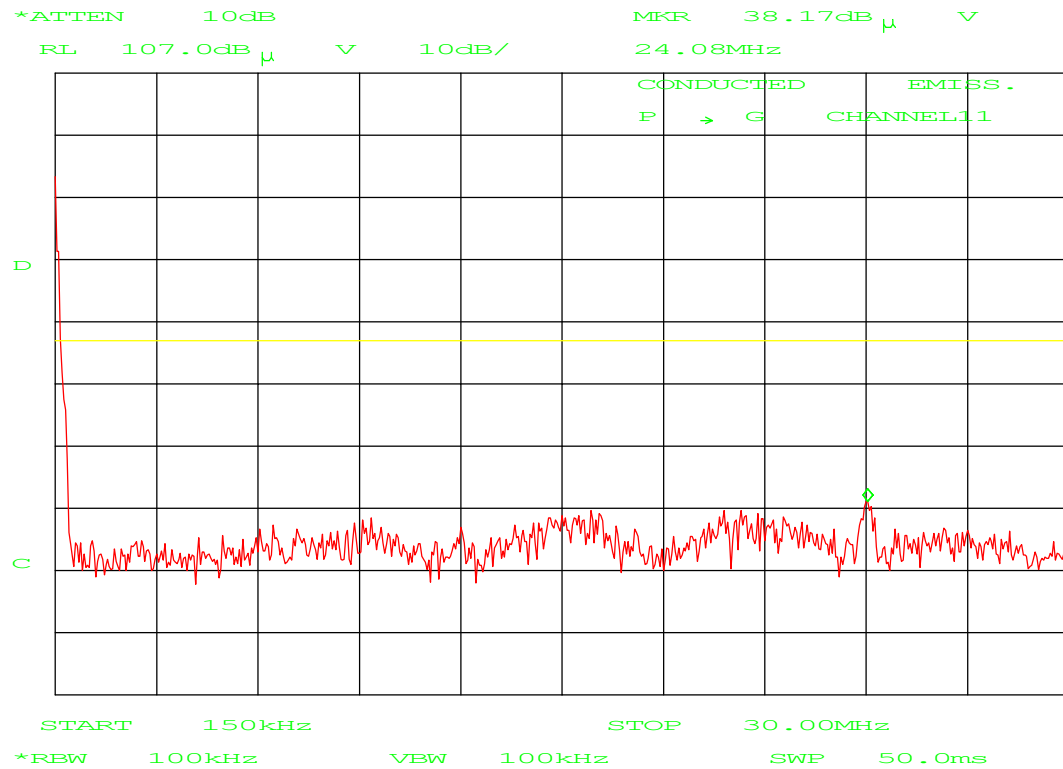
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 11: Neutral to ground



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 11: Phase to ground



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 4 Minimum 6 dB bandwidth

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 15.247(a)(2)

Test Results:

Complies. The 6 dB bandwidth is:

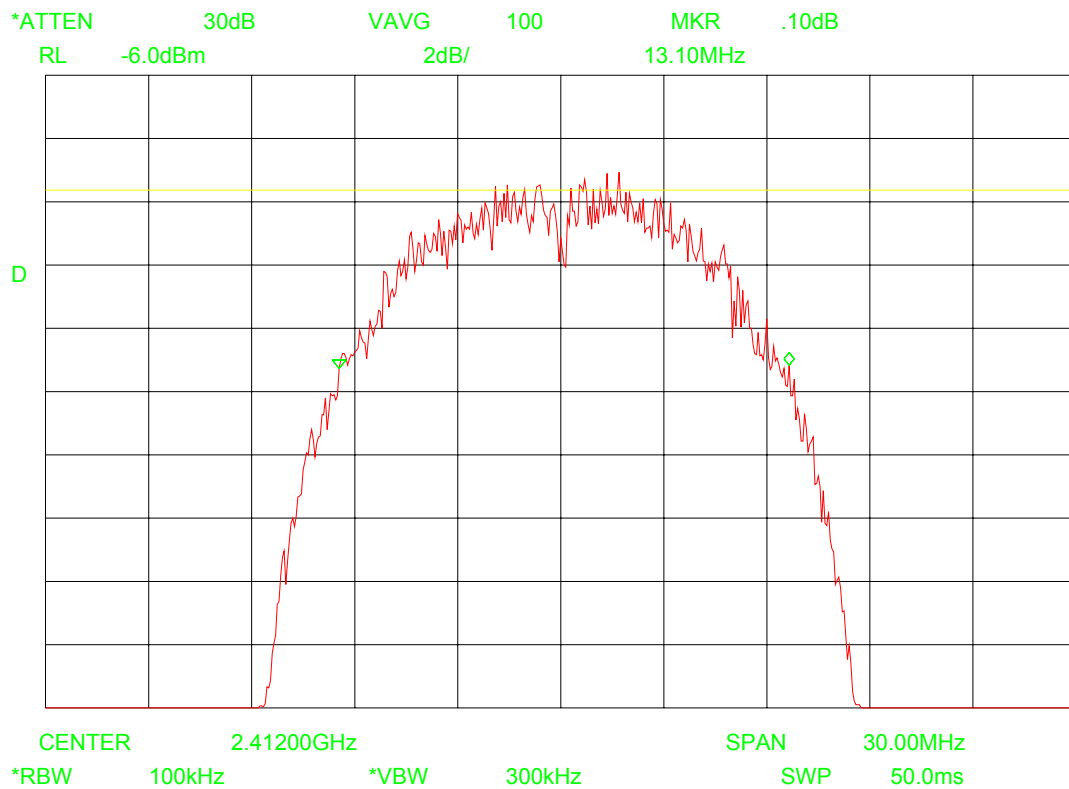
Channel 1	Channel 6	Channel 11
13.1 MHz	13.25 MHz	13.4 MHz

Measurement Data:

See attached graphs

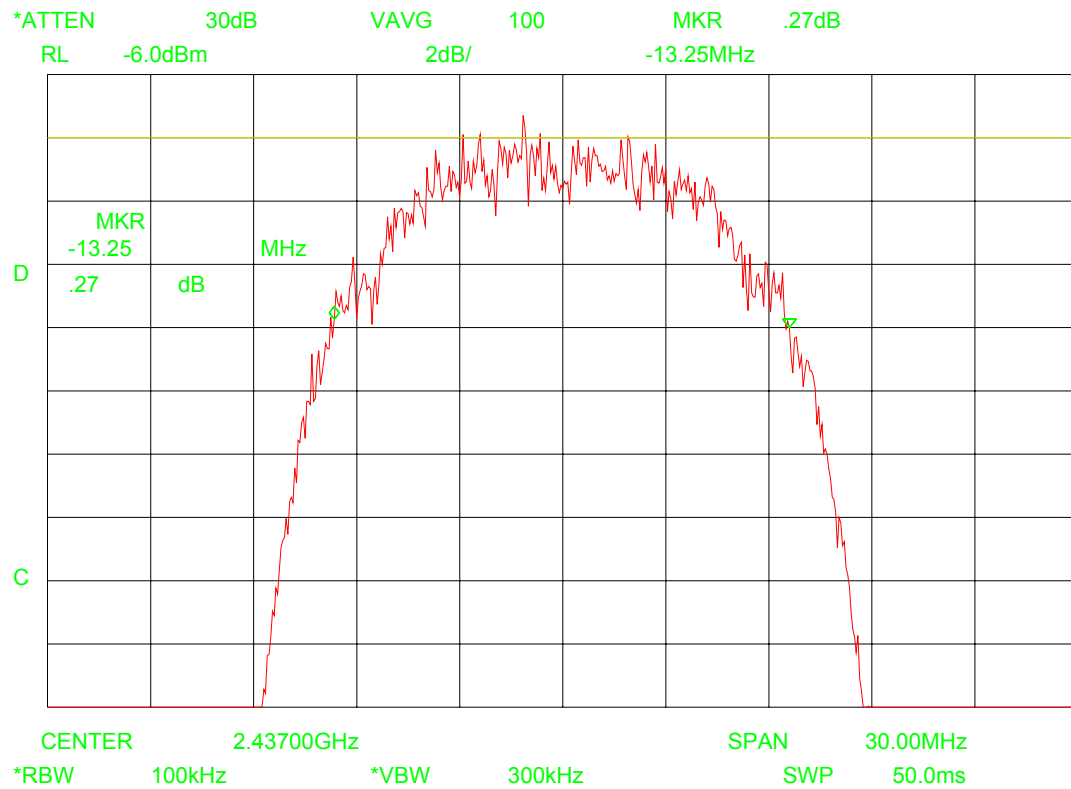
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 1



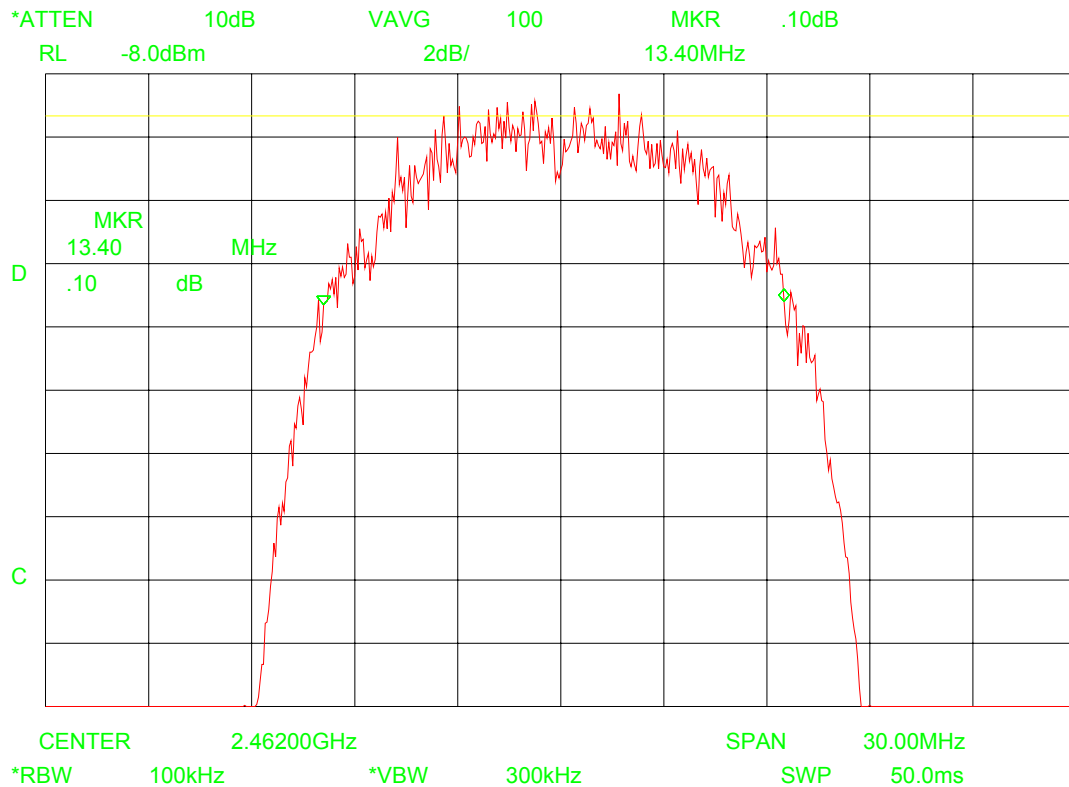
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 6



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 11



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 5 Peak Power Output

NAME OF TEST: Peak Power Output

PARA. NO.: 15.247 (b) (3)

Test Results:
is

Complies. The maximum peak power output of the transmitter

Channel 1	Channel 6	Channel 11
14.8 dBm E.I.R.P.	14.0 dBm E.I.R.P	13.4 dBm E.I.R.P

Measurement Data:

Detachable antenna? ☐ Yes ☒ No

If yes, state the type of non-standard connector used at the antenna port:

Directional Gain of Antenna: 0 dBi or 1.0
Numeric.

Peak Power Output: 30.2 mWatts.

Field Strength: NA dB μ V/m @ 3m or NA V/m @
3m.

Antennas:

Not applicable

Note:

Tests are performed with a temporary antenna connector.

EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 6 Peak power spectral density

NAME OF TEST: Peak power spectral density

PARA. NO.: 15.247 (d)

Test results:

Complies.

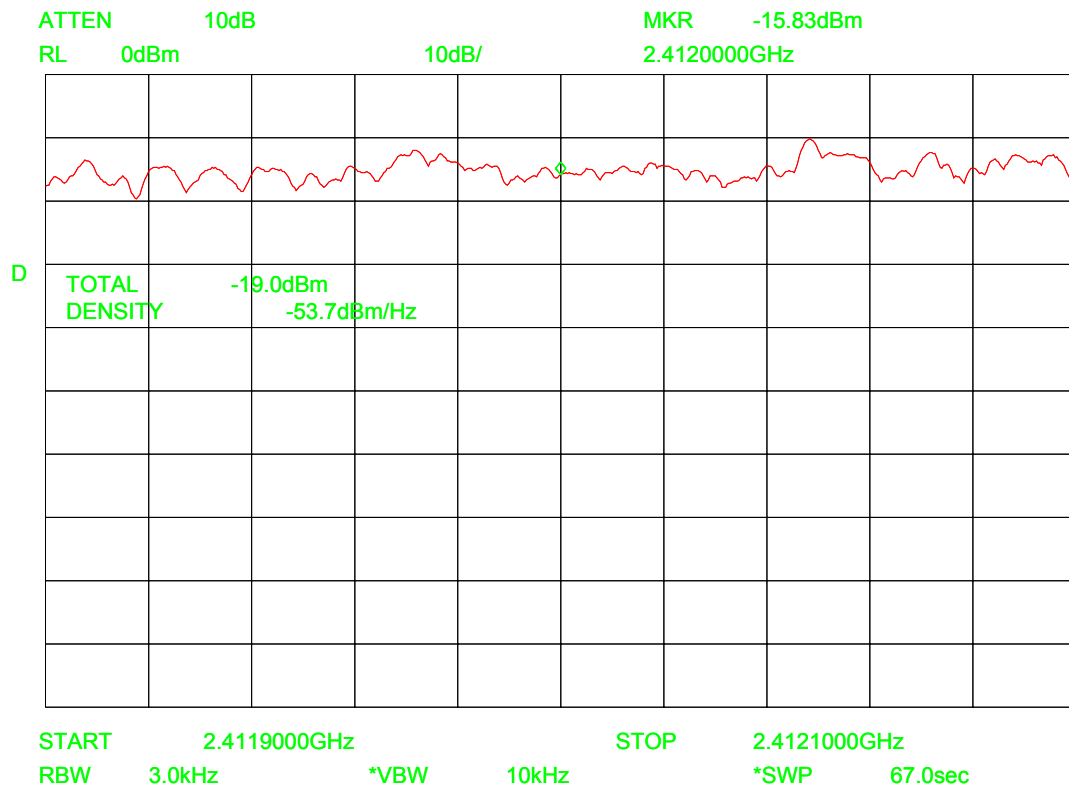
Channel 1	Channel 6	Channel 11
-19.0 dBm	-19.0 dBm	-19.6 dBm

Measurement data:

see attached plots

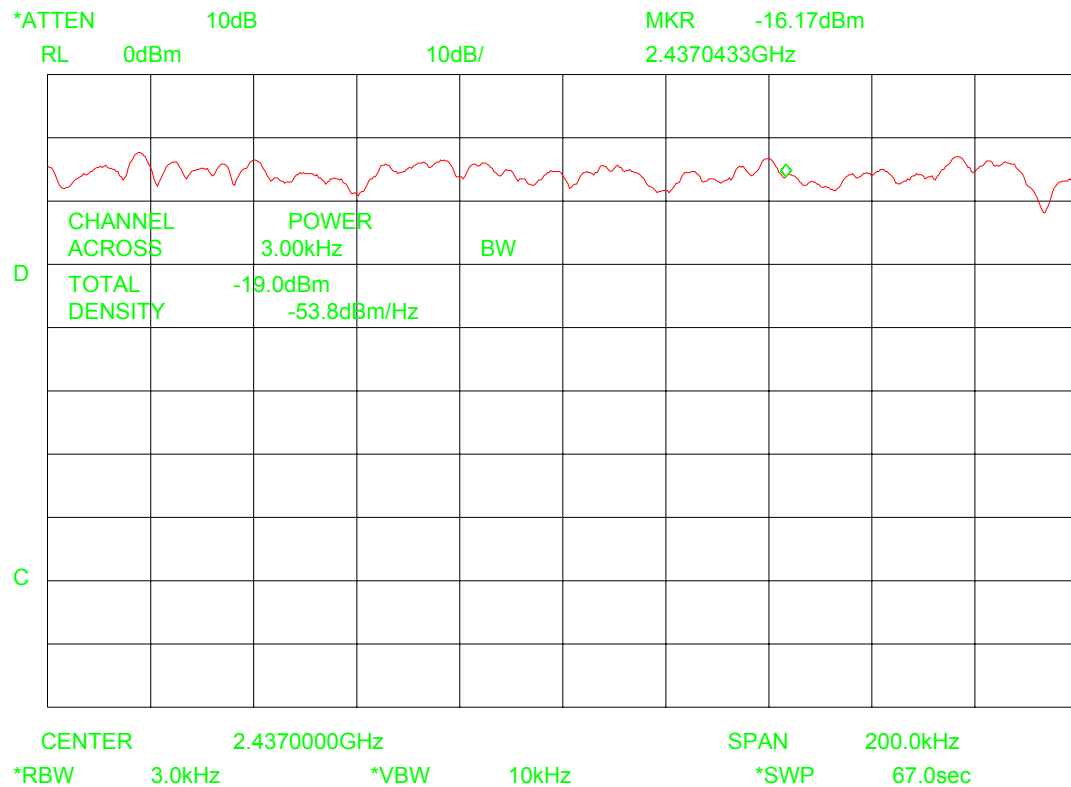
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 1



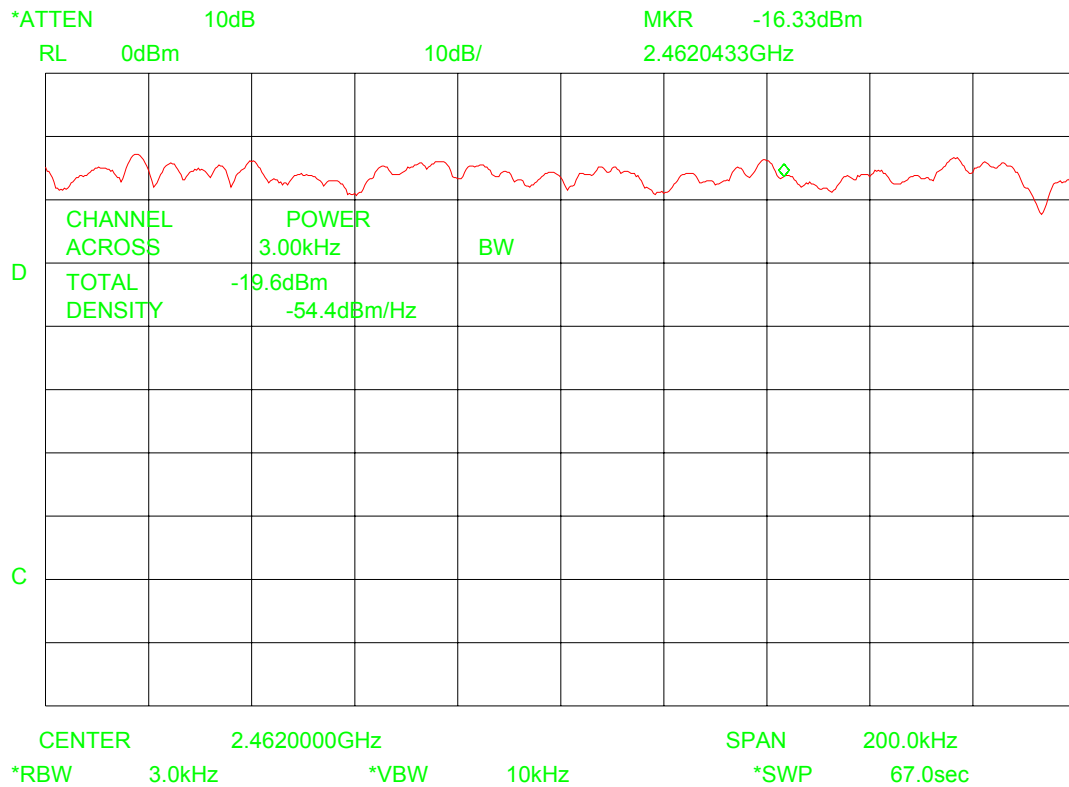
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 6



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 11



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 7 Spurious Emissions (Preliminary radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
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Test Results:

No EUT originating spurious emissions above measurement system noise floor have been determined.
Spurious emissions in the frequency range 30 – 550 MHz have proven to be radiated by the host equipment

Measurement Data:

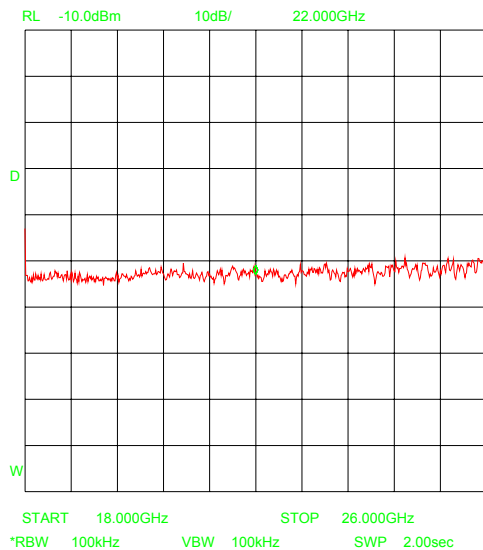
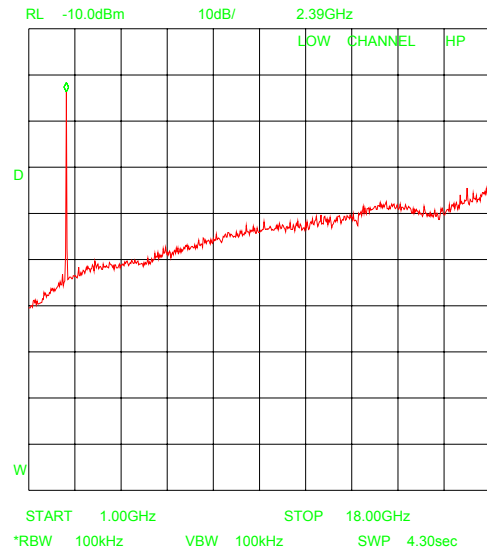
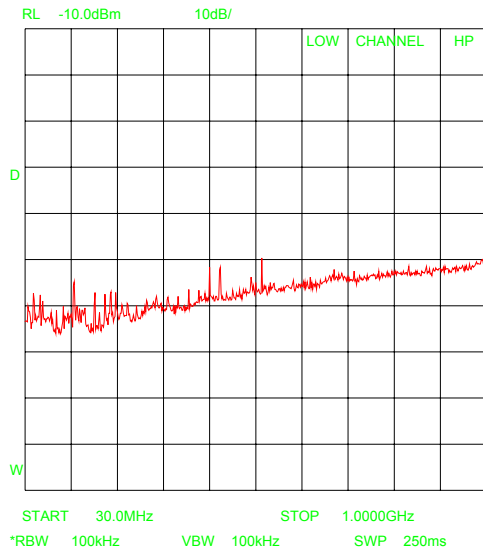
See attached graphs.

Note: The graphs represent effective radiated power (erp) values.

Note: The level of the fundamental shown in the graphs 1 – 18 GHz is exclusive the 20 dB external attenuation.

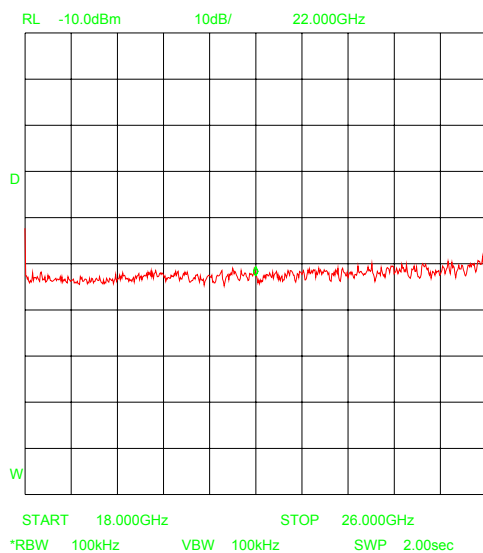
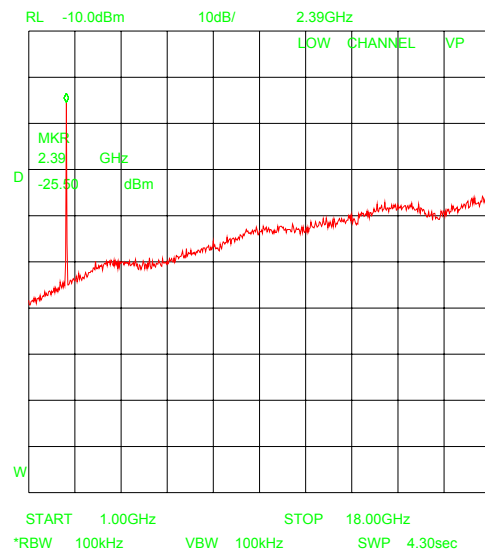
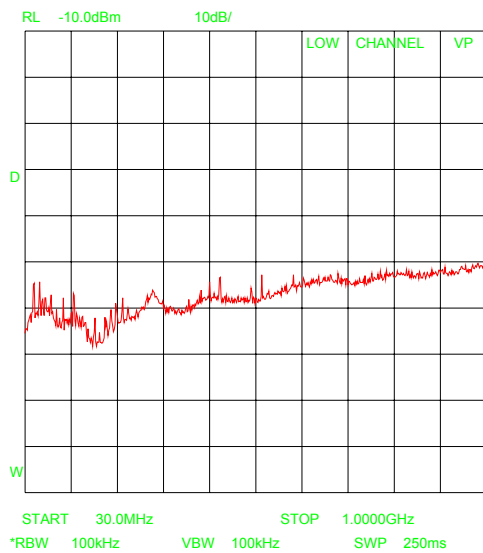
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

CH 1: horizontal polarization



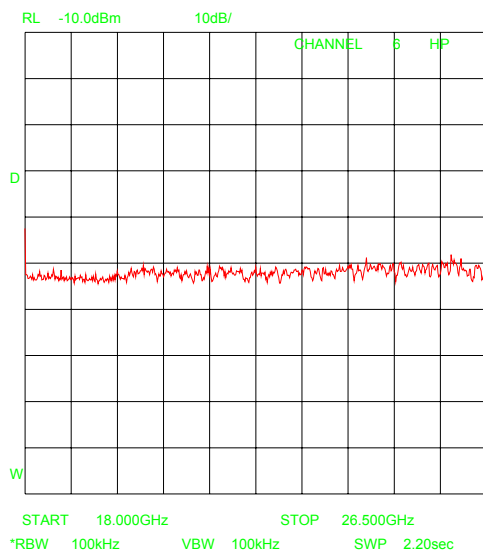
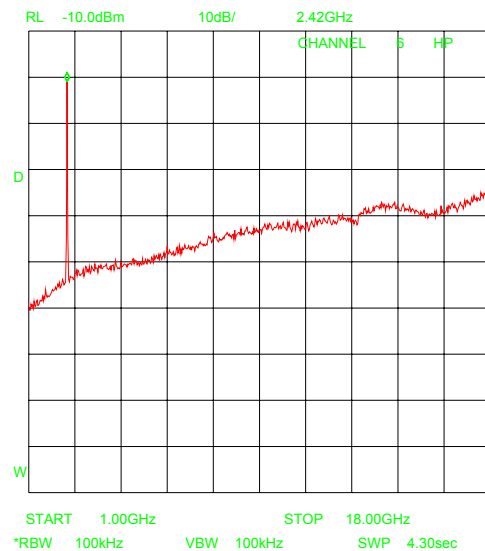
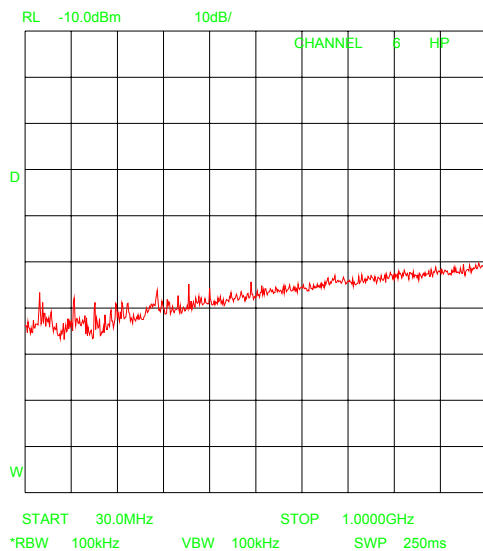
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

CH 1: vertical polarization



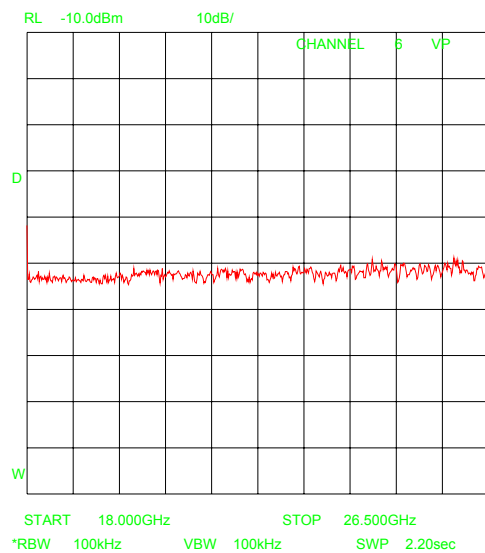
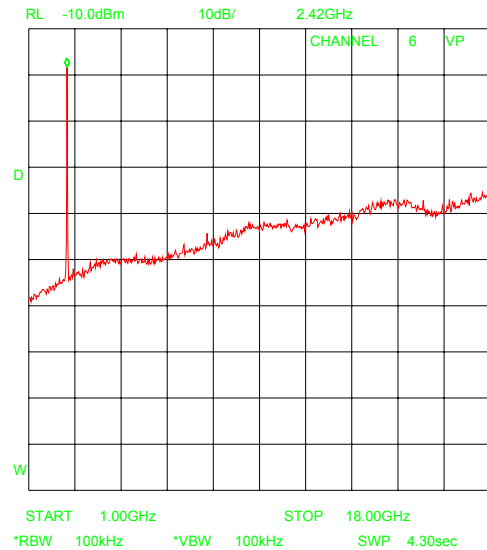
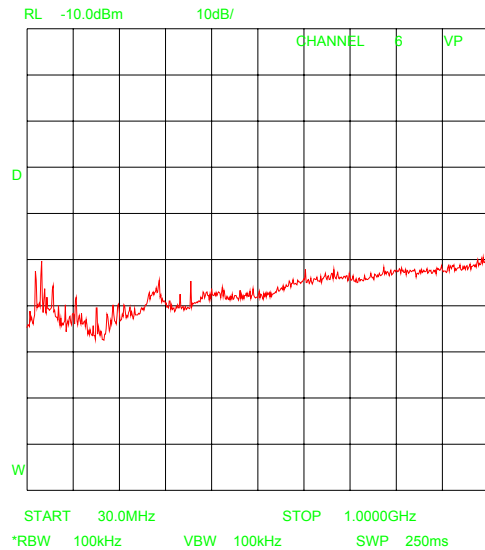
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

CH 6: horizontal polarization



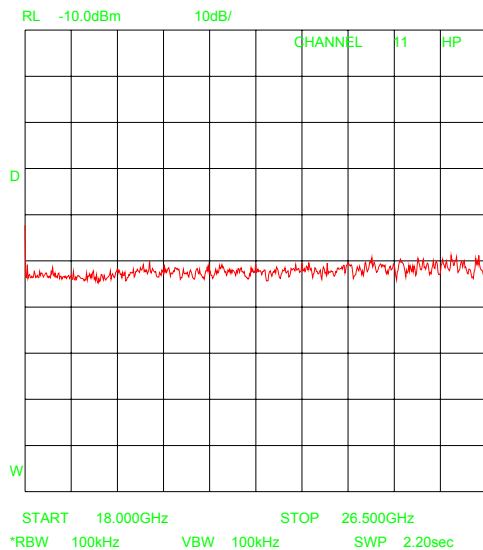
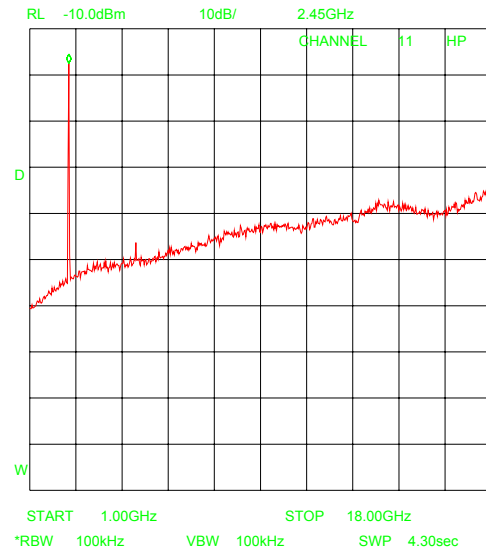
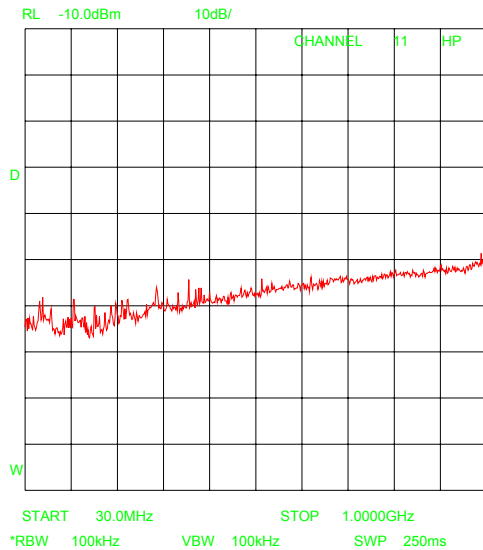
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

CH 6: vertical polarization



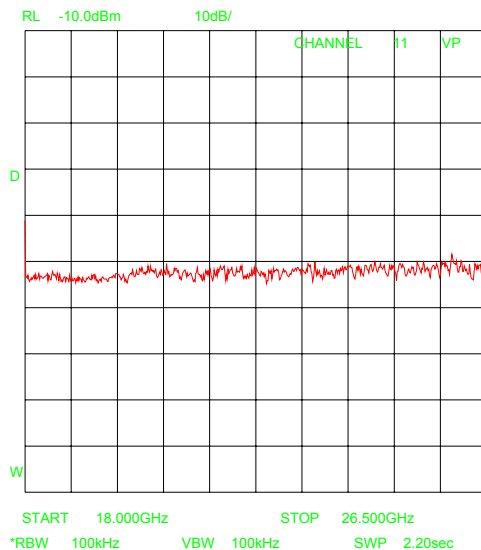
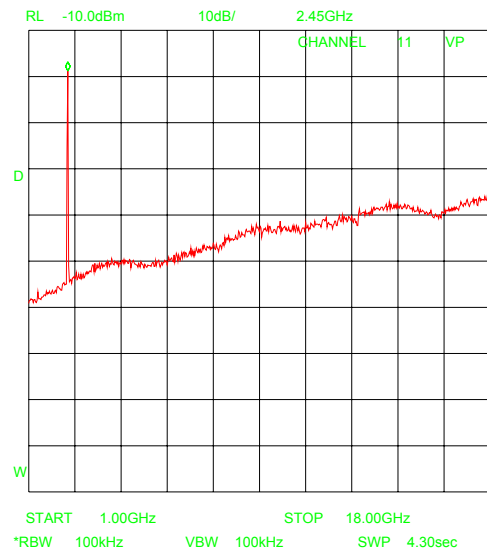
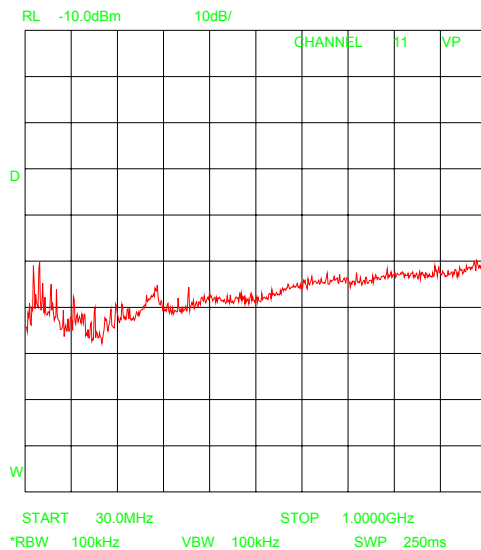
EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

CH 11: horizontal polarization



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

CH 11: vertical polarization



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 8 Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
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Test Results:

Complies.

The preliminary radiated tests did not reveal any spurious emission above noise level.

For measurements obtained on an OATS, refer to test report TNO: 03081901.r01

EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 9 Spurious Emissions (restricted bands, radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
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Test Results:

Complies.

Emissions falling in the adjacent restricted bands shall not exceed 54 dB μ V/m.**Measurement Data:**

See attached graphs.

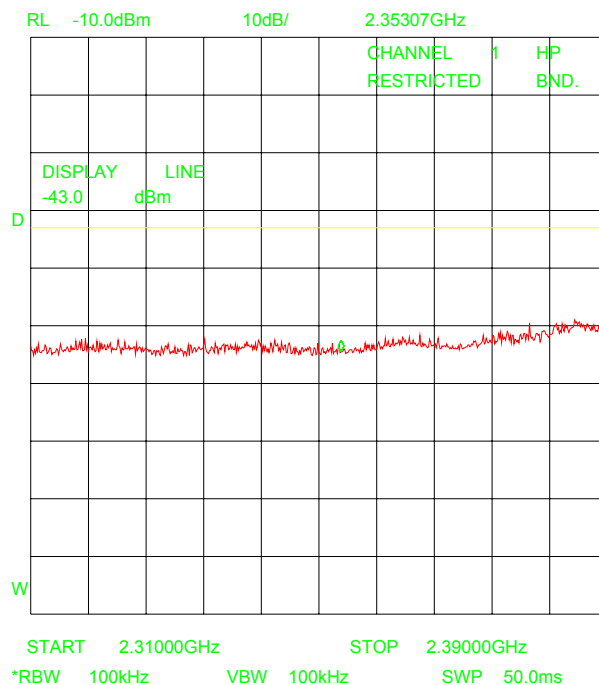
For measurements obtained on an OATS, refer to test report TNO: 03081901.r01

Note: The graphs represent values calibrated in effective radiated power (erp).

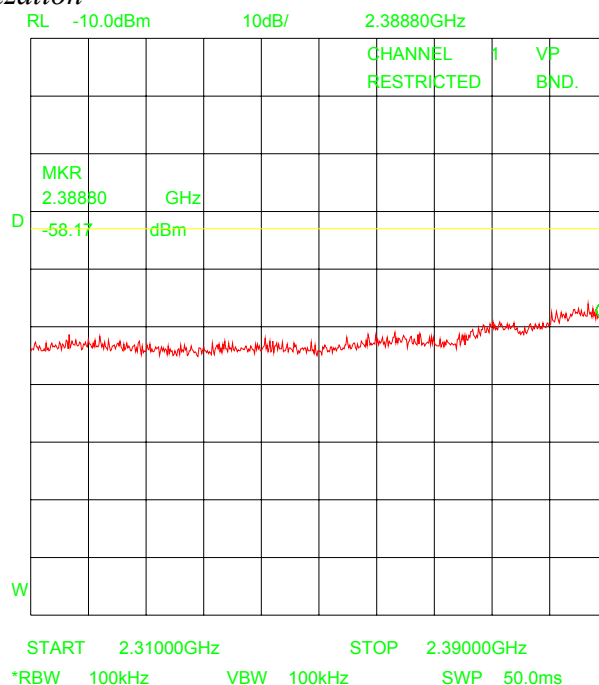
The displayed limit is converted by using the relationship: $ERP_{dBm} = E_{dB\mu V/m} - 97_{dB}$

EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 1; horizontal polarization

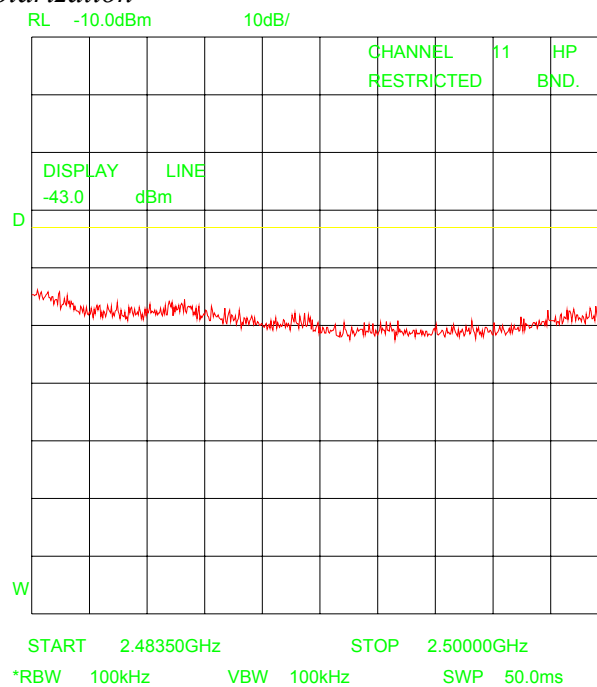


Channel 1; vertical polarization

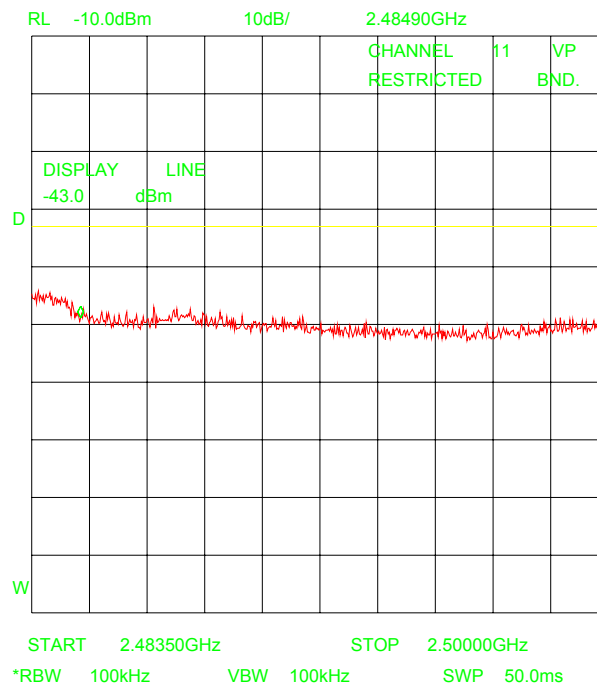


EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Channel 11; horizontal polarization



Channel 11; vertical polarization



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 10 Photographs

Conducted photograph



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Radiated Photographs

Set up 0.03 –1 GHz



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Set up 1 – 18 GHz



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Set up 18 – 26 GHz



EQUIPMENT: SWL-2300U Spread Spectrum Direct Sequence Transceiver
FCC ID: E2XSWL-2300U

Section 11 Test equipment List

Description	Manufacturer	Model	Identification	Used at
Spectrum analyzer	Hewlett Packard	8563E	TE 00481	15.207(a);15.247(a)(2); (c); (d)
Standard gain horn	Scientific Atlanta	12A-18	TE 00608	15.247(c)
Double ridged guide horn antenna	EMCO	3115	TE 00531	15.247(c)
Biconilog antenna	EMCO	3143	TE 00744	15.247(c)
Pre- amplifier	Hewlett Packard	8449B	TE 00092	15.247(c)
Pre-amplifier	Rohde & Schwarz	ESV-Z3	TE 00098	15.247(c)
Power meter	Hewlett Packard	435 B	TE 00249	15.247(b)(3)
Power sensor	Hewlett Packard	8484 A	TE 00245	15.247(b)(3)
40 dB fixed attenuator	Hewlett Packard	8491 B	TE 00406	15.247(b)(3)
Artificial Mains Network	Rohde & Schwarz	ESH2-Z5	TE 00208	15.207(a)

ANNEX A

TEST METHODOLOGIES

NAME OF TEST: Peak Power Output

PARA. NO.: 15.247(b)

Minimum Standard:

The maximum peak power output shall not exceed 1 watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Direct Measurement Method For Detachable Antennas:

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load.

Calculation Of EIRP For Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

The RBW of the spectrum analyzer shall be set to a value greater than the measured 20 dB occupied bandwidth of the E.U.T.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

NAME OF TEST: Radiated Spurious Emissions

PARA. NO.: 15.247(c)

Minimum Standard: In any 100kHz bandwidth outside the 902 - 928 MHz bands emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. **Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:**

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC

15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41	1718		

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom