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DELTA Test Report

Radio parameter test of SpiroCom

Performed for Interspiro AB

REC-E702421 Rev D
Project no.: E702421

05 April 2017

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DELTA Development Technology AB
is a subsidiary company of DELTA

Title	Radio parameter test of SpiroCom
Test object	SpiroCom
Report no.	REC-E702421 Rev D
Project no.	E702421
Test period	29 Apr. 2010 to 04 May 2010
Client	Interspiro AB Box 10060 181 10 Lidingö Sweden Tel.: +46(0)8-636 51 00
Contact person	Tomas Lannér E-mail: tola@wsi.nu
Manufacturer	Interspiro AB
Specifications	FCC Part 15, Subpart C, Section 15.247 and Industry Canada RSS-210 Issue 7
Results	The test object was found to be in compliance with the specifications, as listed in Section 1
Test personnel	Daniela Coman
Date	05 April 2017

Project Manager

Daniela Coman
DELTA

Responsible

Ulf Bjerke Technical Manager
DELTA

Table of contents

1. Summary of tests

FCC reference	Industry Canada reference	Tests SRD	Results
15.247 (a)	A8.1(b)	Carrier frequency separation	Passed
15.247 (a)	A8.1(d)	Number of hopping frequencies	Passed
15.247 (a)	A8.1(d)	Time of occupancy (dwell time)	Passed
15.247 (a)	A8.1(a)	20 dB Bandwidth	Passed
15.247 (b)	A8.4(2)	Peak output power	Passed
15.247	A8.1	Band-edge compliance of RF conducted emissions	Passed
15.247 (d)	2.7, A8.5	Out of band spurious RF conducted emissions	Passed
15.247 (d)	2.7, A2.9 (1), A8.5	Out of band spurious radiated emissions	Passed
15.247 (a)	A8.1(c)	Average time of occupancy	Passed

Conclusion

The test object mentioned in this report meets the requirements of the standard stated below.

- FCC 47 CFR Part 15 (2008) Subpart C: Intentional Radiators Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.
- Industry Canada RSS-210 Issue 7 (June 2007) Low-power Licence-exempt Radiocommunication Devices: Category I Equipment.

The test results relate only to the object(s) tested.

2. Test object(s) and auxiliary equipment

2.1 Test object(s)

Test object 2.1.1

Name of test object	SpiroCom
Model / type	SpiroCom
Part no.	-
Serial no.	10160089, FCCx during spurious measurement 10160090, FCCx during conducted spurious tests 10160091, 202 for conducted tests
FCC ID	
Manufacturer	Interspiro AB
Supply voltage	Battery 4.5 V
Software version	FCCx
Cycle time	100% duty for test objects marked FCCx and between 0% and 20% duty for unit 202.

Photo 2.1.1 Photo of the three test objects. Front side (with the display).

Photo 2.1.2 Photo of the three test objects.

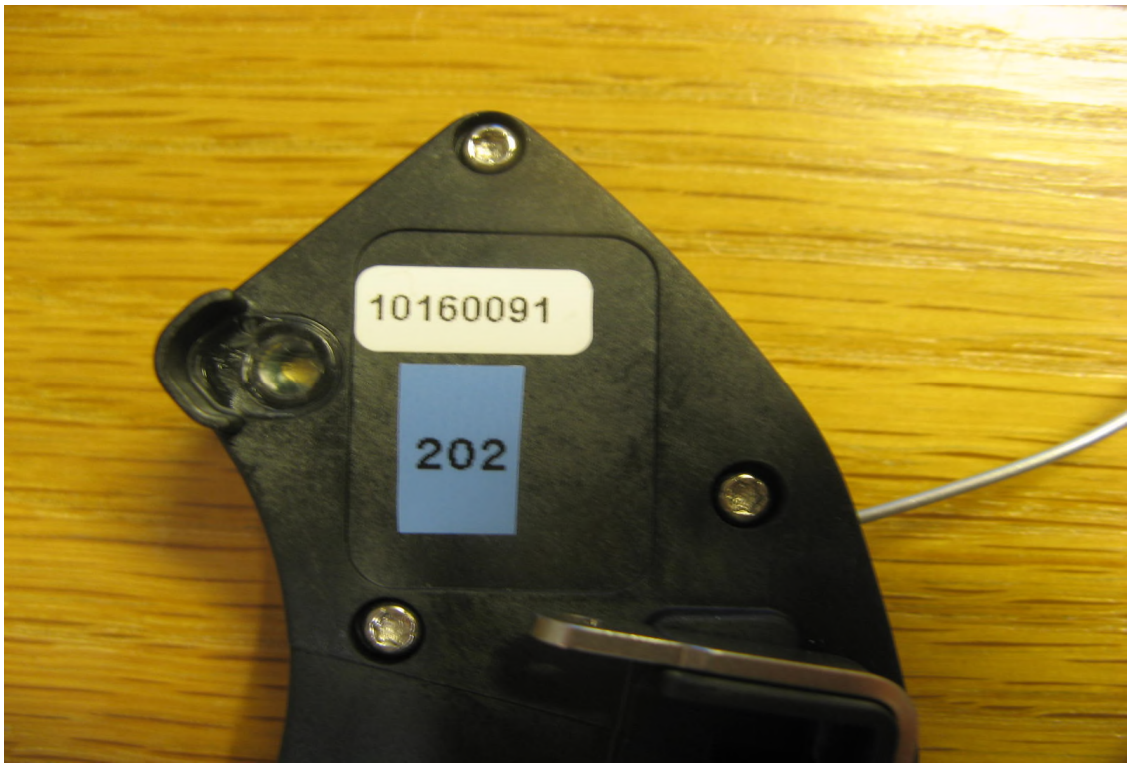


Photo 2.1.3 Photo of the tested object, unit 202, with a soldered SMA coaxial connetor for conducted tests.

Photo 2.1.4 Photo of the tested object, unit FCCx, tested during radiated tests.

Photo 2.1.5 Photo of the tested object, unit FCCx, with a soldered SMA coaxial connetor for conducted tests..

3. General test conditions

3.1 Test setup during test

The test object is battery powered by 4.5 VDC AAA batteries.
The test object was connected via a soldered SMA coaxial connector to the spectrum analyzer or the measurement receiver via a 3 dB attenuator and a coaxial cable during all the conducted tests described in this report.

During the radiated spurious emission tests, the test object was placed on a table 0.8 m above the ground plane. The measurement distance was during these test 3 m.

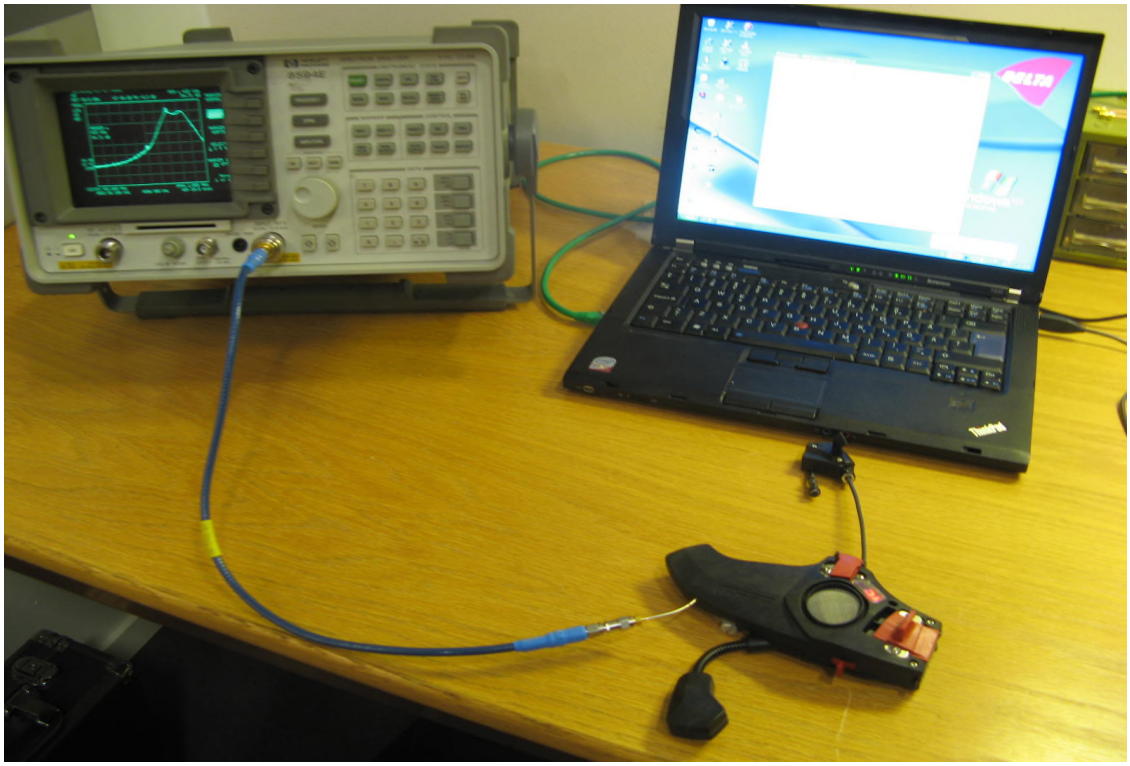


Photo 3.1.1 Test setup regarding conducted measurements.

Photo 3.1.2 Test setup regarding spurious emission measurements.

3.2 Modifications of the test object

No modification was implemented to the test object.

3.3 Test sequence

The tests described in this test report were performed in the following sequence:

1.	Measurement of spurious emission, LF, MF, HF
2.	Measurement of conducted spurious emission, LF, MF, HF
3.	Measurement of carrier frequency separation
4.	Measurement of number of hopping channels
5.	Measurement of dwell time
6.	Measurement of 20 dB bandwidth
7.	Measurement of peak output power
8.	Measurement of band edge compliance

4. Test results

4.1 Carrier frequency separation

Test object	SpiroCom	Sheet	ADJ_PWR-1
Type	SpiroCom	Project no.	E702421
Serial no.	10160091, 202	Date	29 Apr. 2010
Client	Interspiro AB	Initials	DAC
Specification	FCC Part 15, Subpart C, Section 15.247 Industry Canada RSS-210 Issue 7, A8.1 (b)		

Test method	DA 00-705A1	Temperature Humidity	22 °C 35 % RH
Test equipm.	See section 6 List of instruments		
SA Settings	RBW: 10 kHz VBW: 30 kHz SPAN: 1 MHz DET: Peak Trace: Max hold		

Frequency	Measured	Limit	Comments
902.7 MHz	510 kHz	20 dB bandwidth	
914.9 MHz	515 kHz	20 dB bandwidth	
927.2 MHz	510 kHz	20 dB bandwidth	

Test result	The measured channel separation was within the limits
Test modulation	GFSK
Compliant	Yes
Comments	The 20 dB bandwidth of the test object is greater that 25 kHz, this is why the limit was set to the 20 dB bandwidth, see section 4.4

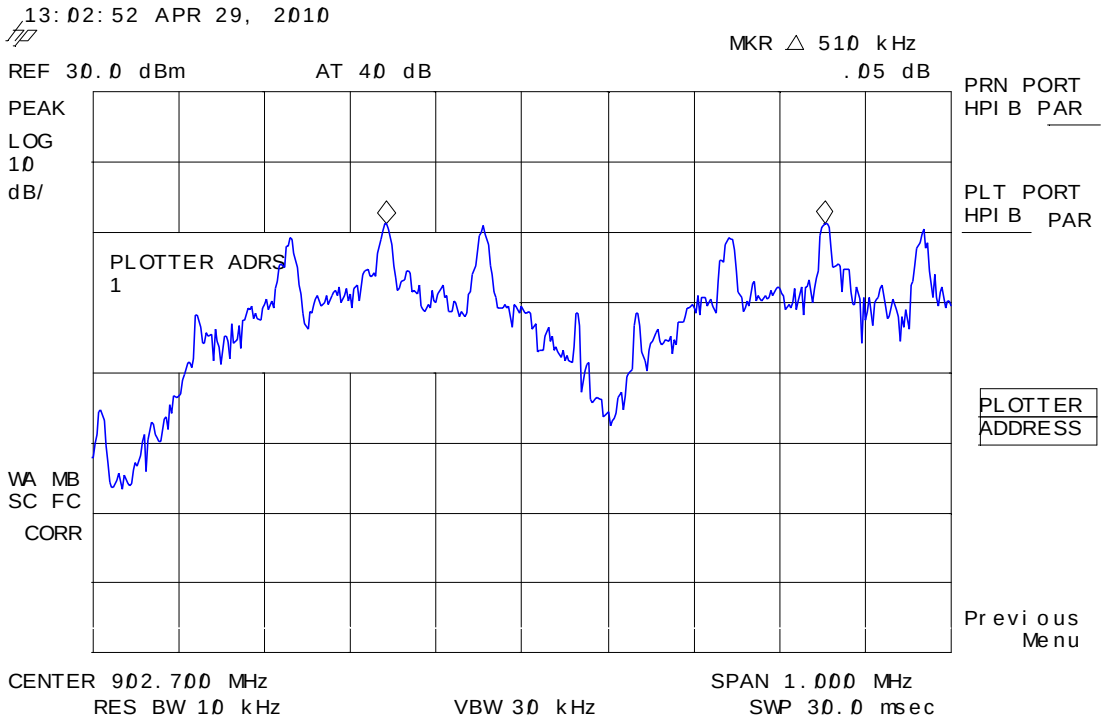


Figure 4.1.1 Carrier frequency separation low channel.

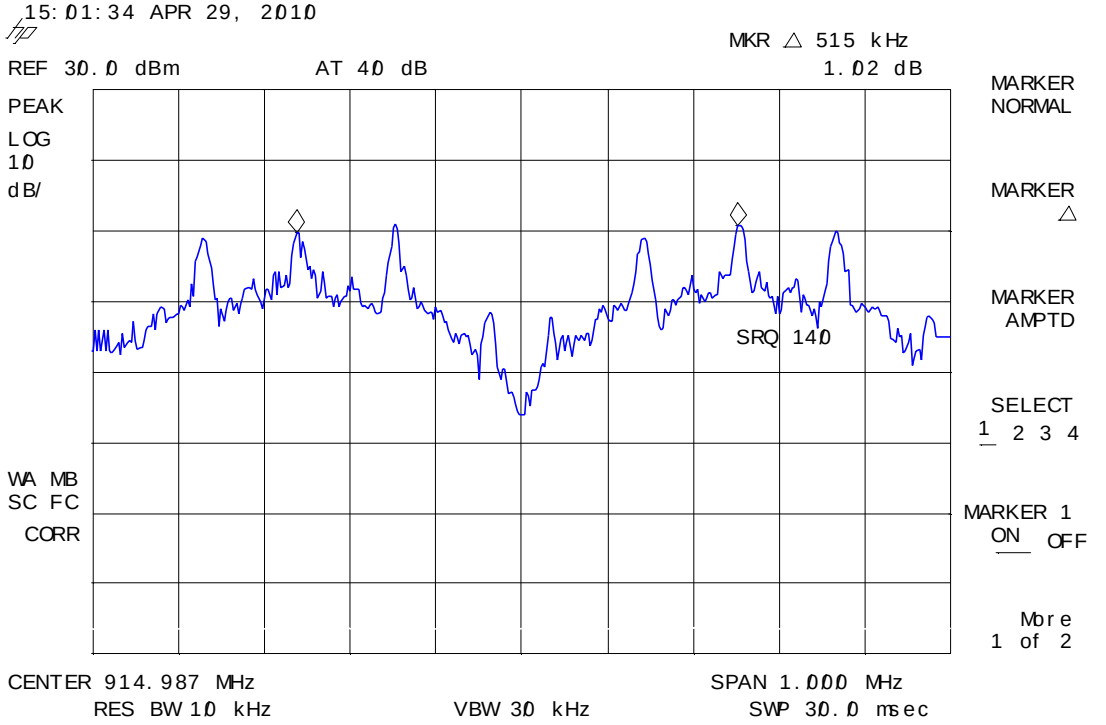


Figure 4.1.2 Carrier frequency separation middle channel.

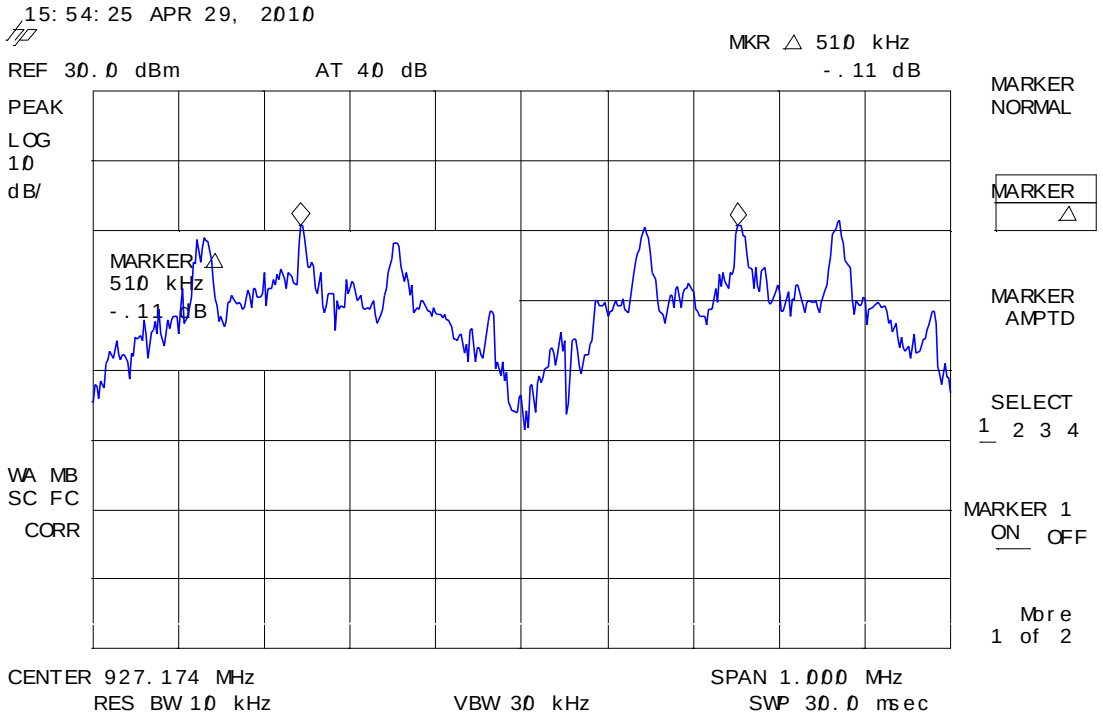


Figure 4.1.3 Carrier frequency separation high channel.

4.2 Measurement of number of hopping channels

Test object	SpiroCom	Sheet	ADJ_PWR-2
Type	SpiroCom	Project no.	E702421
Serial no.	10160091, 202 for conducted tests	Date	29 Apr 2010
Client	Interspiro AB	Initials	DAC
Specification	FCC Part 15, Subpart C, Section 15.247 Industry Canada RSS-210 Issue 7, A8.1 (d)		

Test method	DA 00-705A1	Temperature Humidity	22 °C 35 % RH
Test equipm.	See section 6 List of instruments		
SA Settings	RBW: 300 kHz VBW: 1 MHz SPAN: 26 MHz DET: Peak CF: 915 MHz Trace: Max hold		

Measured number of frequencies	Limit	Comments
50	≥ 50	

Note 1:

Test result — The measured number of hopping frequencies was within the limits

Test modulation

Compliant — Yes

Comments — None

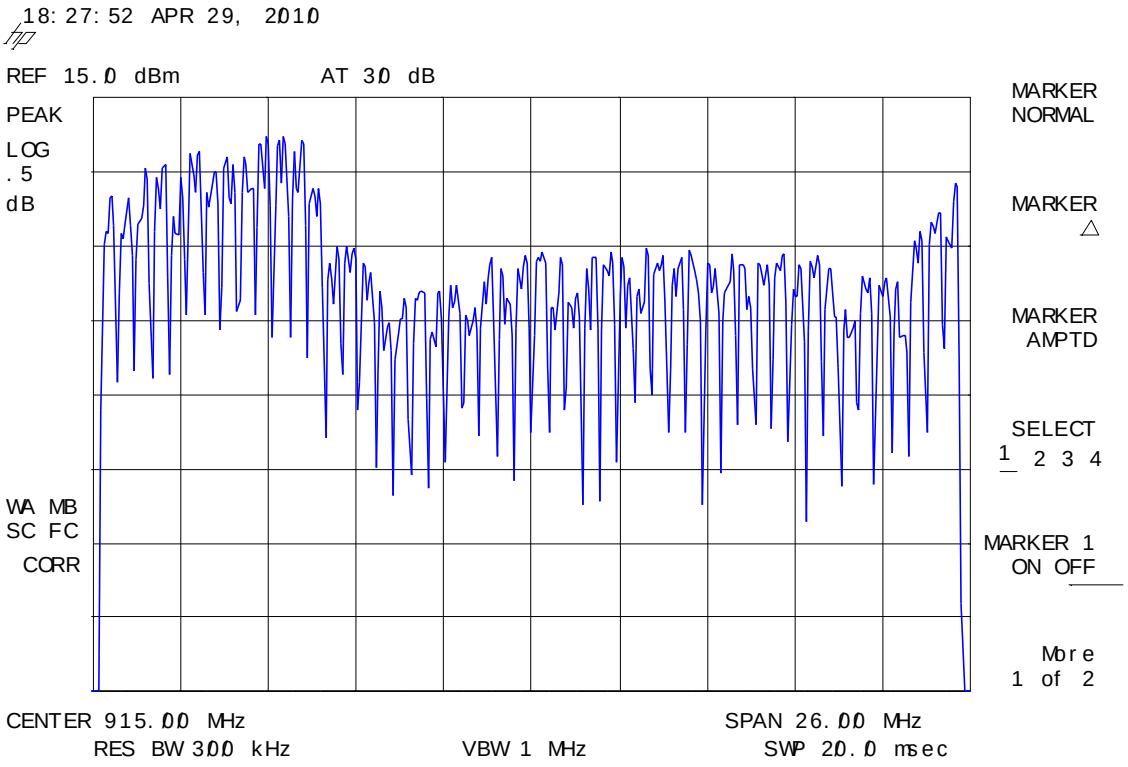


Figure 4.2.1 Graph showing all hopping frequencies used by the system.

Photo 4.2.1 Test setup regarding measurement of hopping channels.

4.3 Measurement of dwell time

Test object	SpiroCom	Sheet	ADJ_PWR-3
Type	SpiroCom	Project no.	E702421
Serial no.	10160090, FCCx	Date	30 Apr. 2010
Client	Interspiro AB	Initials	DAC
Specification	FCC Part 15, Subpart C, Section 15.247 Industry Canada RSS-210 Issue 7, A8.1 (d)		

Test method Characteristics	DA 00-705A1	Temperature Humidity	21 °C 36 % RH
Test equipm.	See section 6 List of instruments Uncertainty: 1•10-7		
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: ZERO DET: Peak Trace: Max hold		

Frequency	Measured	Limit	Comments
902.54 MHz	384 ms	400 ms	
915.0 MHz	384 ms	400 ms	
927.43 MHz	384 ms	400ms	

Note 1: The sweeps were trigged using the measured burst. The trigger in the spectrum analyzer introduces a 1 ms delay. Hence a more accurate dwell time is a 385 ms for all measurements in this section. The analyzer trigger delay was verified using manually triggered single sweeps.

Test result — The measured time of occupancy, or dwell time, at low, midd and high channel was within the limits

Test modulation — GFSK

Compliant — Yes

Comments — None

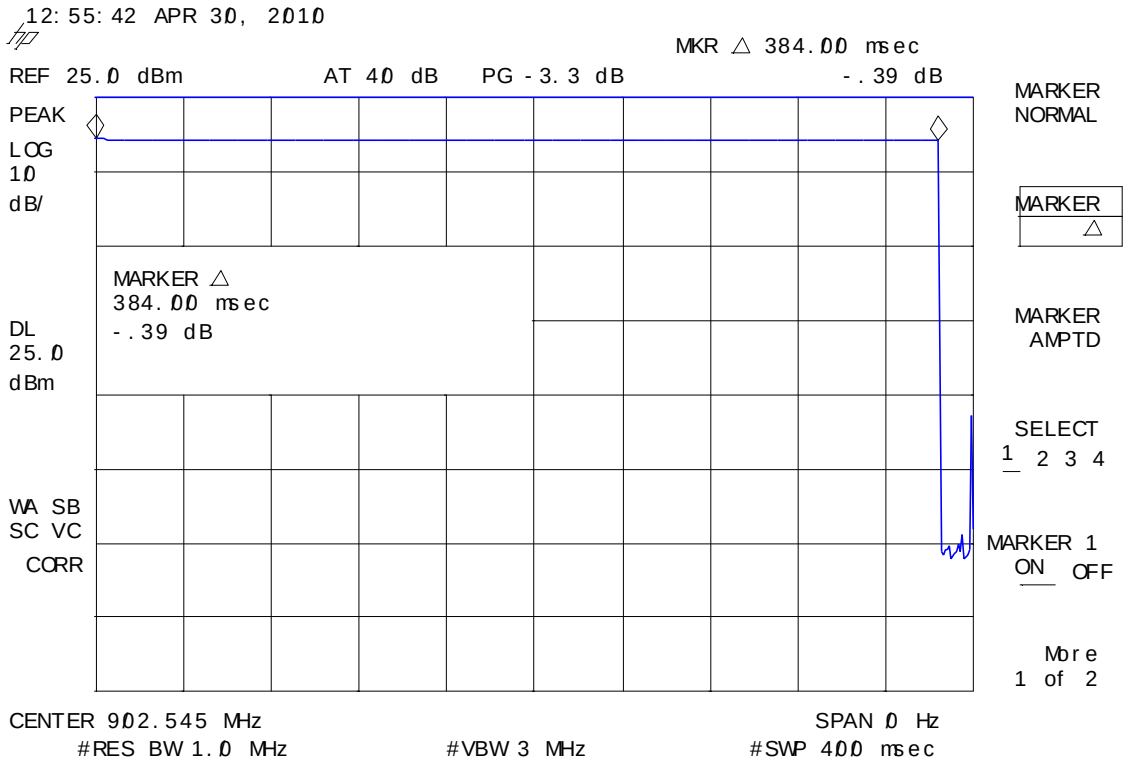


Figure 4.3.1 Graph showing time of occupancy low channel.

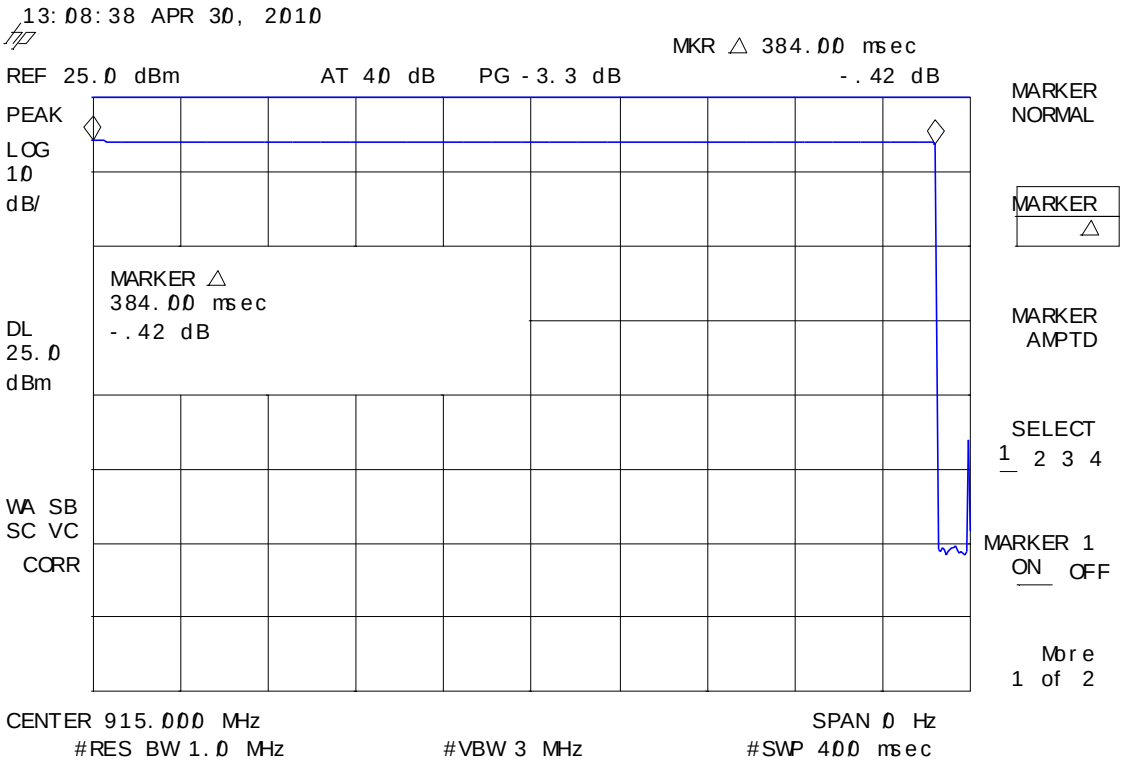


Figure 4.3.2 Graph showing time of occupancy mid channel.

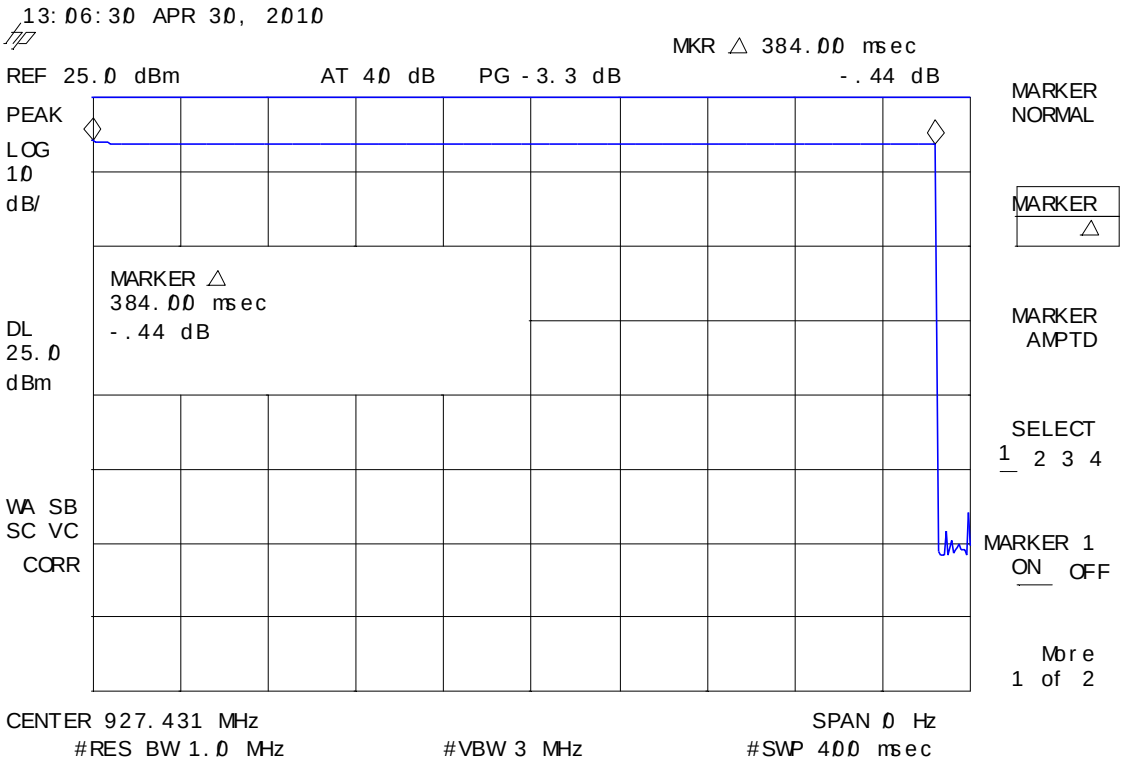


Figure 4.3.3 Graph showing time of occupancy high channel.

4.4 Measurement of 20 dB bandwidth

Test object	SpiroCom	Sheet	ADJ_PWR-4
Type	SpiroCom	Project no.	E702421
Serial no.	10160090, FCCx	Date	30 Apr. 2010
Client	Interspiro AB	Initials	DAC
Specification	FCC Part 15, Subpart C, Section 15.247 Industry Canada RSS-210 Issue 7, A8.1 (a)		

Test method Characteristics	FCC Part 15, Subpart C, Section 15.247	Temperature Humidity	21 °C 36 % RH
Test equipm.	See section 6 List of instruments		
SA Settings	RBW: 10 kHz VBW: 30 kHz SPAN: 1 MHz DET: Peak CF: Low, midd, high frequency Trace: Max hold		

Frequency	Measured	Limit	Comments
902.545 MHz	470 kHz	500 kHz	
915.0 MHz	465 kHz	500 kHz	
927.427 MHz	468 kHz	500 kHz	

Test result	The measured 20 dB bandwidth at low, mid and high channel was within the limits
Test modulation	GFSK
Compliant	Yes
Comments	None

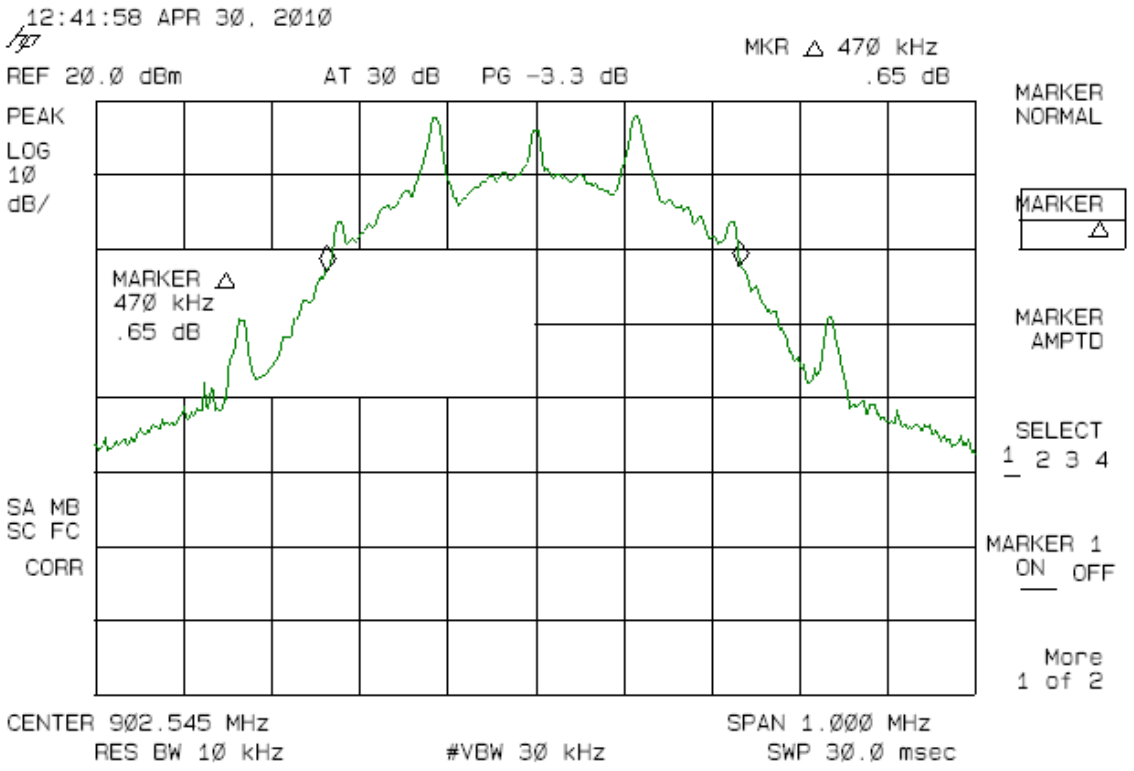


Figure 4.4.1 Graph illustrating 20 dB bandwidth of the modulated carrier at low channel.

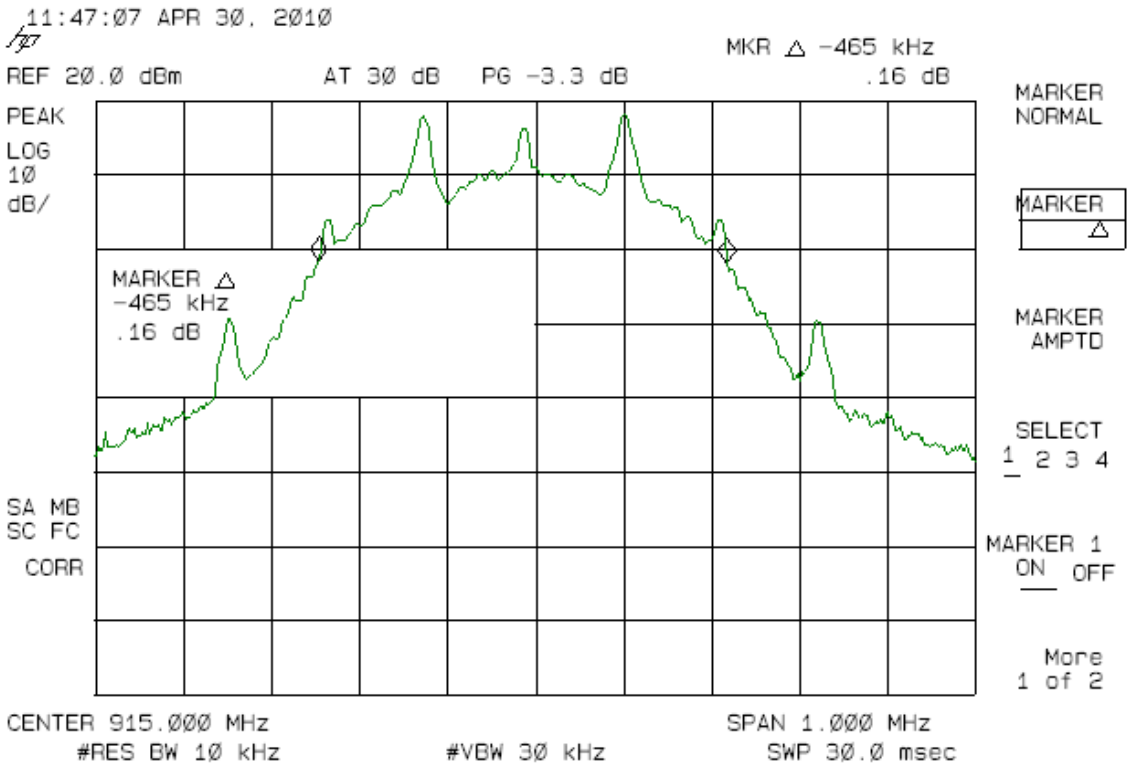


Figure 4.4.2 Graph illustrating 20 dB bandwidth of the modulated carrier at middle channel.

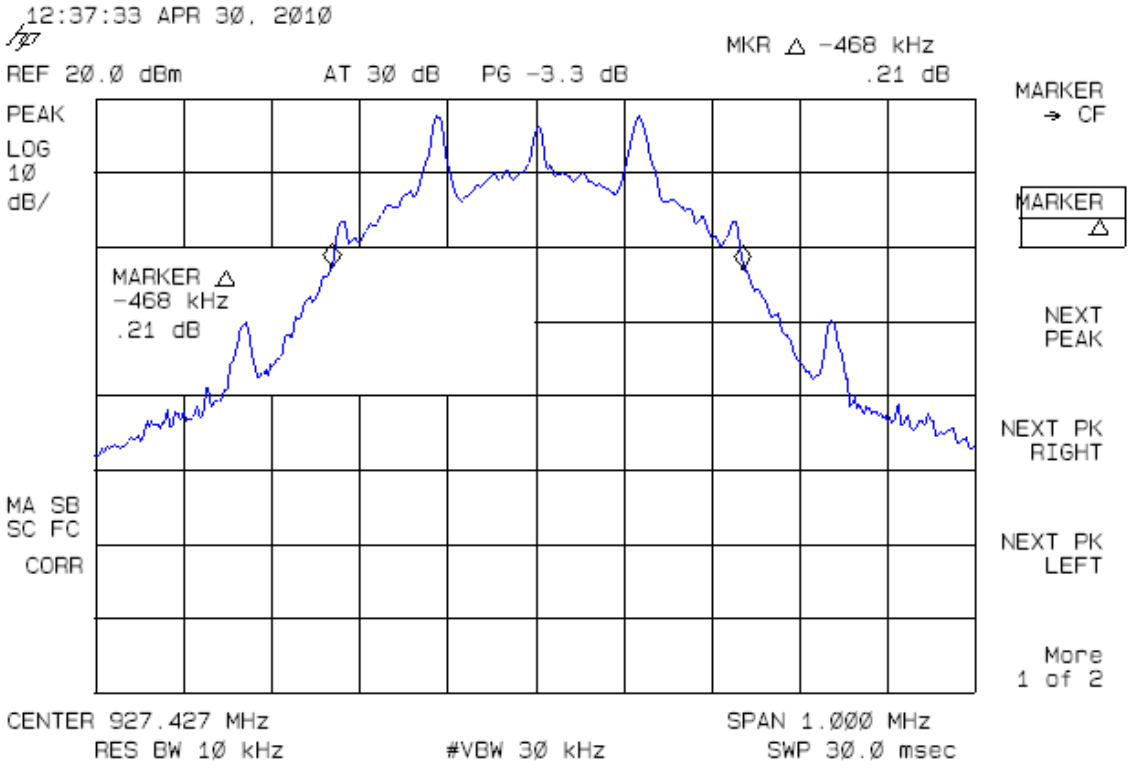


Figure 4.4.3 Graph illustrating 20 dB bandwidth of the modulated carrier at high channel.

4.5 Measurement of peak output power

Test object	SpiroCom	Sheet	ADJ_PWR-5
Type	SpiroCom	Project no.	E702421
Serial no.	10160090, FCCx	Date	30 Apr. 2010
Client	Interspiro AB	Initials	DAC
Specification	FCC Part 15, Subpart C, Section 15.247 Industry Canada RSS-210 Issue 7, A8.4 (2)		

Test method Characteristics	DA 00-705A1	Temperature Humidity	21 °C 36 % RH
Test equipm.	See section 6 List of instruments		
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: 2.5 MHz DET: Peak Trace: Max hold		

Frequency	Measured	Limit	Comments
902.55 MHz	19.37 dBm	30 dBm	
914.975 MHz	19.11 dBm	30 dBm	
927.447 MHz	18.90 dBm	30 dBm	
Note 1:			

Test result — The measured range of operating frequencies was within the limits

Test modulation — GFSK, Hopping disabled.

Compliant — Yes

Comments — None

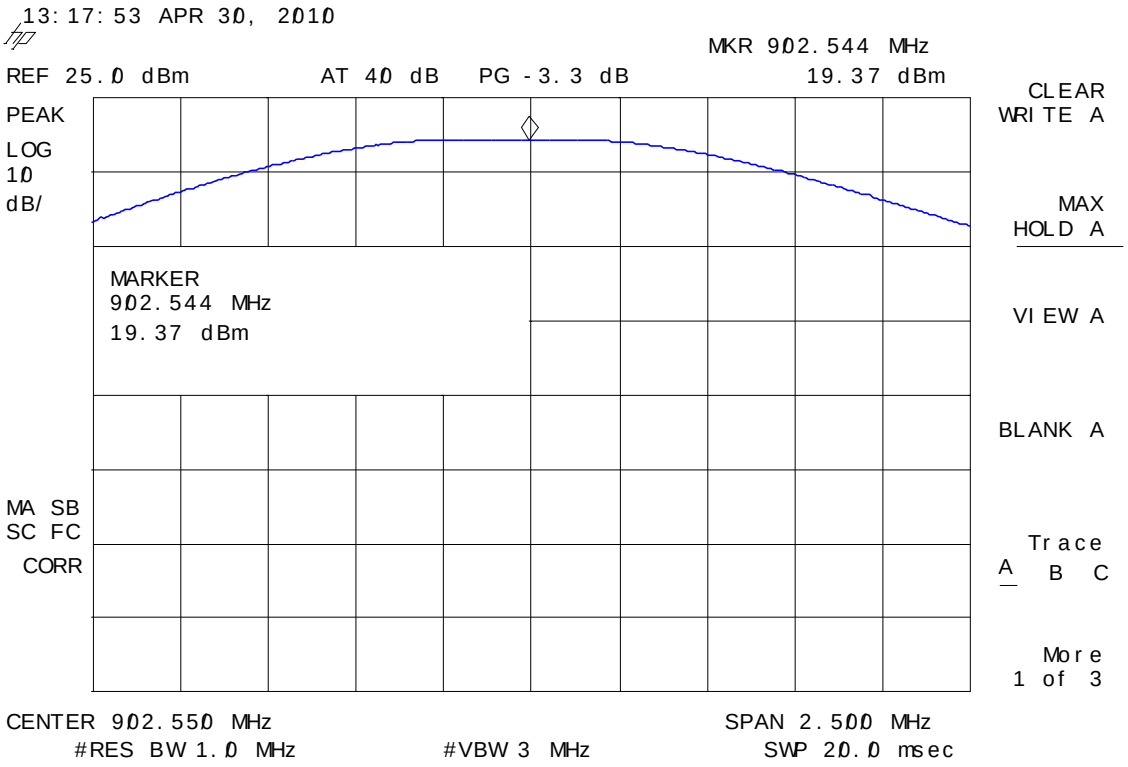


Figure 4.5.1 Graph illustrating peak output power at low channel.

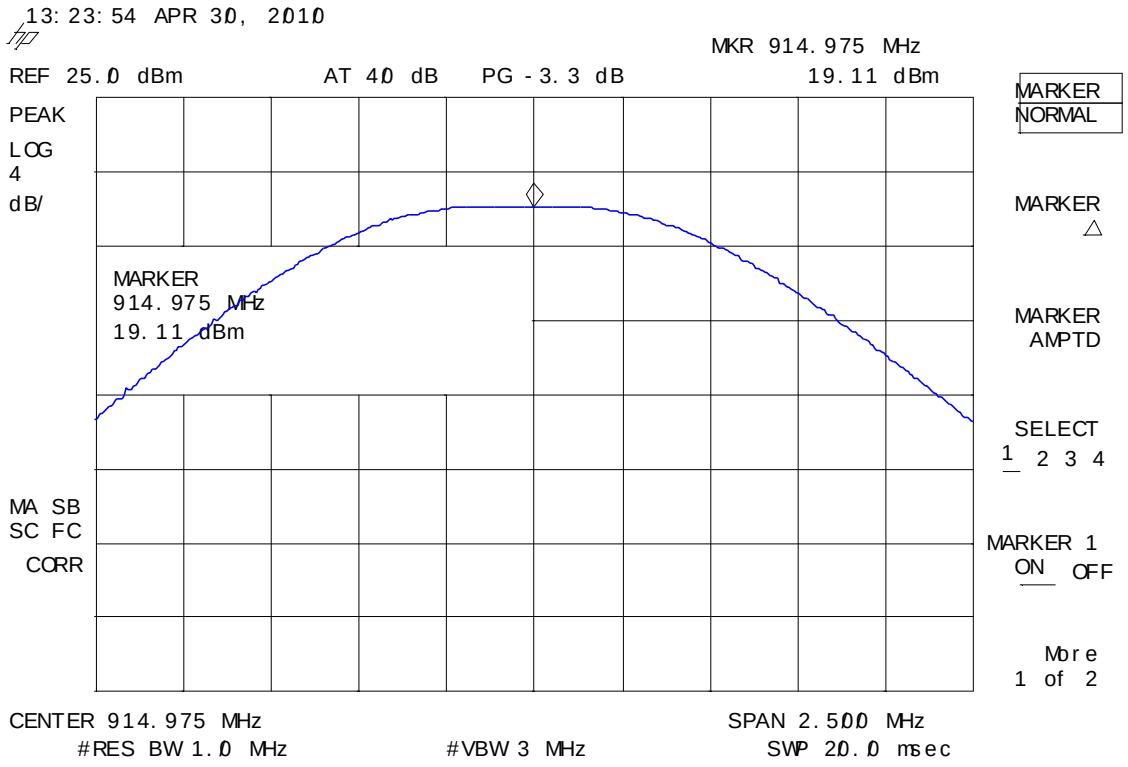


Figure 4.5.2 Graph illustrating peak output power at mid channel.

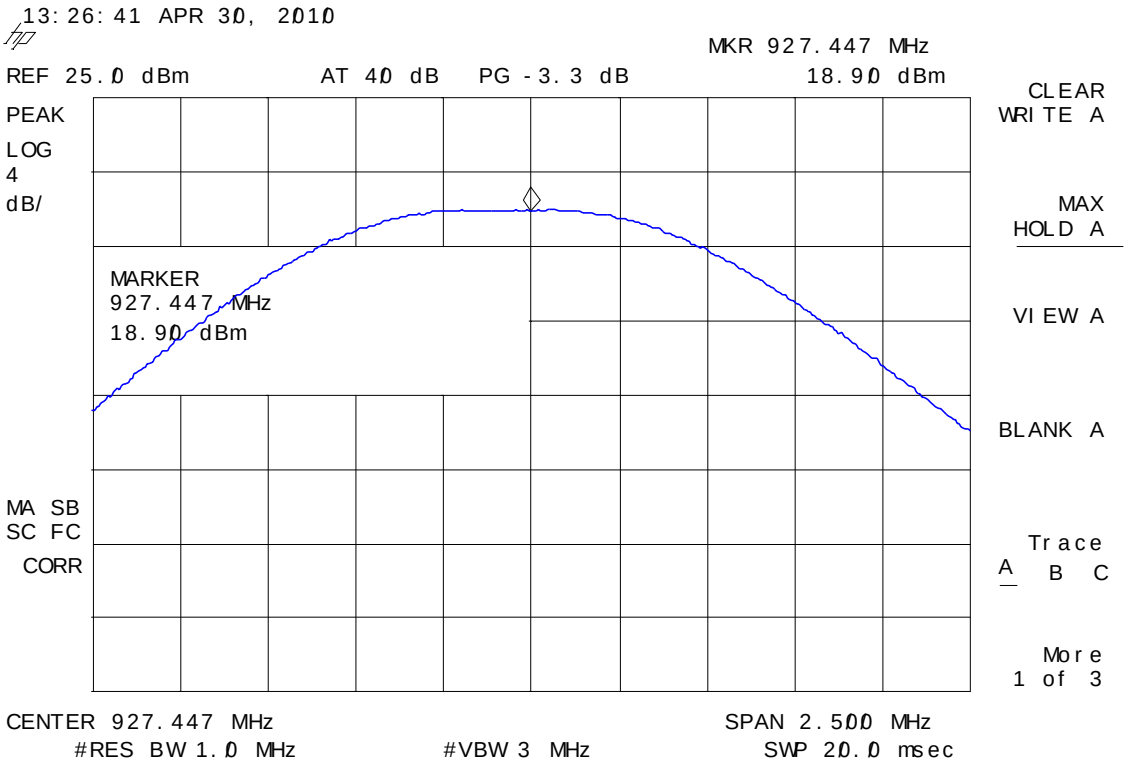


Figure 4.5.3 Graph illustrating peak output power at high channel.

4.6 Measurement of band edge compliance

Test object	SpiroCom	Sheet	ADJ_PWR-6
Type	SpiroCom	Project no.	E702421
Serial no.	10160090, FCCx	Date	30 Apr. 2010
Client	Interspiro AB	Initials	DAC
Specification	FCC Part 15, Subpart C, Section 15.247 Industry Canada RSS-210 Issue 7, A8.1		

Test method Characteristics	DA 00-705A1	Temperature Humidity	21 °C 36 % RH
Test equipm.	See section 6 List of instruments		
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 2 MHz DET: Peak CF: : Low, midd, high frequency Trace: Max hold		

Frequency	Measured	Limit	Comments
902 MHz	-33.66 dBm	-20 dB @ 902 MHz	Hopping disabled
902 MHz	-23.07 dBm	-20 dB @ 902 MHz	Hopping enabled
928 MHz	-35.62 dBm	-20 dB @ 928 MHz	Hopping disabled
928 MHz	-25.25 dBm	-20 dB @ 928 MHz	Hopping enabled

Note 1:

Test result — The measured range of operating frequencies was within the limits

Test modulation — GFSK

Compliant — Yes

Comments — None

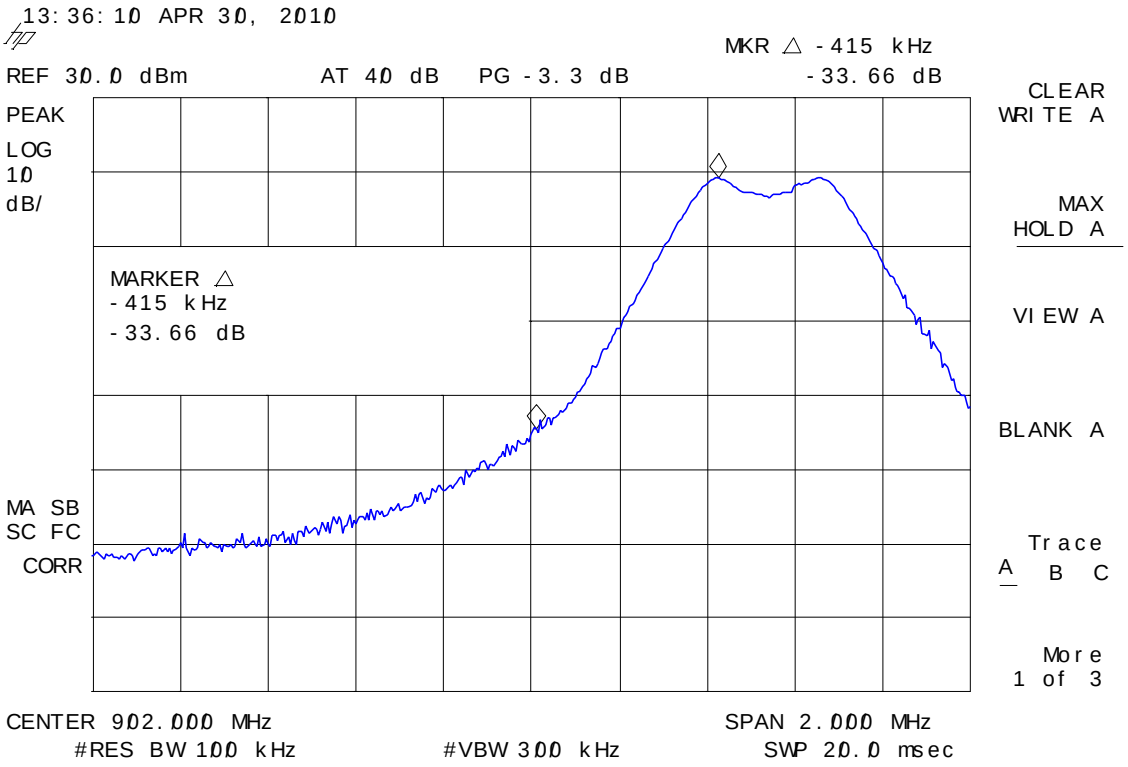


Figure 4.6.1 Graph illustrating band-edge compliance low channel with frequency hopping disabled.

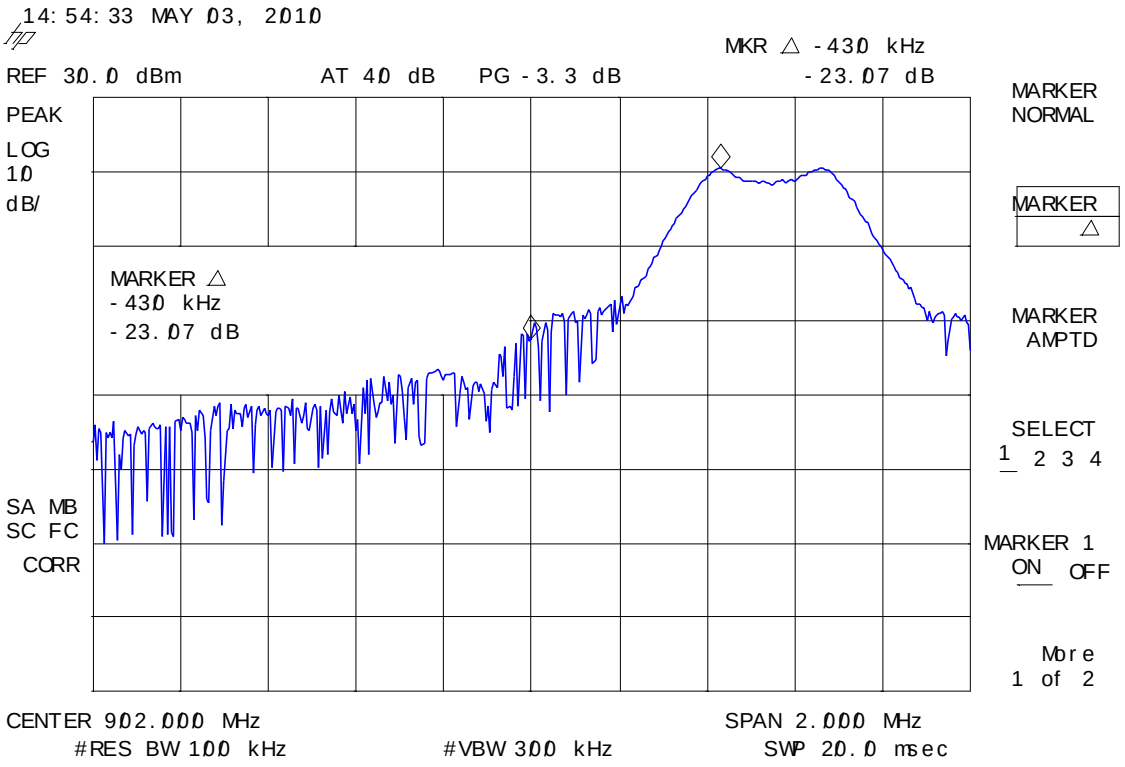


Figure 4.6.2 Graph illustrating band-edge compliance low channel with frequency hopping enabled.

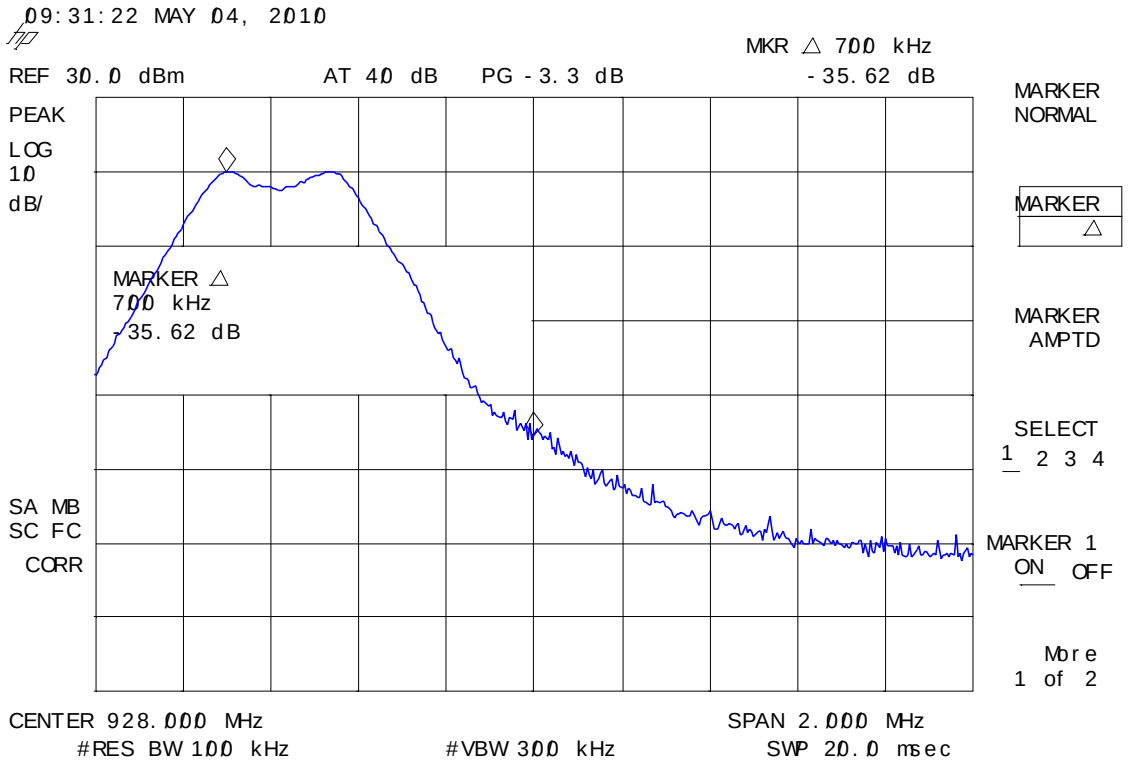


Figure 4.6.3 Graph illustrating band-edge compliance high channel with frequency hopping disabled

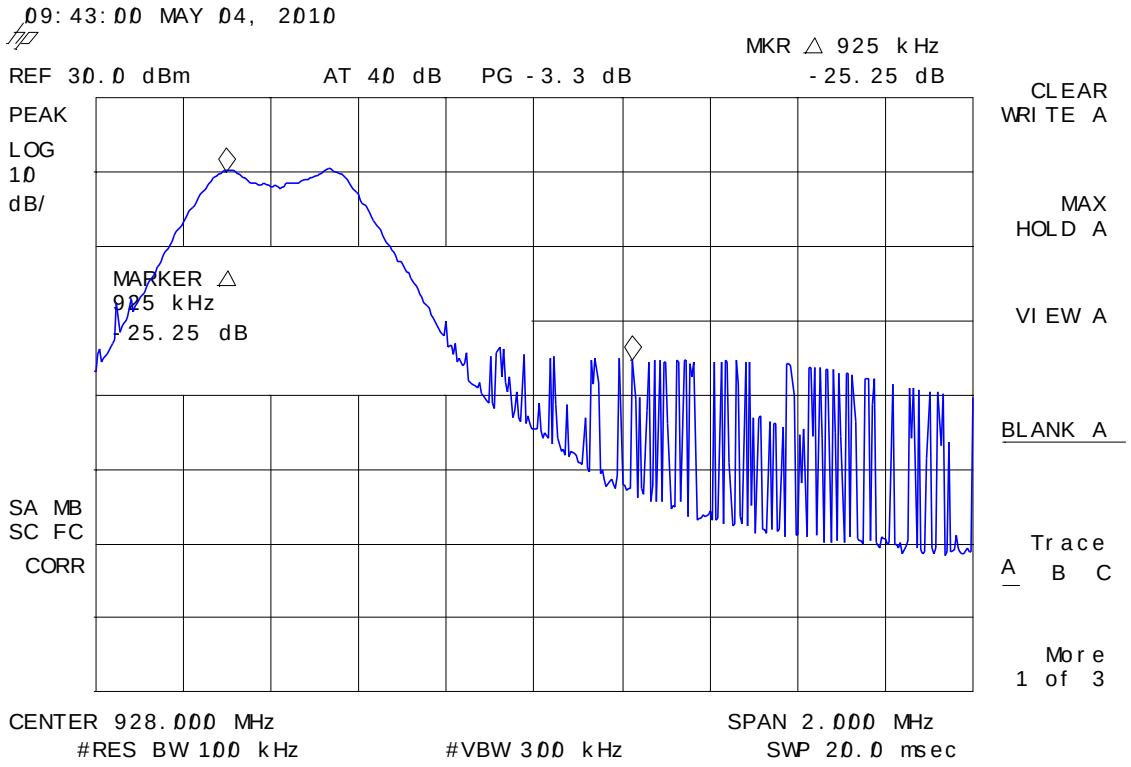


Figure 4.6.4 Graph illustrating band-edge compliance high channel with frequency hopping enabled.

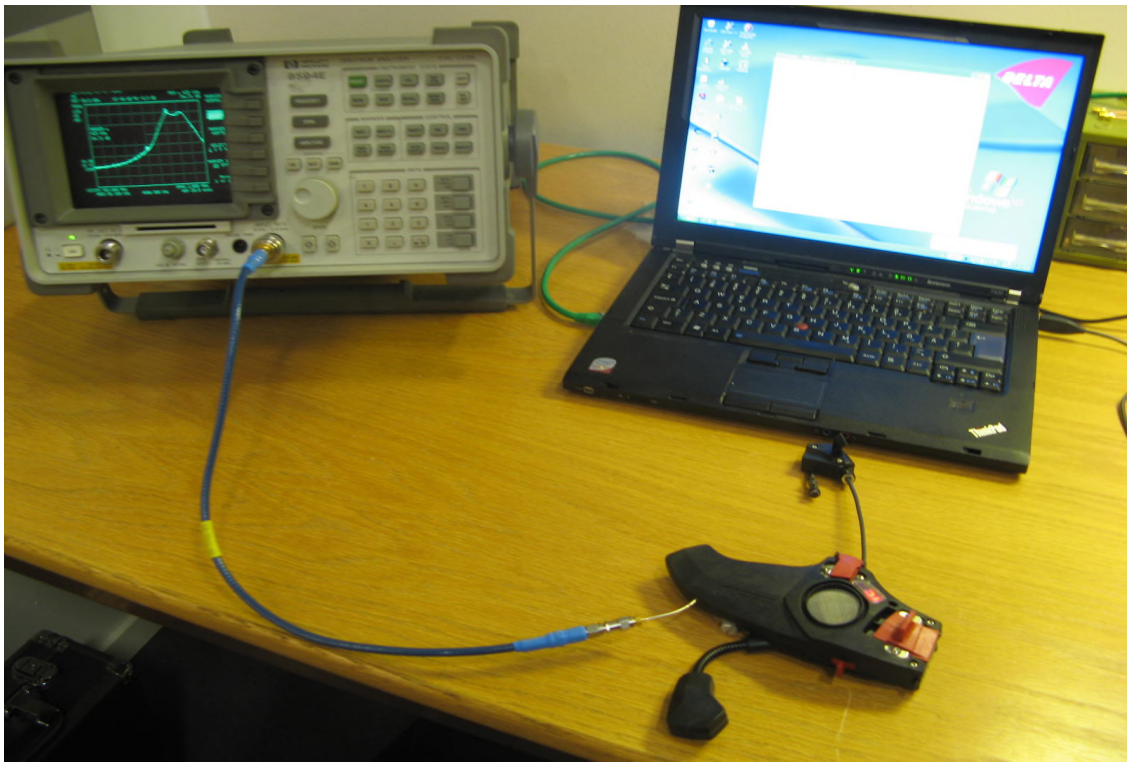


Photo 4.6.1 Test setup regarding measurement of band edge compliance.

4.7 Measurement of conducted spurious emission

Test object	SpiroCom	Sheet	ADJ_PWR-7
Type	SpiroCom	Project no.	E702421
Serial no.	10160090, FCCx	Date	29 Apr. 2010
Client	Interspiro AB	Initials	DAC
Specification	FCC Part 15, Subpart C, Section 15.247		

Test method Characteristics	DA 00-705A1	Temperature Humidity	22 °C 39 % RH
Test equipm.	Control room to semi anechoic chamber. See section 6 Listy of instruments.		
SA Settings	RBW: 100 kHz SPAN: 1.1 GHz DET: Peak		

Frequency	Measured	Limit	Comments
1804.85 MHz	-54.5 dBc	-20 dBc	
1829.75 MHz	-58.8 dBc	-20 dBc	
1854.65 MHz	-58.4 dBc	-20 dBc	
Note 1:			

Test result	The measured range of operating frequencies was within the limits
Test modulation	GFSK
Compliant	Yes
Comments	Measured values and given limits are specified in dBc meaning power relative to maximum peak power of the carrier frequency

Conducted emission 2010-04-29

900 MHz - 10 GHz

```
EUT:                 SpiroCom
Manufacturer:        WSI
Operating Condition: 4.5 VDC
Test Site:           DELTA Development Technology AB
Operator:            Daniela Coman
Test Specification:  FCC Part 247
Comment:             Low channel (902 MHz)
Start of Test:
```

SCAN TABLE: "FCC_cond_spurious"

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
900.0 MHz	10.0 GHz	50.0 kHz	MaxPeak	10.0 ms	100 kHz	None

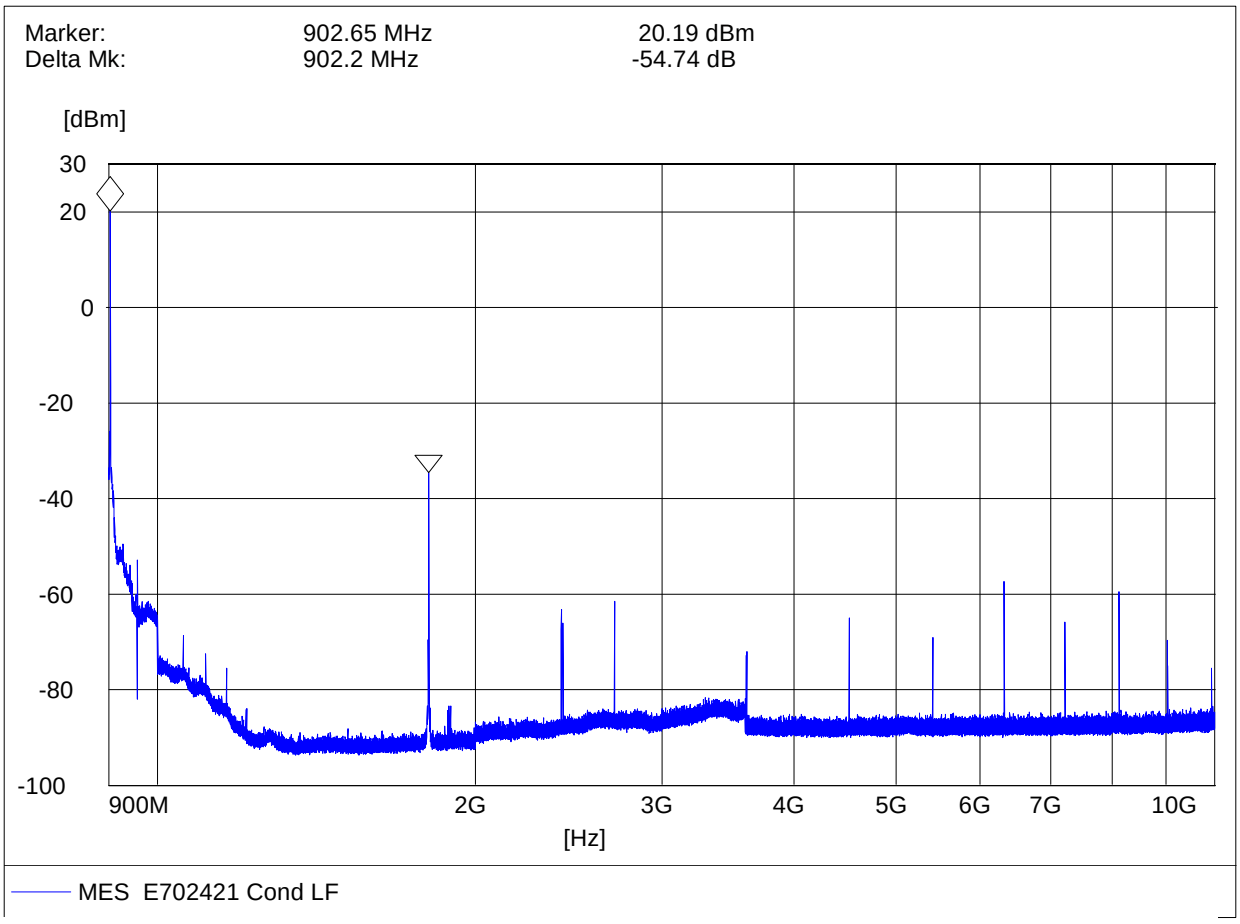


Figure 4.7.1 Conducted spurious emission, low channel.

Conducted emission 2010-04-29

900 MHz - 10 GHz

```
EUT:                 SpiroCom
Manufacturer:        WSI
Operating Condition: 4.5 VDC
Test Site:           DELTA Development Technology AB
Operator:            Daniela Coman
Test Specification:  FCC Part 247
Comment:             Mid channel (915 MHz)
Start of Test:
```

SCAN TABLE: "FCC_cond_spurious"

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
900.0 MHz	10.0 GHz	50.0 kHz	MaxPeak	10.0 ms	100 kHz	None

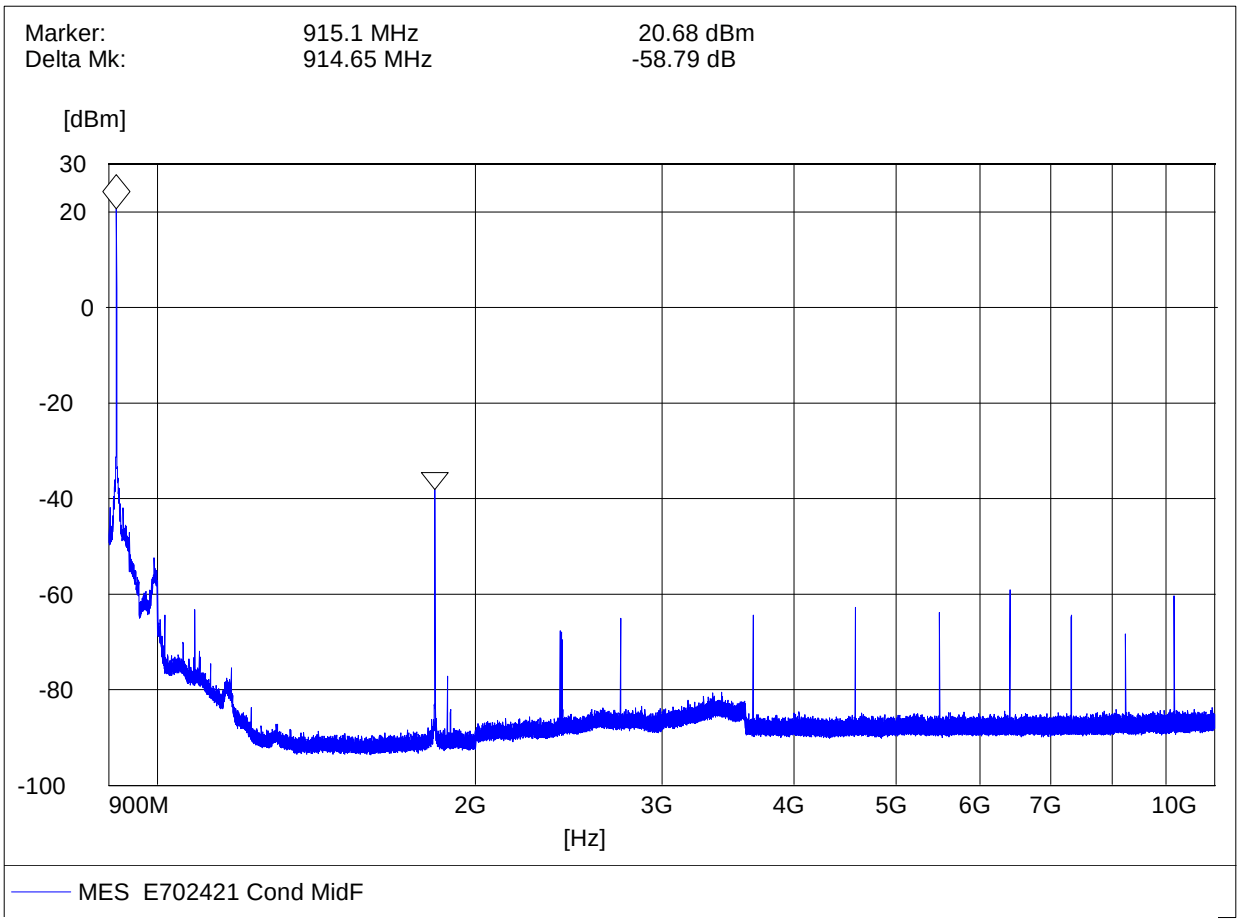


Figure 4.7.2 Conducted spurious emission, mid channel

Conducted emission 2010-04-29

900 MHz - 10 GHz

```
EUT:                 SpiroCom
Manufacturer:        WSI
Operating Condition: 4.5 VDC
Test Site:           DELTA Development Technology AB
Operator:            Daniela Coman
Test Specification:  FCC Part 247
Comment:             High channel (927 MHz)
Start of Test:
```

SCAN TABLE: "FCC_cond_spurious"

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
900.0 MHz	10.0 GHz	50.0 kHz	MaxPeak	10.0 ms	100 kHz	None

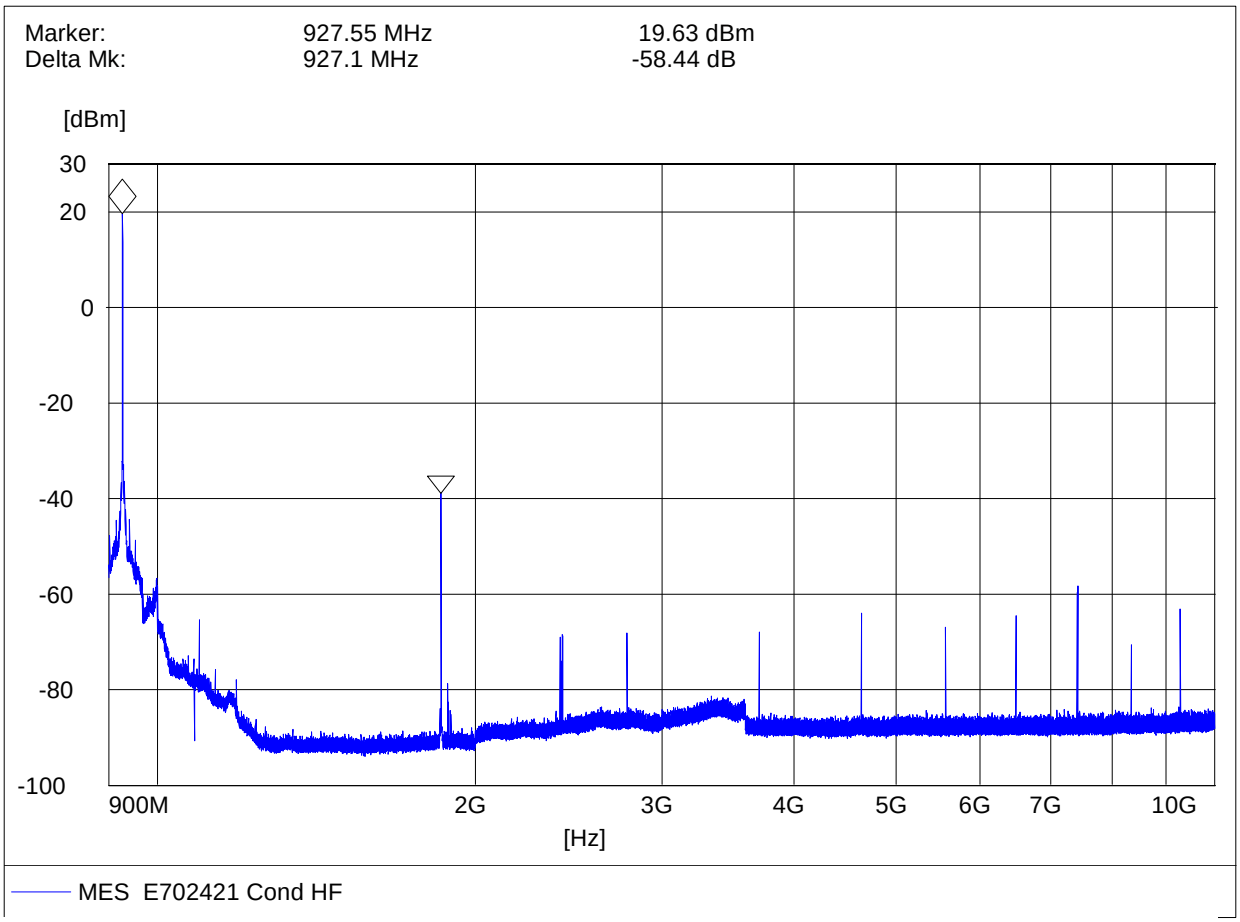


Figure 4.7.3 Conducted spurious emission, high channel

Photo 4.7.1 Test setup regarding measurement of conducted spurious emission.

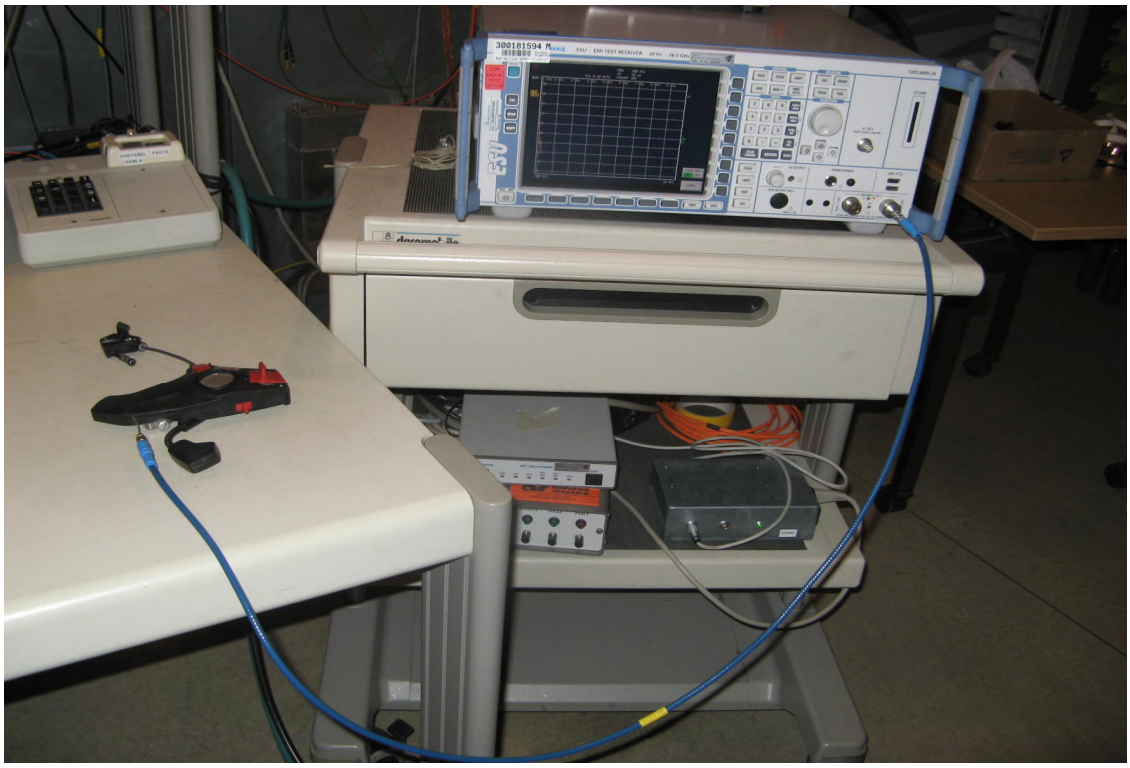


Photo 4.7.2 Test setup regarding measurement of conducted spurious emission.

4.8 Measurement of spurious emission

Test object	SpiroCom	Sheet	RE_Spur-1
Type	SpiroCom	Project no.	E702421
Serial no.	10160089, FCCx during spurious measurement	Date	29 Apr. 2010
Client	Interspiro AB	Initials	DAC
Specification	FCC Part 15, Subpart C, Section 15.247	Frequency	30-1000 MHz and 1- 10 GHz

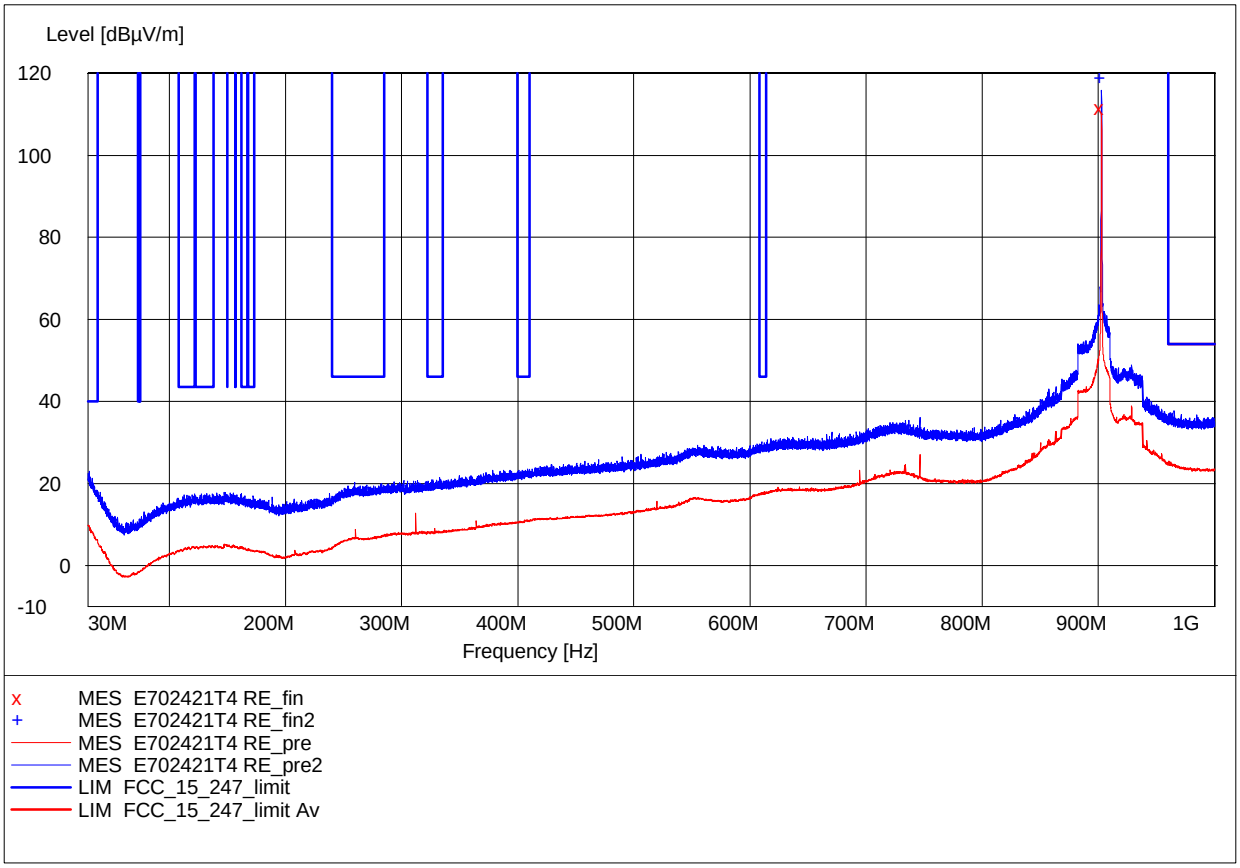
Test method Characteristics	DA 00-705, Released March 30 2000 and ANSI C63.4:2003 Complete search, Antenna distance 3 m	Temperature Humidity	21 °C 39 % RH
Detector	Peak and average	Bandwidth	100 kHz and 1 MHz
Test equipm.	Semi anechoic chamber. See section 6 List of instruments.	Uncertainty 4.9 dB	

Test result	The measured field strengths are below the limit
Test Port	Enclosure
Test frequency	Low, Middle and High frequency i.e. 902 MHz, 915 MHz and 928 MHz.
Test mode	Continuous Tx - GFSK modulation
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation

Radiated emission 2010-04-29

Complete measurement 30-1000 MHz

EUT: SpiroCom
Manufacturer: WSI
Operating Condition: 4.5 VDC Batt
Test Site: DELTA Development Technology AB
Operator: Daniela Coman
Test Specification: FCC 15.247 (15.209)
Comment: Carrier "low"
SN:10160089 FCCx.



MEASUREMENT RESULT: "E702421T4 RE_fin"

29-04-2010 10:51

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Det.	Height cm	Azimuth deg	Polarization
902.650000	111.50	27.5	110.0	AV	111.0	307.00	VERTICAL

MEASUREMENT RESULT: "E702421T4 RE_fin2"

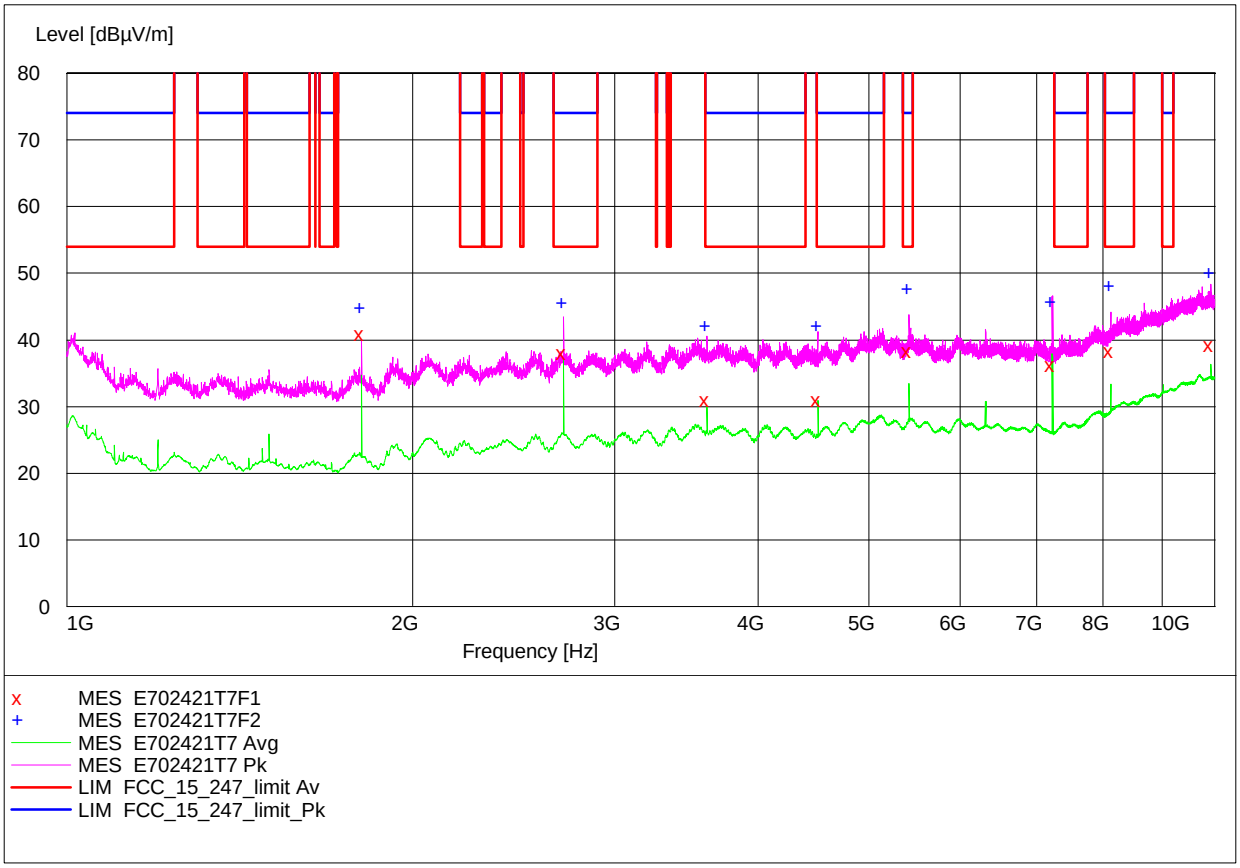
29-04-2010 10:51

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Det.	Height cm	Azimuth deg	Polarization
902.425000	118.80	27.5	110.0	PK	113.0	11.00	VERTICAL

Radiated emission 2010-04-29

Complete measurement 1-10 GHz

```
EUT:                SpiroCom
Manufacturer:       WSI
Operating Condition: 4.5 VDC
Test Site:          DELTA Development Technology AB
Operator:           Daniela Coman
Test Specification: FCC Part 247
Comment:            Low channel (902 MHz)
Start of Test:      2010-04-29 / 15:00:54
```



MEASUREMENT RESULT: "E702421T7F1"

2010-04-29 15:43

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1805.000000	40.90	-14.4	540.0	499.1	AV	147.0	283.00	VERTICAL
2708.000000	38.00	-10.7	54.0	16.0	AV	152.0	68.00	HORIZONTAL
3610.000000	30.90	-8.3	54.0	23.1	AV	100.0	168.00	VERTICAL
4512.000000	31.00	-7.7	54.0	23.0	AV	103.0	121.00	VERTICAL
5416.000000	38.30	-4.9	54.0	15.7	AV	101.0	176.00	VERTICAL
7219.000000	36.20	-0.8	N/A			108.0	28.00	HORIZONTAL
8124.000000	38.30	0.0	54.0	15.7	AV	101.0	9.00	HORIZONTAL
9926.500000	39.30	2.5	N/A			112.0	306.00	VERTICAL

MEASUREMENT RESULT: "E702421T7F2"

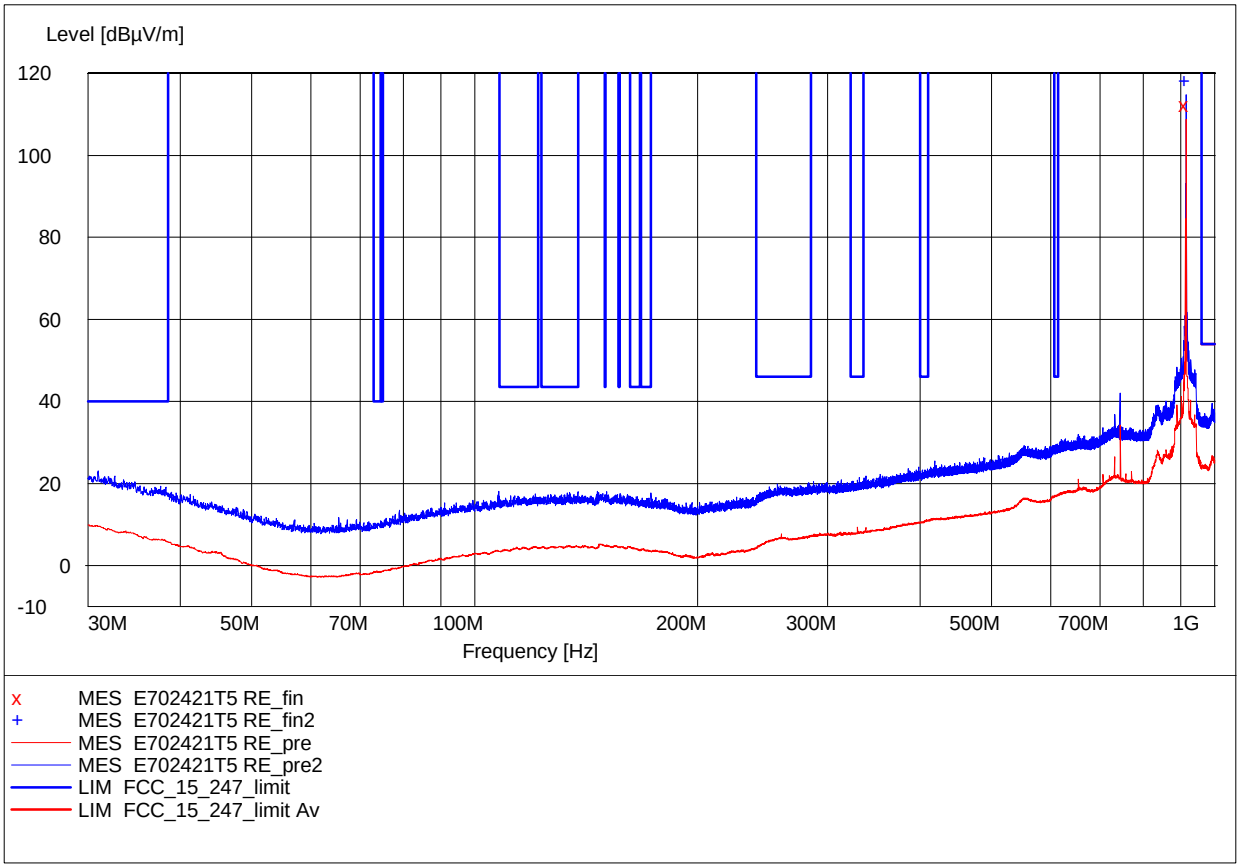
2010-04-29 15:43

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1805.000000	44.80	-14.4	540.0	495.2	PK	148.0	270.00	VERTICAL
2708.000000	45.50	-10.7	74.0	28.5	PK	150.0	43.00	HORIZONTAL
3610.000000	42.20	-8.3	74.0	31.8	PK	126.0	88.00	VERTICAL
4512.000000	42.10	-7.7	74.0	31.9	PK	100.0	123.00	VERTICAL
5416.000000	47.70	-4.9	74.0	26.3	PK	100.0	175.00	VERTICAL
7219.000000	45.60	-0.8	N/A			100.0	187.00	HORIZONTAL
8124.000000	48.00	0.0	74.0	26.0	PK	105.0	360.00	HORIZONTAL
9926.500000	50.00	2.5	N/A			100.0	246.00	HORIZONTAL

Radiated emission 2010-04-29

Complete measurement 30-1000 MHz

```
EUT:                 SpiroCom
Manufacturer:        WSI
Operating Condition: 4.5 VDC Batt
Test Site:           DELTA Development Technology AB
Operator:            Daniela Coman
Test Specification:  FCC 15.247 (15.209)
Comment:             Carrier "mid"
                     SN:10160089 FCCx.
```



MEASUREMENT RESULT: "E702421T5 RE_fin"

29-04-2010 11:26

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Det.	Height cm	Azimuth deg	Polarization
915.100000	112.30	27.8	110.0	AV	111.0	305.00	VERTICAL

MEASUREMENT RESULT: "E702421T5 RE_fin2"

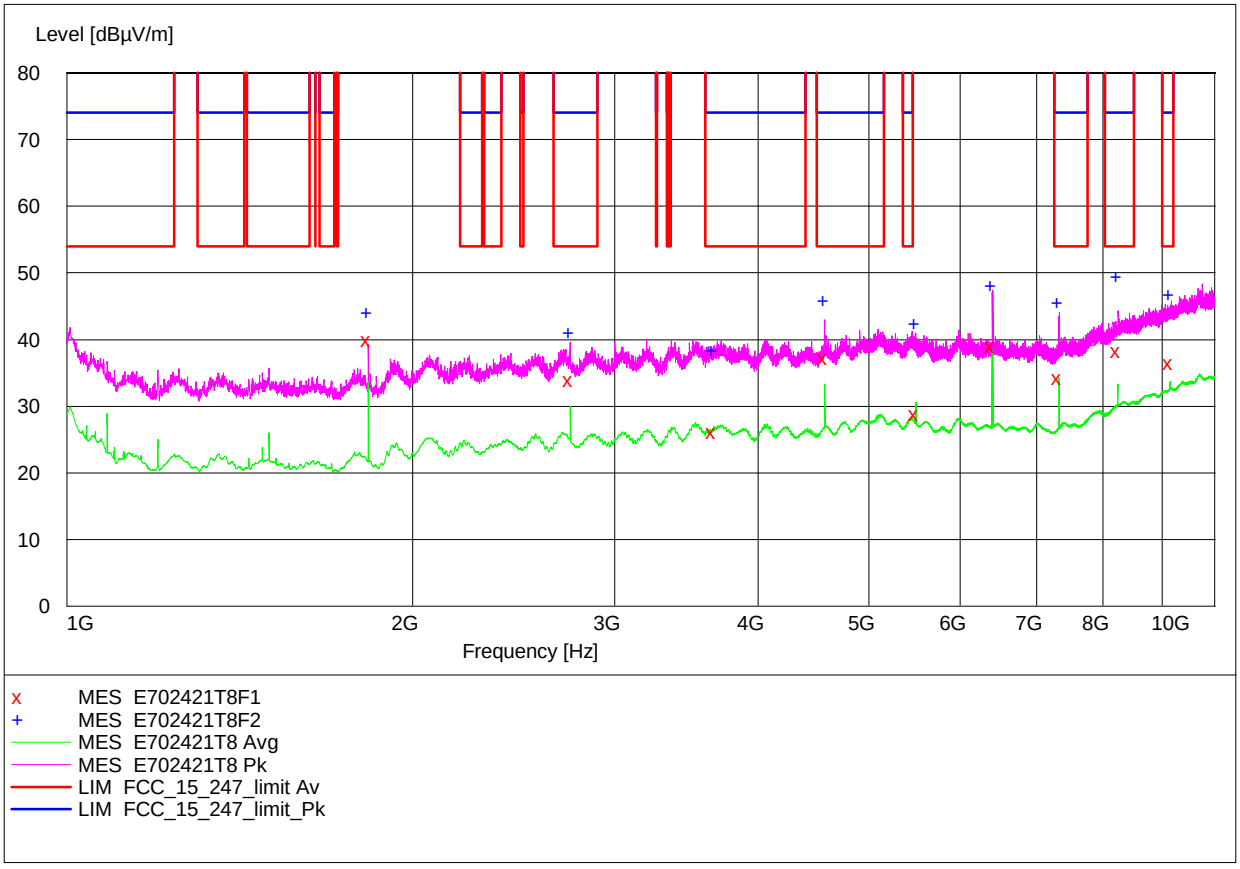
29-04-2010 11:26

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Det.	Height cm	Azimuth deg	Polarization
915.100000	118.20	27.8	110.0	PK	111.0	305.00	VERTICAL

Radiated emission 2010-04-29

Complete measurement 1-10 GHz

EUT: SpiroCom
Manufacturer: WSI
Operating Condition: 4.5 VDC
Test Site: DELTA Development Technology AB
Operator: Daniela Coman
Test Specification: FCC Part 247
Comment: Mid channel (915 MHz)
Start of Test: 2010-04-29 / 16:08:01



MEASUREMENT RESULT: "E702421T8F1"

2010-04-29 16:51

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1830.000000	40.00	-14.2	N/A			125.0	122.00	HORIZONTAL
2745.000000	34.00	-10.7	54.0	20.0	AV	155.0	122.00	HORIZONTAL
3658.500000	26.10	-8.1	54.0	27.9	AV	104.0	80.00	HORIZONTAL
4574.500000	37.30	-7.3	54.0	16.7	AV	111.0	244.00	VERTICAL
5488.500000	28.90	-4.9	N/A			100.0	181.00	VERTICAL
6404.000000	39.00	-3.3	N/A			100.0	62.00	VERTICAL
7319.000000	34.30	-0.5	54.0	19.7	AV	151.0	6.00	HORIZONTAL
8233.500000	38.20	0.1	54.0	15.8	AV	101.0	55.00	VERTICAL
9148.500000	36.50	1.1	54.0	17.5	AV	134.0	107.00	VERTICAL

MEASUREMENT RESULT: "E702421T8F2"

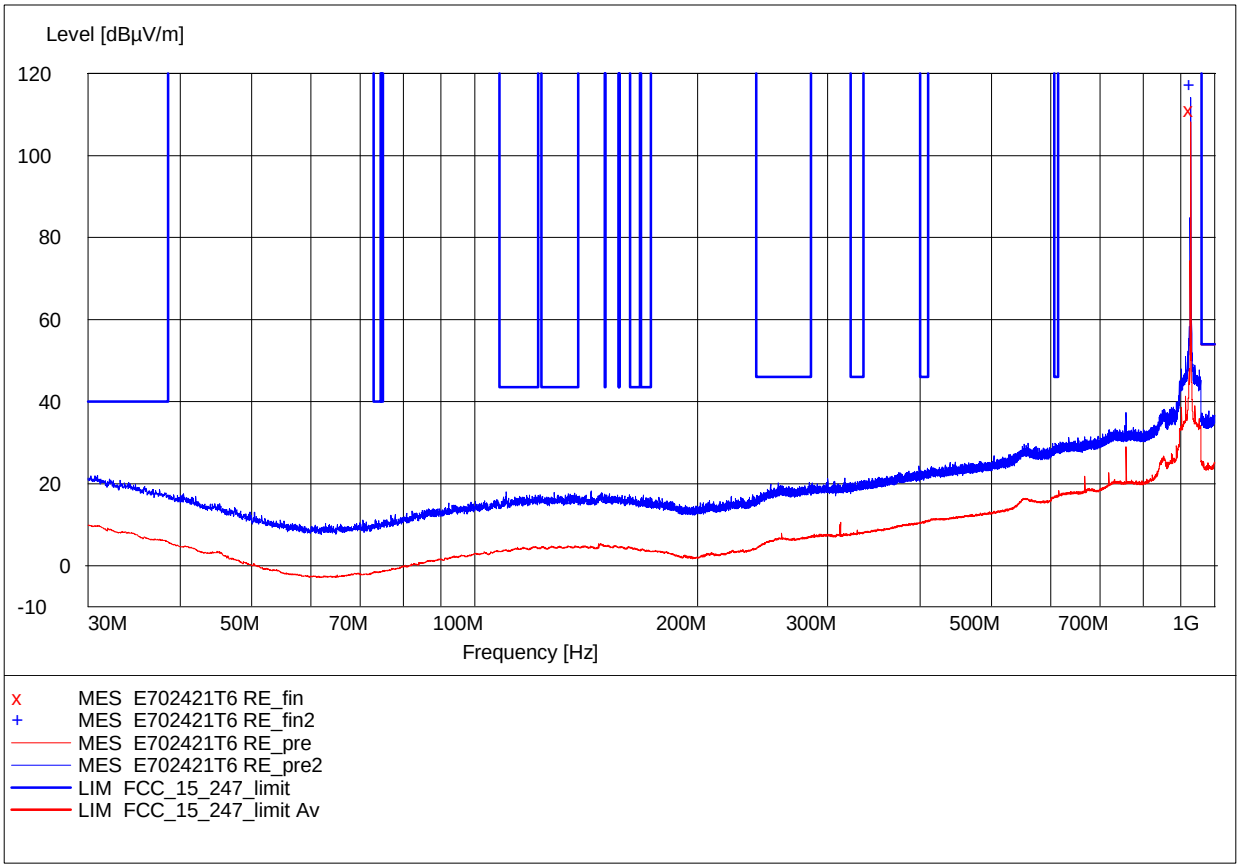
2010-04-29 16:51

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1830.000000	43.90	-14.2	N/A			125.0	123.00	HORIZONTAL
2745.000000	41.00	-10.7	74.0	33.0	PK	175.0	123.00	HORIZONTAL
3658.500000	38.20	-8.1	74.0	35.8	PK	191.0	43.00	VERTICAL
4574.500000	45.90	-7.3	74.0	28.1	PK	125.0	245.00	VERTICAL
5488.500000	42.30	-4.9	N/A			110.0	171.00	VERTICAL
6404.000000	48.10	-3.3	N/A			100.0	63.00	VERTICAL
7319.000000	45.50	-0.5	74.0	28.5	PK	102.0	11.00	HORIZONTAL
8233.500000	49.40	0.1	74.0	24.6	PK	100.0	57.00	VERTICAL
9148.500000	46.70	1.1	74.0	27.3	PK	186.0	176.00	HORIZONTAL

Radiated emission 2010-04-29

Complete measurement 30-1000 MHz

```
EUT:                 SpiroCom
Manufacturer:        WSI
Operating Condition: 4.5 VDC Batt
Test Site:           DELTA Development Technology AB
Operator:            Daniela Coman
Test Specification:  FCC 15.247 (15.209)
Comment:             Carrier "high"
                     SN:10160089 FCCx. Modulated.
```



MEASUREMENT RESULT: "E702421T6 RE_fin"

```
2010-04-29  12:05
   Frequency     Level  Transd   Det.  Height  Azimuth  Polarization
         MHz    dBµV/m      dB            cm      deg

  927.325000   111.10    28.5   AV    109.0   307.00  VERTICAL
```

MEASUREMENT RESULT: "E702421T6 RE_fin2"

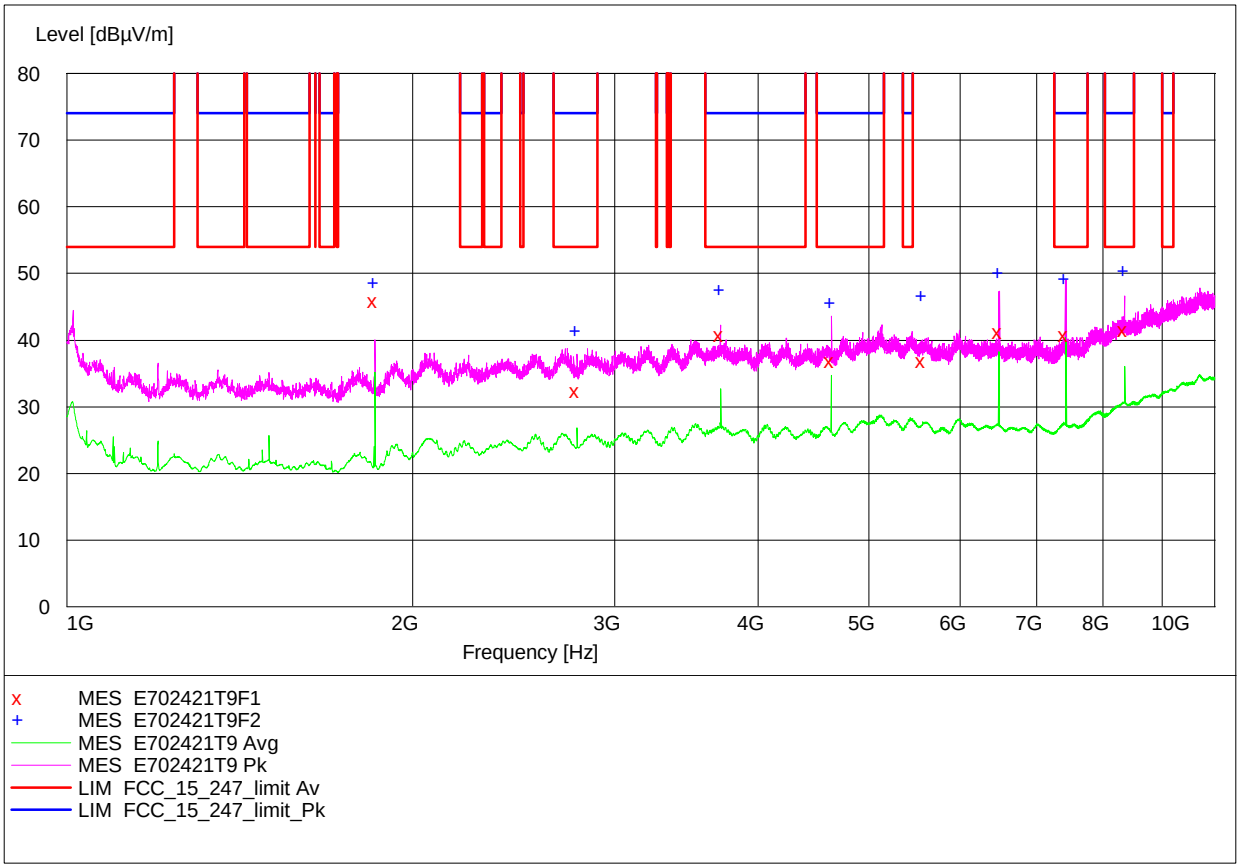
```
2010-04-29  12:05
   Frequency     Level  Transd   Det.  Height  Azimuth  Polarization
         MHz    dBµV/m      dB         cm      deg

  927.550000   117.20    28.5    PK     110.0   305.00  VERTICAL
```

DAC

Radiated emission 2010-04-29

Complete measurement 1-10 GHz

EUT: SpiroCom
Manufacturer: WSI
Operating Condition: 4.5 VDC
Test Site: DELTA Development Technology AB
Operator: Daniela Coman
Test Specification: FCC Part 247
Comment: High channel (928 MHz)
Start of Test: 2010-04-29 / 17:04:13



MEASUREMENT RESULT: "E702421T9F1"

2010-04-29 17:48

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1855.000000	45.80	-14.0	N/A			165.0	305.00	HORIZONTAL
2782.500000	32.30	-10.6	54.0	21.7	AV	132.0	29.00	VERTICAL
3709.500000	40.70	-8.0	54.0	13.3	AV	100.0	119.00	VERTICAL
4637.500000	36.90	-7.0	54.0	17.1	AV	134.0	283.00	VERTICAL
5565.000000	36.80	-4.9	N/A			112.0	176.00	HORIZONTAL
6492.500000	41.20	-3.1	N/A			102.0	46.00	VERTICAL
7418.500000	40.70	-0.2	54.0	13.3	AV	101.0	12.00	HORIZONTAL
8346.000000	41.60	-0.1	54.0	12.4	AV	100.0	62.00	VERTICAL

MEASUREMENT RESULT: "E702421T9F2"

2010-04-29 17:48

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
1855.000000	48.60	-14.0	N/A			165.0	305.00	HORIZONTAL
2782.500000	41.40	-10.6	74.0	32.6	PK	153.0	30.00	VERTICAL
3709.500000	47.50	-8.0	74.0	26.5	PK	100.0	119.00	VERTICAL
4637.500000	45.50	-7.0	74.0	28.5	PK	148.0	283.00	VERTICAL
5565.000000	46.60	-4.9	N/A			112.0	211.00	HORIZONTAL
6492.500000	50.10	-3.1	N/A			111.0	43.00	VERTICAL
7418.500000	49.20	-0.2	74.0	24.8	PK	100.0	12.00	HORIZONTAL
8346.000000	50.40	-0.1	74.0	23.6	PK	100.0	63.00	VERTICAL

Photo 4.8.1 Test setup regarding measurement of spurious emission.

Photo 4.8.2 Test setup regarding measurement of spurious emission.

4.9 Measurement of average time of occupancy

Test object	SpiroCom	Sheet	ADJ_PWR-8
Type	SpiroCom	Project no.	E702544
Serial no.	10160091, 202	Date	08 Sep. 10
Client	Interspiro AB	Initials	laj
Specification	FCC Part 15, Subpart C, Section 15.247 Industry Canada RSS-210 Issue 7, A8.1 (c)		

Test method Characteristics	Test voltage: 6 VDC Normal condition.	Temperature Humidity	22 °C 27 % RH
Test equipm.	HP Uncertainty: 1•10-7		
SA Settings	RBW: 10 kHz VBW: 30 kHz SPAN: ZERO DET: Peak CF: See below Trace: ClearWrite		

Frequency	Number of transmission/ 15 min	Dwell time/ transmission [ms]	Average time of occupancy/ 10 s [ms]	Limit [ms]	Passed	
902.54 MHz	49	385	210	400	Yes	
915.24 MHz	40	385	171	400	Yes	
927.43 MHz	42	385	180	400	Yes	

Test result	The measured average time of occupancy was within the limits
Hopping sequence	Standard hopping sequence
Compliant	Yes
Comments	Three sweeps of 300 s each was performed for low, middle and high channel. The number of transmissions on each sweep was counted. The dwell time for each channel is 385 ms and from that the average time of occupancy for a 10 s period was calculated.

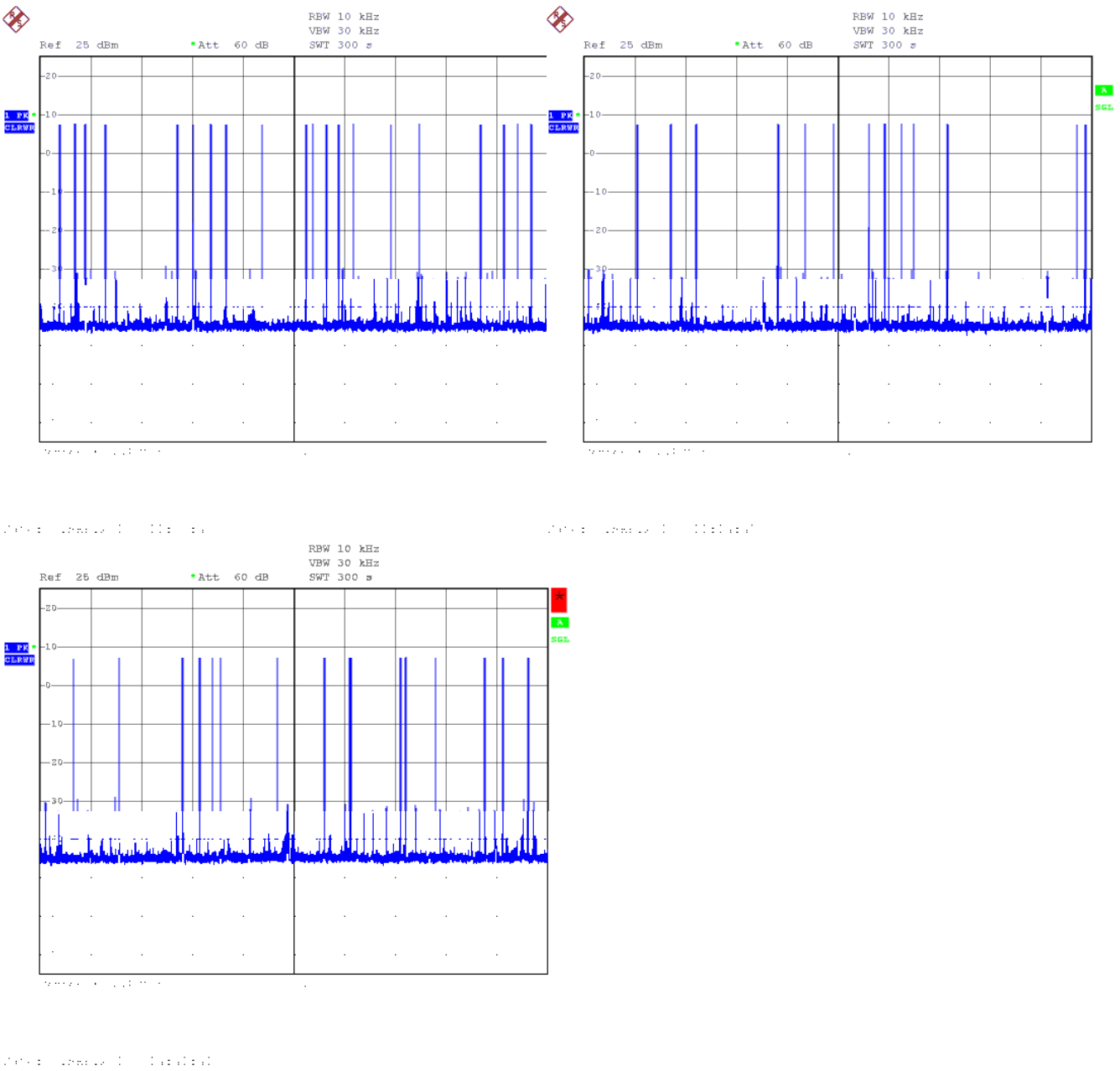


Figure 1 Average time of occupancy. The figure shows three 300 s sweeps for low channel. Here 49 transmissions occurred.

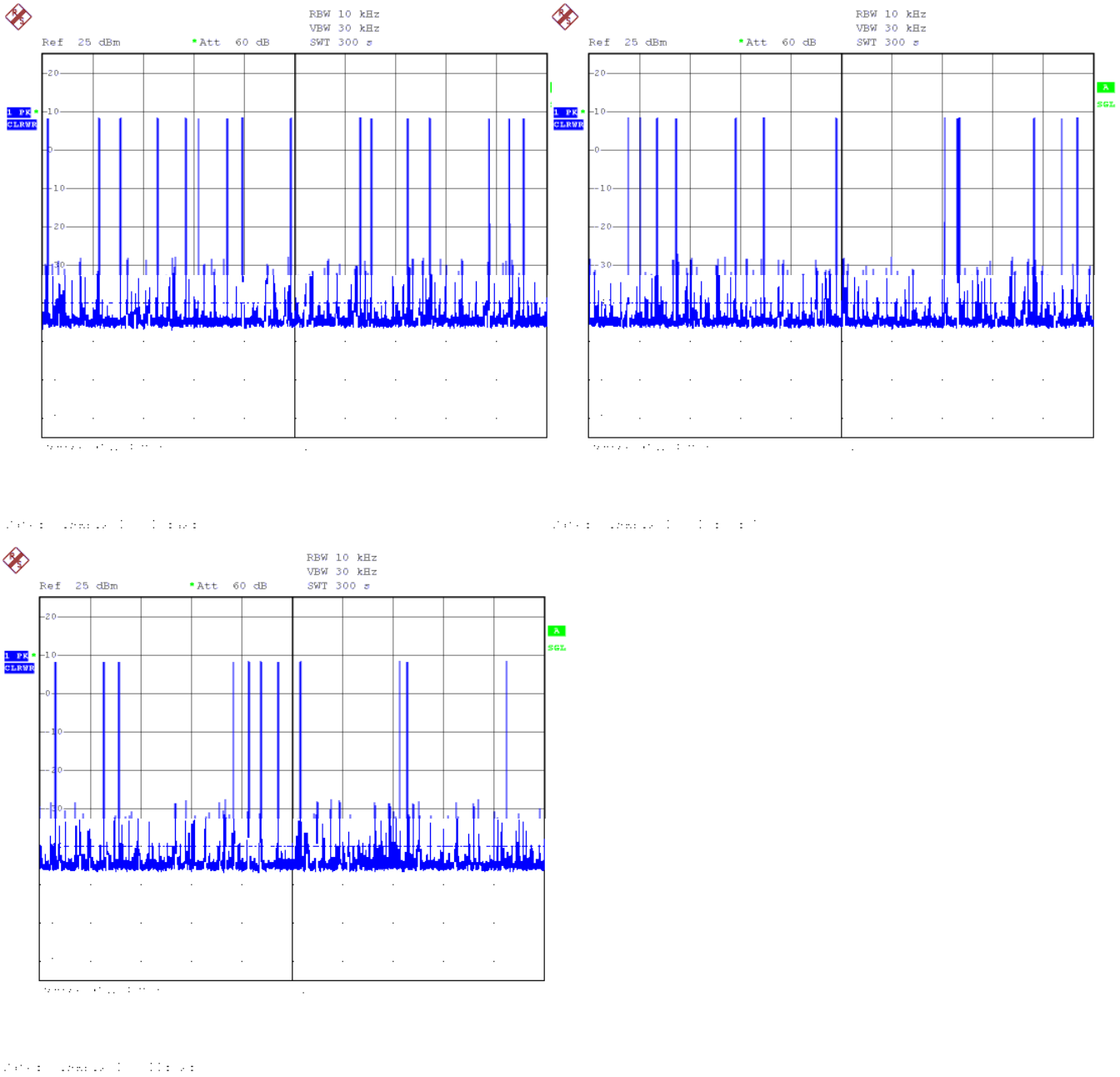


Figure 2. Average time of occupancy. The figure shows three 300 s sweeps for middle channel. Here 40 transmissions occurred.

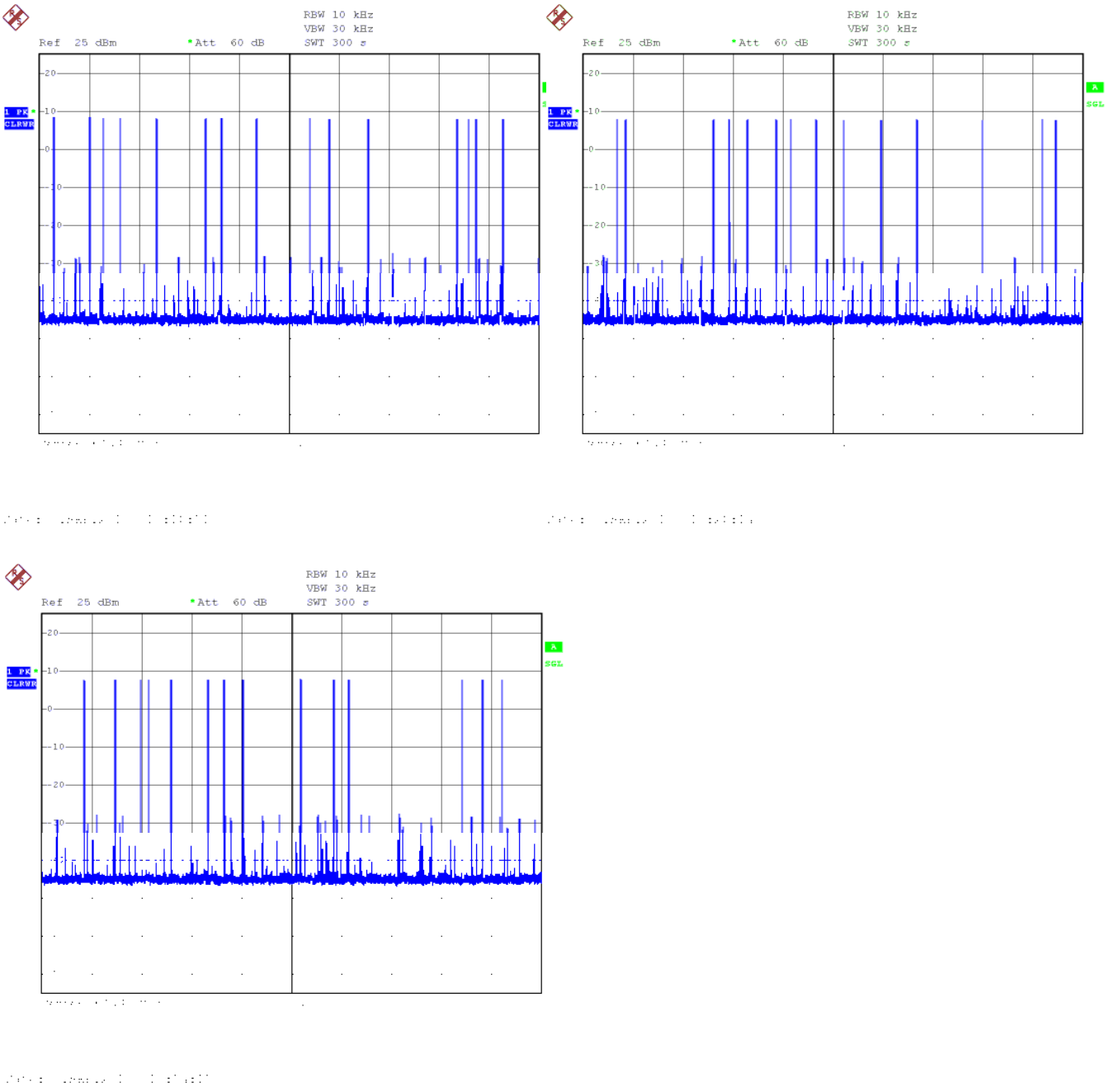


Figure 3. Average time of occupancy. The figure shows three 300 s sweeps for high channel. Here 42 transmissions occurred.

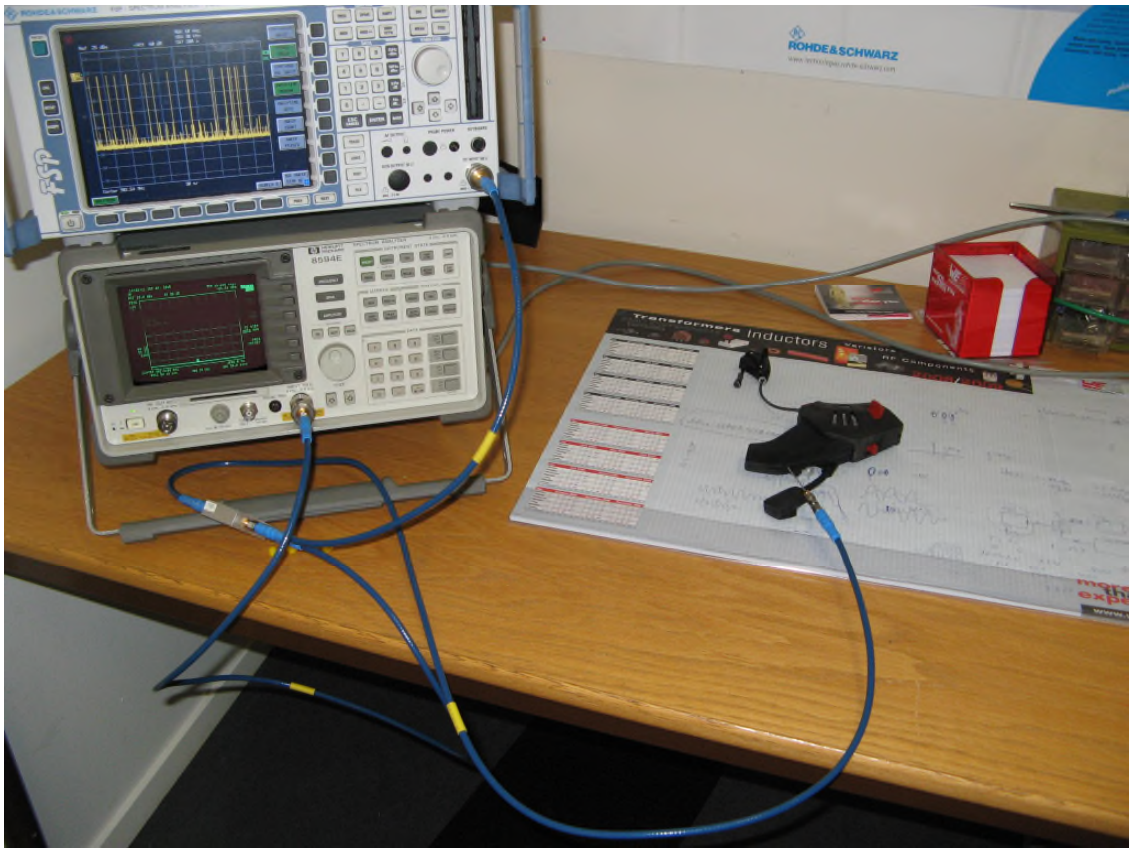


Photo 4.9.1 Test setup regarding average time of occupancy. The signal is divided to both spectrum analyzers. The bottom analyzer is set to a short sweep time to verify that each transmission is received correctly by the “counting” analyzer”

5. National registrations and accreditations

5.1 FCC Registrations

Organization: Federal Communications Commission, USA

Registration Number: 516880

Facilities: EMC chamber A 3 and 10 m

5.2 SWEDAC Accreditation

Organization: Swedish Board for Accreditation and Conformity Assessment - SWEDAC, see www.swedac.se and www.ilac.org

Registration Number: 1688

SWEDAC is part of ILAC (International Laboratory Accreditation Cooperation) including its MRA (Mutual Recognition Arrangement).

6. List of instruments

INSTRUMENT EMI SYSTEM	MANUFACTURER	TYPE	IDENT NO.
Software	Rohde & Schwarz	ES-K1 ver 1.71 SP2	36032
EMI Test receiver 20 Hz - 26.5 GHz	Rohde & Schwarz	ESU26	36020
Antenna Bilog 30-1000MHz	Chase	CBL6111A	IE-B928
Antenna Horn 1-18 GHz	ARA	DRG-118/A	E-I839
Attenuator 3 dB, up to 18 GHz	Aeroflex-INMET	18AH-3 dB	36043
Preamplifier 1 - 12.75 GHz	DELTA	UVB	36021
Power supply for preamplifiers	DELTA	UVB	36022
Spectrum analyzer 9 kHz - 2.9 GHz	Hewlett-Packard	8594E	IE-D018
GPIB Bus extender (A)	ICS	4897-B	36024
GPIB Bus extender (ESU)	ICS	4897-B	36037
GPIB Interface	Amplifier Research	CP3000	36025

7. Revisions

Rev index	Description	Date/ init
-	New document	18 May 2010/ DAC
A	Radiated spurious emission measurements above 1 GHz added in section 4.8.	02 Sep. 2010/DAC
B	Measurement of average time of occupancy added, section 4.9.	08 Sep. 2010/LAJ
C	N/A limit (for spurious emissions located outside of restricted bands of operation) inserted in measurement results lists on page 42, 45 and 48.	20 Sep. 2010/DAC
D	Reference to Industry Canada RSS-210 Issue 7 added in entire document.	05 April 2017/DAC