

# Tantalus Systems Corp.

## TR-1901

### Class II Permissive Change Report of Measurements

per

**Industry Canada RSS-210 Issue 8 – Annex 8**

and

**FCC CFR47 Part 15/C – 15.247**

Revision 1.0  
Sep 17, 2013

Approval		
Approved By:	<hr/> Harry Hodes, Principal EMC Eng.	<hr/> Sept 21 2013 Date
Reviewed By:	<hr/> Parm Singh, EMC Division Manager	<hr/> Sept 17 2013 Date
Tested By:	<hr/> Aman Jathaul, EMC Project Manager	<hr/> Sep 17 2013 Date

**Quality Auditing Institute**  
**19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada**

## **Test Report Summary**

FCC 15.247 / IC RSS-210

Frequency Hopping 902.17 – 927.83MHz Communication Module

**FCC ID:** OZFDC1901 **IC:** 3669A-DC1901

**Organization Requesting Report:** Tantalus Systems Corp.

**Contact:** Mark Fairburn, RF Design Engineer

**Test Organization:** Quality Auditing Institute Ltd.

**Contact:** Aman Jathaul, EMC Project Manager

**Test Personnel:** Aman Jathaul

## **Index**

List of Figures.....	4
Section 1: Information for Test Report of Measurements .....	5
Section II: IC RSS-210 Iss.8, Annex 8 .....	7
Section IV: FCC CFR47 Part 15.247.....	9
Appendix A: Test Plots .....	11
FHSS Compliance Tests.....	11
20 dB Bandwidth .....	11
Channel Separation.....	14
Number of Hopping Channels.....	15
Dwell Time and Time of Occupancy .....	22
Channel Bandedge.....	24

## **List of Figures**

Figure 1: Low Frequency - 126.4kHz	11
Figure 2: Mid Frequency – 300.8kHz	12
Figure 3: High Frequency – 302.4kHz	13
Figure 4: Channel Separation – 323.2kHz	14
Figure 5: Number of Hopping Channels 902-906.5MHz - 9	15
Figure 6: Number of Hopping Channels 906.5-911MHz - 10	16
Figure 7: Number of Hopping Channels 911-916MHz - 8	17
Figure 8: Number of Hopping Channels 916-920MHz - 9	18
Figure 9: Number of Hopping Channels 920-922.5MHz - 5	19
Figure 10: Number of Hopping Channels 922.5-94.7MHz - 6	20
Figure 11: Number of Hopping Channels 924.7-928MHz - 5	21
Figure 12: Dwell Time - 612.9uS	22
Figure 13: Time of Occupancy per Frequency – 2.185mS/10S*	23
Figure 14: Low Channel Bandedge	24
Figure 15: High Channel Bandedge	25

## **Section 1: Information for Test Report of Measurements**

### **Testing Details**

TESTED BY: Aman Jathaul

ENVIRONMENTAL CONDITIONS:

Day 1: Aug-27-2013

Temperature: 26.0°C, R.H.: 40.3%, Barometric Pressure: 1015.8 mBar.

Day 2: Sep-11-2013

Temperature: 27.5°C, R.H.: 39.7%, Barometric Pressure: 1016.3 mBar.

### **Test Facilities**

**Main Laboratory Headquarters:** Quality Auditing Institute

Headquarters Location/Address: 16 – 211 Schoolhouse Street, Coquitlam, BC, 3K 4X9, Canada

**Associated Laboratory:** Quality Auditing Institute (Remote Location)

EMC Test Laboratory Location/Address: 19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada

FCC Test Site Registration Number: 3 m /10 m Open Area Test Site [OATS] and  
3 m Semi-Anechoic Chamber [SAC]: 226383

Industry Canada Test Site Registration Number (3m SAC): 9543B-1

Standard Council of Canada: ISO/IEC 17025:2005 Accredited Laboratory No. 743

International Accreditation Service Inc.: ISO/IEC 17025:2005 Accredited Laboratory: No. TL-239

### **Test Equipment List**

Device	Model Number	Equipment Description	Serial No.	Next Cal
EMI Receiver	Rohde & Schwarz ESU40	EMI Receiver (20Hz-40GHz)	100011	June 26, 2015
10dB Attenuator	Narda 771-10	10dB Attenuator (DC-3GHz)	173	-
10dB Attenuator	Narda 771-10	10dB Attenuator (DC-3GHz)	119	-
RF Cable	SMA Cable	RF cable (SMA48)	216617	

### **Measurement Uncertainty**

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$ MHz
Radiated Emissions	$\pm 3$ dB
Temperature	$\pm 1^\circ\text{C}$
Humidity	$\pm 5$ %
DC and low frequency voltages	$\pm 3$ %

**Company Tested**

NAME: Tantalus Systems Corp.

ADDRESS: 301–3480 Gilmore Way  
Burnaby, BC V5G 4Y1  
Canada

CONTACT PERSON: Mr. Mark Fairburn

PHONE NUMBER: 1-604-299-0458 x229

**Equipment Under Test**

THE TEST SYSTEM: EUT: The Tantalus Systems TR-1901 is a 902-928MHz LAN repeater. The LAN communication module can support a variety of data rates and multi-level FSK modulation formats to achieve data rates upto 640kbps.

Product ID: TR-1901  
Communication Module:  
Manufacturer: Tantalus Systems Corp.  
Part Numbers: 100-0148-D

TEST SETUP: This EUT is designed to communicate with a base unit using a Frequency Hopping Spread Spectrum (FHSS) system operating on the 902-928 MHz band. To test the relevant parametrics, a coaxial pigtail was used.

MODIFICATIONS: No modifications were made for this unit to pass.

CONCLUSION: The Class II modifications to the TR-1901 series of communication modules complies with the requirements of FCC CFR47 and the requirements of Industry Canada RSS-210.

## **Section II: IC RSS-210 Iss.8, Annex 8**

DATE: Aug 27 and Sep11, 2013

TEST STANDARD: RSS-210 Iss.8 Annex 8 Frequency Hopping Systems 902-928MHz Band.

MINIMUM STANDARD: **A8.1 – Frequency Hopping Systems (General Conditions)**

Frequency hopping systems are spread spectrum systems in which the carrier is modulated with coded information in a conventional manner causing a conventional spreading of the RF energy about the carrier frequency. The frequency of the carrier is not fixed but changes at fixed intervals under the direction of a coded sequence. Frequency hopping systems are not required to employ all available hopping frequencies during each transmission. However the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream.

Incorporation of intelligence into a frequency hopping system that enables it to recognize other users of the band and to avoid occupied frequencies is permitted, provided that the frequency hopping system does it individually, and independently chooses or adapts its hopset. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

**(a)** The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset while the long-term distribution appears evenly distributed.

**(b)** Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

**(c)** For frequency hopping systems in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20 second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

### **A8.4 Transmitter Output Power and e.i.r.p. Requirements**

**(1)** For frequency hopping systems operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W, if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W, and the e.i.r.p. shall not exceed 1 W, if the hopset uses less than 50 hopping channels. As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power (see RSS-Gen).

### **A8.5 Out-of-band Emissions**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the

band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB.

**TEST SETUP:** The EUT's were operated and tested at 240Vac and 120V 60Hz for the tests and the units were transmitting at their maximum rate based on the energy that it could couple from the supply.

**MEASUREMENT METHOD:** Measurements were made using a spectrum analyzer. The EUT was set up in a 1 meter open field test site, using the manufacturer's specified normal cabling configuration, with all cables over 1 meter in length bundled at 1 meter and retained from the floor.

Emissions in both horizontal and vertical polarization were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots.

All frequencies 30-1000MHz were tested at 3m and all frequencies 1GHz and up were tested at 1m in accordance with ANSI c63.4.

**EMISSIONS DATA:** See Figure 1 to Figure 15 and **Error! Reference source not found. to Error! Reference source not found.** in Appendix A for corresponding data. A summary of the results as per the above requirements.

Test	Standard	Results
Spread Spectrum Method of Modulation	RSS-210 A8.1	This product meets the requirements of a Frequency Hopping Spread Spectrum (FHSS) system operating in the 902-928MHz band
Channel Bandwidth	RSS-210 A8.1(a)	See Figure 3. in Appendix A. The widest 20dB bandwidth was measured to be 302.4 kHz.
Channel Separation	RSS-210 A8.1(c)	See Figure 4 in Appendix A. The smallest Channel separation was measured to be 323.2 kHz.
Number of Hopping Channels	RSS-210 A8.1(c)	See Figures 5-11 in Appendix A. The number of channels is 54.
Hopping Channels Time of Occupancy	RSS-210 A8.1(c)	See Figures 12-13 in Appendix A; the dwell time per frequency is 0.612mS and the time of occupancy in a 10 second period is 2.185 mS.

**RESULTS:** Complies.



## **Section IV: FCC CFR47 Part 15.247**

DATE: Aug 27 and Sep11, 2013

GENERAL: The FCC Public Notice DA 00-705 (Filing and Measurement Guidelines for Frequency hopping Spread Spectrum Systems) was used as a guide for the tests to be performed.

APPLICABLE REGULATIONS **15.247(a)** Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

**(1)** Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

**(i)** For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

**(b)** The maximum peak conducted output power of the intentional radiator shall not exceed the following:

**(2)** For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

**(d)** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

**(g)** Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply

with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

**(h)** The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

**MODIFICATIONS**

No modifications were required for the devices to pass the test.

**MEASUREMENT DATA:**

See Figure 1 to Figure 15 and **Error! Reference source not found.** to **Error! Reference source not found.** in Appendix A.

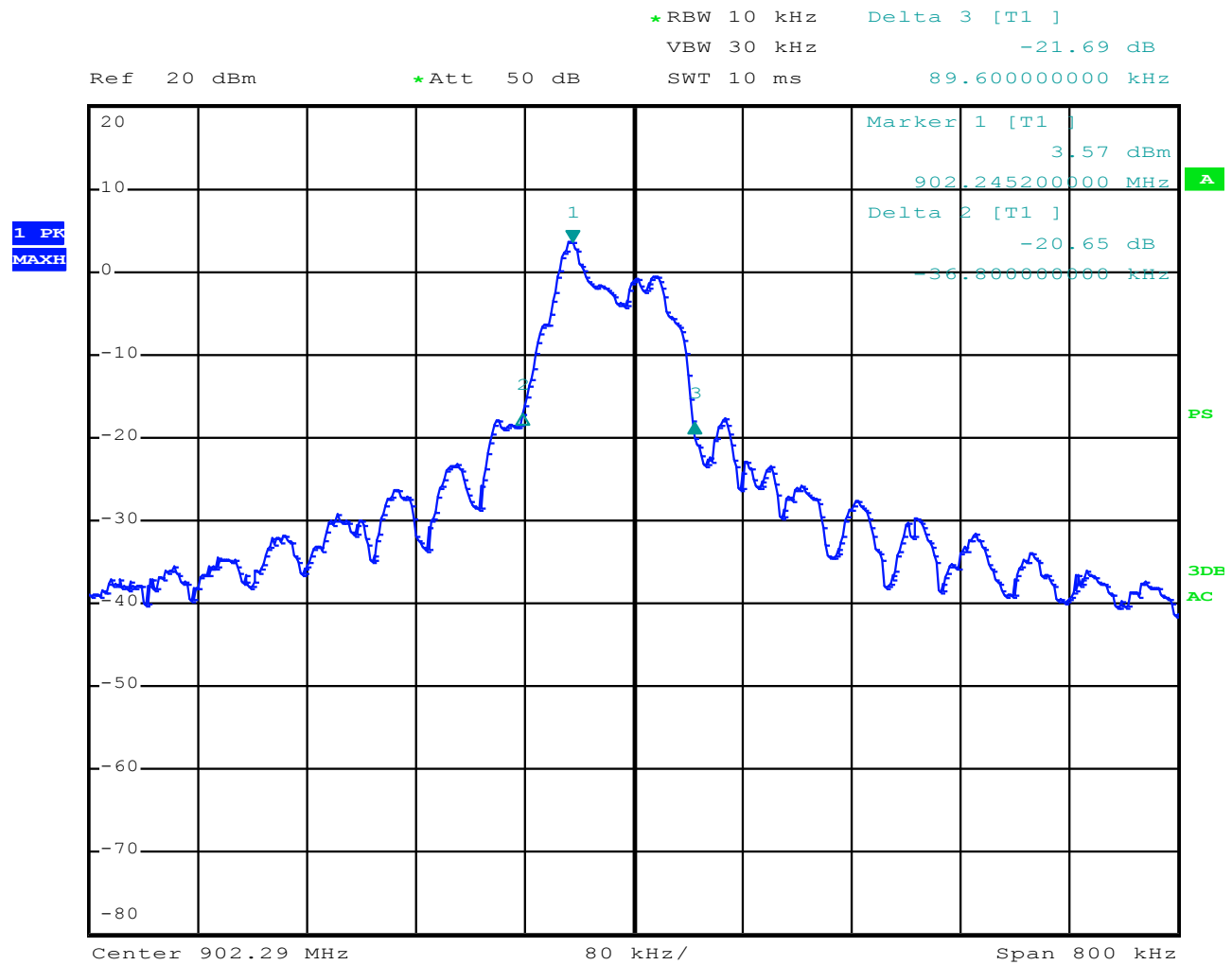
**RESULTS:**

Complies.

## Appendix A: Test Plots

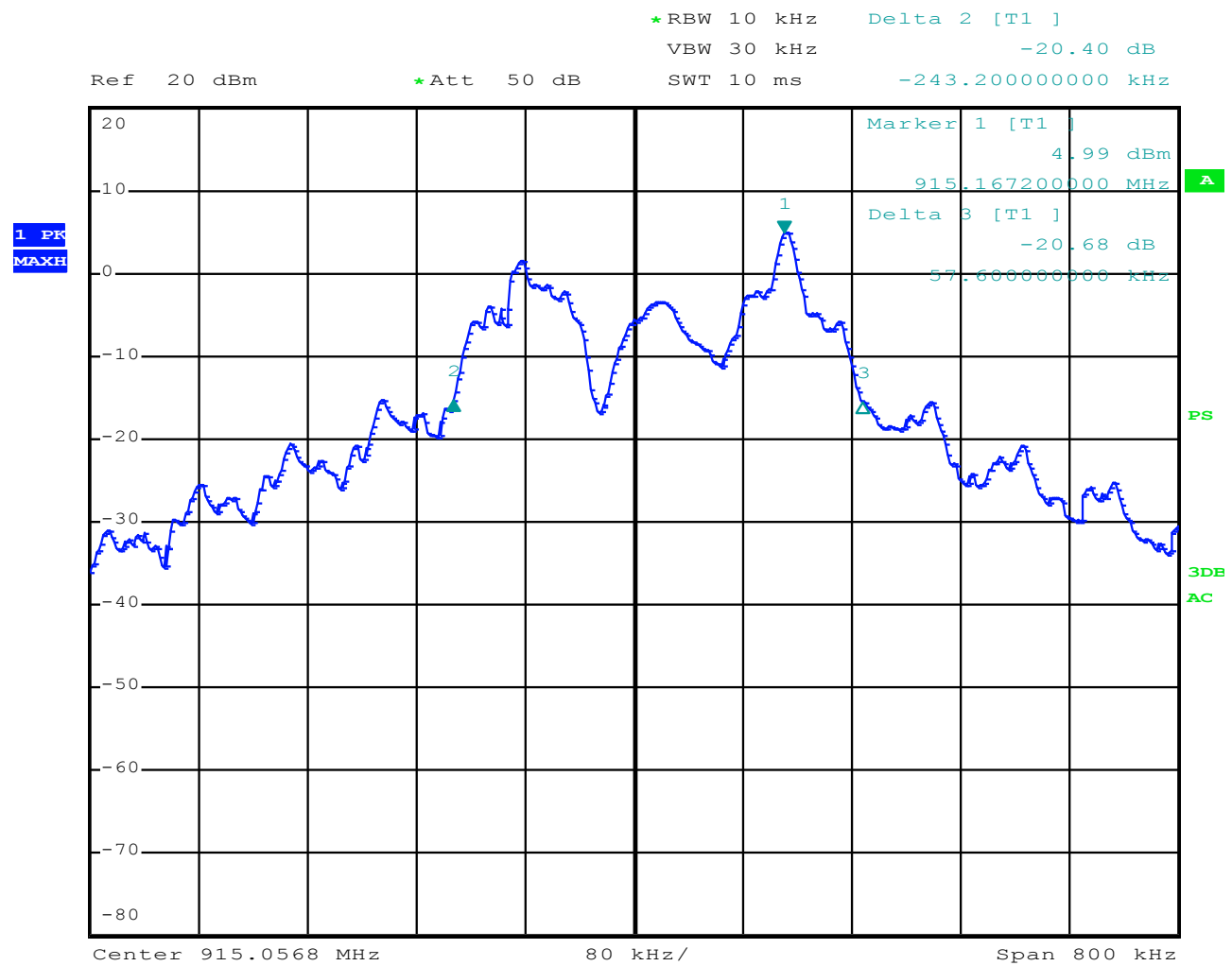
### FHSS Compliance Tests

#### 20 dB Bandwidth



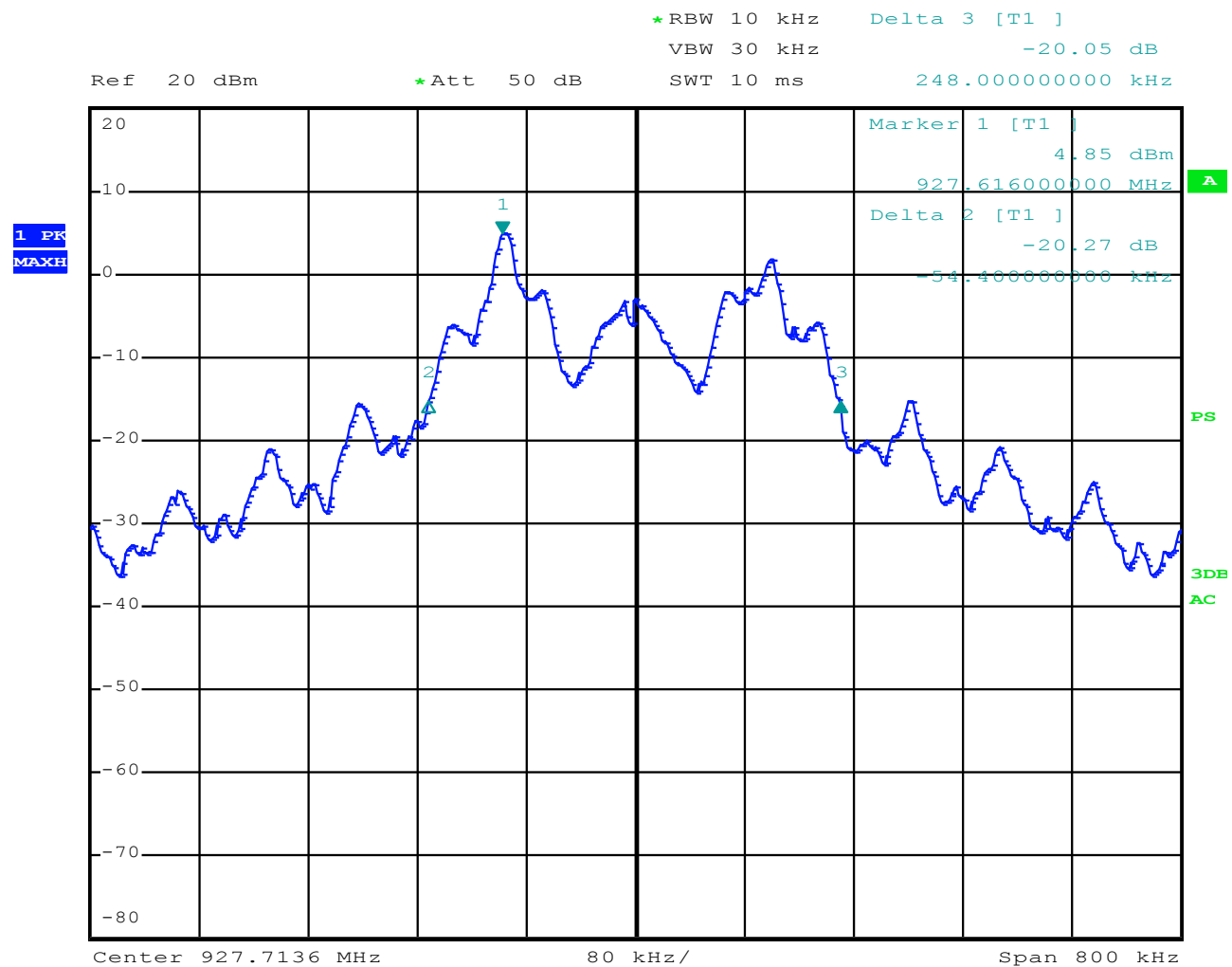
Date: 27.AUG.2013 15:02:14

Figure 1: Low Frequency - 126.4kHz



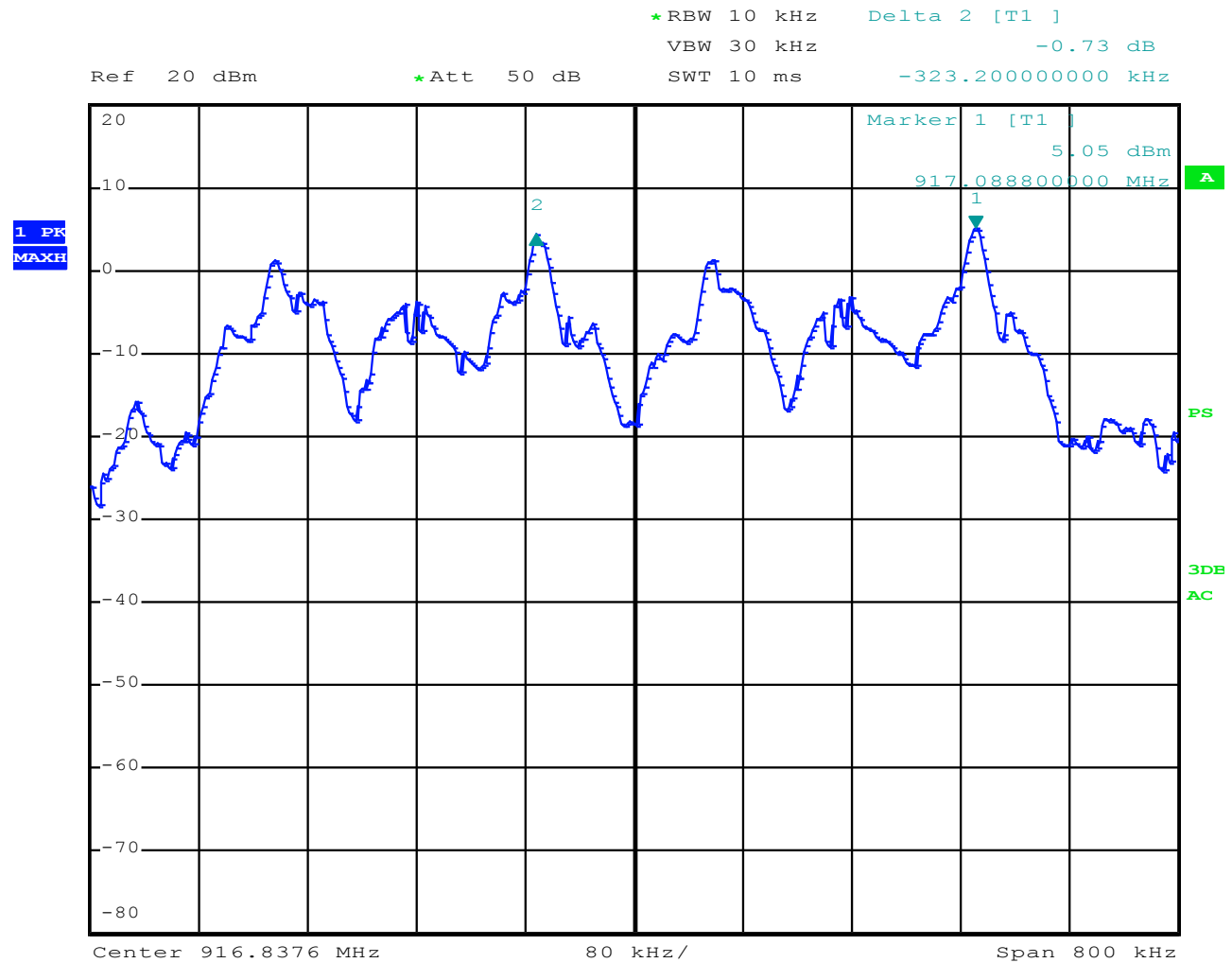
Date: 27.AUG.2013 14:50:53

Figure 2: Mid Frequency – 300.8kHz



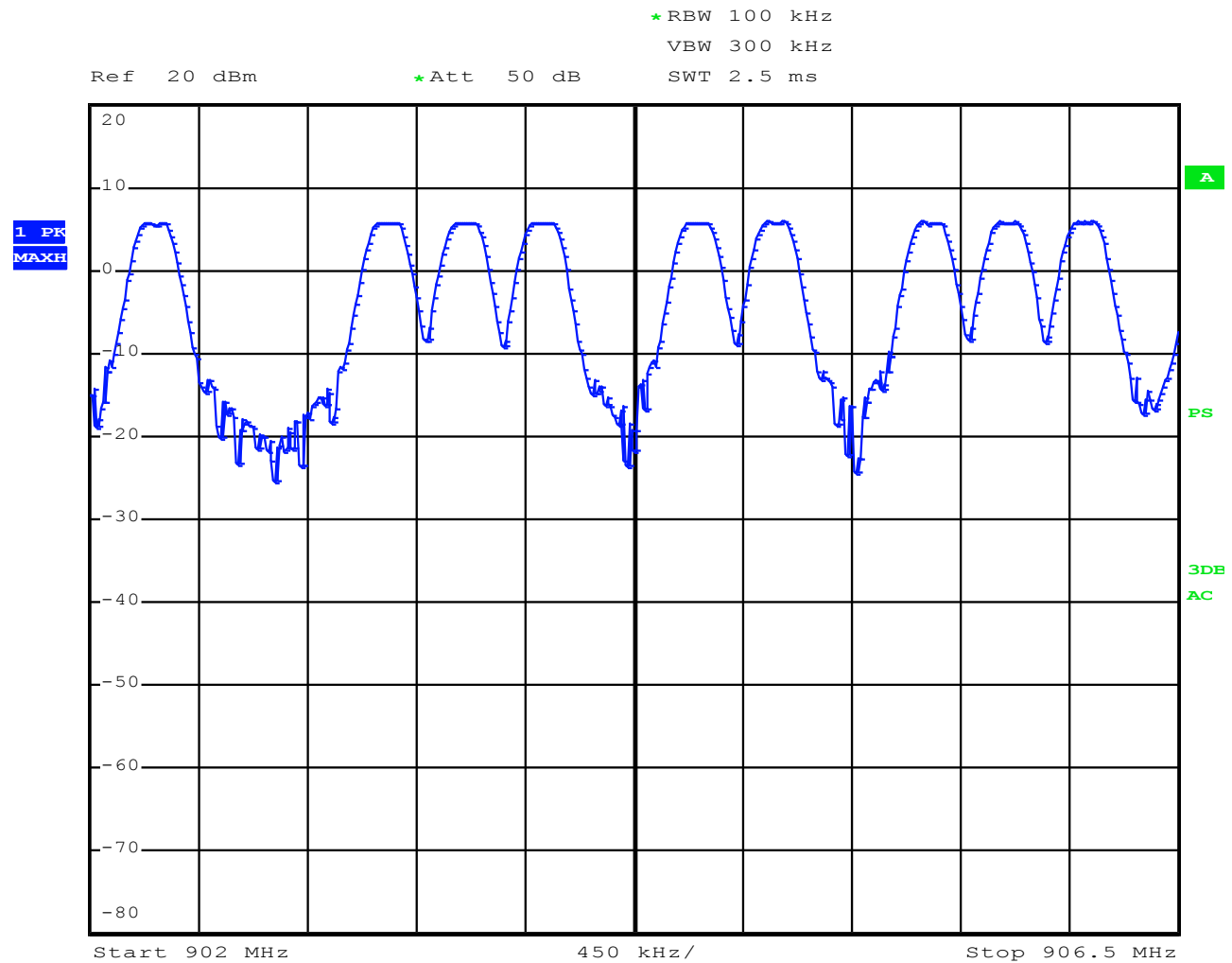
Date: 27.AUG.2013 14:07:02

Figure 3: High Frequency – 302.4kHz

**Channel Separation**

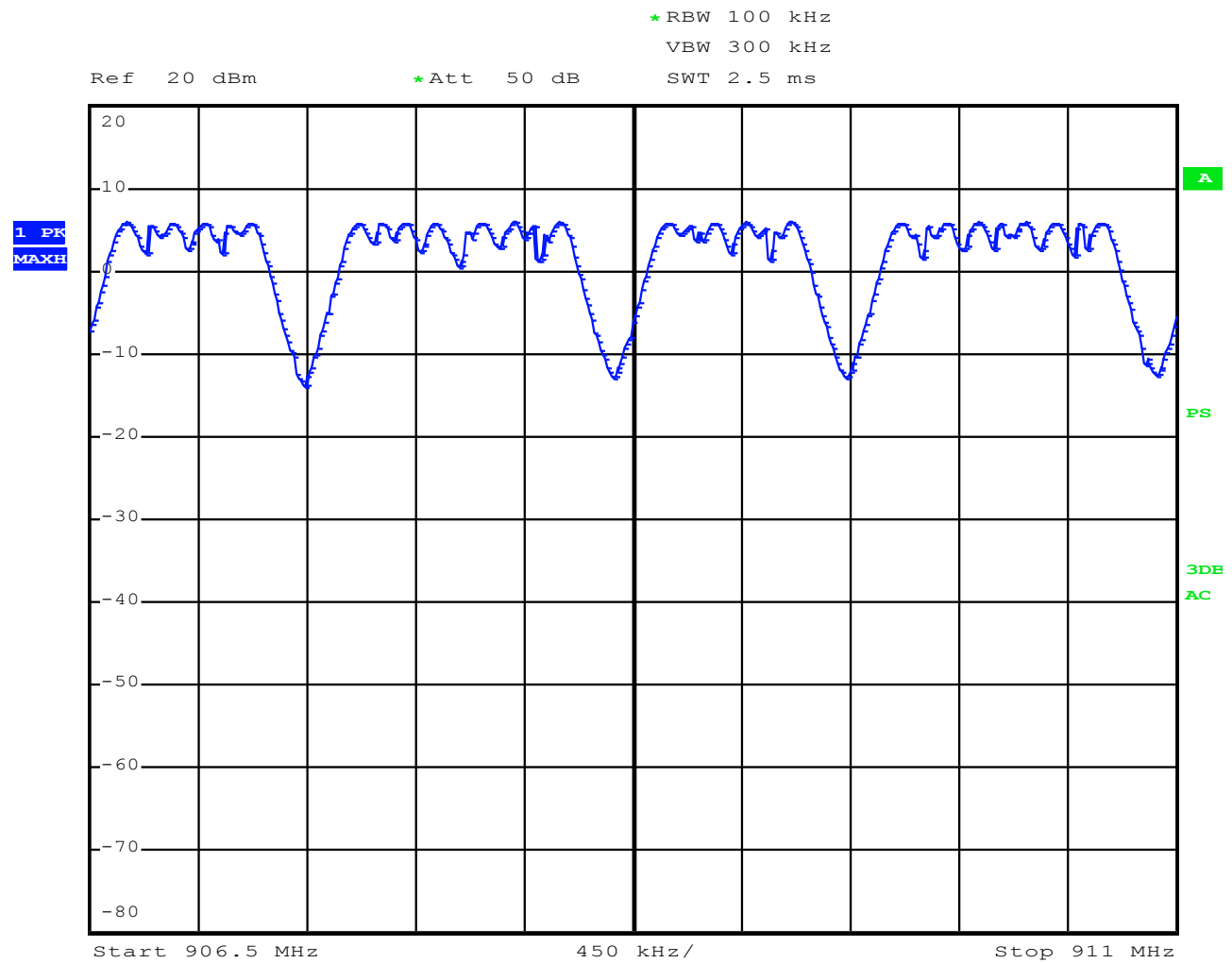
Date: 27.AUG.2013 16:24:15

**Figure 4: Channel Separation – 323.2kHz**

**Number of Hopping Channels**

Date: 27.AUG.2013 15:33:31

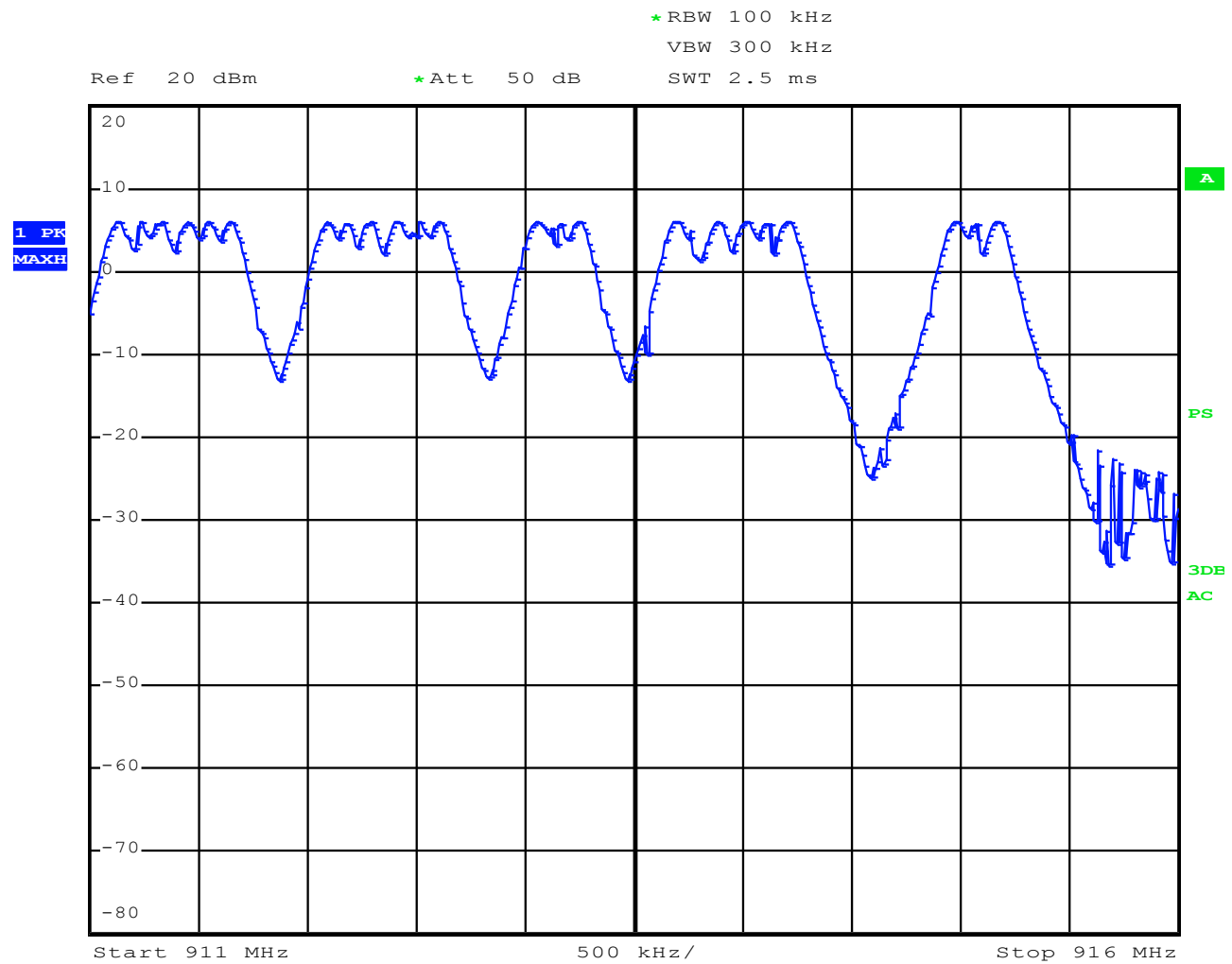
**Figure 5: Number of Hopping Channels 902-906.5MHz - 9**



Date: 27.AUG.2013 15:39:04

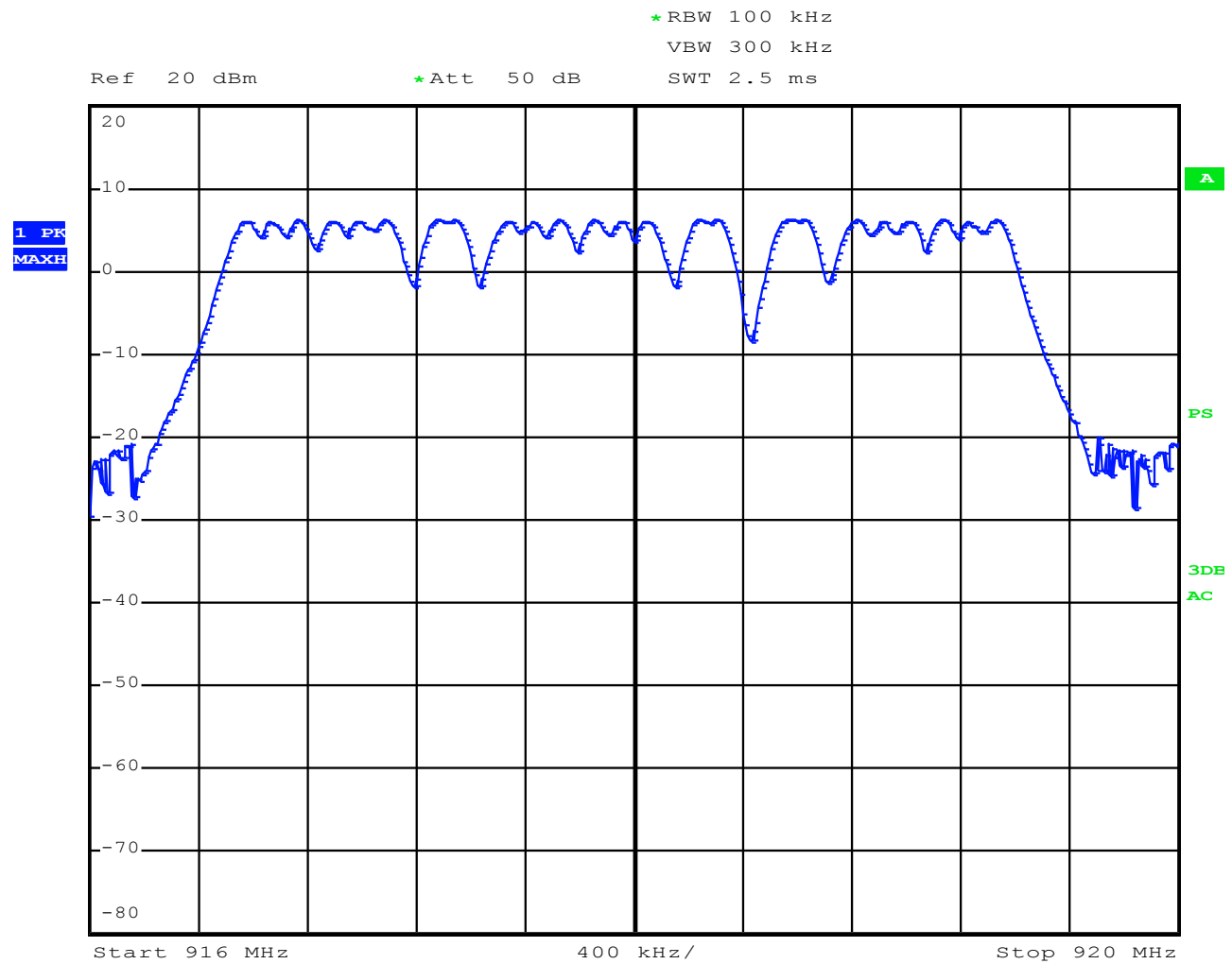
**Figure 6: Number of Hopping Channels 906.5-911MHz - 10**





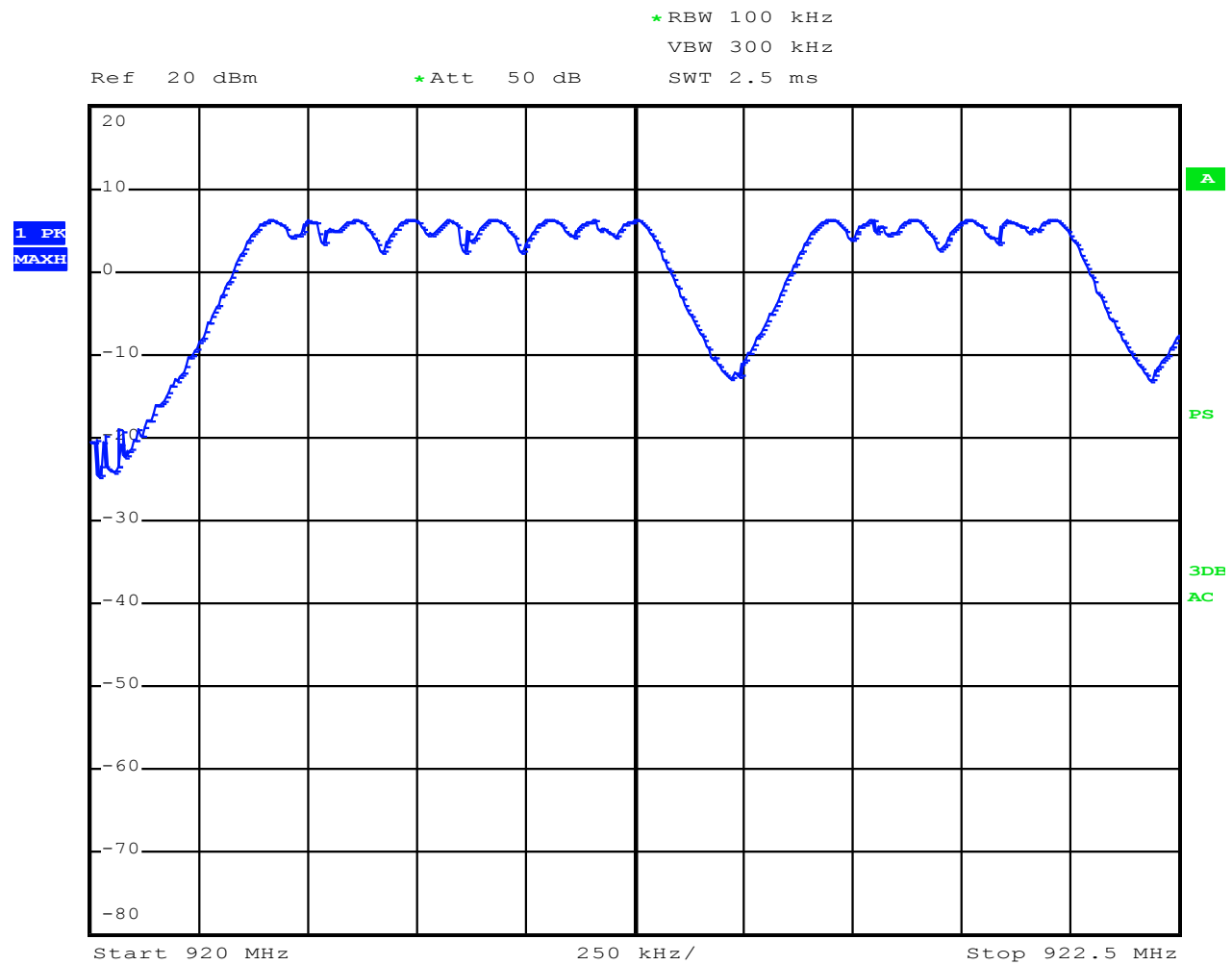
Date: 27.AUG.2013 15:47:00

**Figure 7: Number of Hopping Channels 911-916MHz - 8**



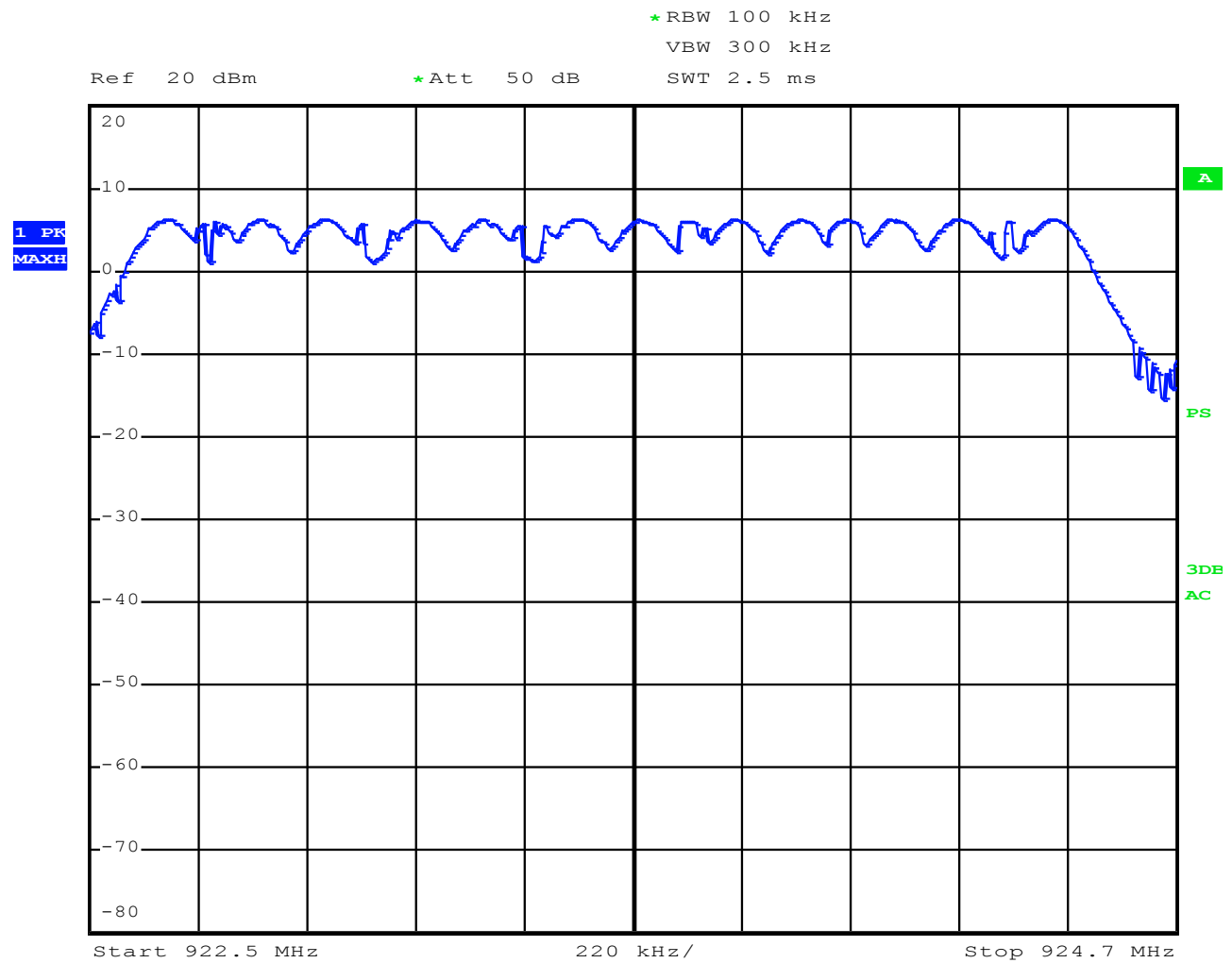
Date: 27.AUG.2013 15:56:56

Figure 8: Number of Hopping Channels 916-920MHz - 9



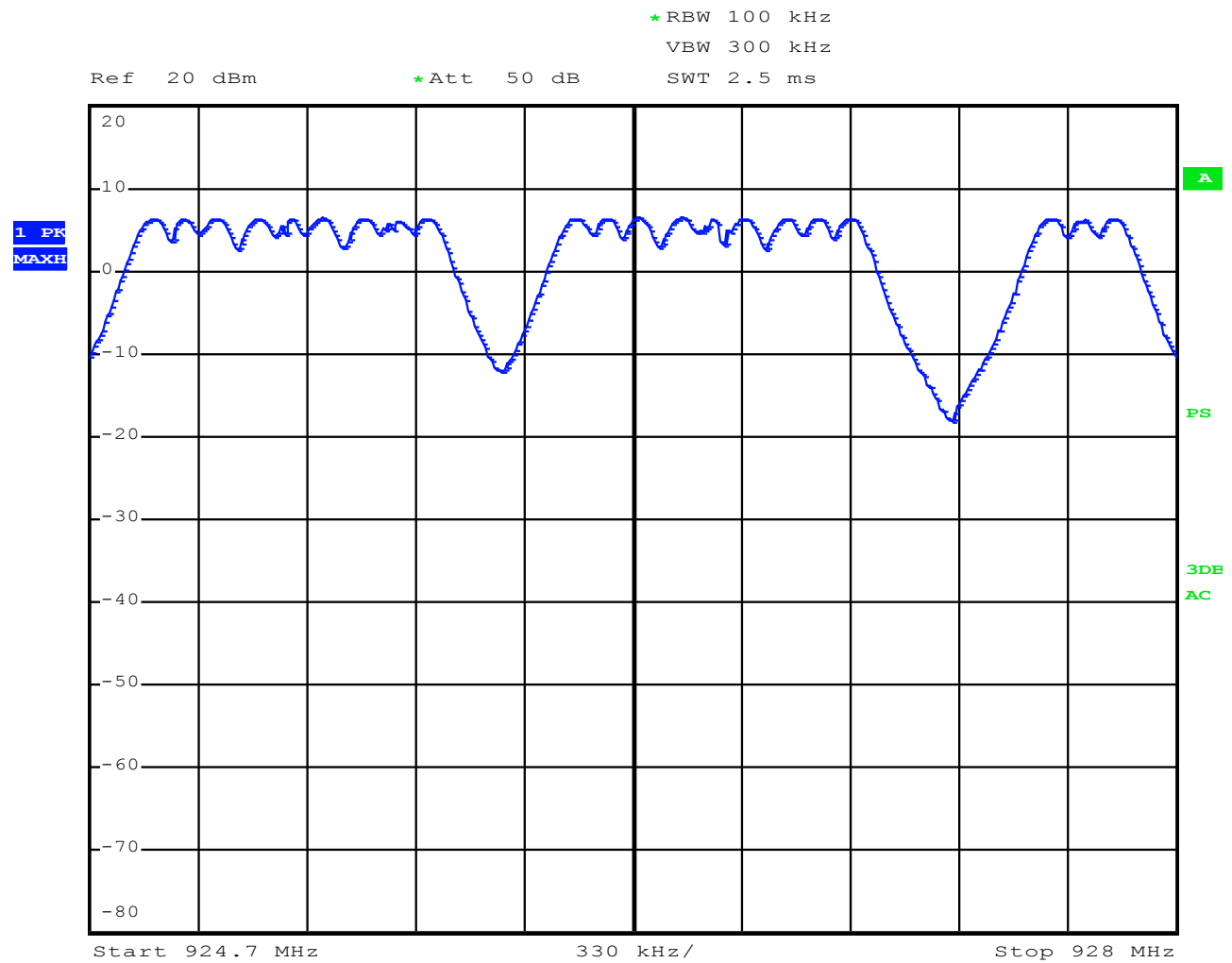
Date: 27.AUG.2013 16:02:17

**Figure 9: Number of Hopping Channels 920-922.5MHz - 5**



Date: 27.AUG.2013 16:04:38

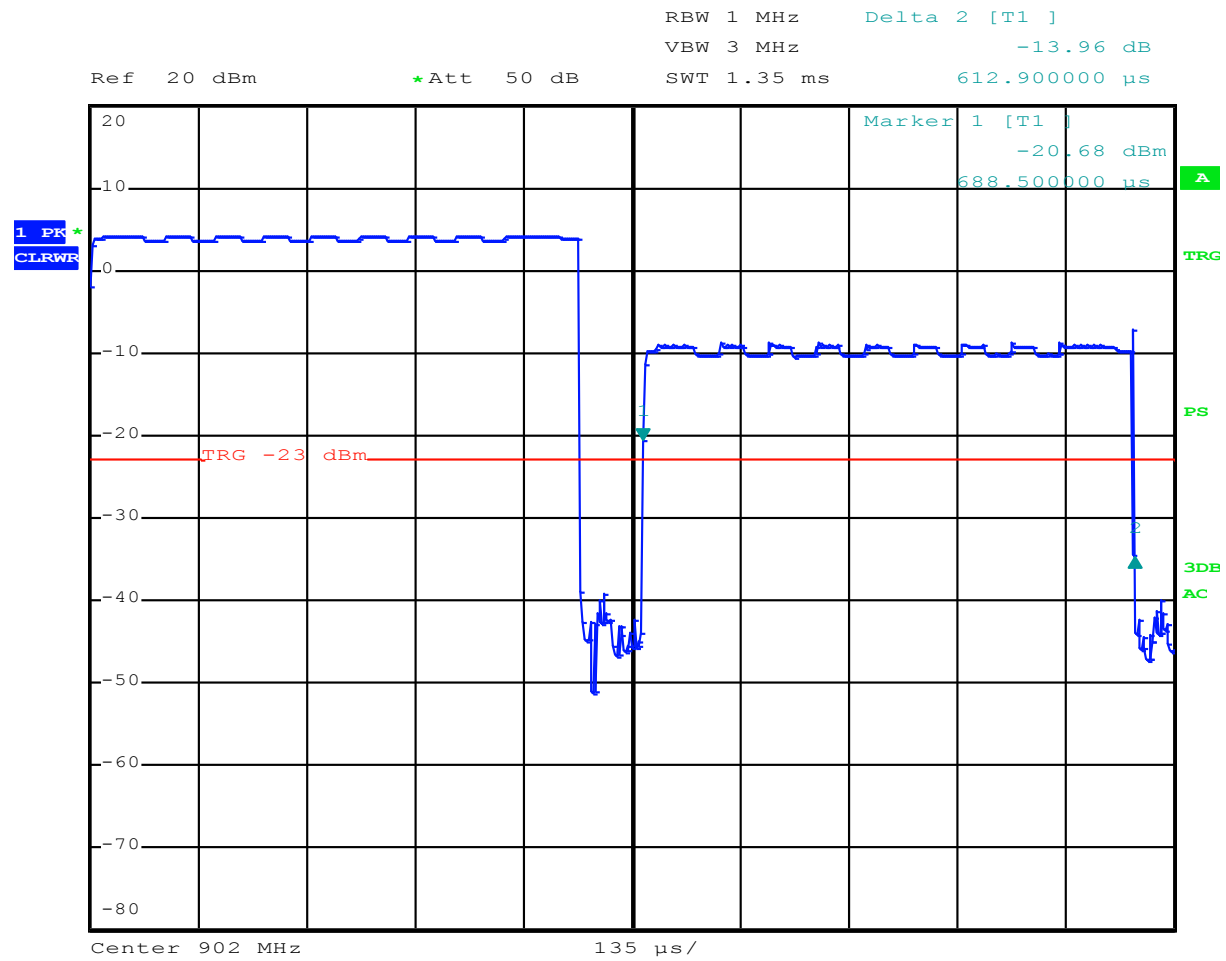
Figure 10: Number of Hopping Channels 922.5-94.7MHz - 6



Date: 27.AUG.2013 16:11:16

Figure 11: Number of Hopping Channels 924.7-928MHz - 5

## Dwell Time and Time of Occupancy



Date: 27.AUG.2013 16:30:34

Figure 12: Dwell Time - 612.9uS



RBW 300 kHz Delta 2 [T1]

VBW 1 MHz

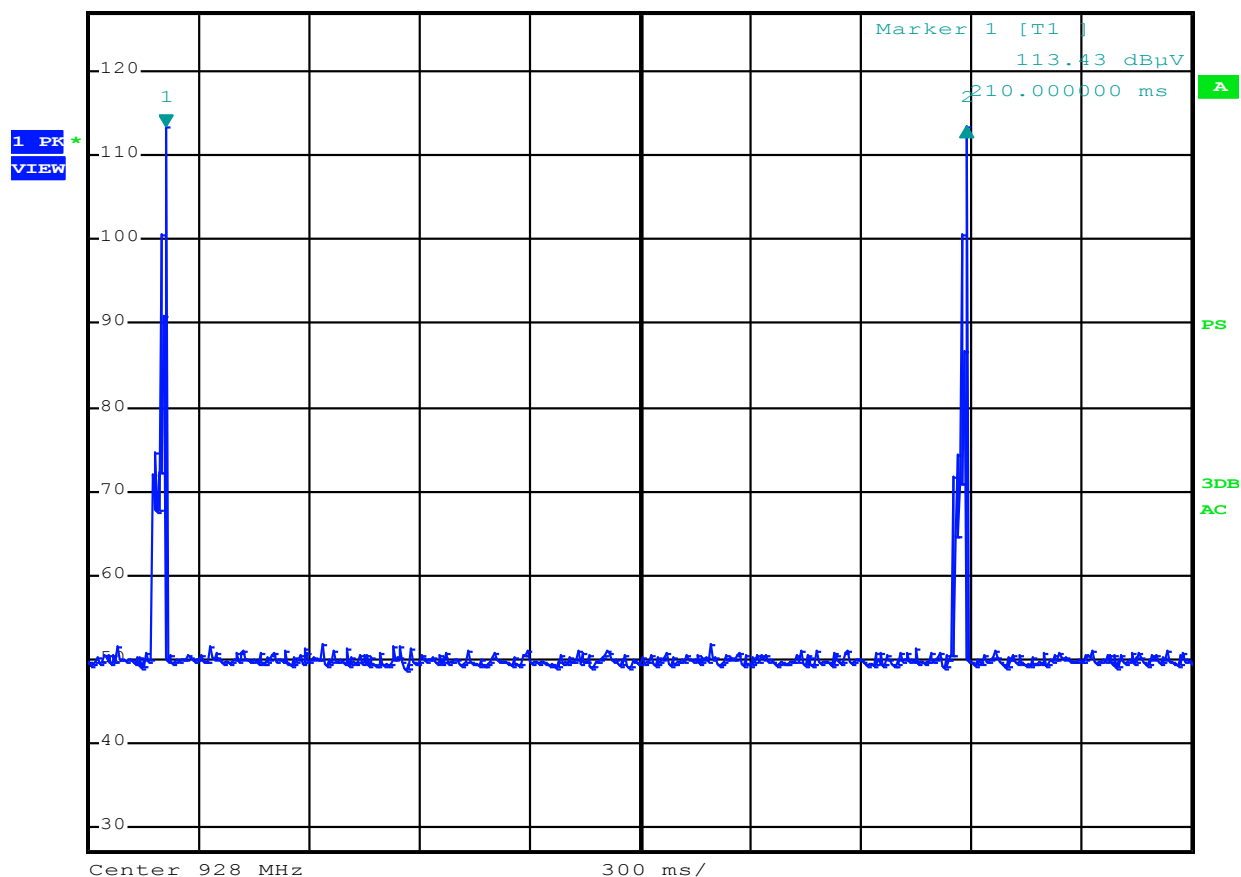
-0.05 dB

Ref 127 dBμV

\*Att 35 dB

SWT 3 s

2.178000 s



Date: 11.SEP.2013 14:04:18

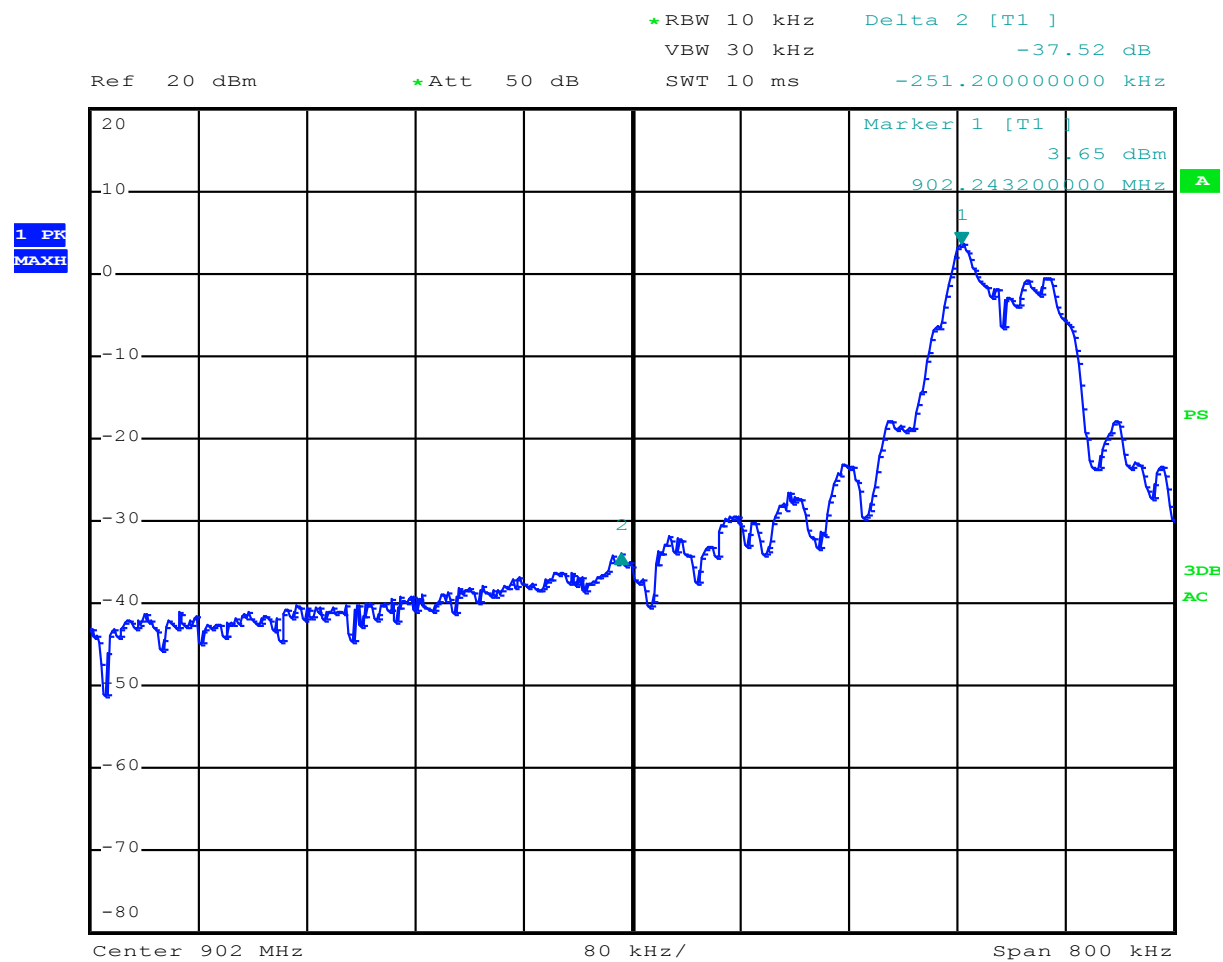
**Figure 13: Time of Occupancy per Frequency – 2.15mS/10S\***

\*Dwell Time per frequency = 0.613mS

Time between each transmission on the same frequency = 2.178S

Total occupancy per frequency in a 10 second period is = 2.185mS

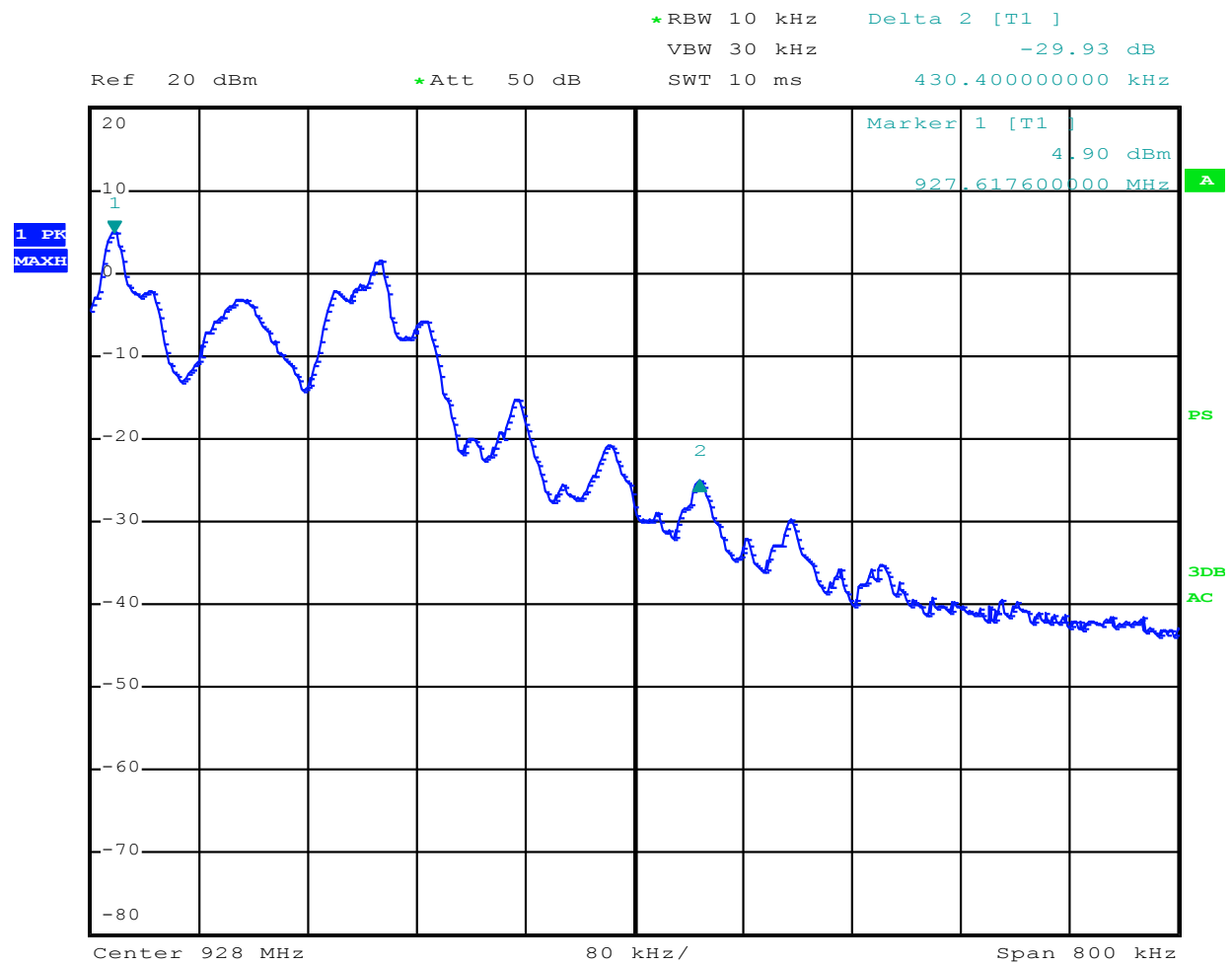
## Channel Bandedge



Date: 27.AUG.2013 15:11:08

Figure 14: Low Channel Bandedge





Date: 27.AUG.2013 15:23:48

Figure 15: High Channel Bandedge