Tantalus Systems Corp.

RT 900

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
Mar 3, 2014

Reviewed By:	**Parm Singh, EMC Division Manager**	Mar 3 2014 **Date**

Tested By:	**Aman Jathaul, EMC Project Manager**	Mar 3 2014 **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: OZFRT900 **IC:** 3669A-RT900

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

Section 1: Information for Test Report of Measurements

Testing Details

TESTED BY: Aman Jathaul

ENVIRONMENTAL CONDITIONS:

Day 1: Jan 02 2013	Temperature: 22.0ºC, R.H.: 40.3%, Barometric Pressure: 1015.8 mBar.
Day 2: Jan 07 2014	Temperature: 21.5ºC, R.H.: 39.7%, Barometric Pressure: 1016.3 mBar.
Day 3: Jan 08 2014	Temperature: 20.5ºC, R.H.: 38.7%, Barometric Pressure: 1016.0 mBar.
Day 4: Feb 04 2014	Temperature: 22.3ºC, R.H.: 39.0%, Barometric Pressure: 1015.3 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	±1 x 10-5 MHz
Radiated Emissions	±3 dB
Temperature	±1°C
Humidity	±5 %
DC and low frequency voltages	±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 RT-900 is the LAN portal and interfaces to the WAN Collector. These modules communicate to all other LAN devices and report energy consumption back to the utlility central office via the Tantalus Utility Network TUNet© and provide time of use consumption readings. The communication module can support a variety of data rates and multi-level FSK modulation formats to achieve data rates upto 640kbps.
Product ID:	RT-900
Communication Module:	
Manufacturer:	Tantalus Systems Corp.
Part Numbers:	100-0128-P

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 modfications to the RT-900 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: Jan 8, 2014

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 11 to Figure 1717 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 163.4 kHz.
Channel Separation	RSS-210 A8.1(c)	See Figure 4 in Appendix A. The smallest Channel separation was measured to be 200.0 kHz.
Number of Hopping Channels	RSS-210 A8.1(c)	See Figures 5-11 in Appendix A. There are 120 channels.
Hopping Channels Time of Occupancy	RSS-210 A8.1(c)	See Figures 12-13 in Appendix A; the dwell time per frequency is 6.4mS and the time of occupancy in a 10 second period is 6.4mS.

PERFORMANCE: Complies.

Section IV: FCC CFR47 Part 15.247

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 11 to Figure 177 in Appendix A.

PERFORMANCE: Complies.

Appendix A: Test Plots

FHSS Compliance Tests

20 dB Bandwidth

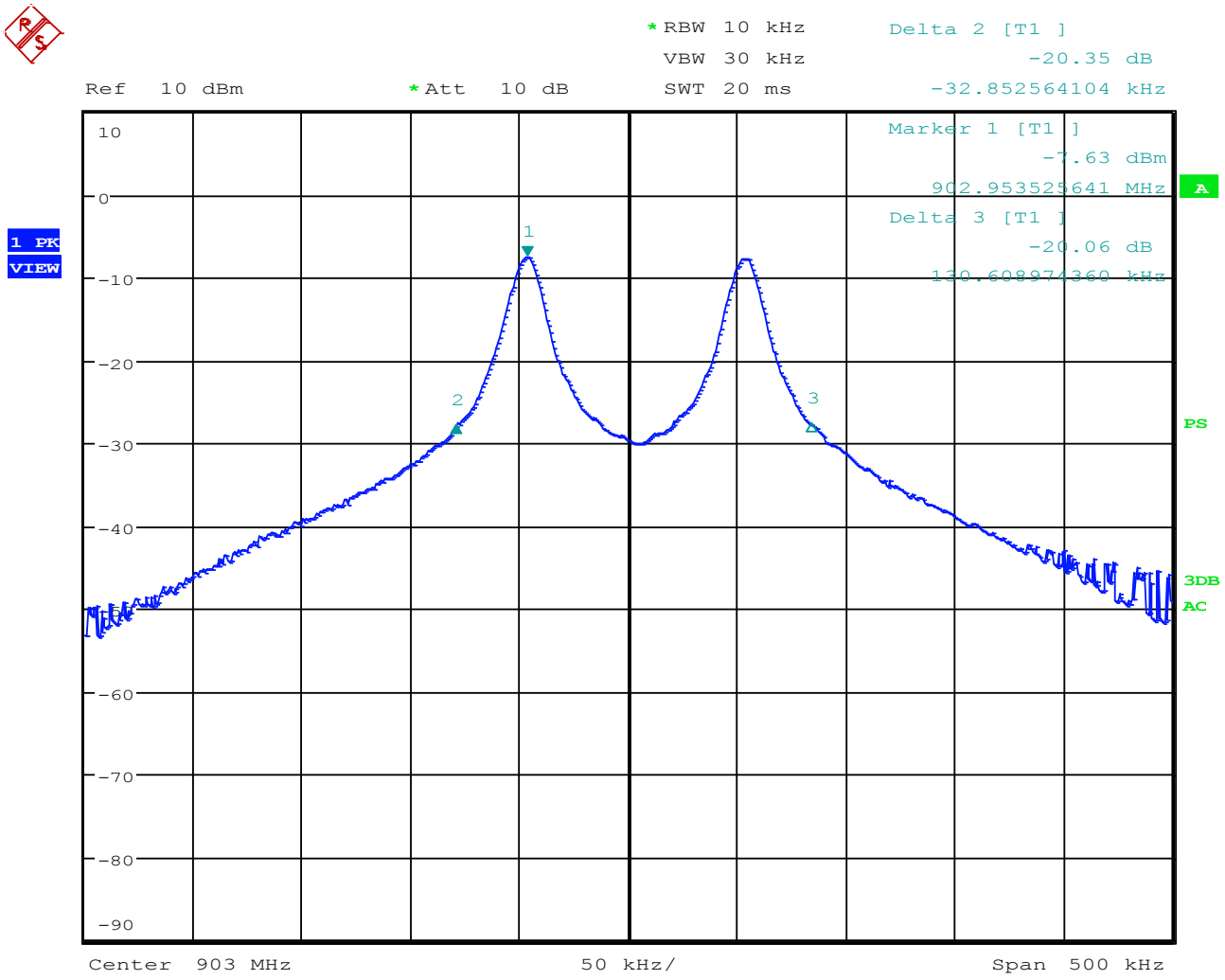

Figure 1: Low Frequency - 163.4kHz

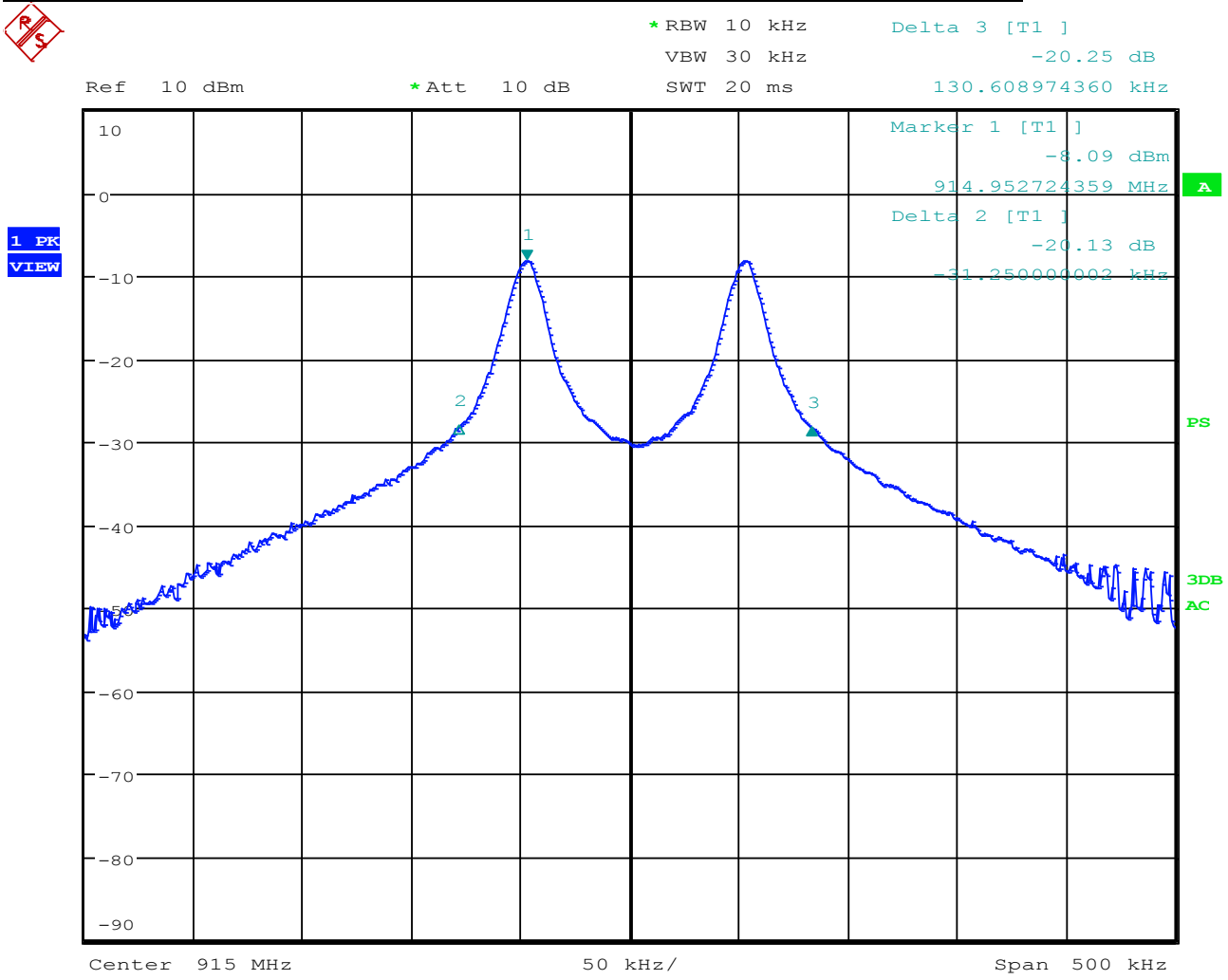

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Figure 2: Mid Frequency – 161.9kHz

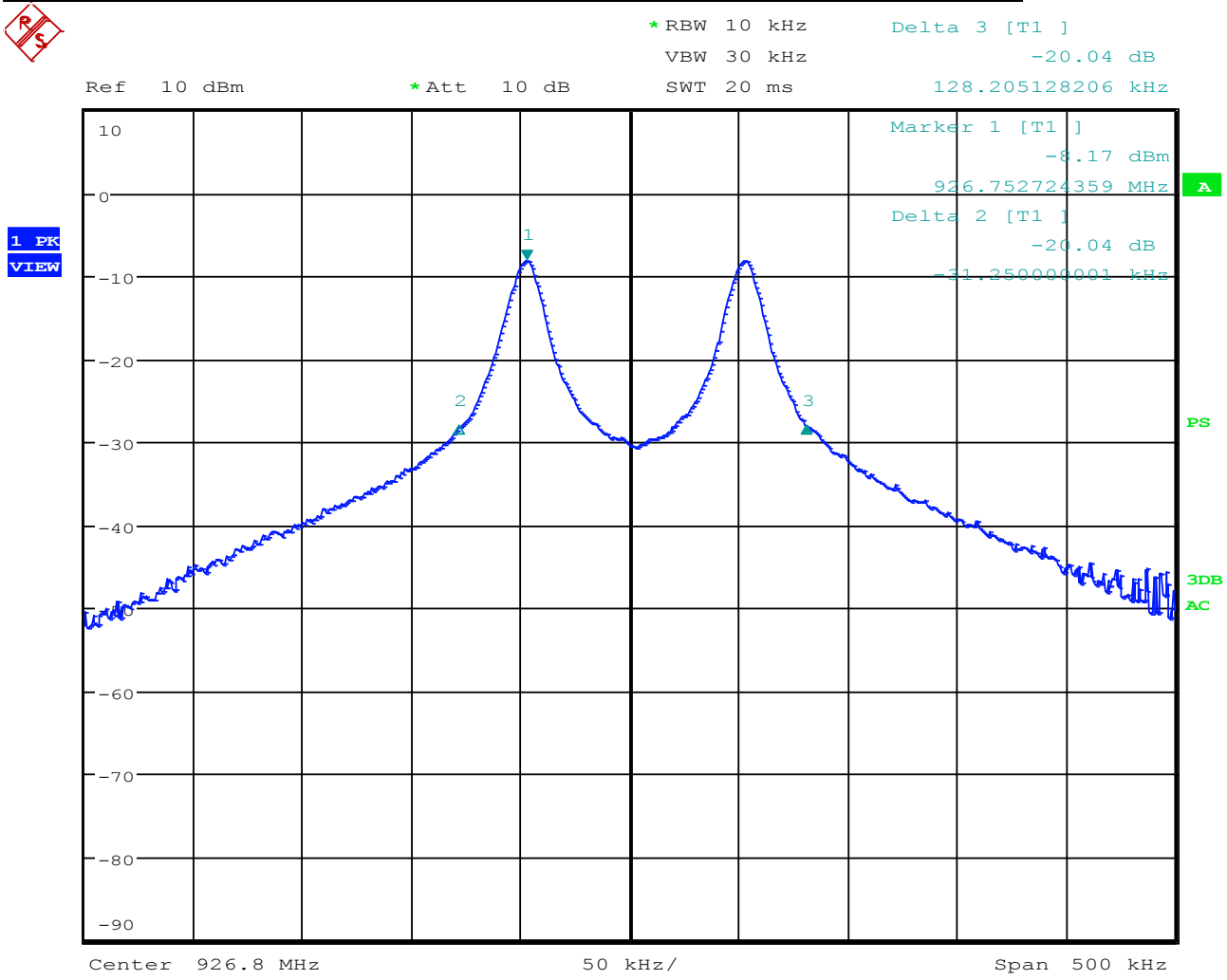

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Figure 3: High Frequency – 159.5kHz

Channel Separation

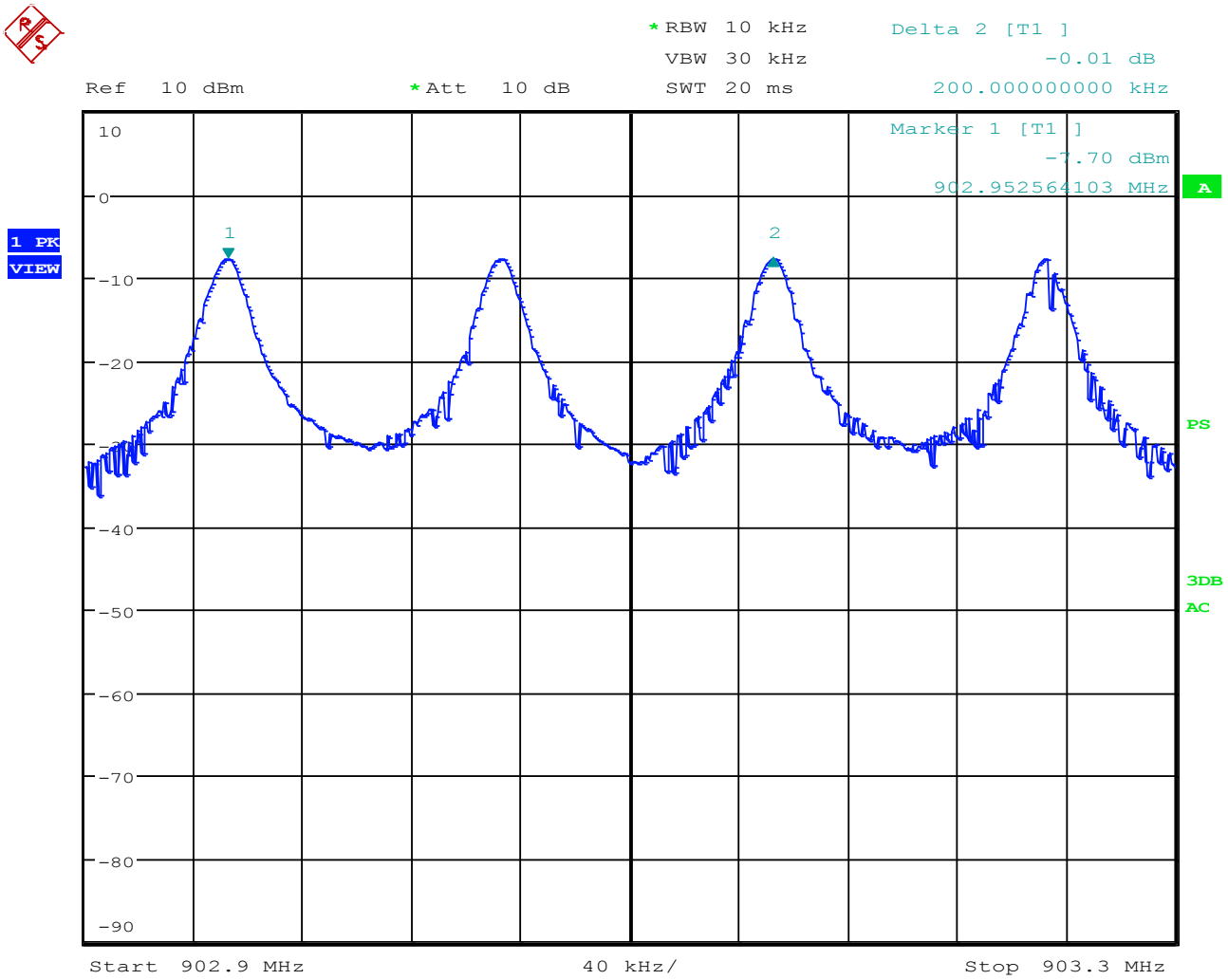

Figure 4: Channel Separation – 200.0kHz

Number of Hopping Channels

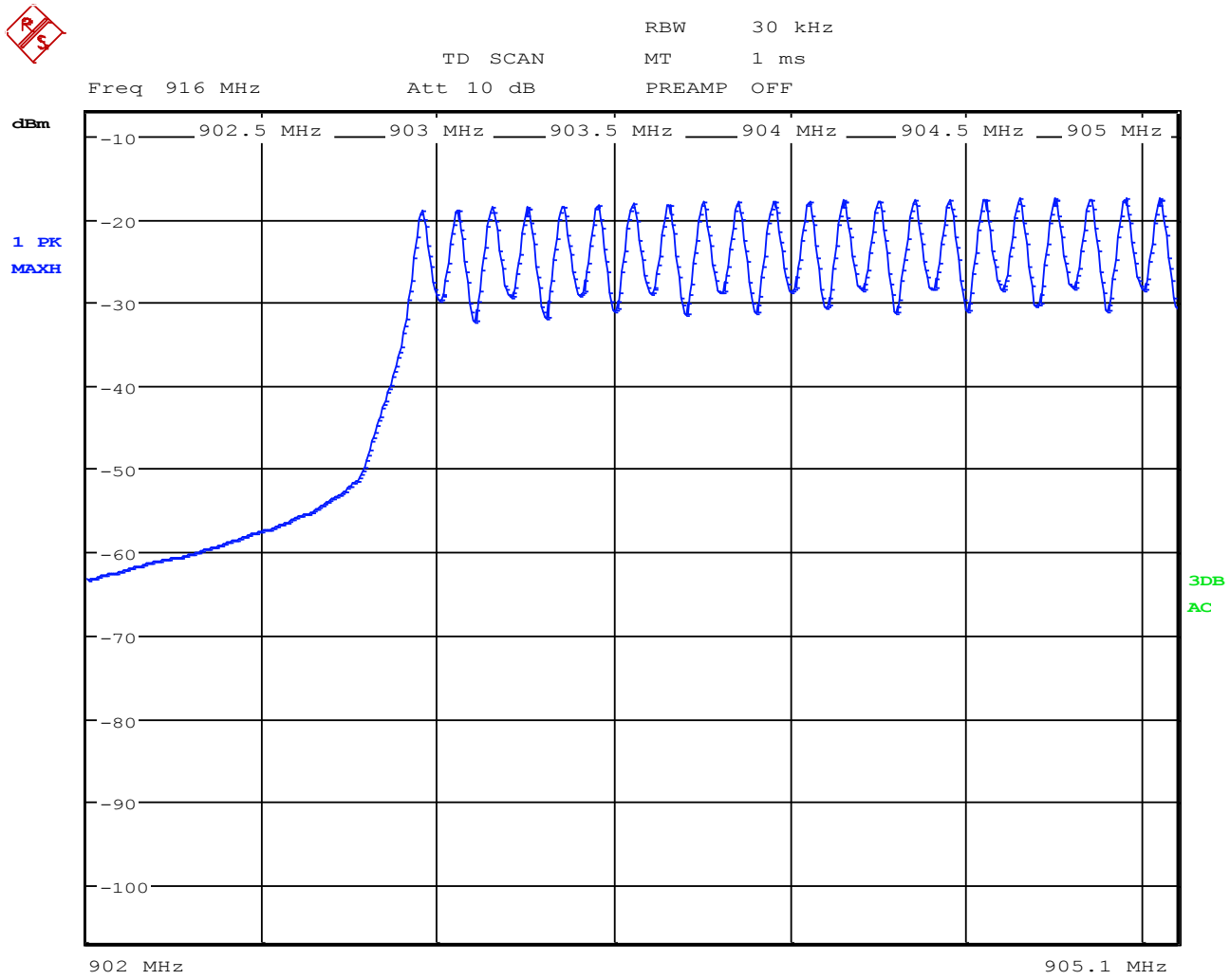

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Figure 5: Number of Hopping Channels 902-905MHz - 11

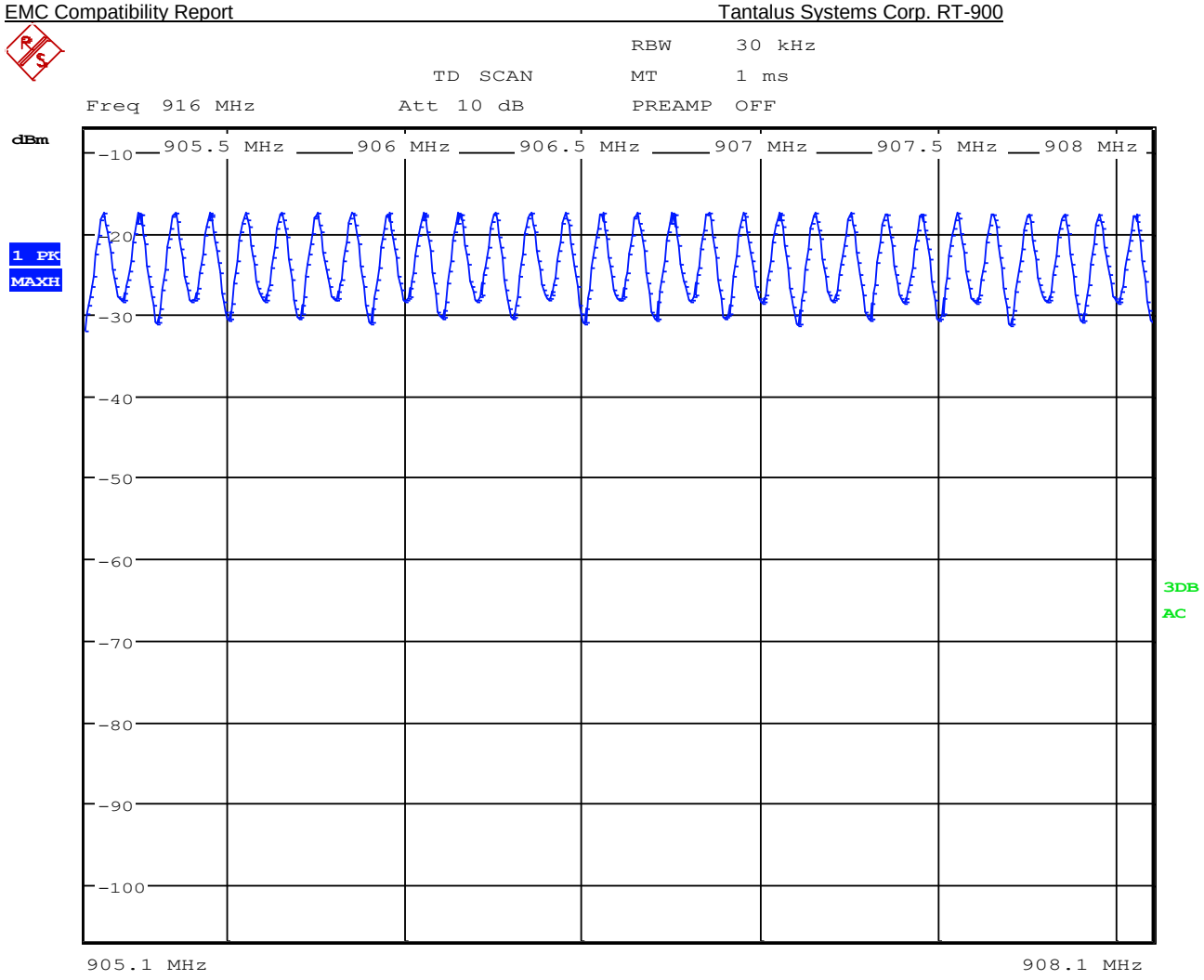

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Figure 6: Number of Hopping Channels 905-908MHz - 15

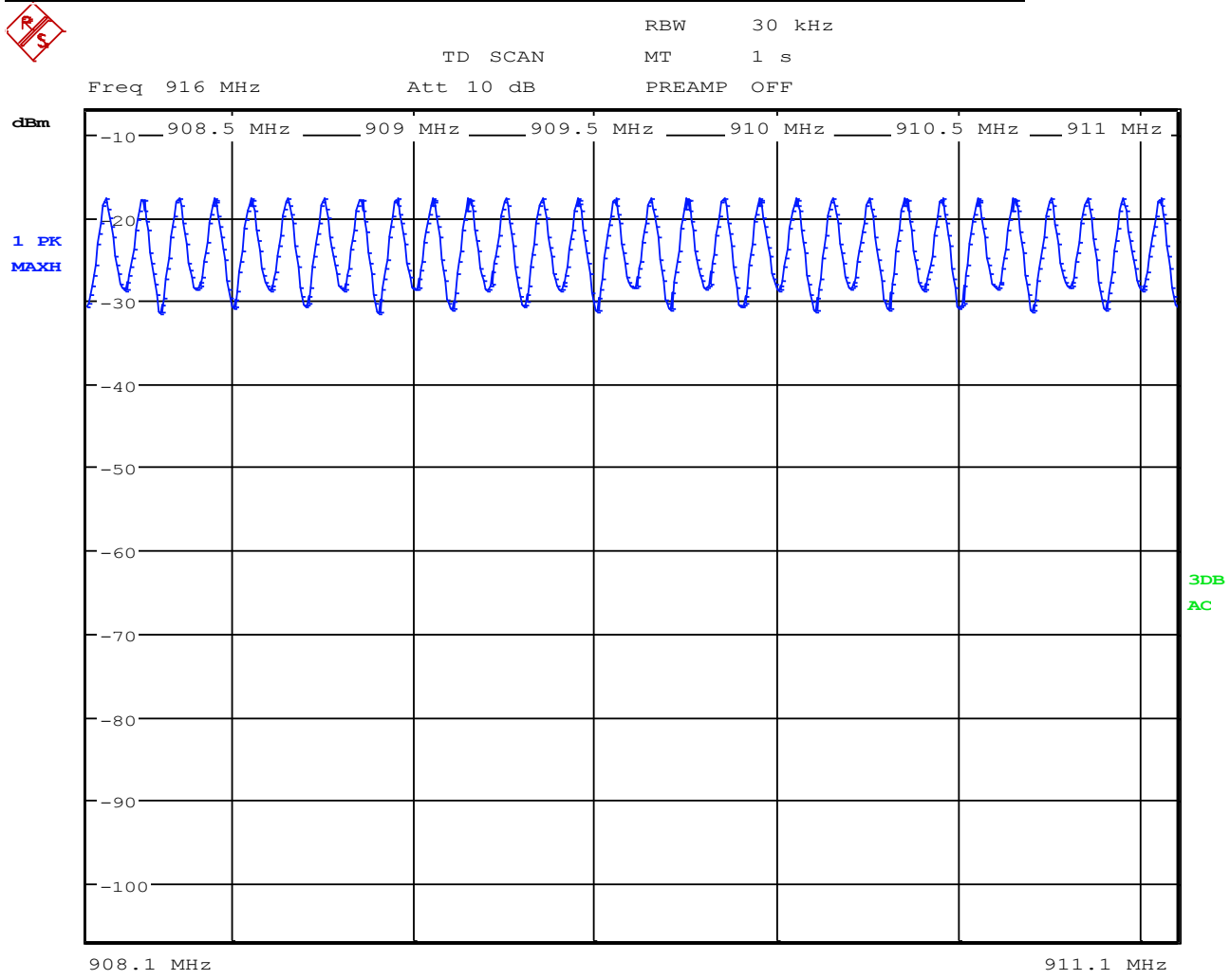

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Figure 7: Number of Hopping Channels 908-911MHz - 15

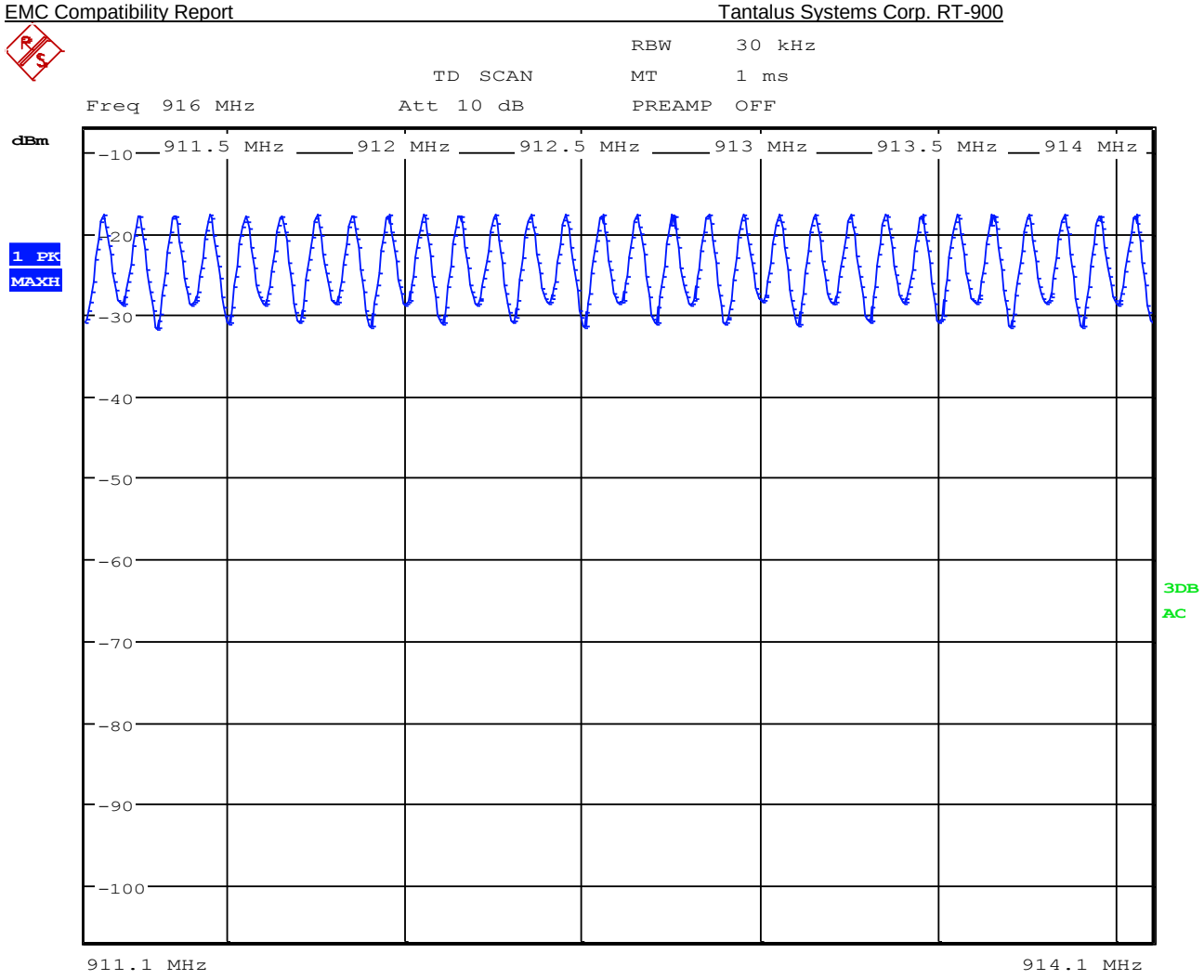

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Figure 8: Number of Hopping Channels 911-914MHz - 15

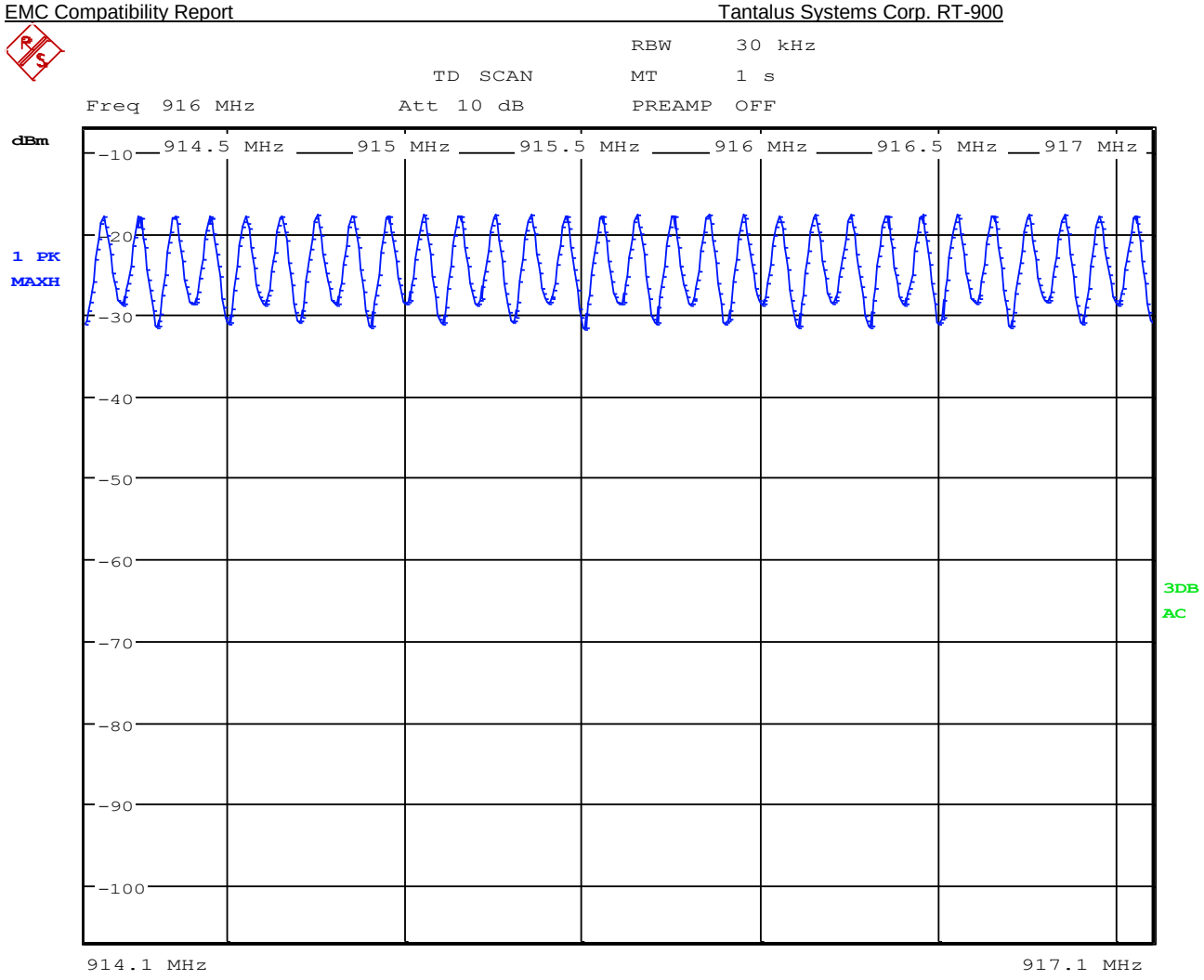

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Figure 9: Number of Hopping Channels 914-917MHz - 15

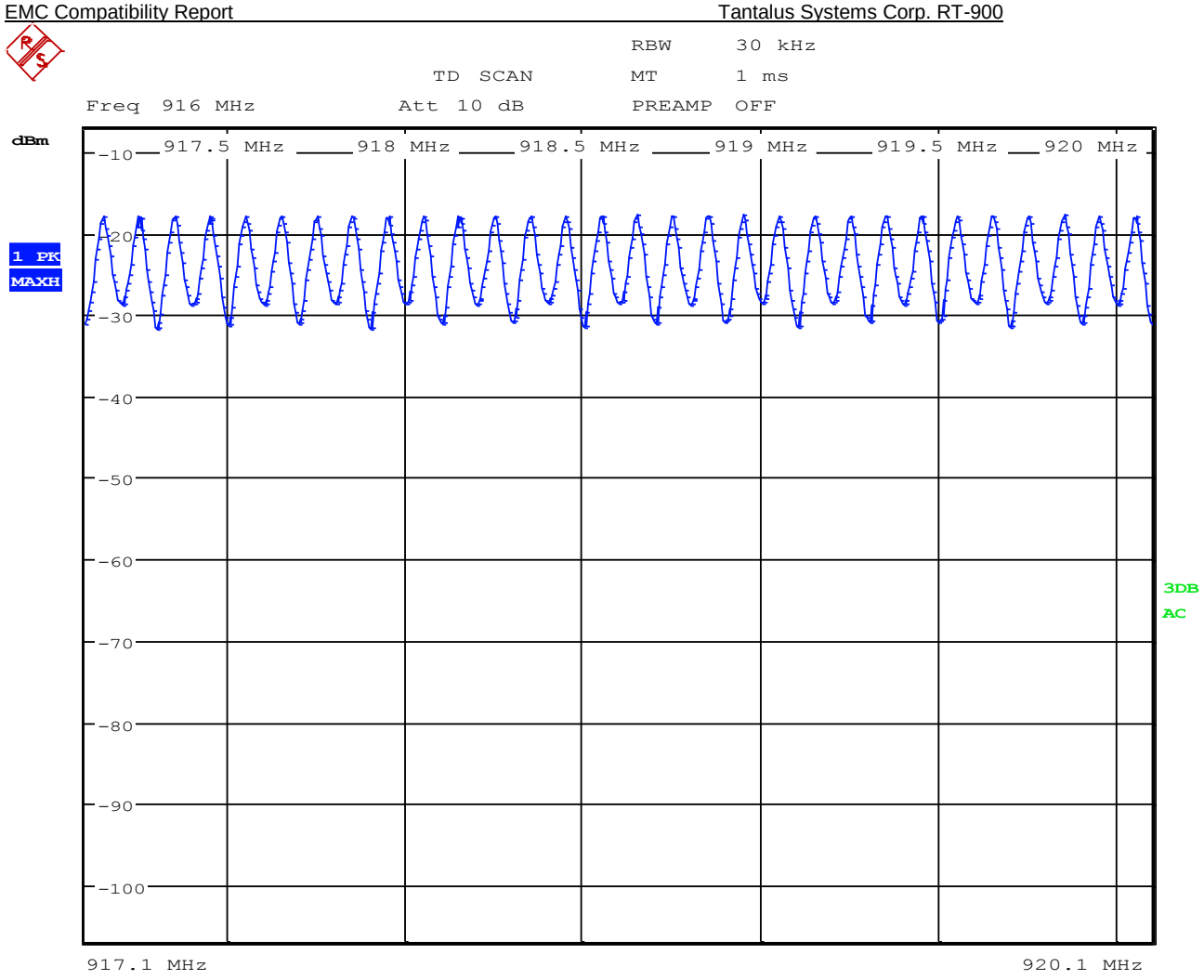

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Figure 10: Number of Hopping Channels 917-920MHz - 15

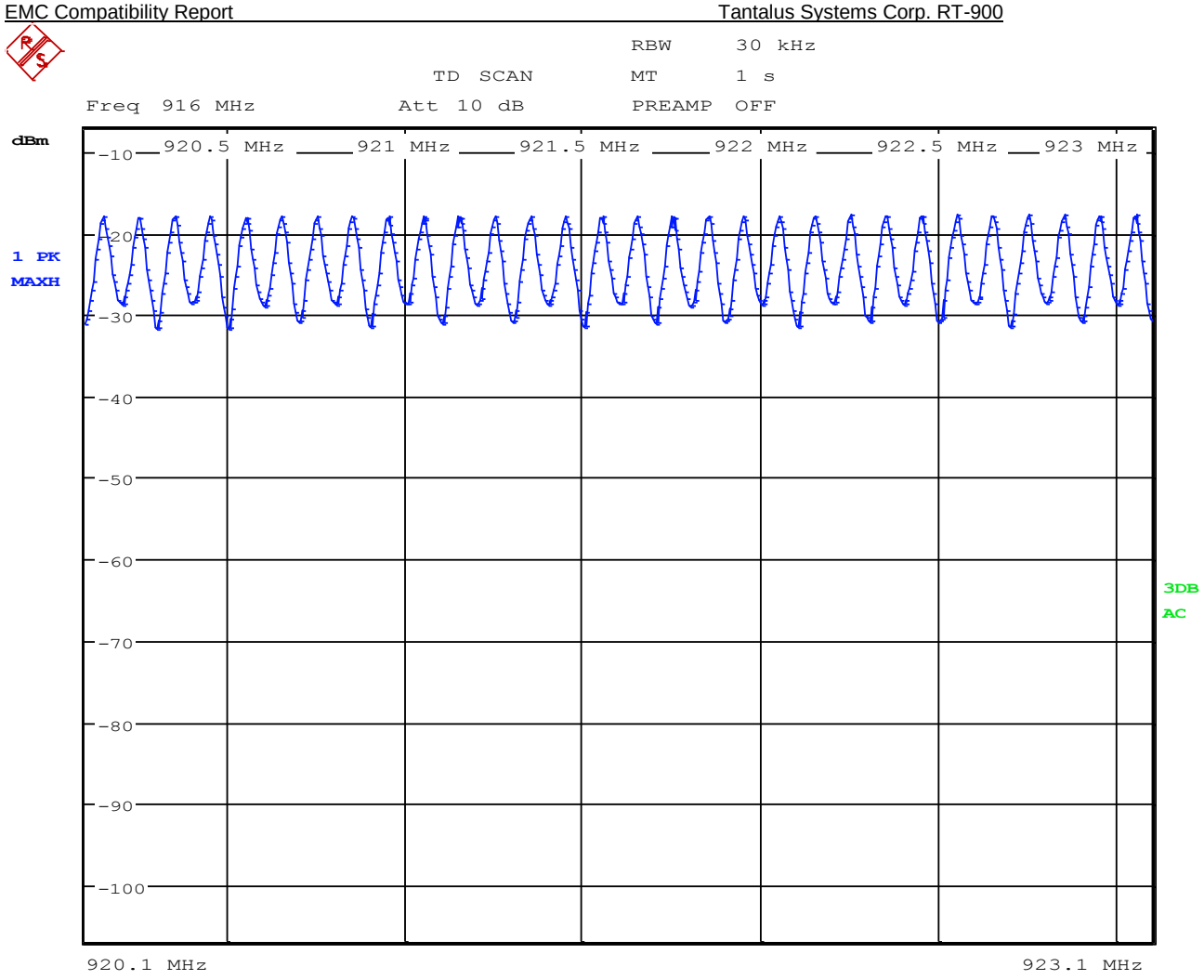

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Figure 11: Number of Hopping Channels 920-923MHz - 15

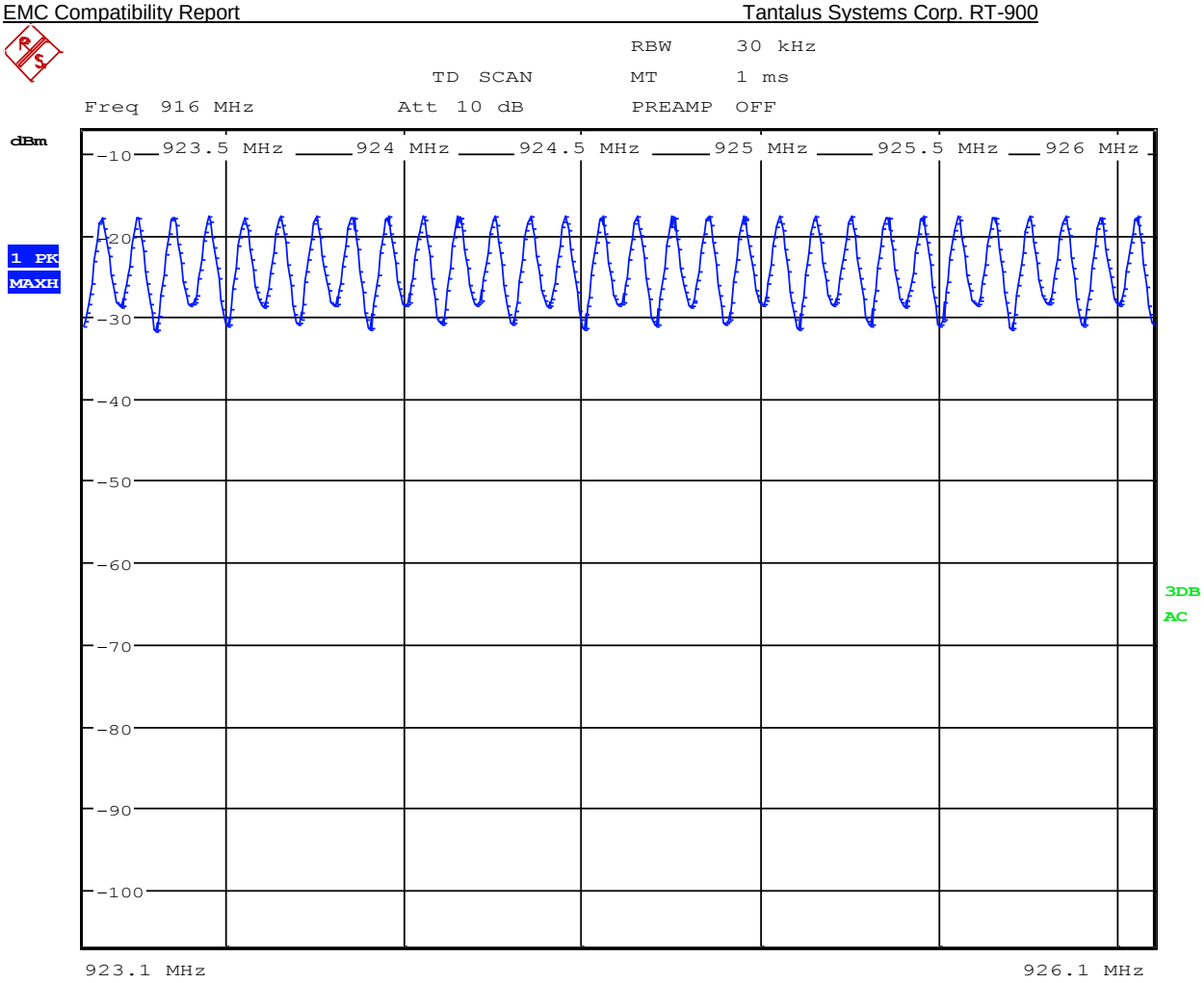

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Figure 12: Number of Hopping Channels 923-926MHz - 15

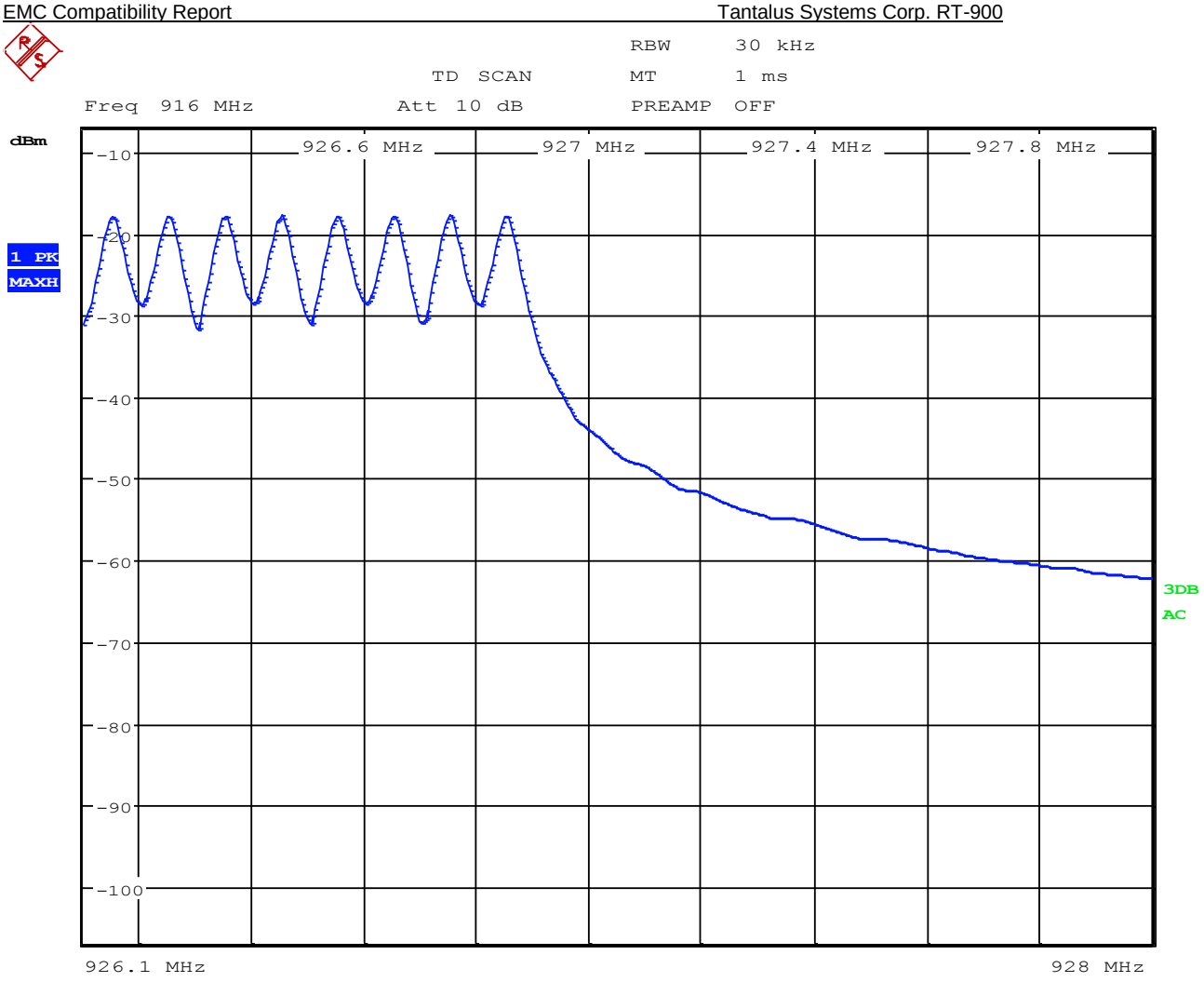

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Figure 13: Number of Hopping Channels 926-928MHz - 4

Dwell Time and Time of Occupancy

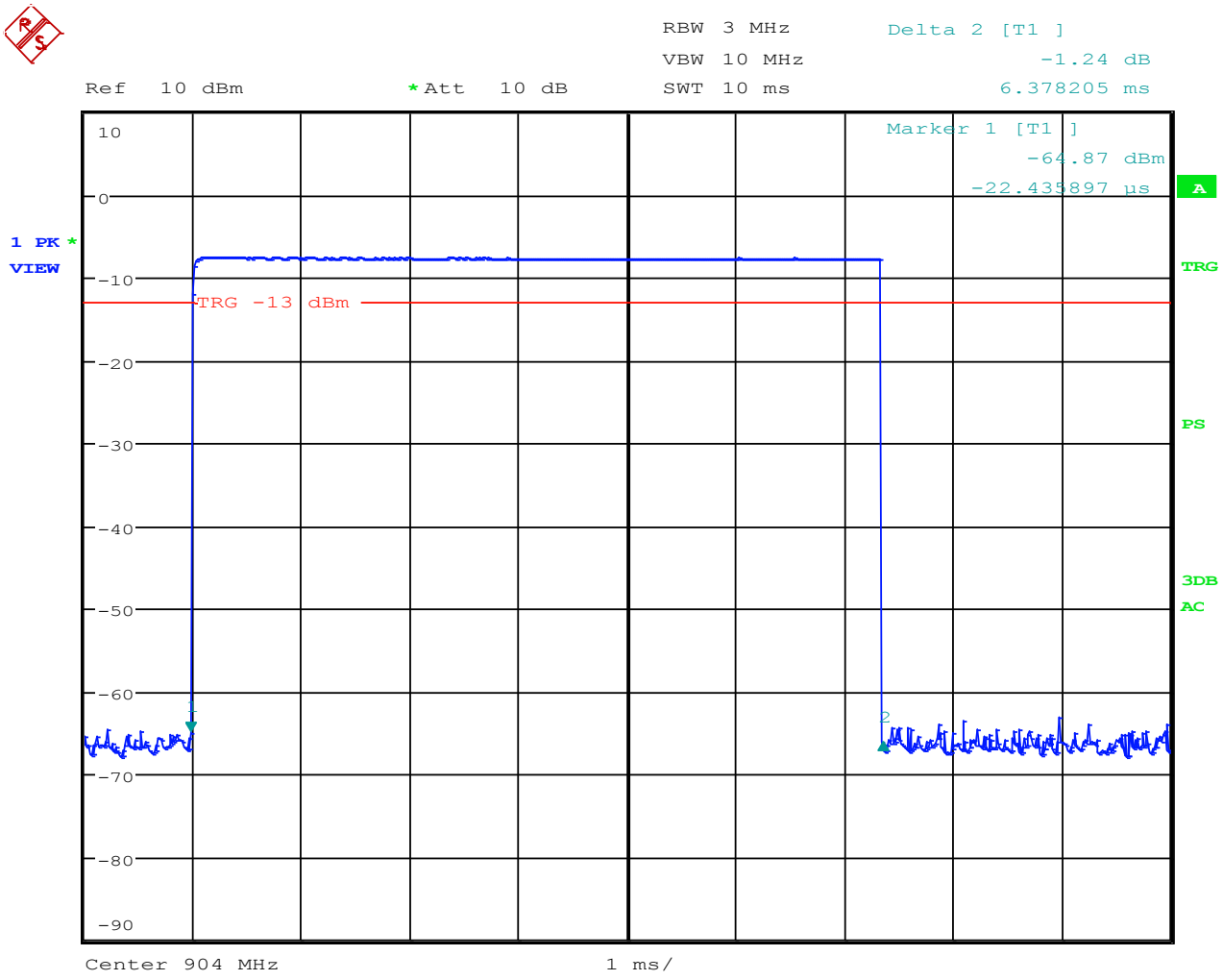

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Figure 14: Dwell Time - 6.4mS

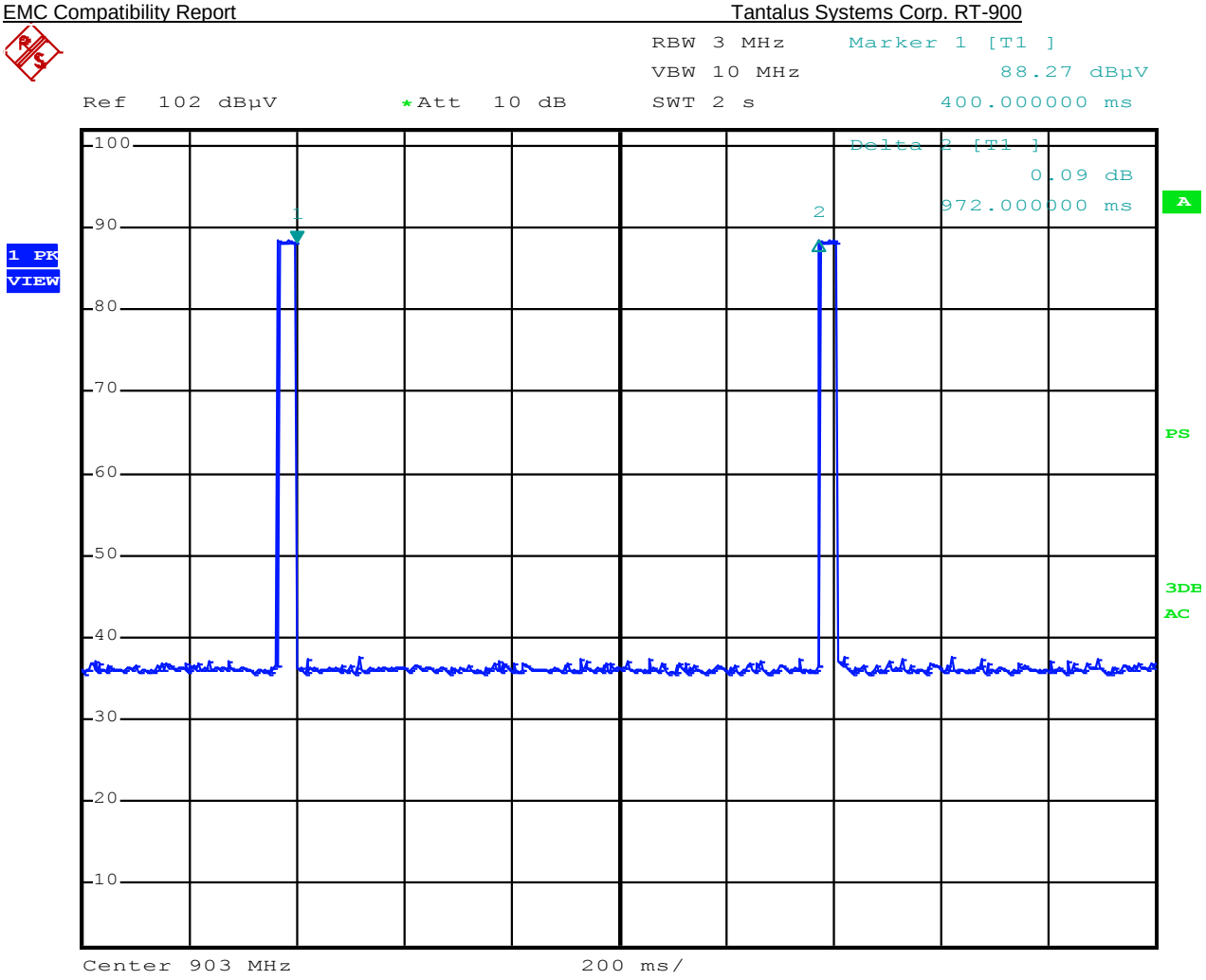

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Figure 15: Time of Occupancy per Frequency – 0.0064/120Seconds*

*Figure 15 indicates that the interval between the frequency of interest and the nearest adjacent frequency in the pseudo random hopping list is 1 second (A wide RBW was used to capture the nearest adjacent channel).

There are 120 channels in the pseudo random so the next time the same channel will be used will be in 120 seconds.

Therefore the time of occupancy per channel is 0.0064/120 Seconds.

Channel Bandedge

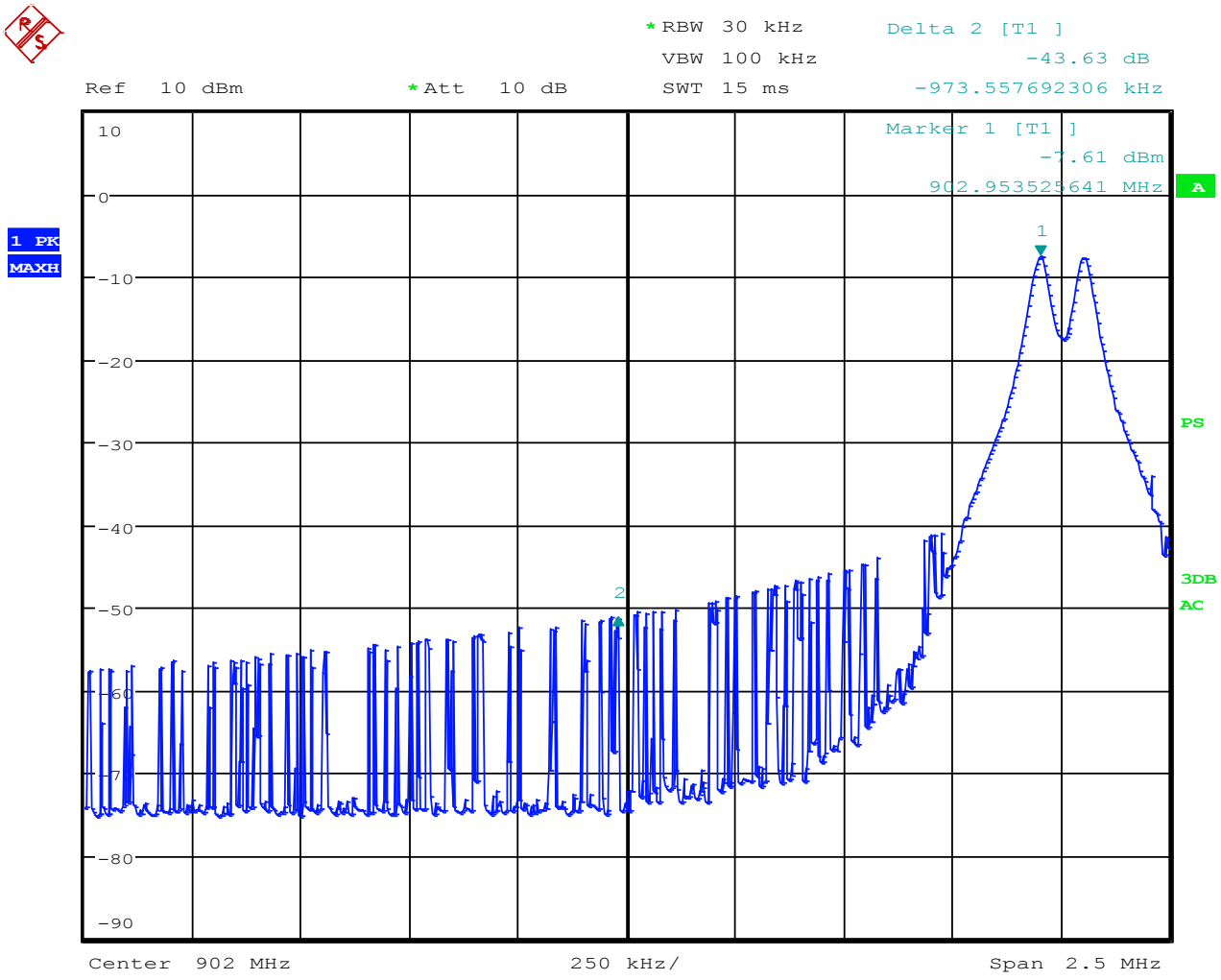

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Figure 16: Low Channel Bandedge

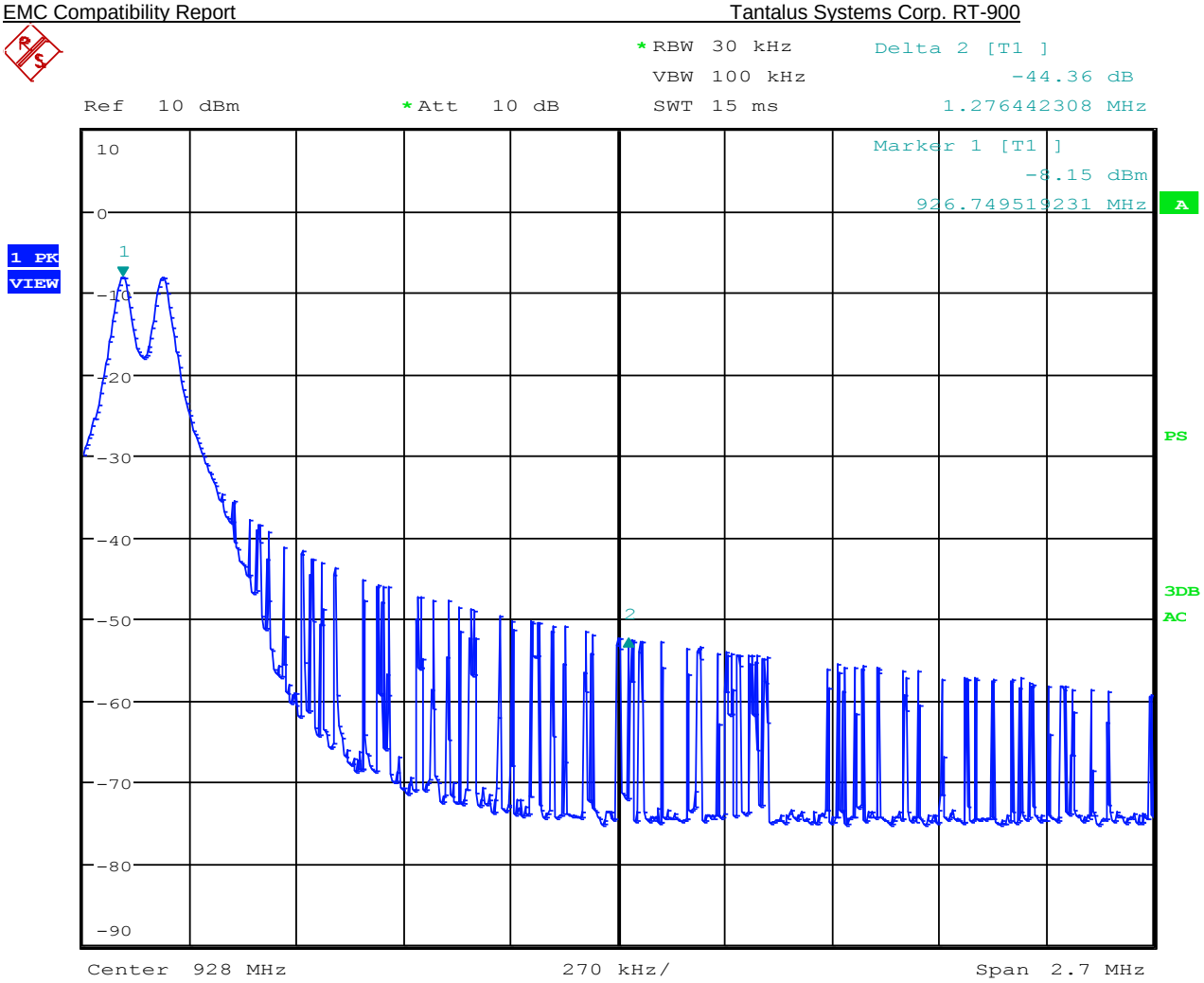

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Figure 17: High Channel Bandedge