



*Nemko USA, Inc.
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CERTIFICATION TEST REPORT
PART 15.247C
IC RSS-210

For The Keyfob
Models: 7941V, 7941P, 7941X

FCC ID: EZSDEI7941
IC: 1513A-7941

PREPARED FOR:

DEI Headquarters, Inc
1 Viper Way
Vista, CA 92081

Prepared on: October 20, 2008

Report Number: 2008 10115465 FCC

Project Number: 19016-1

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DOCUMENT HISTORY

REVISION	DATE	COMMENTS
-	October 20, 2008	Prepared By: Dustin Chapin
-	October 20, 2008	Initial Release: Alan Laudani

NOTE: Nemko USA, Inc. hereby makes the following statements so as to conform to Chapter 10 (Test Reports) Requirements of ANSI C63.4 (2003) "Methods and Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz":

- o The unit described in this report was received at Nemko USA, Inc.'s facilities on October 17, 2008.
- o Testing was performed on the unit described in this report on October 17, 2008 to October 20, 2008
- o The Test Results reported herein apply only to the Unit actually tested, and to substantially identical Units.
- o This report does not imply the endorsement of the Federal Communications Commission (FCC), Industry Canada, NVLAP or any other government agency.

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CERTIFICATION

Nemko USA, Inc., an independent Electromagnetic Compatibility (EMC) Test Laboratory, produced this Test Report and performed the Radio Frequency Interference (RFI) testing and data evaluation contained herein.

Nemko USA, Inc.'s measurement facility is currently registered with the United States Federal Communications Commission (FCC) in accordance with the provisions of 47 United States Code (CFR) Part 2, Subpart I, Section 2.948(a). A current description of Nemko USA, Inc.'s measurement facility is on file with the FCC. Nemko USA Inc. has additionally satisfied the FCC that it complies with the requirements set forth in 47 CFR Part 2, Subpart I, Section 2.948(d) regarding the accreditation of EMC laboratories.

The RFI testing, test data collection and test data evaluation were accomplished in accordance with the ANSI C63.4-2003 Standard, and in accordance with the applicable sections of the FCC rules (47 CFR Parts 2 and 15). The testing was also accomplished in accordance with Industry Canada's ICES-003 standard for unintentional radiating device per EMCAB-3, Issue 3 (May 1998). The administrative summary of this test report provides a description of the test sample.

I hereby certify that the test data, test data evaluation, and equipment configurations used to compile this test report are a true and accurate representation of the test sample's radio frequency interference characteristics as of the test date(s), and, for the design of the test sample.



Alan Laudani
EMC Engineer

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1. ADMINISTRATIVE DATA AND TEST SUMMARY

1.1. Administrative Data

CLIENT: DEI Headquarters, Inc
1 Viper Way
Vista, CA 92081

CONTACT: Minas Minassian
E-Mail: minas.minassian@directed.com

DATE (S) OF TEST: October 17, 2008 to October 20, 2008

EQUIPMENT UNDER TEST (EUT): Keyfob

MODEL: 7941V, 7941P, 7941X

CONDITION UPON RECEIPT: Suitable for Test

TEST SPECIFICATION: FCC, Part 15.247, Subpart C Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz and 24.0-24.25 GHz bands and RSS 210 (Issue 7, June 2007) Annex 8 - Frequency Hopping and Digital Modulation Systems Operating in the Bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

1.2. Test Summary

<i>Specification</i>	<i>Frequency Range</i>	<i>Compliance Status</i>
FCC, CFR 47, Section 15.207	0.15 MHz - 30.00 MHz	PASS
FCC, CFR 47, Section 15.209	30 MHz – 10 th Harmonic	PASS
FCC CFR 47, §15.247 Plus Bandedge	909.4 to 918.5 MHz	PASS
RSS-210 - Low Power License Exempt Radio-communication Devices (All Frequency Bands)	909.4 to 918.5 MHz	PASS

The EUT was scanned from 30MHz to 10th harmonic of the highest fundamental frequency.
Refer to the test results section for further details.

Alan Laudani
EMC Engineer

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2. SYSTEM CONFIGURATION

2.1. Description and Method of Exercising the EUT

The 7941V, 7941P, 7941X is a Keyfob. The EUT is a hand held transmitter used as a remote control for vehicle security/convenience systems. It's comprised of a PCB which has an MCU, Battery, user interface (switches and LED display) and RF circuitry.

When a user activates a command with one of the EUT switches, the command is interpreted by the MCU which generates the data packets to be transmitted and controls the RFIC to generate the hopping sequence for as long as the user presses the button. When there are no buttons pressed, the EUT goes into sleep mode waiting for the next user switch press to wake-up and begin the code hopping transmission again.

The Transmission is achieved via a helical antenna on the PCB.

This design employs 25 channels which operate in the 902MHz to 928MHz band. Each channel has a 20dB BW greater than 250KHz but less than 500KHz.

2.2. System Components and Power Cables

DEVICE	MANUFACTURER MODEL # SERIAL #	POWER CABLE
EUT - Keyfob	DEI Headquarters, Inc Model: 7941V, 7941P, 7941X Serial #: NA	

2.3. Samples Submitted for Assessment

The following samples of the apparatus have been submitted for type assessment:

2.4. Device Interconnection and I/O Cables

Connection	I/O Cable
No Connections	

2.5. Design Modifications for Compliance

The following design modifications were made to the EUT during testing.

No design modifications were made to the EUT during testing.

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2.6. Technical Specifications of the EUT

Manufacturer:	Directed Electronics, Inc.
Operating Frequency:	909.44 to 918.50 MHz in the 902to 928MHz
Rated Power:	93 mW
Modulation:	FSK
Antenna Data:	Helical Coil soldered onto circuit board
Antenna Connector:	None
Power Source:	3 V battery

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3. DESCRIPTION OF TEST SITE AND ENVIRONMENT

3.1. Description of Test Site

The test site is located at 11696 Sorrento Valley Road, Suite F, San Diego, CA 92121. The site is physically located 18 miles Northwest of downtown San Diego. The general area is a valley 1.5 miles east of the Pacific Ocean. This particular part of the valley tends to minimize ambient levels, i.e. radio and TV broadcast stations and land mobile communications. The three and ten-meter Open Area Test Site (OATS) is located behind the office/lab building. It conforms to the normalized site attenuation limits and construction specifications as set in the EN 55022 (1987), CISPR 16 and 22 (1985) and ANSI C63.4-2001 documents. The OATS normalized site attenuation characteristics are verified for compliance every year, and registered with the Federal Communications Commission under Registration Number 90579 and Industry Canada under 2040B-1 and 2040B-2.

3.2. Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	17 – 26 °C
Humidity range	:	20 - 50%
Pressure range	:	87 - 105 kPa

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4. DESCRIPTION OF TESTING METHODS

4.1. Introduction

As required in 47 CFR, Parts 2 and 15, the methods employed to test the radiated and conducted emissions (as applicable) of the EUT are those contained within the American National Standards Institute (ANSI) document ANSI C63.4-2003, titled "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz." All applicable FCC Rule Sections that provide further guidance for performance of such testing are also observed.

For General Test Configuration please refer to Figure 1 on the following page.

Digital devices sold in Canada are required to comply with the Interference Causing Equipment Standard for Digital Apparatus, ICES-003. These test methods and limits are specified in the Canadian Standards Association's (CSA) Standard C108.8-M1983 (1-1-94 version) and are "essentially equivalent" with FCC, Part 15 and CISPR 22 (EN55022) rules for unintentional radiators per EMCAB-3, Issue 3 (May 1998). No further testing is required for compliance to ICES-003.

4.2. Configuration and Methods of Measurements for Conducted Emissions

Section 7 of ANSI C63.4 determines the general configuration of the EUT and associated equipment, as well as the test platform for conducted emissions testing. Tabletop devices are placed on a non-conducting surface 80 centimeters above the ground plane floor and 40 centimeters from the ground plane wall. The EUT and associated system are configured to operate continuously, representing a "normally operating" mode. The EUT is powered via a Line Impedance Stabilization Network (LISN). The emissions are recorded using the required bandwidth of 9 kHz in the quasi-peak mode. The average amplitude is also observed employing a 10 kHz bandwidth to determine the presence of broadband RFI. When such interference is caused by broadband sources (as defined by the FCC and ANSI Rules), the deviation guidelines contained in Section 11.3.1 of ANSI C63.4 are employed, which allows a correction factor of 13 dB to be subtracted from the quasi-peak reading. The emission levels are then compared to the applicable FCC limits to determine compliance.

4.3. Configuration and Methods of Measurements for Frequency Identification

When performing all testing of equipment, the actual emissions of the EUT are segregated from ambient signals present within the laboratory or the open-field test range. Preliminary testing is performed to ensure that ambient signals are sufficiently low to allow for proper observation of the emissions from the EUT. Incoming power lines are filtered using a 120 dB, 30-ampere; 115/208-volt filter to assist in reducing ambient signals for tests of levels of conducted emissions. Ambients within the laboratory are compared to those noted at the nearby open-field site to discriminate between signals produced from the EUT and ambient signals. In the event that a significant emission is produced by the EUT at a frequency which is also demonstrating significant ambient signals, the spectrum analyzer is placed in the peak mode, the bandwidth is narrowed, the EUT's signal is centered on the analyzer, the scan width is expanded to 50 kHz while monitoring the audio to ensure that only the EUT signal is present, the analyzer is switched to quasi-peak mode, and the level of the EUT signal is recorded.

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4.4. Configuration and Methods of Measurements for Radiated Emissions

Section 8 of ANSI C63.4 determines the general configuration and procedures for measuring the radiated emissions of equipment under test. Initially, the primary emission frequencies are identified inside the test lab by positioning a broadband receive antenna one meter from the EUT to locate frequencies of significant radiation. Next, the EUT and associated system are placed on a turntable on a ten meter open area test site (registered with the FCC in accord with its Rules and ANSI C63.4) and the receive antenna is located at a distance of ten meters from the EUT.

The EUT and associated system are configured to operate continuously, representing a “normally operating” mode. All significant radiated emissions are recorded when maximum radiation on each frequency is observed, in accordance with part 8 of ANSI C63.4–2003 and Section 15.33 of the FCC Rules. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters and rotated to horizontal and vertical polarities, and the turntable is also rotated to determine the worst emitting configuration. The numerical results of the test are included herein to demonstrate compliance.

The numerical results that are applied to the emissions limits are arrived at by the following method:

Example: $A=RR+CL+AF$

A = Amplitude dBuV/m

RR = Receiver Reading dBuV

CL = cable loss dB

AF = antenna factor dB/m

Example Frequency = 110MHz

18.5 dBuV (spectrum analyzer reading)

+3.0 dB (cable loss @ frequency)

21.5 dBuV

+15.4 dB/m (antenna factor @ frequency)

36.9 dBuV/m Final adjusted value

The final adjusted value is then compared to the appropriate emission limit to determine compliance.

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5. Test Results

5.1. Bandwidth

RSS-210 Annex 8.1(4)

15.247(a)(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....

15.247(a)(1)

Test Results:

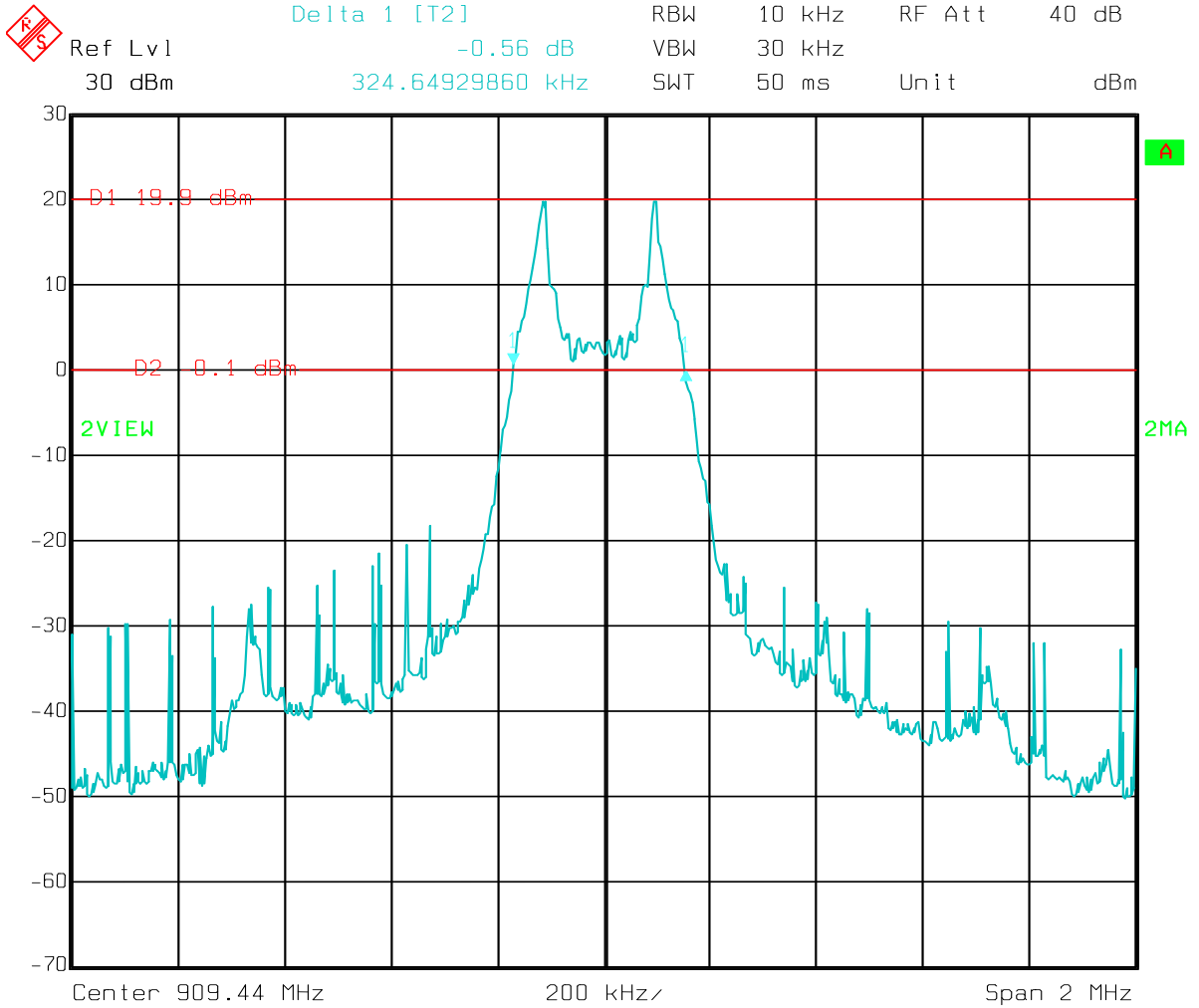
Peak hold, 20 dB display line to determine points of measurement.

The 20 dB bandwidth of the hopping channel is 250 kHz or greater.

20 dB Bandwidth		
Low Channel	Mid Channel	High Channel
324.6 kHz	280.6 kHz	276.5 kHz

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Low Channel

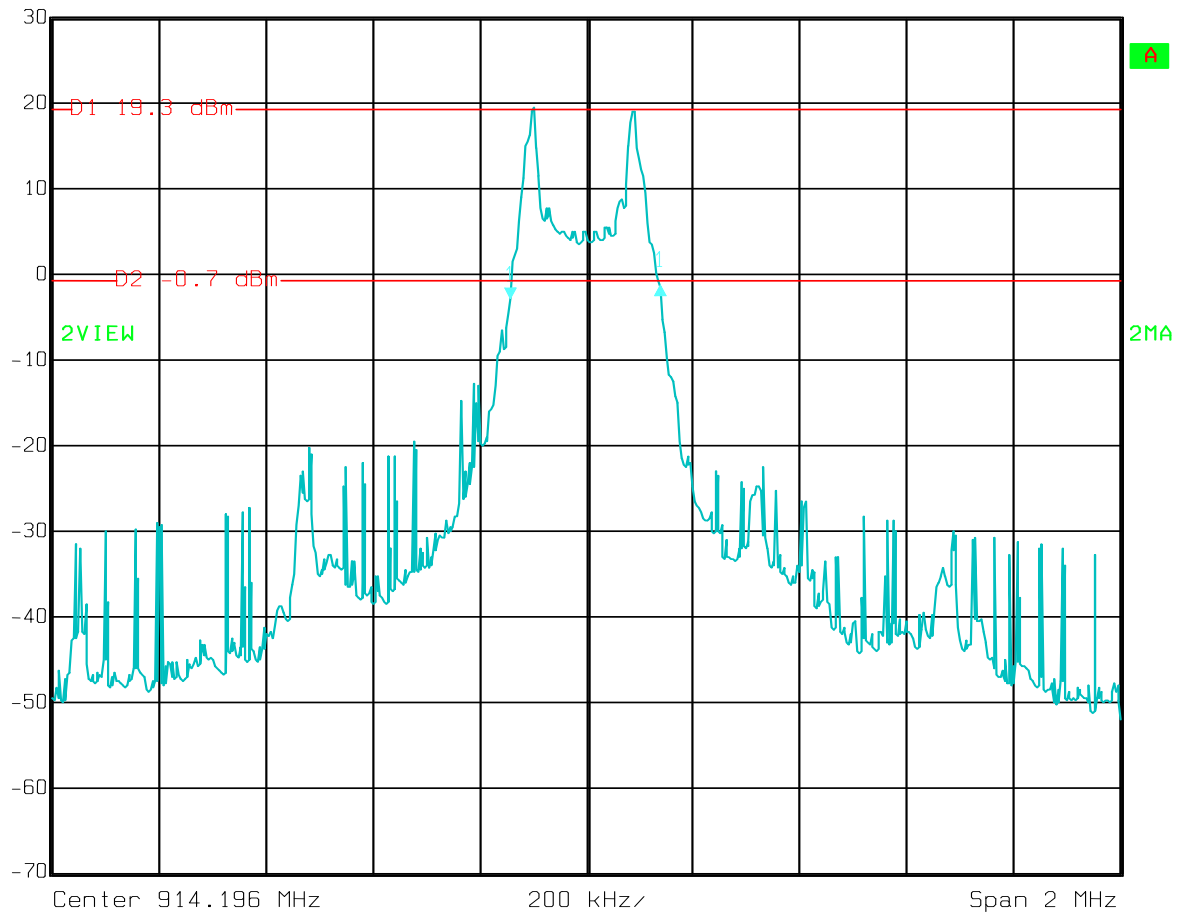


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Mid Channel


Delta 1 [T2]
RBW 10 kHz
RF Att 40 dB
Ref Lvl 1.61 dB
VBW 30 kHz
30 dBm
280.56112224 kHz
SWT 50 ms
Unit dBm

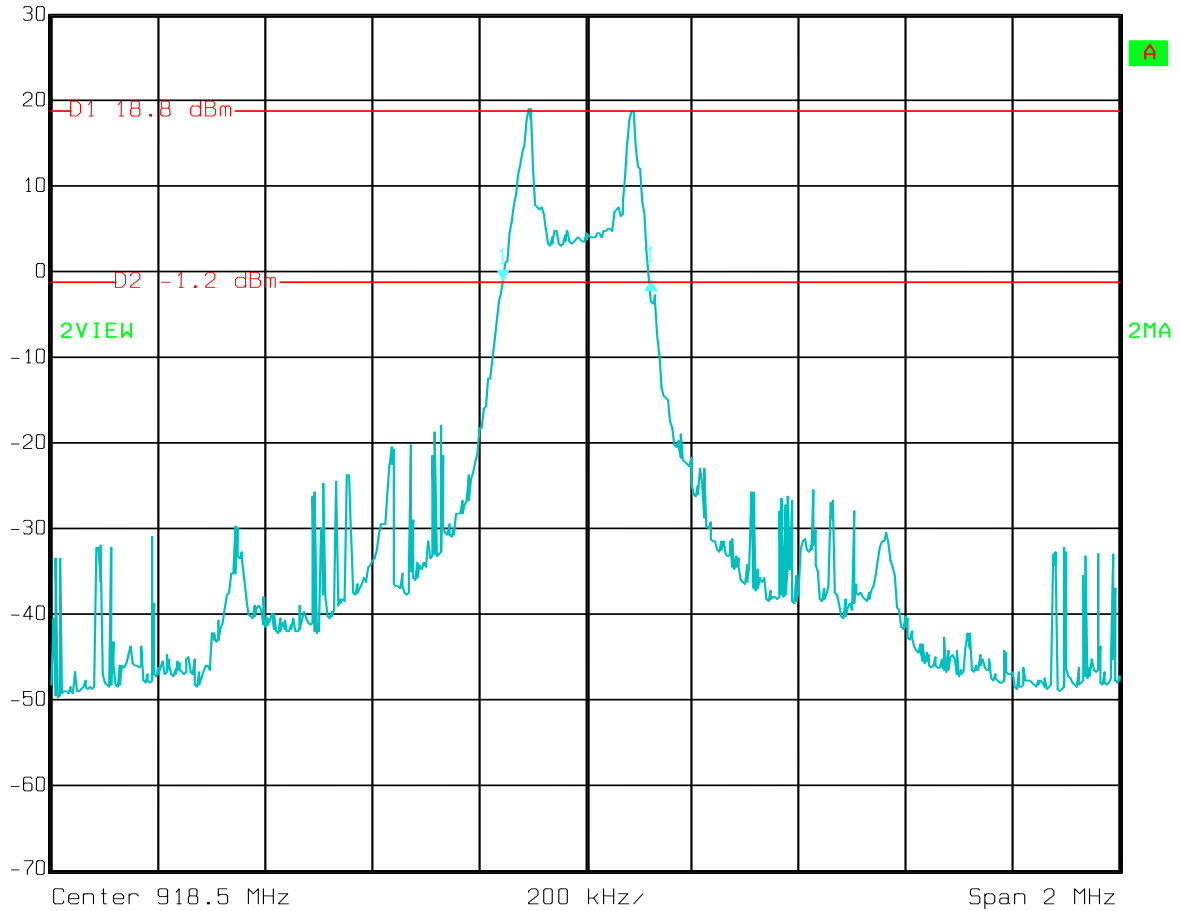


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High Channel


Delta 1 [T2]
RBW 10 kHz
RF Att 40 dB
Ref Lvl 0.24 dB
VBW 30 kHz
30 dBm
276.55310621 kHz
SWT 50 ms
Unit dBm



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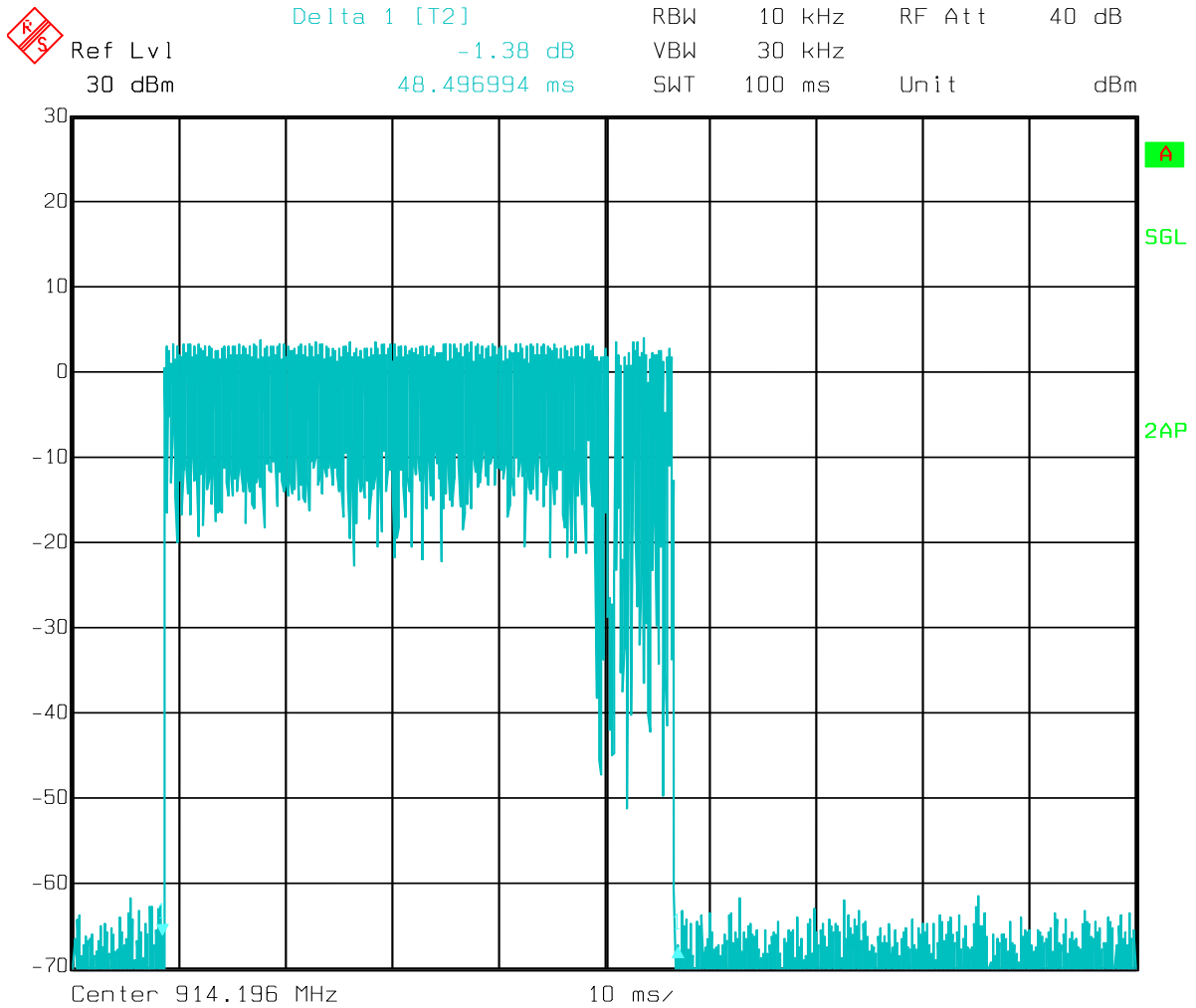
5.2. Duty Cycle Measurement

RSS-210 Annex 8.1(4)

Duty cycle = 48.5 microseconds in 100ms

Duty cycle = 0.485

Duty Cycle Factor = $20 \cdot \log(.485) = -6.28\text{dB}$



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5.3. Time of Occupancy

Clause 15.247(a)(1)(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.

Test Conditions:

Sample Number:	NA	Temperature:	72°F
Date:	10-17-08	Humidity:	32
Modification State:	Digital	Tester:	Dustin Chapin
		Laboratory:	Nemko

Test Results:

The EUT was placed 3m from the receiving antenna to allow a representative signal to fill the display > 30dB from the noise floor. The Spectrum Analyzer RES BW was set to 100 kHz. The test sample was set to hopping mode and the frequency span was set zero centered on a hopping channel. The sweep was set to 10 seconds.

2 occurrences in 10 seconds x 48.5 ms = 96 ms which is less than 400 ms

EUT complies.

Duty Cycle Factor Calculation

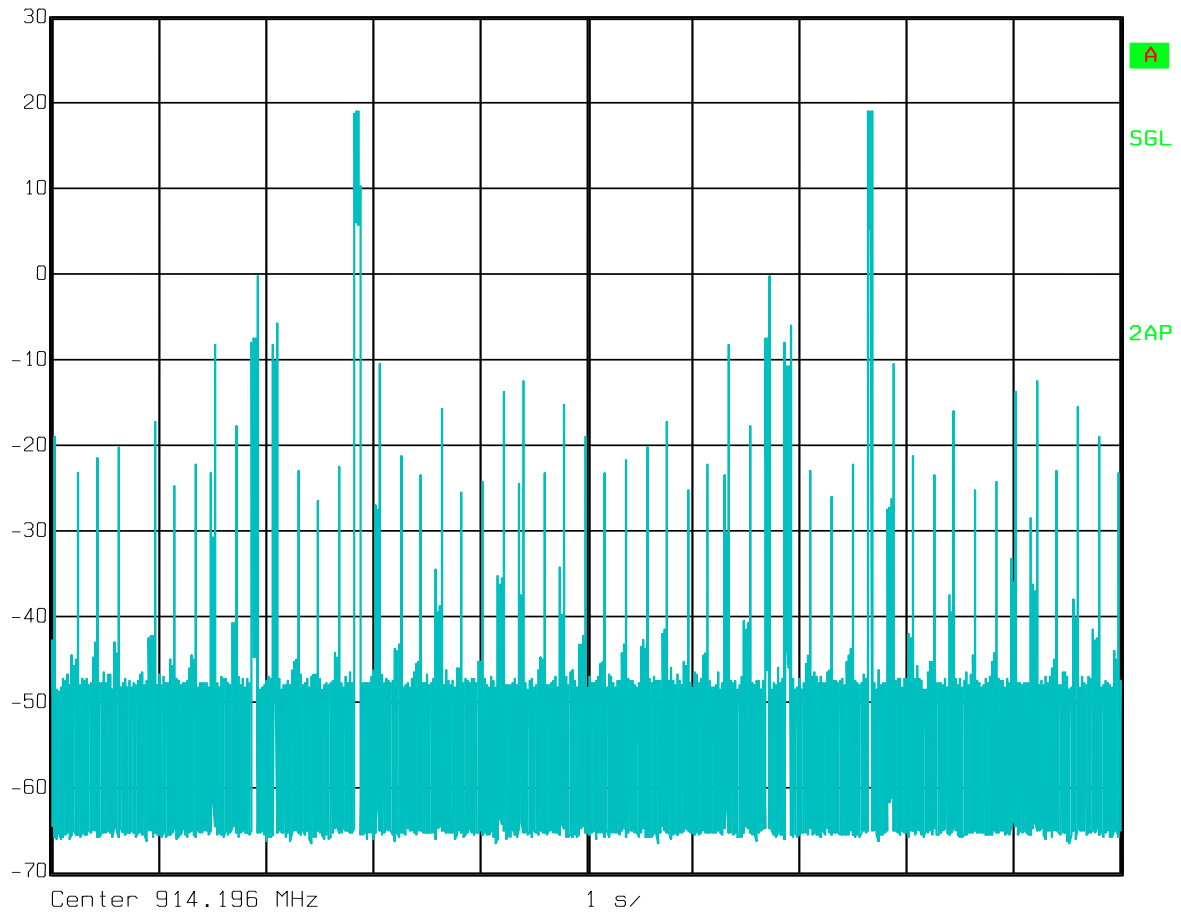
Since there is an emission for each channel 48.5ms in 200 ms and no repeat for 5.5 seconds, one could conclude that a duty cycle exists 48.5ms per 100 ms or 48.5%. Duty cycle factor is $20 \times \log(.485) = -6.28$. Round to -6.3 as measurements are to nearest 0.1. Actual duty cycle would be less. Use of a Keyfob transmitter for remote control devices like garage door openers, automobile alarm systems, etc. imply intermittent use over time.

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Ref Lvl
30 dBm

RBW 100 kHz RF Att 40 dB
VBW 300 kHz
SWT 10 s Unit dBm



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5.4. Channel Separation

<p>(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:</p> <p>(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.</p>
--

Test Conditions:

Sample Number:	NA	Temperature:	72°F
Date:	10-17-08	Humidity:	32
Modification State:	Two or more Channels	Tester:	Dustin Chapin
		Laboratory:	Nemko

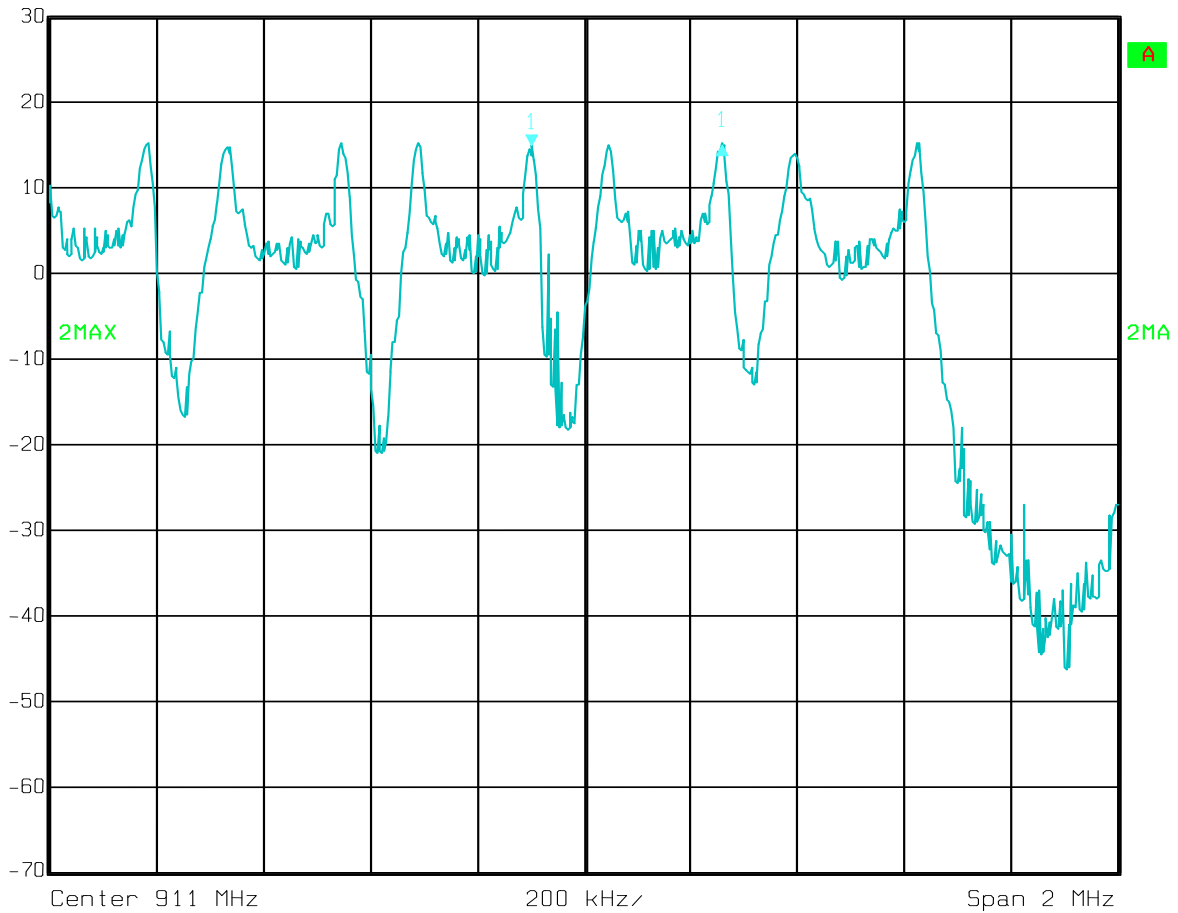
Test Results:

The EUT was placed 3m from the receiving antenna to allow a representative signal to fill the display > 30dB from the noise floor. The Spectrum Analyzer RES BW was set to 10 kHz. The test sample was set to hopping mode and the frequency span was set to a value to capture two or more hopping channels. Marker delta shows frequency separation.

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Channel Separation about equal to the 20 dB bandwidth.
358.7 kHz

	Delta 1 [T2]	RBW	10 kHz	RF Att	40 dB
	Ref Lvl	0.21 dB	VBW	30 kHz	
	30 dBm	356.71342685 kHz	SWT	50 ms	Unit dBm



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5.5. Frequency Plan

(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 pseudo randomly 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.

Test Conditions:

Sample Number:		Temperature:	72°F
Date:	10-17-08	Humidity:	32
Modification State:	All Channels	Tester:	Dustin Chapin
		Laboratory:	Nemko

15.247(a)

This design employs 25 channels which operate in the 902MHz to 928MHz band. Each channel has a 20dB BW greater than 250KHz but less than 500KHz. The time of occupancy of each channel is less than 0.4s in a 10s period. Based on these specifications this transceiver is considered a frequency hopping spread spectrum system under this part.

Pseudorandom Frequency Hopping Sequence

The pseudorandom sequence is based on a pre-defined frequency table.

Channel	<i>f</i>	Channel	<i>f</i>
0	909.44MHz	13	914.560MHz
1	909.767MHz	14	914.909MHz
2	910.095MHz	15	915.294MHz
3	910.452MHz	16	915.657MHz
4	910.800MHz	17	916.000MHz
5	911.158MHz	18	916.364MHz
6	911.515MHz	19	916.727MHz
7	912.457MHz	20	917.073MHz
8	912.821MHz	21	917.434MHz
9	913.171MHz	22	917.787MHz
10	913.500MHz	23	918.154MHz
11	913.829MHz	24	918.500MHz
12	914.196MHz		

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Pseudo-Random Hopping Sequence
Channel 0
Channel 5
Channel 12
Channel 10
Channel 6
Channel 3
Channel 8
Channel 1
Channel 2
Channel 9
Channel 15
Channel 22
Channel 16
Channel 18
Channel 23
Channel 20
Channel 19
Channel 17
Channel 24
Channel 21
Channel 14
Channel 7
Channel 13
Channel 11
Channel 4

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5.6. Number of Hopping Channels

RSS-210 Annex 8.4(2)

(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.**

Clause 15.247(a)(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.

Test Conditions:

Sample Number:		Temperature:	72°F
Date:	10-17-08	Humidity:	32
Modification State:	Lo/Mid/High Channels	Tester:	Dustin Chapin
		Laboratory:	Nemko

Test Results:

The EUT was placed 3m from the receiving antenna to allow a representative signal to fill the display > 30dB from the noise floor. The Spectrum Analyzer RES BW was set to 30 kHz to discriminate channels. The test sample was set to hopping mode and the frequency span was set to a value small enough to display the channels to allow counting. Three continuous scans show the complete band from 902 MHz to 928 MHz and 25 channels are evident.

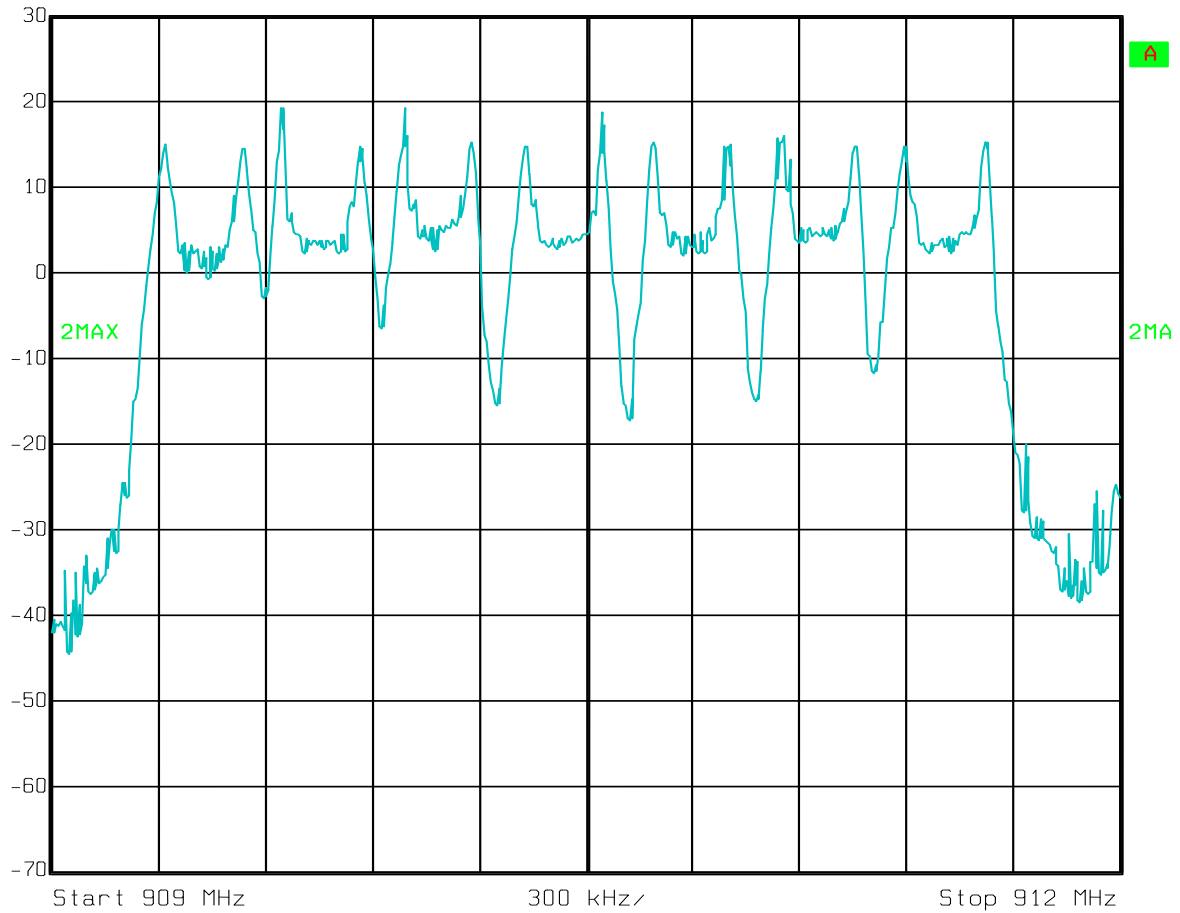
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7 Hopping channels



Ref Lvl
30 dBm

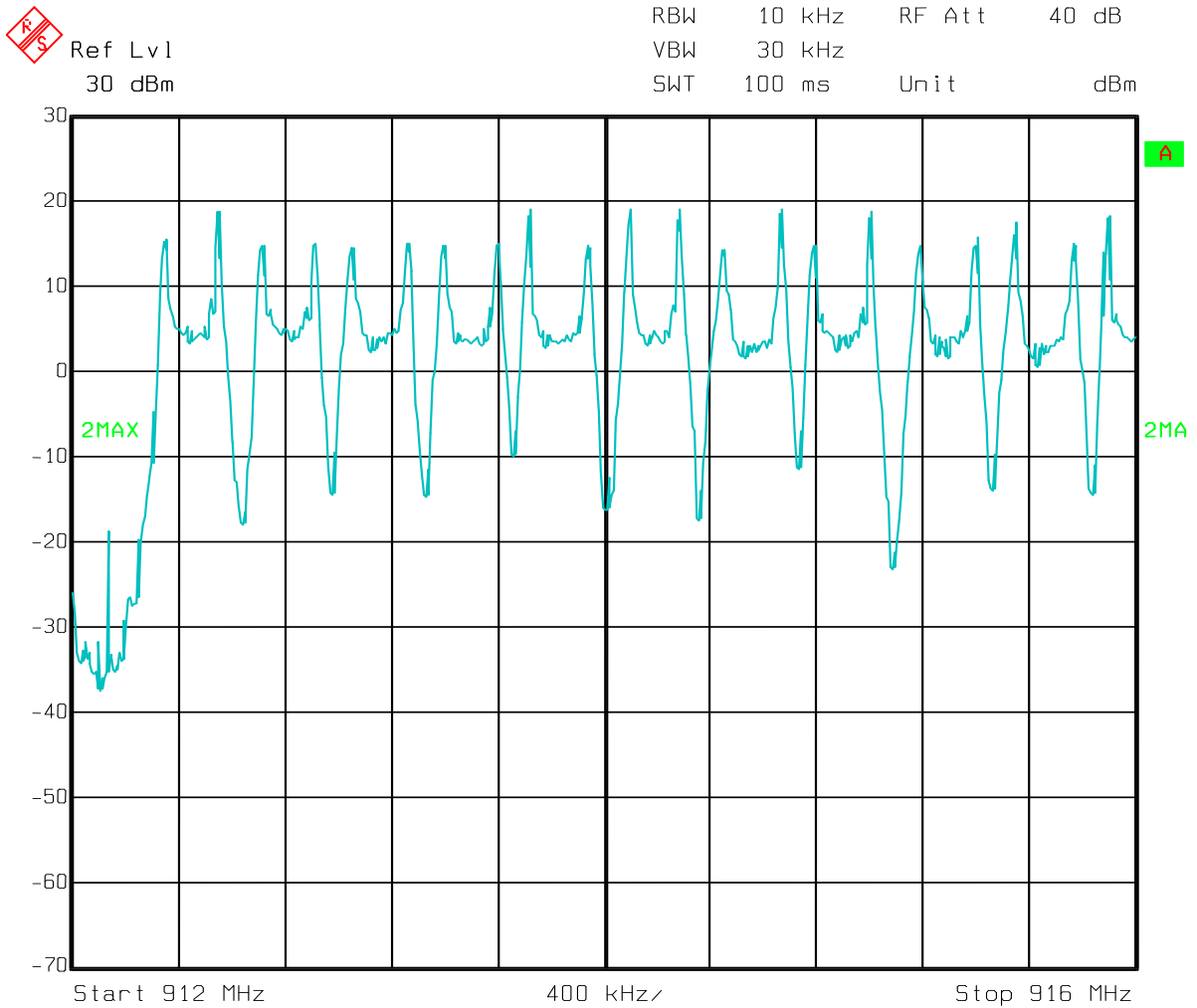
RBW 10 kHz RF Att 40 dB
VBW 30 kHz
SWT 76 ms Unit dBm



Date: 17.OCT.2008 15:59:33

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10.5 Hopping Channels



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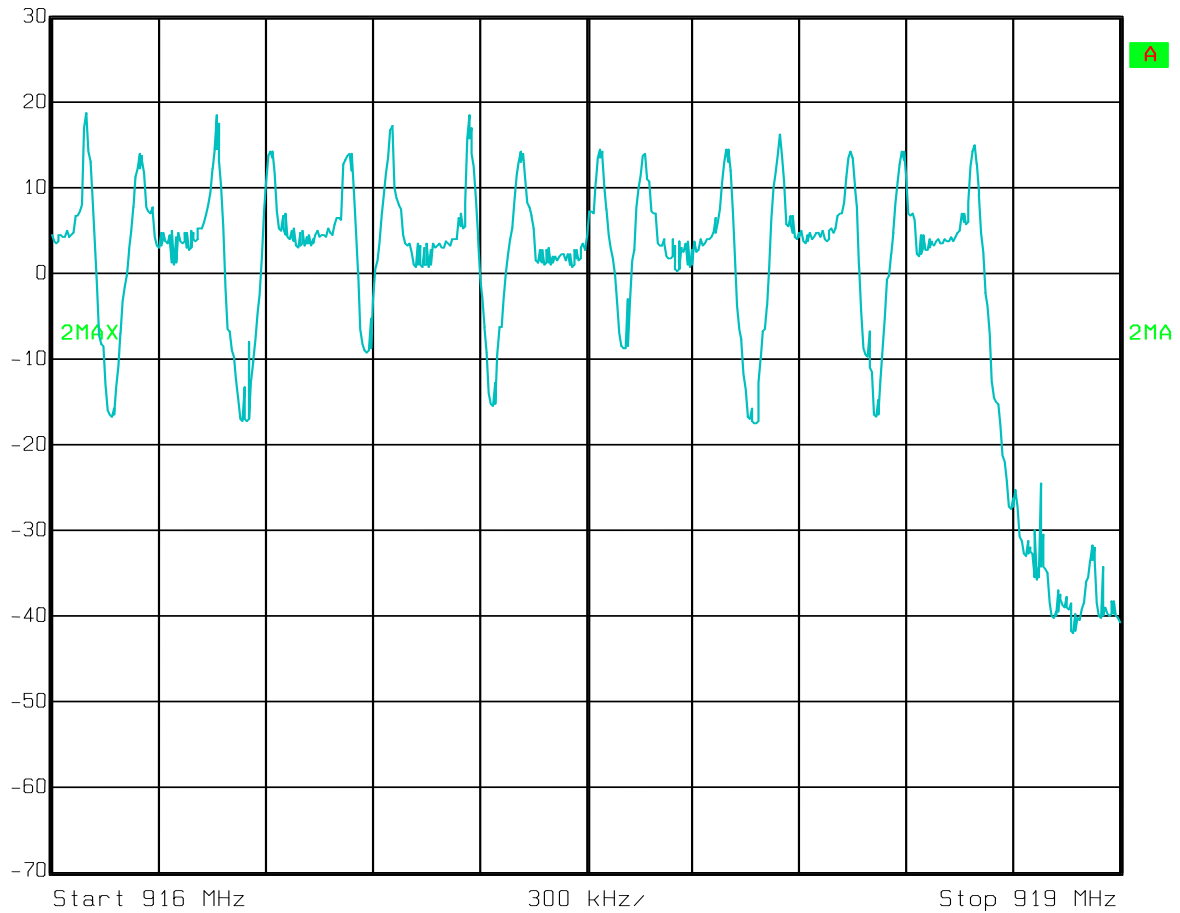
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7.5 Hopping Channels
 $7 + 10.5 + 7.5 = 25$ Hopping Channels



Ref Lvl
30 dBm

RBW 10 kHz RF Att 40 dB
 VBW 30 kHz
 SWT 76 ms Unit dBm



Date: 17.OCT.2008 16:02:09

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5.7. Radiated Emissions Test Data

Clause 15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:		
Frequency (MHz)	Field Strength (uV/meter)	Measurement Distance (meter)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

15.247 (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 Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a) must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

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Test Conditions:

Sample Number:		Temperature:	66°F
Date:	4-3/-8	Humidity:	32
Modification State:	Lo/Mid/High Channels	Tester:	A. Laudani
		Laboratory:	SOATS

Test Results: See Table Below

Additional Observations:

- Emissions were searched over a range of 30 MHz to 10,000 MHz
- Three orthogonal axes were tried to maximize emissions. Worst case was used in measurements presented.
- A new battery was installed initially and replaced every 20 minutes of test time.
- There are no emissions found that occur during receive mode.
- Measurements below 1GHz were performed at 3m with a Quasi-Peak detector while Peak and Average detectors were used above 1GHz. Average for Radio Emissions = Peak + Duty Cycle Factor.
- As the emission is pulsing, a duty cycle factor was introduced to spurious harmonics
- Power Level Limits 250 mWatt or 119.22 dBuV/m @3m. EUT complies.

$$10^{[(\text{Field Strength in dB}\mu\text{V/m} - 120)/20]} = \text{Field Strength in V/m}$$

$$[(\text{Field Strength in V/m} \times 3\text{m})/5.5]^2 = \text{Power in Watts}$$

$$114.7 \text{ dB}\mu\text{V/m} = 88.5 \text{ mW}$$

OATS: IC Site #: 2040B-1; RN#: 90579

Example Frequency @ 909.44 MHz:

- 88.3 dB μ V (spectrum analyzer reading)
- +4.4 dB (cable loss @ frequency)
- +21.6 dB/m (antenna factor @ frequency)
- 114.3 dB μ V/m Final adjusted value

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RADIATED SPURIOUS

Radiated Emissions Data											
Job # :	19016-1		Date :	10/17/08		Page	1		of	1	
NEX # :	115465		Time :	0830							
			Staff :	DC							
Client Name :	Directed Electronics					EUT Voltage :	Battery				
EUT Name :	KeyFob					EUT Frequency :	DC				
EUT Model # :	7941 VPX Family					Phase :	1				
EUT Serial # :	NA					NOATS					
EUT Config. :	Transmit continuously (test mode)					SOATS	X				
						Distance < 1000 MHz:	3 m				
						Distance > 1000 MHz:	3 m				
Specification :	CFR47 Part 15, Subpart C, 15.247 15.205										
Loop Ant. #:	NA		Temp. (°C) :	19		Quasi-Peak		RBW: 120 kHz			
Bicon Ant. #:	114		Humidity (%) :	27		Video Bandwidth		300 kHz			
Log Ant. #:	110		Spec An. #:	898		Peak		RBW: 1 MHz			
DRG Ant. #	752		Spec An. Display #:	898		Video Bandwidth		3 MHz			
Cable LF#:	SOATS		QP #:	898		Average		RBW: 1 MHz			
Cable HF#:	40ft		PreSelect#:	899		Video Bandwidth		10 Hz			
Preamp LF#:	NA		Duty Cycle Factor:	-6.3		Measurements below 1 GHz are Quasi-Peak values, unless otherwise stated.					
Preamp HF#	317					Measurements above 1 GHz are Average values, unless otherwise stated.					
Meas. Freq. (MHz)	Meter Reading Vertical	Meter Reading Horizontal	Det.	EUT Side F/L/R/B	Ant. Height m	Max. Reading (dBµV)	Corrected Reading (dBµV/m)	Spec. limit (dBµV/m)	CR/SL Diff. (dB)	Pass Fail	Comment
909.44	88.1	88.3	Q		1.1	88.3	114.3	119.2	-4.9	Pass	Horizontal
909.44	86.4	87.1	Q		1.1	87.1	113.1	119.2	-6.1	Pass	Vertical
909.44	87.6	88.1	Q		1.1	88.1	114.1	119.2	-5.1	Pass	Side
2728.32	25.3	27.5	P		1.1	27.5	55.9	74.0	-18.0	Pass	Horizontal
2728.32	17.7	20.9	A		1.1	20.9	49.3	54.0	-4.6	Pass	Horizontal
2728.32	23.6	26.3	P		1.1	26.3	60.7	74.0	-13.2	Pass	Vertical
2728.32	16.0	19.7	A		1.1	19.7	48.1	54.0	-5.8	Pass	Vertical
2728.32	24.8	27.3	P		1.1	27.3	61.7	74.0	-12.2	Pass	Side
2728.32	17.2	20.7	A		1.1	20.7	49.1	54.0	-4.8	Pass	Side
914.20	86.4	88.0	Q		1.1	88.0	114.5	119.2	-4.7	Pass	Horizontal
914.20	86.2	86.9	Q		1.1	86.9	113.4	119.2	-5.8	Pass	Vertical
914.20	87.1	87.5	Q		1.1	87.5	114.0	119.2	-5.2	Pass	Side
2742.60	25.6	25.7	P		1.1	25.7	60.1	74.0	-13.8	Pass	Horizontal
2742.60	19.4	19.6	A		1.1	19.6	48.0	54.0	-5.9	Pass	Horizontal
2742.60	25.4	24.6	P		1.1	25.4	59.8	74.0	-14.1	Pass	Vertical
2742.60	19.2	18.5	A		1.1	19.2	47.6	54.0	-6.3	Pass	Vertical
2742.60	26.3	25.2	P		1.1	26.3	60.7	74.0	-13.2	Pass	Side
2742.60	20.1	19.1	A		1.1	20.1	48.5	54.0	-5.4	Pass	Side
918.50	87.9	88.2	Q		1.1	88.2	114.7	119.2	-4.5	Pass	Horizontal
918.50	85.1	87.1	Q		1.1	87.1	113.6	119.2	-5.6	Pass	Vertical
918.50	86.5	87.9	Q		1.1	87.9	114.4	119.2	-4.8	Pass	Side
2755.50	28.4	28.2	P		1.1	28.4	62.8	74.0	-11.1	Pass	Horizontal
2755.50	22.3	21.7	A		1.1	22.3	50.7	54.0	-3.2	Pass	Horizontal
2755.50	25.6	27.1	P		1.0	27.1	61.5	74.0	-12.4	Pass	Vertical
2755.50	19.5	20.6	A		1.0	20.6	49.0	54.0	-4.9	Pass	Vertical
2755.50	27.0	27.9	P		1.1	27.9	62.3	74.0	-11.6	Pass	Side
2755.5	20.9	21.4	A		1.1	21.4	49.8	54.0	-4.1	Pass	Side

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5.8. Conducted Output Power

RSS-210 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.

15.247 (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.

Test Conditions:

Sample Number:		Temperature:	72°F
Date:	10-17-08	Humidity:	32
Modification State:	Lo/Mid/High Channels	Tester:	A. Laudani
		Laboratory:	SOATS

Test Results:

A cable was temporarily soldered across the input to the circuit comprising the antenna. Peak measurements were taken with a spectrum analyzer. Plots shown below.

Conducted Output Power dBm		
Low Channel	Mid Channel	High Channel
19.69	19.08	18.71
Conducted Output Power mW		
Low Channel	Mid Channel	High Channel
93.1	80.9	73.4

Since the low channel is the highest output, to correct for RBW measurement, adding a bandwidth correction factor based on the 325 kHz 20 dB bandwidth:

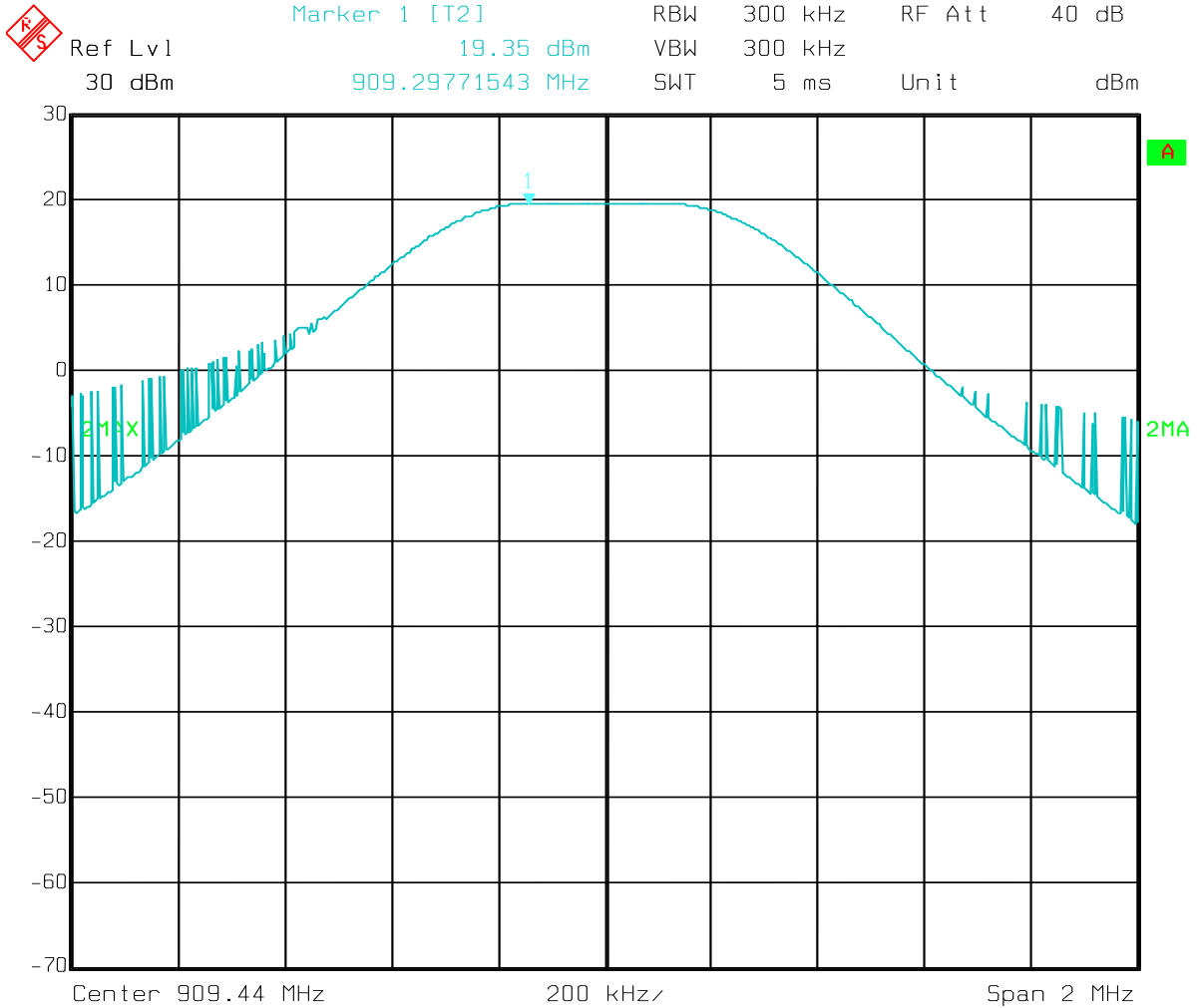
19.35 dBm measured

$10 \times \log(325/300) = 0.34 \text{ dB}$

$19.35 + 0.34 = 19.69 \text{ dBm}$

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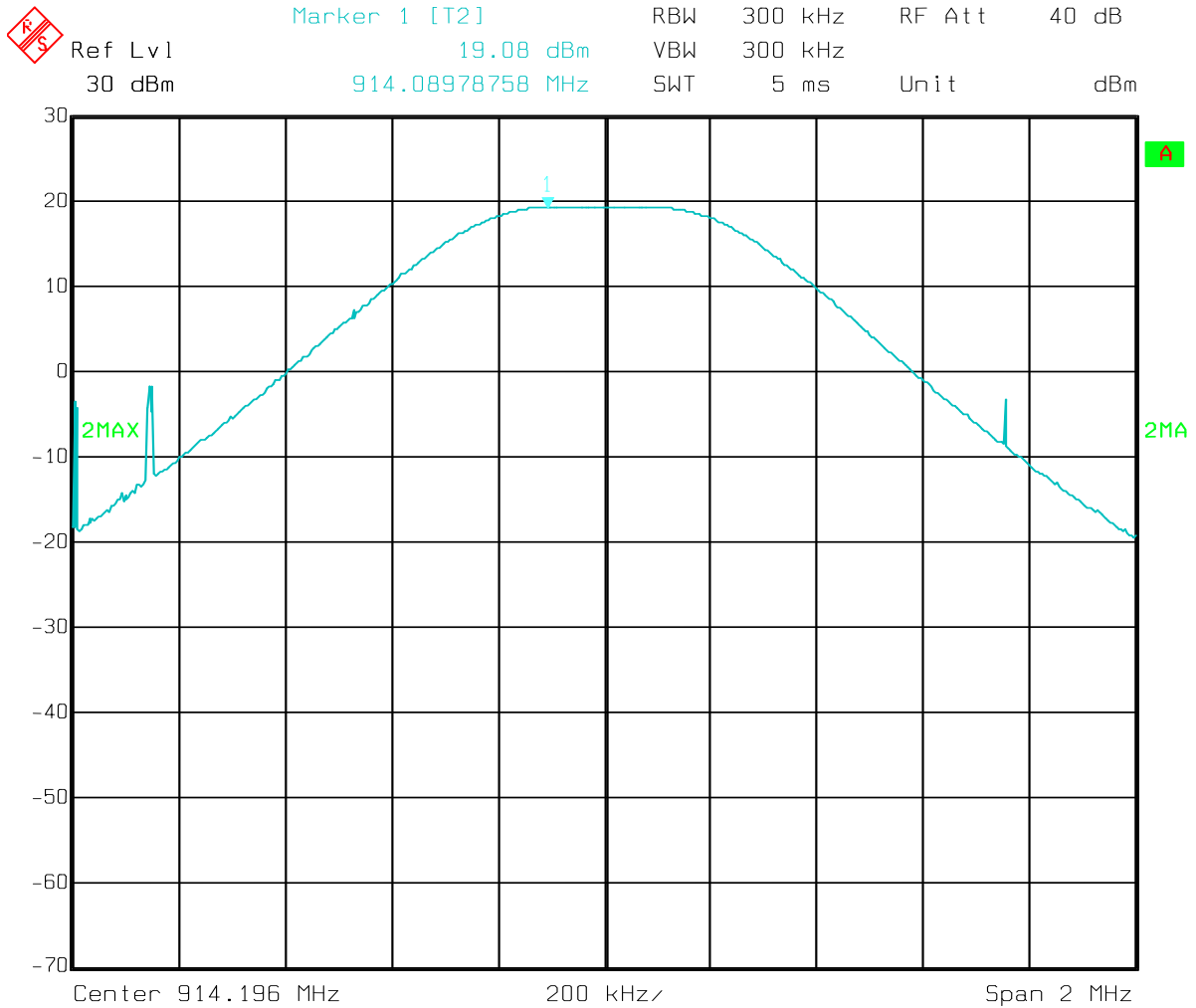
Low Channel.



Date: 17.OCT.2008 16:13:56

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Mid Channel.



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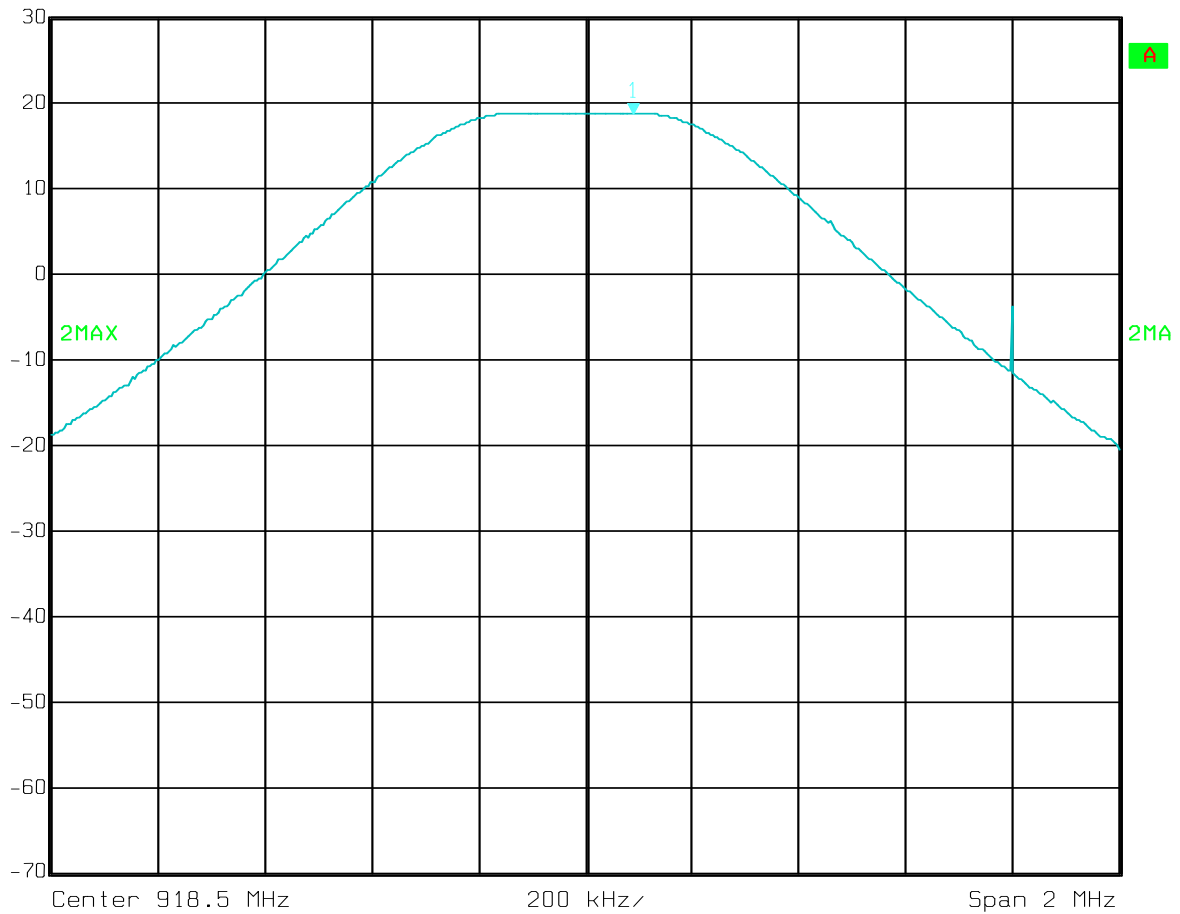
High Channel.



Ref Lvl
30 dBm

Marker 1 [T2]
18.71 dBm
918.59018036 MHz

RBW 300 kHz RF Att 40 dB
VBW 300 kHz
SWT 5 ms Unit dBm



Date: 17.OCT.2008 16:16:00

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5.9. Conducted Spurious

15.247 (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 Sec. 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Sec. 15.205(a) must also comply with the radiated emission limits specified in Sec. 15.209(a) (see Sec. 15.205(c)).

Test Conditions:

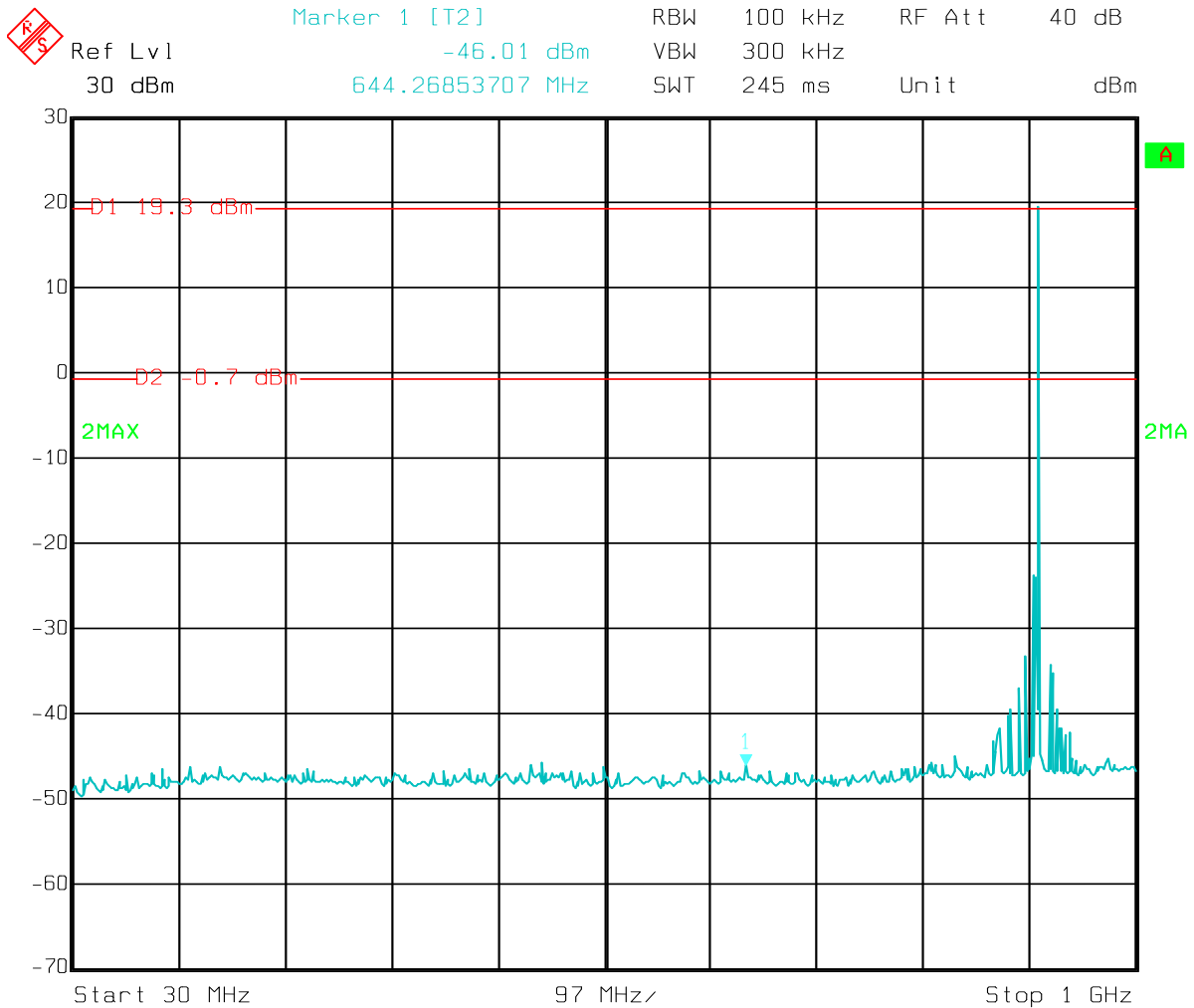
Sample Number:		Temperature:	
Date:		Humidity:	
Modification State:	Lo/Mid/High Channels	Tester:	A. Laudani
		Laboratory:	SOATS

Test Results:

A cable was temporarily soldered across the input to the circuit comprising the antenna. Peak measurements were taken with a spectrum analyzer. Plots shown below. Limit line inserted at 20 dBc.

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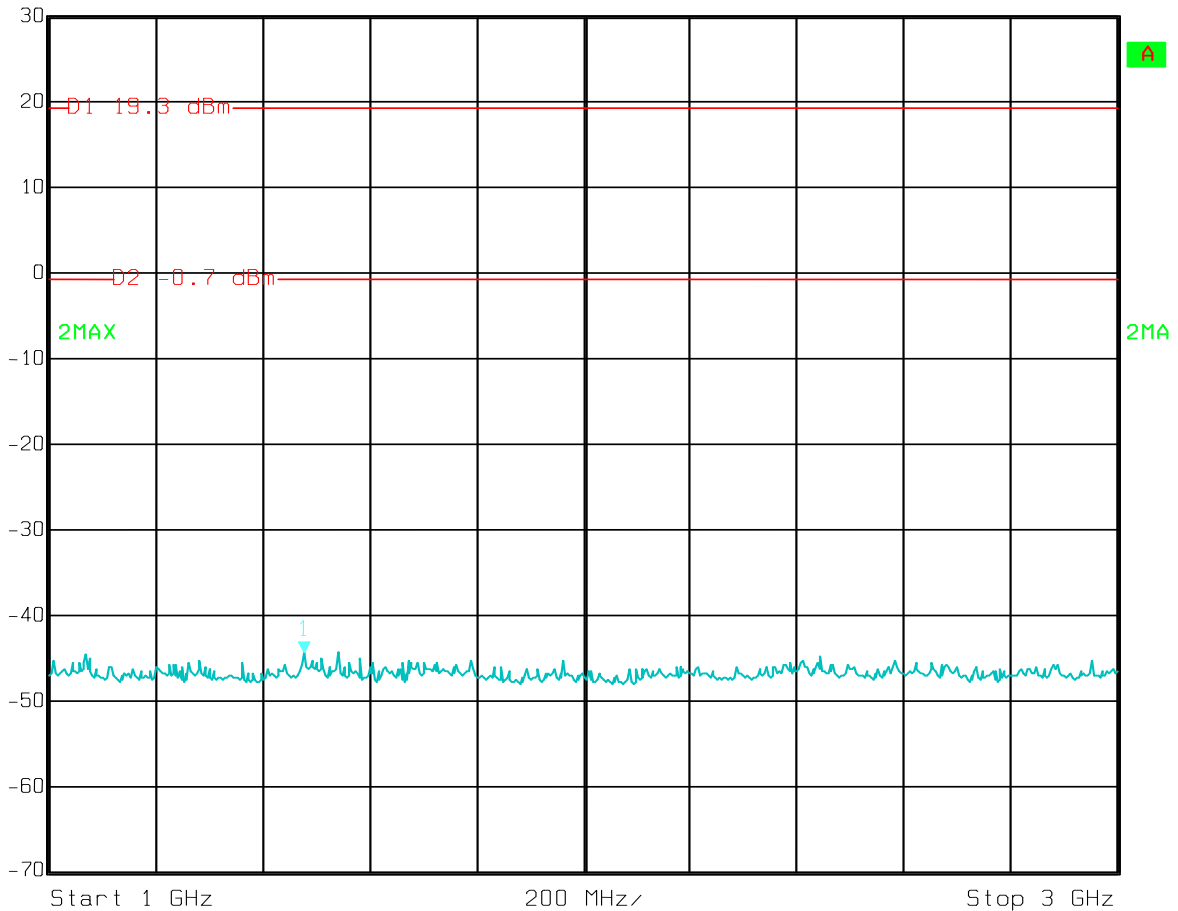
Low Channel.



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Marker 1 [T2]
RBW 100 kHz
RF Att 40 dB
Ref Lvl -44.38 dBm
VBW 300 kHz
30 dBm
1.47695391 GHz
SWT 500 ms
Unit dBm

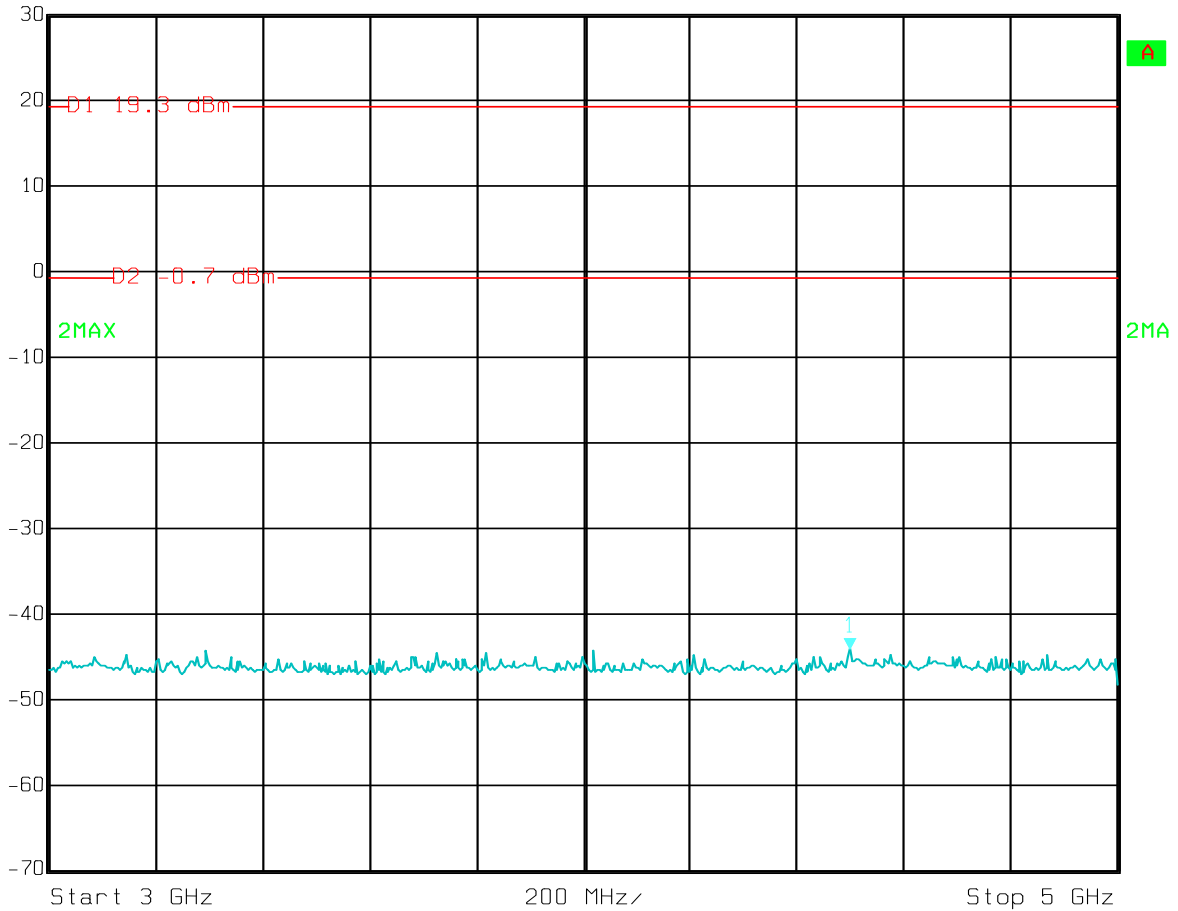


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Marker 1 [T2] RBW 100 kHz RF Att 40 dB
 Ref Lvl -44.08 dBm VBW 300 kHz
 30 dBm 4.49899800 GHz SWT 500 ms Unit dBm

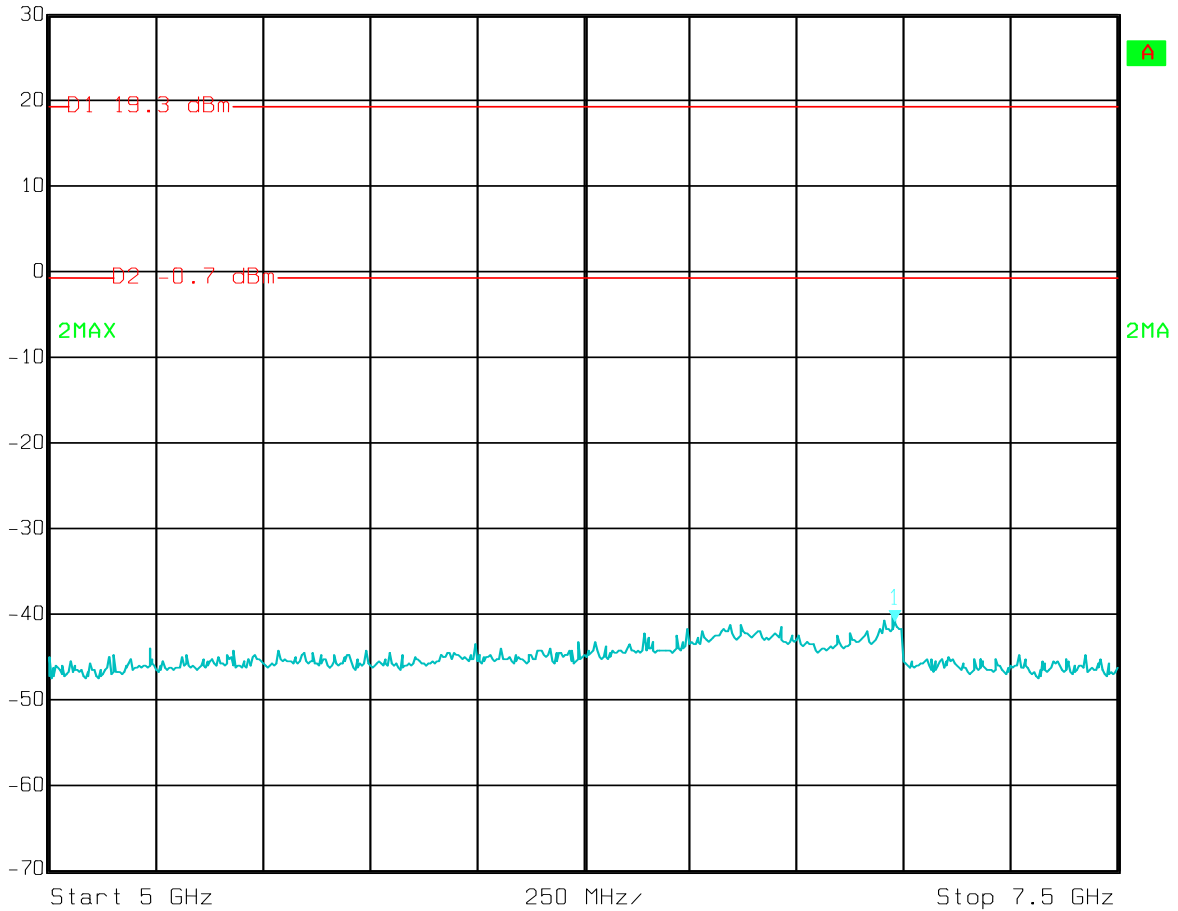


Date: 17.OCT.2008 16:25:50

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Marker 1 [T2] RBW 100 kHz RF Att 40 dB
 Ref Lvl -40.78 dBm VBW 300 kHz
 30 dBm 6.97895792 GHz SWT 640 ms Unit dBm

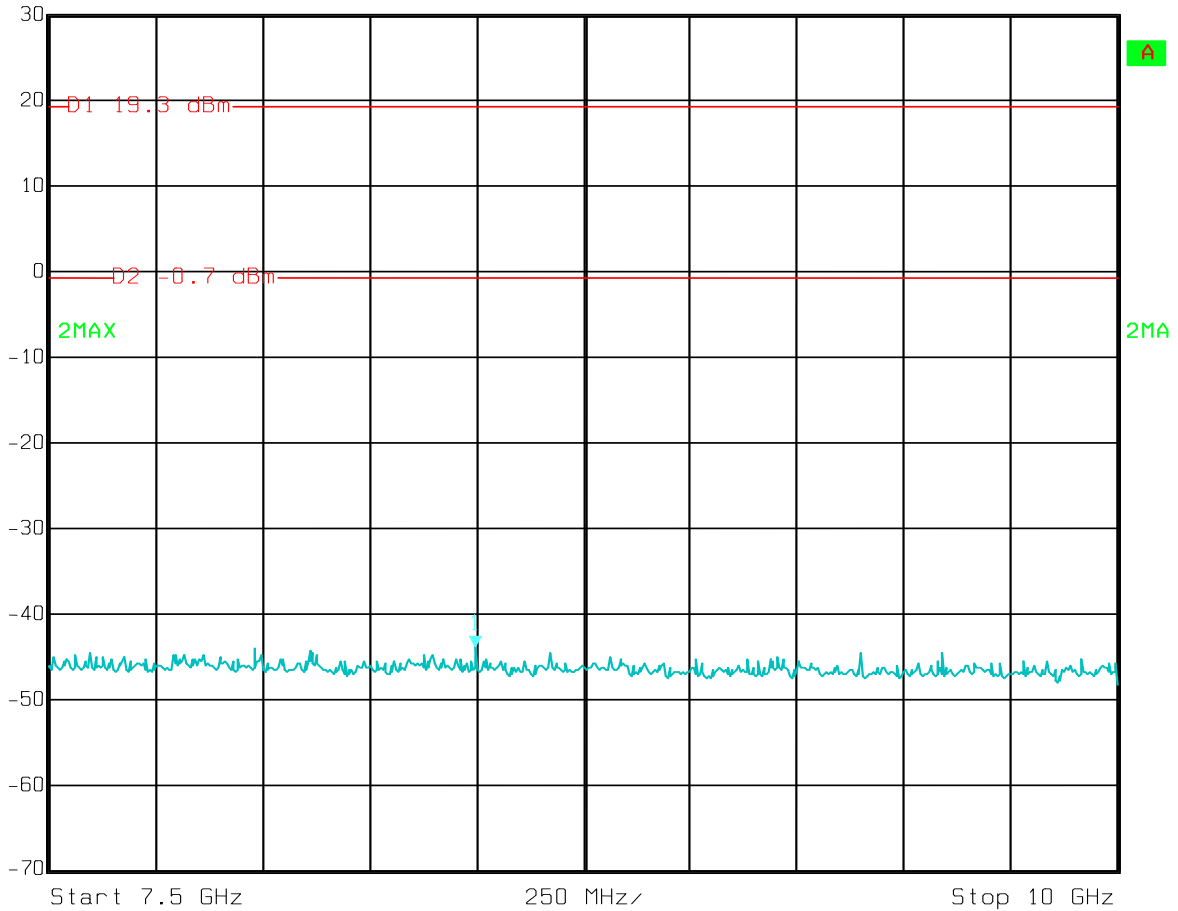


Date: 17.OCT.2008 16:26:28

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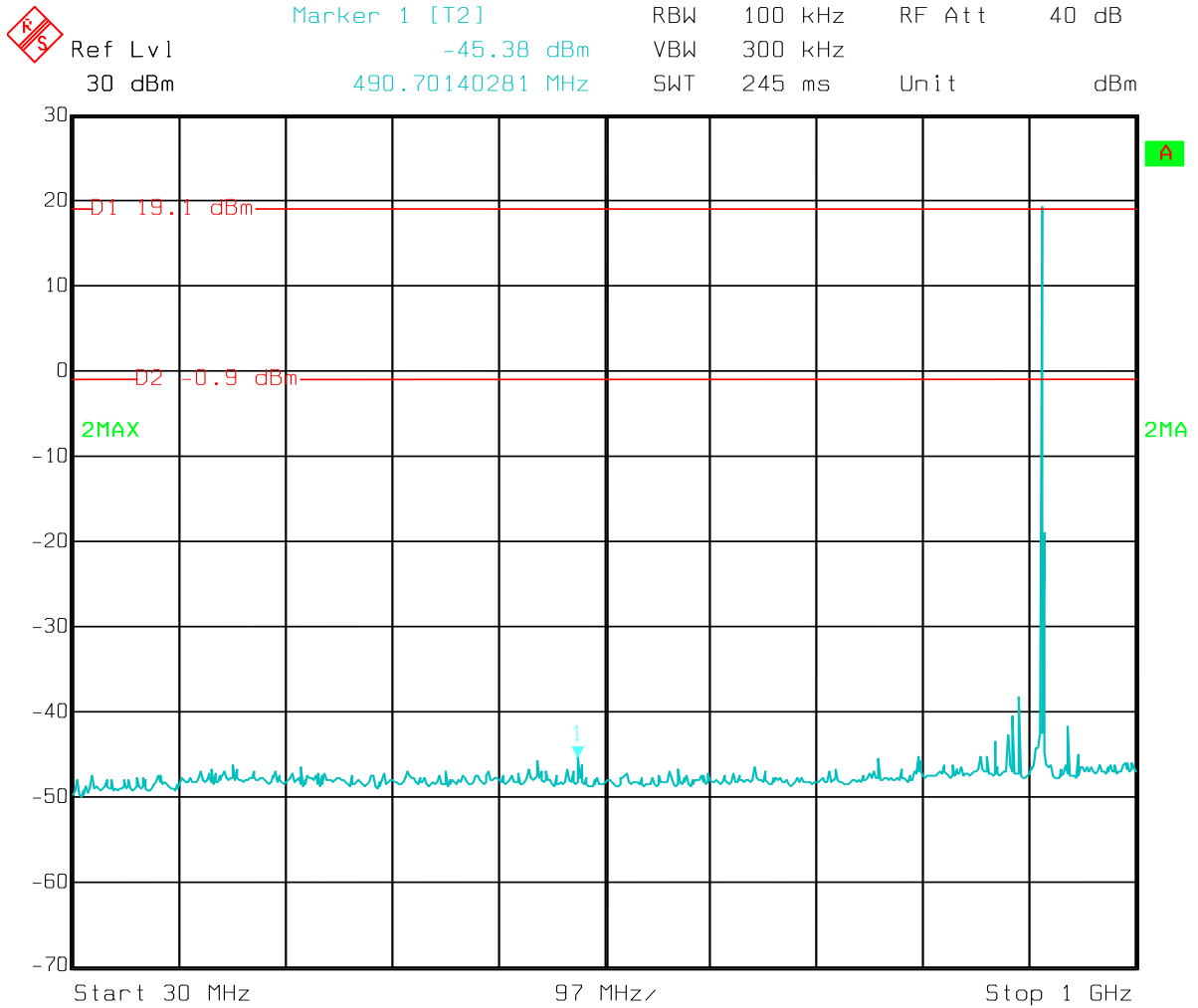
Marker 1 [T2] RBW 100 kHz RF Att 40 dB
 Ref Lvl -43.82 dBm VBW 300 kHz
 30 dBm 8.49699399 GHz SWT 640 ms Unit dBm



Date: 17.OCT.2008 16:27:07

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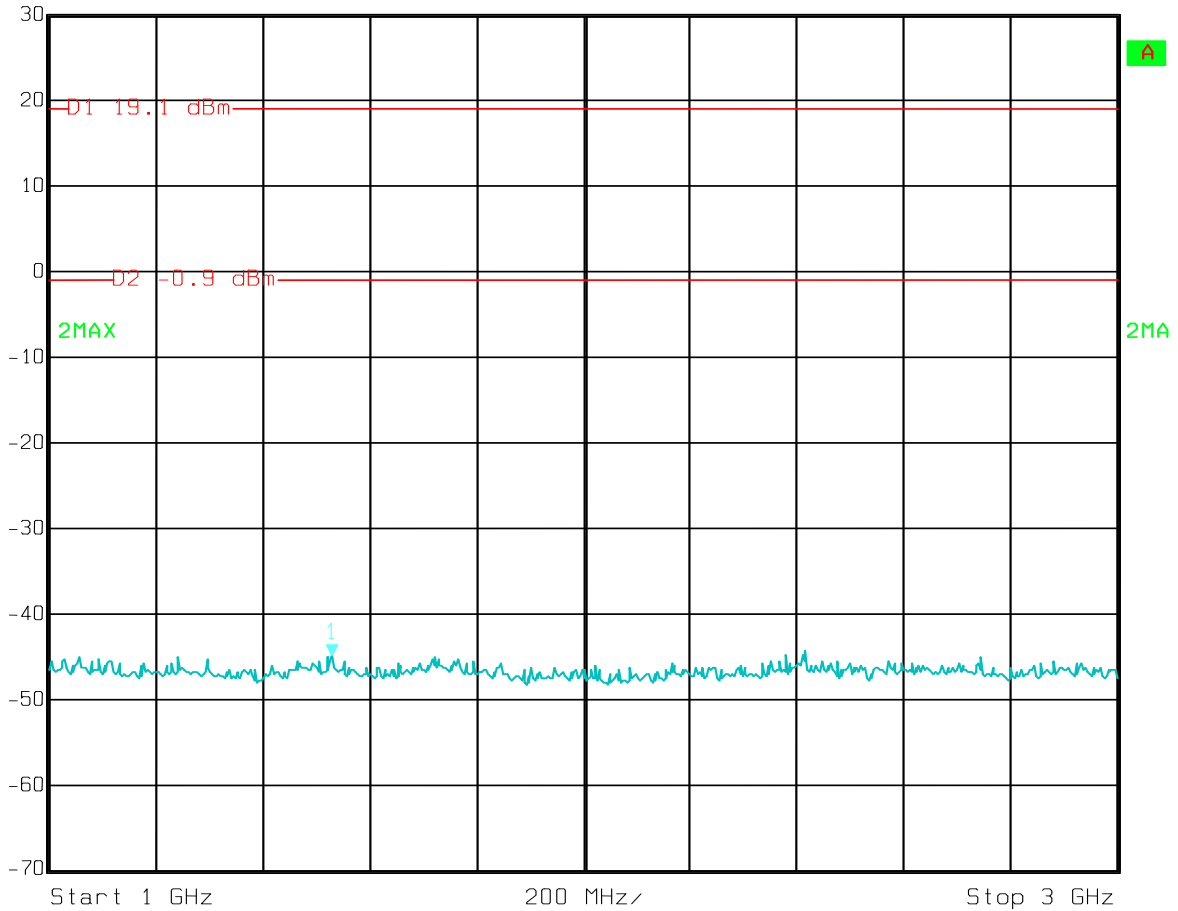
Mid Channel.



Date: 17.OCT.2008 16:33:07

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Marker 1 [T2]
RBW 100 kHz
RF Att 40 dB
Ref Lvl -44.79 dBm
VBW 300 kHz
30 dBm
1.52905812 GHz
SWT 500 ms
Unit dBm

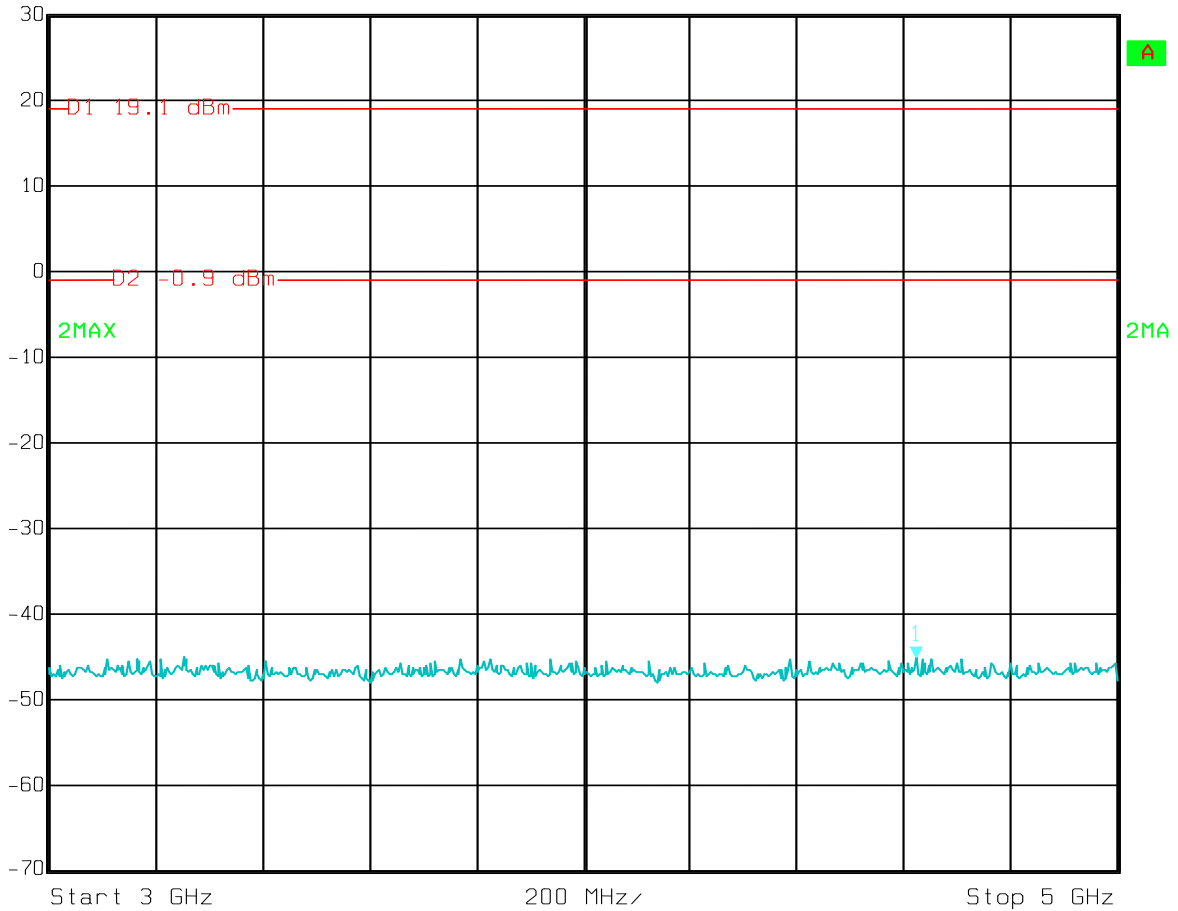


Date: 17.OCT.2008 16:40:52

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Marker 1 [T2] RBW 100 kHz RF Att 40 dB
 Ref Lvl -45.08 dBm VBW 300 kHz
 30 dBm 4.62324649 GHz SWT 500 ms Unit dBm

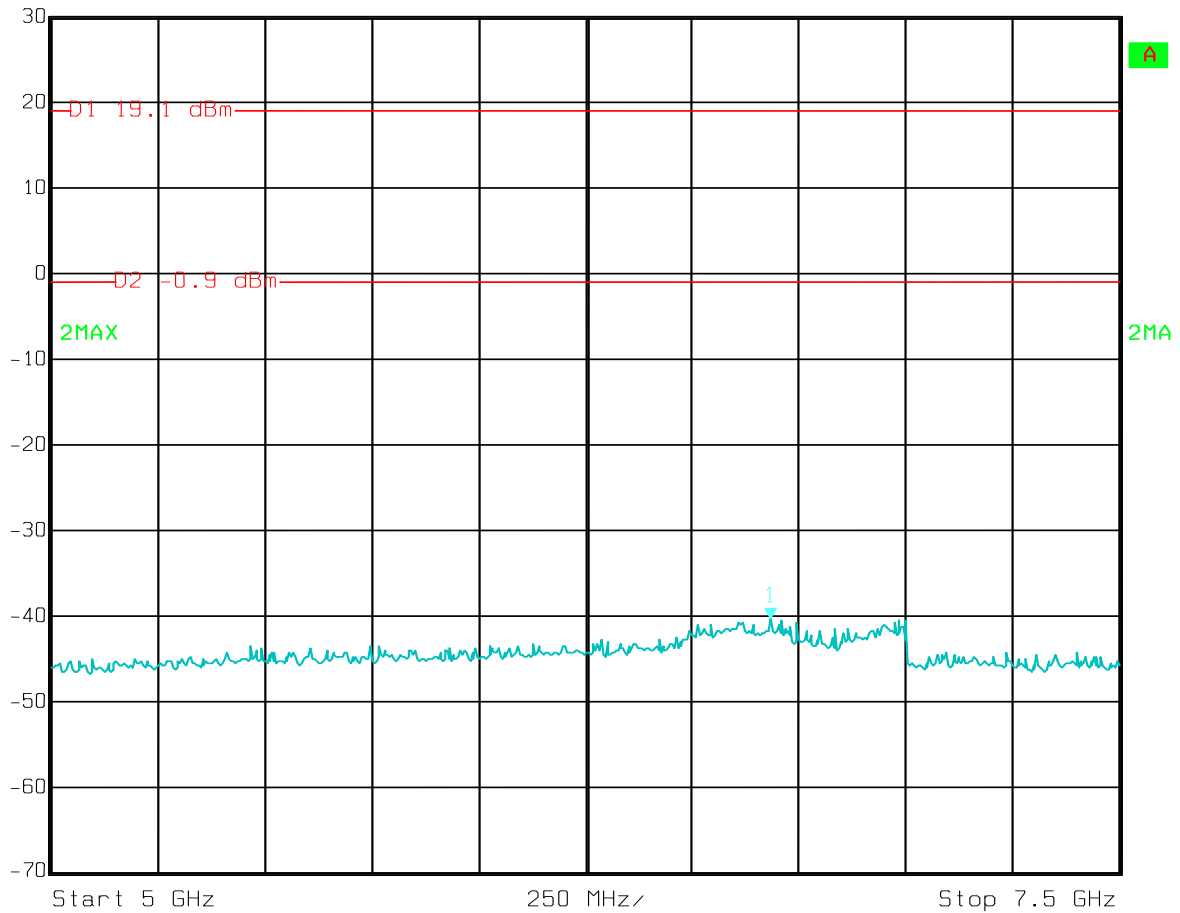


Date: 17.OCT.2008 16:37:04

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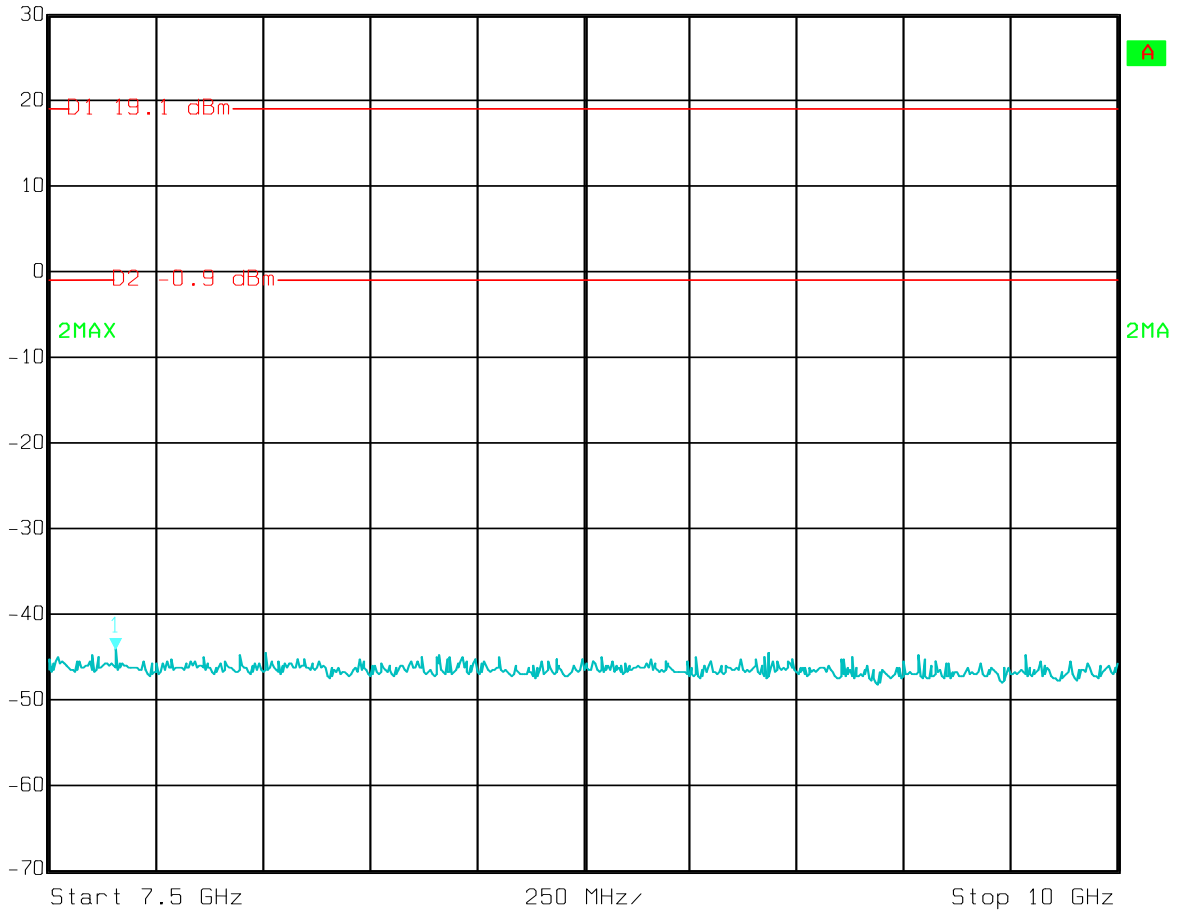
Marker 1 [T2] RBW 100 kHz RF Att 40 dB
 Ref Lvl -40.47 dBm VBW 300 kHz
 30 dBm 6.68336673 GHz SWT 640 ms Unit dBm



Date: 17.OCT.2008 16:46:40

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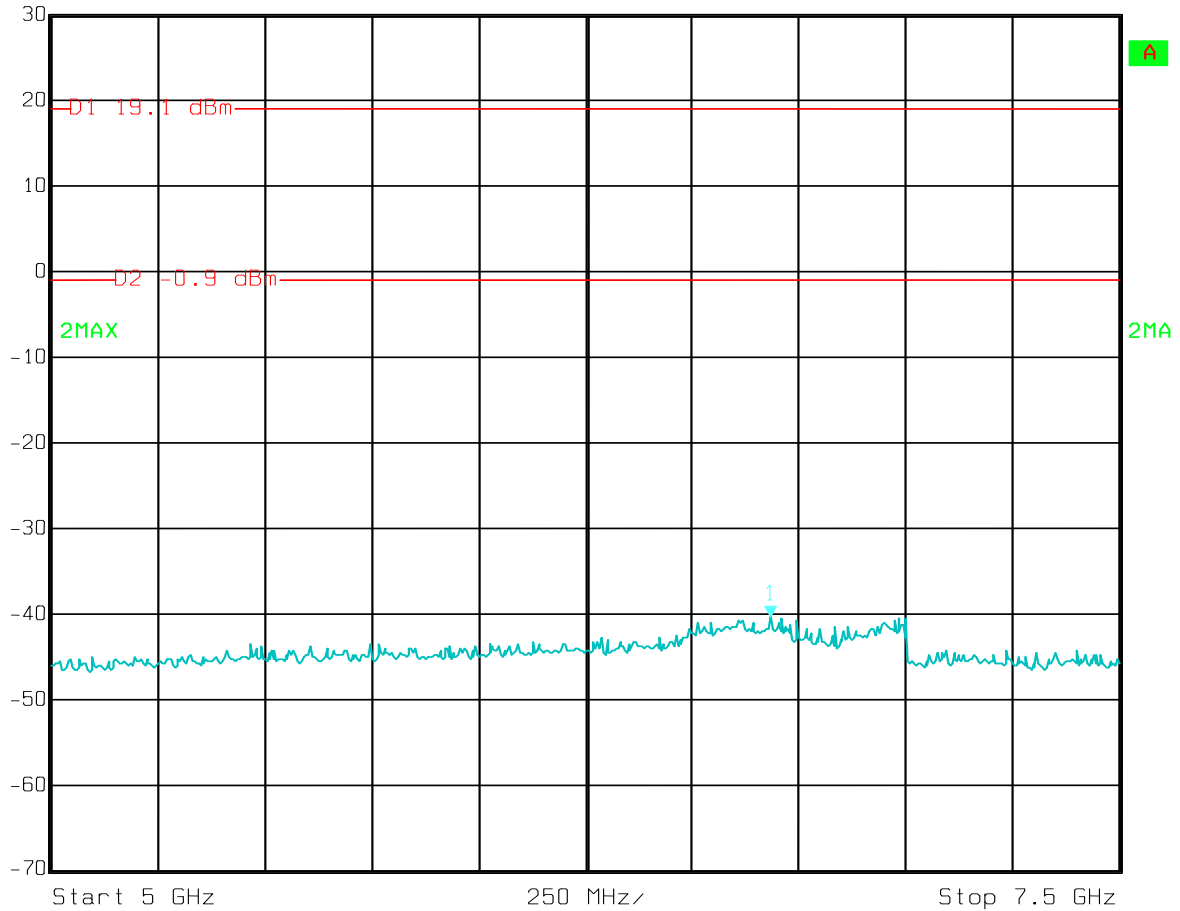

Marker 1 [T2]
RBW 100 kHz
RF Att 40 dB
Ref Lvl -44.20 dBm
VBW 300 kHz
30 dBm
7.65531062 GHz
SWT 640 ms
Unit dBm



Date: 17.OCT.2008 16:47:36

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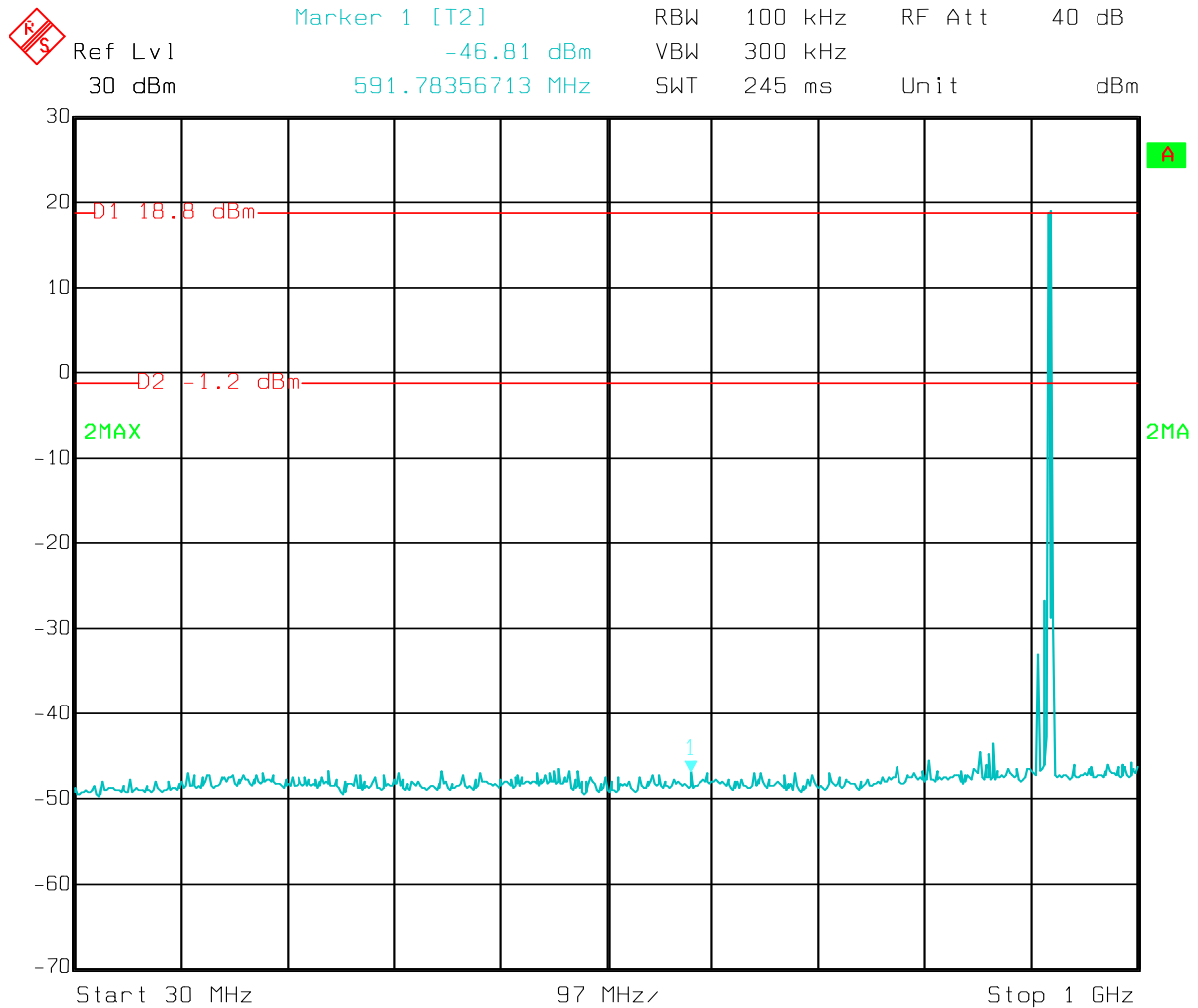

Marker 1 [T2]
RBW 100 kHz
RF Att 40 dB
Ref Lvl -40.47 dBm
VBW 300 kHz
30 dBm
6.68336673 GHz
SWT 640 ms
Unit dBm



Date: 17.OCT.2008 16:46:40

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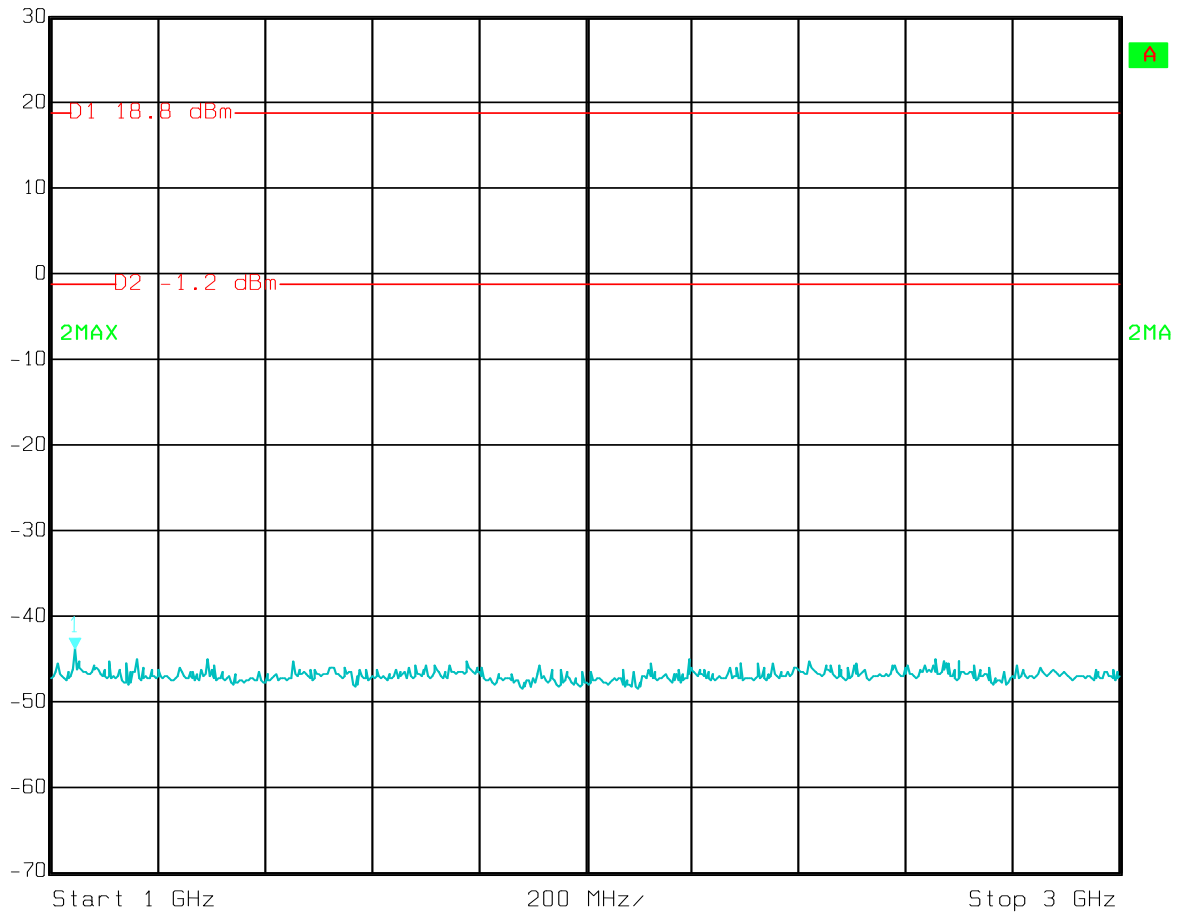
High Channel.



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Nemko USA, Inc.		11696 Sorrento Valley Road, Suite F, San Diego, CA 92121 Phone (858) 755-5525 Fax (858) 452-1810	
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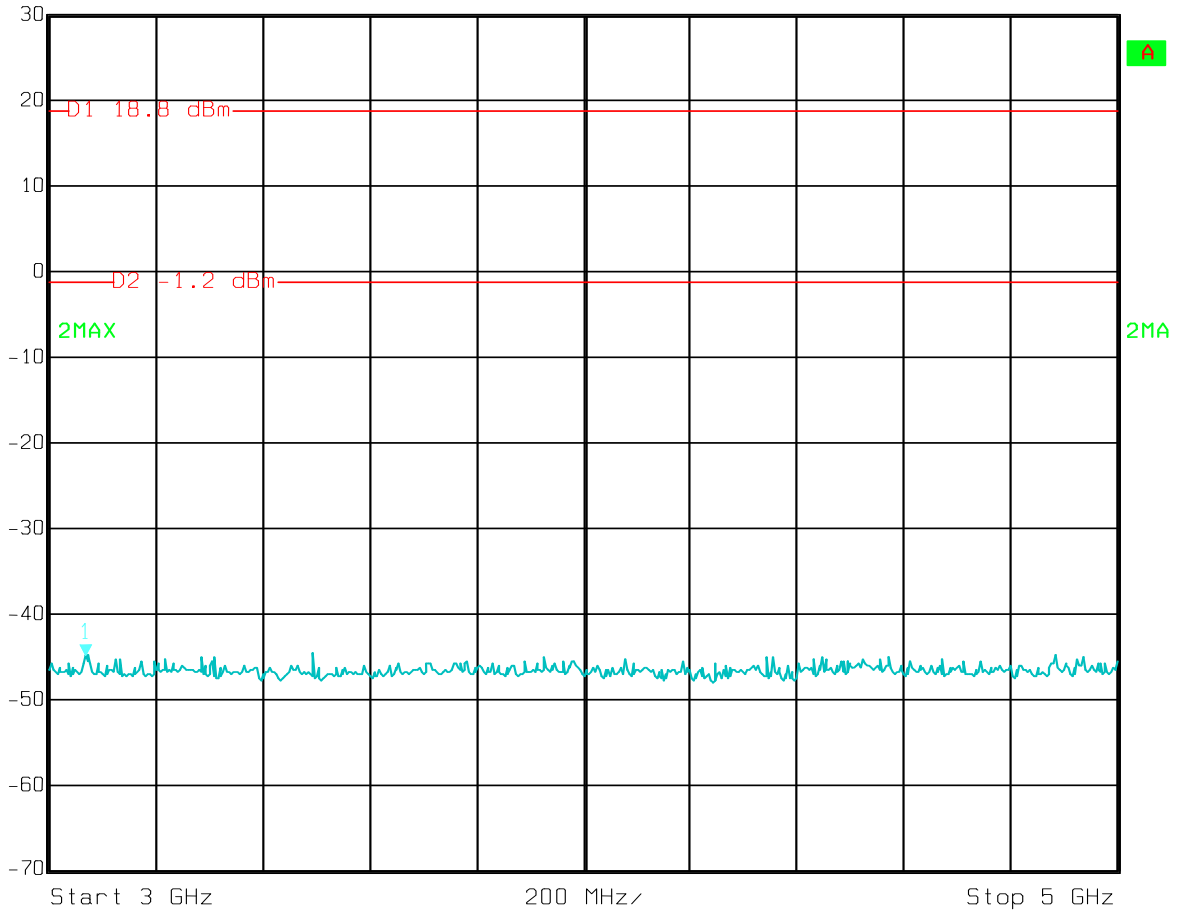

Marker 1 [T2]
RBW 100 kHz
RF Att 40 dB
Ref Lvl -43.91 dBm
VBW 300 kHz
30 dBm
1.04408818 GHz
SWT 500 ms
Unit dBm



Date: 17.OCT.2008 16:53:08

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Marker 1 [T2]
RBW 100 kHz
RF Att 40 dB
Ref Lvl -44.87 dBm
VBW 300 kHz
30 dBm
3.06813627 GHz
SWT 500 ms
Unit dBm

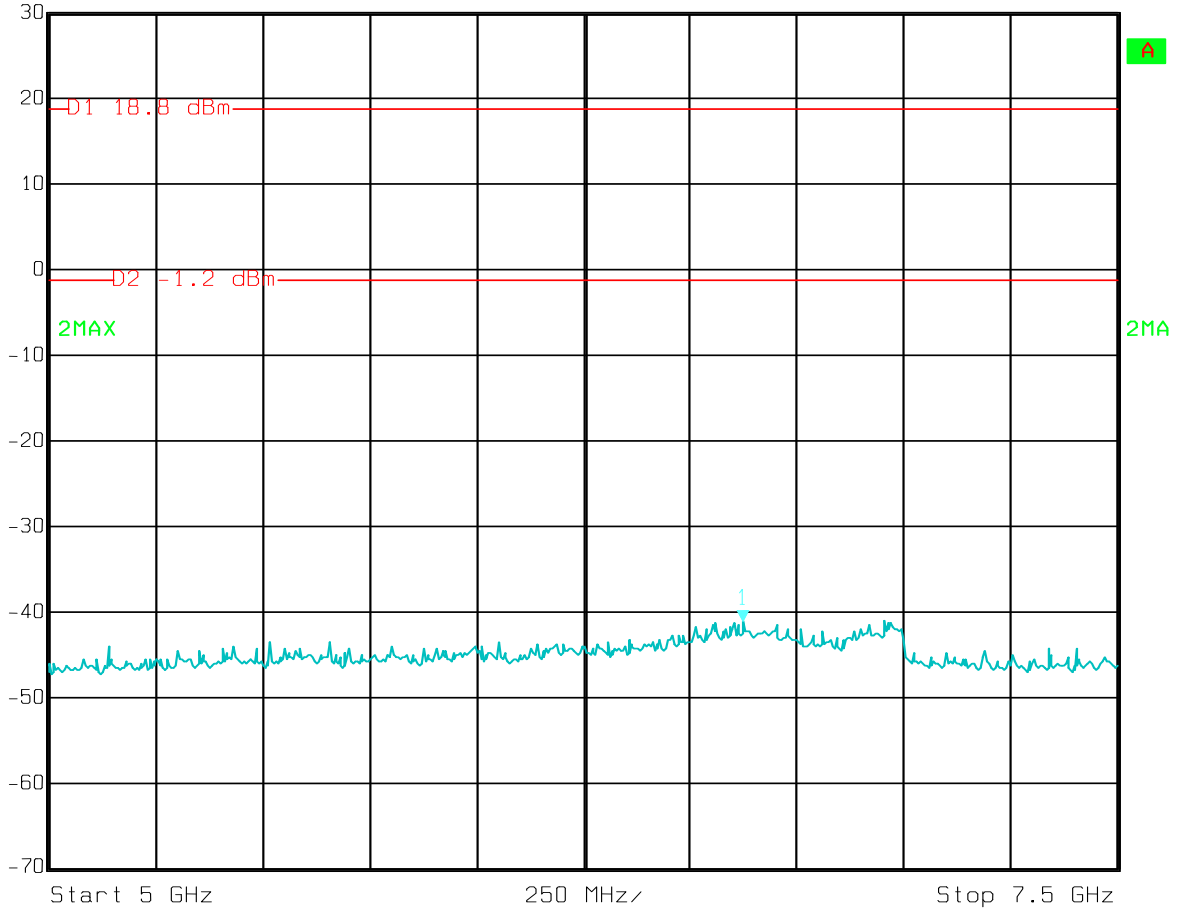


Date: 17.OCT.2008 16:54:22

Nemko USA, Inc.		11696 Sorrento Valley Road, Suite F, San Diego, CA 92121 Phone (858) 755-5525 Fax (858) 452-1810	
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Marker 1 [T2] RBW 100 kHz RF Att 40 dB
 Ref Lvl -41.07 dBm VBW 300 kHz
 30 dBm 6.62324649 GHz SWT 640 ms Unit dBm



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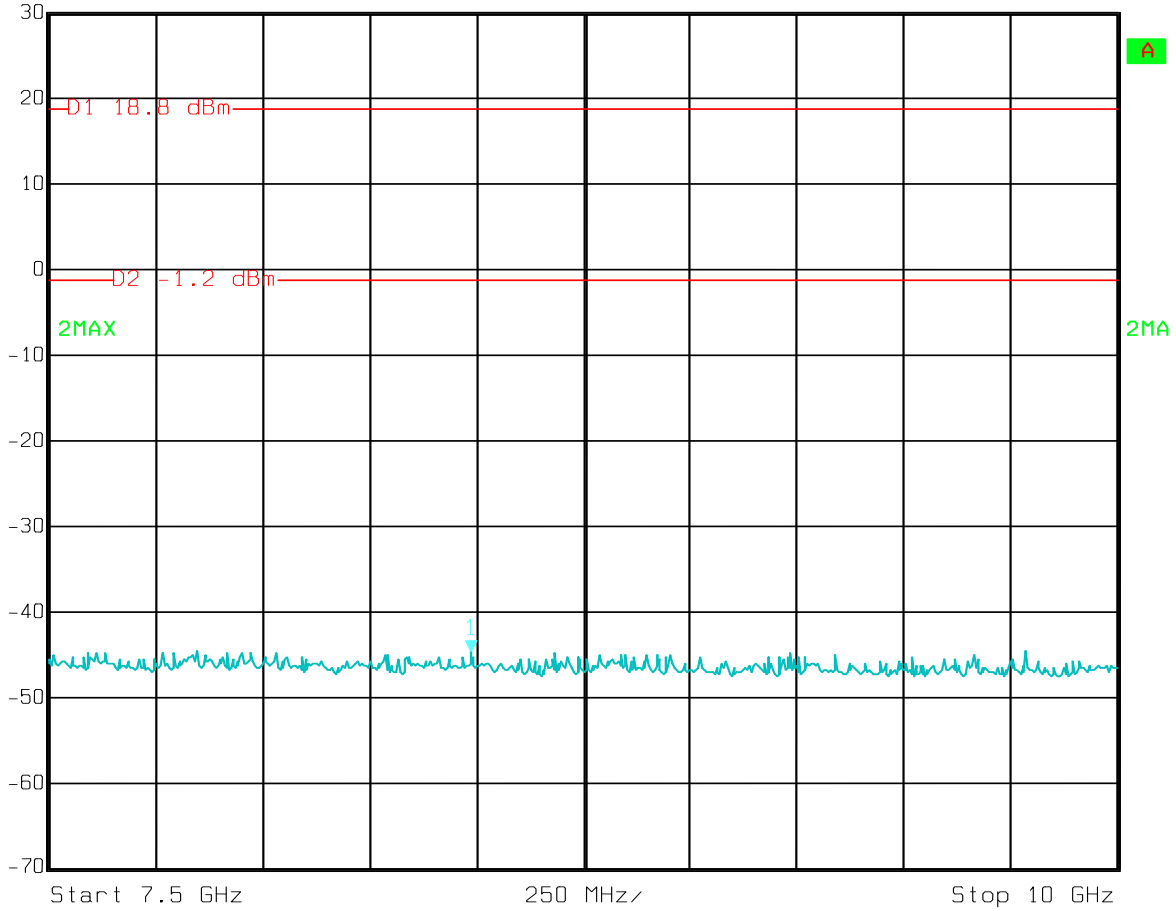
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Ref Lvl
30 dBm

Marker 1 [T2]
-44.54 dBm
8.48697395 GHz

RBW 100 kHz RF Att 40 dB
VBW 300 kHz
SWT 640 ms Unit dBm



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5.10. Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
110	Antenna, LPA	EMCO	LPA-25	1217	10-Jan-08	10-Jan-09
114	Antenna, Bicon	EMCO	3104	2997	10-Jan-08	10-Jan-09
752	Antenna, DRWG	EMCO	3115	4943	31-Oct-07	31-Oct-08
625	Antenna, Dbl Ridge Horn	EMCO	3116	2325	01-Apr-08	01-Apr-09
835	Spectrum Analyzer	Rohde & Schwarz	RHDFSEK	829058/005	27-Jun-08	27-Jun-09
317	Preamplifier	HP	8449A	2749A00167	31-Mar-08	31-Mar-09
898	EMI Receiver & filter set	HP	8546A	3625A00348	09-May-08	09-May-09
899	Filter Section	HP	85460A	3448A00288	09-May-08	09-May-09