FCC PART 15, SUBPART B and C
TEST REPORT

for

2.4 GHz TRANSCEIVER MODULE

MODEL: 924-41484

Prepared for

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DATE: DECEMBER 10, 2008

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GENERAL REPORT SUMMARY

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced without the written permission of Compatible Electronics, unless done so in full.

This report must not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Device Tested:	2.4 GHz Transceiver Module Model: 924-41484 S/N: N/A
Product Description:	See Expository Statement.
Modifications:	The EUT was not modified during the testing.
Manufacturer:	BEI Industrial Encoders 7230 Hollister Avenue Goleta, California 93117
Test Date:	October 16, 2008
Test Specifications:	EMI requirements CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.209, and 15.247
Test Procedure:	ANSI C63.4: 2003
Test Deviations:	The test procedure was not deviated from during the testing.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz – 30 MHz	This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.
2	Spurious Radiated RF Emissions, 30 MHz – 1000 MHz	This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.
3	Spurious Radiated RF Emissions, 10 kHz – 30 MHz and 1000 MHz – 25000 MHz	This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.
4	Fundamental and Emissions produced by the intentional radiator in non-restricted bands, 10 kHz – 25 GHz	This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.
5	Emissions produced by the intentional radiator in restricted bands, 10 kHz – 25 GHz	This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.
6	20 dB Bandwidth	This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.
7	Peak Power Output	This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.
8	RF Conducted Antenna Test	This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.
9	Carrier Frequency Separation	This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.
10	Average Time of Occupancy	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(iii)
11	Peak Power Spectral Density from the Intentional Radiator to the Antenna	This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.

1. PURPOSE

This document is a Class II Permissive Change Test Report on the Electromagnetic Interference (EMI) tests performed on the 2.4 GHz Transceiver Module Model: 924-41484. The EUT was reconfigured to allow a maximum of 20 channels to be active at the same time.

All of the other parameters (power output, total number of channels, available, and channel hop sequence protocol) have not been changed. Please see the Compatible Electronics Report Number: **B7017D1** for these tests.

The EUT was granted on December 6, 2007 for FCC and January 10, 2008 for Industry Canada.

Note: For the unintentional radiator portion of the test, the EUT was within the **Class B** specification limits defined by CFR Title 47, Part 15, Subpart B.

2. ADMINISTRATIVE DATA

2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

BEI Industrial Encoders

Glenn Avolio General Manager
Michael Stephens

Compatible Electronics, Inc.

Kyle Fujimoto Test Engineer
Michael Christensen Lab Manager

2.4 Date Test Sample was Received

The test sample was received on October 16, 2008.

2.5 Disposition of the Test Sample

The sample has not been returned to BEI Industrial Encoders as of December 9, 2008.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network
N/A	Not Applicable

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
FCC Title 47, Part 15 Subpart C	FCC Rules - Radio frequency devices (including digital devices) – Intentional Radiators
ANSI C63.4 2003	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
FCC Title 47, Part 15 Subpart B	FCC Rules - Radio frequency devices (including digital devices) – Unintentional Radiators

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration - EMI

Setup and operation of the equipment under test.

Specifics of the EUT and Peripherals Tested

The 2.4 GHz Transceiver Module Model: 924-41484 (EUT) was connected to the power supply board via 10-centimeter cables. The power supply board was also connected to an AC Adapter via its power port.

4.1.1 Cable Construction and Termination

Cable 1 This is a 10-centimeter unshielded cable connecting the EUT to the power supply board. The cable has a 5 pin connector at each end.

Cable 2 This is a 10-centimeter unshielded cable connecting the EUT to the power supply board. The cable has a 6 pin connector at each end.

Cable 3 This is a 2-meter unshielded cable connecting the AC Adapter to the power supply board. The cable is hard wired at each end.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID
2.4 GHz TRANSCEIVER MODULE (EUT)	BEI INDUSTRIAL ENCODERS	924-41484	N/A	**VSR-SWIFTCOMM07**
AC ADAPTER	COPAL	DC-630	N/A	**N/A**
POWER SUPPLY BOARD	SWIFTCOMM	N/A	N/A	**N/A**
ANTENNA	HYPERLINK TECHNOLOGIES, INC.	HG2405RD-RTP	N/A	**N/A**

5.2 EMI Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CALIBRATION DATE	CALIBRATION DUE DATE
GENERAL TEST EQUIPMENT USED FOR ALL RF EMISSIONS TESTS					
Computer	Hewlett Packard	4530	US91912319	N/A	N/A
EMI Receiver	Rohde & Schwarz	ESIB40	100172	November 26, 2006	Nov. 27, 2008
Monitor	Hewlett Packard	D5258A	TW74500641	N/A	N/A

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and 7.1 of this report for EMI test location.

6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was not grounded.

7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

7.1 RF Emissions

7.1.1 Conducted Emissions Test

The spectrum analyzer was used as a measuring meter. The data was collected with the spectrum analyzer in the peak detect mode with the "Max Hold" feature activated. The quasi-peak was used only where indicated in the data sheets. A transient limiter was used for the protection of the spectrum analyzer input stage, and the offset was adjusted accordingly to read the actual data measured. The LISN output was measured using the spectrum analyzer. The output of the second LISN was terminated by a 50 ohm termination. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI C63.4: 2003. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by the Compatible Electronics conducted emissions software in several overlapping sweeps by running the spectrum analyzer at a minimum scan rate of 10 seconds per octave. The final qualification data is located in Appendix E.

Test Results:

This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.

7.1.2 Radiated Emissions (Spurious and Harmonics) Test

The spectrum analyzer and EMI Receiver were used as a measuring meter along with the quasi-peak adapter. Amplifiers were used to increase the sensitivity of the instrument. The Com Power Preamplifier Model: PA-102 was used for frequencies from 30 MHz to 1 GHz, the Com Power Microwave Preamplifier Model: PA-122 was used for frequencies above 1 GHz, and the Com Power Microwave Preamplifier Model: PA-840 was used for frequencies above 18 GHz. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps.

The quasi-peak adapter was used only for those readings which are marked accordingly on the data sheets.

The frequencies above 1 GHz were averaged manually by narrowing the video filter down to 10 Hz and putting the sweep time on AUTO on the spectrum analyzer to keep the amplitude reading calibrated.

After the readings above 1 GHz were average manually, the reading was further adjusted by a "duty cycle correction factor", derived from 20 log (dwell time / 100 ms). Since the duty cycle was below 10%, the maximum allowed 20 dB was subtracted from the peak reading. The duty cycle correction factor is explained in Appendix E.

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
10 kHz to 150 kHz	200 Hz	Active Loop Antenna
150 kHz to 30 MHz	9 kHz	Active Loop Antenna
30 MHz to 300 MHz	120 kHz	Biconical Antenna
300 MHz to 1 GHz	120 kHz	Log Periodic Antenna
1 GHz to 25 GHz	1 MHz	Horn Antenna

The open field test site of Compatible Electronics, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 2003. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT by the Radiated Emission Manual Test software. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results.

Radiated Emissions (Spurious and Harmonics) Test (con't)

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 10 meter test distance from 10 kHz to 30 MHz, and at a 3 meter test distance from 30 MHz to 25 GHz to obtain the final test data.

Test Results:

This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.

7.2 20 dB Bandwidth

The 20 dB Bandwidth was measured using the EMI Receiver. The bandwidth was measured using a direct connection from the RF output of the EUT. The resolution bandwidth was 10 kHz and the video bandwidth was 30 kHz.

Test Results:

This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.

7.3 Peak Output Power

The Peak Output Power was measured using the EMI Receiver. The peak output power was measured using a direct connection from the RF output of the EUT. The resolution bandwidth was 10 MHz and the video bandwidth was 10 MHz. The cable loss was also added back into the reading using the reference level offset.

Test Results:

This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.

7.4 RF Antenna Conducted Test

The RF antenna conducted test was performed using the EMI Receiver. The RF antenna conducted test measured using a direct connection from the RF out on the EUT into the input of the EMI Receiver. The resolution bandwidth was 100 kHz, and the video bandwidth was 300 kHz. The spans were wide enough to include all the harmonics and emissions that were produced by the intentional radiator.

Test Results:

This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.

7.5 RF Band Edges

The RF band edges were taken at the edges of the ISM spectrum (2400 MHz when the EUT was on the low channel and 2483.5 MHz when the EUT was on the high channel) using the EMI Receiver. A preamplifier was used to boost the signal level, with the plots being taken at a 3 meter test distance. The radiated emissions test procedure as describe in section 8.2 of this test report was used to maximize the emission.

Test Results:

This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.

7.6 Carrier Frequency Separation

The Channel Hopping Separation Test was measured using the EMI Receiver. The EUT was operating in its normal operating mode. The resolution bandwidth was 100 kHz, and the video bandwidth 1 MHz. The frequency span was wide enough to include the peaks of two adjacent channels.

Test Results:

This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.

7.7 Number of Hopping Frequencies

The Channel Hopping Separation Test was measured using the EMI Receiver. The EUT was operating in its normal operating mode. The resolution bandwidth was 1 MHz, and the video bandwidth was 1 MHz. The frequency span was wide enough to include all of the peaks in the frequency band of operation.

Test Results:

This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.

7.8 Average Time of Occupancy Test

The Average Time of Occupancy Test was measured using the EMI Receiver. The EUT was operating in normal operating mode. The frequency span was taken to 0 Hz with a sweep time of 5 msec to determine the time for each transmission.

The EUT was put into its normal transmitting mode. Please note that the EUT only transmits on 20 different channels at the most during normal operation.

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. This means the time of occupancy of any one channel cannot be greater than 0.4 seconds in an 8 second period (0.4 seconds * 20 channels).

The sweep time was then changed to 150 milliseconds and the number of pulses taken. The number of pulses was then multiplied by 53.33 to determine the number of pulses in an 8 second period. The number of pulses in an 8 second period was then multiplied by the time for each pulse to determine the average time of occupancy.

Test Results:

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a)(1)(iii). The EUT does not transmit for more than 400 msec in an 8 second period on any frequency. Please see the data sheets located in Appendix E.

7.9 Spectral Density Test

The spectrum density output was measured using the EMI Receiver. The spectral density output was measured using a direct connection from the RF out on the EUT into the input of the EMI Receiver. The resolution bandwidth 3 kHz, and the video bandwidth was 10 kHz. The highest 1.5 MHz of the signal was used as the frequency span with the sweep rate being 1 second for every 3 kHz of span.

Test Results:

This test was not performed because the EUT is identical to the original unit, except the EUT allows for 20 active channels at the same time.

8. CONCLUSIONS

The 2.4 GHz Transceiver Module Model: 924-41484 meets the average time of occupancy limits defined in CFR Title 47, Part 15, Subpart C, section 15.247 (a)(1)(iii).

APPENDIX A

LABORATORY RECOGNITIONS

LABORATORY RECOGNITIONS

Compatible Electronics has the following agency accreditations:

National Voluntary Laboratory Accreditation Program - Lab Code: 200528-0

Voluntary Control Council for Interference - Registration Numbers: R-983, C-1026, R-984 and C-1027

Bureau of Standards and Metrology Inspection - Reference Number: SL2-IN-E-1031

Conformity Assessment Body for the EMC Directive Under the US/EU MRA Appointed by NIST

Compatible Electronics is recognized or on file with the following agencies:

Federal Communications Commission

Industry Canada

Radio-Frequency Technologies (Competent Body)

APPENDIX B

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

The modifications listed below were made to the EUT to pass FCC Subpart B and FCC 15.247 specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

No modifications were made to the EUT during the testing.

APPENDIX C

ADDITIONAL MODELS COVERED UNDER THIS REPORT

ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	2.4 GHz Transceiver Module Model: 924-41484 S/N: N/A

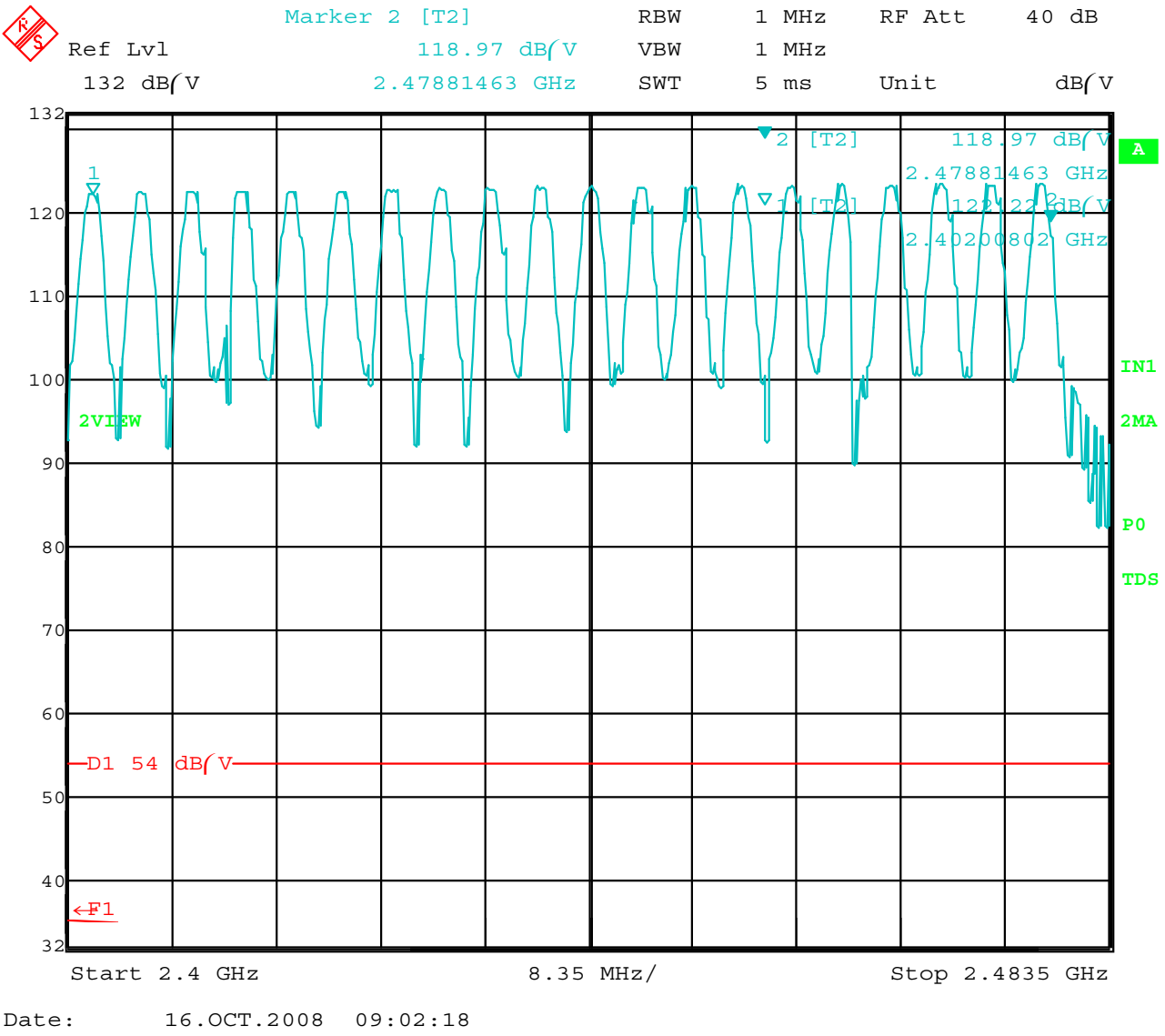
There were no additional models covered under this report.

APPENDIX D

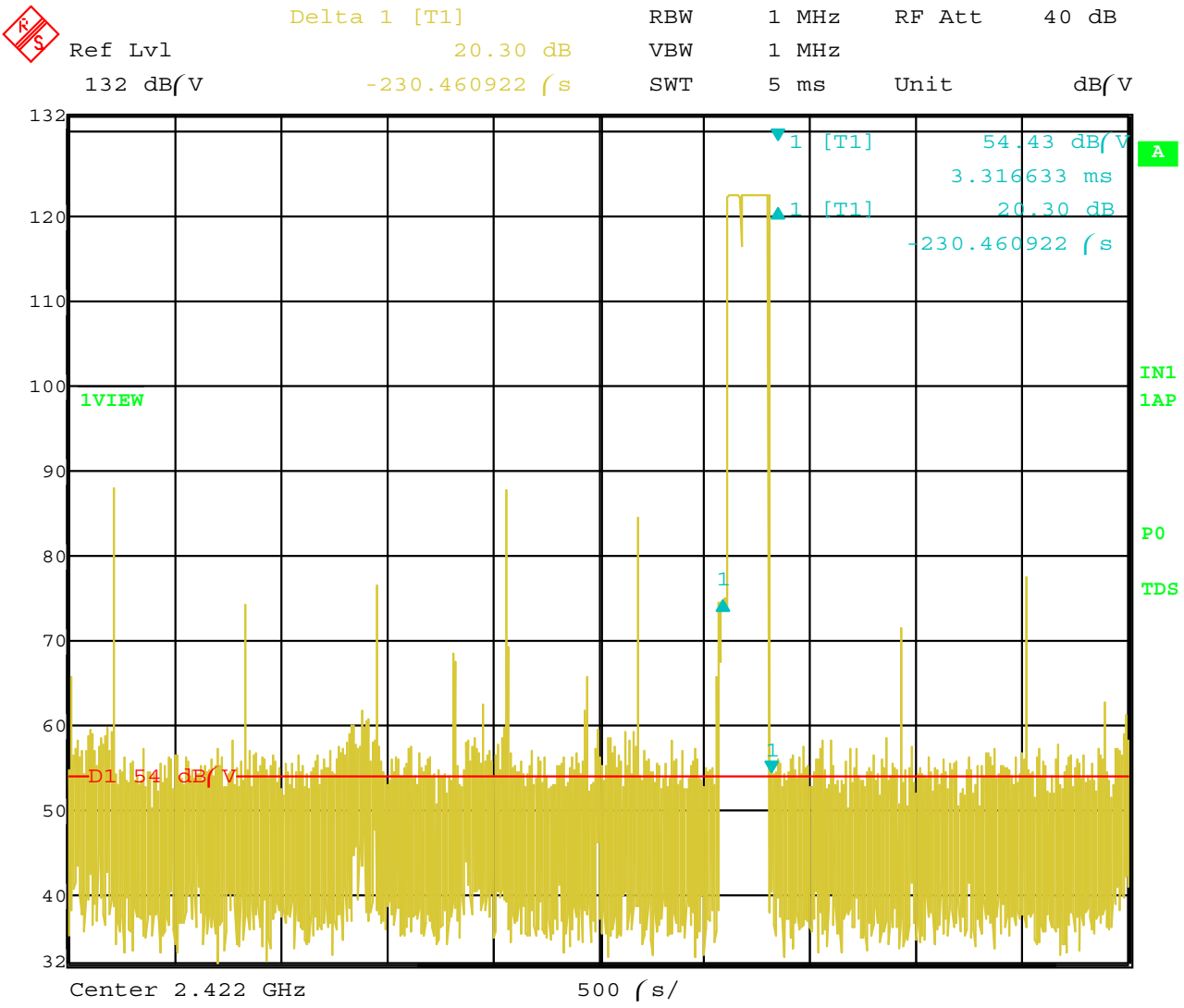
DATA SHEETS

AVERAGE TIME OF OCCUPANCY

DATA SHEETS

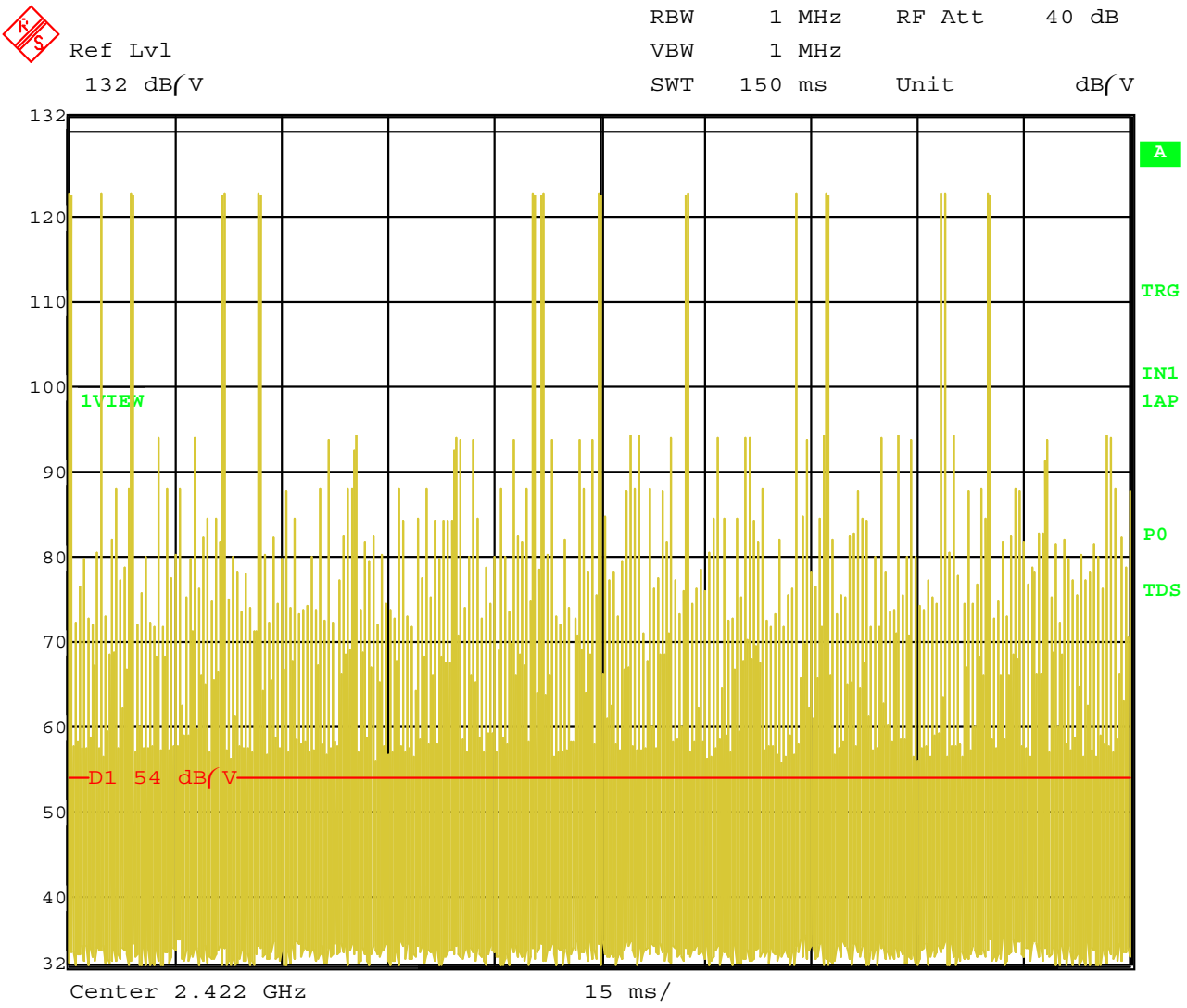


Overview Showing 20 Channels



Date: 16.OCT.2008 09:04:59

Time of the Pulse = 230.460922 uS



Date: 16.OCT.2008 09:11:59

Number of Pulses in 150 mS = 24
Number of Pulses in (400 mS *20 Channels) = 24 * 53.33 = 1280 Pulses
Total Time = 1280 * 230.460922 uS = 294.98998016 mS
Limit = 400 mS per 8000 mS (400 mS * 20 Channels)