



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 60090

FCC Rules and Regulations / Intentional Radiators

Periodic operational in the 40.66-40.70 MHz Band and above 70 MHz.

Part 15, Subpart C, Section 15.231

THE FOLLOWING **"MEETS"** THE ABOVE TEST SPECIFICATION

Formal Name: 6 Button 433 MHz Transmitter

Kind of Equipment: Automotive Aftermarket

Test Configuration: NA

Model Number(s): DK-6BUTTON-TX

Model(s) Tested: DK-6BUTTON-TX

Serial Number(s): NA

Date of Tests: May 4 & 10, 2004

Test Conducted For: SPAL USA
512 Tuttle St
Des Moines, Iowa 50309

NOTICE: "This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government". Please see the "Additional Description of Equipment Under Test" page listed inside of this report. This report must not be reproduced (except in full), without the approval of D.L.S. Electronic Systems.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 60090

SIGNATURE PAGE

Report By:

Arnom C. Rowe
Test Engineer
EMC-001375-NE

Reviewed By:

William Stumpf
OATS Manager

Approved By:

Brian Mattson
General Manager

Company Official:

SPAL USA



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1250 Peterson Dr., Wheeling, IL 6009

United States Department of Commerce
National Institute of Standards and Technology



ISO/IEC 17025:1999
ISO 9002:1994

Certificate of Accreditation

D.L.S. ELECTRONIC SYSTEMS, INC.
WHEELING, IL

is recognized by the National Voluntary Laboratory Accreditation Program
for satisfactory compliance with criteria set forth in NIST Handbook 150:2001,
all requirements of ISO/IEC 17025:1999, and relevant requirements of ISO 9002:1994.
Accreditation is awarded for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

September 30, 2004

Effective through

For the National Institute of Standards and Technology
NVLAP Lab Code: 100276-0

NVLAP-01C (06-01)



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009

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Page: 1 of 9

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

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D.L.S. ELECTRONIC SYSTEMS, INC.

1250 Peterson Drive
Wheeling, IL 60090-6454

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URL: <http://www.dlsemc.com>

NVLAP Code Designation / Description

Emissions Test Methods:

12/160D21	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 21 - Emission of Radio Frequency Energy
12/300220a	EN 300 220-1 V1.3.1 (2000-09): Electromagnetic compatibility and Radio spectrum Matters; Short Range Devices; Radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW; Part 1: Technical characteristics and test methods
12/300386a	EN 300 386 V.1.2.1: Electromagnetic compatibility and radio spectrum matter (ERM); Telecommunication network equipment; Electromagnetic compatibility (EMC) requirements
12/C63.17	ANSI C63.17-1998: American National Standard for Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communications Services (UPCS) Devices

September 30, 2004

Effective through

For the National Institute of Standards and Technology



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009



ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation



Page: 2 of 9

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 100276-0

D.L.S. ELECTRONIC SYSTEMS, INC.

<i>NVLAP Code</i>	<i>Designation / Description</i>
12/C6317a	ANSI C63.17-1998: American National Standard for Methods of Measurement of the Electromagnetic and Operational Compatibility of Unlicensed Personal Communications Services (UPCS) Devices
12/CIS11	IEC/CISPR 11 + A1 (1997), EN 55011 (1998), AS/NZS 2064 (1997), and CNS 137803 (1997): Limits and Methods of Measurement of Electromagnetic Disturbance Characteristics of Industrial, Scientific, and Medical Radio-Frequency Equipment
12/CIS13	IEC/CISPR 13 (2001-04), EN 55013 (2001), AS/NZS 1053 (2001), and CNS 13439 (2001): Sound and television broadcast receivers and associated equipment - Radio disturbance characteristics - Limits and methods of measurement
12/CIS14	CISPR 14-1 (March 30, 2000): Limits and methods of measurement of radio interference characteristics of household electrical appliances, portable tools and similar electrical apparatus - Part 1: Emissions
12/CIS14a	EN 55014-1 (1993) with Amendments A1 (1997) & A2 (1999)
12/CIS14d	IEC/CISPR 14-1 (2001) and A1 (2001): Electromagnetic Compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emissions
12/CIS14e	EN 55014-1 (2001) and A1 (2001): Electromagnetic Compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission

September 30, 2004

Effective through

For the National Institute of Standards and Technology

NVLAP-01S (06-01)



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009



ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation



Page: 3 of 9

**ELECTROMAGNETIC COMPATIBILITY
AND TELECOMMUNICATIONS**

NVLAP LAB CODE 100276-0

D.L.S. ELECTRONIC SYSTEMS, INC.

<i>NVLAP Code</i>	<i>Designation / Description</i>
12/CIS14f	AS/NZS 1044 (2001) and A1 (2001): Electromagnetic Compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission
12/CIS14g	CNS 13783-1 (2001) and A1 (2001): Electromagnetic Compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission
12/CIS15	IEC/CISPR 15 (2000) + A1 (2001): Limits and methods of measurements of radio disturbance characteristics of electrical lighting and similar equipment
12/CIS15a	AS/NZS CISPR (2002): Limits and methods of measurements of radio disturbance characteristics of electrical lighting and similar equipment
12/CIS15b	CNS 13439 (2000) + A1 (2001): Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
12/CIS15c	EN 55015 (2000) + A1 (2001): Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
12/CIS22	IEC/CISPR 22 (1997) and EN 55022 (1998): Limits and methods of measurement of radio disturbance characteristics of information technology equipment
12/CIS22a	IEC/CISPR 22 (1993): Limits and methods of measurement of radio disturbance characteristics of information technology equipment, Amendment 1:1995, and Amendment 2:1996.

September 30, 2004

Effective through

For the National Institute of Standards and Technology

NVLAP-01S (06-01)



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009



ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation



Page: 4 of 9

**ELECTROMAGNETIC COMPATIBILITY
AND TELECOMMUNICATIONS**

NVLAP LAB CODE 100276-0

D.L.S. ELECTRONIC SYSTEMS, INC.

<i>NVLAP Code</i>	<i>Designation / Description</i>
12/CIS22b	CNS 13438 (1997): Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment
12/EM02a	IEC 61000-3-2, Edition 2.1 (2001-10), EN 61000-3-2 (2000), and AS/NZS 2279.1 (2000): Electromagnetic compatibility (EMC) Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A)
12/EM03	EN 61000-3-3 (1995), IEC 61000-3-3 (1995), and AS/NZS 2279.3 (1995): EMC - Part 3: Limits - Section 3. Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current up to 16A
12/F18	FCC OST/MP-5 (1986): FCC Methods of Measurement of Radio Noise Emissions for ISM Equipment (cited in FCC Method 47 CFR Part 18 - Industrial, Scientific, and Medical Equipment)
12/FCC15b	ANSI C63.4 (2001) with FCC Method - 47 CFR Part 15, Subpart B: Unintentional Radiators
12/FCC15c	ANSI C63.4 (2001) with FCC Method - 47 CFR Part 15, Subpart C: Intentional Radiators
12/FCC15d	ANSI C63.4 (2001) with FCC Method - 47 CFR Part 15, Subpart D: Unlicensed Personal Communications Service Devices

September 30, 2004

Effective through

For the National Institute of Standards and Technology

NVLAP-01S (06-01)



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009



ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation



Page: 5 of 9

**ELECTROMAGNETIC COMPATIBILITY
AND TELECOMMUNICATIONS**

NVLAP LAB CODE 100276-0

D.L.S. ELECTRONIC SYSTEMS, INC.

<i>NVLAP Code</i>	<i>Designation / Description</i>
12/FCC15e	ANSI C63.4 (2001) with FCC Method - CFR Part 15, Subpart E: Unlicensed National Information Infrastructure Service Devices
12/T51	AS/NZS CISPR 22 (2002) and AS/NZS 3548 (1997): Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment
12/VCCIa	Agreement of Voluntary Control Council for Interference by Information Technology Equipment - Technical Requirements: V-3/02.04

Immunity Test Methods:

12/1089a	GR-1089-CORE, Issue 3, October 2002: Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment (sections 2, 3.3, and 3.5)
12/160D16	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 16 - Power Input
12/160D17	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 17 - Voltage Spike
12/160D18	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 18 - Audio Frequency Conducted Susceptibility - Power Inputs

September 30, 2004

Effective through

For the National Institute of Standards and Technology



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009



ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation



Page: 6 of 9

**ELECTROMAGNETIC COMPATIBILITY
AND TELECOMMUNICATIONS**

NVLAP LAB CODE 100276-0

D.L.S. ELECTRONIC SYSTEMS, INC.

<i>NVLAP Code</i>	<i>Designation / Description</i>
12/160D19	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 19 - Induced Signal Susceptibility
12/160D20	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 20 - Radio Frequency Susceptibility (Radiated and Conducted)
12/160D22	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 22 - Lightning Induced Transient Susceptibility
12/160D25	RTCA/DO-160D (1997): Environmental Conditions and Test Procedures for Airborne Equipment - Section 25 - Electrostatic Discharge (ESD)
12/I01	IEC 61000-4-2 (1995) and Amendment 1 (1998) and EN 61000-4-2: Electrostatic Discharge Immunity Test
12/I02	IEC 61000-4-3 (1995) and Amendment 1 (1998) and EN 61000-4-3: Radiated, Radio-Frequency Electromagnetic Field Immunity Test
12/I03	IEC 61000-4-4 (1995) and EN 61000-4-4: Electrical Fast Transient/Burst Immunity Test
12/I04	IEC 61000-4-5 (1995) and EN 61000-4-5: Surge Immunity Test

September 30, 2004

Effective through

For the National Institute of Standards and Technology

NVLAP-01S (06-01)



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009



ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation



Page: 7 of 9

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 100276-0

D.L.S. ELECTRONIC SYSTEMS, INC.

<i>NVLAP Code</i>	<i>Designation / Description</i>
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12/I05	IEC 61000-4-6 (1996) and EN 61000-4-6: Immunity to Conducted Disturbances, Induced Radio-Frequency Fields
12/I06	IEC 61000-4-8 (1993): Power Frequency Magnetic Field Immunity Test
12/I07	IEC 61000-4-11 (1994): Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests
12/J111324	SAE J1113/24: Immunity to radiated electromagnetic fields; 10 kHz to 200 MHz - Crawford TEM cell and 10 kHz to 5 GHz - Wideband TEM cell
12/J111341	SAE J1113/41 (1995-07): Limits and methods of measurement of radio disturbance characteristics of components and modules for the protection of receivers used on board vehicles

Radio Test Methods

12/RSS119	RSS-119, Issue 6 (March 25, 2000): Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz
12/RSS123	RSS-123, Issue 1, Rev. 2 (November 6, 1999): Low Power Licensed Radiocommunication Devices
12/RSS137	RSS-137, Issue 1, Rev. 1 (September 25, 1999): Location and Monitoring Service (902 - 928 MHz)

September 30, 2004

Effective through

For the National Institute of Standards and Technology

NVLAP-01S (06-01)



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009



ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation



Page: 8 of 9

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 100276-0

D.L.S. ELECTRONIC SYSTEMS, INC.

NVLAP Code Designation / Description

12/RSS139 RSS-139, Issue 1 (February 5, 2000): Licensed Radiocommunications Devices in the Band 2400 - 2483.5 MHz

12/CIS15c EN 55015 (2000) + A1 (2001): Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

MIL-STD-462 : Conducted Emissions:

12/A18 MIL-STD-461 Version E Method CE106

MIL-STD-462 : Conducted Susceptibility:

12/B12 MIL-STD-462 Version D Method CS101

12/B13 MIL-STD-462 Version D Method CS103

12/B25 MIL-STD-461 Version E Method CS114

12/B26 MIL-STD-461 Version E Method CS115

12/B27 MIL-STD-461 Version E Method CS116

MIL-STD-462 : Radiated Emissions:

12/D04 MIL-STD-462 Version D Method RE101

September 30, 2004

Effective through

For the National Institute of Standards and Technology



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009



ISO/IEC 17025:1999
ISO 9002:1994

Scope of Accreditation



Page: 9 of 9

**ELECTROMAGNETIC COMPATIBILITY
AND TELECOMMUNICATIONS**

NVLAP LAB CODE 100276-0

D.L.S. ELECTRONIC SYSTEMS, INC.

NVLAP Code Designation / Description

12/D05 MIL-STD-462 Version D Method RE102

12/D06 MIL-STD-462 Version D Method RE103

MIL-STD-462 : Radiated Susceptibility:

12/E08 MIL-STD-462 Version D Method RS101

12/E09 MIL-STD-462 Version D Method RS103

September 30, 2004

Effective through

For the National Institute of Standards and Technology

NVLAP-01S (06-01)



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009

TABLE OF CONTENTS

i.	Cover Page	1
ii.	Signature Page	2
iii.	NVLAP Certificate of Accreditation	3
iv.	NVLAP Scope of Accreditation	4
v.	Table of Contents	13
1.0	Summary of Test Report	14
2.0	Introduction	14
3.0	Object	14
4.0	Test Set-Up	15
5.0	Test Equipment	16
6.0	Ambient Measurements	17
7.0	Description of Test Sample	18
8.0	Additional Description of Test Sample	21
9.0	Photo Information and Test Set-Up	22
10.0	Radiated Photos Taken During Testing	23
11.0	Results of Tests	24
12.0	Conclusion	24
	TABLE 1 – EQUIPMENT LIST	25
	Appendix A – Electric Field Radiated Emissions Test	27
1.0	Pulsed Operation (Duty Cycle Correction Factor)	28
1.0	Graph(s) taken of the Pulsed Operation (DCCF)	29
2.0	Bandwidths	33
2.0	Graph(s) taken of the Bandwidth Emissions	34
3.0	Field Strength of Spurious Emission Measurements	36
3.0	Graph(s) taken of the Fundamental and Spurious Emissions	37
4.0	Restricted Bands	40



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009

1.0 SUMMARY OF TEST REPORT

It was found that the 6 Button 433 MHz Transmitter, Model Number(s) DK-6BUTTON-TX, "meets" the radio interference radiated emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Section 15.231 for periodic operational in the 40.66-40.70 MHz Band and above 70 MHz. The conducted emissions test was not required because the 6 Button 433.92 MHz Transmitter is powered from a D.C. power source. It does not have a line cord to plug into the A.C. power line.

This test report relates only to the items tested and contains the following number of pages.

Text: 40

2.0 INTRODUCTION

On May 4 & 10, 2004, a series of radio frequency interference measurements was performed on 6 Button 433 MHz Transmitter, Model Number(s) DK-6BUTTON-TX, Serial Number: NA. The tests were performed according to the procedures of the FCC as stated in the "Methods of Measurement of Radio-Noise Emissions for Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" found in the American National Standards Institute, ANSI C63.4-2001. Tests were performed by personnel of D.L.S. Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer.

3.0 OBJECT

The purpose of this series of tests was to determine if the test sample could meet the radio frequency interference emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Sections 15.33, 15.35, 15.205, 15.209 & 15.231 for Intentional Radiators operating in the Band 40.66-40.70 and above 70 MHz.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009

4.0 TEST SET-UP

All emission tests were performed at D.L.S. Electronic Systems, Inc. and set up according to the American National Standards Institute, ANSI C63.4-2001, Section 8, (Figures 11a and 11b).

All radiated emissions tests were performed with the test item placed on a 80 cm high rotating non-conductive table, located in the test room. Equipment normally operated on the floor was placed on a metal covered turntable which is flush with the surrounding conducting ground plane. The ground plane has an electrical isolation layer over its surface approximately 7 mm thick. The EUT is separated from the turntable ground plane by a non-conductive layer. The equipment under test was set up according to ANSI C63.4-2001, Sections 6 and 8.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009

5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All preliminary data below 1000 MHz was automatically plotted using the HP Spectrum Analyzer or ESI 26/40 Fixed Tuned Receiver. The data was taken using Peak, Quasi-Peak or the Average Detector Functions as required. This information was then used to determine the frequencies of maximum emissions. Above 1000 MHz, final data was taken using the Average Detector.

Below 1000 MHz, final data was taken using the HP Spectrum Analyzer and/or ESI 26/40 Fixed Tuned Receiver. These plots were made using the Peak or Quasi-Peak Detector functions, with manual measurements performed on the questionable frequencies using the Quasi-Peak or the Average Detector Function of the Analyzer or ESI 26/40 Fixed Tuned Receiver as required. Above 1000 MHz, final data was taken using the Average Detector on the Spectrum Analyzer.

The bandwidths shown below are specified by ANSI C63.4-2001, Section 4.2.

Frequency Range	Bandwidth (-6 dB)
10 to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz
Above 1 GHz	1 MHz

A list of the equipment used can be found in Table 1. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009

6.0 AMBIENT MEASUREMENTS

For emissions measurements, broadband antennas and an EMI Test Receiver with a panoramic spectrum display are used. First the frequency range is scanned and displayed on the test receiver display. Next the scanned frequency range is divided into smaller ranges, and then it is manually tuned through to determine the emissions from the EUT. A headset or loudspeaker is connected to the test receiver's AM/FM demodulated output as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT. If there is any doubt as to the source of the emission, it is further investigated by rotating the EUT, or by disconnecting the power from the EUT.

The EUT is set up in its typical configuration and operated in its various modes. For tabletop systems, cables are manipulated within the range of likely configurations. For floor-standing equipment, the cables are located in the same manner as the user would install them and no further manipulation is made. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions. For each mode of operation, the frequency spectrum is monitored. Variations in antenna height, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) are explored to produce the emissions that have the highest amplitude relative to the limit. These methods are performed to the specifications in ANSI C63.4: 2001.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009

7.0 DESCRIPTION OF TEST SAMPLE: (See also Paragraph 8.0)

7.1 Description:

The samples to be tested are a transmitter and receiver/antenna pair. The combination of the two will be used for automotive aftermarket applications such as, but not limited to keyless entry, alarm control, etc. The receiver is built into the antenna and will connect to an auxiliary control box that will ultimately control the type of output the system sends.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 6009

7.0 DESCRIPTION OF TEST SAMPLE: (CON'T)

7.2 PHYSICAL DIMENSIONS OF EQUIPMENT UNDER TEST

Transmitter: Length: 36.7 mm x Width: 67.65 mm x Height: 12.92 mm
Receiver/Antenna: Length: 5.24 cm x Width: 5.10 cm x Height: 1.43 cm
(antenna elements extend beyond the width dimension by 11.2 cm on each side)

7.3 LINE FILTER USED:

NA

7.4 INTERNAL CLOCK FREQUENCIES:

Switching Power Supply Frequencies:

NA

Clock Frequencies:

433.92 MHz



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 60090

7.0 DESCRIPTION OF TEST SAMPLE: (CON'T)

7.5 DESCRIPTION OF ALL CIRCUIT BOARDS:

1. None



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 60090

8.0 ADDITIONAL DESCRIPTION OF TEST SAMPLE:
(See also Paragraph 7.0)

1: There were no changes made at D.L.S. Electronic Systems, Inc.

NOTE:

Due to the short on-time and frequency drift, test was run in analyzer mode using peak trace and max hold.

I certify that the above, as described in paragraph 7.0, describes the equipment tested and will be manufactured as stated.

By: _____
Signature Title

For: _____
Company Date



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 60090

9.0 PHOTO INFORMATION AND TEST SET-UP

Item 0 6 Button 433 MHz Transmitter

Model Number: DK-6BUTTON-TX, Serial Number: NA

1250 Peterson Dr., Wheeling, IL 60090

10.0 RADIATED PHOTOS TAKEN DURING TESTING





Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 60090

11.0 RESULTS OF TESTS

The radio interference emission charts results can be seen on the pages at the end of this report. Data sheets indicating the test measurements taken during testing can also be found at the end of this report. Points on the emission charts shown with a yellow mark are background frequencies that were verified during testing.

12.0 CONCLUSION

It was found that the 6 Button 433 MHz Transmitter, Model Number(s) DK-6BUTTON-TX "meets" the radio interference radiated emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Section 15.231 for periodic operational in the 40.66-40.70 MHz Band and above 70 MHz. The conducted emissions test was not required because the 6 Button 433.92 MHz Transmitter is powered from a D.C. power source. It does not have a line cord to plug into the A.C. power line.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 60090

TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
Spectrum Analyzer	Hewlett/ Packard	8566B	2240A002041	100 Hz – 22 GHz	10/04
Quasi-Peak Adapter	Hewlett/ Packard	85650A	2043A00121	10 kHz – 1 GHz	10/04
Spectrum Analyzer	Hewlett/ Packard	8566B	2421A00452	100 Hz – 22 GHz	2/05
Quasi-Peak Adapter	Hewlett/ Packard	85650A	2043A00450	10 kHz – 1 GHz	2/05
Spectrum Analyzer	Hewlett/ Packard	8591A	3009A00700	9 kHz – 1.8 GHz	3/05
Receiver	Electrometrics	EMC-30	44168	10 kHz – 1 GHz	9/04
Receiver	Rohde & Schwarz	ESI 26	837491/010	20 Hz – 26 GHz	11/04
Receiver	Rohde & Schwarz	ESI 40	837808/006	20 Hz – 40 GHz	12/04
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	12/04
Antenna	EMCO	3104C	00054891	20 MHz – 200 MHz	2/05
Antenna	Electrometrics	LPA-25	1114	200 MHz – 1 GHz	3/05
Antenna	EMCO	3104C	00054892	20 MHz – 200 MHz	3/05

All primary equipment is calibrated against known reference standards with a verified traceable path to NIST.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 60090

TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
Antenna	Electrometrics	3146	1205	200 MHz – 1 GHz	3/05
Antenna	EMCO	3104C	97014785	20 MHz – 200 MHz	2/05
Antenna	EMCO	3146	97024895	200 MHz – 1 GHz	3/05
Antenna	EMCO	3115	2479	1 GHz – 18 GHz	8/04
Antenna	EMCO	3115	99035731	1 GHz – 18 GHz	4/05
Antenna	Rohde & Schwarz	HUF-Z1	829381001	20 MHz – 1 GHz	2/05
Antenna	Rohde & Schwarz	HUF-Z1	829381005	20 MHz – 1 GHz	8/04
LISN	Solar	8012-50-R-24-BNC	8305116	10 MHz – 30 MHz	8/04
LISN	Solar	8012-50-R-24-BNC	814548	10 MHz – 30 MHz	8/04
LISN	Solar	9252-50-R-24-BNC	961019	10 MHz – 30 MHz	12/04
LISN	Solar	9252-50-R-24-BNC	971612	10 MHz – 30 MHz	10/04
LISN	Solar	9252-50-R-24-BNC	92710620	10 MHz – 30 MHz	7/04

All primary equipment is calibrated against known reference standards with a verified traceable path to NIST.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 10724

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

Part 15, Subpart C, Section 15.231e

ELECTRIC FIELD RADIATED EMISSIONS TEST



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

1.0 PULSED OPERATION (Duty Cycle Correction Factor)

The radiated emission tests made at D.L.S. Electronic Systems, Inc. for the 6 Button 433 MHz Transmitter, Model Number DK-6BUTTON-TX, are shown by the graphs on the following pages. The actual total "on time" during the 100 msec is 46.45285 sec with a total "off time" of 53.55 msec resulting in a **6.66 Duty Cycle Correction Factor**.

To find the actual "on time" during the 100 msec period, the data word is multiplied by the number of data words per 100 msec, yielding actual on time. Taking this number and dividing it by the 100 msec period gives us the Duty Cycle. We then take the Log of the Duty Cycle and multiply it by 20. This gives us the Duty Cycle Correction Factor. The following method was used to determine the Duty Cycle Correction Factor:

Total on time during 100 msec.

$0.761523 \text{ sec/pulse on time} * 44 \text{ pulses} = 33.50701 \text{ sec (data word on time)}$

$0.38076 \text{ sec/pulse on time} * 34 \text{ pulses} = 12.94584 \text{ sec (data word on time)}$

$33.50701 \text{ sec (data on time)} + 12.94584 \text{ sec (data on time)} = 46.45285 \text{ sec total "on time"}$

$46.45285 \text{ sec (total "on time")} / 100 \text{ msec} = .4645285 \text{ Duty Cycle}$

$20 * \text{LOG}_{10} .4645285 = \textbf{6.66 dB Duty Cycle Correction Factor}$

NOTE:

For pulsed operation, the switches were set to generate their maximum "on" time, and measurements were made with the peak detector. As stated in Docket 86-422, the duty cycle of the pulse is determined from the total "on" time for the worst case condition during 100 msec. Using the percentage of the total "on" time over a 100 msec period, the total absolute average value was determined. As stated in Section 3, a maximum of 20 dB can be used.

See the following pages for the graphs of the actual measurements that were made:



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

GRAPH(S) TAKEN OF THE PULSED OPERATION

PART 15.231

GRAPHS TAKEN OF THE PULSE TRAIN SHOWING THE FOLLOWING:

1. Number of Bits per Data Word
2. Number of Pulses per 100 msec
3. Off Time between Data Words
4. Data Word On Time



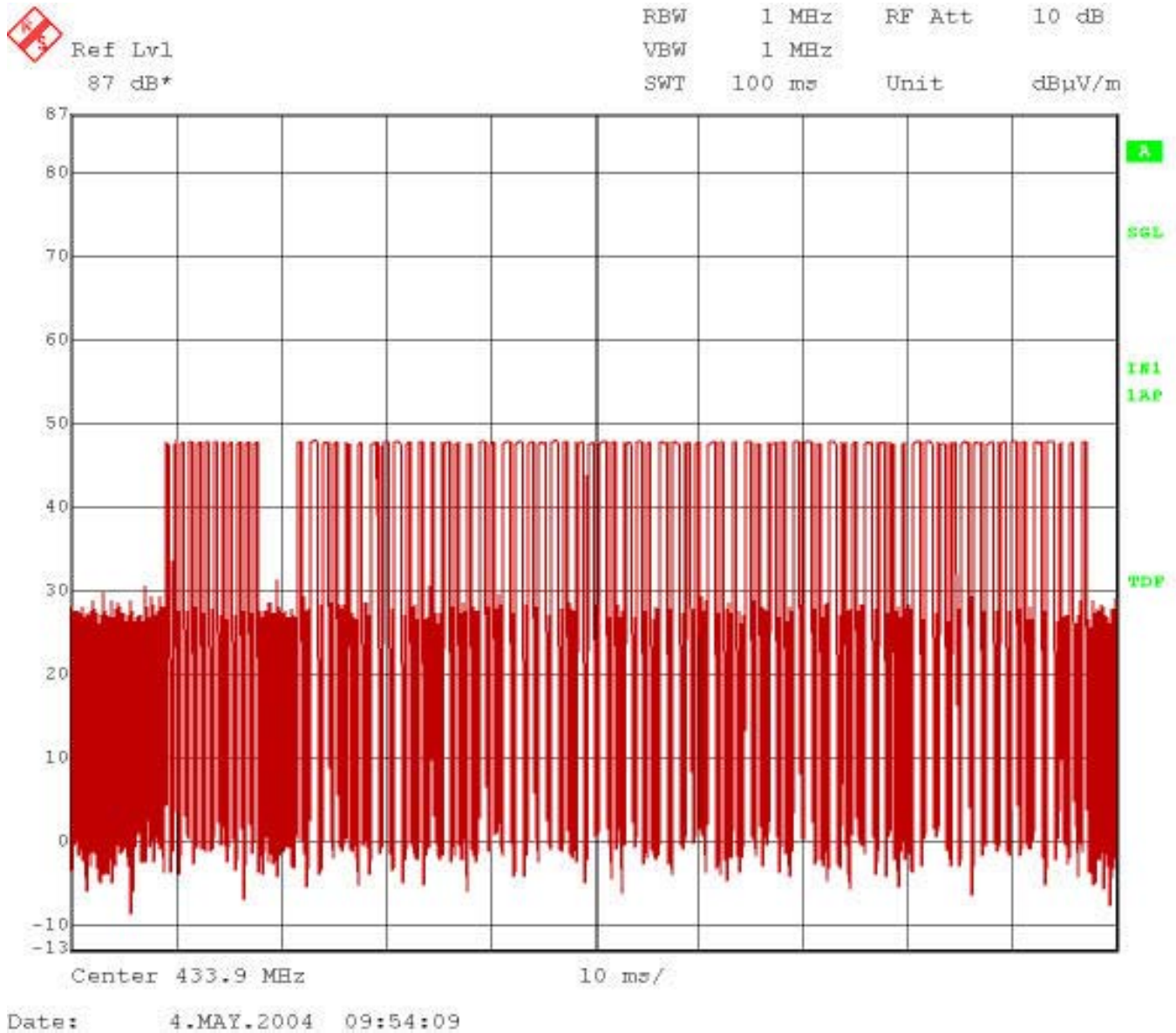
Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

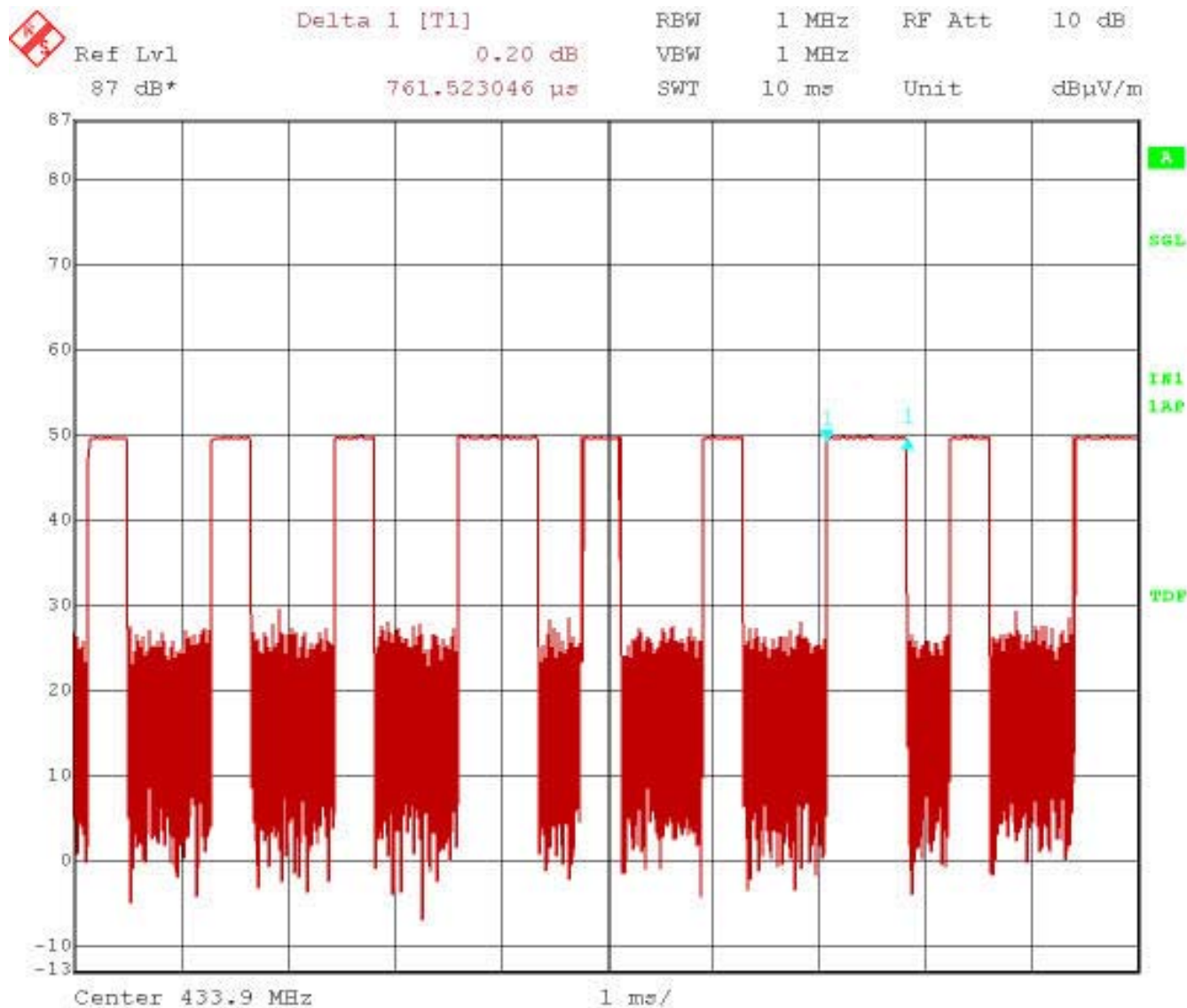
ELECTRIC FIELD RADIATED EMISSIONS TEST



APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

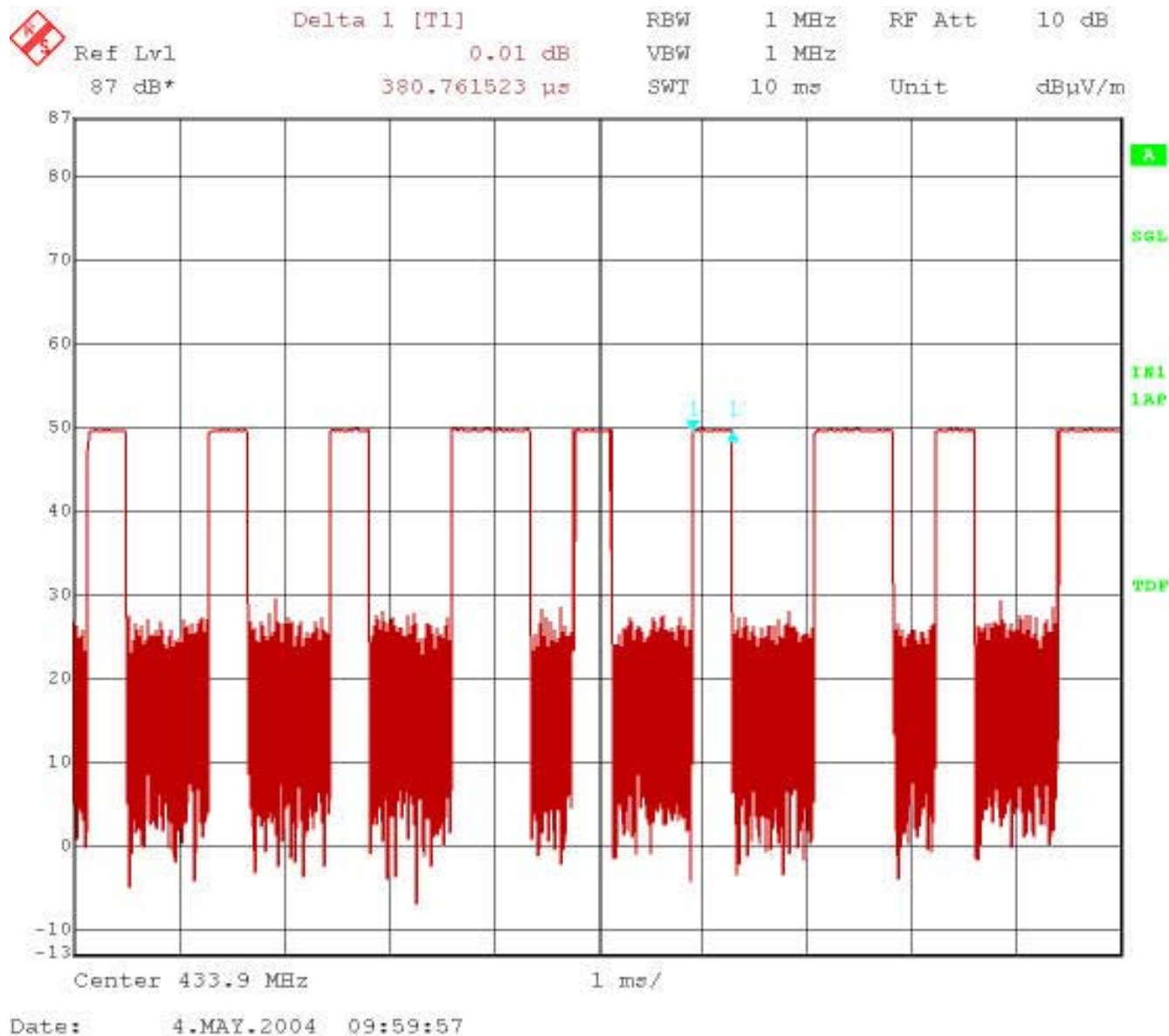


Date: 4.MAY.2004 10:35:55

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST





Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

2.0 BANDWIDTHS

The bandwidth of the transmitter shall be confined to the following specifications as specified in Section 15.231c & d:

40.66 MHz to 40.7 MHz	$\pm .01\%$ within the band edges
70 MHz to 900 MHz	.25% of the center frequency
Above 900 MHz	.50% of the center frequency

The bandwidth is determined at the points 20 dB down from the modulated carrier.

As shown by the graph(s) on the following page(s), the bandwidth for the 6 Button 433 MHz Transmitter was measured at 244.289 kHz, which meets the above specification. With a fundamental frequency of 433.99 MHz, the FCC Bandwidth limit is 840.69 kHz when multiplying the fundamental by 0.25%.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

GRAPH(S) TAKEN OF THE BANDWIDTH EMISSIONS

PART 15.231c & d



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

Model: DK-6 Button ransmitter

Operator: Craig Brandt

Date of test: 05-10-04

20 dB Bandwidth



Date: 10.MAY.2004 08:45:00



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

3.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS - SECTION 15.231e

For operation in the band 40.66 to 40.70 MHz and above 70 MHz the field strength of any emissions within this band shall not exceed the following table at a distance of 3 meters as specified in FCC, Part 15, Section 15.231(e), based on the average value of the measured emissions. The limits are shown in the following table.

Fundamental Frequency in MHz	Field Strength of Fundamental (uV/m at 3m)	Field Strength of Harmonics (uV/m at 3m)
40.66 to 40.70	2250 (67.04 dBuV)	225 (47.04 dBuV)
70 to 130	1250 (61.94 dBuV)	125 (41.94 dBuV)
130 to 174	1250 (61.94 dBuV) to 3750 (71.48 dBuV)	125 (41.94 dBuV) to 375 (51.48 dBuV)
174 to 260	3750 (71.48 dBuV)	375 (51.48 dBuV)
260 to 470	3750 (71.48 dBuV) to 12500 (81.84 dBuV)	375 (51.48 dBuV) to 1250 (61.94 dBuV)
470 and above	12500 (81.84 dBuV)	1250 (61.94 dBuV)

NOTE:

Preliminary radiation measurements may have been performed at a 3 meter or ten meter test distance. The frequency range from 30 MHz to 1000 MHz was scanned at receive antenna heights from one to four meters, and with a 360° rotation of the EUT. Plots were made and the worst-case emissions were recorded.

As stated in 15.35b the 20 dB peak-to-average limit is applicable to all devices measured using an average detector.



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

GRAPH(S) TAKEN OF THE FUNDAMENTAL AND SPURIOUS EMISSIONS

PART 15.231c & d



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

Company: SPAL (Iowa Export / Import Trading)
Model: CMD-10k transmitter
Operator: Craig Brandt
Date of test: 05-10-04

Field Strength of Spurious Radiation -- **Vertical**

Frequency (MHz)	Max. Field Strength of EUT @ 3 meters (dBuV/m)	Correction factor for duty cycle (dB)	Limit (dBuV/m)	Margin (dB)
433.99	77.3	6.65	80.82	10.17
867.98	57.11	6.65	60.82	10.30
1301.97*	47.85	None	54.00	6.10
1735.96	NA			
2169.95	NA			
2603.94	NA			
3037.93	NA			
3471.92	NA			
3905.91	NA			
4339.90	NA			

* Emission is in restricted band. (FCC 15.205; IC section 6.3 Table 2)



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

Model: CMD-10k transmitter

Operator: Craig Brandt

Date of test: 05-10-04

Field Strength of Spurious Radiation -- **Horizontal**

Frequency (MHz)	Max. Field Strength of EUT @ 3 meters (dBuV/m)	Correction factor for duty cycle (dB)	Limit (dBuV/m)	Margin (dB)
433.99	74.57	6.65	80.82	12.90
867.98	53.01	6.65	60.82	14.46
1301.97*	47.51	None	54.00	6.40
1735.96	NA			
2169.95	NA			
2603.94	NA			
3037.93	NA			
3471.92	NA			
3905.91	NA			
4339.90	NA			

* Emission is in restricted band. (FCC 15.205; IC section 6.3 Table 2)



Company: SPAL USA
Model Tested: DK-6BUTTON-TX
Report Number: 1212

1250 Peterson Dr., Wheeling, IL 60090

APPENDIX A

TEST PROCEDURE

ELECTRIC FIELD RADIATED EMISSIONS TEST

4.0 RESTRICTED BANDS

As stated in Section 15.205a, the fundamental emission from the 6 Button 433 MHz Transmitter shall not fall within any of the bands listed below:

Frequency in MHz	Frequency in MHz	Frequency in MHz	Frequency in GHz
.0900 to .1100	162.0125 to 167.17	2310.0 to 2390	9.30 to 9.50
.4900 to .5100	167.7200 to 173.20	2483.5 to 2500	10.60 to 12.70
2.1735 to 2.1905	240.000 to 285.00	2655.0 to 2900	13.25 to 13.40
8.362 to 8.3660	322.200 to 335.40	3260.0 to 3267	14.47 to 14.50
13.36 to 13.410	399.900 to 410.00	3332.0 to 3339	15.35 to 16.20
25.50 to 25.670	608.000 to 614.00	3345.8 to 3358	17.70 to 21.40
37.50 to 38.250	960.000 to 1240.00	3600.0 to 4400	22.01 to 23.13
73.00 to 75.500	1300.000 to 1427.00	4500.0 to 5250	23.60 to 24.00
108.00 to 121.94	1435.000 to 1626.50	5350.0 to 5450	31.20 to 31.80
123.00 to 138.00	1660.000 to 1710.00	7250.0 to 7750	36.43 to 36.50
149.90 to 150.00	1718.800 to 1722.20	8025.0 to 8500	ABOVE 38.60
156.70 to 156.90	2200.000 to 2300.00	9000.0 to 9200	

NOTE:

The noise floor within the Restricted Bands for the EMC Receiver and HP Spectrum Analyzer will typically lay 20 dB below the limit.