ENGINEERING TEST REPORT

Digital LED Lighting Control Unit
Model No.: DCU706B
FCC ID: U33-DCU706B

Applicant:

Rosstech Signals Inc.
71 15th Line South
Orillia, Ontraio
Canada L3V 6H1

In Accordance With

FEDERAL COMMUNICATIONS COMMISSION (FCC)
Part 15, Subpart C, Section 15.231(e)
Momentarily Operation at 433.92 MHz

UltraTech's File No.: RSI-003F15C231

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: June 7, 2007	
Report Prepared by: JaeWook Choi Issued Date: June 7, 2007	Tested by: Hung Trinh, RFI Technician Test Dates: April 19, 21 & 25, 2007

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

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TABLE OF CONTENTS

EXHIBIT 1 SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	▪ Exhibit 1: Submittal check lists ▪ Exhibit 2: Introduction ▪ Exhibit 3: Performance Assessment ▪ Exhibit 4: EUT Operation and Configuration during Tests ▪ Exhibit 5: Summary of test Results ▪ Exhibit 6: Measurement Data ▪ Exhibit 7: Measurement Uncertainty	OK
1	Test Setup Photos	Power Line Conducted Emission and Radiated Emission Test Setup Photos	OK
2	External Photos of EUT	External EUT Photos	OK
3	Internal Photos of EUT	Internal EUT Photos	OK
4	Cover Letters	▪ Certification Request Cover Letter ▪ Agent Authorization Letter ▪ Confidentiality Filing Request Letter	OK
5	ID Label/Location Info	▪ ID Label ▪ Location of ID Label	OK
6	Block Diagrams	Block Diagram	OK
7	Schematic Diagrams	Schematics	OK
8	Parts List/Tune Up Info	--	--
9	Operational Description	Operational Description	OK
10	RF Exposure Info	--	--
11	Users Manual	User Manual	OK

EXHIBIT 2 INTRODUCTION

2.1 SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.231
Title:	Telecommunication - Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Section 15.231(e) - Momentarily Operation at 433.92 MHz.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	Commercial, industrial or business environment

2.2 RELATED SUBMITTAL(S)/GRANT(S)

None.

2.3 NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-15	2006	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
CISPR 22 CISPR 22 +A1 EN 55022	2003-04-10 2004-10-14 2003	Information Technology Equipment - Radio Disturbance Characteristics – Limits and Methods of Measurement
CISPR 16-1-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-2-1	2004	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-1: Conducted disturbance measurement

EXHIBIT 3 PERFORMANCE ASSESSMENT

3.1 CLIENT INFORMATION

APPLICANT	
Name:	Rosstech Signals Inc.
Address:	71 15th Line South Orillia, Ontraio Canada L3V 6H1
Contact Person:	Mr. Rob Love Phone #: 705-326-3761 Fax #: 705-326-6486 Email Address: rlove@rosstech.ca

MANUFACTURER	
Name:	Rosstech Signals Inc.
Address:	71 15th Line South Orillia, Ontraio Canada L3V 6H1
Contact Person:	Mr. Rob Love Phone #: 705-326-3761 Fax #: 705-326-6486 Email Address: rlove@rosstech.ca

3.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Brand Name	Rosstech
Product Name:	Digital LED Lighting Control Unit
Model Name or Number:	DCU706B
Serial Number:	Test Sample
Type of Equipment:	Low Power Transmitter
Input Power Supply Type:	12 VAC
Primary User Functions of EUT:	Digital Control Unit

3.3 EUT'S TEHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Base station (fixed use)
Intended Operating Environment:	Commercial, industrial or business environment
Power Supply Requirement:	12VAC
RF Output Power Rating:	94.88 Peak dBµV/m @ 3 m
Operating Frequency Range:	433.92 MHz
Duty Cycle:	4.39 %
20 dB Bandwidth:	11.02 kHz
Modulation Type:	ASK
Antenna Connector Type:	Integral antenna (part of the printed circuit board) housed inside the enclosure.
Antenna Description:	Manufacturer: Rosstech Signals Inc. Type: PCB Trace Model: DCU706-PCB Gain: -18 dBi Frequency Range: 433.92 MHz

3.4 LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Temperature sensor	1	Header 2pin	Non-shielded
2	LED port	11	Header 10pin	Non-shielded
3	12VAC	2	PCB Trace	Non-shielded
4	Photo Sensor	1	Header 2pin	Non-shielded

3.5 ANCILLARY EQUIPMENT

None.

EXHIBIT 4 EUT OPERATION CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1 CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power Input Source:	12 VAC

4.2 OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	For testing purpose only, the EUT was set to transmit continuously by means of special setting of jumpers on the printed circuit board, which is set to force 1 second of the silence periods (instead of 11 seconds) between each burst of 250 millisecond.
Special Test Software:	None.
Special Hardware Used:	None.
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

Transmitter Test Signal	
Frequency:	433.92 MHz

EXHIBIT 5 SUMMARY OF TEST RESULTS

5.1 LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049-1). Last Date of Site Calibration: June 20, 2006.

5.2 APPLICABILITY & SUMMARY OF EMC EMISSIONS TEST RESULTS

FCC Rules	Test Requirements	Compliance (Yes/No)
15.107(a)	AC Power Line Conducted Emission	Yes
15.203	Antenna requirement (The transmitter shall use a transmitting antenna that is an integral part of the device).	Yes
15.231(a)	Periodic Operation Provisions	N/A
15.231(e)	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious	Yes
15.231(c)	20 dB Bandwidth	Yes

5.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 6 MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1 TEST PROCEDURES

Details of test methods and procedures can be found in Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4.

6.2 MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3 MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C64.3 and CISPR 16-1-1.

6.4 ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

The essential function of the EUT is primarily for LED lighting controller with temperature monitoring capability.

6.5 POWER LINE CONDUCTED EMISSIONS [§ 15.107 (b) & 15.207]

6.5.1 Limits

The equipment shall meet the limits of the following table:

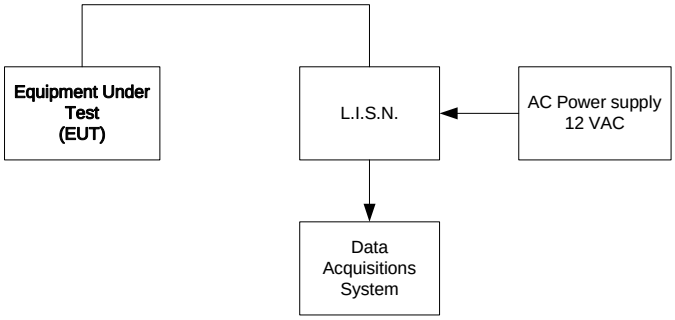
Frequency of emission (MHz)	Class B Conducted Limits (dBμV)		Measuring Bandwidth
	Quasi-peak	Average	
0.15–0.5 0.5–5 5-30	66 to 56* 56 60	56 to 46* 46 50	RBW = 9 kHz VBW ≥ 9 kHz for QP VBW = 1 Hz for Average

* Decreases linearly with logarithm of the frequency

6.5.2 Method of Measurements

Refer to ANSI C63.4.

6.5.3 Test Arrangement

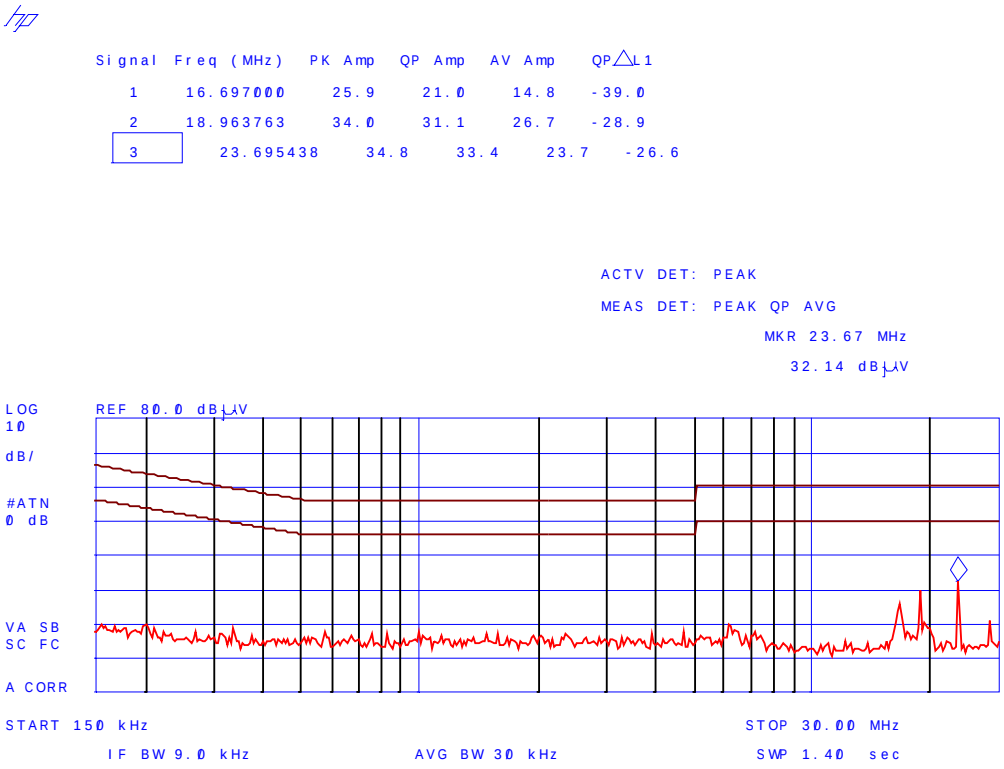


6.5.4 Test Equipment List

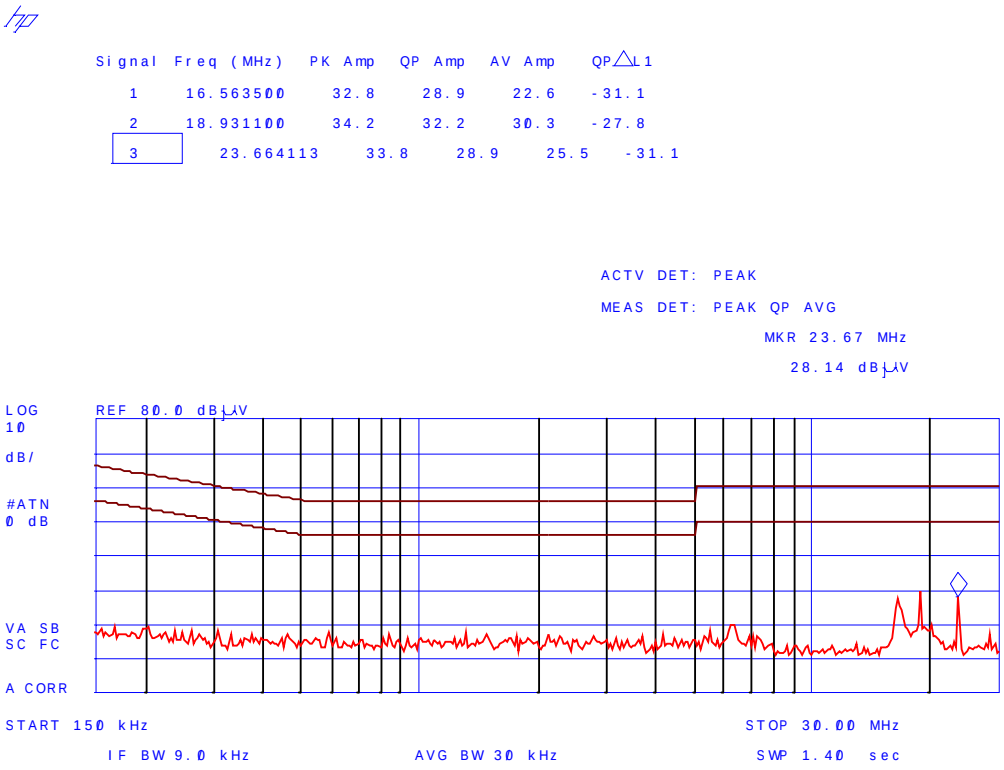
Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Transient Limiter	Hewlett Packard	11947A	310701998	9 kHz – 200 MHz 10 dB attenuation
L.I.S.N.	EMCO	3825/2	89071531	9 kHz – 200 MHz 50 Ohms / 50 μH
24'(L) x 16'(W) x 8'(H) RF Shielded Chamber	Braden Shielding	…	…	…

6.5.5 Test Data

Plot 6.5.5.1. Power Line Conducted Emissions
Line Voltage : 12 VAC
Line Tested: Hot Line



Plot 6.5.5.2. Power Line Conducted Emissions
Line Voltage: 12 VAC
Line Tested: Neutral Line



6.6 TRANSMITTER RADIATED EMISSIONS @ 3 METER – FUNDAMENTAL & SPURIOUS EMISSION [§§15.231(e), 15.209 & 15.205]

6.6.1 Limits

The RF radiated emissions measured at 3 m distance shall not exceed the field strength below:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emission (microvolts/meter)
40.66 - 40.70	1,000	100
70 - 130	500	50
130 - 174	500 to 1,500 **	50 to 150 **
174 - 260	1,500	150
260 - 470	1,500 to 5,000 **	150 to 500 **
Above 470	5,000	500

** linear interpolations

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 22.72727(F) - 2454.545; for the band 260-470 MHz, uV/m at 3 meters = 16.6667(F) - 2833.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Emissions within the restricted bands specified in §15.205(a) shall not exceed the general radiated emission limits specified in §15.209(a).

47 CFR 15.205(a) - Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

47 CFR 15.209(a) - Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field Strength Limits (microvolts/m)	Distance (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

6.6.2 Method of Measurements

Refer to ULTRATECH Test Procedures, File # ULTR P001-2004 and ANSI C63.4.

6.6.3 Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz with external mixer
Microwave Amplifier	Hewlett Packard	HP 83017A	3008A00769	1 GHz to 26.5 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz

6.6.4 Test Data

Remarks:

- The measuring receiver shall be tuned over the frequency range 30 MHz to 4.5 GHz.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- The peak-average correction factor was obtained from the duty cycle calculation.

$$Tx_{ON} = (8 \times 180.36\mu s) + (3 \times 380.76\mu s) + (3 \times 601.20\mu s) = 1.44ms + 1.14ms + 1.81ms = 4.39ms$$

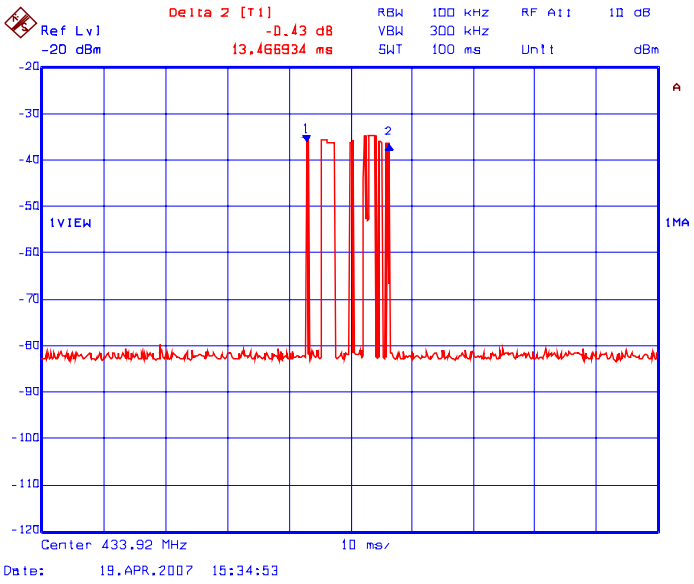
$$\frac{Tx_{ON}}{Tx_{ON+OFF}} = \frac{4.39ms}{100ms} = 0.0439 = 4.39\%$$

Duty Cycle Correction Factor for E-Field = $20 \cdot \log(0.0439) = -27.15dB$

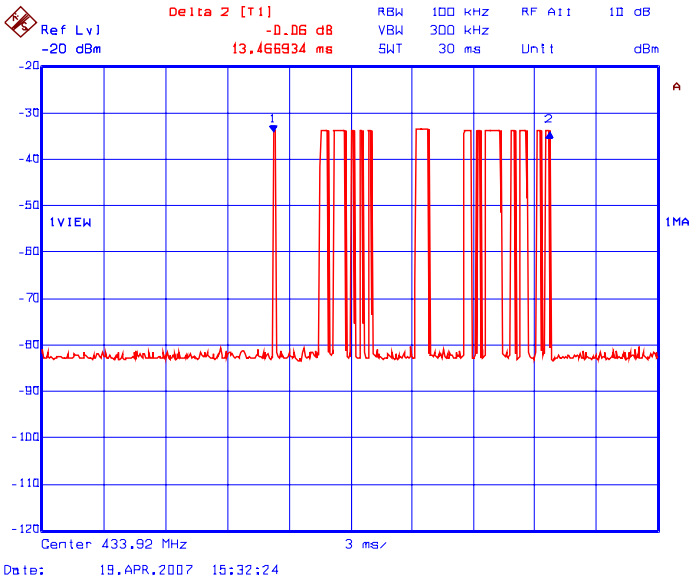
See the following duty cycle plots for details.

Frequency (MHz)	Peak E-Field @3m (dBµV/m)	Average E-Field @3m (dBµV/m)	Antenna Plane (V/H)	§15.231(e) Limits @3m (dBµV/m)	§15.209(a) Limits @3m (dBµV/m)	Margin (dB)
433.92	94.88	67.7	V	72.9	--	-5.1
433.92	91.97	64.8	H	72.9	--	-8.0
867.84	50.65	23.5	V	52.9	46.0	-29.4
867.84	54.74	27.6	H	52.9	46.0	-25.3
1301.76	48.03	20.9	V	52.9	54.0	-32.0
1301.76	53.23	26.1	H	52.9	54.0	-26.8
1735.68	55.79	28.6	V	52.9	54.0	-24.2
1735.68	54.78	27.6	H	52.9	54.0	-25.2
2169.60	61.17	34.0	V	52.9	54.0	-18.8
2169.60	64.48	37.3	H	52.9	54.0	-15.5
2603.52	62.41	35.3	V	52.9	54.0	-17.6
2603.52	62.40	35.2	H	52.9	54.0	-17.6
3037.44	56.90	29.7	V	52.9	54.0	-23.1
3037.44	57.28	30.1	H	52.9	54.0	-22.7
3471.36	53.21	26.1	V	52.9	54.0	-26.8
3471.36	52.25	25.1	H	52.9	54.0	-27.8
3905.28	53.96	26.8	V	52.9	54.0	-26.1
3905.28	55.83	28.7	H	52.9	54.0	-24.2
4339.20	54.01	26.9	V	52.9	54.0	-26.0
4339.20	56.01	28.9	H	52.9	54.0	-24.0

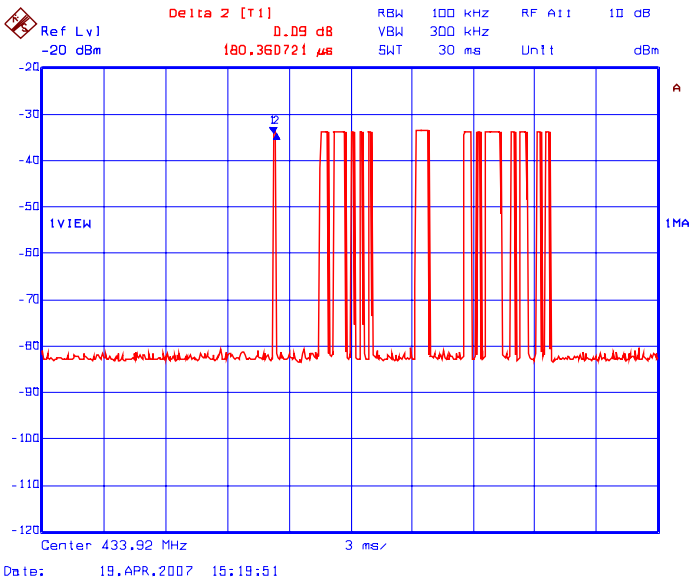
Plot 6.6.4.1. Duty Cycle
Pulse Train in 100 ms



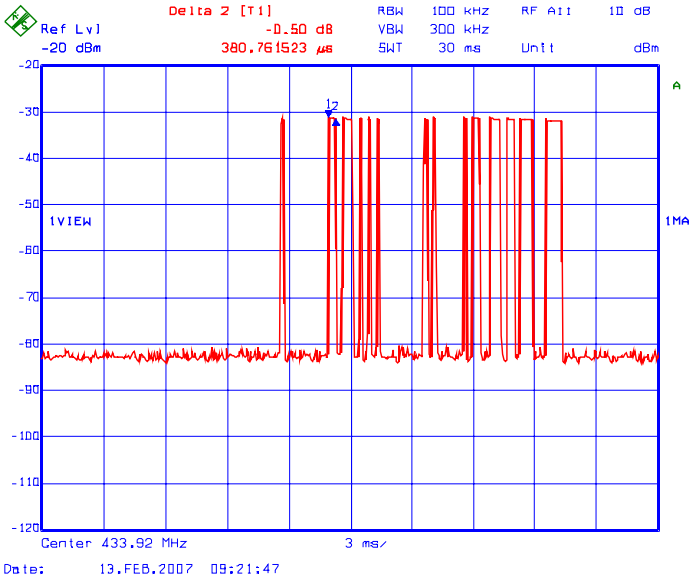
Plot 6.6.4.2. Duty Cycle
Pulse Train in 100 ms



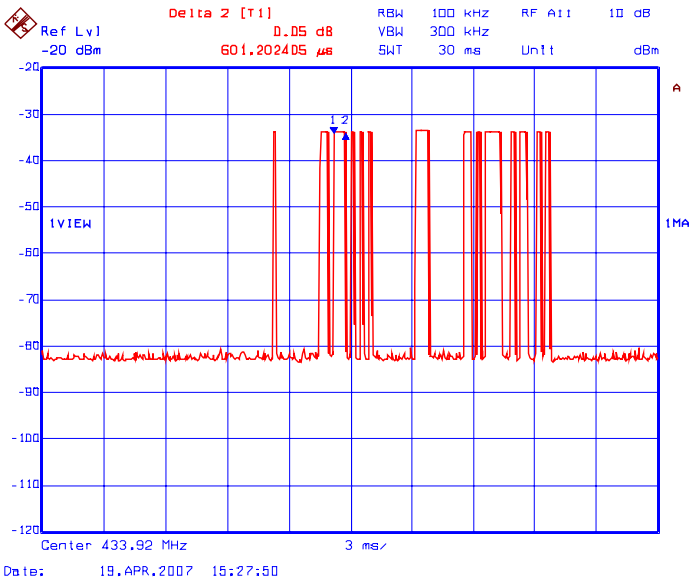
Plot 6.6.4.3. Duty Cycle
Short Pulse: 180.360721 µs



Plot 6.6.4.4. Duty Cycle
Medium Pulse: 380.761523 µs



Plot 6.6.4.5. Duty Cycle
Long Pulse: 601.202405 µs



Duty Cycle in 100 ms:

$$Tx_{ON} = (8 \times 180.36\mu s) + (3 \times 380.76\mu s) + (3 \times 601.20\mu s) = 1.44ms + 1.14ms + 1.81ms = 4.39ms$$

$$\frac{Tx_{ON}}{Tx_{ON+OFF}} = \frac{4.39ms}{100ms} = 0.0439 = 4.39\%$$

Duty Cycle Correction Factor for E-Field $= 20 \cdot \log(0.0439) = -27.15dB$

6.7 EMISSION BANDWIDTH [§15.231(c)]

6.7.1 Limits

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

6.7.2 Method of Measurements

Refer to ULTRATECH Test Procedures, File # ULTR P001-2004, §15.231(c) & ANSI C63.4.

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna and the bandwidth of the fundamental frequency was measured with the spectrum analyzer with the resolution bandwidth of the spectrum analyzer set per ANSI C63.4.

6.7.3 Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz

6.7.4 Test Data

Frequency (MHz)	Modulation	20 dB Bandwidth (kHz)	Maximum Limit (kHz)	Pass/Fail
433.92	ASK	11.02	1084.8	Pass

Plot 6.7.4.1. 20 dB Bandwidth
Test Frequency: 433.92 MHz
Modulation: ASK

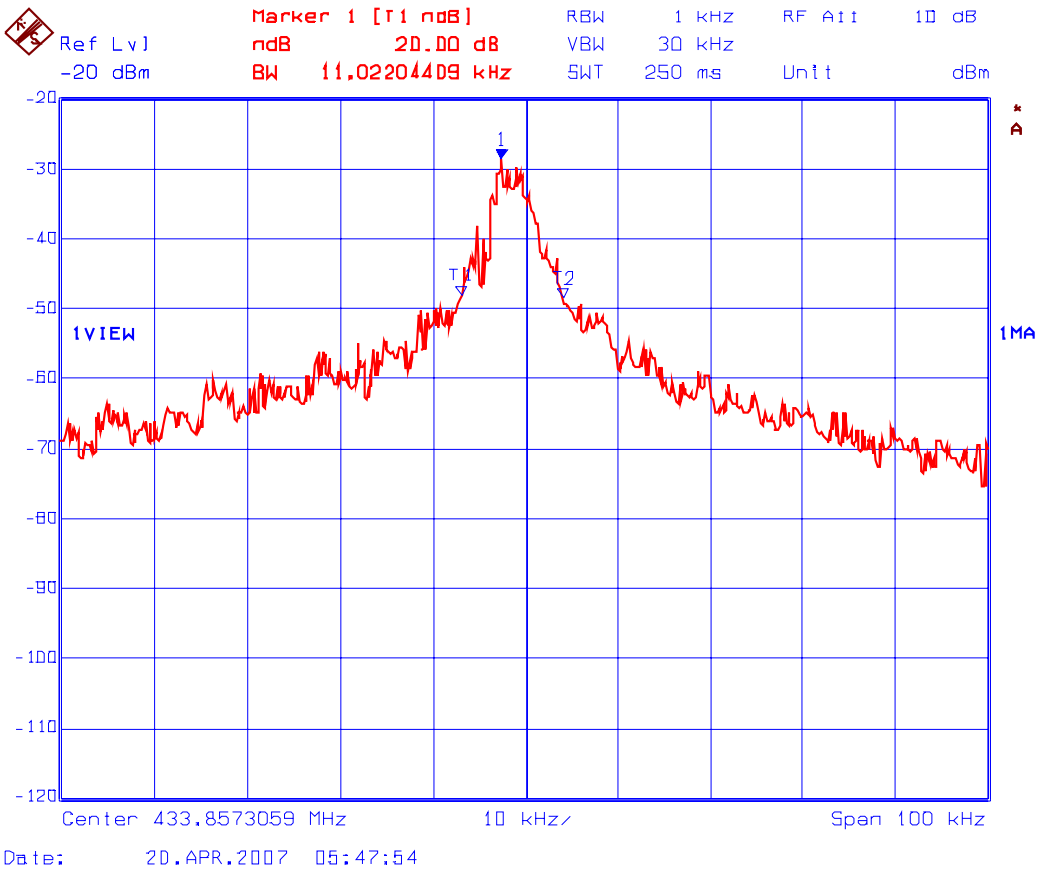


EXHIBIT 7 MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

7.1 LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	±1.5	±1.5
LISN coupling specification	Rectangular	±1.5	±1.5
Cable and Input Transient Limiter calibration	Normal (k=2)	±0.3	±0.5
Mismatch: Receiver VRC Γ_1 = 0.03 LISN VRC Γ_R = 0.8(9 kHz) 0.2 (30 MHz) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	±0.2	±0.3
System repeatability	Std. deviation	±0.2	±0.05
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	±1.25	±1.30
Expanded uncertainty U	Normal (k=2)	±2.50	±2.60

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30$ dB

$U = 2u_c(y) = \pm 2.6$ dB

7.2 RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivit	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB