

APPLICANT

Kussmaul Electronics Co., Inc.
170 Cherry Avenue
West Sayville, NY 11796

MANUFACTURER

Kussmaul Electronics Co., Inc.
170 Cherry Avenue
West Sayville, NY 11796

TEST SPECIFICATION: FCC Rules and Regulations Part 15, Subpart C, Para. 15.231

TEST PROCEDURE: ANSI C63.4:1992

TEST SAMPLE DESCRIPTION

BRANDNAME: Kussmaul Electronics Co., Inc. MODEL: 091-133T

TYPE: Pulsed Transmitter

POWER REQUIREMENTS: +12 VDC derived from vehicle battery

FREQUENCY OF OPERATION: 418 MHz

TESTS PERFORMED

Para. 15.231(b), Radiated Emissions, Fundamental and Harmonics

Para. 15.231(b)(3), Radiated Emissions, Spurious Case

Para. 15.231(c), Occupied Bandwidth

Para. 15.35, Duty Cycle Determination

REPORT OF MEASUREMENTS

Applicant: Kussmaul Electronics Co., Inc.

Device: Pulsed Transmitter

FCC ID: PXFDSC091-133XMTR

Power Requirements: +12 VDC derived from vehicle battery

Applicable Rule Section: Part 15, Subpart C, Section 15.231

**Retlif Testing Laboratories**

Test Report No. R-9180-2

FCC ID: PXFDSC091-133XMTR



Retlif Testing Laboratories

Test Report No. R-9180-2
FCC ID: PXFDSC091-133XMTR

REPORT OF MEASUREMENTS (continued)

TEST RESULTS

- 15.231 (a): This device is used as a remote control transmitter.
- 15.231 (a)(1) & 15.231(a)(2): The transmitter is manually operated and ceases transmission within 5 seconds after deactivation.
- 15.231 (a)(3): The transmitter does not perform periodic transmissions.
- 15.231 (b): The fundamental field strength did not exceed 10330 μ V/M (Average) at a test distance of 3 meters. In addition, the requirements of section 15.35 for averaging pulsed emissions and for limiting peak emissions were met.
- The field strength of harmonic and spurious emissions did not exceed 1033 μ V/M (AVERAGE).

DETERMINATION OF FIELD STRENGTH LIMITS

The field strength limits shown below are found in Section 15.231.

Frequency			Limit		
F1	=	260	3750	=	L1
Fo	=	418			Lo
F2	=	470	12500	=	L2

The formula below was utilized to determine the limits:

$$\text{Limit} = L1 + [(Fo-F1)(L2-L1)/(F2-F1)]$$

Solving yields:

$$\text{Fundamental Limit} = 10330 \mu\text{V/M (AVERAGE) @ 3 Meters}$$

$$\text{Harmonic Limit} = 1033 \mu\text{V/M (AVERAGE) @ 3 Meters}$$



Retlif Testing Laboratories

Test Report No. R-9180-2

FCC ID: PXFDSC091-133XMTR

REPORT OF MEASUREMENTS (continued)

DUTY CYCLE DETERMINATION

The unit's RF output was directly coupled to the input of the spectrum analyzer. The analyzer was set for a frequency span of 0Hz. The sweep time was then adjusted in order to display one full pulse train. The transmitter on time was then summed and compared to the time for one full cycle in order to obtain the duty cycle. (See plots for additional information)

Transmitter On Time	=	23.6 milliseconds (maximum- per cycle)
Transmitter Cycle Time	=	62.85 milliseconds
Transmitter Duty Cycle	=	37.5 %

CALCULATION:

18 x 800 μ s (large pulse)	=	14.4 milliseconds
23 x 400 μ s (small pulse)	=	9.2 milliseconds
9.2 + 14.4	=	23.6 milliseconds
Cycle Time	=	62.85 milliseconds
Duty Cycle	=	37.5 %
Correction Factor = 20 log(0.375)	=	-8.5

SPECTRUM ANALYZER DESENSITIZATION CONSIDERATIONS

Due to the nature of the emissions being measured, care was taken to ensure that the resolution bandwidth of the spectrum analyzer was adequate to provide accurate measurements. The following formula was utilized:

Setting pulse desensitization equal to zero and utilizing the minimum observed pulse width of 400 μ s yields a minimum required bandwidth of 1.67 kHz. FCC specified bandwidths of 100kHz and 1MHz were utilized below and above 1GHz, respectively.



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GENERAL NOTES

1. All readings were taken utilizing a peak detector function at a test distance of 3 meters.
2. The duty cycle was applied to the peak readings in order to determine the average value of the emissions.
3. The frequency range was scanned from 30 MHz to 4.2 GHz. All emissions not reported were more than 20 dB below the specified limit.



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Test Report No. R-9180-2

FCC ID: PXFDSC091-133XMTR

EQUIPMENT LIST

FCC15.231 Compliance Testing

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
067	Open Area Test Site	Retlif	3 Meter	RNY	09/20/2000	09/20/2003
128C	Double Ridge Guide	Eaton Corporation	1 GHz - 18 GHz	96001	09/21/2001	09/21/2002
133	Broadband Pre-Amplifier	Electro-Metrics	10 kHz - 1 GHz, 26dB	BPA-1000	06/13/2001	06/13/2002
141	Spectrum Analyzer	Hewlett Packard	100 Hz - 40 GHz	8566B	07/02/2001	01/02/2002
141A	Graphics Plotter	Hewlett Packard	N/A	7470A	03/05/2001	03/05/2002
141B	Quasi-Peak Adaptor	Hewlett Packard	100 Hz - 1 GHz	85650A	02/20/2001	01/02/2002
206B	6.0 dB Attenuator	Texscan	0 - 1.0 GHz	FP-50 - 6 dB	06/13/2001	06/13/2002
523	Biconilog	Electro-Mechanics	26 - 2000 MHz	3142B	09/28/2001	09/28/2002
543	Preamplifier	Hewlett Packard	1.0 GHz - 26.5 GHz	8449B	06/27/2001	06/27/2002



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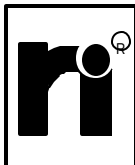
Test Report No. R-9180-2

FCC ID: PXFDSC091-133XMTR

FCC 15.231(b)

RADIATED EMISSIONS, FUNDAMENTAL & SPURIOUS CASE

See separate e-file attachment named REfundharm.pdf and REspur.pdf



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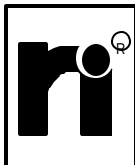
Test Report No. R-9180-2

FCC ID: PXFDSC091-133XMTR

FCC 15.231(c)

OCCUPIED BANDWIDTH

Please refer to separate electronic file named Occbw.pdf



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Test Report No. R-9180-2

FCC ID: PXFDSC091-133XMTR

FCC 15.35

DUTY CYCLE

Please refer to separate electronic file named Dutycycle.pdf

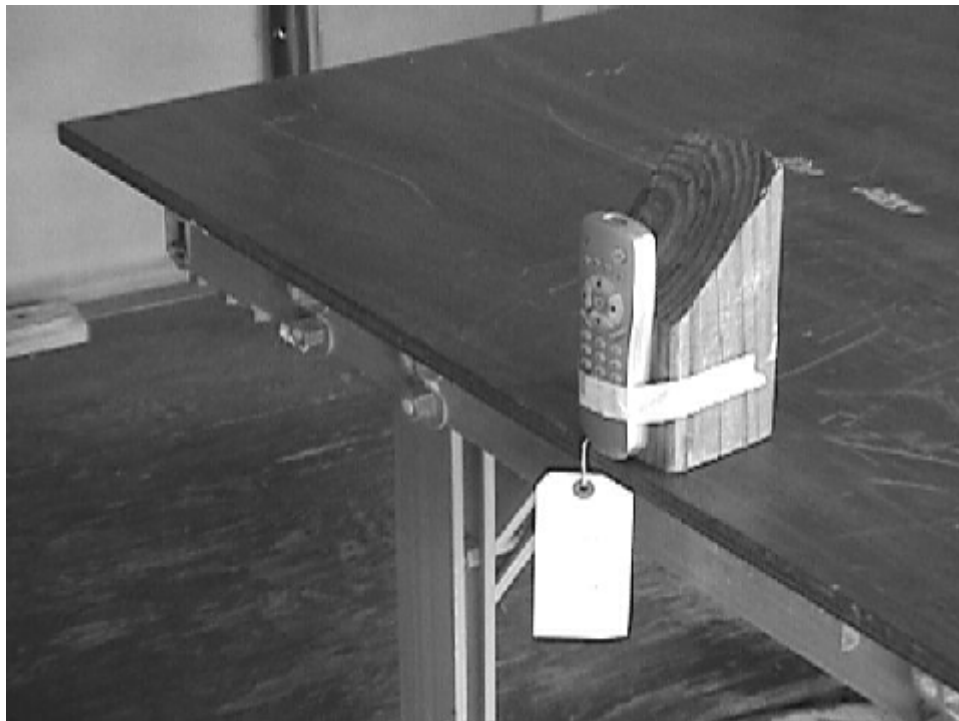


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Test Report No. R-9180-2

FCC ID: PXFDSC091-133XMTR

Test Setup Photograph



Retlif Testing Laboratories

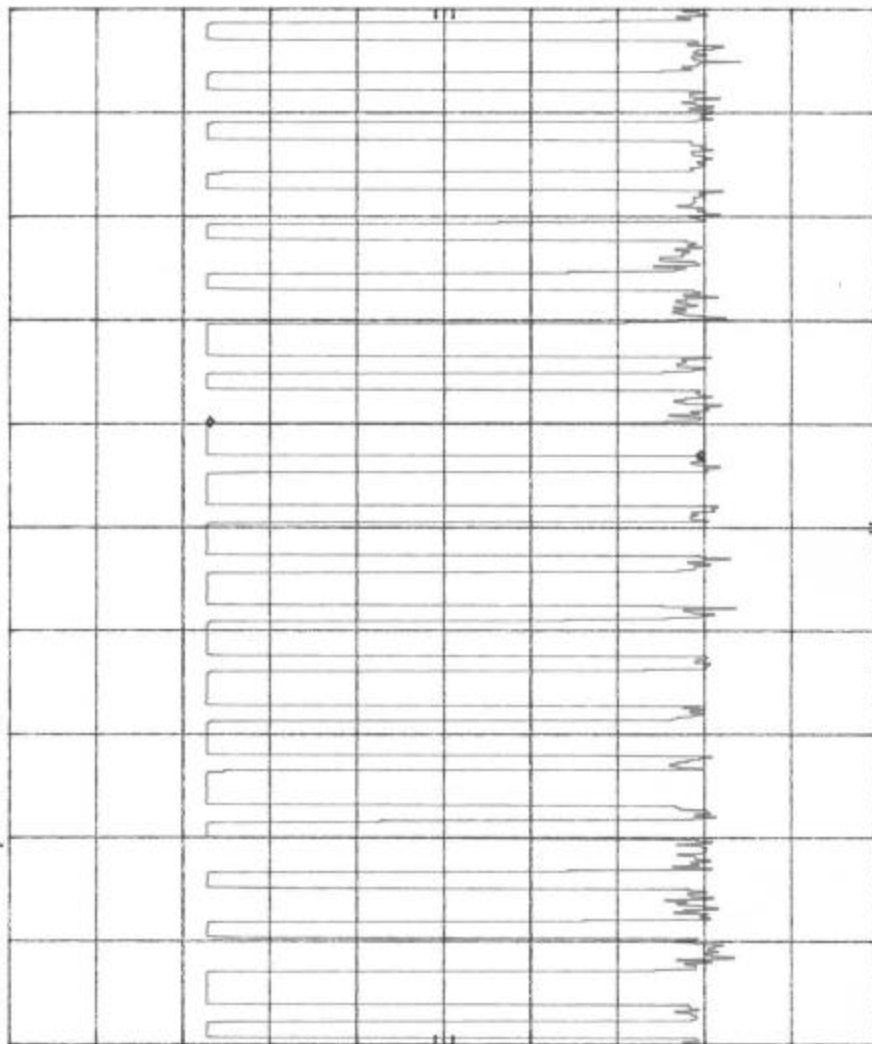
Test Report No. R-9180-2

FCC ID: PXFDSC091-133XMTR

R-9180-2 Kusemaul 091-133T 9/24/01 PL MKR Δ 800.0 μ sec
 REF 105.7 dB μ V ATTEN 10 dB 56.50 dB

hp

10 dB/



CENTER 417.951 000 MHz SPAN 0 Hz
 RES BW 100 kHz SWP 25.0 msec
 VBW 300 kHz

Customer:	Kusemaul Electronics Co., Inc.
Test Sample:	418MHz Pulsed Transmitter
Model No.:	091-133T
Test Method:	FCC15.35 Duty Cycle Determination
Notes:	Large pulse=800usec 18*800usec=14.4msec
Date:	September 24, 2001
Tech:	Peter Lananna
Sheet	1 of 3

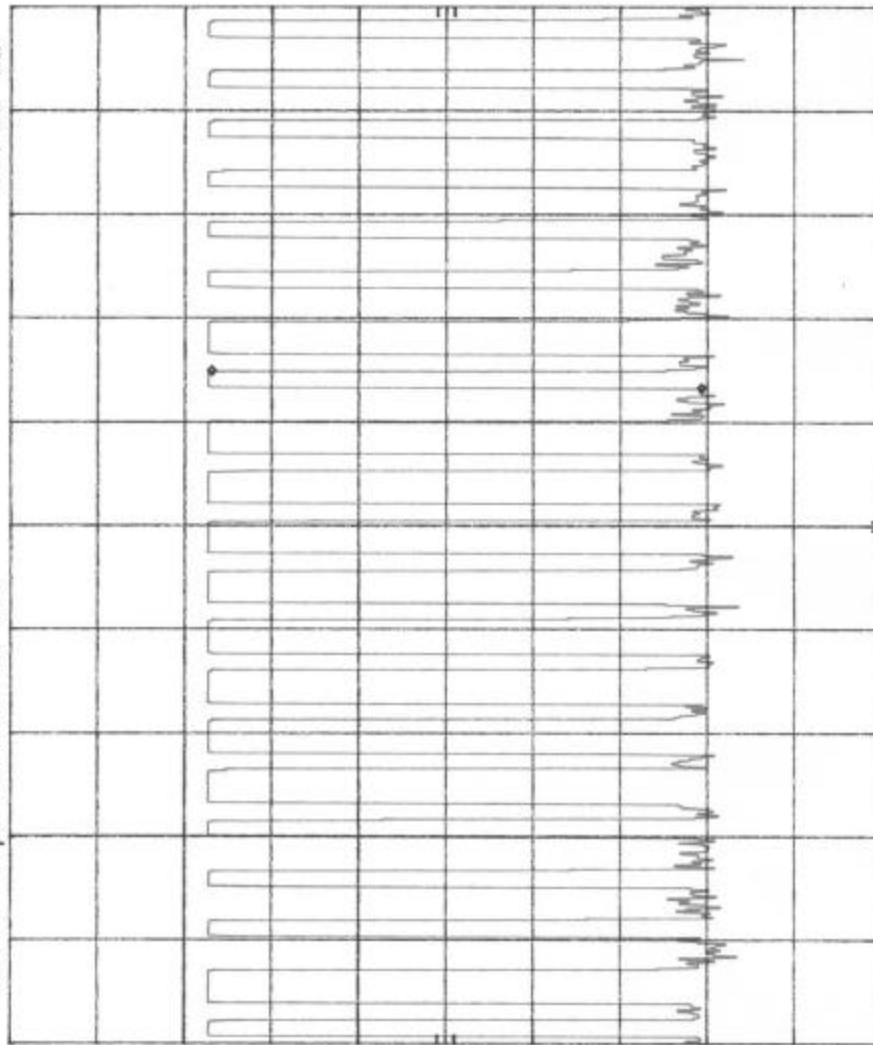


Retlif Testing Laboratories

Report No. R-9180-2

R-9180-2 Kussmaul 091-133T 9/24/01 PL MKR Δ 400.0 μ sec
 REF 105.7 dB μ V ATTN 10 dB 56.30 dB

hp
 10 dB/



CENTER 417.951 000 MHz
 RES BW 100 kHz
 VBW 300 kHz
 SWP 25.0 msec
 SPAN 0 Hz

Customer:	Kussmaul Electronics Co., Inc.
Test Sample:	418MHz Pulsed Transmitter
Model No.:	091-133T
Test Method:	FCC15.35 Duty Cycle Determination
Notes:	Small pulse=400usec 23*400usec=9.2msec
Date:	September 24, 2001
Tech:	Peter Lananna
Sheet	2 of 3

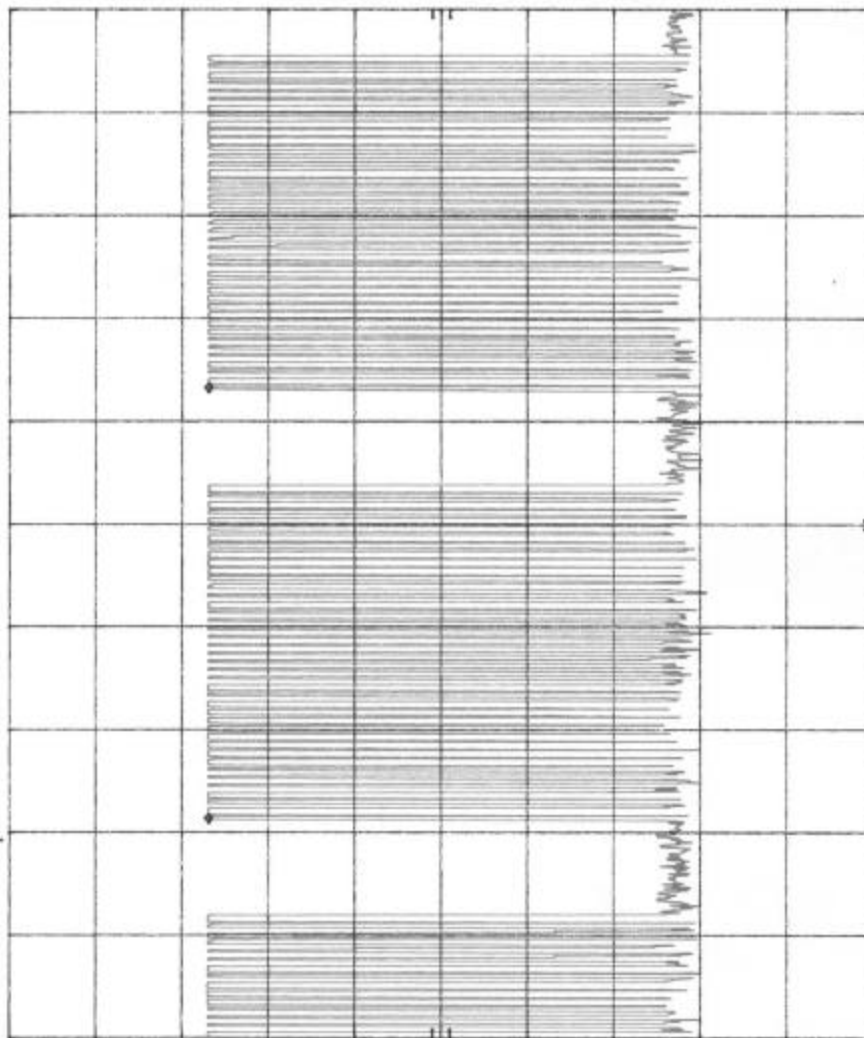


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Report No. R-9180-2

R-9180-2 Kussmaul 091-133T 9/24/01 PL MKR Δ 62.85 msec
 REF 105.7 dB μ V ATTN 10 dB

10 dB/



CENTER 417.951 000 MHz
 RES BW 100 kHz
 VBW 300 kHz
 SWP 150 msec
 SPAN 0 Hz

Customer: Kussmaul Electronics Co., Inc.
 Test Sample: 418MHz Pulsed Transmitter
 Model No.: 091-133T
 Test Method: FCC15.35 Duty Cycle Determination
 Notes: Cycle Time=62.85msec
 14.4m+9.2m=23.6m on time/62.85m cycle time=37.5% Duty Cycle
 Date: September 24, 2001 Tech: Peter Lananna Sheet 3 of 3



Retlif Testing Laboratories

Report No. R-9180-2

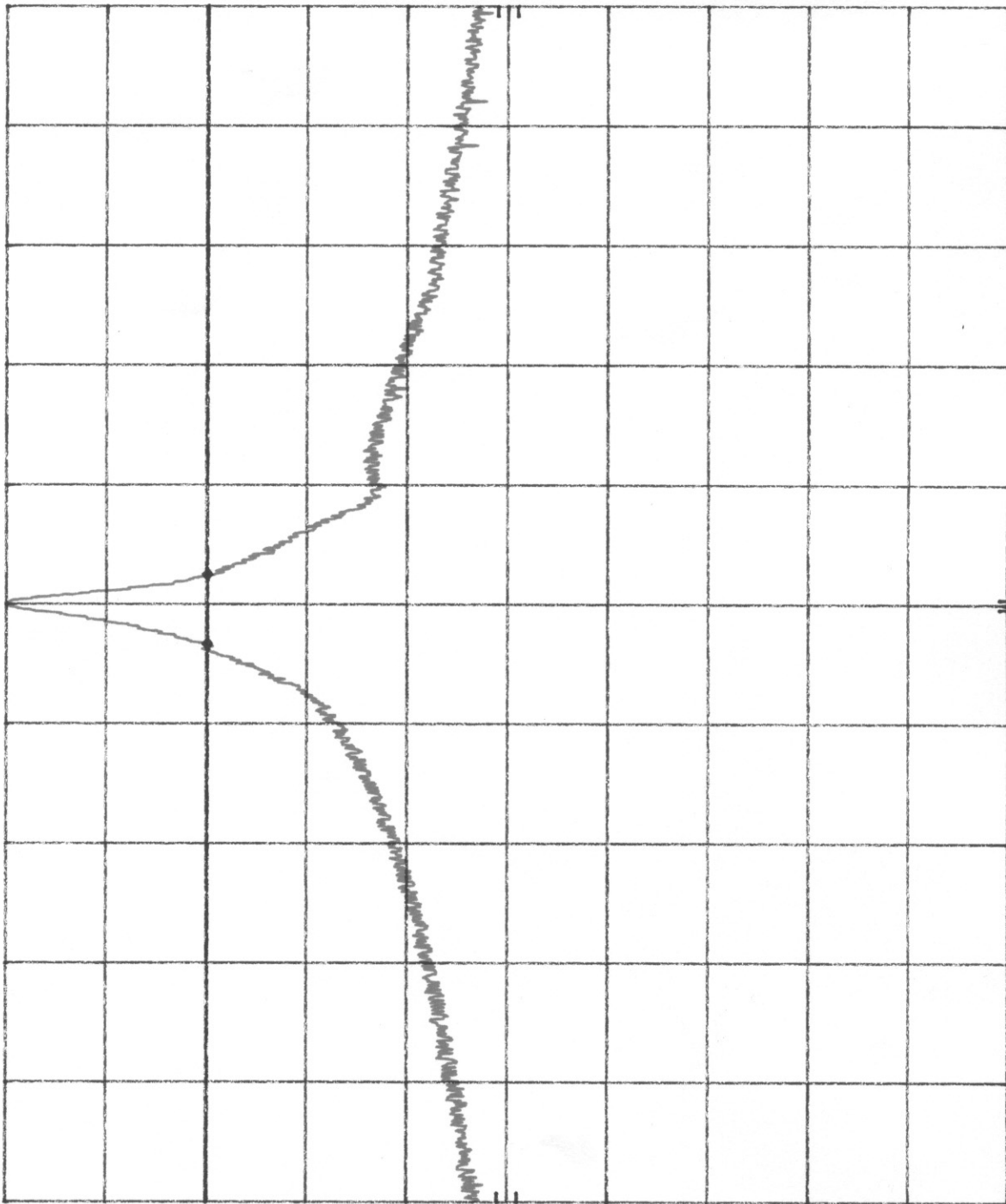
MKR Δ 58 KHz
0.00 dB

R-9180-2 Kussmaul 091-133T 9/24/01 PL
REF 81.9 dB μ V ATTN 10 dB

hp

10 dB/

DL
61.8
dB μ V



SPAN 1.00 MHz
SWP 65.0 msec

VBW 30 KHz

CENTER 417.97 MHz
RES BW 10 KHz

Customer:	Kussmaul Electronics Co., Inc.		
Test Sample:	418MHz Pulsed Transmitter		
Model No.:	091-133T		
Test Method:	FCC15.231(c) Occupied Bandwidth		
Notes:	Emission is less than 0.25% of center frequency, measured 20dB(c). 418MHz*0.25%=1.0MHz		
Date:	September 24, 2001	Tech:	Peter Lananna
Sheet	1	of	1



Retlif Testing Laboratories

Report No. R-9180-2

Test Method:		FCC Part 15 Subpart C Radiated Emissions, Fundamental & Harmonic Emissions					
Customer:		Kussmaul Electronics Co., Inc.			Job No.		R-9180-2
Test Sample:		418MHz Pulsed Transmitter			Paragraph:		15.231(b)
Model No.:		091-133T			FCC ID:		PXFDSC091-133XMTR
Operating Mode:		Continuously Transmitting a Pulsed 418 MHz Signal					
Technician:		Peter Lananna			Date:		September 24, 2001
Notes:		Test Distance: 3 Meters Detector: Peak, Unless otherwise specified					
Test Freq.	Antenna Pol./Height	EUT Orientation	Meter Reading	Correction Factor	Corrected Reading	Converted Reading	Peak Limit
MHz	(V/H)/Meters	X / Y / Z	dBuV	dB	dBuV/m	uV/m	uV/m
418	H / 1.3	X	87.2	-1.2	86.0	19952.6	103300
	H / 2.0	Y	87.6	-1.2	86.4	20893.0	
	H / 2.3	Z	88.1	-1.2	86.9	22130.9	
	V / 1.0	X	89.2	-1.2	88.0	25118.9	
	V / 2.5	Y	88.3	-1.2	87.1	22646.4	
418	V / 1.8	Z	87.1	-1.2	85.9	19724.2	103300
836	H / 1.8	X	44.3	7.7	52.0	398.1	10330
	H / 1.8	Y	41.3	7.7	49.0	281.8	
	H / 2.3	Z	40.4	7.7	48.1	254.1	
	V / 1.0	X	44.3	7.7	52.0	398.1	
	V / 1.3	Y	45.5	7.7	53.2	457.1	
836	V / 1.3	Z	41.9	7.7	49.6	302.0	10330
1254	H / 1.0	X	40.3	-2.8	37.5	75.0*	10330
	H / 1.0	Y	40.3	-2.8	37.5	75.0*	
	H / 1.0	Z	40.3	-2.8	37.5	75.0*	
	V / 1.0	X	40.3	-2.8	37.5	75.0*	
	V / 1.0	Y	40.3	-2.8	37.5	75.0*	
1254	V / 1.0	Z	40.3	-2.8	37.5	75.0*	10330
1672	H / 1.0	X	40.1	1.0	41.1	113.5*	5000
	H / 1.0	Y	40.1	1.0	41.1	113.5*	
	H / 1.0	Z	40.1	1.0	41.1	113.5*	
	V / 1.0	X	40.1	1.0	41.1	113.5*	
	V / 1.0	Y	40.1	1.0	41.1	113.5*	
1672	V / 1.0	Z	40.1	1.0	41.1	113.5*	5000
2090	H / 1.0	X	40.5	0.4	40.9	110.9*	10330
	H / 1.0	Y	40.5	0.4	40.9	110.9*	
	H / 1.0	Z	40.5	0.4	40.9	110.9*	
	V / 1.0	X	40.5	0.4	40.9	110.9*	
	V / 1.0	Y	40.5	0.4	40.9	110.9*	
2090	V / 1.0	Z	40.5	0.4	40.9	110.9*	10330
	The frequency range was scanned from 30 MHz to 4.2 GHz. All emissions not recorded were more						
	Than 10 dB below the specified limit. Emissions from the EUT do not exceed the specified limits.						
	*=Noise Floor Measurements (Minimum system sensitivity)						



Retlif Testing Laboratories

Retlif Job Number R-9180-2

Test Method:		FCC Part 15 Subpart C Radiated Emissions, Fundamental & Harmonic Emissions					
Customer:		Kussmaul Electronics Co., Inc.			Job No.	R-9180-2	
Test Sample:		418MHz Pulsed Transmitter			Paragraph:	15.231(b)	
Model No.:		091-133T			FCC ID:	PXFDS091-133XMTR	
Operating Mode:		Continuously Transmitting a Pulsed 418 MHz Signal					
Technician:		Peter Lananna			Date:	September 24, 2001	
Notes: Test Distance: 3 Meters Detector: Peak, unless otherwise specified							
Test Freq.	Antenna Pol./Height	EUT Orientation	Meter Reading	Correction Factor	Corrected Reading	Converted Reading	Peak Limit
MHz	(V/H)-Meters	X / Y / Z	dBuV	dB	dBuV/m	uV/m	uV/m
2508	H / 1.0	X	39.6	3.8	43.4	147.9*	10330
	H / 1.0	Y	39.6	3.8	43.4	147.9*	
	H / 1.0	Z	39.6	3.8	43.4	147.9*	
	V / 1.0	X	39.6	3.8	43.4	147.9*	
	V / 1.0	Y	39.6	3.8	43.4	147.9*	
2508	V /1.0	Z	39.6	3.8	43.4	147.9*	10330
2926	H / 1.0	X	41.4	6.4	47.8	245.5*	10330
	H / 1.0	Y	41.4	6.4	47.8	245.5*	
	H / 1.0	Z	41.4	6.4	47.8	245.5*	
	V / 1.0	X	41.4	6.4	47.8	245.5*	
	V / 1.0	Y	41.4	6.4	47.8	245.5*	
2926	V /1.0	Z	41.4	6.4	47.8	245.5*	10330
3344	H / 1.0	X	39.0	7.3	46.3	206.5*	10330
	H / 1.0	Y	39.0	7.3	46.3	206.5*	
	H / 1.0	Z	39.0	7.3	46.3	206.5*	
	V / 1.0	X	39.0	7.3	46.3	206.5*	
	V / 1.0	Y	39.0	7.3	46.3	206.5*	
3344	V /1.0	Z	39.0	7.3	46.3	206.5*	10330
3762	H / 1.0	X	40.3	9.2	49.5	298.5*	10330
	H / 1.0	Y	40.3	9.2	49.5	298.5*	
	H / 1.0	Z	40.3	9.2	49.5	298.5*	
	V / 1.0	X	40.3	9.2	49.5	298.5*	
	V / 1.0	Y	40.3	9.2	49.5	298.5*	
3762	V /1.0	Z	40.3	9.2	49.5	298.5*	10330
4180	H / 1.0	X	40.3	10.6	50.9	350.8*	5000
	H / 1.0	Y	40.3	10.6	50.9	350.8*	
	H / 1.0	Z	40.3	10.6	50.9	350.8*	
	V / 1.0	X	40.3	10.6	50.9	350.8*	
	V / 1.0	Y	40.3	10.6	50.9	350.8*	
4180	V /1.0	Z	40.3	10.6	50.9	350.8*	5000
	The frequency range was scanned from 30 MHz to 4.2 GHz. All emissions not recorded were more						
	Than 10 dB below the specified limit. Emissions from the EU T do not exceed the specified limits.						
	*=Noise Floor Measurements (Minimum system sensitivity)						



Retlif Testing Laboratories

Retlif Job Number R-9180-2

Test Method:		FCC Part 15 Subpart C Radiated Emissions, Fundamental & Harmonic Emissions					
Customer:		Kussmaul Electronics Co., Inc.			Job No.	R-9180-2	
Test Sample:		418MHz Pulsed Transmitter			Paragraph:	15.231(b)	
Model No.:		091-133T			FCC ID:	PXFDS091-133XMTR	
Operating Mode:		Continuously Transmitting a Pulsed 418 MHz Signal					
Technician:		Peter Lananna			Date:	September 24, 2001	
Notes:		Test Distance: 3 Meters			Duty Cycle: 37.5%		
		Detector: Peak, unless otherwise specified			Duty Cycle Correction: - 8.5		
Test Freq.	Antenna Pol./Height	EUT Orientation	Peak Reading	Correction Factor	Corrected Reading	Converted Reading	Avg. Limit
MHz	(V/H)-Meters	X / Y / Z	dBuV	dB	dBuV/m	uV/m	uV/m
418	H / 1.3	X	86.0	-8.5	77.5	7498.9	10330
	H / 2.0	Y	86.4	-8.5	77.9	7852.4	
	H / 2.3	Z	86.9	-8.5	78.4	8317.6	
	V / 1.0	X	88.0	-8.5	79.5	9440.6	
	V / 2.5	Y	87.1	-8.5	78.6	8511.4	
418	V / 1.8	Z	85.9	-8.5	77.4	7413.1	10330
836	H / 1.8	X	52.0	-8.5	43.5	149.6	1033
	H / 1.8	Y	49.0	-8.5	40.5	105.9	
	H / 2.3	Z	48.1	-8.5	39.6	95.5	
	V / 1.0	X	52.0	-8.5	43.5	149.6	
	V / 1.3	Y	53.2	-8.5	44.7	171.8	
836	V / 1.3	Z	49.6	-8.5	41.1	113.5	1033
1254	H / 1.0	X	37.5	-8.5	29.0	28.2*	1033
	H / 1.0	Y	37.5	-8.5	29.0	28.2*	
	H / 1.0	Z	37.5	-8.5	29.0	28.2*	
	V / 1.0	X	37.5	-8.5	29.0	28.2*	
	V / 1.0	Y	37.5	-8.5	29.0	28.2*	
1254	V / 1.0	Z	37.5	-8.5	29.0	28.2*	1033
1672	H / 1.0	X	41.1	-8.5	32.6	42.7*	500
	H / 1.0	Y	41.1	-8.5	32.6	42.7*	
	H / 1.0	Z	41.1	-8.5	32.6	42.7*	
	V / 1.0	X	41.1	-8.5	32.6	42.7*	
	V / 1.0	Y	41.1	-8.5	32.6	42.7*	
1672	V / 1.0	Z	41.1	-8.5	32.6	42.7*	500
2090	H / 1.0	X	40.9	-8.5	32.4	41.7*	1033
	H / 1.0	Y	40.9	-8.5	32.4	41.7*	
	H / 1.0	Z	40.9	-8.5	32.4	41.7*	
	V / 1.0	X	40.9	-8.5	32.4	41.7*	
	V / 1.0	Y	40.9	-8.5	32.4	41.7*	
2090	V / 1.0	Z	40.9	-8.5	32.4	41.7*	1033
	The frequency range was scanned from 30 MHz to 4.2 GHz. All emissions not recorded were more						
	Than 10 dB below the specified limit. Emissions from the EUT do not exceed the specified limits.						
	*=Noise Floor Measurements (Minimum system sensitivity)						



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Retlif Job Number R-9180-2

Test Method:		FCC Part 15 Subpart C Radiated Emissions, Fundamental & Harmonic Emissions						
Customer:		Kussmaul Electronics Co., Inc.			Job No.		R-9180-2	
Test Sample:		418MHz Pulsed Transmitter			Paragraph:		15.231(b)	
Model No.:		091-133T			FCC ID:		PXFDS091-133XMTR	
Operating Mode:		Continuously Transmitting a Pulsed 418 MHz Signal						
Technician:		Peter Lananna			Date:		September 24, 2001	
Notes:		Test Distance: 3 Meters			Duty Cycle: 37.5%			
		Detector: Peak, unless otherwise specified			Duty Cycle Correction:-8.5			
Test Freq.	Antenna Pol./Height	EUT Orientation	Peak Reading	Correction Factor	Corrected Reading	Converted Reading	Avg. Limit	
MHz	(V/H)-Meters	X / Y / Z	dBuV	dB	dBuV/m	uV/m	uV/m	
2508	H / 1.0	X	43.4	-8.5	34.9	55.6*	1033	
	H / 1.0	Y	43.4	-8.5	34.9	55.6*		
	H / 1.0	Z	43.4	-8.5	34.9	55.6*		
	V / 1.0	X	43.4	-8.5	34.9	55.6*		
	V / 1.0	Y	43.4	-8.5	34.9	55.6*		
2508	V / 1.0	Z	43.4	-8.5	34.9	55.6*	1033	
2926	H / 1.0	X	47.8	-8.5	39.3	92.3*	1033	
	H / 1.0	Y	47.8	-8.5	39.3	92.3*		
	H / 1.0	Z	47.8	-8.5	39.3	92.3*		
	V / 1.0	X	47.8	-8.5	39.3	92.3*		
	V / 1.0	Y	47.8	-8.5	39.3	92.3*		
2926	V / 1.0	Z	47.8	-8.5	39.3	92.3*	1033	
3344	H / 1.0	X	46.3	-8.5	37.8	77.6*	1033	
	H / 1.0	Y	46.3	-8.5	37.8	77.6*		
	H / 1.0	Z	46.3	-8.5	37.8	77.6*		
	V / 1.0	X	46.3	-8.5	37.8	77.6*		
	V / 1.0	Y	46.3	-8.5	37.8	77.6*		
3344	V / 1.0	Z	46.3	-8.5	37.8	77.6*	1033	
3762	H / 1.0	X	49.5	-8.5	41.0	112.2*	1033	
	H / 1.0	Y	49.5	-8.5	41.0	112.2*		
	H / 1.0	Z	49.5	-8.5	41.0	112.2*		
	V / 1.0	X	49.5	-8.5	41.0	112.2*		
	V / 1.0	Y	49.5	-8.5	41.0	112.2*		
3762	V / 1.0	Z	49.5	-8.5	41.0	112.2*	1033	
4180	H / 1.0	X	50.9	-8.5	42.4	131.8*	500	
	H / 1.0	Y	50.9	-8.5	42.4	131.8*		
	H / 1.0	Z	50.9	-8.5	42.4	131.8*		
	V / 1.0	X	50.9	-8.5	42.4	131.8*		
	V / 1.0	Y	50.9	-8.5	42.4	131.8*		
4180	V / 1.0	Z	50.9	-8.5	42.4	131.8*	500	
	The frequency range was scanned from 30 MHz to 4.2 GHz. All emissions not recorded were more							
	Than 10 dB below the specified limit. Emissions from the EUT do not exceed the specified limits.							
	*=Noise Floor Measurements (Minimum system sensitivity)							



Retlif Testing Laboratories

Retlif Job Number R-9180-2

Notes:	Test Distance: 3 Meters	Temp:20C	Humidity:44%
	Detector: Quasi-Peak Below 30 MHz to 1 GHz, Peak above 1 GHz		

No emissions detected at specified test distance.

	The EUT was scanned from 30 MHz to 4.2 GHz
	The emissions observed from the EUT do not exceed the specified limits. Emissions not recorded were more than 10dB under the specified limit

