EMC MEASUREMENT/TECHNICAL REPORT

Manufacturer: **Martec Access Products, Inc.**
Equipment Under Test: **KWT Transmitter**
FCC ID No.: **KJ802-3039**

Test Report No.: **112384-A**
Purchase Order No.: **1702-00**

DOCUMENT HISTORY

Revision	*Issue Date*	*Affected Page(s)*	*Description of Modifications*	*Revised By*	*Approved By*
0	15 May 2000		Initial release		

EMC MEASUREMENT/TECHNICAL REPORT
Document No.: 112384-A
From
Instrument Specialties Co., Inc.
World Compliance Center

Test for
Martec Access Products, Inc.
KWT Transmitter

Written By: Bridget A. Keesser, EMC Sales Representative — Date: 15 May 2000

Reviewed By: Grant Metzgar, Senior EMC Technician — Date: 15 MAY, 2000

Authorized By: J. Fred Gardner, EMC Quality Assurance Manager — Date: 15 May 2000

TEST PERSONNEL – Instrument Specialties Co., Inc.

Grant Metzgar, Senior EMC Technician	21, 23 December 1999

EUT RECEIPT/DISPOSITION INFORMATION

Date of Receipt of Equipment Under Test (EUT)	21 December 1999
Disposition of EUT	In House

Test Facility	Instrument Specialties Company Incorporated
Address	Shielding Way
City, State Zip Code	Delaware Water Gap, PA 18327
Phone	(570) 424-8510 ext. 1216
Fax	(570) 421-4227

TABLE OF CONTENTS (This document contains a total of 25 pages plus attachments.)

1 MEASUREMENT/TECHNICAL REPORT SUMMARY

Grantee **Address** **City, State Zip Code** **Phone** **Fax**	Wayne Dalton Corp. 3395 Addison Dr. Pensacola, FL 32514 800-474-9890 850-474-1254
Representative **Manufacturer** **Manufacturer Address** **City, State Zip Code** **Phone** **Fax**	Bernard Kasmir Martec Access Products, Inc. 240 Sheffield St. Mountainside, NJ 07092 908-233-0044 908-233-4111
Type of Authorization	Certification Part 15, Subpart C - Intentional Radiators
Applicable FCC Rules	PART 15 – RADIO FREQUENCY DEVICES Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Chapter 1 (10-1-99 Edition). The following subparts are applicable to the results in this test report: Part 2, Subpart J Paragraph 2.1031 - Certification Part 15, Subpart A Paragraph 15.31 – Measurement Standards Paragraph 15.33 – Frequency Range of Radiated Measurements Paragraph 15.35 – Measurement Detector Functions and Bandwidths Part 15, Subpart C – Intentional Radiators Paragraph 15.203 – Antenna Requirement Paragraph 15.205 – Restricted Bands of Operation Paragraph 15.209 – Radiated emission limits, general requirements Paragraph 15.231 – Operation with the bands 40.66 – 40.70 MHz and above 70 MHz
Equipment Under Test	KWT Transmitter, Model 3039
FCC ID	KJ802-3039
Testing Dates	21, 23 December 1999
Summary of Data	The equipment tested is capable of operation in accordance with the requirements of 47 CFR Chapter 1 Part 15.

2 GENERAL INFORMATION

2.1 Product Description

Equipment Under Test	KWT Transmitter
Model Number	02-3039
Serial Number	None
Description	The EUT is a wall mounted transmitter that activates a garage door opener upon receiving a valid code.
Power	9 VDC
Clock Frequencies	12 MHz
Transmit Frequency	303 MHz

2.2 Related Submittal(s)/Grant(s)

This transmitter is manufactured by Martec Access Products for Wayne Dalton Corporation. Challenger a Division of Wayne Dalton Corporation holds the original submittal grant filed under FCC ID. FON02-3039. The test sample is identical to the original filing except that a metal foil shield as been removed which allows for a slightly higher transmit level.

2.3 Table: Tested System Details

Manufacturer	***Description***	***Model No.***	***Serial No.***	***FCC ID***
Martec Access Products	KWT Transmitter	02-3039	N/A	KJ802-3039

Martec Access Products is manufacturing this product for Wayne Dalton Corp. who will hold the Grantee for this application.

2.4 Test Methodology

Radiated emissions tests were performed according to the general provisions of ANSI C63.4-1992 (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). Radiated emissions tests were performed at an antenna to EUT distance of 3 meters. Conducted emissions were not performed since the unit is battery operated.

2.5 Test Facility

The open area test site and measurement facility used to collect the radiated data is located at the Instrument Specialties Co., Inc. test facility in Delaware Water Gap, PA. This site has been fully described in a report submitted to the FCC, and accepted in a letter dated 22 August 1997 (31040/SIT 1300F2). The lab is accredited by NVLAP (LAB CODE: 200076-0) for FCC Part 15 and CISPR 22 emissions measurements.

3 PRODUCT LABELING

3.1 FCC ID Label

3.2 Location of Label on EUT

The ID label shall be located on rear of unit.

4 SYSTEM TEST CONFIGURATION

4.1 Justification

The EUT tested was a prototype unit identical in construction to a production unit. The test sample was arranged in a tabletop configuration. The transmitter was configured for constant transmit in a CW mode.

4.2 Special Accessories

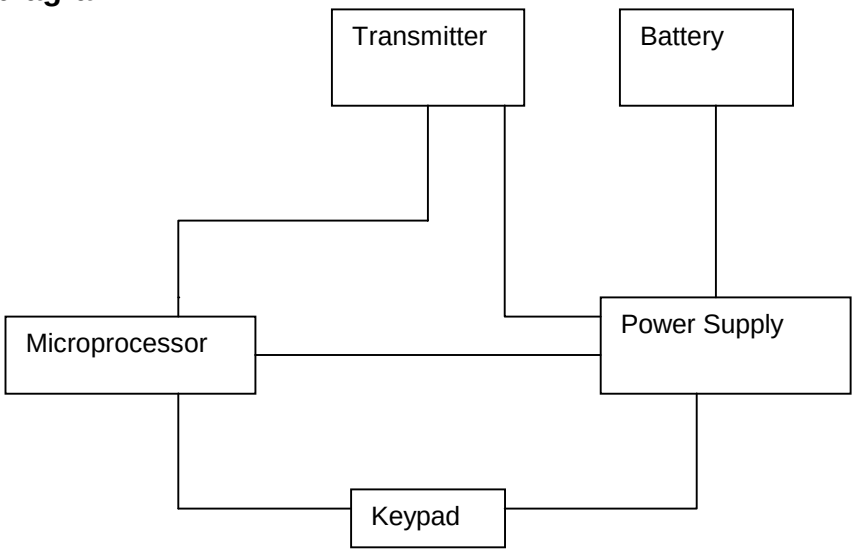
The EUT requires no special accessories to comply with the required specification limits.

4.3 Equipment Modifications

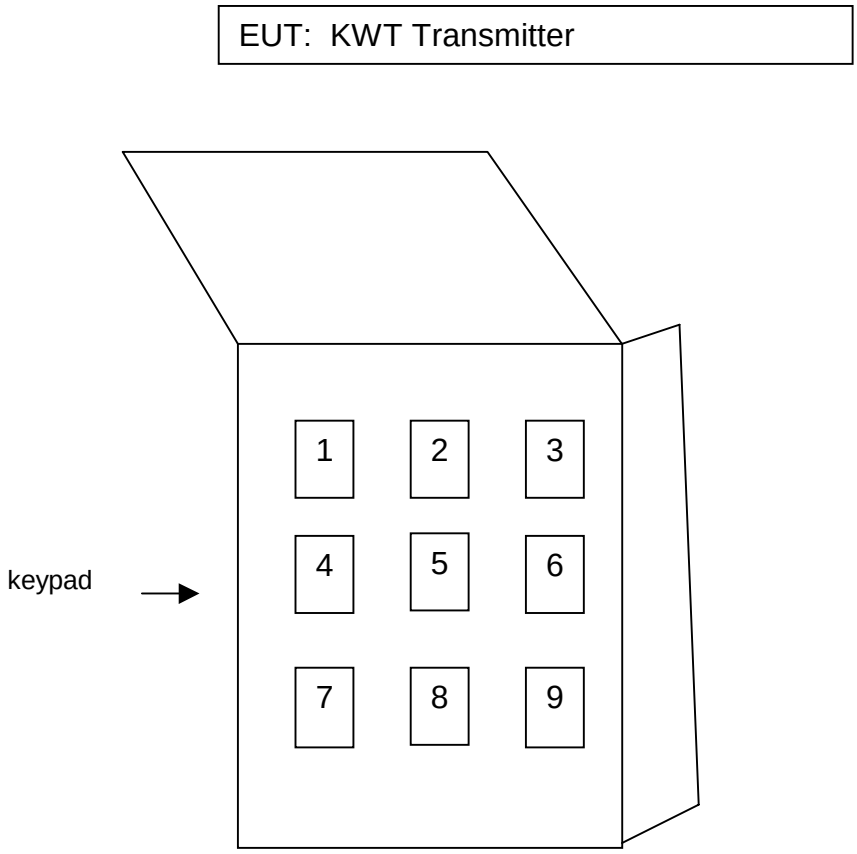
No modifications and/or adjustments were made to the EUT during compliance testing to achieve the required specification limits.

5 BLOCK DIAGRAM(S) OF THE EUT

5.1 Block diagram



5.2 Figure: Configuration of Tested System



Radiated Emissions Table Top

6 TEST DATA

6.1 Radiated Emissions Data

6.1.1 Table: FCC Part 15, Subpart C, Section 15.231 Radiated Emissions Limits

Fundamental Frequency (MHz)	***Field Strength of fundamental dB(μV/m)***	***Field Strength of Spurious Emissions dB(μV/m)***
260 – 470	71.48 – 81.94	51.48 – 61.94
303	74.95*	54.95*

* Linear interpolation of field strength requirement.
Note: Radiated Emission Limits for the Restricted Bands are the same as Table 6.1.4.

6.1.2 Table: Judgement

EUT	KWT Transmitter
Judgement	Passed by 3.97 dB

FCC Part 15 Subpart C Section 15.231
Radiated Emissions @ 3 Meters
Data Sheet

Date :23 December 1999
Customer :Martec Access Products
Technician :Grant Metzgar

EUT : KWT Remote Transmitter

	Frequency (MHz)	Measured Level (dBuV)	Antenna Factor +(dB)	Cable Loss +(dB)	Preamp Gain -(dB)	Corrected Level* (dBuV/m)	Spec Limit (dBuV/m)	Polarity (V/H)	Delta to Limit	Restricted Bands
1	303	92.9	13.8	3.5	32.5	66.70	74.90	V	-8.20	No
2	606	65.8	19.9	5.7	32.0	48.40	54.95	V	-6.55	No
3	909	41.55	23.2	7.3	32.0	29.05	54.95	V	-25.90	No
4	1212	51.3	26.30	4.30	29.90	41.00	54.95	V	-13.95	No
5	1515	60.3	25.80	4.30	29.40	50.00	53.97	V	-3.97	**Yes**
6	1818	40.5	27.10	4.20	29.20	31.60	54.95	V	-23.35	No
7	2121	42.1	29.80	4.00	29.00	35.90	54.95	H	-19.05	No
8	2424	44.2	30.10	4.10	27.50	39.90	54.95	V	-15.05	No
9	2727	-7.2	30.40	5.20	27.50	-10.10	53.97	V	-64.07	**Yes**
10	3030	-5.3	30.80	6.40	24.90	-4.00	54.95	V	-58.95	No

***Includes Duty Cycle Correction Factor :** 11dB

Equipment used :
Low loss cables, S/N 329 (3m), S/N 338 (3m), S/N 331 (1m)
HP8449B Preamp
EMCO 3115 Antenna S/N 2845
HP8572A EMI receiver S/N 3010A01163

6.1.3 Correction Factors

Frequency MHz	*Antenna Factor +(dB)*	*Cable Loss*	*Preamp Gain -(dB)*	*Duty Cycle Correction -(dB)*	*Correction Factor dB(1/m)*
303.0	13.8	3.5	32.5	11	26.2
606.0	19.9	5.7	32.0	11	17.4
909.0	23.2	7.3	32.0	11	12.5
1212.0	26.30	4.30	29.9	11	10.3
1515.0	25.80	4.30	29.40	11	10.3
1818.0	27.10	4.20	29.20	11	8.9
2121.0	29.80	4.00	29.00	11	6.2
2424.0	30.10	4.10	27.50	11	4.3
2727.0	30.40	5.20	27.50	11	2.9

6.1.3.1 Duty cycle calculations

Total pulse length is 58.2 ms
Two pulses of 1.52 ms and 40 pulses of 0.520 ms for a total of 23.84 ms
For reporting purpose a more conservative 28 ms taken from manufacturing data was used.
28 ms /100 ms = 280 ms 20 log 280 ms = 11 dB

6.1.4 Table: Section 15.209 Radiated Emissions Limits General Requirements

Fundamental Frequency (MHz)	*Field Strength dB(µV/m)*
30 – 88	40
88 – 216	43.52
216 – 960	46.02
Above 960	53.97

6.1.5 Data Collection Procedure

The following data lists the significant emission frequencies, measured levels, correction factor (includes cable, preamplifier, antenna and duty cycle), the corrected reading, plus the limit. An initial scan of the device was made over the frequency range of 30 MHz to 10 times the fundamental frequency of 303.83 MHz in a shielded enclosure. Final data was measured in an open field test site at 3 meters. Supplemental data is included in the Section 9 of this report.

6.1.6 Table: Judgement

EUT	KWT Transmitter
Judgement	Passed by 17.8 dB

6.1.7 Table: Summary of Highest Radiated Emissions Levels

Frequency MHz	*Polarity V/H*	*Antenna Height cm*	*Antenna Azimuth deg*	*Correction Factor dB(1/m)*	*Limit dB(µV/m)*	*Corrected Reading dB(µV/m)*	*Margin dB*
636.600	V	100	0	-5.8	46.02	28.2	-17.8
564.700	V	100	0	-7.2	46.02	27.0	-19.0
81.170	V	100	0	-23.4	40.00	20.8	-19.2
291.399	V	100	0	-15.5	46.02	21.3	-24.7
192.300	V	100	0	-20.4	43.52	17.7	-25.8
168.400	V	100	0	-19.8	43.52	17.6	-25.9

- All measured levels are made using a peak detector unless stated otherwise, with an IF bandwidth of 120 kHz, up to 1 GHz and a 1 MHz IF bandwidth above 1 GHz. A video filter was not used.
- No emissions were detected below the fundamental frequency.

6.1.8 Field Strength Calculation

The field strength is calculated by adding the antenna factor and cable factor, and subtracting the amplifier gain (if any) and duty cycle correction factor from the measured reading. The basic equation with a sample calculation is as follows:

FS=RA + AF + CF – AG - DC

Where:

FS = field strength dB (μV/m)

RA = receiver amplitude dB (μV)

AF = antenna factor dB/m

CF = cable attenuation factor dB

AG = amplifier gain dB

DC = duty cycle correction factor

Example: Assume a receiver reading of 99.2 dB (μV) is obtained. The antenna factor of 13.3 and cable factor of 4 is added. The amplifier gain of 32.5 dB is subtracted, and the duty cycle correction factor of 10.7 is subtracted giving a field strength of 73.3 dB (μV/m.)

FS = 99.2 + 13.3 + 4.0 – 32.5 -10.7 = 73.3 dB (μV/m)

6.1.9 Measurement Uncertainty

The measurement uncertainty (with a confidence level of 95%) for this test was: 5.59 dB

6.2 Section 15.231 Bandwidth Measurements

The requirement for bandwidth is 0.25% of the fundamental measured 20 dB down from the modulated carrier. At 303.85 MHz 0.25% is 7.57.71 kHz. The actual measurement at 20 dB down was 211 kHz, which complies with the rules. See Section 9, Supplemental Pages Section for bandwidth measurements.

6.3 Section 15.203 Antenna Requirement

Requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. Since there is no external antenna and no user installable antenna the device complies with the rules.

7 TEST EQUIPMENT

A complete list of test equipment used of reach test can be found in their perspective test procedure. The absolute performance calibration of equipment requiring calibration is performed on an as needed basis in accordance with MIL-STD 45662. The test equipment is capable of making measurements within tolerances of at least +/- 2 dB amplitude and +/- 2% frequency deviation. Equipment certifications showing traceability to NIST (National Institute of Standards and Technology) are maintained on file at Instrument Specialties Corporate offices in Delaware Water Gap, PA. All equipment is checked and verified for proper operation before and after each series of tests.

7.1 Measurement Equipment

Mfgr./Model	Description	Serial	Calibration Due
HP/8572A	(100 Hz – 22 GHz) EMI receiver sys #1	3010A01163	9/29/00
HP/85879A	EMI Radiated Emissions Measurement software	VA 02.01	Calibration Not Required
CHA/CBL6111A	(30 MHz – 1 GHz) bilog	1822	12/28/99
EMCO/3115	Antenna	2845	10/11/00
HP/8449B	1.265 GHz RF amplifier	3008A00373	9/29/00

8 TEST MEASUREMENT PHOTOS

8.1.1 Test Photographs

Photo Layout	***Test Type***	***Remarks***	***Page No.***
Top	Radiated Emissions	FCC Part 15, Class B	13
Bottom	Radiated Emissions	FCC Part 15, Class B	
Top	Radiated Emissions above 1 GHz	FCC Subpart C 15.231	14
Bottom	Radiated Emissions above 1 GHz	FCC Subpart C 15.231	

FCC Class B Radiated Emissions - KWT Transmitter

FCC Class B Radiated Emissions - KWT Transmitter

FCC Class B Radiated Emissions - above 1 GHz - KWT Transmitter

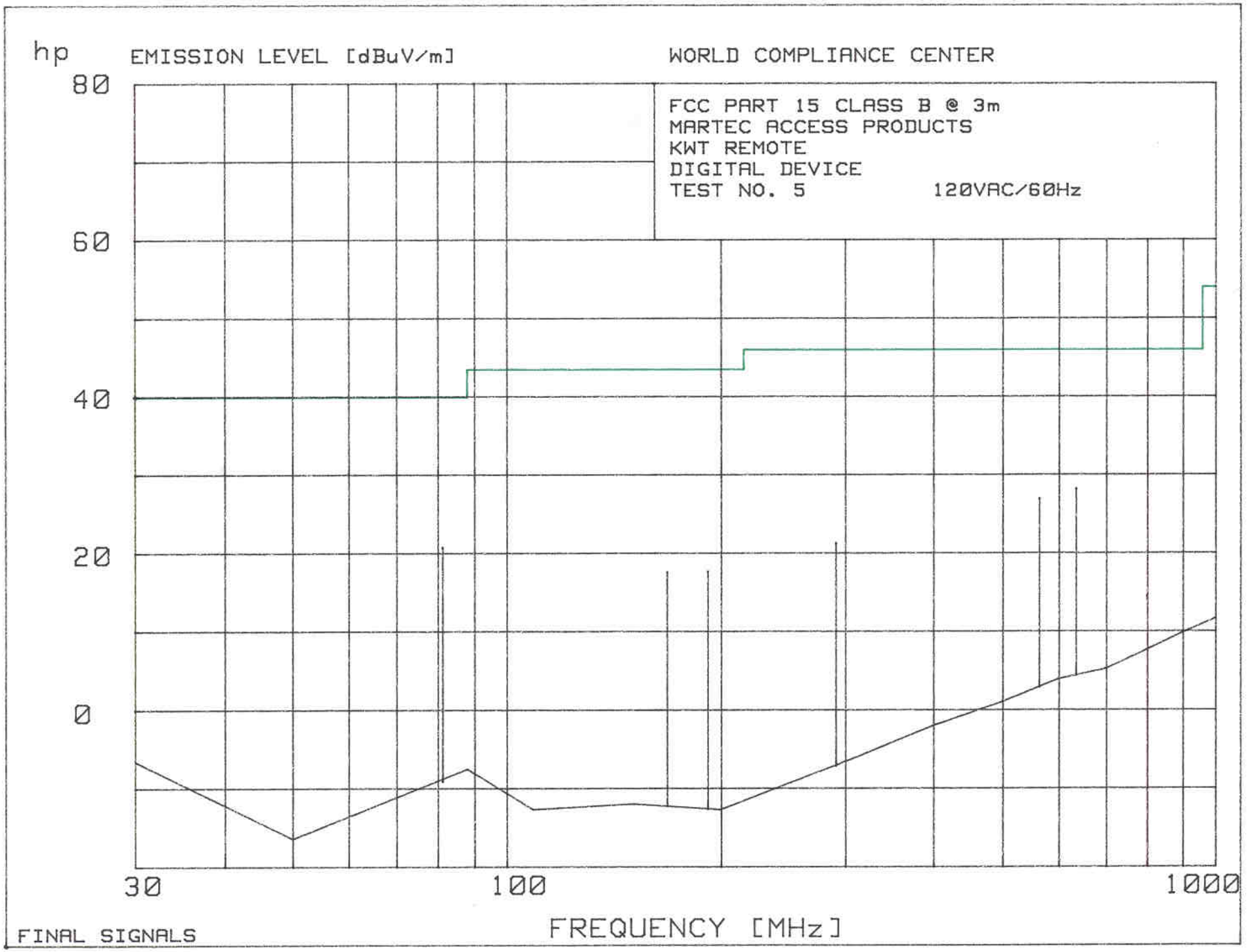
FCC Class B Radiated Emissions - above 1 GHz - KWT Transmitter

9 SUPPLEMENTAL TEST DATA

9.1 Table: Index of Test Data Sheets

9.1.1 Test Data Sheets

Test Type	*Test Name*	*Comments*	*Data Format*	*Page No.*
Radiated Emissions	FCC Part 15 at 3 meters	Spurious Emissions	plotted	16
Radiated Emissions	FCC Part 15 at 3 meters	Spurious Emissions	tabulated	17
Radiated Emissions	FCC Part 15 at 3 meters	Harmonics	tabulated	18
Radiated Emissions	FCC Part 15 at 3 meters	Fundamental	plotted	19
Radiated Emissions	FCC Part 15 at 3 meters	Bandwidth	plotted	20-21
Conducted Emissions	Duty Cycle	Pulse Width	plotted	22
Conducted Emissions	Duty Cycle	Pulse Width	plotted	23
Conducted Emissions	Duty Cycle	Pulse Train Duration	plotted	24
Conducted Emissions	Duty Cycle	Pulse Train Repetition	plotted	25


hp
EMISSION LEVEL [dBuV/m]
WORLD COMPLIANCE CENTER
80
60
40
20
0
FCC PART 15 CLASS B @ 3m
MARTEC ACCESS PRODUCTS
KWT REMOTE
DIGITAL DEVICE
TEST NO. 5
120VAC/60Hz
30
100
1000
FREQUENCY [MHz]
FINAL SIGNALS

INSTRUMENT SPECIALTIES CO., INC
WORLD COMPLIANCE CENTER
TEST DATA

REPORT No.: 112384 DATE: 23 DECEMBER 1999 TEST No.: 5
TITLE OF TEST: FCC PART 15 CLASS B RADIATED EMISSIONS @ 3m
CUSTOMER: MARTEC ACCESS PRODUCTS
EUT DESCRIPTION: KWT REMOTE
TEST MODE: DIGITAL DEIVICE ACTIVE
SERIAL No.: N/A
FREQUENCY RANGE: 30MHz-1000MHz SENSOR LOCATION/POLARIZATION: WORSE CASE
INPUT POWER: 9VDC TEMP: 66.2 f HUM: 15.8 % BAR: 30.25 "
TEST PERFORMED BY: STEVEN R. BULLIS
TEST RESULTS: COMPLIES
TEST CONDITIONS: TABLE TOP ARRANGEMENT. DIGITAL DEVICE ONLY.

PRODUCT EMISSIONS

FCC PART 15 CLASS B @ 3m Data File: TEST NO. 5 23 Dec 1999 09:21

No	EMISSION FREQUENCY MHz	SPEC LIMIT dBuV/m	MEASUREMENTS ABS	dLIM dB	MODE	POL	SITE HGT cm	AZM deg	CORR FACTOR dB	COMMENTS
1	81.170	40.0	20.8	-19.2	PK	V	100	0	-23.4	NOISE FLOOR
2	168.400	43.5	17.6	-25.9	PK	V	100	0	-19.8	NOISE FLOOR
3	192.300	43.5	17.7	-25.8	PK	V	100	0	-20.4	NOISE FLOOR
4	291.399	46.0	21.3	-24.7	PK	V	100	0	-15.5	NOISE FLOOR
5	564.700	46.0	27.0	-19.0	PK	V	100	0	-7.2	NOISE FLOOR
6	636.600	46.0	28.2	-17.8	PK	V	100	0	-5.8	NOISE FLOOR

FCC Part 15 Subpart C Section 15.231
Radiated Emissions @ 3 Meters
Data Sheet

Date : 23-Dec-99
Customer Martec
Tech : Grant Metzgar

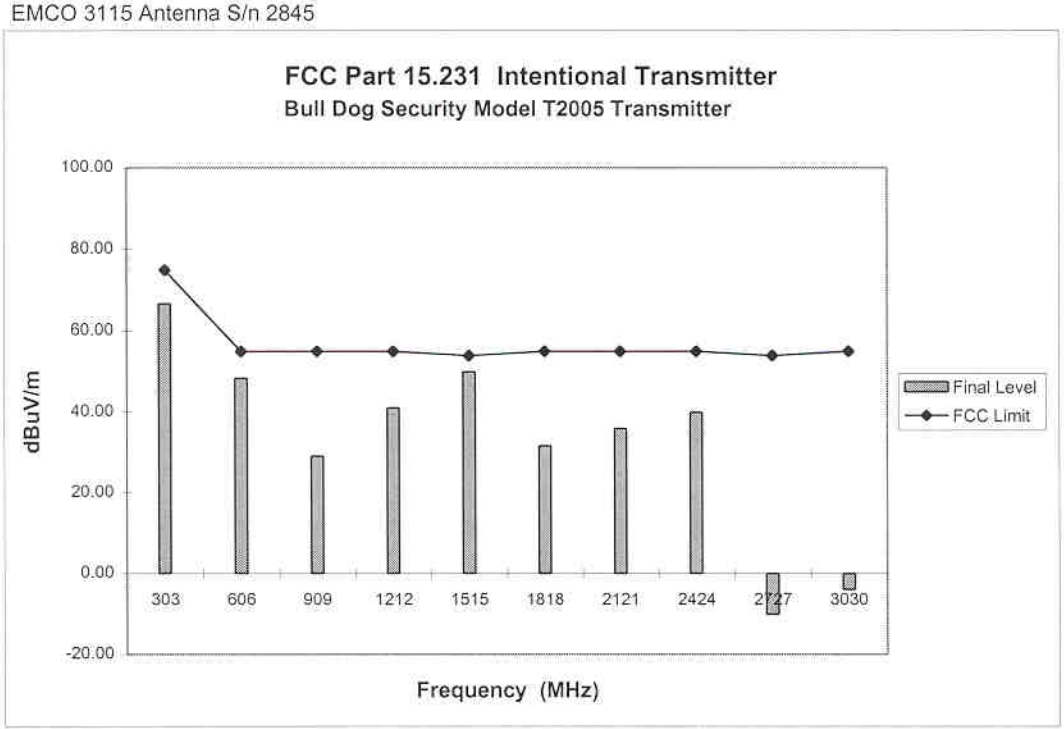
EUT : KWT Remote Transmitter

	Frequency (MHz)	Measured Level (dBuV)	Antenna Factor +(dB)	Cable Loss +(dB)	Preamp Gain -(dB)	Corrected Level (dBuV/m)	Spec Limit (dBuV/m)	Polarity (V/H)	Delta to Limit	Restricted Bands
1	303	92.9	13.8	3.5	32.5	66.70	74.9	V	-8.20	No
2	606	65.8	19.9	5.7	32	48.40	54.95	V	-6.55	No
3	909	41.55	23.2	7.3	32	29.05	54.95	V	-25.90	No
4	1212	51.3	26.30	4.30	29.90	41.00	54.95	V	-13.95	No
5	1515	60.3	25.80	4.30	29.40	50.00	53.97	V	-3.97	**Yes**
6	1818	40.5	27.10	4.20	29.20	31.60	54.95	V	-23.35	No
7	2121	42.1	29.80	4.00	29.00	35.90	54.95	H	-19.05	No
8	2424	44.2	30.10	4.10	27.50	39.90	54.95	V	-15.05	No
9	2727	-7.2	30.40	5.20	27.50	-10.10	53.97	V	-64.07	**Yes**
10	3030	-5.3	30.80	6.40	24.90	-4.00	54.95	V	-58.95	No

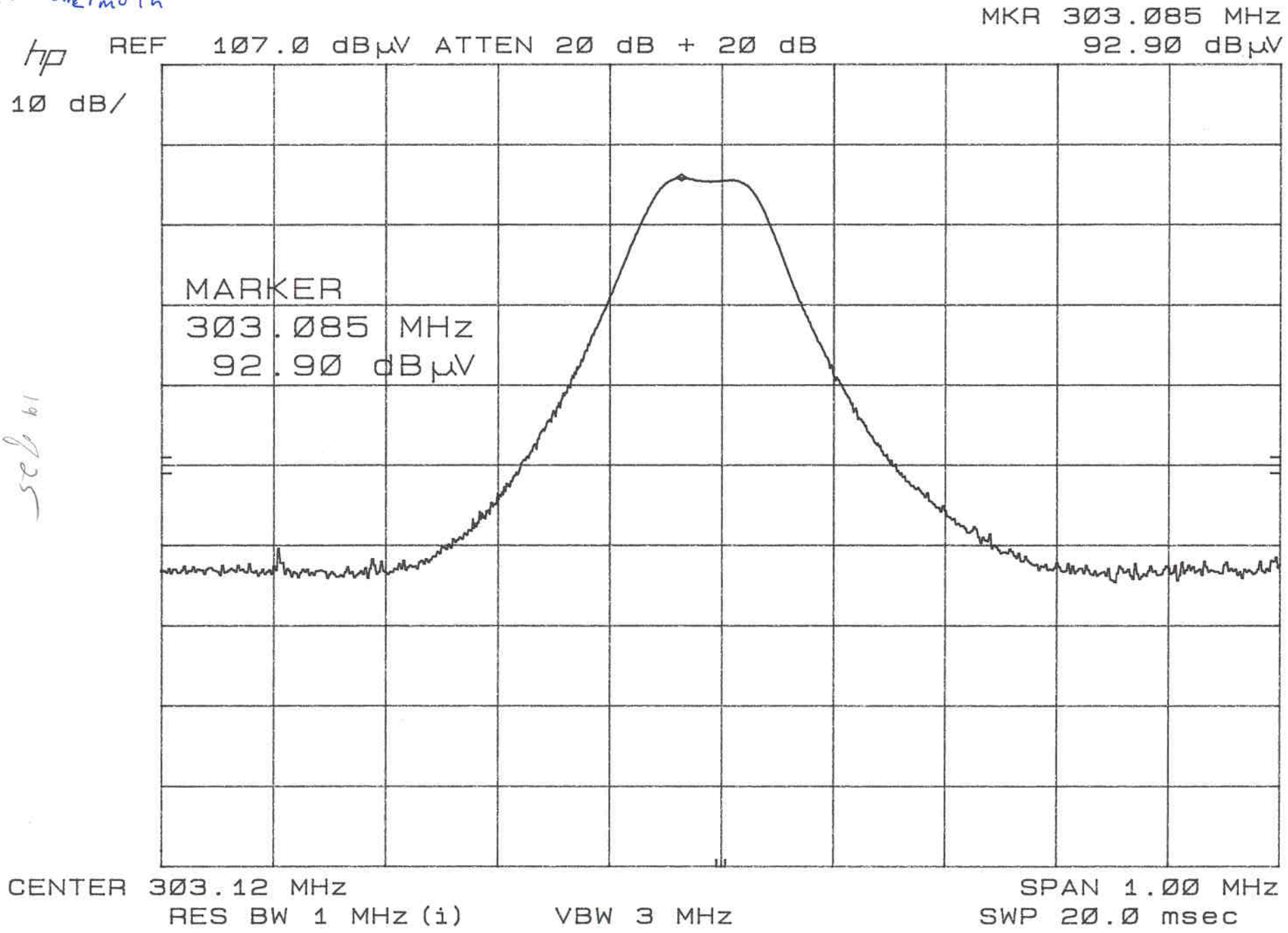
Duty Cycle Correction Factor : 11

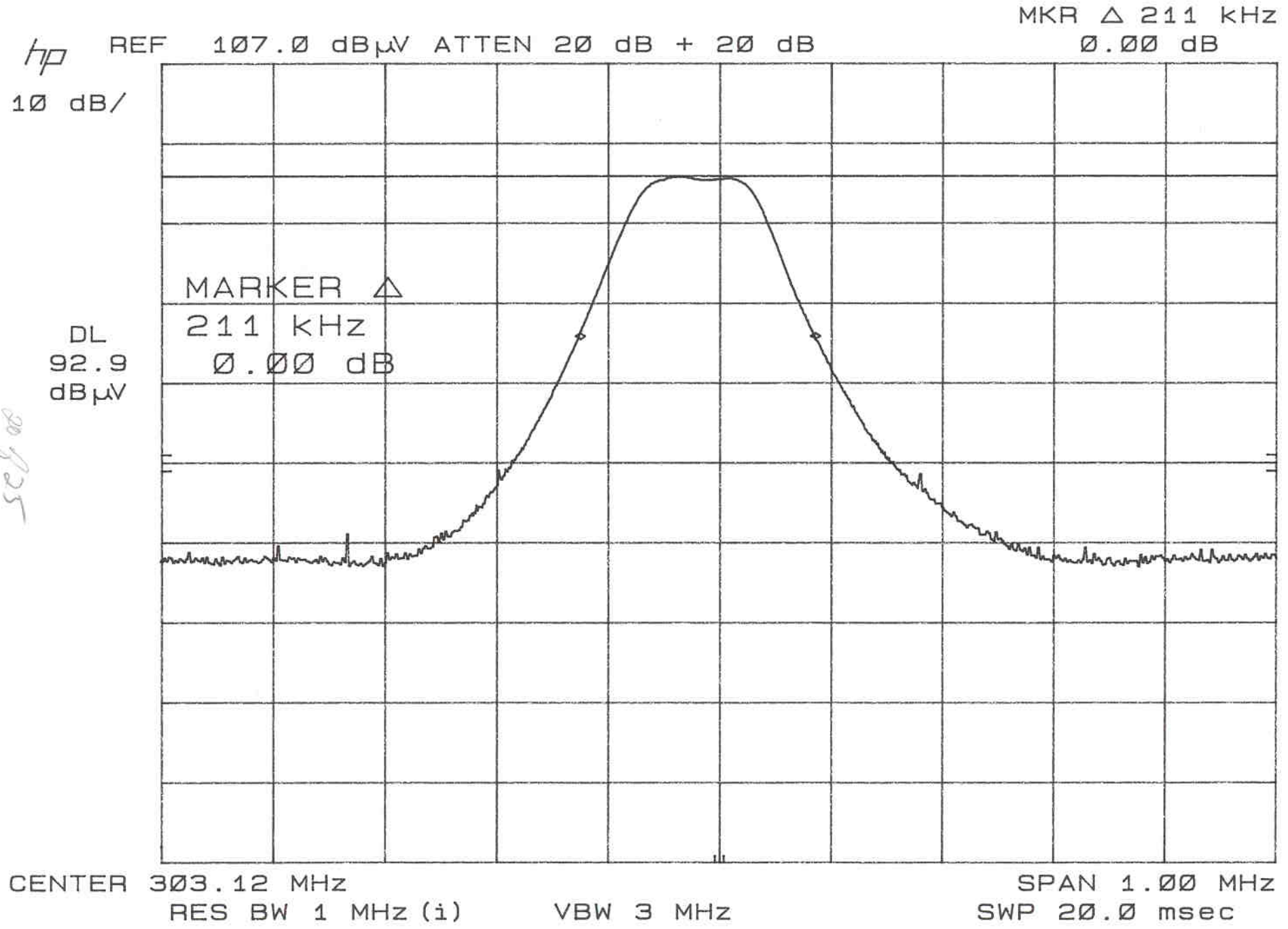
Equipment used :
Low loss cables , S/n 329 (3M), S/n 338 (3m), S/n 331 (1m)
HP8449B Preamp

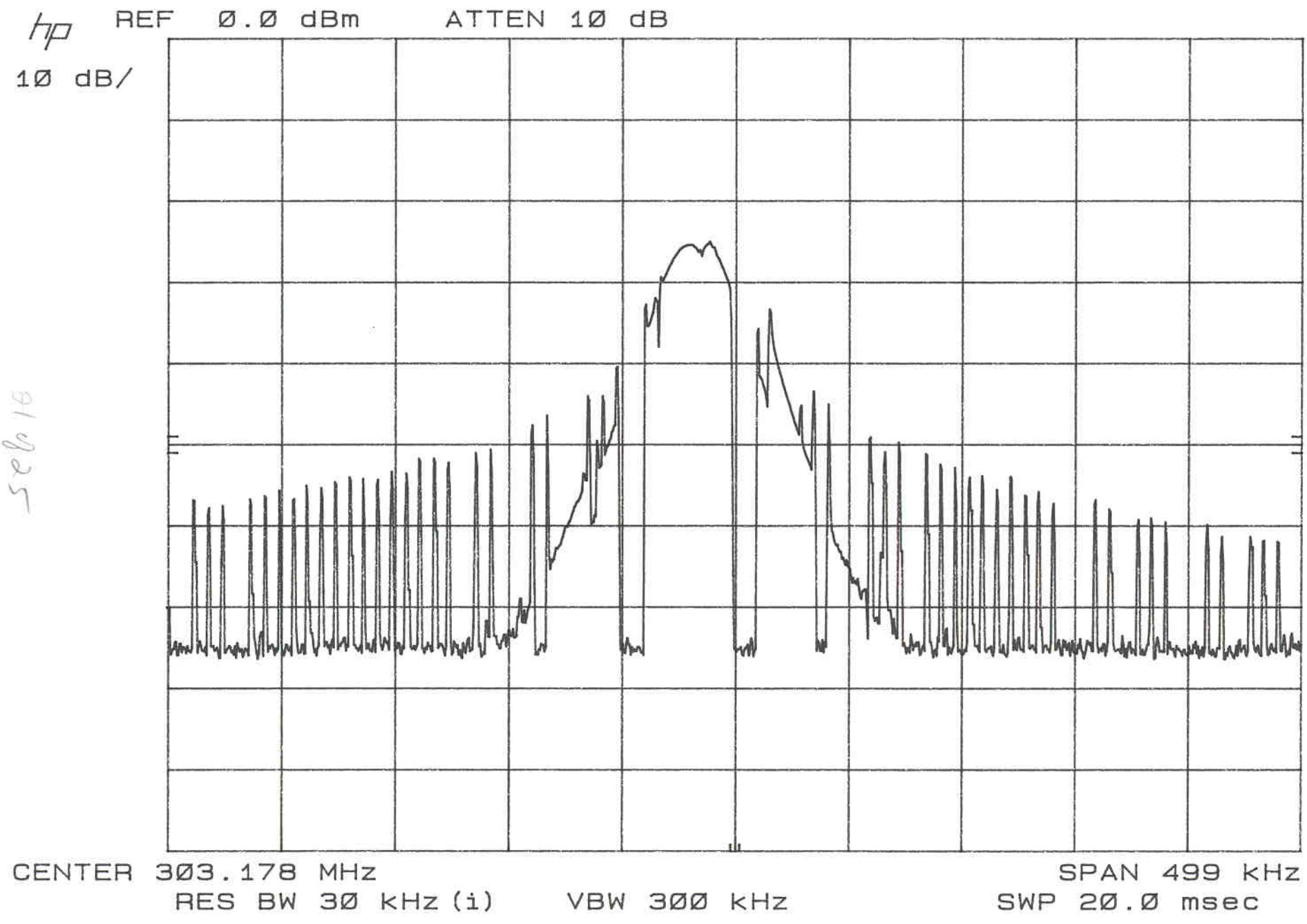
EMCO 3115 Antenna S/n 2845



CW Mode Fundamental
1.64m Vertical Antenna Hieght
90° Azimuth




MKR Δ 211 kHz
Ø.ØØ dB
hp REF 107.Ø dBμV ATTEN 2Ø dB + 2Ø dB
1Ø dB/
MARKER Δ
211 kHz
Ø.ØØ dB
DL
92.9
dBμV
CENTER 3Ø3.12 MHz
SPAN 1.ØØ MHz
RES BW 1 MHz (i)
VBW 3 MHz
SWP 2Ø.Ø msec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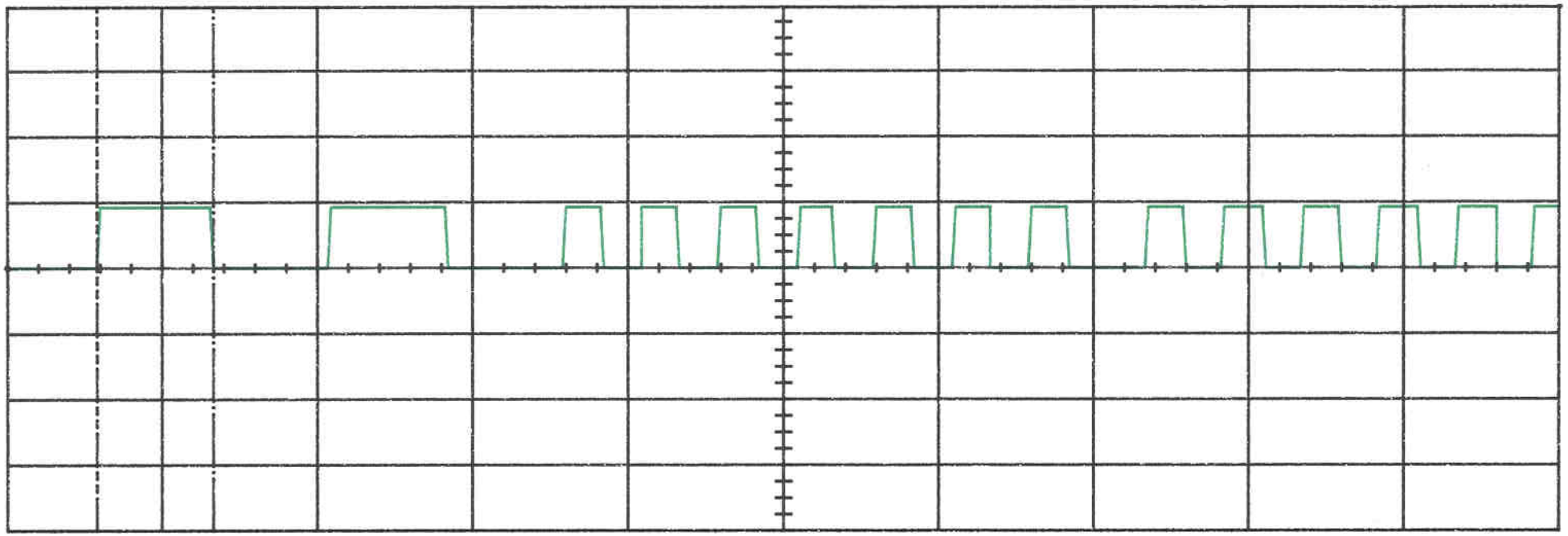
REF 0.0 dBm
ATTEN 10 dB
10 dB/
CENTER 303.178 MHz
SPAN 499 kHz
RES BW 30 kHz (i)
VBW 300 kHz
SWP 20.0 msec



	Timebase	Delay/Pos	Reference	Mode
Main	2.00 ms/div	8.80000 ms	Center	Realtime (NORMAL)
	Sensitivity	**Offset**	**Probe**	**Coupling**
Channel 1	5.00 V/div	0.00000 V	10.00 : 1	dc (1M ohm)

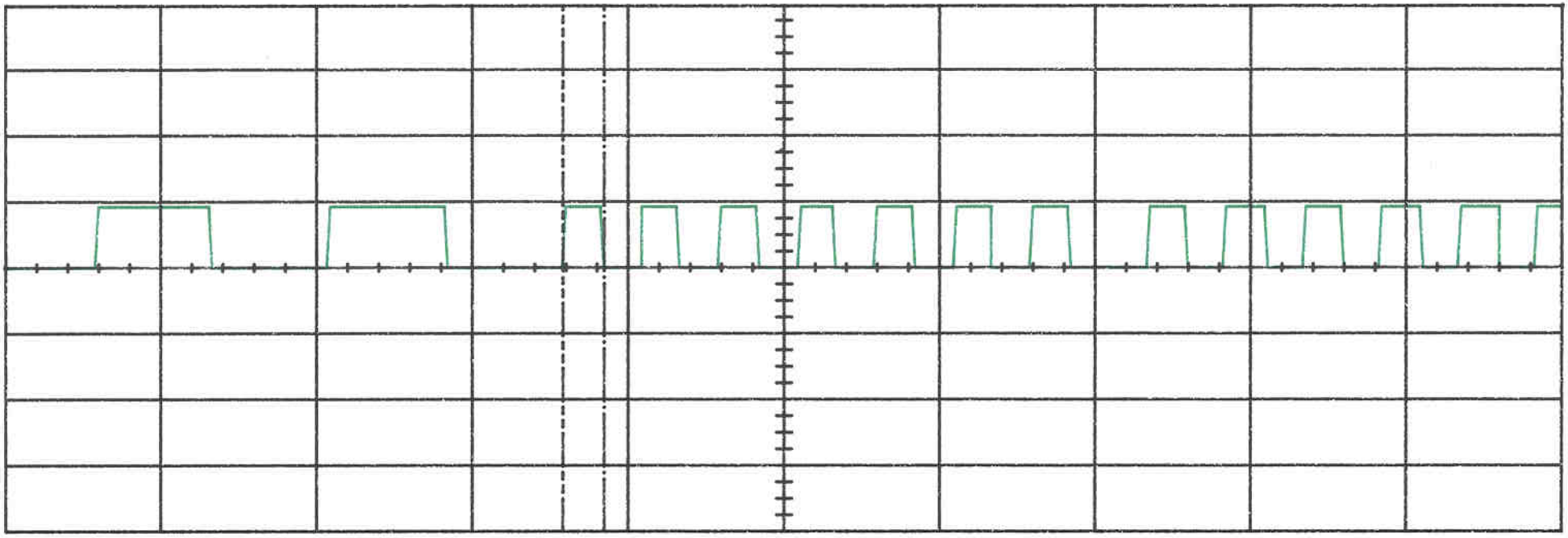
Trigger mode : Edge
On Positive Edge Of Chan1
Trigger Level
Chan1 = 2.50000 V (noise reject OFF)
Holdoff = 40.000 ns

Markers
Vmarker2 (c1) = 5.62500 V
Vmarker1 (c1) = -7.03125 V
delta V (c1) = 12.6563 V

stop = 1.48000 ms
start = -40.0000 us
delta t = 1.52000 ms
1/delta t = 657.895 Hz

Measurements
V rms (c1) = 2.34354 V

Specification	FCC PART 15.231
Characteristics	PULSE WIDTH
Sales Order No.	112384
Date	23 DEC 99
Technician	



	Timebase	Delay/Pos	Reference	Mode
Main	2.00 ms/div	8.80000 ms	Center	Realtime (NORMAL)
	Sensitivity	**Offset**	**Probe**	**Coupling**
Channel 1	5.00 V/div	0.00000 V	10.00 : 1	dc (1M ohm)

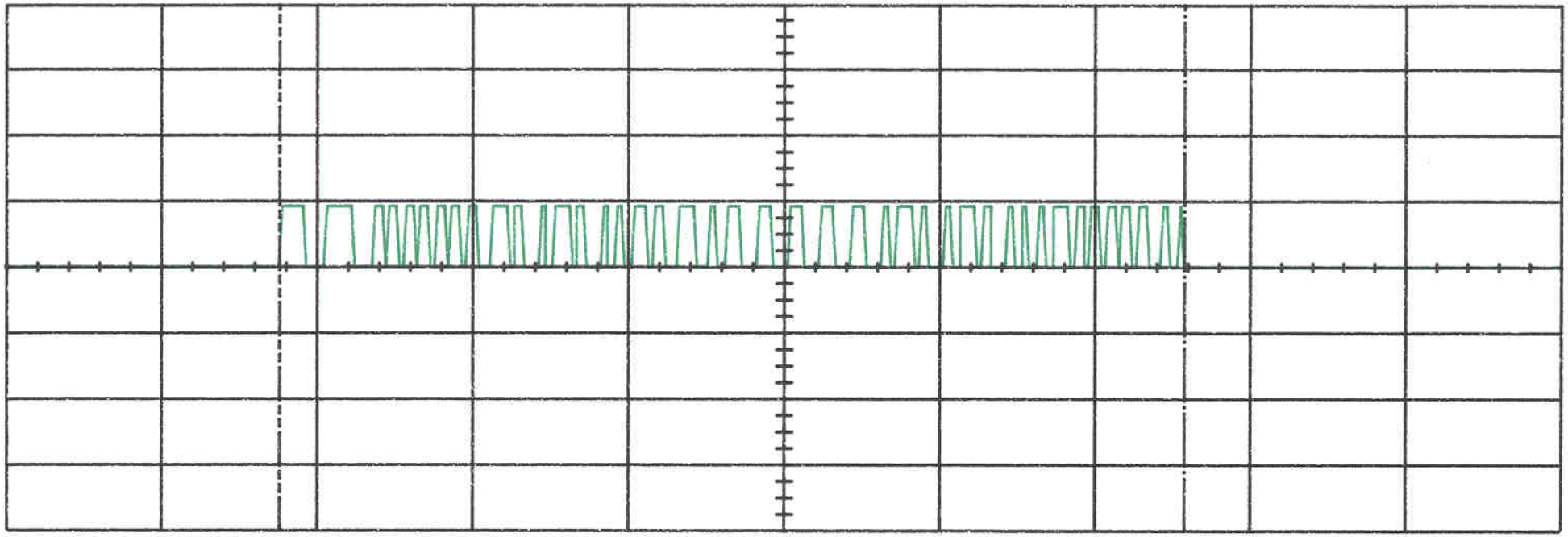
Trigger mode : Edge
On Positive Edge Of Chan1
Trigger Level
Chan1 = 2.50000 V (noise reject OFF)
Holdoff = 40.000 ns

Markers
Vmarker2(c1) = 5.62500 V
Vmarker1(c1) = -7.03125 V
delta V (c1) = 12.6563 V

stop = 6.48000 ms
start = 5.96000 ms
delta t = 520.000 us
1/delta t = 1.92308 kHz

Measurements
V rms (c1) = 2.34354 V

Specification	FCC PART 15.231
Characteristics	PULSE WIDTH
Sales Order No.	112384
Date	23 DEC 99
Technician	



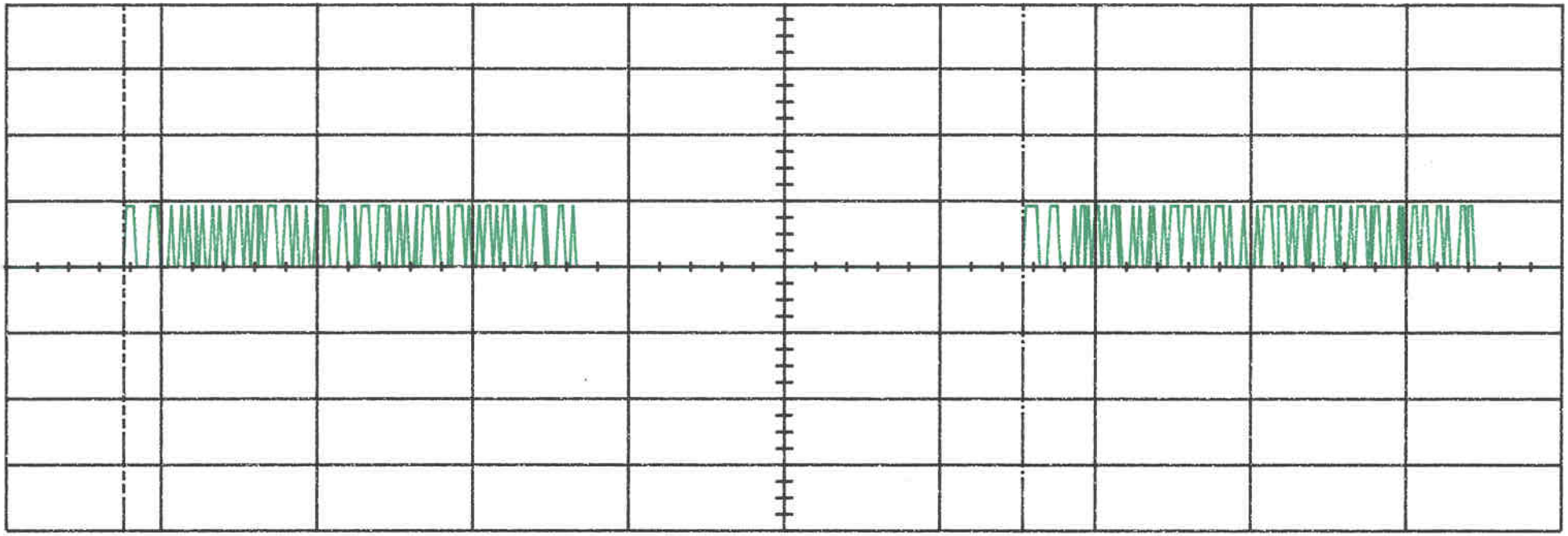
	Timebase	Delay/Pos	Reference	Mode
Main	10.0 ms/div	32.0000 ms	Center	Realtime (NORMAL)
	Sensitivity	**Offset**	**Probe**	**Coupling**
Channel 1	5.00 V/div	0.00000 V	10.00 : 1	dc (1M ohm)

Trigger mode : Edge
On Positive Edge Of Chan1
Trigger Level
Chan1 = 2.50000 V (noise reject OFF)
Holdoff = 40.000 ns

Markers
stop = 57.8000 ms
start = -400.000 us
delta t = 58.2000 ms
1/delta t = 17.1821 Hz

Measurements
V rms (c1) = 2.33854 V

Specification	FCC Part 15.231
Characteristics	Pulse Train Donation
Sales Order No.	112384
Date	23 Dec 99
Technician	



	Timebase	Delay/Pos	Reference	Mode
Main	20.0 ms/div	84.0000 ms	Center	Realtime (NORMAL)
	Sensitivity	**Offset**	**Probe**	**Coupling**
Channel 1	5.00 V/div	0.00000 V	10.00 : 1	dc (1M ohm)

Trigger mode : Edge
On Positive Edge Of Chan1
Trigger Level
Chan1 = 2.50000 V (noise reject OFF)
Holdoff = 40.000 ns

Markers
stop = 114.800 ms
start = -800.000 us
delta t = 115.600 ms
1/delta t = 8.65052 Hz

Measurements
V rms (c1) = 2.34375 V

Specification	FCC PART 15.231
Characteristics	PULSE TRAIN REPETITION
Sales Order No.	112384
Date	23 DEC 99
Technician	