

MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: Millimeter Wave Technology, Inc.

MODEL: DIGI-TALKER Pro

FCC ID: NUM-DTP-1

DATE: March 30, 1998

This report concerns (check one): Original grant X

Class II change _____

Equipment type: Low Power FM Transmitter

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes _____ No X

If yes, defer until: _____
date

N.A. agrees to notify the Commission by N.A.
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

United States Technologies, Inc.
3505 Francis Circle
Alpharetta, GA 30004

Phone Number: (770) 740-0717
Fax Number: (770) 740-1508

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SECTION 1

GENERAL INFORMATION

GENERAL INFORMATION

Product Description

The Equipment Under Test (EUT) is a Millimeter Wave Technology, Inc. low power FM transmitter, Model DIGI-TALKER Pro. The EUT has a 120 second continuous play digital sound recorder.

Related Submittal(s)/Grant(s)

Not Applicable

SECTION 2

TESTS AND MEASUREMENTS

TESTS AND MEASUREMENTS

Configuration of Tested System

The sample was tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (1992). Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are shown in Figure 2.

The EUT was placed into a continuous mode of transmit and rotated about all 3 axis to obtain worse case results.

Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and submitted to the FCC, and accepted in their letter marked 31040/SIT. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number IC2982.

Test Equipment

Table 2 describes test equipment used to evaluate this product.

FCC ID: NUM-DTP-1

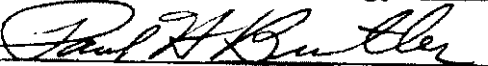
Modifications

The following modifications were made by US Tech, to bring the EUT into compliance with FCC Part 15, Class B Requirements.

- 1) L2 (260 mH) was removed to meet Occupied Bandwidth requirements.
- 2) R41 was originally a 5k Ω variable resistance which was adjusted to meet the Fundamental Emissions requirements. Final adjustment yielded a value of 1.65k Ω and will be replaced by a fixed value in final production units.
- 3) The internal processor software program was changed (function PWM) from a value limit of 111 to 110.

The above modifications will be implemented in all production models of this equipment.

Applicant: Millimeter Wave Technology, Inc.

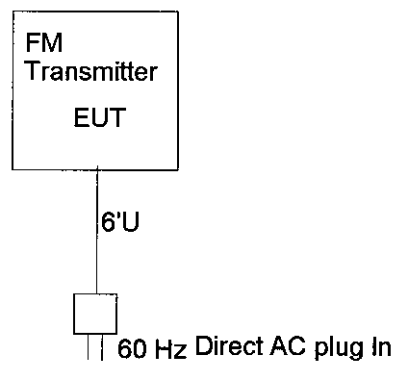
Signature: 

Name: Paul H. Butler

Date: April 9, 1998

Position: Vice President

FIGURE 1
TEST CONFIGURATION



Test Date: February 24, 1998
UST Project: 98-067
Customer: Millimeter Wave Technology, Inc.
Model: DIGI-TALKER Pro

FIGURE 2

Photograph(s) for Spurious and Fundamental Emissions

Photographs are unavailable

Test Date: February 24, 1998
UST Project: 98-067
Customer: Millimeter Wave Technology, Inc.
Model: DIGI-TALKER Pro

TABLE 1
EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
FM Transmitter Millimeter Wave Technology, Inc. (EUT)	DIGI-TALKER Pro	0001	NUM-DTP-1 (Pending)	None
AC Adaptor	None	None	None	6'U Direct Plug In

TABLE 2

TEST INSTRUMENTS

TYPE	MANUFACTURER	MODEL	SN.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124
SPECTRUM ANALYZER	HEWLETT-PACKARD	8558B	2332A09900
S A DISPLAY	HEWLETT-PACKARD	853A	2404A02387
COMB GENERATOR	HEWLETT-PACKARD	8406A	1632A01519
RF PREAMP	HEWLETT-PACKARD	8447D	1937A03355
RF PREAMP	HEWLETT-PACKARD	8449B	3008A00480
HORN ANTENNA	EMCO	3115	3723
ROBERTS ANTENNAS	COMPLIANCE DESIGN	A100	167
BICONICAL ANTENNA	EMCO	3110	9307-1431
LOG PERIODIC ANTENNA	EMCO	3146	9110-3600
BILOG	CHASE	CBL6112A	2238
LISN	SOLAR ELE.	8012-50	N/A
THERMOMETER	FLUKE	52	5215250
MULTIMETER	FLUKE	85	53710469
FUNCTION GENERATOR	TEKTRONIX	CFG250	CFG250TW15059
PLOTTER	HEWLETT-PACKARD	7475A	2325A65394

Bandwidth Limitation 47 CFR 15.239(a)

Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88-108 MHz. The 200 kHz bandwidth limitation is determined by measuring the bandwidth 26 dB below the peak. Figures 3 and 4 show the bandwidth at the lowest and highest frequency. Figures 5 and 6 show that the entire band is within the required frequency range. The EUT's speaker was modulated by a 1000 Hz tone at 100 dB SPL applied to the microphone as stated in ANSI C63.4 13.1.1.1.

Figure 3
Occupied Bandwidth Limitation 15.239(a)
Low Channel

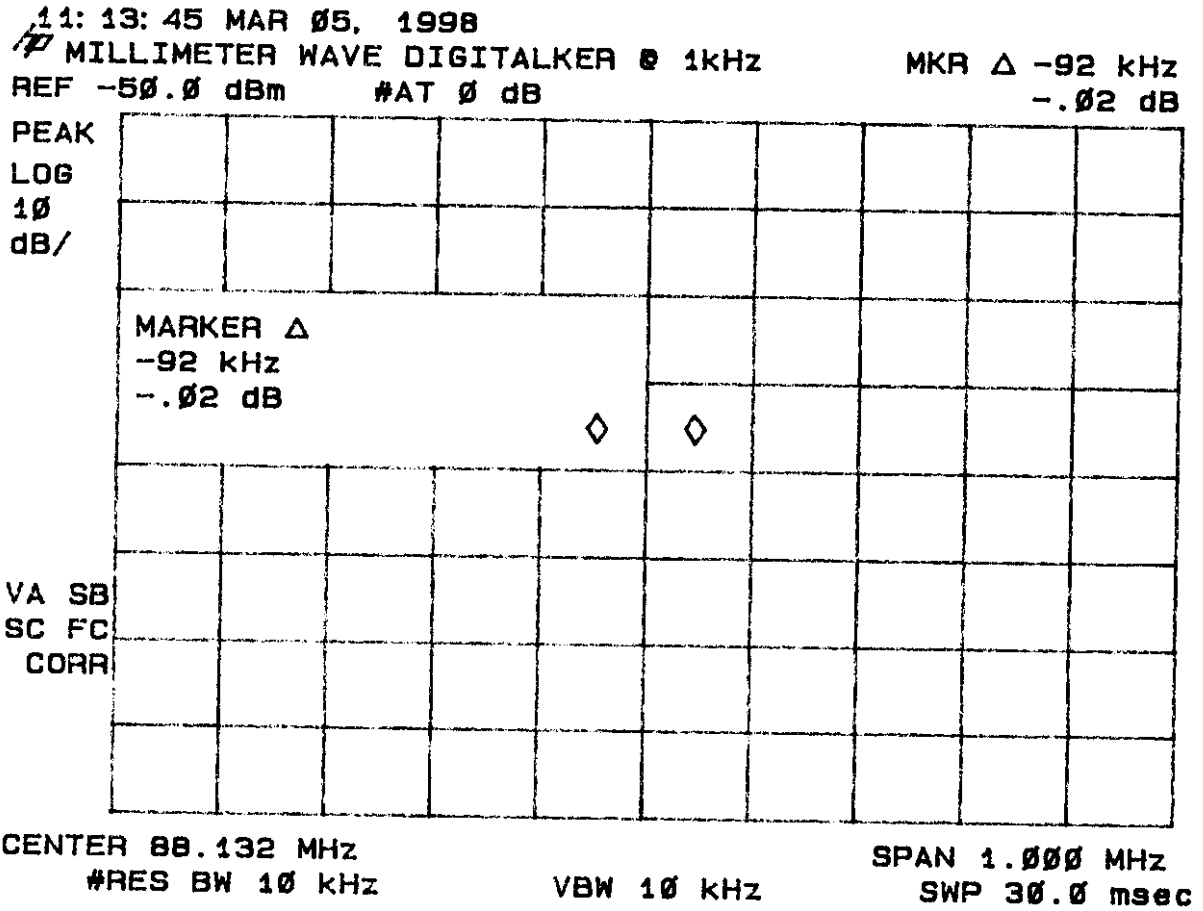


Figure 4
Occupied Bandwidth Limitation 15.239(a)
High Channel

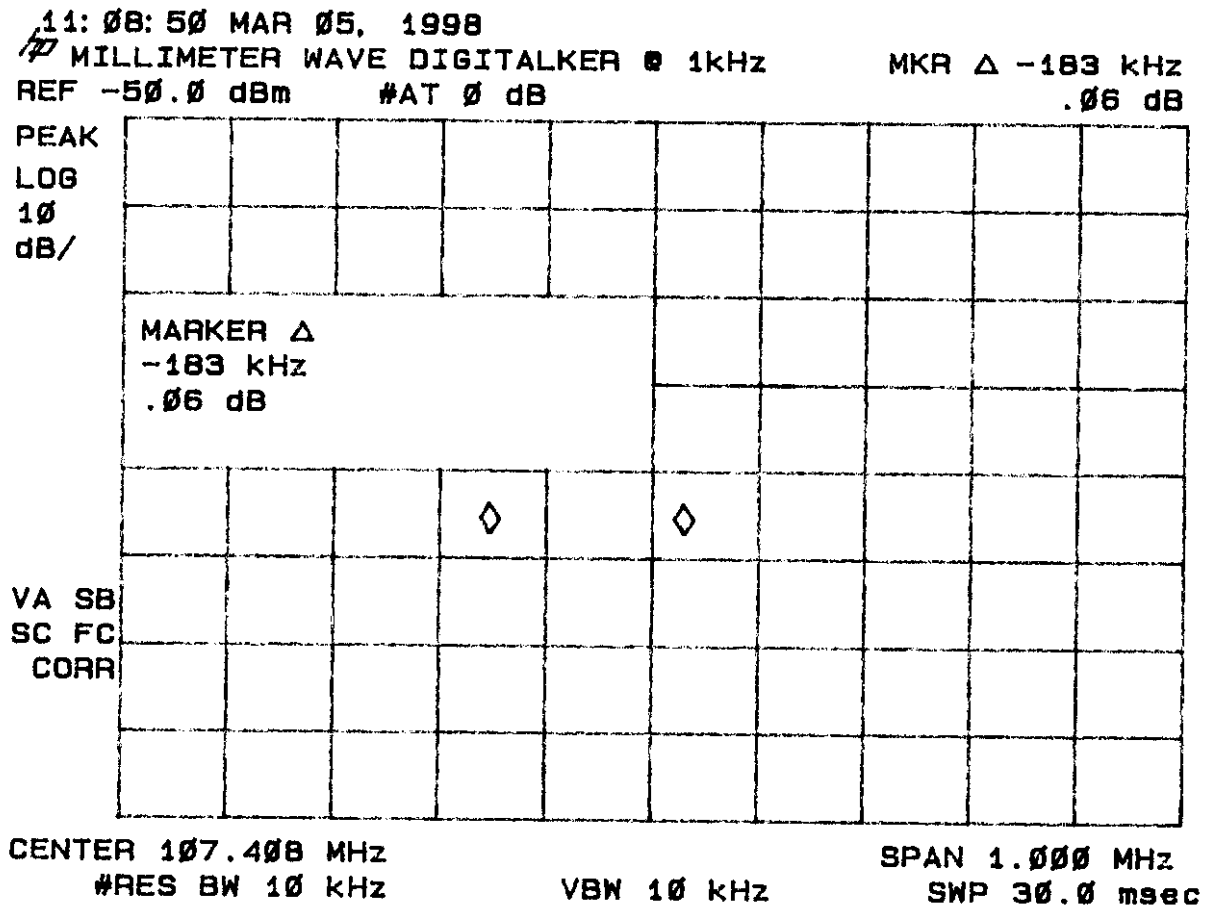


Figure 5
Band Edge Containment 15.239(a)
Low Channel

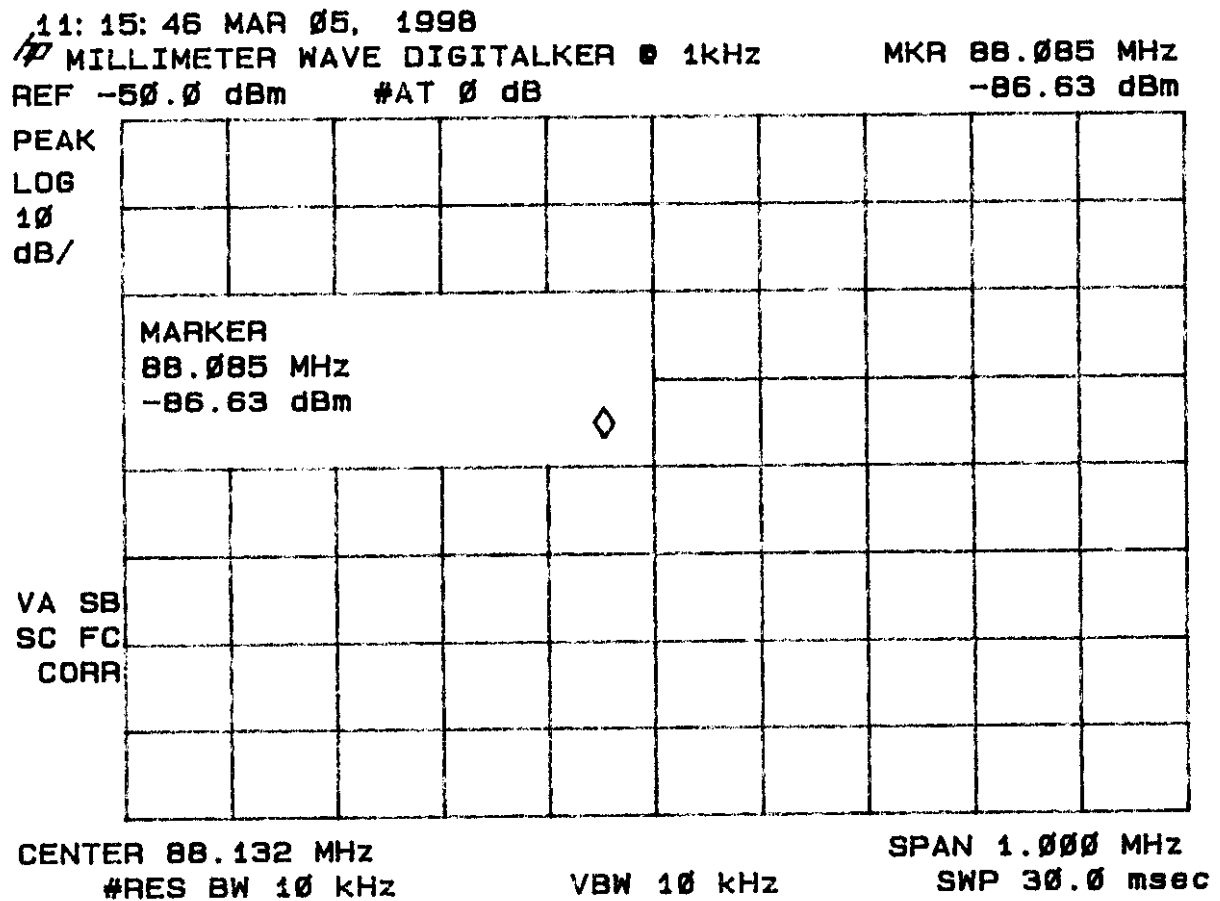
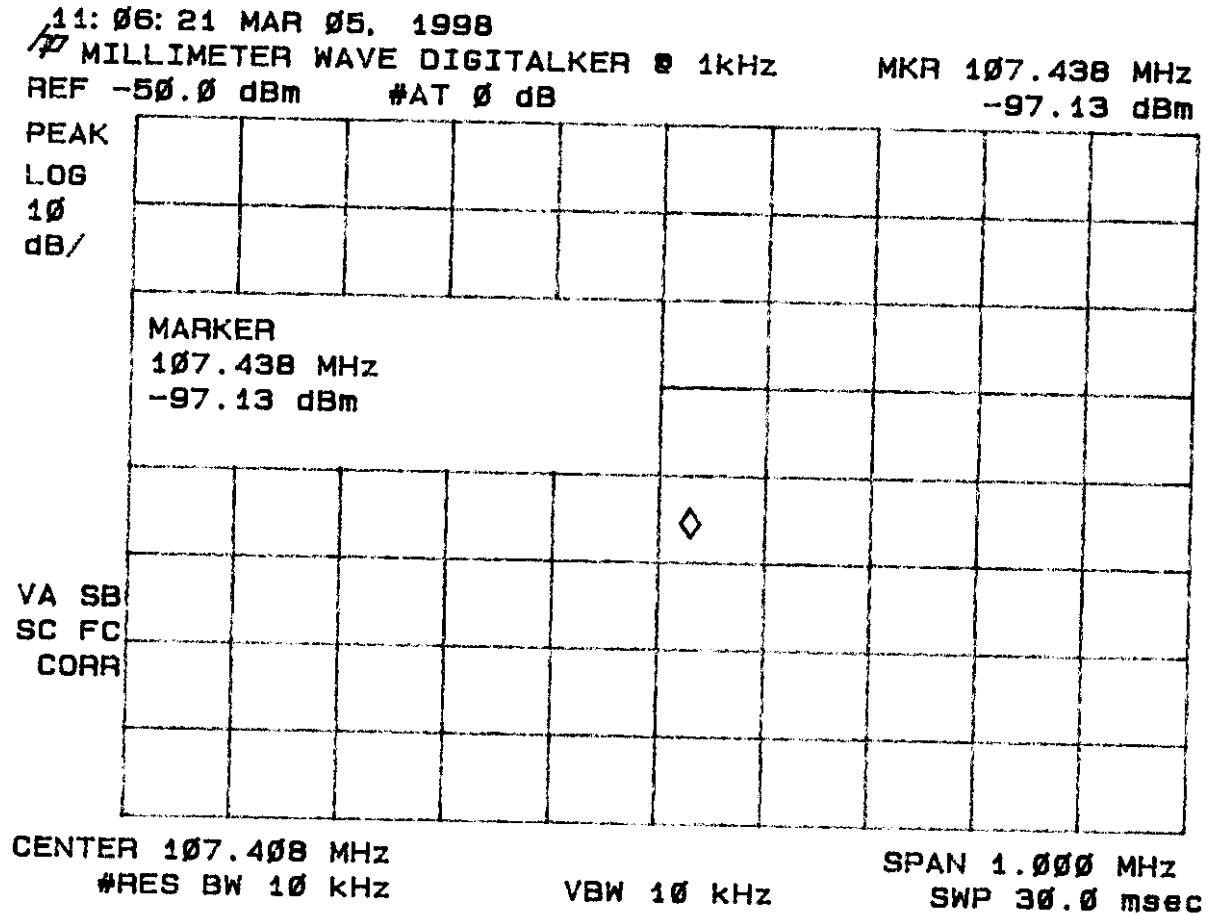


Figure 6
Band Edge Containment 15.239(a)
High Channel



Field Strength of Fundamental Emission (47 CFR 15.239(b))

Measurements were made using a peak detector. Field strength of the peak fundamental emission is shown in Tables 3 - 8 and Figures 7 -12.

TABLE 3

FIELD STRENGTH OF FUNDAMENTAL EMISSION

TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

Low Channel

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
89.5	-71.5	10.7	204.6	2,500

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-71.5 + 10.7 + 107)/20)$ = 204.6
 CONVERSION FROM dBm TO dBuV = 107 dB

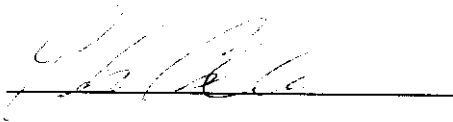
Tested By: Name: Erik Collins

TABLE 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION

TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

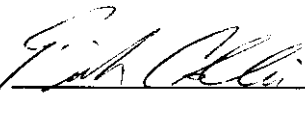
Mid Channel

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
97.7	-69.9	12.4	298.5	2,500

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-69.9 + 12.4 + 107)/20) = 209.3
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By:



Name: Erik Collins

TABLE 5

FIELD STRENGTH OF FUNDAMENTAL EMISSION

TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

High Channel

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
108.0	-70.4	13.3	312.6	2,500

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-70.4 + 13.3 + 107)/20) = 312.6$
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By:


Name: Erik Collins

TABLE 6

FIELD STRENGTH OF FUNDAMENTAL EMISSION

TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

Low Channel

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
89.5	-75.5	10.7	129.1	250

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-75.5 + 10.7 + 107)/20) = 129.1$
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: _____

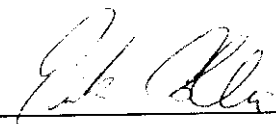

Name: Erik Collins

TABLE 7

FIELD STRENGTH OF FUNDAMENTAL EMISSION

TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

Mid Channel

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
97.7	-73.9	12.4	188.7	250

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-73.9 + 12.4 + 107)/20)$ = 188.7
 CONVERSION FROM dBm TO dBuV = 107 dB

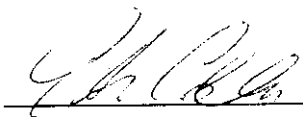
Tested By: Name: Erik Collins

TABLE 8

FIELD STRENGTH OF FUNDAMENTAL EMISSION

TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

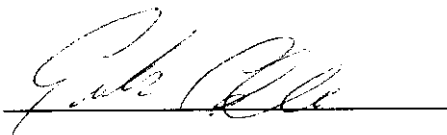
High Channel

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	AVERAGE FCC LIMITS (uV/m) @ 3m
108.0	-73.8	13.3	211.3	250

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-73.8 + 13.3 + 107)/20)$ = 211.3
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By:



Name: Erik Collins

Figure 7

Peak Field Strength of Fundamental Emission 15.239(b)
Low Channel

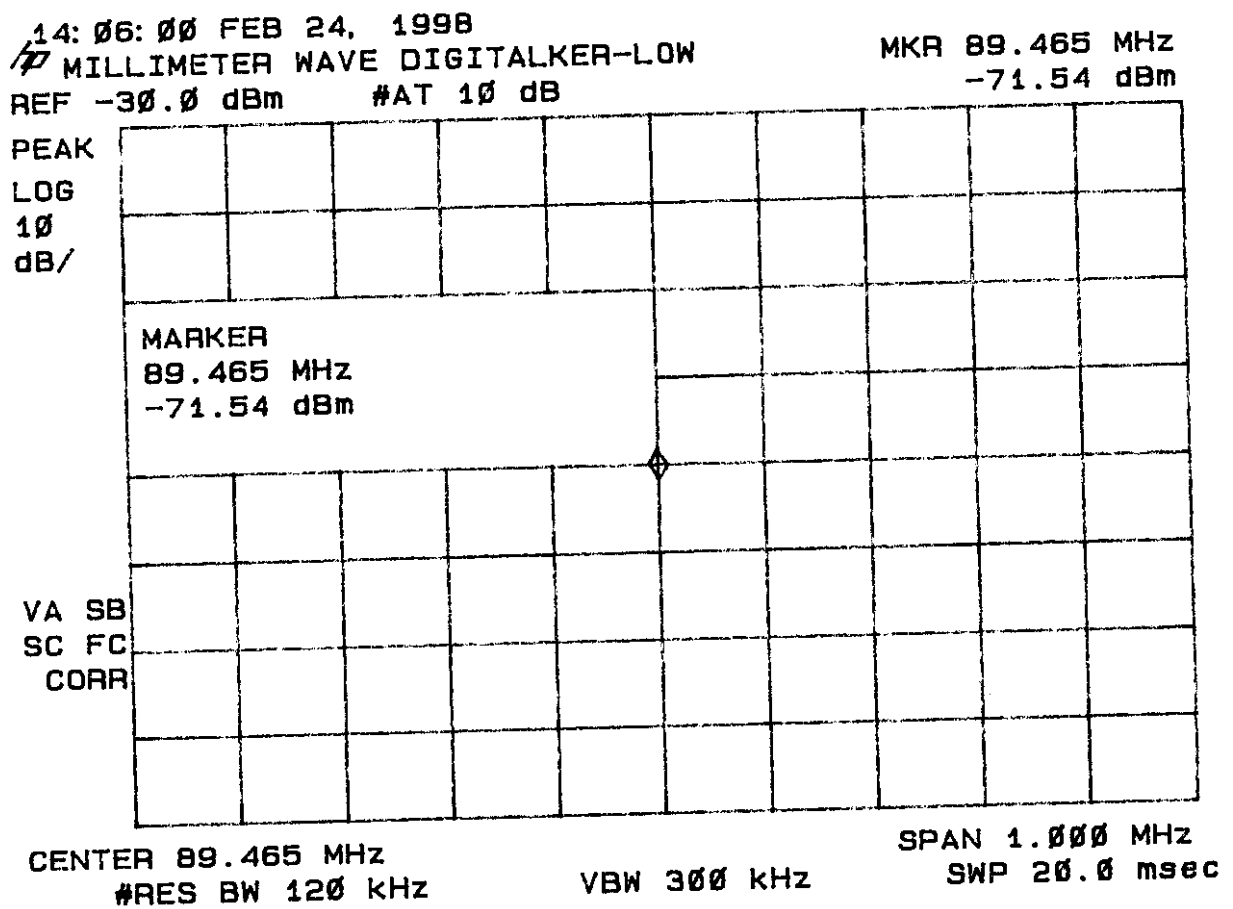


Figure 9

Peak Field Strength of Fundamental Emission 15.239(b)
High Channel

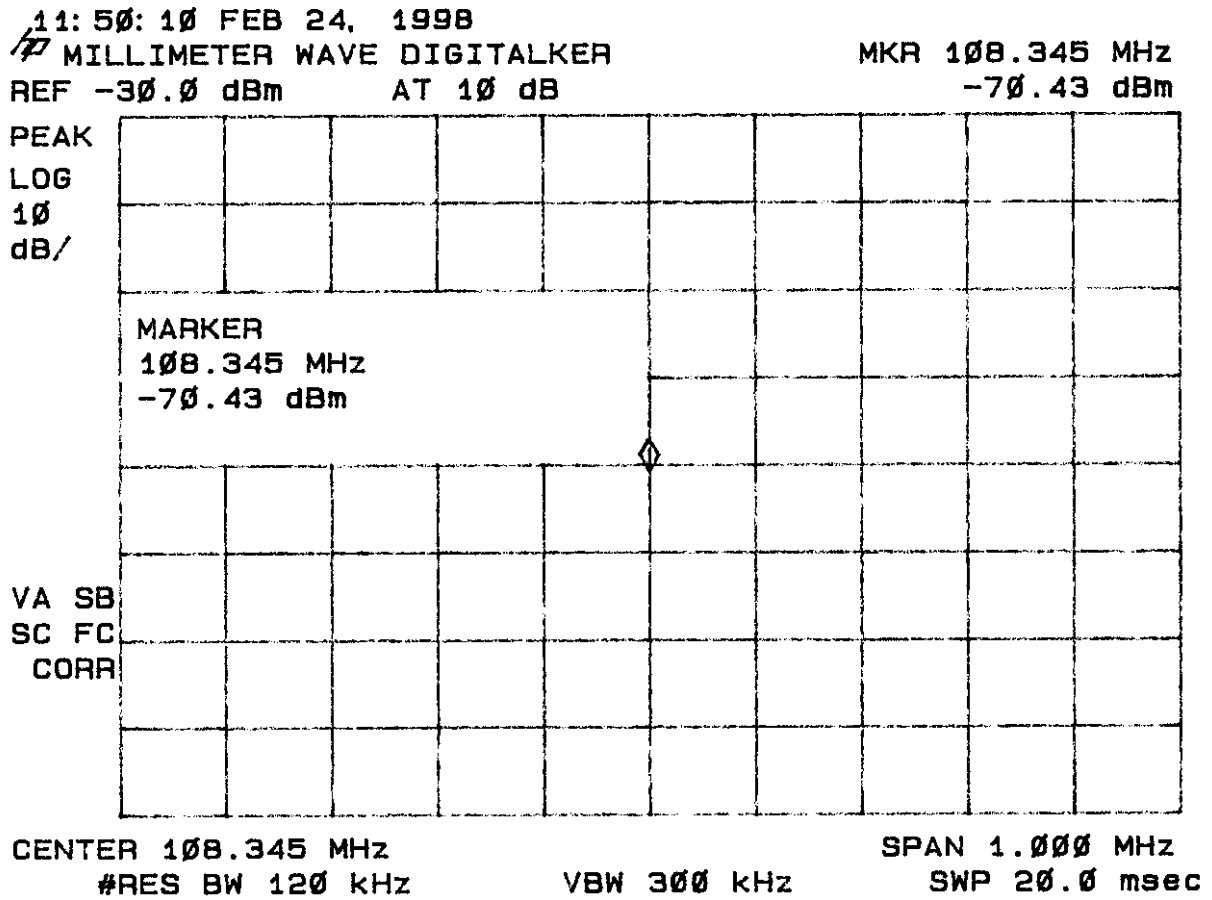


Figure 10

**Average Field Strength of Fundamental Emission 15.239(b)
Low Channel**

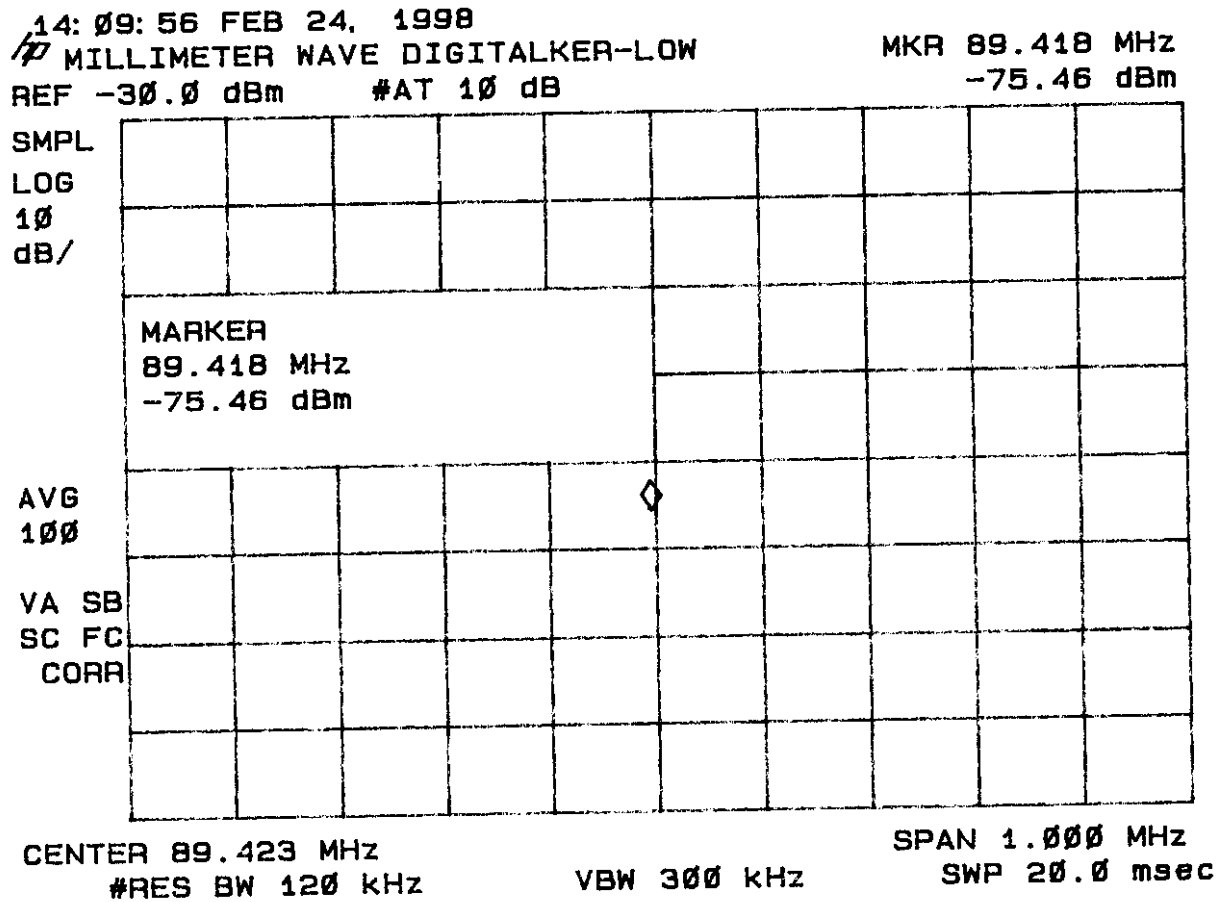


Figure 11

**Average Field Strength of Fundamental Emission 15.239(b)
Mid Channel**

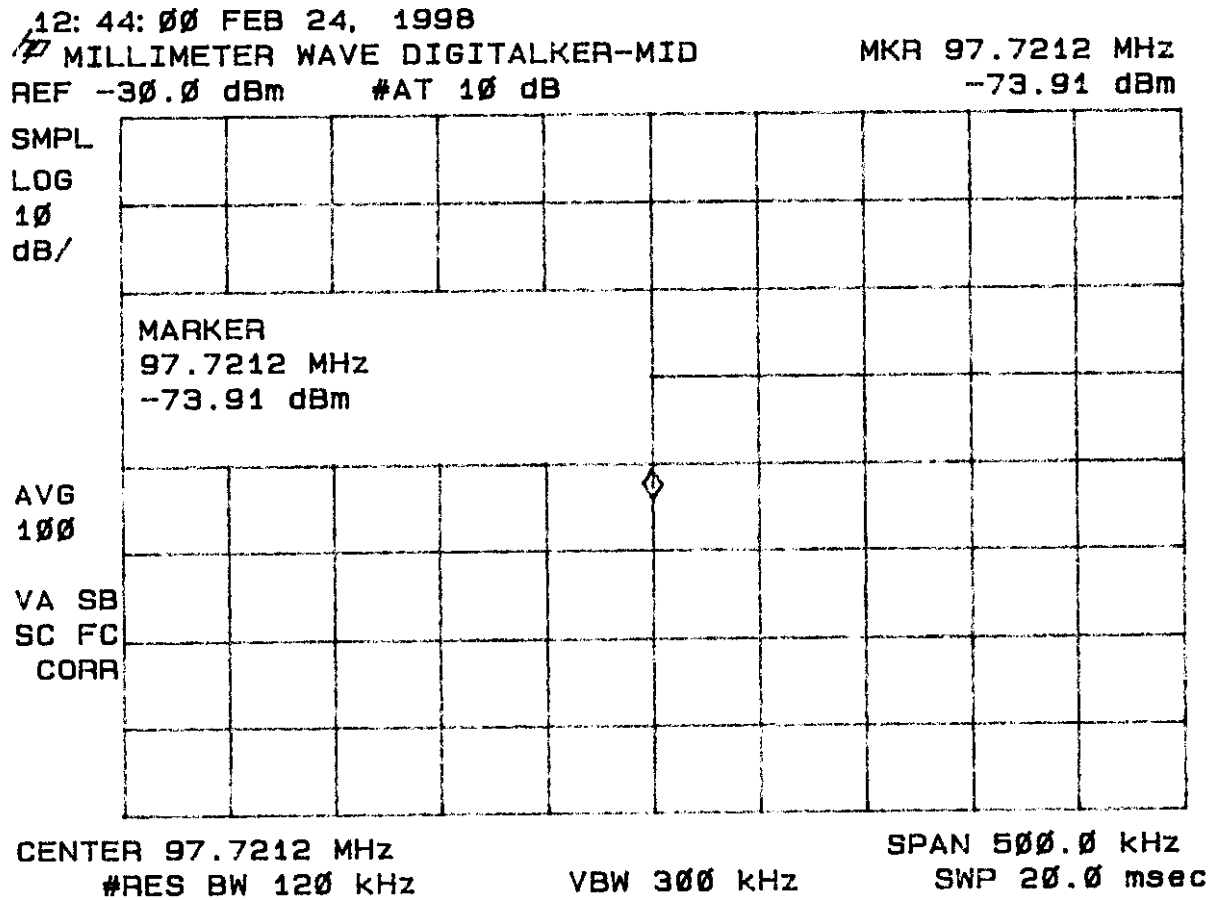
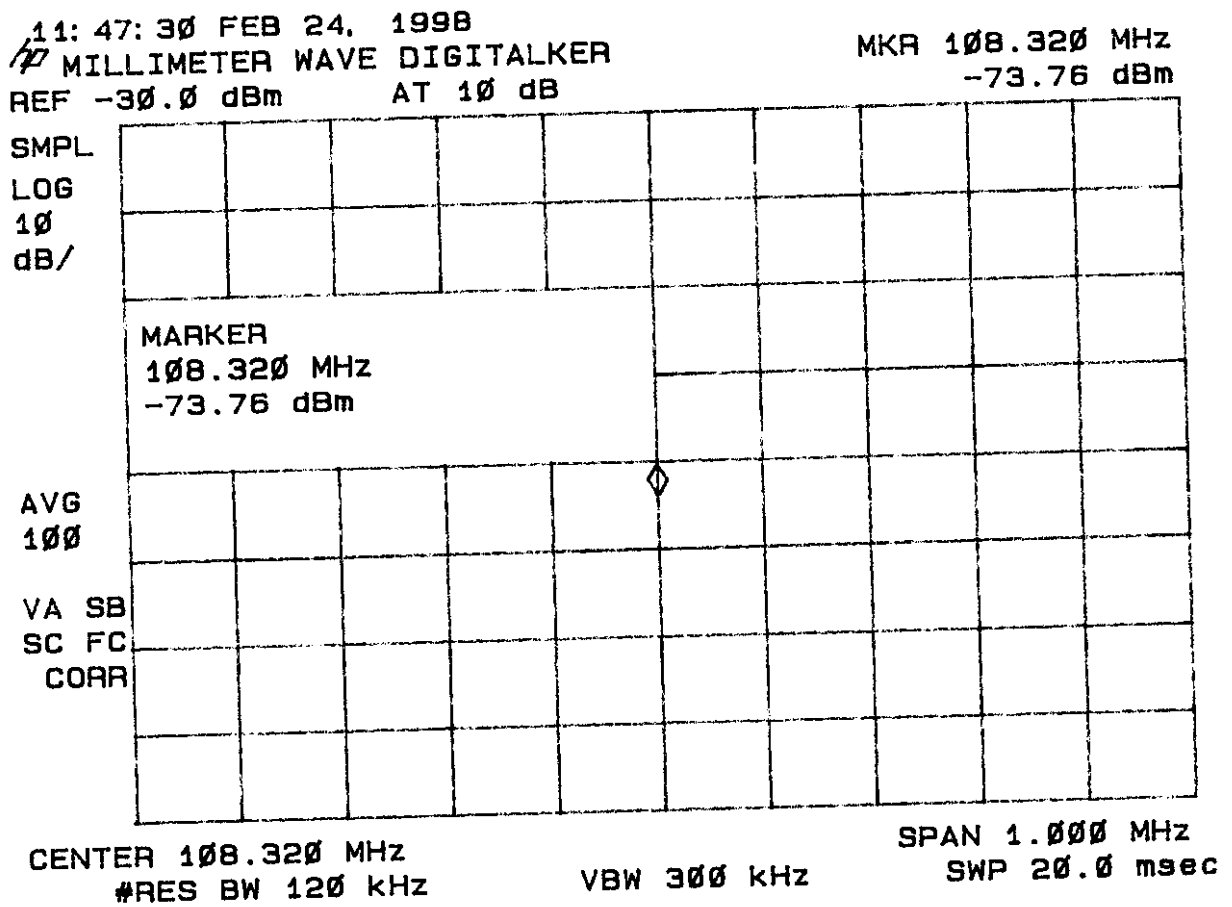


Figure 12

Average Field Strength of Fundamental Emission 15.239(b)
High Channel



Field Strength of Spurious Fundamental Emission (47 CFR 15.239(c))

Measurements were made using a peak detector. Field strength of Spurious Emissions are shown in Tables 9 - 11 and Figures 13 -15. Any emission less than 1000 MHz and falling within the restricted bands of 15.205 were not adjusted for averaging and the limits of 15.209 were applied.

TABLE 9

FIELD STRENGTH OF SPURIOUS EMISSIONS

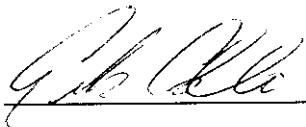
TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

Low Channel

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION + AMP GAIN	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
178.7	-78.5	13.5	126.5	150
268.6	-86.8	16.8	71.0	200
357.4	-87.6	19.7	89.8	200

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-78.5 + 13.5 + 107)/20)$ = 126.5
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By:  _____

Name: Erik Collins

TABLE 10

FIELD STRENGTH OF SPURIOUS EMISSIONS

TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

Mid Channel

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION + AMP GAIN	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
195.4	-81.2	13.8	95.6	150
293.2	-85.2	17.7	94.2	200

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-81.2 + 13.8 + 107)/20)$ = 95.6
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: Erik Collins

Name: Erik Collins

TABLE 11

FIELD STRENGTH OF SPURIOUS EMISSIONS

TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

High Channel

FREQ. (MHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION + AMP GAIN	RESULTS (uV/m) @ 3m	PEAK FCC LIMITS (uV/m) @ 3m
216.6	-83.2	14.7	84.1	200
324.9	-84.3	18.7	117.4	200

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-83.2 + 14.7 + 107)/20)$ = 84.1
 CONVERSION FROM dBm TO dBuV = 107 dB

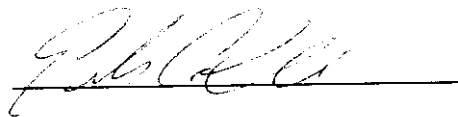
Tested By: Name: Erik Collins

Figure 13B

Peak Spurious Emission 15.239(b)
Low Channel

14:19:23 FEB 24, 1998

MILLIMETER WAVE DIGITALKER-LOW

MKR 267.990 MHz

REF -30.0 dBm #AT 0 dB

-86.78 dBm

PEAK
LOG
10
dB/

MARKER
267.990 MHz
-86.78 dBm

VA SB
SC FC
CORR

CENTER 267.990 MHz
#RES BW 120 kHz

VBW 300 kHz

SPAN 1.000 MHz
SWP 20.0 msec

Figure 13A

Peak Spurious Emission 15.239(b)
Low Channel

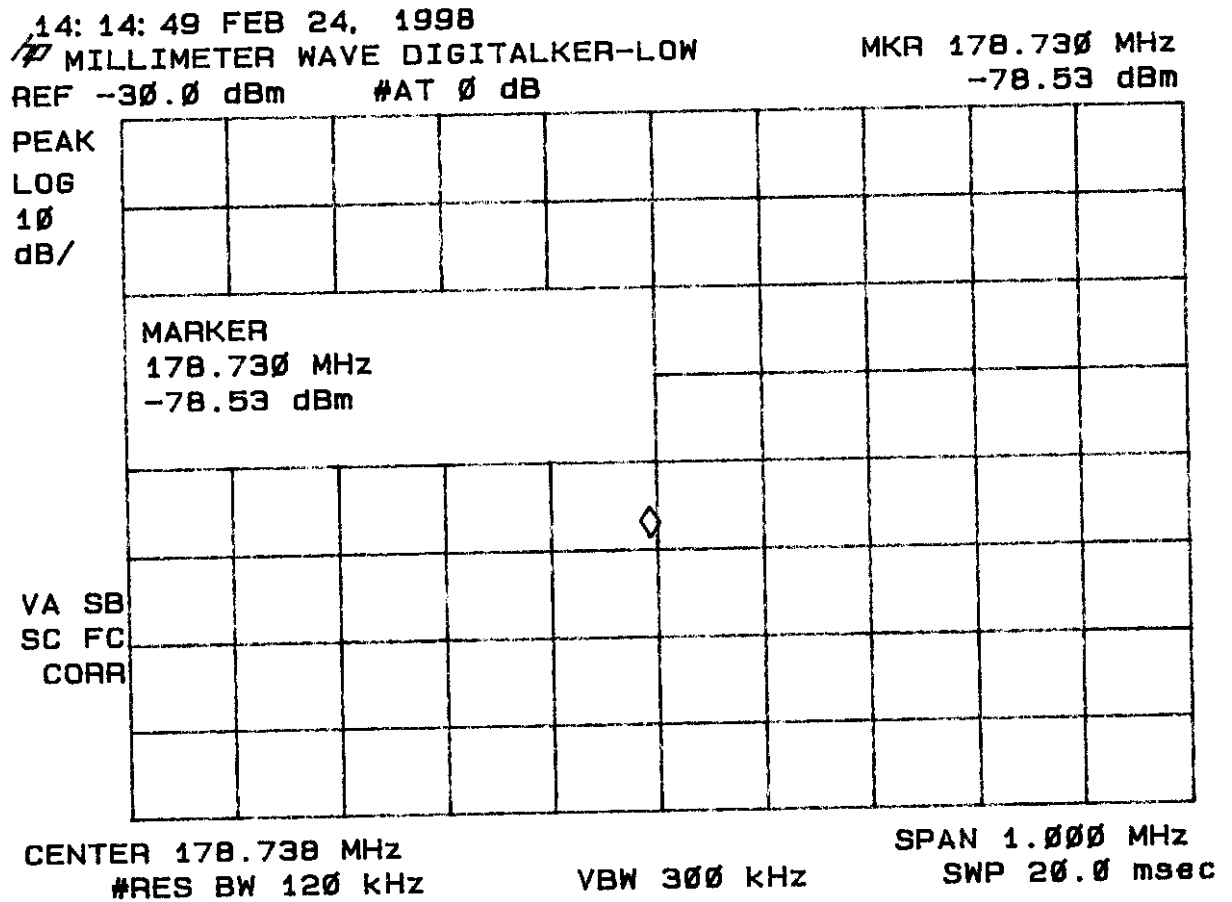


Figure 13C

Peak Spurious Emission 15.239(b)
Low Channel

14: 25: 39 FEB 24, 1998

MILLIMETER WAVE DIGITALKER-LOW

MKR 357.305 MHz

REF -40.0 dBm #AT 0 dB

-87.64 dBm

PEAK
LOG
10
dB/

MARKER
357.305 MHz
-87.64 dBm

VA SB
SC FC
CORR

CENTER 357.305 MHz
#RES BW 120 kHz

VBW 300 kHz

SPAN 1.000 MHz
SWP 20.0 msec

Figure 14A

Peak Spurious Emissions 15.239(c)
Mid Channel

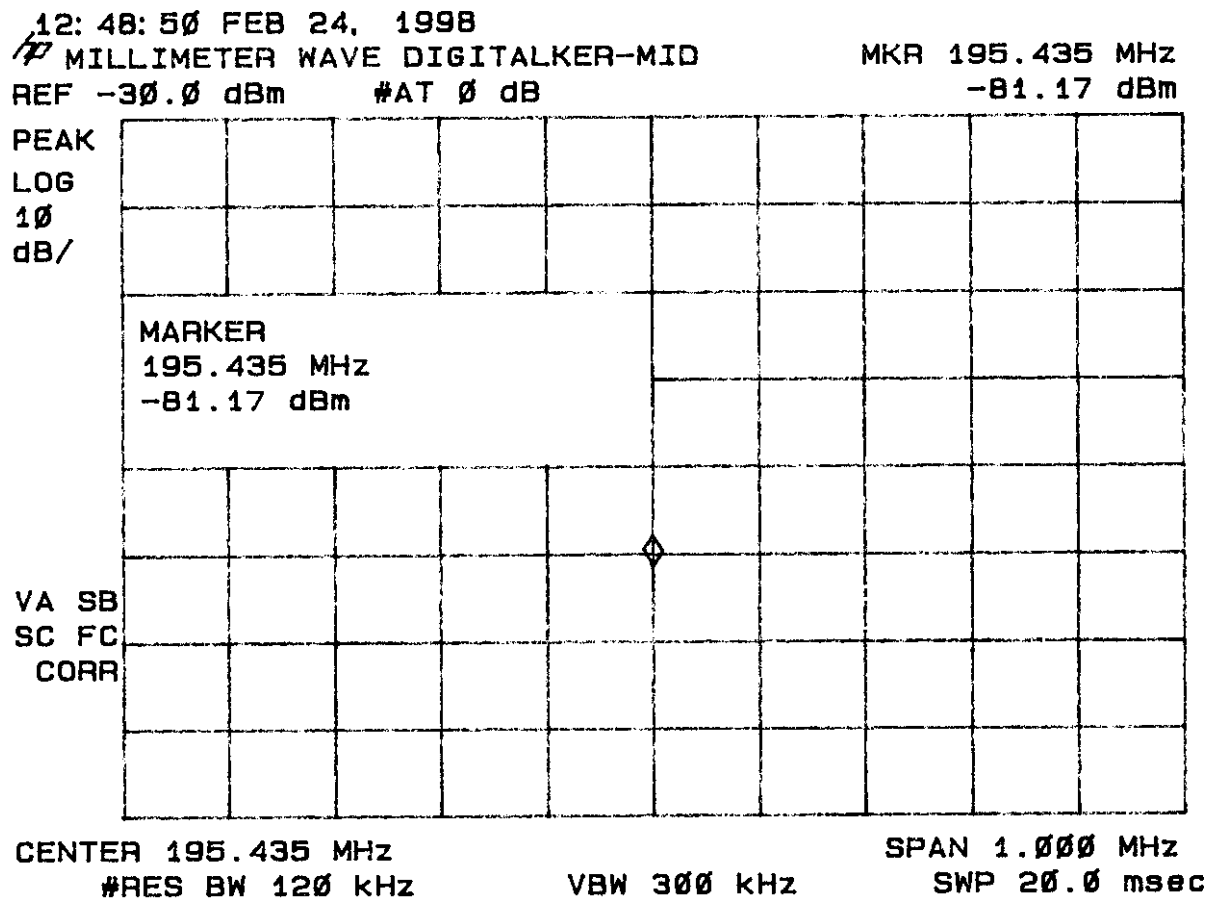


Figure 14B

Peak Spurious Emissions 15.239(c)
Mid Channel

12:51:38 FEB 24, 1998

MILLIMETER WAVE DIGITALKER-MID

MKR 293.193 MHz

REF -30.0 dBm

#AT 0 dB

-85.20 dBm

PEAK
LOG
10
dB/MARKER
293.193 MHz
-85.20 dBmVA SB
SC FC
CORRCENTER 293.193 MHz
#RES BW 120 kHz

VBW 300 kHz

SPAN 1.000 MHz
SWP 20.0 msec

Figure 15A

Peak Spurious Emissions 15.239(c)
High Channel

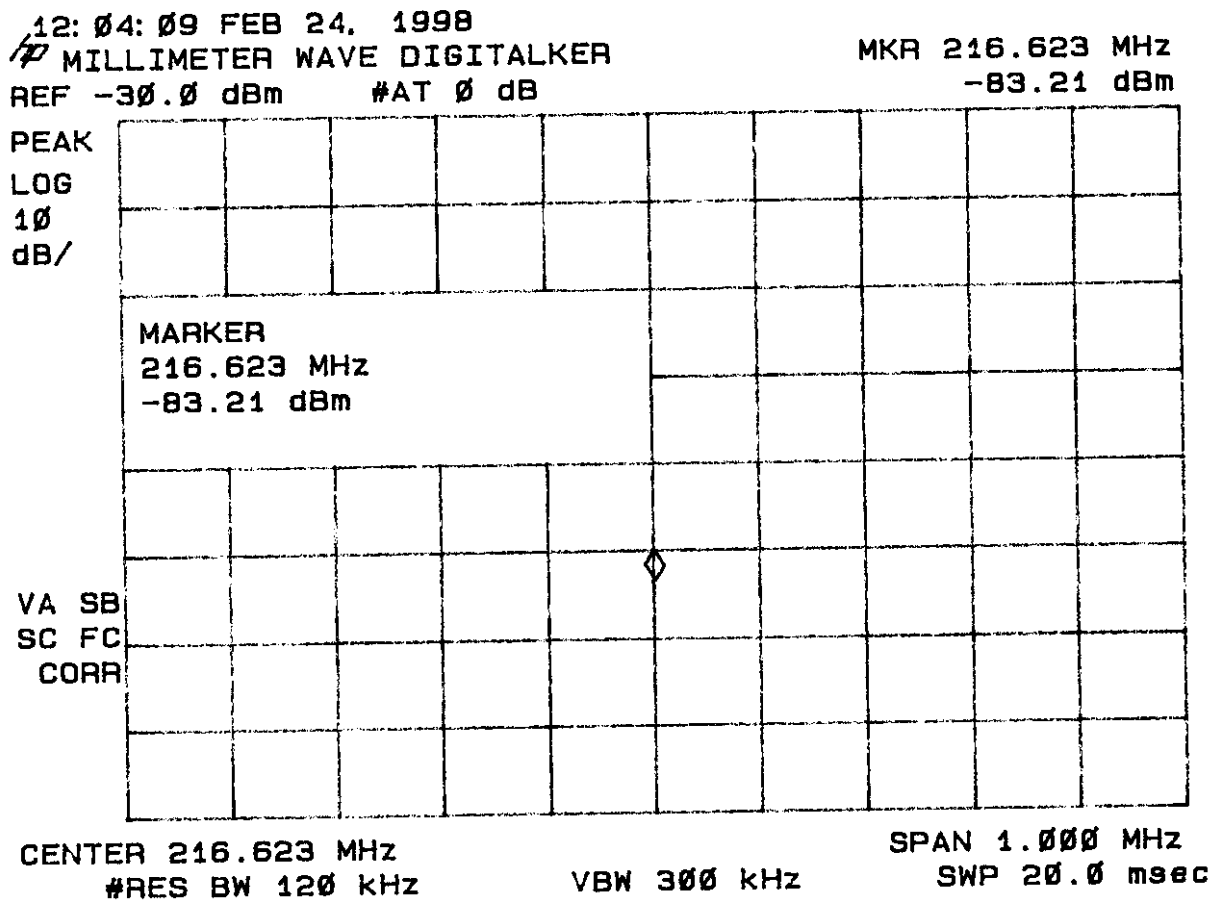


Figure 15B

Peak Spurious Emissions 15.239(c)
High Channel

12: 11: 50 FEB 24, 1998

MILLIMETER WAVE DIGITALKER

MKR 324.875 MHz

REF -30.0 dBm #AT 0 dB

-84.28 dBm

PEAK
LOG
10
dB/

MARKER
324.875 MHz
-84.28 dBm

VA SB
SC FC
CORR

CENTER 324.875 MHz
#RES BW 120 kHz

VBW 300 kHz

SPAN 1.000 MHz
SWP 20.0 msec

Radiated Emissions (47 CFR 15.109a)

Radiated emissions (Digital Device) were evaluated from 30 to 1000 MHz with the transmitter turned off. Measurements were made with the analyzer's bandwidth set to 120 kHz. Emissions are shown in Table 12.

TABLE 12

CLASS B

RADIATED EMISSIONS

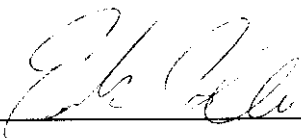
TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

FREQ. (MHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 3m	FCC LIMITS (uV/m) @ 3m
38.9	-93.0	15.9	31.3	100
51.9	-92.0	9.9	17.7	100

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-93.0 + 15.9 + 107)/20)$ = 31.3
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: _____



Name: Erik Collins

Power Line Conducted Emissions (47 CFR 15.107a)

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked. Emissions are shown in Table 13.

TABLE 13

CLASS B

CONDUCTED EMISSIONS

TEST DATE: February 24, 1998
 UST PROJECT: 98-067
 CUSTOMER: Millimeter Wave Technology, Inc.
 MODEL: DIGI-TALKER Pro

FREQUENCY (MHz)	TEST DATA (dBm)		RESULTS (uV)		FCC LIMITS (uV)
	PHASE	NEUTRAL	PHASE	NEUTRAL	
0.45	-85.0	-91.0	12.6	6.3	250
1.0	-86.0	-90.0	11.2	7.1	250
1.5	-77.0	-91.0	31.6	6.3	250
3.0	-86.0	-91.0	11.2	6.3	250
4.4	-81.0	-91.0	20.0	6.3	250
25.6	-87.0	-89.0	10.0	7.9	250

SAMPLE CALCULATIONS:

RESULTS uV = Antilog $((-85.0 + 107)/20) = 12.6$
 CONVERSION FROM dBm TO dBuV = 107 dB

Tested By: Erik Collins

Name: Erik Collins