

# INTERACTIVE TECHNOLOGIES INCORPORATED

## LABORATORY MEASUREMENTS

### PART B

### PREFACE

This device is a security transmitter. The device was placed on a .8 meter high platform, three meters from the receiving antenna. Peak emissions were found by varying the antenna height from one to four meters and rotating the device 360 degrees. Emissions were taken with both vertical and horizontal polarization's.

#### A) TEST NOTES

- 1) Bandwidth measurements were made in the peak mode, using a Hewlett Packard Spectrum Analyzer Model Number (70000).
- 2) Duty Cycle Correction Factors =  $20 \log (t/T)$  Where t = Maximum time during any .1 second interval. T = .1 second
- 3) All emissions from 25 MHz were measured to the tenth harmonic were measured with an Hewlett Packard model 8566B Spectrum Analyzer.
- 4) Emissions below 1000MHz were measured with a 100 kHz bandwidth. Emissions above 1000MHz were measured with a 1MHz bandwidth.
- 5) Forbidden bands measurements were made at 1 meter distance.
- 6) Noise floor measurements. See AMBIENT LEVEL IN THE FORBIDDEN BANDS.

# INTERACTIVE TECHNOLOGIES INCORPORATED

## BANDWIDTH MEASUREMENT

15.205 (d) Bandwidth (see Test Notes). (.25% of Fundamental)

Spectrum Analyzer used: HP 70000

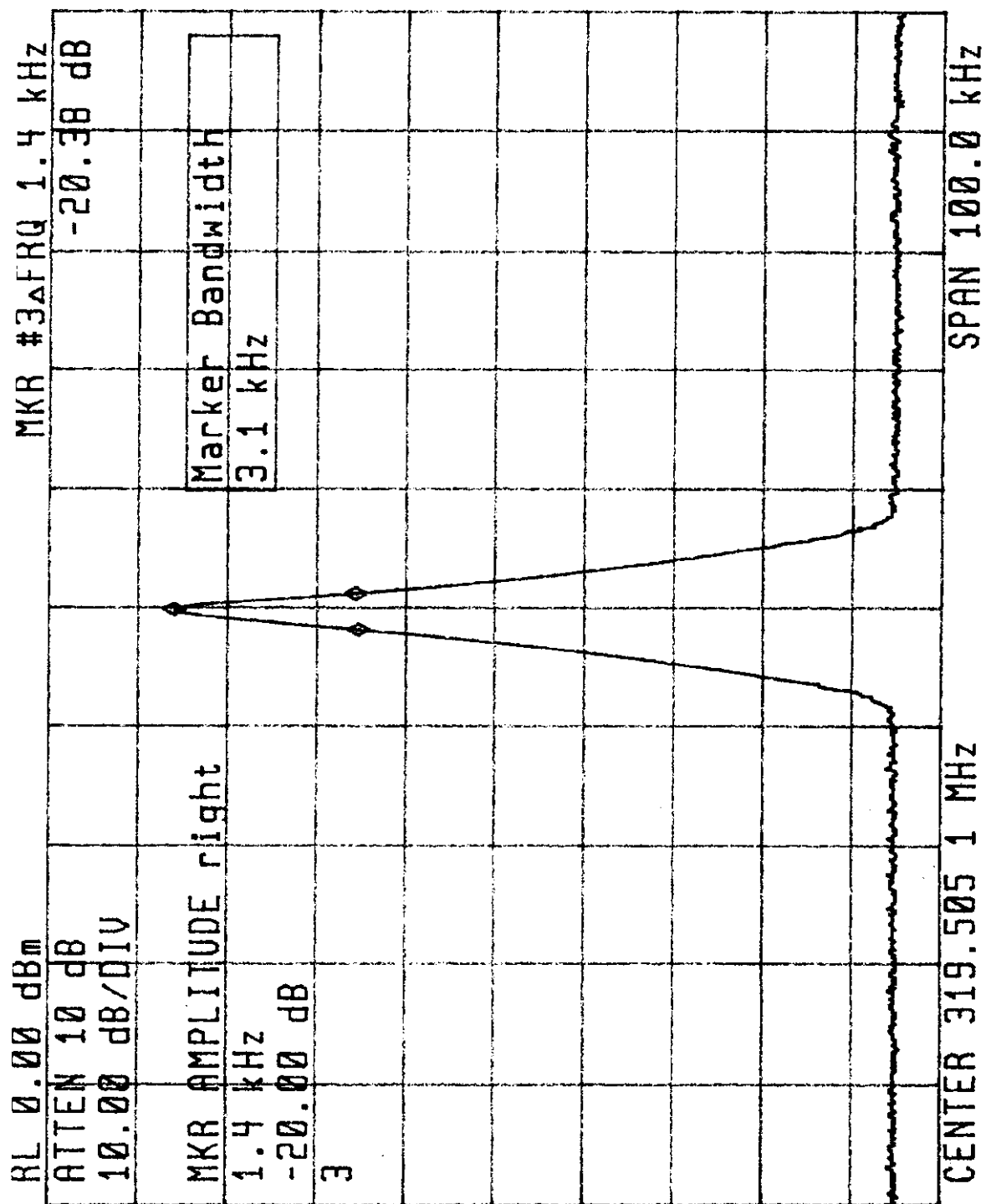
Spectrum analyzer skirt bandwidth (-20 dBm) 1KHz

| <b>FREQUENCY</b><br><b>(MHz)</b> | <b>MEASURED</b><br><b>BANDWIDTH</b><br><b>@ -20dBm</b><br><b>(KHz)</b> | <b>*ESTIMATED</b><br><b>SIGNAL</b><br><b>BANDWIDTH</b><br><b>(KHz)</b> | <b>FCC</b><br><b>BANDWIDTH</b><br><b>LIMIT</b><br><b>(KHz)</b> |
|----------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------|----------------------------------------------------------------|
| <b>319.5</b>                     | <b>40.9</b>                                                            | <b>39.9</b>                                                            | <b>792</b>                                                     |

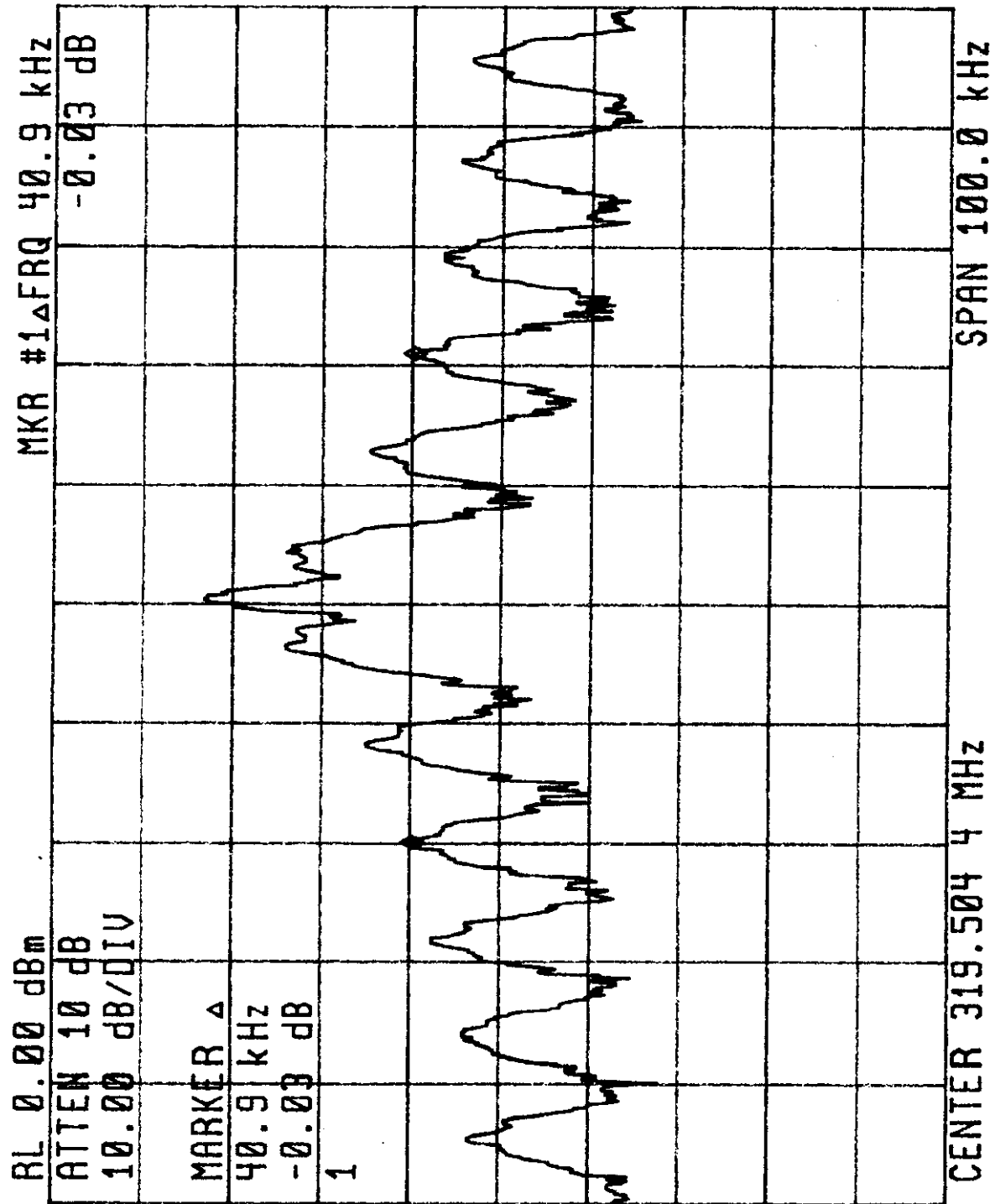
\* Estimated Bandwidth = Measured bandwidth minus analyzer bandwidth

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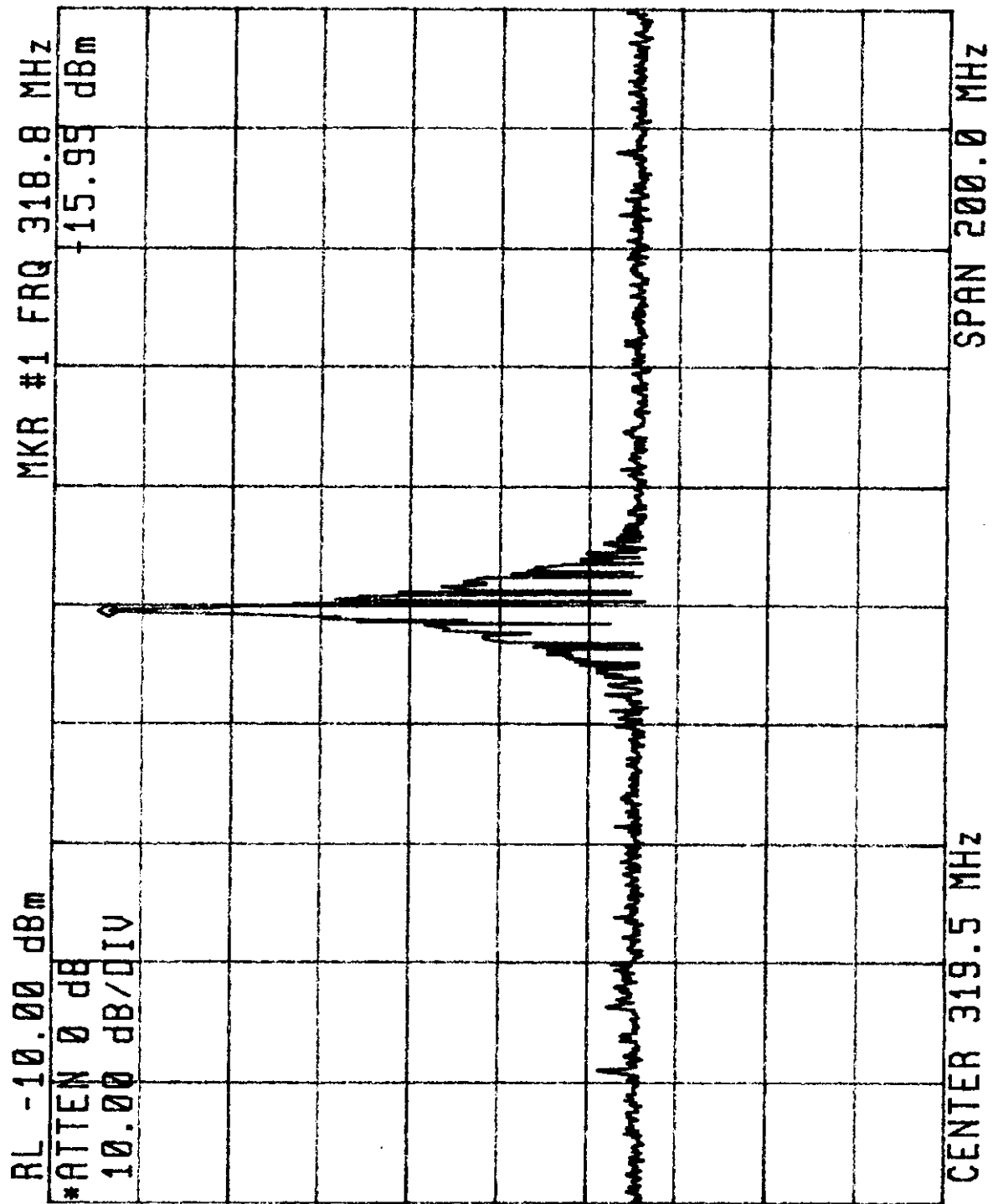
## BANDWIDTH MEASUREMENT



BANDWIDTH MEASUREMENT



BANDWIDTH MEASUREMENT



## DUTY CYCLE CALCULATION

The Learnmode format transmission time varies from 18.1 milliseconds to 21.8 milliseconds. The maximum on time is 8.662 milliseconds. The interval between packets will vary in a pseudo-random manner from about 99 milliseconds to 458 milliseconds.

## SUPERVISORY CALCULATION

If an hour elapses without a data transmission, the chip will trigger itself and send a group of three supervisory data packets. The actual supervisory interval will vary in a pseudo-random manner from about 64 to 68 minutes. The supervisory signal consists of three packet transmissions. Therefore, the maximum supervisory duration is 981.4 milliseconds in duration.  $21.9 \text{ milliseconds} \times 3 = 65.4 \text{ milliseconds} + 2 \times 458 \text{ millisecond interval time in between packets} = 981.4 \text{ milliseconds maximum time.}$

The calculation for the “ Duty Cycle Correction Factor ” is as follows:

### DATA FORMATON TIME

|                        |              |
|------------------------|--------------|
| 1-976uSec AGC Pulse    | 976uSec ON   |
| 12-244uSec Sync Pulses | 1.464mSec ON |
| 1-366uSec Start Pulse  | 122uSec ON   |
| 42-366uSec Data Pulses | 5.124mSec ON |
| 366uSec Old Stop Bit   | 366uSec ON   |
| 366uSec One            | 122uSec ON   |
| 3-366uSec MSB          | 366uSec ON   |
| 244uSec New Stop Bit   | 122uSec ON   |

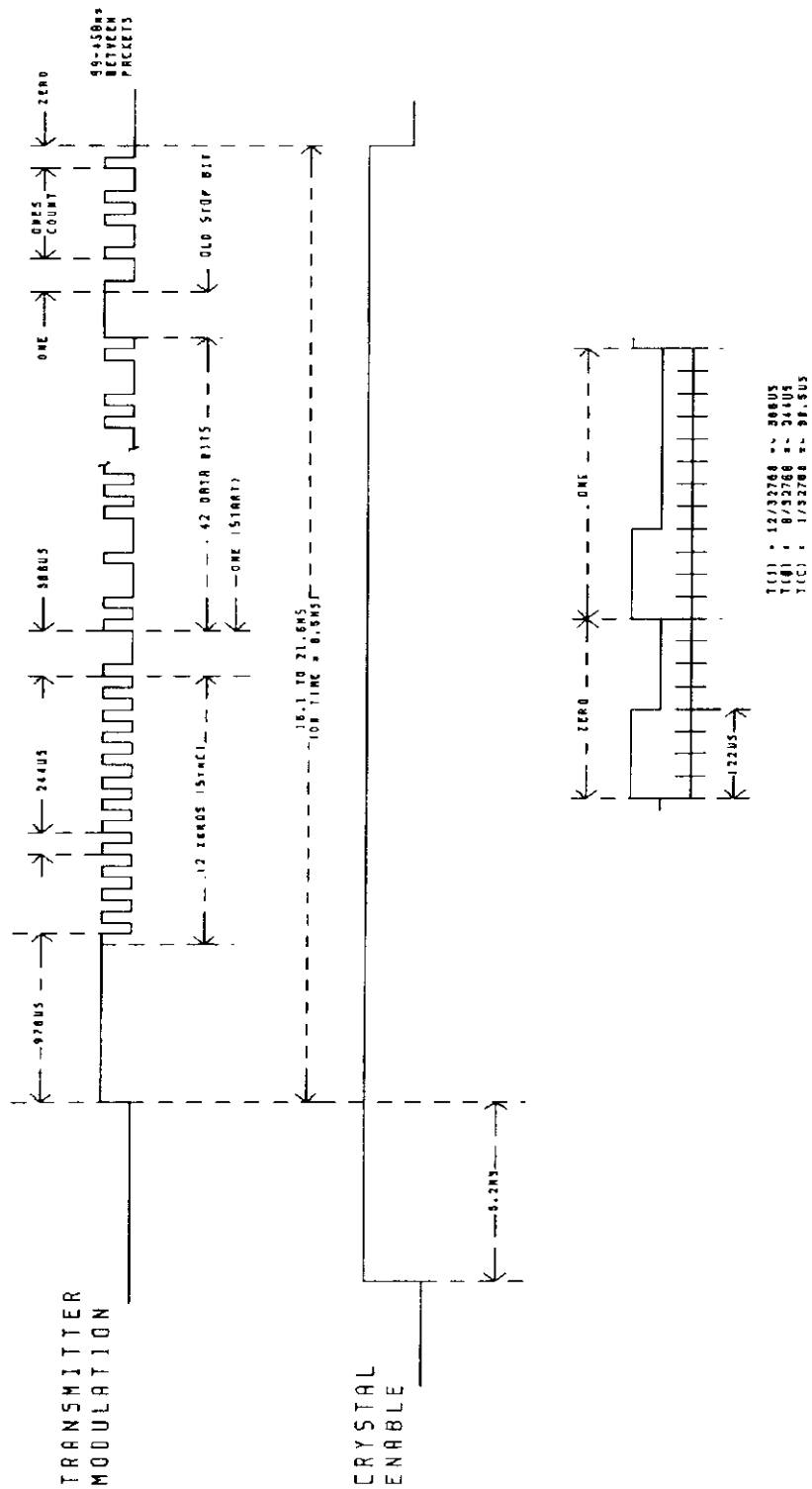
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21.716mSec Total Time    8.662mSec Total On Time

$$8.662\text{mSec TOTAL ON TIME} / 100\text{mSec} = .08662 \text{ ( LOG ) } \times 20 = -21.25\text{dB}$$

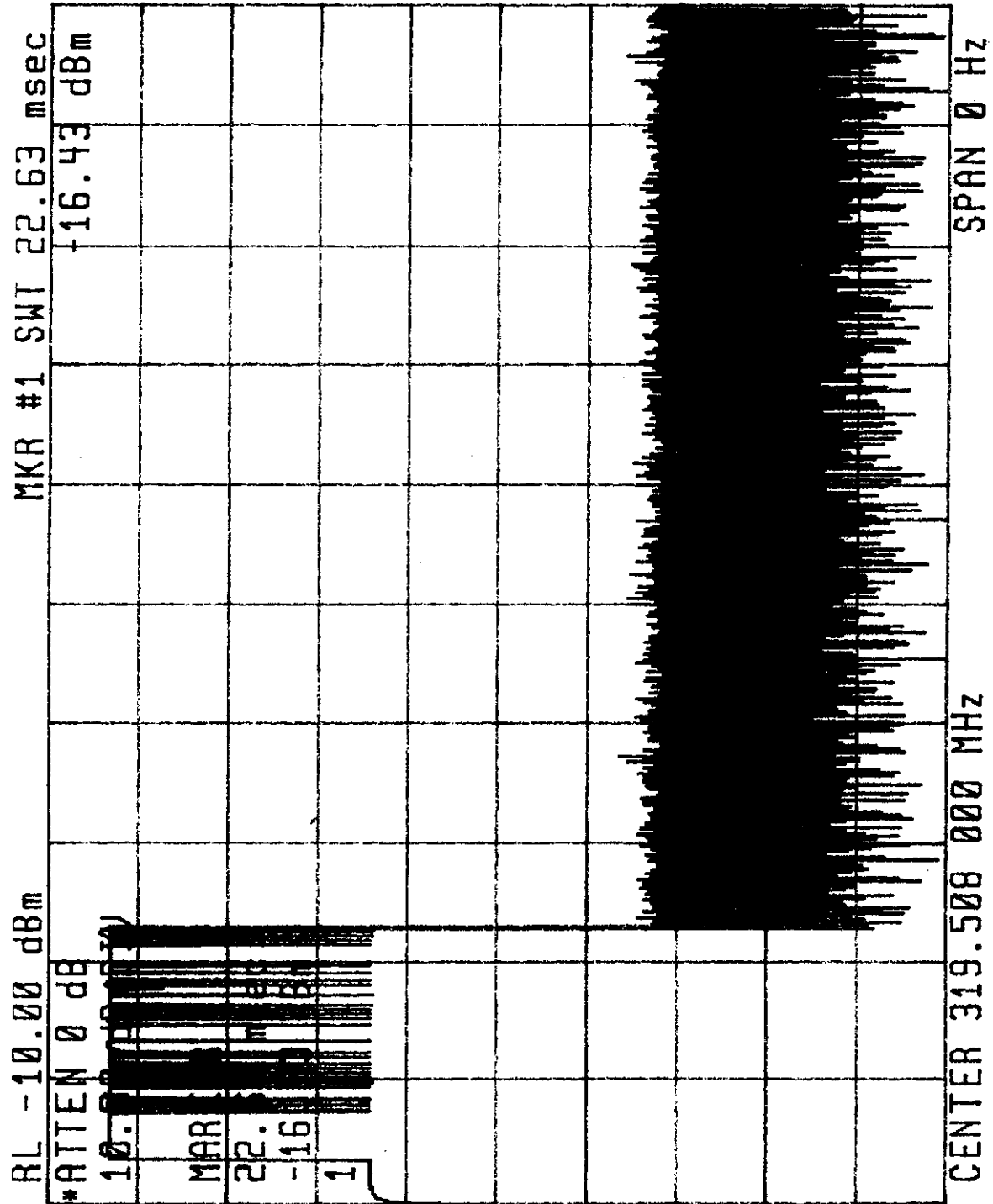
**NOTE:** 20dB is the maximum allowable DUTY CYCLE CORRECTION FACTOR

## B4Z-741-HHTP

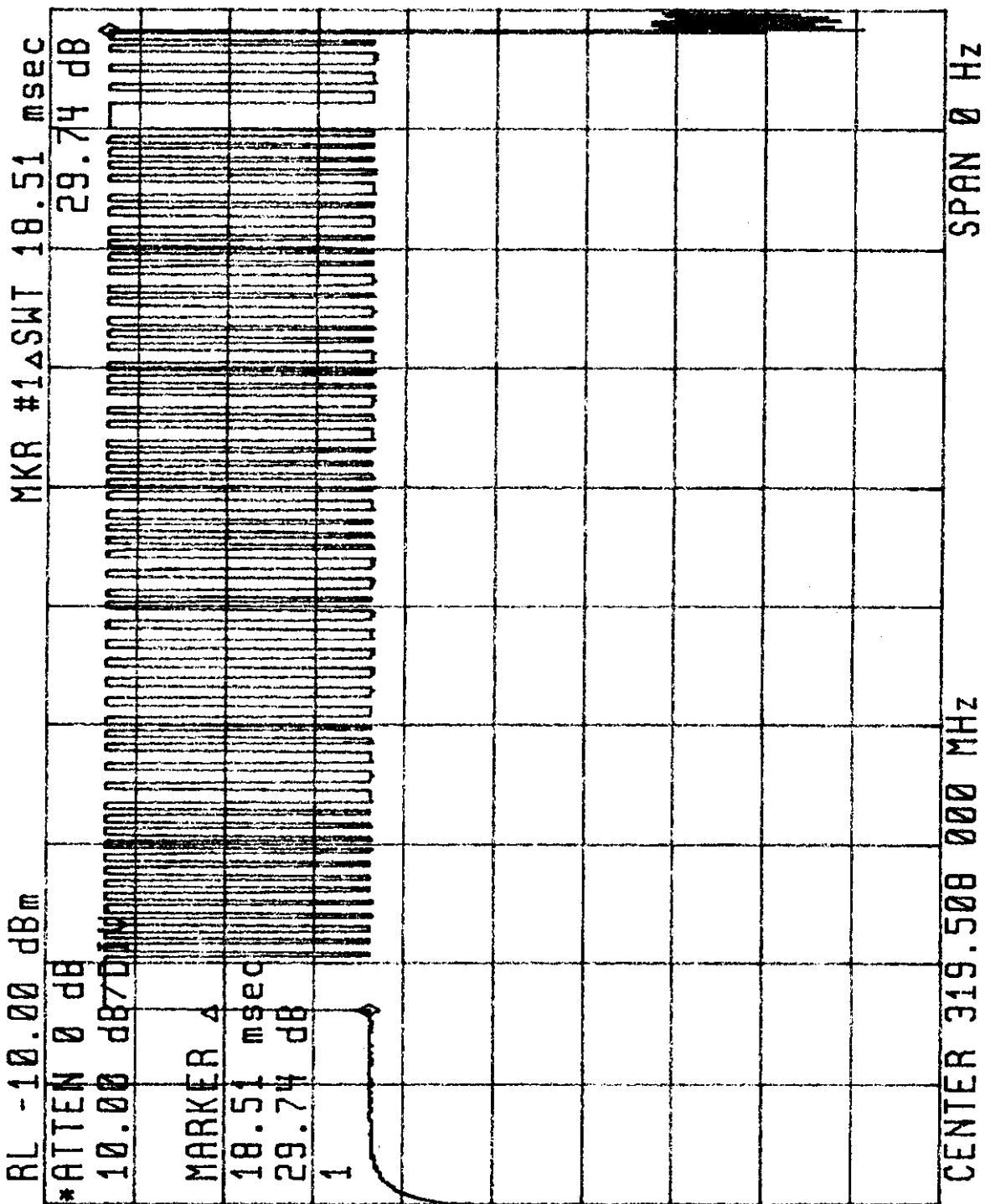


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## SINGLE ALARM PACKET (100 MILLISECOND PLOT)



SINGLE ALARM PACKET  
MAXIMUM PACKET DURATION IS 21.8 MILLISECONDS



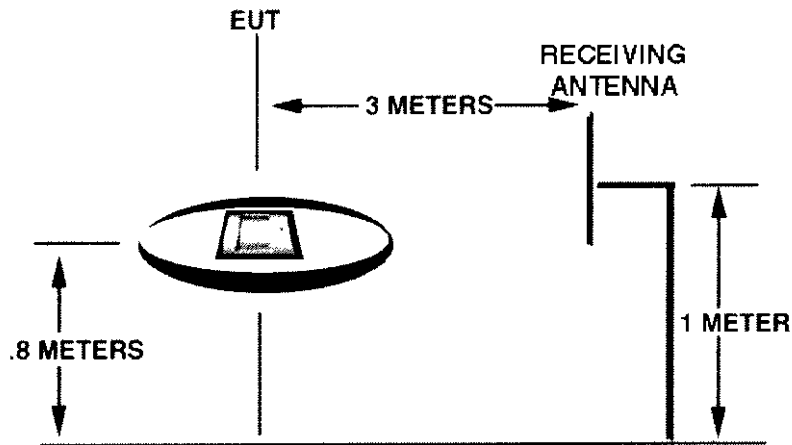
## A COMPLETE TRANSMISSION OF EIGHT INDIVIDUAL ALARM PACKETS



EXHIBIT 4

LABORATORY MEASUREMENT SKETCHES

RADIATED EMISSIONS



# **INTERACTIVE TECHNOLOGIES INCORPORATED**

## **RADIATED EMISSIONS SUMMARY**

The SIMON TOUCH TALK TOUCHPAD passes FCC Rules Part 15, Subpart C, Paragraph 15.231. The highest fundamental radiated emission measurement was 9.14dB below the FCC limit at 319.5MHz. The highest spurious emission measurement was 10.79dB below the FCC limit at 213MHz. The highest forbidden band emission was 28.93dB below the FCC limit at 1065MHz.

# INTERACTIVE TECHNOLOGIES INCORPORATED

## FCC EMISSIONS CALCULATION

### TERMS:

ANALYZER READING ( AR ) ( dBuV )

TOTAL LOSS FACTOR ( TLF ) ( dB ) = ( ANTENNA FACTOR ( AF ) + CABLE LOSS ( CL ) )

DUTY CYCLE CORRECTION ( DC ) ( dB ) = AVERAGE ON TIME OF DATA

### EXAMPLE:

ANALYZER READING = 70dBuV

ANTENNA FACTOR = 18.4dB

CABLE LOSS = 4.1dB

DUTY CYCLE CORRECTION = 20dB

$(AR + TLF ( AF + CL )) - DC = \text{dBuV} / M \quad ( 70\text{dBuV} + 22.5 ) - 20 = 72.5\text{dBuV} / M$

$\text{INVERSE LOG} ( \text{dBuV}/M / 20 ) = \text{uV} / M \quad ( 72.5\text{dBuV}/M / 20 ) = 4217\text{uV} / M$

# INTERACTIVE TECHNOLOGIES INCORPORATED

## LABORATORY MEASUREMENTS

### RADIATED EMISSIONS

PRODUCT DESCRIPTION: SIMON TOUCHTALK TOUCHPAD

MODEL NUMBER: B4Z-741-HHTP

FUNDAMENTAL 319.5MHz

POLARIZATION: HORIZONTAL & VERTICAL

The highest fundamental emission along with, the three highest spurious and restricted band emissions are listed below as per ANSI C63.4 paragraph 10.1.8.2.

Emissions from .009MHz to the tenth harmonic were measured as per FCC Rules Part 15, Subpart C, paragraph 15.33 (a).

| FREQUENCY<br>MHz | ANALYZER<br>READING<br>dBuV | 20*LOG<br>DUTY CYCLE<br>-dB | ANTENNA<br>FACTOR<br>dB | FIELD<br>STRENGTH<br>dBm | FIELD<br>STRENGTH<br>uV/m | FCC<br>LIMIT<br>uV/M |
|------------------|-----------------------------|-----------------------------|-------------------------|--------------------------|---------------------------|----------------------|
| 319.5            | 70.55                       | 20                          | 16.2                    | 66.8                     | 2175.2                    | 6229.7               |
| 213              | 50.9                        | 20                          | 14.2                    | 45.1                     | 179.9                     | 623                  |
| 426              | 47.25                       | 20                          | 17.8                    | 45.1                     | 178.9                     | 623                  |
| 106.5            | 54.4                        | 20                          | 10.5                    | 44.9                     | 175.8                     | 623                  |
| 1065             | 16.35                       | 20                          | 28.7                    | 25.1                     | 17.9                      | 500                  |
| 1491             | 13.1                        | 20                          | 31.1                    | 24.2                     | 16.2                      | 500                  |
| 1704             | 11.85                       | 20                          | 32.2                    | 24.1                     | 15.9                      | 500                  |

75.9

# INTERACTIVE TECHNOLOGIES INCORPORATED

## AMBIENT LEVEL IN FORBIDDEN BANDS

Noise floor of spectrum analyzer with antenna factors and duty cycle correction converted to uV/M at approximately one meter. 15.205(a) All forbidden band information is listed below. All measurements were taken with an HP 8566B Spectrum Analyzer. The bandwidth was 100kHz for measurements below 100MHz. The bandwidth was 1MHz for measurements above 1000MHz. The video filter was off. \*Calculated based on  $2400/F$  (kHz)  $\times$  300. (See Rule 15.209.)

| FREQUENCY<br>MHz | NOISE<br>FLOOR<br>READING<br>dBuV | 20 LOG<br>DUTY<br>CYCLE<br>dB | LOSS<br>FACTOR<br>dB | FIELD<br>STRENGTH<br>uV/M | FCC<br>LIMIT<br>uV/M |
|------------------|-----------------------------------|-------------------------------|----------------------|---------------------------|----------------------|
| .09-.11          | N.A.                              | N.A.                          | N.A.                 | N.A.                      | *                    |
| .49-.51          | N.A.                              | N.A.                          | N.A.                 | N.A.                      | *                    |
| 2.1735-2.1905    | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 300                  |
| 8.362-8.366      | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 300                  |
| 13.36-13.41      | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 300                  |
| 25.5-25.67       | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 300                  |
| 37.5-38.25       | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 300                  |
| 73-75.4          | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 300                  |
| 108-121.94       | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 450                  |
| 123-138          | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 450                  |
| 149.9-150.05     | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 450                  |
| 156.7-156.9      | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 450                  |
| 162.0125-167.17  | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 450                  |
| 167.72-173.2     | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 450                  |
| 240-285          | N.A.                              | N.A.                          | N.A.                 | N.A.                      | 600                  |
| 322-335.4        | -5.2                              | -20                           | 23.8                 | 0.9                       | 600                  |
| 399.9-410        | -6.8                              | -20                           | 22.1                 | 0.6                       | 600                  |
| 608-614          | -5.6                              | -20                           | 24.6                 | 0.9                       | 600                  |
| 960-999          | -5.75                             | -20                           | 33.4                 | 2.4                       | 600                  |
| 999-1240         | -4.85                             | -20                           | 26                   | 1.1                       | 1500                 |
| 1300-1427        | -4.85                             | -20                           | 28                   | 1.4                       | 1500                 |
| 1435-1626.5      | -6.7                              | -20                           | 28                   | 1.2                       | 1500                 |
| 1660-1710        | -6.7                              | -20                           | 28                   | 1.2                       | 1500                 |
| 1717.8-1722.2    | -6.7                              | -20                           | 28                   | 1.2                       | 1500                 |
| 2200-2300        | -5.75                             | -20                           | 32                   | 2.1                       | 1500                 |
| 2310-2390        | -5.75                             | -20                           | 32                   | 2.1                       | 1500                 |
| 2483.5-2500      | -4.65                             | -20                           | 32                   | 2.3                       | 1500                 |
| 2655-2900        | -4.65                             | -20                           | 34                   | 2.9                       | 1500                 |
| 3260-3267        | NA                                | NA                            | NA                   | NA                        | 1500                 |
| 3332-3339        | NA                                | NA                            | NA                   | NA                        | 1500                 |
| 3345.8-3358      | NA                                | NA                            | NA                   | NA                        | 1500                 |
| 3600-4400        | NA                                | NA                            | NA                   | NA                        | 1500                 |

# INTERACTIVE TECHNOLOGIES INCORPORATED

## TEST FACILITY DATA SHEETS NOISE FLOOR MEASUREMENTS

T U V P R O D U C T S E R V I C E

### RADIATED EMISSIONS

Large Test Site  
10 Meter Antenna Distance  
Equipment Under Test:  
ITI  
SIMON TOUCH TALK TOUCHPAD  
Notes: MODEL: 55-741.

Report W8374 Run 2  
Date 08-17-98 Page 1  
Engineer \_\_\_\_\_  
Tech: JCS \_\_\_\_\_  
Requester \_\_\_\_\_

| Frequency<br>MHz | Level<br>dBuV | Factor<br>dB | Cable<br>dB | Final<br>dBuV/m | Az<br>deg | Polar\<br>Height | Delta | Delta |
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|-------|-------|
| 106.5            | 34.4          | 9.3          | 1.2         | 45              | --        | V --             |       |       |
| 106.42           | 54.5          | 9.3          | 1.2         | 65.1            | --        | H --             |       |       |
| 212.92           | 50.9          | 12.5         | 1.7         | 65.1            | --        | H --             |       |       |
| 319.42           | 70.55         | 14           | 2.1         | 86.6            | --        | H --             |       |       |
| 425.92           | 47.25         | 15.5         | 2.6         | 65.3            | --        | H --             |       |       |
| 532.43           | 28.4          | 17.2         | 2.8         | 48.4            | --        | H --             |       |       |
| 638.93           | 28.35         | 21.1         | 3           | 52.5            | --        | H --             |       |       |
| 745.43           | 22.2          | 21.1         | 3.6         | 46.9            | --        | H --             |       |       |
| 851.93           | 21.65         | 21.4         | 3.7         | 46.8            | --        | H --             |       |       |
| 958.44           | 7.95          | 22.8         | 4.2         | 35              | --        | H --             |       |       |

NOTE: THE ABOVE MEASUREMENTS WERE MADE WITH REW BW = 100 KHZ

THE FOLLOWING MEASUREMENTS ARE WITH 1 MHZ RES BW:

|        |       |      |     |      |    |      |  |  |
|--------|-------|------|-----|------|----|------|--|--|
| 1064.9 | 16.35 | 23.9 | 4.8 | 45.1 | -- | V -- |  |  |
| 1171.4 | 8.6   | 24.3 | 5   | 37.9 | -- | V -- |  |  |
| 1277.9 | 14.8  | 24.7 | 5.2 | 44.7 | -- | H -- |  |  |
| 1384.4 | 11.75 | 25.1 | 5.4 | 42.2 | -- | H -- |  |  |
| 1490.9 | 13.1  | 25.5 | 5.6 | 44.2 | -- | H -- |  |  |
| 1597.4 | 7.85  | 25.9 | 5.8 | 39.5 | -- | H -- |  |  |
| 1703.9 | 11.85 | 26.2 | 6   | 44.1 | -- | H -- |  |  |
| 1810.4 | 11.5  | 26.6 | 6.2 | 44.3 | -- | H -- |  |  |
| 1916.9 | 5.4   | 27   | 6.4 | 38.8 | -- | H -- |  |  |

# INTERACTIVE TECHNOLOGIES INCORPORATED

## T U V P R O D U C T S E R V I C E

### RADIATED EMISSIONS

Large Test Site  
3 Meter Antenna Distance  
Equipment Under Test:  
ITI  
SIMON TOUCH TALK TOUCHPAD  
Notes: MODEL: 55-741.

Report W8374 Run 3  
Date 08-17-98 Page 1  
Engineer \_\_\_\_\_  
Tech: JCS \_\_\_\_\_  
Requester \_\_\_\_\_

| Frequency<br>MHz | Level<br>dBuV | Factor<br>dB | Cable<br>dB | Final<br>dBuV/m | Az<br>deg | Polar\<br>Height | Delta | Delta |
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|-------|-------|
| 2023.4           | 3.25          | 27.4         | 6.4         | 37              | --        | H --             |       |       |
| 2129.9           | 8.05          | 27.6         | 9.3         | 45              | --        | H --             |       |       |
| 2236.4           | .35           | 27.8         | 12          | 40.1            | --        | H --             |       |       |
| 2342.9           | 3.3           | 28.1         | 12.1        | 43.5            | --        | H --             |       |       |
| 2449.4           | 1.9           | 28.3         | 9.9         | 40.1            | --        | H --             |       |       |
| 2555.9           | 4.25          | 28.7         | 7.5         | 40.4            | --        | V --             |       |       |
| 2555.9           | 4.6           | 28.7         | 7.5         | 40.8            | --        | H --             |       |       |
| 2662.4           | 7.7           | 29.2         | 6.3         | 43.2            | --        | H --             |       |       |
| 2768.9           | 7.55          | 29.7         | 5.6         | 42.9            | --        | H --             |       |       |
| 2875.4           | -.9           | 30.2         | 5.4         | 34.7            | --        | H --             |       |       |
| 2981.9           | 3             | 30.7         | 5.4         | 39.1            | --        | H --             |       |       |
| 3088.4           | 2.8           | 30.9         | 5.3         | 39.1            | --        | V --             |       |       |
| 3194.8           | 2.45          | 31.1         | 5.4         | 38.9            | --        | H --             |       |       |

END OF HARMONIC MEASUREMENTS.

# INTERACTIVE TECHNOLOGIES INCORPORATED

## T U V P R O D U C T S E R V I C E

### RADIATED EMISSIONS

Large Test Site  
3 Meter Antenna Distance  
Equipment Under Test:  
ITI  
NOISE FLOOR  
Notes:

Report W8374 Run 6  
Date 08-17-98 Page 1  
Engineer \_\_\_\_\_  
Tech: JCS \_\_\_\_\_  
Requester \_\_\_\_\_

| Frequency<br>MHz | Level<br>dBuV | Factor<br>dB | Cable<br>dB | Final<br>dBuV/m | Az<br>deg | Polar\<br>Height | Delta | Delta |
|------------------|---------------|--------------|-------------|-----------------|-----------|------------------|-------|-------|
| 1499.9           | -6.7          | 25.5         | 3.8         | 22.6            | --        | H --             |       |       |
| 2000             | -5.75         | 27.3         | 6.1         | 27.6            | --        | H --             |       |       |
| 2499.9           | -4.65         | 28.4         | 8.6         | 32.4            | --        | H --             |       |       |
| 2999.9           | -4.8          | 30.8         | 5.4         | 31.4            | --        | H --             |       |       |
| 3500             | -2.6          | 31.5         | 5.6         | 34.5            | --        | H --             |       |       |
| 4000             | -6.05         | 32.6         | 6.3         | 32.9            | --        | H --             |       |       |
| 4500             | -3.65         | 32.3         | 6.5         | 35.1            | --        | H --             |       |       |
| 300              | -5.2          | 14.1         | 1.5         | 10.4            | --        | H --             |       |       |
| 400              | -6.8          | 17.8         | 1.8         | 12.8            | --        | H --             |       |       |
| 500              | -4.35         | 18.2         | 2           | 15.9            | --        | H --             |       |       |
| 600              | -5.6          | 19.6         | 2.2         | 16.2            | --        | H --             |       |       |
| 700              | -6.3          | 20           | 2.4         | 16.1            | --        | H --             |       |       |
| 800              | -7.4          | 21.6         | 2.6         | 16.8            | --        | H --             |       |       |
| 900              | -5.75         | 22.3         | 2.8         | 19.4            | --        | H --             |       |       |
| 1000             | -4.85         | 24.2         | 3           | 22.3            | --        | H --             |       |       |
| 30               | -4.4          | 12.6         | .5          | 8.7             | --        | H --             |       |       |
| 106.35           | -5.65         | 10.2         | .9          | 5.5             | --        | H --             |       |       |
| 200              | -8.45         | 14.5         | 1.3         | 7.3             | --        | H --             |       |       |

END OF NOISE FLOOR MEASUREMENTS.

# INTERACTIVE TECHNOLOGIES INCORPORATED

## PRODUCT DESCRIPTION

The Touchtalk transmitter is on off keyed transmitting pulse width encoded digital data packets. The transmitter is based on a simple phase lock loop ( PLL ) synthesizer deriving a 319.5 MHz carrier from a 13.3125 MHz crystal. A single integrated circuit ( U2 ) contains the phase detector, programmable counters, voltage controlled oscillator ( VCO ), and rf amplifiers. The PLL is turned on by the microprocessor prior to the rf amplifiers being enabled to allow time for the loop to lock. The carrier signal outputted at U2, pin 5 is applied to the amplifier through a band- pass filter consisting of L4 and C11. The rf amplifiers are on off keyed by the transmitter data signal applied to Q3.

**NOTE:** See schematic on page 37.



## EM MICROELECTRONIC-MARIN SA

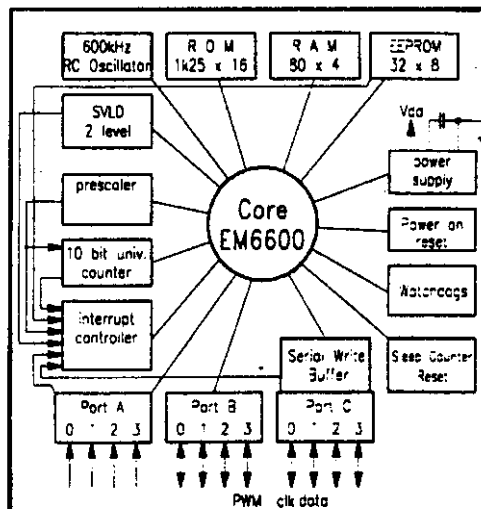
une société de la **SMI**

### EM6640 4 bit Microcontroller

#### Features

- Low Power
  - 28µA active mode
  - 11µA standby mode
  - 0.3µA sleep mode
  - Ⓢ 1.8V, 600kHz, 25°C, typ
- Voltage Range - 1.8 to 3.6 V
- Supply voltage level detection (SVLD)
- ROM - 1k25 x 16
- RAM - 80 x 4
- EEPROM - 32 x 8
- 2 clocks per instruction cycle
- 72 basic instructions
- RC oscillator
- Oscillation detection circuit / Digital watchdog timer reset.
- max. 12 inputs (3 ports)
- max. 8 outputs (2 ports)
- Serial Write Buffer - 256 bits (SWB)
- 10 bit up/down counter with PWM capability
- frequency output 600kHz, 37.5kHz, 2.3kHz, PWM
- Sleep Counter Reset (SCR) programmable.
- 8 internal interrupt sources (3xprescaler, 2xtimer, 1xSWB, 1xSVLD, 1xEEPROM)
- 4 external interrupt sources (port A)
- Reset with input combinations

Figure 1 Architecture



#### Description

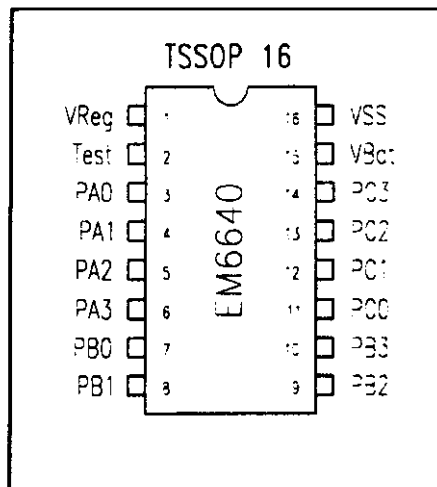
The EM66XX series is an advanced single chip low cost CMOS 4-bit microcontroller. It contains ROM, RAM, EEPROM, watchdog timer, oscillation detection circuit, 10 bit up/down counter, prescaler, supply voltage level detector (SVLD), sleep counter reset (SCR), frequency output and SWB.

The low voltage feature and low power consumption make it the most suitable controller for battery, stand alone and mobile equipment. The EM66XX series is manufactured using EM's Advanced Low Power (ALP) CMOS Process.

#### Typical Applications

- remote controls
- medical applications
- domestic appliance
- safety and security devices
- measurement equipment
- interactive system
- keyless entry with rolling code

Figure 2 Pin Configuration



**PRODUCT SCHEMATICS**

\* **NOTE:** Schematics give pertinent information on oscillators, frequency blocks and microprocessors.