2.1 On-board Oscillators

The Transportation Safety Devices, Inc. Transmitter contains a 4.00 MHz that is used for the digital portion of the unit. The transmitter is a RF Monolithics HX1003-1 miniature module which contains a 418 MHz transmitter.

3.0 Test Configuration

To complete the test configuration required by the FCC, the cigarette lighter cord was connected to EUT. The transmitter was tested in all three orthogonal planes. Since the different keypads do not change the duty cycle of the RF carrier, the 16 key keypad was tested and data is representative of both models.

3.1 Testing Algorithm

The transmitter was turned on and constantly transmitting with the worst case modulation. Worst case emissions are recorded in the data tables.

3.2 Conducted Emissions Testing

Conducted emissions testing was not performed since the unit is battery powered and does not connect to the AC power mains.

3.3 Radiated Emissions Testing

The EUT was placed on an 80 cm high 1 x 1.5 meters non-conductive motorized turntable for radiated testing on a 3 meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Biconical log periodic and horn broadband antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The output from the antenna was connected, via a preselector or preamplifier, to the input of the spectrum analyzer. The detector function was set to peak. For emissions below 1 GHz, the measurement bandwidth on the spectrum analyzer system was set to at least 120 kHz, with all post-detector filtering no less than 10 times the measurement bandwidth. For emissions above 1 GHz, the measurement bandwidth on the spectrum analyzer system was set to at least 1 MHz, with all post-detector filtering no less than 10 times the measurement bandwidth.

3.3.1 Radiated Data Reduction and Reporting

To convert the raw spectrum analyzer radiated data into a form that can be compared with the FCC limit, it is necessary to account for various calibration factors that are supplied with the antennas and other measurement accessories. These factors are grouped into a composite antenna factor (AFc) and are supplied in the AFc column of Table 1. The AFc in dB/m and AFd (duty cycle factor) in dBμV (see Exhibit 1) are algebraically added to the Spectrum Analyzer Voltage in dBμV to obtain the Radiated Electric Field in dBμV/m. This level is then compared with the FCC limit.

Example:

Spectrum Analyzer Voltage:	VdBμV
Composite Antenna Factor:	AFcdB/m
Duty Cycle Factor:	AFddBμV
Electric Field:	EdBμV/m = VdBμV + AFcdB/m + AFddBμV
To convert to linear units:	EμV/m = antilog (EdBμV/m/20)

Data is recorded in Table 1.

Table 1

FCC Class B 3M Radiated Emissions Data - Site 2

CLIENT: Transportation Safety Devices, Inc.
FCC ID: NVX-TSD-RR-MPX
DATE: 5/11/98
CARRIER: 418 MHz
BY: Steve Koster
JOB #: 4505X

FREQ MHz	POL H/V	Azimuth Degree	Ant Height m	SA LEVEL (Peak) dBuV	AFc dB/m	AFd dB	E-FIELD dBuV/m	E-FIELD uV/m	LIMIT uV/m	MARGIN dB	
418.00	H	90.00	1:0	60.7	19.0	-4.2	75.5	5956.6	10333.0	-4.7	
836.00	H	135.00	1.0	4.2	27.2	-4.2	27.2	22.9	1033.0	-33.1	
1254.00	V	180.00	1.0	55.0	-14.0	-4.2	36.8	69.2	1033.0	-23.5	
1672.00	H	45.00	1.0	41.5	-12.0	-4.2	25.3	18.4	500.0	-28.7	
2090.00	H	180.00	1.0	35.4	-6.9	-4.2	24.3	16.4	1033.0	-36.0	
2508.00	H	0.00	1.0	45.3	-6.7	-4.2	34.4	52.5	1033.0	-25.9	*
2926.00	H	0.00	1.0	44.0	-7.1	-4.2	32.7	43.2	1033.0	-27.6	*
3344.00	H	0.00	1.0	45.0	-6.5	-4.2	34.3	51.9	1033.0	-26.0	*

* No emissions were detected from the unit at these frequencies. Ambient emission levels were recorded.

Table 2

System Under Test

FCC ID: NVX-TSD-RR-MPX

EUT:	Transportation Safety Devices, Inc. Transmitter; FCC ID: NVX-TSD-RR-MPX

Table 3

Interface Cables Used

Non-shielded I/O cables were used throughout the system under test.

Table 4

Measurement Equipment Used

The following equipment is used to perform measurements:

Hewlett-Packard Spectrum Analyzer: HP 8568B
Hewlett-Packard Spectrum Analyzer: HP 8593A
Hewlett-Packard Quasi-Peak Adapter: HP 85650A
Hewlett-Packard Preselector: HP 85685A
Hewlett-Packard Preamplifier: HP 8449B
Antenna Research Associates, Inc. Biconical Log Periodic Antenna: LPB-2520
Antenna Research Associates Horn Antenna: DRG-118/A
Solar 50 Ω/50 µH Line Impedance Stabilization Network
AH Systems, Inc. Portable Antenna Mast: AMS-4
AH Systems, Inc. Antenna Tripod: ATU-200/510
AH Systems, Inc. Motorized Turntable
RG-214 semi-rigid coaxial cable
RG-223 double-shielded coaxial cable

EXHIBIT 1

DUTY CYCLE CALCULATIONS

The following page shows a spectrum analyzer plot of the transmitter coding. The following calculations show the worst case 100 ms duty cycle correction used for calculating the average level of the carrier, harmonics, and emissions.

The wide "on" pulse has a pulse width of 1.28 ms and the narrow "on" pulse has a pulse width of 0.84 ms.

ON TIME PER 100 ms:

(29 x 1.28 ms) + (29 x 0.84 ms) = 61.48 ms ON TIME PER 100 ms

= 61.48% DUTY CYCLE
= - 4.2 dB

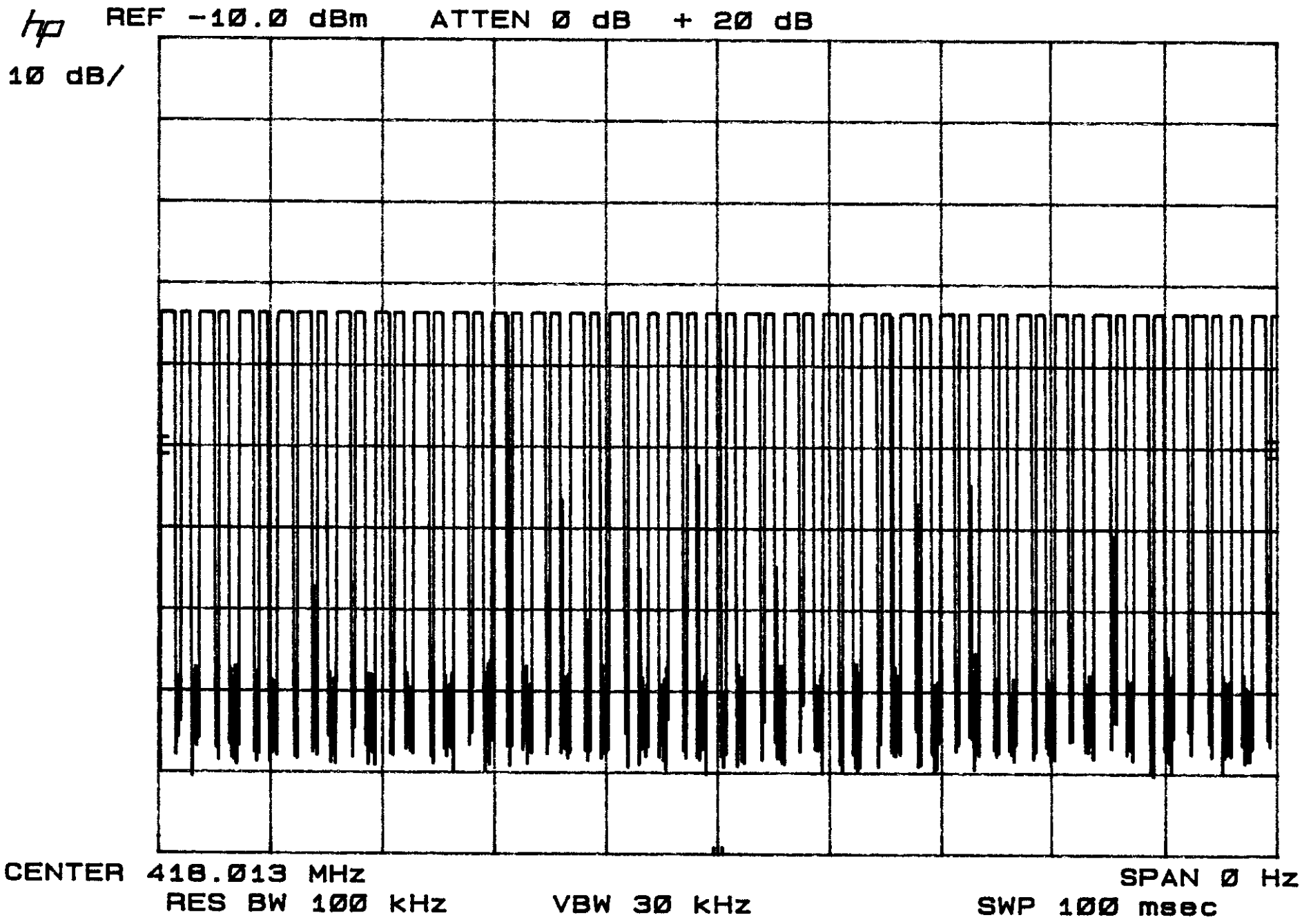
REF -10.0 dBm
ATTEN 0 dB + 20 dB
10 dB/
CENTER 418.013 MHz
SPAN 0 Hz
RES BW 100 kHz
VBW 30 kHz
SWP 100 msec

EXHIBIT 2

CARRIER BANDWIDTH DATA

The 20 dB modulated bandwidth shall be no wider than 0.25% of the center frequency.

Bandwidth Limit = Carrier Frequency x .0025

Bandwidth Limit = 418 MHz x .0025 = 1.045 MHz

Measured EUT Bandwidth = 215.0 kHz

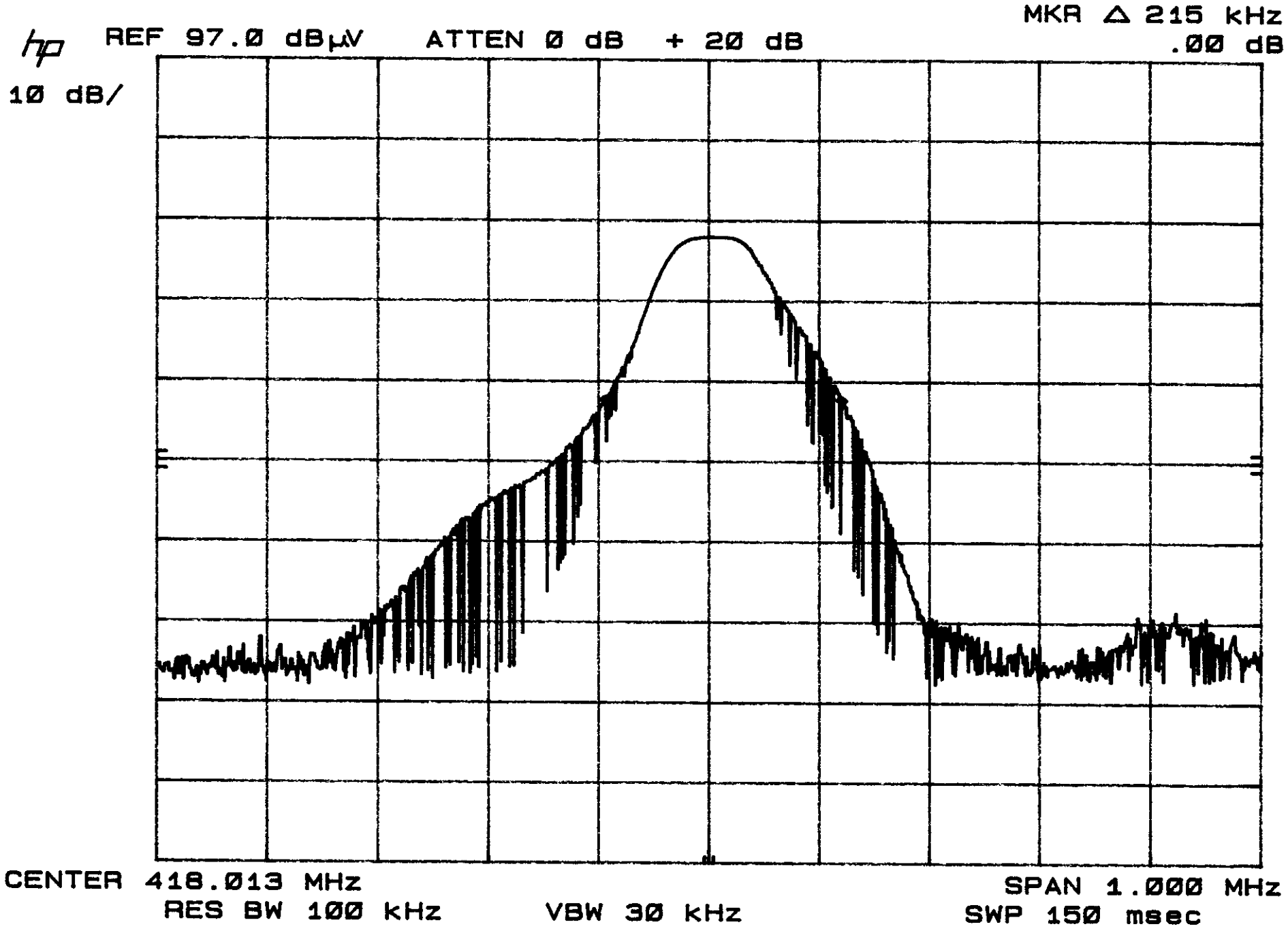
MKR Δ 215 kHz
.00 dB
REF 97.0 dBμV
ATTEN 0 dB + 20 dB
10 dB/
CENTER 418.013 MHz
RES BW 100 kHz
VBW 30 kHz
SPAN 1.000 MHz
SWP 150 msec

EXHIBIT 3

EUT PHOTOGRAPHS

EXHIBIT 4

MAXIMUM RADIATED EMISSIONS CONFIGURATION