EMISSIONS TEST REPORT

Report Number: 3125816BOX-007
Project Number: 3125816

Testing performed on the

Anti-Theft Device

Model: Phazor

To

FCC Part 15 Subpart C 15.223

For

Ketec, Inc.

Test Performed by:	Test Authorized by:
Intertek – ETL SEMKO	Ketec, Inc.
70 Codman Hill Road	1256 N. Church Street, Unit A
Boxborough, MA 01719	Moorestown, NJ 08057

Prepared by: _____ Date: 08/23/2007
Nicholas Abbondante

Reviewed by: _____ Date: 08/24/07
Jeff Goulet

1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company:	Ketec, Inc. 1256 N. Church Street Unit A Moorestown, NJ 08057
Contact:	Mr. Rich Frohberg
Telephone:	856-778-4343
Fax:	856-778-8337
Email:	Rich.frohberg@ketec.com

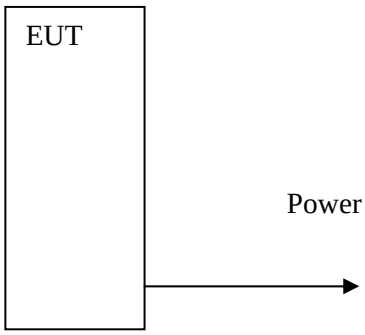
1.2 Equipment Under Test

Equipment Type:	Anti-Theft Device
Model Number(s):	Phazor
Serial number(s):	BOX0706200824-001
Manufacturer:	Ketec, Inc.
EUT receive date:	08/15/2007
EUT received condition:	Prototype in Good Condition
Test start date:	08/15/2007
Test end date:	08/16/2007

1.3 Test Plan Reference: Tested according to the standards listed and ANSI C63.4:2003.

1.4 Test Configuration

1.4.1 Block Diagram



1.4.2. Cables:

Cable	Shielding	Connector	Length (m)	Qty.
Power Cable	None	Plastic/wire	~2.5	1

1.4.3. Support Equipment:

Name: None
Model No.:
Serial No.:

1.5 Mode(s) of Operation:

The EUT was activated from nominal 120V/60Hz power and was transmitting continuously (normal operation) during testing. The EUT is a transmitter that operates centered at 8.175 MHz, with using 8 discrete frequencies, the lowest of which is 7.65 MHz and the highest of which is 8.7 MHz. The transmitter operates in a sept frequency hopping arrangement. During testing, the highest amplitude representative frequency of the 8 was selected for test at both fundamental frequencies and at harmonics.

1.6 Floor Standing Equipment: Applicable:_X__ Not Applicable:___

2.0 Test Summary

TEST STANDARD	RESULTS	
FCC Part 15 Subpart C 15.223		
SUB-TEST	**TEST PARAMETER**	**COMMENT**
Fundamental Field Strength FCC 15.223	Fundamental field strength must not exceed 60 dBuV/m peak and 40 dBuV/m average at a test distance of 30m, when measured with a 300 kHz RBW. See Appendix A for details. Average values are obtained from application of the calculated duty cycle correction factor to the fundamental field strength amplitude measured with a peak detector.	Pass
Radiated Emissions, <30 MHz FCC 15.209	Emissions must be below FCC 15.209 limits	Pass
Radiated Emissions, >30 MHz FCC 15.209	Emissions must be below FCC 15.209 limits	Pass
Duty Cycle FCC 15.35(c)	No limit	No Limit
Emission Bandwidth FCC 15.205(d)(1)	The ratio of the maximum restricted band infringed upon divided by the fundamental emission bandwidth must be less than 1%.	Pass
AC Line-Conducted Emissions FCC 15.207	Emissions must be below FCC 15.207 limits	Pass

REVISION SUMMARY – The following changes have been made to this Report:

Date	Project No.	Project Handler	Page(s)	Item	Description of Change

3.0 Sample Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

Level in μV/m = [10(32 dBμV/m)/20] = 39.8 μV/m

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(48.1\ dB\mu V / 20)}$ = 254 μV/m

3.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.
The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be:

±3.5 dB at 10m, ±3.8 dB at 3m

The expanded uncertainty (k = 2) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:

±2.6 dB

The expanded uncertainty (k = 2) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:

±3.2 for ISN and voltage probe measurements
±3.1 for current probe measurements

3.2 Site Description

Test Site(s): 2

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-2003 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

The EMC Lab has two Semi-anechoic Chambers and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference groundplanes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Test Results: Pass

Test Standard: FCC Part 15 Subpart C

Test: Fundamental Field Strength, FCC 15.223

Performance Criterion: Fundamental field strength must not exceed 60 dBuV/m peak and 40 dBuV/m average at a test distance of 30m, when measured with a 300 kHz RBW. See Appendix A for details. Average values are obtained from application of the calculated duty cycle correction factor to the fundamental field strength amplitude measured with a peak detector.

Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	21	Humidity (%):	67	Pressure (hPa):	1001
Pretest Verification Performed		Yes		Equipment under Test:		Phazor	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		BOX0706200824-001	

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	12/19/2007
3	LOOP ANTENNA	Empire	LP-105	905	09/13/2007
4	10 Meter in floor cable for site 2	ITS	RG214B/U	S2 10M FLR	09/26/2007

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

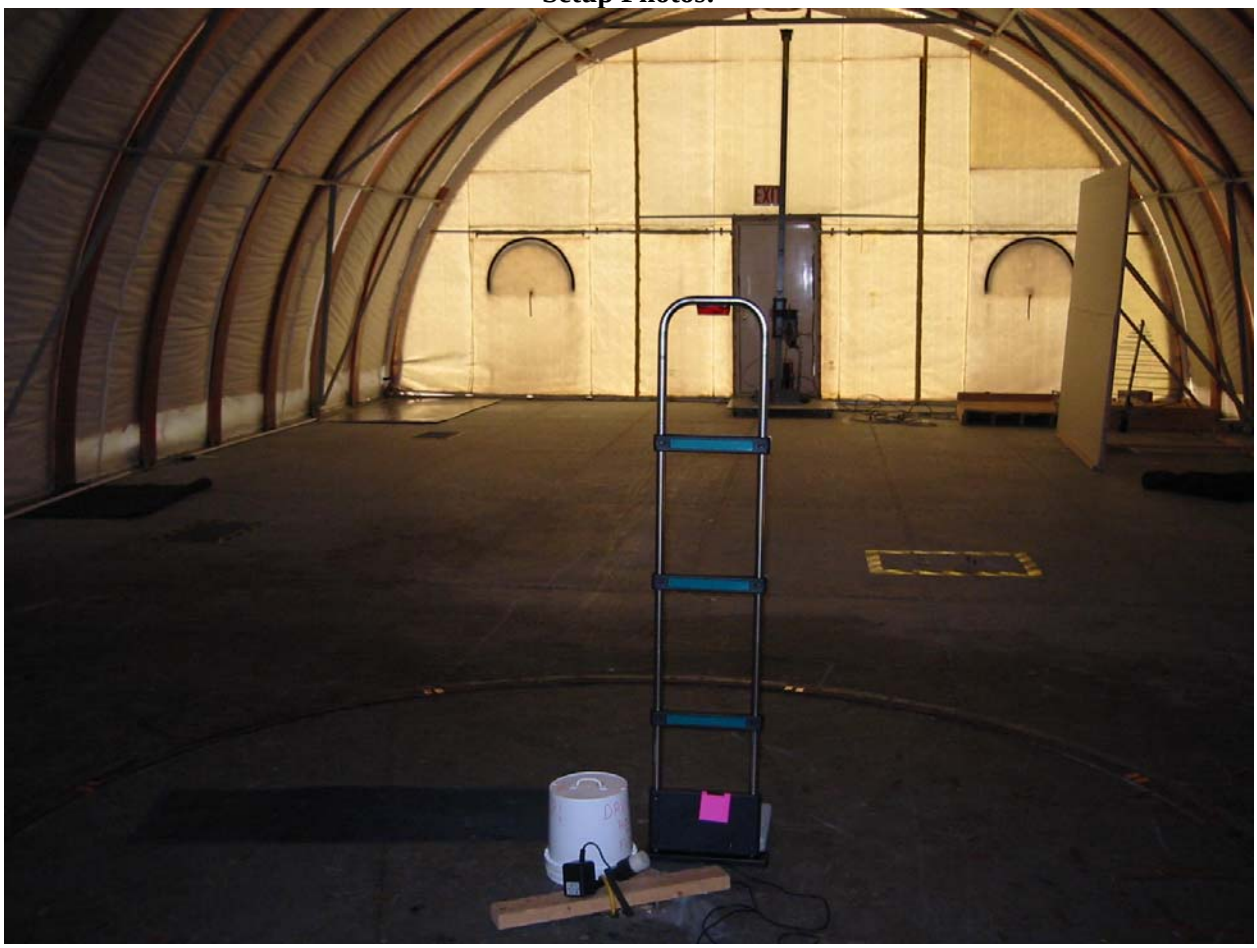
Test Details:

Special Radiated Emissions

Company: Ketec, Inc. Antenna & Cables: LF Bands: N, LF, HF, SHF
Model #: Phazor Antenna: Loop2 E 9-13-07.txt Loop2 H 9-13-07.txt
Serial #: BOX0706200824-001 Cable(s): S2 10M FLR 9-26-07.txt NONE.
Engineers: Nicholas Abbondante Location: Site 2 Barometer: BAR2
Project #: 3125816 Date(s): 08/15/07
Standard: FCC Part 15 Subpart C 15.223 Temp/Humidity/Pressure: 21c 67% 1001mB
Receiver: R&S ESCI (ROS002) Limit Distance (m): 30
PreAmp: NONE. Test Distance (m): 10
PreAmp Used? (Y or N): N Voltage/Frequency: 120V/60Hz Frequency Range: Frequencies Shown
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Note: Plane of loop antenna (loop face) facing EUT for following radials													
Note: Radial 1 (EUT perpendicular to antenna)													
PK	V	8.392	18.8	42.5	0.8	0.0	19.1	43.0	60.0	-17.0	300/1000 kHz		
AVG	V	8.392	-30.1	42.5	0.8	0.0	19.1	-5.9	40.0	-45.9	300/1000 kHz		
Note: Radial 2													
PK	V	8.704	30.1	42.4	0.8	0.0	19.1	54.2	60.0	-5.8	300/1000 kHz		
AVG	V	8.704	-18.8	42.4	0.8	0.0	19.1	5.3	40.0	-34.7	300/1000 kHz		
Note: Radial 3 (EUT parallel to antenna, back facing antenna)													
PK	V	8.210	33.2	42.5	0.8	0.0	19.1	57.4	60.0	-2.6	300/1000 kHz		
AVG	V	8.210	-15.7	42.5	0.8	0.0	19.1	8.5	40.0	-31.5	300/1000 kHz		
Note: Radial 4													
PK	V	8.093	29.3	42.6	0.8	0.0	19.1	53.5	60.0	-6.5	300/1000 kHz		
AVG	V	8.093	-19.6	42.6	0.8	0.0	19.1	4.6	40.0	-35.4	300/1000 kHz		
Note: Radial 5 (EUT perpendicular to antenna)													
PK	V	7.950	11.7	42.6	0.8	0.0	19.1	36.0	60.0	-24.0	300/1000 kHz		
AVG	V	7.950	-37.2	42.6	0.8	0.0	19.1	-12.9	40.0	-52.9	300/1000 kHz		
Note: Radial 6													
PK	V	7.949	29.3	42.6	0.8	0.0	19.1	53.6	60.0	-6.4	300/1000 kHz		
AVG	V	7.949	-19.6	42.6	0.8	0.0	19.1	4.7	40.0	-35.3	300/1000 kHz		
Note: Radial 7 (EUT parallel to antenna, board facing antenna)													
PK	V	8.202	31.9	42.5	0.8	0.0	19.1	56.1	60.0	-3.9	300/1000 kHz		
AVG	V	8.202	-17.0	42.5	0.8	0.0	19.1	7.2	40.0	-32.8	300/1000 kHz		
Note: Radial 8													
PK	V	8.223	30.1	42.5	0.8	0.0	19.1	54.3	60.0	-5.7	300/1000 kHz		
AVG	V	8.223	-18.8	42.5	0.8	0.0	19.1	5.4	40.0	-34.6	300/1000 kHz		
Note: Side of loop antenna facing EUT for following radials													
Note: Radial 1 (EUT in-line with side of loop antenna)													
PK	V	8.696	31.1	42.4	0.8	0.0	19.1	55.2	60.0	-4.8	300/1000 kHz		
AVG	V	8.696	-17.8	42.4	0.8	0.0	19.1	6.3	40.0	-33.7	300/1000 kHz		
Note: Radial 2													
PK	V	8.566	28.4	42.4	0.8	0.0	19.1	52.6	60.0	-7.4	300/1000 kHz		
AVG	V	8.566	-20.5	42.4	0.8	0.0	19.1	3.7	40.0	-36.3	300/1000 kHz		
Note: Radial 3 (EUT perpendicular to side of loop antenna, back facing antenna)													
PK	V	8.592	21.3	42.4	0.8	0.0	19.1	45.5	60.0	-14.5	300/1000 kHz		
AVG	V	8.592	-27.6	42.4	0.8	0.0	19.1	-3.4	40.0	-43.4	300/1000 kHz		
Note: Radial 4													
PK	V	8.548	28.1	42.4	0.8	0.0	19.1	52.2	60.0	-7.8	300/1000 kHz		
AVG	V	8.548	-20.8	42.4	0.8	0.0	19.1	3.3	40.0	-36.7	300/1000 kHz		
Note: Radial 5 (EUT in-line with side of loop antenna)													
PK	V	8.584	30.4	42.4	0.8	0.0	19.1	54.5	60.0	-5.5	300/1000 kHz		
AVG	V	8.584	-18.6	42.4	0.8	0.0	19.1	5.6	40.0	-34.4	300/1000 kHz		
Note: Radial 6													
PK	V	8.519	27.5	42.4	0.8	0.0	19.1	51.6	60.0	-8.4	300/1000 kHz		
AVG	V	8.519	-21.4	42.4	0.8	0.0	19.1	2.7	40.0	-37.3	300/1000 kHz		
Note: Radial 7 (EUT perpendicular to side of loop antenna, board side facing antenna)													
PK	V	8.571	22.1	42.4	0.8	0.0	19.1	46.2	60.0	-13.8	300/1000 kHz		
AVG	V	8.571	-26.9	42.4	0.8	0.0	19.1	-2.7	40.0	-42.7	300/1000 kHz		
Note: Radial 8													
PK	V	8.514	27.4	42.4	0.8	0.0	19.1	51.6	60.0	-8.4	300/1000 kHz		
AVG	V	8.514	-21.5	42.4	0.8	0.0	19.1	2.7	40.0	-37.3	300/1000 kHz		

Setup Photos:



Setup Photos Continued:

Test Results: No Limit

Test Standard: FCC Part 15 Subpart C

Test: Duty Cycle, FCC 15.35(c)

Performance Criterion: No Limit

Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	22	Humidity (%):	57	Pressure (hPa):	999
Pretest Verification Performed		Yes		Equipment under Test:		Phazor	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		BOX0706200824-001	

Test Equipment Used:

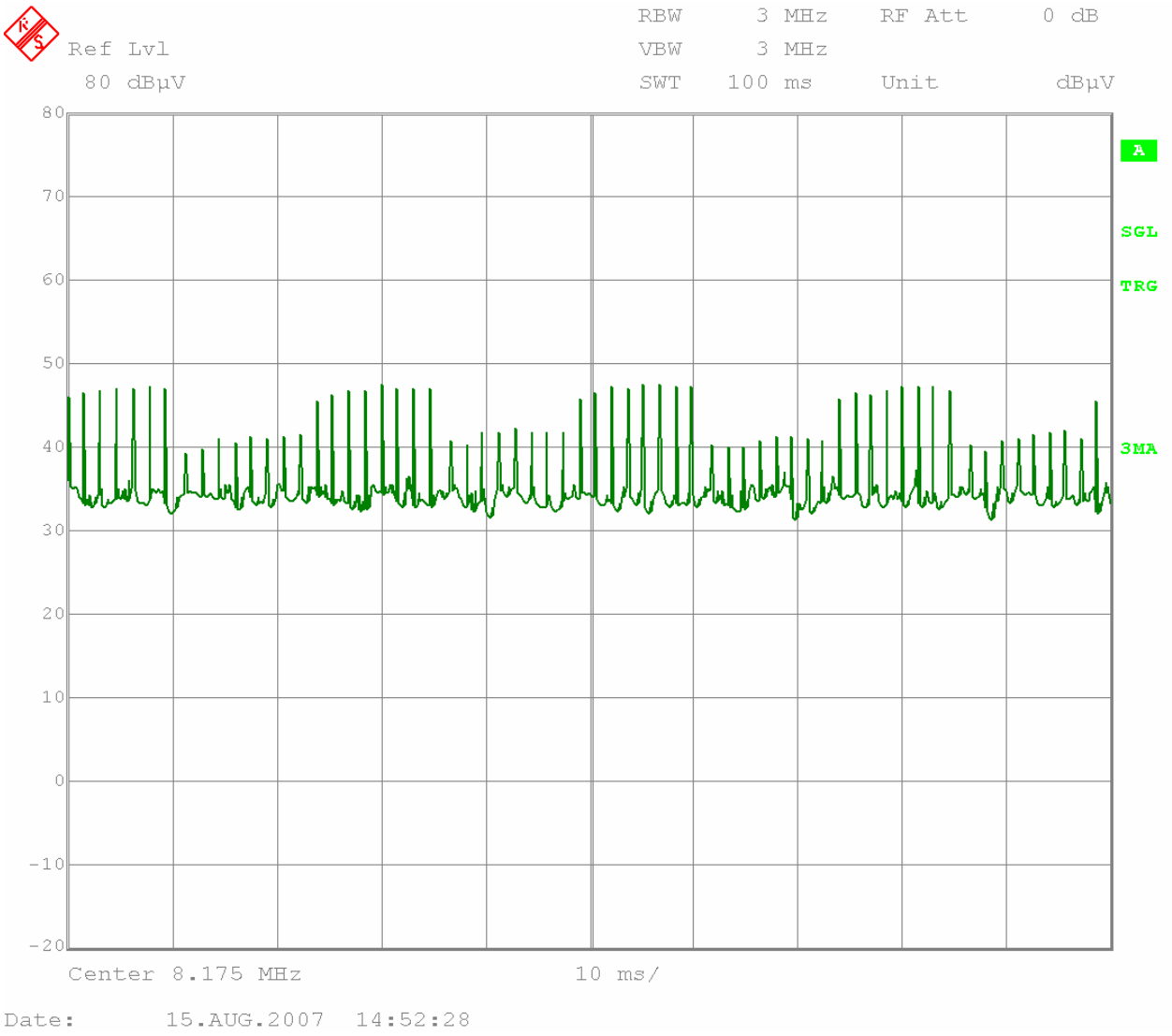
TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	10/23/2007
3	LOOP ANTENNA	Empire	LP-105	905	09/13/2007
4	10 Meter in floor cable for site 2	ITS	RG214B/U	S2 10M FLR	09/26/2007

Software Utilized:

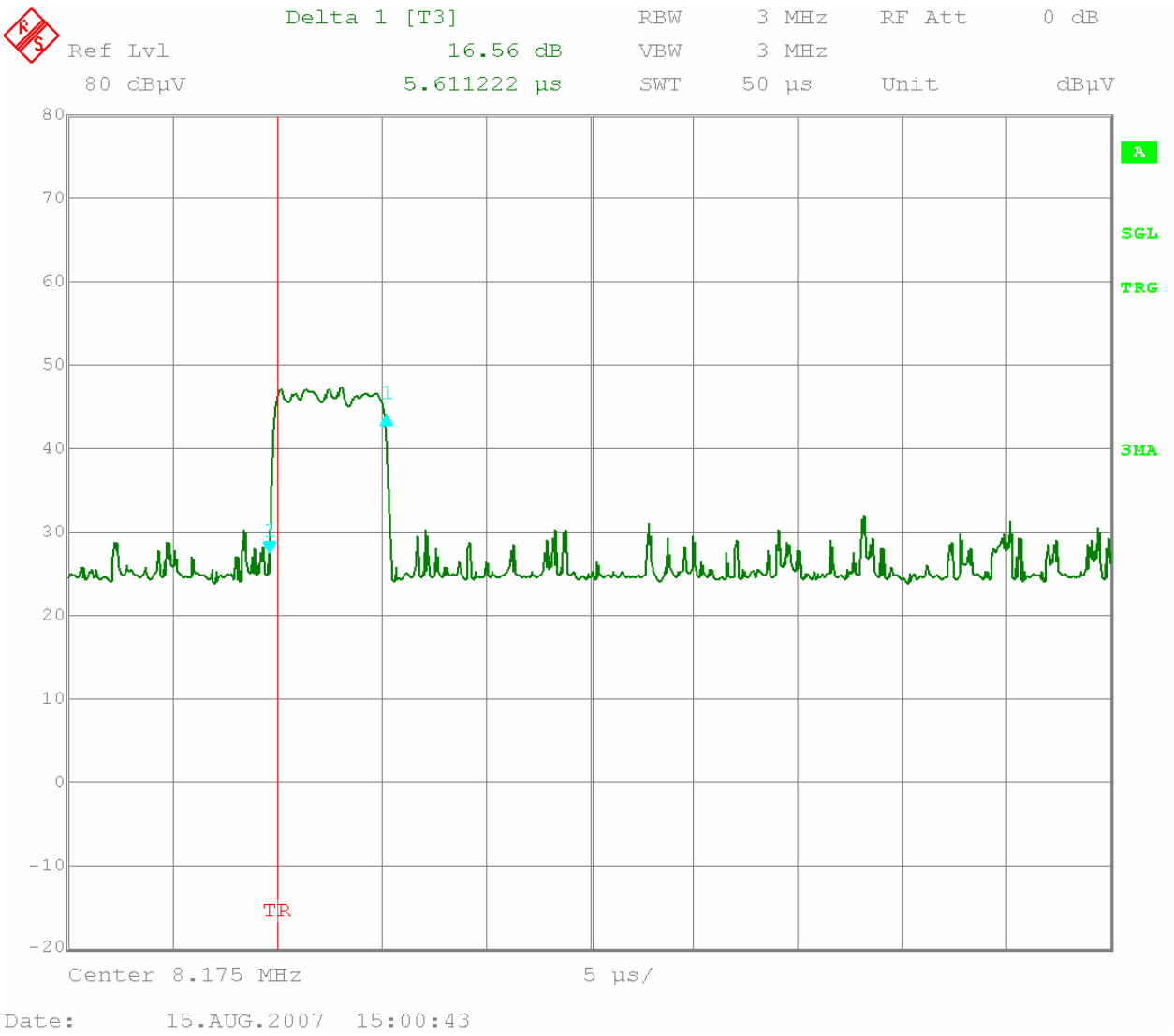
Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Details:

Notes: 64 peaks were observed in a 100 ms interval. Each peak was measured to have a duration of 5.61 us. This yields a total on-time of 359 us in a 100 ms interval. This yields a percent on-time of 0.00359 %. Using the formula Average factor (dB) = 20*LOG(% on-time), the duty cycle average factor is therefore
-48.9 dB.



64 peaks in 100 ms



5.61us peak duration

Test Results: Pass

Test Standard: FCC Part 15 Subpart C

Test: Emission Bandwidth, FCC 15.205(d)(1)

Performance Criterion: The ratio of the maximum restricted band infringed upon divided by the fundamental 6 dB emission bandwidth must be less than 1%.

Test Environment:

Environmental Conditions During Testing:	Ambient (°C):	22	Humidity (%):	57	Pressure (hPa):	999
Pretest Verification Performed	Yes		Equipment under Test:		Phazor	
Test Engineer(s):	Nicholas Abbondante		EUT Serial Number:		BOX0706200824-001	

Test Equipment Used:

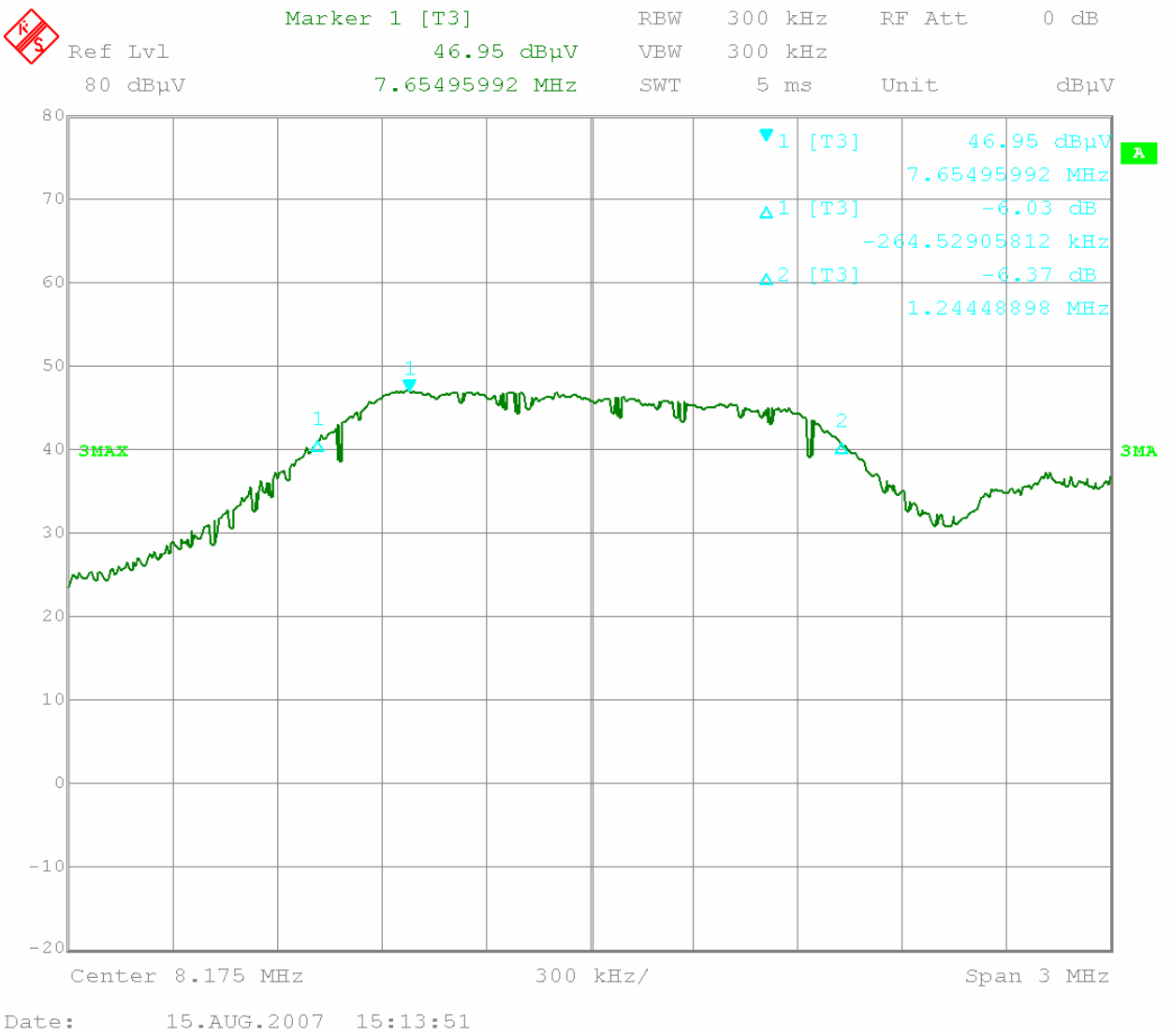
TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	10/23/2007
3	LOOP ANTENNA	Empire	LP-105	905	09/13/2007
4	10 Meter in floor cable for site 2	ITS	RG214B/U	S2 10M FLR	09/26/2007

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Details:

Notes: The 6 dB emission bandwidth when measured with a 300 kHz RBW is 1.509 MHz. The largest restricted band that the EUT sweeps through is 10.5 kHz wide (8.37625-8.38675 MHz). This yields a ratio of 0.7%.



Test Results: Pass

Test Standard: FCC Part 15 Subpart C

Test: Radiated Emissions <30 MHz, FCC 15.209

Performance Criterion: Emissions must be below FCC 15.209 limits

Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	22	Humidity (%):	63	Pressure (hPa):	1000
Pretest Verification Performed		Yes		Equipment under Test:		Phazor	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		BOX0706200824-001	

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	LOOP ANTENNA	Empire	LP-105	905	09/13/2007
3	10 Meter in floor cable for site 2	ITS	RG214B/U	S2 10M FLR	09/26/2007
4	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	12/19/2007

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

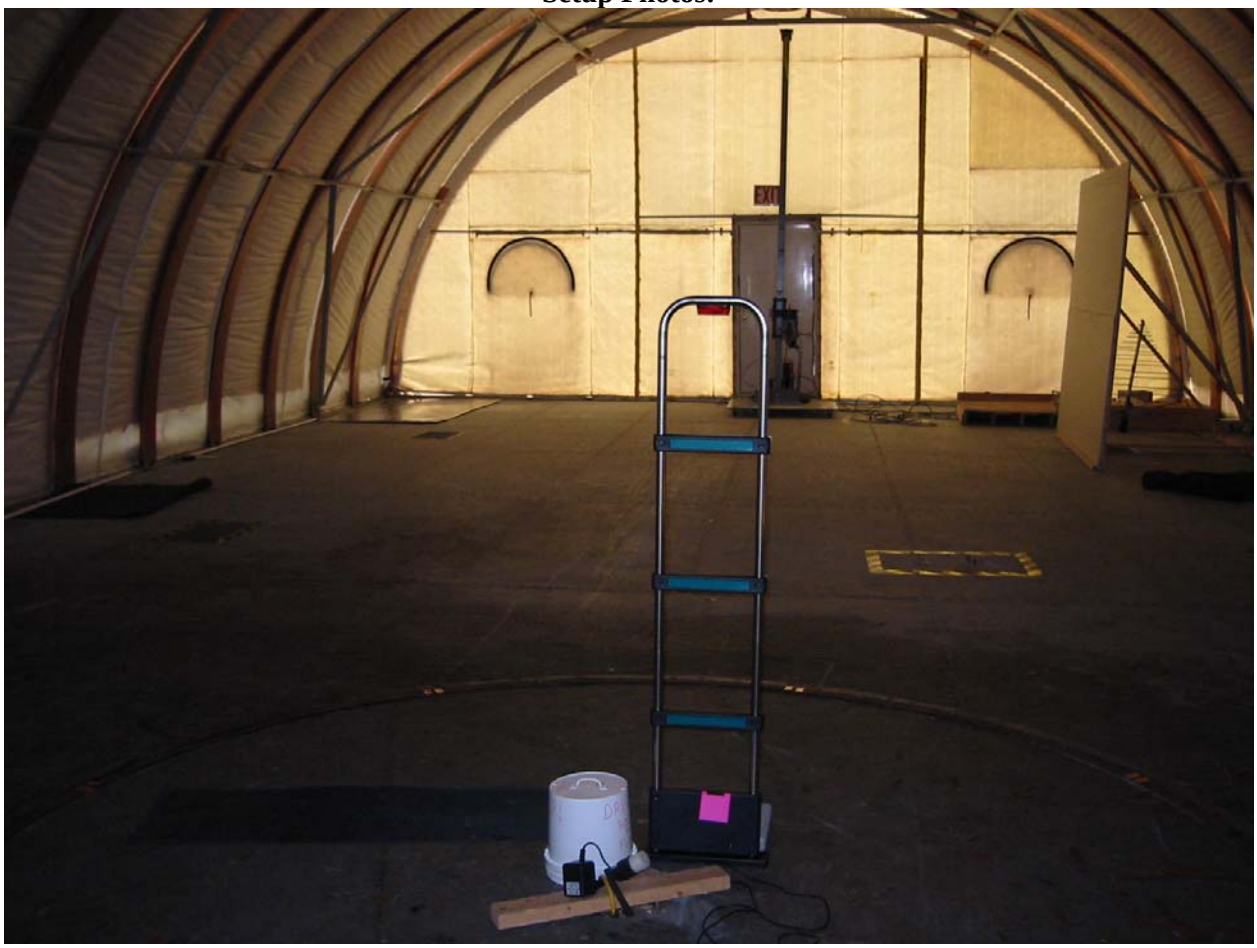
Test Details:

Special Radiated Emissions													
Company:	Ketec, Inc.						Antenna & Cables:	LF	Bands: N, LF, HF, SHF				
Model #:	Phazor						Antenna:	Loop2 E 9-13-07.txt	Loop2 H 9-13-07.txt				
Serial #:	BOX0706200824-001						Cable(s):	S2 10M FLR 9-26-07.txt	NONE.				
Engineers:	Nicholas Abbondante			Location:	Site 2		Barometer:	BAR2					
Project #:	3125816	Date(s):	08/15/07										
Standard:	FCC Part 15 Subpart C 15.209						Temp/Humidity/Pressure:	22c	63%	1000mB			
Receiver:	R&S ESCI (ROS002)		Limit Distance (m):	3									
PreAmp:	NONE.		Test Distance (m):	10									
PreAmp Used? (Y or N):	N	Voltage/Frequency:	120V/60Hz				Frequency Range:	Frequencies Shown					
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)													
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW													

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
QP	V	16.110	3.8	41.1	0.8	0.0	-20.9	66.6	69.5	-2.9	9/30 kHz		
QP	V	24.525	4.2	40.5	0.8	0.0	-20.9	66.4	69.5	-3.1	9/30 kHz		

Notes: Rather than adjust the emissions to the limit distance of 30m, the limit has been adjusted to a test distance of 3m. Actual test distance was 10m. Extrapolation was performed using a 40 dB/decade distance factor.

Setup Photos:



Setup Photos Continued:

Test Results: Pass

Test Standard: FCC Part 15 Subpart C

Test: Radiated Emissions >30 MHz, FCC 15.209

Performance Criterion: Emissions must be below FCC 15.209 limits

Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	21/22	Humidity (%):	58/53	Pressure (hPa):	999/999
Pretest Verification Performed		Yes		Equipment under Test:		Phazor	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		BOX0706200824-001	

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	3 Meter In floor cable for site 2	ITS	RG214B/U	S2 3M FLR	09/26/2007
3	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	12/19/2007
4	ANTENNA	EMCO	3142	9701-1116	12/04/2007

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Results:

Special Radiated Emissions

Company: Ketec, Inc. Antenna & Cables: N Bands: N, LF, HF, SHF
Model #: Phazor Antenna: LOG1 12-04-2007 V3.txt LOG1 12-04-2007 H3.txt
Serial #: BOX0706200824-001 Cable(s): S2 3M FLR 9-26-07.txt NONE.
Engineers: Nicholas Abbondante Location: Site 2 Barometer: BAR2
Project #: 3125816 Date(s): 08/15/07 08/16/07
Standard: FCC Part 15 Subpart C 15.209 Temp/Humidity/Pressure: 21c 58% 999mB
Receiver: R&S ESCI (ROS002) Limit Distance (m): 3 22c 53% 999mB
PreAmp: NONE. Test Distance (m): 3
PreAmp Used? (Y or N): N Voltage/Frequency: 120V/60Hz Frequency Range: 30-1000 MHz
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC
QP	V	30.600	8.6	16.6	0.8	0.0	0.0	26.0	40.0	-14.0	120/300 kHz	
QP	V	40.500	20.5	11.4	0.9	0.0	0.0	32.8	40.0	-7.2	120/300 kHz	
QP	V	49.500	20.7	8.5	1.0	0.0	0.0	30.2	40.0	-9.8	120/300 kHz	
QP	V	50.400	21.1	8.4	1.0	0.0	0.0	30.5	40.0	-9.5	120/300 kHz	
QP	V	53.510	22.3	8.4	1.0	0.0	0.0	31.7	40.0	-8.3	120/300 kHz	
QP	V	66.050	21.5	7.8	1.1	0.0	0.0	30.5	40.0	-9.5	120/300 kHz	
QP	V	69.580	28.8	7.5	1.1	0.0	0.0	37.4	40.0	-2.6	120/300 kHz	
QP	V	84.160	21.5	7.6	1.2	0.0	0.0	30.3	40.0	-9.7	120/300 kHz	
QP	V	86.992	19.7	7.7	1.3	0.0	0.0	28.7	40.0	-11.3	120/300 kHz	
QP	V	109.226	9.8	8.0	1.4	0.0	0.0	19.2	43.5	-24.3	120/300 kHz	RB
QP	V	121.814	18.9	6.8	1.5	0.0	0.0	27.2	43.5	-16.3	120/300 kHz	RB
QP	V	128.251	13.0	6.5	1.4	0.0	0.0	20.9	43.5	-22.6	120/300 kHz	RB
QP	H	137.720	13.7	8.2	1.5	0.0	0.0	23.4	43.5	-20.1	120/300 kHz	RB
QP	V	167.730	18.5	9.2	1.8	0.0	0.0	29.5	43.5	-14.0	120/300 kHz	RB
QP	H	182.696	21.0	10.4	1.9	0.0	0.0	33.3	43.5	-10.2	120/300 kHz	
QP	V	200.000	14.7	10.2	2.0	0.0	0.0	26.9	43.5	-16.6	120/300 kHz	
QP	V	202.700	11.3	10.4	2.0	0.0	0.0	23.7	43.5	-19.8	120/300 kHz	
QP	H	206.276	16.3	10.5	2.0	0.0	0.0	28.9	43.5	-14.6	120/300 kHz	
QP	H	209.700	6.9	10.7	2.0	0.0	0.0	19.6	43.5	-23.9	120/300 kHz	
QP	V	214.800	10.5	11.1	2.0	0.0	0.0	23.6	43.5	-19.9	120/300 kHz	
QP	V	222.400	9.4	11.6	2.0	0.0	0.0	23.0	46.0	-23.0	120/300 kHz	
QP	V	239.400	15.8	12.2	2.2	0.0	0.0	30.2	46.0	-15.8	120/300 kHz	
QP	V	243.600	17.7	12.4	2.2	0.0	0.0	32.3	46.0	-13.7	120/300 kHz	RB
QP	H	258.596	4.9	12.5	2.2	0.0	0.0	19.6	46.0	-26.4	120/300 kHz	RB
QP	V	283.200	11.9	13.5	2.5	0.0	0.0	27.9	46.0	-18.1	120/300 kHz	RB
QP	V	288.770	18.5	13.7	2.4	0.0	0.0	34.6	46.0	-11.4	120/300 kHz	
QP	H	299.200	16.8	14.1	2.4	0.0	0.0	33.3	46.0	-12.7	120/300 kHz	
QP	V	333.466	23.1	14.6	2.5	0.0	0.0	40.2	46.0	-5.8	120/300 kHz	RB
QP	V	357.780	18.3	15.2	2.8	0.0	0.0	36.3	46.0	-9.7	120/300 kHz	
QP	H	361.200	21.3	15.8	2.7	0.0	0.0	39.8	46.0	-6.2	120/300 kHz	
QP	V	382.400	19.5	15.2	2.9	0.0	0.0	37.6	46.0	-8.4	120/300 kHz	
QP	H	394.800	18.3	16.2	2.7	0.0	0.0	37.2	46.0	-8.8	120/300 kHz	

Special Radiated Emissions

Company: Ketec, Inc.
Model #: Phazor
Serial #: BOX0706200824-001
Engineers: Nicholas Abbondante
Project #: 3125816
Standard: FCC Part 15 Subpart C 15.209
Receiver: R&S ESCI (ROS002)
PreAmp: NONE.

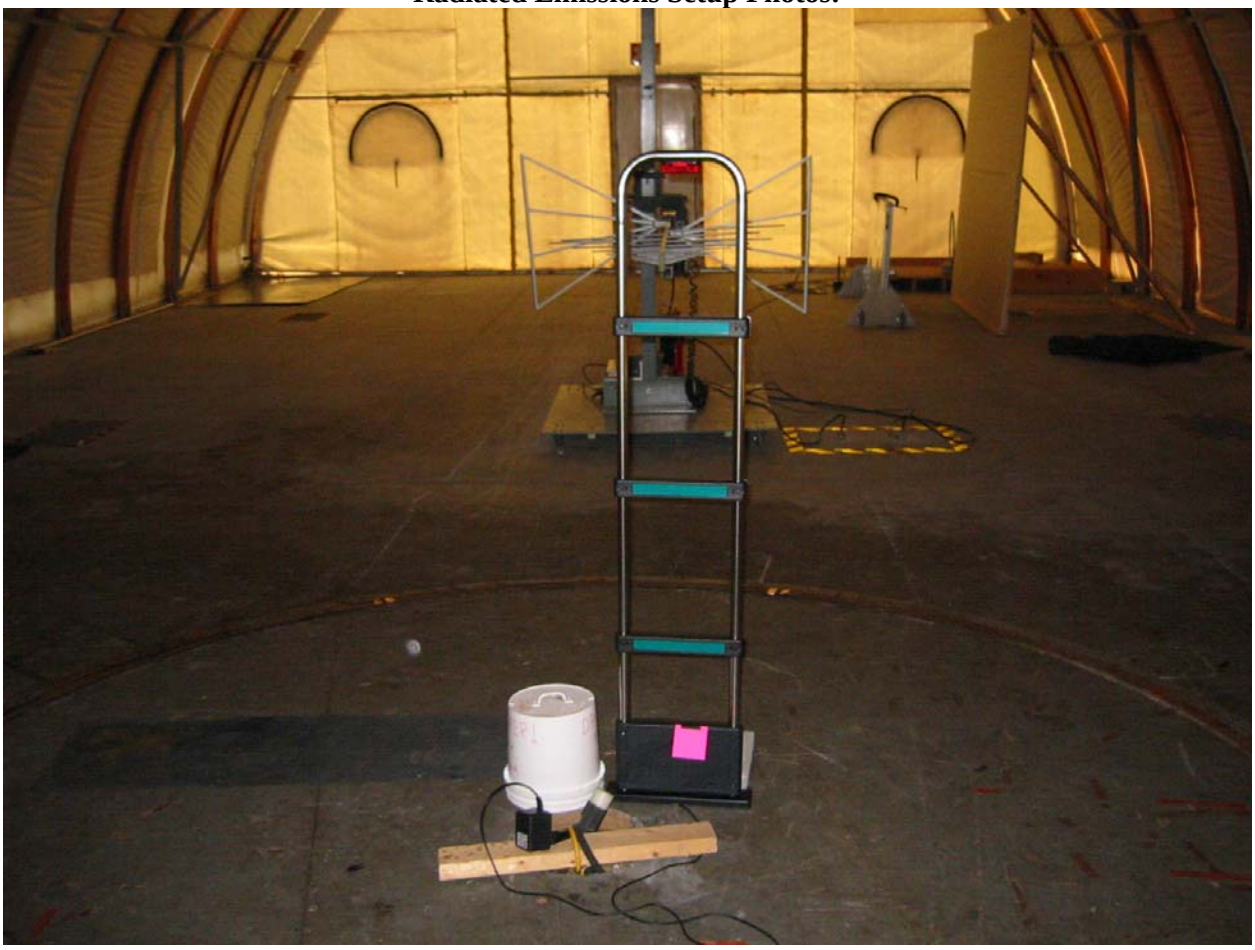
Antenna & Cables: N
Antenna: LOG1 12-04-2007 V3.txt
Cable(s): S2 3M FLR 9-26-07.txt
Location: Site 2
Barometer: BAR2
Date(s): 08/15/07 08/16/07
Limit Distance (m): 3
Test Distance (m): 3
PreAmp Used? (Y or N): N
Voltage/Frequency: 120V/60Hz

Bands: N, LF, HF, SHF
LOG1 12-04-2007 H3.txt
NONE.
Temp/Humidity/Pressure: 21c 58% 999mB
22c 53% 999mB
Frequency Range: 30-1000 MHz

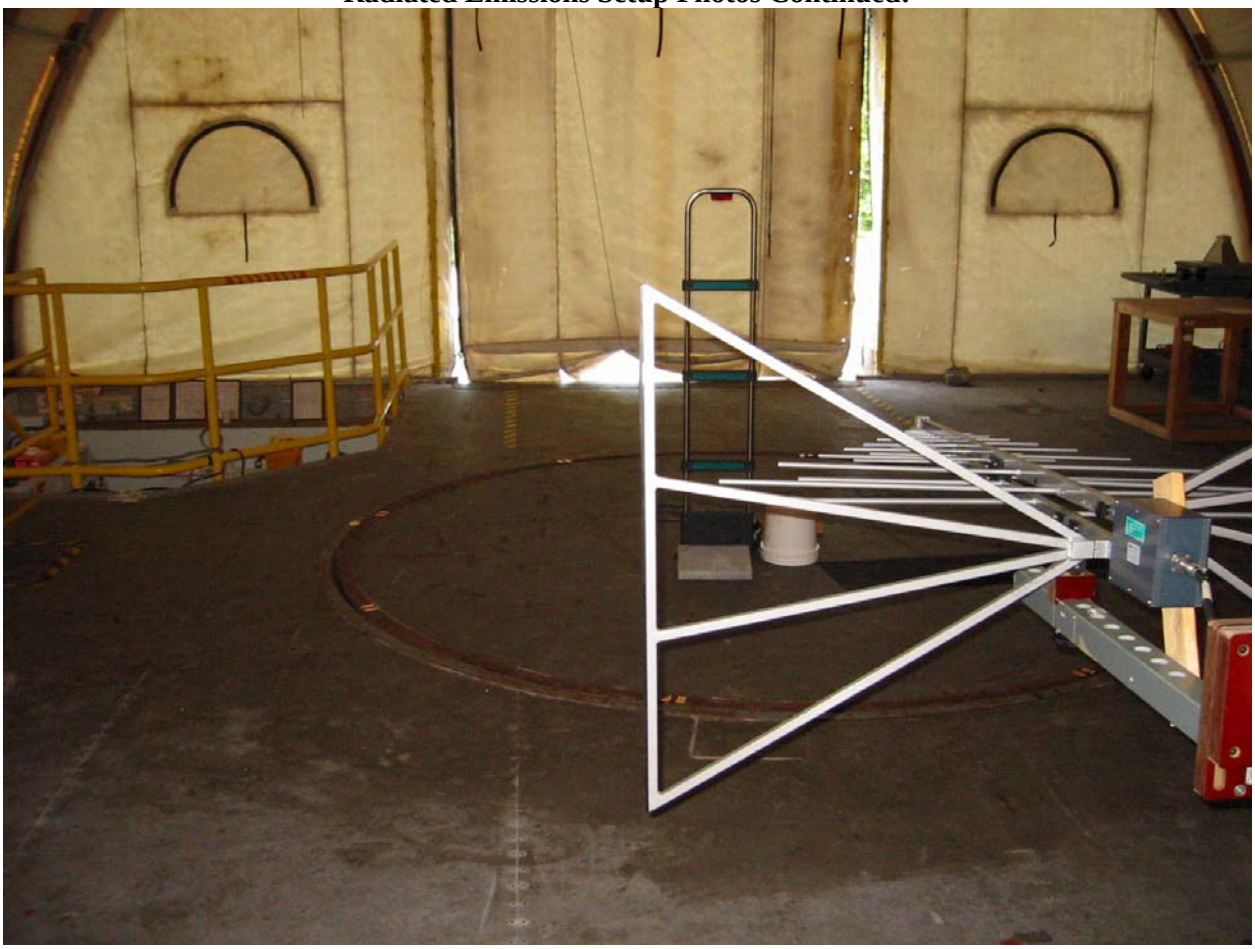
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC
QP	V	408.900	19.1	15.5	2.8	0.0	0.0	37.4	46.0	-8.6	120/300 kHz	RB
QP	V	420.800	21.0	15.9	2.8	0.0	0.0	39.7	46.0	-6.3	120/300 kHz	
QP	V	453.756	8.8	17.3	3.2	0.0	0.0	29.3	46.0	-16.7	120/300 kHz	
QP	V	478.542	12.1	18.2	3.0	0.0	0.0	33.3	46.0	-12.7	120/300 kHz	
QP	V	487.400	14.8	18.4	3.2	0.0	0.0	36.4	46.0	-9.6	120/300 kHz	
QP	V	513.400	23.0	18.9	3.5	0.0	0.0	45.3	46.0	-0.7	120/300 kHz	
QP	V	522.600	22.2	19.1	3.4	0.0	0.0	44.7	46.0	-1.3	120/300 kHz	
QP	V	532.800	21.5	19.1	3.2	0.0	0.0	43.8	46.0	-2.2	120/300 kHz	
QP	V	546.200	17.3	19.1	3.4	0.0	0.0	39.8	46.0	-6.2	120/300 kHz	
QP	V	555.800	15.6	19.0	3.6	0.0	0.0	38.1	46.0	-7.9	120/300 kHz	
QP	V	589.200	13.5	19.0	3.4	0.0	0.0	35.9	46.0	-10.1	120/300 kHz	
QP	V	604.400	16.0	19.3	3.5	0.0	0.0	38.8	46.0	-7.2	120/300 kHz	
QP	V	630.000	14.5	19.4	3.7	0.0	0.0	37.6	46.0	-8.4	120/300 kHz	
QP	H	658.400	12.6	21.2	3.9	0.0	0.0	37.7	46.0	-8.3	120/300 kHz	
QP	H	672.200	6.4	21.6	4.1	0.0	0.0	32.1	46.0	-13.9	120/300 kHz	
QP	V	680.800	11.1	20.0	3.8	0.0	0.0	34.9	46.0	-11.1	120/300 kHz	
QP	H	718.000	10.3	21.9	4.0	0.0	0.0	36.2	46.0	-9.8	120/300 kHz	
QP	V	734.400	12.7	20.7	4.1	0.0	0.0	37.5	46.0	-8.5	120/300 kHz	
QP	H	743.890	11.1	22.0	4.3	0.0	0.0	37.3	46.0	-8.7	120/300 kHz	
QP	H	756.800	10.0	22.2	4.3	0.0	0.0	36.4	46.0	-9.6	120/300 kHz	
QP	H	774.400	7.2	22.6	4.5	0.0	0.0	34.3	46.0	-11.7	120/300 kHz	
QP	H	792.080	6.0	22.4	4.4	0.0	0.0	32.8	46.0	-13.2	120/300 kHz	
QP	H	803.200	6.6	22.3	4.5	0.0	0.0	33.4	46.0	-12.6	120/300 kHz	
QP	H	826.200	15.1	22.7	4.2	0.0	0.0	42.0	46.0	-4.0	120/300 kHz	
QP	H	838.800	5.7	22.7	4.6	0.0	0.0	33.0	46.0	-13.0	120/300 kHz	
QP	V	850.700	5.6	22.8	4.5	0.0	0.0	32.9	46.0	-13.1	120/300 kHz	
QP	H	898.380	6.2	23.4	4.6	0.0	0.0	34.1	46.0	-11.9	120/300 kHz	
QP	V	915.379	5.9	22.9	4.7	0.0	0.0	33.5	46.0	-12.5	120/300 kHz	
QP	V	977.900	5.4	23.4	4.6	0.0	0.0	33.4	54.0	-20.6	120/300 kHz	RB

Radiated Emissions Setup Photos:



Radiated Emissions Setup Photos Continued:



Test Results: Pass

Test Standard: FCC Part 15 Subpart C

Test: AC Line-Conducted Emissions, FCC 15.207

Performance Criterion: Emissions must be below FCC 15.207 limits

Test Environment:

Environmental Conditions During Testing:		Ambient (°C):	22	Humidity (%):	57	Pressure (hPa):	999
Pretest Verification Performed		Yes		Equipment under Test:		Phazor	
Test Engineer(s):	Nicholas Abbondante			EUT Serial Number:		BOX0706200824-001	

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	**Equipment Type**	**Make**	**Model No.**	**Serial No.**	**Next Cal. Due**
1	Digital 4 Line Barometer	Mannix	0ABA116	BAR2	05/20/2008
2	LISN, 50uH, .01 - 50MHz, 24A	Solar Electronics	8012-50-R-24-BNC	934610	08/23/2007
3	Cable BNC/BNC, 30'	ITS	BNC-30	CBLBNC1	05/30/2008
4	Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS25A	03/05/2008
5	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	12/19/2007

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Results:

Conducted Emissions

Company:	Ketec, Inc.			Receiver:	R&S ESCI (ROS002)
Model #:	Phazor			Cable:	CBLBNC1 5-30-08.txt
Serial #:	BOX0706200824-001			LISN 1:	LISN5 [1] 8-23-07.txt
Engineer(s):	Nicholas Abbondante	Location:	Site 2	LISN 2:	LISN5 [2] 8-23-07.txt
Project #:	3125816	Date:	08/15/07	LISN 3:	NONE.
Standard:	FCC Part 15 Subpart C 15.207			LISN 4:	NONE.
Barometer:	BAR2	Temp/Humidity/Pressure:	22c 57% 999mB	Attenuator:	DS25A 03-05-08.txt
	Voltage/Frequency:	120V/60Hz	Frequency Range:	150 kHz - 30 MHz	

Net is the sum of worst-case lisn, cable, & attenuator losses, and initial reading, factors are not shown

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor; Bandwidth denoted as RBW/VBW

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	QP Limit dB(uV)	Margin dB	Bandwidth
QP	0.156	8.8	17.4			37.6	65.7	-28.1	9/30 kHz
QP	0.351	1.5	9.6			29.6	58.9	-29.4	9/30 kHz
QP	0.900	12.4	5.7			32.4	56.0	-23.6	9/30 kHz
QP	7.820	14.9	13.9			35.4	60.0	-24.6	9/30 kHz
QP	8.390	15.7	13.6			36.2	60.0	-23.8	9/30 kHz
QP	15.705	8.0	7.6			28.6	60.0	-31.4	9/30 kHz
QP	18.960	-0.7	0.1			20.8	60.0	-39.2	9/30 kHz
QP	23.840	9.1	4.5			29.9	60.0	-30.1	9/30 kHz
QP	25.660	9.8	5.2			30.6	60.0	-29.4	9/30 kHz

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Line 4 dB(uV)	Net dB(uV)	Average Limit dB(uV)	Margin dB	Bandwidth
AVG	0.156	2.7	11.3			31.5	55.7	-24.2	9/30 kHz
AVG	0.351	-10.8	-4.9			15.1	48.9	-33.9	9/30 kHz
AVG	0.900	7.8	1.3			27.8	46.0	-18.2	9/30 kHz
AVG	7.820	-7.8	-8.1			12.7	50.0	-37.3	9/30 kHz
AVG	8.390	-7.3	-7.9			13.2	50.0	-36.8	9/30 kHz
AVG	15.705	5.3	4.0			25.9	50.0	-24.1	9/30 kHz
AVG	18.960	-5.6	-4.8			15.9	50.0	-34.1	9/30 kHz
AVG	23.840	-7.1	-7.2			13.7	50.0	-36.3	9/30 kHz
AVG	25.660	-6.8	-7.3			14.0	50.0	-36.0	9/30 kHz

AC Line-Conducted Emissions Setup Photos:

AC Line-Conducted Emissions Setup Photos Continued:

Appendix A – FCC Correspondence

Testing the Phazor for FCC Part 15 Certification:

The Phazor system uses a swept frequency transmitter that is gated on and off at a frequency of 667Hz. The sweep technique, definition, and measurement is the same as used and previously agreed upon by the FCC for similar devices manufactured by Checkpoint Systems Inc. and Ketec Inc. See included documents from Ed Gibbons and Rich Fabina of the FCC.

1. The Phazor will produce 8 pulsed emissions at 8 different frequencies. The generation and transmission of these frequencies constitutes the fundamental frequency band and will be considered as a frequency hopping swept emission. The bandwidth is considered to be the spectrum between the lowest and highest pulsed frequencies and is greater than 10%. This satisfies the swept frequency requirement of Section 15.205(d).

2. The 8 frequencies will be considered as one fundamental frequency centered at 8.175 MHz.

3. The ratio of the maximum restricted band infringed upon divided by the fundamental emission bandwidth must be less than 1% to satisfy Section 15.205.

4. The transmitter is microprocessor controlled and is not capable of stopping in any restricted band. By its' inherent design, the transmitter is also incapable of stopping the sweep during measurements.

5. Fundamental and harmonic emissions up to 10 MHz will be measured at their true peak value according to the analyzer. To measure true peak, the analyzer is set to a frequency span of 6-10 MHz, peak detector, 300KHz Bandwidth, in the "max hold" condition. (Increasing the bandwidth beyond 300KHz does not increase the peak reading.) The peak reading of the displayed emission is then compared to the average limit of 15.223 (100uv/m @ 30m or 40dbuv/m) plus 20db. The corrected limit will be 60dbuv/m @ 30m. This is done due to the swept and pulsed nature of the transmission and in agreement with the FCC.

6. Emissions above 10 MHz will be made using CISPR quasi-peak measurements.

7. Conducted emissions remain as specified in Part 15 rules.

Included are a copy of the FAX from Ed Gibbons to Checkpoint Systems, dated 8/2/96, agreeing with the above measurement method, a reprint of text for clarity, and a copy of the email from Rich Fabina to Ketec Inc. confirming the same method for a similar Ketec product.

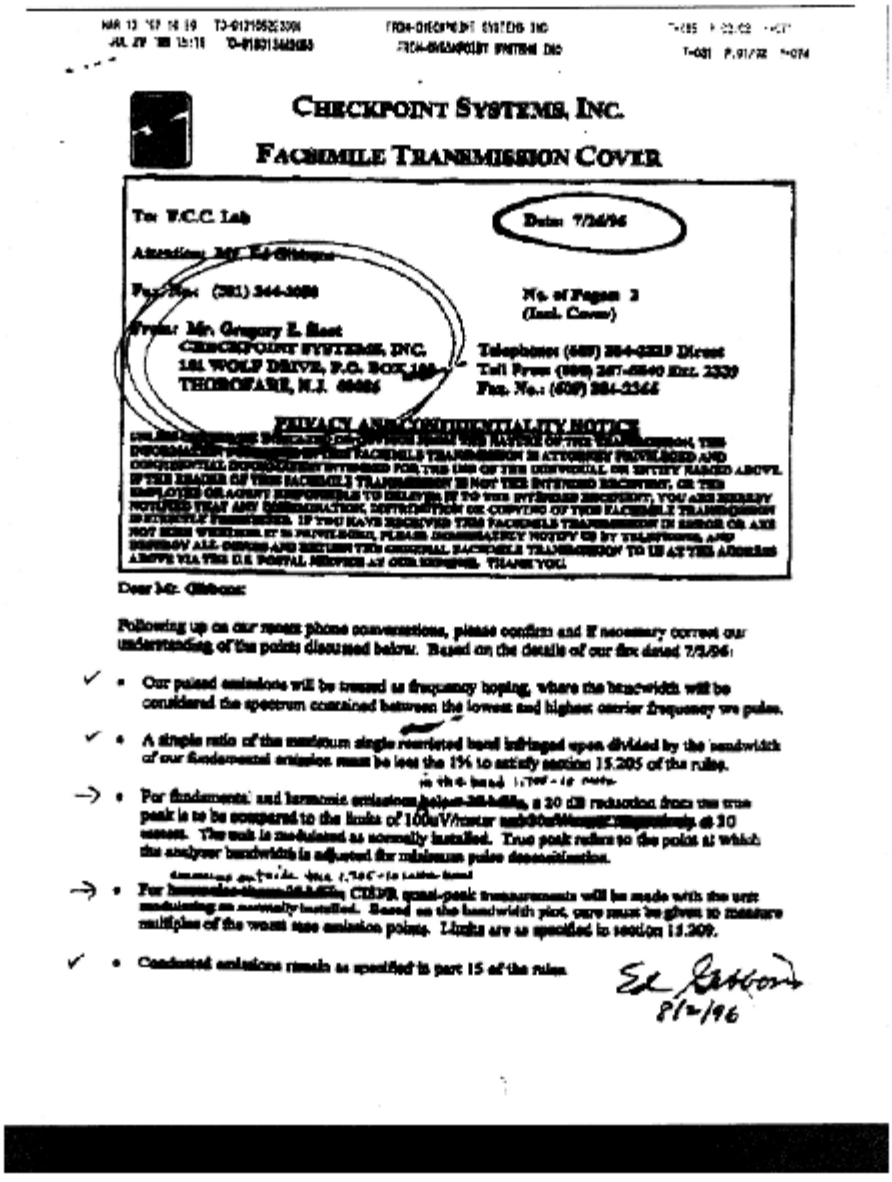
Text clarification of the Ed Gibbons Fax. Corrections made by Mr. Gibbons edited in.

Dear Mr. Gibbons,

Following up on our recent phone conversations, please confirm and if necessary correct our understanding of the points discussed below. Based on the details of our fax dated 7/3/96.

- *Our pulsed emissions will be treated as frequency hopping, where the bandwidth will be considered the spectrum contained between the lowest and highest carrier frequency we pulse.*
- *A simple ratio of the maximum single restricted band infringed upon divided by the bandwidth of our fundamental emission must be less than 1% to satisfy section 15.205 of the rules.*
- *For fundamental and harmonic emissions in the band 1.705 - 10 MHz, a 20db reduction from the true peak is to be compared to the limits of 100 uv/m at 30 meters. The unit is modulated as normally installed. True peak refers to the point at which the analyzer bandwidth is adjusted for maximum pulse desensitization.*
- *For emissions outside the 1.705 - 10MHz band, CISPR quasi-peak measurements will be made with the unit modulating as normally installed. Based on the bandwidth plot, care must be given to measure multiples of the worst case emission points. Limits are specified in section 15.209.*
- *Conducted emissions remain as specified in part 15 of the rules.*

A copy of the fax from Ed Gibbons to Checkpoint and the email from Rich Fabina to Ketec:



CHECKPOINT SYSTEMS, INC.

FACSIMILE TRANSMISSION COVER

To: W.C.C. Lab

Date: 7/26/96

Attention: Mr. Ed Gibbons

Fax No.: (201) 344-3029

No. of Pages: 2 (Incl. Cover)

From: Mr. Gregory L. Rost
CHECKPOINT SYSTEMS, INC.
101 WOLF DRIVE, P.O. BOX 188
THOROFARE, N.J. 08086

Telephone: (609) 384-2323 Direct
Toll Free (800) 257-0040 Ext. 2323
Fax. No.: (609) 384-2344

PRIVACY AND CONFIDENTIALITY NOTICE

Dear Mr. Gibbons:

Following up on our recent phone conversations, please confirm and if necessary correct our understanding of the points discussed below. Based on the details of our fax dated 7/3/96:

✓ • Our pulsed emissions will be treated as frequency hoping, where the bandwidth will be considered the spectrum contained between the lowest and highest carrier frequency we pulse.

✓ • A simple ratio of the maximum single restricted band infringed upon divided by the bandwidth of our fundamental emission must be less the 1% to satisfy section 15.205 of the rules.

→ • For fundamental and harmonic emissions below 960 MHz, a 20 dB reduction from the true peak is to be compared to the limits of 100uV/meter and 500uV/meter respectively @ 10 meters. The unit is mounted as normally installed. True peak refers to the point at which the analyzer bandwidth is adjusted for minimum pulse desensitization.

→ • For frequencies above 960 MHz, CISPR quasi-peak measurements will be made with the unit mounting as normally installed. Based on the bandwidth plot, care must be given to measure multiples of the worst case emission points. Limits are as specified in section 15.209.

✓ • Conducted emissions remain as specified in part 15 of the rules.

Ed Gibbons
8/2/96

[redacted]

Rich F

From: Rich Fabina <RFABINA@fcc.gov>
To: <richfro@snip.net>
Sent: Friday, May 18, 2001 11:21 AM
Subject: Re: Rule Interpetation

Rich,

Yes, the attached meets the conditions in our (Checkpoint) interpretation for frequecy hopping field disturbance sensors to meet the swept frequency field disturbance sensor requirements in Section 15.295(d)(1) of the FCC Rules.

Please attach a copy of this correspondence to the application filed for this modified device.

I trust that this has responded to this inquiry.

Rich Fabina

>>> "Rich F" <[redacted]> 05/15/01 11:50AM >>>
Dear Mr. Fabina,

Thank you for your recent response to my inquiry. Although we do not agree with your assessment, we are proposing an alternate method that we believe will meet all of the requirements (1-5) that you indicated in Section 1 of your reply. We propose the following:

1. Our device will produce 8 randomly sequenced pulsed emissions at 8 discrete frequencies which will be treated as frequency hopping, where the bandwidth will be considered the spectrum between the lowest and highest carrier frequency that we pulse. Frequency hopping satisfies the swept frequency requirement of Section 15.205(d). This method was agreed to between Ed Gibbons and Checkpoint Systems.

2. The generation and transmission of these 8 discrete frequencies constitutes the fundamental, which is centered at 8.11MHz and has a 1.1MHz bandwidth. Although there are 8 individual frequencies used, together they constitute the fundamental operating frequency or frequency band of the device. They are not 8 individual fundamentals.

3. The transmitter will be microprocessor controlled and will not be capable of transmitting in or stopping in any restricted band as per Section 15.205 of the rules. The frequencies proposed are:
   7.500000 MHz, 7.648077 MHz, 7.799078 MHz, 7.953059 MHz
   8.110081 MHz, 8.270204 MHz, 8.433487 MHz, 8.600000 MHz

4. A simple ratio of the maximum restricted band infringed upon divided by the bandwidth of our fundamental emission (see item 1) must be less than 1% to satisfy Section 15.205 of the rules.

5/18/01

5. For the fundamental and harmonic emissions in the band between 1.7 MHz to 10 MHz, a 20db reduction from the true peak is to be compared to the limits of 100 uV/meter @ 30 meters. The unit will be modulated (pulsed) in its normal operating condition to produce the maximum emission level. True peak refers to the point at which the analyzer bandwidth is adjusted for minimum pulse desensitization.

6. For emissions outside the 1.705 MHz to 10 MHz band, CISPR quasi-peak measurements will be made with the device in the maximum emission level mode as described in item 5 above. Limits specified in Section 15.209 shall apply.

7. Conducted emissions remain as specified in Part 15 of the Rules.

Before we proceed with the expense and time required to redesign our product, please review this proposal and verify that it will meet the requirements of Section 15.205(d). Thank you.

Sincerely,

Rich Frohbergh
Ketec Inc.

[redacted]

5/18/01

[redacted]