Electromagnetic Emission

F C C M E A S U R E M E N T R E P O R T

According to the FCC Rule Part 15 Subpart C

Product : Backup View System

Model : NSP-700

Serial Number : Prototype

FCC ID : DFCNSP-700

Prepared for :

TeleVideo, Inc.

2345 Harris Way

San Jose, CA 95131

Prepared by:

Report Date : March 06, 2001

E-RAE Testing Laboratory Inc.

371-51, Gasan-Dong, Geumcheon-Gu,

Seoul, 153-023, Korea

FCC Part 15, Subpart C
MEASUREMENT REPORT

For

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Signature	Yo han, Park	Signature	Kayoung Kim
Tested by	Yo Han, Park	Reviewed by	Kayoung Kim
Title	Test Engineer	Title	EMC Lab. Manager
Date	February 28,2001	Date	March 06,2001

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FCC MEASUREMENT REPORT

Scope – Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)

Applicant Name : TeleVideo Inc.

Address : 2345 Harris Way
San Jose, CA 95131

Attention : JK Yum / Vice President &CTO

EUT Type :	Vehicle Backup View System
Model Number :	NSP-700
Trade Name :	TeleVideo,Inc.
Freq. Range :	447.700MHz – 447.725MHz
Number of channel :	2 ch
Channel Spacing :	25KHz
FCC Rule Part(s) :	FCC Part 15 Subpart B FCC Part 15 Subpart C Section15.209
FCC Procedure :	Certification
Dates of Tests :	Feb.28 , 2001
Place of Tests :	E-Rae Testing Lab. EMI Test Site 584, Sangwhal-Ri, Kanam-Myun, Yoju-Kun, Kyounggi-Do, Korea Tel : (031) 885-0072 Fax : (031) 885-0074
Test Report No. :	E01.0228.FCC15C.0095.N

1. Introduction

The measurement test for radiated and conductedd emission test were conducted at the open area test site of E-RAE Testing Laboratiry Inc. facility located at 584, Sangwhal-ri, Ganam-myun, Youju-kun, Kyoungki-do, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-1992 and CISPR Publication 22. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-1992 and registered to the Federal Communications Commission(Registration Number : 95422).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C.63.4-1992) was used in determining radiated and conducted emissions from the RF TECH CO., LTD. Model : RFN-350 Numeric Paging Receiver.

ETL Site Location

E-RAE Testing Laboratory Inc.
584, Sangwhal-ri, Ganam-myun, Youju-kun, Kyoungki-do, 469-880. Korea
ETL has site descriptions on file with the FCC for 3 and 10 meter site configurations.

2. Product Information

2.1 Equipment Description

The Equipment Under Test(EUT) Model : NSP-700 by the TeleVideo, Inc.is the wireless backup view system for fitment into the vehicle. The system assists the driver to be in better control when reversing. When the vehicle moves too close to an object within the detection zone, an alarm sounds, the sound increases in intensity proportional to the distance from the object, simultaneously displaying the direction and distance in metres. This allows the driver to have better control when parking in tight spaces and moving large vehicles with greatly improved safety level.

2.2 General Specification

Freq. Range :	447.700 MHz ~ 447.725 MHz
Channel Spacing :	25 kHz
Crystal/ Oscillator(s) :	Logic 76.8 kHz, RF 21.4 MHz
Modulation :	FM
Detection :	Ultrasonic Sensor(Freq. 40kHz)
Antenna :	Loop
Power supply :	DC 12V (vehicle battery)
Weight :	910g
Dimension(HxWxT) :	Display Unit(97mm x 69mm x 27 mm) Control Box(55mm x 90mm x 22mm)

2.3 EUT Configuration

Peripheral	Connecting Cables
Display Receiver :	Unshielded power cable(1.5m) to vehicle battery
Control Box(Tx) :	Unshielded power cable(5m) to vehicle battery
Sensors :	Unshielded cable(5m) to Control Box

2.4 EMI Suppression Device(s)

EMI suppression device(s) added and/or modified during testing : None

3. Test Summary

Equipment Under Test : Backup View System NSP-700

FCC Requirement : FCC Rule Part 15 Subpart B and C

Test Results:

Requirement	Results
15.207	N/A
15.209	Passed
15.107	N/A
15.108	Passed

4. Description of Radiated Emissions Test

Preliminary measurements were made at indoors 3 meter semi EMC Anechoic Chamber using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME.
Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000MHz using biconilog antenna and above 1000MHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors open site at 3-meter test range using biconilog and horn antennas. The outputn from the antenna was connected, via a preselector or a preamplifier, to the input of the spectrum analyzer. The detector function was set to the quasi-peak or peak mode as appropriate. The measurement bandwidth on the Field strength receiver was set to at least 120kHz (1MHz for measurement above 1GHz), with all post-detector filtering no less than 10 times the measurement bandwidth. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was reexamined and investigated using Rohde & Schwarz EMI field strength meter.

The EUT , support equipment and interconnecting cables were configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1m x 1.5 meter table. The turntable containing the system was rotated and the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission.

Each emission was maximized by normal operating condition which the transmitter continuously transmitting the sensor detection data to the display receiver unit; powering the control box from the floor mounted DC battery. The system was tested in all the three orthogonal planes and changing the polarity of the antenna. The worst case emissions are recorded in the data tables. Photographs of the worst-case emission can be seen in Appendix B.

5. Radiated Emissions Results

The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

Humidity & Temperature : 43 % , 15 ℃
Limit apply to : FCC CFR 47, Part 15 Subpart C 15.209
Date : February 28, 2001
EUT : Vehicle Backup View System NSP-700
Control Box(Transmitter)
Operating Condition : Continuous transmitting (CH1 Freq. : 447.700 MHz)
Result : Passed by – 2.22 dB

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Radiated Emissions Test Data

Freq. (MHz)	Level (dBm)	Level (dBuV)	AFCL (dB)	POL (H/V)	Height (m)	Azimuth (° angle)	F/S (dBuV/m)	FCC Limit dBuV/m	MARGIN (dB)
49.74	-84.81	22.19	11.8	V	1	298	33.99	40	6.01
149.25	-86.97	20.03	14.86	H	2.3	258	34.89	43.5	8.61
199.0	-87.09	19.91	12.58	V	1.2	56	32.49	43.5	11.01
248.74	-85.45	21.55	13.14	V	1	98	34.69	46	11.31
298.49	-86.24	20.76	15.65	V	1.6	123	36.41	46	9.59
447.7	-82.75	24.25	19.53	H	2.1	189	43.78	46	2.22
596.95	-89.92	17.08	23.06	H	2	78	40.14	46	5.86
746.2	-93.84	13.16	25.99	H	2.3	276	39.15	46	6.85
895.42	-93.29	13.71	28.46	H	2	156	42.17	46	3.83
1343.1	-97.41	9.59	30.9	V	1.5	99	40.49	54	13.51
1790.8	-101.18	5.82	32.9	H	1	23	38.72	54	15.28
2238.5	-101.45	5.55	34.4	H	1	223	39.95	54	14.05
2686.2	-105.46	1.54	36.6	H	1	328	38.14	54	15.86
3133.9	-	-	-	-	-	-	-	-	-
3581.6	-	-	-	-	-	-	-	-	-
4029.3	-	-	-	-	-	-	-	-	-
4477	-	-	-	-	-	-	-	-	-
4029.5	-	-	-	-	-	-	-	-	-
4477.2	-	-	-	-	-	-	-	-	-

Table 1. Radiated Measurements at 3-meters

Notes :

-. The antenna is manipulated through typical positions and/or three orthogonal position during the tests.
-. The emissions are maximized by changing polarity of the antenna.
-. The EUT is supplied with a DC 12V vehicle battery.
-. AFCL : Antenna Factor (Pipole) + Cable loss
-. HA : Horn Antenna, used above 1GHz
Limit 54.0dBuV above 1GHz

Humidity & Temperature : 43 % , 15 ℃
Limit apply to : FCC CFR 47, Part 15 Subpart C 15.209
Date : February 28, 2001
EUT : Vehicle Backup View System NSP-700
Control Box(Transmitter)
Operating Condition : Continuous transmitting (CH2 Freq. : 447.725 MHz)
Result : Passed by – 2.42 dB

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Radiated Emissions Test Data

Freq. (MHz)	Level (dBm)	Level (dBuV)	AFCL (dB)	POL (H/V)	Height (m)	Azimuth (° angle)	F/S (dBuV/m)	FCC Limit dBuV/m	MARGIN (dB)
49.74	-82.86	24.14	11.8	V	1	298	35.94	40	4.51
149.24	-82.12	24.88	14.86	H	2.3	258	39.74	43.5	3.76
198.99	-89.14	17.86	12.58	V	1.2	56	30.44	43.5	15.55
248.73	-83.49	23.51	13.14	V	1	98	36.65	46	9.35
298.48	-82.53	24.47	15.65	V	1.6	123	40.12	46	5.88
348.22	-82.41	24.59	16.7	H	2.1	189	41.29	46	4.71
397.98	-93.19	13.81	23.06	H	2	78	36.87	46	9.13
447.72	-82.95	24.05	19.53	H	2.3	276	43.58	46	2.42
497.47	-88.34	18.66	20.79	H	2	156	39.45	46	6.55
696.45	-92.97	14.03	25.14	V	1.5	99	39.17	46	6.83
895.44	-93.66	13.34	28.46	H	1	23	41.8	46	4.02
1343.1	-97.41	9.59	30.9	H	1	223	40.49	54	13.51
1709	-101.92	5.08	32.9	H	1	328	37.98	54	16.02
2238.6	-104.93	2.07	34.4	H	1	324	36.47	54	17.53
2686.3	-104.88	2.12	36.6	H	1	68	38.72	54	15.28
3134.0	-	-	-	-	-	-	-	-	-
3581.9	-	-	-	-	-	-	-	-	-
4029.5	-	-	-	-	-	-	-	-	-
4477.2	-	-	-	-	-	-	-	-	-

Table 2. Radiated Measurements at 3-meters

Notes :

-. The antenna is manipulated through typical positions and/or three orthogonal position during the tests.
-. The emissions are maximixed by changing polarity of the antenna.
-. The EUT is supplied with a new/fully changed battery.
-. AFCL : Antenna Factor (Pipole) + Cable loss
-. HA : Horn Antenna, used above 1GHz
Limit 54.0dBuV above 1GHz

Humidity & Temperature	: 43 % , 15 ℃
Limit apply to	: FCC CFR 47, Part 15 Subpart C 15.209
Date	: February 28, 2001
EUT	: Vehicle Backup View System NSP-700 Display Unit (Receiver)
Operating Condition	: Receiving Condition (Tuned CH1)
Result	: Passed by – 4.79 dB

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Radiated Emissions Test Data

Freq. (MHz)	Level (dBm)	Level (dBuV)	AFCL (dB)	POL (H/V)	Height (m)	Azimuth (° angle)	F/S (dBuV/m)	FCC Limit dBuV/m	MARGIN (dB)
47.31	-86.03	20.97	14.24	V	1	98	35.21	40	4.79
142.09	-86.84	20.16	14.59	V	1.2	123	34.75	43.5	8.75
236.82	-87.82	19.18	13.19	V	1	296	32.37	46	13.53
284.19	-85.34	21.66	15.46	V	1.5	276	37.12	46	8.88
331.56	-97.8	9.2	16.7	V	2.1	287	25.9	46	20.28
378.94	-98.25	8.75	18.14	H	2	190	26.89	46	19.11
426.29	-86.55	20.45	19.53	H	1.8	95	39.98	46	16.02
473.66	-87.15	19.85	20.13	H	2.3	153	39.98	46	5.75
521.04	-90.79	16.21	21.39	V	1.5	89	37.6	46	8.4
663.41	-93.08	13.92	24.8	H	1.3	284	38.72	46	7.28
757.88	-96.26	10.74	26.75	H	1	291	37.49	46	8.51
852.61	-94.23	12.77	28.19	H	1	186	40.96	46	5.04
899.96	-94.23	12.77	28.46	H	1.2	143	41.23	46	3.77

Table 3. Radiated Measurements at 3-meters

Notes :

-. The antenna is manipulated through typical positions and/or three orthogonal position during the tests.
-. The emissions are maximixed by changing polarity of the antenna.
-. The EUT is supplied with a new/fully changed battery.
-. AFCL : Antenna Factor (Pipole) + Cable loss
-. HA : Horn Antenna, used above 1GHz
Limit 54.0dBuV above 1GHz

Humidity & Temperature : 43 % , 15 ℃
Limit apply to : FCC CFR 47, Part 15 Subpart C 15.209
Date : February 28, 2001
EUT : Vehicle Backup View System NSP-700
Display Unit (Receiver)
Operating Condition : Receiving Condition (Tuned CH2)
Result : Passed by – 5.02 dB

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Radiated Emissions Test Data

Freq. (MHz)	Level (dBm)	Level (dBuV)	AFCL (dB)	POL (H/V)	Height (m)	Azimuth (° angle)	F/S (dBuV/m)	FCC Limit dBuV/m	MARGIN (dB)
47.37	-86.26	20.74	14.24	V	1	298	34.98	40	5.02
142.11	-84.81	22.19	14.59	H	2.3	258	36.78	43.5	6.72
236.86	-89.11	17.89	13.19	V	1.2	56	31.08	46	15.02
284.22	-85.03	21.97	15.46	V	1	98	37.43	46	8.57
331.58	-97.96	9.04	16.7	V	1.6	123	25.74	46	20.26
378.96	-98.25	8.75	18.14	H	2.1	189	26.89	46	19.11
426.33	-88.33	18.67	19.53	H	2	78	38.2	46	7.86
473.7	-86.28	20.72	20.13	H	2.3	276	40.85	46	5.15
521.07	-93.27	13.73	21.39	H	2	156	35.12	46	10.88
663.17	-92.16	14.84	24.8	V	1.5	99	39.64	46	6.36
757.92	-96.63	10.37	26.75	H	1	23	37.12	46	8.88
852.65	-98.32	8.68	28.46	H	1	223	37.14	46	8.86
900.02	-95.15	11.85	28.19	H	1	328	40.04	46	5.96

Table 4. Radiated Measurements at 3-meters

Notes :

-. The antenna is manipulated through typical positions and/or three orthogonal position during the tests.
-. The emissions are maximixed by changing polarity of the antenna.
-. The EUT is supplied with a new/fully changed battery.
-. AFCL : Antenna Factor (Pipole) + Cable loss
-. HA : Horn Antenna, used above 1GHz
Limit 54.0dBuV above 1GHz

6. Sample Calculations

Sample Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor.
The basic equation with a sample calculation is as follows:

FS = RA + AF + CF

where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor

$dB(\mu V/m) = 20 \log_{10} (\mu V/m)$: Equation 1
$dB\mu V = dBm + 107$: Equation 2

Level $\mu V/m \cong$ 3meters = Log 10^{-1}(dBm + 107 + AFCL) / 20
If signal generator level is –14 dBm, then the field strength is calculated as follows,
Log 10^{-1}(-14 + 107 + 31.7) / 20 = 1717908.4 $\mu V/m \cong$ 3meters

For margin calculation, use the Equation 2
$dB(\mu V/m) = 20 \log_{10} (\mu V/m)$

7. List of Test Equipment

Test Equipment	Model	Mfg.	Serial No.	Cal. Due Date
Spectrum Analyzer	R3261A	Advantest	21720033	01-10-08
Receiver	ESVS 10	R & S	835165/001	01-04-06
Spectrum Analyzer	R3265A	Advantest	45060321	02-02-28
Preamplifier	HP8447B	HP	2944A07626	01-03-05
Preamplifier	HP 8347A	HP	2834A00544	01-05-23
TriLog Antenna	VULB9160	Schwarz Beck	3082	01-05-08
LogBicon	VULB9165	Schwarz Beck	2023	01-05-08
Dipole Antenna	VHAP	Schwarz Beck	964	01-05-03
Dipole Antenna	VHAP	Schwarz Beck	965	01-05-03
Dipole Antenna	UHAP	Schwarz Beck	949	01-05-03
Dipole Antenna	UHAP	Schwarz Beck	950	01-05-03
Double Ridged Horn	3115	EMCO	9809-2334	01-09-20
Turn-Table	DETT-03	Daeil EMC	-	N/A
Antenna Master	DEAM-03	Daeil EMC	-	N/A
Plotter	7440A	H.P	2725A 75722	N/A
Chamber	DTEC01	DAETONG	-	N/A
Thermo Hygrograph	3-3122	ISUZU	3312201	01-12-20
BaroMeter	-	Regulus		