YOUNGSHIN ELECTRONICS CO., LTD. TEST REPORT

FOR THE

TRANSCEIVER OF CAR ALARM/REMOTE ENGINE STARTER, COMPUSTAR 2000AS-SYSTEM
(Only Transmitter Data In This Report)

FCC PART 15 SUBPART C
PART 15.231

COMPLIANCE

DATE OF ISSUE: JULY 10, 2000

PREPARED FOR:

Youngshin Electronics Co., LTD.
4 FL Hirun Town Bldg 536-3
Unhaeng-Dong
Sihung, Kyungki-Do
Korea 429-060

P.O. No: Wire transfer
W.O. No: 74524

Report No: FC00-061

PREPARED BY:

Joyce Walker
CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

Date of test: June 8-19, 2000

DOCUMENTATION CONTROL:

Tracy Phillips
Documentation Control Supervisor
CKC Laboratories, Inc.

APPROVED BY:

Dennis Ward
Director of Laboratories
CKC Laboratories, Inc.

TABLE OF CONTENTS

ADMINISTRATIVE INFORMATION

DATE OF TEST:	June 8-19, 2000
PURPOSE OF TEST:	To demonstrate the compliance of the Transceiver of Car Alarm/Remote Engine Starter, Compustar 2000AS-System, with the requirements for FCC Part 15 Subpart C Part 15.231 devices.
MANUFACTURER:	Youngshin Electronics Co., LTD. 4 FL Hirun Town Bldg 536-3 Unhaeng-Dong Sihung, Kyungki-Do Korea 429-060
REPRESENTATIVE:	Young Il Chang
TEST LOCATION:	CKC Laboratories, Inc. 22105 Wilson River Hwy Tillamook, OR 97141
TEST PERSONNEL:	Mike Wilkinson
TEST METHOD:	ANSI C63.4 1992
FREQUENCY RANGE TESTED:	9 kHz - 5000 MHz
EQUIPMENT UNDER TEST:	**Transceiver of Car Alarm/Remote Engine Starter** Manuf: Young Shin Electronics Co., LTD. Model: 2000AS-System Serial: None FCC ID: XXXJ2000S (pending)

SUMMARY OF RESULTS

The Youngshin Electronics Co., LTD. Transceiver of Car Alarm/Remote Engine Starter, Compustar 2000AS-System, was tested in accordance with ANSI C63.4 1992 for compliance with FCC Part 15 Subpart C Part 15.231 devices.

As received, the above equipment was found to be fully compliant with the limits of FCC Part 15 Subpart C Part 15.231. The results in this report apply only to the items tested, as identified herein.

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Radio transceiver that is installed underneath the dashboard of a vehicle.

MEASUREMENT UNCERTAINTY

Associated with data in this report is a ±4dB measurement uncertainty.

EUT OPERATING FREQUENCY

The EUT was operating at 447.7 MHz.

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within +15°C and + 35°C.
The relative humidity was between 20% and 75%.

PERIPHERAL DEVICES

The EUT was not tested with peripheral devices.

REPORT OF MEASUREMENTS

The following tables report the highest worst case levels recorded during the tests performed on the Transceiver of Car Alarm/Remote Engine Starter, Compustar 2000AS-System. All readings taken are peak readings unless otherwise noted by a "Q" or "A". The data sheets from which these tables were compiled are contained in Appendix B.

Table 1: Fundamental Radiated Emission Levels

FREQUENCY	METER READING	CORRECTION FACTORS				CORRECTED READING	SPEC LIMIT	MARGIN	NOTES
		Bilog	Amp	Cable	Duty Cycle				
MHz	dBµV	dB	dB	dB	dB	dBµV/m	dBµV/m	dB	
447.713	99.2	17.0	-27.7	4.9	-12.7	80.7	81.3	-0.6	HA
447.737	96.3	17.0	-27.7	4.9	-12.7	77.8	81.3	-3.5	VA

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.231(b)
Test Distance: 3 Meters

NOTES:
H = Horizontal Polarization
V = Vertical Polarization
N = No Polarization
D = Dipole Reading
Q = Quasi Peak Reading
A = Average Reading

COMMENTS: EUT is transmitting continuously. Measured transmitter on time is 23.2 mSec with a PRF of 104.2 mSec yielding a 100 mSec duty cycle of .232 % or 12.7 dB correction factor. EUT is battery operated and a fresh battery is connected. The supplied Siren and Shock Sensor are connected and all other connectors have unterminated wire harness connected. The Temperature was 70°F and the humidity was 50 %.

Table 2: Six Highest Radiated Emission Levels

FREQUENCY	METER READING	CORRECTION FACTORS				CORRECTED READING	SPEC LIMIT	MARGIN	NOTES
		Ant	Amp	Cable	Duty Cycle				
MHz	dBµV	dB	dB	dB	dB	dBµV/m	dBµV/m	dB	
895.399	63.9	23.3	-27.6	7.2	-12.7	54.1	61.3	-7.2	V
1343.086	62.4	25.5	-38.2	5.4	-12.7	42.4	54.0	-11.6	V
1790.811	55.3	27.2	-36.9	5.7	-12.7	38.6	61.3	-22.7	H
2238.479	51.0	27.9	-36.0	6.5	-12.7	36.7	54.0	-17.3	V
2686.368	49.2	29.1	-35.0	7.5	-12.7	38.1	54.0	-15.9	V
3581.565	35.6	31.1	-34.0	9.4	-12.7	29.4	61.3	-31.9	V

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.231(b)
Test Distance: 3 Meters

NOTES: H = Horizontal Polarization
V = Vertical Polarization
N = No Polarization
D = Dipole Reading
Q = Quasi Peak Reading
A = Average Reading

COMMENTS: EUT is transmitting continuously. Measured transmitter on time is 23.2 mSec with a PRF of 104.2 mSec yielding a 100 mSec duty cycle of .232 % or 12.7 dB correction factor. EUT is battery operated and a fresh battery is connected. The supplied Siren and Shock Sensor are connected and all other connectors have unterminated wire harness connected. The Temperature was 70°F and the humidity was 50 %. Frequency range investigated was 9 kHz to 5.0 GHz. Note: No readings were found below 30 MHz using the magnetic loop antenna.

TABLE A

LIST OF TEST EQUIPMENT

Function	S/N	Calibration Date	Cal Due Date	Asset #
HP 8447D	2727A05392	02/14/2000	02/14/2001	10
Chase Bilog CBL6111C	2455	08/30/1999	08/30/2000	1992
HP 8593EM	3624A00159	10/05/1999	10/05/2000	2111
EMCO Horn 3115	9006-3413	05/02/2000	05/02/2001	327
HP 83017A	3123A00321	10/21/1999	10/21/2000	2114
ELEC Mech Mag Loop 6502	2156	1/26/2000	1/26/2001	00297

EUT SETUP

The equipment under test (EUT) was set up in a manner that represented its normal use. Any special conditions required for the EUT to operate normally are identified in the comments that accompany Table 1 for fundamental radiated emissions and Table 2 for radiated emissions. Additionally, a complete description of all the ports and I/O cables is included on the information sheets contained in Appendix A.

During radiated emissions testing, the EUT was mounted on a nonconductive, rotating table 80 cm above the conductive grid. The nonconductive table dimensions were 1 meter by 1.5 meters. This configuration is typical for radiated emissions testing of table top devices.

I/O cables were connected to the EUT in the manner required for normal operation of the system. Excess cabling was bundled in the center in a serpentine fashion using 30-40 centimeter lengths.

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed in Table A were used to collect the radiated emissions data for the Transceiver of Car Alarm/Remote Engine Starter, Compustar 2000AS-System. For frequencies below 30 MHz the magnetic loop antenna was used. For frequencies from 30 to 1000 MHz, the biconilog antenna was used. For frequencies above 1000 MHz the horn antenna was used. All antennas were located at a distance of 3 meters from the edge of the EUT.

The HP spectrum analyzer was used for all measurements. Table B shows the analyzer bandwidth settings that were used in designated frequency bands. During radiated testing, the measurements were made with 0 dB of attenuation, a reference level of 97 dBµV, and a vertical scale of 10 dB per division.

TABLE B : ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE

TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
RADIATED EMISSIONS	9 kHz	30 MHz	200 Hz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	5 GHz	1 MHz

SPECTRUM ANALYZER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in Tables 1 and 2 indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the six highest readings, this is indicated as a "Q" or an "A" in the appropriate table. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the Transceiver of Car Alarm/Remote Engine Starter, Compustar 2000AS-System.

Peak

In this mode, the Spectrum Analyzer or test engineer recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the analyzer called "peak hold," the analyzer had the ability to measure transients or low duty cycle transient emission peak levels. In this mode the analyzer made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the HP Quasi-Peak Adapter for the HP Spectrum Analyzer. The detailed procedure for making quasi peak measurements contained in the HP Quasi-Peak Adapter manual were followed.

Average

Average measurements may be made using the spectrum analyzer. To make these measurements, the test engineer reduces the video bandwidth on the analyzer until the modulation of the signal is filtered out. At this point the analyzer is set into the linear mode and the scan time is reduced.

TEST METHODS

The radiated emissions data of the Transceiver of Car Alarm/Remote Engine Starter, Compustar 2000AS-System, was taken with the HP Spectrum Analyzer. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the "Sample Calculations". The corrected data was then compared to the FCC Part 15, Subpart C 15.231 emissions limits to determine compliance.

Preliminary and final measurements were taken in order to better ensure that all emissions from the EUT were found and maximized.

Radiated Emissions Testing

During the preliminary radiated scan, the EUT was powered up and operating in its defined FCC test mode with the cables facing the antenna. For frequencies below 30 MHz the magnetic loop antenna was used. The frequency range of 30 MHz - 1000 MHz was then scanned with the biconilog antenna located about 1.5 meter above the ground plane in the vertical polarity. During this scan, the turntable was rotated and all peaks, which were at or near the limit, were recorded. Lastly, a scan of the FM band from 88 - 110 MHz was made, using a reduced resolution bandwidth and a reduced frequency span. The biconilog antenna was changed to the horizontal polarity and the above steps were repeated. The horn antenna was used to scan for frequencies above 1000 MHz. Care was taken to ensure that no frequencies were missed within the FM and TV bands. An analysis was performed to determine if the signals that were at or near the limit were caused by an ambient transmission. If unable to determine by analysis, the equipment was powered down to make the final determination if the EUT was the source of the emission.

For the final radiated scan, the equipment was again positioned with its cables facing the antenna. A thorough scan of all frequencies was manually made using a small frequency span, rotating the turntable as needed. Comparison with the previously recorded measurements was then made.

Using the peak readings from both scans as a guide, the test engineer then maximized the readings with respect to the table rotation, antenna height and configuration of the cables. Maximizing of the cables was achieved by monitoring the spectrum analyzer on a closed circuit television monitor while the EUT cables were being moved and rearranged on the EUT table for maximum emissions. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

FCC Part 15.231(a)(2) & (3) - Transmit Times

The 5 second turn off measurements were made using a remote transmitter to key the transmitter EUT under test. Measurements were made of the “on time” and the “off time” (sleep mode). Plots showing the test results are contained in Appendix B.

FCC Part 15.231(c) - Occupied Bandwidth Measurements

In accordance with Part 15.215(c), the fundamental frequency was kept within the central 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Plots showing the test results are contained in Appendix B.

SAMPLE CALCULATIONS

The basic spectrum analyzer reading was converted using correction factors as shown in the emissions readings in Tables 1 and 2. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula:

Meter reading (dBµV)
+ Antenna Factor (dB)
+ Cable Loss (dB)
- Distance Correction (dB)
- Pre-amplifier Gain (dB)

= Corrected Reading (dBµV/m)

This reading was then compared to the applicable specification limit to determine compliance.

A typical data sheet will display the following in column format:

#	Freq MHz	Rdng dBuV	Cable	Amp	Bilog	Horn	Duty Cycle	Dist	Corr dBuV/m	Spec	Margin	Polar

means reading number
Freq MHz is the frequency in MHz of the obtained reading.
Rdng dBuV is the reading obtained on the spectrum analyzer in dBµV.
Amp is short for the preamplifier factor or gain in dB.
Bilog is the biconilog antenna factor in dB.
Horn is the horn antenna factor in dB.
Cable is the cable loss in dB of the coaxial cable on the OATS.
Dist is the distance factor (in dB). It is used when testing at a different test distance than the one stated in the spec.
Corr dBµV/m is the corrected reading which is now in dBµV/m (field strength).
Spec is the specification limit (dB) stated in the regulations.
Margin is the closeness to the specified limit in dB; + is over and - is under the limit.
Polar is the Polarity of the antenna with respect to earth.
Duty Cycle is the duty cycle factor used in dB.

APPENDIX A

INFORMATION ABOUT THE EQUIPMENT UNDER TEST

INFORMATION ABOUT THE EQUIPMENT UNDER TEST	
Test Software/Firmware:	
CRT was displaying:	
Power Supply Manufacturer:	
Power Supply Part Number:	
AC Line Filter Manufacturer:	
AC Line Filter Part Number:	
Line voltage used during testing:	

I/O PORTS	
Power Supply Input	#3
Relay Output	#7
Tr-Positive Output	#1
Tr-Negative Output	#12
Rf I/O via Antenna	#1
Diode Input	#14
Power Supply Output	#11

CRYSTAL OSCILLATORS	
Type	Freq In MHz
Ceramic Resonator	8
Channel Crystal	447.7
Channel Crystal	469.1

PRINTED CIRCUIT BOARDS				
Function	Model & Rev	Clocks, MHz	Layers	Location
Control Board	Com20002was&Rev0	8MHz	2	
Rf-Board	Usmrf&Rev0	447.7, 469.1	2	

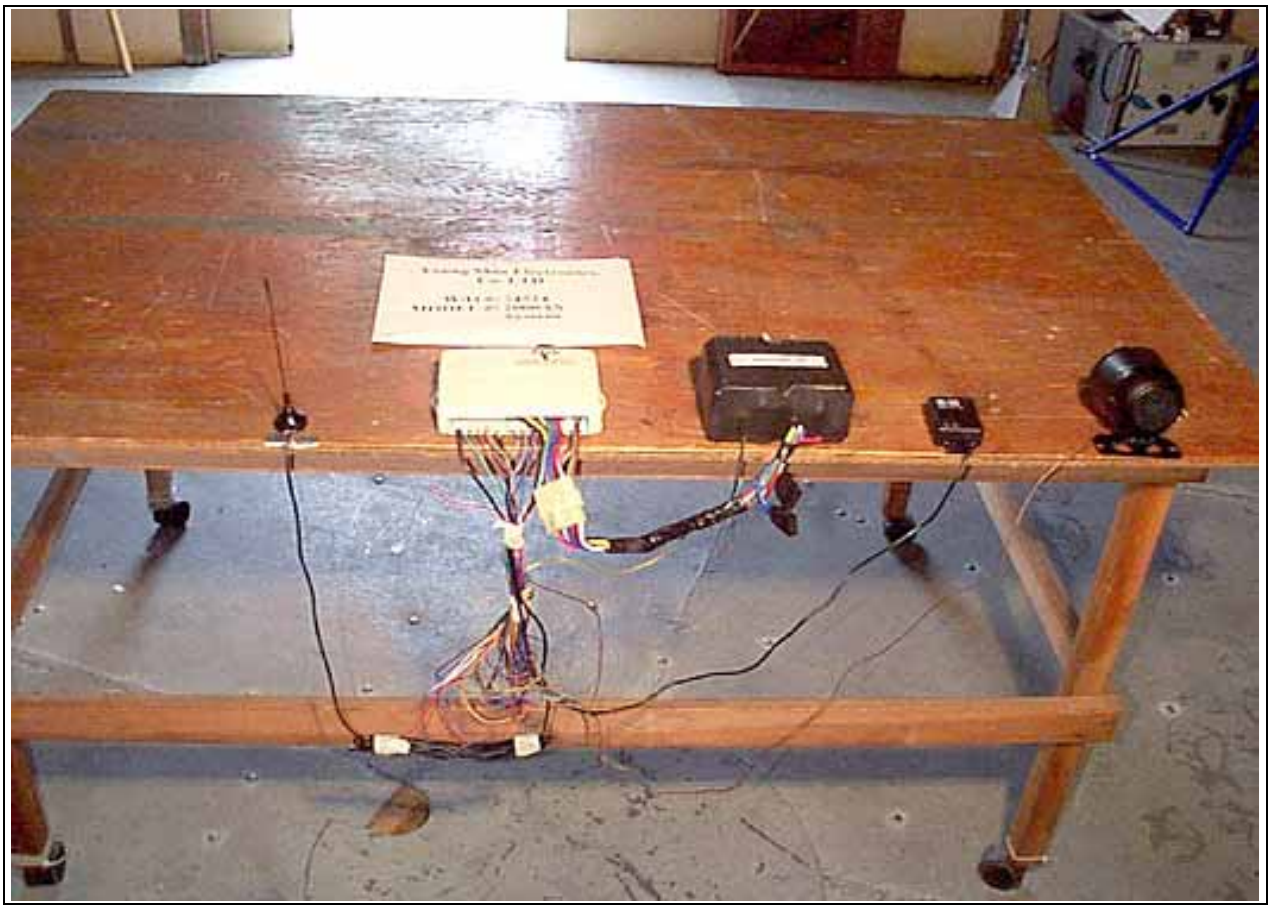
CABLE INFORMATION

Cable #:	Cable1	Cable(s) of this type:	
Cable Type:	Wire Harness	Shield Type:	N/A
Construction:	Polyvinyle+Copper	Length In Meters:	0.6
Connected To End (1):	Wafer of system	Connected To End (2):	Battery of the car
Connector At End (1):	Housing	Connector At End (2):	Housing
Shield Grounded At (1):	N/A	Shield Grounded At (2):	N/A
Part Number:	C1-1	Number of Conductors:	37
Notes and/or description:			

PHOTOGRAPH SHOWING RADIATED EMISSIONS

Radiated Emissions - Front View

PHOTOGRAPH SHOWING RADIATED EMISSIONS

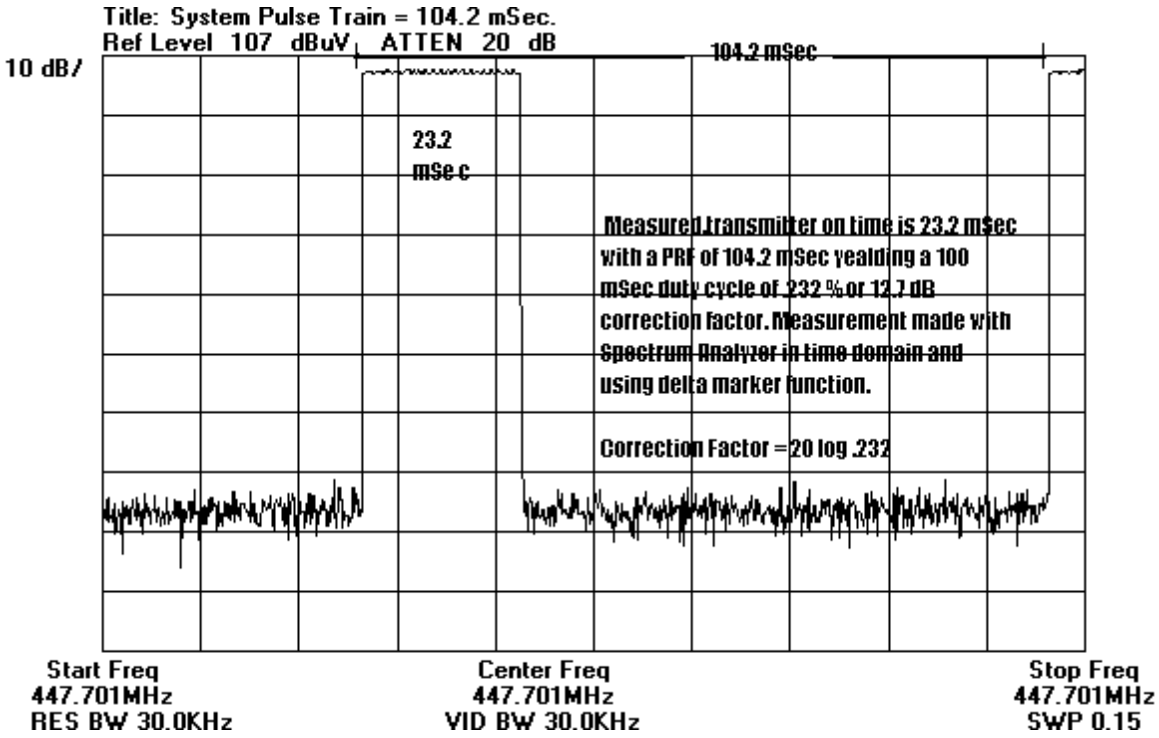


Radiated Emissions - Back View

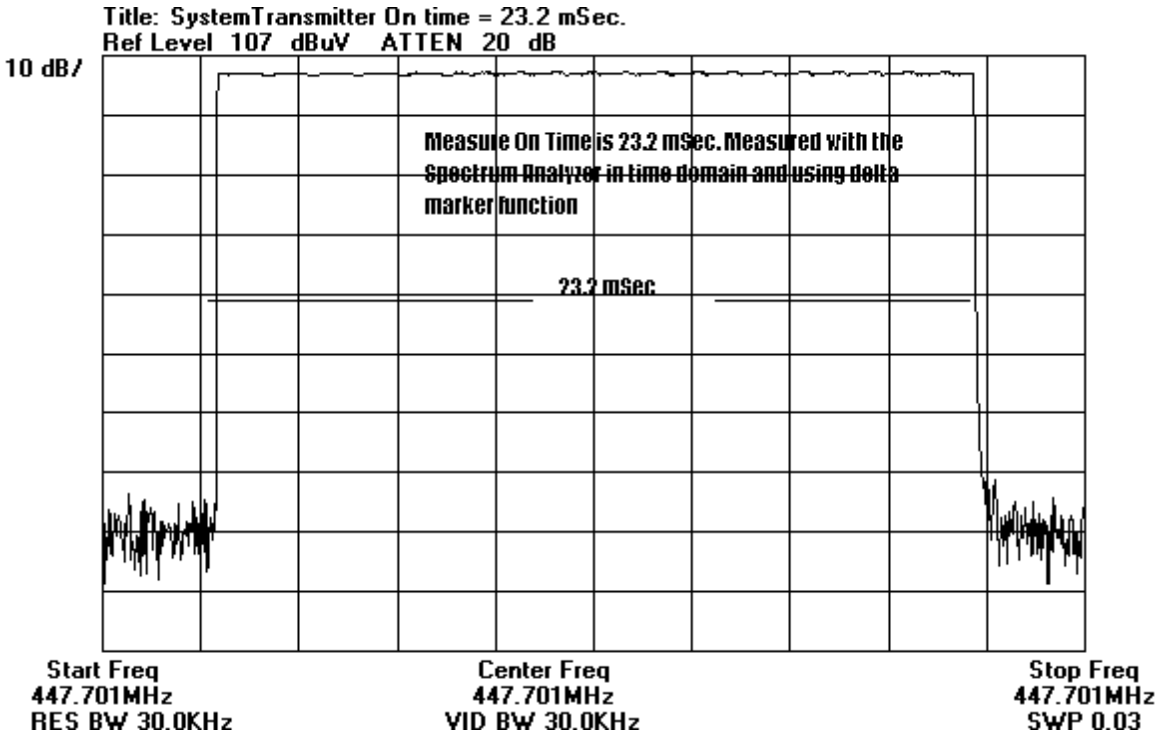
APPENDIX B

MEASUREMENT DATA SHEETS

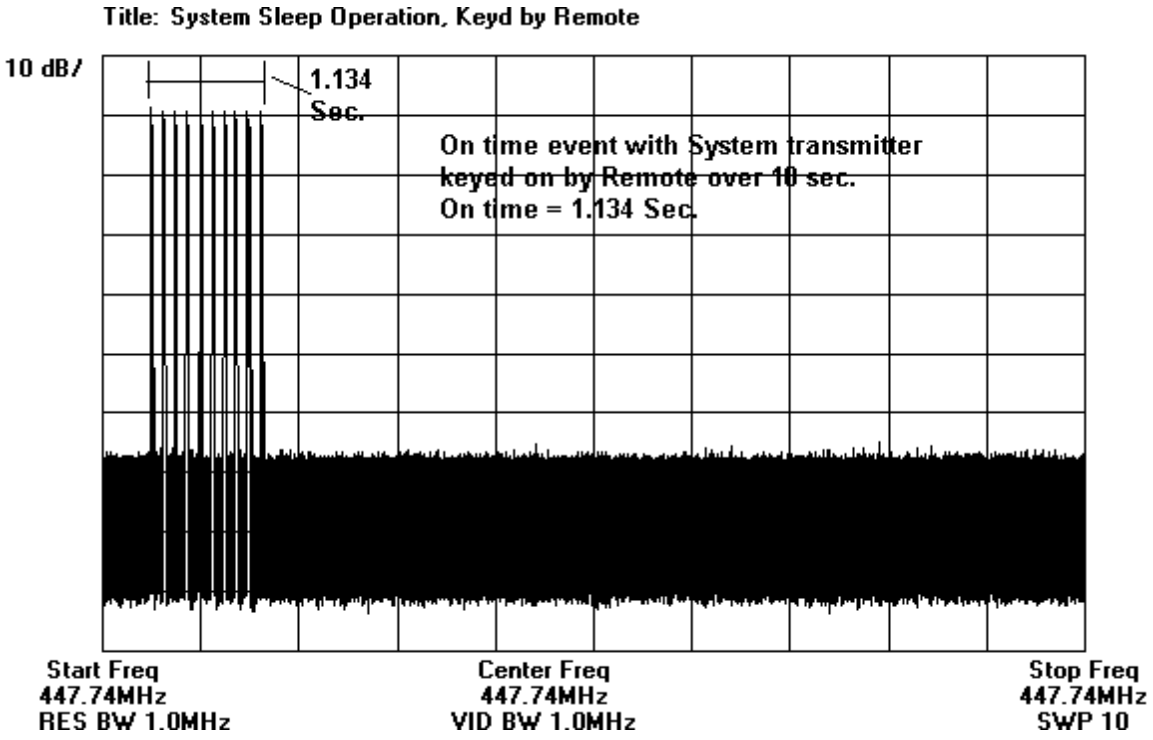
Pulse Train Plot



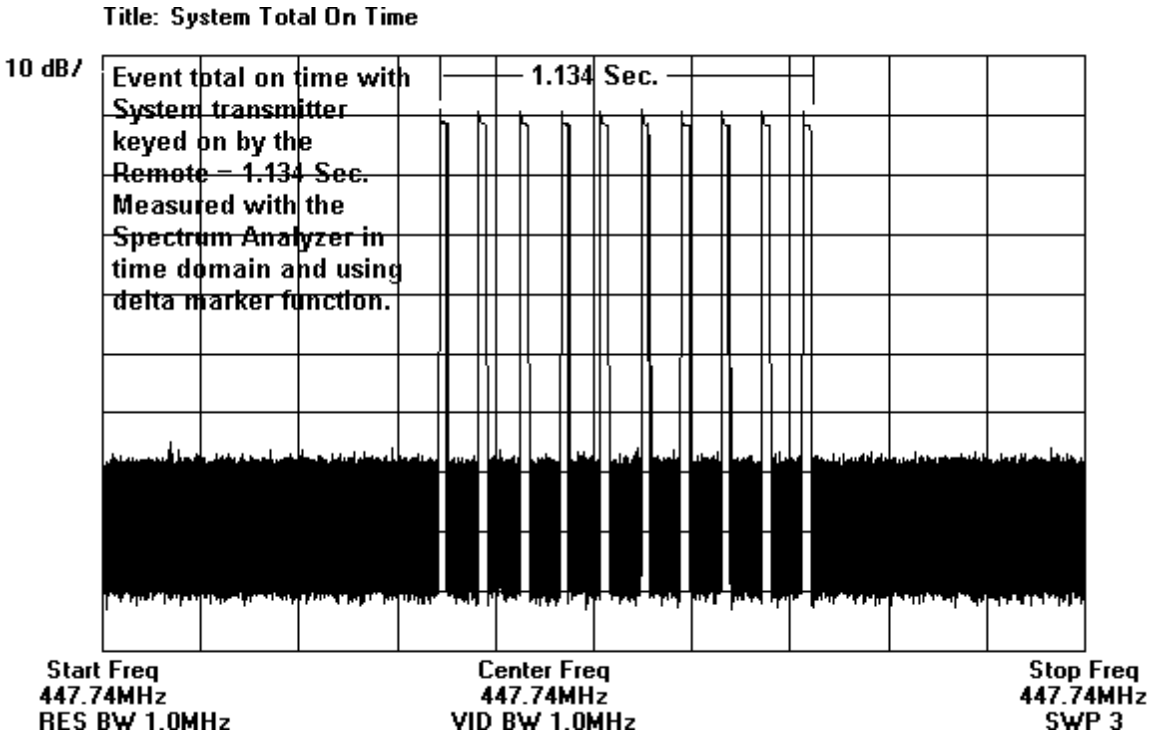
On Time Plot


Title: SystemTransmitter On time = 23.2 mSec.
Ref Level 107 dBuV ATTEN 20 dB
10 dB/
Measure On Time is 23.2 mSec. Measured with the Spectrum Analyzer in time domain and using delta marker function
23.2 mSec
Start Freq
447.701MHz
RES BW 30.0KHz
Center Freq
447.701MHz
VID BW 30.0KHz
Stop Freq
447.701MHz
SWP 0.03

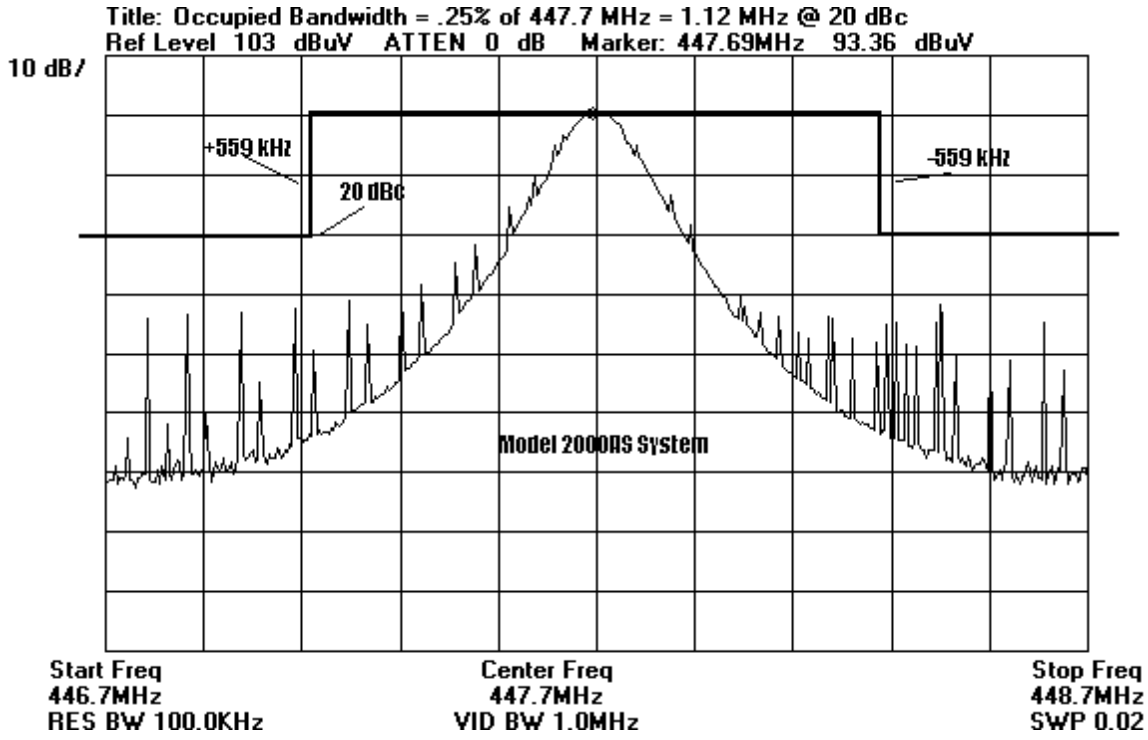
Time Out Plot



Total On Time Plot

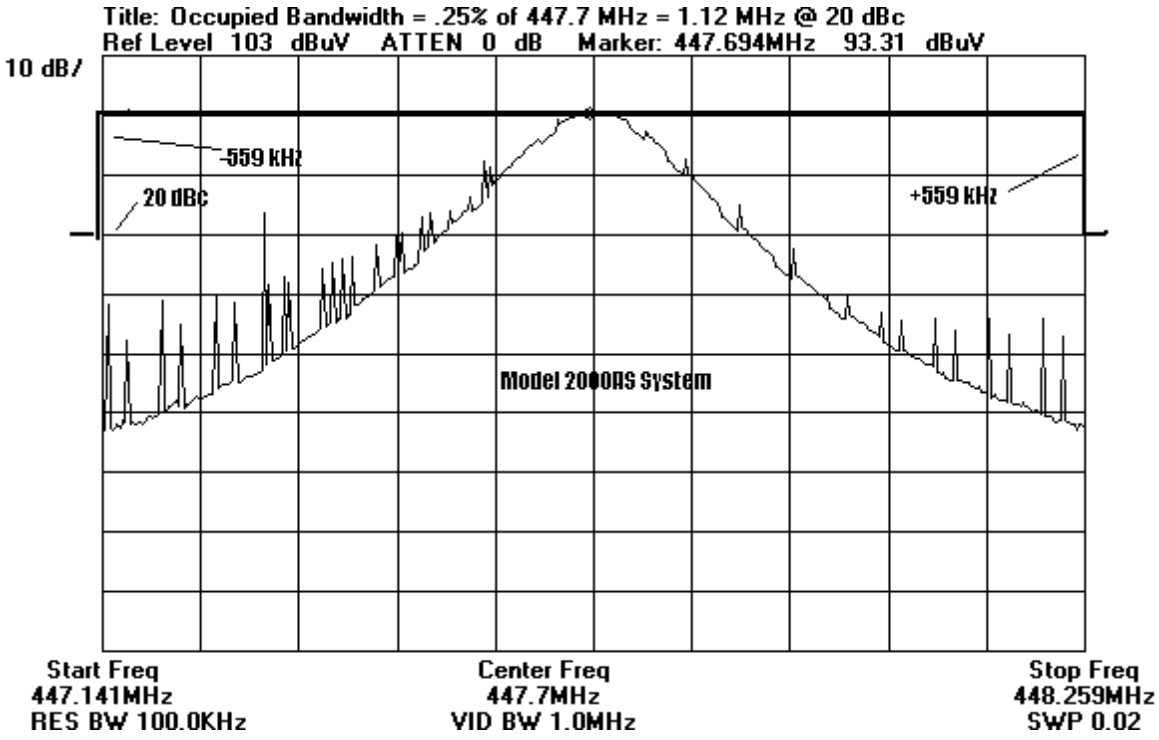


Occupied Bandwidth Plot



Note: Bandwidth plot amplitude values were corrected to the fundamental data sheet peak corrected readings.

Occupied Bandwidth Plot



Note: Bandwidth plot amplitude values were corrected to the fundamental data sheet peak corrected readings.

Test Location:	CKC Laboratories, Inc. • 22105 Wilson River Hwy • Tillamook, OR 97141 • 800 500-4EMC		
Customer:	Youngshin Electronics		
Specification:	**15.231 Fundamental**		
Work Order #:	**74524**	Date:	06/09/2000
Test Type:	**Maximized Emissions**	Time:	18:23:54
Equipment:	**Car Alarm/Car Start**	Sequence#:	4
Manufacturer:	Young Shin Electronics, Co LTD	Tested By:	Mike Wilkinson
Model:	2000AS System		
S/N:	None		

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Car Alarm/Car Start*	Young Shin Electronics, Co LTD	2000AS System	None

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT is transmitting continuously. Measured transmitter on time is 23.2 mSec with a PRF of 104.2 mSec yielding a 100 mSec duty cycle of .232 % or 12.7 dB correction factor. EUT is battery operated and a fresh battery is connected. The supplied Siren and Shock Sensor are connected and all other connectors have unterminated wire harness connected. The Temperature was 70°F and the humidity was 50 %.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Duty Cycle dB	Amp dB	Bilog dB	Cable dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	447.713M Ave	99.2	-12.7	-27.7	+17.0	+4.9	+0.0	80.7	81.3 12.7 dB correction factor applied	-0.6	Horiz
^	447.713M	99.2	+0.0	-27.7	+17.0	+4.9	+0.0	93.4	81.3	+12.1	Horiz
2	447.737M Ave	96.3	-12.7	-27.7	+17.0	+4.9	+0.0	77.8	81.3 12.7 dB correction factor applied	-3.5	Vert
^	447.737M	96.3	+0.0	-27.7	+17.0	+4.9	+0.0	90.5	81.3	+9.2	Vert

Test Location:	CKC Laboratories, Inc. • 22105 Wilson River Hwy • Tillamook, OR 97141 • 800 500-4EMC		
Customer:	Youngshin Electronics		
Specification:	**15.231 spurs**		
Work Order #:	**74524**	Date:	06/10/2000
Test Type:	**Maximized Emissions**	Time:	10:34:05
Equipment:	**Car Alarm/Car Start**	Sequence#:	7
Manufacturer:	Young Shin Electronics, Co LTD	Tested By:	Mike Wilkinson
Model:	2000AS System		
S/N:	None		

***Equipment Under Test* (* = EUT):**

Function	Manufacturer	Model #	S/N
Car Alarm/Car Start*	Young Shin Electronics, Co LTD	2000AS System	None

Support Devices:

Function	Manufacturer	Model #	S/N

Test Conditions / Notes:

EUT is transmitting continuously. Measured transmitter on time is 23.2 mSec with a PRF of 104.2 mSec yielding a 100 mSec duty cycle of .232 % or 12.7 dB correction factor. EUT is battery operated and a fresh battery is connected. The supplied Siren and Shock Sensor are connected and all other connectors have unterminated wire harness connected. The Temperature was 70°F and the humidity was 50 %. Frequency range investigated was 9kHz to 5.0 GHz. Note: No readings were found below 30 MHz using the magnetic loop antenna.

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	Duty Cycle Amp dB	Amp Cable dB	Bilog Cable dB	Cable Horn dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	895.399M	63.9	-12.7 +0.0	-27.6 +0.0	+23.3 +0.0	+7.2 +0.0	+0.0	54.1	61.3	-7.2	Vert
2	895.397M	59.9	-12.7 +0.0	-27.6 +0.0	+23.3 +0.0	+7.2 +0.0	+0.0	50.1	61.3	-11.2	Vert
3	1343.086M	62.4	-12.7 -38.2	+0.0 +4.8	+0.0 +0.6	+0.0 +25.5	+0.0	42.4	54.0	-11.6	Vert
4	1343.131M	59.1	-12.7 -38.2	+0.0 +4.8	+0.0 +0.6	+0.0 +25.5	+0.0	39.1	54.0	-14.9	Horiz
5	2686.368M	49.2	-12.7 -35.0	+0.0 +6.5	+0.0 +1.0	+0.0 +29.1	+0.0	38.1	54.0	-15.9	Vert
6	2686.380M	48.6	-12.7 -35.0	+0.0 +6.5	+0.0 +1.0	+0.0 +29.1	+0.0	37.5	54.0	-16.5	Horiz
7	2238.479M	51.0	-12.7 -36.0	+0.0 +5.8	+0.0 +0.7	+0.0 +27.9	+0.0	36.7	54.0	-17.3	Vert
8	2238.666M	46.4	-12.7 -36.0	+0.0 +5.8	+0.0 +0.7	+0.0 +27.9	+0.0	32.1	54.0	-21.9	Horiz
9	1790.811M	55.3	-12.7 -36.9	+0.0 +5.0	+0.0 +0.7	+0.0 +27.2	+0.0	38.6	61.3	-22.7	Horiz
10	1791.005M	54.2	-12.7 -36.9	+0.0 +5.0	+0.0 +0.7	+0.0 +27.2	+0.0	37.5	61.3	-23.8	Vert
11	3581.565M	35.6	-12.7 -34.0	+0.0 +7.8	+0.0 +1.6	+0.0 +31.1	+0.0	29.4	61.3	-31.9	Vert