



FCC 47 CFR PART 15 SUBPART C AND ANSI C63.4:2009
TEST REPORT

For

Car Camera and Warning System

Model : 2300is

Trade Name : App-Tronics

Issued for

App-Tronics LLC

1605 Commodore Cove, Painesville, Ohio 44077, U.S.A.

Issued by

**Compliance Certification Services Inc.
Hsinchu Lab.**

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Issued Date: December 20, 2013



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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	12/20/2013	Initial Issue	All Page 25	Gloria Chang

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1. TEST REPORT CERTIFICATION

Applicant : App-Tronics LLC
Address : 1605 Commodore Cove, Painesville, Ohio 44077, U.S.A.
Equipment Under Test : Car Camera and Warning System
Model : 2300is
Trade Name : App-Tronics
Tested Date : September 23 ~ December 20, 2013

APPLICABLE STANDARD	
Standard	Test Result
FCC Part 15 Subpart C AND ANSI C63.4:2009	PASS

WE HEREBY CERTIFY THAT: The above equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Sb. Lu
Sr. Engineer

Reviewed by:

Gundam Lin
Sr. Engineer



2. EUT DESCRIPTION

Product Name	Car Camera and Warning System
Model Number	2300is
Identify Number	T130923D06
Received Date	September 23, 2013
Frequency Range	433.92 MHz
Transmit Power	81.86 dB μ V/m
Type of Modulation	ASK
Antenna Type	Chip Antenna, Antenna Gain 0 dBi
Power Rating	12Vdc (From Car Battery)
Test Voltage	12Vdc
DC Power Cord Type	Non-shielded cable 0.5m × 1 (For car charger)
I/O Port	Power Port × 1, PS2 Port × 2 (Link sensor)
Signal Cable	Shielded PS2 cable 0.1m × 2 (Non-detachable)

Remark :

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. For more details, please refer to the User's manual of the EUT.
3. This submittal(s) (test report) is intended for FCC ID: 2ABRK86869937000001 filing to comply with Section 15.207, 15.209 and 15.231 of the FCC Part 15, Subpart C Rules.



3. DESCRIPTION OF TEST MODES

Radiated Emission (Below 1 GHz) Test:

1. The following test modes were scanned during the preliminary test:

No.	Pre-Test Mode
1	TX Mode

2. After the preliminary scan, the following test mode was found to produce the highest emission level.

Final Test Mode		
Emission	Radiated Emission	TX Mode
	Conducted Emission	N/A

Remark : Then, the above highest emission mode of the configuration of the EUT and cable was chosen for all final test items.

Radiated Emission Test (Above 1 GHz) and Antenna Port Conducted Measurement :

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

TX Mode :

Channel	Frequency (MHz)
1	433.92

Remark : The field strength of spurious emission was measured in the following position: EUT stand-up position(X axis), lie-down position(X, Z axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2009 and FCC CFR 47, 15.207, 15.209 and 15.231.



5. FACILITIES AND ACCREDITATION

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

NO. 989-1 Wen Shan Rd., Shang Shan Village,
Qionglin Shiang Hsinchu County 30741, Taiwan, R.O.C

The sites are constructed in conformance with the requirements of ANSI C63.4:2009 and CISPR 22. All receiving equipment conforms to CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-3, CISPR 16-1-4, CISPR 16-1-5.

5.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Taiwan TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	INDUSTRY CANADA
Japan	VCCI
Taiwan	BSMI
USA	FCC MRA

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsrf.com>



5.3 MEASUREMENT UNCERTAINTY

The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4-2.

PARAMETER	UNCERTAINTY
Semi Anechoic Chamber (966 Chamber) / Radiated Emission, 30 to 1000 MHz	+/- 3.97
Semi Anechoic Chamber (966 Chamber) / Radiated Emission, 1 to 18GHz	+/- 3.58
Semi Anechoic Chamber (966 Chamber) / Radiated Emission, 18 to 26 GHz	+/- 3.59
Semi Anechoic Chamber (966 Chamber) / Radiated Emission, 26 to 40 GHz	+/- 3.81
Conducted Emission (Mains Terminals), 9kHz to 30MHz	+/- 2.48

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Consistent with industry standard (e.g. CISPR 22, clause 11, Measurement Uncertainty) determining compliance with the limits shall be base on the results of the compliance measurement. Consequently the measure emissions being less than the maximum allowed emission result in this be a compliant test or passing test.

The acceptable measurement uncertainty value without requiring revision of the compliance statement is base on conducted and radiated emissions being less than U_{CISPR} which is 3.6dB and 5.2dB respectively. CCS values (called U_{Lab} in CISPR 16-4-2) is less than U_{CISPR} as shown in the table above. Therefore, MU need not be considered for compliance.



6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

N/A

SETUP DIAGRAM FOR TESTS

EUT & peripherals setup diagram is shown in appendix setup photos.

EUT OPERATING CONDITION

1. Setup whole system for test as shown on diagram.

2. Power on all equipments.

 TX Mode: Frequency: 433.92MHz.

 Infrared sensor signals given.

3. All of the functions are under run.

4. Start test.



7. FCC PART 15.231 REQUIREMENTS

7.1 20dB BANDWIDTH

LIMITS

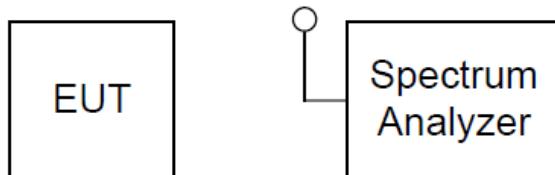
§15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360132	06/10/2014

Remark: Each piece of equipment is scheduled for calibration once a year.

TEST SETUP

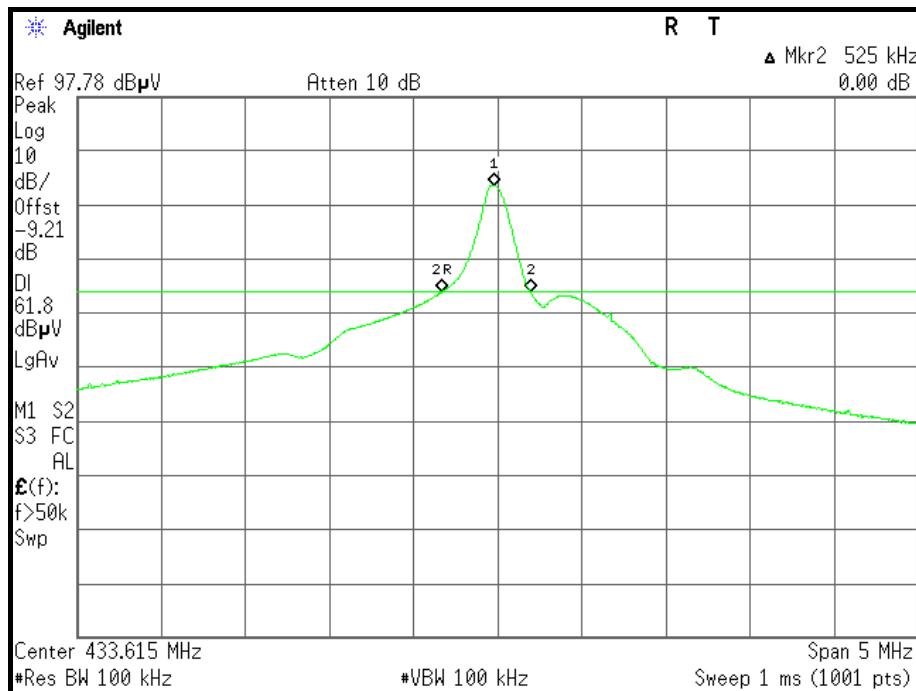


TEST PROCEDURE

The 20dB band width was measured with a spectrum analyzer connected to RF antenna while EUT was operating in transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer. Display Line and Marker Delta functions, the 20dB band width of the emission was determined.

**TEST RESULTS**

Channel Frequency (MHz)	20dB Bandwidth (kHz)	Minimum Limit (kHz)	Result
433.92	525	1084.8	PASS





7.2 LIMIT OF TRANSMISSION TIME

LIMITS

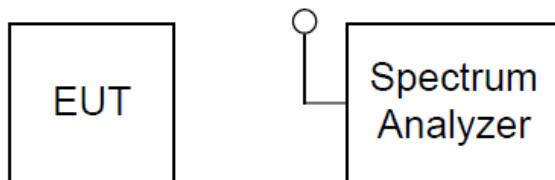
According to § 15.231(a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360132	06/10/2014

Remark: Each piece of equipment is scheduled for calibration once a year.

TEST SETUP

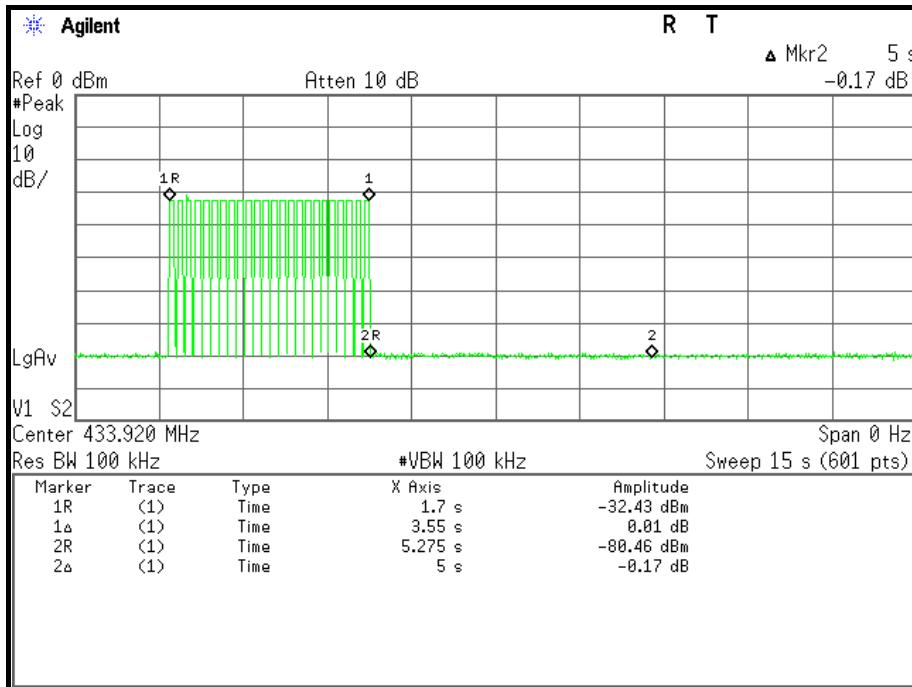


TEST PROCEDURE

The spectrum analyzer connected to RF antenna. The spectrum analyzer center frequency is set to the transmitter frequency. The RBW and VBW are set to 100kHz.

TEST RESULTS

Frequency (MHz)	Transmission Time (Second)	Limit (Second)	Pass / Fail
433.92	3.55	5.00	PASS





7.3 DUTY CYCLE CORRECTION FACTOR

LIMITS

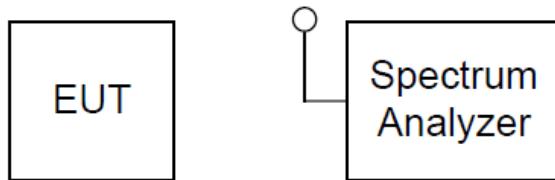
Nil (No dedicated limit specified in the Rules).

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360132	06/10/2014

Remark: Each piece of equipment is scheduled for calibration once a year.

TEST SETUP



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. The spectrum analyzer connected to RF antenna.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span = 0Hz.
5. Repeat above procedures until all frequency measured were complete.



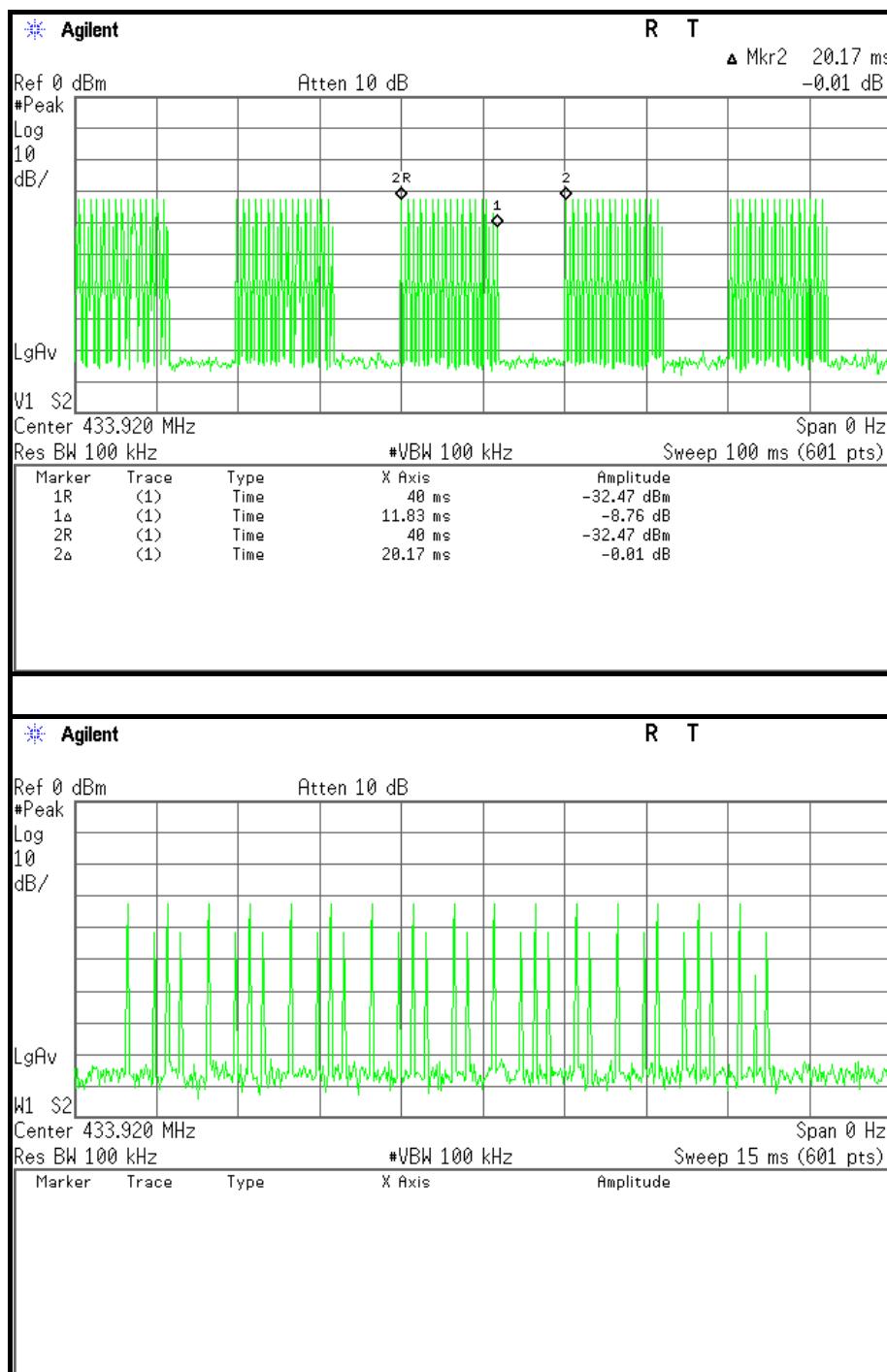
TEST RESULTS

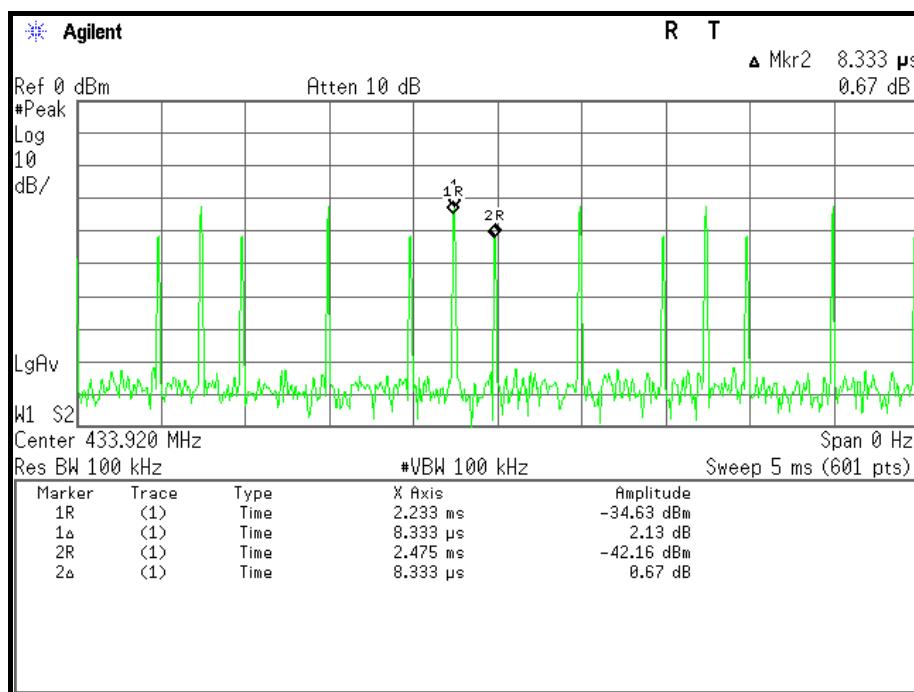
T_p = 20.17ms

T_{on} = 0.00833 × 33 = 0.275 (ms)

Duty Cycle Correction Factor= 20×log (Ton / T_p) = 20×log (0.275/20.17) = -37.31 dB

Because -37.31 less than -20, so the Duty Cycle Correction Factor = -20







7.4 RADIATED EMISSION

LIMITS

(1) According to §15.231(b), in addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 – 40.70	2250	225
70 – 130	1250	125
130 – 174	1250 to 3750 **	125 to 375 **
174 – 260	3750	375
260 – 470	3750 to 12500 **	375 to 1250 **
Above 470	12500	1250

Remark: ** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

(2) According to § 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	$2400/F(\text{KHz})$	300
0.490 – 1.705	$24000/F(\text{KHz})$	30
1.705 – 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

Remark: **Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

(3) According to § 15.209 (b) In the emission table above, the tighter limit applies at the band edges.



TEST EQUIPMENT

966Chamber_B

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY46180323	04/15/2014
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101131	01/14/2014
Bi-log Antenna	SCHWARZBECK	VULB 9168	9168-250	09/12/2014
Double-Ridged Waveguide Horn	ETS-LINDGREN	3117	00078733	12/05/2014
Horn Antenna	COM-POWER	AH-840	03077	12/18/2014
Pre-Amplifier	Agilent	8447D	2944A10052	07/16/2014
Pre-Amplifier	Agilent	8449B	3008A01916	07/16/2014
LOOP Antenna	EMCO	6502	8905-2356	08/20/2014
Notch Filters Band Reject	Micro-Tronics	BRM05702-01	026	N.C.R
TUNABLE BANDREJECT FILTER	K&L	3TNF-250/500 N/N	205	N.C.R.

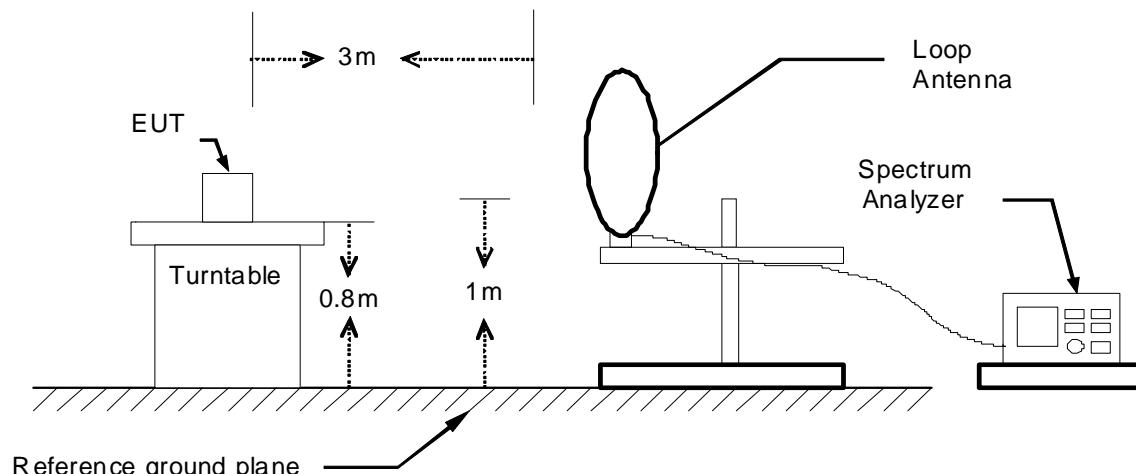
Remark: 1. Each piece of equipment is scheduled for calibration once a year.

2. N.C.R = No Calibration Request.

TEST SETUP

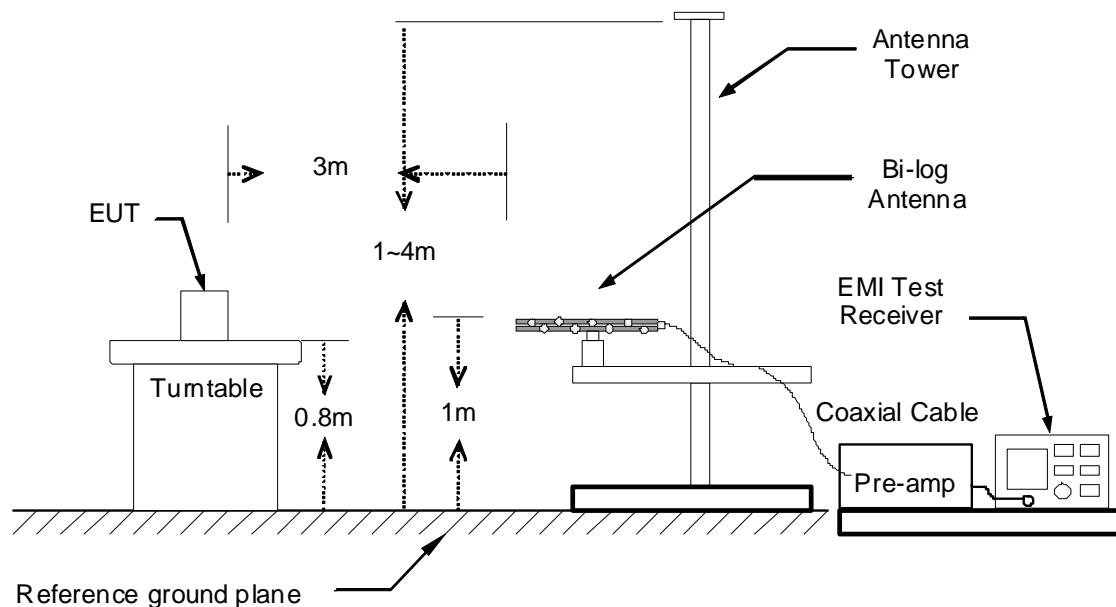
The diagram below shows the test setup that is utilized to make the measurements for emission from below 1GHz.

9kHz ~ 30MHz

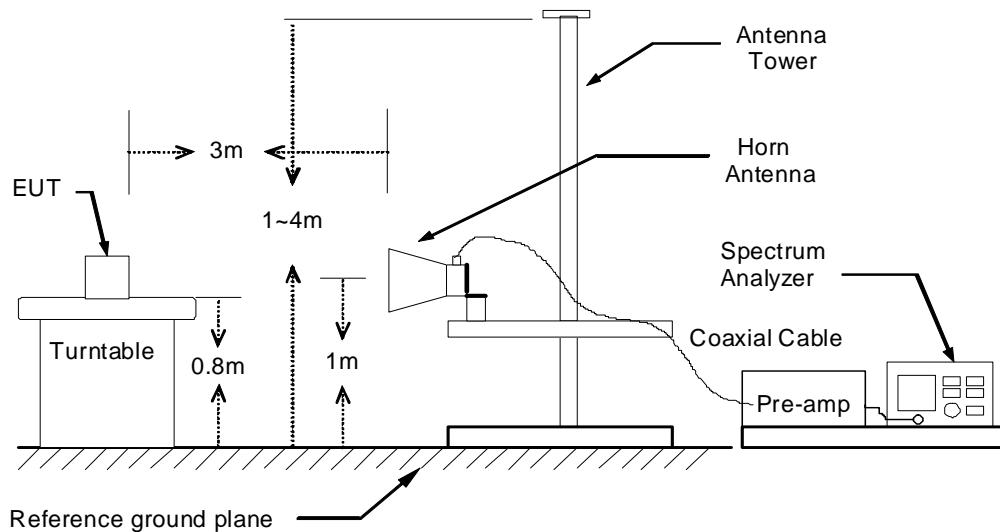




30MHz ~ 1GHz



The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.





TEST PROCEDURE

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground. The table was rotated 360 degrees to determine the position of the highest radiation.
2. While measuring the radiated emission below 1GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. While measuring the radiated emission above 1GHz, the EUT was set 3 meters away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Remark :

1. *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.*
2. *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.*
3. *The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.*

**TEST RESULTS****Below 1 GHz (9kHz ~ 30MHz)**

No emission found between lowest internal used/generated frequency to 30MHz.

Below 1 GHz (30MHz ~ 1GHz)

Product Name	Car Camera and Warning System	Test By	Waternal Guan
Test Model	2300is	Test Date	2013/12/17
Test Mode	TX Mode	Temp. & Humidity	22°C, 58%

966 Chamber_B at 3Meter / Horizontal								
Frequency (MHz)	Reading (dB μ V)	Correction Factor (dB/m)	Result (dB μ V/m)	Duty Cycle Correction Factor	Result (AVG/QP)	Limit (AVG/QP) (dB μ V/m)	Margin (dB)	Remark
*433.92	86.27	-9.21	77.06	-20.00	57.06	80.83	-23.77	AVG
320.03	56.50	-11.50	45.00		---	46.00	-1.00	Peak
340.40	51.40	-11.09	40.31		---	46.00	-5.69	Peak
359.80	52.99	-10.70	42.29		---	46.00	-3.71	Peak
380.17	47.87	-10.31	37.56		---	46.00	-8.44	Peak
399.57	51.87	-9.94	41.93		---	46.00	-4.07	Peak
440.31	46.18	-9.06	37.12		---	46.00	-8.88	Peak
*867.11	65.71	-1.79	63.92	-20.00	43.92	60.83	-16.91	AVG

966 Chamber_B at 3Meter / Vertical								
Frequency (MHz)	Reading (dB μ V)	Correction Factor (dB/m)	Result (dB μ V/m)	Duty Cycle Correction Factor	Result (AVG/QP)	Limit (AVG/QP) (dB μ V/m)	Margin (dB)	Remark
*433.92	91.07	-9.21	81.86	-20.00	61.86	80.83	-18.97	AVG
280.26	52.83	-12.32	40.51		---	46.00	-5.49	Peak
299.66	50.05	-11.92	38.13		---	46.00	-7.87	Peak
320.03	55.50	-11.50	44.00		---	46.00	-2.00	Peak
340.40	50.85	-11.09	39.77		---	46.00	-6.23	Peak
359.80	50.85	-10.70	40.14		---	46.00	-5.86	Peak
440.31	48.66	-9.06	39.61		---	46.00	-6.39	Peak
*867.11	59.90	-1.79	58.11	-20.00	38.11	60.83	-22.72	AVG

Remark:

- Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit.
- Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) - PreAmp.Gain (dB).
- Result (dB μ V/m) = Reading (dB μ V) + Correction Factor (dB/m).
- Margin (dB) = Remark result (dB μ V/m) - limit (dB μ V/m).
- (*) For Fundamental & Harmonics: Average Level = Peak Level + Duty Cycle Factor.



Above 1 GHz

Product Name	Car Camera and Warning System	Test By	Waternal Guan
Test Model	2300is	Test Date	2013/12/17
Test Mode	TX Mode	Temp. & Humidity	22°C, 58%

966 Chamber_B at 3Meter / Horizontal

Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
2128.00	43.45	---	-3.47	39.98	---	74.00	54.00	-14.02	Peak
2216.00	43.90	---	-3.12	40.78	---	74.00	54.00	-13.22	Peak
2412.00	43.53	---	-2.34	41.19	---	74.00	54.00	-12.81	Peak
3028.00	42.70	---	-0.46	42.24	---	74.00	54.00	-11.76	Peak
3460.00	41.97	---	0.50	42.47	---	74.00	54.00	-11.53	Peak
3984.00	40.91	---	2.69	43.60	---	74.00	54.00	-10.40	Peak

966 Chamber_B at 3Meter / Vertical

Frequency (MHz)	Reading-PK (dBuV)	Reading-AV (dBuV)	Correction Factor (dB/m)	Result-PK (dBuV/m)	Result-AV (dBuV/m)	Limit-PK (dBuV/m)	Limit-AV (dBuV/m)	Margin (dB)	Remark
1916.00	43.96	---	-4.37	39.59	---	74.00	54.00	-14.41	Peak
2016.00	43.48	---	-3.92	39.56	---	74.00	54.00	-14.44	Peak
2308.00	43.92	---	-2.75	41.17	---	74.00	54.00	-12.83	Peak
2552.00	42.99	---	-1.84	41.15	---	74.00	54.00	-12.85	Peak
3036.00	43.28	---	-0.44	42.84	---	74.00	54.00	-11.16	Peak
3356.00	42.49	---	0.27	42.76	---	74.00	54.00	-11.24	Peak

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Average test would be performed if the peak result were greater than the average limit.
3. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Result = Reading + Correction Factor
Margin = Result - Limit
Remark Peak = Result(PK) - Limit(AV)
Remark AVG = Result(AV) - Limit(AV)



7.5 CONDUCTED EMISSION

LIMITS

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5.00	56	46
5.00 - 30.0	60	50

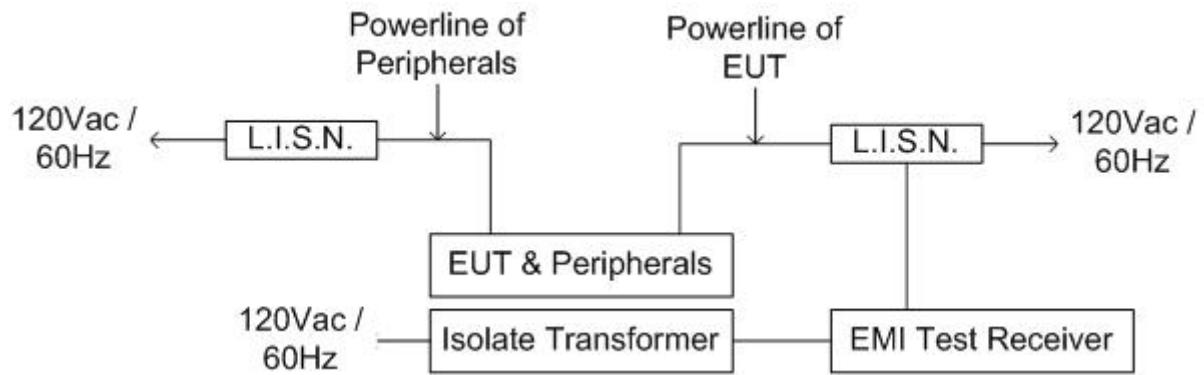
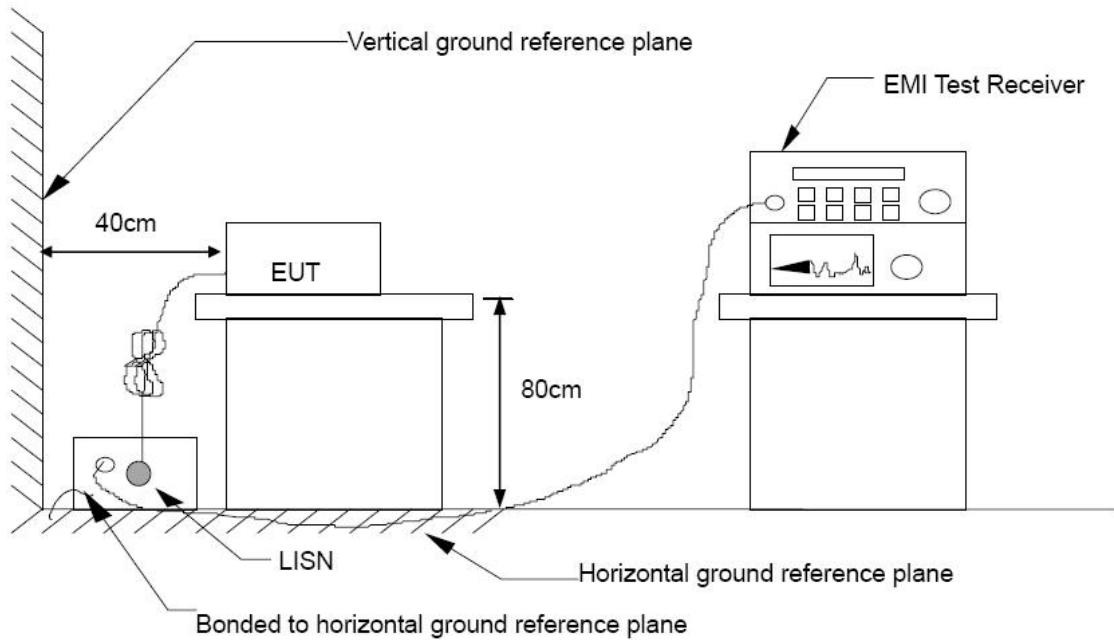
TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
L.I.S.N	SCHWARZBECK	NSLK 8127	8127-465	08/11/2014
L.I.S.N	SCHWARZBECK	NSLK 8127	8127-473	03/07/2014
EMI Receiver	ROHDE & SCHWARZ	ESCS 30	835418/008	10/16/2014
Pulse Limiter	ROHDE & SCHWARZ	ESH3-Z2	100117	07/01/2014

Remark: Each piece of equipment is scheduled for calibration once a year.



TEST SETUP





TEST PROCEDURE

The basic test procedure was in accordance with ANSI C63.4:2009.

The test procedure is performed in a 4m x 3m x 2.4m (LxWxH) shielded room.

The EUT along with its peripherals were placed on a 1.0m (W) x 1.5m (L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.

The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.

The EUT was located so that the distance between the boundary of the EUT and the closest surface of the LISN is 0.8 m. Where a mains flexible cord was provided by the manufacturer shall be 1 m long, or if in excess of 1 m, the excess cable was folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

TEST RESULTS

Since the EUT is powered by battery powered, this test item is not applicable.