SGS-CSTC Standards Technical Services Co., Ltd.

198 Kezhu Road, Scientech Park, Guangzhou Economic & Technological Development District, Guangzhou, China 510663
Telephone: +86 (0) 20 82155555
Fax: +86 (0) 20 82075059
Email: ee.guangzhou@sgs.com

TEST REPORT

Application No.:	GZEM1405002199RF
Applicant:	SHANTOU DOUBLE EAGLE TOYS INDUSTRY CO., LTD.
FCC ID:	2AAFASY-ZXC520
Product Name:	Engineering vehicle
Product Description:	Engineering vehicle with 27.145MHz as a carrier
Model No.:	E520-001, E520-002, E520-003 ♣
♣	Please refer to section 3 of this report for details
Standards:	CFR 47 PART 15 Subpart C: 2013 section 15.227
Date of Receipt:	2014-05-13
Date of Test:	2014-05-19 to 2014-05-22
Date of Issue:	2014-06-26
Test Result :	**Pass***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above. Please refer to section 3 of this report for further details.

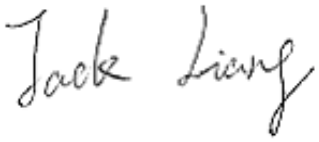
.

Richard Li

Manager

2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		2014-06-26		Original

Authorized for issue by:				
Tested By		 **(Jack Liang) /Project Engineer**		2014-05-19 to 2014-05-22 **Date**
Prepared By		 **(June Chen) /Clerk**		2014-06-24 **Date**
Checked By		 **(Fred Zhu) /Reviewer**		2014-06-26 **Date**

3 Test Summary

TEST	TEST REQUIREMENT	TEST METHOD	RESULT
Radiated Emission	FCC PART 15 C section 15.227	ANSI C 63.10: Clasue 6.4, 6.5	PASS**
Occupied Bandwidth	FCC PART 15 C section 15.215	ANSI C 63.10 Clasue 6.9	PASS

Remark:

N/A: not applicable. Refer to the relative section for the details.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

♣Model No.: E520-001, E520-002, E520-003

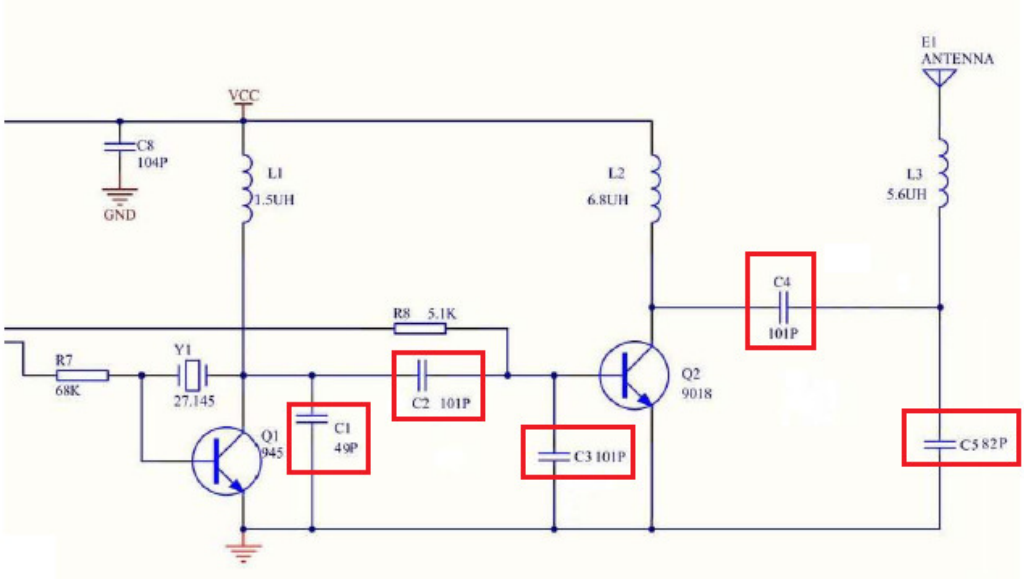
According to the confirmation from the applicant, since the electrical circuit design, layout, components used and internal wiring were identical for the above models, only difference being out colouir.

Therefore only one model E520-003 was tested in this report.

** The EUT passed Radiated Emission test after modification as show as below:

Radiated Emission

Add one capacitor C5 and replace four capacitors C1, C2, C3 and C4 for the transmitter as the following photo shown.



C1: 49pF C2, C3, C4:100pF C5:82pF

4 Contents

5 General Information

5.1 Client Information

Applicant:	SHANTOU DOUBLE EAGLE TOYS INDUSTRY CO., LTD.
Address of Applicant:	XINGDA INDUSTRIAL PARK, CHENGHAI SHANTOU CITY, GUANGDONG PROVINCE, CHINA

5.2 General Description of E.U.T.

Product Name:	Engineering vehicle
Model No.:	E520-003

5.3 Details of E.U.T.

Modulation and Antenna Type:	The Tx is a ASK modulation by internal signal with a dedicated antenna
Power Supply:	DC 3.0 V (2 x 1.5 V 'AA' batteries)
Power cord:	N/A

5.4 Description of Support Units

The EUT has been tested as an independent unit.

5.5 Deviation from Standards

None.

5.6 Abnormalities from Standard Conditions

The EUT passed Radiated Emission test after modification.

5.7 Other Information Requested by the Customer

None.

5.8 Test Location

All tests were performed at:
SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory,
198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District,
Guangzhou, China 510663
Tel: +86 20 82155555 Fax: +86 20 82075059
No tests were sub-contracted.

5.9 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **NVLAP (Lab Code: 200611-0)**

  SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited und the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

  The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any a of the Federal Government.

- **ACMA**

  SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for tl Australian C-Tick mark as a result of our NVLAP accreditation.

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

  Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

  SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

- **FCC (Registration No.: 282399)**

  SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance le from the FCC is maintained in our files. Registration 282399, May 31, 2002.

- **Industry Canada (Registration No.: 4620B-1)**

  The 3m/10m Alternate Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., L has been registered by Certification and Engineering of Industry Canada for radio equipment testin with Registration No. 4620B-1.

- **VCCI (Registration No.: R-2460, C-2584, G-449 and T-1179)**

  The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Service Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2460, C-2584，G-449 and T-1179 respectively.

- **CBTL (Lab Code: TL129)**

  SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2005, the Basic Rules, IECEE 01:2006-10 and Rul procedure IECEE 02:2006-10, and the relevant IECEE CB-Scheme Operational documents.

6 Equipment Used during Test

RE in Chamber						
No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Due date (YYYY-MM-DD)	Calibration Interval
EMC0525	Compact Semi-Anechoic Chamber	ChangZhou ZhongYu	N/A	N/A	2014-08-30	2Y
EMC0522	EMI Test Receiver	Rohde & Schwarz	ESIB26	100283	2015-04-19	1Y
EMC0056	EMI Test Receiver	Rohde & Schwarz	ESCI	100236	2015-03-03	1Y
EMC0528	RI High frequency Cable	SGS	20 m	N/A	2015-05-09	1Y
EMC2025	Trilog Broadband Antenna 30-3000MHz	SCHWARZBECK MESS-ELEKTRONIK	VULB 9163	9163-450	2016-08-31	3Y
EMC0524	Bi-log Type Antenna	Schaffner -Chase	CBL6112B	2966	2016-08-31	3Y
EMC0519	Bilog Type Antenna	Schaffner -Chase	CBL6143	5070	2016-05-04	2Y
EMC2026	Horn Antenna 1-18GHz	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	9120D-841	2016-08-31	3Y
EMC0518	Horn Antenna	Rohde & Schwarz	HF906	100096	2014-07-01	2Y
EMC0521	1-26.5 GHz Pre-Amplifier	Agilent	8449B	3008A01649	2015-03-03	1Y
EMC2065	Amplifier	HP	8447F	N/A	2014-08-31	1Y
EMC2063	1-26GHz Pre Amplifier	Compliance Direction System Inc.	PAP-1G26-48	6279.628	2014-07-29	1Y
EMC0075	310N Amplifier	Sonama	310N	272683	2015-03-03	1Y
EMC0523	Active Loop Antenna	EMCO	6502	42963	2016-03-03	2Y
EMC2041	Broad-Band Horn Antenna (14)15-26.5(40)GHz	SCHWARZBECK MESS-ELEKTRONI	BBHA 9170	9170-375	2017-06-01	3Y
EMC2069	2.4GHz filter	Micro-Tronics	BRM 50702	149	2015-04-19	1Y
EMC0530	10m Semi-Anechoic Chamber	ETS	N/A	N/A	2016-05-03	2Y

General used equipment						
No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Due date (YYYY-MM-DD)	Calibration Interval
EMC0006	DMM	Fluke	73	70681569	2014-09-13	1Y
EMC0007	DMM	Fluke	73	70671122	2014-09-13	1Y

7 Test Results

7.1 E.U.T. test conditions

Test Voltage: DC 3.0 V (new battery)

Requirements: **15.31(e)**: For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Operating Environment:

Temperature: 22-25.0 °C

Humidity: 48-55% RH

Atmospheric Pressure: 1001-1010 mbar

Test frequencies and frequency range: According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

Remark:Test frequency is 27.145 MHz.

7.2 Antenna Requirement

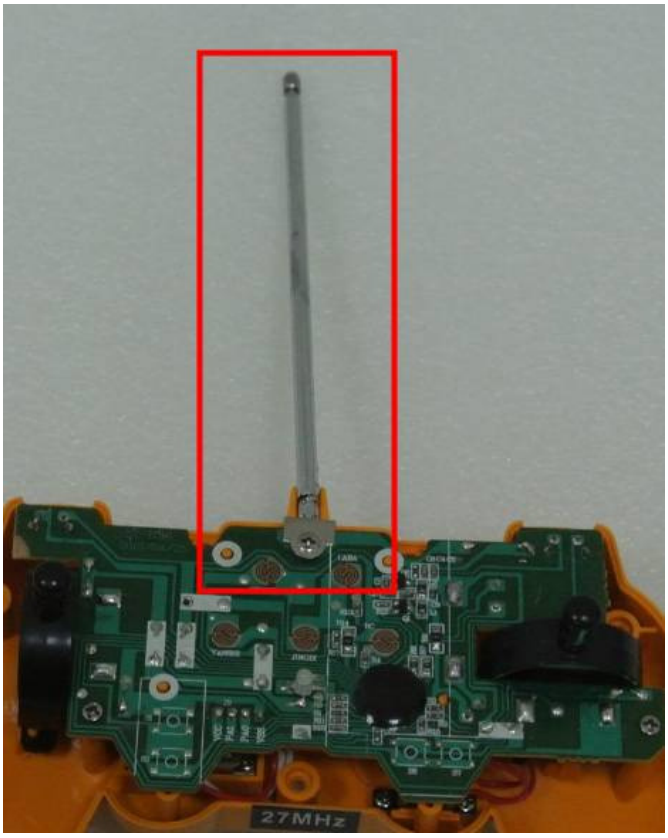
Standard requirement

15.203 requirement:

For intentional device. According to 15.203. an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

EUT Antenna

The antenna is a whip dedicated antenna and no consideration of replacement. The best case gain of the antenna is 0 dBi.



Test result: The unit does meet the FCC requirements.

7.3 Radiated Emissions

Test Requirement: FCC Part 15 C section 15.227

Test Method: ANSI C63.10: Clause 6.4, 6.5 and 6.6

Measurement Distance: 3 m (Semi-Anechoic Chamber)

Test Status: Test in transmitting mode.

Requirements:

the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

15.227(a):The field strength of any emission within this band shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

15.227(b) :The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in Section 15.209.

Out of band emissions shall not exceed:

Frequency range(MHz)	**Quasi-peak limits** dB (μV/m)
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960	54
At transitional frequencies the lower limit applies.	

Test Procedure:

1) 9 kHz to 30 MHz emissions:

For testing performed with the loop antenna. The center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specied distance from the EUT.During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane.

2) 30 MHz to 1 GHz emissions:

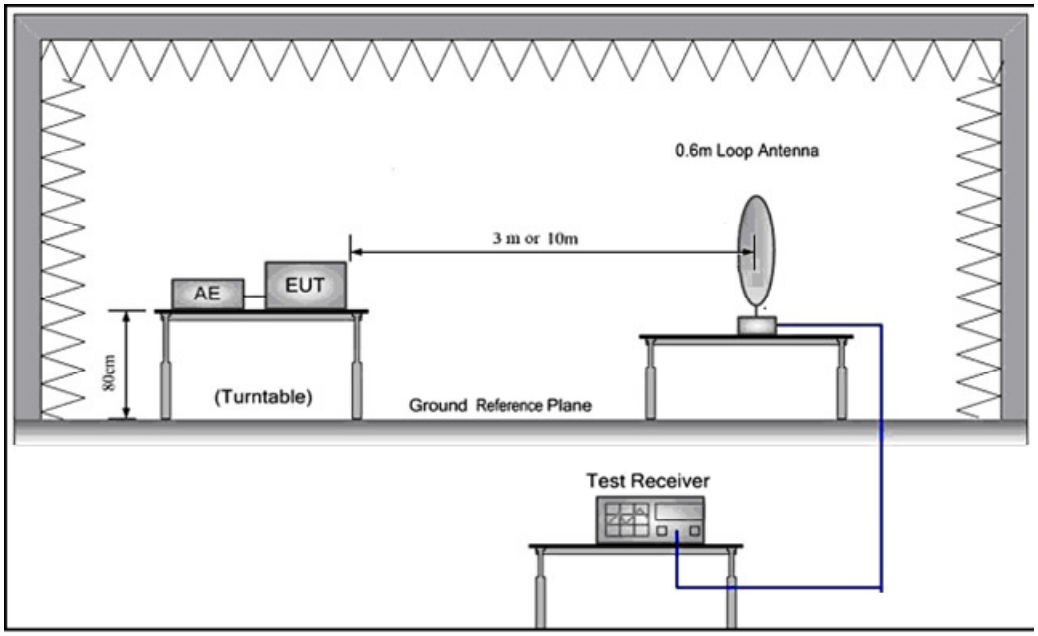
For testing perfomed with the bi-log type antenna. The measurement is performed with the EUT rotated 360º, the antenna height scaned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

Detector :

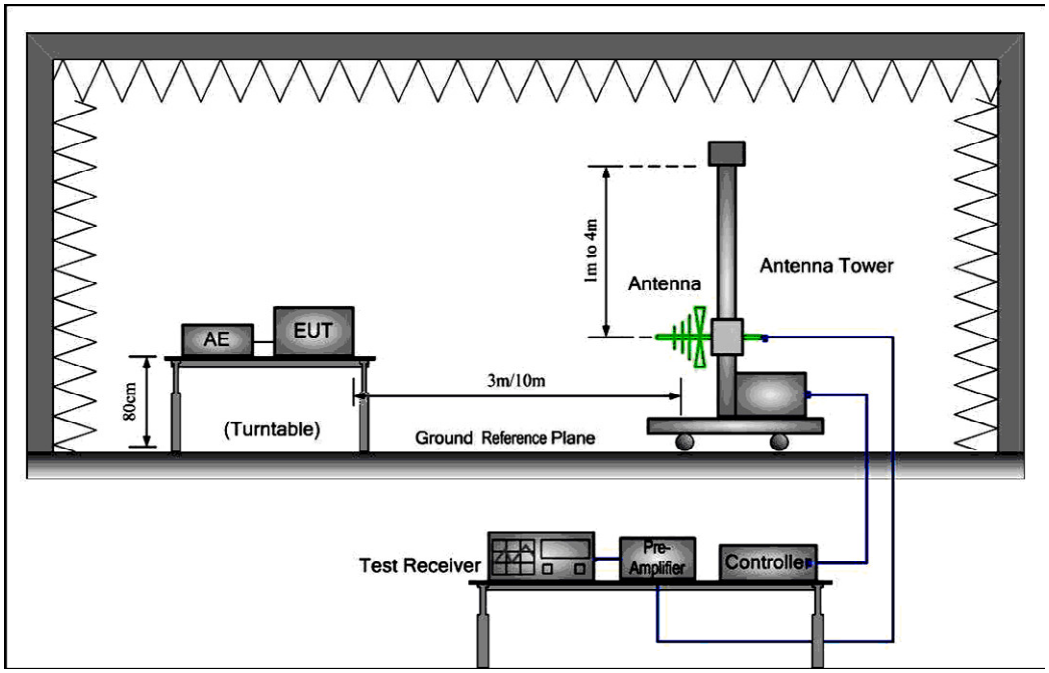
Test Receiver test setup	Detector	
	Peak	Average
RBW	120 kHz for f < 1 GHz	120 kHz for f < 1 GHz
VBW	≥ RBW	≥ RBW
Sweep	auto	auto
Detector function	peak	AV
Trace	max hold	max hold

Test Configuration:

1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



1) Fundamental emission:

Antenna polarization: Vertical:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
27.145	65.7	9.5	0.6	75.8	100.0	-24.2	Peak
27.145	41.5	9.5	0.6	51.6	80.0	-28.4	Average

Antenna polarization: Horizontal :

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
27.145	57.8	9.5	0.6	67.9	100.0	-32.1	Peak
27.145	35.2	9.5	0.6	45.3	80.0	-34.7	Average

Y: rotate EUT by 90° vertically.

X: rotate EUT by 90° clockwise.

Z: EUT as Radiated Emission test setup photograph.

Remark: Radiated Emission test setup photograph is the worst case and reported.

2) other emissions:

The receiver was scanned from the lowest frequency generated within the EUT to 1 GHz.When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. The worst case emissions were reported.
An initial pre-scan was performed in the 3 m chamber using the spectrum analyzer in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by Bilog antenna with 2 orthogonal polarities.
The field strength is calculated by adding the Antenna Factor, Cable Factor & Peramplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor –Peramplifier Factor.
The following test results were performed on the EUT.

9 kHz~30 MHz Field Strength of Unwanted Emissions.Quasi-Peak Measurement

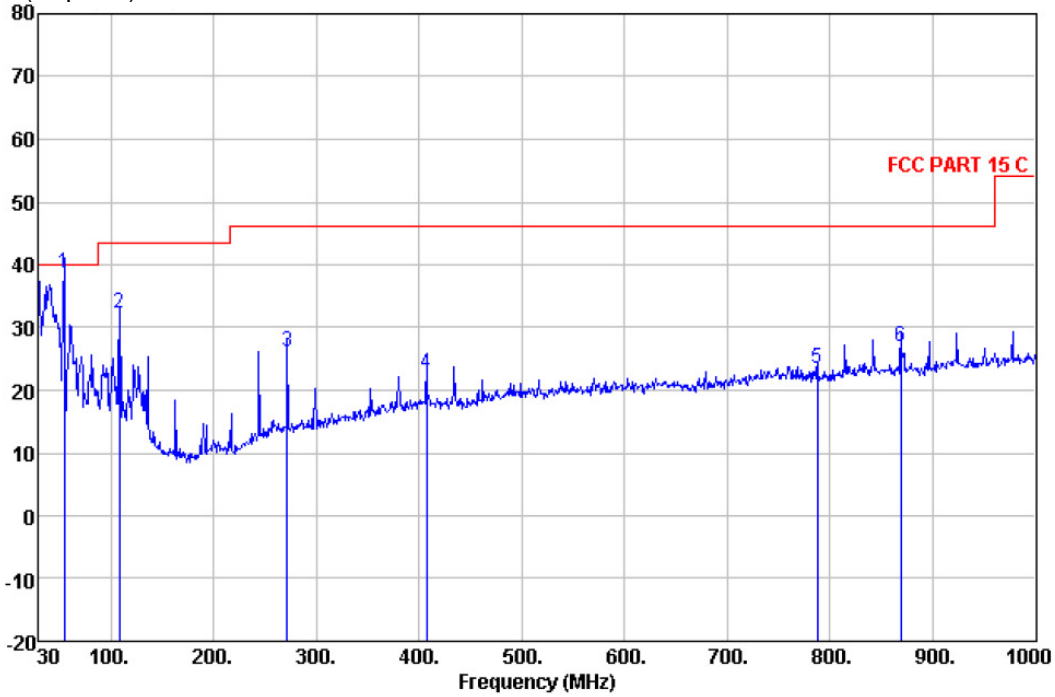
The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~1 GHz Field Strength of Unwanted Emissions.Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBµV/m)



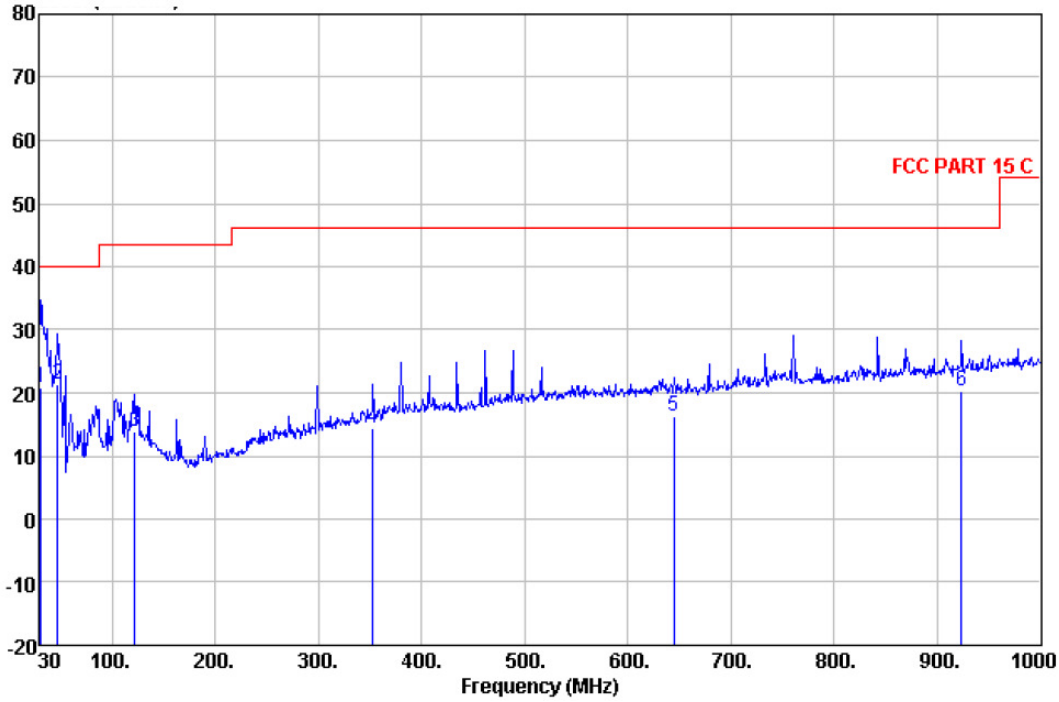
Quasi-peak measurement

Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
54.290	60.90	4.42	0.10	26.70	38.72	40.00	-1.28	QP
108.570	46.84	11.81	0.24	26.56	32.33	43.50	-11.17	QP
271.530	38.85	12.26	0.86	25.93	26.04	46.00	-19.96	QP
407.330	31.76	16.29	1.21	26.51	22.75	46.00	-23.25	QP
787.570	28.96	19.88	1.73	27.06	23.51	46.00	-22.49	QP
869.050	31.21	20.70	2.01	26.86	27.06	46.00	-18.94	QP

Horizontal:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
30.970	28.10	19.50	0.03	26.81	20.82	40.00	-19.18	QP
47.460	39.61	8.32	0.08	26.73	21.28	40.00	-18.72	QP
122.150	28.18	11.84	0.31	26.50	13.83	43.50	-29.67	QP
353.010	24.73	14.47	1.20	26.07	14.33	46.00	-31.67	QP
644.980	23.00	18.75	1.78	27.20	16.33	46.00	-29.67	QP
923.370	23.86	21.03	2.00	26.74	20.15	46.00	-25.85	QP

Remark:

According to 15.35 (b) When average radiated emission measurements are specified in the regulations, including emission measurements below 1000 MHz, there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules, e.g., see Section 15.255.

7.4 Occupied Bandwidth

Test Requirement: FCC Part 15 C section 15.215

Test Method: ANSI C63.10: Clause 6.9

Test Status: Test in transmitting mode.

Requirements:

15.215(c), Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Operation within the band: 26. 96 – 27.28 MHz.

Test Procedure:

The useful radiated emission from the EUT was detected by the spectrum analyzer with peak detector. Record the 20 dB bandwidth of the carrier.

The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector. The vertical Scale is set to 10dB per division. The horizontal scale is set to 20KHz per division. Read the down 20dB bandwidth of the carrier.

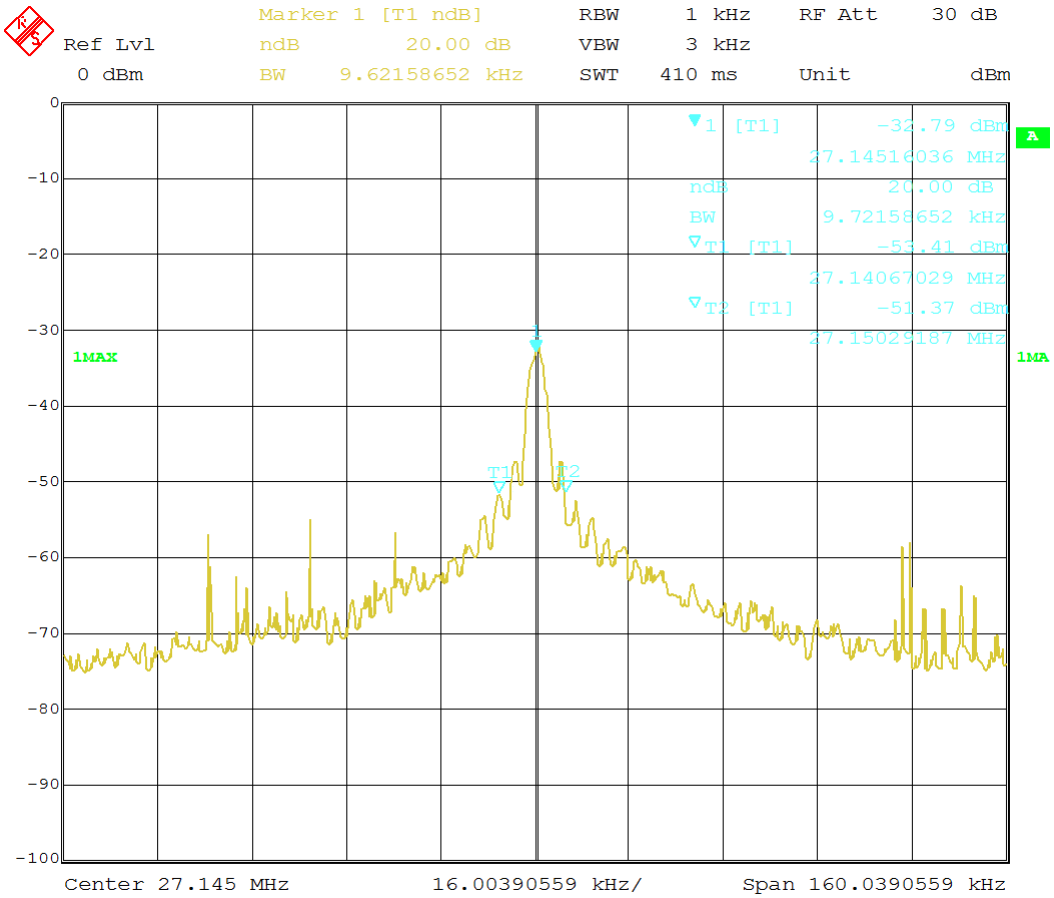
Set the spectrum analyzer: start at 26.96MHz and stop at 27.28MHz

Set the spectrum analyzer: RBW = 1 kHz, VBW = 3 kHz

Sweep = auto; Detector Function = Peak. Trace = Max Hold.

Mark the peak frequency and -20dB points bandwidth.

Test plot as below:



20dB bandwidth lower frequency: 27.14067029MHz

20dB bandwidth upper frequency: 27.15029187MHz

--The End of Report--