



SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch

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Report No.: SZEM150800489501
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FCC TEST REPORT

Application No.: SZEM1508004895CR (SGS GZ No.:GZEM1508004063CR)
Applicant: Capstone Industries, Inc.
Manufacturer: Minwa China (Huizhou) Electronics Co., Ltd
Factory: Minwa China (Huizhou) Electronics Co., Ltd
Product Name: Remote control
Model No.: WRCO-RM
FCC ID: 2ACN4WRCO-RM
Standards: 47 CFR Part 15, Subpart C (2014)
Date of Receipt: 2015-07-15 (for original report SZEM150700402701)
Date of Test: 2015-07-15 to 2015-07-23(for original report SZEM150700402701)
Date of Issue: 2015-07-30 (for original report SZEM150700402701)
2015-08-11 (for new report SZEM150800489501)

Test Result:	PASS *
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* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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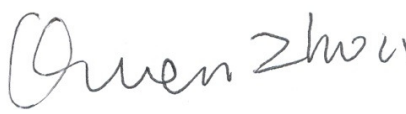


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2 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2015-08-11		Original

Authorized for issue by:				
Tested By		 (Eric Fu) /Project Engineer		2015-07-23
				Date
Prepared By		 (Jade Chen) /Clerk		2015-08-11
				Date
Checked By		 (Owen Zhou) /Reviewer		2015-08-11
				Date

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3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203	ANSI C63.10(2009)	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10(2009)	PASS
Field Strength of the Fundamental Signal	47 CFR Part 15, Subpart C Section 15.231 (b)	ANSI C63.10(2009)	PASS
Spurious Emissions	47 CFR Part 15, Subpart C Section 15.231 (b)/15.209	ANSI C63.10(2009)	PASS
20dB Bandwidth	47 CFR Part 15, Subpart C Section 15.231 (c)	ANSI C63.10(2009)	PASS
Dwell Time	47 CFR Part 15, Subpart C Section 15.231 (a)	ANSI C63.10(2009)	PASS

Remark:

Original model No. in report SZEM15070040270101: WMRC1.

New model No. in report SZEM150800489501: WRCO-RM.

Only the model WMRC1 was tested in report SZEM15070040270101.

This report was an additional report copied from the report SZEM15070040270101, just changed the model No. , information of applicant and manufacture. Since the electrical circuit design, layout, components used and internal wiring for the model WMRC1 in the report SZEM15070040270101 was exactly the same as the model WRCO-RM in this report, only the model number is different.

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5 General Information

5.1 Client Information

Applicant:	Capstone Industries, Inc.
Address of Applicant:	350 Jim Moran Blvd., Suite 120, Deerfield Beach, F133442, USA
Manufacturer:	Minwa China (Huizhou) Electronics Co., Ltd
Address of Manufacturer:	Huizhou Industrial Park, Minwa(Dalian)Industrial Park, Ruhu Town, Huicheng, Huizhou, 516169 Guangdong, China
Factory:	Minwa China (Huizhou) Electronics Co., Ltd
Address of Factory:	Huizhou Industrial Park, Minwa(Dalian)Industrial Park, Ruhu Town, Huicheng, Huizhou, 516169 Guangdong, China

5.2 General Description of EUT

Product Name:	Remote control
Model No.:	WMRC1
Operation Frequency:	315MHz
Channel Numbers:	1
Modulation Type:	ASK
Sample Type:	Portable production
Antenna Type:	Integral
Antenna Gain:	2dBi
Power Supply:	DC 24V



5.3 Test Environment and Mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	52 % RH
Atmospheric Pressure:	1005 mbar
Test mode:	
Transmitting mode:	Keep the EUT in transmitting mode with modulation.

5.4 Description of Support Units

The EUT has been tested independent unit.

5.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch E&E Lab,

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China.
518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.



5.6 Test Facility

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

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **VCCI**

The 10m Semi-anechoic chamber and Shielded Room (7.5m x 4.0m x 3.0m) of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

- **FCC – Registration No.: 556682**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

- **Industry Canada (IC)**

Two 3m Semi-anechoic chambers of SGS-CSTC Standards Technical Services Co., Ltd. have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-2.

5.7 Deviation from Standards

None.

5.8 Abnormalities from Standard Conditions

None.

5.9 Other Information Requested by the Customer

None.



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5.10 Equipment List

RE in Chamber					
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEL0017	2016-05-13
2	EMI Test Receiver	Agilent Technologies	N9038A	SEL0312	2015-09-16
3	EMI Test software	AUDIX	E3	SEL0050	N/A
4	Coaxial cable	SGS	N/A	SEL0027	2016-05-13
5	Coaxial cable	SGS	N/A	SEL0189	2016-05-13
6	Coaxial cable	SGS	N/A	SEL0121	2016-05-13
7	Coaxial cable	SGS	N/A	SEL0178	2016-05-13
8	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEL0015	2015-10-24
9	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEL0006	2015-10-24
10	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEL0053	2016-05-13
11	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEL0168	2015-10-24
12	Barometer	ChangChun	DYM3	SEL0088	2016-05-13
13	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-24
14	Humidity/ Temperature Indicator	Shanghai Qixiang	ZJ1-2B	SEL0103	2015-10-24
15	Signal Generator	Rohde & Schwarz	SMY01	SEL0155	2015-10-24
16	Signal Generator (10M-27GHz)	Rohde & Schwarz	SMR27	SEL0067	2016-05-13
17	Loop Antenna	Beijing Daze	ZN30401	SEL0203	2016-05-13

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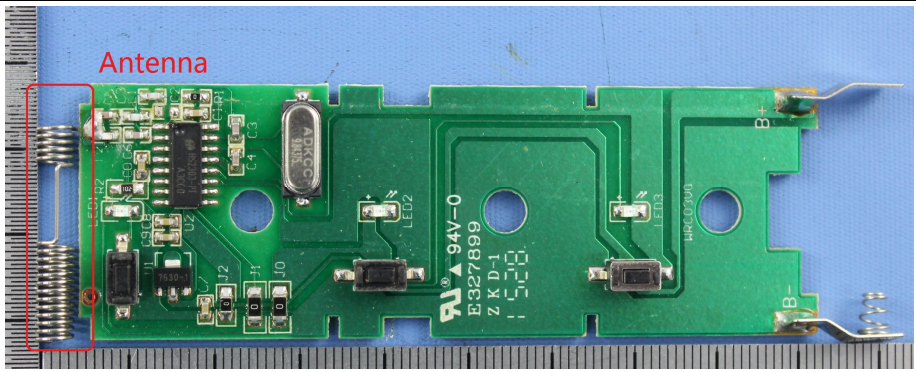
RF connected test					
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Due date (yyyy-mm-dd)
1	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-24
2	Humidity/ Temperature Indicator	HYGRO	ZJ1-2B	SEL0033	2015-10-24
3	Spectrum Analyzer	Rohde & Schwarz	FSP	SEL0154	2015-10-24
4	Coaxial cable	SGS	N/A	SEL0178	2016-05-13
5	Coaxial cable	SGS	N/A	SEL0179	2016-05-13
6	Barometer	ChangChun	DYM3	SEL0088	2016-05-13
7	Signal Generator	Rohde & Schwarz	SML03	SEL0068	2016-04-25
8	Band filter	amideon	82346	SEL0094	2016-05-13
9	POWER METER	R & S	NRVS	SEL0144	2015-10-24
10	Attenuator	Beijin feihang taida	TST-2-6dB	SEL0205	2016-04-25
11	Power Divider(splitter)	Agilent Technologies	11636B	SEL0130	2015-10-24

Note: The calibration interval is one year, all the instruments are valid.

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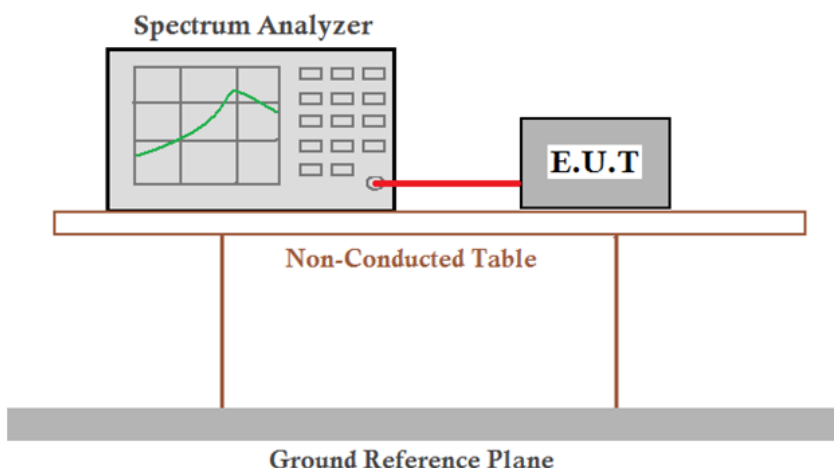
6 Test results and Measurement Data

6.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203
15.203 requirement: 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.	
EUT Antenna:	
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2dBi.	

6.2 Spurious Emissions

6.2.1 Duty Cycle

Test Requirement:	47 CFR Part 15C Section 15.35 (c)
Test Method:	ANSI C63.10:2009
Test Setup:	
Limit:	N/A
Test Mode:	Transmitting mode
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

Measurement Data

Calculate Formula:	$PDCF = 20 \log(\text{Duty cycle})$
	$\text{Duty cycle} = T_{\text{on time}} / T_{\text{period}}$
Test data:	$T_{\text{on time}} = 21.108$
	$T_{\text{period}} = 100$
	$\text{Average value} = PK + 20 \log(\text{Duty cycle})$



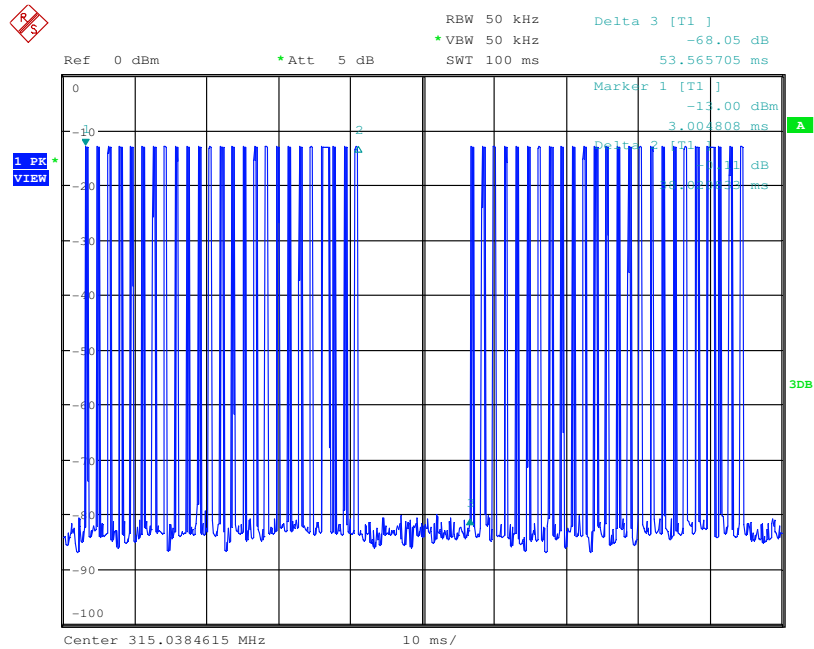
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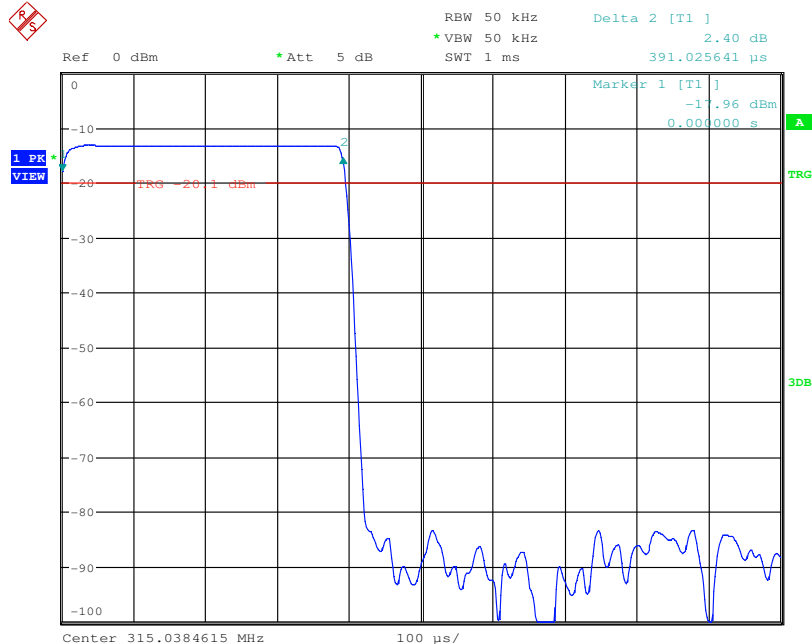
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Test plot as follows:

Duty cycle numbers



Time slot:



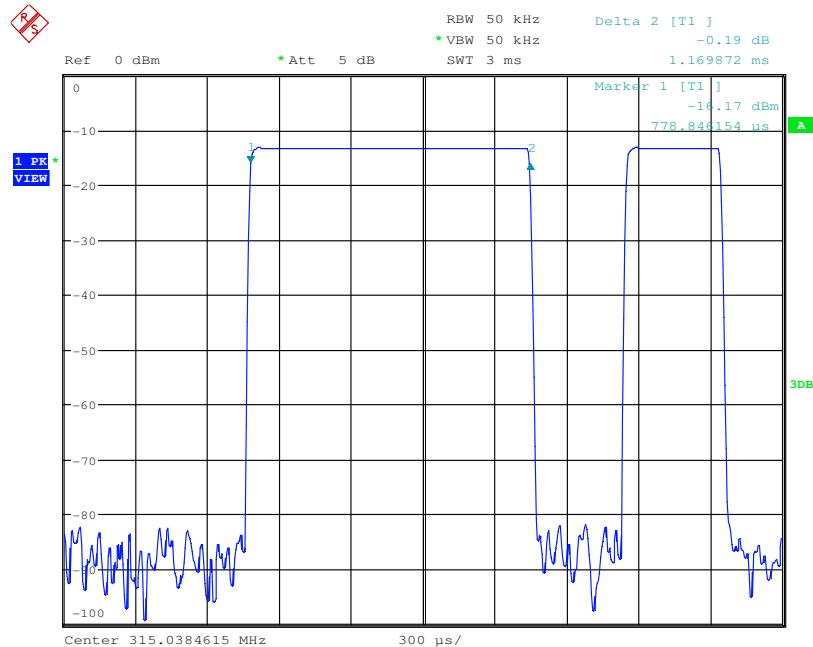
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6.2.2 Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.231(b) and 15.209				
Test Method:	ANSI C63.10: 2009				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit: (Spurious Emissions)	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
	Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.				
Limit: (Field strength of the fundamental signal)	Frequency	Limit (dBuV/m @3m)		Remark	
	315MHz	75.62		Average Value	
		95.72		Peak Value	

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Test Procedure:	- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. - The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. - The antenna 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 polarizations of the antenna are set to make the measurement. - 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. - The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. - If the emission level of the EUT in peak mode was 10dB 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 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. - The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.
Test Setup:	

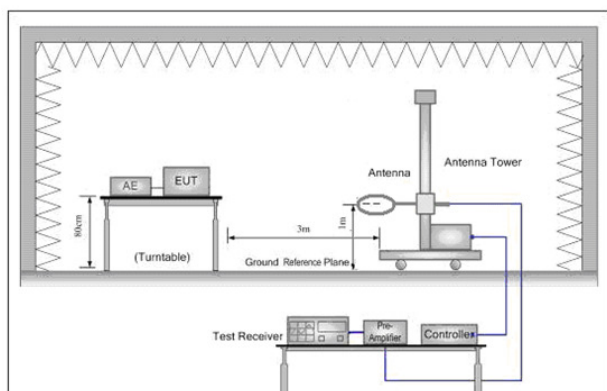


Figure 1. Below 30MHz

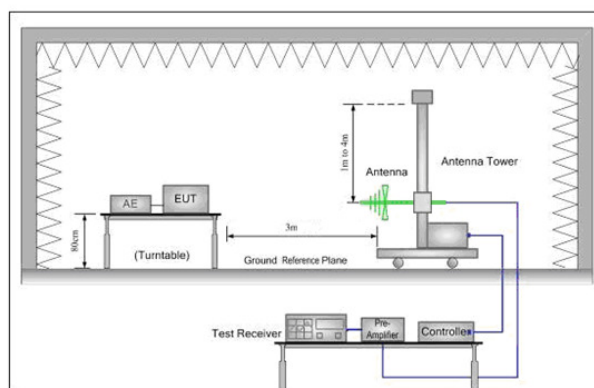


Figure 2. 30MHz to 1GHz

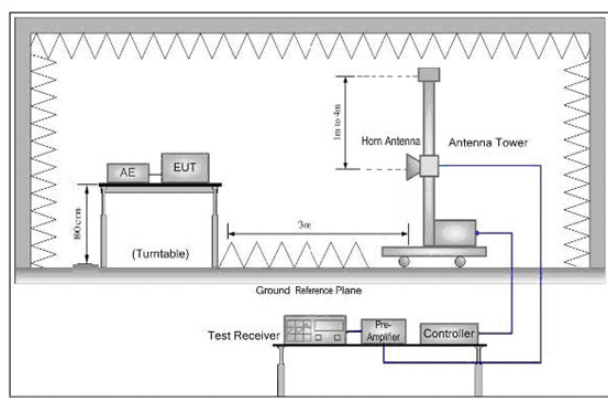


Figure 3. Above 1 GHz

Test Mode:	Transmitting mode
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

Measurement Data

6.2.2.1 Field Strength Of The Fundamental Signal

Peak value:								
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamplifier Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
315.48	2.85	14.34	0.00	58.62	75.81	95.62	-19.81	Horizontal
315.48	2.85	14.34	0.00	55.31	72.50	95.62	-23.12	Vertical

Average value:	
Calculate Formula:	Average value=Peak value + PDCF
	PDCF=20 log(Duty cycle)
	Duty cycle= T on time / T period
Test data:	Ton time =21.108
	T period =100
	Average value= PK+20 log(Duty cycle)



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Average value= PK value+20 log(Duty cycle)

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
315.48	62.30	75.62	-13.32	Horizontal
315.48	58.99	75.62	-16.63	Vertical

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6.2.2.2 Spurious Emissions

Radiated emission below 1GHz

Test mode:		Transmitter mode		Test channel		315MHz	Remark:		Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamplifier Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	
157.56	1.92	9.60	0.00	28.57	40.09	43.50	-3.41	Vertical	
236.64	2.43	11.77	0.00	17.14	31.34	46.00	-14.66	Vertical	
276.12	2.61	12.74	0.00	17.65	33.00	46.00	-13.00	Vertical	
543.27	3.96	18.84	0.00	14.89	37.69	46.00	-8.31	Vertical	
630.96	4.35	20.33	0.00	35.70	60.38	75.62	-15.24	Vertical	
711.67	4.61	21.65	0.00	16.14	42.40	46.00	-3.60	Vertical	
111.35	1.50	8.62	0.00	15.04	25.16	43.50	-18.34	Horizontal	
157.56	1.92	9.60	0.00	23.73	35.25	43.50	-8.25	Horizontal	
236.64	2.43	11.77	0.00	22.77	36.97	46.00	-9.03	Horizontal	
276.12	2.61	12.74	0.00	22.43	37.78	46.00	-8.22	Horizontal	
531.96	3.87	18.57	0.00	15.25	37.69	46.00	-8.31	Horizontal	
630.96	4.35	20.33	0.00	20.51	45.19	75.62	-30.43	Horizontal	



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Above 1GHz

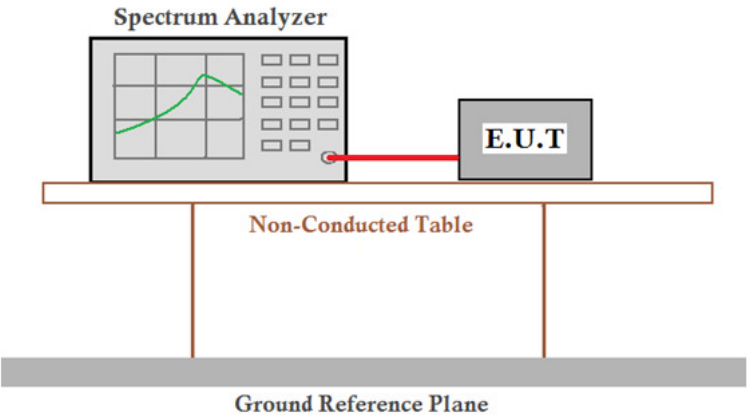
Peak value:

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1260.000	3.46	27.63	38.34	55.42	48.17	74.00	-25.83	Vertical
1575.000	3.77	29.05	38.38	48.91	43.35	74.00	-30.65	Vertical
1890.000	4.18	30.84	38.42	47.30	43.90	74.00	-30.10	Vertical
2205.000	4.63	31.10	38.44	51.76	49.05	74.00	-24.95	Vertical
2520.000	5.08	32.45	38.47	48.06	47.12	74.00	-26.88	Vertical
2835.000	5.54	32.06	38.49	49.06	48.17	74.00	-25.83	Vertical
1260.000	3.46	27.63	38.34	50.17	42.92	74.00	-31.08	Horizontal
1575.000	3.77	29.05	38.38	52.57	47.01	74.00	-26.99	Horizontal
1890.000	4.18	30.84	38.42	57.21	53.81	74.00	-20.19	Horizontal
2205.000	4.63	31.10	38.44	50.78	48.07	74.00	-25.93	Horizontal
2520.000	5.08	32.45	38.47	49.11	48.17	74.00	-25.83	Horizontal
2835.000	5.54	32.06	38.49	48.39	47.50	74.00	-26.50	Horizontal

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 2) The disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.
- 3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

6.3 20dB Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.231 (c)
Test Method:	ANSI C63.10:2009
Test Setup:	
Limit:	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 Mode:	Transmitting mode
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

Measurement Data

20dB bandwidth (MHz)	Limit (MHz)	Results
17.147kHz	787.60	Pass

Remark:

The bandwidth limit is $315.039 \times 0.0025 = 787.60\text{KHz}$

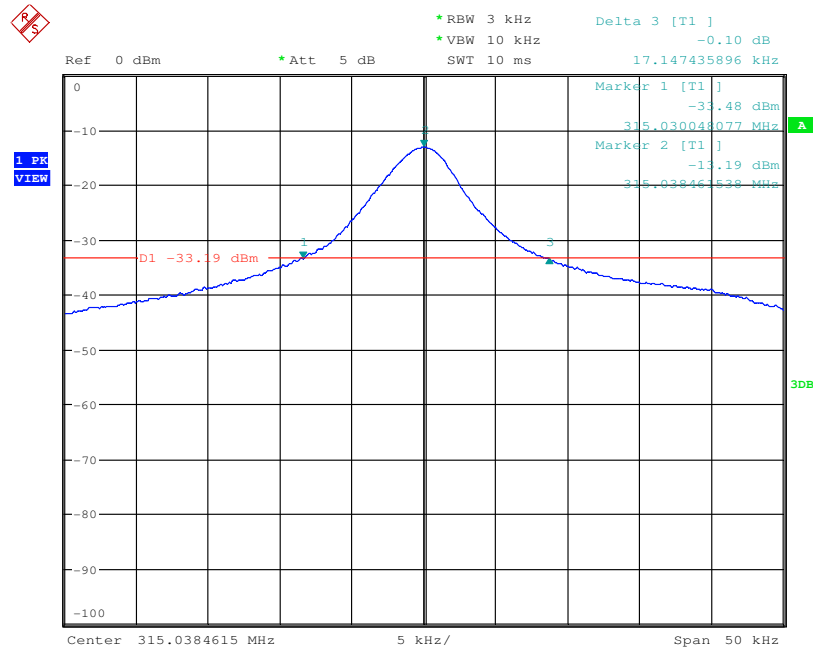


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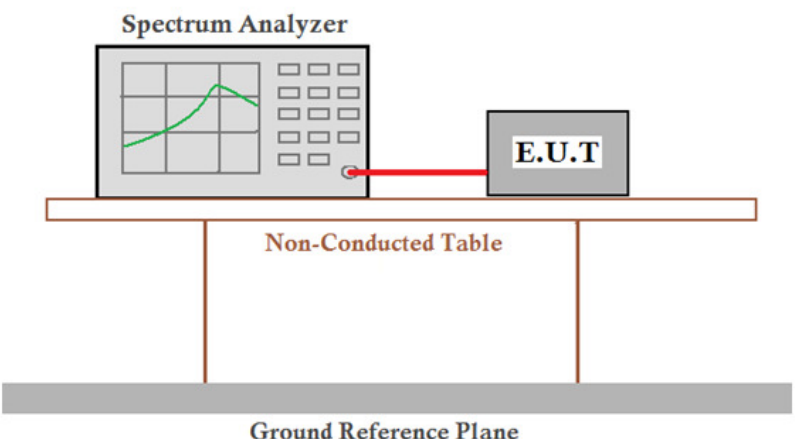
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Test plot as follows:



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6.4 Dwell Time

Test Requirement:	47 CFR Part 15C Section 15.231 (a) (1)
Test Method:	ANSI C63.10:2009
Test Setup:	
Limit:	Not more than 5 seconds
Test Mode:	Transmitting mode
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

Measurement Data

Test item	Limit (MHz)	Results
Transmitting time	≤5S	0.144

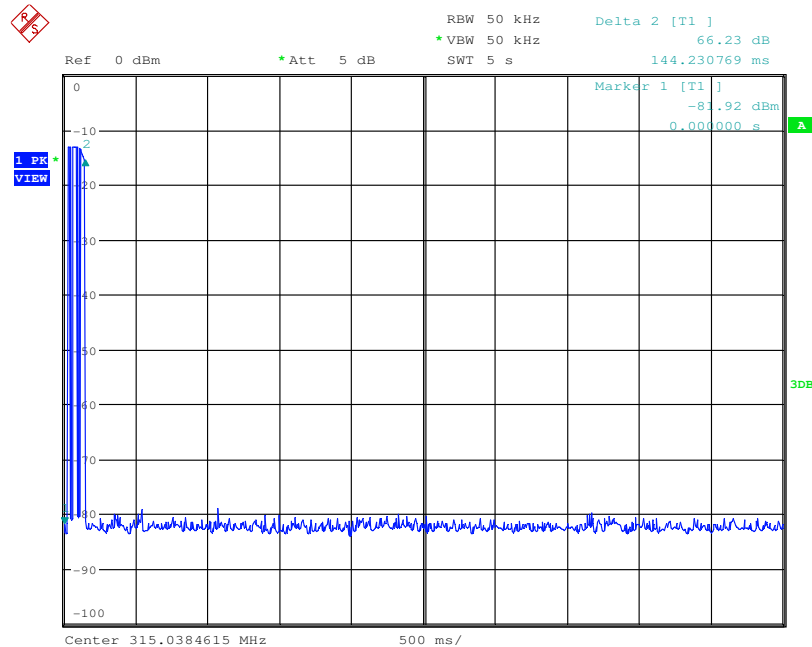


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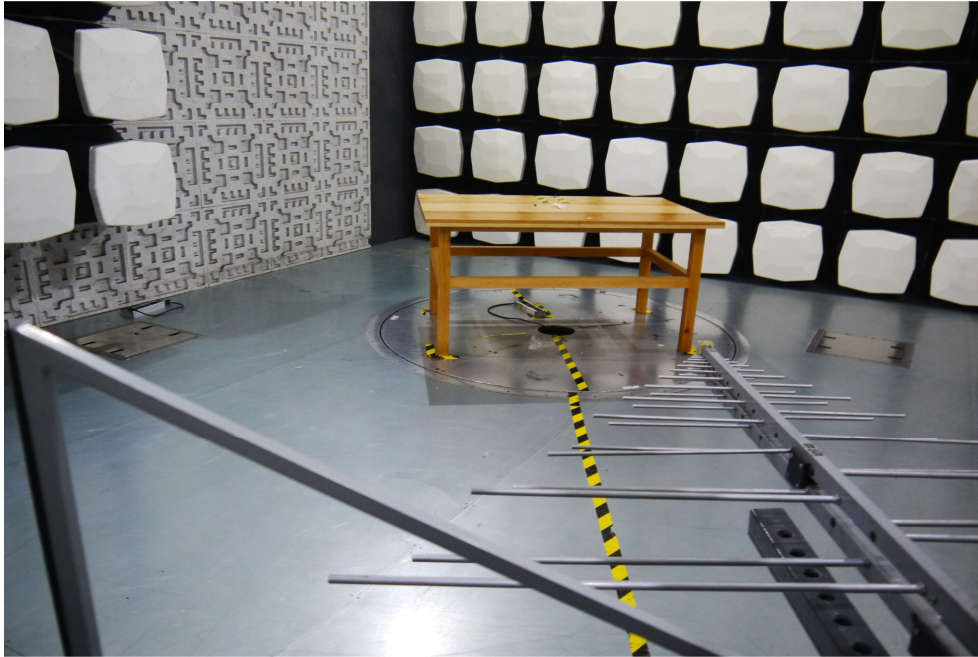
Test plot as follows:



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7 Photographs - Test setup

7.1 Radiated Emission



7.2 Radiated Spurious Emission





8 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1508004895CR.