



**SGS-CSTC Standards Technical Services Co., Ltd.
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Report No.: SZEM180800735801
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TEST REPORT

Application No.: SZEM1808007358CR
Applicant: SHANGHAI BAOLONG AUTOMOTIVE CORPORATION
Address of Applicant: 5500, Shenzhuan Rd., Songjiang District, Shanghai 201619, China
Manufacturer: SHANGHAI BAOLONG AUTOMOTIVE CORPORATION
Address of Manufacturer: 5500, Shenzhuan Rd., Songjiang District, Shanghai 201619, China
Factory: SHANGHAI BAOLONG AUTOMOTIVE CORPORATION
Address of Factory: 5500, Shenzhuan Rd., Songjiang District, Shanghai 201619, China
Equipment Under Test (EUT):
EUT Name: TPMS-sensor
Model No.: TPMS-CG
FCC ID: Z9F-TPMS-CG
Standard(s) : 47 CFR Part 15, Subpart C 15.231
Date of Receipt: 2018-08-14
Date of Test: 2018-08-27 to 2018-11-14
Date of Issue: 2018-11-20

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



Keny Xu
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.

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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2018-11-20		Original

Authorized for issue by:				
				
		Powell Bao /Project Engineer		
				
		Eric Fu /Reviewer		



2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.231	N/A	47 CFR Part 15, Subpart C 15.203	Pass

N/A: Not applicable

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
20dB Bandwidth	47 CFR Part 15, Subpart C 15.231	ANSI C63.10 (2013) Section 6.9	47 CFR Part 15, Subpart C 15.231(c)	Pass
Dwell Time (15.231(e))	47 CFR Part 15, Subpart C 15.231	ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.231(e)	Pass
Duty Cycle	47 CFR Part 15, Subpart C 15.231	ANSI C63.10:2013	47 CFR Part 15, Subpart C 15.231(e)	Pass
Field Strength of the Fundamental Signal (15.231(e))	47 CFR Part 15, Subpart C 15.231	ANSI C63.10 (2013) Section 6.5	47 CFR Part 15, Subpart C 15.231(e)	Pass
Radiated Emissions	47 CFR Part 15, Subpart C 15.231	ANSI C63.10 (2013) Section 6.4&6.5&6.6	47 CFR Part 15, Subpart C 15.231(e)	Pass

N/A: Not applicable



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4 General Information

4.1 Details of E.U.T.

Power supply:	3V DC(3V x 1 "CR2032" Button Cells)
Operation Frequency:	433.92MHz
Modulation Type:	ASK
Number of Channels:	1
Antenna Gain:	-5dBi
Antenna Type:	Monopole antenna

4.2 Description of Support Units

The EUT has been tested as an independent unit.



4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	$\pm 7.25 \times 10^{-8}$
2	Duty cycle	$\pm 0.37\%$
3	Occupied Bandwidth	$\pm 3\%$
4	RF conducted power	$\pm 0.75\text{dB}$
5	RF power density	$\pm 2.84\text{dB}$
6	Conducted Spurious emissions	$\pm 0.75\text{dB}$
7	RF Radiated power	$\pm 4.5\text{dB}$ (below 1GHz)
		$\pm 4.8\text{dB}$ (above 1GHz)
8	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (Above 1GHz)
9	Temperature test	$\pm 1^\circ\text{C}$
10	Humidity test	$\pm 3\%$
11	Supply voltages	$\pm 1.5\%$
12	Time	$\pm 3\%$



4.4 Test Location

All tests were performed at:

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

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.

4.5 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.

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



5 Equipment List

20dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2018-04-02	2019-04-01
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2018-07-12	2019-07-11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24

Dwell Time (15.231(e)) and Duty Cycle					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2018-09-25	2019-09-24
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2018-04-02	2019-04-01
Measurement Software	JS Tonscend	JS1120-2 BT/WIFI V2.	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2018-07-12	2019-07-11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018-09-27	2019-09-26
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018-09-25	2019-09-24

Field Strength of the Fundamental Signal (15.231(e))					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017-08-05	2020-08-04
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2018-07-12	2019-07-11
EMI Test Receiver	Agilent Technologies	N9038A	SEM004-05	2018-09-25	2019-09-24
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017-06-27	2020-06-26
Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2018-04-02	2019-04-01



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Radiated Emissions(Below 1GHz)						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017-08-05	2020-08-04
2	MXE EMI Receiver (20Hz-8.4GHz)	Agilent Technologies	N9038A	SEM004-05	2018-09-25	2019-09-24
3	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017-06-27	2020-06-26
4	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2018-04-02	2019-04-01
5	Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
6	Coaxial Cable	SGS	N/A	SEM025-01	2018-07-12	2019-07-11

Radiated Emissions(Above 1GHz)						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018-03-13	2021-03-12
2	EXA Signal Analyzer (10Hz-26.5GHz)	Agilent Technologies Inc	N9010A	SEM004-09	2018-04-13	2019-04-12
3	BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017-06-27	2020-06-26
4	Horn Antenna (800MHz-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018-04-13	2021-04-12
5	Amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2018-09-25	2019-09-24
6	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEM004-11	2018-09-27	2019-09-26
7	Band filter	N/A	N/A	N/A	N/A	N/A
8	Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
9	Coaxial Cable	SGS	N/A	SEM026-01	2018-07-12	2019-07-11



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General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2018-09-27	2019-09-26
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2018-09-27	2019-09-26
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2018-04-08	2019-04-07



6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203

6.1.2 Conclusion

Standard 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 antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of an 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 -5dBi.

7 Radio Spectrum Matter Test Results

7.1 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.231(c)

Test Method: ANSI C63.10 (2013) Section 6.9

Limit:

Frequency range(MHz)	Limit
70-900	No wider than 0.25% of the center frequency
Above 900	No wider than 0.5% of the center frequency

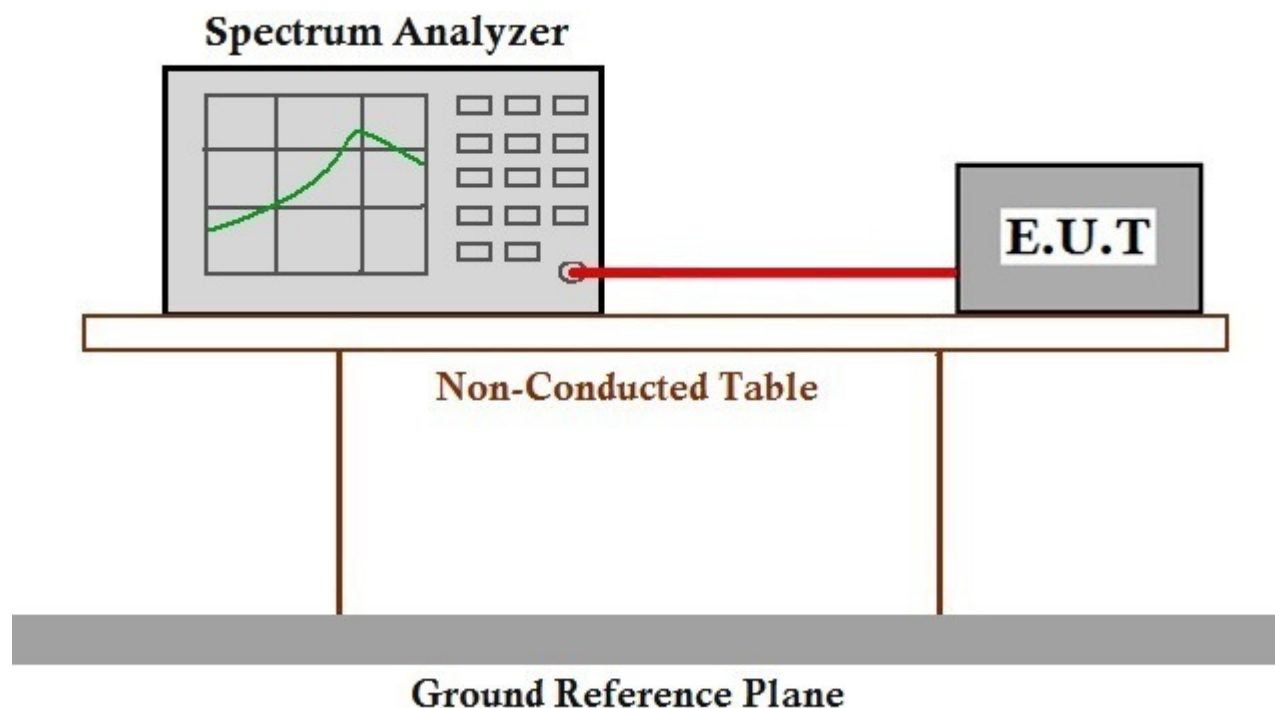
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 23.8 °C Humidity: 78.5 % RH Atmospheric Pressure: 1000 mbar

Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

7.1.2 Test Setup Diagram



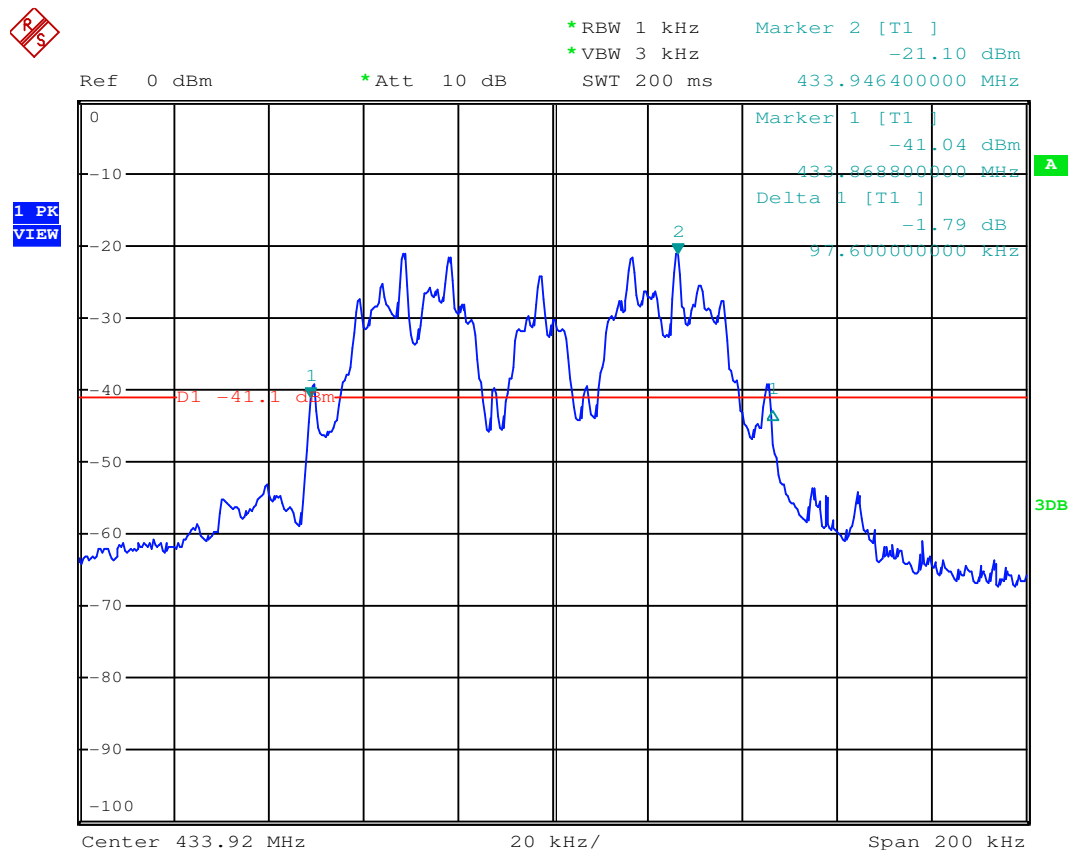
7.1.3 Measurement Procedure and Data



Test Result:

20dB bandwidth (MHz)	Limit (MHz)	Results
0.0976	1.0848	Pass

Test plot as follows:



7.2 Dwell Time (15.231(e))

Test Requirement 47 CFR Part 15, Subpart C 15.231(e)

Test Method: ANSI C63.10 (2013) Section 7.8.4

Limit:

Device type	Limit
Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) 15.231 and may be employed for any type of operation, including operation prohibited in paragraph (a) 15.231	The duration of each transmission $\leq 1\text{S}$
	Silent period >30 times the duration of the transmission and $\geq 10\text{S}$

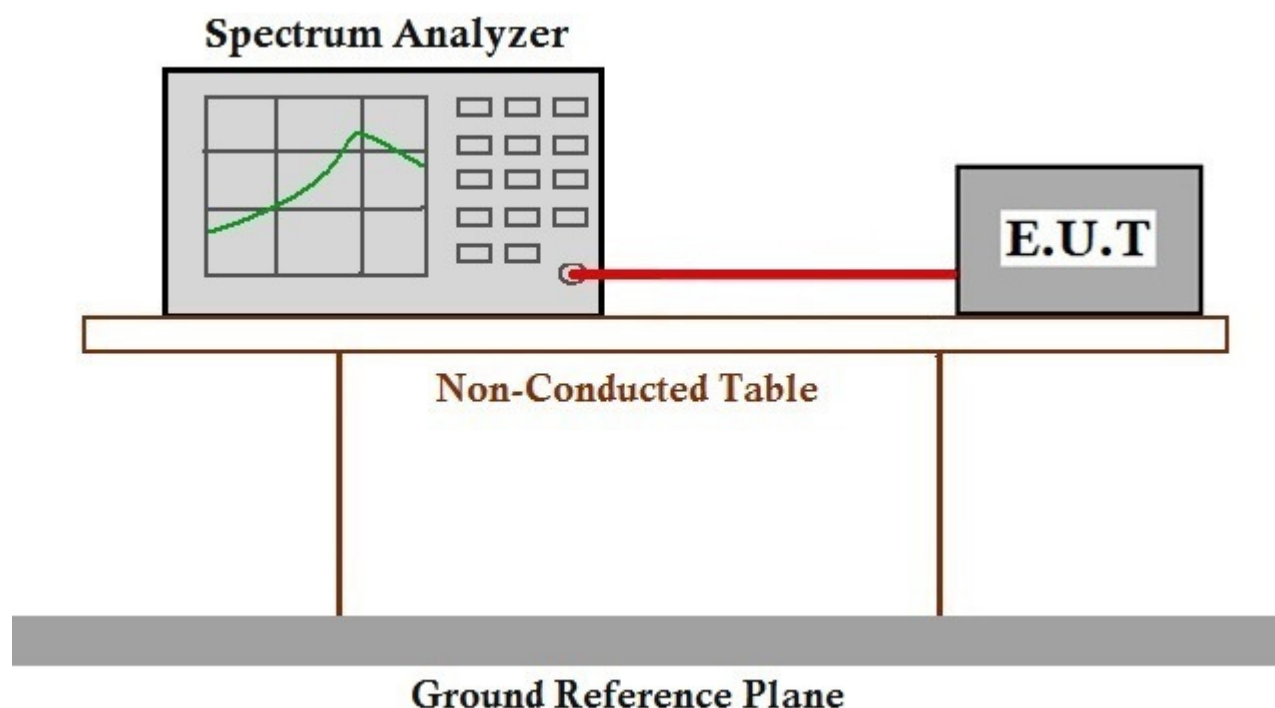
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 23.7 °C Humidity: 45.5 % RH Atmospheric Pressure: 1015 mbar

Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

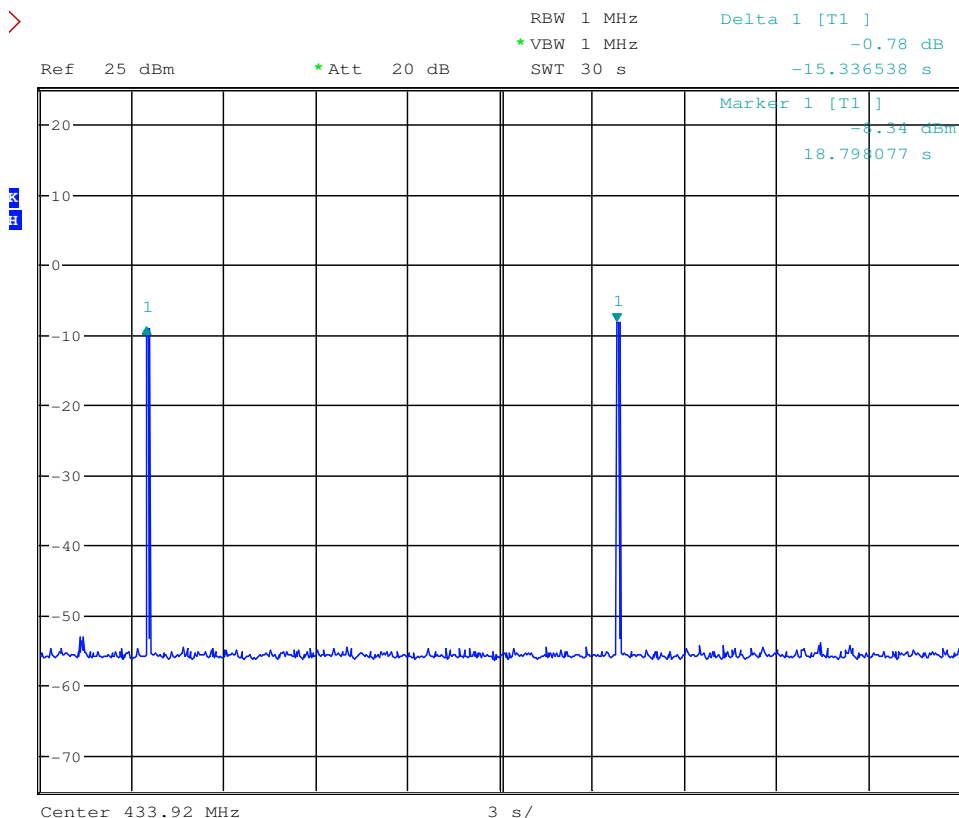
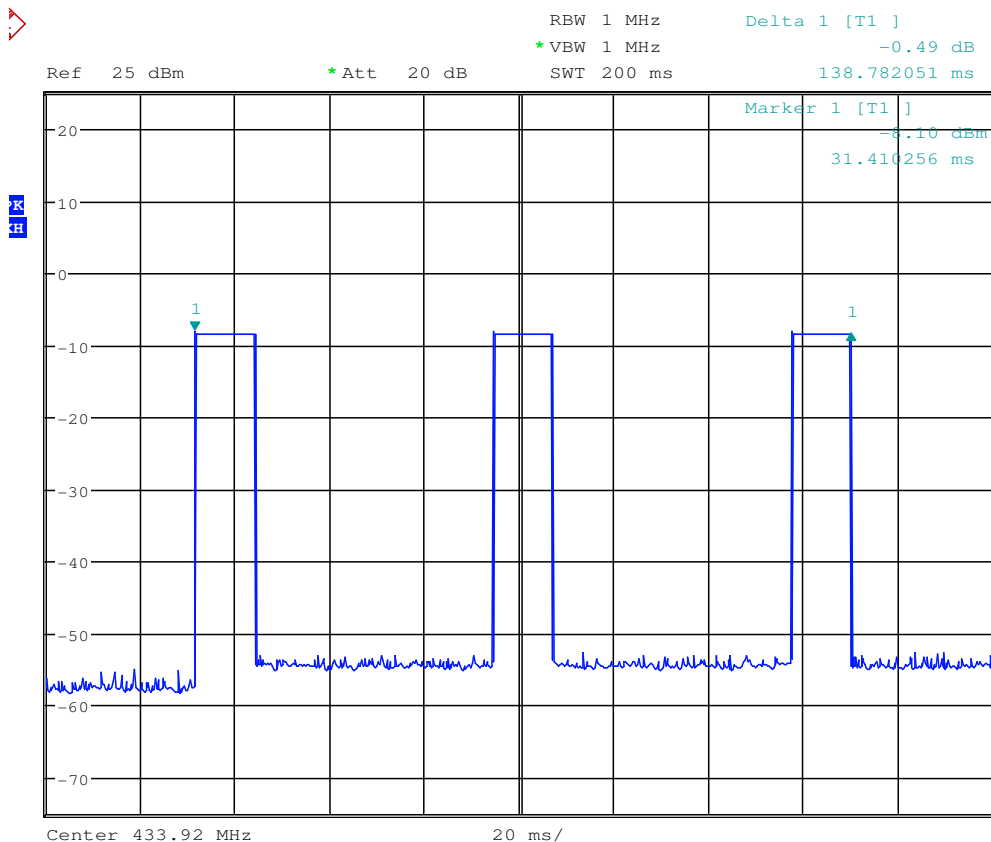
7.2.2 Test Setup Diagram



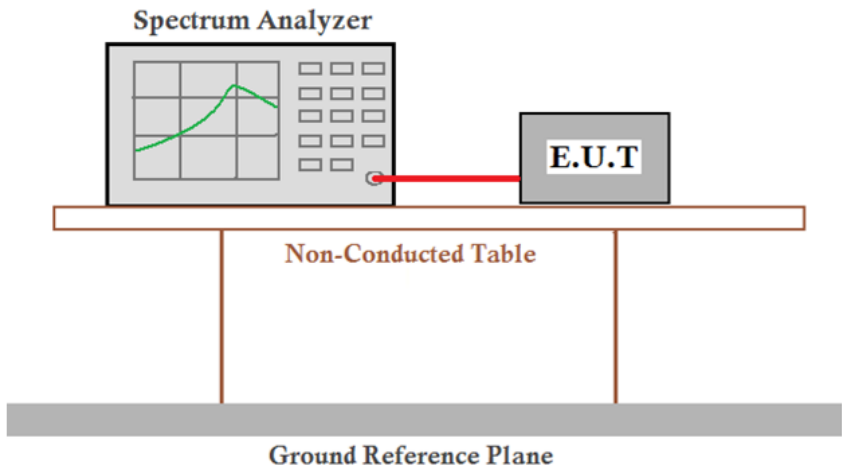
7.2.3 Measurement Procedure and Data

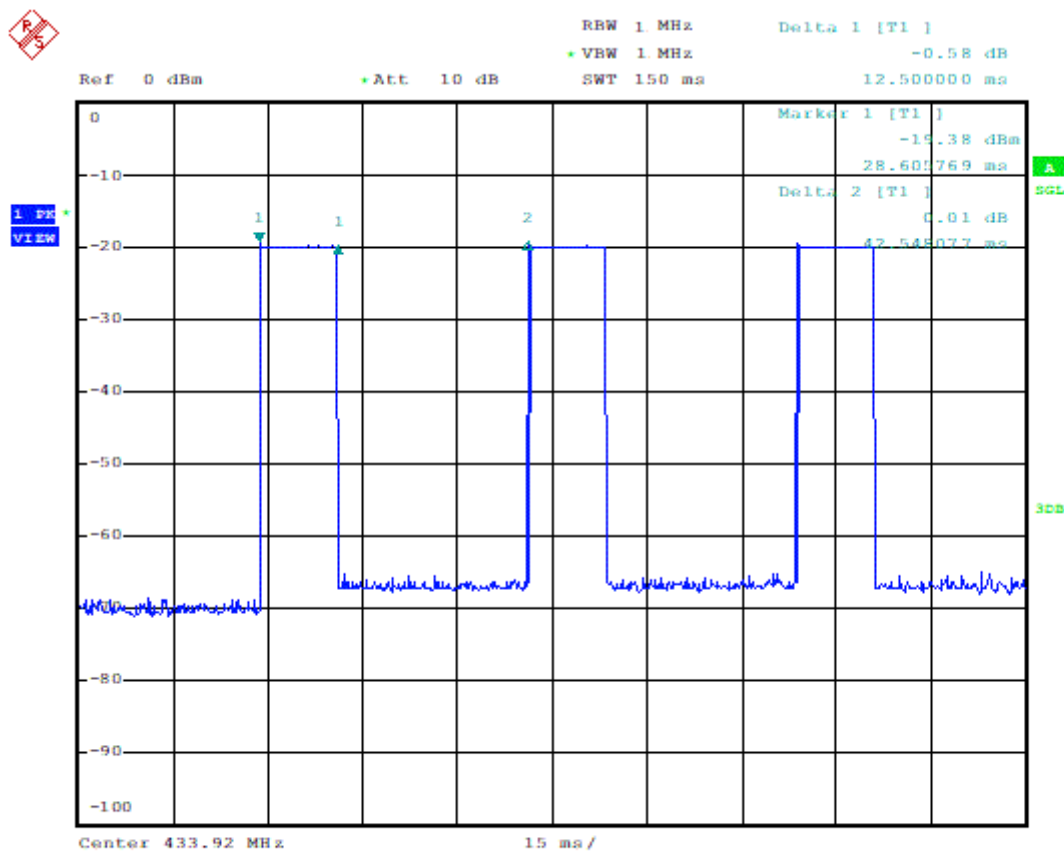
Measurement Data

Test Item	Limit	Results
Transmitting time:0.139s	$\leq 1\text{s}$	Pass
Cycle: 15.3s	$> 10\text{s}$	Pass



7.3 Duty Cycle

Test Requirement:	47 CFR Part 15, Subpart C 15.231(e)
Test Method:	ANSI C63.10:2013
Test Setup:	
Limit:	N/A
Test Mode:	Transmitting mode
Instruments Used:	Refer to section 5 for details
Test Results:	The average correction factor is computed by analyzing the on time in 100ms over one complete pulse train. Analysis of the remote transmitter on time in one complete pulse train, therefore the average value of fundamental frequency is: Average = Peak value + 20*log (Duty cycle), where the duty factor is calculated from following formula: $20 \cdot \log (\text{Duty cycle}) = 20 \cdot \log (12.5/42.5) = 20 \cdot \log (0.294) = -10.63$ Please refer to below plots for more details.





7.4 Field Strength of the Fundamental Signal (15.231(e))

Test Requirement N/A

Test Method: ANSI C63.10 (2013) Section 6.5

Measurement Distance: 3m

Limit:

Fundamental frequency(MHz)	Field strength of fundamental(microvolts/meter)	Field strength of spurious emissions(microvolts/meter)
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1500	50 to 150
174-260	1500	150
260-470	1500 to 5000	150 to 500
Above 470	5000	500

Remark: the emission limit is based on measurement instrumentation employing an average detector at a distance of 3 meters. The frequencies above 1000MHz 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.

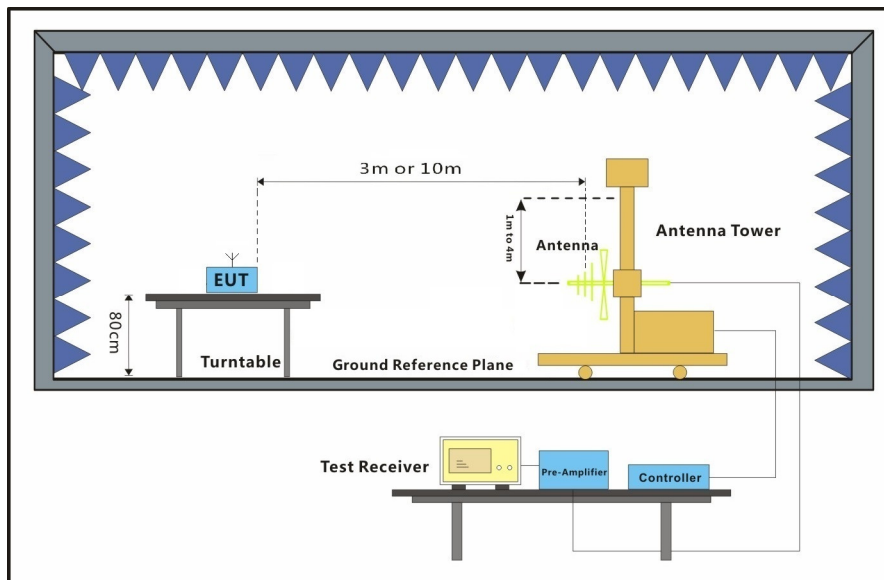
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 25.2 °C Humidity: 55 % RH Atmospheric Pressure: 1010 mbar

Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

7.4.2 Test Setup Diagram



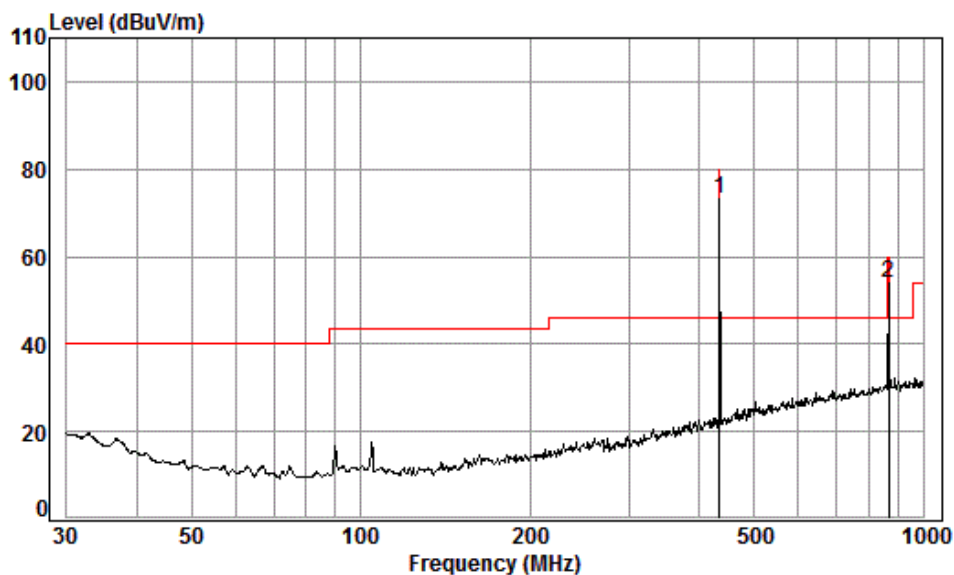
7.4.3 Measurement Procedure and Data

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 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.

Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor



Mode:a; Polarization: Horizontal



Condition: 3m HORIZONTAL

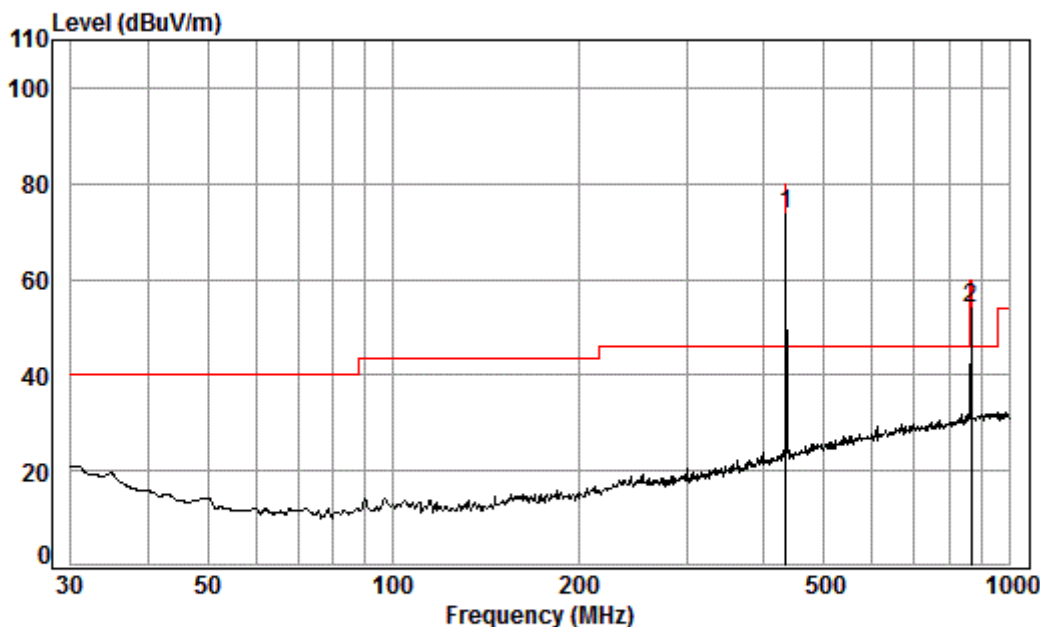
Job No. : 07358CR

Test mode: a

Frequency (MHz)	Cable Loss(dB)	Ant Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV/m)	Average factor (dB)	Level @ 3m (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Remark
433.92	2.35	23.2	27.79	68.13		65.89	92.87	-26.98	Peak
433.92	2.35	23.2	27.79	68.13	-10.63	55.26	72.87	-17.61	Average



Mode:a; Polarization:Vertical



Condition: 3m VERTICAL

Job No. : 07358CR

Test mode: a

Frequency (MHz)	Cable Loss(dB)	Ant Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV/m)	Average factor (dB)	Level @ 3m (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Remark
433.92	2.35	23.2	27.33	68.80		67.02	92.87	-25.85	Peak
433.92	2.35	23.2	27.33	68.80	-10.63	56.39	72.87	-16.48	Average



7.5 Radiated Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.231(e)
Test Method: ANSI C63.10 (2013) Section 6.4&6.5&6.6
Measurement Distance: 3m
Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(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: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, 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.

Fundamental frequency(MHz)	Field strength of fundamental(microvolts/meter)	Field strength of spurious emissions(microvolts/meter)
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1500	50 to 150
174-260	1500	150
260-470	1500 to 5000	150 to 500
Above 470	5000	500

Remark: the emission limit is based on measurement instrumentation employing an average detector at a distance of 3 meters. The frequencies above 1000MHz 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.

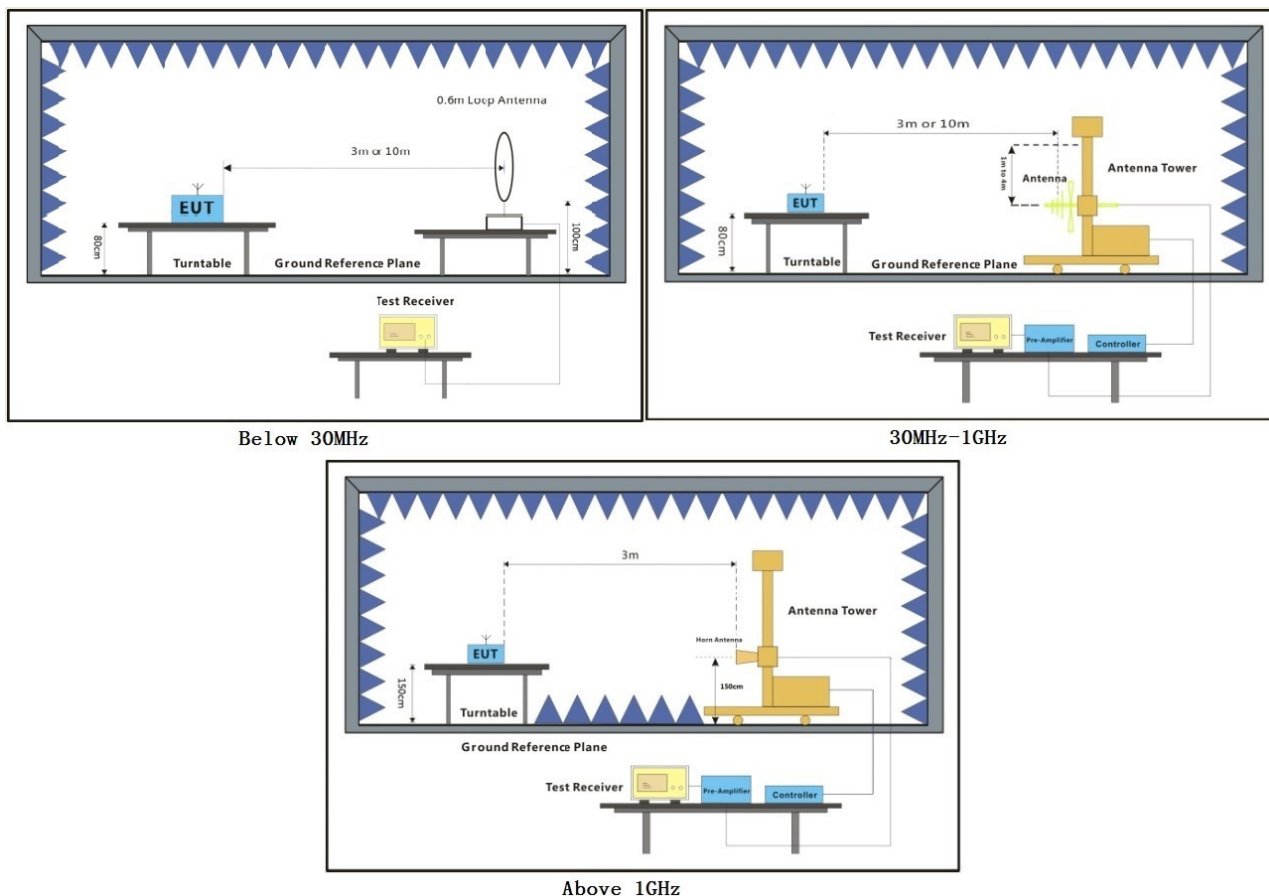
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 23.5 °C Humidity: 55.6 % RH Atmospheric Pressure: 1010 mbar

Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

7.5.2 Test Setup Diagram



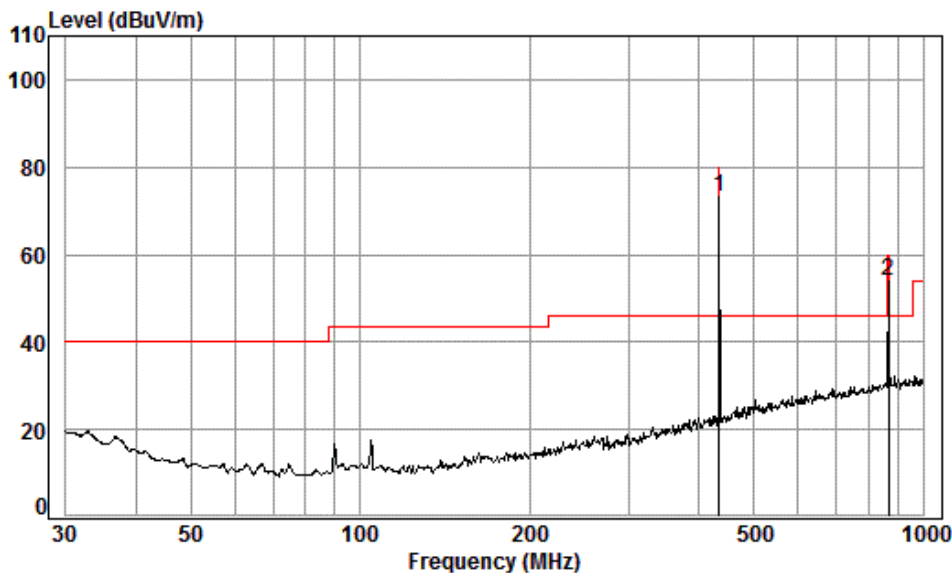
7.5.3 Measurement Procedure and Data

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 specified 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. Only the worst position of vertical was shown in the report.



30MHz~1GHz

Mode:a; Polarization:Horizontal



Condition: 3m HORIZONTAL

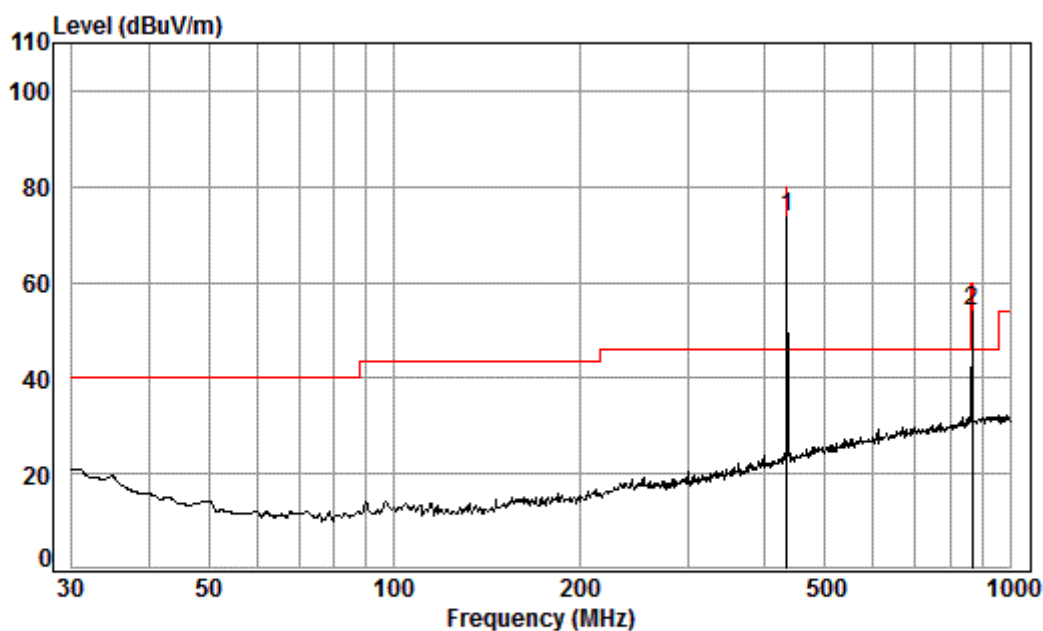
Job No. : 07358CR

Test mode: a

Frequency (MHz)	Cable Loss (dB)	Ant Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV/ m)	Average factor (dB)	Level @ 3m (dBuV/ m)	Limit Line (dBuV/m)	Margin (dB)	Remark
867.84	3.48	29.4	26.92	45.53		51.49	72.87	-31.38	Peak
867.84	3.48	29.4	26.92	55.53	-10.63	40.86	52.87	-12.01	Average



Mode:a; Polarization:Vertical



Condition: 3m VERTICAL

Job No. : 07358CR

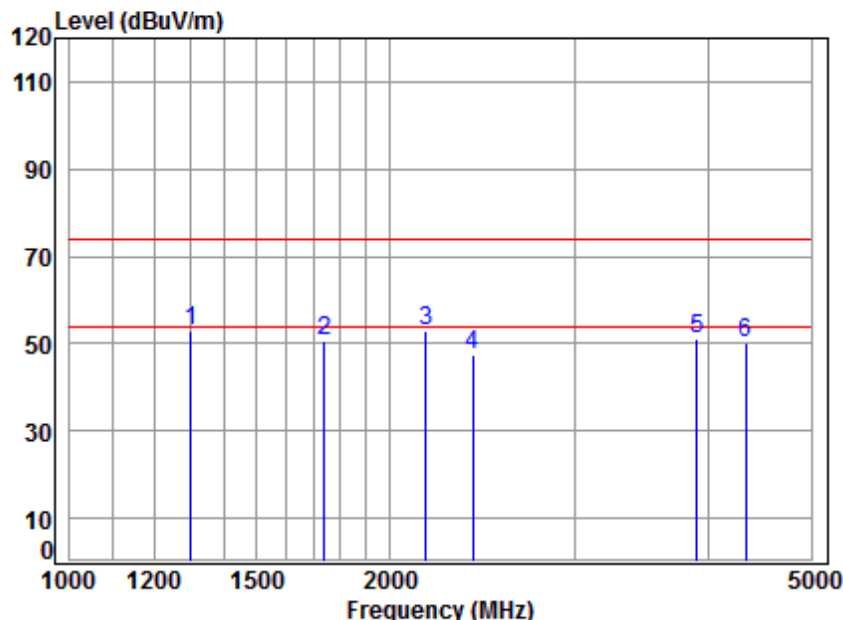
Test mode: a

Frequency (MHz)	Cable Loss (dB)	Ant Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV/m)	Average factor (dB)	Level @ 3m (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Remark
867.84	3.48	29.4	26.92	48.82		54.78	72.87	-18.09	Peak
867.84	3.48	29.4	26.92	48.82	-10.63	44.15	52.87	-8.72	Average



Above 1GHz

Mode:a; Polarization:Horizontal

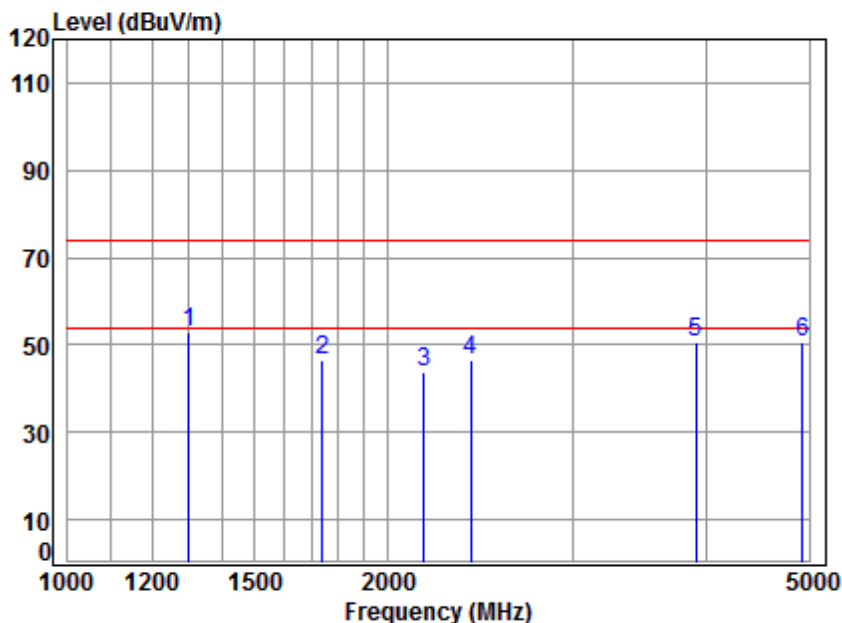


Site : chamber
Condition: 3m HORIZONTAL
Job No : 07358CR
Mode : 433 TX SE

	Freq	Cable	Ant	Preamp	Read		Limit	Over	
	MHz	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1302.060	4.81	25.03	41.26	64.55	53.13	74.00	-20.87	Peak
2	1736.788	5.18	26.82	41.55	60.41	50.86	74.00	-23.14	Peak
3	2168.725	5.16	28.13	41.78	61.42	52.93	74.00	-21.07	Peak
4	2400.157	5.49	28.54	41.88	55.31	47.46	74.00	-26.54	Peak
5	3902.372	6.88	32.51	42.31	53.88	50.96	74.00	-23.04	Peak
6	4339.709	7.38	33.32	42.39	51.85	50.16	74.00	-23.84	Peak



Mode:a; Polarization:Vertical



Site : chamber
Condition: 3m VERTICAL
Job No : 07358CR
Mode : 433 TX SE

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1302.060	4.81	25.03	41.26	64.27	52.85	74.00	-21.15	Peak
2	1736.788	5.18	26.82	41.55	56.22	46.67	74.00	-27.33	Peak
3	2168.725	5.16	28.13	41.78	52.49	44.00	74.00	-30.00	Peak
4	2400.157	5.49	28.54	41.88	54.36	46.51	74.00	-27.49	Peak
5	3908.657	6.89	32.53	42.31	53.63	50.74	74.00	-23.26	Peak
6	4928.097	8.02	34.12	42.49	51.04	50.69	74.00	-23.31	Peak



8 Photographs

8.1 Test Setup

Refer to test setup photos.

8.2 EUT Constructional Details (EUT Photos)

Refer to external and internal photos.

- End of the Report -