



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

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Report No.: SZEM170500478901
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TEST REPORT

Application No.: SZEM1705004789CR
Applicant: Robert Bosch Security Solutions Pte Ltd
Address of Applicant: 11 Bishan Street 21 Singapore 573943
Manufacturer: Bosch (Zhuhai) Security Systems co., Ltd
Address of Manufacturer: 20 Ji Chang Bei Road, Qingwan Industrial Estate, Sanzao, Jinwan, Zhuhai, 519040, Guangdong, China
Factory: Bosch (Zhuhai) Security Systems co., Ltd
Address of Factory: 20 Ji Chang Bei Road, Qingwan Industrial Estate, Sanzao, Jinwan, Zhuhai, 519040, Guangdong, China
Equipment Under Test (EUT):
EUT Name: Personnel transmitter 433MHz
Model No.: SE-TRM-433T01
Trade mark: BOSCH
FCC ID: 2AMLH-SE-TRM-433T01
Standards: 47 CFR Part 15, Subpart C (2016)
Date of Receipt: 2017-05-22
Date of Test: 2017-06-05 to 2017-06-12
Date of Issue: 2017-06-24

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





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.

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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2017-06-24		Original

Authorized for issue by:				
				
		Leo Li /Project Engineer		
				
		Eric Fu /Reviewer		



2 Test Summary

Radio Spectrum Technical Requirement			
Item	Requirement	Method	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.203	ANSI C63.10(2013)	Pass

Radio Spectrum Matter Part			
Item	Requirement	Method	Result
20dB Bandwidth	47 CFR Part 15, Subpart C 15.231(c)	ANSI C63.10(2013)	Pass
Dwell Time (15.231(a))	47 CFR Part 15, Subpart C 15.231(a)(1)	ANSI C63.10(2013)	Pass
Field Strength of the Fundamental Signal (15.231(b))	47 CFR Part 15, Subpart C 15.231(b)	ANSI C63.10(2013)	Pass
Radiated Emissions	47 CFR Part 15, Subpart C Section 15.209	ANSI C63.10(2013)	Pass



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4 General Information

4.1 Details of E.U.T.

EUT Name:	Personnel transmitter 433MHz
Model No.:	SE-TRM-433T01
Sample Type:	Portable production
Operation Frequency:	433.420MHz
Channel Numbers:	1
Modulation Type:	ASK
Antenna Type:	Integral
Antenna Gain:	-18.15dBi
Power supply:	DC 3.0V(1x3.0 "CR2" LITHIUM BATTERY)
Test voltage:	DC 3V

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	7.25 x 10 ⁻⁸
2	Duty cycle	0.37%
3	Occupied Bandwidth	3%
4	RF conducted power	0.75dB
5	RF power density	2.84dB
6	Conducted Spurious emissions	0.75dB
7	RF Radiated power	4.5dB (below 1GHz)
		4.8dB (above 1GHz)
8	Radiated Spurious emission test	4.5dB (30MHz-1GHz)
		4.8dB (1GHz-18GHz)
9	Temperature test	1 °C
10	Humidity test	3%
11	Supply voltages	1.5%
12	Time	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 10m Semi-anechoic chamber and Shielded Room 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 and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

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	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Occupy Time (15.231(e))					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

RE in Chamber					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017-05-10	2018-05-10
EMI Test Receiver	Agilent Technologies	N9038A	SEM004-05	2016-10-09	2017-10-09
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2014-11-01	2017-11-01
Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEM003-11	2015-10-17	2018-10-17
Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEM003-12	2014-11-24	2017-11-24



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RE in Chamber					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2017-05-10	2018-05-10
EXA Signal Analyzer (10Hz-26.5GHz)	Agilent Technologies Inc	N9010A	SEM004-09	2017-06-05	2018-06-04
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2014-11-01	2017-11-01
Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2015-06-14	2018-06-13
Amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2016-10-09	2017-10-09
Low Noise Amplifier (100MHz-18GHz)	Black Diamond Series	BDLNA- 0118-352810	SEM005-05	2016-10-09	2017-10-09
Band filter	N/A	N/A	N/A	N/A	N/A
Measurement Software	AUDIX	e3 V8.2014- 6-27	N/A	N/A	N/A

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	2016-10-12	2017-10-12
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-04	2016-10-12	2017-10-12
Humidity/ Temperature Indicator	Mingle	N/A	SEM002-08	2016-10-12	2017-10-12
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2017-04-18	2018-04-18



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 -18.15dBi.

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)
Limit:

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

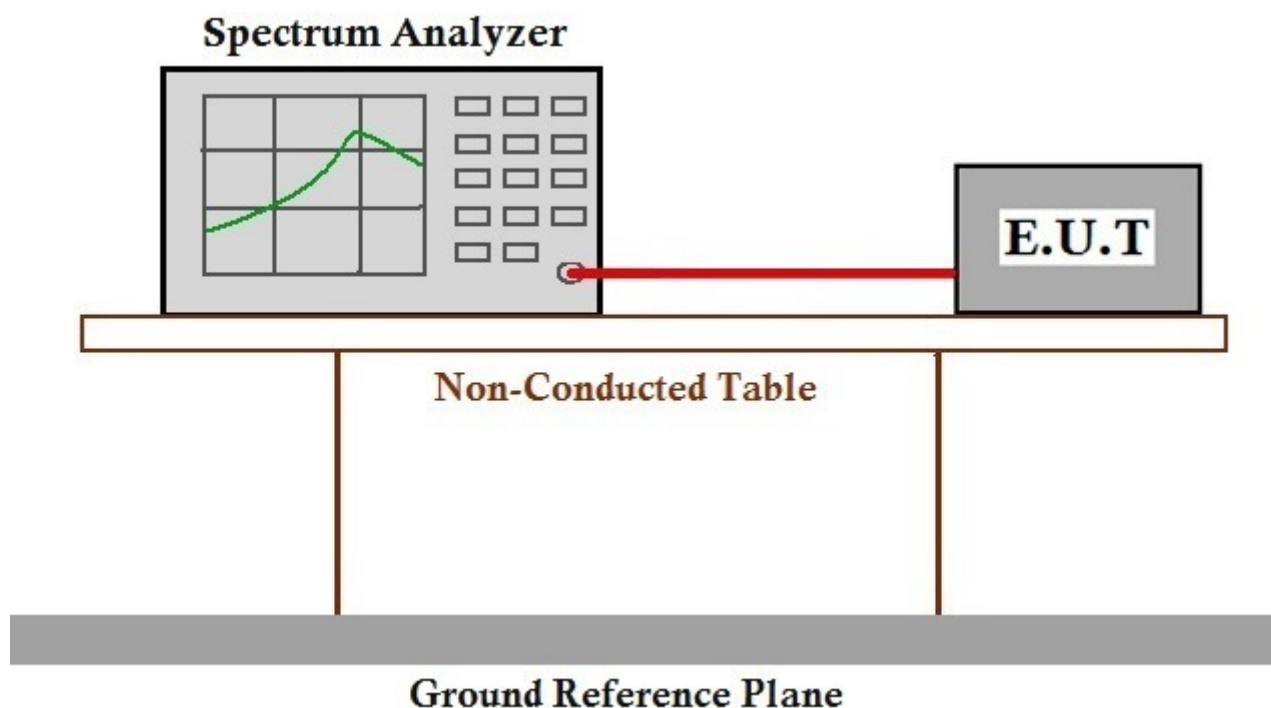
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 55 % RH Atmospheric Pressure: 1010 mbar

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

7.1.2 Test Setup Diagram

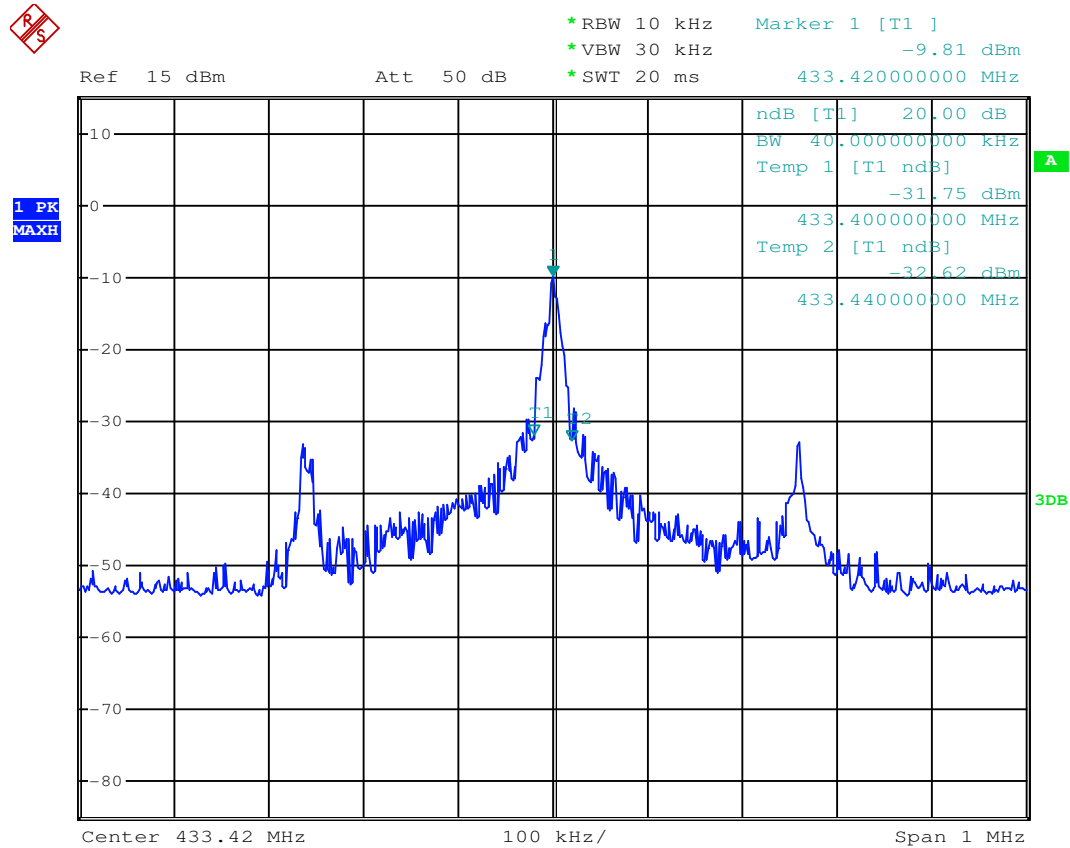


7.1.3 Measurement Procedure and Data

20dB bandwidth (MHz)	Limit (MHz)	Results
0.040	1.084	Pass



Test plot as follows:



7.2 Dwell Time

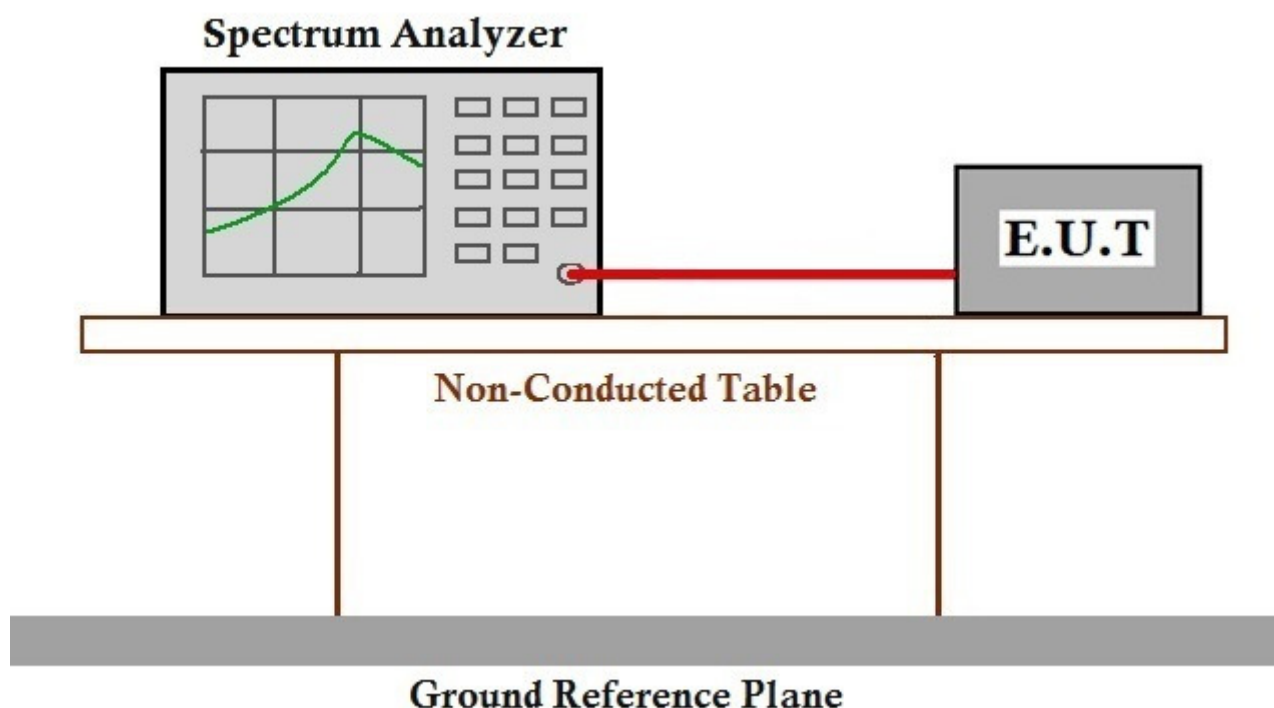
Test Requirement: 47 CFR Part 15C Section 15.231 (a) (1)
Test Method: ANSI C63.10:2013
Instruments Used: Refer to section 5 for details
Limit: Not more than 5 seconds
Test Mode: Transmitter mode
Test Results: Pass

7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 55 % RH Atmospheric Pressure: 1010 mbar
Test mode a:TX mode_Keep the EUT in transmitting with modulation mode.

7.2.2 Test Setup Diagram

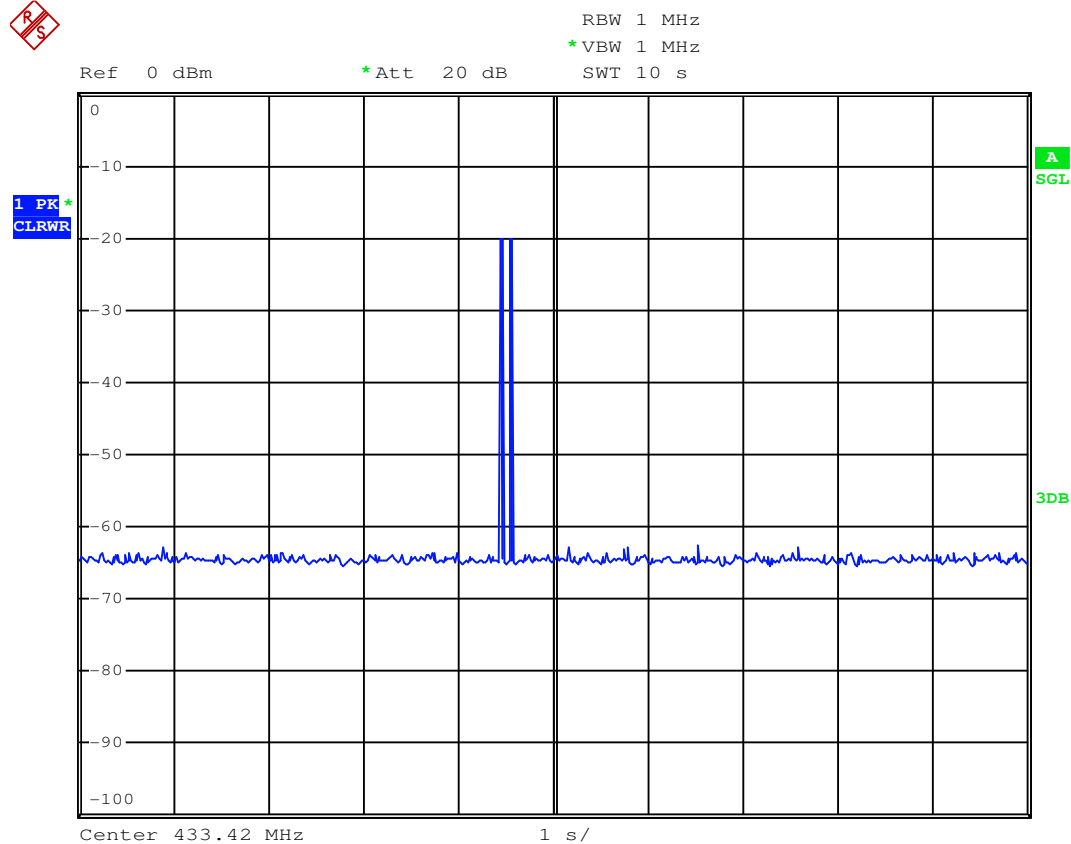


7.2.3 Measurement Procedure and Data

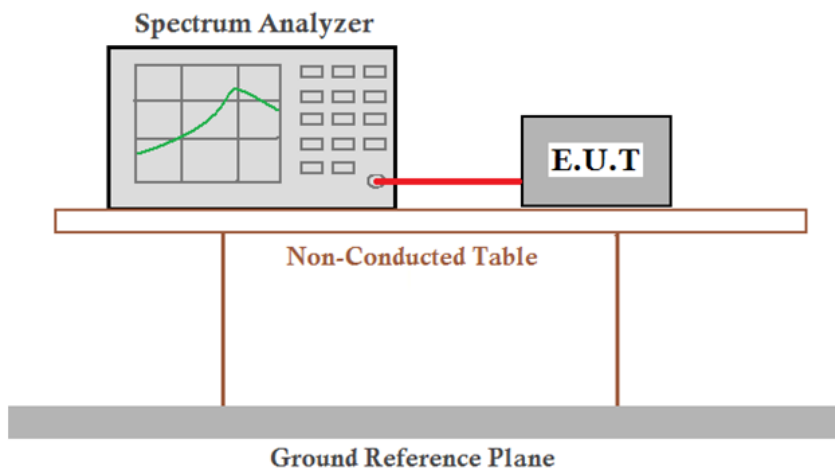
Test item	Limit	Results
Transmitting time	≤5S	Pass



Test plot as follows:



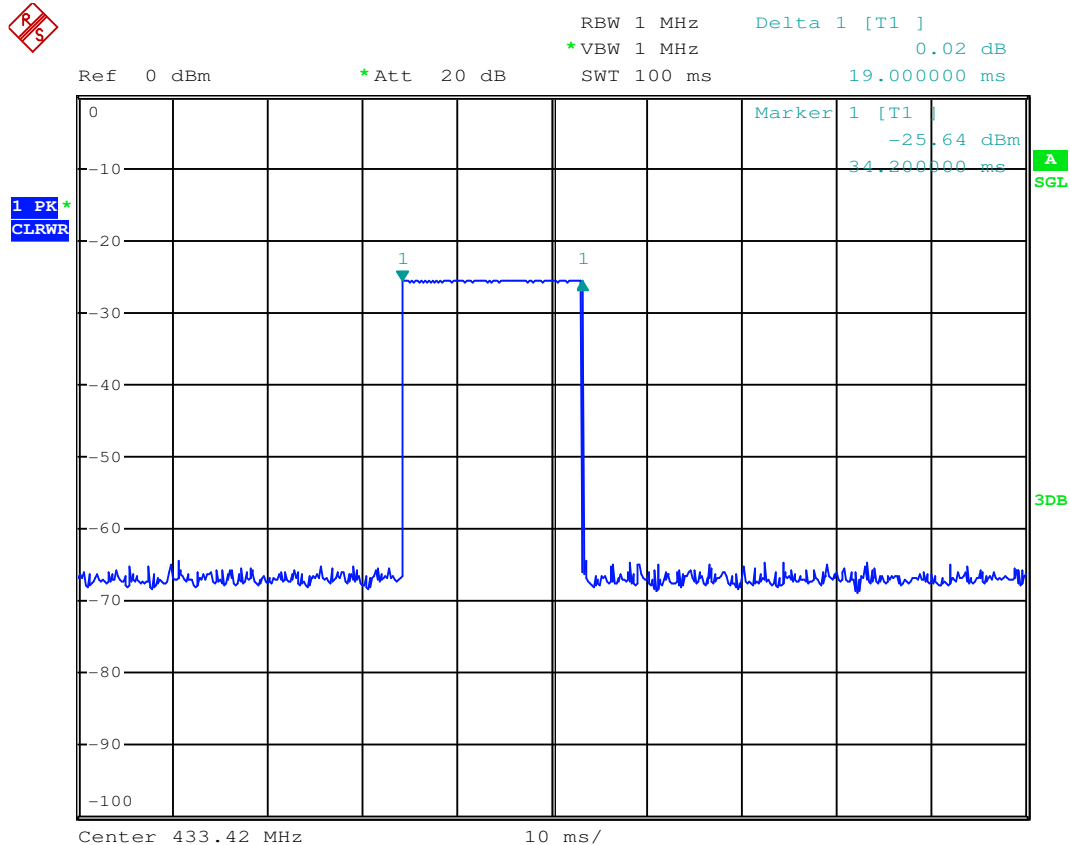
7.3 Duty Cycle

Test Requirement:	47 CFR Part 15C Section 15.35 (c)
Test Method:	ANSI C63.10:2013
Test Setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer and an E.U.T (Equipment Under Test) are positioned on a Non-Conducted Table. A red cable connects the Spectrum Analyzer to the E.U.T. The table is supported by two vertical legs, and a Ground Reference Plane is indicated below the table.</p>
Limit:	N/A
Test Mode:	Transmitting mode
Instruments Used:	Refer to section 5 for details
Test Results:	Pass



Test plot as follows:

Duty cycle numbers



7.4 Field Strength of the Fundamental Signal

Test Requirement:	47 CFR Part 15C Section 15.231(b)				
Test Method:	ANSI C63.10: 2013				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber) 3m (Fully-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.015MHz	Quasi-peak	200Hz	1KHz	Quasi-peak
	0.015MHz-30MHz	Quasi-peak	9kHz	30KHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120 kHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	Quasi-peak	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	Quasi-peak	30
	1.705MHz-30MHz	30	-	Quasi-peak	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
			74.0	Peak	3
Limit: (Field strength of the fundamental signal)	Frequency	Limit (dBuV/m @3m)		Remark	
	433.42MHz	80.81		Average Value	
		100.81		Peak Value	
Test Setup:					

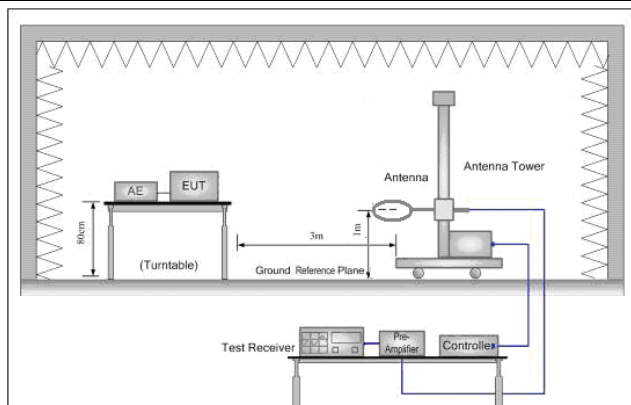


Figure 1. Below 30MHz

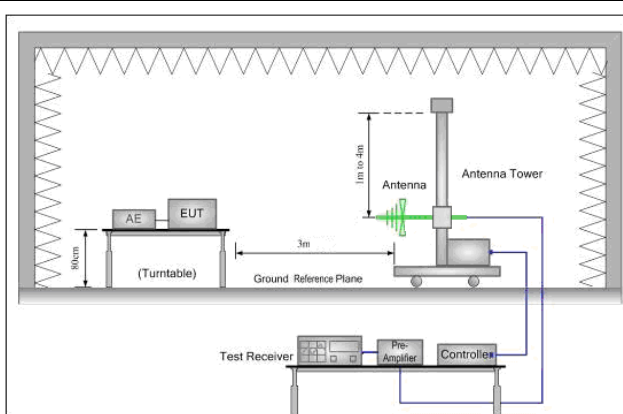


Figure 2. 30MHz to 1GHz

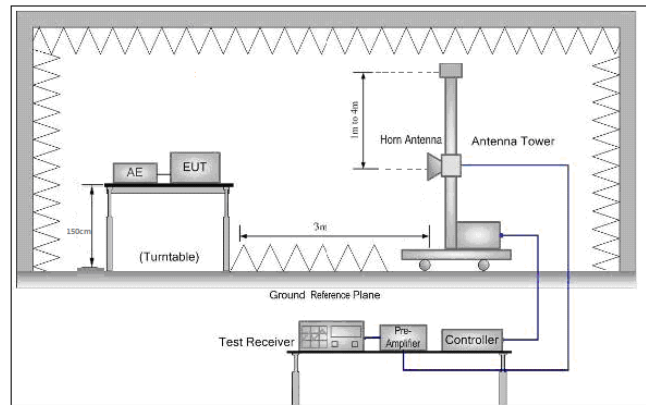


Figure 3. Above 1 GHz

Test Procedure:	<p>a. For below 1GHz test, 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.</p> <p>b. For above 1GHz test, 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.</p> <p>c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</p> <p>d. 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.</p> <p>e. 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.</p> <p>f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>g. 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.</p> <p>h. 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.</p>
Test Mode:	Transmitting mode
Instruments Used:	Refer to section 5 for details
Test Results:	Pass



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Measurement Data

Average value:

Calculate Formula:	Average value=Peak value + PDCF
	PDCF=20 log(Duty cycle)= 20 log(19/100)=-14.42
	Duty cycle= T on time / T period
Test data:	Ton time =19ms
	T period =100ms

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
433.420	2.35	16.58	27.35	90.84	82.42	100.81	-18.39	Horizontal
433.420	2.35	16.58	27.35	91.09	82.67	100.81	-18.14	Vertical
Average Value:								
Frequency (MHz)	PDCF	Average Level (dBuV/m)		Limit Line (dBuV/m)		Over Limit (dB)		Polarization
433.420	-14.42	68.00		80.81		-12.81		Horizontal
433.420		68.25		80.81		-12.56		Vertical



7.5 Radiated Emissions

Test Requirement 47 CFR Part 15C Section 15.209

Test Method: ANSI C63.10: 2013

Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
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 above 1000MHz. Radiated emission limits above 1000MHz is based on measurements employing an average detector.

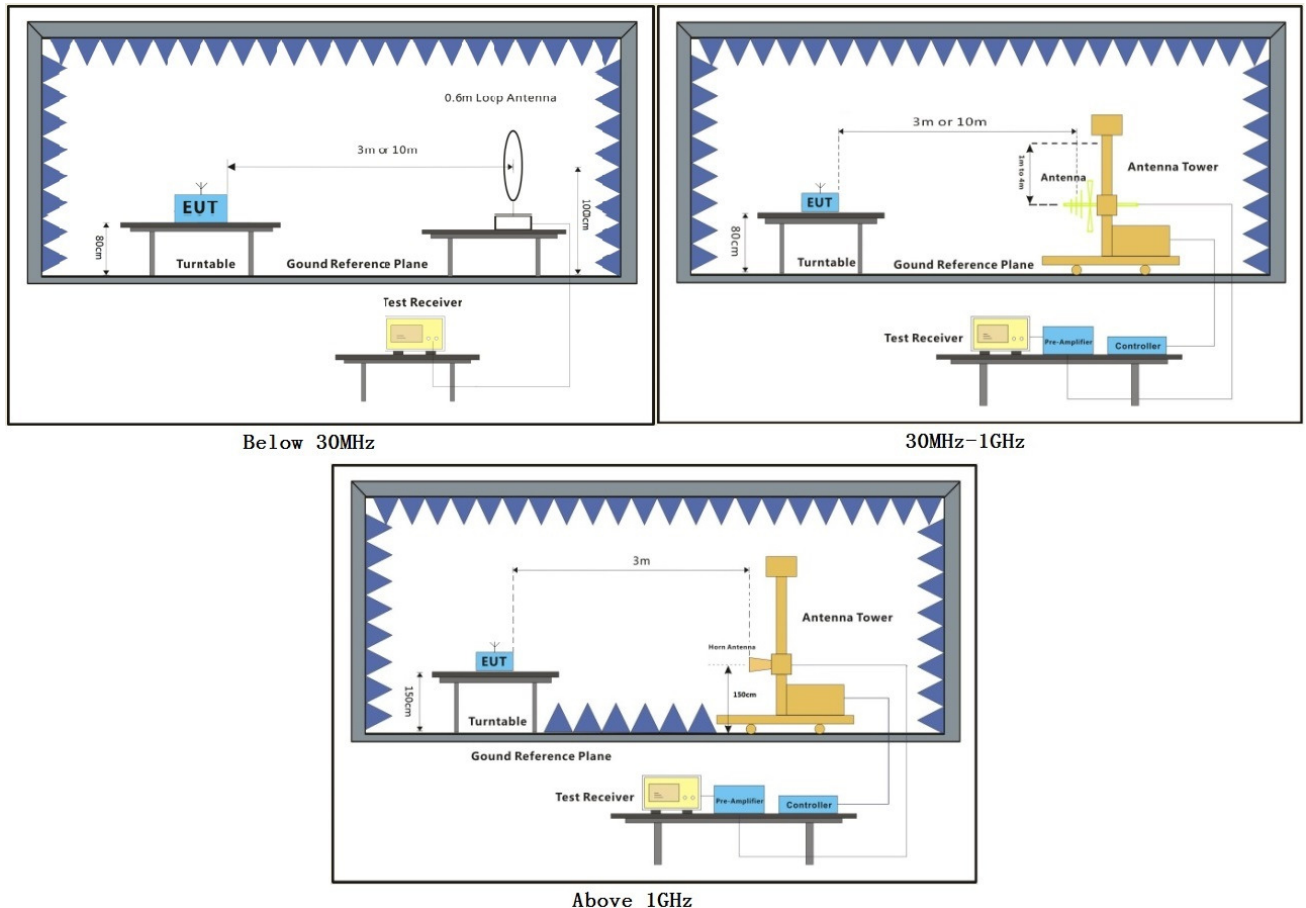
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 23 °C Humidity: 54 % RH Atmospheric Pressure: 1010 mbar

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

7.5.2 Test Setup Diagram

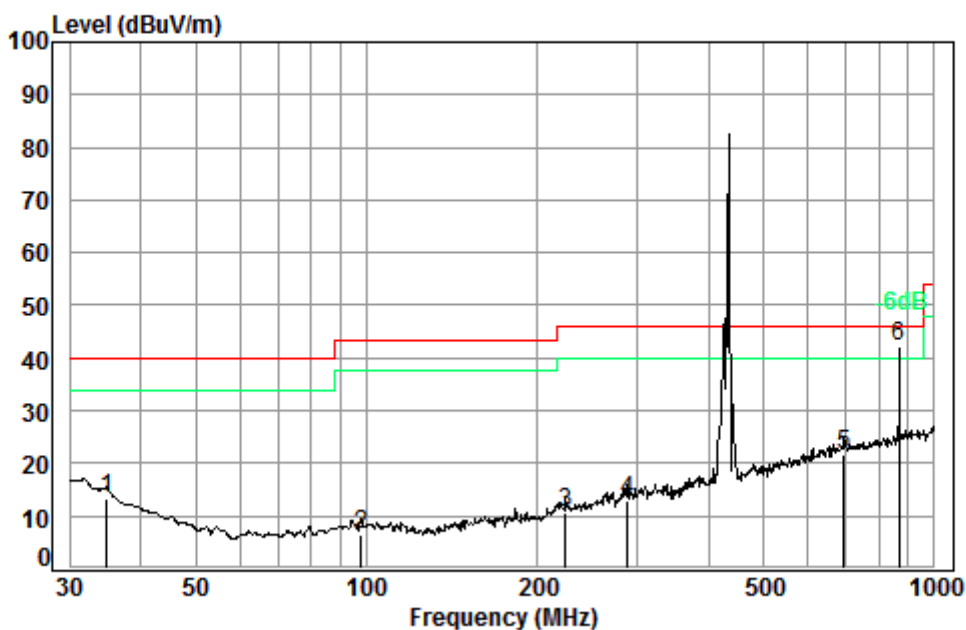


7.5.3 Measurement Procedure and Data

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.

Below 1GHz

Mode:a; Polarization:Horizontal



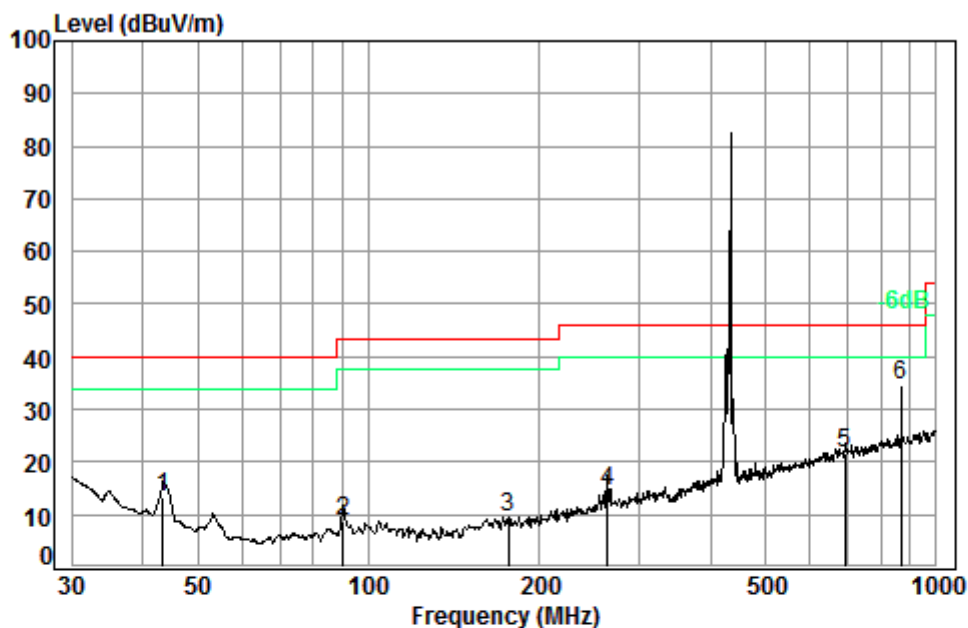
Condition: 3m HORIZONTAL

Job No. : 04789CR

Test mode: a

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB		dB/m	dB	dBuV	dBuV/m	dBuV/m
1	34.88	0.60	15.97	27.34	24.21	13.44	40.00	-26.56
2	97.80	1.18	9.01	27.20	23.53	6.52	43.50	-36.98
3	223.73	1.54	11.43	26.62	24.29	10.64	46.00	-35.36
4	287.99	1.85	13.37	26.43	24.02	12.81	46.00	-33.19
5 pp	694.42	2.89	21.56	27.42	24.52	21.55	46.00	-24.45
6	866.09	3.47	22.79	26.96	43.00	42.30	80.81	-38.51

Mode:a; Polarization:Vertical



Condition: 3m VERTICAL

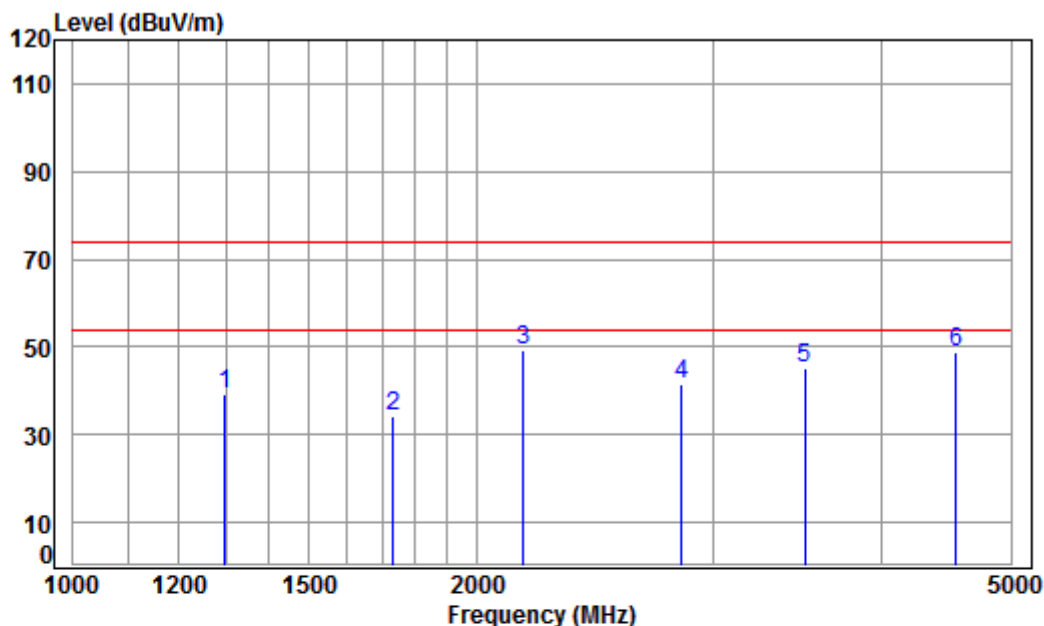
Job No. : 04789CR

Test mode: a

		Cable	Ant	Preamp	Read		Limit	Over
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	43.51	0.68	11.56	27.31	28.42	13.35	40.00	-26.65
2	90.22	1.10	8.71	27.21	26.03	8.63	43.50	-34.87
3	176.27	1.36	9.75	26.79	25.17	9.49	43.50	-34.01
4	263.82	1.74	12.58	26.50	26.80	14.62	46.00	-31.38
5 pp	689.56	2.88	21.52	27.43	24.78	21.75	46.00	-24.25
6	866.83	3.47	22.80	26.96	35.47	34.78	80.81	-46.03

Above 1GHz:

Mode:a; Polarization:Horizontal



Condition: 3m HORIZONTAL

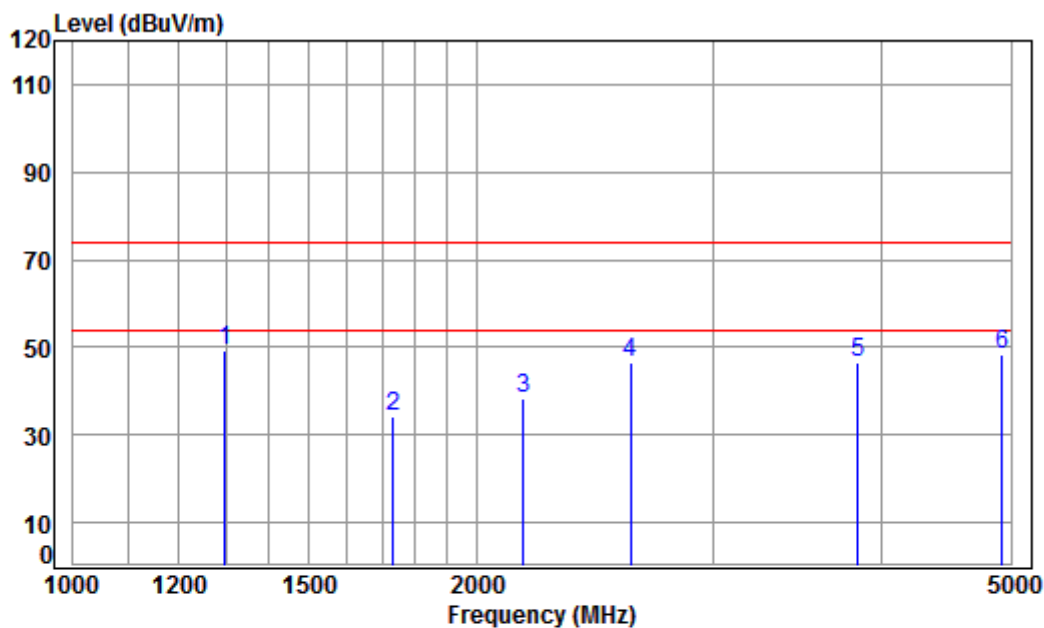
Job No: : 04789CR

Mode: : 433 TX SE

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1299.000	4.22	24.51	38.07	48.62	39.28	74.00	-34.72	Peak
2	1732.000	4.74	26.53	38.03	40.95	34.19	74.00	-39.81	Peak
3 pp	2165.000	5.16	28.05	37.98	54.03	49.26	74.00	-24.74	Peak
4	2842.049	5.78	29.84	37.92	43.86	41.56	74.00	-32.44	Peak
5	3509.107	6.31	31.97	37.95	44.97	45.30	74.00	-28.70	Peak
6	4554.385	7.36	33.57	38.28	46.19	48.84	74.00	-25.16	Peak



Mode:a; Polarization:Vertical



Condition: 3m VERTICAL

Job No: : 04789CR

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	pp 1299.000	4.22	24.51	38.07	58.85	49.51	74.00	-24.49	peak
2	1732.000	4.74	26.53	38.03	40.95	34.19	74.00	-39.81	peak
3	2165.000	5.16	28.05	37.98	43.04	38.27	74.00	-35.73	peak
4	2601.286	5.53	29.50	37.94	49.63	46.72	74.00	-27.28	peak
5	3846.253	6.58	32.95	37.98	45.07	46.62	74.00	-27.38	peak
6	4928.097	7.90	34.23	38.46	44.51	48.18	74.00	-25.82	peak



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) Scan from 9kHz to 5GHz, the disturbance above 18GHz 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. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

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.