



Test Report No.:
FCC2024-0031-RF3

TEST REPORT

FCC ID	:	2BG9T-TCLSMARTDM
Applicant	:	Shenzhen TCL Smart Home Technology Co., Ltd
Product Name	:	Smart Lock
Mode No.	:	D1 Max,D11 Max,D12 Max,D13 Max,D14 Max,D15 Max,D16 Max,D17 Max,D18 Max,D19 Max
Classification Of Test:		COMMISSION TEST

CVC Testing Technology Co., Ltd.

Applicant		Name: Shenzhen TCL Smart Home Technology Co., Ltd Address: 7/F,TCL G1 Building. TCL International E City, No.1001 Zhongshan Yuan Road, Nanshan District,Shenzhen	
Manufacturer		Name: Shenzhen TCL Smart Home Technology Co., Ltd Address: 7/F,TCL G1 Building. TCL International E City, No.1001 Zhongshan Yuan Road, Nanshan District,Shenzhen	
Equipment Under Test		Product Name : Smart Lock Model No. : D1 Max Trade mark : TCL Serial no. : D1Max240800001 Sampling : 1-1	
Date of Receipt.	2024.7.4	Date of Testing	2024.8.19
Test Specification		Test Result	
FCC CFR47 Part 15C Radio Frequency Devices ANSI C63.10-2020/Cor1-2023		PASS	
Evaluation of Test Result		The equipment under test was found to comply with the requirements of the standards applied. Seal of CVC Issue Date: 2024-8-19	
Approved by: Chen Huawen 		Reviewed by: Xu Zhenfei 	Tested by: Lu Weiji 
Other Aspects: NONE.			
Abbreviations:OK, Pass= passed Fail = failed N/A= not applicable EUT= equipment, sample(s) under tested			
This test report relates only to the EUT, and shall not be reproduced except in full, without written approval of CVC .			

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1. General Product Information

1.1 General information

Product Name	Smart Lock	
Model No.	D1 Max	
Additional model	D11 Max,D12 Max,D13 Max,D14 Max,D15 Max,D16 Max,D17 Max,D18 Max,D19 Max	
Power Supply	Rated voltage	DC 5.0V
	Battery voltage	DC 3.7V
Serial Number(SN)	D1Max240800001	
firmware	V0.6	
software	V1.0	
specific power settings	Default	
Antenna Type	Internal Antenna	
Antenna Gain	-10 dBi (provided by client)	
Beamforming gain	Unsupported (provided by client)	
Frequency Range	433.05~434.79MHz	
Channel Number	1 Channel	
Type of Modulation	ASK/OOK	
Max. Power	-16.66dBm	
Operate Temp.Range	-20~70℃	

Note:

1. The information of the EUT is declared by the manufacturer.
2. The laboratory is not responsible for the product technical specification provided by the client.
3. All the models are electrical identical including the same software parameter and hardware design (i.e., circuit design, PCB Layout, RF module/circuit, antenna type(s) and antenna location, components on PCB, etc.), same mechanical structure and design (including product enclosure, materials, etc.), the only difference is the model name, color, package.

No.	Model	Difference	Remarks
1	D1 Max	1. Only the appearance color difference is different. 2. Only the printing style on the surface of the package is different, the product inside the package is the same.	Inspection model
2	D11 Max		Coverage model
3	D12 Max		Coverage model
4	D13 Max		Coverage model
5	D14 Max		Coverage model
6	D15 Max		Coverage model
7	D16 Max		Coverage model
8	D17 Max		Coverage model
9	D18 Max		Coverage model
10	D19 Max		Coverage model

2. Test Sites

2.1 Test Facilities

The tests and measurements refer to this report were performed by RF testing Lab. of CVC Testing Technology Co., Ltd.

Add.: No.3, Tiantaiyi Road, Kaitai Avenue, Science City, Guangzhou,Guangdong,510663, People's Republic of China

Telephone : +86-20-32293888

Fax : +86-20-32293889

FCC(Test firm designation number: CN1282)

IC(Test firm CAB identifier number: CN0103)

2.2 Description of Non-standard Method and Deviations

The testing and measurement methods used in this report are applied by all standard methods. Not any non-standard method or deviation from the used standards was used.

2.3 List of Test and Measurement Instruments

Refer to **Appendix A**.

3. Test Configuration

3.1 Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

Test Mode	Antenna Delivery	Test Channel
Transmitting	1TX	433.92MHz

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate and different channels. Preliminary tests have been done on all the configurations for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates and channels are shown as following table.

Test Mode	Antenna 1	Antenna 2	MIMO
Transmitting	√	/	/

Test Items	Test Antenna	Test Mode	Test Channel
Conducted Emissions	Antenna 1	Transmitting	433.92MHz
Radiated Emissions	Antenna 1	Transmitting	433.92MHz
Deactivation time measurement	Antenna 1	Transmitting	433.92MHz
Emission Bandwidth Measurement	Antenna 1	Transmitting	433.92MHz

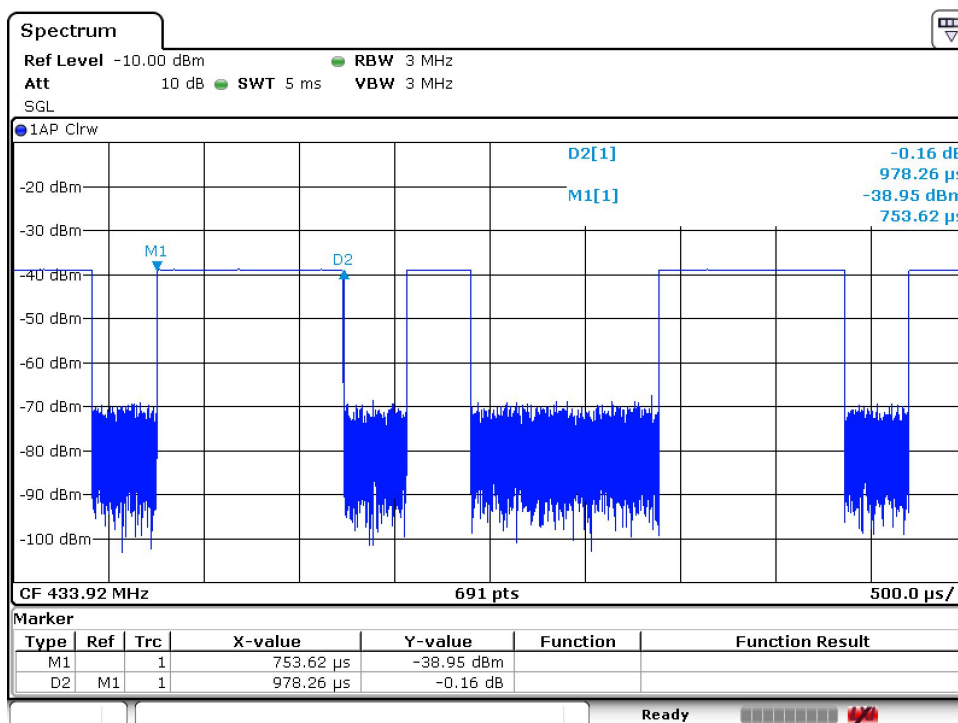
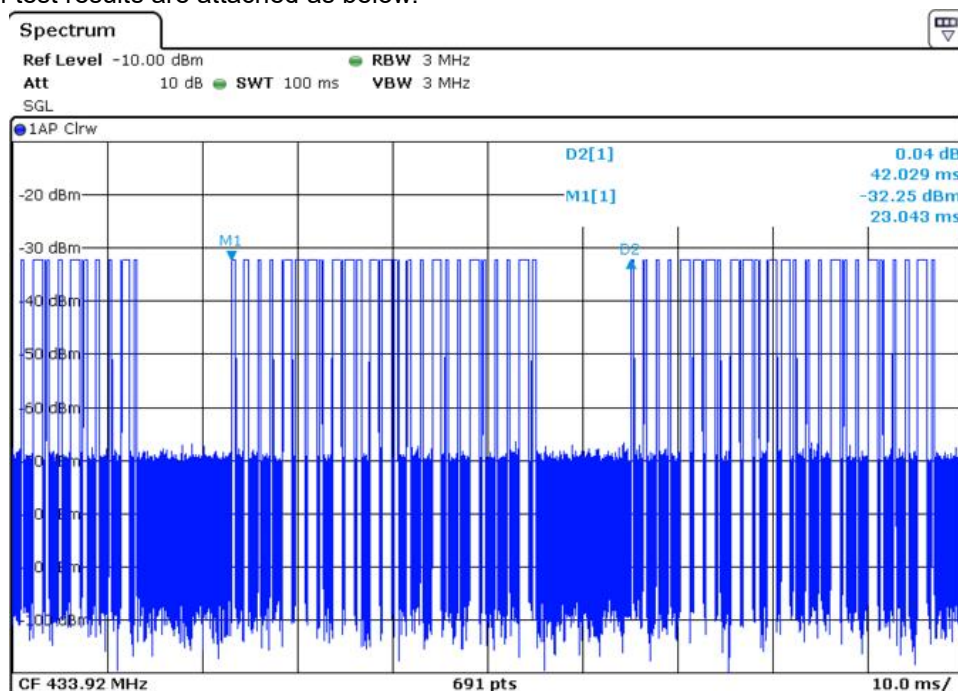
3.2 Duty cycle

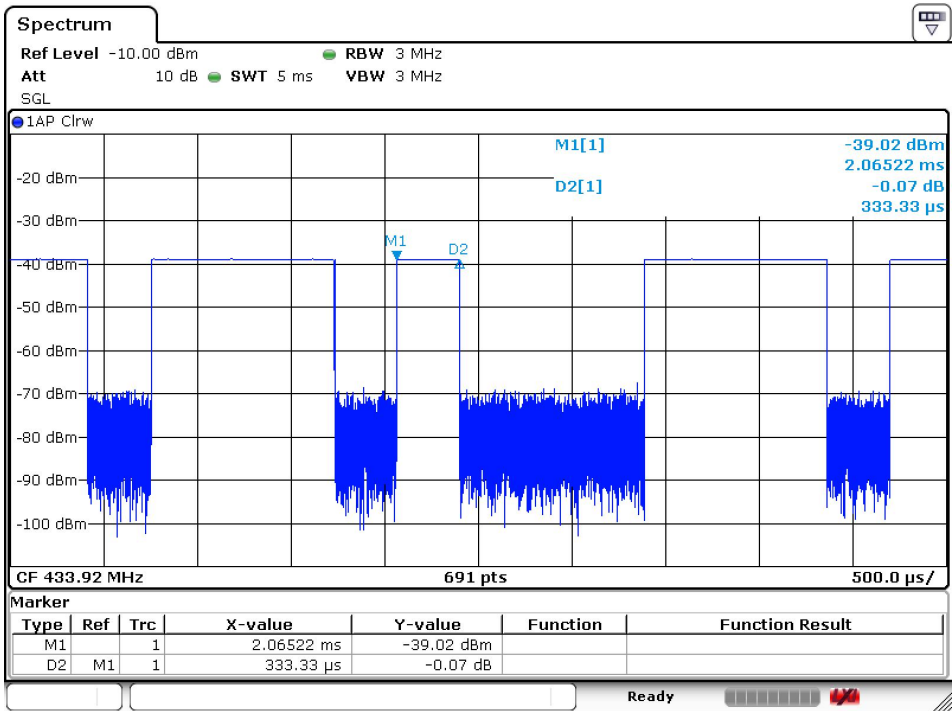
$$\text{Ton} = \text{Ton1} * \text{Number} + \text{Ton2} * \text{Number} = 0.97826 * 10 + 0.33333 * 15 = 14.78255 \text{ ms}$$

$$\text{Duty Cycle} = \text{Ton} / \text{Tp} * 100\% = 14.78255 / 42.029 * 100\% = 35.17\%$$

$$\text{Factor} = 20\text{Log}(\text{Duty Cycle}) = 20\text{Log}(35.17\%) = -9.08 \text{ dB}$$

The plots of test results are attached as below.





4. Summary of measurement results

Summary of measurements of results	Clause in FCC rules	Verdict	Note
Conducted Emissions	15.207	PASS	/
Radiated Emissions	15.231(b), 15.209	PASS	/
Deactivation time measurement	15.231 (a)	PASS	/
Emission Bandwidth Measurement	15.231(c)	PASS	/
Antenna Requirement	15.203	PASS	See note 1

Note 1: According to 15.203, it is considered sufficient to comply with the provisions of this section.

5. Measurement procedure

5.1 Conducted Emission

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

The EUT was setup according to ANSI C63.10-2020/Cor1-2023 for compliance to FCC 47CFR 15.247 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

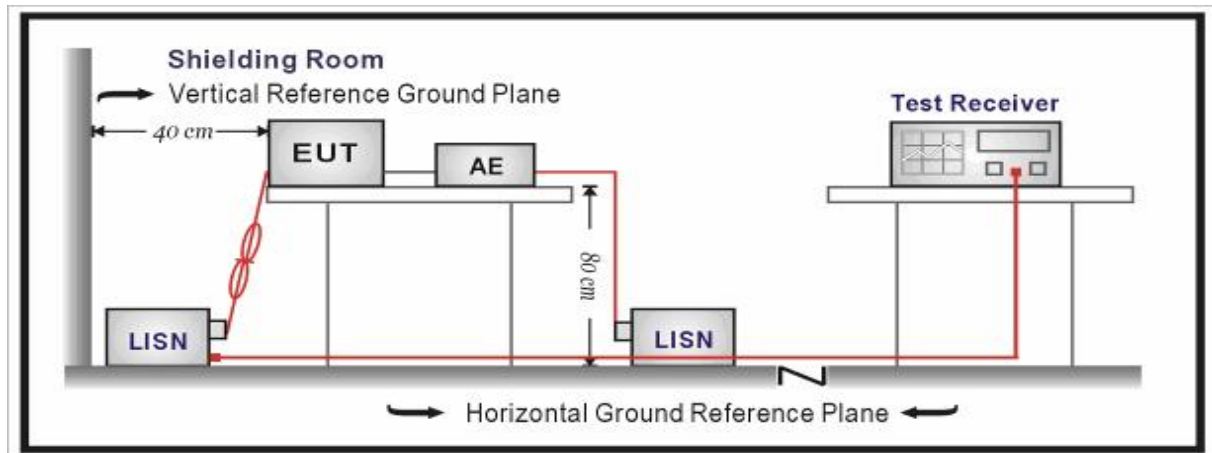
Limits:

Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Test Setup:



Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Level = Reading + Factor.

Measurement Uncertainty:

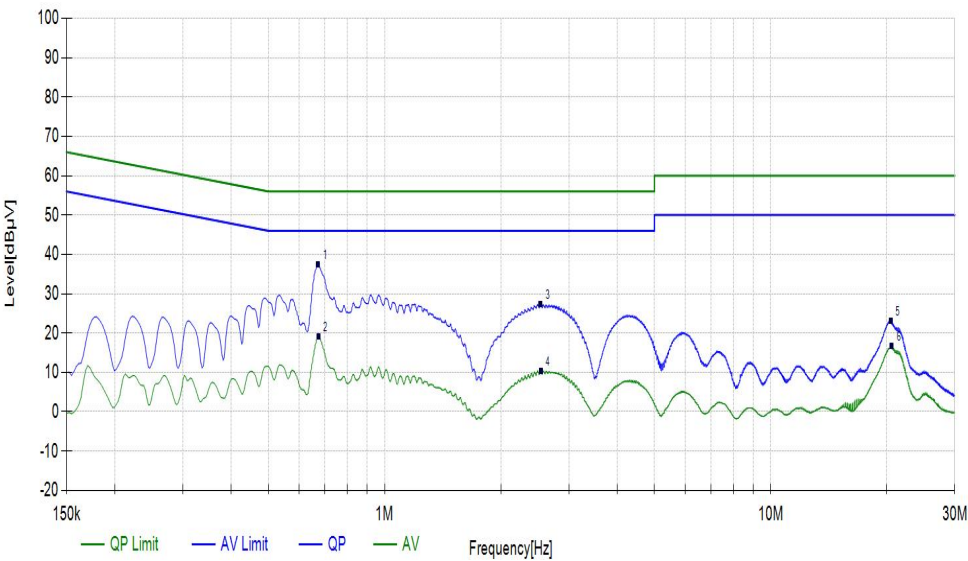
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$. $U = 3.12$ dB.

Test Results:

During the test, the Conducted Emission from 150kHz to 30MHz was performed in all modes with all channels, and all antennas. Transmitting, Channel 1, Antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

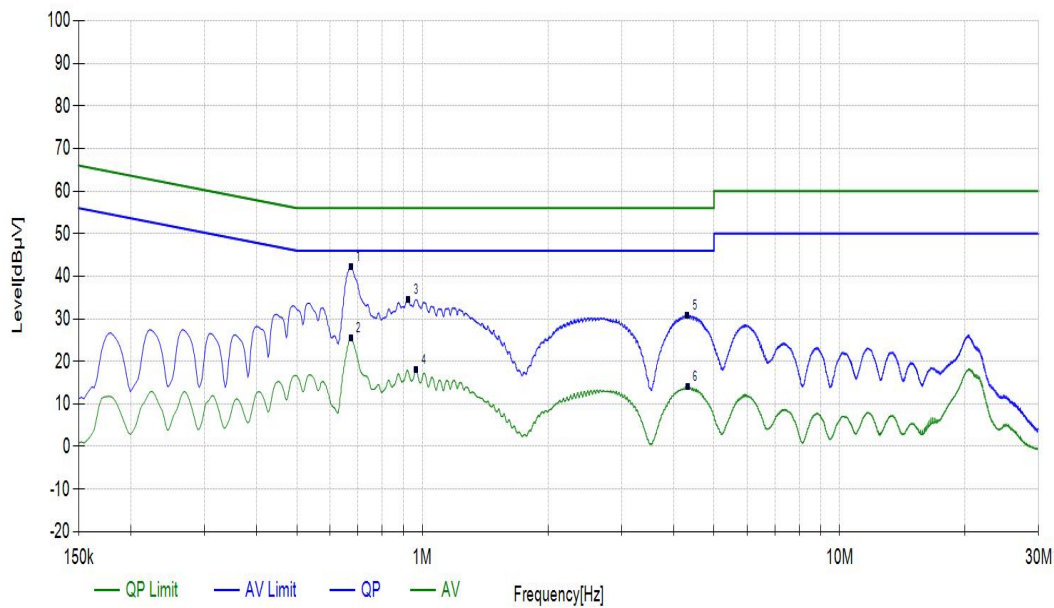
Power Line	L
Test channel	Worst-Case

NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV]	Limit [dBμV]	Margin [dB]	Detector	Pass/ Fail
1	0.6720	10.24	27.17	37.41	56.00	18.59	QP	PASS
3	2.5350	10.32	17.13	27.45	56.00	28.55	QP	PASS
5	20.4585	11.43	11.73	23.16	60.00	36.84	QP	PASS
2	0.6743	10.24	8.93	19.17	46.00	26.83	AV	PASS
4	2.5395	10.32	0.10	10.42	46.00	35.58	AV	PASS
6	20.5890	11.44	5.15	16.59	50.00	33.41	AV	PASS



Power Line	N
Test channel	Worst-Case

NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV]	Limit [dBμV]	Margin [dB]	Detector	Pass/ Fail
1	0.6743	10.22	32.01	42.23	56.00	13.77	QP	PASS
3	0.9240	10.24	24.31	34.55	56.00	21.45	QP	PASS
5	4.3103	10.37	20.51	30.88	56.00	25.12	QP	PASS
2	0.6743	10.22	15.18	25.40	46.00	20.60	AV	PASS
4	0.9668	10.25	7.69	17.94	46.00	28.06	AV	PASS
6	4.3193	10.37	3.73	14.10	46.00	31.90	AV	PASS



5.2 Radiated Emission

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

The EUT was setup and tested according to ANSI C63.10-2020/Cor1-2023.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from Antenna to the EUT was 3 meters.

The Antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the Antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2020 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn Antenna will be bended down a little (as horn Antenna has the narrow beamwidth) in order to keeping the Antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

Limits:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Frequency	Limit (μV/m)	Limit (dBμV/m @3m)	Remark
0.009MHz-0.490MHz	2400/F(kHz)@300m	20lg(24000000/F(kHz))	Quasi-peak Level
0.490MHz~1.705MHz	24000/F(kHz)@30m	20lg(2400000/F(kHz))	Quasi-peak Level
1.705MHz~30.0MHz	30@30m	69.54	Quasi-peak Level
30MHz-88MHz	100@3m	40.0	Quasi-peak Level
88MHz-216MHz	150@3m	43.5	Quasi-peak Level
216MHz-960MHz	200@3m	46.0	Quasi-peak Level
960MHz-1GHz	500@3m	54.0	Quasi-peak Level
Above 1GHz	500@3m	54.0	Average Level
	5000@3m	74.0	Peak Level

According to 15.231(b), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

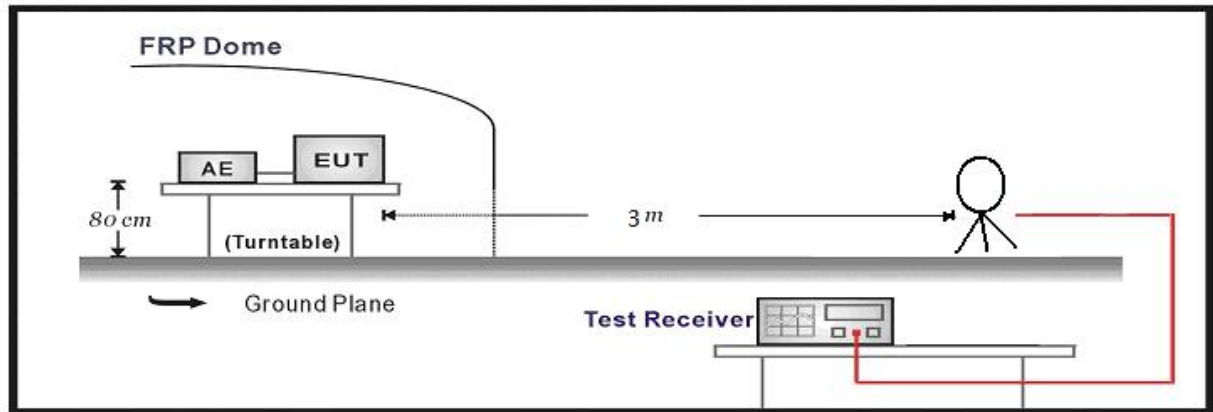
Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66–40.70	2,250	225
70–130	1,250	125
130–174	¹ 1,250 to 3,750	¹ 125 to 375
174–260	3,750	375
260–470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

NOTE:

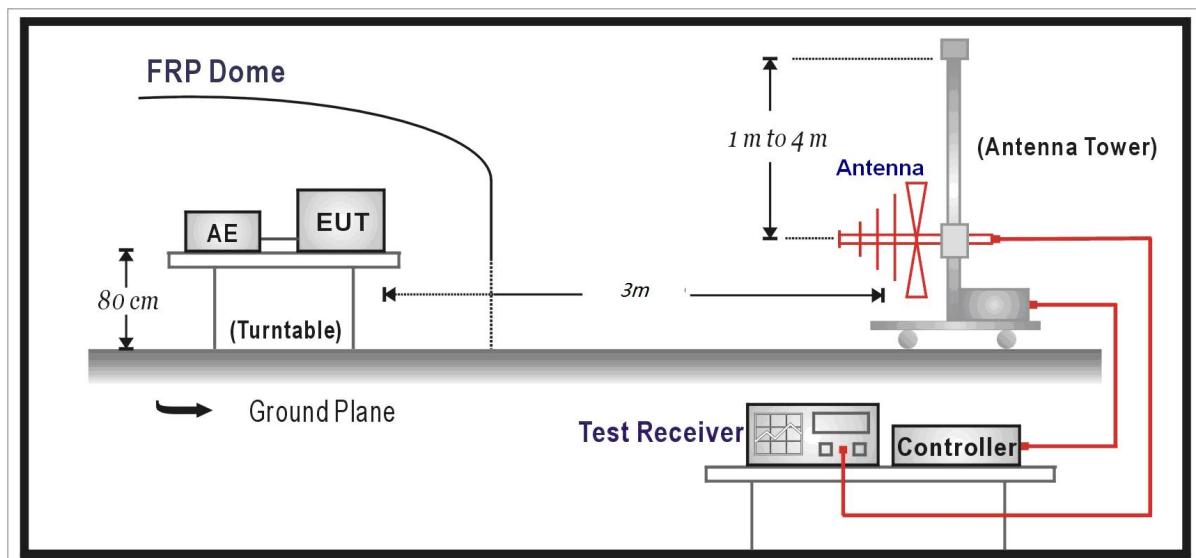
- ¹ Linear interpolations.
- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Test Setup:

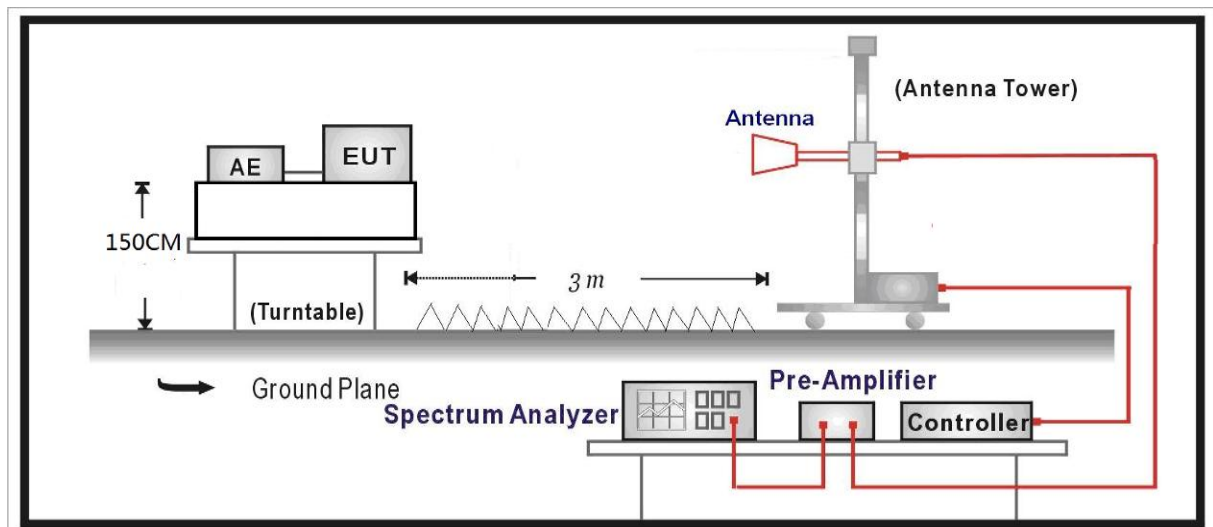
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



Measurement Data:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Level =Reading - Factor

Factor = Preamplifier Factor – Antenna Factor–Cable Loss

Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96.

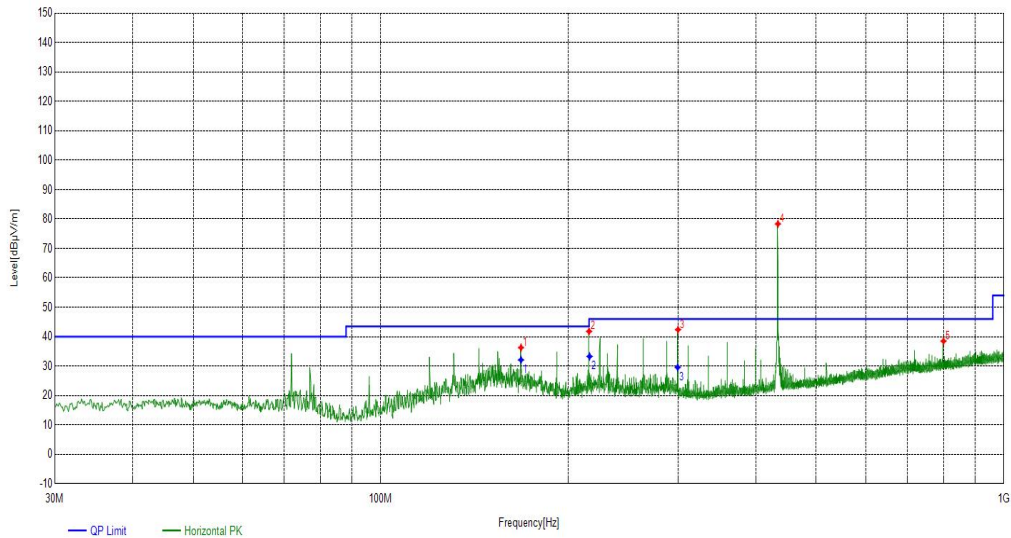
Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.19 dB
200MHz-1GHz	3.63 dB
Above 1GHz	3.68 dB

Test Results:

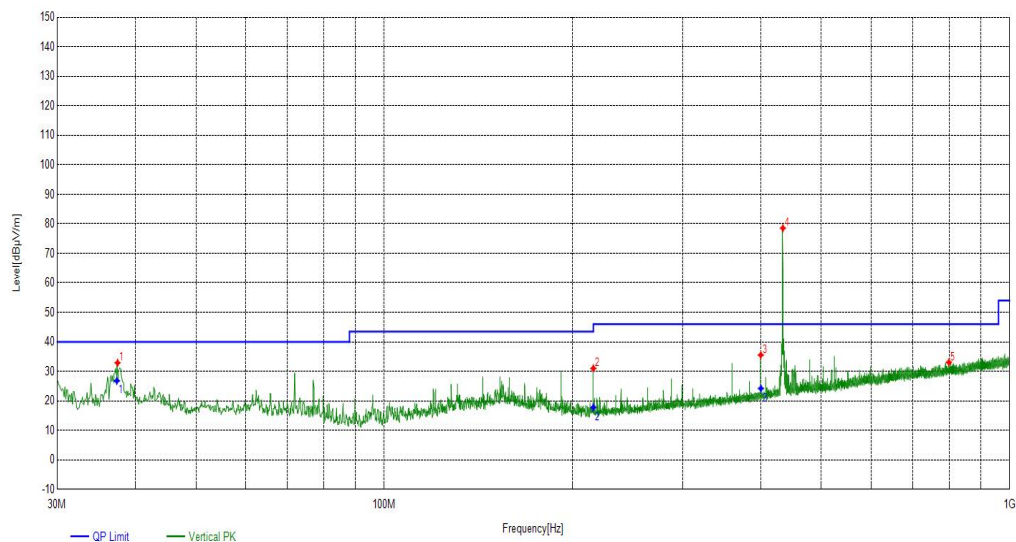
BELOW 1GHz WORST-CASE DATA:

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M									
No.	Freq. (MHz)	Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detect or	Antenna Height (cm)	Table Angle (Degree)	Pass/Fail
1	167.9478	20.59	36.28	43.50	7.22	PK	100	100	Pass
2	215.9676	18.03	41.80	43.50	1.70	PK	100	349	Pass
3	299.978	21.47	42.38	46.00	3.62	PK	100	152	Pass
4	167.9389	20.59	32.10	43.50	11.40	QP	110	100	Pass
5	216.362	18.03	33.28	46.00	12.72	QP	210	349	Pass
6	299.5998	21.47	29.54	46.00	16.46	QP	140	152	Pass
7	*433.92	24.85	78.35	100.82	22.47	PK	100	204	Pass
8	*433.92	---	69.27	80.82	11.55	AV	100	204	Pass

Note: 9kHz~30MHz have been test and test data more than 20dB margin.



ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M									
No.	Freq. (MHz)	Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detect or	Antenna Height (cm)	Table Angle (Degree)	Pass/Fail
1	37.4697	19.70	32.90	40.00	7.10	PK	100	72	Pass
2	215.9676	18.03	31.02	43.50	12.48	PK	100	125	Pass
3	399.995	24.10	35.56	46.00	10.44	PK	100	354	Pass
4	37.3682	19.70	26.80	40.00	13.20	QP	140	72	Pass
5	215.9207	18.03	17.79	43.50	25.71	QP	170	125	Pass
6	400.2269	24.10	24.21	46.00	21.79	QP	120	354	Pass
7	*433.92	24.85	78.54	100.82	22.28	PK	100	190	Pass
8	*433.92	---	69.46	80.82	11.36	AV	100	190	Pass

**NOTE:**

1. Margin value = Limit value - Emission level.
2. " * ": Fundamental frequency.
3. " # ": Harmonic frequency.
4. Fundamental AV value = PK Emission + 20*log(duty cycle) Where the duty factor is calculated from following formula: $20\text{Log}(\text{Duty Cycle}) = 20\text{Log}(35.17\%) = -9.08\text{dB}$, Please see page 7 for plotted duty.

ABOVE 1GHz WORST-CASE DATA:

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M									
No.	Freq. (MHz)	Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detect or	Antenna Height (cm)	Table Angle (Degree)	Pass/Fail
1	3037.7037	-2.74	54.23	74.00	19.77	PK	150	30	Pass
2	3904.7904	-0.18	56.73	74.00	17.27	PK	150	200	Pass
3	4773.3773	0.73	51.87	74.00	22.13	PK	150	310	Pass
4	3037.7037	-2.74	40.68	54.00	13.32	AV	150	20	Pass
5	3905.7905	-0.18	37.52	54.00	16.48	AV	150	320	Pass
6	4773.3773	0.73	35.91	54.00	18.09	AV	150	110	Pass

Note: The emission levels of other frequencies were greater than 20dB margin.

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M									
No.	Freq. (MHz)	Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detect or	Antenna Height (cm)	Table Angle (Degree)	Pass/Fail
1	2169.1169	-5.71	51.38	74.00	22.62	PK	150	260	Pass
2	3904.7904	-0.18	56.23	74.00	17.77	PK	150	320	Pass
3	5640.4640	3.66	49.50	74.00	24.50	PK	150	70	Pass
4	2170.1170	-5.71	41.00	54.00	13.00	AV	150	10	Pass
5	3905.7905	-0.18	46.17	54.00	7.83	AV	150	10	Pass
6	5646.4646	3.69	36.05	54.00	17.95	AV	150	120	Pass

NOTE:

- 1 Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
- 2 Margin value = Emission level – Limit value.
- 3 The emission levels of other frequencies were less than 20dB margin against the limit.

5.3 20dB BANDWIDTH MEASUREMENT

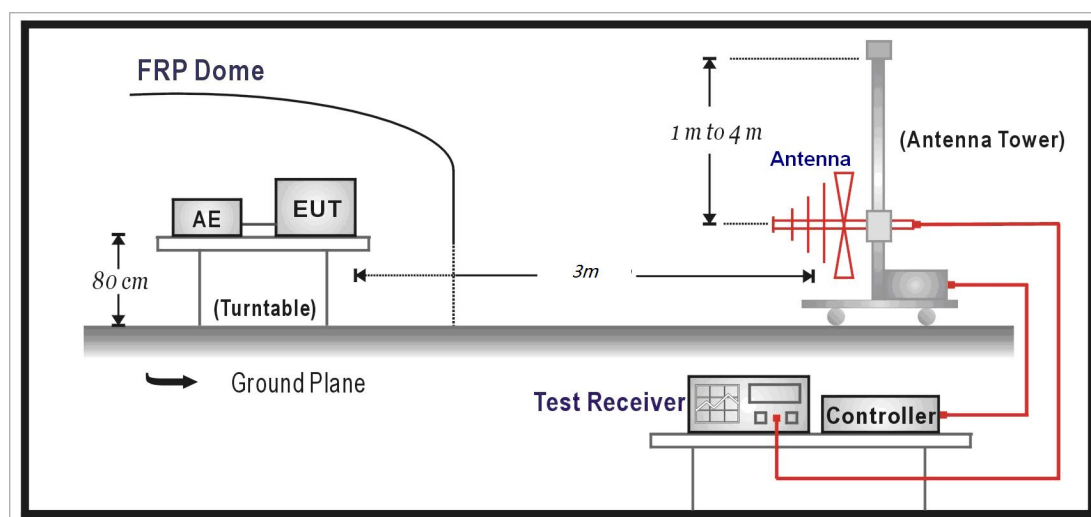
Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

The spectrum analyzer was receiving the maximum emission level. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Setup:



LIMITS OF 20dB BANDWIDTH MEASUREMENT

According to FCC 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

$$\text{Limit} = \text{Fundamental Frequency} \times 0.25\% = 433.92\text{MHz} \times 0.25\% = 1084.75 \text{ kHz}$$

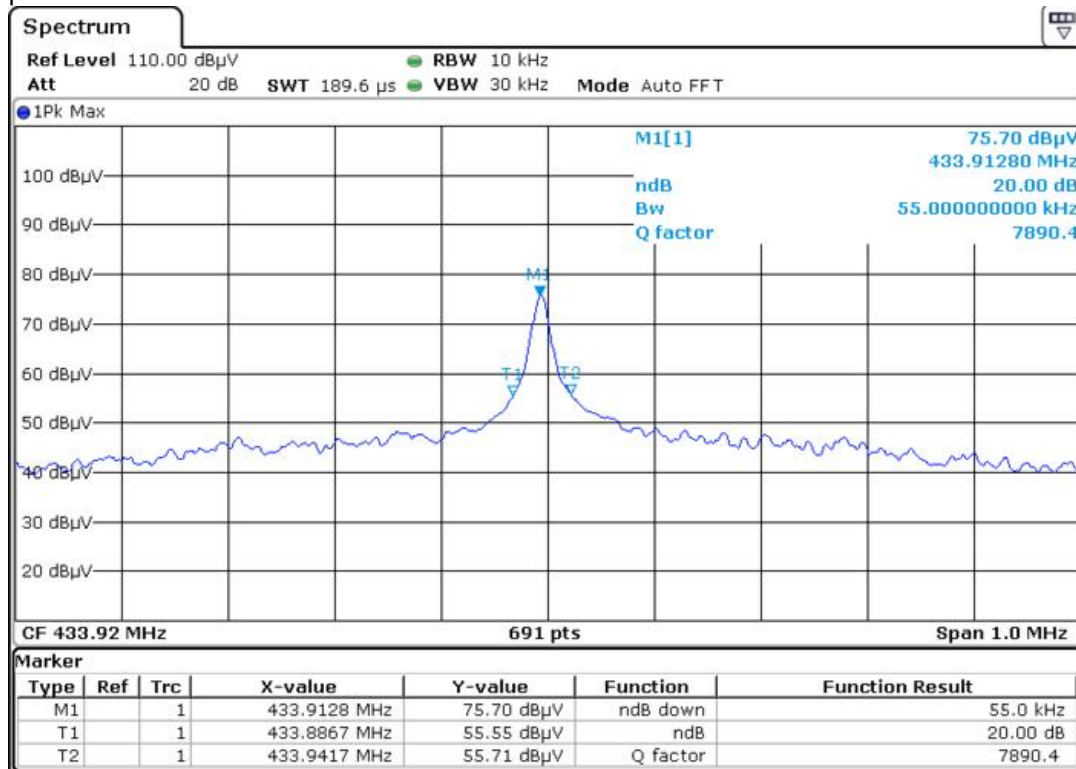
Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936 \text{ Hz}$.

Test Results:

Frequency (MHz)	20dB Bandwidth (kHz)	Maximum Limit (kHz)	PASS/FAIL
433.92	55.0	1084.75	PASS

The plots of test results are attached as below.



5.4 DEACTIVATION TIME MEASUREMENT

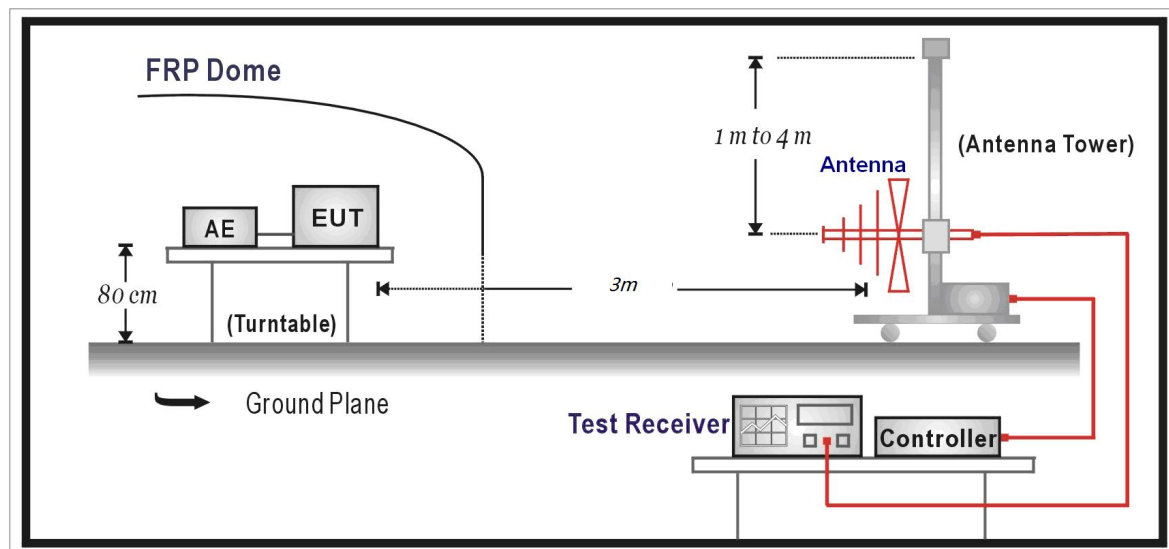
Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer set the center frequency, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the transmission duration was measured and recorded.

Test Setup:



LIMITS OF DEACTIVATION TIME MEASUREMENT

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.

15.231 (a)(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

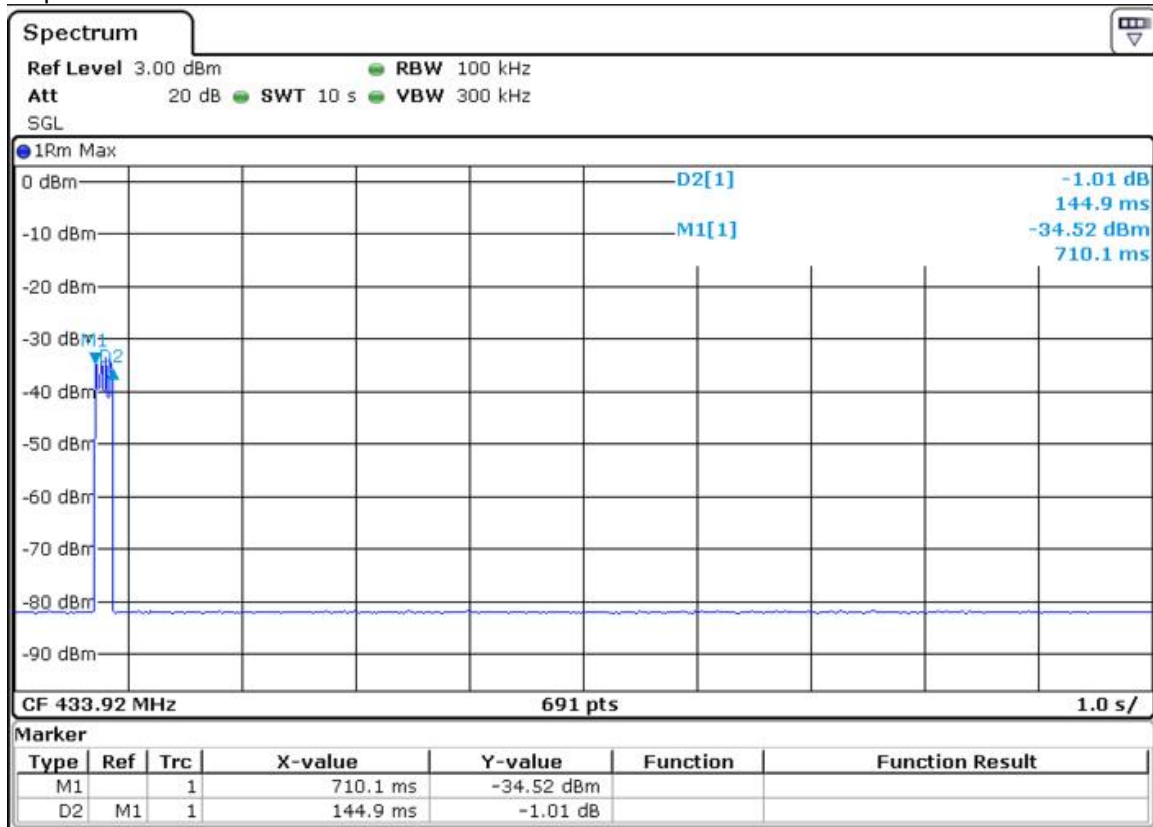
Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.005s$.

Test Results:

Frequency (MHz)	Measurement Result (sec)	Maximum limit (sec)	PASS/FAIL
433.92	0.1449	5	PASS

The plots of test results are attached as below.



6. Appendix A

Test Equipment	Type/Mode	SERIAL NO.	Equipment No.	Manufacturer	Cal. Due
5m Semi-Anechoic Chamber	SAC-5	SAC-5-2.0	EM-000557	COMTEST	2024/11/02
Spectrum Analyzer	N9010B	MY57470323	DZ-000174	KEYSIGHT	2025/01/02
EMI Test Receiver	N9038A-508	MY532290079	EM-000397	Agilent	2025/01/13
EMI Test Receiver	ESR7	102235	EM-000574	R&S	2025/01/13
loop antenna	HLA 6121	540046	EM-000546	TESEQ	2025/06/04
Broadband Antenna	VULB 9163	9163-530	EM-000342	SCHWARZBECK	2025/06/09
Waveguide Horn Antenna	HF906	360306/008	EM-000093	R&S	2025/01/13
Waveguide Horn Antenna	BBHA9170	00949	DZ-000209-2	SCHWARZBECK	2024/08/05
Preamplifier	BBV 9721	9721-050	DZ-000209-1	SCHWARZBECK	2025/06/03
Temperature and humidity meter	MHO-C201	/	DZ-000249-5	Seconds test	2024/08/30
SuperCharge	HW-100400C01	/	/	HUAWEI	/

Dynacomm	Software Release	Software Developer
TS+ (5m,Radiation test)	JS32-RE 5.0.0	Tonscend

The End

Important

1. The test report is invalid without the official stamp of CVC;
2. Any part photocopies of the test report are forbidden without the written permission from CVC;
3. The test report is invalid without the signatures of Author and Reviewer;
4. The test report is invalid if altered;
5. Objections to the test report must be submitted to CVC within 15 days;
6. Generally, commission test is responsible for the tested samples only;
7. As for the test result, “—” or “N/A” means “not applicable”, “/” means “not testing”, “P” means “pass” and “F” means “fail”.

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