DEKRA Testing and Certification (Suzhou) Co., Ltd.
No.99 Hongye Rd., Suzhou Industrial Park, Suzhou, 215006, Jiangsu, China
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Test report No:
20B0790R-RF-US-P06V01

TEST REPORT
FCC Rules&Requlations 47 CFR Chapter I - Part 15C

Product Name	Smart Key
Trademark	KOSTAL
Model and /or type reference	BC30
FCC ID	2AYARBC30
Applicant's name / address	Kostal (Shanghai) Management Co., Ltd. Room 201-202 3# Building, 77 Yuan Gao Road, Jiading District Shanghai China
Test method requested, standard	FCC CFR Title 47 Part 15 Subpart C
Verdict Summary	IN COMPLIANCE
Documented by (name / position & signature)	Kitty Li/Project Assistant
Reviewed by (name / position & signature)	Frank He/ Technical Supervisor
Approved by (name / position & signature)	Jack Zhang/ Supervisor
Date of issue	2020-12-29
Report template No	Template_FCC Part 15C-RF-V1.0

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page

COMPETENCES AND GUARANTEES

DEKRA is a testing laboratory competent to carry out the tests described in this report.
In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA.

GENERAL CONDITIONS

Test Location	No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China
Date(receive sample)	Nov. 23, 2020
Date (start test)	Nov. 23, 2020
Date (finish test)	Dec. 16, 2020

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

POSSIBLE TEST CASE VERDICTS

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not measured	N/M

ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT : Equipment Under Test
QP : Quasi-Peak
CAV : CISPR Average
AV : Average
CDN : Coupling Decoupling Network
SAC : Semi-Anechoic Chamber
OATS : Open Area Test Site
BW : Bandwidth
AM : Amplitude Modulation
PM : Pulse Modulation
HCP : Horizontal Coupling Plane
VCP : Vertical Coupling Plane
U_N : Nominal voltage
*T*x : Transmitter
*R*x : Receiver
N/A : Not Applicable
N/M : Not Measured

DOCUMENT HISTORY

Report No.	Version	Description	Issued Date
20B0790R-RF-US-P06V01	V1.0	Initial issue of report.	2020-12-17
20B0790R-RF-US-P06V01	V1.1	Page 7: Remote equipment for AC-Line conducted emission; Page 14: Update the description of testing process; Page 22: Add chapter 4.2.4 EUT test Axis definition; Chapter 4.2.5: Update test data.	2020-12-29

REMARKS AND COMMENTS

1. The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).
2. These test results on a sample of the device are for the purpose of demonstrating Compliance with Part 15 Subpart C.
3. The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.
4. The test results presented in this report relate only to the object tested.
5. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification (Suzhou) Co., Ltd.
6. This report will not be used for social proof function in China market.
7. DEKRA declines any responsibility with the following test data provided by customer that may affect the validity of result:
   - Chapter 1.1 General Description of the Item(s);
   - Chapter 1.2 Antenna information.

USED EQUIPMENT

Emission in non-restricted frequency bands / TR-8					
Instrument	Manufacturer	Type No.	Serial No.	Cal. Date	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2020.08.15	2021.08.14
EXA Spectrum Analyzer	Keysight	N9010A	MY55370495	2020.04.17	2021.04.16
MXA Signal Analyzer	Keysight	N9020A	MY56060147	2020.08.15	2021.08.14
Temperature/Humidity Meter	Zhichen	ZC1-2	TR8-TH	2020.08.19	2021.08.18
Note: All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.					

Radiated Emission(Below 1GHz) / AC-3					
Instrument	Manufacturer	Type No.	Serial No.	Cal. Date	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100176	2020.08.15	2021.08.14
Loop Antenna	R&S	HFH2-Z2	833799/003	2020.02.17	2021.02.16
Bilog Antenna	Teseq GmbH	CBL6112D	27613	2020.08.19	2021.08.18
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC3-C	2020.04.13	2021.04.12
Temperature/Humidity Meter	RTS	RTS-8S	AC3-TH	2020.08.19	2021.08.18
Quietek EMI V3(test software)	Quietek	N/A	N/A	N/A	N/A
Note: All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.					

Radiated Emission / AC5(1GHz-40GHz)(Chamber details)					
Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
EMI Receiver	Agilent	N9038A	MY51210196	2020.04.18	2021.04.17
DRG Horn	ETS-Lindgren	3117	00123988	2020.09.21	2021.09.20
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170D	750	2019.01.05	2021.01.04
Pre-Amplifier	Schwarzbeck	BBV 9721	9721-024	2019.07.17	2021.07.16
Temperature/Humidity Meter	RTS	RTS-8S	AC5-TH	2020.08.13	2021.08.12
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2020.04.05	2021.04.04
DEKRA test software	N/A	N/A	N/A	N/A	N/A

UNCERTAINTY

Uncertainties have been calculated according to the DEKRA internal document. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%, The Uncertainties is complice with standard required as below.

Test item	Uncertainty
AC Power Line Conducted Emission	± 2.02 dB
Peak Power Output	± 1.27 dB
Radiated Emission(30MHz~1GHz)	± 3.80 dB
RF antenna conducted test	± 1.27 dB
DTS Bandwidth	± 1kHz
Occupied Bandwidth	± 1kHz
Power Density	± 1.27 dB
Frequency Stability	± 100 Hz

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

Product Name.....:	Smart Key
Model No.....:	BC30
Trademark.....:	KOSTAL
FCC ID.....:	2AYARBC30
Manufacturer.....:	Kostal (Shanghai) Management Co., Ltd.
Manufacturer Address .....:	Room 201-202 3# Building, 77 Yuan Gao Road, Jiading District Shanghai China

Wireless specification .....:	N/A
Operating frequency(s) .....:	433.92 MHz
Type of modulation .....:	ASK
Number of channel .....:	1

Rated power supply.....:	Voltage and Frequency	
	☐	AC: 220 – 240 V, 50/60 Hz
	☐	AC: 100 – 240 V, 50/60 Hz
	☐	DC: 12 V
	☒	Battery: 3V
Mounting position.....:	☐	Table top equipment
	☐	Wall/Ceiling mounted equipment
	☐	Floor standing equipment
	☒	Hand-held equipment
	☐	Other: ……

1.2 Antenna Information

Antenna model / type number .....:	N/A			
Antenna serial number.....:	N/A			
Antenna Delivery .....:	☒	1TX + 1RX		
	☐	2TX + 2RX		
	☐	Others:……		
Antenna technology.....:	☒	SISO		
	☐	MIMO	☐	CDD
			☐	Beam-forming
Antenna Type .....:	☐	External	☐	Dipole
			☐	Sectorized
	☒	Internal	☐	Monopole
			☒	PCB
			☐	Metal
			☐	PIFA
			☐	Others……..
Antenna Gain.....:	N/A			

Note: The General Description of the Item and antenna information in clause 1 are provided and confirmed by the client.

2 DESCRIPTION OF TEST SETUP

2.1 Operating mode(s) used for tests

During the tests the following operating mode(s) has(have) been used.

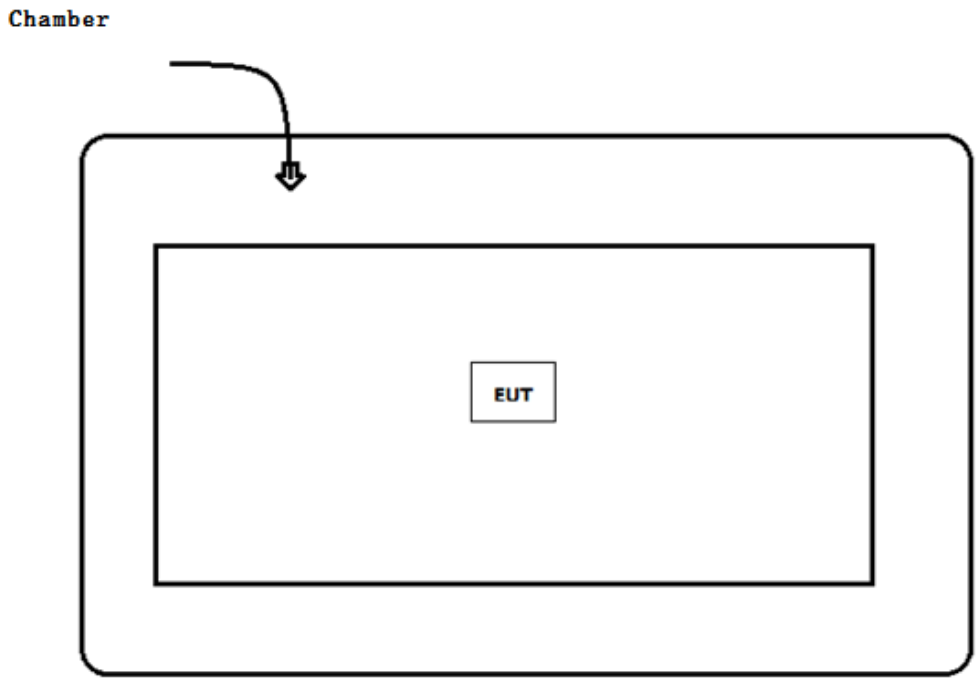
Test Mode	Mode 1: Transmit

2.2 Support / Auxiliary equipment / unit / Test software for the EUT

Auxiliary equipment	Type / Version	Manufacturer	Supplied by
N/A	N/A	N/A	N/A
software	Type / Version	Manufacturer	Supplied by
N/A	N/A	N/A	N/A

2.3 Test Configuration / Block diagram used for tests

Test setup Diagram- Radiated Emission



2.4 Testing process

1	Setup the EUT as shown in Section 2.3.
2	Press the  button on the EUT.
3	Verify that the EUT works properly.

3 VERDICT SUMMARY SECTION

This chapter presents an overview of standards and results. Refer to the next chapters for details of measured test results and applied test levels.

3.1 Standards

Standard	Year	Description
FCC CFR Title 47 Part 15 Subpart C	2020	Intentional Radiators

3.2 Overview of results

Requirement – Test case	Basic standard(s)	Verdict	Remark
Conducted Emission	FCC CFR Title 47 Part 15 Subpart C Section 15.207	N/A	---
Field Strength of Spurious	FCC CFR Title 47 Part 15 Subpart C Section 15.209	PASS	---
Channel Bandwidth	FCC CFR Title 47 Part 15 Subpart C Section 15.231(c)	PASS	---
Antenna Requirement	FCC CFR Title 47 Part 15 Subpart C Section 15.203	PASS	---
Supplementary information:			

3.3 Test Facility

USA	**:**	**FCC Designation Number: CN1199**
Canada	**:**	**CAB identifier Number: CN0040**

4 TEST RESULTS

4.1 AC Power Line Conducted Emission	VERDICT: N/A

4.1.1 Limit

Standard	FCC Part 15 Subpart E Paragraph 15.207	
Frequency range [MHz]	Limit: QP [dB(μV)[1)]]	Limit: AV [dB(μV) [1)]]
0,15 - 0,50	66 – 56 [2)]	56 - 46 [2)]
0,50 - 5,0	56	46
5,0 - 30	60	50

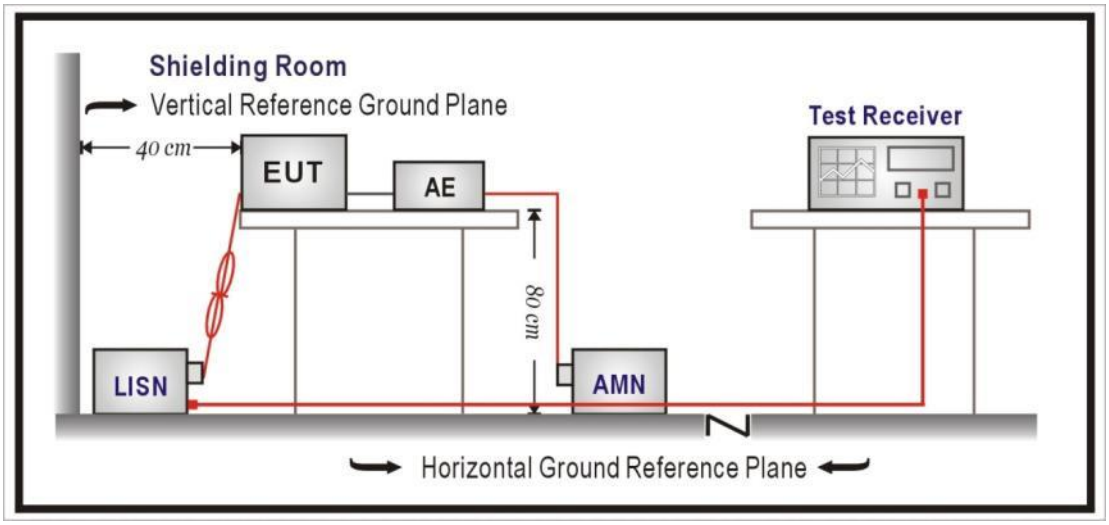
[1)] At the transition frequency, the lower limit applies.

[2)] The limit decreases linearly with the logarithm of the frequency.

NOTE 1: The exclusion band for transmitters shall be considered for transmitters operating at frequencies below 30 MHz.

NOTE 2: Where the AC output port is directly connected (or via a circuit breaker) to the AC power input port of the EUT the AC power output port need not to be tested.

4.1.2 Test Setup



4.1.3 Test Procedure

	References Rule	Chapter	Item
☒	ANSI C63.10-2013	6.2	Standard test method for ac power-line conducted emissions from unlicensed wireless devices

4.1.4 Test Data

N/A: The sample is supply by DC .

4.2 Radiated Emissions	VERDICT: PASS

4.2.1 Limit	
Standard	FCC Part 15 Subpart C Paragraph 15. 209

Restricted Band Emissions Limit

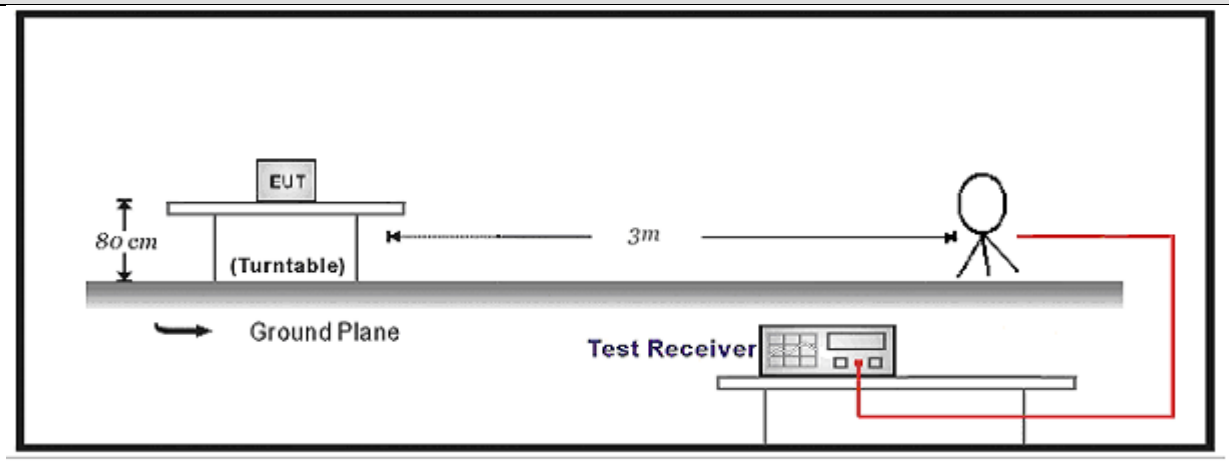
Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009 - 0.49	2400/F(kHz)	48.5 – 13.8	300(Note 1)
0.49 - 1.705	24000/F(kHz)	33.8 - 23	30(Note 1)
1.705 - 30	30	29.5	30(Note 1)
30 - 88	100	40	3(Note 2)
88 - 216	150	43.5	3(Note 2)
216 - 960	200	46	3(Note 2)
Above 960	500	54	3(Note 2)

Note 1: At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

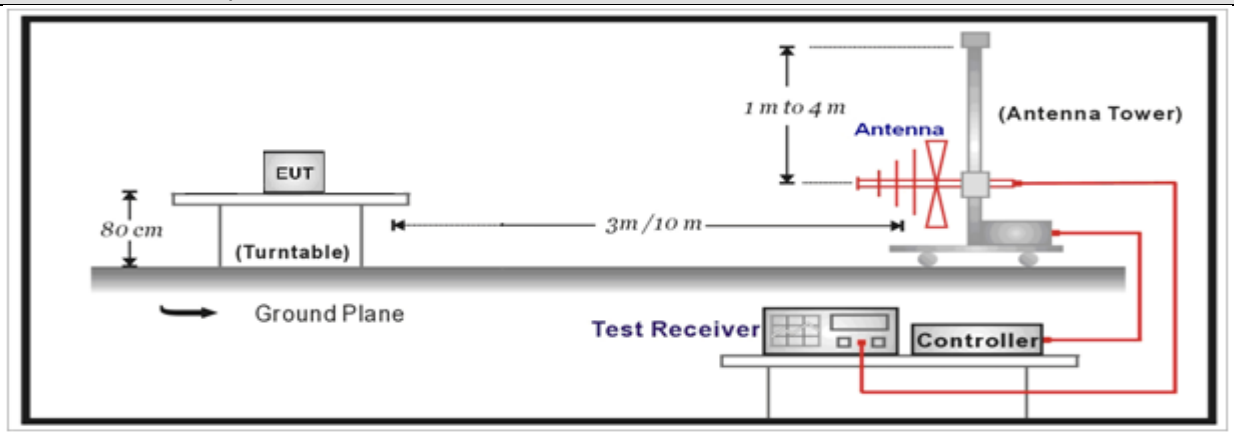
Note 2: At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

4.2.2 Test Setup

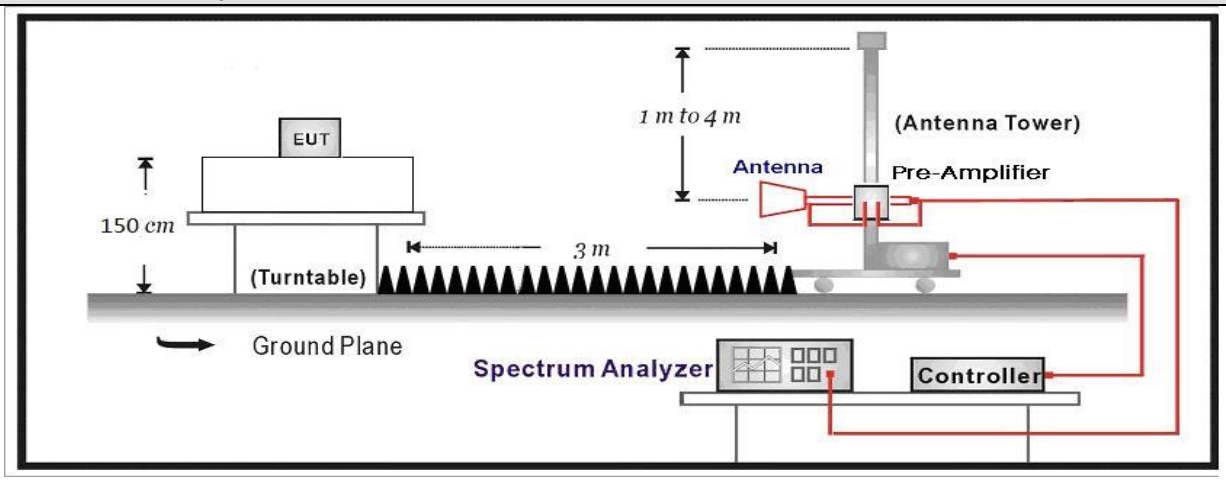
Below 30MHz Test Setup:



30MHz-1GHz Test Setup:



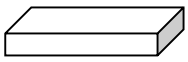
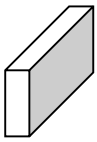
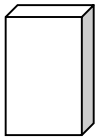
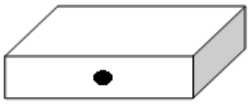
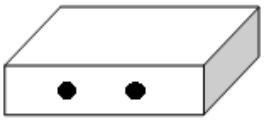
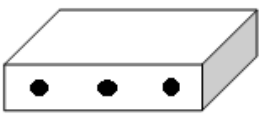
Above 1GHz Test Setup:



4.2.3 Test Procedure

	References Rule		Chapter	Description
	☒	ANSI C63.10	6.4	Radiated emissions from unlicensed wireless devices below 30 MHz
	☒	ANSI C63.10	6.5	Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz
	☒	ANSI C63.10	6.6	Radiated emissions from unlicensed wireless devices above 1 GHz

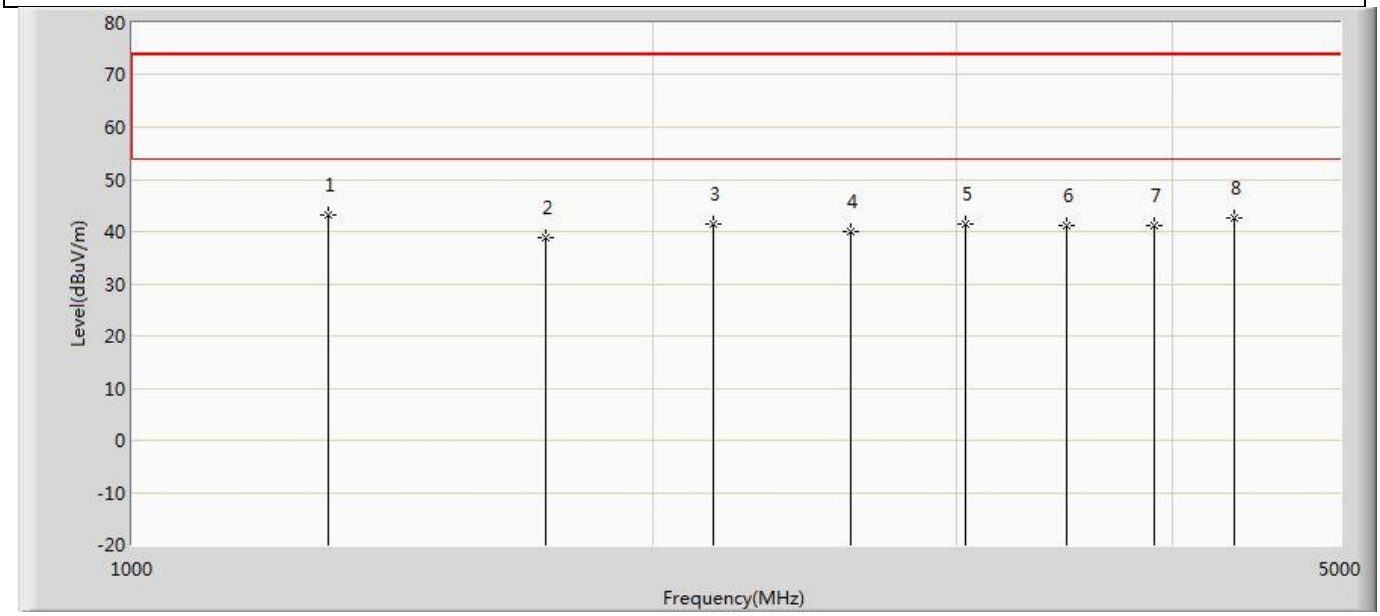
4.2.4 EUT test Axis definition

Item	Emissions in restricted frequency bands			
Device Category	☐	Fixed point-to-point		
	☐	Emit multiple directional beams, simultaneously or sequentially		
	☒	Other cases		
Test mode	Mode 1			
Test method	☒	Radiated		
		X Axis	Y Axis	Z Axis
				
		Worst Axis ☒	Worst Axis ☐	Worst Axis ☐
	☐	Conducted		
	☐	Chain 1		
				
	☐	Chain 1	Chain 2	
				
	☐	Chain 1	Chain 2	Chain 3
				

4.2.5 Test Data

Fundamental Frequency （MHz）	Field Strength of fundamental (dBuV/m) (Peak)	Field Strength of fundamental (dBuV/m) (AV)	Limit (dBuV/m) (Peak)	Limit (dBuV/m) (AV)	Result
433.92	86.565	79.318	100.08	80.08	Pass

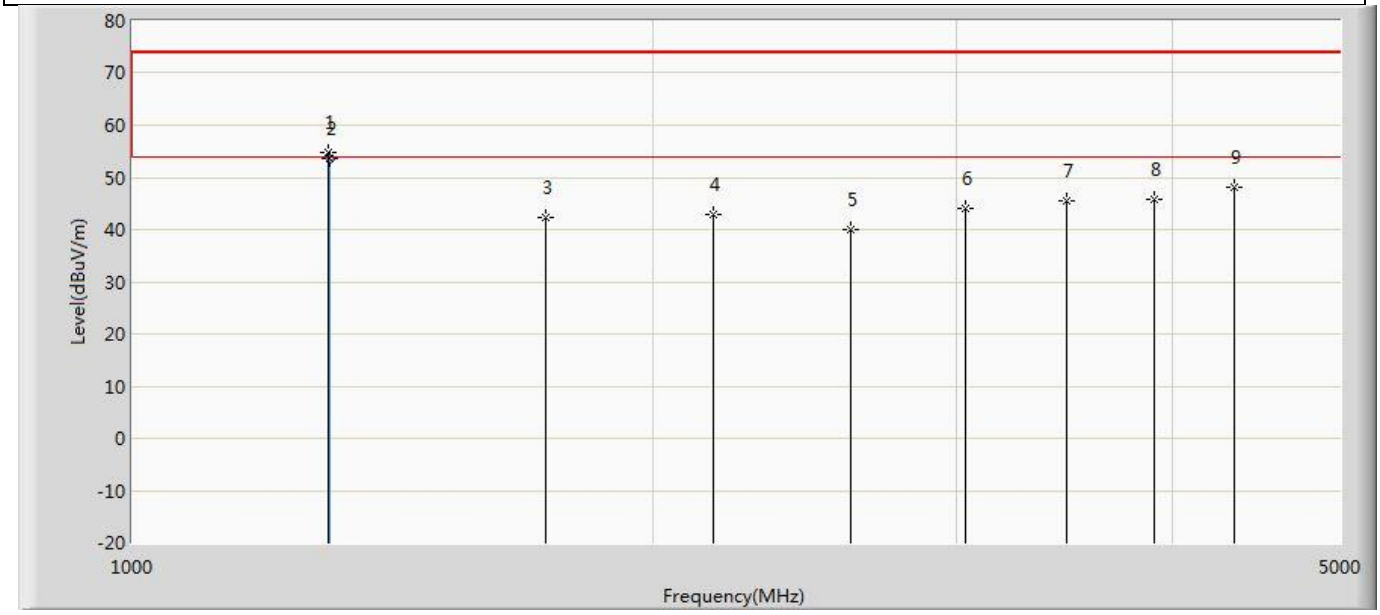
Profile: 20B0790R	Page No.: 7
Engineer: Pawn	
Site: AC5	Time: 2020/11/26 - 20:34
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: Smart Key BC30	Power: Battery
Note: Mode 1: Transmit	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	1300.000	43.106	56.700	-30.894	74.000	-13.594	PK
2		1735.680	38.762	50.930	-41.318	80.080	-12.168	PK
3		2169.600	41.369	51.382	-32.631	74.000	-10.013	PK
4		2603.520	39.984	49.669	-40.096	80.080	-9.686	PK
5		3037.440	41.581	50.595	-38.499	80.080	-9.014	PK
6		3471.360	41.041	48.139	-39.039	80.080	-7.098	PK
7		3905.280	41.112	47.523	-32.888	74.000	-6.410	PK
8		4339.200	42.590	47.668	-31.410	74.000	-5.078	PK

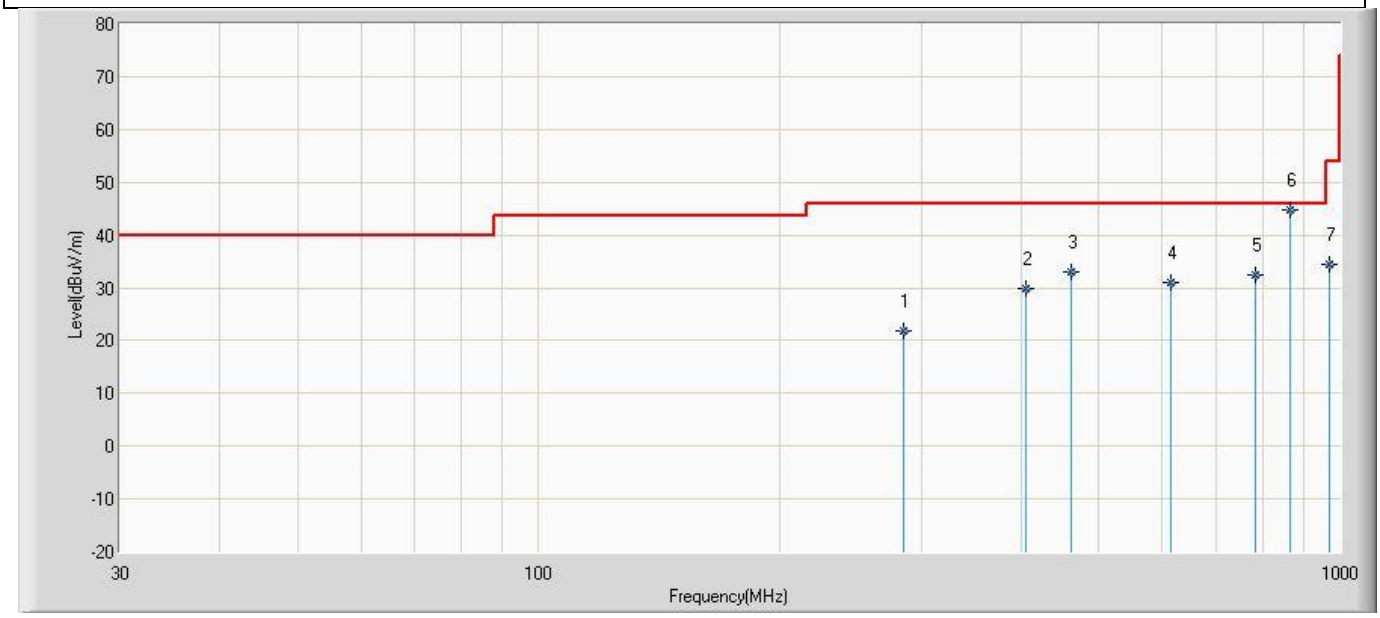
Note: 1.Measure level =Reading Level + Factor

Profile: 20B0790R	Page No.: 8
Engineer: Pawn	
Site: AC5	Time: 2020/11/26 - 20:34
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: Smart Key BC30	Power: Battery
Note: Mode 1: Transmit	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		1300.000	54.790	68.384	-19.210	74.000	-13.594	PK
2	*	1301.790	53.720	67.254	-0.280	54.000	-13.534	AV
3		1736.000	42.231	54.397	-37.849	80.080	-12.166	PK
4		2168.000	42.864	52.963	-37.216	80.080	-10.100	PK
5		2603.520	40.011	49.696	-40.069	80.080	-9.686	PK
6		3036.000	44.173	53.183	-35.907	80.080	-9.010	PK
7		3472.000	45.489	52.638	-34.591	80.080	-7.149	PK
8		3904.000	45.758	52.083	-28.242	74.000	-6.325	PK
9		4340.000	48.214	53.336	-25.786	74.000	-5.121	PK

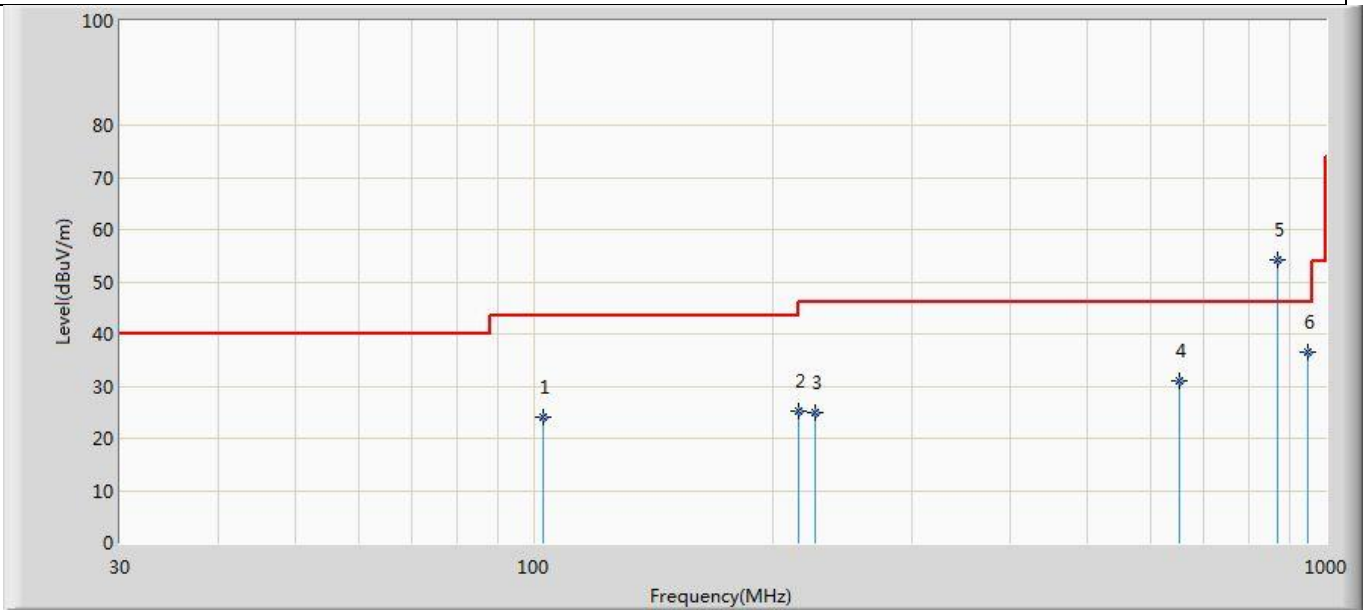
Profile: 20B0790R	Page No.: 9
Engineer: Pawn	
Site: AC3	Time: 2020/12/15 - 20:50
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: AC3_3m (30-1000MHz)	Polarity: Horizontal
EUT: Smart Key BC30	Power: Battery
Note: Mode 1: Transmit	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		285.231	21.770	0.764	-24.230	46.000	21.006	QP
2		406.239	29.728	4.449	-16.272	46.000	25.280	QP
3		461.529	32.915	6.343	-13.085	46.000	26.572	QP
4		615.880	30.918	2.079	-15.082	46.000	28.839	QP
5		785.388	32.417	2.492	-13.583	46.000	29.925	QP
6	*	867.838	44.785	13.027	-35.295	80.080	31.758	PK
7		971.749	34.323	1.910	-19.677	54.000	32.412	QP

Note: 1.Measure level =Reading Level + Factor
2. Mark 6 is 2th harmonic.

Profile: 20B0790R	Page No.: 10
Engineer: Pawn	
Site: AC3	Time: 2020/12/15 - 20:51
Limit: FCC_Part15.109_RE(3m)_ClassB	Margin: 0
Probe: AC3_3m (30-1000MHz)	Polarity: Vertical
EUT: Smart Key BC30	Power: Battery
Note: Mode 1: Transmit	



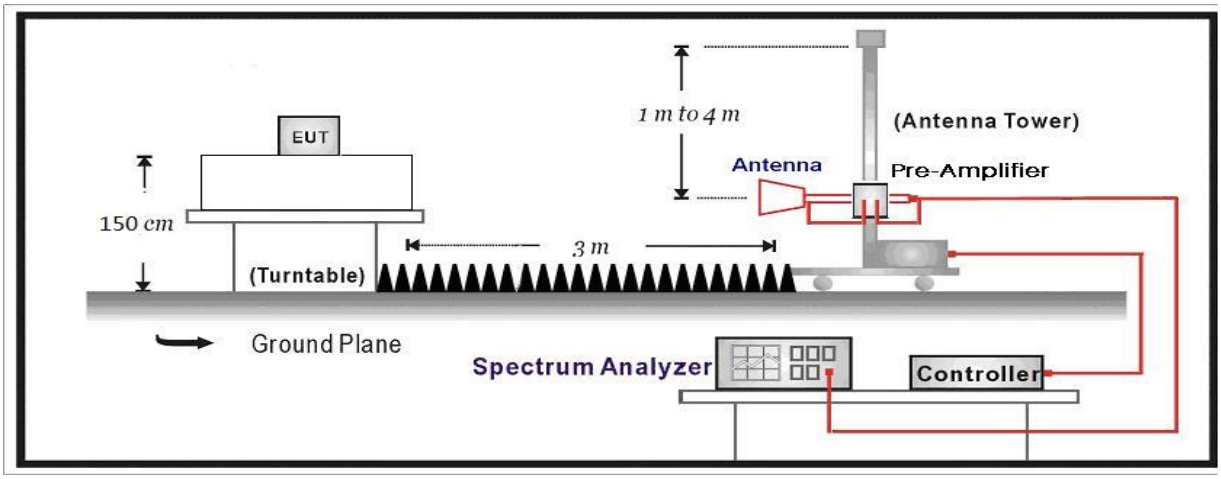
No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		102.750	24.070	2.089	-19.430	43.500	21.981	QP
2		215.512	25.110	2.387	-18.390	43.500	22.723	QP
3		226.910	24.827	2.860	-21.173	46.000	21.967	QP
4		652.376	30.905	3.311	-15.095	46.000	27.594	QP
5		867.838	54.087	21.401	-25.993	80.080	32.686	PK
6	*	948.590	36.505	1.554	-9.495	46.000	34.951	QP

Note: 1.Measure level =Reading Level + Factor
2. Mark 5 is 2th harmonic.

4.3 Emission bandwidth	VERDICT: PASS

4.3.1 Limit	
Standard	FCC Part 15 Subpart C Paragraph 15.215
Within the band.	

4.3.2 Test Setup



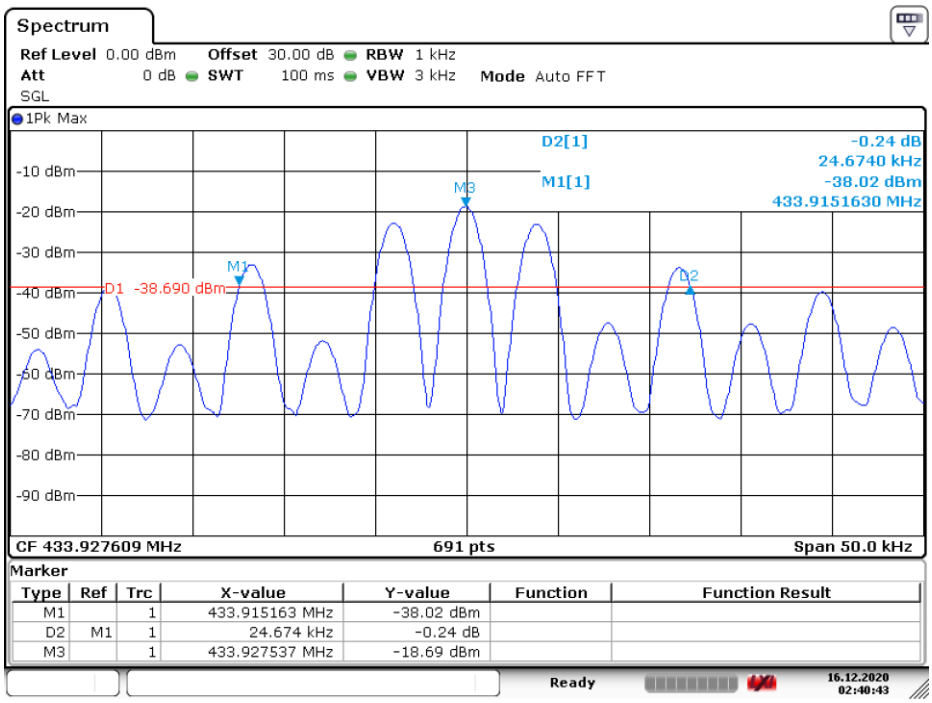
4.3.3 Test Procedure

	Reference Rule	Chapter	Description
☒	ANSI C63.10	6.9.2	Occupied bandwidth—relative measurement procedure

4.3.4 Test Data

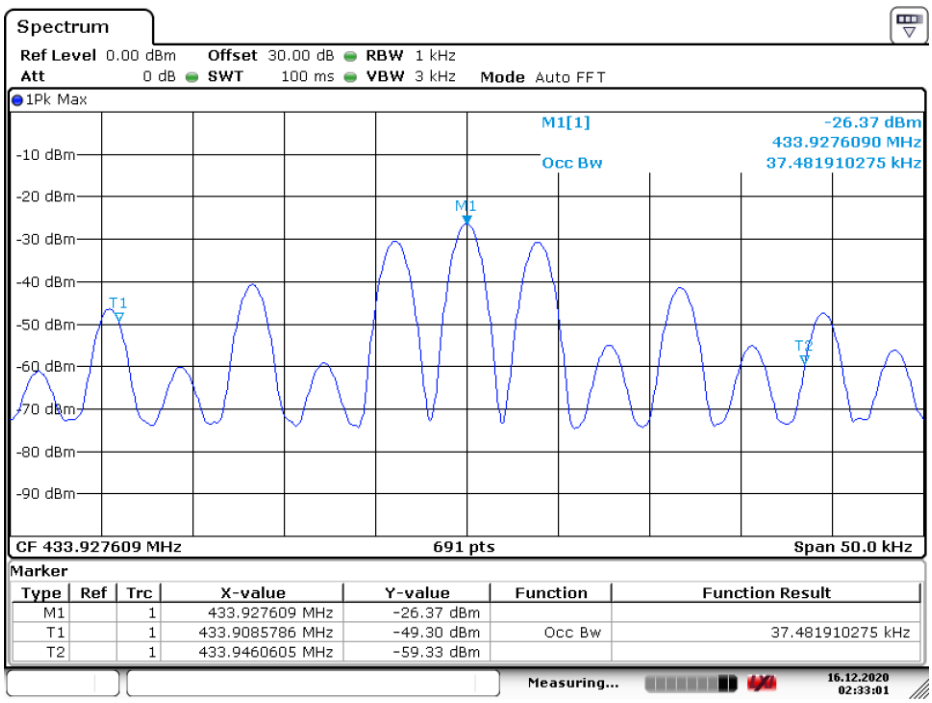
Frequency (MHz)	20dB bandwidth (kHz)	99% bandwidth (kHz)	Result
433.92	24.67	37.48	Pass

20dB bandwidth



Date: 16.DEC.2020 02:40:44

99% bandwidth

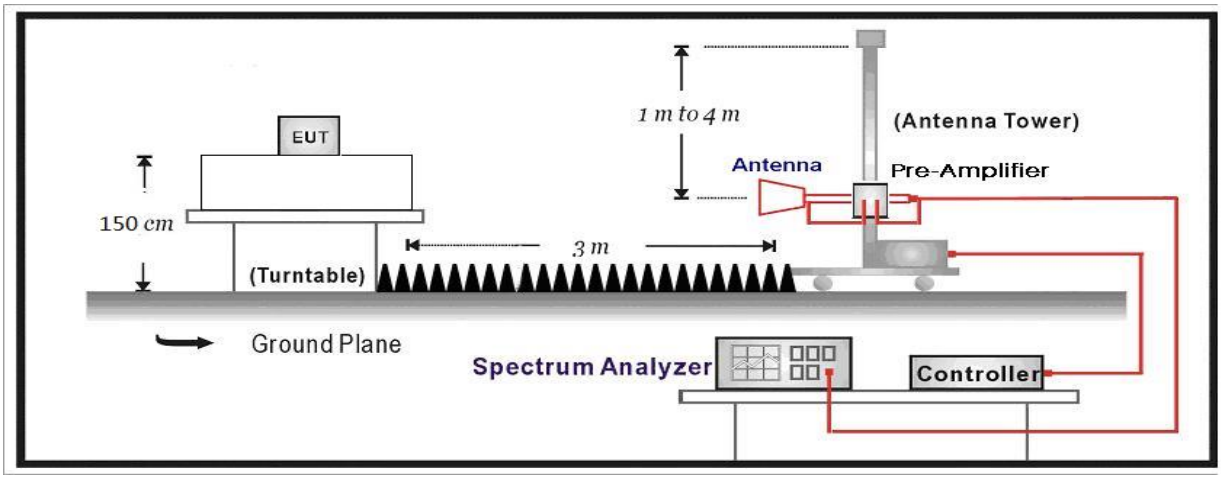


Date: 16.DEC.2020 02:33:02

4.4 Duration Time	VERDICT: PASS

4.4.1 Limit	
Standard	FCC Part 15 Subpart C Paragraph 15.221(a)
A transmitter activated automatically shall cease transmission within 5 seconds after activation.	

4.4.2 Test Setup



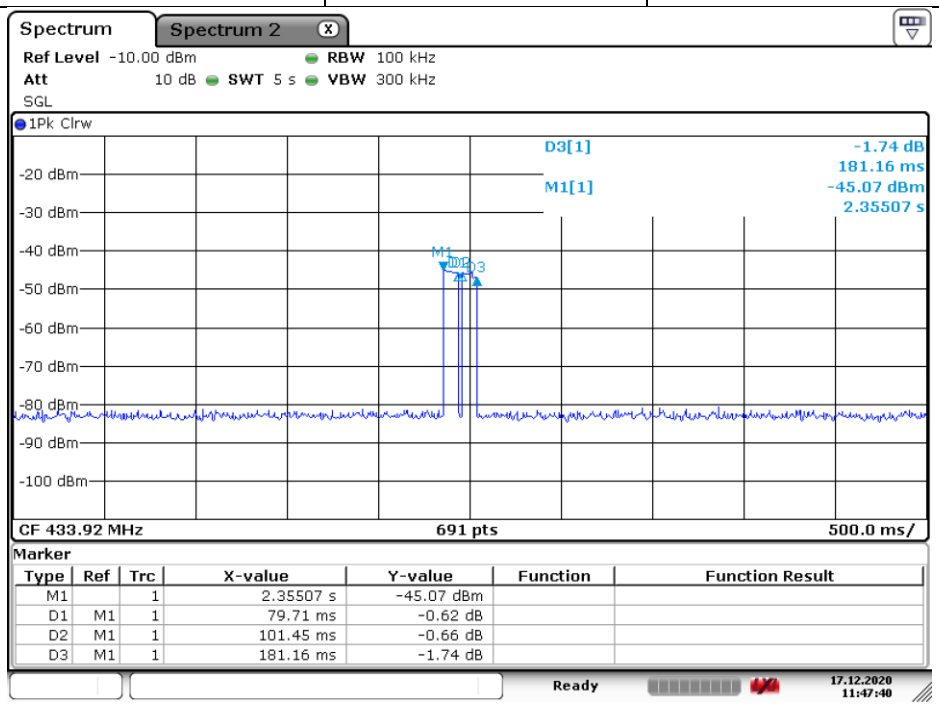
4.4.3 Test Procedure

	Reference Rule	Chapter	Description
☒	CFR 47	15.231	Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.
2. Set the EUT to proper test channel.
3. Single scan the transmission, and read the transmission time.

4.4.4 Test Data

Frequency (MHz)	Duration Time (ms)	Limit (S)	Result
433.92	159.42	＜5.0	Pass



Date: 17.DEC.2020 11:47:40

4.5 Antenna Requirement	VERDICT: PASS

4.5.1 Limit:	
Standard	FCC Part 15 Subpart E Paragraph 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.	

4.5.2 Antenna Connector Construction:	
☒	The use of a permanently attached antenna
☐	The antenna use of a unique coupling to the intentional radiator
☐	The use of a nonstandard antenna jack or electrical connector
Please refer to the attached document “Internal Photograph” to show the antenna connector.	

5 TEST SETUP PHOTO AND EUT PHOTO	VERDICT: PASS

Remark: The test setup photo and EUT Photo please see appendix.

The End