

FCC Test Report

Application No.: HKEM1810000864HS
Applicant: Contin Technology Limited
Address: Flat H, 4/F, Valiant industrial Building, 2-12 Au Pui Wan Street,
Fo Tan, Sha Tin, New Territories, Hong Kong.

Product Information:
Product Description: Single Door Strip Monitor
Model No.: TL-4005
Product Class : Low Power Communication Device – Transmitter (433MHz)
FCC ID : 2AROFTL-4005
Requirement: CFR 47 FCC PART 15 SUBPART C, 2018
- Intentional Radiators. (Section 15.231)
Date of Receipt: 2018-10-29, 2019-01-31
Date of Test: 2018-11-16 to 2019-02-21
Date of Issue: 2019-02-21

Test Result :	PASS*
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* In the configuration tested, the EUT complied with the requirements for the relevant clauses of Federal Communications Commission Rules as specified above.

Authorized Signature:



Ivan Toa
EMC 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.

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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2 Test Summary

Test	Test Requirement	Test Method	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.203:2019	N/A	PASS
Conducted Emissions at Mains Terminals (150 KHz to 30 MHz)	47 CFR Part 15, Subpart C 15.209:2018	ANSI C63.10 (2013) Section 6.2	PASS
Radiated Emission	47 CFR Part 15, Subpart C 15.231(b):2018	ANSI C 63.10: Clause 6.4, 6.5 and 6.6	PASS
20dB Bandwidth	47 CFR Part 15, Subpart C 15.231(c):2018	ANSI C63.10 (2013) Section 6.9	PASS
Dwell Time	47 CFR Part 15, Subpart C 15.231(a):2018	ANSI C63.10 (2013) Section 7.6.3	PASS
Remark : 1) ANSI C 63.10 is version ANSI C 63.10:2013			

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4 General Information

4.1 General Description of EUT

EUT Name: Single Door Strip Monitor
Model No.: TL-4005

4.2 Details of EUT

Power Supply: AC120V~ 60Hz to DC 12V
Power Cord: DC cable: unscreened 180cm cable
Operating frequency: 433.81MHz
Modulation Type: FSK
Antenna type: Wire Antenna
Antenna gain: 2.5 dBi

4.3 Conditions of EUT

The received sample was under good condition.

4.4 Description of Support Units

The EUT has been tested as an independent unit.

4.5 Standards Applicable for Testing

CFR 47, FCC Part 15, 2018
ANSI C63.10:2013

4.6 Test Location

All tests were performed at: -

SGS IECC Limited (Member of the SGS Group (SGS SA))

Units 303-305, 3/F., 31 Lok Yip Road, On Lok Tsuen, Fanling, N.T., Hong Kong

Tel: +852 2305 2570 Fax: +852 2756 4480.

No tests were sub-contracted.

4.7 Test Facility

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

- **HOKLAS (Lab Code: 125)**

SGS IECC Limited has been accepted by HKAS Executive, on the recommendation of the Accreditation Advisory Board, as a HOKLAS Accredited Laboratory, this laboratory meets the requirements of ISO/IEC 17025:2005 as it has been accredited for performing specific test as listed in the scope of accreditation within the test category of Electrical and Electronic Products.

- **FCC Recognized Accredited Test Firm(CAB Registration No.: 446297)**

SGS IECC Limited has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.
Designation Number: HK0010, Test Firm Registration Number: 446297.

- **Industry Canada (Registration No.: 5193A-2)**

The 3m Alternative Semi-anechoic chamber of SGS IECC Limited has been registered by Certification and Engineering of Industry Canada for radio equipment testing with Registration No. **5193A-2**.

4.8 Deviation from Standards

None.

4.9 Abnormalities from Standard Conditions

None.

4.10 Declaration of Family Grouping

None.

4.11 Abbreviations

N/A: Not Applicable
EUT: Equipment Under Test

4.12 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radiated disturbance 9 kHz - 30MHz	±4.09
2	Radiated disturbance 30MHz – 1GHz	±5.26
3	Radiated disturbance 1GHz – 18GHz	±5.11
4	Conducted Emissions	±2.71

Remark:

The Ulab (lab Uncertainty) is less than Ucispr (CISPR Uncertainty), so the test results

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

5 Equipments Used during Test

Equipment	Manufacturer	Model / Serial No.	Cal. Due Date
EMI Test Receiver 9kHz to 3.6GHz	Rohde & Schwarz	ESR3 / 102326	2019/08/12
Antenna	Schaffner	CBL6111C / 2791	2019/10/26
Loop Antenna	Rohde & Schwarz	HFH2-Z2 / 871336/48	2020/01/21
Antenna	Schwarzbeck	BBA9106 / TE039A	2020/01/29
Antenna	Schwarzbeck	UHALP9107 / TE039B	2020/01/29
Millivoltmeter	Rohde & Schwarz	URV5 / 846254/013	2019/09/24
100V insertion Unit	Rohde & Schwarz	URV5-Z4 / 100138	2019/09/24
Amplifier	TESEQ	CBAIG-070 / T43859	--
Antenna Mast System	Schwarzbeck	AM9104 / -	--
Turntable with Controller	Drehtisch	DT312 / -	--
Spectrum Analyzer	Rohde & Schwarz	FSP30 / 101474	2019/05/22
Horn Antenna	Schwarzbeck	BBHA9120D / 9120D-1070	2020/01/29
Horn Antenna	Schwarzbeck	BBHA9170 / 9170-492	2019/10/16
Preamplifier	Schwarzbeck	BBV9718 / 9718-223	2020/01/27
Preamplifier	Schwarzbeck	BBV9719 / 9719-019	2019/12/20
Highpass Filter	Wainwright	WHNX3.5/26.5G-6SS / nil	2019/12/18
Band Reject Filter	Wainwright	WRCJV 2400/2500-2100/2800-40/3SS / nil	2019/12/18
RF cable	HUBER+SUHNER	SF104-26.5/2	2019/12/26

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Conducted Emission			
Equipment	Manufacturer	Model / Serial No.	Calibration Due
Test Receiver	Rohde & Schwarz	ESHS 30 / 839667/002	2019/09/17
Signal Generator	Rohde & Schwarz	SMT03 / 832939/017	2019/05/22
Artificial Mains Network (LISN)	Schwarzbeck	NSLK 8127 / 8127312	2019/05/22
Impulse Limiter	Rohde & Schwarz	ESH-3-Z2 / 357881052	2019/10/07

Test Results

5.1 Antenna Requirement

5.1.1 Standard Requirement

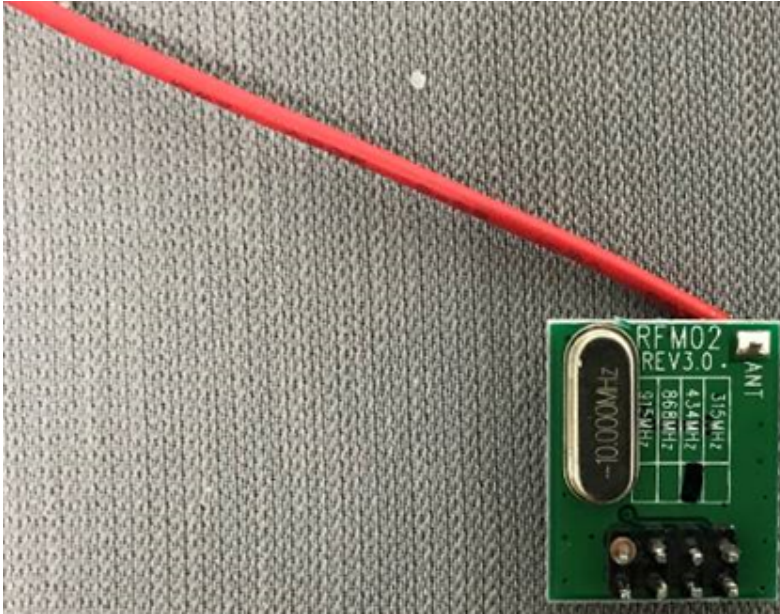
15.203 requirement:

For intentional device. According to 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.

5.1.2 EUT Antenna

The antenna type is wire antenna. The maximum gain of the antenna is 2.5 dBi.

Photos of the antenna refer to Section 5: Photograph of this report.



Test result: The unit does meet the FCC requirements.

5.2 Conducted Emissions Mains Terminals, 150 kHz to 30MHz

Test Requirement: FCC Part15 C
Test Method: ANSI C63.10
Test Voltage: AC 120V
Test Date: 2019-02-21
Frequency Range: 150kHz to 30MHz
Detector: Peak for pre-scan
 Quasi-Peak and Average at frequency with maximum peak
 (9 kHz resolution bandwidth)
Class / Limit: Class B

Frequency range MHz	Class B Limits	
	dB (μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

NOTE 1: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz

NOTE 2: The lower limit is applicable at the transition frequency.

5.2.1 E.U.T. Operation

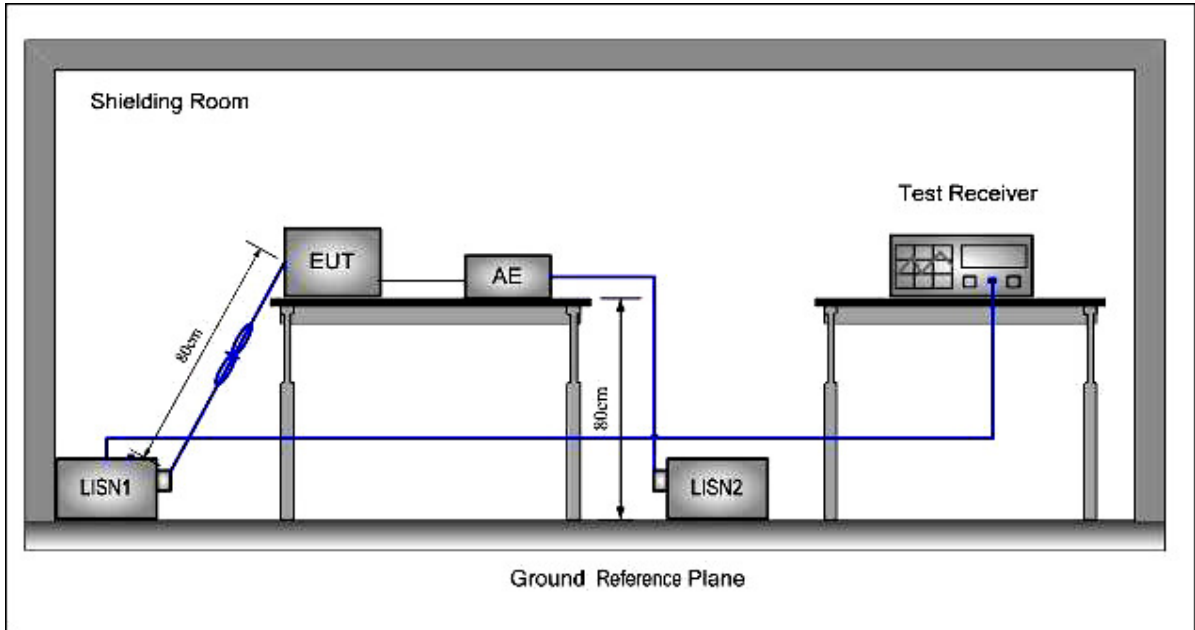
Operating Environment:

Temperature: 24.7 °C Humidity: 57 %RH

EUT Operation: Pre-test with Peak detector with the following mode(s):
1: Transmission in continuous transmitting mode.

Final test with Quasi-Peak and Average detector with the following mode(s):
1: Transmission in continuous transmitting mode.

5.2.2 Test Setup and Procedure



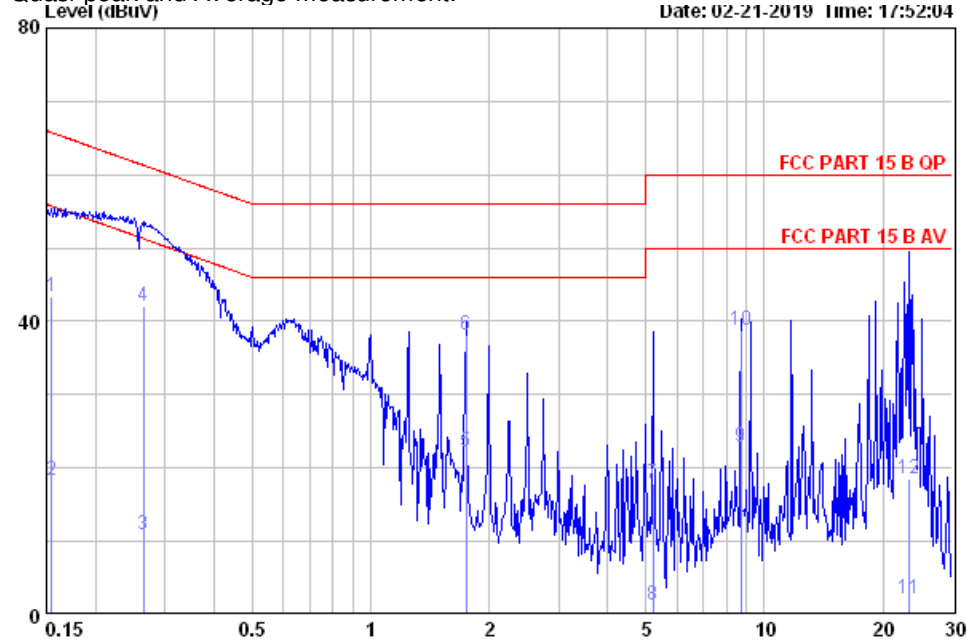
1. The mains terminal disturbance voltage test was conducted in a shielded room.
2. The EUT was connected to nominal power supply through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.
4. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5.2.3 Measurement Data

Live line:

Peak Scan:

Quasi-peak and Average measurement:



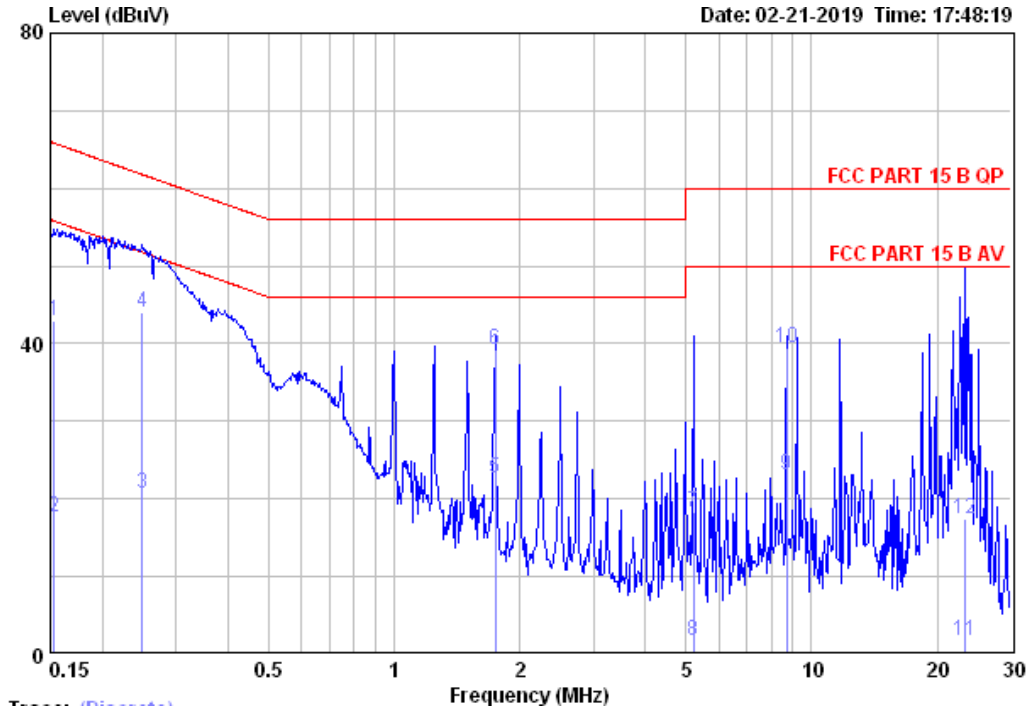
	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.15	0.00	9.93	33.53	43.46	65.74	-22.28	QP
2	0.15	0.00	9.93	8.36	18.29	55.74	-37.45	AVERAGE
3	0.26	0.00	9.93	0.96	10.89	51.29	-40.40	AVERAGE
4	0.26	0.00	9.93	32.04	41.97	61.29	-19.32	QP
5	1.74	0.00	9.99	12.15	22.14	46.00	-23.86	AVERAGE
6 peak	1.74	0.00	9.99	28.23	38.22	56.00	-17.78	QP
7	5.22	0.00	10.12	7.82	17.94	60.00	-42.06	QP
8	5.22	0.00	10.12	-8.84	1.28	50.00	-48.72	AVERAGE
9	8.73	0.00	10.28	12.54	22.82	50.00	-27.18	AVERAGE
10	8.73	0.00	10.28	28.58	38.86	60.00	-21.14	QP
11	23.39	0.00	10.69	-8.47	2.22	50.00	-47.78	AVERAGE
12	23.39	0.00	10.69	7.73	18.42	60.00	-41.58	QP

Level = Read Level + LISN Factor + Cable Loss.

Neutral line:

Peak Scan:

Quasi-peak and Average measurement:



	Freq	Cable Loss	LISN Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.15	0.00	9.95	32.92	42.87	65.82	-22.95	QP
2	0.15	0.00	9.95	7.69	17.64	55.82	-38.18	AVERAGE
3	0.25	0.00	9.95	10.66	20.61	51.78	-31.17	AVERAGE
4	0.25	0.00	9.95	34.17	44.12	61.78	-17.66	QP
5	1.74	0.00	10.01	12.70	22.71	46.00	-23.29	AVERAGE
6 peak	1.74	0.00	10.01	29.20	39.21	56.00	-16.79	QP
7	5.22	0.00	10.14	8.10	18.24	60.00	-41.76	QP
8	5.22	0.00	10.14	-8.37	1.77	50.00	-48.23	AVERAGE
9	8.73	0.00	10.29	12.86	23.15	50.00	-26.85	AVERAGE
10	8.73	0.00	10.29	29.24	39.53	60.00	-20.47	QP
11	23.39	0.00	10.72	-8.97	1.75	50.00	-48.25	AVERAGE
12	23.39	0.00	10.72	6.62	17.34	60.00	-42.66	QP

Level = Read Level + LISN Factor + Cable Loss.

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5.3 Radiated Emissions, 9kHz to 1GHz

Test Requirement: FCC Part15 C
 Test Method: ANSI C63.10
 Test Date: 2019-01-26
 Frequency Range: 9kHz to 1GHz
 Measurement Distance: 3m
 Detector: Peak for pre-scan
 (200Hz resolution bandwidth and 1kHz video bandwidth for measurement between 9kHz – 150kHz)
 (9kHz resolution bandwidth and 100kHz video bandwidth for measurement between 150kHz – 30MHz)
 120kHz resolution bandwidth and 1MHz video bandwidth for measurement between 30MHz to 1GHz)
 Quasi-Peak if maximised peak within 6dB of limit

Limit :

Frequency range MHz	Quasi-peak limits dB (µV/m)
0.009 – 0.490	-72.4 – 20logF(MHz)
0.490 – 1.705	-12.4 – 20logF(MHz)
1.705 – 30.0	-10.5
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960	54
Note: 1) At transitional frequencies the lower limit applies. 2) F is the frequency of the spurious emission measured in MHz. 3) Limit from 0.009 – 30 MHz is converted from measuring distance 300m or 30m to 3m with the formula provided in FCC Part 15, section 15.31(f)(2)	

5.3.1 EUT Operation

Operating Environment:

Temperature: 24°C Humidity: 57%

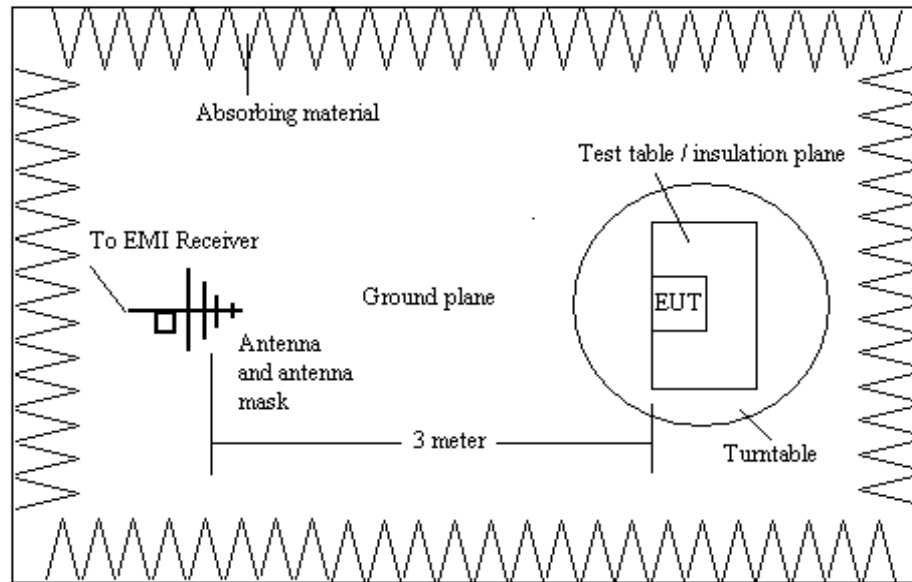
EUT Operation: Pre-test with Peak detector with the following mode(s):

1. Transmission in continuous transmitting mode.

Final test with Peak detector with the following mode(s):

1. Transmission in continuous transmitting mode.

5.3.2 Test Setup and Procedure



1. The pre-test of the radiated emissions test was conducted in a semi-anechoic chamber and the final measurement was conducted in the open area test site.
2. The EUT was operated with new battery. The EUT was placed upon a non-metallic table 0.8m above the ground reference plane.
3. Bilog antenna was used for the frequency range from 30MHz to 1GHz
4. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emissions spectrum plots of the EUT with located frequencies.
5. The actual frequencies of maximum emission were confirmed in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.

5.3.3 Measurement Data

An initial pre-scan was performed in the 3m chamber using the spectrum analyser in peak detection mode. The EUT was measured by Bilog antenna with 2 orthogonal polarities and frequencies of peak emissions from the EUT were detected within 6dB of the limit line. Final measurement was conducted in the open area test site with data as follows:

(a) Measurement within operation band (Fundamental emission):

Frequency (MHz)	Antenna Polarity	Test Results (dB μ V/m)		FCC Limit (dB μ V/m)	
		Peak	Average*	Peak	Average
433.81	H	81.90	76.84	100.82	80.82
	V	70.40	65.34	100.82	80.82

Note : (1) The above peak value is the maximum value of the measurement in the 3 orthogonal planes

(2) * Calculation for radiation (average) :

Formula : Duty cycle = (N1L1 + N2L2 + ... + Nn-1Ln-1 + NnLn) / 100 or T

where

N1 is the number of type 1 pulse, L1 is length of type 1 pulse, etc.

T is the period of the pulse train (if less than 100ms)

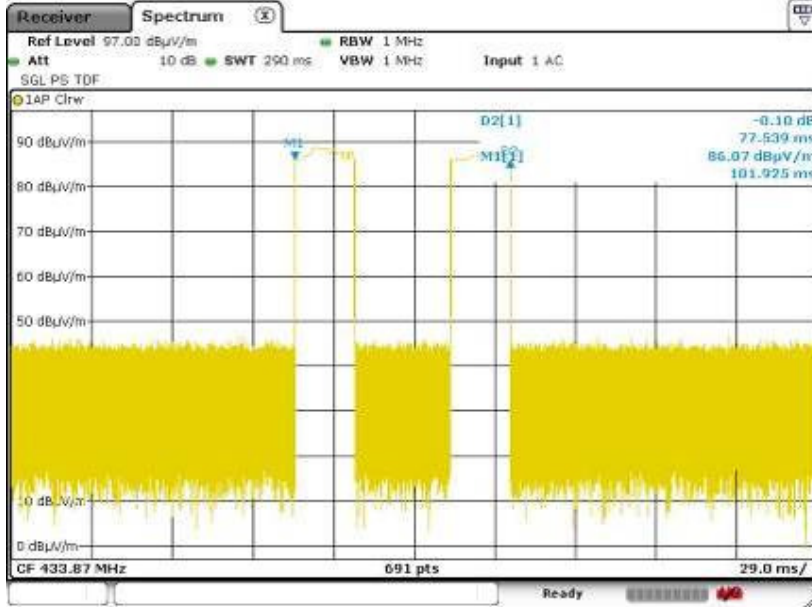
According to the time domain plots shown on the section 6.2.3 (b) & (c) in this report :

$$\begin{aligned} \text{Duty cycle of the EUT} &= (2 \times 21.641) / 77.539 \\ &= 0.558 \end{aligned}$$

$$\begin{aligned} \text{Av correction factor} &= 20 \times \log(0.558) \text{ dB} \\ &= -5.06 \text{ dB} \end{aligned}$$

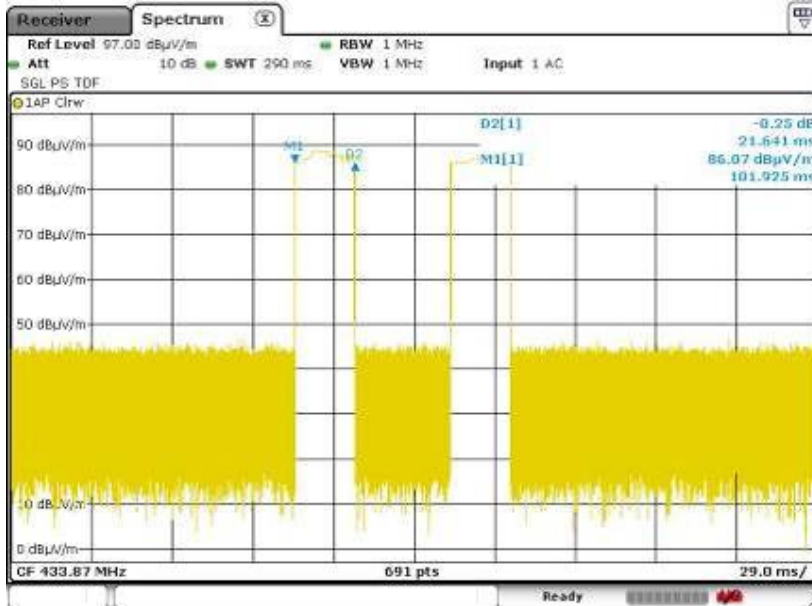
$$\begin{aligned} \text{Radiation (average)} &= \text{Radiation (peak)} + \text{Av correction factor} \\ &= 81.90 - 5.06 \text{ dB}(\mu\text{V/m}) = 76.84 \text{ dB}(\mu\text{V/m}) \quad (\text{Horizontal ant.}) \\ &= 70.40 - 5.06 \text{ dB}(\mu\text{V/m}) = 65.34 \text{ dB}(\mu\text{V/m}) \quad (\text{Vertical ant.}) \end{aligned}$$

(b) Time Domain Plots (Fundamental frequency of Transmitter) :



Pulse cycle period = 77.539 ms

(c) Time Domain Plots (Fundamental frequency of Transmitter) :



Pulse width = 21.641 ms (total no. of pulse : 2)

(d) Test results of spurious emission, section 15.209 & 15.231:

Frequency (MHz)	Antenna Polarization	Correction Factor (dB/m)	Receiver QP Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)	Over Limit (dB)
33.120	H	13.7	8.3	22.0	40	-18.0
56.300	H	13.2	6.3	19.5	40	-20.5
100.430	V	10.7	14.4	25.1	43.5	-18.4
158.150	V	14.6	7.1	21.7	43.5	-21.8
398.330	H	16.2	6.1	22.3	46	-23.7
726.130	V	23.6	9.8	33.4	46	-12.6

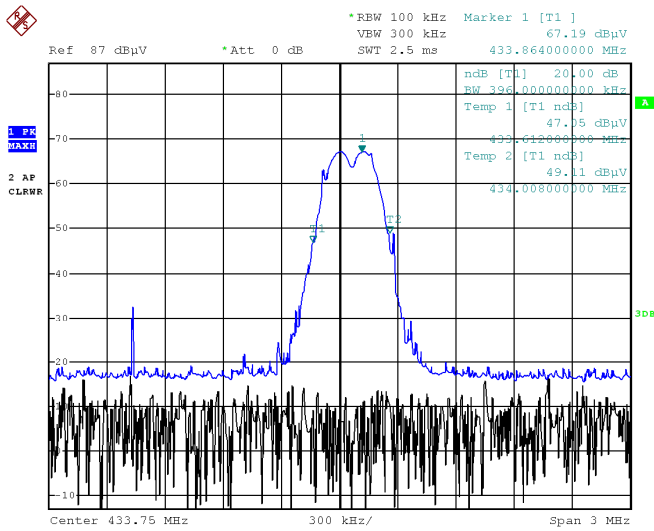
Note:

- 1) The spurious radiated emissions (9kHz to 30MHz) measured by the loop antenna was negligible (more than 20dB below limit)
- 2) All readings are Quasi-Peak values.
- 3) Correction Factor = Antenna Factor + Cable Loss.
- 4) The above results were the worst case results with the EUT positioned in all 3 axis during the test. The EUT was positioned vertically and horizontally on the table for vertical and horizontal measurement respectively and with its antenna fully extended.
- 5) The actual frequencies of maximum emission were confirmed in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance.
- 6) Other emission more than 20dB below limit is not recorded.

5.4 20 dB Bandwidth

Test Requirement: FCC Part15 C
 Test Method: ANSI C63.10
 Test Date: 2019-02-02
 EUT Operation: 1: Transmission in continuous transmitting mode.
 Result: Pass

Test Plot :



Date: 2.FEB.2019 12:25:09

Test Results:

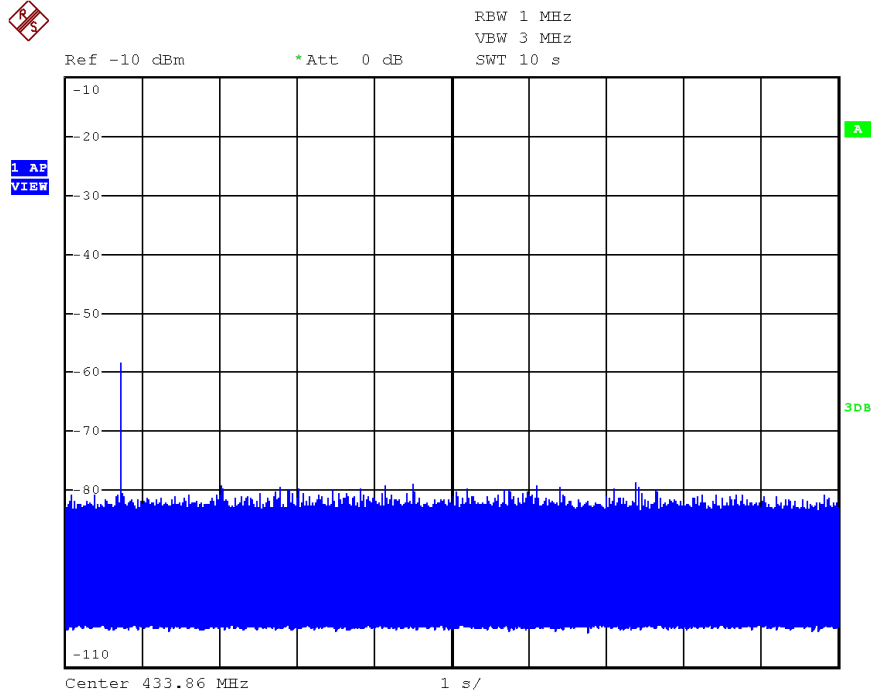
Frequency (MHz)	20dB Bandwidth (kHz)	Maximum Limit (kHz)	Result
433.81	396	1084.75	PASS

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5.5 Transmission Time control:

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released, and the below plot shown the requirement is meet



5.6 Radiated Emissions above 1 GHz

Test Requirement: FCC Part15 C
 Test Method: ANSI C63.10
 Test Date: 2019-02-12
 Test Voltage: AC120V
 Frequency Range: 1GHz – 5GHz
 Measurement Distance: 3m
 Detector: Peak for pre-scan (1MHz resolution bandwidth, 1MHz video bandwidth)
 Average and Peak detector for final test

Limit:

Spurious Emission:

Frequency range MHz	Limits (Peak) dB (μV/m)	Limits (Average) dB (μV/m)
Over 1000	74	54

5.6.1 EUT Operation

Operating Environment:

Temperature: 21 °C Humidity: 59 %

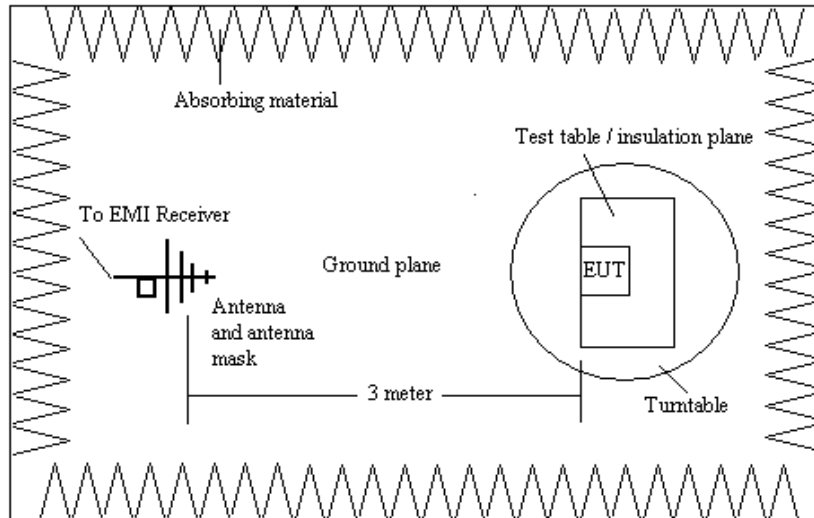
EUT Operation: Pre-test with Peak detector with the following mode(s):

- 1: Transmission in continuous transmitting mode.

Final test with Quasi-Peak detector with the following mode(s):

- 1: Transmission in continuous transmitting mode.

5.6.2 Test Setup and Procedure



1. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 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.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. 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.
4. 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.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. 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.
7. Test the EUT in the lowest channel, the middle channel, the Highest channel
8. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the Y axis positioning which it is worse case.
9. Repeat above procedures until all frequencies measured was complete.

5.6.3 Measurement Data

An initial pre-scan was performed in the 3m chamber using the spectrum analyzer in peak detection mode. The EUT was measured with 3 orthogonal polarities and frequencies of average emissions from the EUT were measured as follows:

Test results:

(1) Spurious Emission

Frequency (MHz)	Antenna Polarization	Emission Level (dB μ V/m)		Limit (dB μ V/m)		Remark
		Peak	Average	Peak	Average	
1008	H	36.64	17.75	74	54	Pass
1790	H	32.84	15.39	74	54	Pass
1890	V	33.21	18.95	74	54	Pass
2791	H	43.58	41.04	74	54	Pass
3440	H	38.12	23.48	74	54	Pass
4690	V	40.75	26.38	74	54	Pass

Note:

- 1) The above results were the worst-case results with the EUT positioned in all 3 axes during the test. The EUT was positioned vertically and horizontally on the table for vertical and horizontal measurement respectively.
- 2) Other emissions more than 20dB below the limit are not shown on the above table and only worst six emissions below 1GHz are listed.

6 Photographs

6.1 Radiated Emissions Test Setup

Remark: Photos refer to Setuo photo.

6.2 EUT Constructional Details

Remark: Photos refer to Appendix:External photo and nternal photo.

-- END OF REPORT --