FCC TEST REPORT

Product Name:	Smart TAG
Trade Mark:	Smart TAG
Model No.:	TAG-BASCULAMENTO E IMPLEMENTO
Report Number:	180516001RFC-1
Test Standards:	FCC 47 CFR Part 15 Subpart C
FCC ID:	2AP5J-GC303637
Test Result:	PASS
Date of Issue:	June 19, 2018

Prepared for:

TECSOIL AUTOMACAO E SISTEMAS S.A.
RUA ABRAHAO VINHAS, 242, SALA 1 E 2, ARACATUBA, Brazil

Prepared by:

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Date: June 19, 2018

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Version

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V1.0	June 19, 2018	Original

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	TECSOIL AUTOMACAO E SISTEMAS S.A.
Address of Applicant:	RUA ABRAHAO VINHAS, 242, SALA 1 E 2, ARACATUBA, Brazil
Manufacturer:	TECSOIL AUTOMACAO E SISTEMAS S.A.
Address of Manufacturer:	RUA ABRAHAO VINHAS, 242, SALA 1 E 2, ARACATUBA, Brazil

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Smart TAG
Model No.:	TAG-BASCULAMENTO E IMPLEMENTO
Add. Model No.:	N/A
Trade Mark:	Smart TAG
DUT Stage:	Production Unit
EUT Supports Function:	433.100 MHz
Sample Received Date:	May 15, 2018
Sample Tested Date:	May 15, 2018 to May 18, 2018

1.2.2 Description of Accessories

None

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Nominal Operating Frequency:	433.100 MHz
Type of Modulation:	FSK
Number of Channels:	1
Antenna Type:	Onboard omnidirectional
Antenna Gain:	-3 dBi
Maximum Field Strength:	71.18 dBµV/m
Normal Test Voltage:	3.0V Battery

1.4 OTHER INFORMATION

None

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested independently

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China 518109
Telephone: +86 (0) 755 2823 0888
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1.7 TEST FACILITY

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

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

IC-Registration No.: 21600-1
The 3m Semi-anechoic chamber of Shenzhen UnionTrust Quality and Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 21600-1.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	±3.8 dB
2	Conducted emission 150KHz-30MHz	±3.4 dB
3	Radiated emission 9KHz-30MHz	±4.9 dB
4	Radiated emission 30MHz-1GHz	±4.7 dB
5	Radiated emission 1GHz-18GHz	±5.1 dB
6	Radiated emission 18GHz-26GHz	±5.2 dB
7	Radiated emission 26GHz-40GHz	±5.2 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart C Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203	ANSI C63.10-2013	PASS
Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	N/A Note 1, 2
Radiated Emissions	FCC 47 CFR Part 15 Subpart C Section 15.231(e)/15.209/15.205	ANSI C63.10-2013	PASS
20DB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.231 (c)	ANSI C63.10-2013	PASS
Transmit Time and Silent Period	FCC 47 CFR Part 15 Subpart C Section 15.231 (e)	ANSI C63.10-2013	PASS

Note:

1) N/A: In this whole report not application.
2) The EUT is powered by 3.0V battery.

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☑	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Dec. 20, 2015	Dec. 19, 2018
☑	Receiver	R&S	ESIB26	100114	Dec. 10, 2017	Dec. 10, 2018
☑	Loop Antenna	ETS-LINDGREN	6502	00202525	Dec. 22, 2017	Dec. 22, 2018
☑	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Dec. 17, 2017	Dec. 17, 2018
☑	Preamplifier	HP	8447F	2805A02960	Dec. 10, 2017	Dec. 10, 2018
☑	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☑	Test Software	Audix	e3	Software Version: 9.160323		

Conducted RF test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☐	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Dec. 10, 2017	Dec. 10, 2018
☑	Receiver	R&S	ESR7	1316.3003K07 -101181-K3	Dec. 10, 2017	Dec. 10, 2018

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage	Relative Humidity (%)
NT/NV	+15 to +35	3.0V Battery	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.2 TEST CHANNELS

Frequency	Test RF Channel
433.100 MHz	Channel 1
	433.100 MHz

4.3 EUT TEST STATUS

Frequency	Tx Function	Description
433.100 MHz	1Tx	1. Keep the EUT in continuously transmitting with modulation test single.

4.4 TEST SETUP

4.4.1 For Radiated Emissions test setup

Figure 1. Below 30MHz

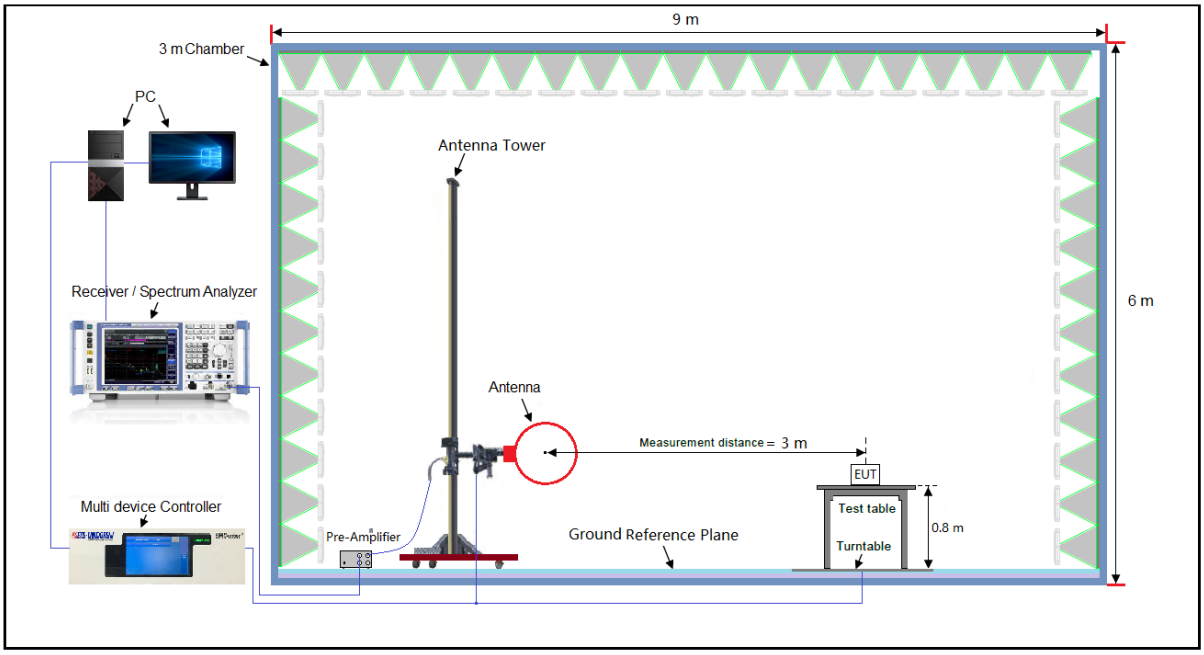
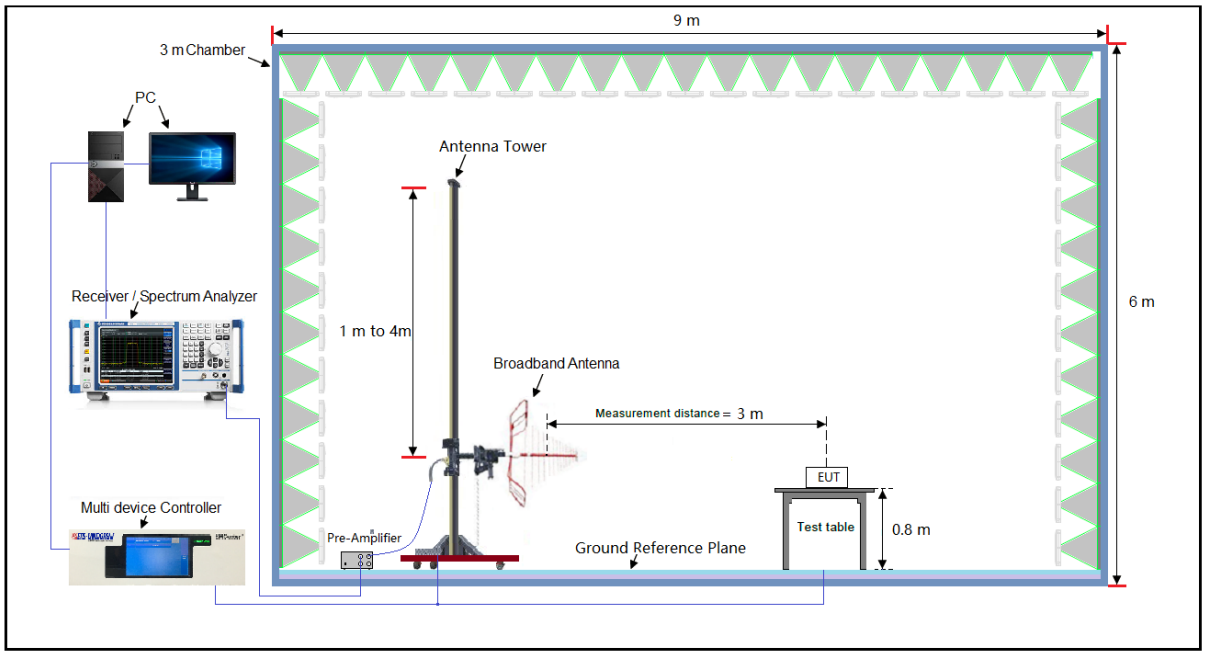
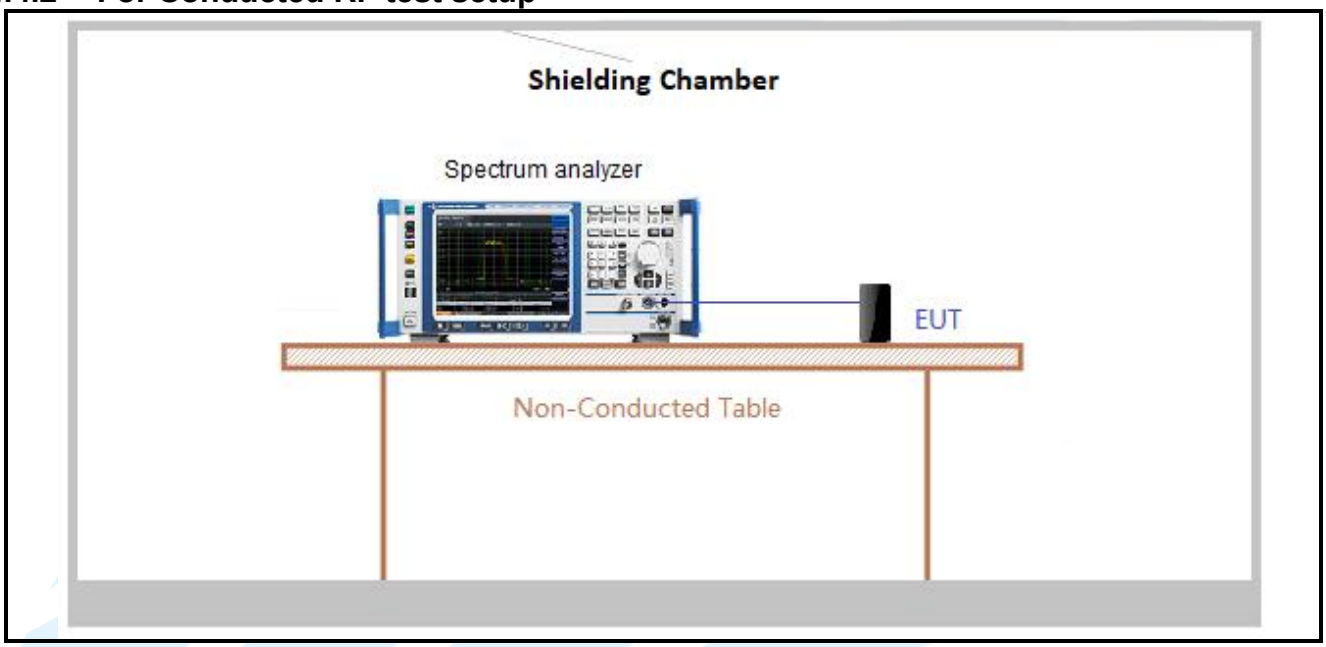


Figure 2. 30MHz to 1GHz



4.4.2 For Conducted RF test setup



4.5 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 3.0V battery. Only the worst case data were recorded in this test report.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 15	Radio Frequency Devices
2	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 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 permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, 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.
EUT Antenna:
This product has a permanent antenna, fulfill the requirement of this section.

5.3 20DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.231 (c)

Test Method: ANSI C63.10

Limit: 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. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Procedure: Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

a) Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
b) 1% ≤RBW ≤5% of the 20 dB bandwidth
c) VBW ≥ RBW
d) Sweep = auto;
e) Detector function = peak
f) Trace = max hold
g) All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down bandwidth of the emission.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.4.3 for details.

Instruments Used: Refer to section 3 for details

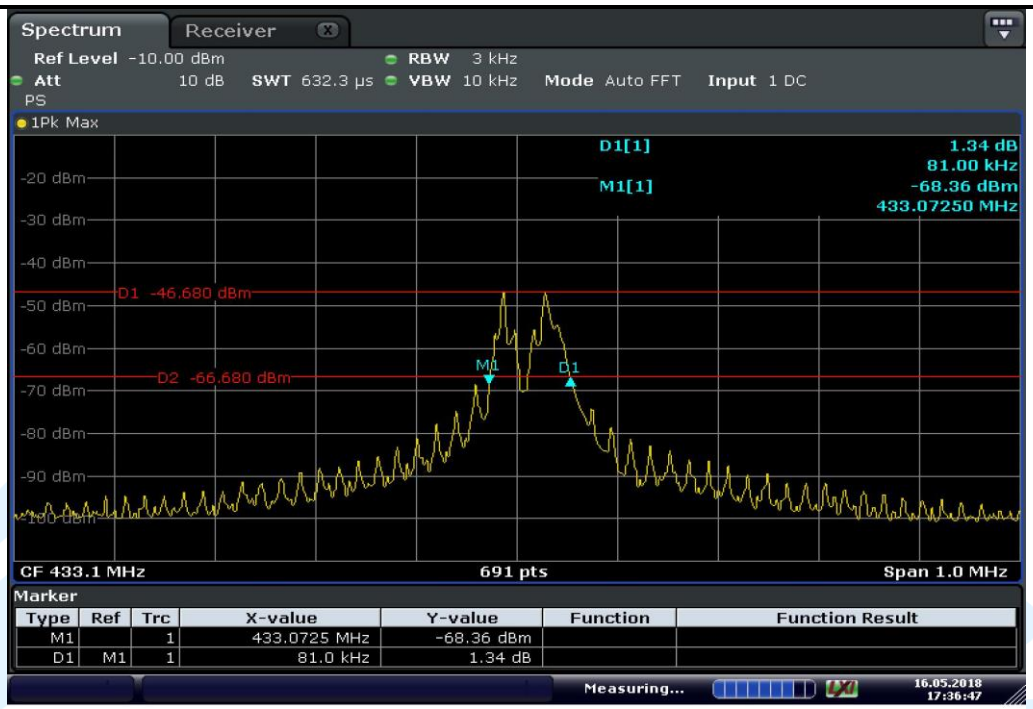
Test Mode: Transmitter mode

Test Results: Pass

Test Data:

Frequency (MHz)	20 dB Bandwidth (MHz)	Limit	Pass / Fail
433.100 MHz	0.081	**433.100 MHz * 0.25% = 1.08275 MHz**	Pass

Test plot as follows:


Spectrum
Receiver
Ref Level -10.00 dBm
RBW 3 kHz
Att 10 dB
SWT 632.3 µs
VBW 10 kHz
Mode Auto FFT
Input 1 DC
PS
1Pk Max
D1[1]
1.34 dB
81.00 kHz
M1[1]
-68.36 dBm
433.07250 MHz
-20 dBm
-30 dBm
-40 dBm
D1 -46.680 dBm
-50 dBm
-60 dBm
D2 -66.680 dBm
M1
D1
-70 dBm
-80 dBm
-90 dBm
CF 433.1 MHz
691 pts
Span 1.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 433.0725 MHz -68.36 dBm
D1 M1 1 81.0 kHz 1.34 dB
Measuring...
16.05.2018
17:36:47
Date: 16.MAY.2018 17:36:46

5.4 TRANSMIT TIME AND SILENT PERIOD

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.231 (e)

Test Method: ANSI C63.10

Limit: Devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Test Setup: Refer to section 4.4.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Transmitter mode

Test Results: Pass

Test Data:

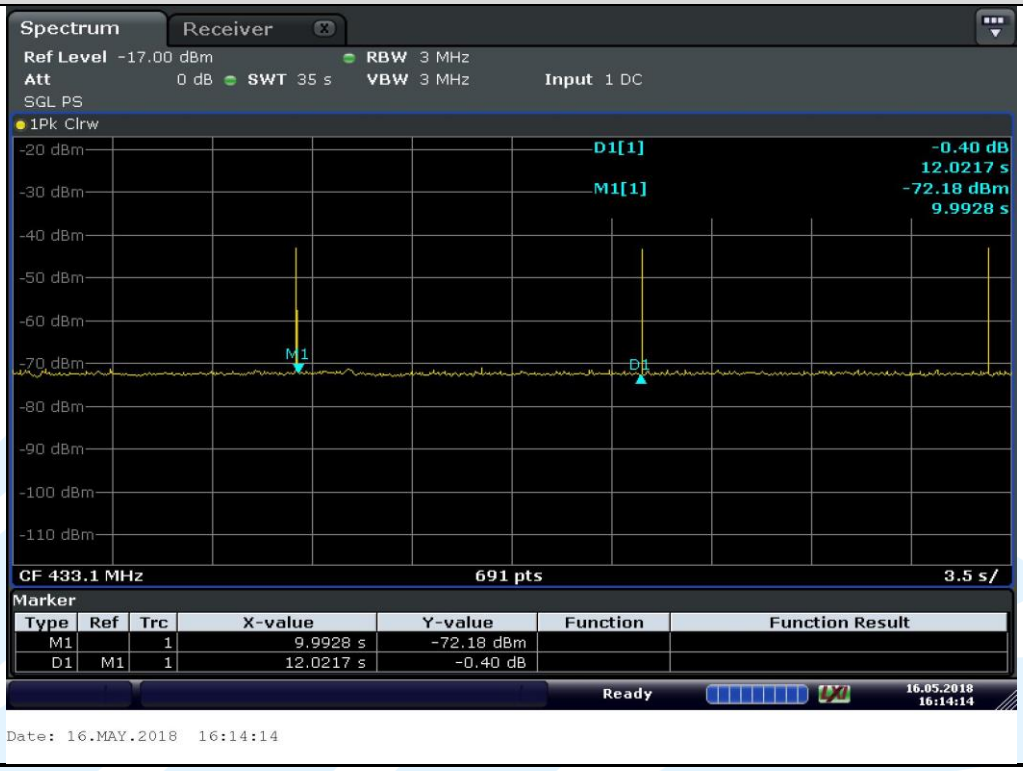
Test item	Test Value	Limit	Pass / Fail
Transmitting time	13.768 ms	not be greater than one second	Pass
Silent Period	12.02	>30 times the transmit time and >=10 seconds.	Pass

Test plot as follows:

Transmitting time

Date: 16.MAY.2018 16:17:26

Silent Period



5.5 RADIATED EMISSIONS

Test Requirement: FCC 47 CFR Part 15 Subpart C 15.231(e)/15.209/15.205

Test Method: ANSI C63.10-2013 Section 6.6.4.3

Receiver Setup:

Frequency	RBW
0.009 MHz-0.150 MHz	200/300 kHz
0.150 MHz -30 MHz	9/10 kHz
30 MHz-1 GHz	100/120 kHz
Above 1 GHz	1 MHz

Limits:

For FCC 47 CFR Part 15 Subpart C 15.231(e)

Frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of fundamental (dBμV/m)	Field strength of spurious emission (microvolts/meter)	Field strength of spurious emission (dBμV/m)
40.66-40.70	1,000	60.00	100	40.0
70-130	500	53.98	50	33.98
130-174	500 to 1,500[1]	53.98 to	50 to 150[1]	33.98 to 43.52
174-260	1,500	63.52	150	43.52
260-470	1,500 to 5,000[1]	63.52 to 73.98	150 to 500[1]	43.52 to 53.98
Above 470	5,000	73.98	500	53.98
[1]Linear interpolations.				

FCC 47 CFR Part 15 Subpart C 15.209

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009 MHz-0.490 MHz	2400/F(kHz)	--	--	300
0.490 MHz-1.705 MHz	24000/F(kHz)	--	--	30
1.705 MHz-30 MHz	30	--	--	30
30 MHz-88 MHz	100	40.0	Quasi-peak	3
88 MHz-216 MHz	150	43.5	Quasi-peak	3
216 MHz-960 MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1 GHz	500	54.0	Average	3

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, 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 20 dB under any condition of modulation.

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. 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 rota table 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) The radiation measurements are performed in X, Y, Z axis positioning. And found the Y axis positioning which it is worse case, only the test worst case mode is recorded in the report.(for portable and mobile devices)

Remark: Test Procedure: For testing performed with the loop antenna, testing was performed in accordance to ANSI C63.10: 2009. 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.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

Field strength of fundamental:					
Fundamental frequency	**Polari-zation**	**Detector**	**Result at 3m (dBμV/m)**	**Limit at 3m (dBμV/m)**	**Margin (dB)**
433.100 MHz	V	Peak	71.18	92.84	-21.66
	V	Average	53.96	72.84	-18.88
	H	Peak	66.86	92.84	-25.98
	H	Average	49.64	72.84	-23.20

Note:

1. Average value = Peak value + Average factor;
2. Average factor =20 log (Duty cycle) = -17.22;
3. Duty cycle = T on time / T period;
4. T on time = 13.768 ms;
5. T period = 100 ms;

Radiated Emission Test Data (9 KHz ~ 30 MHz):
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

Radiated Emission Test Data:

No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	866.20	53.99	72.84	-18.85	Peak	Horizontal
2	866.20	36.77	52.84	-16.07	Average	Horizontal
3	1299.30	54.97	72.84	-17.87	Peak	Horizontal
4	1299.30	37.75	52.84	-15.09	Average	Horizontal
5	1732.40	48.76	72.84	-24.08	Peak	Horizontal
6	1732.40	31.54	52.84	-21.30	Average	Horizontal
7	2165.50	50.19	72.84	-22.65	Peak	Horizontal
8	2165.50	32.97	52.84	-19.87	Average	Horizontal
9	866.20	51.61	72.84	-21.23	Peak	Vertical
10	866.20	34.39	52.84	-18.45	Average	Vertical
11	1299.30	49.30	72.84	-23.54	Peak	Vertical
12	1299.30	32.08	52.84	-20.76	Average	Vertical
13	1732.40	45.65	72.84	-27.19	Peak	Vertical
14	1732.40	28.43	52.84	-24.41	Average	Vertical
15	2165.50	47.80	72.84	-25.04	Peak	Vertical
16	2165.50	30.58	52.84	-22.26	Average	Vertical
17	3031.70	48.49	72.84	-24.35	Peak	Horizontal
18	3031.70	31.27	52.84	-21.57	Average	Horizontal
19	4331.00	58.30	72.84	-14.54	Peak	Horizontal
20	4331.00	41.08	52.84	-11.76	Average	Horizontal
21	3031.70	51.27	72.84	-21.57	Peak	Horizontal
22	3031.70	34.05	52.84	-18.79	Average	Horizontal
23	4331.00	59.58	72.84	-13.26	Peak	Vertical
24	4331.00	42.36	52.84	-10.48	Average	Vertical

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

The test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of UnionTrust, this report can't be reproduced except in full.