FCC REPORT
(LoRa WAN)

Applicant:	SPE SMARTICO, LLC
Address of Applicant:	82G, Oleksandra Polya Avenue, Dnipro, Ukraine, 49000
Equipment Under Test (EUT)	
Product Name:	Smartico Industrial Sensor LoRaWAN
Model No.:	IS-LR
Trade mark:	Smartico
FCC ID:	2AURW-SISLR02
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	07 Jan., 2021
Date of Test:	05 Mar., to 21 May, 2021
Date of report issued:	10 Jun., 2021
Test Result:	PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Bruce Zhang
Laboratory Manager

2 Version

Version No.	Date	Description
00	*24 May, 2021*	*Original*
01	*10 Jun., 2021*	*Update page 4, 7, 8, 10, 19, and update FCC ID.*

Tested by: Mike.ou ***Date:*** *10 Jun., 2021*

Test Engineer

Reviewed by: Winner Zhang ***Date:*** *10 Jun., 2021*

Project Engineer

3 Contents

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4 Test Summary

Test Items	Section in CFR 47	Result
Antenna Requirement	15.203 & 15.247 (b)(4)	Pass
AC Power Line Conducted Emission	15.207	Pass*
Conducted Peak Output Power	15.247 (b)(2)	Pass*
20dB Occupied Bandwidth	15.247 (a)(1) (i)	Pass*
Carrier Frequencies Separation	15.247 (a)(1)	Pass*
Hopping Channel Number	15.247 (a)(1) (i)	Pass*
Dwell Time	15.247 (a)(1) (i)	Pass*
Spurious Emission	15.205 & 15.209	Pass

Remark:

1. Pass: The EUT complies with the essential requirements in the standard.

2. N/A: Not Applicable.

3. Pass: refer to the FCC ID: 2AURW-LORARF, Report No.: RDG190927003-00B.*

Test Method:	*ANSI C63.10-2013* *KDB 558074 D01 15.247 Meas Guidance v05r02*

5 General Information

5.1 Client Information

Applicant:	SPE SMARTICO, LLC
Address:	82G, Oleksandra Polya Avenue, Dnipro, Ukraine, 49000
Manufacturer/Factory:	SPE SMARTICO, LLC
Address:	82G, Oleksandra Polya Avenue, Dnipro, Ukraine, 49000

5.2 General Description of E.U.T.

Product Name:	Smartico Industrial Sensor LoRaWAN
Model No.:	IS-LR
Operation Frequency:	902.3 MHz~914.9MHz
Number of channel:	64
Modulation type:	LoRa
Antenna Type:	Internal antenna External antenna
Antenna gain:	Internal antenna: 1.6dBi External antenna: 5.0dBi
Power supply:	Rechargeable Li-ion Battery DC3.6V, 9000mAh
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	**902.3MHz**	17	905.5MHz	33	908.7MHz	49	911.9MHz
2	902.5MHz	18	905.7MHz	34	908.9MHz	50	912.1MHz
3	902.7MHz	19	905.9MHz	35	909.1MHz	51	912.3MHz
4	902.9MHz	20	906.1MHz	36	**909.3MHz**	52	912.5MHz
5	903.1MHz	21	906.3MHz	37	909.5MHz	53	912.7MHz
6	903.3MHz	22	906.5MHz	38	909.7MHz	54	912.9MHz
7	903.5MHz	23	906.7MHz	39	909.9MHz	55	913.1MHz
8	903.7MHz	24	906.9MHz	40	910.1MHz	56	913.3MHz
9	903.9MHz	25	904.1MHz	41	910.3MHz	57	913.5MHz
10	904.1MHz	26	907.3MHz	42	910.5MHz	58	913.7MHz
11	904.3MHz	27	907.5MHz	43	910.7MHz	59	913.9MHz
12	904.5MHz	28	907.7MHz	44	910.9MHz	60	914.1MHz
13	904.7MHz	29	907.9MHz	45	911.1MHz	61	914.3MHz
14	904.9MHz	30	908.1MHz	46	911.3MHz	62	914.5MHz
15	905.1MHz	31	908.3MHz	47	911.5MHz	63	914.7MHz
16	905.3MHz	32	908.5MHz	48	911.7MHz	64	**914.9MHz**
Remark: Channel 1, 36 & 64 were selected to test.							

5.3 Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test Modes:	
Non-hopping mode:	Keep the EUT in continuous transmitting mode with worst case data rate.
Hopping mode:	Keep the EUT in hopping mode.
The sample was placed 0.8m (below 1GHz)/1.5m (above 1GHz) above the ground plane of 3m chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working with a fresh battery, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

5.4 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
LENOVO	Laptop	SL510	2847A65	DoC

5.5 Measurement Uncertainty

Parameters	Expanded Uncertainty
Conducted Emission (9kHz ~ 30MHz)	±1.60 dB (k=2)
Radiated Emission (9kHz ~ 30MHz)	±3.12 dB (k=2)
Radiated Emission (30MHz ~ 1000MHz)	±4.32 dB (k=2)
Radiated Emission (1GHz ~ 18GHz)	±5.16 dB (k=2)
Radiated Emission (18GHz ~ 40GHz)	±3.20 dB (k=2)

5.6 Additions to, deviations, or exclusions from the method

No

5.7 Laboratory Facility

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

- **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

5.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.
Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info@ccis-cb.com, Website: http://www.ccis-cb.com

5.9 Test Instruments list

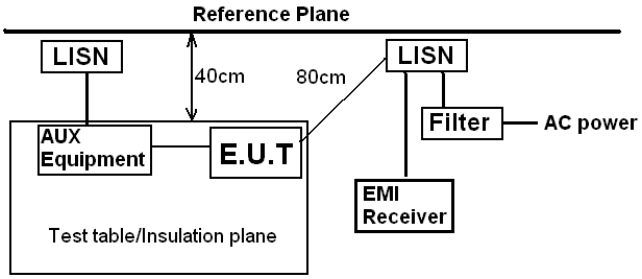
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	ETS	9m*6m*6m	966	01-19-2021	01-18-2024
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-03-2021	03-02-2022
Biconical Antenna	SCHWARZBECK	VUBA9117	359	06-18-2020	06-17-2021
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-03-2021	03-02-2022
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-18-2020	06-17-2021
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170582	11-18-2020	11-17-2021
Loop Antenna	SCHWARZBECK	FMZB 1519 B	00044	06-20-2020	06-19-2023
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-03-2021	03-02-2022
Pre-amplifier	CD	PAP-1G18	11804	03-03-2021	03-02-2022
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-03-2021	03-02-2022
Spectrum analyzer	Rohde & Schwarz	FSP40	100363	11-18-2020	11-17-2021
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-03-2021	03-02-2022
Spectrum Analyzer	Agilent	N9020A	MY50510123	11-18-2020	11-17-2021
Signal Generator	Rohde & Schwarz	SMX	835454/016	03-03-2021	03-02-2022
Signal Generator	R&S	SMR20	1008100050	03-03-2021	03-02-2022
EMI Test Software	Tonscend	TS+	Version: 3.0.0.1		
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-03-2021	03-02-2022
Cable	MICRO-COAX	MFR64639	K10742-5	03-03-2021	03-02-2022
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-03-2021	03-02-2022
DC Power Supply	XinNuoEr	WYK-10020K	1409050110020	09-25-2020	09-24-2021
Temperature Humidity Chamber	HengPu	HPGDS-500	20140828008	11-01-2020	10-31-2021

6 Test results and measurement data

6.1 Antenna Requirement

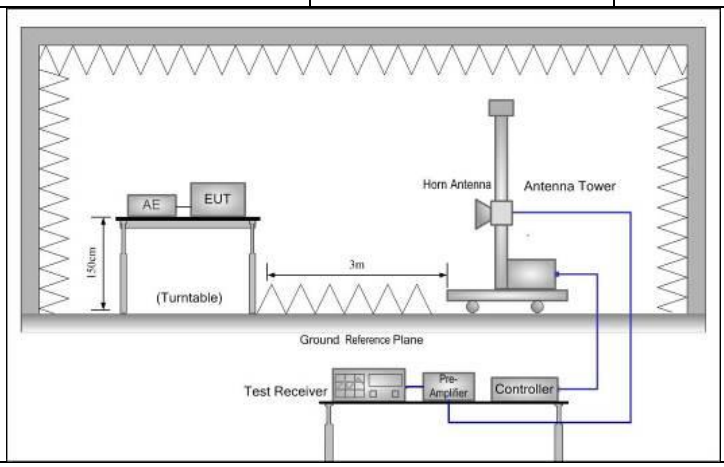
Standard requirement:	FCC Part 15 C Section 15.203 & 247(b)(4)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses 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. 15.247(b) (4)requirement: The conducted output power limit specified in paragraph (b) of this section is basedon the use of antennas with directional gains that do not exceed 6 dBi. Except as shown inparagraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBiare used, the conducted output power from the intentional radiator shall be reduced belowthe stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by theamount in dB that the directional gain of the antenna exceeds 6 dBi.	
E.U.T Antenna:	
The antenna is an interna antenna which permanently attached, and the best case gain of the antenna is 1.6 dBi. The antenna is an external antenna which uses a unique connector, and the best case gain of the antenna is 5.0 dBi.	

6.2 Conducted Emissions

Test Requirement:	FCC Part 15 C Section 15.207
Test Frequency Range:	150 kHz to 30 MHz
Class / Severity:	Class B
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto
Limit:	Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average 0.15-0.5: 66 to 56* / 56 to 46* 0.5-5: 56 / 46 5-30: 60 / 50 * Decreases with the logarithm of the frequency.
Test setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test procedure:	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4-2014 on conducted measurement.
Test Instruments:	Refer to section 5.9 for details
Test mode:	Hopping mode
Test results:	N/A(EUT is powered by DC 3.6V)

6.3 Restricted bands

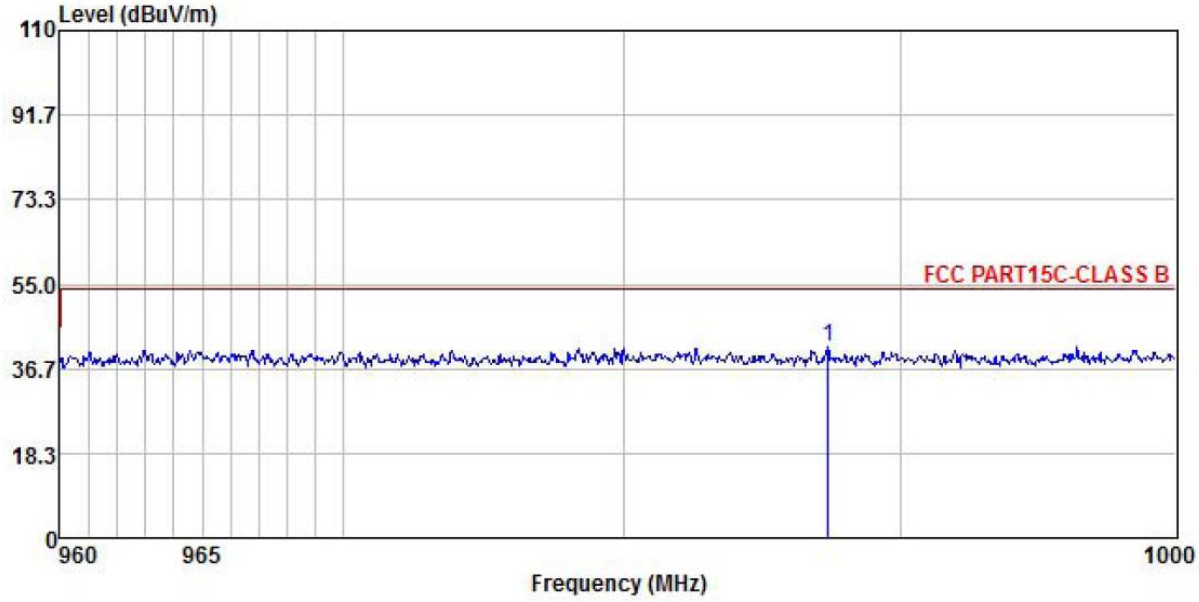
6.3.1 Radiated Emission Method

Test Requirement:	FCC Part 15 C Section 15.209 and 15.205				
Test Frequency Range:	960MHz to1240MHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	Above 1GHz		54.00		Average Value
			74.00		Peak Value
Test setup:					
Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5meters above the ground at a 3 meter 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 and the rota 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.				
Test Instruments:	Refer to section 5.9 for details				
Test mode:	Non-hopping mode				
Test results:	Passed				

Internal antenna

Below 1GHz:

Product Name:	Smartico Industrial Sensor LoRaWAN	**Product Model:**	IS-LR
Test By:	Mike	**Test mode:**	Tx mode
Test Channel:	Highest channel	**Polarization:**	Vertical
Test Voltage:	DC3.6V	**Environment:**	Temp: 24℃ Huni: 57%

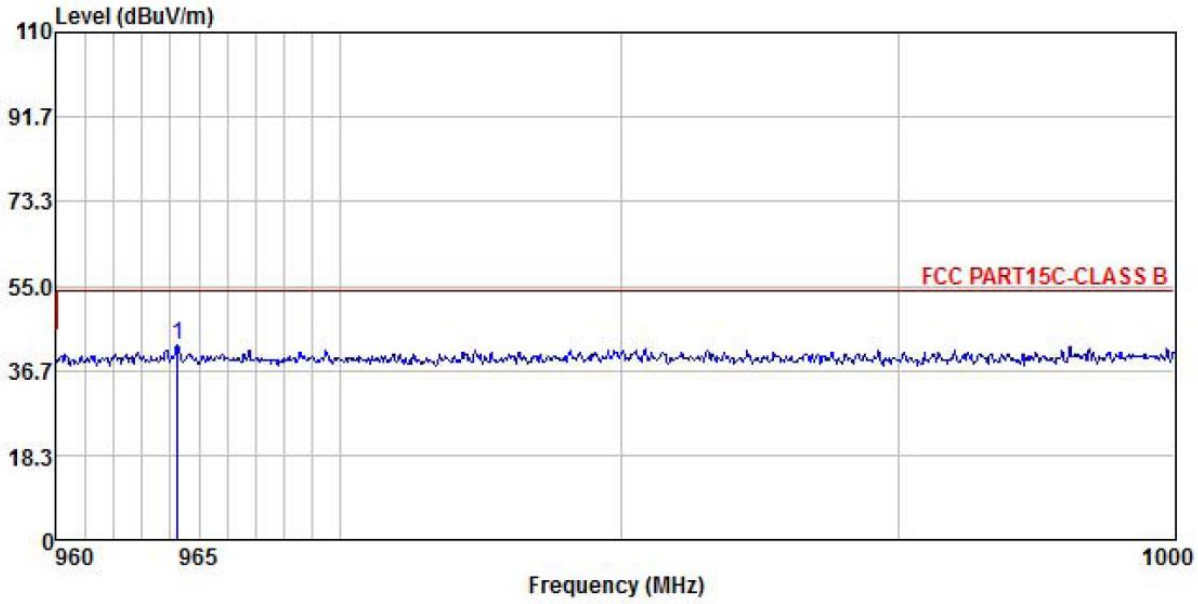


	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	987.344	14.77	23.02	3.62	0.00	41.41	54.00	-12.59	QP

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Smartico Industrial Sensor LoRaWAN	Product Model:	IS-LR
Test By:	Mike	Test mode:	Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC3.6V	Environment:	Temp: 24℃ Huni: 57%



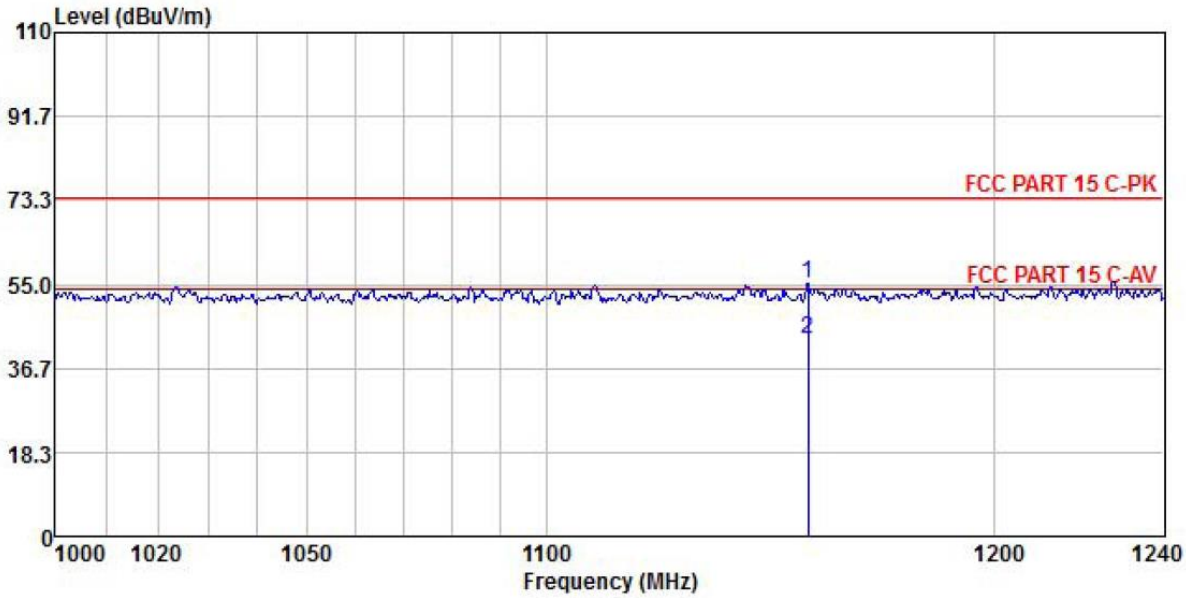
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	964.242	15.81	22.90	3.54	0.00	42.25	54.00	-11.75	QP

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Above 1GHz:

Product Name:	Smartico Industrial Sensor LoRaWAN	**Product Model:**	IS-LR
Test By:	Mike	**Test mode:**	Tx mode
Test Channel:	Highest channel	**Polarization:**	Vertical
Test Voltage:	DC3.6V	**Environment:**	Temp: 24℃ Huni: 57%

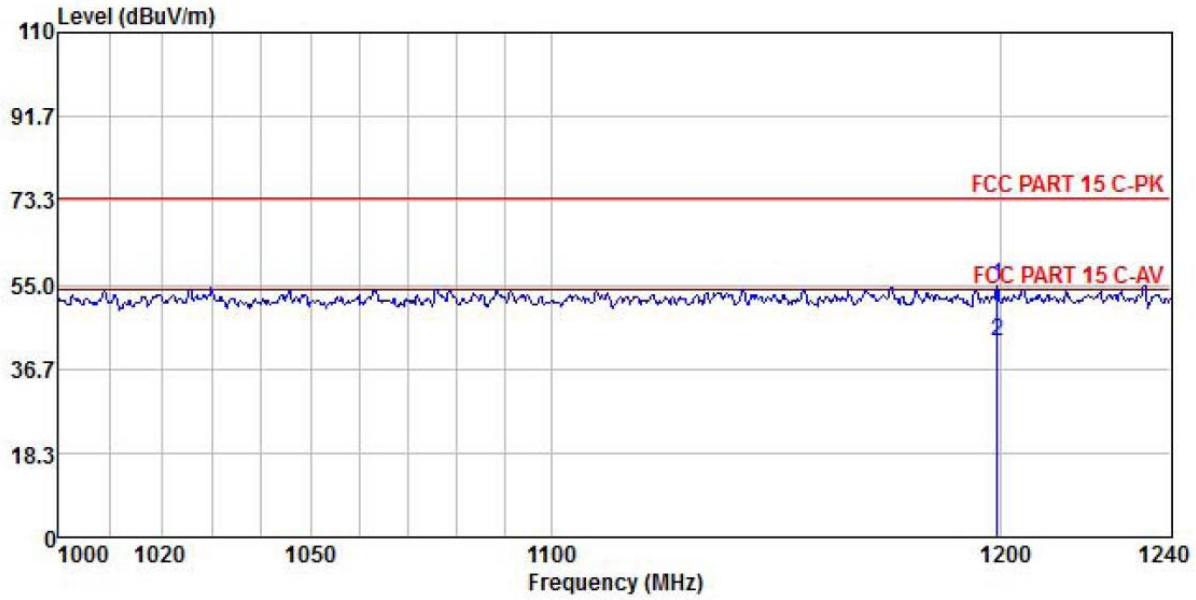


	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1157.266	24.98	24.28	5.96	0.00	55.22	74.00	-18.78	Peak
2	1157.266	12.68	24.28	5.96	0.00	42.92	54.00	-11.08	Average

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Smartico Industrial Sensor LoRaWAN	Product Model:	IS-LR
Test By:	Mike	Test mode:	Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC3.6V	Environment:	Temp: 24℃ Huni: 57%



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1199.079	24.26	24.30	6.10	0.00	54.66	74.00	-19.34	Peak
2	1199.079	12.14	24.30	6.10	0.00	42.54	54.00	-11.46	Average

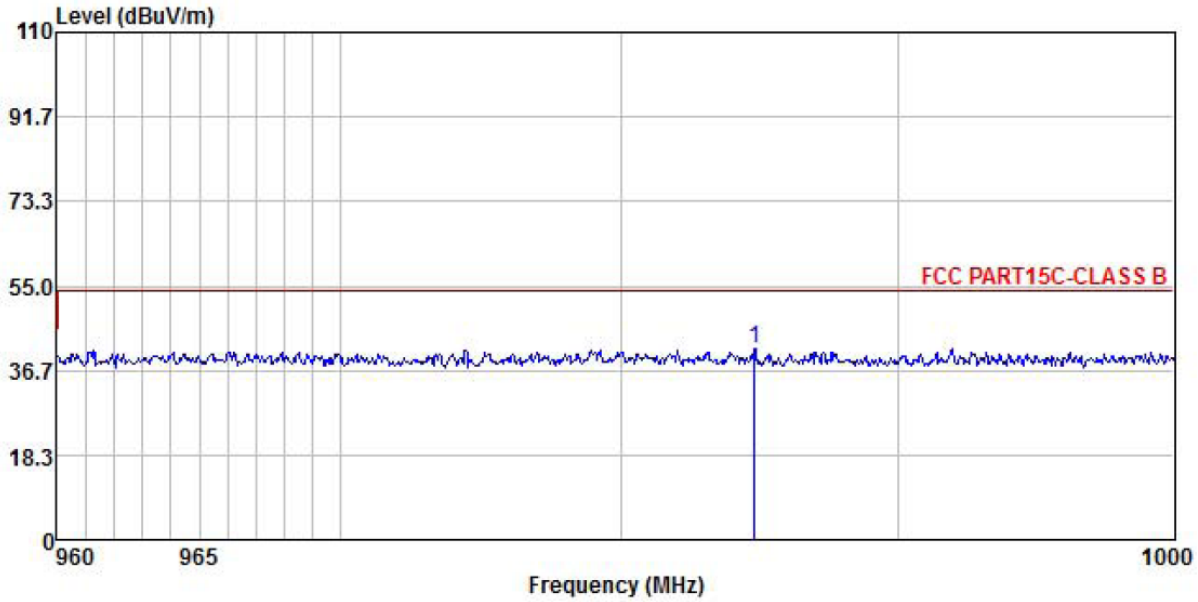
Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

External antenna

Below 1GHz:

Product Name:	Smartico Industrial Sensor LoRaWAN	**Product Model:**	IS-LR
Test By:	Mike	**Test mode:**	Tx mode
Test Channel:	Highest channel	**Polarization:**	Vertical
Test Voltage:	DC3.6V	**Environment:**	Temp: 24℃ Huni: 57%



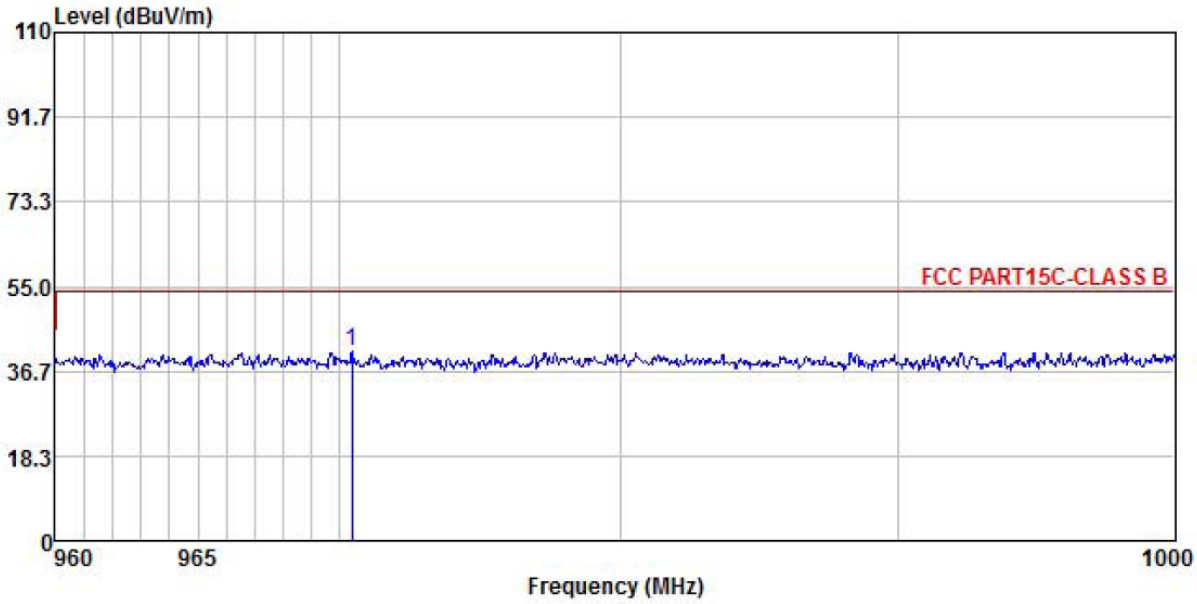
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	984.768	14.93	23.02	3.62	0.00	41.57	54.00	-12.43	QP

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	Smartico Industrial Sensor LoRaWAN	Product Model:	IS-LR
Test By:	Mike	Test mode:	Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC3.6V	Environment:	Temp: 24℃ Huni: 57%



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	970.442	14.48	22.92	3.55	0.00	40.95	54.00	-13.05	QP

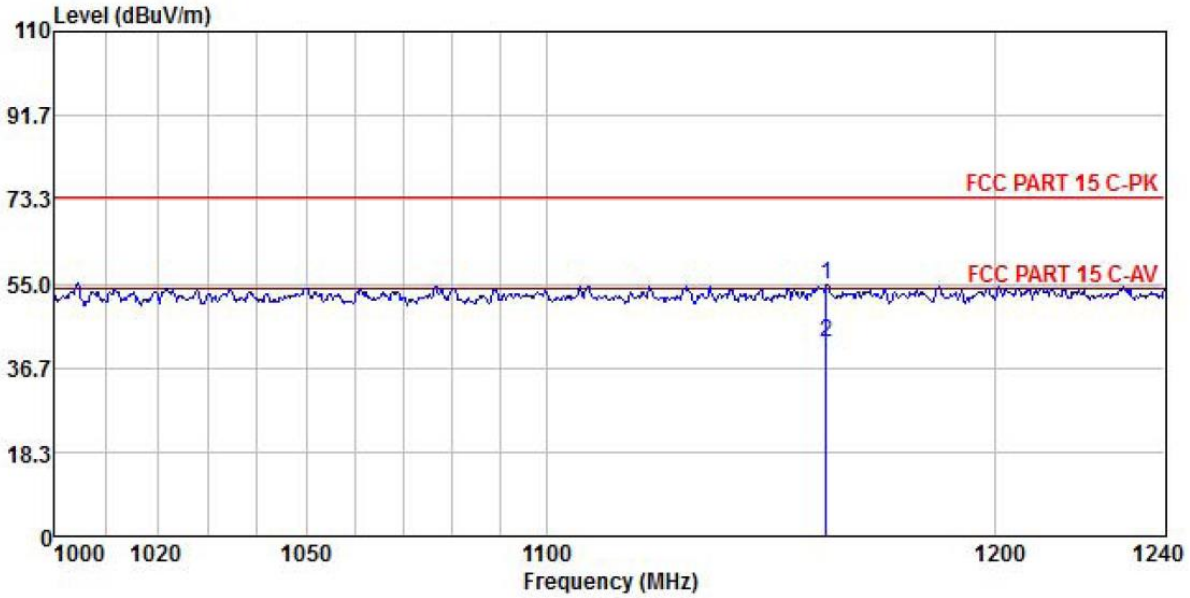
Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Above 1GHz:

Product Name:	Smartico Industrial Sensor LoRaWAN	**Product Model:**	IS-LR
Test By:	Mike	**Test mode:**	Tx mode
Test Channel:	Highest channel	**Polarization:**	Vertical
Test Voltage:	DC3.6V	**Environment:**	Temp: 24℃ Huni: 57%



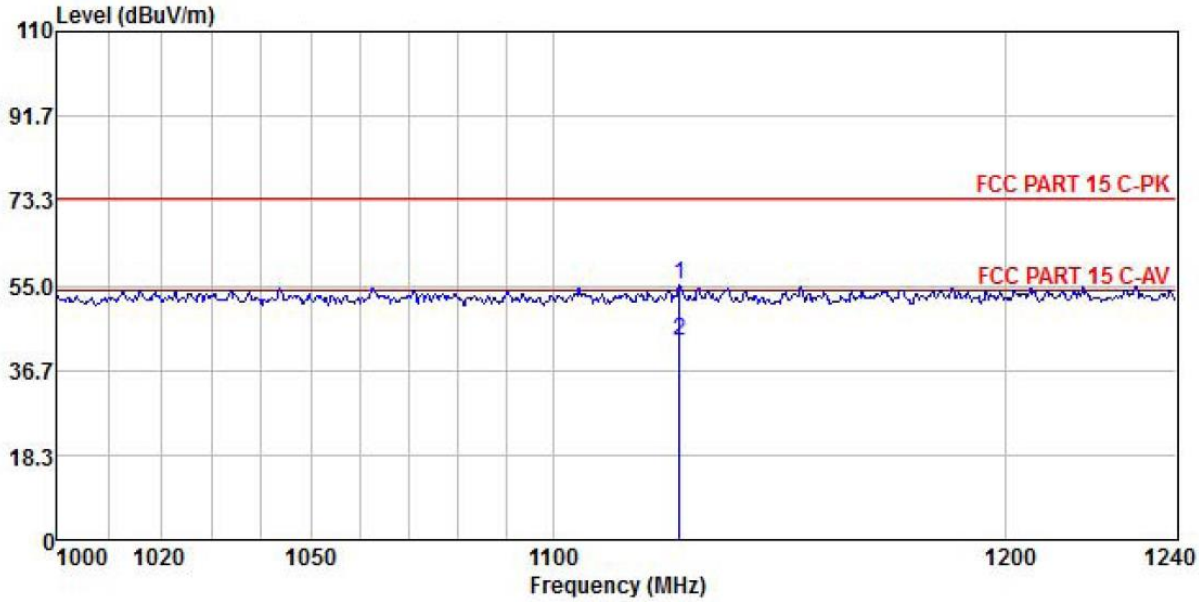
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1161.256	24.55	24.28	5.96	0.00	54.79	74.00	-19.21	Peak
2	1161.256	12.09	24.28	5.96	0.00	42.33	54.00	-11.67	Average

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	Smartico Industrial Sensor LoRaWAN	Product Model:	IS-LR
Test By:	Mike	Test mode:	Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC3.6V	Environment:	Temp: 24℃ Huni: 57%



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1127.048	24.87	24.27	5.87	0.00	55.01	74.00	-18.99	Peak
2	1127.048	12.68	24.27	5.87	0.00	42.82	54.00	-11.18	Average

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

6.4 Spurious Emission

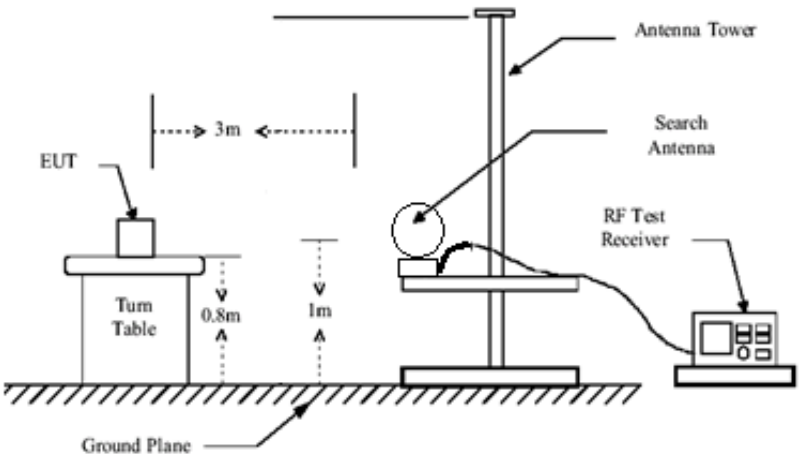
6.4.1 Radiated Emission Method

Test Requirement:	FCC Part 15 C Section 15.209				
Test Frequency Range:	9 kHz to 10 GHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value

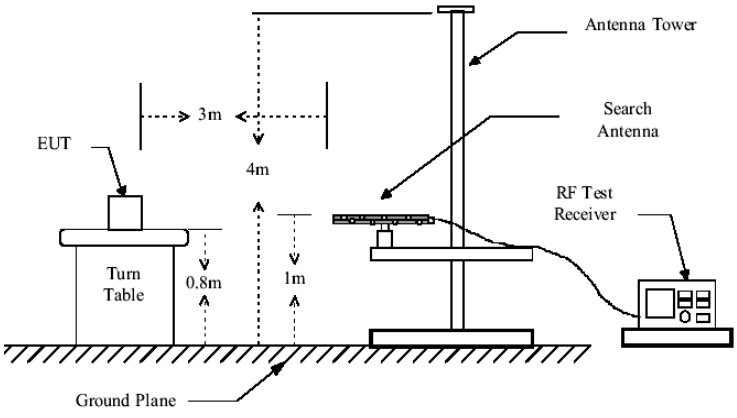
Limit:	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	46.0	Quasi-peak Value
	960MHz-1GHz	54.0	Quasi-peak Value
	Above 1GHz	54.0	Average Value
		74.0	Peak Value

Test setup:

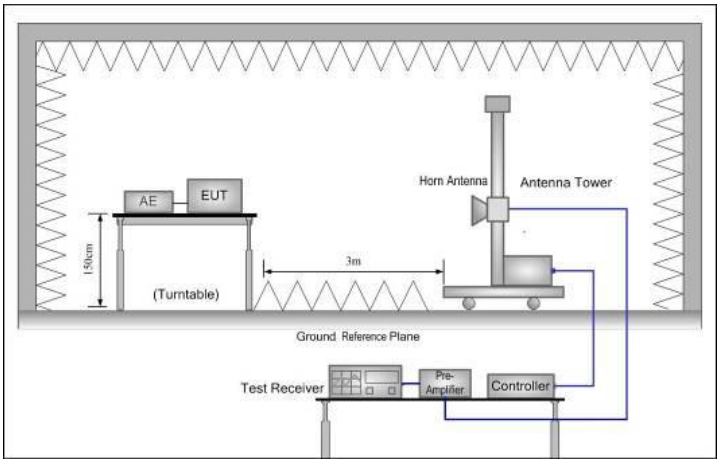
9kHz-30MHz



30MHz-1GHz



Above 1GHz

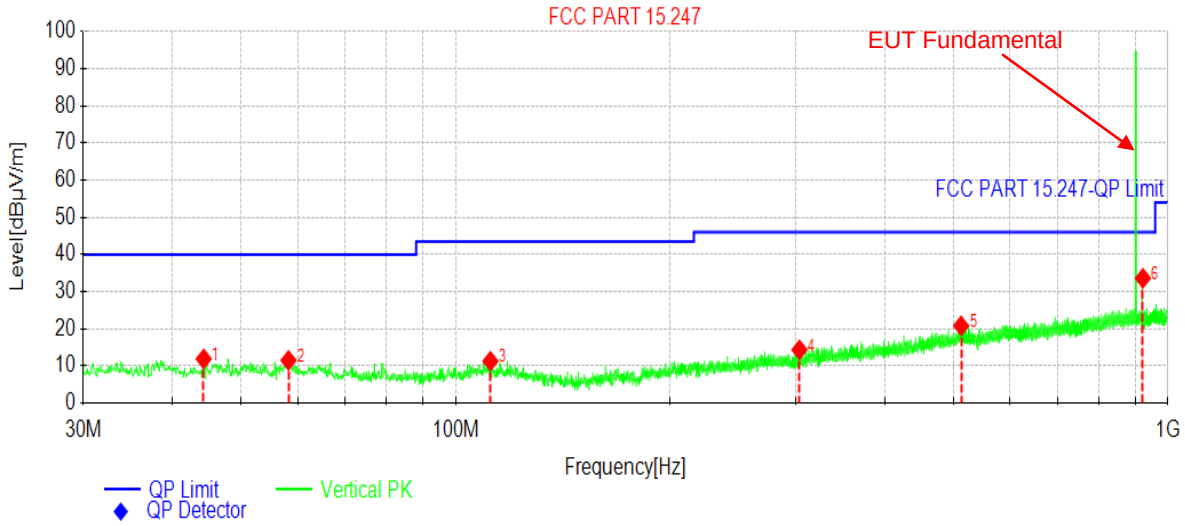
	
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8m(below 1GHz) /1.5m(above 1GHz) above the ground at a 3 meter chamber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, 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 and the rota 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.
Test Instruments:	Refer to section 5.9 for details
Test mode:	Non-hopping mode
Test results:	Pass
Remark:	1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case. 2. 9 kHz to 30 MHz is noise floor, so only shows the data of above 30MHz in this report.

Measurement Data (worst case):

Below 1GHz:

Internal antenna:

Product Name:	Smartico Industrial Sensor LoRaWAN	**Product Model:**	IS-LR
Test By:	Mike	**Test mode:**	Tx mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical
Test Voltage:	DC3.6V	**Environment:**	Temp: 24℃ Huni: 57%

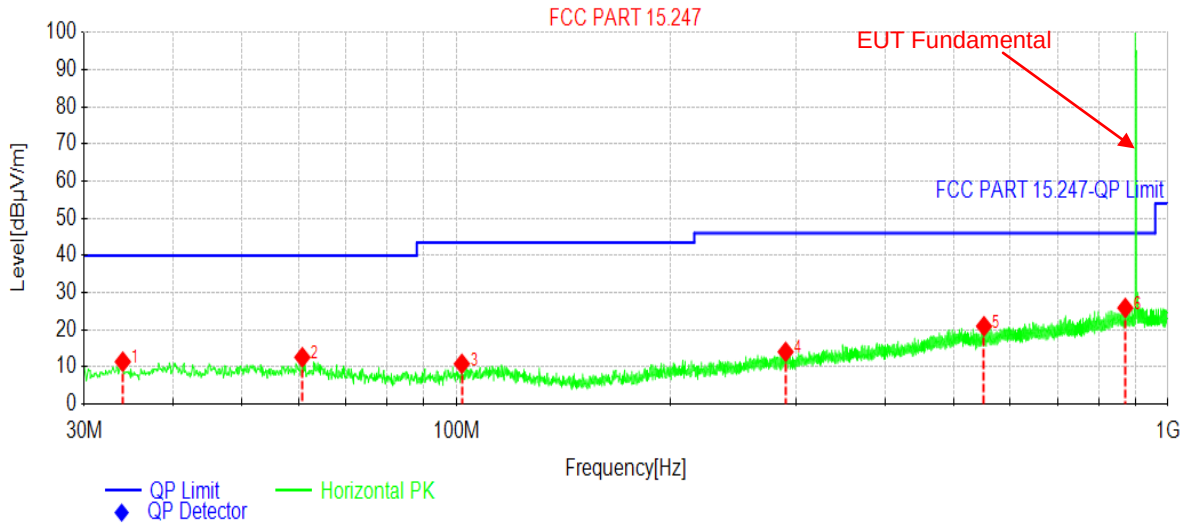


NO.	Freq. [MHz]	Reading[dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	44.2604	29.21	11.89	-17.32	40.00	28.11	QP	Vertical
2	58.2298	28.60	11.48	-17.12	40.00	28.52	QP	Vertical
3	111.876	29.09	11.26	-17.83	43.50	32.24	QP	Vertical
4	303.858	28.41	14.33	-14.08	46.00	31.67	QP	Vertical
5	512.429	30.26	20.79	-9.47	46.00	25.21	QP	Vertical
6	922.295	37.42	33.57	-3.85	46.00	12.43	QP	Vertical

Remark:

1. *Final Level = Receiver Read level + Factor.*
   Factor = Antenna Factor + Cable Loss – Preamplifier Factor.
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Smartico Industrial Sensor LoRaWAN	Product Model:	IS-LR
Test By:	Mike	Test mode:	Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	DC3.6V	Environment:	Temp: 24℃ Huni: 57%



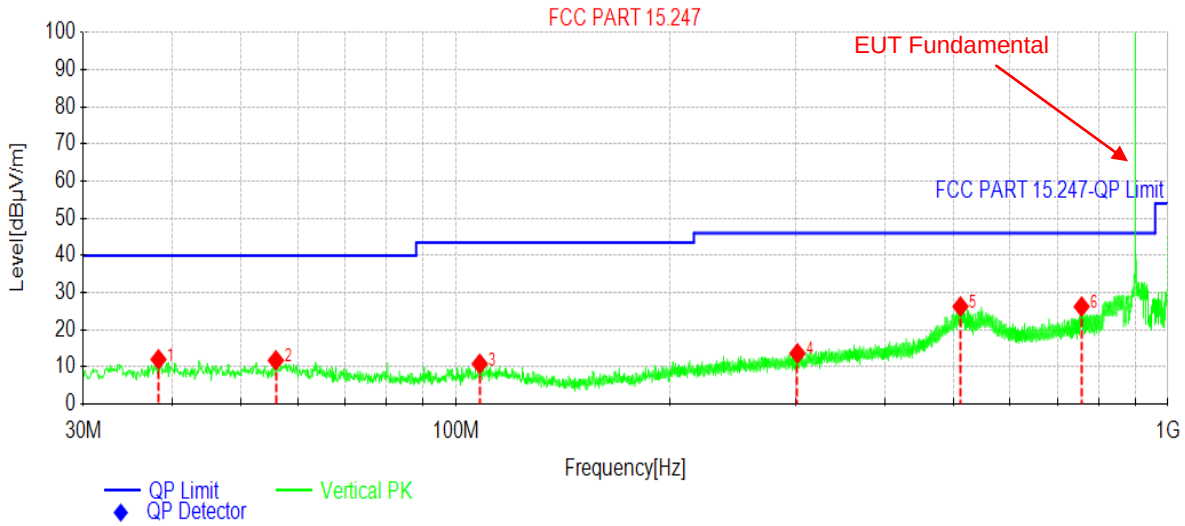
NO.	Freq. [MHz]	Reading[dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	33.9774	28.96	11.40	-17.56	40.00	28.60	QP	Horizontal
2	60.7521	29.89	12.59	-17.30	40.00	27.41	QP	Horizontal
3	101.787	29.02	10.82	-18.20	43.50	32.68	QP	Horizontal
4	290.277	28.29	14.05	-14.24	46.00	31.95	QP	Horizontal
5	551.524	30.44	20.95	-9.49	46.00	25.05	QP	Horizontal
6	871.268	29.93	25.86	-4.07	46.00	20.14	QP	Horizontal

Remark:

1. *Final Level = Receiver Read level + Factor.*
2. *Factor = Antenna Factor + Cable Loss – Preamplifier Factor.*
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

External antenna

Product Name:	Smartico Industrial Sensor LoRaWAN	**Product Model:**	IS-LR
Test By:	Mike	**Test mode:**	Tx mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical
Test Voltage:	DC3.6V	**Environment:**	Temp: 24℃ Huni: 57%

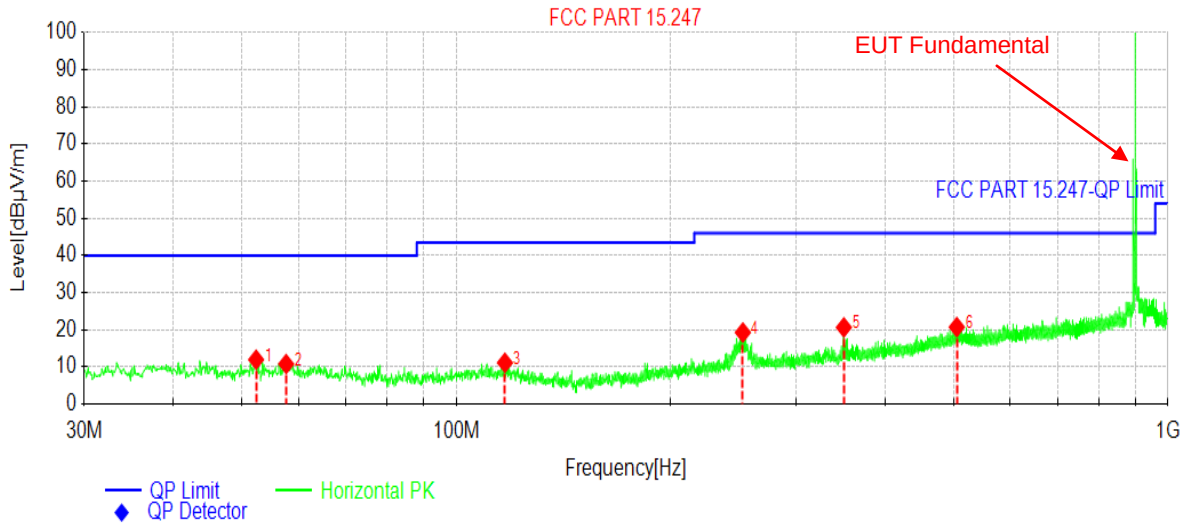


NO.	Freq. [MHz]	Reading[dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	38.2458	29.00	12.01	-16.99	40.00	27.99	QP	Vertical
2	55.9016	28.73	11.75	-16.98	40.00	28.25	QP	Vertical
3	108.092	28.88	10.83	-18.05	43.50	32.67	QP	Vertical
4	301.918	27.74	13.64	-14.10	46.00	32.36	QP	Vertical
5	511.362	35.72	26.24	-9.48	46.00	19.76	QP	Vertical
6	756.699	32.71	26.22	-6.49	46.00	19.78	QP	Vertical

Remark:

1. *Final Level = Receiver Read level + Factor.*
   Factor = Antenna Factor + Cable Loss – Preamplifier Factor.
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Smartico Industrial Sensor LoRaWAN	Product Model:	IS-LR
Test By:	Mike	Test mode:	Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	DC3.6V	Environment:	Temp: 24℃ Huni: 57%



NO.	Freq. [MHz]	Reading[dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	52.3122	28.98	11.94	-17.04	40.00	28.06	QP	Horizontal
2	57.6478	27.85	10.77	-17.08	40.00	29.23	QP	Horizontal
3	117.017	28.93	11.10	-17.83	43.50	32.40	QP	Horizontal
4	252.734	34.42	19.26	-15.16	46.00	26.74	QP	Horizontal
5	350.423	33.60	20.62	-12.98	46.00	25.38	QP	Horizontal
6	504.959	30.20	20.71	-9.49	46.00	25.29	QP	Horizontal

Remark:

1. *Final Level = Receiver Read level + Factor.*
   Factor = Antenna Factor + Cable Loss – Preamplifier Factor.
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Above 1GHz:

Internal antenna

Test channel: Lowest channel									
Detector: Peak Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1804.60	56.14	30.78	6.80	2.44	41.81	54.35	74.00	-19.65	Vertical
1804.60	55.62	30.78	6.80	2.44	41.81	53.83	74.00	-20.17	Horizontal
2706.90	57.55	30.78	6.80	2.44	41.81	55.76	74.00	-18.24	Vertical
2706.90	56.60	30.78	6.80	2.44	41.81	54.81	74.00	-19.19	Horizontal
3609.20	55.79	30.78	6.80	2.44	41.81	54.00	74.00	-20.00	Vertical
3609.20	55.68	30.78	6.80	2.44	41.81	53.89	74.00	-20.11	Horizontal
Detector: Average Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1804.60	48.17	30.78	6.80	2.44	41.81	46.38	54.00	-7.62	Vertical
1804.60	48.09	30.78	6.80	2.44	41.81	46.30	54.00	-7.70	Horizontal
2706.90	47.64	30.78	6.80	2.44	41.81	45.85	54.00	-8.15	Vertical
2706.90	48.58	30.78	6.80	2.44	41.81	46.79	54.00	-7.21	Horizontal
3609.20	47.44	30.78	6.80	2.44	41.81	45.65	54.00	-8.35	Vertical
3609.20	47.81	30.78	6.80	2.44	41.81	46.02	54.00	-7.98	Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss + AUX Factor – Preamplifier Factor.

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Test channel: Middle channel									
Detector: Peak Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1818.60	56.07	30.96	6.86	2.47	41.84	54.52	74.00	-19.48	Vertical
1818.60	55.54	30.96	6.86	2.47	41.84	53.99	74.00	-20.01	Horizontal
2727.90	57.06	30.96	6.86	2.47	41.84	55.51	74.00	-18.49	Vertical
2727.90	56.52	30.96	6.86	2.47	41.84	54.97	74.00	-19.03	Horizontal
3637.20	55.62	30.96	6.86	2.47	41.84	54.07	74.00	-19.93	Vertical
3637.20	55.35	30.96	6.86	2.47	41.84	53.80	74.00	-20.20	Horizontal
Detector: Average Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1818.60	48.59	30.96	6.86	2.47	41.84	47.04	54.00	-6.96	Vertical
1818.60	47.76	30.96	6.86	2.47	41.84	46.21	54.00	-7.79	Horizontal
2727.90	47.62	30.96	6.86	2.47	41.84	46.07	54.00	-7.93	Vertical
2727.90	48.85	30.96	6.86	2.47	41.84	47.30	54.00	-6.70	Horizontal
3637.20	47.43	30.96	6.86	2.47	41.84	45.88	54.00	-8.12	Vertical
3637.20	48.17	30.96	6.86	2.47	41.84	46.62	54.00	-7.38	Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss + AUX Factor – Preamplifier Factor.

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Test channel: Highest channel									
Detector: Peak Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1829.80	55.90	31.11	6.91	2.49	41.87	54.54	74.00	-19.46	Vertical
1829.80	55.64	31.11	6.91	2.49	41.87	54.28	74.00	-19.72	Horizontal
2744.70	56.85	31.11	6.91	2.49	41.87	55.49	74.00	-18.51	Vertical
2744.70	56.13	31.11	6.91	2.49	41.87	54.77	74.00	-19.23	Horizontal
3659.60	56.07	31.11	6.91	2.49	41.87	54.71	74.00	-19.29	Vertical
3659.60	55.60	31.11	6.91	2.49	41.87	54.24	74.00	-19.76	Horizontal
Detector: Average Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1829.80	48.98	31.11	6.91	2.49	41.87	47.62	54.00	-6.38	Vertical
1829.80	48.25	31.11	6.91	2.49	41.87	46.89	54.00	-7.11	Horizontal
2744.70	47.41	31.11	6.91	2.49	41.87	46.05	54.00	-7.95	Vertical
2744.70	48.49	31.11	6.91	2.49	41.87	47.13	54.00	-6.87	Horizontal
3659.60	47.66	31.11	6.91	2.49	41.87	46.30	54.00	-7.70	Vertical
3659.60	48.30	31.11	6.91	2.49	41.87	46.94	54.00	-7.06	Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss + AUX Factor – Preamplifier Factor.

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

External antenna

Test channel: Lowest channel									
Detector: Peak Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1804.60	57.35	30.78	6.80	2.44	41.81	55.56	74.00	-18.44	Vertical
1804.60	56.13	30.78	6.80	2.44	41.81	54.34	74.00	-19.66	Horizontal
2706.90	58.54	30.78	6.80	2.44	41.81	56.75	74.00	-17.25	Vertical
2706.90	57.24	30.78	6.80	2.44	41.81	55.45	74.00	-18.55	Horizontal
3609.20	60.78	30.78	6.80	2.44	41.81	58.99	74.00	-15.01	Vertical
3609.20	56.82	30.78	6.80	2.44	41.81	55.03	74.00	-18.97	Horizontal
Detector: Average Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1804.60	50.08	30.78	6.80	2.44	41.81	48.29	54.00	-5.71	Vertical
1804.60	52.05	30.78	6.80	2.44	41.81	50.26	54.00	-3.74	Horizontal
2706.90	50.73	30.78	6.80	2.44	41.81	48.94	54.00	-5.06	Vertical
2706.90	49.74	30.78	6.80	2.44	41.81	47.95	54.00	-6.05	Horizontal
3609.20	47.89	30.78	6.80	2.44	41.81	46.10	54.00	-7.90	Vertical
3609.20	51.59	30.78	6.80	2.44	41.81	49.80	54.00	-4.20	Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss + AUX Factor – Preamplifier Factor.

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Test channel: Middle channel									
Detector: Peak Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1818.60	57.32	30.96	6.86	2.47	41.84	55.77	74.00	-18.23	Vertical
1818.60	56.51	30.96	6.86	2.47	41.84	54.96	74.00	-19.04	Horizontal
2727.90	58.24	30.96	6.86	2.47	41.84	56.69	74.00	-17.31	Vertical
2727.90	56.94	30.96	6.86	2.47	41.84	55.39	74.00	-18.61	Horizontal
3637.20	61.11	30.96	6.86	2.47	41.84	59.56	74.00	-14.44	Vertical
3637.20	56.35	30.96	6.86	2.47	41.84	54.80	74.00	-19.20	Horizontal
Detector: Average Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1818.60	50.26	30.96	6.86	2.47	41.84	48.71	54.00	-5.29	Vertical
1818.60	52.28	30.96	6.86	2.47	41.84	50.73	54.00	-3.27	Horizontal
2727.90	51.02	30.96	6.86	2.47	41.84	49.47	54.00	-4.53	Vertical
2727.90	49.85	30.96	6.86	2.47	41.84	48.30	54.00	-5.70	Horizontal
3637.20	47.45	30.96	6.86	2.47	41.84	45.90	54.00	-8.10	Vertical
3637.20	52.03	30.96	6.86	2.47	41.84	50.48	54.00	-3.52	Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss + AUX Factor – Preamplifier Factor.

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Test channel: Highest channel									
Detector: Peak Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1829.80	57.39	31.11	6.91	2.49	41.87	56.03	74.00	-17.97	Vertical
1829.80	56.31	31.11	6.91	2.49	41.87	54.95	74.00	-19.05	Horizontal
2744.70	58.53	31.11	6.91	2.49	41.87	57.17	74.00	-16.83	Vertical
2744.70	56.85	31.11	6.91	2.49	41.87	55.49	74.00	-18.51	Horizontal
3659.60	61.32	31.11	6.91	2.49	41.87	59.96	74.00	-14.04	Vertical
3659.60	56.78	31.11	6.91	2.49	41.87	55.42	74.00	-18.58	Horizontal
Detector: Average Value									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	AUX Factor(dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1829.80	50.12	31.11	6.91	2.49	41.87	48.76	54.00	-5.24	Vertical
1829.80	52.29	31.11	6.91	2.49	41.87	50.93	54.00	-3.07	Horizontal
2744.70	51.07	31.11	6.91	2.49	41.87	49.71	54.00	-4.29	Vertical
2744.70	50.30	31.11	6.91	2.49	41.87	48.94	54.00	-5.06	Horizontal
3659.60	47.40	31.11	6.91	2.49	41.87	46.04	54.00	-7.96	Vertical
3659.60	52.35	31.11	6.91	2.49	41.87	50.99	54.00	-3.01	Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss + AUX Factor – Preamplifier Factor.

2. The emission levels of other frequencies are very lower than the limit and not show in test report.