

FCC Report (NFC)

Applicant: Zhejiang Hanshow Technology Co., Ltd.

Address of Applicant: Bld. 33, No. 966 xiuyuan Rd., BeiKeJian Innovation Park,
XiuZhou District, Jiaxing, Zhejiang, China

Manufacturer: Zhejiang Hanshow Technology Co., Ltd.

Address of Manufacturer: Bld. 33, No. 966 xiuyuan Rd., BeiKeJian Innovation Park,
XiuZhou District, Jiaxing, Zhejiang, China

Equipment Under Test (EUT)

Product Name: Electronic shelf label

Model No.: Stellar-XL3N@, Stellar-XL3YN@, Stellar-XLN@

Trade Mark: Hanshow

FCC ID: 2AHB5-XL3N

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.225:2017

Date of sample receipt: April 23, 2018

Date of Test: April 23, 2018-May 10, 2018

Date of report issued: May 10, 2018

Test Result : PASS *

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

Authorized Signature:

A circular blue ink stamp from GTS Global United Technology Services Co., Ltd. is visible. Overlaid on the stamp is a handwritten signature in black ink, which appears to read 'Robinson Lo'.

Robinson Lo

Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	May 10, 2018	Original

Prepared By:

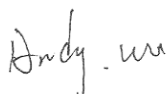


Date:

May 10, 2018

Project Engineer

Check By:



Date:

May 10, 2018

Reviewer

3 Contents

	Page
1 COVER PAGE.....	1
2 VERSION.....	2
3 CONTENTS.....	3
4 TEST SUMMARY	4
4.1 MEASUREMENT UNCERTAINTY.....	4
5 GENERAL INFORMATION	5
5.1 GENERAL DESCRIPTION OF EUT	5
5.2 TEST MODE	6
5.3 TEST FACILITY.....	6
5.4 TEST LOCATION.....	6
6 TEST INSTRUMENTS LIST.....	7
7 TEST RESULTS AND MEASUREMENT DATA	8
7.1 ANTENNA REQUIREMENT:	8
7.2 CONDUCTED EMISSIONS	9
7.3 FIELD STRENGTH OF FUNDAMENTAL EMISSIONS AND MASK MEASUREMENT	10
7.4 RADIATED EMISSION	12
7.5 20dB EMISSION BANDWIDTH.....	15
7.6 FREQUENCY STABILITY MEASUREMENT.....	16
8 TEST SETUP PHOTO.....	18

4 Test Summary

Test Item	Section in CFR 47	Result
Antenna Requirement	15.203	Pass
AC Power Line Conducted Emission	15.207	Pass
Field Strength of Fundamental Emissions and Mask Measurement	15.225	Pass
Radiated Emission	15.209	Pass
20dB Emission Bandwidth	15.225	Pass
Frequency Stability Measurement	15.225	Pass

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

Remark: Test according to ANSI C63.10 2013 and ANSI C63.4: 2014.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	$\pm 4.34\text{dB}$	(1)
Radiated Emission	30MHz ~ 1000MHz	$\pm 4.24\text{dB}$	(1)
Radiated Emission	1GHz ~ 26.5GHz	$\pm 4.68\text{dB}$	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	$\pm 3.45\text{dB}$	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

5 General Information

5.1 General Description of EUT

Product Name:	Electronic shelf label
Model No.:	Stellar-XL3N@, Stellar-XL3YN@, Stellar-XLN@
Test Model No:	Stellar-XL3N@
<i>Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are Screen color and model name for commercial purpose.</i>	
Quantity of tested samples	1
Serial No.:	N/A
Tested Sample(s) ID:	N/A
Hardware Version:	N/A
Software Version:	N/A
Operation Frequency:	13.56MHz
Channel Number:	1
Modulation:	ASK
Antenna type:	PCB Antenna
Antenna gain:	20dBi
Power supply:	DC 3V*4 by battery

5.2 Test mode

Transmitter mode	Keep the EUT in continuously transmitting. New battery is used during all test
------------------	--

5.3 Test Facility

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

- **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 381383, January 08, 2018.

- **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016

5.4 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

Tel: 0755-27798480

Fax: 0755-27798960

6 Test Instruments list

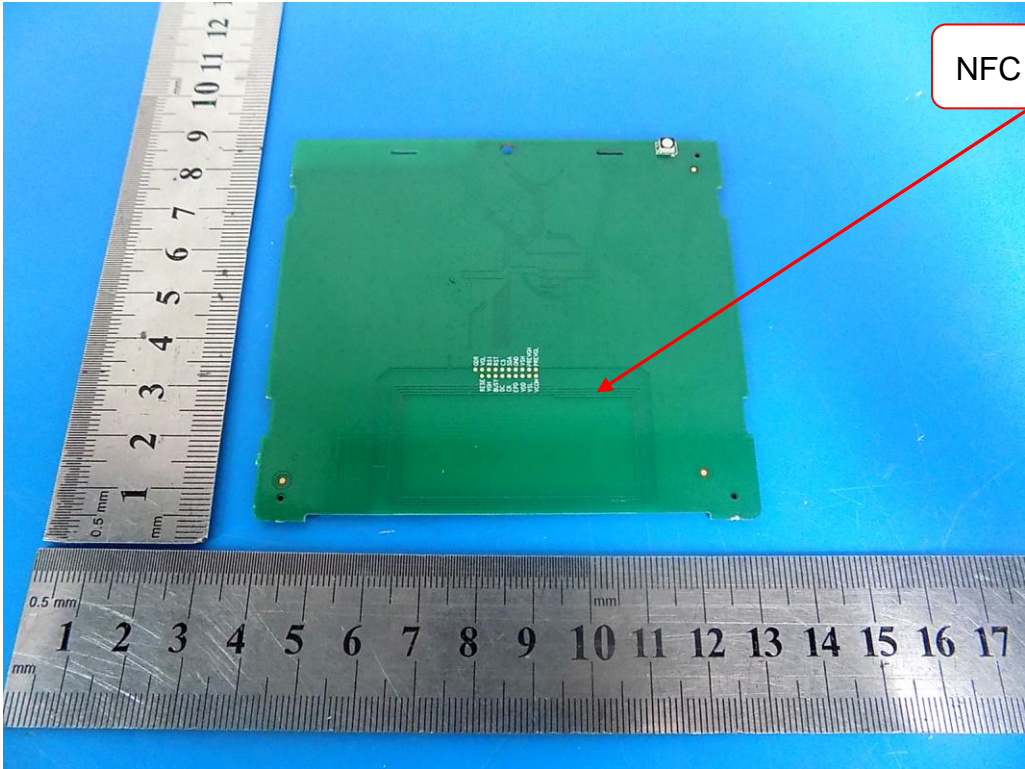
Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July 03 2015	July 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	Spectrum Analyzer	Agilent	N9020A	GTS533	June 29 2017	June 28 2018
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June 29 2017	June 28 2018
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June 29 2017	June 28 2018
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 29 2017	June 28 2018
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	June 29 2017	June 28 2018
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial Cable	GTS	N/A	GTS213	June 29 2017	June 28 2018
10	Coaxial Cable	GTS	N/A	GTS211	June 29 2017	June 28 2018
11	Coaxial cable	GTS	N/A	GTS210	June 29 2017	June 28 2018
12	Coaxial Cable	GTS	N/A	GTS212	June 29 2017	June 28 2018
13	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June 29 2017	June 28 2018
14	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June 29 2017	June 28 2018
15	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 29 2017	June 28 2018
16	Band filter	Amindeon	82346	GTS219	June 29 2017	June 28 2018
17	Power Meter	Anritsu	ML2495A	GTS540	June 29 2017	June 28 2018
18	Power Sensor	Anritsu	MA2411B	GTS541	June 29 2017	June 28 2018

Conducted Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.16 2014	May.15 2019
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 29 2017	June. 28 2018
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 29 2017	June. 28 2018
4	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June. 29 2017	June. 28 2018
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June. 29 2017	June. 28 2018

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Barometer	ChangChun	DYM3	GTS257	June 29 2017	June 28 2018

7 Test results and Measurement Data

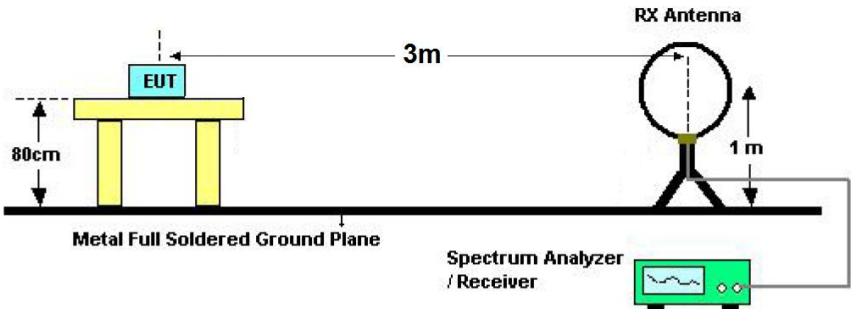
7.1 Antenna requirement:

Standard requirement:	FCC Part15 C Section 15.203
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.	
E.U.T Antenna: <i>The antenna is I Internal Antenna the best case gain of the antenna is 20dBi</i>	
	

7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207																
Test Method:	ANSI C63.10:2013																
Test Frequency Range:	150KHz to 30MHz																
Class / Severity:	Class B																
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto																
Limit:	<table><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBuV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></table> <p>* Decreases with the logarithm of the frequency.</p>			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
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															
Test setup:	<div><p>Reference Plane</p><p>40cm 80cm</p><p>LISN</p><p>AUX Equipment</p><p>E.U.T</p><p>Test table/Insulation plane</p><p>Filter</p><p>AC power</p><p>EMI Receiver</p><p>Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p></div>																
Test procedure:	<div><div></div><div><ol style="list-style-type: none">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 C63.10:2013 on conducted measurement.</div></div>																
Test Instruments:	Refer to section 6.0 for details																
Test mode:	Refer to section 5.3 for details																
Test results:	EUT power supply by battery, so the test not applicable.																

7.3 Field Strength of Fundamental Emissions and Mask Measurement

Test Requirement:	FCC Part15 C Section 15.225 and 15.209		
Test Method:	ANSI C63.10:2013		
Test site:	Measurement Distance: 3m		
Receiver setup:	RBW=1KHz, VBW=3KHz, Sweep time=Auto		
Limit:	Frequency (MHz)	Field Strength (microvolts/meter) at 30m	Field Strength (dBuV/m) at 3m
	13.553~13.567	15848	124 (QP)
Mark limit:	Frequency (MHz)	Field Strength (microvolts/meter) at 30m	Field Strength (dBuV/m) at 3m
	1.705~13.110	30	69.5
	13.110~13.410	106	80.5
	13.410~13.553	334	90.5
	13.553~13.567	15848	124.0
	13.567~13.710	334	90.5
	13.710~14.010	106	80.5
	14.010~30.000	30	69.5
Test setup:	 <p>The diagram illustrates the test setup. On the left, a yellow turntable is mounted on a stand, with the EUT (Equipment Under Test) placed on top. The EUT is 80cm high from the ground plane. A horizontal line indicates a 3m distance to the RX Antenna on the right. The RX Antenna is mounted on a tower that is 1m high from the ground plane. A Spectrum Analyzer / Receiver is connected to the RX Antenna. The ground plane is labeled 'Metal Full Soldered Ground Plane'.</p>		
Test Procedure:	<ol style="list-style-type: none"> 1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable. 2. Power on the EUT, the turntable was rotated by 360 degrees to determine the position of the highest radiation. 3. The height of the receiving antenna was fixed at one meter above ground to find the maximum emissions field strength. 4. For Fundamental emissions, use the receiver to measure QP reading. 5. When the radiated emissions limits are expressed in terms of the average value of the emissions and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field 		

	<p>strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.</p> <p>6. Compliance with the spectrum mask is tested using a spectrum analyzer with RB set to a 1KHz for the band 13.553~13.567MHz.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Freq. (MHz)	Position H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limits 3m (dBuV/m)	
13.560	H	Peak	103.76	-13.94	89.82	104	
13.560	H	AV	90.27	-13.94	76.33	84	
13.110	H	Peak	43.50	-13.94	29.56	69.5	
13.410	H	Peak	44.31	-13.94	30.37	80.5	
13.553	H	Peak	42.50	-13.94	28.56	90.5	
13.567	H	Peak	46.40	-13.93	32.47	90.5	
13.710	H	Peak	43.20	-13.93	29.27	80.5	
14.010	H	Peak	44.98	-13.93	31.05	69.5	
Freq. (MHz)	Position H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limits 3m (dBuV/m)	
13.560	V	Peak	94.88	-13.94	80.94	104	
13.560	V	AV	87.31	-13.94	73.37	84	
13.110	V	Peak	43.39	-13.94	29.45	69.5	
13.410	V	Peak	45.49	-13.94	31.55	80.5	
13.553	V	Peak	44.27	-13.94	30.33	90.5	
13.567	V	Peak	43.82	-13.93	29.89	90.5	
13.710	V	Peak	43.27	-13.93	29.34	80.5	
14.010	V	Peak	44.01	-13.93	30.08	69.5	

Note:

1: 30m to 3m correction factor calculation:

$$40 * \log(30m/3m) = 40$$

2: --Means other frequency and mode comply with standard requirements and at least have 20dB margin.

3: Correct Factor=Cable Loss+ Antenna Factor- Amplifier Gain

$$\text{Measurement Result} = \text{Reading} + \text{Correct Factor}$$

$$\text{Margin} = \text{Measurement Result} - \text{Limit}$$

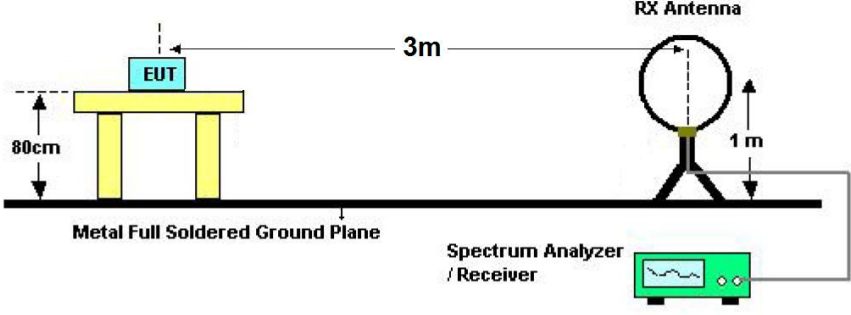
Global United Technology Services Co., Ltd.

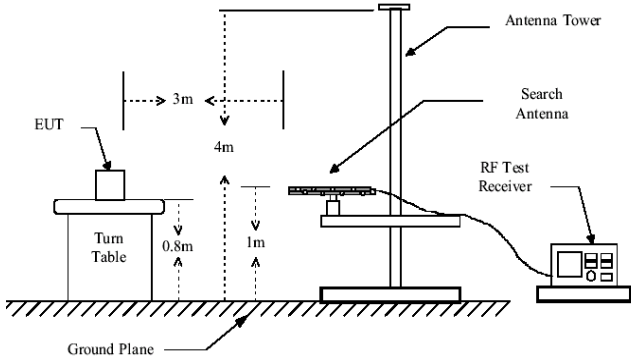
No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone,

Xixiang Road, Baoan District, Shenzhen, Guangdong, China

Telephone: +86 (0) 755 2779 8480 Fax: +86 (0) 755 2779 8960

7.4 Radiated Emission

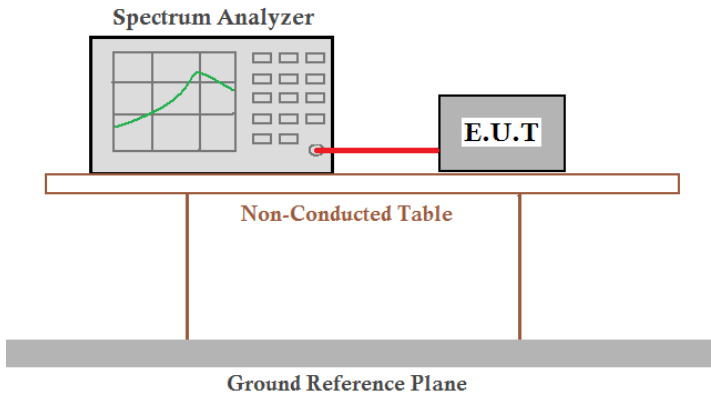
Test Requirement:	FCC Part15 C Section 15.209		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	9KHz to 1000MHz		
Test site:	Measurement Distance: 3m		
Receiver setup:	Frequency (MHz)	RBW(KHz)	Detector
	0.009~0.15	0.2	QP
	0.15~30	9	QP
	30~1000	120	QP
Limit:	The Field strength of any emissions which appear outside of 13.553~13.567MHz band shall not exceed the general radiated emissions limits		
	Frequency (MHz)	Field strength (micorvolts/meter)	Measurement distance (meters)
	0.009~0.490	2400/F(KHz)	300
	0.490~1.705	24000/F(KHz)	30
	1.705~30	30	30
	30~88	100	3
	88~216	150	3
	216~960	200	3
	960~1000	500	3
Test setup:	Below 30MHz		
	 <p>Above 30MHz</p>		

	 <p>The diagram illustrates the test setup. An EUT (Equipment Under Test) is placed on a Turn Table at a height of 0.8m above the Ground Plane. The Turn Table is rotated 360 degrees. A Search Antenna is mounted on an Antenna Tower, which is positioned 3m horizontally from the Turn Table. The Search Antenna is moved vertically along the tower, with a height range from 1m to 4m above the Ground Plane. The Search Antenna is connected to an RF Test Receiver.</p>
<p>Test Procedure:</p>	<ol style="list-style-type: none"> 1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable. 2. Power on the EUT, the turntable was rotated by 360 degrees to determine the position of the highest radiation. 3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization. 4. For each suspected emissions, the antenna tower was scan (from 1M to 4M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading. 5. Set the test-receiver system to Peak or CISPR quasi-peak detect function with specified bandwidth under maximum hold mode. 6. When the radiated emissions limits are expressed in terms of the average value of the emissions and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. 7. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver.
<p>Test Instruments:</p>	<p>Refer to section 6.0 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.3 for details</p>
<p>Test results:</p>	<p>Pass</p>

Measurement data:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	QP Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
35.62	33.36	11.20	0.62	30.07	15.11	40.00	-24.89	Vertical
51.84	32.45	12.20	0.79	29.98	15.46	40.00	-24.54	Vertical
98.14	27.24	11.73	1.18	29.71	10.44	43.50	-33.06	Vertical
219.85	26.63	10.88	1.96	29.39	10.08	46.00	-35.92	Vertical
382.59	20.92	15.15	2.77	29.58	9.26	46.00	-36.74	Vertical
793.40	22.50	21.21	4.43	29.20	18.94	46.00	-27.06	Vertical
39.72	31.30	12.30	0.66	30.04	14.22	40.00	-25.78	Horizontal
89.59	27.19	10.60	1.11	29.75	9.15	43.50	-34.35	Horizontal
147.92	32.29	7.50	1.56	29.42	11.93	43.50	-31.57	Horizontal
302.48	21.63	13.56	2.37	29.98	7.58	46.00	-38.42	Horizontal
485.61	21.68	17.20	3.24	29.33	12.79	46.00	-33.21	Horizontal
897.00	25.04	22.17	4.83	29.10	22.94	46.00	-23.06	Horizontal

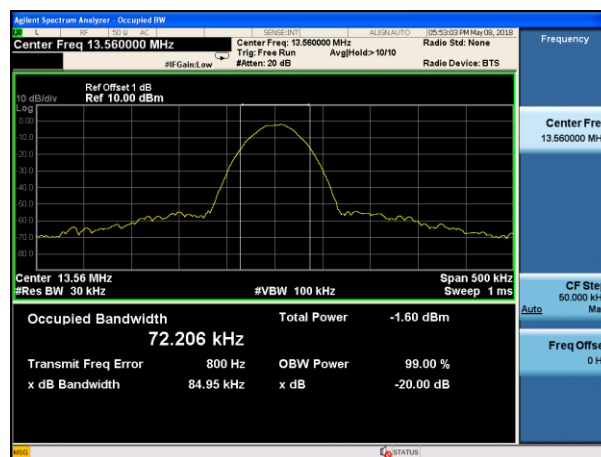
7.5 20dB Emission Bandwidth

Test Requirement:	FCC Part15 C Section 15.225 and 15.215
Test Method:	ANSI C63.10:2013
Limit:	N/A
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

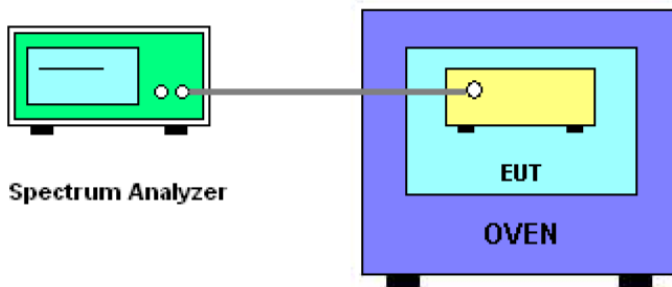
Measurement Data

Frequency (MHz)	20dB Bandwidth (KHz)	99% OBW (KHz)	Frequency range (MHz) fL>13.553MHz	Frequency range (MHz) fH<13.567MHz	Result
13.56MHz	84.95	72.206	13.559	13.565	Pass

Test plot as follows:



7.6 Frequency Stability Measurement

Test Requirement:	FCC Part15 C Section 15.225
Test Method:	ANSI C63.10: 2013
Receiver setup:	RBW=1KHz, VBW=1KHz, Sweep time=Auto
Limit:	<p>The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage,</p> <p>for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.</p> <p>For battery operated equipment, the equipment tests shall be performed using a new battery.</p>
Test setup:	 <p>The diagram illustrates the test setup. On the left is a green Spectrum Analyzer. A cable connects its antenna port to the antenna port of a yellow Equipment Under Test (EUT). The EUT is placed inside a blue Oven. The labels 'Spectrum Analyzer', 'EUT', and 'OVEN' are present below their respective components.</p>
Test Procedure:	<ol style="list-style-type: none"> 1. The transmitter output (antenna port) was connected to the spectrum analyzer. 2. EUT have transmitted absence of modulation signal and fixed channelize 3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth. 4. Set RBW=1KHz, VBW=1KHz with peak detector and maxhold settings. 5. fc is declaring of channel frequency. Then the frequency error formula is $(f_c - f)/f_c \times 10^6$ ppm and the limit is less than ± 100ppm. 6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value 7. Extreme temperature rule is -20°C ~50°C
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

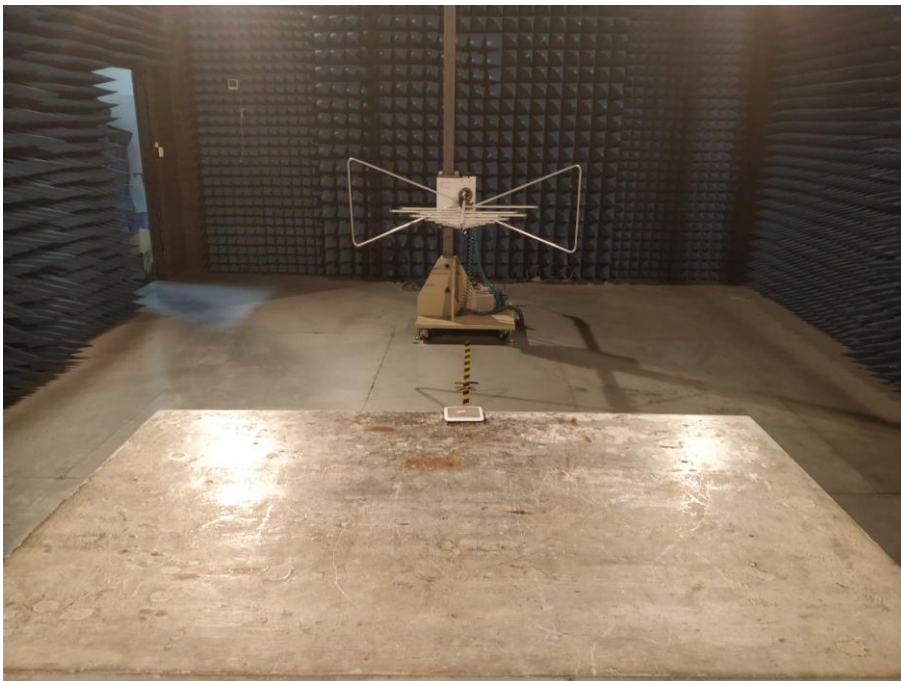
Measurement data:

Reference Frequency: 13.56MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit	Result
		Hz	ppm (%)		
6.0	-20	54	0.00039	+/- 0.01%	Pass
	-10	54	0.00040		
	0	53	0.00039		
	10	55	0.00041		
	20	50	0.00037		
	30	50	0.00037		
	40	62	0.00046		
	50	62	0.00046		

Reference Frequency: 13.56MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit	Result
		Hz	ppm (%)		
20	5.1	39	0.00029	+/- 0.01%	Pass
	6.0	50	0.00037		
	6.9	69	0.00051		

8 Test Setup Photo

Radiated Emission



EUT Constructional Details

Reference to the test report No. GTS201805000125F02

----- End -----