

# TEST REPORT

**Applicant:** SOYAL TECHNOLOGY CO., LTD.

**Address of Applicant:** 11F, No.368, Gongjian Rd., Xizhi Dist, New Taipei City 221, Taiwan, R.O.C.

**Manufacturer:** SOYAL TECHNOLOGY CO., LTD.

**Address of Manufacturer:** 11F, No.368, Gongjian Rd., Xizhi Dist, New Taipei City 221, Taiwan, R.O.C.

## Equipment Under Test (EUT)

**Product Name:** Illuminated LED Frame Access Controller

**Model No.:** AR-888-H, AR-888H, AR-888-K, AR-888K, AR-888-U, AR-888U, AR-888-UL, AR-888-PBI, AR-PBI-888, AR-888-W, AR-888W, AR-888-T, AR-SW-888, AR-888-CPI, AR-888-CPO, AR-CPI-888, AR-CPO-888, AR-888

**Trade Mark:** SOYAL

**FCC ID:** 2ACLEAR-888H

**Applicable standards:** FCC CFR Title 47 Part 15 Subpart C

**Date of sample receipt:** August 05, 2021

**Date of Test:** August 05-12, 2021

**Date of report issued:** August 12, 2021

**Test Result :** PASS \*

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

Authorized Signature:



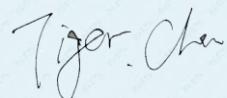
Robinson Lo  
Laboratory Manager

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	August 12, 2021	Original

Prepared By:

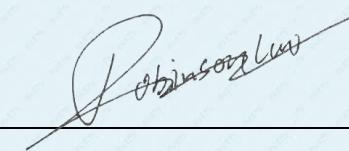


Date:

August 12, 2021

Project Engineer

Check By:



Date:

August 12, 2021

Reviewer

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## 4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203	Pass
AC Power Line Conducted Emission	15.207	Pass
Radiated Emission	15.209	Pass
20dB Bandwidth	15.215	Pass

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

## 5 General Information

### 5.1 General Description of EUT

Product Name:	Illuminated LED Frame Access Controller
Model No.:	AR-888-H, AR-888H, AR-888-K, AR-888K, AR-888-U, AR-888U, AR-888-UL, AR-888-PBI, AR-PBI-888, AR-888-W, AR-888W, AR-888-T, AR-SW-888, AR-888-CPI, AR-888-CPO, AR-CPI-888, AR-CPO-888, AR-888
Test Model No.:	AR-888-H
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are appearance color and model name for commercial purpose.	
S/N:	N/A
Hardware Version:	B7920 for 125kHz, B2301 for 13.56MHz
Software Version:	N/A
Test sample(s) ID:	GTSL202108000049-1
Sample(s) Status	Engineered sample
Operation Frequency:	125KHz
Modulation type:	ASK
Antenna Type:	Integral antenna
Antenna gain:	0dBi
Power supply:	SWITCHING ADAPTER Model No.: GQ24-120200-AU Input: AC100-240V,50/60Hz 1.0A Max Output: DC12V, 2.0A

## 5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode
<p><i>Remark: the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i></p>	

## 5.3 Description of Support Units

None.

## 5.4 Test Facility

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

- **FCC—Registration No.: 381383**

Designation Number: CN5029

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.

- **IC —Registration No.: 9079A**

CAB identifier: CN0091

The 3m Semianechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

- **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

## 5.5 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

Tel: 0755-27798480

Fax: 0755-27798960

## 5.6 Other Information Requested by the Customer

None.

## 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. 02 2020	July. 01 2025
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 24 2021	June. 23 2022
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 24 2021	June. 23 2022
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 24 2021	June. 23 2022
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 24 2021	June. 23 2022
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 24 2021	June. 23 2022
9	Coaxial Cable	GTS	N/A	GTS211	June. 24 2021	June. 23 2022
10	Coaxial cable	GTS	N/A	GTS210	June. 24 2021	June. 23 2022
11	Coaxial Cable	GTS	N/A	GTS212	June. 24 2021	June. 23 2022
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 24 2021	June. 23 2022
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 24 2021	June. 23 2022
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 24 2021	June. 23 2022
15	Band filter	Amindeon	82346	GTS219	June. 24 2021	June. 23 2022
16	Power Meter	Anritsu	ML2495A	GTS540	June. 24 2021	June. 23 2022
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 24 2021	June. 23 2022
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 24 2021	June. 23 2022
19	Splitter	Agilent	11636B	GTS237	June. 24 2021	June. 23 2022
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 24 2021	June. 23 2022
21	Breitband hornantenne	SCHWARZBECK	BBHA 9170	GTS579	Oct. 18 2020	Oct. 17 2021
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 18 2020	Oct. 17 2021
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 18 2020	Oct. 17 2021
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June. 24 2021	June. 23 2022

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.15 2019	May.14 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 24 2021	June. 23 2022
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 24 2021	June. 23 2022
4	ENV216 2-L-V- NETZNACHB.DE	ROHDE&SCHWARZ	ENV216	GTS226	June. 24 2021	June. 23 2022
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. 24 2021	June. 23 2022
8	Absorbing clamp	Elektronik- Feinmechanik	MDS21	GTS229	June. 24 2021	June. 23 2022
9	ISN	SCHWARZBECK	NTFM 8158	GTS565	June. 24 2021	June. 23 2022
10	High voltage probe	SCHWARZBECK	TK9420	GTS537	July. 09 2021	July. 08 2022

RF Conducted Test:						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	June. 24 2021	June. 23 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 24 2021	June. 23 2022
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June. 24 2021	June. 23 2022
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	June. 24 2021	June. 23 2022
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	June. 24 2021	June. 23 2022
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	June. 24 2021	June. 23 2022
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	June. 24 2021	June. 23 2022
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	June. 24 2021	June. 23 2022

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 24 2021	June. 23 2022
2	Barometer	ChangChun	DYM3	GTS255	June. 24 2021	June. 23 2022

## 7 Test results and Measurement Data

### 7.1 Antenna requirement:

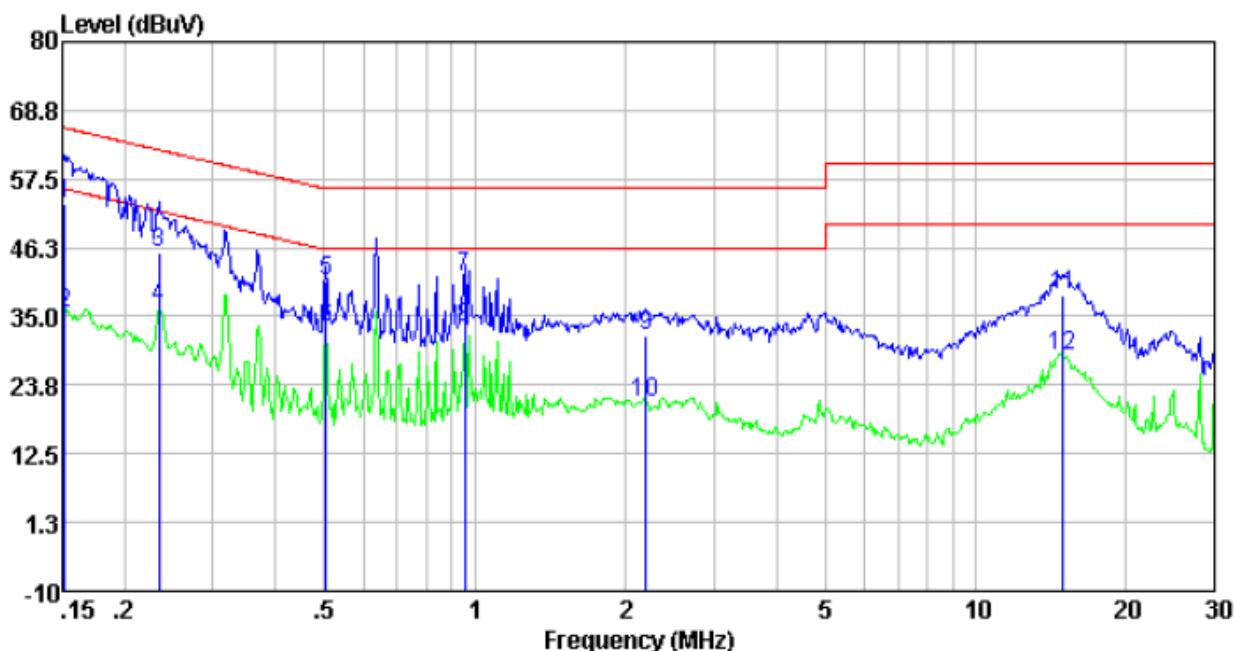
Standard requirement:	FCC Part15 C Section 15.203
<b>15.203 requirement:</b>	
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique 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.	
<b>EUT Antenna:</b>	
<i>The antenna is Integral Antenna, the best case gain of the antenna is 0dBi. reference to the appendix II for details</i>	

## 7.2 Conducted Emissions

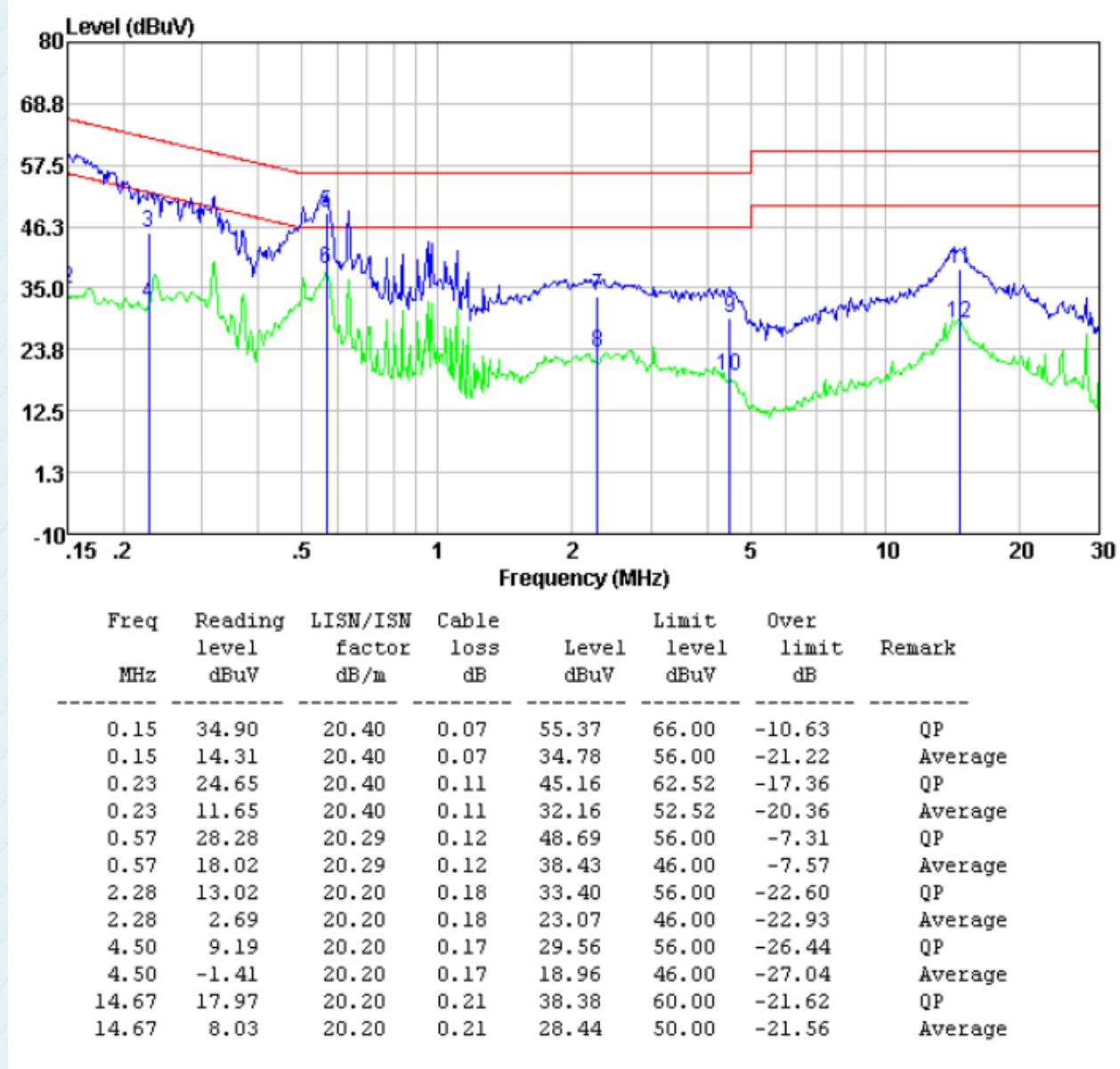
Test Requirement:	FCC Part15 C Section 15.207																
Test Method:	ANSI C63.10:2013																
Test Frequency Range:	150KHz to 30MHz																
Class / Severity:	Class B																
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto																
Limit:	<table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <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> </tbody> </table>			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															
	<small>* Decreases with the logarithm of the frequency.</small>																
Test setup:	<p>Reference Plane</p> <p>LISN</p> <p>40cm</p> <p>80cm</p> <p>AUX Equipment</p> <p>E.U.T</p> <p>Test table/Insulation plane</p> <p>EMI Receiver</p> <p>Filter</p> <p>AC power</p> <p>Remark E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>																
Test procedure:	<ol style="list-style-type: none"> <li>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.</li> <li>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).</li> <li>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 on conducted measurement.</li> </ol>																
Test Instruments:	Refer to section 6.0 for details																
Test mode:	Refer to section 5.2 for details																
Test results:	Pass																

### Measurement data:

Line:



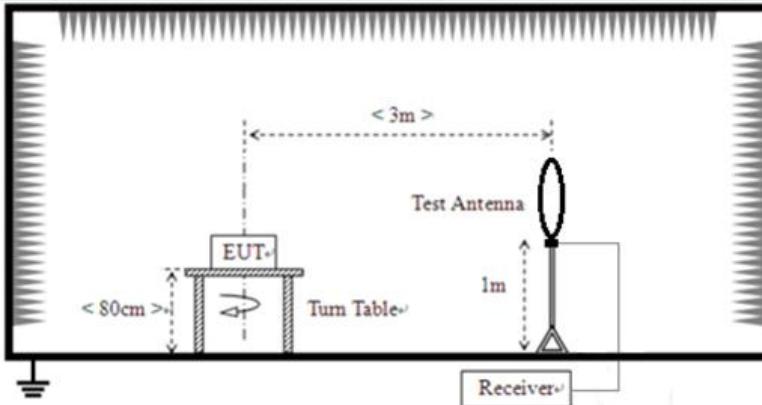
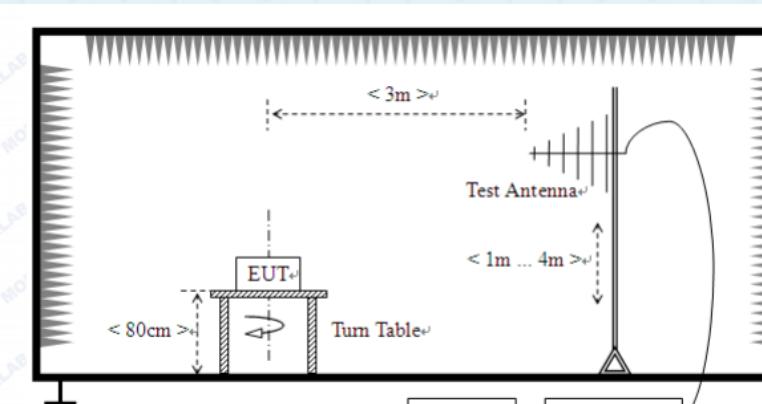
Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.15	33.02	20.40	0.07	53.49	65.91	-12.42	QP
0.15	15.10	20.40	0.07	35.57	55.91	-20.34	Average
0.23	24.98	20.40	0.11	45.49	62.30	-16.81	QP
0.23	16.00	20.40	0.11	36.51	52.30	-15.79	Average
0.50	20.44	20.31	0.11	40.86	56.00	-15.14	QP
0.50	12.64	20.31	0.11	33.06	46.00	-12.94	Average
0.95	21.06	20.21	0.15	41.42	56.00	-14.58	QP
0.95	12.78	20.21	0.15	33.14	46.00	-12.86	Average
2.20	11.50	20.20	0.18	31.88	56.00	-24.12	QP
2.20	0.60	20.20	0.18	20.98	46.00	-25.02	Average
14.99	18.09	20.20	0.21	38.50	60.00	-21.50	QP
14.99	7.98	20.20	0.21	28.39	50.00	-21.61	Average

**Neutral:**

**Notes:**

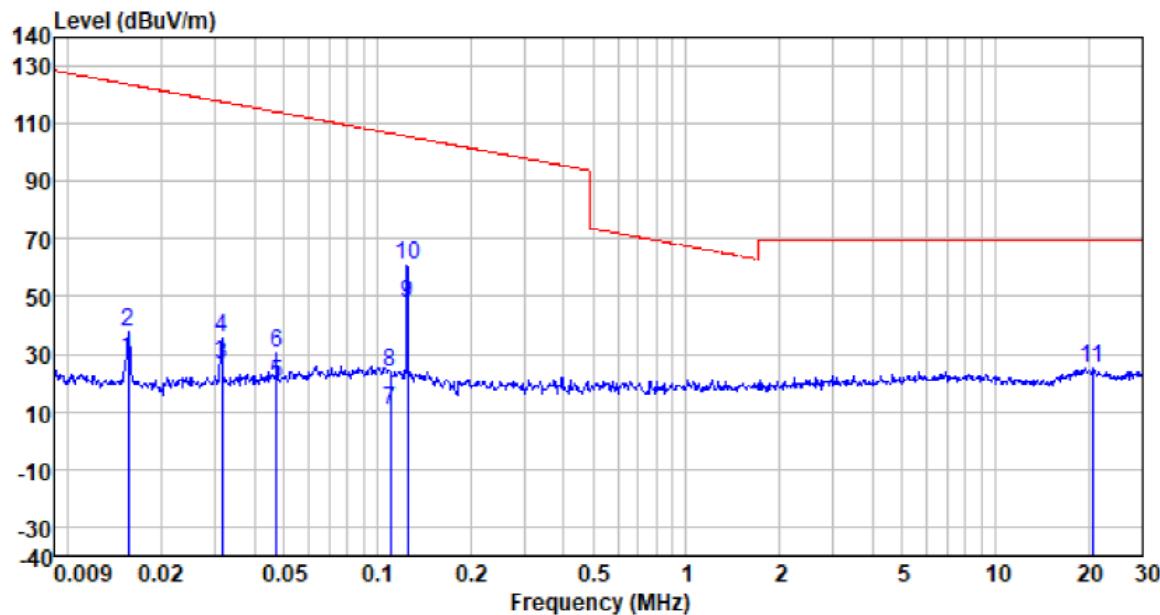
1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

### 7.3 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209																											
Test Method:	ANSI C63.10:2013																											
Test Frequency Range:	9kHz to 1GHz																											
Test site:	Measurement Distance: 3m																											
Receiver setup:	Frequency	Detector	RBW	VBW	Remark																							
	9kHz-150kHz	Quasi-peak	200Hz	300Hz	Quasi-peak Value																							
	150kHz-30MHz	Quasi-peak	9kHz	10kHz	Quasi-peak Value																							
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value																							
Limit: (Spurious Emissions)	<table border="1"> <thead> <tr> <th>Frequency (MHz)</th><th>Field strength (microvolts/meter)</th><th>Measurement distance (meters)</th></tr> </thead> <tbody> <tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr> <tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr> <tr><td>1.705-30.0</td><td>30</td><td>30</td></tr> <tr><td>30-88</td><td>100**</td><td>3</td></tr> <tr><td>88-216</td><td>150**</td><td>3</td></tr> <tr><td>216-960</td><td>200**</td><td>3</td></tr> <tr><td>Above 960</td><td>500</td><td>3</td></tr> </tbody> </table>				Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	0.009-0.490	2400/F(kHz)	300	0.490-1.705	24000/F(kHz)	30	1.705-30.0	30	30	30-88	100**	3	88-216	150**	3	216-960	200**	3	Above 960	500	3
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)																										
0.009-0.490	2400/F(kHz)	300																										
0.490-1.705	24000/F(kHz)	30																										
1.705-30.0	30	30																										
30-88	100**	3																										
88-216	150**	3																										
216-960	200**	3																										
Above 960	500	3																										
	Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.																											
Test Procedure:	<ol style="list-style-type: none"> <li>1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>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.</li> <li>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.</li> </ol>																											

Test setup:	<p>Below 30MHz</p>  <p>30MHz ~ 1000MHz</p> 
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

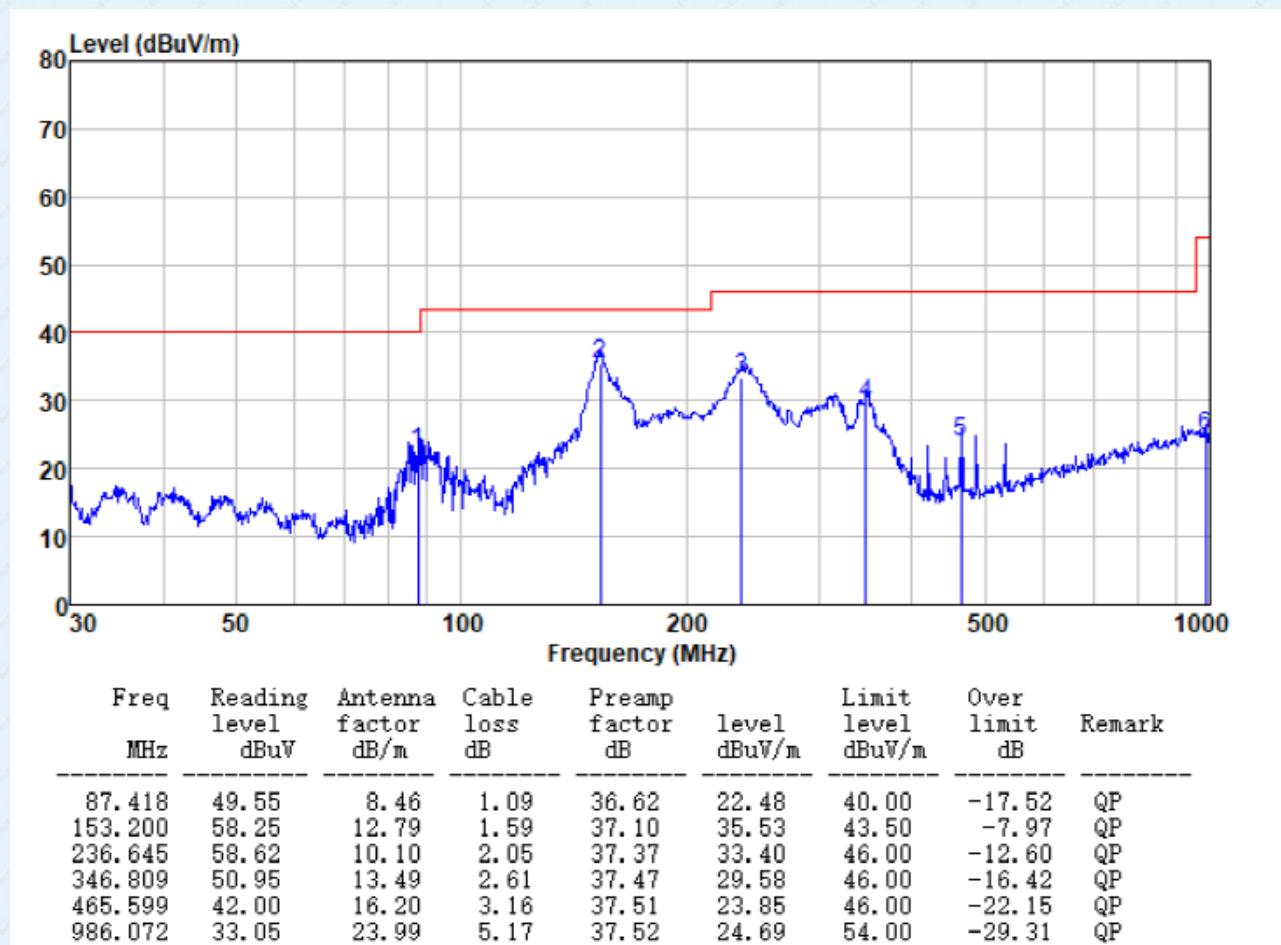
#### Measurement data:

**Measurement data:**
**Note: Limit dBuV/m @3m = Limit dBuV/m @300m+ 80**
**Limit dBuV/m @3m = Limit dBuV/m @30m + 40**
**Below 30MHz**


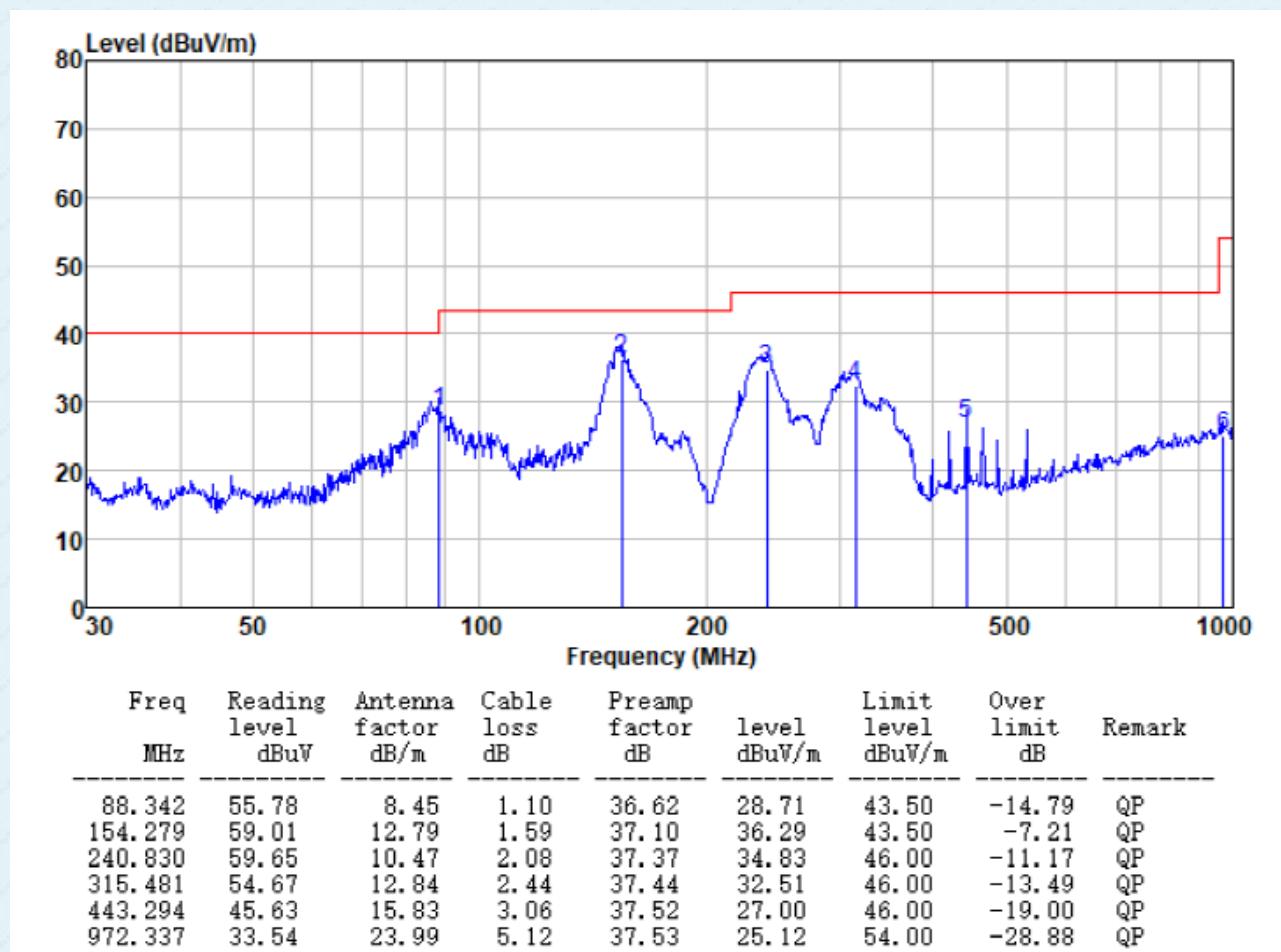
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	Limit level dBuV/m	Over limit dB	Remark
0.016	8.56	20.04	0.04	0.00	28.64	123.73	Average
0.016	17.56	20.04	0.04	0.00	37.64	123.73	Peak
0.031	6.27	20.09	0.09	0.00	26.45	117.67	Average
0.031	15.27	20.09	0.09	0.00	35.45	117.67	Peak
0.047	-1.27	21.24	0.11	0.00	20.08	114.14	Average
0.047	8.73	21.24	0.11	0.00	30.08	114.14	Peak
0.110	-13.98	24.12	0.17	0.00	10.31	106.78	Average
0.110	-0.80	24.12	0.17	0.00	23.49	106.78	Peak
0.125	24.03	23.64	0.18	0.00	47.85	105.66	Average
0.125	37.03	23.64	0.18	0.00	60.85	105.66	Peak
20.657	-3.00	27.81	0.53	0.00	25.34	69.54	QP

30MHz ~ 1GHz

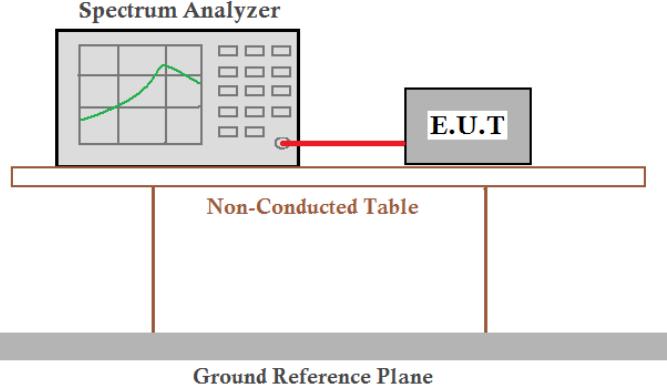
Horizontal



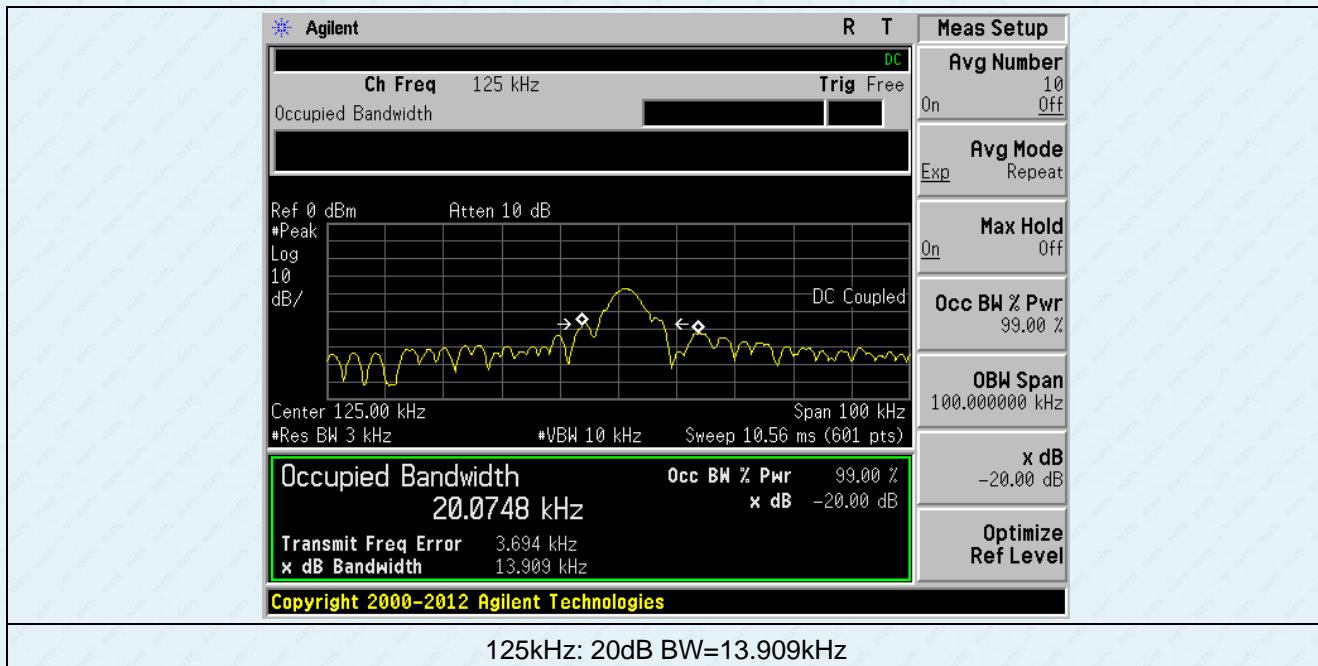
Vertical



## 7.4 20dB Occupy Bandwidth

Test Requirement:	FCC Part15 C Section 15.215
Test Method:	ANSI C63.10:2013
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

### Measurement Data



## 8 Test Setup Photo

Reference to the **appendix I** for details.

## 9 EUT Constructional Details

Reference to the **appendix II** for details.

-----End-----