

FCC PART 15C

Measurement and Test Report

For

Voxnetwork USA, LLC

15905 Greenway Hayden Loop, Ste. 107 Scottsdale, AZ USA

FCC ID: 2AMBKCT96C

FCC Rules:	<u>FCC Part 15.236</u>
Product Description:	<u>Card Transmitter</u>
Tested Model:	<u>CT-96C</u>
Report No.:	<u>STRD1706051I</u>
Tested Date:	<u>2017-06-16 to 2017-07-01</u>
Issued Date:	<u>2017-07-01</u>
Tested By:	<u>Iven Guo / Engineer</u>
Reviewed By:	<u>Silin Chen / EMC Manager</u>
Approved & Authorized By:	<u>Jandy So / PSQ Manager</u>
Prepared By:	

Iven Guo

Silin Chen

Jandy So

Shenzhen SEM.Test Technology Co., Ltd.

1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,
Bao'an District, Shenzhen, P.R.C. (518101)

Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM.Test Technology Co., Ltd

TABLE OF CONTENTS

1. GENERAL INFORMATION.....	3
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
1.2 TEST STANDARDS.....	4
1.3 TEST METHODOLOGY	4
1.4 TEST FACILITY	4
1.5 EUT EXERCISE SOFTWARE	5
1.6 MEASUREMENT UNCERTAINTY	5
1.7 TEST EQUIPMENT LIST AND DETAILS	6
2. SUMMARY OF TEST RESULTS	7
3. RF OUTPUT POWER	8
3.1 STANDARD APPLICABLE.....	8
3.2 TEST PROCEDURE.....	8
3.3 ENVIRONMENTAL CONDITIONS	8
3.4 TEST RESULT/PLOTS	8
4. OCCUPIED BANDWIDTH.....	11
4.1 STANDARD APPLICABLE.....	11
4.2 TEST PROCEDURE.....	11
4.3 ENVIRONMENTAL CONDITIONS	11
4.4 TEST RESULTS/PLOTS.....	11
5. RADIATED SPURIOUS EMISSION.....	15
5.1 STANDARD APPLICABLE.....	15
5.2 TEST PROCEDURE.....	15
5.3 ENVIRONMENTAL CONDITIONS	17
5.4 SUMMARY OF TEST RESULTS/PLOTS	17
6. FREQUENCY STABILITY	25
6.1 STANDARD APPLICABLE.....	25
6.2 TEST PROCEDURE.....	25
6.3 ENVIRONMENTAL CONDITIONS	25
6.4 TEST RESULTS/PLOTS.....	25

1. GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Voxnetwork USA, LLC
Address of applicant: 15905 Greenway Hayden Loop, Ste. 107 Scottsdale, AZ USA

Manufacturer: Qsound Electronics Co., LTD
Address of manufacturer: No.9 1st Junye Road XiaoLan Town, Zhongshan China

General Description of EUT	
Product Name:	Card Transmitter
Trade Name:	VOX
Model No.:	CT-96C
Adding Model(s):	/
Rated Voltage:	Battery DC 3V
<i>Note: The test data is gathered from a production sample provided by the manufacturer.</i>	

Items	Description
RF Output Power:	Max. 8.909dBm (Conducted)
Frequency Range:	640.10MHz - 663.90MHz
Modulation:	FM
Antenna Type:	Integral Antenna
Antenna Gain:	0 dBi
For more information refer to the circuit diagram form and the user's manual.	

The test data gathered are from a production sample, provided by the manufacturer.

1.2 Test Standards

The following report is prepared on behalf of the Voxnetwork USA, LLC in accordance with Part 15.236 of the Federal Communication Commissions rules.

The objective is to determine compliance with the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which results in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

Measurements contained in this report were also conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted with Low Channel, Middle Channel and High Channel, accordingly in reference to the Operating Instructions.

1.4 Test Facility

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. 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 our files and the Registration is 934118.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

1.5 EUT Exercise Software

The EUT exercise program used during the testing was designed to exercise the system components. The test software is started while the whole system is on.

Test Mode List		
Test Mode	Description	Remark
TM1	Transmitter	Low, Middle, High Channels

Test Conditions					
	Normal	LTLV	LTHV	HTHV	HTLV
Temperature (°C)	20	-30	-30	50	50
Voltage (V)	3.0	2.6	3.0	2.6	3.0

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	---	$\pm 1 \times 10^{-7}$
Frequency Stability	2.3%	$\pm 5\%$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.2\text{dB}$

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-12	2018-06-11
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-12	2018-06-11
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-12	2018-06-11
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-12	2018-06-11
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11

2. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.236(d)	Output Power Measurement	Compliant
§15.236(f)	Occupied Bandwidth Emission	Compliant
§15.236(g)	Radiated Spurious Emission	Compliant
§15.236(g)	Emission mask	Compliant
§15.236(f)(3)	Frequency Stability	Compliant

3. RF OUTPUT POWER

3.1 Standard Applicable

According to FCC 15.236(d), (1) In the bands allocated and assigned for broadcast television and in the 600 MHz service band: 50 mW EIRP

(2) In the 600 MHz guard bands including the duplex gap: 20 mW EIRP

3.2 Test Procedure

1. The maximum peak output power was measured with a Spectrum Analyzer connected to the antenna terminal while EUT was operating in unmodulated situation.
2. Power was supplied to the battery input connector a power supply. The power supply was set for +3.0VDC. The Spectrum Analyzer was connected at antenna terminal to measure RF power of the carrier.
3. A Multimeter was connected in series with final RF Stage to measure the current; A Multimeter was used to measure final RF Stage supply voltage. Then the voltage v.s. current of the final RF Stage can be showed.

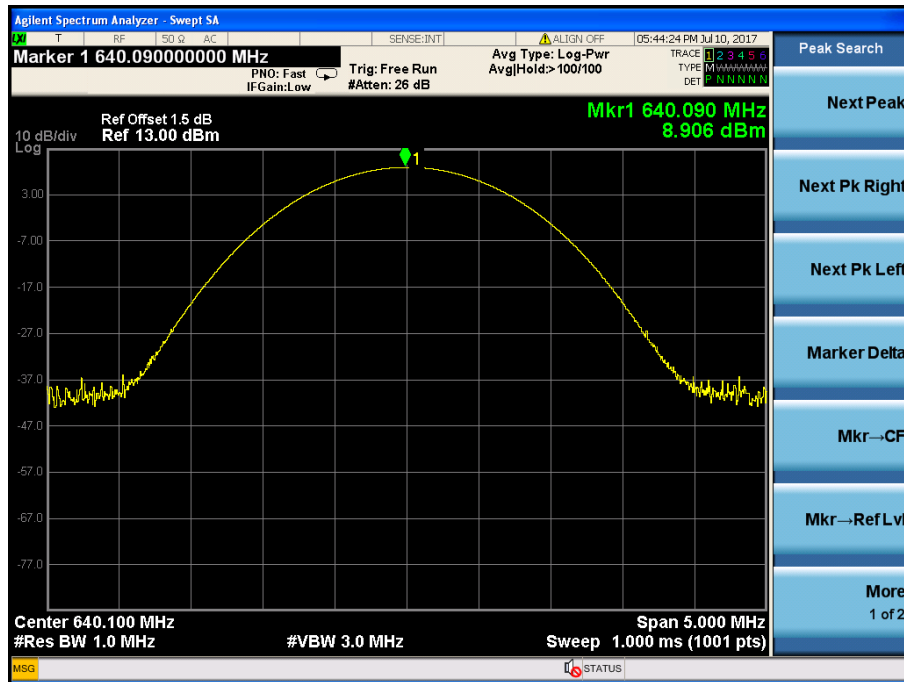
3.3 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

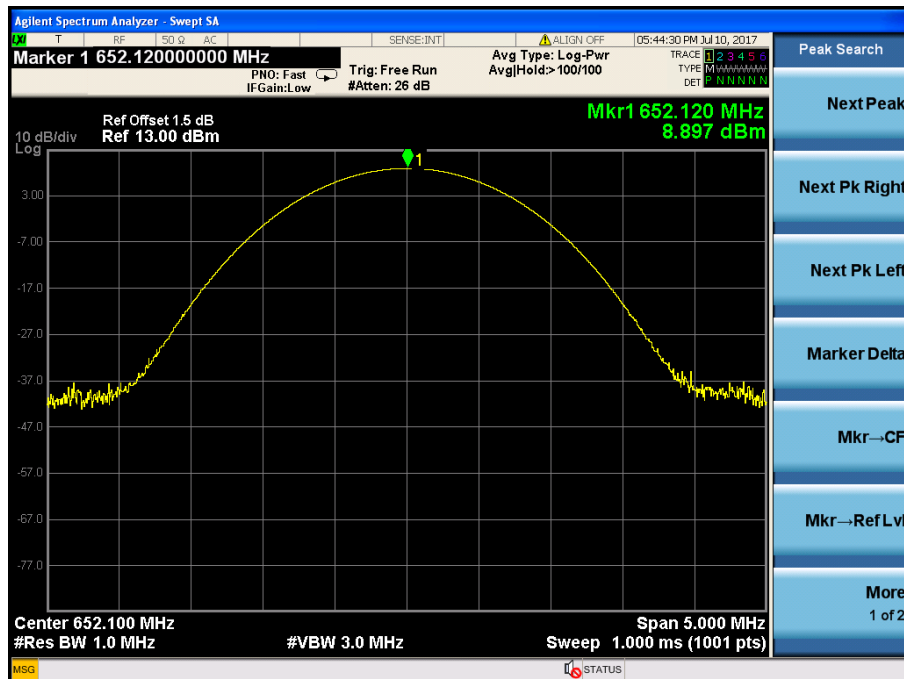
3.4 Test Result/Plots

Channel	Frequency (MHz)	RF Stage Voltage (Vdc)	Collected Current (mA)	Output Power (dBm)	Limit (dBm)
Low	640.10	3.00	0.35	8.906	13
Middle	652.10	3.00	0.35	8.897	13
High	663.90	3.00	0.35	8.909	13

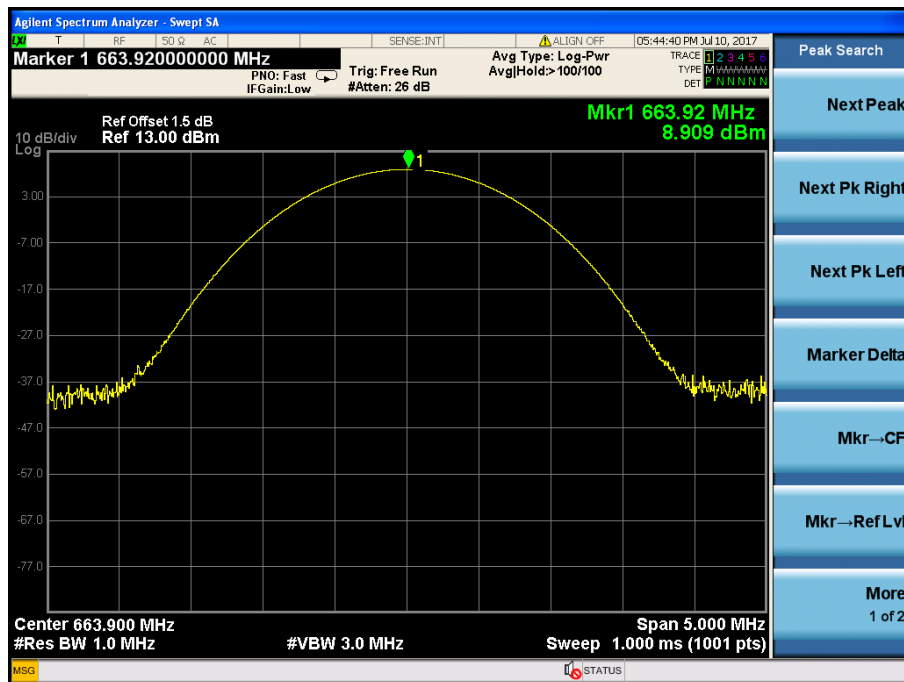
Low Channel (640.10MHz)



Middle Channel (652.10MHz)



High Channel (663.90MHz)



4. OCCUPIED BANDWIDTH

4.1 Standard Applicable

According to FCC 15.236(f), The operating frequency within a permissible band of operation as defined in paragraph (c) must comply with the following requirements.

(1) The frequency selection shall be offset from the upper or lower band limits by 25 kHz or an integral multiple thereof.

(2) One or more adjacent 25 kHz segments within the assignable frequencies may be combined to form a channel whose maximum bandwidth shall not exceed 200 kHz. The operating bandwidth shall not exceed 200 kHz.

Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3 of ETSI EN 300 422-1 V1.4.2 (2011-08) (incorporated by reference, see §15.38). Emissions outside this band shall comply with the limit specified at the edges of the ETSI mask

4.2 Test Procedure

According to ANSI C63.10-2013 section 6.9 for additional Test Set-Up procedures, the occupied bandwidth of emission was measured with a Spectrum Analyzer connected to the antenna terminal while EUT was operating in 2.5kHz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. Then mark the -26dB Bandwidth and record it.

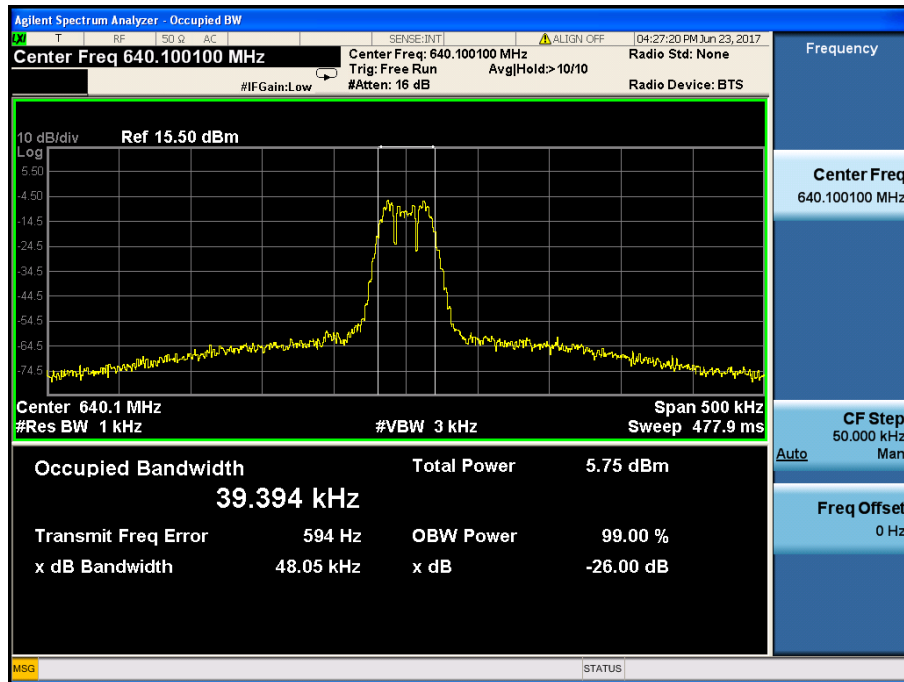
4.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

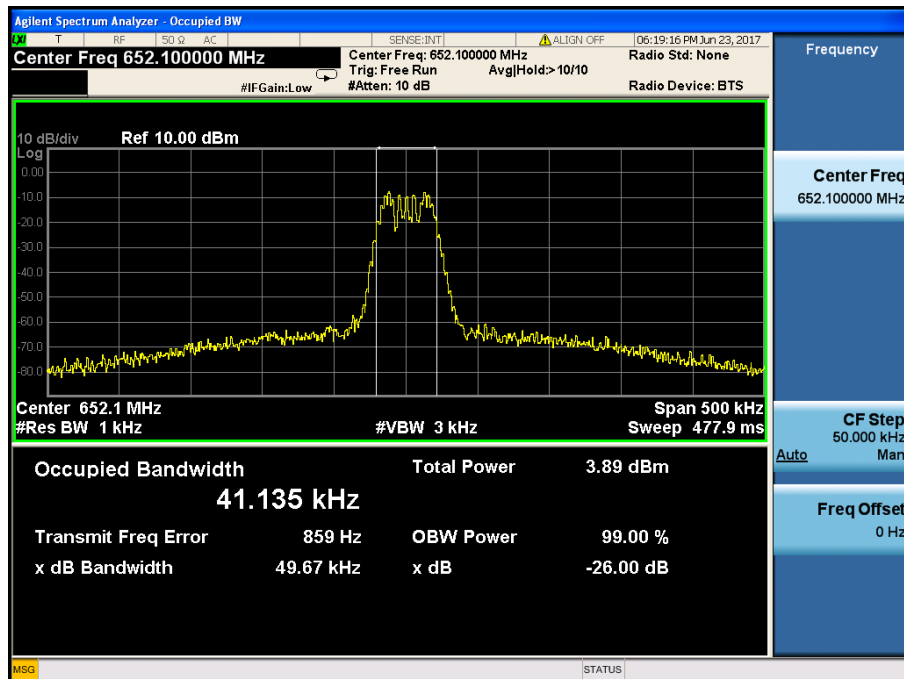
4.4 Test Results/Plots

Test Channel	Frequency (MHz)	-26dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit (kHz)
Low	640.10	48.05	39.394	200
Middle	652.10	49.67	41.135	200
High	663.90	52.10	42.944	200

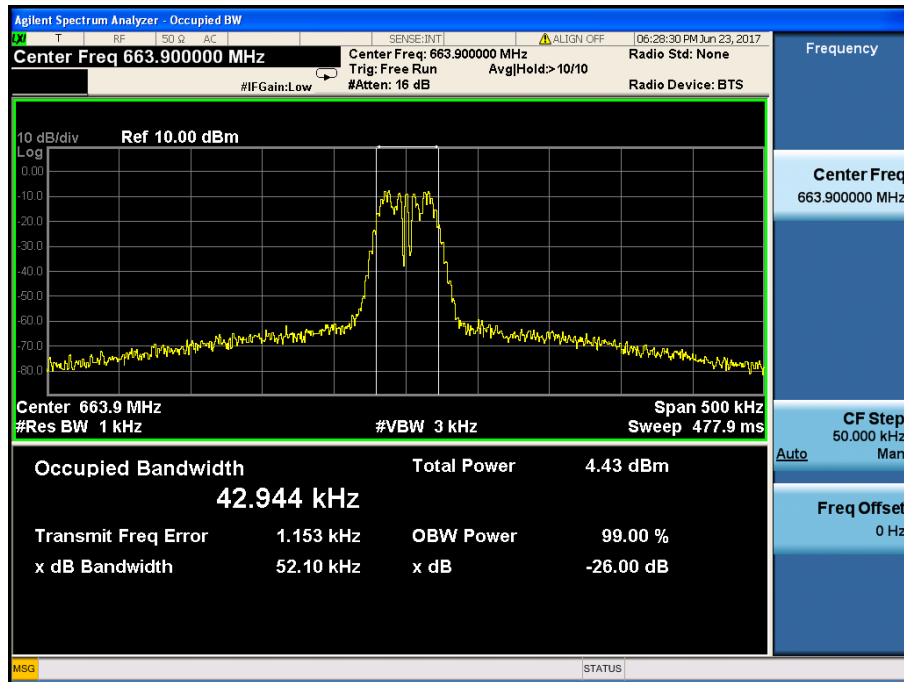
Low Channel (640.10MHz)



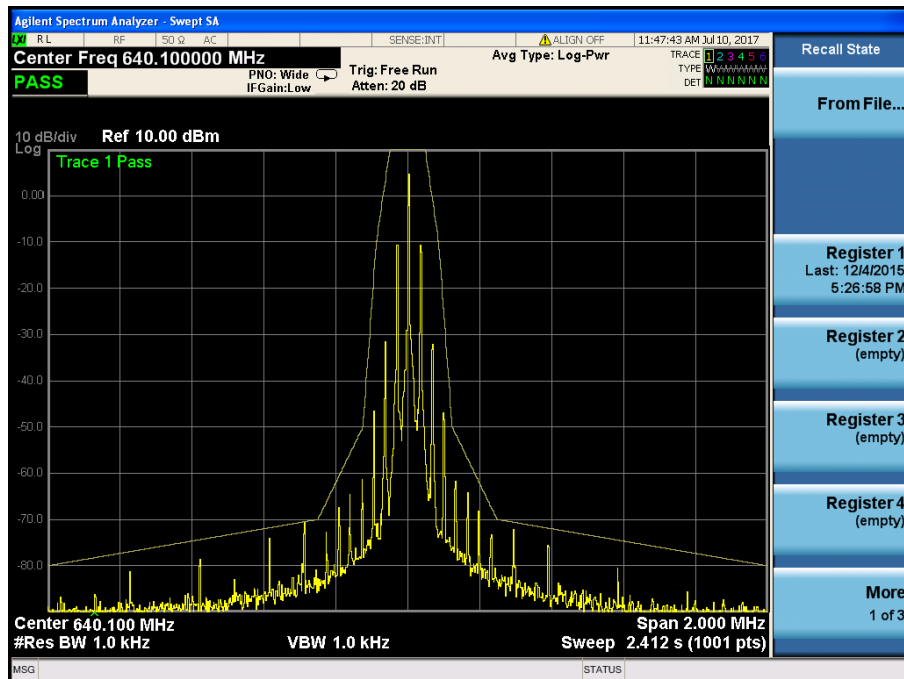
Middle Channel (652.10MHz)



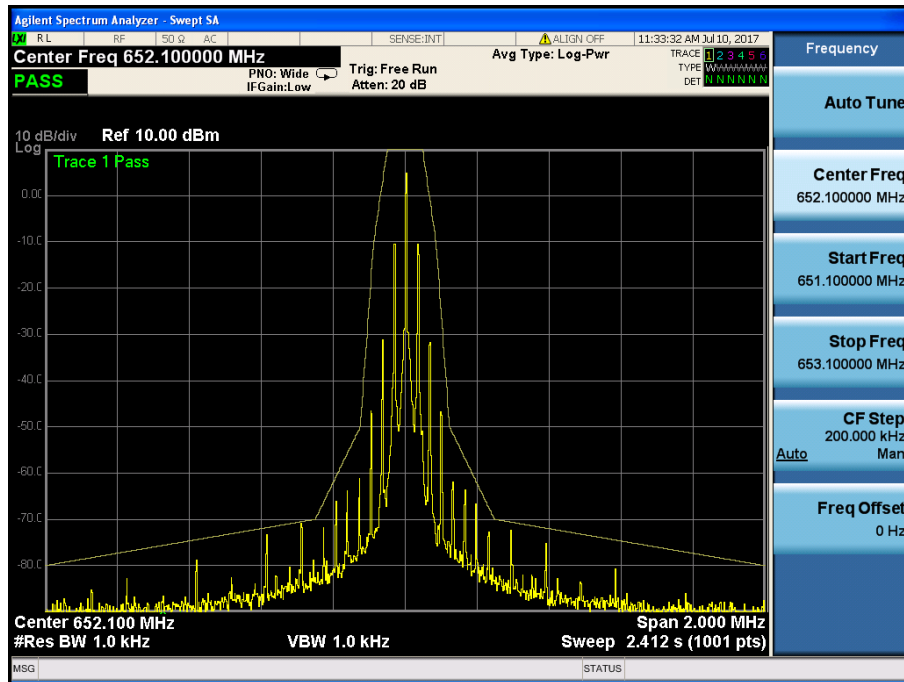
High Channel (663.90MHz)



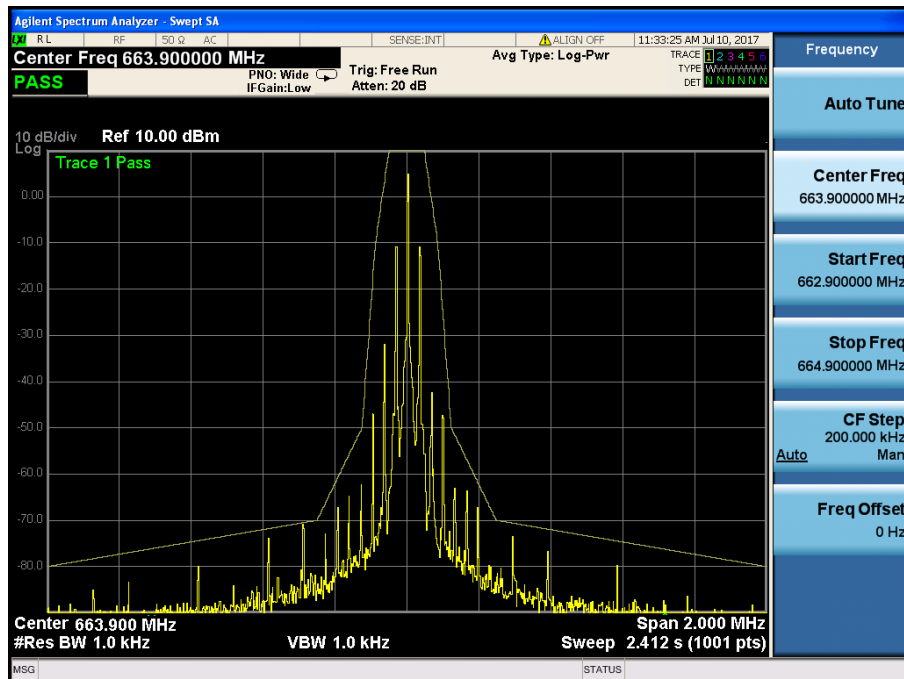
Emission Mask (640.10MHz)



Emission Mask (652.10MHz)



Emission Mask (663.90MHz)



5. RADIATED SPURIOUS EMISSION

5.1 Standard Applicable

According to FCC 15.236(g), Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3 of ETSI EN 300 422-1 V1.4.2 (2011-08) (incorporated by reference, see §15.38). Emissions outside this band shall comply with the limit specified at the edges of the ETSI mask.

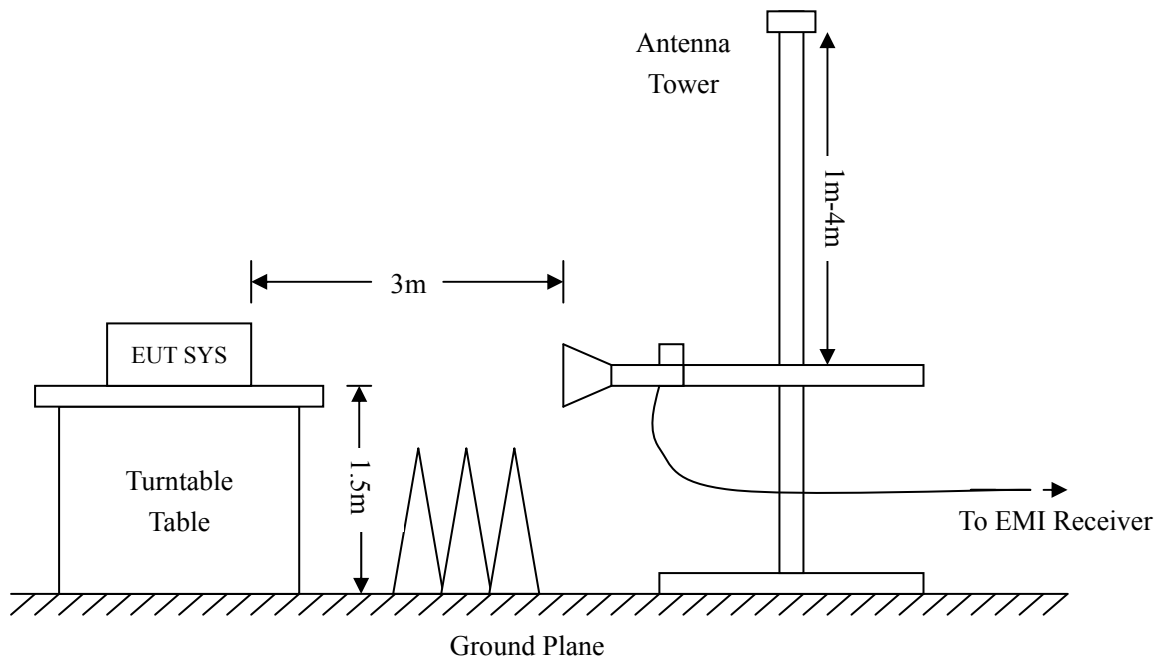
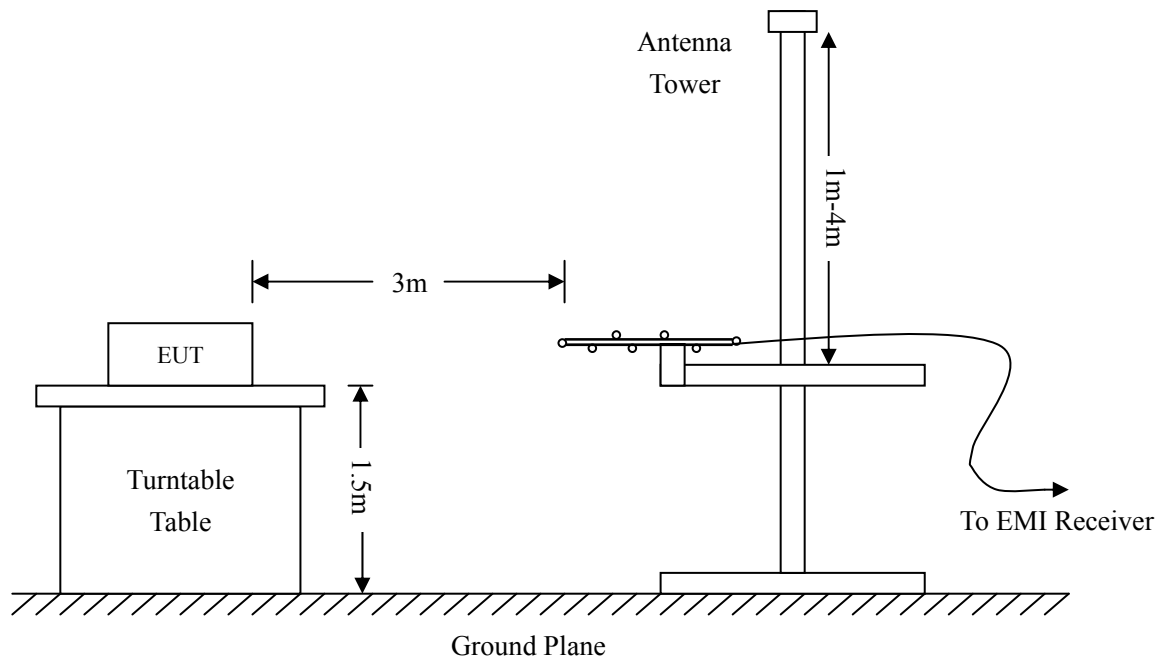
5.2 Test Procedure

The setup of EUT is according with ANSI C63.4-2014 measurement procedure.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.



Frequency :9kHz-30MHz
 RBW=10KHz,
 VBW =30KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak

Frequency :30MHz-1GHz
 RBW=120KHz,
 VBW=300KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, QP

Frequency :Above 1GHz
 RBW=1MHz,
 VBW=3MHz(Peak), 10Hz(AV)
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, AV

5.3 Environmental Conditions

Temperature:	26° C
Relative Humidity:	52%
ATM Pressure:	1022 mbar

5.4 Summary of Test Results/Plots

According to the data below, the FCC Part 15.236 standards, and had the worst margin of:

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Plot of Radiated Emissions Test Data (30MHz to 1GHz)

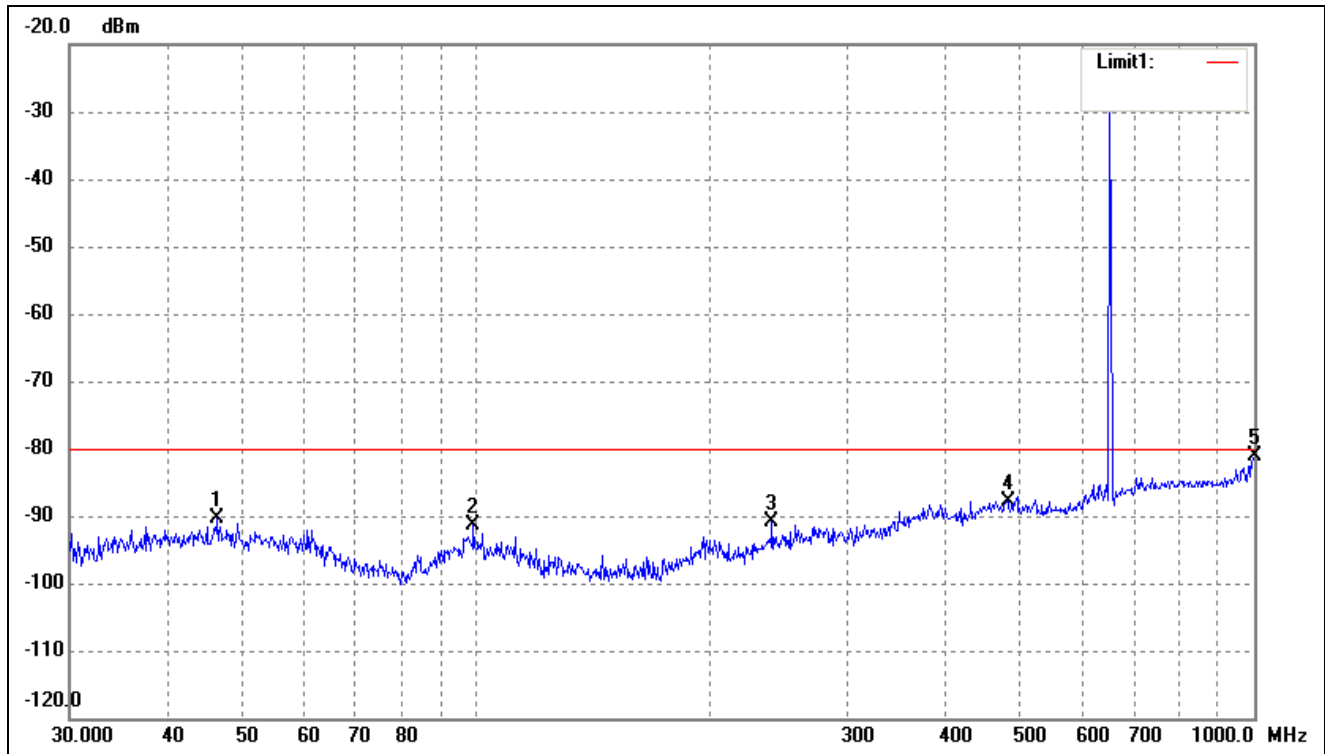
EUT: Card Transmitter

Tested Model: CT-96C

Operating Condition: Transmitting Low Channel (640.10MHz)

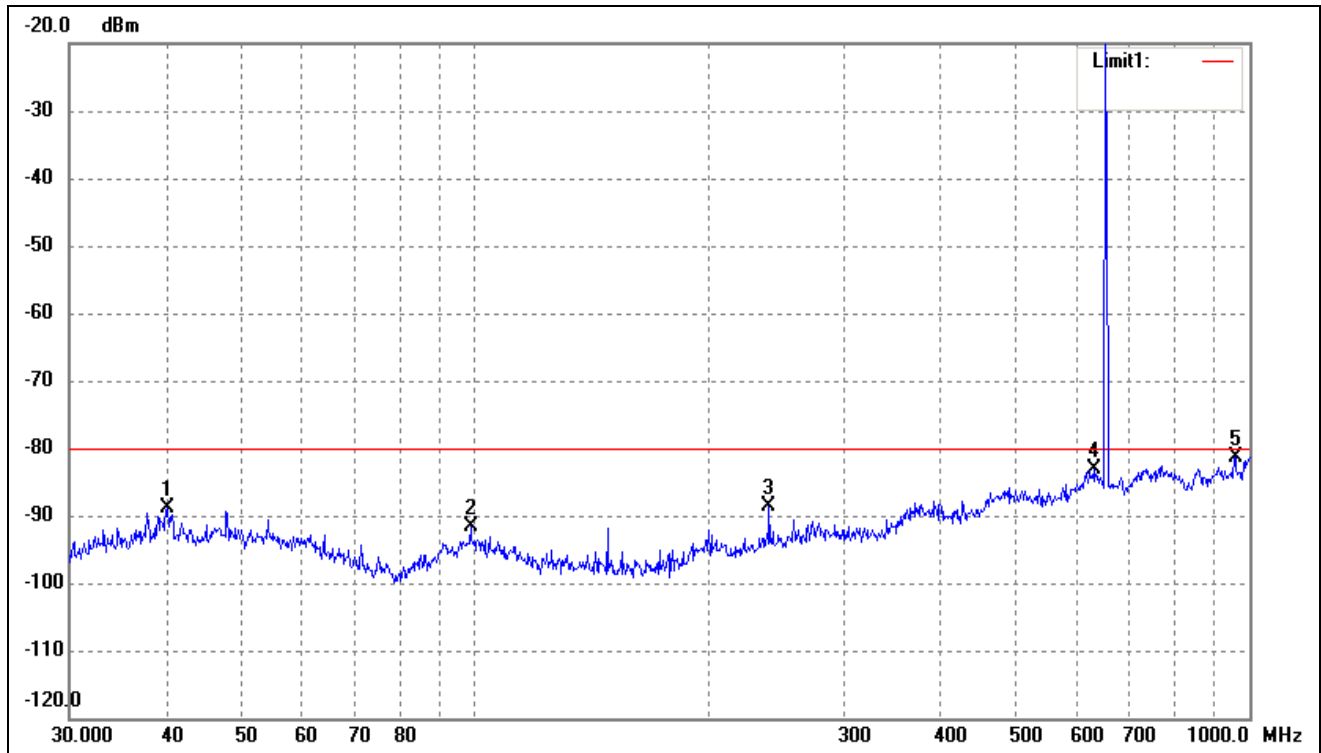
Comment: DC 3V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	46.5030	-79.64	-10.63	-90.27	-80.00	-10.27	ERP
2	99.1797	-79.71	-11.58	-91.29	-80.00	-11.29	ERP
3	239.9874	-79.85	-10.96	-90.81	-80.00	-10.81	ERP
4	482.2156	-82.32	-5.44	-87.76	-80.00	-7.76	ERP
5	1000.0000	-83.81	2.65	-81.16	-80.00	-1.16	ERP

Test Specification: Vertical

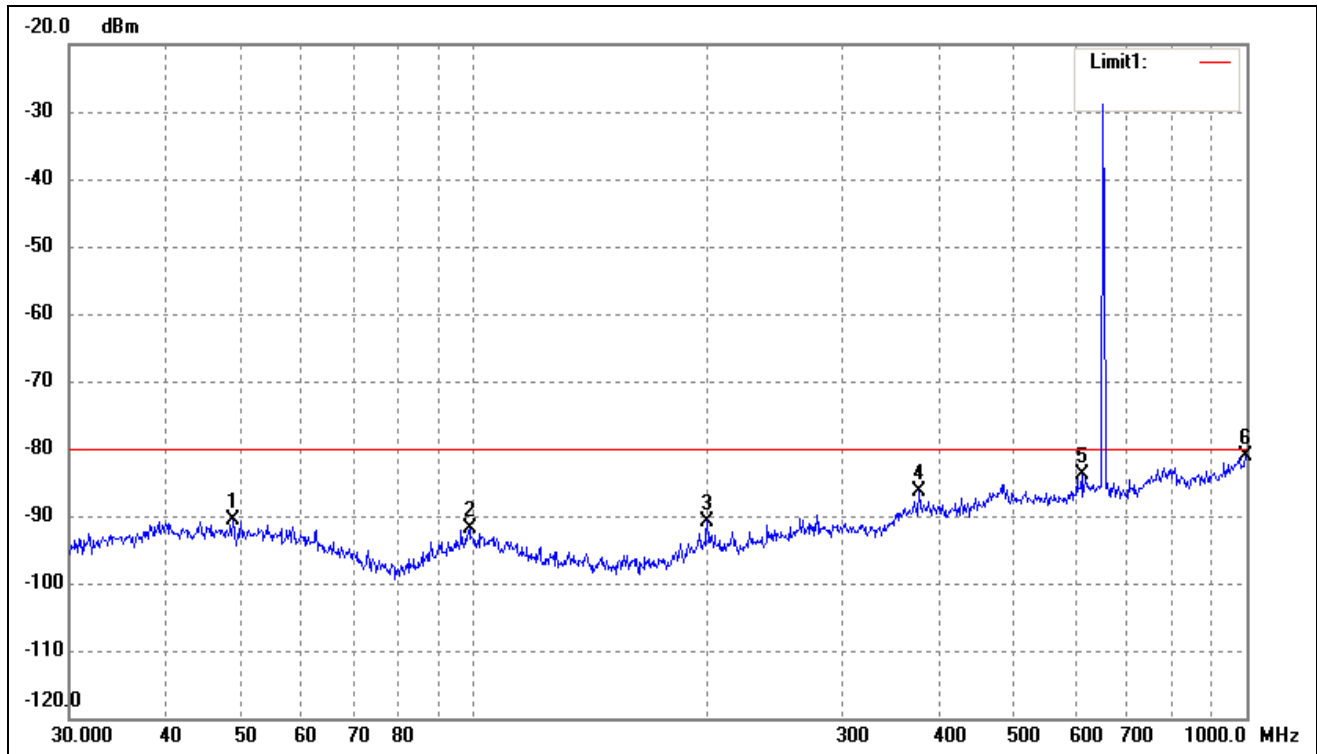


No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	40.1347	-78.41	-10.40	-88.81	-80.00	-8.81	ERP
2	98.8326	-80.04	-11.66	-91.70	-80.00	-11.70	ERP
3	239.9874	-77.78	-10.96	-88.74	-80.00	-8.74	ERP
4	629.4772	-80.23	-2.99	-83.22	-80.00	-3.22	ERP
5	958.7943	-82.88	1.60	-81.28	-80.00	-1.28	ERP

Plot of Radiated Emissions Test Data (30MHz to 1GHz)

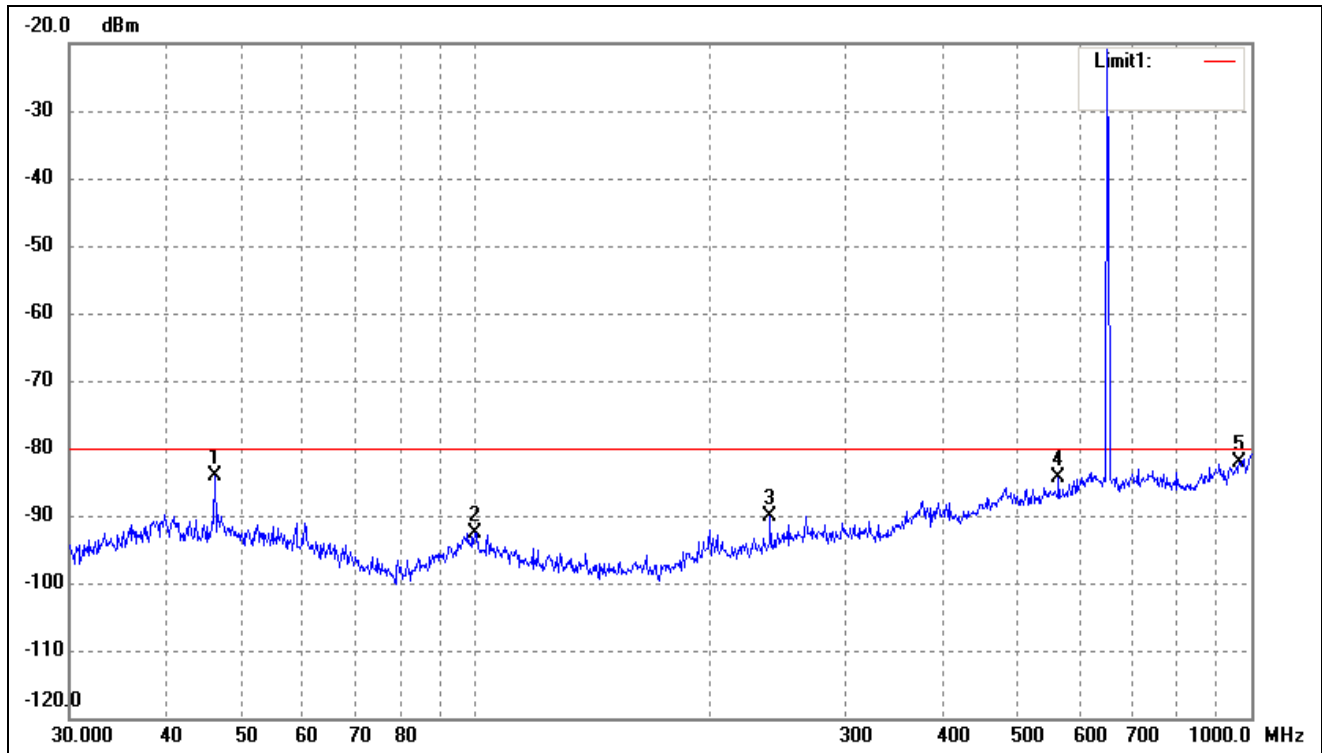
EUT: Card Transmitter
Tested Model: CT-96C
Operating Condition: Transmitting Middle Channel (652.10MHz)
Comment: DC 3V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	48.8429	-79.99	-10.68	-90.67	-80.00	-10.67	ERP
2	98.8326	-80.22	-11.66	-91.88	-80.00	-11.88	ERP
3	200.6881	-79.12	-11.63	-90.75	-80.00	-10.75	ERP
4	377.2591	-79.13	-7.13	-86.26	-80.00	-6.26	ERP
5	612.0642	-80.55	-3.40	-83.95	-80.00	-3.95	ERP
6	996.4996	-83.62	2.53	-81.09	-80.00	-1.09	ERP

Test Specification: Vertical

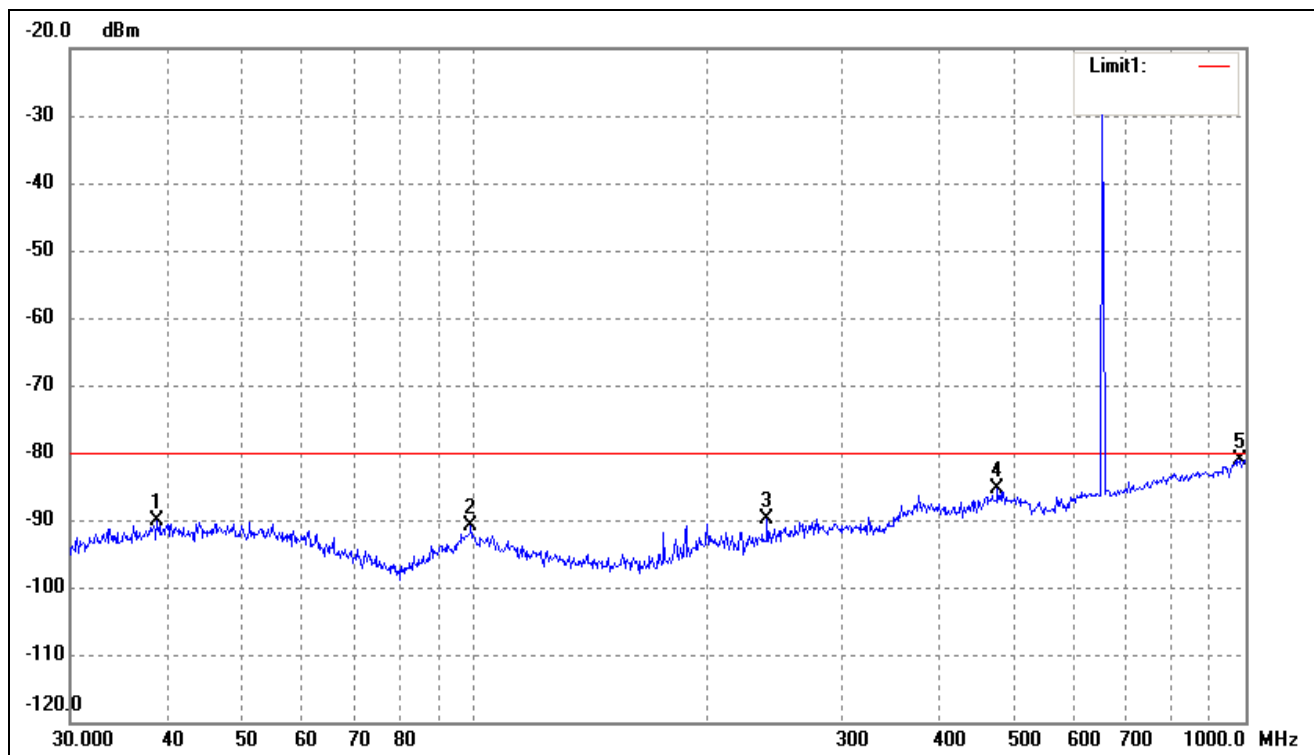


No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	46.1780	-73.80	-10.44	-84.24	-80.00	-4.24	ERP
2	99.8777	-81.18	-11.43	-92.61	-80.00	-12.61	ERP
3	239.9874	-79.14	-10.96	-90.10	-80.00	-10.10	ERP
4	564.6389	-78.84	-5.62	-84.46	-80.00	-4.46	ERP
5	965.5421	-83.79	1.67	-82.12	-80.00	-2.12	ERP

Plot of Radiated Emissions Test Data (30MHz to 1GHz)

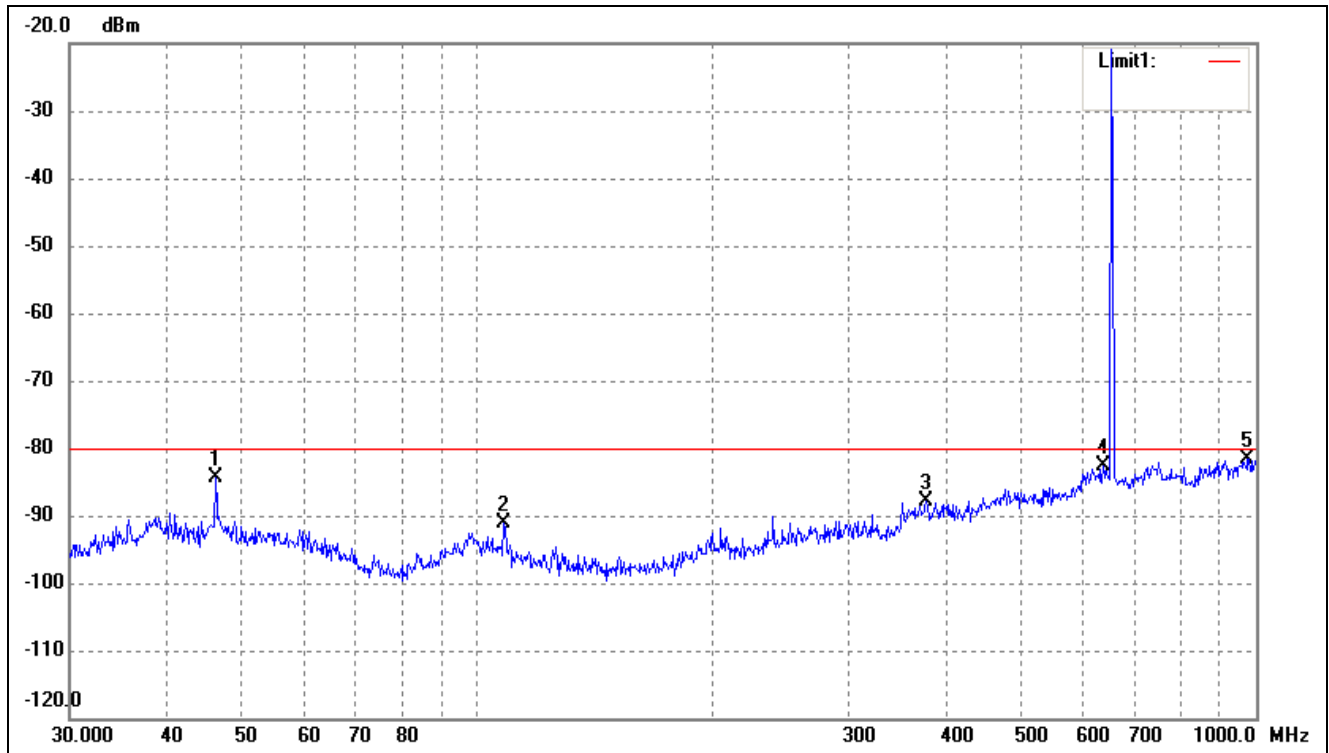
EUT: Card Transmitter
 Tested Model: CT-96C
 Operating Condition: Transmitting High Channel (663.90MHz)
 Comment: DC 3V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	38.8879	-79.52	-10.66	-90.18	-80.00	-10.18	ERP
2	99.1797	-79.25	-11.58	-90.83	-80.00	-10.83	ERP
3	239.9874	-79.00	-10.96	-89.96	-80.00	-9.96	ERP
4	477.1694	-79.87	-5.55	-85.42	-80.00	-5.42	ERP
5	982.6200	-83.23	2.09	-81.14	-80.00	-1.14	ERP

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	46.1780	-73.84	-10.44	-84.28	-80.00	-4.28	ERP
2	108.2667	-78.84	-12.35	-91.19	-80.00	-11.19	ERP
3	377.2591	-80.85	-7.13	-87.98	-80.00	-7.98	ERP
4	636.1340	-79.44	-3.12	-82.56	-80.00	-2.56	ERP
5	975.7529	-83.56	1.91	-81.65	-80.00	-1.65	ERP

Spurious Emission Above 1GHz

Frequency	Reading	Correct	Result	Limit	Margin	Polar
(MHz)	(dBm)	dB	(dBm)	(dBm)	(dB)	H/V
Low Channel (640.10MHz)						
1280.20	-90.54	8.23	-82.31	-80	-2.31	H
1280.20	-91.04	8.23	-82.81	-80	-2.81	V
1920.30	-91.70	9.57	-82.13	-80	-2.13	H
1920.30	-92.02	9.57	-82.45	-80	-2.45	V
2560.40	-94.97	13.02	-81.95	-80	-1.95	H
2560.40	-94.55	13.02	-81.53	-80	-1.53	V
Middle Channel (652.10MHz)						
1304.20	-90.97	8.51	-82.46	-80	-2.46	H
1304.20	-91.13	8.51	-82.62	-80	-2.62	V
1956.30	-91.84	9.61	-82.23	-80	-2.23	H
1956.30	-92.05	9.61	-82.44	-80	-2.44	V
2608.40	-94.81	13.13	-81.68	-80	-1.68	H
2608.40	-94.50	13.13	-81.37	-80	-1.37	V
High Channel (663.90MHz)						
1327.80	-91.03	8.59	-82.44	-80	-2.44	H
1327.80	-91.38	8.59	-82.79	-80	-2.79	V
1991.70	-92.13	9.67	-82.46	-80	-2.46	H
1991.70	-92.15	9.67	-82.48	-80	-2.48	V
2655.60	-94.52	13.22	-81.30	-80	-1.30	H
2655.60	-94.90	13.22	-81.68	-80	-1.68	V

Note: is carried out with frequency rang 30MHz to the tenth harmonics, which above 3th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

With above 1GHz date is based on 1m test transform to 3m.

6. FREQUENCY STABILITY

6.1 Standard Applicable

According to FCC 15.236(f)(3), The frequency tolerance of the carrier signal shall be maintained within $\pm 0.005\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. Battery operated equipment shall be tested using a new battery.

6.2 Test Procedure

1. Setup the configuration of the ambient temperature form -20°C to 50°C with sufficient time. And measure the different power of the EUT with an artificial power from highest to end point voltage.
2. Set frequency counter center frequency to the right frequency needs to be measured.

6.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

6.4 Test Results/Plots

Test conditions		Frequency Error		
		640.10 MHz	652.10 MHz	663.90 MHz
T _{nom} (20°C)	V _{min} (2.55V)	640.0985	652.0951	663.8975
	V _{max} (3.0V)	640.0971	652.0936	663.8963
T(-20°C)	V _{nom} (3.0V)	640.0955	652.0919	663.8927
T(-10°C)	V _{nom} (3.0V)	640.0963	652.0963	663.8956
T(0°C)	V _{nom} (3.0V)	640.0927	652.0917	663.8937
T(10°C)	V _{nom} (3.0V)	640.0935	652.0955	663.8917
T _{nom} (20°C)	V _{nom} (3.0V)	640.0905	652.0987	663.8922
T(30°C)	V _{nom} (3.0V)	640.0963	652.0962	663.8905
T(40°C)	V _{nom} (3.0V)	640.0992	652.0921	663.8939
T(50°C)	V _{nom} (3.0V)	640.0955	652.0963	663.8950
T _{nom} (20°C)	V _{min} (2.55V)	640.0951	652.0939	663.8957
	V _{max} (3.0V)	640.0981	652.0955	663.8969
Max. frequency error (ppm)		-14.84	-12.73	-14.31
Limit (ppm)		±50ppm		
End Point		DC 3.0V		

***** END OF REPORT *****