

FCC PART 74
Measurement and Test Report
For
CAD Audio, LLC
6573 Cochran RD, BLDG I, Solon, OH44139, USA

FCC ID: OQ5GXL-U

FCC Rules:	<u>FCC Part 74</u>	
Product Description:	<u>Wireless Microphone</u>	
Tested Model:	<u>GXL-U</u>	
Report No.:	<u>STR13048481I</u>	
Tested Date:	<u>2013-05-08 to 2013-06-04</u>	
Issued Date:	<u>2013-06-25</u>	
Tested By:	<u>Seven Song / Engineer</u>	<i>Seven Song</i>
Reviewed By:	<u>Lahm Peng / EMC Manager</u>	<i>Lahm peng</i>
Approved & Authorized By:	<u>Jandy so / PSQ Manager</u>	<i>Jandyso</i>
Prepared By:	SEM.Test Compliance Service Co., Ltd 3/F, Jinbao Commerce Building, Xin'an Fanshen 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 SEM.Test Compliance Service Co., Ltd

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1. GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

Client Information

Applicant: CAD Audio, LLC
 Address of applicant: 6573 Cochran RD, BLDG I, Solon, OH44139, USA

Manufacturer: Enbao Electronics Co., Ltd.
 Address of manufacturer: Qijie Temple, East Zhongnan road, Enping city, Guangdong, China

General Description of EUT	
Product Name:	wireless microphone
Trade Name:	CAD
Model No.:	GXL-U
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. 15.48 dBm (Conducted)
Frequency Range:	543.1MHz, 554.5MHz, 567.1MHz, 593.5MHz
Modulation:	FM
Antenna Type:	PCB Antenna
Antenna Gain:	-3 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 CAD Audio, LLC in accordance with Part 74 Subpart H 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 result 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 TIA/EIA Standard 603, Telecommunications Industry Association Land Mobile FM or PM Communications Equipment Measurement and Performance Standards and ANSI C63.4-2003, 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.: 994117**

SEM.Test Compliance Services 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 994117.

- **Industry Canada (IC) Registration No.: 7673A**

The 3m Semi-anechoic chamber of SEM.Test Compliance Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 7673A.

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.

1.6 Accessories Equipment List and Details

Description	Manufacturer	Model	Serial Number
/	/	/	/

1.7 EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Cord/Without Cord
/	/	/	/

2. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§74.861(e)(1)(ii)	Output Power Measurement	Compliant
§74.861(e)(3)	Modulation Characteristics	Compliant
§74.861(e)(5)	Occupied Bandwidth Emission	Compliant
§74.861(e)(6)	Radiated Spurious Emission	Compliant
§2.1051	Spurious Emission at Antenna Port	Compliant
§74.86(e)(4)	Frequency Stability	Compliant

3. RF OUTPUT POWER

3.1 Standard Applicable

According to FCC 74.861(e)(1)(ii), for low power auxiliary station operating in the 470-608, and 614–806 MHz bands, the power of the measured unmodulated carrier power ant the output of the transmitter power amplifier (antenna input power) may not exceed 250mW.

3.1 Test Equipment List and Detail

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2013-05-07	2014-05-06
VICTOR	Multimeter	VC9801A	98965350	2013-05-07	2014-05-06
FLUKE	Multimeter	15B	91280239	2013-05-07	2014-05-06

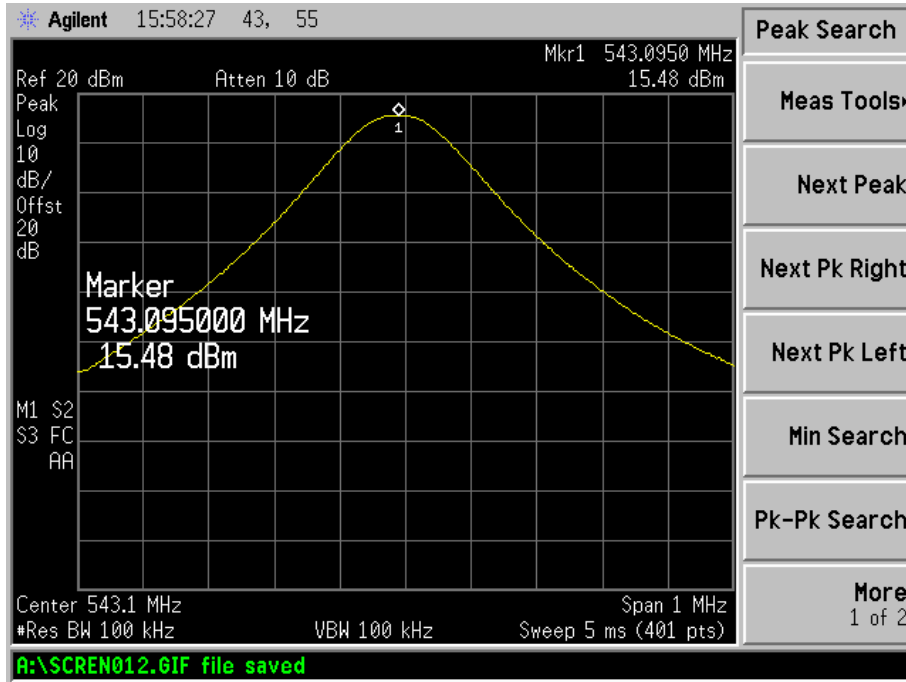
3.3 Test Procedure

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.

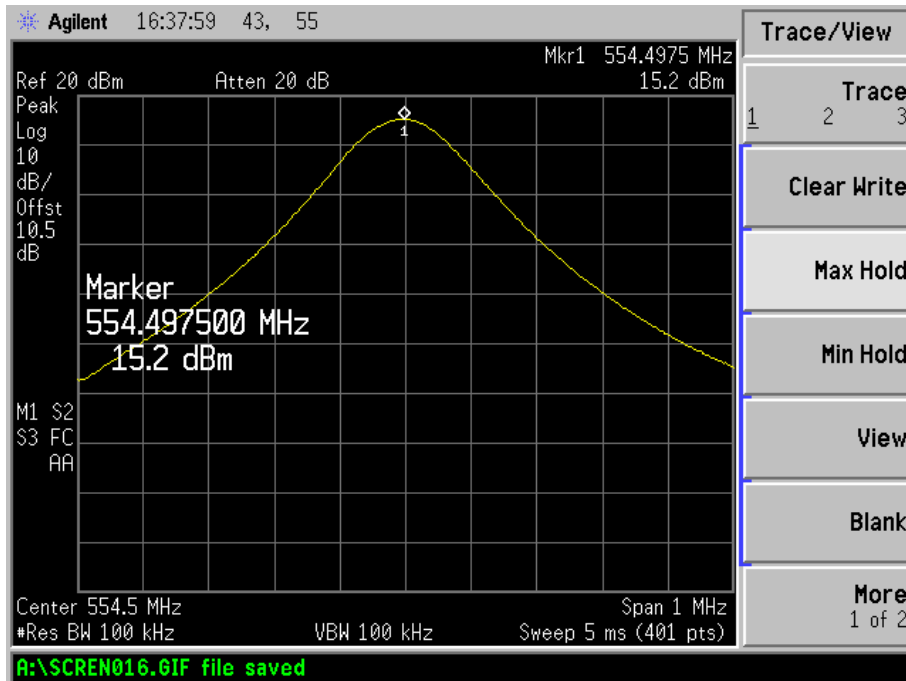
3.2 Test Result/Plots

Channel	Frequency (MHz)	RF Stage Voltage (Vdc)	Collected Current (mA)	Output Power (dBm)	Limit (dBm)
1	543.1	3.00	0.35	15.48	24
2	554.5	3.00	0.34	15.20	24
3	567.1	3.00	0.34	15.35	24
4	593.5	3.00	0.35	15.19	24

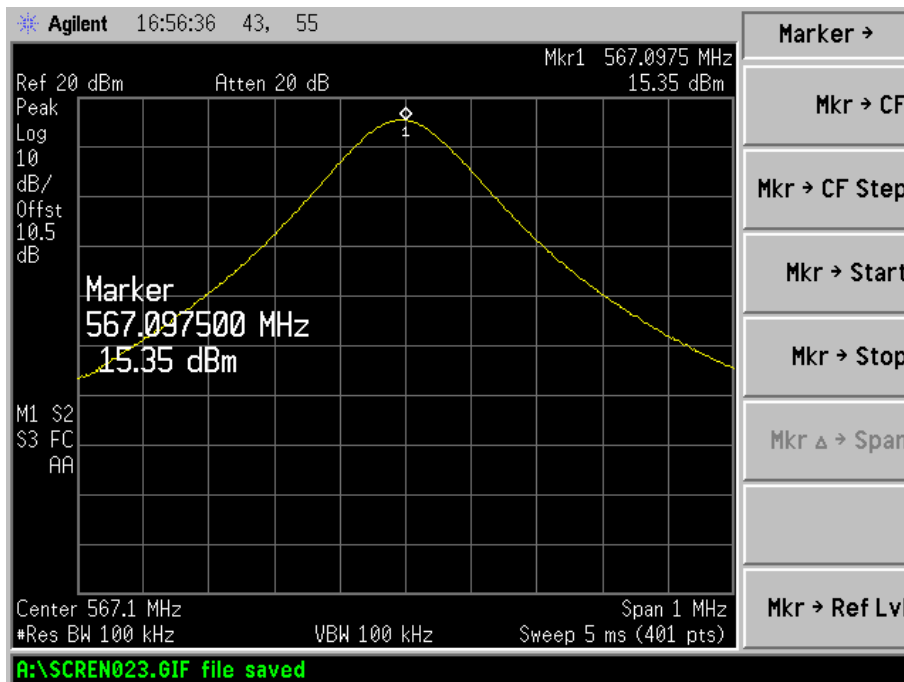
Channel 1 (543.1MHz)



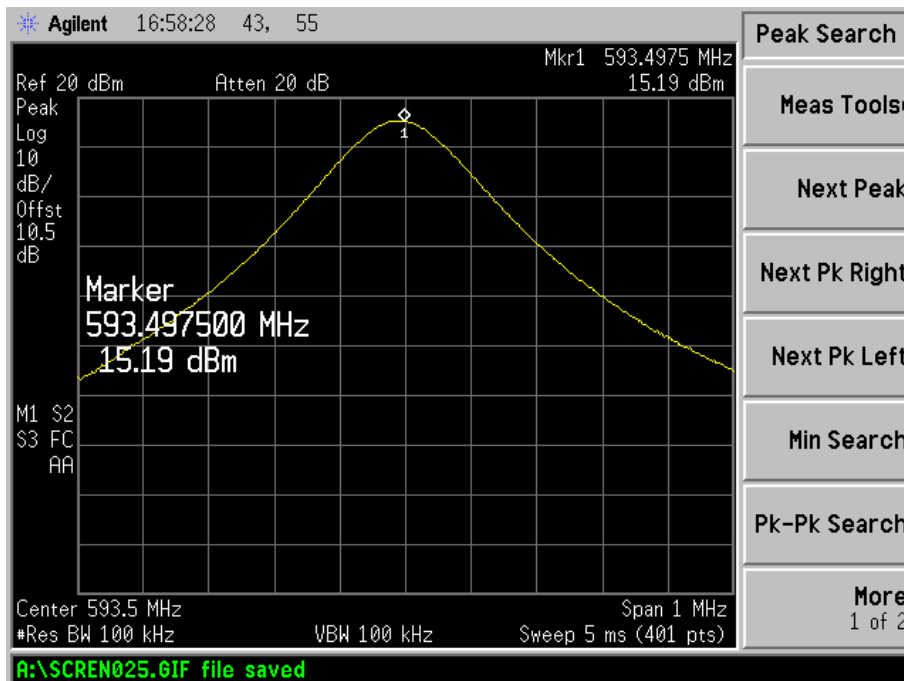
Channel 2 (554.5MHz)



Channel 3 (567.1MHz)



Channel 4 (593.5MHz)



4. MODULATION CHARACTERISTICS

4.1 Standard Applicable

According to FCC 2.1047 (a), for Voice Modulated Communication Equipment, the frequency response of the audio modulating circuit over a range of 100Hz to 5000Hz shall be measured. For equipment required to have an audio low-pass filter, the frequency response of the filter or of all circuitry installed between the modulation limiter and the modulated stage shall be measured.

According to §74.861(e)(3), any form of modulation may be used. A maximum deviation of ± 75 kHz is permitted when frequency modulation is employed.

4.2 Test Equipment List and Details

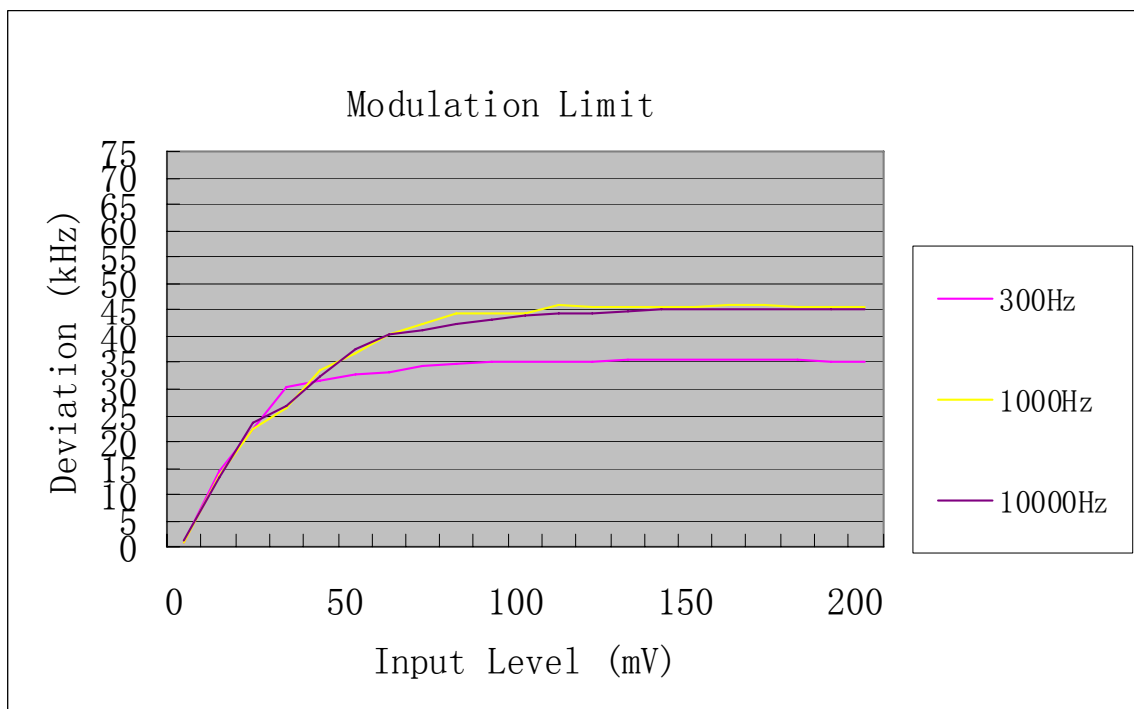
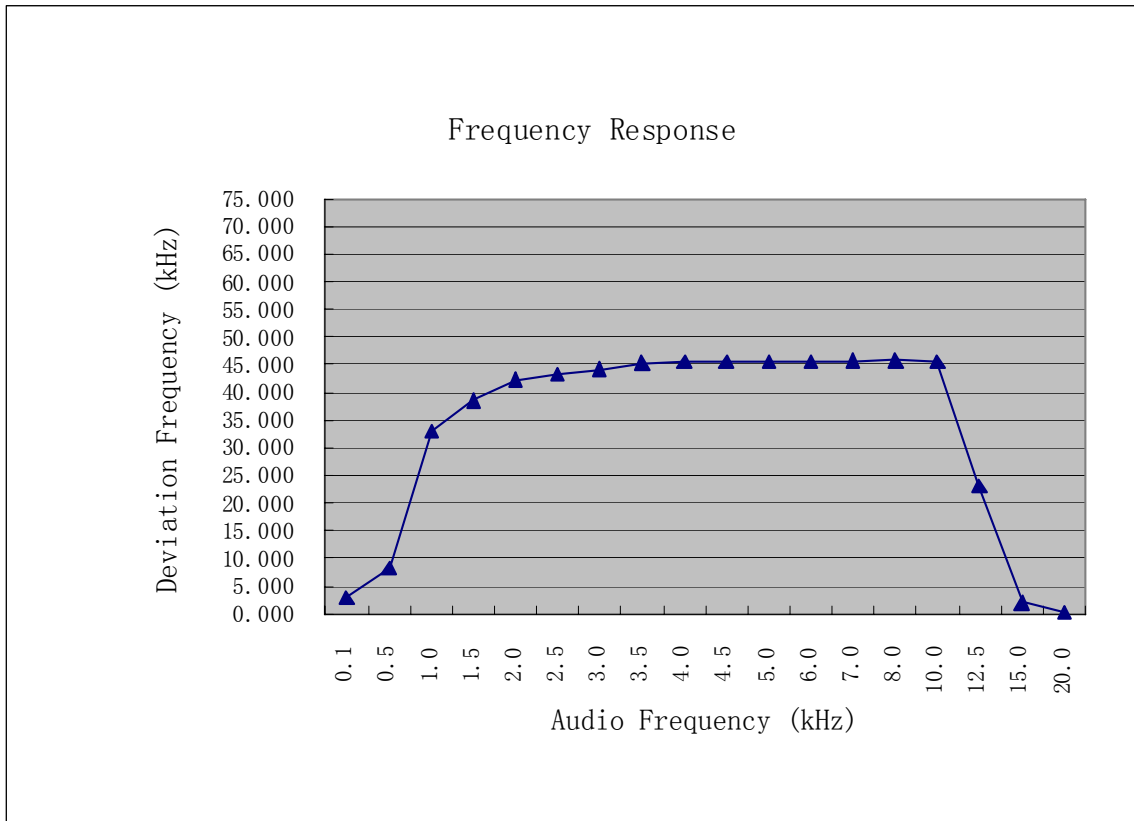
Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Modulation Analyzer	Rohde & Schwarz	FAM 54	334.2015.54	2013-05-07	2014-05-06
Audio Generator	MEILI	MFG-3005	200612187	2013-05-07	2014-05-06

4.3 Test Procedure

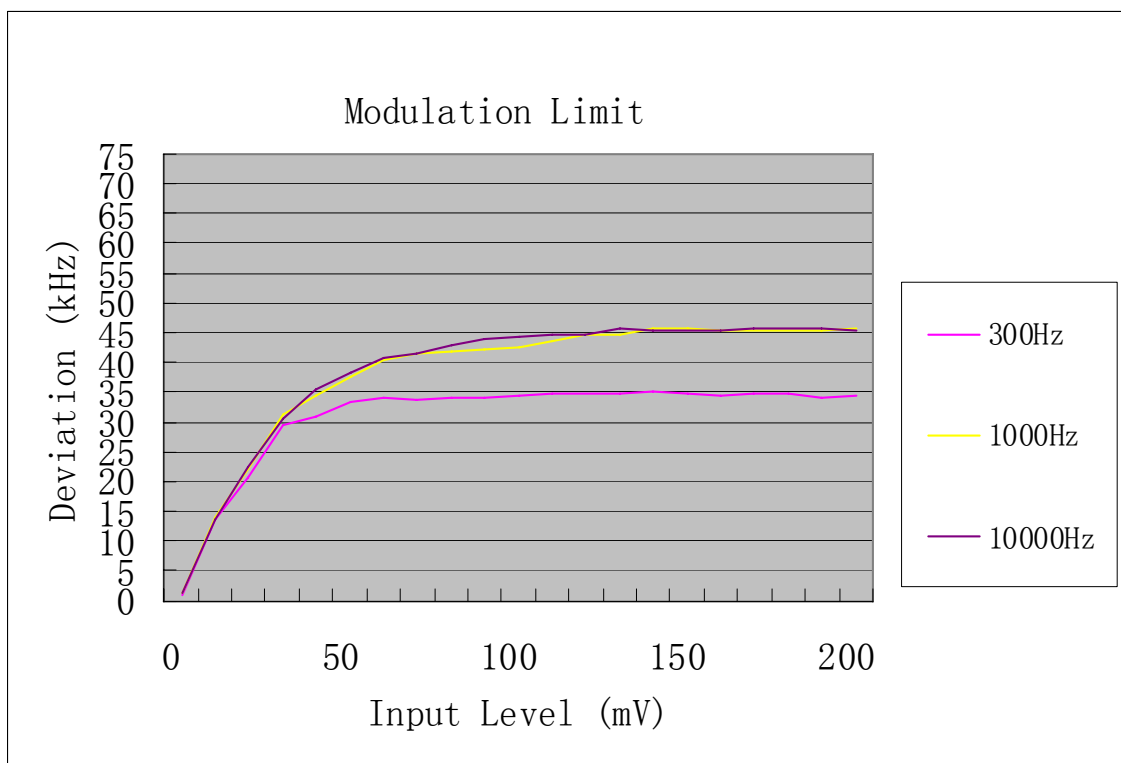
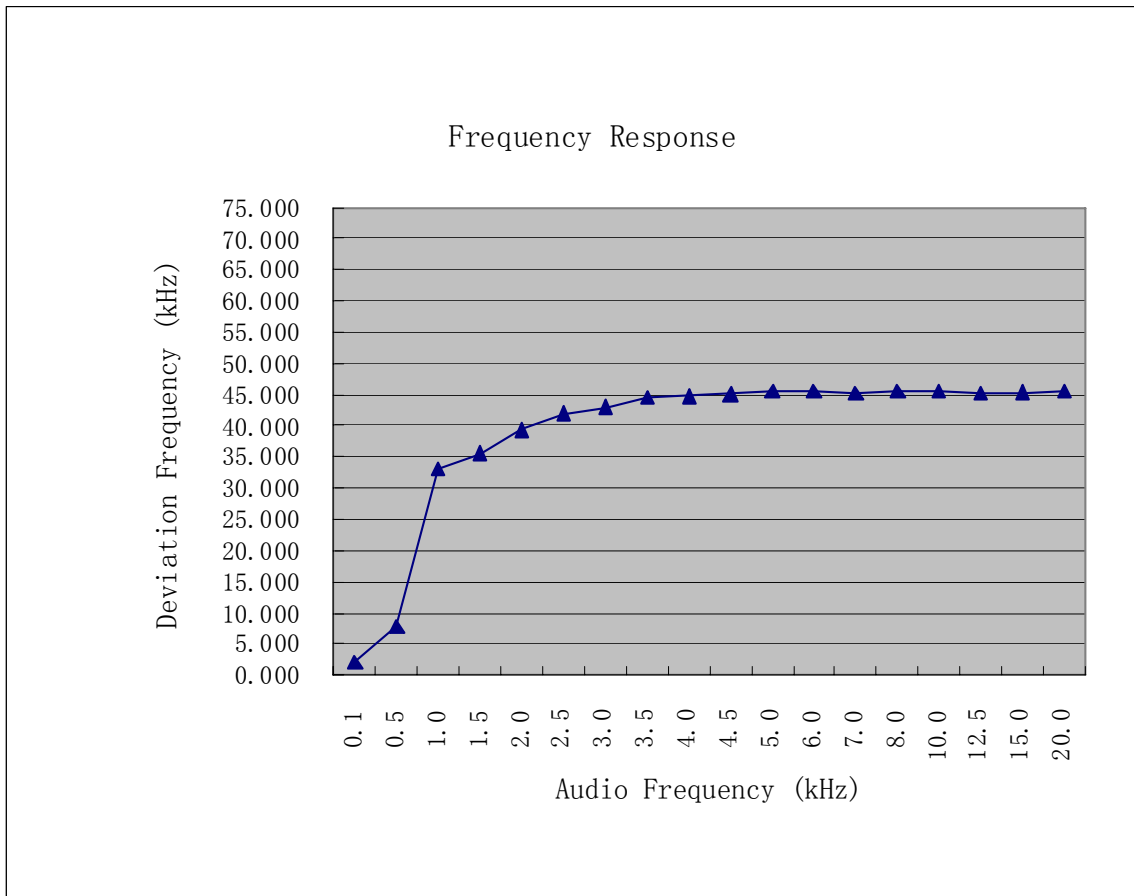
- 1) Position the EUT as shown in figure 1, adjust the audio input frequency to 100 Hz and the input level from 0V to maximum permitted input voltage with recording each carrier frequency deviation responding to respective input level.
- 2) Repeat step 1 with changing the input frequency for 100, 300, 1000, 2500 and 3000 Hz in sequence.

4.4 Test Results/Plots

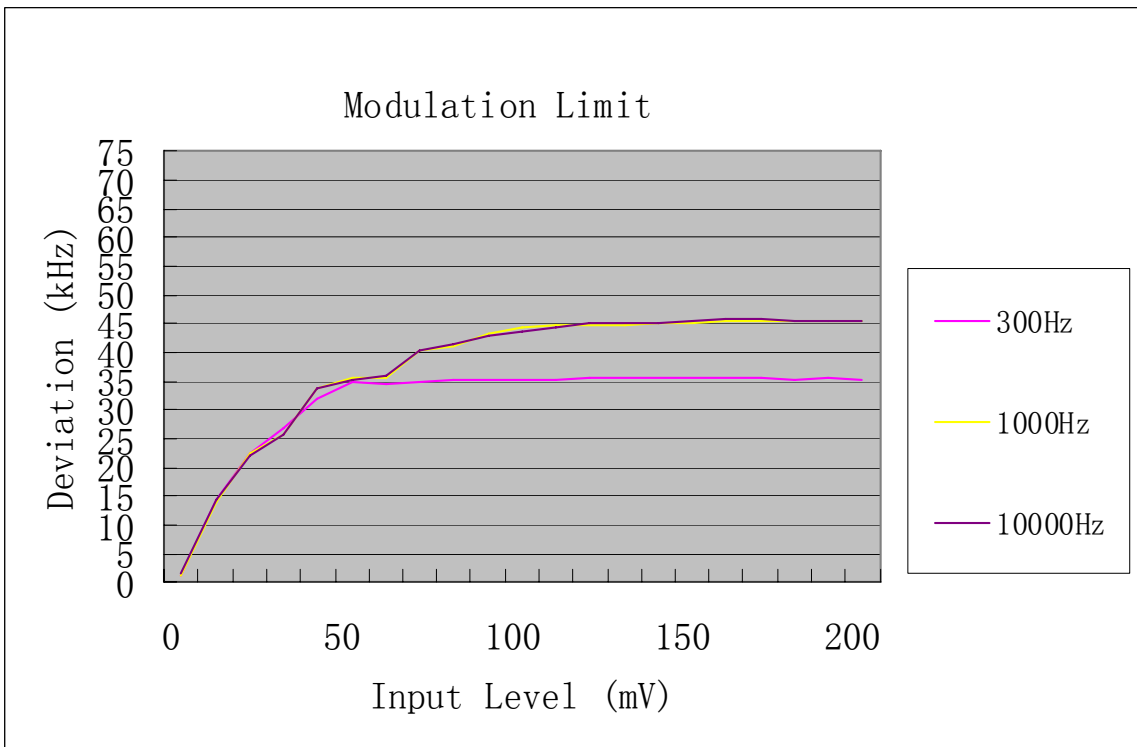
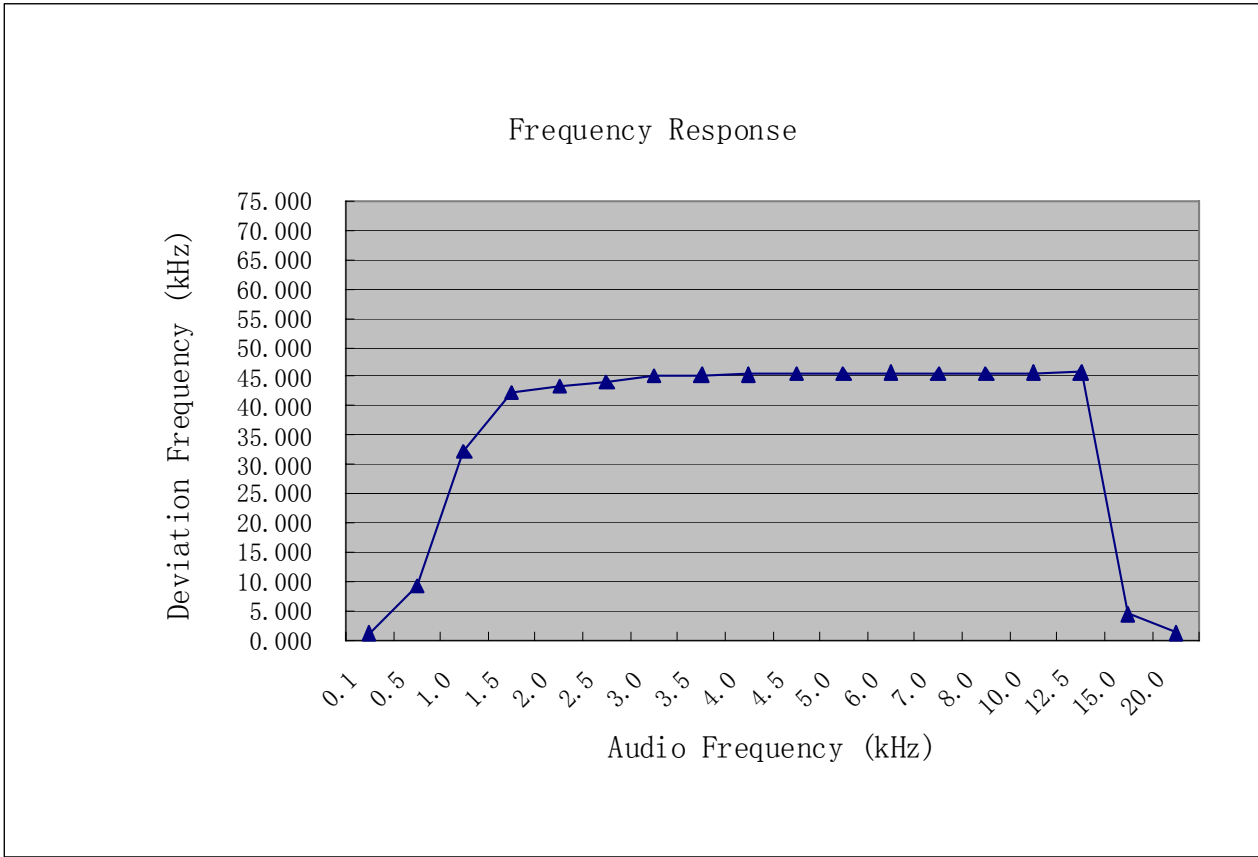
For Channel 1(543.1MHz)



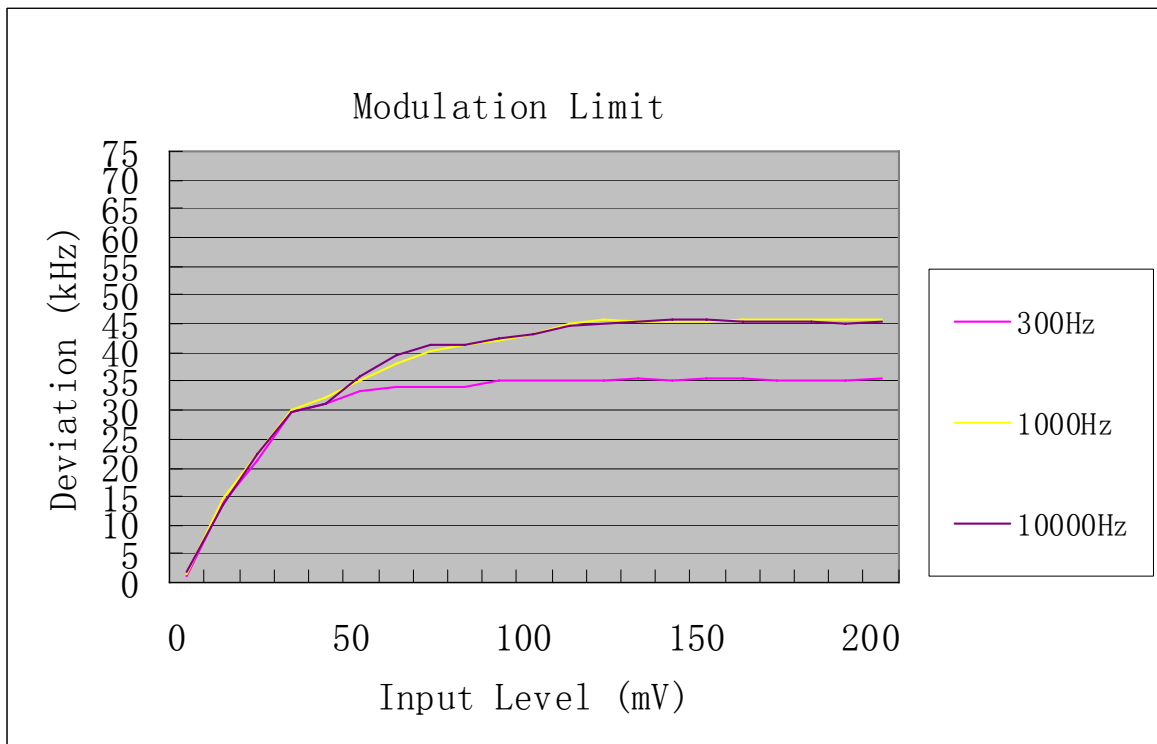
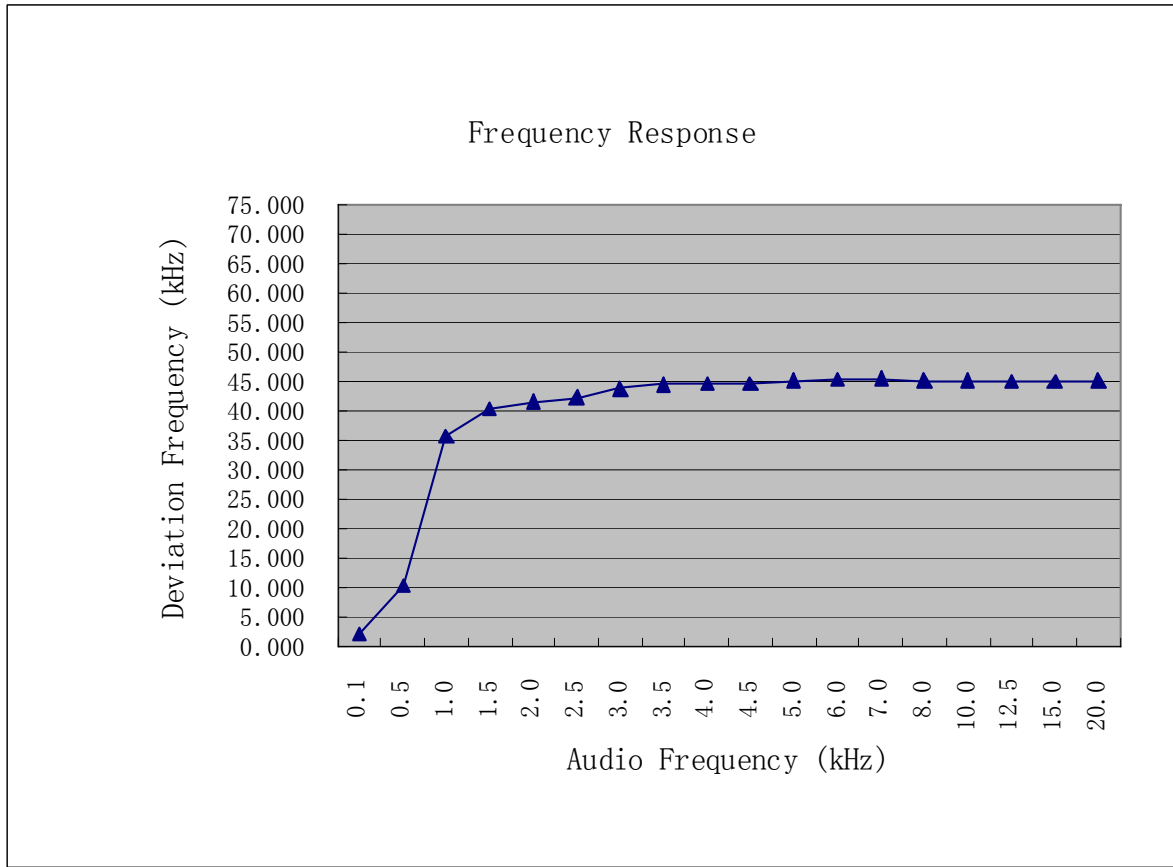
For Middle Channel (554.5 MHz)



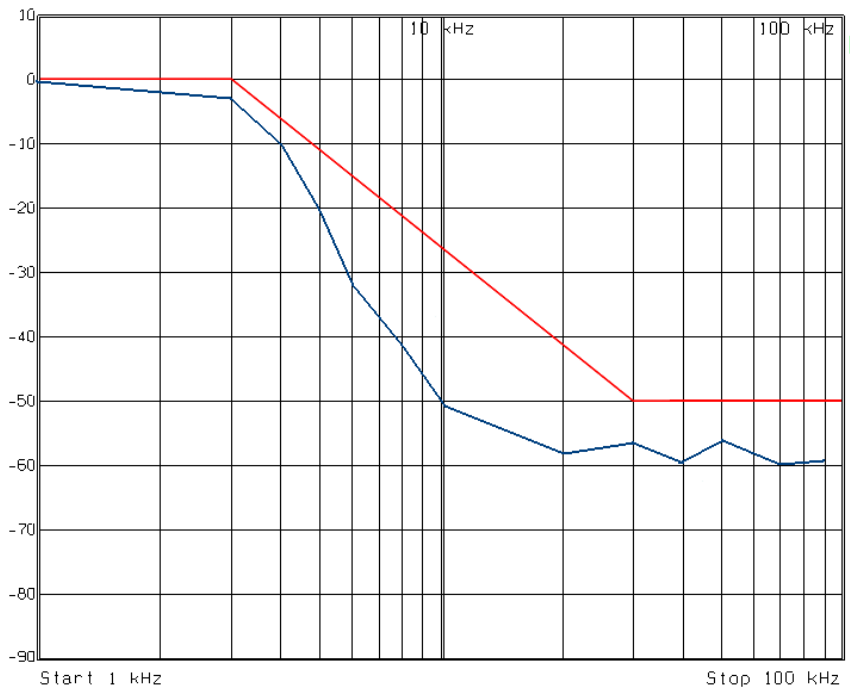
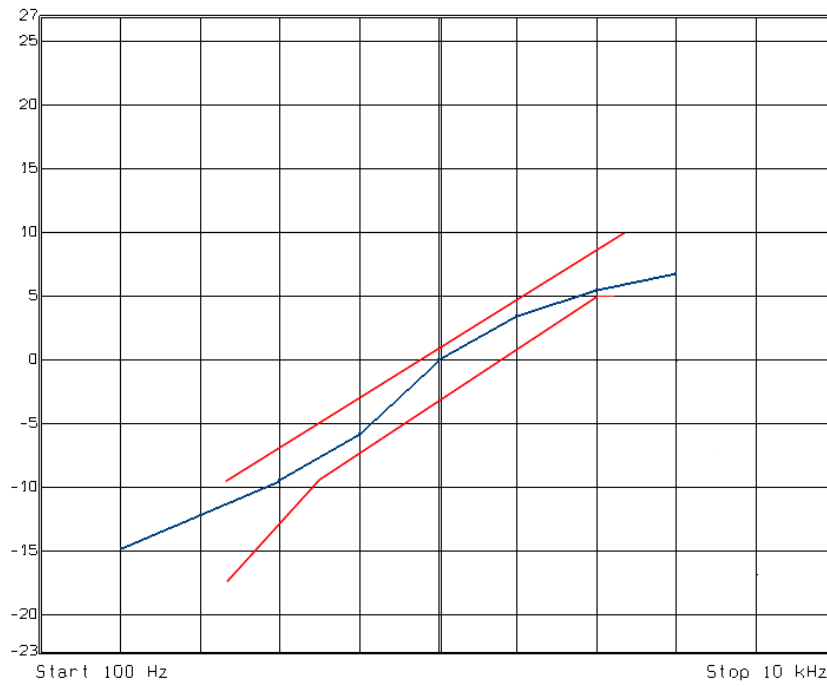
For Channel 1(567.1MHz)



For Middle Channel (593.5MHz)



Audio Low Pass Filter Characteristic Curve



5. OCCUPIED BANDWIDTH

5.1 Standard Applicable

According to FCC 2.1049 (c) (1), for radiotelephone transmitter, other than single sideband or independent sideband transmitter, when modulated by a 2.5 kHz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.

According to §74.861(e)(5), the operating bandwidth shall not exceed 200 kHz.

According to FCC 74.861(e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

1. On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.
2. On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.
3. On any frequency removed from the operating frequency by more than 250 percent up to and the authorized bandwidth shall be attenuated below the un-modulated carrier by at least 43 plus 10 Log (output power in watts) dB.

5.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2013-05-07	2014-05-06
Audio Generator	MEILI	MFG-3005	200612187	2013-05-07	2014-05-06

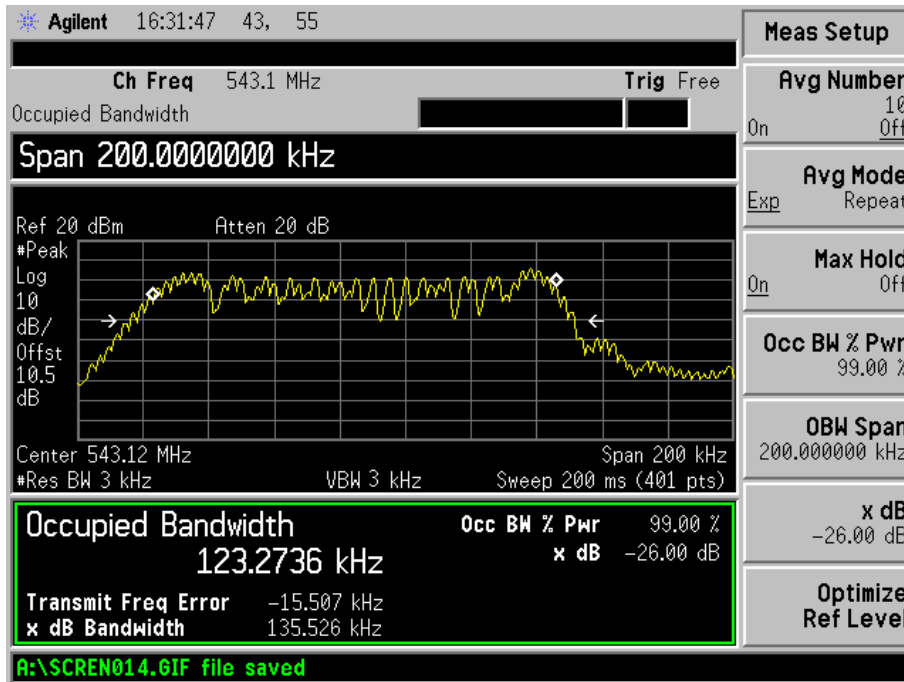
5.3 Test Procedure

According to TIA-603 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.

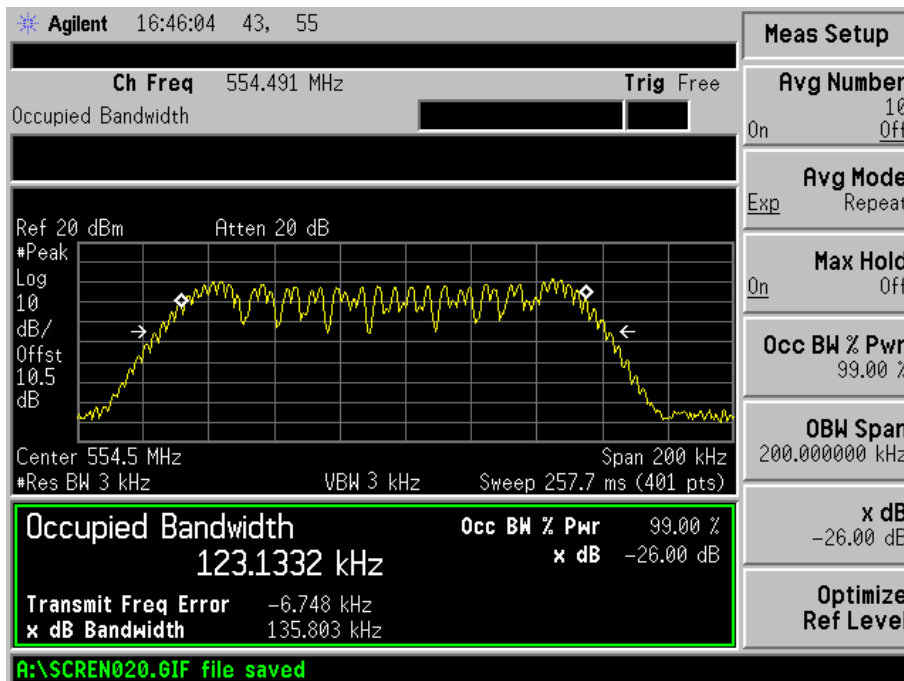
5.4 Test Results/Plots

Test Channel	Frequency (MHz)	-26dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit (kHz)
1	543.1	135.526	123.2736	200
2	554.5	135.803	123.1332	200
3	567.1	135.840	123.3785	200
4	593.5	135.798	123.1998	200

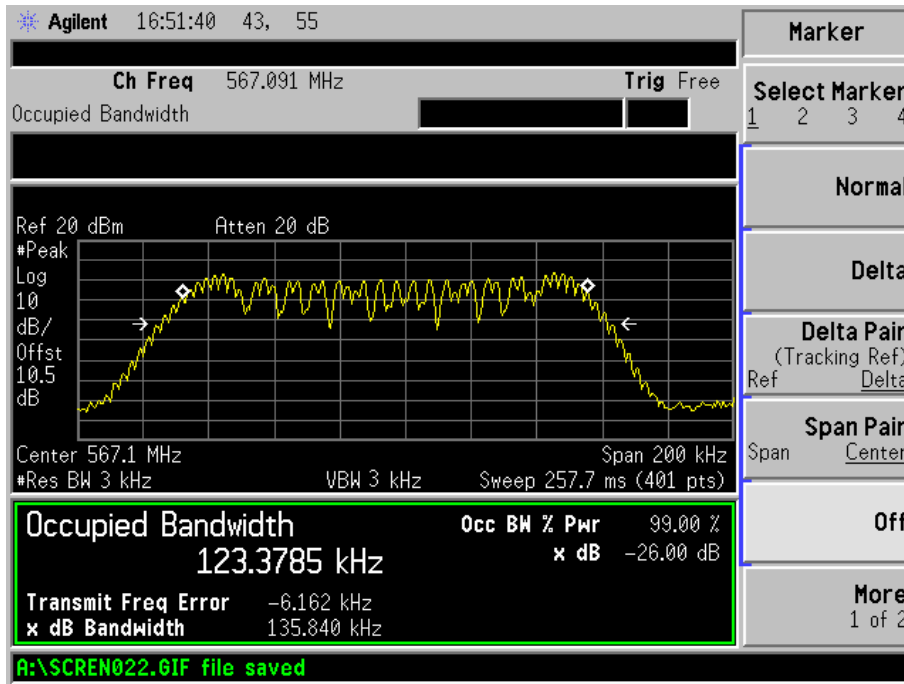
Channel 1 (543.1Hz)



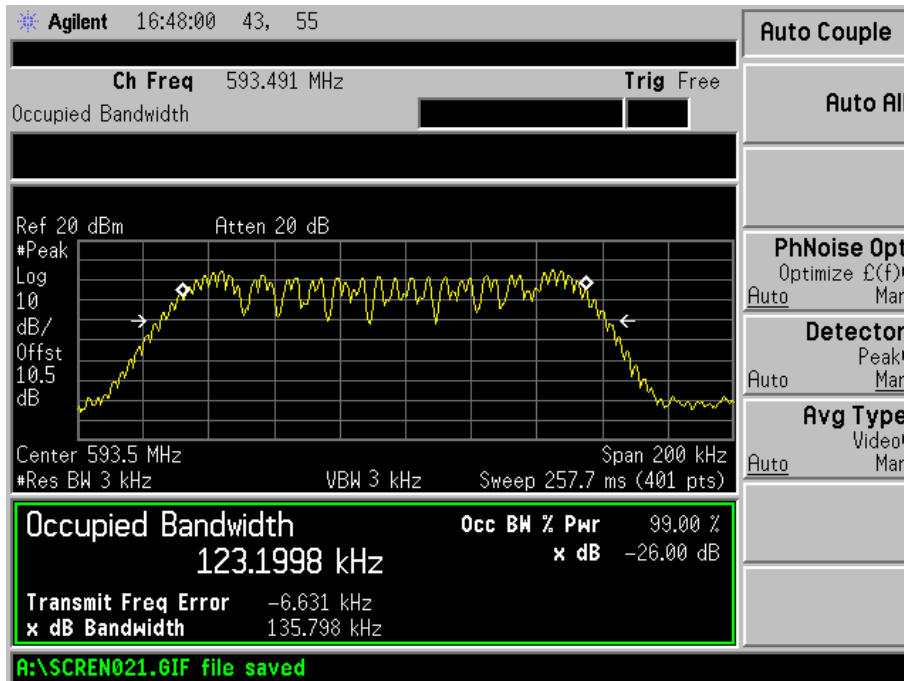
Channel 2 (554.5MHz)



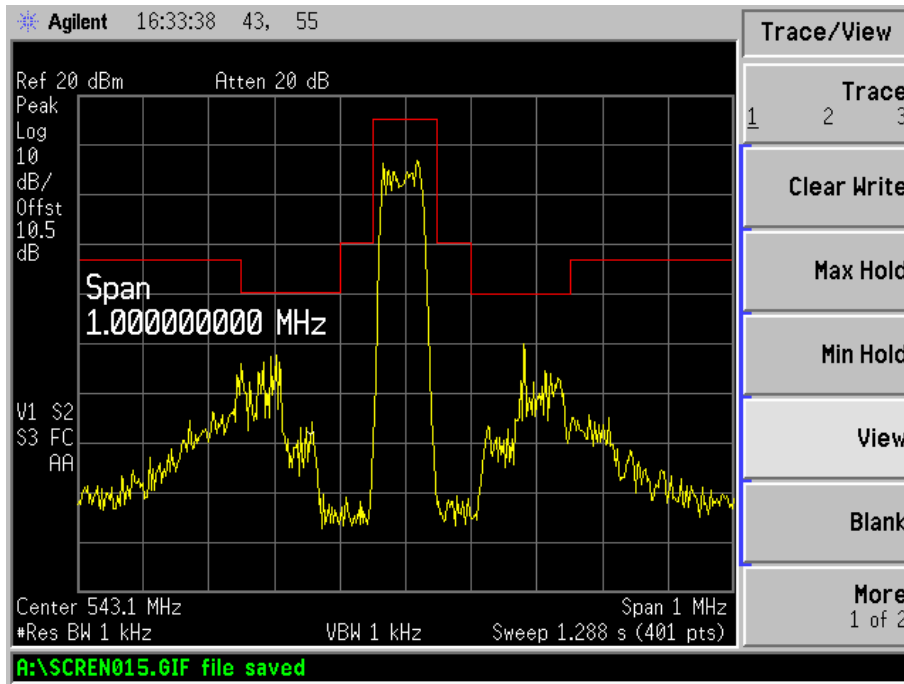
Channel 3 (567.1MHz)



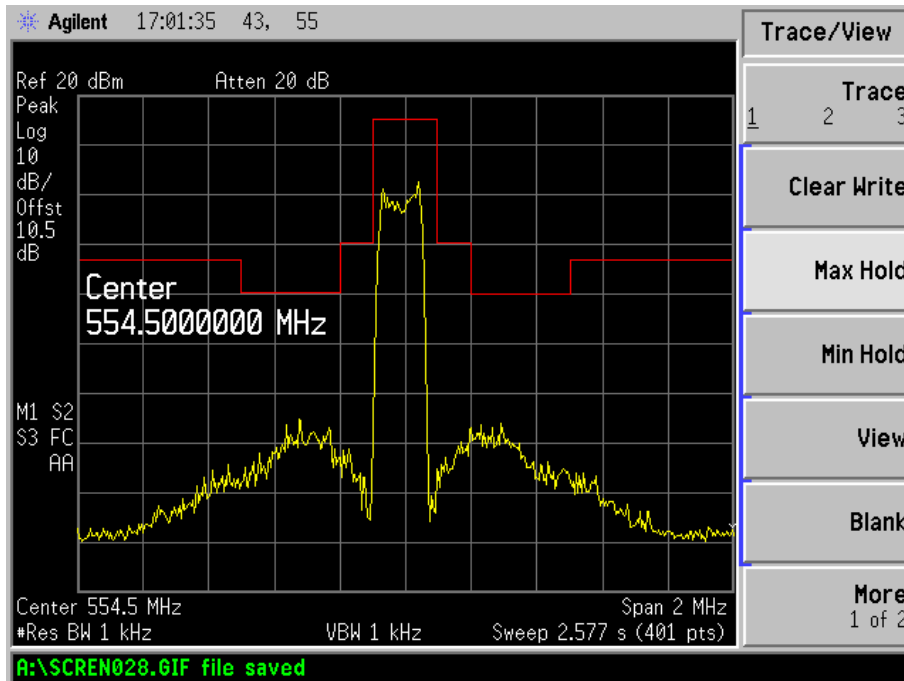
Channel 4 (593.5MHz)



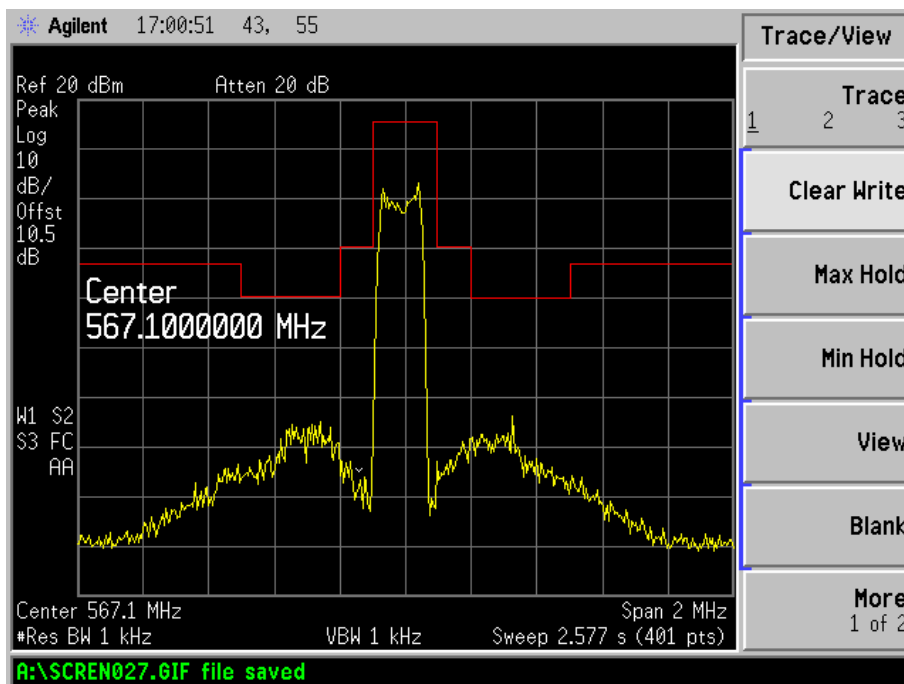
Emission Mask (543.1MHz)



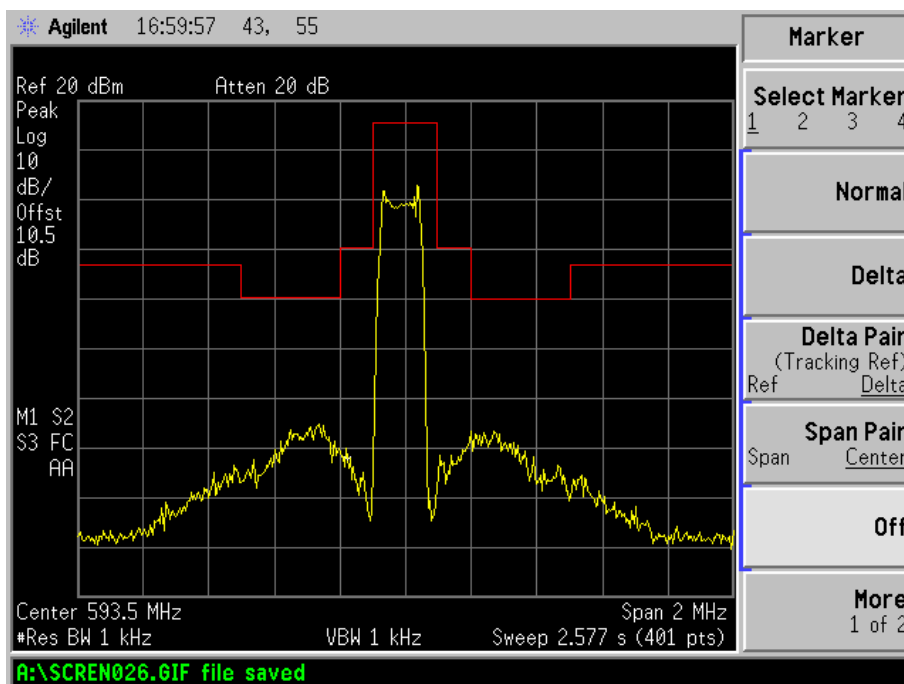
Emission Mask (554.5MHz)



Emission Mask (567.1MHz)



Emission Mask (593.5MHz)



6. RADIATED SPURIOUS EMISSION

6.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ± 3.0 dB.

6.2 Standard Applicable

According to FCC 2.1053, measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediated circuit elements under normal condition of installation and operation. Information submitted shall include the relative radiated power of spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a halfwave dipole antenna.

According to FCC74.861 (e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

4. On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.
5. On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.
6. On any frequency removed from the operating frequency by more than 250 percent up to and the authorized bandwidth shall be attenuated below the un-modulated carrier by at least 43 plus 10 Log (output power in watts) dB.

6.3 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2013-05-07	2014-05-06
Pre-amplifier	Agilent	8447F	3113A06717	2013-05-07	2014-05-06
Pre-amplifier	Compliance Direction	PAP-0118	24002	2013-05-07	2014-05-06
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2013-04-20	2014-04-19
Horn Antenna	ETS	3117	00086197	2013-04-20	2014-04-19
Signal Generator	Rohde & Schwarz	SMR20	100047	2013-05-07	2014-05-06

6.4 Test Procedure

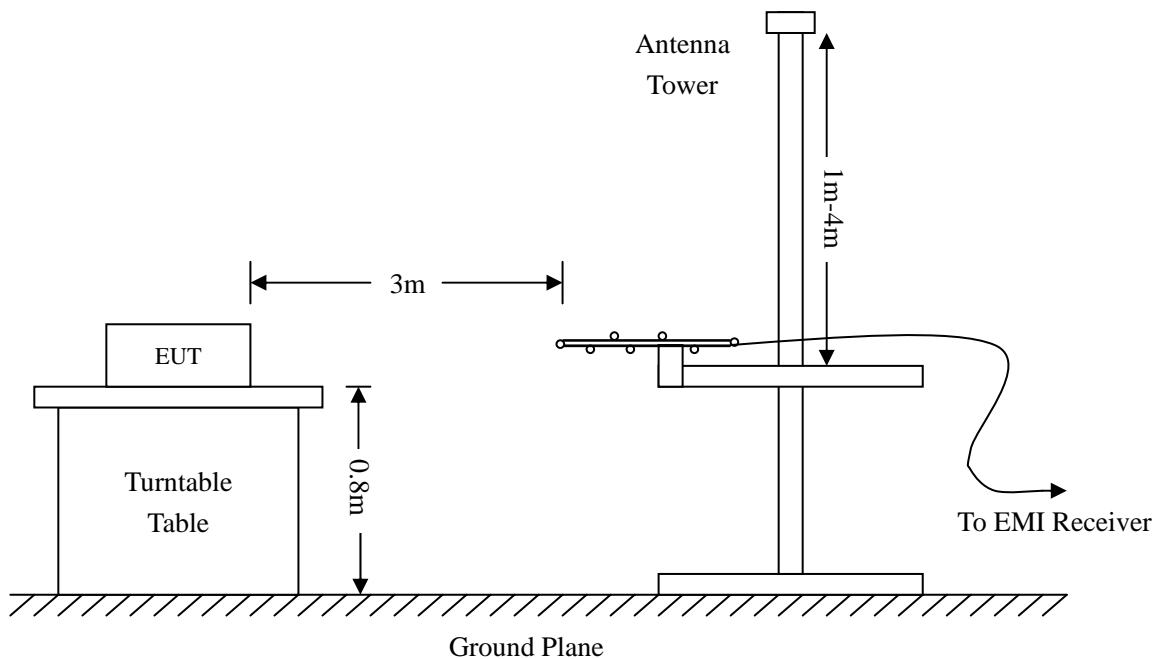
The setup of EUT is according with per TIA/EIA Standard 603 and ANSI C63.4-2003 measurement procedure.

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.

Spurious attenuation limit in dB = $43 + 10 \text{Log}_{10}$ (power in Watts)



6.5 Environmental Conditions

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

6.6 Summary of Test Results/Plots

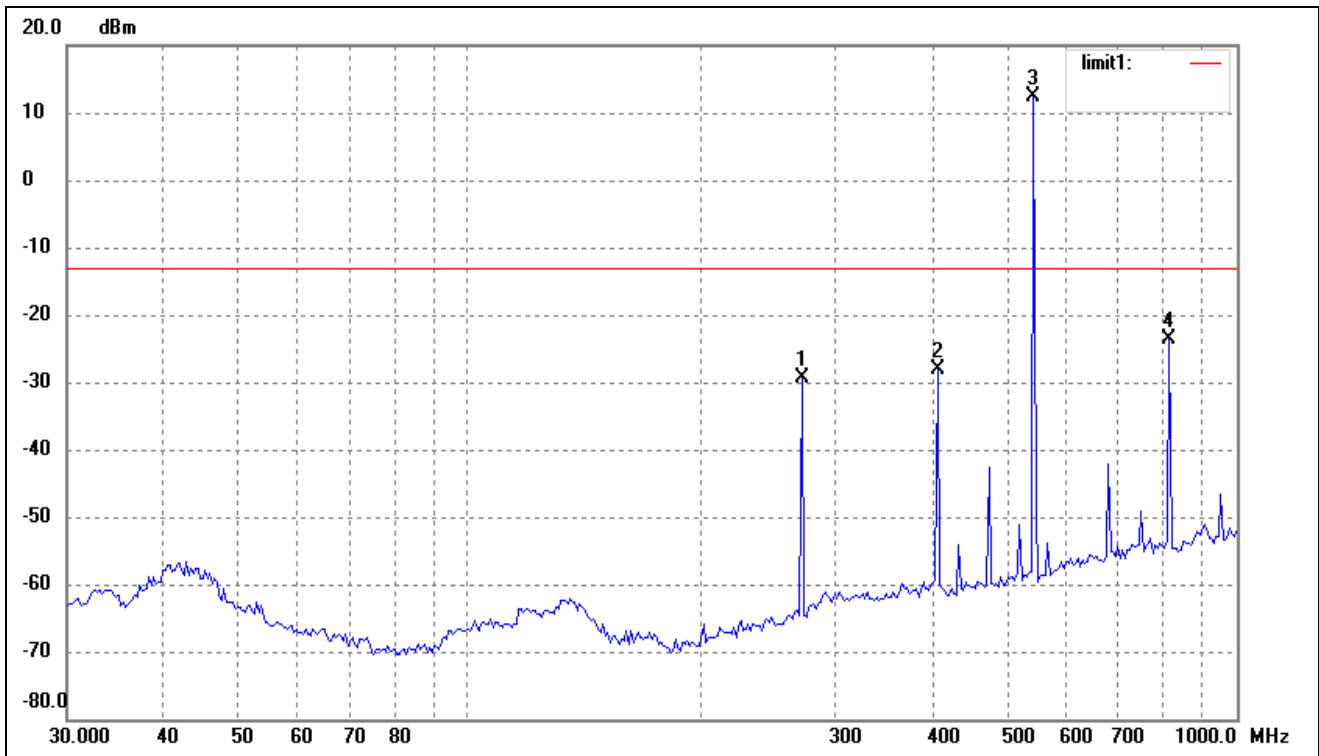
According to the data below, the FCC Part 74.861 standards, and had the worst margin of:

-4.72 dB at 427.0193 MHz in the Vertical polarization Transmitting 593.5 MHz Mode, 30 MHz to 6 GHz.

Spurious Emission from 30MHz to 1GHz

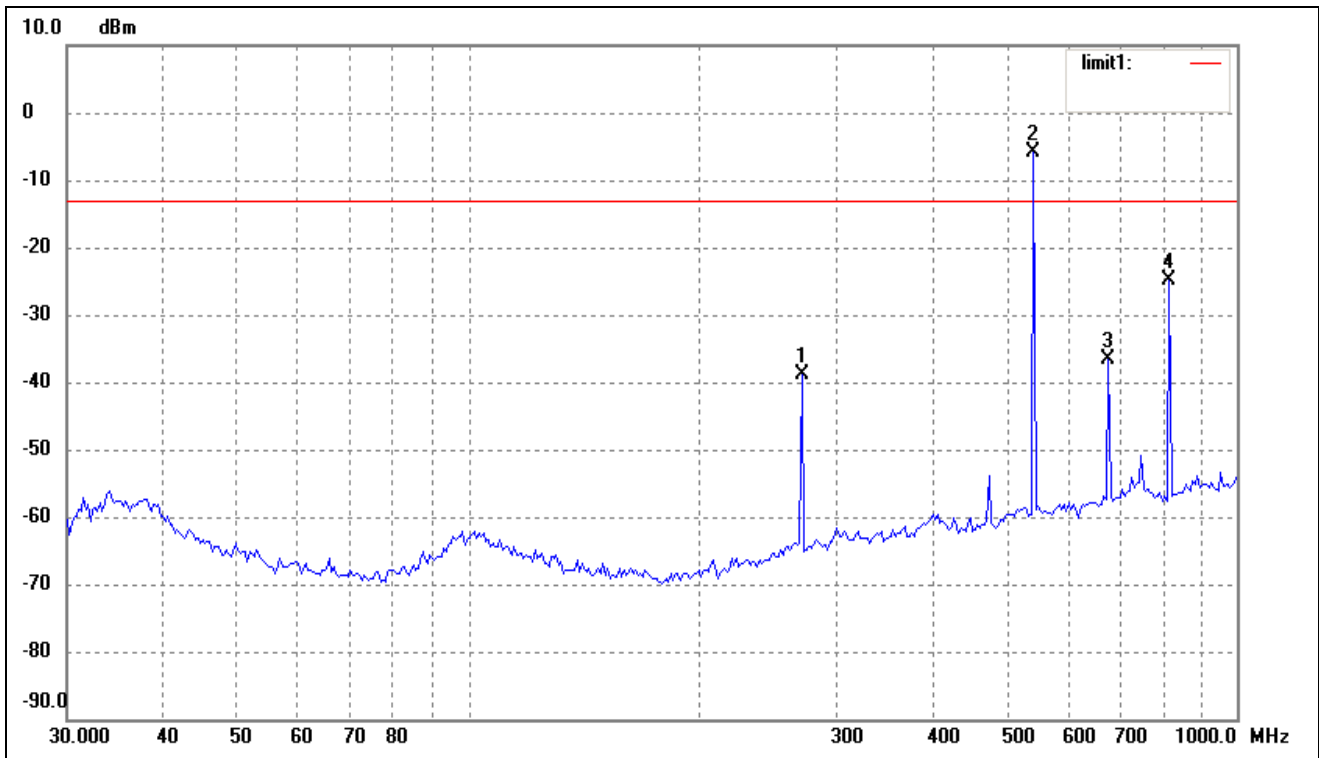
Test Mode: Transmitting-543.1MHz

Horizontal:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	271.3245	-49.71	20.38	-29.33	-13.00	-16.33	ERP
2	407.5144	-51.06	23.02	-28.04	-13.00	-15.04	ERP
3	543.0941	-12.51	24.90	12.39	/	/	Fundamental
4	815.9678	-52.10	28.50	-23.60	-13.00	-10.60	ERP

Vertical:

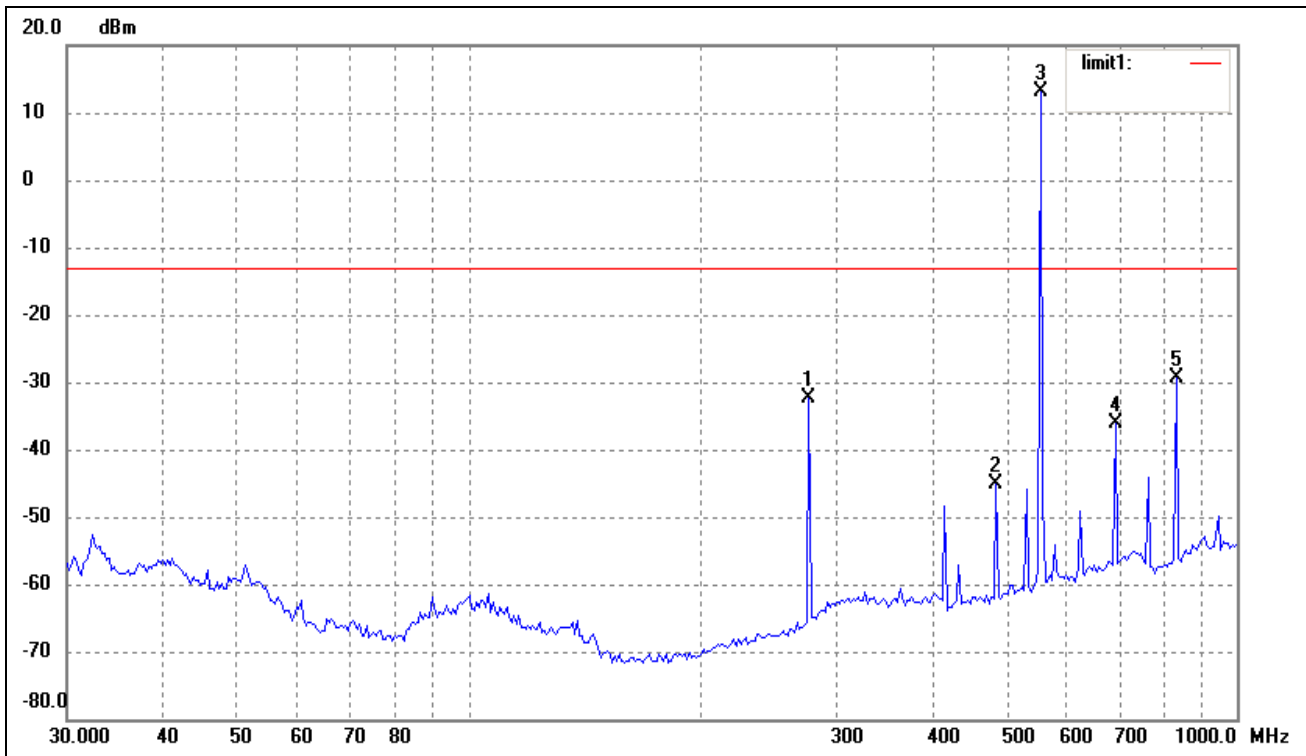


No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	271.3245	-59.21	20.38	-38.83	-13.00	-25.83	ERP al
2	543.0941	-30.67	24.90	-5.77	/	/	Fundament
3	679.9600	-64.01	27.35	-36.66	-13.00	-23.66	ERP
4	815.9678	-53.48	28.50	-24.98	-13.00	-11.98	ERP

Spurious Emission from 30MHz to 1GHz

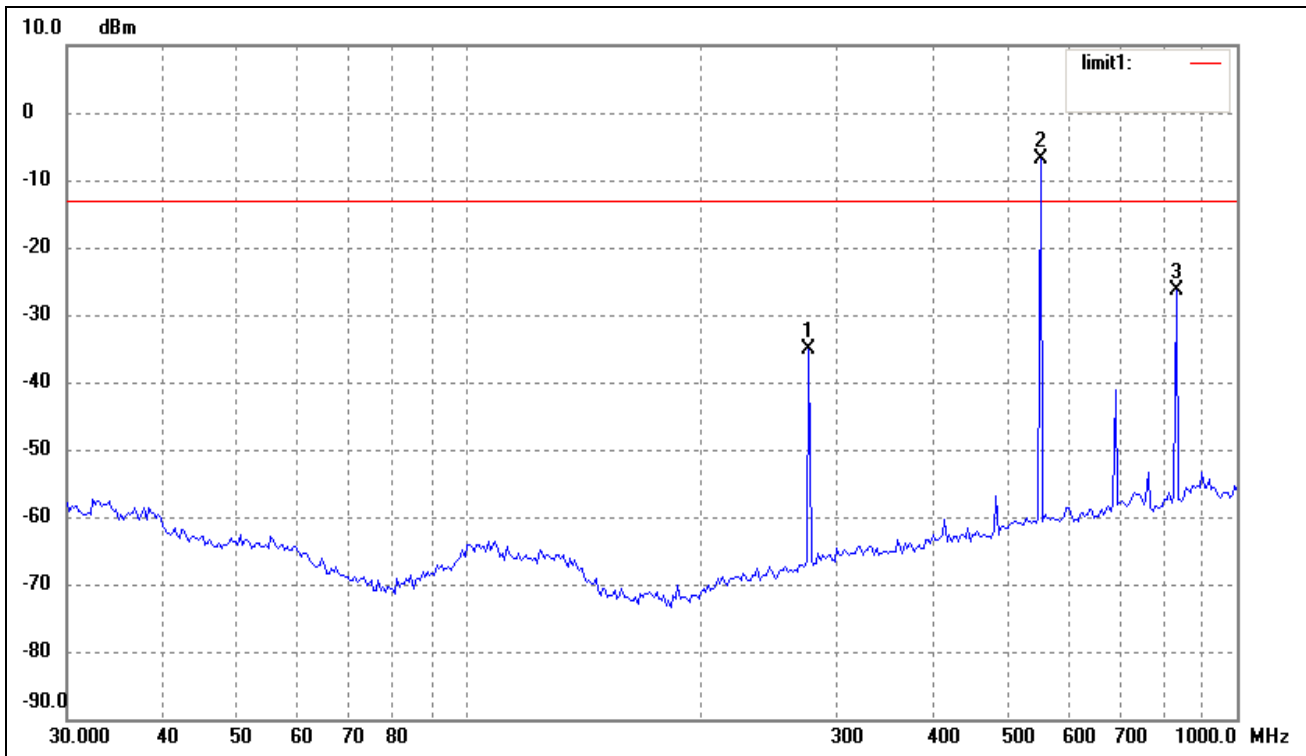
Test Mode: Transmitting-554.5MHz

Horizontal:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	277.0935	-53.10	20.81	-32.29	-13.00	-19.29	ERP
2	485.6093	-68.53	23.42	-45.11	-13.00	-32.11	ERP
3	554.8253	-12.02	25.07	13.05	/	/	Fundamental
4	694.4174	-63.62	27.49	-36.13	-13.00	-23.13	ERP
5	833.3170	-58.26	28.94	-29.32	-13.00	-16.32	ERP

Vertical:

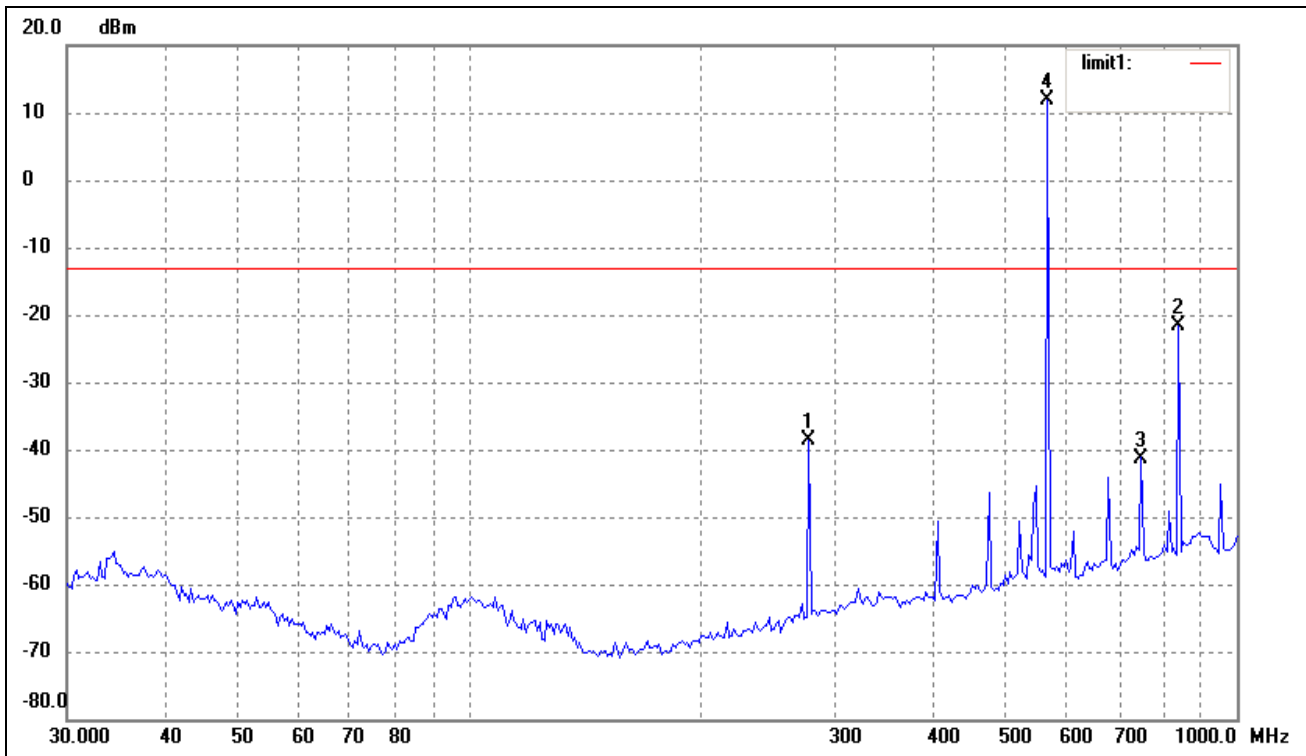


No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	277.0935	-56.02	20.81	-35.21	-13.00	-22.21	ERP
2	554.8253	-31.93	25.07	-6.86	/	/	Fundamental
3	833.3170	-55.42	28.94	-26.48	-13.00	-13.48	ERP

Spurious Emission from 30MHz to 1GHz

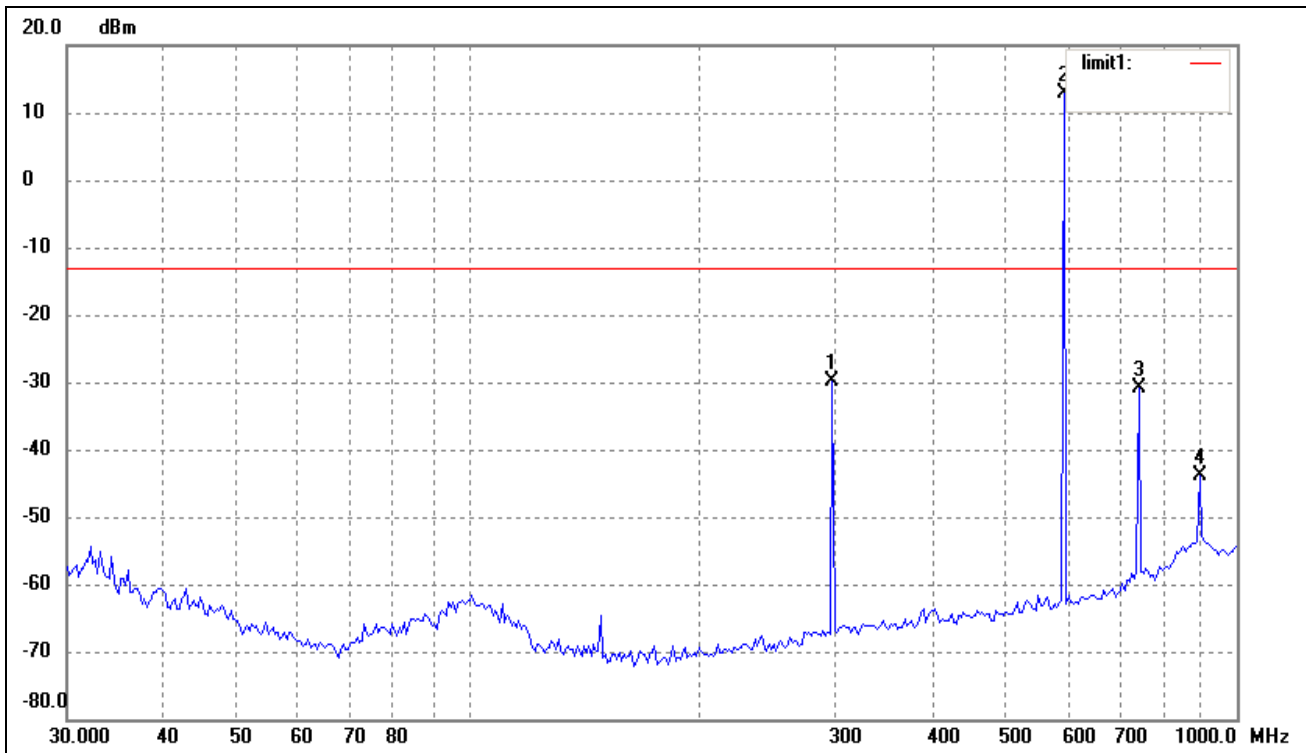
Test Mode: Transmitting-567.1MHz

Horizontal:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	277.0935	-59.48	20.81	-38.67	-13.00	-25.67	ERP
2	839.1817	-50.64	29.08	-21.56	-13.00	-8.56	ERP
3	750.1082	-70.83	29.58	-41.25	-13.00	-28.25	ERP
4	566.6222	-13.60	25.38	11.78	/	/	Fundamental

Vertical:

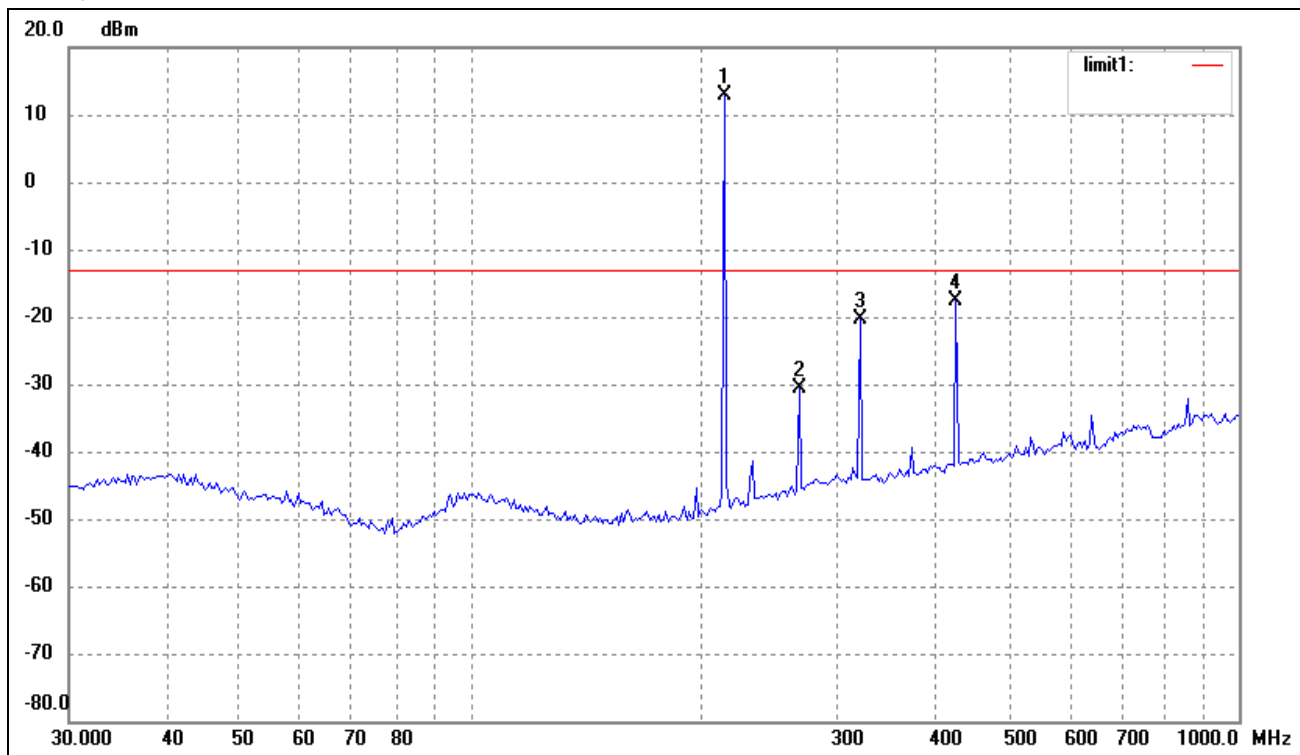


No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	297.2241	-51.64	21.84	-29.80	-13.00	-16.80	ERP
2	595.1328	-13.60	26.43	12.83	/	/	Fundamental
3	744.8660	-60.64	29.74	-30.90	-13.00	-17.90	ERP
4	893.8567	-75.01	31.07	-43.94	-13.00	-30.94	ERP

Spurious Emission from 30MHz to 1GHz

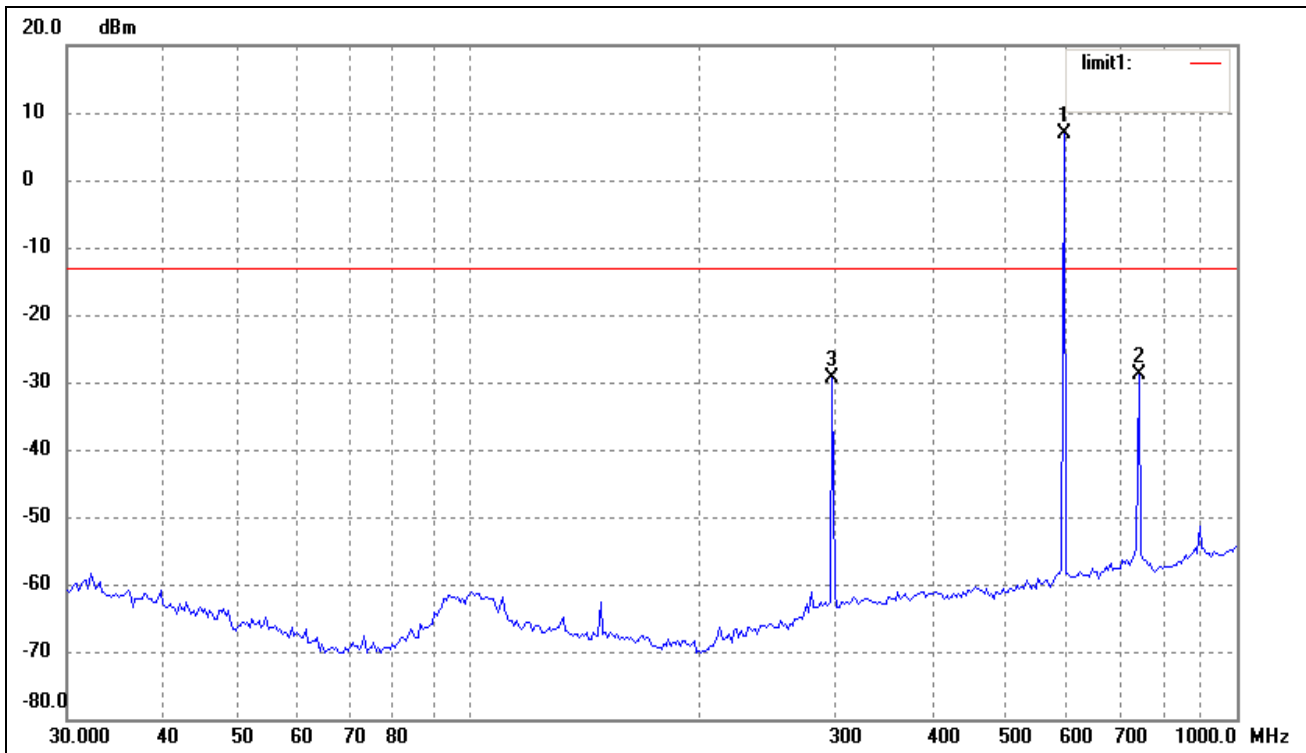
Test Mode: Transmitting-593.5MHz

Horizontal:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	213.7412	-2.87	21.39	12.52	/	/	Fundamental
2	267.5455	-54.68	23.99	-30.69	-13.00	-17.69	ERP
3	321.0608	-46.14	25.78	-20.36	-13.00	-7.36	ERP
4	427.0193	-44.74	27.02	-17.72	-13.00	-4.72	ERP

Vertical:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	595.1329	-19.60	26.43	6.83	/	/	Fundamental
2	744.8661	-58.65	29.75	-28.90	-13.00	-15.90	ERP
3	297.2241	-51.14	21.84	-29.30	-13.00	-16.30	ERP

Note: Testing is carried out with frequency rang 30MHz to the tenth harmonics, which above 1GHz are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

7. SPURIOUS EMISSION AT ANTENNA TERMINAL

7.1 Standard Applicable

According to §2.1051, the radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate.

According to FCC74.861 (e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

On any frequency removed from the operating frequency by more than 250 percent up to and the authorized bandwidth shall be attenuated below the un-modulated carrier by at least 43 plus 10 Log (output power in watts) dB.

7.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2013-05-07	2014-05-06
ETS	50 ohm Coaxial Cable	SUCOFLEX 104	25498514	2013-05-07	2014-05-06

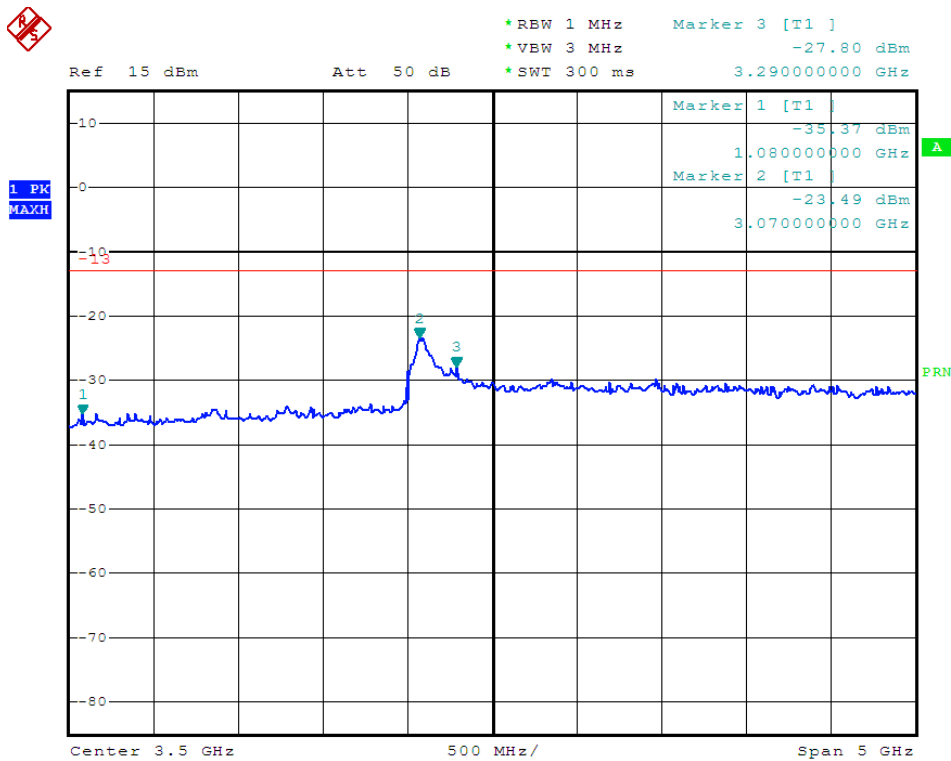
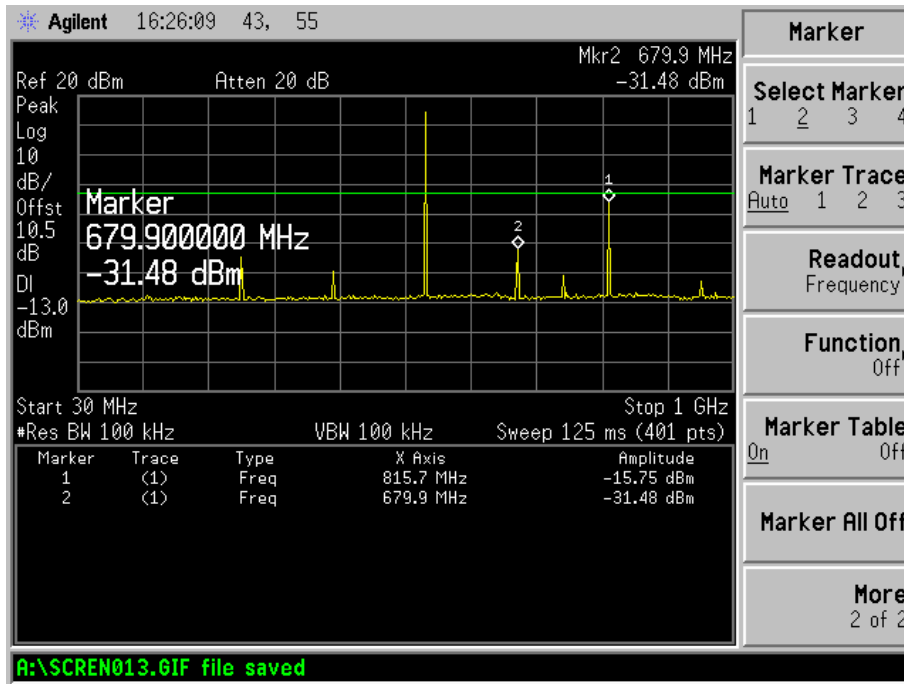
7.3 Test Procedure

Connect a suitable artificial antenna properly, set the Low, Middle and High Transmitting Channel, observed the spurious emissions from antenna port, and then mark the higher-level emission for comparing with the FCC rules.

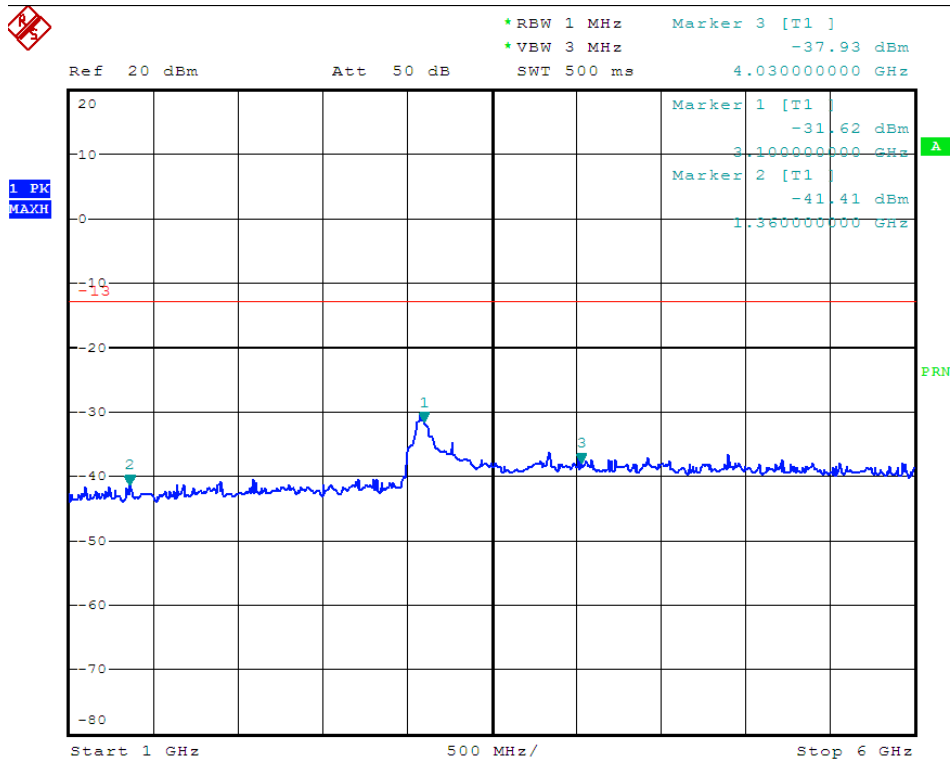
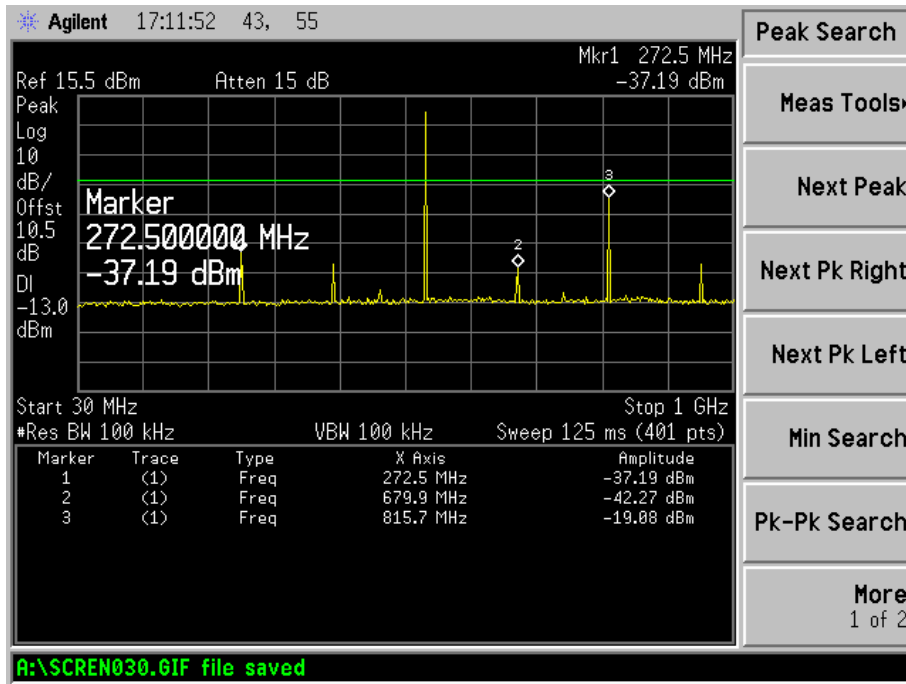
7.4 Summary of Test Results/Plots

Refer to the attached plots.

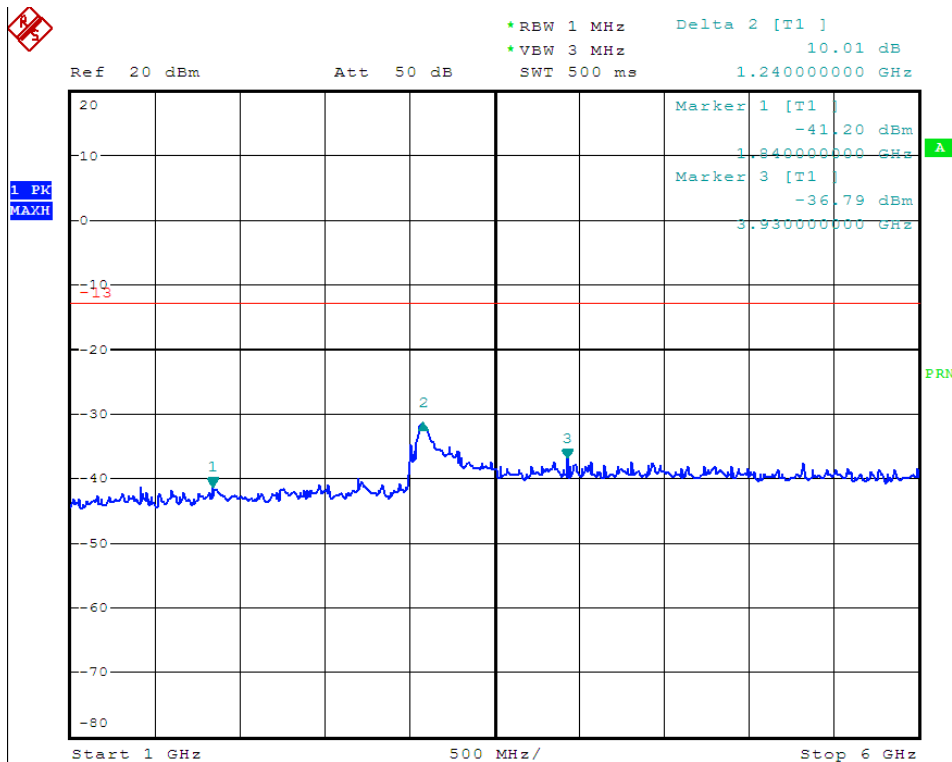
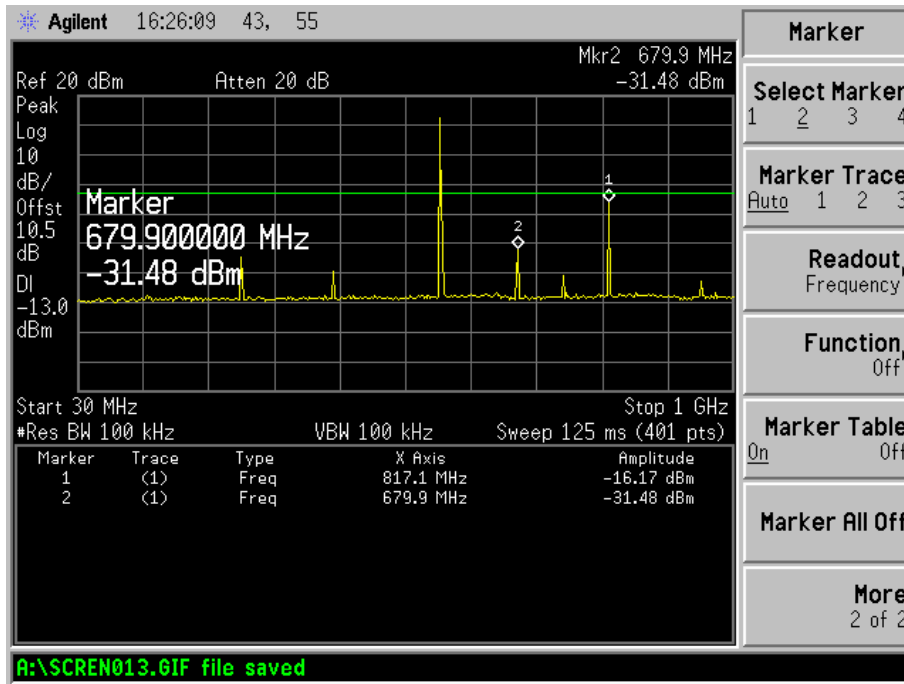
Channel 1 (543.1MHz)



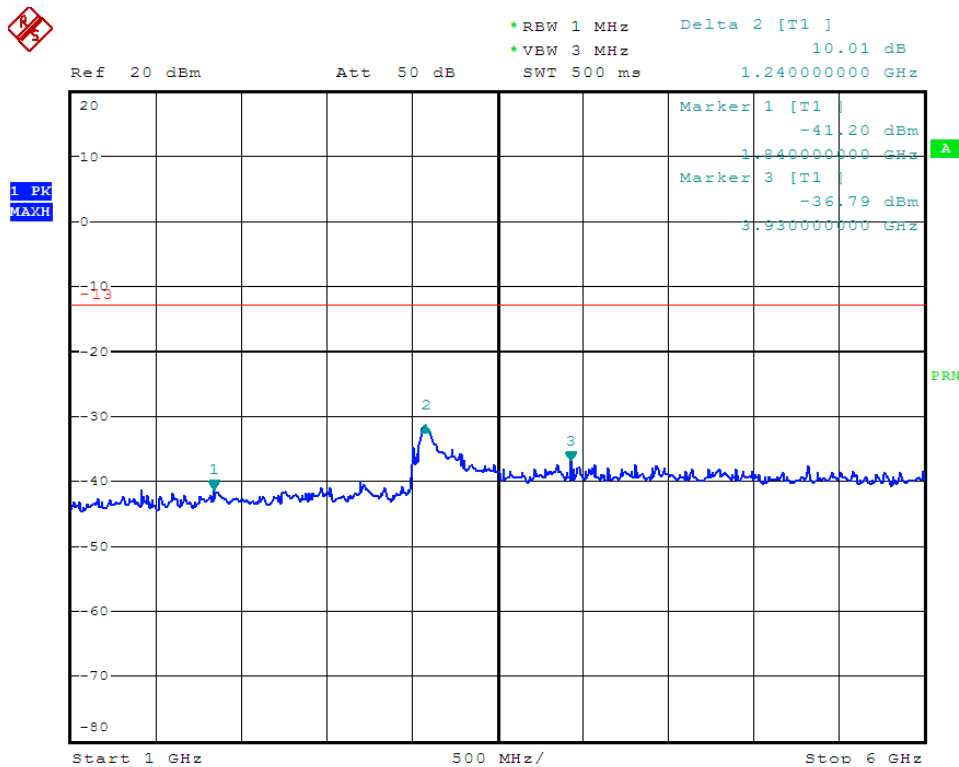
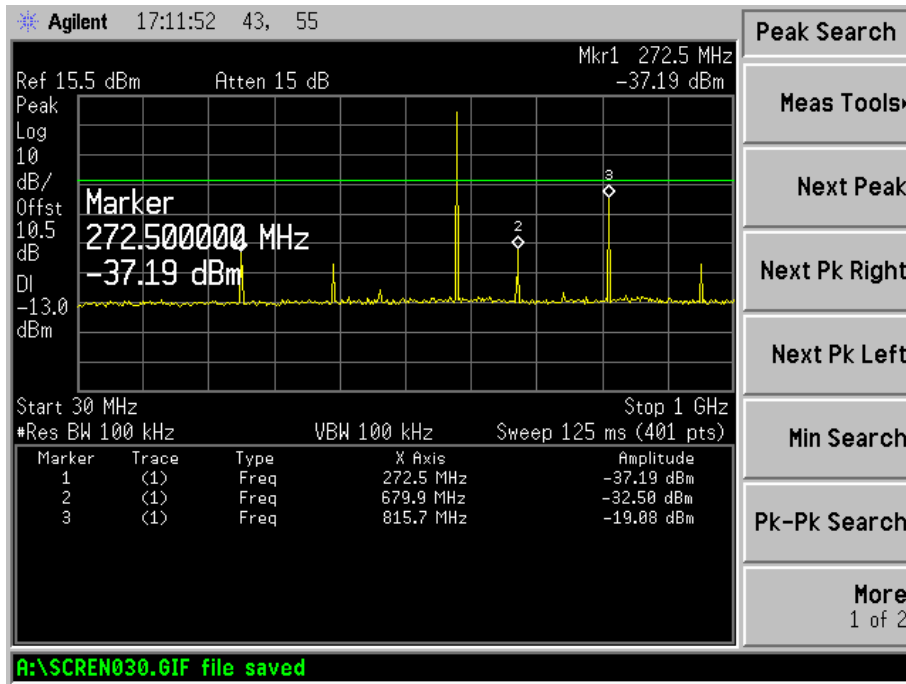
Channel 2 (554.5MHz)



Channel 3 (567.1MHz)



Channel 4(593.5MHz)



8. FREQUENCY STABILITY

8.1 Standard Applicable

According to FCC 2.1055(a)(1), the frequency stability shall be measure with variation of ambient temperature from -30°C to $+50^{\circ}\text{C}$, and according to FCC 2.1055(d)(2), the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.

According to FCC 74.861, the frequency tolerance of the transmitter shall be 0.005 percent.

8.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2013-05-07	2014-05-06
GONGWEN	Moisture Test Chamber	GDS-150	SEMT-0013	2013-05-07	2014-05-06

8.3 Test Procedure

1. Setup the configuration of the ambient temperature form -30°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.

8.4 Test Results/Plots

Test conditions		Frequency Error			
		543.1 MHz	554.5 MHz	567.1 MHz	593.5 MHz
T _{min} (-30°C)	V _{min} (2.6V)	543.1125	554.4858	567.0862	593.4863
	V _{max} (3.4V)	543.1127	554.4856	567.0868	593.4865
T(-20°C)	V _{nom} (3.0V)	543.1108	554.4887	567.0884	593.4882
T(-10°C)	V _{nom} (3.0V)	543.1097	554.4910	567.0898	593.4905
T(0°C)	V _{nom} (3.0V)	543.1083	554.4912	567.0912	593.4923
T(10°C)	V _{nom} (3.0V)	543.1045	554.4956	567.0952	593.4968
T _{nom} (20°C)	V _{nom} (3.0V)	543.1015	554.4988	567.0989	593.4989
T(30°C)	V _{nom} (3.0V)	543.1010	554.4978	567.1012	593.5012
T(40°C)	V _{nom} (3.0V)	543.0987	554.5037	567.1040	593.5022
T _{max} (50°C)	V _{min} (2.6V)	543.0940	554.5058	567.1051	593.5045
	V _{max} (3.4V)	543.0942	554.5055	567.1053	593.5050
Max. frequency error (ppm)		23.4	-26.0	-24.3	-23.1
Limit (ppm)		±50ppm			
End Point		DC 2.6V			

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