



BUREAU VERITAS

Test Report No.: RF131121N042-2

# TEST REPORT



Applicant	SEIKAKU TECHNICAL GROUP LIMITED
Address	Offshore Chambers, P.O. Box 217, Apia, Samoa

Manufacturer or Supplier	SEIKAKU TECHNICAL GROUP LIMITED
Address	Offshore Chambers, P.O. Box 217, Apia, Samoa
Product	wireless microphone
Brand Name	SHOW
Model	U-899P
Additional Model & Model Difference	N/A
Date of tests	Nov. 21 ~ Dec. 05, 2013

The tests have been carried out according to the requirements of the following standards:

**FCC Part 74, Subpart H (Section 74.861e)**

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

Tested by Venless Long Project Engineer / EMC Department	Approved by Glyn He Supervisor / EMC Department
	  Date: Dec. 05, 2013

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification



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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF131121N042-2	Original release	Dec. 05, 2013

## 1. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 74, SUBPART H (SECTION 74.861e)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
§74.861(e)(1)	Power Output Measurement	PASS	Compliant
§74.861 (e)(6) (III)	Spurious Radiated Emission	PASS	Compliant
§74.861 (e)(6) (III)	Conducted Spurious Measurement	PASS	Compliant
§74.861(e)(3,5,6)	Occupied Bandwidth	PASS	Compliant
§74.861(e)(4)	Frequency Tolerance	PASS	Compliant
§2.1047(a)(b)	Modulation Characteristics Measurement	PASS	Compliant

## 2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44dB
Radiated emissions	9kHz~30MHz	2.74dB
	30MHz ~ 200MHz	3.19dB
	200MHz ~1000MHz	3.21dB
	1GHz ~ 18GHz	2.26dB
	18GHz ~ 40GHz	1.94dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	wireless microphone
<b>MODEL NO.</b>	U-899P
<b>FCC ID</b>	H38U-899P
<b>NOMINAL VOLTAGE</b>	DC 3.0V From Battery(Two AA)
<b>MODULATION TYPE</b>	FM
<b>OPERATING FREQUENCY</b>	542.125 - 564.400MHz 638.125 - 660.400MHz
<b>ANTENNA TYPE</b>	External Wire Antenna; 0dBi gain
<b>CONDUCTED OUTPUT POWER</b>	11.86dBm
<b>I/O PORTS</b>	Refer to user's manual
<b>CABLE SUPPLIED</b>	N/A

**NOTE:**

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was showed in test report.

### 3.2 DESCRIPTION OF TEST MODES

CHANNEL	FREQUENCY
Low	542.125MHz
Middle	552.475MHz
High	564.400MHz

CHANNEL	FREQUENCY
Low	638.125MHz
Middle	648.475MHz
High	660.400MHz

For a more detailed channel list, please refer to the manufacturer's specifications or the User's Manual.

### 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 74, Subpart H (74.861e)**  
**TIA-603-C-2009**

All test items have been performed and recorded as per the above standards.

### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	DC Power Supply	LWDQGS	PS-6403D	010970922	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	AC Cable---Unshielded----1.5M

## 4. TEST TYPES AND RESULTS

### 4.1 CONDUCTED POWER OUTPUT MEASUREMENT

#### 4.1.1 LIMITS OF CONDUCTED POWER OUTPUT MEASUREMENT

According to FCC Part 74 Section 74.861(e) (1): The power of the measured unmodulated carrier power at the output of the transmitter power amplifier may not exceed 250mW

#### 4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Digital Multimeter FLUKE	15B	A1220010DG	Oct. 30,13	Oct. 29,14
Power Meter Anritsu	ML2495A	1139001	Nov. 04,13	Nov. 03,14

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA and NIM/CHINA.
  2. The test was performed in Oven Room.

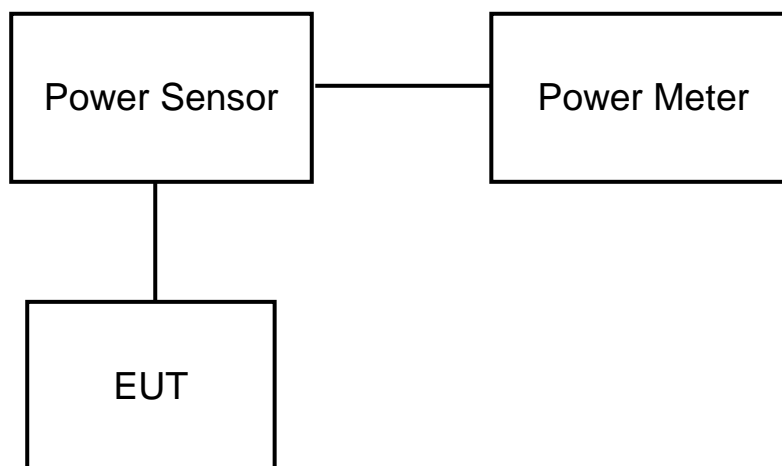
#### 4.1.3 TEST PROCEDURES

According to the clause 2.2.1.2 of TIA – 603 – C

- a) Connect the equipment as illustrated.
- b) Measure the transmitter output power during the defined duty cycle (see 1.3.2 ). Correct for all losses in the RF path (The duty cycle is 100% for this product, Correction Factor is 0).
- c) The value recorded in step b) is the conducted carrier output power rating.



#### 4.1.4 TEST SETUP



#### 4.1.5 EUT OPERATING CONDITIONS

- a. Placed the EUT on the testing table.
- b. Trun on the EUT power by battery,
- c. Enable EUT under transmission condition continuously at specific channel frequency.

#### 4.1.6 TEST RESULTS

FREQUENCY (MHz)	Output Power dBm	Output Power mW	Limit mW
542.125	11.36	13.68	250
552.475	<b>11.86</b>	15.35	250
564.400	11.45	13.96	250
638.125	11.82	15.21	250
648.475	10.35	10.84	250
660.400	8.72	7.45	250

## 4.2 SPURIOUS RADIATION MEASUREMENT

### 4.2.1 LIMITS OF SPURIOUS RADIATION MEASUREMENT

According to FCC 74.861(e)(6)(iii), On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least 43+10Log<sub>10</sub> (mean output power in watts) dB.

### 4.2.2 TEST INSTRUMENTS

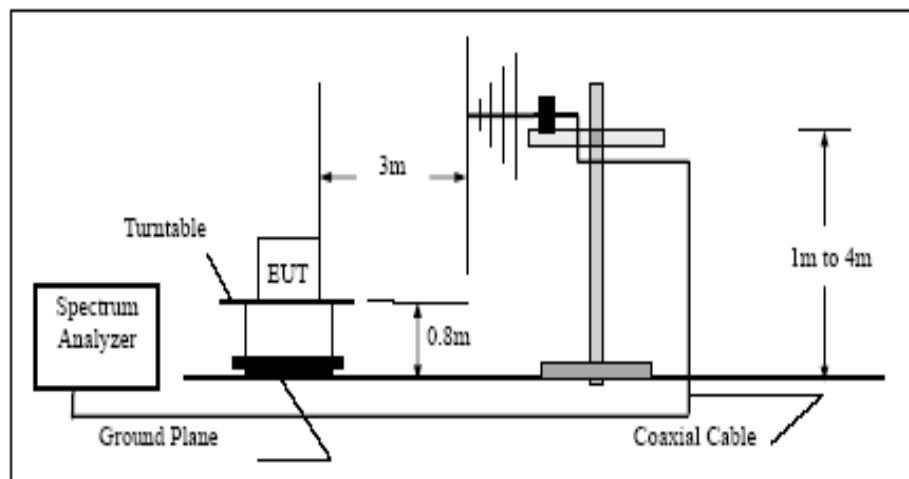
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4446A	MY46180622	Apr. 24,13	Apr. 23,14
EMI Test Receiver	Rohde& Schwarz	ESVD	847398/003	May 14,13	May 13,14
Bilog Antenna	Teseq	CBL 6111D	27089	Jul. 27, 13	Jul. 26, 14
Horn Antenna (1GHz -18GHz)	ETS -Lindgren	3117	00062558	Oct. 18, 13	Oct. 17, 14
Pre-Amplifier (9kHz~1GHz)	SONOMA	310D	186955	Mar. 06,13	Mar. 05,14
Pre-Amplifier (100MHz-26.5GHz)	Agilent	8449B	3008A00409	May 14,13	May 13,14
10m Semi-anechoic Chamber	CHANGLING	21.4m*12.1m*8 .8m	NSEMC006	Mar. 24,13	Mar. 23,14
Power Meter	Anritsu	ML2495A	1139001	Nov. 04,13	Nov. 03,14
Digital Multimeter	FLUKE	15B	A1220010D G	Oct. 30, 13	Oct. 29, 14
Signal Analyzer	Rohde& Schwarz	FSV7	102331	Nov. 26,13	Nov. 25,14
Test Software	ADT	ADT_Radiated _V7.6.15	N/A	N/A	N/A

- NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA and NIM/CHINA.
2. The test was performed in Dongguan Chamber 10m.
3. The horn antenna are used only for the measurement of emission frequency above 1GHz if tested.

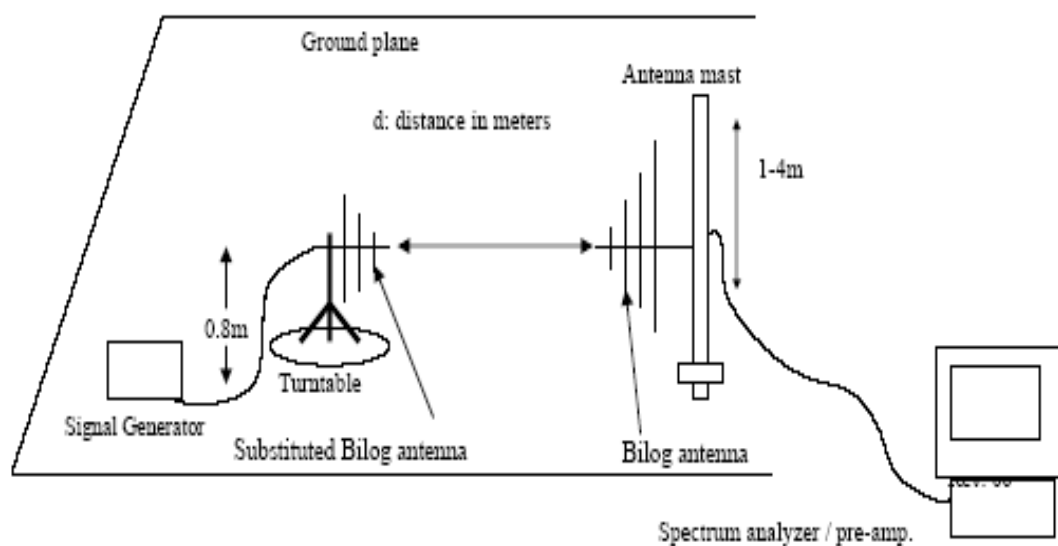
#### 4.2.3 TEST PROCEDURE

1. On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
2. The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
3. The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
4. The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
6. The transmitter shall than be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. Replace the antenna with a proper Antenna (substitution antenna).
10. The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
14. The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.
17. The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for the gain of the substitution antenna if necessary.

#### 4.2.4 TEST SETUP



#### SUBSTITUTION METHOD:



#### Adjust the spectrum analyzer for the following settings:

- 1) Resolution Bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1GHz.
- 2) Video Bandwidth = 300 kHz for spurious emissions below 1 GHz, and 3 MHz for spurious emissions above 1 GHz.
- 3) Sweep Speed slow enough to maintain measurement calibration.
- 4) Detector Mode = Positive Peak.

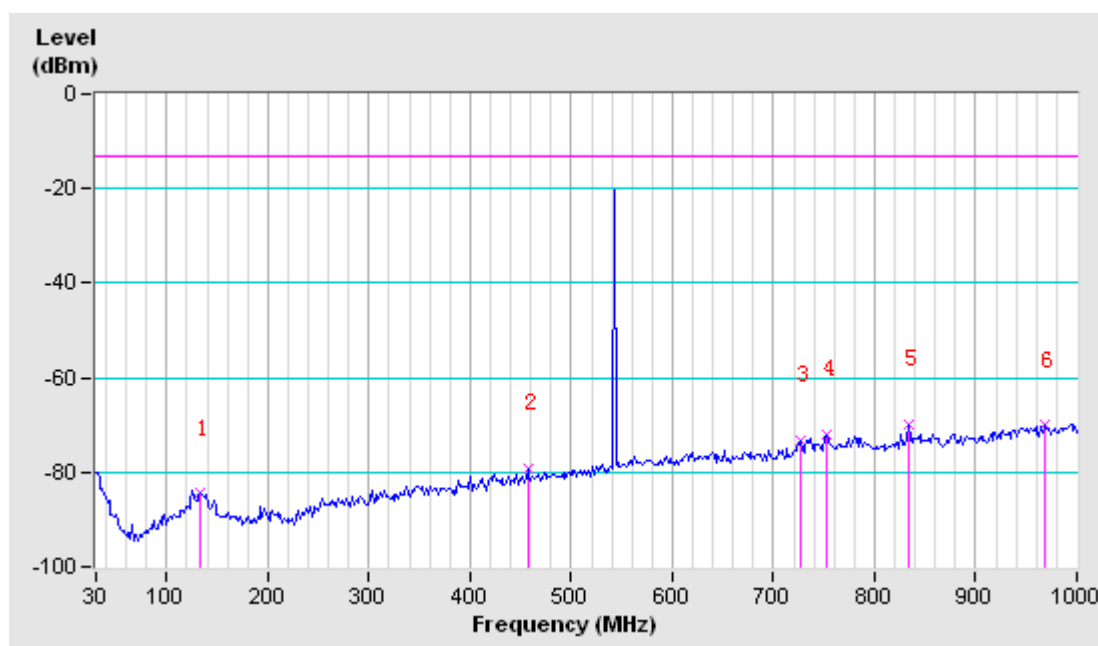
## 4.2.5 TEST RESULTS

### BELOW 1GHz WORST-CASE DATA: 542.125MHz

<b>SPURIOUS EMISSION FREQUENCY RANGE</b>	30MHz ~ 1GHz	<b>OPERATING CHANNEL</b>	CH 0
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SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
133.47	H	-84.52	-13	-71.52
456.8	H	-79.14	-13	-66.14
726.78	H	-73.21	-13	-60.21
752.65	H	-72.07	-13	-59.07
833.48	H	-69.97	-13	-56.97
969.28	H	-70.06	-13	-57.06

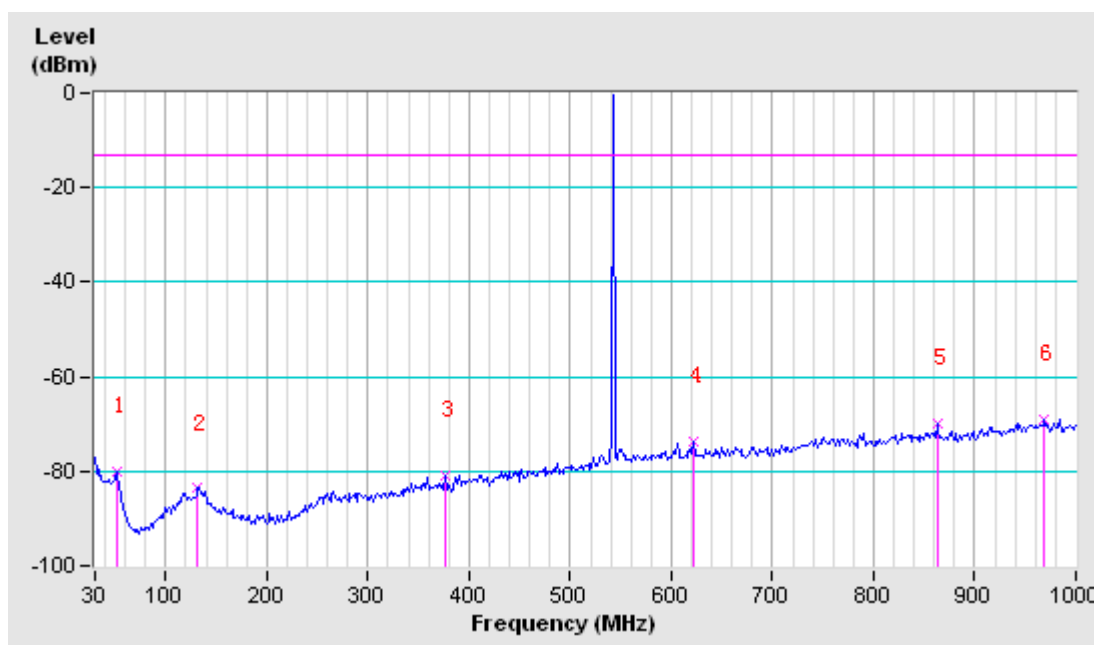
**NOTE:** The emission behavior belongs to narrowband spurious emission.



<b>SPURIOUS EMISSION FREQUENCY RANGE</b>	30MHz ~ 1GHz	<b>OPERATING CHANNEL</b>	CH 0
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SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
51.02	V	-80.21	-13	-67.21
131.85	V	-83.61	-13	-70.61
375.97	V	-80.86	-13	-67.86
621.7	V	-73.54	-13	-60.54
862.58	V	-69.88	-13	-56.88
969.28	V	-69.19	-13	-56.19

**NOTE:** The emission behavior belongs to narrowband spurious emission.

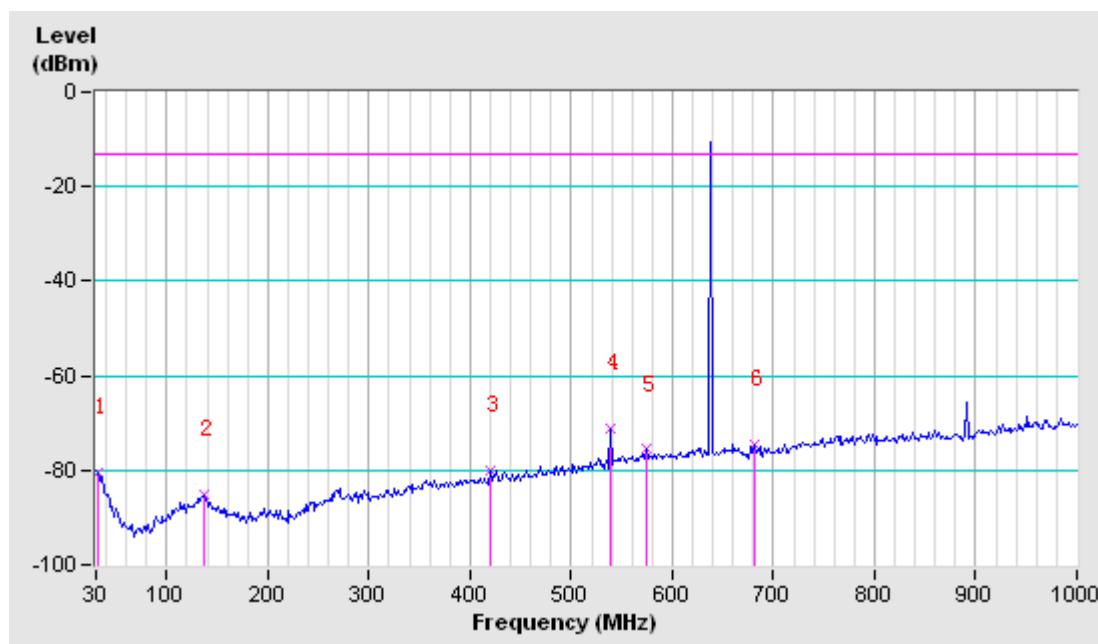


**BELOW 1GHz WORST-CASE DATA : 638.125MHz**

<b>SPURIOUS EMISSION FREQUENCY RANGE</b>	30MHz ~ 1GHz	<b>OPERATING CHANNEL</b>	CH 0
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SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
31.62	H	-80.31	-13	-67.31
136.7	H	-85.06	-13	-72.06
419.62	H	-79.92	-13	-66.92
539.25	H	-71.05	-13	-58.05
574.82	H	-75.62	-13	-62.62
681.52	H	-74.49	-13	-61.49

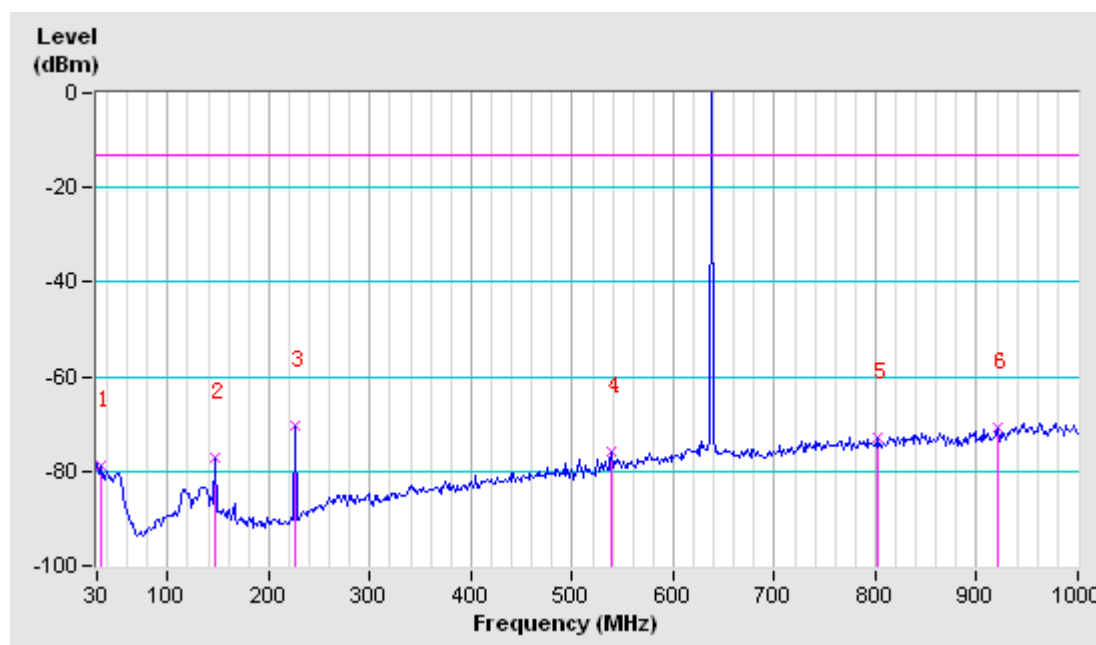
**NOTE:** The emission behavior belongs to narrowband spurious emission.



<b>SPURIOUS EMISSION FREQUENCY RANGE</b>	30MHz ~ 1GHz	<b>OPERATING CHANNEL</b>	CH 0
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SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
34.85	V	-78.74	-13	-65.74
146.4	V	-77.23	-13	-64.23
225.62	V	-70.33	-13	-57.33
539.25	V	-75.86	-13	-62.86
802.77	V	-72.89	-13	-59.89
920.78	V	-70.65	-13	-57.65

**NOTE:** The emission behavior belongs to narrowband spurious emission.





**ABOVE 1GHz WORST-CASE DATA : 542.125MHz---564.400M**

<b>SPURIOUS EMISSION FREQUENCY RANGE</b>	1GHz ~ 6GHz	<b>OPERATING CHANNEL</b>	0, 46, 49
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<b>SPURIOUS EMISSION LEVEL</b>					
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Antenna Polarization</b>	<b>Level (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
0	1084.25	H	-44.21	-13.00	-31.21
	1084.25	V	-41.85	-13.00	-28.85
	1626.37	H	-46.95	-13.00	-33.95
	1626.37	V	-43.78	-13.00	-30.78
	2168.50	H	-50.74	-13.00	-37.74
	2168.50	V	-47.56	-13.00	-34.56
46	1104.95	H	-45.38	-13.00	-32.38
	1104.95	V	-42.58	-13.00	-29.58
	1657.42	H	-47.31	-13.00	-34.31
	1657.42	V	-44.58	-13.00	-31.58
	2209.90	H	-50.75	-13.00	-37.75
	2209.90	V	-46.75	-13.00	-33.75
49	1128.85	H	-45.27	-13.00	-32.27
	<b>1128.85</b>	<b>V</b>	<b>-40.85</b>	<b>-13.00</b>	<b>-27.85</b>
	1693.28	H	-47.19	-13.00	-34.19
	1693.28	V	-43.12	-13.00	-30.12
	2257.70	H	-50.78	-13.00	-37.78
	2257.70	V	-45.78	-13.00	-32.78

**ABOVE 1GHz WORST-CASE DATA : 638.125MHz---660.400M**

<b>SPURIOUS EMISSION FREQUENCY RANGE</b>	1GHz ~ 7GHz	<b>OPERATING CHANNEL</b>	0, 46, 49
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<b>SPURIOUS EMISSION LEVEL</b>					
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Antenna Polarization</b>	<b>Level (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
0	1276.25	H	-43.50	-13.00	-30.50
	<b>1276.25</b>	<b>V</b>	<b>-42.50</b>	<b>-13.00</b>	<b>-29.50</b>
	1914.37	H	-46.85	-13.00	-33.85
	1914.37	V	-44.85	-13.00	-31.85
	2552.50	H	-49.74	-13.00	-36.74
	2552.50	V	-48.74	-13.00	-35.74
46	1296.95	H	-48.62	-13.00	-35.62
	1296.95	V	-45.62	-13.00	-32.62
	1945.42	H	-49.47	-13.00	-36.47
	1945.42	V	-47.47	-13.00	-34.47
	2593.90	H	-50.58	-13.00	-37.58
	2593.90	V	-48.58	-13.00	-35.58
49	1320.85	H	-44.84	-13.00	-31.84
	1320.85	V	-42.84	-13.00	-29.84
	1981.28	H	-45.14	-13.00	-32.14
	1981.28	V	-43.14	-13.00	-30.14
	2641.70	H	-47.69	-13.00	-34.69
	2641.70	V	-46.69	-13.00	-33.69

### 4.3 CONDUCTED SPURIOUS MEASUREMENT

#### 4.3.1 LIMITS OF CONDUCTED SPURIOUS MEASUREMENT

According to FCC 74.861(e)(6)(iii), On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least  $43+10\text{Log}_{10}$  (mean output power in watts) dB..

#### 4.3.2 TEST INSTRUMENTS

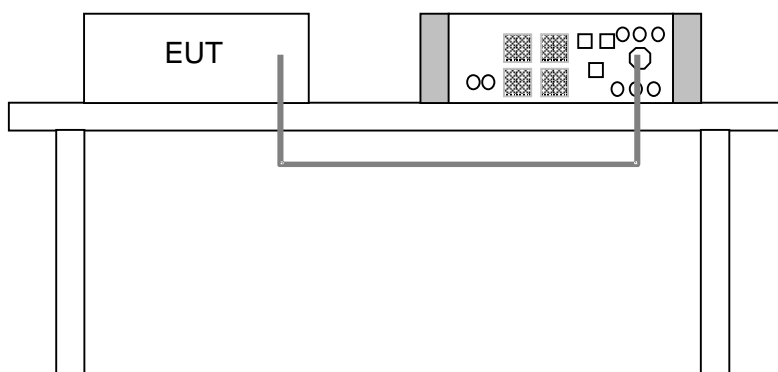
DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Signal Analyzer Rohde & Schwarz	FSV7	102331	Nov. 25,13	Nov. 24,14

- NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA and NIM/CHINA.  
2. The test was performed in Dongguan Chamber RF.

#### 4.3.3 TEST PROCEDURE

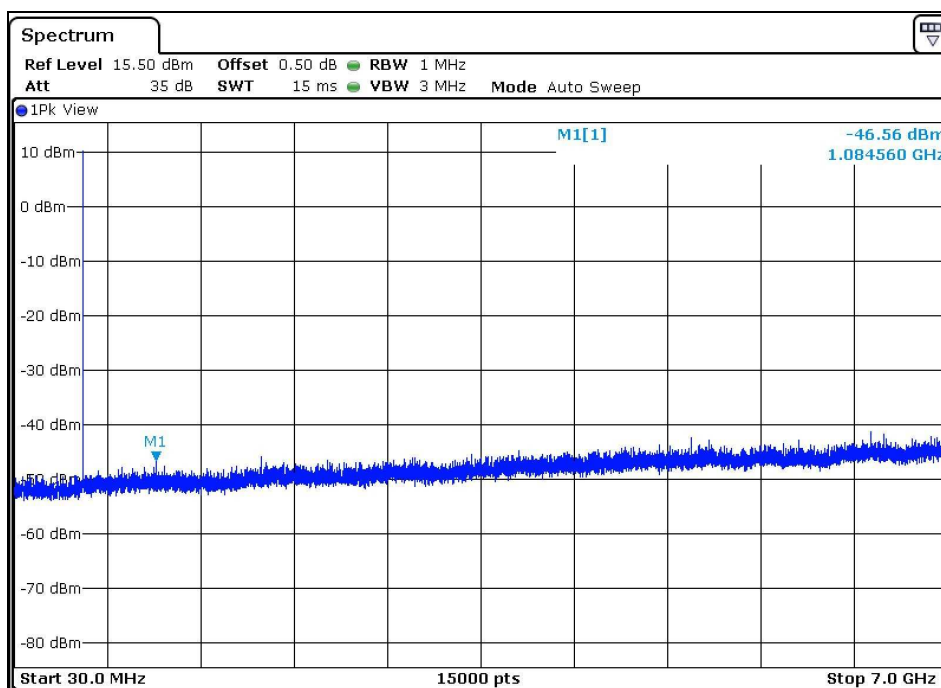
Reference to chapter FCC 2.1051

#### 4.3.4 TEST SETUP

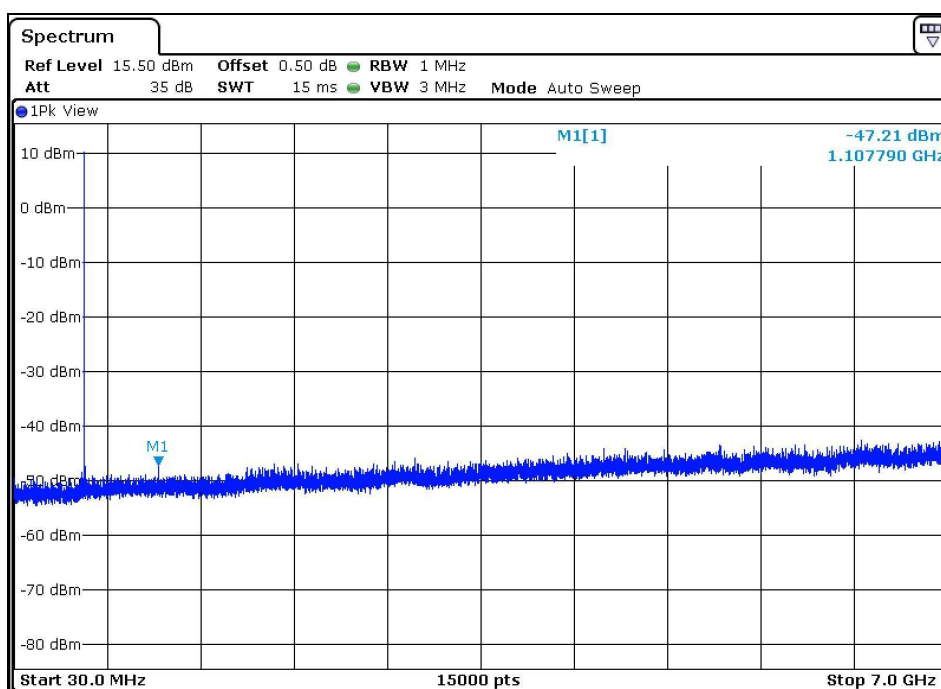


### 4.3.5 TEST RESULTS

#### CH 0-542.125MHz



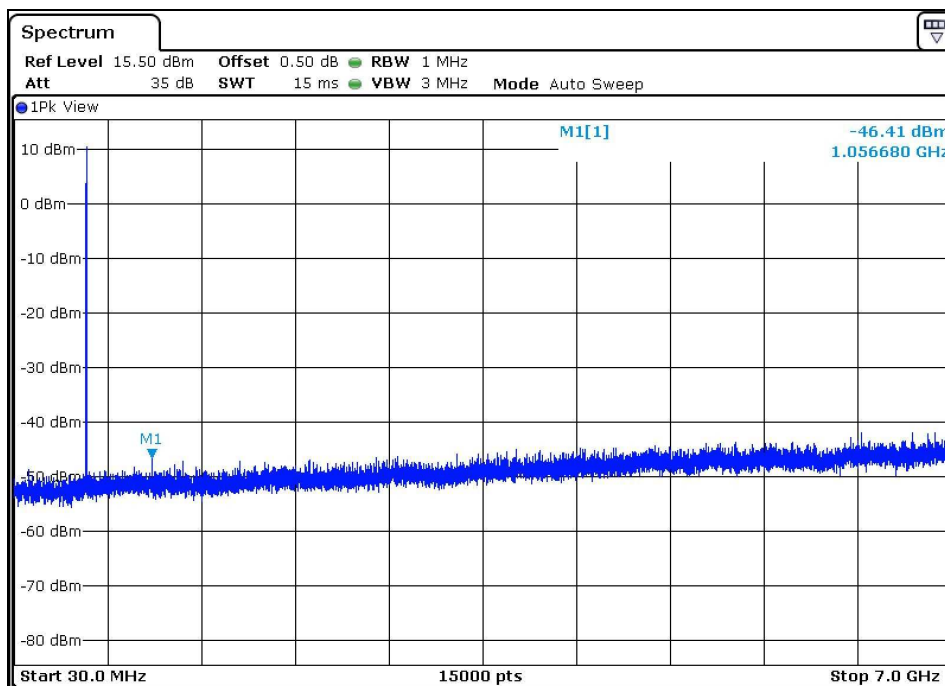
#### CH 46-552.475MHz



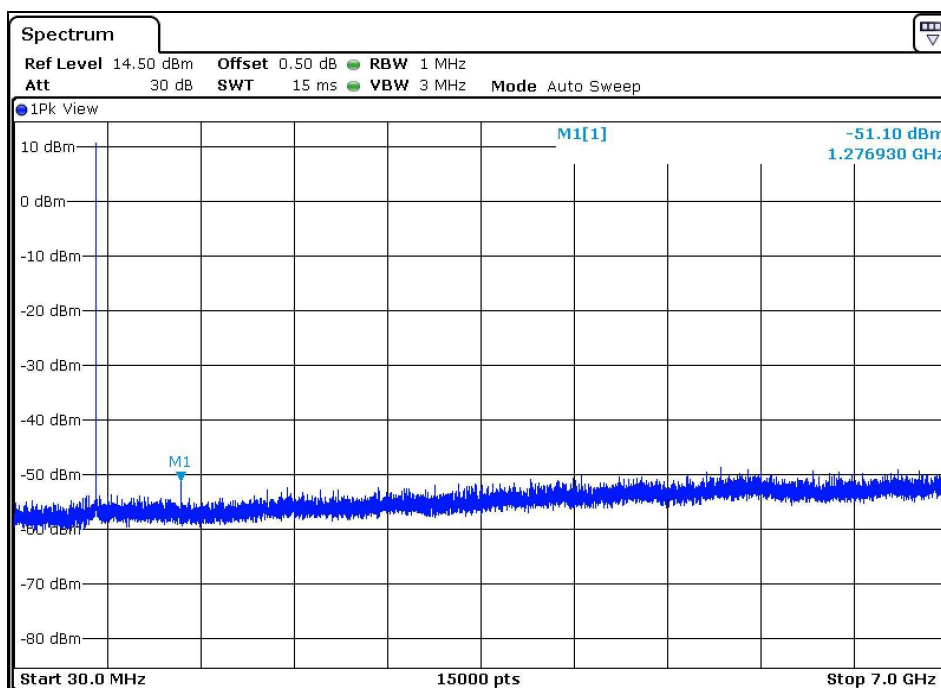


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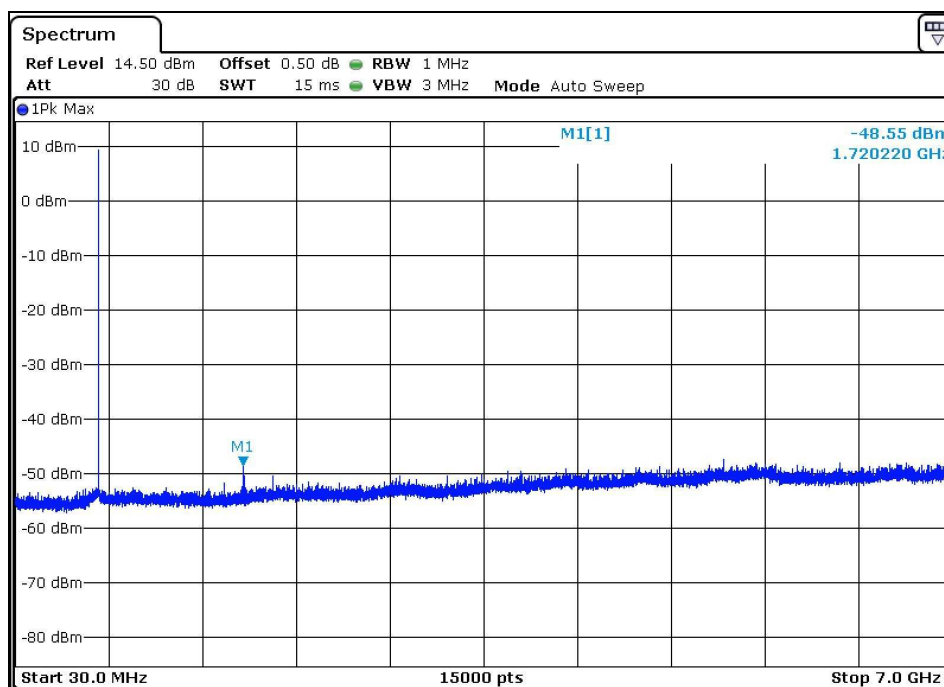
CH 49-564.400MHz



CH 0-638.125MHz



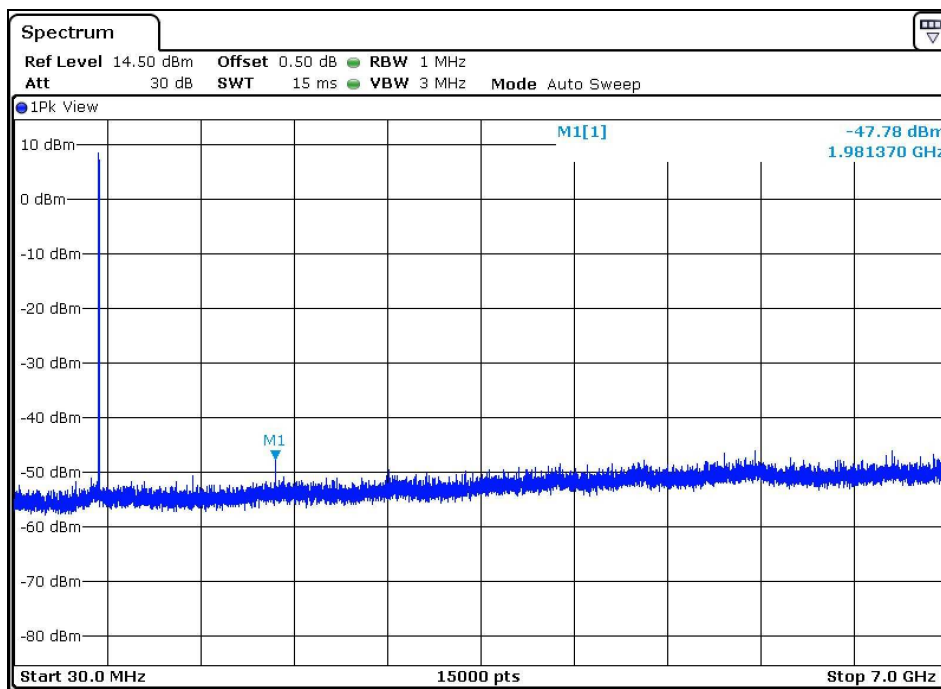
CH 46-648.475MHz





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CH 49-660.400MHz





### 4.4 OCCUPIED BANDWIDTH

#### 4.4.1 STANDARD APPLICABLE

According to FCC 74.861(e)(3) Any form of modulation may be used. A maximum deviation of  $\pm 75$  kHz is permitted when frequency modulation is employed.

- (5) The operating bandwidth shall not exceed 200 kHz.
- (6) The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:
  - (i) 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;
  - (ii) 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;

#### 4.4.2 TEST EQUIPMENT LIST AND DETAILS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Signal Analyzer Rohde & Schwarz	FSV7	102331	Nov. 25,13	Nov. 24,14
Audio Test System BOSCH	ATS-1	0000300054270000	Nov. 01, 13	Oct. 30, 14
Communications Tester JUNG JIN	MM-2500	N/A	Nov. 01, 13	Oct. 30, 14

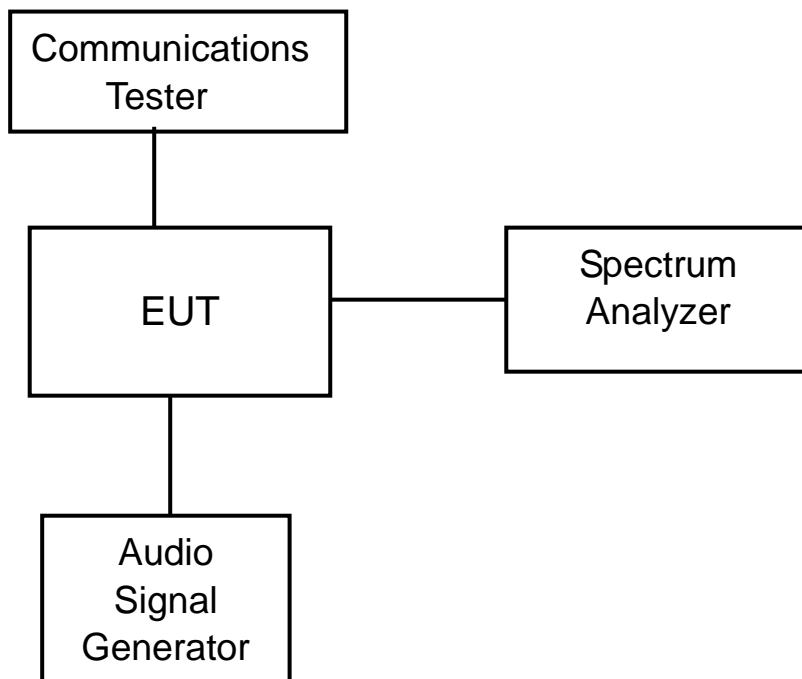
Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

#### 4.4.3 TEST PROCEDURE

According to FCC 2.1049(c)(1) Other than single sideband or independent sideband transmitters—when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.



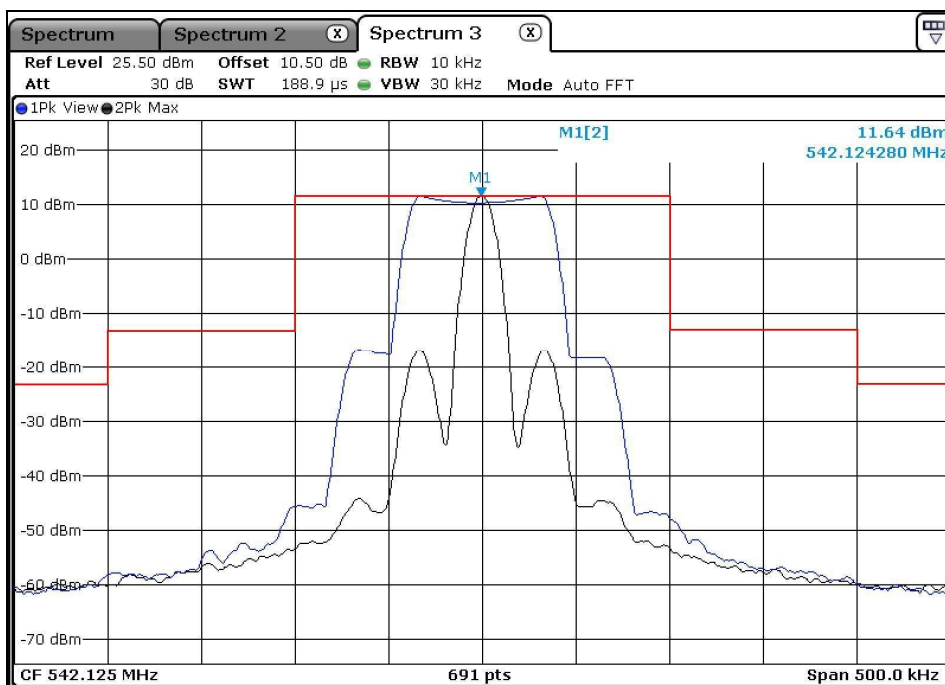
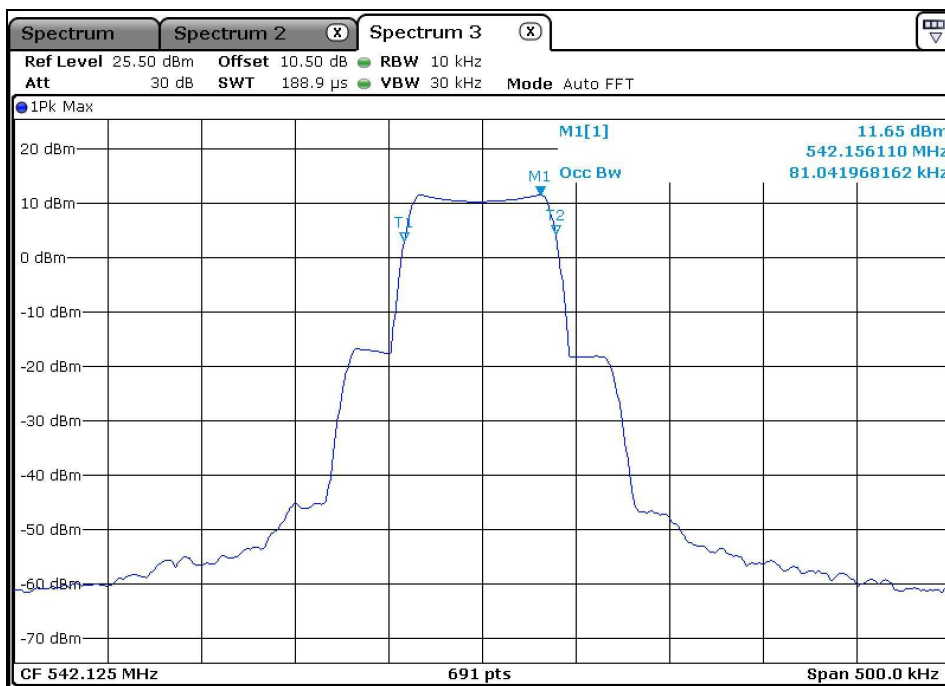
#### 4.4.4 TEST SETUP



### 4.4.5 TEST RESULTS

The 100% deviation is 70 KHz; 50% deviation is 35KHz

CH 0: 542.125 MHz

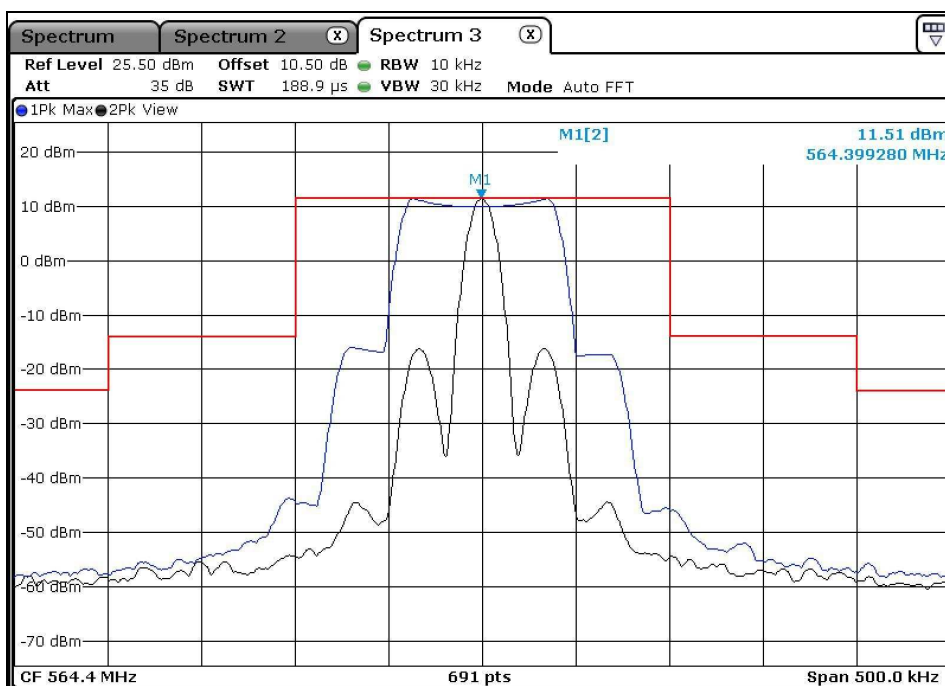
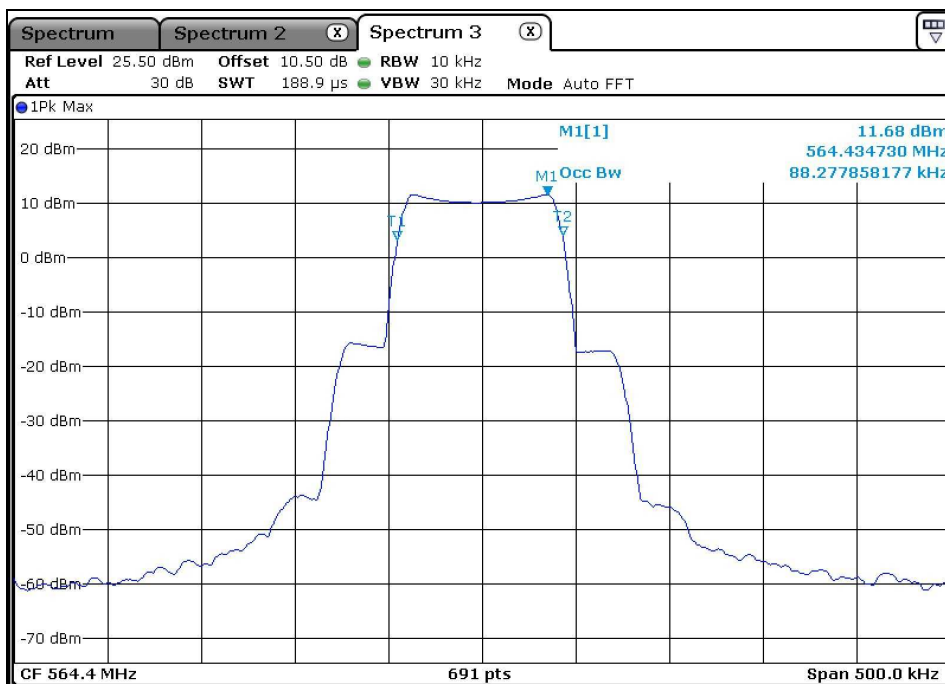






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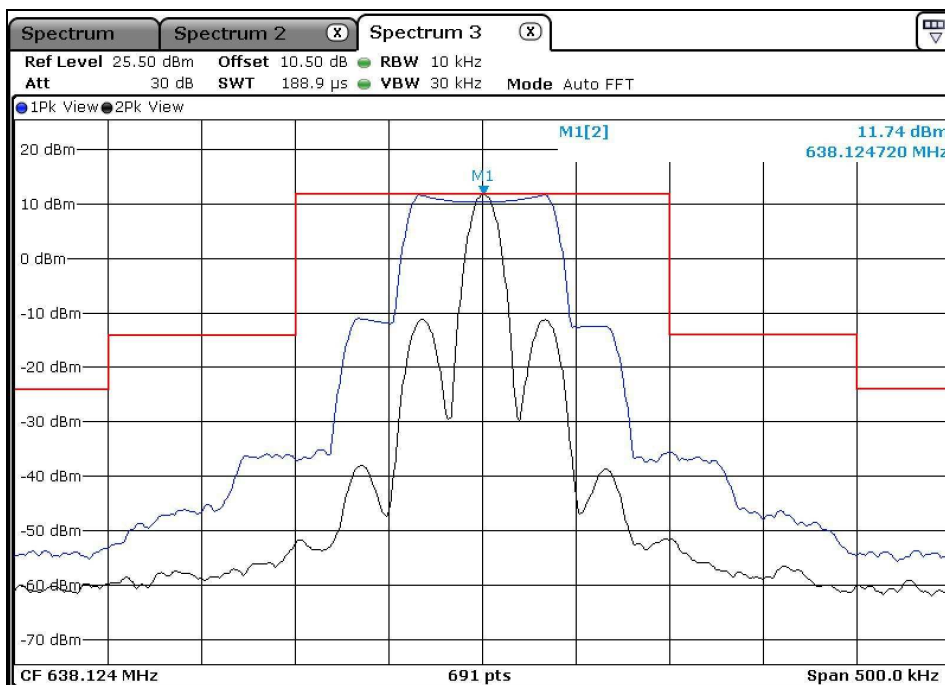
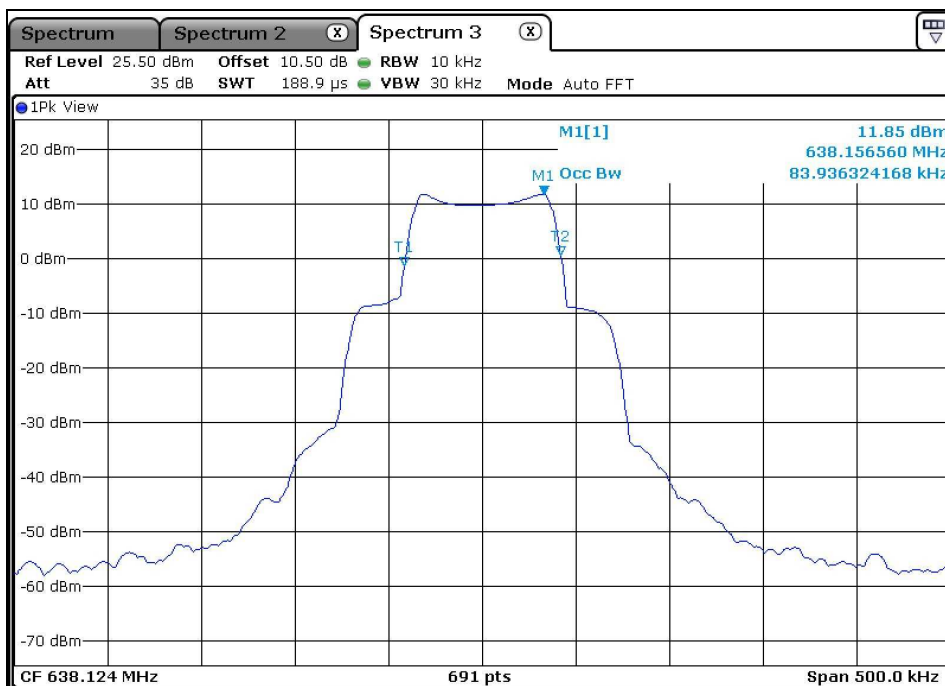
CH 49: 564.400 MHz



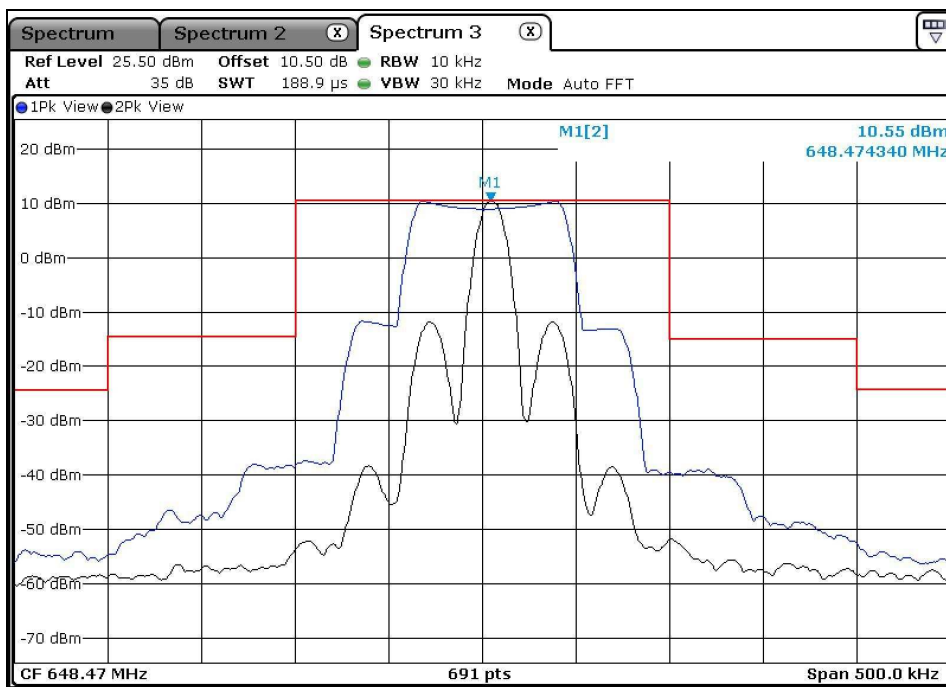
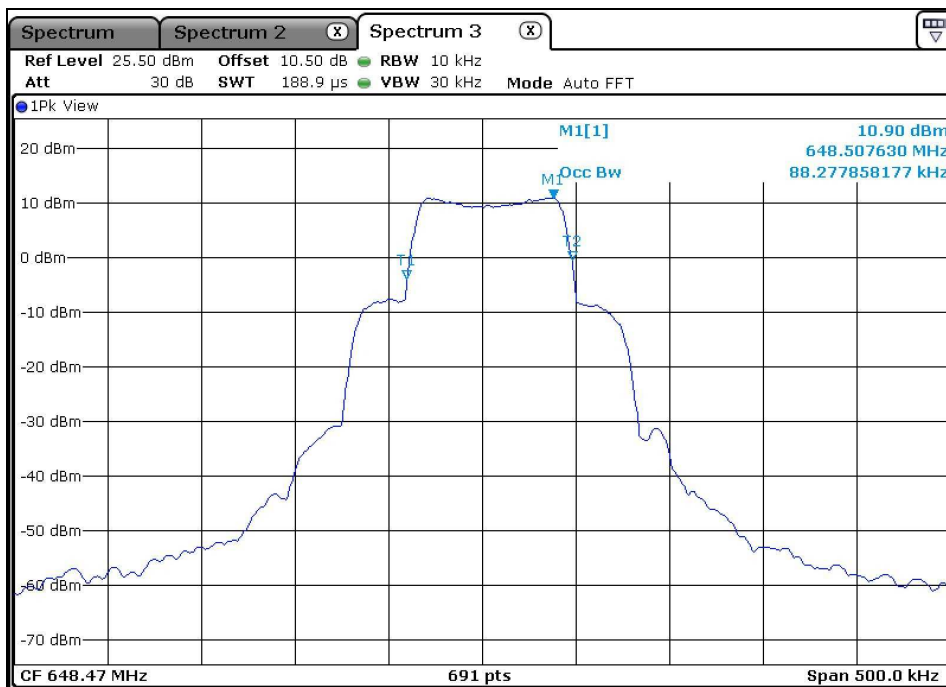


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CH 0: 638.125 MHz



CH 46: 648.475 MHz







Test Report No.: RF131121N042-2

## 4.5 FREQUENCY TOLERANCE MEASUREMENT

### 4.5.1 STANDARD APPLICABLE

According to FCC Part 74 Section 74.861(e)(4), the frequency tolerance must be maintained within 0.005%.

### 4.5.2 TEST EQUIPMENT LIST AND DETAILS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Signal Analyzer Rohde & Schwarz	FSV7	102331	Nov. 25,13	Nov. 24,14

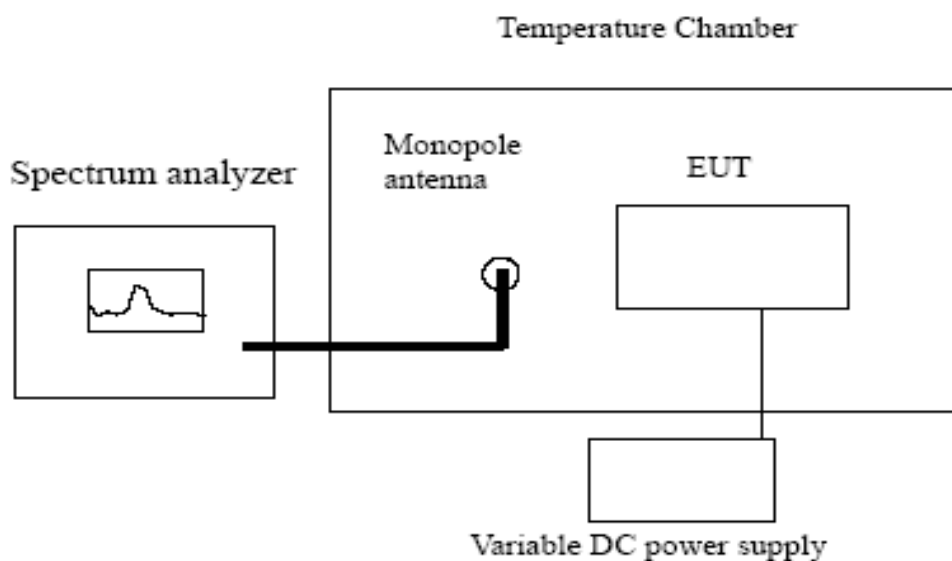
Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

### 4.5.3 TEST PROCEDURE

1. Turn on EUT and set spectrum analyzer center frequency to the EUT operating frequency. Set spectrum analyzer Resolution Bandwidth to 1 kHz and Video Resolution Bandwidth to 1 kHz and Frequency Span to 50kHz. Record this frequency as reference frequency.
2. Set the temperature of chamber to 50 °C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
3. Repeat step 2 with a 10°C decreased per stage until the lowest temperature -30°C is measured, record all measured frequencies on each temperature step.
4. Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.



#### 4.5.4 TEST SETUP



#### 4.5.5 TEST RESULTS

Test Data: 542.125MHz-564.400MHz

A, measurement of Frequency Tolerance (temperature)

Test condition	Power supply	Low Frequency (542.125 MHz)	Middle Frequency (552.475 MHz )	High Frequency (564.400MHz )
-30	3V	542.1234	552.4725	564.3981
-20	3V	542.1239	552.473	564.3982
-10	3V	542.1243	552.4731	564.3987
0	3V	542.1245	552.4735	564.3993
10	3V	542.1252	552.4745	564.3995
20	3V	542.1252	552.4751	564.3999
30	3V	542.1255	552.4753	564.4005
40	3V	542.1259	552.4761	564.4005
50	3V	542.1270	552.4764	564.4008
Frequency Error		+2.0 KHz	-2.5 KHz	-1.9 KHz
Frequency tolerance		0.00037%	0.00045%	0.00034%
Frequency Tolerance Limit		0.005%		

B, The measurement of Frequency Tolerance (supply voltage)

Test condition	Power supply	Low Frequency (542.125 MHz)	Middle Frequency (552.475 MHz )	High Frequency (564.400MHz )
20	2.55V	542.1253	552.4748	564.3997
20	3.45V	542.1253	552.4749	564.3998
Frequency Error		+0.3 KHz	-0.2 KHz	-0.3 KHz
Frequency tolerance		0.000055%	0.000036%	0.000053%
Frequency Tolerance Limit		0.005%		

Test Data: 638.125MHz-660.400MHz

A, measurement of Frequency Tolerance (temperature)

Test condition	Power supply	Low Frequency (638.125 MHz)	Middle Frequency (648.475 MHz )	High Frequency (660.400MHz )
-30	3V	638.1223	648.4716	660.3978
-20	3V	638.1228	648.4721	660.398
-10	3V	638.1234	648.4725	660.3986
0	3V	638.124	648.4742	660.3992
10	3V	638.1247	648.4743	660.3998
20	3V	638.1254	648.4747	660.4005
30	3V	638.1259	648.4754	660.4012
40	3V	638.1262	648.4757	660.4018
50	3V	638.1265	648.476	660.4023
Frequency Error		-2.7 KHz	-3.4 KHz	+2.3 KHz
Frequency tolerance		0.00042%	0.00052%	0.00035%
Frequency Tolerance Limit		0.005%		

B, The measurement of Frequency Tolerance (supply voltage)

Test condition	Power supply	Low Frequency (638.125 MHz)	Middle Frequency (648.475 MHz )	High Frequency (660.400MHz )
20	2.55V	638.1253	648.4747	660.4006
20	3.45V	638.1252	648.4748	660.4005
Frequency Error		+0.3 KHz	-0.3 KHz	+0.6 KHz
Frequency tolerance		0.000047%	0.000046%	0.000091%
Frequency Tolerance Limit		0.005%		



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## 4.6 MODULATION CHARACTERISTICS MEASUREMENT

### 4.6.1 STANDARD APPLICABLE

According to FCC Part 2.1047(a) (b)

### 4.6.2 TEST EQUIPMENT LIST AND DETAILS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Audio Test System BOSCH	ATS-1	0000300054270000	Nov. 01, 13	Oct. 30, 14
Communications Tester JUNG JIN	MM-2500	N/A	Nov. 01, 13	Oct. 30, 14

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

### 4.6.3 TEST PROCEDURE

#### Audio Frequency Response:

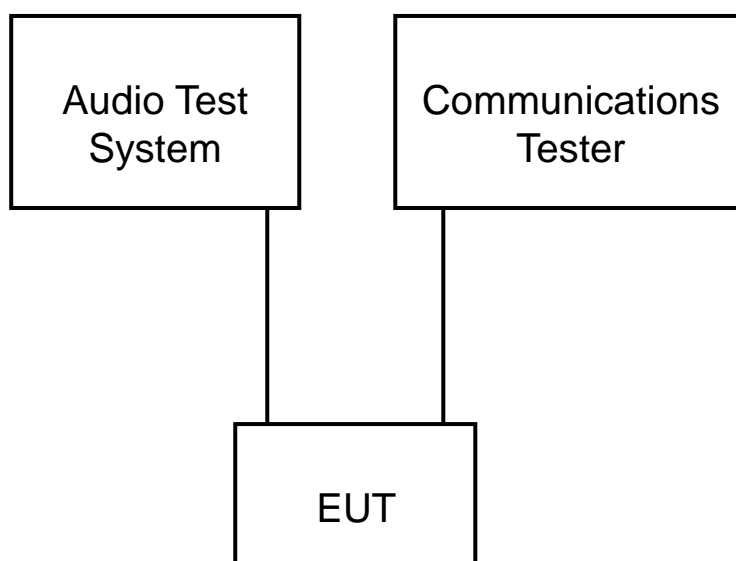
- 1) Apply a 1000 Hz tone and adjust the audio frequency generator to produce 20% of the rated system deviation.
- 2) Set the test receiver to measure rms deviation and record the deviation reading.
- 3) Record the DMM reading as  $V_{REF}$ .
- 4) Set the audio frequency generator to the desired test frequency between 100Hz and 5000Hz.
- 5) Vary the audio frequency generator output level until the deviation reading that was recorded in step f) is obtained.
- 6) Record the DMM reading as  $V_{FREQ}$ .
- 7) Calculate the audio frequency response at the present frequency as:  

$$\text{audio frequency response} = 20 \log (V_{FREQ} / V_{REF})$$
- 8) Repeat steps 4) through 7) for all the desired test frequencies.

### Modulation Limiting:

- 1) Apply a 1000 Hz modulating signal to the transmitter from the audio frequency generator, and adjust the level to obtain 60% of full rated system deviation.
- 2) Measure both the instantaneous and steady-state deviation at and after the time of increasing the audio input level.
- 3) With the level from the audio frequency generator held constant at the level obtained in step e), slowly vary the audio frequency from 300 Hz to 3000 Hz and observe the steady-state deviation. Record the maximum deviation.
- 4) Set the test receiver to measure peak negative deviation and repeat steps 1) through 3).
- 5) The values recorded in steps 3) and 4) are the modulation limiting.

#### 4.6.4 TEST SETUP



#### 4.6.5 TEST RESULTS

### Audio Frequency Response

#### 542.125 MHz

Modulation Frequency(Hz)	Input Level(mV)	Audio Frequency Response(dB)
100	26.44	1.898
300	25.81	1.689
500	24.38	1.193
700	22.99	0.684
1000	21.25	0
1500	20.13	-0.470
2000	18.65	-1.134
2500	17.26	-1.806
3500	15.27	-2.870
5000	13.58	-3.889

#### 552.475 MHz

Modulation Frequency(Hz)	Input Level(mV)	Audio Frequency Response(dB)
100	26.73	1.462
300	25.35	1.001
500	24.28	0.627
700	23.43	0.317
1000	22.59	0
1500	20.77	-0.730
2000	18.35	-1.806
2500	16.21	-2.883
3500	14.53	-3.833
5000	12.32	-5.266

564.400 MHz

Modulation Frequency(Hz)	Input Level(mV)	Audio Frequency Response(dB)
100	26.04	1.680
300	24.98	1.319
500	23.20	0.677
700	22.15	0.275
1000	21.46	0
1500	19.14	-0.994
2000	17.57	-1.737
2500	15.82	-2.648
3500	13.19	-4.228
5000	11.33	-5.548

638.125 MHz

Modulation Frequency(Hz)	Input Level(mV)	Audio Frequency Response(dB)
100	25.34	2.008
300	24.92	1.863
500	23.74	1.441
700	22.45	0.956
1000	20.11	0
1500	18.19	-0.872
2000	16.25	-1.851
2500	14.74	-2.698
3500	13.01	-3.783
5000	11.95	-4.521

648.475 MHz

Modulation Frequency(Hz)	Input Level(mV)	Audio Frequency Response(dB)
100	24.66	1.487
300	23.39	1.028
500	22.64	0.745
700	21.52	0.304
1000	20.78	0
1500	18.24	-1.132
2000	16.43	-2.040
2500	14.12	-3.356
3500	12.32	-4.541
5000	11.07	-5.470

660.400 MHz

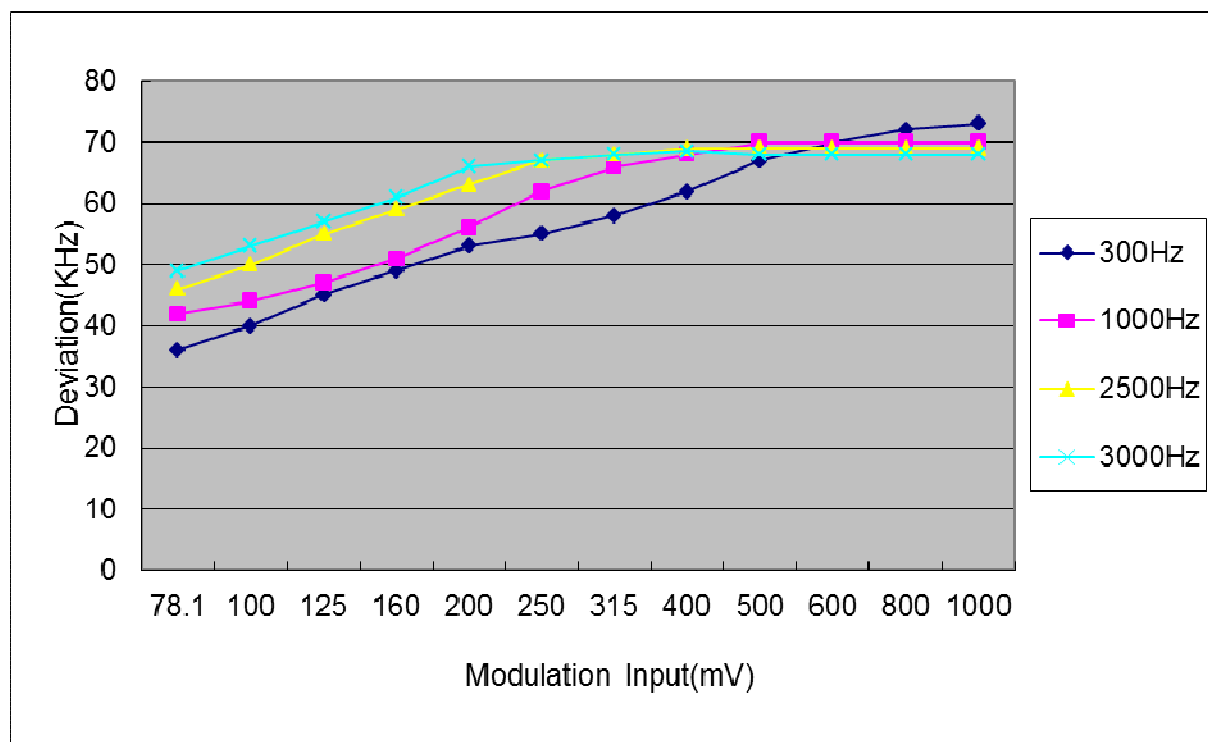
Modulation Frequency(Hz)	Input Level(mV)	Audio Frequency Response(dB)
100	26.05	1.487
300	25.47	1.292
500	24.34	0.898
700	23.02	0.413
1000	21.95	0
1500	19.48	-1.037
2000	17.33	-2.053
2500	15.15	-3.220
3500	13.74	-4.069
5000	11.30	-5.767



### Modulation Limiting

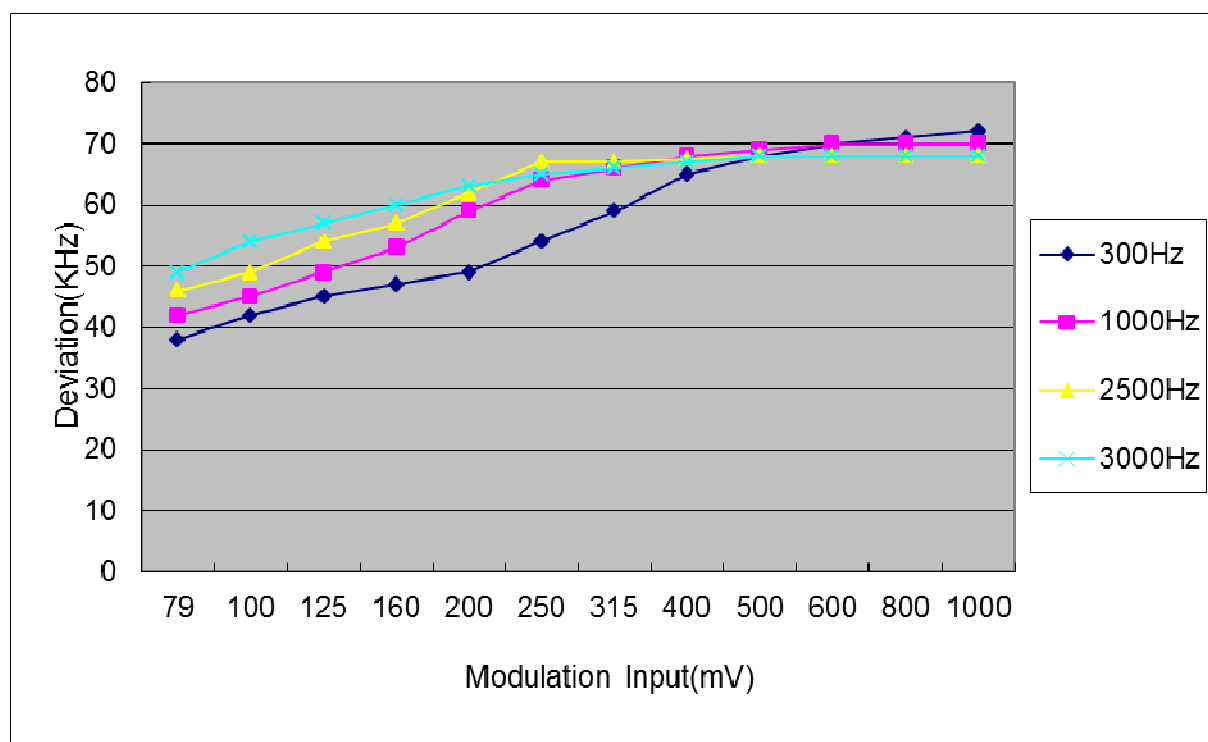
542.125 MHz

Modulation Input(mV)	Peak Frequency Deviation(KHz)			
	300Hz	1000Hz	2500Hz	3000Hz
78.1	36	42	46	49
100	40	44	50	53
125	45	47	55	57
160	49	51	59	61
200	53	56	63	66
250	55	62	67	67
315	58	66	68	68
400	62	68	69	68.5
500	67	70	69	68
600	70	70	69	68
800	72	70	69	68
1000	73	70	69	68



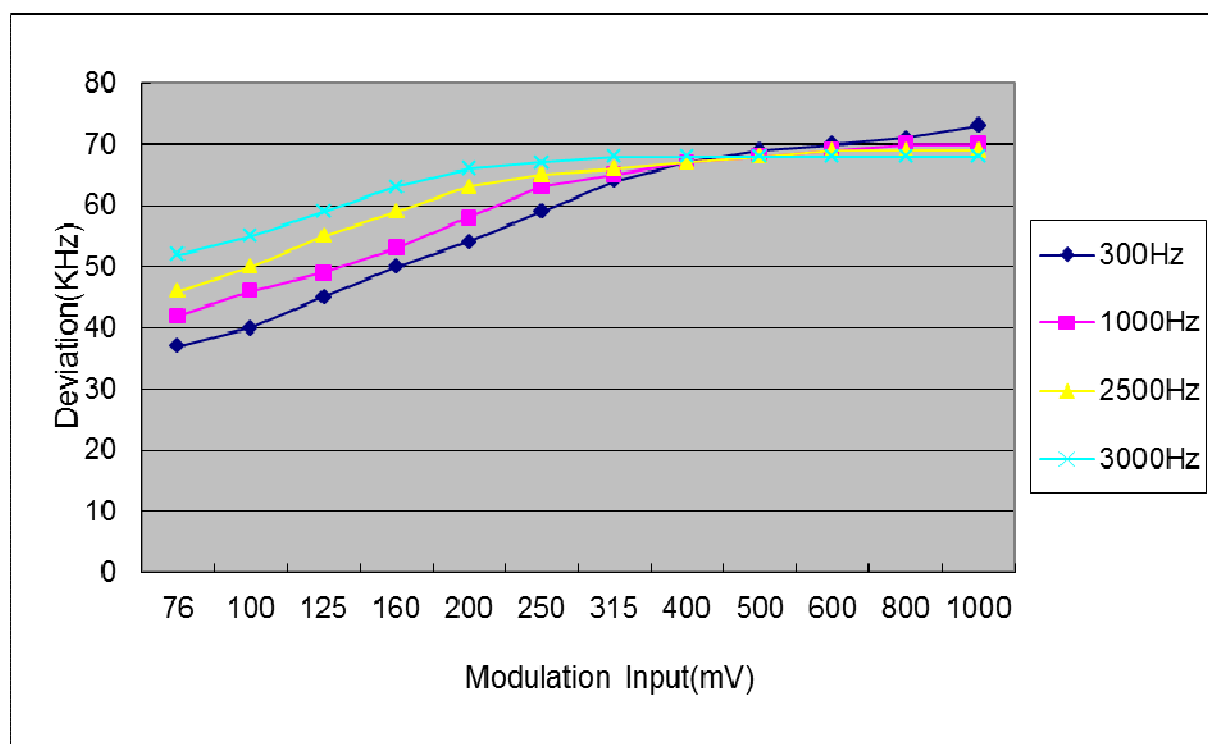
552.475 MHz

Modulation Input(mV)	Peak Frequency Deviation(KHz)			
	300Hz	1000Hz	2500Hz	3000Hz
79	38	42	46	49
100	42	45	49	54
125	45	49	54	57
160	47	53	57	60
200	49	59	62	63
250	54	64	67	65
315	59	66	67	66
400	65	68	67.5	67
500	68	69	68	68
600	70	70	68	68
800	71	70	68	68
1000	72	70	68	68



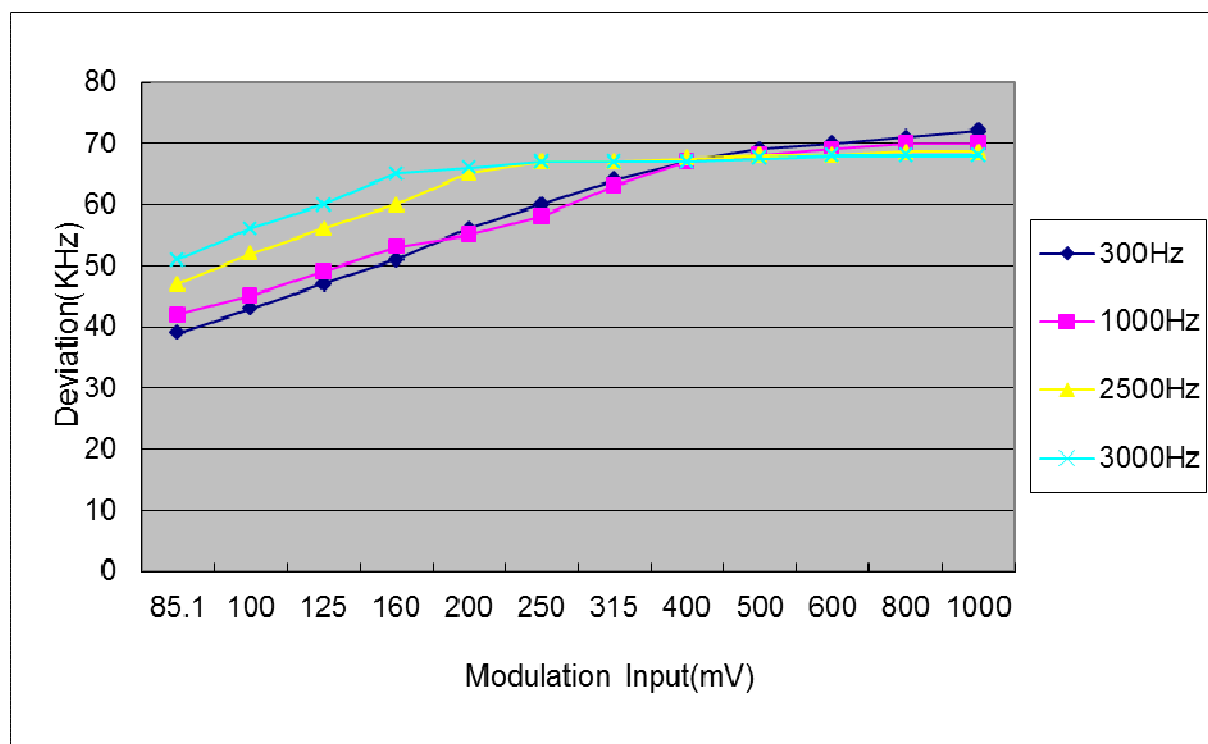
564.400 MHz

Modulation Input(mV)	Peak Frequency Deviation(KHz)			
	300Hz	1000Hz	2500Hz	3000Hz
76	37	42	46	52
100	40	46	50	55
125	45	49	55	59
160	50	53	59	63
200	54	58	63	66
250	59	63	65	67
315	64	65	66	68
400	67	67	67	68
500	69	68	68	68
600	70	69	69	68
800	71	70	69	68
1000	73	70	69	68



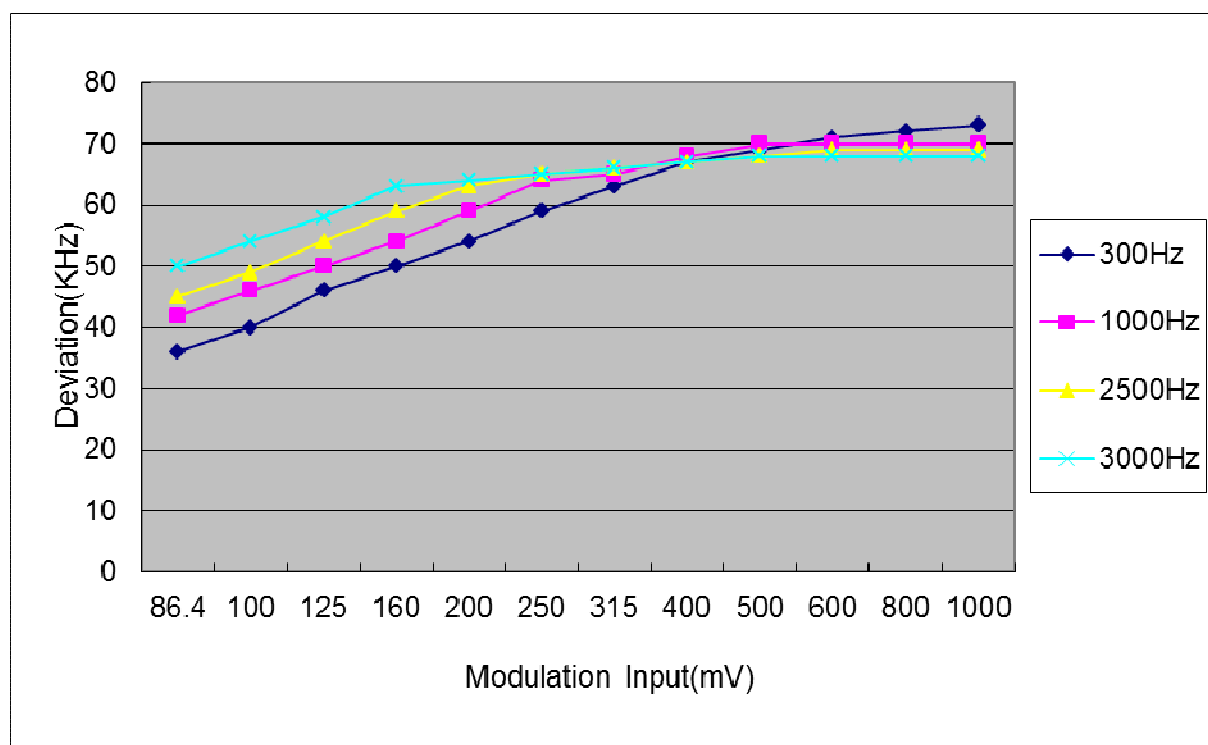
638.125 MHz

Modulation Input(mV)	Peak Frequency Deviation(KHz)			
	300Hz	1000Hz	2500Hz	3000Hz
85.1	39	42	47	51
100	43	45	52	56
125	47	49	56	60
160	51	53	60	65
200	56	55	65	66
250	60	58	67	67
315	64	63	67	67
400	67	67	67.5	67
500	69	68	68	67.5
600	70	69	68	68
800	71	70	68.5	68
1000	72	70	68.5	68



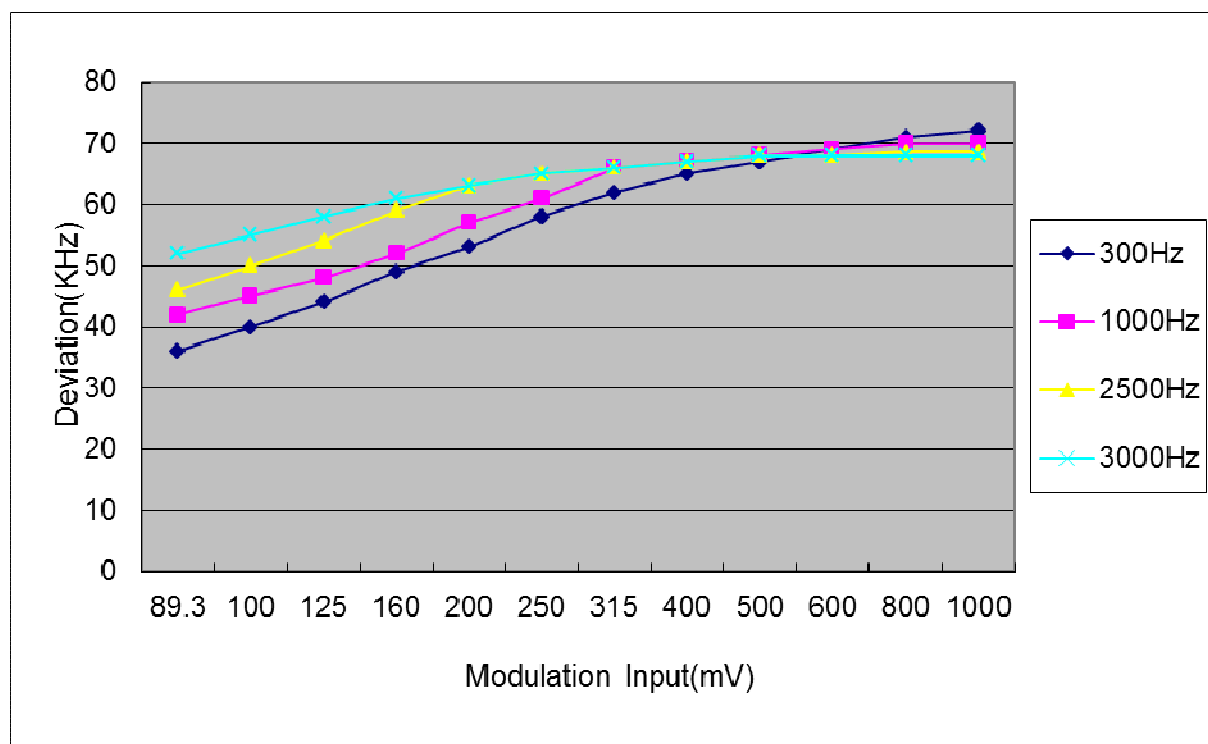
648.475 MHz

Modulation Input(mV)	Peak Frequency Deviation(KHz)			
	300Hz	1000Hz	2500Hz	3000Hz
86.4	36	42	45	50
100	40	46	49	54
125	46	50	54	58
160	50	54	59	63
200	54	59	63	64
250	59	64	65	65
315	63	65	66	66
400	67	68	67	67
500	69	70	68	68
600	71	70	69	68
800	72	70	69	68
1000	73	70	69	68



660.400 MHz

Modulation Input(mV)	Peak Frequency Deviation(KHz)			
	300Hz	1000Hz	2500Hz	3000Hz
89.3	36	42	46	52
100	40	45	50	55
125	44	48	54	58
160	49	52	59	61
200	53	57	63	63
250	58	61	65	65
315	62	66	66	66
400	65	67	67	67
500	67	68	68	68
600	69	69	68	68
800	71	70	68.5	68
1000	72	70	68.5	68





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## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



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## 6 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

---END---