# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LICENSED TRANSMITTER

| | |
|---|---|
| **Test Report No.** | **: E124R-021** |
| **AGR No.** | **: A122A-154** |
| **Applicant** | **: SOLiD Technologies, Inc.** |
| **Address** | **: 10,9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-400, Korea** |
| **Manufacturer** | **: SOLiD Technologies, Inc.** |
| **Address** | **: 10,9th Floor, SOLiD Space, Pangyoyeok-ro 220, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-400, Korea** |
| **Type of Equipment** | **: RDU MODULE (900I)** |
| **FCC ID.** | **: W6UH900I** |
| **Model Name** | **: 900I RDU44.5** |
| **Serial number** | **: N/A** |
| **Total page of Report** | **: 89 pages (including this page)** |
| **Date of Incoming** | **: February 06, 2012** |
| **Date of issue** | **: April 10, 2012** |

## SUMMARY

The equipment complies with the regulation; **FCC Part 90 Subpart I.**

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

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ONETECH Corp.

Approved by: Y. K. Kwon / Exe. Managing Director
ONETECH Corp.



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# CONTENTS

**PAGE**



 

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# Revision History

| Issued Report No. | Issued Date | Revisions | Effect Section |
|---|---|---|---|
| E124R-021 | April 10, 2012 | Initial Issue | All |
| | | | |
| | | | |



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# 1. VERIFICATION OF COMPLIANCE

APPLICANT : SOLiD Technologies, Inc.
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CONTACT PERSON : Mr. Yong-Chul, Kim / Researcher
TELEPHONE NO : +82-31-627-6292
FCC ID : W6UH900I
MODEL NAME : 900I RDU44.5
SERIAL NUMBER : N/A
DATE : April 10, 2012

| | |
|---|---|
| EQUIPMENT CLASS | PCB - PCS Licensed Transmitter |
| EQUIPMENT DESCRIPTION | RDU MODULE (900I) |
| THIS REPORT CONCERNS | Original Grant |
| MEASUREMENT PROCEDURES | ANSI C63.4: 2009, EIA/TIA-603-C |
| TYPE OF EQUIPMENT TESTED | Pre-Production |
| KIND OF EQUIPMENT AUTHORIZATION REQUESTED | Certification |
| EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S) | FCC Part 90 Subpart I |
| MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE | No |
| FINAL TEST WAS CONDUCTED ON | 3 m open area test site |

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.



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# 2. TEST SUMMARY

## 2.1 Test items and results

| SECTION | TEST ITEMS | RESULTS |
|---|---|---|
| 2.1046(a), 90.205 | RF Power Output at Antenna Terminals | Met the Limit / PASS |
| 2.1047 | Modulation Characteristics | PASS (See Note 1) |
| 2.1049, 90.210 | Occupied Bandwidth, Bandwidth Limitation | Met the Limit / PASS |
| 2.1049 | Band Edge | Met the Limit / PASS |
| 2.1051, 90.210 | Spurious Emissions at Antenna Terminals | Met the Limit / PASS |
| 2.1053, 90.210 | Field strength of Spurious Radiation | Met the Limit / PASS |
| 2.1055, 90.213 | Frequency Stability with Temperature variation | Met the requirement / PASS |
| 2.1055, 90.213 | Frequency stability with primary voltage variation | Met the requirement / PASS |
| 1.1307(b), 90.205 | RF Safety | PASS (See Note 2) |

Note 1: The Equipment under Test (EUT) is a repeater which reproduces the modulated input signal, so the EUT meets the requirement

Note 2: End users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance, because the applicant does not provide an antenna for sale with the EUT

## 2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

## 2.3 Related Submittal(s) / Grant(s)

Original Grant

## 2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

## 2.5 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4: 2009 & EIA/TIA-603-C: 2004 and was performed at a distance of 3 m from EUT to the antenna.

## 2.6 Test Facility

The open area test site and conducted measurement facilities are located on at 301-14, Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862, Korea. The Onetech Corp. has been accredited as a Conformity Assessment Body (CAB) with designation number KR0013.



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# 3. GENERAL INFORMATION

## 3.1 Product Description

The SOLiD Technologies, Inc., Models 900I RDU44.5 (referred to as the EUT in this report) is RDU MODULE (900I) has function for transmitting of Iden and paging signal. And the device shall be plugged in RDU (Remote Drive Unit).

RDU devices are varied for each frequency band, including the following:

| No | Unit naming | Description | Frequency | |
|---|---|---|---|---|
| | | | TX | RX |
| 1 | 1900PCS RDU44.5 | Single band | 1 930-1995 MHz | 1 850-1 915 MHz |
| 2 | 850CEL RDU44.5 | Single band | 869-894 MHz | 824-849 MHz |
| 3 | 700LTE RDU44.5 | Single band | 728-756 MHz | 698-716 MHz<br>777-787 MHz |
| 4 | AWS-1 RDU44.5 | Single band | 2 110-2155 MHz | 1 710-1 755 MHz |
| 5 | 700PS RDU44.5 | Single band | 758-775 MHz | 788-805 MHz |
| 6 | 800I/PS RDU44.5 | Single band | 851-869 MHz | 806-824 MHz |
| 7 | 900I RDU44.5 | Single band | 929-941 MHz | 896-902 MHz |

When receiving TX signals from each band through Remote Optic, RDU filters the signals and amplifies them with High Power Amplifier. The unit also filters RX signals given through cavity filter and amplifies them to send the signals to Remote Optic. In the unit, there is ATT to adjust gain. RDU consist of RFU, PAU and cavity duplexer and all modules are merged with one package. The product specification described herein was obtained from product data sheet or user's manual.

| | |
|---|---|
| DEVICE TYPE | RDU MODULE (900I) |
| LIST OF EACH OSC. or CRY. FREQ.(FREQ. >= 1 MHz) | 14.745 6 MHz, 8 MHz |
| EMISSION DESIGNATOR | GXW(iDEN) |
| OPERATING FREQUENCY | 929 MHz ~ 941 MHz |
| CHANNEL SEPARATION | 25 kHz |
| RF OUTPUT POWER | 44.5 dBm |
| DC VOLTAGE & CURRENT INTO FINAL AMPLIFIER | 28 V, 10 A |
| ELECTRICAL RATING | AC 120 V |
| OPERATING TEMPERATURE | -10 °C ~ 50 °C |

## 3.2 Alternative type(s)/model(s); also covered by this test report.

-. None



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### 3.3 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

| Model | Manufacturer | FCC ID | Description | Connected to |
|---|---|---|---|---|
| 900I RDU44.5 | SOLiD Technologies | W6UHAWS1 | RDU MODULE (900I) (EUT) | Signal Generator |
| SMJ100A | Rohde & Schwarz | N/A | Vector Signal Generator | EUT |

### 3.4 Mode of operation during the test

The EUT was received signal form signal generator and then each modulation was configured for maximum signal gain and bandwidth. The EUT was operated in a manner representative of the typical usage of the equipment. During all testing, system components were manipulated within the confines of typical usage to maximize each emission. The applicant does not supply antenna(s) with the system, so the dummy loads were connected to the RF output ports on the EUT for radiated spurious emission testing.

For the above testing, following frequencies and signal per channel were selected.

| Modulation | Channel | Frequency (MHz) |
|---|---|---|
| iDEN (929 MHz ~ 930 MHz) | Middle | 929.500 0 |
| SMR (929 MHz ~ 930 MHz) | Middle | 929.500 0 |
| iDEN (935 MHz ~ 940 MHz) | Low | 935.012 5 |
| | High | 939.987 5 |
| SMR (935 MHz ~ 940 MHz) | Low | 935.025 0 |
| | High | 939.975 0 |
| iDEN (940 MHz ~ 941 MHz) | Middle | 940.500 0 |
| SMR (940 MHz ~ 941 MHz) | Middle | 940.500 0 |

## 4. EUT MODIFICATIONS

-. None



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# 5. RF POWER OUTPUT at ANTENNA TERMINAL

## 5.1 Operating environment

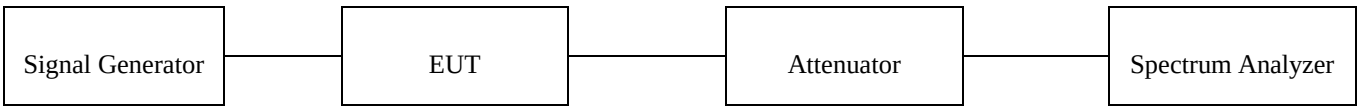
Temperature : (22 ~ 23) °C

Relative humidity : 49 % R.H.

## 5.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

RF output power was measured by channel power measurement function of the spectrum analyzer with rms detector mode.




## 5.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. (Interval) |
|---|---|---|---|---|---|
| ■ - | E4432B | HP | Signal Generator | US38440950 | June 10, 2011 (1Y) |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 02, 2012 (1Y) |
| ■ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 15, 2011 (1Y) |
| □ - | 8564E | HP | Spectrum Analyzer | 3650A00756 | Jun. 10, 2011 (1Y) |
| ■ - | FSV30 | R/S | Spectrum Analyzer | 101372 | Aug. 29, 2011 (1Y) |
| ■ - | 67-30-43 | Aeroflex Weinschel | Power Attenuator | CA5760 | Nov. 30, 2011 (1Y) |

All test equipment used is calibrated on a regular basis.



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## 5.4 Test data

### 5.4.1 Test Result for frequency range 929 MHz ~ 930 MHz

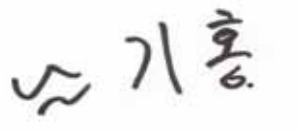
-. Test Date : March 09, 2012

-. Measurement Function : Channel Power

-. Detector Mode : RMS detector

-. Test Result : Pass

| Modulation | Channel | Frequency (MHz) | Input Power (dBm) | Output Power (dBm) | Output Power (W) | Limit (W) |
|---|---|---|---|---|---|---|
| iDEN | Middle | 929.500 0 | -9.80 | 44.50 | 28.183 829 | 100.00 |
| SMR | Middle | 929.500 0 | -9.80 | 44.50 | 28.183 829 | |



**Tested by: Ki-Hong, Nam / Senior Engineer**



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**5.4.2 Test Result for frequency range 935 MHz ~ 940 MHz**

-. Test Date : March 13, 2012

-. Measurement Function : Channel Power

-. Detector Mode : RMS detector

-. Test Result : Pass

| Modulation | Channel | Frequency (MHz) | Input Power (dBm) | Output Power (dBm) | Output Power (W) | Limit (W) |
|---|---|---|---|---|---|---|
| iDEN | Low | 935.012 5 | -9.80 | 44.50 | 28.183 829 | 100.00 |
| | High | 939.987 5 | -9.90 | 44.50 | 28.183 829 | |
| SMR | Low | 935.025 0 | -9.90 | 44.50 | 28.183 829 | |
| | High | 939.975 0 | -9.80 | 44.50 | 28.183 829 | |

**Tested by: Ki-Hong, Nam / Senior Engineer**



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### 5.4.3 Test Result for frequency range 940 MHz ~ 941 MHz

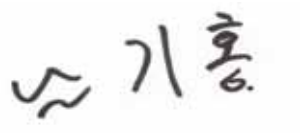
-. Test Date : March 14, 2012

-. Measurement Function : Channel Power

-. Detector Mode : RMS detector

-. Test Result : Pass

| Modulation | Channel | Frequency (MHz) | Input Power (dBm) | Output Power (dBm) | Output Power (W) | Limit (W) |
|---|---|---|---|---|---|---|
| iDEN | Middle | 940.500 0 | -9.80 | 44.50 | 28.183 829 | 100.00 |
| SMR | Middle | 940.500 0 | -9.90 | 44.50 | 28.183 829 | |



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# 6. OCCUPIED BANDWIDTH

## 6.1 Operating environment

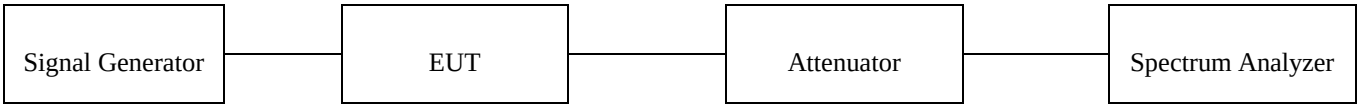
Temperature : (23 ~ 25) °C

Relative humidity : (49 ~ 50) % R.H.

## 6.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

For the testing, the RBW was set to 1 % to 3 % of the - 26 dB bandwidth. The VBW is set to 3 times the RBW and sweep time is coupled.




## 6.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. (Interval) |
|---|---|---|---|---|---|
| ■ - | E4432B | HP | Signal Generator | US38440950 | June 10, 2011 (1Y) |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 02, 2012 (1Y) |
| ■ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 15, 2011 (1Y) |
| □ - | 8564E | HP | Spectrum Analyzer | 3650A00756 | Jun. 10, 2011 (1Y) |
| ■ - | FSV30 | R/S | Spectrum Analyzer | 101372 | Aug. 29, 2011 (1Y) |
| ■ - | 67-30-43 | Aeroflex Weinschel | Power Attenuator | CA5760 | Nov. 30, 2011 (1Y) |

All test equipment used is calibrated on a regular basis.



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## 6.4 Test data

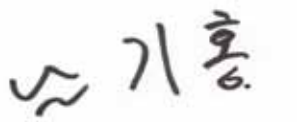
### 6.4.1 Test Result for frequency range 929 MHz ~ 930 MHz

-. Test Date : March 09, 2012

-. Test Result : Pass

| Modulation | Channel | 26 dB Bandwidth (kHz) | 99 % Occupied Bandwidth (kHz) |
|---|---|---|---|
| iDEN | Middle | 20.20 | 18.10 |
| SMR | Middle | 14.70 | 12.40 |

Remark: According to above result, the carrier frequency shall be within the frequency block edges.



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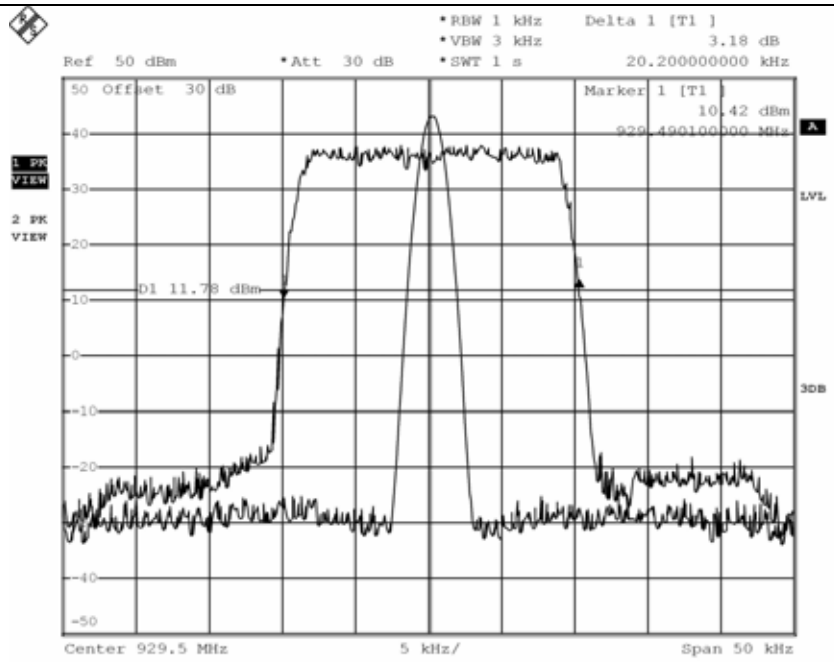
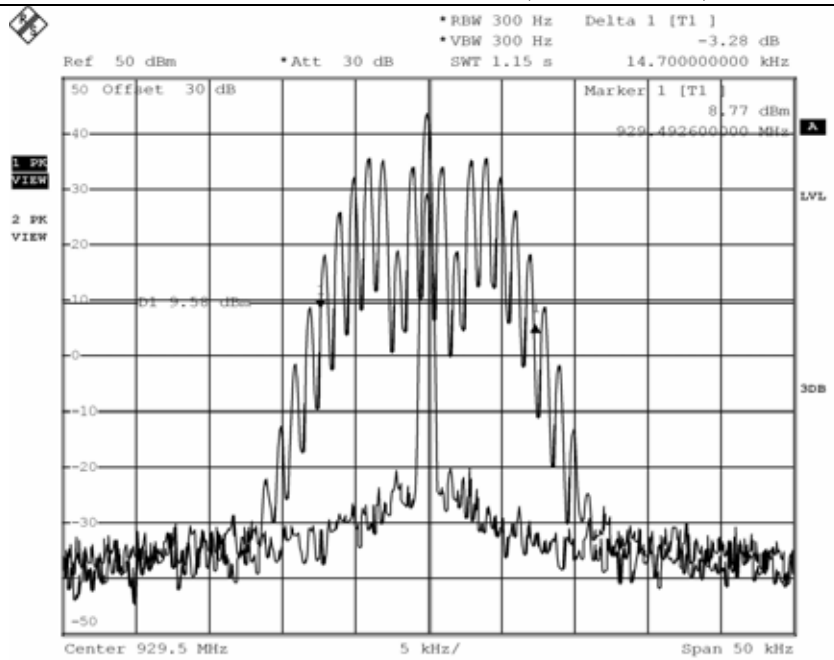



iDEN – 26 dB Bandwidth (Middle Channel)




SMR – 26 dB Bandwidth (Middle Channel)



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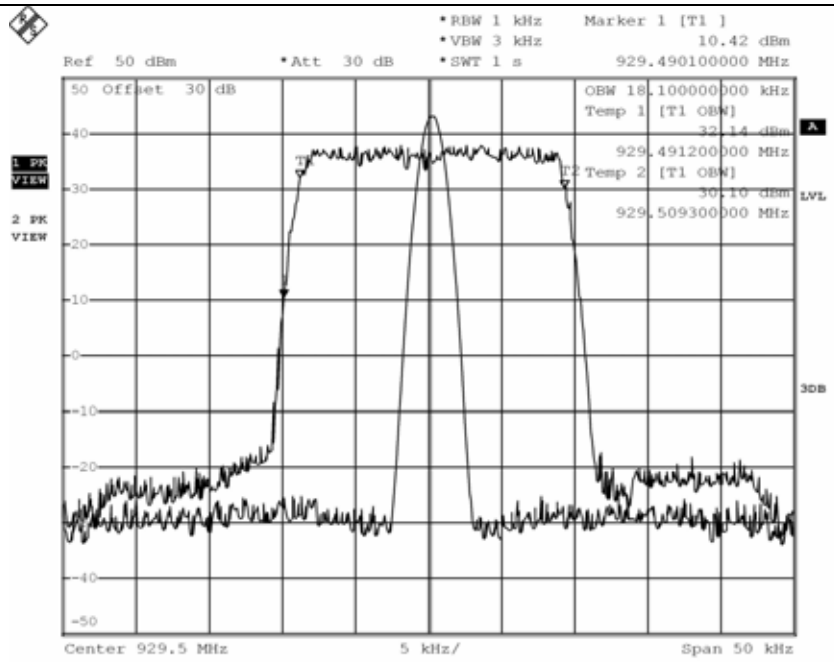
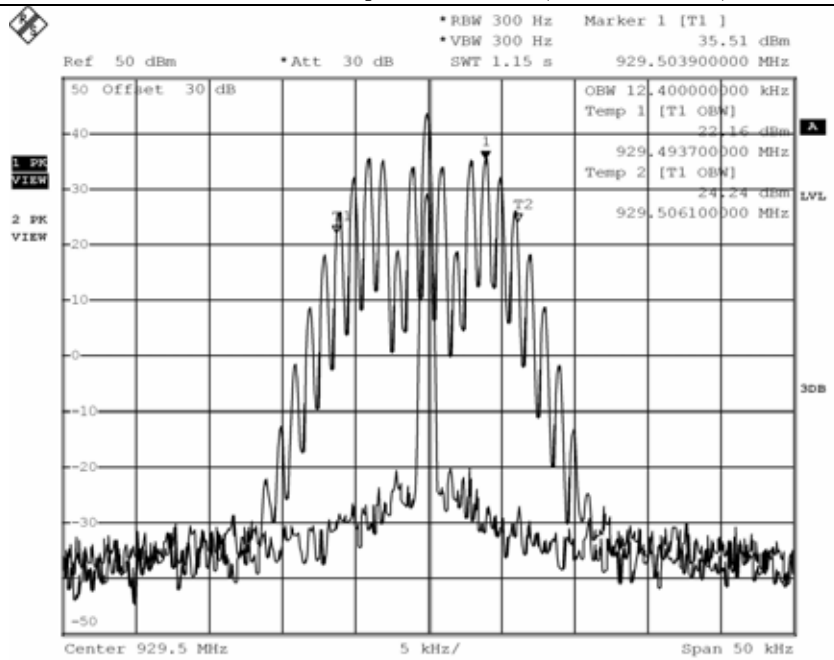



iDEN – Occupied Bandwidth (Middle Channel)




SMR – Occupied Bandwidth (Middle Channel)



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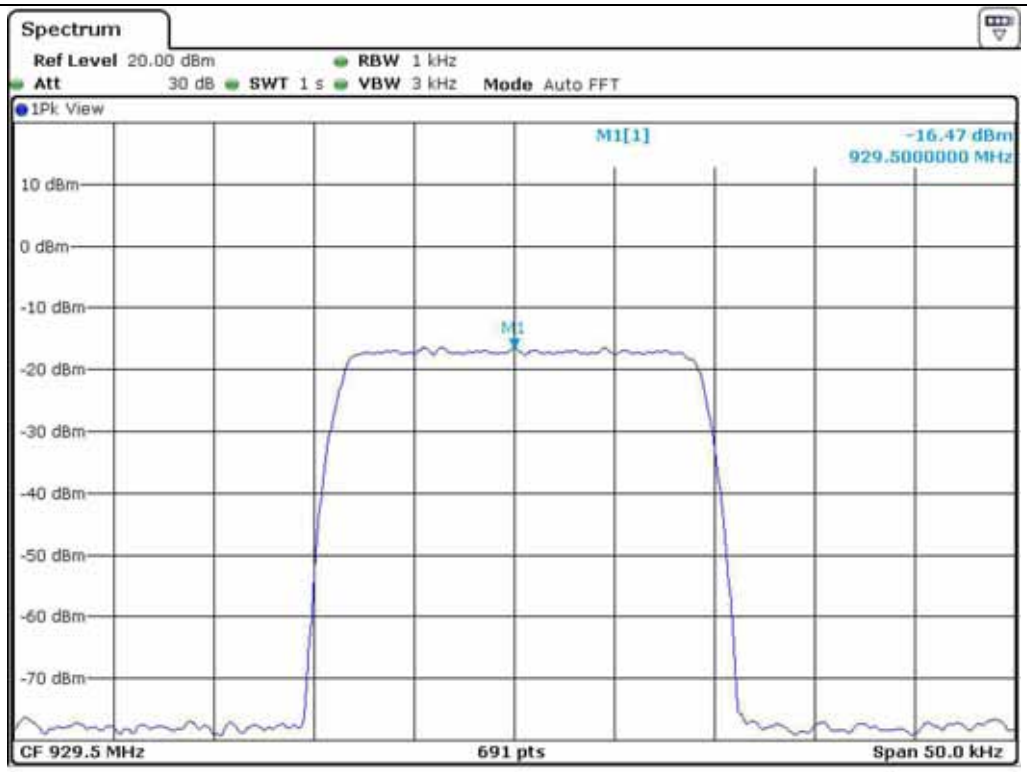
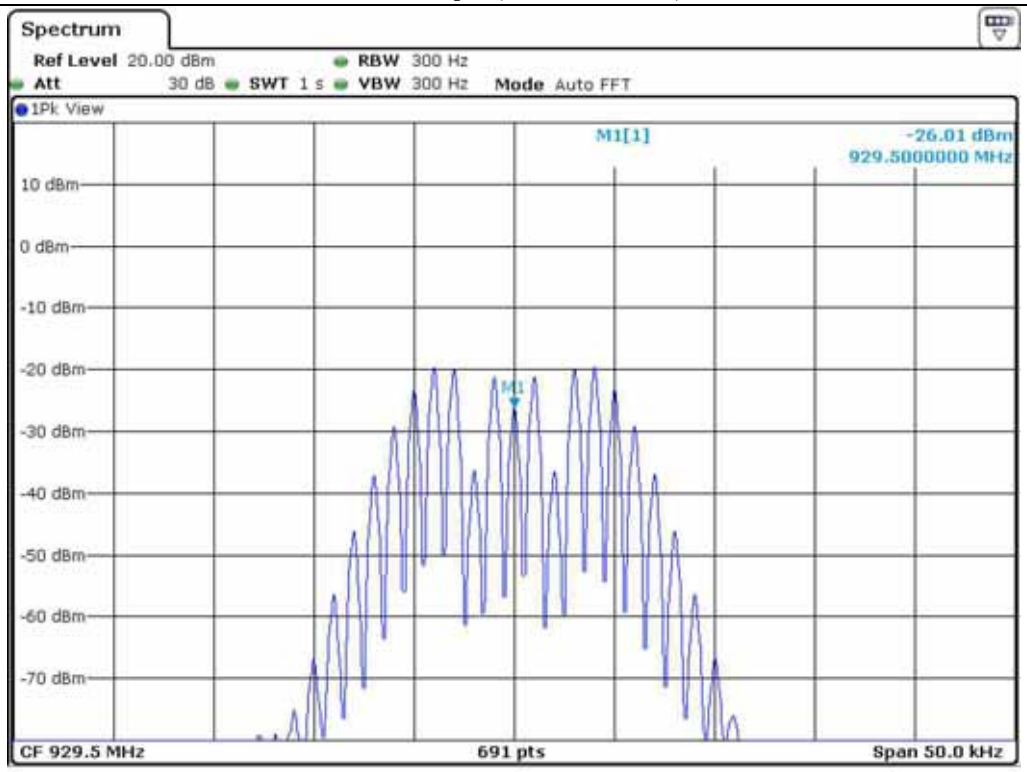



iDEN – Input (Middle Channel)




SMR – Input (Middle Channel)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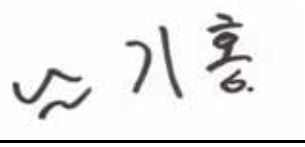
### 6.4.2 Test Result for frequency range 935 MHz ~ 940 MHz

-. Test Date : March 13, 2012

-. Test Result : Pass

| Modulation | Channel | 26 dB Bandwidth (kHz) | 99 % Occupied Bandwidth (kHz) |
|---|---|---|---|
| iDEN | Low | 20.30 | 18.10 |
| | High | 20.30 | 18.20 |
| SMR | Low | 14.70 | 12.40 |
| | High | 14.70 | 12.40 |

Remark: According to above result, the carrier frequency shall be within the frequency block edges.



**Tested by: Ki-Hong, Nam / Senior Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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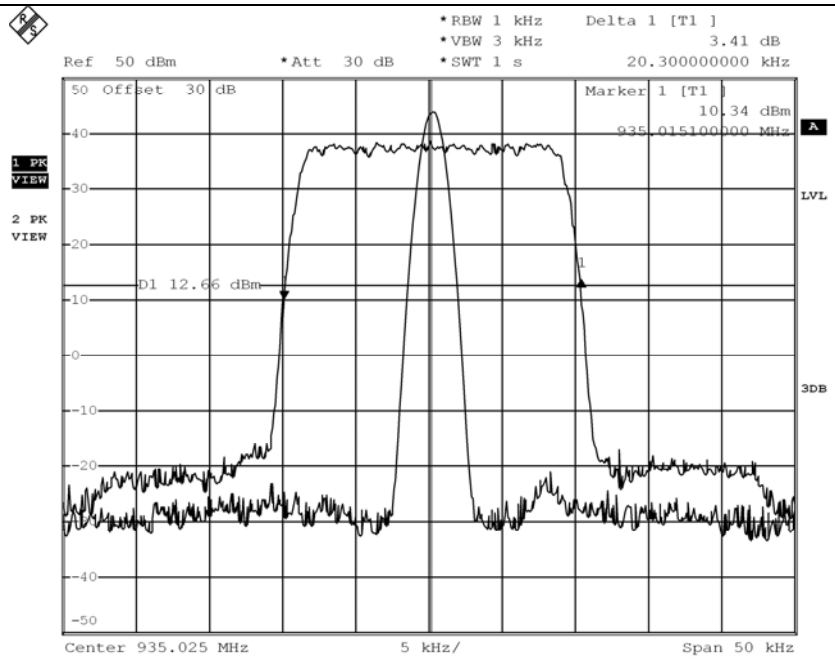
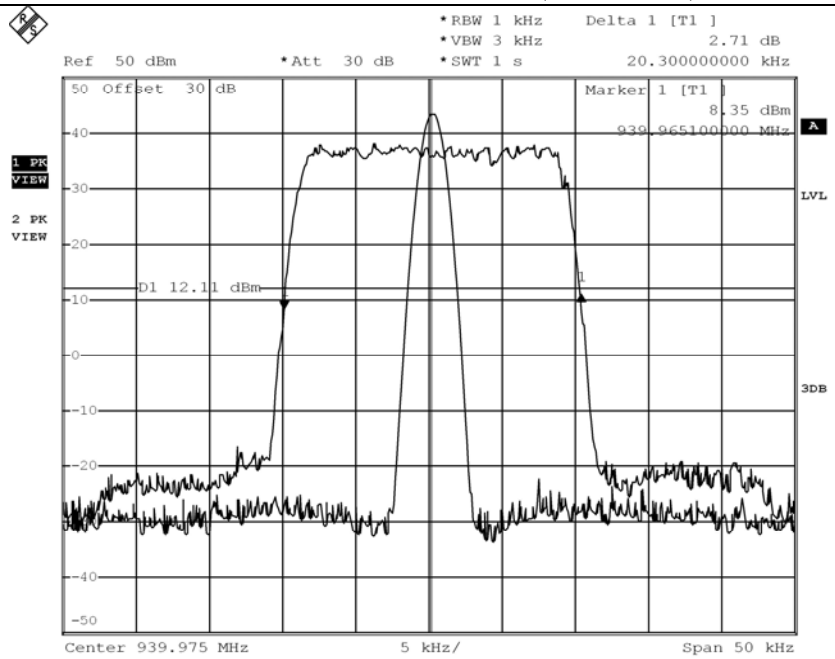



iDEN – 26 dB Bandwidth (Low Channel)




iDEN – 26 dB Bandwidth (High Channel)



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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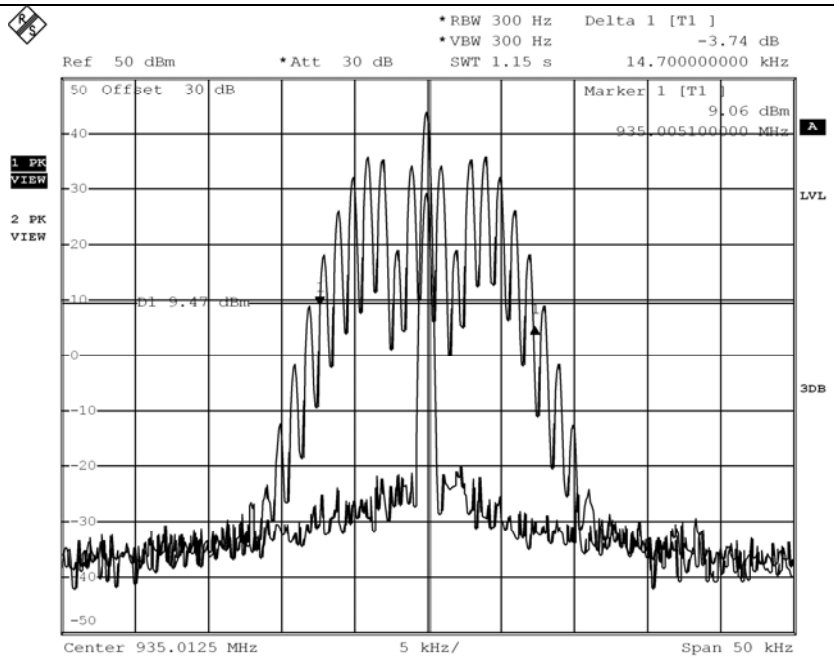
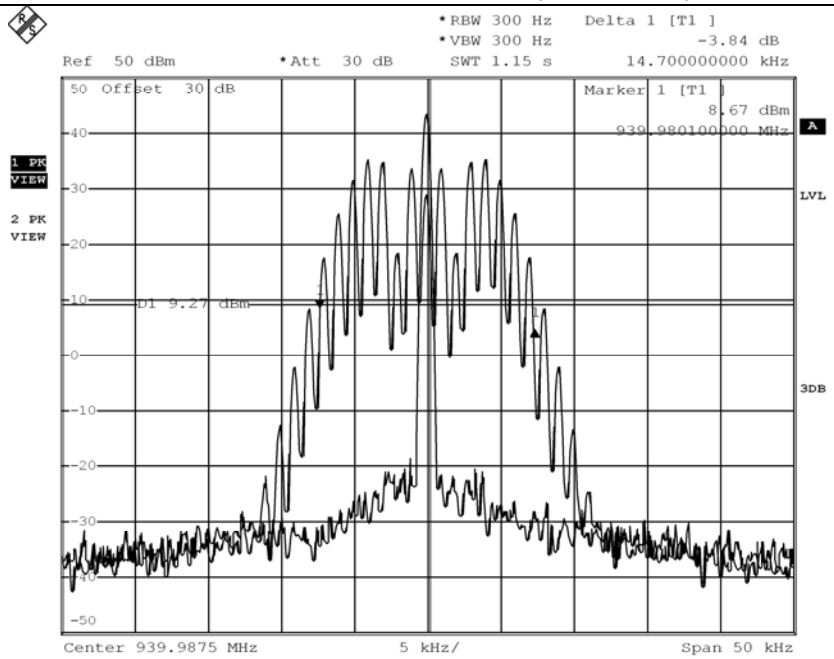



SMR – 26 dB Bandwidth (Low Channel)




SMR – 26 dB Bandwidth (High Channel)


**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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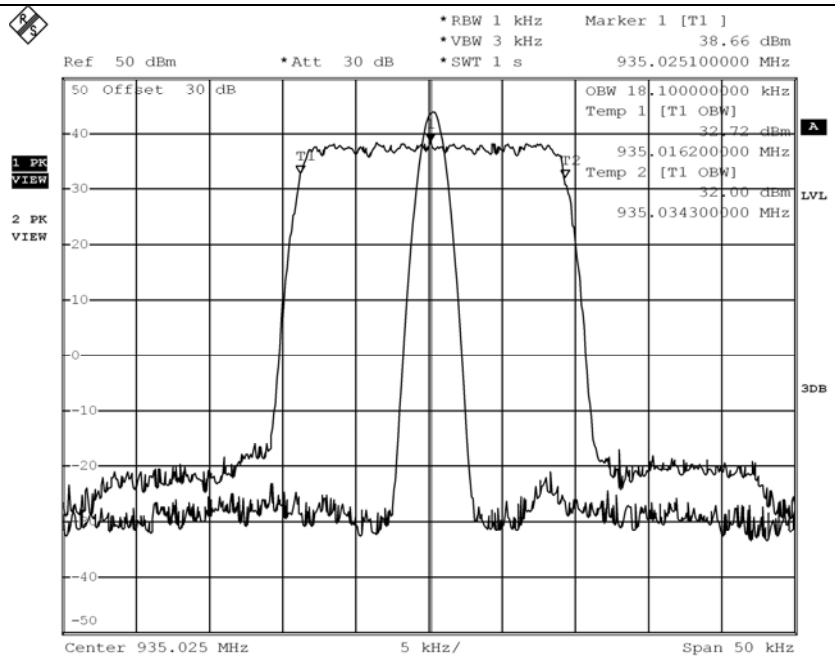
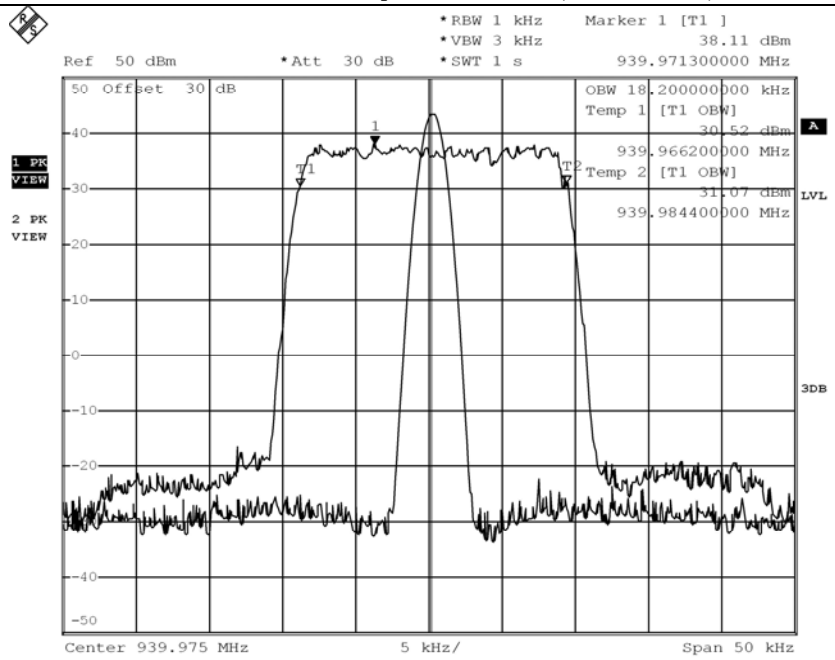



iDEN – Occupied Bandwidth (Low Channel)




iDEN – Occupied Bandwidth (High Channel)


**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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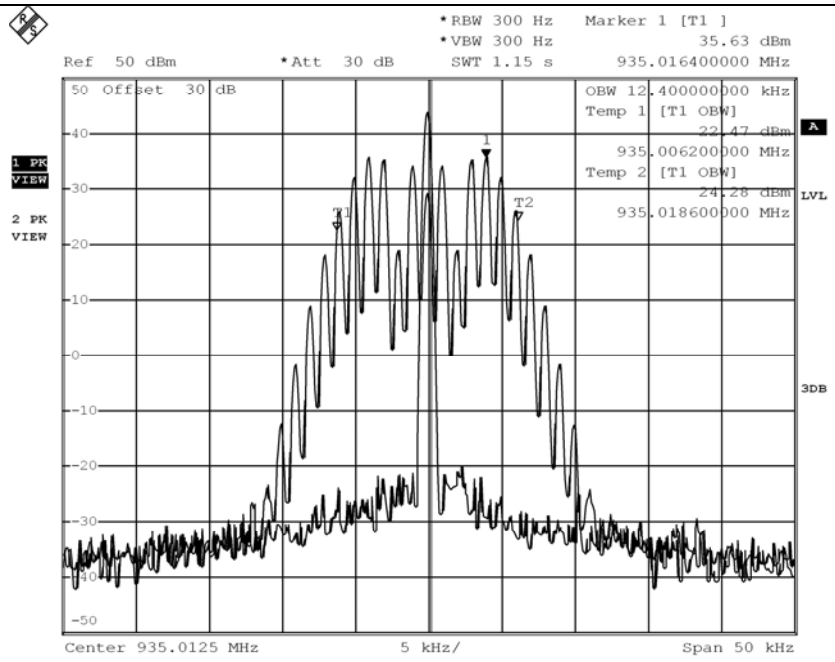
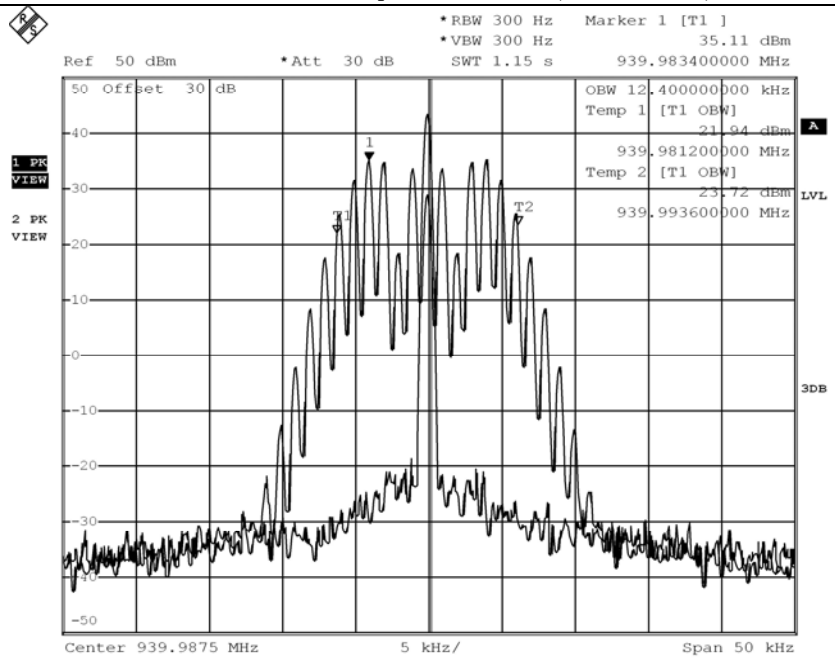



SMR – Occupied Bandwidth (Low Channel)




SMR – Occupied Bandwidth (High Channel)



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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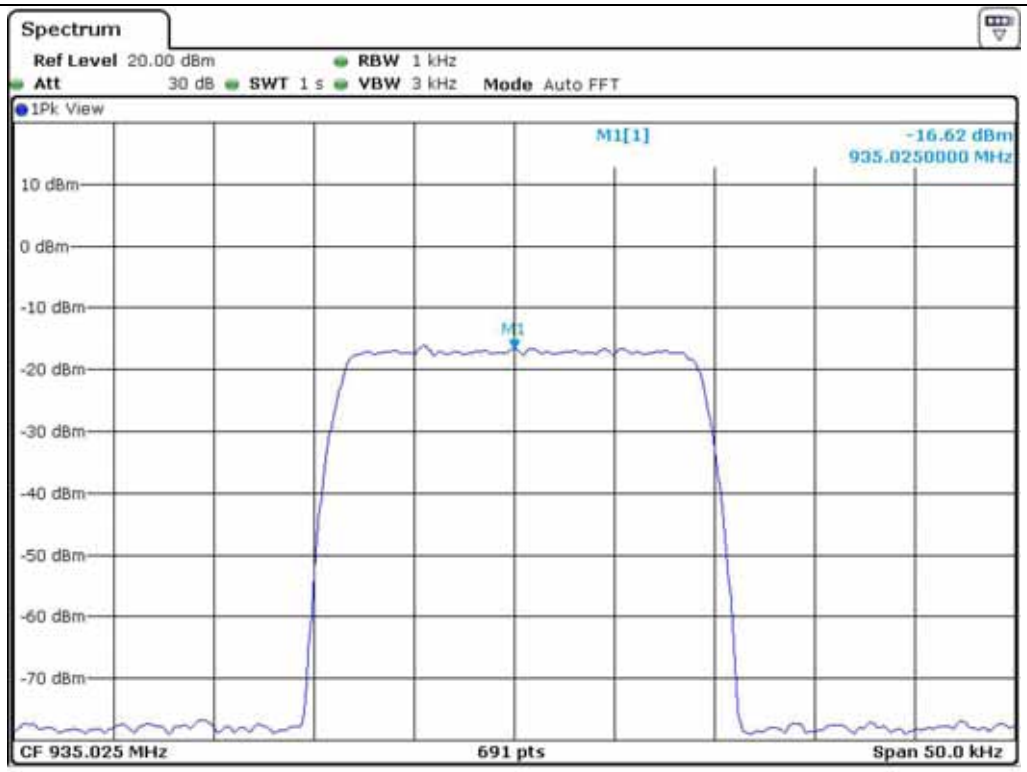
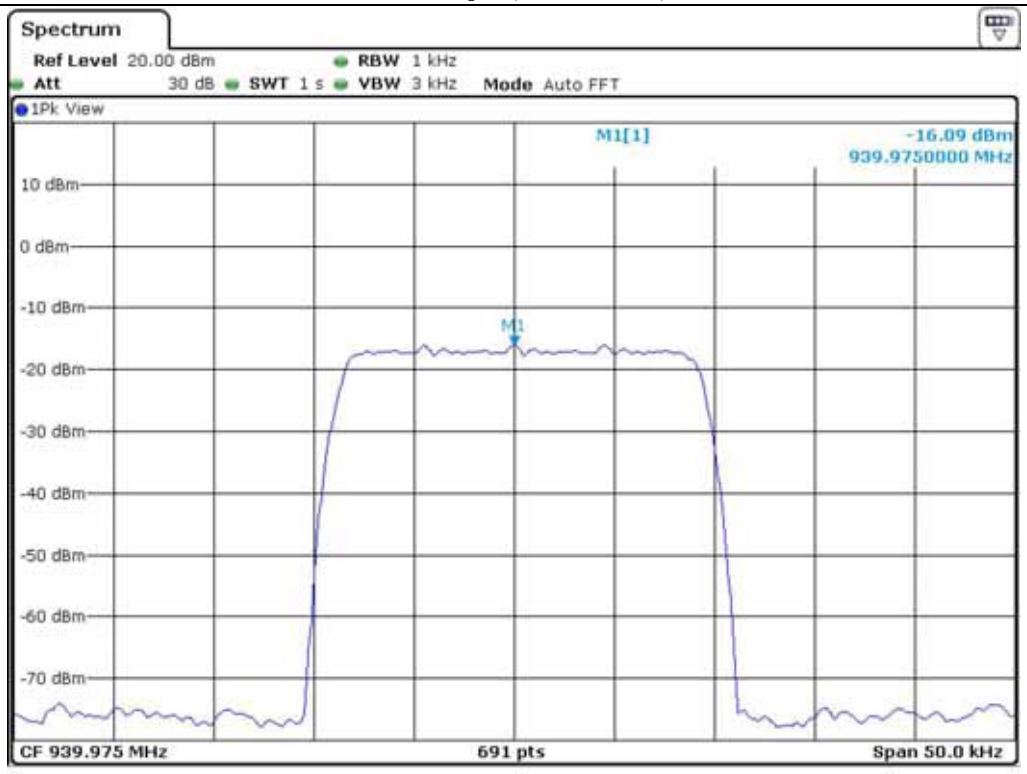



iDEN – Input (Low Channel)




iDEN – Input (High Channel)

**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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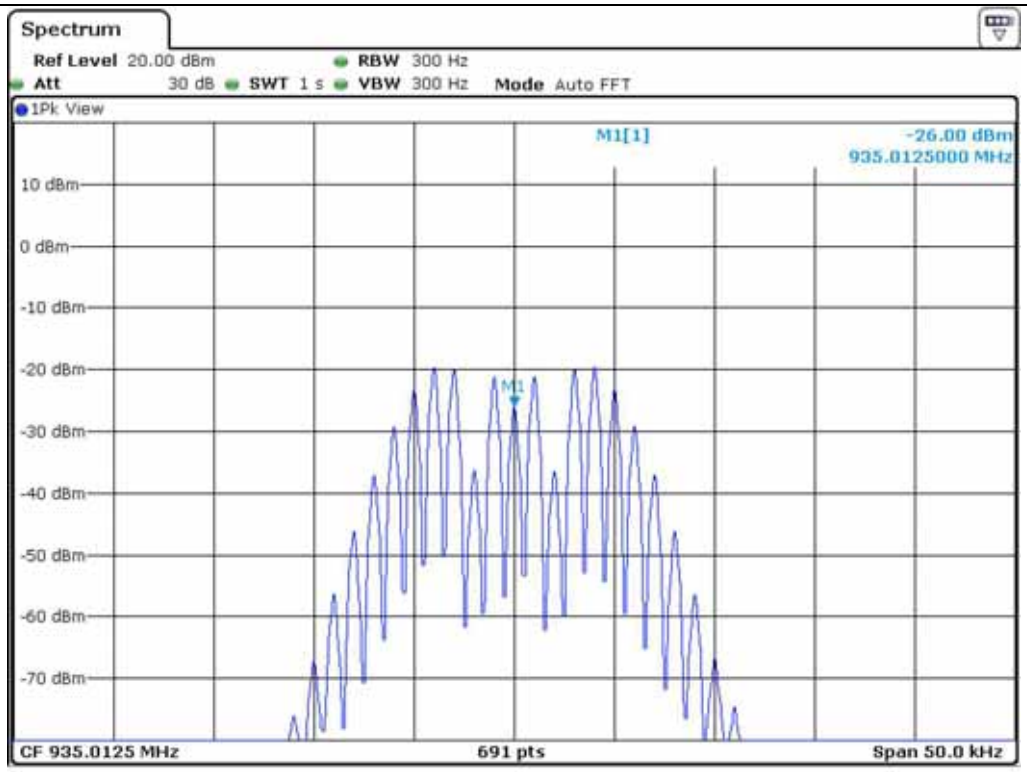
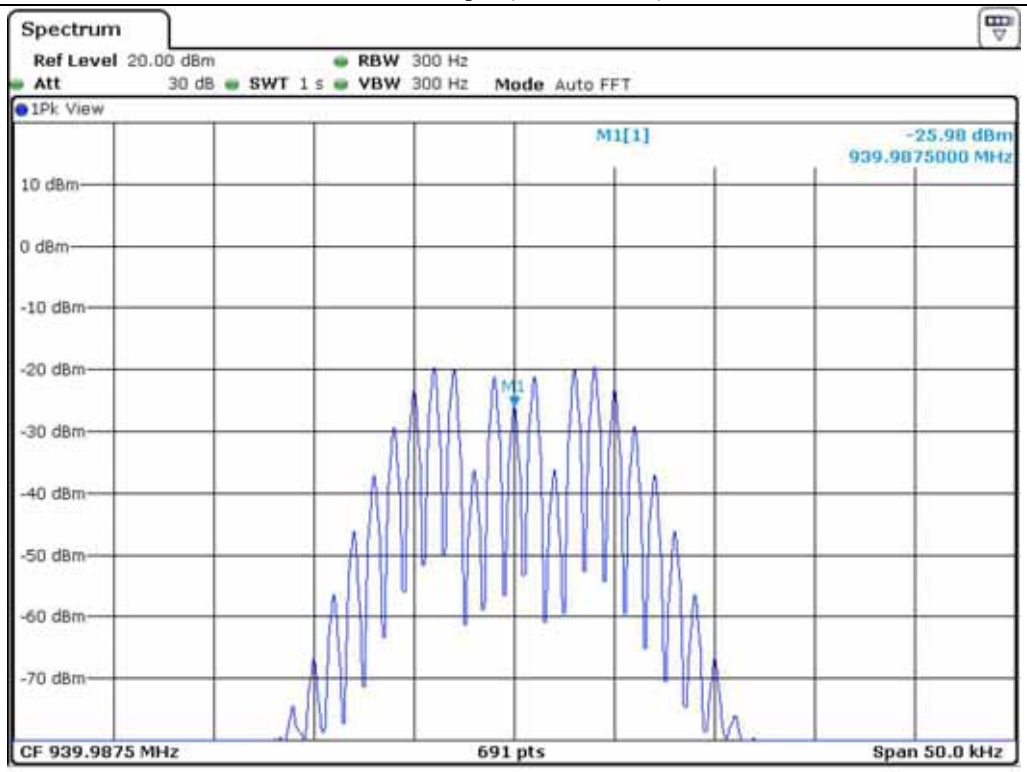



SMR – Input (Low Channel)




SMR – Input (High Channel)



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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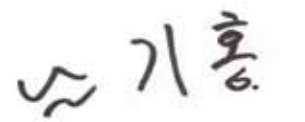
### 6.4.3 Test Result for frequency range 940 MHz ~ 941 MHz

-. Test Date : March 14, 2012

-. Test Result : Pass

| Modulation | Channel | 26 dB Bandwidth (kHz) | 99 % Occupied Bandwidth (kHz) |
|---|---|---|---|
| iDEN | Middle | 20.20 | 18.20 |
| SMR | Middle | 14.70 | 12.40 |

Remark: According to above result, the carrier frequency shall be within the frequency block edges.



**Tested by: Ki-Hong, Nam / Senior Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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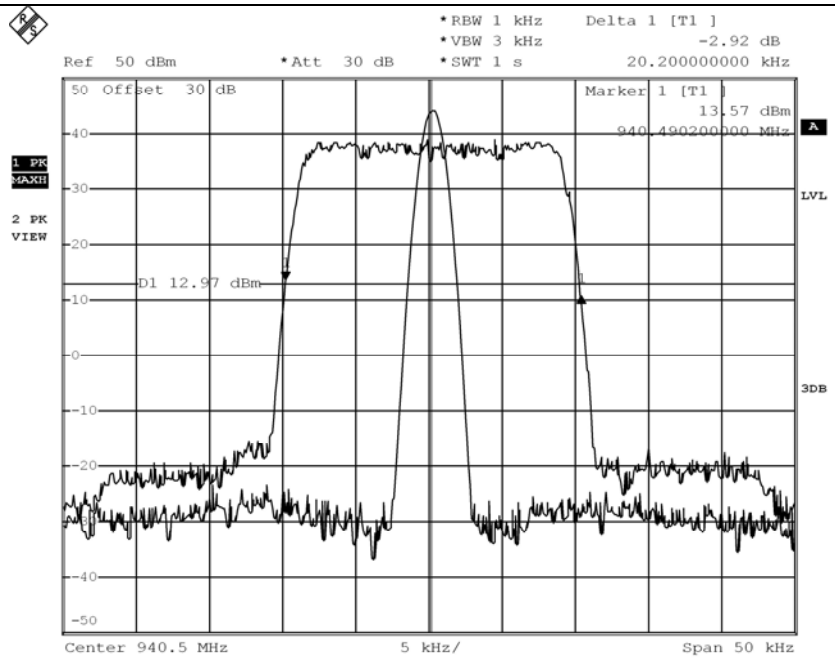
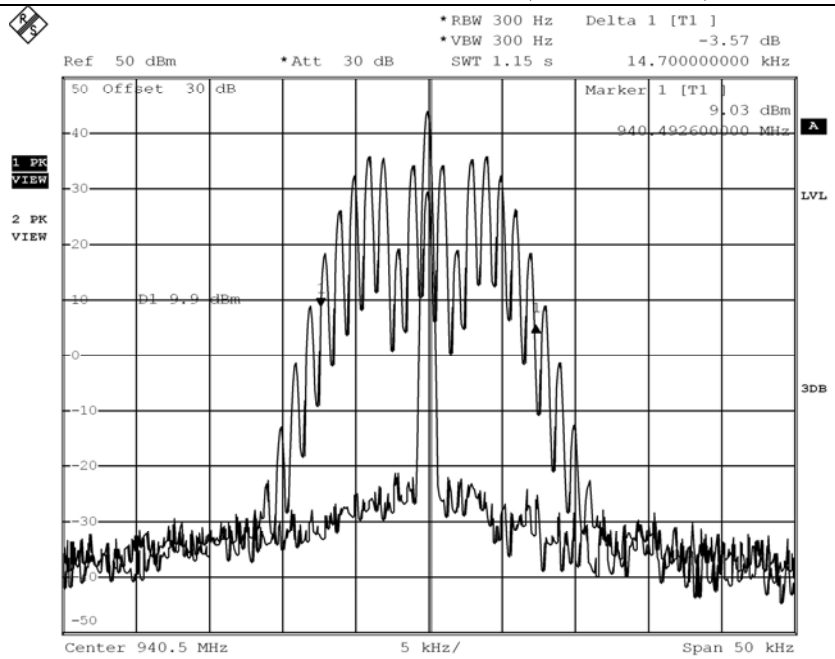



iDEN – 26 dB Bandwidth (Middle Channel)




SMR – 26 dB Bandwidth (Middle Channel)



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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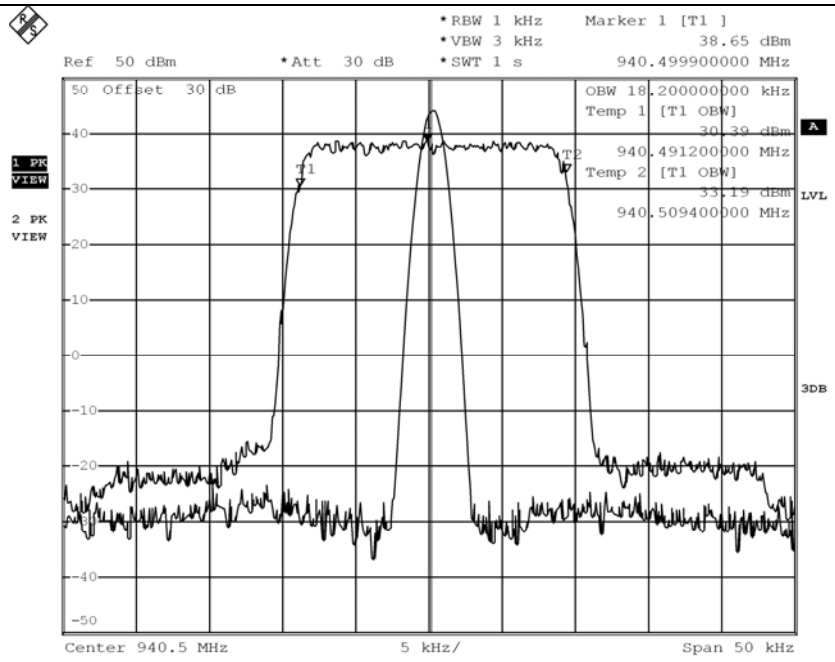
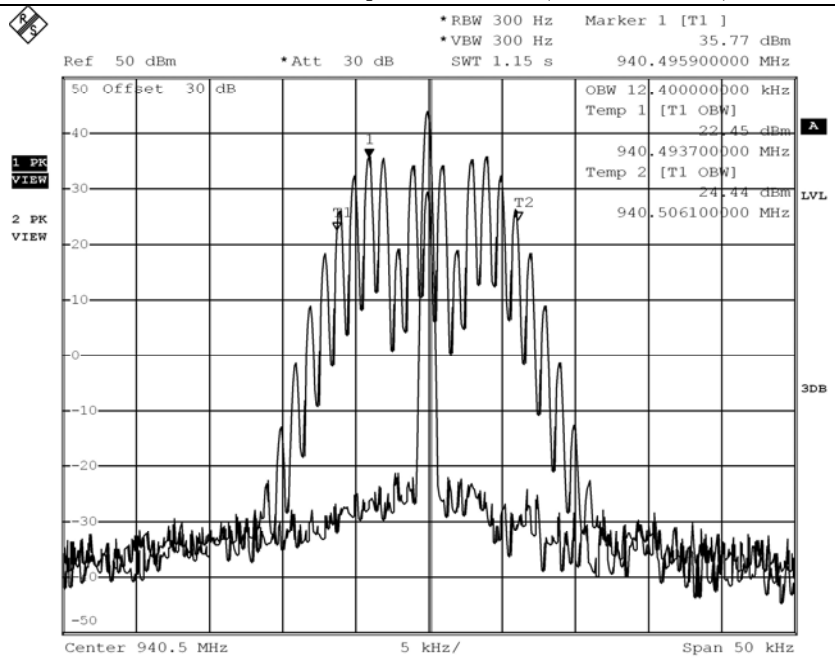



iDEN – Occupied Bandwidth (Middle Channel)




SMR – Occupied Bandwidth (Middle Channel)



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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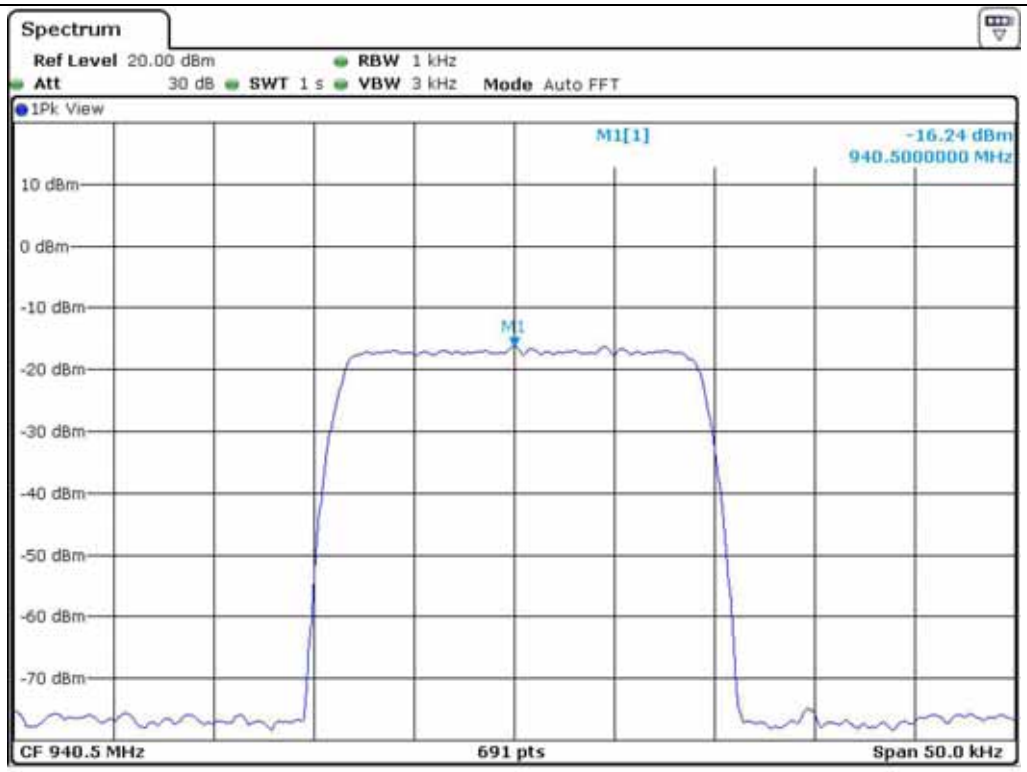
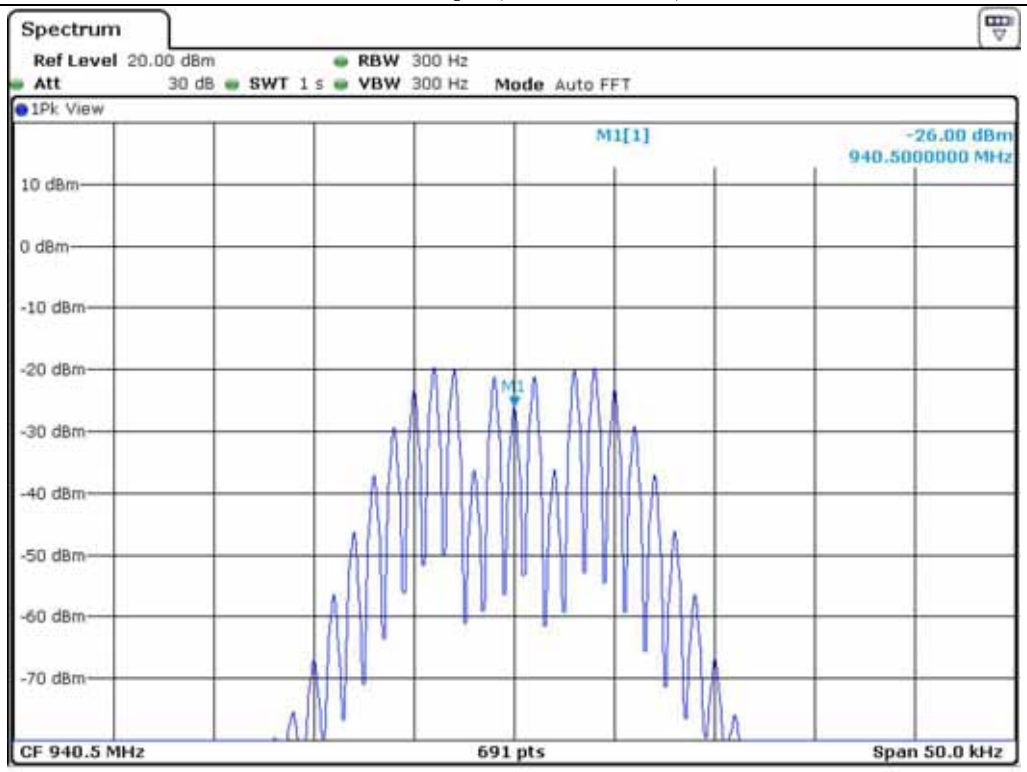



iDEN – Input (Middle Channel)




SMR – Input (Middle Channel)

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# 7. SPURIOUS EMISSION AT ANTENNA TERMINAL

## 7.1 Operating environment

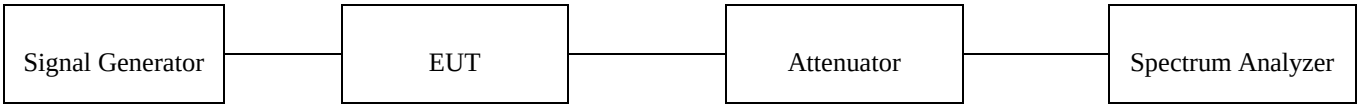
Temperature : 22 °C

Relative humidity : 49 % R.H.

## 7.2 Test set-up for conducted measurement

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

The resolution bandwidth and video bandwidth of the spectrum analyzer was set at 1 MHz and sufficient scans were taken to show any out of band emissions up to 10 GHz.




## 7.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. (Interval) |
|---|---|---|---|---|---|
| ■ - | E4432B | HP | Signal Generator | US38440950 | June 10, 2011 (1Y) |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 01, 2012 (1Y) |
| ☐ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 15, 2011 (1Y) |
| ☐ - | 8564E | HP | Spectrum Analyzer | 3650A00756 | Jun. 10, 2011 (1Y) |
| ■ - | FSV30 | R/S | Spectrum Analyzer | 101372 | Aug. 29, 2011 (1Y) |
| ■ | WRCT 890/ 960-5/40-8SSK | Wainwright Instruments GmbH | Tunable Band Reject Filter | 7 | Oct. 21, 2011(2Y) |
| ■ - | 67-30-43 | Aeroflex Weinschel | Power Attenuator | CA5760 | Nov. 30, 2011 (1Y) |

All test equipment used is calibrated on a regular basis.



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## 7.4 Test data

### 7.4.1 Test data for frequency range 929 MHz ~ 930 MHz

-. Test Date : March 09, 2012

-. Frequency range : 30 MHz ~ 10 GHz

-. Result : PASSED BY -14.06 dB at iDEN mode

| Modulation | Harmonic Frequency (MHz) | | Measured Value (dBm) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| iDEN | Middle | 797.20 | -52.05 | 0.70 | -51.35 | -13.00 | -38.35 |
| | | 7 844.00 | -30.56 | 3.50 | -27.06 | | -14.06 |
| SMR | Middle | 800.00 | -51.61 | 0.70 | -50.91 | | -37.91 |
| | | 7 818.00 | -31.49 | 3.50 | -27.99 | | -14.99 |

According to Part 90I, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0 dBm.

**Tested by: Ki-Hong, Nam / Project Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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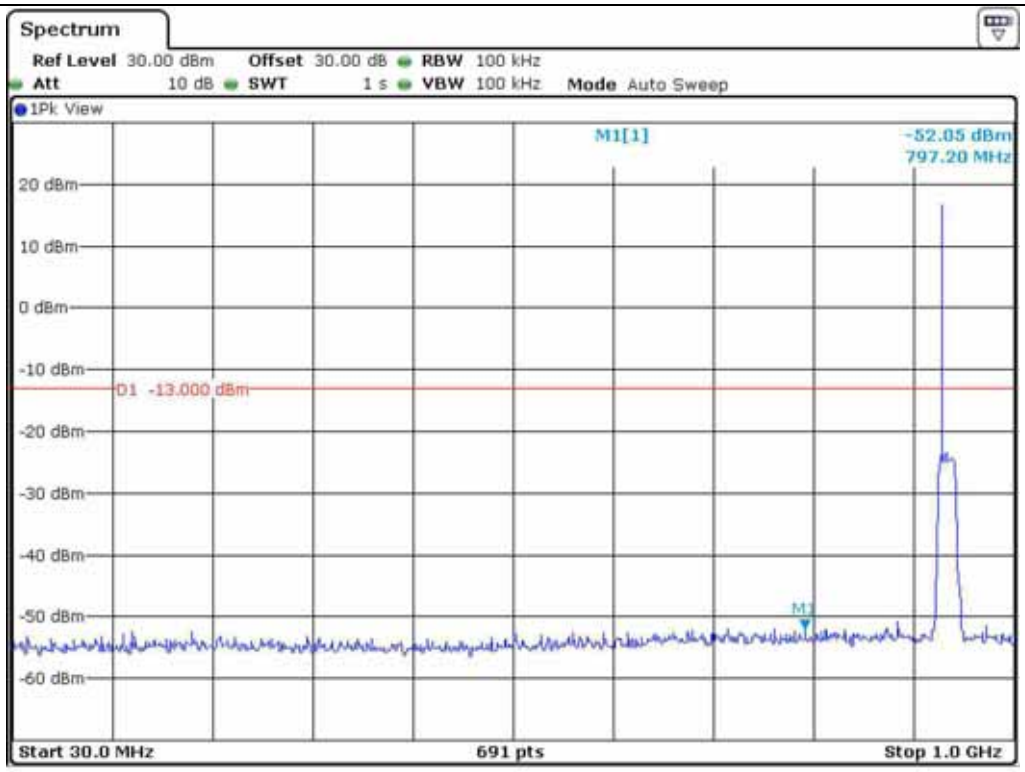
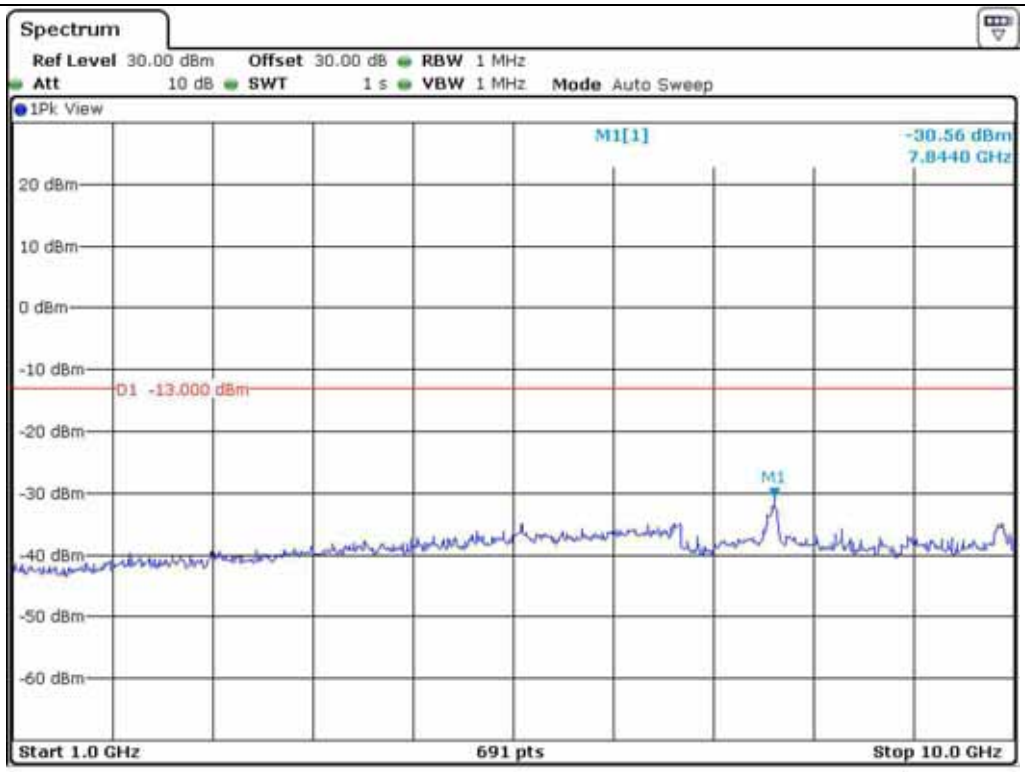



iDEN – Middle Channel




iDEN – Middle Channel

**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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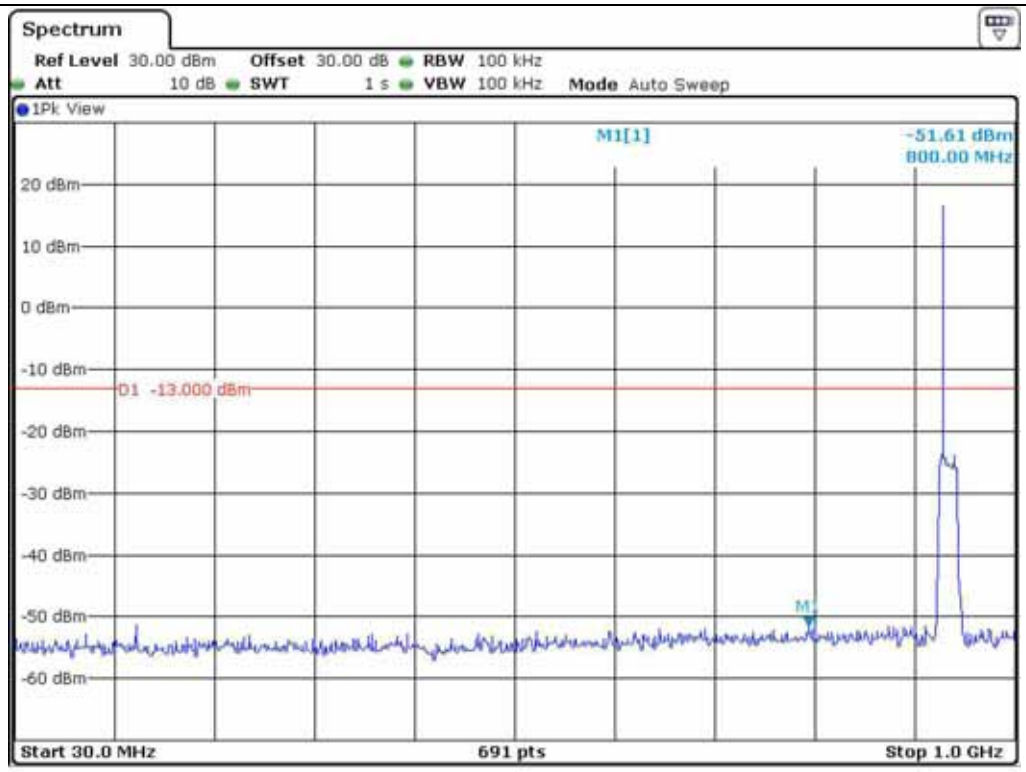
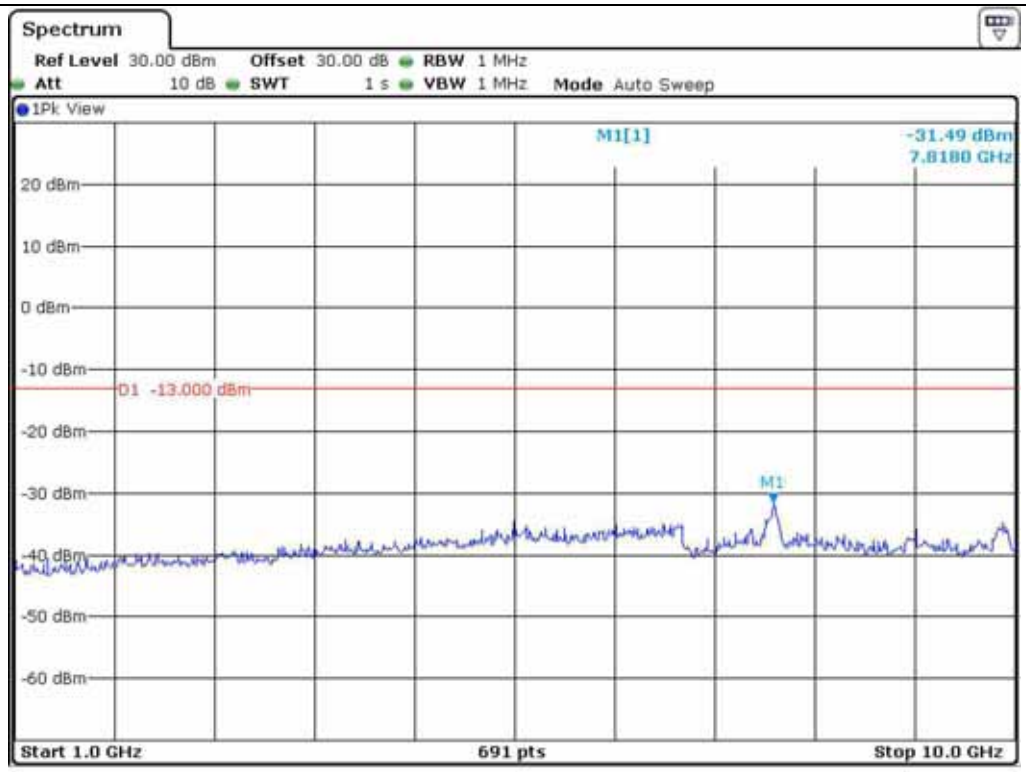



SMR – Middle Channel




SMR – Middle Channel



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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**7.4.2 Test data for frequency range 935 MHz ~ 940 MHz**

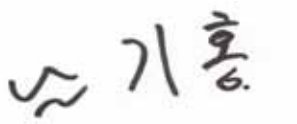
-. Test Date : March 13, 2012

-. Frequency range : 30 MHz ~ 10 GHz

-. Result : PASSED BY -14.76 dB at iDEN mode

| Modulation | Harmonic Frequency (MHz) | | Measured Value (dBm) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| iDEN | Low | 785.90 | -51.79 | 0.70 | -51.09 | -13.00 | -38.09 |
| | | 7 844.00 | -31.26 | 3.50 | -27.76 | | -14.76 |
| | High | 819.60 | -50.55 | 0.70 | -49.85 | | -36.85 |
| | | 7 831.00 | -31.98 | 3.50 | -28.48 | | -15.48 |
| SMR | Low | 804.20 | -51.38 | 0.70 | -50.68 | -13.00 | -37.68 |
| | | 7 831.00 | -31.78 | 3.50 | -28.28 | | -15.28 |
| | High | 807.00 | -51.23 | 0.70 | -50.53 | | -37.53 |
| | | 7 831.00 | -31.97 | 3.50 | -28.47 | | -15.47 |

According to Part 90I, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0 dBm.



**Tested by: Ki-Hong, Nam / Project Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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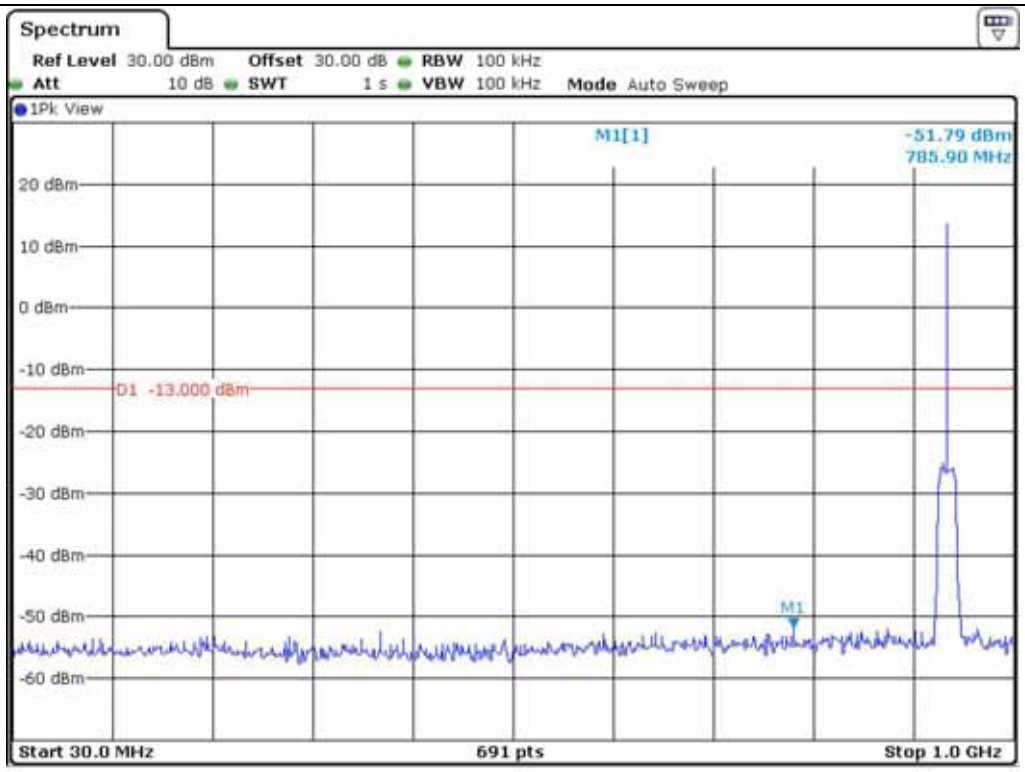
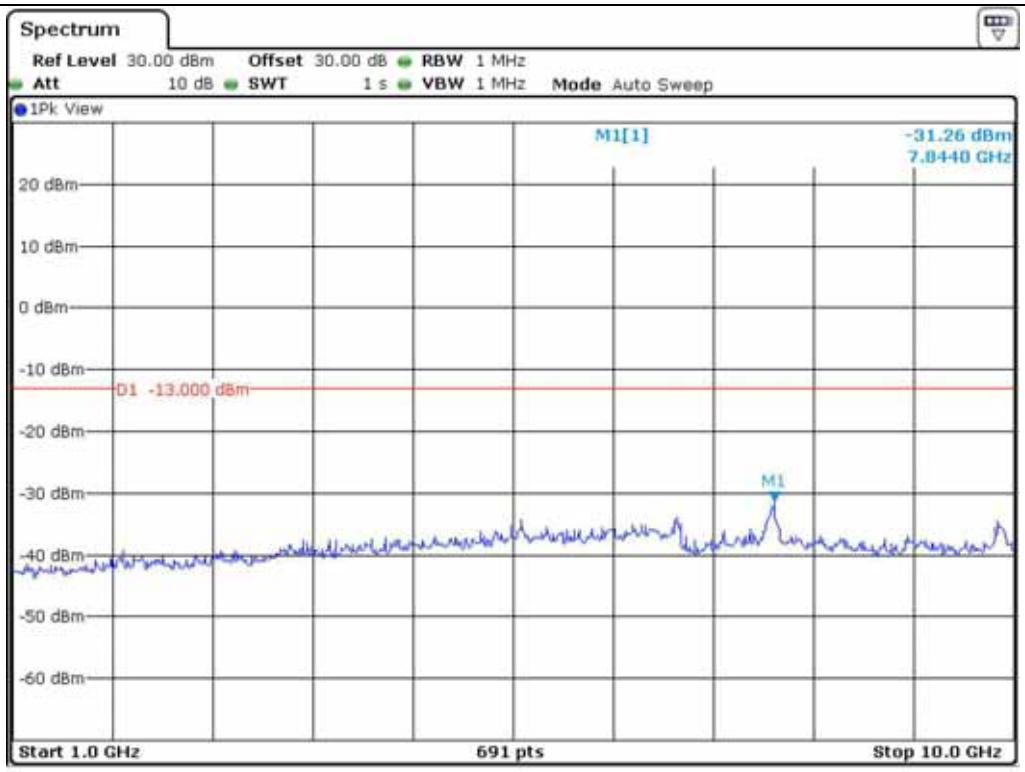



iDEN – Low Channel




iDEN – Low Channel

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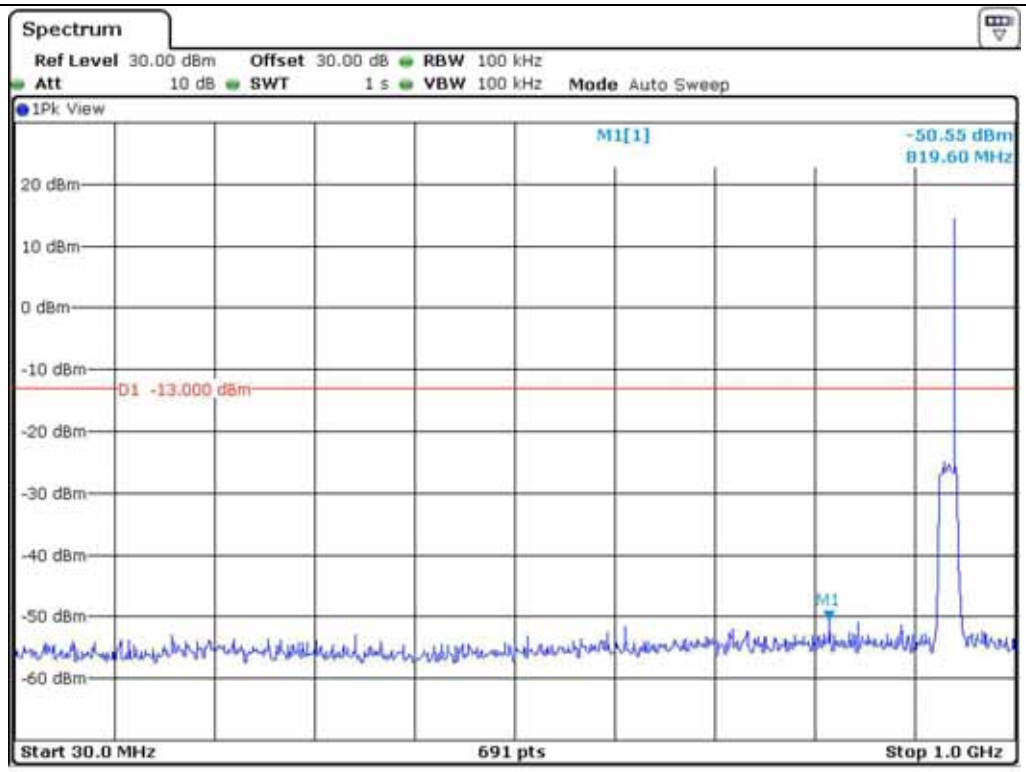
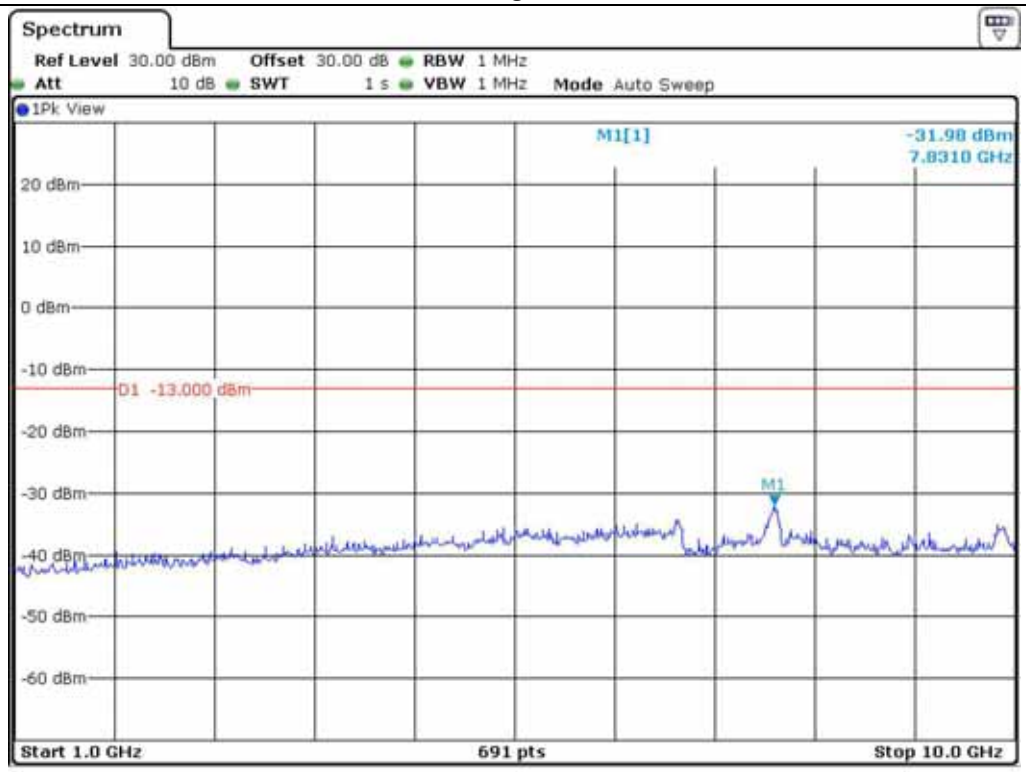



iDEN – High Channel




iDEN – High Channel



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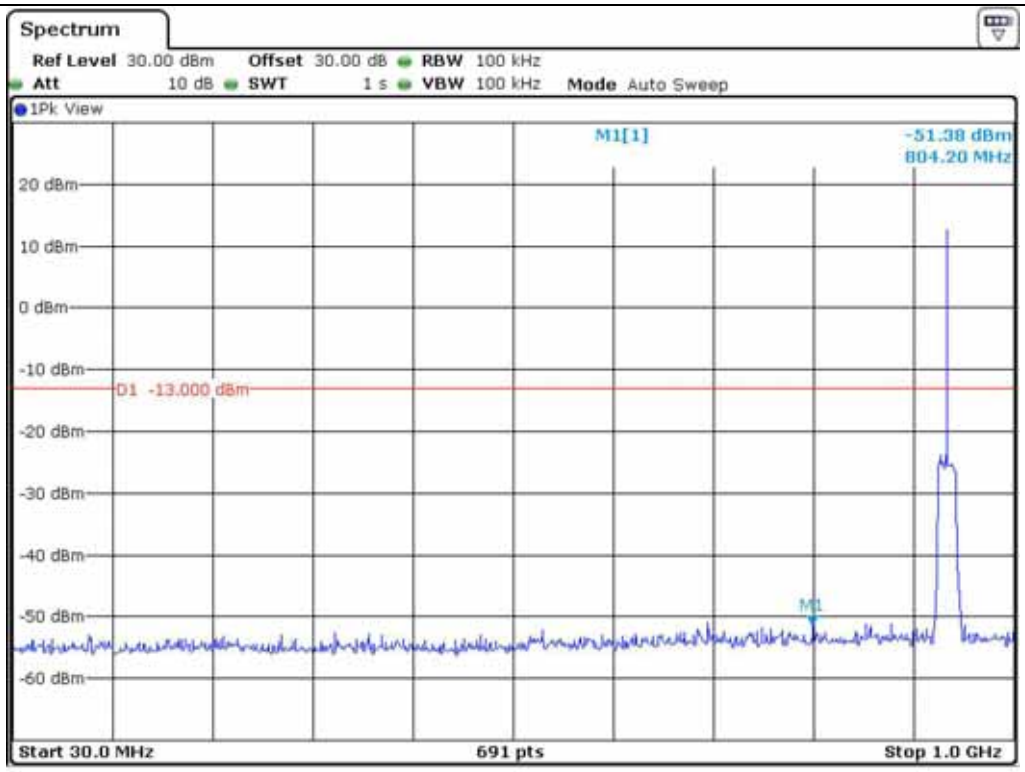
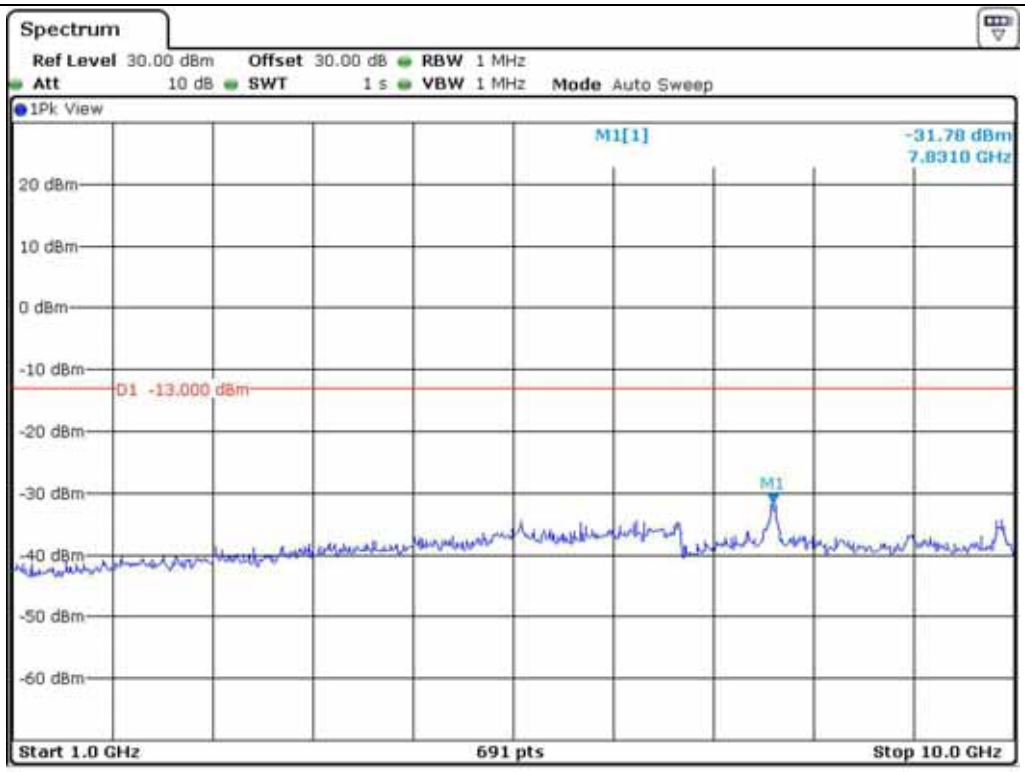
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)




SMR – Low Channel




SMR – Low Channel



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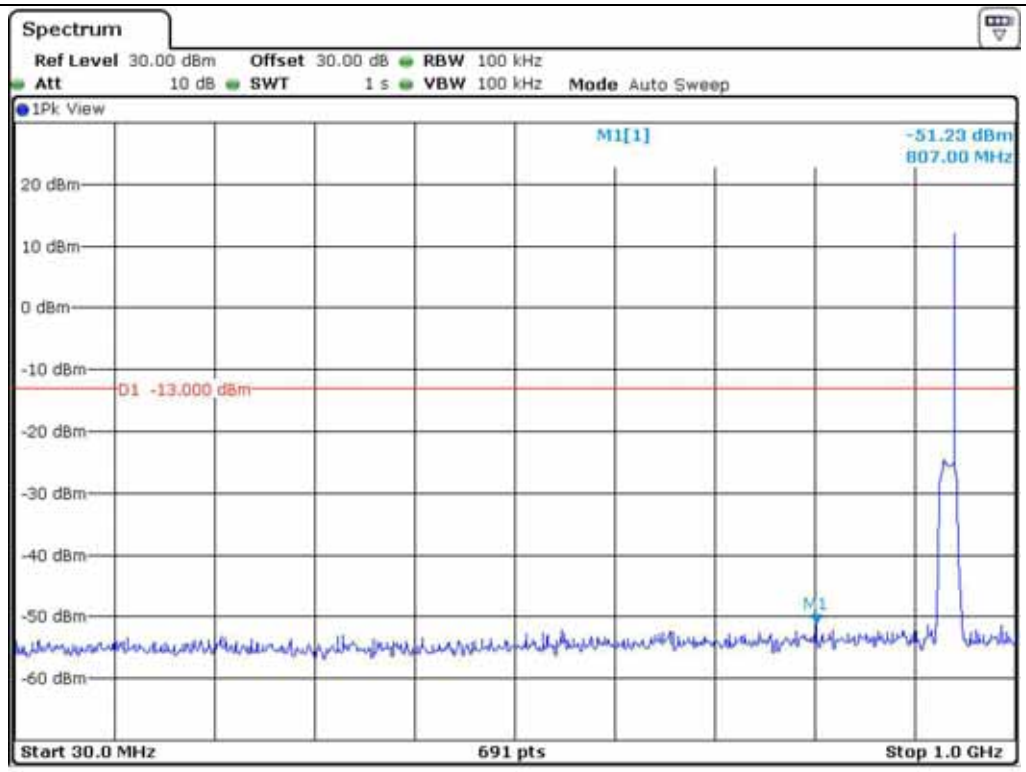
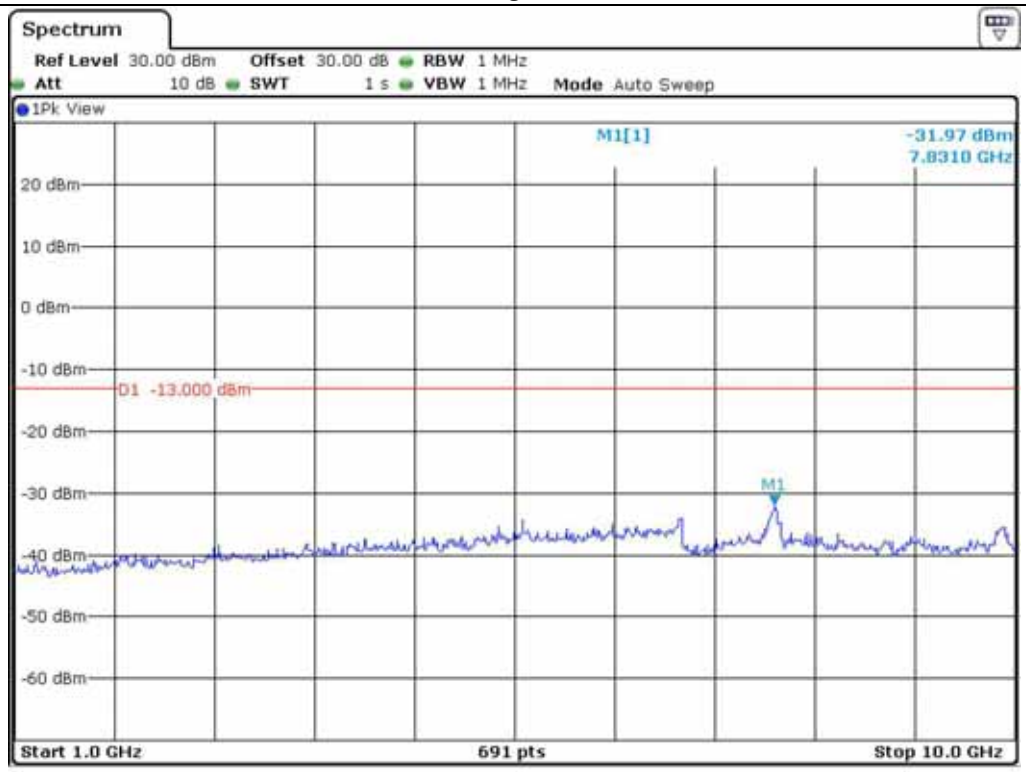



SMR – High Channel




SMR – High Channel

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**7.4.3 Test data for frequency range 940 MHz ~ 941 MHz**

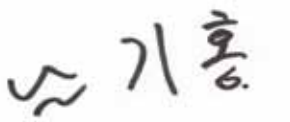
-. Test Date : March 14, 2012

-. Frequency range : 30 MHz ~ 10 GHz

-. Result : PASSED BY -15.39 dB at iDEN mode

| Modulation | Harmonic Frequency (MHz) | | Measured Value (dBm) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| iDEN | Middle | 847.70 | -52.44 | 0.80 | -51.64 | -13.00 | -38.64 |
| | | 7 844.00 | -31.89 | 3.50 | -28.39 | | -15.39 |
| SMR | Middle | 807.00 | -51.87 | 0.80 | -51.07 | | -38.07 |
| | | 7 831.00 | -31.90 | 3.50 | -28.40 | | -15.40 |

According to Part 90I, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0 dBm.



**Tested by: Ki-Hong, Nam / Project Engineer**



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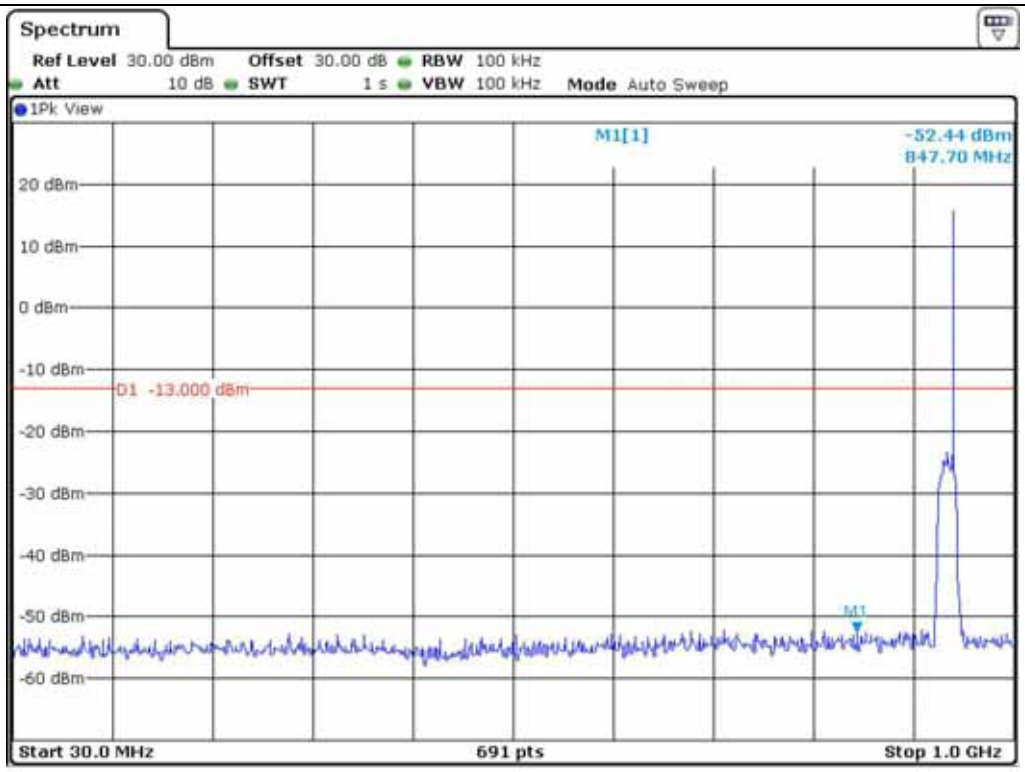
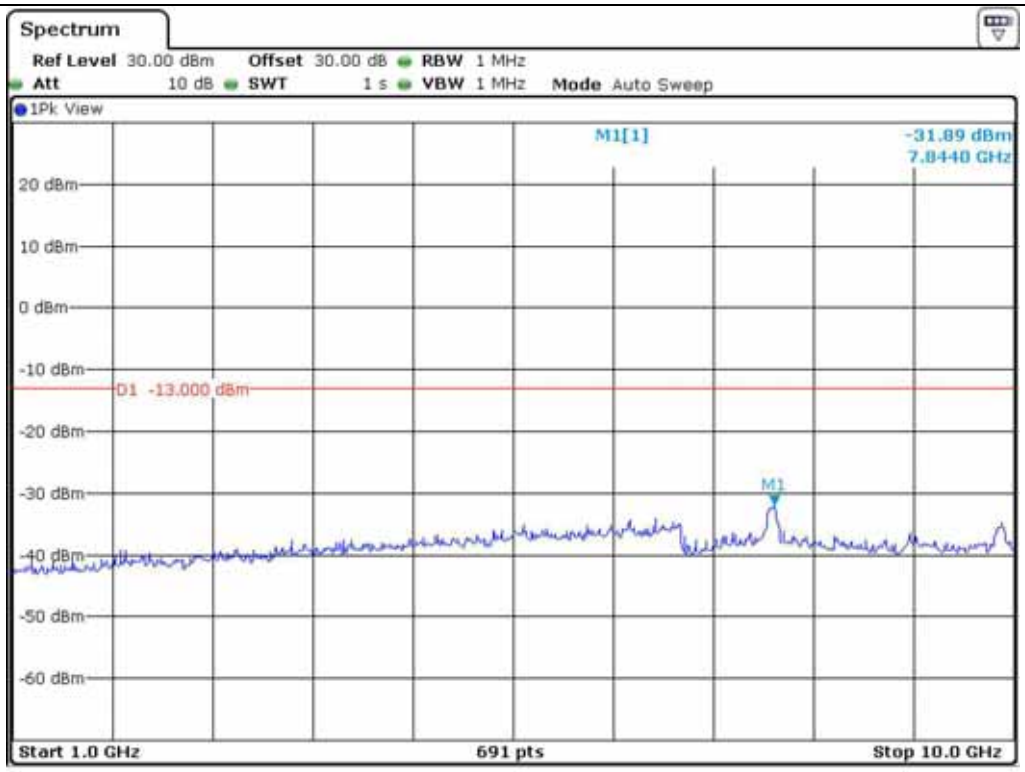



iDEN – Middle Channel




iDEN – Middle Channel

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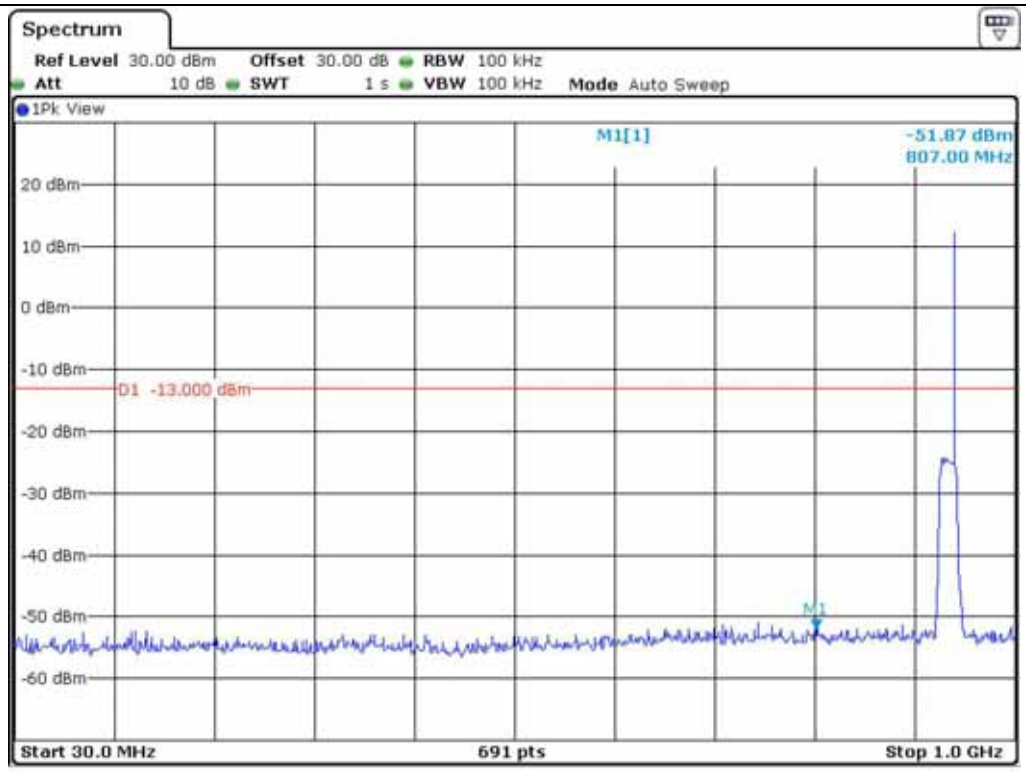
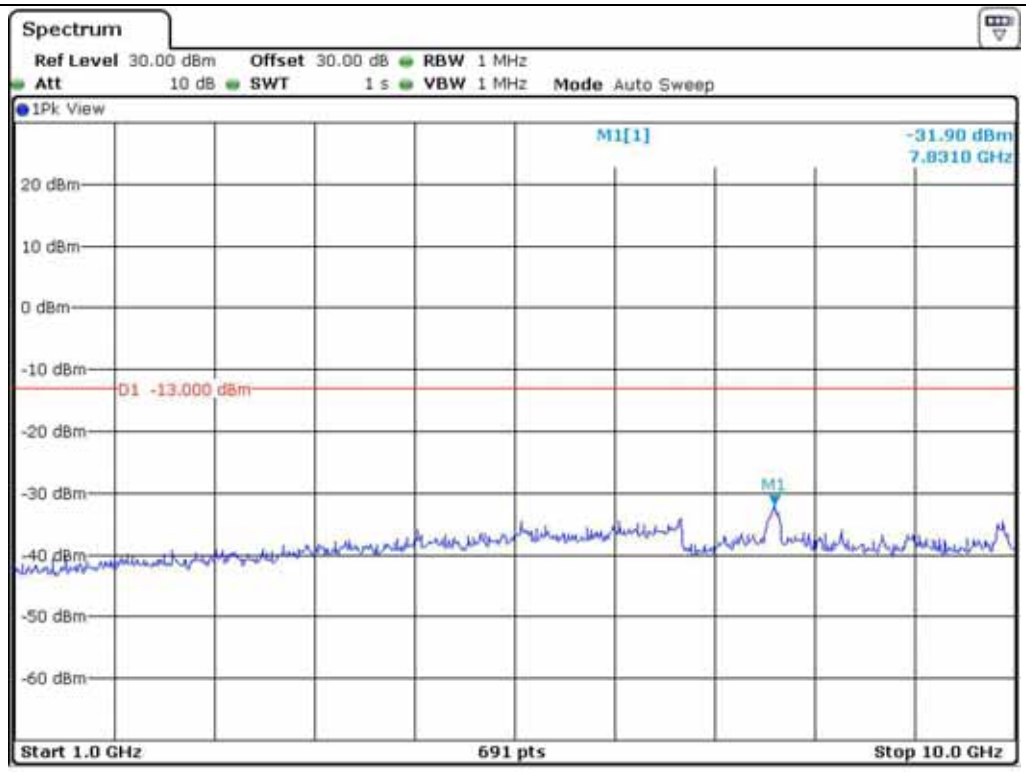



SMR – Middle Channel




SMR – Middle Channel



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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# 8. BAND EDGE MEASUREMENT

## 8.1 Operating environment

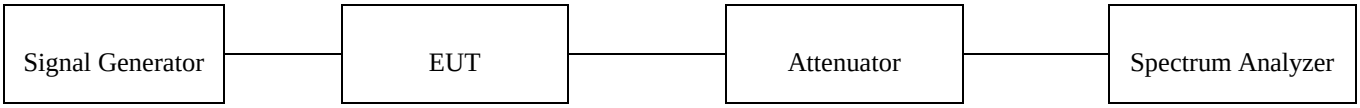
Temperature : 22 °C

Relative humidity : 49 % R.H.

## 8.2 Test set-up for conducted measurement

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

The resolution bandwidth and video bandwidth of the spectrum analyzer was set according to the regulation and sufficient scans were taken to show any out of band emissions.




## 8.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. (Interval) |
|---|---|---|---|---|---|
| ■- | E4432B | HP | Signal Generator | US38440950 | June 10, 2011 (1Y) |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 01, 2012 (1Y) |
| ■ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 15, 2011 (1Y) |
| □ - | 8564E | HP | Spectrum Analyzer | 3650A00756 | Jun. 10, 2011 (1Y) |
| □ - | FSV30 | R/S | Spectrum Analyzer | 101372 | Aug. 29, 2011 (1Y) |
| ■ - | 67-30-43 | Aeroflex Weinschel | Power Attenuator | CA5760 | Nov. 30, 2011 (1Y) |

All test equipment used is calibrated on a regular basis.



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## 8.4 Test data

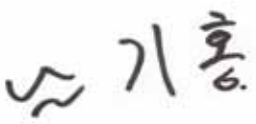
### 8.4.1 Test Result for frequency range 929 MHz ~ 930 MHz

-. Test Date : March 09, 2012

-. Result : PASSED BY -17.71 dB at high channel of SMR mode

| Modulation | Channel | Measured Frequency (MHz) | Max. Measured Value (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| iDEN | Low | 929.000 | -32.56 | -13.00 | -19.56 |
| | High | 930.000 | -35.25 | | -22.25 |
| SMR | Low | 929.000 | -33.85 | | -20.85 |
| | High | 930.000 | -30.71 | | -17.71 |

According to Part 90I, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.



**Tested by: Ki-Hong, Nam / Project Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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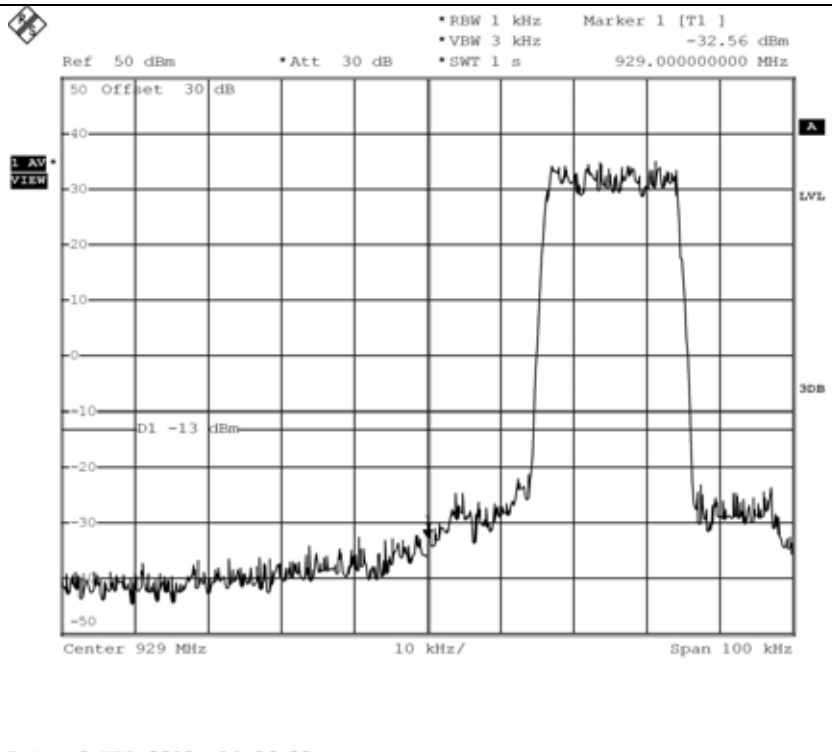
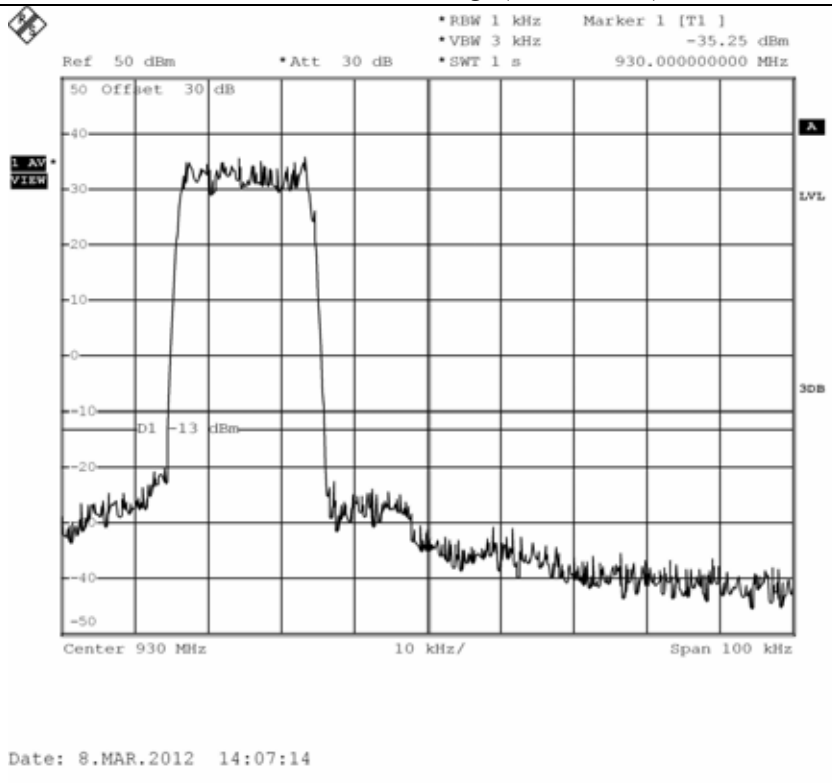



iDEN – Band Edge (Low Channel)




iDEN – Band Edge (High Channel)



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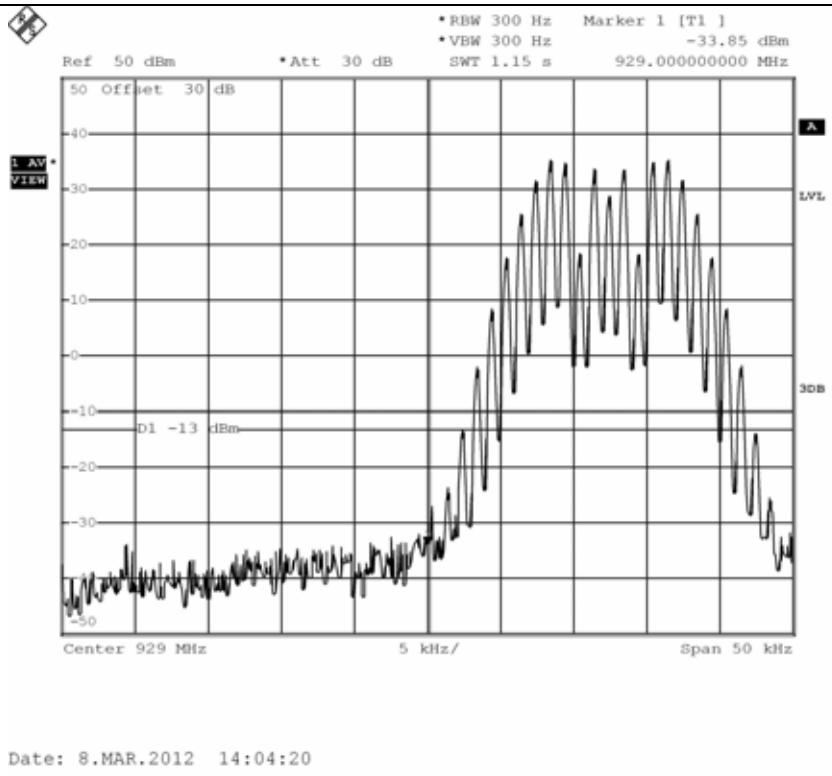
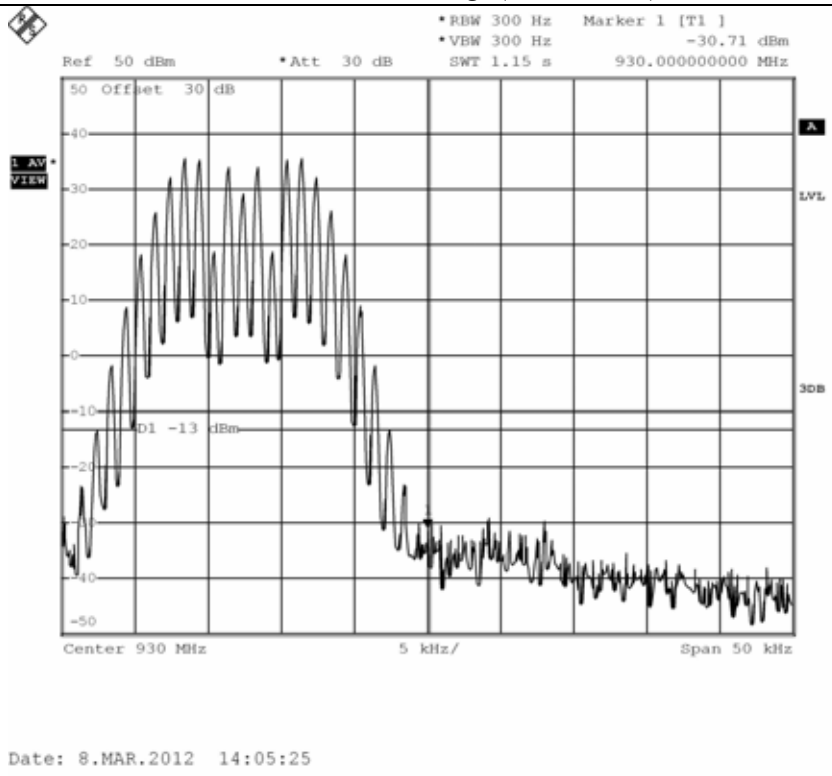



SMR – Band Edge (Low Channel)




SMR – Band Edge (High Channel)



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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**8.4.2 Test Result for frequency range 935 MHz ~ 940 MHz**

-. Test Date : March 13, 2012

-. Result : PASSED BY -17.93 dB at high channel of SMR mode

| Modulation | Channel | Measured Frequency (MHz) | Max. Measured Value (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| iDEN | Low | 935.000 | -33.62 | -13.00 | -20.62 |
| | High | 940.000 | -30.93 | | -17.93 |
| SMR | Low | 935.000 | -32.44 | | -19.44 |
| | High | 940.000 | -30.93 | | -21.67 |

According to Part 90I, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.

**Tested by: Ki-Hong, Nam / Project Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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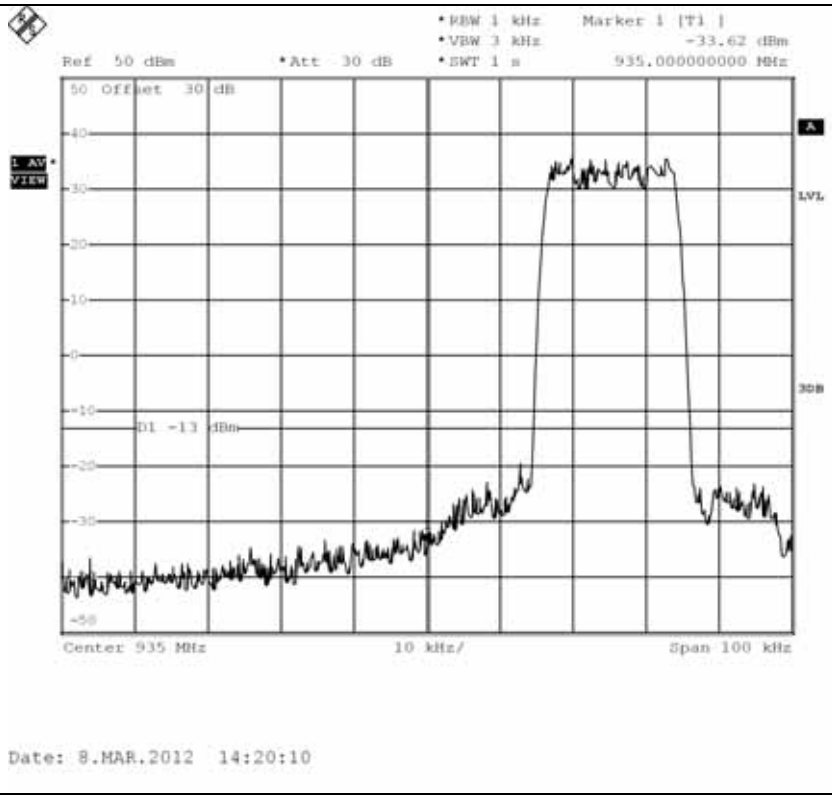
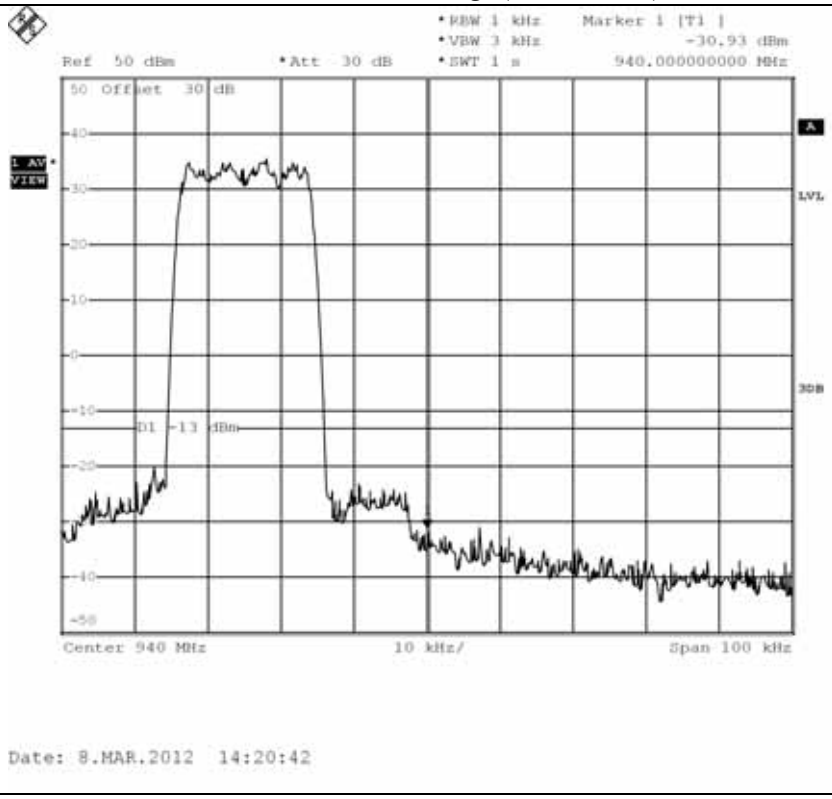



iDEN – Band Edge (Low Channel)




iDEN – Band Edge (High Channel)



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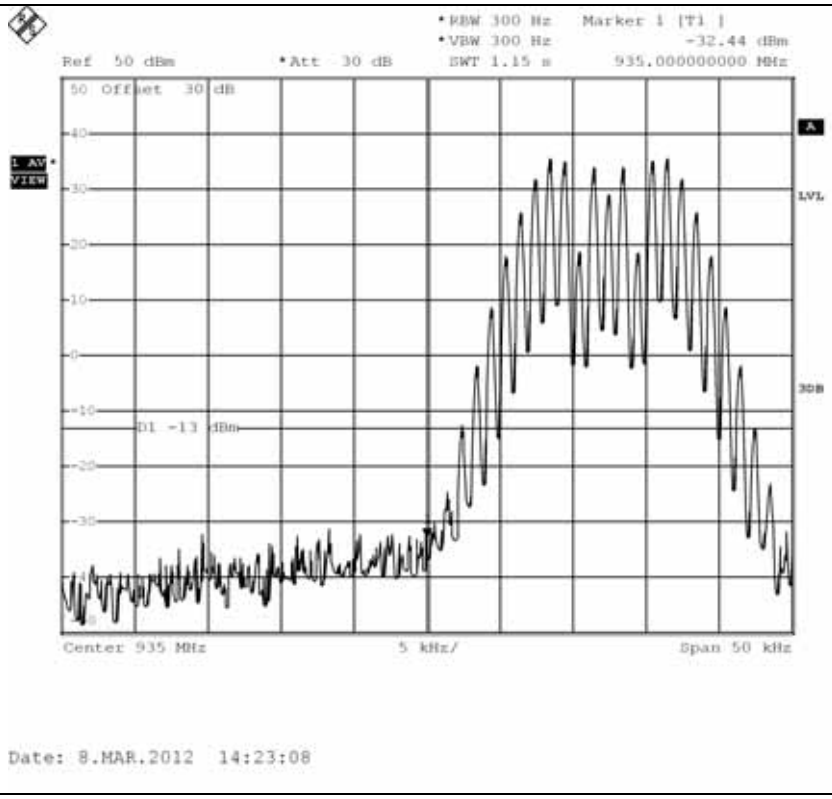
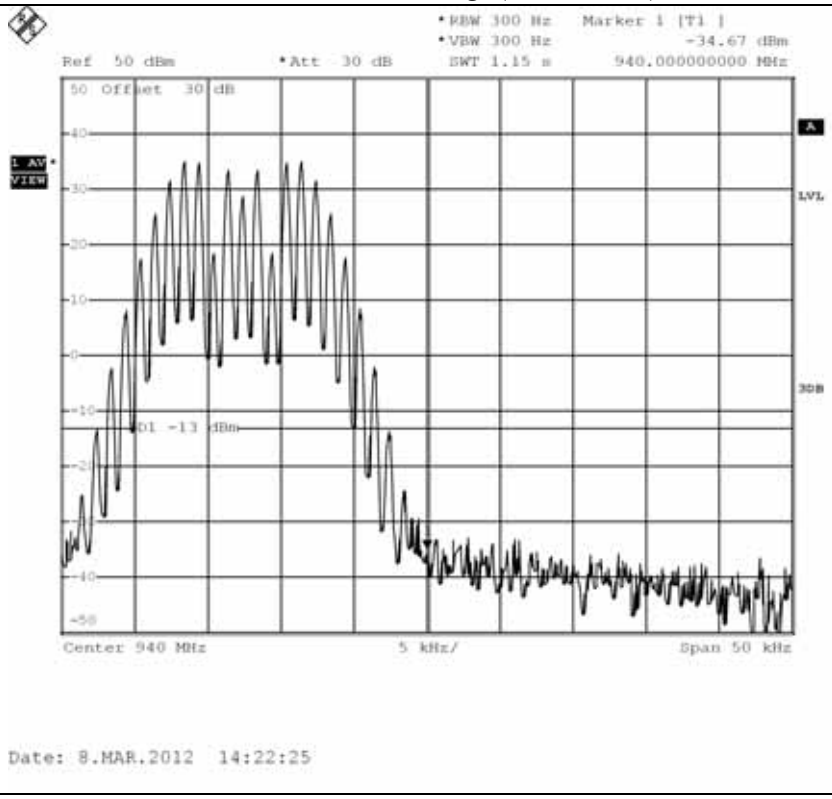



SMR – Band Edge (Low Channel)




SMR – Band Edge (High Channel)



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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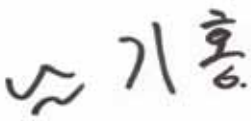
**8.4.3 Test Result for frequency range 940 MHz ~ 941 MHz**

-. Test Date : March 14, 2012

-. Result : PASSED BY -16.97 dB at high channel of SMR mode

| Modulation | Channel | Measured Frequency (MHz) | Max. Measured Value (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| iDEN | Low | 940.000 | -31.12 | -13.00 | -18.12 |
| | High | 941.000 | -30.22 | | -17.22 |
| SMR | Low | 940.000 | -32.36 | | -19.36 |
| | High | 941.000 | -29.97 | | -16.97 |

According to Part 90I, out of band emission shall be attenuated by 43 + 10 log (P) dBc, equates to -13.0dBm.



**Tested by: Ki-Hong, Nam / Project Engineer**



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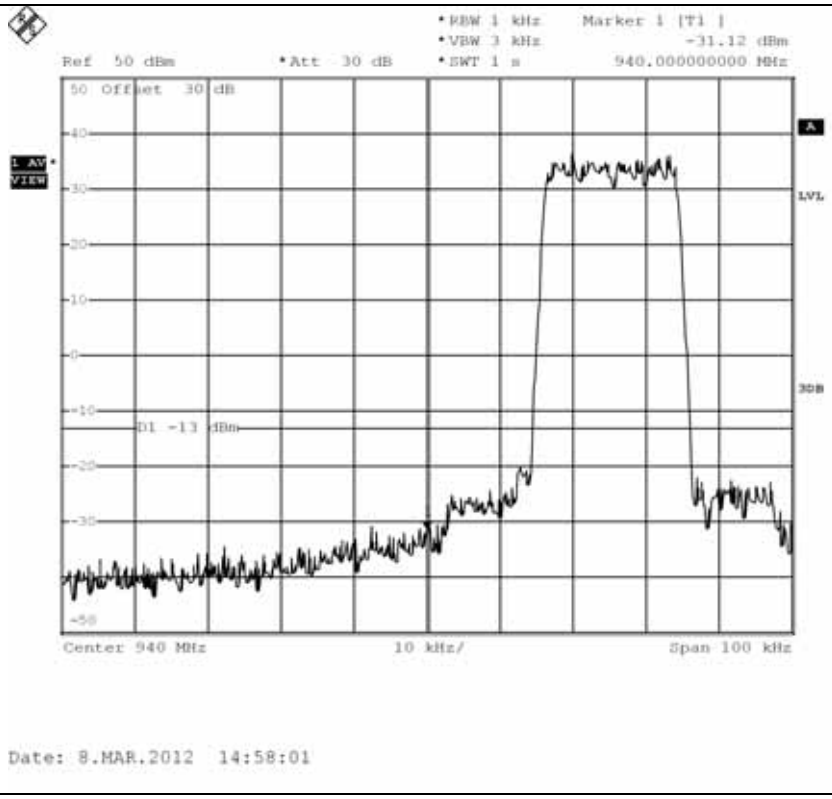
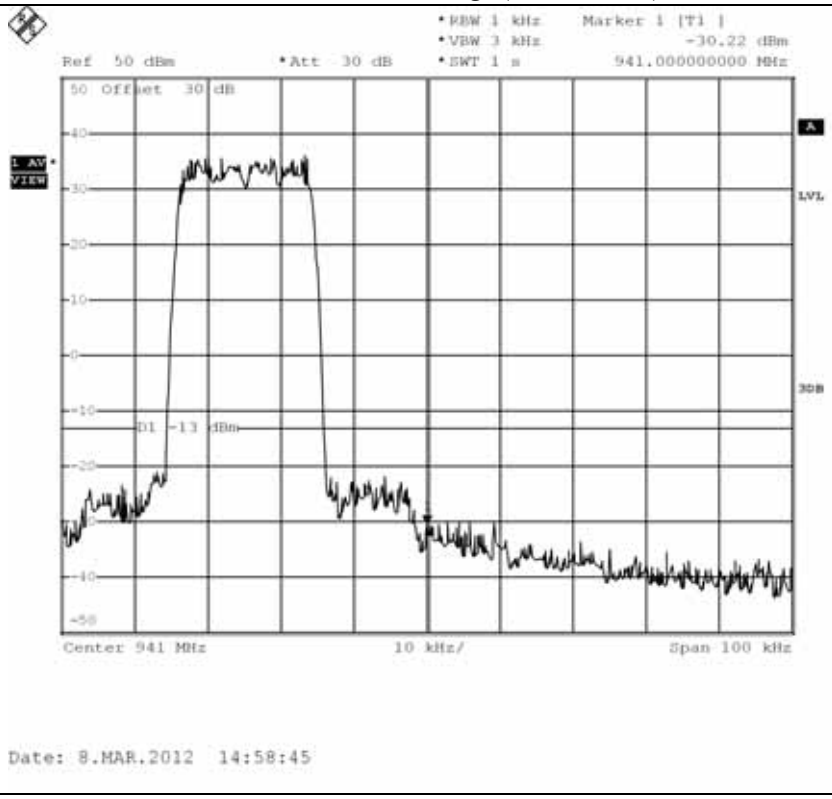



iDEN – Band Edge (Low Channel)




iDEN – Band Edge (High Channel)



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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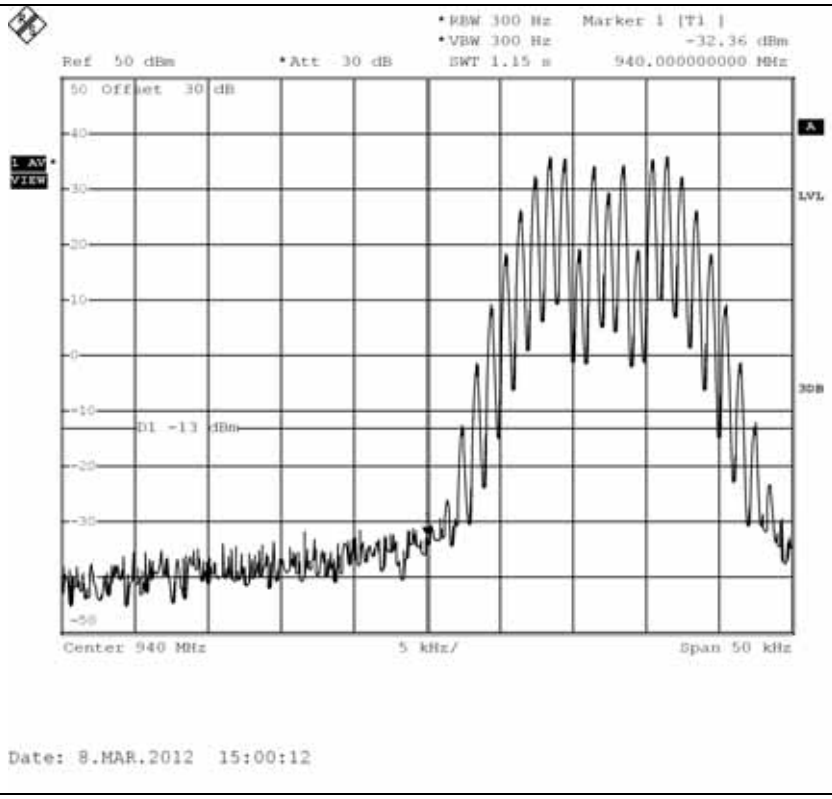
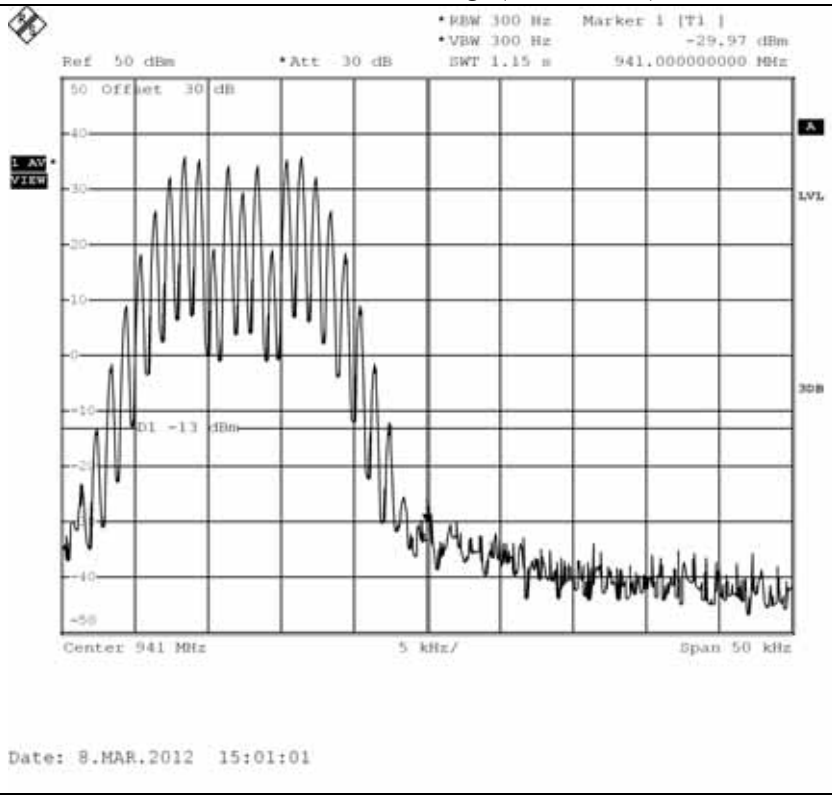



SMR – Band Edge (Low Channel)




SMR – Band Edge (High Channel)



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

# 9. INTERMODULATION TEST

## 9.1 Operating environment

Temperature : (22 ~ 23) °C

Relative humidity : (49 ~ 50) % R.H.

## 9.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

Three input signals are equal in level and were sent to the input of the EUT.


## 9.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. (Interval) |
|---|---|---|---|---|---|
| ■ - | FSV30 | R/S | Spectrum Analyzer | 101372 | Aug. 29, 2011 (1Y) |
| ■ - | E4432B | HP | Signal Generator | US38440950 | Jun. 10, 2011 (1Y) |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 01, 2011 (1Y) |
| ■ - | 83650L | HP | Swept CW Generator | 3844A00415 | Jun. 10, 2011 (1Y) |
| □ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 15, 2011 (1Y) |
| ■ - | 67-30-43 | Aeroflex Weinschel | Power Attenuator | CA5760 | Nov. 30, 2011 (1Y) |

All test equipment used is calibrated on a regular basis.



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

## 9.4 Test data

### 9.4.1 Test Result for frequency range 929 MHz ~ 930 MHz

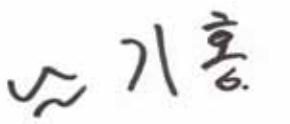
#### 9.4.1.1 Test Result for peak power

-. Test Date : March 09, 2012

-. Test Result : Pass

-. Modulation : No-Modulation

| Frequency (MHz) | Number of Input Channel | Input Power (dBm) | Output Power (dBm) |
|---|---|---|---|
| 929.03 | 1 | -9.80 | 44.49 |
| 929.03 & 929.06 | 2 | -9.80 | 44.51 |
| 929.03 & 929.06 & 929.09 | 3 | -9.70 | 44.49 |
| 929.97 | 1 | -9.70 | 44.50 |
| 929.97 & 929.94 | 2 | -9.70 | 44.50 |
| 929.97 & 929.94 & 929.91 | 3 | -9.80 | 44.49 |



**Tested by: Ki-Hong, Nam / Senior Engineer**



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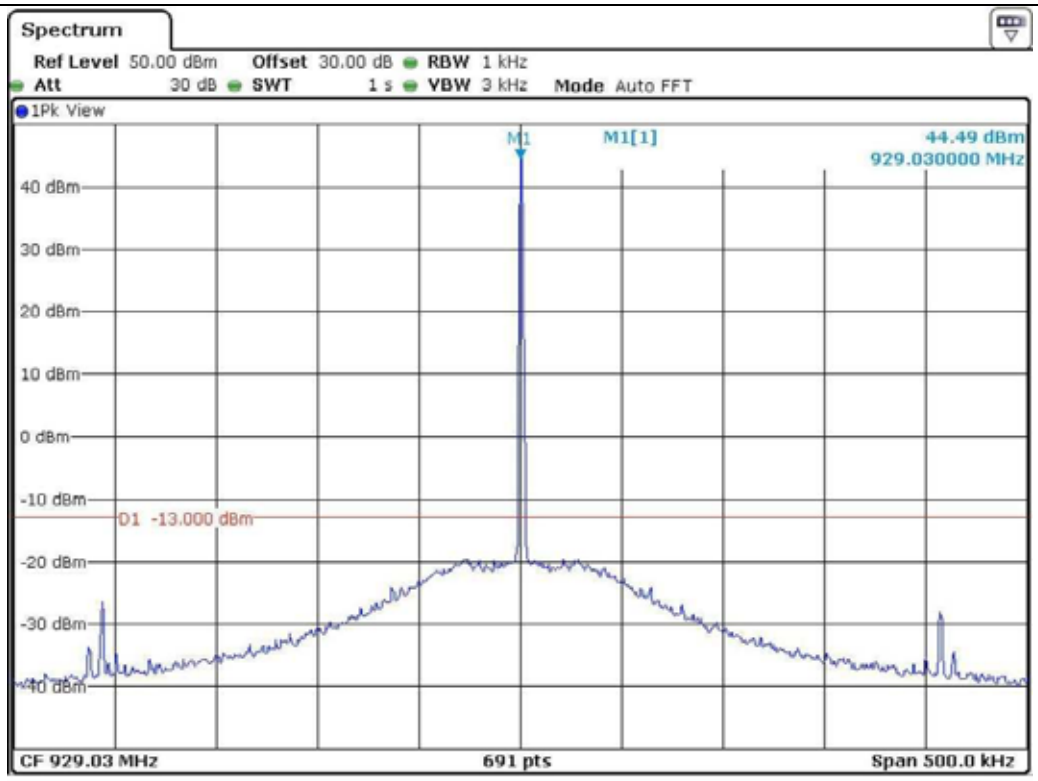
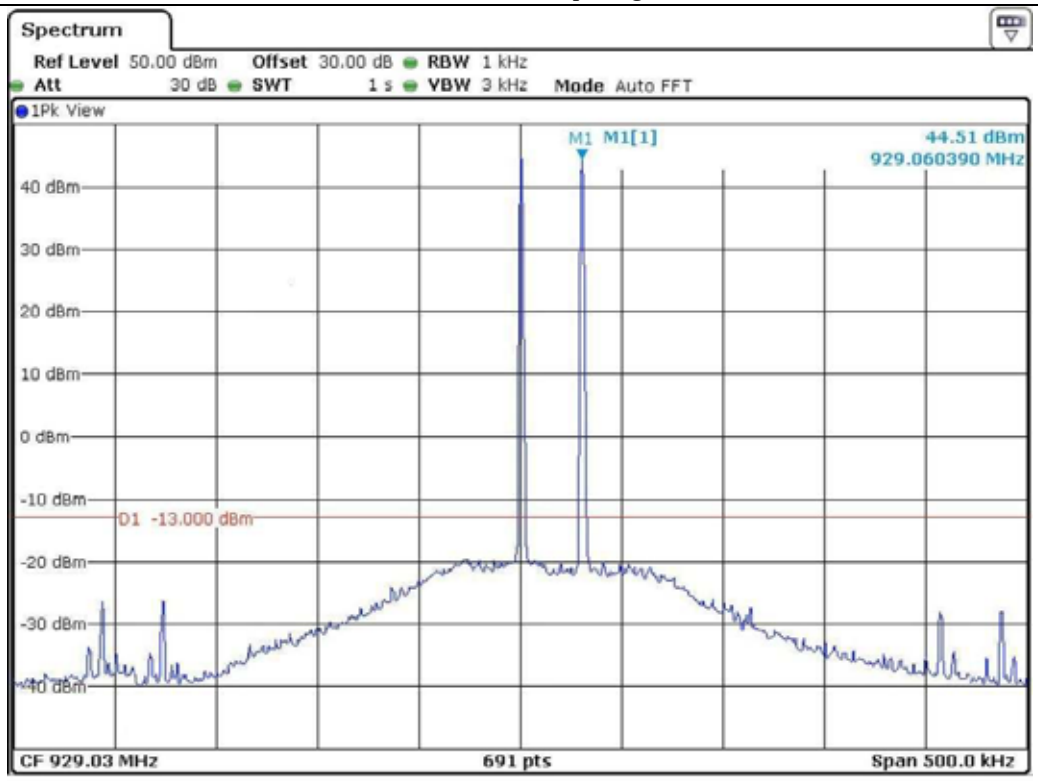



Low Channel – 1 input signal




Low Channel – 2 input signals

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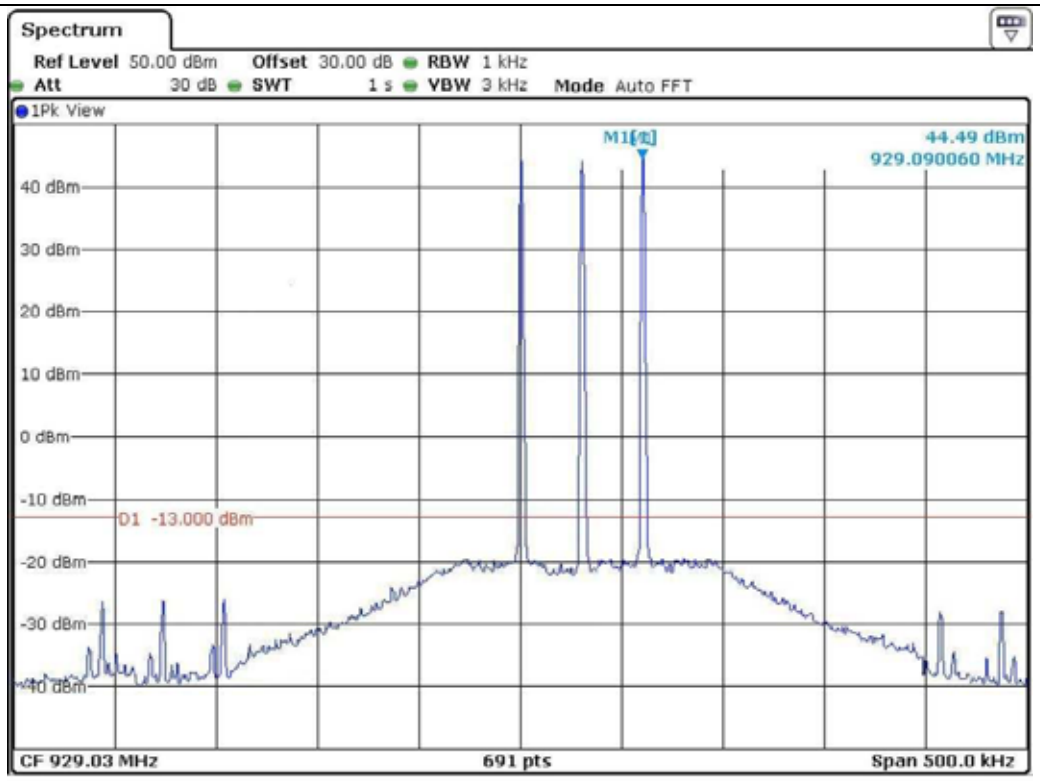
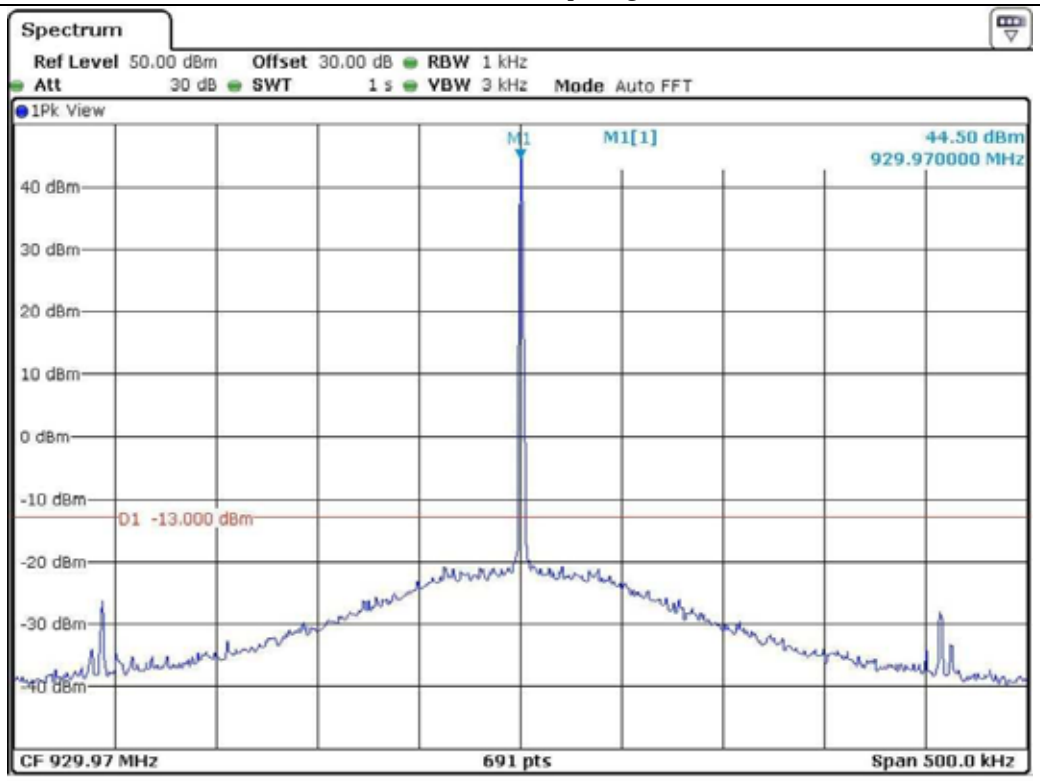



Low Channel – 3 input signals




High Channel – 1 input signal

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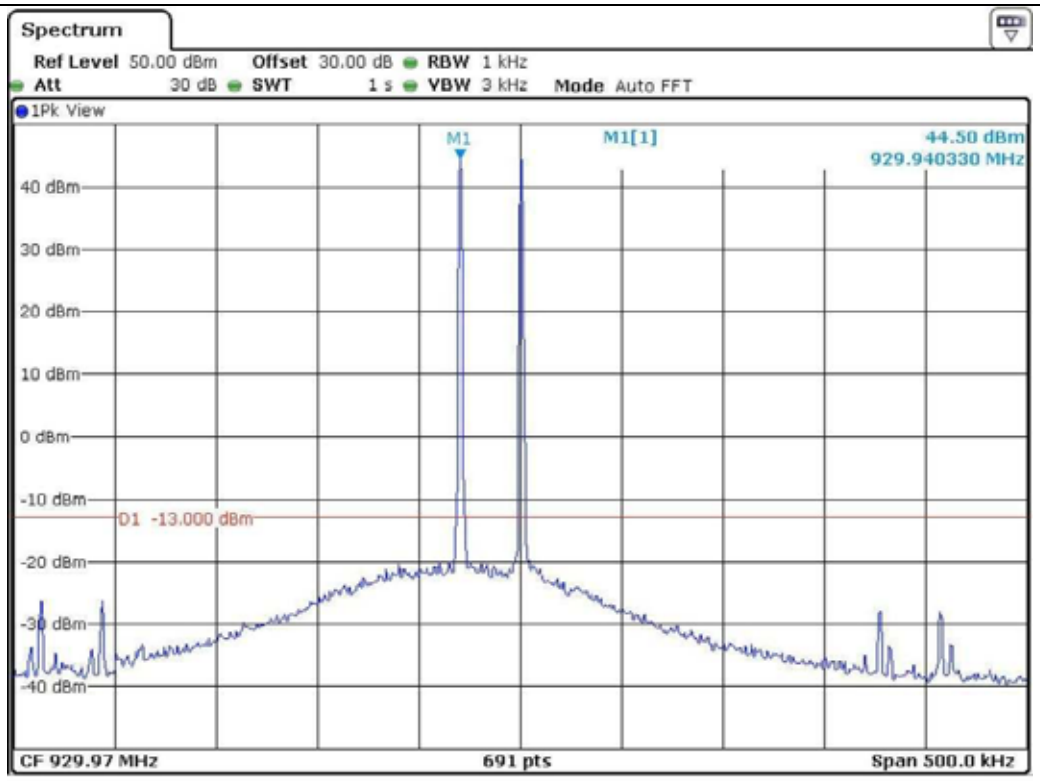
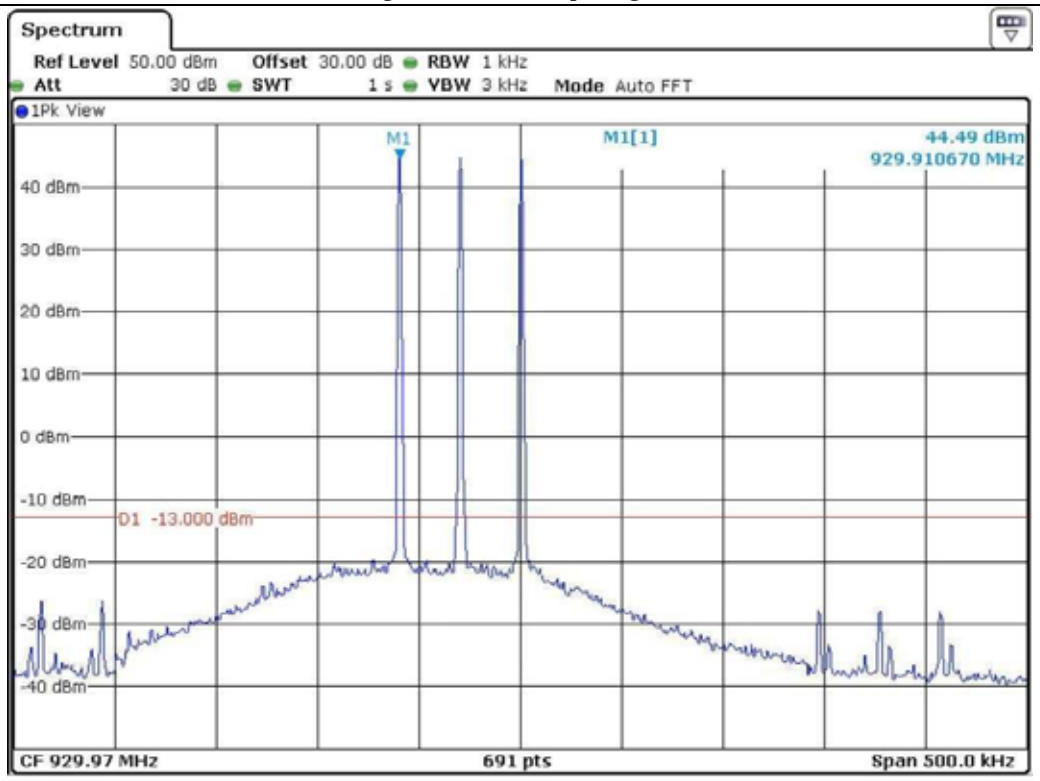



High Channel – 2 input signals




High Channel – 3 input signals


**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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**9.4.1.2 Test Result for Spurious emission**

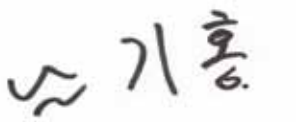
-. Test Date : March 09, 2012

-. Test Result : Pass

-. Modulation : No-Modulation

| Frequency (MHz) | Number of Input Channel | Measured Value | Result |
|---|---|---|---|
| 929.03 | 1 | < -13 dBm | Pass |
| 929.03 & 929.06 | 2 | | |
| 929.03 & 929.06 & 929.09 | 3 | | |
| 929.97 | 1 | < -13 dBm | Pass |
| 929.97 & 929.940 | 2 | | |
| 929.97 & 929.94 & 929.91 | 3 | | |

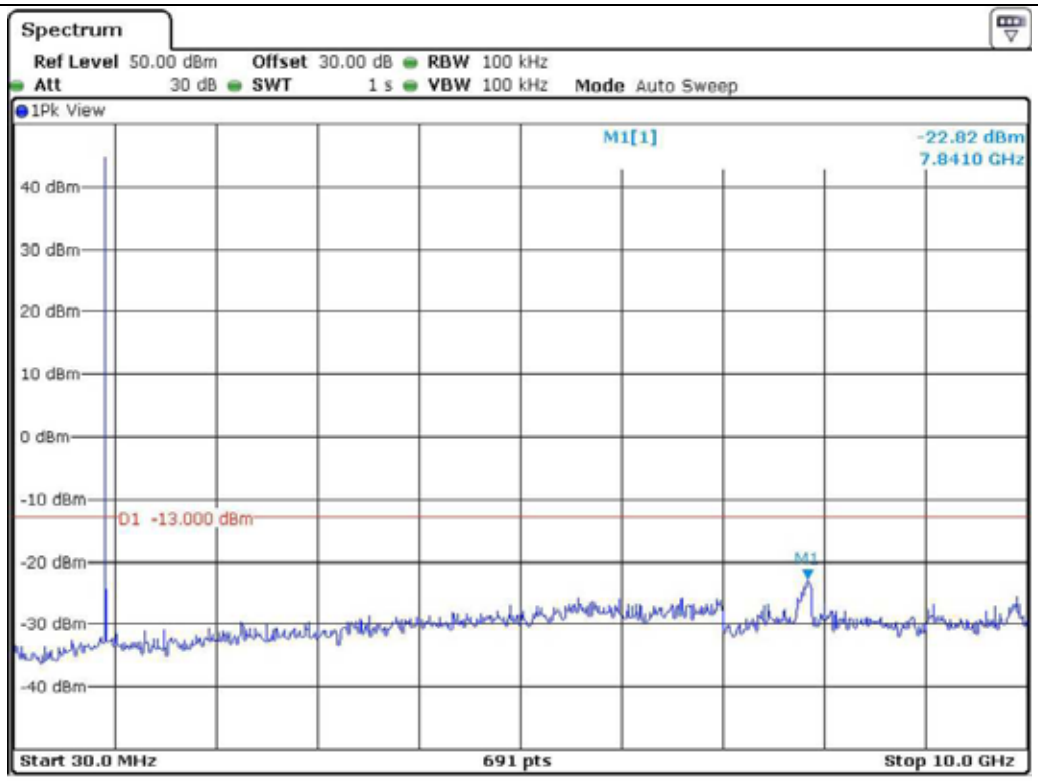
Remark: Intermodulation products must be attenuated below the rated power of the EUT at least 43 + 10log (Pw), equivalent to -13 dBm. Please refer to test data hereinafter.



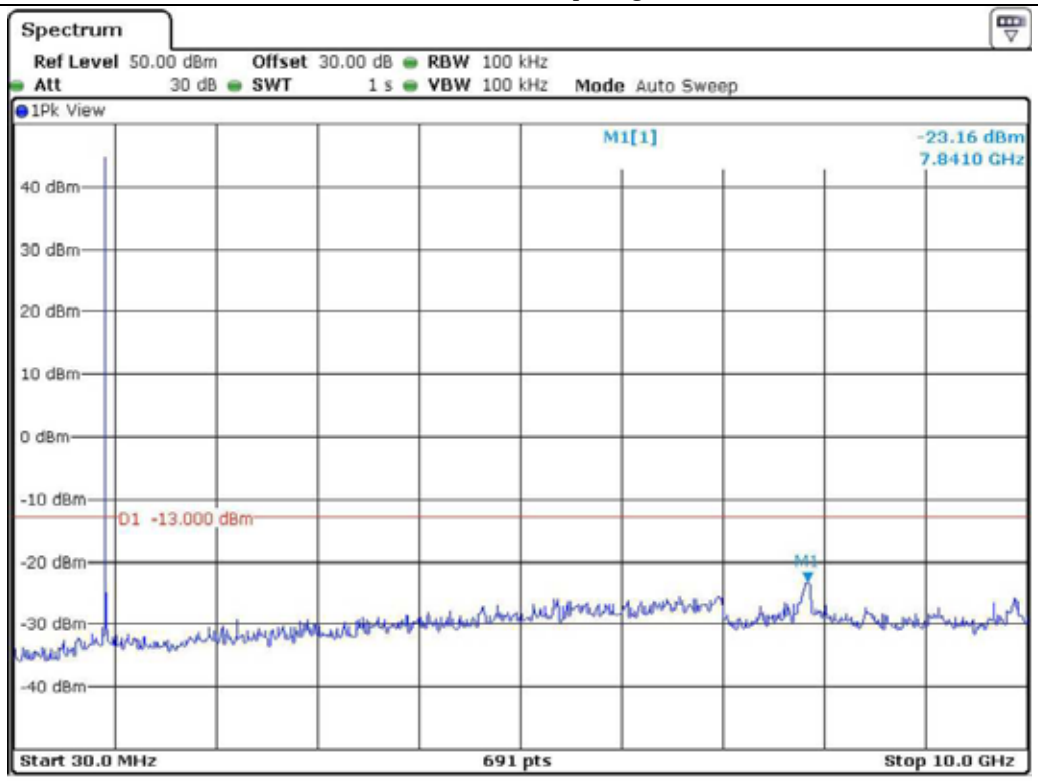
**Tested by: Ki-Hong, Nam / Senior Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

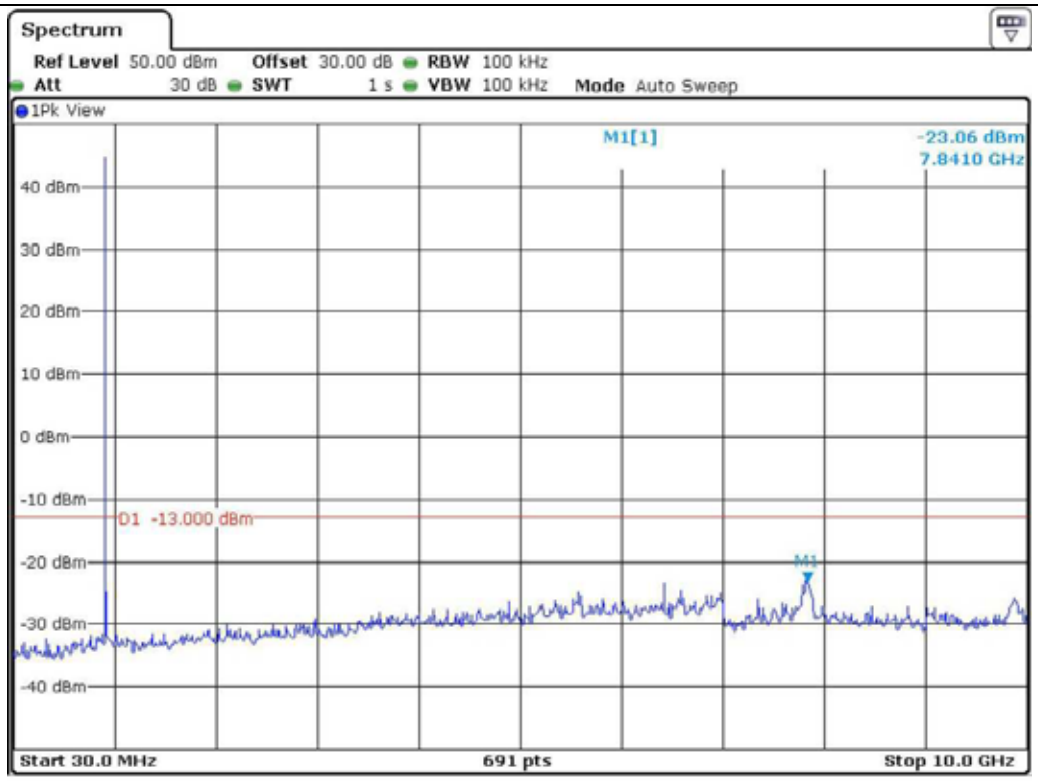



Low Channel – 1 input signal

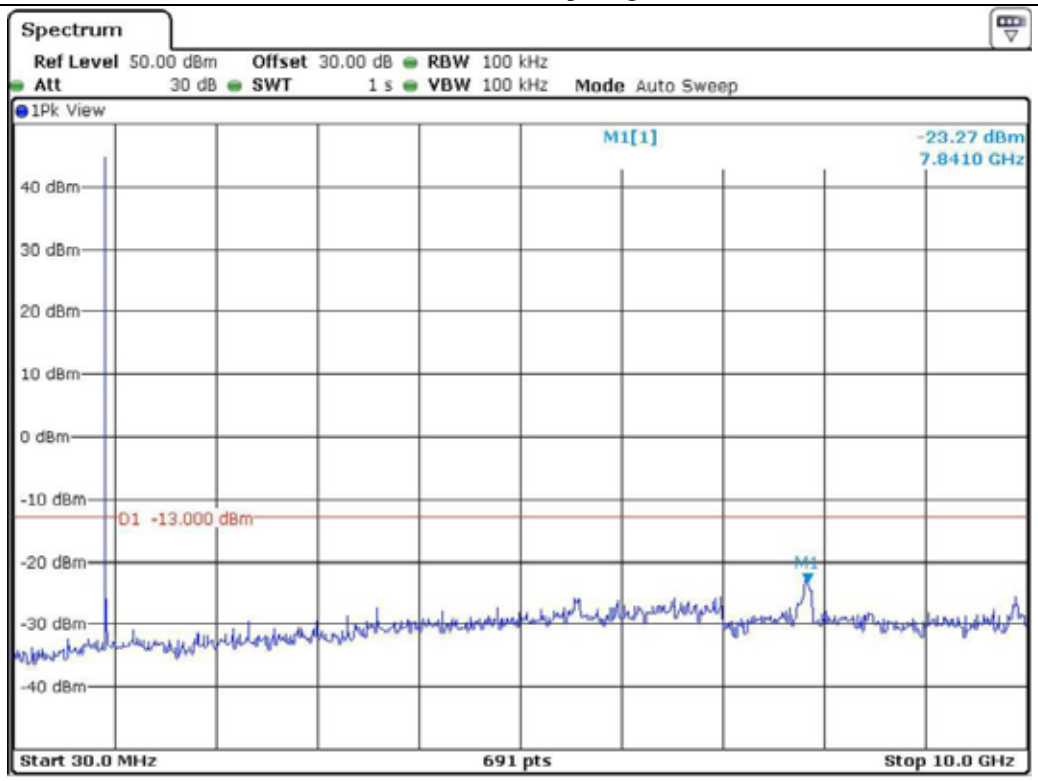



Low Channel – 2 input signals


**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

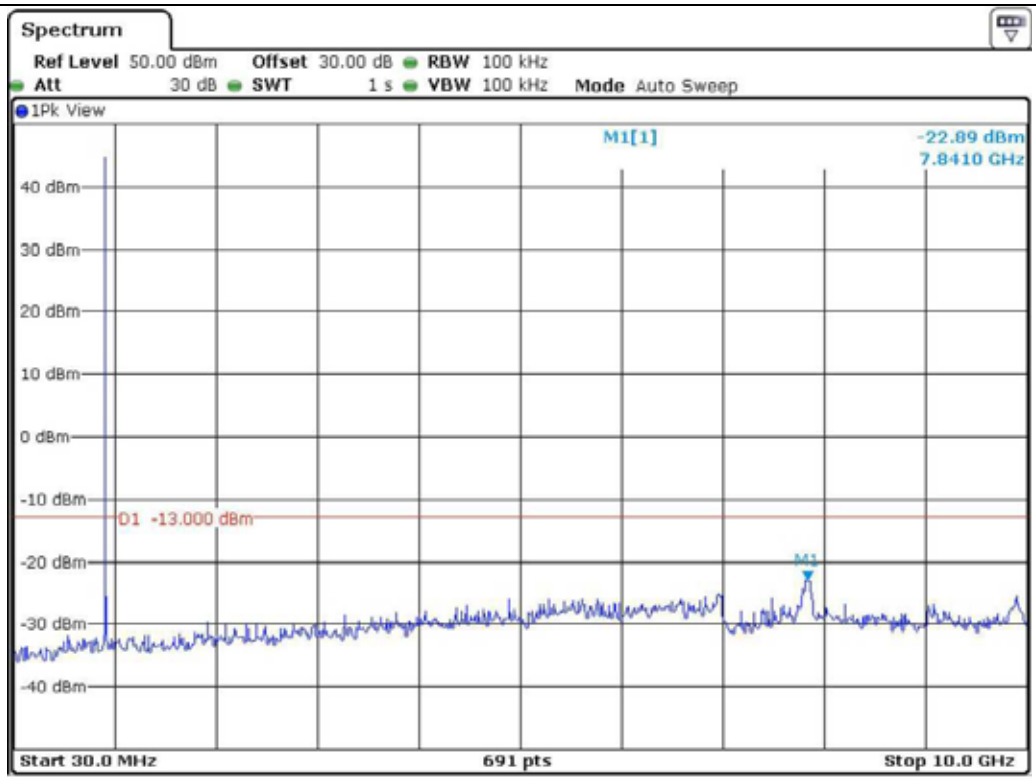



Low Channel – 3 input signals

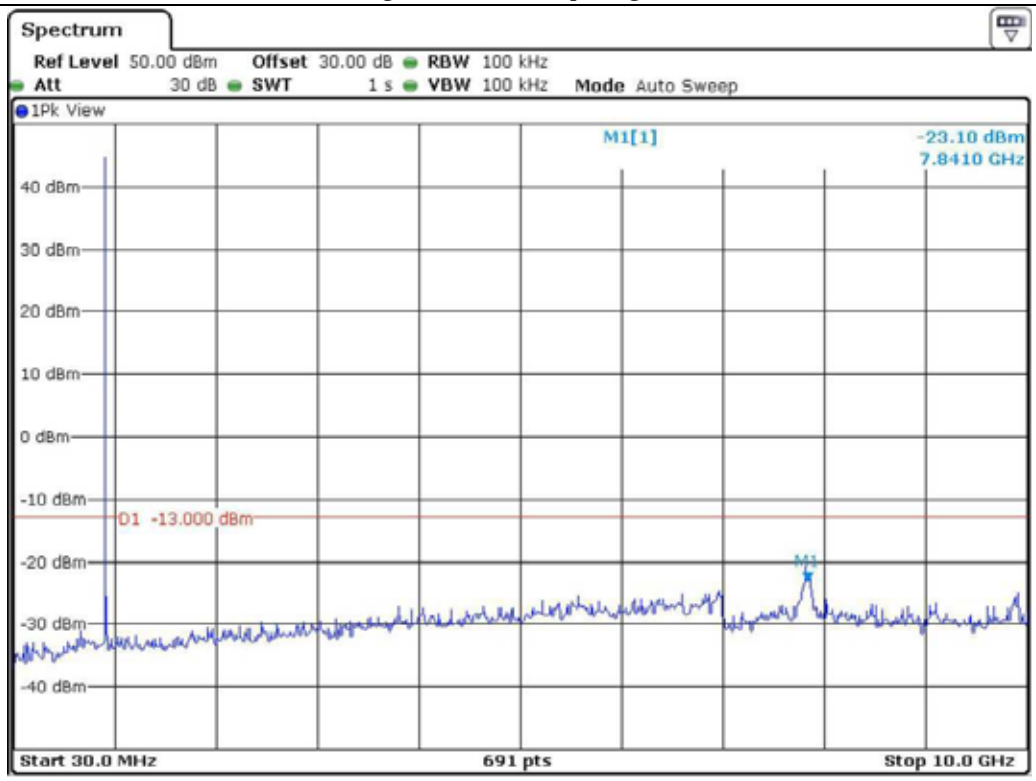



High Channel – 1 input signal


**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)




High Channel – 2 input signals




High Channel – 3 input signals


**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

### 9.4.2 Test Result for frequency range 935 MHz ~ 940 MHz

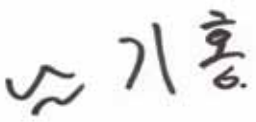
#### 9.4.2.1 Test Result for peak power

-. Test Date : March 13, 2012

-. Test Result : Pass

-. Modulation : No-Modulation

| Frequency (MHz) | Number of Input Channel | Input Power (dBm) | Output Power (dBm) |
|---|---|---|---|
| 935.03 | 1 | -9.90 | 44.50 |
| 935.03 & 935.06 | 2 | -9.90 | 44.50 |
| 935.03 & 935.06 & 935.09 | 3 | -9.80 | 44.50 |
| 939.97 | 1 | -9.70 | 44.50 |
| 939.97 & 939.94 | 2 | -9.90 | 44.49 |
| 939.97 & 939.94 & 939.91 | 3 | -9.70 | 44.49 |



**Tested by: Ki-Hong, Nam / Senior Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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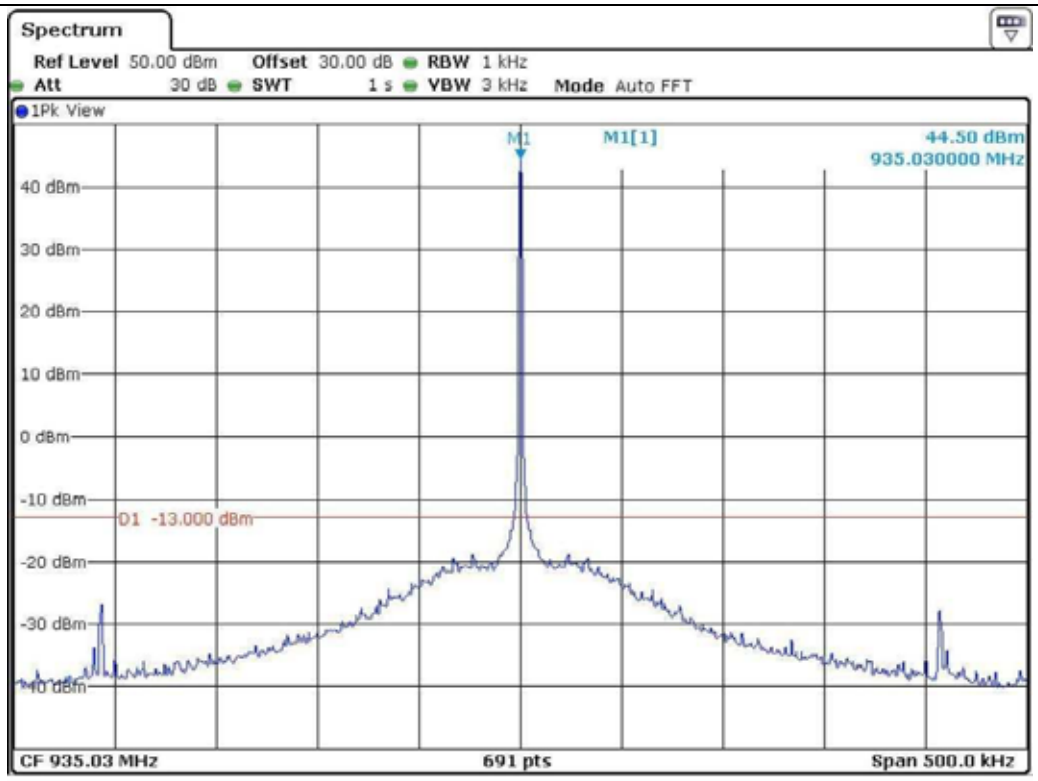
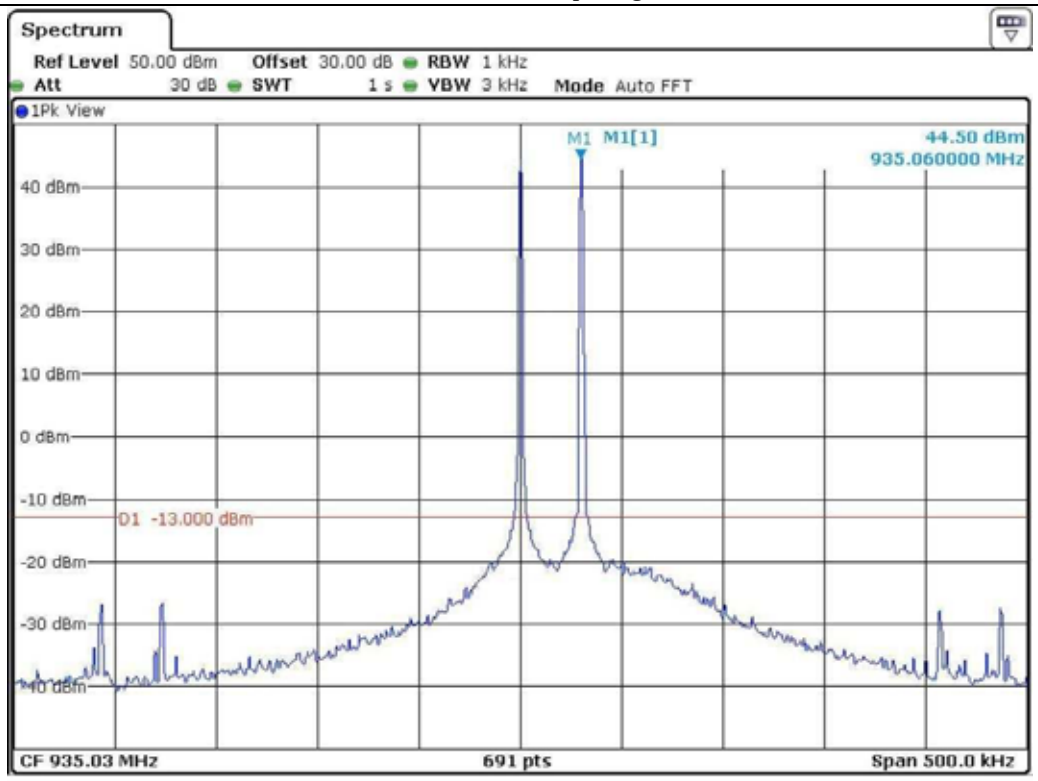



Low Channel – 1 input signal




Low Channel – 2 input signals

**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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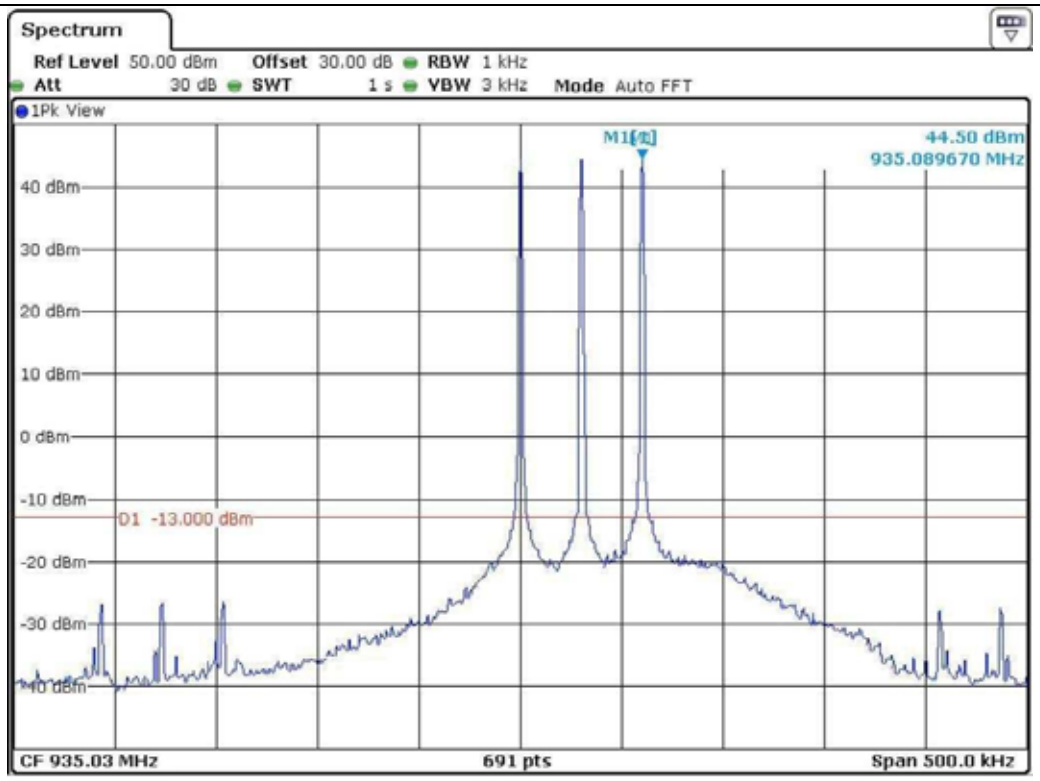
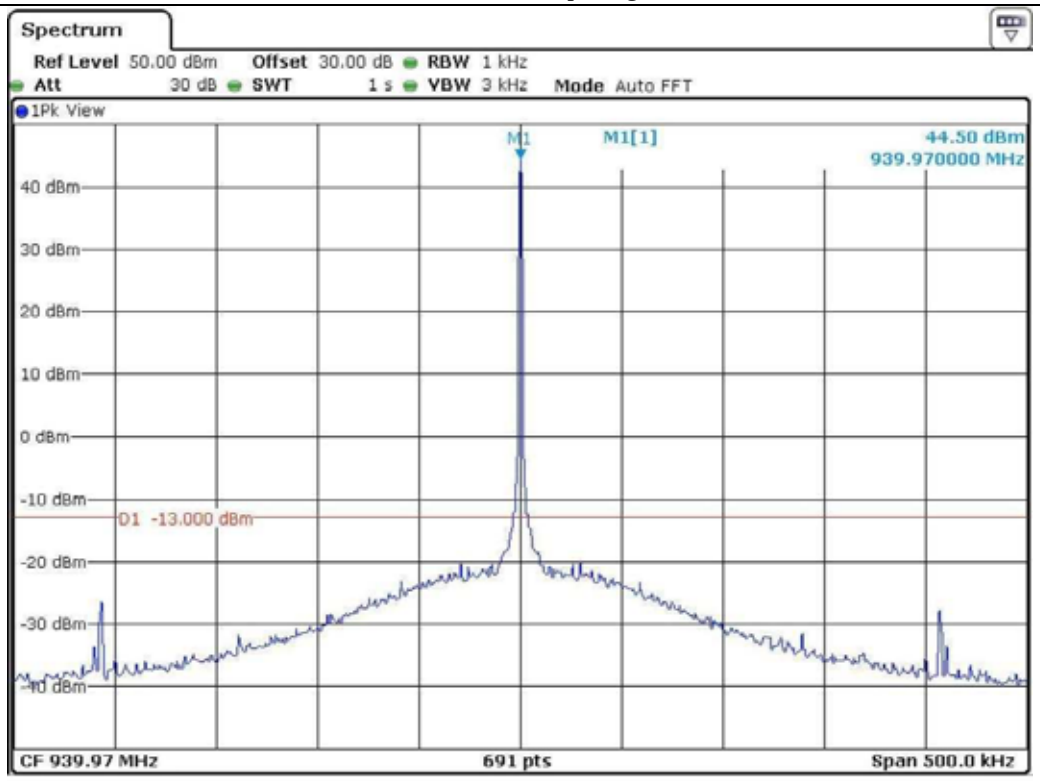



Low Channel – 3 input signals




High Channel – 1 input signal



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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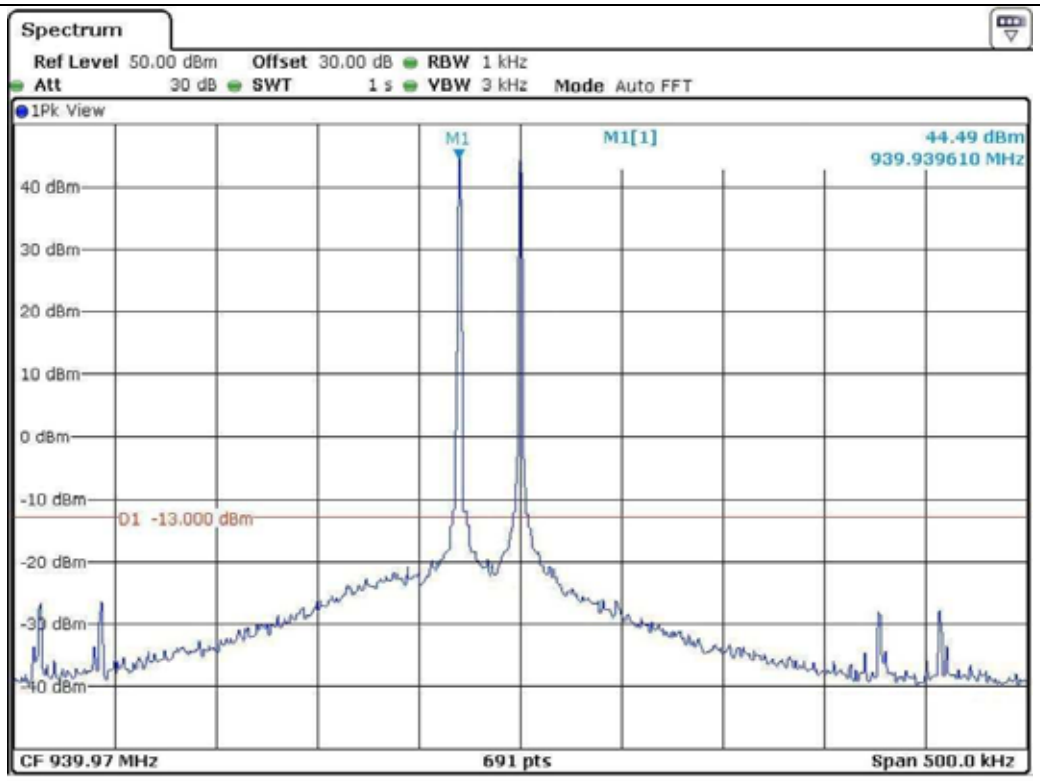
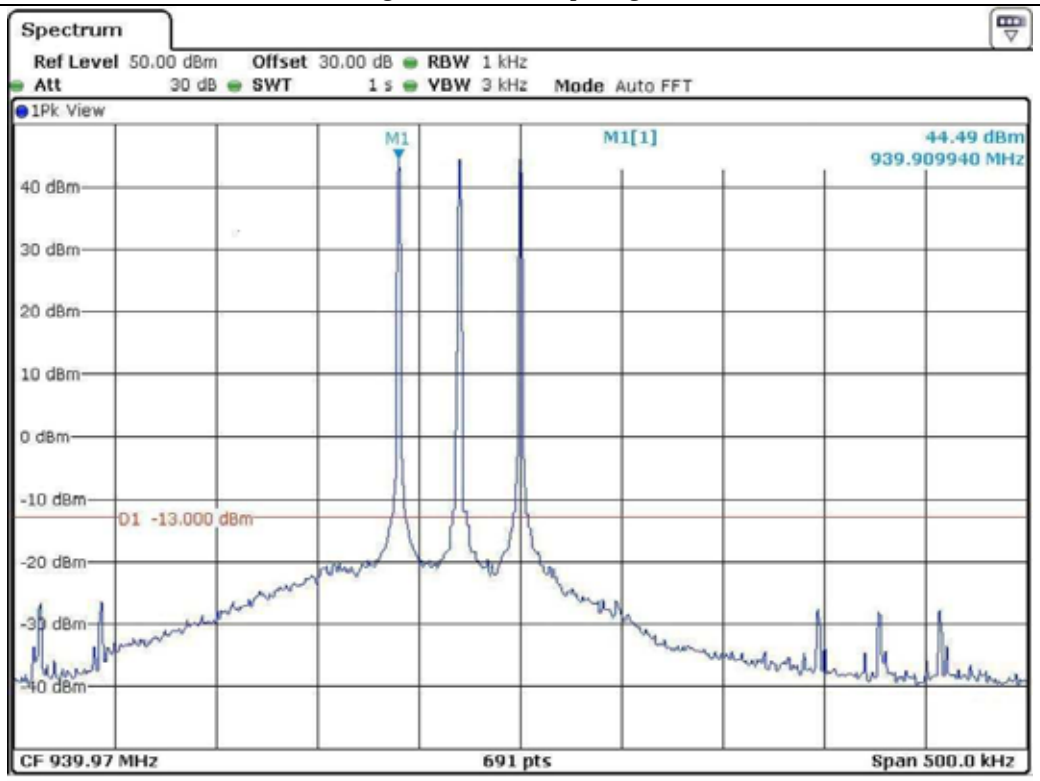



High Channel – 2 input signals




High Channel – 3 input signals

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**9.4.2.2 Test Result for Spurious emission**

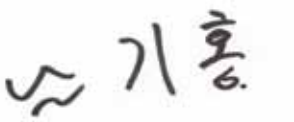
-. Test Date : March 13, 2011

-. Test Result : Pass

-. Modulation : No-Modulation

| Frequency (MHz) | Number of Input Channel | Measured Value | Result |
|---|---|---|---|
| 935.030 | 1 | < -13 dBm | Pass |
| 935.030 & 935.06 | 2 | | |
| 935.030 & 935.06 & 935.09 | 3 | | |
| 939.970 | 1 | < -13 dBm | Pass |
| 939.970 & 939.940 | 2 | | |
| 939.970 & 939.940 & 939.910 | 3 | | |

Remark: Intermodulation products must be attenuated below the rated power of the EUT at least 43 + 10log (Pw), equivalent to -13 dBm. Please refer to test data hereinafter.



**Tested by: Ki-Hong, Nam / Senior Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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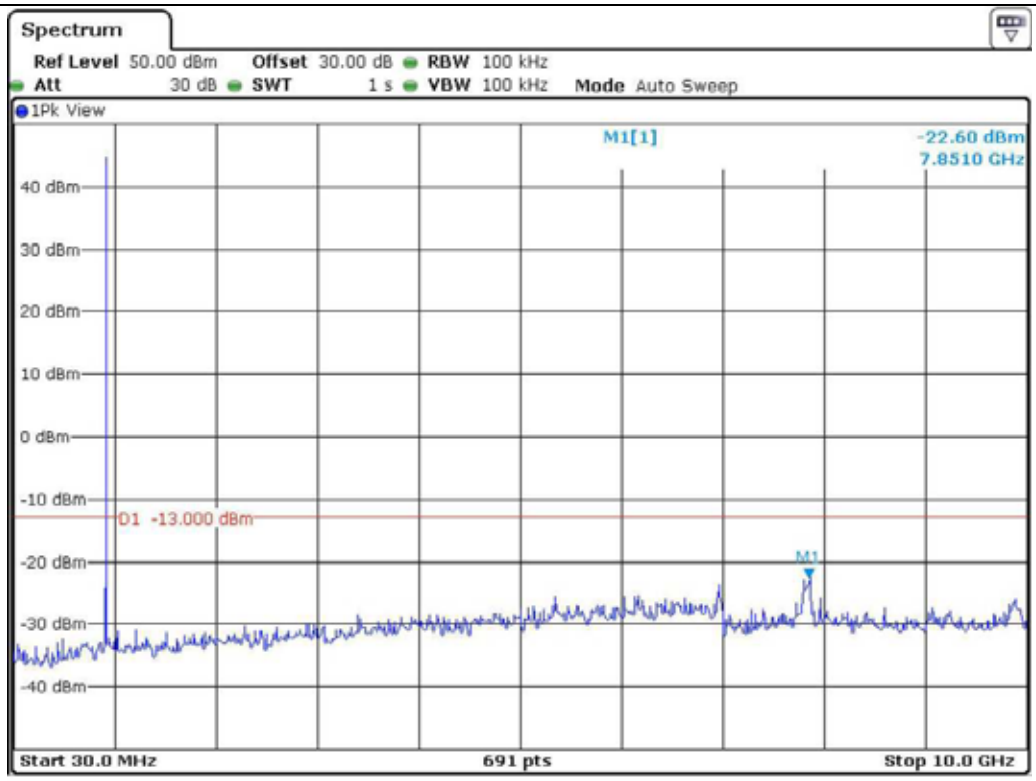
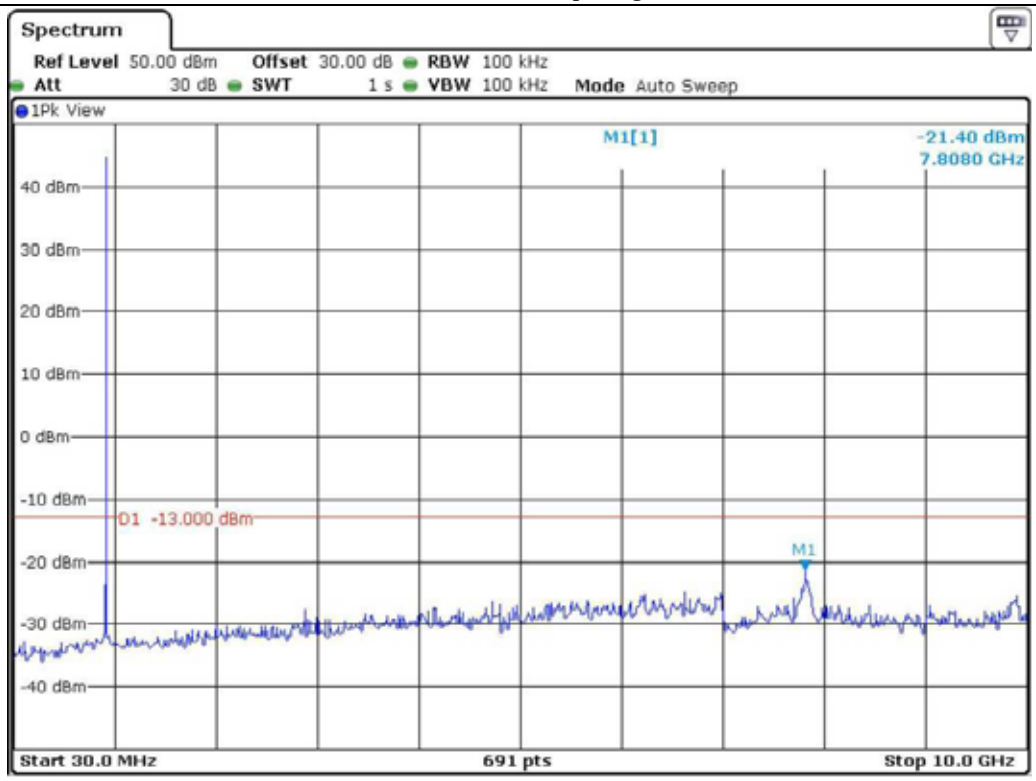


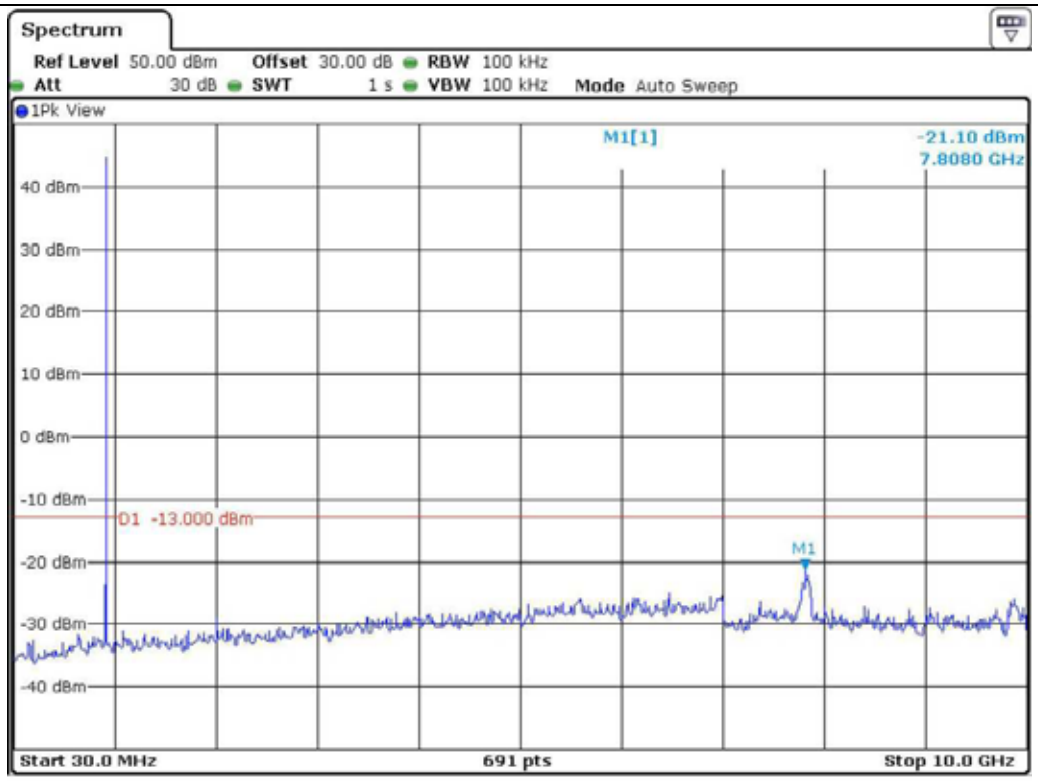

Low Channel – 1 input signal



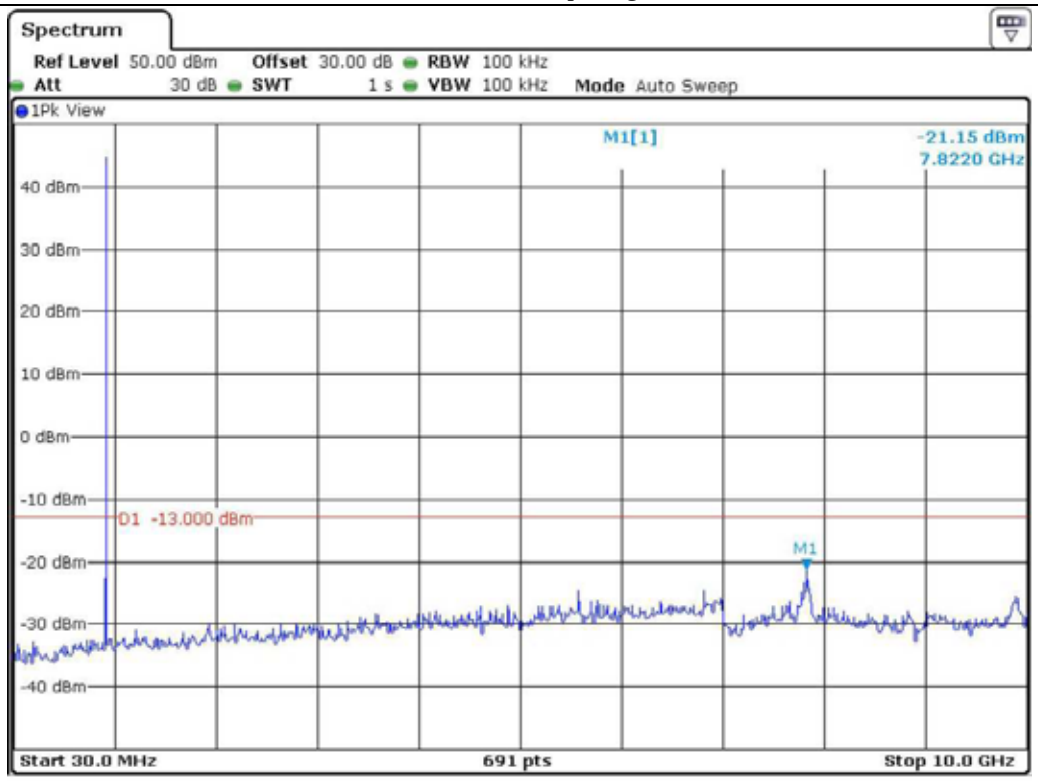

Low Channel – 2 input signals



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)




Low Channel – 3 input signals




High Channel – 1 input signal



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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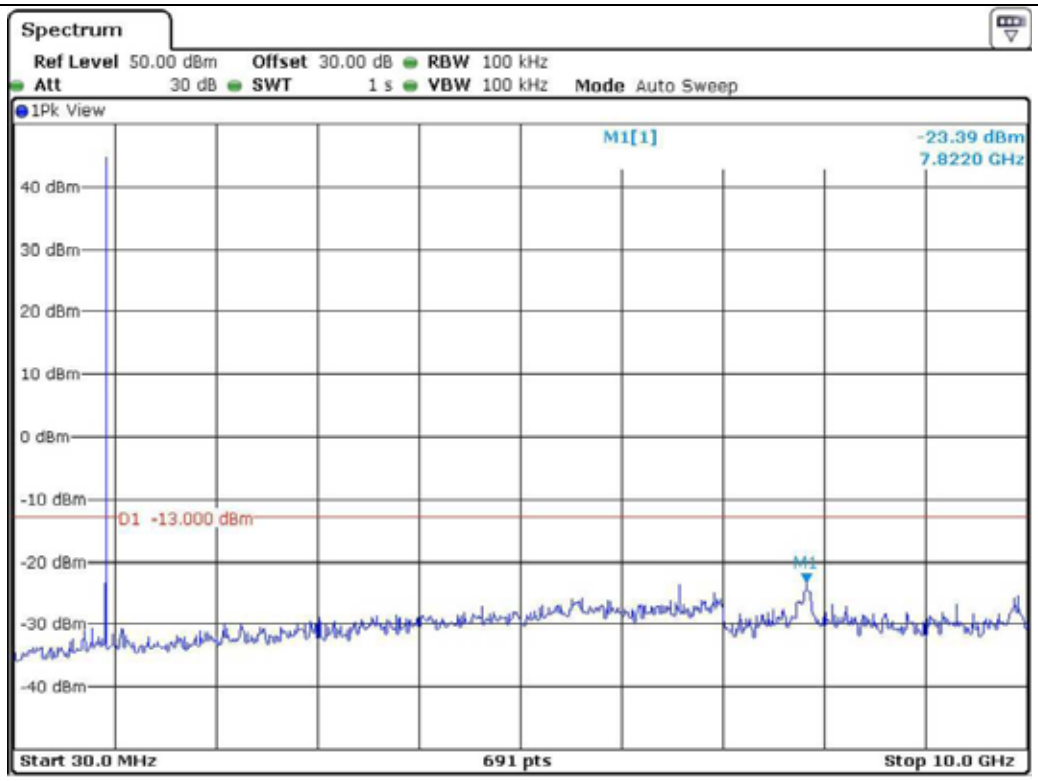
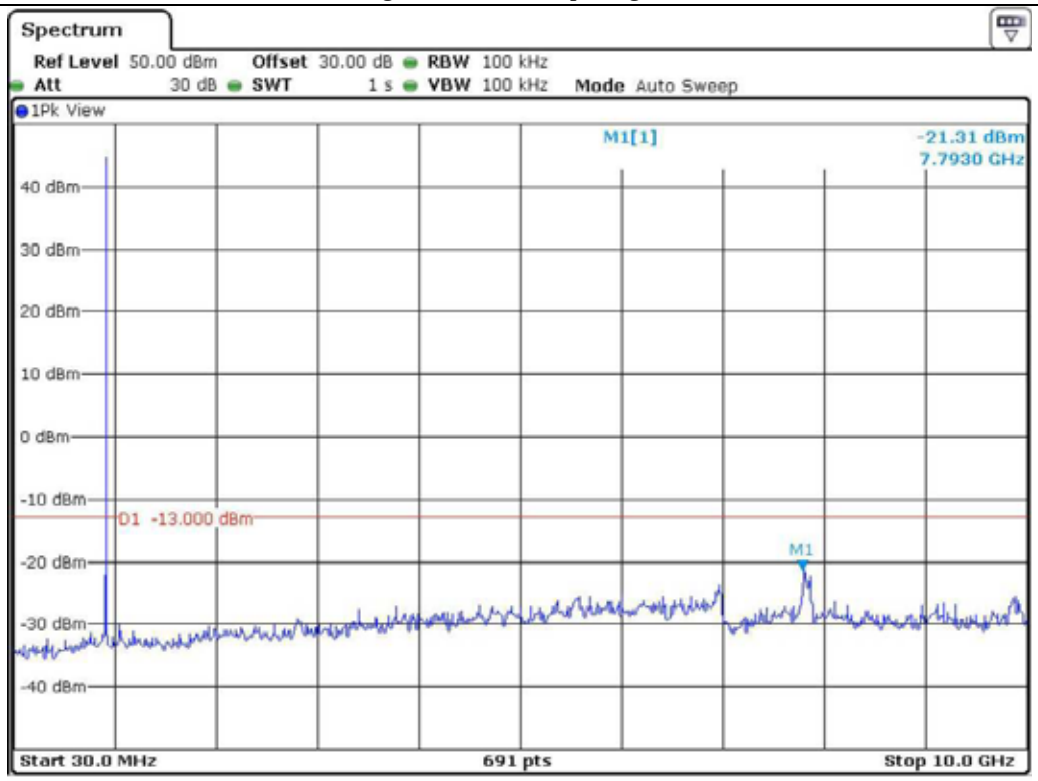



High Channel – 2 input signals




High Channel – 3 input signals

**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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### 9.4.3 Test Result for frequency range 940 MHz ~ 941 MHz

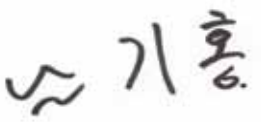
#### 9.4.3.1 Test Result for peak power

-. Test Date : March 14, 2012

-. Test Result : Pass

-. Modulation : No-Modulation

| Frequency (MHz) | Number of Input Channel | Input Power (dBm) | Output Power (dBm) |
|---|---|---|---|
| 940.03 | 1 | -9.90 | 44.49 |
| 940.030 & 940.06 | 2 | -9.80 | 44.50 |
| 940.030 & 940.06 & 940.09 | 3 | -9.90 | 44.49 |
| 940.970 | 1 | -9.70 | 44.50 |
| 940.970 & 940.940 | 2 | -9.90 | 44.51 |
| 940.970 & 940.940 & 940.910 | 3 | -9.80 | 44.50 |



**Tested by: Ki-Hong, Nam / Senior Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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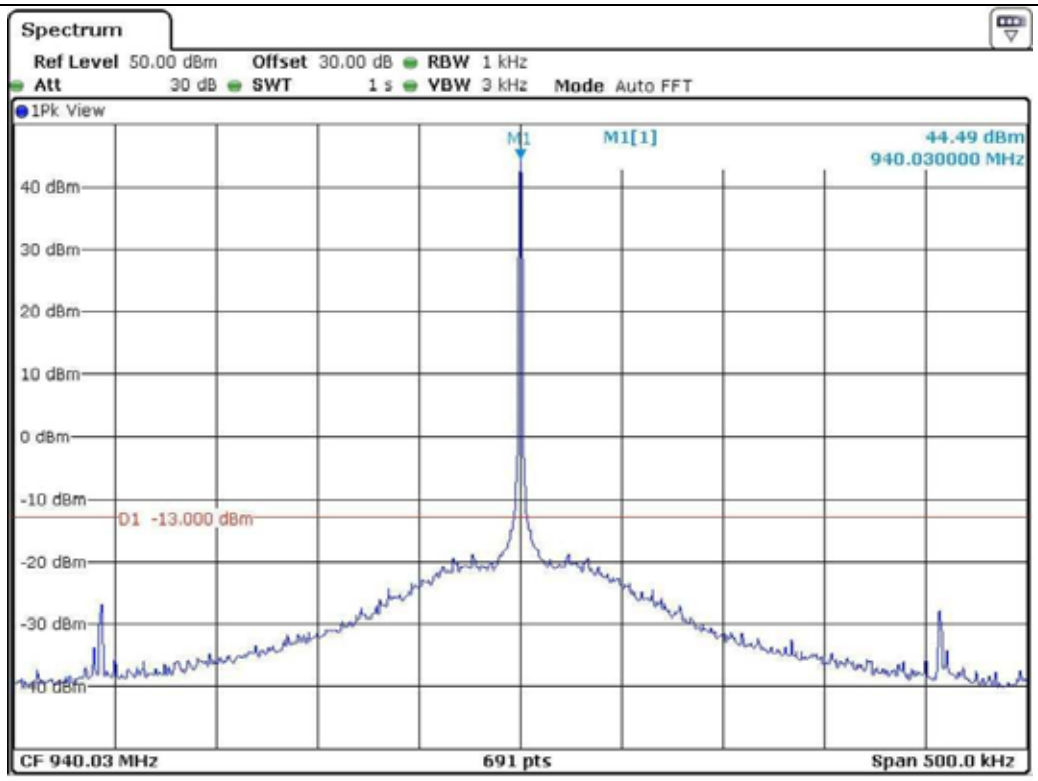
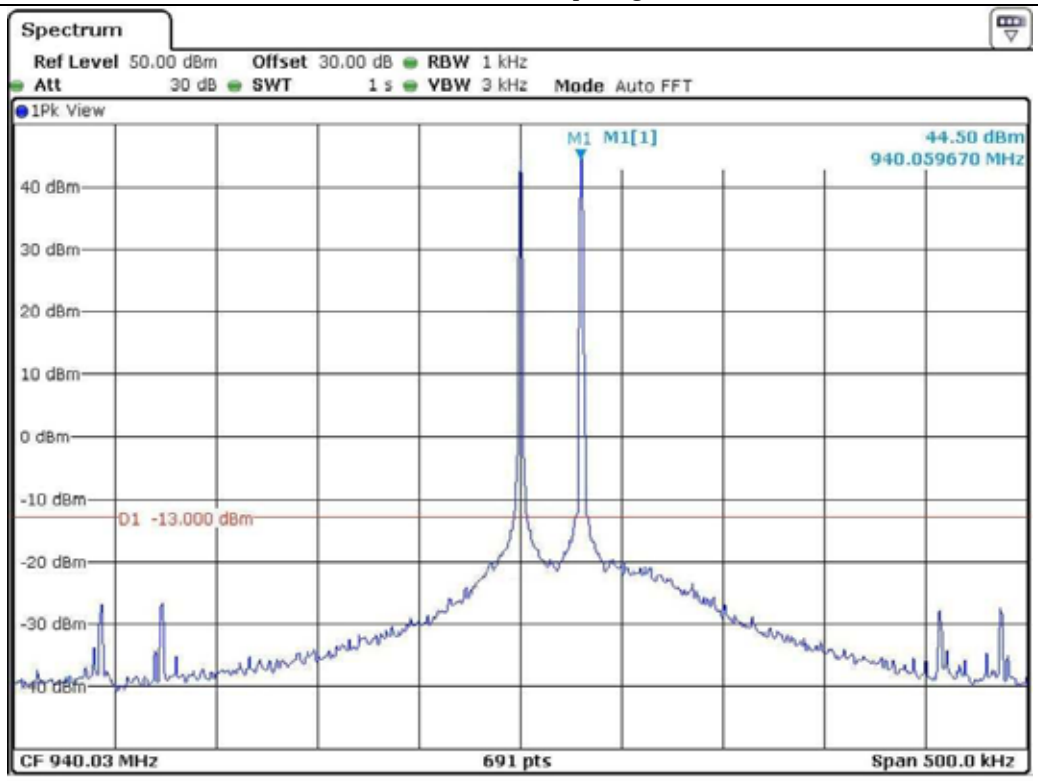



Low Channel – 1 input signal




Low Channel – 2 input signals


**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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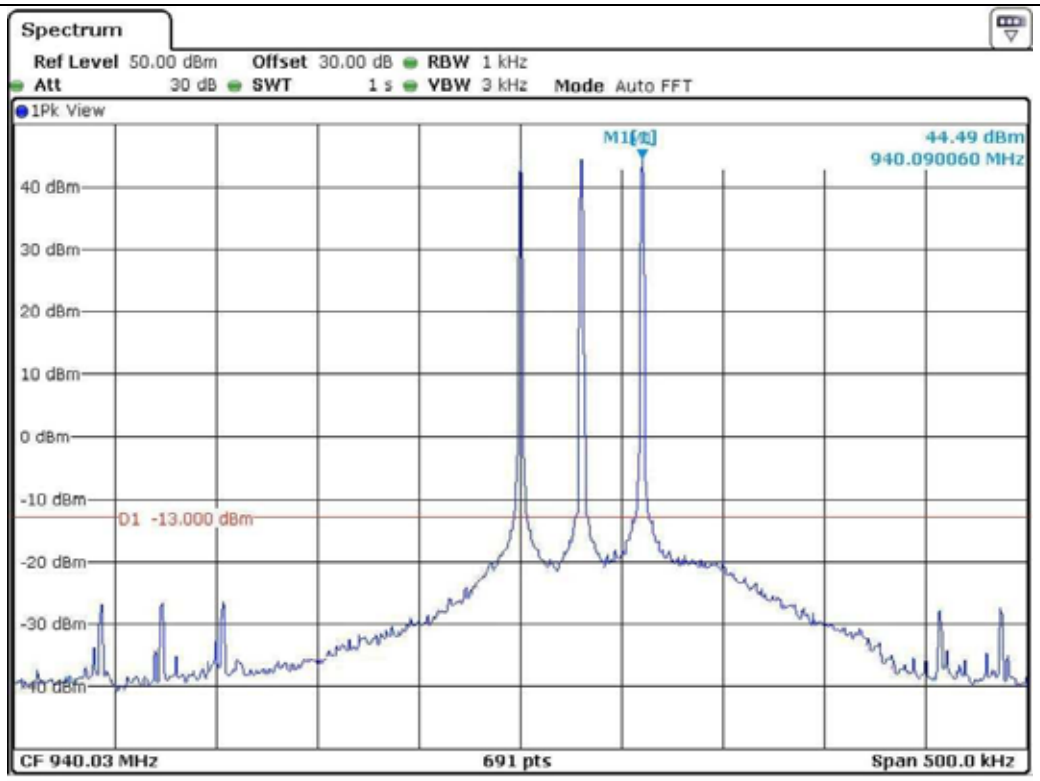
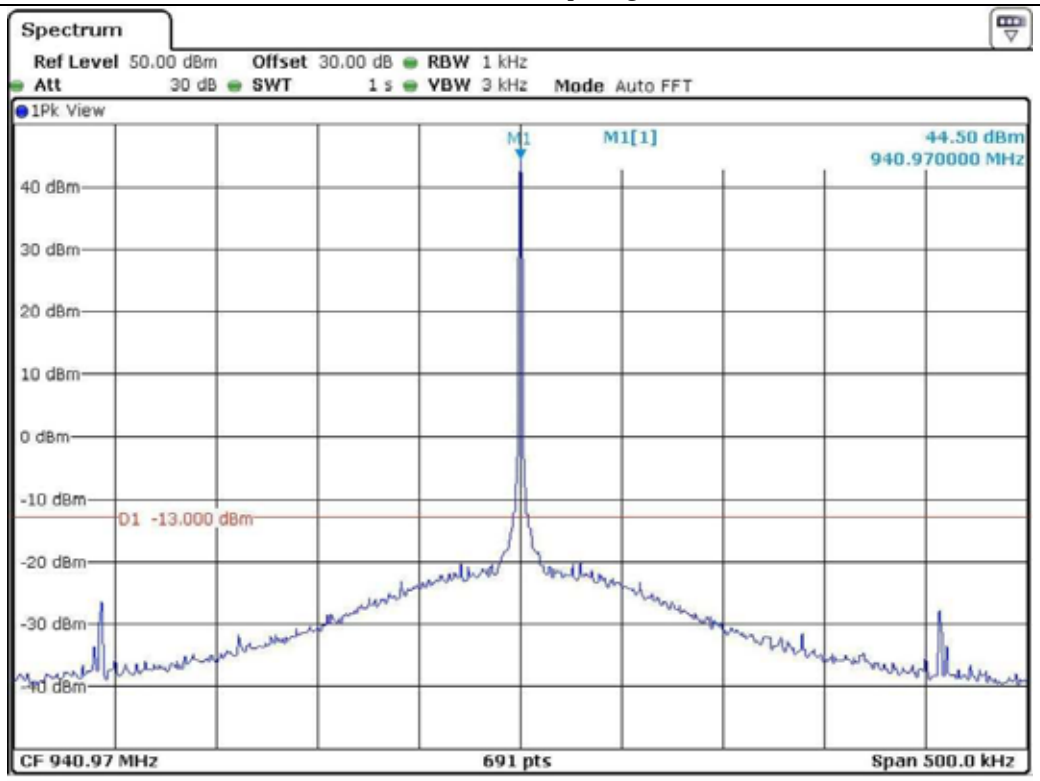



Low Channel – 3 input signals




High Channel – 1 input signal


**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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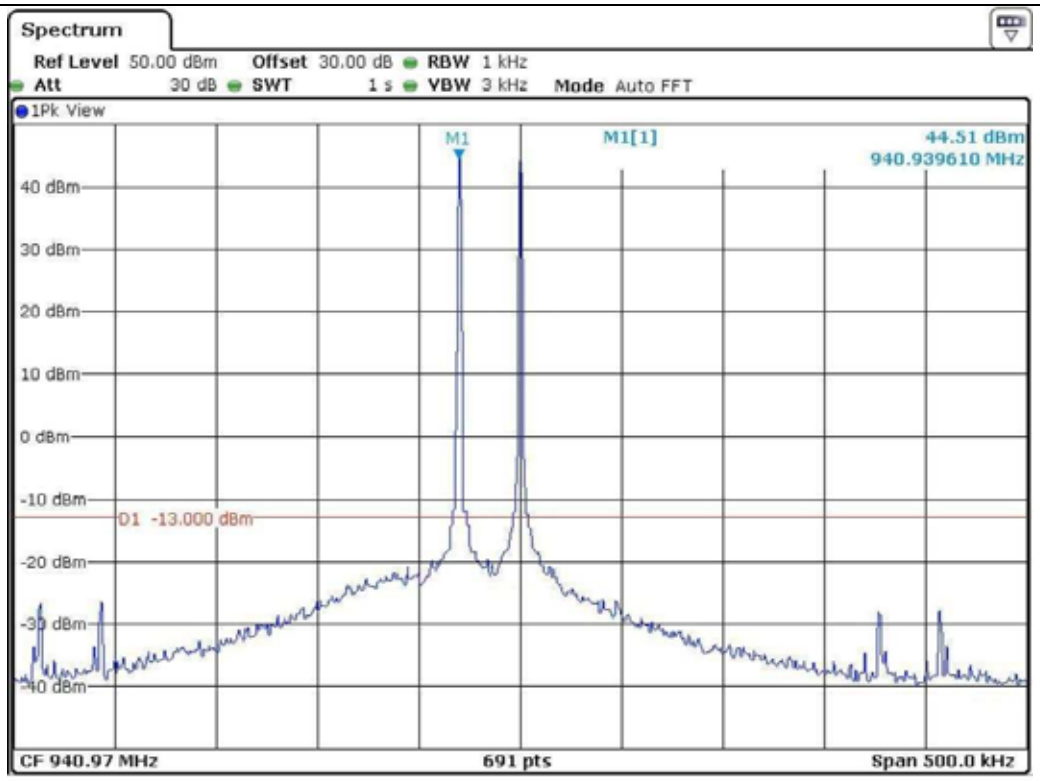
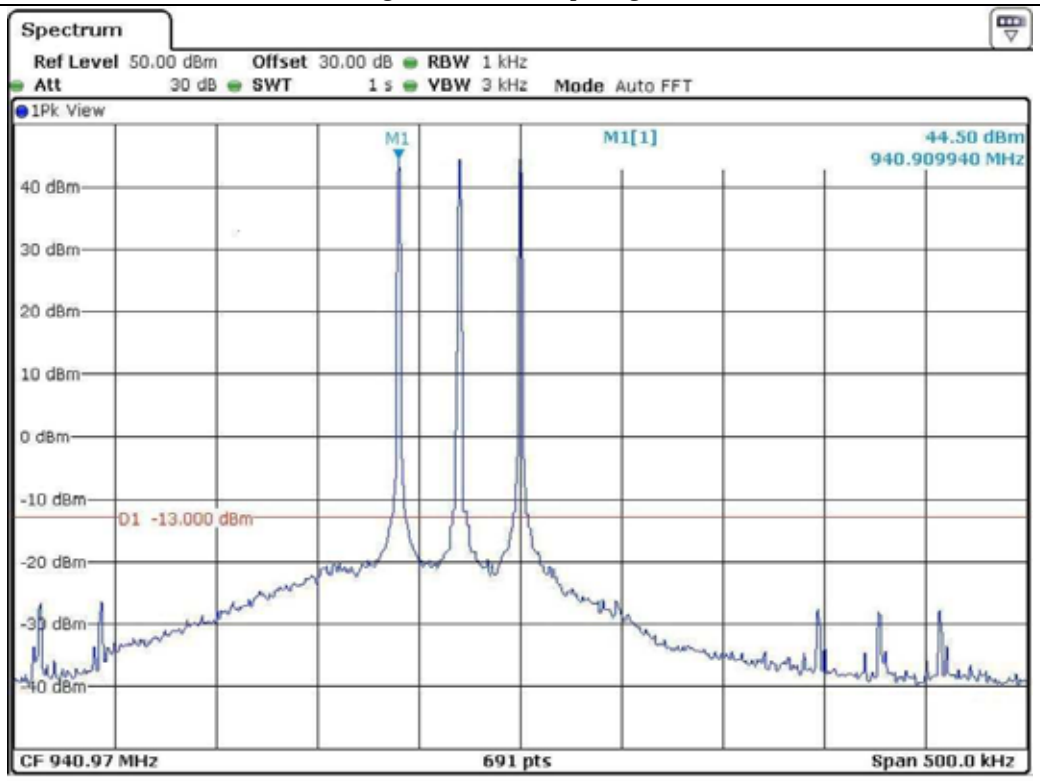



High Channel – 2 input signals




High Channel – 3 input signals



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**9.4.3.2 Test Result for Spurious emission**

-. Test Date : March 14, 2012

-. Test Result : Pass

-. Modulation : No-Modulation

| Frequency (MHz) | Number of Input Channel | Measured Value | Result |
|---|---|---|---|
| 940.030 | 1 | < -13 dBm | Pass |
| 940.030 & 940.06 | 2 | | |
| 940.030 & 940.06 & 940.09 | 3 | | |
| 940.970 | 1 | < -13 dBm | Pass |
| 940.970 & 940.940 | 2 | | |
| 940.970 & 940.940 & 940.910 | 3 | | |

Remark: Intermodulation products must be attenuated below the rated power of the EUT at least 43 + 10log (Pw), equivalent to -13 dBm. Please refer to test data hereinafter.

**Tested by: Ki-Hong, Nam / Senior Engineer**



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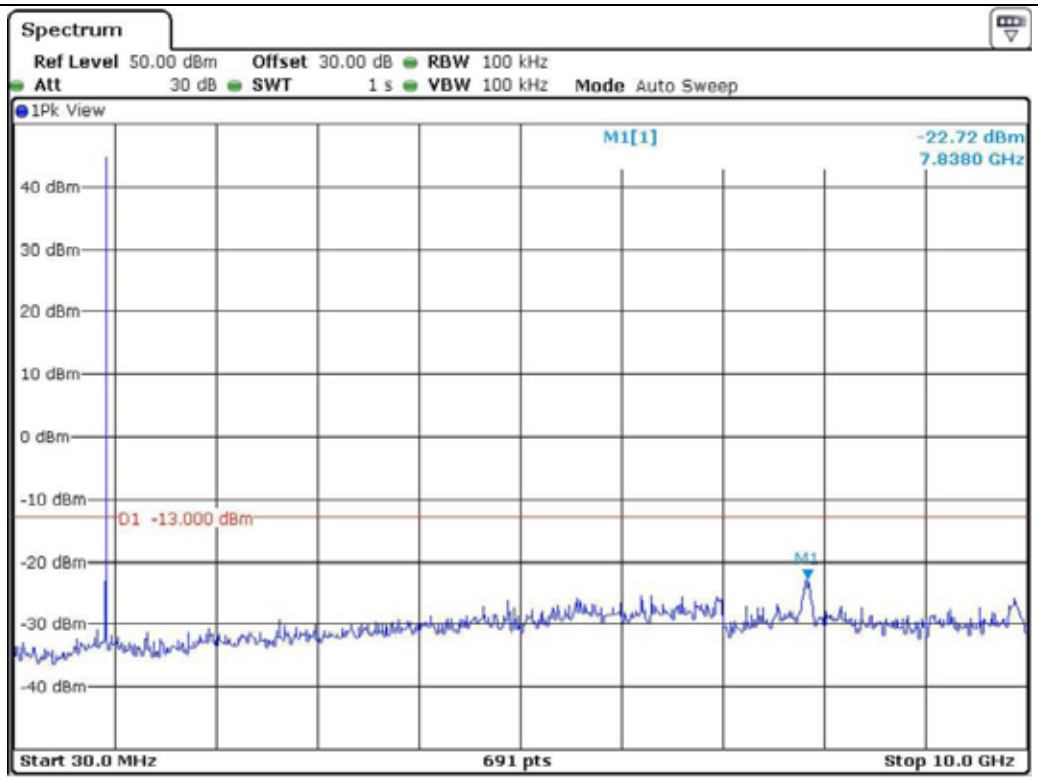
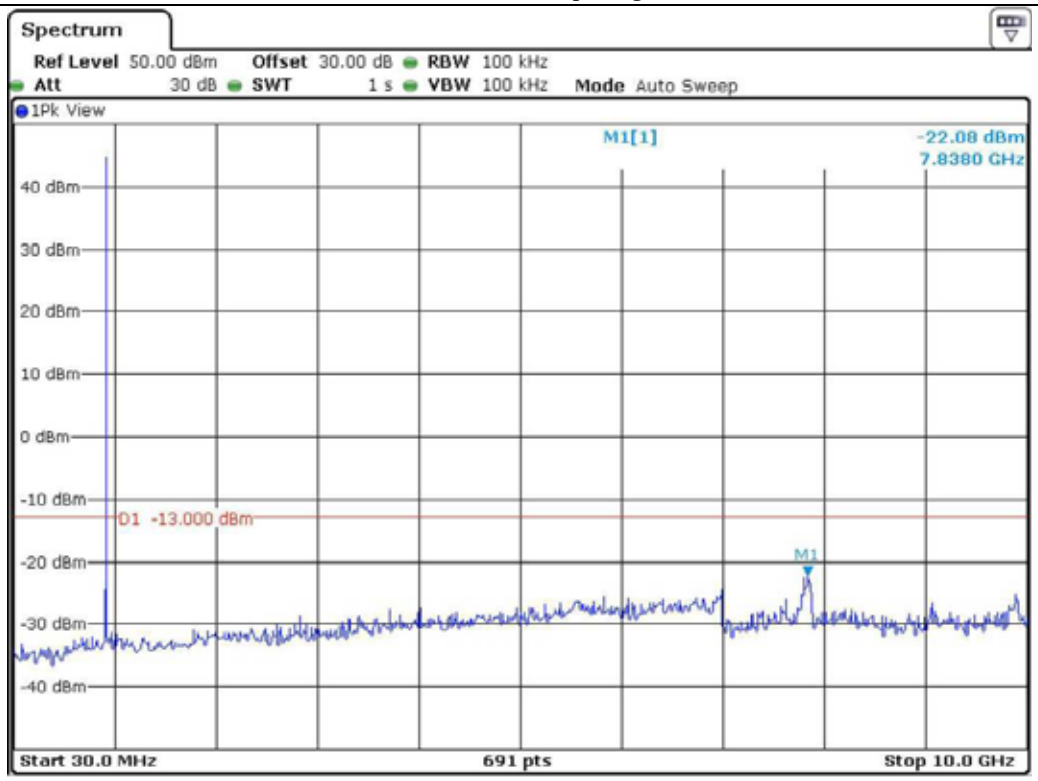



Low Channel – 1 input signal




Low Channel – 2 input signals



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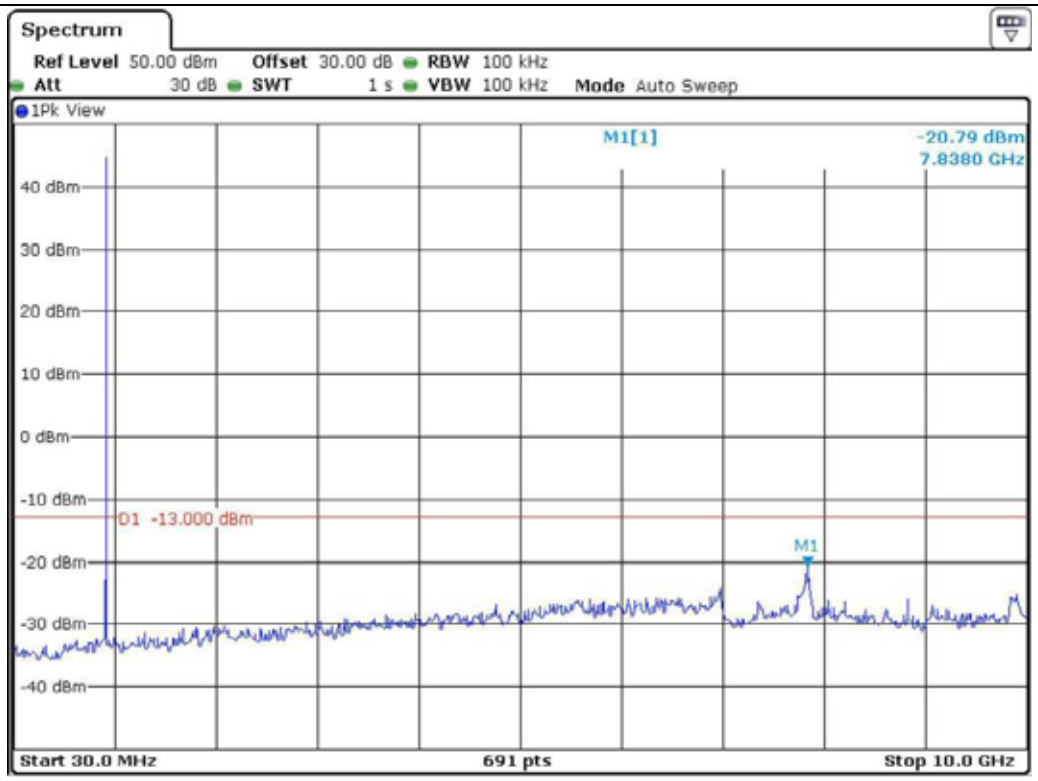
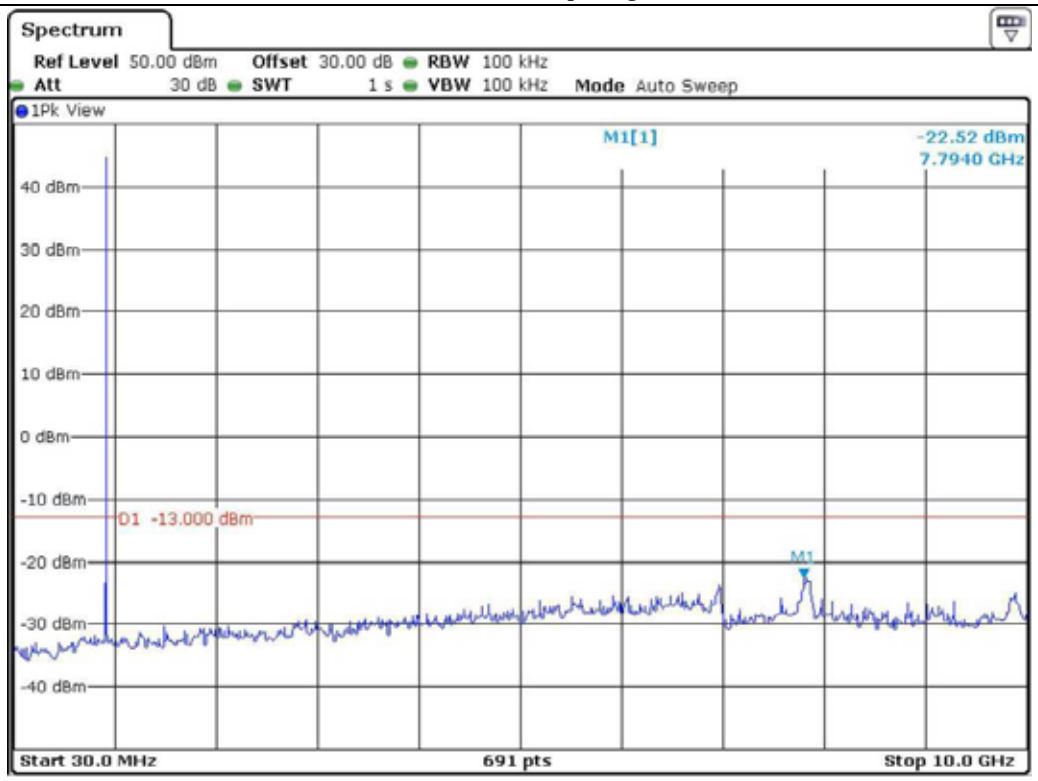



Low Channel – 3 input signals




High Channel – 1 input signal

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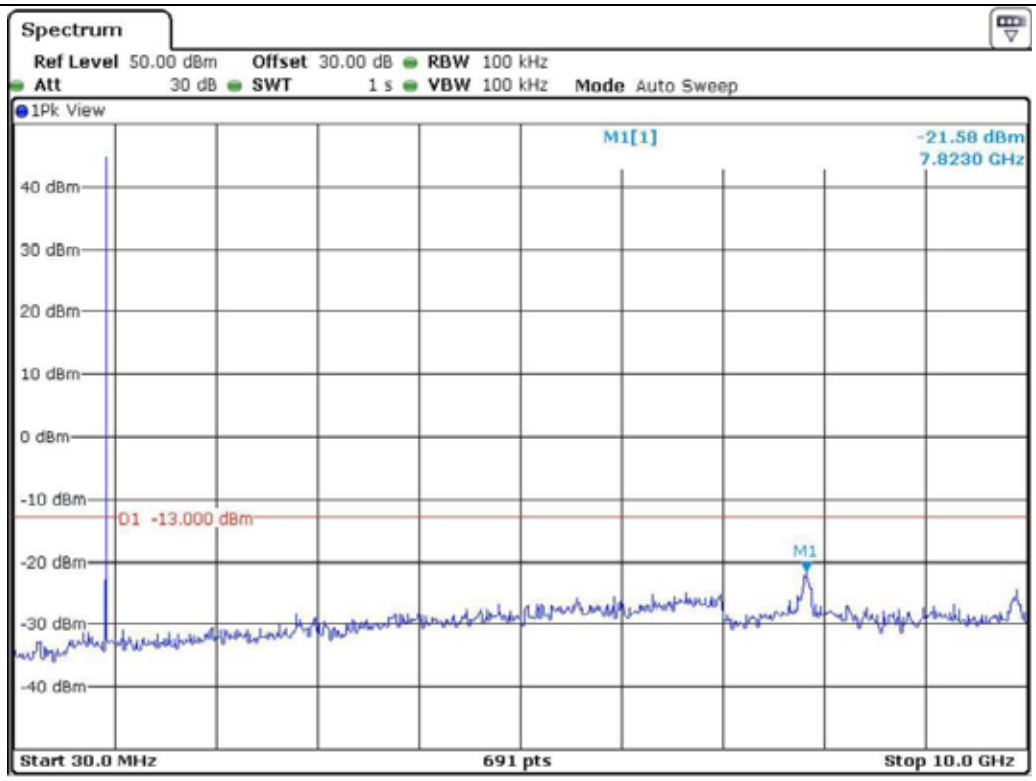
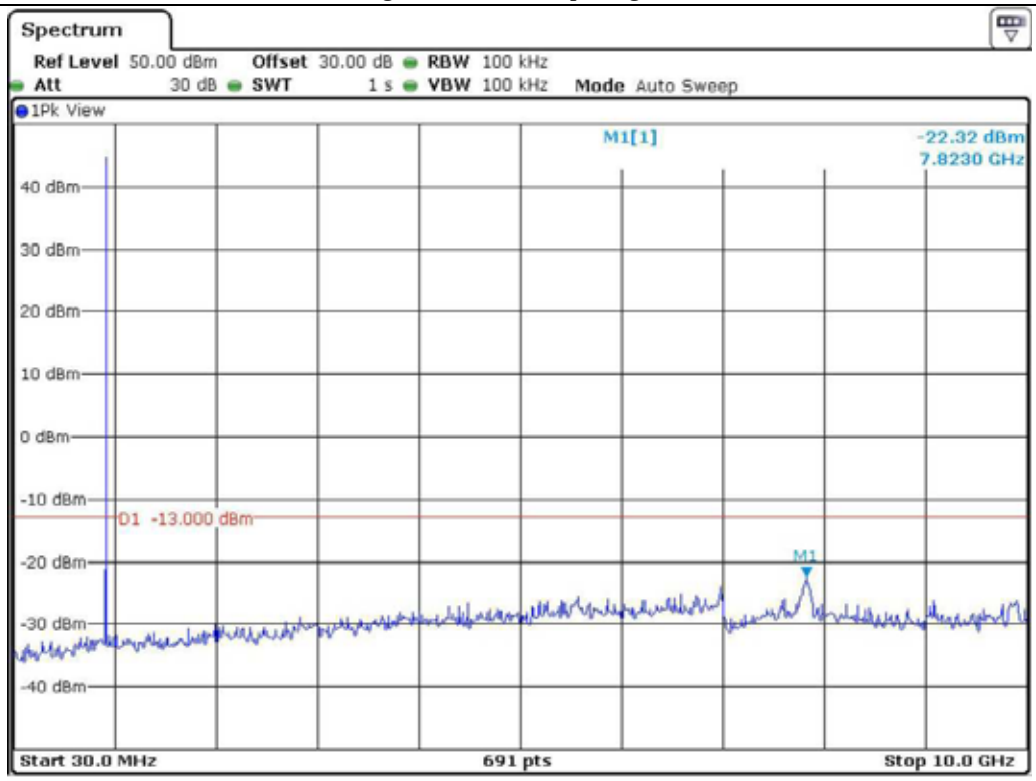



High Channel – 2 input signals




High Channel – 3 input signals

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# 10. FIELD STRENGTH OF SPURIOUS RADIATION

## 10.1 Operating environment

Temperature : 10 °C

Relative humidity : 45 % R.H.

## 10.2 Test set-up

The radiated emissions measurements were on the 3 m, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to up to 10$^{th}$ harmonic of the fundamental frequency was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. The test was performed by placing the EUT on 3-orthogonal axis. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

The maximum radiated emission was recorded and used as reference for the effective radiated power measurement. The EUT was then replaced by a tuned dipole antenna or Horn antenna and was oriented for vertical polarization and then the length was adjusted to correspond to the frequency of the transmitter. The substitution antenna was connected to a signal generator with a coaxial cable. The receiving antenna height was raised and lowered again through the specified range of height until maximum signal level is detected by the measuring receiver. The signal to the substitution antenna was adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the EUT radiated power measured, corrected for the change of input attenuation setting of the measuring receiver. The signal generator level was recorded and corrected by the power loss in the cable between the signal generator and substitution antenna and further corrected for the gain of the dipole antenna or horn antenna used relative to an ideal tuned dipole antenna. The measurement was repeated with the test antenna and the substitution antenna oriented for horizontal polarization. The measure of the effective radiated power is the larger of the two levels recorded.

## 10.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. (Interval) |
|---|---|---|---|---|---|
| ☐ - | ESVD | Rohde & Schwarz | EMI Test Receiver | 838453/018 | Oct. 20, 2011 (1Y) |
| ☐ - | 8564E | Hewlett-Packard | Spectrum Analyzer | 3650A00756 | Jun. 10, 2011 (1Y) |
| ■ - | 83051A | Agilent | Preamplifier | 3950M00201 | Jun. 11, 2011 (1Y) |
| ☐ - | E4432B | Hewlett-Packard | Signal Generator | US38440950 | Jun. 10, 2011 (1Y) |
| ☐ - | 83650L | Hewlett-Packard | Signal Generator | 3844A00415 | Jun. 10, 2011 (1Y) |
| ■ - | BBHA9120D | Schwarzbeck | Horn Antenna | BBHA9120D294 | Aug. 23, 2011 (2Y) |
| ■ - | BBHA9120D | Schwarzbeck | Horn Antenna | BBHA9120D295 | Aug. 23, 2011 (2Y) |
| ☐ - | BBHA9170 | Schwarzbeck | Horn Antenna | BBHA9170178 | Aug. 23, 2011 (2Y) |
| ☐ - | BBHA9170 | Schwarzbeck | Horn Antenna | BBHA9170179 | Aug. 23, 2011 (2Y) |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 01, 2012 (1Y) |
| ☐ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 16, 2011 (1Y) |
| ■ - | FSV30 | R/S | Spectrum Analyzer | 101372 | Aug. 29, 2011 (1Y) |

All test equipment used is calibrated on a regular basis.




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## 10.4 Test data for radiated emission

### 10.4.1 Test Result for frequency range 929 MHz ~ 930 MHz

-. Test Date : February 27, 2012

-. Resolution bandwidth : 120 kHz (below 1 GHz), 1 MHz (above 1 GHz)

-. Video bandwidth : 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)

-. Frequency range : 30 MHz ~ 10 GHz

-. Measurement distance : 3 m

-. Result : PASSED BY -47.61 dB at 136.80 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Middle Channel** | | | | | | | | |
| 929.500 0 | 75.50 | 8.17 | -0.52 | H | 3.50 | 4.15 | - | - |
| | 78.67 | 9.50 | | V | | 5.48 | - | - |
| 38.00 | 29.00 | -65.00 | 1.22 | V | 0.50 | -64.28 | -13.00 | -51.28 |
| 42.83 | 28.50 | -64.50 | 1.53 | V | 1.50 | -61.47 | -13.00 | -48.47 |
| 136.80 | 35.33 | -65.01 | 2.57 | V | 1.83 | -60.61 | -13.00 | -47.61 |
| 163.86 | 32.67 | -65.83 | 2.92 | V | 2.17 | -60.74 | -13.00 | -47.74 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Senior Engineer**



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**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

**10.4.2 Test Result for frequency range 935 MHz ~ 940 MHz**

-. Test Date : February 27, 2012

-. Resolution bandwidth : 120 kHz (below 1 GHz), 1 MHz (above 1 GHz)

-. Video bandwidth : 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)

-. Frequency range : 30 MHz ~ 10 GHz

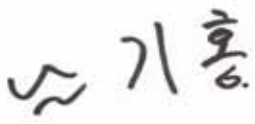
-. Measurement distance : 3 m

-. Result : PASSED BY -47.27 dB at 136.80 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 935.012 5 | 75.33 | 8.00 | -0.51 | H | 3.50 | 3.99 | - | - |
| | 78.83 | 9.33 | | V | | 5.32 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 935.987 5 | 75.17 | 7.83 | -0.49 | H | 3.50 | 3.84 | - | - |
| | 78.50 | 9.00 | | V | | 5.01 | - | - |
| 38.00 | 29.33 | -64.67 | 1.22 | V | 0.50 | -63.95 | -13.00 | -50.95 |
| 42.83 | 28.00 | -65.00 | 1.53 | V | 1.50 | -61.97 | -13.00 | -48.97 |
| 136.80 | 35.67 | -64.67 | 2.57 | H | 1.83 | -60.27 | -13.00 | -47.27 |
| 163.86 | 32.83 | -65.70 | 2.92 | V | 2.17 | -60.61 | -13.00 | -47.61 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical



**Tested by: Ki-Hong, Nam / Senior Engineer**



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**10.4.3 Test Result for frequency range 940 MHz ~ 941 MHz**

-. Test Date : February 27, 2012

-. Resolution bandwidth : 120 kHz (below 1 GHz), 1 MHz (above 1 GHz)

-. Video bandwidth : 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)

-. Frequency range : 30 MHz ~ 10 GHz

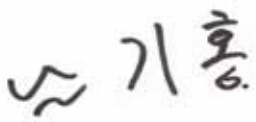
-. Measurement distance : 3 m

-. Result : PASSED BY -47.61 dB at 136.80 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Middle Channel** | | | | | | | | |
| 940.500 0 | 75.17 | 7.83 | -0.49 | H | 3.50 | 3.84 | - | - |
| | 78.50 | 9.17 | | V | | 5.18 | - | - |
| 38.00 | 29.50 | -64.50 | 1.22 | V | 0.50 | -63.78 | -13.00 | -50.78 |
| 42.83 | 28.33 | -64.67 | 1.53 | V | 1.50 | -61.64 | -13.00 | -48.64 |
| 136.80 | 35.33 | -65.01 | 2.57 | V | 1.83 | -60.61 | -13.00 | -47.61 |
| 163.86 | 32.17 | -66.36 | 2.92 | V | 2.17 | -61.27 | -13.00 | -48.27 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical



**Tested by: Ki-Hong, Nam / Senior Engineer**



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# 11. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

## 11.1 Operating environment

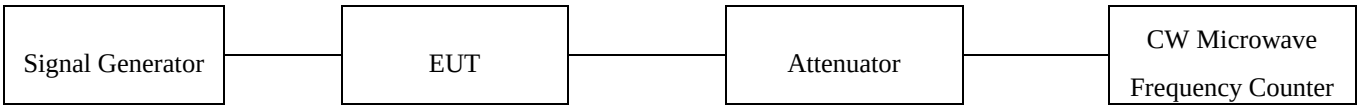
Temperature : (22 ~ 23) °C

Relative humidity : (49 ~ 50) % R.H.

## 11.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at Middle channel at each band using all applicable unmodulation.

Turn EUT off and set chamber temperature to -30 °C and then allow sufficient time (approximately 20 min to 30 min after chamber reach the assigned temperature) for EUT to stabilize. Turn on the EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -30 °C to +50 °C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.




## 11.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. (Interval) |
|---|---|---|---|---|---|
| ☐ - | E4432B | HP | Signal Generator | US38440950 | June 10, 2011 (1Y) |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 01, 2012 (1Y) |
| ☐ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 15, 2011 (1Y) |
| ☐ - | 8564E | HP | Spectrum Analyzer | 3650A00756 | Jun. 10, 2011 (1Y) |
| ☐ - | FSV30 | R/S | Spectrum Analyzer | 101372 | Aug. 29, 2011 (1Y) |
| ■ - | 53152A | R/S | CW Microwave Frequency Counter | US39270295 | Dec. 30, 2011 (1Y) |
| ■ - | 67-30-43 | Aeroflex Weinschel | Power Attenuator | CA5760 | Nov. 30, 2011 (1Y) |
| ■ - | SSE-43CI-A | Samkun Tech | Chamber | 060712 | Jun. 11, 2011 (1Y) |

All test equipment used is calibrated on a regular basis.



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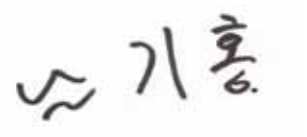
## 11.4 Test data

### 11.4.1 Test Result for frequency range 929 MHz ~ 930 MHz

-. Test Date : March 09 ~ 12, 2012

-. Result : PASSED

| Temperature (˚C) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| -30 | 929 500 000 | 929 500 001 | 0.001 1 | Within the Authorized Frequency block |
| -20 | | 929 500 000 | 0.000 0 | |
| -10 | | 929 500 001 | 0.001 1 | |
| 0 | | 929 500 002 | 0.002 2 | |
| 10 | | 929 500 001 | 0.001 1 | |
| 20 | | 929 500 000 | 0.000 0 | |
| 30 | | 929 500 002 | 0.002 2 | |
| 40 | | 929 500 001 | 0.001 1 | |
| 50 | | 929 500 000 | 0.000 0 | |



**Tested by: Ki-Hong, Nam / Senior Engineer**



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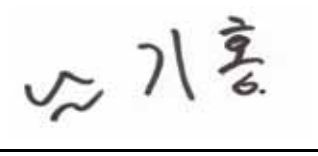
**11.4.2 Test Result for frequency range 935 MHz ~ 940 MHz**

-. Test Date : March 13 ~ 14, 2012

-. Result : PASSED

| Temperature (˚C) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| -30 | 937 500 000 | 937 500 001 | 0.001 1 | Within the Authorized Frequency block |
| -20 | | 937 500 000 | 0.000 0 | |
| -10 | | 937 500 002 | 0.002 1 | |
| 0 | | 937 500 001 | 0.001 1 | |
| 10 | | 937 500 001 | 0.001 1 | |
| 20 | | 937 500 000 | 0.000 0 | |
| 30 | | 937 500 002 | 0.002 1 | |
| 40 | | 937 500 001 | 0.001 1 | |
| 50 | | 937 500 000 | 0.000 0 | |



**Tested by: Ki-Hong, Nam / Senior Engineer**



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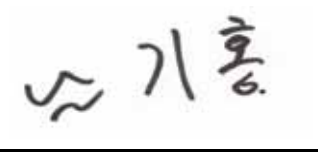
**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-765-8289, FAX: 82-31-766-2904)

**11.4.3 Test Result for frequency range 940 MHz ~ 941 MHz**

-. Test Date : March 14 ~ 15, 2012

-. Result : PASSED

| Temperature (˚C) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| -30 | 940 500 000 | 940 500 001 | 0.001 1 | Within the Authorized Frequency block |
| -20 | | 940 500 000 | 0.000 0 | |
| -10 | | 940 500 001 | 0.001 1 | |
| 0 | | 940 500 001 | 0.001 1 | |
| 10 | | 940 500 000 | 0.000 0 | |
| 20 | | 940 500 002 | 0.002 1 | |
| 30 | | 940 500 002 | 0.002 1 | |
| 40 | | 940 500 001 | 0.001 1 | |
| 50 | | 940 500 001 | 0.001 1 | |



**Tested by: Ki-Hong, Nam / Senior Engineer**



**HEAD OFFICE** : 301-14 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)
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# 12. FREQUENCY STABILITY WITH VOLTAGE VARIATION

## 12.1 Operating environment

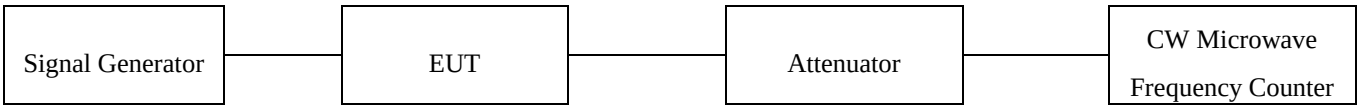
Temperature : (22 ~ 23) °C

Relative humidity : (49 ~ 50) % R.H.

## 12.2 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to CW Microwave Frequency Counter. The test was performed at Middle channel at each band using all applicable unmodulation.

The RF output port of the EUT was connected to the input of the spectrum analyzer. The signal generator was set to center frequency for each band with an un-modulated signal. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.




## 12.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. (Interval) |
|---|---|---|---|---|---|
| ☐ - | E4432B | HP | Signal Generator | US38440950 | June 10, 2011 (1Y) |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 01, 2012 (1Y) |
| ☐ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 15, 2011 (1Y) |
| ☐ - | 8564E | HP | Spectrum Analyzer | 3650A00756 | Jun. 10, 2011 (1Y) |
| ☐ - | FSV30 | R/S | Spectrum Analyzer | 101372 | Aug. 29, 2011 (1Y) |
| ■ - | 53152A | R/S | CW Microwave Frequency Counter | US39270295 | Dec. 30, 2011 (1Y) |
| ■ - | DH-60 | Dea Kwang Elec. | Slidacs | N/A | Sep 03, 2011 (1Y) |
| ■ - | 67-30-43 | Aeroflex Weinschel | Power Attenuator | CA5760 | Nov. 30, 2011 (1Y) |

All test equipment used is calibrated on a regular basis.



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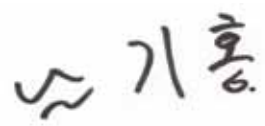
## 12.4 Test data

### 12.4.1 Test Result for frequency range 929 MHz ~ 930 MHz

-. Test Date : March 09 ~ 12, 2012

-. Result : PASSED

| Voltage (Vac) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| 138 (115 %) | 929 500 000 | 929 500 001 | 0.001 1 | Within the Authorized Frequency block |
| 120 (100 %) | | 929 500 000 | 0.000 0 | |
| 102 (85 %) | | 929 500 001 | 0.001 1 | |



**Tested by: Ki-Hong, Nam / Senior Engineer**



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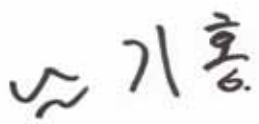
**12.4.2 Test Result for frequency range 935 MHz ~ 940 MHz**

-. Test Date : March 13 ~ 14, 2012

-. Result : PASSED

| Voltage (Vac) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| 138 (115 %) | 937 500 000 | 937 500 001 | 0.001 1 | Within the Authorized Frequency block |
| 120 (100 %) | | 937 500 000 | 0.000 0 | |
| 102 (85 %) | | 937 500 002 | 0.002 1 | |



**Tested by: Ki-Hong, Nam / Senior Engineer**



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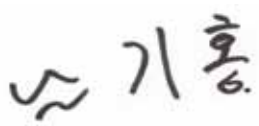
**12.4.2 Test Result for frequency range 940 MHz ~ 941 MHz**

-. Test Date : March 14 ~ 15, 2012

-. Result : PASSED

| Voltage (Vac) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| 138 (115 %) | 940 500 000 | 940 500 002 | 0.002 1 | Within the Authorized Frequency block |
| 120 (100 %) | | 940 500 002 | 0.002 1 | |
| 102 (85 %) | | 940 500 001 | 0.001 1 | |



**Tested by: Ki-Hong, Nam / Senior Engineer**



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# 13. MAXIMUM PERMISSIBLE EXPOSURE

## 13.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment is f/1500 mW/cm² or the frequency range between 300 MHz and 1500 MHz.

The electric field generated for a 1 mW/cm² exposure is calculated as follows:

$E = \sqrt{(30 * P * G)} / d$, and $S = E^2 / Z = E^2 / 377$, because 1 mW/cm² = 10 W/m²

Where

S = Power density in mW/cm², Z = Impedance of free space, 377 Ω

E = Electric filed strength in V/m, G = Numeric antenna gain, and d = distance in meter

Combing equations and rearranging the terms to express the distance as a function of the remaining variable

$d = \sqrt{(30 * P * G) / (377 * S)}$

Changing to units of mW and cm, using P (mW) = P (W) / 1 000, d (cm) = 100 * d (m)

$d = 0.282 * \sqrt{(P * G) / S}$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm²

## 13.2 Calculated MPE Safe Distance

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain | | Safe Distance | Power Density (mW/cm²) | FCC Limit |
|---|---|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | (cm) | @ 80 cm Separation | (mW/cm²) |
| 44.50 | 28 183.8 | 2.0 | 1.58 | 75.58 | 0.55 | 0.62 |

According to above table, safe distance, $D = 0.282 * \sqrt{28\ 183.8 * 1.58/0.62}$ = 75.58 cm.

For getting power density at 80 cm separation in above table, following formula was used.

$S = P * G / (4\pi * R^2) = 28\ 183.8 * 1.58 / (4 * 3.14 * 80\text{^}2) = 0.55$

Where:

S = Power Density,

P = Power input to the external antenna (Output power from the EUT antenna port (dBm) – cable loss (dB)),

G = Gain of Transmit Antenna (linear gain), R = Distance from Transmitting Antenna

Note: End users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance, because the applicant does not provide an antenna for sale with the EUT.



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