

# FCC Part 22H & 24E Measurement and Test Report

For

**Hyundai Corporation**

25, Yulgok-ro 2-Gil, Jongno-gu, Seoul, South Korea

**FCC ID: RQQHLT-FSL502**

**FCC Rules:** FCC Part 22H, FCC Part 24E

**Product Description:** Smart Phone

**Tested Model:** L502

**Report No.:** STR17118176I-1

**Sample Receipt Date:** 2017-11-15

**Tested Date:** 2017-11-16 to 2017-12-04

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

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## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment Under Test (EUT)

#### Client Information

Applicant: Hyundai Corporation  
Address of applicant: 25, Yulgok-ro 2-Gil, Jongno-gu, Seoul, South Korea

Manufacturer: Guizhou Fortuneship Technology Co., Ltd  
Address of manufacturer: 2nd Floor, Factory Building 4, Hi-Tech Industrial Park, Xinpu Economic Development Zone, Xinpu New District, Zunyi City, Guizhou Province, P. R. China

General Description of EUT:	
Product Name:	Smart Phone
Brand Name:	Hyundai
Model No.:	L502
Hardware version:	A885-MB-V0.5
Software version:	A885_05N_HYUNDAI_L502_V02_20171110_1840
Rated Voltage:	Battery:DC3.7V
Battery:	2600mAh
Power Adapter:	Model:ZHY-EU050100USB01 INPUT:100-240V~50/60Hz ,0.2A; OUTPUT:5V,1000mA
Device Category:	Portable Device
<i>The EUT Main board support GSM850/900/DCS1800/PCS1900, WCDMA Band 2/5, LTE Band 2/4/7 function. It is intended for speech, Multimedia Message Service (MMS) transmission. It is equipped with GPRS/EDGE class 12 for GSM850/900/DCS1800/PCS1900, GPS, FM, Bluetooth and Wi-Fi functions. For more information see the following datasheet</i>	
<i>Note: The test data is gathered from a production sample provided by the manufacturer.</i>	

<b>Technical Characteristics of EUT:</b>	
<b>2G</b>	
Support Networks:	GSM, GPRS, EDGE
Support Band:	GSM850/PCS1900
Uplink Frequency:	GSM/GPRS/EDGE 850: 824~849MHz GSM/GPRS/EDGE 1900: 1850~1910MHz
Downlink Frequency:	GSM/GPRS/EDGE 850: 869~894MHz GSM/GPRS/EDGE 1900: 1930~1990MHz
Max RF Output Power:	GSM850: 33.81dBm, GSM1900: 30.56dBm EDGE850: 28.20dBm, EDGE1900: 27.31dBm
Type of Emission:	GSM850: 249KGXW, GSM1900: 251KGXW EDGE850: 250KG7W, EDGE1900: 250KG7W
Type of Modulation:	GMSK, 8PSK
Type of Antenna:	Integral Antenna
Antenna Gain:	GSM850: 0.43dBi; GSM1900: 0.68dBi
GPRS/EDGE Class:	Class 12
<b>3G</b>	
Support Networks:	WCDMA, HSDPA, HSUPA
Support Band:	WCDMA Band 2, WCDMA Band 5
Uplink Frequency:	WCDMA Band 2: 1850~1910MHz WCDMA Band 5: 824~849MHz
Downlink Frequency:	WCDMA Band 2: 1930~1990MHz WCDMA Band 5: 869~894MHz
RF Output Power:	WCDMA Band 2: 22.83dBm, WCDMA Band 5: 23.46dBm
Type of Emission:	WCDMA Band 2: 4M24F9W WCDMA Band 5: 4M23F9W
Type of Modulation:	BPSK
Antenna Type:	Integral Antenna
Antenna Gain:	WCDMA Band 2: 0.75dBi, WCDMA Band 5: 0.45dBi

## 1.2 Test Standards

The following report is prepared on behalf of the Hyundai Corporation in accordance with FCC Part 2 subpart J, FCC Part 22 subpart H and FCC Part 24 subpart E of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 2 subpart J, FCC Part 22 subpart H and FCC Part 24 subpart E of the Federal Communication Commissions rules.

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

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI/TIA-603-D: 2010 and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 971168 D01 Power Meas License Digital Systems v02r02 shall be performed also.

## 1.4 Test Facility

### **FCC – Registration No.: 125990**

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

### **Industry Canada (IC) Registration No.: 11464A**

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

## 1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

<b>Test Mode List</b>		
Test Mode	Description	Remark
TM1	GSM 850	Low, Middle, High Channels
TM2	GPRS 850	Low, Middle, High Channels
TM3	EDGE 850	Low, Middle, High Channels
TM4	GSM 1900	Low, Middle, High Channels
TM5	GPRS 1900	Low, Middle, High Channels
TM6	EDGE 1900	Low, Middle, High Channels
TM7	WCDMA Band 5	Low, Middle, High Channels
TM8	HSDPA Band 5	Low, Middle, High Channels
TM9	HSUPA Band 5	Low, Middle, High Channels
TM10	WCDMA Band 2	Low, Middle, High Channels
TM11	HSDPA Band 2	Low, Middle, High Channels
TM12	HSUPA Band 2	Low, Middle, High Channels

Testing Configure			
Support Band	Support Standard	Channel Frequency	Channel Number
GSM 850	GSM/GPRS/EDGE	824.2 MHz	128
		836.6 MHz	190
		848.8 MHz	251
PCS 1900	GSM/GPRS/EDGE	1850.2 MHz	512
		1880.0 MHz	661
		1909.8 MHz	810
WCDMA Band 5	WCDMA/HSDPA/HSUPA	826.4 MHz	4132
		836.6 MHz	4183
		846.6 MHz	4233
WCDMA Band 2	WCDMA/HSDPA/HSUPA	1852.4 MHz	9262
		1880.0 MHz	9400
		1907.6 MHz	9538

Note: the transmitter has been tested on the communications mode of GSM, GPRS, EDGE, WCDMA, HSDPA, HSUPA compliance test and record the worst case.

EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
USB Cable	1.2	Unshielded	Without Core
Earphone Cable	1.2	Unshielded	Without Core

Auxiliary Equipment List and Details

Description	Manufacturer	Model	Serial Number
/	/	/	/

Special Cable List and Details

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

## 1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Frequency Stability	Conducted	2.3%
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$
Transmitter Spurious Emissions	Conducted	$\pm 0.42\text{dB}$

## 1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
SEMT-1075	Communication Tester	Rohde & Schwarz	CMW500	148650	2017-06-12	2018-06-11
SEMT-1034	GSM Tester	Rohde & Schwarz	CMU200	104036	2017-06-12	2018-06-11
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1079	Spectrum Analyzer	Agilent	N9020A	US47140102	2017-06-12	2018-06-11
SEMT-1080	Signal Generator	Agilent	83752A	3610A01453	2017-06-12	2018-06-11
SEMT-1081	Vector Signal Generator	Agilent	N5182A	MY47070202	2017-06-12	2018-06-11
SEMT-1028	Power Divider	Weinschel	1506A	PM204	2017-06-12	2018-06-11
SEMT-1082	Power Divider	RF-Lambda	RFLT4W5M18G	14110400027	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2018-06-07
SEMT-1068	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2018-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2018-06-07
SEMT-1121	Horn Antenna	ETS	3116B	00088203	2017-06-08	2018-06-07
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2017-08-15	2018-08-14
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2017-08-15	2018-08-14
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2017-06-12	2018-06-11
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2017-03-09	2018-03-08



## 2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 1.1307, § 2.1093	RF Exposure	Compliant
§ 22.913 (a), § 24.232 (c)	RF Output Power	Compliant
§ 24.51	Peak-to-average Ratio (PAR) of Transmitter	Compliant
§ 22.917 (b), § 24.238 (b)	Emission Bandwidth	Compliant
§ 22.917 (a), § 24.238 (a)	Spurious Emissions at Antenna Terminal	Compliant
§ 22.917 (a), § 24.238 (a)	Spurious Radiation Emissions	Compliant
§ 22.917 (a), § 24.238 (a)	Out of Band Emissions	Compliant
§ 22.355, § 24.235	Frequency Stability	Compliant

### **3. RF Exposure**

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#### **3.1 Standard Applicable**

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

#### **3.2 Test Result**

This product complied with the requirement of the RF exposure, please see the SAR report.

## 4. RF Output Power

### 4.1 Standard Applicable

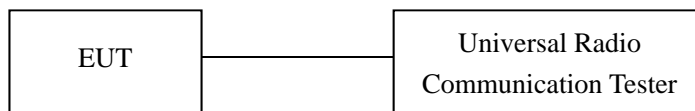
According to §22.913(a)(2), The ERP of mobile and portable stations transmitters and auxiliary test transmitters must not exceed 7 Watts.

According to §24.232 (c), Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

According to §27.50(d)(4), Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

### 4.2 Test Procedure

Conducted output power test method:



Radiated power test method:

- 1.The setup of EUT is according with per ANSI/TIA Standard 603D and ANSI C63.4-2014 measurement procedure.
2. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.
3. The frequency range up to tenth harmonic of the fundamental frequency was investigated.
4. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

### 4.3 Environmental Conditions

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

#### 4.4 Summary of Test Results/Plots

##### Max. Radiated Power

##### ERP For GSM Mode GSM850

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
824.2	29.75	1.5	0	H	1.5	0	28.25	38.45
824.2	29.37	1.5	0	V	1.5	0	27.87	38.45
Middle Channel								
836.4	29.70	1.5	0	H	1.5	0	28.20	38.45
836.4	29.28	1.5	0	V	1.5	0	27.78	38.45
High Channel								
848.8	29.82	1.5	0	H	1.5	0	28.32	38.45
848.8	29.42	1.5	0	V	1.5	0	27.92	38.45

##### EIRP For GSM Mode PCS1900

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 24E Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
1850.2	21.77	1.5	0	H	1.9	7.7	27.57	33.00
1850.2	21.53	1.5	0	V	1.9	7.7	27.33	33.00
Middle Channel								
1880.0	21.86	1.5	0	H	1.9	7.7	27.66	33.00
1880.0	21.45	1.5	0	V	1.9	7.7	27.25	33.00
High Channel								
1909.8	21.66	1.5	0	H	1.9	7.7	27.46	33.00
1909.8	21.72	1.5	0	V	1.9	7.7	27.52	33.00

## ERP For GPRS Mode GSM850

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
824.2	28.74	1.5	0	H	1.5	0	27.24	38.45
824.2	29.41	1.5	0	V	1.5	0	27.91	38.45
Middle Channel								
836.4	28.76	1.5	0	H	1.5	0	27.26	38.45
836.4	29.43	1.5	0	V	1.5	0	27.93	38.45
High Channel								
848.8	28.65	1.5	0	H	1.5	0	27.15	38.45
848.8	29.16	1.5	0	V	1.5	0	27.66	38.45

## EIRP For GPRS Mode PCS1900

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 24E Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
1850.2	21.01	1.5	0	H	1.9	7.7	26.81	33.00
1850.2	21.79	1.5	0	V	1.9	7.7	27.59	33.00
Middle Channel								
1880.0	21.10	1.5	0	H	1.9	7.7	26.90	33.00
1880.0	21.78	1.5	0	V	1.9	7.7	27.58	33.00
High Channel								
1909.8	20.99	1.5	0	H	1.9	7.7	26.79	33.00
1909.8	21.95	1.5	0	V	1.9	7.7	27.75	33.00

## ERP For EDGE Mode GSM850

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
824.2	28.11	1.5	0	H	1.5	0	26.61	38.45
824.2	29.14	1.5	0	V	1.5	0	27.64	38.45
Middle Channel								
836.4	28.18	1.5	0	H	1.5	0	26.68	38.45
836.4	29.26	1.5	0	V	1.5	0	27.76	38.45
High Channel								
848.8	28.17	1.5	0	H	1.5	0	26.67	38.45
848.8	29.26	1.5	0	V	1.5	0	27.76	38.45

## EIRP For EDGE Mode PCS1900

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 24E Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
1850.2	18.75	1.5	0	H	1.9	7.7	24.55	33.00
1850.2	19.09	1.5	0	V	1.9	7.7	24.89	33.00
Middle Channel								
1880.0	18.89	1.5	0	H	1.9	7.7	24.69	33.00
1880.0	19.02	1.5	0	V	1.9	7.7	24.82	33.00
High Channel								
1909.8	18.90	1.5	0	H	1.9	7.7	24.70	33.00
1909.8	19.10	1.5	0	V	1.9	7.7	24.90	33.00

## ERP For WCDMA Mode Band 5

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dBd	dBm	dBm
Low Channel								
826.4	23.03	1.5	0	H	1.5	0	21.53	38.45
826.4	21.19	1.5	0	V	1.5	0	19.69	38.45
Middle Channel								
836.6	23.28	1.5	0	H	1.5	0	21.78	38.45
836.6	21.24	1.5	0	V	1.5	0	19.74	38.45
High Channel								
846.6	23.02	1.5	0	H	1.5	0	21.52	38.45
846.6	21.24	1.5	0	V	1.5	0	19.74	38.45

## ERP For HSDPA Mode Band 5

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dBd	dBm	dBm
Low Channel								
826.4	22.21	1.5	0	H	1.5	0	20.71	38.45
826.4	20.52	1.5	0	V	1.5	0	19.02	38.45
Middle Channel								
836.6	22.20	1.5	0	H	1.5	0	20.70	38.45
836.6	20.56	1.5	0	V	1.5	0	19.06	38.45
High Channel								
846.6	22.25	1.5	0	H	1.5	0	20.75	38.45
846.6	20.65	1.5	0	V	1.5	0	19.15	38.45

## ERP For HSUPA Mode Band 5

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dBd	dBm	dBm
Low Channel								
826.4	22.11	1.5	0	H	1.5	0	20.61	38.45
826.4	20.37	1.5	0	V	1.5	0	18.87	38.45
Middle Channel								
836.6	22.02	1.5	0	H	1.5	0	20.52	38.45
836.6	20.35	1.5	0	V	1.5	0	18.85	38.45
High Channel								
846.6	22.10	1.5	0	H	1.5	0	20.60	38.45
846.6	20.29	1.5	0	V	1.5	0	18.79	38.45

## EIRP For WCDMA Mode Band 2

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 24E Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
1852.4	14.45	1.5	0	H	1.9	7.7	20.25	33
1852.4	15.84	1.5	0	V	1.9	7.7	21.64	33
Middle Channel								
1880.0	16.28	1.5	0	H	1.9	7.7	22.08	33
1880.0	15.12	1.5	0	V	1.9	7.7	20.92	33
High Channel								
1907.6	15.75	1.5	0	H	1.9	7.7	21.55	33
1907.6	14.69	1.5	0	V	1.9	7.7	20.49	33



## EIRP For HSDPA Mode Band 2

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 24E Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
1852.4	13.85	1.5	0	H	1.9	7.7	19.65	33
1852.4	11.99	1.5	0	V	1.9	7.7	17.79	33
Middle Channel								
1880.0	12.68	1.5	0	H	1.9	7.7	18.48	33
1880.0	11.18	1.5	0	V	1.9	7.7	16.98	33
High Channel								
1907.6	11.87	1.5	0	H	1.9	7.7	17.67	33
1907.6	11.46	1.5	0	V	1.9	7.7	17.26	33

## EIRP For HSUPA Mode Band 2

Frequency	Substitute SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 24E Limit
MHz	DBm	Meter	Degree	H / V	dB	dB	DBm	dBm
Low Channel								
1852.4	12.99	1.5	0	H	1.9	7.7	18.79	33
1852.4	11.88	1.5	0	V	1.9	7.7	17.68	33
Middle Channel								
1880.0	13.38	1.5	0	H	1.9	7.7	19.18	33
1880.0	12.32	1.5	0	V	1.9	7.7	18.12	33
High Channel								
1907.6	12.95	1.5	0	H	1.9	7.7	18.75	33
1907.6	13.39	1.5	0	V	1.9	7.7	19.19	33

## 5. Peak-to-average Ratio (PAR) of Transmitter

### 5.1 Standard Applicable

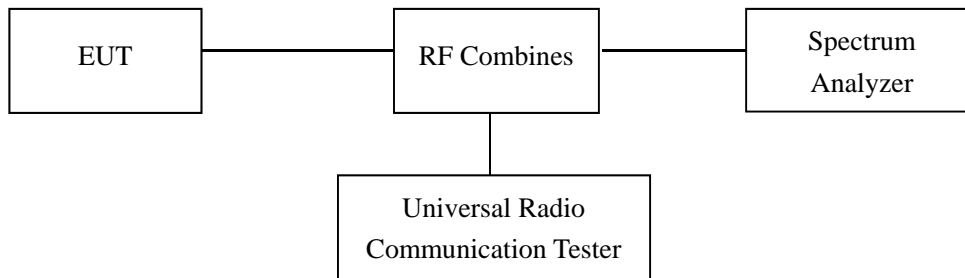
According to §24.232(d), Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

According to §27.50(B), the peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

### 5.2 Test Procedure

The RF output terminal of the transmitter was connected to the input of the spectrum analyzer via a suitable attenuation. The RBW of the spectrum analyzer was set to 30kHz and the peak-to-average ratio (PAR) of the transmission was recorded. Record the maximum PAPR level associated with a probability of 0.1%.

Test Configuration for the emission bandwidth testing:



### 5.3 Environmental Conditions

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

## 5.4 Summary of Test Results

Only the worst case was selected to record

For PCS Band

Test Mode	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)
GSM	512	1850.2	7.00	13
GPRS(1 Slot)	512	1850.2	7.54	13
EDGE(1 Slot)	512	1850.2	7.68	13

For WCDMA Band 2

Test Mode	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)
WCDMA	9400	1880	8.80	13
HSDPA	9400	1880	5.57	13
HSUPA	9400	1880	11.33	13

## 6. Emission Bandwidth

### 6.1 Standard Applicable

According to §22.917(b), The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

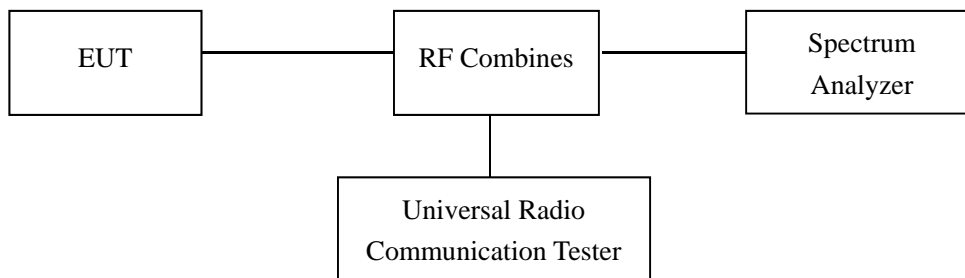
According to §24.238(b), The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

According to §27.53, The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

### 6.2 Test Procedure

The RF output terminal of the transmitter was connected to the input of the spectrum analyzer via a suitable attenuation. The RBW of the spectrum analyzer was set to 10kHz for GSM mode and 100kHz for WCDMA mode, VBW shall be at least 3 times the RBW, and the 26dB bandwidth was recorded.

Test Configuration for the emission bandwidth testing:



### 6.3 Environmental Conditions

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

## 6.4 Summary of Test Results/Plots

For Cellular Band

Test Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (kHz)	26 dB Emission Bandwidth (kHz)
GSM	128	824.2	248.0522	323.302
	190	836.6	242.9482	321.913
	251	848.8	246.0272	322.671
GPRS	128	824.2	246.9122	321.626
	190	836.6	249.3468	319.807
	251	848.8	243.8826	321.851
EDGE	128	824.2	246.1724	313.732
	190	836.6	246.9678	323.733
	251	848.8	250.2884	320.043

For PCS Band

Test Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (kHz)	26 dB Emission Bandwidth (kHz)
GSM	512	1850.2	250.9217	325.571
	661	1880.0	248.5836	321.407
	810	1909.8	250.6206	320.319
GPRS	512	1850.2	247.5938	320.510
	661	1880.0	248.5519	318.970
	810	1909.8	249.9116	323.637
EDGE	512	1850.2	248.2865	328.386
	661	1880.0	247.5697	320.594
	810	1909.8	249.8817	319.653

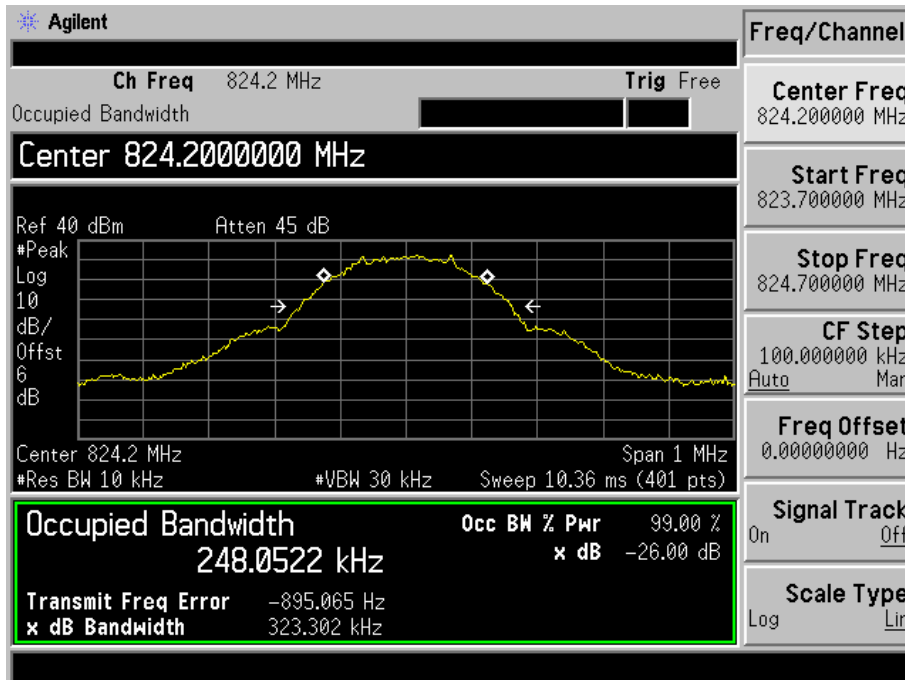
## For Band 5

Test Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	26 dB Emission Bandwidth (MHz)
WCDMA	4132	826.4	4.2226	4.868
	4183	836.6	4.2233	4.909
	4233	846.6	4.2368	4.983
HSDPA	4132	826.4	4.2155	4.883
	4183	836.6	4.2240	4.858
	4233	846.6	4.2414	4.936
HSUPA	4132	826.4	4.2159	4.885
	4183	836.6	4.1531	4.706
	4233	846.6	4.1644	4.738

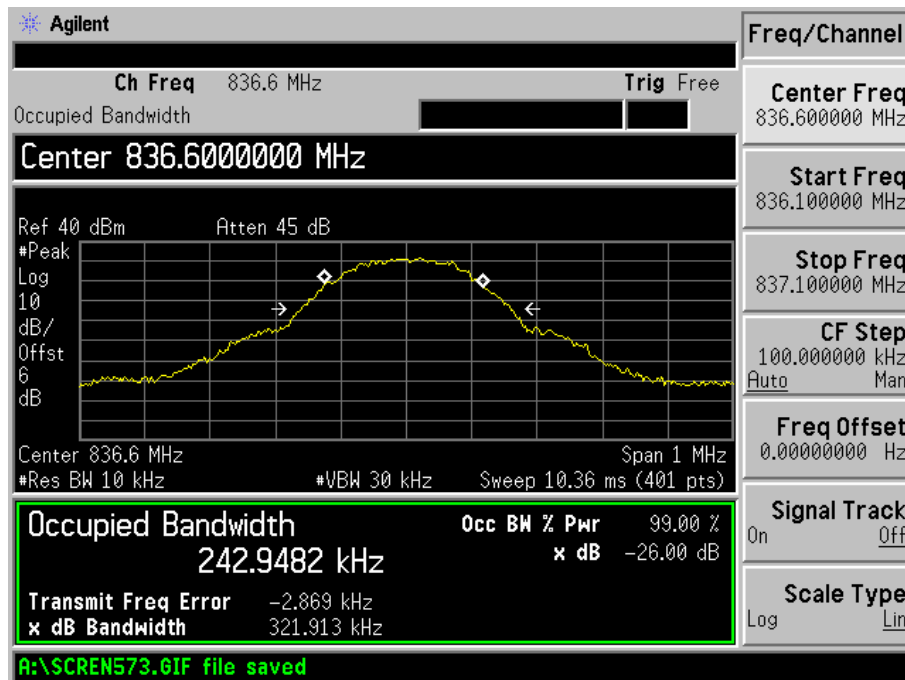
## For Band 2

Test Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	26 dB Emission Bandwidth (MHz)
WCDMA	9262	1852.4	4.2065	4.903
	9400	1880.0	4.2214	4.845
	9538	1907.6	4.2203	4.895
HSDPA	9262	1852.4	4.2071	4.862
	9400	1880.0	4.2096	4.803
	9538	1907.6	4.2252	4.834
HSUPA	9262	1852.4	4.1999	4.842
	9400	1880.0	4.2114	4.875
	9538	1907.6	4.2178	4.872

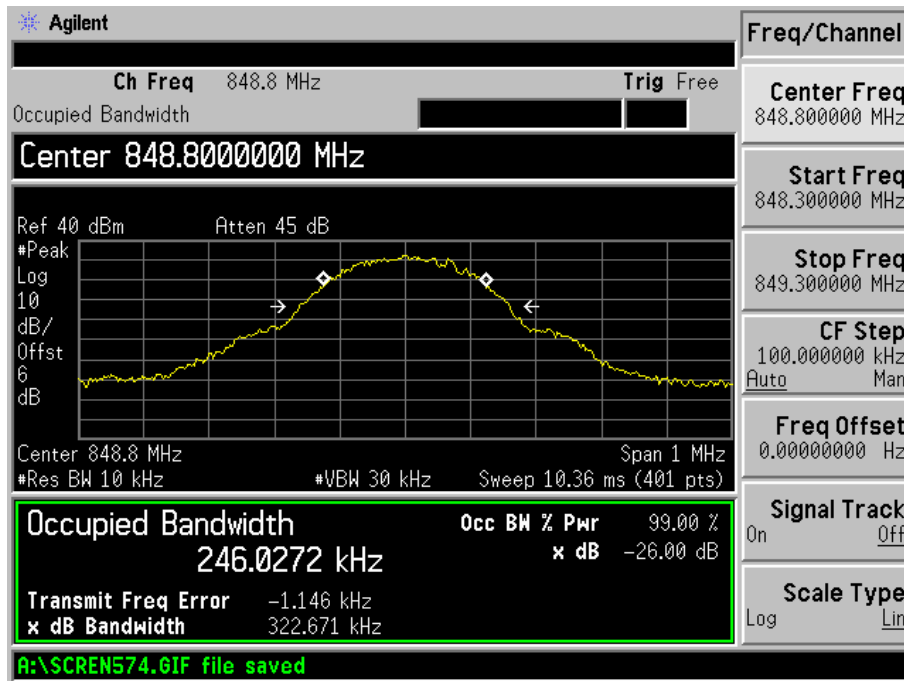
For Cellular Band  
GSM Low Channel



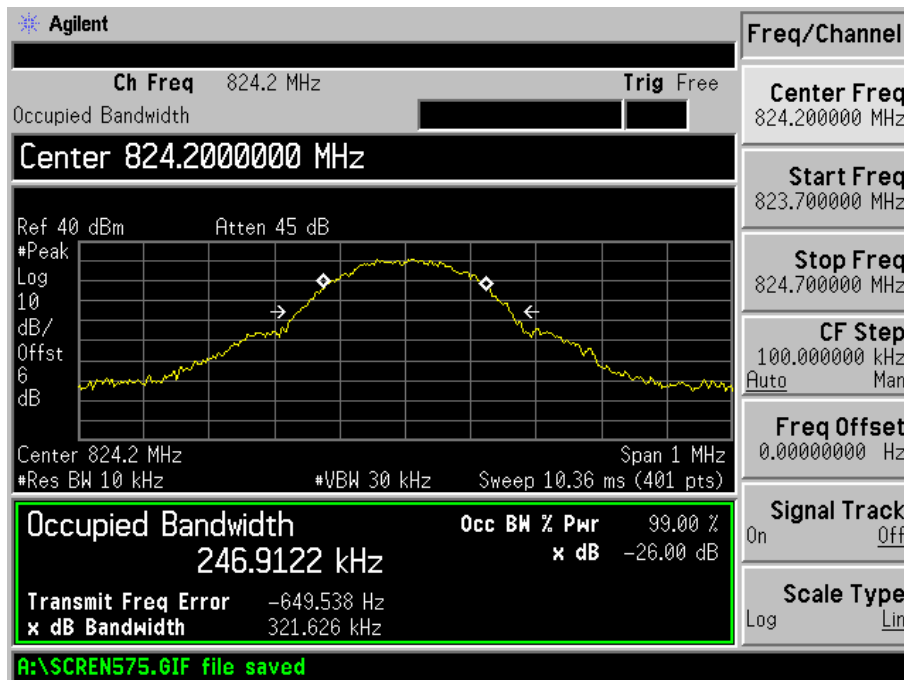
GSM Middle Channel



GSM High channel



GPRS Low Channel

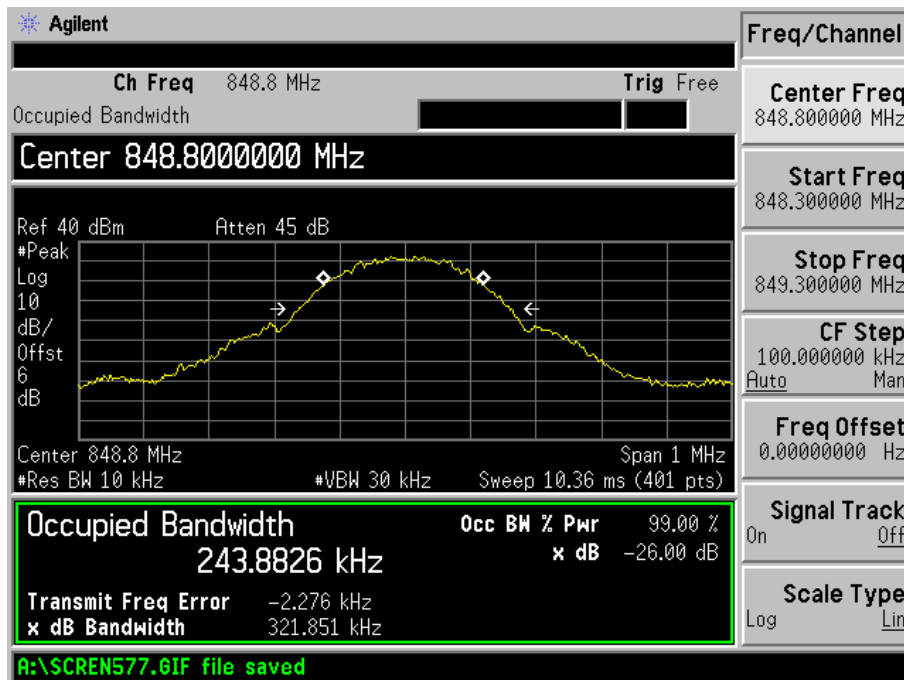




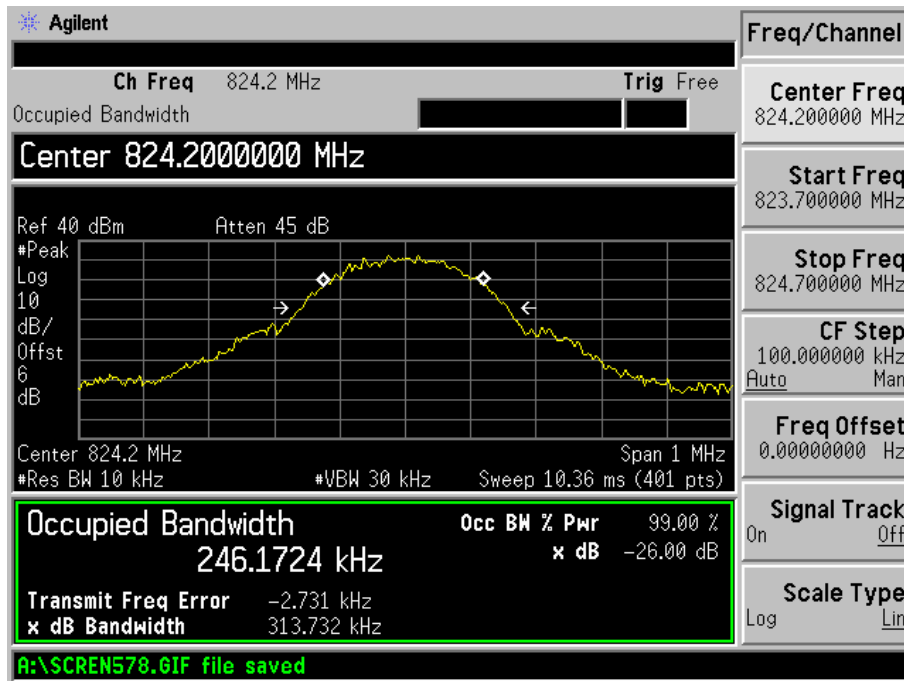
GPRS Middle Channel



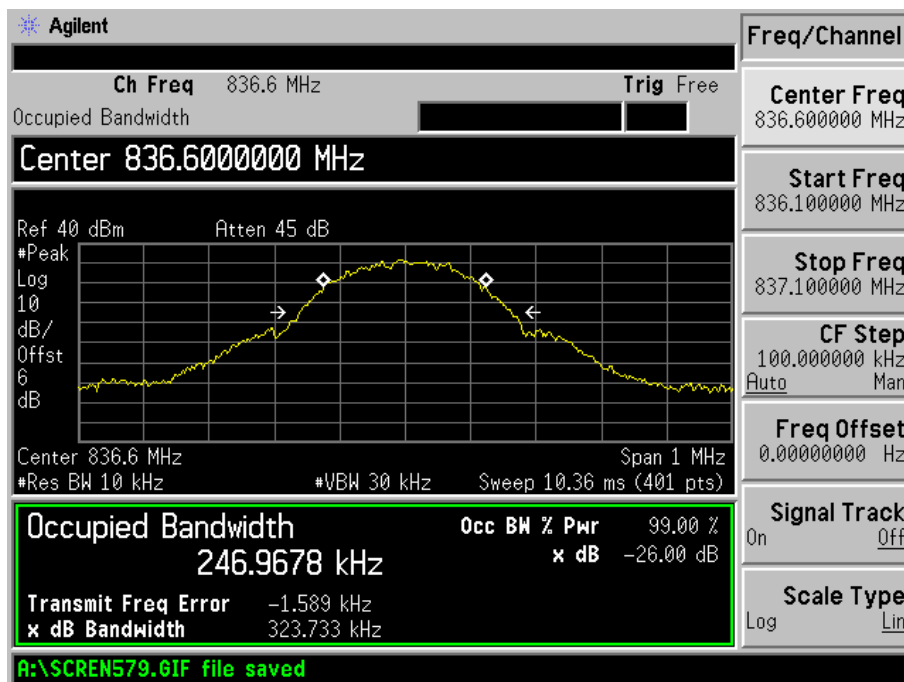
GPRS High Channel



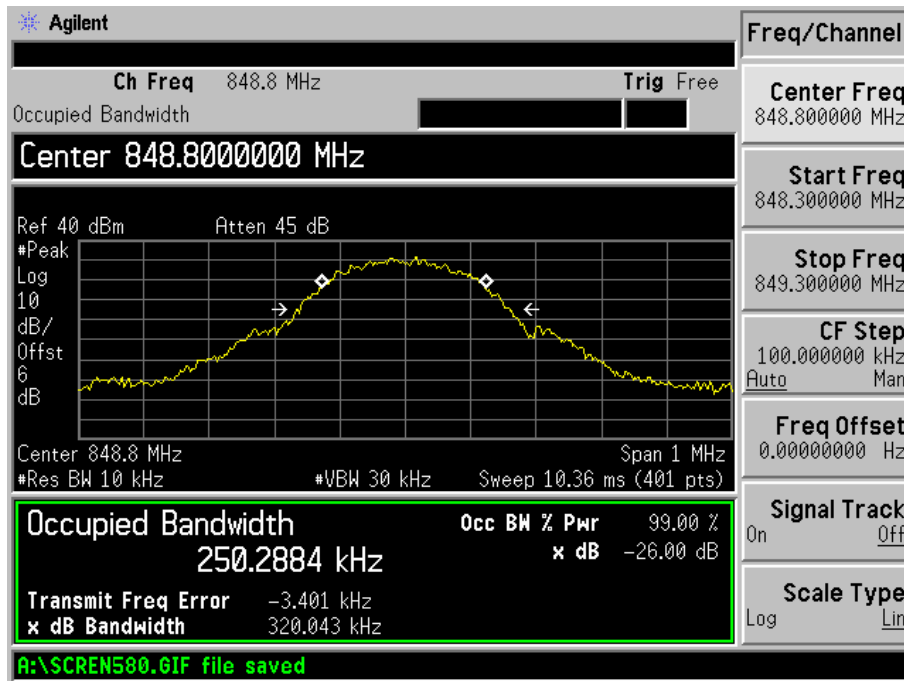
EDGE Low Channel



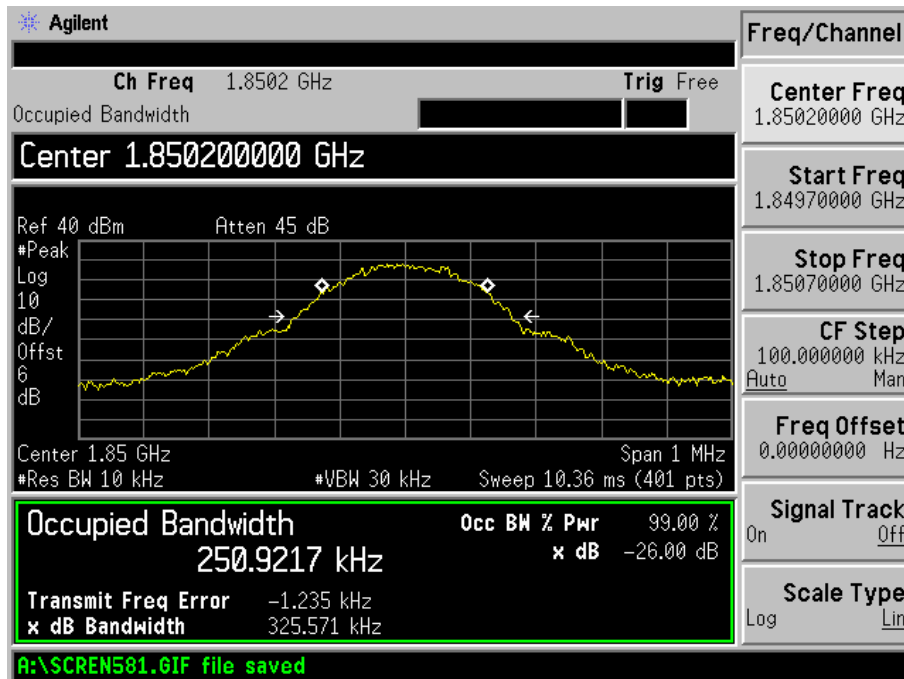
EDGE Middle Channel



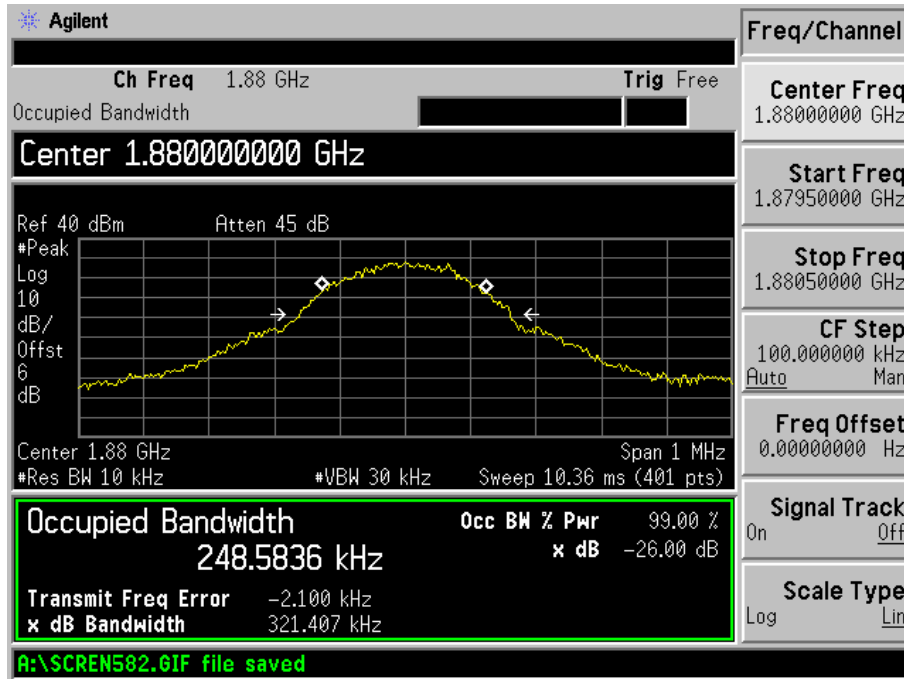
EDGE High Channel



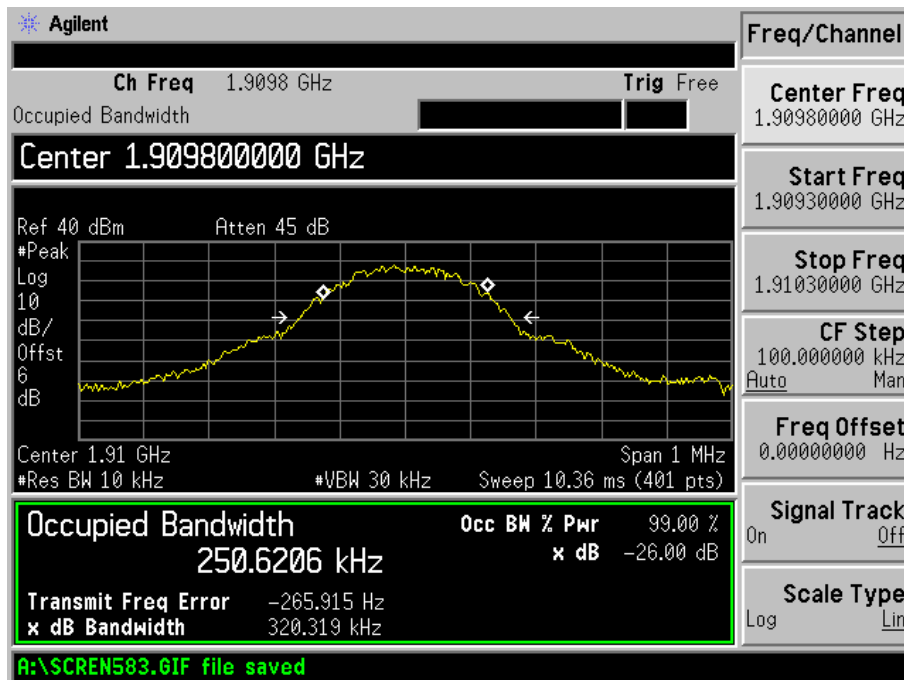
For PCS Band  
GSM Low Channel



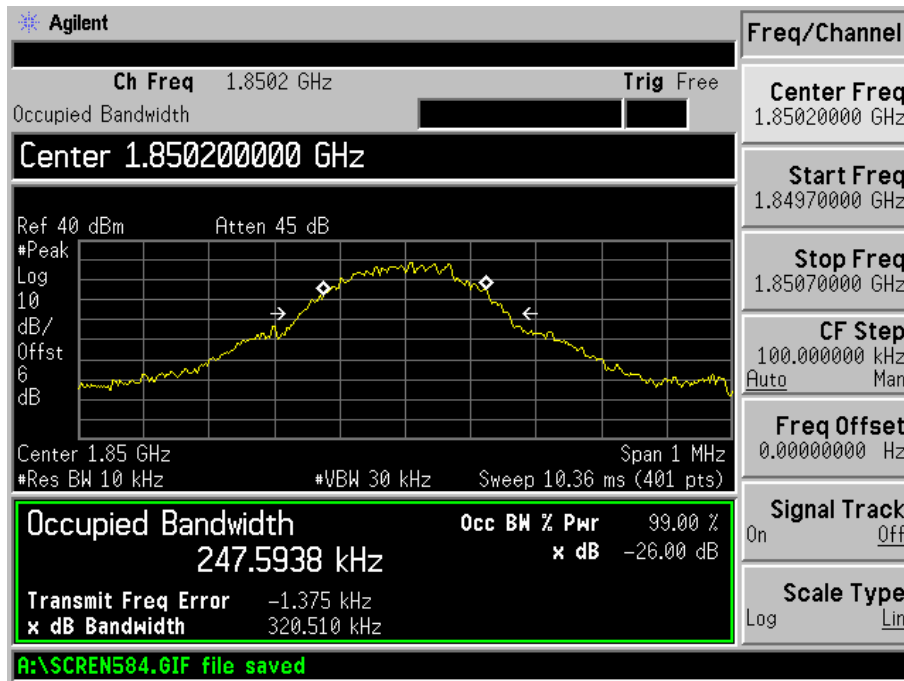
GSM Middle Channel



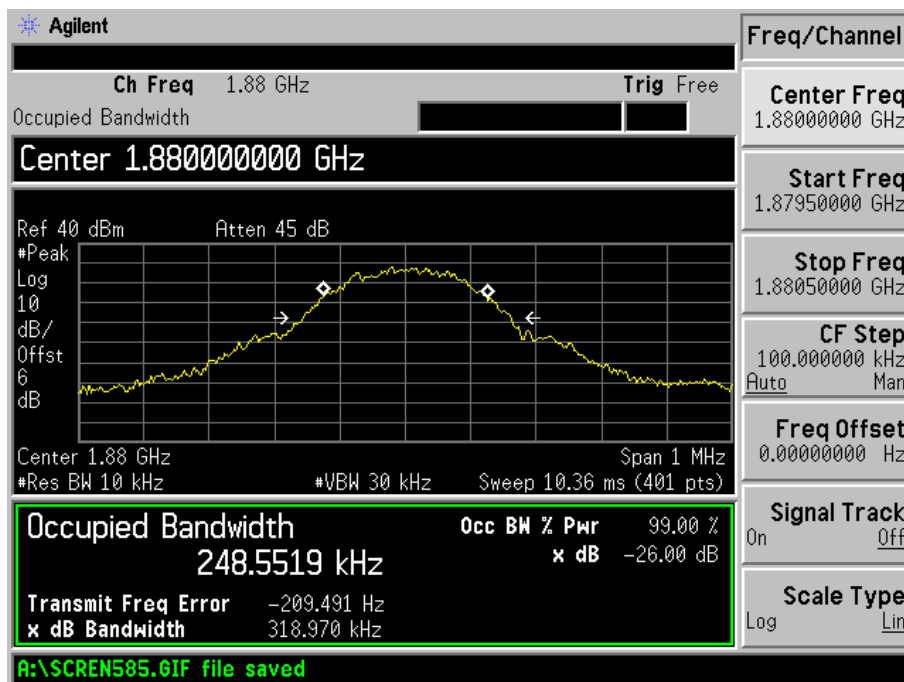
GSM High channel



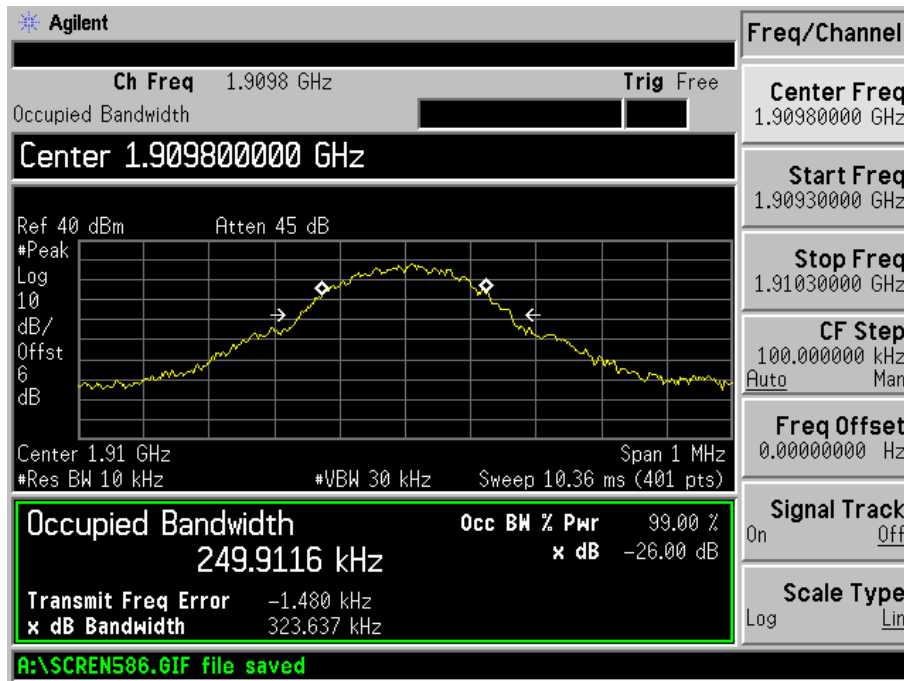
GPRS Low Channel



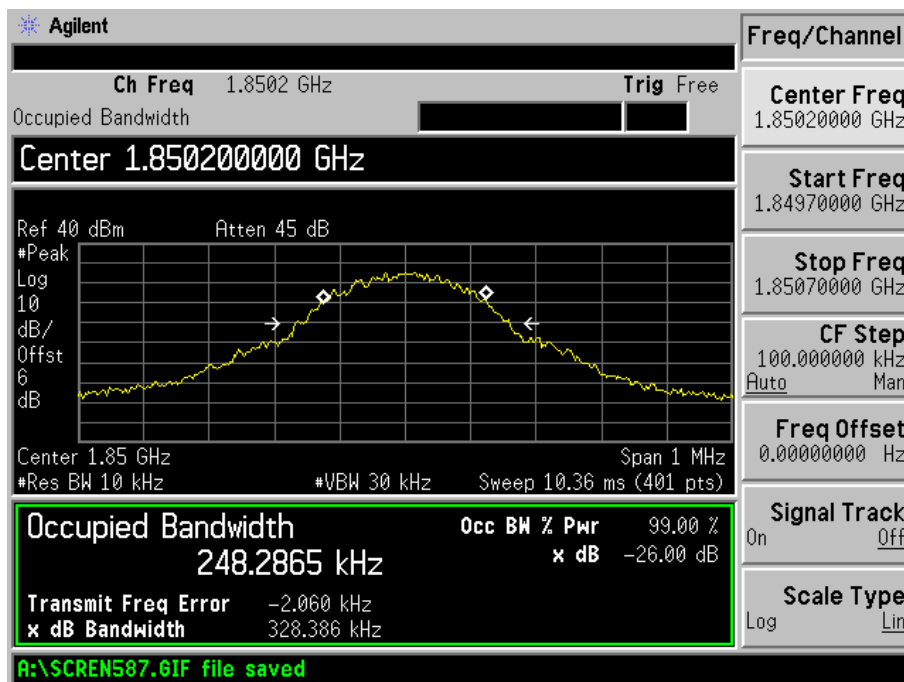
GPRS Middle Channel



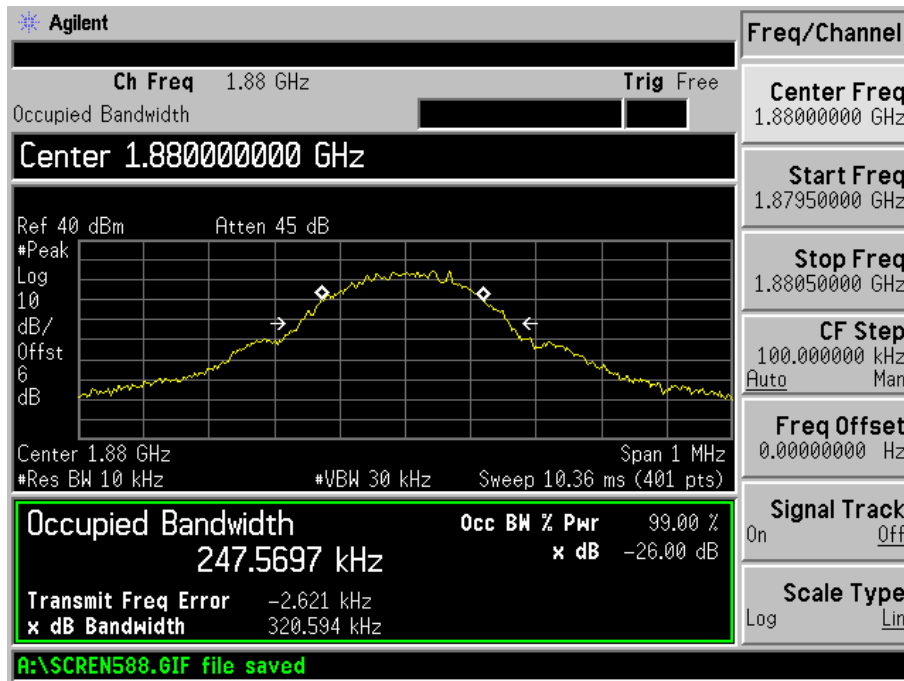
GPRS High Channel



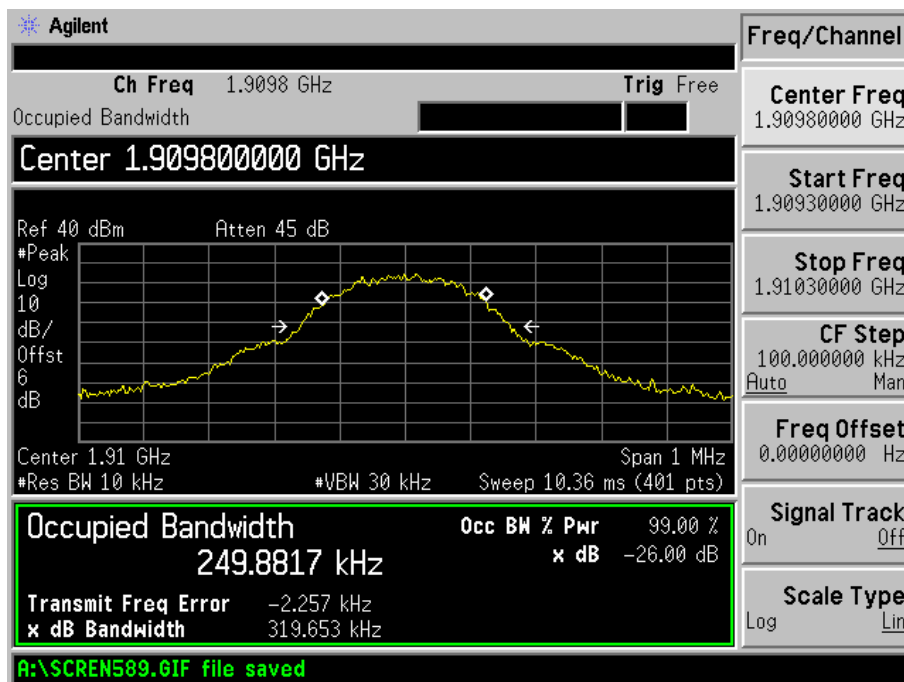
EDGE Low Channel



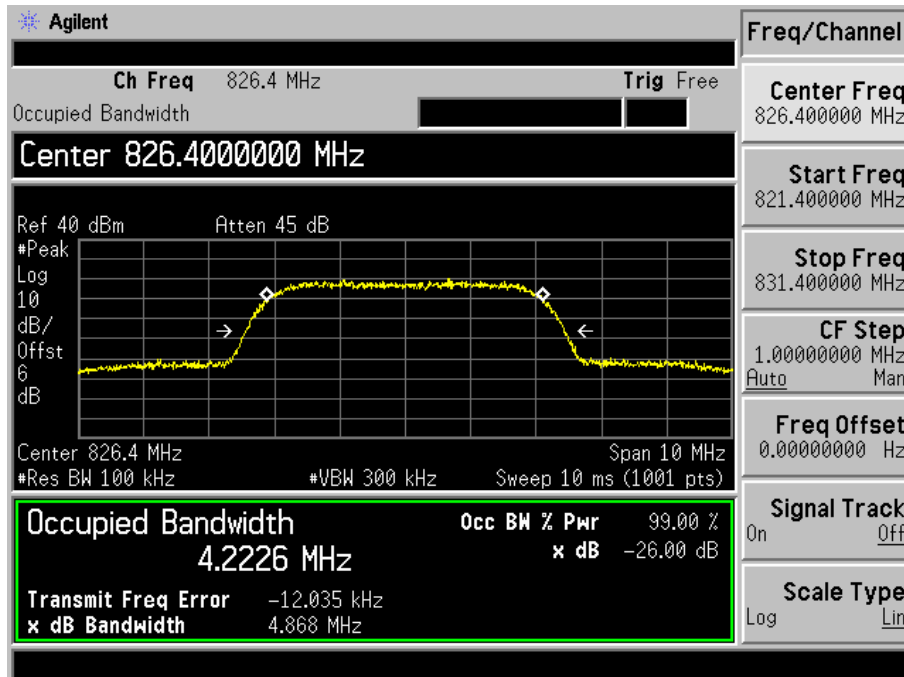
EDGE Middle Channel



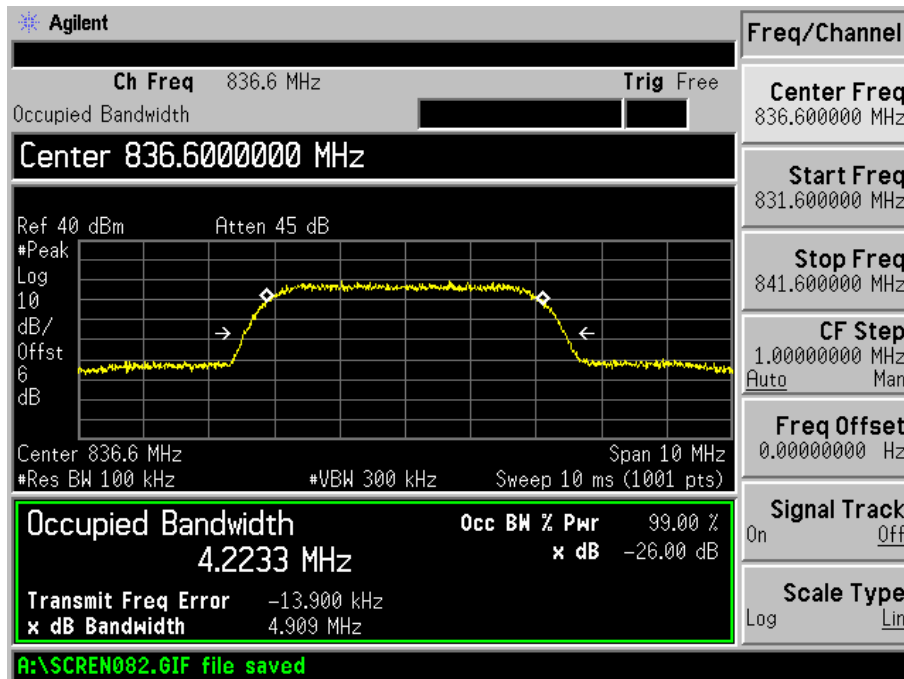
EDGE High Channel



For Band V  
WCDMA Low Channel

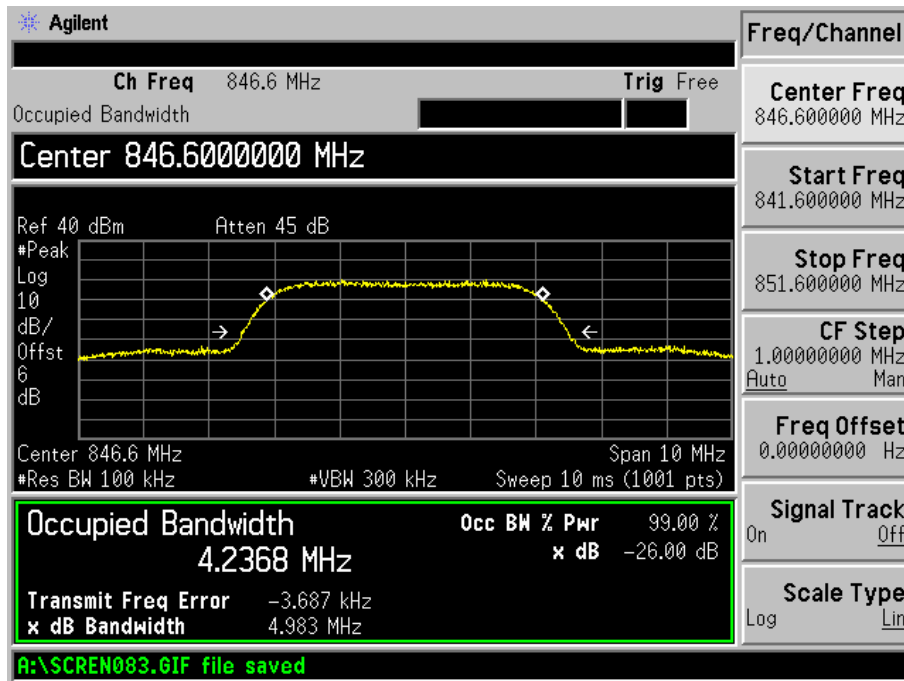


WCDMA Middle Channel

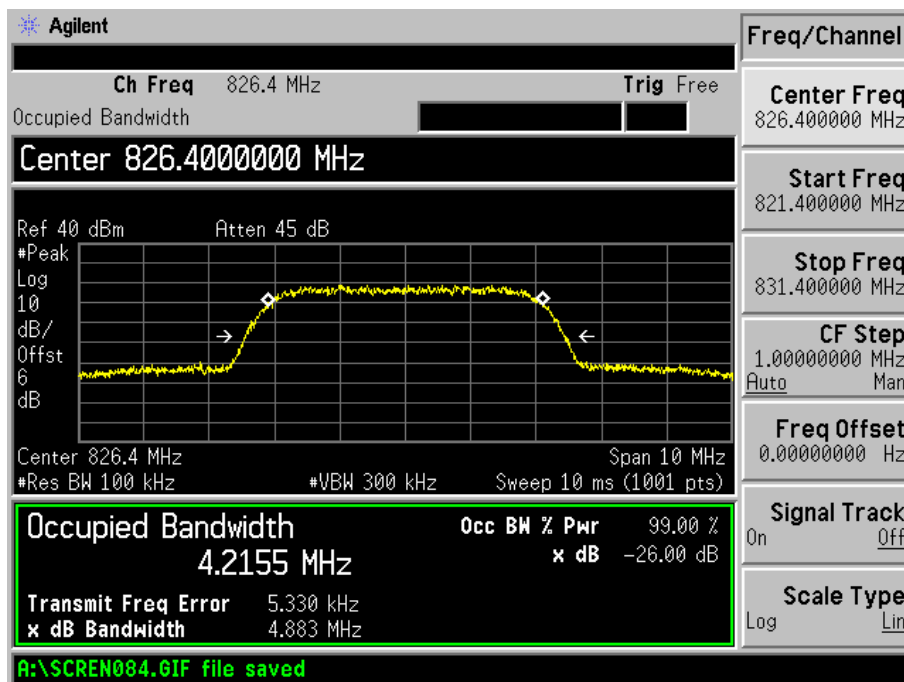




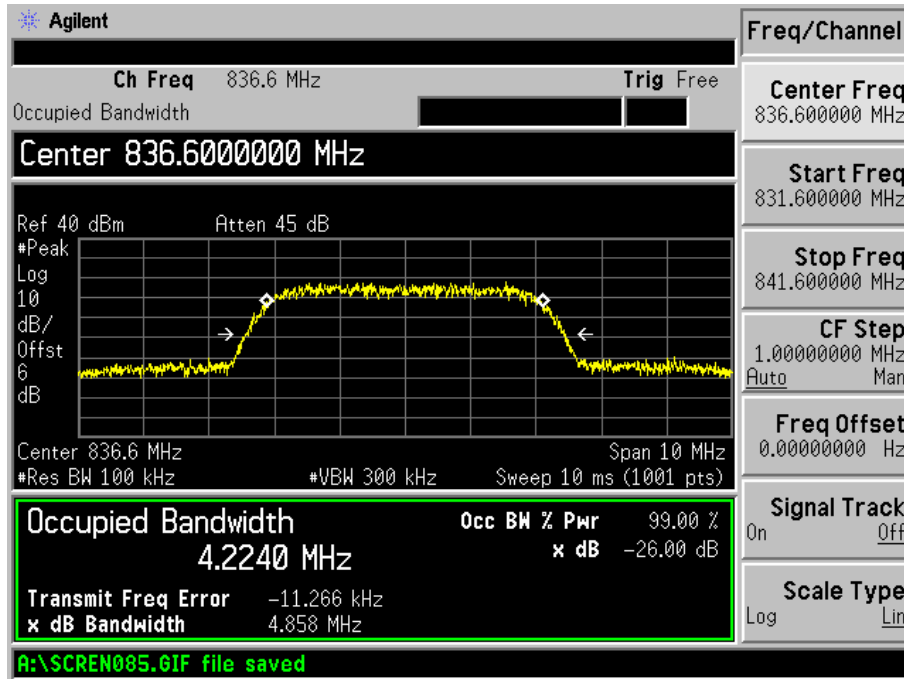
WCDMA High Channel



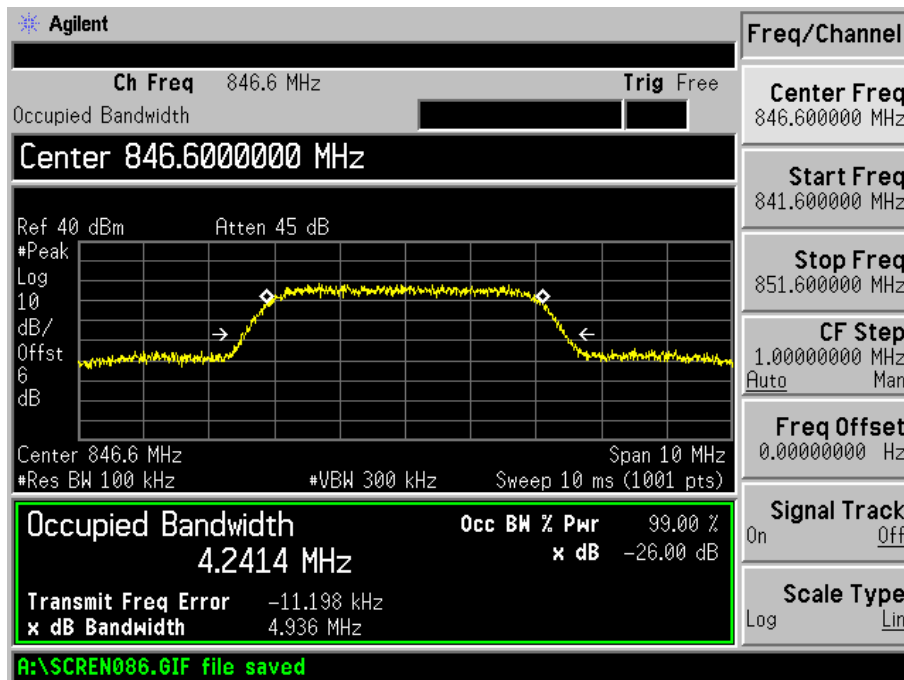
HSDPA Low Channel



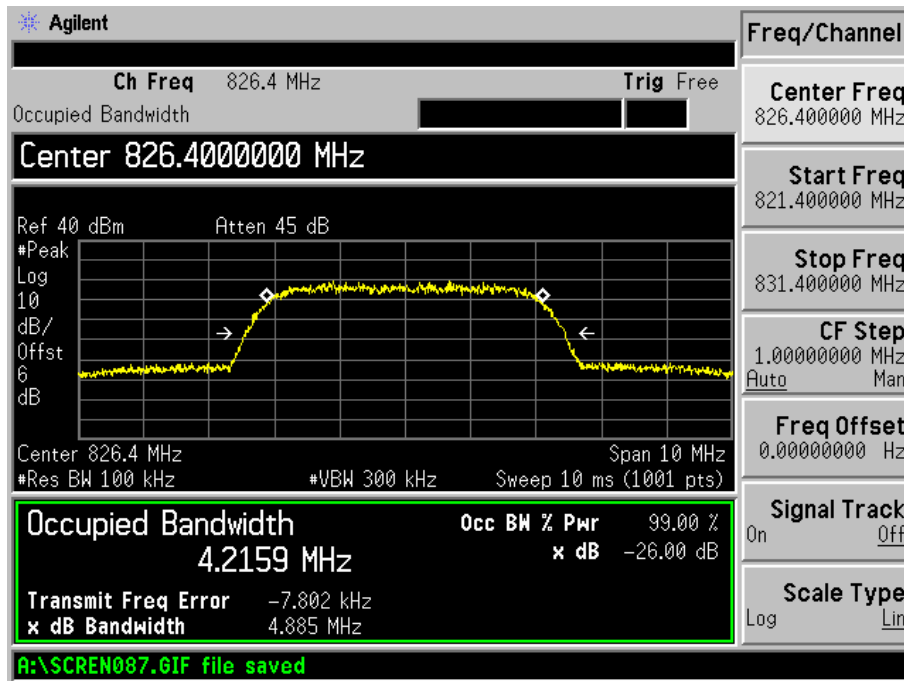
HSDPA Middle Channel



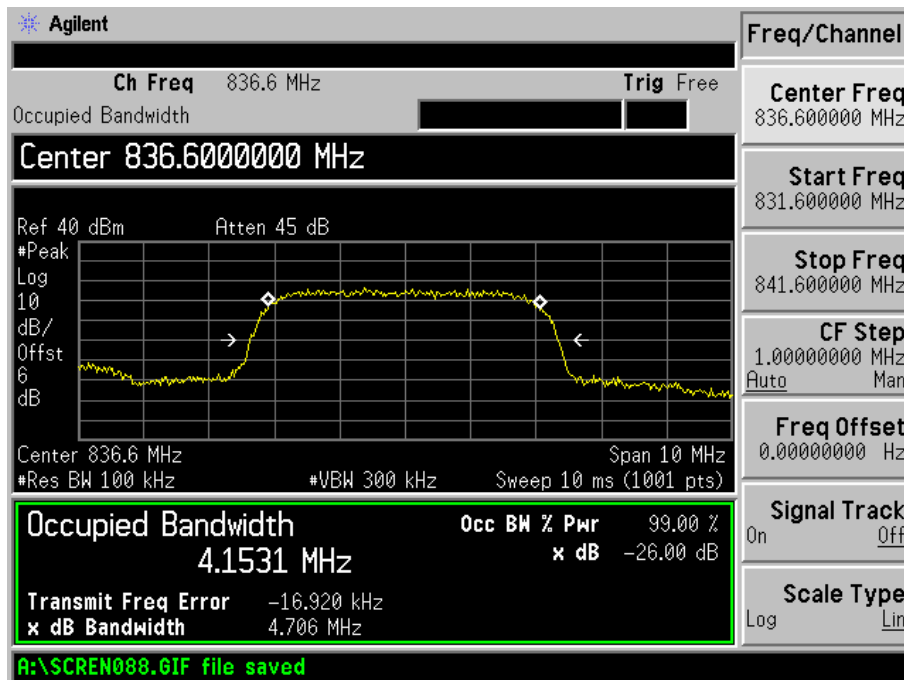
HSDPA High Channel



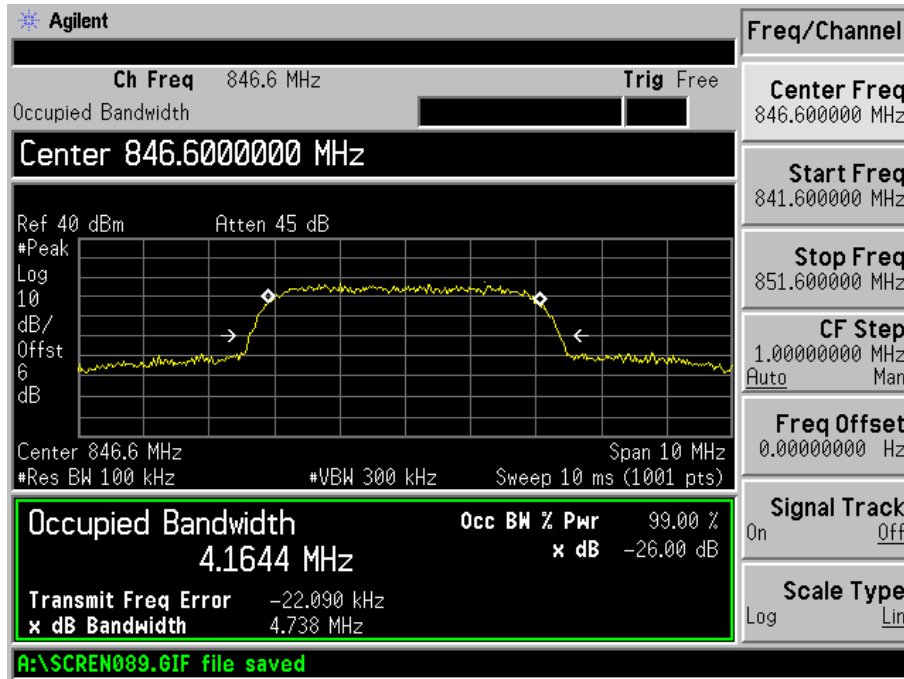
HSUPA Low Channel



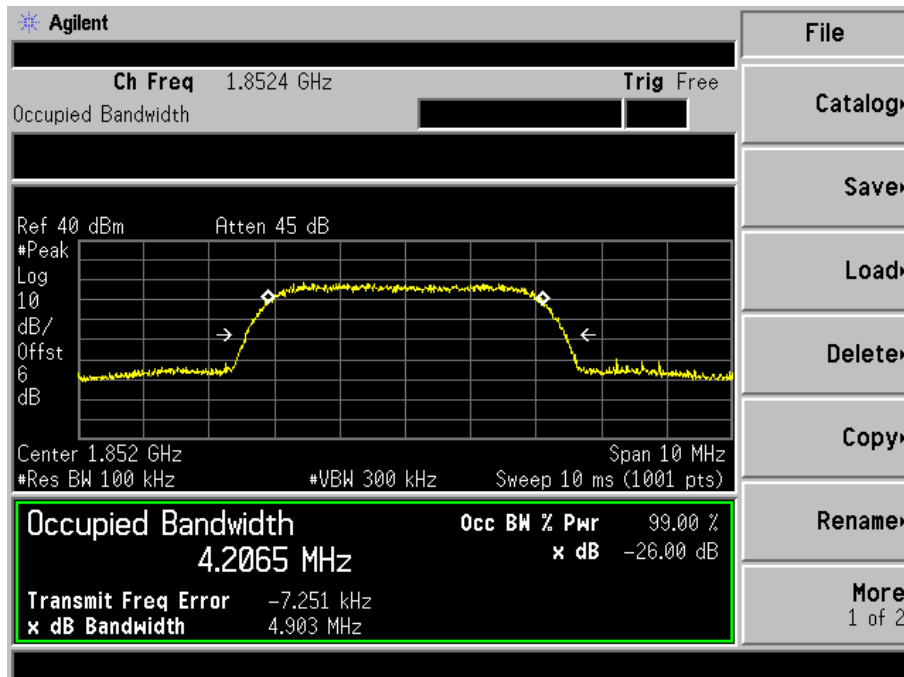
HSUPA Middle Channel



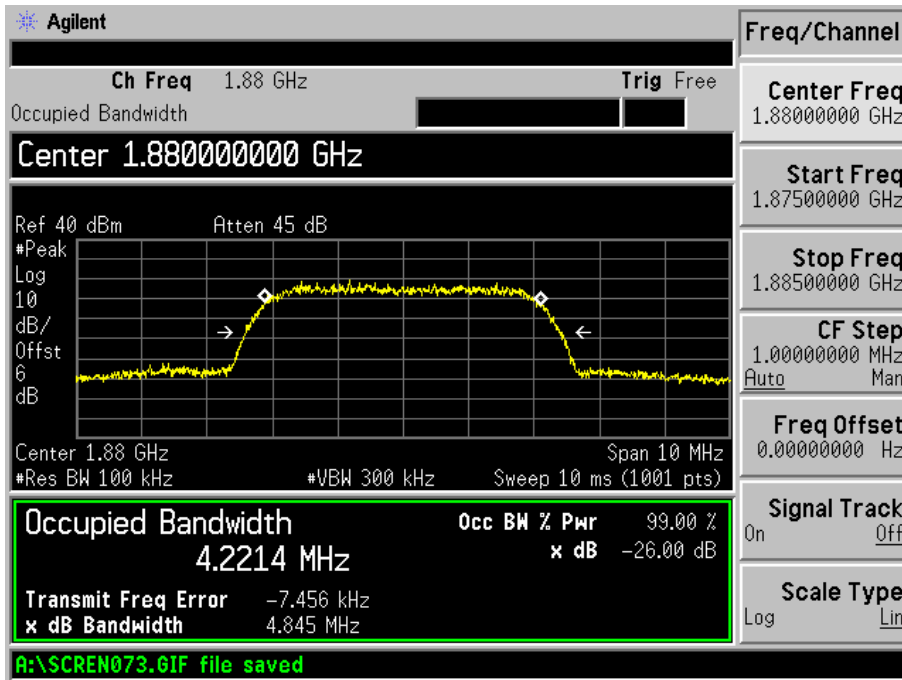
HSUPA High Channel



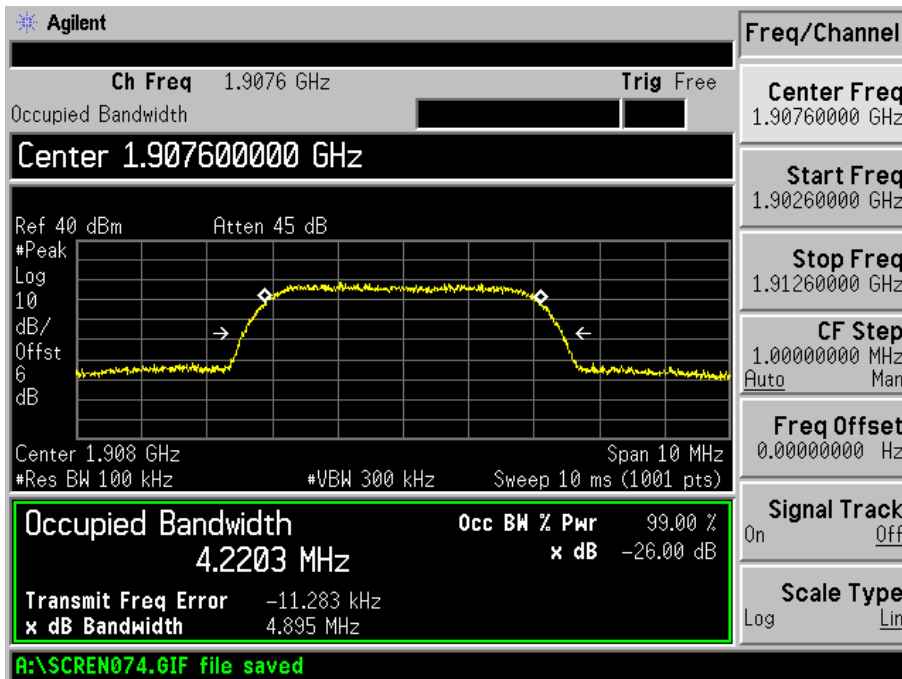
For Band II  
WCDMA Low Channel



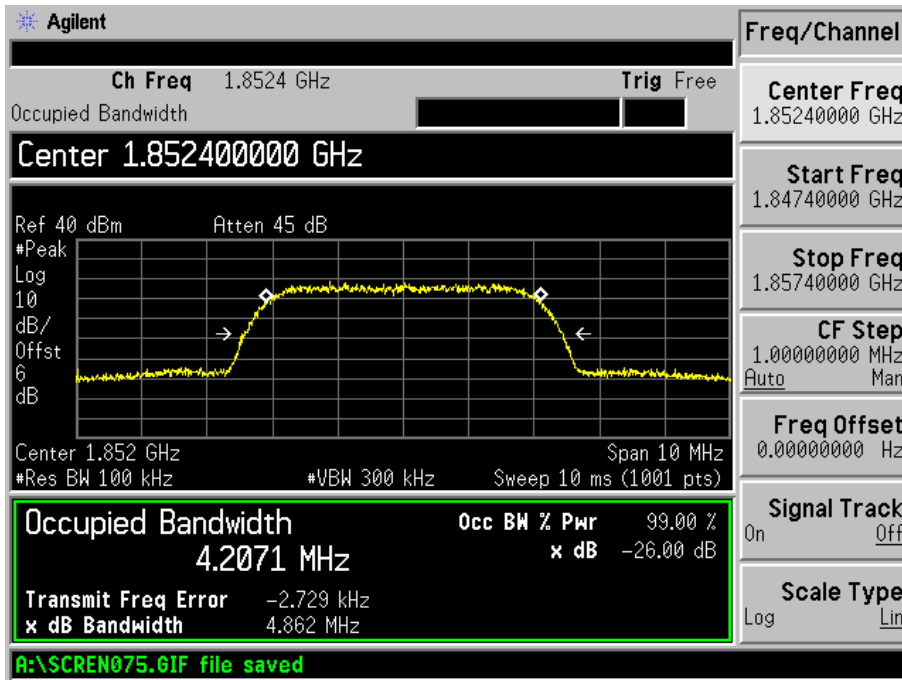
WCDMA Middle Channel



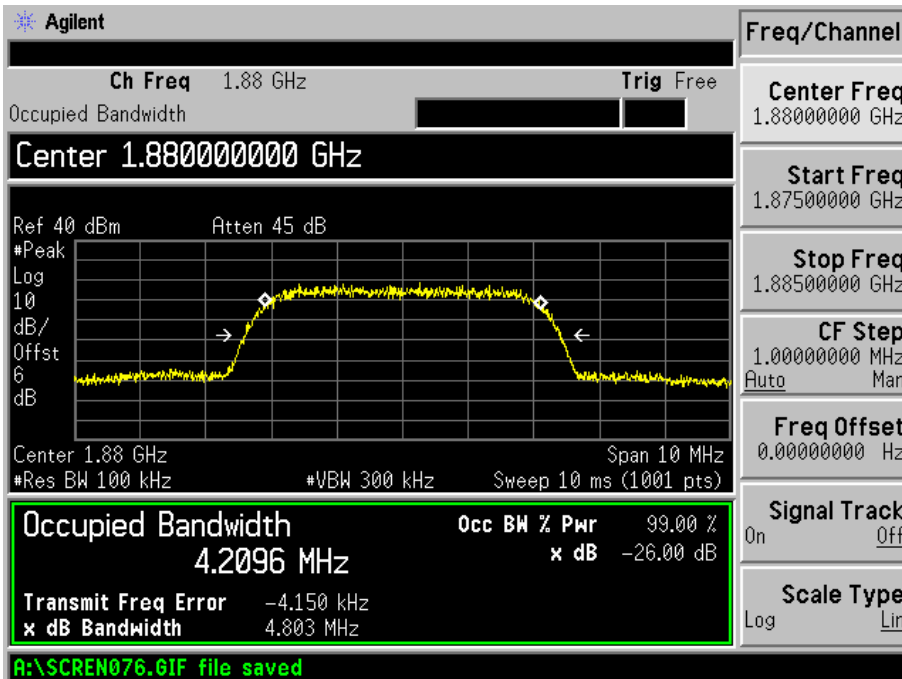
WCDMA High Channel



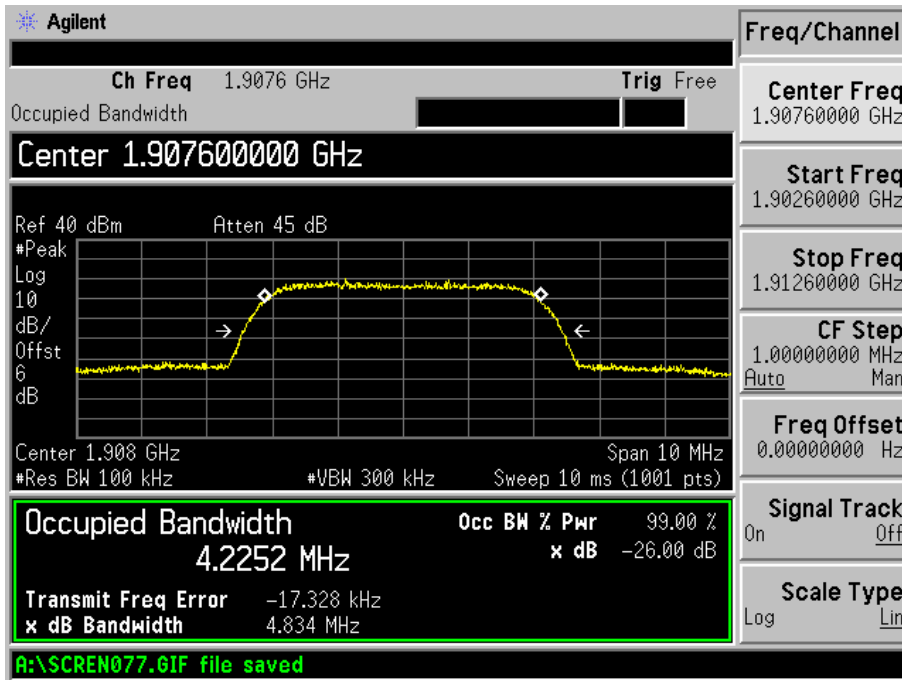
HSDPA Low Channel



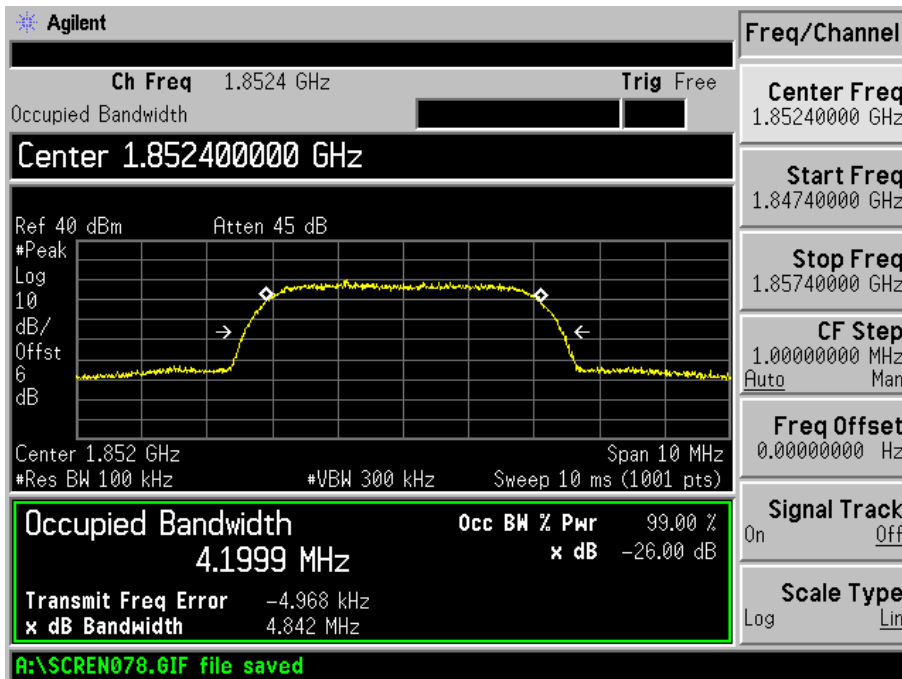
HSDPA Middle Channel



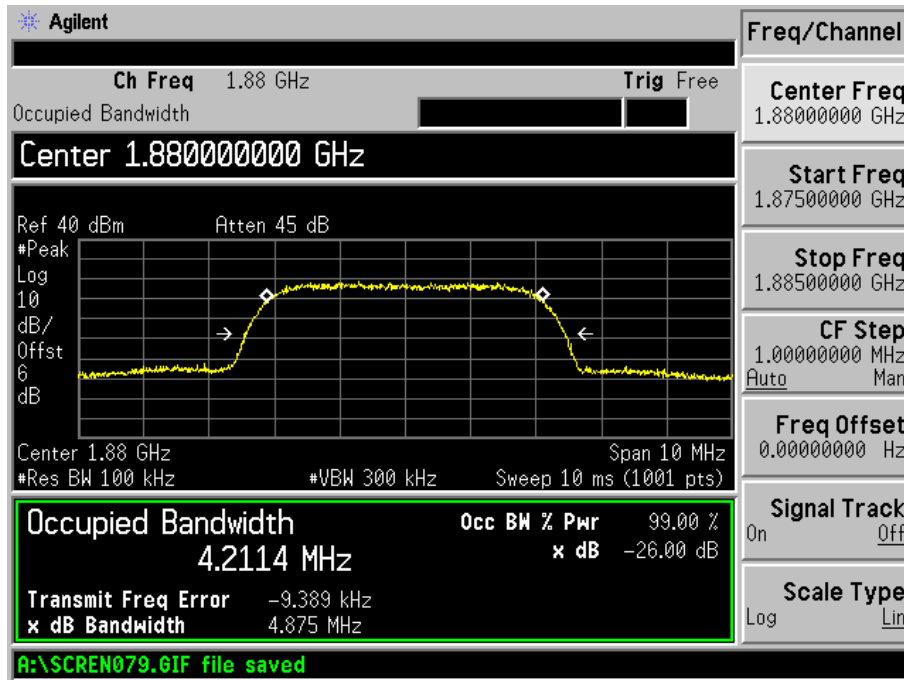
HSDPA High Channel



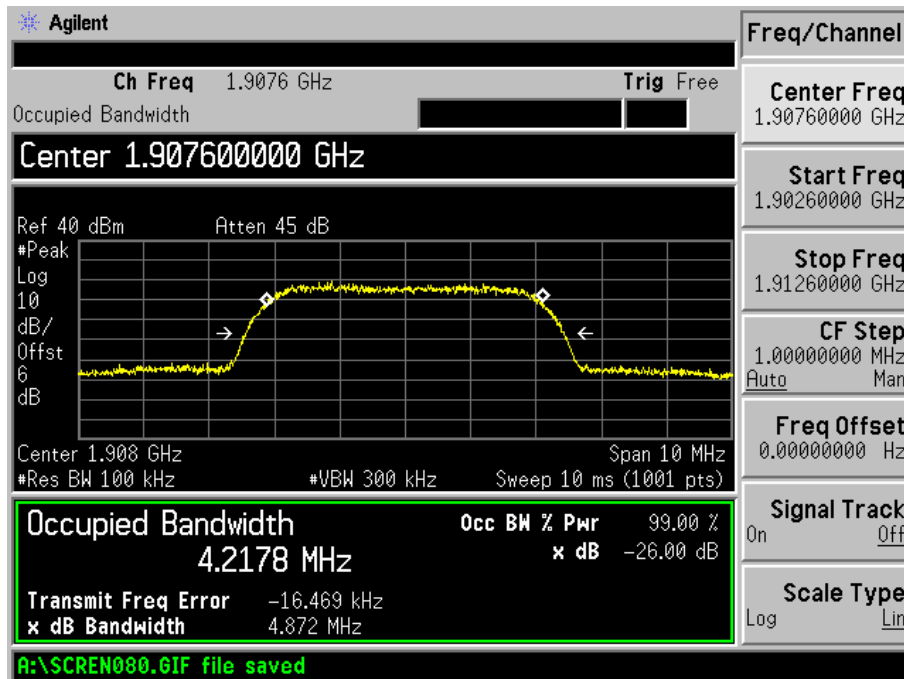
HSUPA Low Channel



HSUPA Middle Channel



HSUPA High Channel





## 7. Out of Band Emissions at Antenna Terminal

### 7.1 Standard Applicable

According to §22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

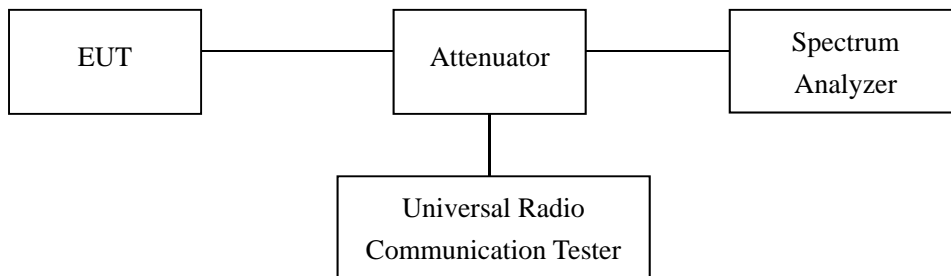
According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

According to §27.53 (h), the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10}(P)$  dB.

### 7.2 Test Procedure

The RF output terminal of the transmitter was connected to the input of the spectrum analyzer via a suitable attenuation. The RBW of the spectrum analyzer was set to 100kHz and 1MHz for the scan frequency from 30MHz to 1GHz and the scan frequency from 1GHz to up to 10<sup>th</sup> harmonic.

Test Configuration for the out of band emissions testing:



### 7.3 Environmental Conditions

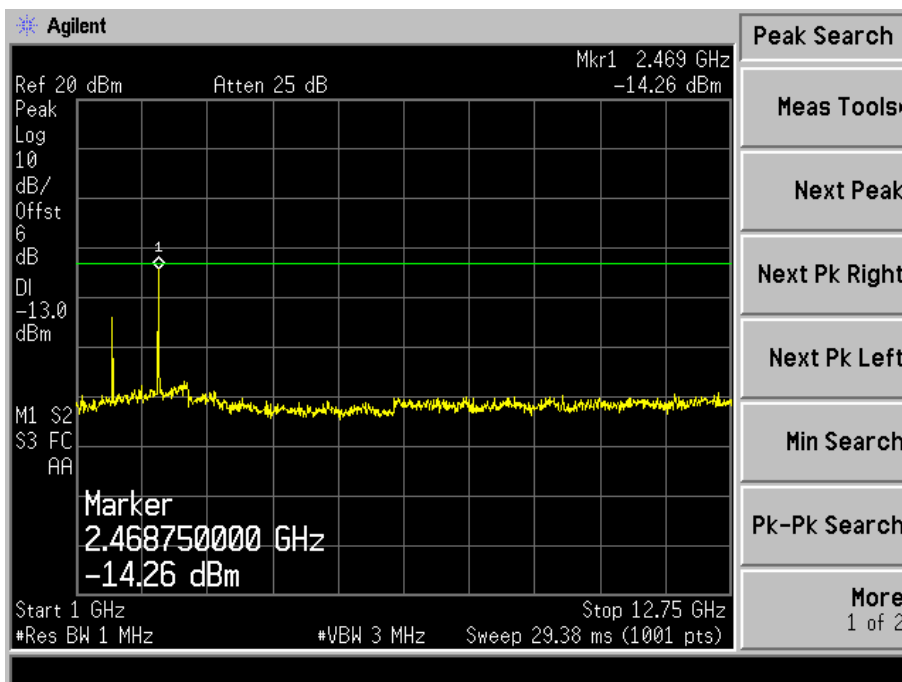
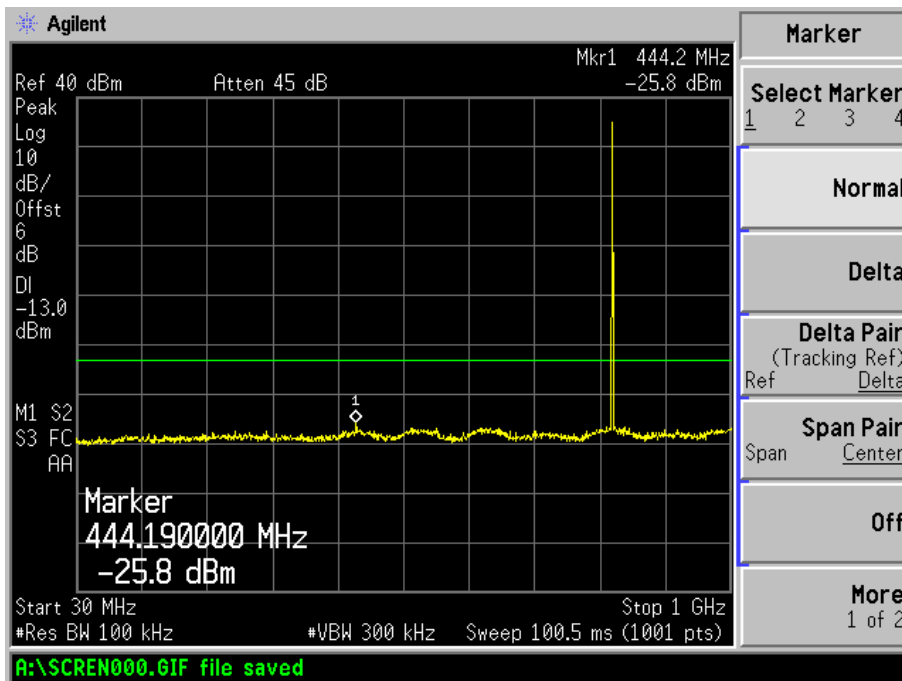
Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

### 7.4 Summary of Test Results/Plots

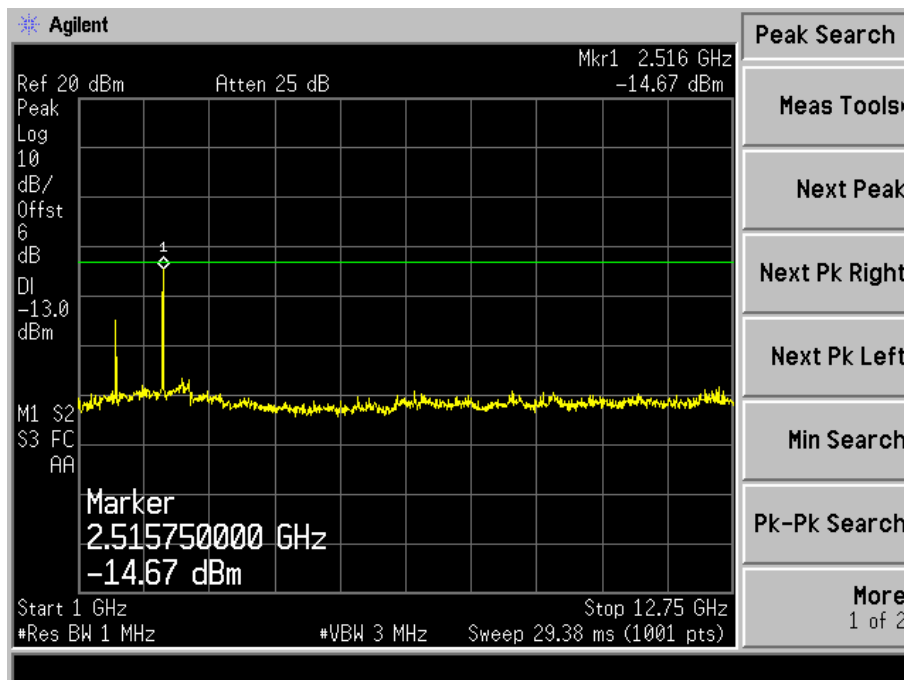
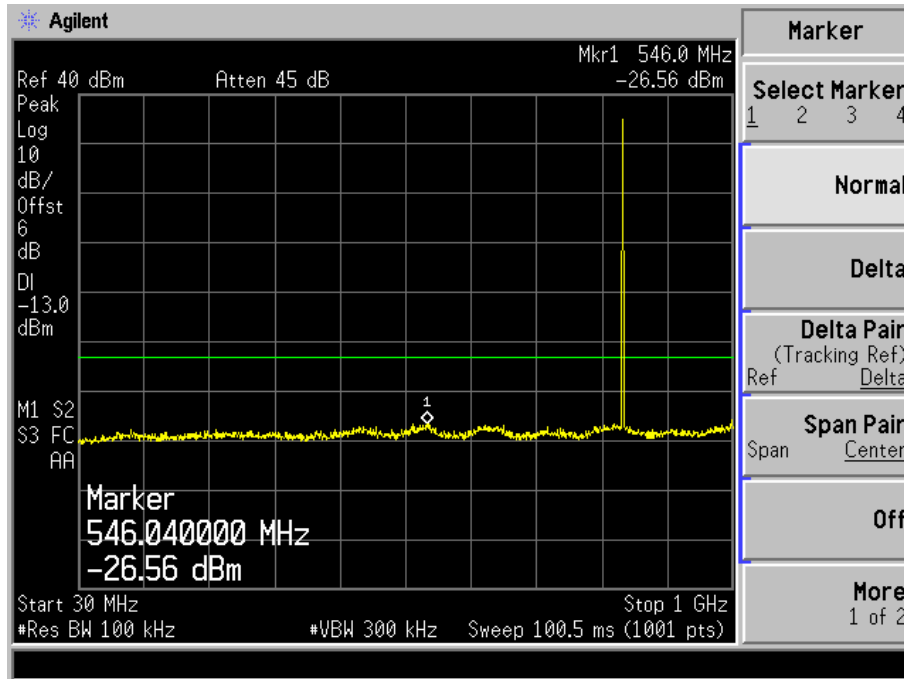
Please refer to the following test plots For Cellular Band

Please refer to the following test plots For Cellular Band

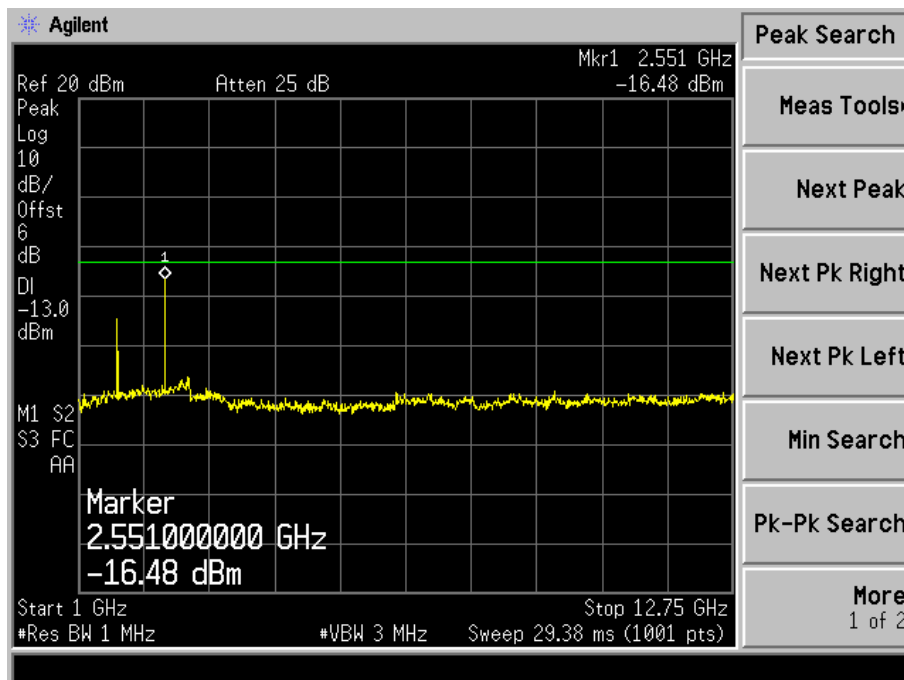
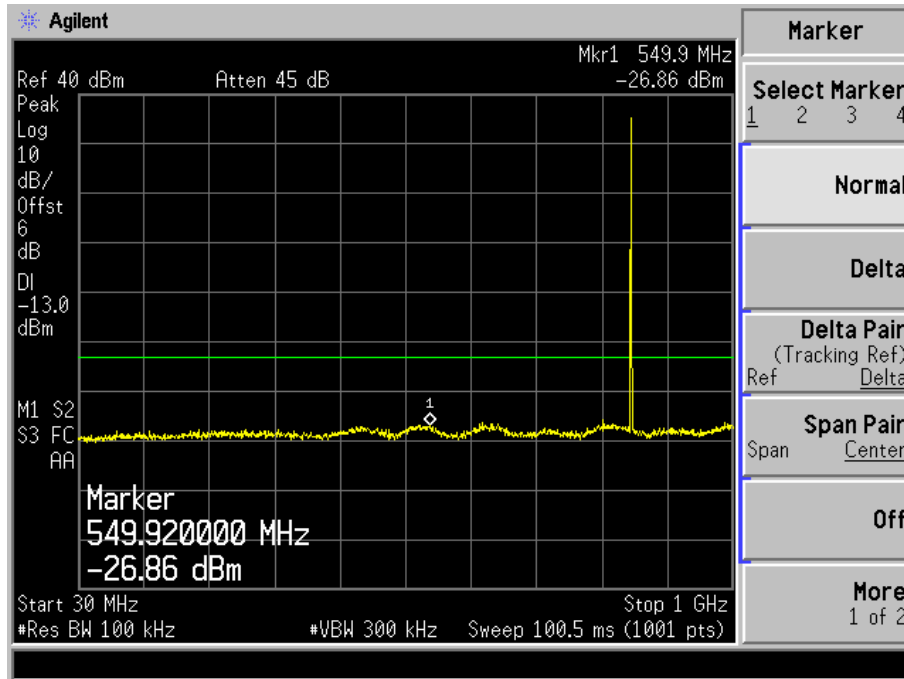
GSM Low Channel



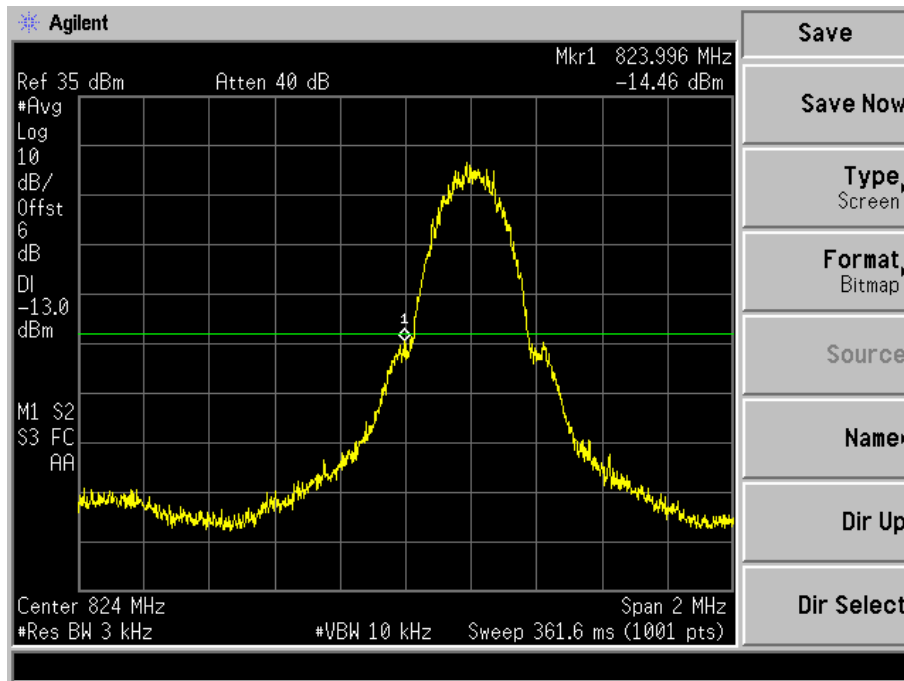
GSM Middle Channel



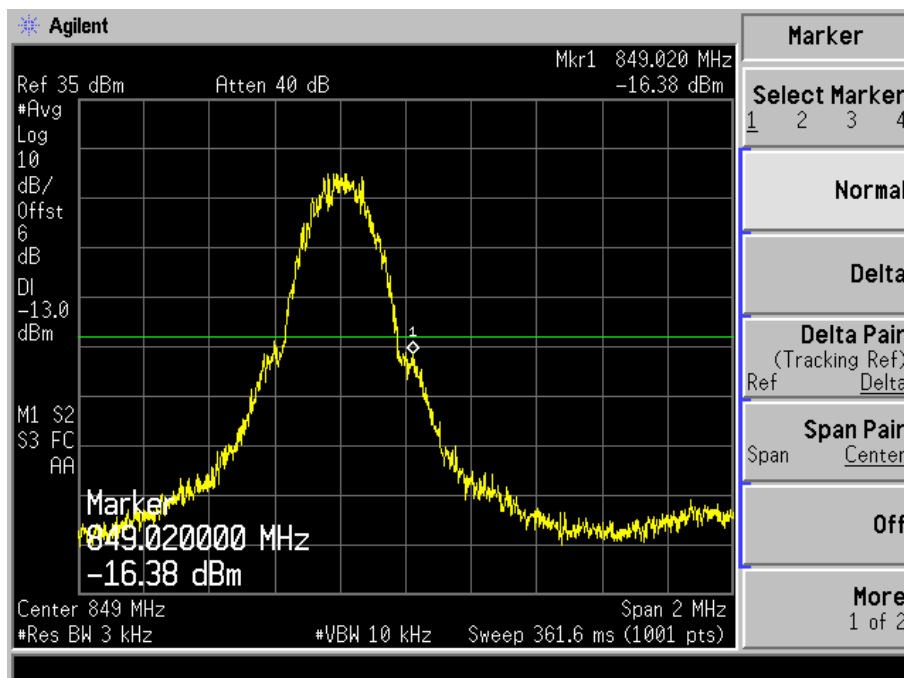
GSM High Channel



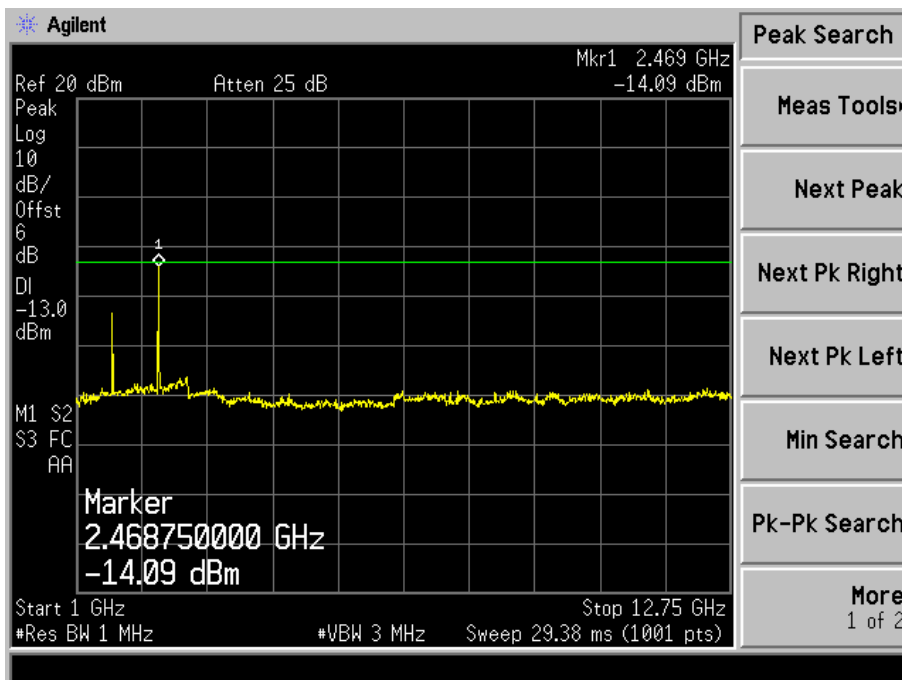
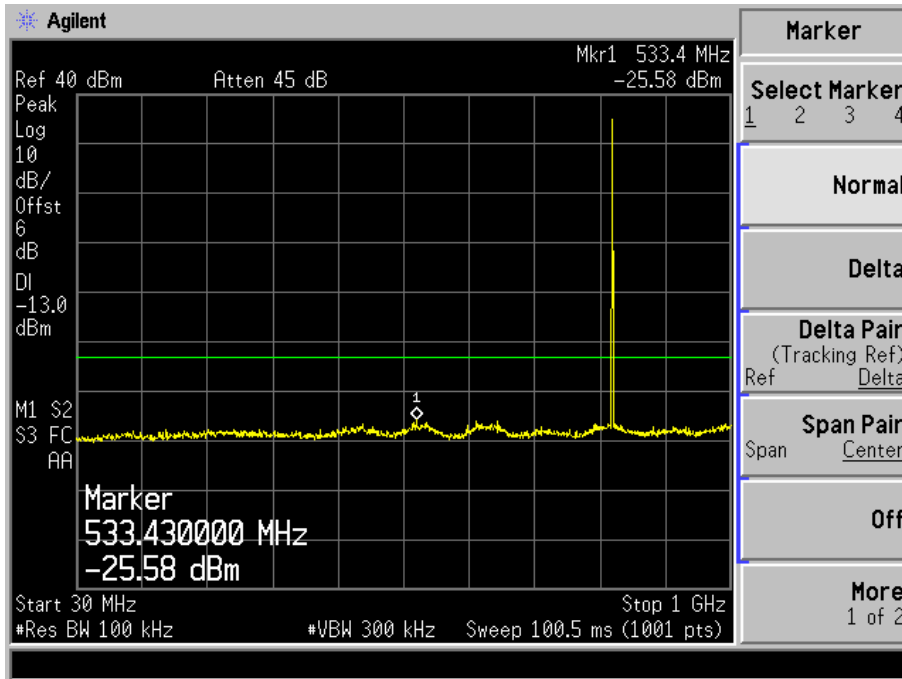
GSM Low Band Emission



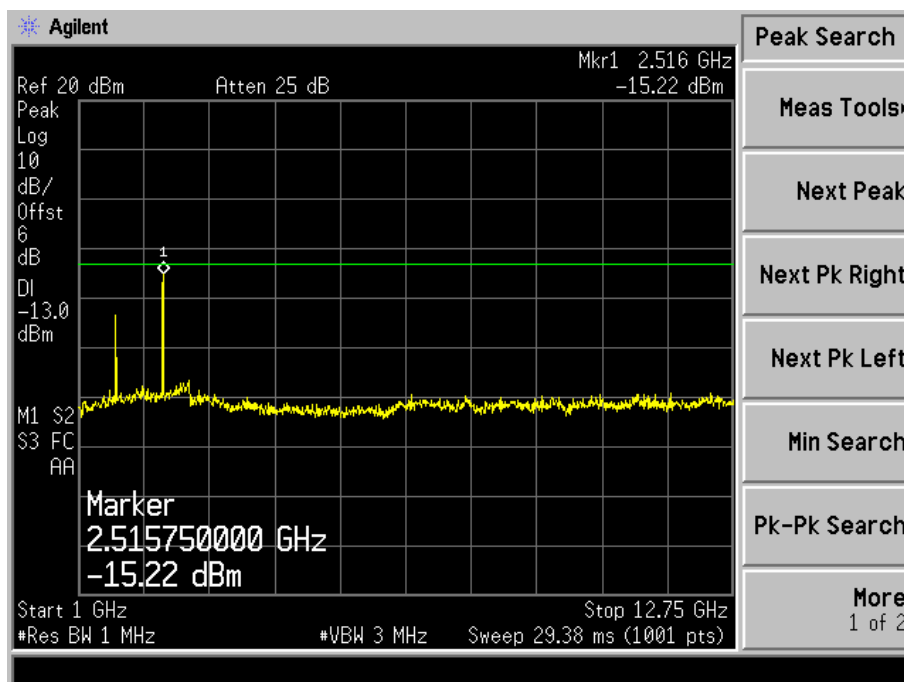
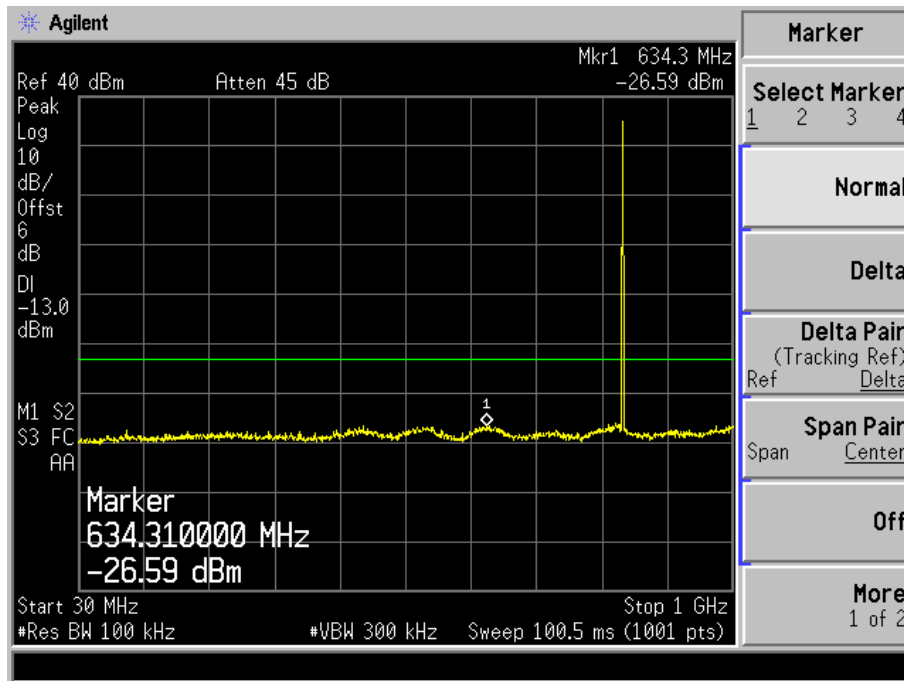
GSM High Band Emission



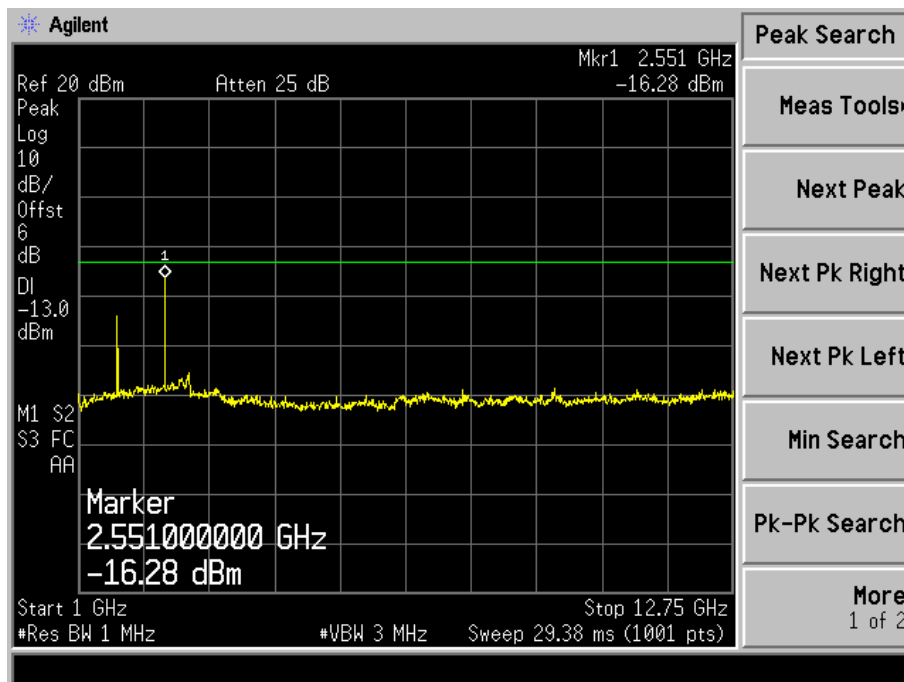
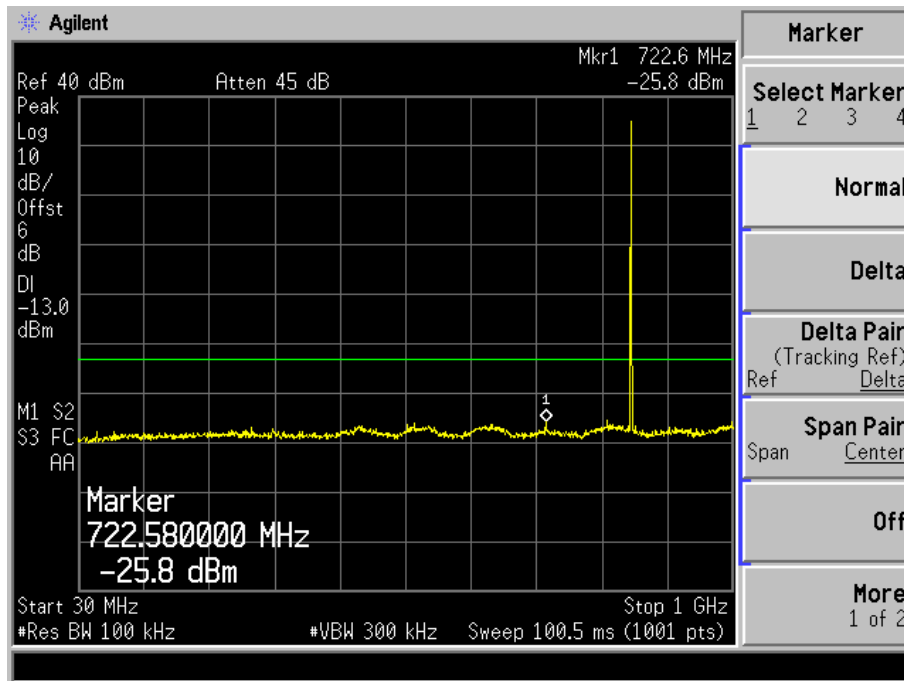
GPRS Low Channel



GPRS Middle Channel

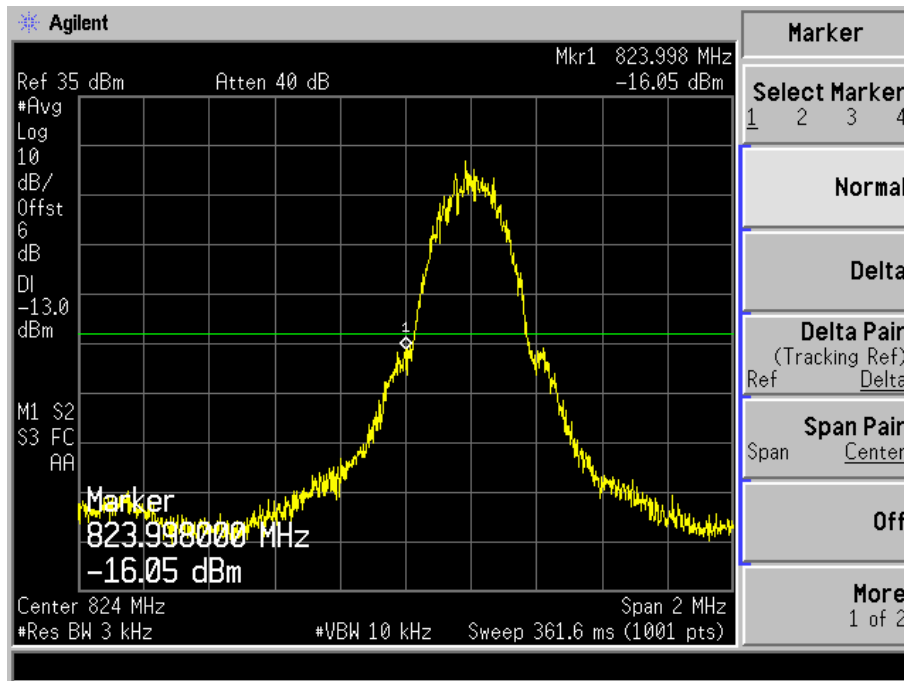


GPRS High Channel

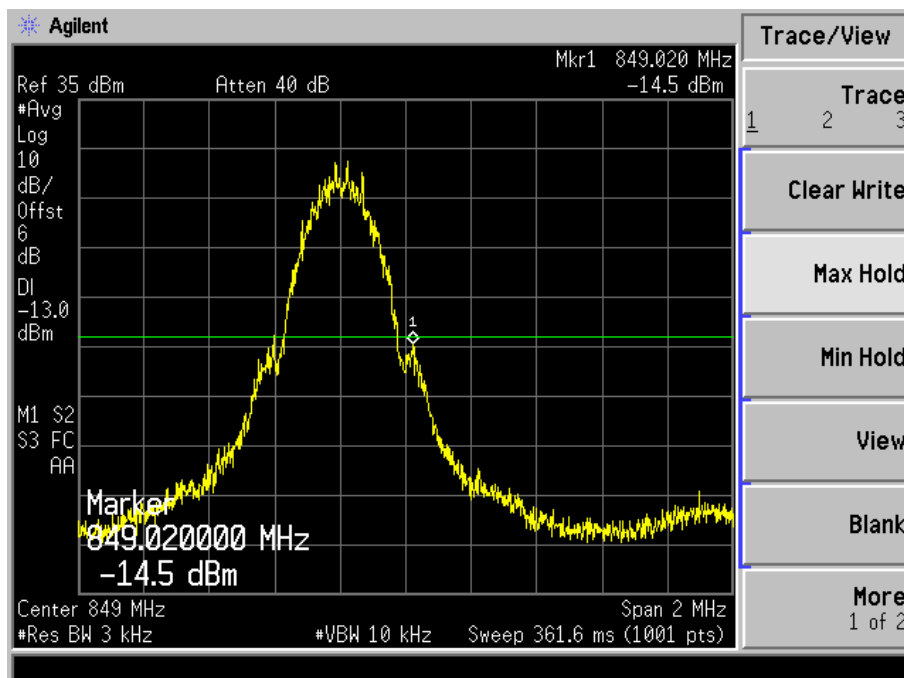




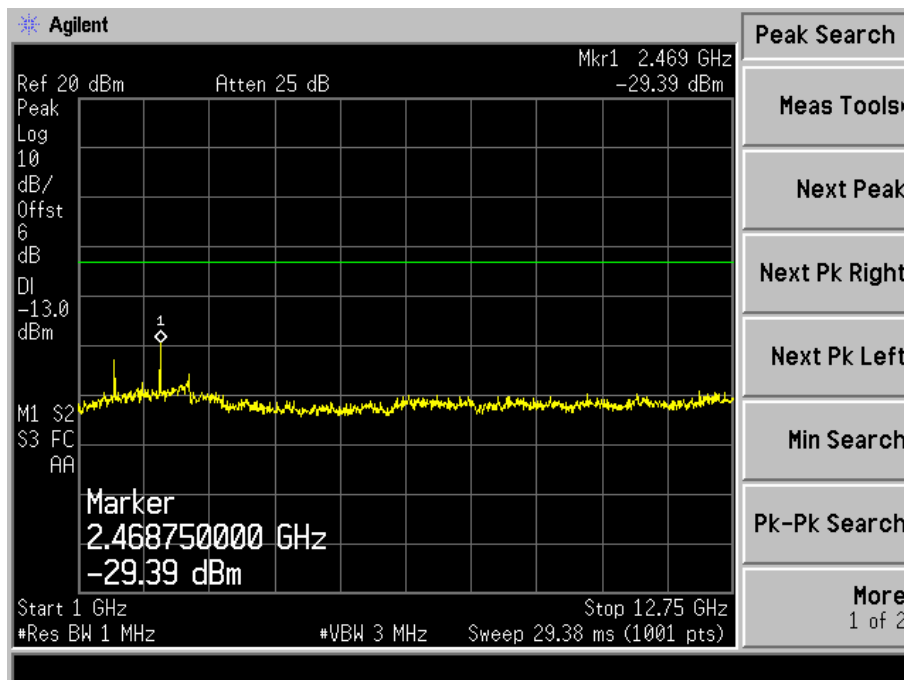
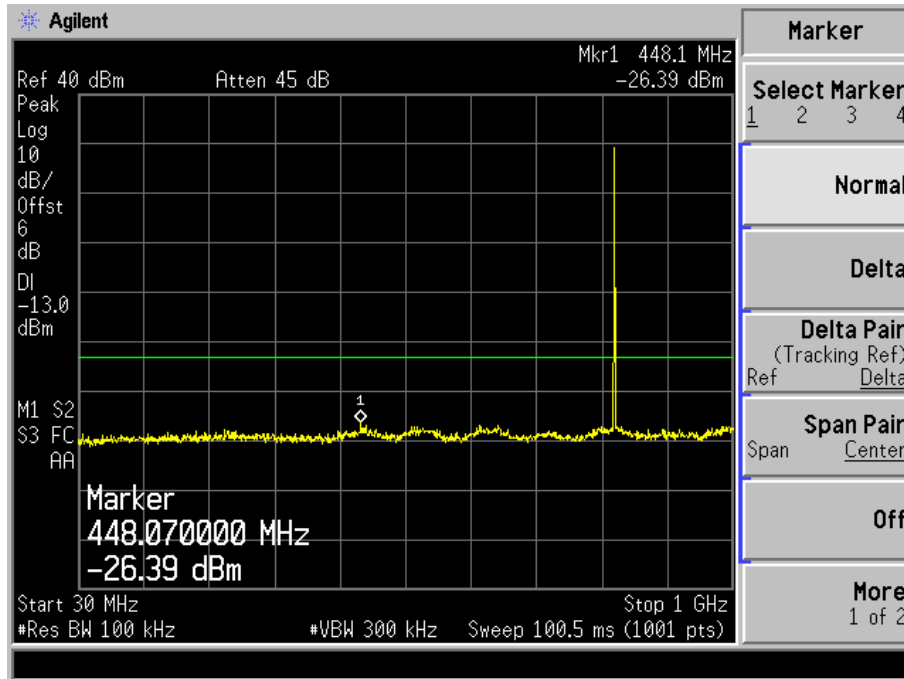
GPRS Low Band Emission



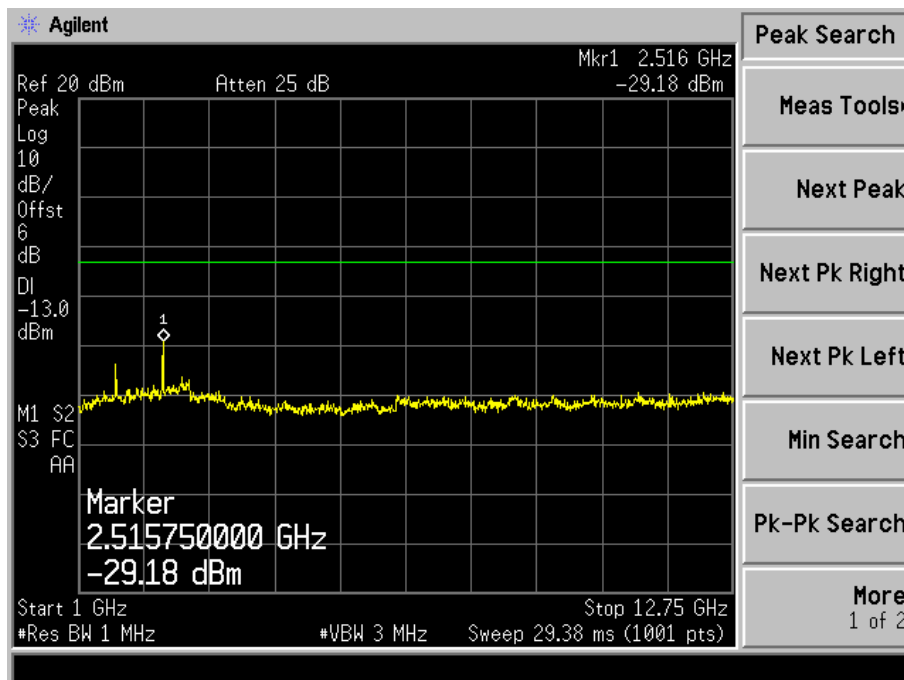
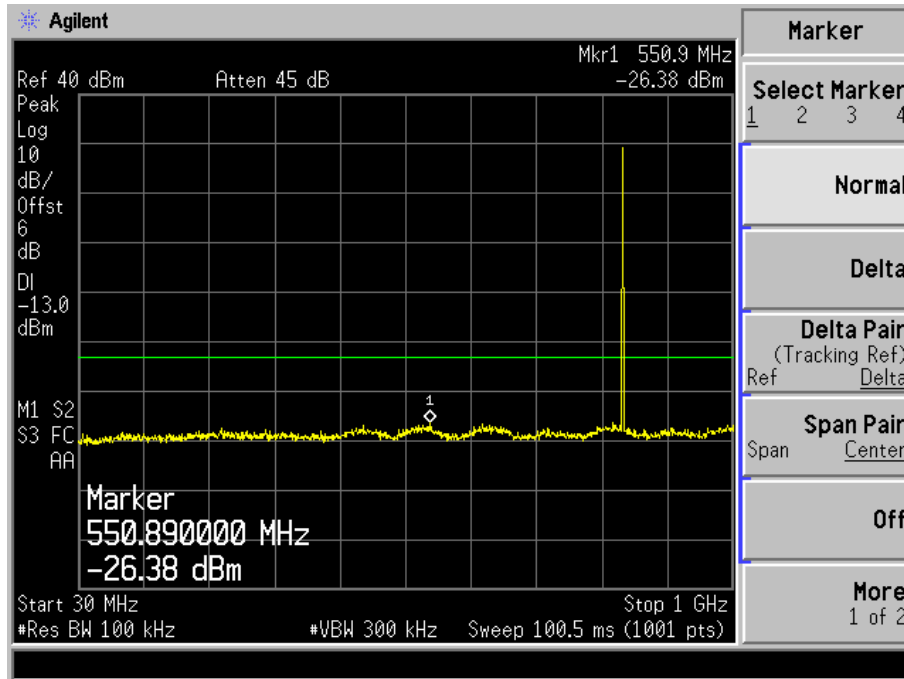
GPRS High Band Emission



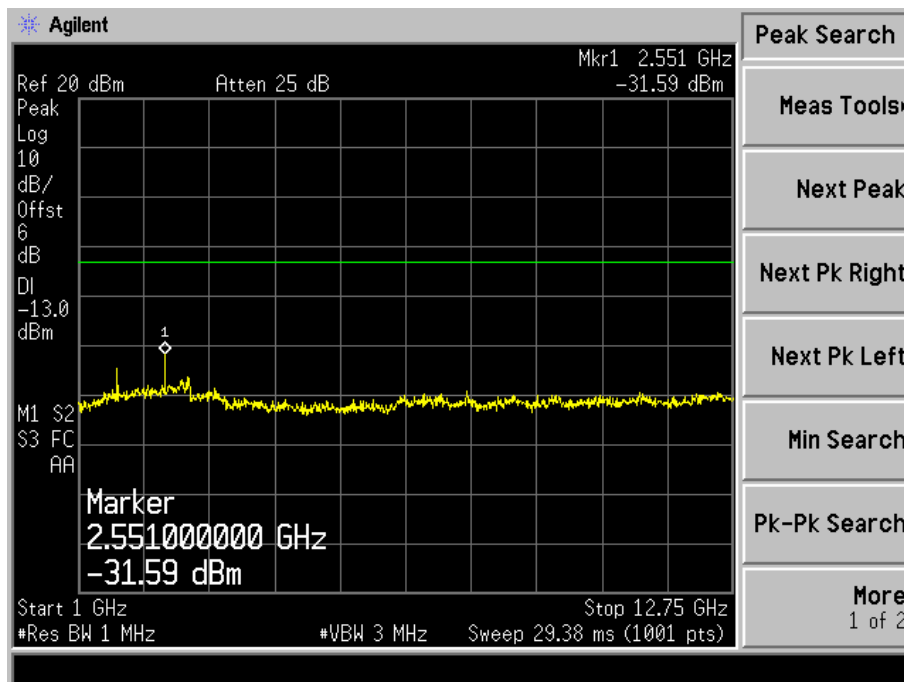
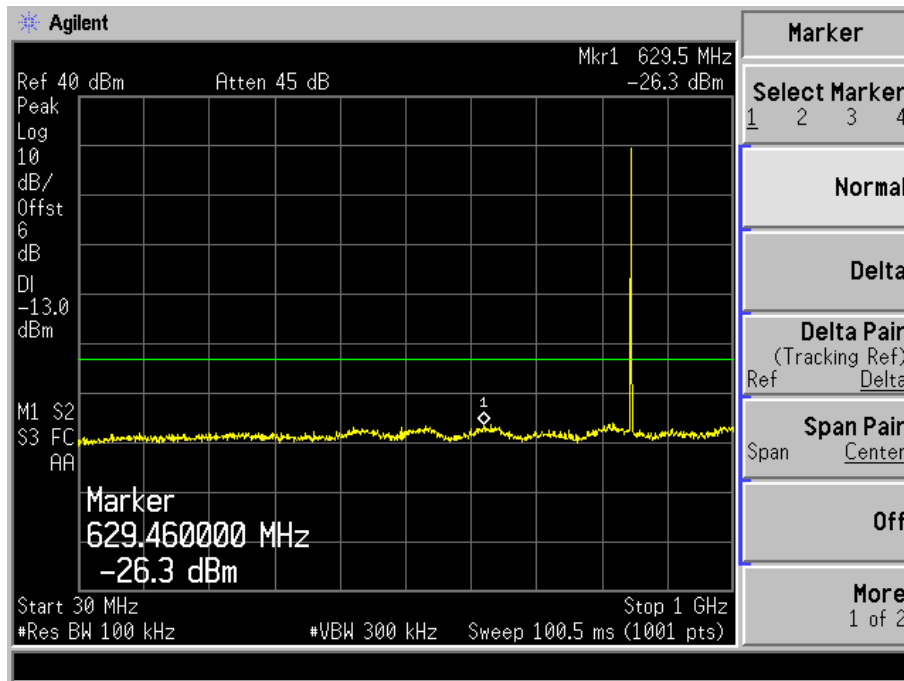
EDGE Low Channel



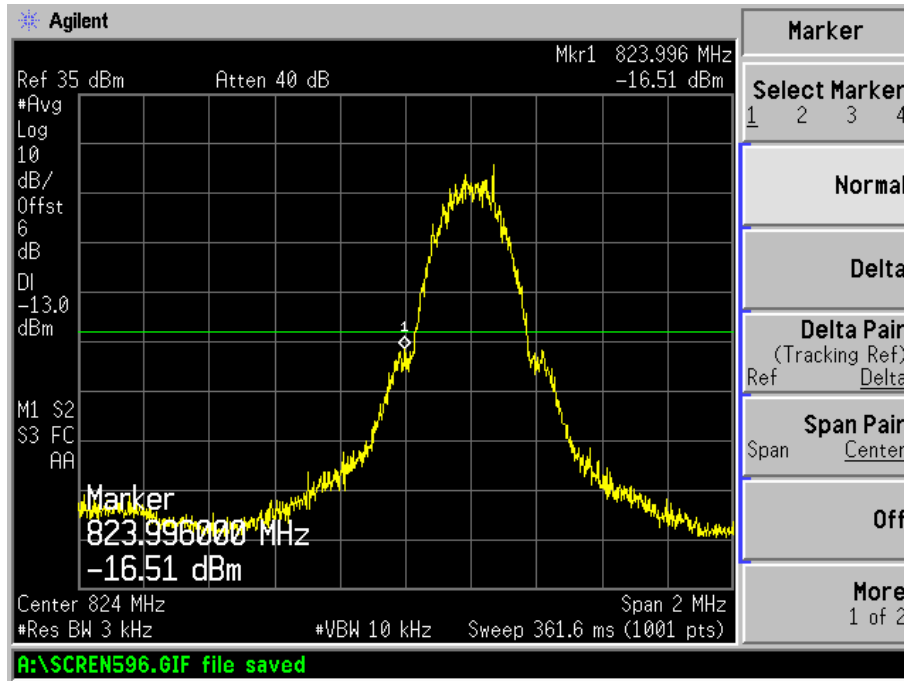
EDGE Middle Channel



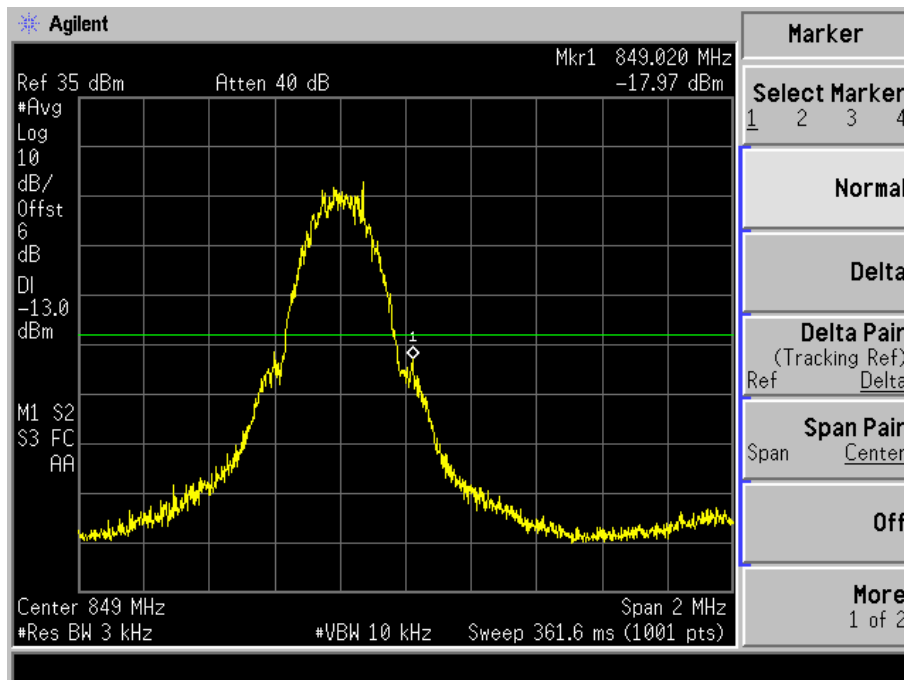
EDGE High Channel



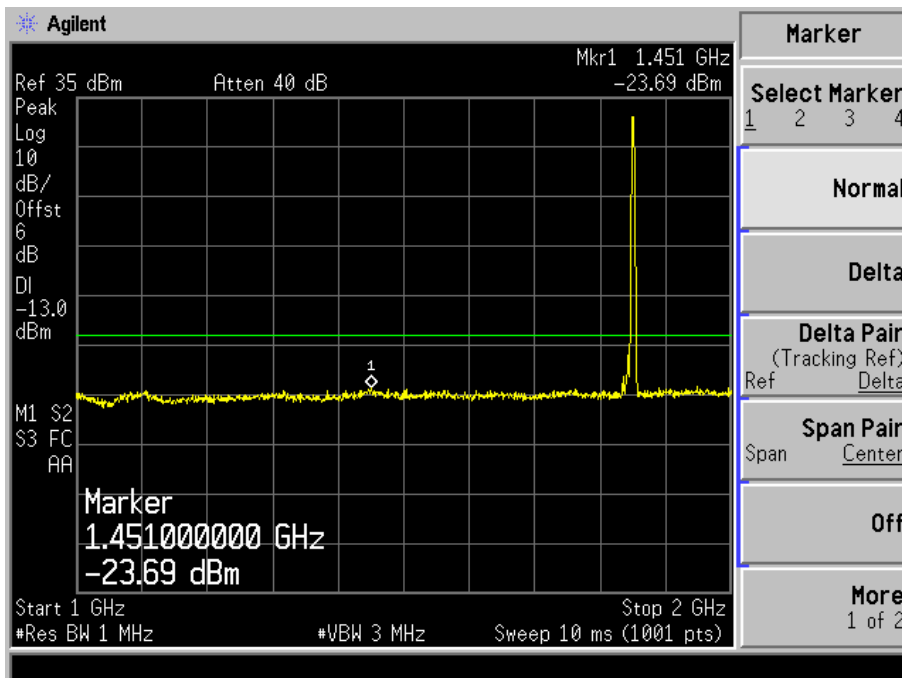
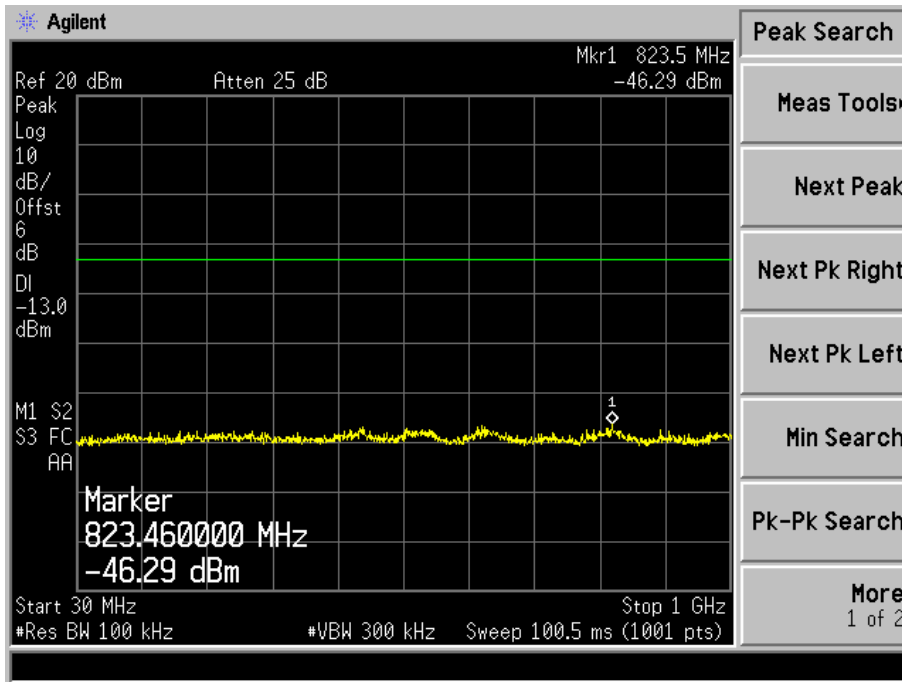
EDGE Low Band Emission

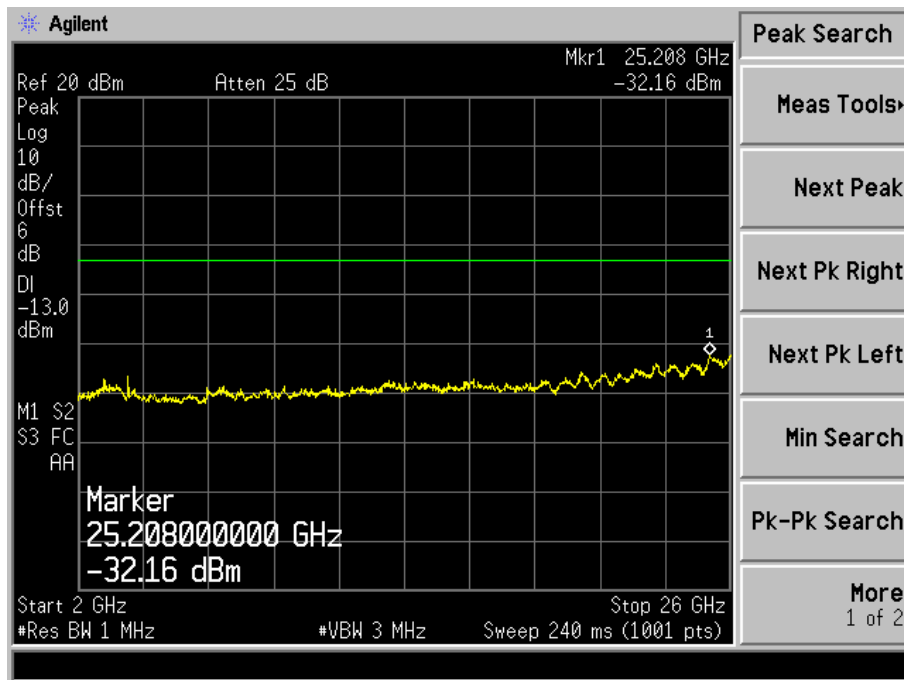


EDGE High Band Emission

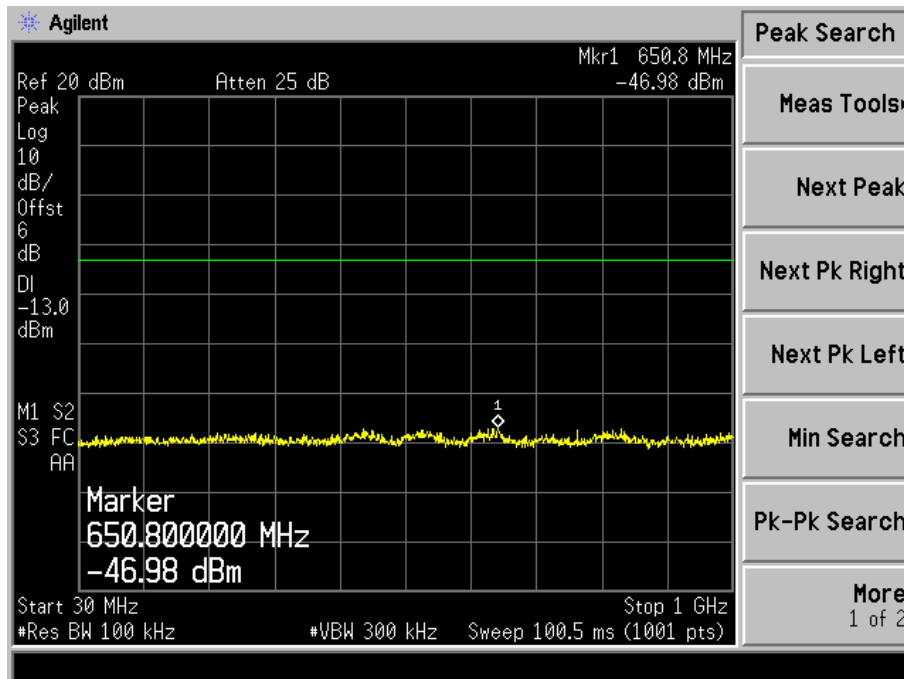


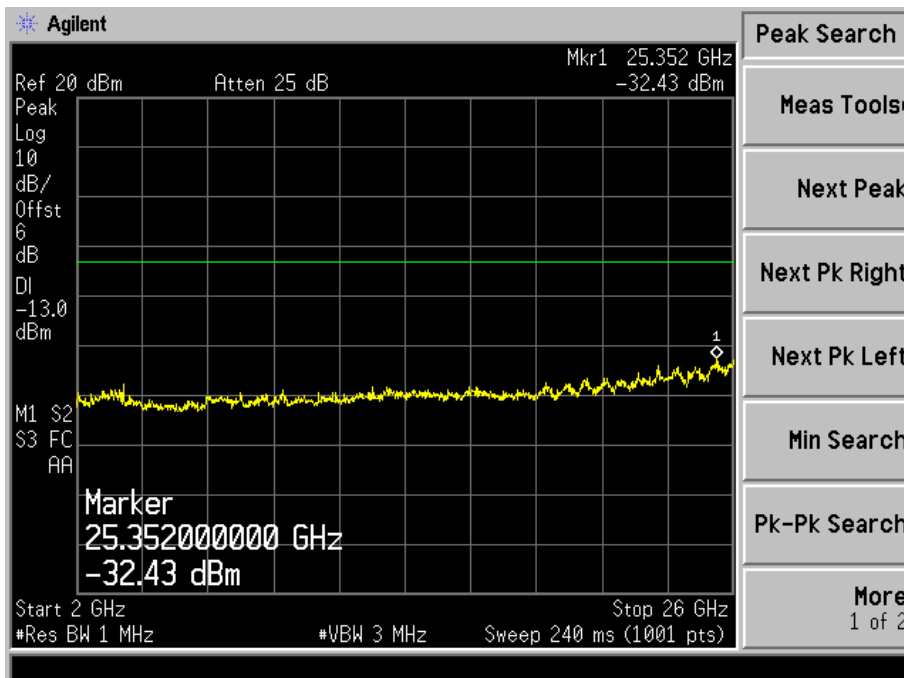
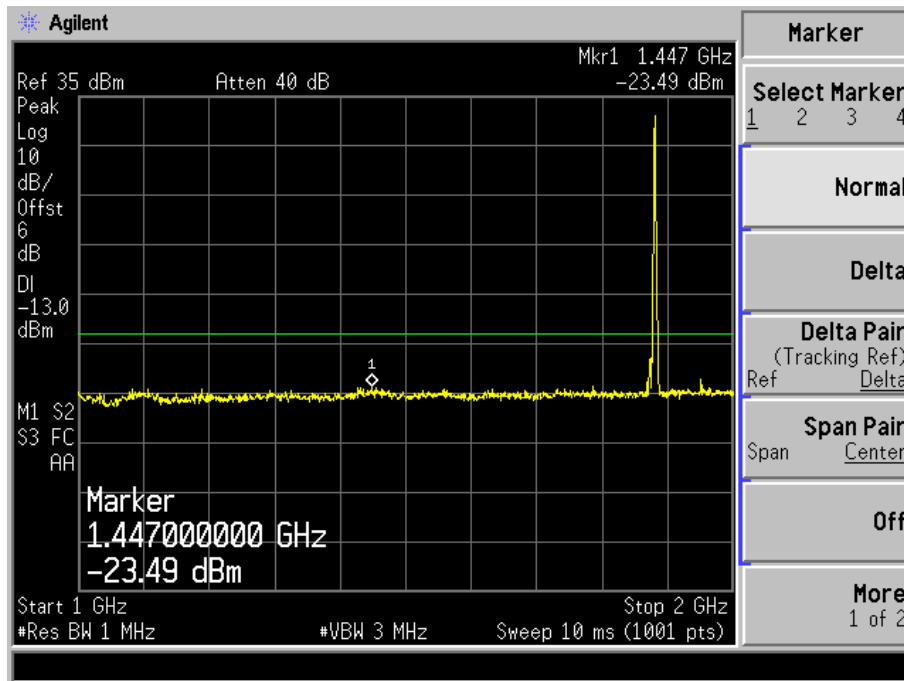
For PCS Band  
GSM Low Channel





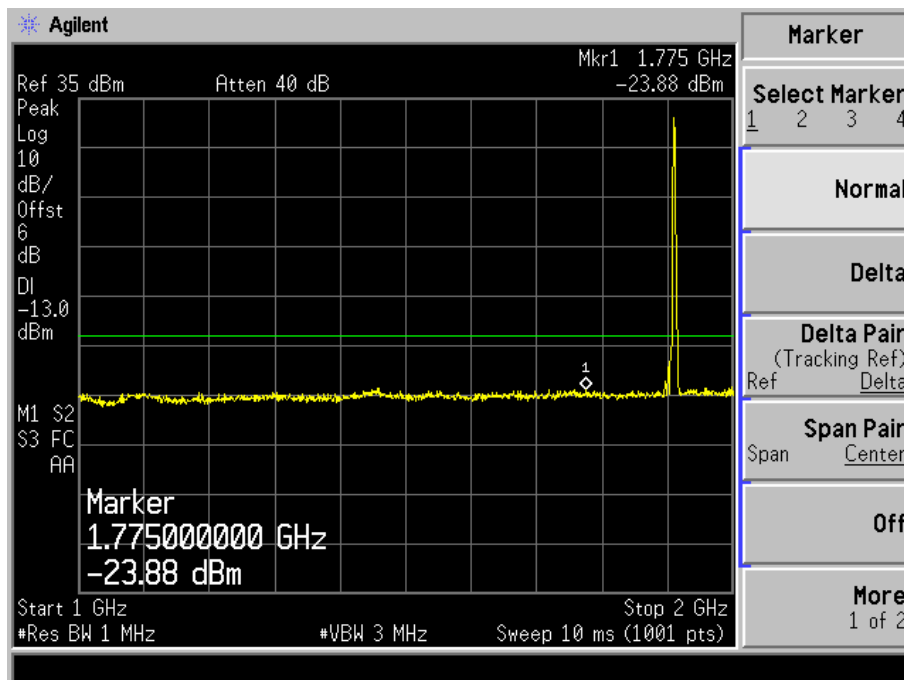
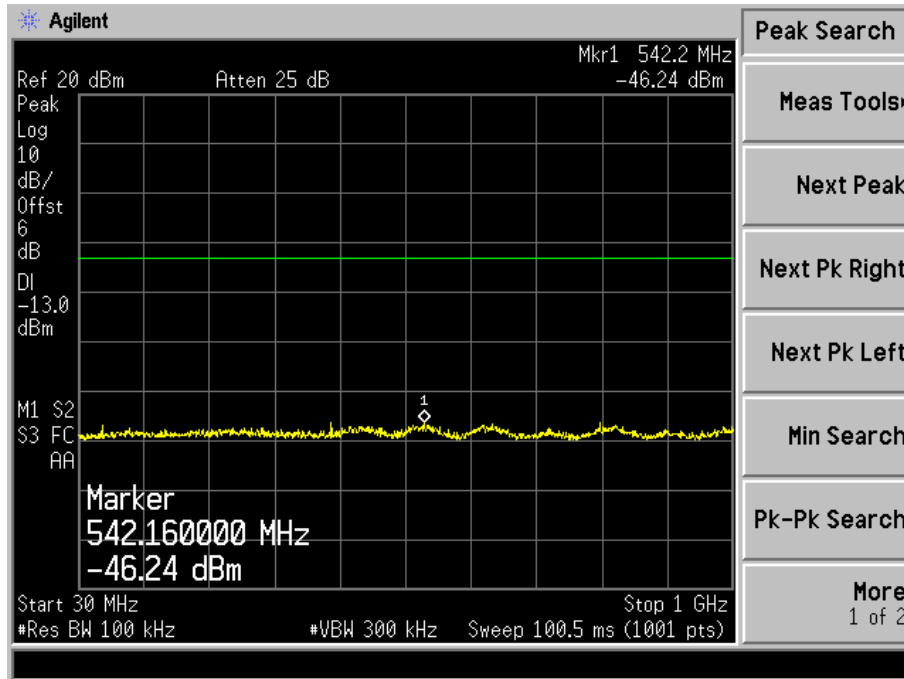
GSM Middle Channel

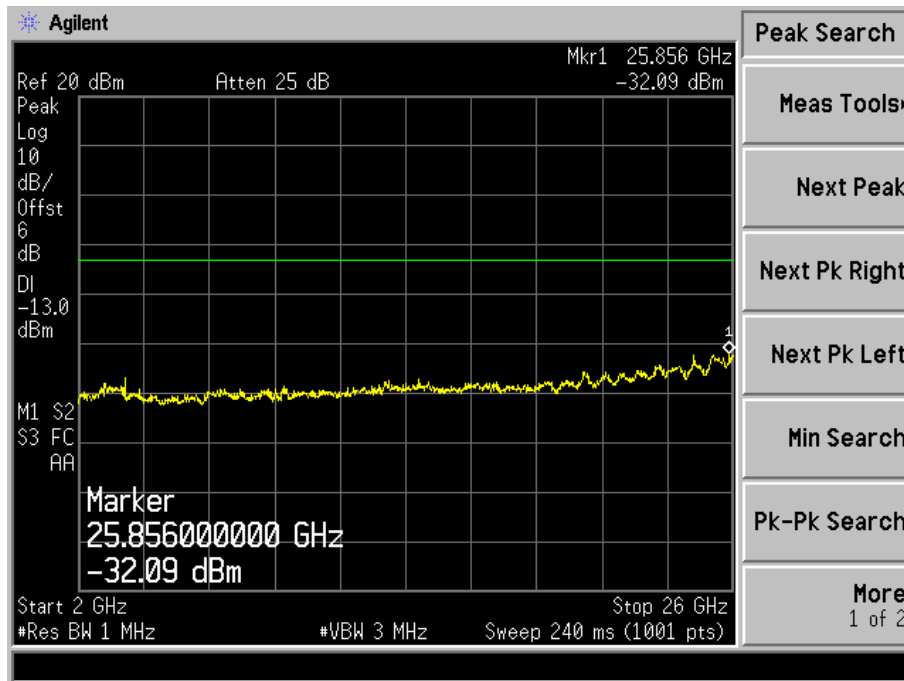




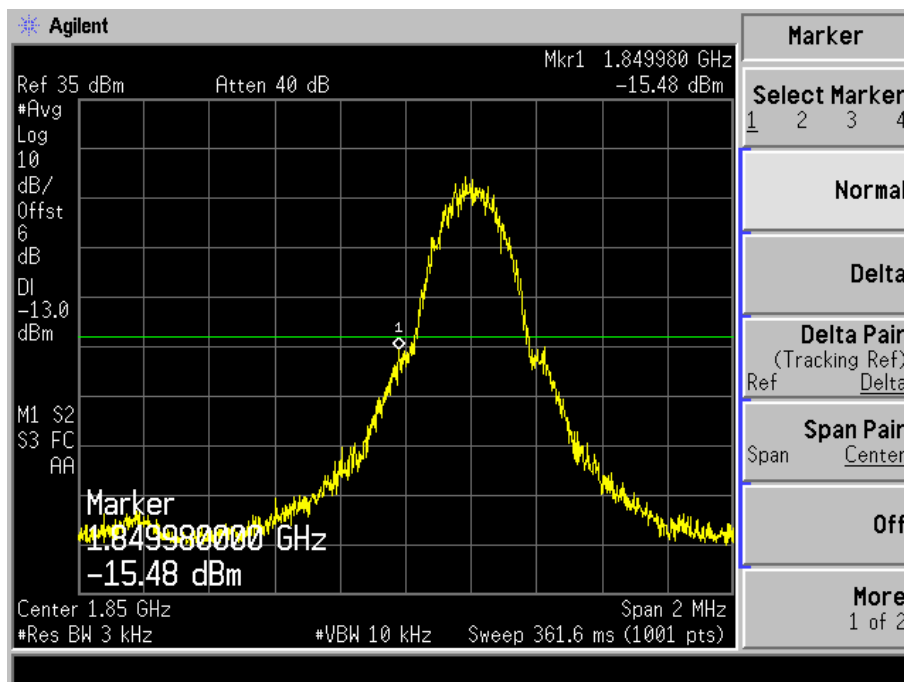


GSM High Channel

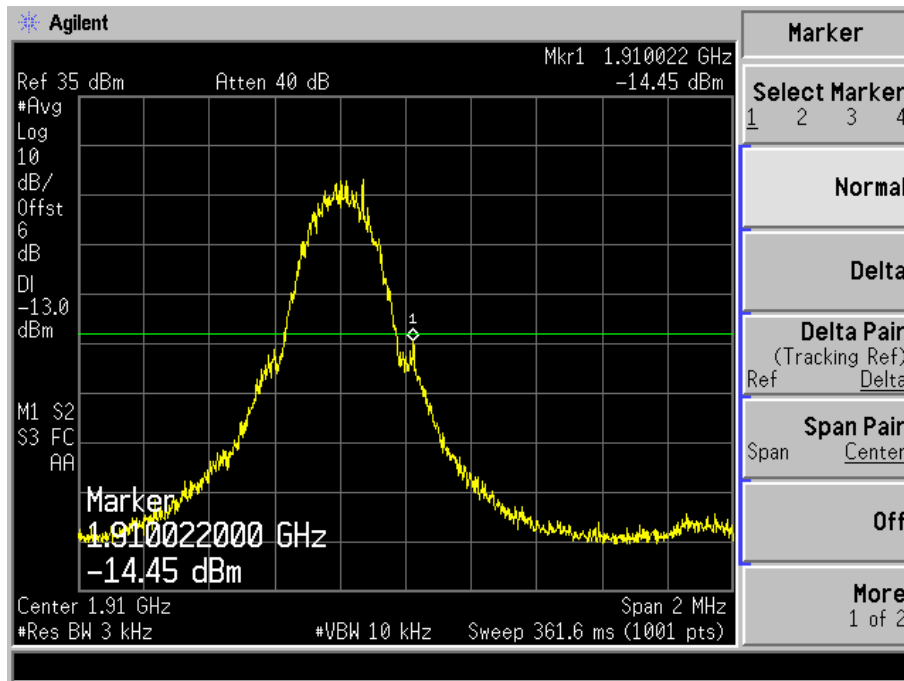




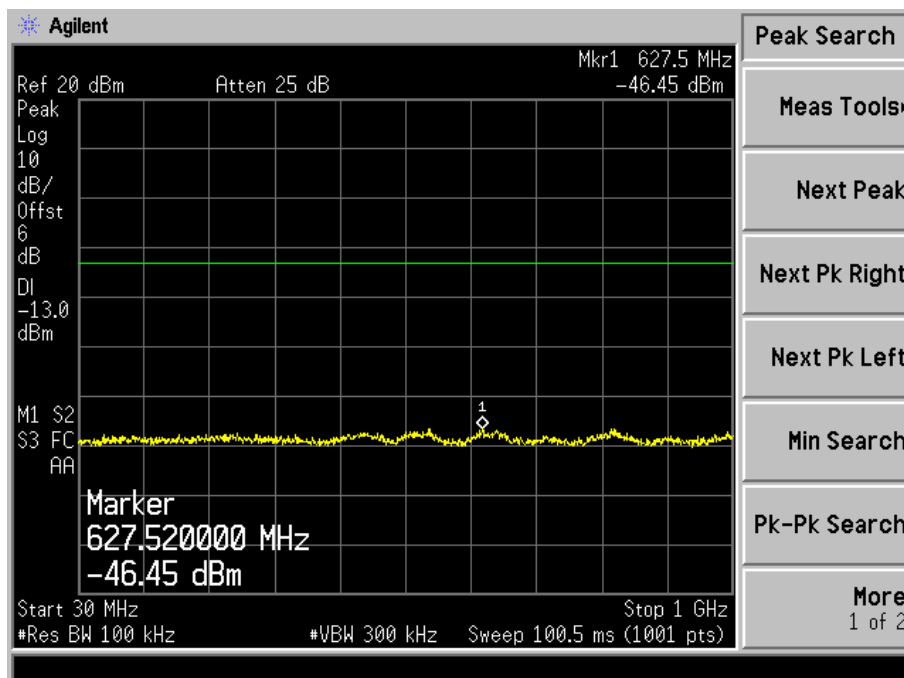
GSM Low Band Emission

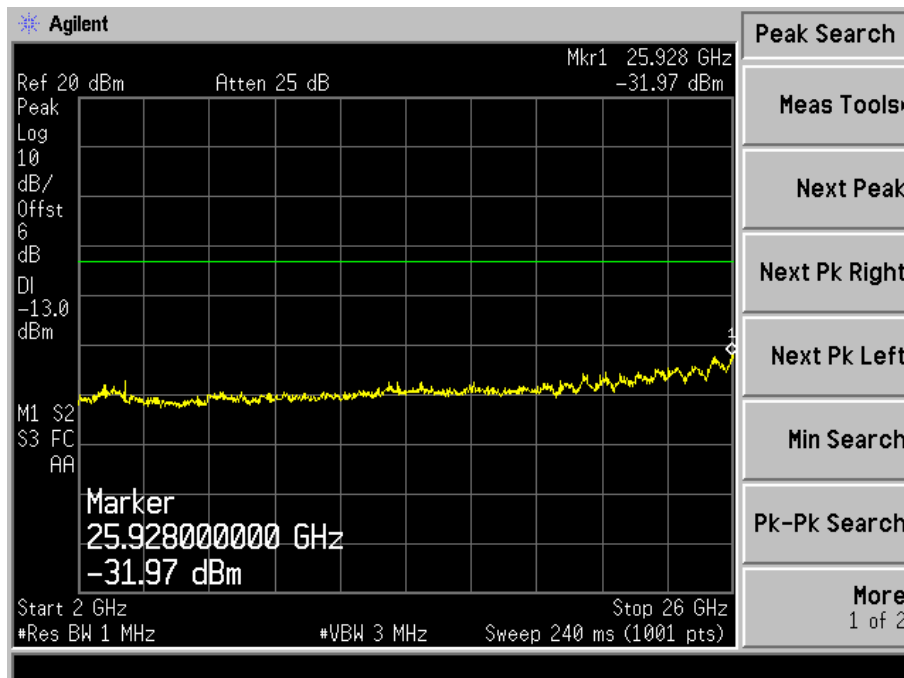
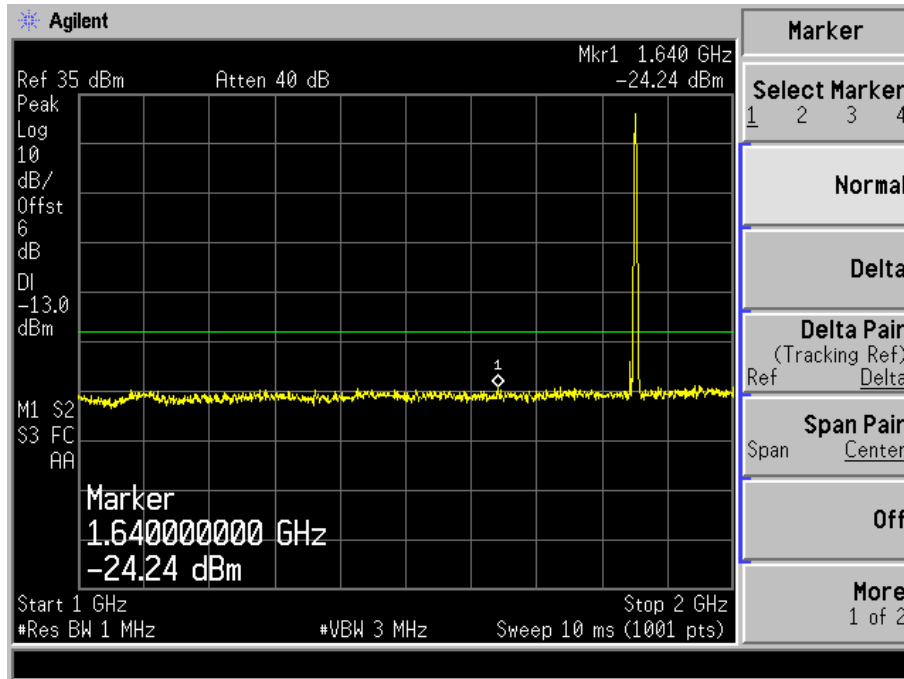


GSM High Band Emission

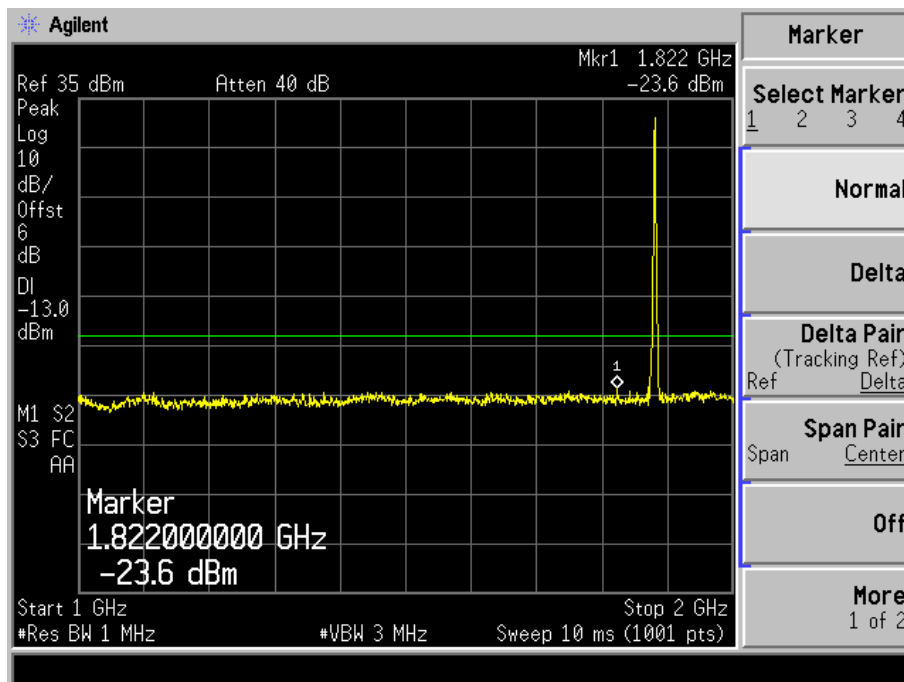
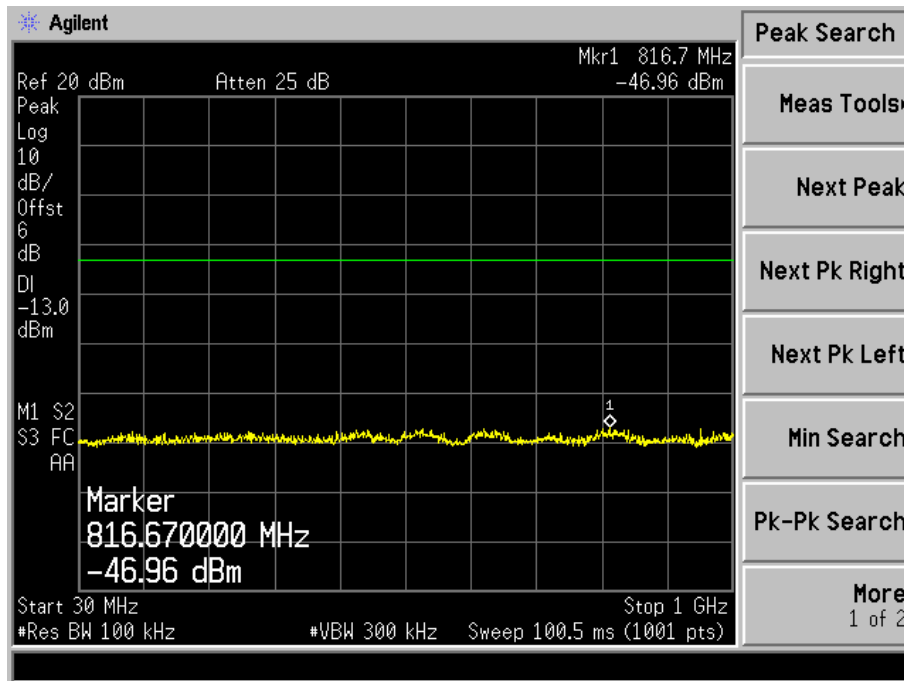


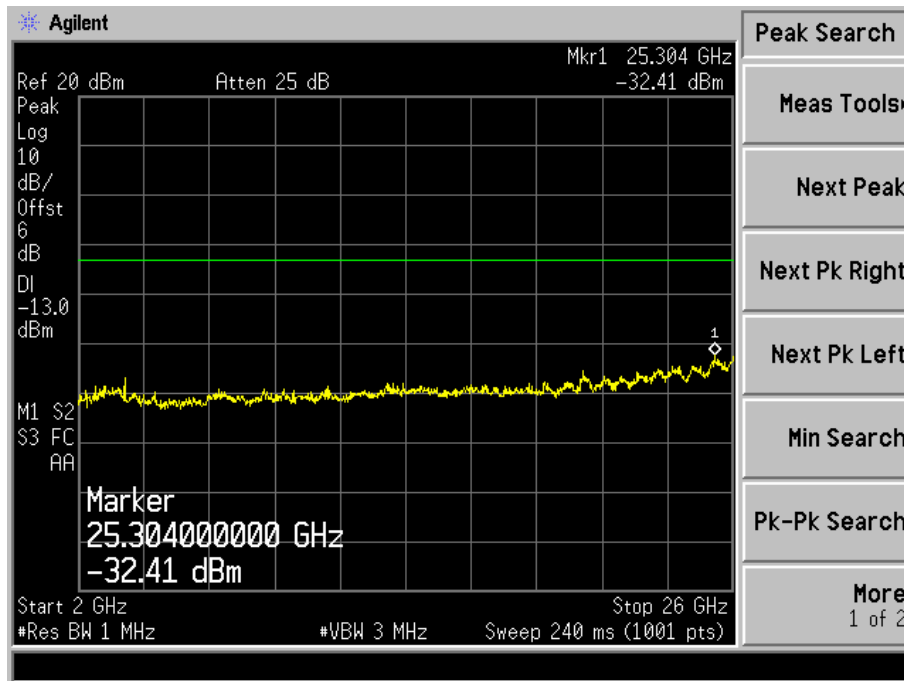
GPRS Low Channel



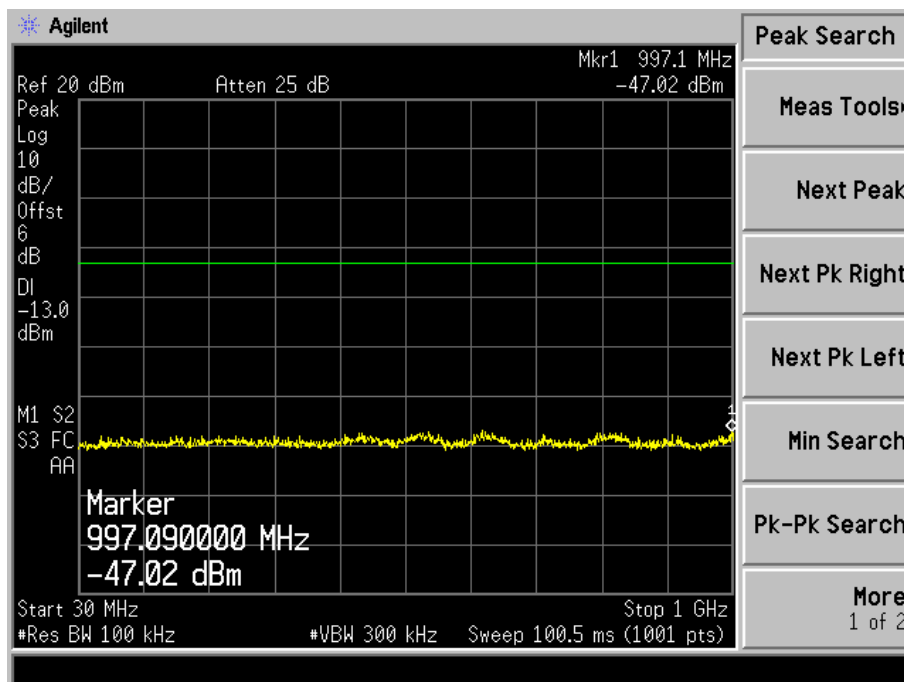


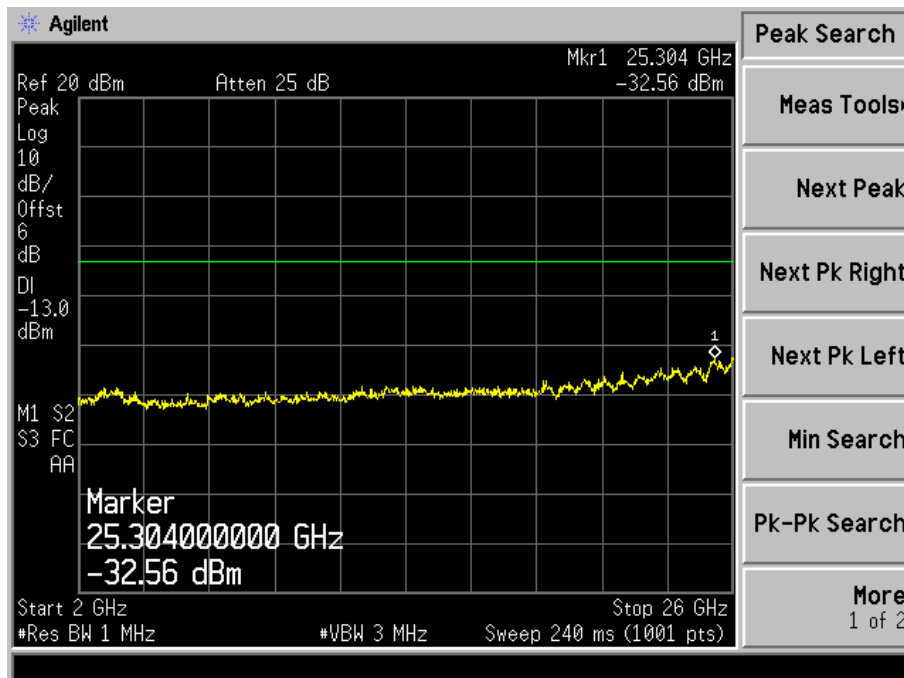
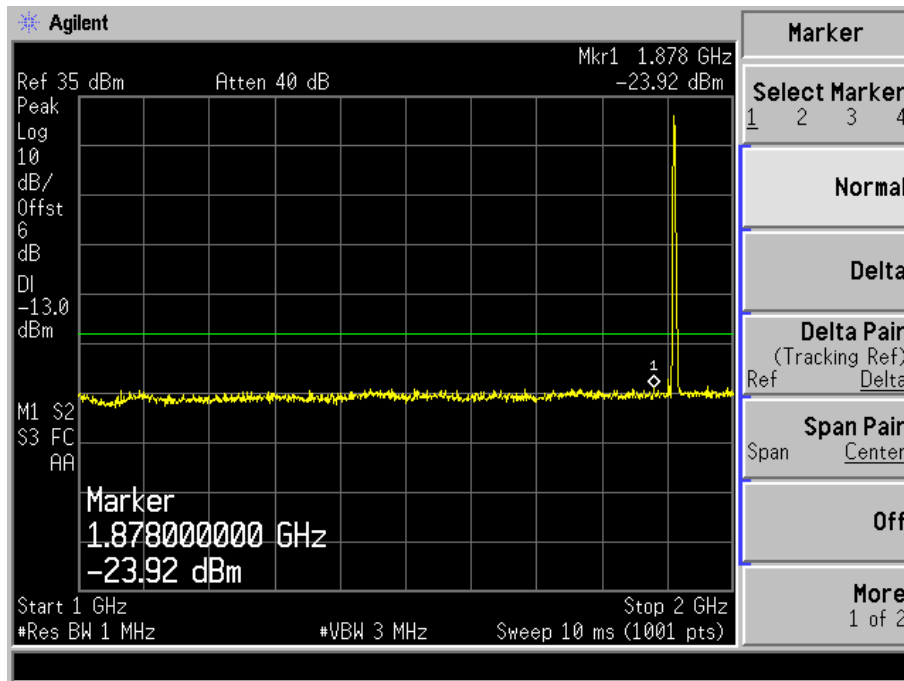
GPRS Middle Channel



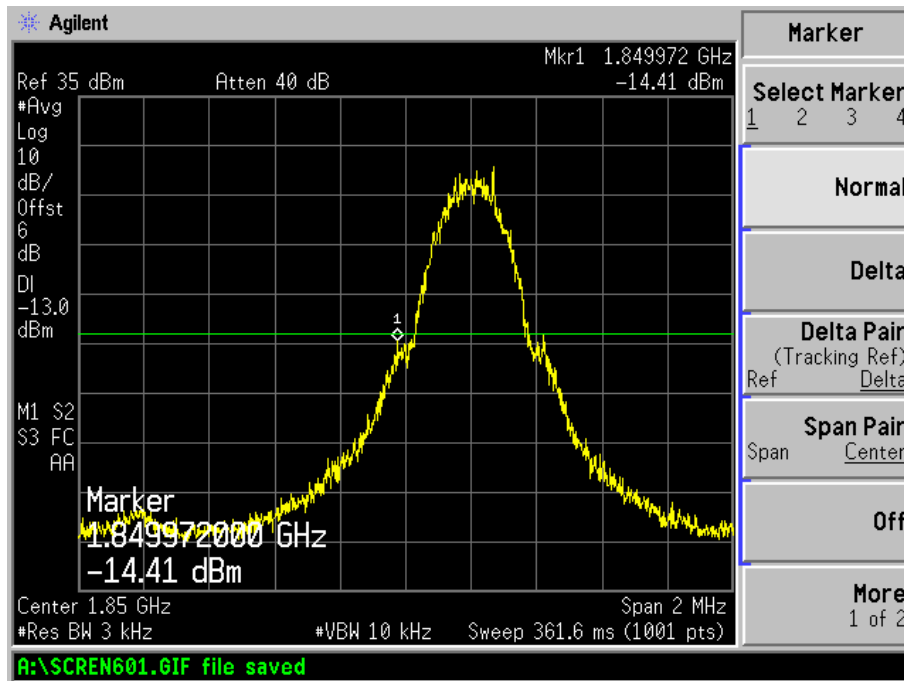


GPRS High Channel

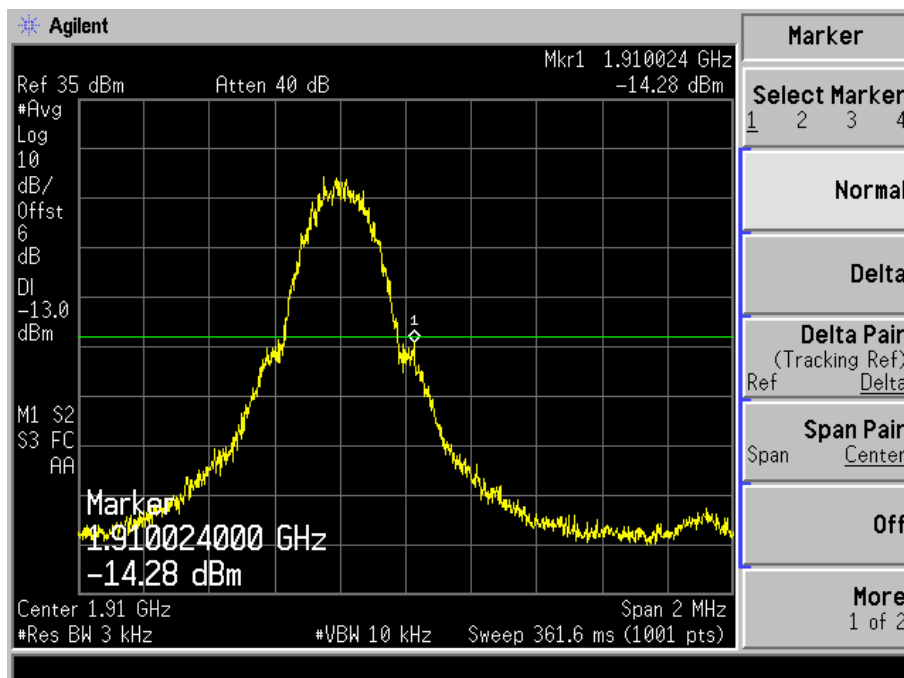




GPRS Low Band Emission

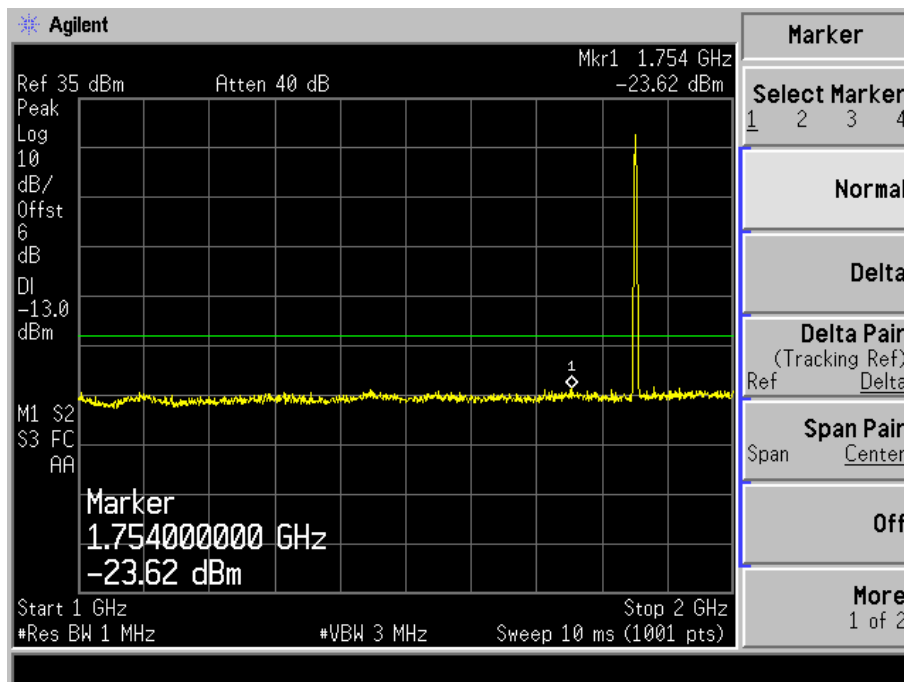
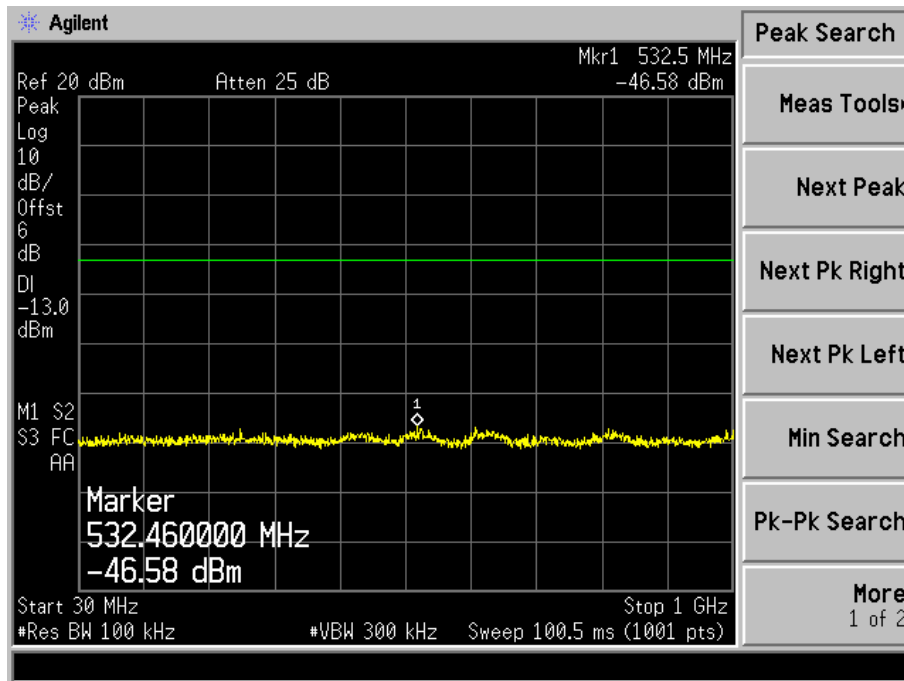


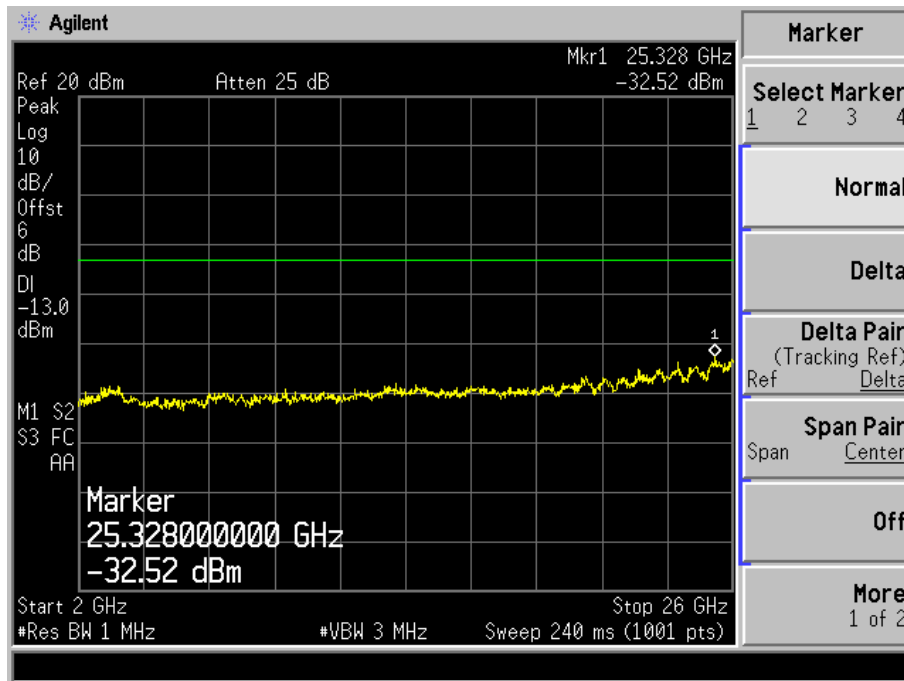
GPRS High Band Emission



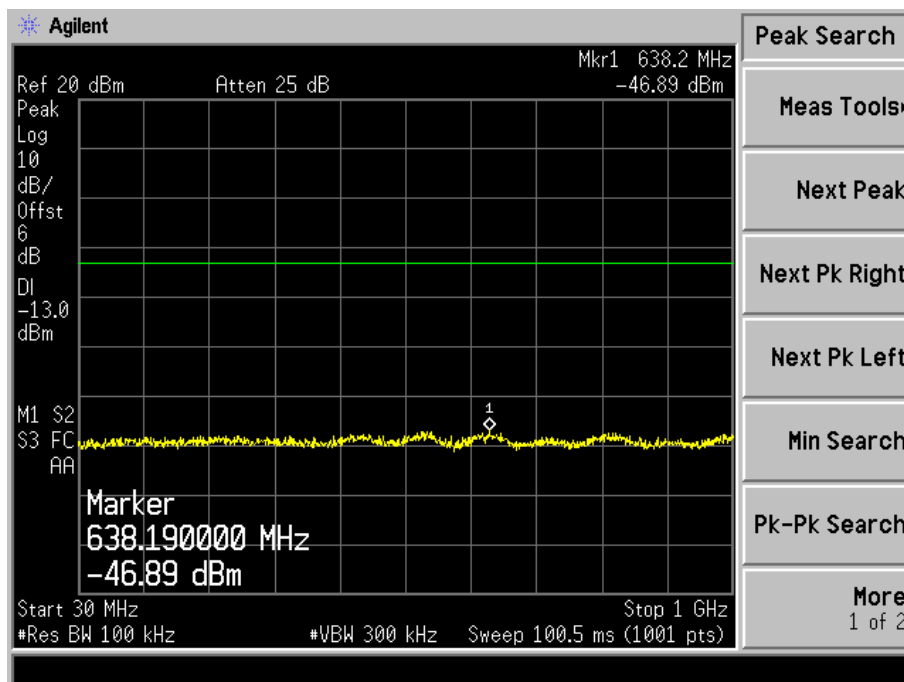


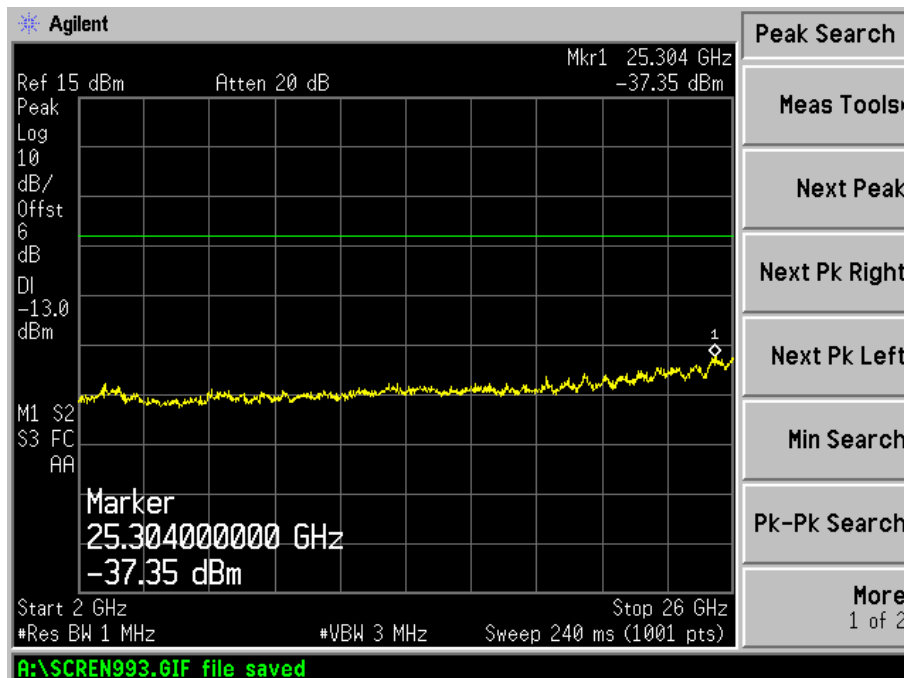
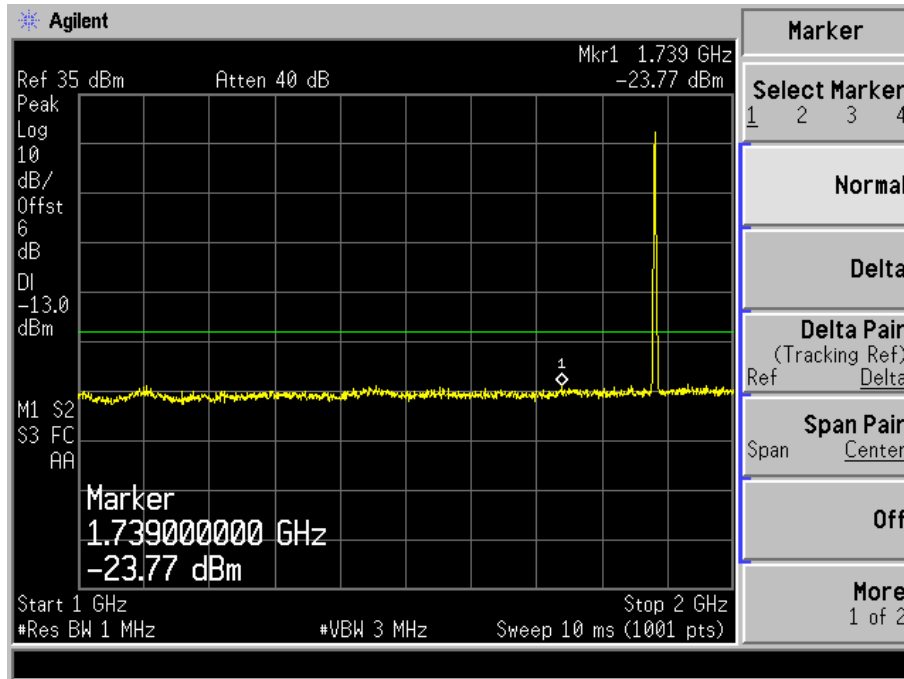
EDGE Low Channel



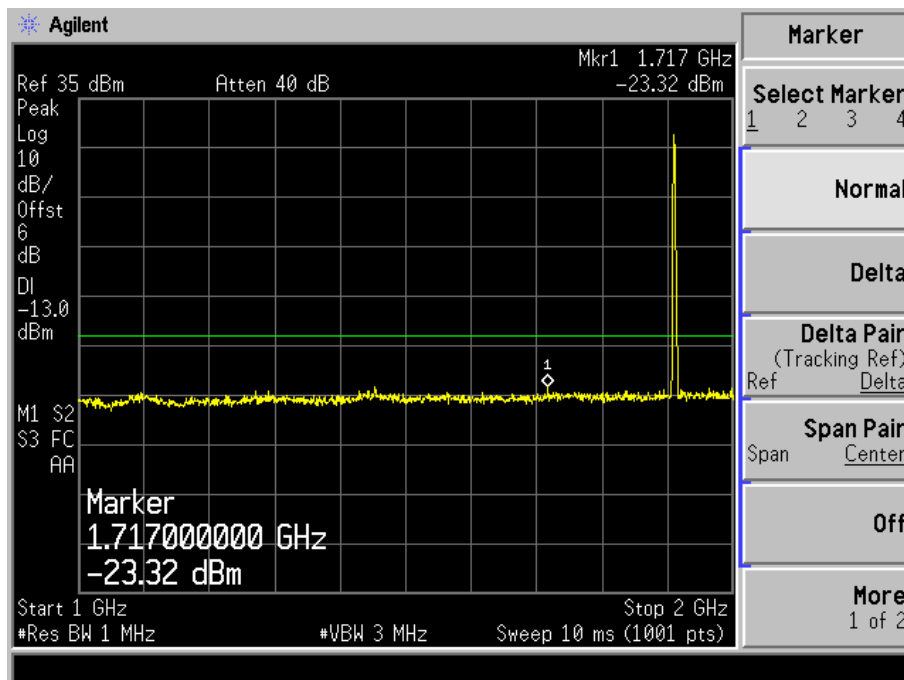
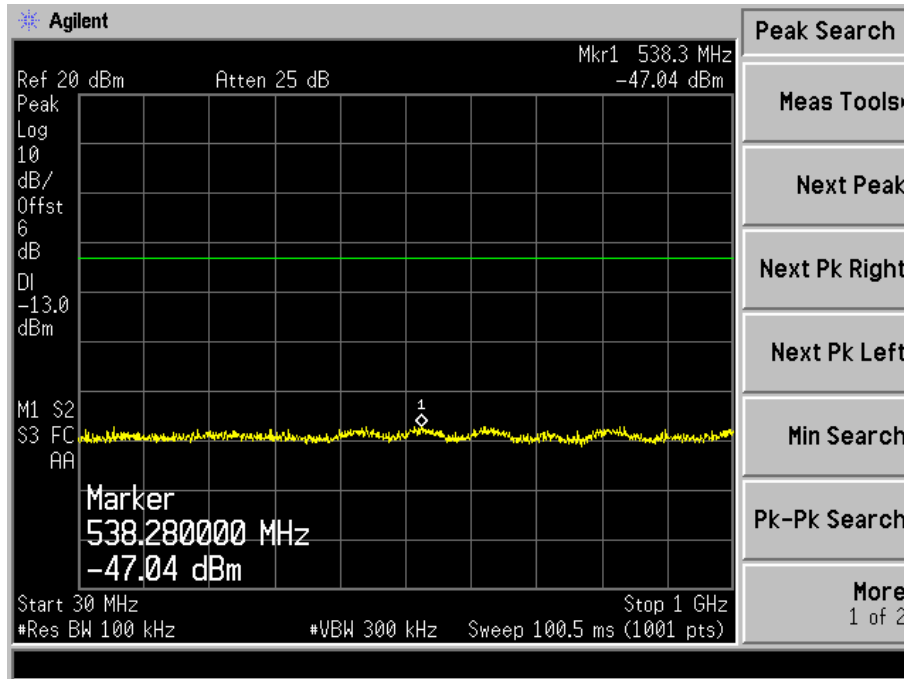


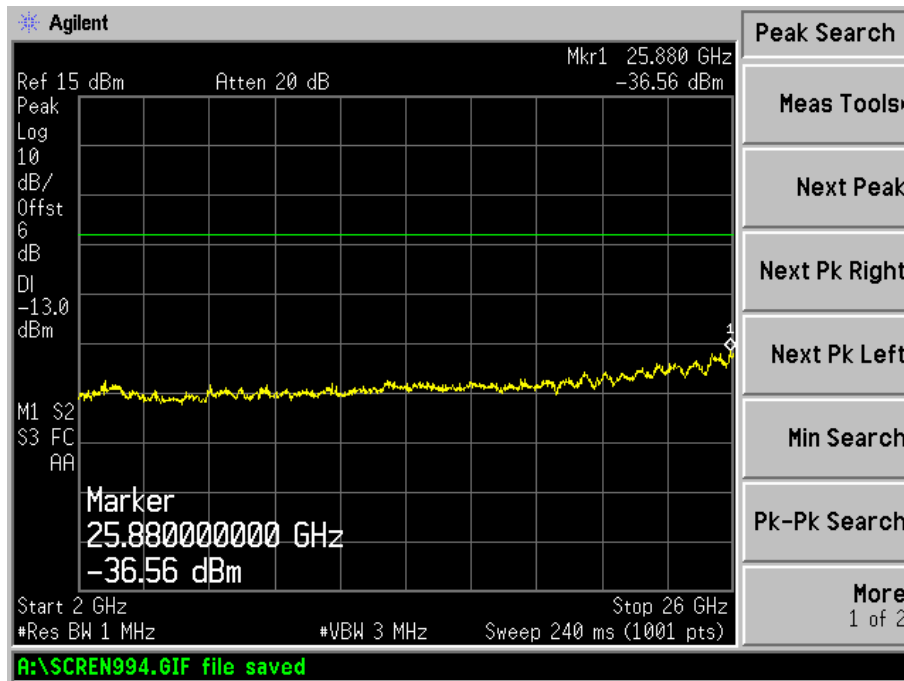
EDGE Middle Channel



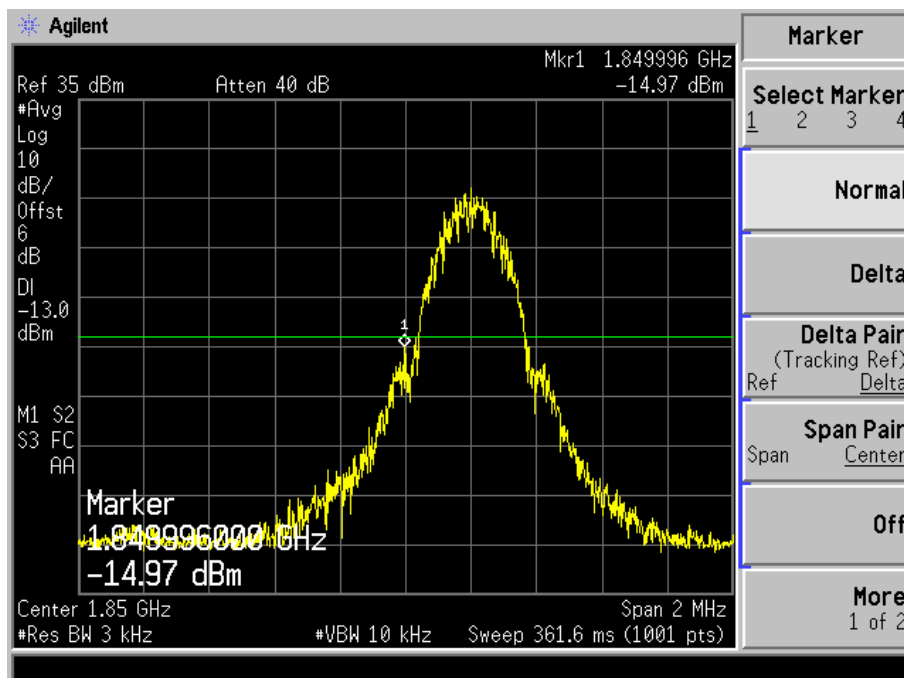


EDGE High Channel

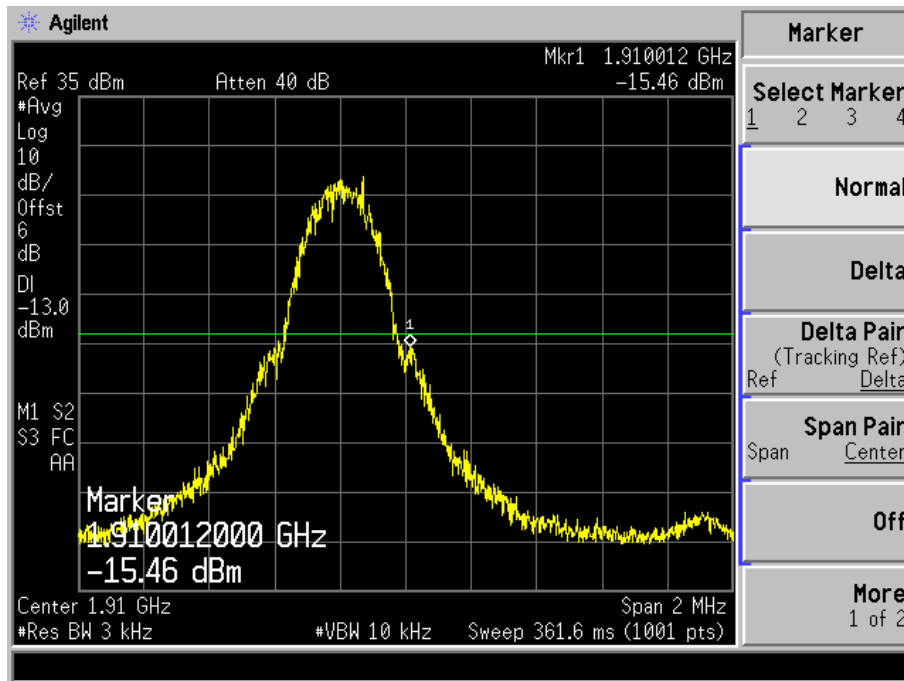




EDGE Low Band Emission

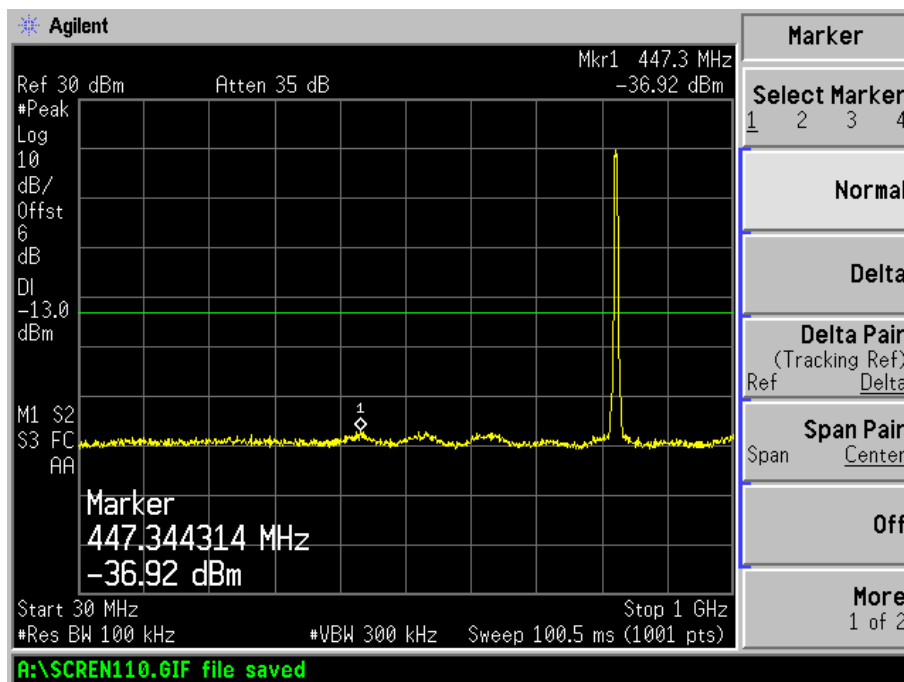


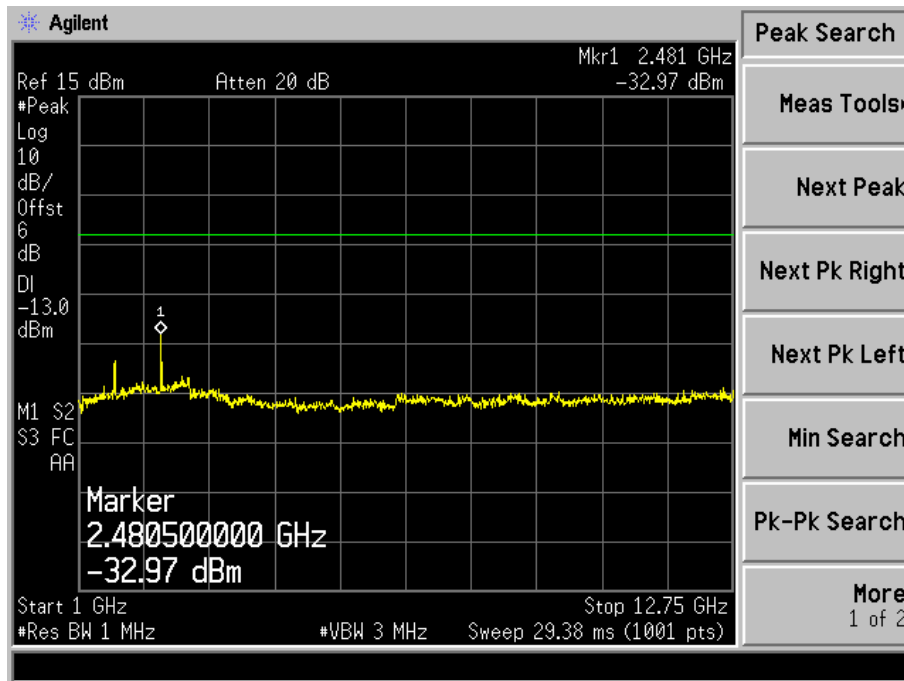
EDGE High Band Emission



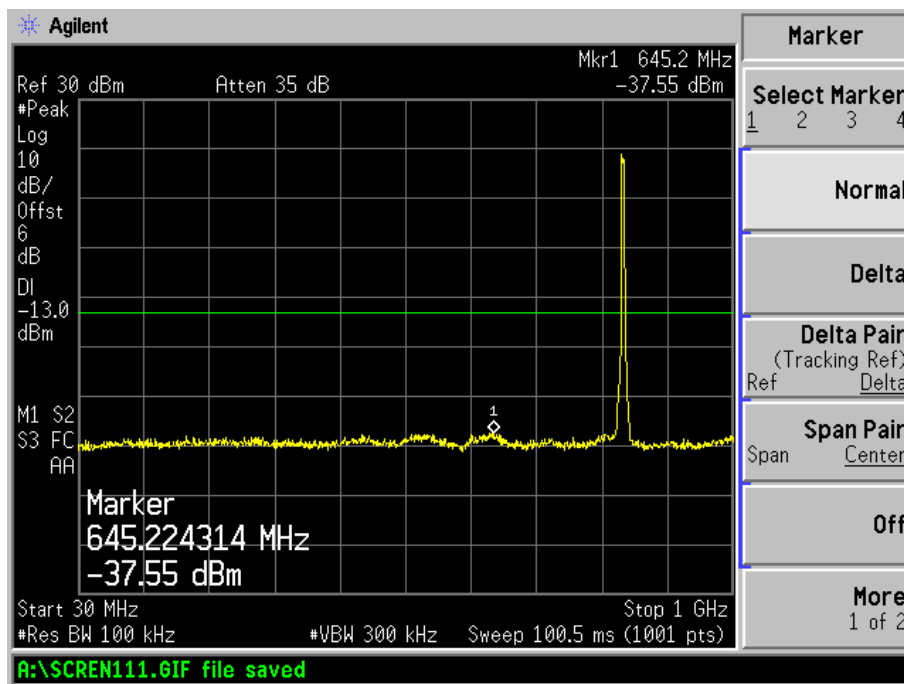
For Band V

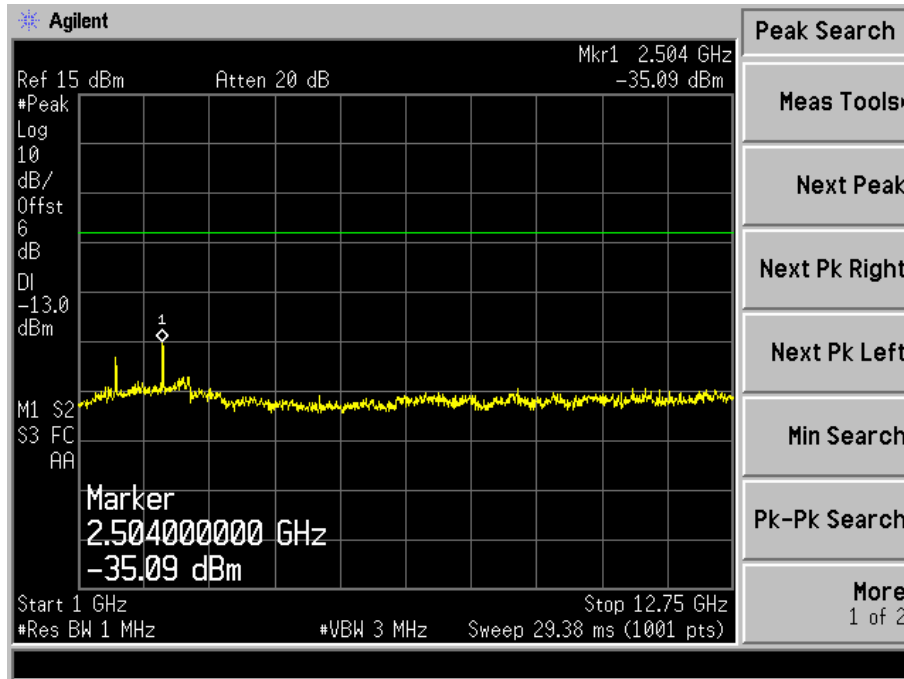
WCDMA Low Channel



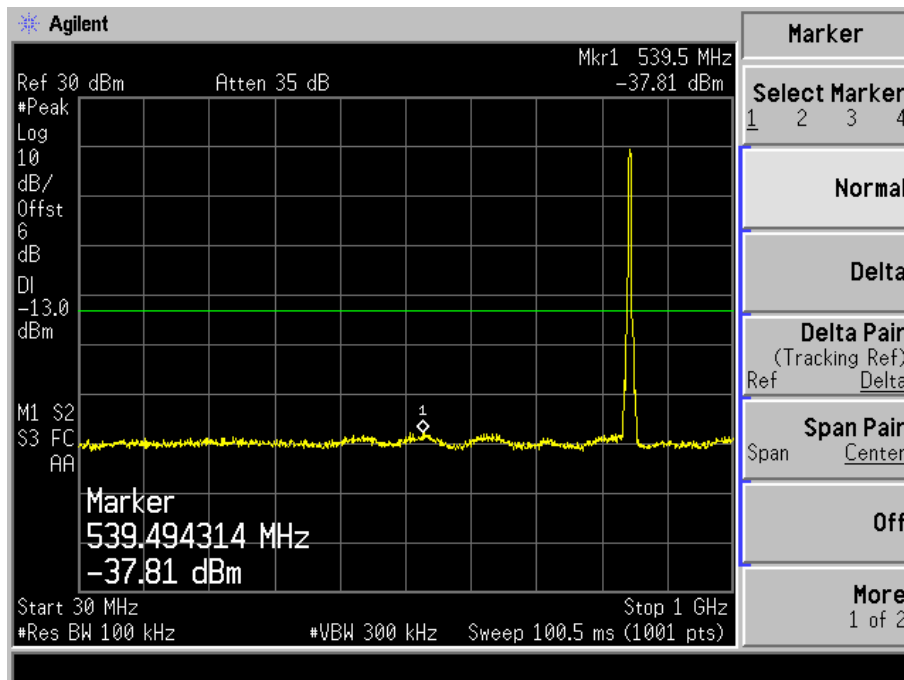


WCDMA Middle Channel

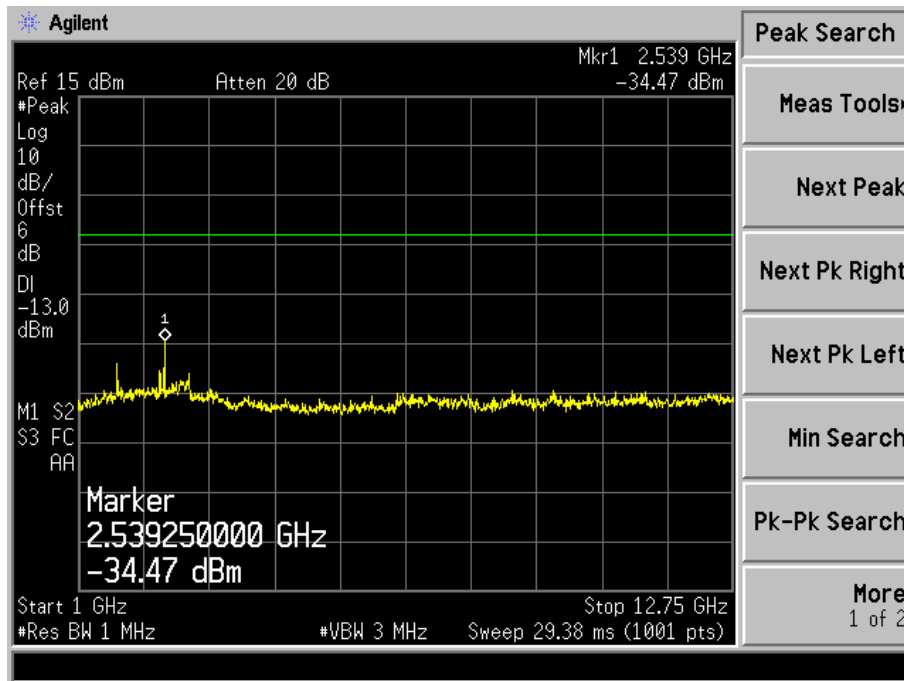




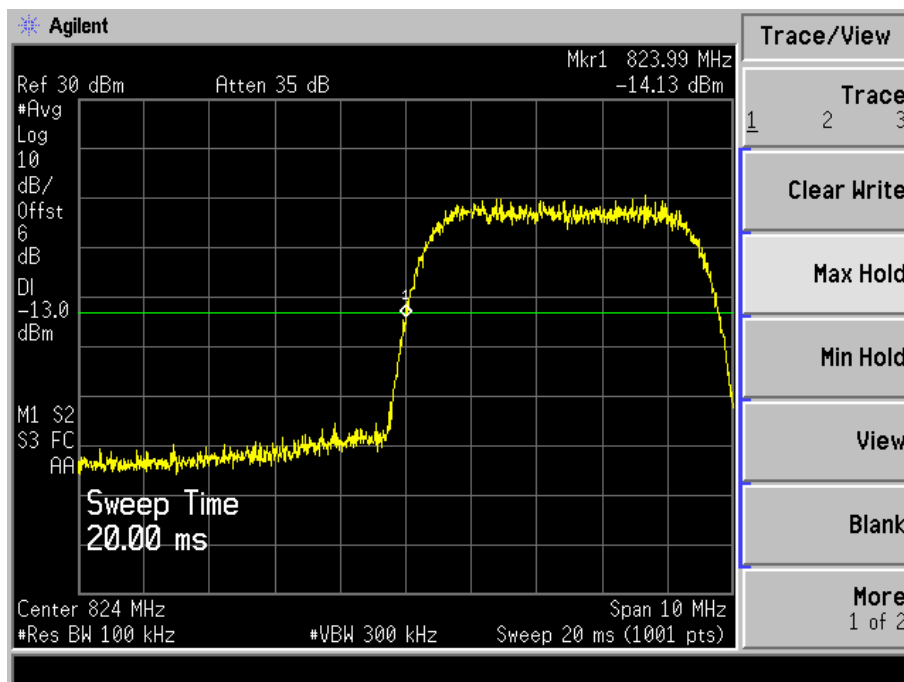
WCDMA High Channel



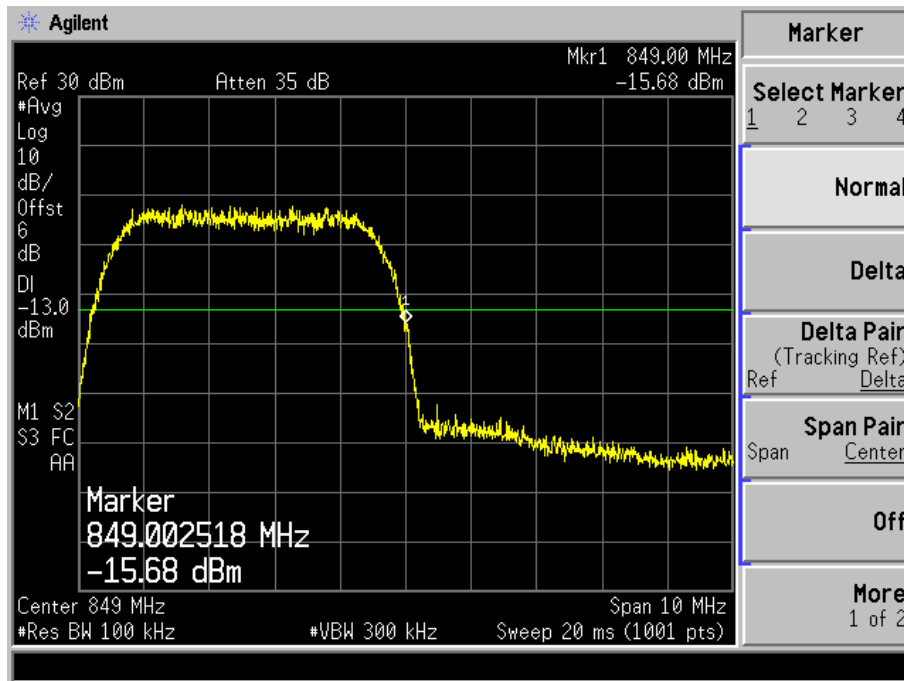




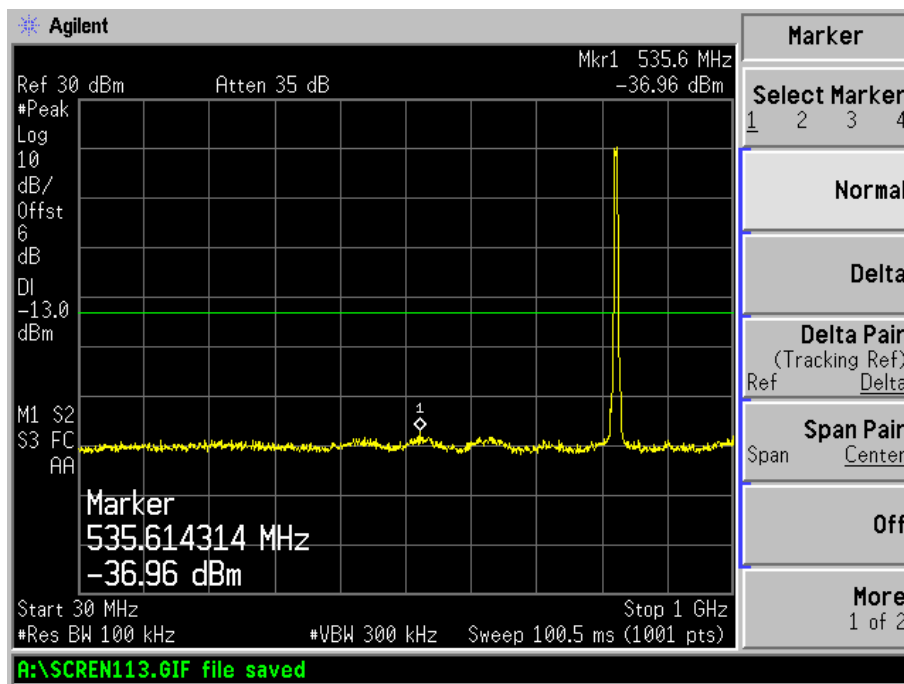
WCDMA Low Band Spurious Emission

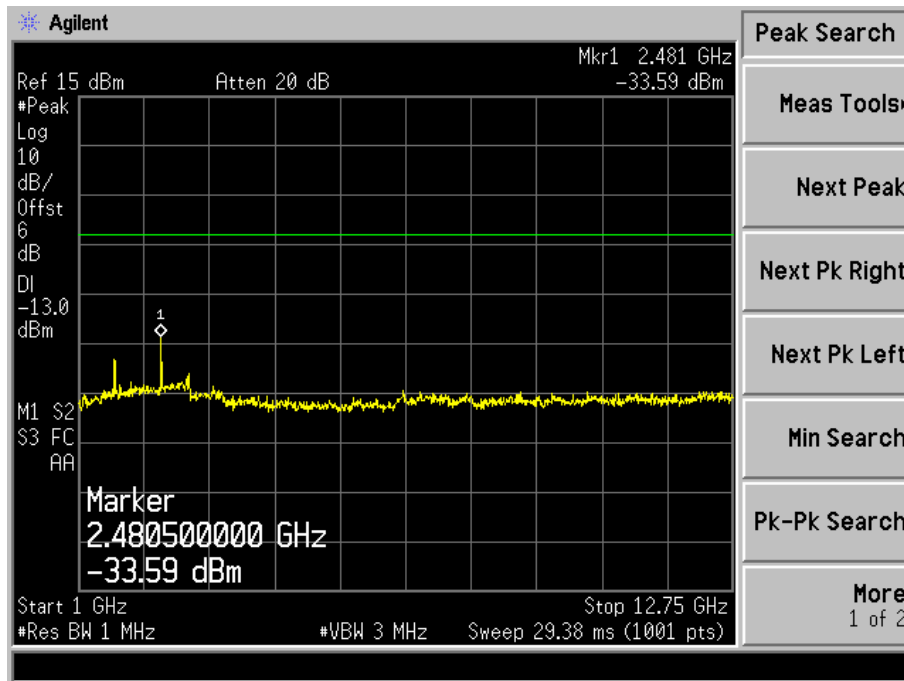


WCDMA High Band Spurious Emission

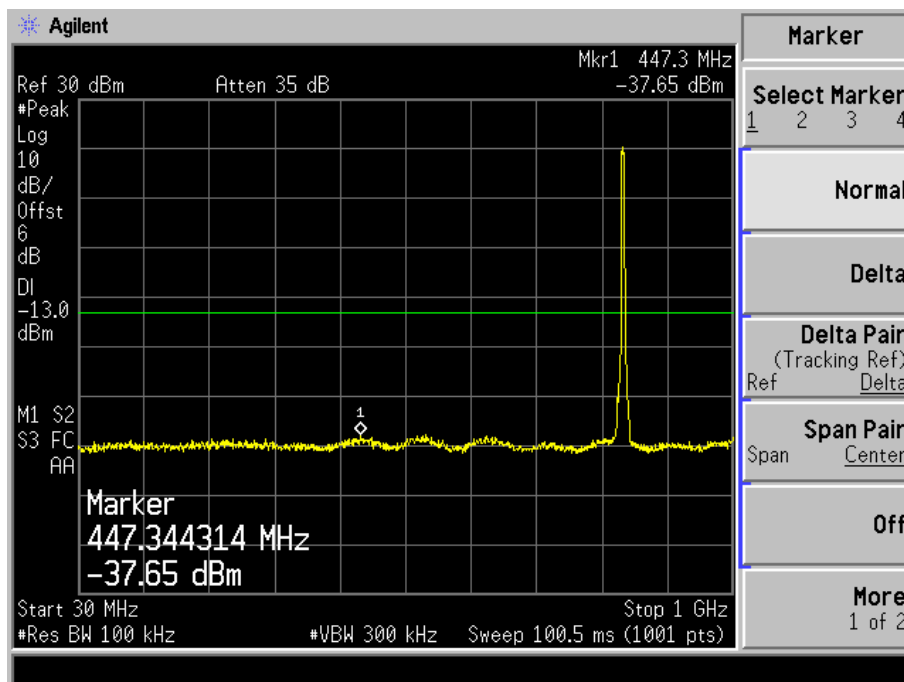


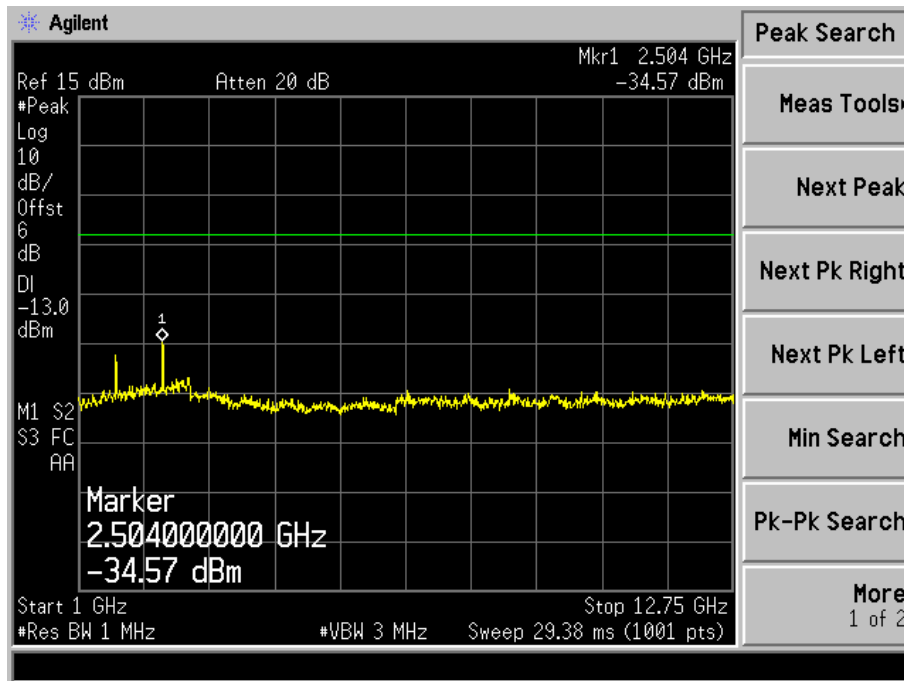
HSDPA Low Channel



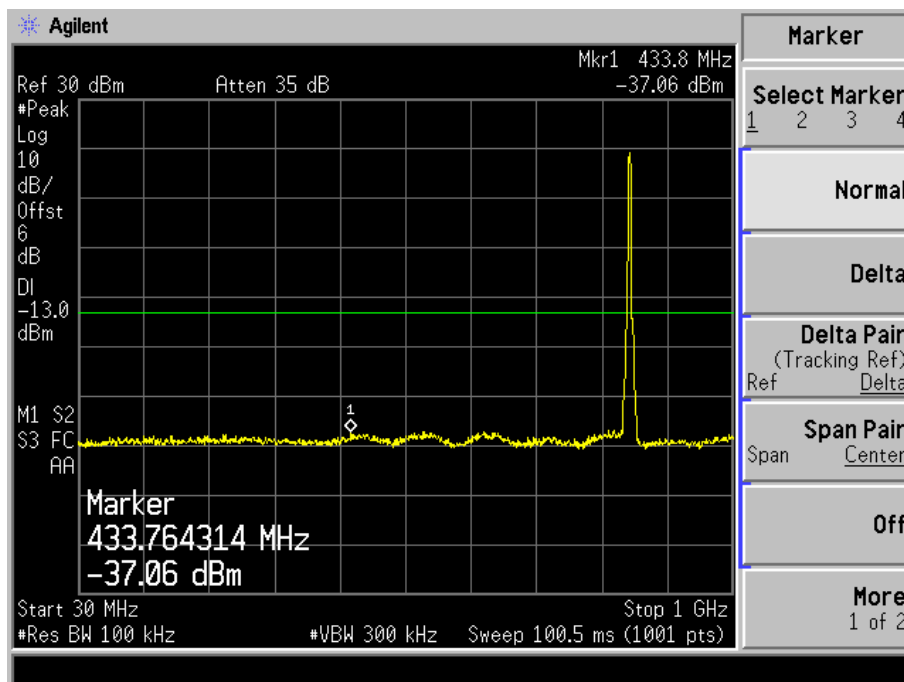


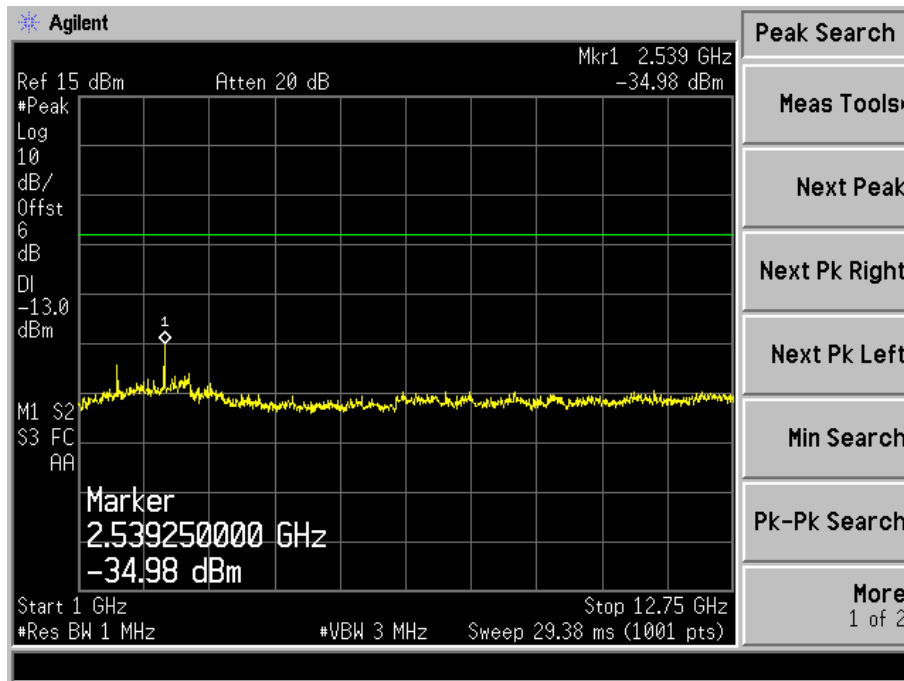
HSDPA Middle Channel



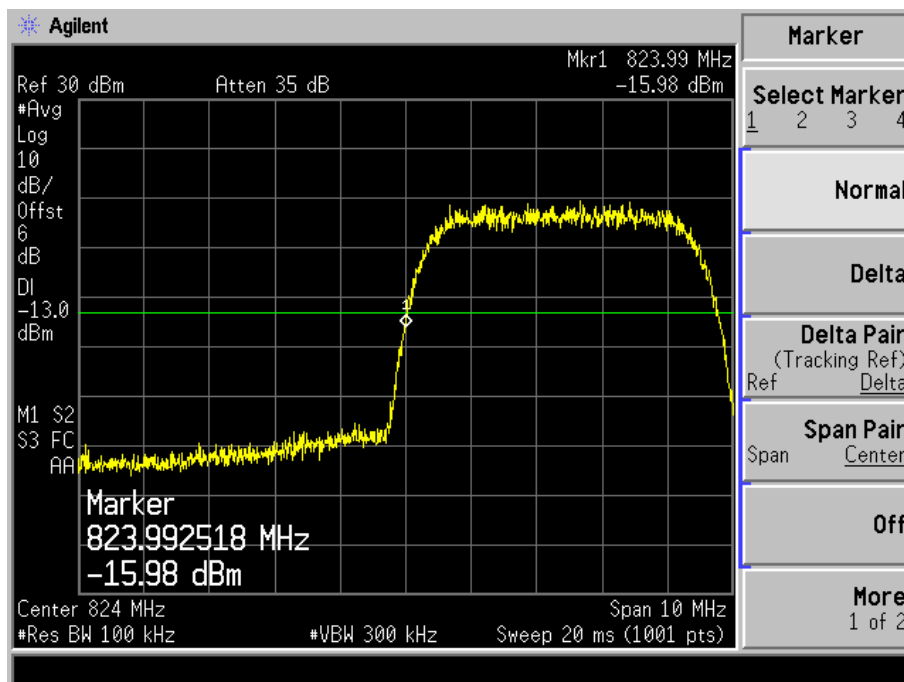


HSDPA High Channel

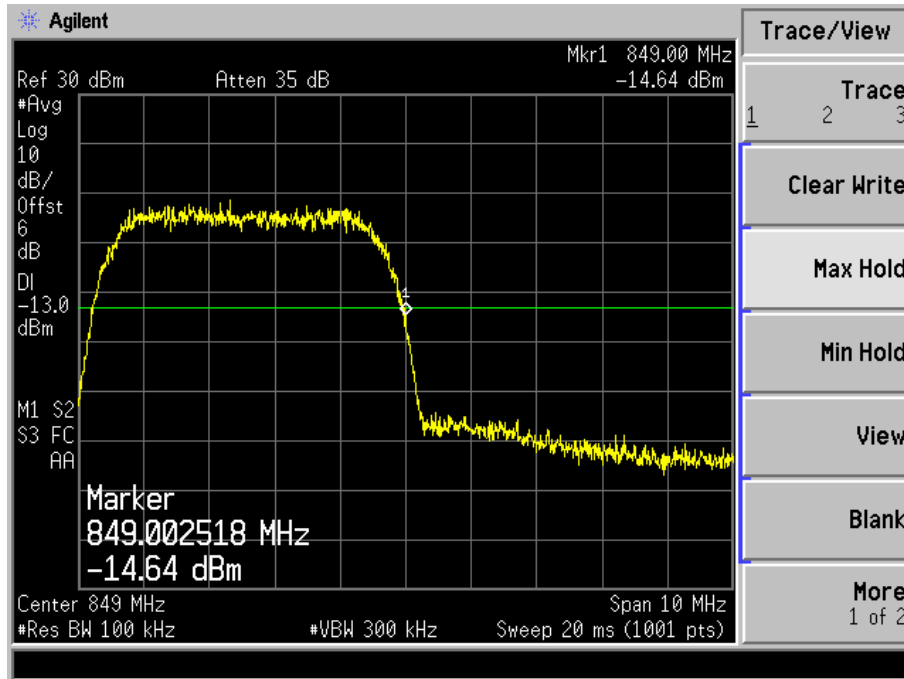




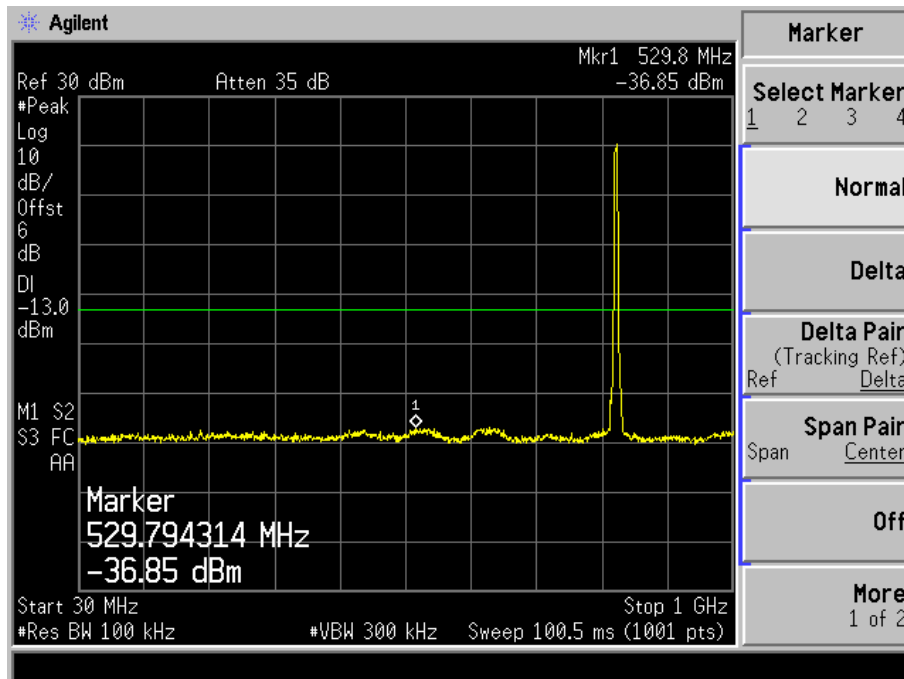
HSDPA Low Band Spurious Emission

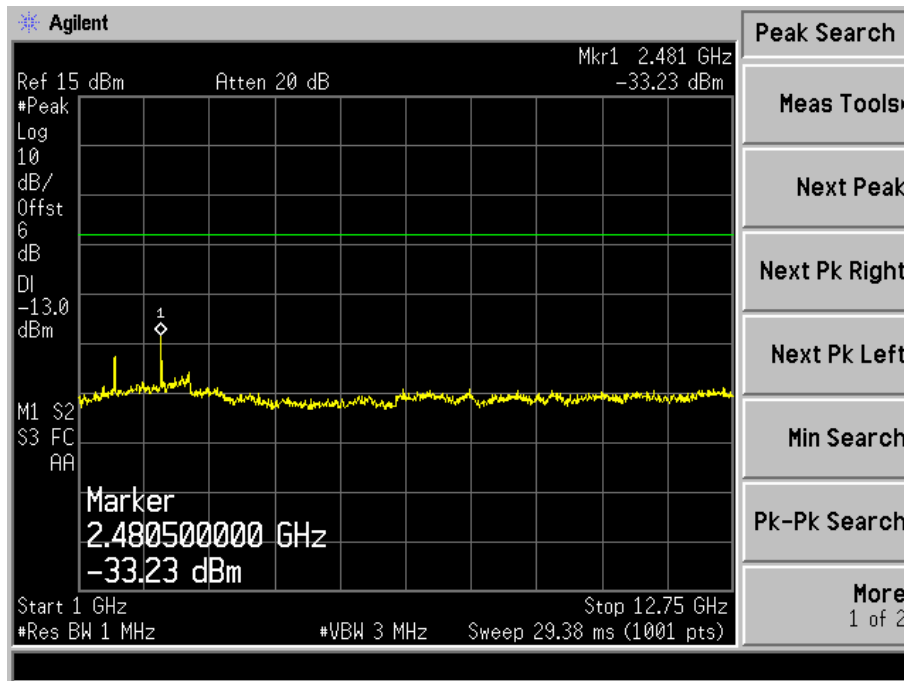


HSDPA High Band Spurious Emission

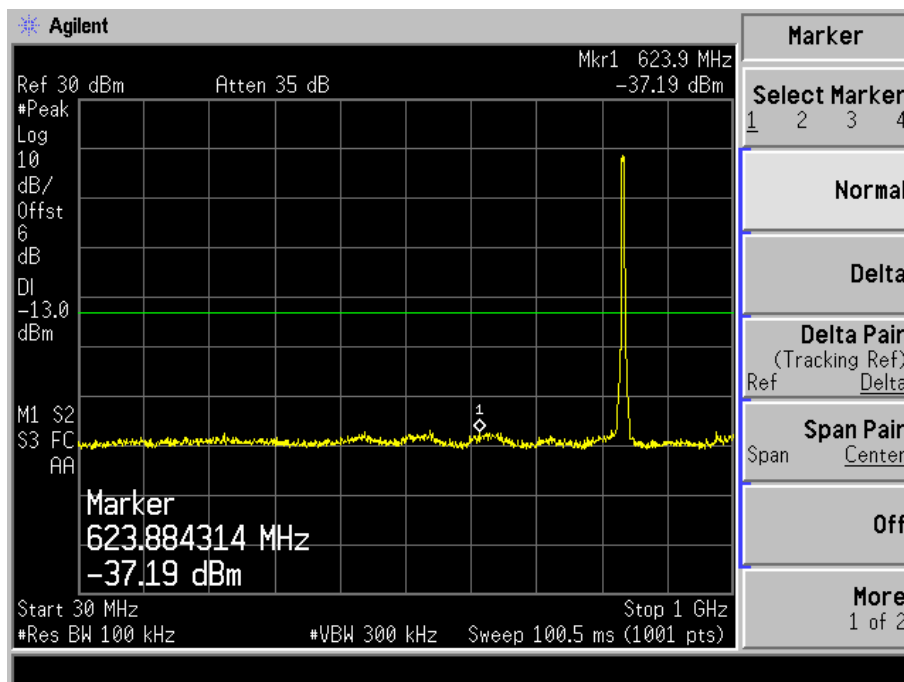


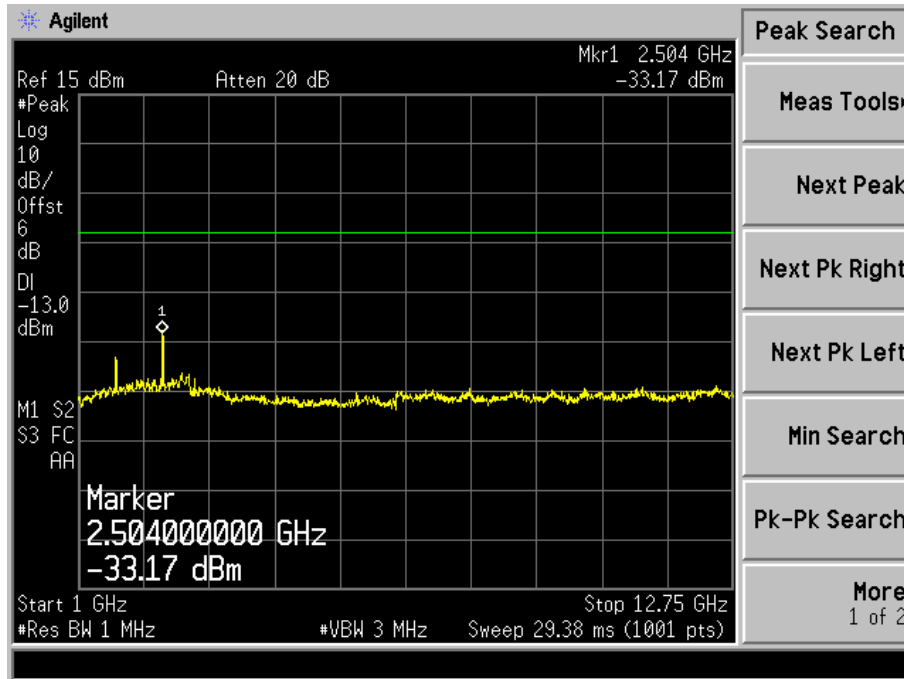
HSUPA Low Channel



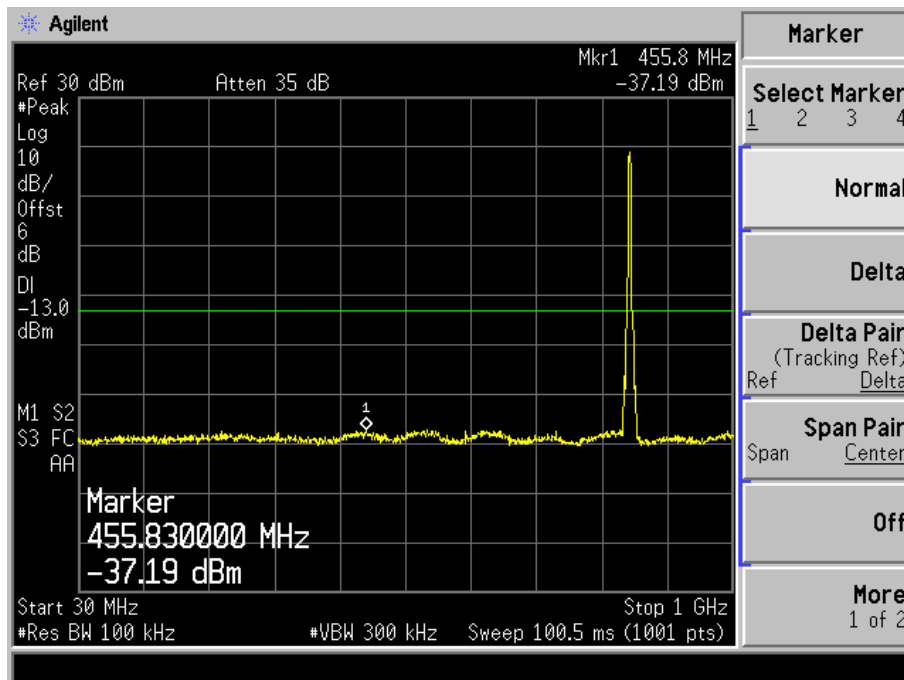


HSUPA Middle Channel

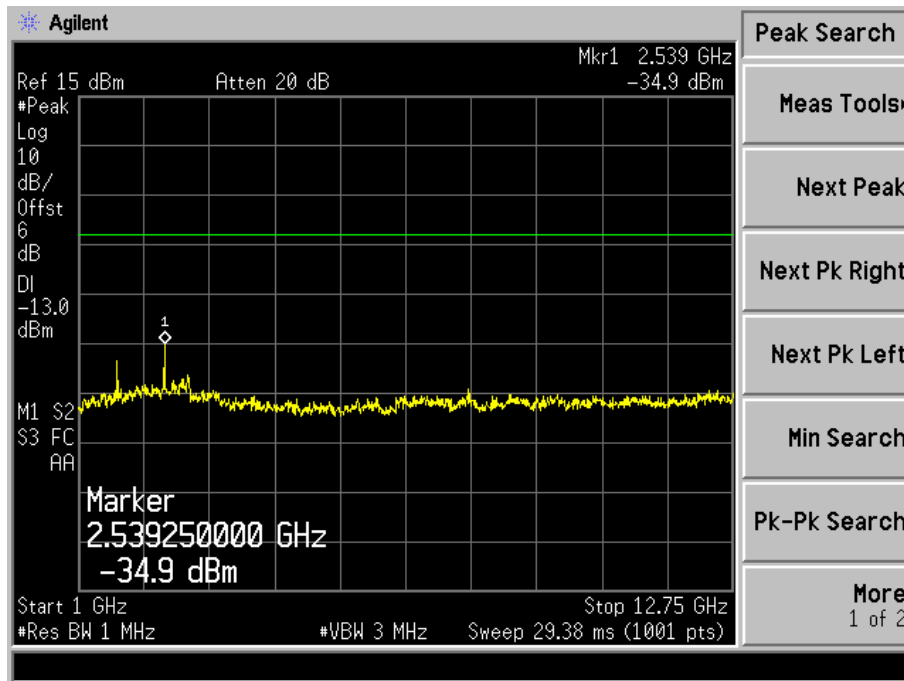




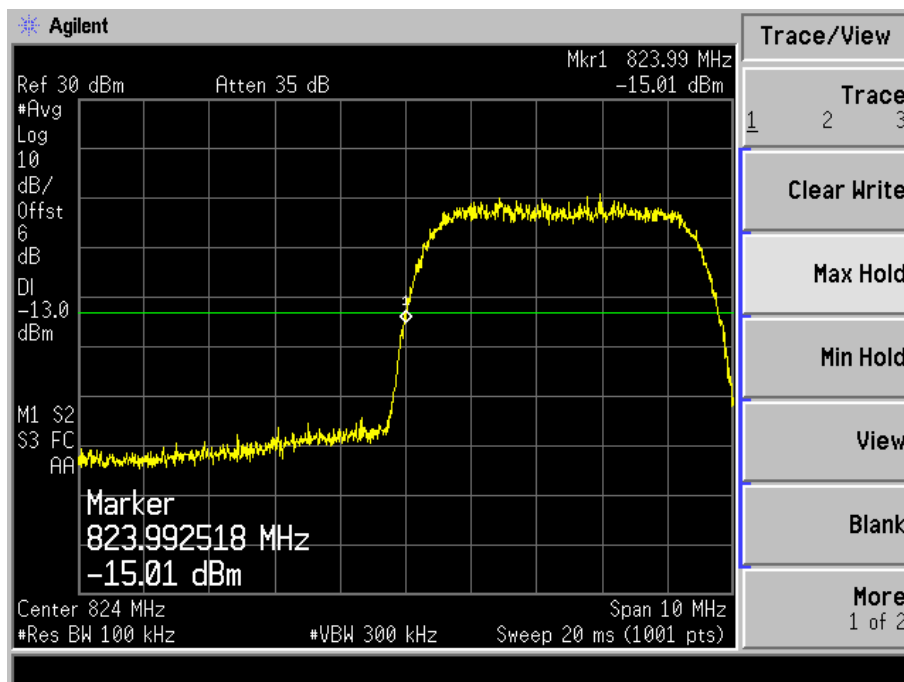
HSUPA High Channel



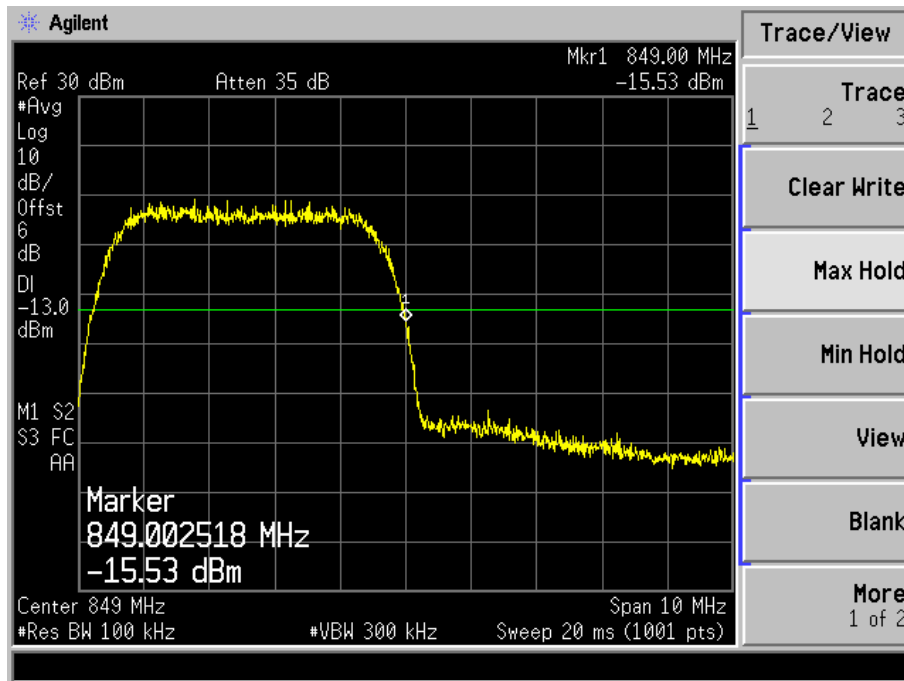




HSUPA Low Band Spurious Emission

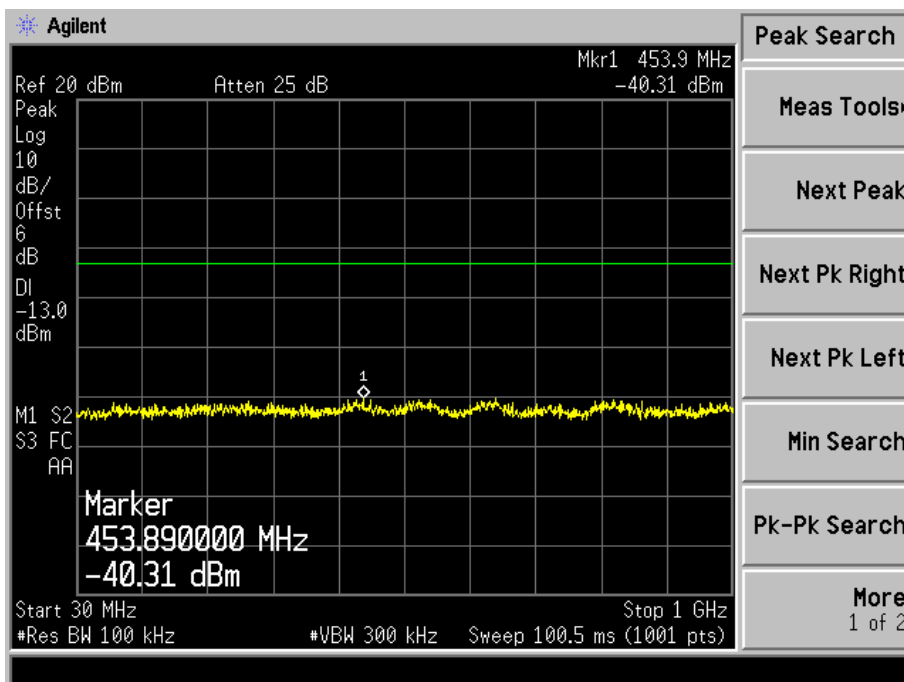


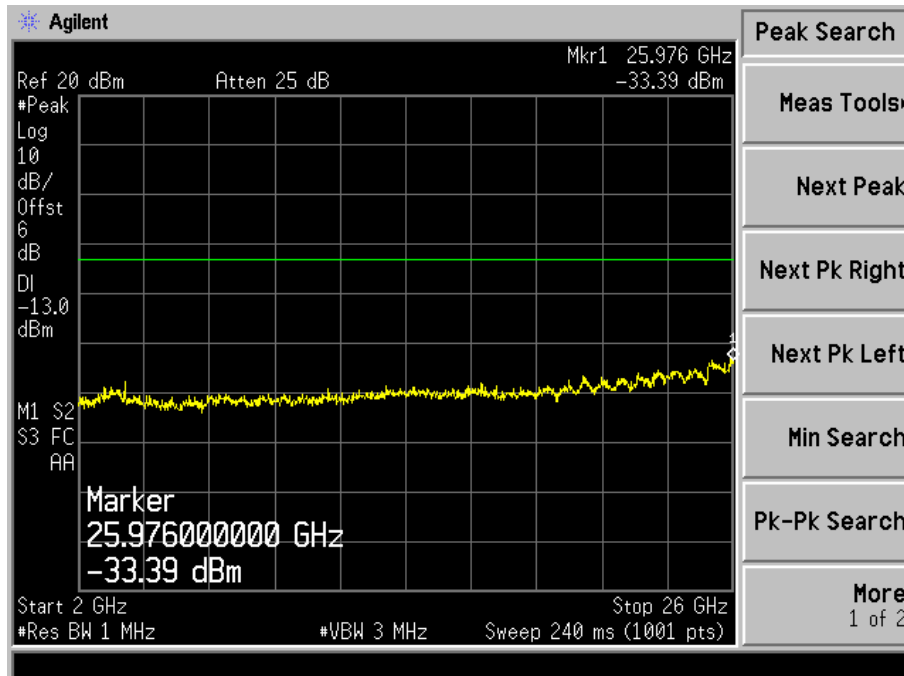
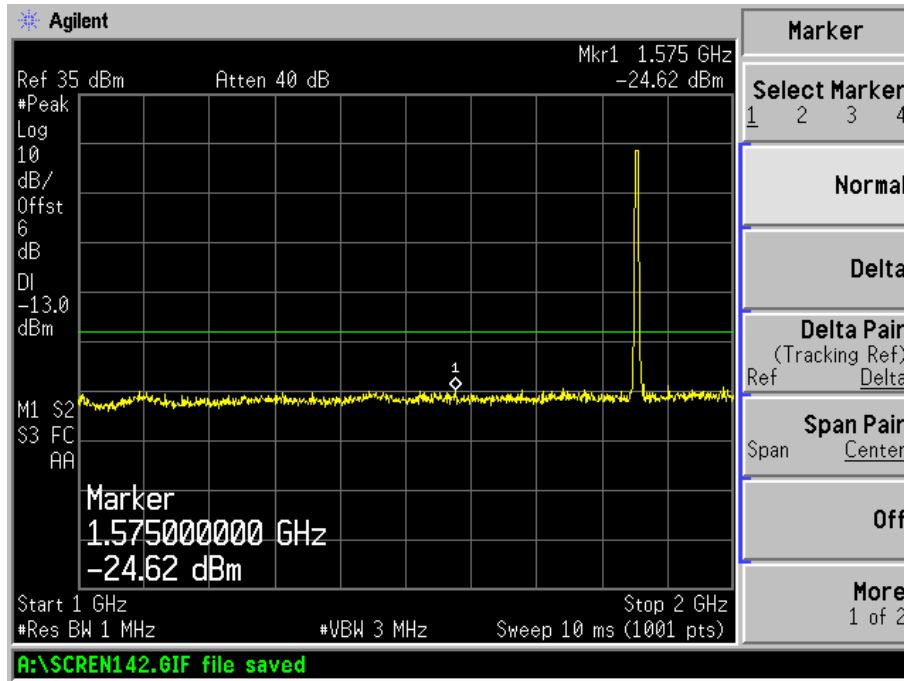
HSUPA High Band Spurious Emission



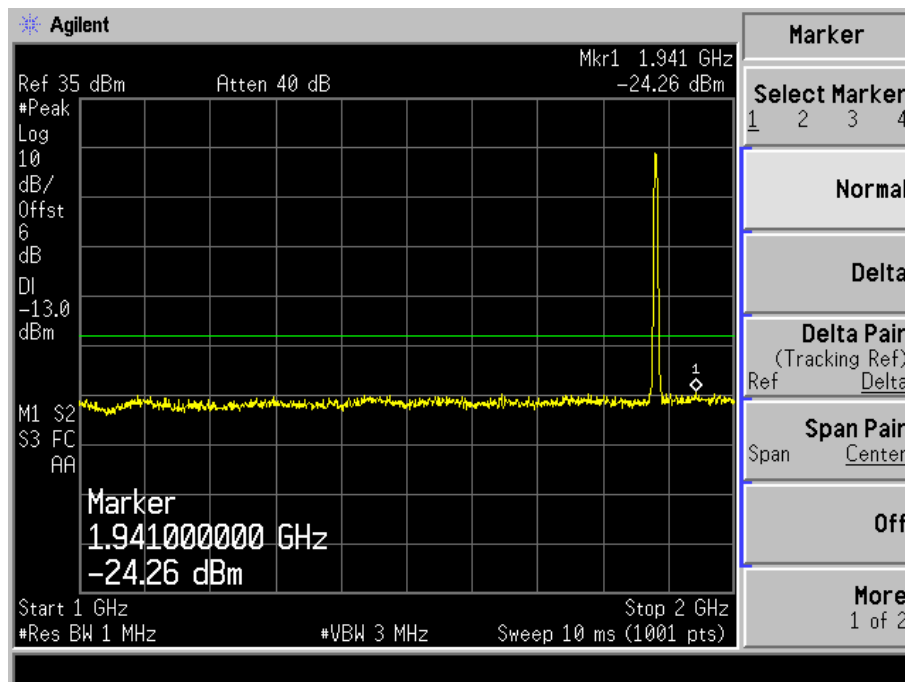
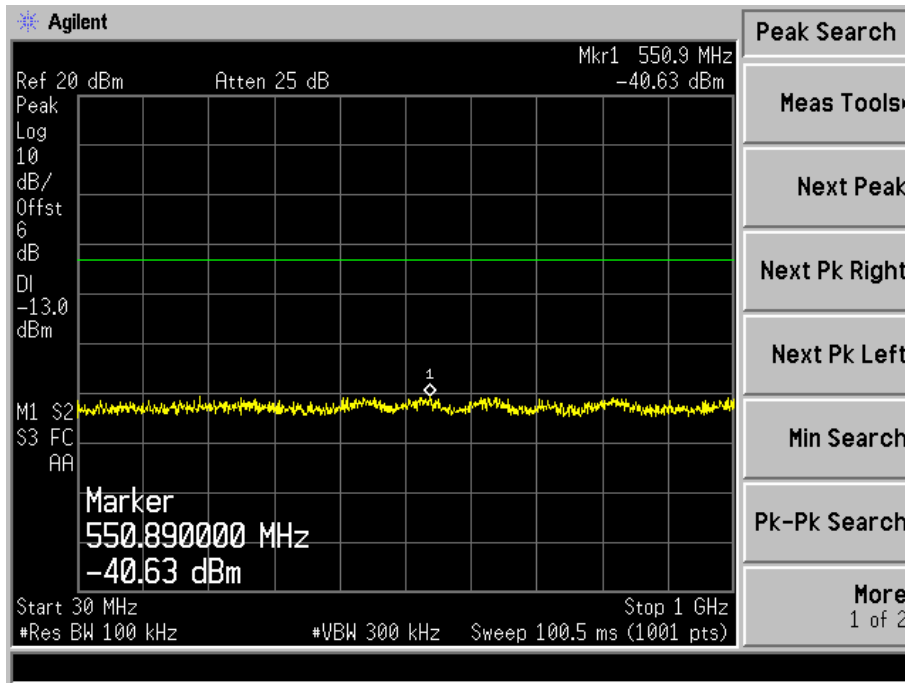
For Band II

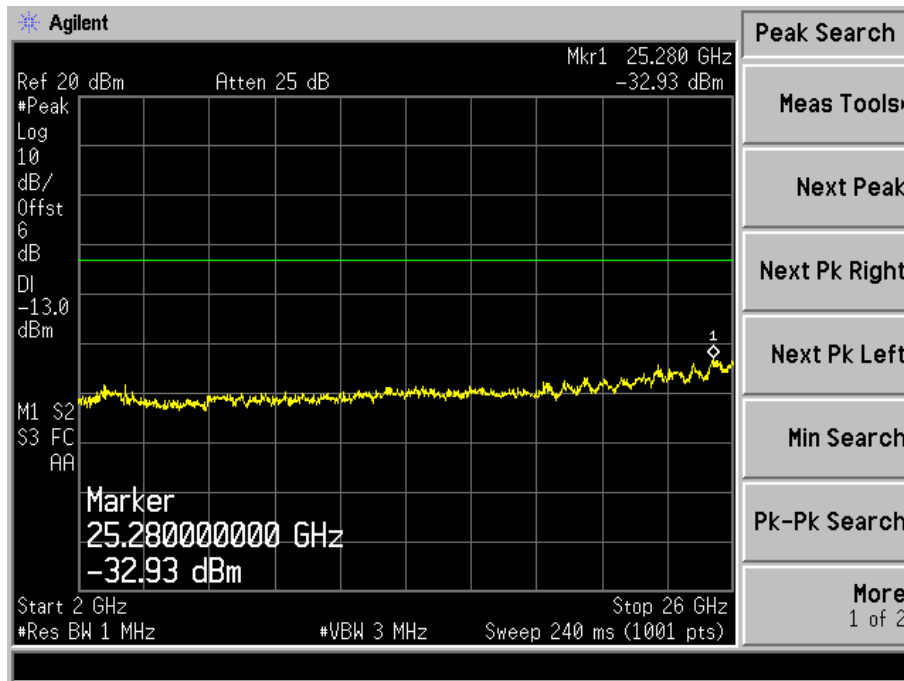
WCDMA Low Channel



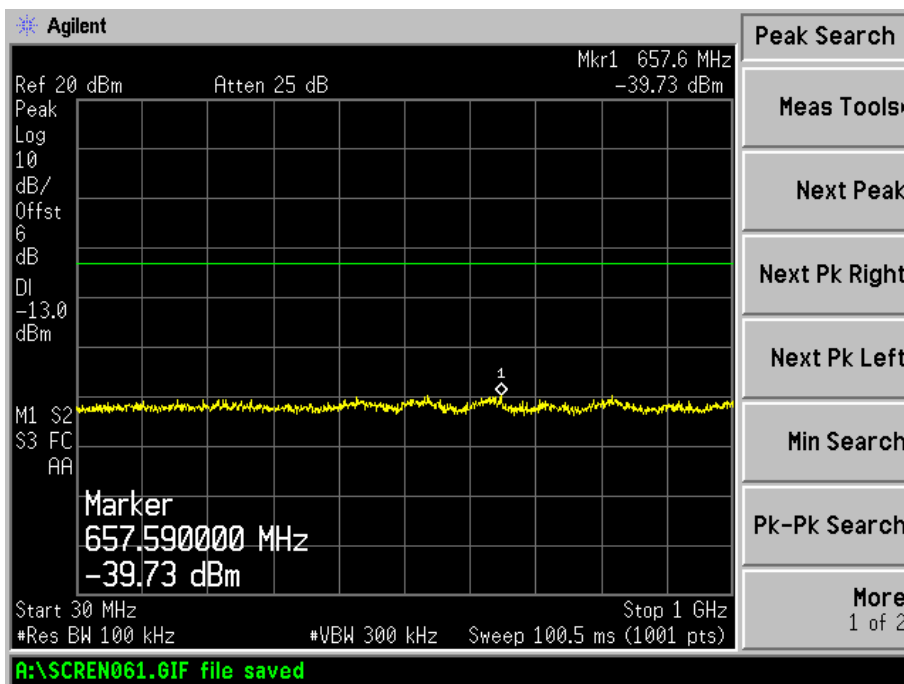


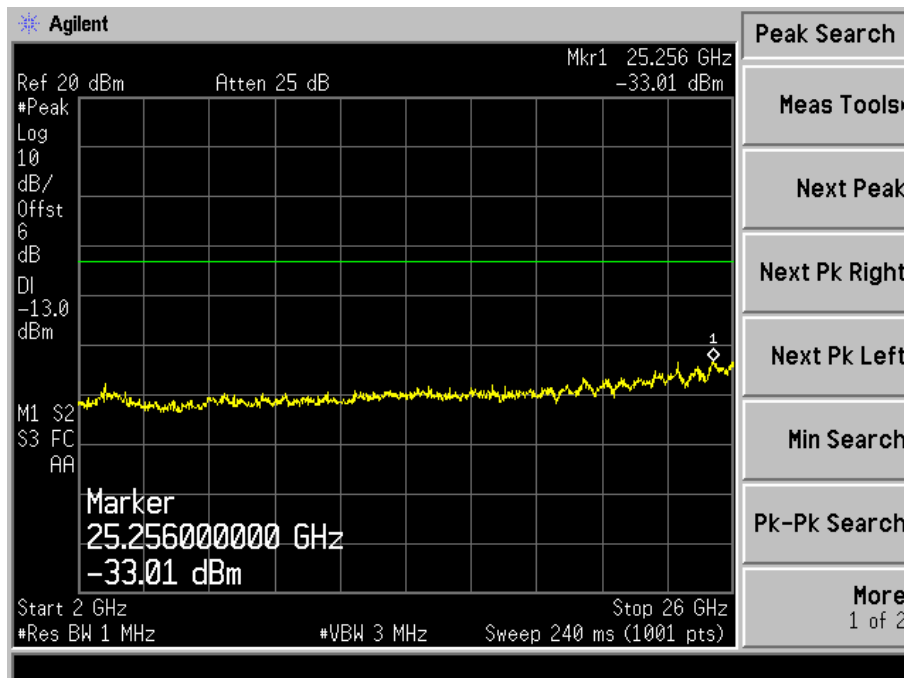
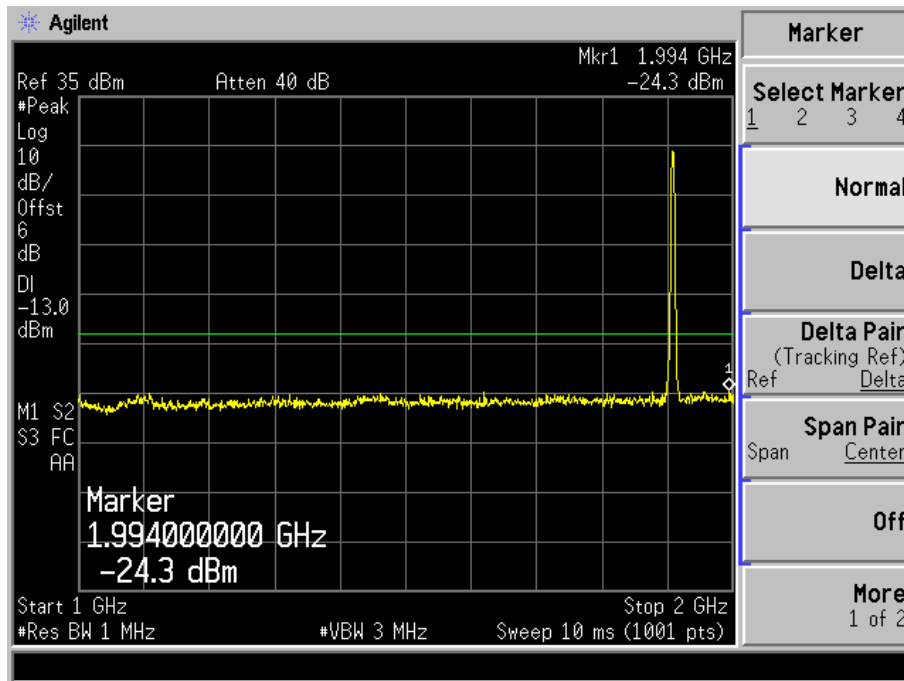
WCDMA Middle Channel



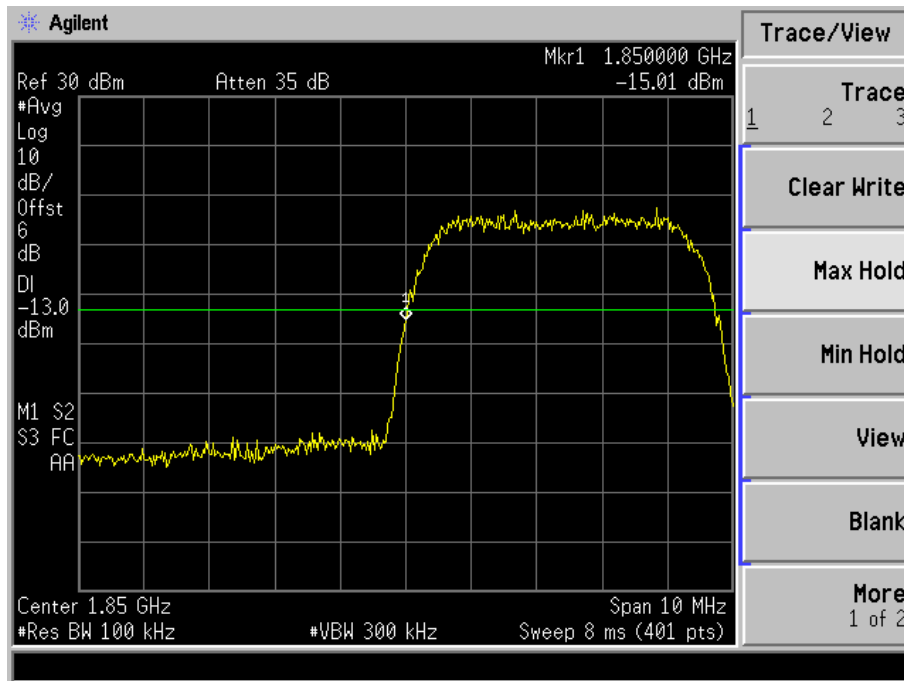


WCDMA High Channel

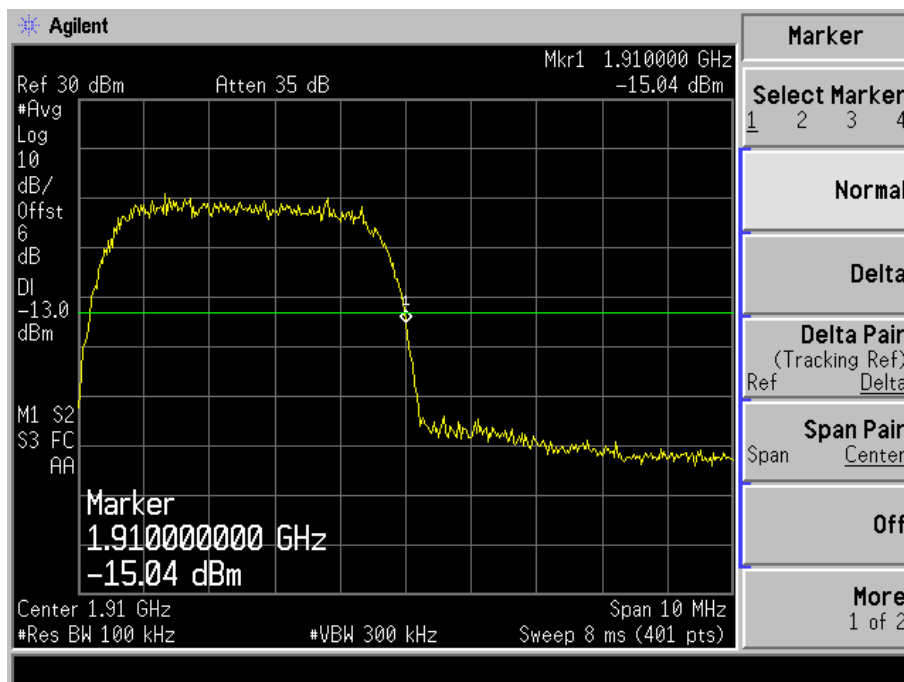




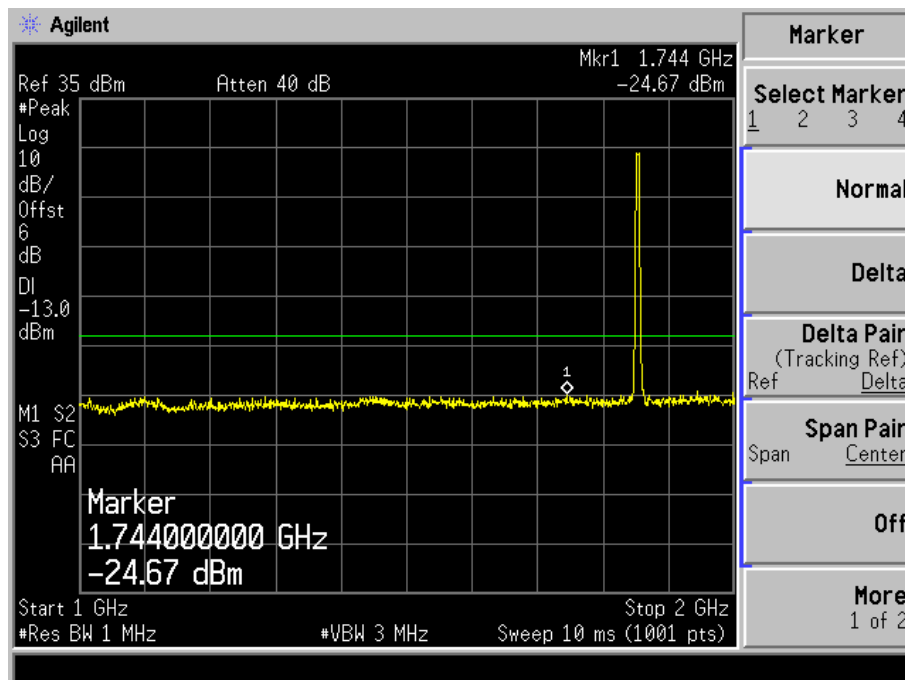
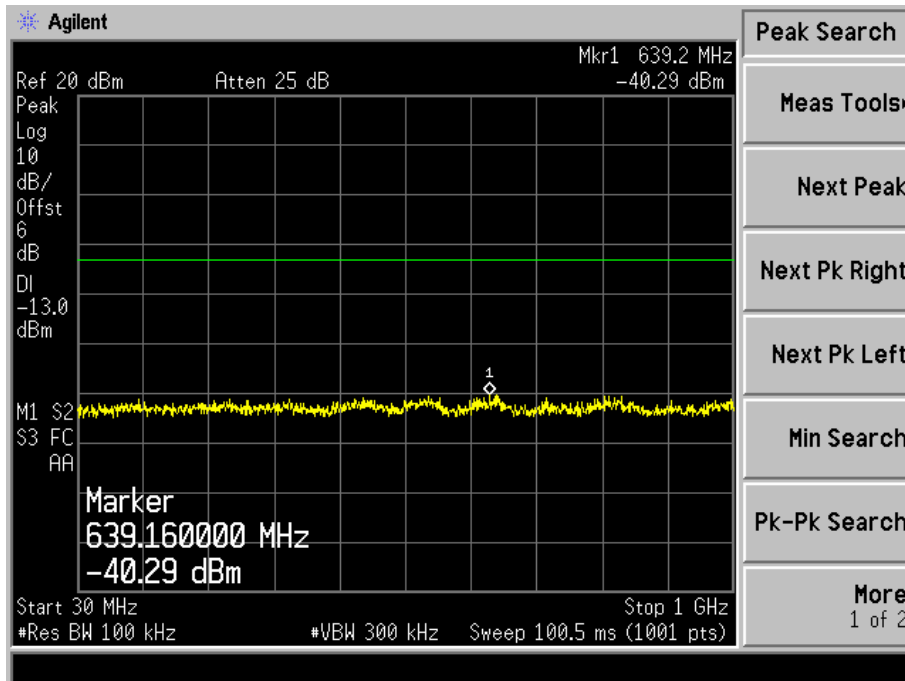
WCDMA Low Band Spurious Emission



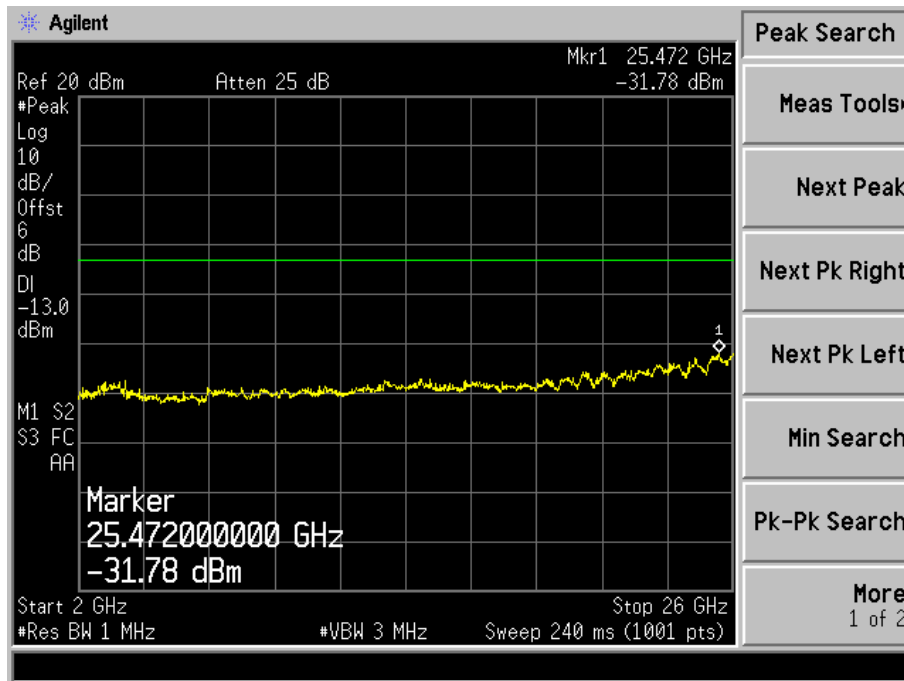
WCDMA High Band Spurious Emission



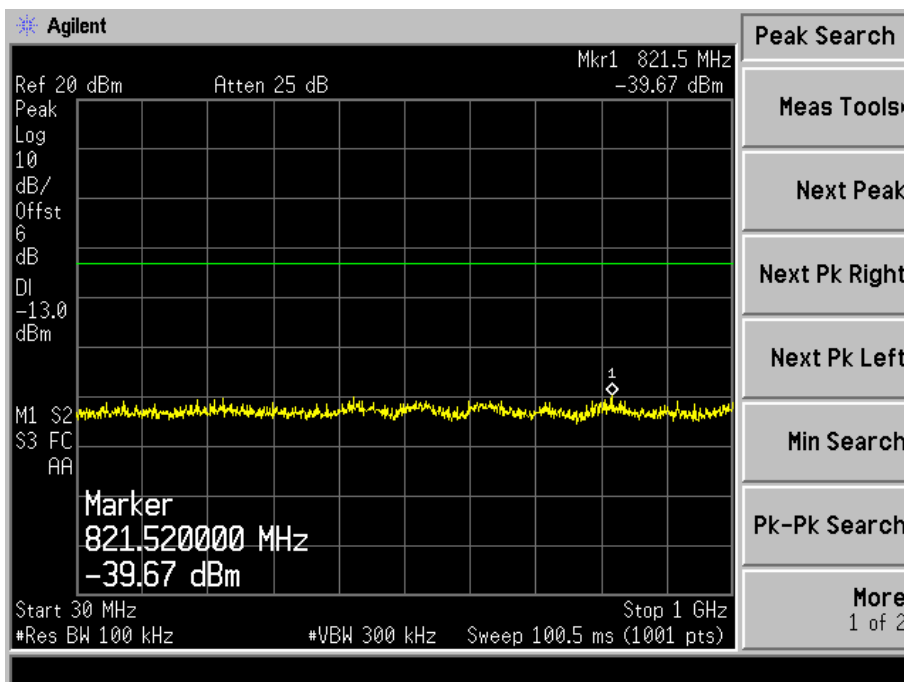
HSDPA Low Channel

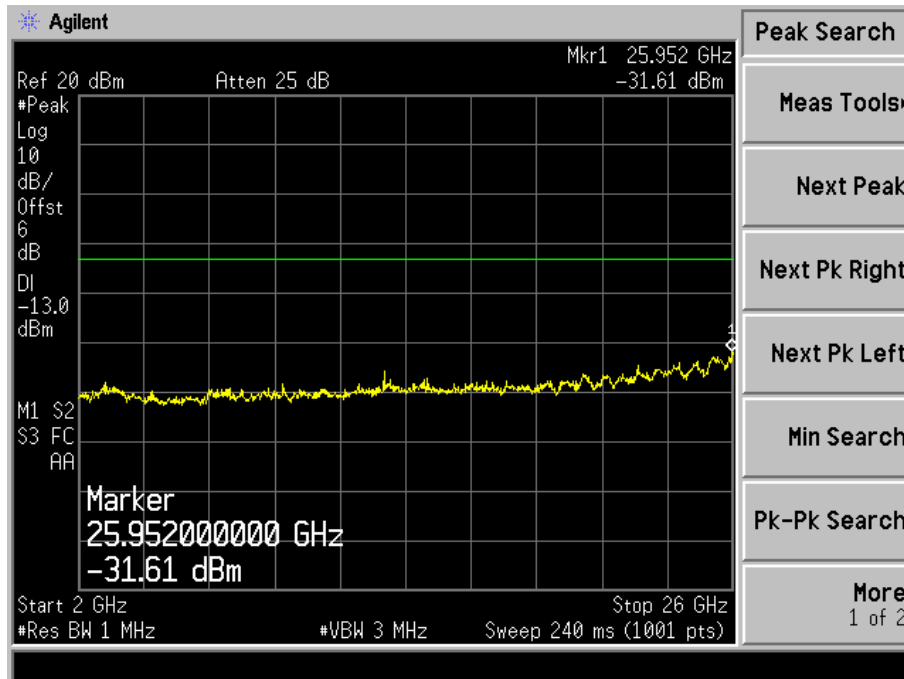
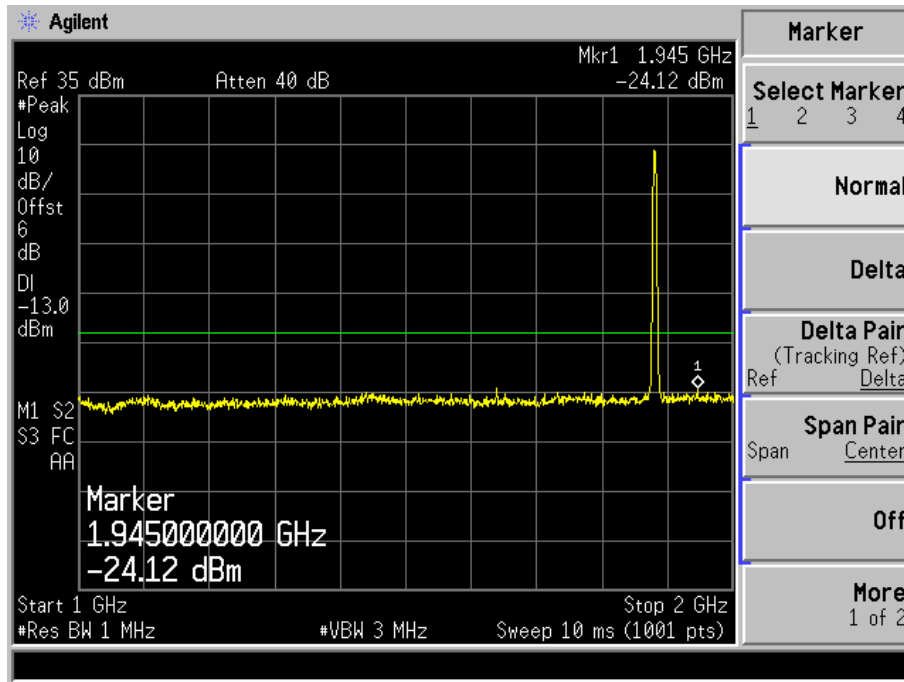




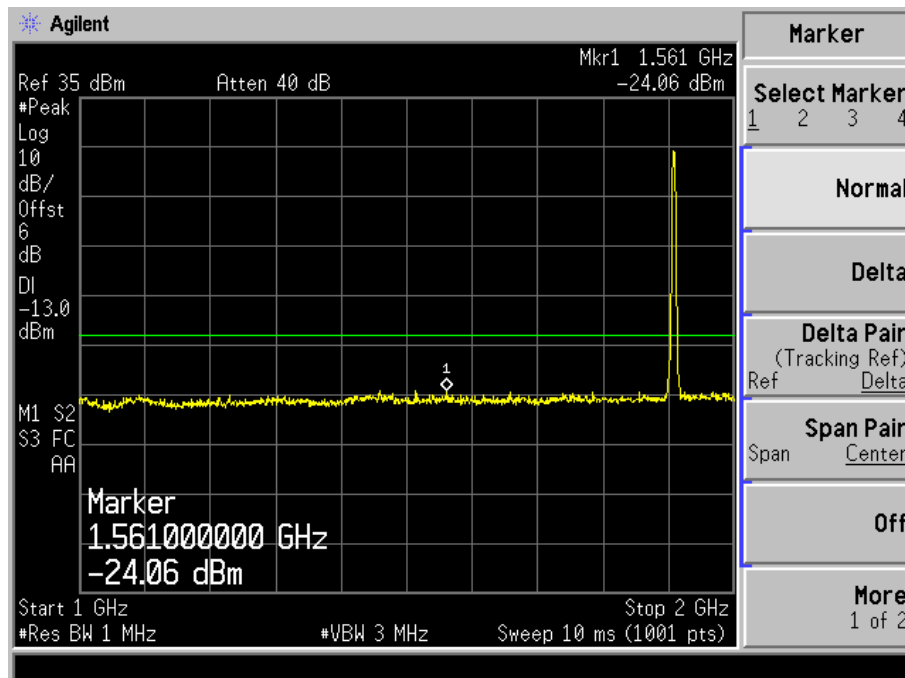
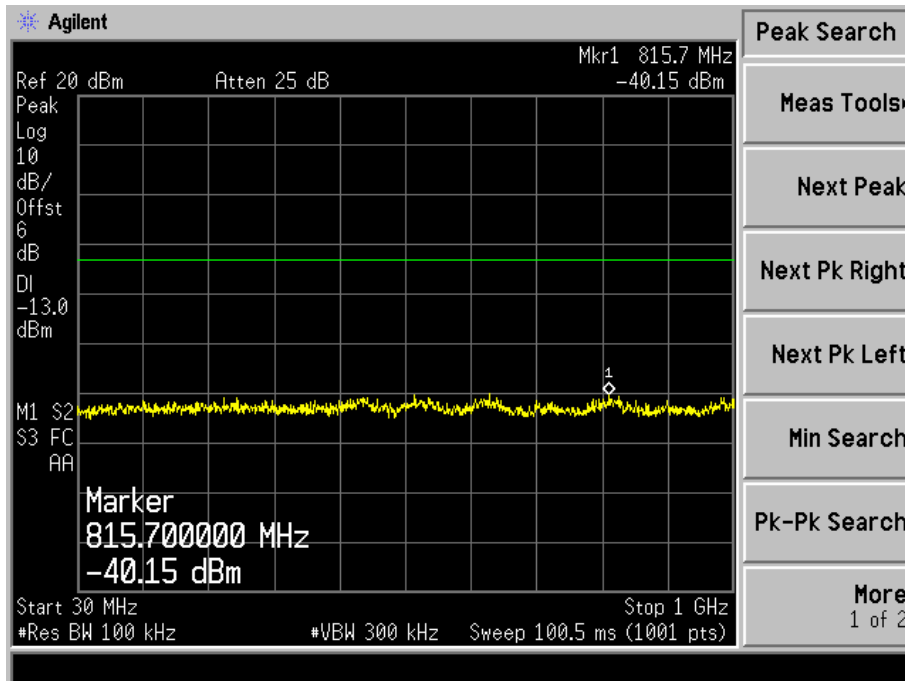


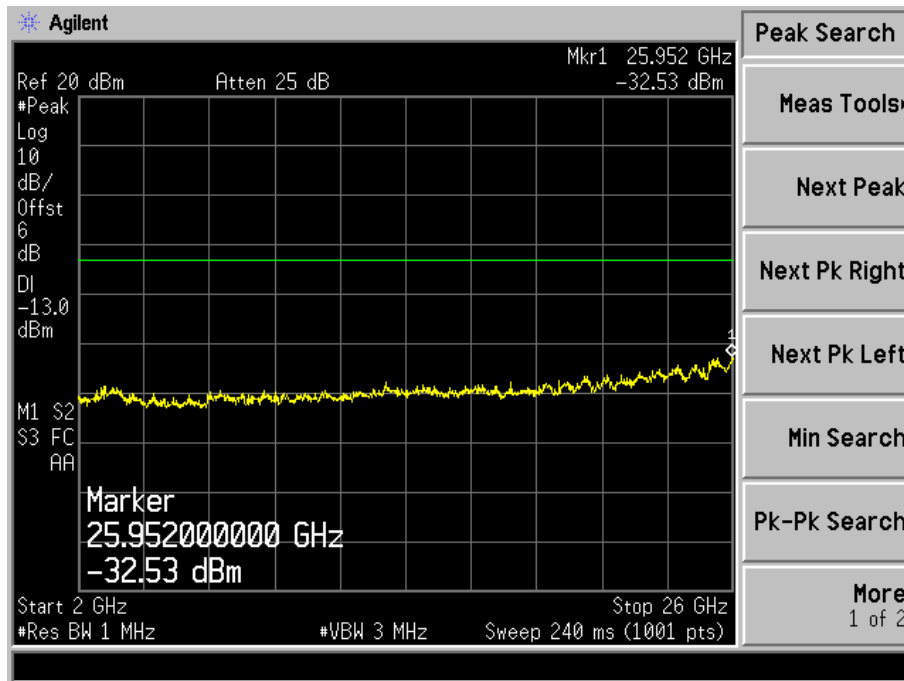
HSDPA Middle Channel



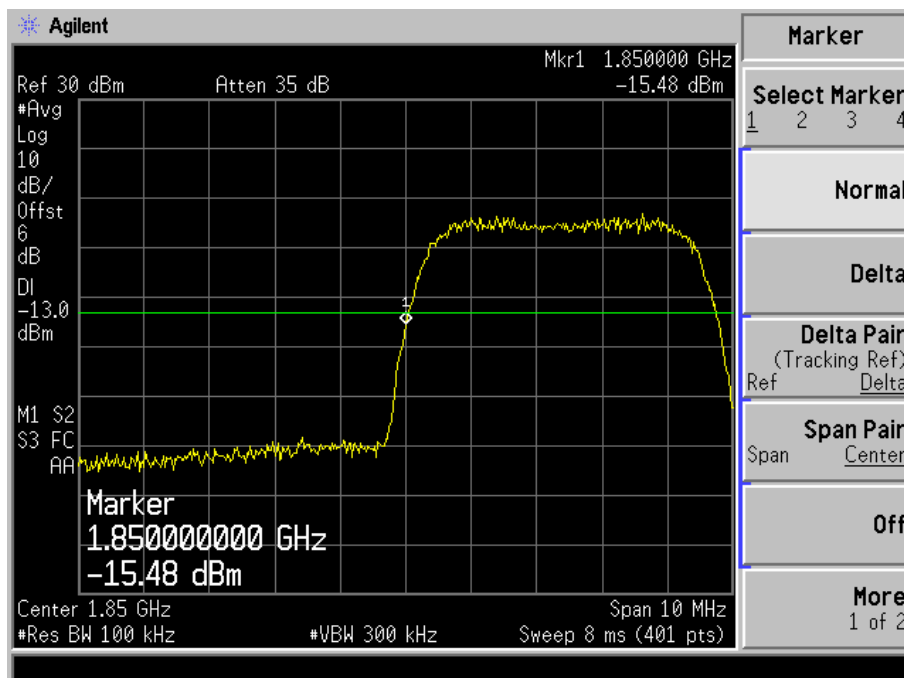


HSDPA High Channel

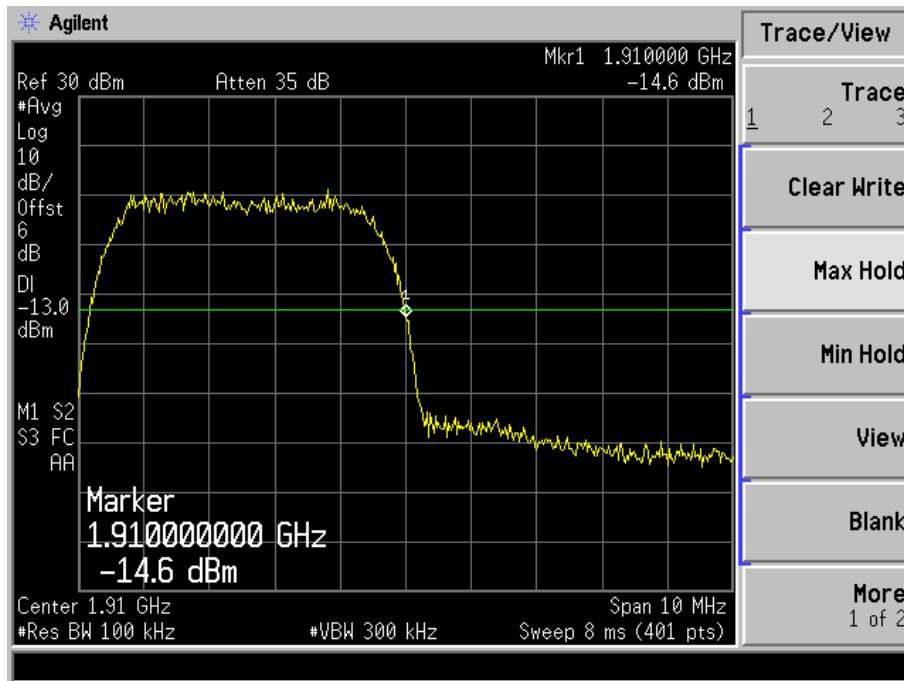




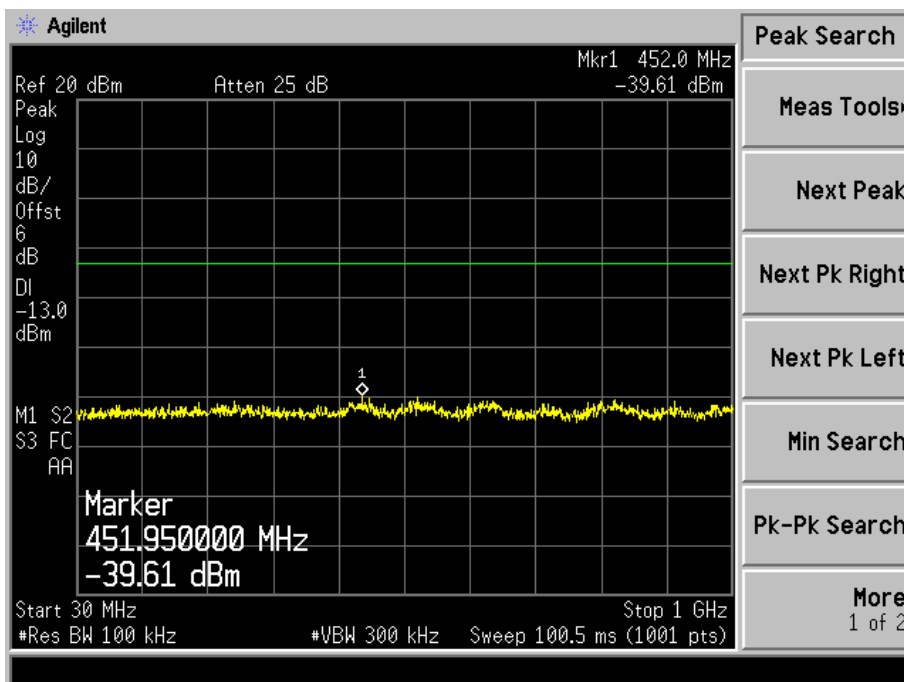
HSDPA Low Band Spurious Emission

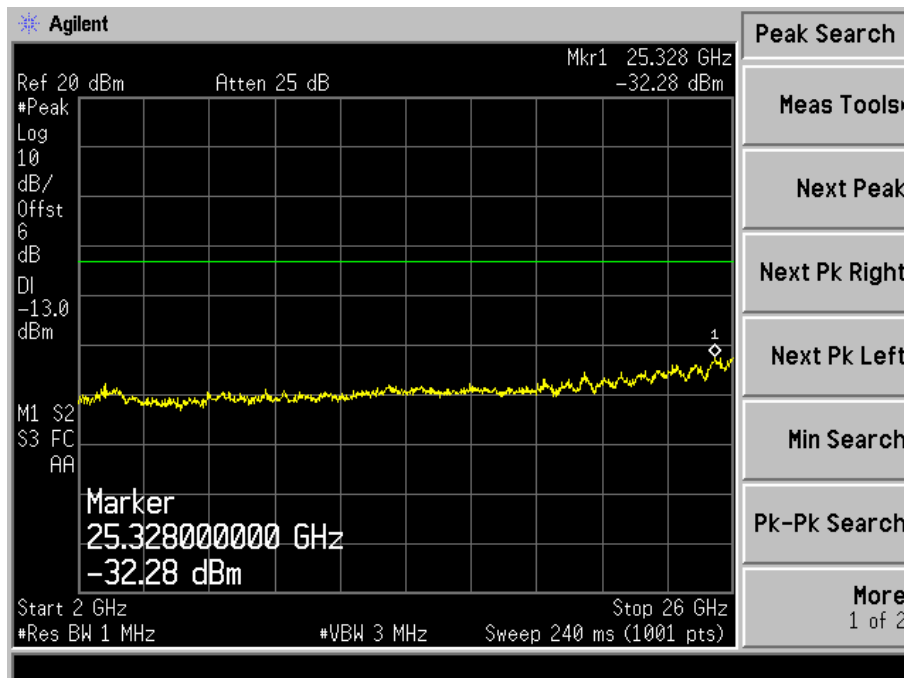
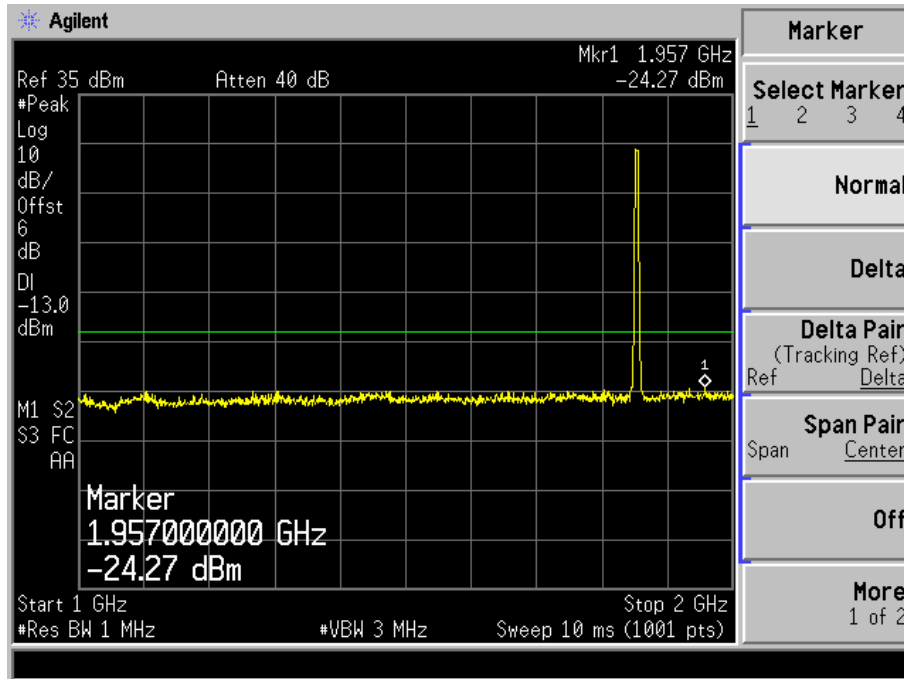


HSDPA High Band Spurious Emission

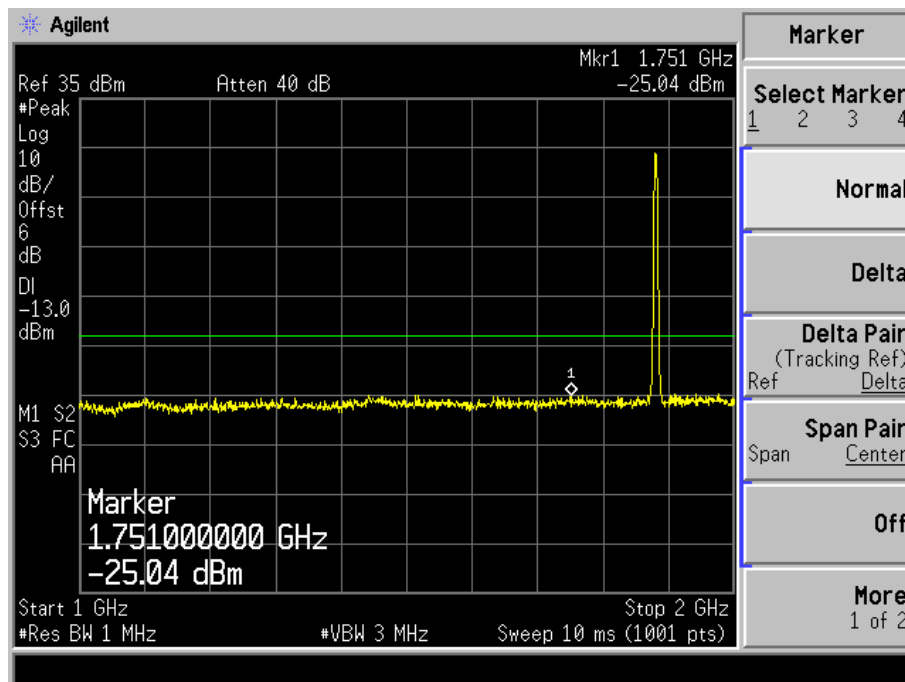
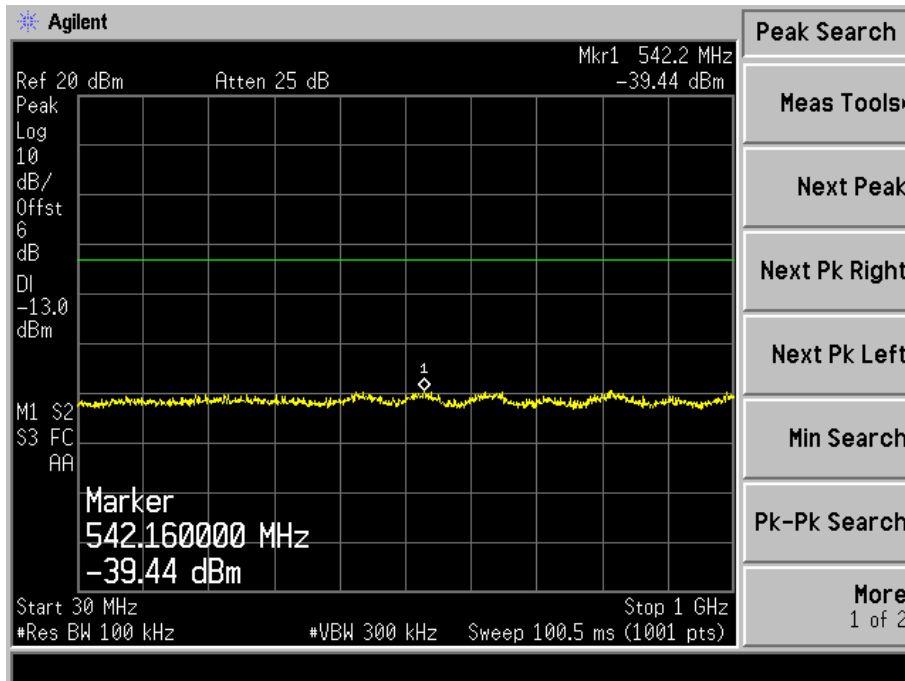


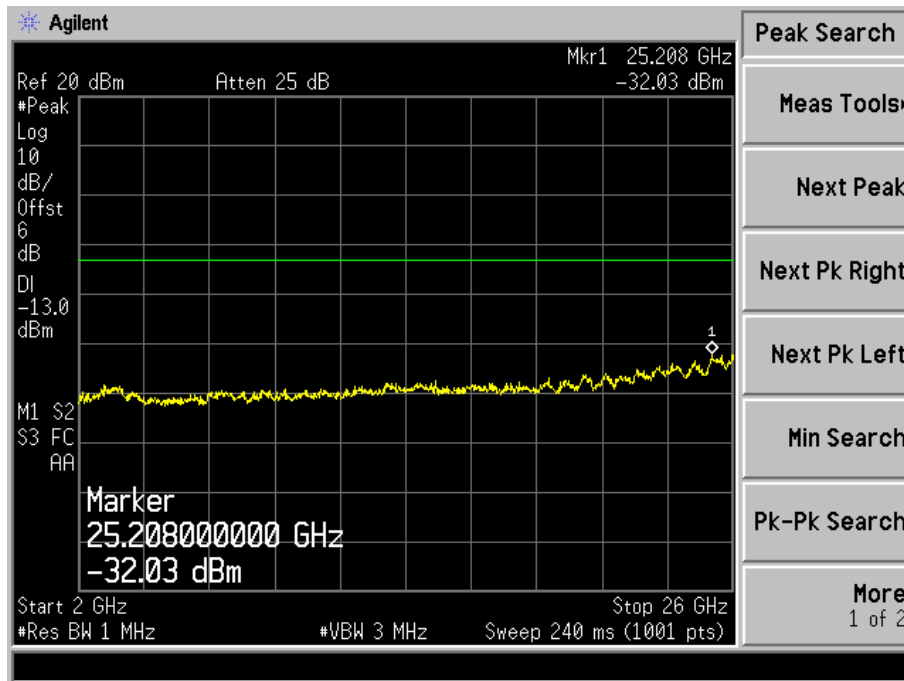
HSUPA Low Channel



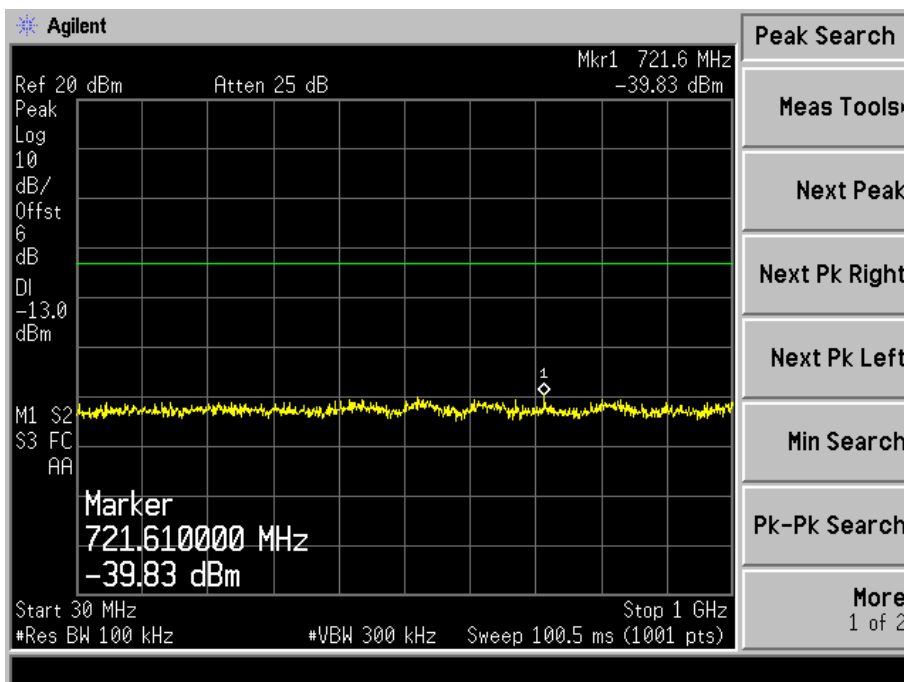


HSUPA Middle Channel

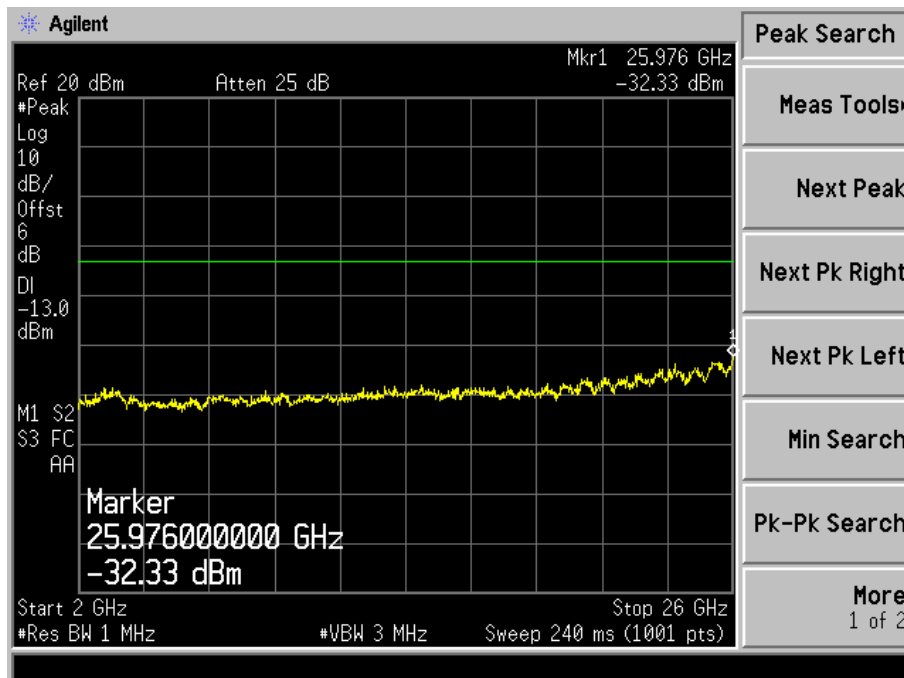
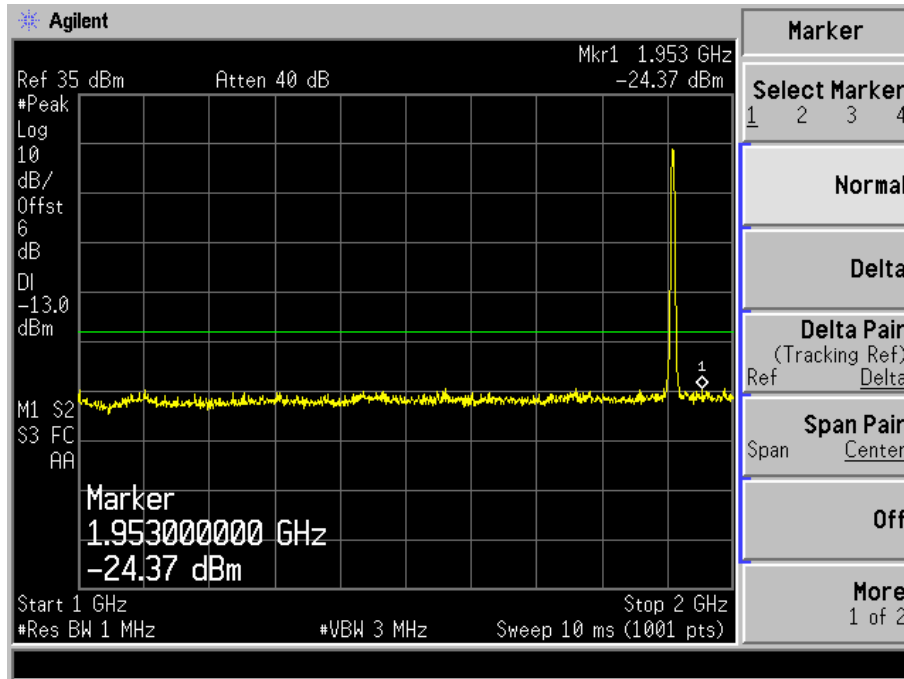




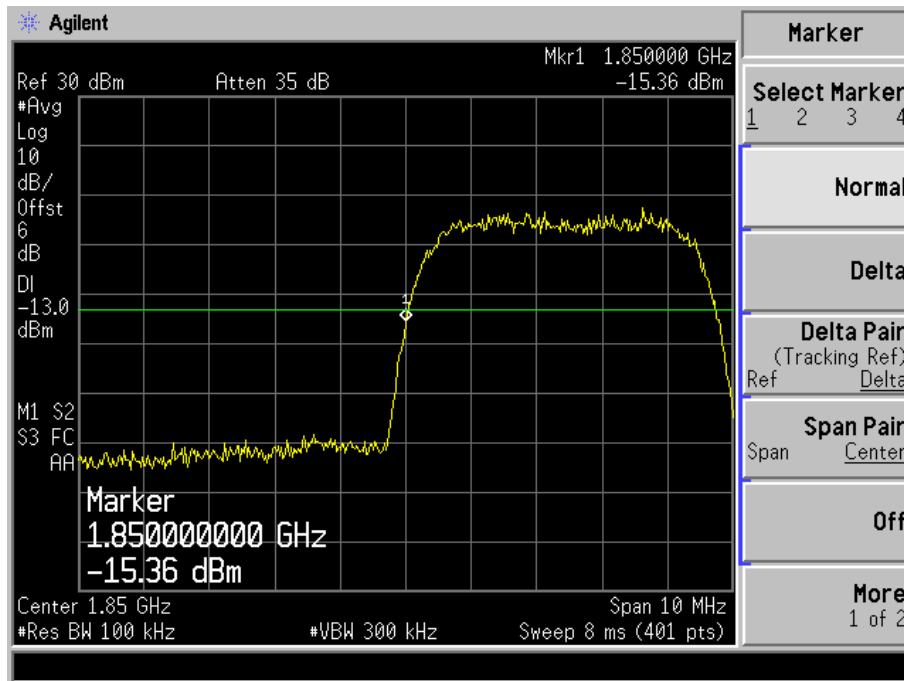
HSUPA High Channel



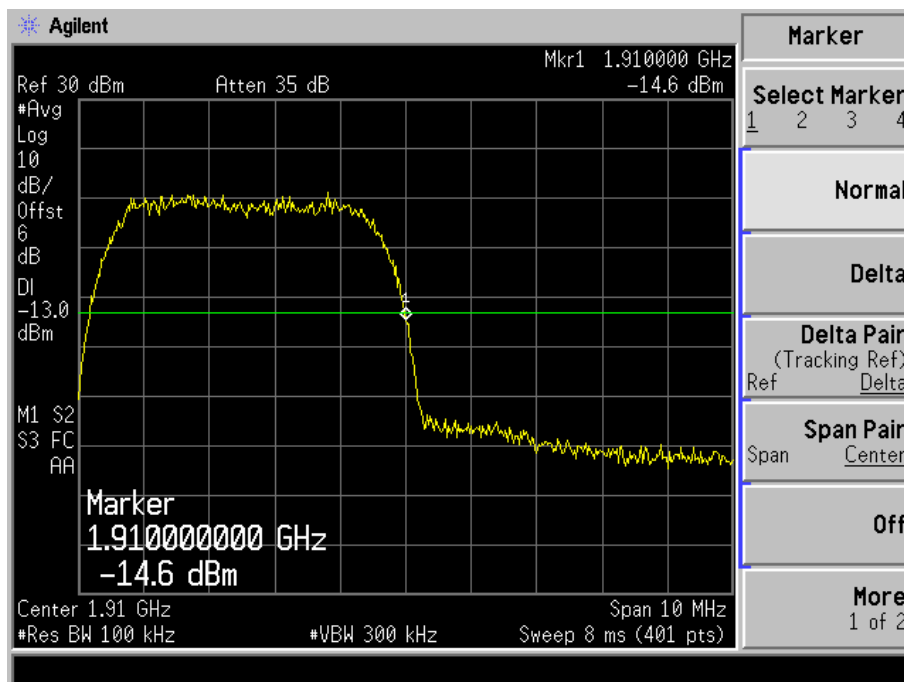




HSUPA Low Band Spurious Emission



HSUPA High Band Spurious Emission



## 8. Spurious Radiated Emissions

### 8.1 Standard Applicable

According to §22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

According to §27.53 (h), the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least  $43 + 10 \log_{10}(P)$  dB.

### 8.2 Test Procedure

1. The setup of EUT is according with per ANSI/TIA Standard 603D and ANSI C63.4-2014 measurement procedure.
2. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.
3. The frequency range up to tenth harmonic of the fundamental frequency was investigated.
4. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

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

### 8.3 Environmental Conditions

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

### 8.4 Summary of Test Results/Plots

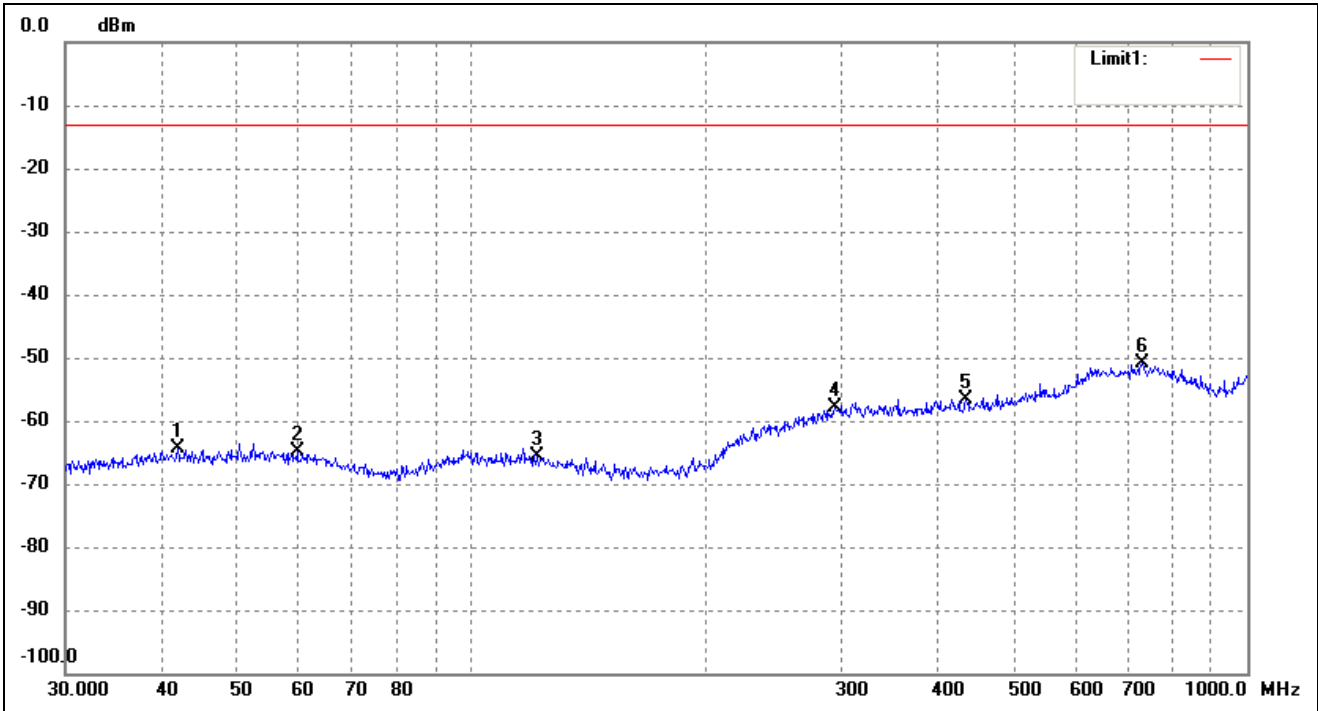
According to the data below, the FCC Part 22.917 and 24.238 standards, and had the worst margin of:

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

Spurious Emission From 30MHz to 1GHz

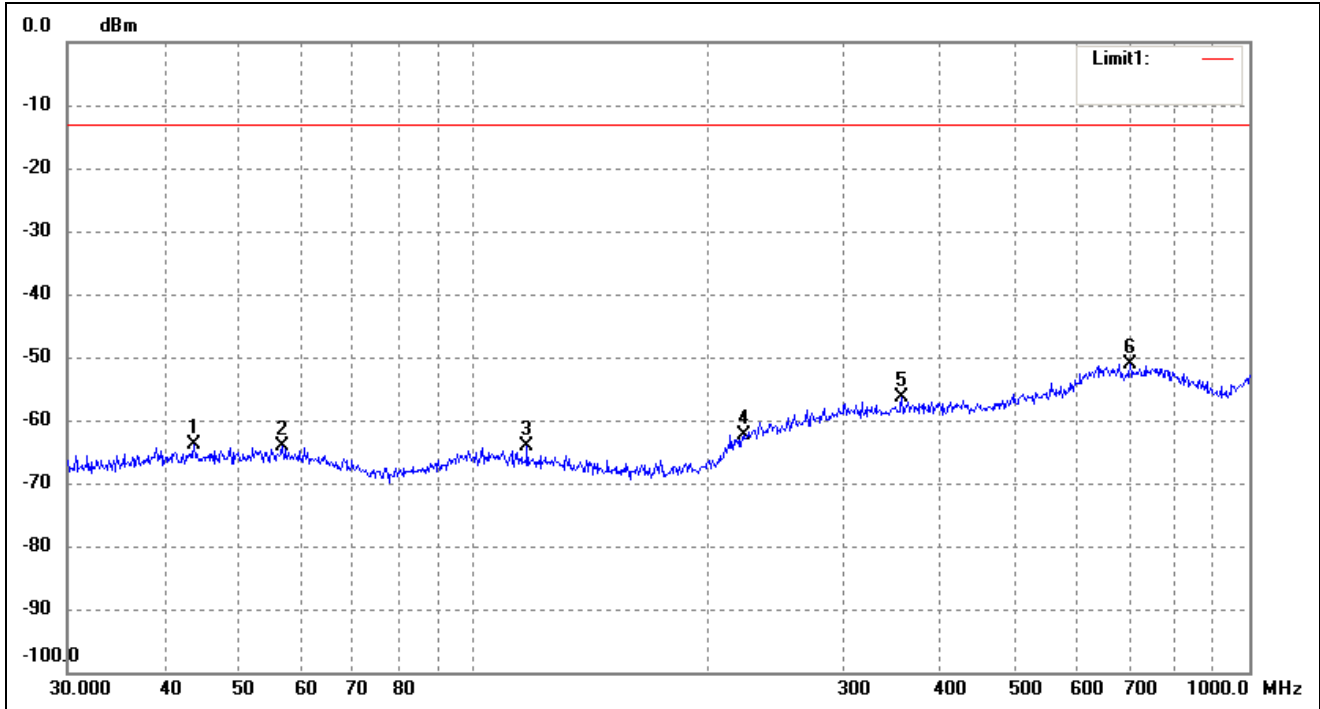
For Cellular Band\_ GSM850 Mode

Horizontal:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	41.8596	-81.04	16.73	-64.31	-13.00	-51.31	ERP
2	59.6493	-81.82	16.83	-64.99	-13.00	-51.99	ERP
3	121.5486	-82.08	16.49	-65.59	-13.00	-52.59	ERP
4	294.1137	-81.30	23.54	-57.76	-13.00	-44.76	ERP
5	434.0651	-80.81	24.11	-56.70	-13.00	-43.70	ERP
6	731.9203	-81.31	30.34	-50.97	-13.00	-37.97	ERP

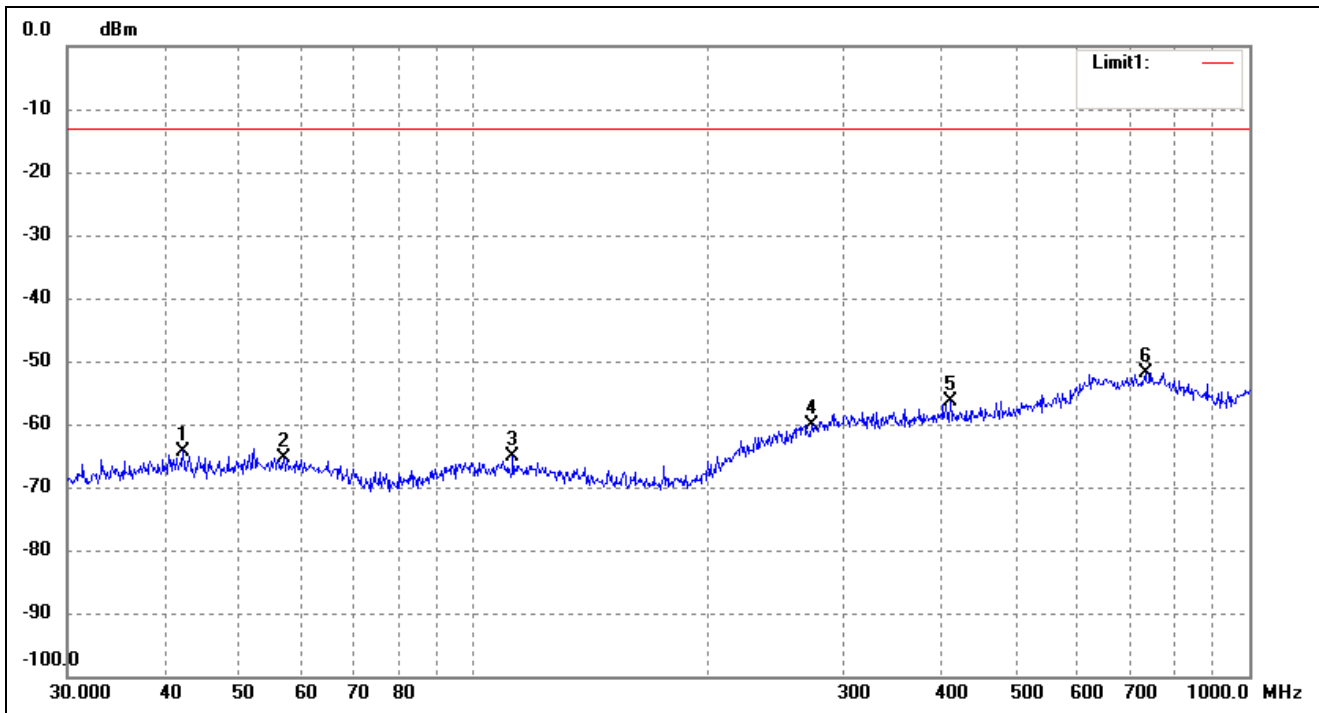
Vertical:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	43.6585	-80.70	16.74	-63.96	-13.00	-50.96	ERP
2	56.7917	-80.98	16.80	-64.18	-13.00	-51.18	ERP
3	117.3603	-80.67	16.63	-64.04	-13.00	-51.04	ERP
4	222.9502	-81.90	19.65	-62.25	-13.00	-49.25	ERP
5	356.6758	-79.96	23.62	-56.34	-13.00	-43.34	ERP
6	701.7610	-80.05	29.04	-51.01	-13.00	-38.01	ERP

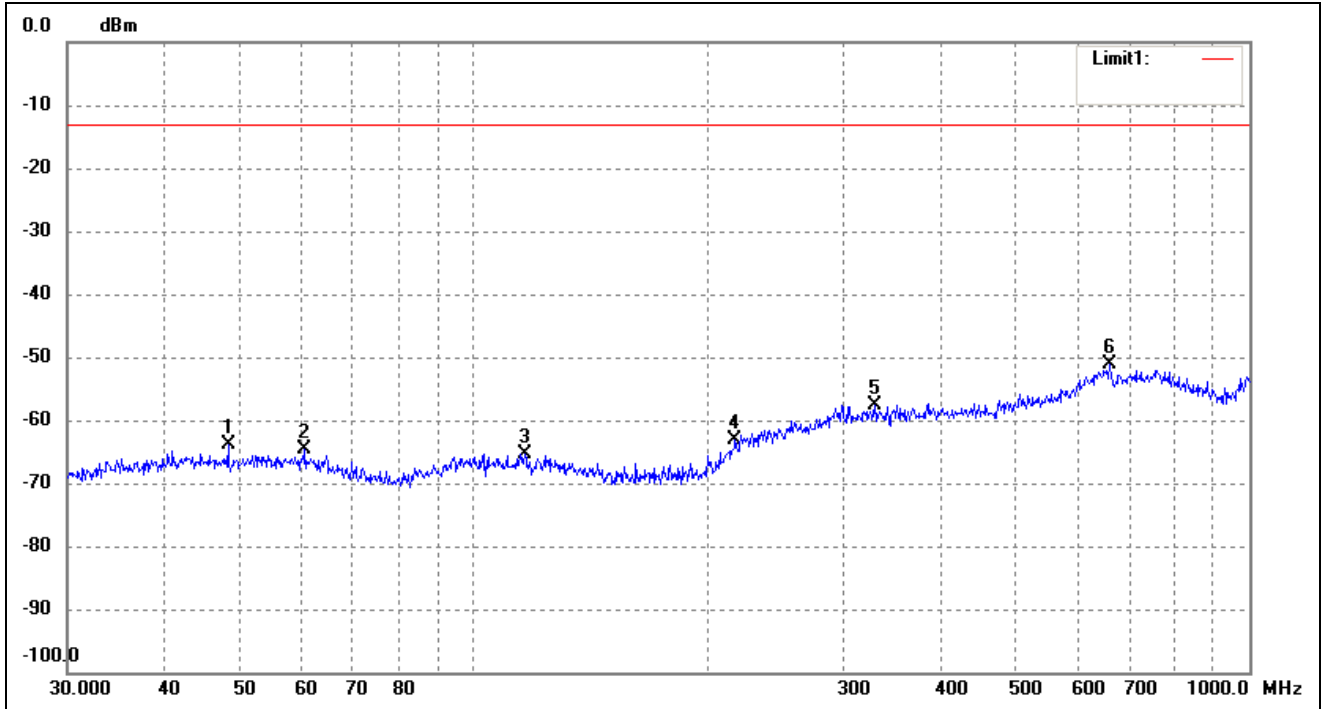
For Cellular Band\_ GSM1900 Mode

Horizontal:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	42.3022	-80.99	16.74	-64.25	-13.00	-51.25	ERP
2	56.9912	-82.11	16.80	-65.31	-13.00	-52.31	ERP
3	112.5244	-81.78	16.65	-65.13	-13.00	-52.13	ERP
4	273.2341	-82.51	22.44	-60.07	-13.00	-47.07	ERP
5	411.8240	-80.40	24.02	-56.38	-13.00	-43.38	ERP
6	734.4913	-82.34	30.49	-51.85	-13.00	-38.85	ERP

Vertical:

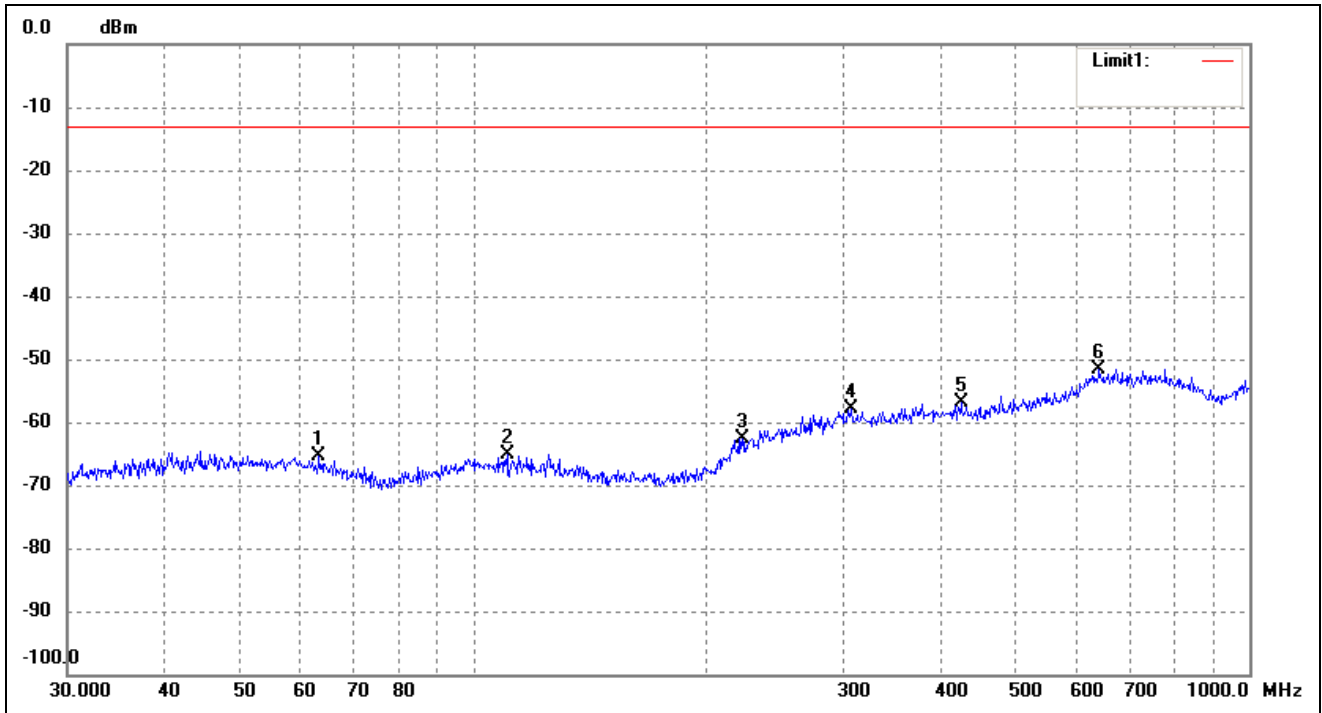


No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	48.3318	-80.69	16.76	-63.93	-13.00	-50.93	ERP
2	60.7044	-81.28	16.70	-64.58	-13.00	-51.58	ERP
3	116.5401	-81.89	16.63	-65.26	-13.00	-52.26	ERP
4	217.5443	-82.04	18.95	-63.09	-13.00	-50.09	ERP
5	329.0390	-81.03	23.47	-57.56	-13.00	-44.56	ERP
6	661.1505	-80.55	29.44	-51.11	-13.00	-38.11	ERP

Note: Margin= (Reading+ Correct)- Limit

For band 5 Mode

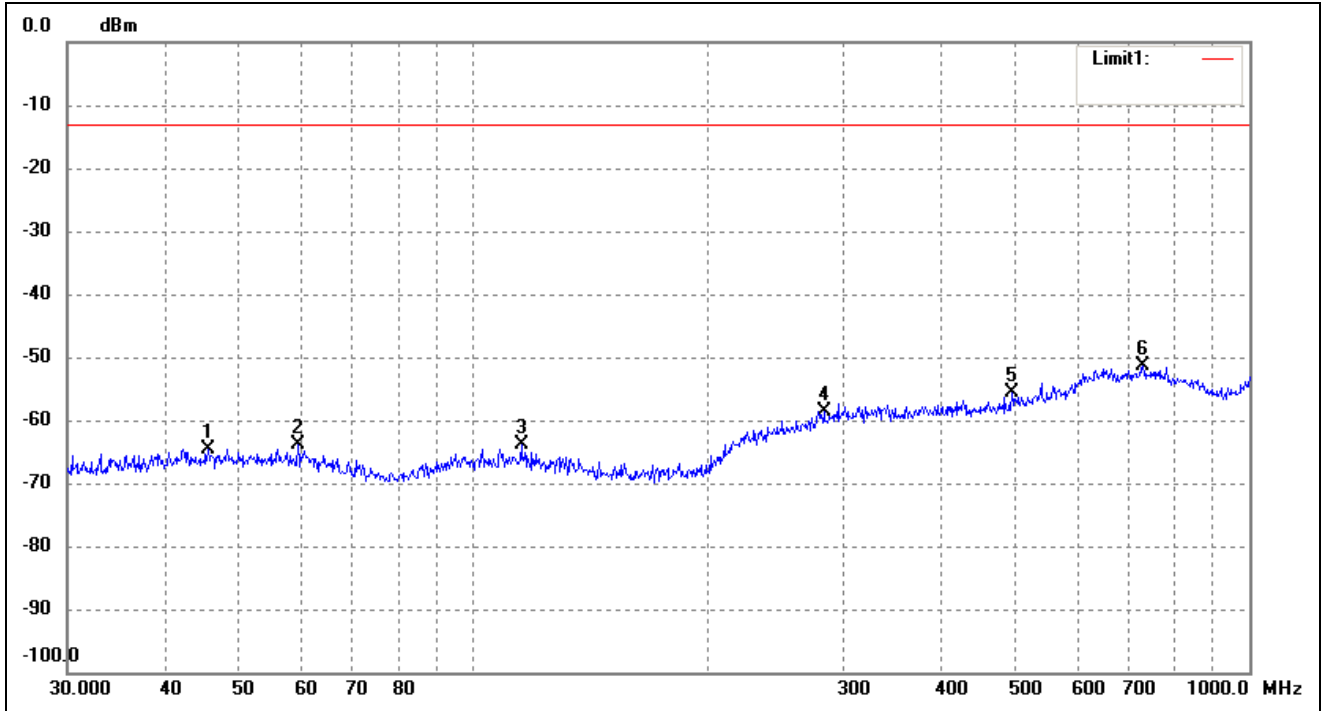
Horizontal:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	63.3132	-81.60	16.15	-65.45	-13.00	-52.45	ERP
2	110.5687	-81.68	16.67	-65.01	-13.00	-52.01	ERP
3	222.1698	-82.15	19.60	-62.55	-13.00	-49.55	ERP
4	306.7537	-81.67	23.74	-57.93	-13.00	-44.93	ERP
5	425.0280	-80.82	23.84	-56.98	-13.00	-43.98	ERP
6	640.6110	-81.48	29.85	-51.63	-13.00	-38.63	ERP



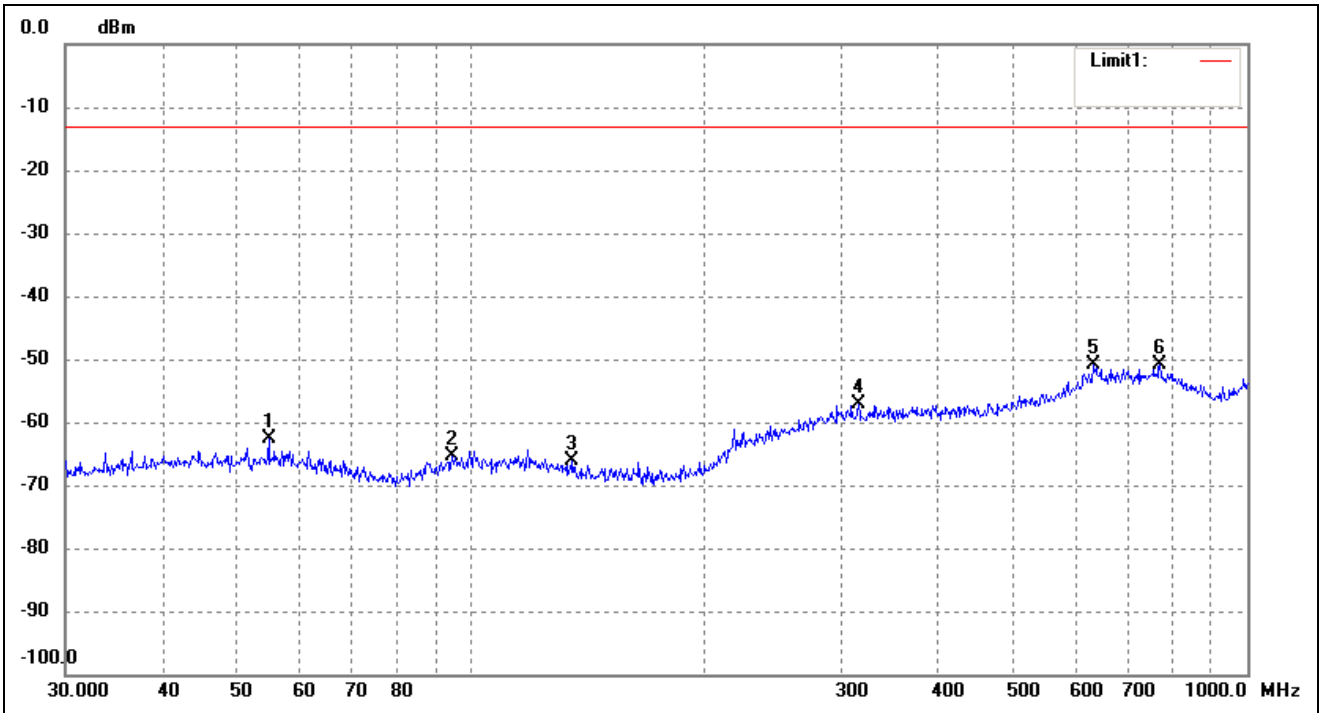
Vertical:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	45.5348	-81.26	16.75	-64.51	-13.00	-51.51	ERP
2	59.4405	-80.72	16.82	-63.90	-13.00	-50.90	ERP
3	115.3205	-80.58	16.65	-63.93	-13.00	-50.93	ERP
4	282.9852	-81.56	23.06	-58.50	-13.00	-45.50	ERP
5	494.1984	-80.63	24.91	-55.72	-13.00	-42.72	ERP
6	729.3583	-81.67	30.18	-51.49	-13.00	-38.49	ERP

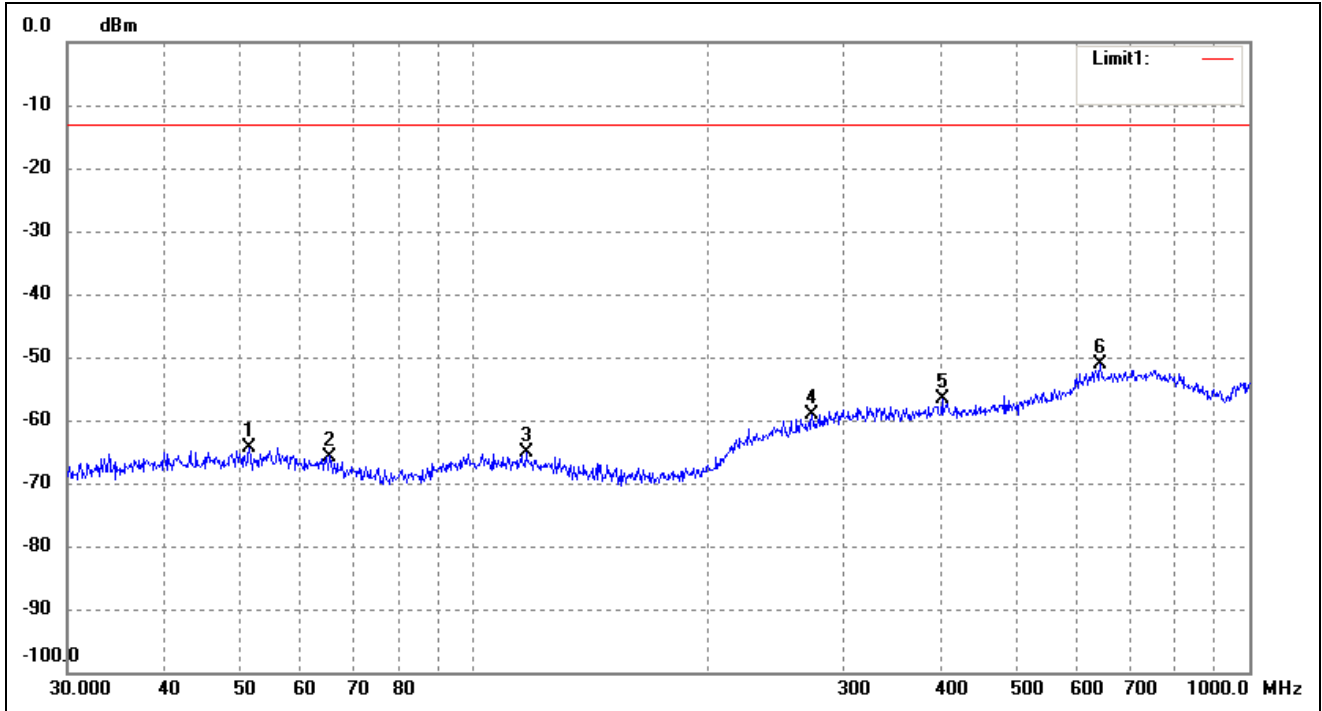
For band 2 Mode

Horizontal:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	54.8348	-79.46	16.83	-62.63	-13.00	-49.63	ERP
2	94.4284	-81.20	15.90	-65.30	-13.00	-52.30	ERP
3	135.0319	-81.59	15.36	-66.23	-13.00	-53.23	ERP
4	315.4808	-80.90	23.75	-57.15	-13.00	-44.15	ERP
5	633.9073	-80.57	29.66	-50.91	-13.00	-37.91	ERP
6	771.4486	-79.98	29.19	-50.79	-13.00	-37.79	ERP

Vertical:



No.	Frequency (MHz)	Reading (dBm)	Correct (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	51.4807	-81.09	16.82	-64.27	-13.00	-51.27	ERP
2	65.3432	-81.45	15.70	-65.75	-13.00	-52.75	ERP
3	116.9495	-81.73	16.63	-65.10	-13.00	-52.10	ERP
4	273.2341	-81.52	22.44	-59.08	-13.00	-46.08	ERP
5	401.8385	-81.13	24.41	-56.72	-13.00	-43.72	ERP
6	642.8613	-80.97	29.80	-51.17	-13.00	-38.17	ERP

Note: Margin= (Reading+ Correct)- Limit

*Spurious Emissions Above 1GHz*
*For Cellular Band\_GSM850 Mode*

Frequency	Reading	Correct	Result	Limit	Margin	Polar
(MHz)	(dBm)	dB	(dBm)	(dBm)	(dB)	H/V
Low Channel (824.2MHz)						
1648.4	-37.88	4.94	-32.94	-13.00	-19.94	H
2472.6	-36.55	8.46	-28.09	-13.00	-15.09	H
1648.4	-37.91	4.94	-32.97	-13.00	-19.97	V
2472.6	-39.61	8.46	-31.15	-13.00	-18.15	V
Middle Channel (836.6MHz)						
1673.2	-31.82	5.11	-26.71	-13.00	-13.71	H
2509.8	-40.28	8.54	-31.74	-13.00	-18.74	H
1673.2	-35.00	5.11	-29.89	-13.00	-16.89	V
2509.8	-39.30	8.54	-30.76	-13.00	-17.76	V
High Channel (848.8MHz)						
1697.6	-35.16	5.25	-29.91	-13.00	-16.91	H
2546.4	-37.23	8.57	-28.66	-13.00	-15.66	H
1697.6	-34.49	5.25	-29.24	-13.00	-16.24	V
2546.4	-38.27	8.57	-29.70	-13.00	-16.70	V

*For PCS Band\_GSM1900 Mode*

Frequency	Reading	Correct	Result	Limit	Margin	Polar
(MHz)	(dBm)	dB	(dBm)	(dBm)	(dB)	H/V
Low Channel (1850.2MHz)						
3700.4	-37.18	10.54	-26.64	-13.00	-13.64	H
5550.6	-37.78	13.37	-24.41	-13.00	-11.41	H
3700.4	-34.68	10.54	-24.14	-13.00	-11.14	V
5550.6	-38.70	13.37	-25.33	-13.00	-12.33	V
Middle Channel (1880MHz)						
3760.0	-37.10	10.64	-26.46	-13.00	-13.46	H
5640.0	-41.87	13.54	-28.33	-13.00	-15.33	H
3760.0	-38.13	10.64	-27.49	-13.00	-14.49	V
5640.0	-43.23	13.54	-29.69	-13.00	-16.69	V
High Channel (1909.8MHz)						
3819.6	-36.28	10.74	-25.54	-13.00	-12.54	H
5729.4	-39.63	13.71	-25.92	-13.00	-12.92	H
3819.6	-34.99	10.74	-24.25	-13.00	-11.25	V
5729.4	-35.71	13.71	-22.00	-13.00	-9.00	V

## For Band 5 Mode

Frequency	Reading	Correct	Result	Limit	Margin	Polar
(MHz)	(dBm)	dB	(dBm)	(dBm)	(dB)	H/V
Low Channel (826.4MHz)						
1652.8	-31.55	4.94	-26.61	-13.00	-13.61	H
2479.2	-37.70	8.46	-29.24	-13.00	-16.24	H
1652.8	-37.79	4.94	-32.85	-13.00	-19.85	V
2479.2	-39.96	8.46	-31.50	-13.00	-18.50	V
Middle Channel (836.6MHz)						
1672.8	-37.43	5.11	-32.32	-13.00	-19.32	H
2509.2	-38.47	8.54	-29.93	-13.00	-16.93	H
1672.8	-34.49	5.11	-29.38	-13.00	-16.38	V
2509.2	-40.52	8.54	-31.98	-13.00	-18.98	V
High Channel (846.6MHz)						
1693.2	-38.94	5.25	-33.69	-13.00	-20.69	H
2539.8	-38.09	8.57	-29.52	-13.00	-16.52	H
1693.2	-38.78	5.25	-33.53	-13.00	-20.53	V
2539.8	-38.30	8.57	-29.73	-13.00	-16.73	V

## For Band 2 Mode

Frequency	Reading	Correct	Result	Limit	Margin	Polar
(MHz)	(dBm)	dB	(dBm)	(dBm)	(dB)	H/V
Low Channel (1852.4MHz)						
3704.8	-37.35	14.69	-22.66	-13.00	-9.66	H
5557.2	-36.01	10.17	-25.84	-13.00	-12.84	H
3704.8	-37.81	14.69	-23.12	-13.00	-10.12	V
5557.2	-39.25	14.69	-24.56	-13.00	-11.56	V
Middle Channel (1880MHz)						
3760.8	-41.98	10.08	-31.90	-13.00	-18.90	H
5640.0	-41.37	13.53	-27.84	-13.00	-14.84	H
3760.8	-36.25	10.08	-26.17	-13.00	-13.17	V
5640.0	-42.56	13.53	-29.03	-13.00	-16.03	V
High Channel (1907.6MHz)						
3815.2	-39.10	10.59	-28.51	-13.00	-15.51	H
5722.8	-40.38	15.03	-25.35	-13.00	-12.35	H
3815.2	-31.03	10.59	-20.44	-13.00	-7.44	V
5722.8	-39.59	15.03	-24.56	-13.00	-11.56	H

Note: Result=Reading+ Correct, Margin= Result- Limit

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

## 9. Frequency Stability

### 9.1 Standard Applicable

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Cellular Band

Frequency range (MHz)	Base, fixed (ppm)	Mobile >3 watts (ppm)	Mobile ≤3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929	5.0	N/A	N/A
929 to 960	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

According to §27.54 The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

### 9.2 Test Procedure

According to §2.1055, the following test procedure was performed.

The Frequency Stability is measured directly with a Frequency Domain Analyzer. Frequency Deviation in ppm is calculated from the measured peak to peak value.

The Carrier Frequency Stability over Power Supply Voltage and over Temperature is measured with a Frequency Domain Analyzer in histogram mode

Temperature:	Supply Voltage
20°C	DC 3.3-4.2V declared by manufacturer
-30°C to +50°C	Normal

### 9.3 Environmental Conditions

Temperature:	20°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

## 9.4 Summary of Test Results/Plots

For Cellular Band GSM Mode

Reference Frequency(Middle Channel): 836.6 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	58	0.0693
40	3.7	54	0.0645
30	3.7	43	0.0514
20	3.7	39	0.0466
10	3.7	35	0.0418
0	3.7	30	0.0359
-10	3.7	35	0.0418
-20	3.7	43	0.0514
-30	3.7	51	0.0610

For PCS Band GSM Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	60	0.0319
40	3.7	45	0.0239
30	3.7	39	0.0207
20	3.7	32	0.0170
10	3.7	25	0.0133
0	3.7	20	0.0106
-10	3.7	26	0.0138
-20	3.7	31	0.0165
-30	3.7	37	0.0197

## For Cellular Band GPRS Mode

Reference Frequency(Middle Channel): 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	55	0.0657
40	3.7	47	0.0562
30	3.7	39	0.0466
20	3.7	32	0.0383
10	3.7	27	0.0323
0	3.7	19	0.0227
-10	3.7	25	0.0299
-20	3.7	29	0.0347
-30	3.7	33	0.0394

## For PCS Band GPRS Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	59	0.0314
40	3.7	52	0.0277
30	3.7	47	0.0250
20	3.7	40	0.0213
10	3.7	36	0.0191
0	3.7	32	0.0170
-10	3.7	40	0.0213
-20	3.7	46	0.0245
-30	3.7	53	0.0282



## For Cellular Band EDGE Mode

Reference Frequency(Middle Channel): 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	72	0.0861
40	3.7	66	0.0789
30	3.7	58	0.0693
20	3.7	52	0.0622
10	3.7	45	0.0538
0	3.7	38	0.0454
-10	3.7	43	0.0514
-20	3.7	48	0.0574
-30	3.7	52	0.0622

## For PCS Band EDGE Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	78	0.0415
40	3.7	68	0.0362
30	3.7	58	0.0309
20	3.7	50	0.0266
10	3.7	46	0.0245
0	3.7	38	0.0202
-10	3.7	44	0.0234
-20	3.7	48	0.0255
-30	3.7	55	0.0293

For WCDMA Band 5 Mode

Reference Frequency(Middle Channel): 836.6 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	68	0.0813
40	3.7	53	0.0634
30	3.7	48	0.0574
20	3.7	41	0.0490
10	3.7	37	0.0442
0	3.7	32	0.0383
-10	3.7	38	0.0454
-20	3.7	45	0.0538
-30	3.7	50	0.0598

For WCDMA Band 2 Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	68	0.0362
40	3.7	60	0.0319
30	3.7	53	0.0282
20	3.7	45	0.0239
10	3.7	41	0.0218
0	3.7	33	0.0176
-10	3.7	38	0.0202
-20	3.7	45	0.0239
-30	3.7	52	0.0277

## For HSDPA Band 5 Mode

Reference Frequency(Middle Channel): 836.6 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	62	0.0741
40	3.7	51	0.0610
30	3.7	45	0.0538
20	3.7	39	0.0466
10	3.7	33	0.0394
0	3.7	29	0.0347
-10	3.7	37	0.0442
-20	3.7	43	0.0514
-30	3.7	48	0.0574

## For HSDPA Band 2 Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	55	0.0293
40	3.7	48	0.0255
30	3.7	44	0.0234
20	3.7	38	0.0202
10	3.7	32	0.0170
0	3.7	24	0.0128
-10	3.7	30	0.0160
-20	3.7	35	0.0186
-30	3.7	41	0.0218

## For HSUPA Band 5 Mode

Reference Frequency(Middle Channel): 836.6 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	50	0.0598
40	3.7	45	0.0538
30	3.7	38	0.0454
20	3.7	33	0.0394
10	3.7	25	0.0299
0	3.7	22	0.0263
-10	3.7	25	0.0299
-20	3.7	30	0.0359
-30	3.7	36	0.0430

## For HSUPA Band 2 Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	68	0.0362
40	3.7	58	0.0309
30	3.7	47	0.0250
20	3.7	42	0.0223
10	3.7	36	0.0191
0	3.7	29	0.0154
-10	3.7	34	0.0181
-20	3.7	40	0.0213
-30	3.7	45	0.0239

So, Frequency Stability Versus Input Voltage is:

Reference Frequency(Middle Channel): GSM 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	35	0.0418
	3.7	39	0.0466
	4.3	32	0.0383
Reference Frequency(Middle Channel): GSM 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	33	0.0176
	3.7	32	0.0170
	4.3	35	0.0186
Reference Frequency(Middle Channel): GPRS 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	41	0.0490
	3.7	32	0.0383
	4.3	39	0.0466
Reference Frequency(Middle Channel): GPRS 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	44	0.0234
	3.7	40	0.0213
	4.3	33	0.0176

Reference Frequency(Middle Channel): EDGE 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	41	0.0490
	3.7	52	0.0622
	4.2	39	0.0466
Reference Frequency(Middle Channel): EDGE 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	46	0.0245
	3.7	50	0.0266
	4.3	47	0.0250
Reference Frequency(Middle Channel): WCDMA 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	37	0.0442
	3.7	41	0.0490
	4.3	26	0.0311
Reference Frequency(Middle Channel): WCDMA 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	39	0.0207
	3.7	45	0.0239
	4.3	35	0.0186
Reference Frequency(Middle Channel): HSDPA 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	35	0.0418
	3.7	39	0.0466
	4.3	25	0.0299

Reference Frequency(Middle Channel): HSDPA 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	42	0.0223
	3.7	38	0.0202
	4.3	42	0.0223
Reference Frequency(Middle Channel): HSUPA 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	35	0.0418
	3.7	33	0.0394
	4.3	36	0.0430
Reference Frequency(Middle Channel): HSUPA 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	42	0.0223
	3.7	42	0.0223
	4.3	43	0.0229

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