

FCC Part 22H & 24E Measurement and Test Report

For

Worldwide telecom limited

2F Block C; Shenfang Building, Zhen Hualu, Futian, Shenzhen, China.

FCC ID: 2ARO3-WS5SE

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

Product Description: Smart phone

Tested Model: WS5SE

Report No.: WTX19X10071420W-1

Sample Receipt Date: 2019-10-17

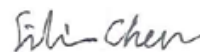
Tested Date: 2019-10-17 to 2019-11-07

Issued Date: 2019-11-07

Tested By: Jason Su / Engineer



Reviewed By: Silin Chen / EMC Manager



Approved & Authorized By: Jandy So / PSQ Manager



Prepared By:

Shenzhen SEM Test Technology Co., Ltd.

1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,

Bao'an District, Shenzhen, P.R.C. (518101)

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

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

TABLE OF CONTENTS

1. GENERAL INFORMATION.....	4
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	4
1.2 TEST STANDARDS.....	6
1.3 TEST METHODOLOGY.....	6
1.4 TEST FACILITY	6
1.5 EUT SETUP AND TEST MODE.....	7
1.6 MEASUREMENT UNCERTAINTY	8
1.7 TEST EQUIPMENT LIST AND DETAILS	9
2. SUMMARY OF TEST RESULTS	11
3. RF EXPOSURE	12
3.1 STANDARD APPLICABLE.....	12
3.2 TEST RESULT.....	12
4. RF OUTPUT POWER	13
4.1 STANDARD APPLICABLE.....	13
4.2 TEST PROCEDURE.....	13
4.3 SUMMARY OF TEST RESULTS/PLOTS	13
5. PEAK-TO-AVERAGE RATIO (PAR) OF TRANSMITTER.....	17
5.1 STANDARD APPLICABLE.....	17
5.2 TEST PROCEDURE.....	17
5.3 SUMMARY OF TEST RESULTS	17
6. EMISSION BANDWIDTH.....	19
6.1 STANDARD APPLICABLE.....	19
6.2 TEST PROCEDURE.....	19
6.3 SUMMARY OF TEST RESULTS/PLOTS	19
7. OUT OF BAND EMISSIONS AT ANTENNA TERMINAL.....	32
7.1 STANDARD APPLICABLE.....	32
7.2 TEST PROCEDURE.....	32
7.3 SUMMARY OF TEST RESULTS/PLOTS	32
8. SPURIOUS RADIATED EMISSIONS.....	57
8.1 STANDARD APPLICABLE.....	57
8.2 TEST PROCEDURE.....	57
8.3 SUMMARY OF TEST RESULTS/PLOTS	57
9. FREQUENCY STABILITY	68
9.1 STANDARD APPLICABLE.....	68
9.2 TEST PROCEDURE.....	68
9.3 SUMMARY OF TEST RESULTS/PLOTS	68
10. MODULATION CHARACTERISTICS	72
10.1 STANDARD APPLICABLE.....	72
10.2 TEST PROCEDURE.....	72
10.3 SUMMARY OF TEST RESULTS/PLOTS	72

Report version

Version No.	Date of issue	Description
Rev.00	2019-11-07	Original
/	/	/

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Worldwide telecom limited
Address of applicant: 2F Block C; Shenfeng Building, Zhen Hualu, Futian, Shenzhen, China.

Manufacturer: Worldwide telecom limited
Address of manufacturer: 2F Block C; Shenfeng Building, Zhen Hualu, Futian, Shenzhen, China.

General Description of EUT:	
Product Name:	Smart phone
Brand Name:	WOLKI
Model No.:	WS5SE
Adding Model(s):	/
Rated Voltage:	DC3.7V
Battery Capacity:	1580mAh
Adapter Model:	WCH05 Input: AC100-240V, 50/60Hz, 0.15A; Output: DC5V, 1000mA
Software Version:	/
Hardware Version:	/
Note: The test data is gathered from a production sample provided by the manufacturer.	

Technical Characteristics of EUT:	
2G	
Support Networks:	GSM, GPRS
Support Band:	GSM850/PCS1900
Uplink Frequency:	GSM/GPRS 850: 824~849MHz GSM/GPRS 1900: 1850~1910MHz
Downlink Frequency:	GSM/GPRS 850: 869~894MHz GSM/GPRS 1900: 1930~1990MHz
Max RF Output Power:	GSM850: 31.85dBm, GSM1900: 29.10dBm
Type of Emission:	GSM850: 247KGXW, GSM1900: 253KGXW
Type of Modulation:	GMSK, 8PSK
Type of Antenna:	Integral Antenna
Antenna Gain:	GSM850: -0.5dBi; GSM1900: 0.5dBi
GPRS/EDGE Class:	Class 12
3G	
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: 25.04dBm, WCDMA Band 5: 24.51dBm
Type of Emission:	WCDMA Band 2: 4M17F9W WCDMA Band 5: 4M19F9W
Type of Modulation:	BPSK
Antenna Type:	Integral Antenna
Antenna Gain:	WCDMA Band 2: 0.5dBi, WCDMA Band 5: -0.5dBi

1.2 Test Standards

The tests were performed according to following standards:

FCC Rules Part 2: FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

FCC Rules Part 22: PRIVATE LAND MOBILE RADIO SERVICES.

FCC Rules Part 24: PUBLIC MOBILE SERVICES

TIA/EIA 603 E March 2016: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

KDB 971168 D01 Power Meas License Digital Systems v03r01: MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS

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 TIA/EIA 603 E/ KDB 971168/ ANSI C63.26

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

1.4 Test Facility

Address of the test laboratory

Laboratory: Shenzhen SEM Test Technology Co., Ltd.

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

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. 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:

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

Testing Configure			
Support Band	Support Standard	Channel Frequency(MHz)	Channel Number
GSM 850	GSM/GPRS	824.2	128
		836.6	190
		848.8	251
PCS 1900	GSM/GPRS	1850.2	512
		1880.0	661
		1909.8	810
WCDMA Band 5	WCDMA/HSDPA/HSUPA	826.4	4132
		836.6	4183
		846.6	4233
WCDMA Band 2	WCDMA/HSDPA/HSUPA	1852.4	9262
		1880.0	9400
		1907.6	9538
Note: the transmitter has been tested on the communications mode of GSM, GPRS,WCDMA, HSDPA, HSUPA compliance test and record the worst case.			

Test Conditions	
Temperature:	22~25 °C
Relative Humidity:	50~55 %.
ATM Pressure:	1019 mbar

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

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

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

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Frequency Stability	Conducted	2.3%
Transmitter Spurious Emissions	Conducted	$\pm 0.42\text{dB}$
Transmitter Spurious Emissions	Radiated	30-200MHz $\pm 4.52\text{dB}$
		0.2-1GHz $\pm 5.56\text{dB}$
		1-6GHz $\pm 3.84\text{dB}$
		6-18GHz $\pm 3.92\text{dB}$

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	2019-04-30	2020-04-29
SEMT-1063	GSM Tester	Rohde & Schwarz	CMU200	114403	2019-04-30	2020-04-29
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2019-04-30	2020-04-29
SEMT-1079	Spectrum Analyzer	Agilent	N9020A	US47140102	2019-04-30	2020-04-29
SEMT-1080	Signal Generator	Agilent	83752A	3610A01453	2019-04-30	2020-04-29
SEMT-1081	Vector Signal Generator	Agilent	N5182A	MY47070202	2019-04-30	2020-04-29
SEMT-1028	Power Divider	Weinschel	1506A	PM204	2019-04-30	2020-04-29
SEMT-1082	Power Divider	RF-Lambda	RFLT4W5M18G	14110400027	2019-04-30	2020-04-29
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2019-04-30	2020-04-29
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2019-04-30	2020-04-29
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2019-04-30	2020-04-29
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2019-04-30	2020-04-29
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2019-05-05	2021-05-04
SEMT-1068	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2019-05-05	2021-05-04
SEMT-1042	Horn Antenna	ETS	3117	00086197	2019-05-05	2021-05-04
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2019-05-05	2021-05-04
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2019-04-30	2020-04-29
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2019-04-30	2020-04-29
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2019-04-30	2020-04-29
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2019-05-05	2021-05-04
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2019-04-30	2020-04-29
SEMT-1055	RF Limiter	ATTEN	AT-BSF-0820~0920	/	2019-04-30	2020-04-29
SEMT-1056	RF Limiter	ATTEN	AT-BSF-1710~1910	/	2019-04-30	2020-04-29
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2019-04-30	2020-04-29
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2019-03-18	2020-03-17
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2019-03-18	2020-03-17
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2019-03-18	2020-03-17

SEMT-C004	Cable	Zheng DI	2M0RFC	/	2019-03-18	2020-03-17
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2019-03-18	2020-03-17
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2019-03-18	2020-03-17

Software List			
Description	Manufacturer	Model	Version
EMI Test Software (Radiated Emission)*	Farad	EZ-EMC	RA-03A1
EMI Test Software (Conducted Emission)*	Farad	EZ-EMC	RA-03A1

*Remark: indicates software version used in the compliance certification testing

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

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

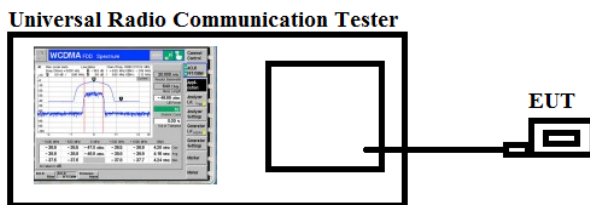
4.1 Standard Applicable

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.

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 603E and ANSI C63.26 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 Summary of Test Results/Plots

➤ **Max. Radiated Power**

Mode	Channel	Antenna Polar	ERP (dBm)	Limit (dBm)	Result
GSM850	128	V	29.11	<38.45	Pass
		H	23.52		
	190	V	29.58		
		H	23.05		
	251	V	29.64		
		H	23.16		
GPRS850	128	V	29.52	<38.45	Pass
		H	22.17		
	190	V	29.63		
		H	22.15		
	251	V	29.52		
		H	22.13		

Mode	Channel	Antenna Polar	EIRP (dBm)	Limit (dBm)	Result
PCS1900	512	V	27.45	<33.00	Pass
		H	21.35		
	661	V	27.04		
		H	21.11		
	810	V	26.36		
		H	20.25		
GPRS1900	512	V	27.42	<33.00	Pass
		H	21.11		
	661	V	27.35		
		H	21.05		
	810	V	27.64		
		H	21.26		

Mode	Channel	Antenna Polar	ERP	Limit (dBm)	Result
WCDMA Band V	4132	V	23.45	<38.45	Pass
		H	17.35		
	4183	V	23.09		
		H	17.52		
	4233	V	23.28		
		H	17.43		

Mode	Channel	Antenna Polar	EIRP	Limit (dBm)	Result
WCDMA Band II	9262	V	22.15	<33.00	Pass
		H	16.53		
	9400	V	22.38		
		H	16.18		
	9538	V	22.43		
		H	16.12		

Note: Pre-scan mode WCDMA/HSDPA/HSUPA find the worst case at WCDMA mode and recorded in the test report.

➤ **Max. Conducted Power (Average power)**

Conducted Average power (dBm)						
Band	GSM850			PCS1900		
Channel	128	190	251	512	661	810
Frequency(MHz)	824.20	836.60	848.80	1850.20	1880.00	1909.80
GSM	31.19	31.47	31.76	29.10	28.54	28.20
GPRS(1Slot)	31.26	31.60	31.85	29.06	28.53	28.22

Conducted Average power (dBm)						
Band	WCDMA Band V			WCDMA Band II		
Channel	4132	4183	4233	9262	9400	9538
Frequency(MHz)	826.4	836.6	846.6	1852.4	1880.0	1907.6
RMC 12.2k	24.08	24.15	24.51	25.04	25.03	24.91
HSDPA Subtest-1	23.77	23.04	23.67	24.38	23.12	23.87
HSDPA Subtest-2	23.75	23.01	23.65	24.36	23.11	23.85
HSDPA Subtest-3	23.75	23.02	23.64	24.37	23.10	23.86
HSDPA Subtest-4	23.76	23.02	23.63	24.36	23.09	23.86
HSUPA Subtest-1	23.96	23.98	23.61	24.61	24.99	24.66
HSUPA Subtest-2	23.92	23.96	23.59	24.59	24.96	24.61
HSUPA Subtest-3	23.94	23.97	23.57	24.56	24.95	24.62
HSUPA Subtest-4	23.95	23.96	23.57	24.57	24.93	24.62
HSUPA Subtest-5	23.94	23.96	23.58	24.56	24.96	24.63

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

5.1 Standard Applicable

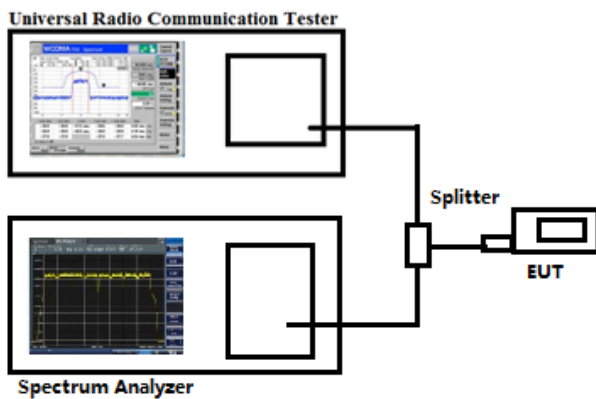
According to §24.232(d), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in 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.

5.2 Test Procedure

According with KDB 971168

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

Test Configuration for the emission bandwidth testing:



5.3 Summary of Test Results

PCS1900				
Test Mode	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)
GSM	661	1850.2	5.64	13
GPRS(1 Slot)	661	1850.2	5.88	13

WCDMA Band II				
Test Mode	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)
WCDMA	9262	1852.4	6.52	13
	9400	1880.0	6.71	13
	9538	1907.6	6.06	13

Note: Only the worst case was selected to record.

6. Emission Bandwidth

6.1 Standard Applicable

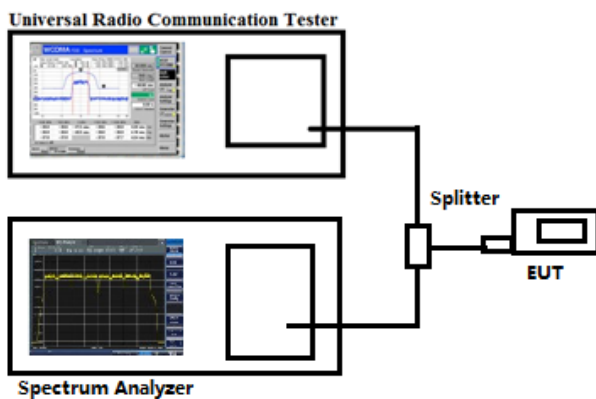
According to §22.917(b), the emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

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.

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:



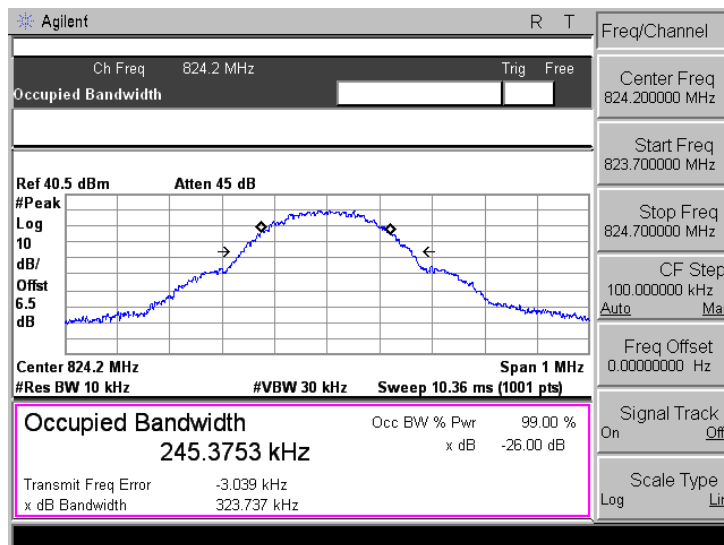
6.3 Summary of Test Results/Plots

EUT Mode	Channel	Frequency (MHz)	99% Occupy bandwidth (kHz)	-26dB bandwidth (kHz)
GSM 850 (GMSK)	128	824.20	245.3753	323.737
	190	836.60	246.9095	321.691
	251	848.80	244.1166	320.468
GPRS850 (GMSK,1Slot)	128	824.20	246.5348	317.415
	190	836.60	247.3268	318.025
	251	848.80	244.8785	324.876
PCS1900 (GMSK)	512	1850.20	252.7498	314.927
	661	1880.00	246.1101	316.004
	810	1909.80	251.9074	316.310
GPRS1900 (GMSK,1Slot)	512	1850.20	241.2754	312.884
	661	1880.00	247.4543	318.784
	810	1909.80	247.7790	305.258

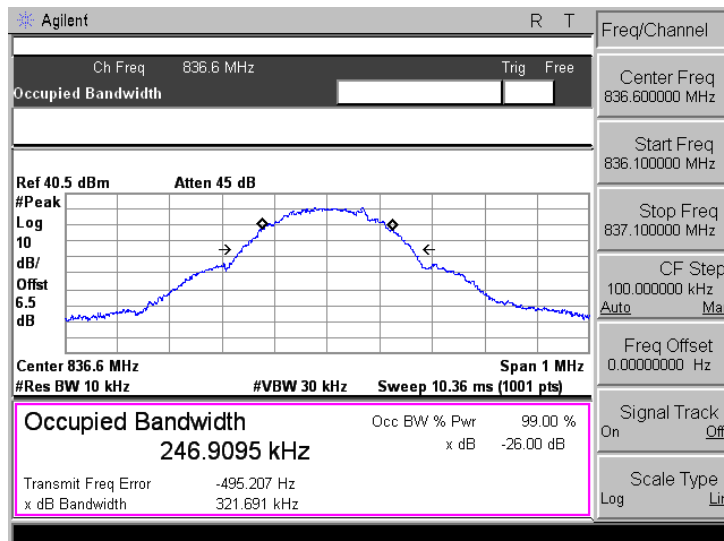
EUT Mode	Channel	Frequency (MHz)	99% Occupy bandwidth (kHz)	-26dB bandwidth (kHz)
WCDMA Band V	4132	826.40	4155.1	4690
	4183	836.60	4158.1	4704
	4233	846.60	4172.6	4717
HSDPA	4132	826.40	4150.5	4687
	4183	836.60	4158.7	4656
	4233	846.60	4165.1	4703
HSUPA	4132	826.40	4156.2	4699
	4183	836.60	4170.4	4666
	4233	846.60	4173.4	4661
WCDMA Band II	9262	1852.40	4164.0	4705
	9400	1880.00	4179.3	4706
	9538	1907.60	4156.9	4702
HSDPA	9262	1852.40	4168.0	4722
	9400	1880.00	4166.9	4690
	9538	1907.60	4184.5	4710
HSUPA	9262	1852.40	4182.3	4670
	9400	1880.00	4172.6	4729
	9538	1907.60	4189.6	4688

GSM850

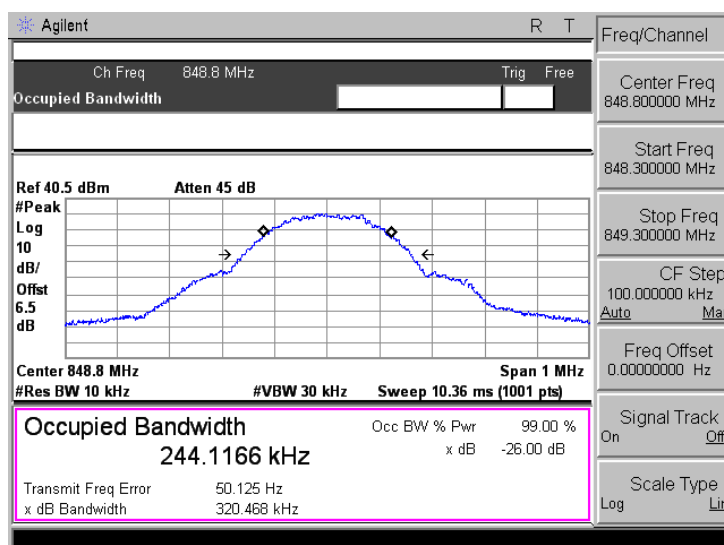
Low Channel



Middle Channel

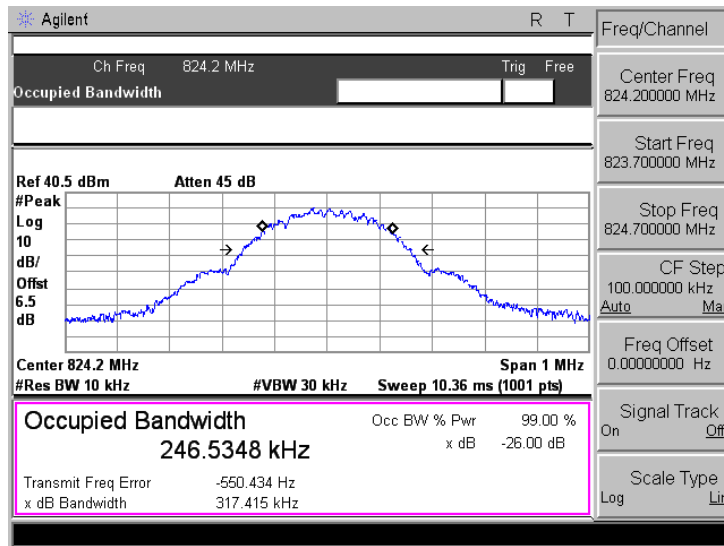


High Channel

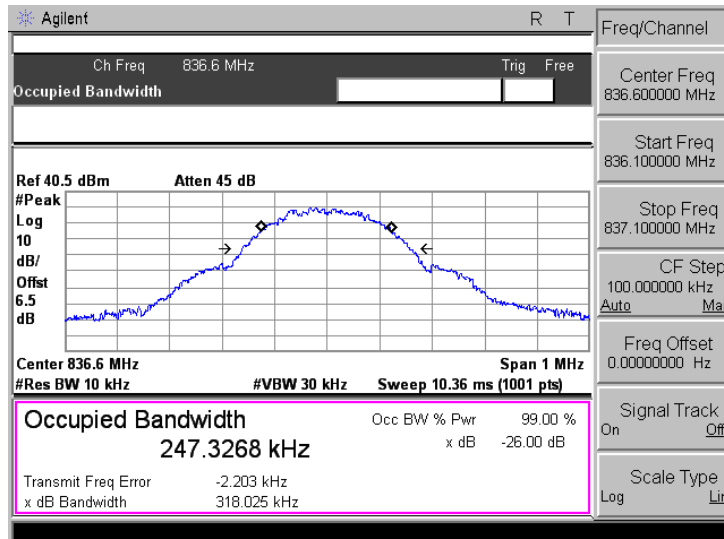


GPRS850

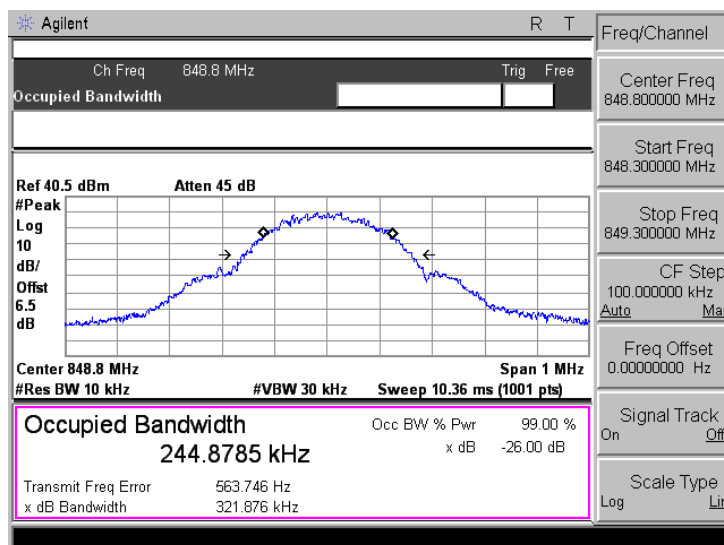
Low Channel



Middle Channel

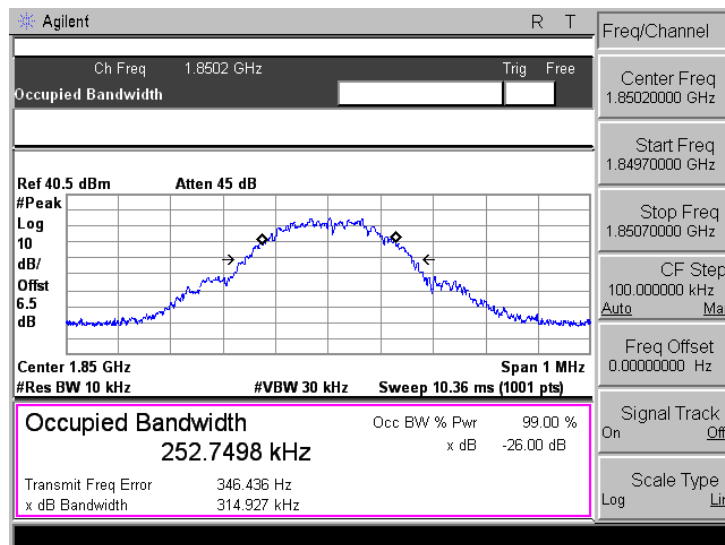


High Channel

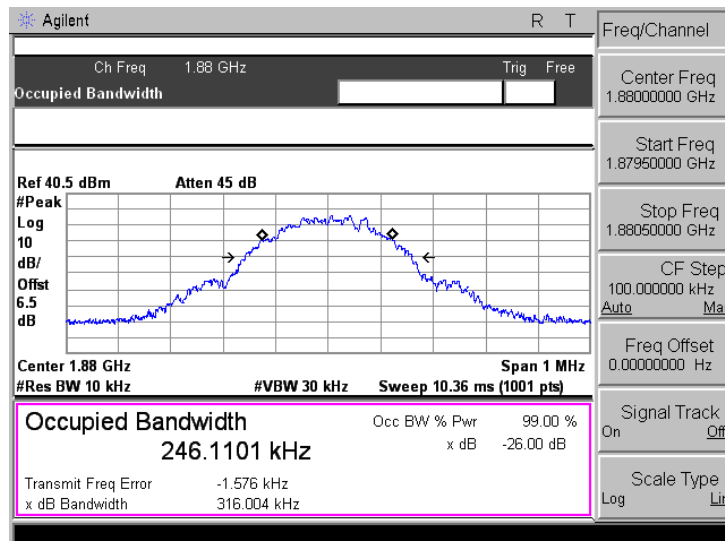


PCS1900

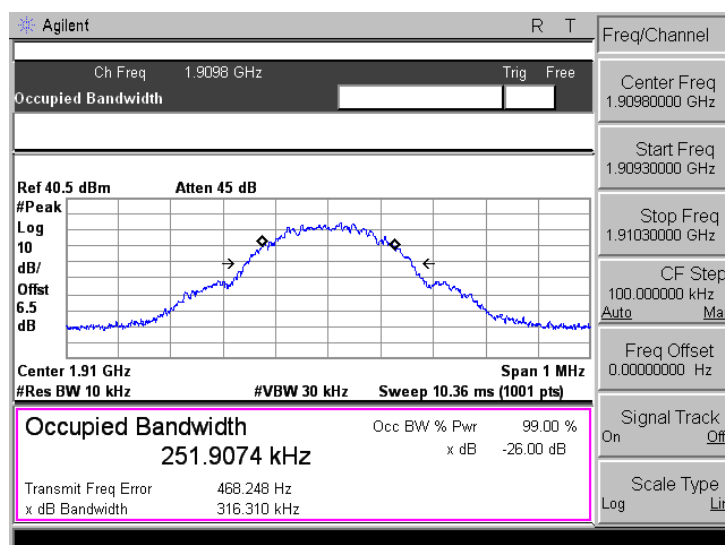
Low Channel



Middle Channel

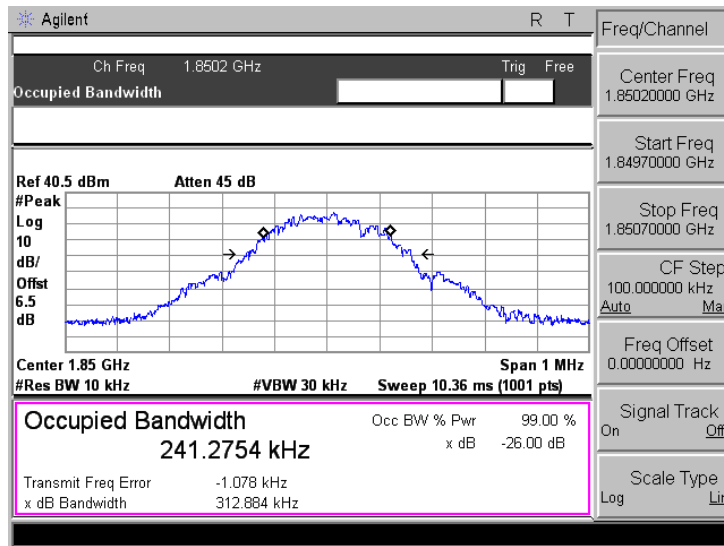


High Channel

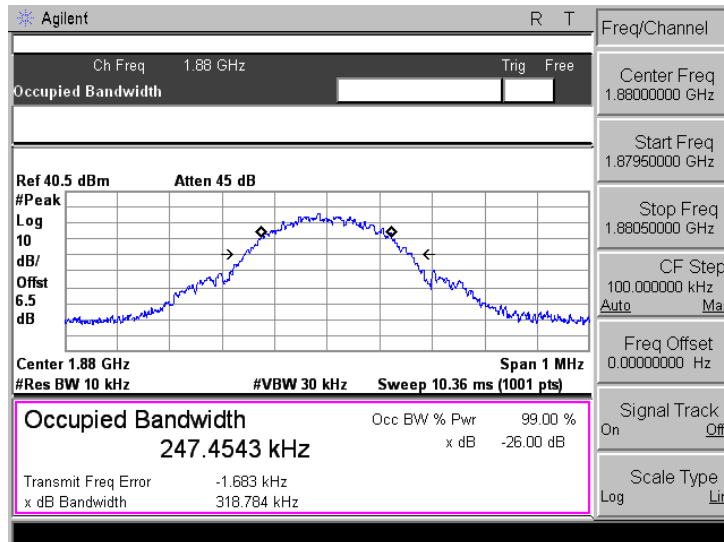


GPRS1900

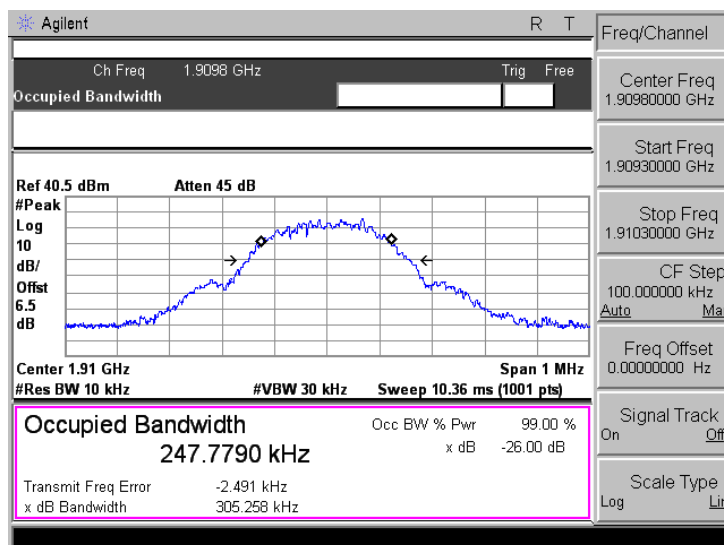
Low Channel



Middle Channel

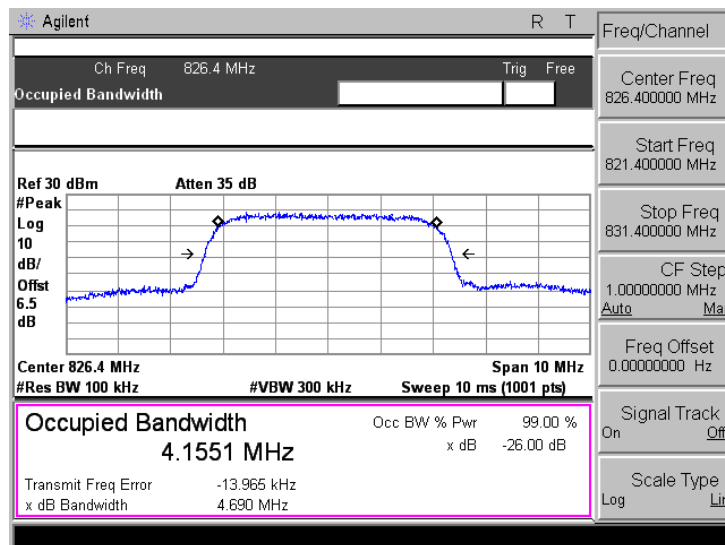


High Channel

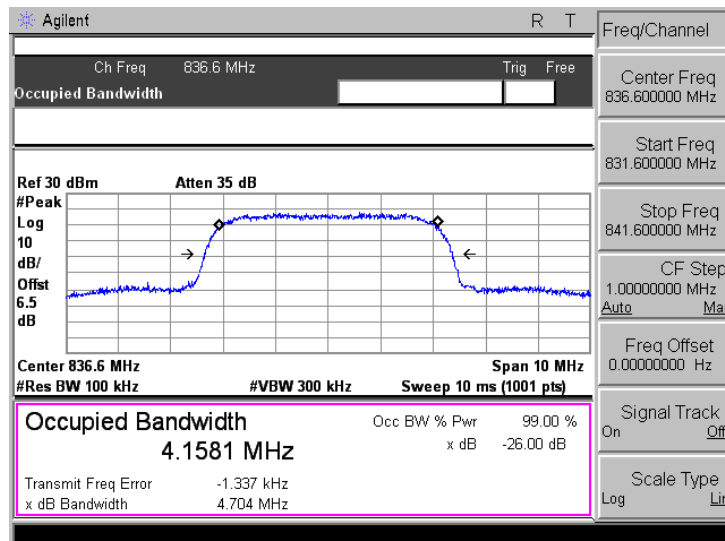


WCDMA Band V

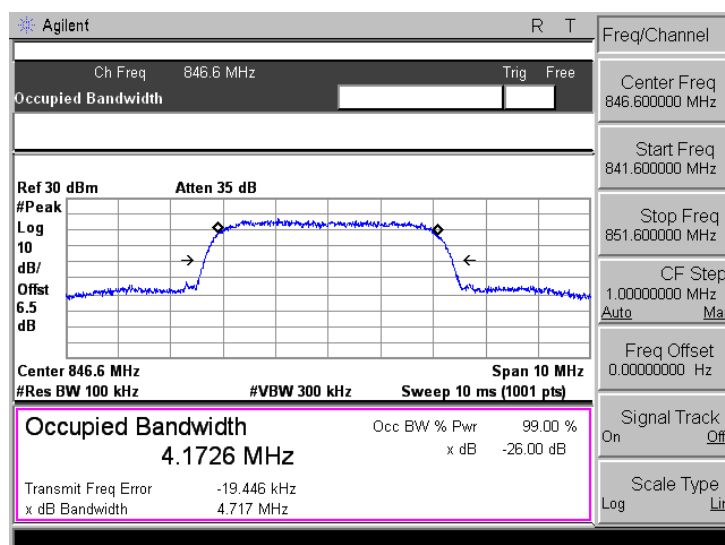
Low Channel



Middle Channel

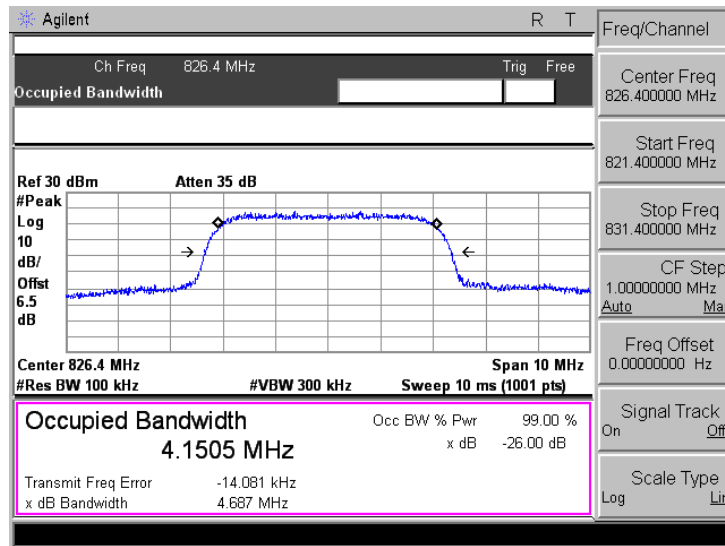


High Channel

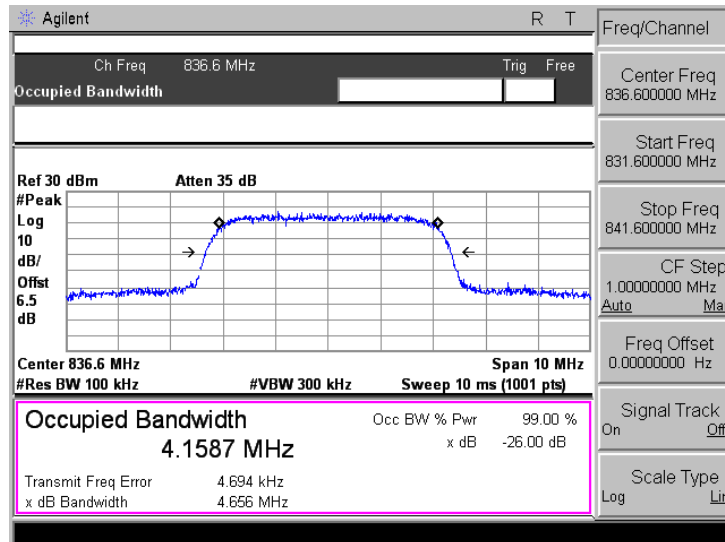


WCDMA Band V- HSDPA

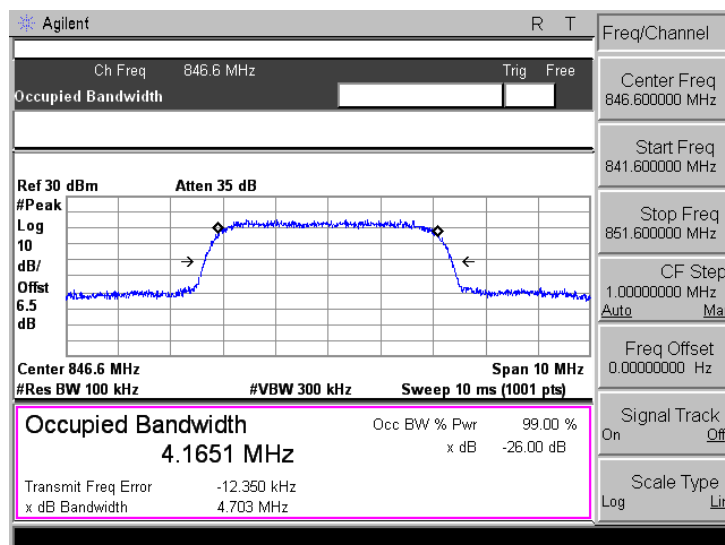
Low Channel



Middle Channel

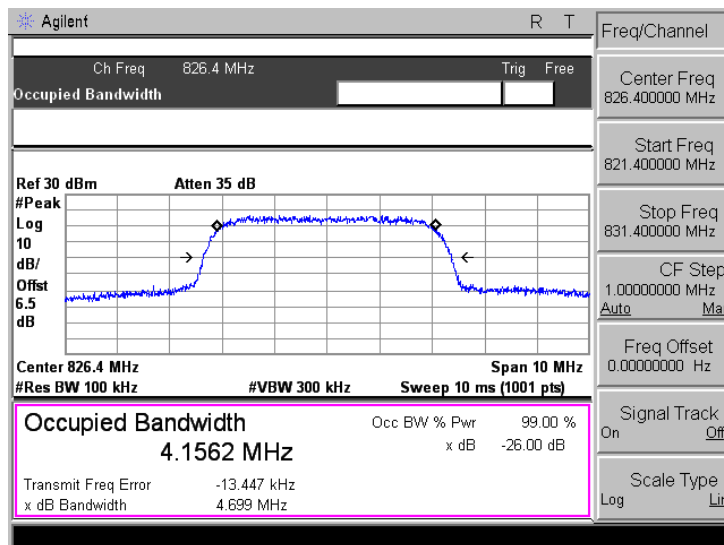


High Channel

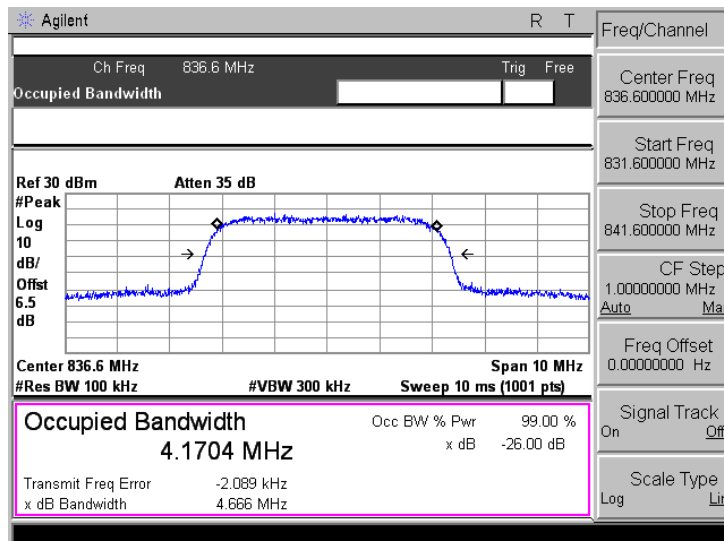


WCDMA Band V- HSUPA

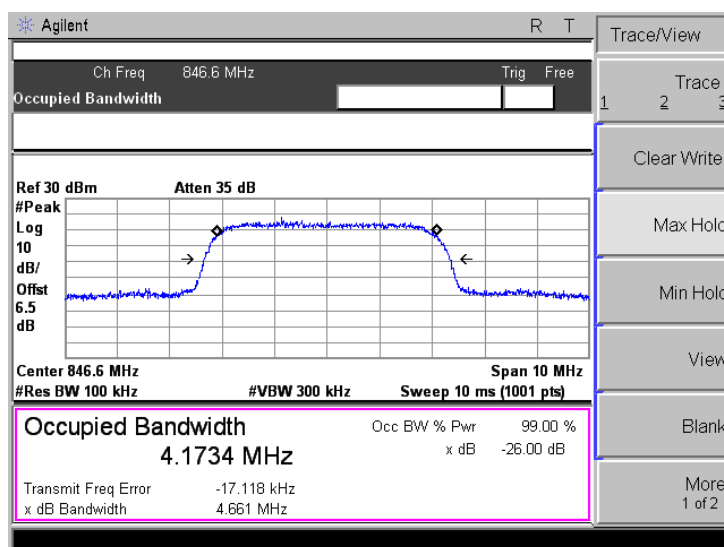
Low Channel



Middle Channel

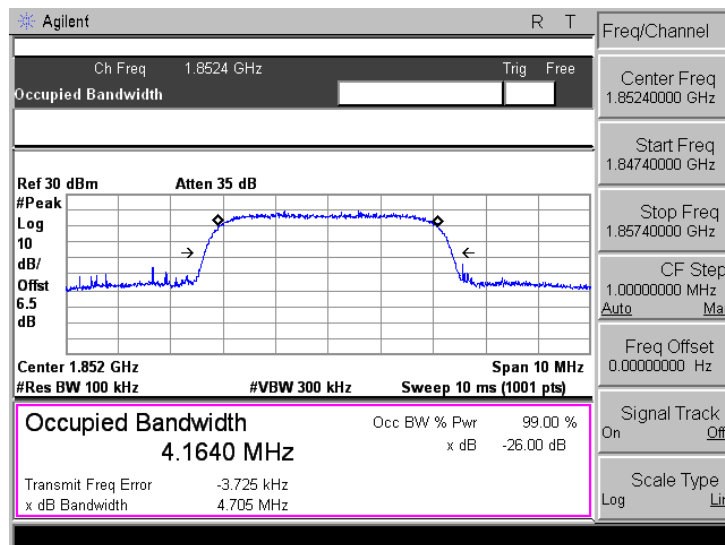


High Channel

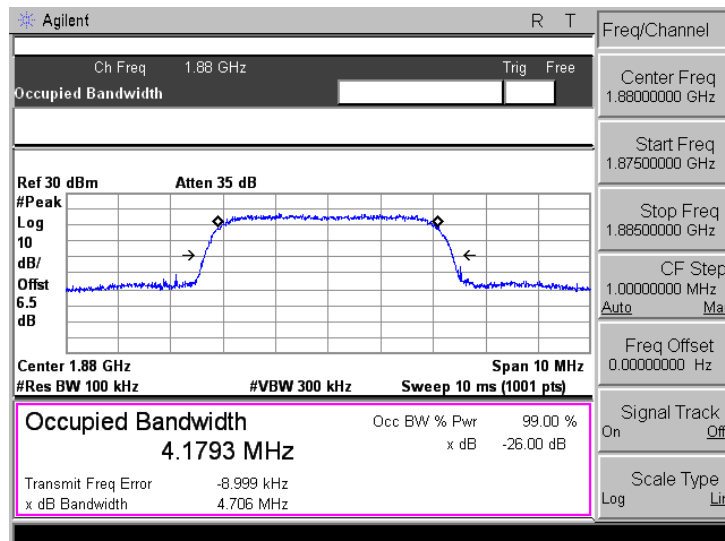


WCDMA Band II

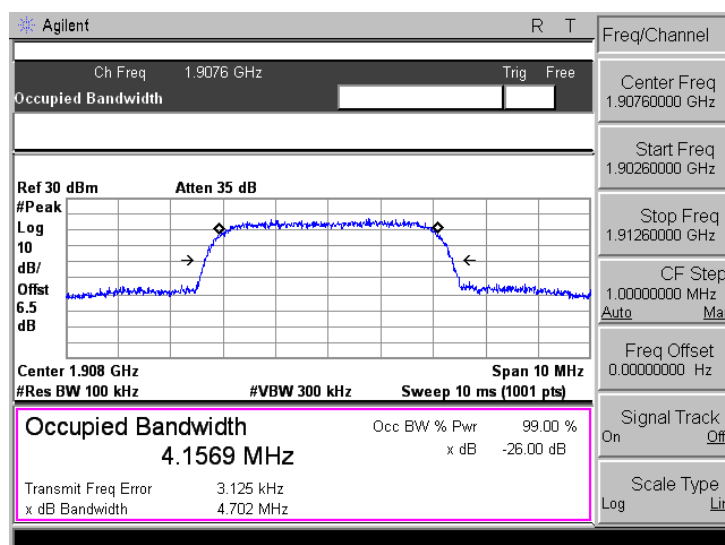
Low Channel



Middle Channel

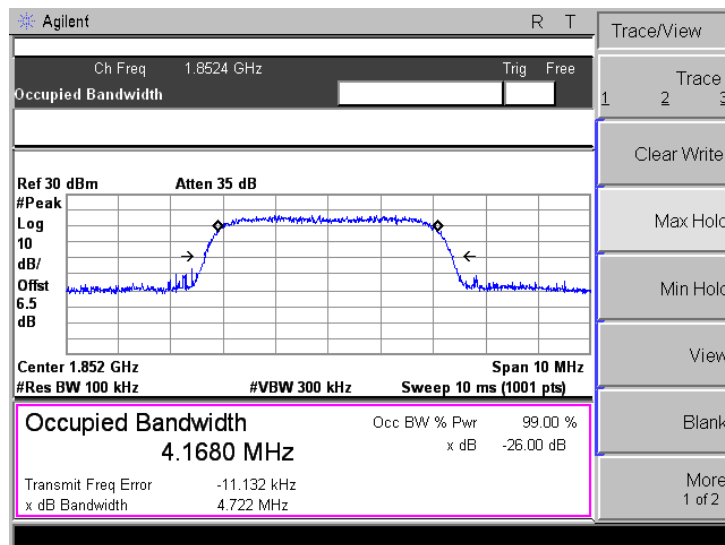


High Channel

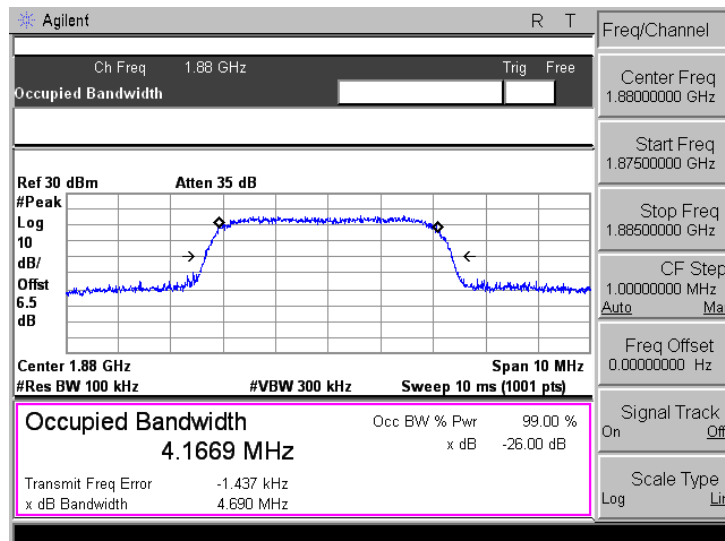


WCDMA Band II- HSDPA

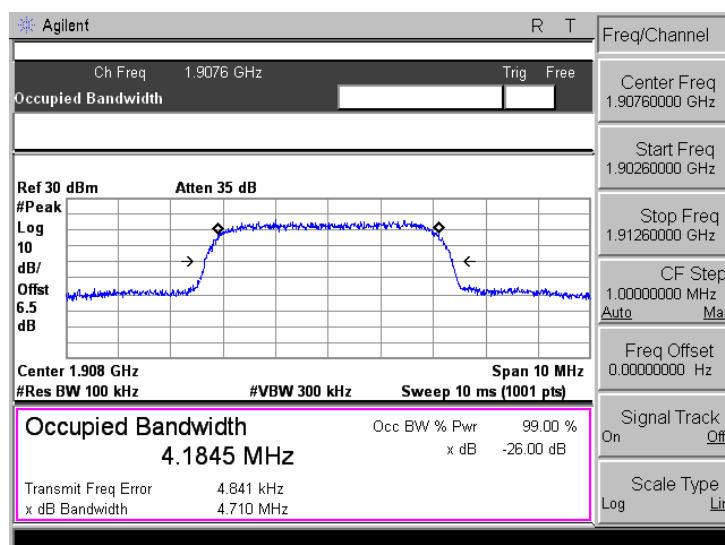
Low Channel



Middle Channel

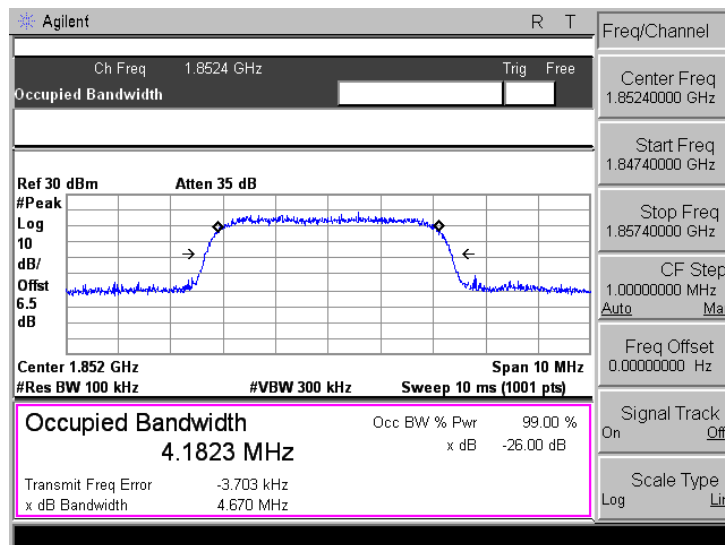


High Channel

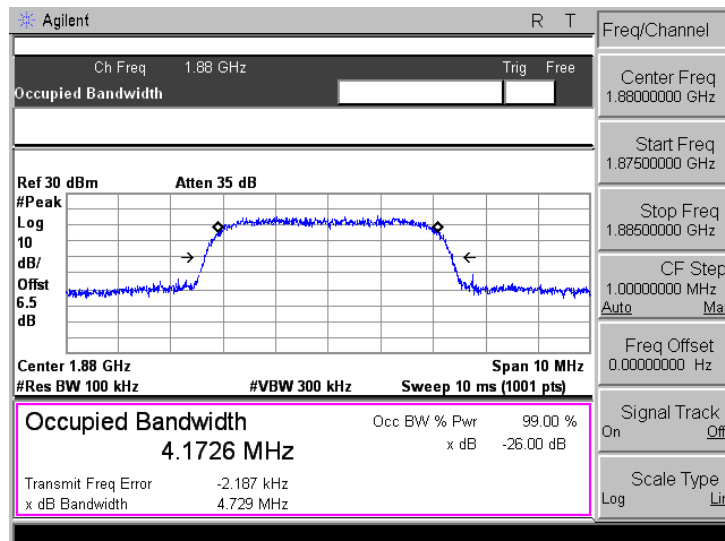


WCDMA Band II- HSUPA

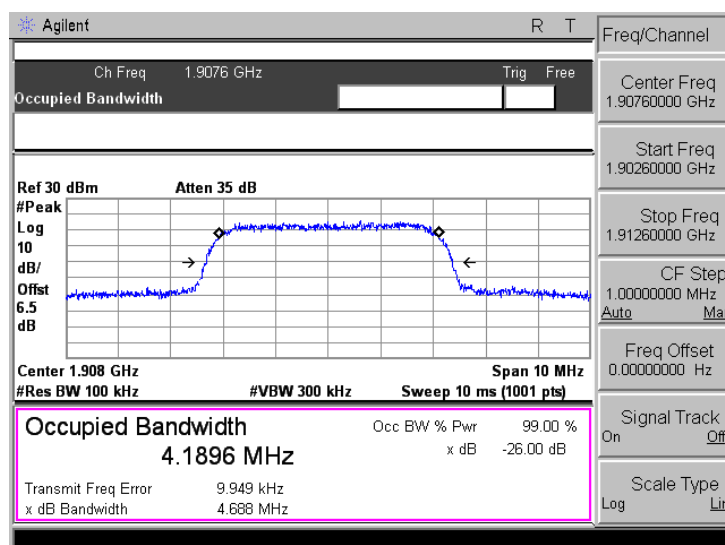
Low Channel



Middle Channel



High Channel



7. Out of Band Emissions at Antenna Terminal

7.1 Standard Applicable

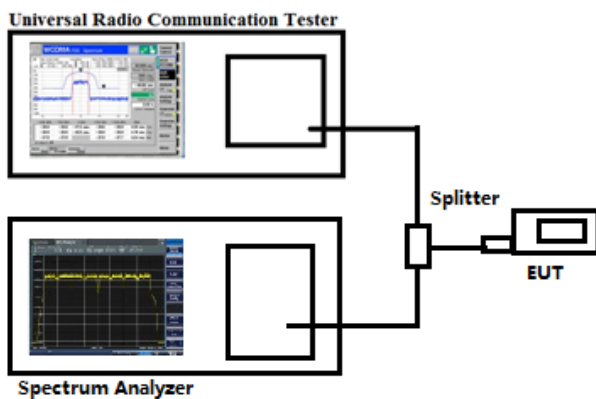
According to §22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

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.

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 10th harmonic.

Test Configuration for the out of band emissions testing:



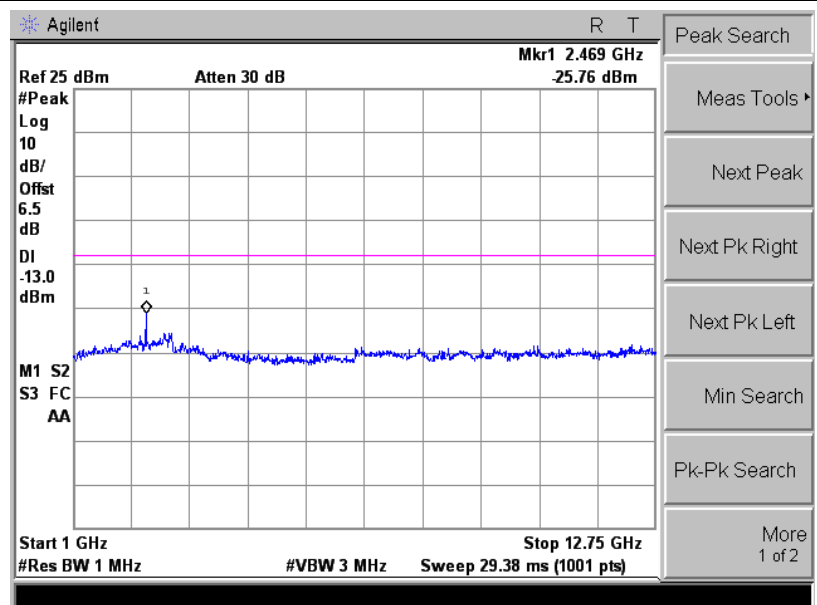
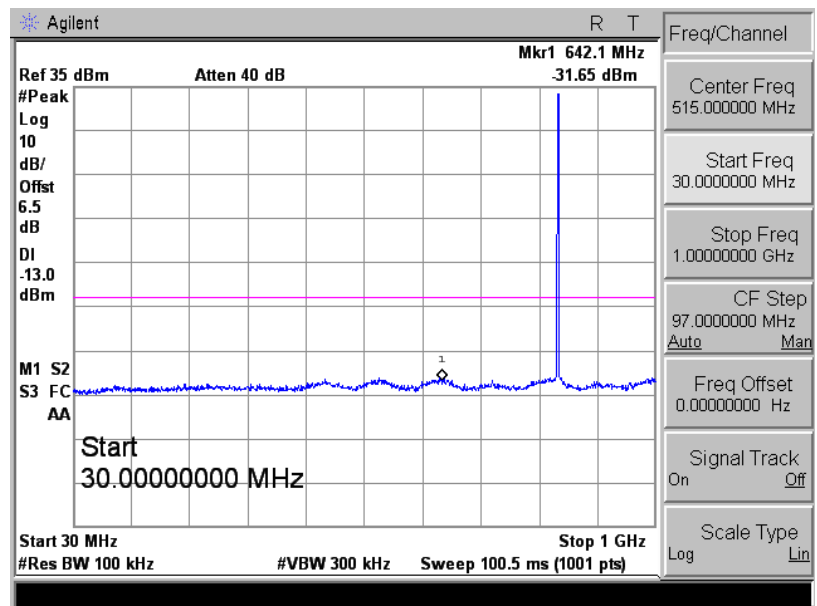
7.3 Summary of Test Results/Plots

Note: Pre-scan mode WCDMA/HSDPA/HSUPA find the worst case at WCDMA mode and recorded in the test report.

Please refer to the following test plots

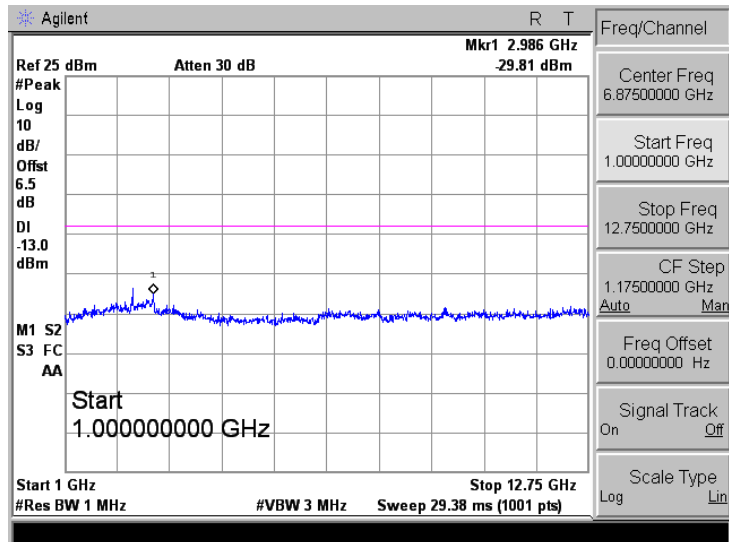
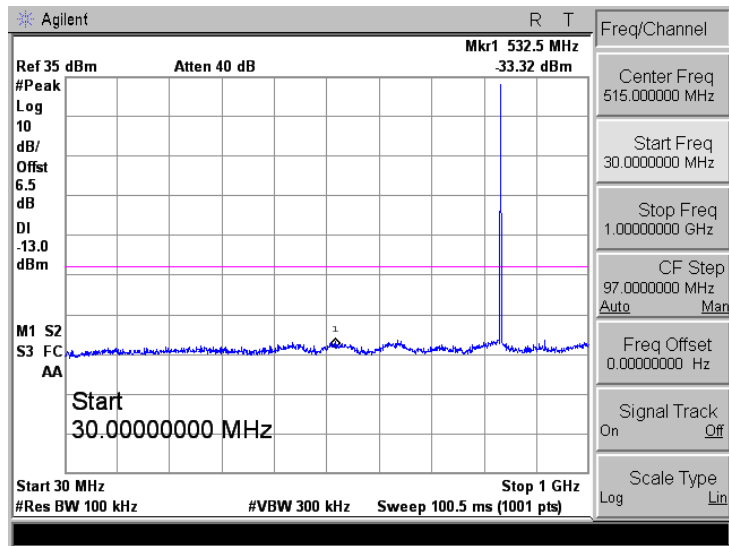
GSM850

Low Channel



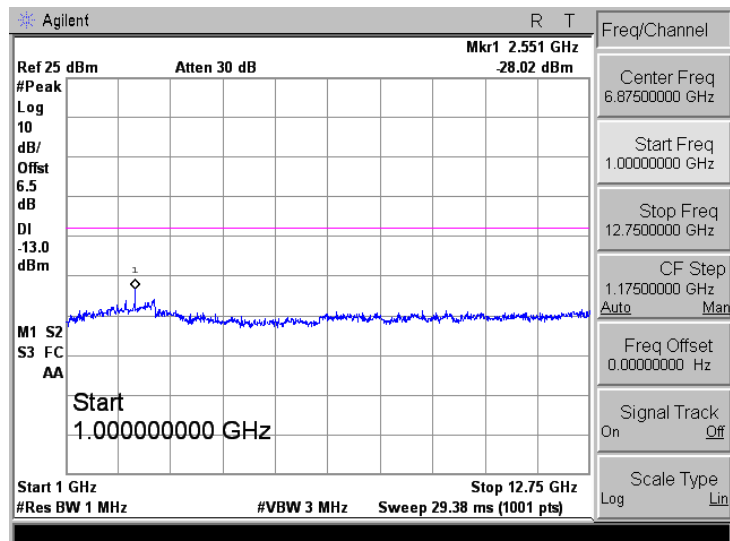
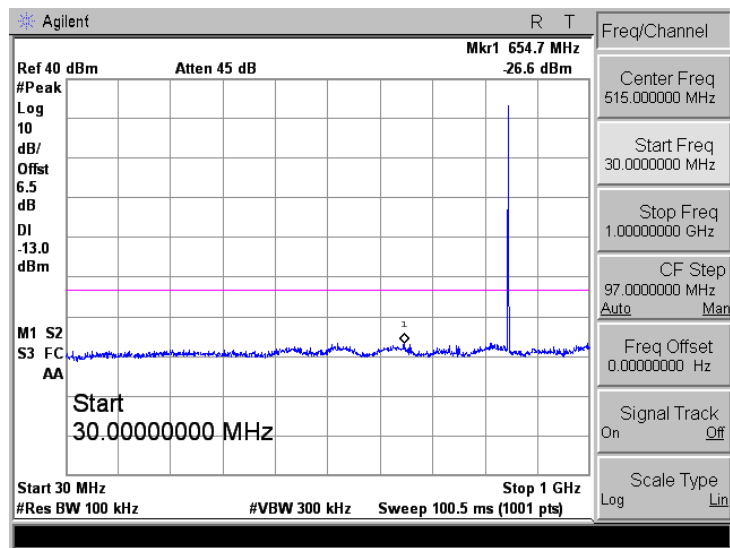
GSM850

Middle Channel



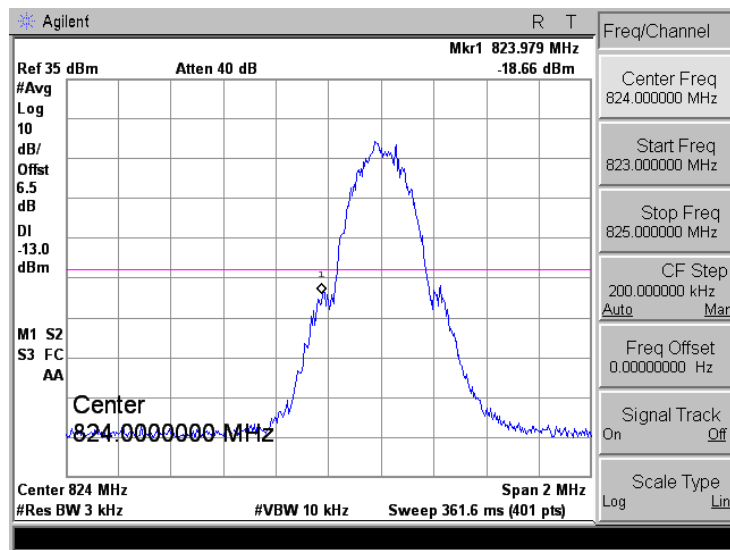
GSM850

High Channel

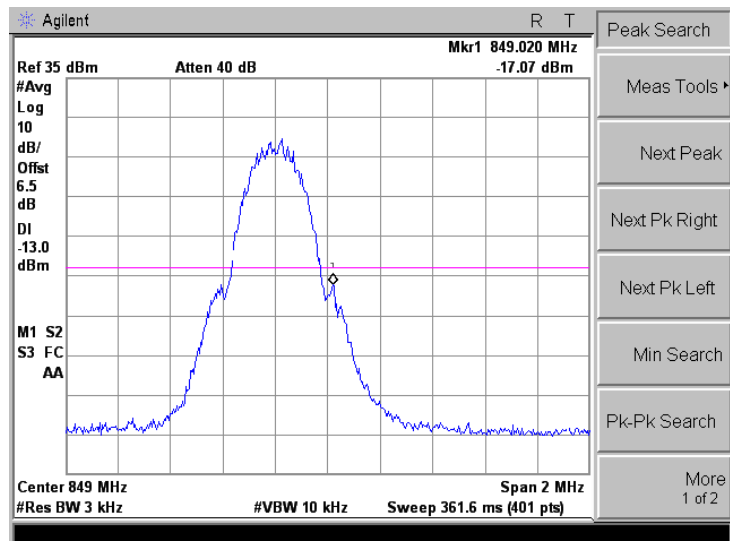


GSM850

Low Band Emission

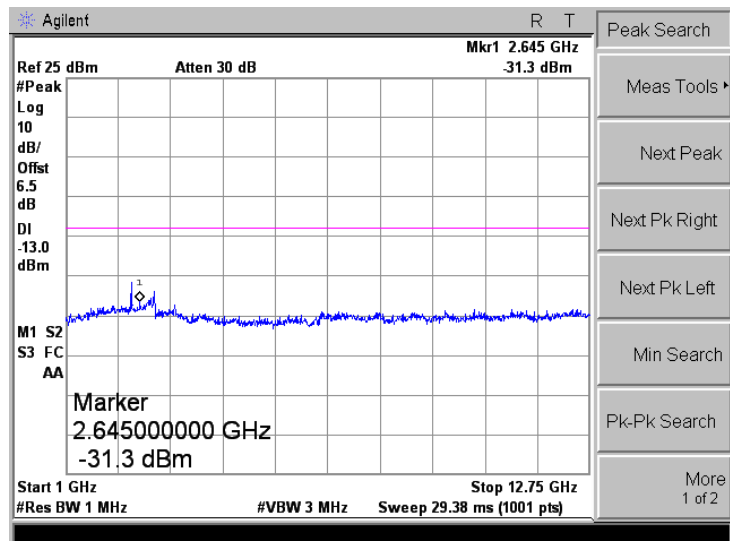
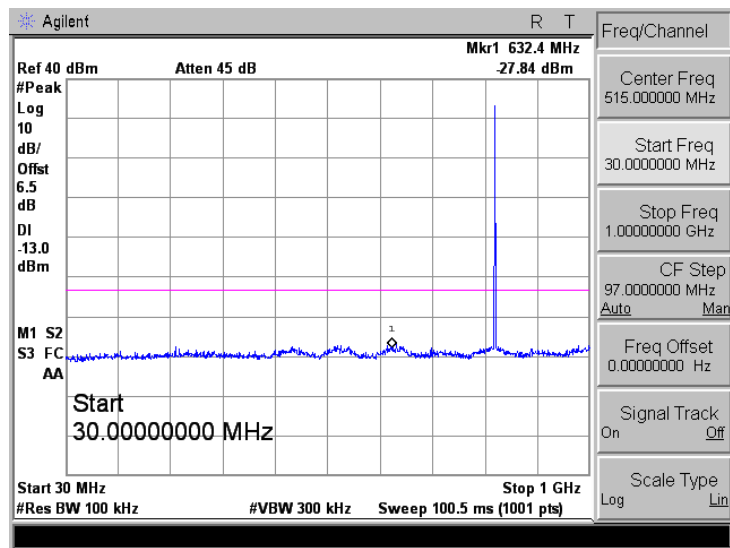


High Band Emission



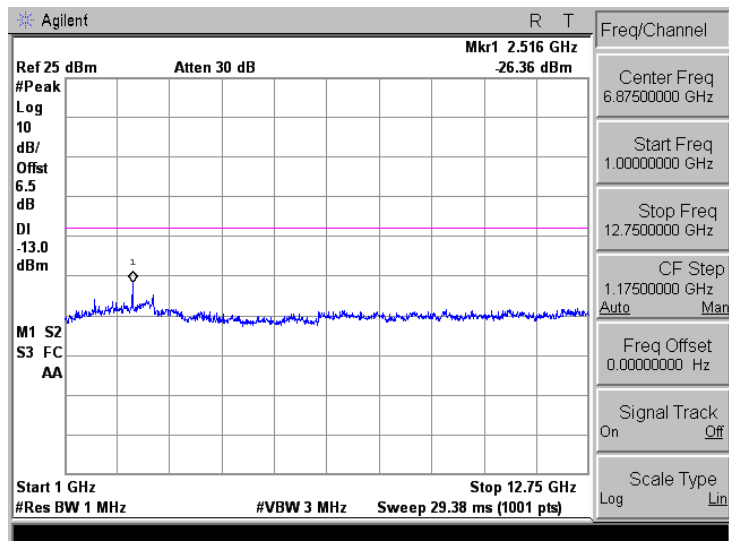
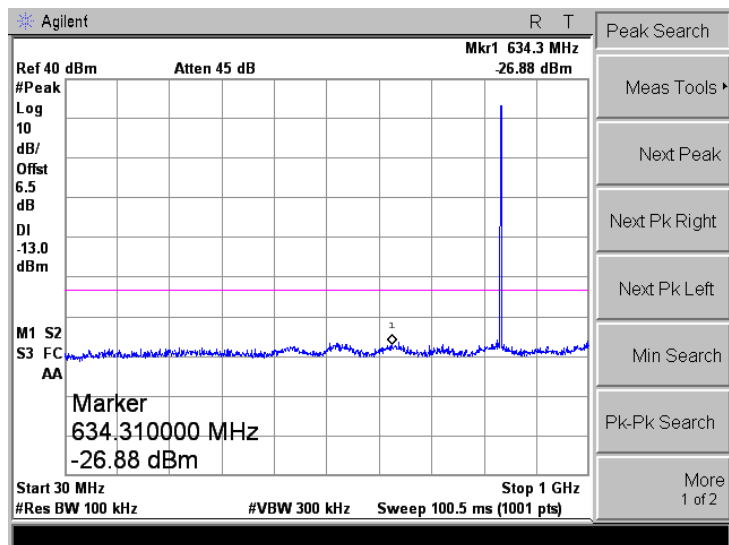
For Cellular Band

GPRS Low Channel



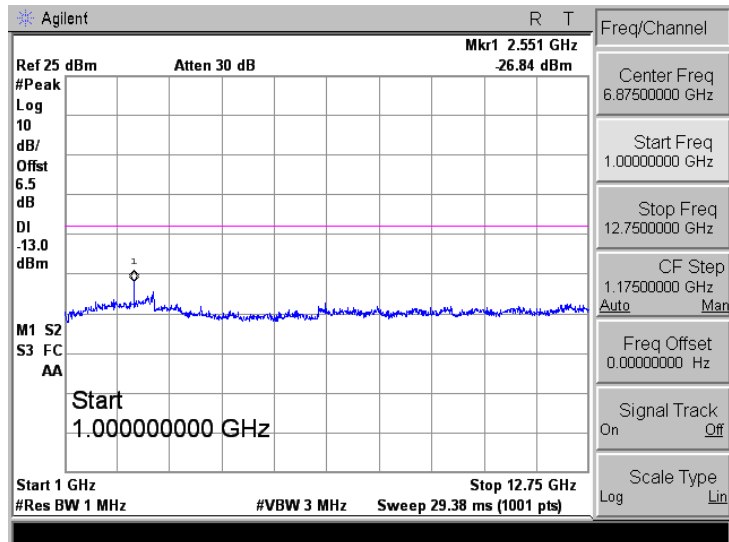
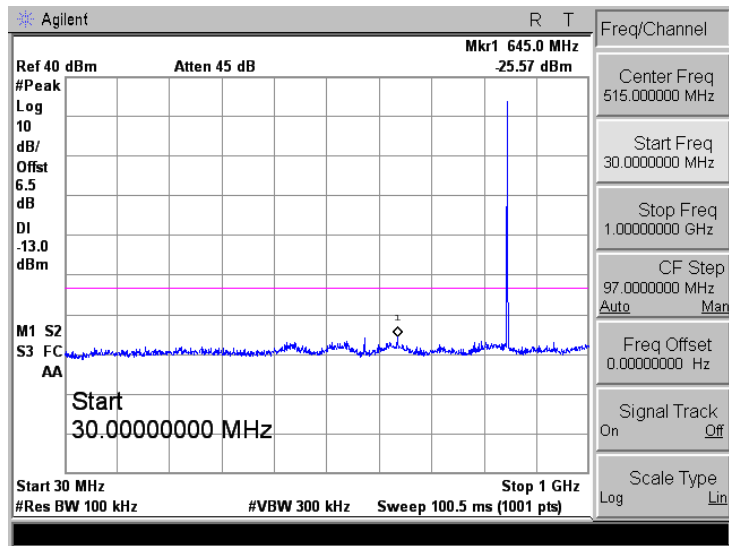
GPRS850

Middle Channel



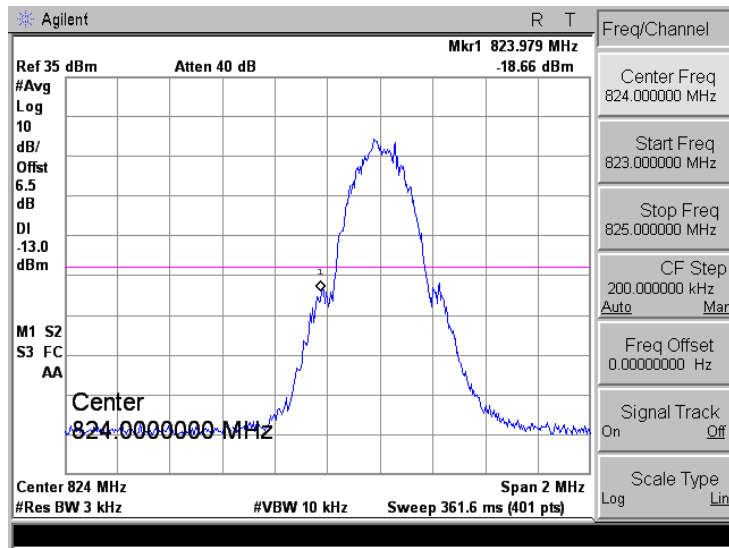
GPRS850

High Channel

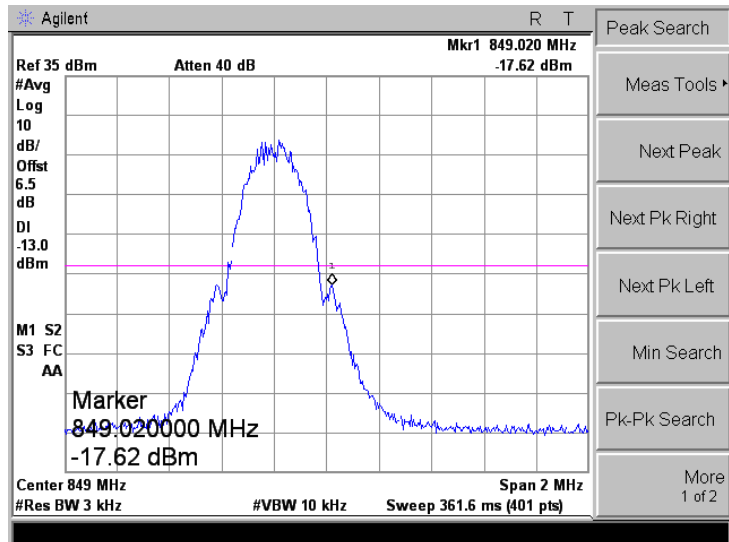


GPRS850

Low Band Emission

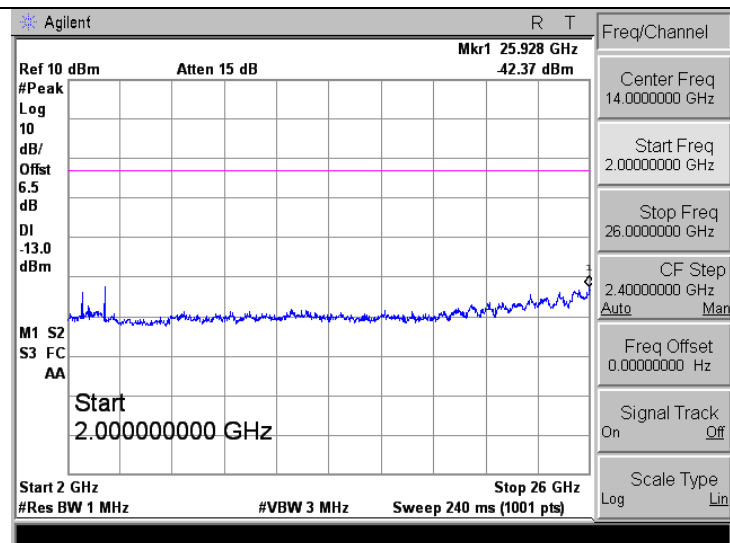
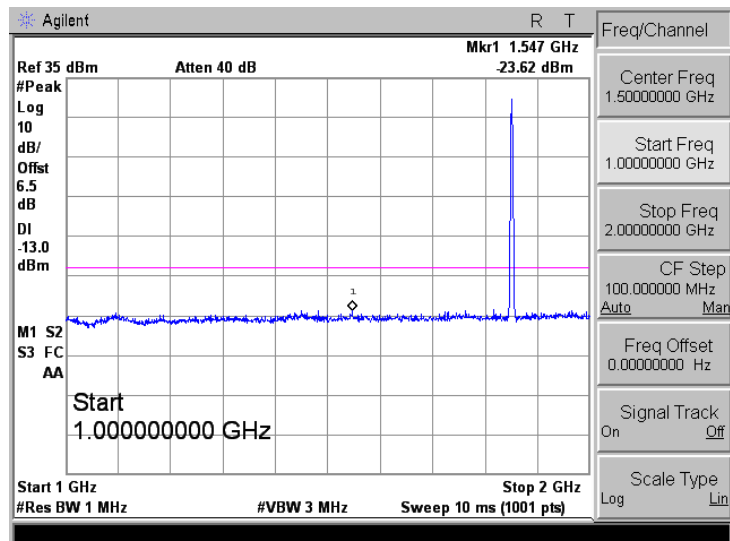
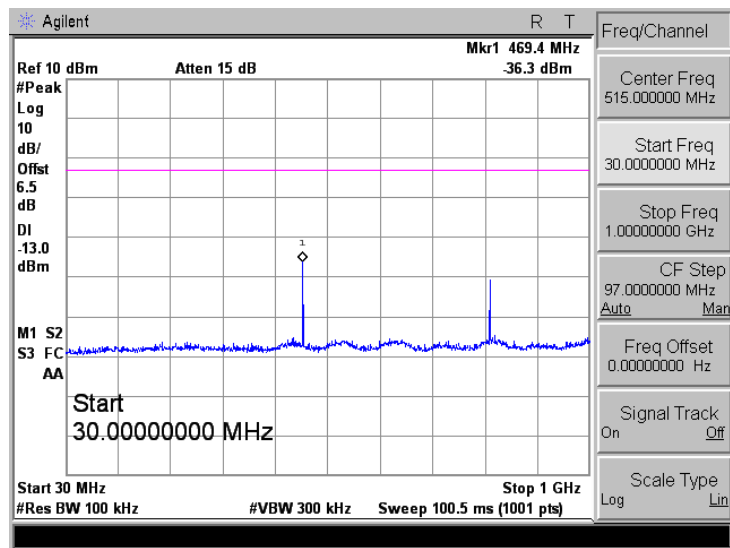


High Band Emission



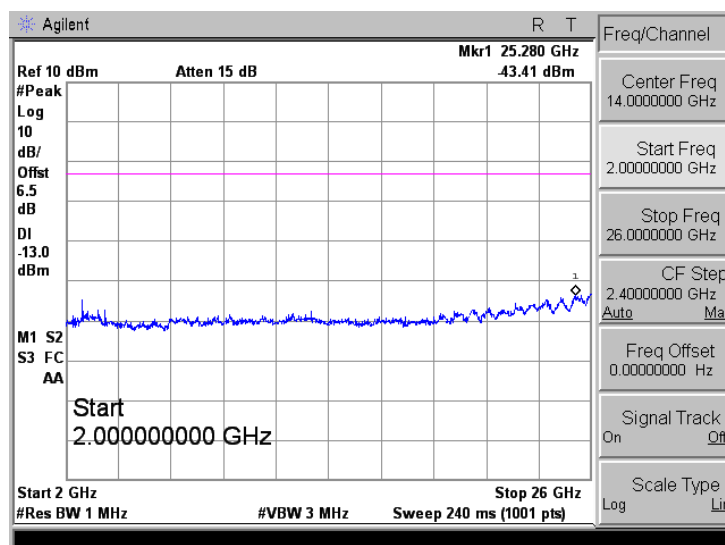
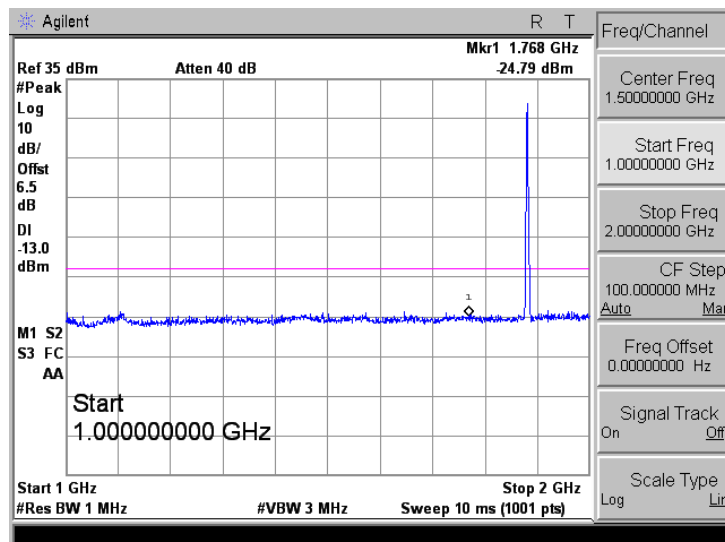
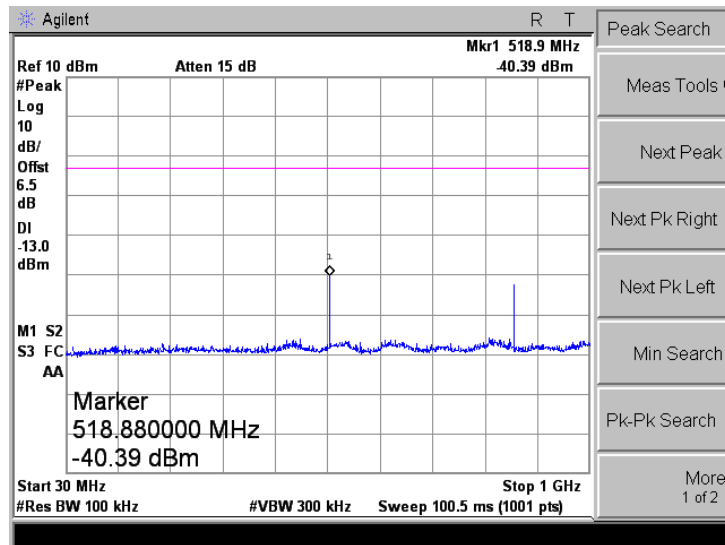
PCS1900

Low Channel



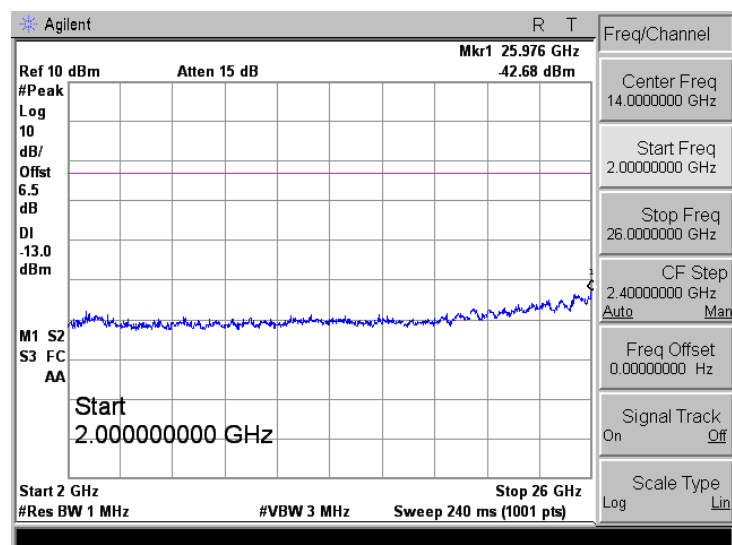
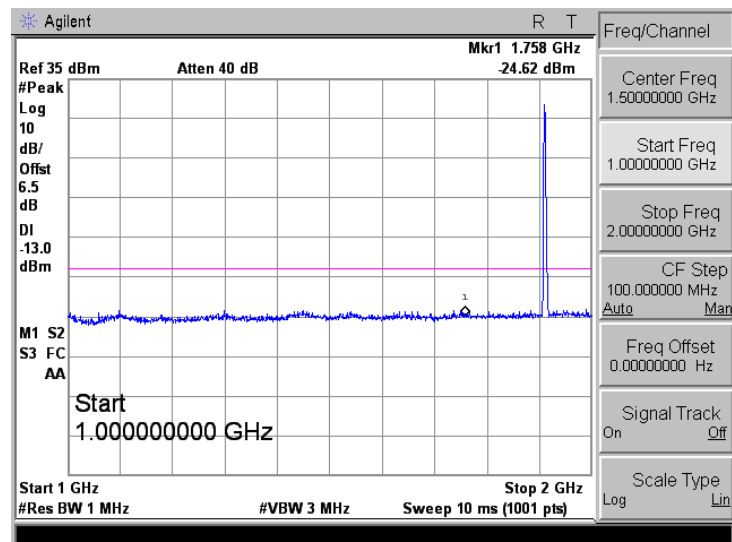
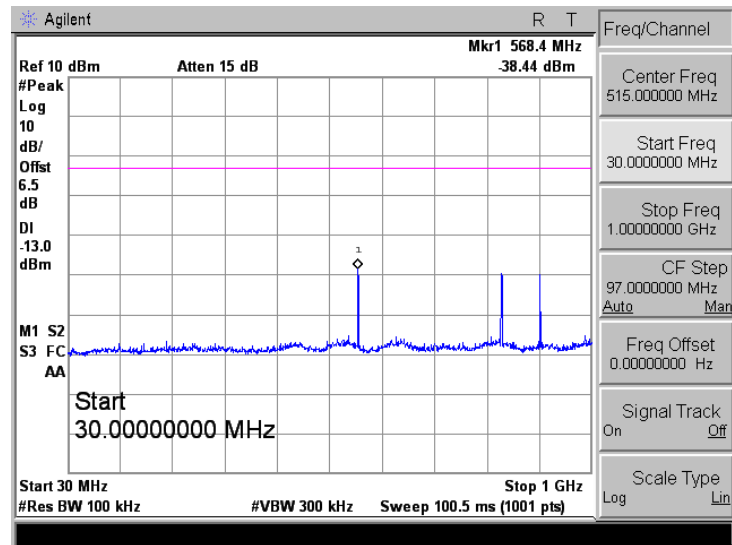
PCS1900

Middle Channel



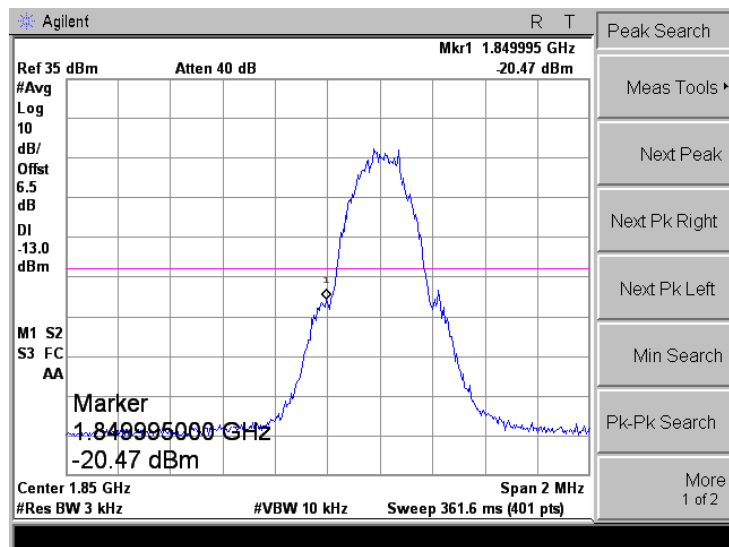
PCS1900

High Channel

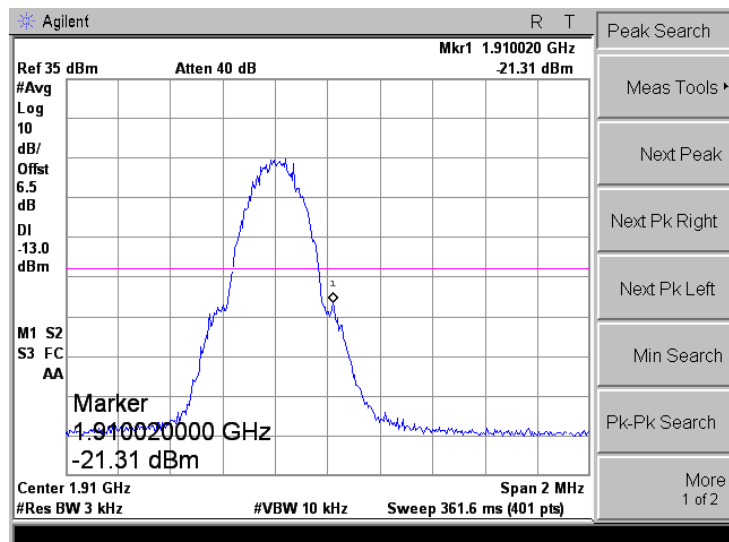


PCS1900

Low Band Emission

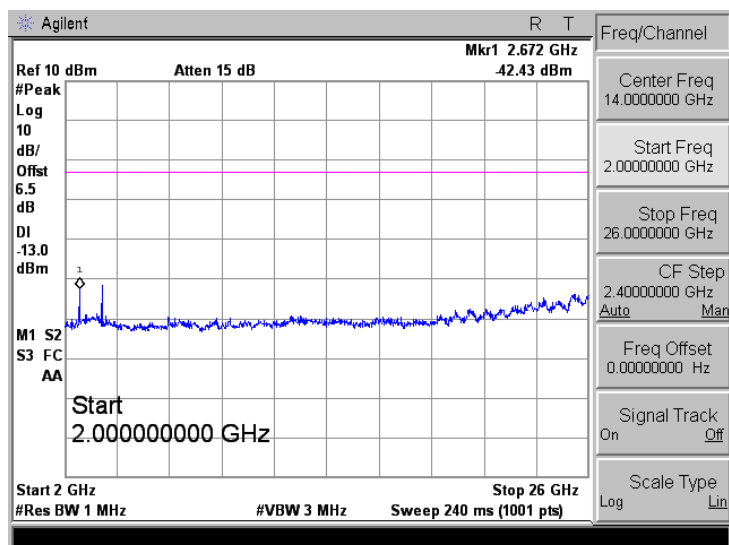
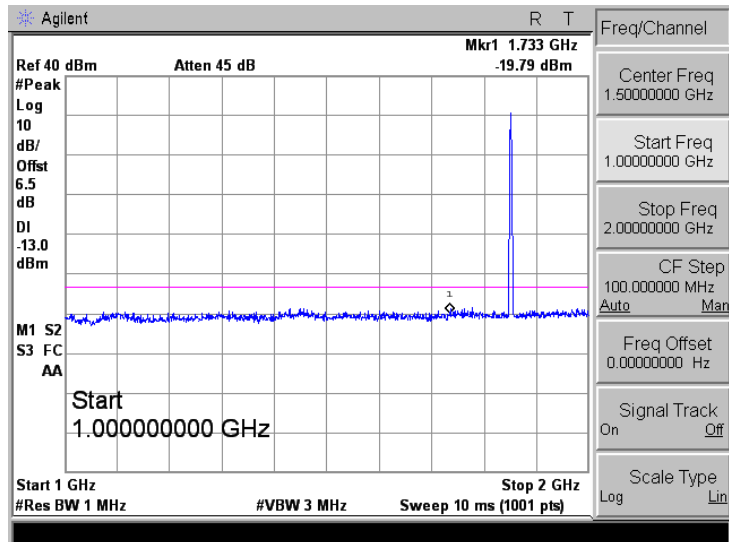
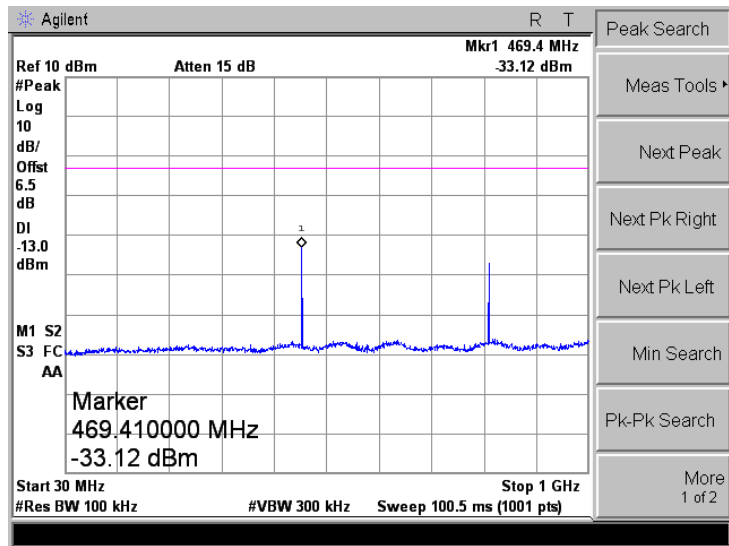


High Band Emission



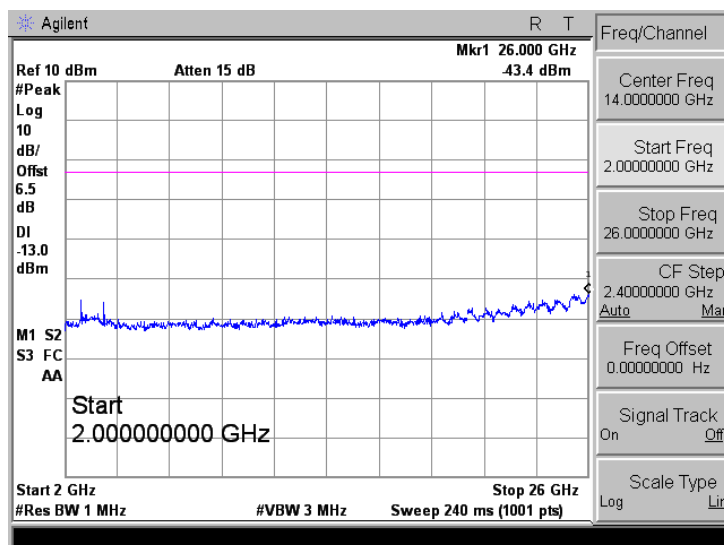
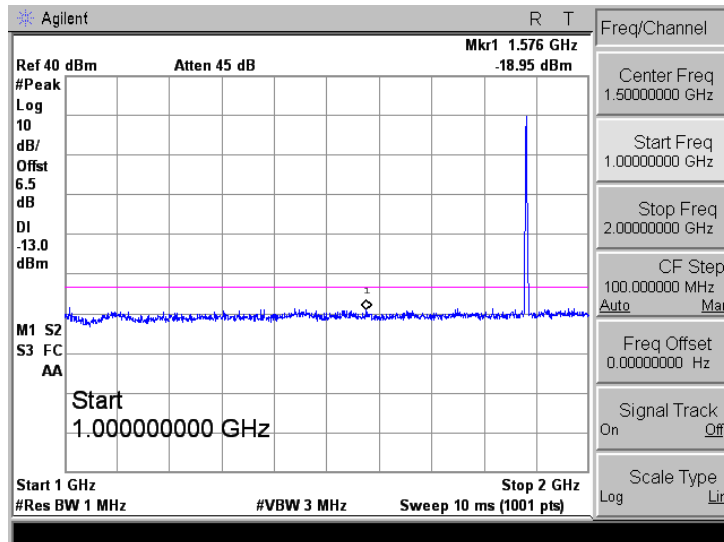
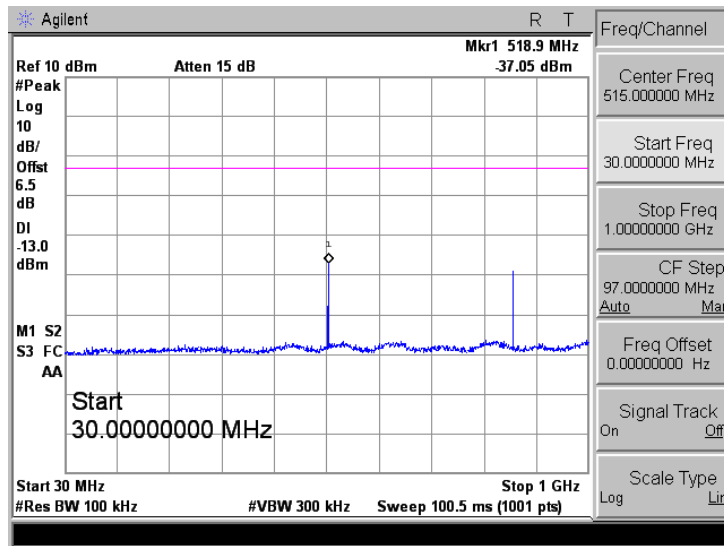
GPRS1900

Low Channel

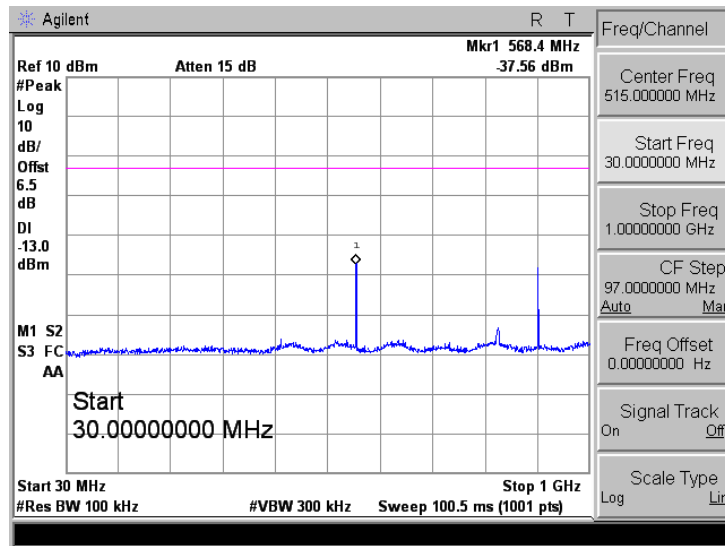


GPRS1900

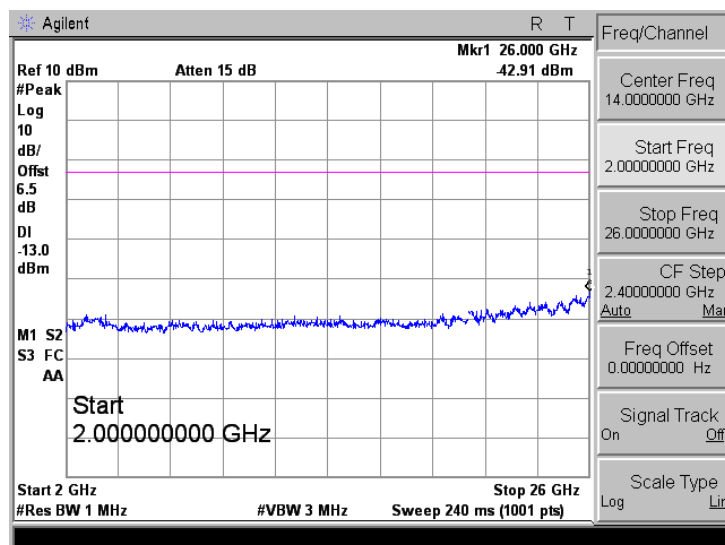
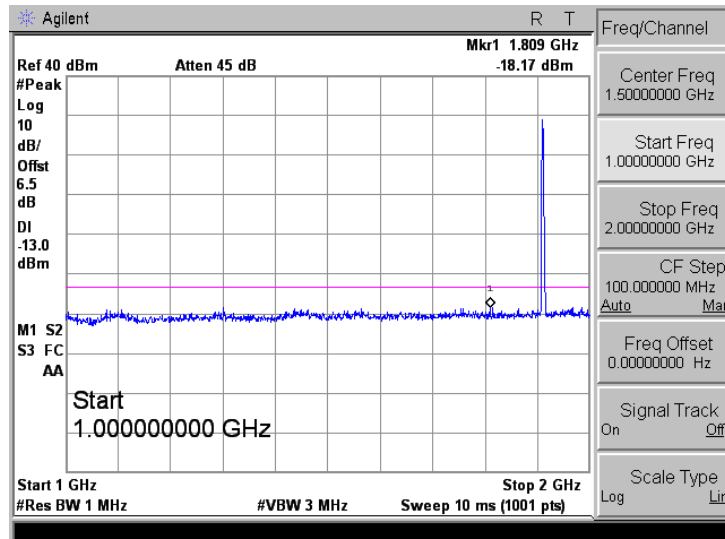
Middle Channel



GPRS1900

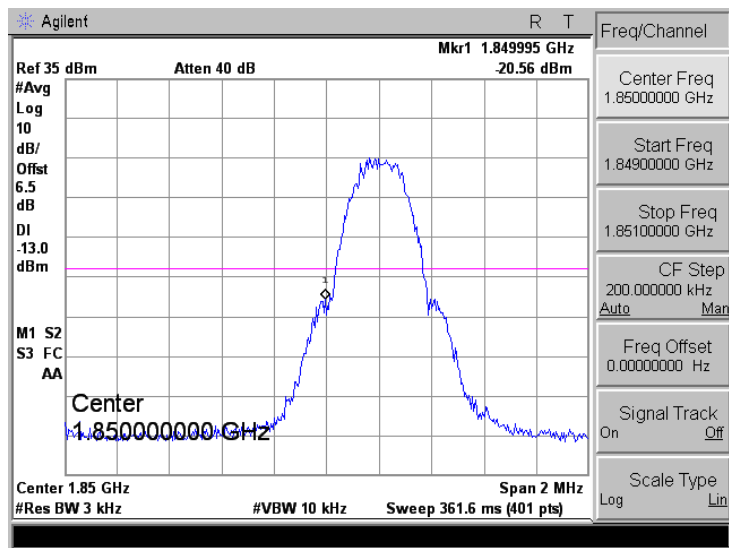


High Channel

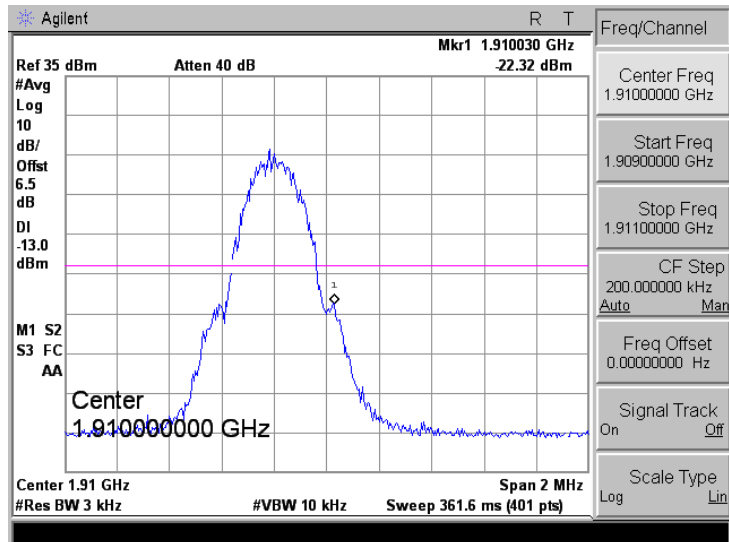


GPRS1900

Low Band Emission

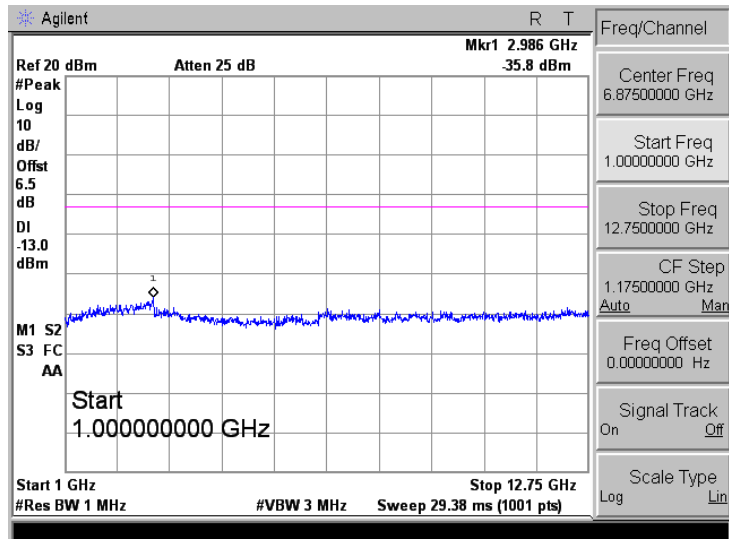
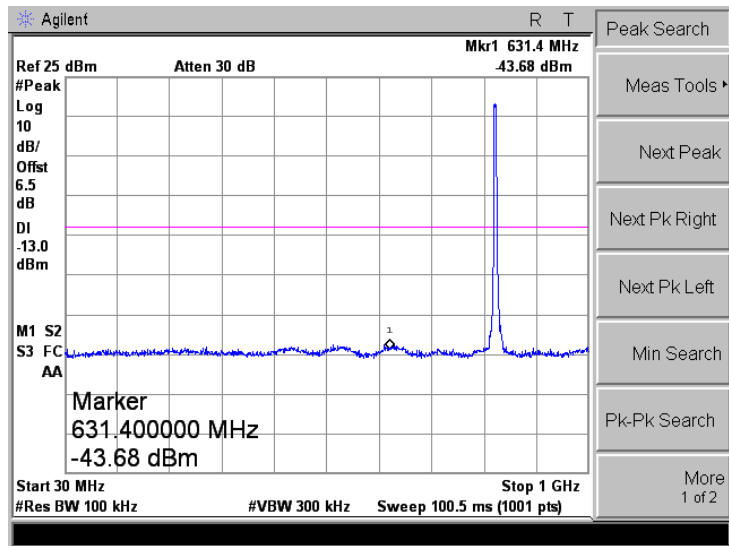


High Band Emission



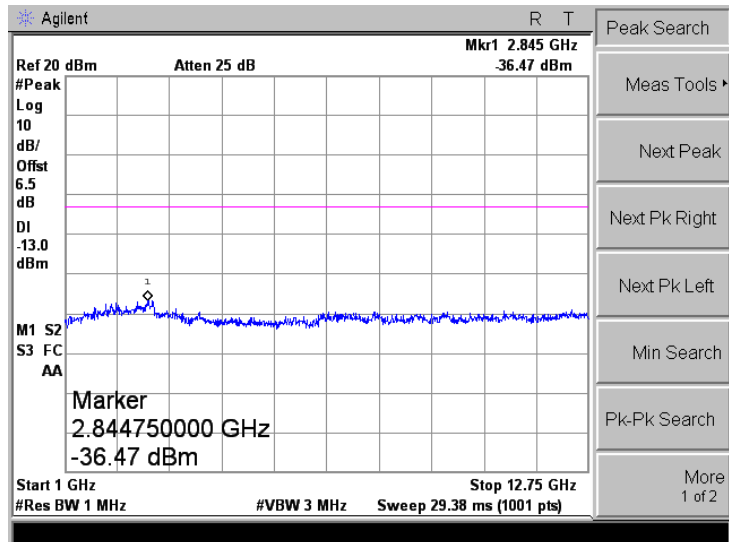
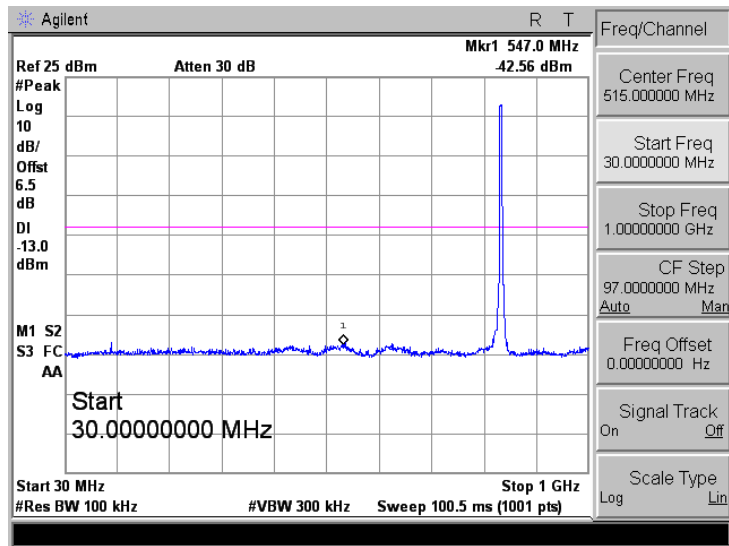
WCDMA Band V

Low Channel



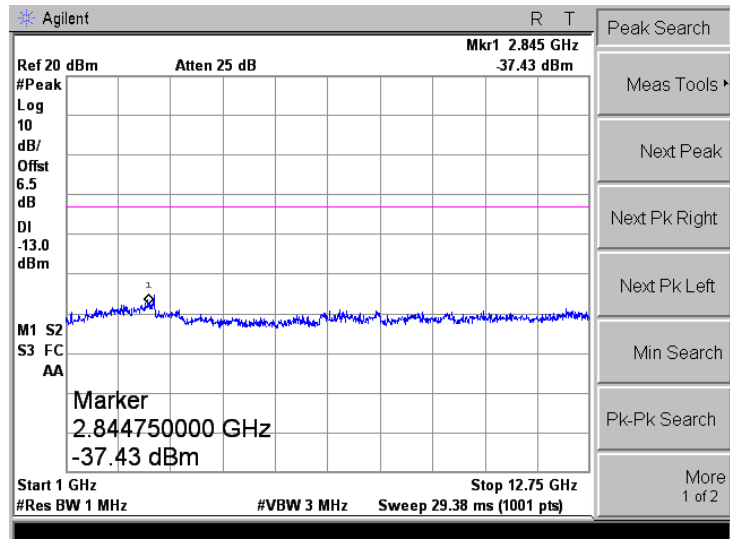
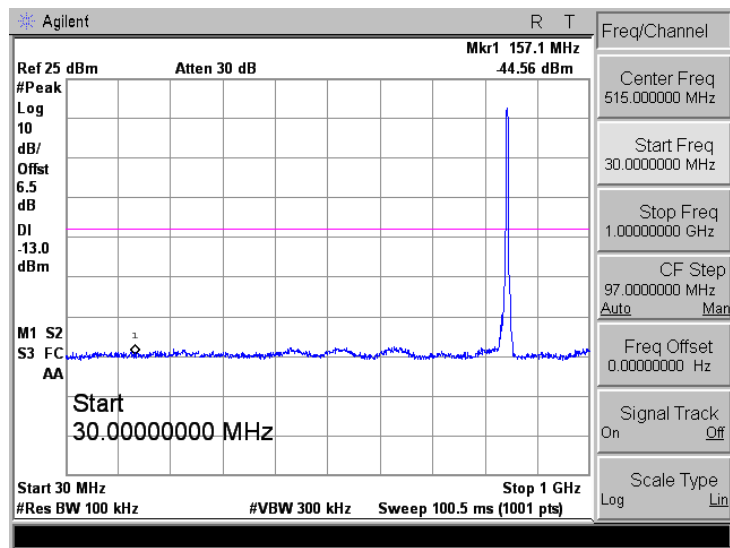
WCDMA Band V

Middle Channel



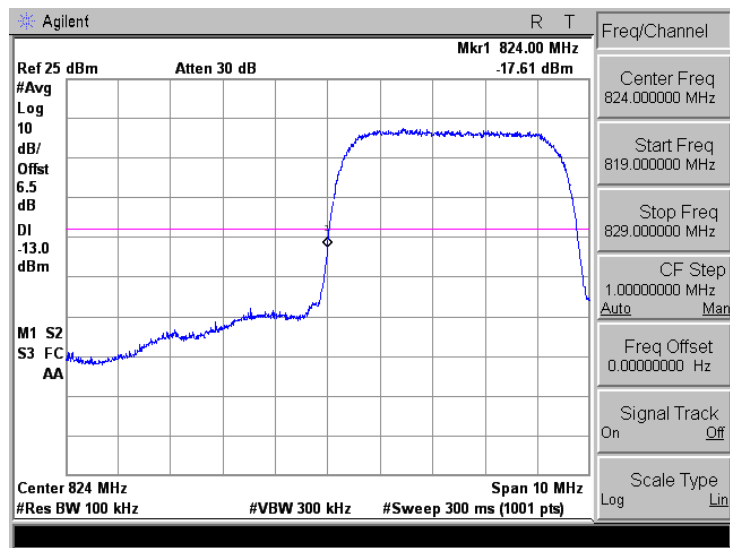
WCDMA Band V

High Channel

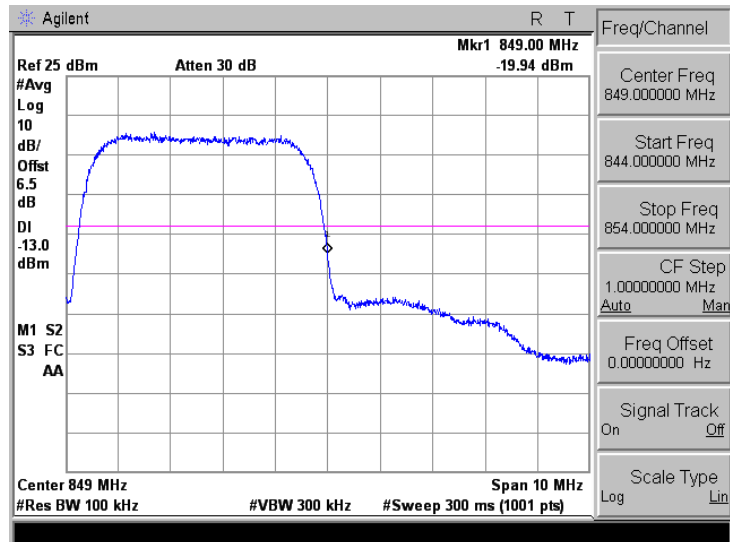


WCDMA Band V

Low Band Emission

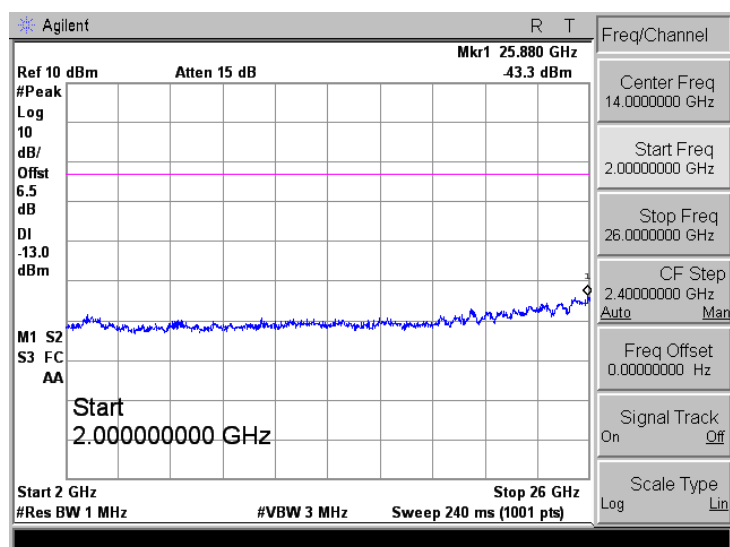
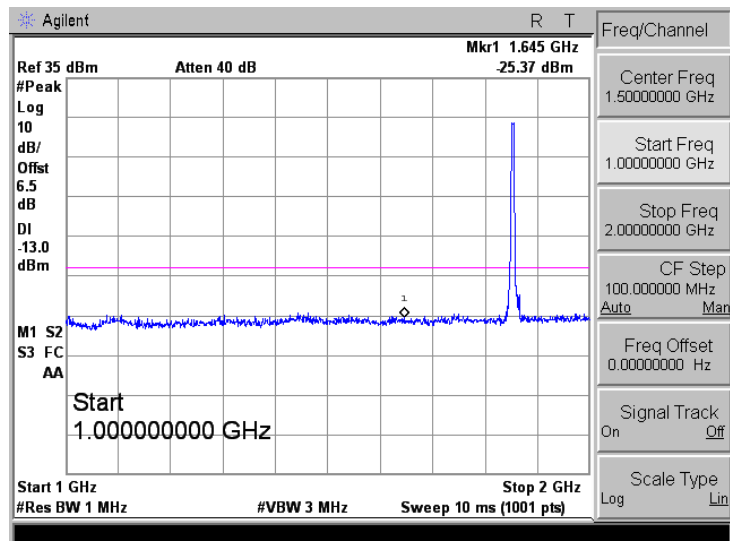
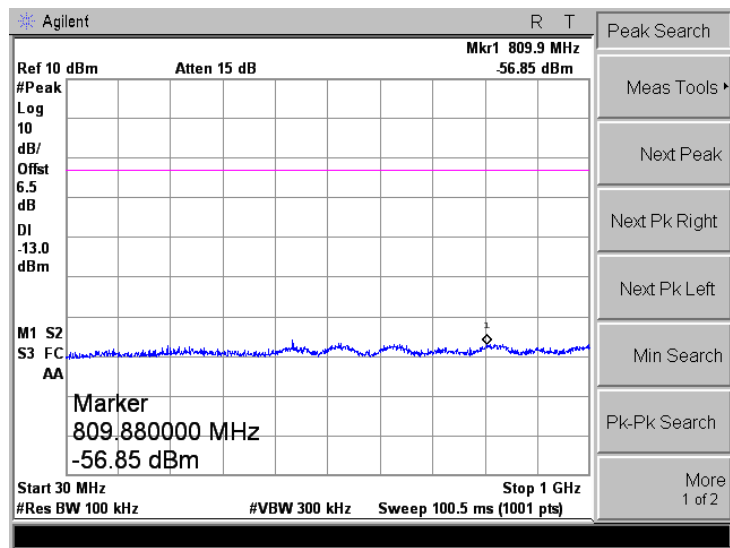


High Band Emission



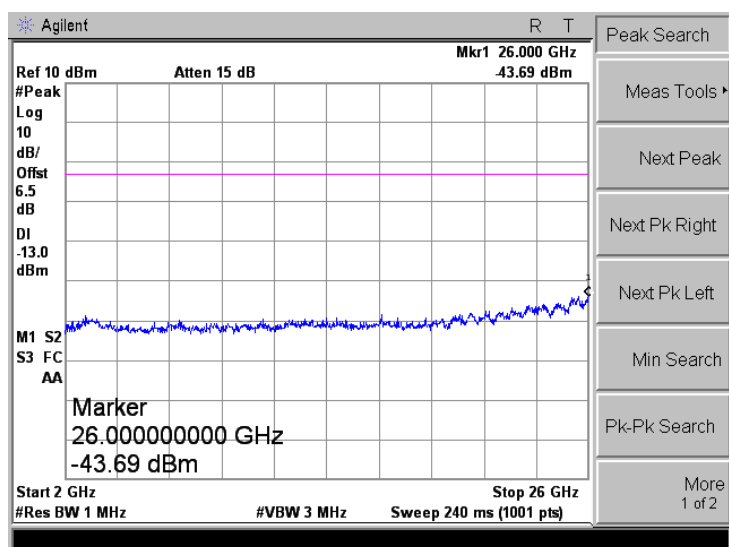
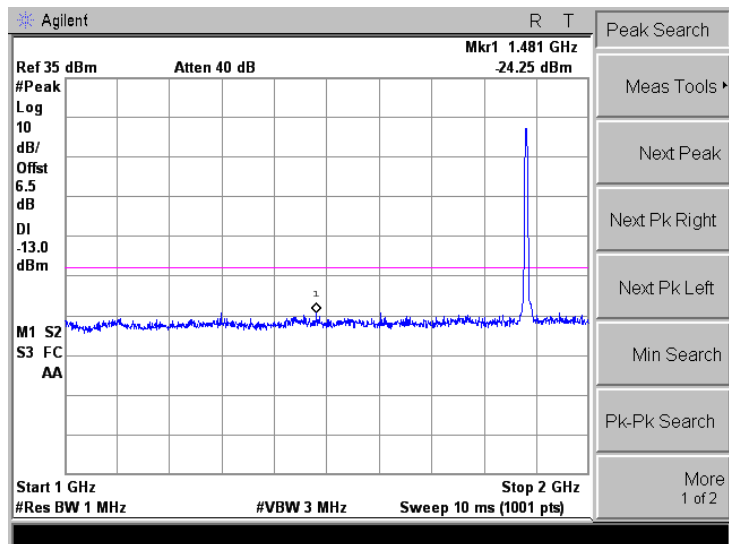
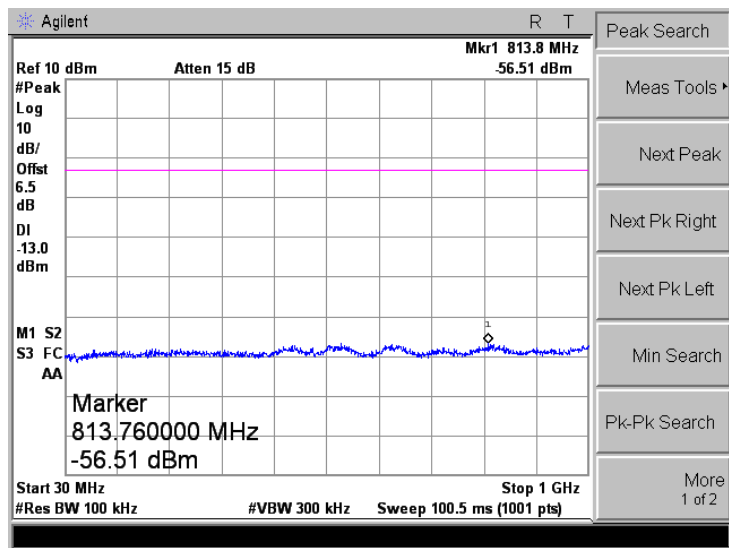
WCDMA Band II

Low Channel



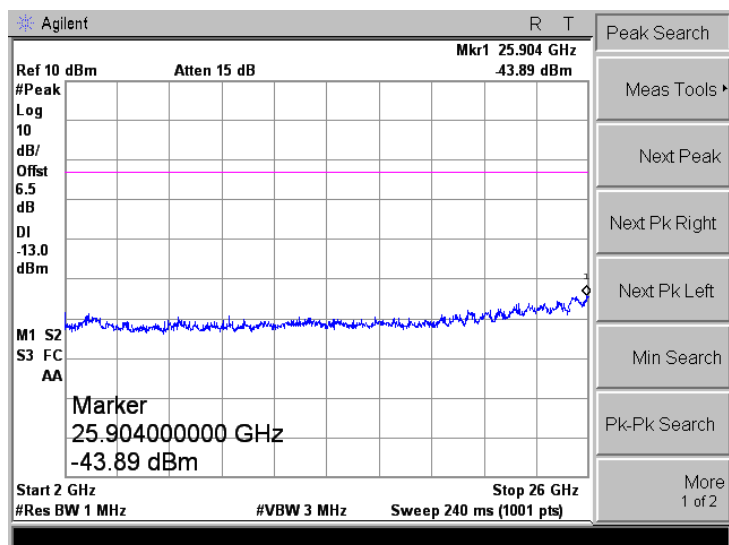
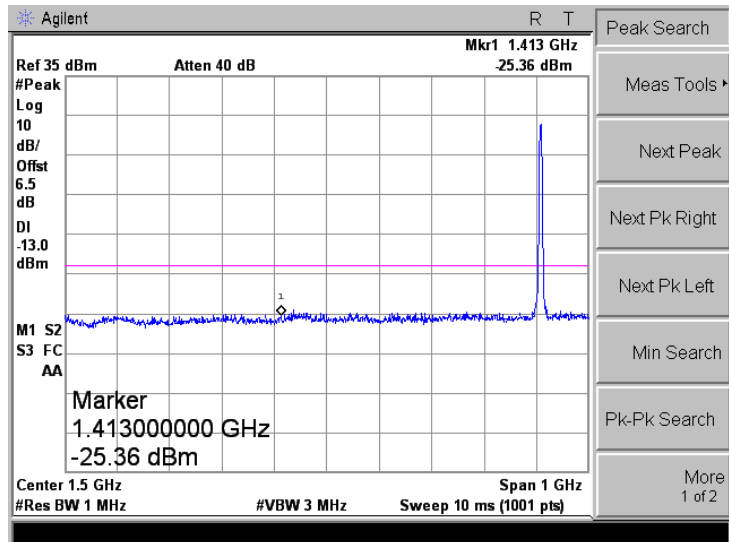
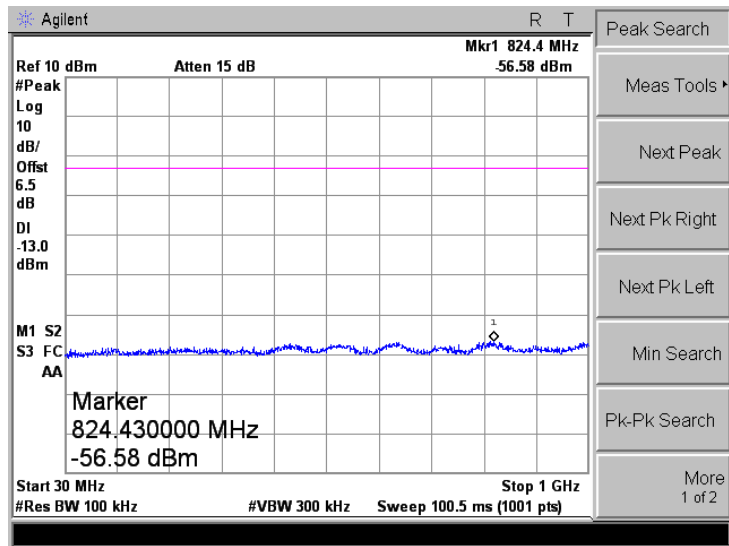
WCDMA Band II

Middle Channel



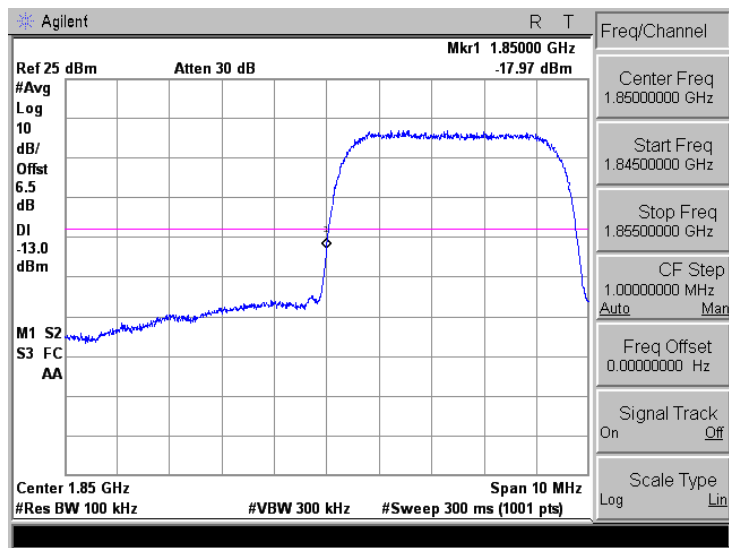
WCDMA Band II

High Channel

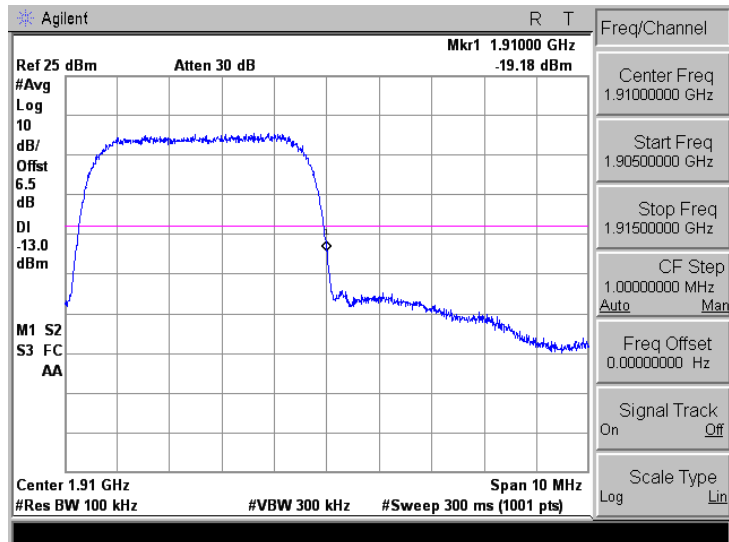


WCDMA Band II

Low Band Emission



High Band 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.

8.2 Test Procedure

1. The setup of EUT is according with per ANSI/TIA Standard 603E and ANSI C63.26 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.

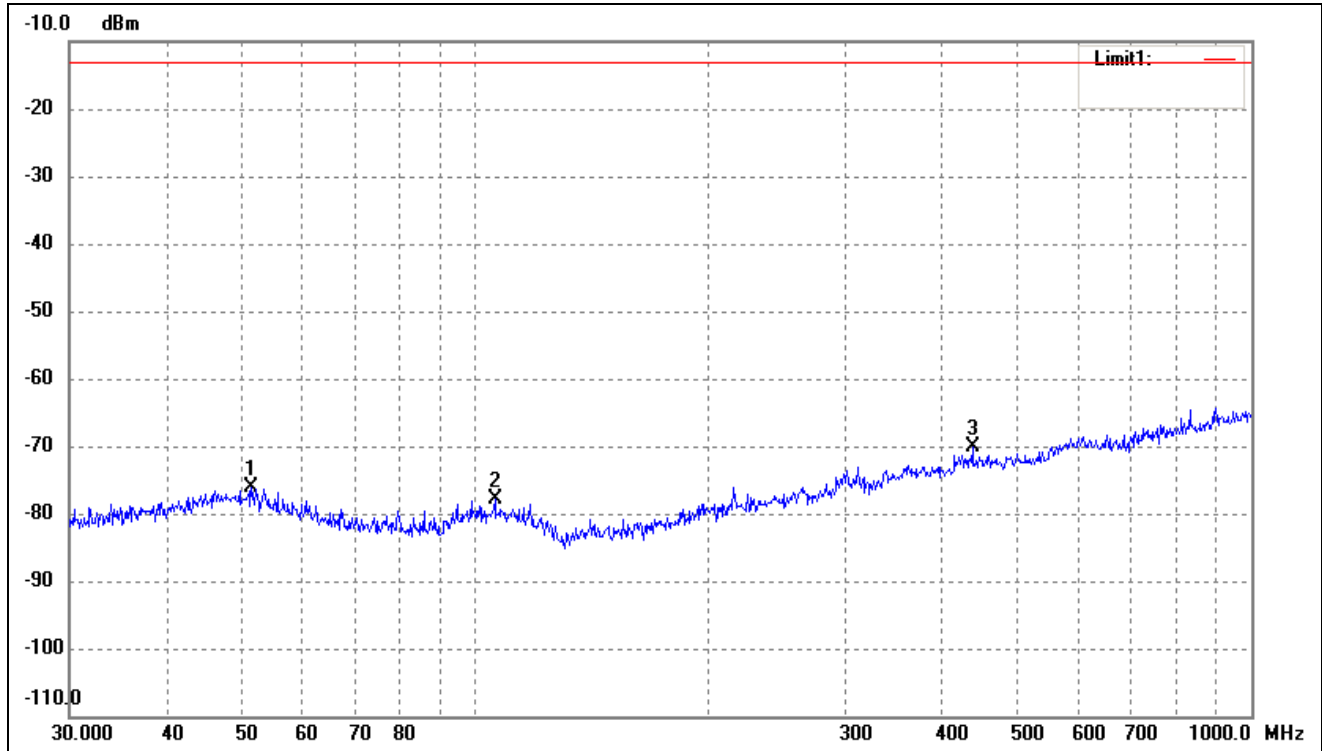
Spurious attenuation limit in dB = $43 + 10 \log_{10}(\text{power out in Watts})$

8.3 Summary of Test Results/Plots

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

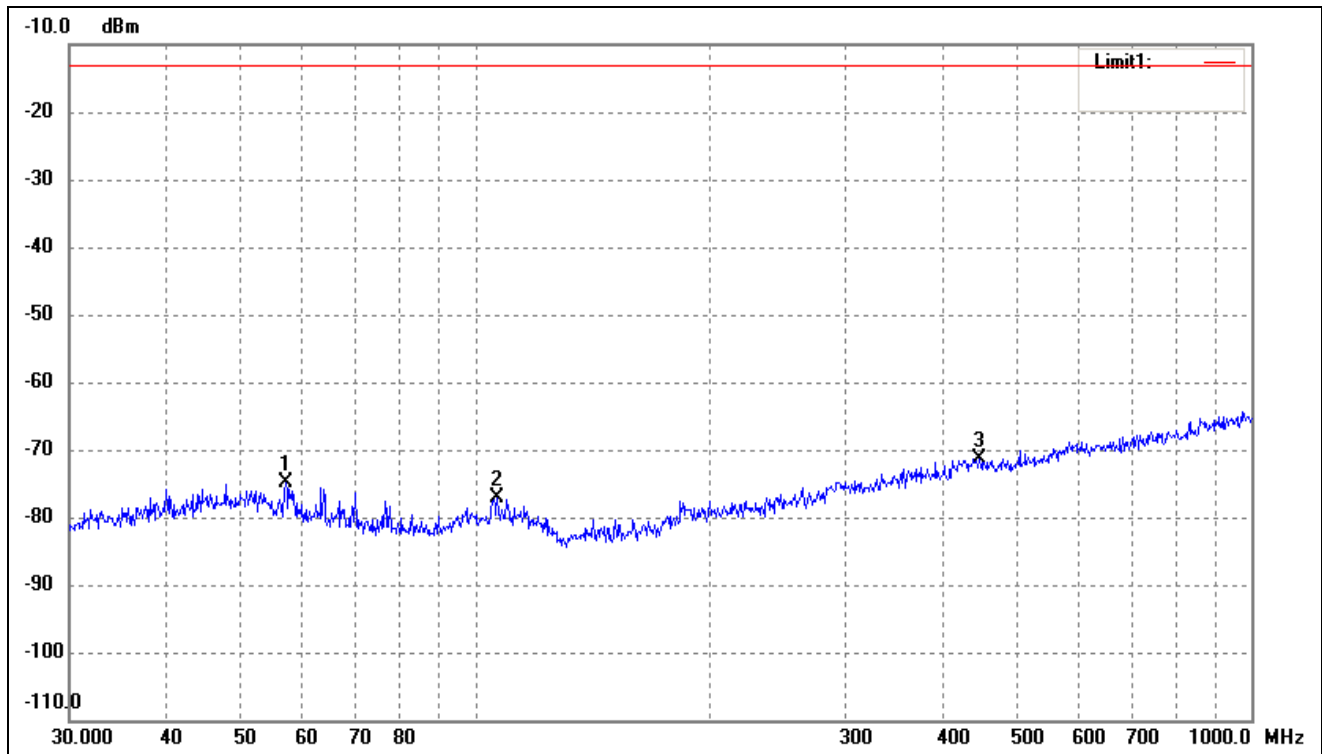
➤ Spurious Emissions Below 1GHz

For Cellular Band			
Test Channel	GSM850	Polarity:	Horizontal



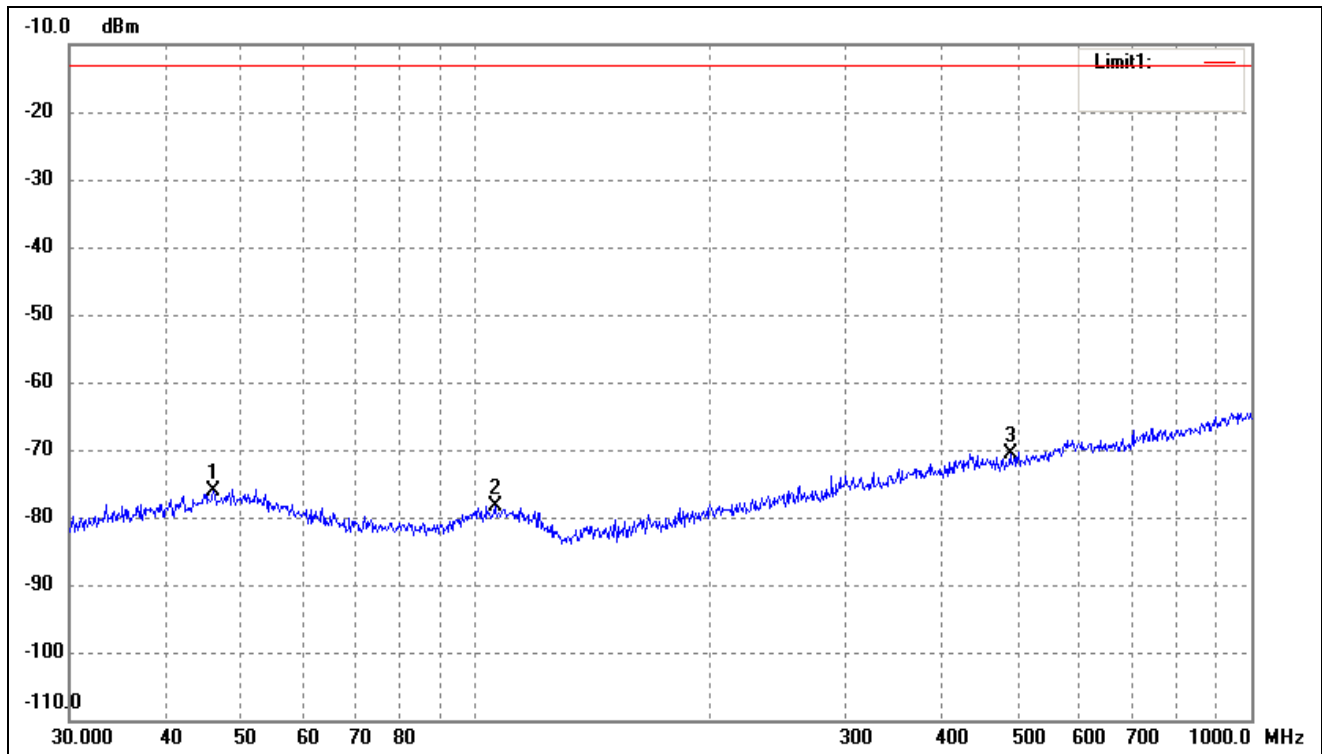
No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Degree ()	Height (cm)	Remark
1	51.4807	-76.67	0.47	-76.20	-13.00	-63.20	166	100	peak
2	106.0126	-76.47	-1.28	-77.75	-13.00	-64.75	193	100	peak
3	437.1199	-75.70	5.61	-70.09	-13.00	-57.09	75	100	peak

For Cellular Band			
Test Channel	GSM850	Polarity:	Vertical



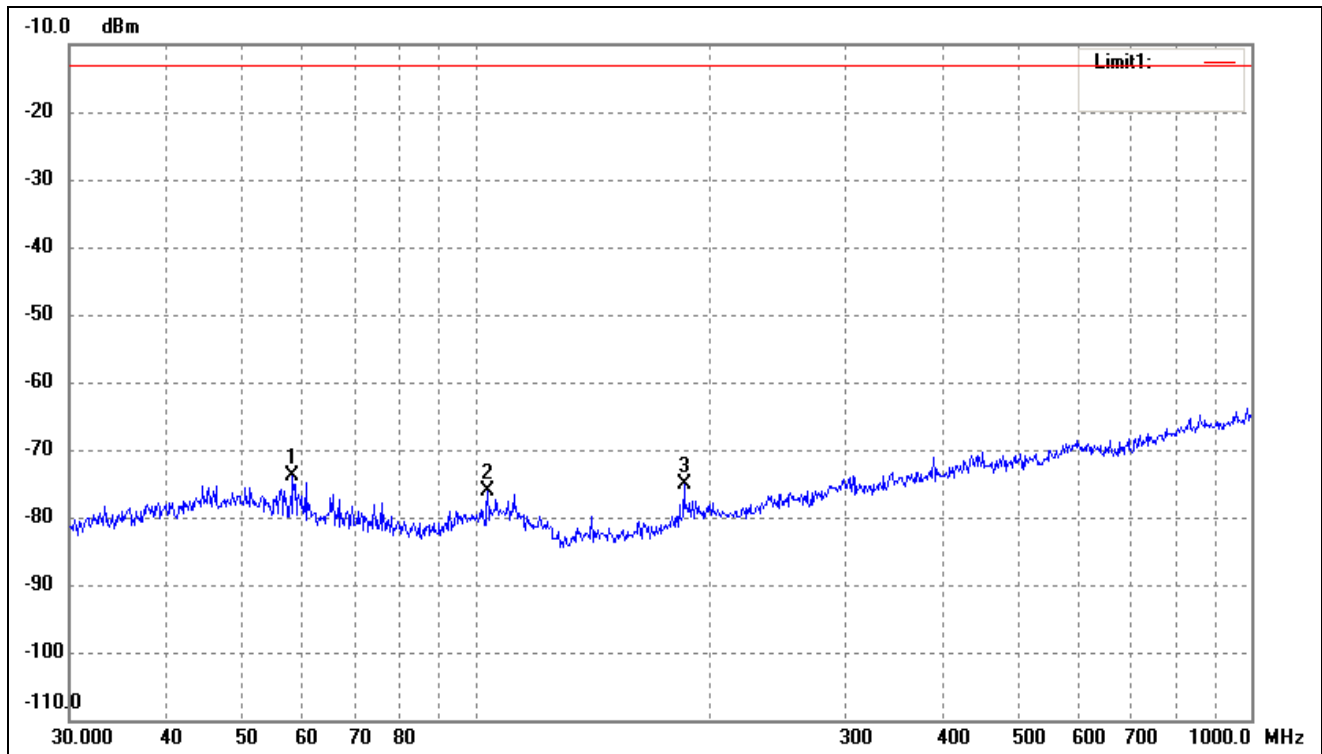
No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Degree ()	Height (cm)	Remark
1	56.9912	-74.04	-0.82	-74.86	-13.00	-61.86	100	100	peak
2	106.7587	-75.81	-1.27	-77.08	-13.00	-64.08	167	100	peak
3	446.4141	-76.91	5.49	-71.42	-13.00	-58.42	50	100	peak

For Cellular Band			
Test Channel	GSM1900	Polarity:	Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Degree ()	Height (cm)	Remark
1	46.0164	-76.72	0.53	-76.19	-13.00	-63.19	68	100	peak
2	106.0126	-76.98	-1.28	-78.26	-13.00	-65.26	236	100	peak
3	489.0269	-75.99	5.47	-70.52	-13.00	-57.52	63	100	peak

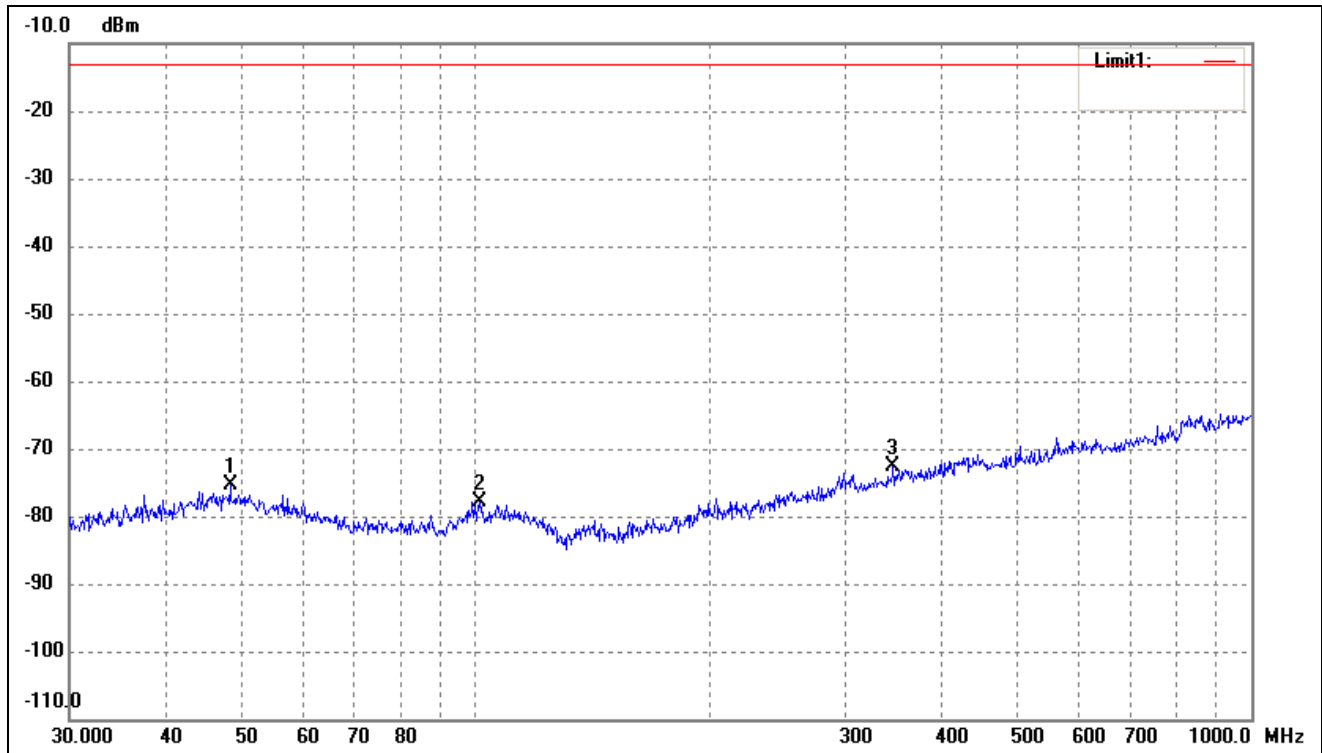
For Cellular Band			
Test Channel	GSM1900	Polarity:	Vertical



No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Degree ()	Height (cm)	Remark
1	58.2030	-72.88	-1.10	-73.98	-13.00	-60.98	223	100	peak
2	103.8055	-74.90	-1.32	-76.22	-13.00	-63.22	95	100	peak
3	185.7882	-73.12	-2.10	-75.22	-13.00	-62.22	97	100	peak

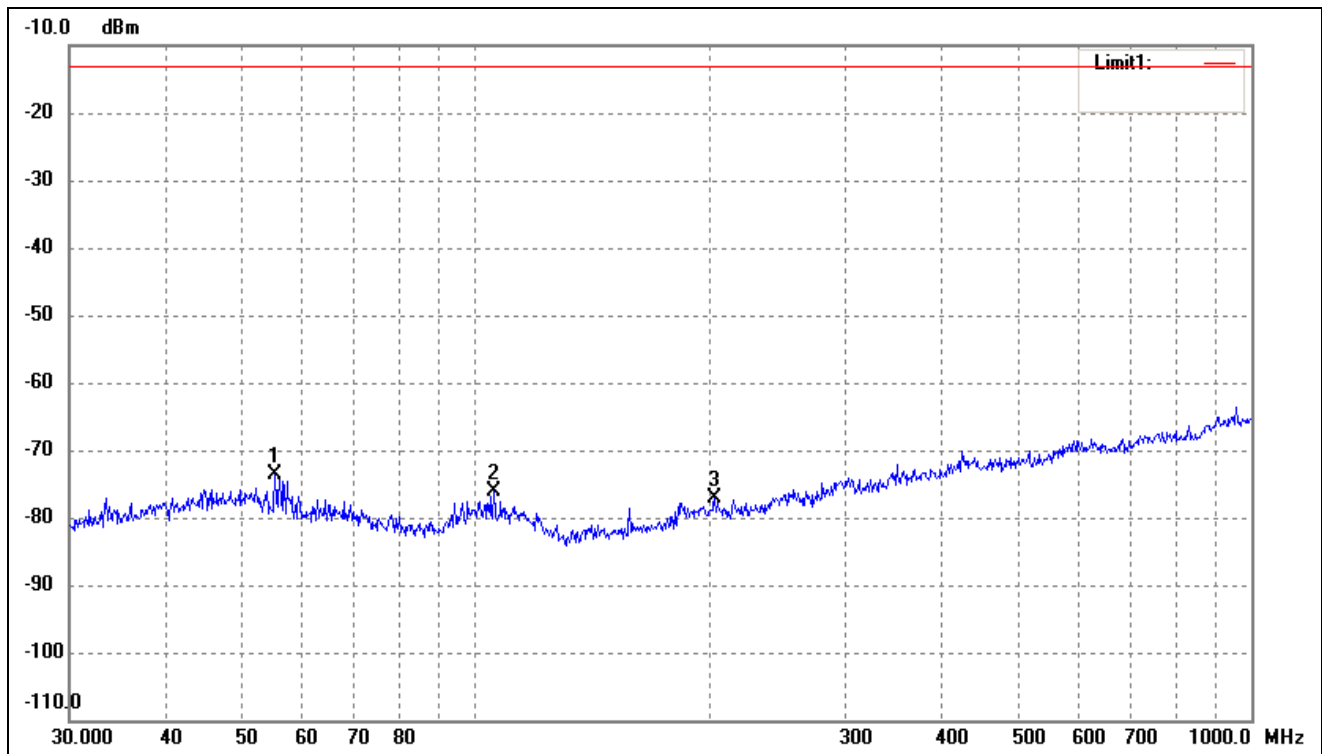
Note: Margin= (Reading+ Correct)- Limit

Test Channel	band 5	Polarity:	Horizontal
--------------	--------	-----------	------------



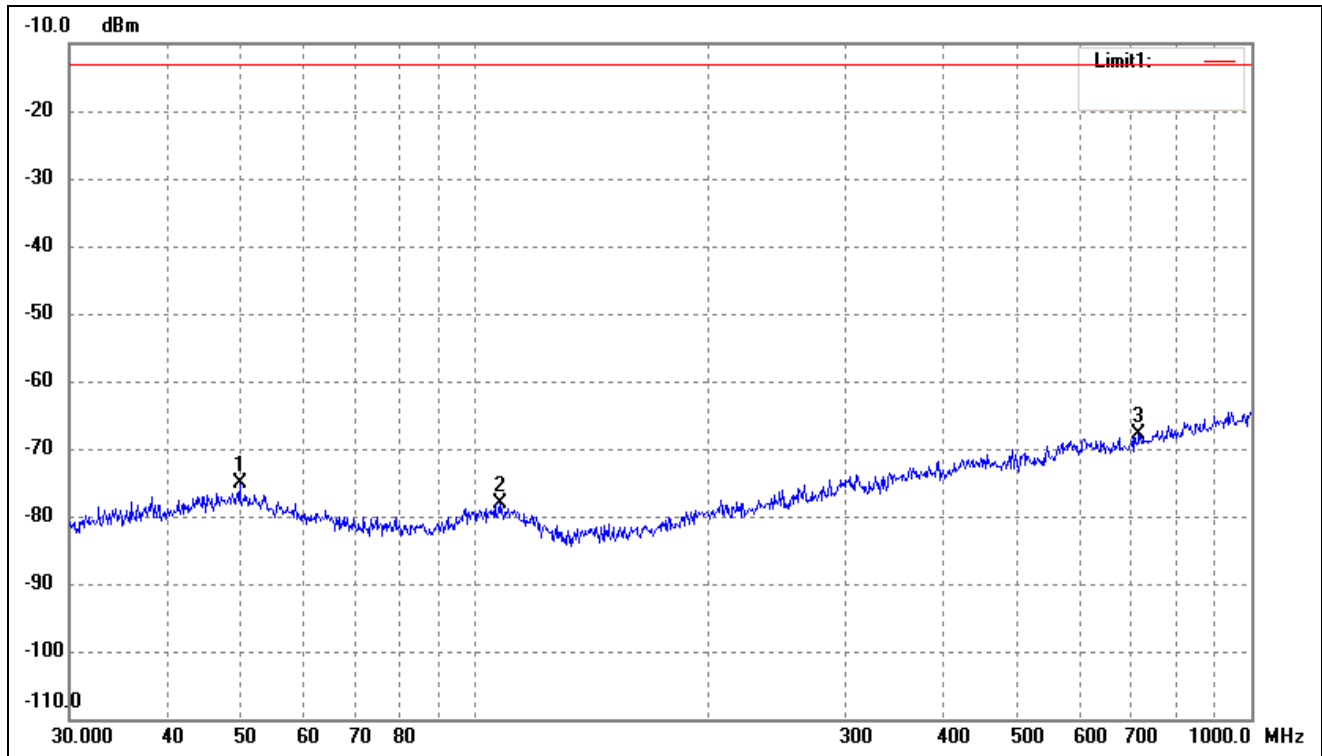
No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Degree ()	Height (cm)	Remark
1	48.3318	-76.08	0.69	-75.39	-13.00	-62.39	92	100	peak
2	101.2885	-76.52	-1.37	-77.89	-13.00	-64.89	347	100	peak
3	345.5952	-76.15	3.50	-72.65	-13.00	-59.65	77	100	peak

Test Channel	band 5	Polarity:	Vertical
--------------	--------	-----------	----------



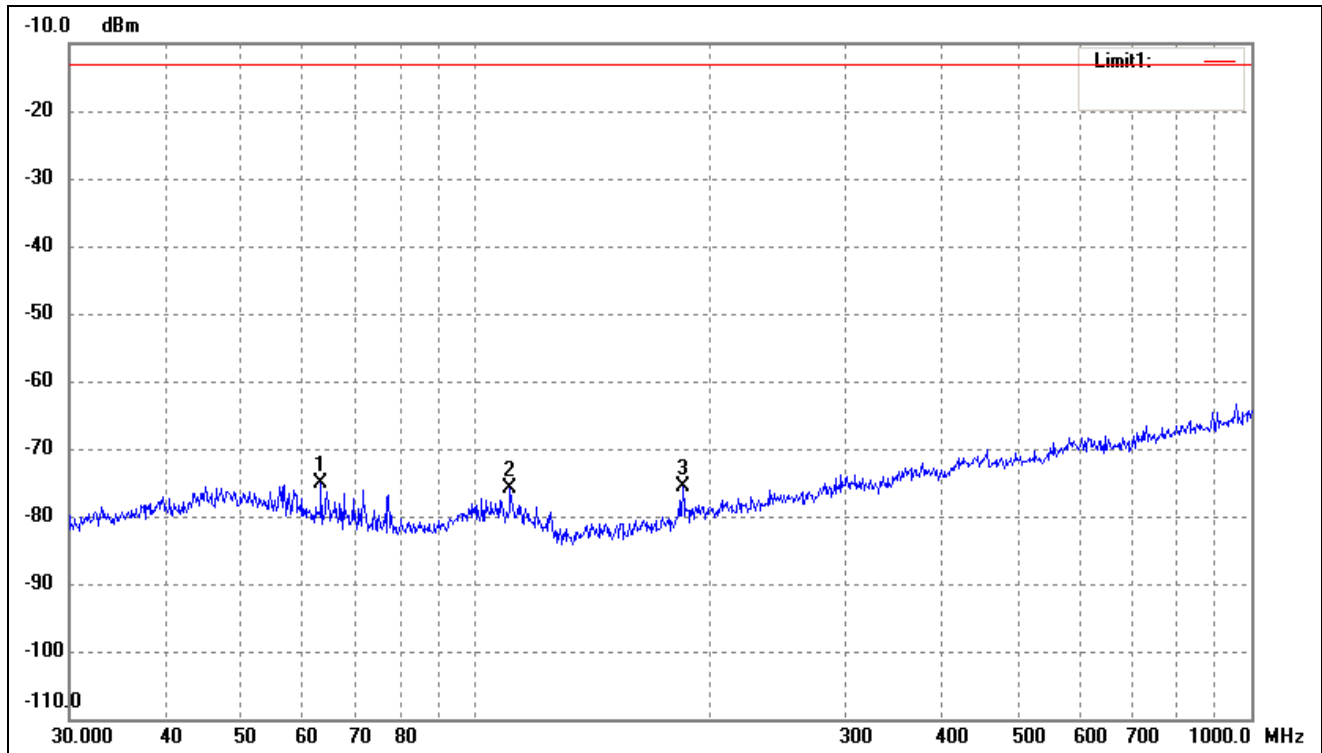
No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Degree ()	Height (cm)	Remark
1	55.2207	-73.29	-0.40	-73.69	-13.00	-60.69	315	100	peak
2	105.6415	-74.81	-1.28	-76.09	-13.00	-63.09	195	100	peak
3	203.5228	-76.32	-0.84	-77.16	-13.00	-64.16	59	100	peak

Test Channel	band 2	Polarity:	Horizontal
--------------	--------	-----------	------------



No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Degree ()	Height (cm)	Remark
1	49.7068	-75.97	0.79	-75.18	-13.00	-62.18	246	100	peak
2	107.5101	-76.81	-1.25	-78.06	-13.00	-65.06	91	100	peak
3	716.6820	-76.40	8.51	-67.89	-13.00	-54.89	334	100	peak

Test Channel	band 2	Polarity:	Vertical
--------------	--------	-----------	----------



No.	Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Degree ()	Height (cm)	Remark
1	63.3132	-73.11	-2.02	-75.13	-13.00	-62.13	210	100	peak
2	110.9571	-74.57	-1.32	-75.89	-13.00	-62.89	98	100	peak
3	185.1379	-73.39	-2.17	-75.56	-13.00	-62.56	137	100	peak

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	-34.18	4.94	-29.24	-13	-16.24	H
2472.6	-43.1	8.46	-34.64	-13	-21.64	H
1648.4	-35.7	4.94	-30.76	-13	-17.76	V
2472.6	-41.39	8.46	-32.93	-13	-19.93	V
Middle Channel (836.6MHz)						
1673.2	-37.25	5.11	-32.14	-13	-19.14	H
2509.8	-43.74	8.54	-35.2	-13	-22.2	H
1673.2	-35.22	5.11	-30.11	-13	-17.11	V
2509.8	-42.24	8.54	-33.7	-13	-20.7	V
High Channel (848.8MHz)						
1697.6	-37.24	5.25	-31.99	-13	-18.99	H
2546.4	-44.88	8.57	-36.31	-13	-23.31	H
1697.6	-37.79	5.25	-32.54	-13	-19.54	V
2546.4	-44.94	8.57	-36.37	-13	-23.37	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	-42.6	10.54	-32.06	-13	-19.06	H
5550.6	-46.04	13.37	-32.67	-13	-19.67	H
3700.4	-39.09	10.54	-28.55	-13	-15.55	V
5550.6	-48.53	13.37	-35.16	-13	-22.16	V
Middle Channel (1880MHz)						
3760.0	-42.38	10.64	-31.74	-13	-18.74	H
5640.0	-48.65	13.54	-35.11	-13	-22.11	H
3760.0	-40	10.64	-29.36	-13	-16.36	V
5640.0	-47.34	13.54	-33.8	-13	-20.8	V
High Channel (1909.8MHz)						
3819.6	-39.33	10.74	-28.59	-13	-15.59	H
5729.4	-46.01	13.71	-32.3	-13	-19.3	H
3819.6	-39.93	10.74	-29.19	-13	-16.19	V
5729.4	-49.79	13.71	-36.08	-13	-23.08	V

➤ For WCDMA Band V Mode

Frequency	Reading	Correct	Result	Limit	Margin	Polar
(MHz)	(dBm)	dB	(dBm)	(dBm)	(dB)	H/V
Low Channel (826.4MHz)						
1652.8	-35.36	4.94	-30.42	-13	-17.42	H
2479.2	-43.02	8.46	-34.56	-13	-21.56	H
1652.8	-35.27	4.94	-30.33	-13	-17.33	V
2479.2	-42.19	8.46	-33.73	-13	-20.73	V
Middle Channel (836.6MHz)						
1672.8	-35.41	5.11	-30.3	-13	-17.3	H
2509.2	-44.31	8.54	-35.77	-13	-22.77	H
1672.8	-36.36	5.11	-31.25	-13	-18.25	V
2509.2	-44.54	8.54	-36	-13	-23	V
High Channel (846.6MHz)						
1693.2	-35.18	5.25	-29.93	-13	-16.93	H
2539.8	-44.08	8.57	-35.51	-13	-22.51	H
1693.2	-36.63	5.25	-31.38	-13	-18.38	V
2539.8	-43.71	8.57	-35.14	-13	-22.14	V

➤ For WCDMA Band II Mode

Frequency	Reading	Correct	Result	Limit	Margin	Polar
(MHz)	(dBm)	dB	(dBm)	(dBm)	(dB)	H/V
Low Channel (1852.4MHz)						
3704.8	-41.04	10.54	-30.5	-13	-17.5	H
5557.2	-47.33	13.37	-33.96	-13	-20.96	H
3704.8	-40.38	10.54	-29.84	-13	-16.84	V
5557.2	-46.22	13.37	-32.85	-13	-19.85	V
Middle Channel (1880MHz)						
3760.8	-41.83	10.64	-31.19	-13	-18.19	H
5640.0	-47.72	13.54	-34.18	-13	-21.18	H
3760.8	-39.13	10.64	-28.49	-13	-15.49	V
5640.0	-48.45	13.54	-34.91	-13	-21.91	V
High Channel (1907.6MHz)						
3815.2	-39.45	10.74	-28.71	-13	-15.71	H
5722.8	-46.68	13.71	-32.97	-13	-19.97	H
3815.2	-39.44	10.74	-28.7	-13	-15.7	V
5722.8	-46.72	13.71	-33.01	-13	-20.01	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, §24.235 the limit is 2.5ppm.

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

9.3 Summary of Test Results/Plots

Note: 1. Worst case at GSM850/PCS1900/WCDMA B2/B5 middle channel

2. Normal Voltage NV=DC3.7V; Low Voltage LV=DC3.5V; High Voltage HV=DC4.2V

➤ Frequency stability V.S. Temperature measurement

Reference Frequency: GSM850 Middle channel=190 channel=836.6MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
NV	-30	66	0.0791	2.50	Pass
	-20	55	0.0653		
	-10	48	0.0579		
	0	42	0.0497		
	10	37	0.0441		
	20	31	0.0368		
	30	35	0.0414		
	40	40	0.0478		
	50	45	0.0542		
Reference Frequency: PCS1900 Middle channel=661 channel=1880MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
NV	-30	67	0.0356	2.50	Pass
	-20	57	0.0303		
	-10	49	0.0262		
	0	43	0.0229		
	10	37	0.0196		
	20	32	0.0168		
	30	35	0.0188		
	40	42	0.0225		
	50	46	0.0245		

Reference Frequency: WCDMA Band V Middle channel=4183 channel=836.6MHz					
Power supplied (Vdc)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
NV	-30	38	0.0460	2.50	Pass
	-20	34	0.0405		
	-10	30	0.0359		
	0	26	0.0313		
	10	22	0.0267		
	20	16	0.0193		
	30	21	0.0248		
	40	26	0.0313		
	50	31	0.0368		
Reference Frequency: WCDMA Band II Middle channel=9400 channel=1880MHz					
Power supplied (Vdc)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
NV	-30	59	0.0315	2.50	Pass
	-20	55	0.0291		
	-10	51	0.0270		
	0	45	0.0237		
	10	38	0.0200		
	20	31	0.0164		
	30	35	0.0188		
	40	39	0.0209		
	50	45	0.0237		

➤ Frequency stability V.S. Voltage measurement

Reference Frequency: GSM850 (GSM link) Middle channel=190 channel=836.6MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	HV	54	0.0644	2.50	Pass
	NV	50	0.0598		
	LV	39	0.0469		
Reference Frequency: PCS1900 (GSM link) Middle channel=661 channel=1880MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error			Result
		Hz	ppm		
25	HV	63	0.0336	2.50	Pass
	NV	56	0.0299		
	LV	48	0.0254		
Reference Frequency: WCDMA Band V Middle channel=4183 channel=836.6MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error			
		Hz	ppm		
25	HV	28	0.0331	2.50	Pass
	NV	35	0.0414		
	LV	42	0.0506		
Reference Frequency: WCDMA Band II Middle channel=9400 channel=1880MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error			
		Hz	ppm		
25	HV	34	0.0180	2.50	Pass
	NV	39	0.0209		
	LV	47	0.0250		

10. Modulation characteristics

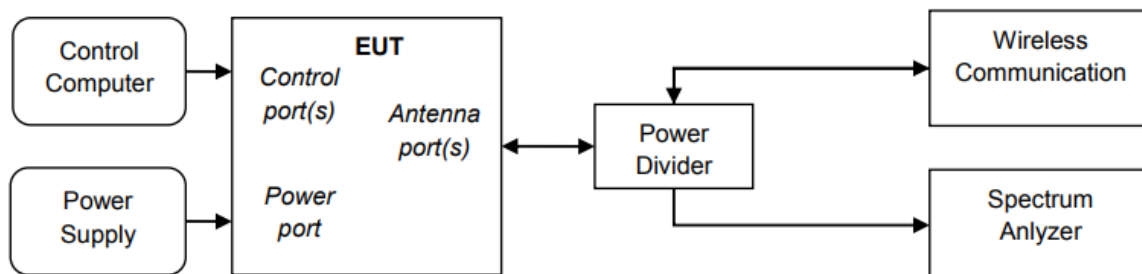
10.1 Standard Applicable

According to §2.1047, measurements required: Modulation characteristics is given below:

- (a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.
- (b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.
- (c) Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power. A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of §2.1049 for the occupied bandwidth tests.
- (d) Other types of equipment. A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

10.2 Test Procedure

According to ANSI C63.26-2015 section 5.3.2, the following test setup was performed.

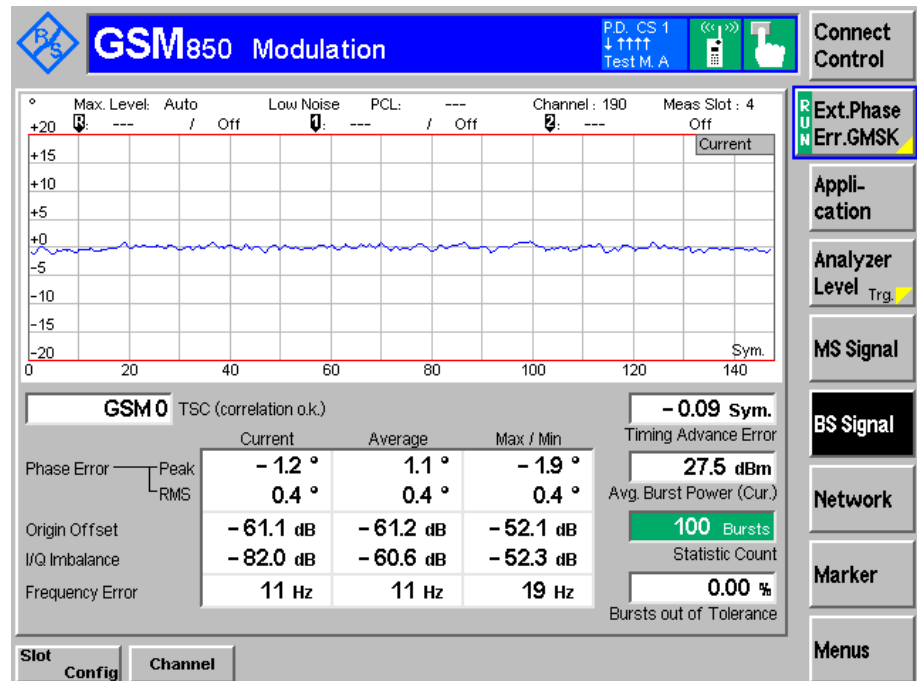


10.3 Summary of Test Results/Plots

Only the worst case was selected to record

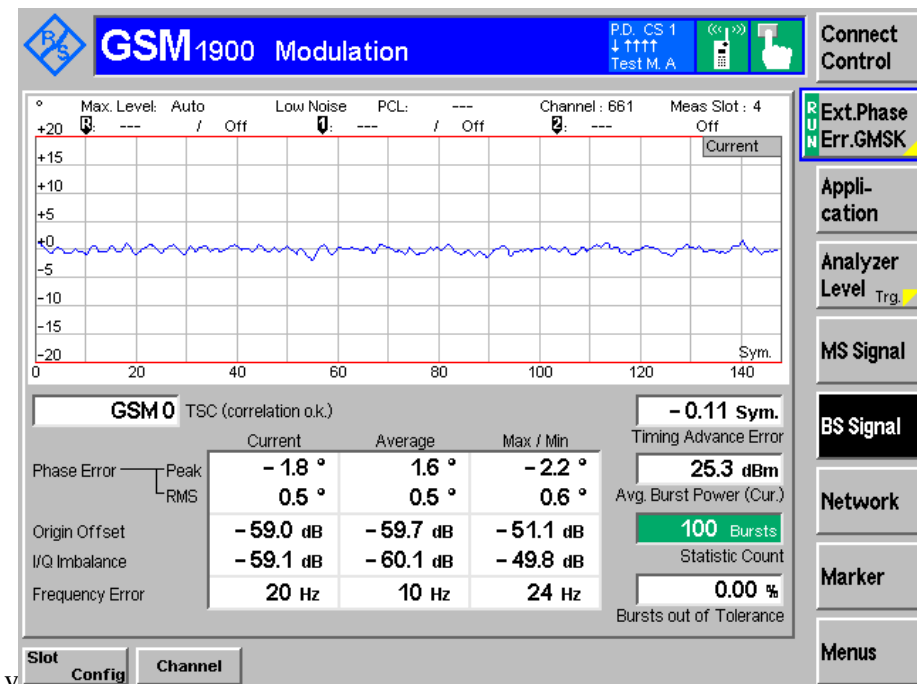
GSM850

Middle Channel-GMSK

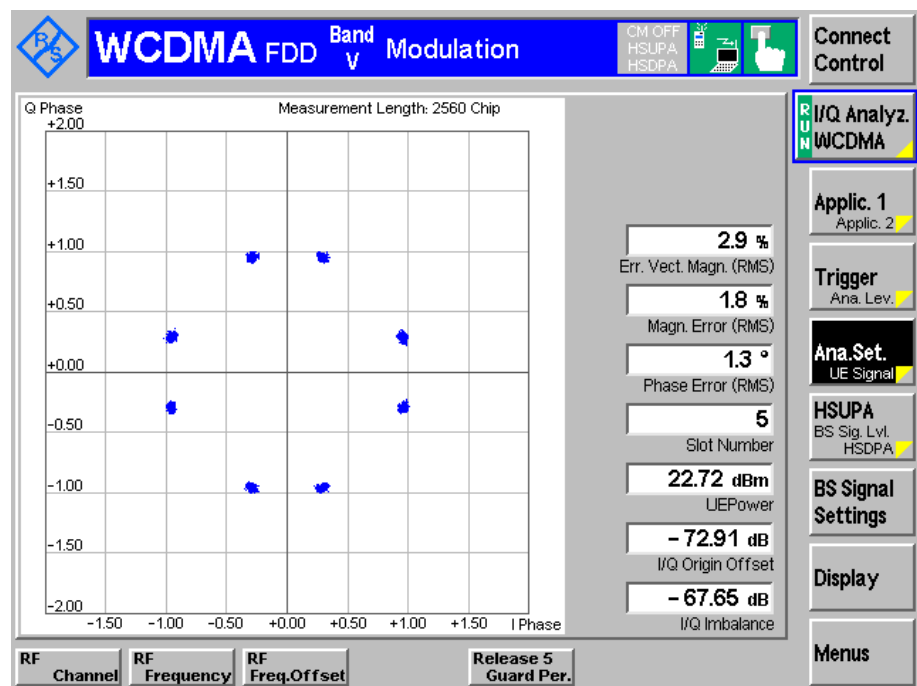


GSM1900

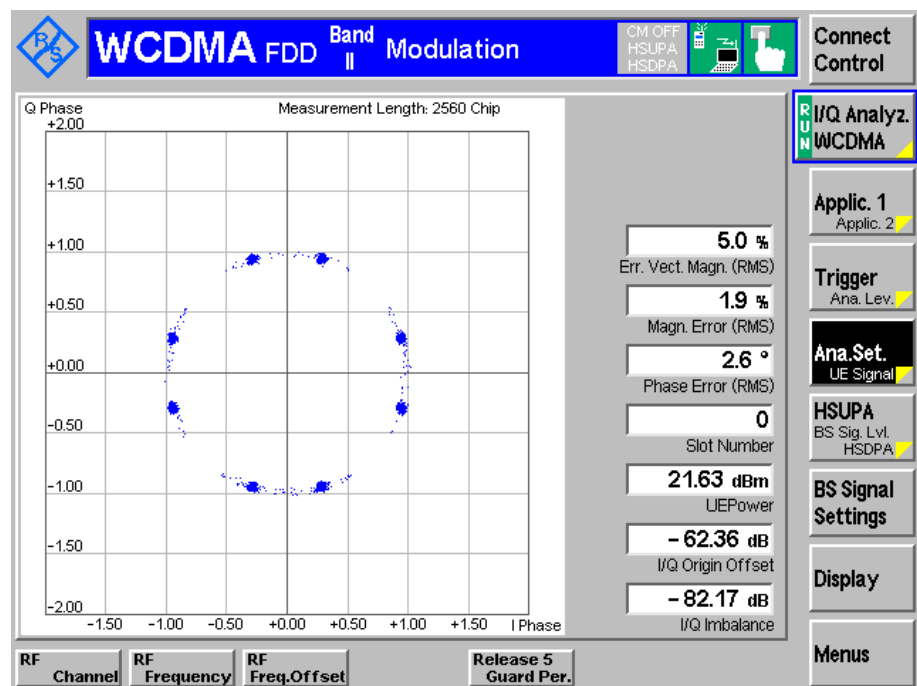
Middle Channel-GMSK



WCDMA B5



WCDMA B2



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