

FCC Part 22H & 24E Measurement and Test Report

For

Shenzhen Jimi IOT Co., Ltd

Floor 4th, Building C, Gaoxinqi Industrial Park, Liuxian 1st Road,

District 67, Bao'an, Shenzhen, China

FCC ID: 2AMLF-JM-VL01

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

Product Description: 4G Vehicle GPS Tracker

Tested Model: JM-VL01

Report No.: WTX19X09067049W-2

Sample Receipt Date: 2019-09-25

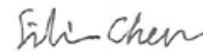
Tested Date: 2019-09-25 to 2019-11-04

Issued Date: 2019-11-04

Tested By: Jason Su / Engineer



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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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Report version

Version No.	Date of issue	Description
Rev.00	2019-11-04	Original
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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Shenzhen Jimi IOT Co., Ltd
Address of applicant: Floor 4th, Building C, Gaoxinqi Industrial Park, Liuxian 1st Road, District 67, Bao'an, Shenzhen, China

Manufacturer: Shenzhen Jimi IOT Co., Ltd
Address of manufacturer: Floor 4th, Building C, Gaoxinqi Industrial Park, Liuxian 1st Road, District 67, Bao'an, Shenzhen, China

General Description of EUT:	
Product Name:	4G Vehicle GPS Tracker
Brand Name:	Jimi
Model No.:	JM-VL01
Adding Model(s):	GV40,VL01
Rated Voltage:	DC3.7V battery/DC9-36V
Battery:	450mAh
Adapter Model:	/
Software Version:	/
Hardware Version:	/
<i>Note: The test data is gathered from a production sample provided by the manufacturer. The appearance of others models listed in the report is different from main-test model JM-VL01, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT:	
2G	
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: 31.98dBm, GSM1900: 29.43dBm EDGE850: 25.55dBm, EDGE1900: 25.82dBm
Type of Emission:	GSM850: 248KGXW, GSM1900: 249KGXW EDGE850: 248KG7W, EDGE1900: 253KG7W
Type of Modulation:	GMSK, 8PSK
Type of Antenna:	Integral Antenna
Antenna Gain:	GSM850: -2.3dBi; GSM1900: -2.0dBi
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 5: 22.61dBm, WCDMA Band 2: 23.08dBm
Type of Emission:	WCDMA Band 5: 4M17F9W WCDMA Band 2: 4M18F9W
Type of Modulation:	BPSK
Antenna Type:	Integral Antenna
Antenna Gain:	WCDMA Band 2: -2.0dBi, WCDMA Band 5: -2.3dBi

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	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(MHz)	Channel Number
GSM 850	GSM/GPRS/EDGE	824.2	128
		836.6	190
		848.8	251
PCS 1900	GSM/GPRS/EDGE	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, EDGE, 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

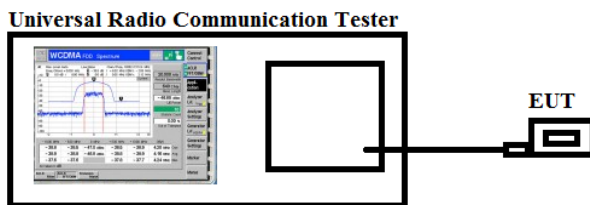
4.1 Standard Applicable

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	29.05	<38.45	Pass
		H	17.11		
	190	V	29.41		
		H	17.52		
	251	V	28.98		
		H	17.03		
GPRS850	128	V	28.52	<38.45	Pass
		H	16.36		
	190	V	28.78		
		H	16.64		
	251	V	28.97		
		H	16.20		
EGPRS850	128	V	23.05	<38.45	Pass
		H	14.11		
	190	V	23.52		
		H	13.09		
	251	V	23.64		
		H	13.44		

Mode	Channel	Antenna Polar	EIRP (dBm)	Limit (dBm)	Result
PCS1900	512	V	27.36	<33.00	Pass
		H	14.41		
	661	V	27.64		
		H	14.65		
	810	V	27.97		
		H	14.05		
GPRS1900	512	V	27.01	<33.00	Pass
		H	14.39		
	661	V	27.86		
		H	14.42		
	810	V	27.31		
		H	14.09		
EGPRS1900	512	V	23.01	<33.00	Pass
		H	13.11		
	661	V	23.52		
		H	13.59		
	810	V	23.3		
		H	13.41		

Mode	Channel	Antenna Polar	ERP	Limit (dBm)	Result
WCDMA Band V	4132	V	20.52	<38.45	Pass
		H	13.58		
	4183	V	20.42		
		H	13.97		
	4233	V	20.54		
		H	13.05		

Mode	Channel	Antenna Polar	EIRP	Limit (dBm)	Result
WCDMA Band II	9262	V	20.97	<33.00	Pass
		H	13.81		
	9400	V	20.31		
		H	13.07		
	9538	V	20.36		
		H	13.65		

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	31.92	31.83	31.83	29.16	29.09	29.02
GPRS(1Slot)	31.17	31.09	31.98	29.25	29.43	29.12
EGPRS(1Slot)	25.5	25.55	25.38	25.23	25.82	24.94

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	22.05	22.61	22.03	23.08	23.01	22.94
HSDPA Subtest-1	21.68	22.14	21.29	22.00	21.80	21.76
HSDPA Subtest-2	21.63	22.13	21.27	21.98	21.78	21.75
HSDPA Subtest-3	21.65	22.12	21.26	21.96	21.76	21.75
HSDPA Subtest-4	21.65	22.11	21.26	21.97	21.78	21.76
HSUPA Subtest-1	21.59	22.09	21.33	22.05	21.93	21.87
HSUPA Subtest-2	21.56	22.05	21.31	22.02	21.9	21.85
HSUPA Subtest-3	21.57	22.05	21.32	22.02	21.91	21.86
HSUPA Subtest-4	21.56	22.06	21.32	22.03	21.92	21.85
HSUPA Subtest-5	21.56	22.07	21.32	22.03	21.91	21.86

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

5.1 Standard Applicable

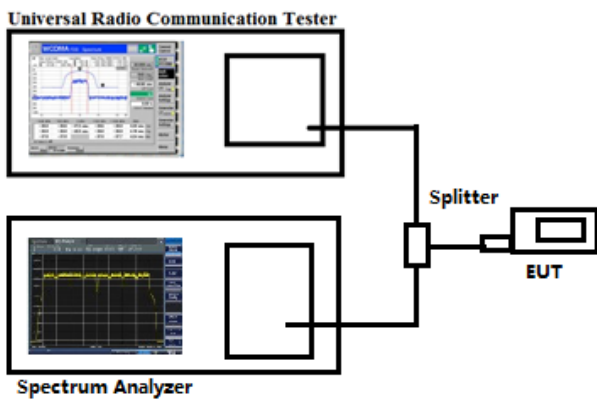
According to §24.232(d), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in 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	6.24	13
GPRS(1 Slot)	661	1850.2	6.54	13
EDGE(1 Slot)	661	1850.2	6.15	13

WCDMA Band II				
Test Mode	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)
WCDMA	9262	1852.4	5.98	13
	9400	1880.0	5.41	13
	9538	1907.6	5.39	13

Note: Only the worst case was selected to record.

6. Emission Bandwidth

6.1 Standard Applicable

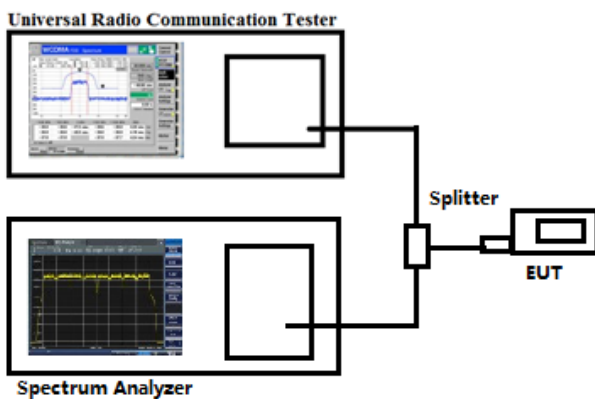
According to §22.917(b), the emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

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:



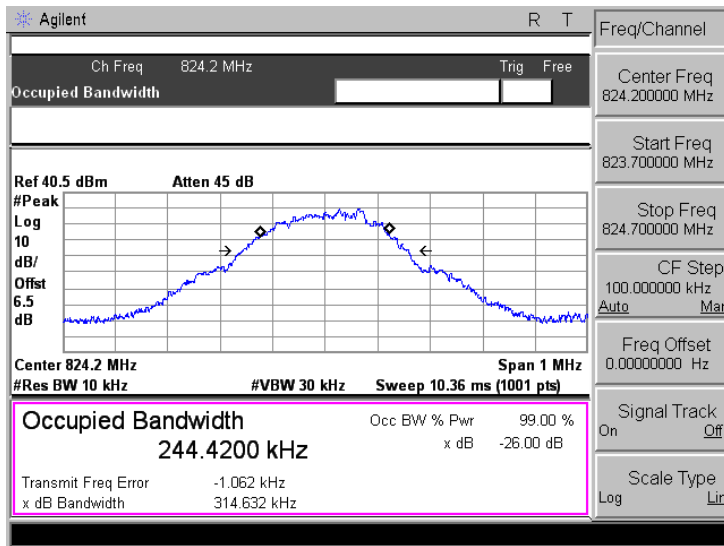
6.3 Summary of Test Results/Plots

EUT Mode	Channel	Frequency (MHz)	99% Occupy bandwidth (kHz)	-26dB bandwidth (kHz)
GSM 850 (GMSK)	128	824.20	244.4200	314.632
	190	836.60	243.7301	313.199
	251	848.80	242.7567	310.774
GPRS850 (GMSK,1Slot)	128	824.20	239.9320	314.020
	190	836.60	248.1240	320.312
	251	848.80	238.6707	312.368
EGPRS850 (8PSK,1Slot)	128	824.20	247.6102	319.648
	190	836.60	243.6447	318.160
	251	848.80	245.0471	314.402
PCS1900 (GMSK)	512	1850.20	246.7417	310.650
	661	1880.00	242.3694	312.107
	810	1909.80	249.3645	306.053
GPRS1900 (GMSK,1Slot)	512	1850.20	249.4822	297.639
	661	1880.00	244.2203	321.285
	810	1909.80	247.0007	317.220
EGPRS1900 (8PSK,1Slot)	512	1850.20	253.0949	307.423
	661	1880.00	242.8367	299.146
	810	1909.80	237.6850	313.091

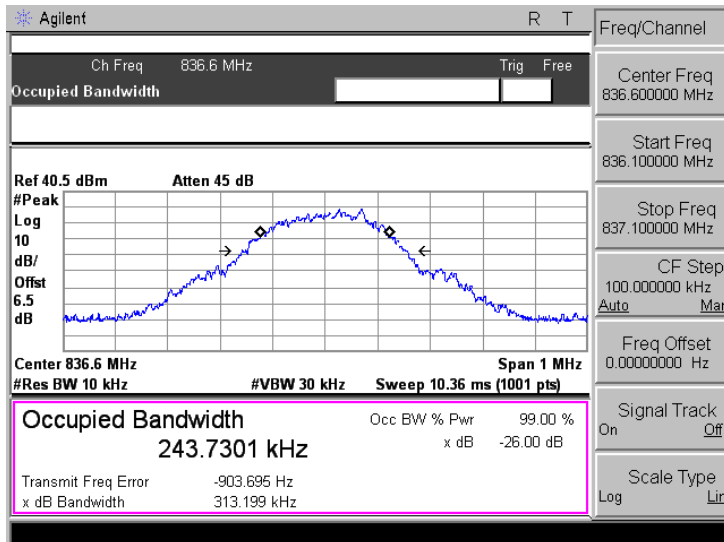
EUT Mode	Channel	Frequency (MHz)	99% Occupy bandwidth (kHz)	-26dB bandwidth (kHz)
WCDMA Band V	4132	826.40	4146.9	4667
	4183	836.60	4159.7	4691
	4233	846.60	4157.5	4698
HSDPA	4132	826.40	4165.4	4643
	4183	836.60	4156.9	4707
	4233	846.60	4148.4	4676
HSUPA	4132	826.40	4154.3	4682
	4183	836.60	4151.7	4680
	4233	846.60	4162.9	4685
WCDMA Band II	9262	1852.40	4182.3	4702
	9400	1880.00	4159.9	4688
	9538	1907.60	4154.2	4711
HSDPA	9262	1852.40	4166.6	4667
	9400	1880.00	4151.9	4701
	9538	1907.60	4161.2	4700
HSUPA	9262	1852.40	4162.8	4683
	9400	1880.00	4152.1	4679
	9538	1907.60	4147.0	4664

GSM850

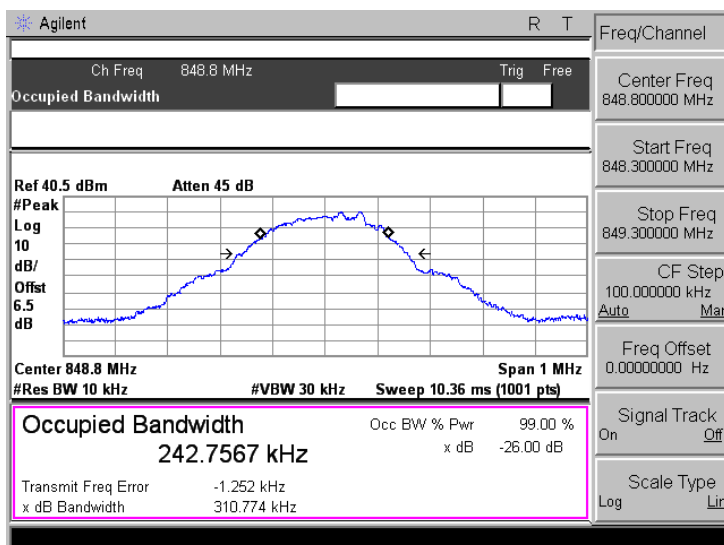
Low Channel



Middle Channel

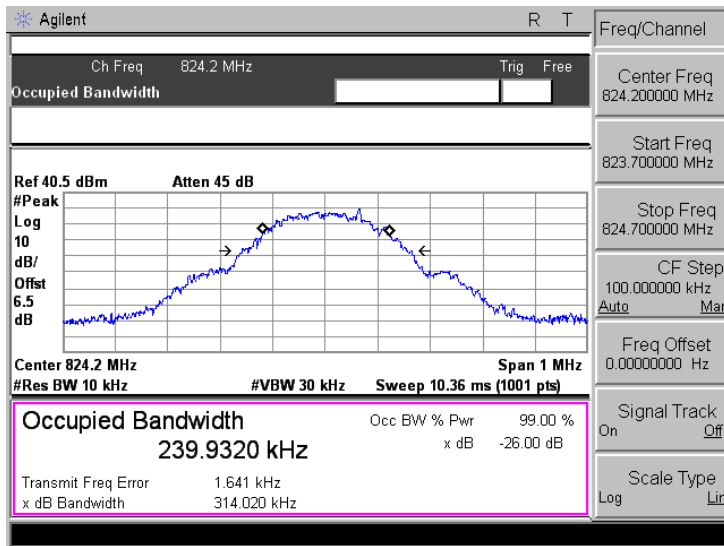


High Channel

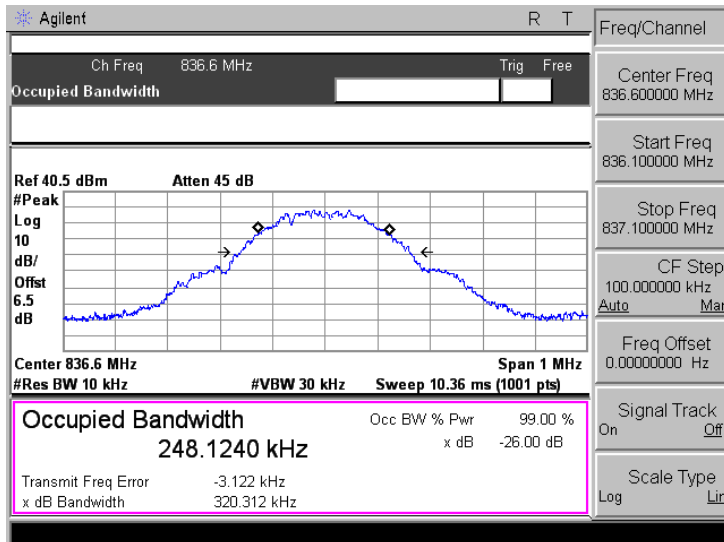


GPRS850

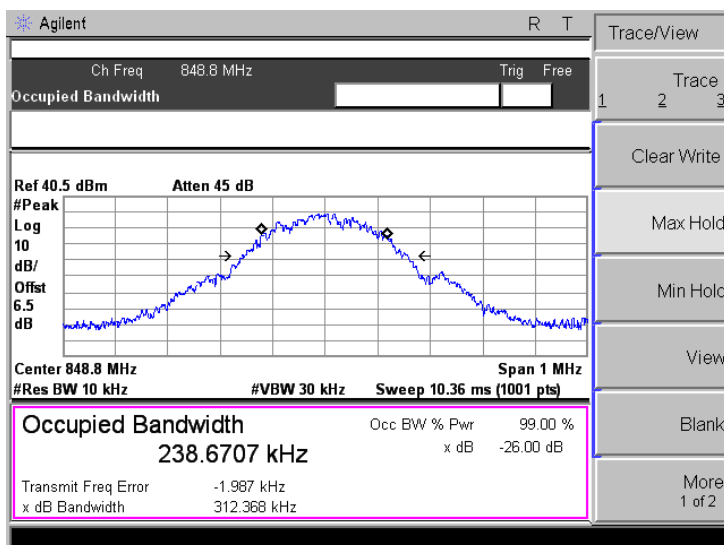
Low Channel



Middle Channel

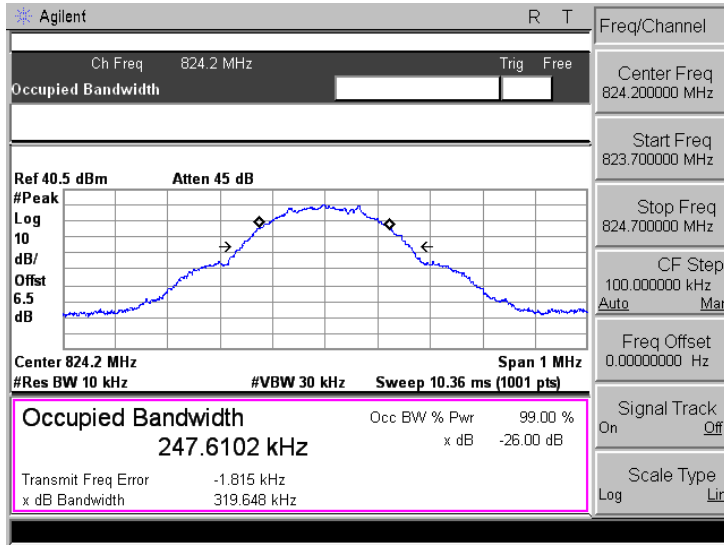


High Channel

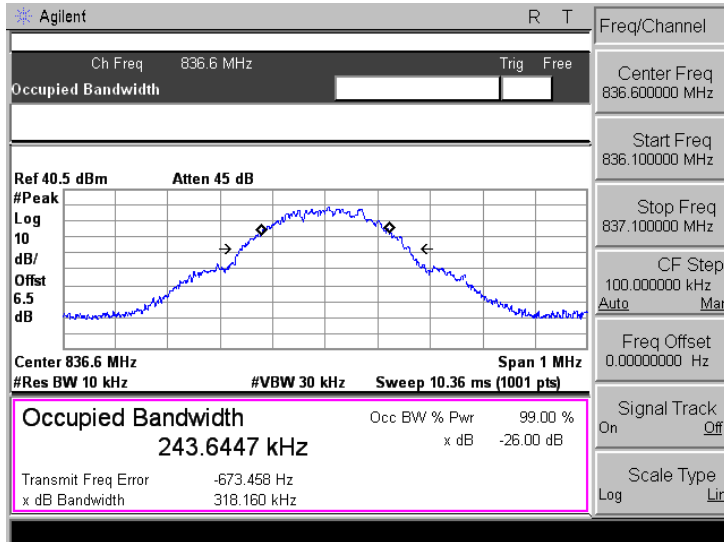


EGPRS850

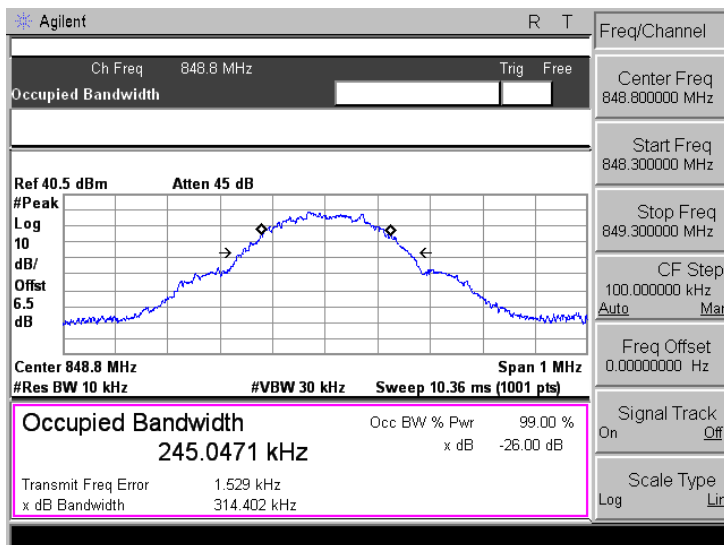
Low Channel



Middle Channel

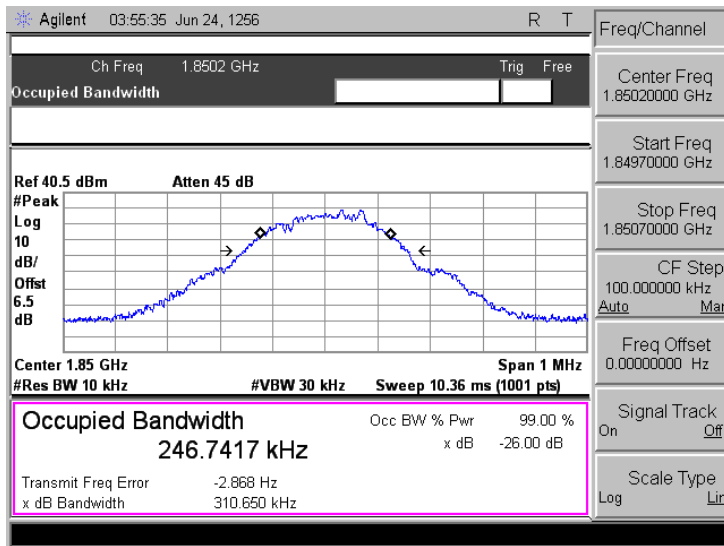


High Channel

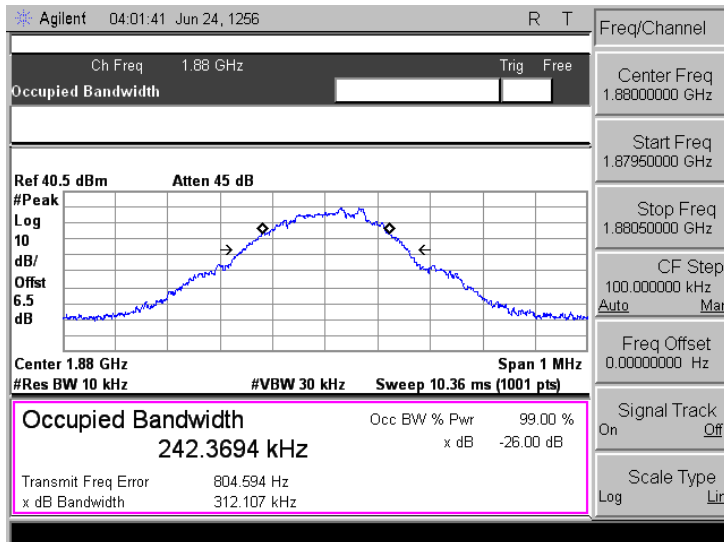


PCS1900

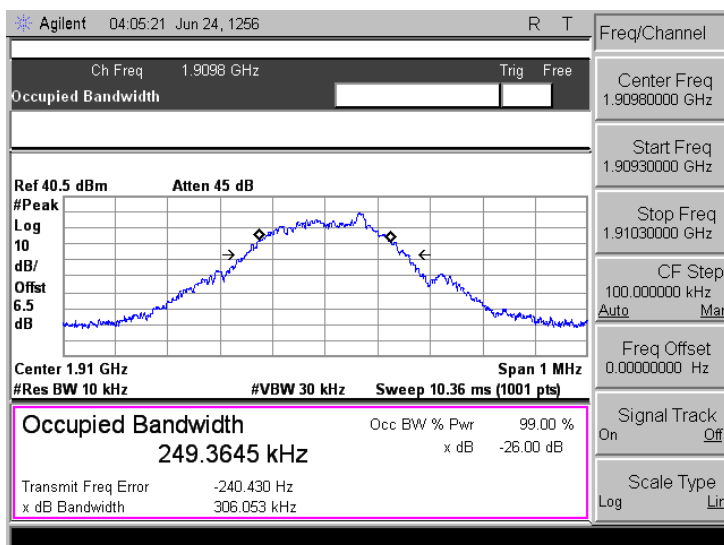
Low Channel



Middle Channel

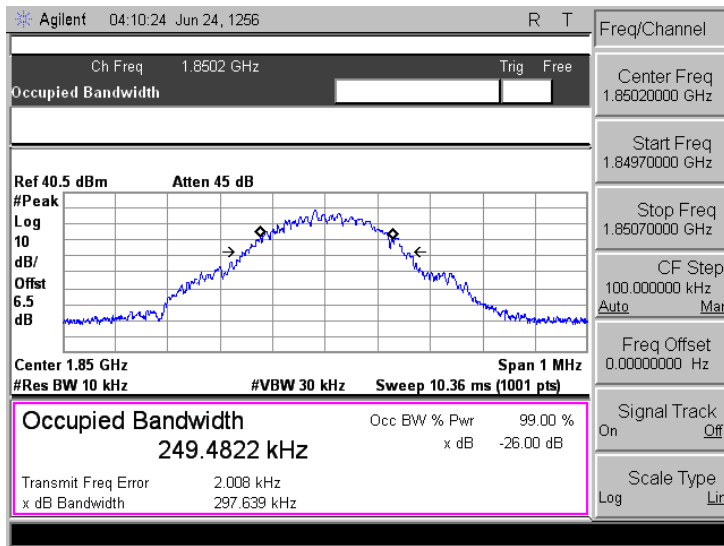


High Channel

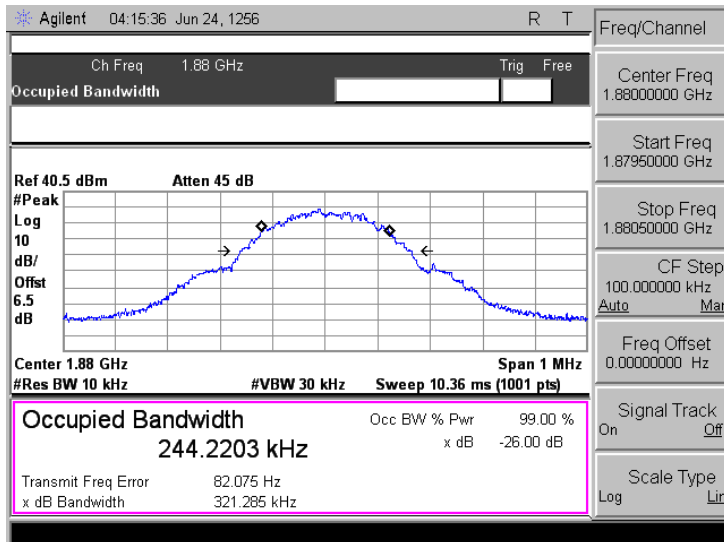


GPRS1900

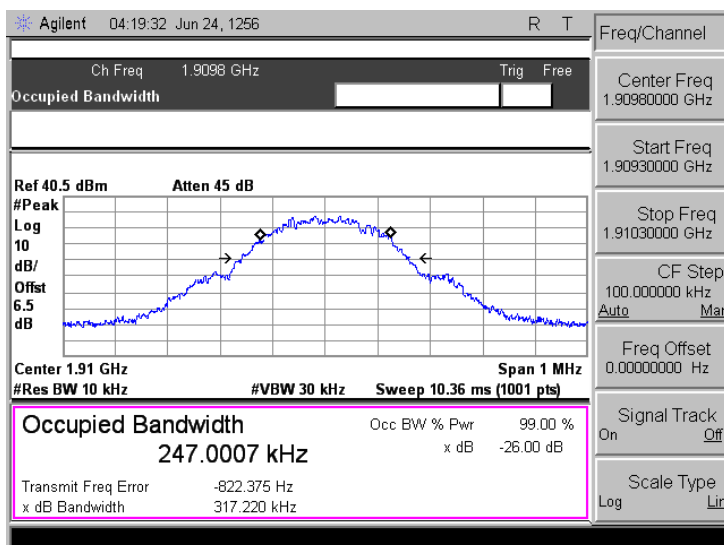
Low Channel



Middle Channel

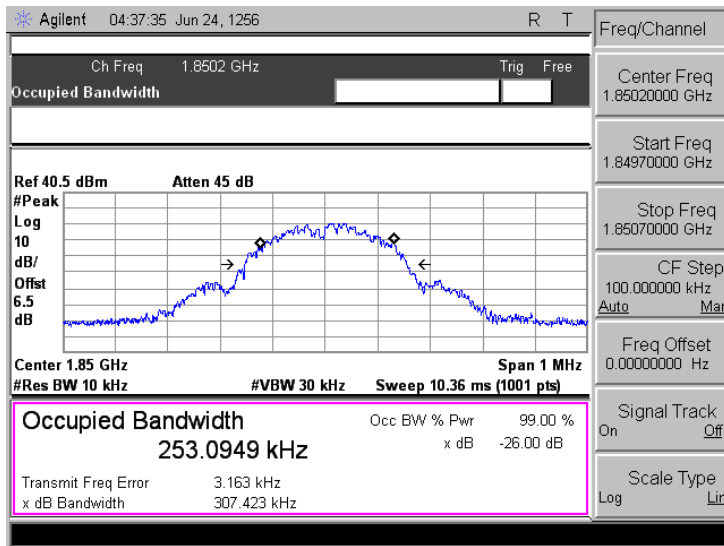


High Channel

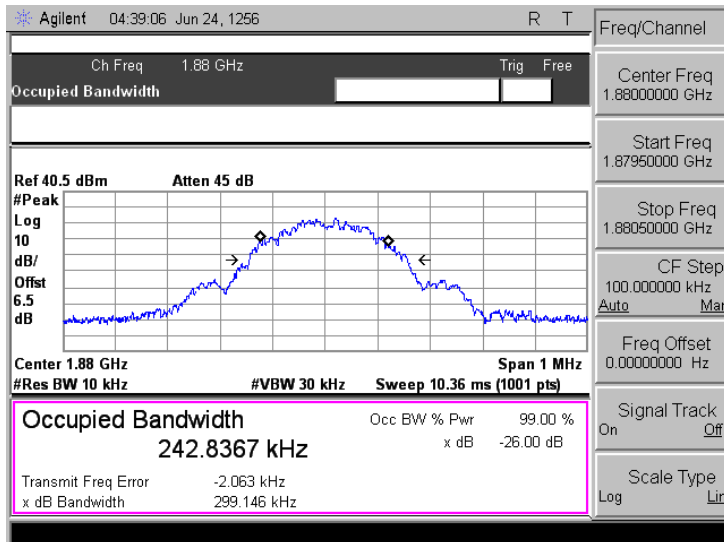


EGPRS1900

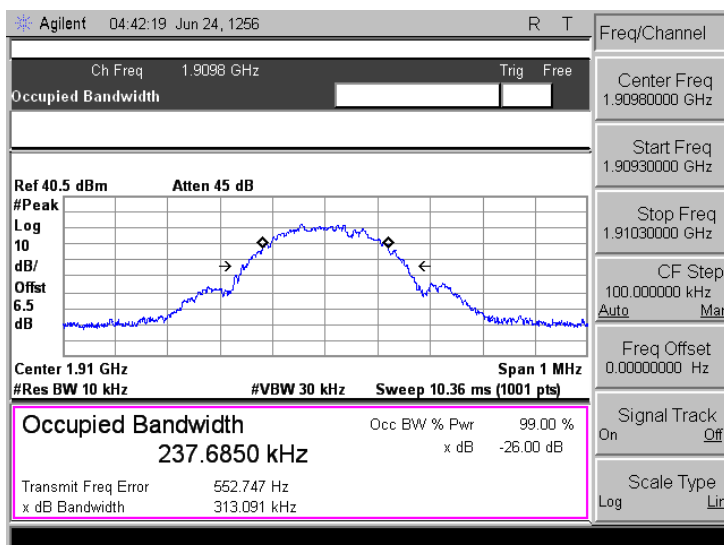
Low Channel



Middle Channel

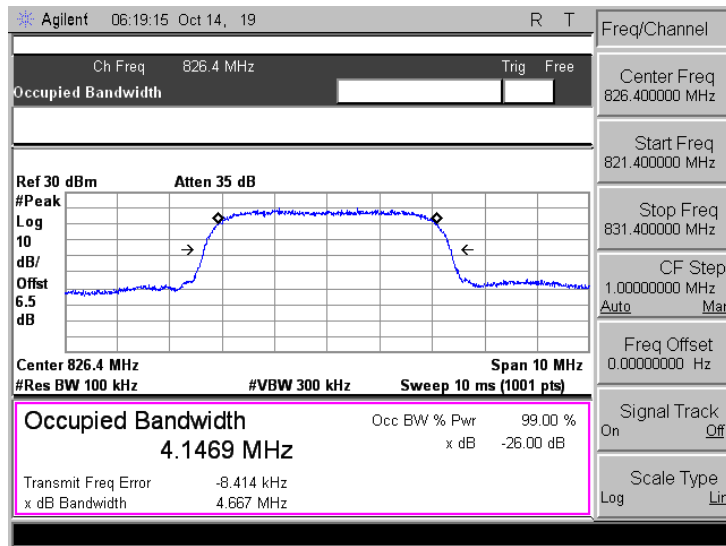


High Channel

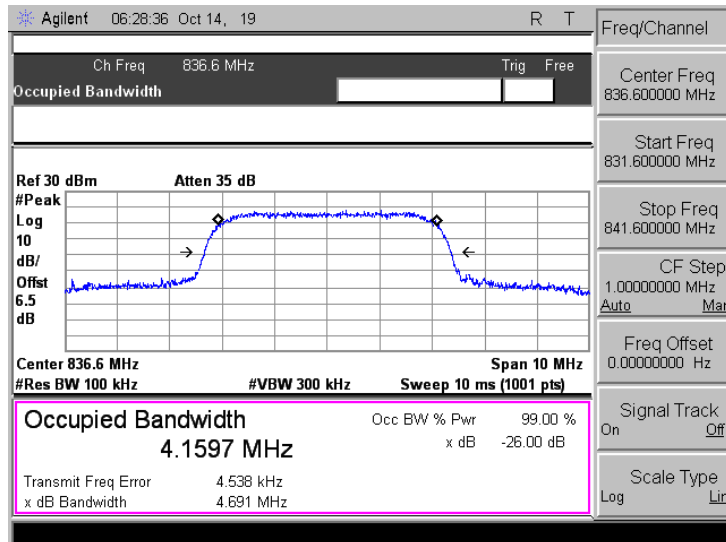


WCDMA Band V

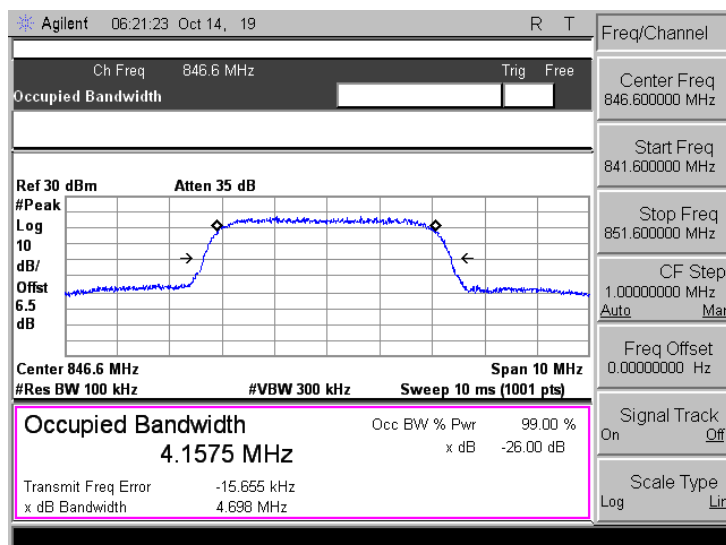
Low Channel



Middle Channel

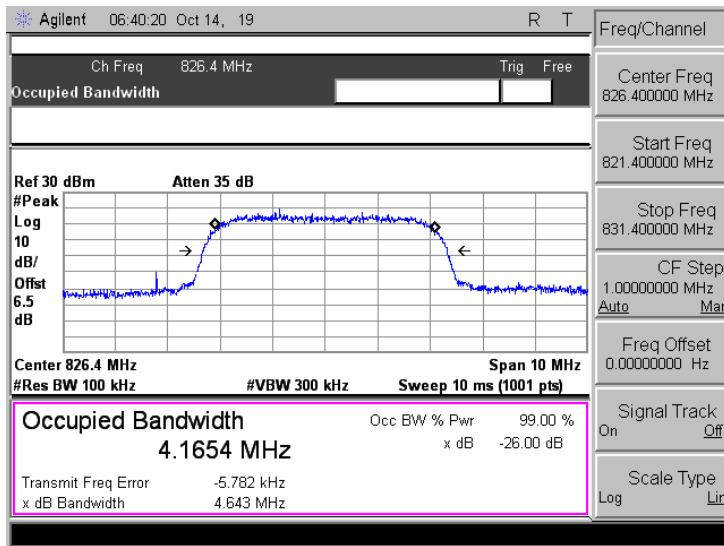


High Channel

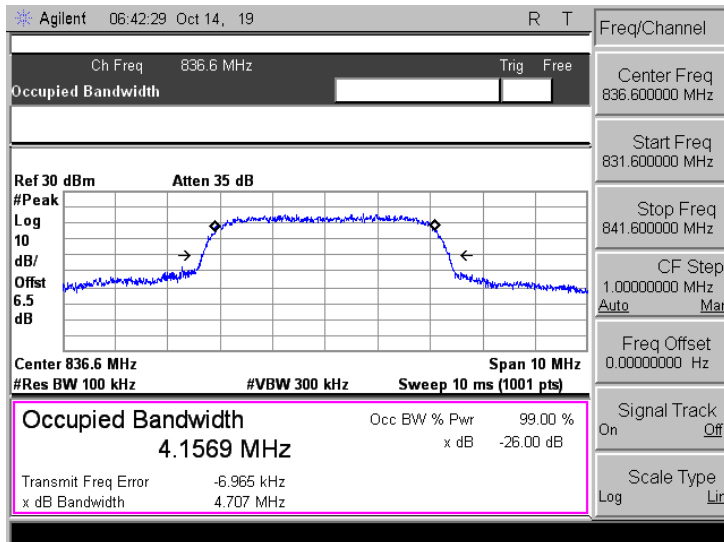


WCDMA Band V- HSDPA

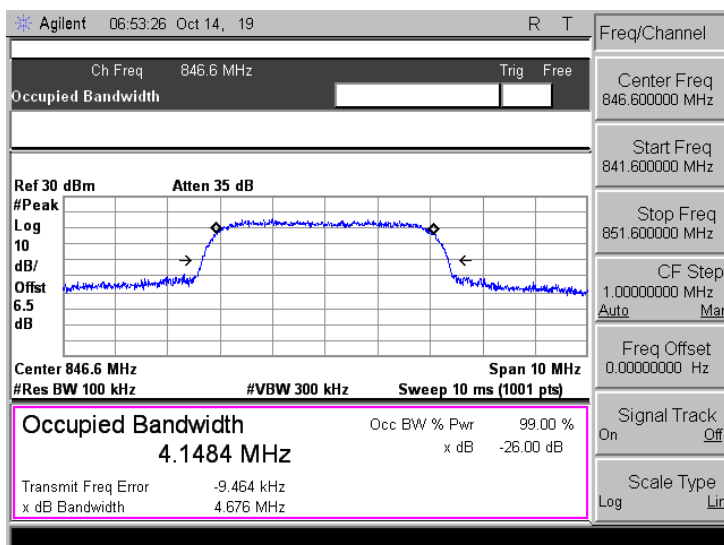
Low Channel



Middle Channel

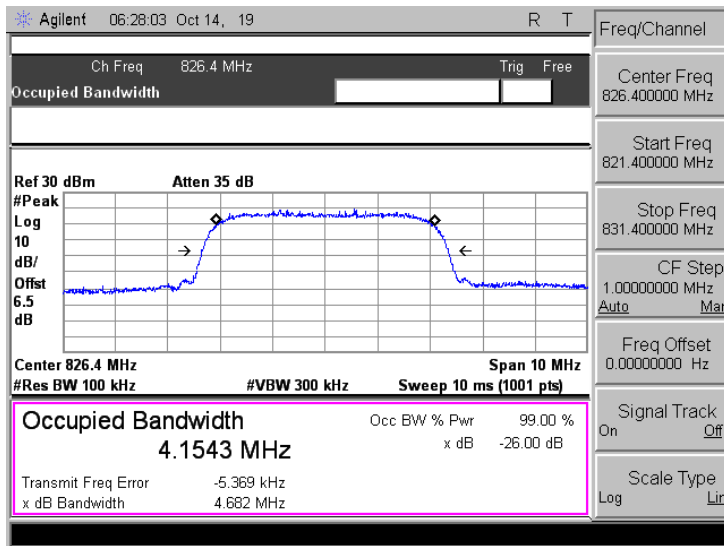


High Channel

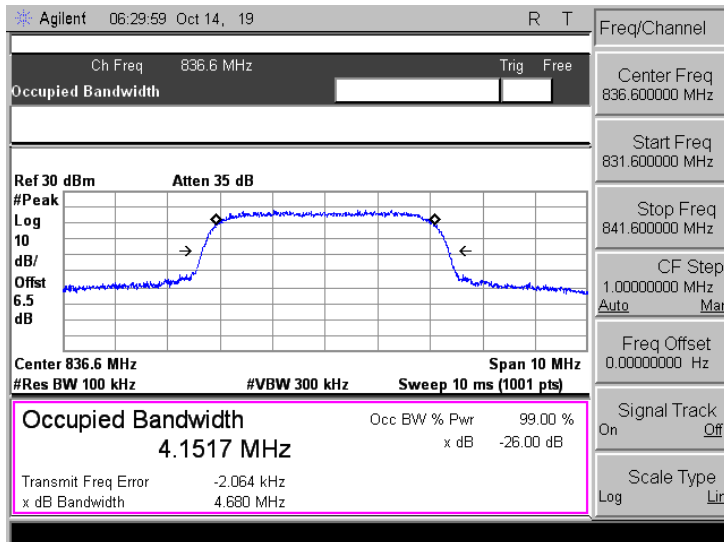


WCDMA Band V- HSUPA

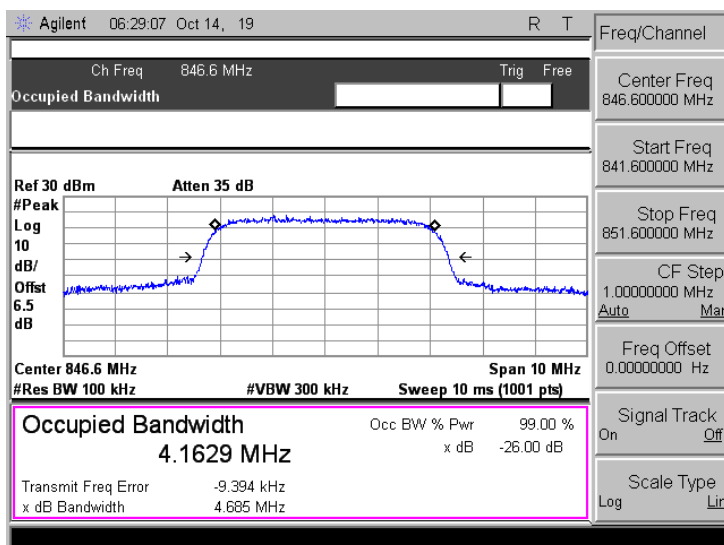
Low Channel



Middle Channel

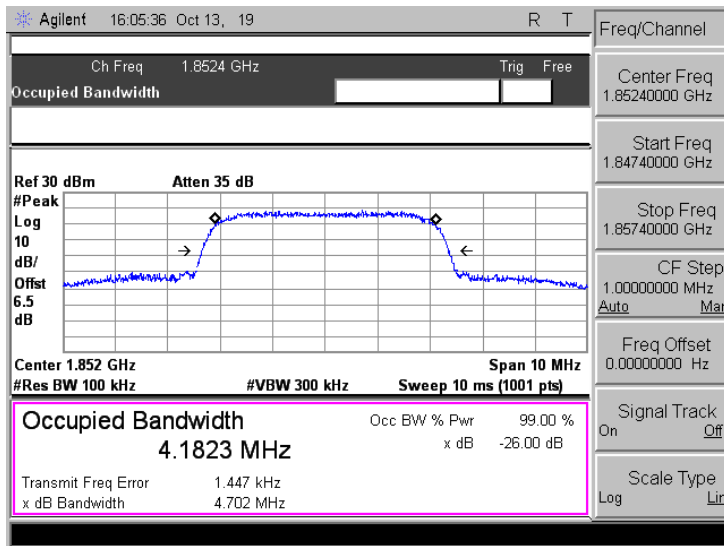


High Channel

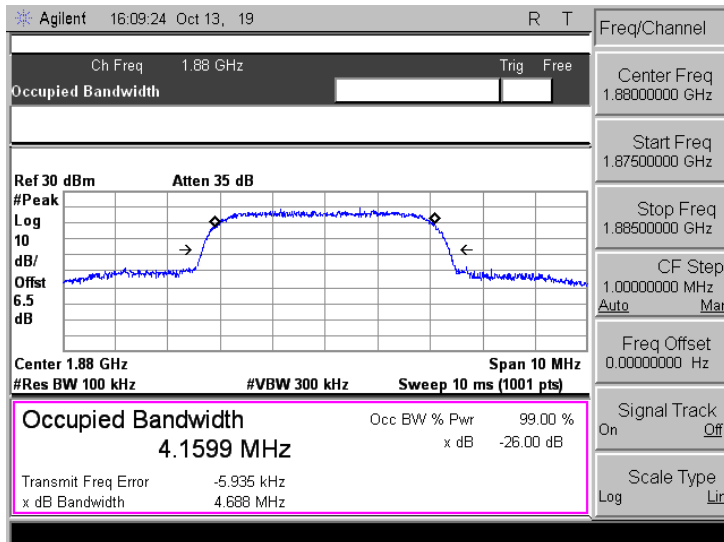


WCDMA Band II

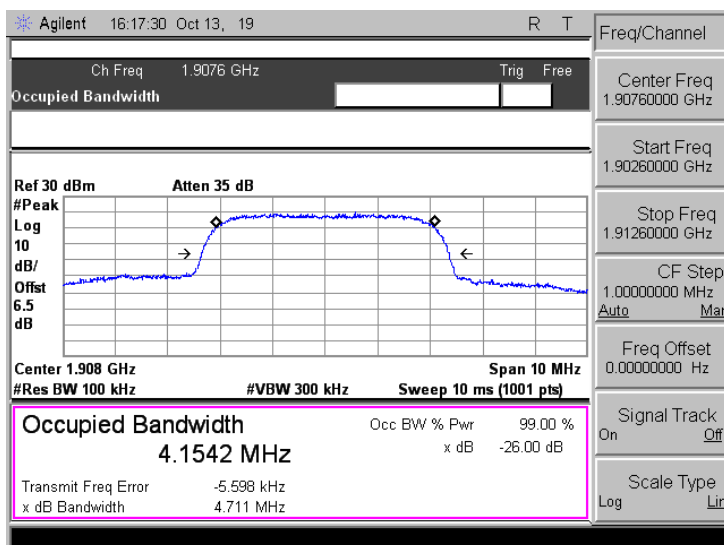
Low Channel



Middle Channel

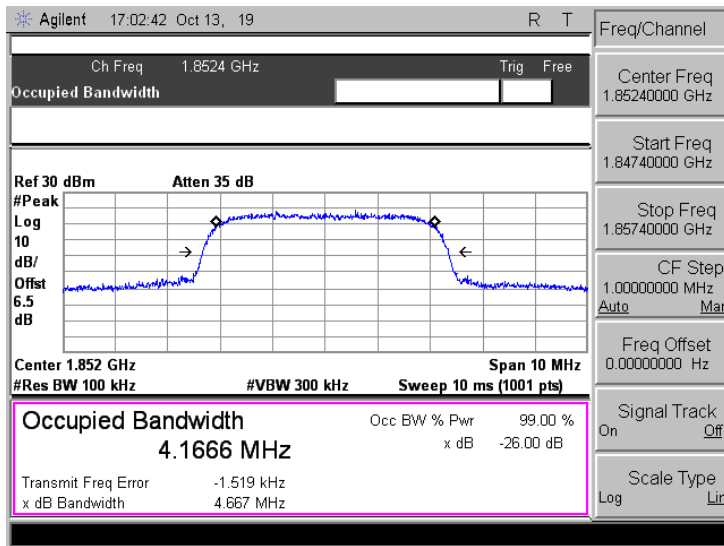


High Channel

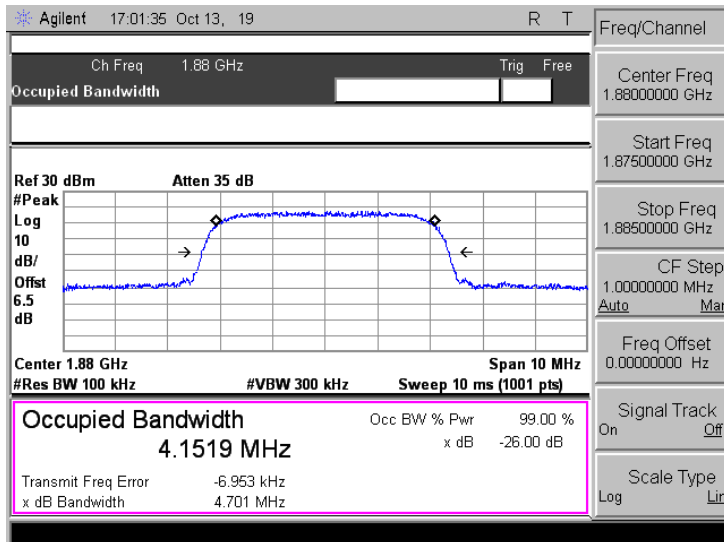


WCDMA Band II- HSDPA

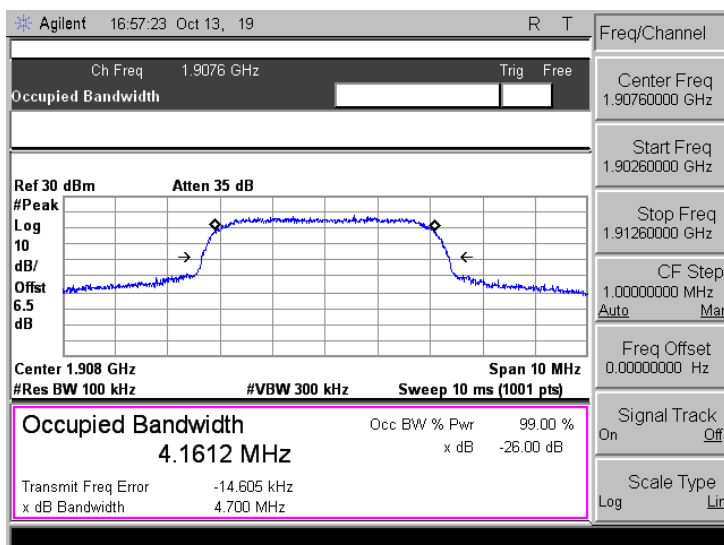
Low Channel



Middle Channel

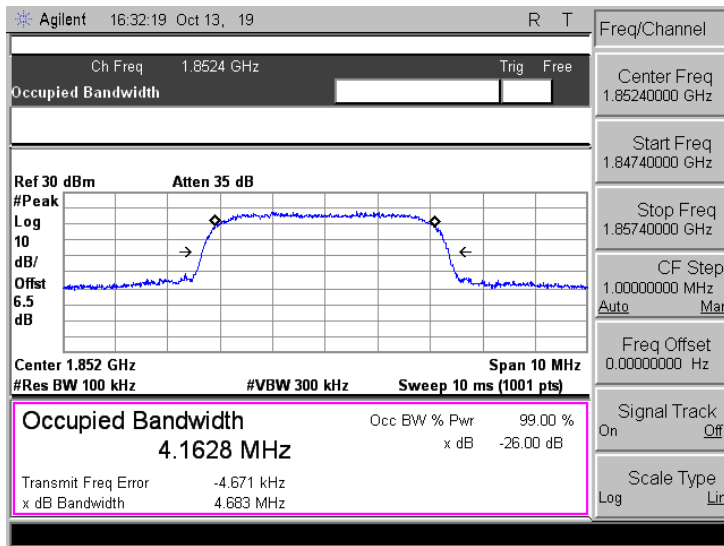


High Channel

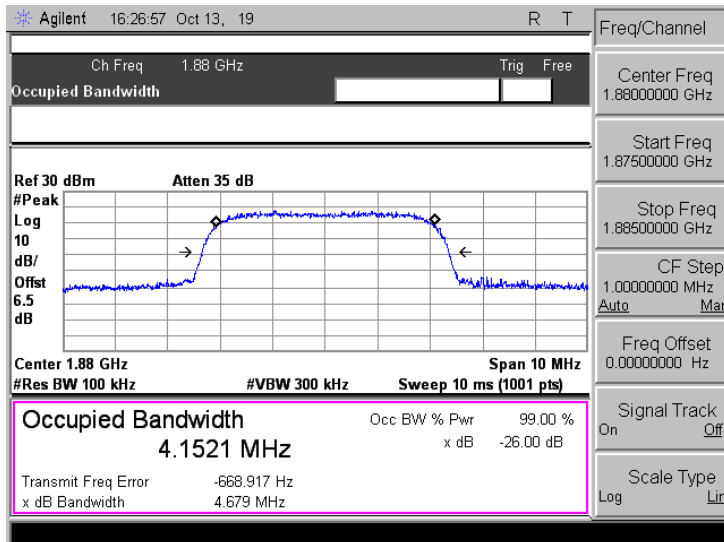


WCDMA Band II- HSUPA

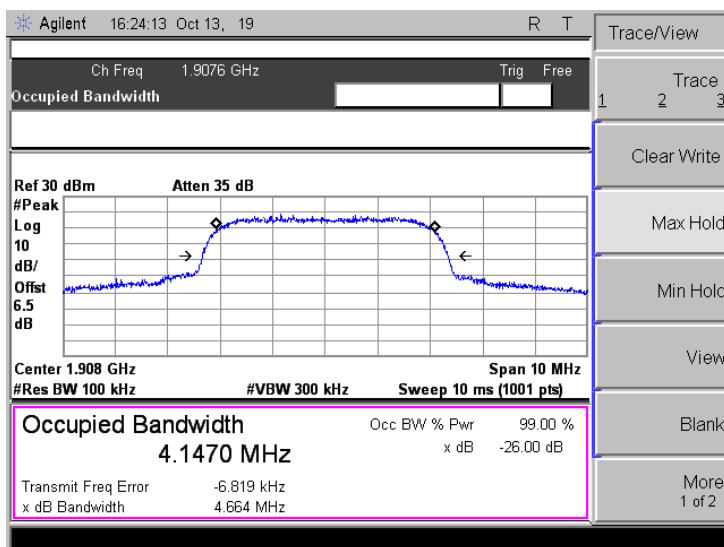
Low Channel



Middle Channel



High Channel



7. Out of Band Emissions at Antenna Terminal

7.1 Standard Applicable

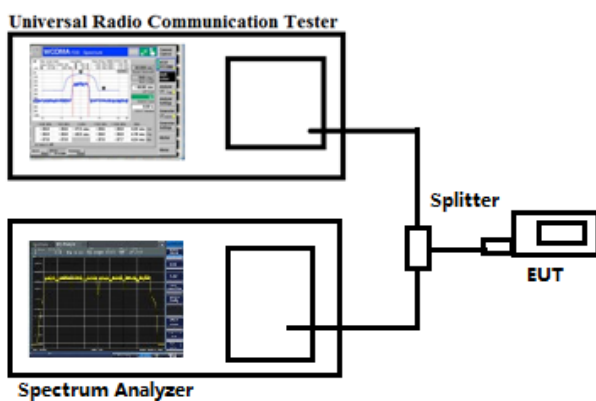
According to §22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

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:



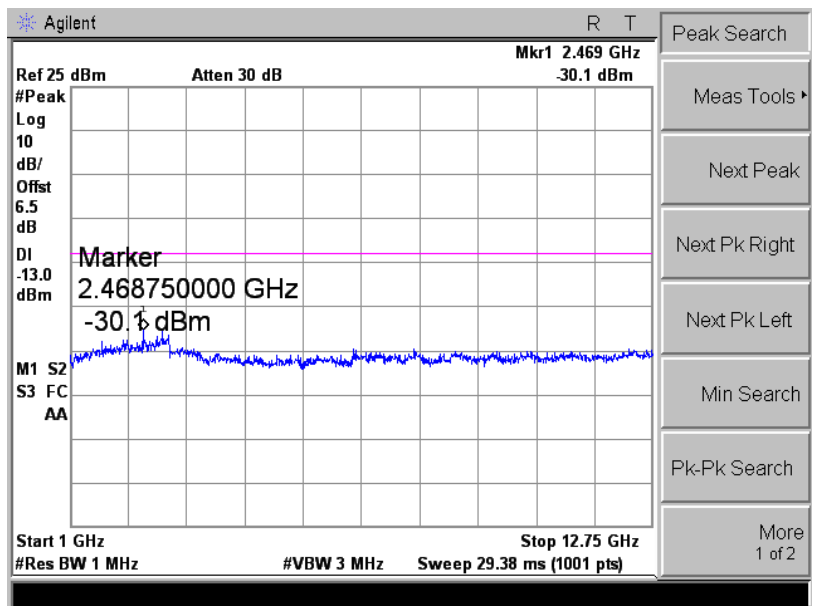
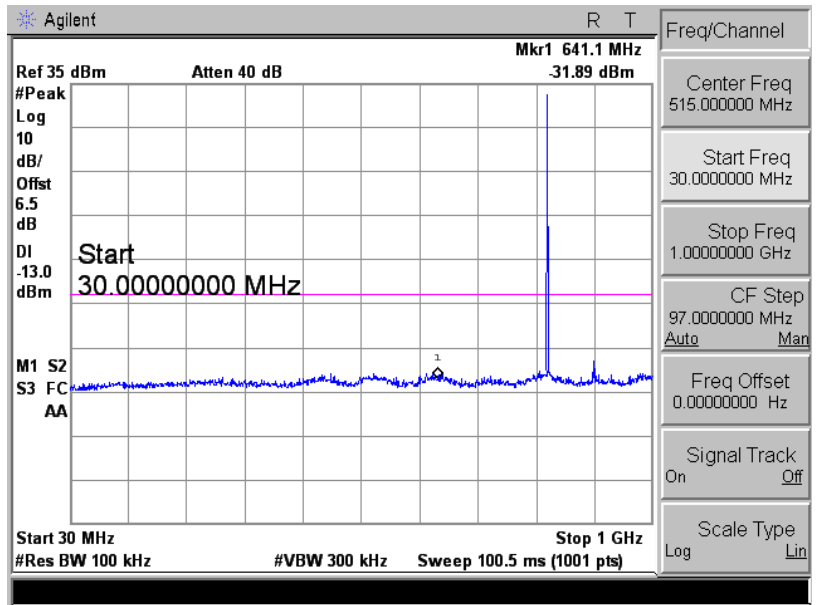
7.3 Summary of Test Results/Plots

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

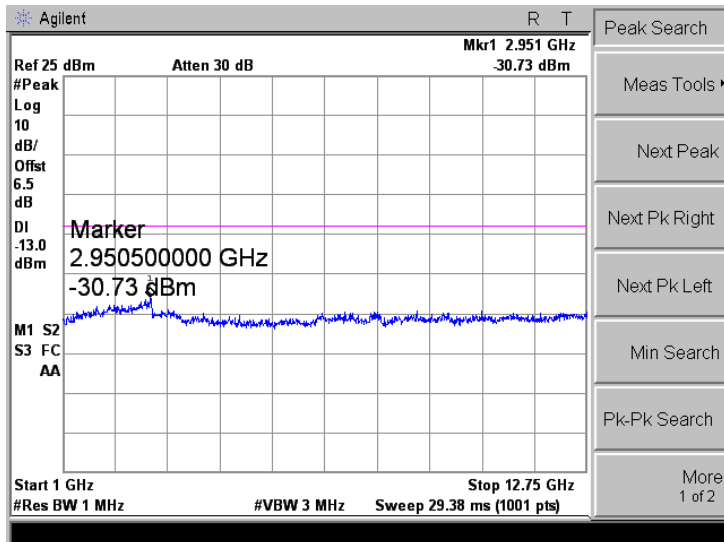
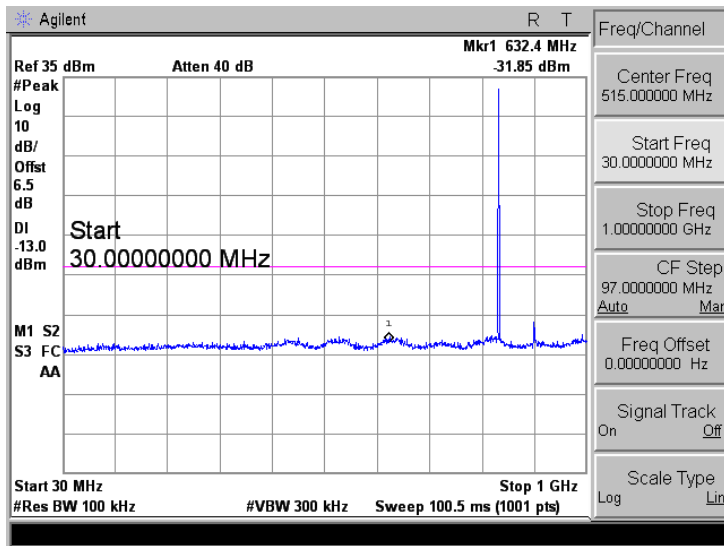
GSM850

Low Channel



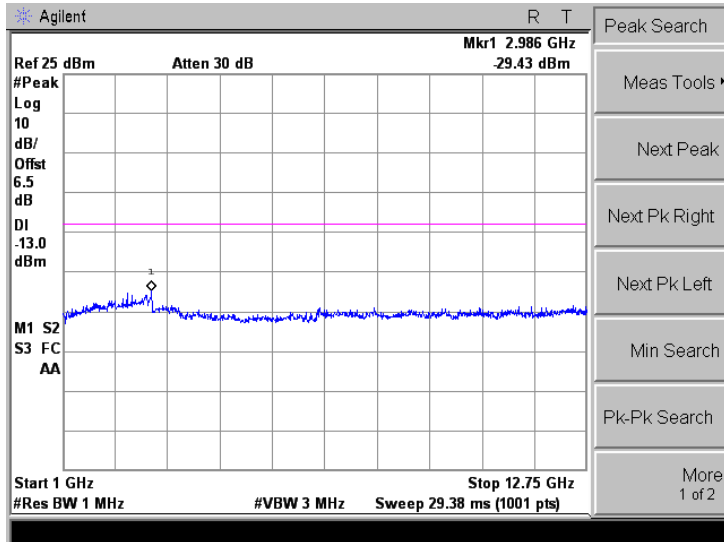
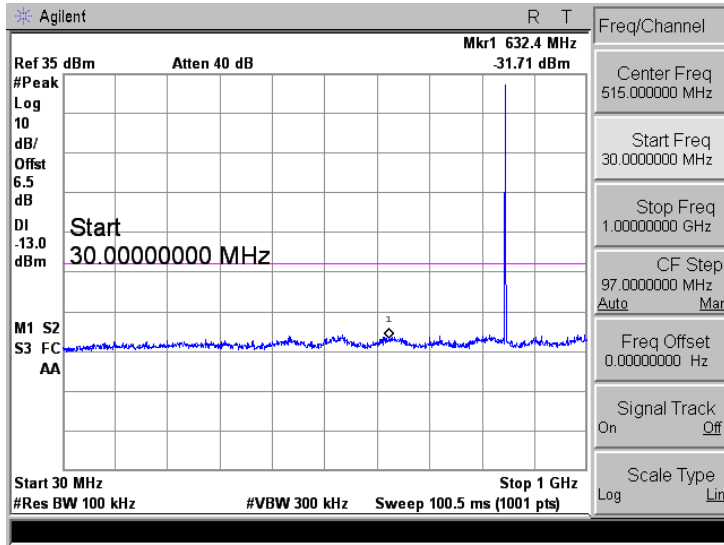
GSM850

Middle Channel



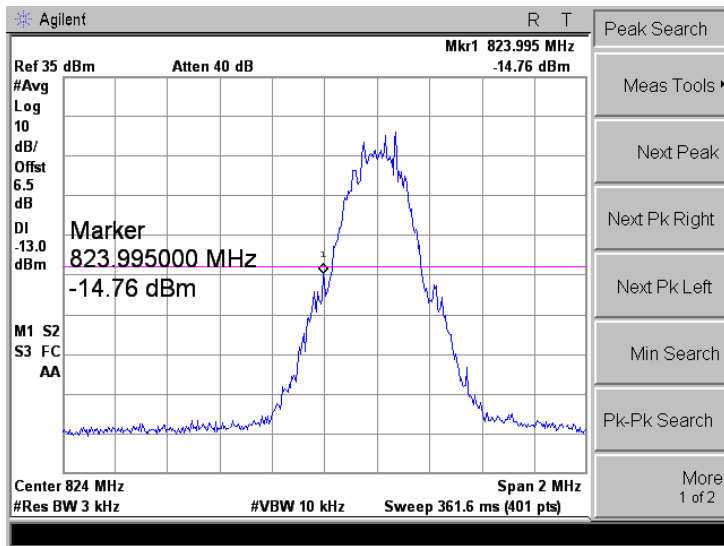
GSM850

High Channel

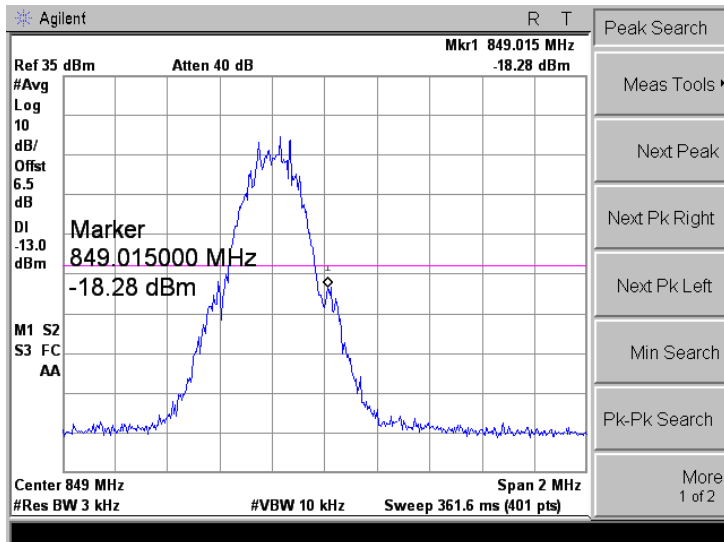


GSM850

Low Band Emission

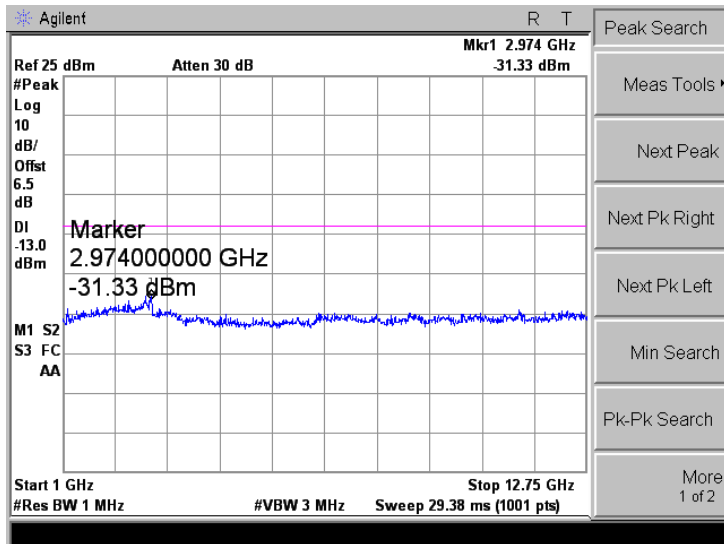
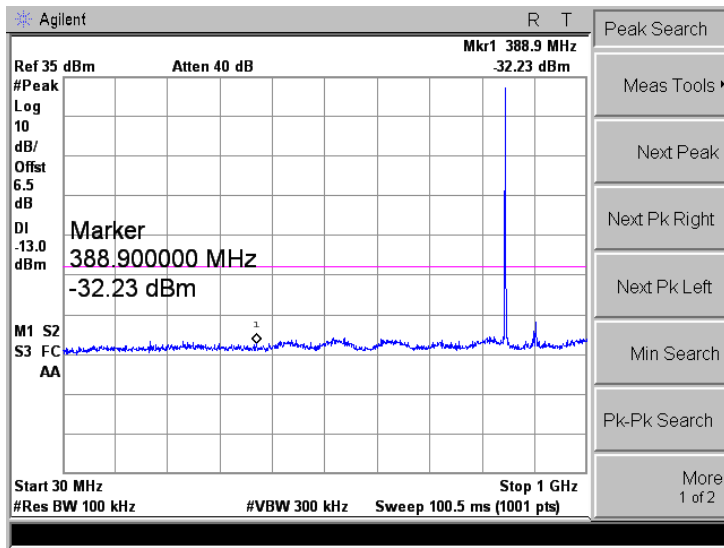


High Band Emission



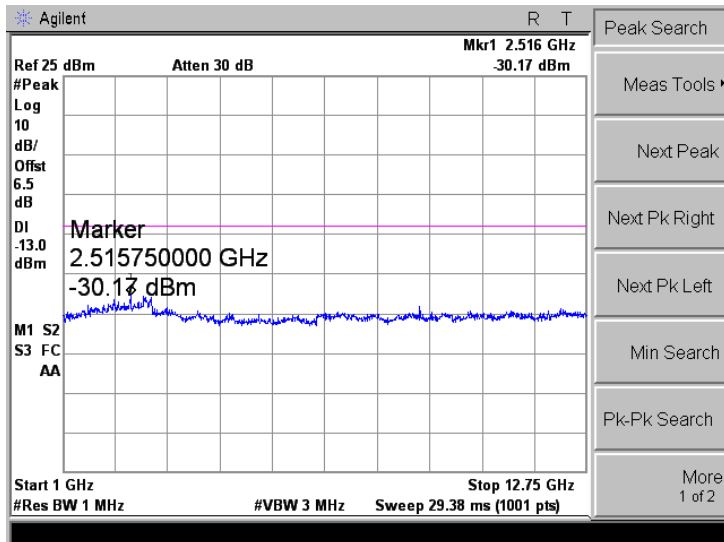
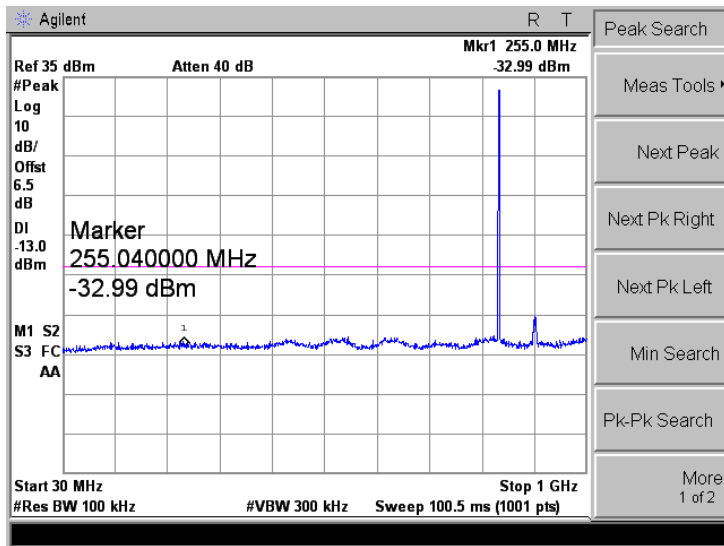
For Cellular Band

GPRS Low Channel



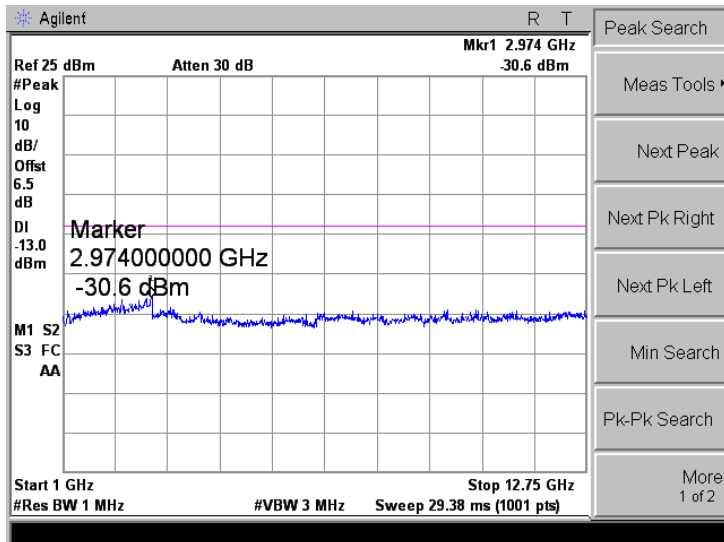
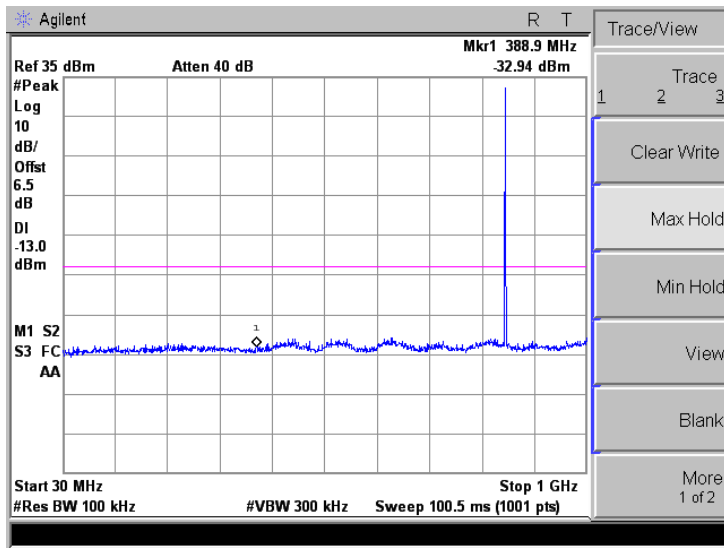
GPRS850

Middle Channel



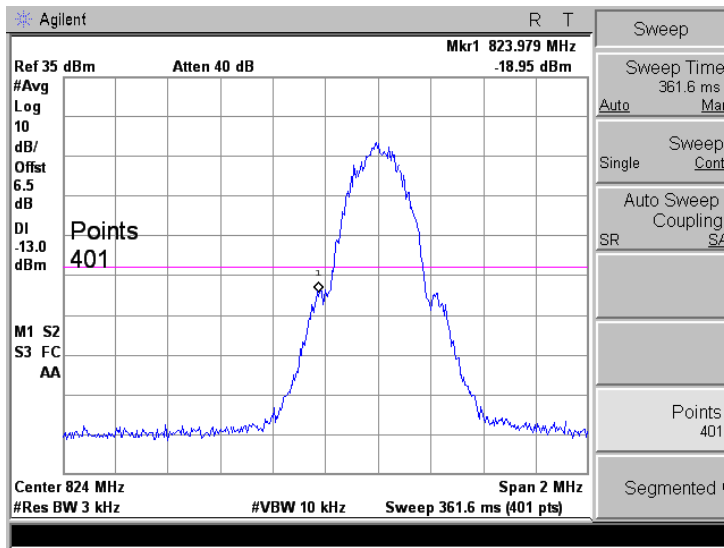
GPRS850

High Channel

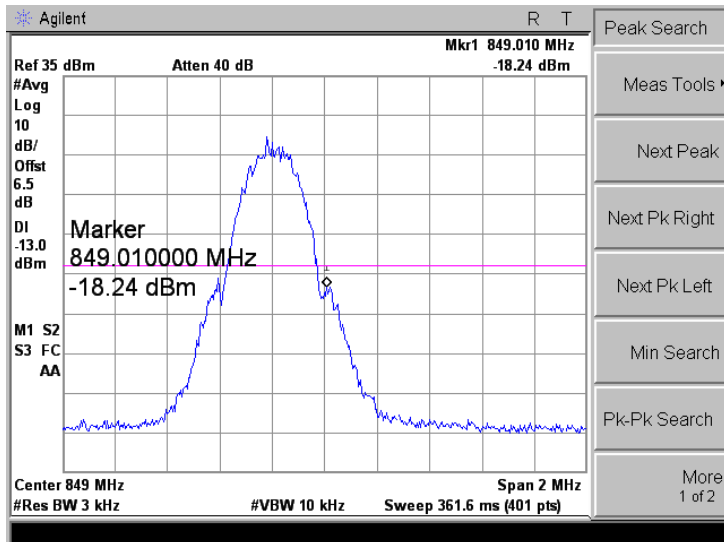


GPRS850

Low Band Emission

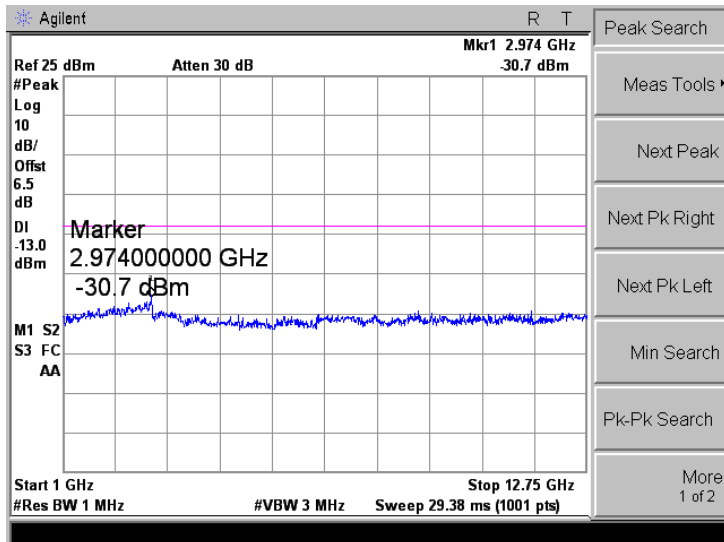
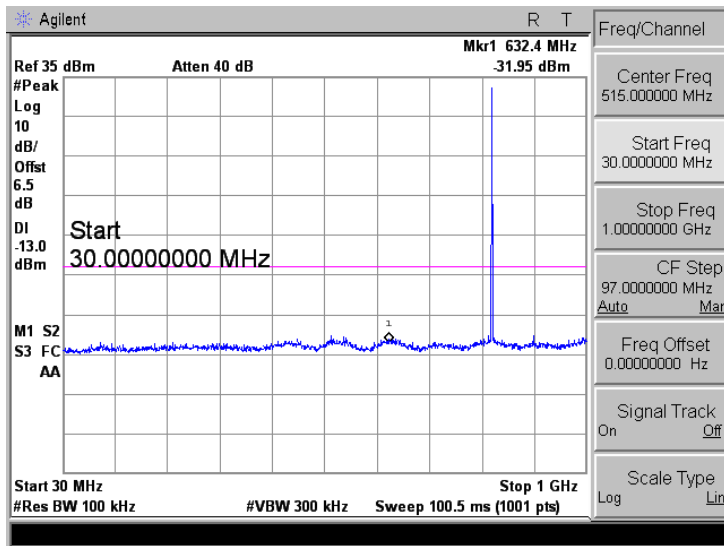


High Band Emission



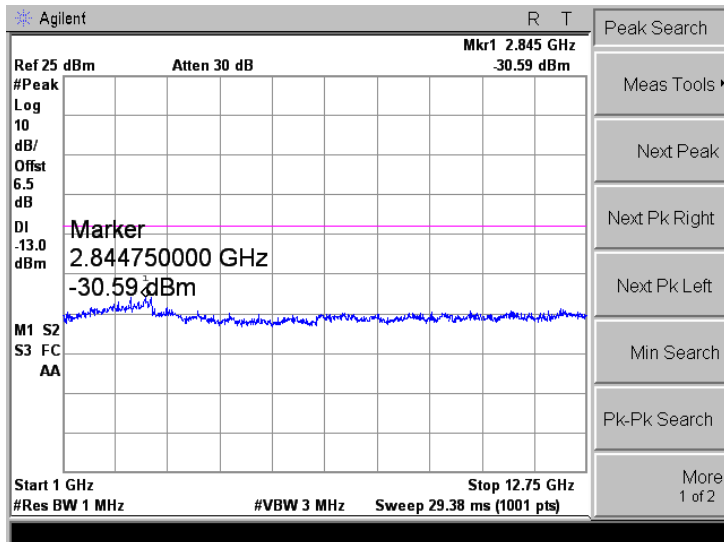
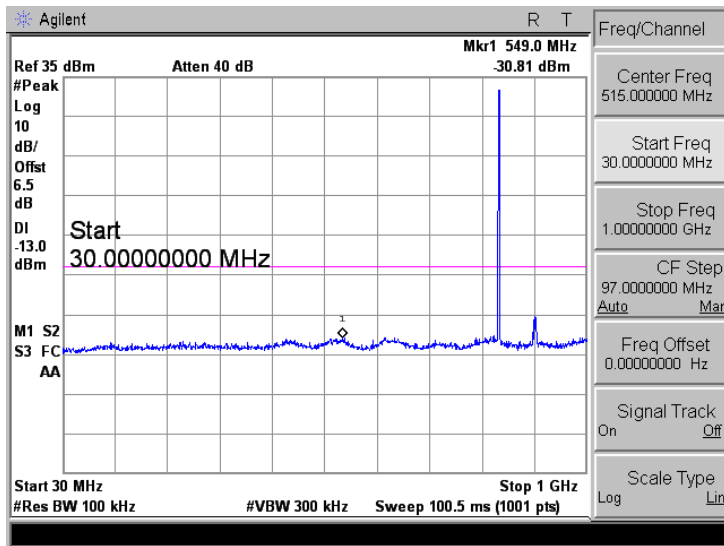
EGPRS850

Low Channel



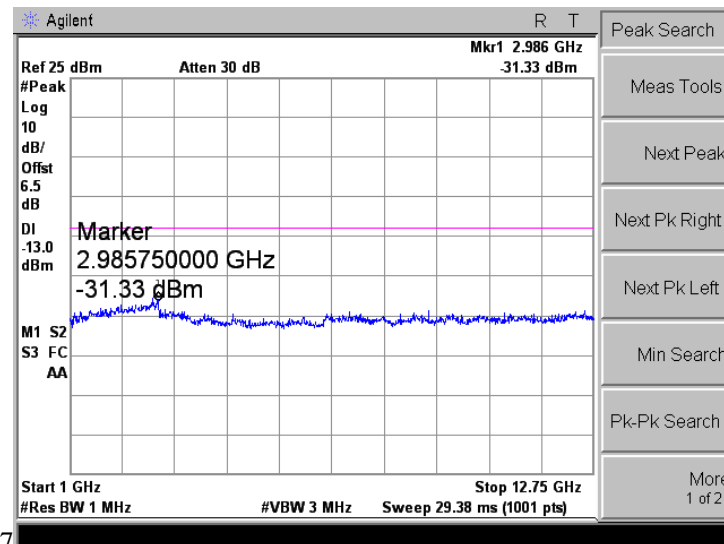
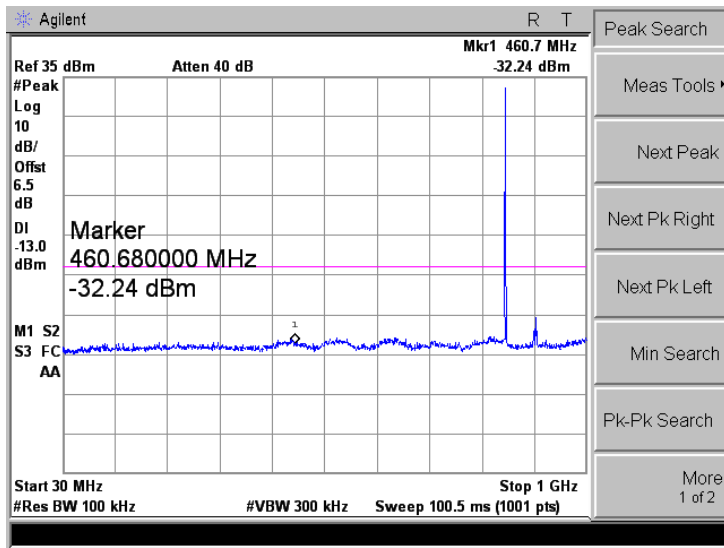
EGPRS850

Middle Channel



EGPRS850

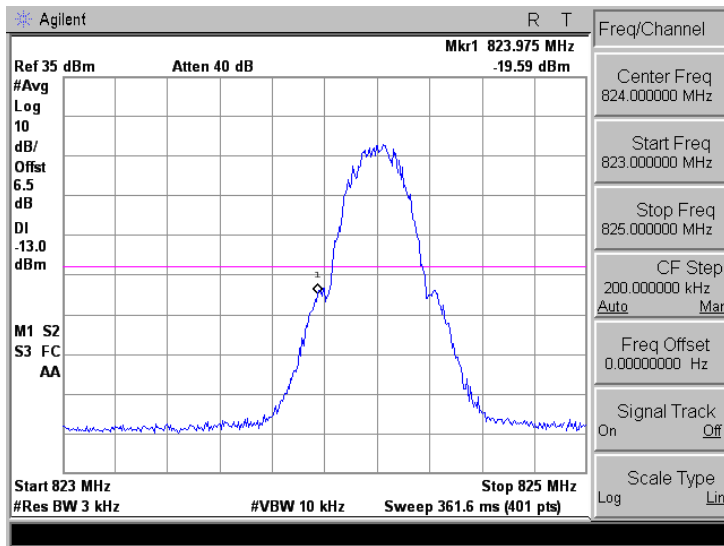
High Channel



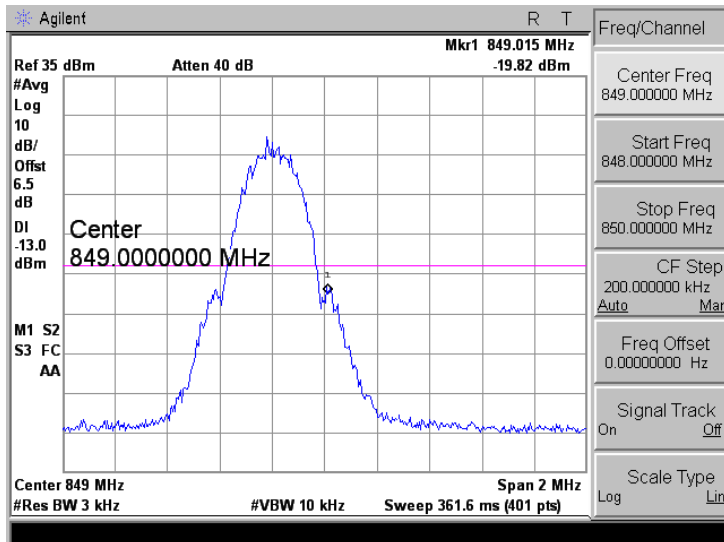
7

EGPRS850

Low Band Emission

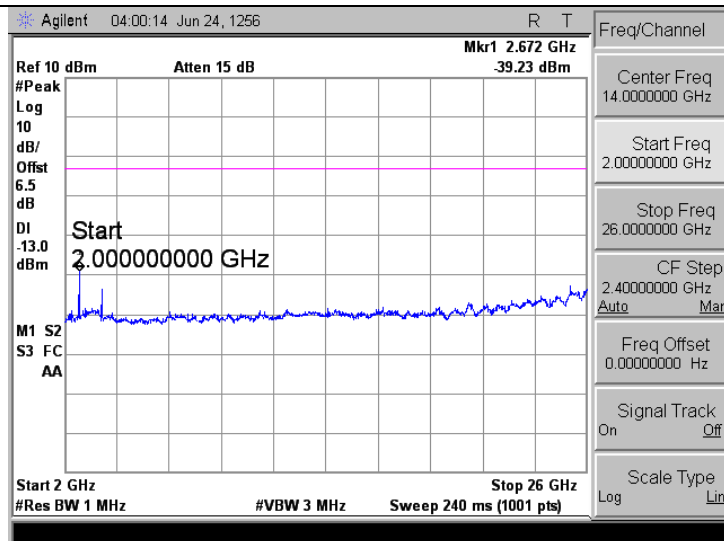
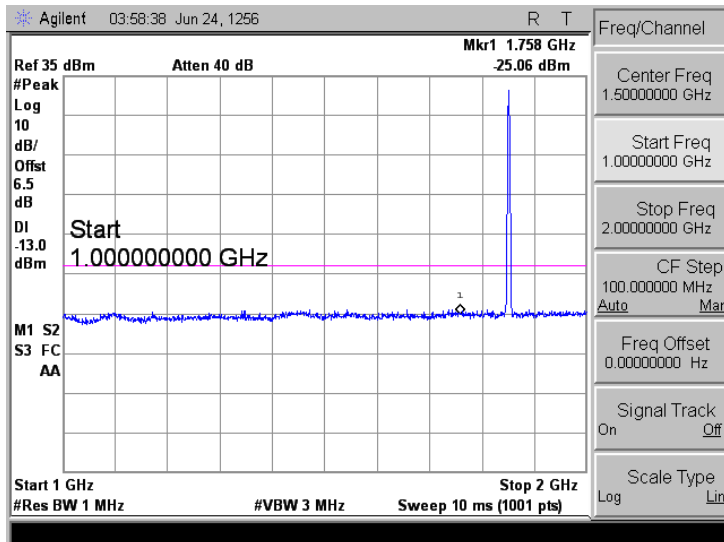
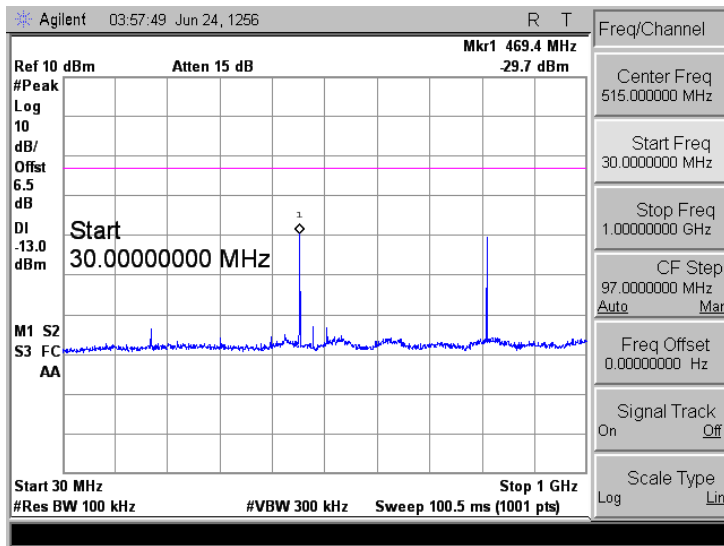


High Band Emission



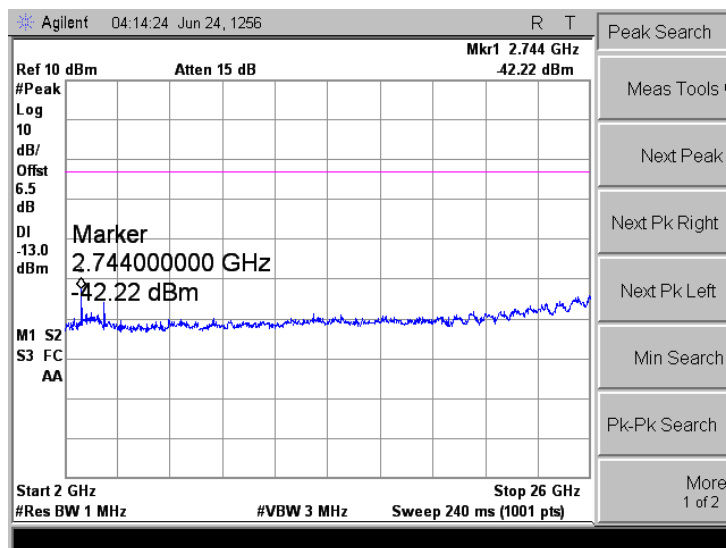
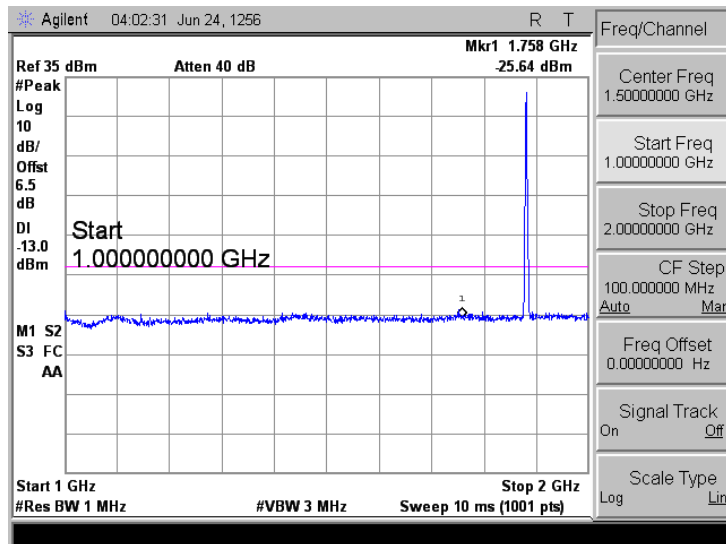
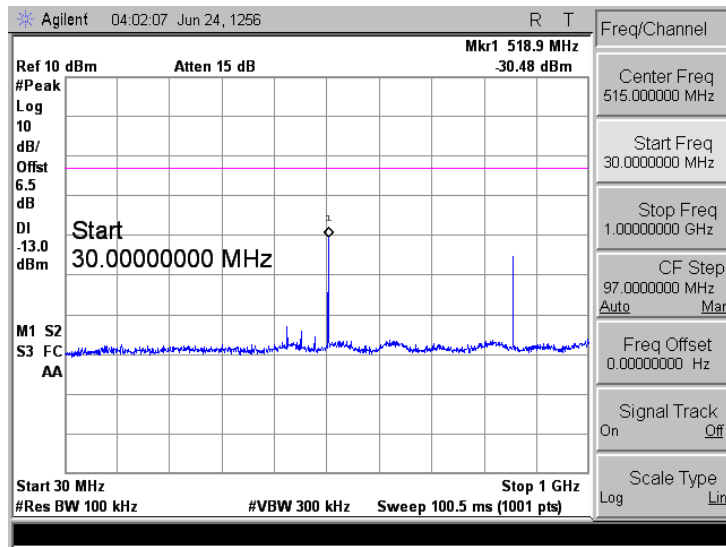
PCS1900

Low Channel



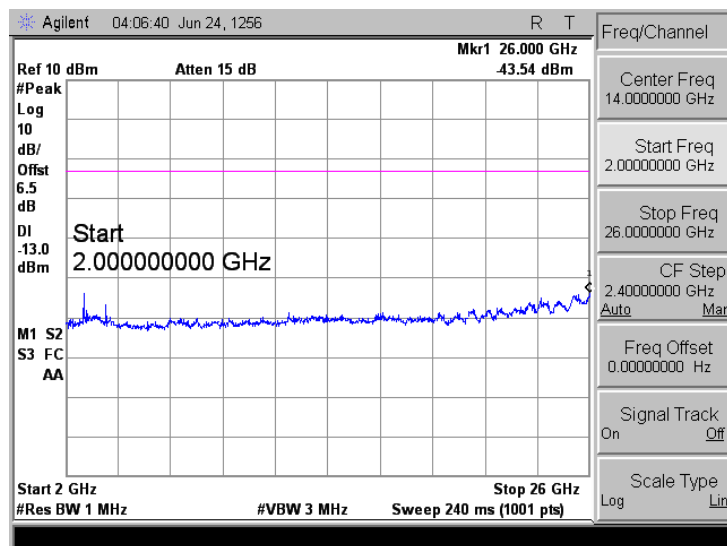
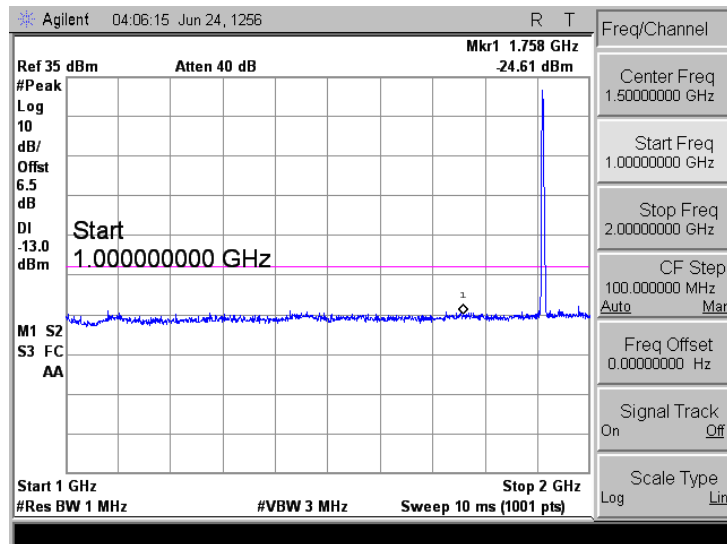
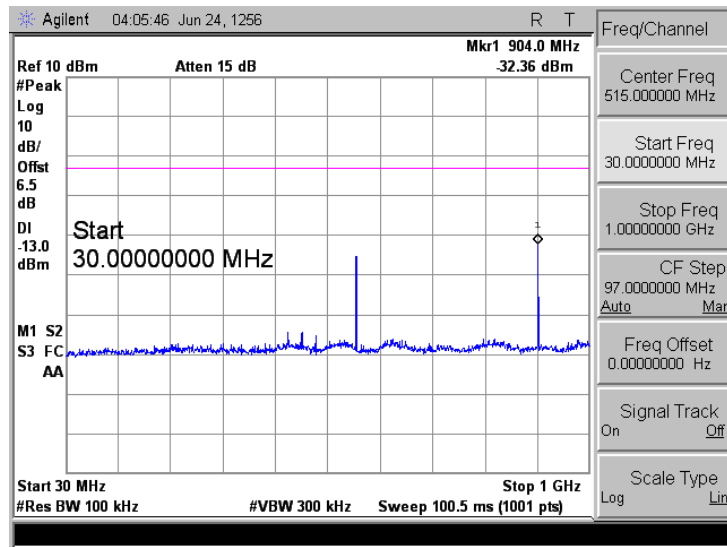
PCS1900

Middle Channel



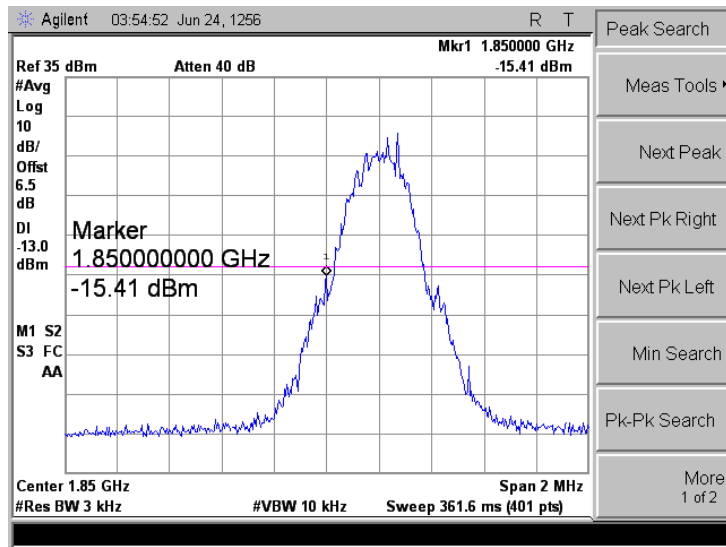
PCS1900

High Channel

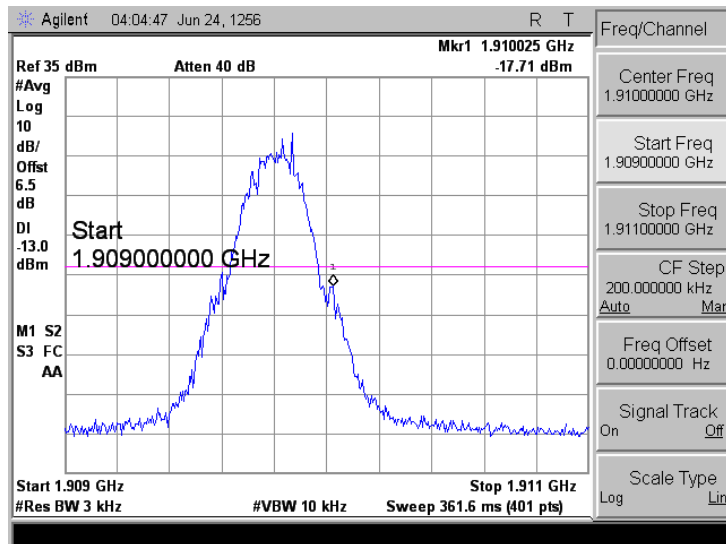


PCS1900

Low Band Emission

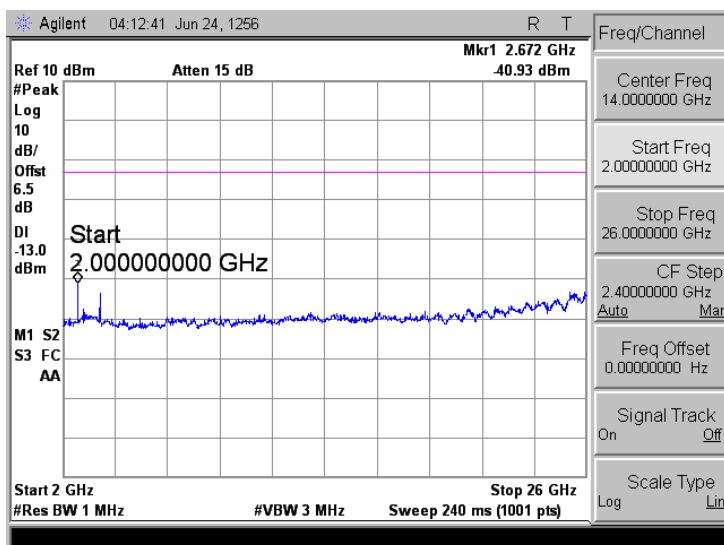
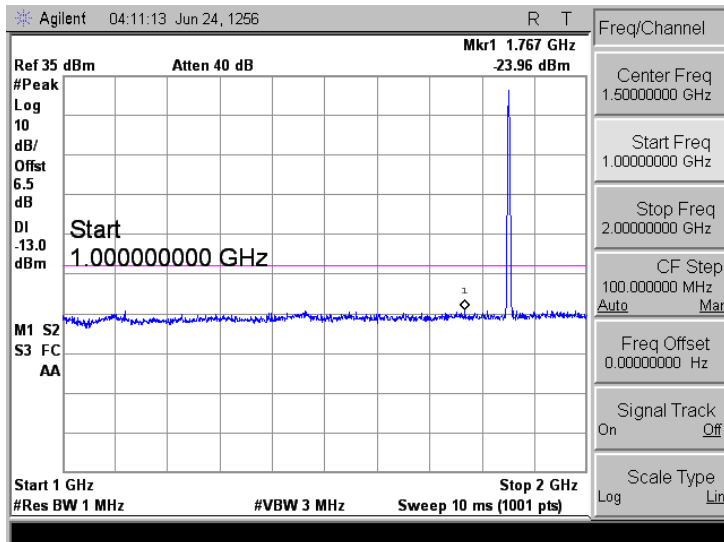
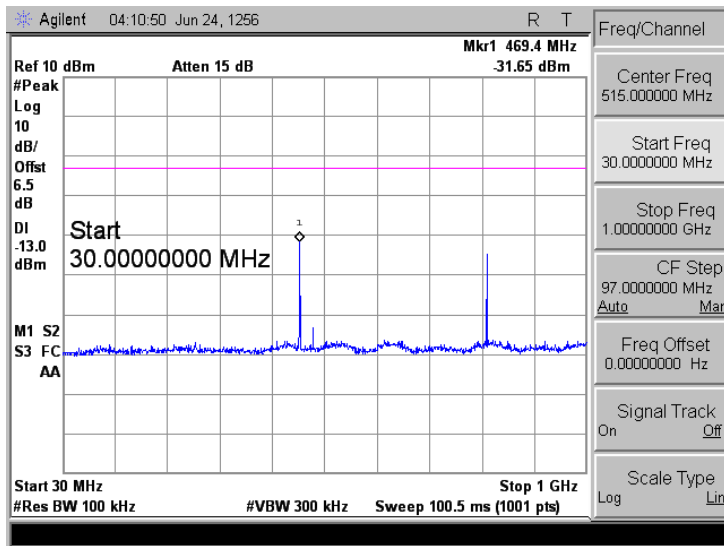


High Band Emission



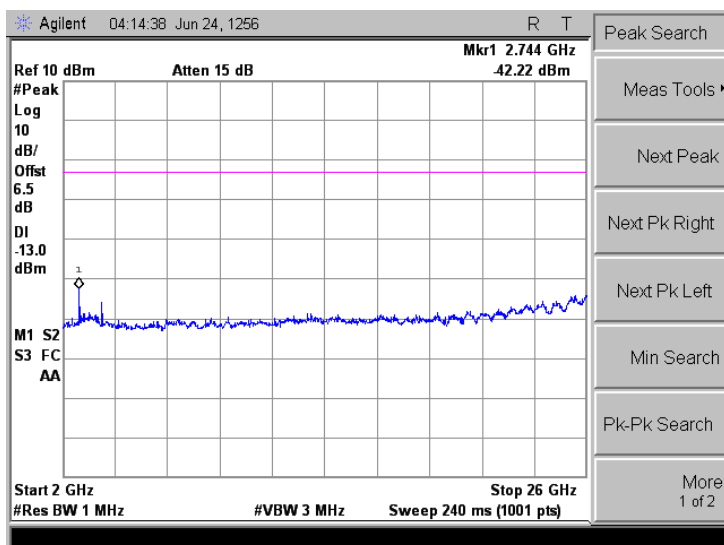
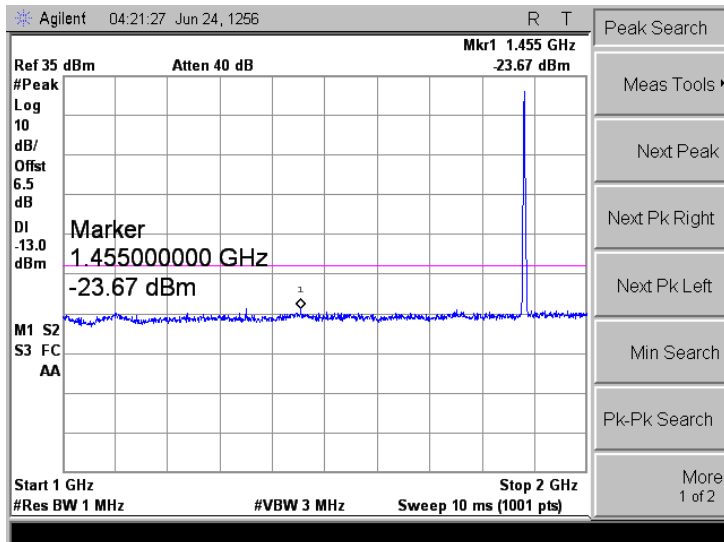
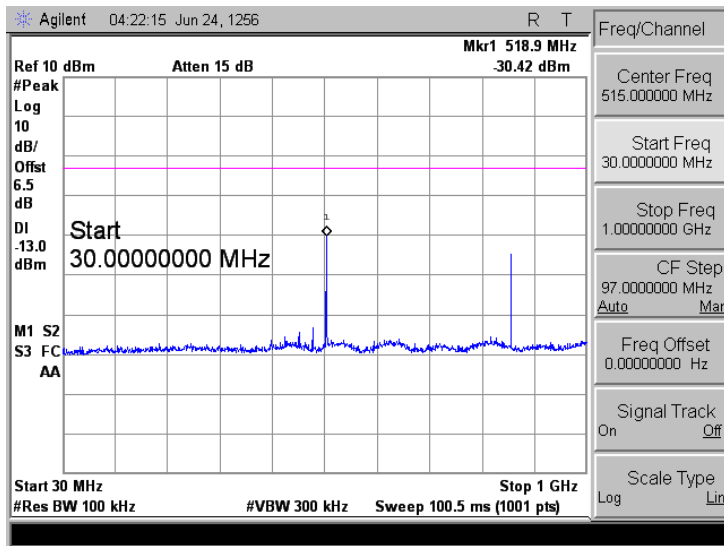
GPRS1900

Low Channel



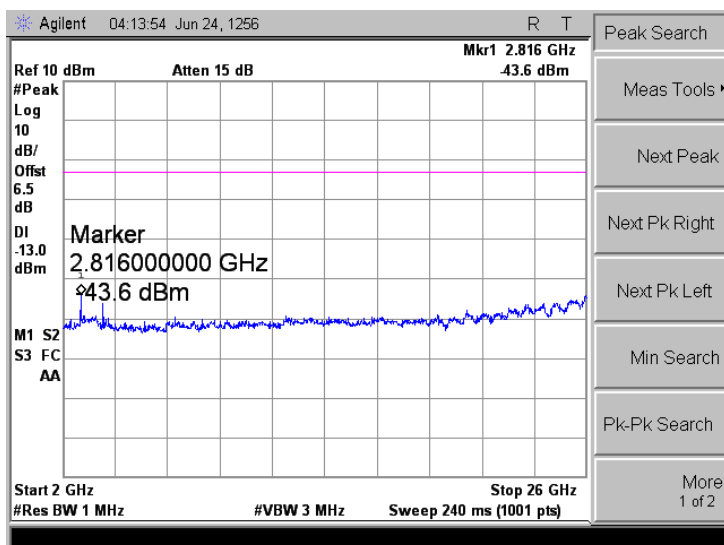
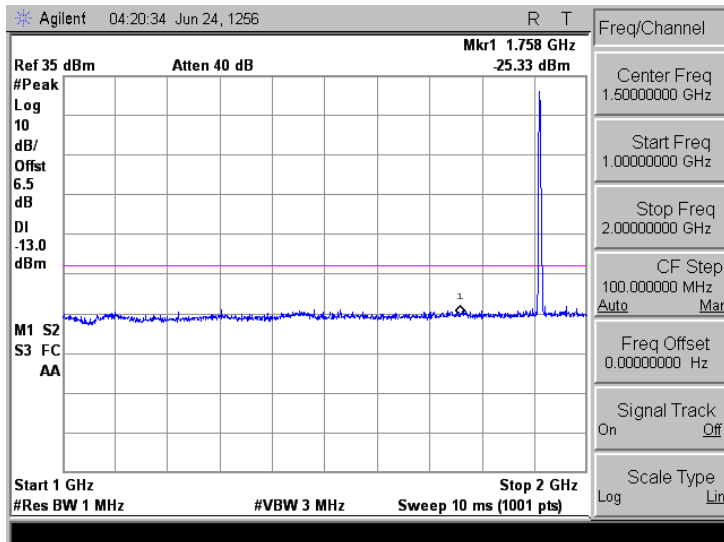
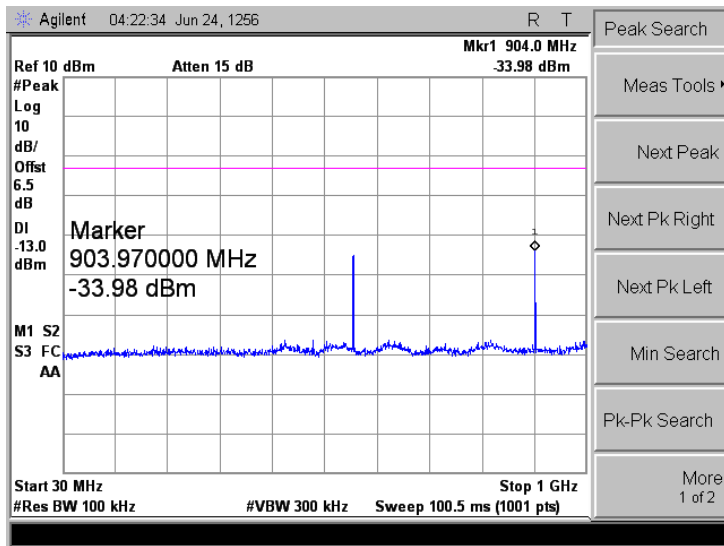
GPRS1900

Middle Channel



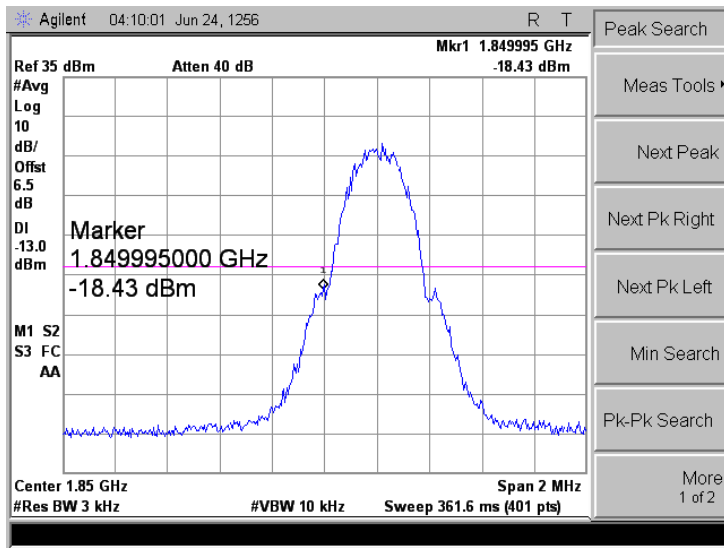
GPRS1900

High Channel

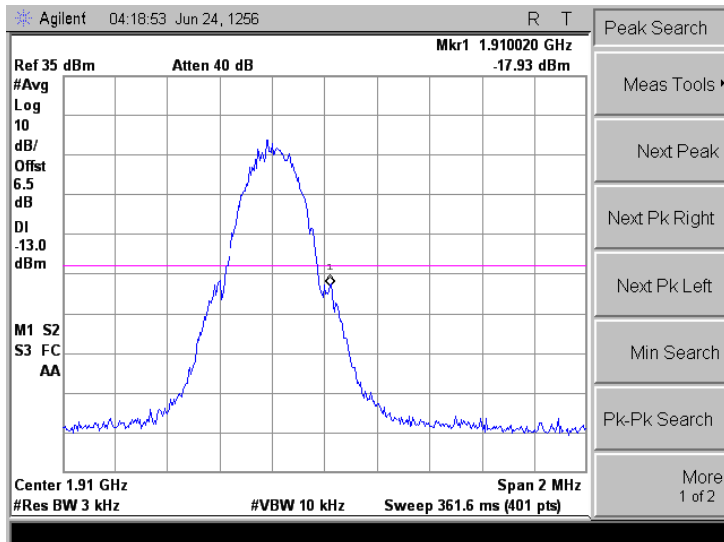


GPRS1900

Low Band Emission

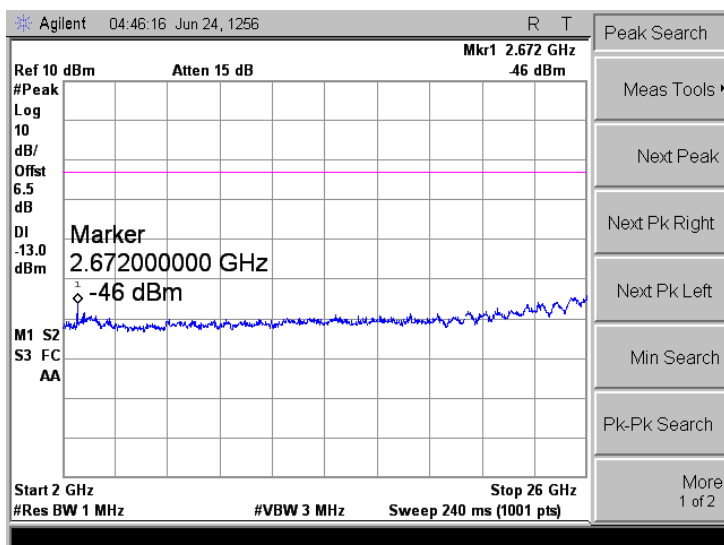
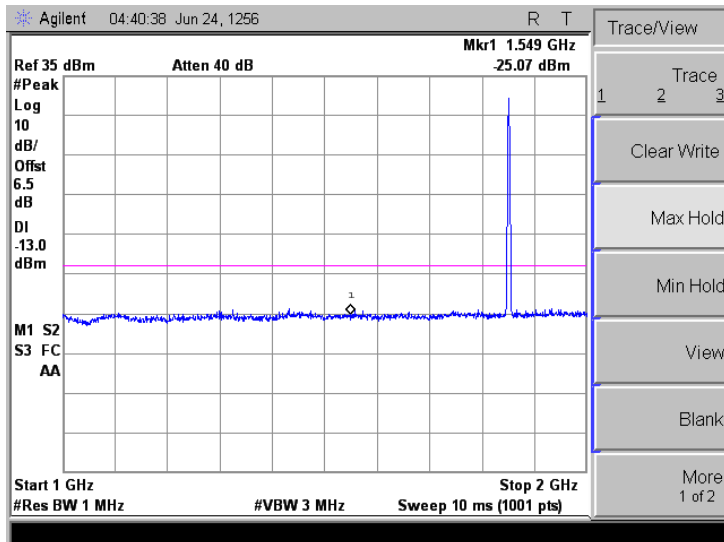
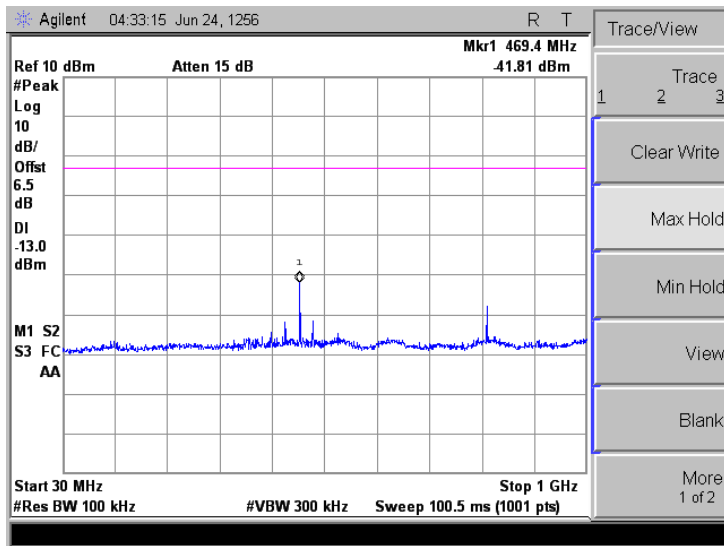


High Band Emission



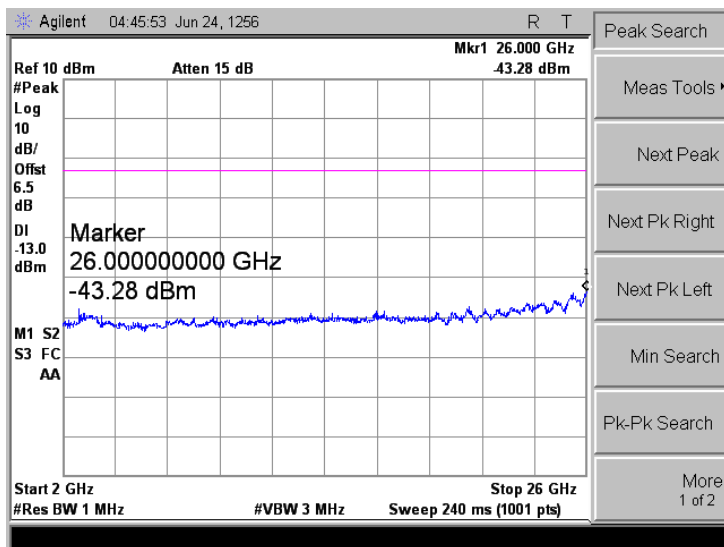
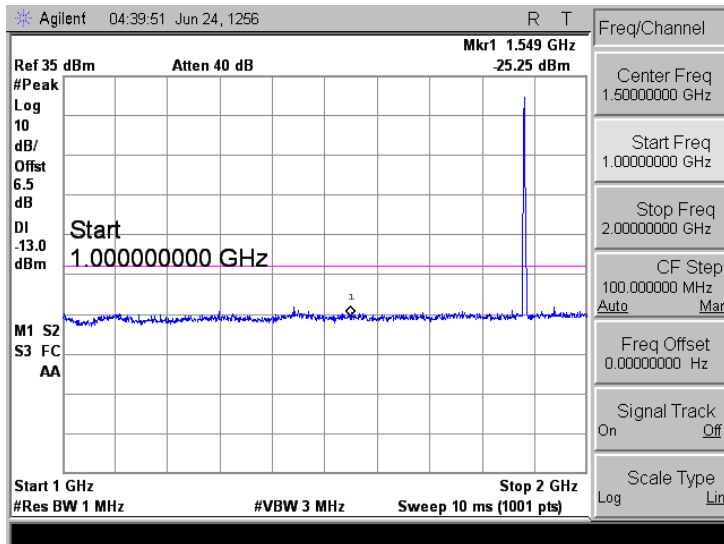
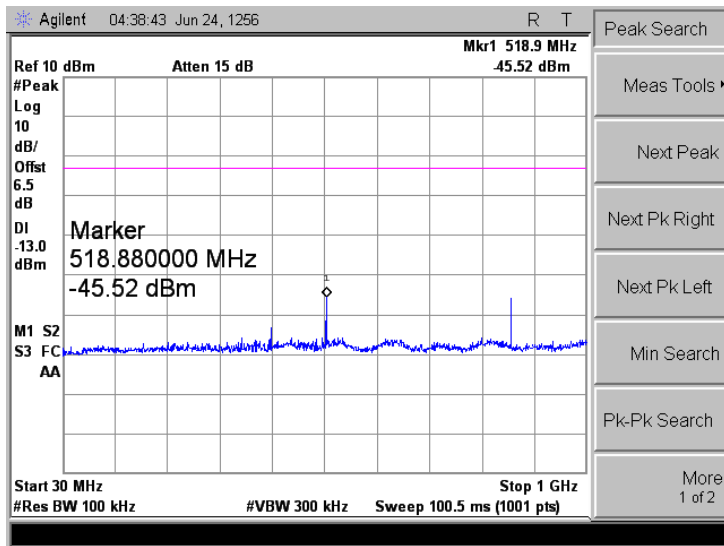
EGPRS1900

Low Channel



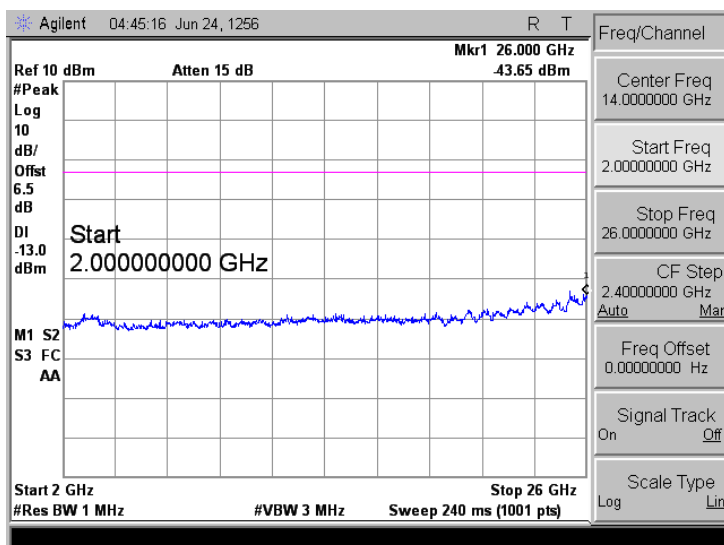
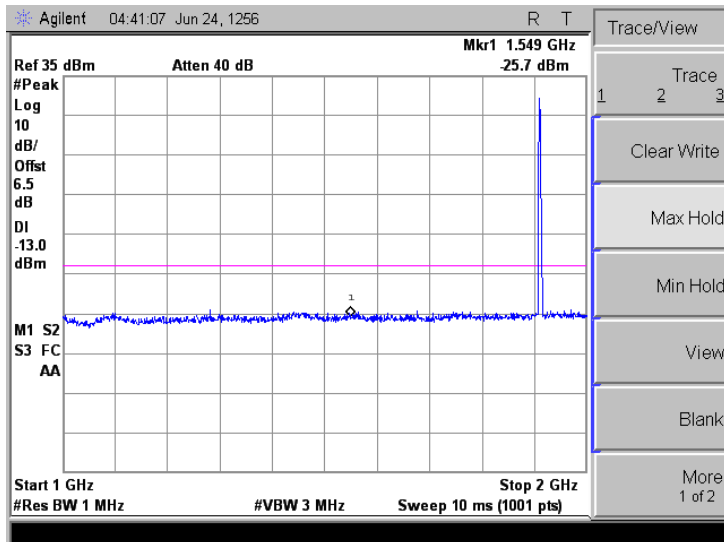
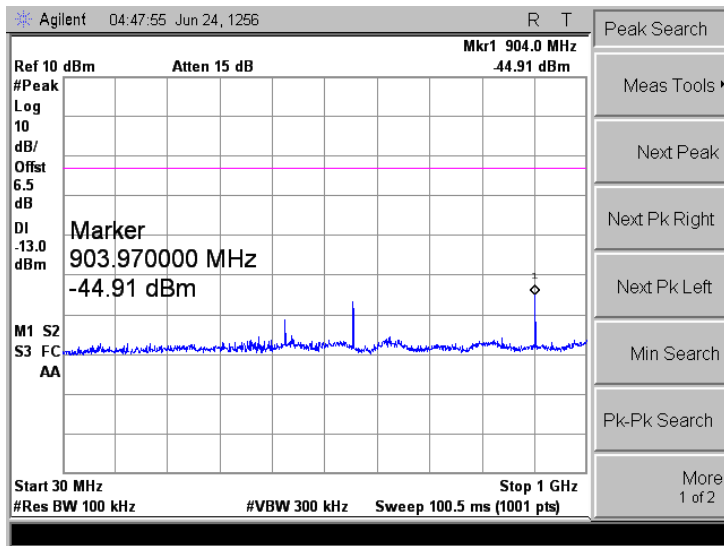
EGPRS1900

Middle Channel



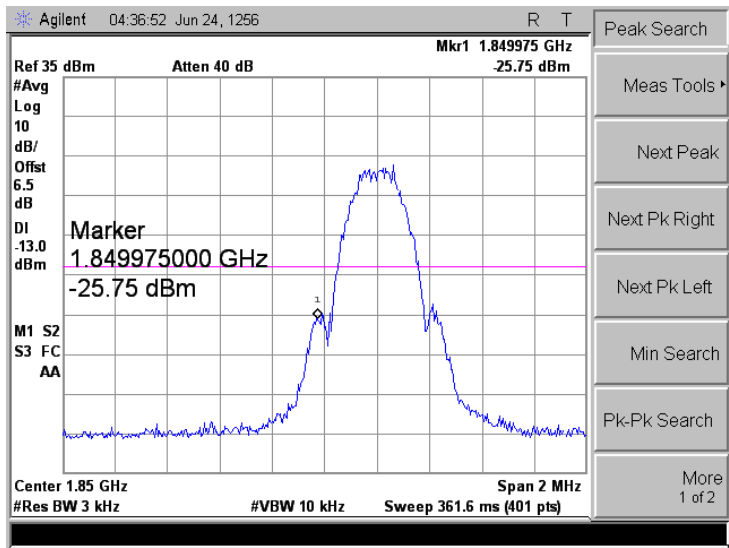
EGPRS1900

High Channel

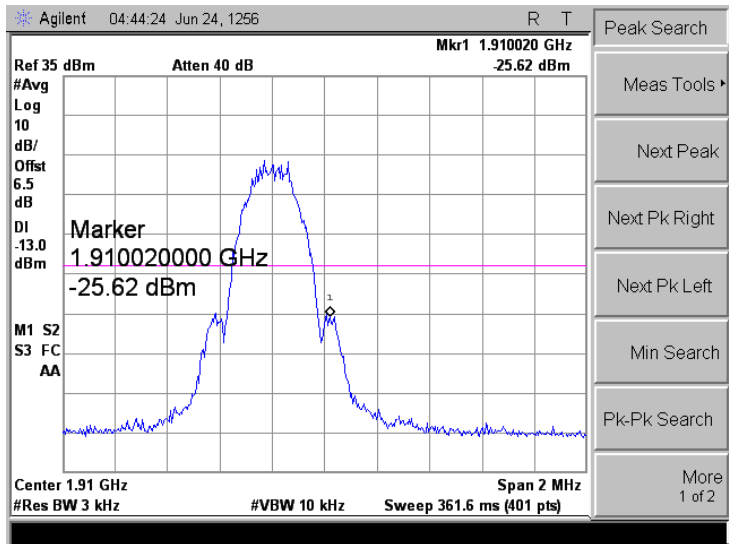


EGPRS1900

Low Band Emission

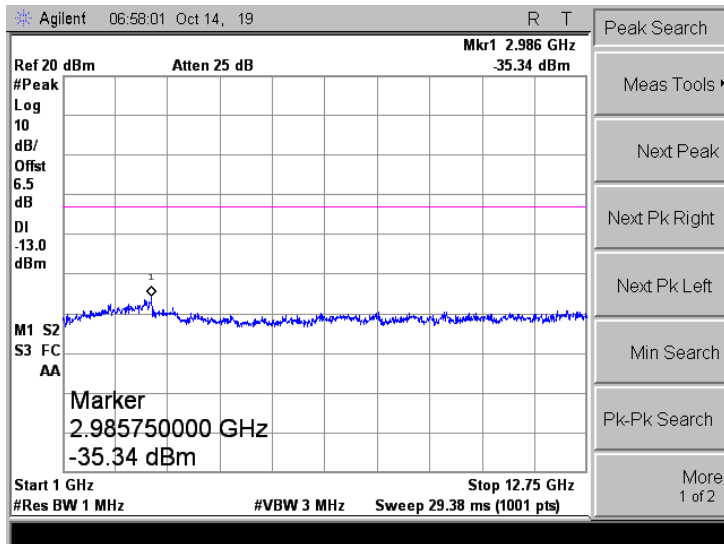
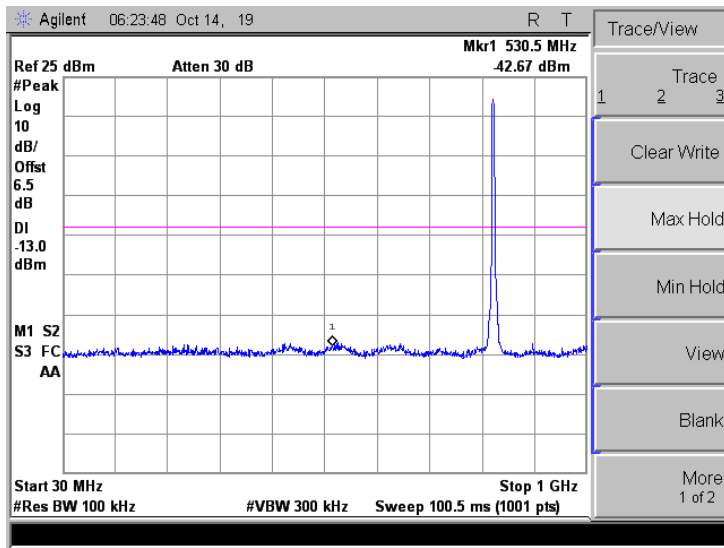


High Band Emission



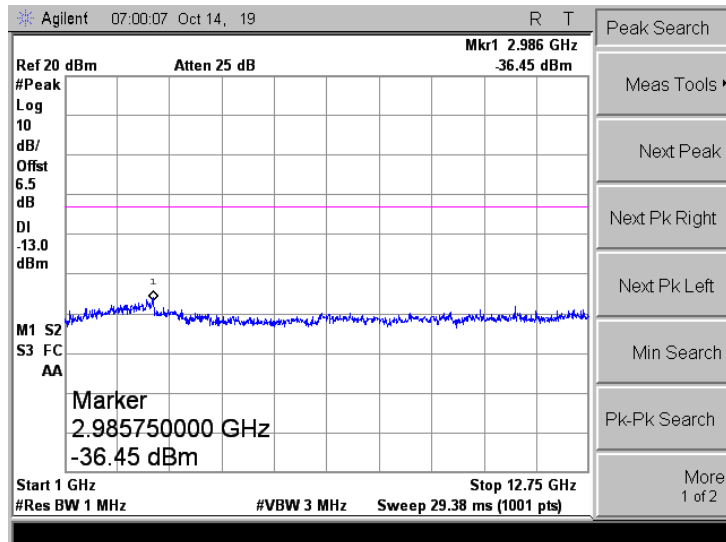
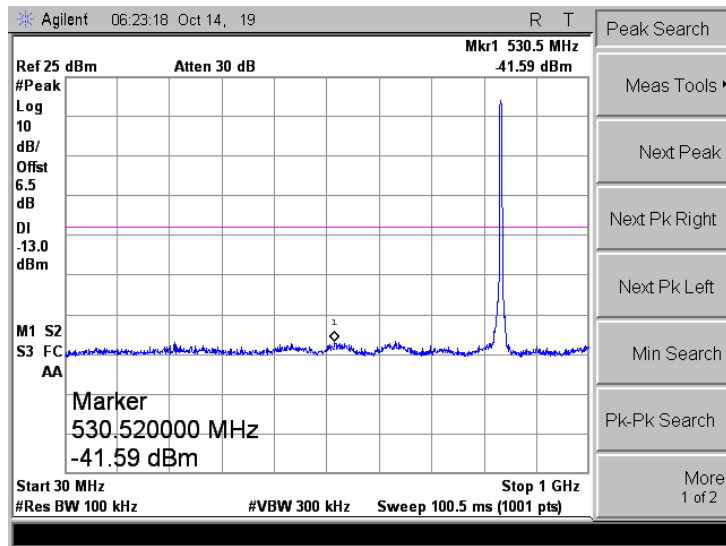
WCDMA Band V

Low Channel



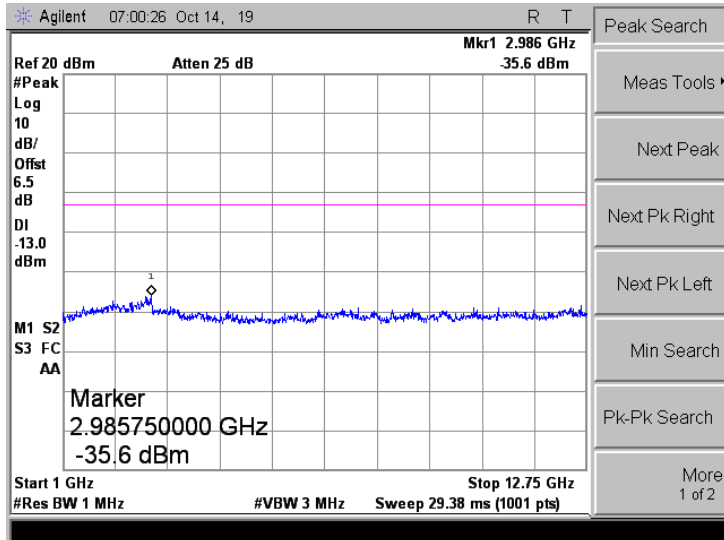
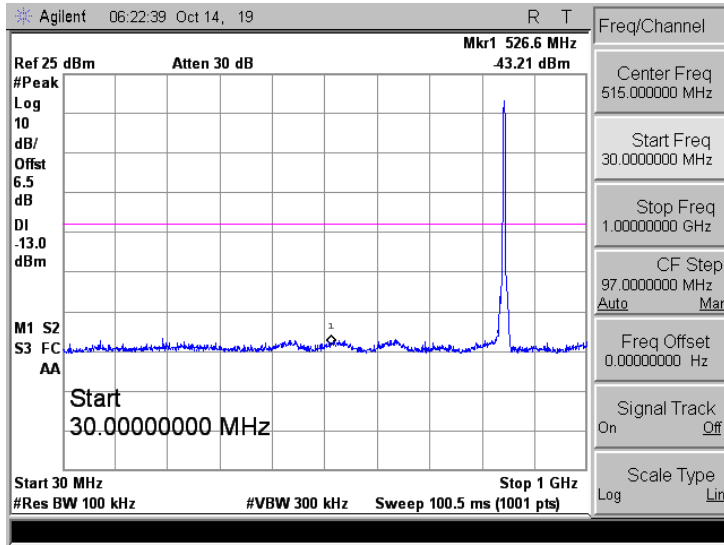
WCDMA Band V

Middle Channel



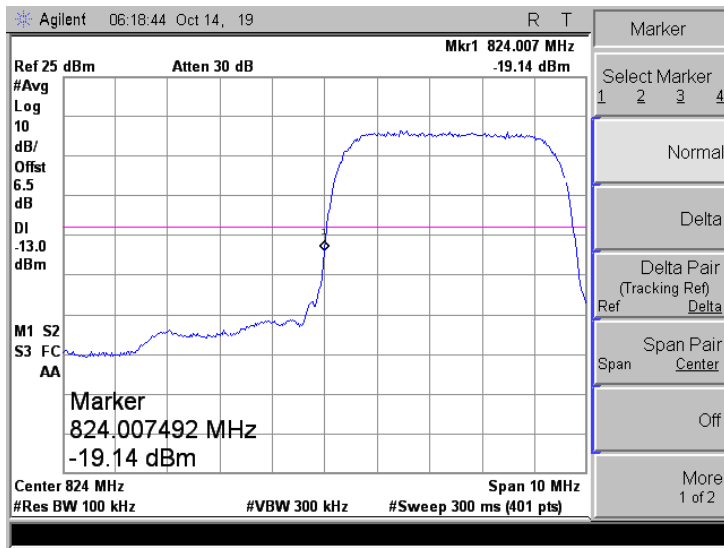
WCDMA Band V

High Channel

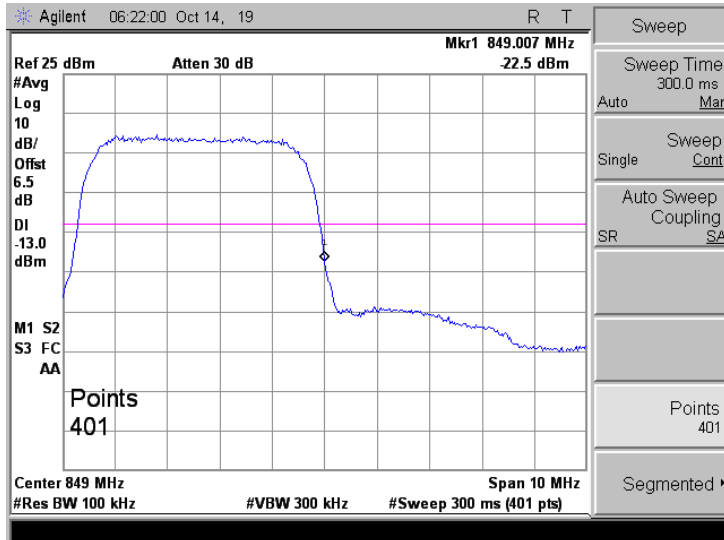


WCDMA Band V

Low Band Emission

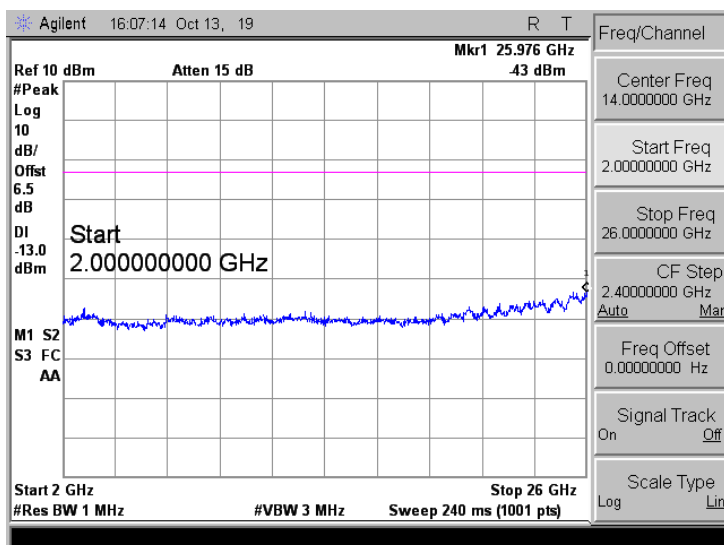
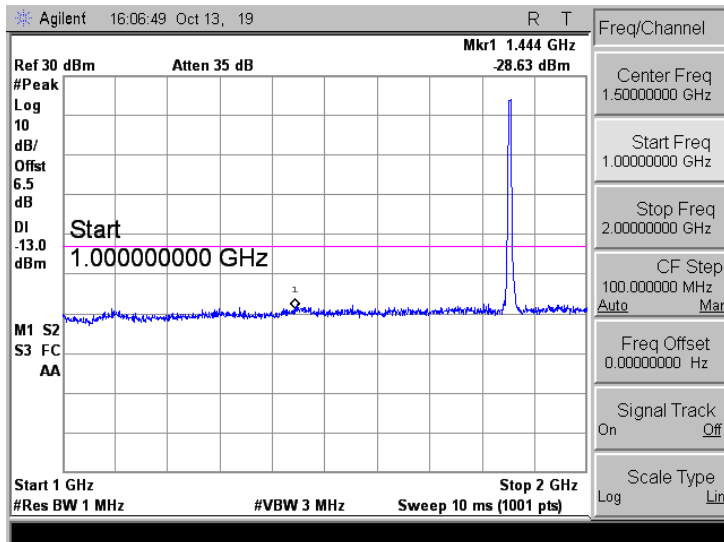
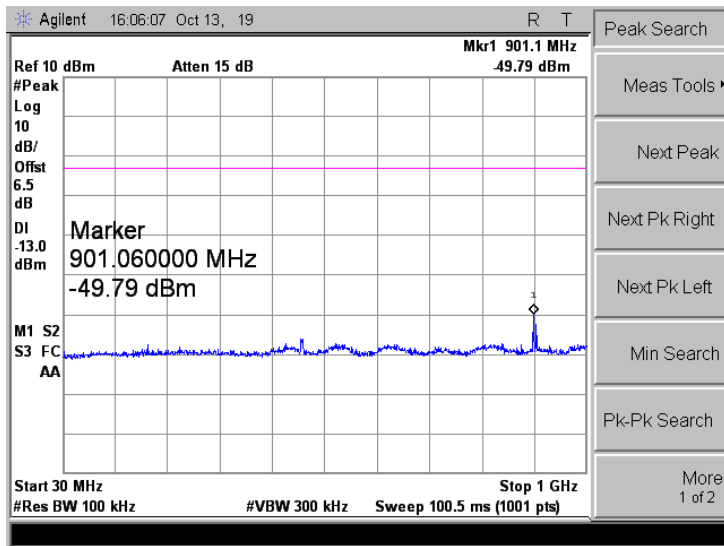


High Band Emission



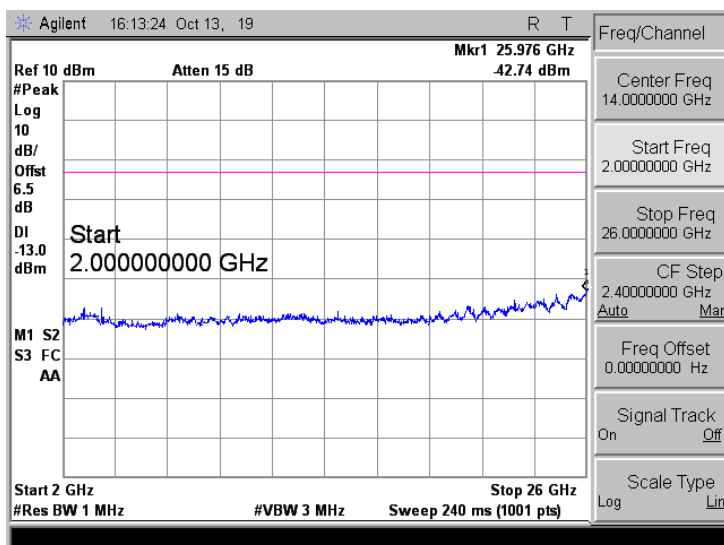
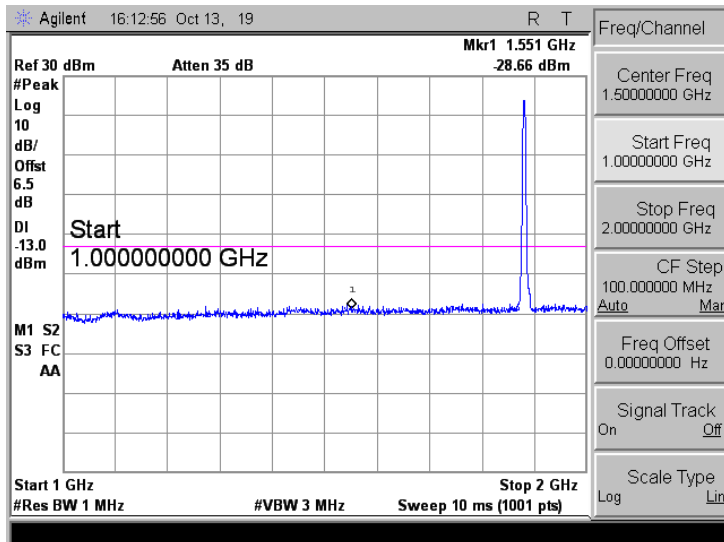
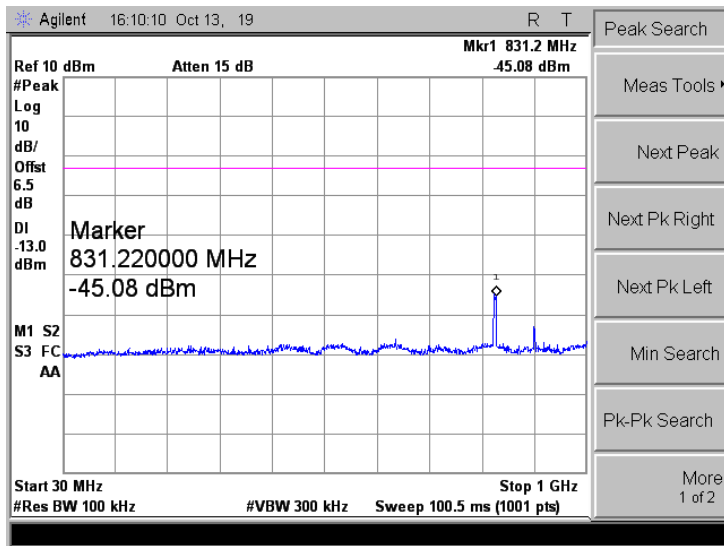
WCDMA Band II

Low Channel



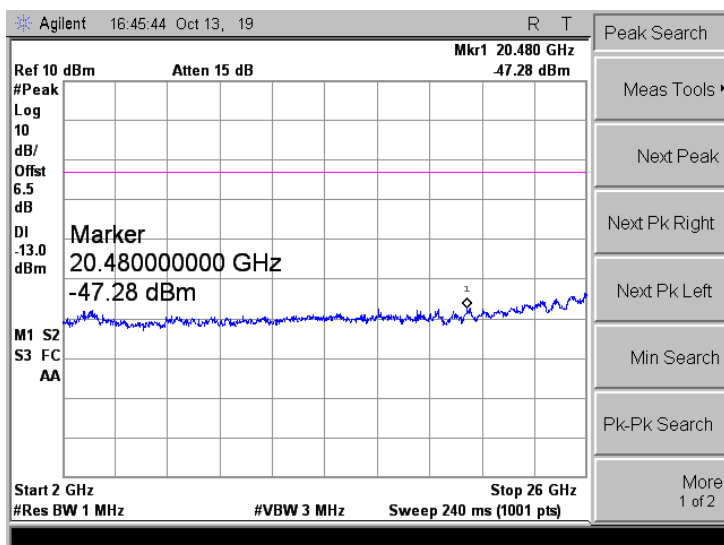
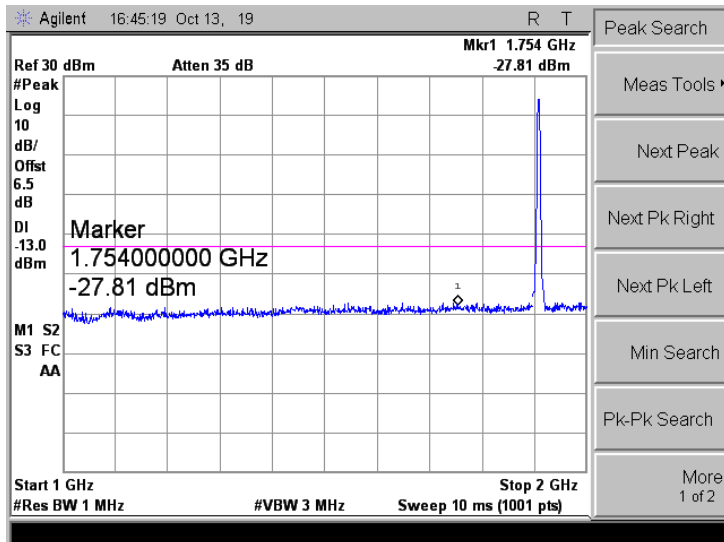
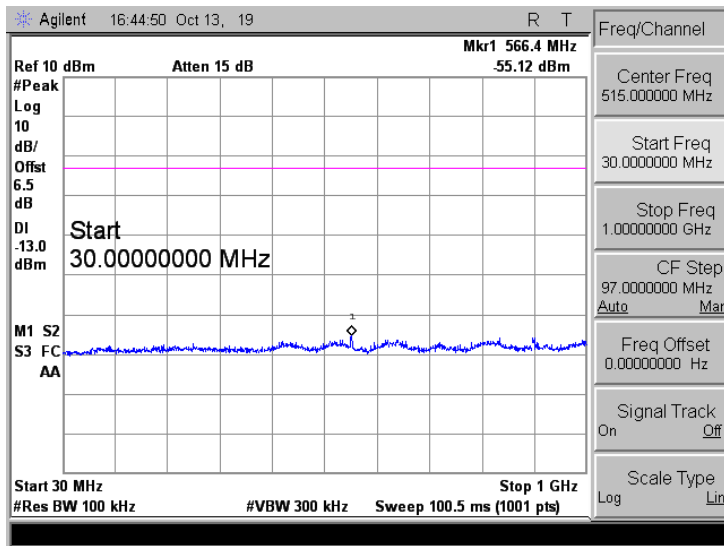
WCDMA Band II

Middle Channel



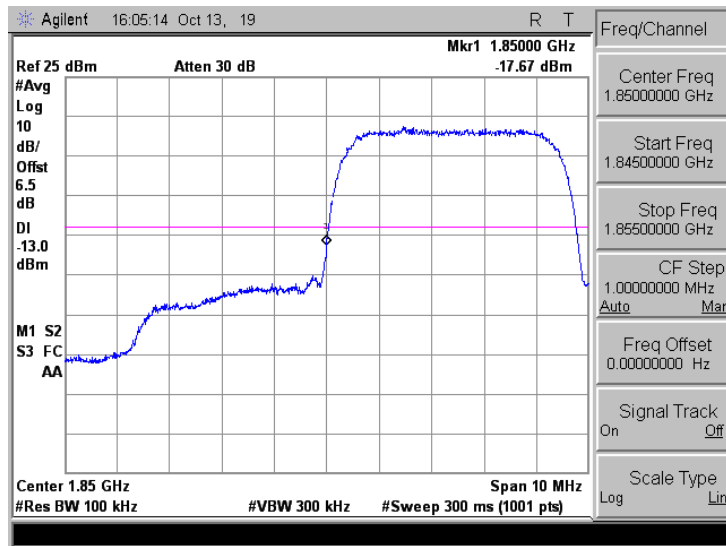
WCDMA Band II

High Channel

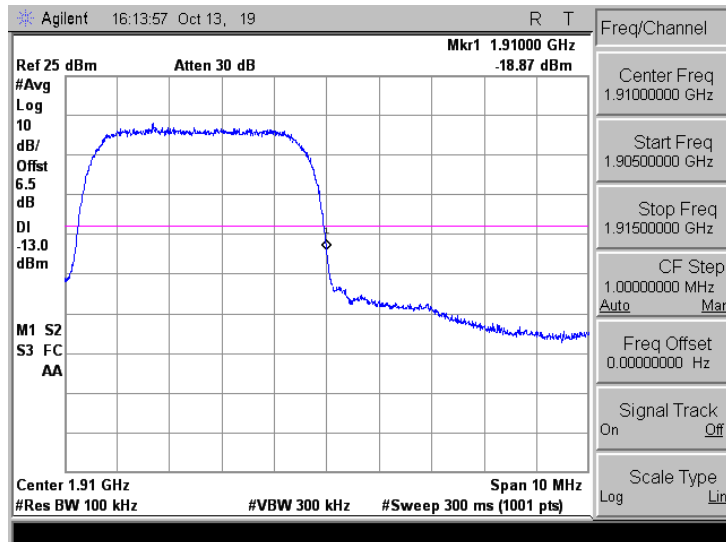


WCDMA Band II

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.

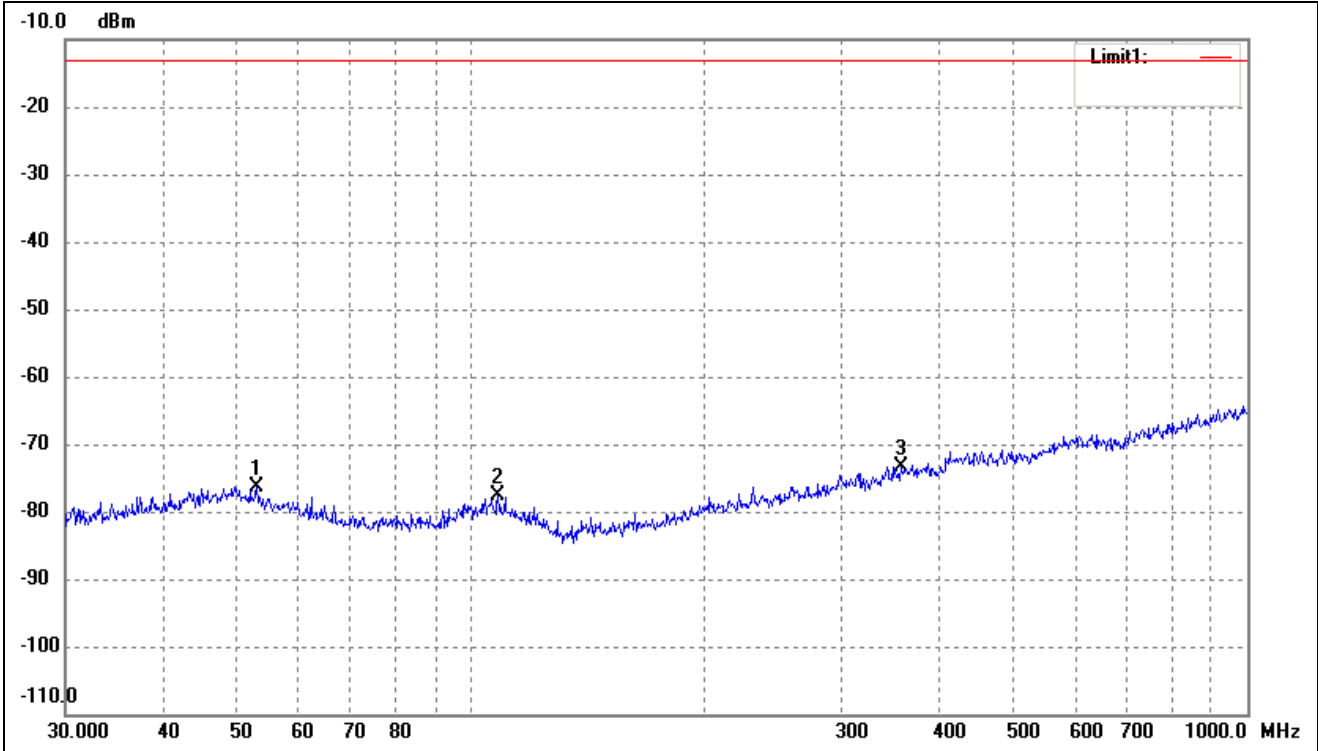
Spurious attenuation limit in dB = $43 + 10 \log_{10}(\text{power out in Watts})$

8.3 Summary of Test Results/Plots

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

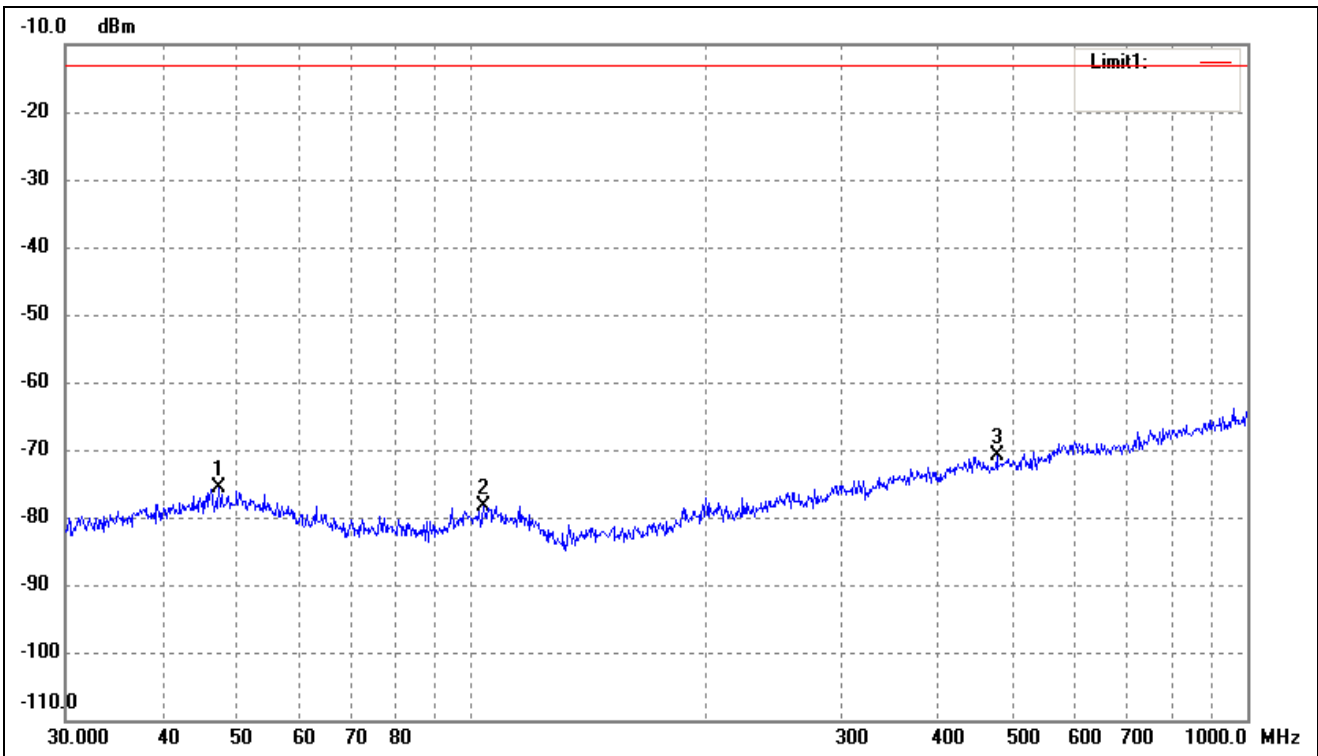
➤ Spurious Emissions Below 1GHz

For Cellular Band			
Test Channel	GSM850	Polarity:	Horizontal



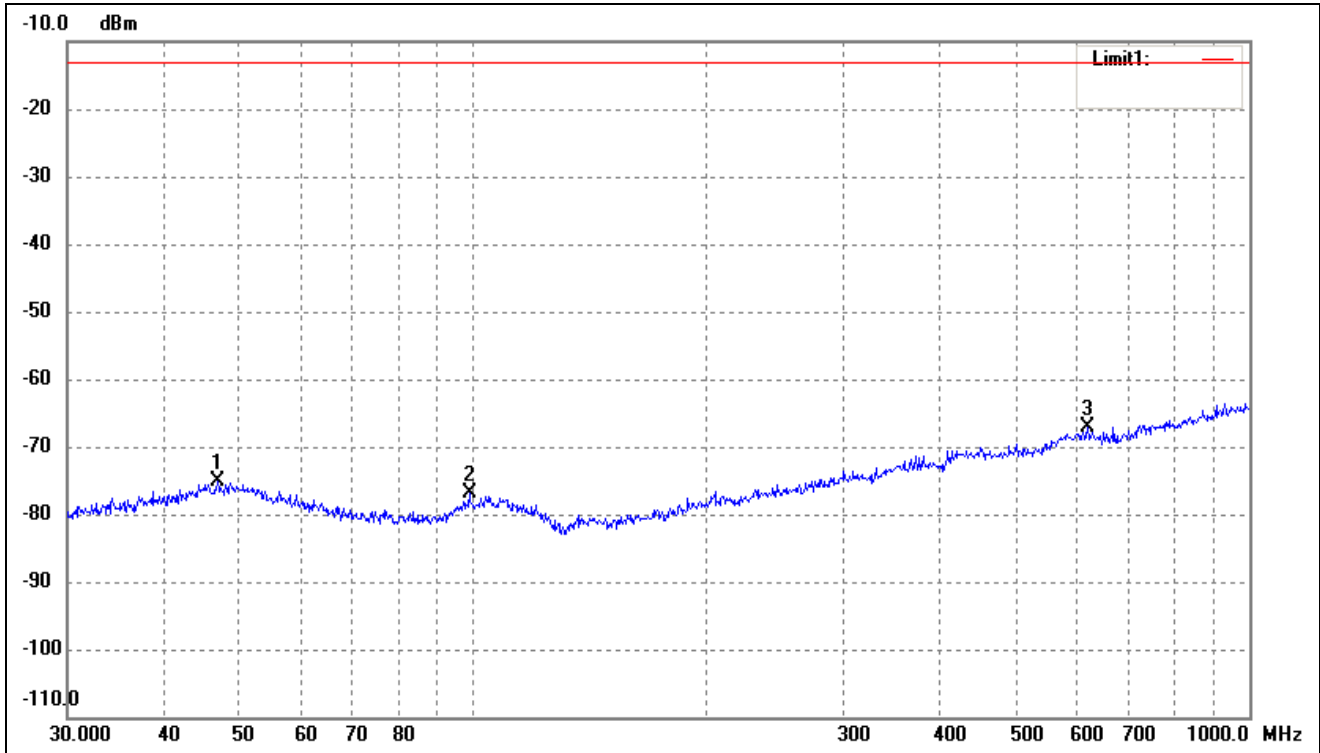
No.	Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	52.9453	-76.41	0.12	-76.29	-13.00	-63.29	ERP
2	108.2667	-76.32	-1.25	-77.57	-13.00	-64.57	ERP
3	357.9287	-77.16	3.89	-73.27	-13.00	-60.27	ERP

For Cellular Band			
Test Channel	GSM850	Polarity:	Vertical



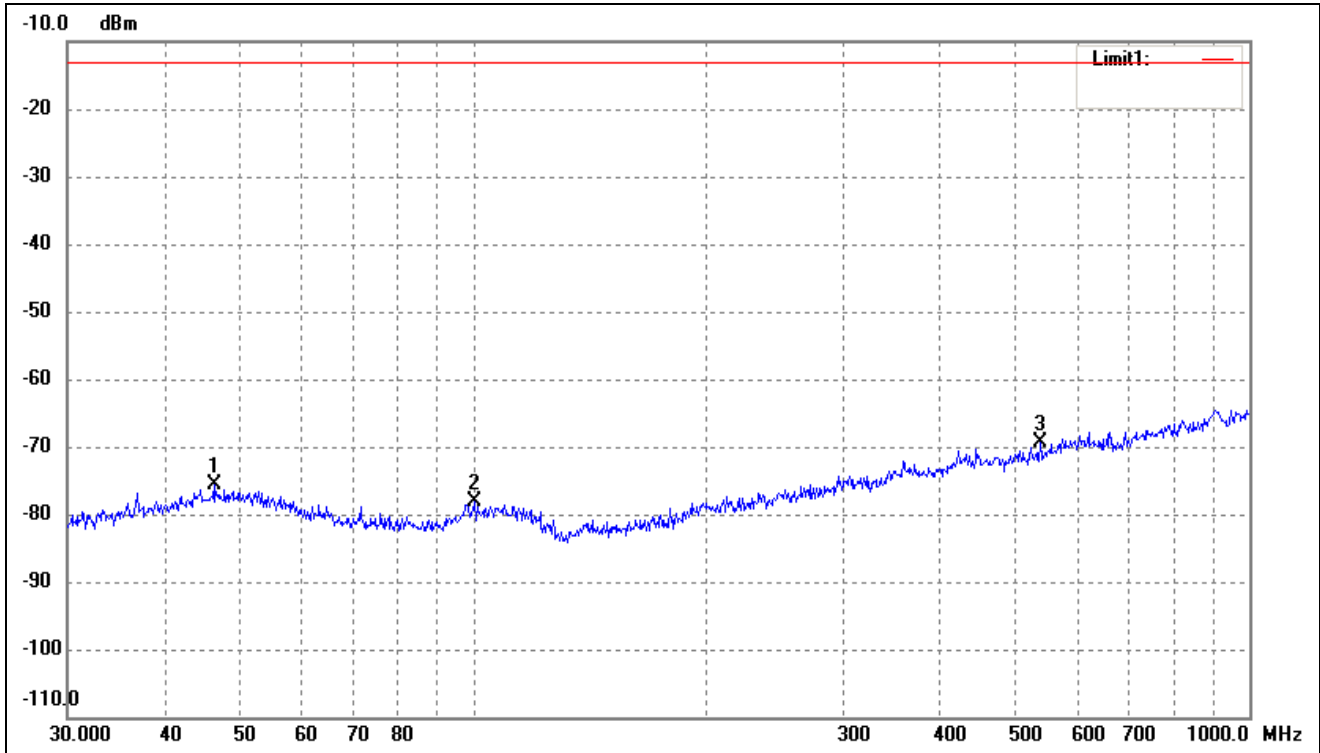
No.	Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	47.3255	-76.33	0.62	-75.71	-13.00	-62.71	ERP
2	103.8055	-76.95	-1.32	-78.27	-13.00	-65.27	ERP
3	475.4991	-76.15	5.21	-70.94	-13.00	-57.94	ERP

For Cellular Band			
Test Channel	GSM1900	Polarity:	Horizontal



No.	Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	46.8303	-75.68	0.59	-75.09	-13.00	-62.09	ERP
2	98.8326	-75.20	-1.65	-76.85	-13.00	-63.85	ERP
3	618.5369	-74.84	7.70	-67.14	-13.00	-54.14	ERP

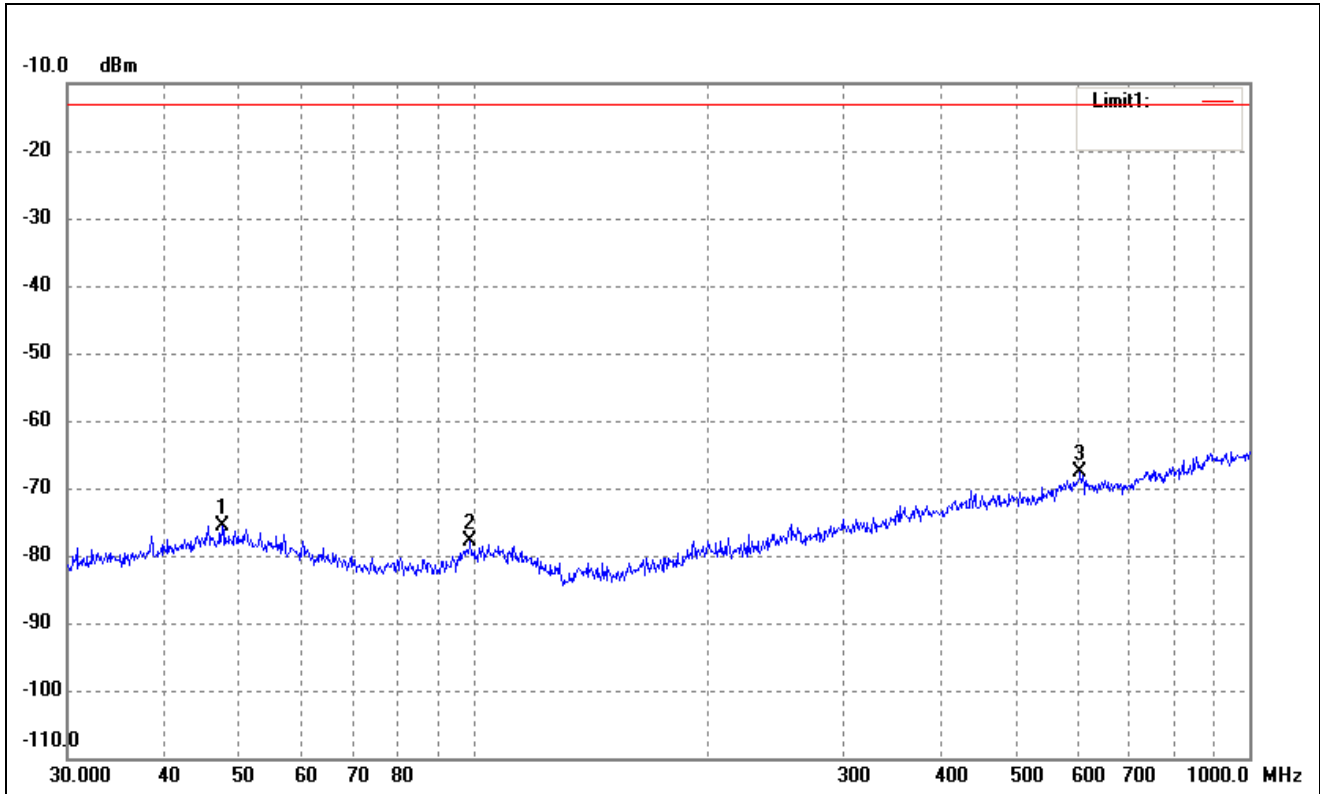
For Cellular Band			
Test Channel	GSM1900	Polarity:	Vertical



No.	Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	46.3402	-76.27	0.55	-75.72	-13.00	-62.72	ERP
2	100.5806	-76.74	-1.37	-78.11	-13.00	-65.11	ERP
3	537.5891	-75.29	5.97	-69.32	-13.00	-56.32	ERP

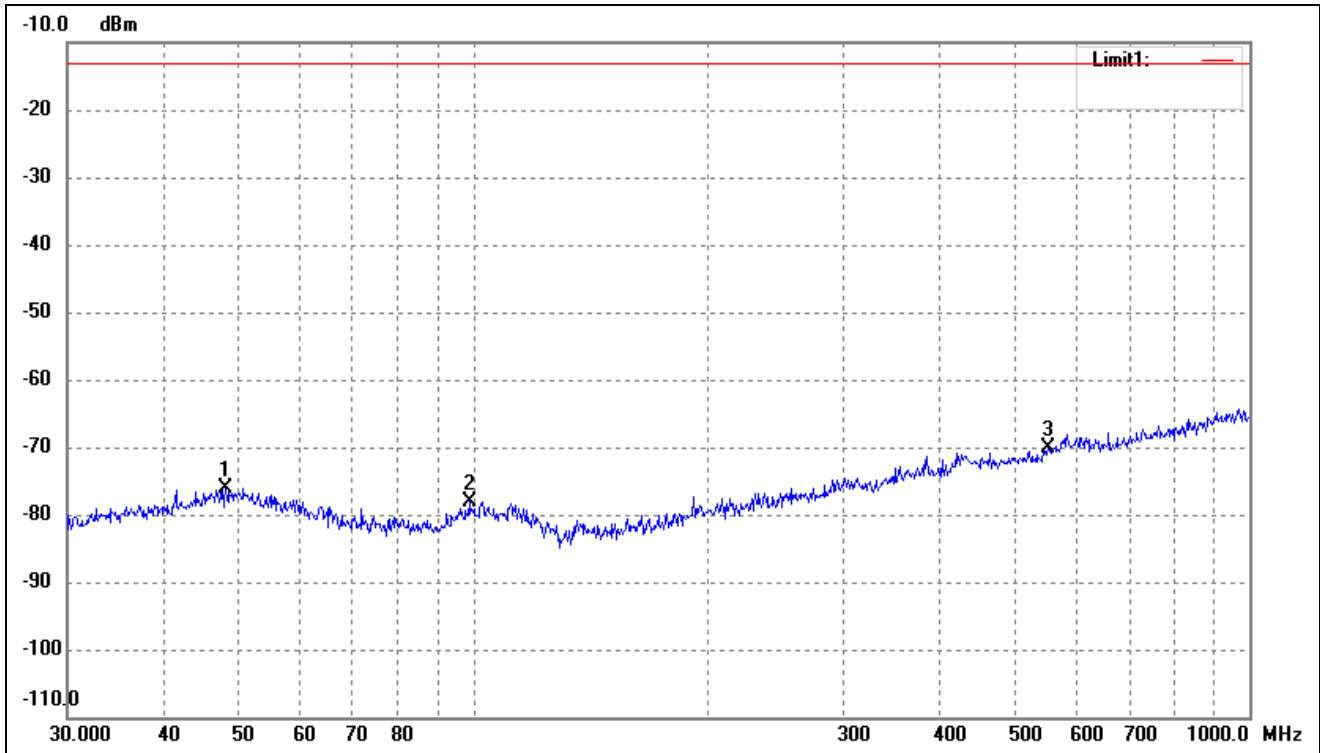
Note: Margin= (Reading+ Correct)- Limit

Test Channel	band 5	Polarity:	Horizontal
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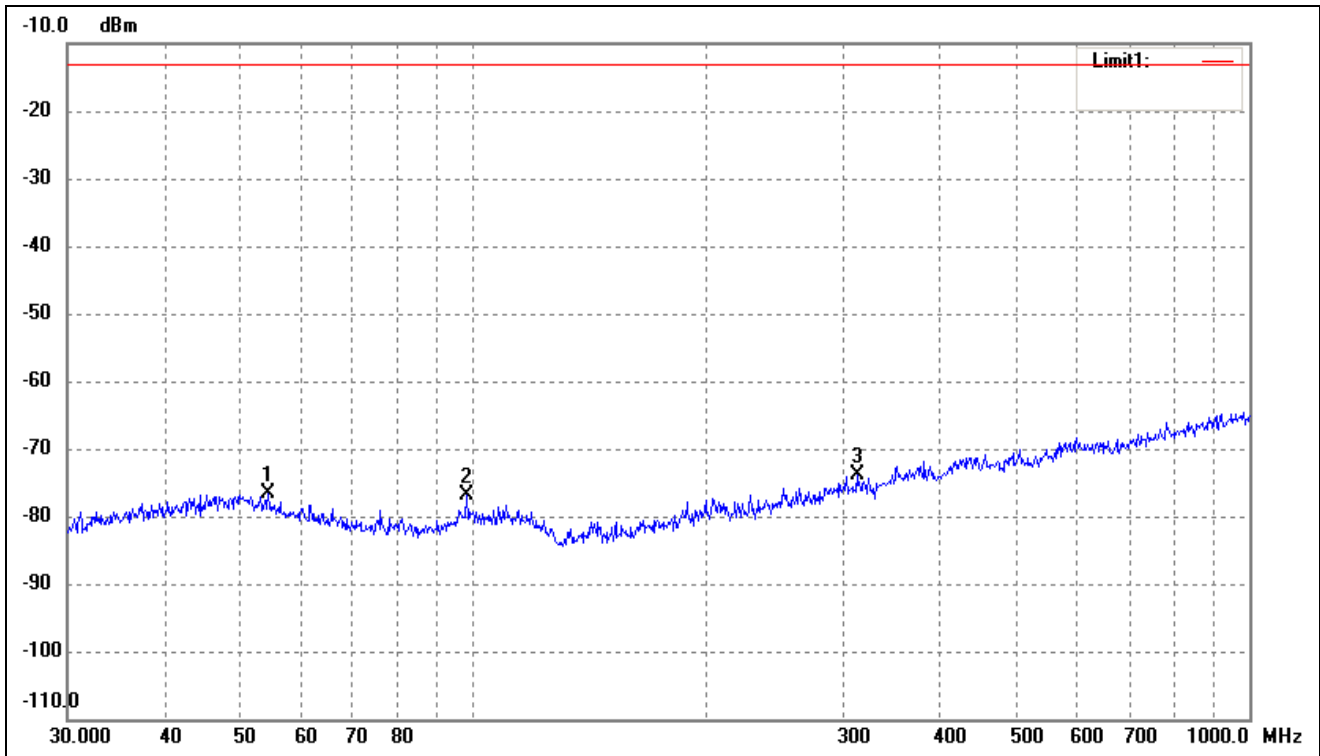
No.	Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	47.4918	-76.20	0.63	-75.57	-13.00	-62.57	ERP
2	99.1797	-76.38	-1.56	-77.94	-13.00	-64.94	ERP
3	605.6592	-75.42	7.75	-67.67	-13.00	-54.67	ERP

Test Channel	band 5	Polarity:	Vertical
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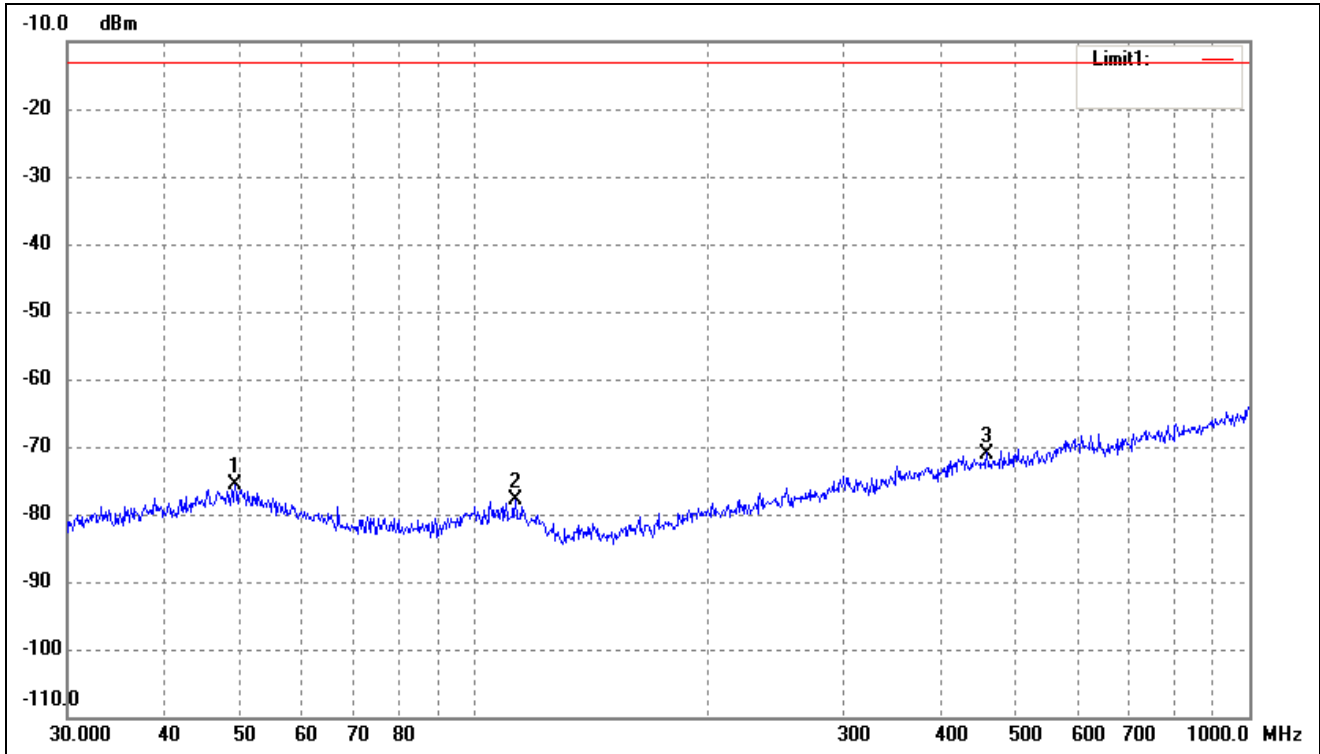
No.	Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	47.9940	-76.88	0.67	-76.21	-13.00	-63.21	ERP
2	98.8326	-76.35	-1.65	-78.00	-13.00	-65.00	ERP
3	550.9480	-76.45	6.34	-70.11	-13.00	-57.11	ERP

Test Channel	band 2	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	54.4516	-76.49	-0.22	-76.71	-13.00	-63.71	ERP
2	98.1419	-75.02	-1.81	-76.83	-13.00	-63.83	ERP
3	312.1794	-76.29	2.50	-73.79	-13.00	-60.79	ERP

Test Channel	band 2	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark
1	49.3594	-76.32	0.76	-75.56	-13.00	-62.56	ERP
2	113.3163	-76.38	-1.59	-77.97	-13.00	-64.97	ERP
3	459.1144	-76.22	5.22	-71.00	-13.00	-58.00	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	-37.26	4.94	-32.32	-13	-19.32	H
2472.6	-44.48	8.46	-36.02	-13	-23.02	H
1648.4	-37.65	4.94	-32.71	-13	-19.71	V
2472.6	-41.74	8.46	-33.28	-13	-20.28	V
Middle Channel (836.6MHz)						
1673.2	-36.13	5.11	-31.02	-13	-18.02	H
2509.8	-43.32	8.54	-34.78	-13	-21.78	H
1673.2	-35.07	5.11	-29.96	-13	-16.96	V
2509.8	-42.93	8.54	-34.39	-13	-21.39	V
High Channel (848.8MHz)						
1697.6	-37.35	5.25	-32.1	-13	-19.1	H
2546.4	-41.25	8.57	-32.68	-13	-19.68	H
1697.6	-36.41	5.25	-31.16	-13	-18.16	V
2546.4	-41.4	8.57	-32.83	-13	-19.83	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	-41.11	10.54	-30.57	-13	-17.57	H
5550.6	-47.02	13.37	-33.65	-13	-20.65	H
3700.4	-39.25	10.54	-28.71	-13	-15.71	V
5550.6	-47.19	13.37	-33.82	-13	-20.82	V
Middle Channel (1880MHz)						
3760.0	-42.92	10.64	-32.28	-13	-19.28	H
5640.0	-49.76	13.54	-36.22	-13	-23.22	H
3760.0	-40.49	10.64	-29.85	-13	-16.85	V
5640.0	-46.14	13.54	-32.6	-13	-19.6	V
High Channel (1909.8MHz)						
3819.6	-42.88	10.74	-32.14	-13	-19.14	H
5729.4	-47.91	13.71	-34.2	-13	-21.2	H
3819.6	-41.2	10.74	-30.46	-13	-17.46	V
5729.4	-49.18	13.71	-35.47	-13	-22.47	V

➤ For WCDMA Band V Mode

Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Polar H/V
Low Channel (826.4MHz)						
1652.8	-36.59	4.94	-31.65	-13	-18.65	H
2479.2	-43.57	8.46	-35.11	-13	-22.11	H
1652.8	-36.82	4.94	-31.88	-13	-18.88	V
2479.2	-41.64	8.46	-33.18	-13	-20.18	V
Middle Channel (836.6MHz)						
1672.8	-35.43	5.11	-30.32	-13	-17.32	H
2509.2	-44.22	8.54	-35.68	-13	-22.68	H
1672.8	-37.43	5.11	-32.32	-13	-19.32	V
2509.2	-44.8	8.54	-36.26	-13	-23.26	V
High Channel (846.6MHz)						
1693.2	-34.88	5.25	-29.63	-13	-16.63	H
2539.8	-41.11	8.57	-32.54	-13	-19.54	H
1693.2	-34.38	5.25	-29.13	-13	-16.13	V
2539.8	-41.51	8.57	-32.94	-13	-19.94	V

➤ For WCDMA Band II Mode

Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Polar H/V
Low Channel (1852.4MHz)						
3704.8	-42.94	10.54	-32.4	-13	-19.4	H
5557.2	-46.64	13.37	-33.27	-13	-20.27	H
3704.8	-41.49	10.54	-30.95	-13	-17.95	V
5557.2	-49.92	13.37	-36.55	-13	-23.55	V
Middle Channel (1880MHz)						
3760.8	-41.09	10.64	-30.45	-13	-17.45	H
5640.0	-47.74	13.54	-34.2	-13	-21.2	H
3760.8	-39.72	10.64	-29.08	-13	-16.08	V
5640.0	-49.06	13.54	-35.52	-13	-22.52	V
High Channel (1907.6MHz)						
3815.2	-40.35	10.74	-29.61	-13	-16.61	H
5722.8	-46.94	13.71	-33.23	-13	-20.23	H
3815.2	-40.44	10.74	-29.7	-13	-16.7	V
5722.8	-48.1	13.71	-34.39	-13	-21.39	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	68	0.0818	2.50	Pass
	-20	53	0.0634		
	-10	49	0.0588		
	0	43	0.0515		
	10	36	0.0432		
	20	28	0.0340		
	30	35	0.0423		
	40	43	0.0515		
	50	51	0.0607		
Reference Frequency: PCS1900 Middle channel=661 channel=1880MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
NV	-30	65	0.0344	2.50	Pass
	-20	58	0.0307		
	-10	48	0.0258		
	0	42	0.0225		
	10	38	0.0205		
	20	31	0.0164		
	30	35	0.0188		
	40	40	0.0213		
	50	47	0.0250		

Reference Frequency: WCDMA Band V Middle channel=4183 channel=836.6MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
NV	-30	62	0.0736	2.50	Pass
	-20	56	0.0671		
	-10	47	0.0561		
	0	39	0.0469		
	10	34	0.0405		
	20	28	0.0340		
	30	35	0.0423		
	40	42	0.0497		
	50	49	0.0588		
Reference Frequency: WCDMA Band II Middle channel=9400 channel=1880MHz					
Power supplied (Vdc)	Temperature (°C)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
NV	-30	53	0.0282	2.50	Pass
	-20	45	0.0241		
	-10	37	0.0196		
	0	33	0.0176		
	10	28	0.0151		
	20	23	0.0123		
	30	28	0.0151		
	40	34	0.0180		
	50	38	0.0200		

➤ 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	59	0.0708	2.50	Pass
	NV	45	0.0533		
	LV	36	0.0432		
Reference Frequency: PCS1900 (GSM link) Middle channel=661 channel=1880MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	HV	58	0.0311	2.50	Pass
	NV	51	0.0270		
	LV	42	0.0225		
Reference Frequency: WCDMA Band V Middle channel=4183 channel=836.6MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	HV	53	0.0634	2.50	Pass
	NV	43	0.0515		
	LV	36	0.0432		
Reference Frequency: WCDMA Band II Middle channel=9400 channel=1880MHz					
Temperature (°C)	Power supplied (Vdc)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
25	HV	59	0.0315	2.50	Pass
	NV	50	0.0266		
	LV	40	0.0213		

10. Modulation characteristics

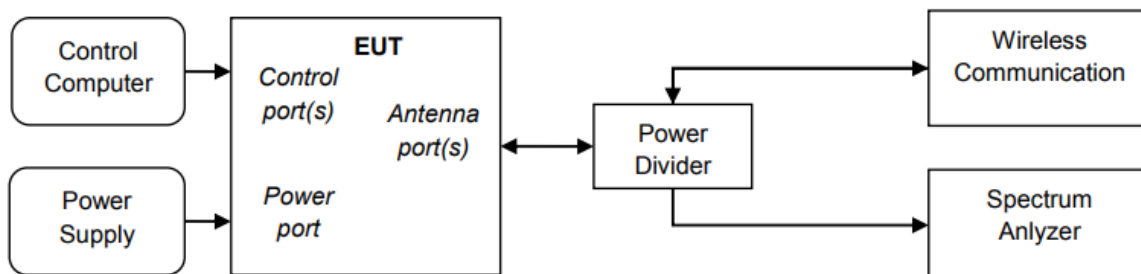
10.1 Standard Applicable

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.

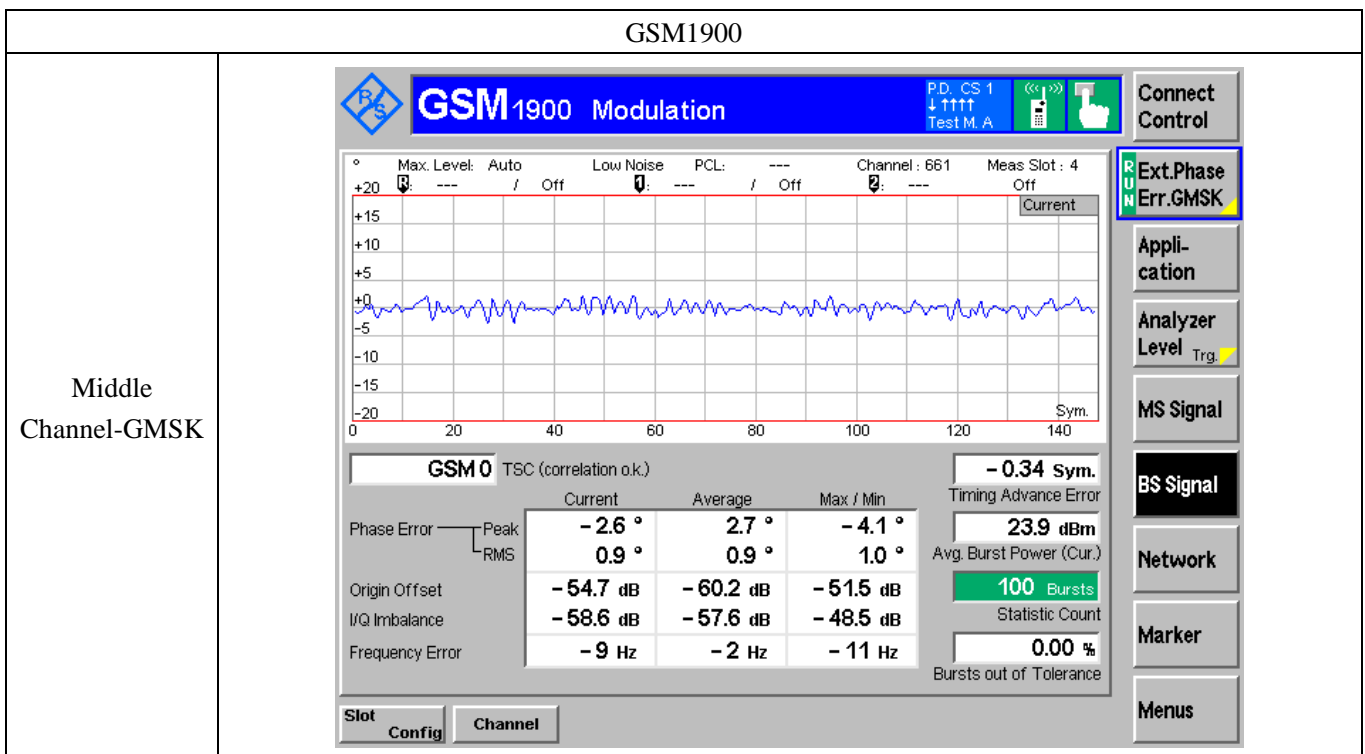
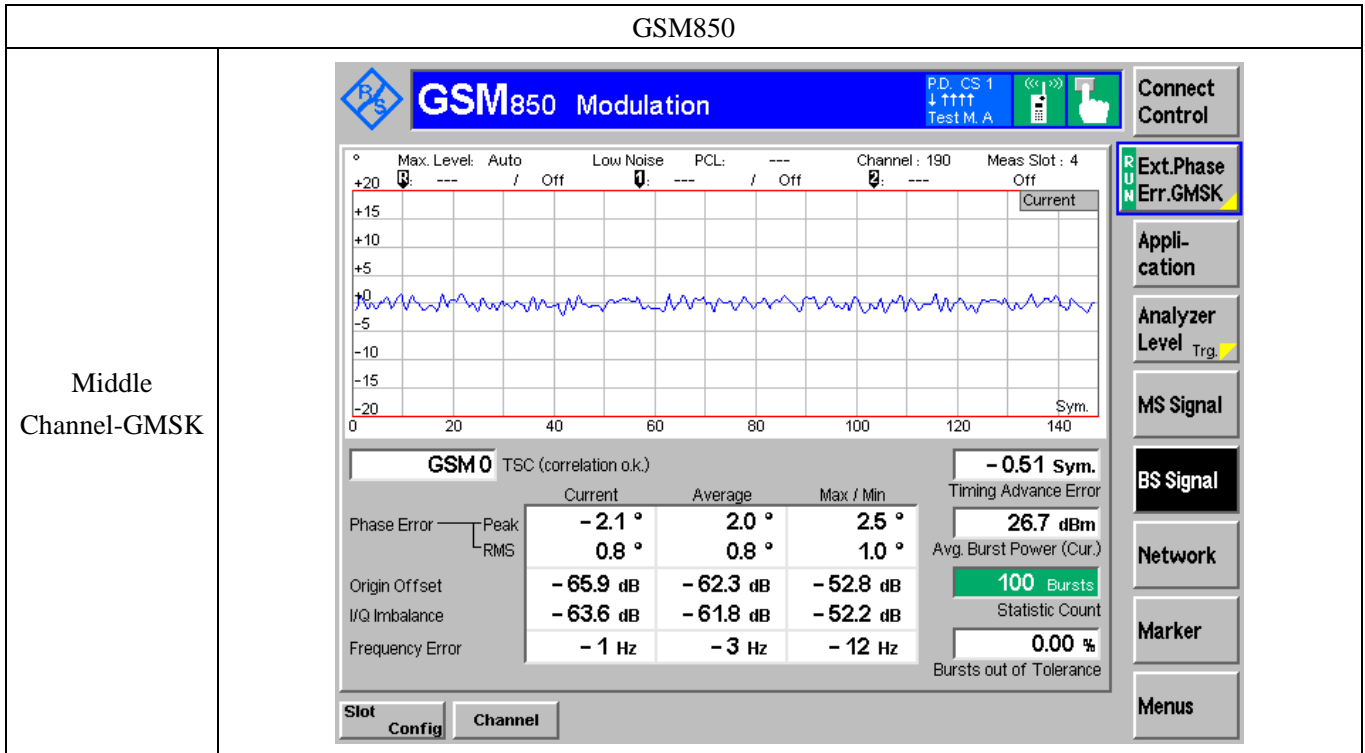
10.2 Test Procedure

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

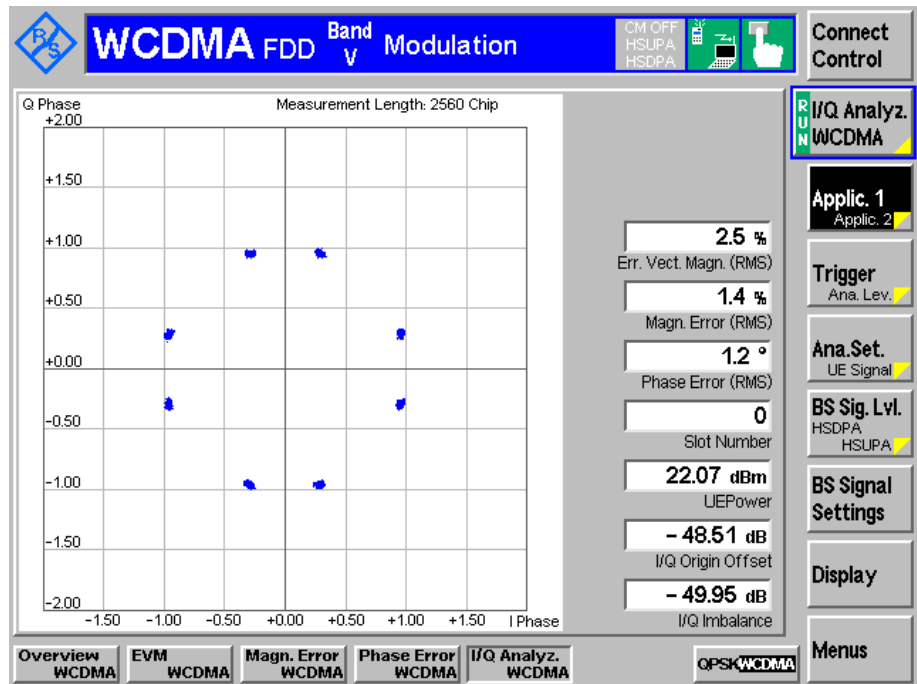


10.3 Summary of Test Results/Plots

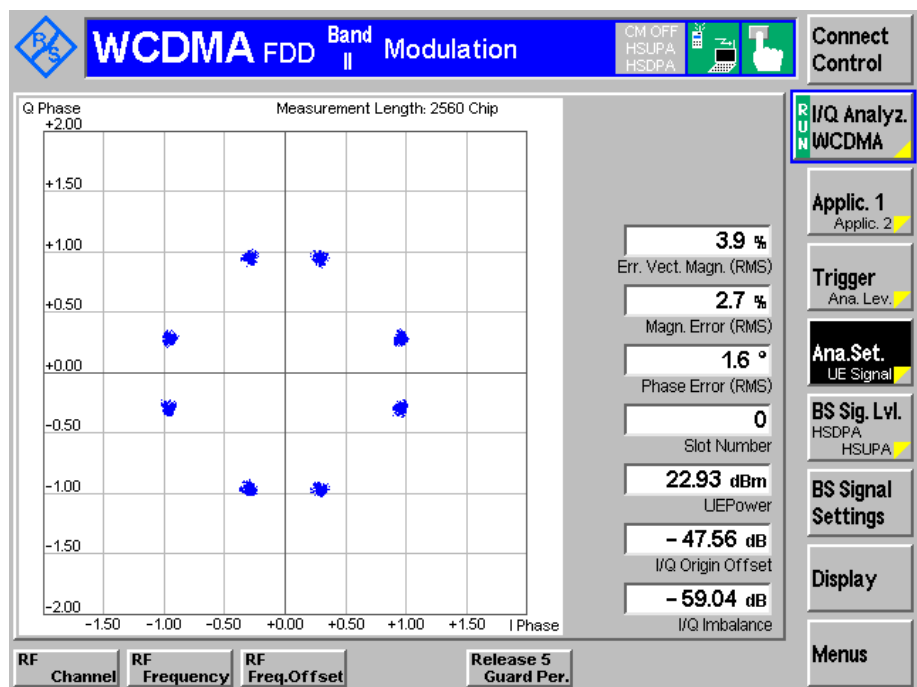
Only the worst case was selected to record



WCDMA B5



WCDMA B2



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