MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313
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July 31, 2014

Digital Receiver Technology, Inc.
12409 Milestone Center Dr.
Germantown, MD 20876

Dear Steve Hudson,

Enclosed is the EMC Wireless test report for compliance testing of the Digital Receiver Technology, Inc., DRT9957B - Amplifier as tested to the requirements of the FCC Certification rules under Title 47 of the CFR Part 22 Subpart H for Cellular Devices and FCC Part 24 Subpart E for Broadband PCS Devices.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\Digital Receiver Technology, Inc.\EMC39286A-FCC22_24 Rev. 2)

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Electromagnetic Compatibility Criteria
Test Report

for the

Digital Receiver Technology, Inc.
Model DRT9957B - Amplifier

Tested under
FCC Certification Rules
Title 47 of the CFR,
Part 22 Subpart H for Cellular Devices
&
Part 24 Subpart E for Broadband PCS Devices

MET Report: EMC39286A-FCC22_24 Rev. 2

July 31, 2014

Prepared For:

Digital Receiver Technology, Inc.
12409 Milestone Center Dr.
Germantown, MD 20876

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave
Baltimore, MD 21230

Electromagnetic Compatibility Criteria
Test Report

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Digital Receiver Technology, Inc.
Model DRT9957B - Amplifier

Tested Under
FCC Certification Rules
Title 47 of the CFR,
Part 22 Subpart H for Cellular Devices
&
Part 24 Subpart E for Broadband PCS Devices

Benjamin Taylor
Project Engineer, Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 22 Subpart H and Part 15 Subpart B of the FCC Rules under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	January 23, 2014	Initial Issue
1	February 3, 2014	Revised to correct equipment code.
2	July 31, 2014	Revised to reflect engineer corrections.

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**er**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Digital Receiver Technology, Inc. DRT9957B - Amplifier, with the requirements of Part 22 Subpart H and Part 24 Subpart E. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the DRT9957B - Amplifier. Digital Receiver Technology, Inc. should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the DRT9957B - Amplifier, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 22 Subpart H and Part 24 Subpart E, in accordance with Digital Receiver Technology, Inc., purchase order number 053066.

Reference	Description	Compliance
Part 22 Subpart H §2.1046; §22.913 Part 24 Subpart E §2.1046; §24.232	RF Power Output	Compliant
§2.1049	Occupied Bandwidth	Compliant
§2.1051; §22.917, §24.238	Conducted Spurious Emissions at Antenna Terminals	Compliant
§2.1053; §22.917, §24.238	Radiated Spurious Emissions from the Cabinet	Compliant
§2.1055; §22.355, §24.135	Frequency stability	N/A
	Filter Response	Compliant
	Inter-Modulation	Compliant

Table 1. Executive Summary of EMC ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Digital Receiver Technology, Inc. to perform testing on the DRT9957B - Amplifier, under Digital Receiver Technology, Inc.'s purchase order number 053066.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Digital Receiver Technology, Inc., DRT9957B - Amplifier.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	DRT9957B - Amplifier		
Model(s) Covered:	DRT9957B - Amplifier		
Filing Status:	Original		
EUT Specifications:	Primary Power: 120 VAC, 60 Hz		
	FCC ID: XLM9957B1		
	Type of Modulations:	GSM, CDMA, and WCDMA	
	Equipment Code:	AMP	
	RF Power Output	43.97 dBm	43.97 dBm
	EUT Frequency Ranges:	869 – 894	1930 – 1990
Analysis:	The results obtained relate only to the item(s) tested.		
Environmental Test Conditions:	Temperature: 15-35º C		
	Relative Humidity: 30-60%		
	Barometric Pressure: 860-1060 mbar		
Evaluated by:	Benjamin Taylor		
Date(s):	July 31, 2014		

B. References

CFR 47, Part 22, Subpart H	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 22: Rules and Regulations for Cellular Devices.
CFR 47, Part 24, Subpart E	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 24: Rules and Regulations for Personal Communications Services
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories
EIA/TIA-603-A-2001	Land Mobile FM or PM Communication Equipment Measurement and Performance Standards

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave, Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The DRT9957B - Amplifier, Equipment Under Test (EUT), is an RF power amplifier used with DRT base stations operating in the cellular, PCS, AWS, and TDMA 850MHz bands.

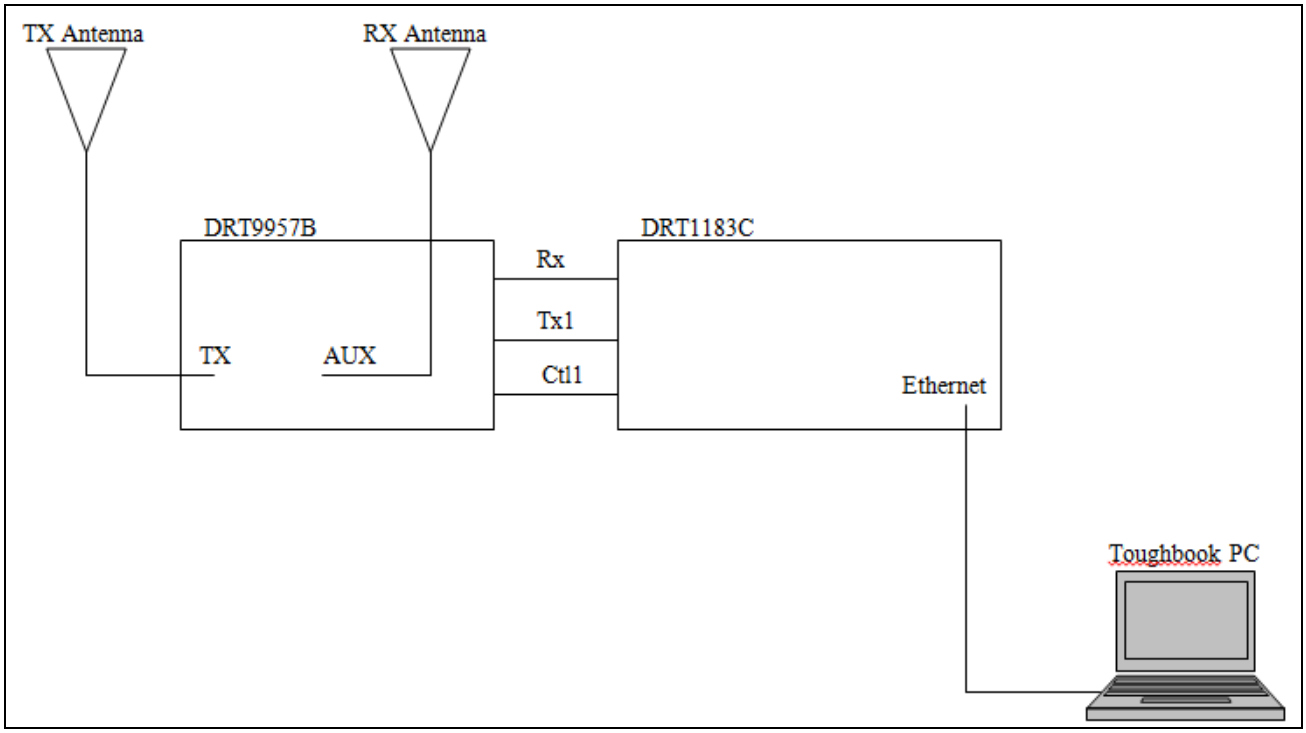


Figure 1. Block Diagram of Equipment Configuration

E. Equipment Configuration

Name / Description	Model Number	Part Number	Serial Number
TacTRAM	DRT9957B	--	--

Table 2. Equipment Configuration

F. Support Equipment

Ref. ID	Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
--	Base Station	DRT	DRT1183C	--
--	Toughbook PC	Panasonic	CF-19	CF-19KDRAX6M

Table 3. Support Equipment

G. Mode of Operation

EUT operates as an RF power amplifier for DRT mobile base stations in GSM, CDMA, and WCDMA in the Cellular, PCS, and AWS bands, and TDMA in the 850 MHz band.

H. Method of Monitoring EUT Operation

Ran control software on a connected PC.

I. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

J. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Digital Receiver Technology, Inc.. upon completion of testing.

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1046 RF Power Output

Test Requirements: **§ 2.1046 Measurements required: RF power output:**

§ 2.1046 (a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8).The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

§ 2.1046 (b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters, the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and as applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

§ 2.1046 (c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

§ 22.913 Power and antenna height limits.

§ 22.913(a): The Effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 watts.

§ 24.232 Power and antenna height limits.

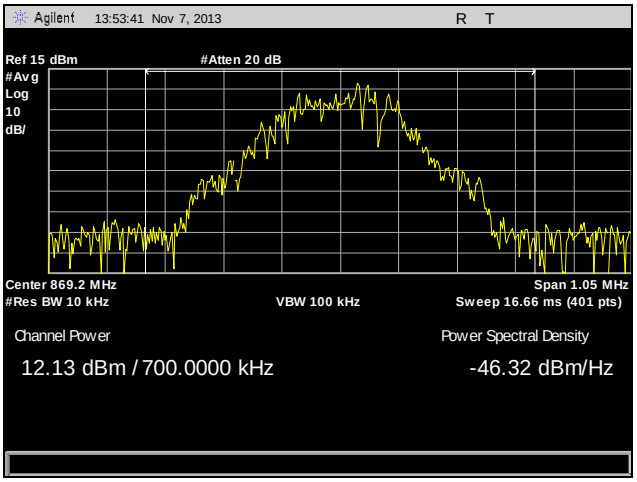
§ 24.232 (b): Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

Test Procedures: As required by 47 CFR 2.1046, RF power output measurements were made at the RF output terminals using an attenuator and spectrum analyzer or power meter. The spectrum analyzer was set to its default settings – RBW, VBW, Sweep Time, etc. – except that the detector was set to an average detector. The "Channel Power" measurement feature of the spectrum analyzer was used. Measurements were taken in both high and low power modes, as permissible by compliance with Intermodulation requirements. Lower power mode must be used when operating in multi-channel mode.

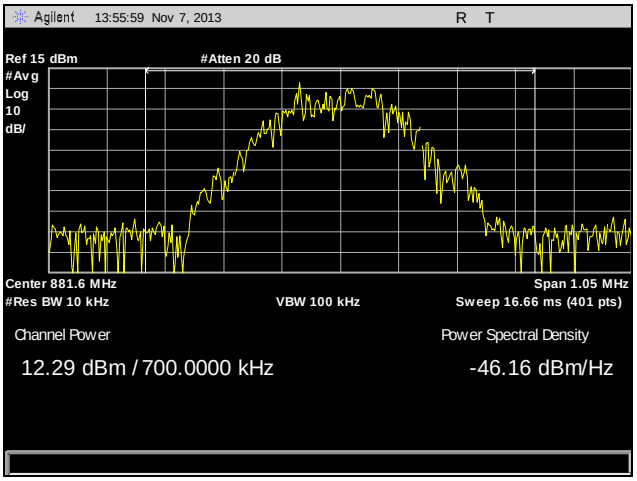
Test Results: The EUT complies with the requirements of this section.

Test Engineer(s): Benjamin Taylor

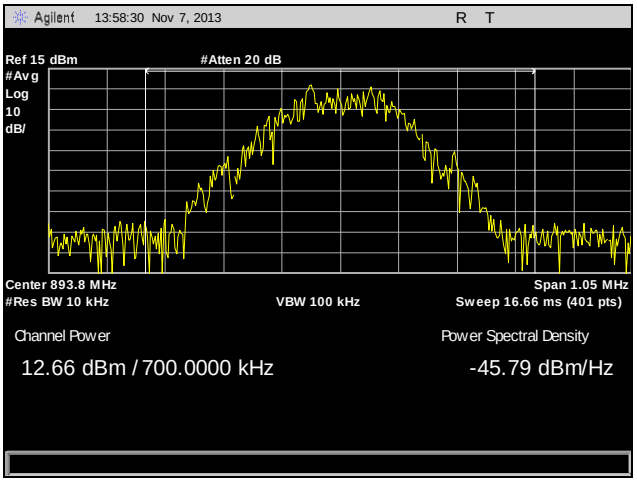
Test Date(s): 11/24/13



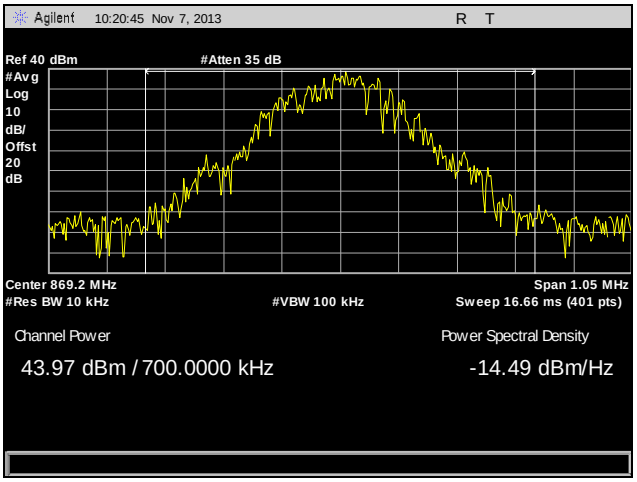
Plot 1. RF Power, Single Channel Operation – High Power, In GSM, Low Channel, Part 22



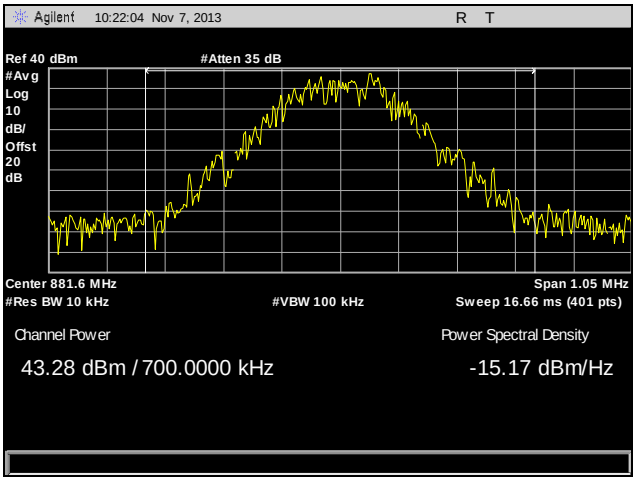
Plot 2. RF Power, Single Channel Operation – High Power, In GSM, Mid Channel, Part 22



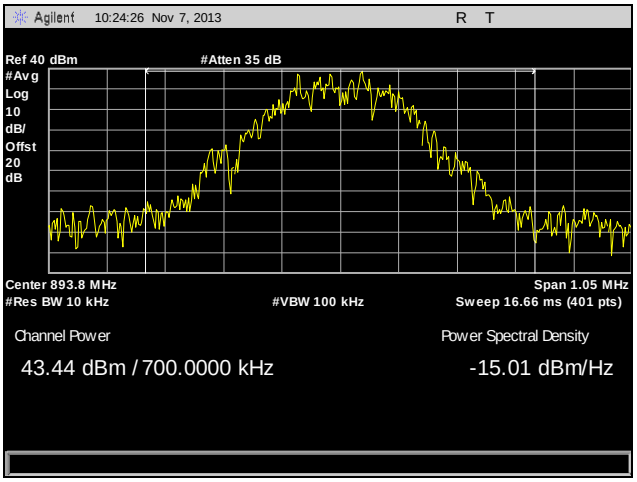
Plot 3. RF Power, Single Channel Operation – High Power, In GSM, High Channel, Part 22



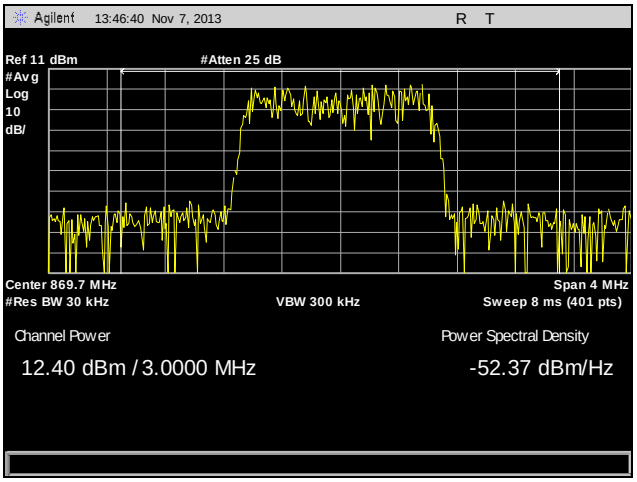
Plot 4. RF Power, Single Channel Operation – High Power, Out GSM, Low Channel, Part 22



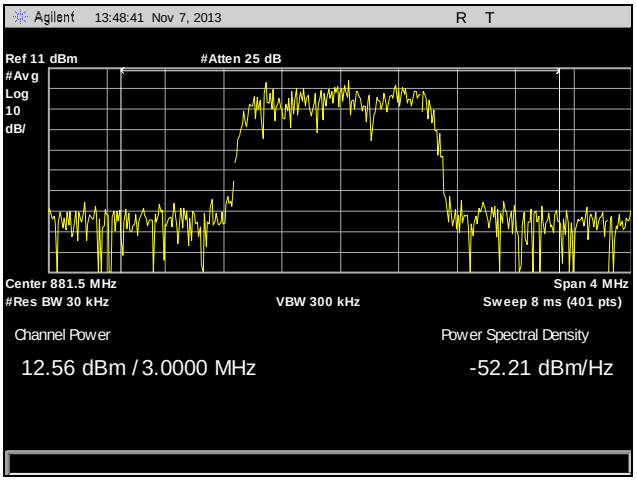
Plot 5. RF Power, Single Channel Operation – High Power, Out GSM, Mid Channel, Part 22



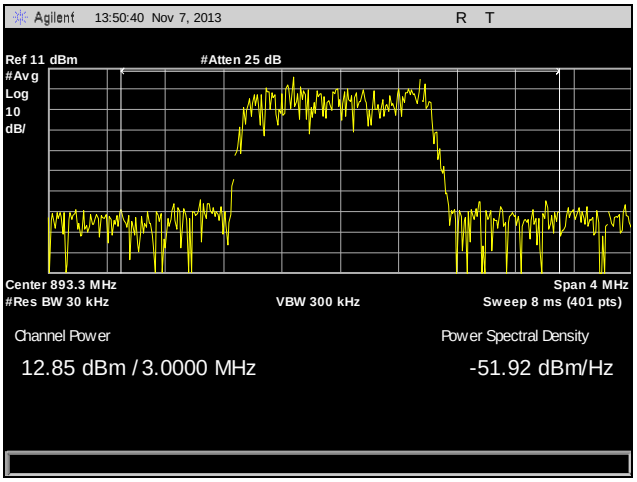
Plot 6. RF Power, Single Channel Operation – High Power, Out GSM, High Channel, Part 22



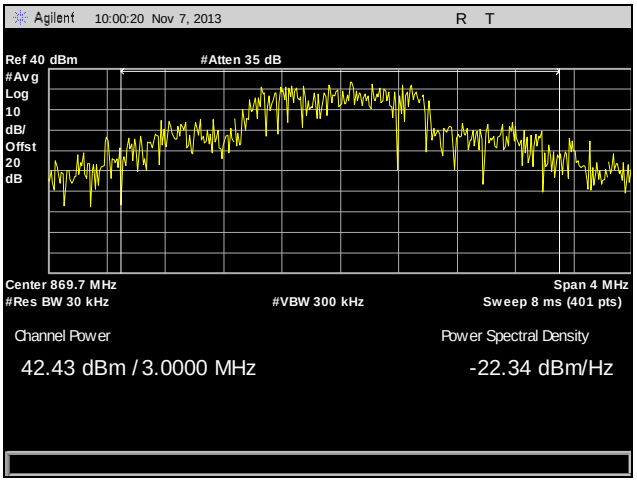
Plot 7. RF Power, Single Channel Operation – High Power, In CDMA, Low Channel, Part 22



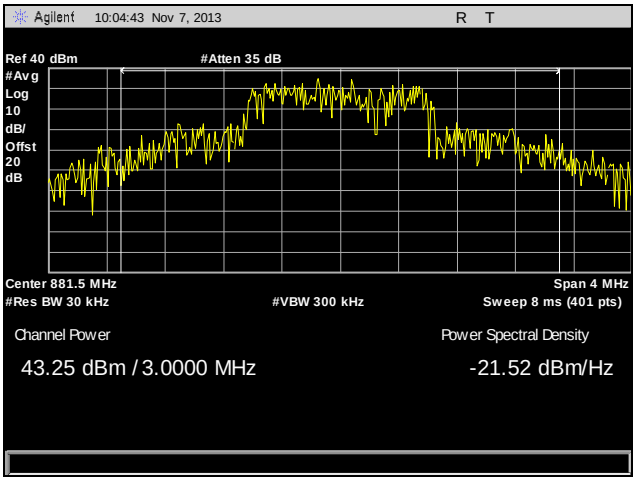
Plot 8. RF Power, Single Channel Operation – High Power, In CDMA, Mid Channel, Part 22



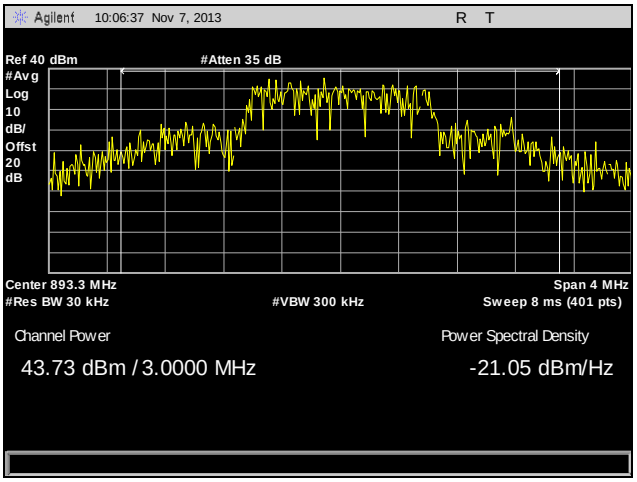
Plot 9. RF Power, Single Channel Operation – High Power, In CDMA, High Channel, Part 22



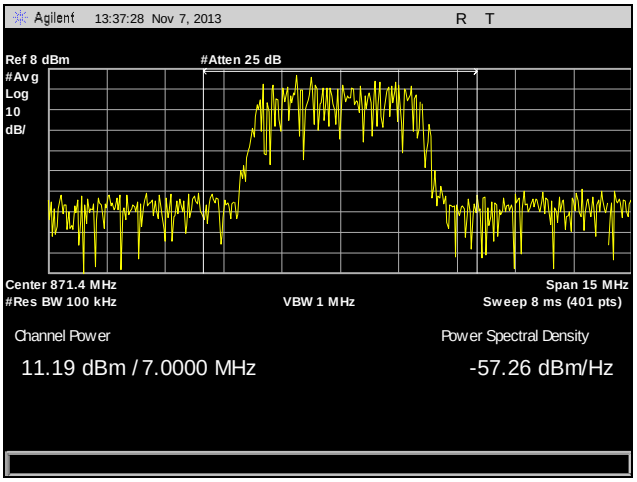
Plot 10. RF Power, Single Channel Operation – High Power, Out CDMA, Low Channel, Part 22



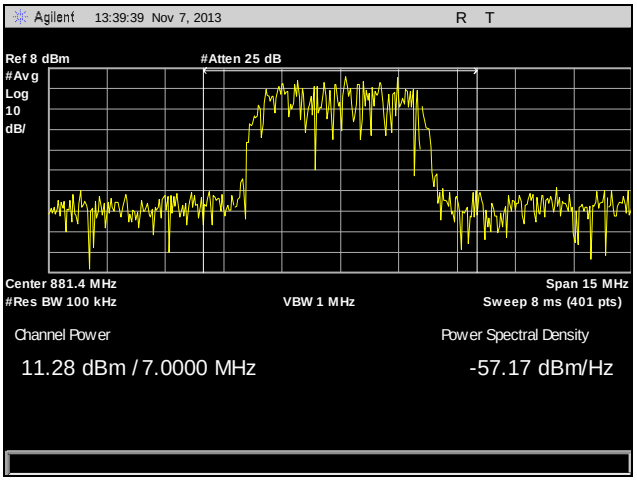
Plot 11. RF Power, Single Channel Operation – High Power, Out CDMA, Mid Channel, Part 22



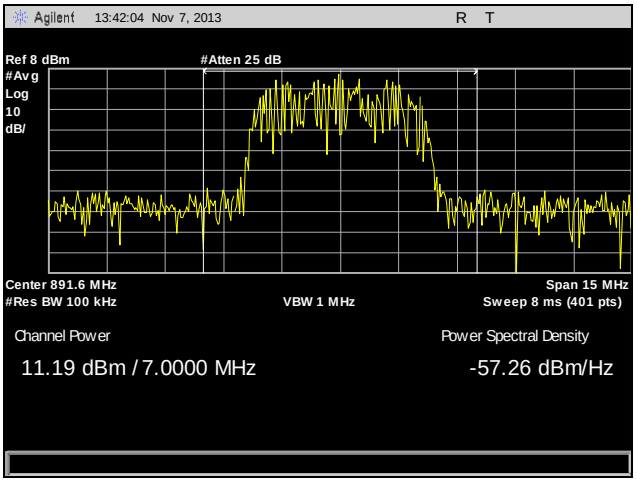
Plot 12. RF Power, Single Channel Operation – High Power, Out CDMA, High Channel, Part 22



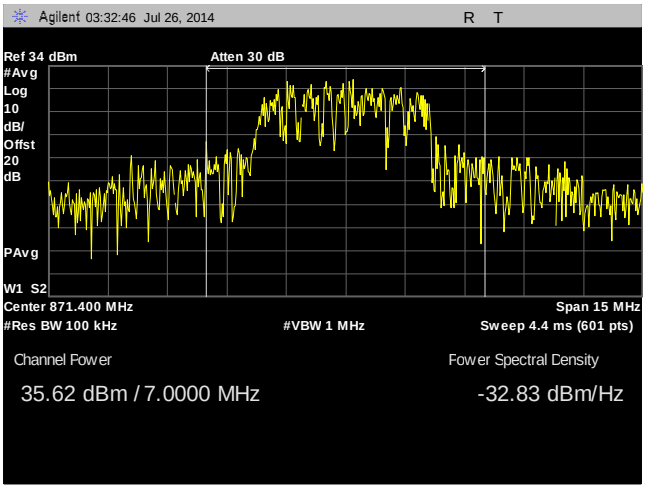
Plot 13. RF Power, Single Channel Operation – High Power, In WCDMA, Low Channel, Part 22



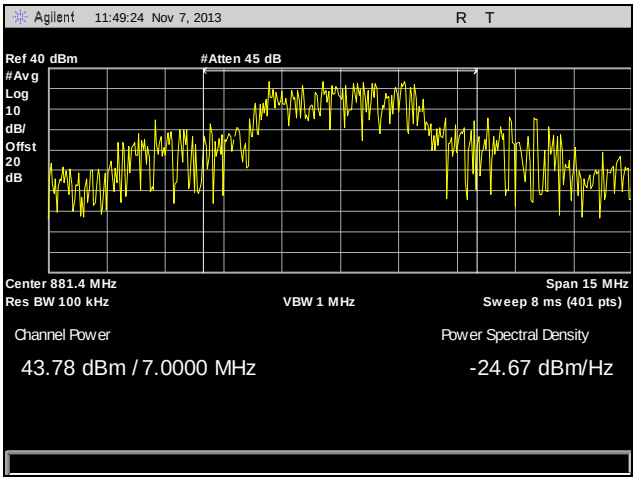
Plot 14. RF Power, Single Channel Operation – High Power, In WCDMA, Mid Channel, Part 22



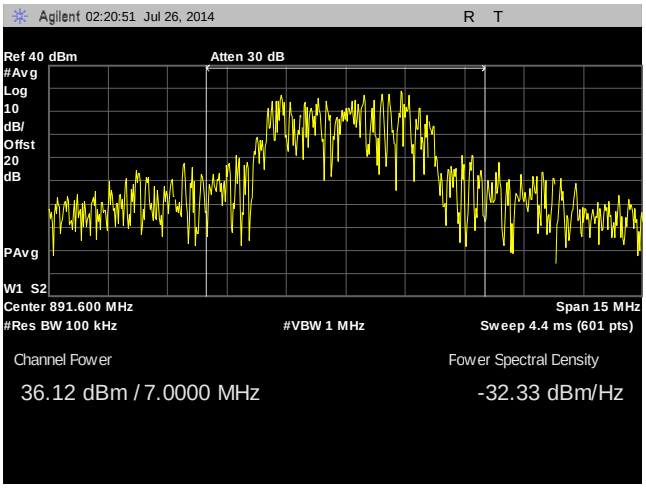
Plot 15. RF Power, Single Channel Operation – High Power, In WCDMA, High Channel, Part 22



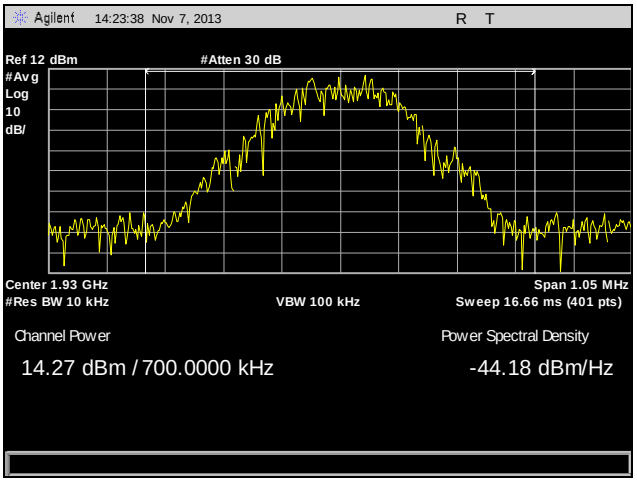
Plot 16. RF Power, Single Channel Operation – High Power, Out WCDMA, Low Channel, Part 22



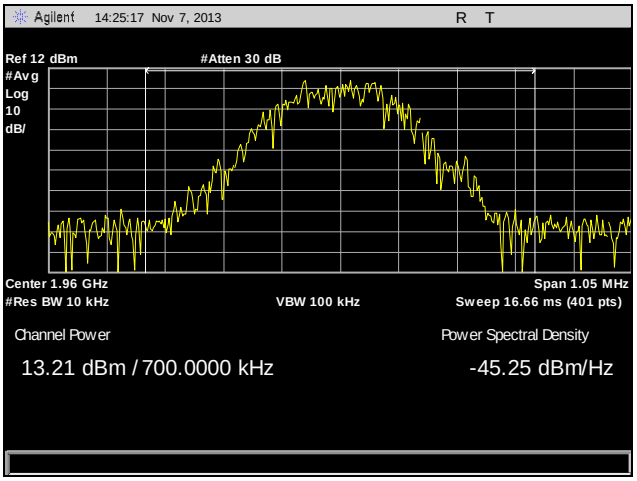
Plot 17. RF Power, Single Channel Operation – High Power, Out WCDMA, Mid Channel, Part 22



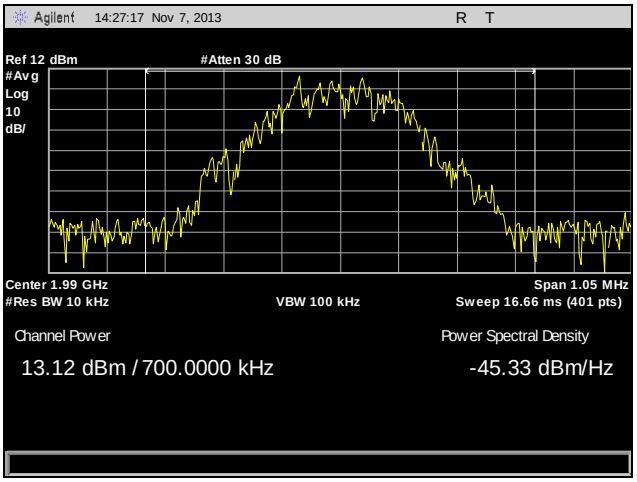
Plot 18. RF Power, Single Channel Operation – High Power, Out WCDMA, High Channel, Part 22



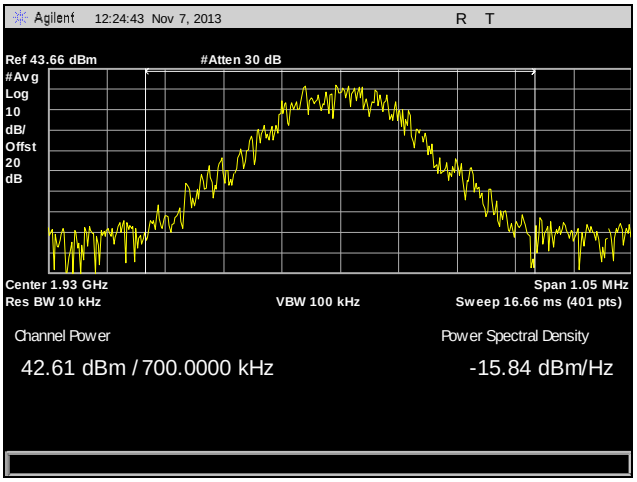
Plot 19. RF Power, Single Channel Operation – High Power, In GSM, Low Channel, Part 24



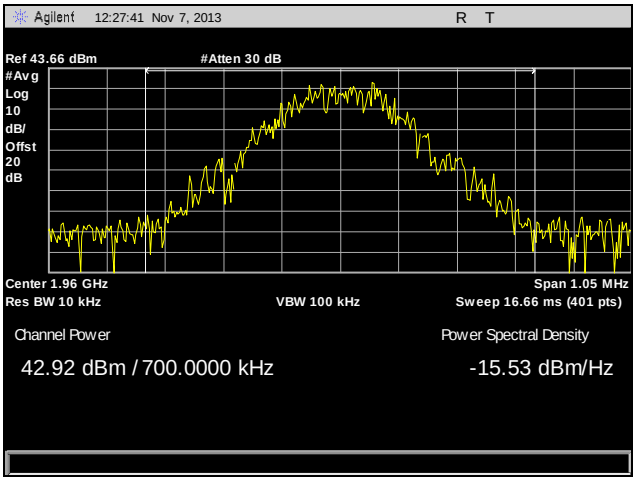
Plot 20. RF Power, Single Channel Operation – High Power, In GSM, Mid Channel, Part 24



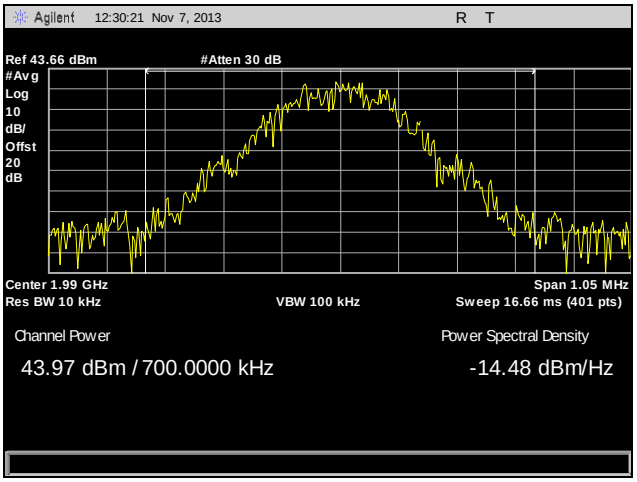
Plot 21. RF Power, Single Channel Operation – High Power, In GSM, High Channel, Part 24



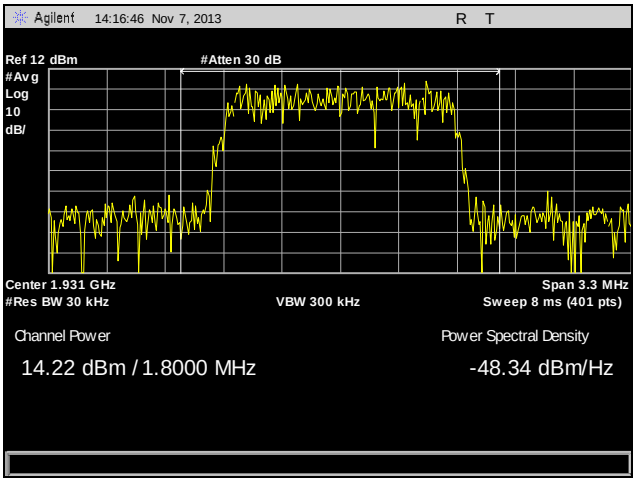
Plot 22. RF Power, Single Channel Operation – High Power, Out GSM, Low Channel, Part 24



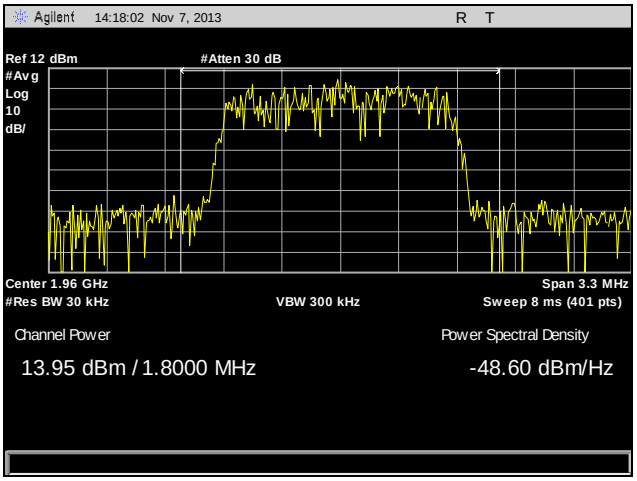
Plot 23. RF Power, Single Channel Operation – High Power, Out GSM, Mid Channel, Part 24



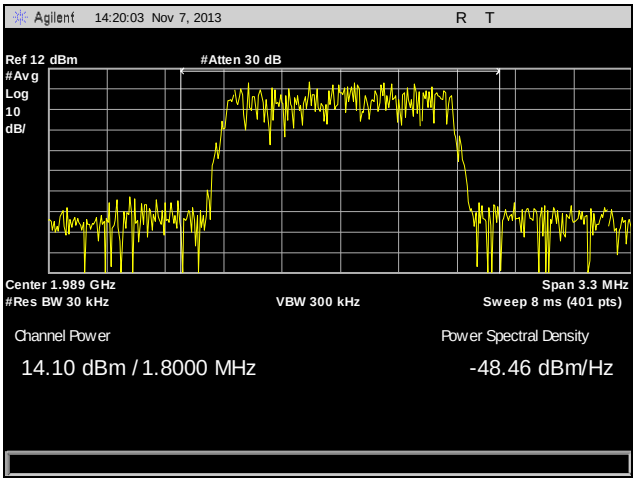
Plot 24. RF Power, Single Channel Operation – High Power, Out GSM, High Channel, Part 24



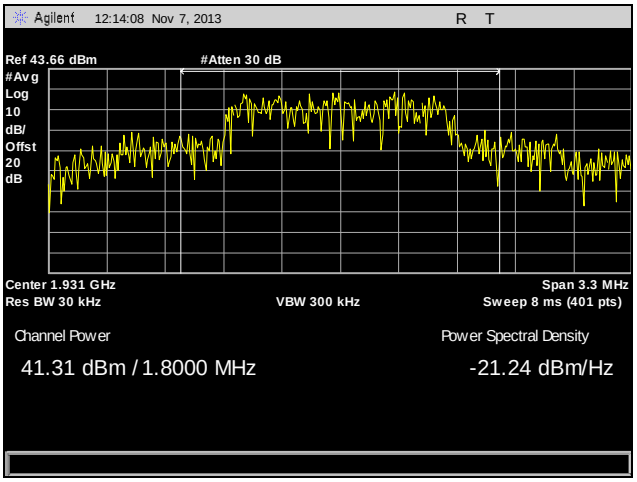
Plot 25. RF Power, Single Channel Operation – High Power, In CDMA, Low Channel, Part 24



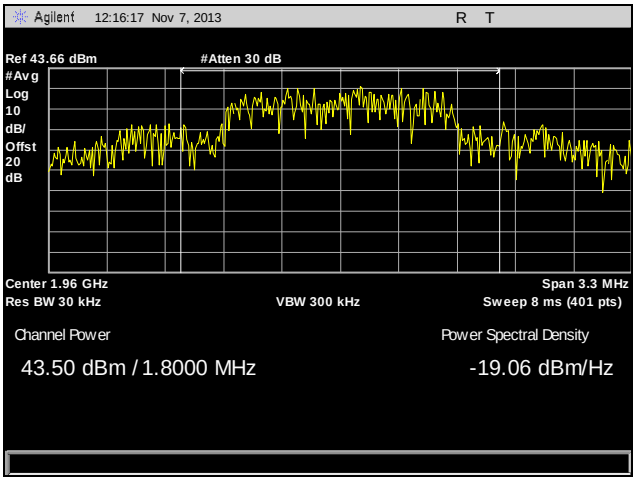
Plot 26. RF Power, Single Channel Operation – High Power, In CDMA, Mid Channel, Part 24



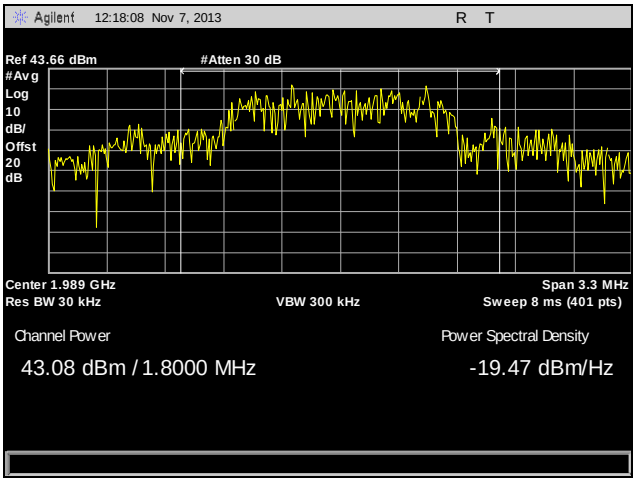
Plot 27. RF Power, Single Channel Operation – High Power, In CDMA, High Channel, Part 24



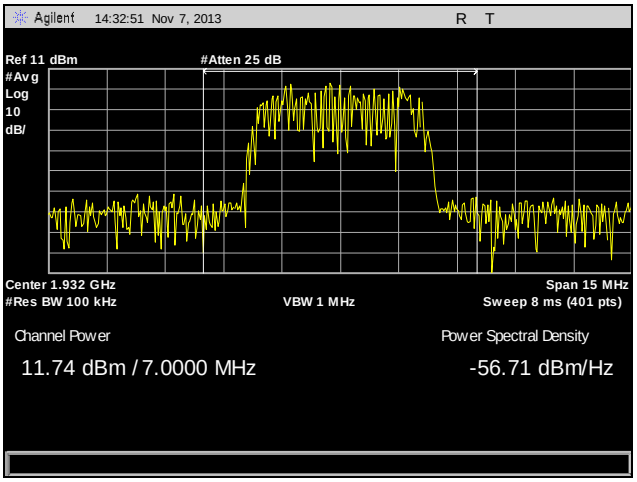
Plot 28. RF Power, Single Channel Operation – High Power, Out CDMA, Low Channel, Part 24



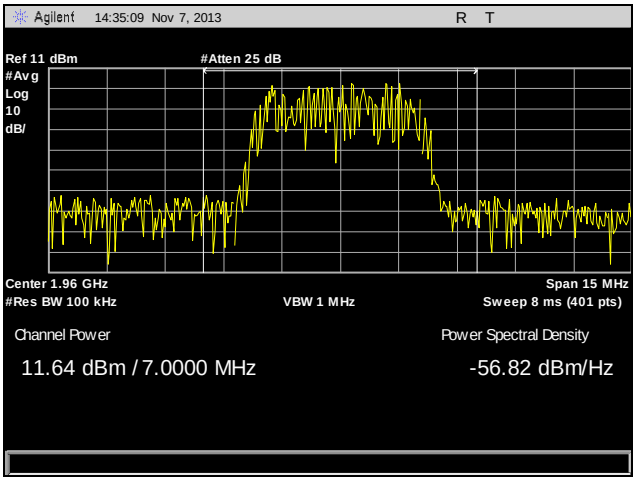
Plot 29. RF Power, Single Channel Operation – High Power, Out CDMA, Mid Channel, Part 24



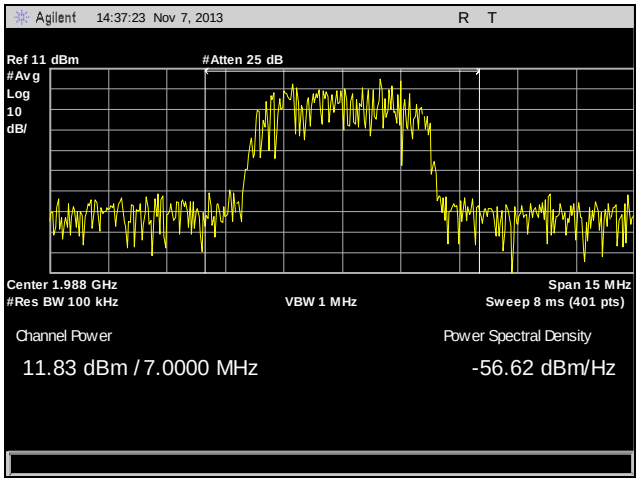
Plot 30. RF Power, Single Channel Operation – High Power, Out CDMA, High Channel, Part 24



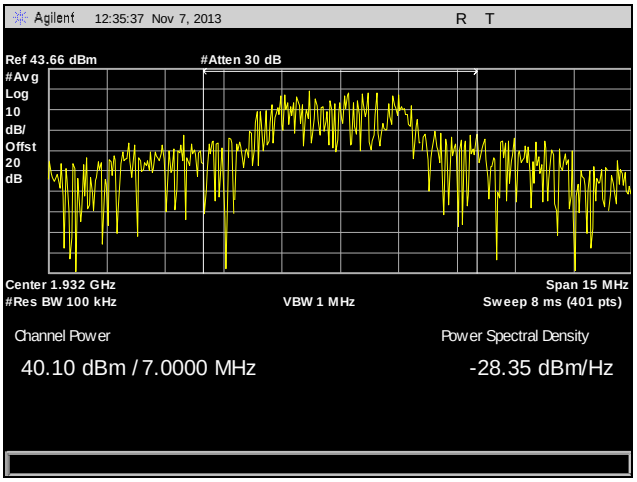
Plot 31. RF Power, Single Channel Operation – High Power, In WCDMA, Low Channel, Part 24



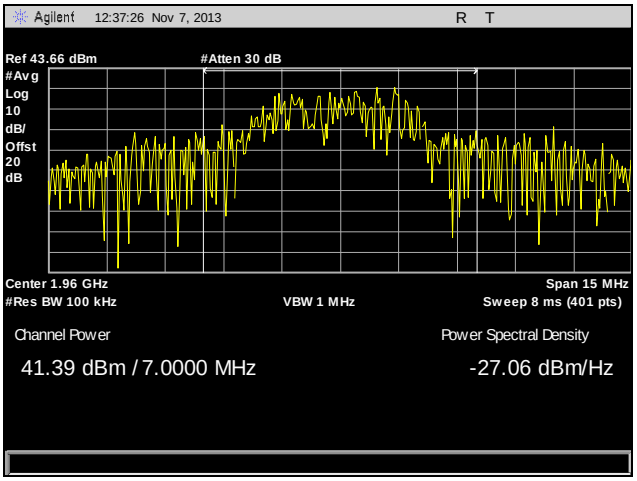
Plot 32. RF Power, Single Channel Operation – High Power, In WCDMA, Mid Channel, Part 24



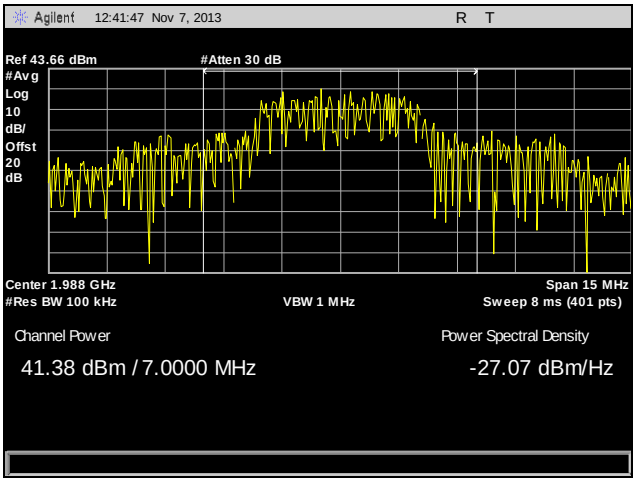
Plot 33. RF Power, Single Channel Operation – High Power, In WCDMA, High Channel, Part 24



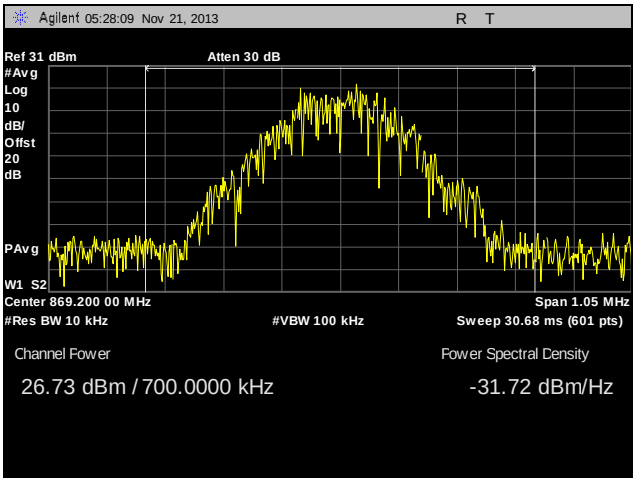
Plot 34. RF Power, Single Channel Operation – High Power, Out WCDMA, Low Channel, Part 24



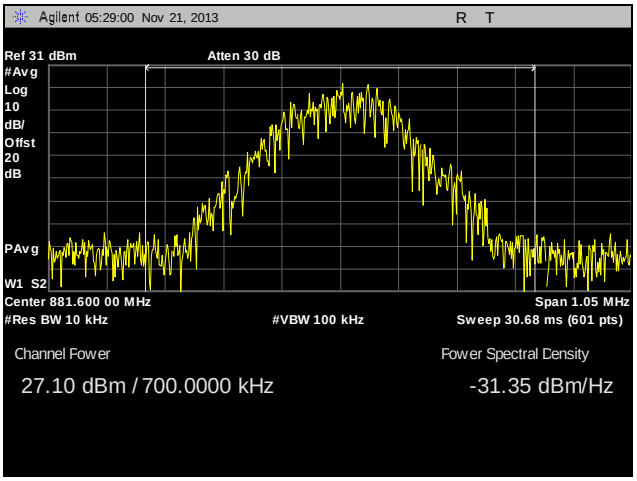
Plot 35. RF Power, Single Channel Operation – High Power, Out WCDMA, Mid Channel, Part 24



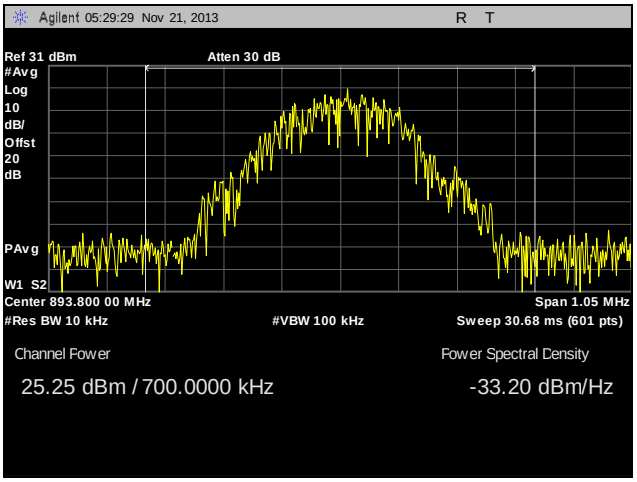
Plot 36. RF Power, Single Channel Operation – High Power, Out WCDMA, High Channel, Part 24



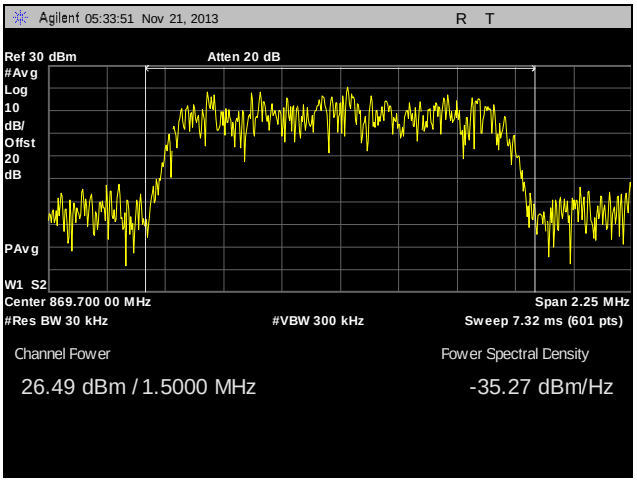
Plot 37. RF Power, Multi-Channel Operation – Lower Power, GSM, 869.2 MHz, Part 22



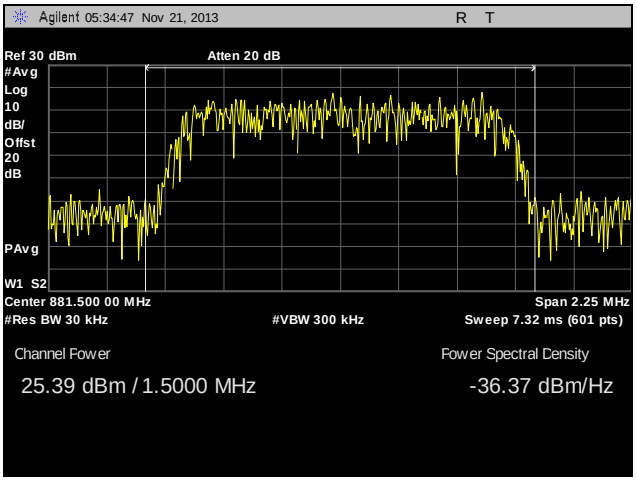
Plot 38. RF Power, Multi-Channel Operation – Lower Power, GSM, 881.6 MHz, Part 22



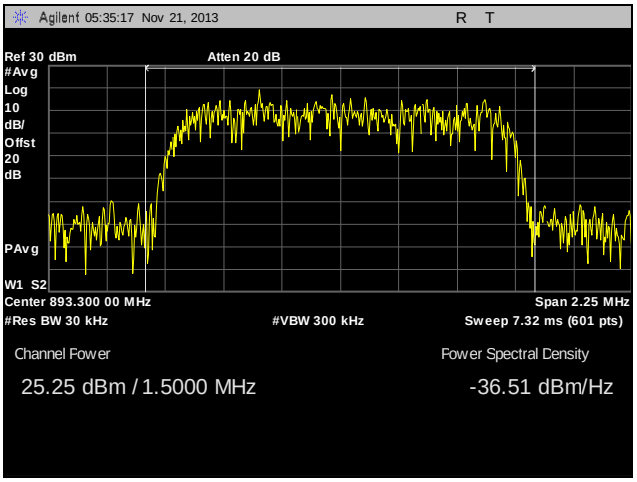
Plot 39. RF Power, Multi-Channel Operation – Lower Power, GSM, 893.8 MHz, Part 22



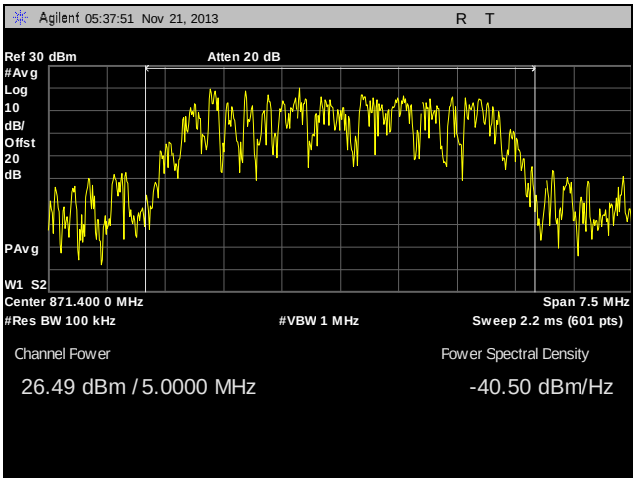
Plot 40. RF Power, Multi-Channel Operation – Lower Power, CDMA, 869.7 MHz, Part 22



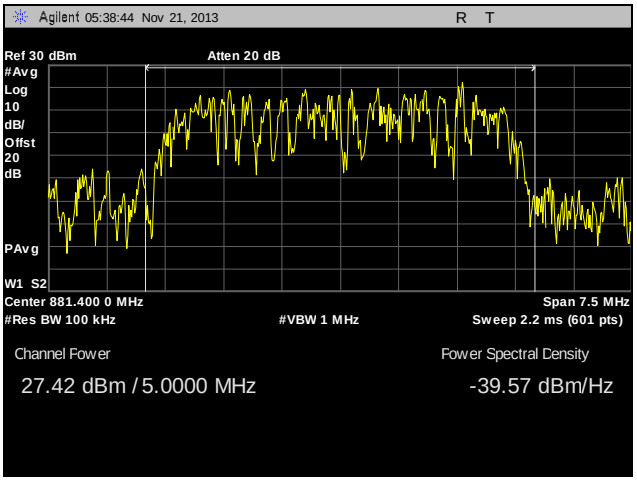
Plot 41. RF Power, Multi-Channel Operation – Lower Power, CDMA, 881.5 MHz, Part 22



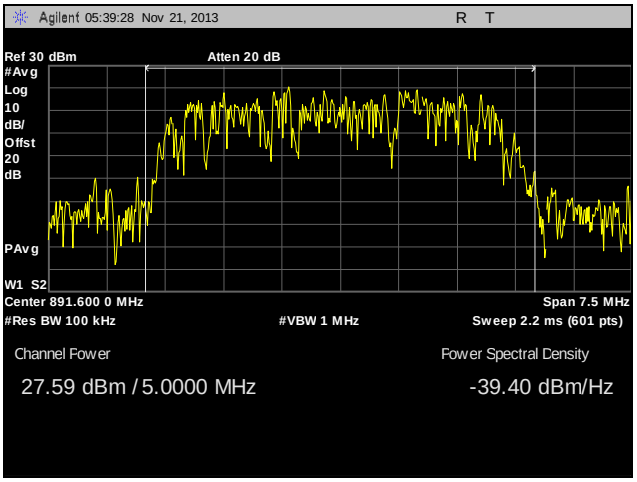
Plot 42. RF Power, Multi-Channel Operation – Lower Power, CDMA, 893.3 MHz, Part 22



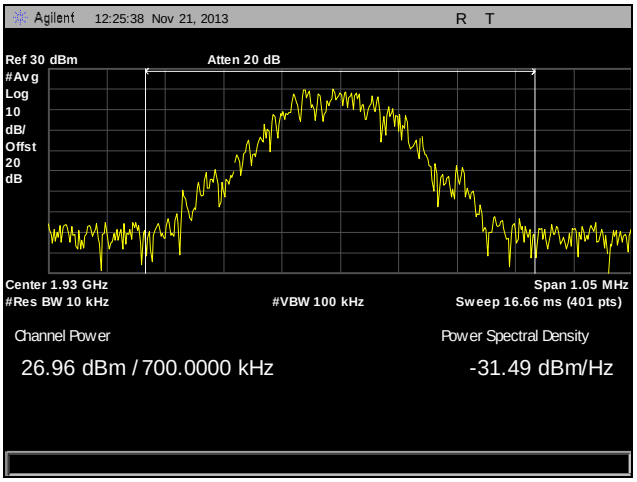
Plot 43. RF Power, Multi-Channel Operation – Lower Power, WCDMA, 871.4 MHz, Part 22



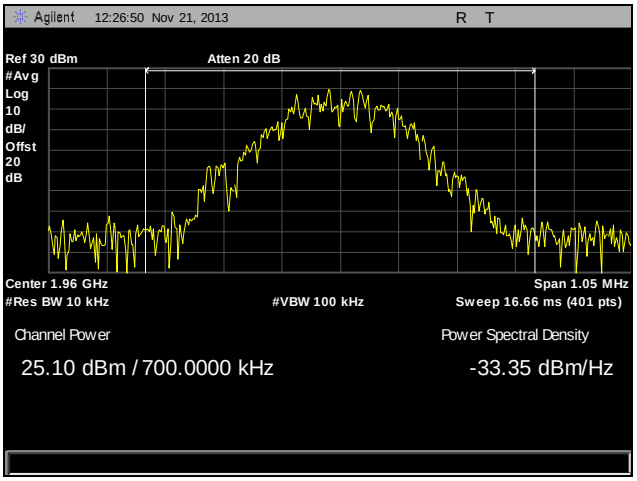
Plot 44. RF Power, Multi-Channel Operation – Lower Power, WCDMA, 881.4 MHz, Part 22



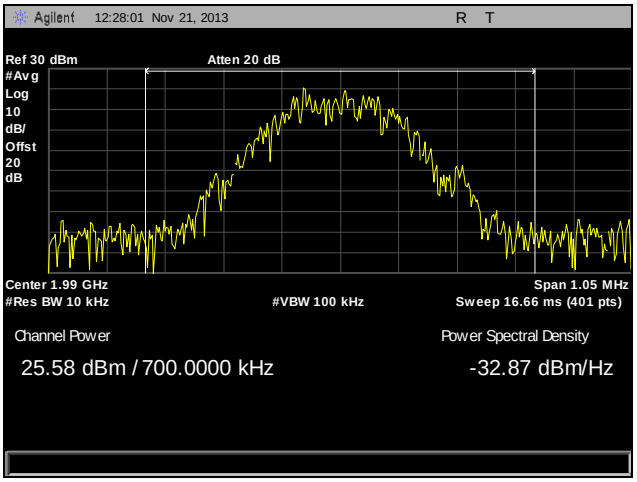
Plot 45. RF Power, Multi-Channel Operation – Lower Power, WCDMA, 891.6 MHz, Part 22



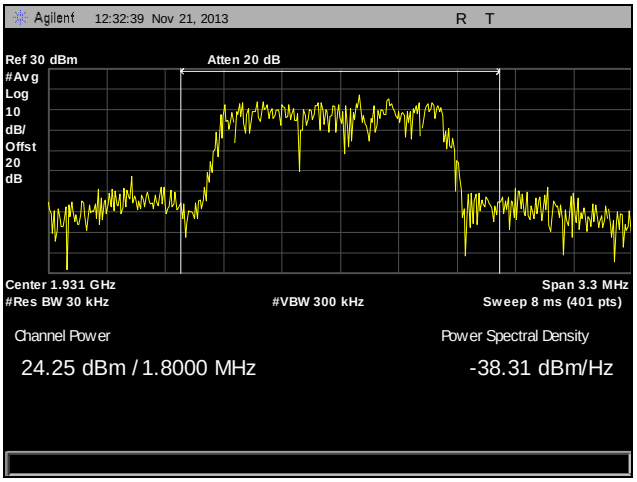
Plot 46. RF Power, Multi-Channel Operation – Lower Power, GSM, Low Channel, Part 24



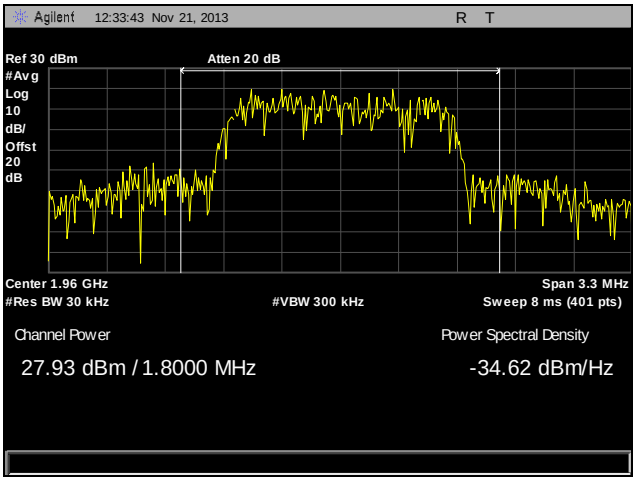
Plot 47. RF Power, Multi-Channel Operation – Lower Power, GSM, Mid Channel, Part 24



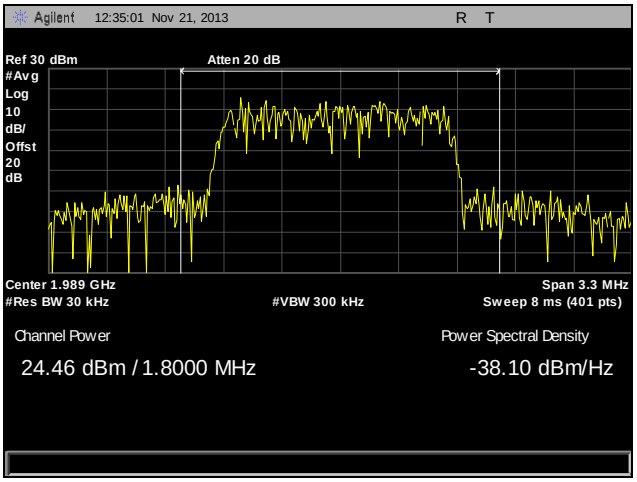
Plot 48. RF Power, Multi-Channel Operation – Lower Power, GSM, High Channel, Part 24



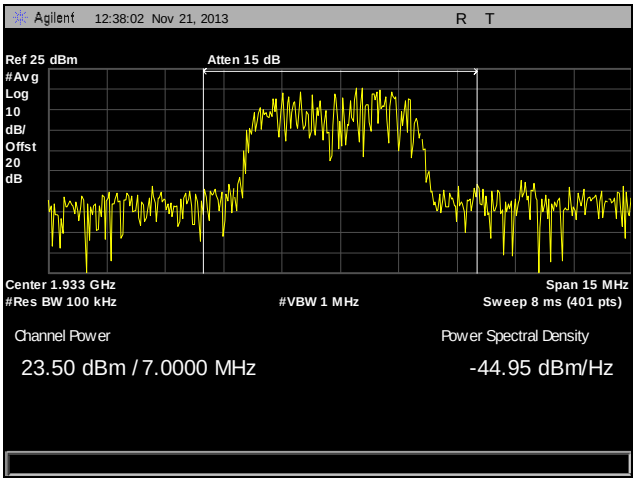
Plot 49. RF Power, Multi-Channel Operation – Lower Power, CDMA, Low Channel, Part 24



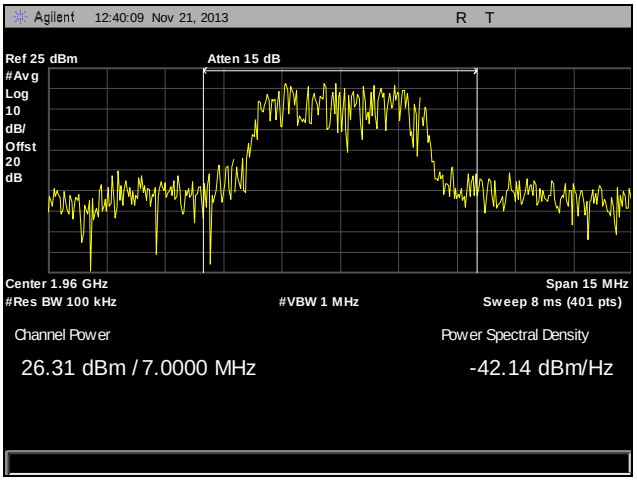
Plot 50. RF Power, Multi-Channel Operation – Lower Power, CDMA, Mid Channel, Part 24



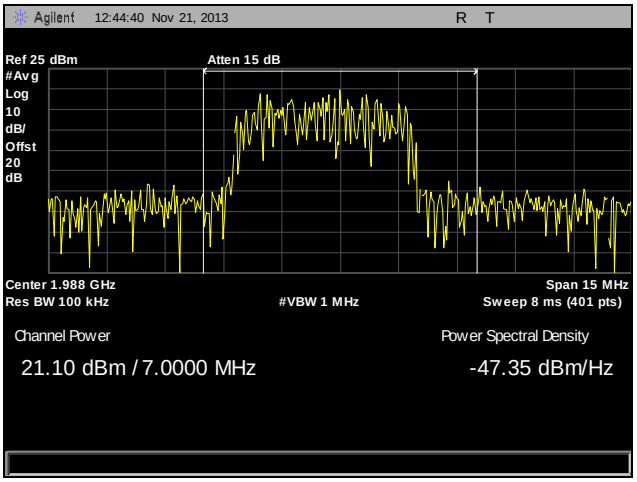
Plot 51. RF Power, Multi-Channel Operation – Lower Power, CDMA, High Channel, Part 24



Plot 52. RF Power, Multi-Channel Operation – Lower Power, WCDMA, Low Channel, Part 24



Plot 53. RF Power, Multi-Channel Operation – Lower Power, WCDMA, Mid Channel, Part 24



Plot 54. RF Power, Multi-Channel Operation – Lower Power, WCDMA, High Channel, Part 24

§ 2.1049 Occupied Bandwidth

Test Requirement(s): **§ 2.1049 Measurements required: Occupied bandwidth:** The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the specified conditions of § 2.1049 (a) through (i) as applicable.

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF frequency channel. The EUT was connected to a Spectrum Analyzer via attenuator. The RBW of the Spectrum Analyzer was set to at least 1% of the channel bandwidth. Measurements were carried out at the low, mid, and high channels of the TX band.

Test Results: Equipment complies with FCC requirements.

Test Engineer(s): Benjamin Taylor

Test Date(s): 11/24/13

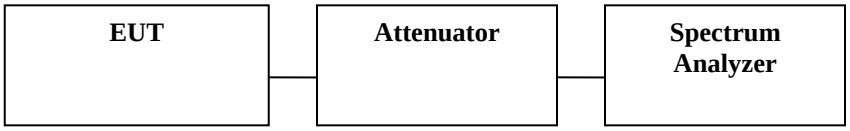
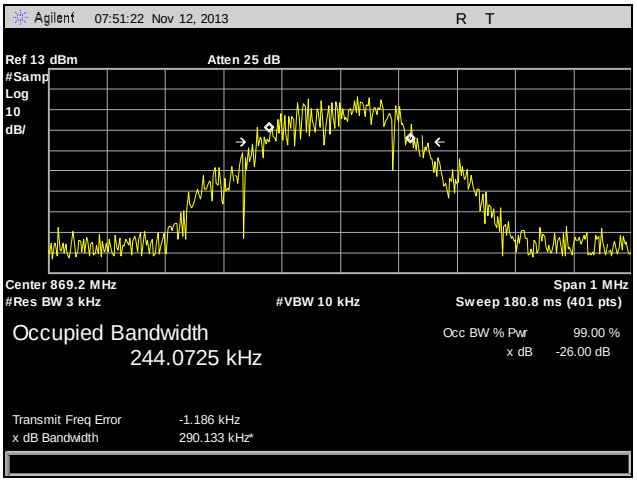
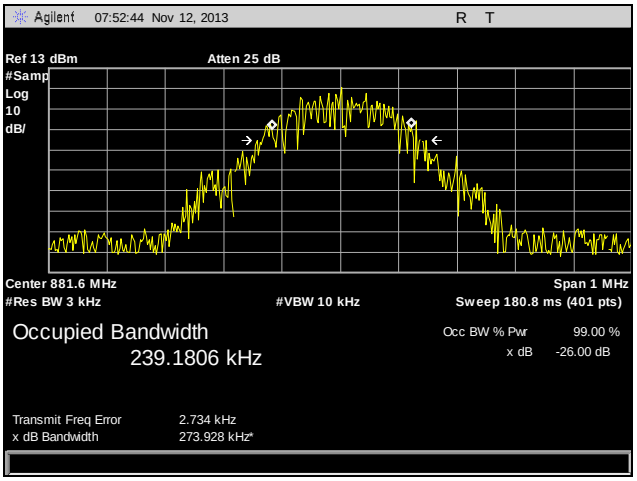


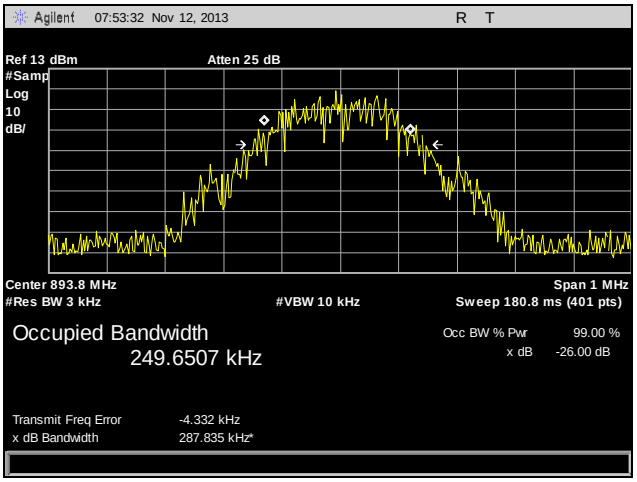
Figure 2. Occupied Bandwidth Test Setup



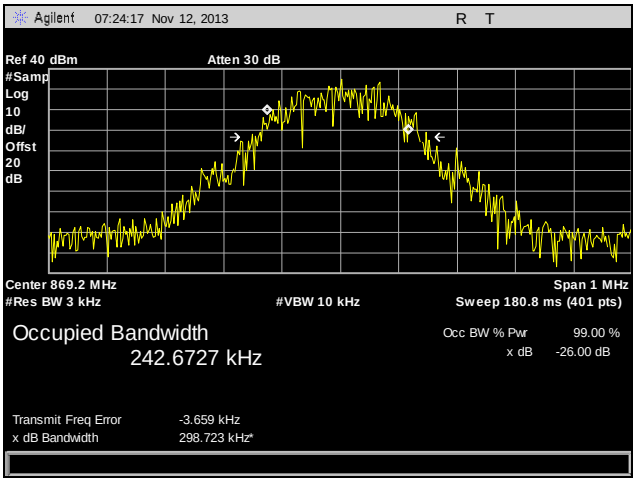
Plot 55. Occupied Bandwidth, GSM, Low Channel, Input, Part 22



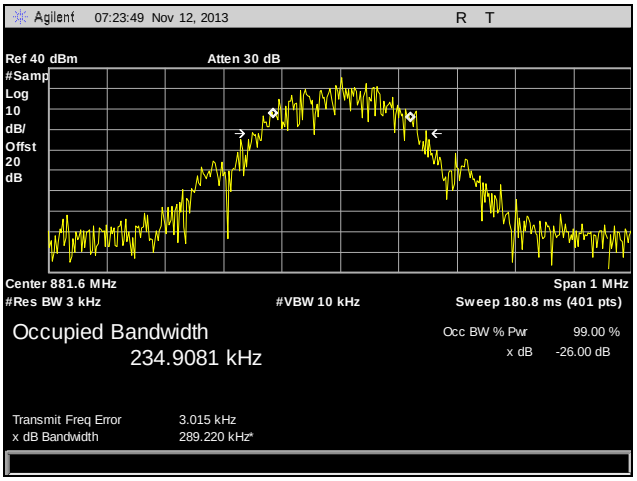
Plot 56. Occupied Bandwidth, GSM, Mid Channel, Input, Part 22



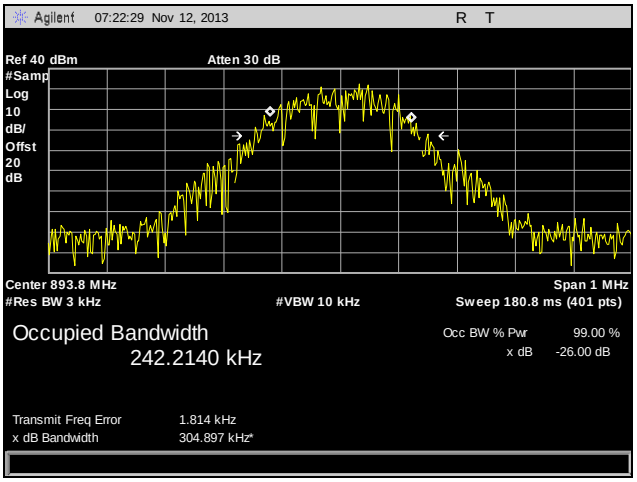
Plot 57. Occupied Bandwidth, GSM, High Channel, Input, Part 22



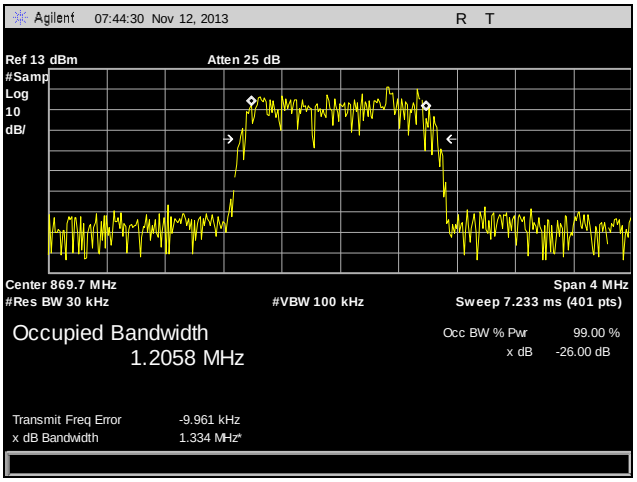
Plot 58. Occupied Bandwidth, GSM, Low Channel, Output, Part 22



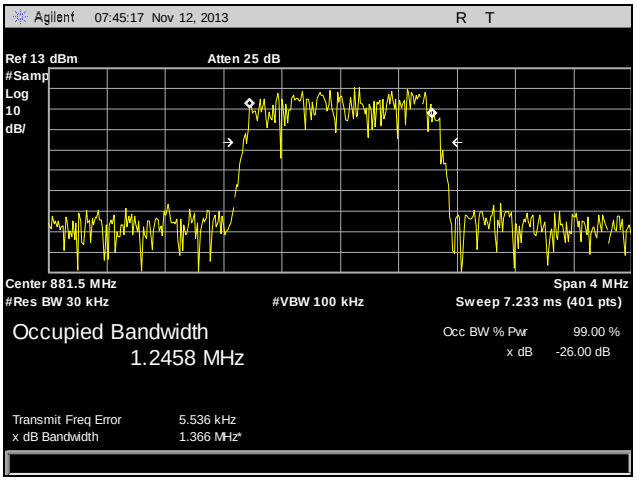
Plot 59. Occupied Bandwidth, GSM, Mid Channel, Output, Part 22



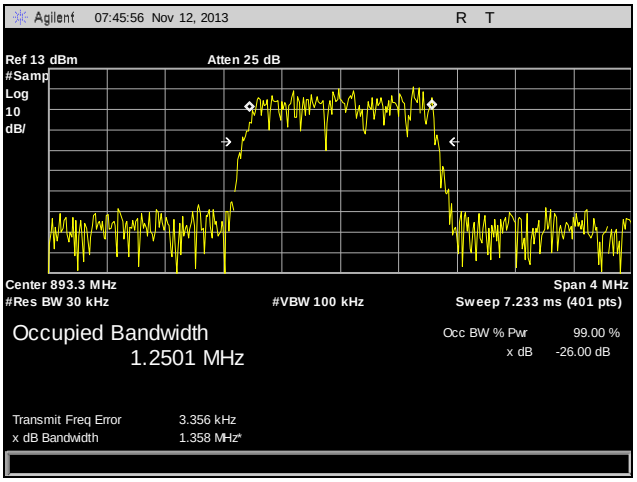
Plot 60. Occupied Bandwidth, GSM, High Channel, Output, Part 22



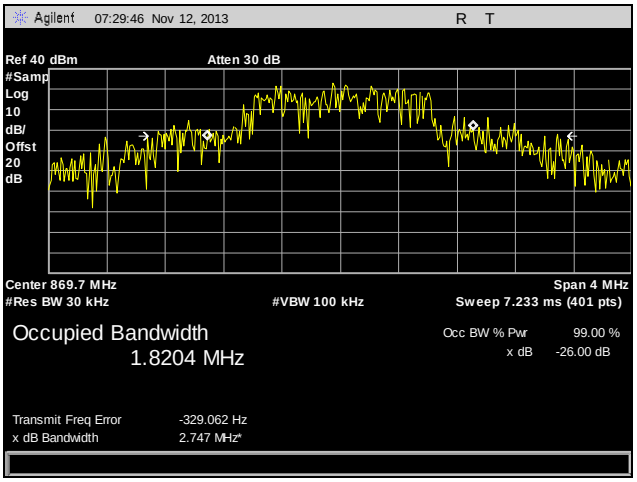
Plot 61. Occupied Bandwidth, CDMA, Low Channel, Input, Part 22



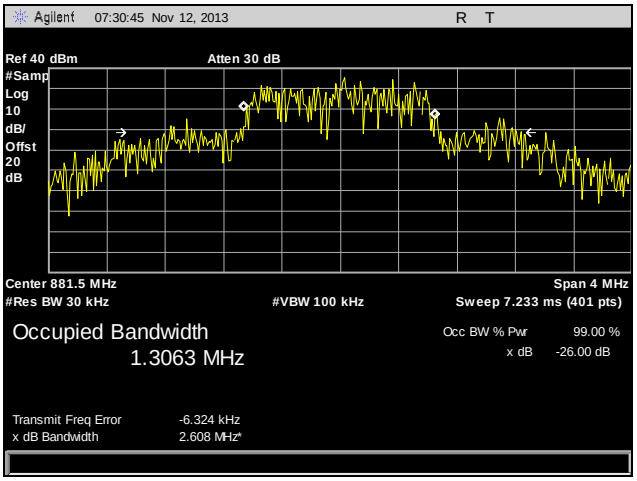
Plot 62. Occupied Bandwidth, CDMA, Mid Channel, Input, Part 22



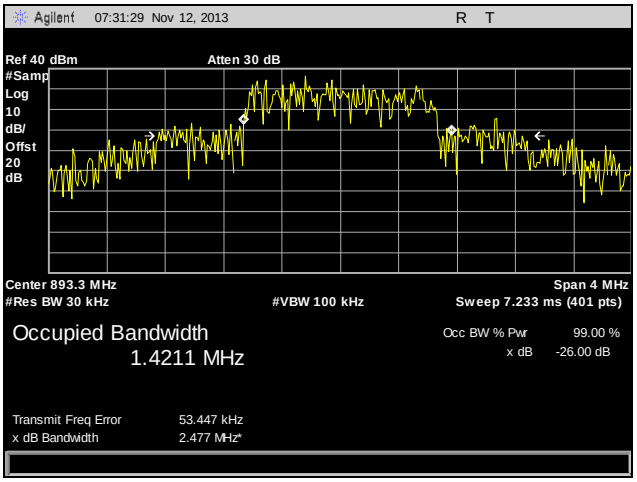
Plot 63. Occupied Bandwidth, CDMA, High Channel, Input, Part 22



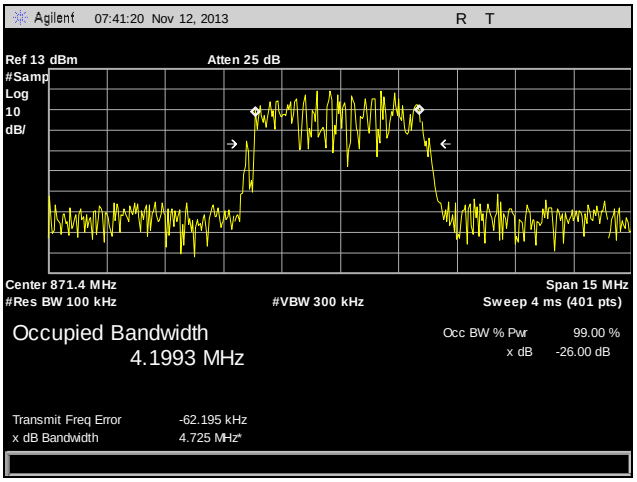
Plot 64. Occupied Bandwidth, CDMA, Low Channel, Output, Part 22



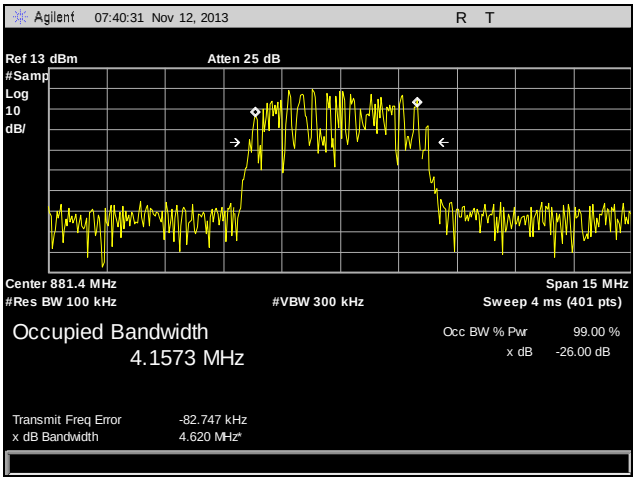
Plot 65. Occupied Bandwidth, CDMA, Mid Channel, Output, Part 22



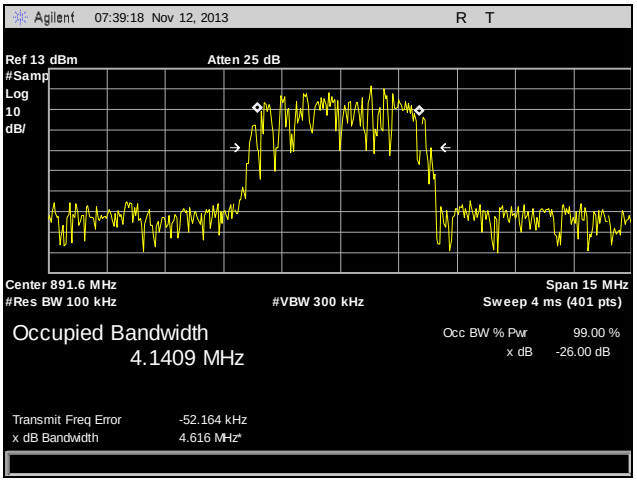
Plot 66. Occupied Bandwidth, CDMA, High Channel, Output, Part 22



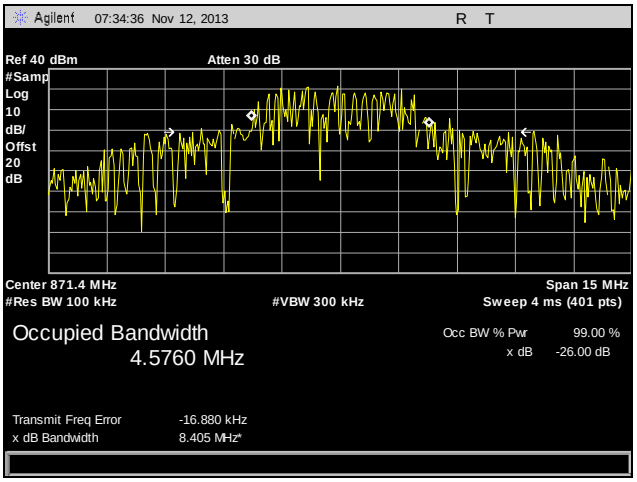
Plot 67. Occupied Bandwidth, WCDMA, Low Channel, Input, Part 22



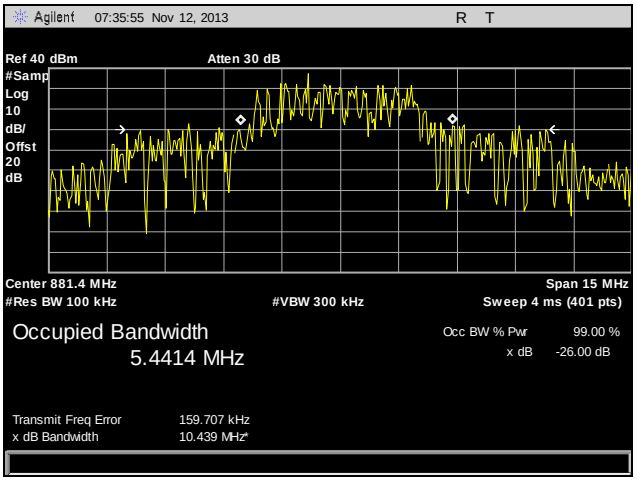
Plot 68. Occupied Bandwidth, WCDMA, Mid Channel, Input, Part 22



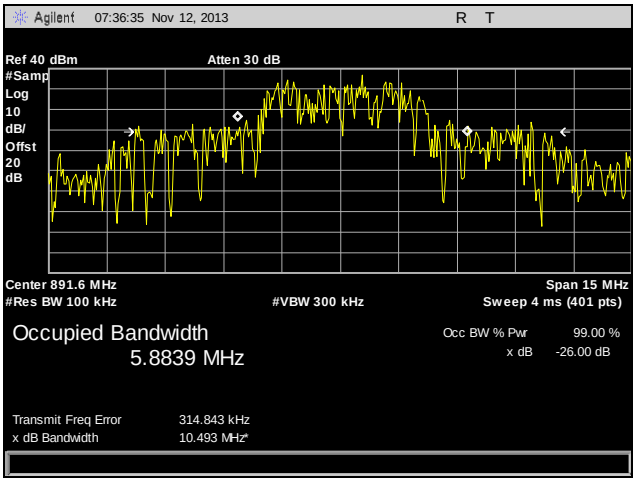
Plot 69. Occupied Bandwidth, WCDMA, High Channel, Input, Part 22



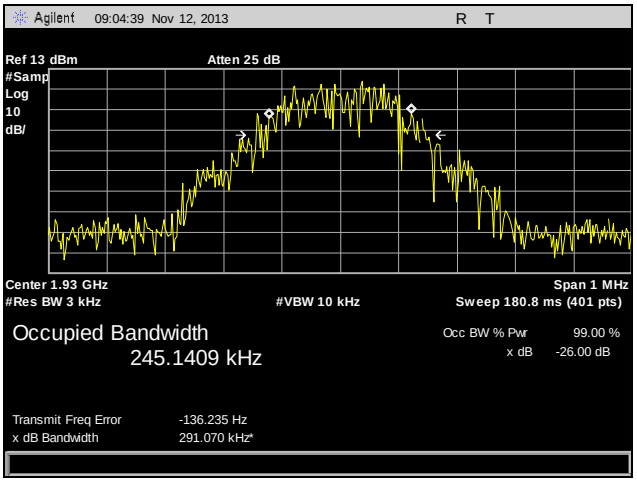
Plot 70. Occupied Bandwidth, WCDMA, Low Channel, Output, Part 22



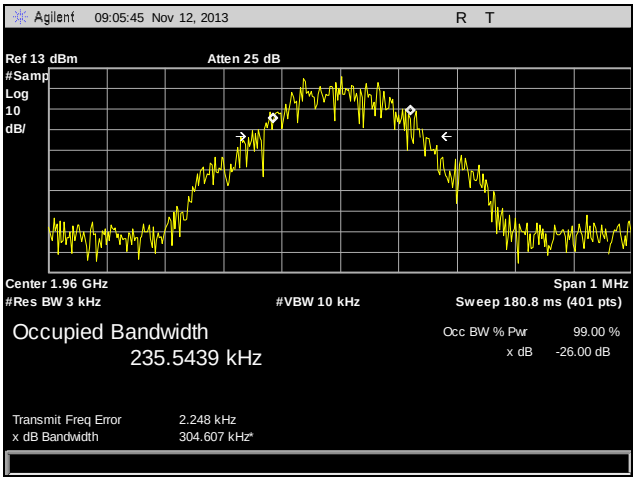
Plot 71. Occupied Bandwidth, WCDMA, Mid Channel, Output, Part 22



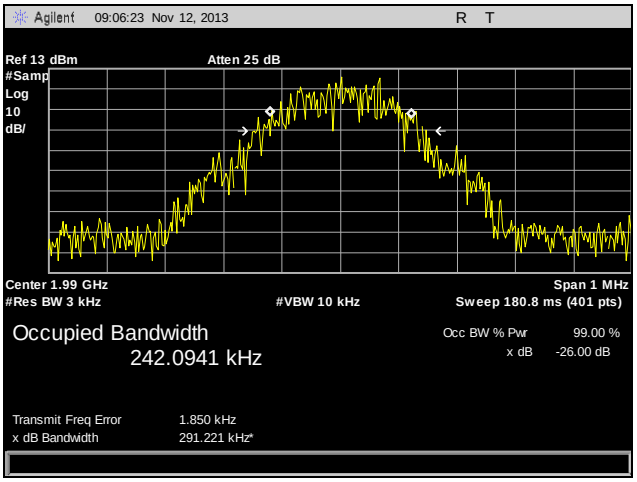
Plot 72. Occupied Bandwidth, WCDMA, High Channel, Output, Part 22



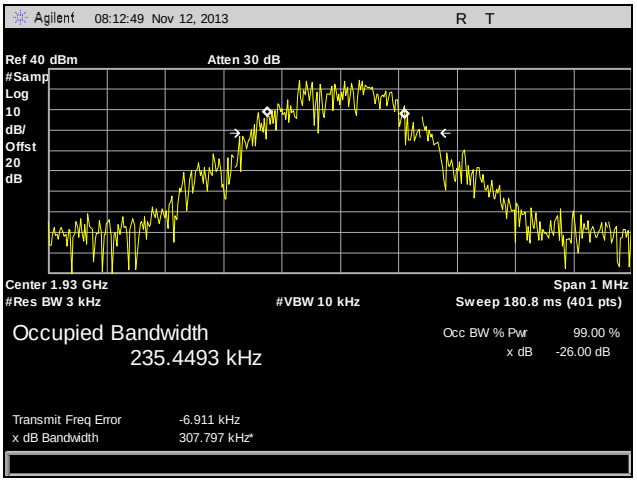
Plot 73. Occupied Bandwidth, GSM, 1930.2 MHz, Input, Part 24



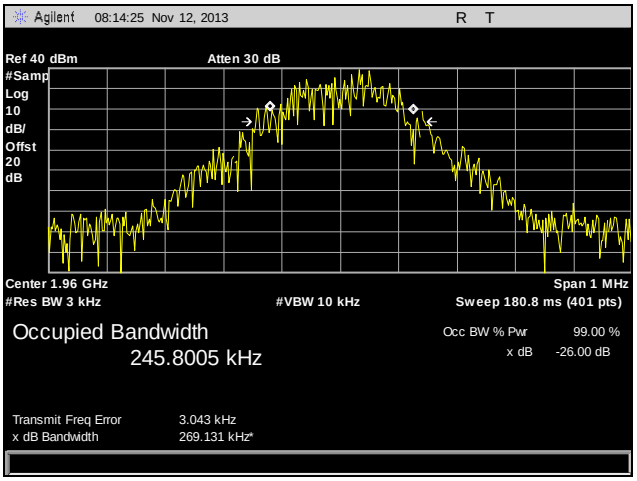
Plot 74. Occupied Bandwidth, GSM, 1960 MHz, Input, Part 24



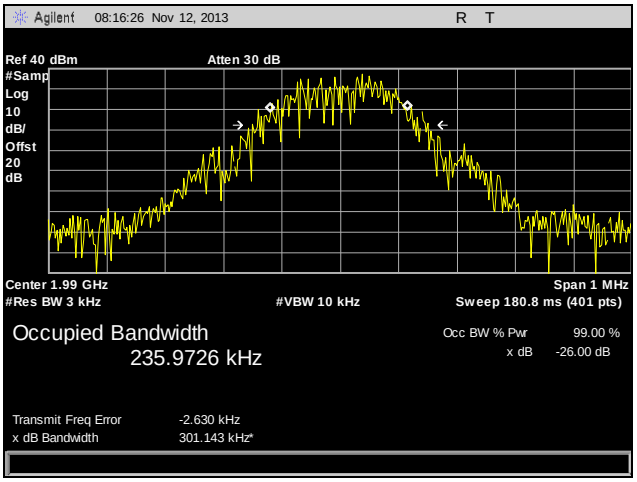
Plot 75. Occupied Bandwidth, GSM, 1989.8 MHz, Input, Part 24



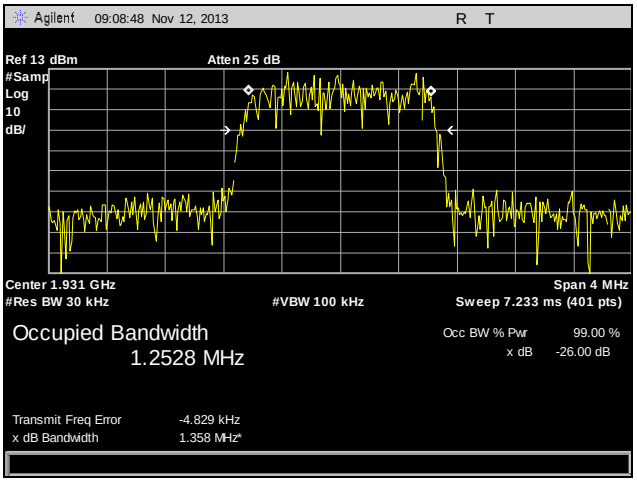
Plot 76. Occupied Bandwidth, GSM, 1930.2 MHz, Output, Part 24



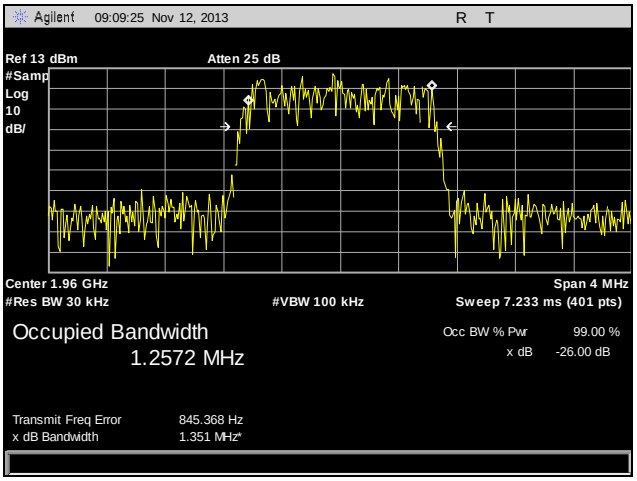
Plot 77. Occupied Bandwidth, GSM, 1960 MHz, Output, Part 24



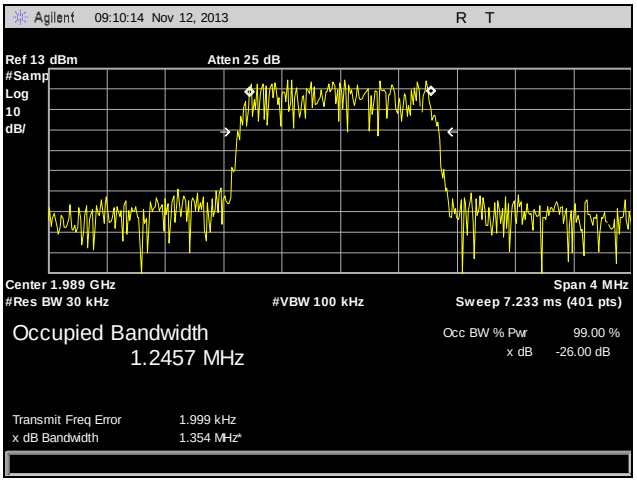
Plot 78. Occupied Bandwidth, GSM, 1989.8 MHz, Output, Part 24



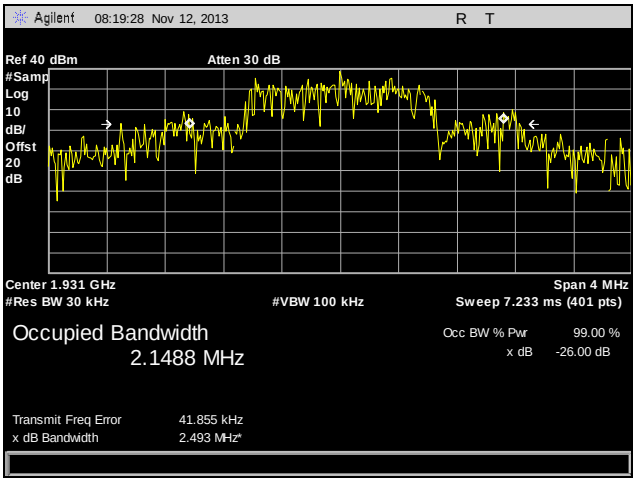
Plot 79. Occupied Bandwidth, CDMA, 1989.8 MHz, Input, Part 24



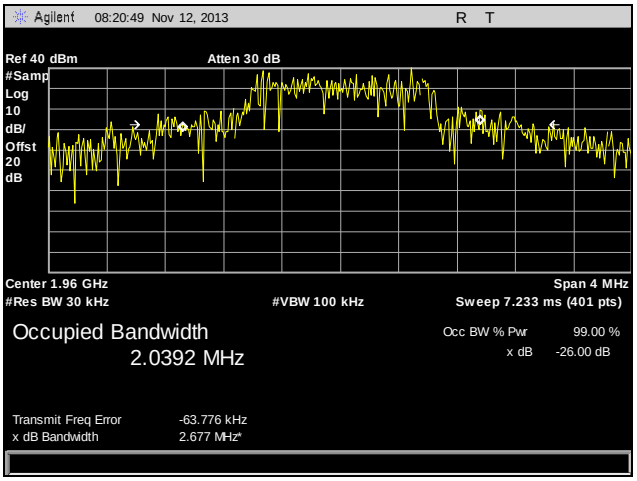
Plot 80. Occupied Bandwidth, CDMA, 1960 MHz, Input, Part 24



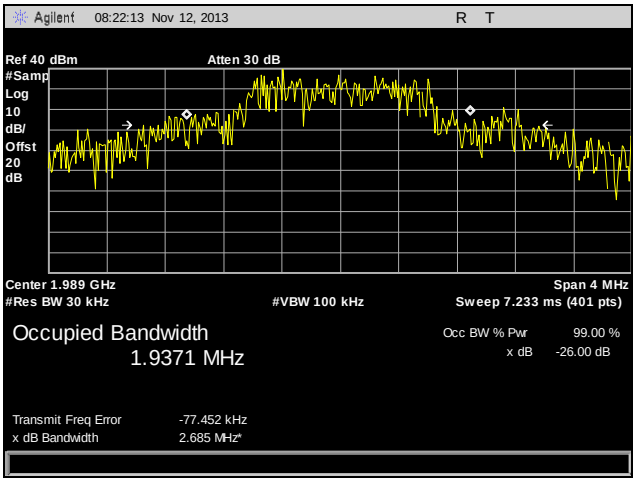
Plot 81. Occupied Bandwidth, CDMA, 1988.75 MHz, Input, Part 24



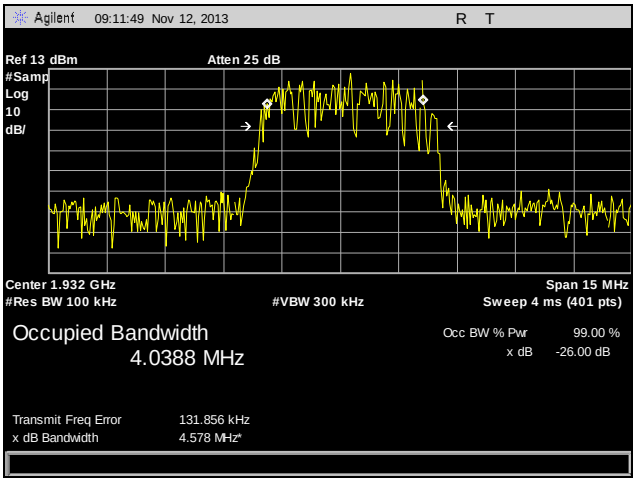
Plot 82. Occupied Bandwidth, CDMA, 1931.25 MHz, Output, Part 24



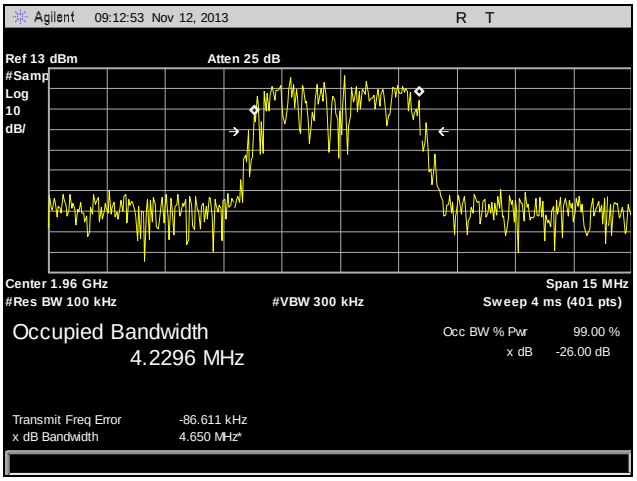
Plot 83. Occupied Bandwidth, CDMA, 1960 MHz, Output, Part 24



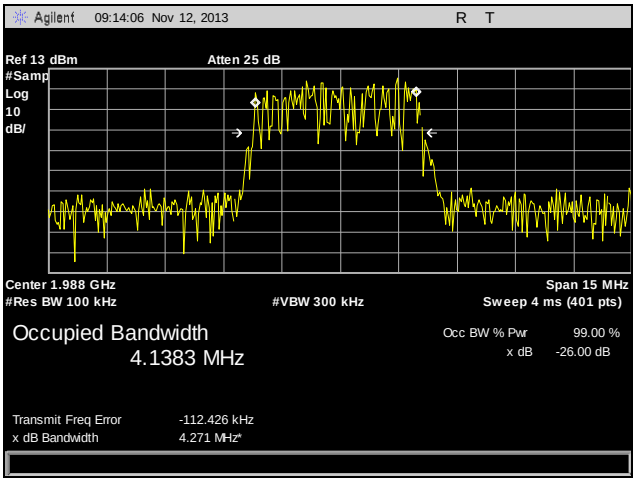
Plot 84. Occupied Bandwidth, CDMA, 1988.75 MHz, Output, Part 24



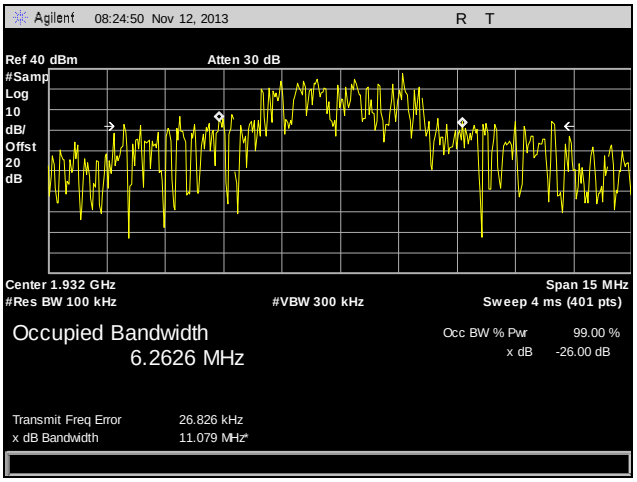
Plot 85. Occupied Bandwidth, WCDMA, 1932.4 MHz, Input, Part 24



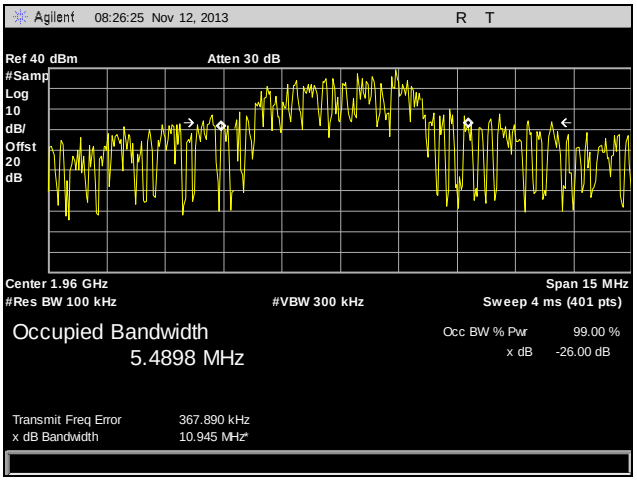
Plot 86. Occupied Bandwidth, WCDMA, 1960 MHz, Input, Part 24



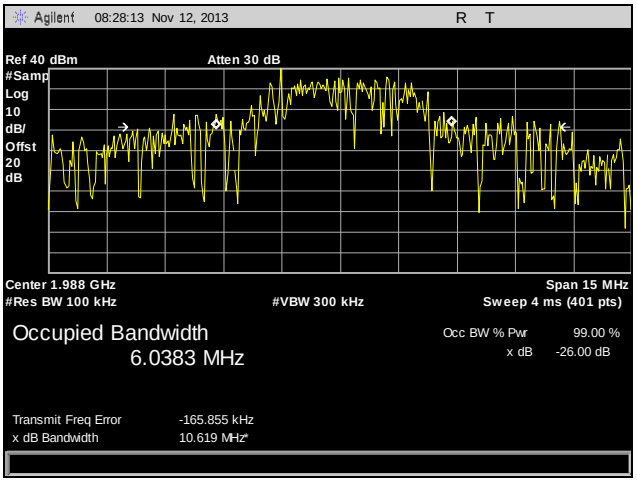
Plot 87. Occupied Bandwidth, WCDMA, 1987.6 MHz, Input, Part 24



Plot 88. Occupied Bandwidth, WCDMA, 1932.4 MHz, Output, Part 24



Plot 89. Occupied Bandwidth, WCDMA, 1960 MHz, Output, Part 24



Plot 90. Occupied Bandwidth, WCDMA, 1987.6 MHz, Output, Part 24

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1053 Radiated Spurious Emissions

Test Requirement(s): **§ 2.1053 Measurements required: Field strength of spurious radiation.**

§ 2.1053 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

§ 2.1053 (b): The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

§ 22.917 Emission limitations Cellular equipment: The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

§ 22.917 (a): Out of band emissions. The power of any emission 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).

Test Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* was made in accordance with the procedures of TIA/EIA-603-A-2001 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber. The EUT's RF ports were terminated to 50ohm load. The EUT was tested using both modulations and at the low, mid, and high channels. The EUT was rotated about 360^0 and the receiving antenna scanned from 1-4m in order to capture the maximum emission. The plots are corrected for cable loss, antenna correction factor, and distance correction. The field strength was mathematically corrected to an E.I.R.P. Harmonic emissions up to the 10^{th} or 40GHz, which ever was the lesser, were investigated.

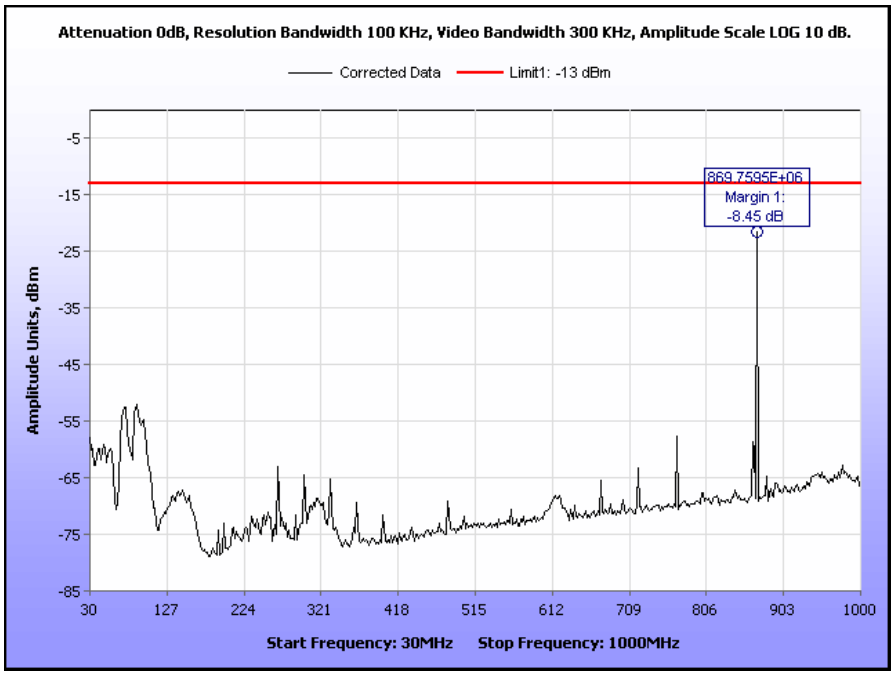
The spectrum analyzer was set to 1MHz RBW and 3MHz VBW above 1 GHz and 100 kHz RBW and 300 kHz VBW below 1 GHz. The spectrum was investigated from 30MHz to the 10^{th} harmonic of the carrier.

Test Results: The EUT complies with the requirements of this section.

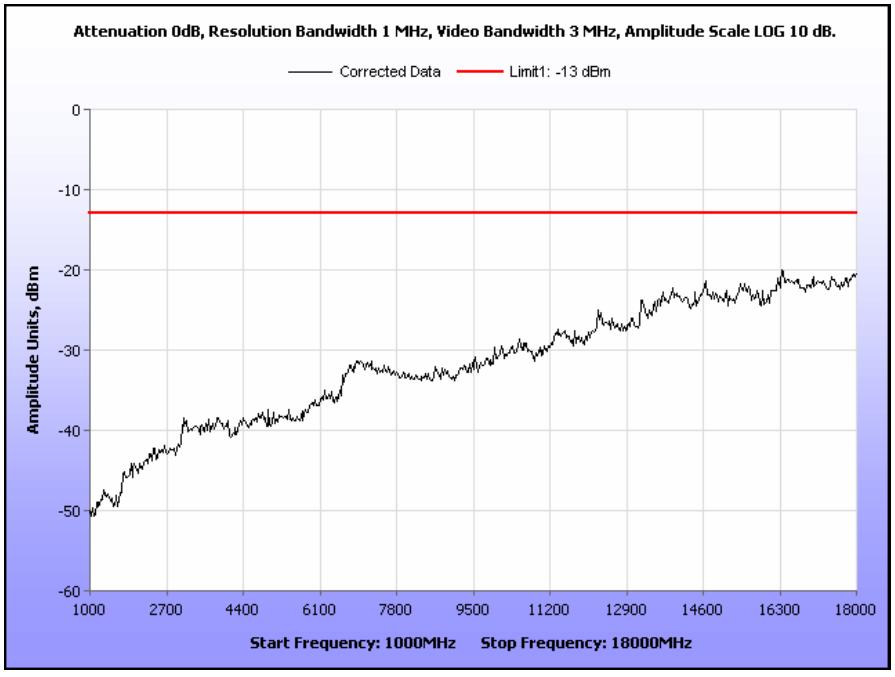
Test Engineer: Benjamin Taylor

Test Date(s): 11/24/13

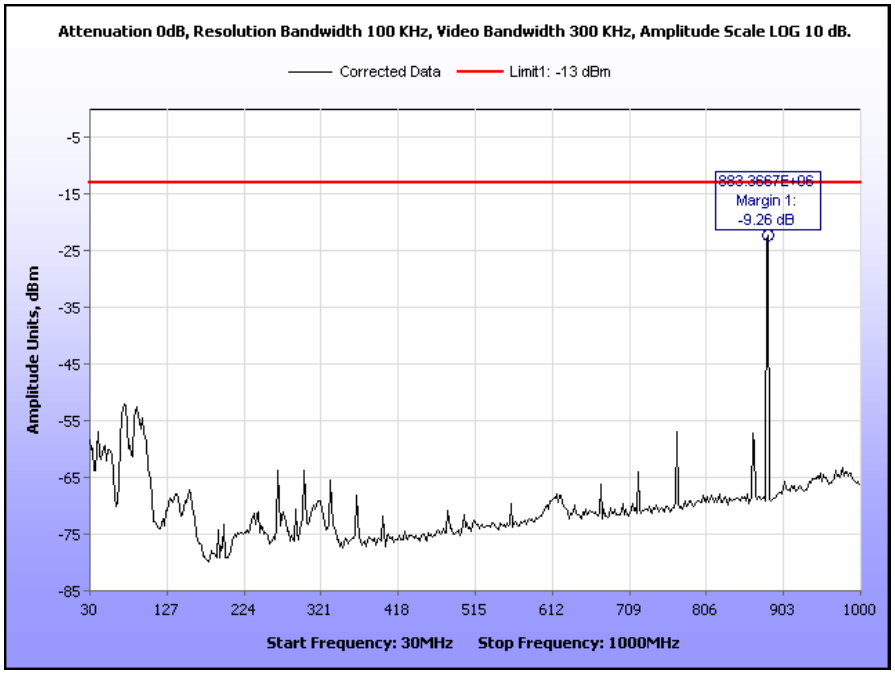
Radiated Spurious Emissions, Part 22



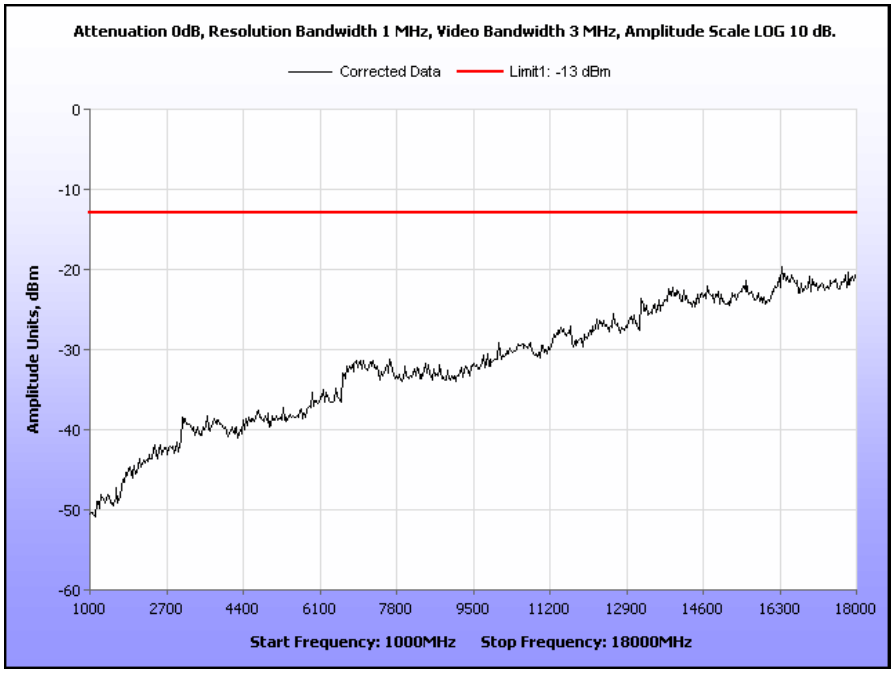
Plot 91. Radiated Spurious Emissions, GSM, AMP, Low Channel, 30 MHz – 1 GHz, Part 22



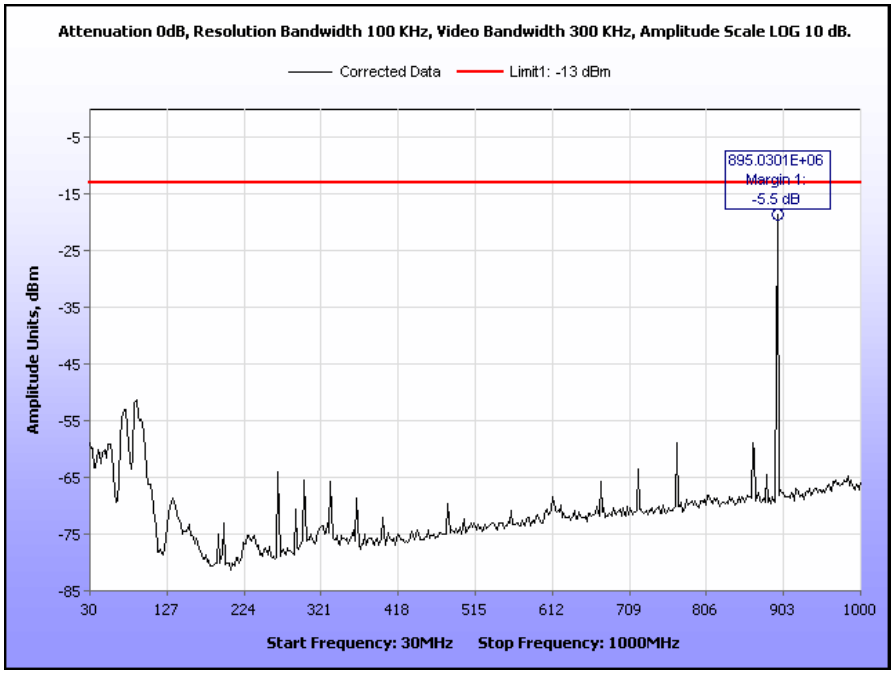
Plot 92. Radiated Spurious Emissions, GSM, AMP, Low Channel, 1 GHz – 18 GHz, Part 22



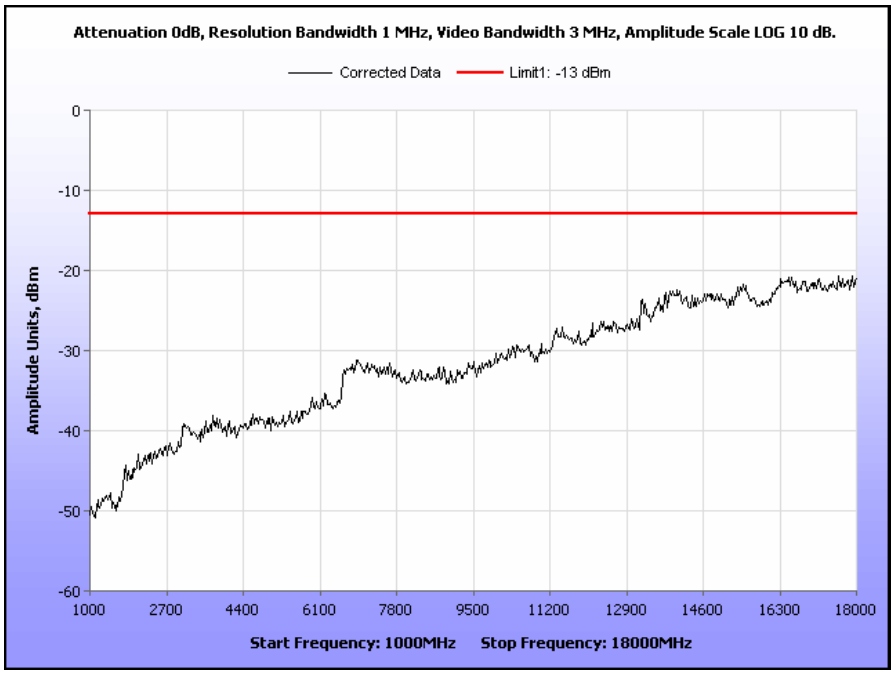
Plot 93. Radiated Spurious Emissions, GSM, AMP, Mid Channel, 30 MHz – 1 GHz, Part 22



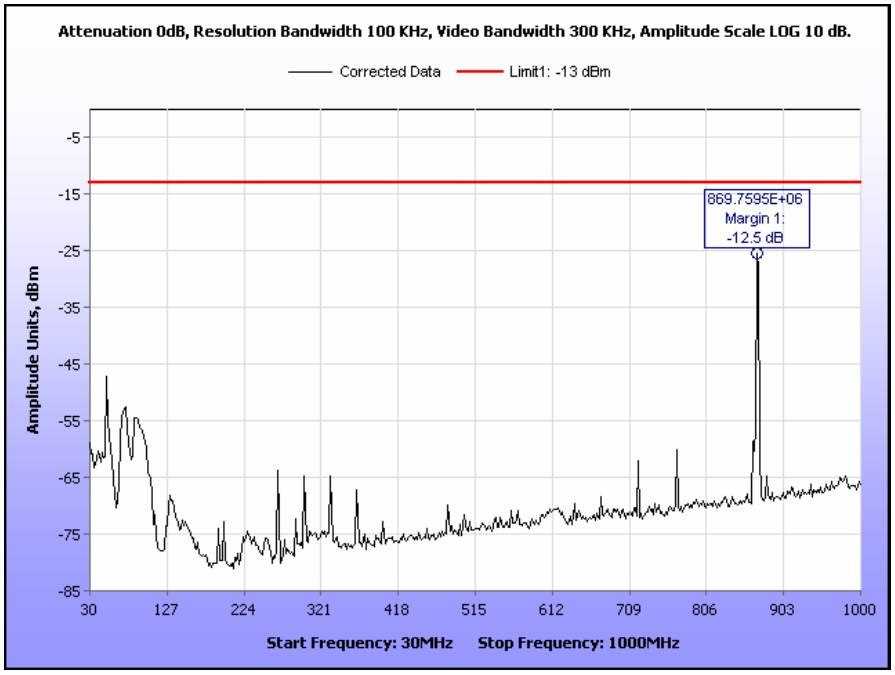
Plot 94. Radiated Spurious Emissions, GSM, AMP, Mid Channel, 1 GHz – 18 GHz, Part 22



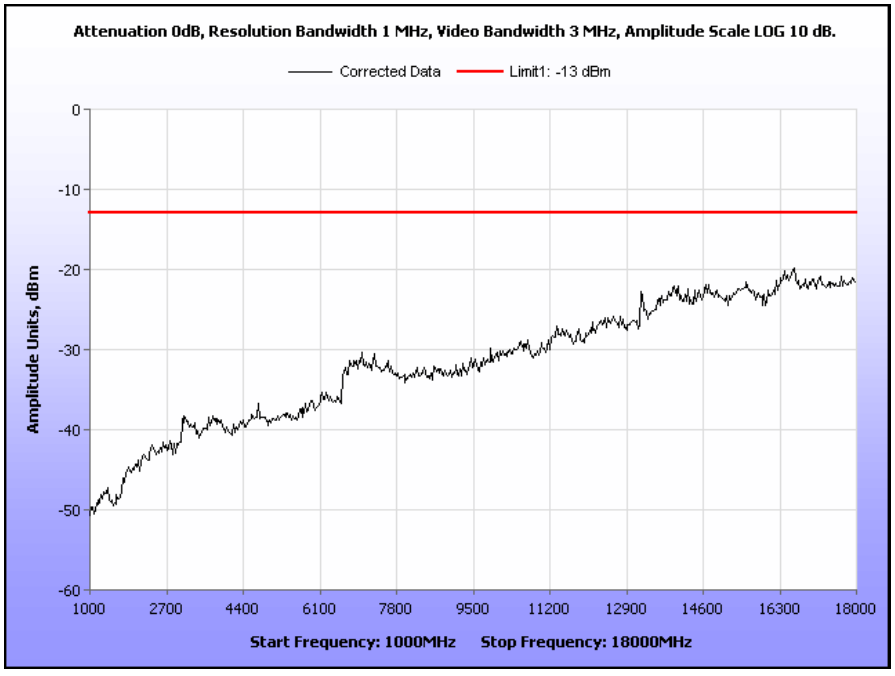
Plot 95. Radiated Spurious Emissions, GSM, AMP, High Channel, 30 MHz – 1 GHz, Part 22



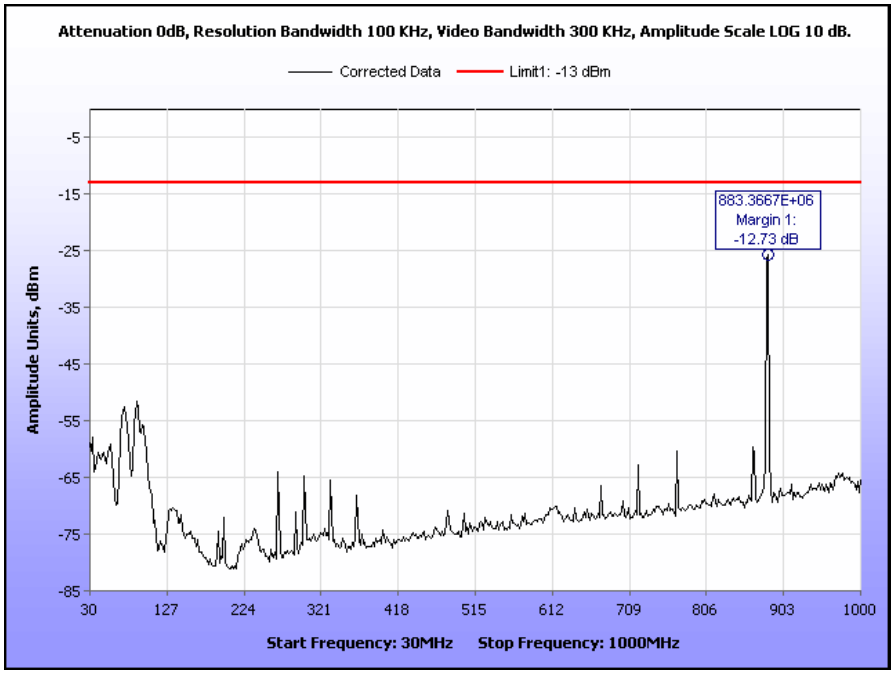
Plot 96. Radiated Spurious Emissions, GSM, AMP, High Channel, 1 GHz – 18 GHz, Part 22



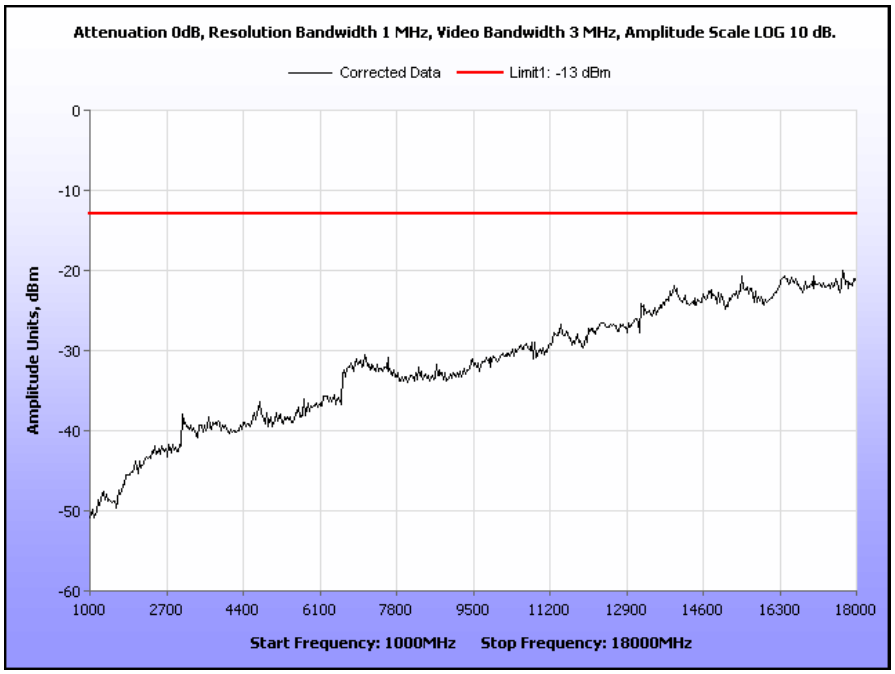
Plot 97. Radiated Spurious Emissions, CDMA, AMP, Low Channel, 30 MHz – 1 GHz, Part 22



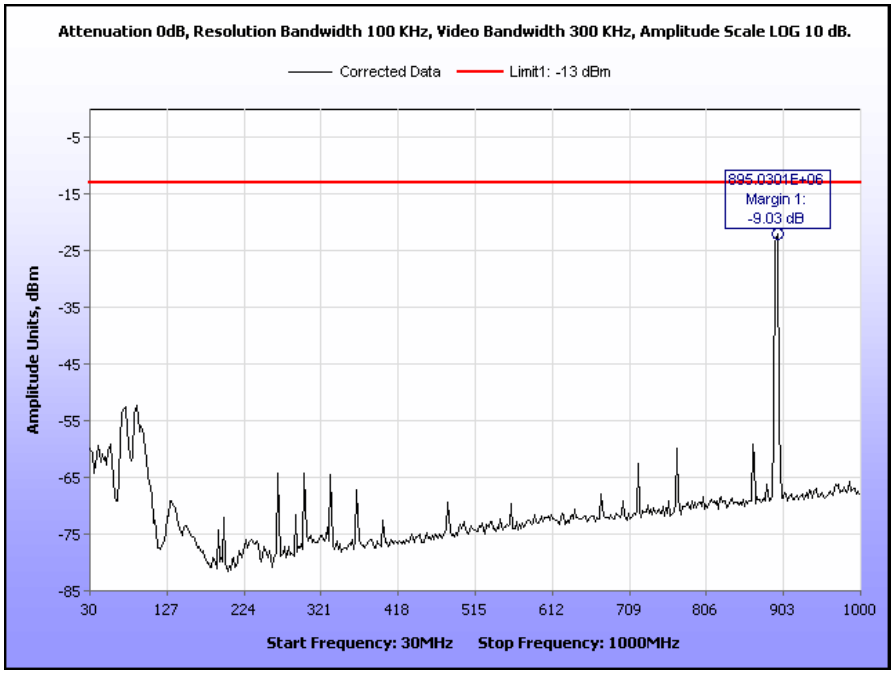
Plot 98. Radiated Spurious Emissions, CDMA, AMP, Low Channel, 1 GHz – 18 GHz, Part 22



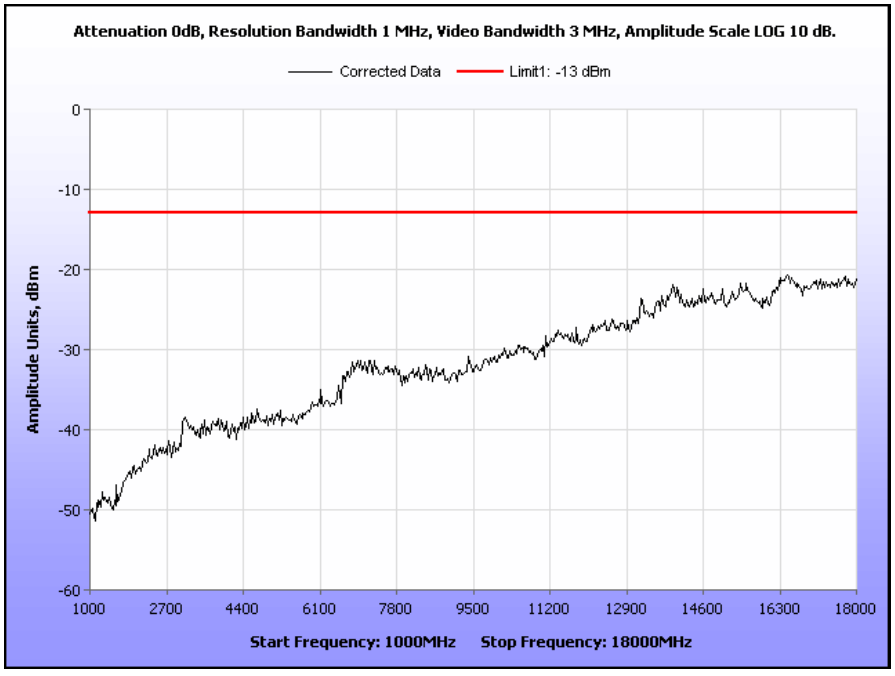
Plot 99. Radiated Spurious Emissions, CDMA, AMP, Mid Channel, 30 MHz – 1 GHz, Part 22



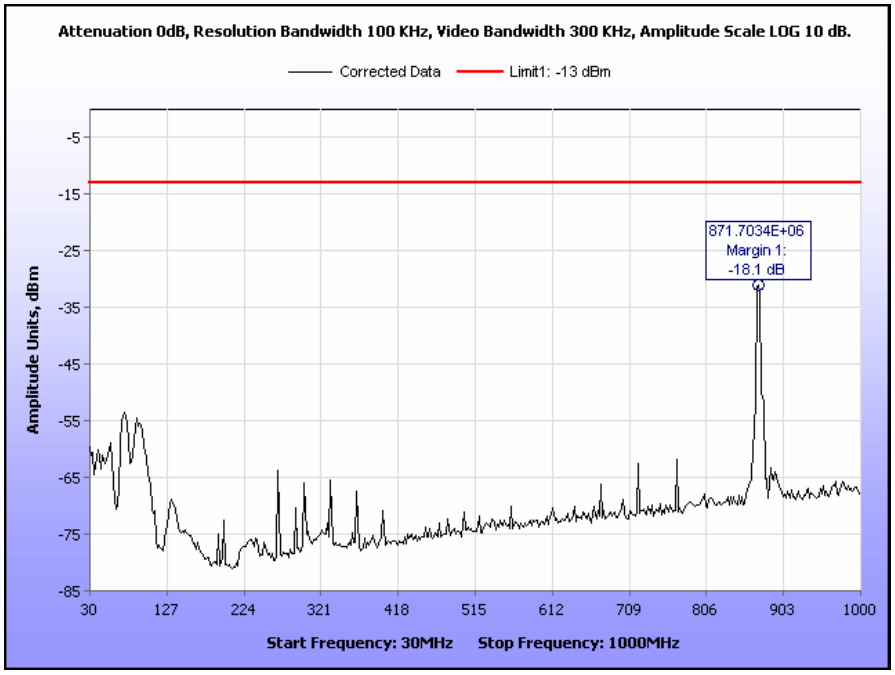
Plot 100. Radiated Spurious Emissions, CDMA, AMP, Mid Channel, 1 GHz – 18 GHz, Part 22



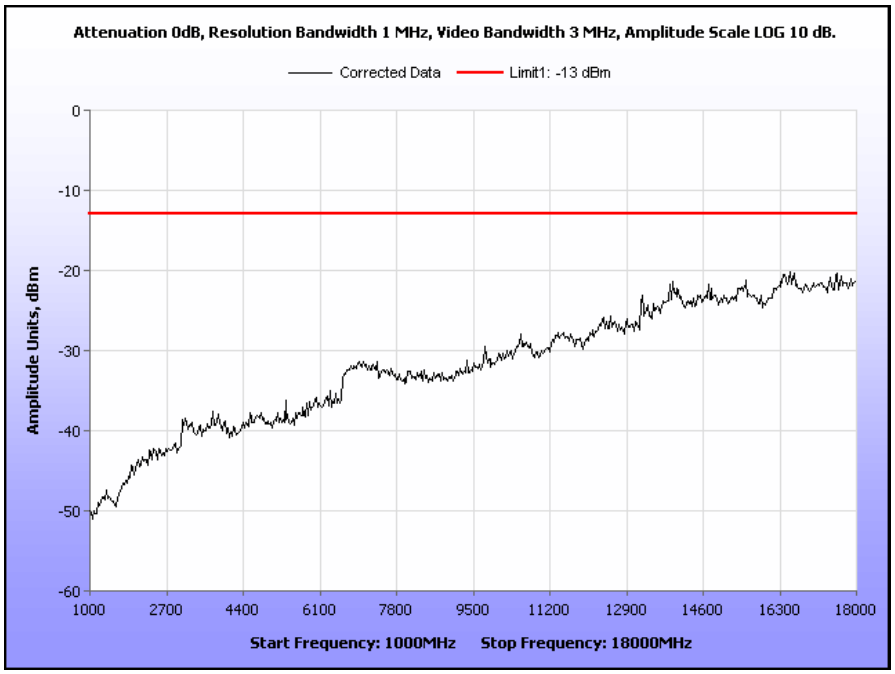
Plot 101. Radiated Spurious Emissions, CDMA, AMP, High Channel, 30 MHz – 1 GHz, Part 22



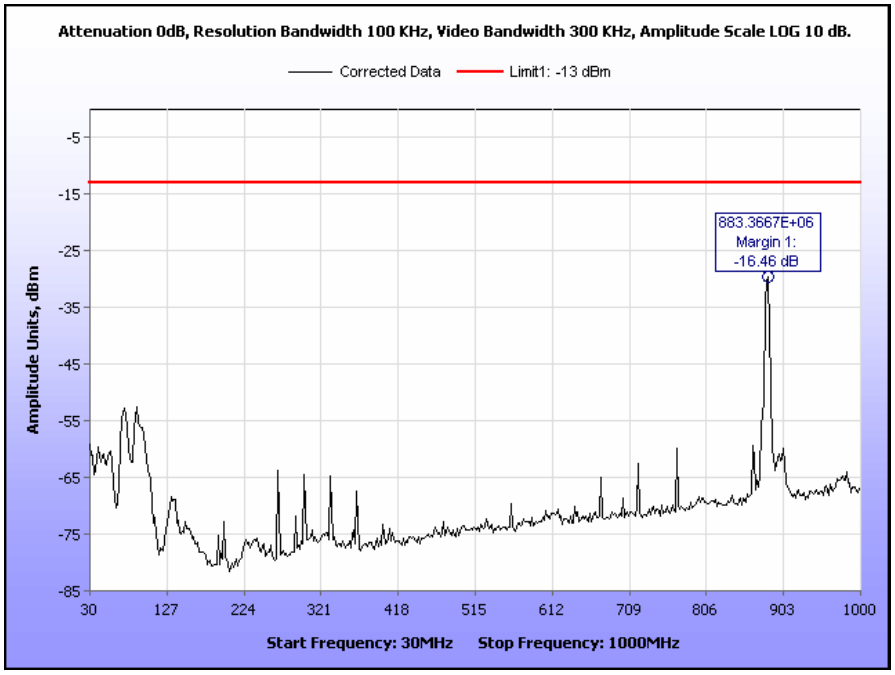
Plot 102. Radiated Spurious Emissions, CDMA, AMP, High Channel, 1 GHz – 18 GHz, Part 22



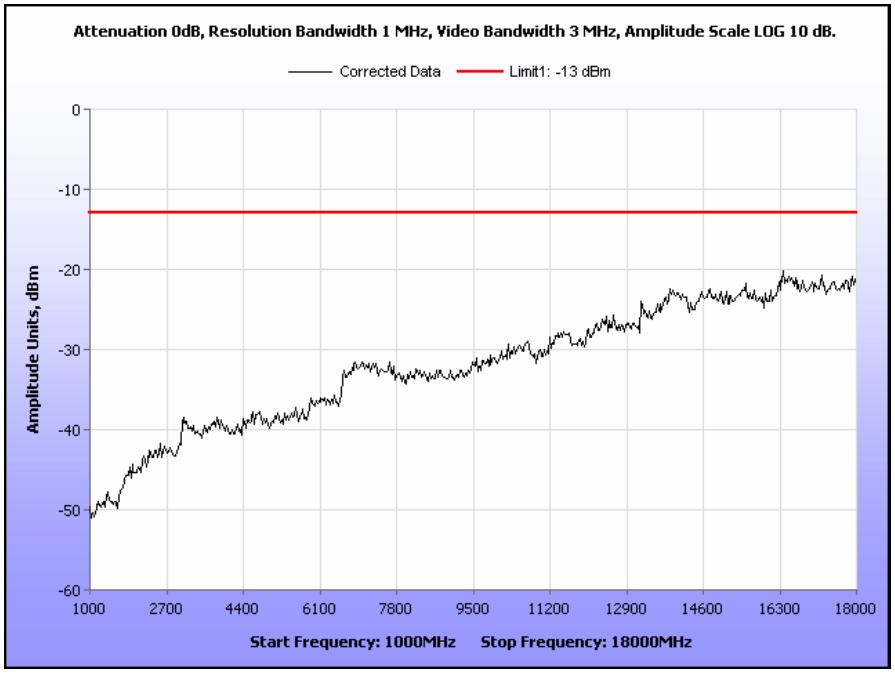
Plot 103. Radiated Spurious Emissions, WCDMA, AMP, Low Channel, 30 MHz – 1 GHz, Part 22



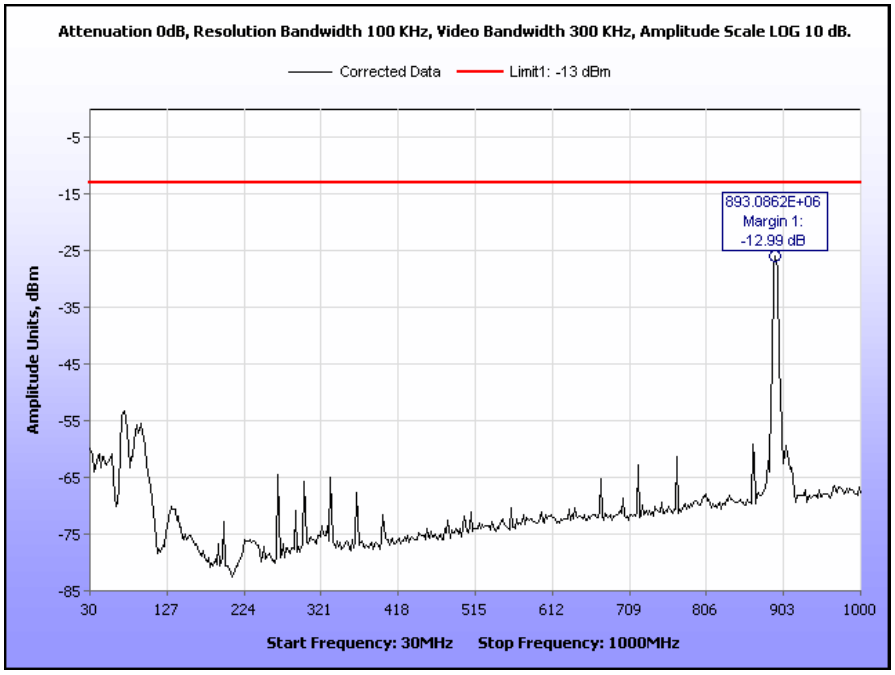
Plot 104. Radiated Spurious Emissions, WCDMA, AMP, Low Channel, 1 GHz – 18 GHz, Part 22



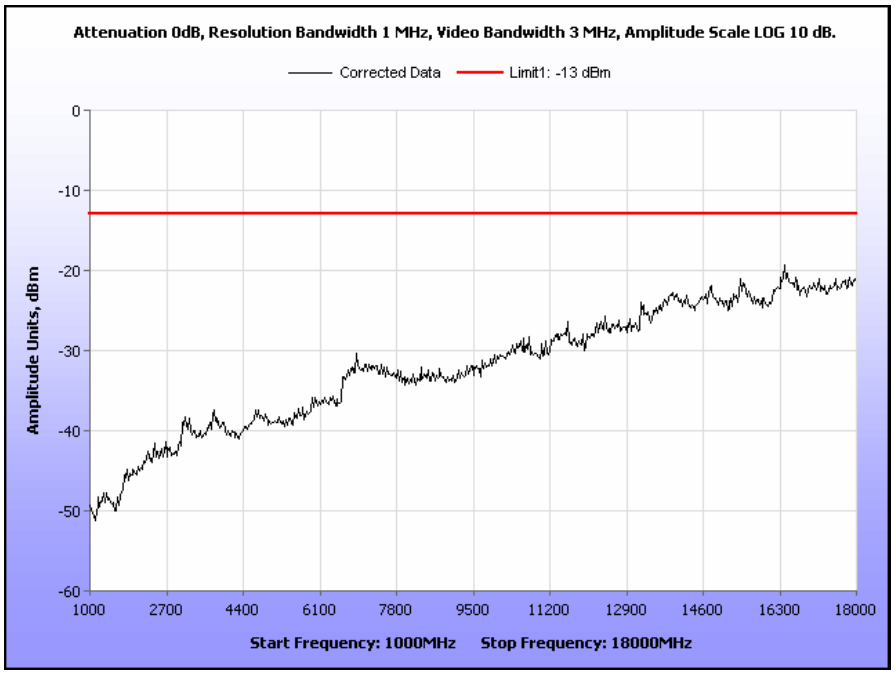
Plot 105. Radiated Spurious Emissions, WCDMA, AMP, Mid Channel, 30 MHz – 1 GHz, Part 22



Plot 106. Radiated Spurious Emissions, WCDMA, AMP, Mid Channel, 1 GHz – 18 GHz, Part 22

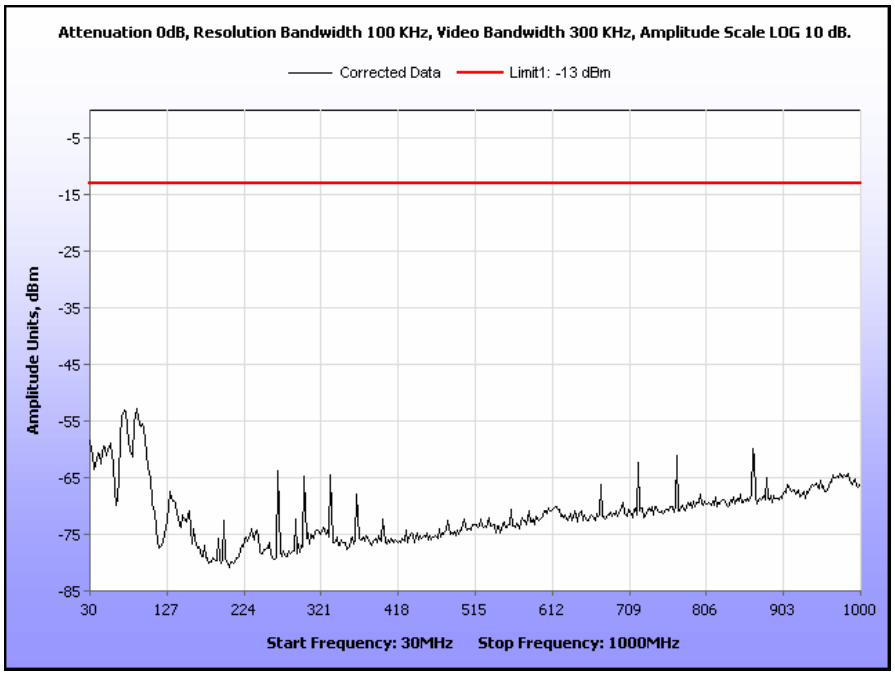


Plot 107. Radiated Spurious Emissions, WCDMA, AMP, High Channel, 30 MHz – 1 GHz, Part 22

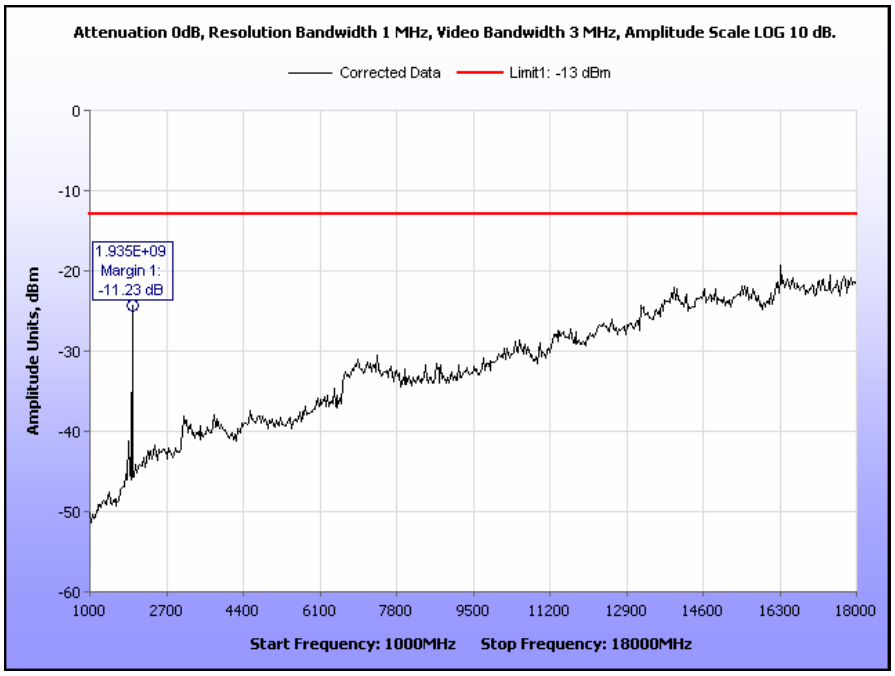


Plot 108. Radiated Spurious Emissions, WCDMA, AMP, High Channel, 1 GHz – 18 GHz, Part 22

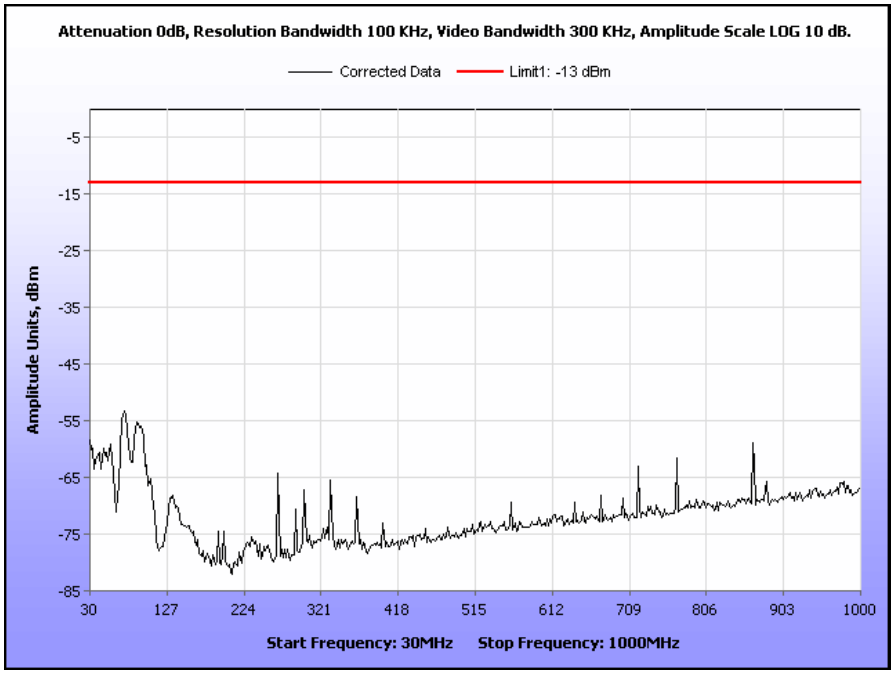
Radiated Spurious Emissions, Part 24



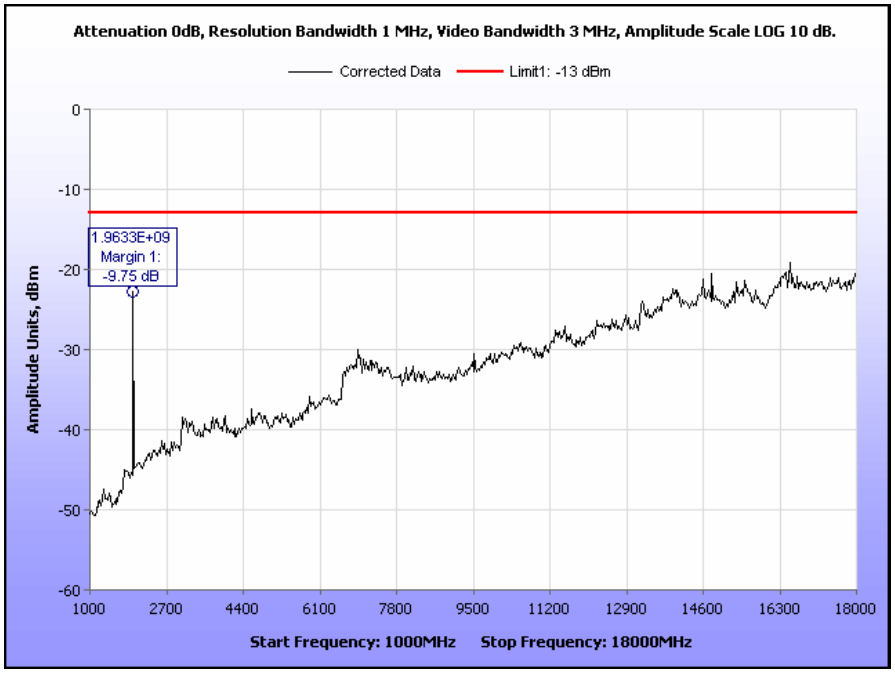
Plot 109. Radiated Spurious Emissions, GSM, AMP, Low Channel, 30 MHz – 1 GHz, Part 24



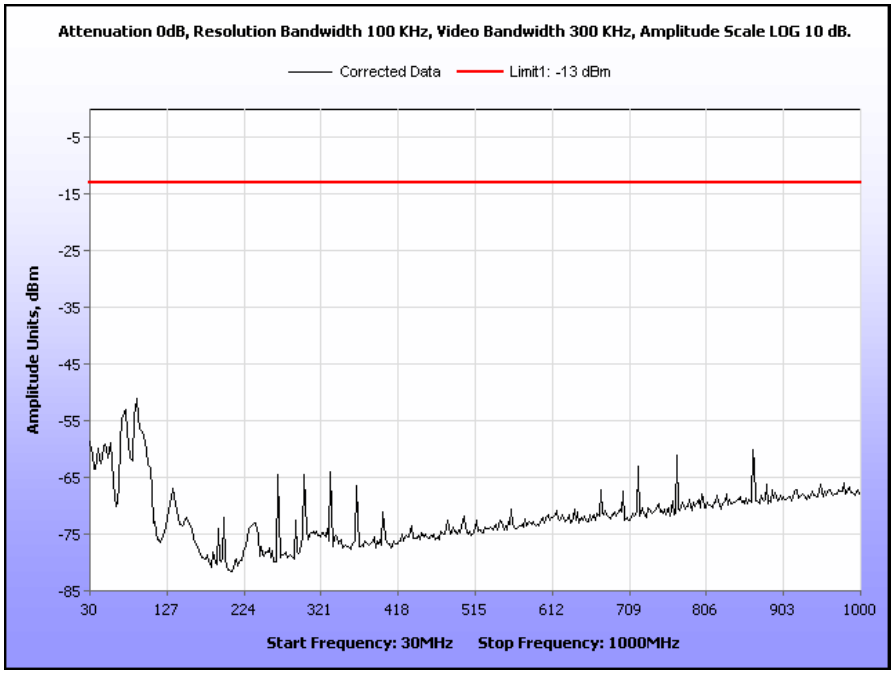
Plot 110. Radiated Spurious Emissions, GSM, AMP, Low Channel, 1 GHz – 18 GHz, Part 24



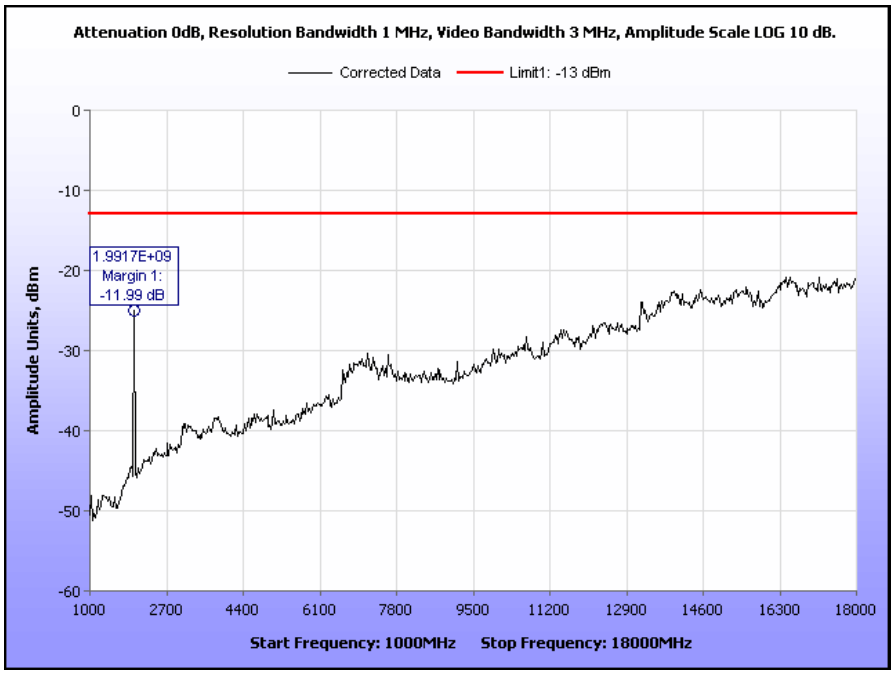
Plot 111. Radiated Spurious Emissions, GSM, AMP, Mid Channel, 30 MHz – 1 GHz, Part 24



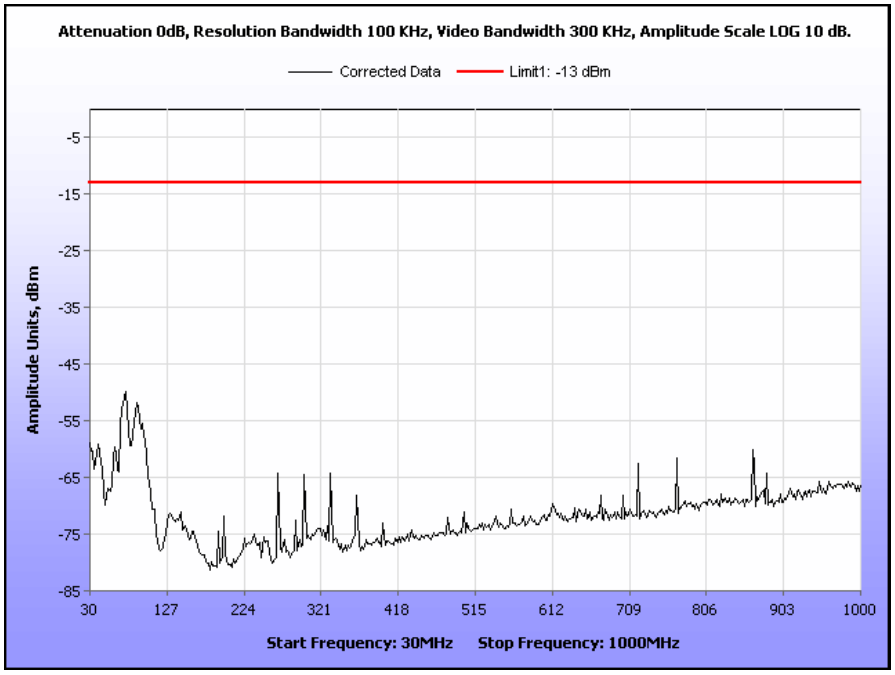
Plot 112. Radiated Spurious Emissions, GSM, AMP, Mid Channel, 1 GHz – 18 GHz, Part 24



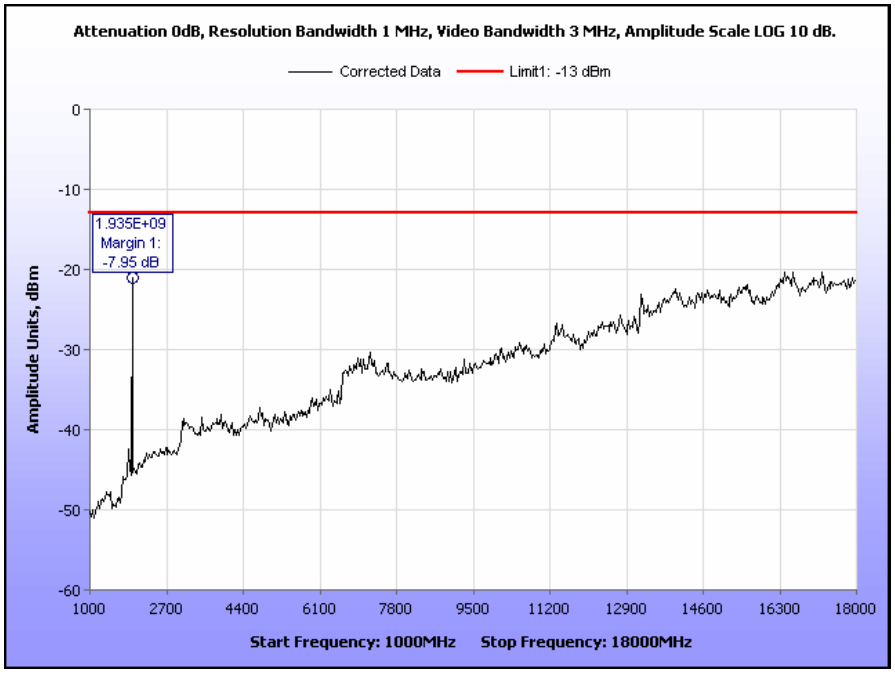
Plot 113. Radiated Spurious Emissions, GSM, AMP, High Channel, 30 MHz – 1 GHz, Part 24



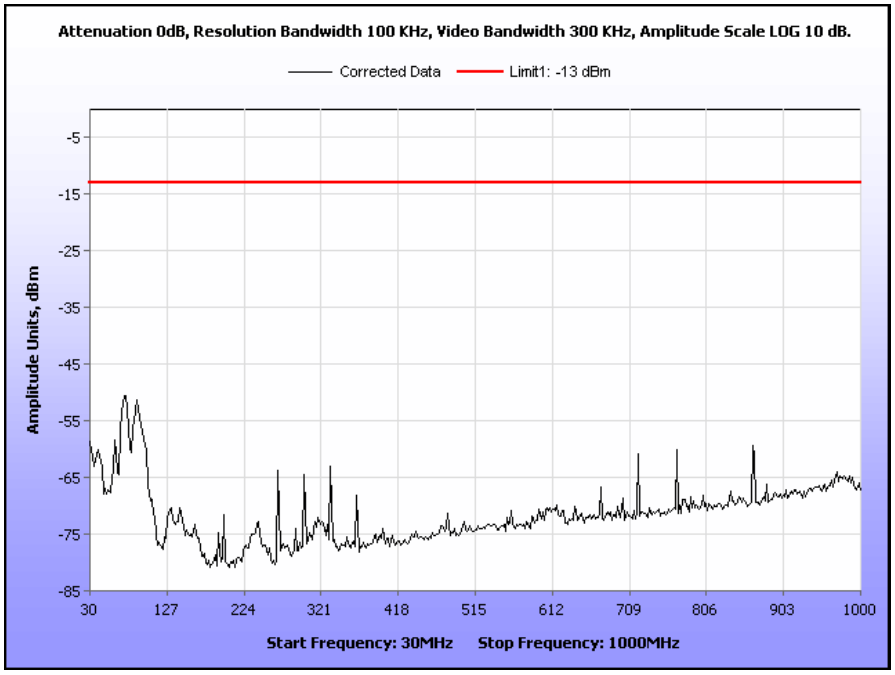
Plot 114. Radiated Spurious Emissions, GSM, AMP, High Channel, 1 GHz – 18 GHz, Part 24



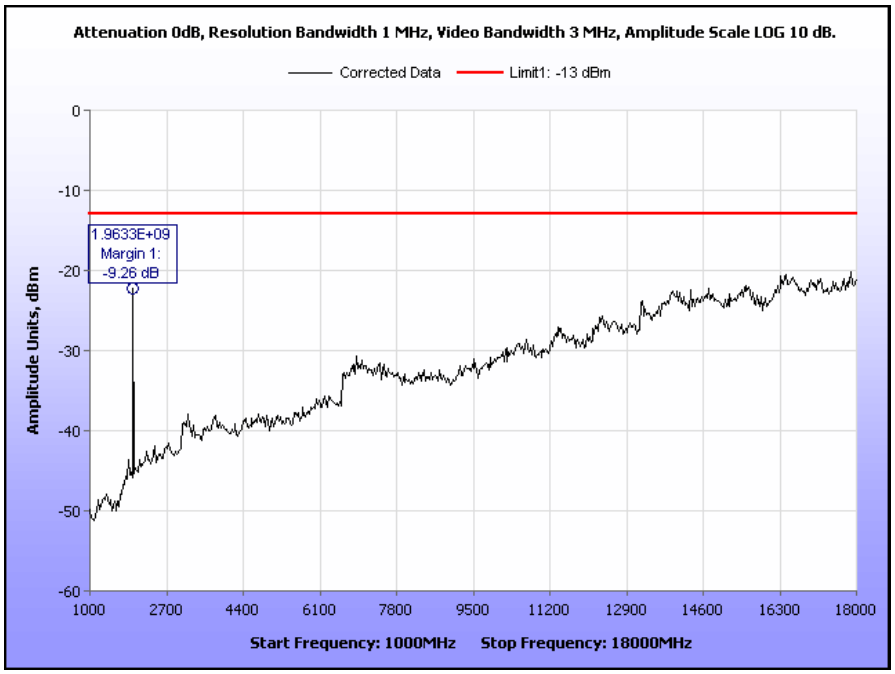
Plot 115. Radiated Spurious Emissions, CDMA, AMP, Low Channel, 30 MHz – 1 GHz, Part 24



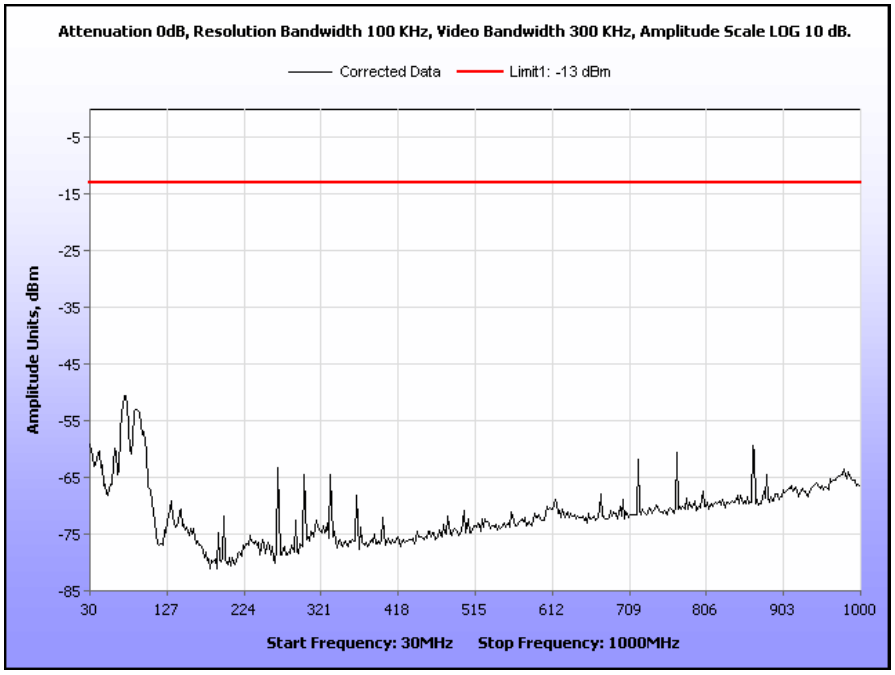
Plot 116. Radiated Spurious Emissions, CDMA, AMP, Low Channel, 1 GHz – 18 GHz, Part 24



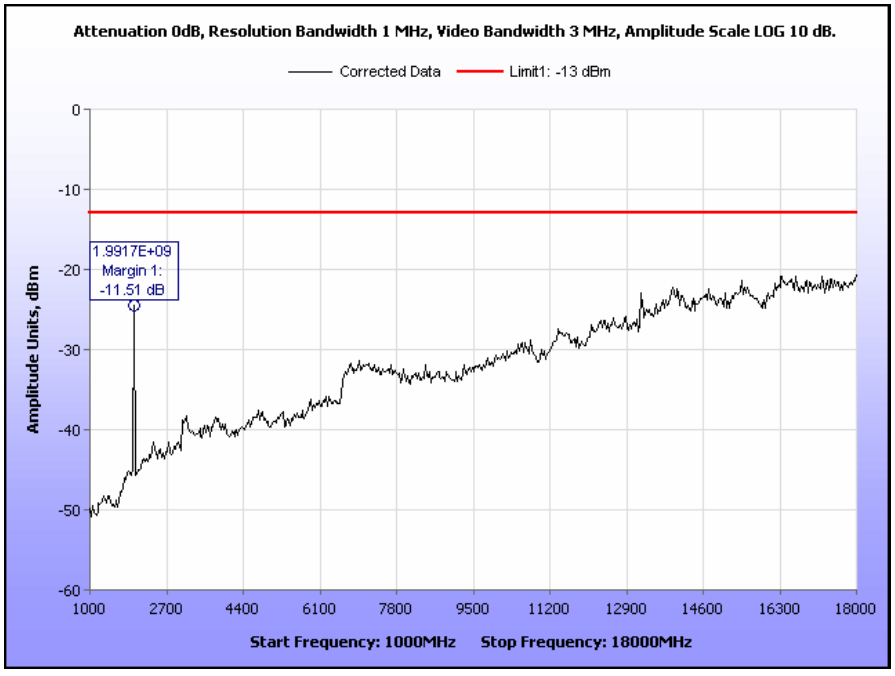
Plot 117. Radiated Spurious Emissions, CDMA, AMP, Mid Channel, 30 MHz – 1 GHz, Part 24



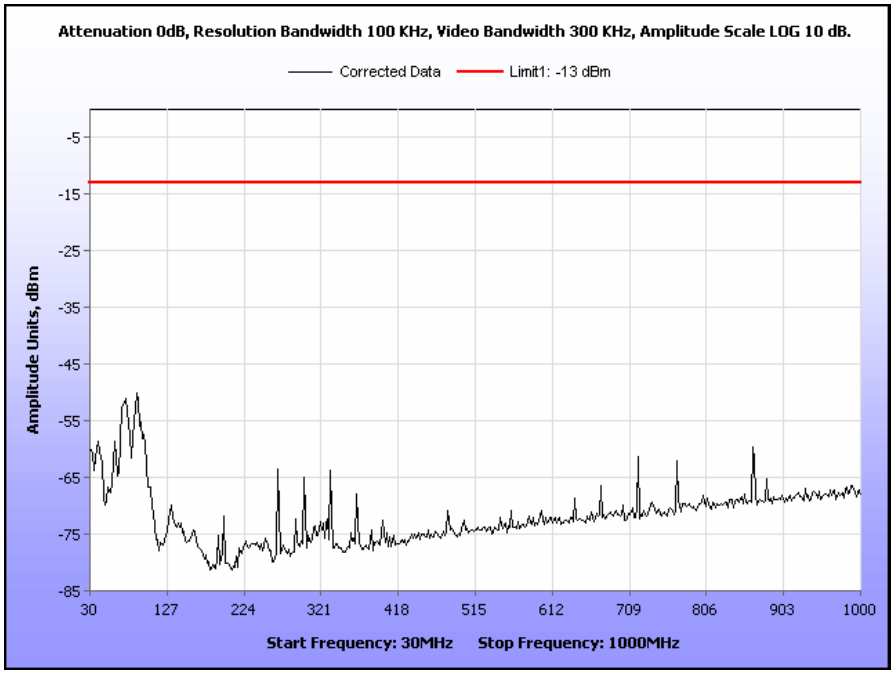
Plot 118. Radiated Spurious Emissions, CDMA, AMP, Mid Channel, 1 GHz – 18 GHz, Part 24



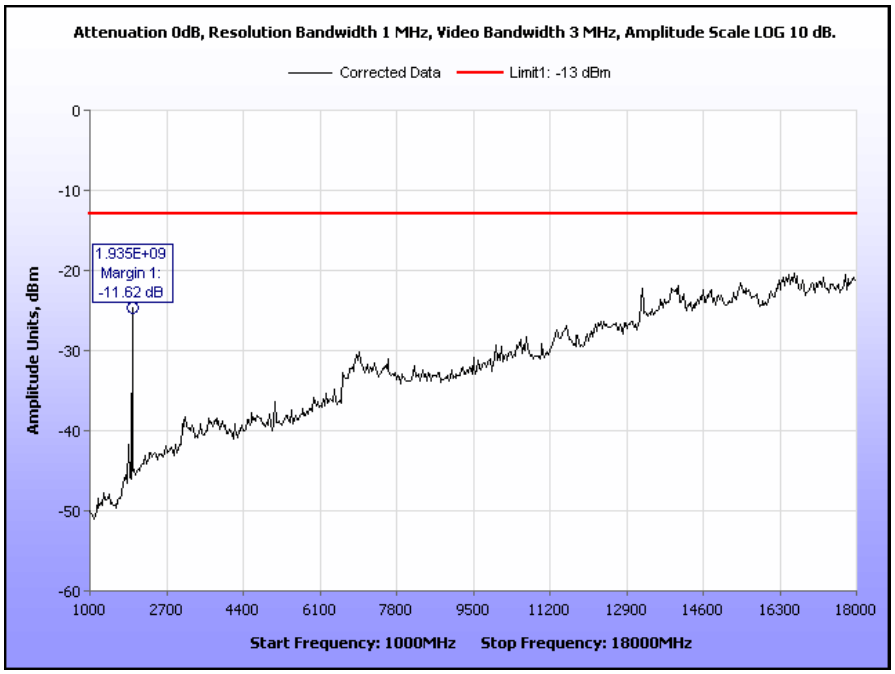
Plot 119. Radiated Spurious Emissions, CDMA, AMP, High Channel, 30 MHz – 1 GHz, Part 24



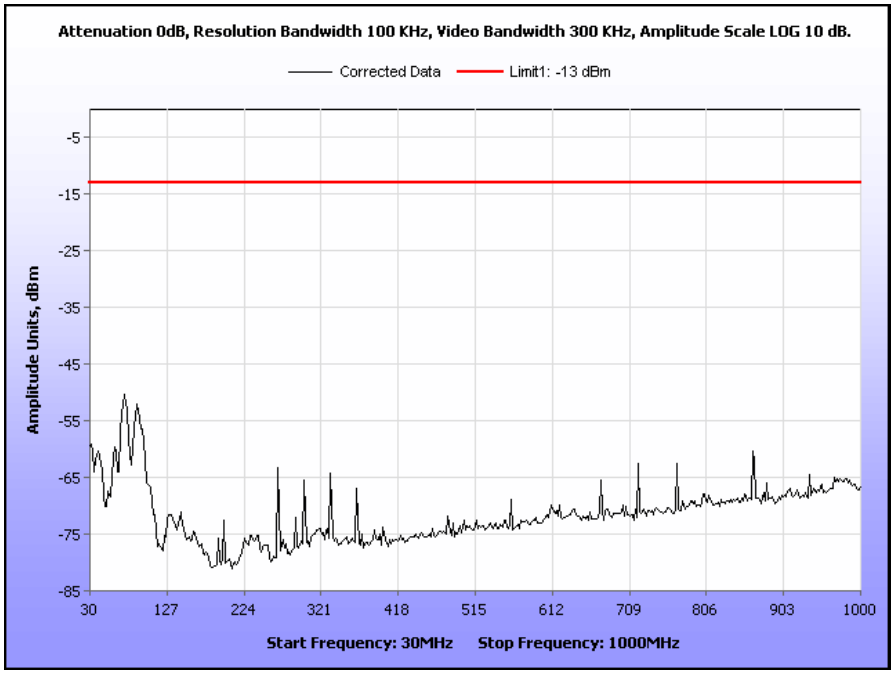
Plot 120. Radiated Spurious Emissions, CDMA, AMP, High Channel, 1 GHz – 18 GHz, Part 24



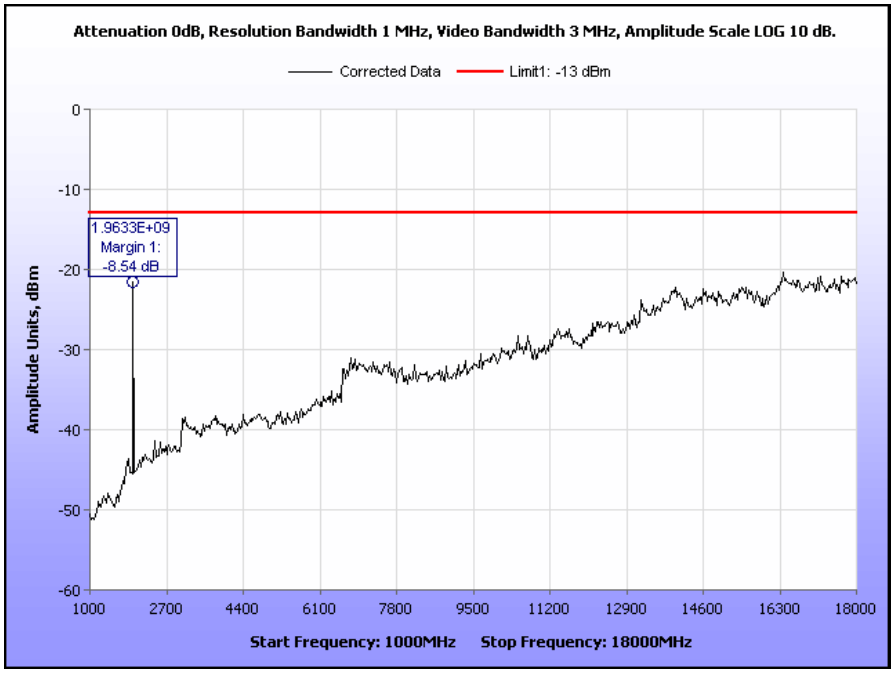
Plot 121. Radiated Spurious Emissions, WCDMA, AMP, Low Channel, 30 MHz – 1 GHz, Part 24



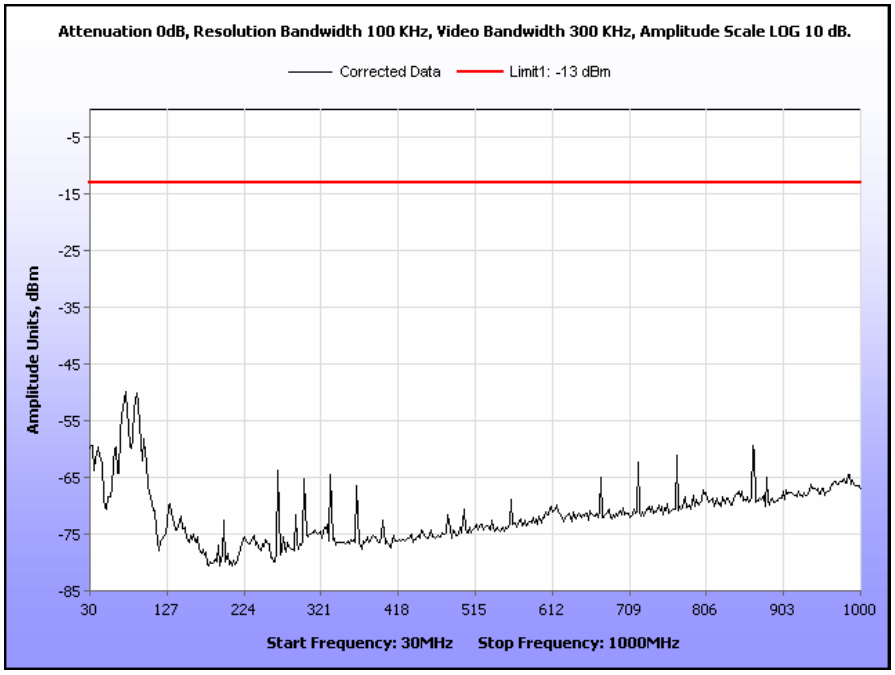
Plot 122. Radiated Spurious Emissions, WCDMA, AMP, Low Channel, 1 GHz – 18 GHz, Part 24



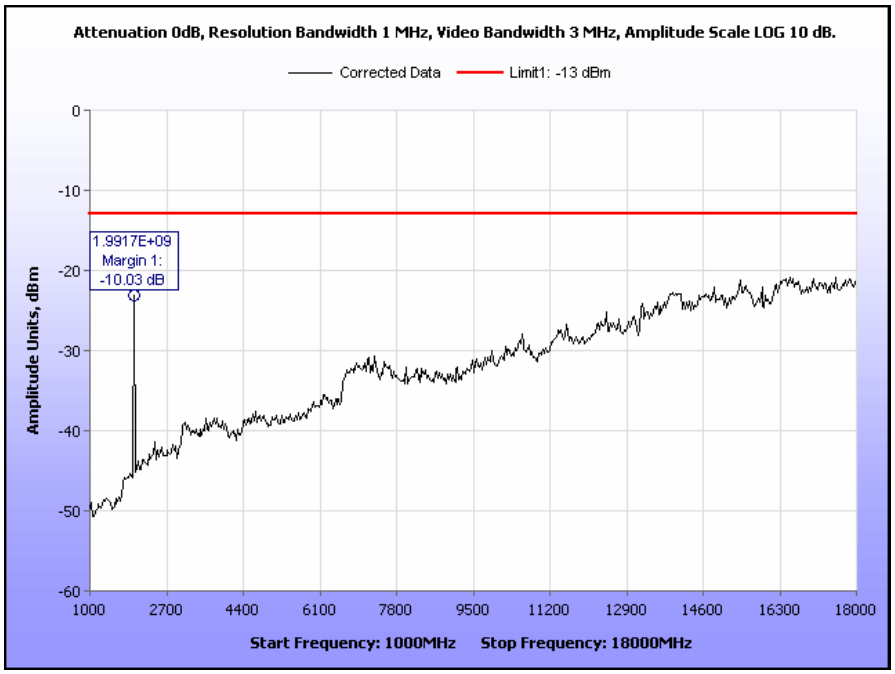
Plot 123. Radiated Spurious Emissions, WCDMA, AMP, Mid Channel, 30 MHz – 1 GHz, Part 24



Plot 124. Radiated Spurious Emissions, WCDMA, AMP, Mid Channel, 1 GHz – 18 GHz, Part 24



Plot 125. Radiated Spurious Emissions, WCDMA, AMP, High Channel, 30 MHz – 1 GHz, Part 24



Plot 126. Radiated Spurious Emissions, WCDMA, AMP, High Channel, 1 GHz – 18 GHz, Part 24

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1051 Spurious Emissions at Antenna Terminals

Test Requirement(s):

§ 2.1051 Measurements required: Spurious emissions at antenna terminals: The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§ 22.917 The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

§ 22.917 (a) Out of band emissions. The power of any emission 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.

§ 22.917 (b) *Measurement procedure*. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 30 kHz or more. In the 60 kHz bands immediately outside and adjacent to the authorized frequency range or channel, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy approved the measured power is integrated over the full required measurement bandwidth (i.e., 30 kHz or 1 percent of emission bandwidth, as specified). 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.

§24.238 Emission limitations for Broadband PCS equipment: The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

§ 24.238 (a) Out of band emissions. The power of any emission 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.

§ 24.238 (b) *Measurement procedure*. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e., 1 MHz or 1 percent of emission bandwidth, as specified). 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.

Test Procedures: As required by 47 CFR §2.1051, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer through an attenuator. The Spectrum Analyzer was set to sweep 30 MHz and up to 10th harmonic of the fundamental or 40 GHz whichever is the lesser. Measurements were made in all applicable frequency bands.

Test Results: Equipment complies with these requirements.

Test Engineer(s): Benjamin Taylor

Test Date(s): 11/24/13

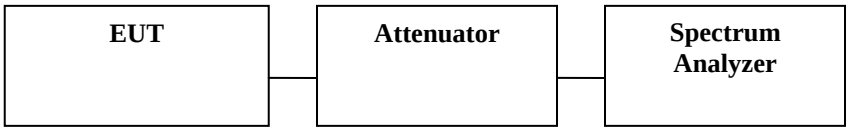
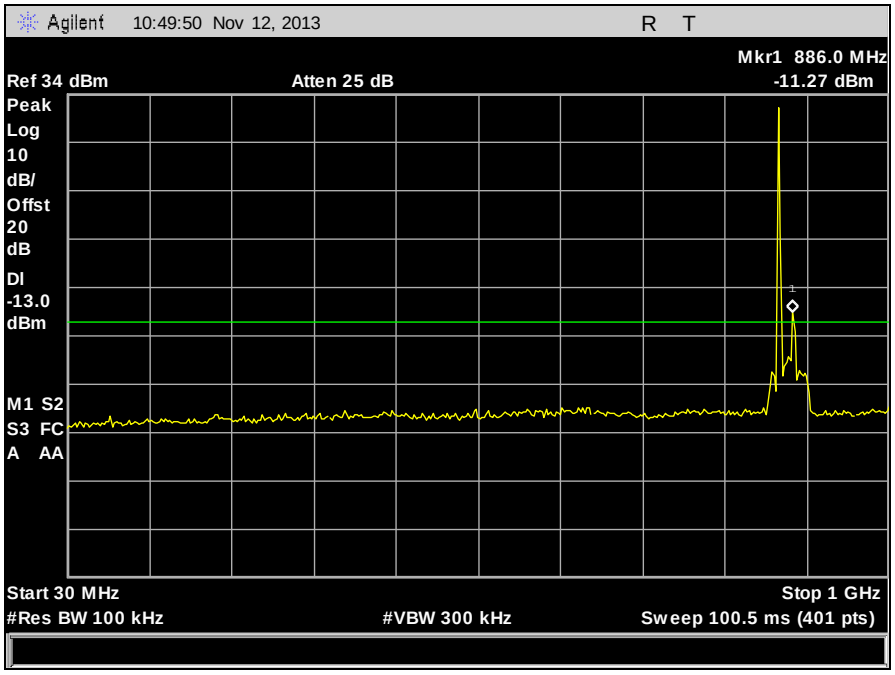
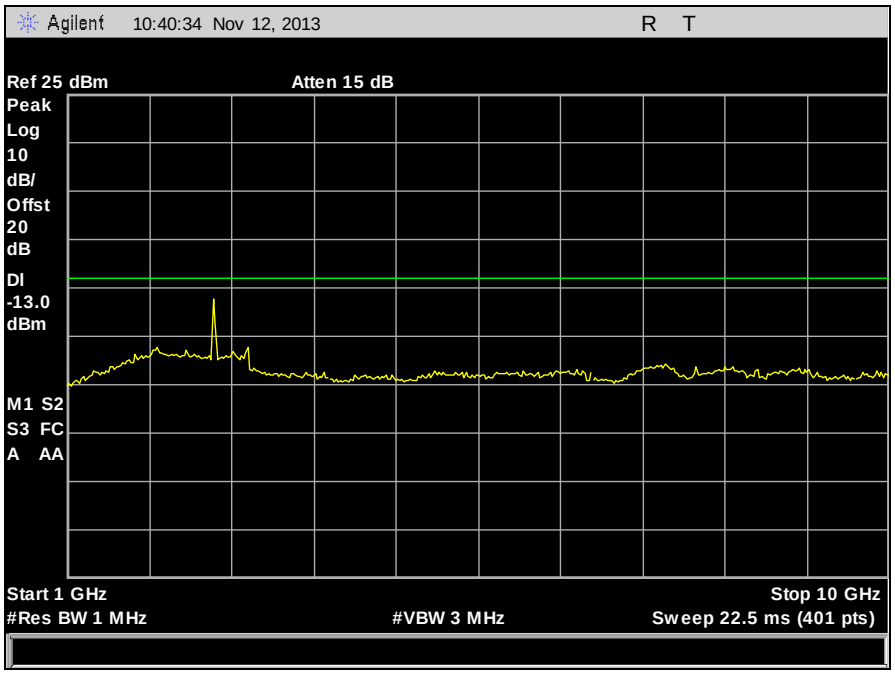


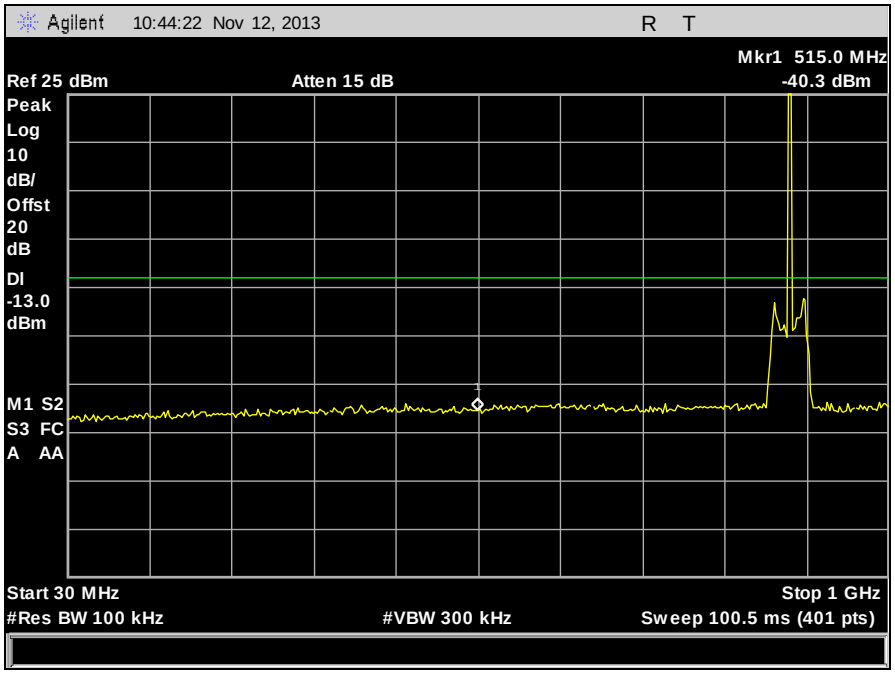
Figure 3. Spurious Emissions at Antenna Terminals Test Setup



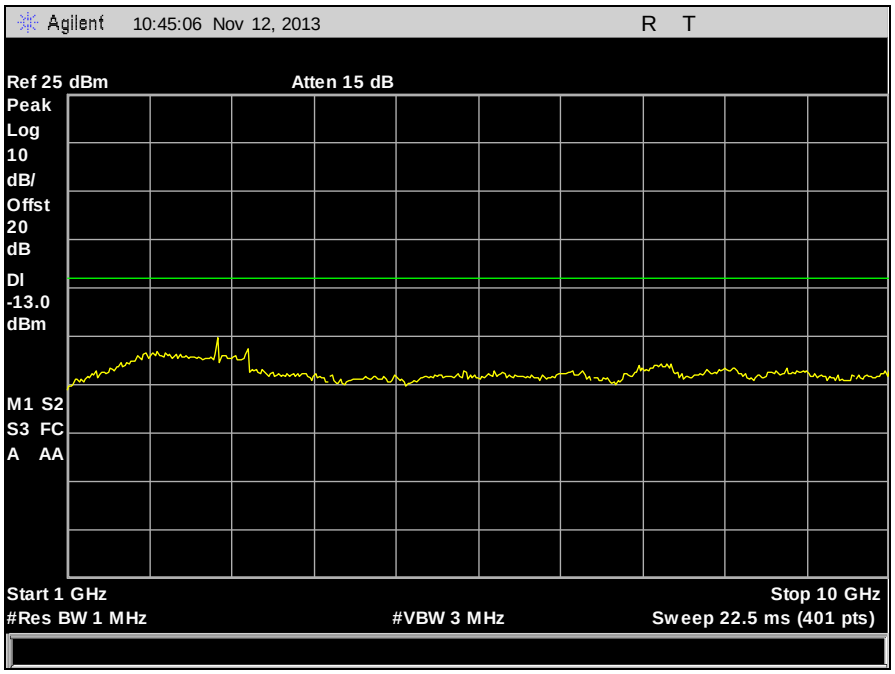
Plot 127. Conducted Spurious Emissions, GSM, Low Channel, 30 MHz – 1 GHz, Part 22



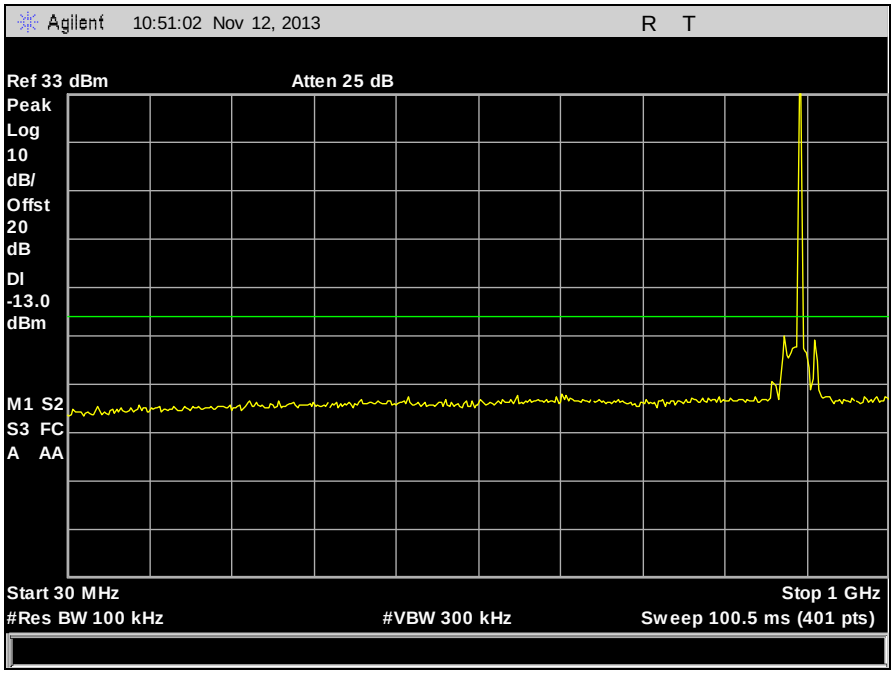
Plot 128. Conducted Spurious Emissions, GSM, Low Channel, 1 GHz – 10 GHz, Part 22



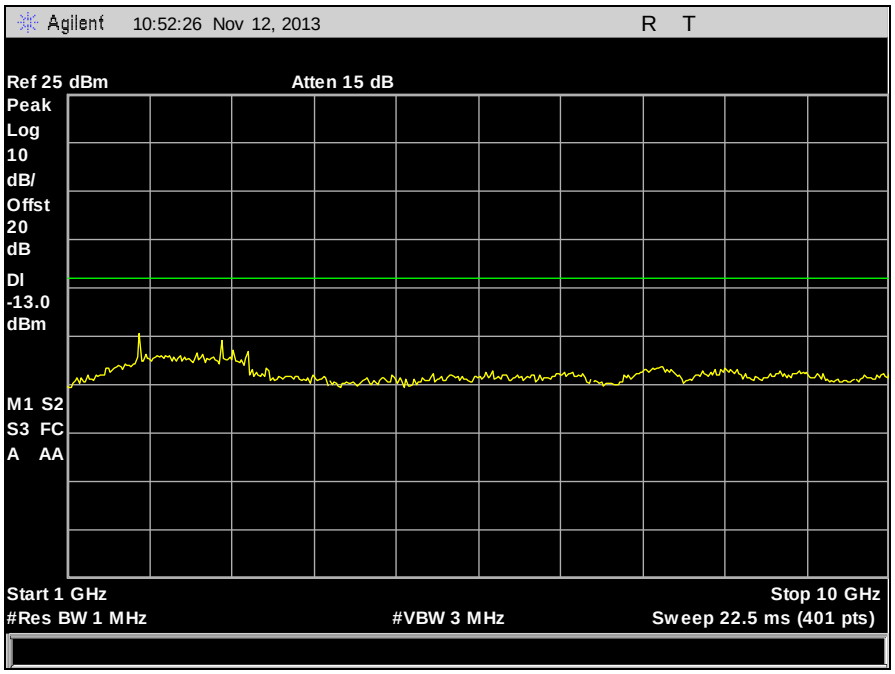
Plot 129. Conducted Spurious Emissions, GSM, Mid Channel, 30 MHz – 1 GHz, Part 22



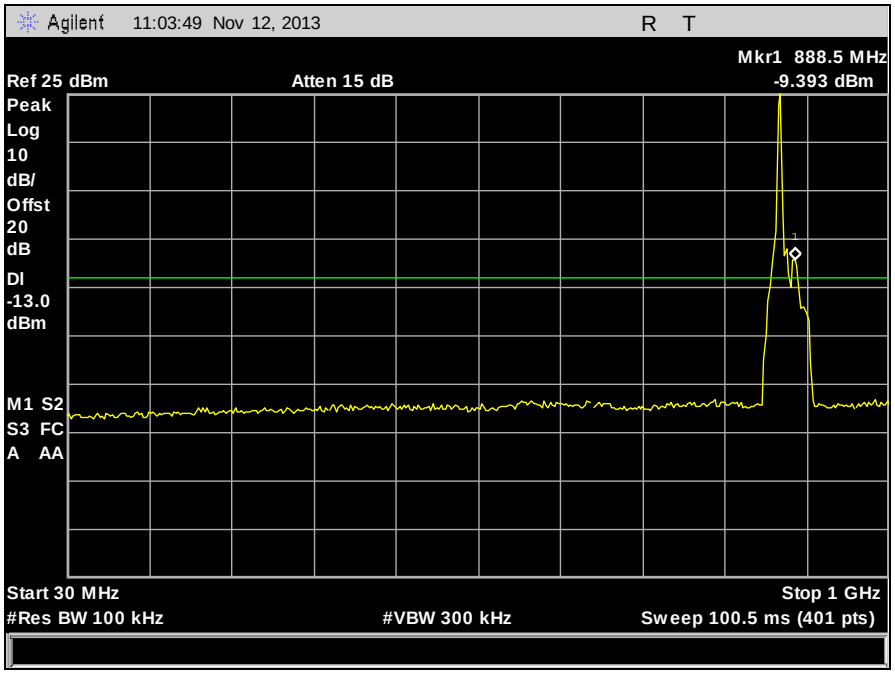
Plot 130. Conducted Spurious Emissions, GSM, Mid Channel, 1 GHz – 10 GHz, Part 22



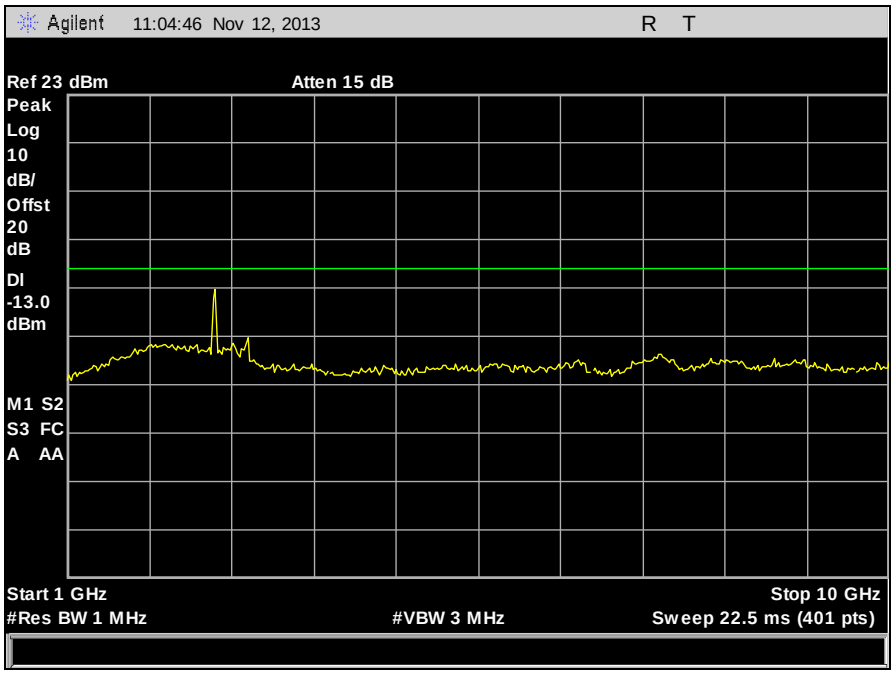
Plot 131. Conducted Spurious Emissions, GSM, High Channel, 30 MHz – 1 GHz, Part 22



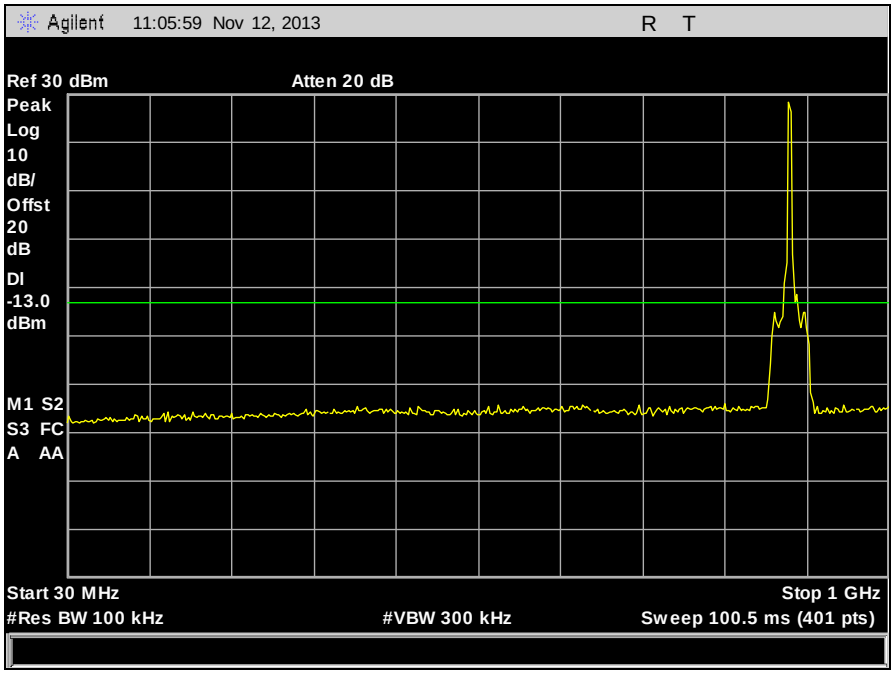
Plot 132. Conducted Spurious Emissions, GSM, High Channel, 1 GHz – 10 GHz, Part 22



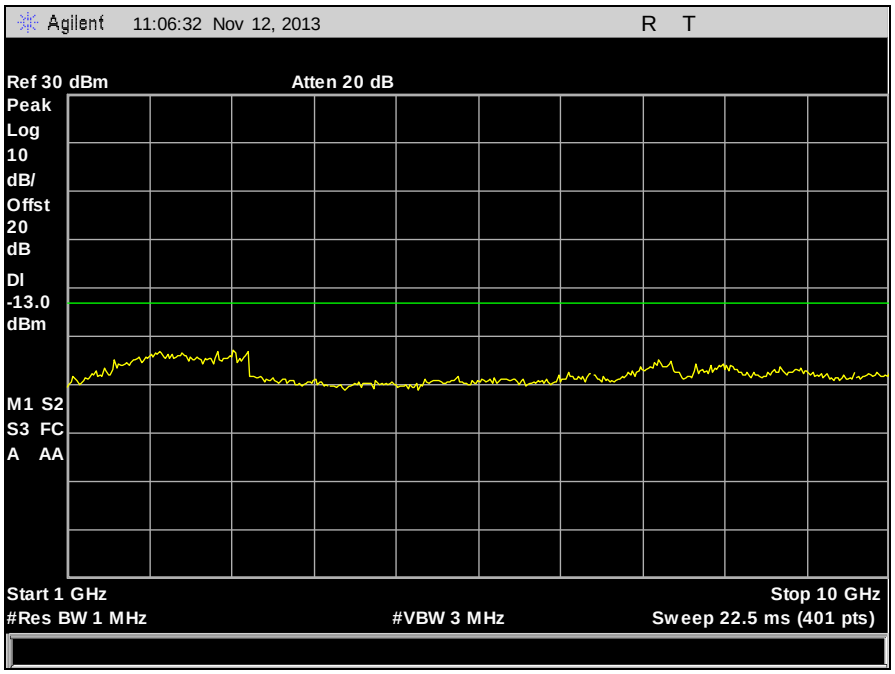
Plot 133. Conducted Spurious Emissions, CDMA, Low Channel, 30 MHz – 1 GHz, Part 22



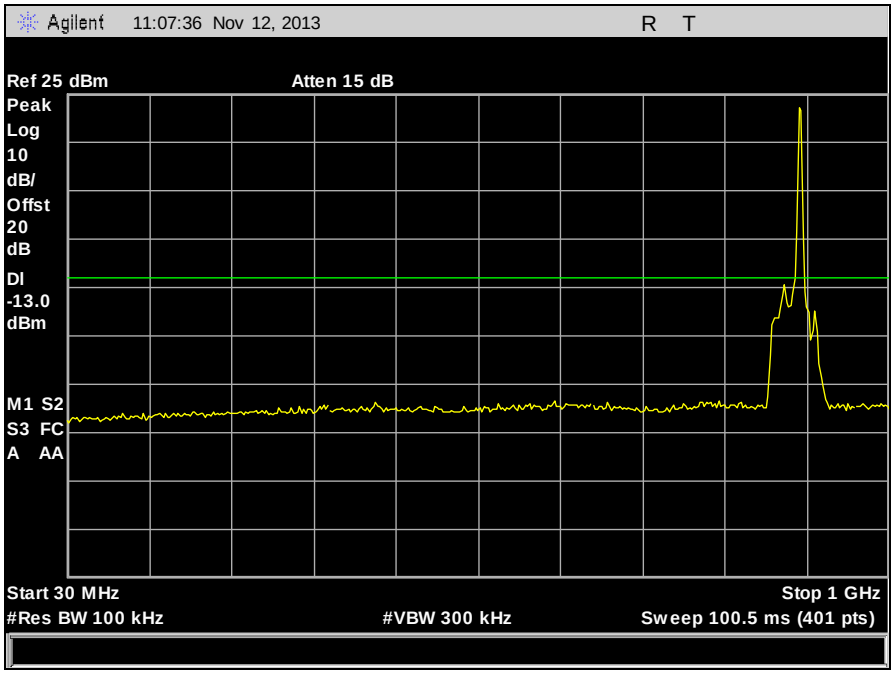
Plot 134. Conducted Spurious Emissions, CDMA, Low Channel, 1 GHz – 10 GHz, Part 22



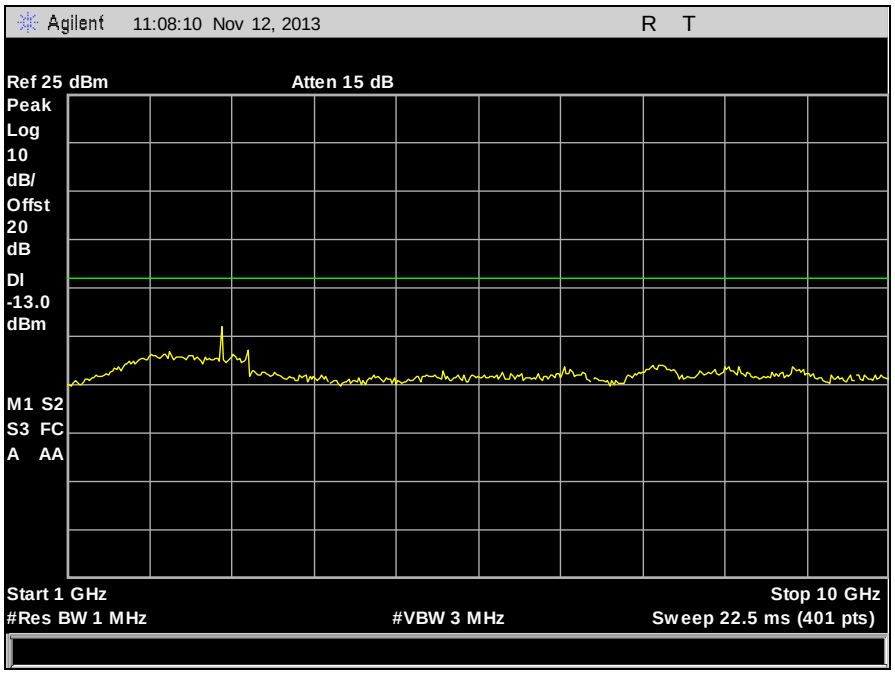
Plot 135. Conducted Spurious Emissions, CDMA, Mid Channel, 30 MHz – 1 GHz, Part 22



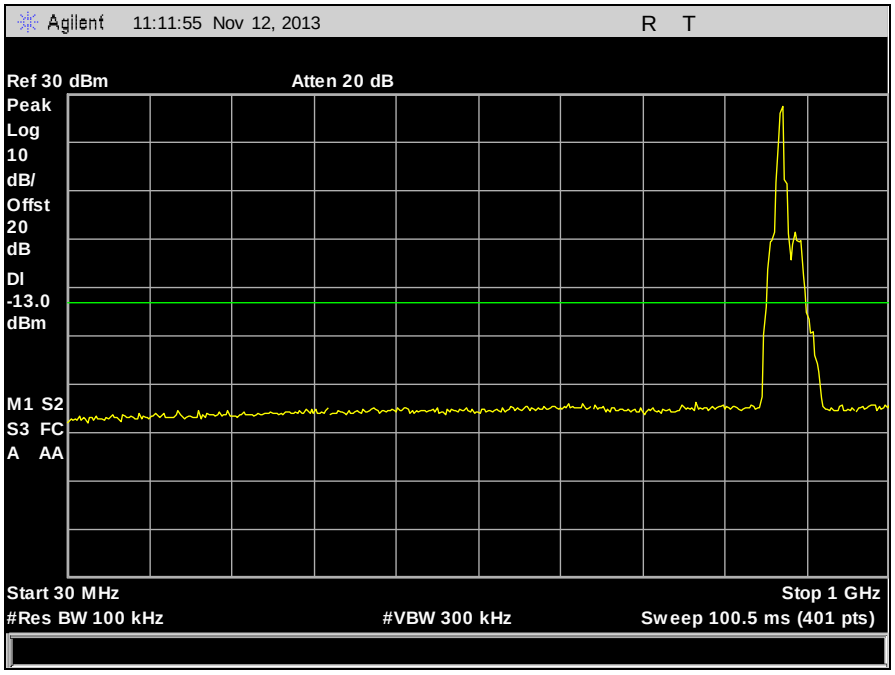
Plot 136. Conducted Spurious Emissions, CDMA, Mid Channel, 1 GHz – 10 GHz, Part 22



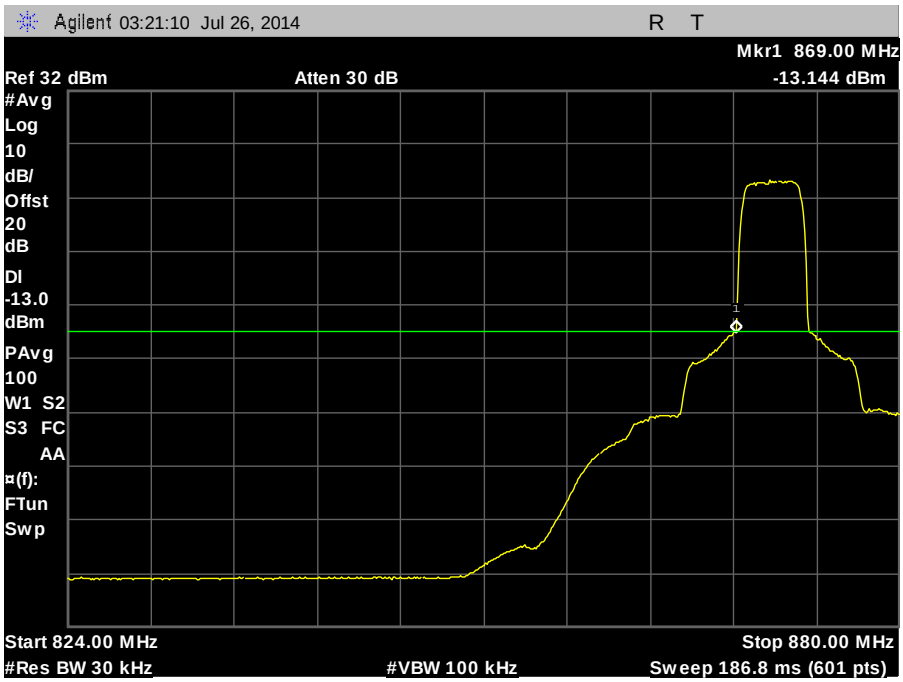
Plot 137. Conducted Spurious Emissions, CDMA, High Channel, 30 MHz – 1 GHz, Part 22



Plot 138. Conducted Spurious Emissions, CDMA, High Channel, 1 GHz – 10 GHz, Part 22

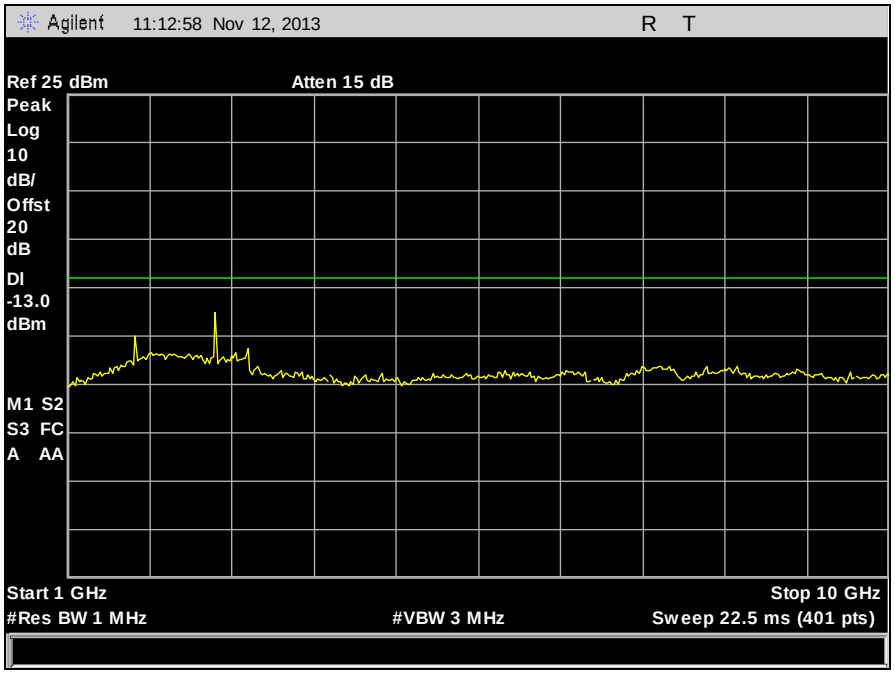


Plot 139. Conducted Spurious Emissions, WCDMA, Low Channel, 30 MHz – 1 GHz, Part 22

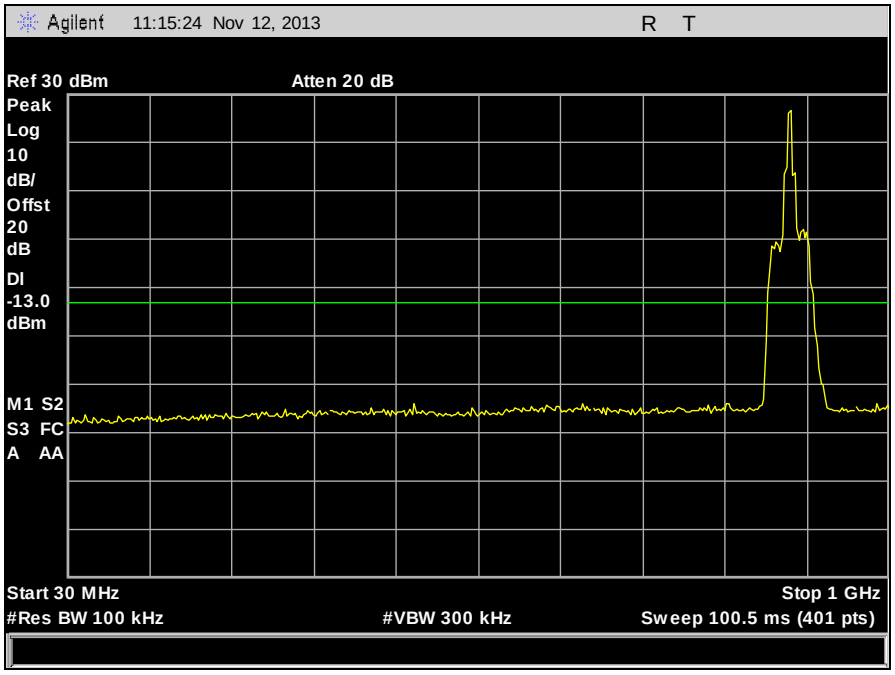


Plot 140. Conducted Band Edge, WCDMA, Low Channel, Low Band Edge

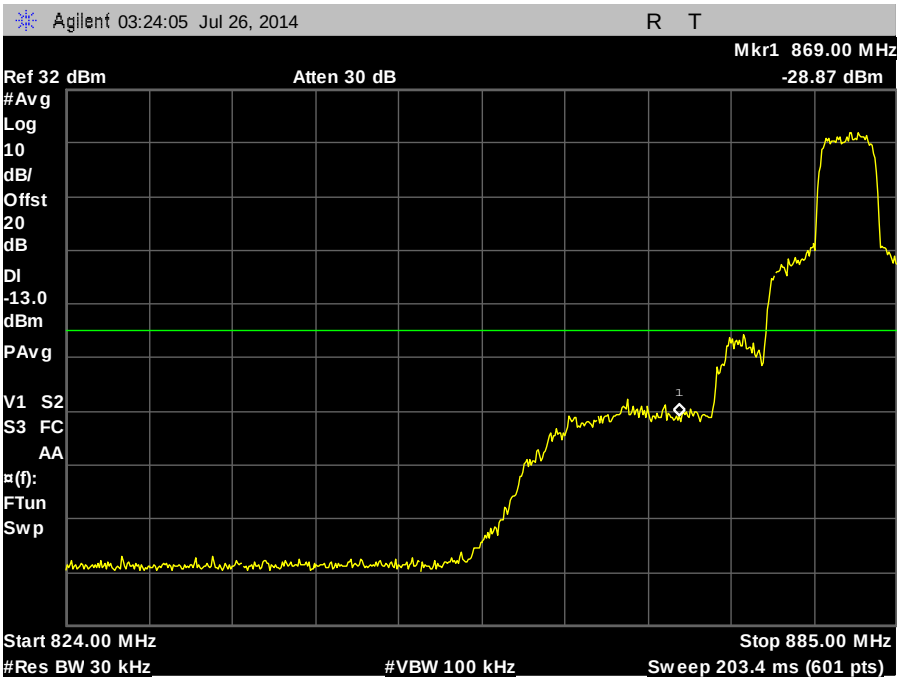
Plot 141. Conducted Band Edge, WCDMA, Low Channel, High Band Edge



Plot 142. Conducted Spurious Emissions, WCDMA, Low Channel, 1 GHz – 10 GHz, Part 22

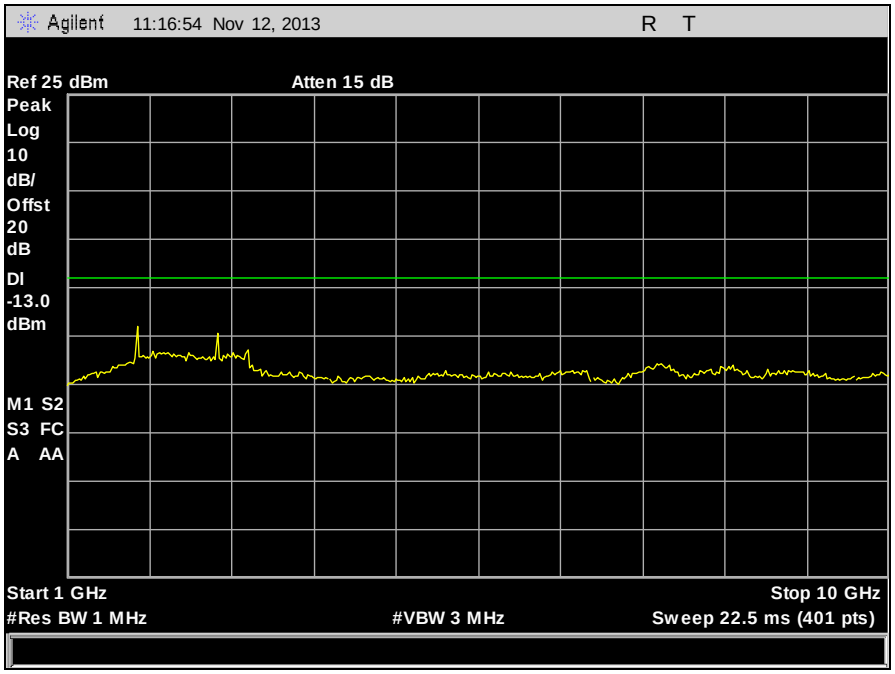


Plot 143. Conducted Spurious Emissions, WCDMA, Mid Channel, 30 MHz – 1 GHz, Part 22

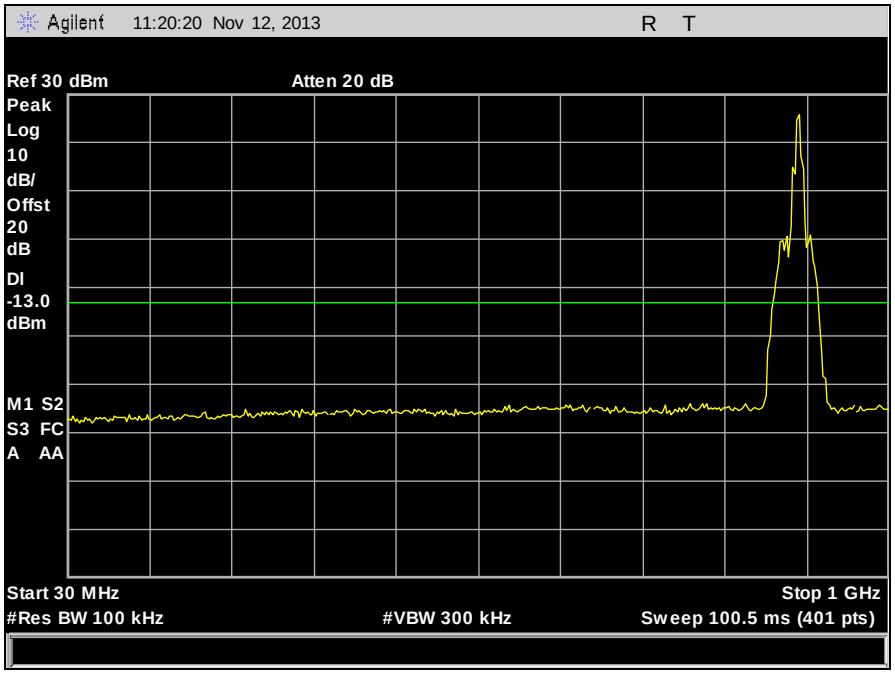


Plot 144. Conducted Band Edge, WCDMA, Mid Channel, Low Band

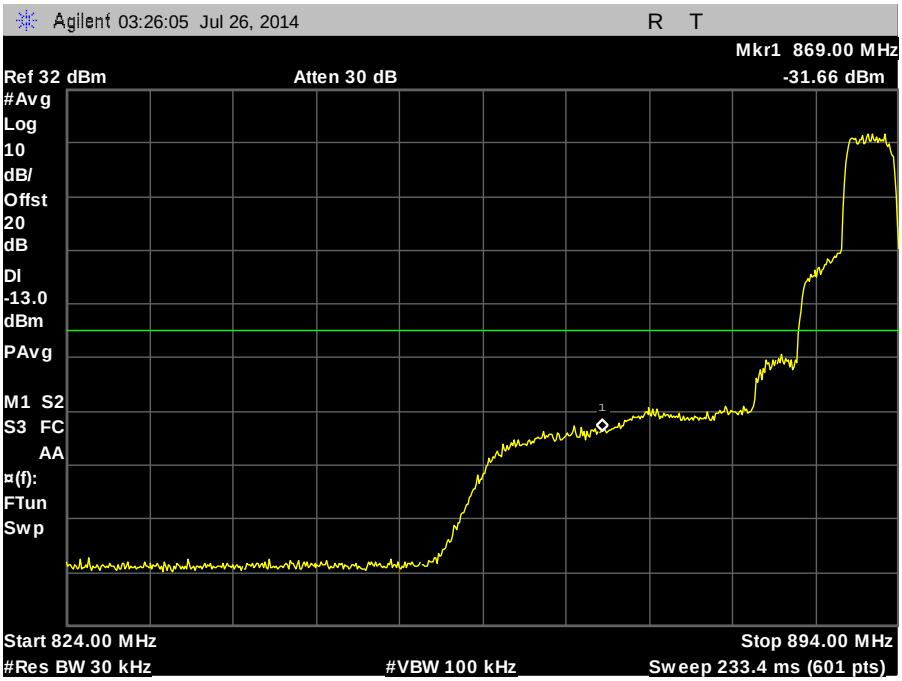
Plot 145. Conducted Band Edge, WCDMA, Mid Channel, High Band



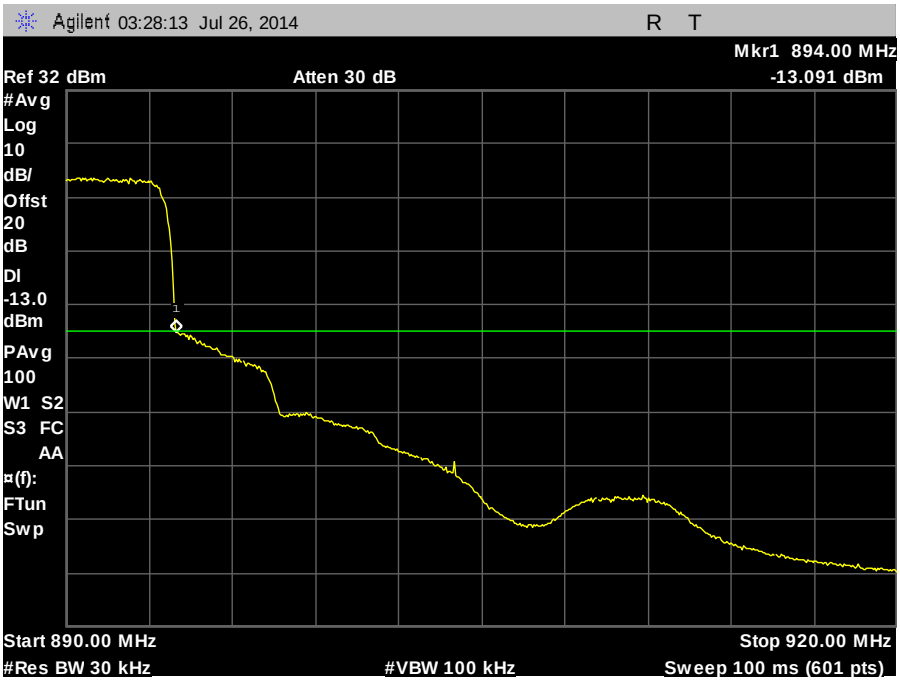
Plot 146. Conducted Spurious Emissions, WCDMA, Mid Channel, 1 GHz – 10 GHz, Part 22



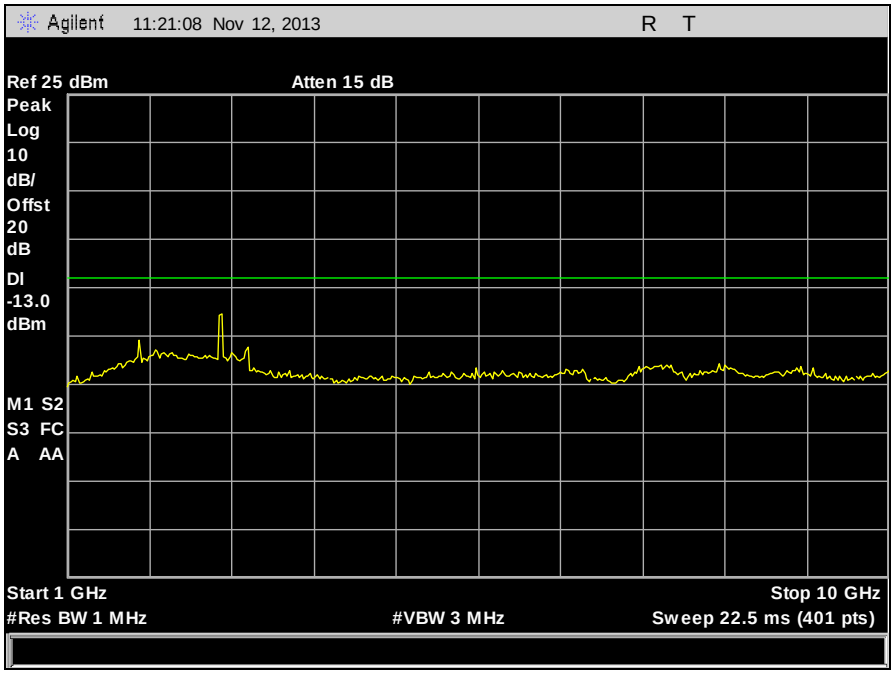
Plot 147. Conducted Spurious Emissions, WCDMA, High Channel, 30 MHz – 1 GHz, Part 22



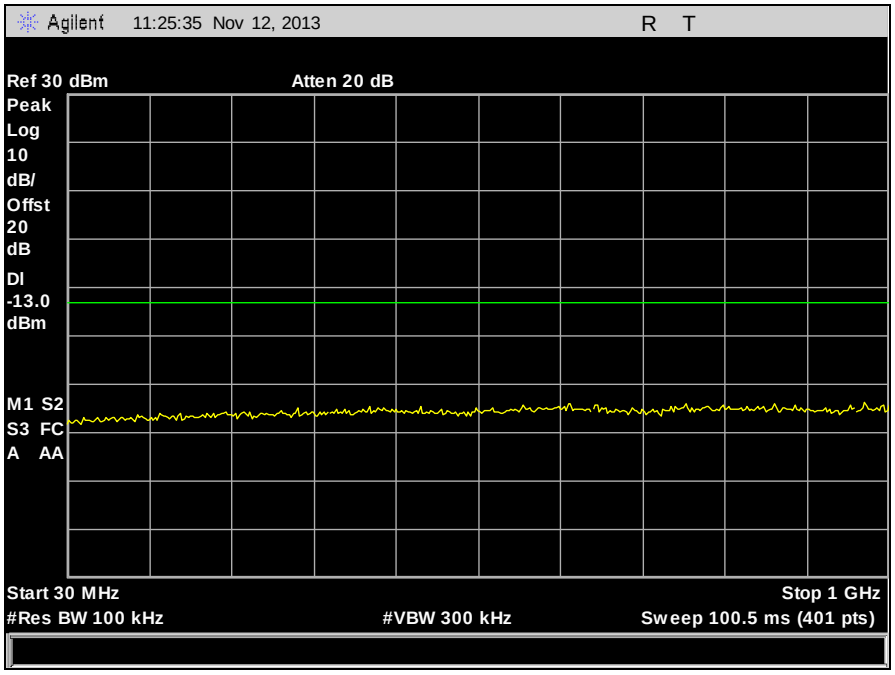
Plot 148. Conducted Band Edge, WCDMA, High Channel, Low Band



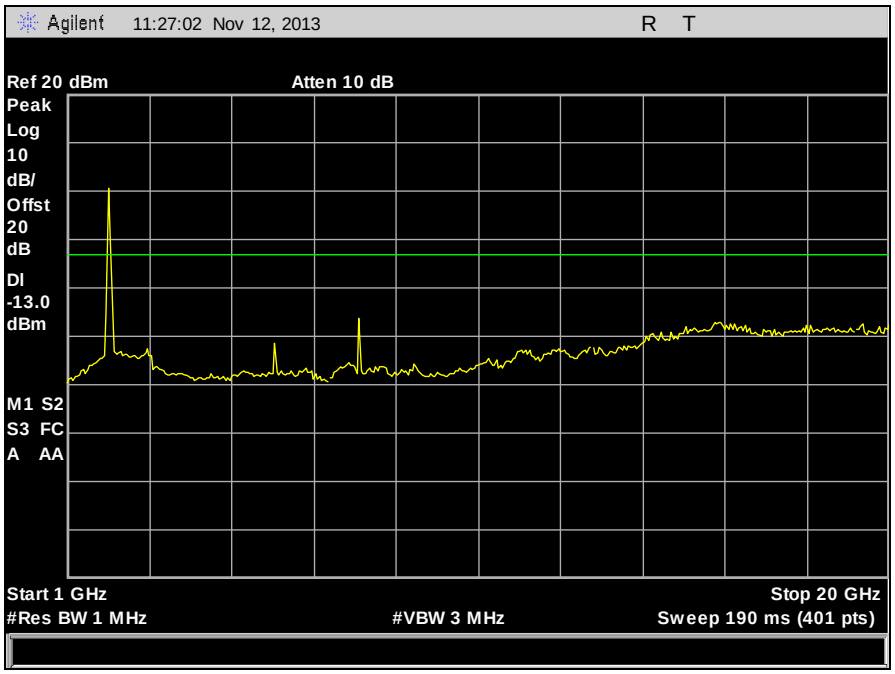
Plot 149. Conducted Band Edge, WCDMA, High Channel, High Band



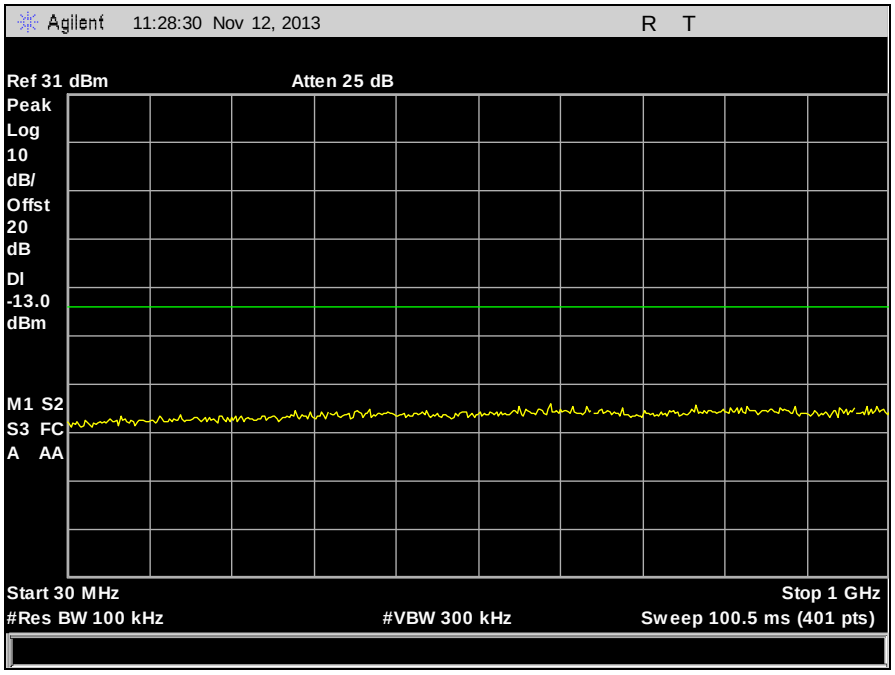
Plot 150. Conducted Spurious Emissions, WCDMA, High Channel, 1 GHz – 10 GHz, Part 22



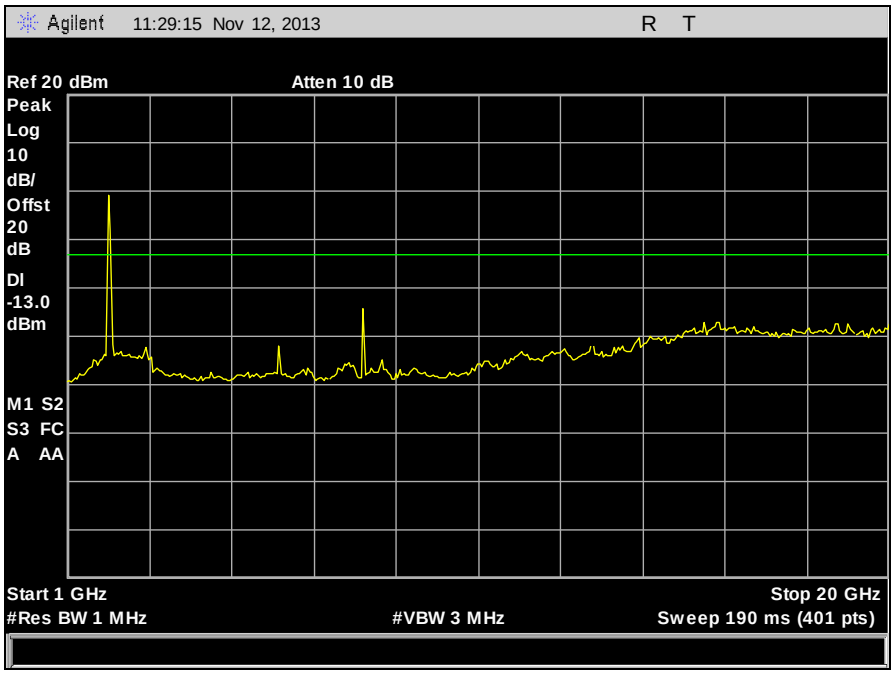
Plot 151. Conducted Spurious Emissions, GSM, Low Channel, 30 MHz – 1 GHz, Part 24



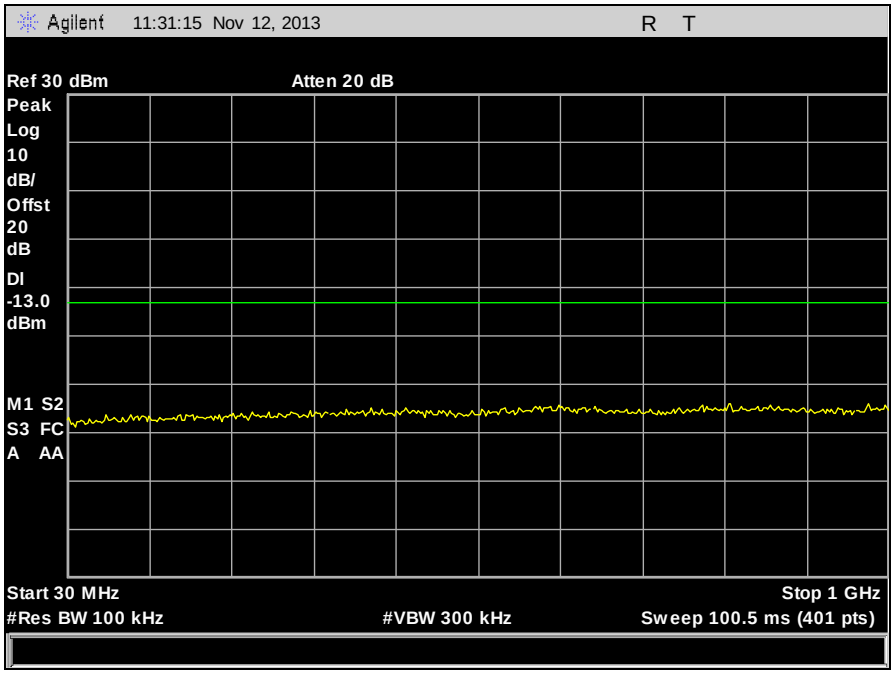
Plot 152. Conducted Spurious Emissions, GSM, Low Channel, 1 GHz – 20 GHz, Part 24



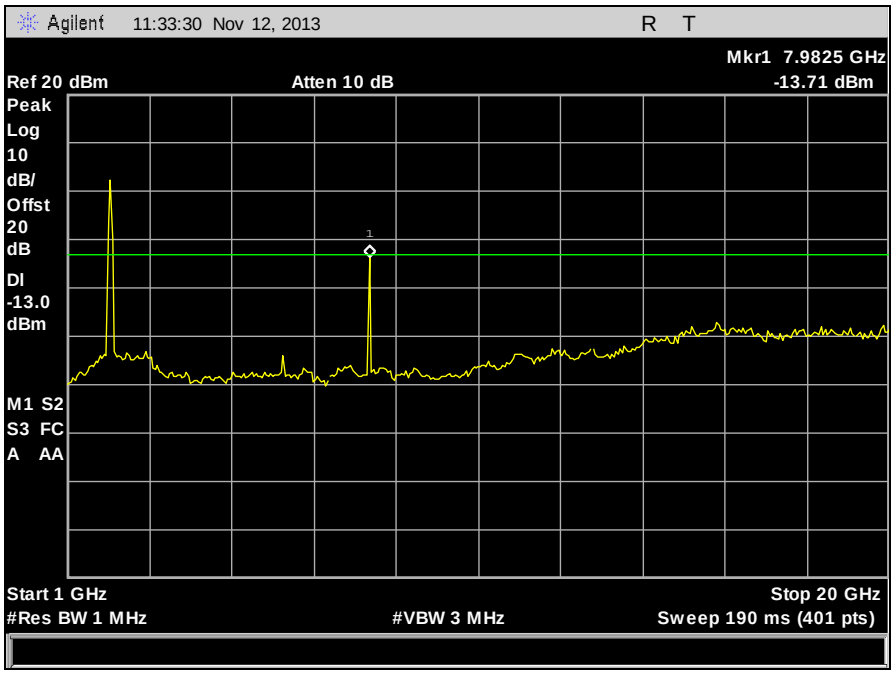
Plot 153. Conducted Spurious Emissions, GSM, Mid Channel, 30 MHz – 1 GHz, Part 24



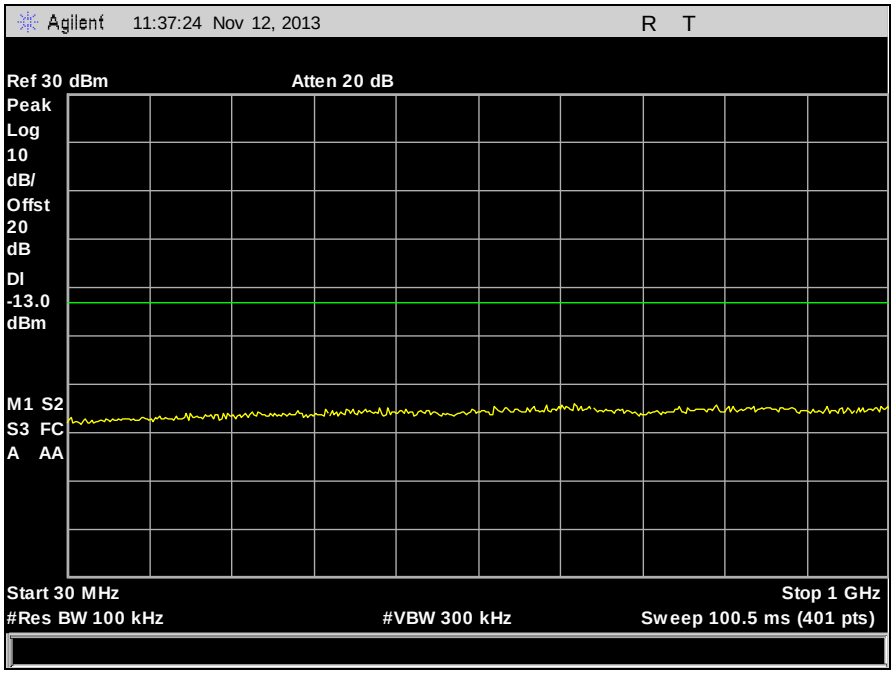
Plot 154. Conducted Spurious Emissions, GSM, Mid Channel, 1 GHz – 20 GHz, Part 24



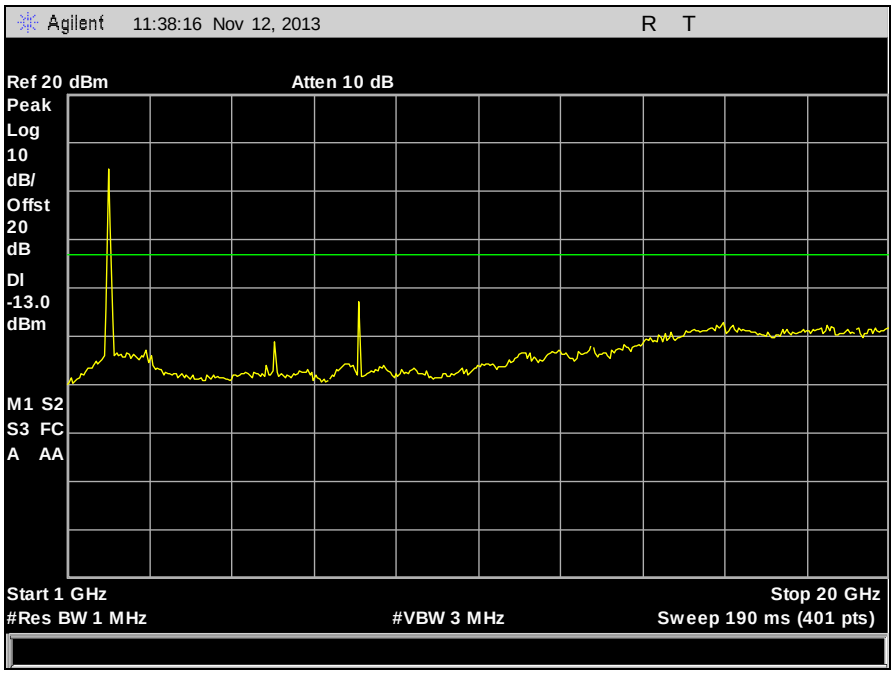
Plot 155. Conducted Spurious Emissions, GSM, High Channel, 30 MHz – 1 GHz, Part 24



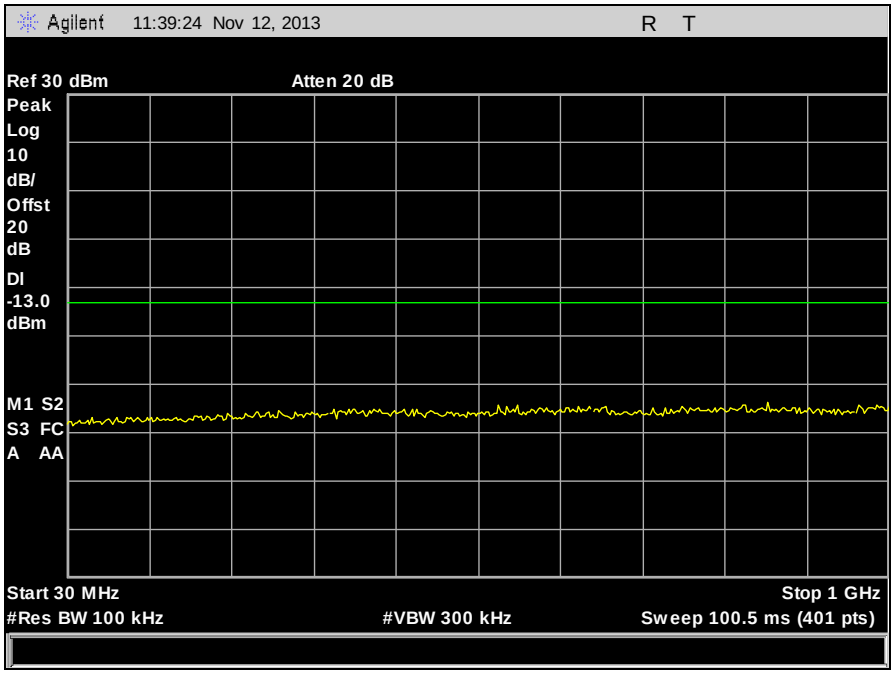
Plot 156. Conducted Spurious Emissions, GSM, High Channel, 1 GHz – 20 GHz, Part 24



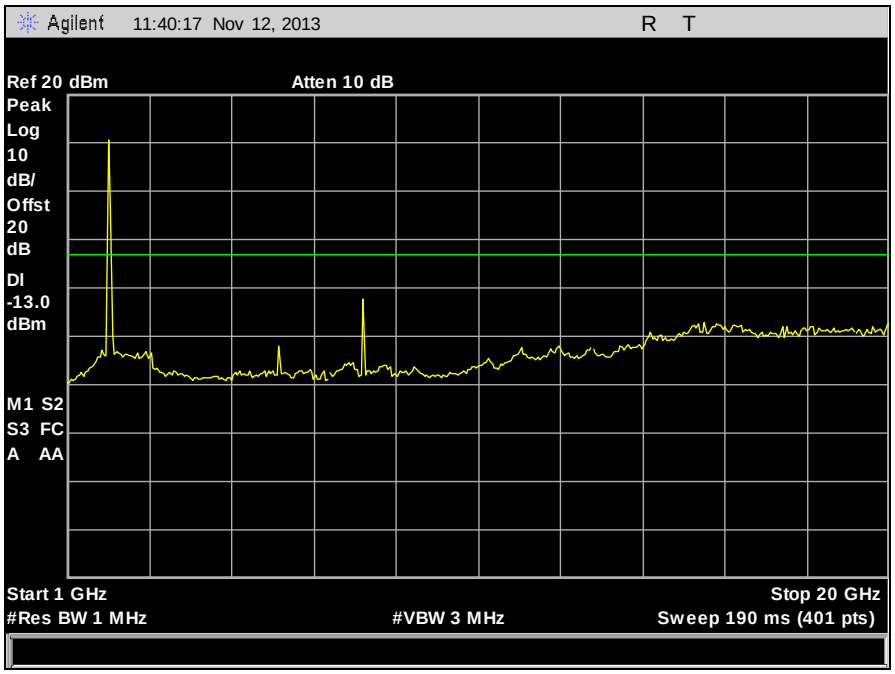
Plot 157. Conducted Spurious Emissions, CDMA, Low Channel, 30 MHz – 1 GHz, Part 24



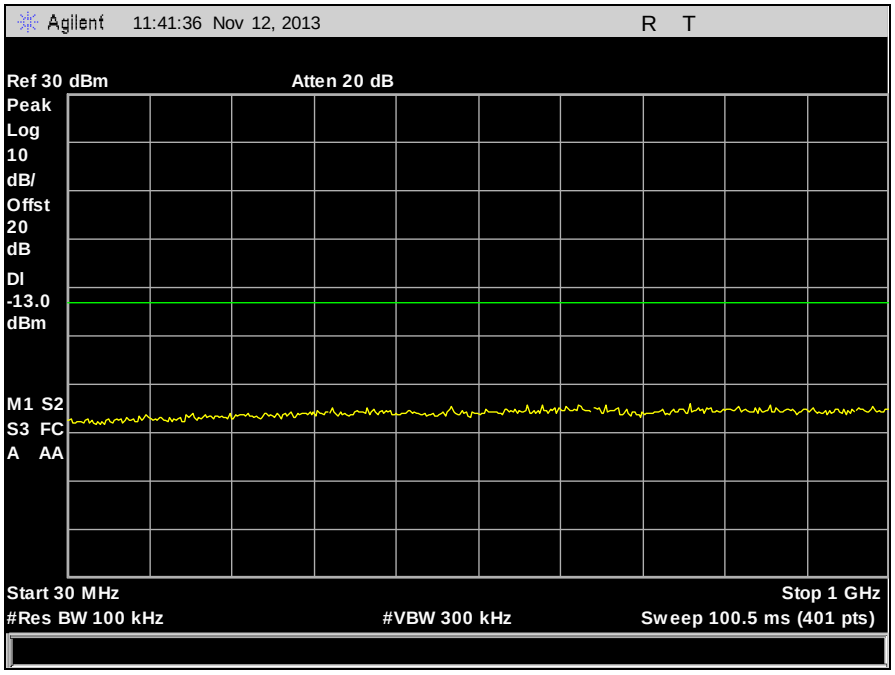
Plot 158. Conducted Spurious Emissions, CDMA, Low Channel, 1 GHz – 20 GHz, Part 24



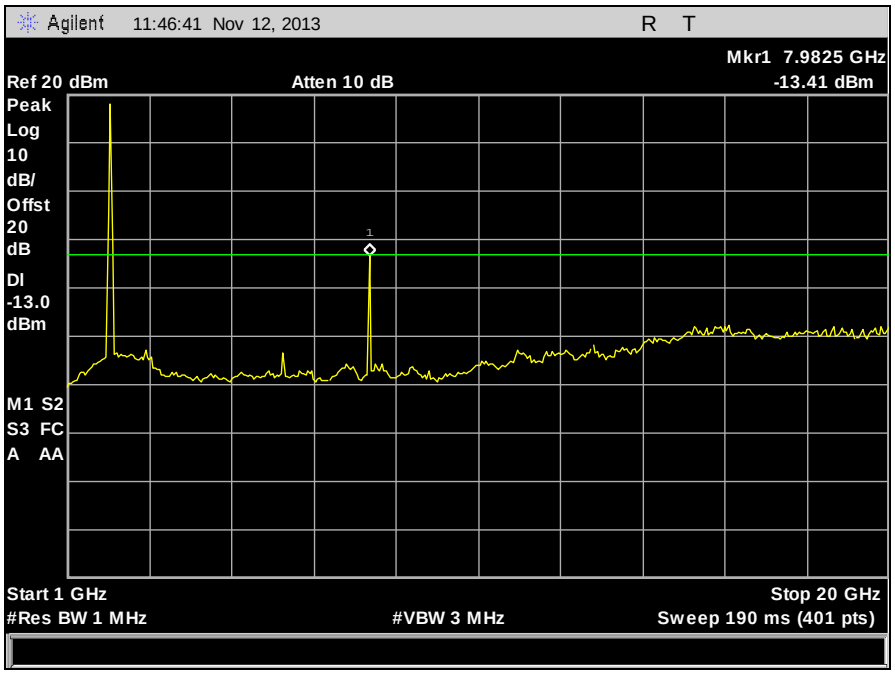
Plot 159. Conducted Spurious Emissions, CDMA, Mid Channel, 30 MHz – 1 GHz, Part 24



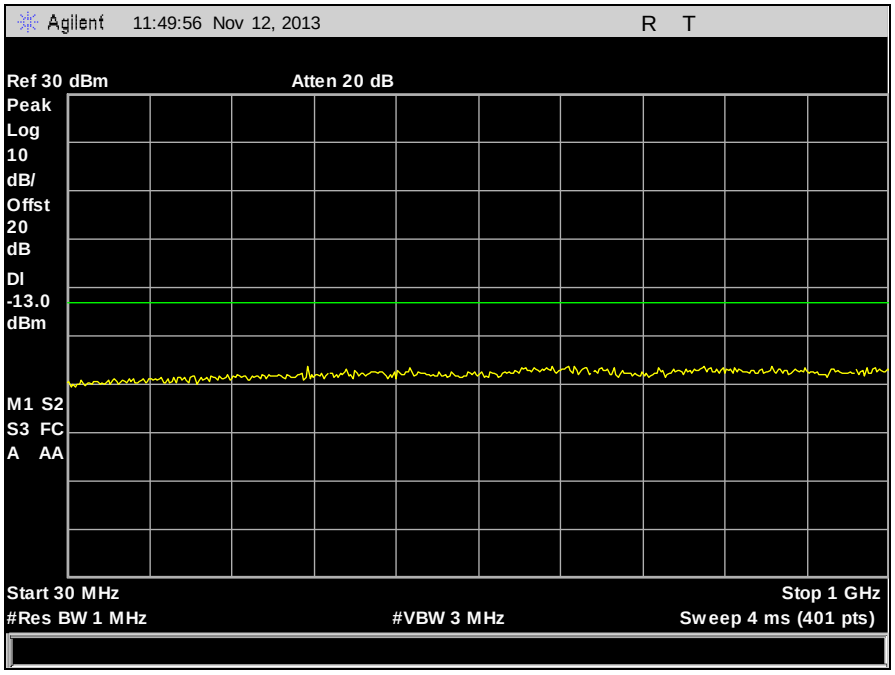
Plot 160. Conducted Spurious Emissions, CDMA, Mid Channel, 1 GHz – 20 GHz, Part 24



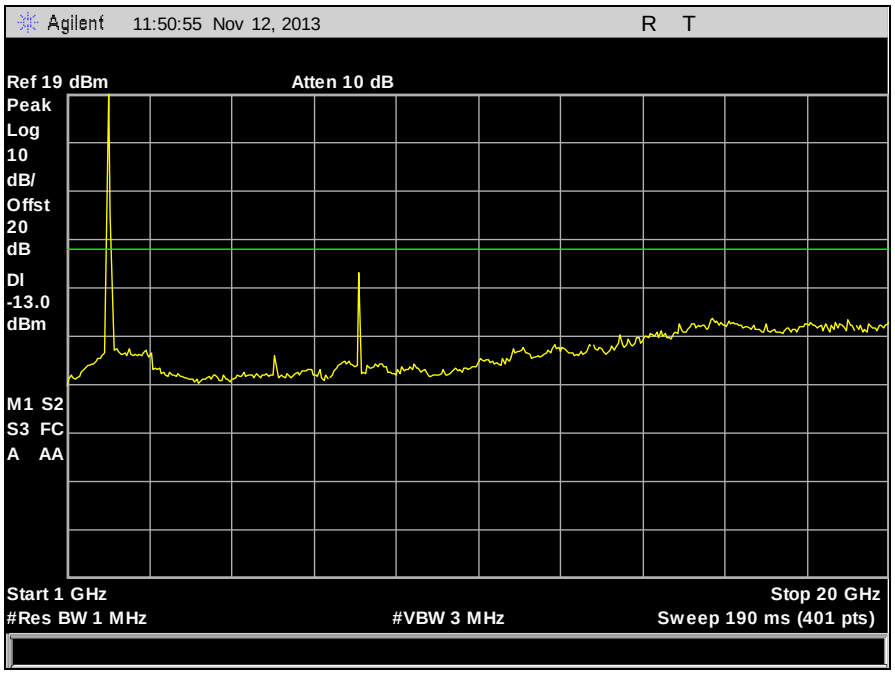
Plot 161. Conducted Spurious Emissions, CDMA, High Channel, 30 MHz – 1 GHz, Part 24



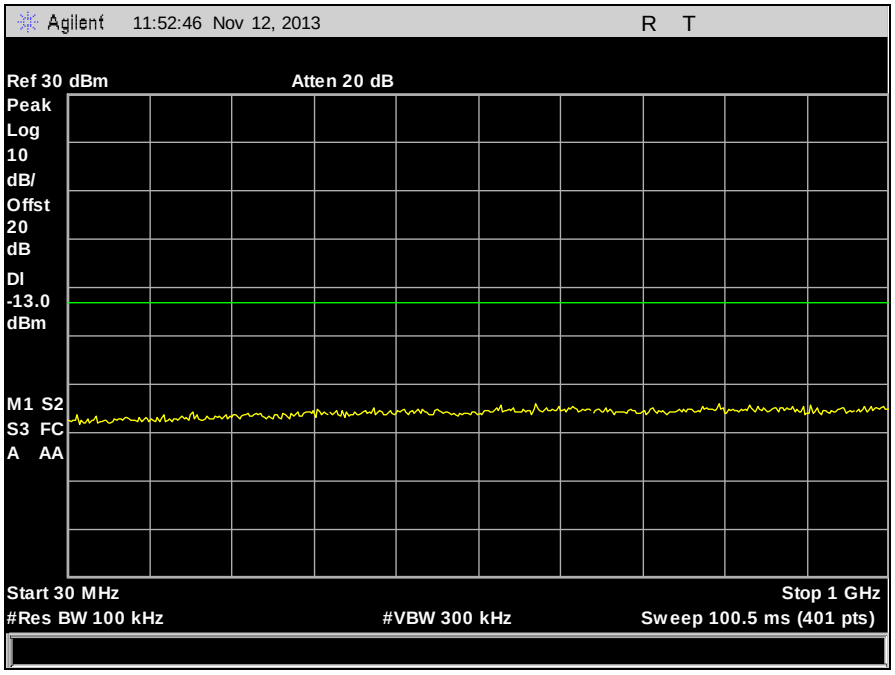
Plot 162. Conducted Spurious Emissions, CDMA, High Channel, 1 GHz – 20 GHz, Part 24



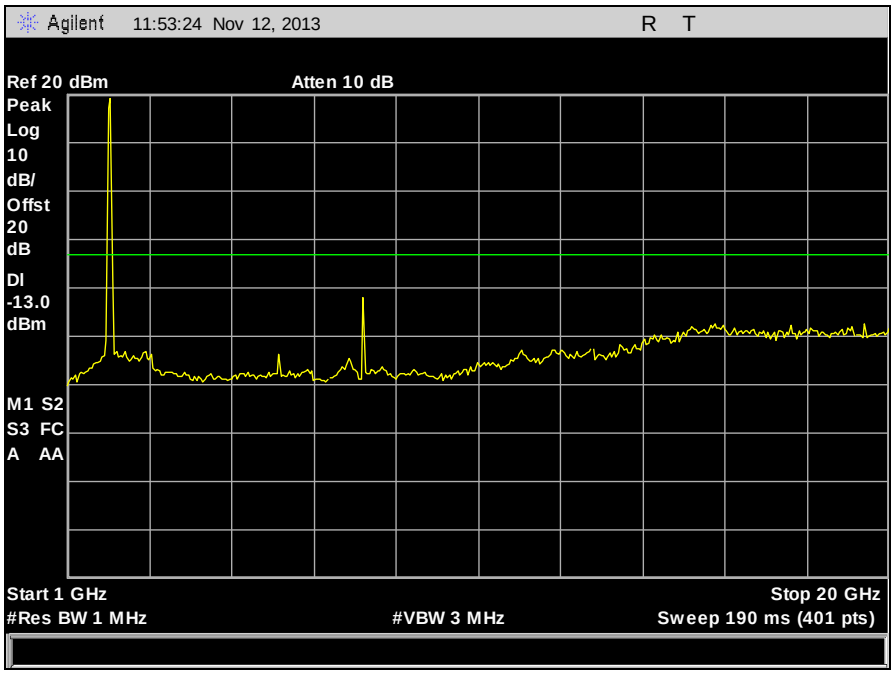
Plot 163. Conducted Spurious Emissions, WCDMA, Low Channel, 30 MHz – 1 GHz, Part 24



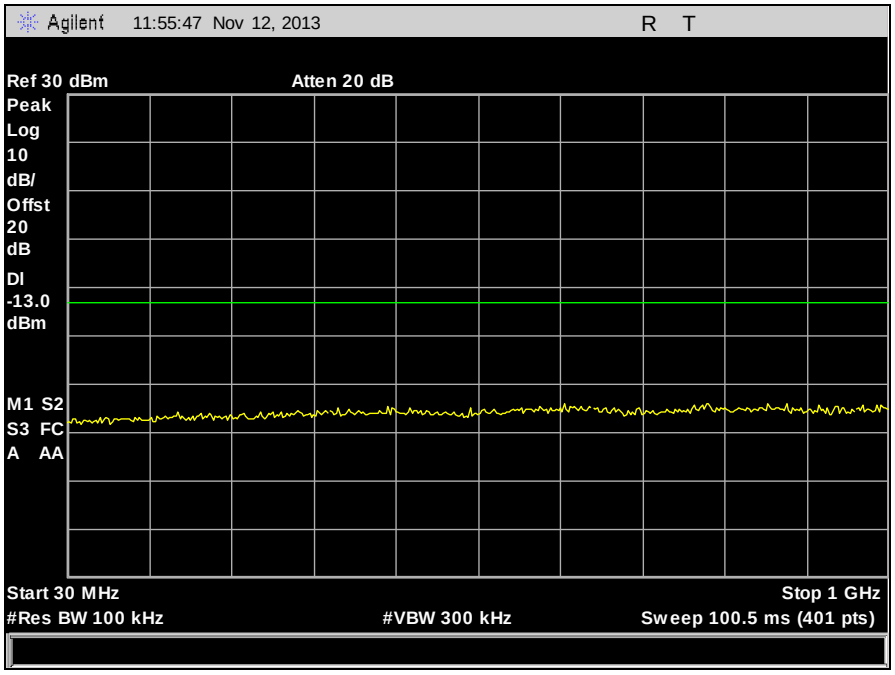
Plot 164. Conducted Spurious Emissions, WCDMA, Low Channel, 1 GHz – 20 GHz, Part 24



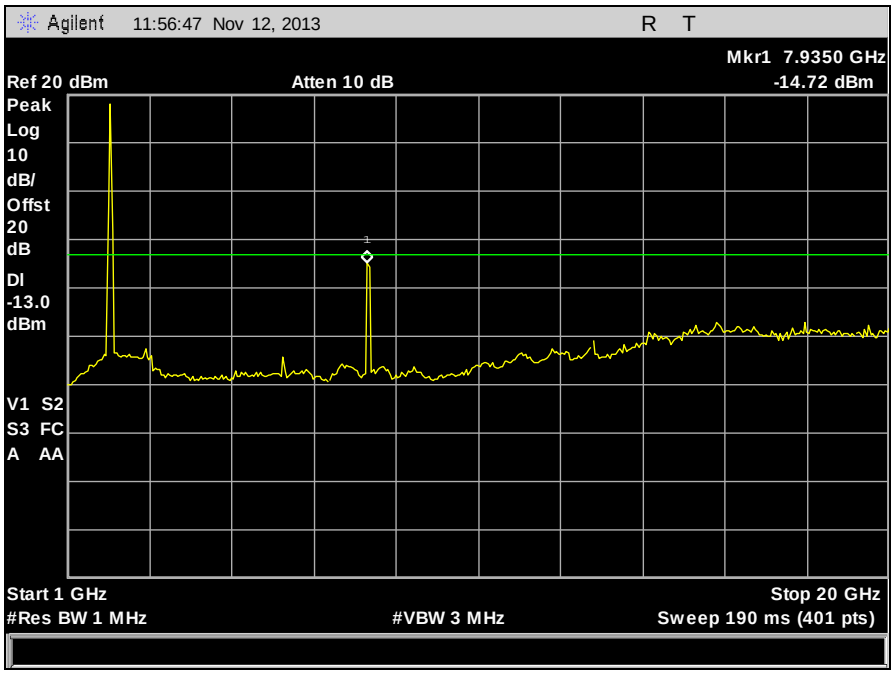
Plot 165. Conducted Spurious Emissions, WCDMA, Mid Channel, 30 MHz – 1 GHz, Part 24



Plot 166. Conducted Spurious Emissions, WCDMA, Mid Channel, 1 GHz – 20 GHz, Part 24



Plot 167. Conducted Spurious Emissions, WCDMA, High Channel, 30 MHz – 1 GHz, Part 24



Plot 168. Conducted Spurious Emissions, WCDMA, High Channel, 1 GHz – 20 GHz, Part 24

Electromagnetic Compatibility Criteria for Intentional Radiators

Out of Band Rejection

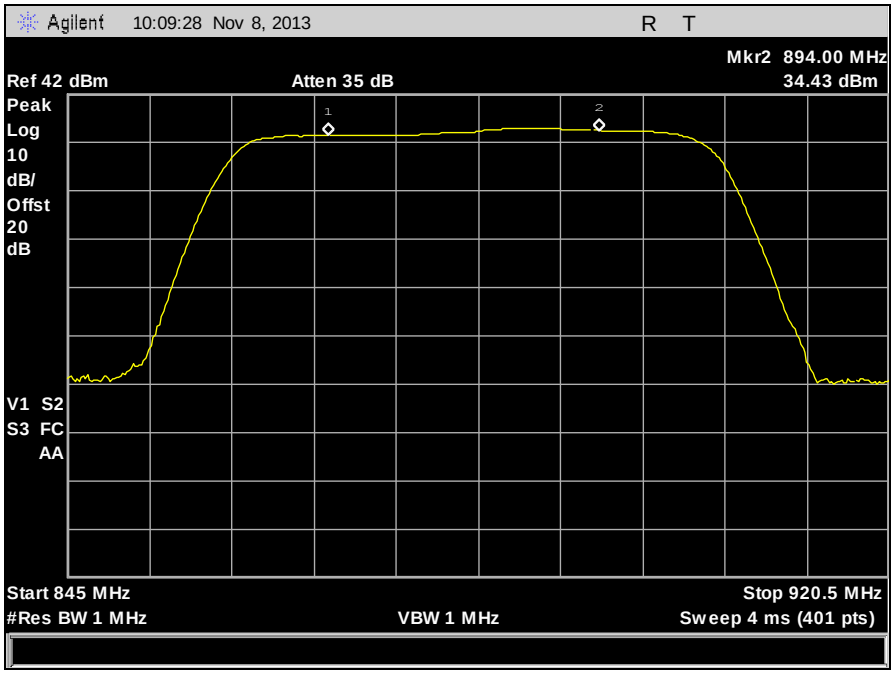
Test Requirement(s): Test for rejection of out-of-band signals

Test Procedures: A signal generator was used to drive the input of the EUT. The signal generator was swept across the band of interest. Filter frequency response plots were taken.

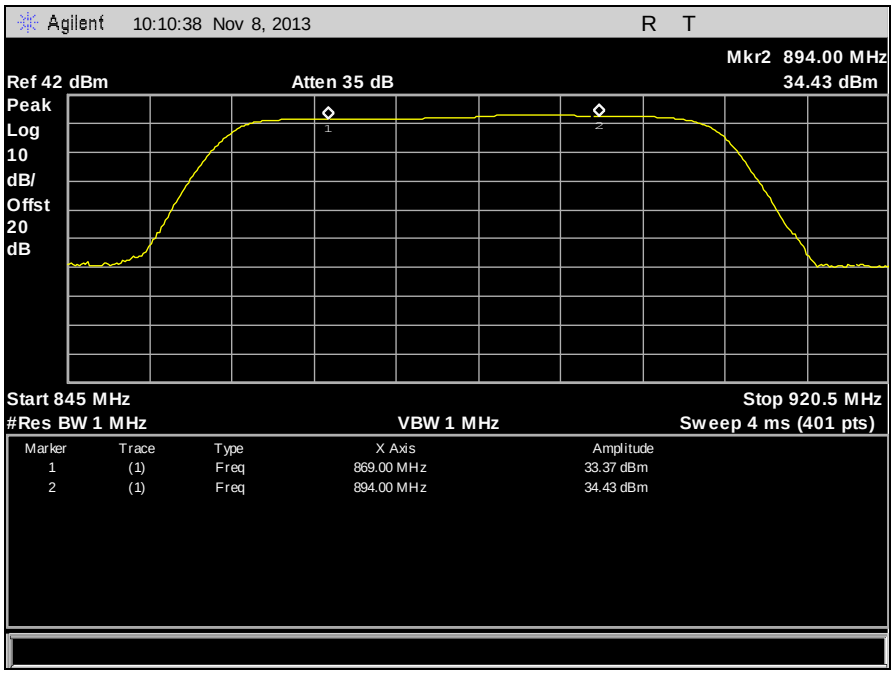
Test Results: The EUT complies with the requirements of this section.

Test Engineer: Len Knight

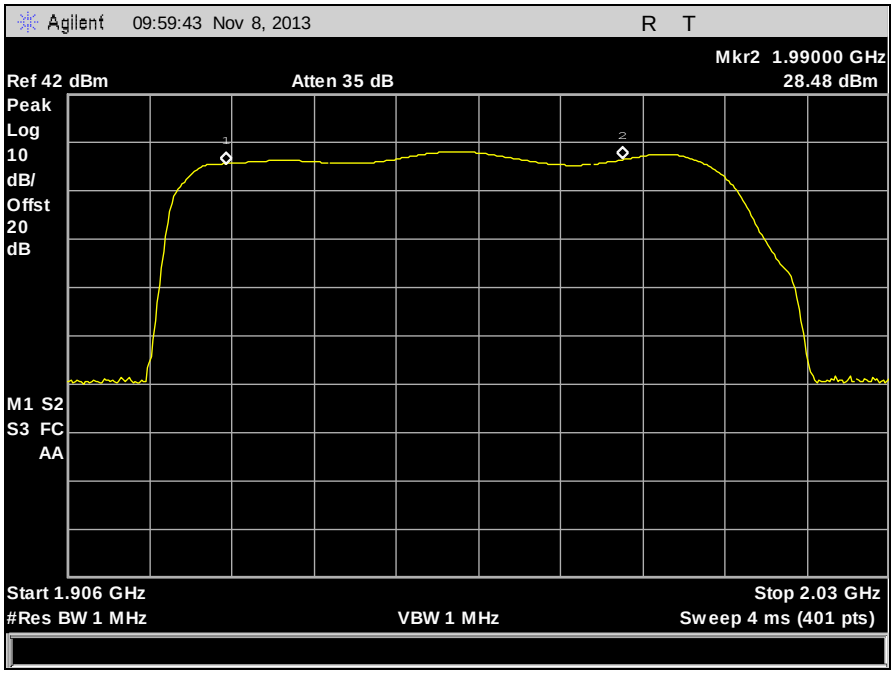
Test Results: 11/08/13



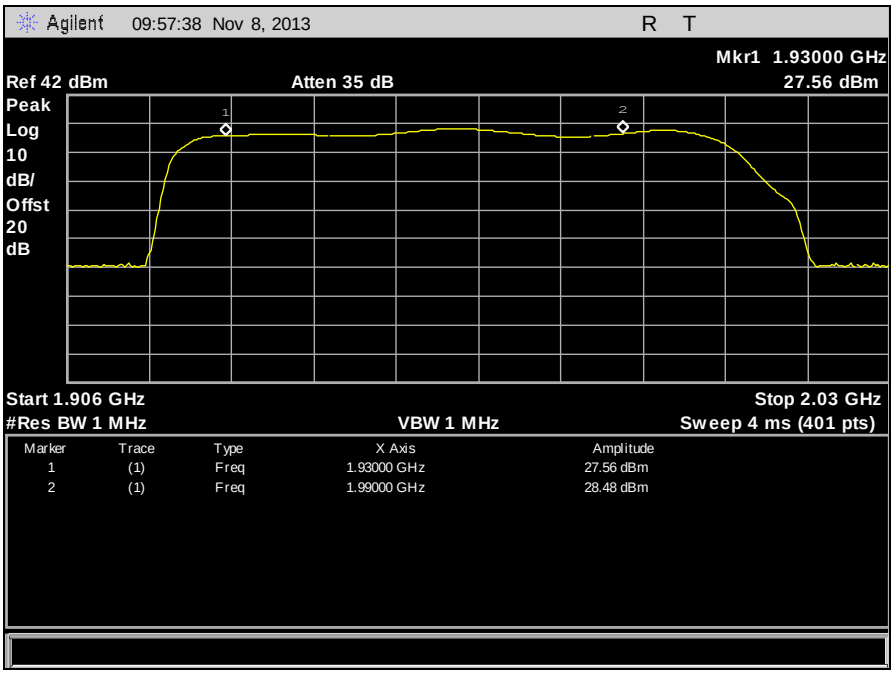
Plot 169. Filter Response, Part 22



Plot 170. Filter Response with Marker Table, Part 22



Plot 171. Filter Response, Part 24



Plot 172. Filter Response with Marker Table, Part 24

Electromagnetic Compatibility Criteria for Intentional Radiators

Intermodulation

Test Requirement(s): Intermodulation – Test all modulation types [TDMA, CDMA, and FM (covers GSM and F1D)]

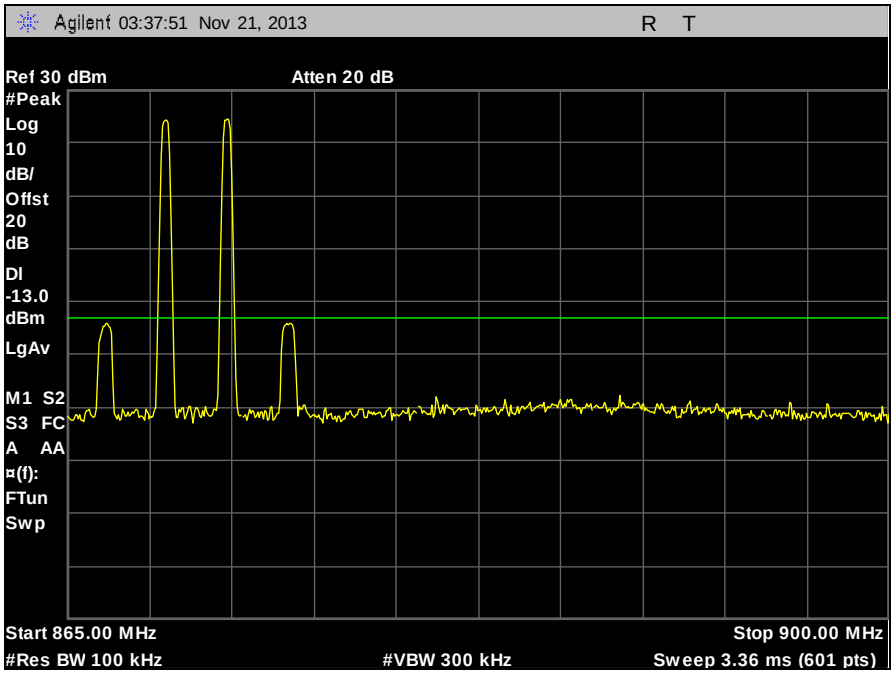
- CW signal rather than typical signal is acceptable (for FM).
- At maximum drive level, for each modulation: one test with three tones, or two tests (High-, low-band edge) with two tones)
- Limit usually is -13 dBm conducted.
- Not needed for Single Channel systems
- Combination of modulation types not needed.

Test Procedures: The two tone test method was used. A signal generator was used to drive the input of the EUT. The EUT was evaluated at the high and low band edge.

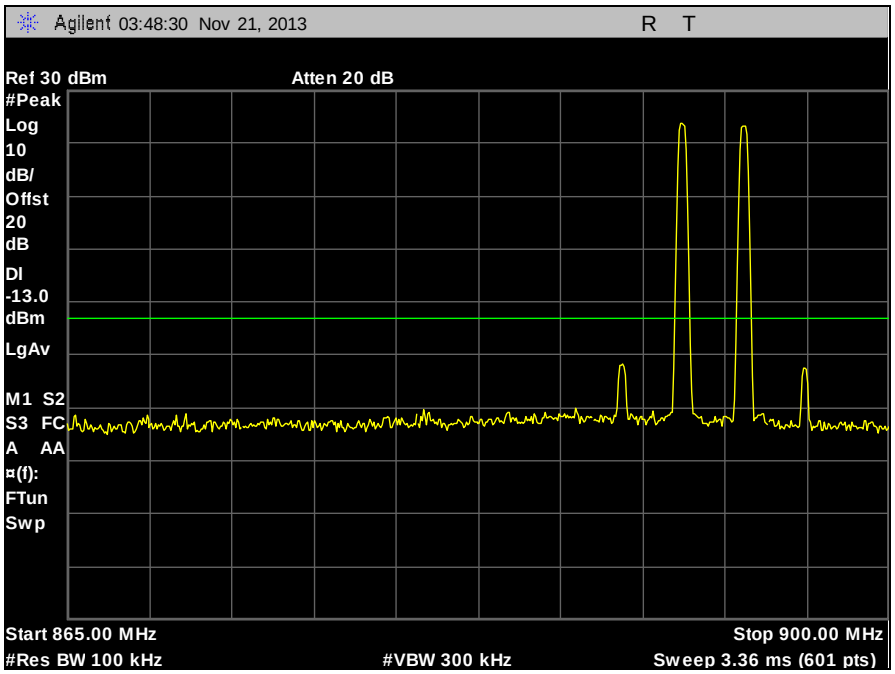
Test Results: The EUT complies with the requirements of this section. Inter modulation will only pass for low power setting. Therefore, high power setting cannot be used when there are multiple channels per band.

Test Engineer(s): Len Knight

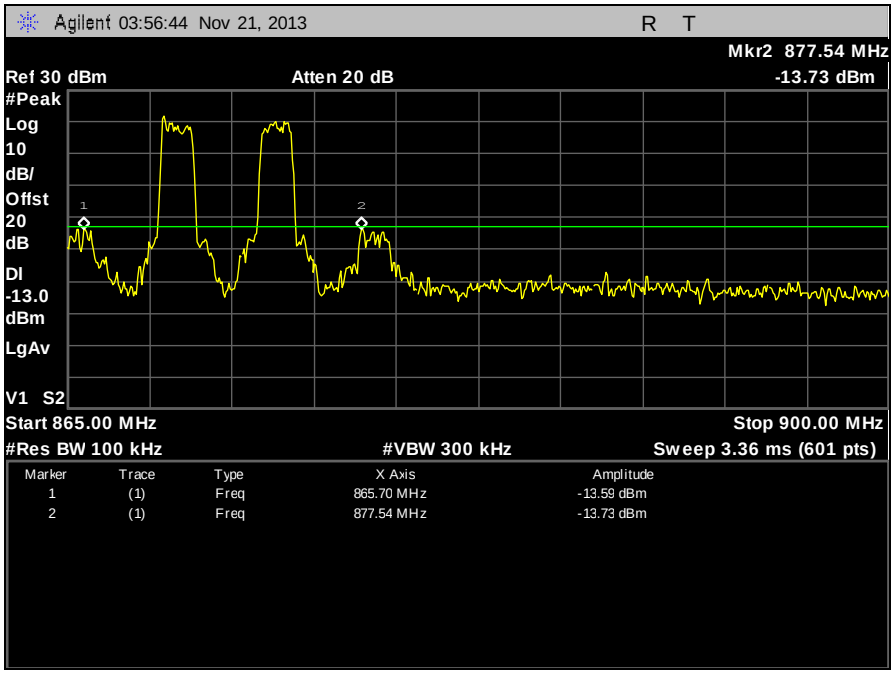
Test Date(s): 11/24/13



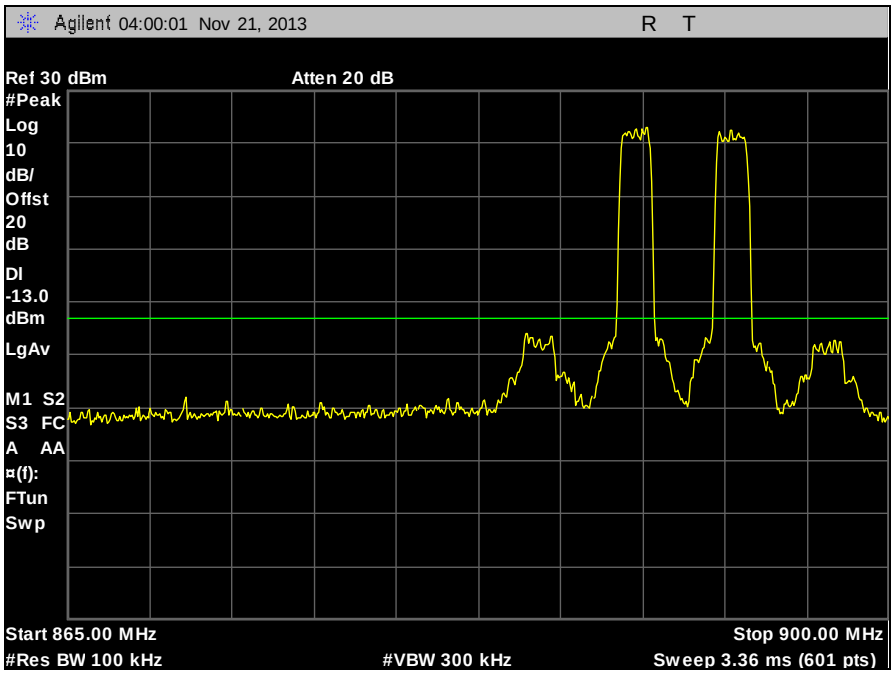
Plot 173. Intermodulation, GSM, Low Channel, Part 22



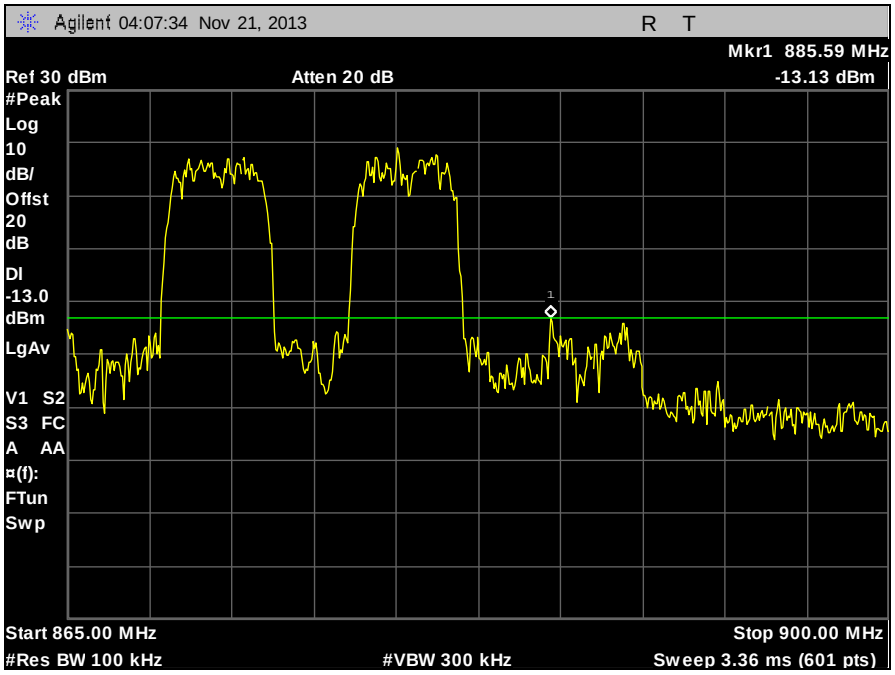
Plot 174. Intermodulation, GSM, High Channel, Part 22



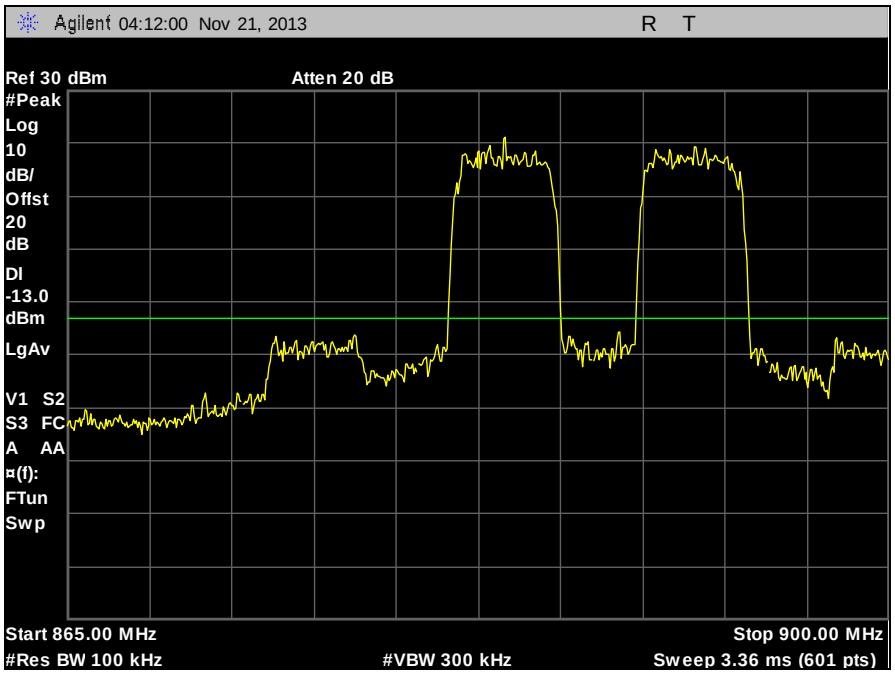
Plot 175. Intermodulation, CDMA, Low Channel, Part 22



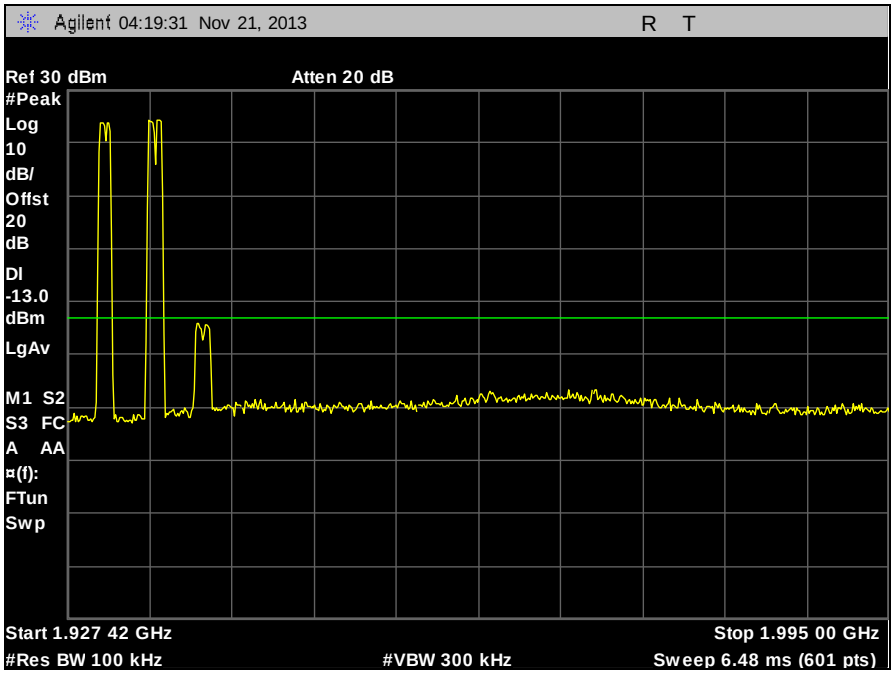
Plot 176. Intermodulation, CDMA, High Channel, Part 22



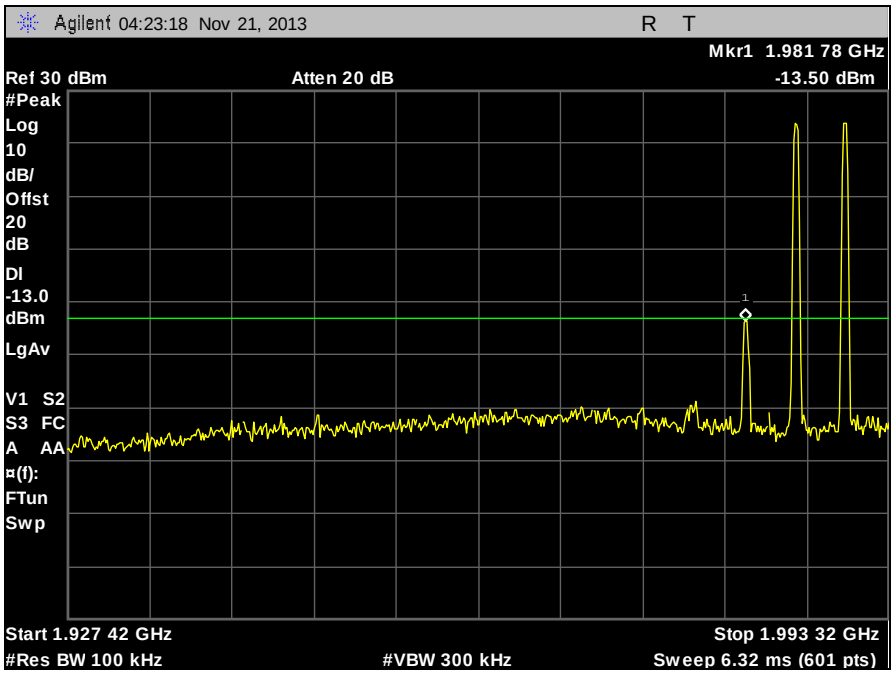
Plot 177. Intermodulation, WCDMA, Low Channel, Part 22



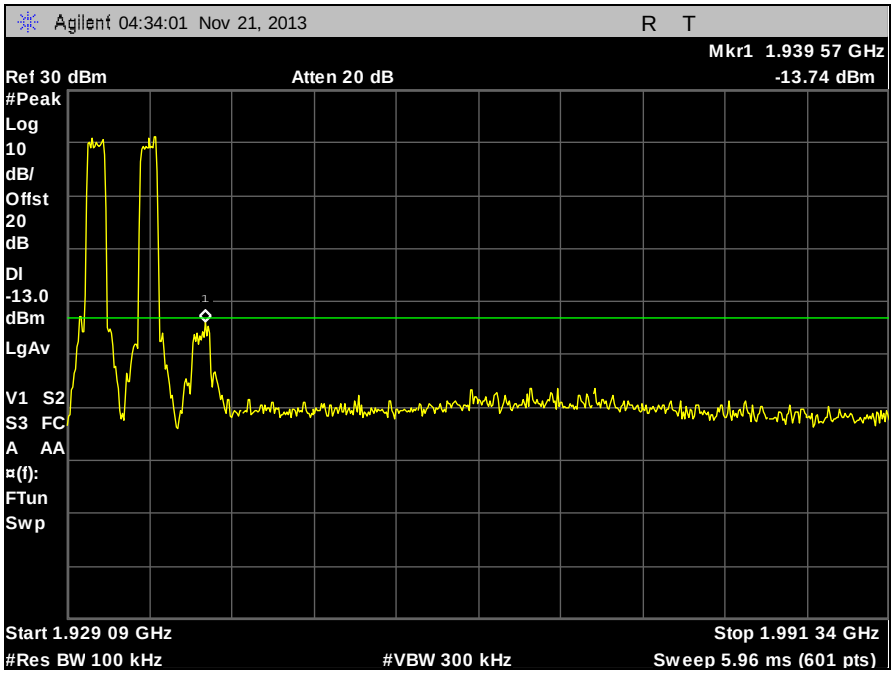
Plot 178. Intermodulation, WCDMA, High Channel, Part 22



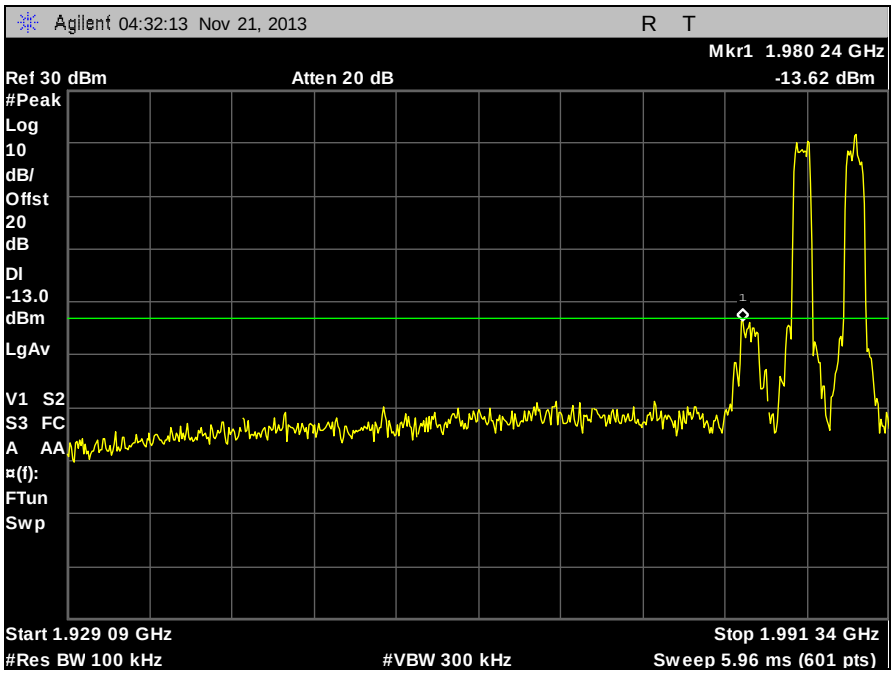
Plot 179. Intermodulation, GSM, Low Channel, Part 24



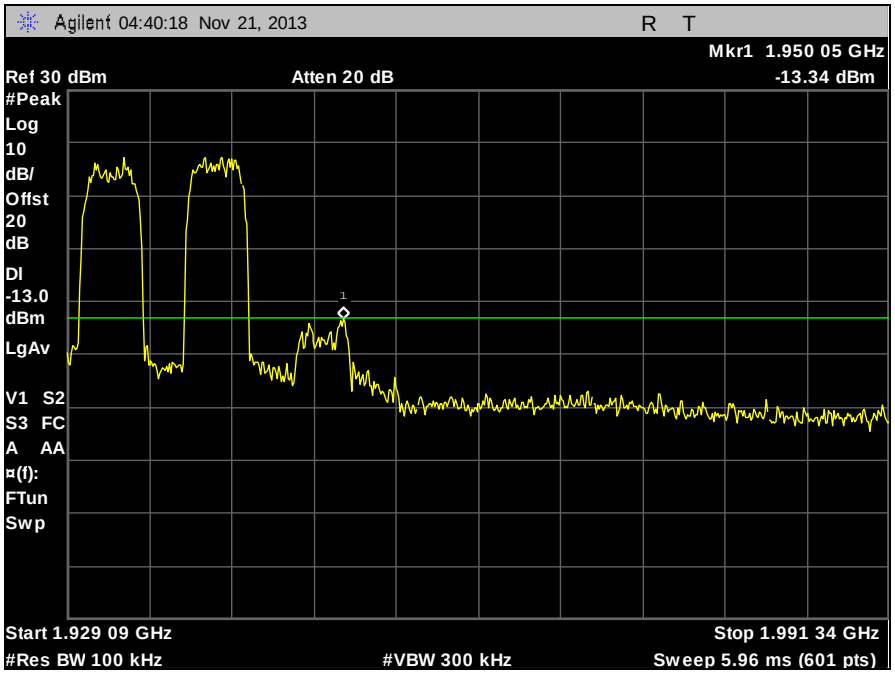
Plot 180. Intermodulation, GSM, High Channel, Part 24



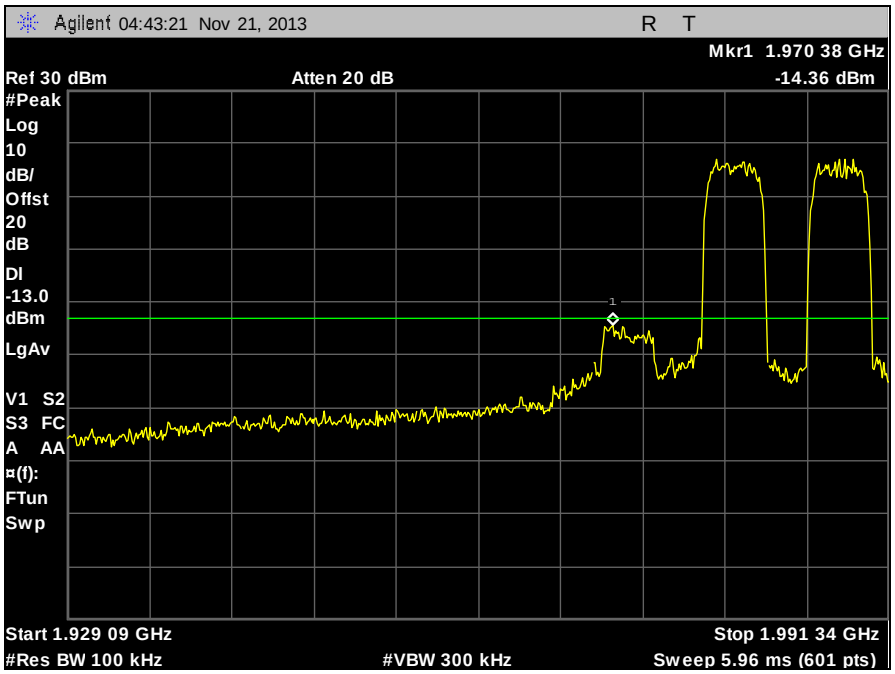
Plot 181. Intermodulation, CDMA, Low Channel, Part 24



Plot 182. Intermodulation, CDMA, High Channel, Part 24



Plot 183. Intermodulation, WCDMA, Low Channel, Part 24



Plot 184. Intermodulation, WCDMA, High Channel, Part 24

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2005.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4612	SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4407B	07/30/2013	01/30/2015
1T4300	SEMI-ANECHOIC CHAMBER # 1 (NSA)	EMC TEST SYSTEMS	NONE	07/24/2012	07/24/2015
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	07/16/2012	07/16/2014
1T4299	SIGNAL GENERATOR	HP	E4432B	11/13/2013	05/13/2015
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	08/06/2012	02/06/2014
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	01/08/2013	07/08/2014
1T4354	SIGNAL GENERATOR	HEWLETT PACKARD	83752A	10/28/2013	04/28/2015
1T4592	RF FILTER KIT	VARIOUS	N/A	NOT REQUIRED	
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4149	HIGH-FREQUENCY ANECHOIC CHAMBER	RAY-PROOF	81	NOT REQUIRED	
1T4548	AC POWER SOURCE	CALIFORNIA INSTRUMENTS	1251P	SEE NOTE	
2T1083	TEMPHUMIDITY CHAMBER/ CONTROLLER/ RECORDER/ TRANSMITTER	THERMOTRON/ THERMOTRON/ HONEYWELL/ VAISALA	SE-1000-3-3/ 7800/ DR4500/ HMM30C	05/25/2013	05/25/2014
1T4377	TRUE RMS MULTIMETER	FLUKE	189	07/25/2013	01/25/2015

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

End of Report

