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
33439 WESTERN AVENUE • UNION CITY, CALIFORNIA 94587 • PHONE (510) 489-6300 • FAX (510) 489-6372
3162 BELICK STREET • SANTA CLARA, CA 95054 • PHONE (408) 748-3585 • FAX (510) 489-6372
13501 MCCALLEN PASS • AUSTIN, TEXAS 78753 • PHONE (512) 287-2500 • FAX (512) 287-2513

December 13, 2016

Conexus World Global, LLC
1240 East Campbell Road, Suite 200
Richardson, TX 75081

Dear Danny Rhee,

Enclosed is the EMC Wireless test report for compliance testing of the Conexus World Global, LLC, Outdoor CDMA Femto / CWFEW19AC15W01 as tested to the requirements of the FCC Certification rules under Title 47 of the CFR Part 24 Subpart E.

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.

Amy Graziano
Documentation Department

Reference: (\Conexus World Global, LLC\EMC92090-FCC24 REV 4)

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Electromagnetic Compatibility Criteria
Test Report

for the

Conexus World Global, LLC
Model Outdoor CDMA Femto / CWFEW19AC15W01

Tested under
FCC Certification Rules
Title 47 of the CFR,
Part 24 Subpart E

MET Report: EMC92090-FCC24 REV 4

December 13, 2016

Prepared For:

Conexus World Global, LLC
1240 East Campbell Road, Suite 200
Richardson, TX 75081

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

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Donald Salguero
Project Engineer, Electromagnetic Compatibility Lab

Amy Graziano
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 24 Subpart E of the FCC Rules under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	November 10, 2016	Initial Issue
1	November 15, 2016	3 Adjacent Channels Test Data Added to Report
2	November 15, 2016	EIRP Value Revised
3	November 23, 2016	Revisions Made During TCB Review
4	December 13, 2016	Revisions Made During TCB Review

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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**ert**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 Conexus World Global, LLC Outdoor CDMA Femto / CWFEW19AC15W01, with the requirements of 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 Outdoor CDMA Femto / CWFEW19AC15W01. Conexus World Global, LLC should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Outdoor CDMA Femto / CWFEW19AC15W01, 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 24 Subpart E, in accordance with Conexus World Global, LLC, purchase order number 642685083.

FCC Reference	Description	Compliance
§2.1046; §24.232(d)	Output Power	Compliant
§2.1049; §24.232(d)	Occupied Bandwidth	Compliant
§2.1055, §24.238	Frequency stability	Compliant
§2.1051; §24.238	Conducted Spurious Emissions at Antenna Terminals and Band Edge	Compliant
§2.1053; §24.238	Radiated Spurious Emissions	Compliant

Table 1. Executive Summary of EMC ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Conexus World Global, LLC to perform testing on the Outdoor CDMA Femto / CWFEW19AC15W01, under Conexus World Global, LLC's purchase order number 642685083.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Conexus World Global, LLC, Outdoor CDMA Femto / CWFEW19AC15W01.

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

Model(s) Tested:	Outdoor CDMA Femto / CWFEW19AC15W01	
Model(s) Covered:	Outdoor CDMA Femto / CWFEW19AC15W01	
Filing Status:	Original	
EUT Specifications:	Primary Power: 110 - 220 VAC, 50 Hz	
	FCC ID: 2AJ4NCWOFEMTO	
	Type of Modulations:	QPSK
	Equipment Code:	PCB
	RF Power Output	Part 24 EIRP(W): 242.66
	EUT Frequency Ranges:	Tx: 1930-1990 MHz
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:	Donald Salguero	
Date(s):	December 13, 2016	

B. References

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 C63.4:2014	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-D-2010	Land Mobile FM or PM Communication Equipment Measurement and Performance Standards
KDB 971168	Power measurement of fundamental for licensed devices with bandwidths > 1 MHz

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 3 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 Outdoor CDMA Femto / CWFEW19AC15W01), Equipment Under Test (EUT), is a mini/micro cellular base station which operates over 3GPP2 Band class 1(BTS TX: 1930~1990MHz, RX: 1850~1910MHz). It expands 3G cellular service coverage so mobile users can experience full voice and data service in areas that have inconsistent or no cellular signal.

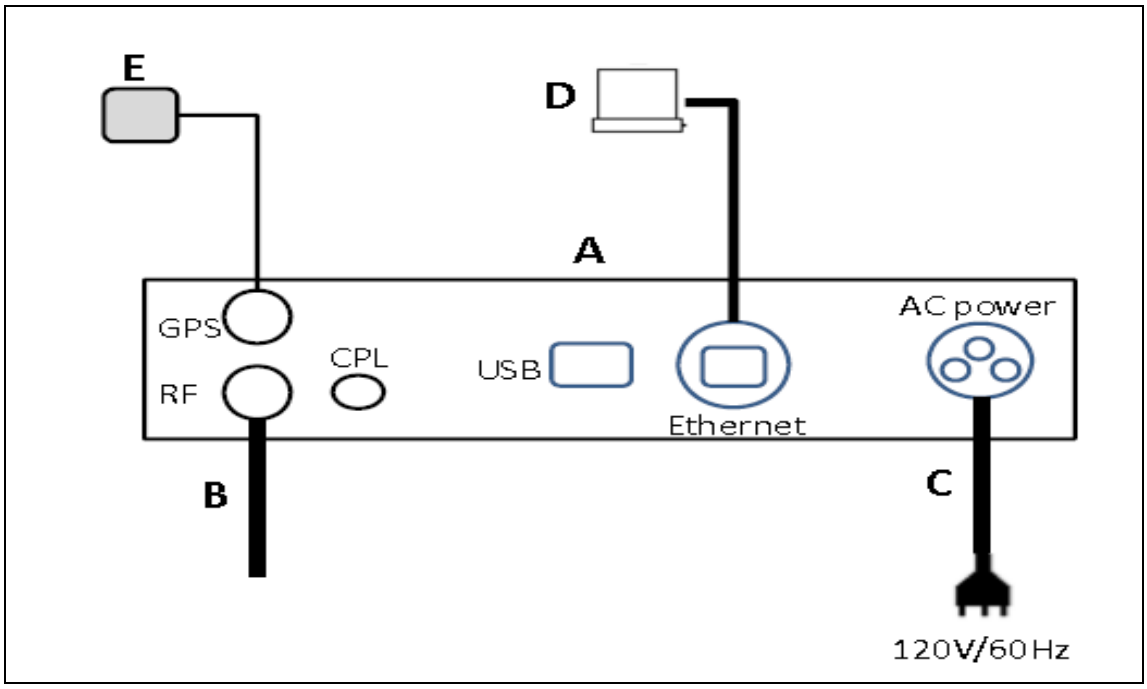


Figure 1. Block Diagram of Equipment Configuration

E. Equipment Configuration

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Revision
A	OUTDOOR CDMA FEMTO	N/A	N/A	N/A	

Table 2. Equipment Configuration

F. Support Equipment

Ref. ID	Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
C	POWER CORD	AMPHENOL/RIT	PWF-03BFFA-SL7001	N/A
D	TEST LAPTOP	IBM THINK PAD	2668-CTO	N/A
E	GPS ANTENNA	TALLYSMAN	TW3012	N/A

Table 3. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
B	ANT	50 OHM RF CABLE	1		12	Y	50 OHM TERMINATED / TEST EQUIPMENT
C	AC IN	3 X 18AWG	1	3M	N/A	N/A	AC OUTLET

D	RJ-45	CAT-5	1	2M	12M	N	TEST LAPTOP
E	GPS	RG58	1	30M	30M	Y	GPS ANTENNA(TW3012)
	CPL	N/A	N/A	N/A	N/A	N/A	50 OHM TERMINATED
	USB	N/A	1	0.9M	N/A	Y	UNTERMINATED

Table 4. Ports and Cabling Information

H. Mode of Operation

The Outdoor CDMA Femto has three carriers (CDMA 2000, EvDo and Pilot Beacon) with the maximum RF power level of 5W per carrier. So the maximum total RF output power is 15Watts. The system is controlled by a test laptop. During the test, CDMA2000 channel is set to the maximum output power with QPSK modulation signal, EvDo channel is set to the maximum output power with QPSK/8-PSK/16QAM modulation signal, and Pilot Beacon channel is set to the maximum output power with QPSK modulation signal.

I. Method of Monitoring EUT Operation

1. Green (solid or blinking) “PWR”, “LINK”, “NET”, “GPS” LED indicates the Outdoor CDMA Femto is operating normally. “OVEN” LED will turn on when ambient temperature is below 0 degree Celsius. “SYS” LED is used for test purpose only.
2. Red status of any of the LEDs other than “SYS” indicates that the Outdoor CDMA Femto is not operating normally.

J. 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.

K. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Conexus World Global, LLC 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.

§ 24.232 Power and antenna height limits.

§ 24.232 (a): **(**1**)** Base stations with an emission bandwidth of 1 MHz or less are limited to 1640 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

(2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

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 configured in accordance with the licensed measurement guidance procedure. 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.

RF power output measurement was made at the RF output terminal using a spectrum analyzer, with suitable attenuation where appropriate.

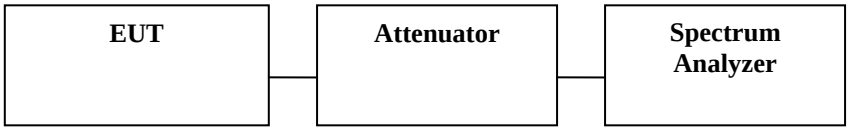


Figure. RF Power Output Test Setup

CDMA Channel Number (Band Class 1)	
Channel Number	Transmit Frequency (MHz)
25	1931.25
50	1932.50
75	1933.75
575	1958.75
600	1960.00
625	1961.25
1125	1986.25
1150	1987.50
1175	1988.75

Table 5. Operating Channels of the EUT

Test Results: The EUT complies with the requirements of this section. The QPSK modulation was found to be the worst case. Between single channel transmission and three adjacent channel transmissions, it was found that the second is the worst case. Peak conducted output power measurements were also taken to compute the peak to average ratio.

Test Engineer(s): Donald Salguero

Test Date(s): 10/10/16 and 11/15/16

Channel	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP W	Limit W
25	37.03	12.1	81.84648	1640
600	37.21	12.1	85.31001	1640
1175	36.58	12.1	73.79042	1640

Table 6. EIRP, Test Results for Pilot Beacon, Part 24

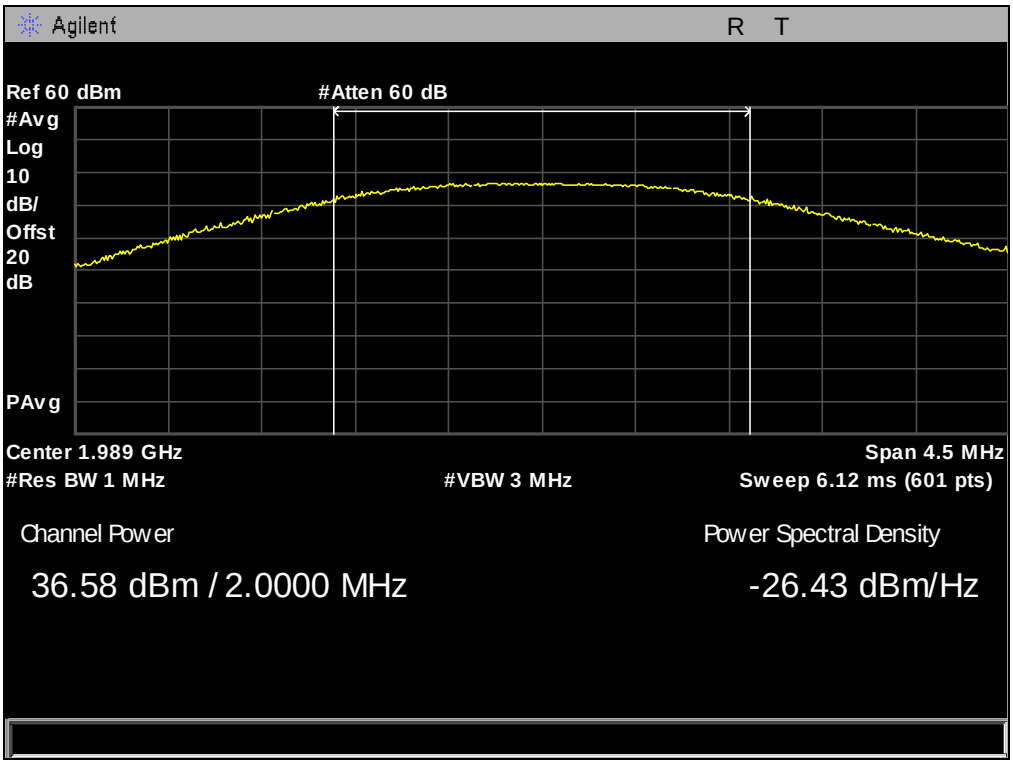
Channel	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP W	Limit W
25	34.65	12.1	47.31513	1640
600	34.44	12.1	45.08167	1640
1175	33.8	12.1	38.90451	1640

Table 7. EIRP, Test Results for CDMA 2000, Part 24

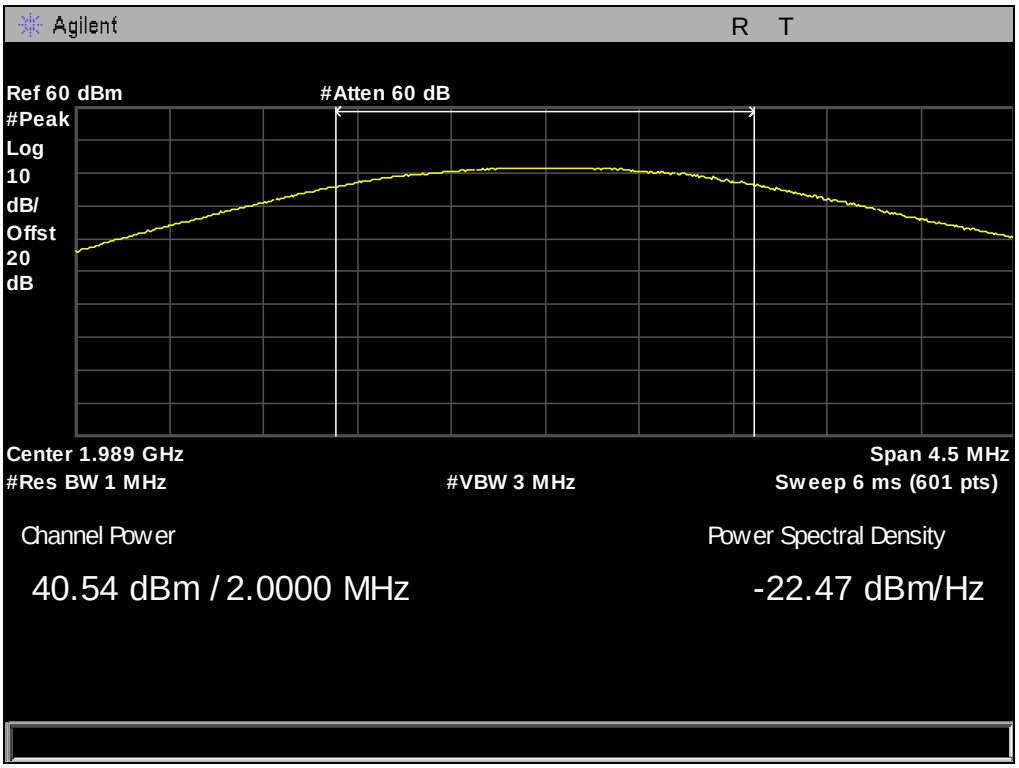
Channel	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP W	Limit W
25	35.24	12.1	54.20009	1640
600	34.29	12.1	43.55119	1640
1175	35.28	12.1	54.7016	1640

Table 8. EIRP, Test Results for EVDO (QPSK), Part 24

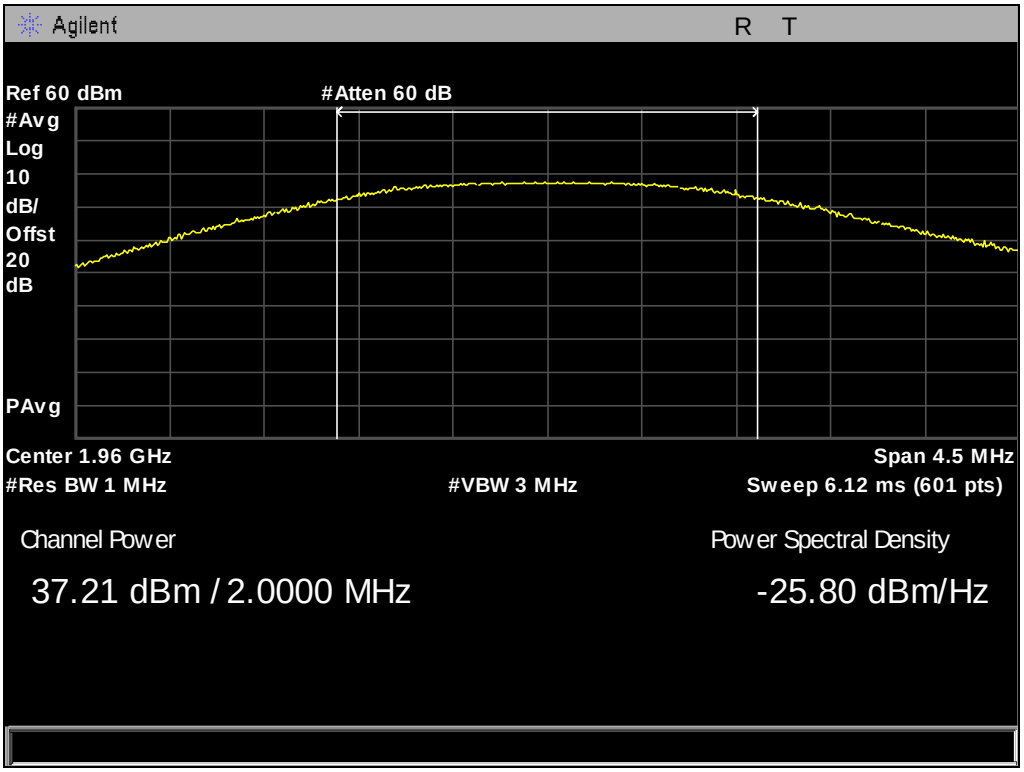
Part 24, EIRP



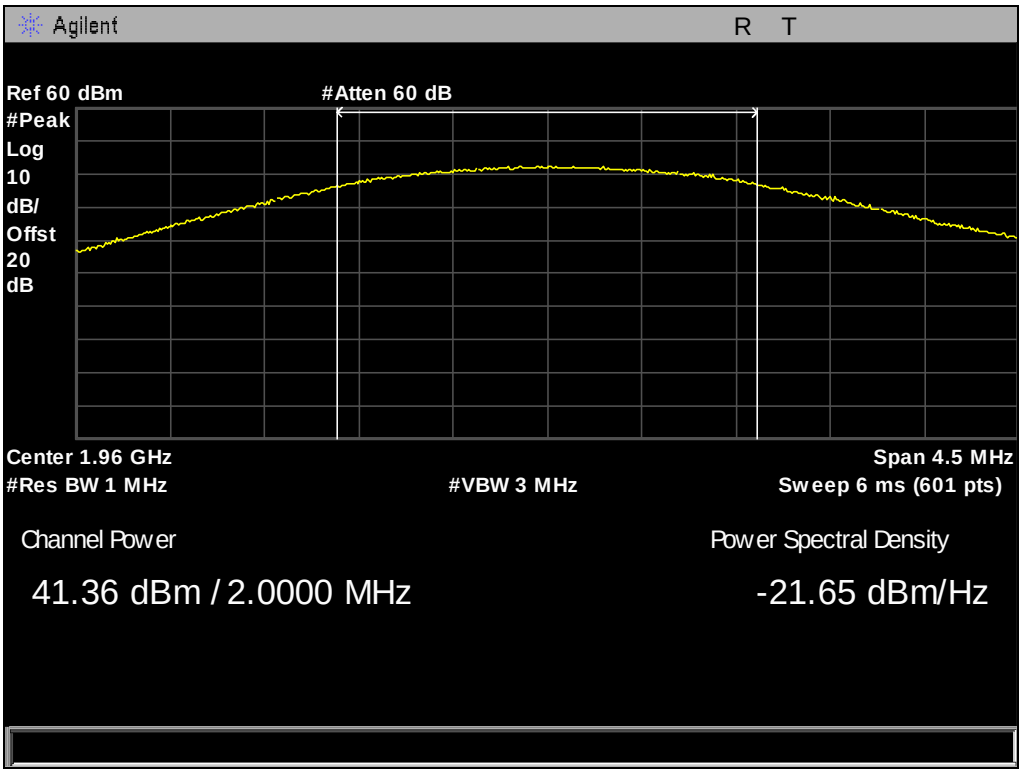
Plot 1. EIRP, Channel 1175, Conducted Power, Pilot Beacon, Part 24, Average



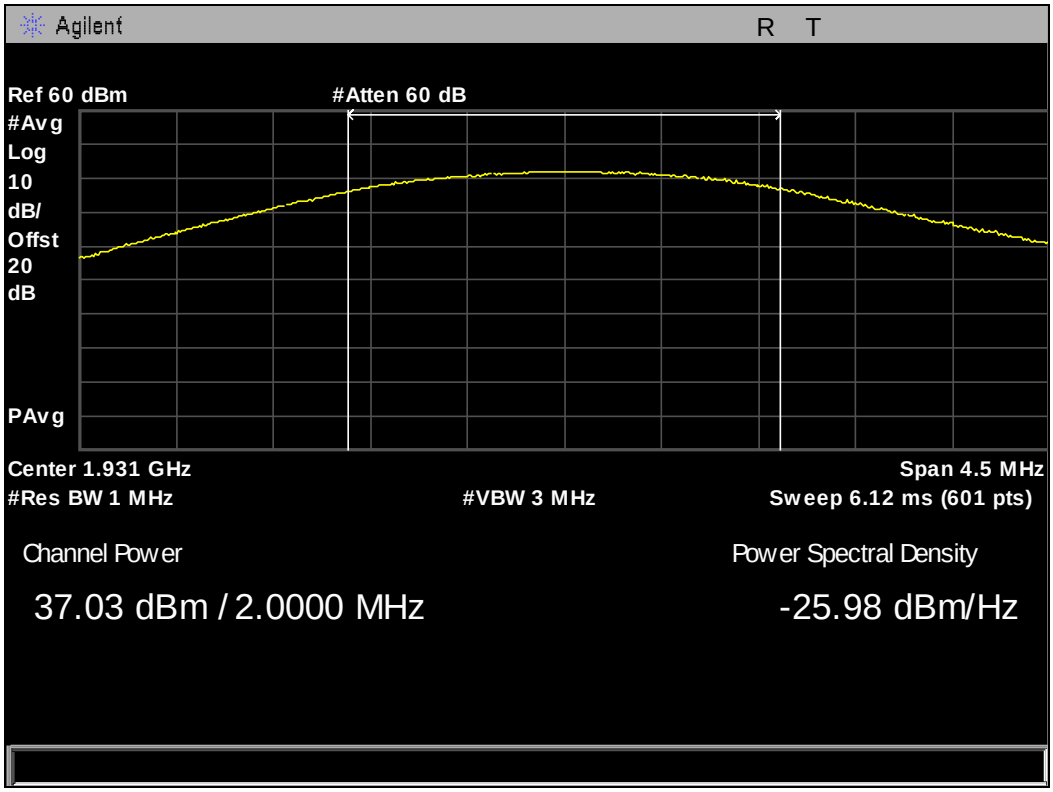
Plot 2. EIRP, Channel 1175, Conducted Power, Pilot Beacon, Part 24, Peak



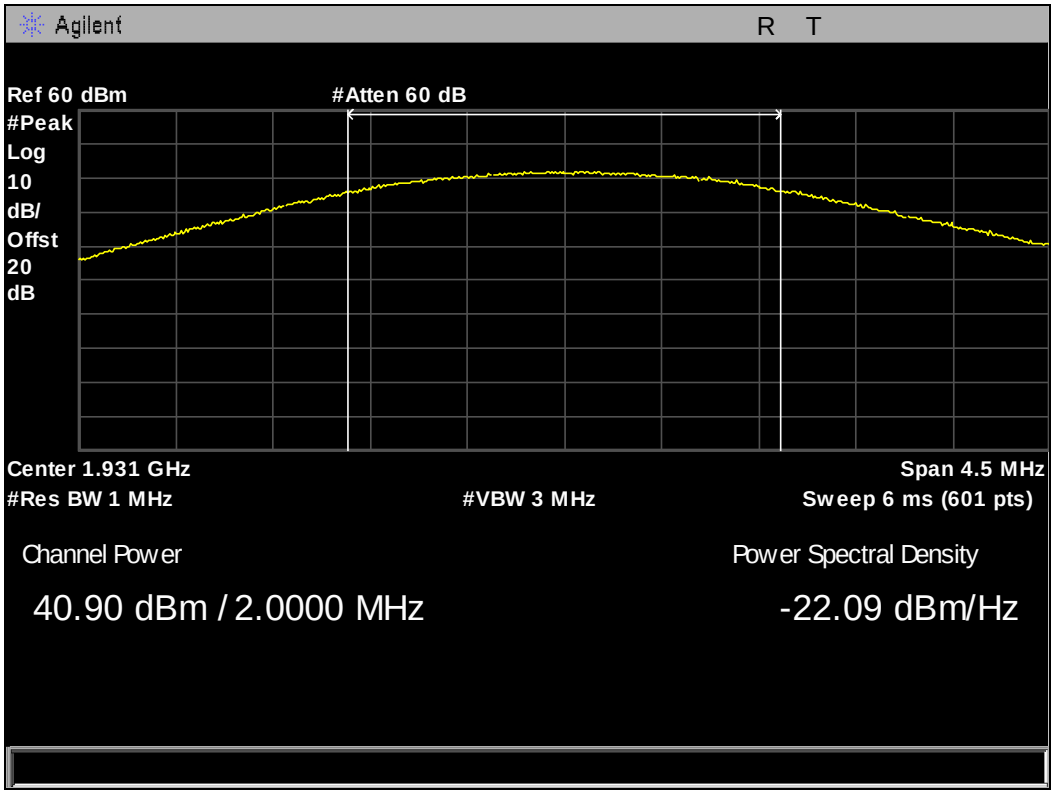
Plot 3. EIRP, Channel 600, Conducted Power, Pilot Beacon, Part 24, Average



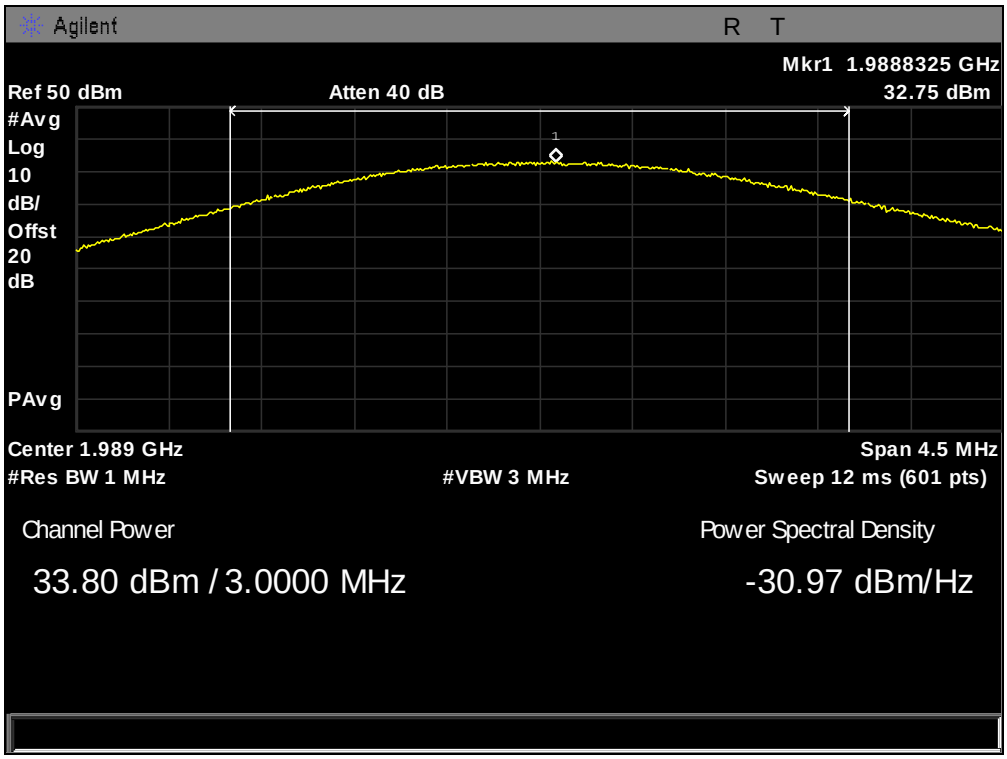
Plot 4. EIRP, Channel 600, Conducted Power, Pilot Beacon, Part 24, Peak



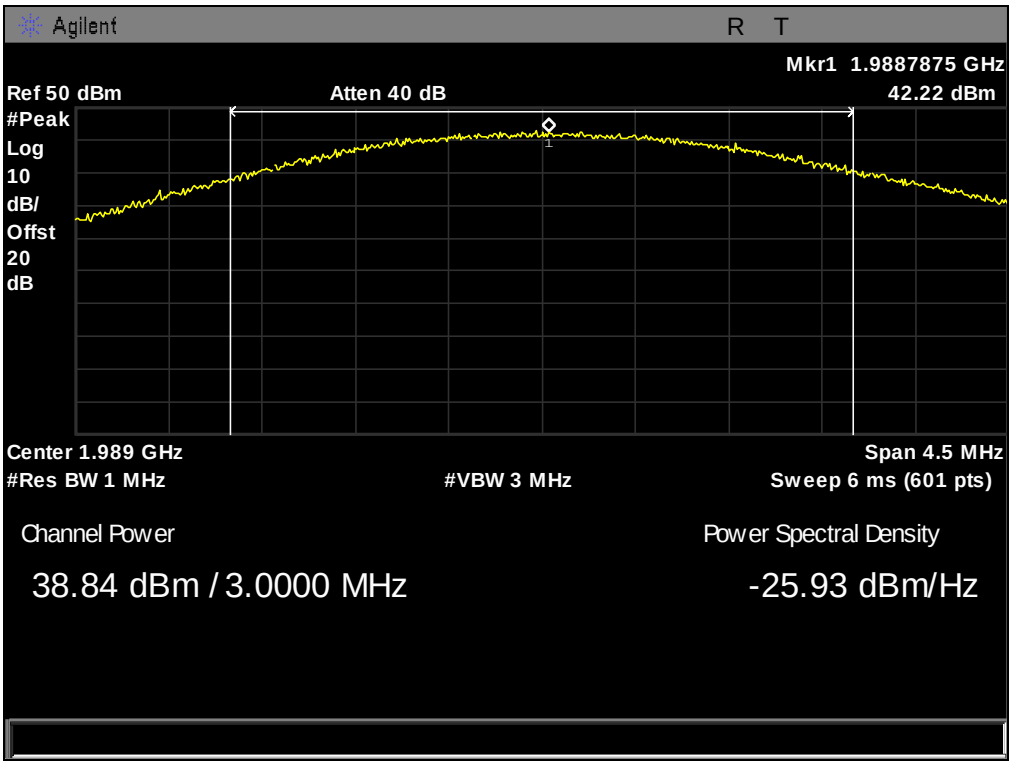
Plot 5. EIRP, Channel 25, Conducted Power, Pilot Beacon, Part 24, Average



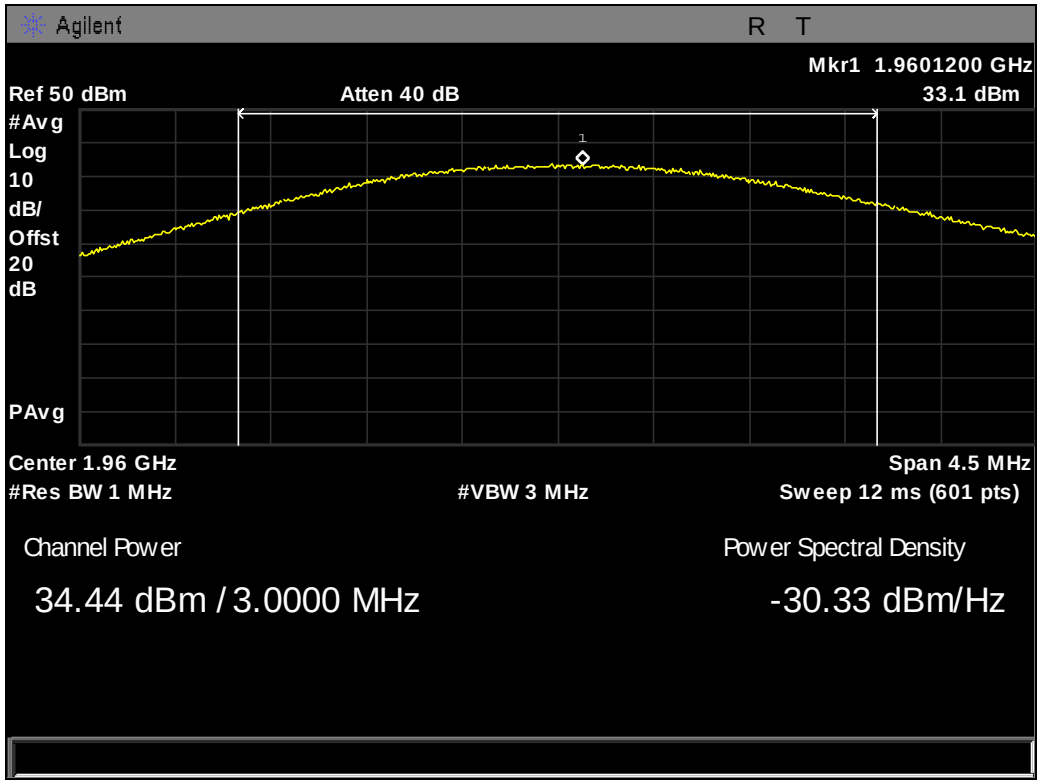
Plot 6. EIRP, Channel 25, Conducted Power, Pilot Beacon, Part 24, Peak



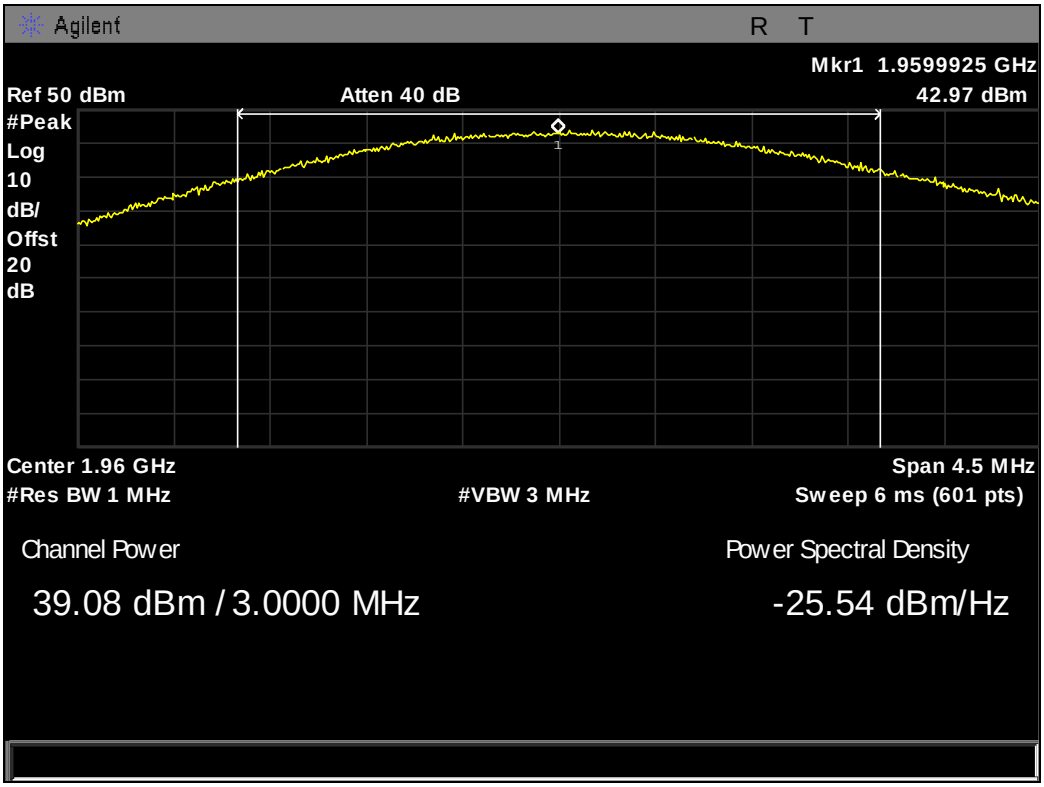
Plot 7. EIRP, Channel 1175, Conducted Power, CDMA 2000, Part 24, Average



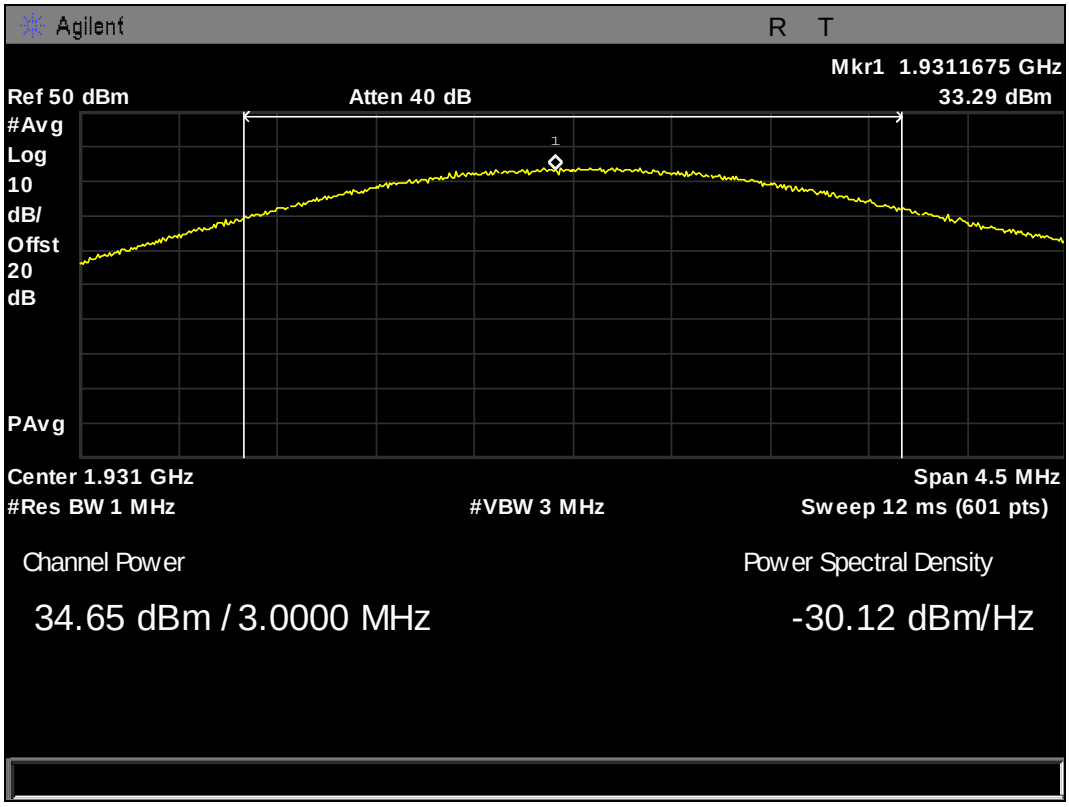
Plot 8. EIRP, Channel 1175, Conducted Power, CDMA 2000, Part 24, Peak



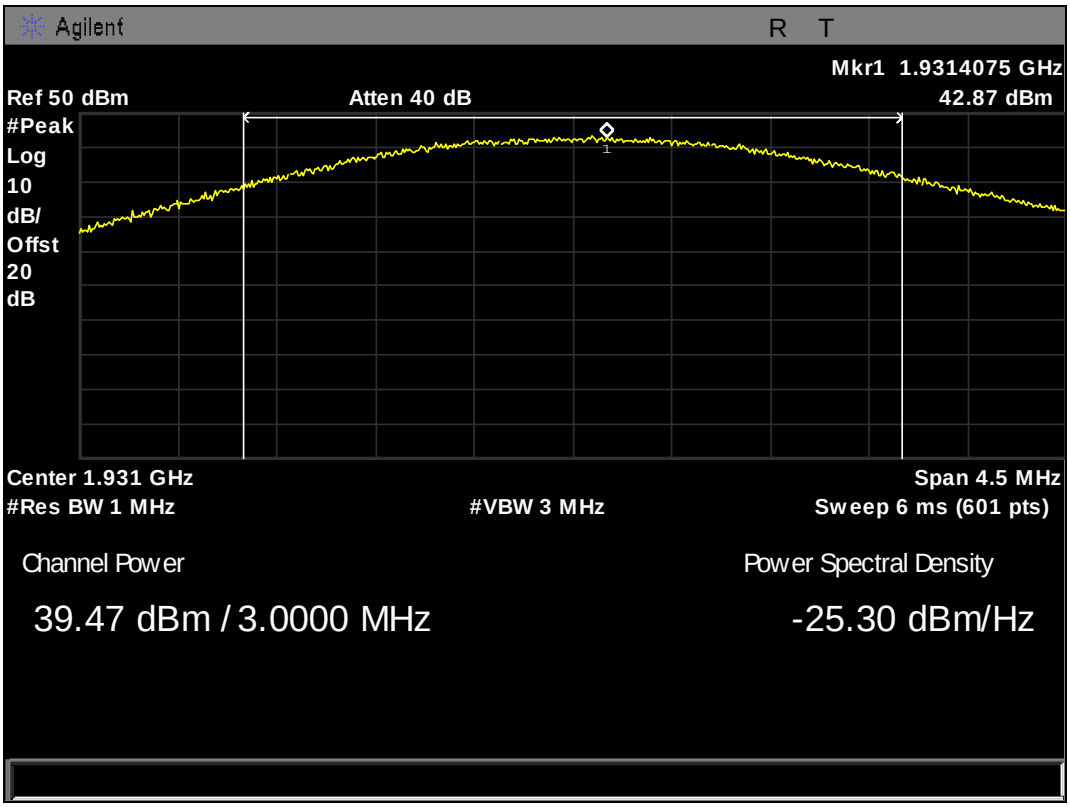
Plot 9. EIRP, Channel 600, Conducted Power, CDMA 2000, Part 24, Average



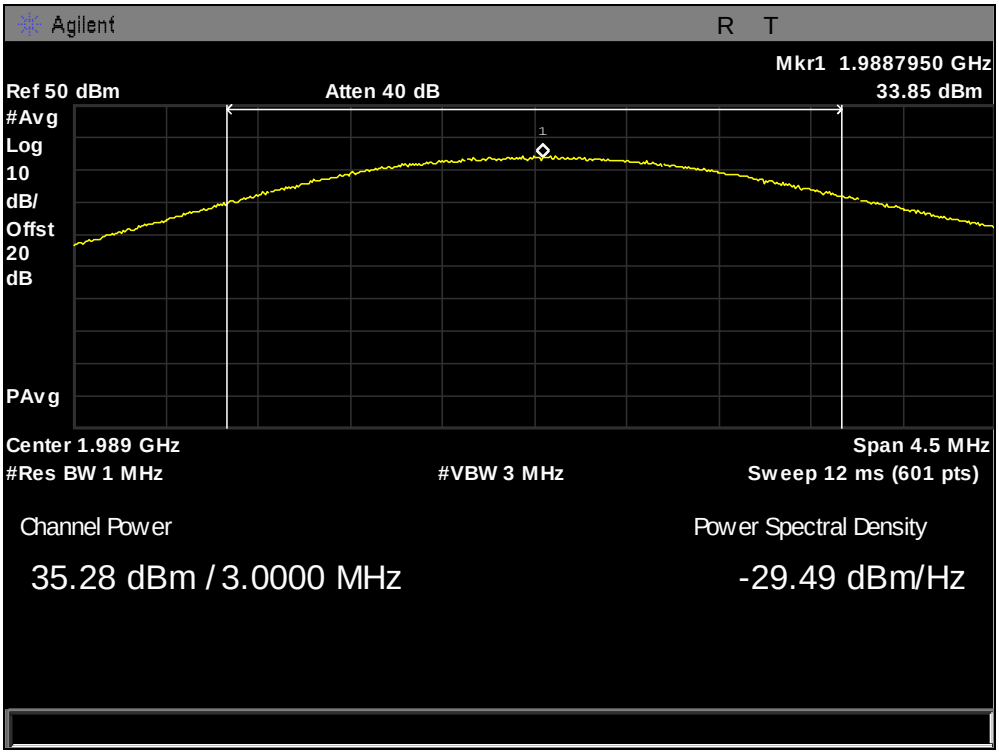
Plot 10. EIRP, Channel 600, Conducted Power, CDMA 2000, Part 24, Peak



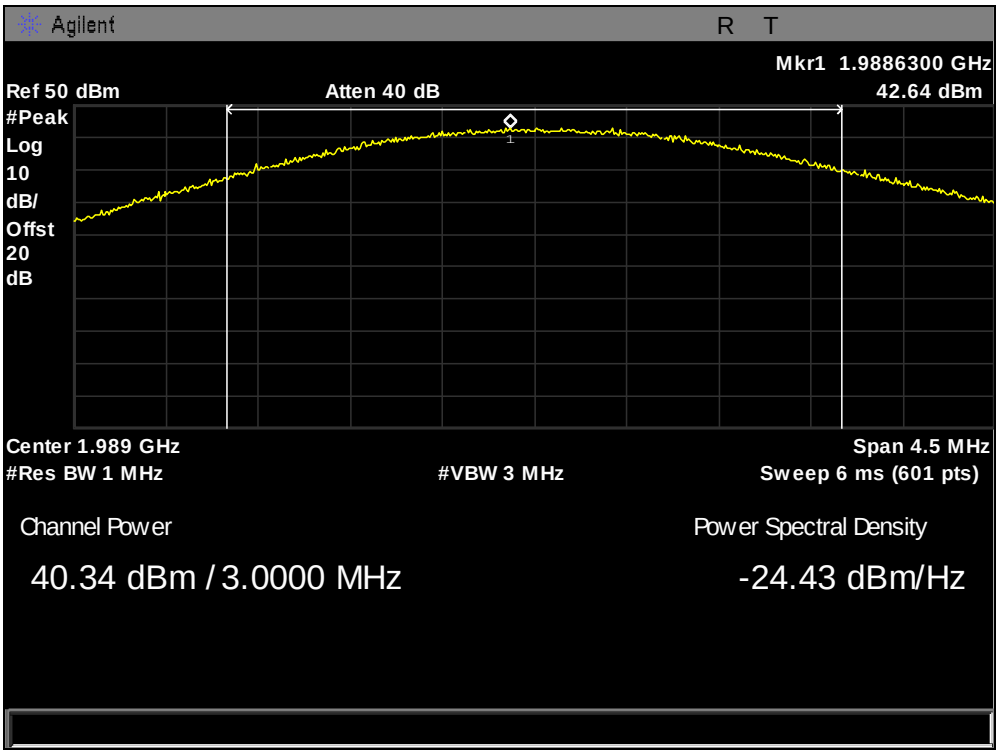
Plot 11. EIRP, Channel 25, Conducted Power, CDMA 2000, Part 24, Average



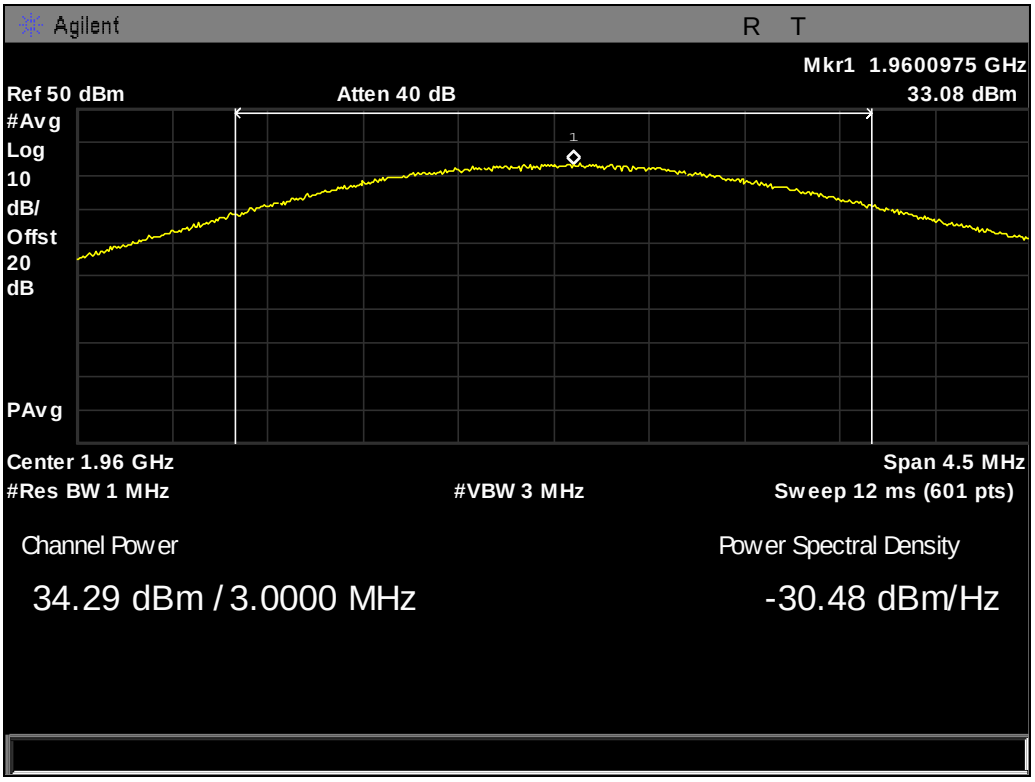
Plot 12. EIRP, Channel 25, Conducted Power, CDMA 2000, Part 24, Peak



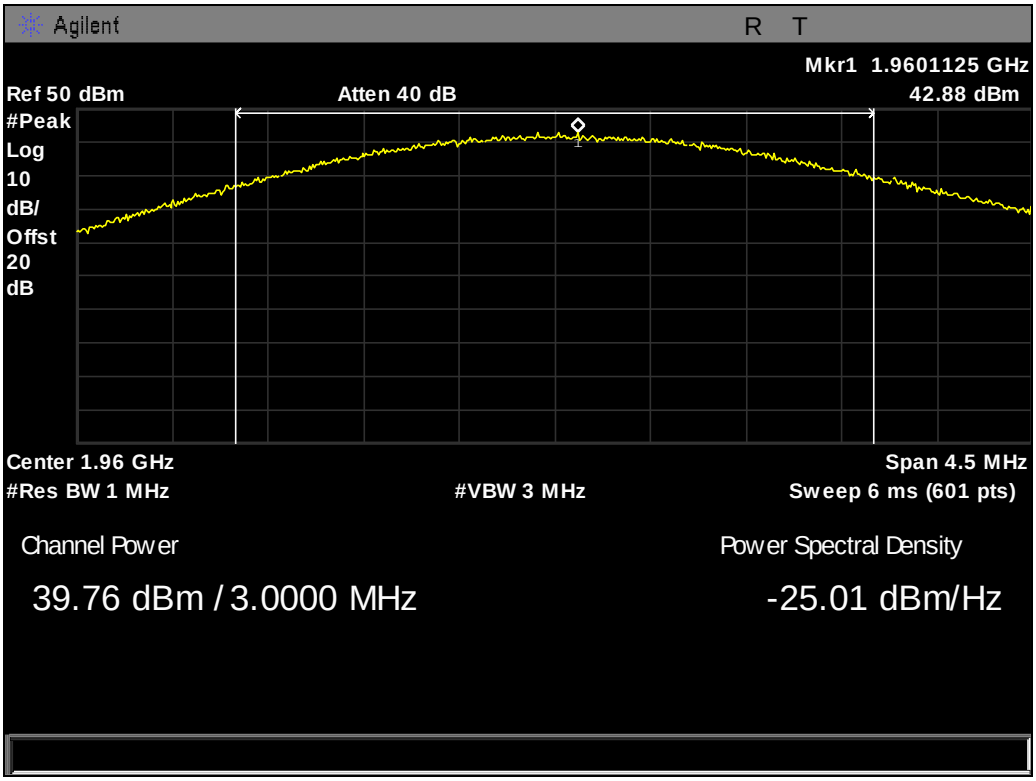
Plot 13. EIRP, Channel 1175, Conducted Power, EVDO (QPSK), Part 24, Average



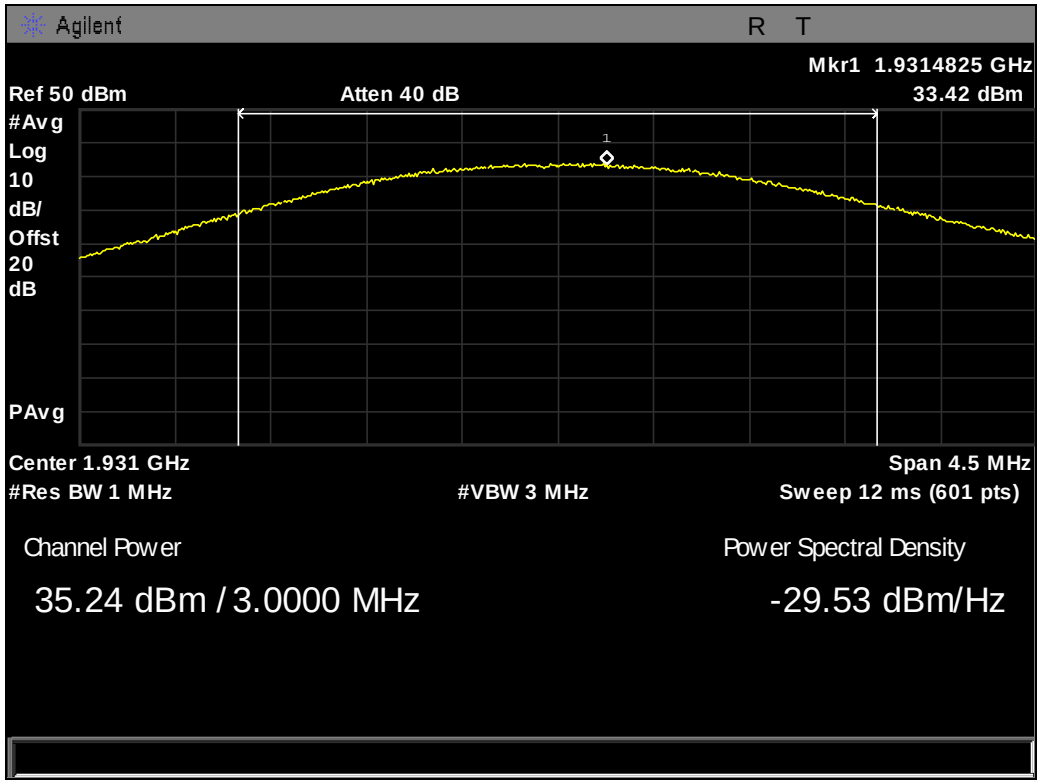
Plot 14. EIRP, Channel 1175, Conducted Power, EVDO (QPSK), Part 24, Peak



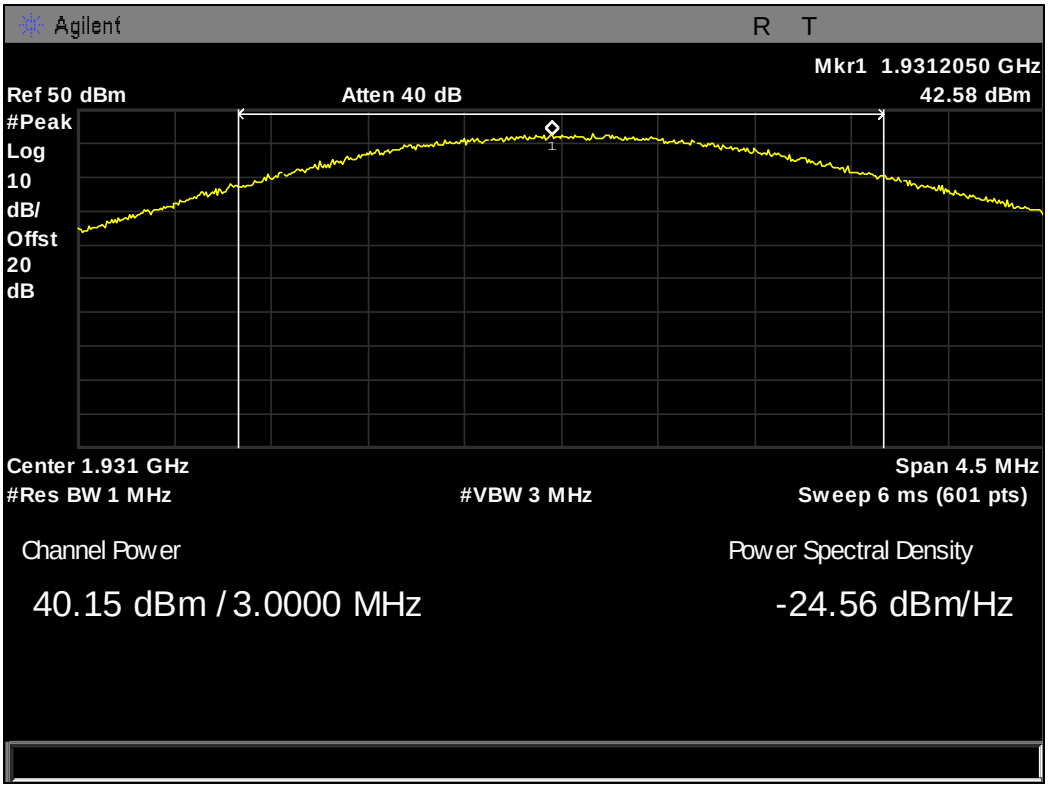
Plot 15. EIRP, Channel 600, Conducted Power, EVDO (QPSK), Part 24, Average



Plot 16. EIRP, Channel 600, Conducted Power, EVDO (QPSK), Part 24, Peak



Plot 17. EIRP, Channel 25, Conducted Power, EVDO (QPSK), Part 24, Average



Plot 18. EIRP, Channel 25, Conducted Power, EVDO (QPSK), Part 24, Peak

§ 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 spectrum analyzer was set in accordance with the licensed measurement procedure guidance. 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): Donald Salguero

Test Date(s): 10/10/16 and 11/15/16

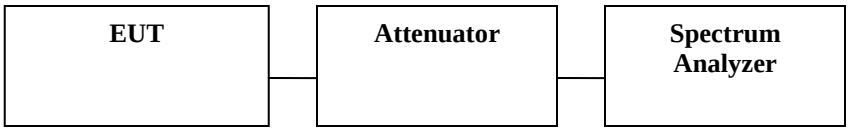
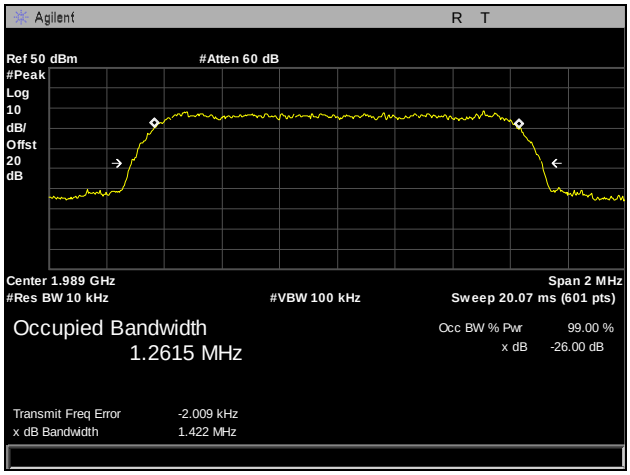
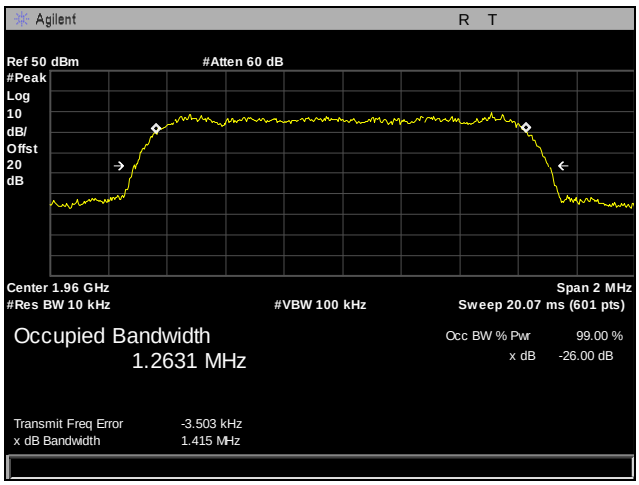


Figure 2. Occupied Bandwidth Test Setup

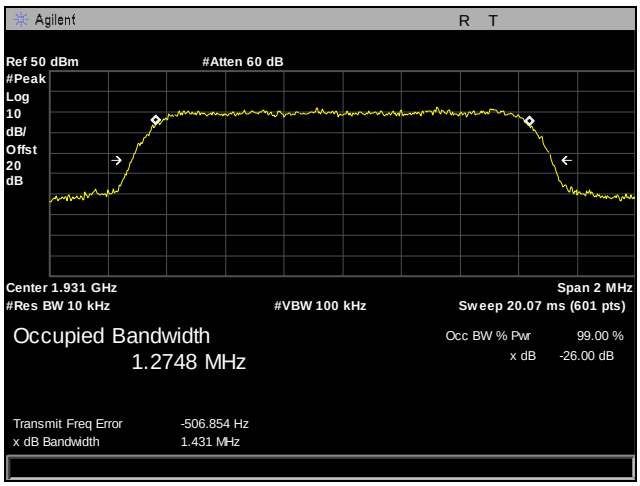
Part 24



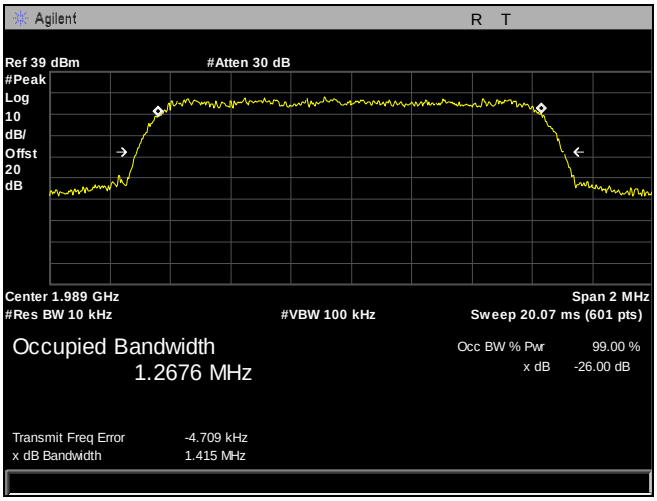
Plot 19. Occupied Bandwidth, Channel 1175, Pilot Beacon, Part 24



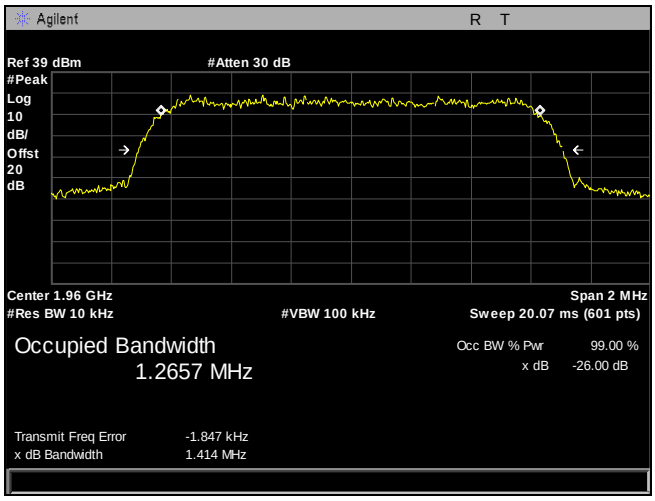
Plot 20. Occupied Bandwidth, Channel 600, Pilot Beacon, Part 24



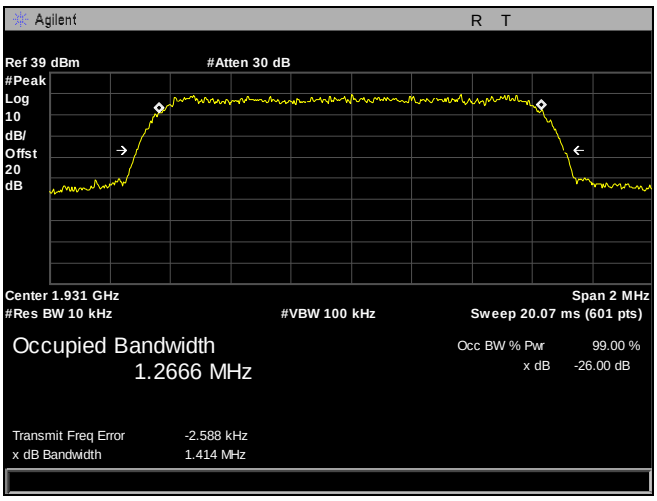
Plot 21. Occupied Bandwidth, Channel 25, Pilot Beacon, Part 24



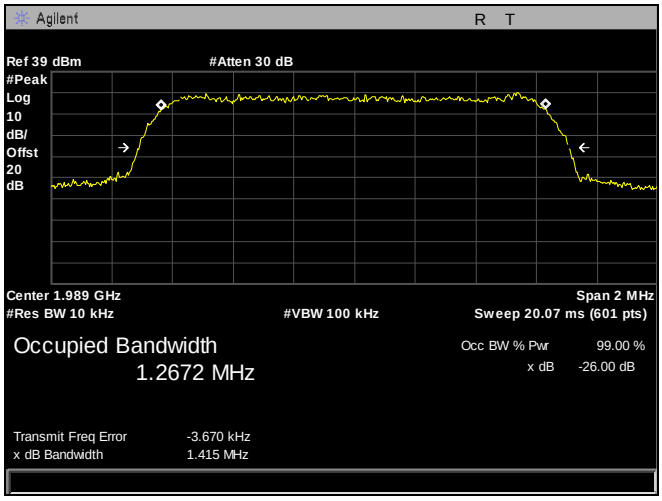
Plot 22. Occupied Bandwidth, Channel 1175, CDMA 2000, Part 24



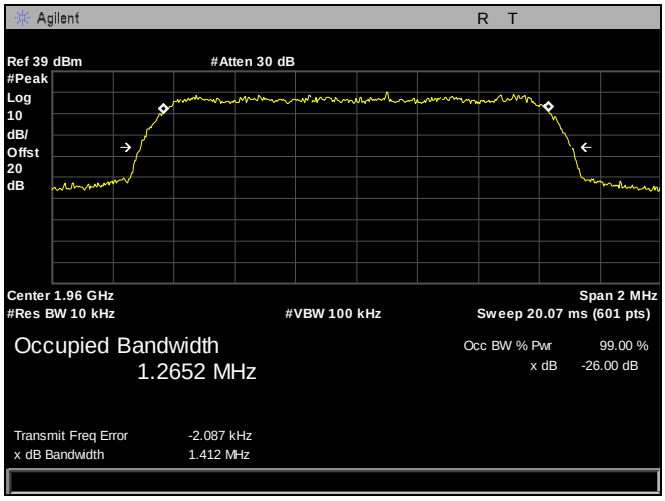
Plot 23. Occupied Bandwidth, Channel 600, CDMA 2000, Part 24



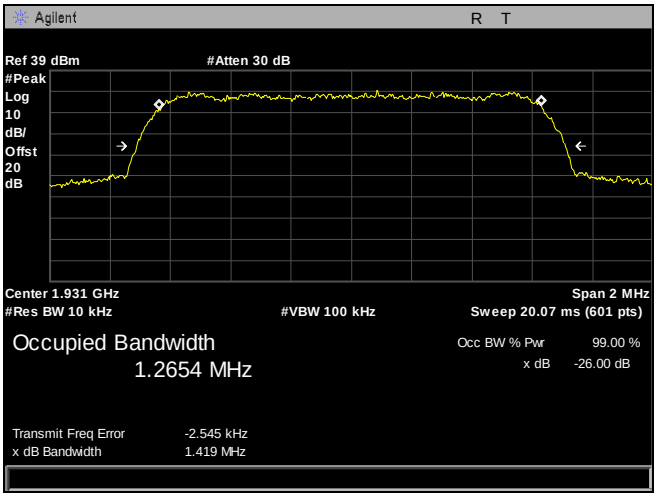
Plot 24. Occupied Bandwidth, Channel 25, CDMA 2000, Part 24



Plot 25. Occupied Bandwidth, Channel 1175, EVDO (QPSK), Part 24



Plot 26. Occupied Bandwidth, Channel 600, EVDO (QPSK), Part 24



Plot 27. Occupied Bandwidth, Channel 25, EVDO (QPSK), 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.

Test Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* was made in accordance with the procedures of EIA/TIA-603-D-2010 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

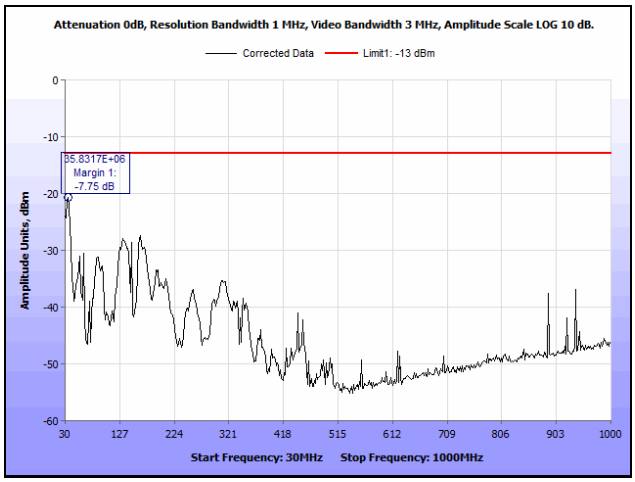
Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber. The EUT's RF ports were terminated to 50ohm load. The EUT was tested using both modulations and at the low, mid, and high channels. The EUT was rotated about 360^0 and the receiving antenna scanned from 1-4m in order 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 configured in accordance with the licensed measurement guidance, and as per rule Part 24.

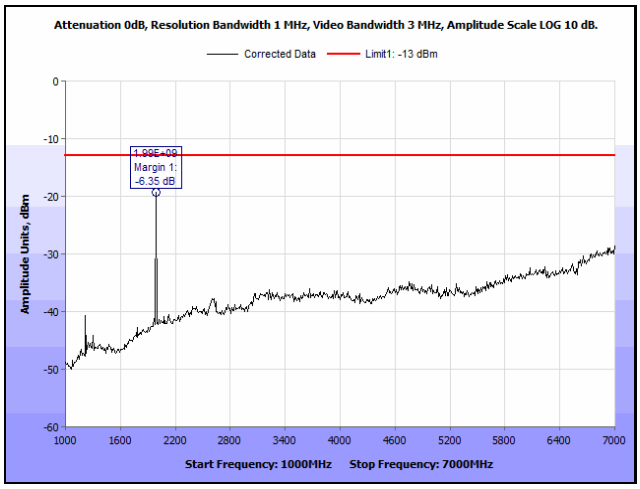
The distance between the EUT and the test antenna was 3 meters for below 1 GHz and 1m for frequencies above 1 GHz. The EUT's RF ports were connected to a dummy load. The intensities of the radiated emissions were maximized by rotating the turntable 360 degrees and varying the receive antenna from 1 to 4m. Measurements were made with the receive antenna in both horizontal and vertical polarizations.

Test Results:	Equipment complies with Section 2.1053. For the three adjacent channels testing, this test was not applicable since the behavior for conducted emissions during three adjacent channels transmitting simultaneously matches that of one channel, it is concluded that no change is expected for radiated emissions between three adjacent channels and a single channel.
Test Engineer:	Donald Salguero
Test Date(s):	10/13/16 – 10/19/16

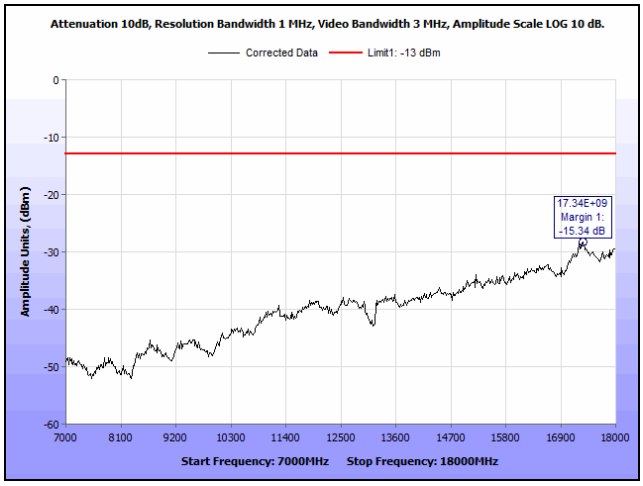
Radiated Spurious Emissions, Part 24



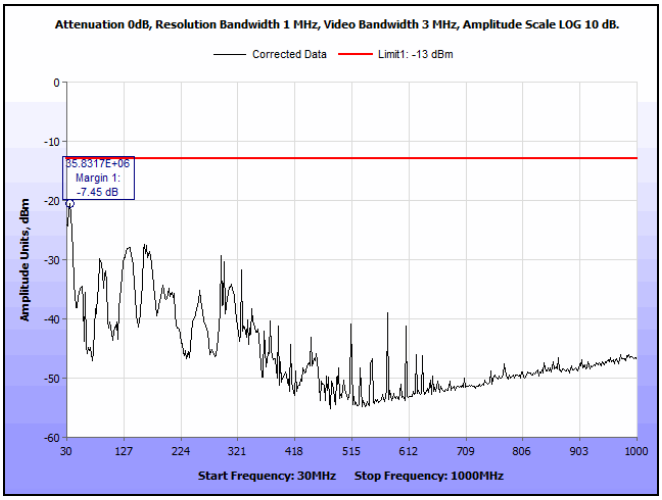
Plot 28. Radiated Spurious Emissions, Channel 1175, 30 MHz – 1 GHz, Part 24



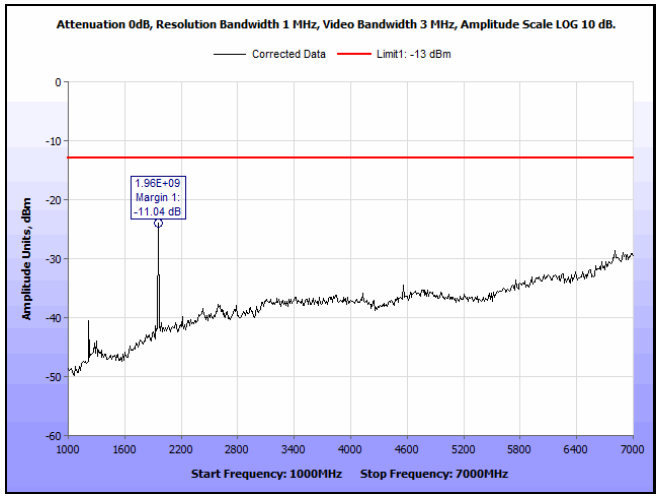
Plot 29. Radiated Spurious Emissions, Channel 1175, 1 GHz – 7 GHz, Part 24



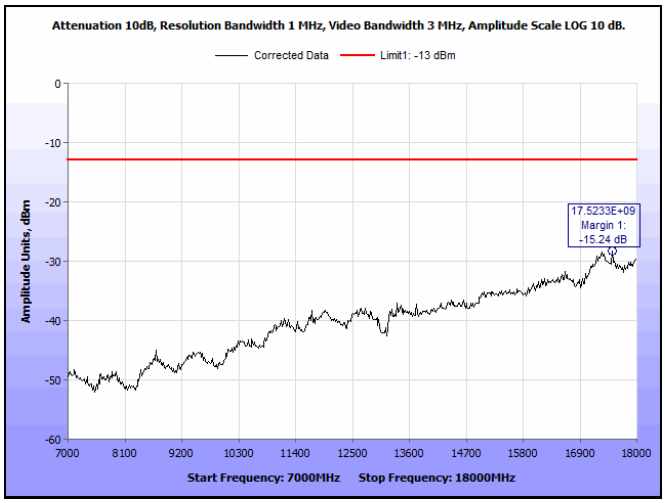
Plot 30. Radiated Spurious Emissions, Channel 1175, 7 GHz – 18 GHz, Part 24



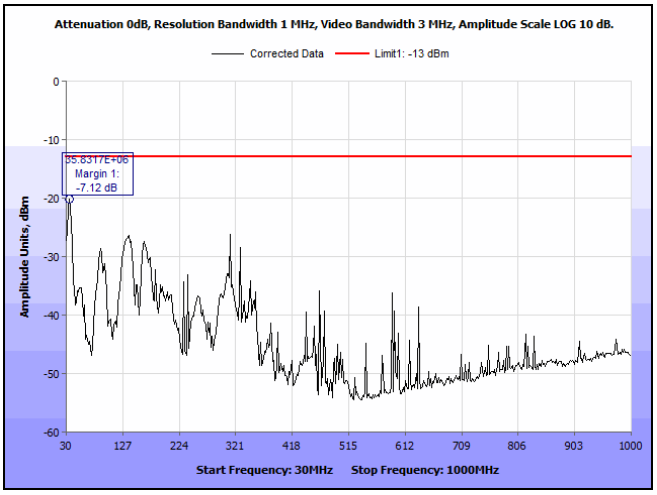
Plot 31. Radiated Spurious Emissions, Channel 600, 30 MHz – 1 GHz, Part 24



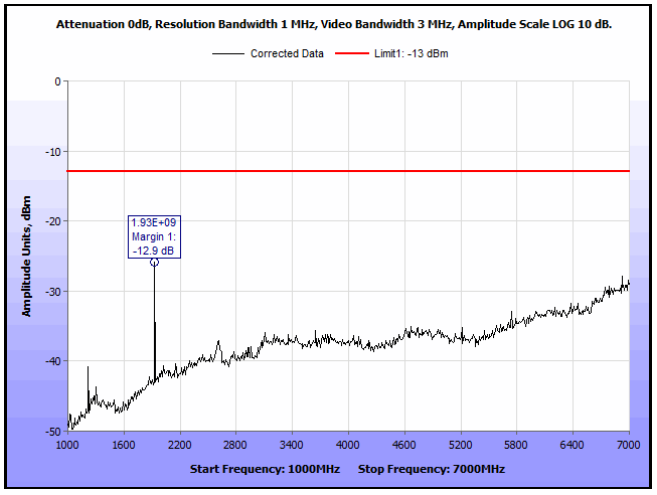
Plot 32. Radiated Spurious Emissions, Channel 600, 1 GHz – 7 GHz, Part 24



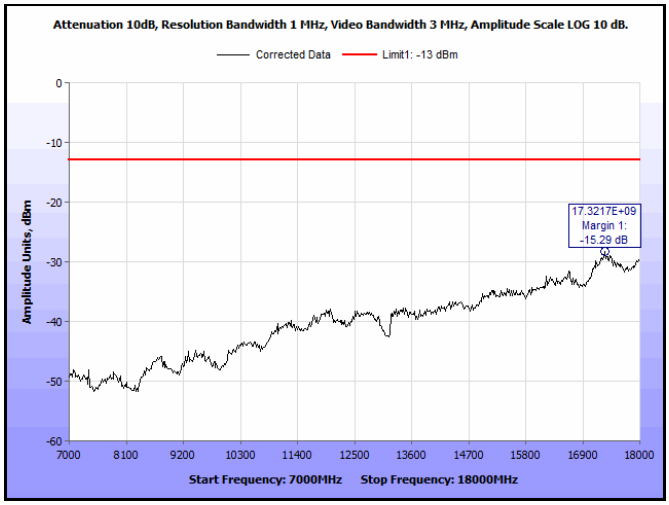
Plot 33. Radiated Spurious Emissions, Channel 600, 7 GHz – 18 GHz, Part 24



Plot 34. Radiated Spurious Emissions, Channel 25, 30 MHz – 1 GHz, Part 24



Plot 35. Radiated Spurious Emissions, Channel 25, 1 GHz – 7 GHz, Part 24



Plot 36. Radiated Spurious Emissions, Channel 25, 7 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.

§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.

Band Edge Plots: If a reduction of power was necessary for compliance at band edges, a second band edge plot was taken at the outermost channel that was compliant at the highest power. The channel number is noted in the caption of those plots.

Test Results: Equipment complies with these requirements.

Test Engineer(s): Donald Salguero

Test Date(s): 10/07/16, 10/11/16, and 11/15/16

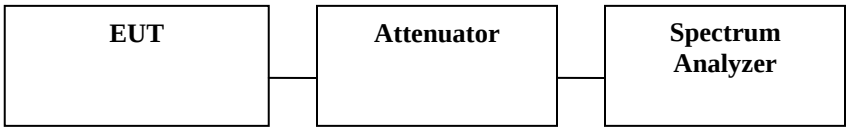
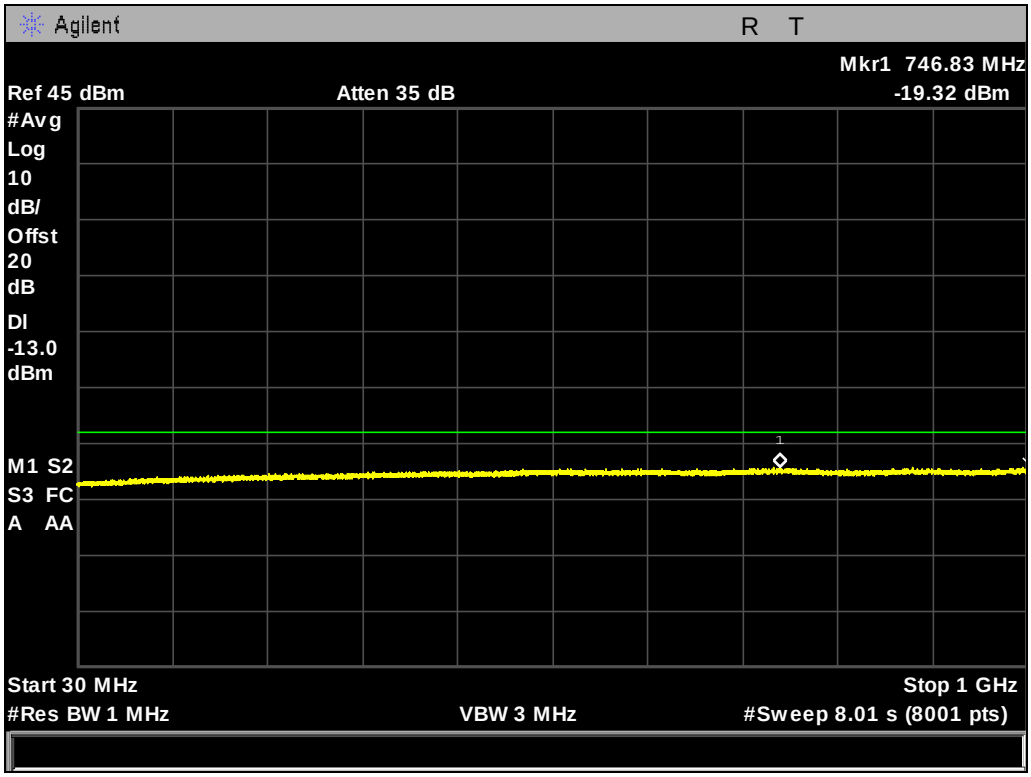
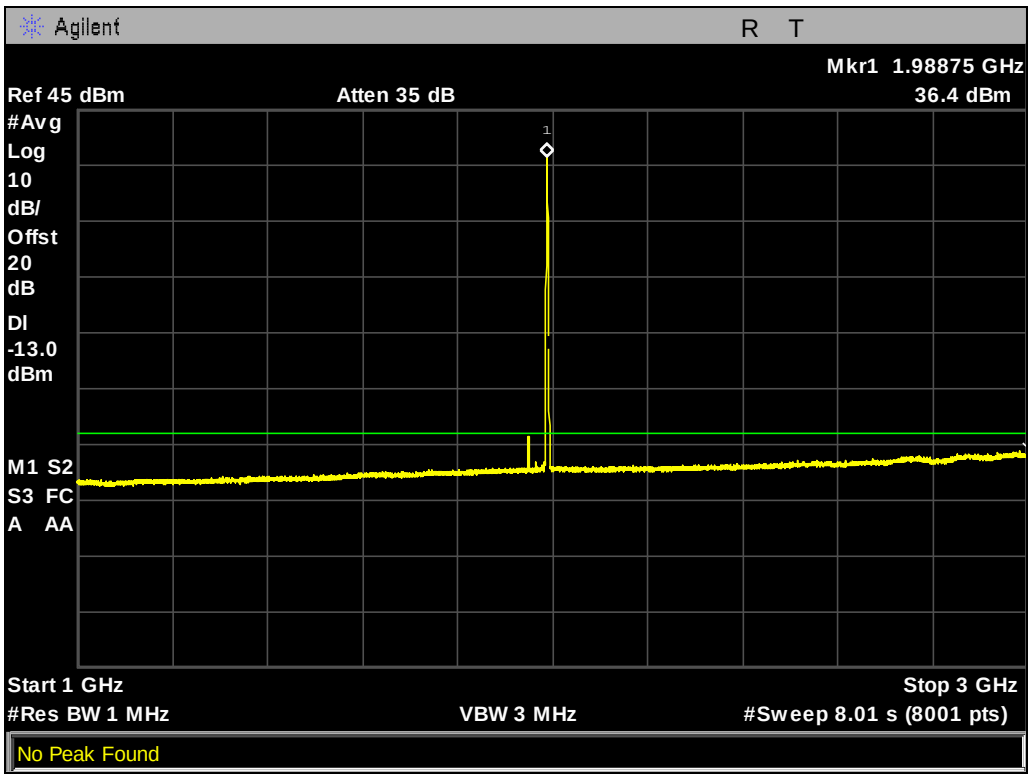


Figure 3. Spurious Emissions at Antenna Terminals Test Setup

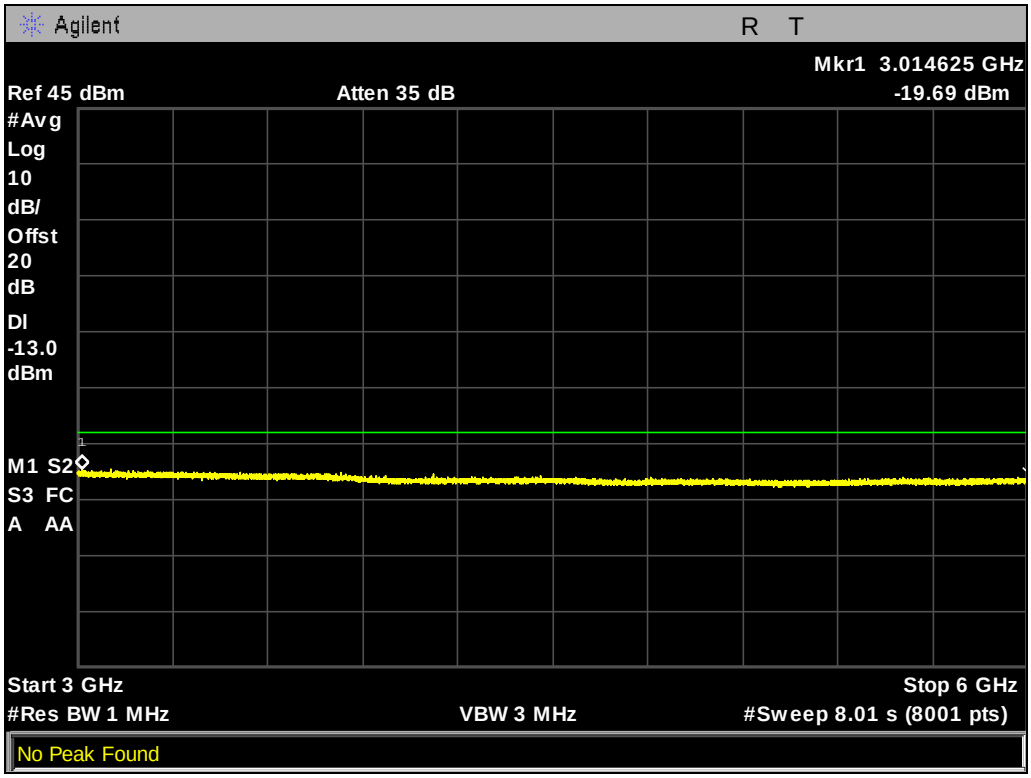
Part 24



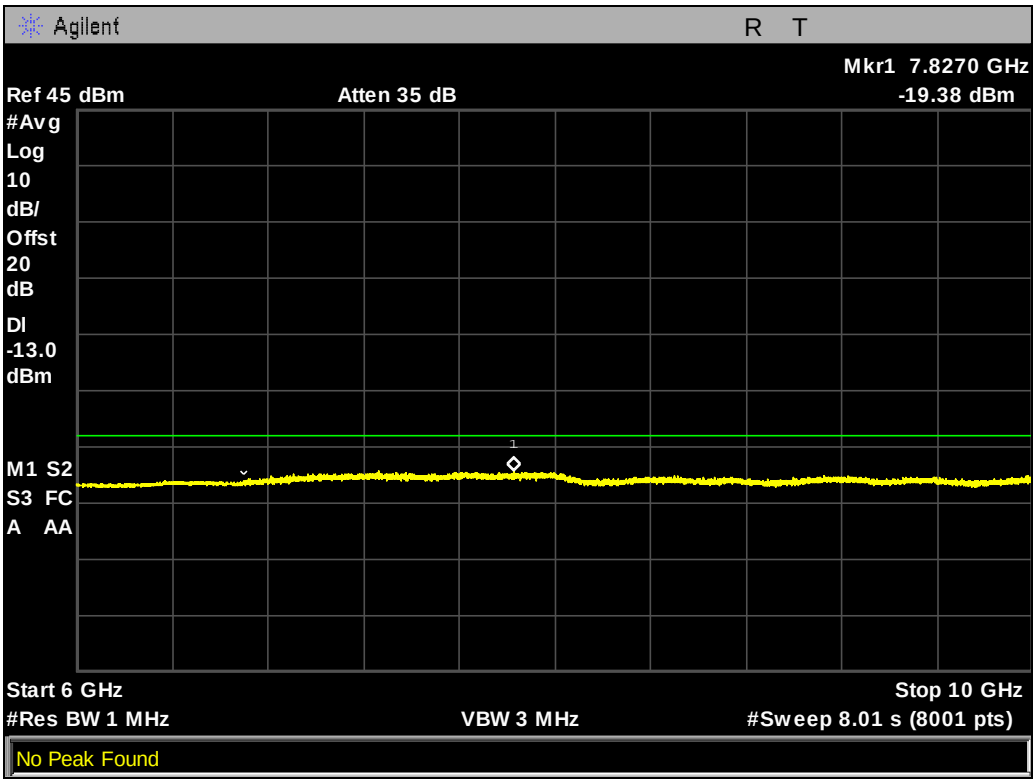
Plot 37. Conducted Spurious Emissions, Channel 1175, 30 MHz – 1 GHz, Part 24



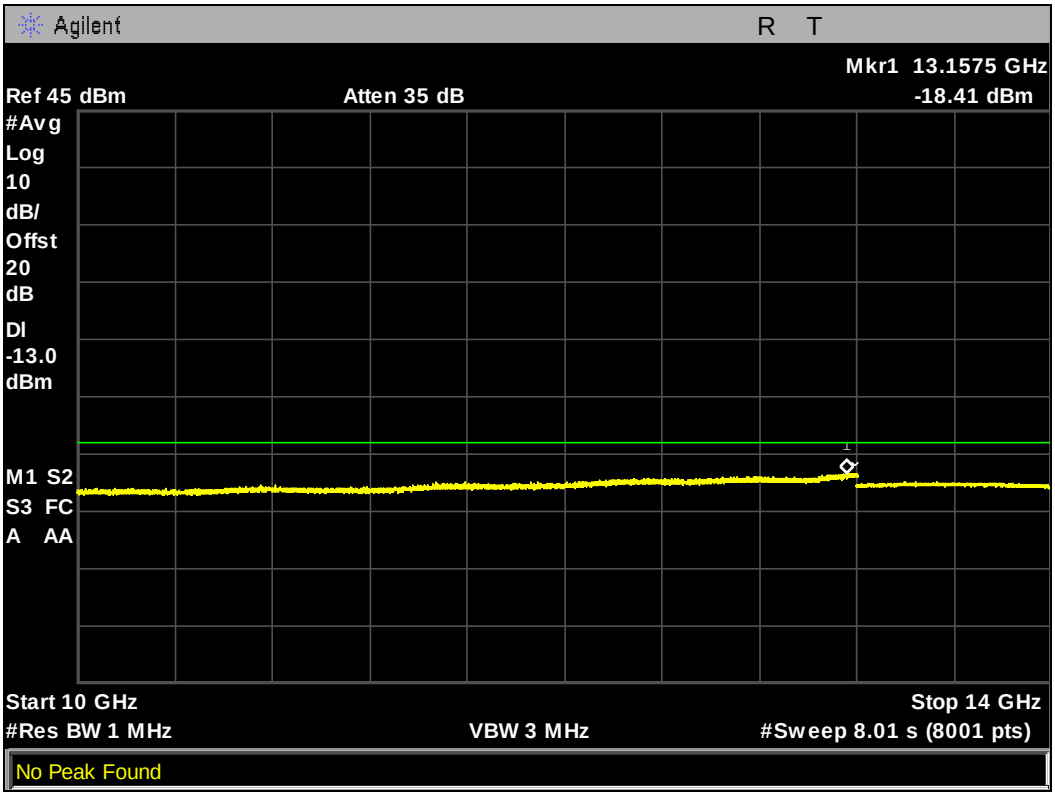
Plot 38. Conducted Spurious Emissions, Channel 1175, 1 GHz – 3 GHz, Part 24



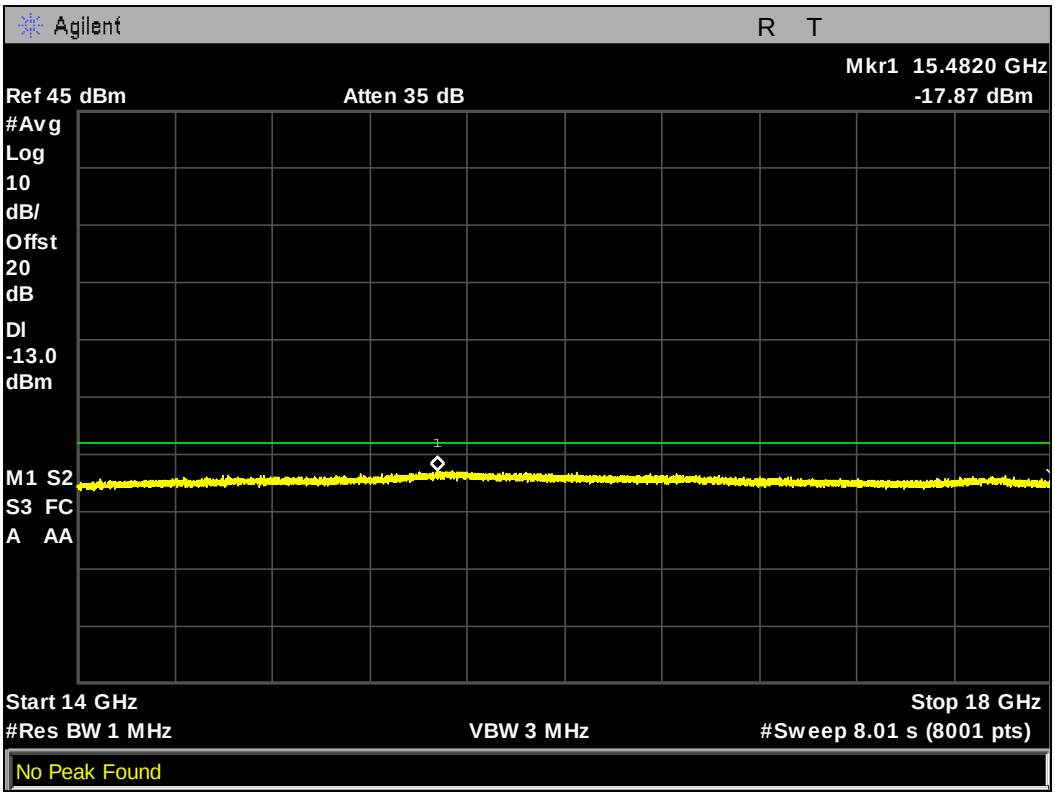
Plot 39. Conducted Spurious Emissions, Channel 1175, 3 GHz – 6 GHz, Part 24



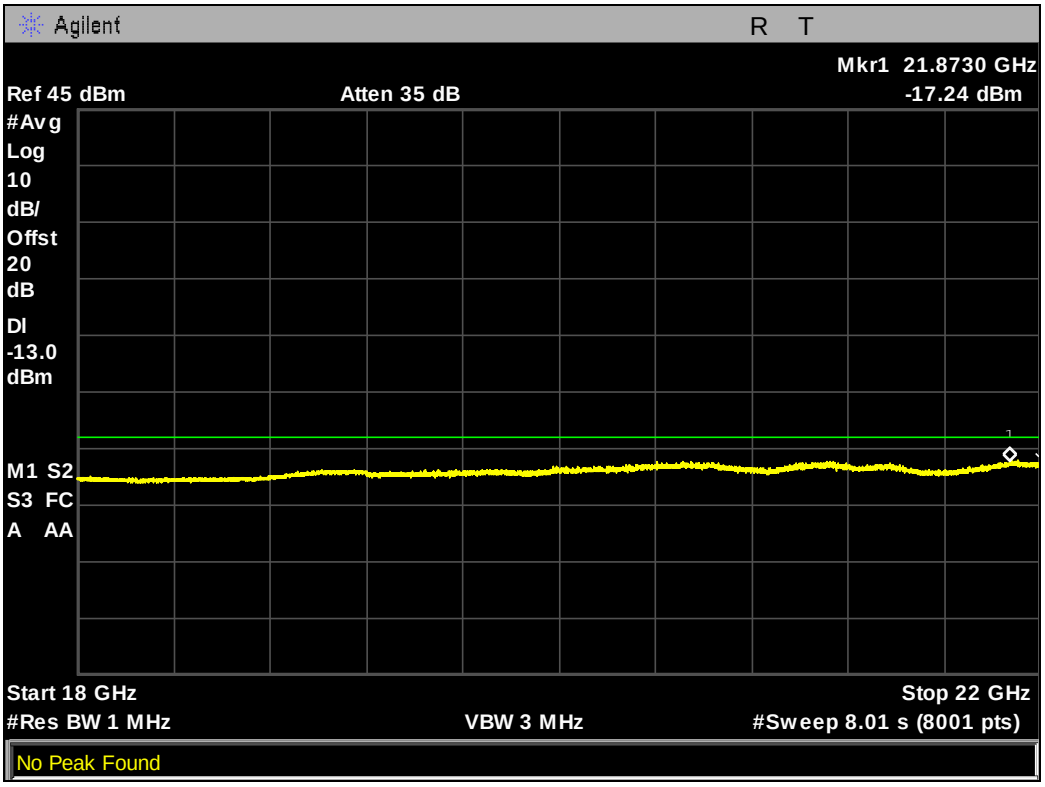
Plot 40. Conducted Spurious Emissions, Channel 1175, 6 GHz – 10 GHz, Part 24



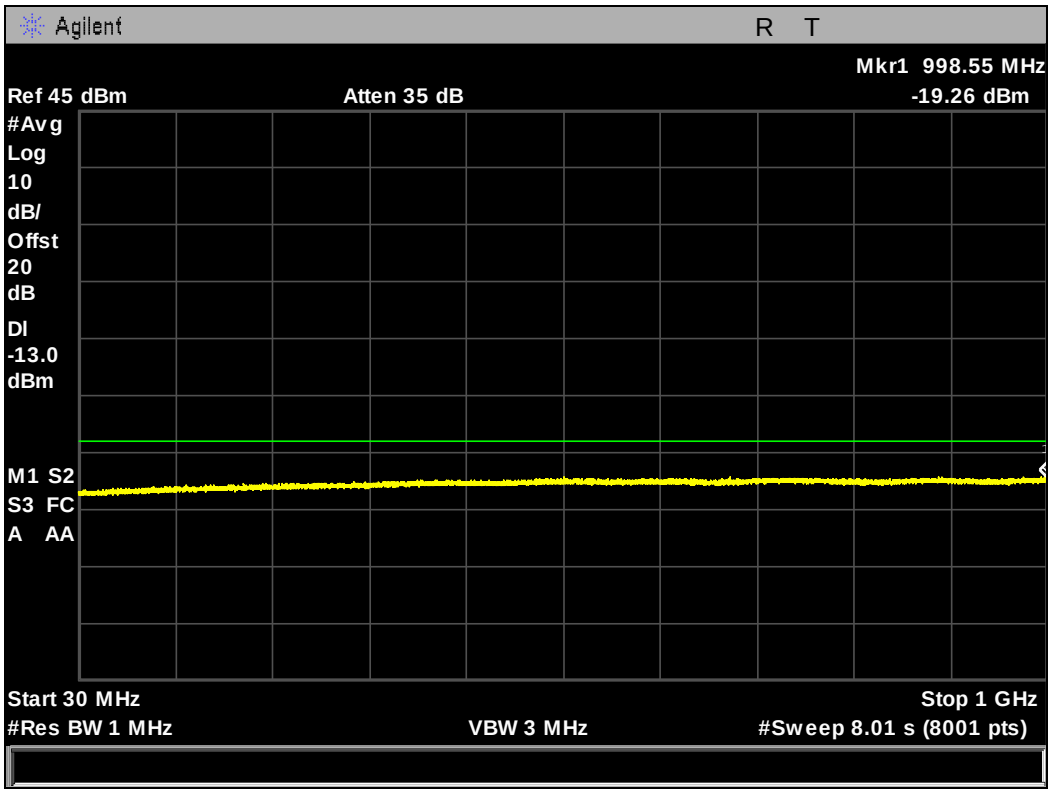
Plot 41. Conducted Spurious Emissions, Channel 1175, 10 GHz – 14 GHz, Part 24



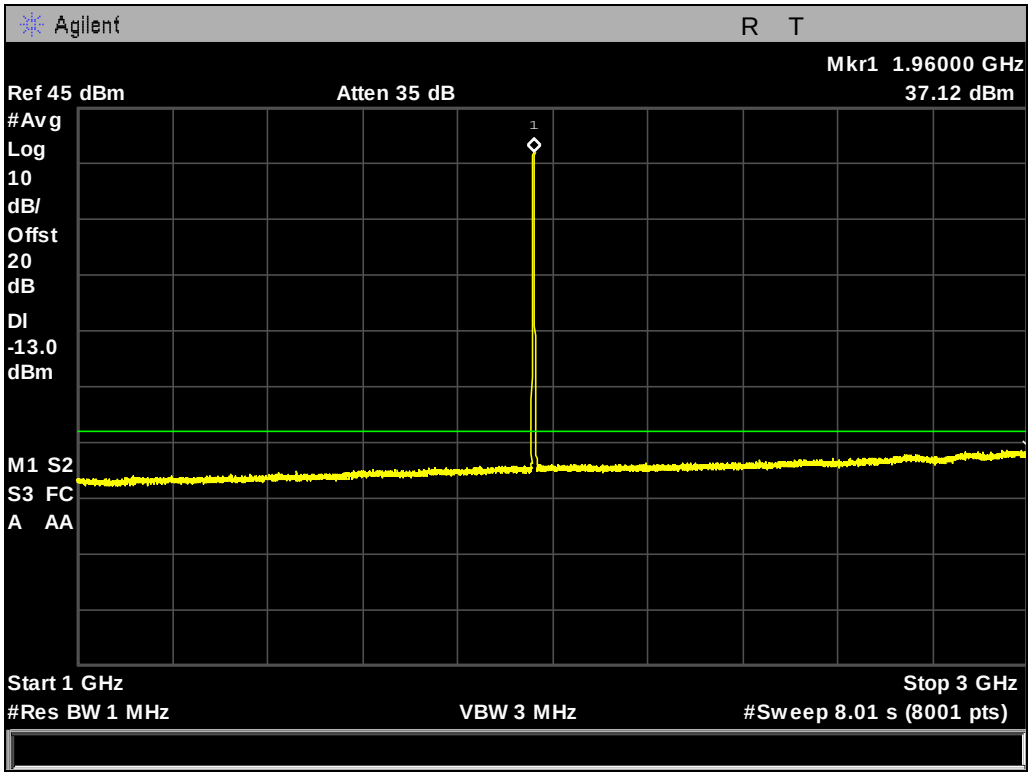
Plot 42. Conducted Spurious Emissions, Channel 1175, 14 GHz – 18 GHz, Part 24



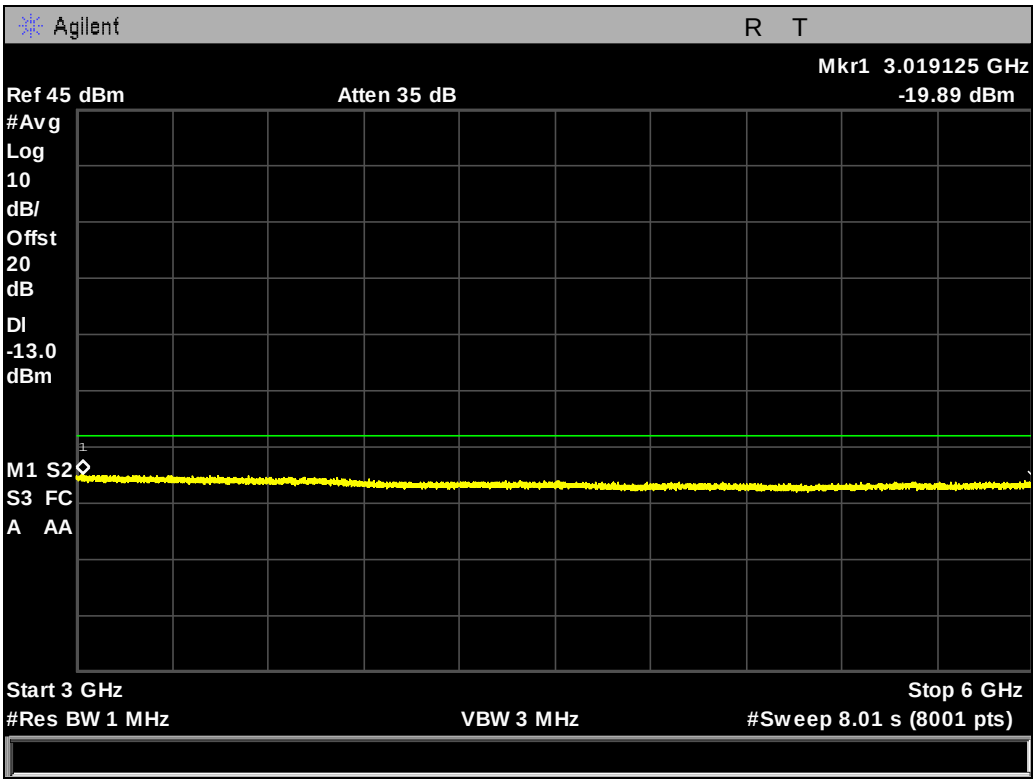
Plot 43. Conducted Spurious Emissions, Channel 1175, 18 GHz – 22 GHz, Part 24



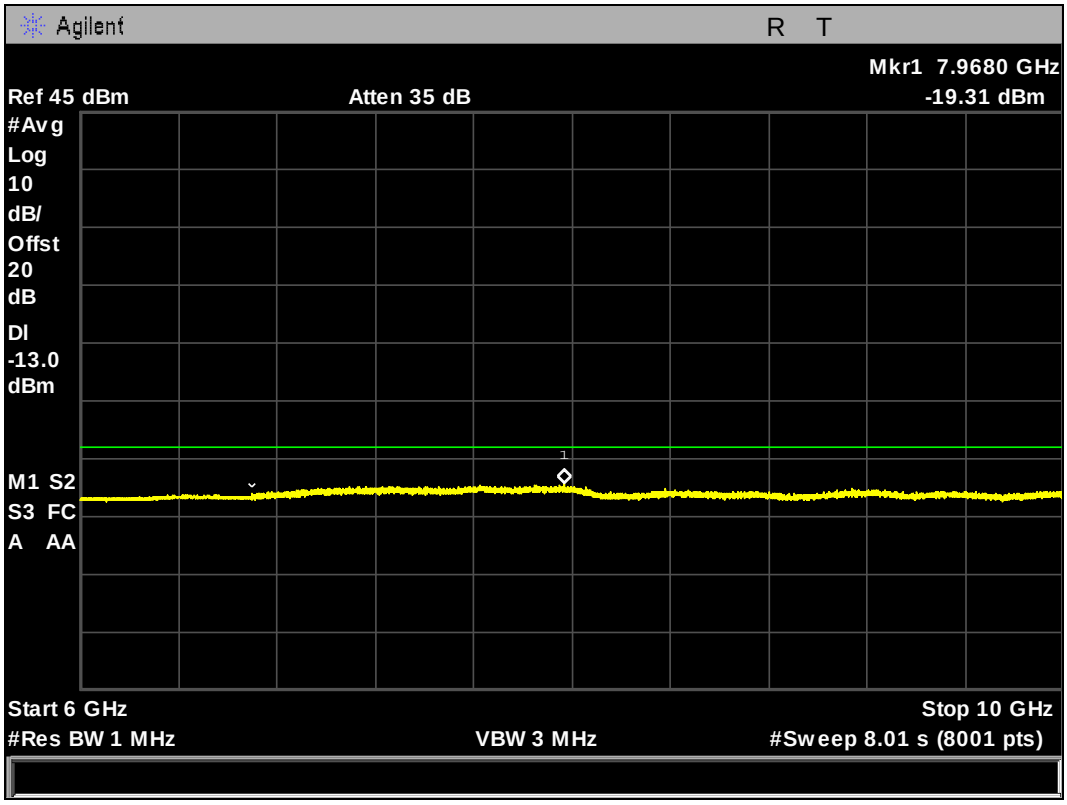
Plot 44. Conducted Spurious Emissions, Channel 600, 30 MHz – 1 GHz, Part 24



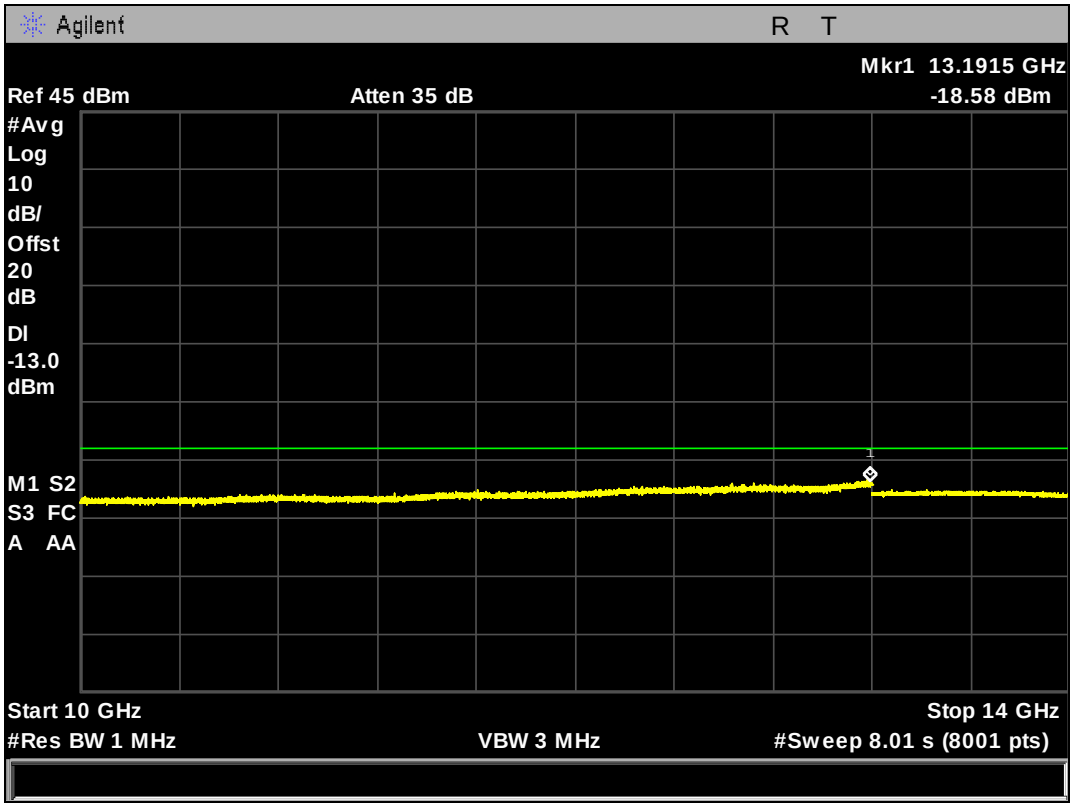
Plot 45. Conducted Spurious Emissions, Channel 600, 1 GHz – 3 GHz, Part 24



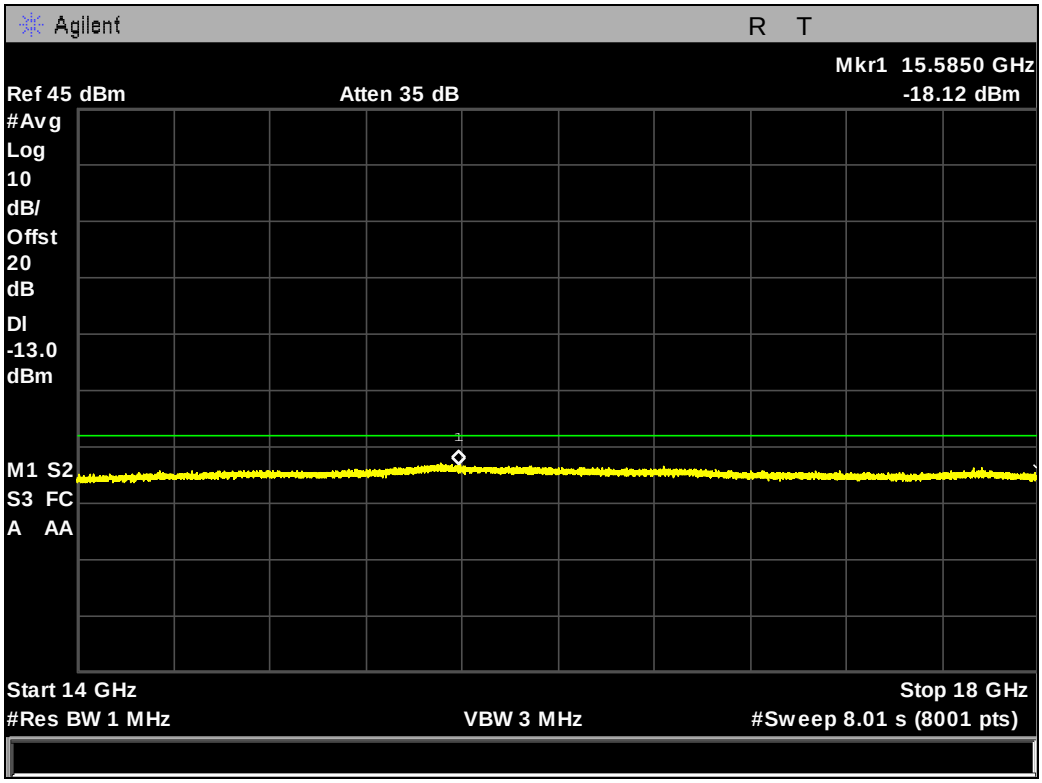
Plot 46. Conducted Spurious Emissions, Channel 600, 3 GHz – 6 GHz, Part 24



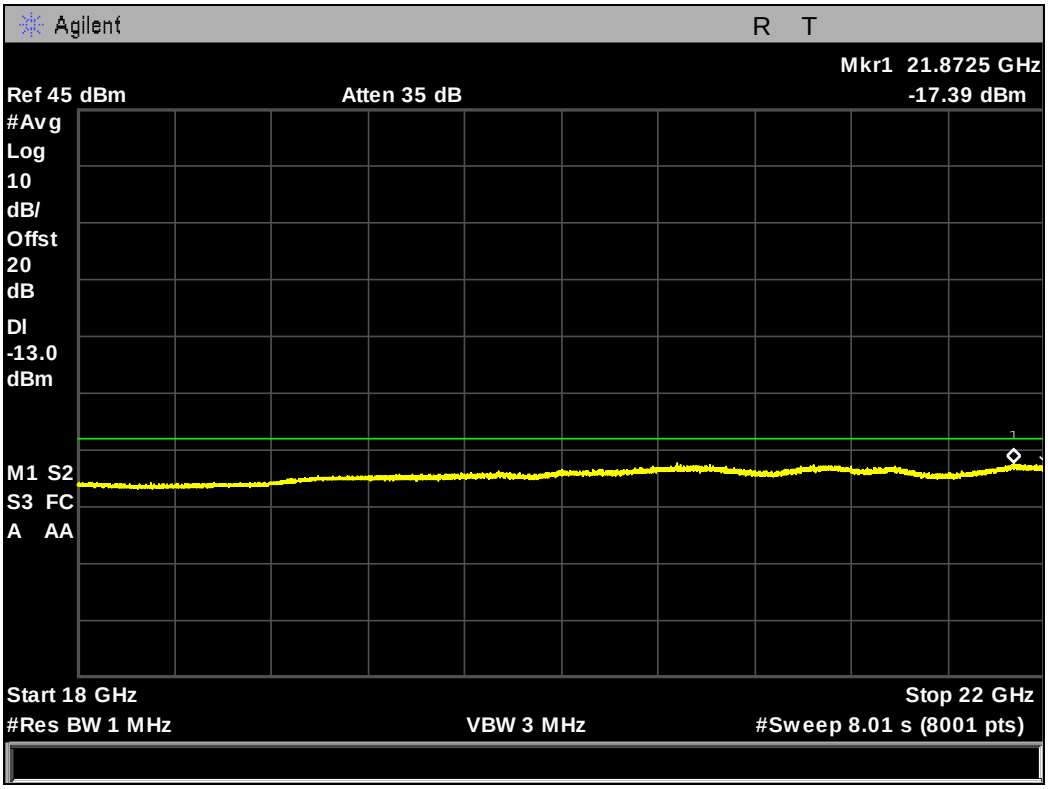
Plot 47. Conducted Spurious Emissions, Channel 600, 6 GHz – 10 GHz, Part 24



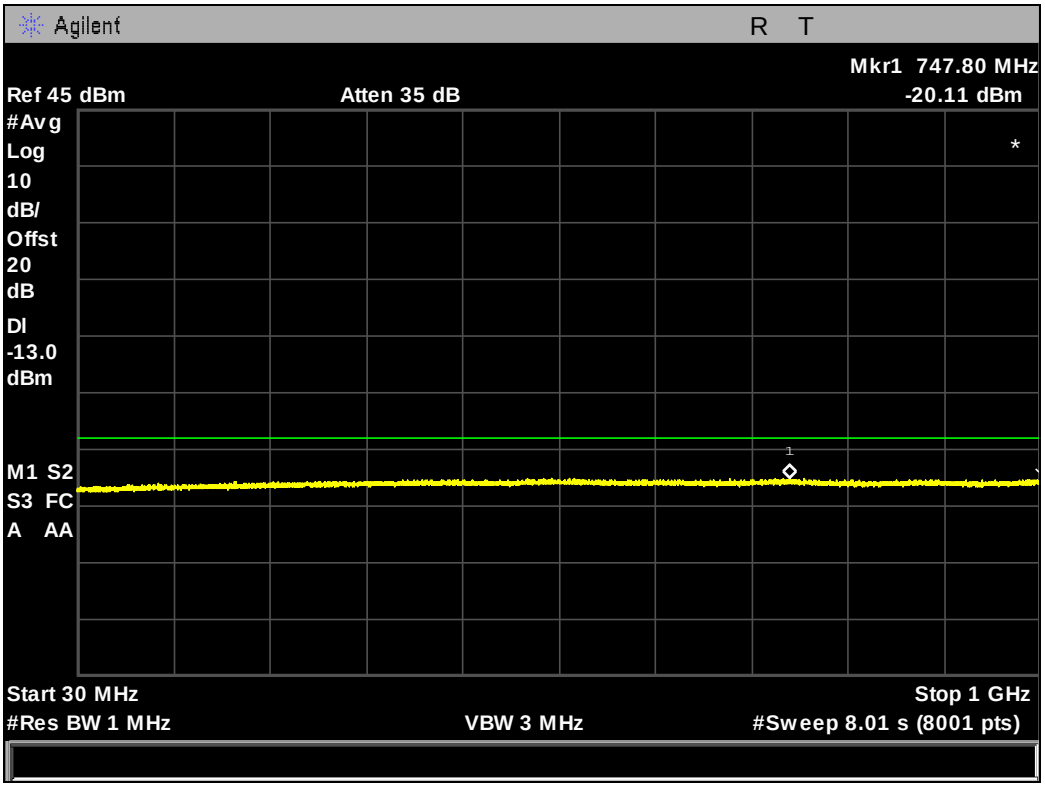
Plot 48. Conducted Spurious Emissions, Channel 600, 10 GHz – 14 GHz, Part 24



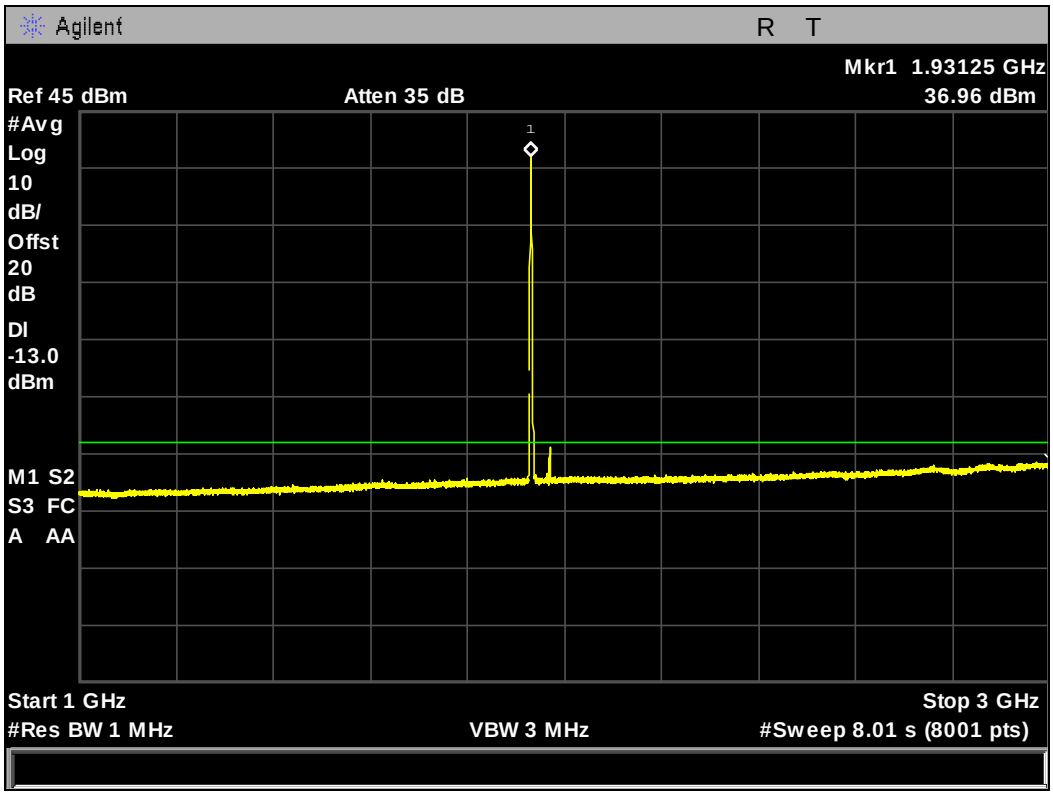
Plot 49. Conducted Spurious Emissions, Channel 600, 14 GHz – 18 GHz, Part 24



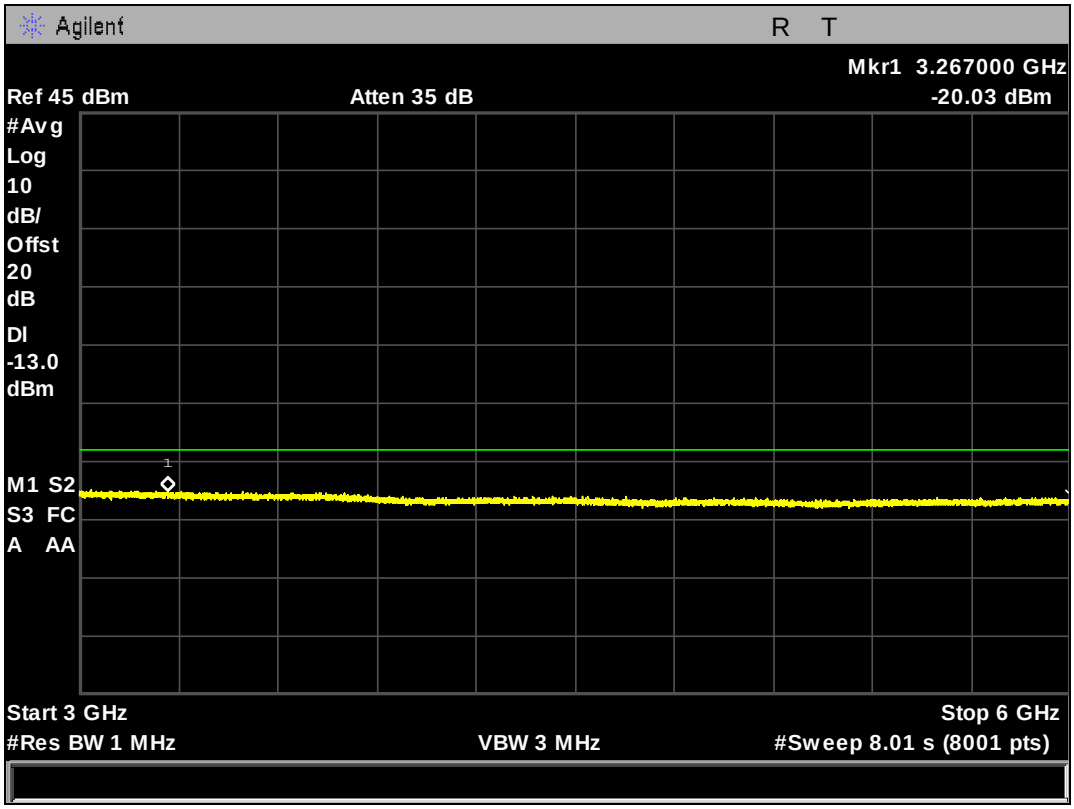
Plot 50. Conducted Spurious Emissions, Channel 600, 18 GHz – 22 GHz, Part 24



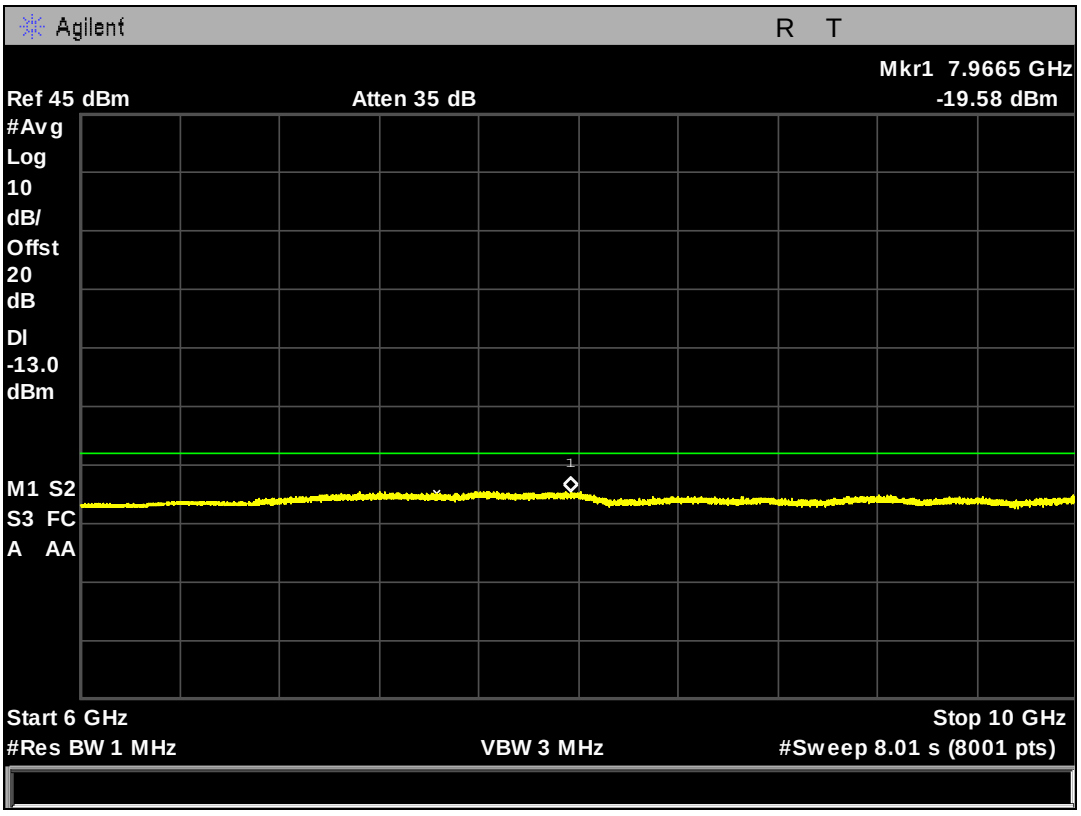
Plot 51. Conducted Spurious Emissions, Channel 25, 30 MHz – 1 GHz, Part 24



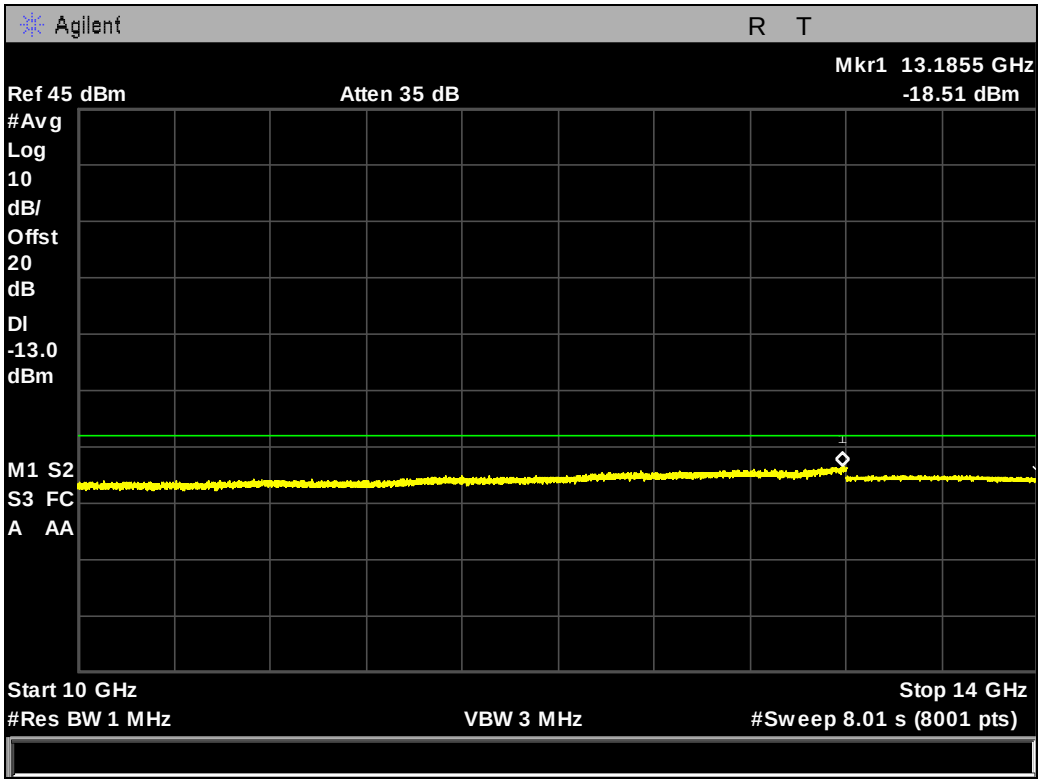
Plot 52. Conducted Spurious Emissions, Channel 25, 1 GHz – 3 GHz, Part 24



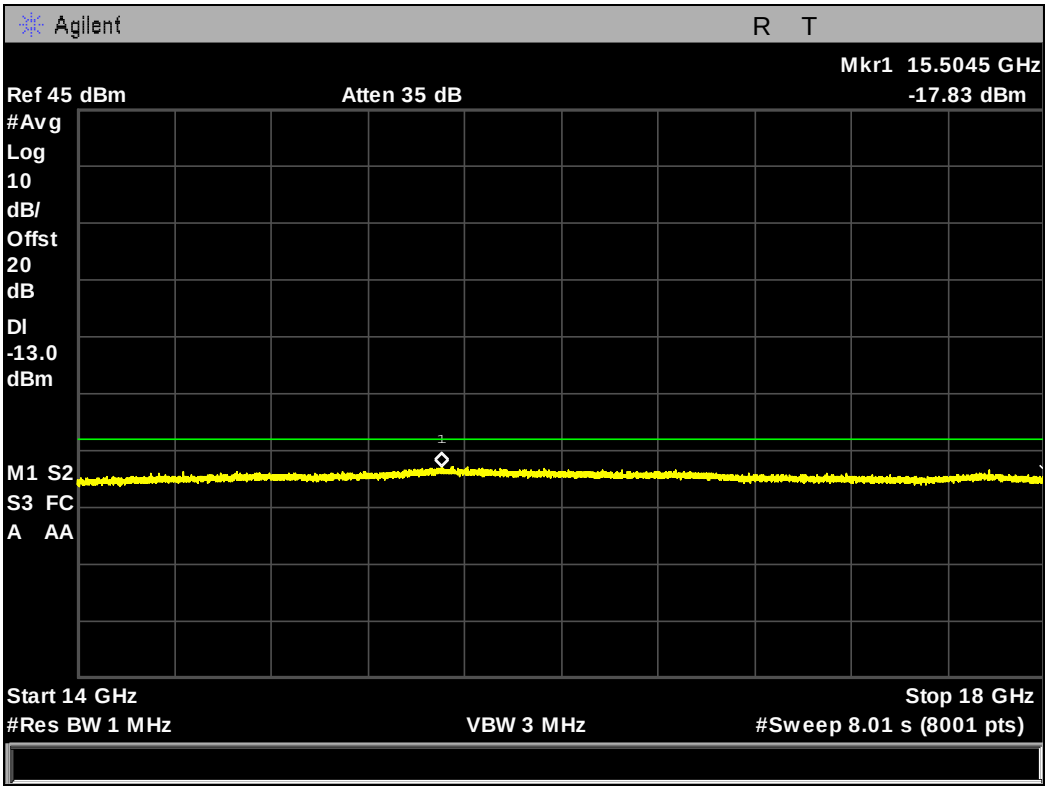
Plot 53. Conducted Spurious Emissions, Channel 25, 3 GHz – 6 GHz, Part 24



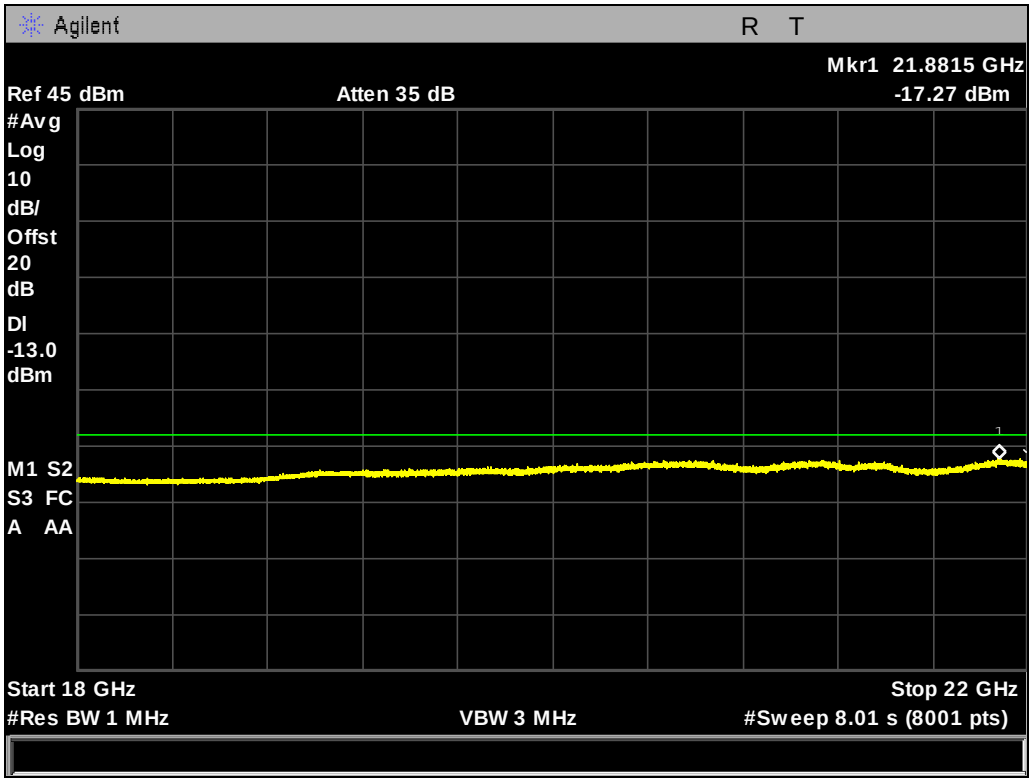
Plot 54. Conducted Spurious Emissions, Channel 25, 6 GHz – 10 GHz, Part 24



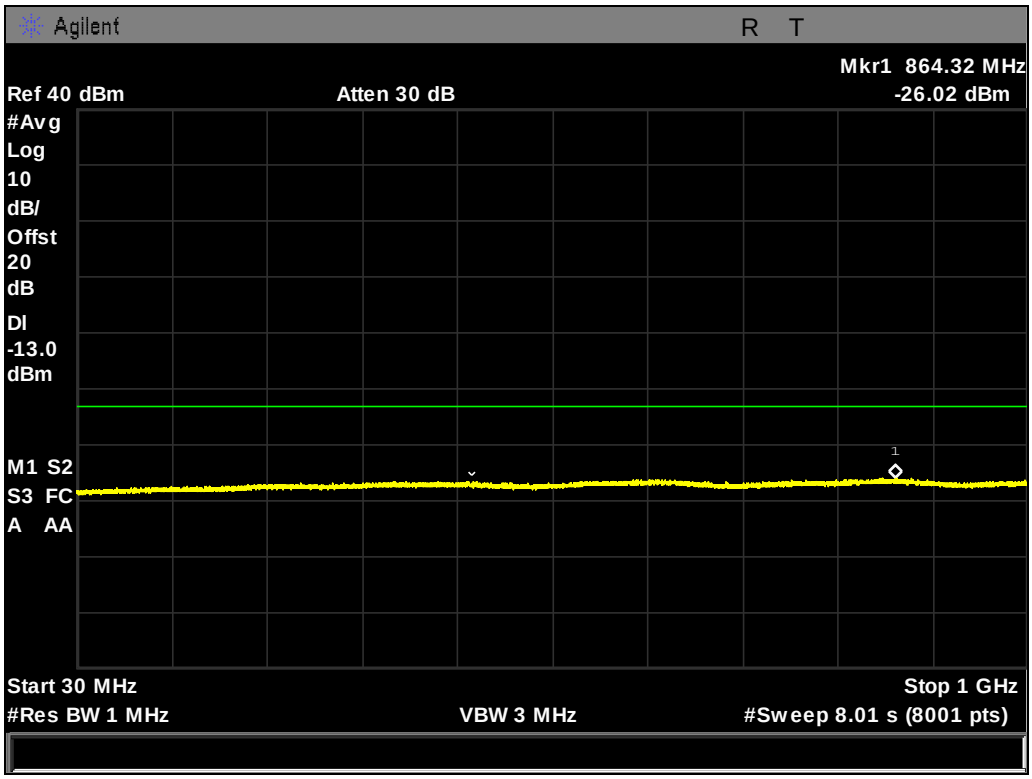
Plot 55. Conducted Spurious Emissions, Channel 25, 10 GHz – 14 GHz, Part 24



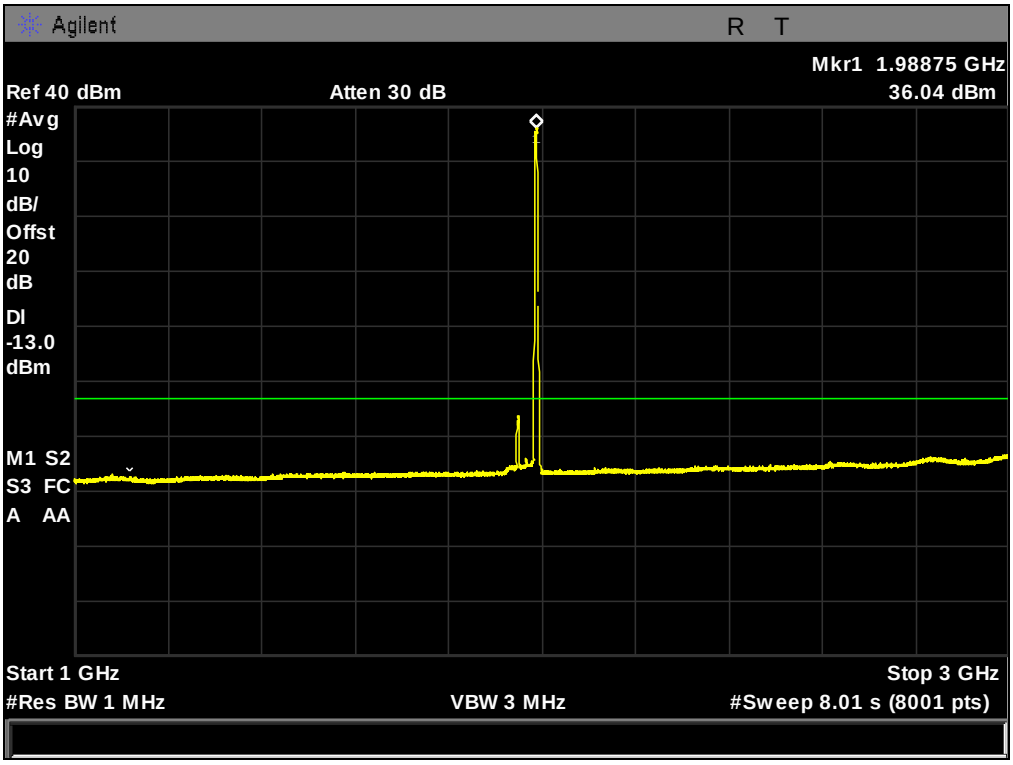
Plot 56. Conducted Spurious Emissions, Channel 25, 14 GHz – 18 GHz, Part 24



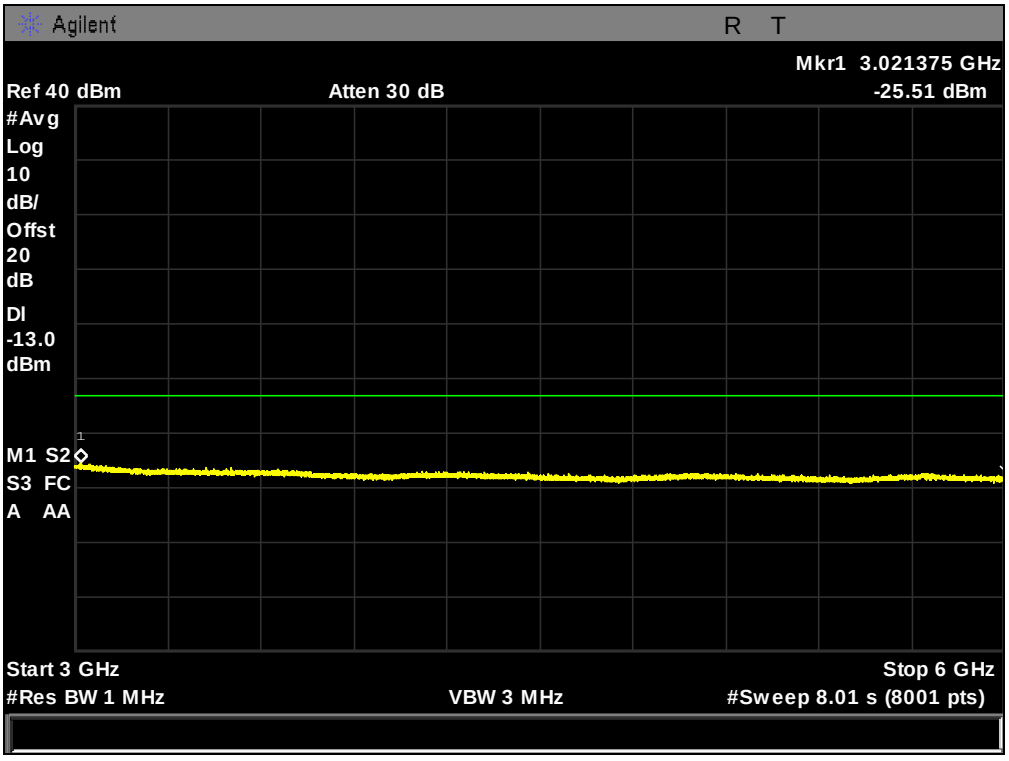
Plot 57. Conducted Spurious Emissions, Channel 25, 18 GHz – 22 GHz, Part 24



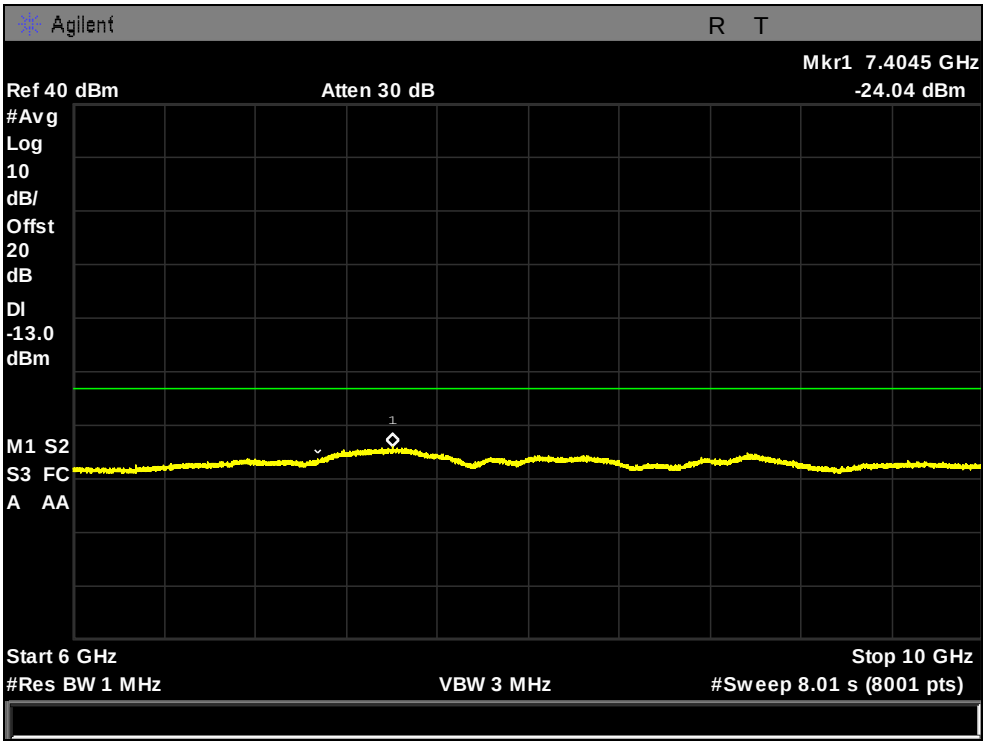
Plot 58. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 1125-1150-1175, 30 MHz – 1 GHz, Part 24



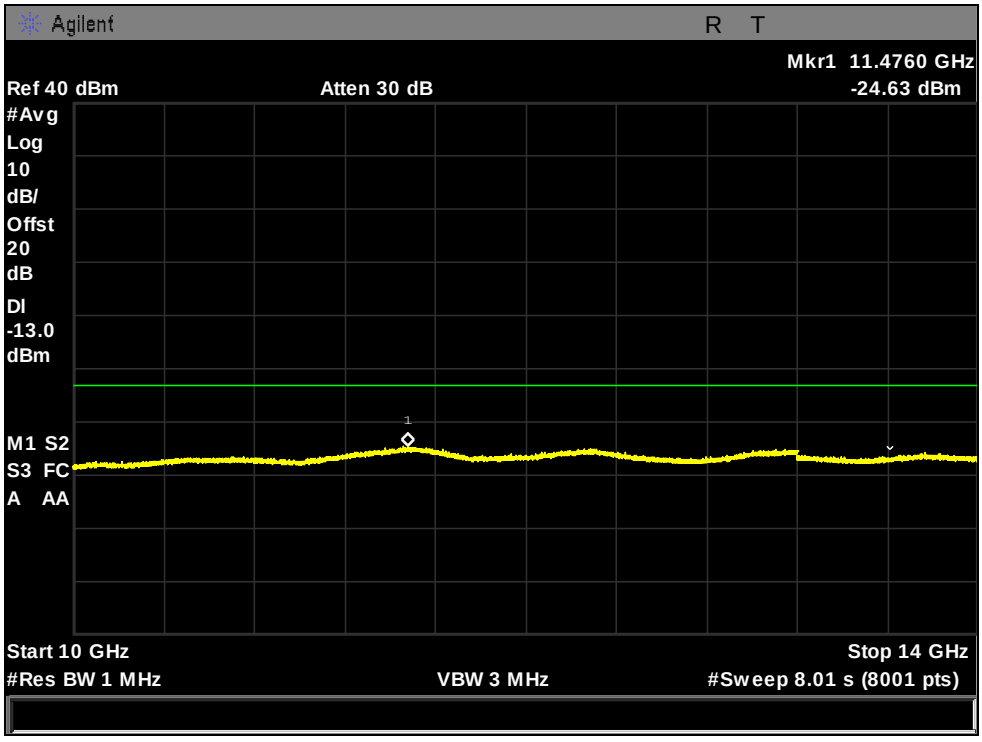
Plot 59. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 1125-1150-1175, 1 GHz – 3 GHz, Part 24



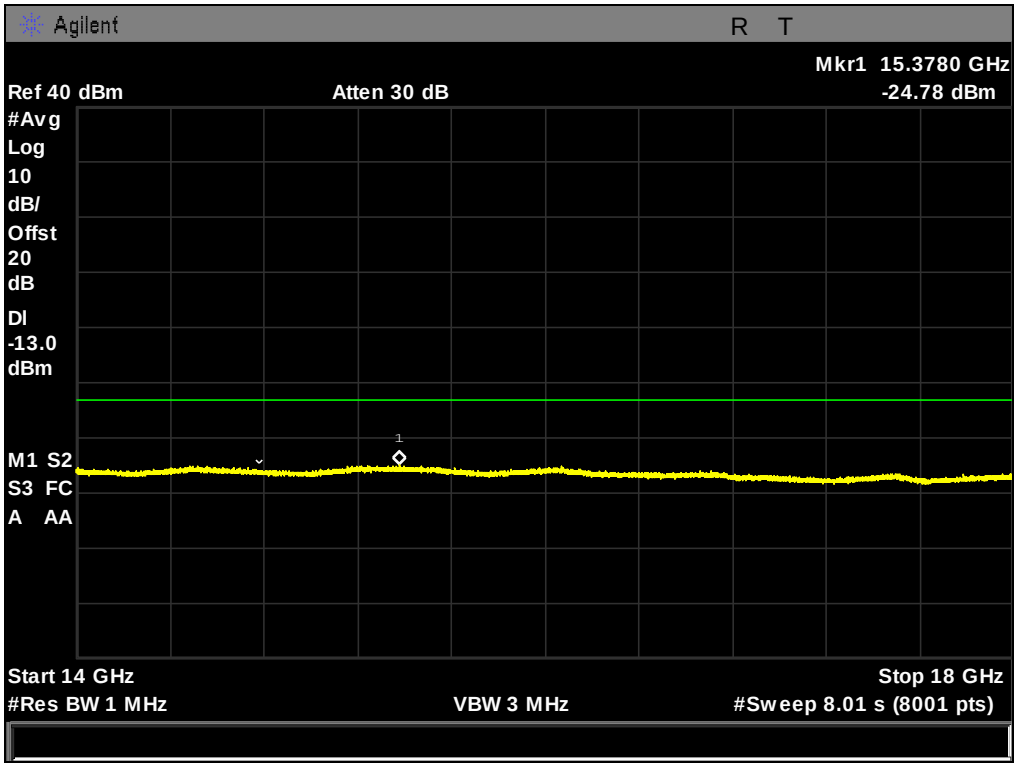
Plot 60. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 1125-1150-1175, 3 GHz – 6 GHz, Part 24



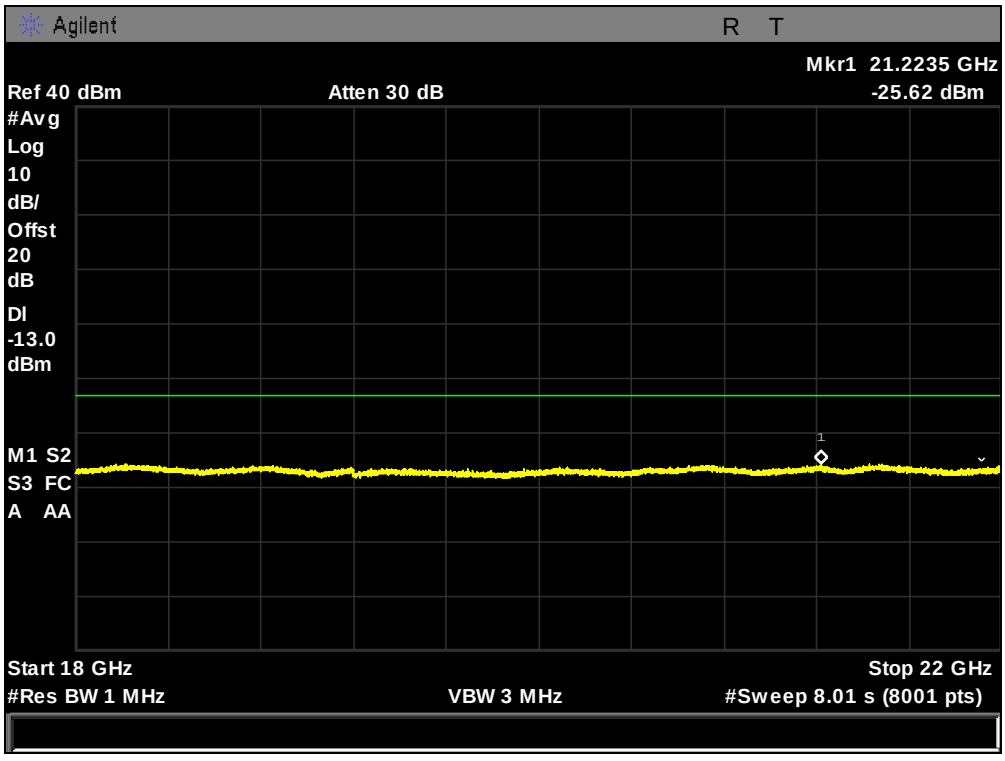
Plot 61. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 1125-1150-1175, 6 GHz – 10 GHz, Part 24



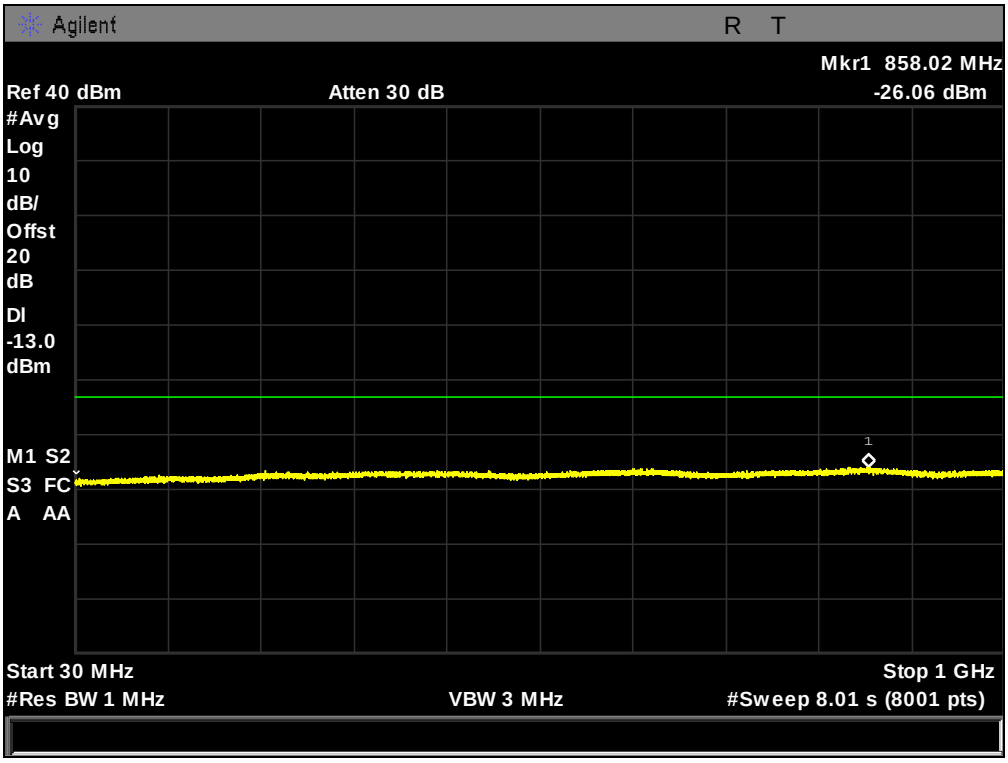
Plot 62. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 1125-1150-1175, 10 GHz – 14 GHz, Part 24



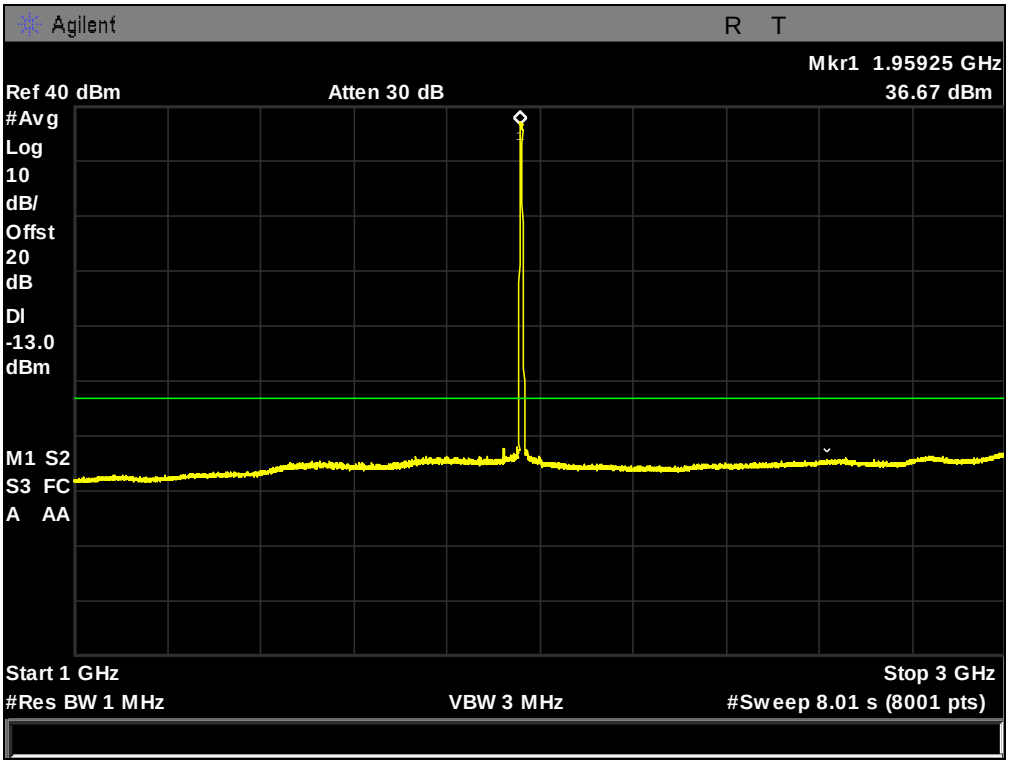
Plot 63. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 1125-1150-1175, 14 GHz – 18 GHz, Part 24



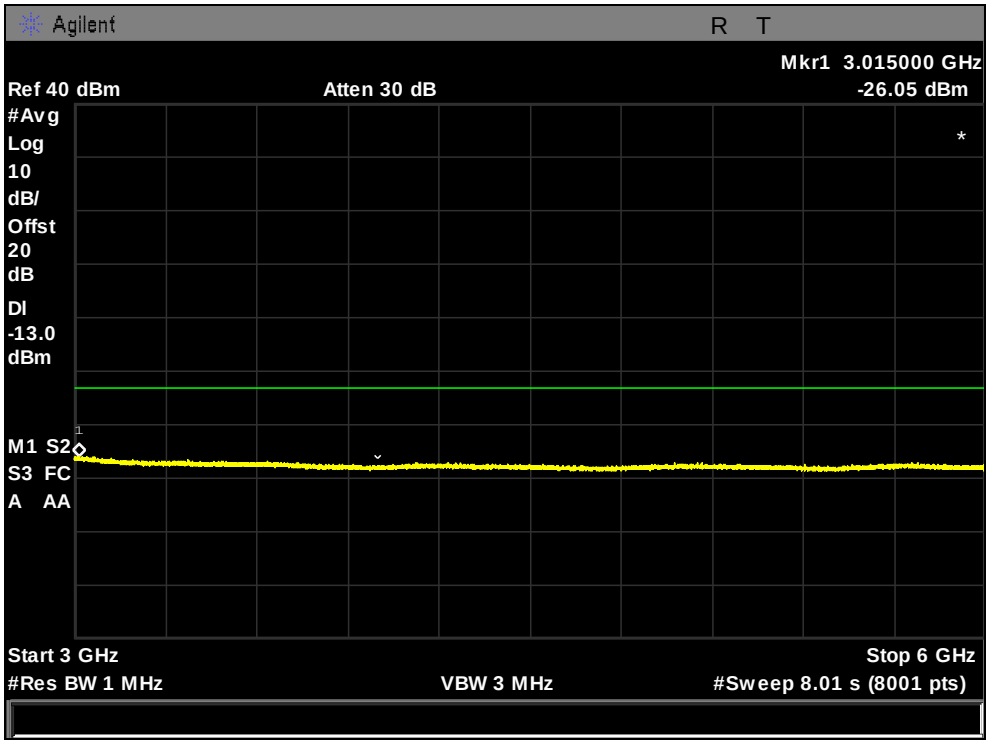
Plot 64. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 1125-1150-1175, 18 GHz – 22 GHz, Part 24



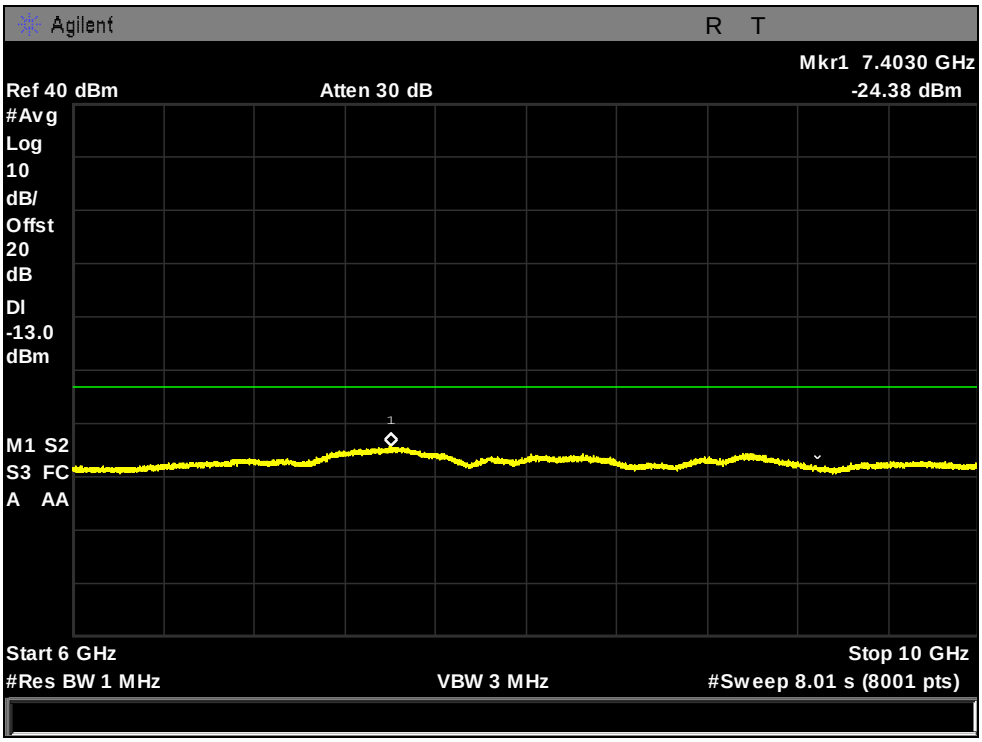
Plot 65. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 575-600-625, 30 MHz – 1 GHz, Part 24



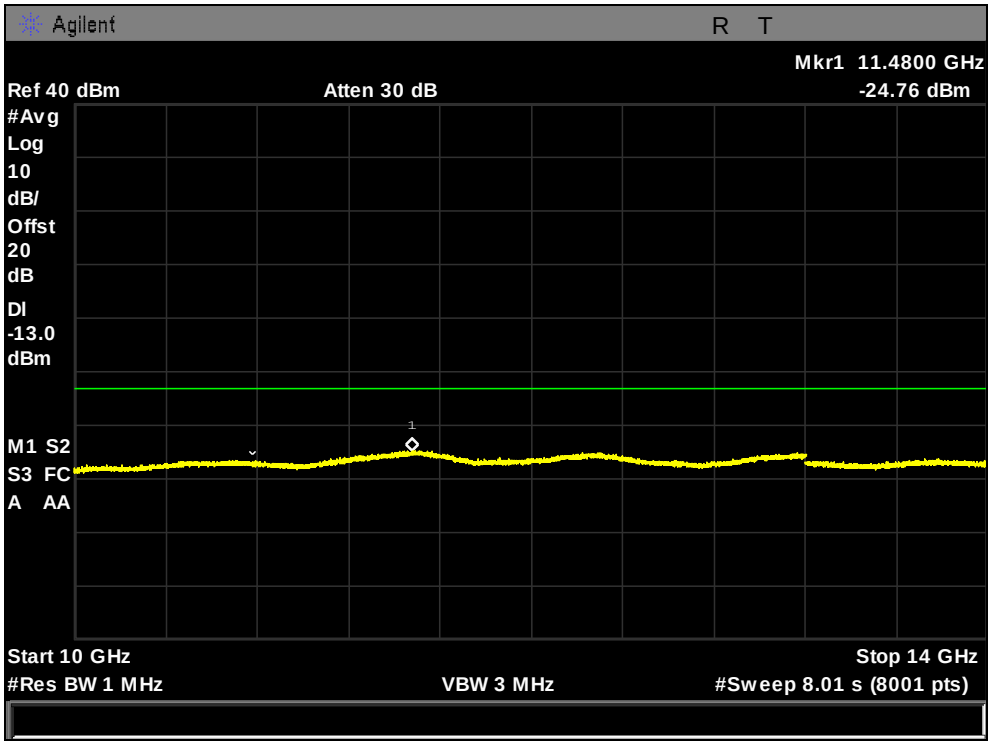
Plot 66. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 575-600-625, 1 GHz – 3 GHz, Part 24



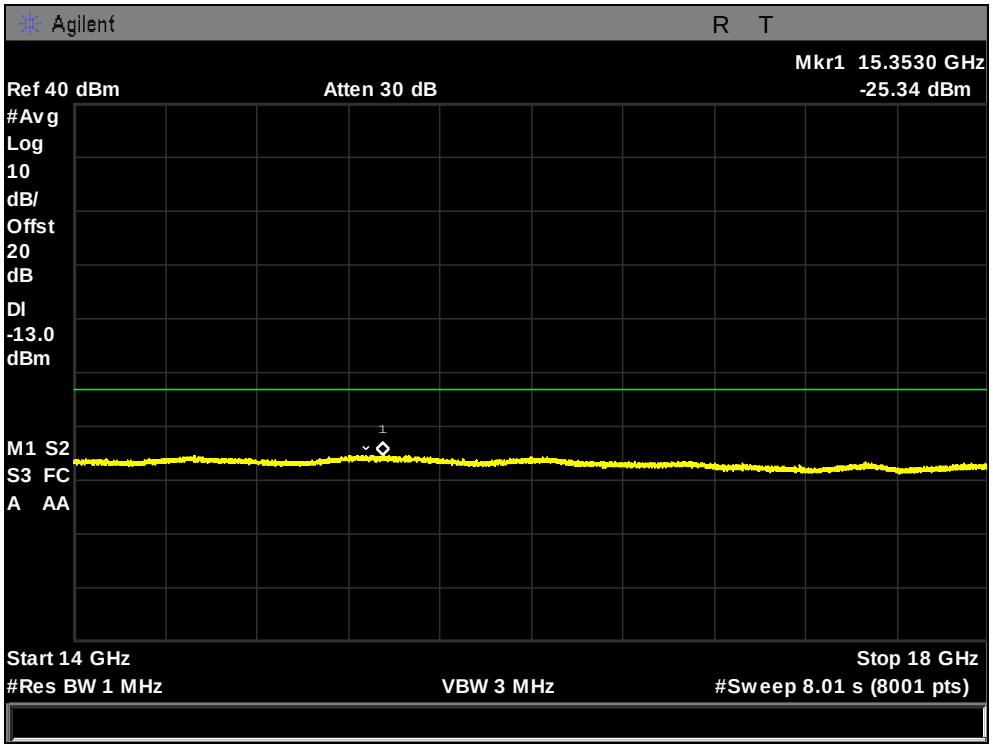
Plot 67. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 575-600-625, 3 GHz – 6 GHz, Part 24



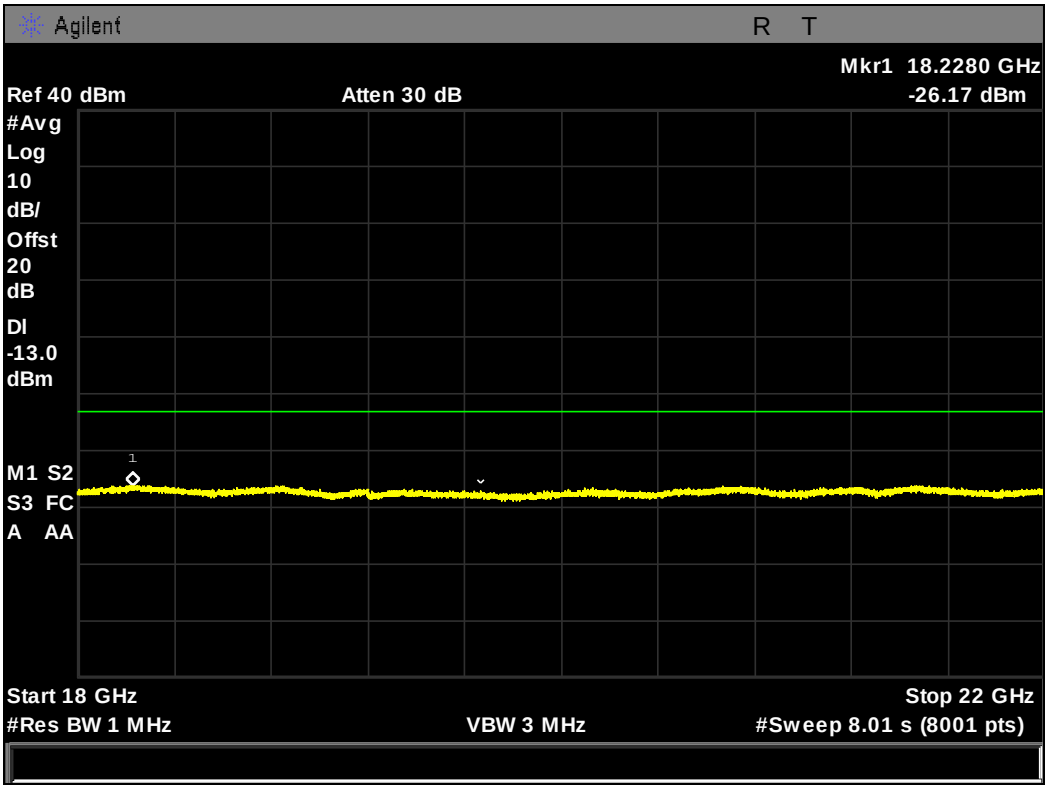
Plot 68. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 575-600-625, 6 GHz – 10 GHz, Part 24



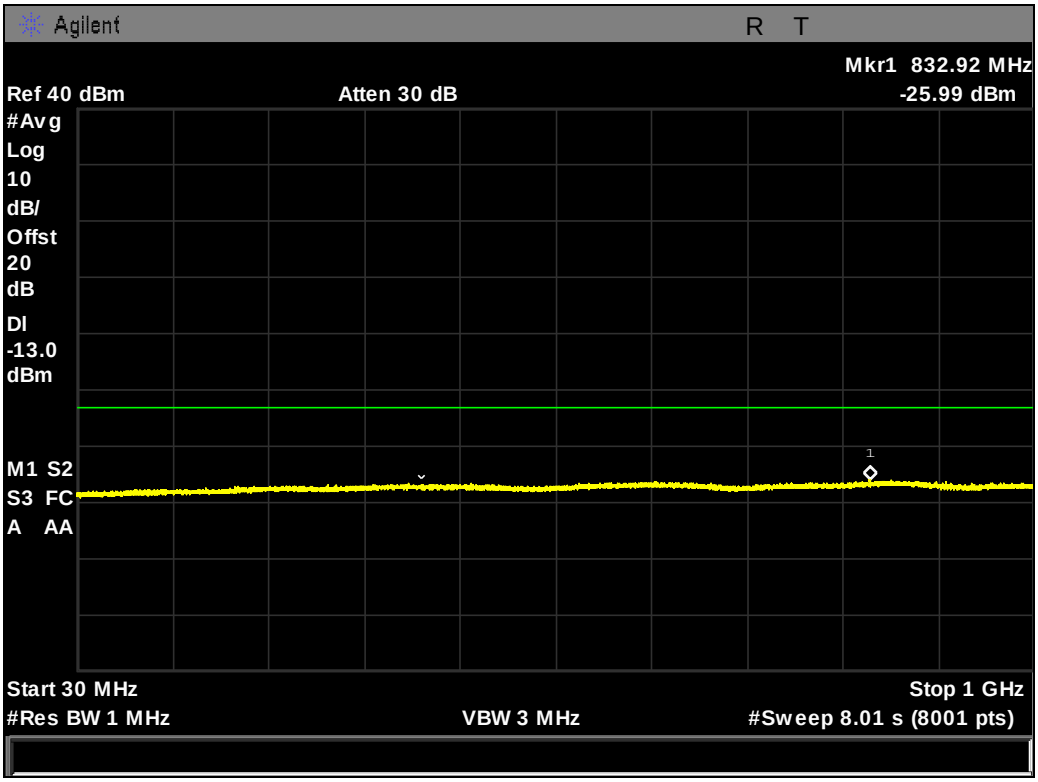
Plot 69. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 575-600-625, 10 GHz – 14 GHz, Part 24



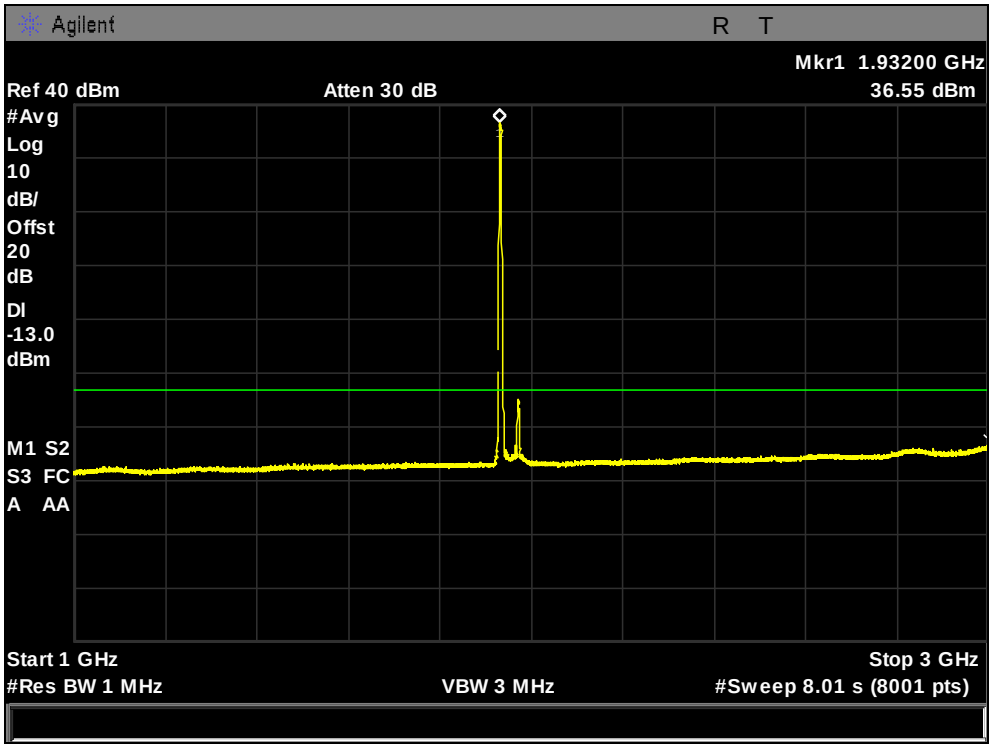
Plot 70. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 575-600-625, 14 GHz – 18 GHz, Part 24



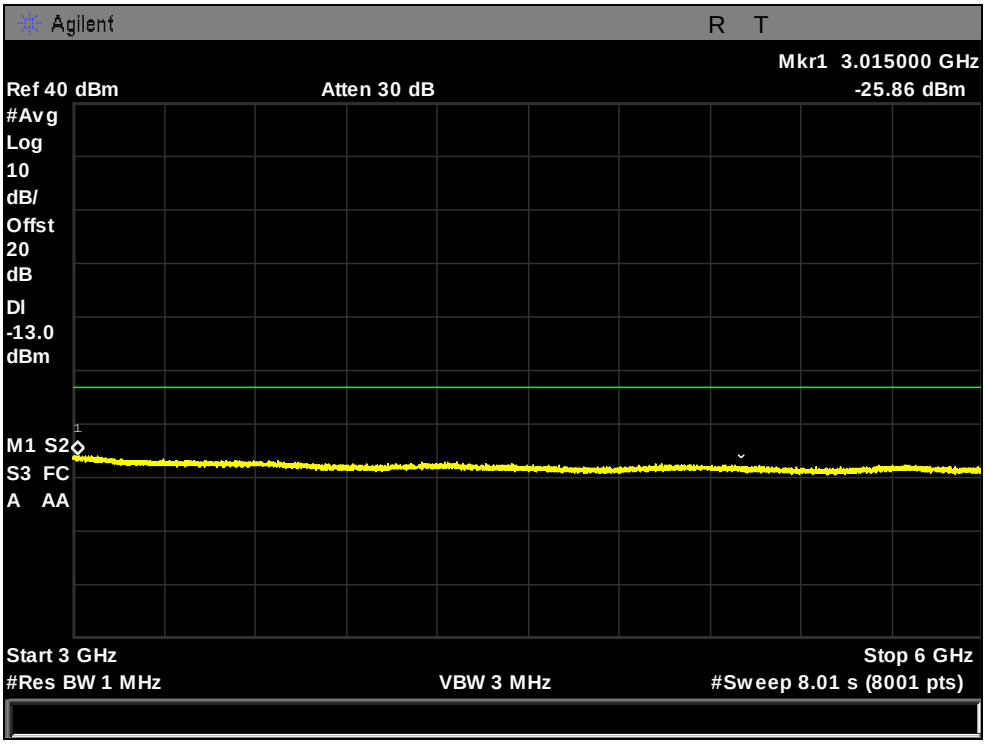
Plot 71. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 575-600-625, 18 GHz – 22 GHz, Part 24



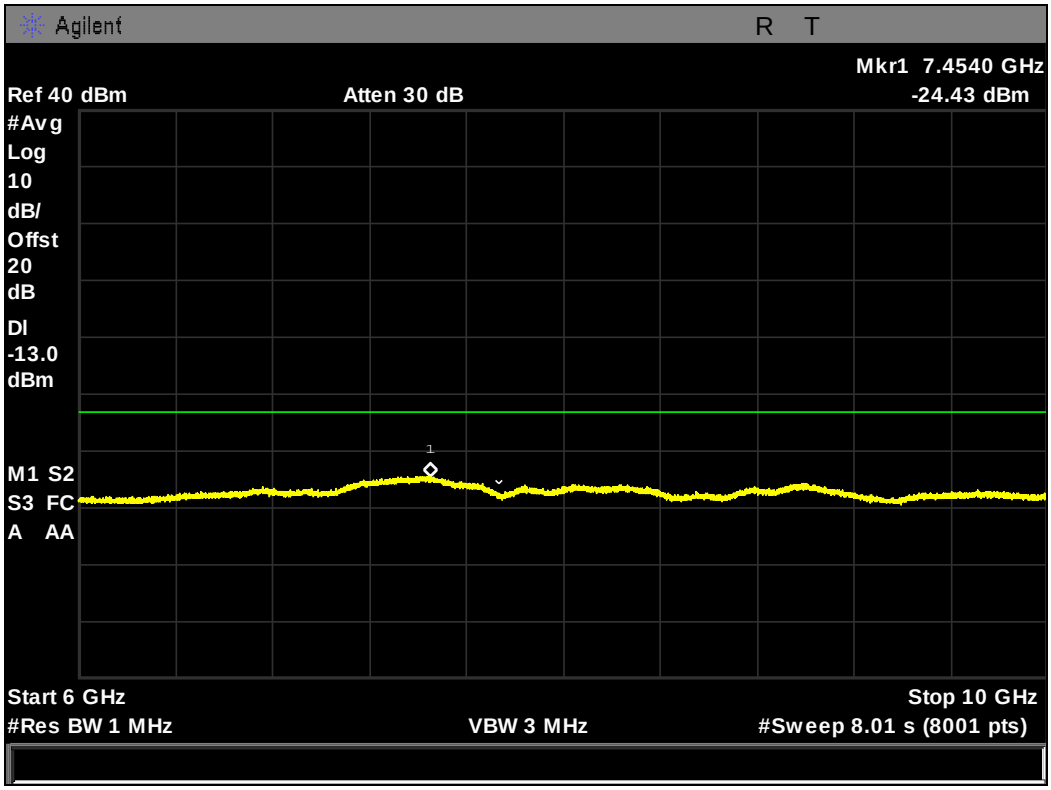
Plot 72. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 25-50-75, 30 MHz – 1 GHz, Part 24



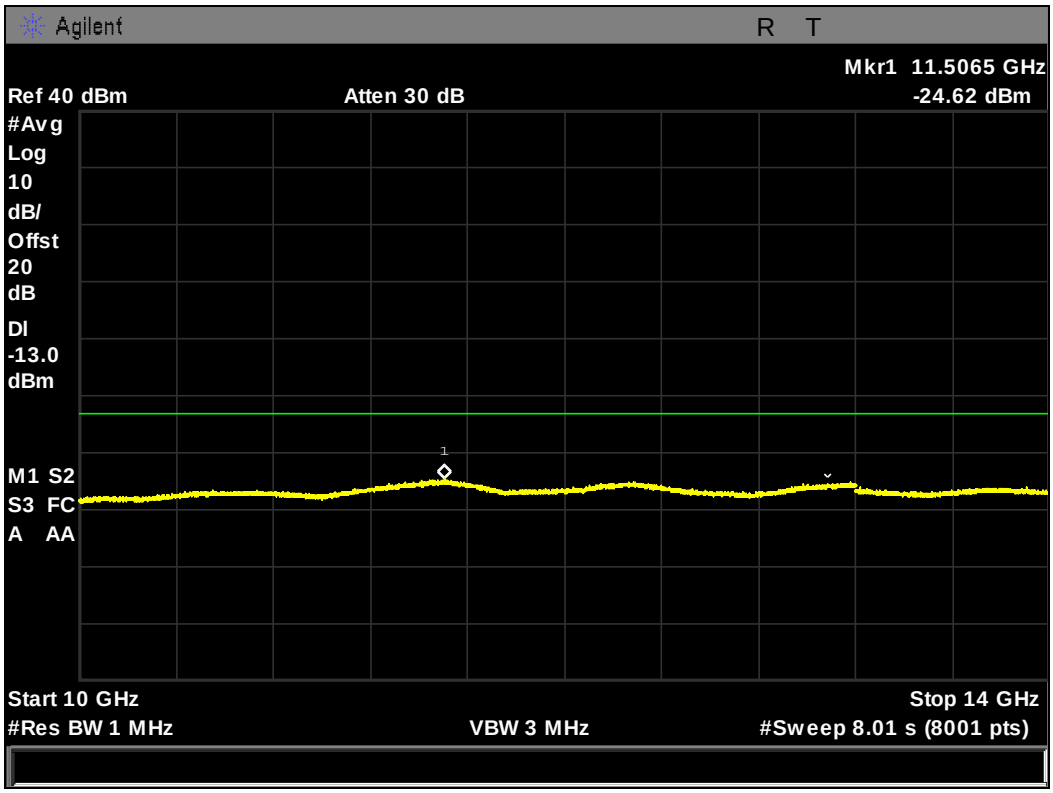
Plot 73. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 25-50-75, 1 GHz – 3 GHz, Part 24



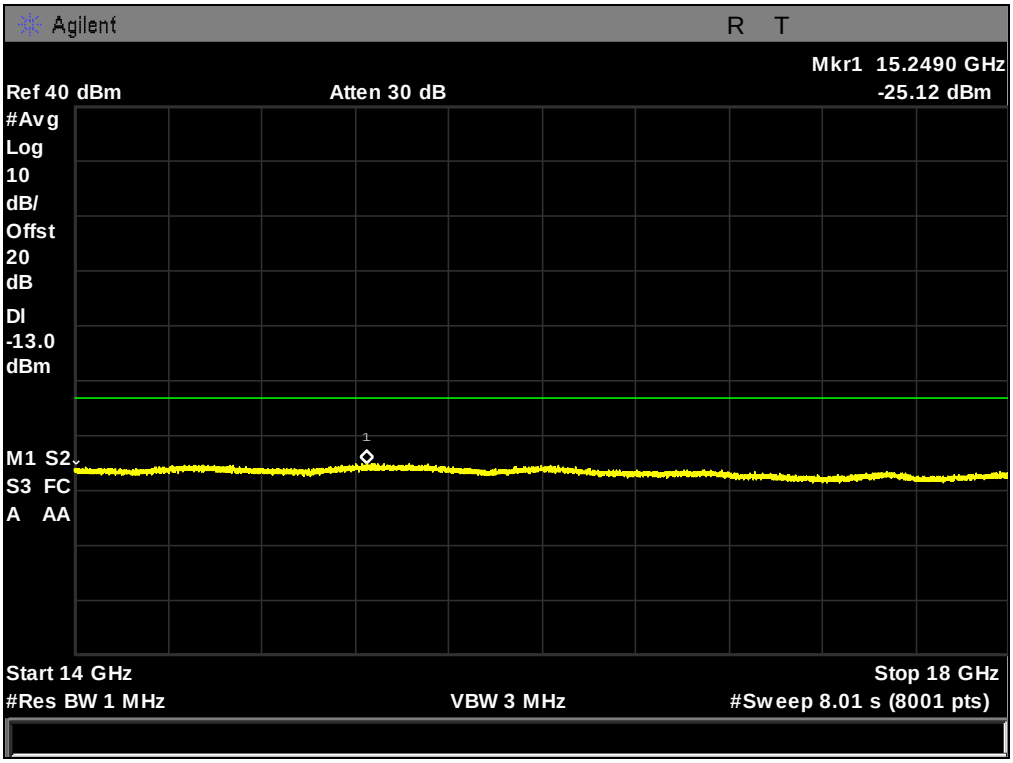
Plot 74. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 25-50-75, 3 GHz – 6 GHz, Part 24



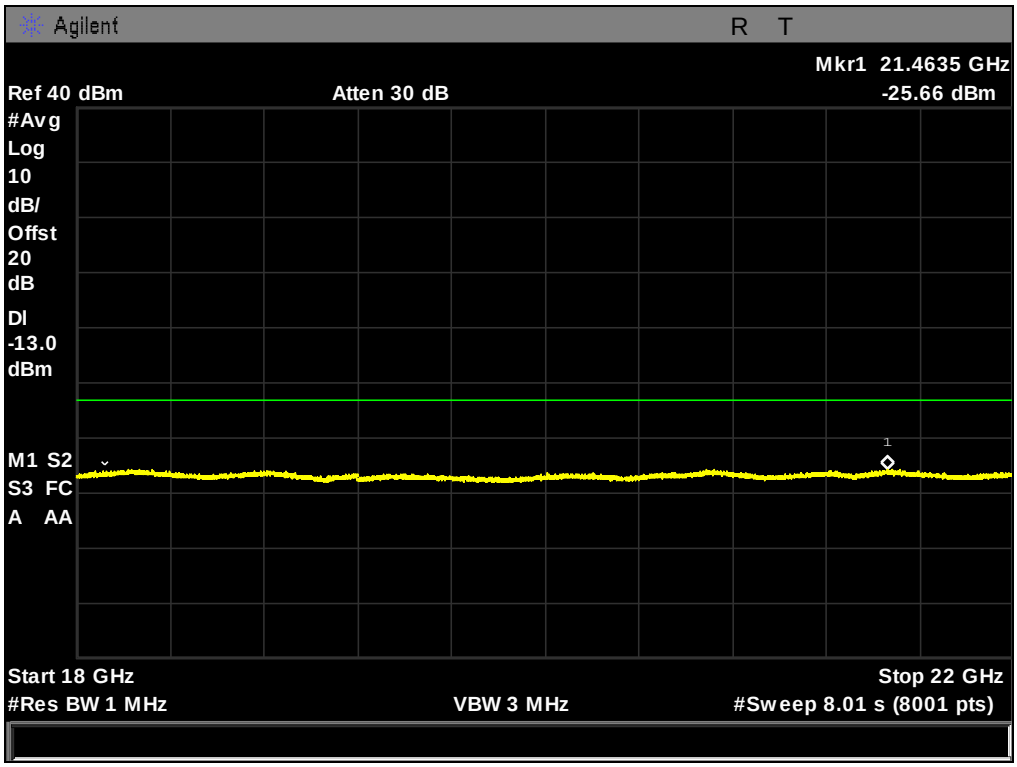
Plot 75. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 25-50-75, 6 GHz – 10 GHz, Part 24



Plot 76. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 25-50-75, 10 GHz – 14 GHz, Part 24

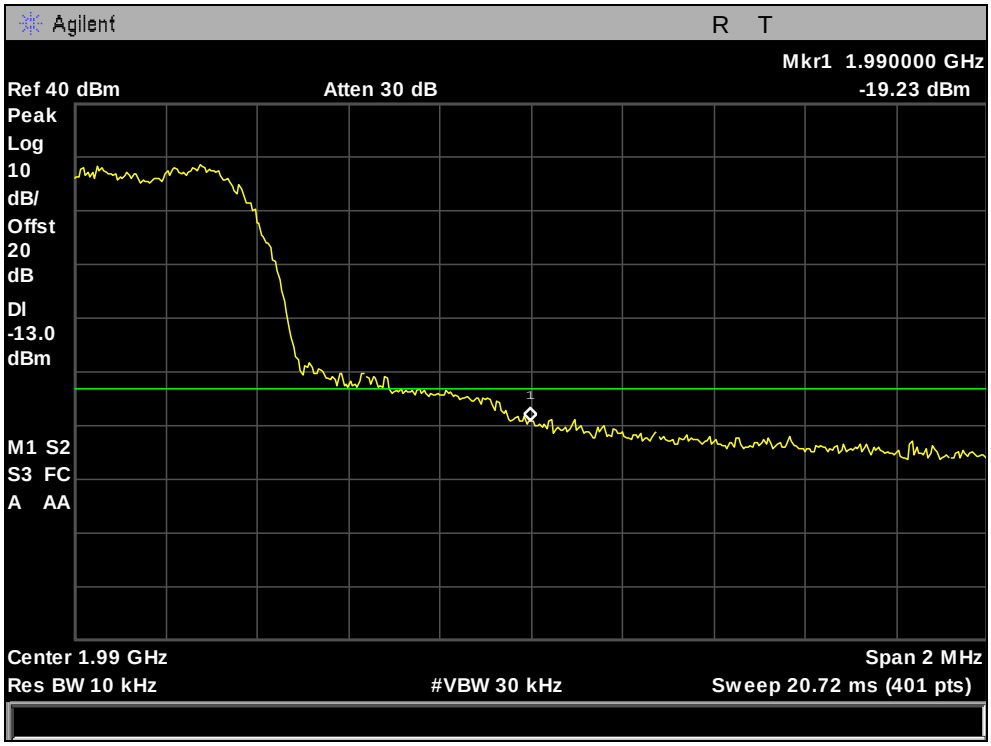


Plot 77. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 25-50-75, 14 GHz – 18 GHz, Part 24

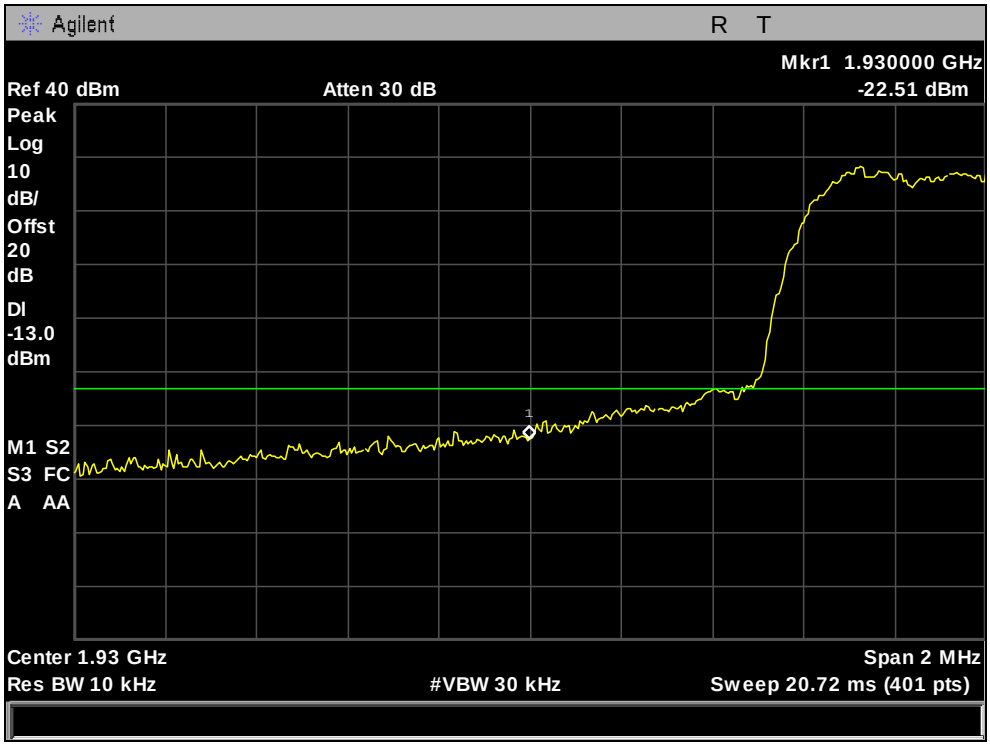


Plot 78. Conducted Spurious Emissions, 3 Adjacent Channels, Channels 25-50-75, 18 GHz – 22 GHz, Part 24

Band Edge, Part 24



Plot 79. Conducted Band Edge, Channel 1175, Part 24



Plot 80. Conducted Band Edge, Channel 25, Part 24

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 24.232(d) Peak to Average Ratio

Test Requirement(s): **§ 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 ration (PAR) of the transmission may not exceed 13 dB.

Test Results: Equipment complies with these requirements.

Test Engineer(s): Donald Salguero

Test Date(s): 11/15/2016

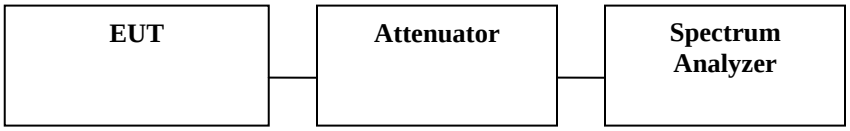


Figure 4. Spurious Emissions at Antenna Terminals Test Setup

Channel	Peak Conducted Output Power (dbm)	Average Conducted Output Power (dBm)	Peak to Average Ratio	Limit (dB)
25	40.9	37.03	3.87	13
600	41.36	37.21	4.15	13
1125	40.54	36.58	3.96	13

Table 9. Single Channel, Peak to Average Ratio, Pilot Beacon, Test Results, Part 24

Channel	Peak Conducted Output Power (dBm)	Average Conducted Output Power (dBm)	Peak to Average Ratio Average Ratio	Limit (dBm)
25	39.47	34.65	4.82	13
600	39.08	34.44	4.64	13
1175	38.84	33.8	5.04	13

Table 10. Single Channel, Peak to Average Ratio, CDMA 2000, Test Results, Part 24

Channel	Peak Conducted Output Power (dBm)	Average Conducted Output Power (dBm)	Peak to Average Ratio Average Ratio	Limit (dBm)
25	40.15	35.24	4.91	13
600	39.76	34.29	5.47	13
1175	40.34	35.28	5.06	13

Table 11. Single Channel, Peak to Average Ratio, EVDO (QPSK), Test Results, Part 24

Electromagnetic Compatibility Criteria for Intentional Radiators

§2.1049 Frequency Stability 2.1049

Test Requirement(s): §2.1049 §24.238

Test Procedures: The EUT was placed inside a temperature chamber and Frequency measurements were made at the extremes of the specified temperature range and at intervals of than 10° centigrade through the range. The operating voltage is varied to +/- 15 % of the nominal voltage at normal temperature. The frequency deviations are then compared to frequency of normal operation and shall not exceed 1ppm.

Test Results: Equipment complies with this section.

Test Engineer(s): Donald Salguero

Test Date(s): 10/13/16 and 10/19/16

	CDMA	ch 600	1960		
Voltage	**Temperature**	**Measured Frequency (MHz)**	**ΔHz**	**Δppm**	**Limit**
120	-30	1960.000009	9	0.004592	1
120	-20	1960.000009	9	0.004592	1
120	-10	1960.000008	8	0.004082	1
120	0	1960.000007	7	0.003571	1
120	10	1960.000007	7	0.003571	1
120	20	1960.000005	5	0.002551	1
120	30	1960.000005	5	0.002551	1
120	40	1960.000005	5	0.002551	1
120	50	1960.000004	4	0.002041	1

Table 12. Frequency Stability Over Temperature Variations, Test Results, Part 24

	CDMA	ch 600	1960		
Voltage	**Temperature**	**Measured Frequency (MHz)**	**ΔHz**	**Δppm**	**Limit**
120	20	1960.000005	5	0.002551	1
102	20	1959.99913	-870	0.443878	1
138	20	1959.999176	-824	0.420408	1

Table 13. Frequency Stability Over Supply Voltage Variations, Test Results, 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
1T4149	HIGH-FREQUENCY ANECHOIC CHAMBER	RAY PROOF	81	NOT REQUIRED	
1T4300	SEMI-ANECHOIC CHAMBER # 1 (NSA)	EMC TEST SYSTEMS	NONE	2/6/2015	2/6/2018
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	11/29/2014	11/29/2016
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	10/8/2015	4/8/2017
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	2/26/2016	8/26/2017
1T4771	PSA SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4446A	8/10/2016	2/10/2018
2T5295	TEMPERATURE CHAMBER - (T5)	THERMOTRON	F270 CH(V) 30-30/ECA	2/10/2016	2/10/2017
1T4596	AC POWER SOURCE	CALIFORNIA INSTRUMENTS	2001RP	NOT REQUIRED	

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

End of Report

