

COMPLIANCE WORLDWIDE INC. TEST REPORT 385-16AR1

In Accordance with the Requirements of

FCC PART 24:2015 Subpart E
FCC PART 20:2015
IC RSS-133, Issue 6
1850-1915 MHz & 1930-1995 MHz

Issued to

Westell, Inc.
750 North Commons Drive
Aurora, IL 60504

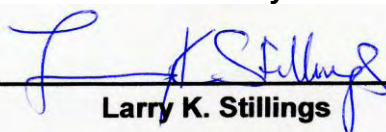
for

DSP85 Series Digital Repeater
DSP85-PG
Representing Model DSP85-PG/AW

FCC ID: NVRDSP85-PGAW
IC: 4307A-DSP85PGAW

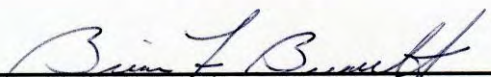
Original Report Issued on August 15, 2016
Revision R1 Issued on September 30, 2016

Tested by



Larry K. Stillings

Reviewed By



Brian F. Breault

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1. Scope

This test report certifies that the Westell DSP85-PG/AW, as tested, meets the FCC Part 24 Subpart E and IC RSS-133, Issue 6 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required. Revision R1 updates the FCC ID on the cover page, adds booster gain information on page 21 in Section 6.1.3 and added Radiated Emissions Test setup photographs for above 1 GHz in Section 8.

2. Product Details

- 2.1. Manufacturer:** Westell Technologies, Inc.
- 2.2. Model Numbers:** DSP85-PG tested also represents Model DSP85-PG/AW
- 2.3. Serial Number:** C6AA12345
- 2.4. Description:** An in-building digital repeater is utilized to propagate over-the-air radio frequency signals from a local cell tower into buildings via a fiber or coax distributed antenna system (DAS). Once installed, a digital repeater provides the signal power necessary for wireless devices in the building to operate seamlessly.
- 2.5. Power Source:** 120 VAC, 60 Hz via APX Technologies AS4528R
- 2.6. Software Version:** 03.00.10 RC5
- 2.7. EMC Modifications:** None

3. Product Configuration

3.1. Support Equipment

Device	Manufacturer	Model	Serial No.	Comment
RF Signal Generator	R & S	SMIQ06B	10090	Generating W-CDMA Signals
IQ Modulation Generator	R & S	AMIQ04	100540	Generating AWS Signals
Power Supply	APX Technologies	AS4528R	101710062	
Notebook PC	Dell	Latitude C400	9760689253	Configuring Unit

3.2. Cables

Cable Type	Length	Shield	From	To
RF, 50 Ω , N male – N male	1M	Yes	DUT	Signal Generator
RF, 50 Ω , N male – N male	1M	Yes	DUT	50 Ω Load
Power Supply	2M + 2M	Yes	DUT	120 VAC, 60 Hz
Serial	2M	Yes	DUT	Notebook PC
USB	2M	Yes	DUT	Notebook PC
Ethernet	2M	No	DUT	Notebook PC

Notebook PC is connected only during setup

3.3. Operational Characteristics & Software

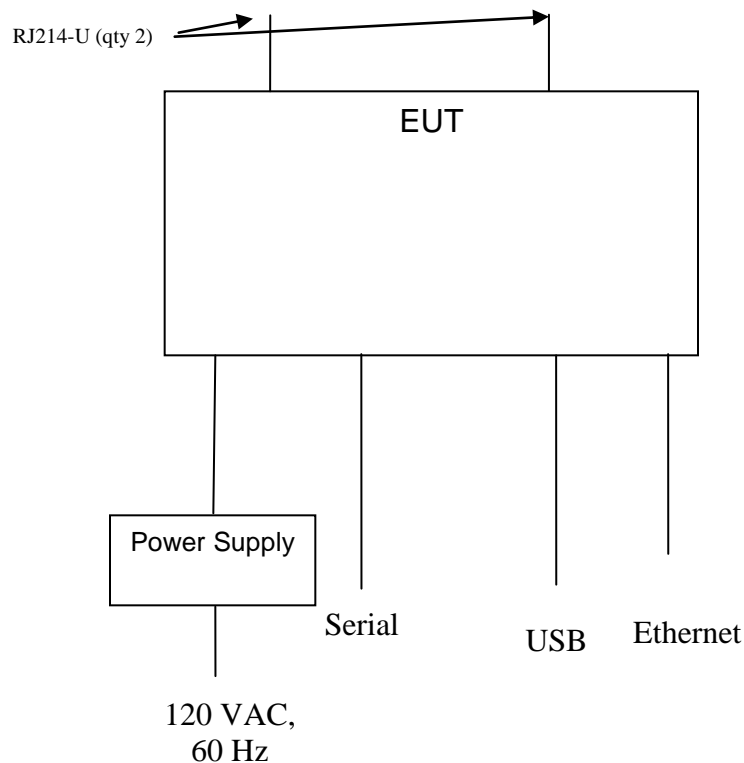
Emission Designator	Modulation	Occupied Bandwidth	Channel Bandwidth
4M10F9W	AWGN	4.1 MHz	5 MHz
1M28F9W	CDMA	1.275 MHz	1.25 MHz
2K44GXW	GSM	244 kHz	200 kHz

3. Product Configuration (continued)

3.3. Operational Characteristics & Software

- (1) The unit was allowed to power up normally and go through its configuration cycle.
- (2) Using an RF Signal Generator on the Input and a Spectrum Analyzer on the output Downlink or Uplink frequencies a signal was generated over the intended bandwidth of operation.
- (3) The signal generator was configured to provide AWS / LTE 4.1 MHz AWGN digital modulation to the input of the amplifier across the PCS-G bands to be used by the product.
- (4) The units internal AGC threshold was determined by applying an input signal until a 1 dB increase in input signal did not cause a 1 dB in output signal for each of the Uplink and Downlink frequencies.
- (5) The signal generator was then configured to provide narrowband GSM and CDMA signals.

3.4. Block Diagram



4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Test Receiver, 9kHz - 7GHz ¹	Rohde & Schwarz	ESR7	101156	7/23/2017	2 Years
Spectrum Analyzer 20 Hz – 40 GHz ²	Rohde & Schwarz	FSV40	100899	7/23/2017	2 Years
Spectrum Analyzer, 9 kHz to 40 GHz ³	Rohde & Schwarz	FSVR40	100909	7/23/2017	2 Years
EMI Receiver, 9 kHz to 6.5 GHz	Hewlett Packard	8546A	3650A00360	6/4/2016	2 Years
Combilog Antenna, 30 MHz to 2 GHz	Com-Power	AC-220	25509	5/12/2018	2 Years
Horn Antenna, 960 MHz – 18 GHz	Electro-Metrics	RGA-50 / 60	2813	7/15/2016	2 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A01323	7/21/2017	2 Years
Digital Barometer	Control Company	4195	ID236	10/8/2017	2 Years

¹ ESR7 Firmware revision: V2.26,

Date installed: 8/15/2014

Previous V2.17, installed 6/11/2014.

² FSV40 Firmware revision: V2.30 SP1

Date installed: 10/22/2014

Previous V2.30, installed 7/23/2014.

³ FSVR40 Firmware revision: V2.23,

Date installed: 10/20/2014

Previous V1.63 SP1, installed 8/28/2013.

4.2. Measurement & Equipment Setup

Test Dates: 5/27/2016, 8/10/2016

Test Engineer: Larry Stillings

Normal Site Temperature (15 – 35°C): 24

Relative Humidity (20 -75%RH): 33

4.3. Test Procedure

The test measurements contained in this report are based on the requirements detailed in FCC Part 24, Subpart E and RSS-133, Issue 6.

The test methods used to generate the data in this test report are in accordance with ANSI C63.4:2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz, FCC OET KDB 935210 D05 Indus Booster Basic Meas v01 dated 2-12-2016, Measurements Guidance for Industrial and Non-Consumer Signal Booster, Repeater and Amplifier Devices and FCC OET KDB 971168 D01 Power Meas License Digital Systems v02r02 dated 10-17-2014.

Measurements were also made in accordance with TIA-603-C:2004 Land Mobile FM or PM Communications Equipment Measurement and Performance Standard.

5. Measurement Summary

Section Description or Test Requirement	FCC Part Reference	IC RSS-133 Reference	Test Report Section	Result	Comment
Power and Antenna height limits, Output Power	24.232 (a)	6.4	6.1	Compliant	
Occupied Bandwidth	Part 2.1049	2.3 RSS-GEN 6.6	6.2	Compliant	
Spurious Emissions at Antenna Terminals	24.238 (a)	6.5	6.3	Compliant	
Field Strength of Spurious Emissions	24.238 (a)	6.5	6.4	Compliant	
Frequency Stability	24.235	6.3	6.5	N/A	The EUT does not translate the frequency of the input signal
Out of Band Rejection	N/A	N/A	6.6	Compliant	FCC KDB 935210
Public Exposure to Radio Frequency Energy Levels	Section 1.1307 (b)(1)	RSS-GEN 3.2 RSS-102	6.7	Compliant	

6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4

Requirements: FCC: Base stations transmitting a signal in the 1850-1915 MHz & 1930-1995 MHz band are limited to 1640 watts peak equivalent isotropically radiated power (EIRP) with an antenna height of up to 300 meters HAAT.

IC: Base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 Watts.

Test Method: KDB 935210 Section 3.5 & KDB 971168 Section 5.2

6.1.1. Mean Transmitter Output Power, Transmitter Only

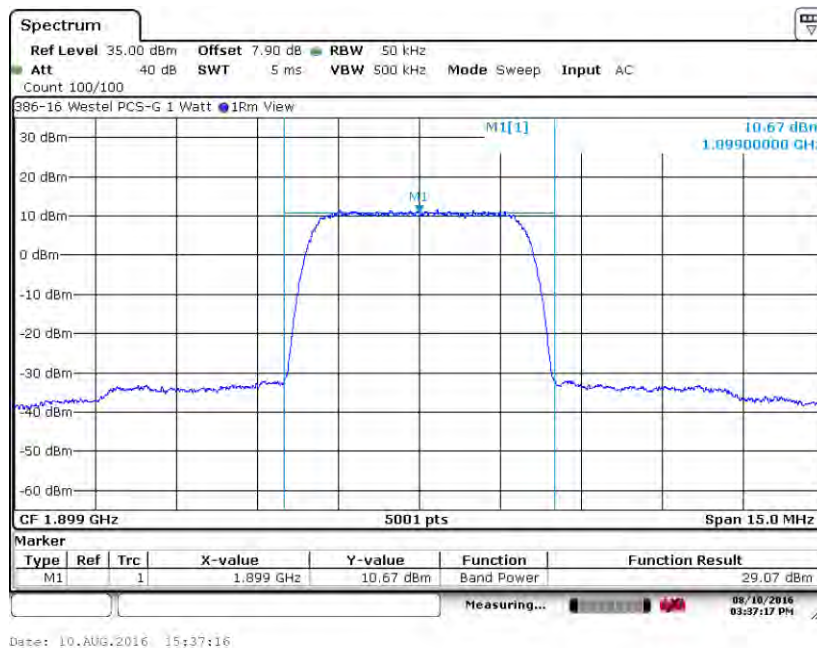
Description of Measurement	Center Frequency	Output Power	
	(MHz)	(dBm)	(Watts)
Output Power - AWGN	1899	29.07	0.807
Output Power - GSM	1899	29.11	0.815
Output Power - CDMA	1899	28.99	0.793
Output Power - AWGN	1985	29.48	0.887
Output Power - GSM	1985	29.59	0.910
Output Power - CDMA	1985	29.14	0.820
3 dB Above AGC - AWGN	1899	29.08	0.809
3 dB Above AGC - GSM	1899	28.83	0.764
3 dB Above AGC - CDMA	1899	28.89	0.774
3 dB Above AGC - AWGN	1985	29.28	0.847
3 dB Above AGC - GSM	1985	29.19	0.830
3 dB Above AGC - CDMA	1985	28.83	0.764
Input Power - AWGN	1899	-56.56	N/A
Input Power - GSM	1899	-56.21	N/A
Input Power - CDMA	1899	-56.50	N/A
Input Power - AWGN	1985	-56.25	N/A
Input Power - GSM	1985	-56.02	N/A
Input Power - CDMA	1985	-56.21	N/A

Notes: Input Power is AGC threshold Level, Center Frequencies are determined from Out of Band Rejection f_0 measurement.

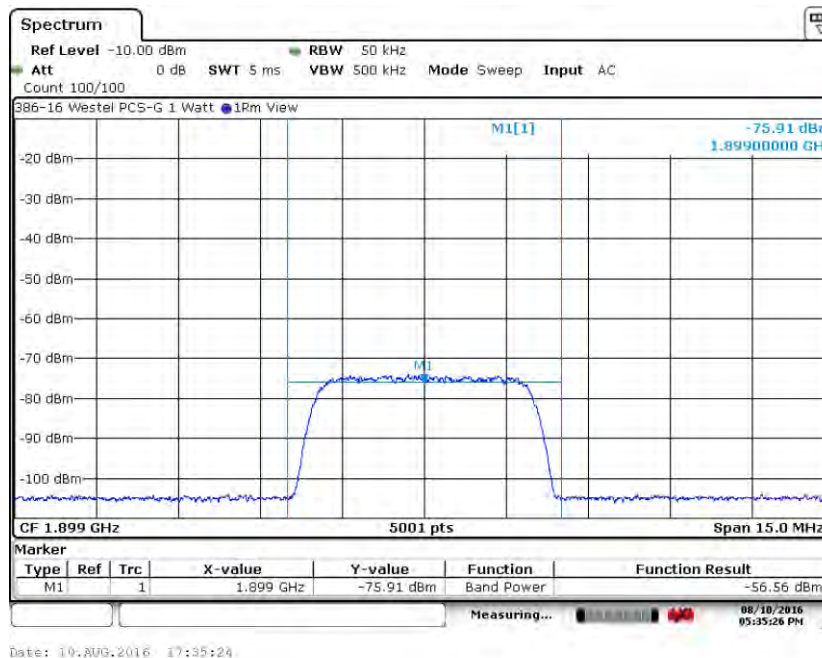
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont)

6.1.2. Mean Transmitter Output Power, 1899 MHz AWGN



6.1.3. Mean Transmitter Output Power, 1899 MHz – Input Power AWGN



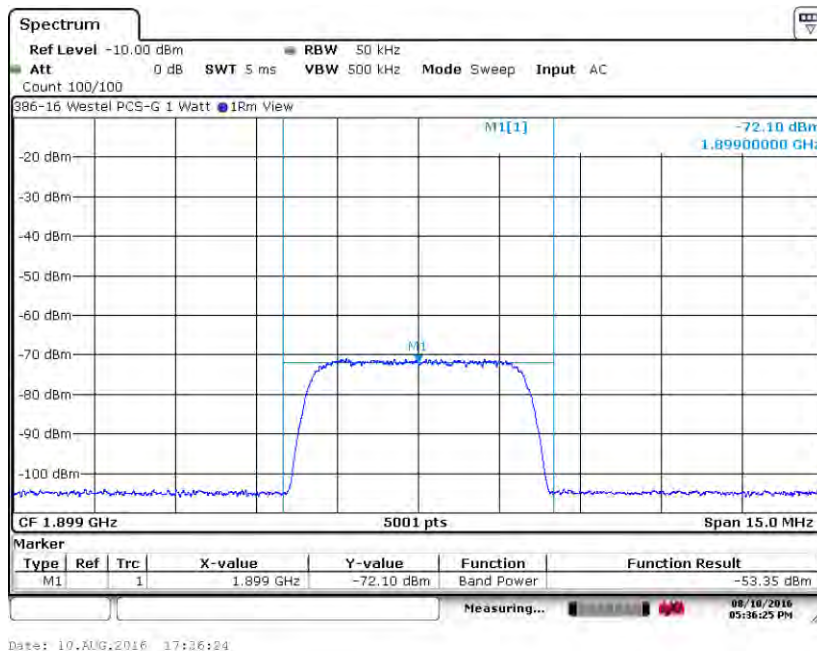
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont)

6.1.4. Mean Transmitter Output Power, 1899 MHz AWGN plus 3 dB



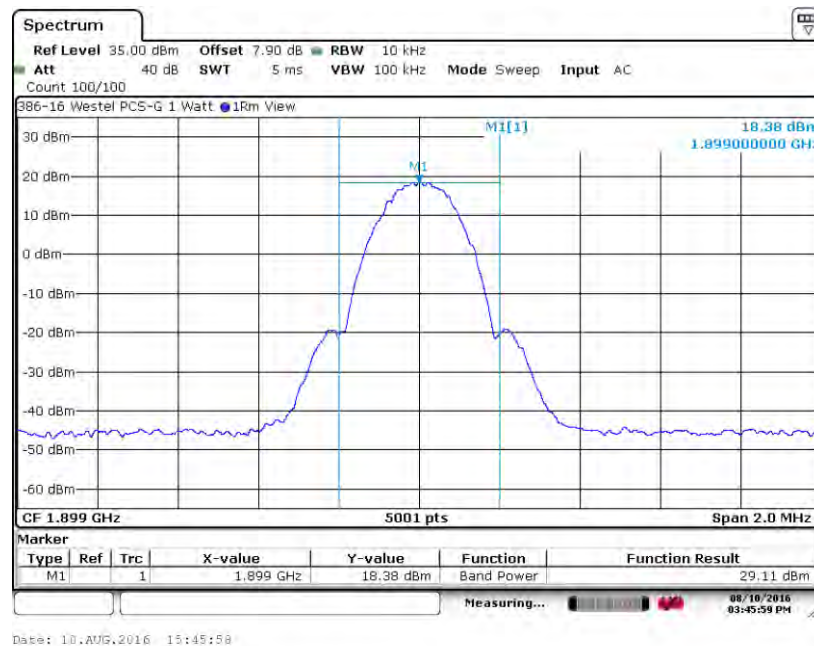
6.1.5. Mean Transmitter Output Power, 1899 MHz – Input Power AWGN plus 3 dB



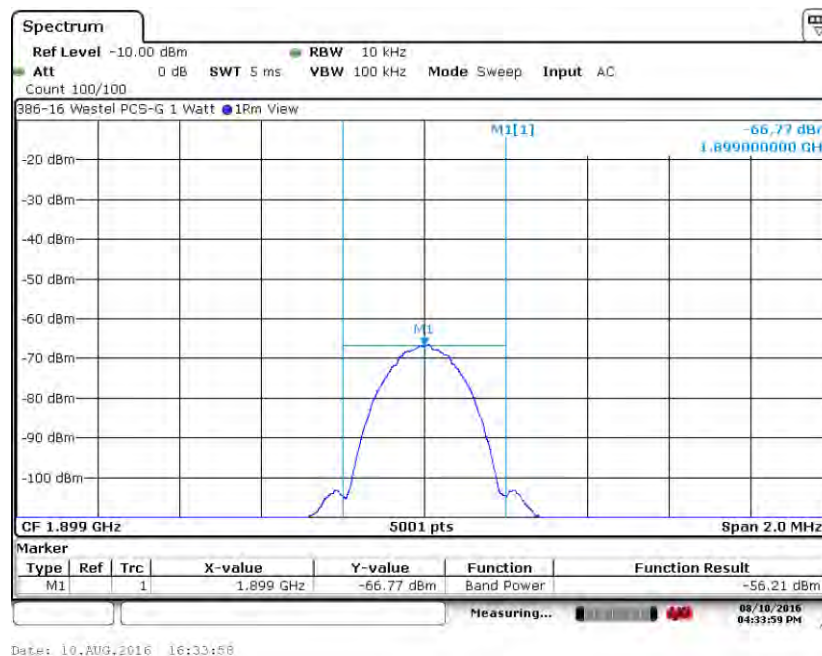
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont)

6.1.6. Mean Transmitter Output Power, 1899 MHz GSM



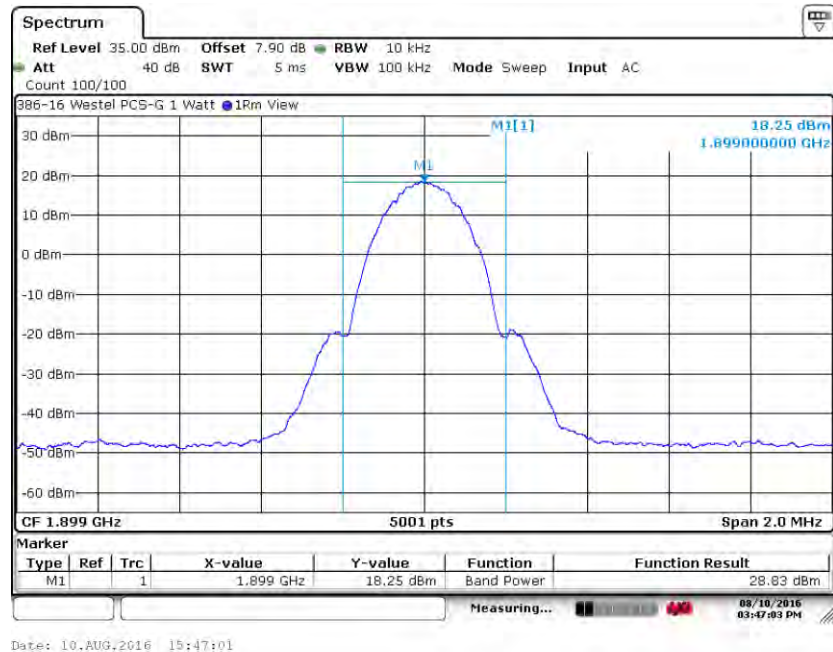
6.1.7. Mean Transmitter Output Power, 1899 MHz – Input Power GSM



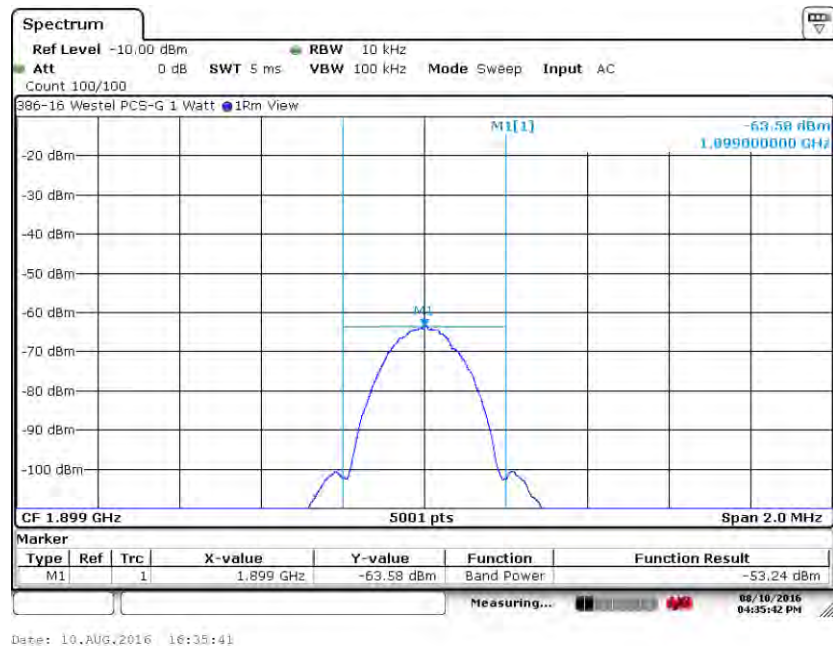
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont)

6.1.8. Mean Transmitter Output Power, 1899 MHz GSM plus 3 dB



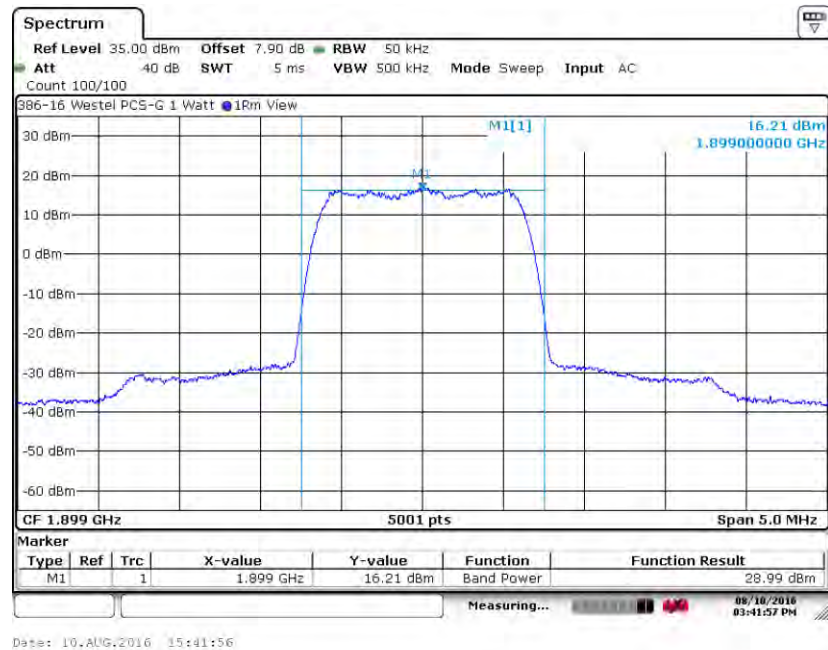
6.1.9. Mean Transmitter Output Power, 1899 MHz – Input Power GSM plus 3 dB



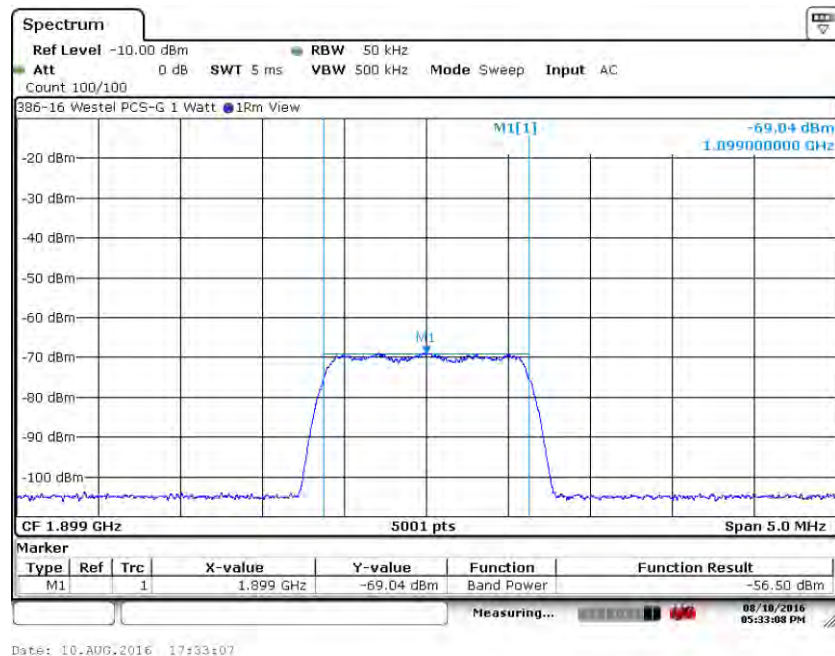
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont)

6.1.10. Mean Transmitter Output Power, 1899 MHz, CDMA



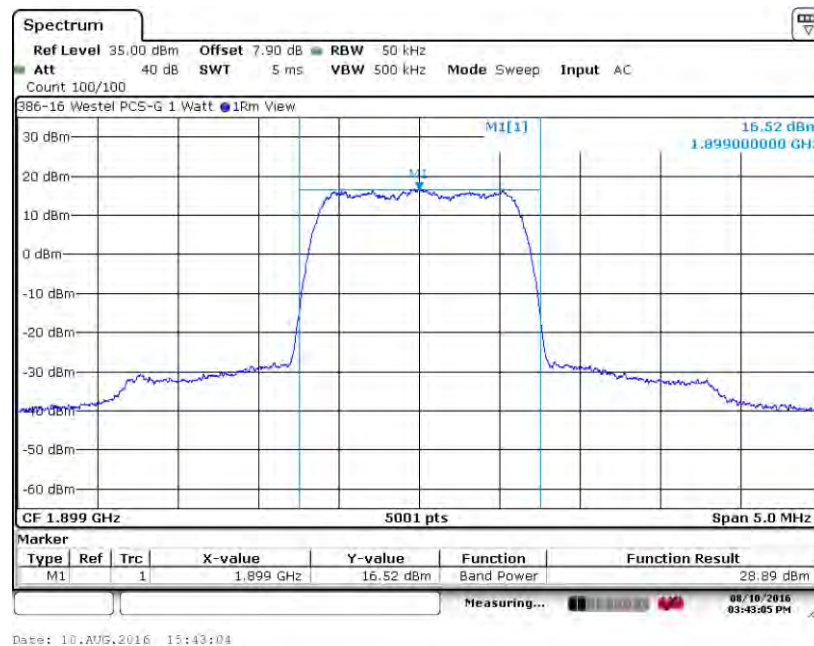
6.1.11. Mean Transmitter Output Power, 1899 MHz – Input Power CDMA



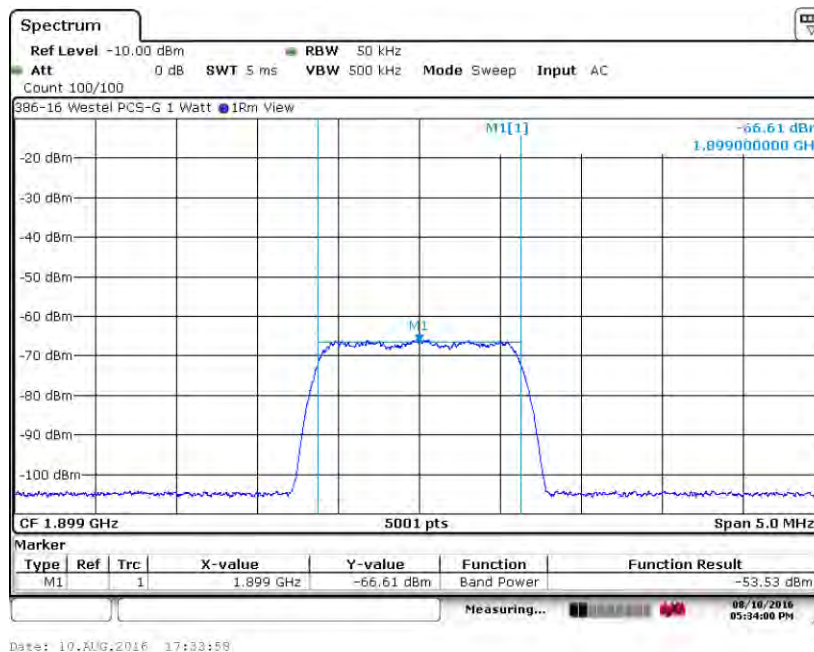
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont)

6.1.12. Mean Transmitter Output Power, 1899 MHz, CDMA plus 3 dB



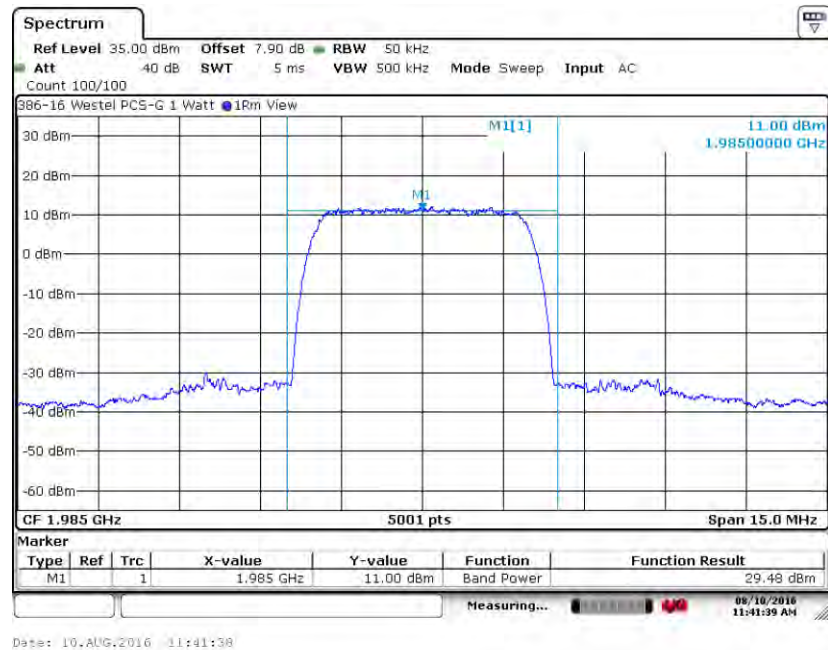
6.1.13. Mean Transmitter Output Power, 1899 MHz – Input Power CDMA plus 3 dB



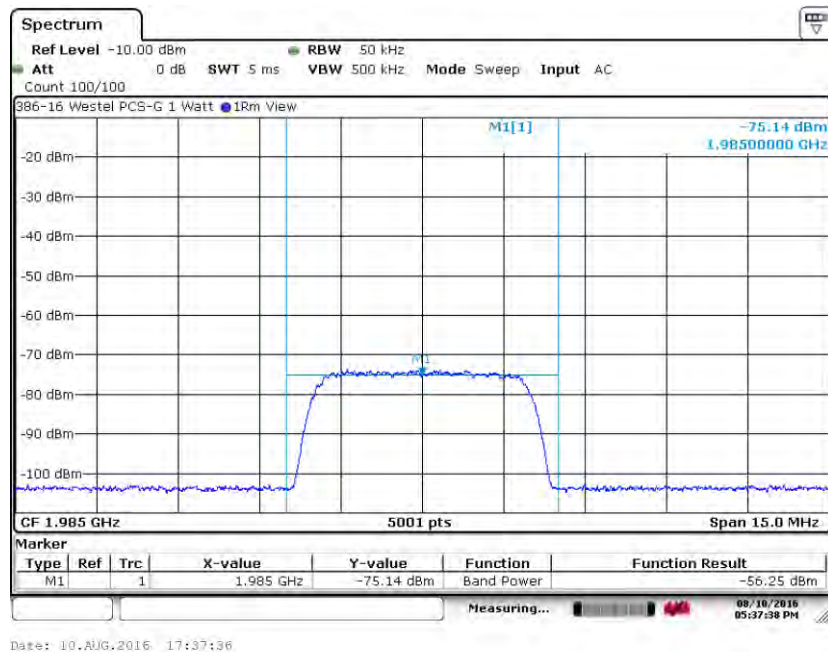
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont)

6.1.14. Mean Transmitter Output Power, 1985 MHz AWGN



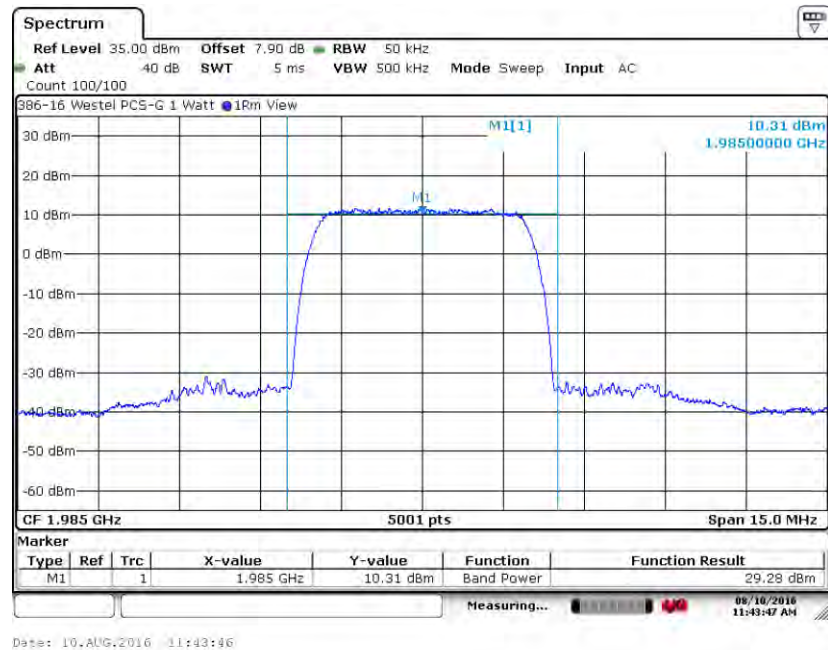
6.1.15. Mean Transmitter Output Power, 1985 MHz – Input Power AWGN



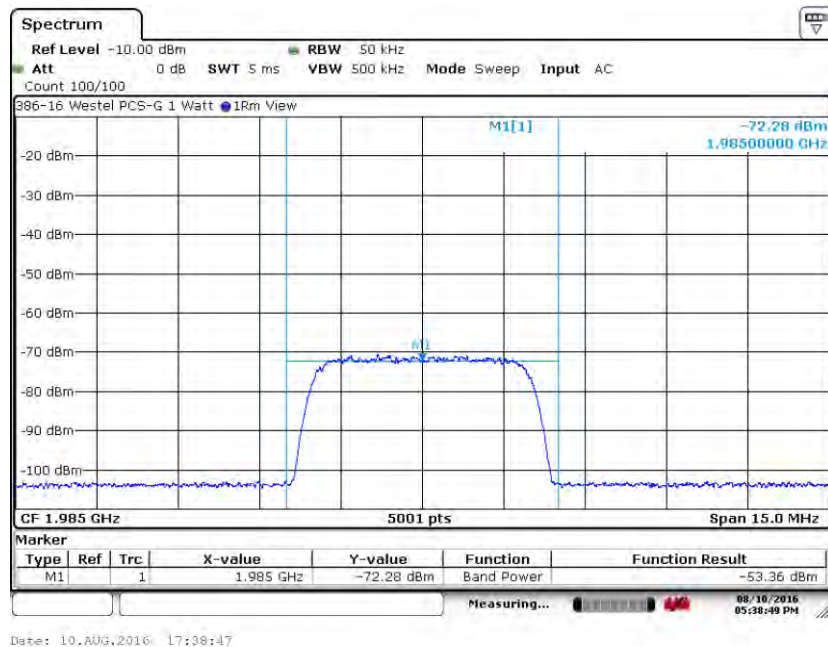
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont)

6.1.16. Mean Transmitter Output Power, 1985 MHz AWGN plus 3 dB



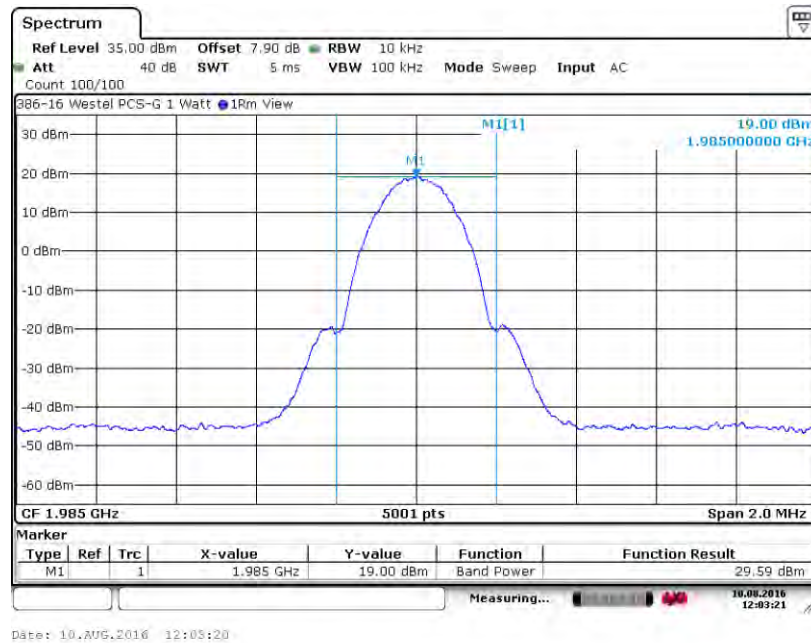
6.1.17. Mean Transmitter Output Power, 1985 MHz – Input Power AWGN plus 3 dB



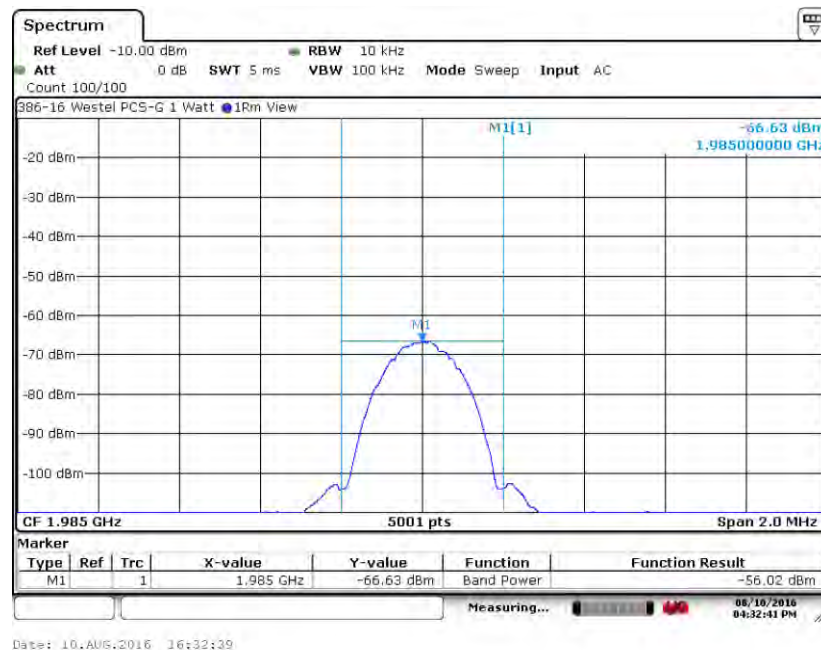
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont.)

6.1.18. Mean Transmitter Output Power, 1985 MHz GSM



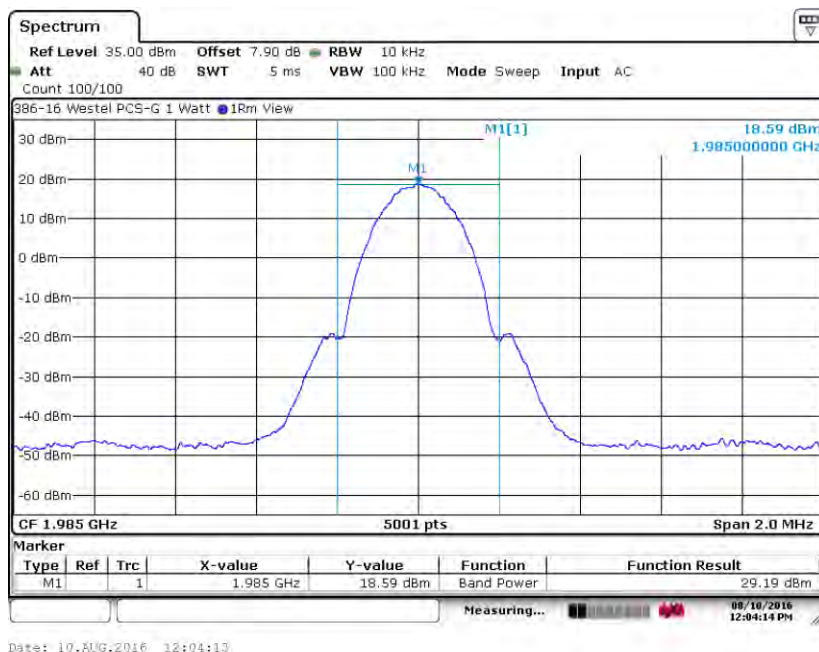
6.1.19. Mean Transmitter Output Power, 1985 MHz – Input Power GSM



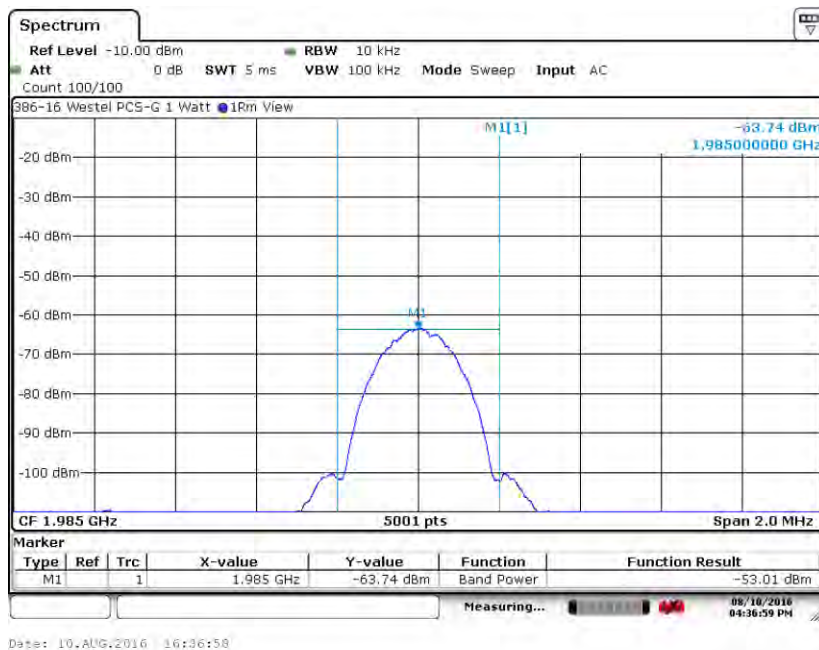
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont.)

6.1.20. Mean Transmitter Output Power, 1985 MHz GSM plus 3 dB



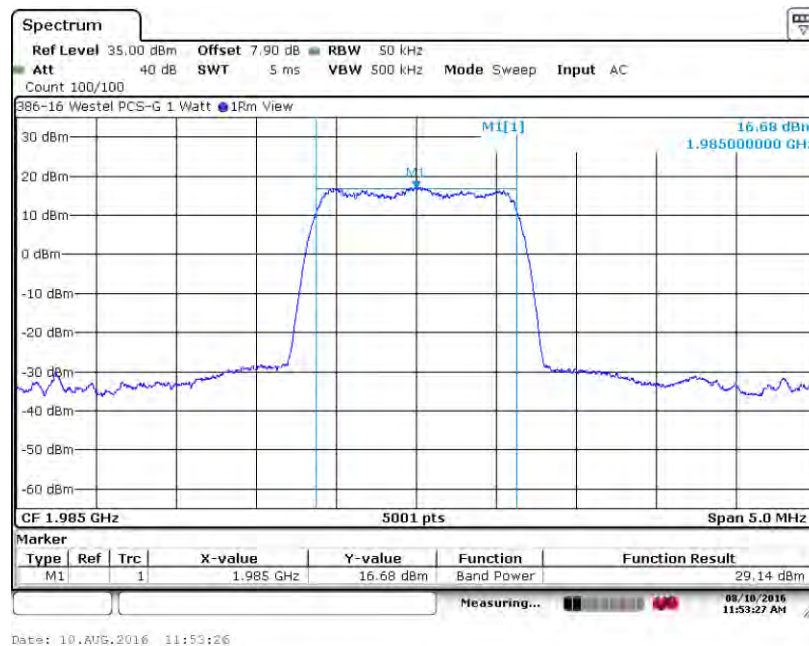
6.1.21. Mean Transmitter Output Power, 1985 MHz – Input Power GSM plus 3 dB



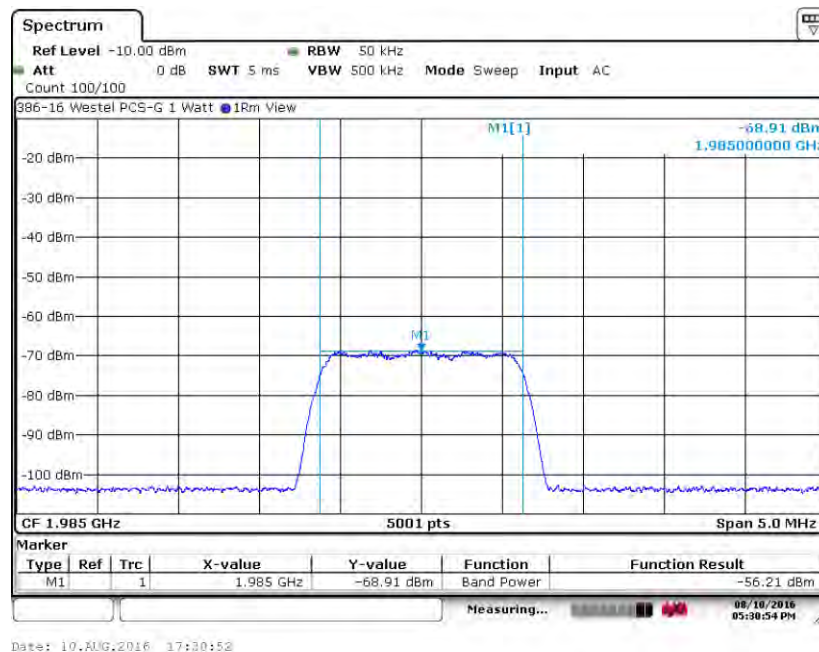
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont)

6.1.22. Mean Transmitter Output Power, 1985 MHz CDMA



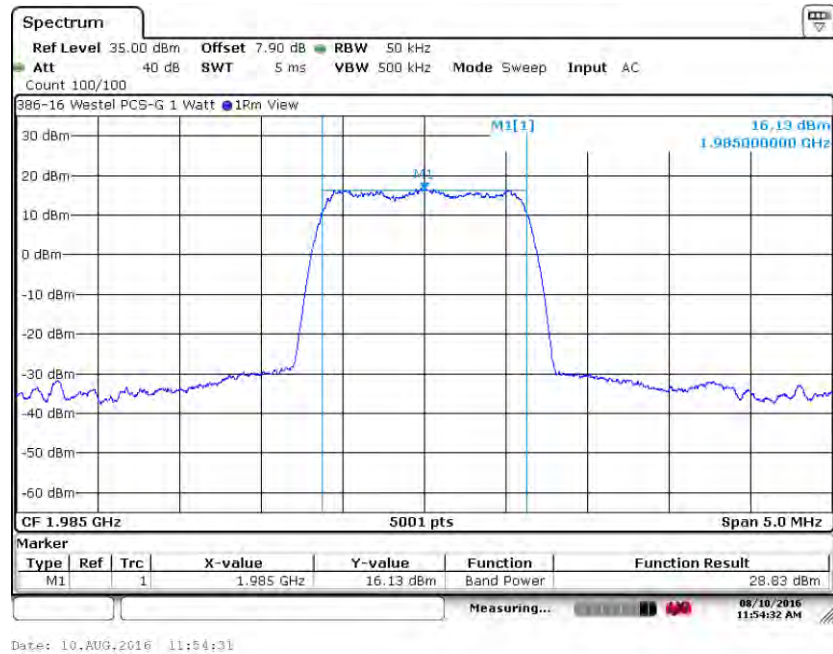
6.1.23. Mean Transmitter Output Power, 1985 MHz – Input Power CDMA



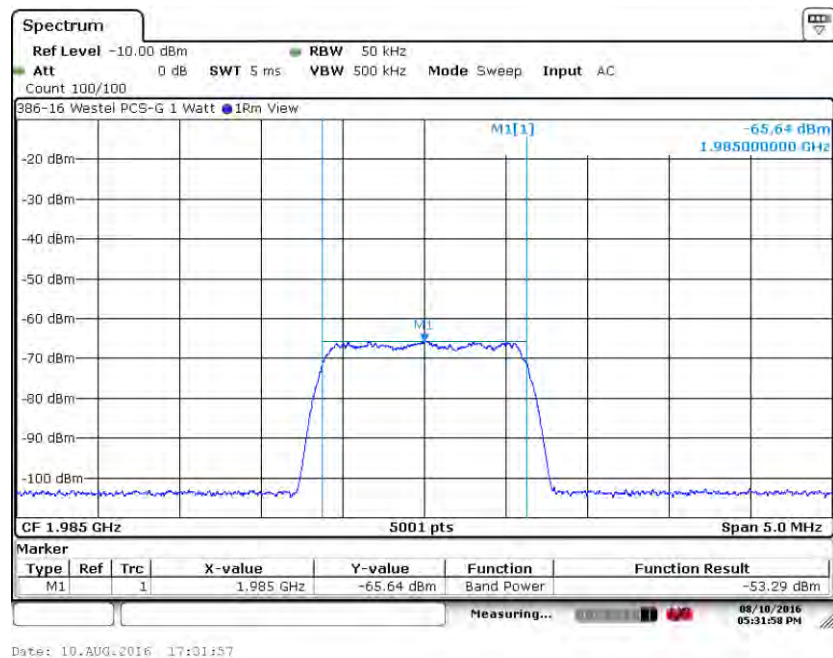
6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (cont)

6.1.24. Mean Transmitter Output Power, 1985 MHz CDMA plus 3 dB



6.1.25. Mean Transmitter Output Power, 1985 MHz – Input Power CDMA plus 3 dB



6. Measurement Data

6.1. Power and Antenna Height Limits 24.232, RSS-133 Section 6.4 (continued)

6.1.2. Maximum ERP

ERP is defined in FCC Title 47, Chapter I, Part 2, Subpart A, Section 2.1 as "Effective Radiated Power. The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction."

ERP = Transmitter Power (dBm) - Cable Loss (dB) + Antenna Gain (dBi)

The manufacturer of the device under test recommends one antenna and cable combination for use with their product. The following table provides the worst case effective radiated power based on the measured transmitter output power and the antenna gain:

Description of Measurement	Center Frequency	Transmitter Power ¹	Cable Insertion Loss	Antenna Gain ²	Total Output Power	
	(MHz)	(dBm)	(dB)	(dBi)	(dBm)	(Watts)
Output Power - AWGN	1899	29.07	0.00	3.00	32.07	1.61
Output Power - GSM	1899	29.11	0.00	3.00	32.11	1.63
Output Power - CDMA	1899	28.99	0.00	3.00	31.99	1.58
Output Power - AWGN	1985	29.48	0.00	3.00	32.48	1.77
Output Power - GSM	1985	29.59	0.00	3.00	32.59	1.82
Output Power - CDMA	1985	29.14	0.00	3.00	32.14	1.64
3 dB Above AGC - AWGN	1899	29.08	0.00	3.00	32.08	1.61
3 dB Above AGC - GSM	1899	28.83	0.00	3.00	31.83	1.52
3 dB Above AGC - CDMA	1899	28.89	0.00	3.00	31.89	1.55
3 dB Above AGC - AWGN	1985	29.28	0.00	3.00	32.28	1.69
3 dB Above AGC - GSM	1985	29.19	0.00	3.00	32.19	1.66
3 dB Above AGC - CDMA	1985	28.83	0.00	3.00	31.83	1.52

¹ Measured. See section 6.1.1.

² Customer supplied 3 dBi for gain. Factor is a combination of both antenna gain and cable loss.

6.1.3. Booster gain – 85 dB Nominal

Description of Measurement	Center Frequency	Output Power	Input Power	Gain
	(MHz)	(dBm)	(dBm)	dB
Output Power - AWGN	1899	29.07	-56.56	85.63
Output Power - GSM	1899	29.11	-56.21	85.32
Output Power - CDMA	1899	28.99	-56.50	85.49
Output Power - AWGN	1985	29.48	-56.25	85.73
Output Power - GSM	1985	29.59	-56.02	85.61
Output Power - CDMA	1985	29.14	-56.21	85.35

6. Measurement Data (continued)
6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6

Requirement: Each authorization issued to a station licensed under this part will show an emission designator representing the class of emission authorized. The designator will be prefixed by a specified necessary bandwidth. This number does not necessarily indicate the bandwidth occupied by the emission at any instant.

Test Method: KDB 935210 Section 3.4

6.2.1. Occupied (99% Power) Bandwidth

Modulation Type	Center Frequency	Output Occupied Bandwidth	Input Occupied Bandwidth	Difference	Result
	MHz	kHz	kHz	kHz	
AWGN	1882.5	4010.00	4070.00	-60.00	Compliant
AWGN + 3dB	1882.5	4019.00	4037.00	-18.00	Compliant
GSM	1882.5	241.95	245.95	-4.00	Compliant
GSM + 3dB	1882.5	243.55	244.35	-0.80	Compliant
CDMA	1882.5	1275.00	1278.00	-3.00	Compliant
CDMA + 3dB	1882.5	1271.00	1275.00	-4.00	Compliant
AWGN	1960	4067.00	4100.00	-33.00	Compliant
AWGN + 3dB	1960	4073.00	4043.00	30.00	Compliant
GSM	1960	243.55	245.55	-2.00	Compliant
GSM + 3dB	1960	243.95	243.55	0.40	Compliant
CDMA	1960	1275.00	1280.00	-5.00	Compliant
CDMA + 3dB	1960	1273.00	1276.00	-3.00	Compliant

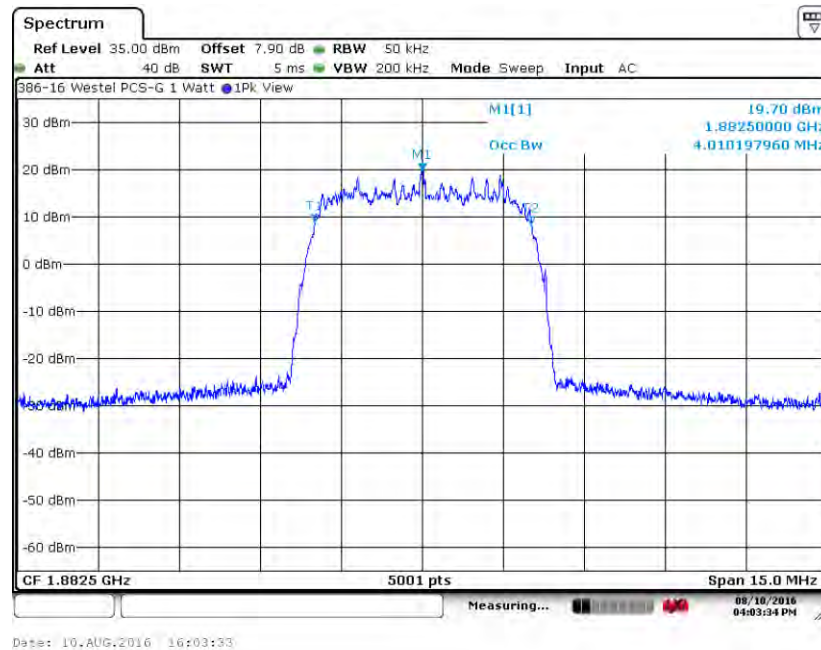
Test Number: 385-16AR1

Issue Date: 9/30/2016

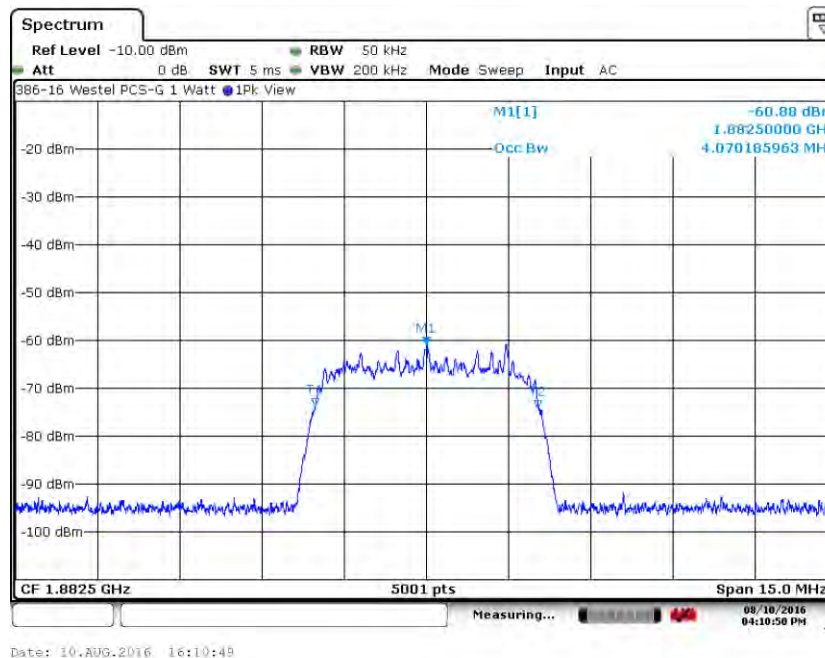
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.1. Occupied (99% Power) Bandwidth Measurement, 1882.5 MHz AWGN



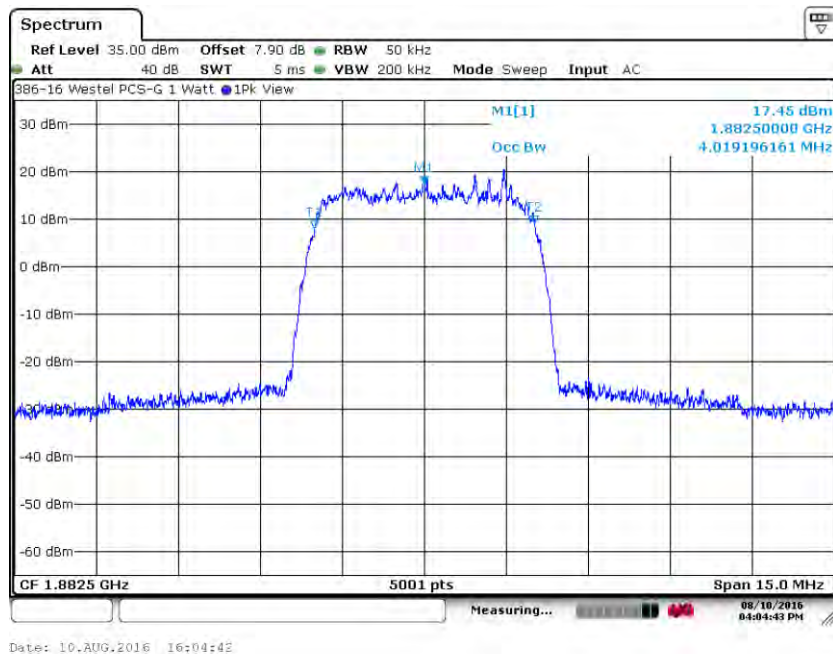
6.2.1.2. Occupied (99% Power) Bandwidth Input Signal, 1882.5 MHz AWGN



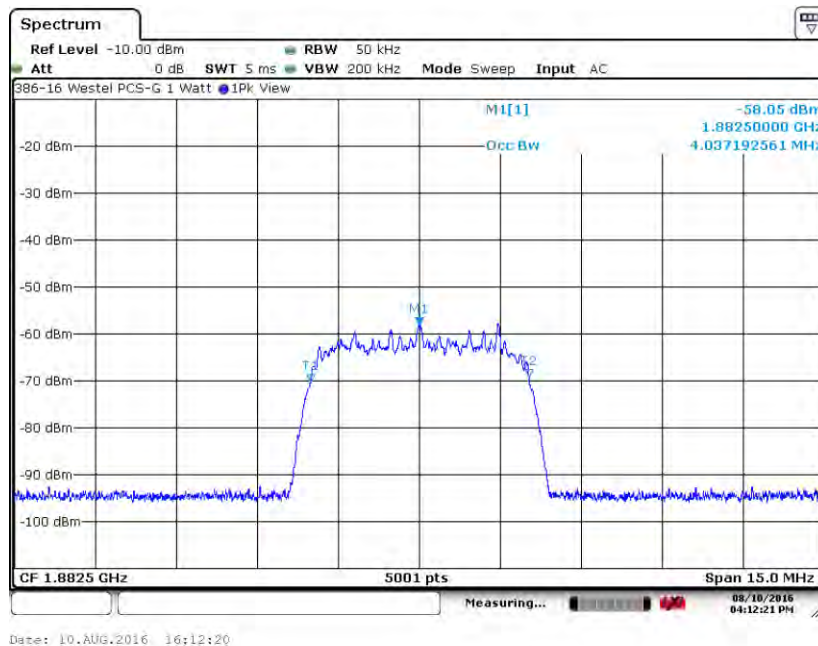
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.3. Occupied (99% Power) Bandwidth Measurement, 1882.5 MHz AWGN +3dB



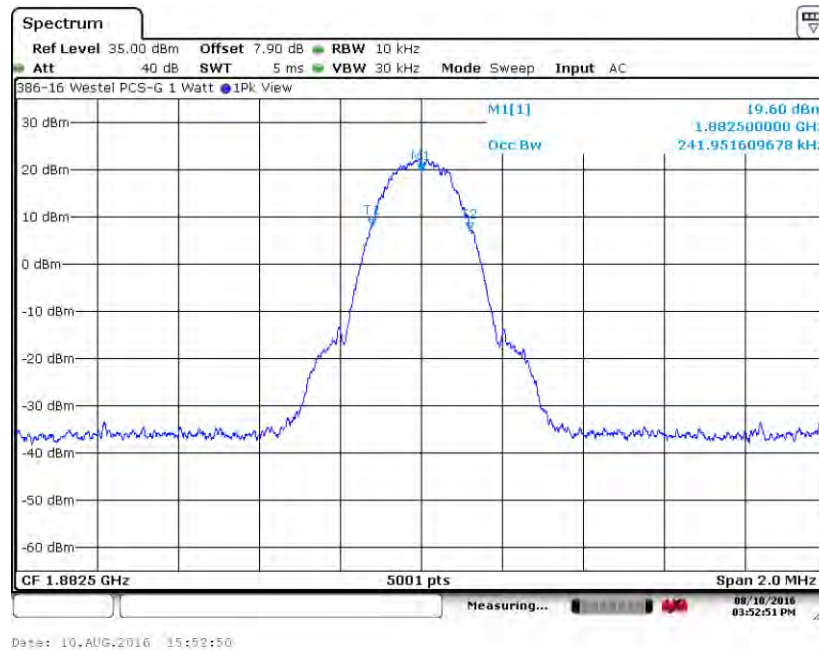
6.2.1.4. Occupied (99% Power) Bandwidth Input Signal, 1882.5 MHz AWGN + 3dB



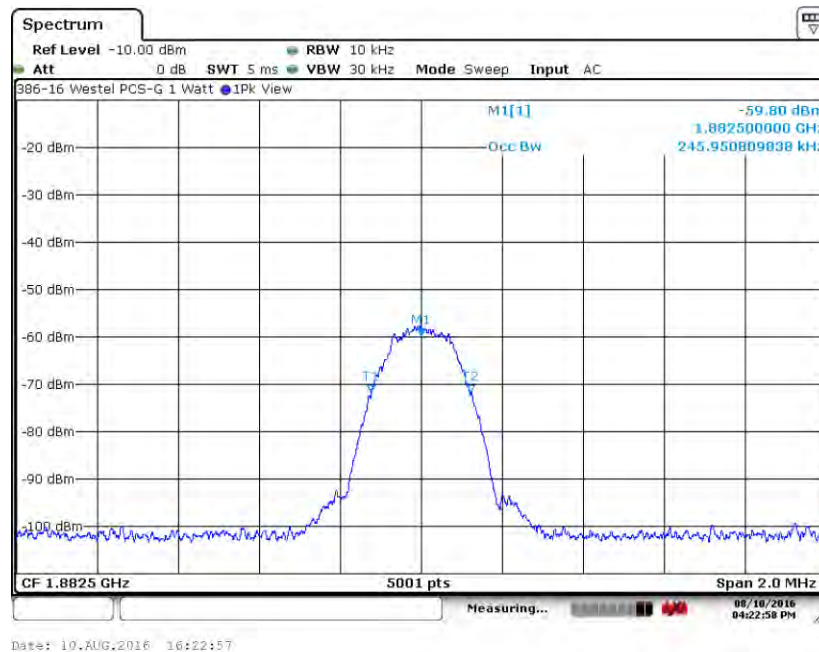
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.5. Occupied (99% Power) Bandwidth Measurement, 1882.5 MHz GSM



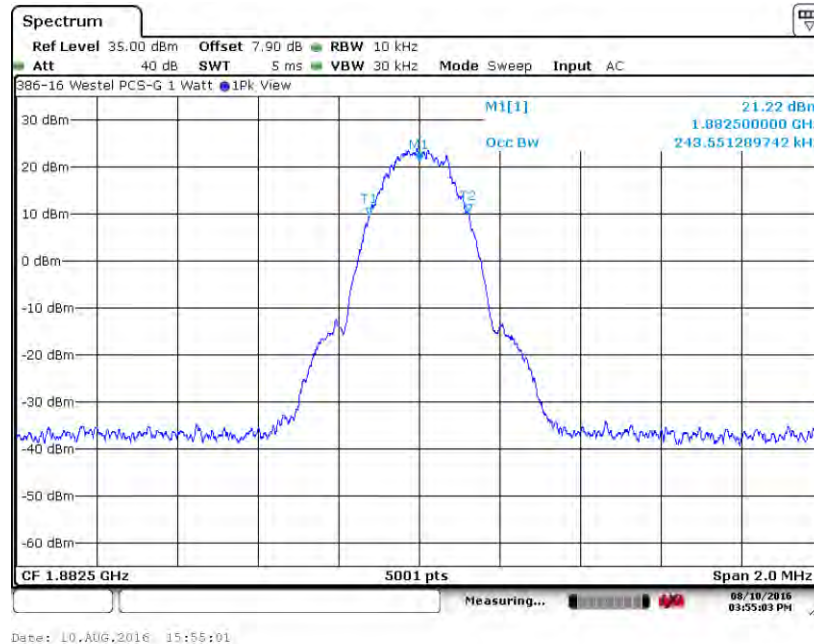
6.2.1.6. Occupied (99% Power) Bandwidth Input Signal, 1882.5 MHz GSM



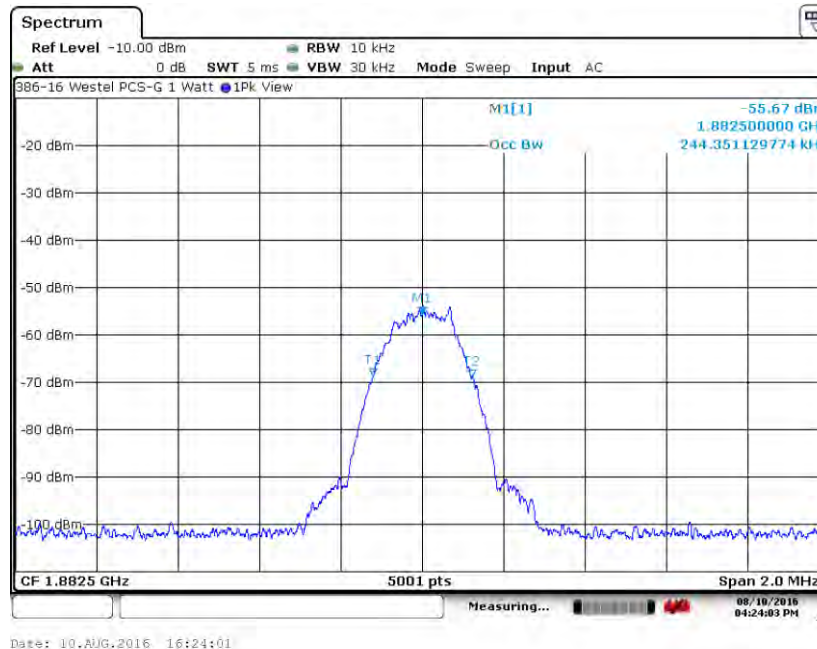
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.7. Occupied (99% Power) Bandwidth Measurement, 1882.5 MHz GSM +3dB



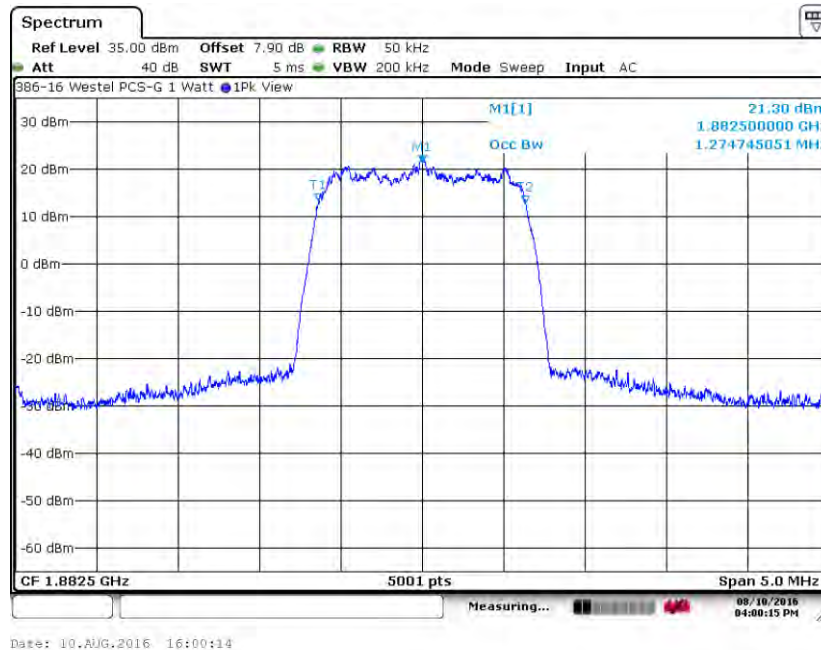
6.2.1.8. Occupied (99% Power) Bandwidth Input Signal, 1882.5 MHz GSM + 3dB



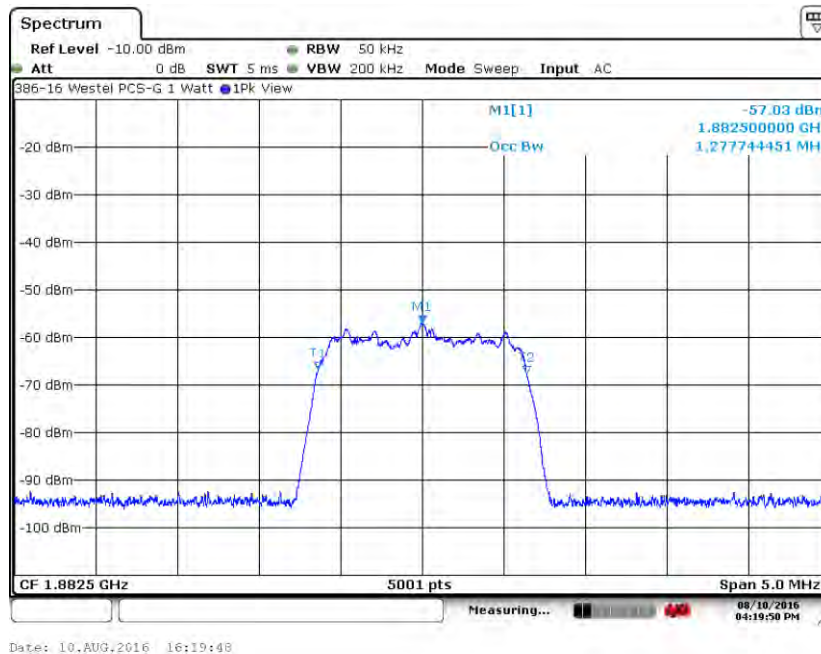
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.9. Occupied (99% Power) Bandwidth Measurement, 1882.5 MHz CDMA



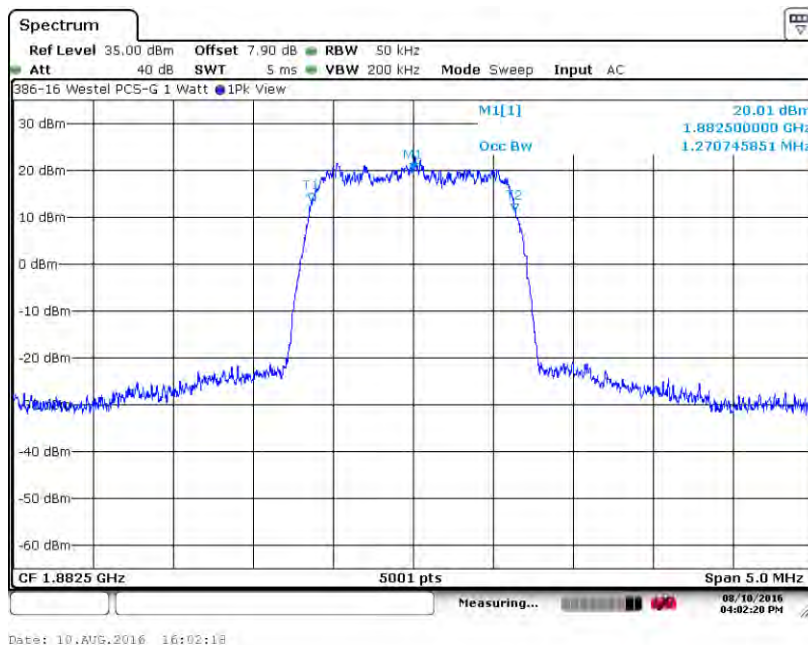
6.2.1.10. Occupied (99% Power) Bandwidth Input Signal, 1882.5 MHz CDMA



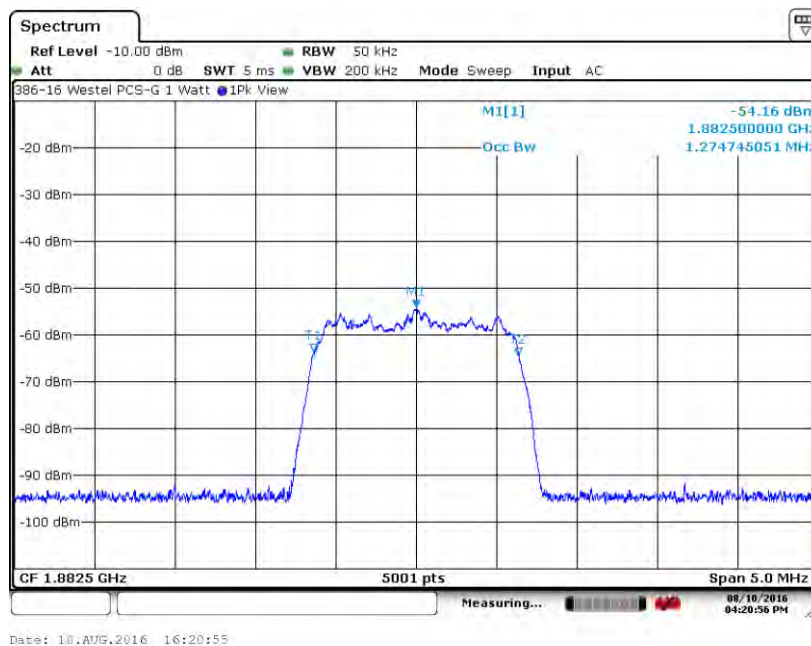
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.11. Occupied (99% Power) Bandwidth Measurement 1882.5 MHz CDMA +3dB



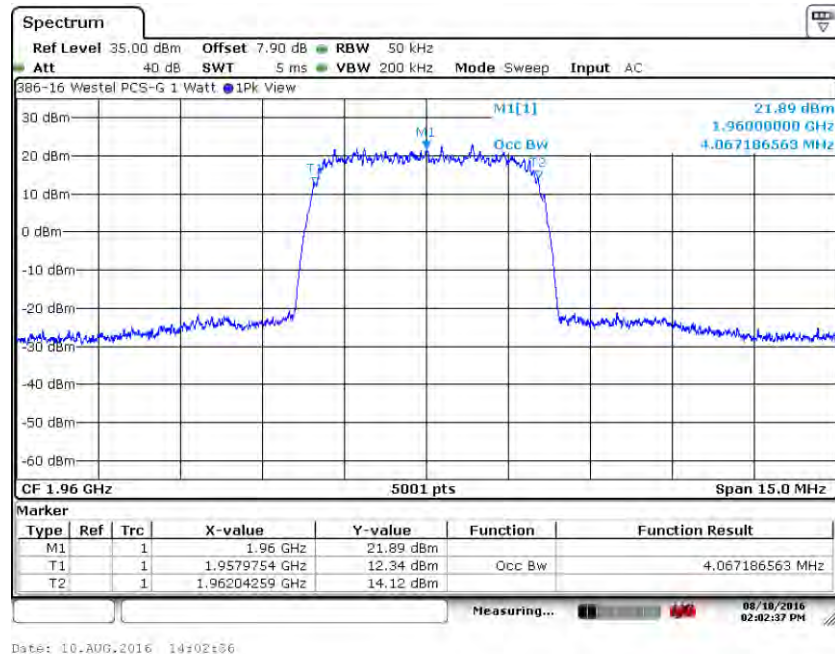
6.2.1.12. Occupied (99% Power) Bandwidth Input Signal, 1882.5 MHz CDMA +3dB



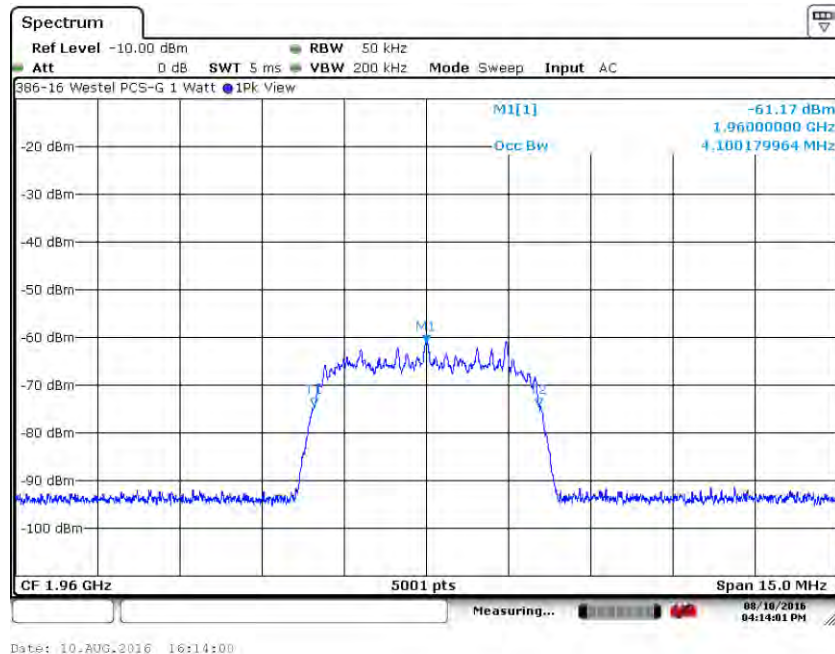
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.13. Occupied (99% Power) Bandwidth Measurement, 1960 MHz AWGN



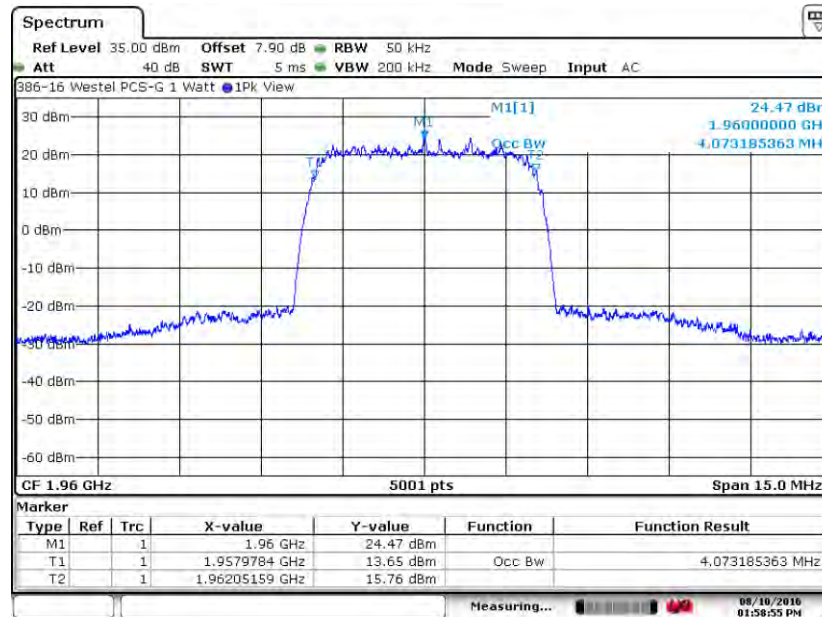
6.2.1.14. Occupied (99% Power) Bandwidth Input Signal, 1960 MHz AWGN



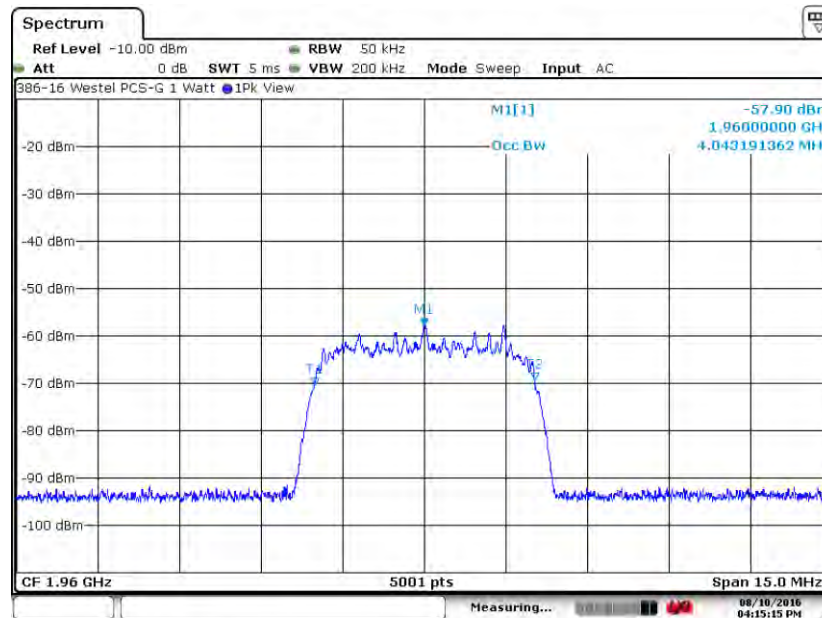
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.15. Occupied (99% Power) Bandwidth Measurement, 1960 MHz AWGN + 3dB



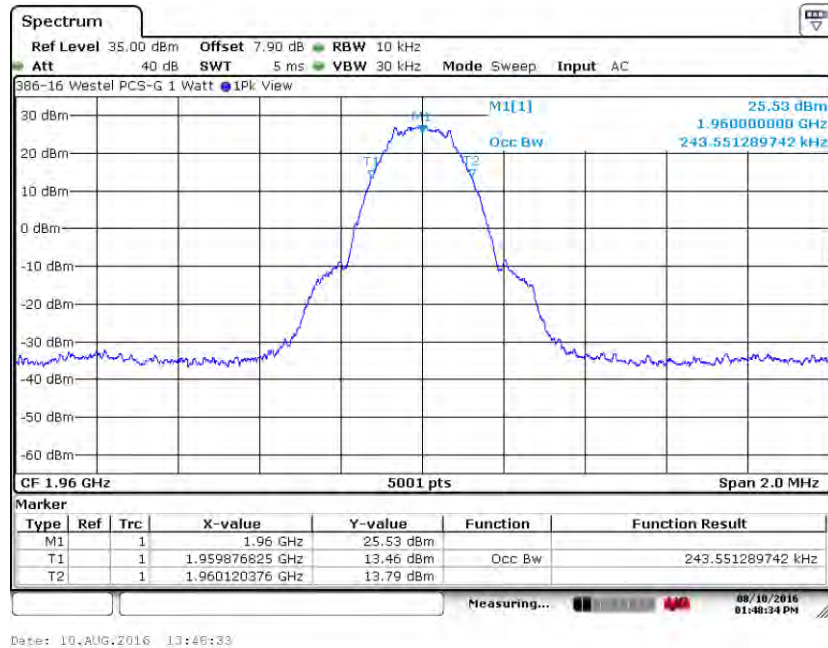
6.2.1.16. Occupied (99% Power) Bandwidth Input Signal, 1960 MHz AWGN +3dB



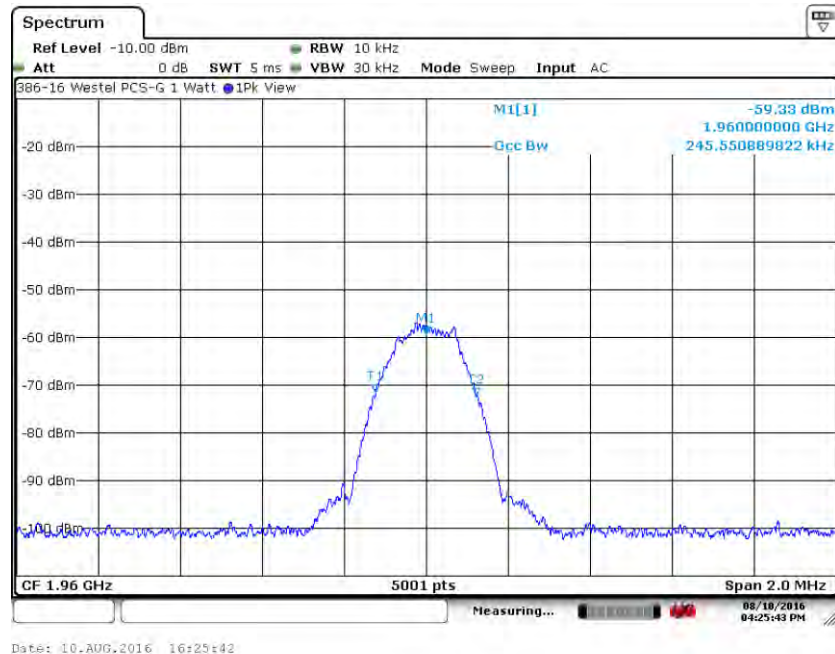
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.17. Occupied (99% Power) Bandwidth Measurement, 1960 MHz GSM



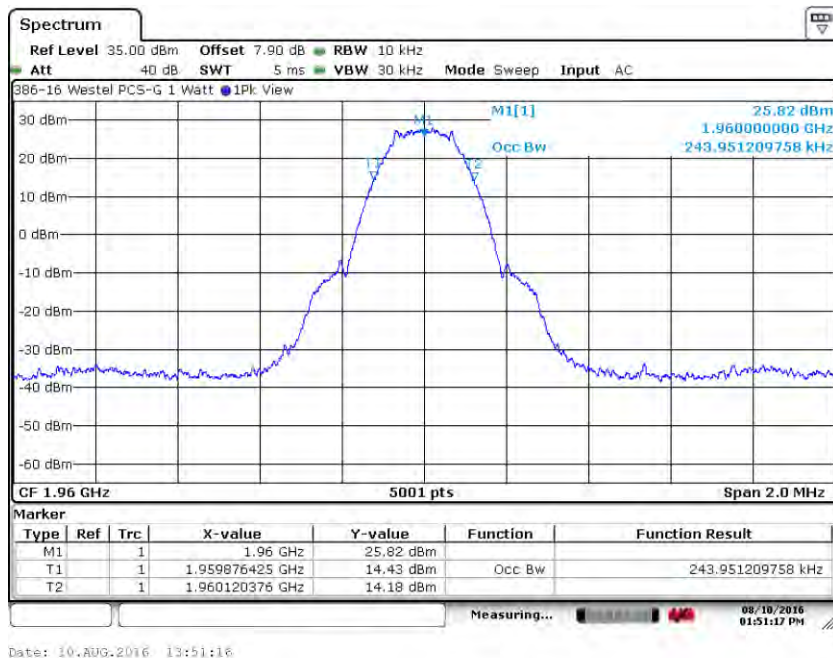
6.2.1.18. Occupied (99% Power) Bandwidth Input Signal, 1960 MHz GSM



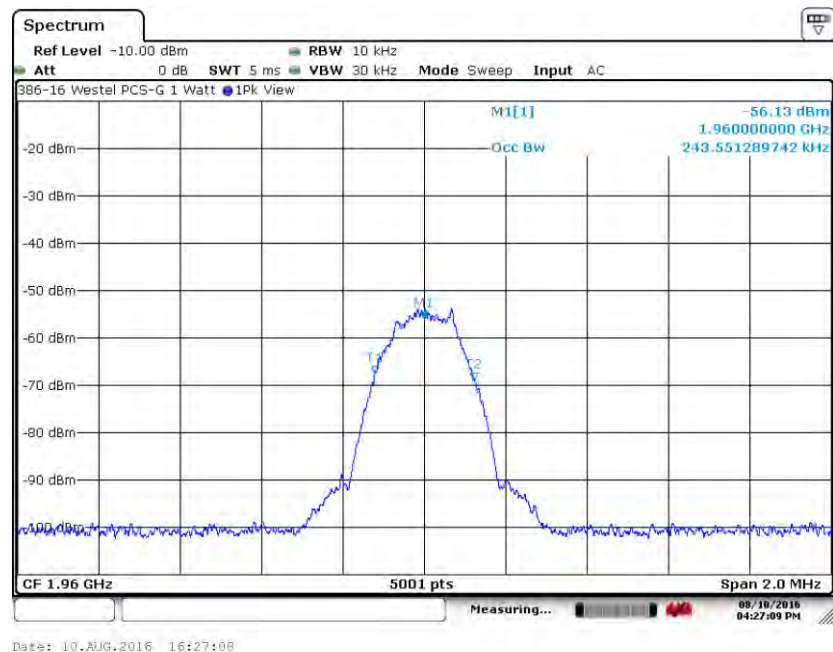
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.19. Occupied (99% Power) Bandwidth Measurement, 1960 MHz GSM +3dB



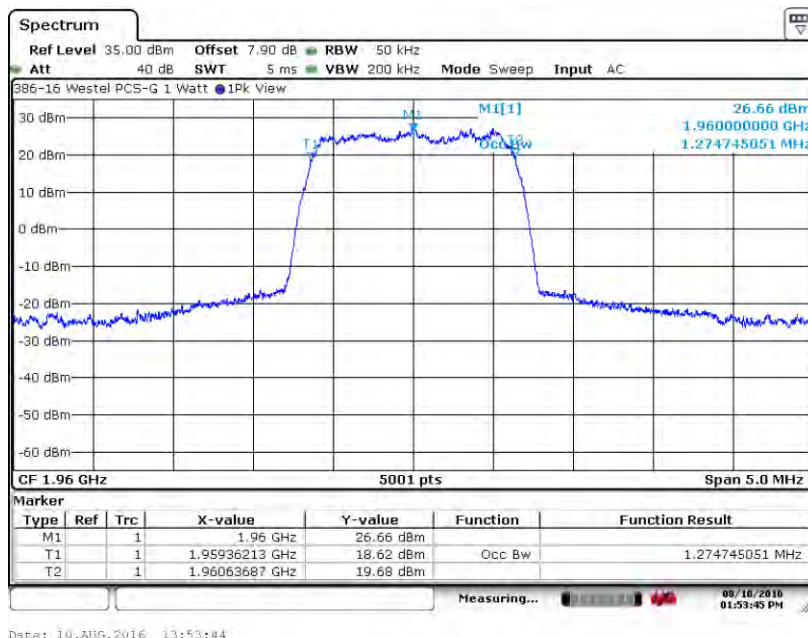
6.2.1.20. Occupied (99% Power) Bandwidth Input Signal, 1960 MHz GSM +3dB



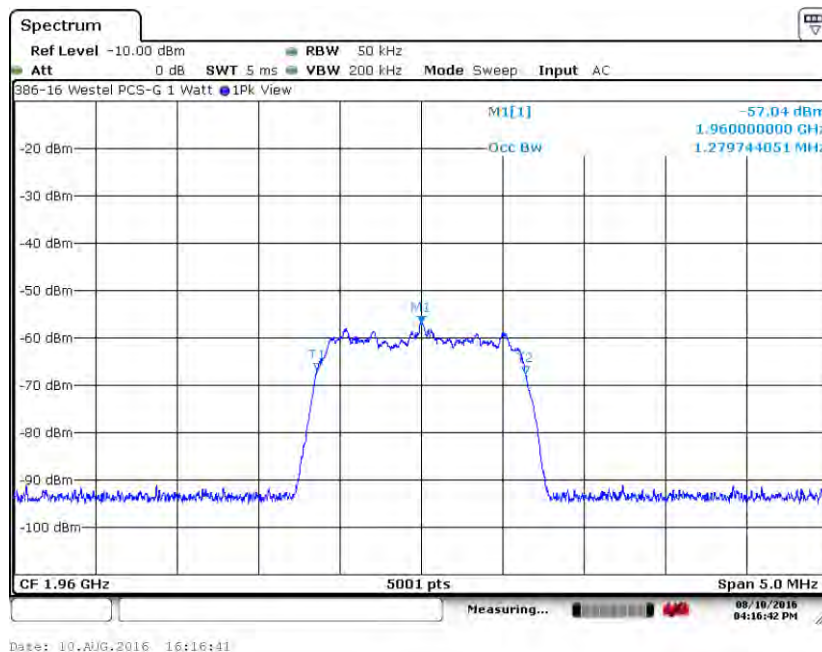
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.21. Occupied (99% Power) Bandwidth Measurement, 1960 MHz CDMA



6.2.1.22. Occupied (99% Power) Bandwidth Input Signal, 1960 MHz CDMA



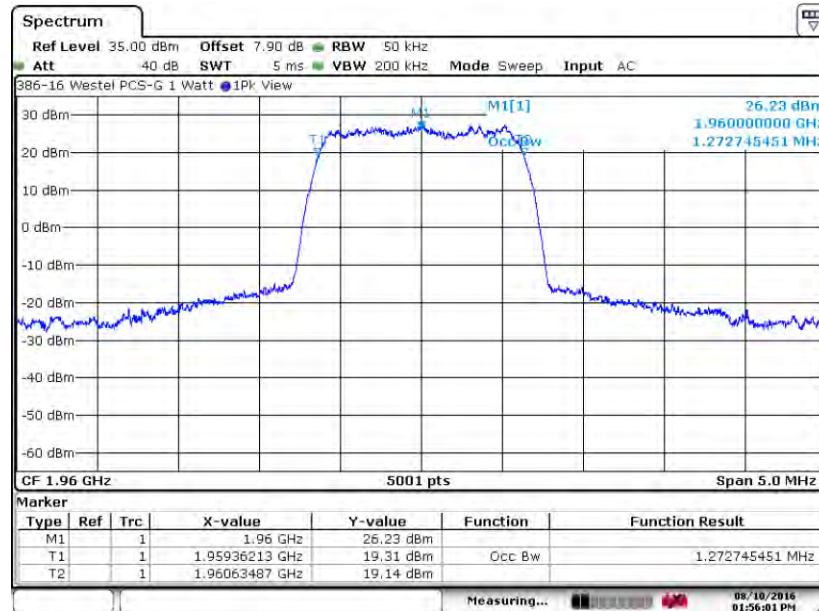
Test Number: 385-16AR1

Issue Date: 9/30/2016

6. Measurement Data (continued)

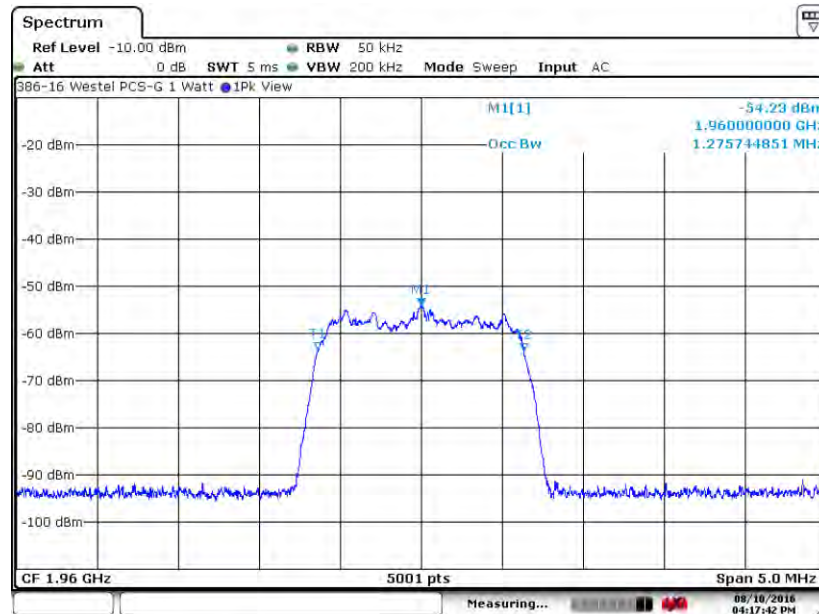
6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.23. Occupied (99% Power) Bandwidth Measurement, 1960 MHz CDMA +3dB



Date: 10.AUG.2016 13:55:59

6.2.1.24. Occupied (99% Power) Bandwidth Input Signal, 1960 MHz CDMA + 3dB



Date: 10.AUG.2016 16:17:41

6. Measurement Data (continued)

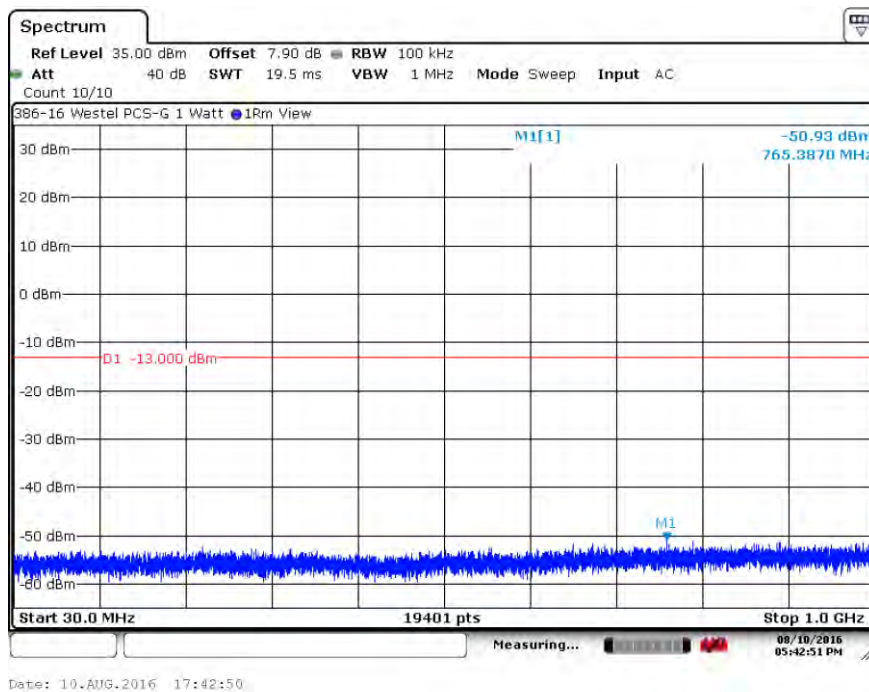
6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5

Requirement: For operations in the 1850-1915 MHz and 1930-1995 MHz bands, the power of any emission outside of the licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB.

Compliance with this provision is based upon 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 licensee's frequency block a resolution bandwidth of at least one percent of the emissions bandwidth of the fundamental emission of the transmitter may be employed. 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 emission are attenuated at least 26 dB below the transmitter power.

Test Method: KDB 935210 Section 3.6.3

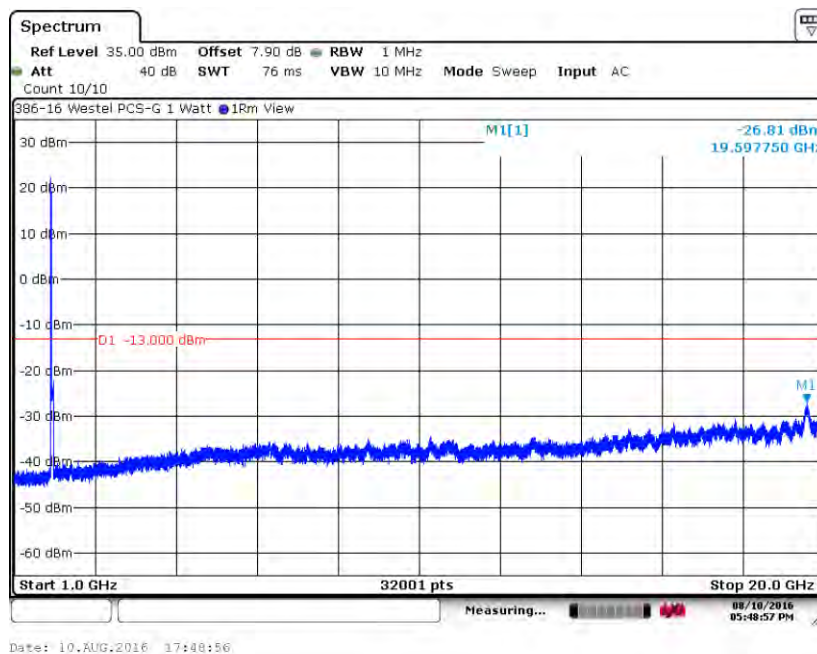
6.3.1. 1852 MHz, 30 MHz to 1 GHz, AWGN



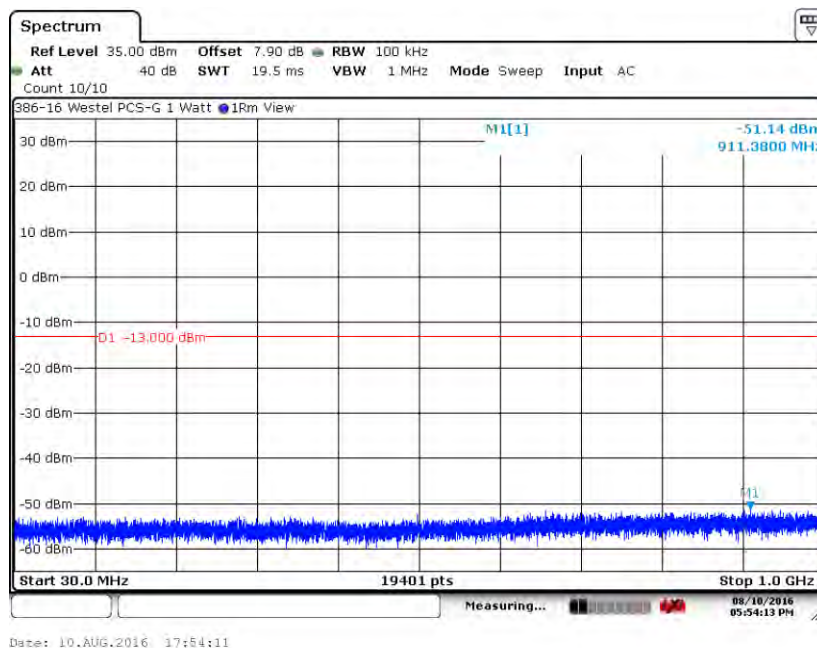
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.2. 1852 MHz, 1 to 20 GHz, AWGN



6.3.3. 1850 MHz, 30 MHz to 1 GHz, GSM



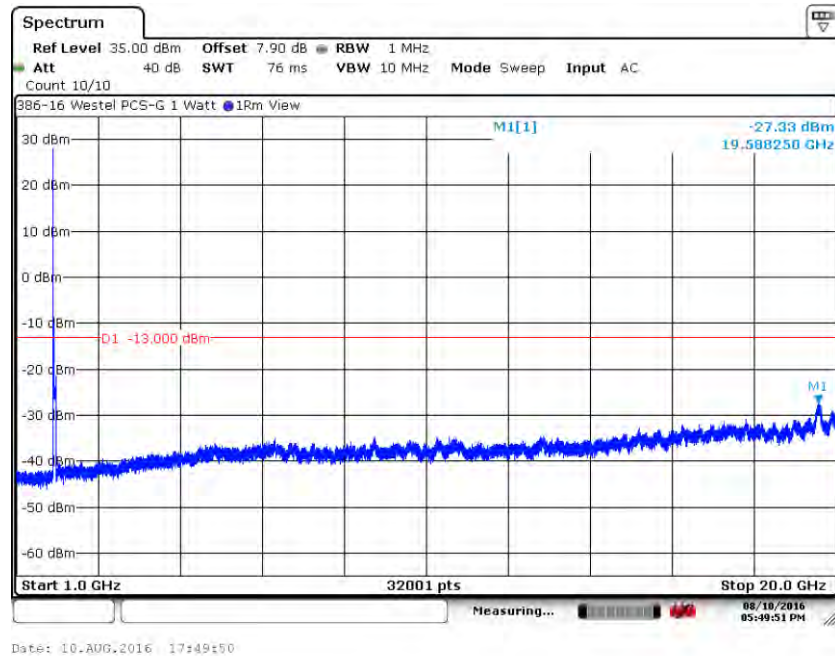
Test Number: 385-16AR1

Issue Date: 9/30/2016

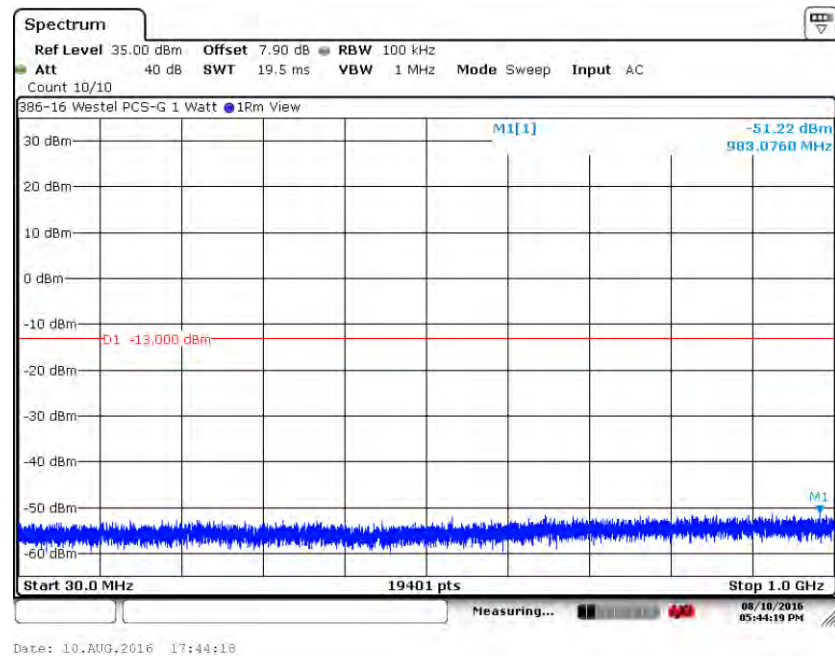
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.4. 1850 MHz, 1 to 20 GHz, GSM



6.3.5. 1882.5 MHz, 30 MHz to 1 GHz, AWGN



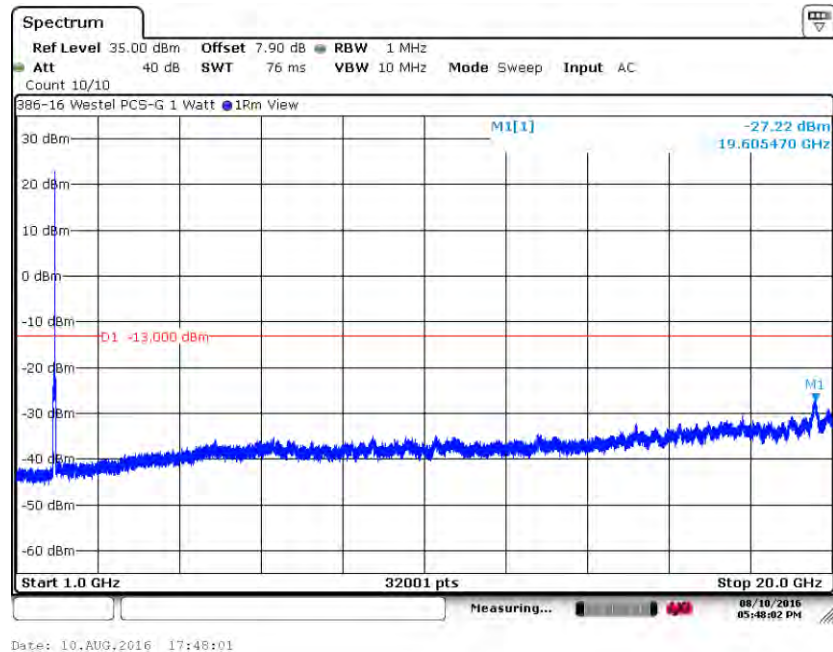
Test Number: 385-16AR1

Issue Date: 9/30/2016

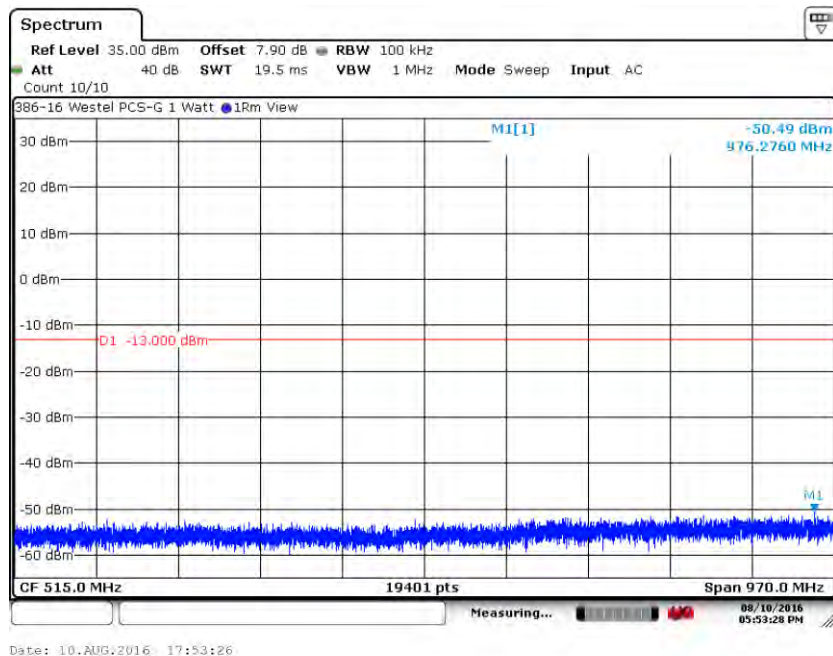
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.6. 1882.5 MHz, 1 to 20 GHz, AWGN



6.3.7. 1882.5 MHz, 30 MHz to 1 GHz, GSM



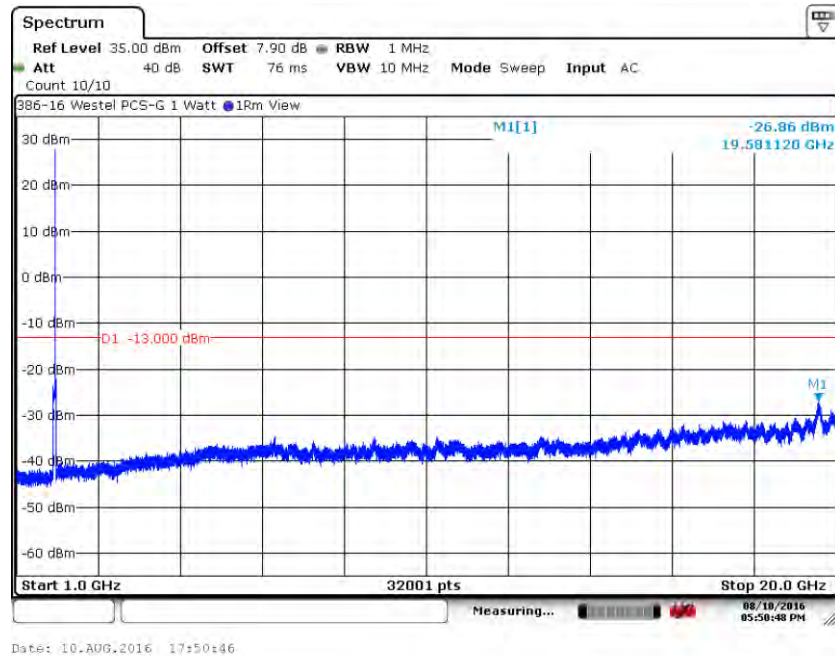
Test Number: 385-16AR1

Issue Date: 9/30/2016

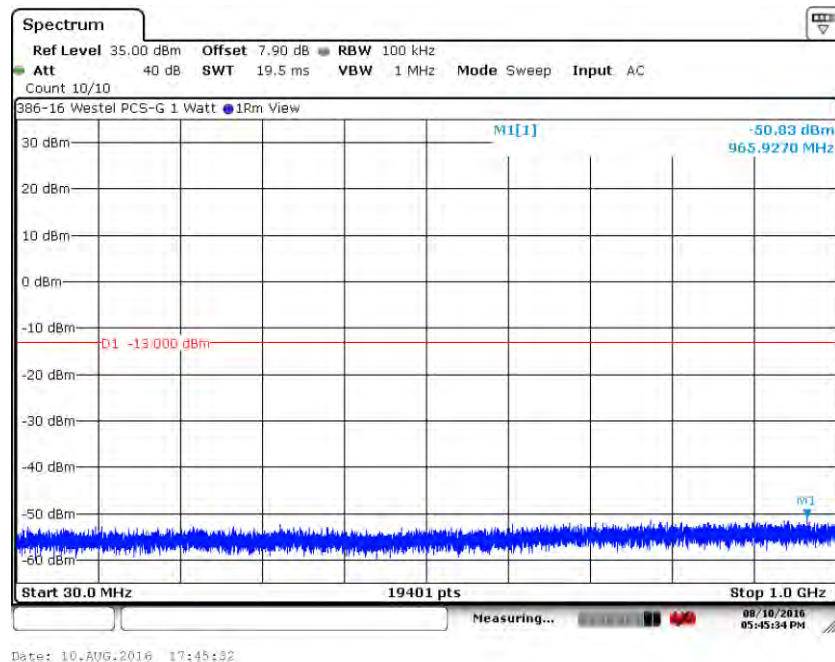
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.8. 1882.5 MHz, 1 to 20 GHz, GSM



6.3.9. 1913 MHz, 30 MHz to 1 GHz, AWGN



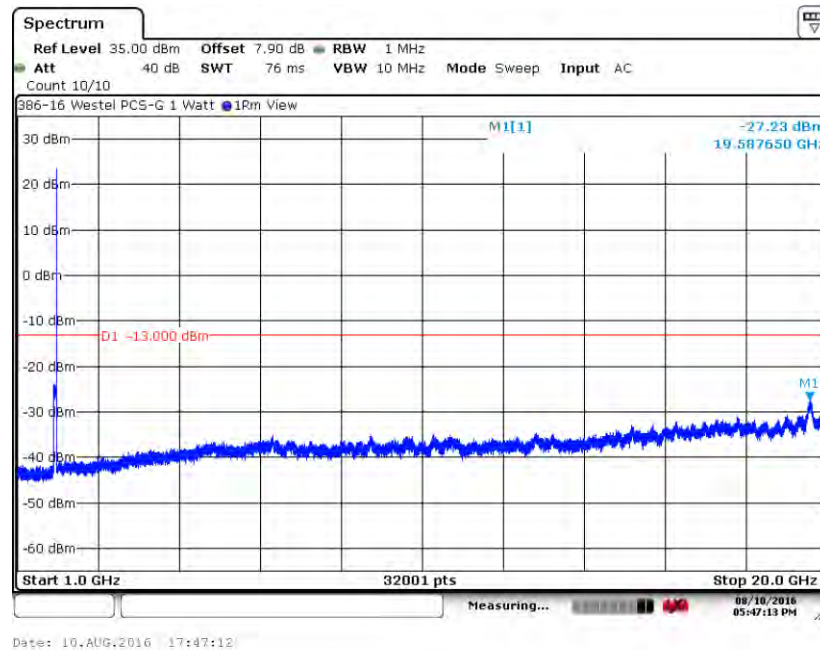
Test Number: 385-16AR1

Issue Date: 9/30/2016

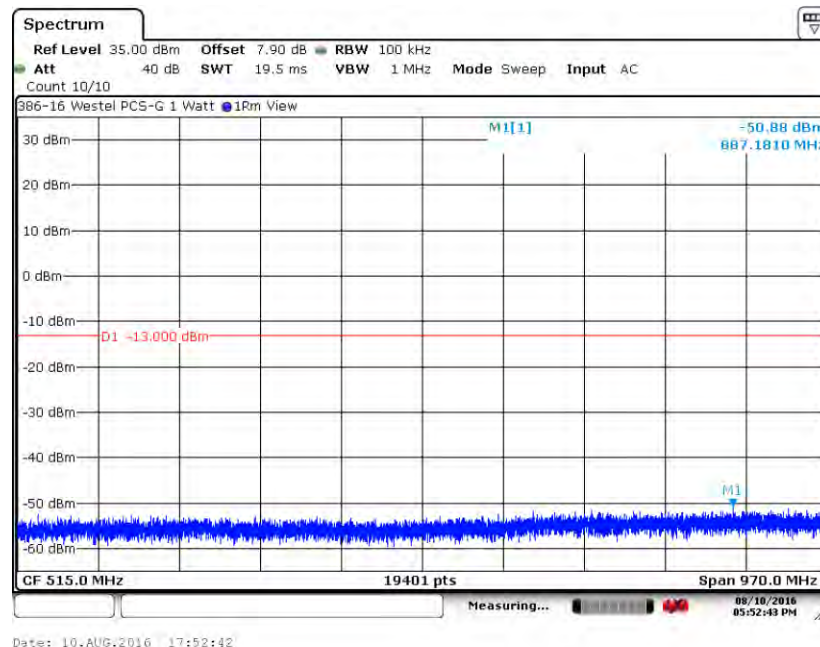
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.10. 1913 MHz, 1 to 20 GHz, AWGN



6.3.11. 1915 MHz, 30 MHz to 1 GHz, GSM



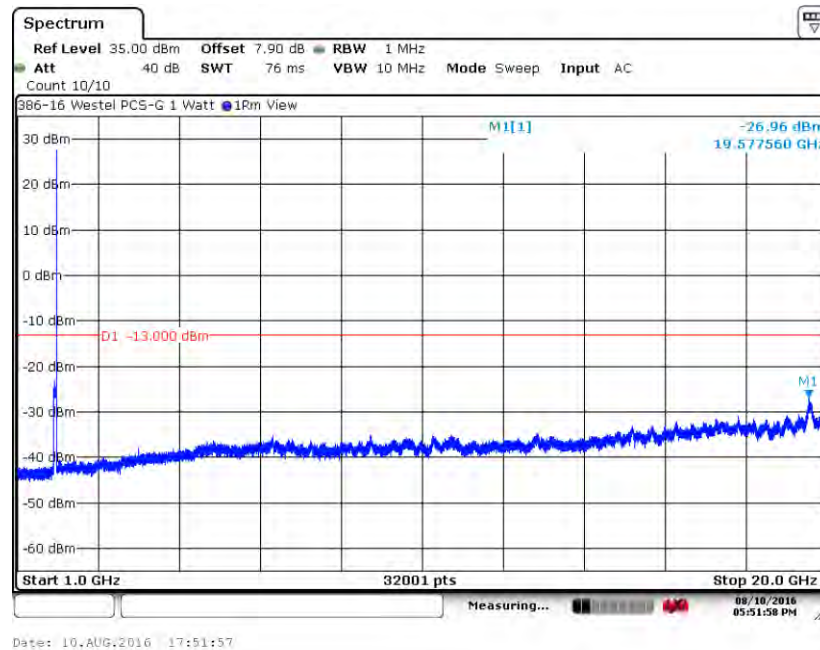
Test Number: 385-16AR1

Issue Date: 9/30/2016

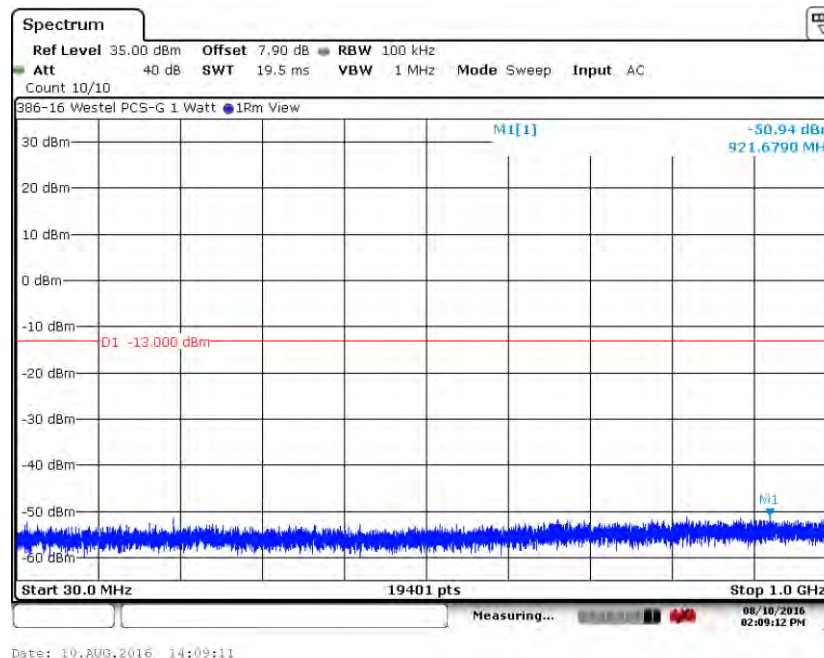
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.12. 1915 MHz, 1 to 20 GHz, GSM



6.3.13. 1932 MHz, 30 MHz to 1 GHz, AWGN



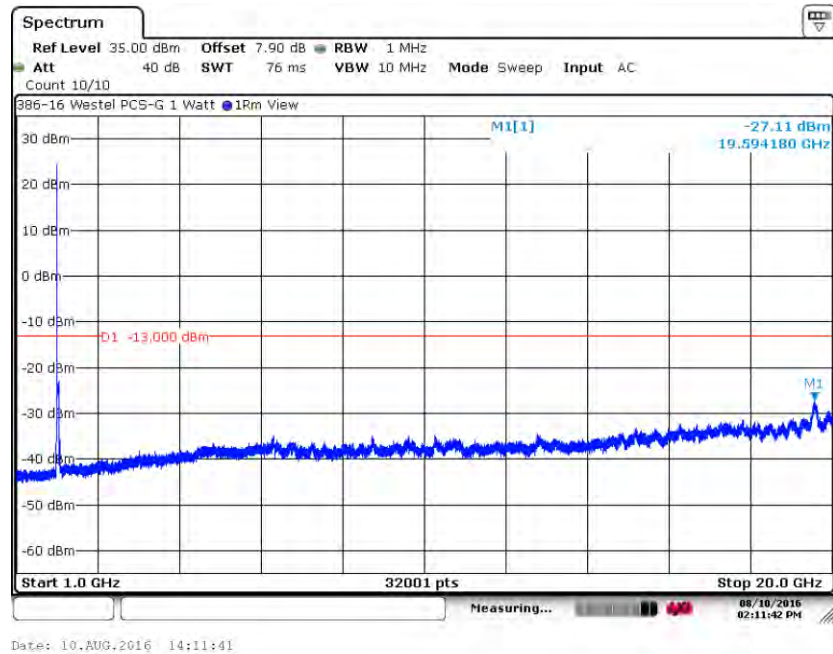
Test Number: 385-16AR1

Issue Date: 9/30/2016

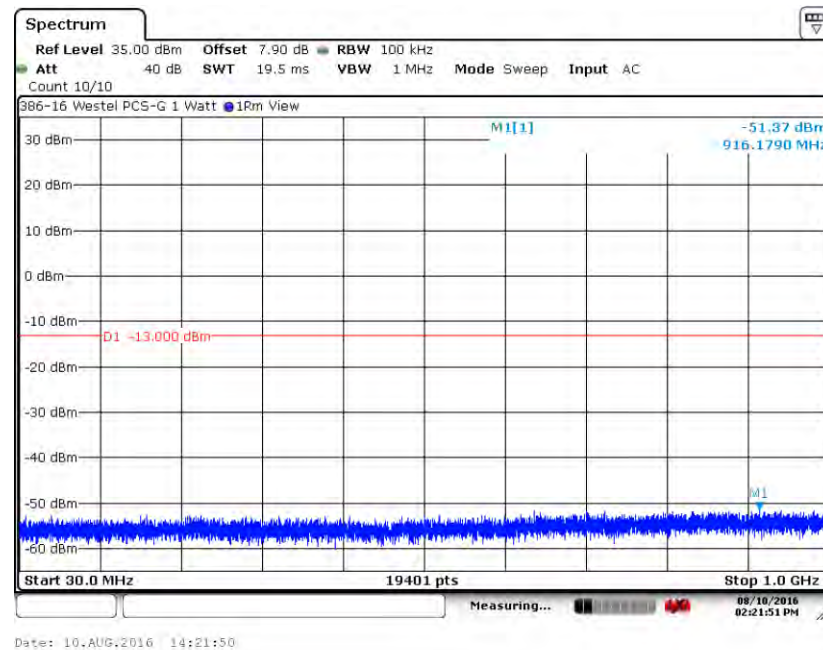
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.14. 1932 MHz, 1 to 20 GHz, AWGN



6.3.15. 1930 MHz, 30 MHz to 1 GHz, GSM



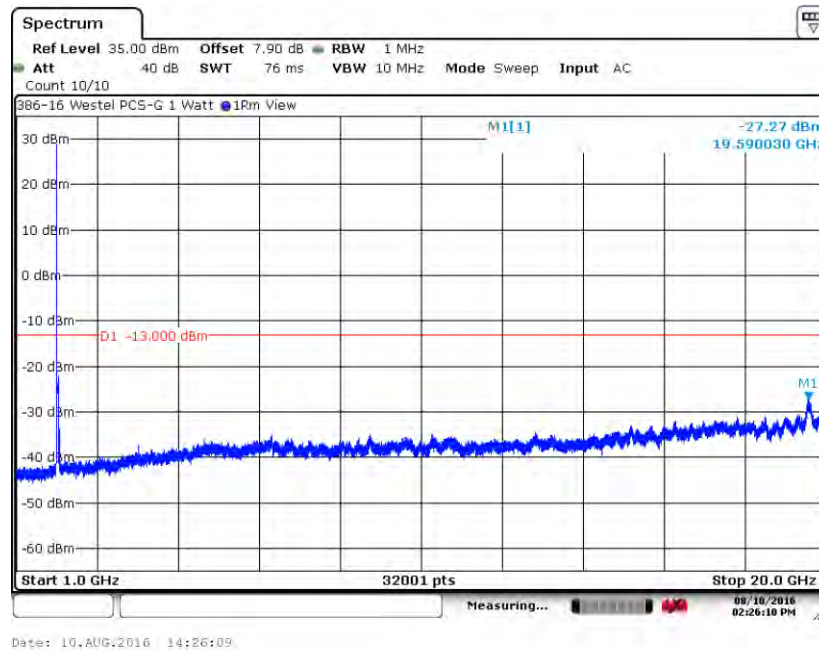
Test Number: 385-16AR1

Issue Date: 9/30/2016

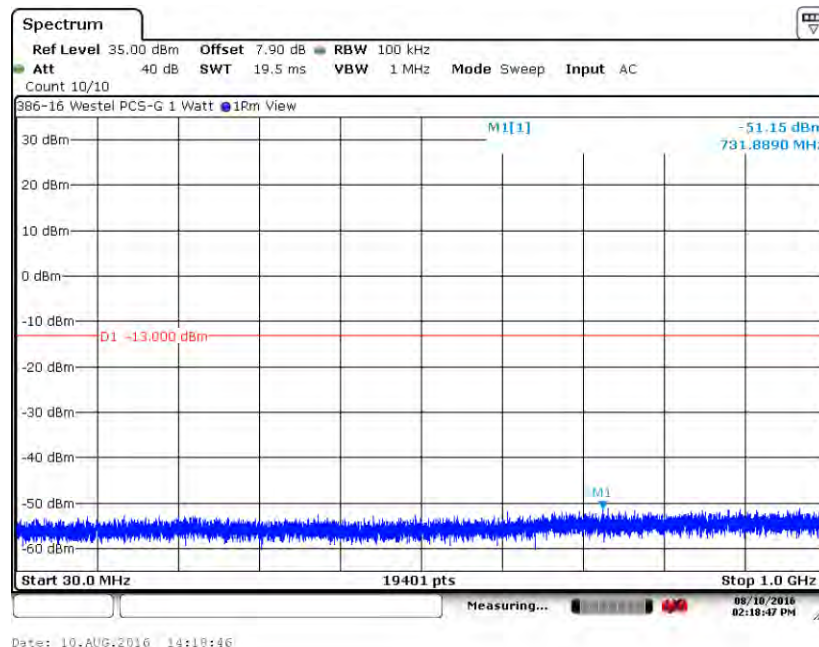
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.16. 1930 MHz, 1 to 20 GHz, GSM



6.3.17. 1960 MHz, 30 MHz to 1 GHz, AWGN



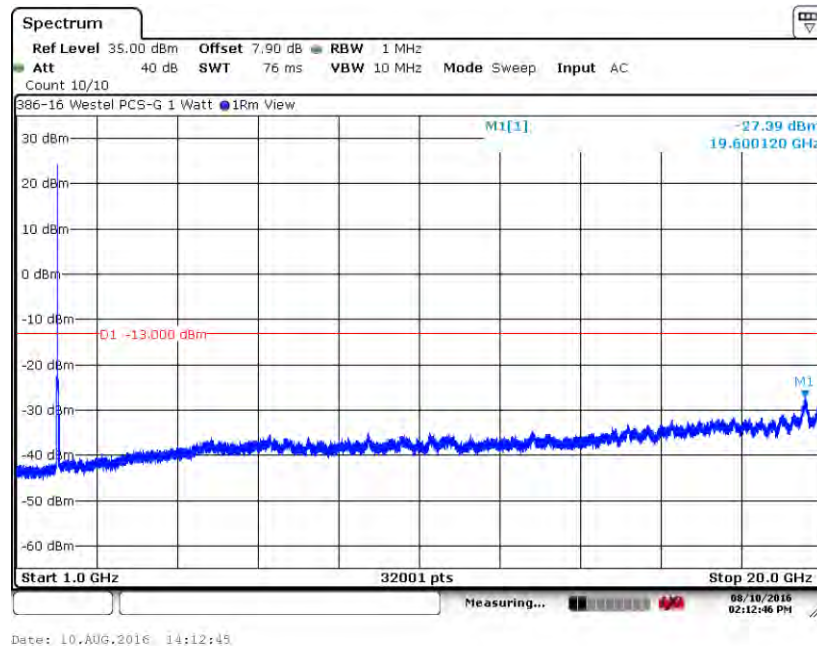
Test Number: 385-16AR1

Issue Date: 9/30/2016

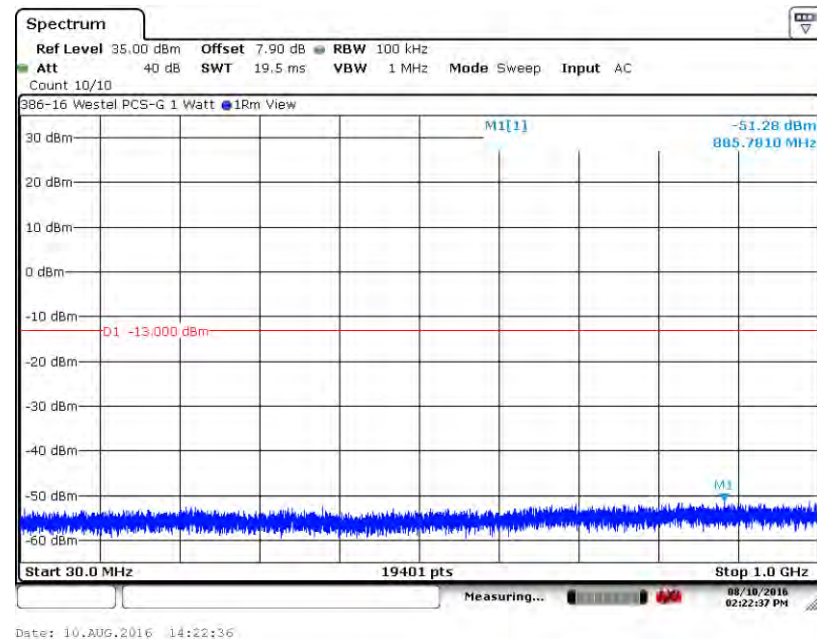
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.18. 1960 MHz, 1 to 20 GHz, AWGN



6.3.19. 1962.5 MHz, 30 MHz to 1 GHz, GSM



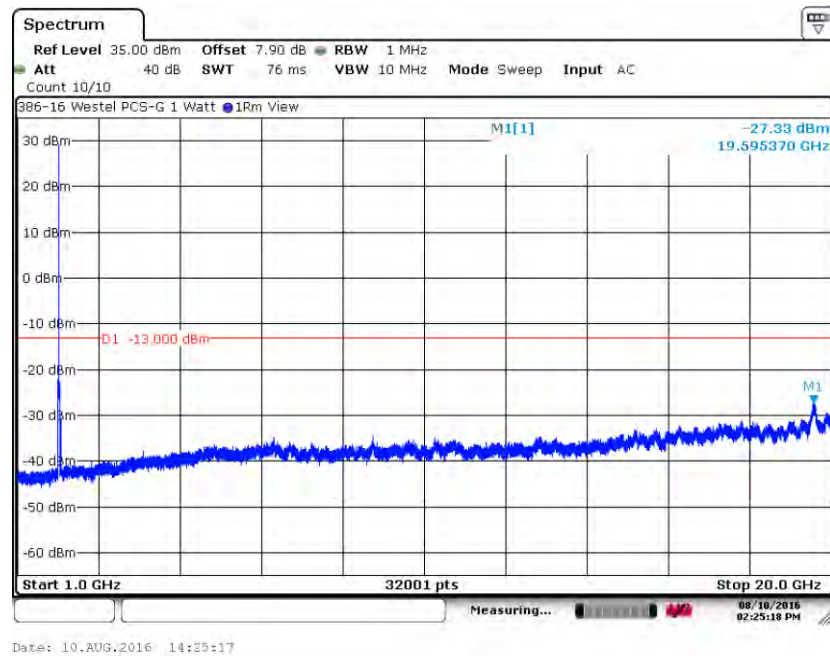
Test Number: 385-16AR1

Issue Date: 9/30/2016

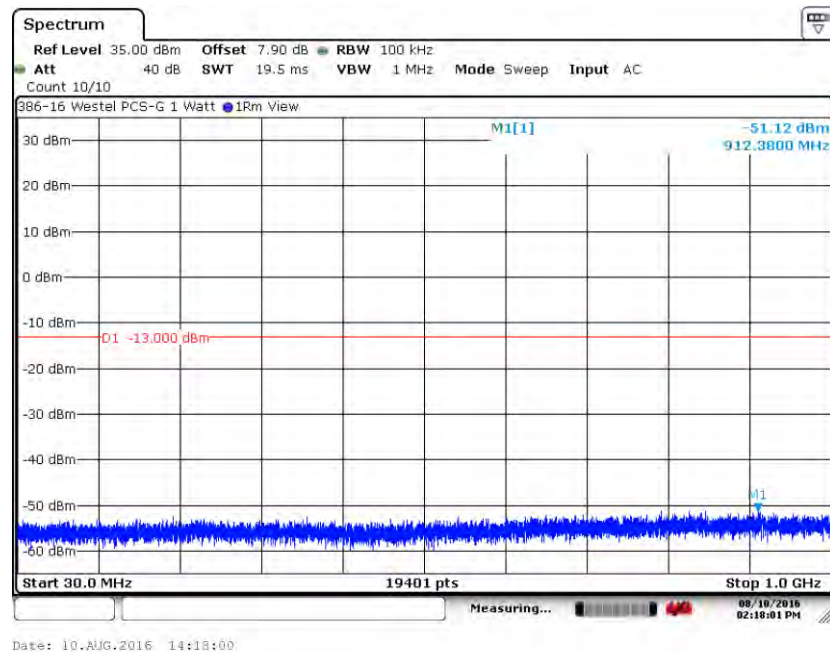
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.20. 1962.5 MHz, 1 to 20 GHz, GSM



6.3.21. 1993 MHz, 30 MHz to 1 GHz, AWGN



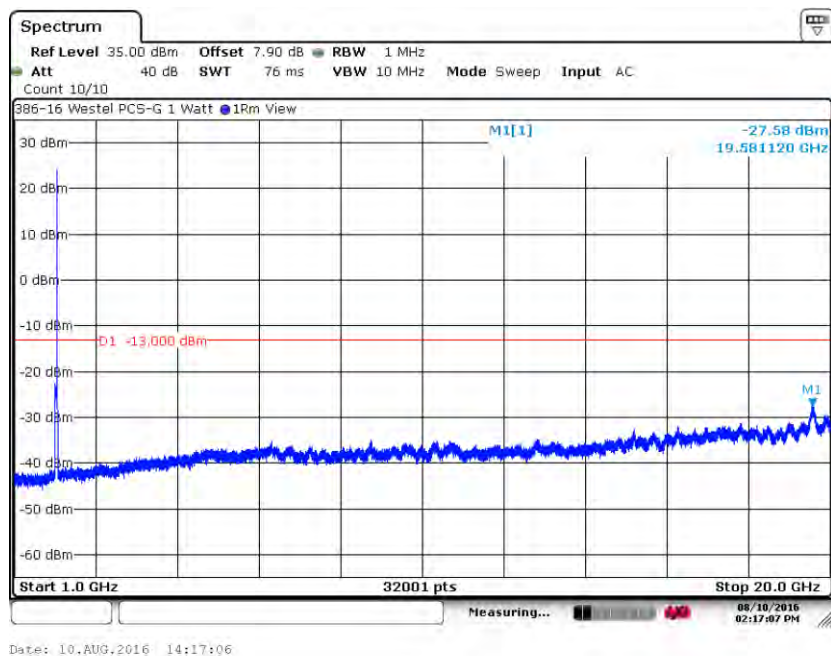
Test Number: 385-16AR1

Issue Date: 9/30/2016

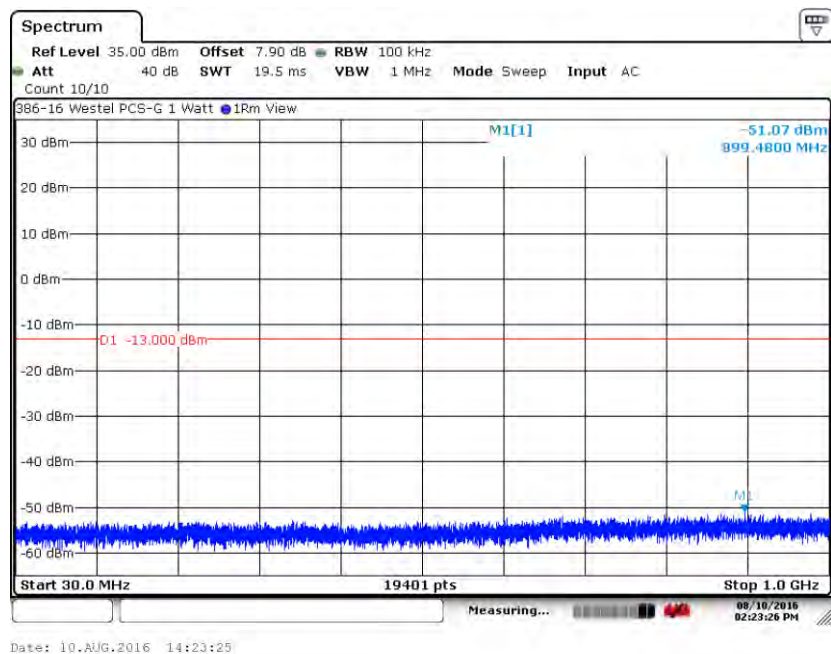
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.22. 1993 MHz, 1 to 20 GHz, AWGN



6.3.23. 1995 MHz, 30 MHz to 1 GHz, GSM



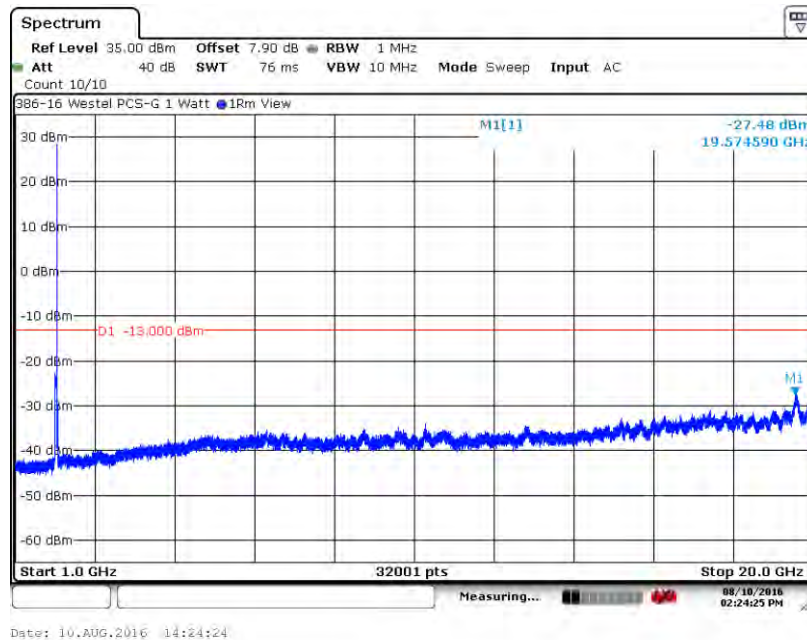
Test Number: 385-16AR1

Issue Date: 9/30/2016

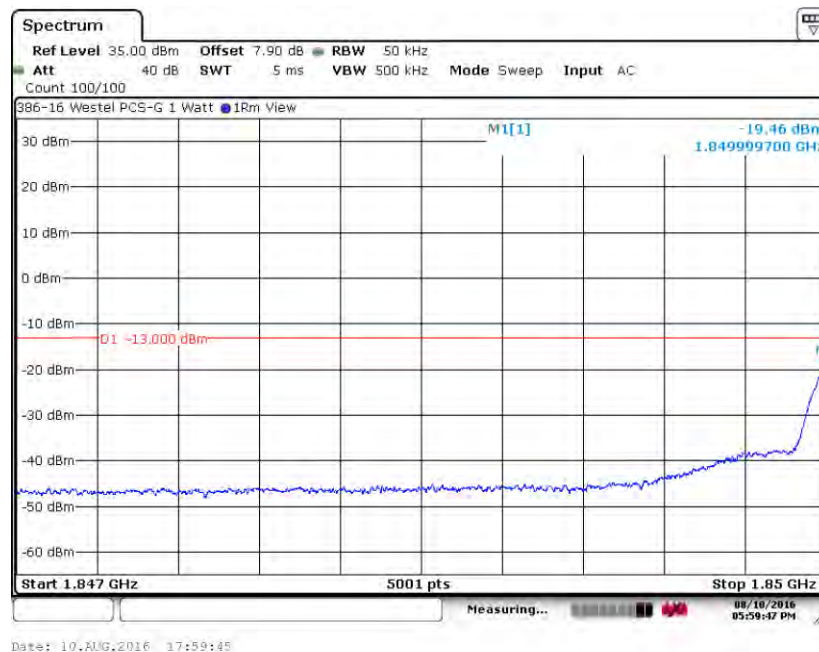
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.24. 1995 MHz, 1 to 20 GHz, GSM



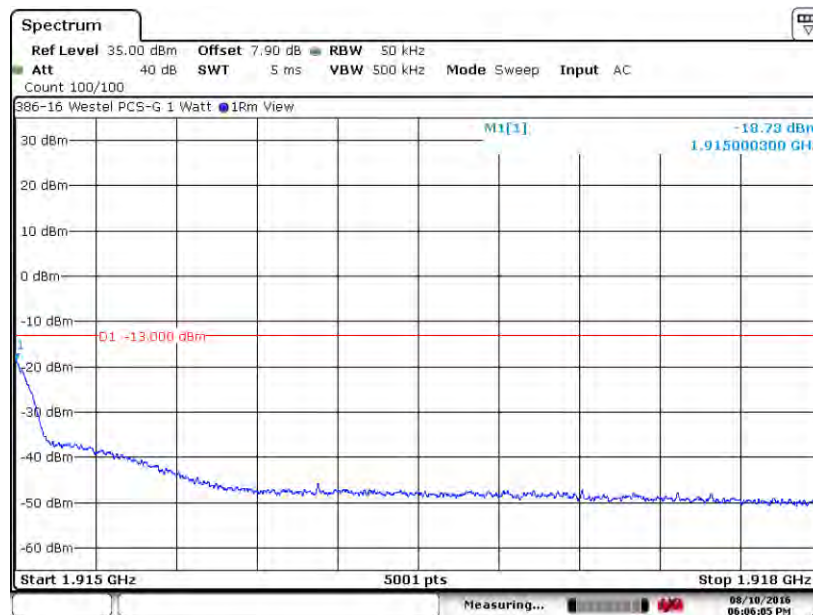
6.3.25. 1850 MHz Lower Bandedge, AWGN



6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.26. 1915 MHz Upper Bandedge, AWGN



Date: 10.AUG.2016 18:06:04

6.3.27. 1850 MHz Lower Bandedge, GSM



Date: 10.AUG.2016 18:10:37

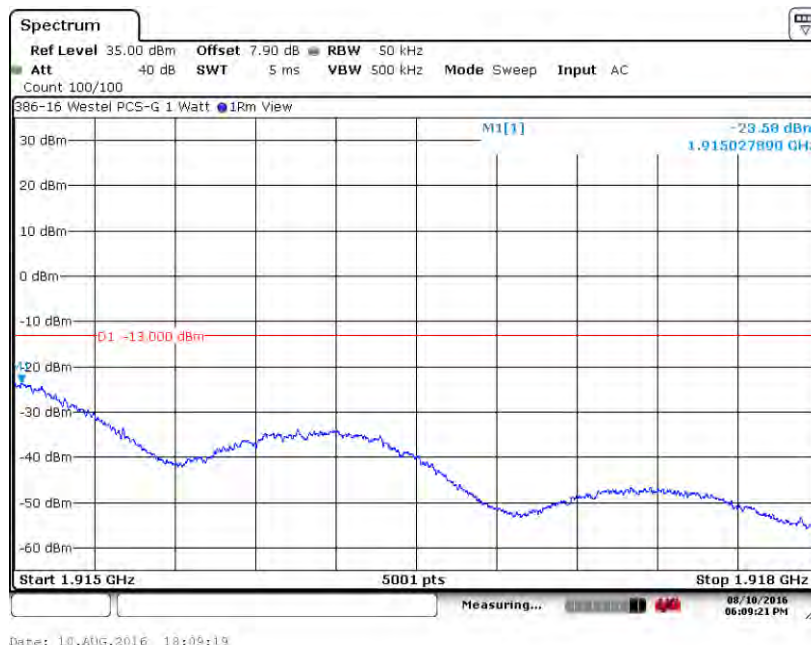
Test Number: 385-16AR1

Issue Date: 9/30/2016

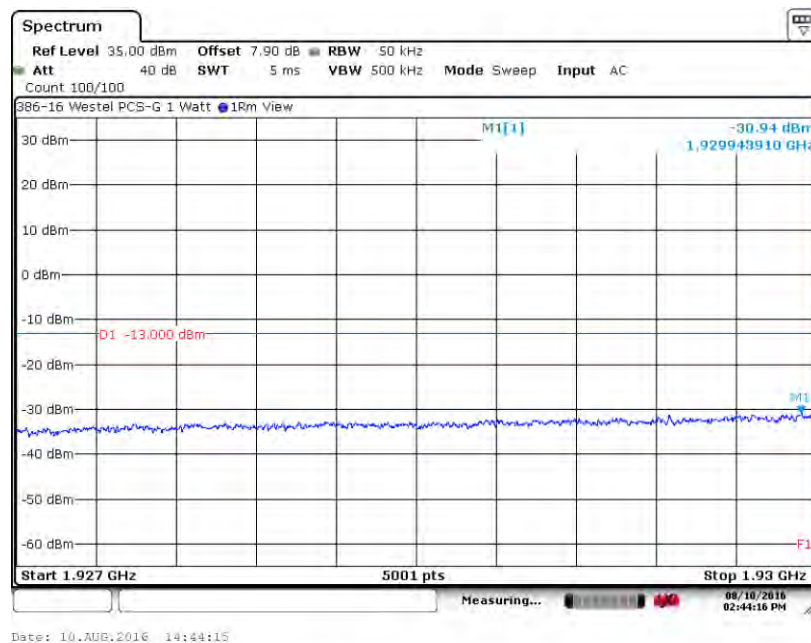
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.26. 1915 MHz Upper Bandedge, GSM



6.3.27. 1930 MHz, Lower bandedge, AWGN



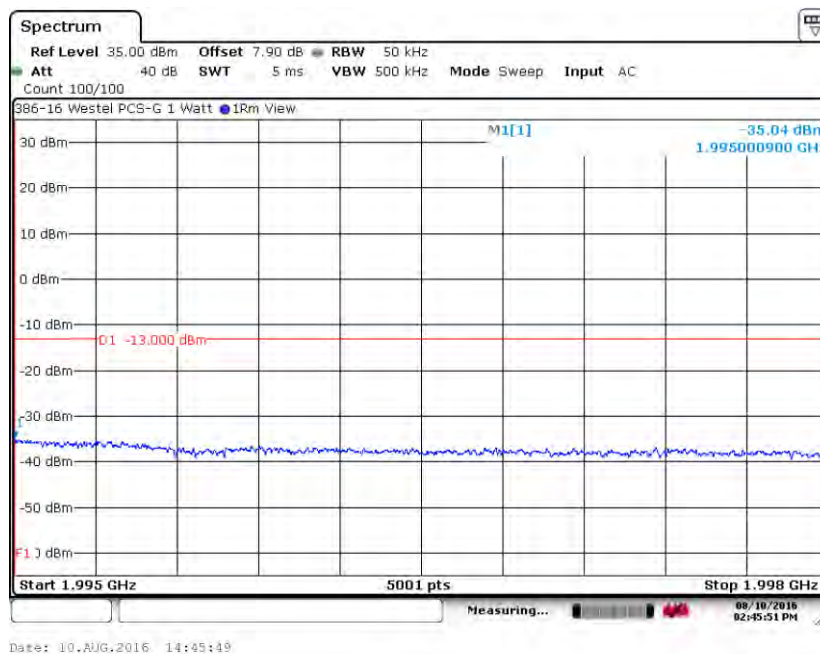
Test Number: 385-16AR1

Issue Date: 9/30/2016

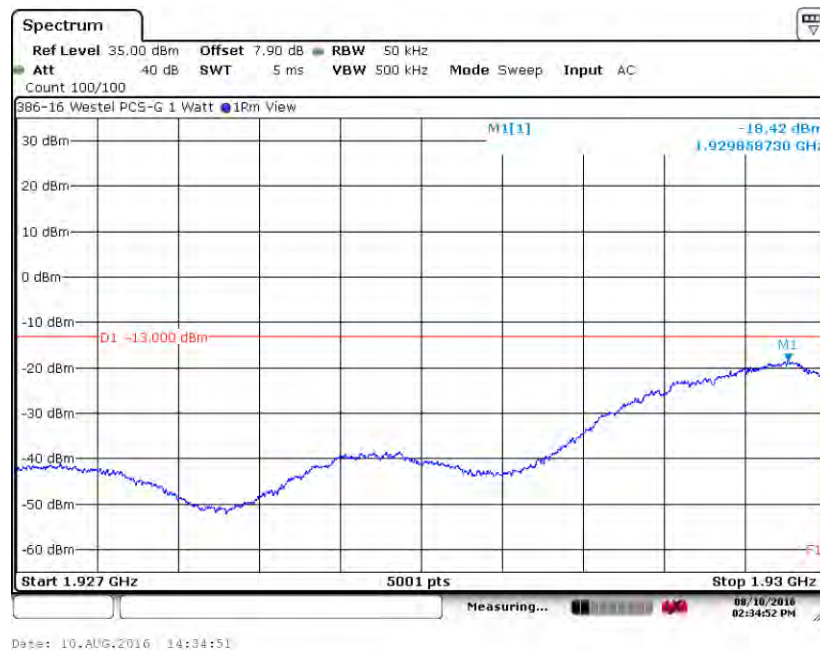
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.28. 1995 MHz, Upper bandedge, AWGN



6.3.29. 1930 MHz, Lower bandedge, GSM



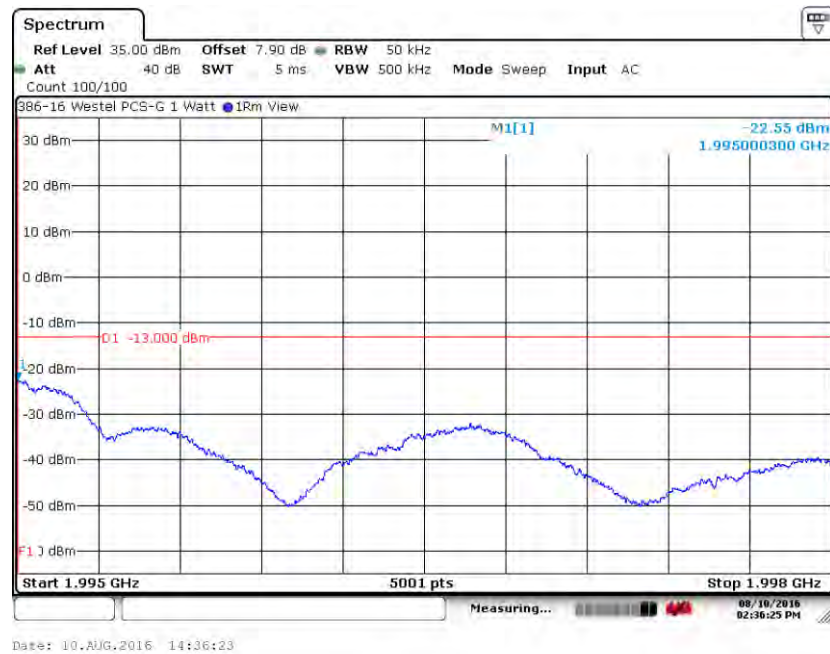
Test Number: 385-16AR1

Issue Date: 9/30/2016

6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 24.238 (a), RSS-133 6.5 (continued)

6.3.30. 1995 MHz, Upper bandedge, GSM



6. Measurement Data (continued)**6.4. Field Strength of Spurious Emissions 24.238 (a), RSS-133 6.5**

Requirement: For operations in the 1850-1915 MHz and 1930-1995 MHz bands, the power of any emission outside of the licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB.

Compliance with this provision is based upon 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 licensee's frequency block a resolution bandwidth of at least one percent of the emissions bandwidth of the fundamental emission of the transmitter may be employed. 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 emission are attenuated at least 26 dB below the transmitter power.

Test Method: KDB 935210 Section 3.8

6.4.1. Measurement and Equipment Setup

Test Date:	5/27/2016
Test Engineer:	Cody Merry
Site Temperature (°C):	22
Relative Humidity (%RH):	32
Frequency Range:	30 MHz to 1 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	120 kHz
EMI Receiver Avg Bandwidth:	300 kHz
Detector Functions:	Peak and Quasi-Peak.
Antenna Height:	1 to 4 meters

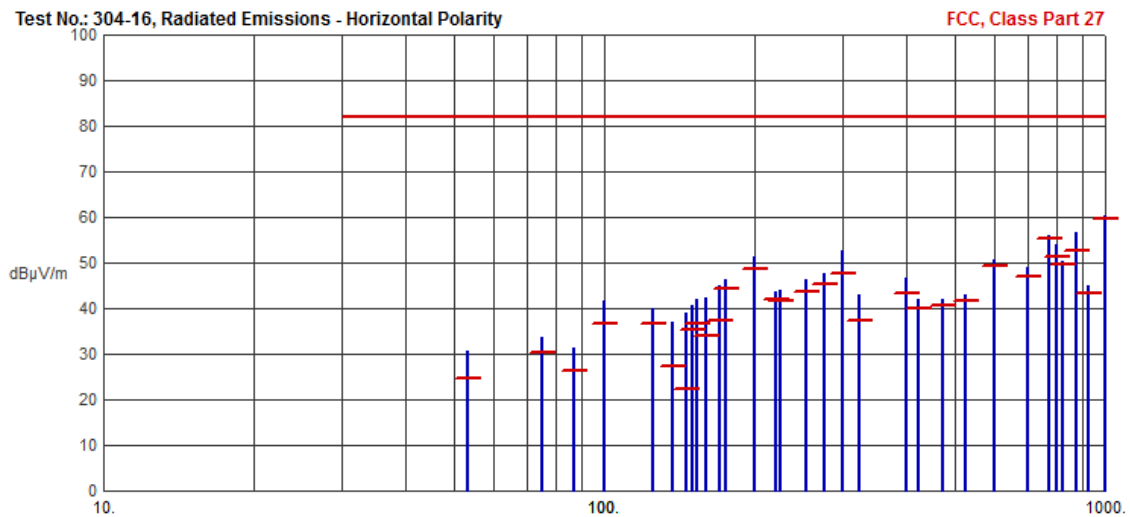
6.4.2 Test Procedure

Test measurements were made in accordance with ANSI C63.4-2014, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 24.238 (a), RSS-133 6.5 (continued)

6.4.3. Horizontal Polarity



6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 24.238 (a), RSS-133 6.5 (continued)

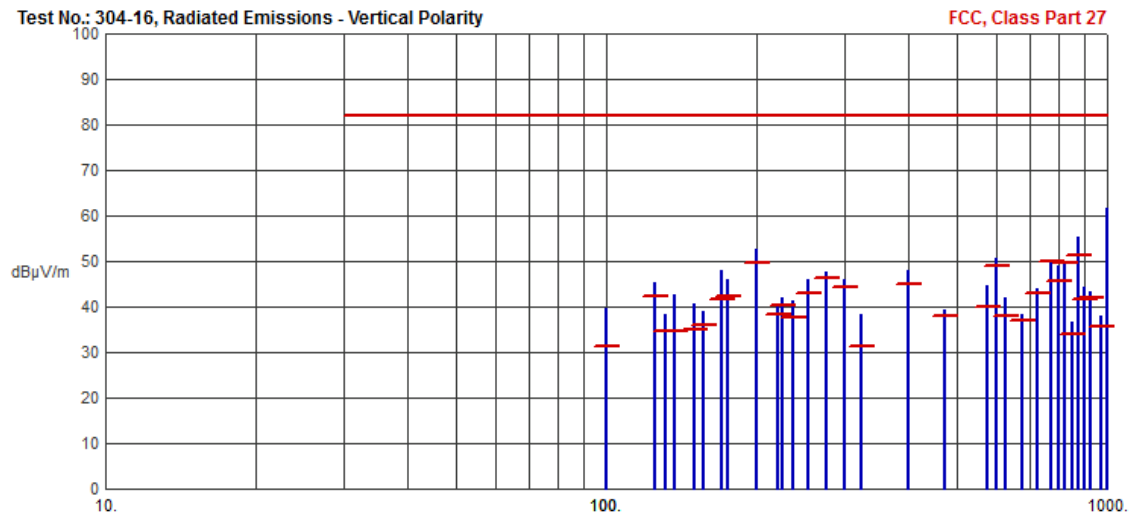
6.4.3. Horizontal Polarity

Frequency (MHz)	Pk Amp (dBμV/m)	QP Amp (dBμV/m)	QP Limit (dBμV/m)	Margin (dB)	Ant Ht (cm)	Table (Deg)	Comments
53.5523	30.78	24.60	82.00	-57.40	N/A	N/A	
75.0063	33.51	30.19	82.00	-51.81	N/A	N/A	
86.7000	31.22	26.32	82.00	-55.68	N/A	N/A	
100.0041	41.67	36.77	82.00	-45.23	N/A	N/A	
125.0156	40.14	36.70	82.00	-45.30	N/A	N/A	
136.7170	36.88	27.49	82.00	-54.51	N/A	N/A	
145.9500	39.15	22.48	82.00	-59.52	N/A	N/A	
149.9712	40.82	35.33	82.00	-46.67	N/A	N/A	
153.3505	41.93	36.78	82.00	-45.22	N/A	N/A	
159.9674	42.41	33.99	82.00	-48.01	N/A	N/A	
169.9827	45.04	37.35	82.00	-44.65	N/A	N/A	
174.9914	46.26	44.19	82.00	-37.81	N/A	N/A	
200.0400	51.50	48.58	82.00	-33.42	N/A	N/A	
220.0155	43.68	41.88	82.00	-40.12	N/A	N/A	
225.0177	44.02	41.62	82.00	-40.38	N/A	N/A	
253.3552	46.37	43.78	82.00	-38.22	N/A	N/A	
275.0116	47.54	45.22	82.00	-36.78	N/A	N/A	
300.0517	52.59	47.80	82.00	-34.20	N/A	N/A	
322.8827	43.09	37.32	82.00	-44.68	N/A	N/A	
400.0113	46.69	43.40	82.00	-38.60	N/A	N/A	
425.0381	42.08	40.14	82.00	-41.86	N/A	N/A	
475.0356	42.16	40.76	82.00	-41.24	N/A	N/A	
525.0463	43.11	41.62	82.00	-40.38	N/A	N/A	
600.0006	50.70	49.40	82.00	-32.60	N/A	N/A	
700.1484	49.02	47.08	82.00	-34.92	N/A	N/A	
775.0402	55.89	55.38	82.00	-26.62	N/A	N/A	
799.9964	53.98	51.21	82.00	-30.79	N/A	N/A	
825.0565	50.27	49.53	82.00	-32.47	N/A	N/A	
875.0714	56.54	52.68	82.00	-29.32	N/A	N/A	
925.0619	44.86	43.39	82.00	-38.61	N/A	N/A	
999.9781	60.27	59.71	82.00	-22.29	N/A	N/A	

6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 24.238 (a), RSS-133 6.5 (continued)

6.4.4. Vertical Polarity



6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 24.238 (a), RSS-133 6.5 (continued)

6.4.4. Vertical Polarity

Frequency (MHz)	Pk Amp (dBμV/m)	QP Amp (dBμV/m)	QP Limit (dBμV/m)	Margin (dB)	Ant Ht (cm)	Table (Deg)	Comments
100.0199	39.68	31.28	82.00	-50.72	N/A	N/A	
125.0018	45.45	42.21	82.00	-39.79	N/A	N/A	
130.9679	38.28	34.59	82.00	-47.41	N/A	N/A	
136.6637	42.79	34.80	82.00	-47.20	N/A	N/A	
150.0032	40.62	35.01	82.00	-46.99	N/A	N/A	
156.7822	39.08	36.05	82.00	-45.95	N/A	N/A	
169.9844	48.16	41.73	82.00	-40.27	N/A	N/A	
175.0285	45.95	42.23	82.00	-39.77	N/A	N/A	
200.0439	52.62	49.81	82.00	-32.19	N/A	N/A	
220.0140	39.88	38.22	82.00	-43.78	N/A	N/A	
225.0040	41.91	40.32	82.00	-41.68	N/A	N/A	
236.6969	41.17	37.81	82.00	-44.19	N/A	N/A	
253.3437	45.85	42.95	82.00	-39.05	N/A	N/A	
275.0116	47.65	46.19	82.00	-35.81	N/A	N/A	
300.0332	46.02	44.17	82.00	-37.83	N/A	N/A	
322.8553	38.23	31.21	82.00	-50.79	N/A	N/A	
400.0040	48.00	45.14	82.00	-36.86	N/A	N/A	
475.0290	39.40	37.96	82.00	-44.04	N/A	N/A	
575.0469	44.55	39.96	82.00	-42.04	N/A	N/A	
599.9975	50.53	49.16	82.00	-32.84	N/A	N/A	
625.0600	41.93	38.14	82.00	-43.86	N/A	N/A	
675.0548	38.44	36.84	82.00	-45.16	N/A	N/A	
725.0476	44.14	43.05	82.00	-38.95	N/A	N/A	
775.0516	50.42	49.85	82.00	-32.15	N/A	N/A	
799.9841	49.02	45.79	82.00	-36.21	N/A	N/A	
825.0400	50.05	49.51	82.00	-32.49	N/A	N/A	
850.0610	36.71	33.95	82.00	-48.05	N/A	N/A	
875.0659	55.41	51.49	82.00	-30.51	N/A	N/A	
900.1695	44.26	41.83	82.00	-40.17	N/A	N/A	
925.0621	43.27	42.08	82.00	-39.92	N/A	N/A	
975.0823	37.97	35.82	82.00	-46.18	N/A	N/A	

6. Measurement Data (continued)**6.4. Field Strength of Spurious Emissions 24.238 (a), RSS-133 6.5 (continued)****6.4.5. Measurement and Equipment Setup**

Test Date:	5/27/2016
Test Engineer:	Cody Merry
Site Temperature (°C):	24
Relative Humidity (%RH):	33
Frequency Range:	Above 1 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	1 MHz
EMI Receiver Avg Bandwidth:	3 MHz
Detector Functions:	Peak and Average
Antenna Height:	1 to 4 meters

6.4.6. Radiated Emissions above 1 GHz

There were no measureable emissions above 1 GHz

6. Measurement Data (continued)

6.5. Frequency Stability 27.54, RSS-133 6.3 and RSS-GEN

Requirement: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized band of operation.

Test Method: KDB 935210 Section 3.7

Note: The EUT does not translate the input frequency and therefore this testing was not performed.

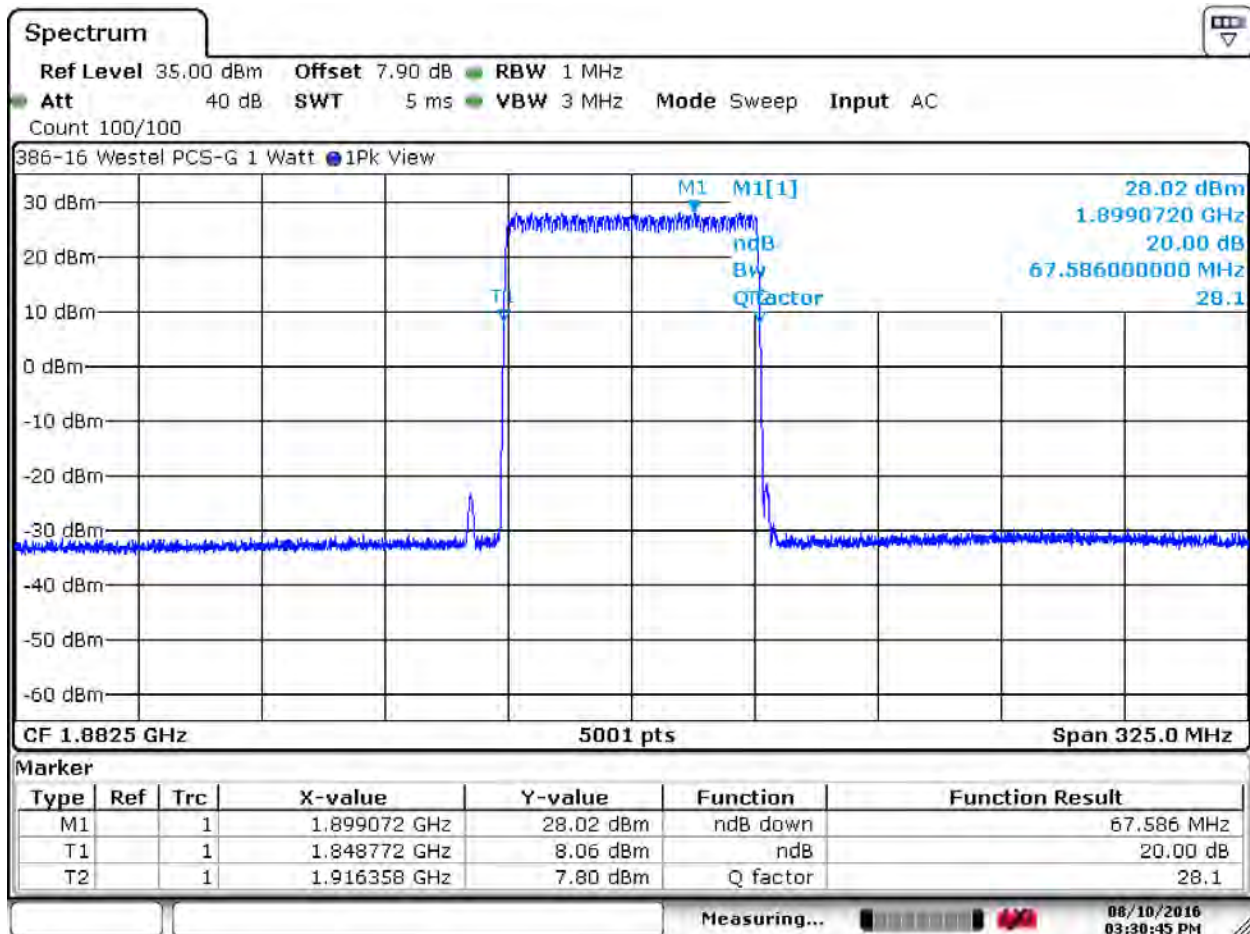
6. Measurement Data (continued)

6.6. Out of Band Rejection FCC KDB 935210

Requirement: Over a +/- 250 % span of the passband of the EUT measure the 20 dB bandwidth of the pass band of the EUT.

Test Method: KDB 935210 Section 3.3

6.6.1. 1882.5 MHz Center Frequency, $f_0 = 1899$ MHz



Date: 10.AUG.2016 15:30:44

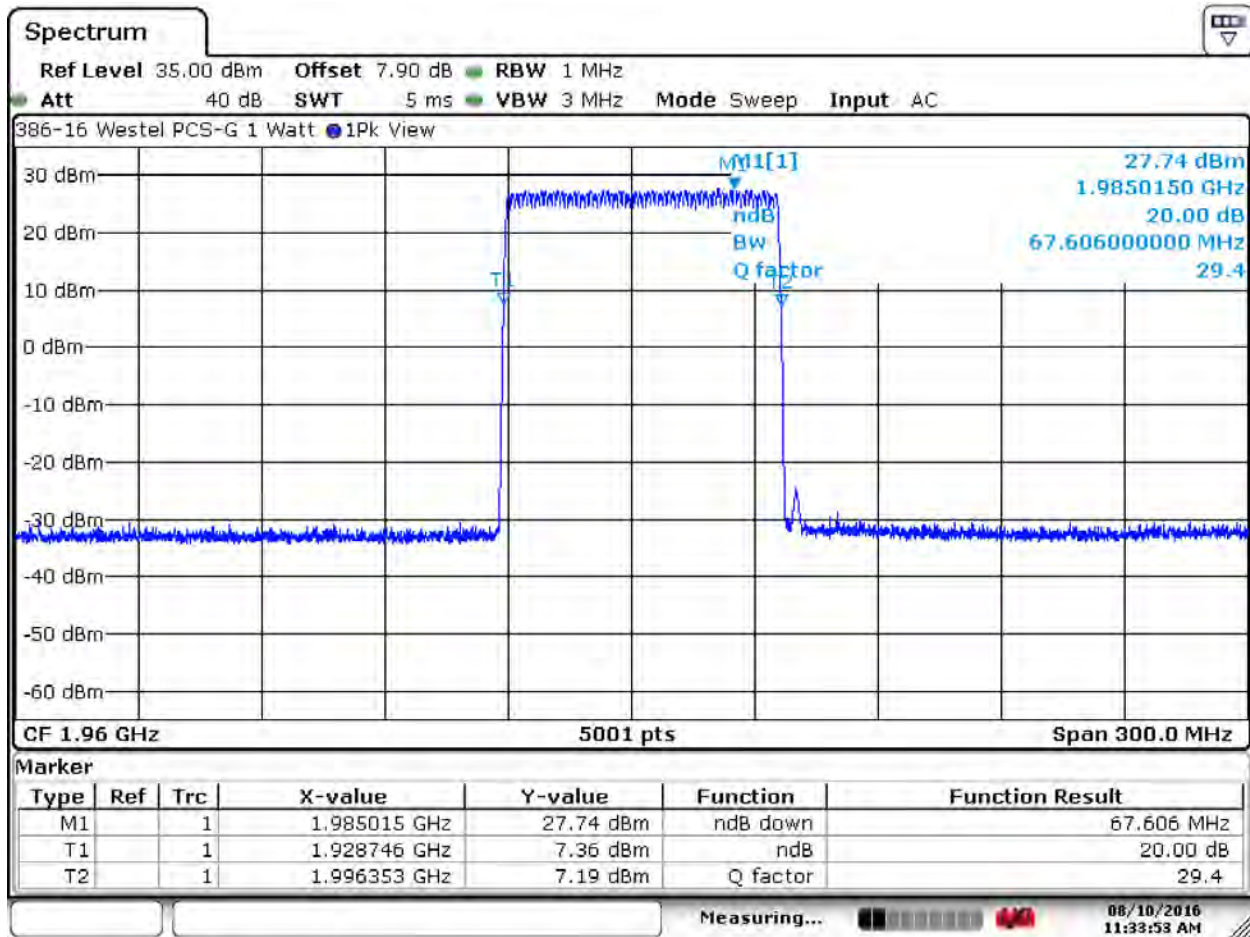
Test Number: 385-16AR1

Issue Date: 9/30/2016

6. Measurement Data (continued)

6.6. Out of Band Rejection FCC KDB 935210 (continued)

6.6.2. 1960 MHz, Center Frequency, $f_0 = 1985$ MHz



Date: 10.AUG.2016 11:33:53

6. Measurement Data (continued)

6.7. Public Exposure to Radio Frequency Energy Levels 1.1307 (b)(1), RSS-GEN, Issue 4 Section 3.2, RSS 102

Center Frequency (MHz)	MPE Distance (cm)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	Power Density		FCC Limit (mW/cm ²)	IC Limit (W/m ²)
				(mW/cm ²)	(W/m ²)		
	(1)	(2)	(3)	(4)		(5)	(6)
1899	20.0	29.07	3.00	0.3204278	3.2042777	5	28.13
1899	20.0	29.11	3.00	0.3233926	3.2339265	5	28.13
1899	20.0	28.99	3.00	0.3145793	3.1457930	5	28.13
1985	20.0	29.48	3.00	0.3521520	3.5215199	5	28.76
1985	20.0	29.59	3.00	0.3611854	3.6118536	5	28.76
1985	20.0	29.14	3.00	0.3256343	3.2563430	5	28.76

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

1. Reference CFR 2.1093(b): For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.
2. Section 6.1.2 of this test report. Note that the value has been adjusted to include the cable insertion loss.
3. Data supplied by the client for combination of cable loss and antenna gain.
4. Power density is calculated from field strength measurement and antenna gain.
5. Reference CFR 1.1310, Table 1: Limits for Maximum Permissible Exposure (MPE), Section (A): Limits for Occupational/Controlled Exposure.
6. Reference IC RSS-102 Section 4 Table 6 Controlled Use Devices (Controlled Environment) for equipment operating from 100 to 6000 MHz, the W/m² limit is determined by the formula $0.6455 \times F \text{ (MHz)}^{0.5}$

7. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with with Federal Communications Commission (FCC) and Industry Canada standards. Through our American Association for Laboratory Accreditation (A2LA) ISO Guide 17025:2005 Accreditation our test sites are designated with the FCC (designation number **US1091**), Industry Canada (file number **IC 3023A-1**) and VCCI (Member number 3168) under registration number A-0208.

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 22, Chinese-Taipei (Taiwan) BSMI CNS 13438 and Korea (RRA) KN 11, KN 13, KN 14-1, KN 22, KN 32, KN 61000-6-3, KN 61000-6-4.

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane required by EN 55022. A second conducted emissions site is also located in the basement of the OATS site with a 2.3 x 2.5 meter ground plane and a 2.4 x 2.4 meter vertical wall.

Both sites are designed to test products or systems 1.5 meters W x 1.5 meters L x 2.0 meters H, floor standing or table top.

8. Test Setup Photographs

8.1 Antenna Port Conducted Emissions



8. Test Setup Photographs (cont)

8.2 Radiated Emissions (Front) 30 MHz to 1 GHz



8. Test Setup Photographs (cont)

8.3 Radiated Emissions (Rear) 30 MHz to 1 GHz



8. Test Setup Photographs (cont)

8.4 Radiated Emissions (Front) 1 to 18 GHz



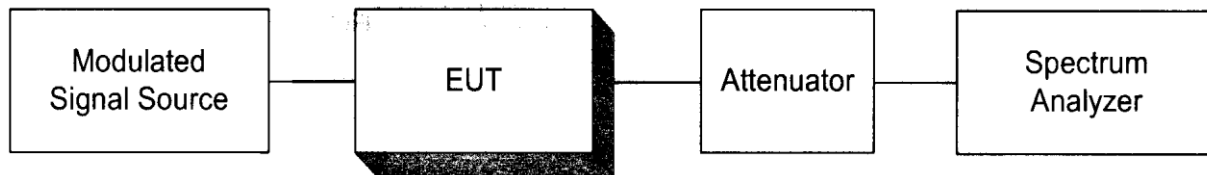
8. Test Setup Photographs (cont)

8.5 Radiated Emissions (Rear) 1 to 18 GHz

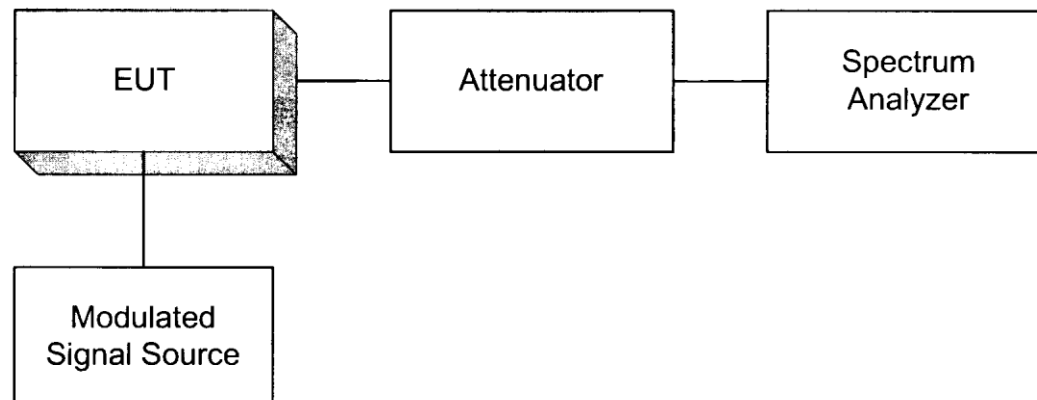


Appendix A

RF Output Power

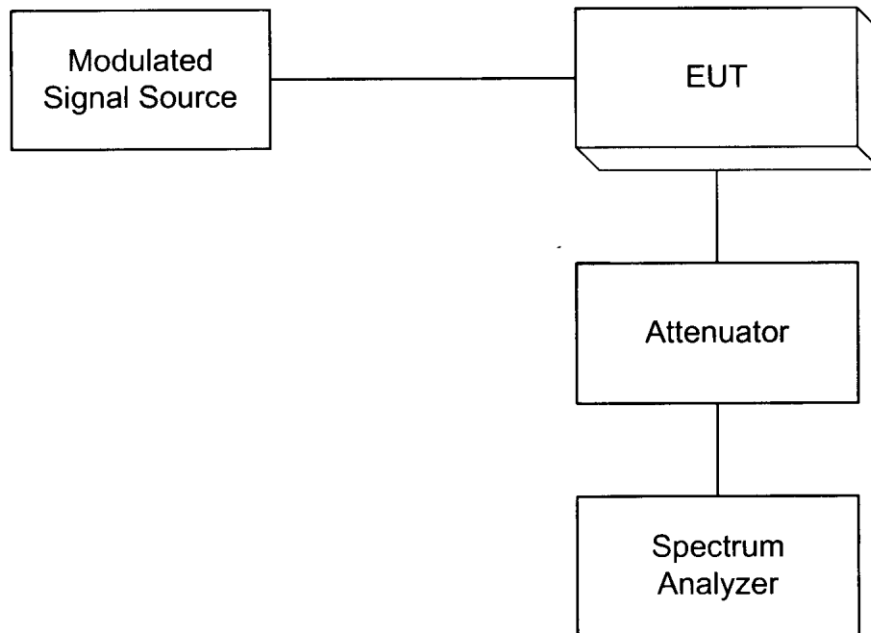


Occupied Bandwidth



Appendix A

Spurious Emissions at the Antenna Terminals



Field Strength of Spurious Radiation

