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Report On

FCC and IC Testing of the
Ericsson WCDMA/LTE ARUS 32 B4 (2100 MHz) Base Station Radio in
accordance with FCC CFR 47 Part 2 and 27 and Industry Canada
RSS-139 and RSS-GEN

COMMERCIAL-IN-CONFIDENCE

FCC ID: TA8AKRC118050-1

IC: 287AB-AS1180501

PREPARED BY

A handwritten signature in black ink.

Neil Rousell
Senior Engineer

APPROVED BY

A handwritten signature in black ink.

Nic Forsyth
Authorised Signatory

DATED

02 February 2015

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Product Service

SECTION 1

REPORT INFORMATION



Product Service

1.1 REPORT DETAILS

Manufacturer	Ericsson
Address	349 Terry Fox Drive Ottawa Ontario K2K 2V6 Canada
Product Name	ARUS 32 B4
Product Number	KRC 118 050/1
IC Model Name	AS1180501
Serial Number(s)	C828422391
Software Version	CXP9017316/5 R59BK
Hardware Version	R2A
Test Specification/Issue/Date	FCC CFR 47 Part 2: 2013 FCC CFR 47 Part 27: 2013 Industry Canada RSS-139 Issue 2: 2009
Start of Test	04 November 2014
Finish of Test	10 November 2014
Name of Engineer(s)	Neil Rousell
Related Document(s)	Industry Canada RSS-GEN Issue 3: 2010

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results for each configuration, in accordance with FCC CFR 47 Part 2 and 27 and Industry Canada RSS-139 and RSS-GEN is shown below.

Section	Spec Clause			Test Description	Result
	Part 2	Part 27	RSS 139		
2.1	2.1046	27.50(d)	4.1 / 6.4 SRSP-513	Power Limits and Duty Cycle	Pass
2.2	2.1049(h)	27.53(h)(1)	2.3	Occupied Bandwidth	Pass
2.3	2.1051	27.53(h)	4.2 / 6.5	Spurious Emissions at Band Edge	Pass
2.4	2.1051	27.53(h)	4.2 / 6.5	Conducted Spurious Emissions	Pass
2.5	2.1055	27.54	6.3	Frequency Stability Under Temperature Variations	Pass
2.6	2.1055	27.54	6.3	Frequency Stability Under Voltage Variations	Pass
-	-	-	6.6	Receiver Spurious Emissions	Pass*
-	2.1053	27.53	6.5	Transmitter Radiated Emissions	Pass*

N/A – Not Applicable

* - Reference Flextronics Design Validation Centre, Canada EMC Test Report: Reference Number K0002479-TR-RAD-02-01.

Flextronics Canada Design Services Inc.
1280 Teron Side Road
Kanata, Ontario, K2K 2C1
Canada

Accreditations (Flextronics)

The Design Validation Centre (DVC) test facilities are accredited by the Standards Council of Canada (SCC) to ISO/IEC 17025 in accordance with the scope of accreditation outlined at the web site http://palcan.scc.ca/Specs/PDF/95_e.pdf. The SCC is a signatory of the APLAC [4] and ILAC [14] Mutual Recognition Arrangements. The SCC's Laboratory Accreditation Program has been evaluated and has demonstrated its competence to operate according to the requirements of ISO/IEC 17011.

- 4) APLAC, Asia Pacific Laboratory Accreditation Cooperation, Website (<http://www.aplac.org>).
- 14) ILAC, International Laboratory Accreditation Cooperation, Website (<http://www.ilac.org/>)

1.3 CONFIGURATION DESCRIPTION

The ARUS 32 B4 / KRC 118 050/1 supports Single, Dual, 3 and 4 Carrier operation from either a single, dual or 4 port configuration. Pre-test results were used to establish the worst case configuration of the EUT in the above mentioned operating modes. The reported results represent testing in the worst case modes of operation. Testing was carried out on all test ports to confirm that each antenna output was electrically identical. Results of these tests are available on request.

The ARUS 32 B4 / KRC 118 050/1 supports WCDMA Test Models TM1, TM5 and TM6 at 2110 – 2155 MHz. The following test models were used as defined in 3GPP TS 25.141. Test Model TM1 was used to represent QPSK modulation, Test Model TM5 was used to represent 16QAM modulation, and Test Model TM6 was used to represent 64QAM modulation.

The ARUS 32 B4 has been tested and authorized for LTE Transmission SC, MC. Test cases for MM LTE/WCDMA will also be compiled in this report. The LTE Test Model used, unless otherwise stated is TM1.1.

For TX test cases: Maximum Conducted Output Power, Spurious Emissions at Antenna Terminals ($\pm 1\text{MHz}$) and Conducted Spurious Emissions, measurements were performed on all RF Ports using a test limit accounting for MIMO operation with 4 ports. All RF ports were tested for RF Carrier Power and results recorded using the Measure and Sum approach to account for MIMO operation. The test limits shown are representative of the worst case. All testing was performed with the EUT transmitting at maximum RF power unless otherwise stated.

The ARUS 32 B4 operates over Band 4 from 2110 MHz to 2155 MHz for LTE configuration.

The EUT was powered by a -48V DC Power supply.

Channel Configurations WCDMA B4
2110 MHz – 2155 MHz
All tests except Band Edge Emissions

Mode Description	RAT	Number of Carriers	Bandwidth	Carrier Frequency Configuration (MHz)		
				Bottom (BRFBW)	Middle (MRFBW)	Top (TRFBW)
WCDMA-SC	WCDMA	1	5 MHz	2112.4	2132.6	2152.6
WCDMA-SC	WCDMA	1	4.2 MHz	2112.4	2132.6	2152.6
WCDMA-MC1	WCDMA	2	5 MHz	2112.4 + 2147.6	2115 + 2150	2117.6 + 2152.6
WCDMA-MC2	WCDMA	4	5 MHz	2112.4 + 2117.4 + 2142.6 + 2147.6	2115 + 2120 + 2145 + 2150	2117.6 + 2122.6 + 2147.6 + 2152.6

Table 1
Band Edge Emissions

Mode Description	RAT	Number of Carriers	Bandwidth	Carrier Frequency Configuration (MHz)	
				BRFBW (Bottom Edge)	TRFBW (Top Edge)
WCDMA-SC	WCDMA	1	5 MHz	2112.4	2152.6
WCDMA-MC1	WCDMA	2	5 MHz	2112.4 + 2117.4	2147.6 + 2152.6

Table 2
Channel Configurations WCDMA/LTE (MM) B4
2110 MHz – 2155 MHz
All tests except Band Edge Emissions

Mode Description	RAT	Number of Carriers	Bandwidth	Carrier Frequency Configuration (MHz)		
				BRFBW	MRFBW	TRFBW
WCDMA/LTE MC-3	WCDMA / LTE	2	5 MHz + 1.4 MHz	-	2112.6 + 2154.3	-
WCDMA/LTE MC-3	WCDMA / LTE	2	5 MHz + 20 MHz	-	2112.6 + 2145	-
WCDMA/LTE MC-4	WCDMA / LTE	4	5 MHz + 1.4 MHz	-	2112.6 + 2117.6 + 2152.9 + 2154.3	-
WCDMA/LTE MC-4	WCDMA / LTE	4	5 MHz + 15 MHz	-	2112.6 + 2117.6 + 2132.5 + 2147.5	-

Table 3
Band Edge Emissions

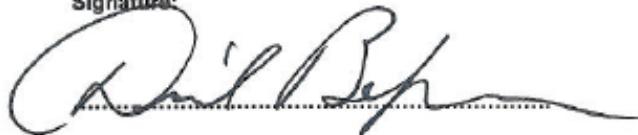
Mode Description	RAT	Number of Carriers	Bandwidth	Carrier Frequency Configuration (MHz)	
				BRFBW (Bottom Edge)	TRFBW (Top Edge)
WCDMA/LTE MC-3	WCDMA / LTE	2	5 MHz + 1.4 MHz	2110.7 + 2113.8	2151.2 + 2154.3
WCDMA/LTE MC-4	WCDMA / LTE	4	5 MHz + 1.4 MHz	2110.7 + 2112.1 + 2115.2 + 2120.2	2144.8 + 2149.8 + 2152.9 + 2154.3

Table 4

1.4 DECLARATION OF BUILD STATUS

MAIN EUT	
MANUFACTURING DESCRIPTION	Antenna Radio Unit (Multi-standard)
MANUFACTURER	Ericsson
TYPE	Remote Radio Base Station
PART NUMBER	KRC 118 050/1
SERIAL NUMBER	C828422391, C828422382
HARDWARE VERSION	R2A
SOFTWARE VERSION	CXP9017316/5 R59BK
TRANSMITTER OPERATING RANGE	2110MHz – 2155MHz
RECEIVER OPERATING RANGE	1710MHz – 1755MHz
COUNTRY OF ORIGIN	Sweden
INTERMEDIATE FREQUENCIES	Direct Conversion
EMISSION DESIGNATOR(S): (i.e. G1D, GXW)	LTE 1M40 W7D 3M00 W7D 5M00 W7D 10M0 W7D 15M0 W7D 20M0 W7D WCDMA 5M00 F9W
MODULATION TYPES: (i.e. GMSK, QPSK)	LTE: QPSK, 16QAM, 64QAM WCDMA: QPSK, 16QAM, 64QAM
HIGHEST INTERNALLY GENERATED FREQUENCY	2307.90MHz
OUTPUT POWER (W or dBm)	SC, MC, MM: 4 x 30W (44.77dBm) MC: 2C x 15W (41.78dBm) / port 3C x 10W (40.0dBm) / port 4C x 7.5W (38.75dBm) / port
FCC ID	TA8AKRC118050-1
INDUSTRY CANADA ID	287AB-AS1180501
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	The ARUS 32 B4 (KRC 118 050/1) is a multi-standard Antenna Radio Unit (ARUS) forming part of the Ericsson Radio Base Station (RBS) equipment. The ARUS provides radio access for mobile and fixed devices and is intended for the outdoor environment, designed to be co-located and directly mated with a compatible antenna. The radio operates over 4 Transmit ports in Single, Multi-Carrier, Mixed Mode and MIMO transmission with a maximum rated RF Output of 30W per port over an operational temperature of -40°C to +55°C. The unit is designed to be mast, pole or building mounted. Altitude during operation: Below 3000.

Signature:



David Bolzon

Date: 14 January 2015

Declaration of Build Status Serial Number: C828422391, C828422382

1.5 PRODUCT INFORMATION

1.5.1 Technical Description

The ARUS 32 B4 (KRC 118 050/1) is a multi-standard radio forming part of Ericsson's RBS 6000 series Radio Base Station (RBS) equipment. The ARUS (Antenna Radio Unit) product provides radio access for mobile and fixed devices and is intended for the outdoor environment. Classed under ITE (Information Technology Equipment), the ARUS is designed to be co-located and directly mated with a compatible antenna, specified for path loss optimization. A fibre optic interface provides the ARUS / RBS control and digital communications between the Radio and RBS. The location of the ARUS with respect to the RBS is only limited to a distance dictated by the limitations of the fibre link.

The ARUS 32 B4 supports four (4) Transmit / Receive ports operating in the WCDMA/E-UTRA Band 4 (AWS) at a Downlink (transmit) frequency from 2110 MHz to 2155 MHz and an Uplink (receive) frequency from 1710 MHz to 1755 MHz. The radio operates in FDD (Frequency Division Duplex) with a duplex spacing of 400 MHz and supports operation on multi Radio Access Transmission Standards (RATS) at transmit bandwidths up to 20 MHz.

The radio operates over 4 transmit ports in Single, Multi-Carrier, Mixed Mode, and MIMO transmission with a maximum rated RF output power of 30W per port over an operational temperature of -40° C to +55° C.

The ARUS is mounted directly behind a specified antenna along with a Fan Tray, which provides Forced Air Cooling for radio operation. The Fan Tray is powered and controlled from the ARUS via closed loop telemetry to maintain thermals through redundant variable speed fans to optimize air flow.

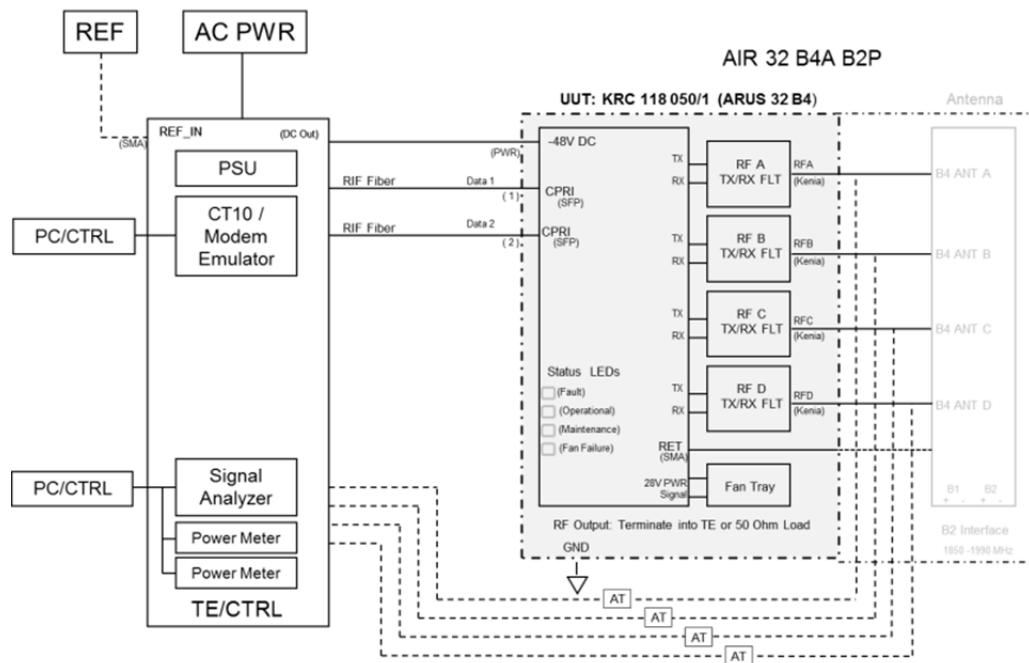
For directional optimization, the ARUS product has an active RET (Remote Electronic Tilt) function. Power for this option is provided via the ARUS RET interface (30V @ < 2A).

A full technical description can be found in the Manufacturer's documentation.

1.6 TEST SETUP

Test Setup, Conducted Measurement:

AIR 32 Test Set Up / Configuration (Radio Compliance)



See Section 3 for a list of the test equipment used in the test.

Test Setup, Radiated Measurement:

Reference: Flextronics Design Validation Centre, Canada Report Reference Number K0002479-TR-RAD-02-01

1.7 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure, test laboratories or a chamber as appropriate.

The EUT was powered from a -48 V DC supply.

1.8 DEVIATION FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.9 MODIFICATION RECORD

No modifications were made to the EUT during testing.

1.10 ALTERNATIVE TEST SITE

Under our group UKAS Accreditation, TÜV SÜD Product Service conducted the following tests at Ericsson in Ottawa, Canada.

1.11 ADDITIONAL INFORMATION

Testing performed in the presence of Mr Denis Lalonde.

Prior to commencement of the test program, measurements were made in different carrier configurations to determine the worst case operating mode. The results reported indicate the identified worst case operating modes of the BTS. In addition, tests were performed on all ports to confirm that each radio was electrically identical.

Radiated Emissions compliance measurements were executed by:

Flextronics Canada Design Services Inc.

1280 Teron Side Road
Kanata, Ontario, K2K 2C1
Canada

Accreditations (Flextronics)

The Design Validation Centre (DVC) test facilities are accredited by the Standards Council of Canada (SCC) to ISO/IEC 17025 in accordance with the scope of accreditation outlined at the web site http://palcan.scc.ca/Specs/PDF/95_e.pdf. The SCC is a signatory of the APLAC [4] and ILAC [14] Mutual Recognition Arrangements. The SCC's Laboratory Accreditation Program has been evaluated and has demonstrated its competence to operate according to the requirements of ISO/IEC 17011.

4) APLAC, Asia Pacific Laboratory Accreditation Cooperation, Website (<http://www.aplac.org>).

14) ILAC, International Laboratory Accreditation Cooperation, Website (<http://www.ilac.org/>)

SECTION 2

TEST DETAILS

2.1 MAXIMUM PEAK OUTPUT POWER AND PEAK TO AVERAGE RATIO - CONDUCTED**2.1.1 Specification Reference**

FCC CFR 47 Part 2, Clause 2.1046
FCC CFR 47 Part 27, Clause 27.50(d)
Industry Canada RSS-139, Clause 4.1 / 6.4 – (IC SRSP-513, Clause 5)

2.1.2 Date of Test and Modification State

04 until 10 November 2014 - Modification State 0

2.1.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.4 Environmental Conditions

Ambient Temperature	24.4 - 24.8°C
Relative Humidity	32.2 - 32.9%

2.1.5 Test Method

The EUT was connected to a Spectrum Analyser via 30dB of attenuation. The path loss between the EUT and the Spectrum Analyser was measured using a Network Analyser. The measured path loss was entered as a Reference Level Offset in the Spectrum Analyser.

Measurements were performed with the Spectrum Analyser Band Power measurement function in accordance with FCC KDB 971168 D01 v02r02. The detector was set to RMS with a RBW of at least 1% of the theoretical signal bandwidth and a VBW of 3 times the RBW. The detection bandwidth was configured to be wider than the total bandwidth of the carrier or combinations of carriers, (multi-carrier). The sweep time was set to Auto and 200 averages were performed before the result was recorded. Prior to testing, comparative measurements were made with an Average Power sensor and Power Meter to confirm correlation with the method used.

Due to Average measurements being recorded, an additional Peak to Average measurement was made in all single carrier configurations. This was achieved using the CCDF function of the Spectrum Analyser with the RBW being set to a value wider than the largest signal being measured – in this case – 80MHz, (45MHz total RF Bandwidth in multi-carrier mode). A comparison was made with a wide band Power Meter capable of measuring Peak to Average ratio to confirm correlation with the method used.

2.1.6 Test Results

Configuration WCDMA SC (see Table 1 for carrier frequency)

Maximum Output Power 44.77 dBm per carrier, TM5

Antenna	Modulation	Channel Position B					
		PAR (dB)	Measured Conducted Average Power (dBm)	Antenna Gain (dBi)	Average EIRP (dBm)	Average EIRP (dBm/MHz)	Average EIRP (W/MHz)
A	16QAM	7.19	44.62	18.40	63.02	56.03	400.87
B	16QAM	7.18	44.54	18.40	62.94	55.95	393.55
C	16QAM	7.18	44.80	18.40	63.20	56.21	417.83
D	16QAM	7.18	44.52	18.40	62.92	55.93	391.74

Antenna	Modulation	Channel Position M					
		PAR (dB)	Measured Conducted Average Power (dBm)	Antenna Gain (dBi)	Average EIRP (dBm)	Average EIRP (dBm/MHz)	Average EIRP (W/MHz)
A	16QAM	7.18	44.60	18.40	63.00	56.01	399.02
B	16QAM	7.17	44.66	18.40	63.06	56.07	404.58
C	16QAM	7.18	44.85	18.40	63.25	56.26	422.67
D	16QAM	7.18	44.59	18.40	62.99	56.00	398.11

Antenna	Modulation	Channel Position T					
		PAR (dB)	Measured Conducted Average Power (dBm)	Antenna Gain (dBi)	Average EIRP (dBm)	Average EIRP (dBm/MHz)	Average EIRP (W/MHz)
A	16QAM	7.17	44.64	18.40	63.04	56.05	402.72
B	16QAM	7.17	44.66	18.40	63.06	56.07	404.58
C	16QAM	7.18	44.76	18.40	63.16	56.17	414.00
D	16QAM	7.17	44.72	18.40	63.12	56.13	410.20

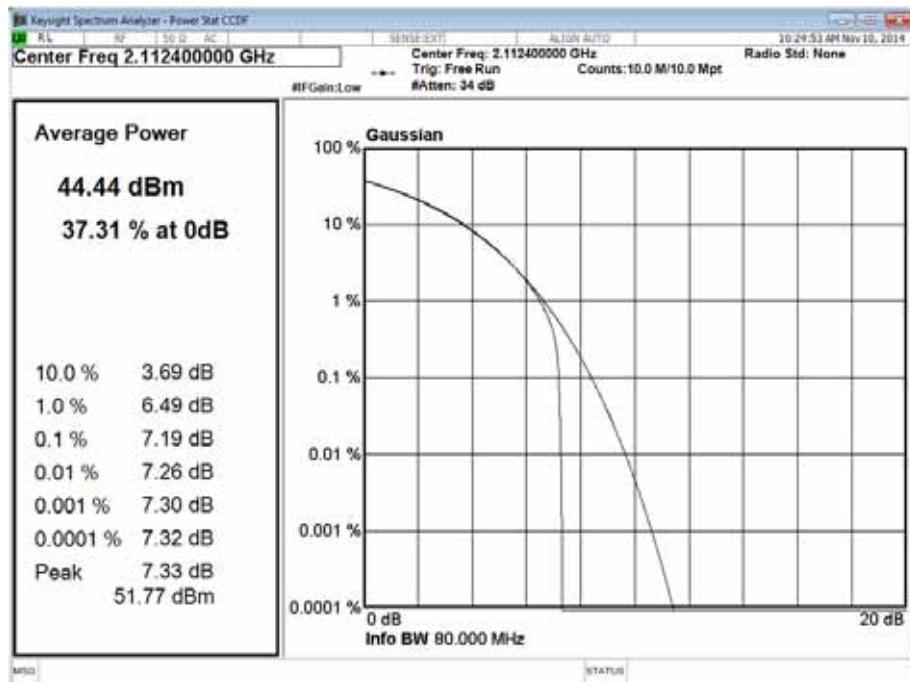
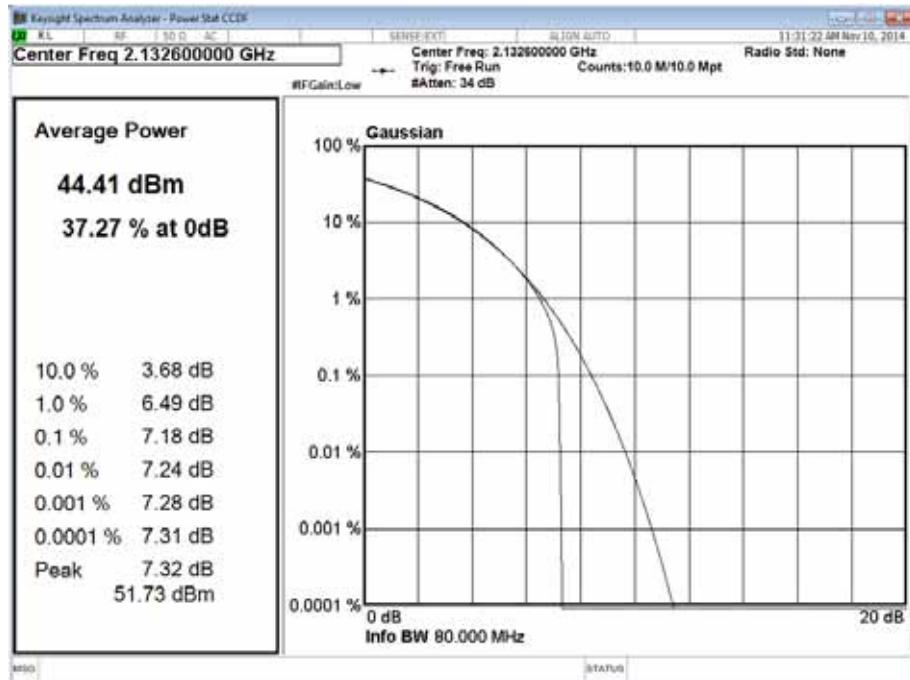


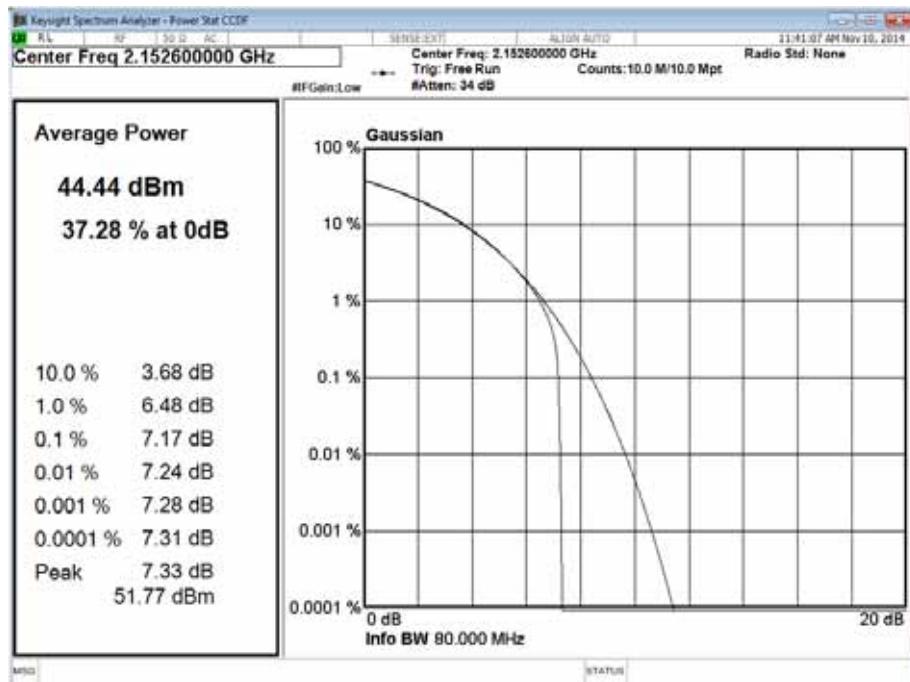
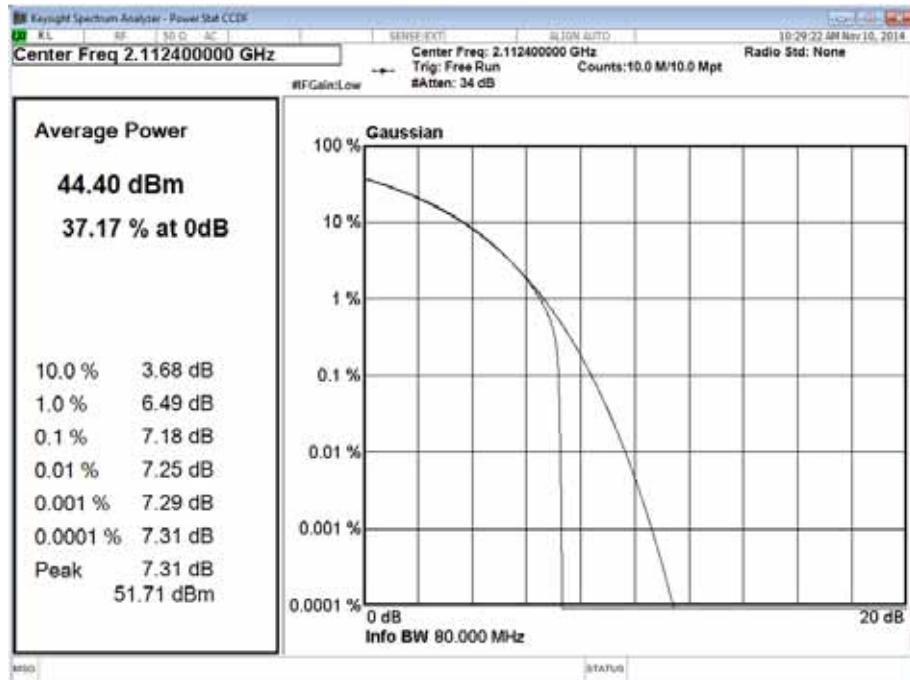
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Worst Case/Maximum EIRP Calculation:

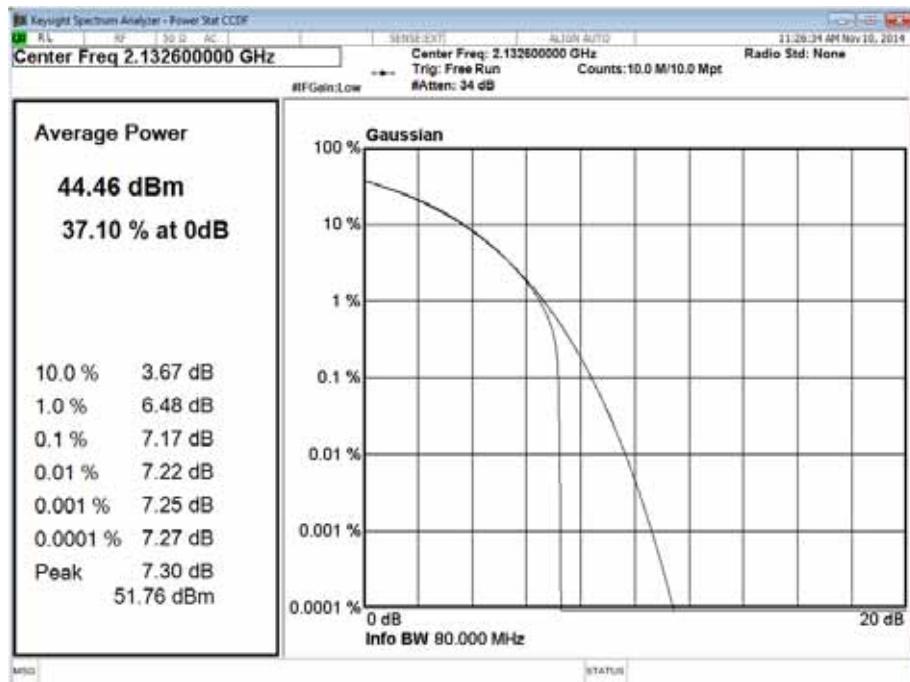
$$\text{EIRP} = \text{PT} + \text{GANT} = 44.77 + 18.40 = 63.17 \text{ dBm} = 414.95 \text{ W/MHz}$$

Remark: Measurements are conducted at the radio output connector without the antenna. ERP/EIRP compliance is addressed by the licensee and is based on operational Bandwidth and mode of operation in combination with antenna and propagation gains. The Licensee is required to consider all necessary operational parameters to maintain EIRP compliance limits.

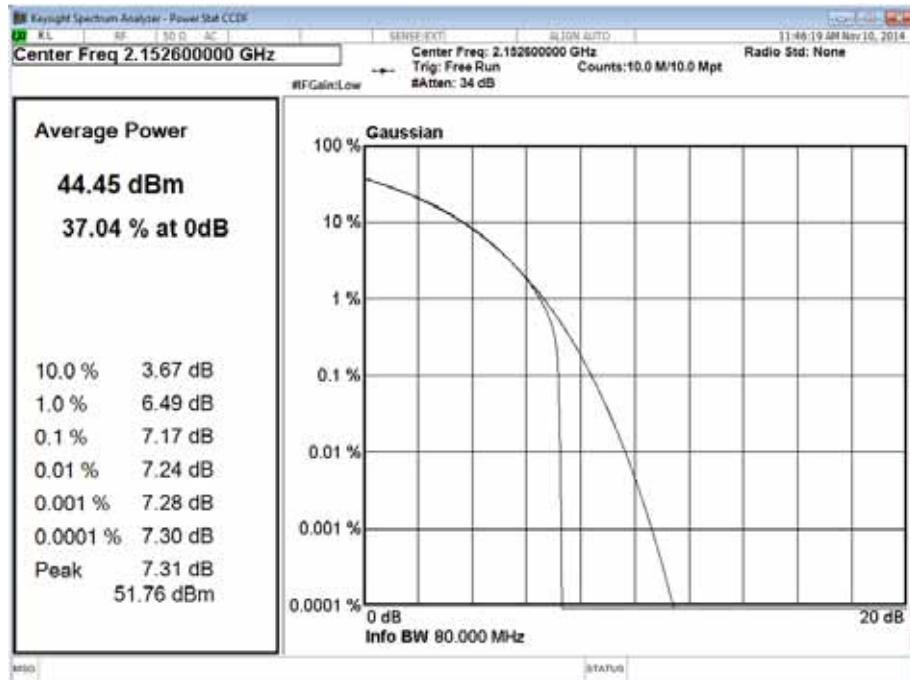
Channel Position B - Antenna A

Channel Position M - Antenna A


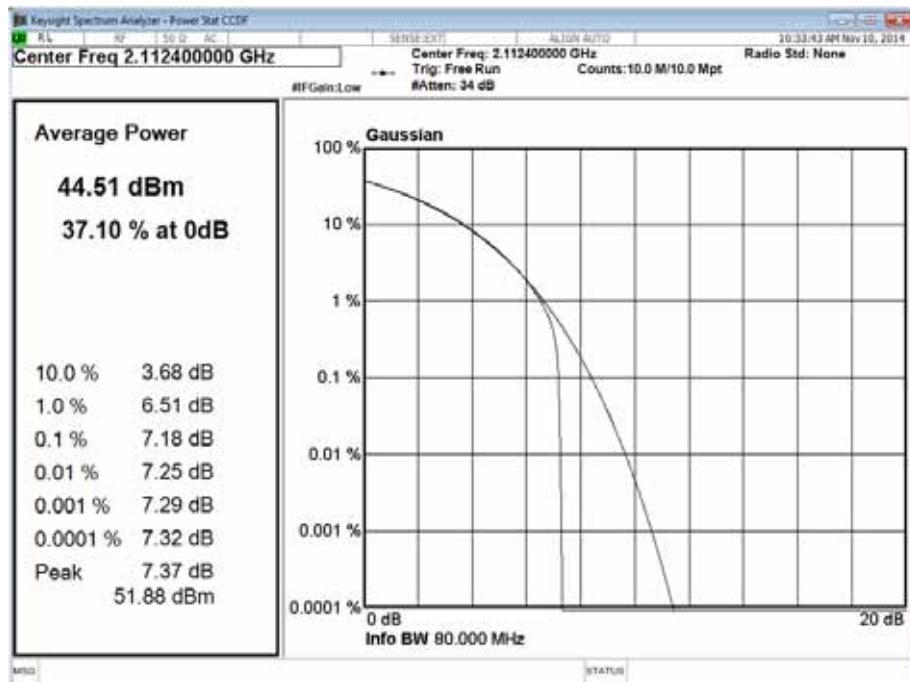
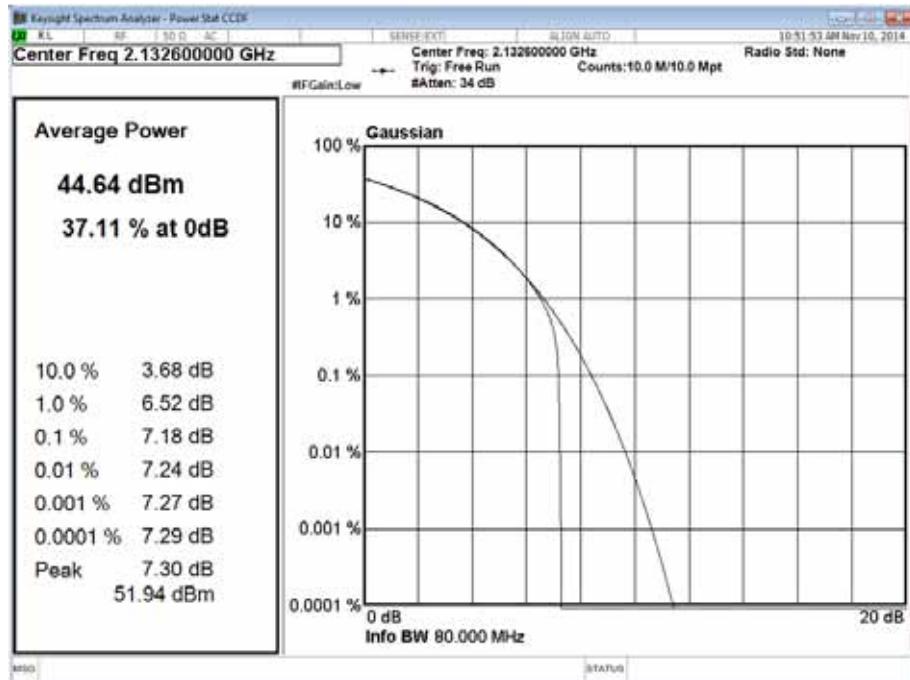
Channel Position T - Antenna A

Channel Position B - Antenna B


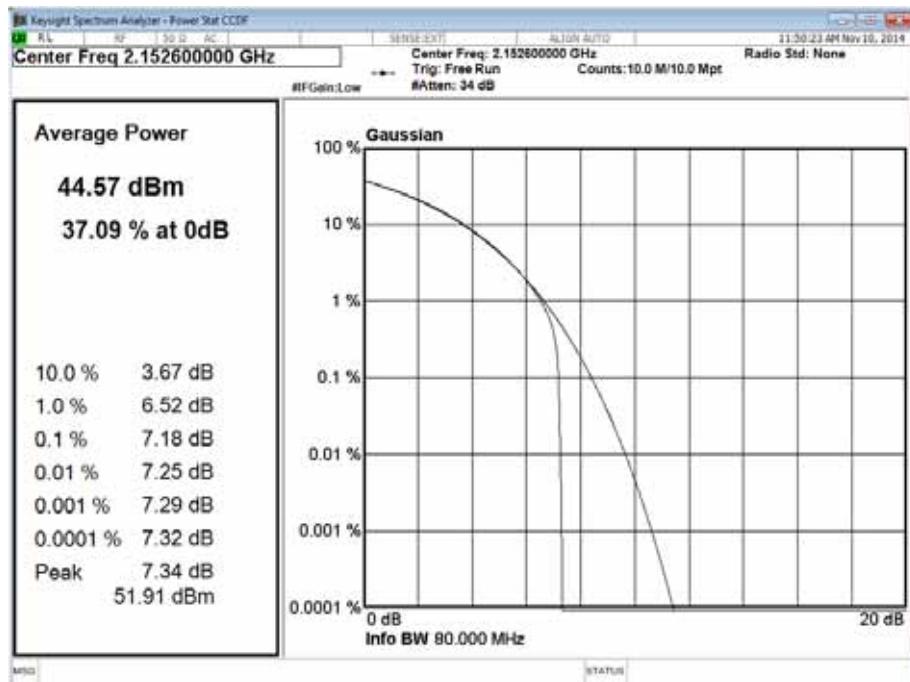
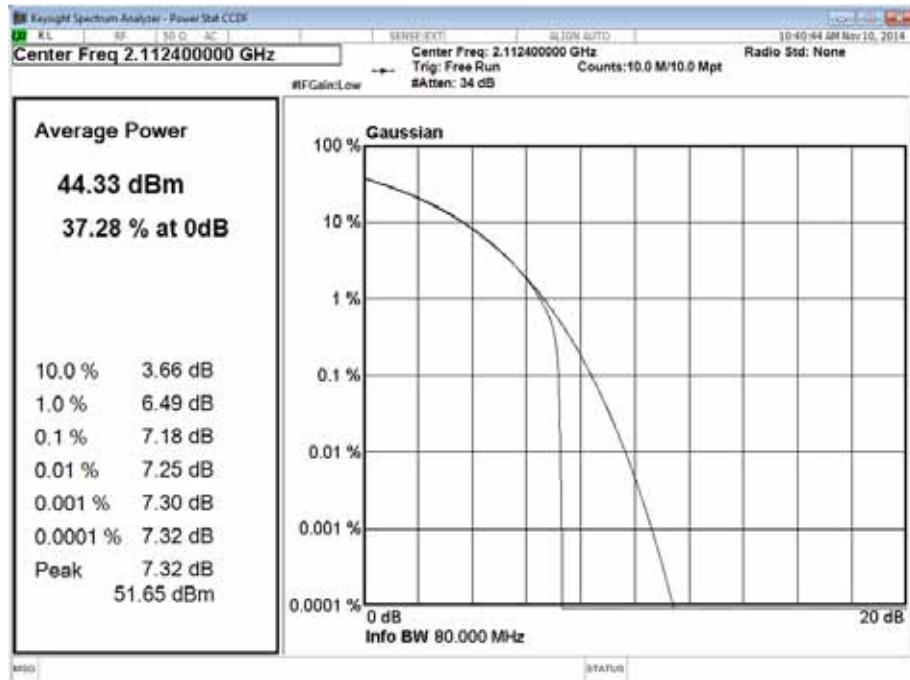
Channel Position M - Antenna B



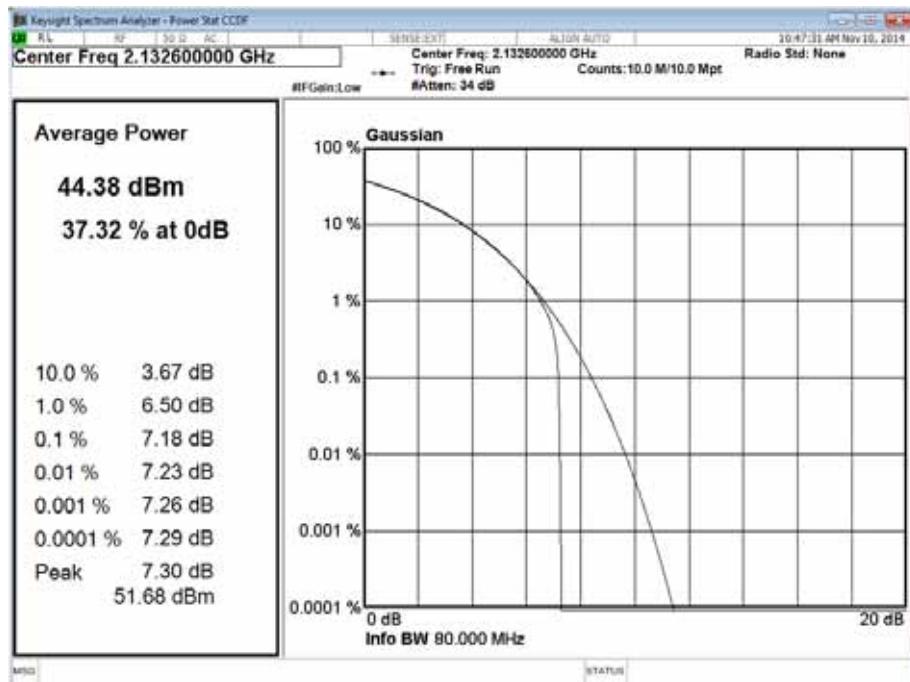
Channel Position T - Antenna B



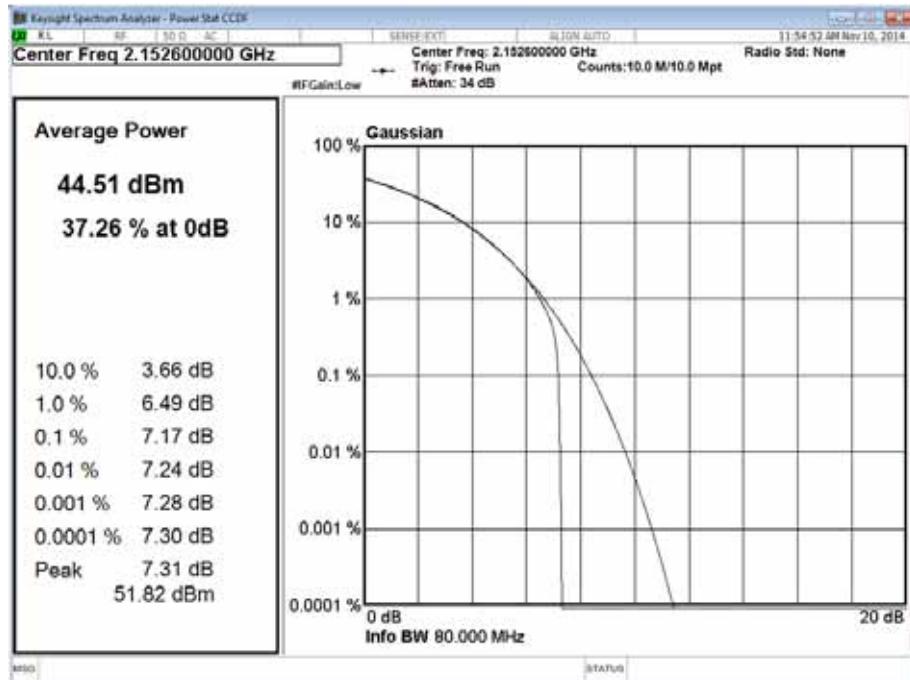
Channel Position B - Antenna C

Channel Position M - Antenna C


Channel Position T - Antenna C

Channel Position B - Antenna D


Channel Position M - Antenna D



Channel Position T - Antenna D



Configuration 2 WCDMA-MC1 (See Table 1 for carrier frequency)

Maximum Output Power 41.76 dBm per carrier, TM5 (2 Carrier)

Antenna	Modulation	Channel Position B
		Measured Conducted Average Power (dBm)
A	16QAM	44.59
B	16QAM	44.56
C	16QAM	44.59
D	16QAM	44.46

Antenna	Modulation	Channel Position M
		Measured Conducted Average Power (dBm)
A	16QAM	44.60
B	16QAM	44.68
C	16QAM	44.73
D	16QAM	44.52

Antenna	Modulation	Channel Position T
		Measured Conducted Average Power (dBm)
A	16QAM	44.62
B	16QAM	44.63
C	16QAM	44.73
D	16QAM	44.83

Configuration 3 WCDMA-MC2 (See Table 1 for carrier frequency)

Maximum Output Power 38.75 dBm per carrier, TM5 (4 Carrier)

Antenna	Modulation	Channel Position B
		Measured Conducted Average Power (dBm)
A	16QAM	44.69
B	16QAM	44.89
C	16QAM	44.67
D	16QAM	44.49

Antenna	Modulation	Channel Position M
		Measured Conducted Average Power (dBm)
A	16QAM	44.56
B	16QAM	44.63
C	16QAM	44.78
D	16QAM	44.58

Antenna	Modulation	Channel Position T
		Measured Conducted Average Power (dBm)
A	16QAM	44.72
B	16QAM	44.63
C	16QAM	44.67
D	16QAM	44.56

Configuration 4 WCDMA/LTE MC-3 (See Table 3 for carrier frequency)

Maximum Output Power 41.76 dBm per carrier, TM5 (WCDMA), TM1.1 (LTE)

Antenna	Modulation / LTE Bandwidth	Channel Position M
		Measured Conducted Average Power (dBm)
A	16QAM / 1.4 MHz	44.64
B	16QAM / 1.4 MHz	44.86
C	16QAM / 1.4 MHz	44.90
D	16QAM / 1.4 MHz	44.85

Antenna	Modulation / LTE Bandwidth	Channel Position M
		Measured Conducted Average Power (dBm)
A	16QAM / 20 MHz	44.23
B	16QAM / 20 MHz	44.45
C	16QAM / 20 MHz	44.51
D	16QAM / 20 MHz	44.57

Configuration 5 WCDMA/LTE MC-4 (See Table 3 for carrier frequency)

Maximum Output Power 38.75 dBm per carrier, TM5 (WCDMA), TM1.1 (LTE)

Antenna	Modulation / LTE Bandwidth	Channel Position M
		Measured Conducted Average Power (dBm)
A	16QAM / 1.4 MHz	43.95
B	16QAM / 1.4 MHz	44.23
C	16QAM / 1.4 MHz	44.16
D	16QAM / 1.4 MHz	44.33

Antenna	Modulation / LTE Bandwidth	Channel Position M
		Measured Conducted Average Power (dBm)
A	16QAM / 15 MHz	44.25
B	16QAM / 15 MHz	44.50
C	16QAM / 15 MHz	44.51
D	16QAM / 15 MHz	44.54

Limit	
Peak Power	≤500 W or ≤+57 dBm
Peak to Average Ratio	13 dB

2.2 OCCUPIED BANDWIDTH

2.2.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049
FCC CFR 47 Part 27, Clause 27.53(h)(1)
Industry Canada RSS-139, Clause 2.3
Industry Canada RSS-GEN, Clause 4.6

2.2.2 Date of Test and Modification State

4 November 2014 - Modification State 0

2.2.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.4 Environmental Conditions

Ambient Temperature	24.7°C
Relative Humidity	33.6%

2.2.5 Test Method

The EUT was connected to a Spectrum Analyser via 30dB of attenuation. The path loss between the EUT and the Spectrum Analyser was measured using a Network Analyser. The measured path loss was entered as a Reference Level Offset in the Spectrum Analyser.

The Spectrum Analyser RBW was configured to be at least 1% of the channel bandwidth of the carrier to be measured.

For 26dB and 99% Occupied Bandwidth, the Spectrum Analysers measurement mode was used in conjunction with an RMS detector and a long sweep time as described in the operating manual for the test equipment. Measurements were made on Bottom, Middle and Top Channels.

The results are shown in the plots below.

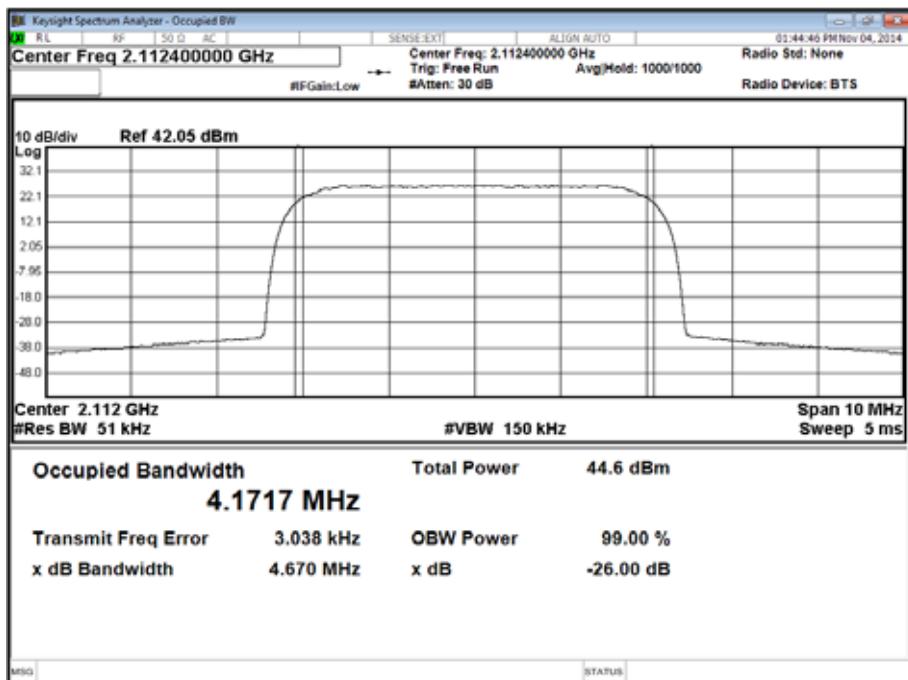
2.2.6 Test Results

Configuration 1 WCDMA SC (see Table 1 for carrier frequency)

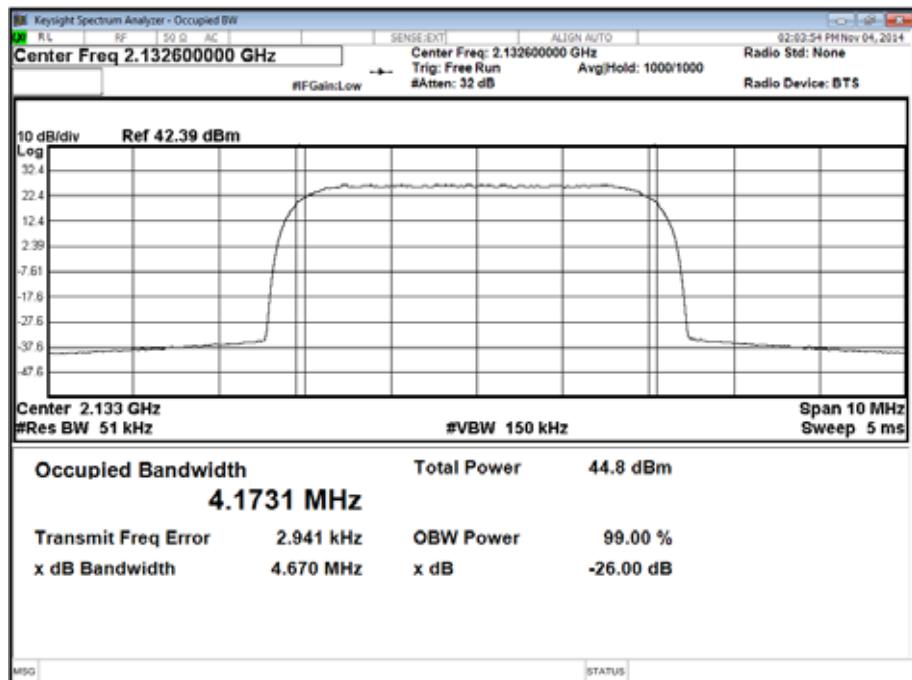
Maximum Output Power 44.77 dBm per carrier, TM5

Antenna	Modulation / Bandwidth	Result (MHz)					
		Channel Position B		Channel Position M		Channel Position T	
		Occupied Bandwidth	-26 dB Bandwidth	Occupied Bandwidth	-26 dB Bandwidth	Occupied Bandwidth	-26 dB Bandwidth
A	QPSK / 5.0 MHz	4,171.68	4,669.99	4,173.07	4,670.47	4,171.56	4,668.11
B	QPSK / 5.0 MHz	4,169.10	4,664.56	4,168.70	4,662.64	4,166.13	4,662.73
C	QPSK / 5.0 MHz	4,164.36	4,665.40	4,164.70	4,666.19	4,161.58	4,666.57
D	QPSK / 5.0 MHz	4,170.55	4,665.30	4,172.57	4,663.20	4,170.13	4,664.78

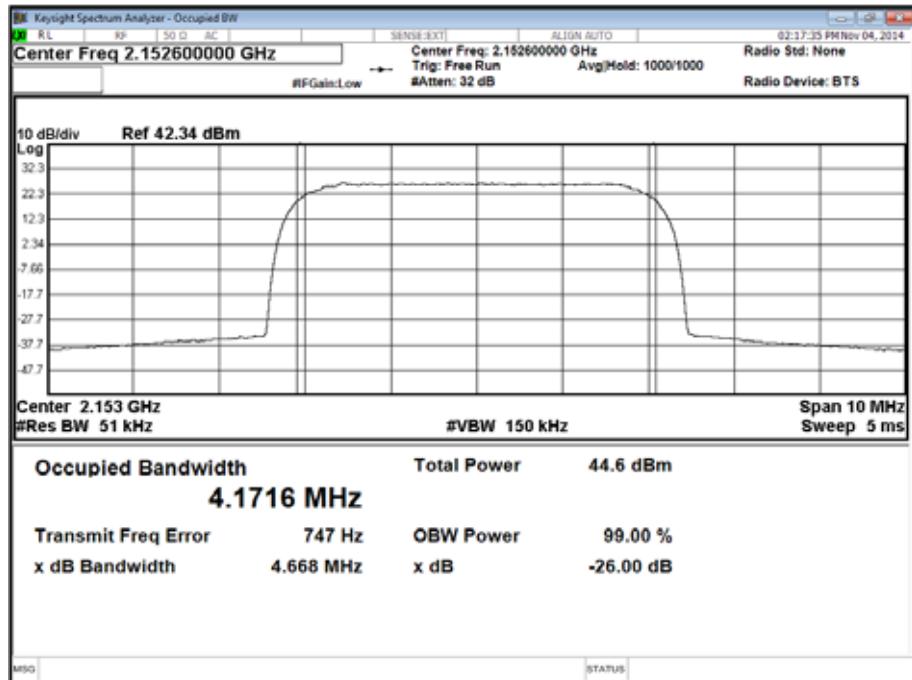
Channel Position B - Antenna A



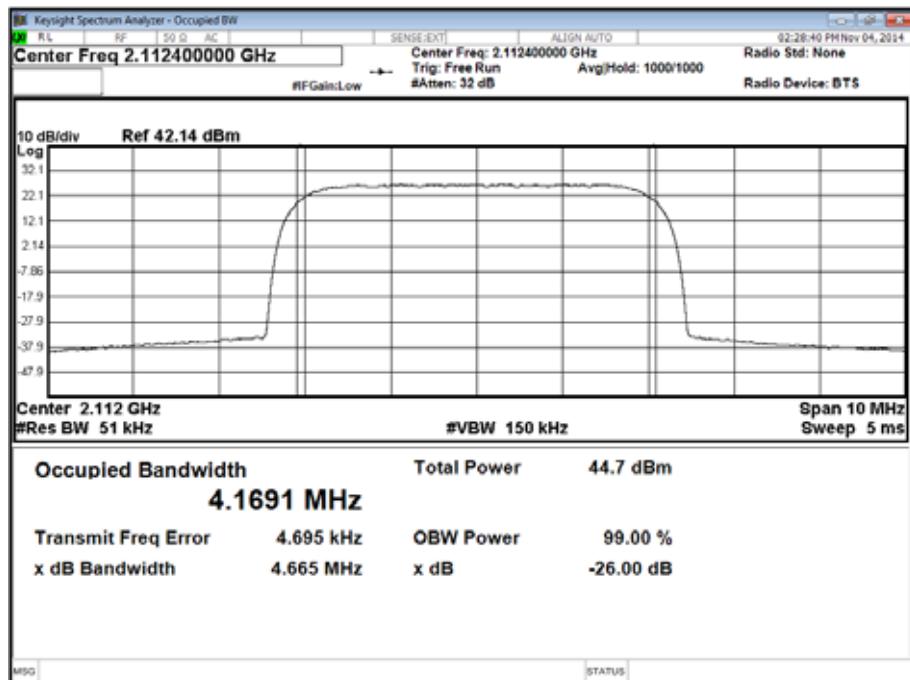
Channel Position M - Antenna A



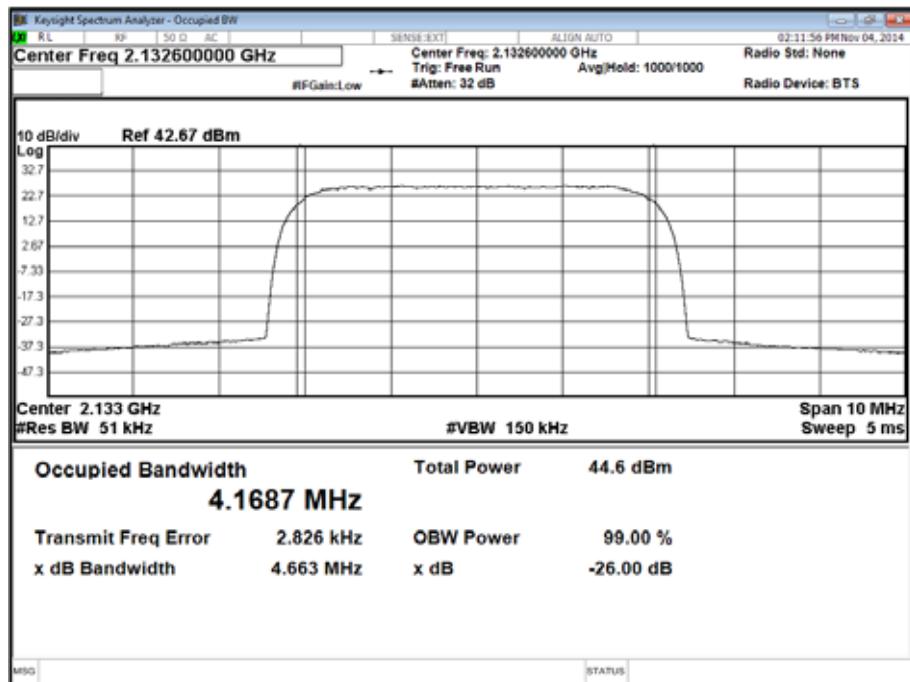
Channel Position T - Antenna A



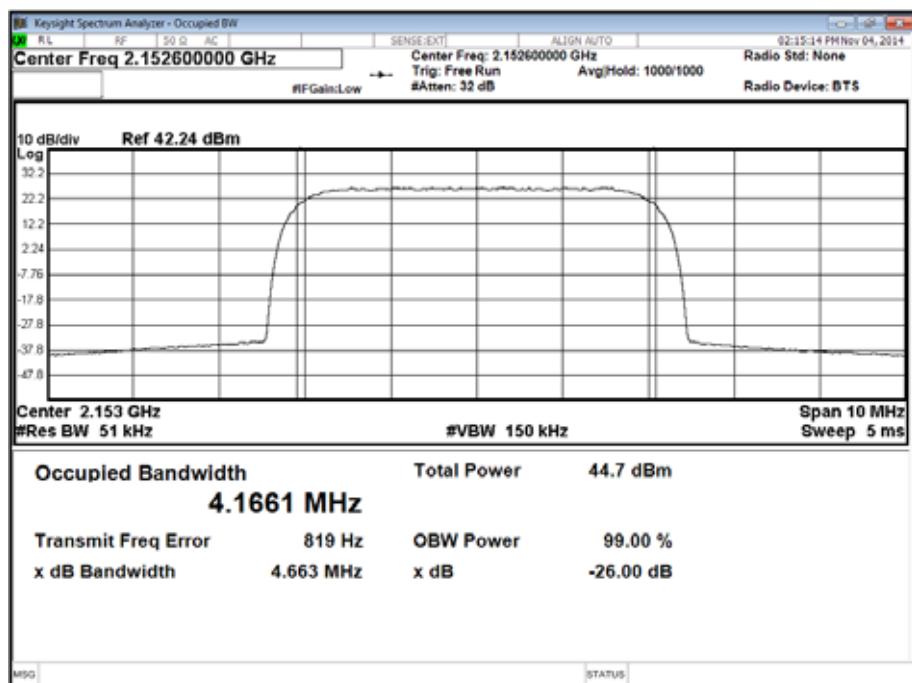
Channel Position B - Antenna B



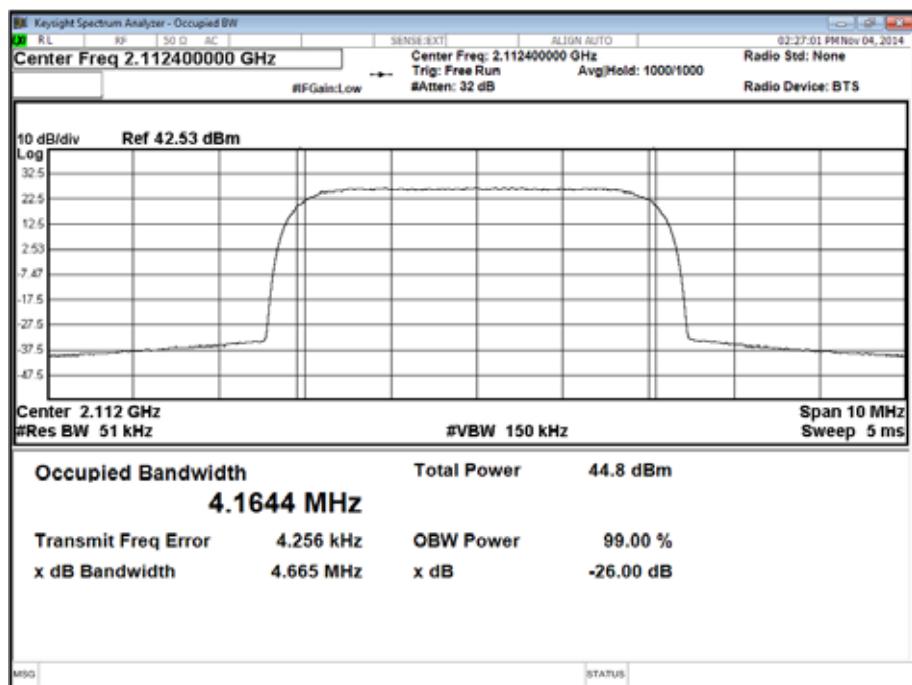
Channel Position M - Antenna B



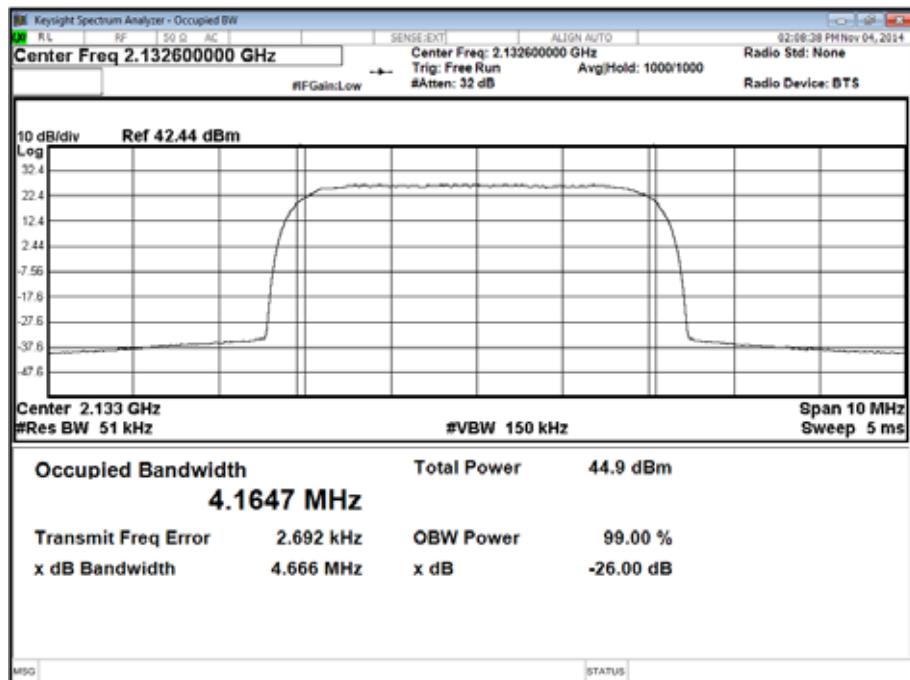
Channel Position T - Antenna B



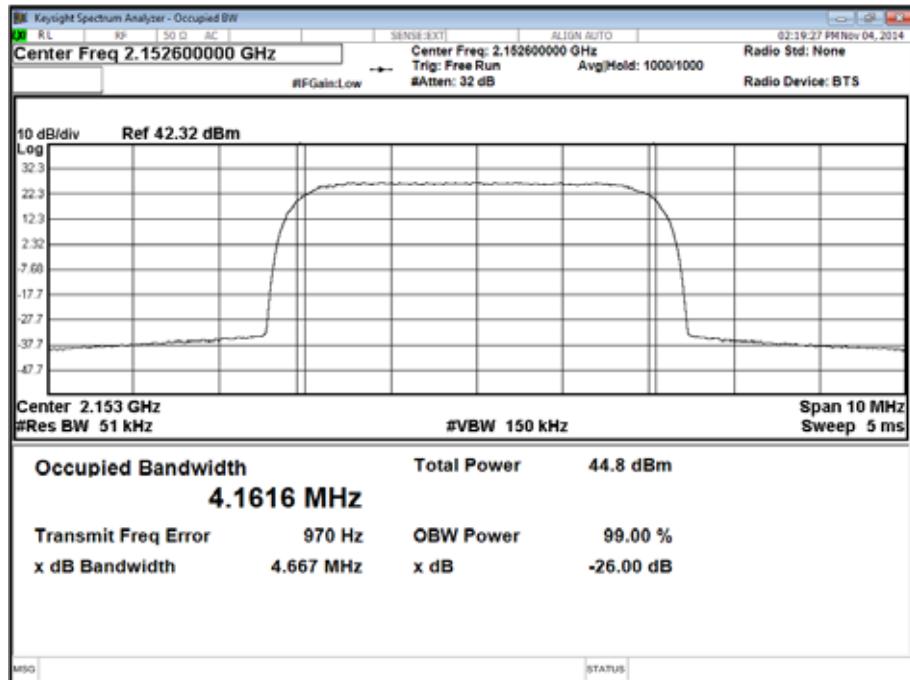
Channel Position B - Antenna C



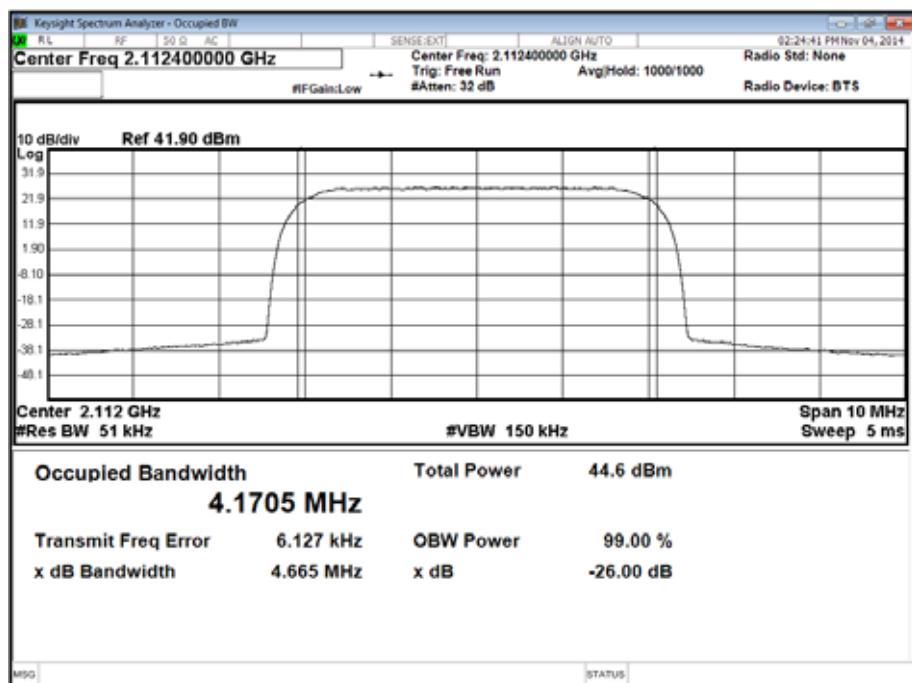
Channel Position M - Antenna C



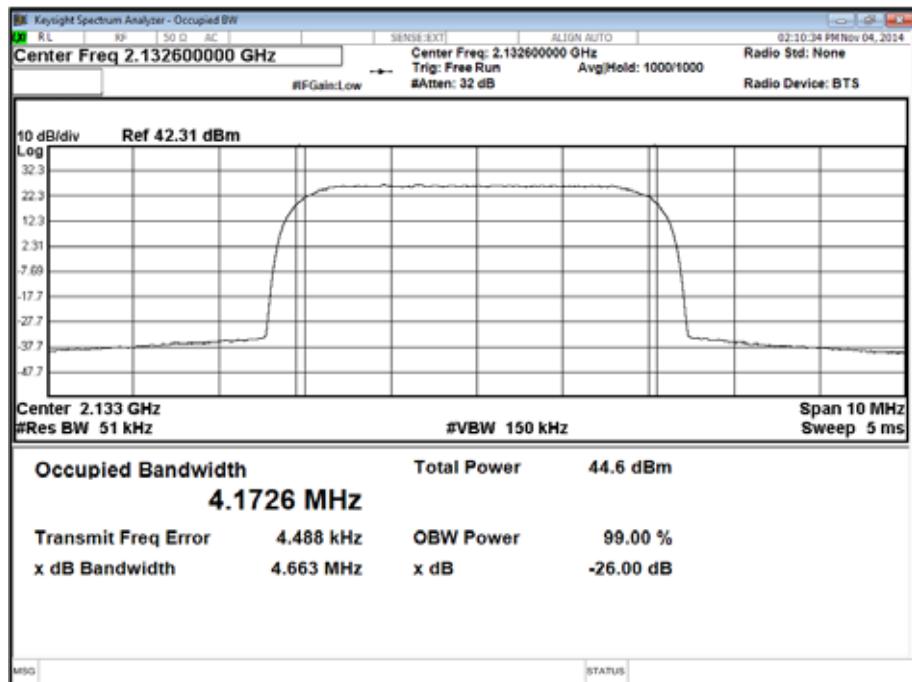
Channel Position T - Antenna C



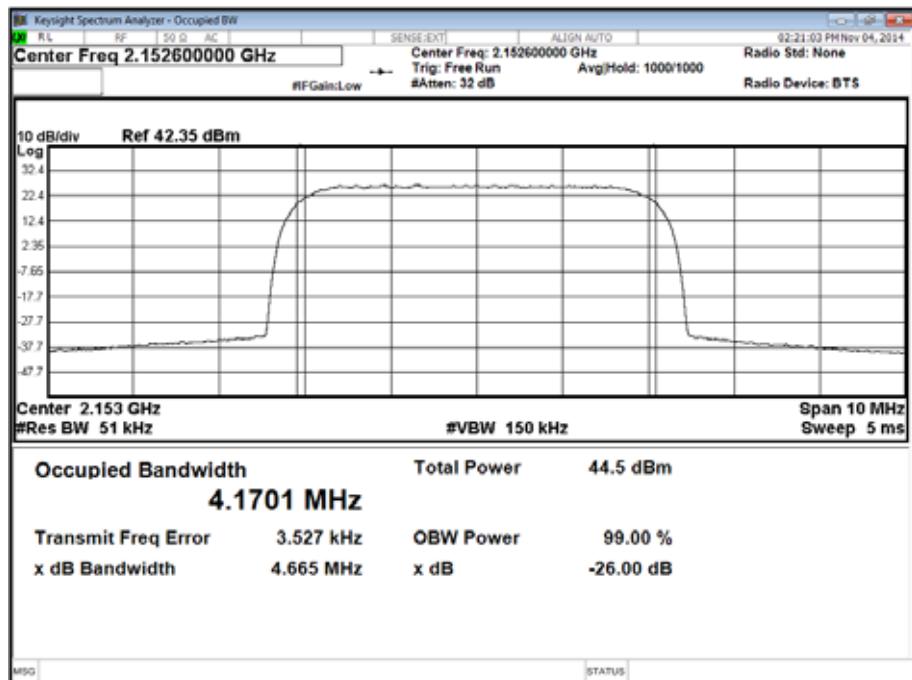
Channel Position B - Antenna D



Channel Position M - Antenna D



Channel Position T - Antenna D

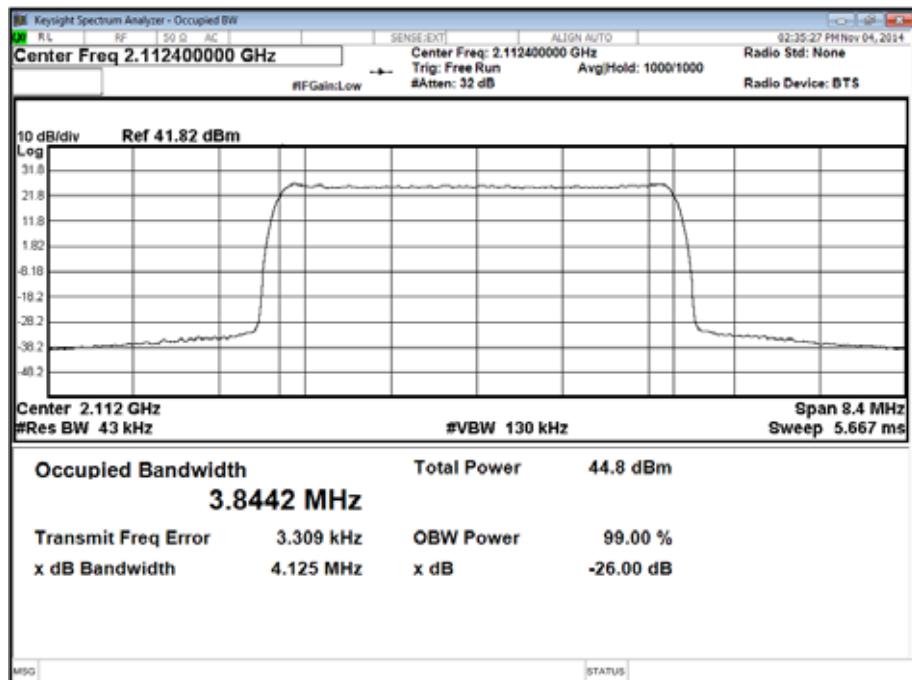


Configuration 1 WCDMA SC (see Table 1 for carrier frequency)

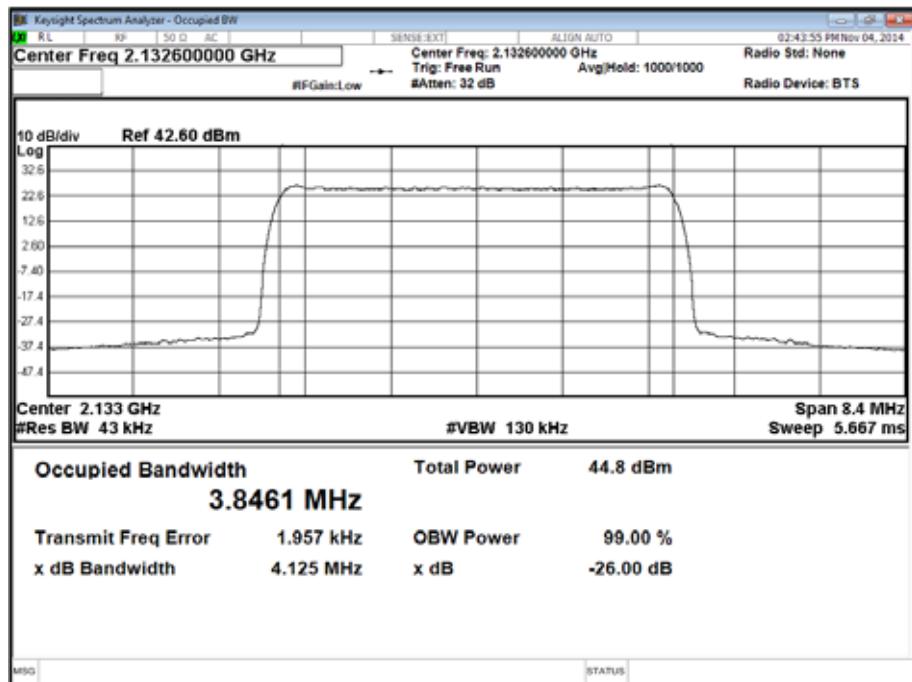
Maximum Output Power 44.77 dBm per carrier, TM5

Antenna	Modulation / Bandwidth	Result (MHz)					
		Channel Position B		Channel Position M		Channel Position T	
		Occupied Bandwidth	-26 dB Bandwidth	Occupied Bandwidth	-26 dB Bandwidth	Occupied Bandwidth	-26 dB Bandwidth
A	QPSK / 4.2 MHz	3,844.18	4,125.14	3,846.05	4,125.14	3,844.00	4,124.25
B	QPSK / 4.2 MHz	3,850.93	4,124.25	3,848.92	4,123.51	3,850.37	4,124.59
C	QPSK / 4.2 MHz	3,846.96	4,123.21	3,848.80	4,123.11	3,848.24	4,122.58
D	QPSK / 4.2 MHz	3,845.06	4,124.40	3,844.29	4,124.25	3,844.42	4,124.06

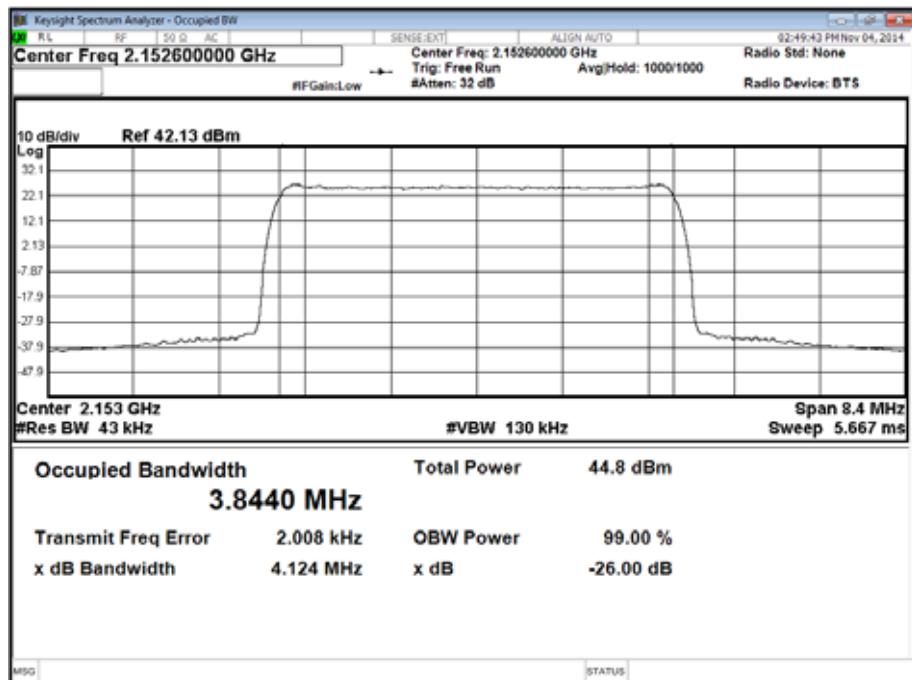
Channel Position B - Antenna A



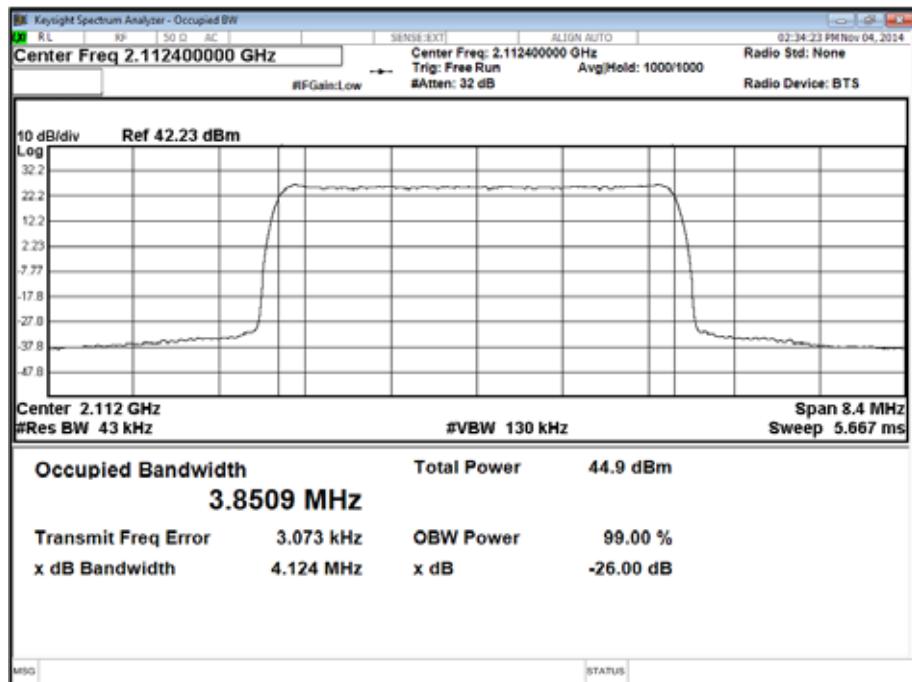
Channel Position M - Antenna A



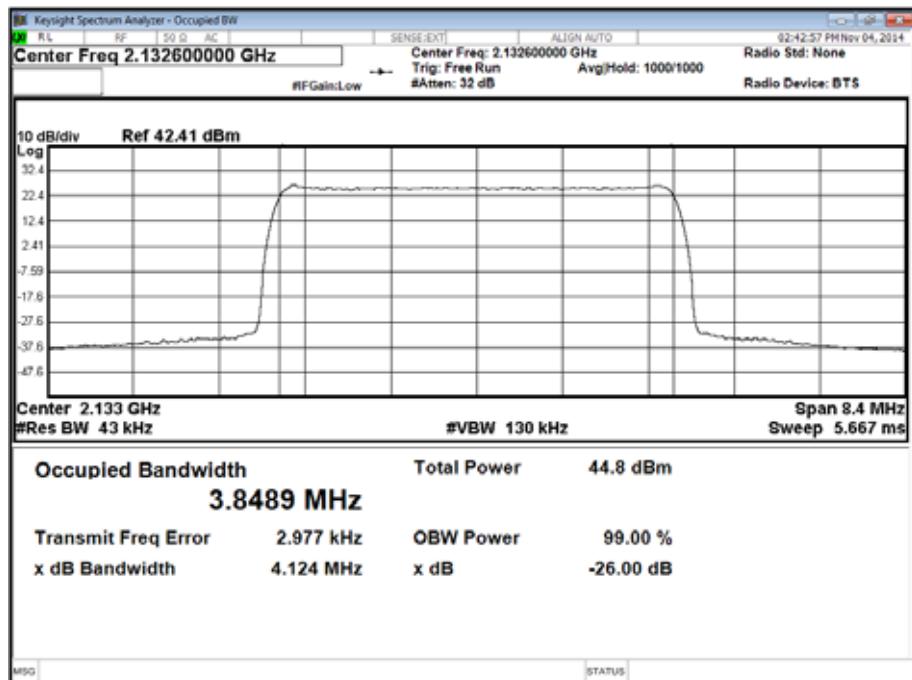
Channel Position T - Antenna A



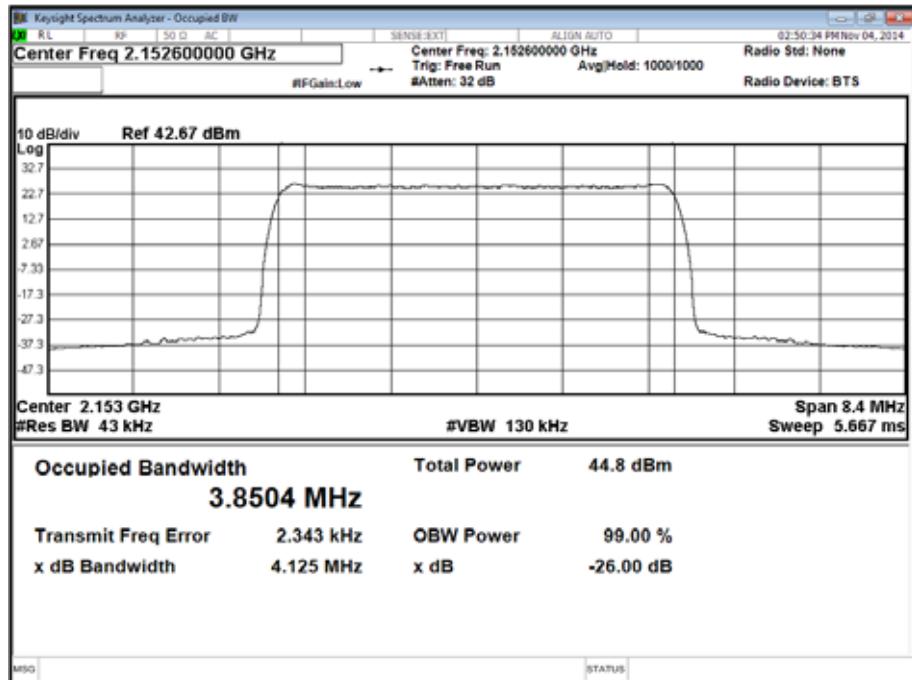
Channel Position B - Antenna B



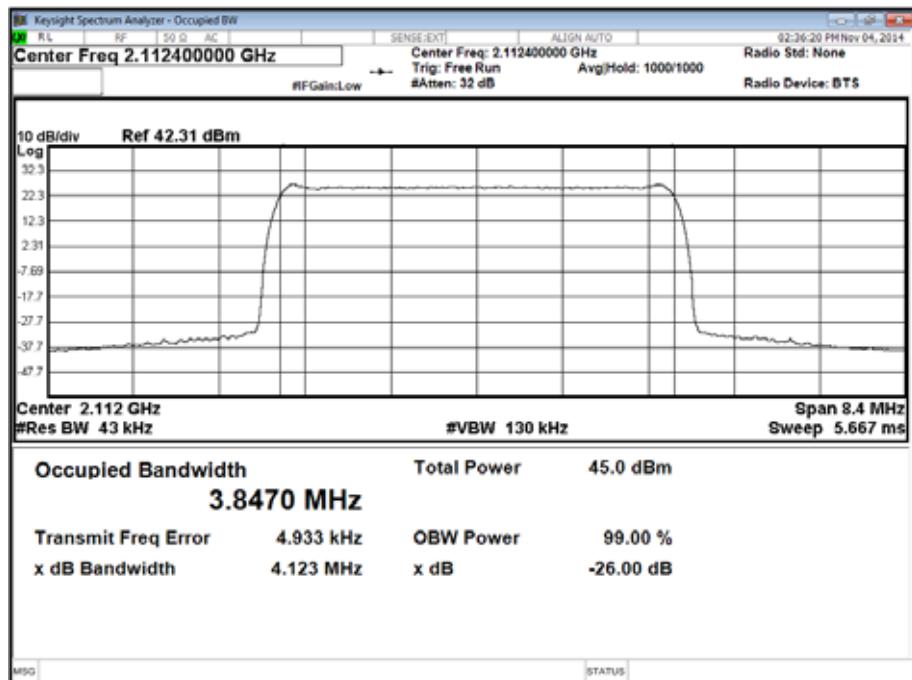
Channel Position M - Antenna B



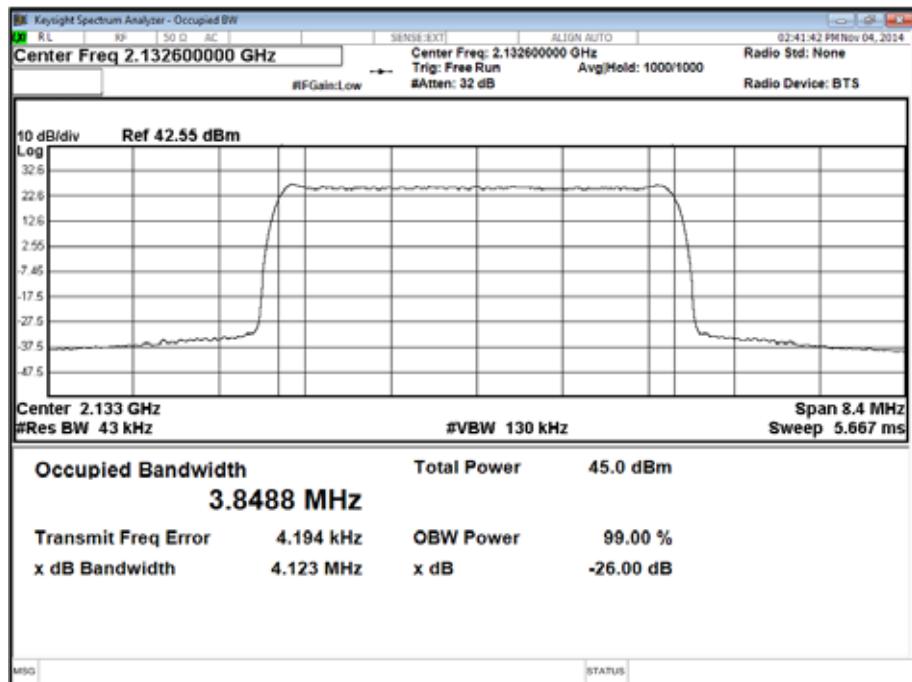
Channel Position T - Antenna B



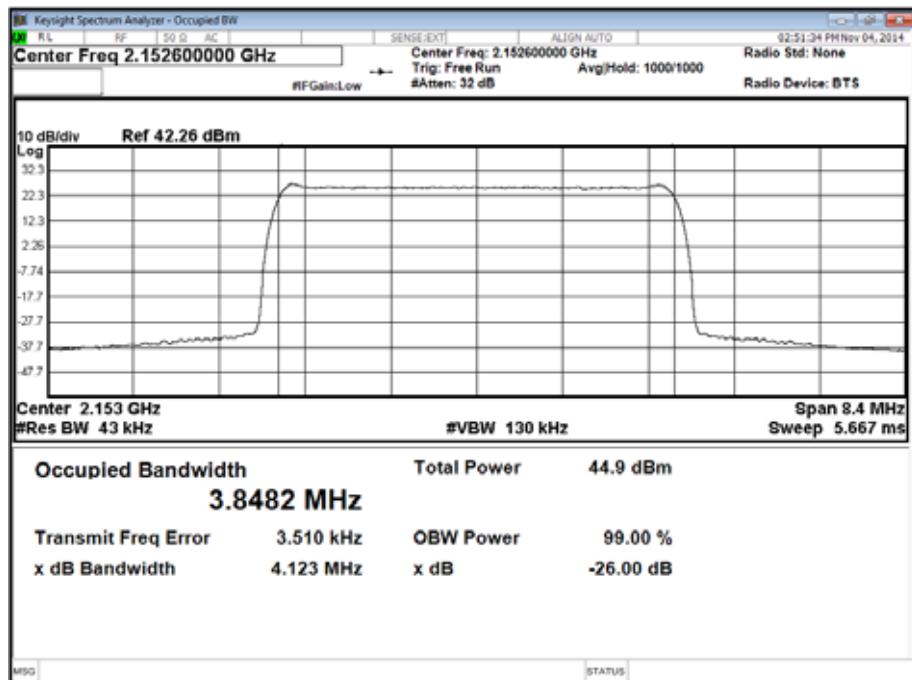
Channel Position B - Antenna C



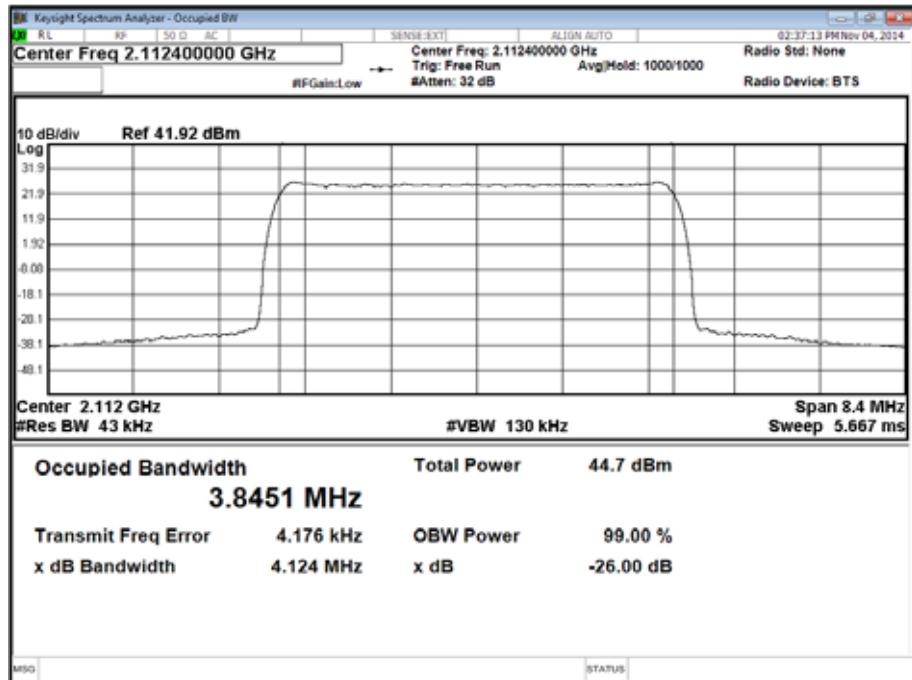
Channel Position M - Antenna C



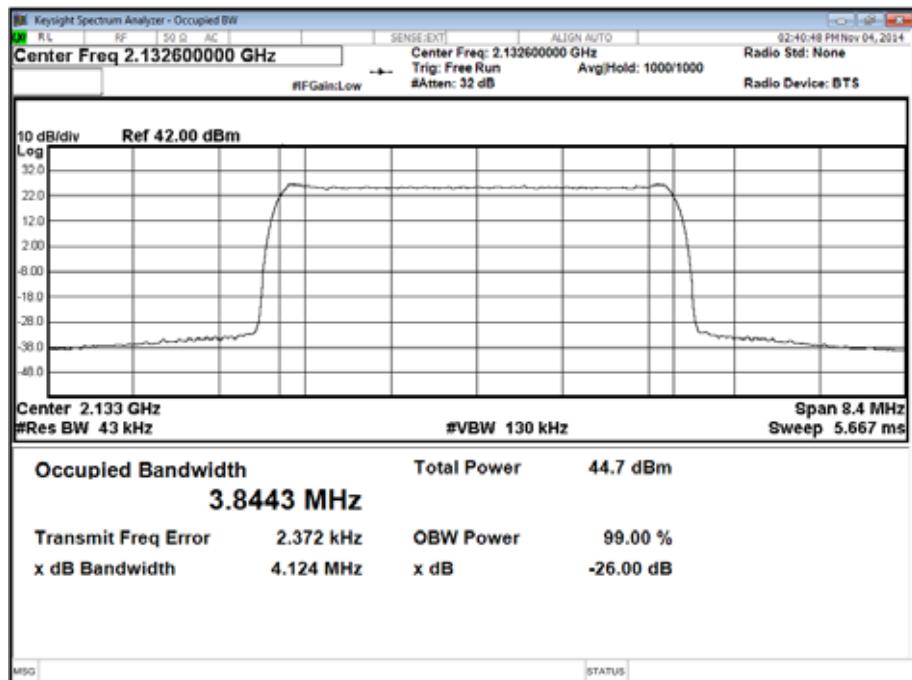
Channel Position T - Antenna C



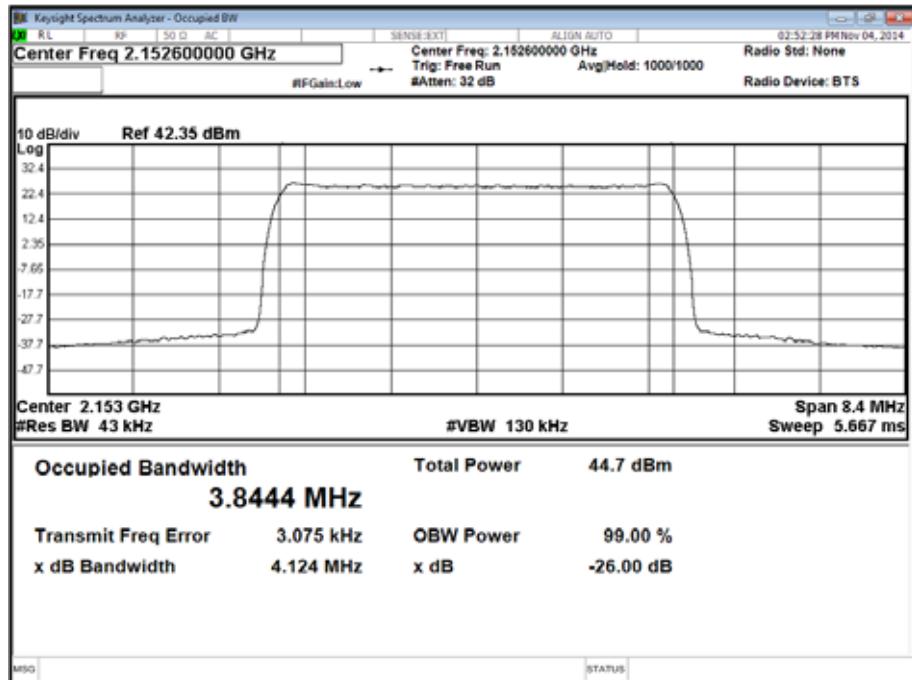
Channel Position B - Antenna D



Channel Position M - Antenna D



Channel Position T - Antenna D



2.3 BAND EDGE

2.3.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049
FCC CFR 47 Part 27, Clause 27.53(h)(1)
Industry Canada RSS-139, Clause 4.2 / 6.5 (i)

2.3.2 Date of Test and Modification State

11 November 2014 - Modification State 0

2.3.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.4 Environmental Conditions

Ambient Temperature 24.8°C
Relative Humidity 32.2%

2.3.5 Test Method

The EUT was connected to a Spectrum Analyser via 30dB of attenuation. The path loss between the EUT and the Spectrum Analyser was measured using a Network Analyser. The measured path loss was entered as a Reference Level Offset in the Spectrum Analyser.

The Spectrum Analyser RBW was adjusted to be at least 1% of the measured 26dB Bandwidth. Using an RMS detector, the frequency spectrum up to 1MHz away from the Band Edge was investigated. The Band Power measurement function of the Spectrum Analyser was used. The Band Power span was configured to be at least 1% of the 26dB Bandwidth and was positioned in the 1MHz region which gave the worst case result. The display line was set to a worst case value of -19dBm.

The results are shown in the plots below.

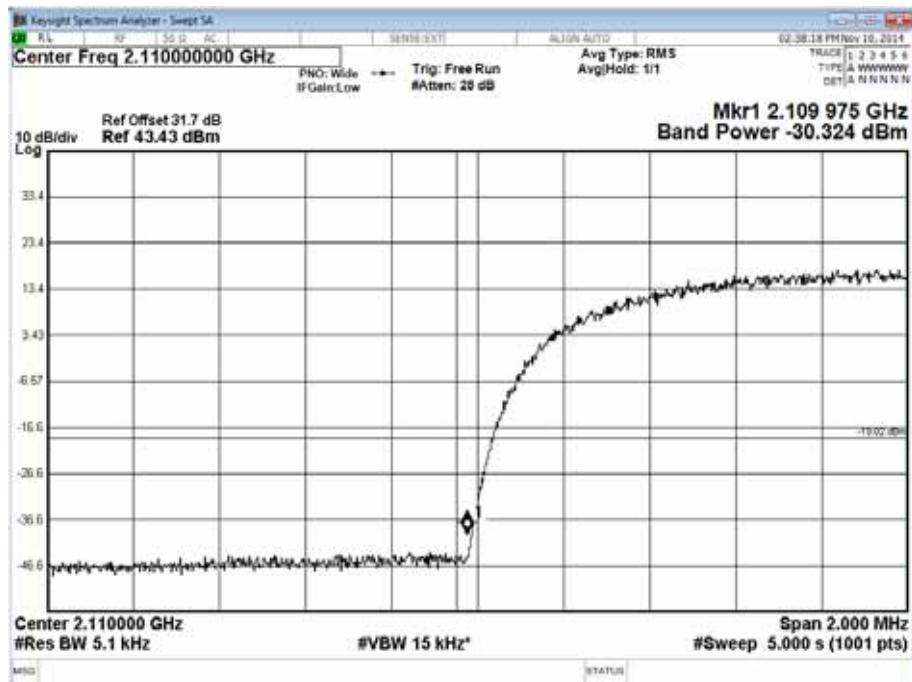
2.3.6 Test Results

Configuration WCDMA SC

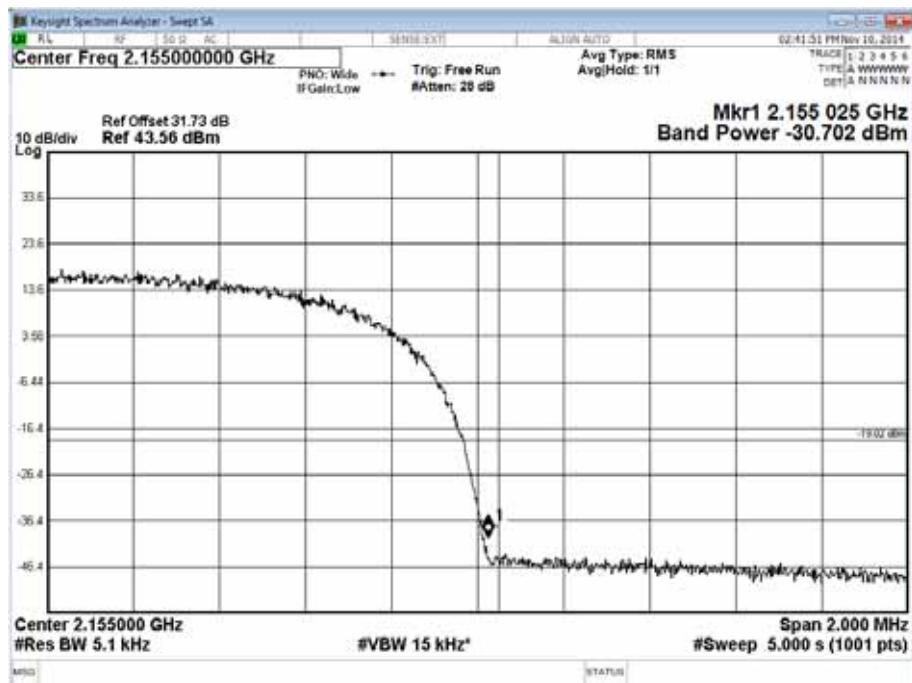
Maximum Output Power 44.77 dBm per carrier, TM5

Antenna	Modulation	Band Edge (MHz)	
		Channel Position B	Channel Position T
A	16QAM	2,112.40	2,152.60
B	16QAM	2,112.40	2,152.60
C	16QAM	2,112.40	2,152.60
D	16QAM	2,112.40	2,152.60

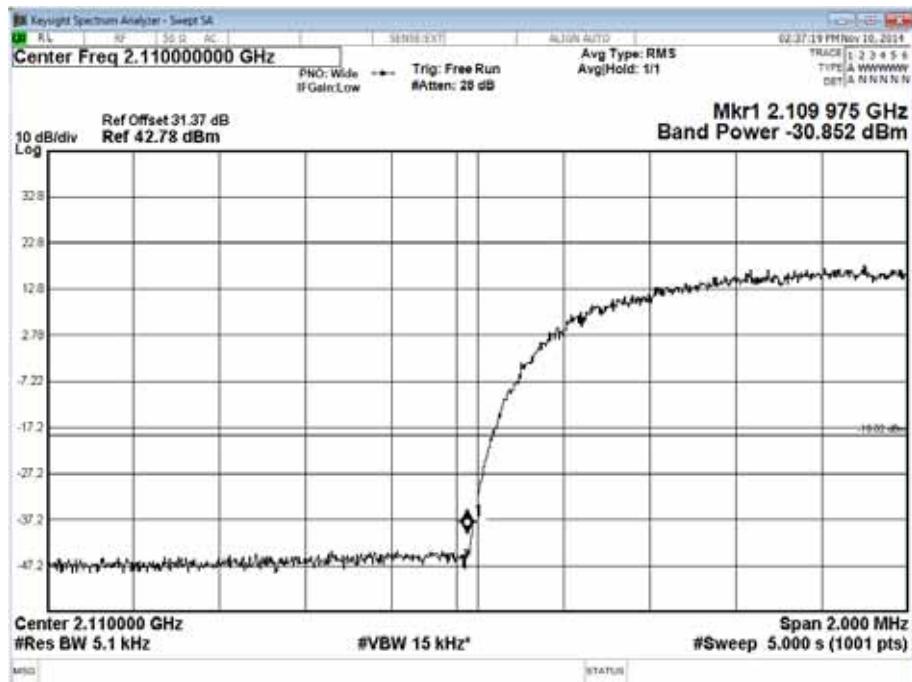
Channel Position B - Antenna A



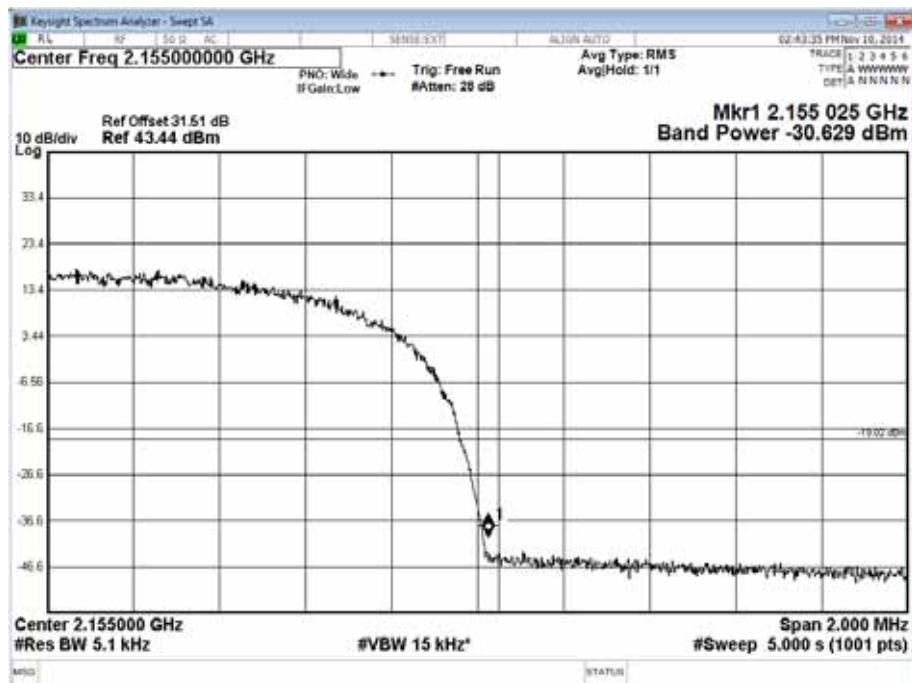
Channel Position T - Antenna A



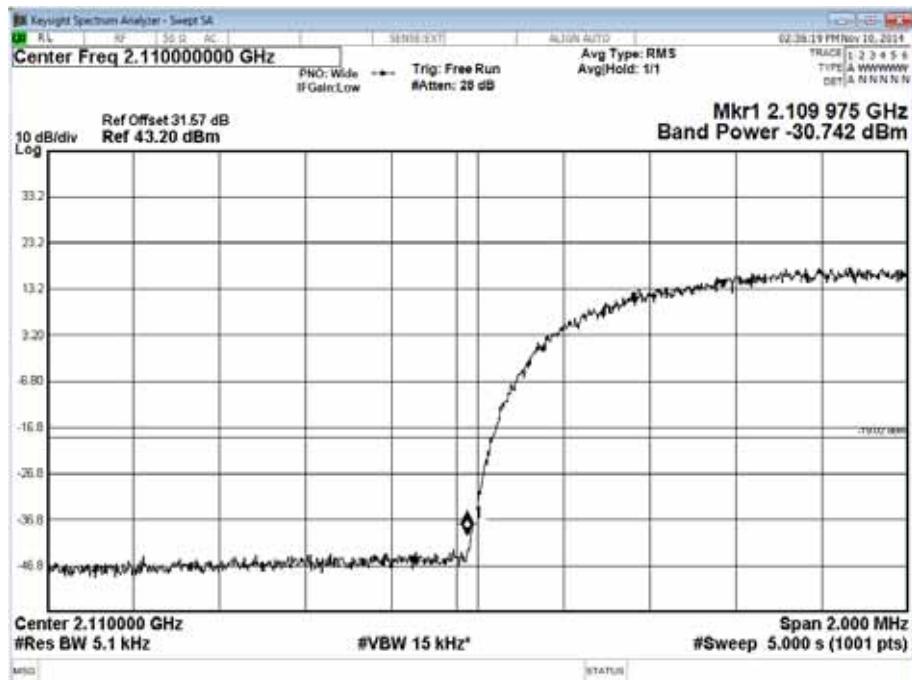
Channel Position B - Antenna B



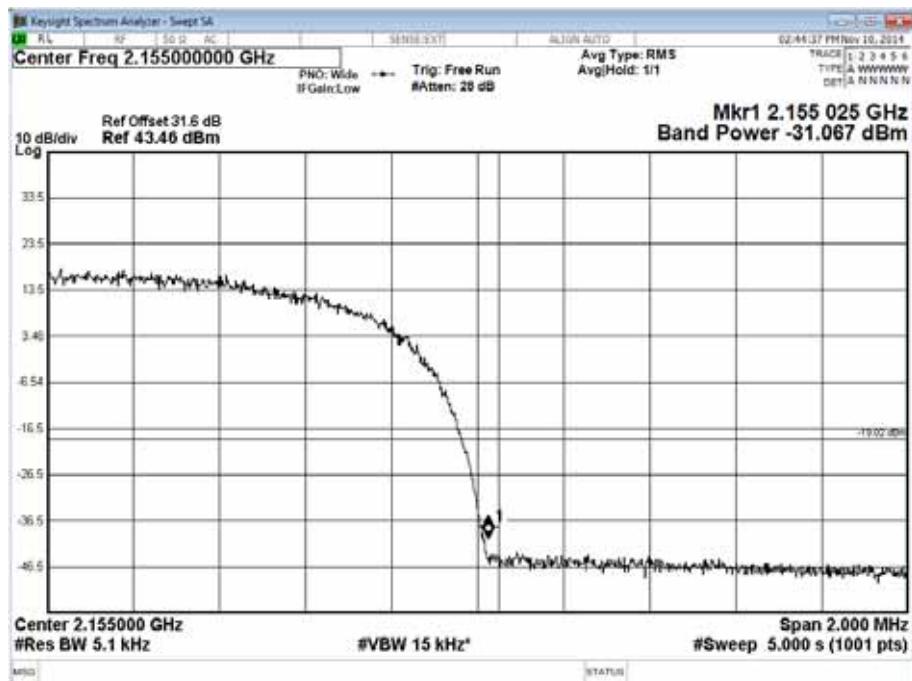
Channel Position T - Antenna B



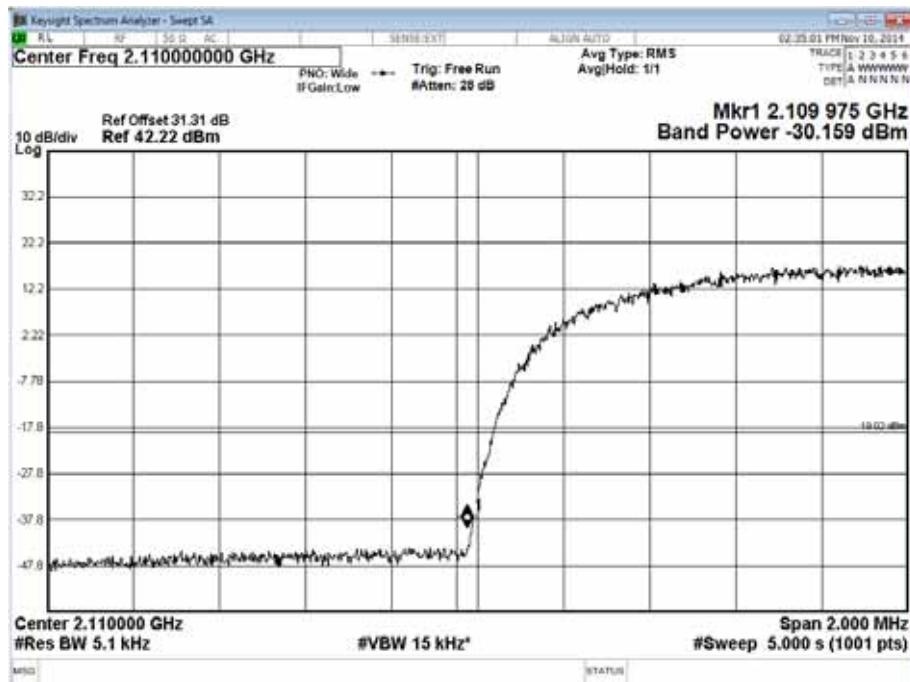
Channel Position B - Antenna C



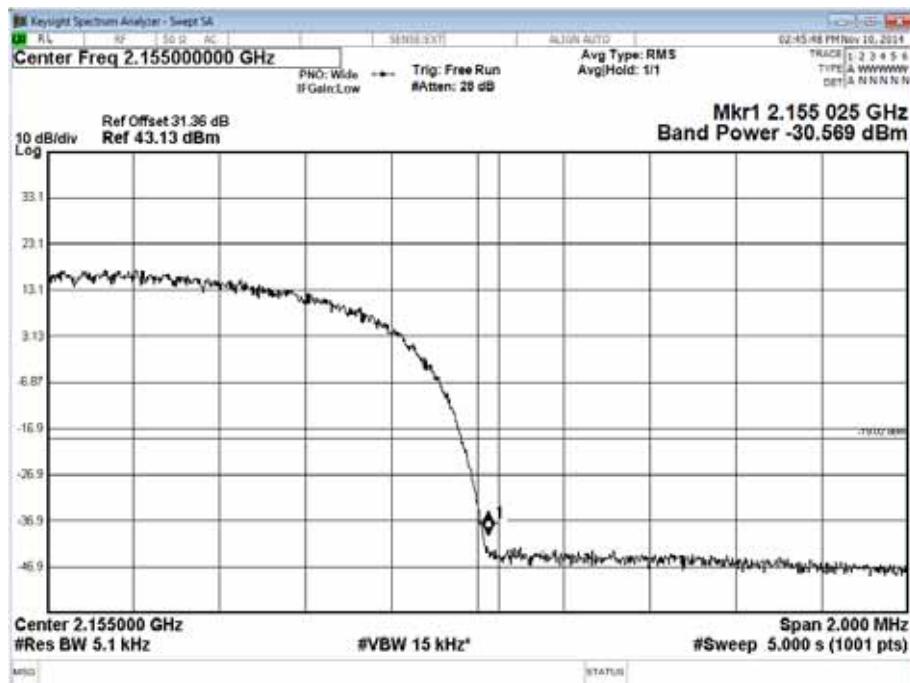
Channel Position T - Antenna C



Channel Position B - Antenna D



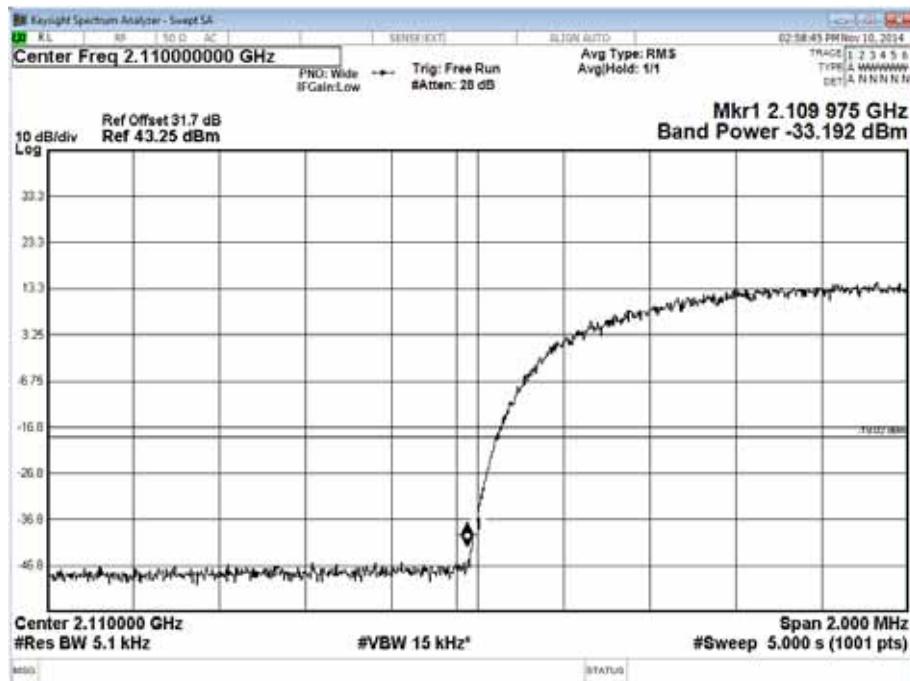
Channel Position T - Antenna D



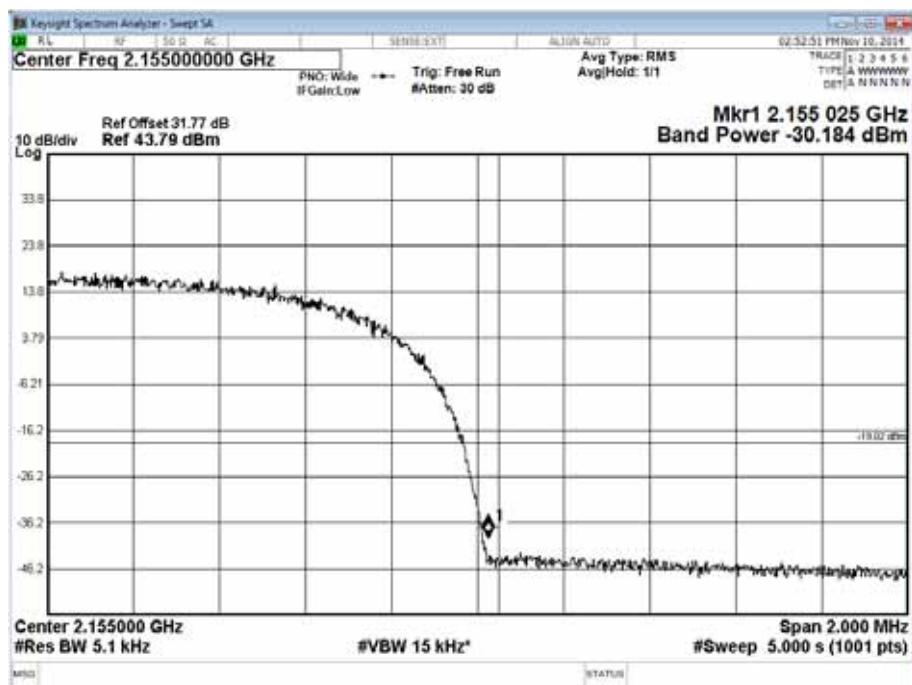
Configuration 2 WCDMA-MC1 (See Table 2 for carrier frequencies)

Maximum Output Power 41.76 dBm per carrier, TM5 (2 Carrier)

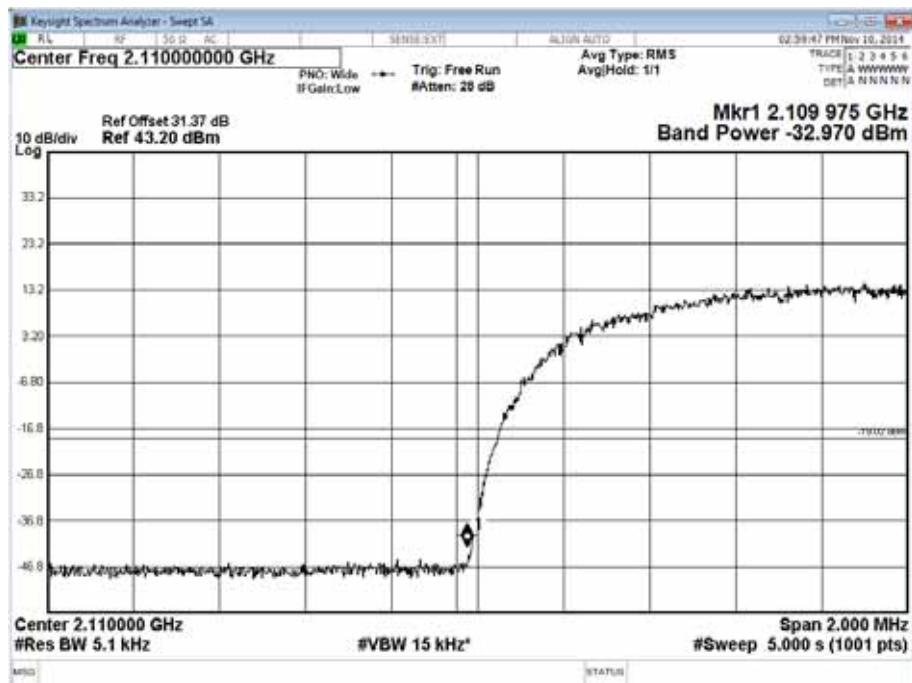
Antenna	Modulation	Band Edge (MHz)	
		Channel Position B	Channel Position T
A	16QAM	2,112.40	2,152.60
B	16QAM	2,112.40	2,152.60
C	16QAM	2,112.40	2,152.60
D	16QAM	2,112.40	2,152.60

Channel Position B - Antenna A


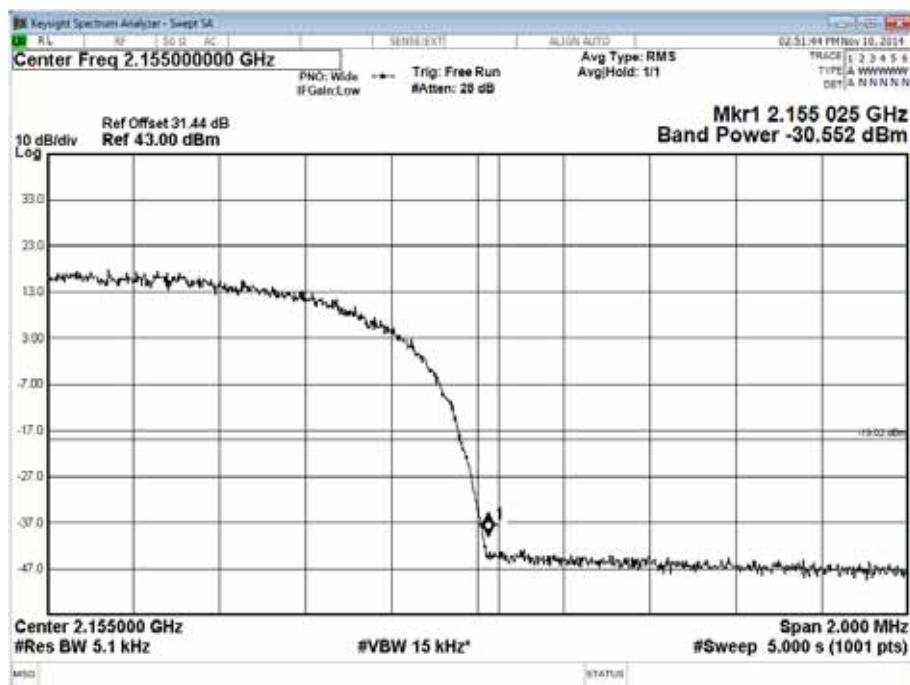
Channel Position T - Antenna A



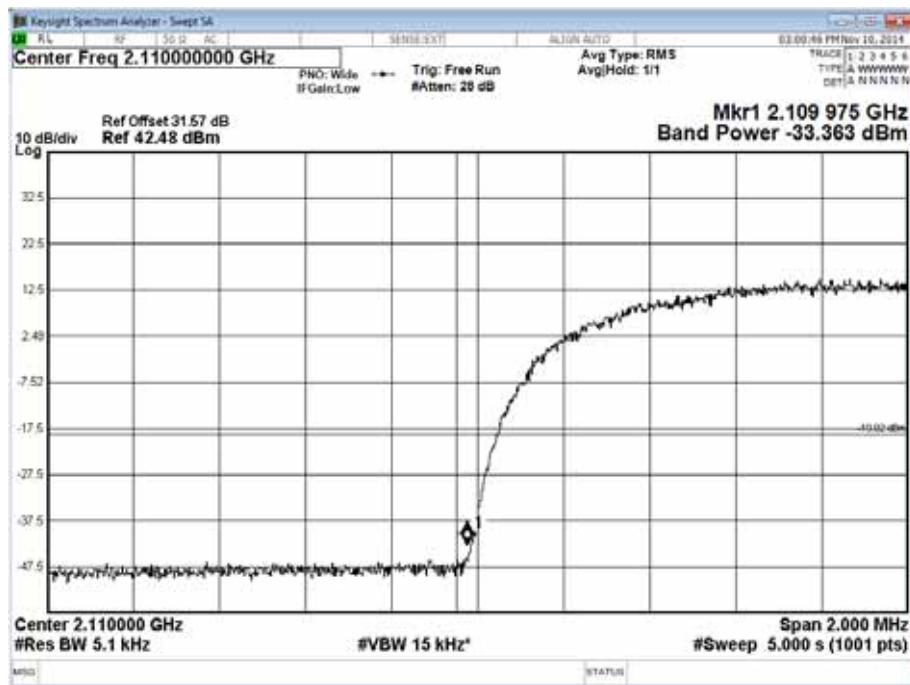
Channel Position B - Antenna B



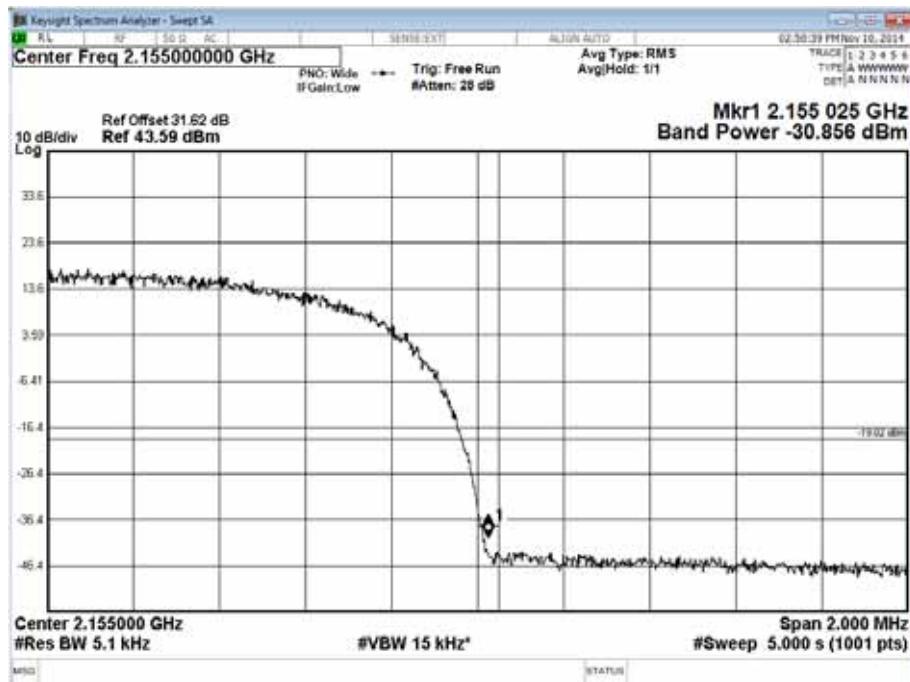
Channel Position T - Antenna B



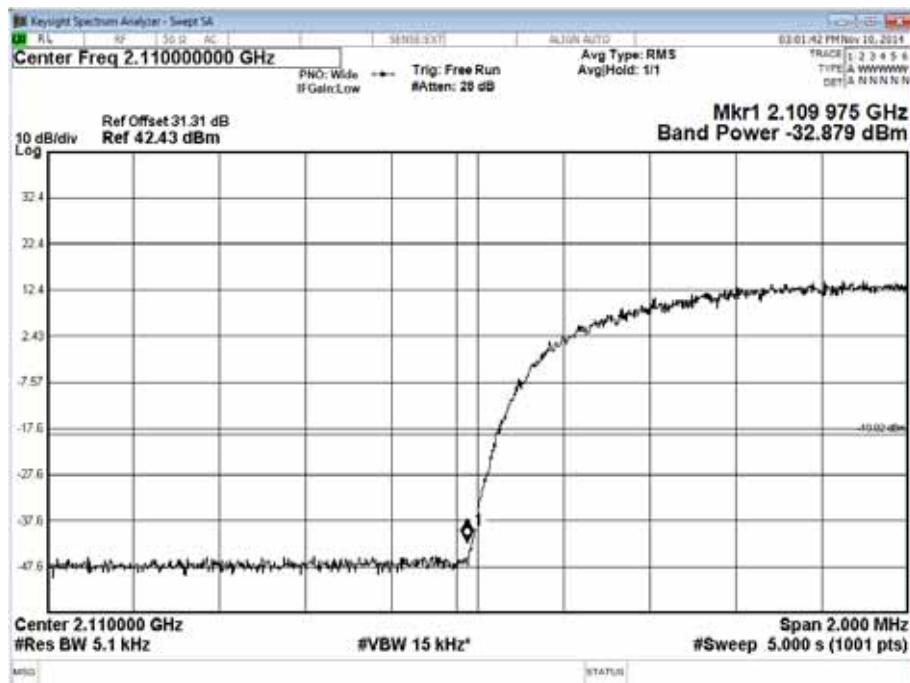
Channel Position B - Antenna C



Channel Position T - Antenna C



Channel Position B - Antenna D



Channel Position T - Antenna D

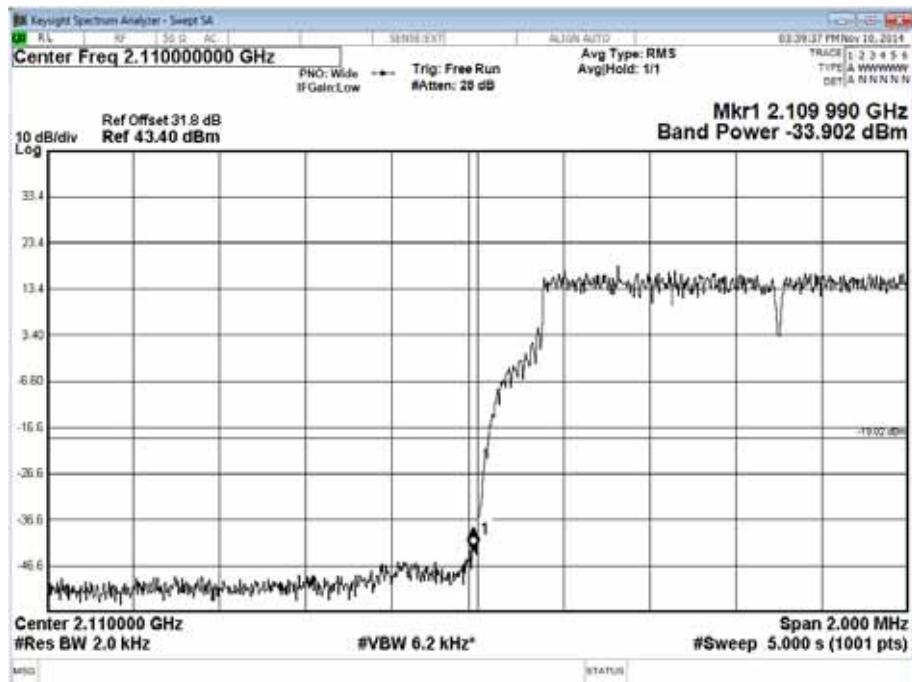


Configuration 4 WCDMA/LTE MC-3 (See Table 4 for carrier frequencies)

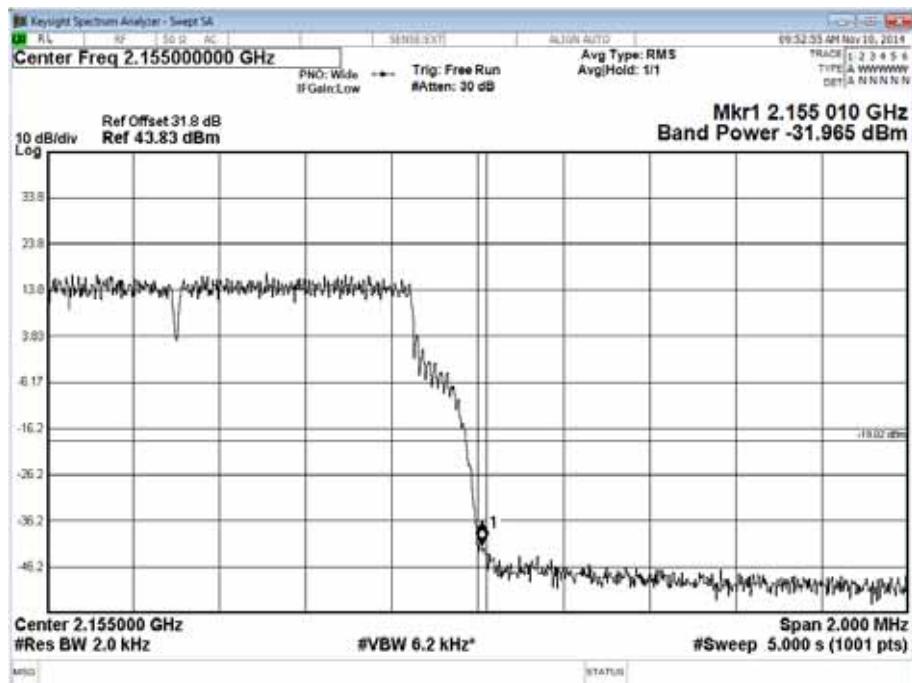
Maximum Output Power 41.76 dBm per carrier, TM5 (WCDMA), TM1.1 (LTE)

Antenna	WCDMA Modulation / LTE Bandwidth	Band Edge (MHz)	
		Channel Position BRFBW	Channel Position TRFBW
A	16QAM / 1.4 MHz	2,110.70	2,154.30
B	16QAM / 1.4 MHz	2,110.70	2,154.30
C	16QAM / 1.4 MHz	2,110.70	2,154.30
D	16QAM / 1.4 MHz	2,110.70	2,154.30

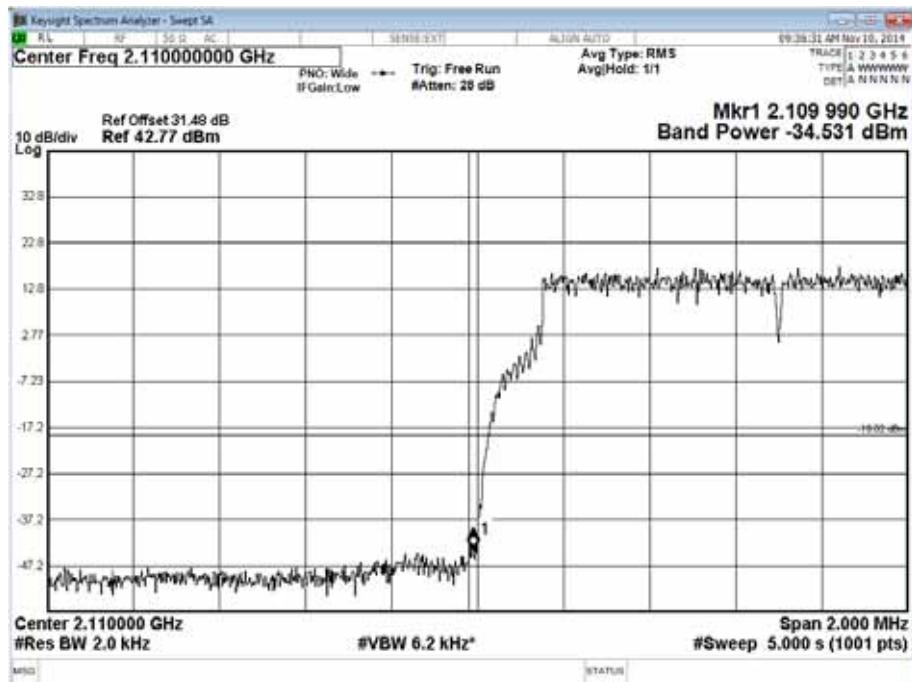
Channel Position BRFBW - Antenna A



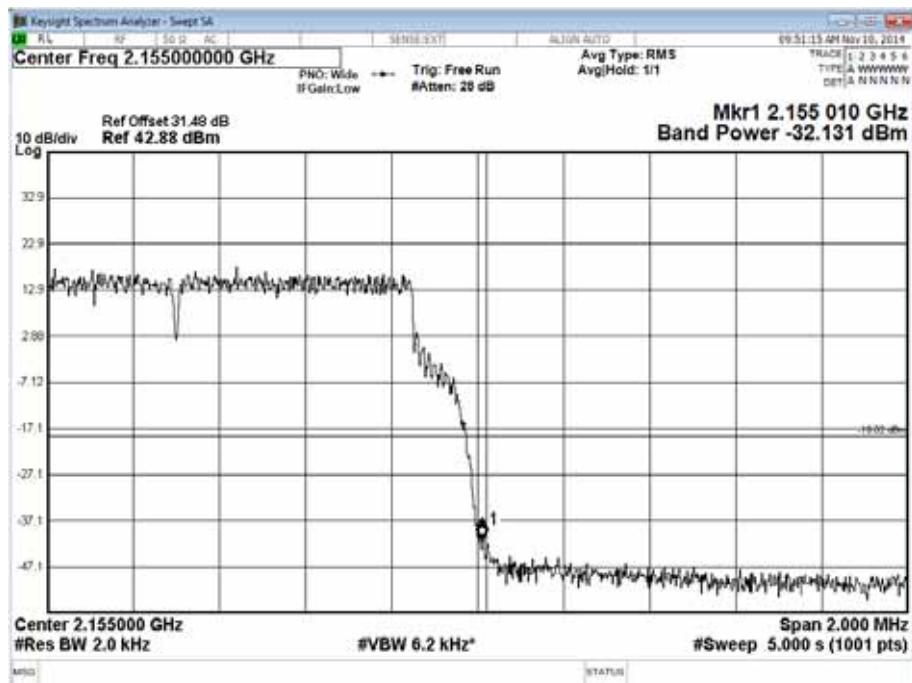
Channel Position TRFBW - Antenna A



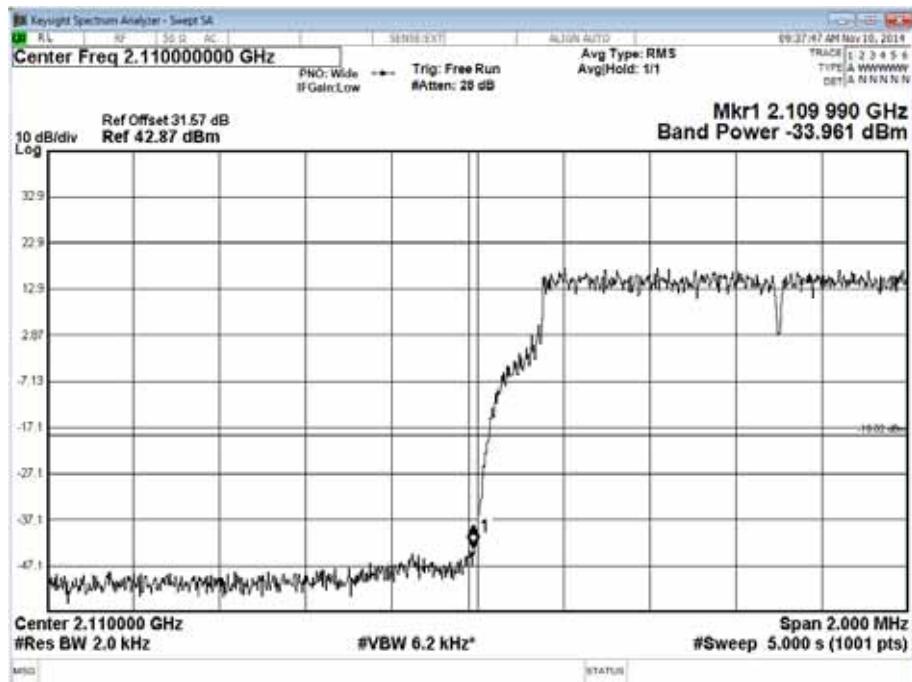
Channel Position BRFBW - Antenna B



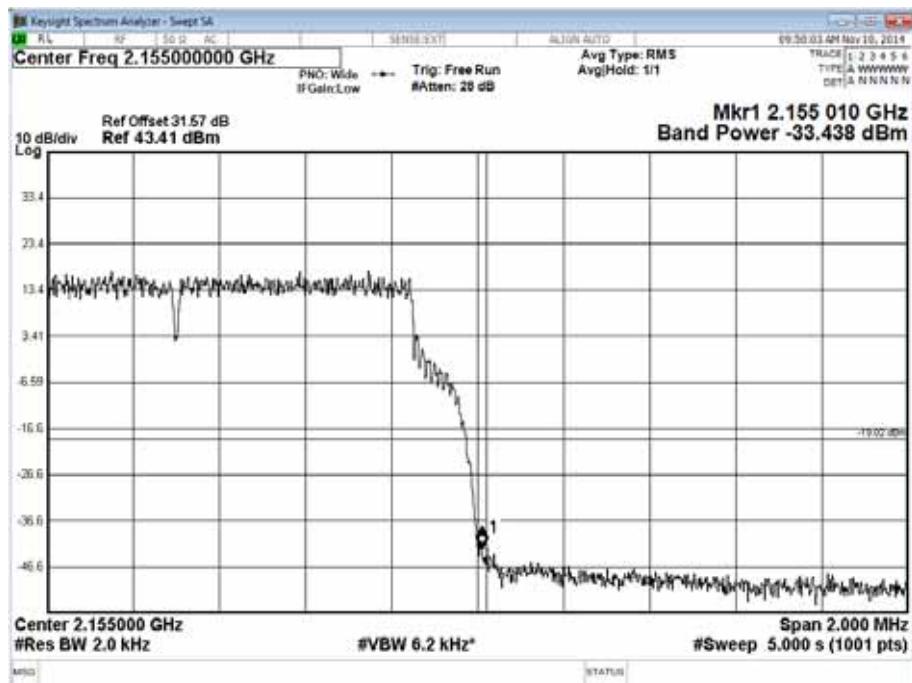
Channel Position TRFBW - Antenna B



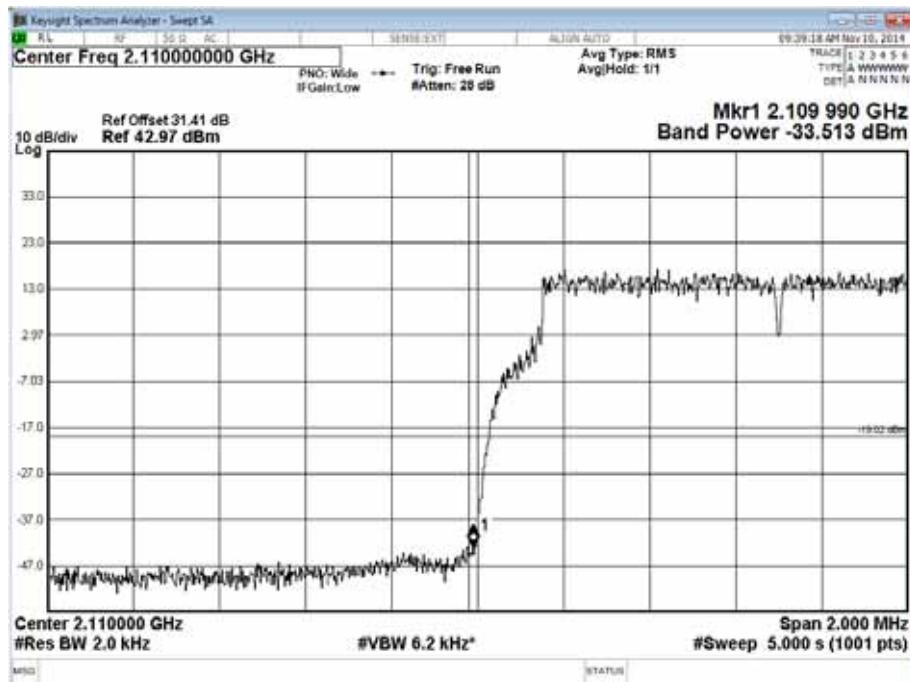
Channel Position BRFBW - Antenna C



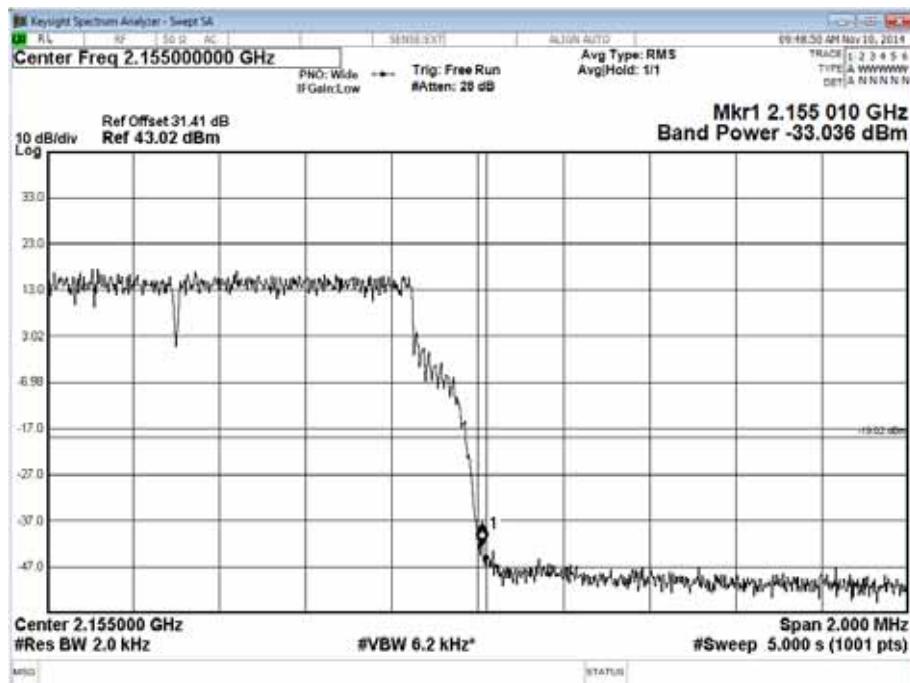
Channel Position TRFBW - Antenna C



Channel Position BRFBW - Antenna D



Channel Position TRFBW - Antenna D

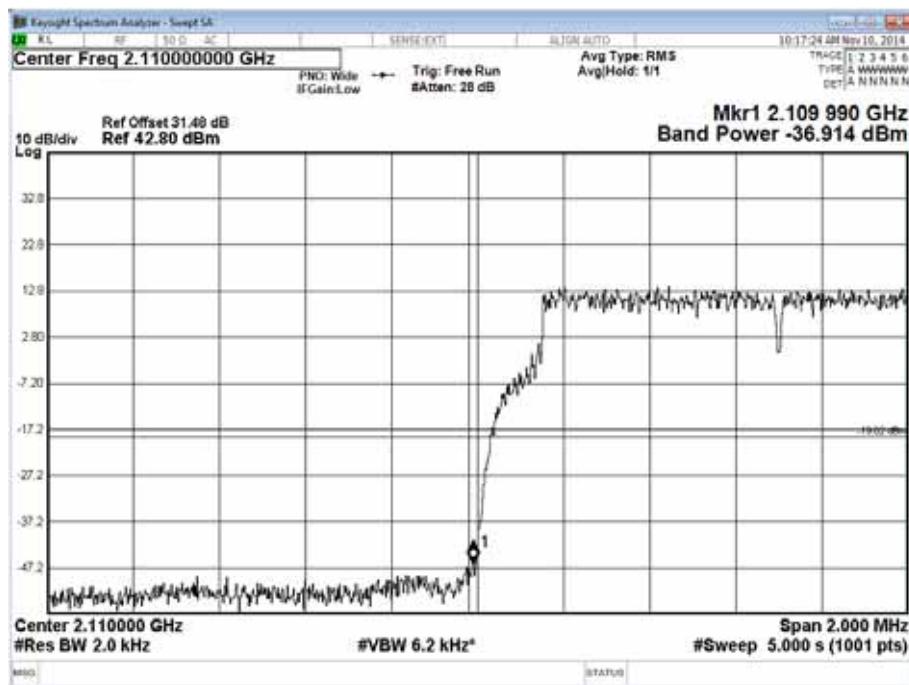


Configuration 5 WCDMA/LTE MC-4 (See Table 4 for carrier frequency)

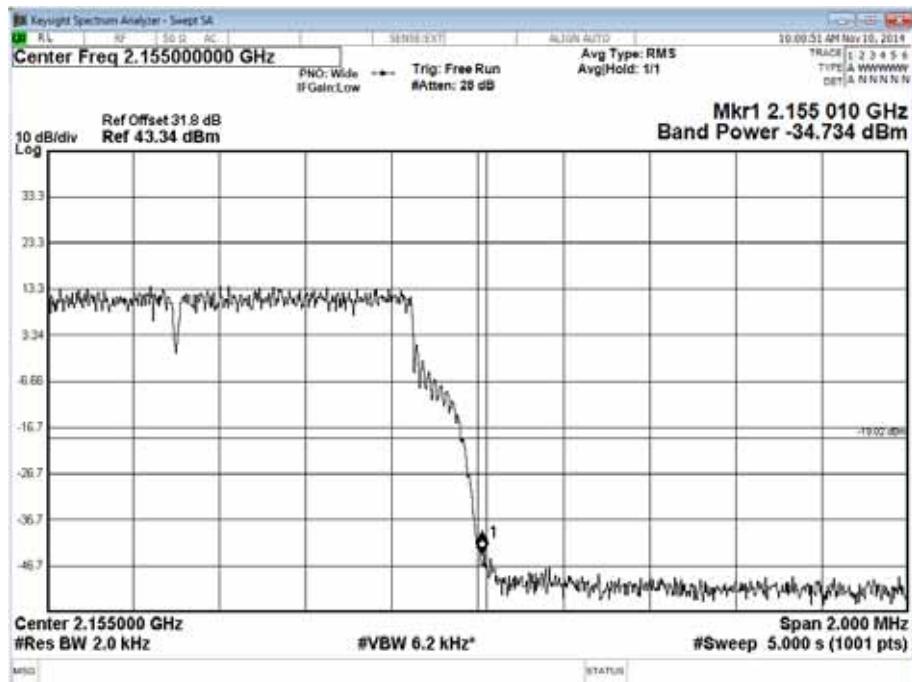
Maximum Output Power 38.75 dBm per carrier, TM5 (WCDMA), TM1.1 (LTE)

Antenna	WCDMA Modulation / LTE Bandwidth	Band Edge (MHz)	
		Channel Position BRFBW	Channel Position TRFBW
A	16QAM / 1.4 MHz	2,110.70	2,154.30
B	16QAM / 1.4 MHz	2,110.70	2,154.30
C	16QAM / 1.4 MHz	2,110.70	2,154.30
D	16QAM / 1.4 MHz	2,110.70	2,154.30

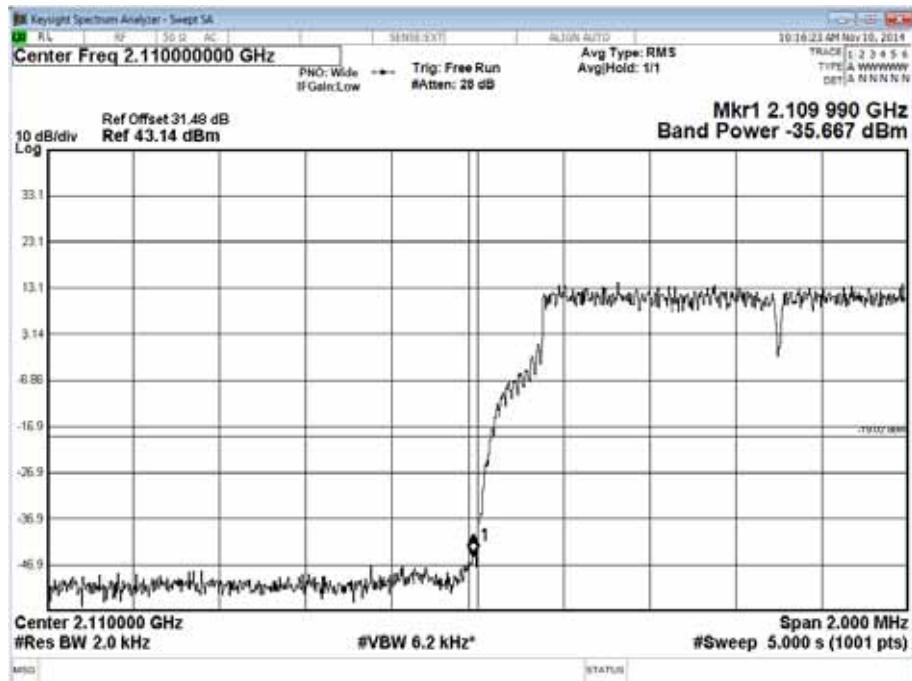
Channel Position BRFBW - Antenna A



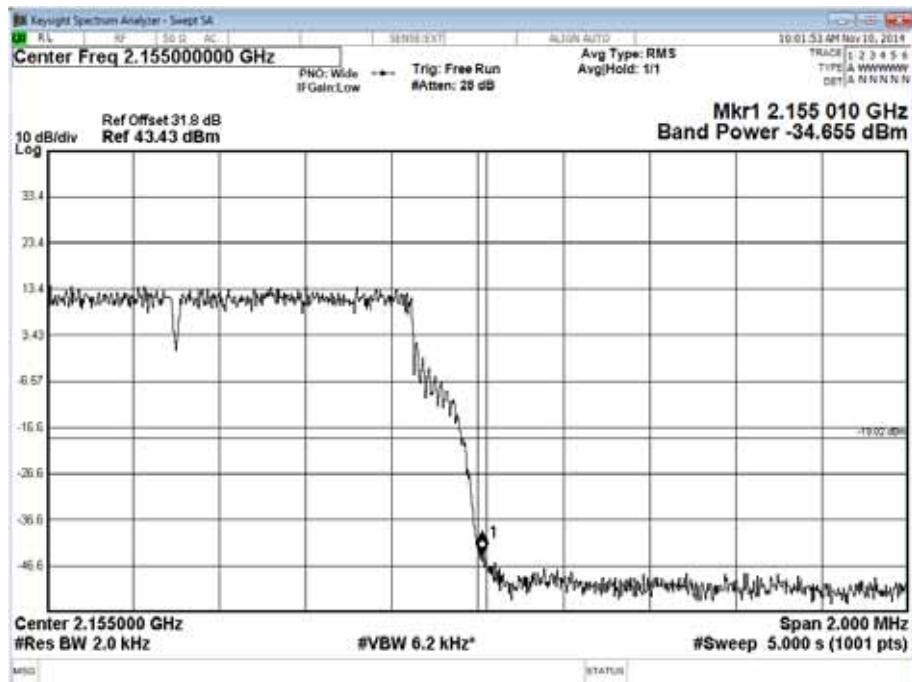
Channel Position TRFBW - Antenna A



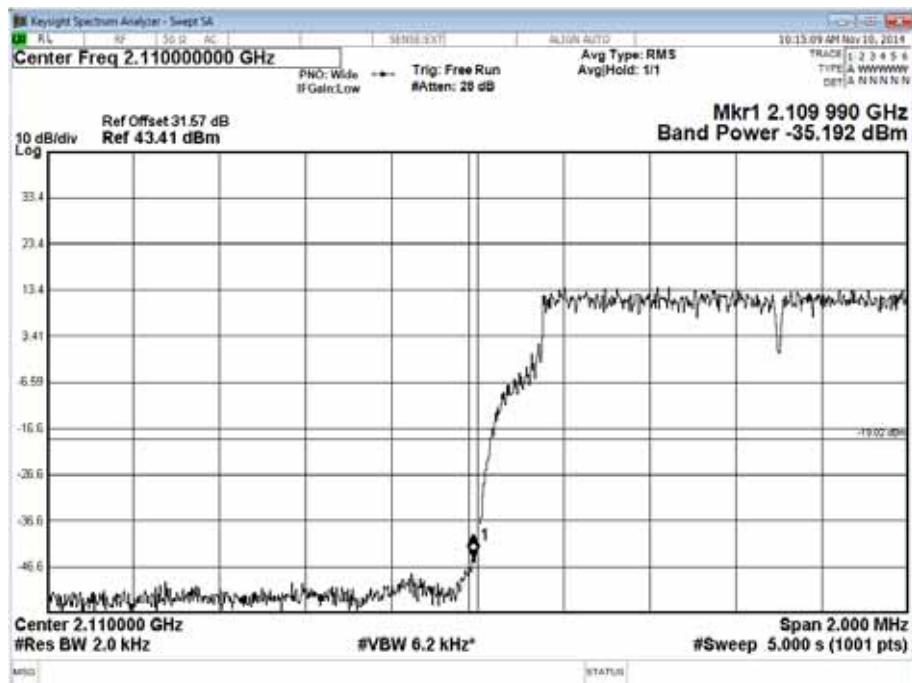
Channel Position BRFBW - Antenna B



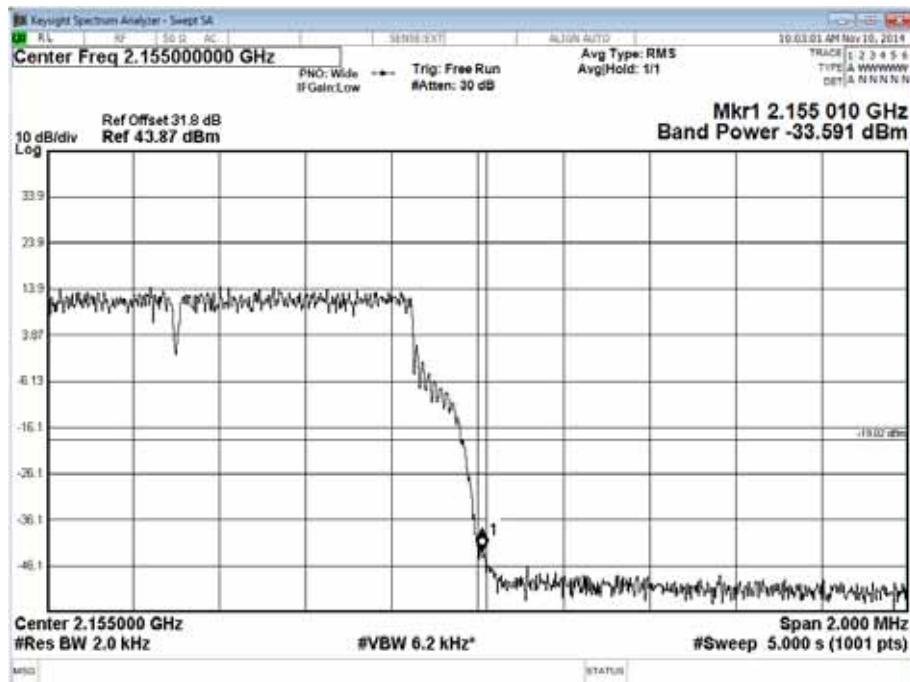
Channel Position TRFBW - Antenna B



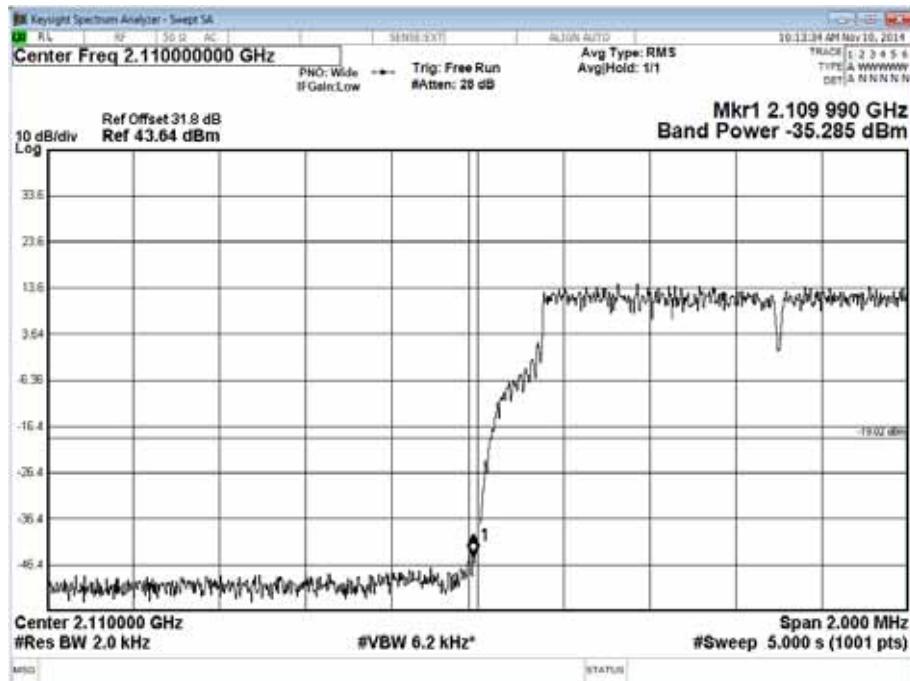
Channel Position BRFBW - Antenna C



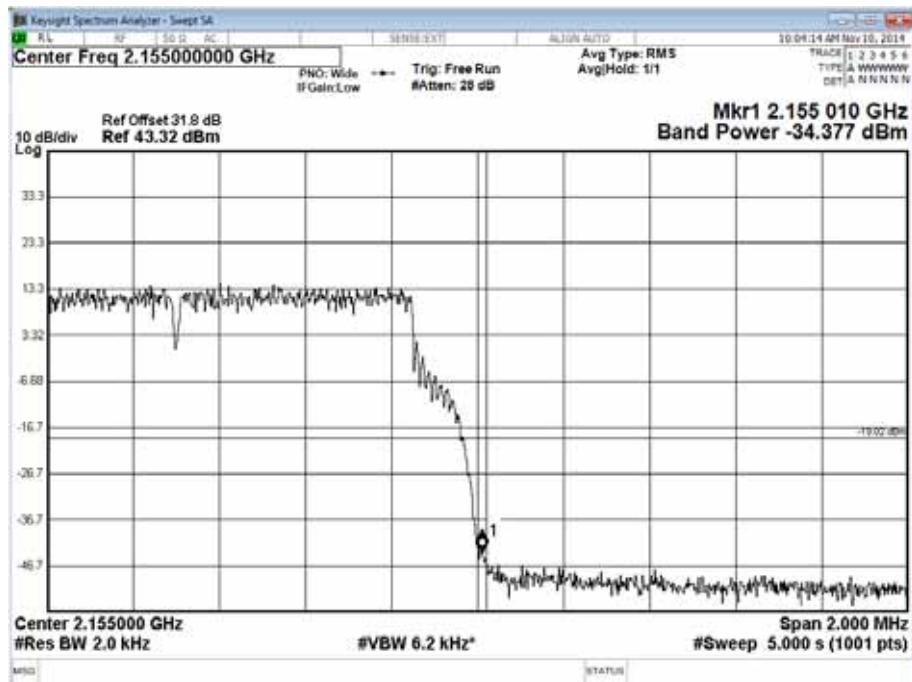
Channel Position TRFBW - Antenna C



Channel Position BRFBW - Antenna D



Channel Position TRFBW - Antenna D



Limit	-19 dBm (-13 dBm - 10log(NANT) where N = 4)
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2.4 TRANSMITTER SPURIOUS EMISSIONS

2.4.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 27, Clause 27.53(h)
Industry Canada RSS-139, Clause 4.2 / 6.5 (ii)

2.4.2 Date of Test and Modification State

6 and 10 November 2014 - Modification State 0

2.4.3 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.4 Environmental Conditions

Ambient Temperature	24.4 - 24.8°C
Relative Humidity	32.2 - 32.9%

2.4.5 Test Method

The EUT was connected to a Spectrum Analyser via 30dB of attenuation for measurements below 3.5GHz and 30dB of attenuation and a high pass filter for measurements from 3.5GHz to 22GHz. A Network Analyser was used to calibrate the path loss between the EUT and the Spectrum Analyser and the worst case path loss in the measured ranges was entered as a reference level offset.

Over the measured ranges, the RBW was set to 1MHz with a VBW of 3MHz. All measurement results are specified as average with an RMS detector being used in conjunction with a trace setting of Max Hold. Measurements were performed in configurations of the EUT as reported below. The configurations chosen were worst case based on pre-test results.

Testing was performed on all ports. The test limits were set to a worst case value of -19dBm.

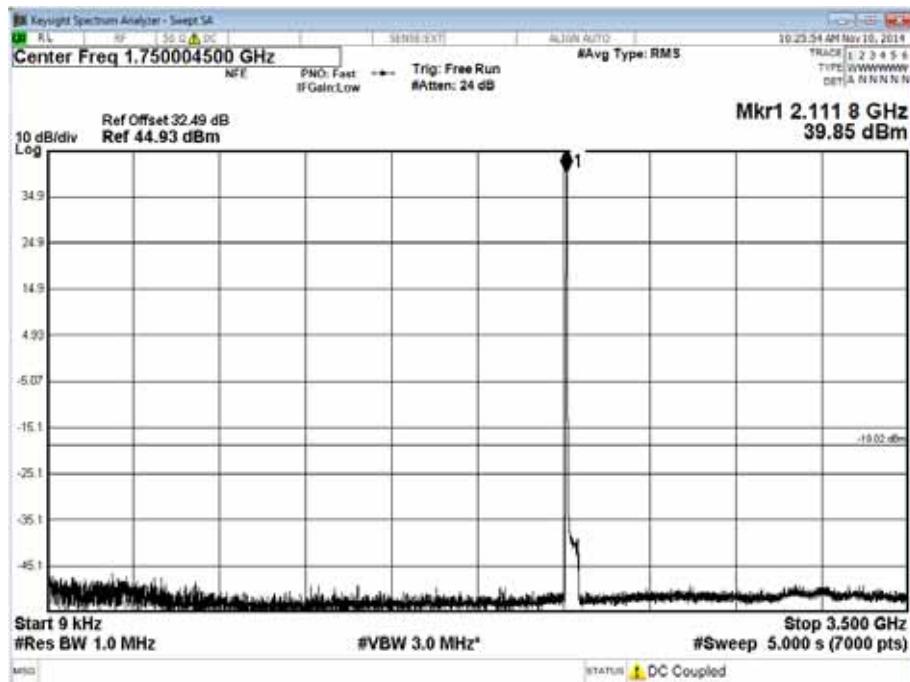
The results are shown in the plots below.

2.4.6 Test Results

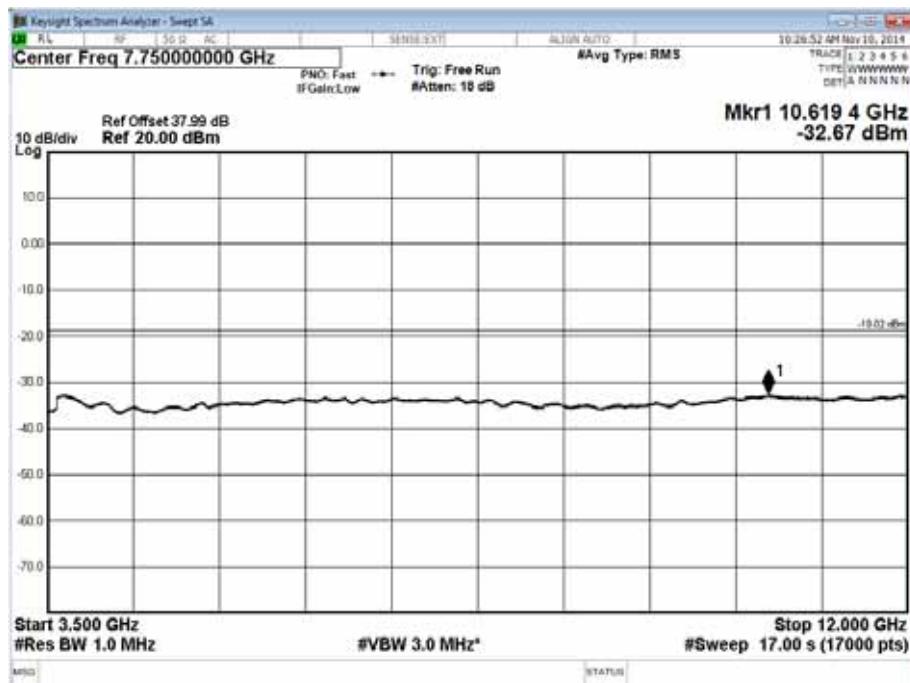
Configuration WCDMA SC (see Table 1 for carrier frequency)

Maximum Output Power 44.77 dBm per carrier, TM5, Antenna Port A

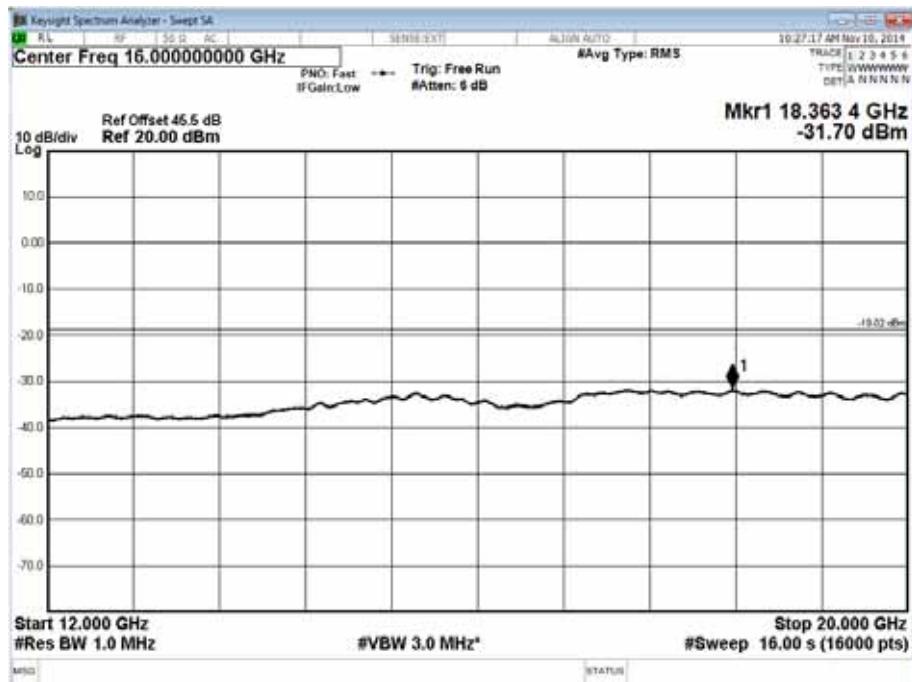
Channel Position B - Band 1 - Range 0.009 to 3500 MHz - Antenna A



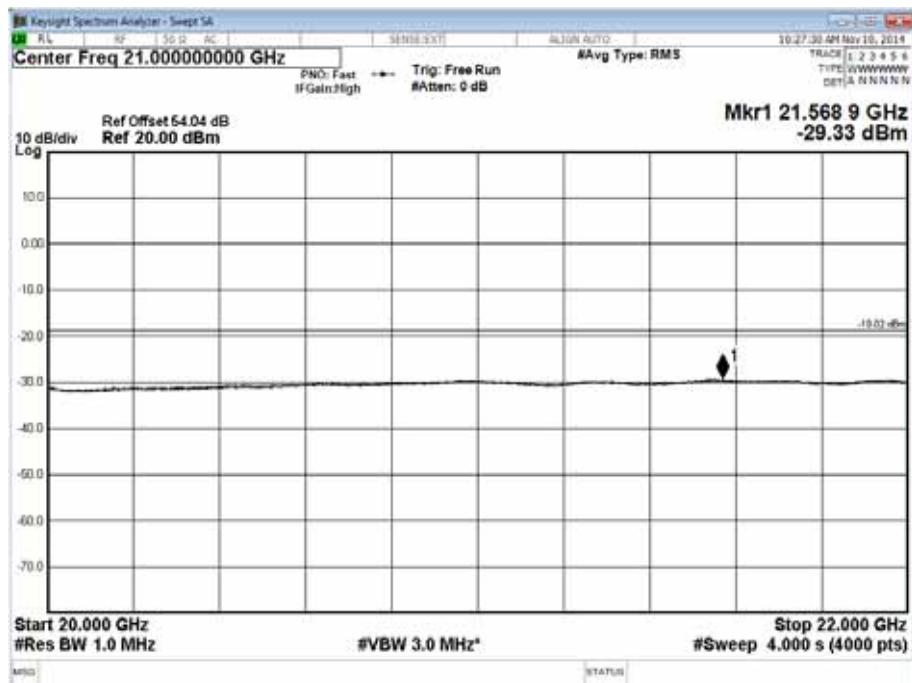
Channel Position B - Band 2 - Range 3500 to 12000 MHz - Antenna A



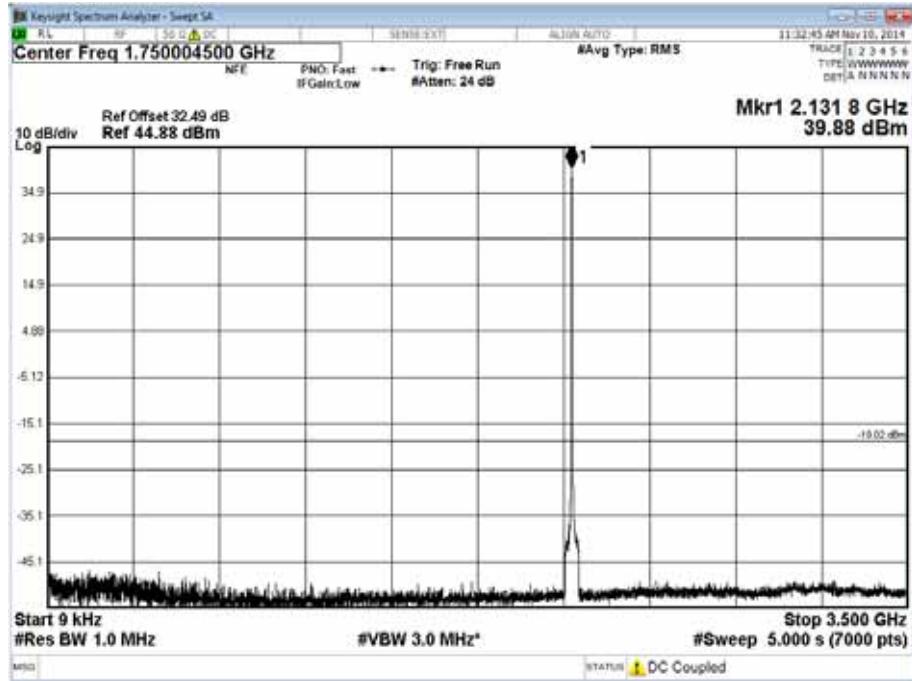
Channel Position B - Band 3 - Range 12000 to 20000 MHz - Antenna A



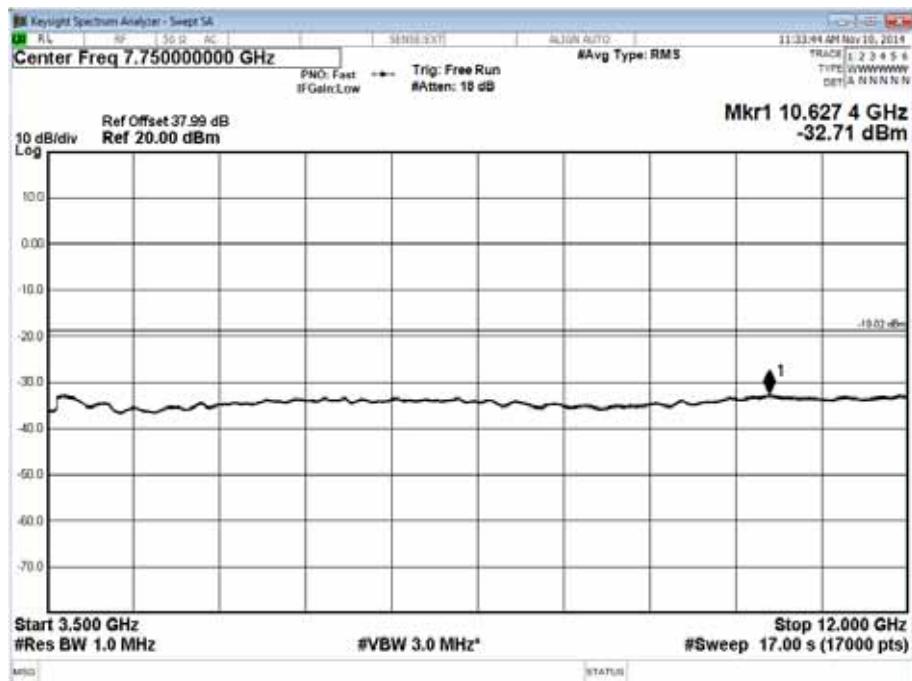
Channel Position B - Band 4 - Range 20000 to 22000 MHz - Antenna A



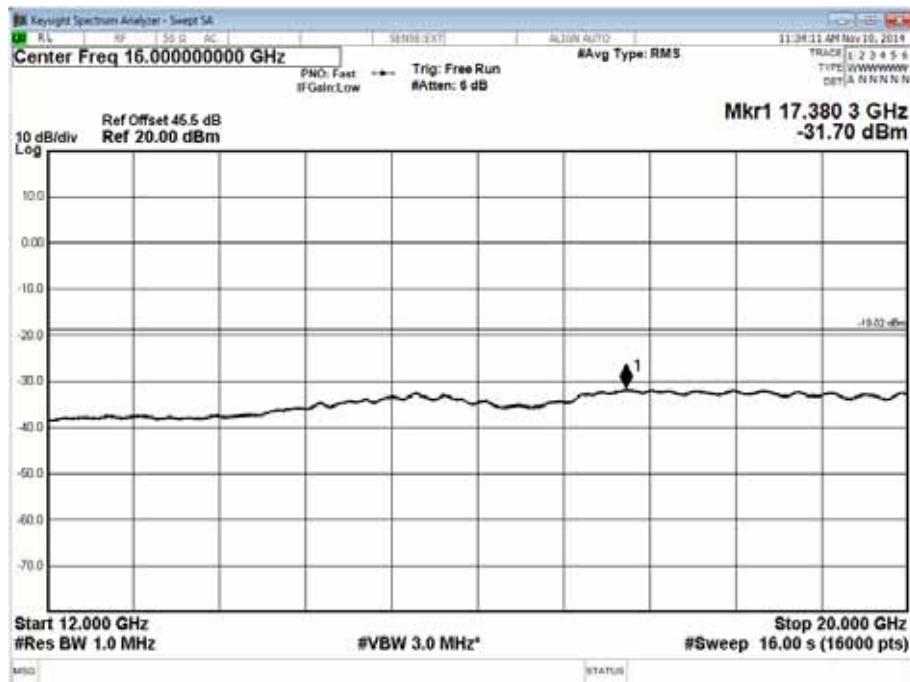
Channel Position M - Band 1 - Range 0.009 to 3500 MHz - Antenna A



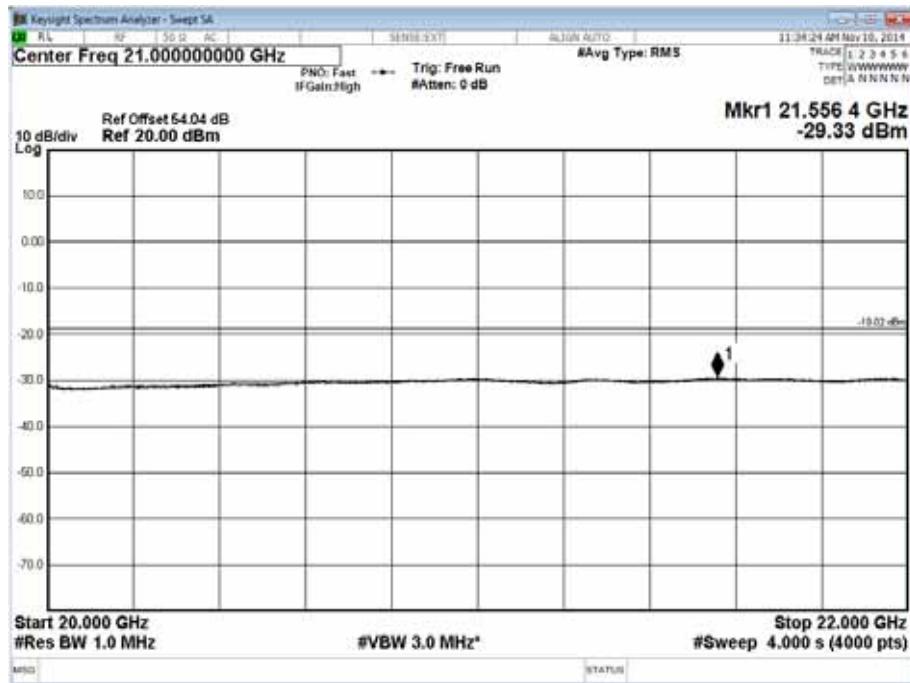
Channel Position M - Band 2 - Range 3500 to 12000 MHz - Antenna A



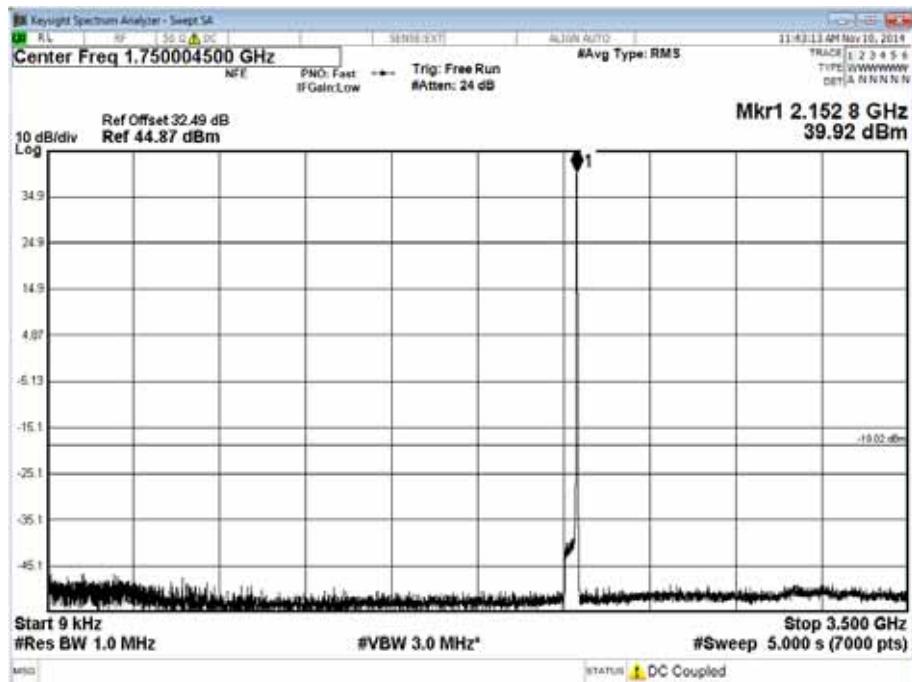
Channel Position M - Band 3 - Range 12000 to 20000 MHz - Antenna A



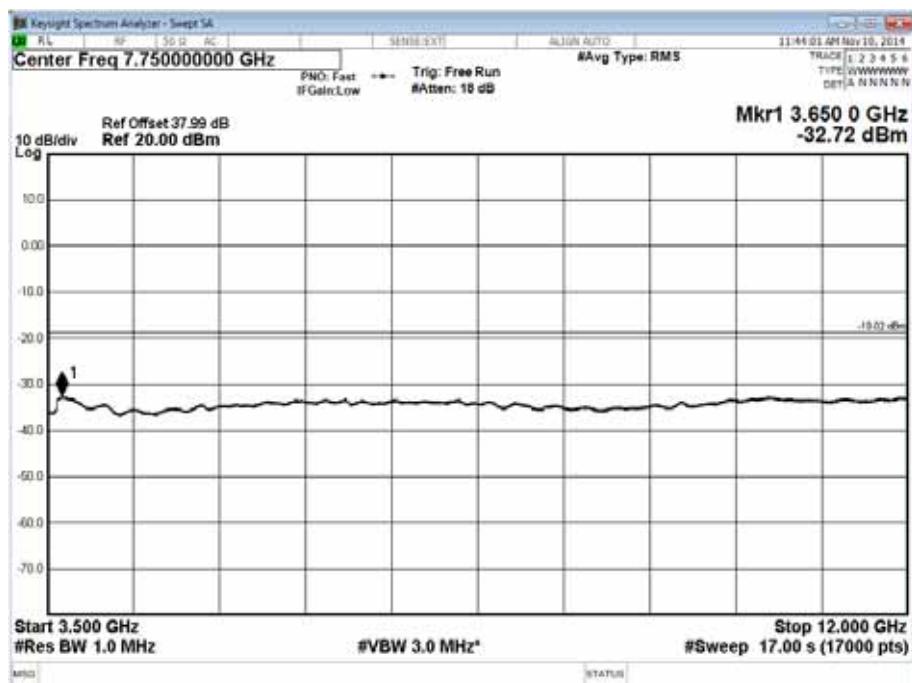
Channel Position M - Band 4 - Range 20000 to 22000 MHz - Antenna A



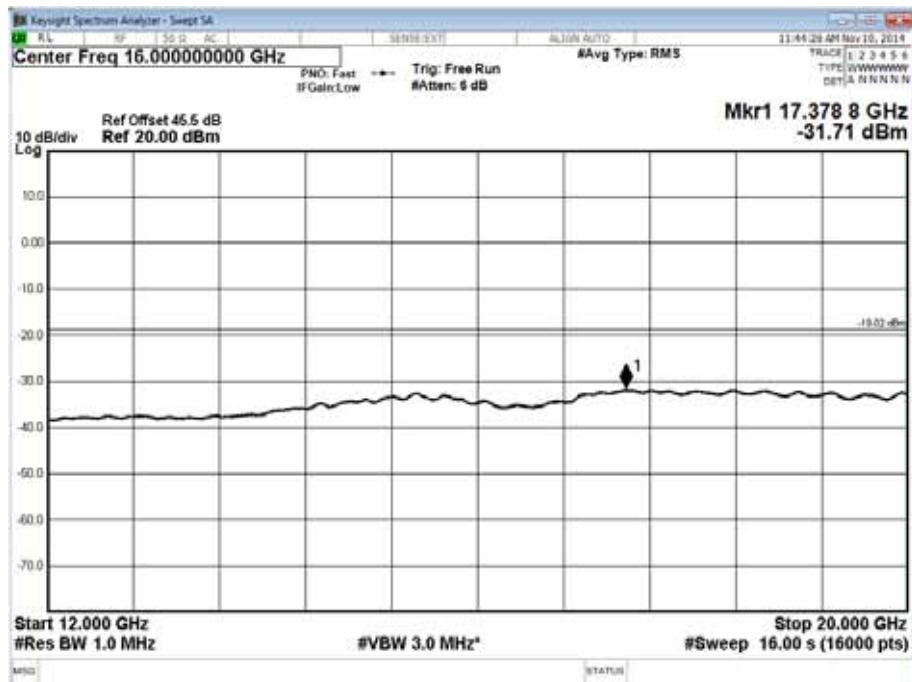
Channel Position T - Band 1 - Range 0.009 to 3500 MHz - Antenna A



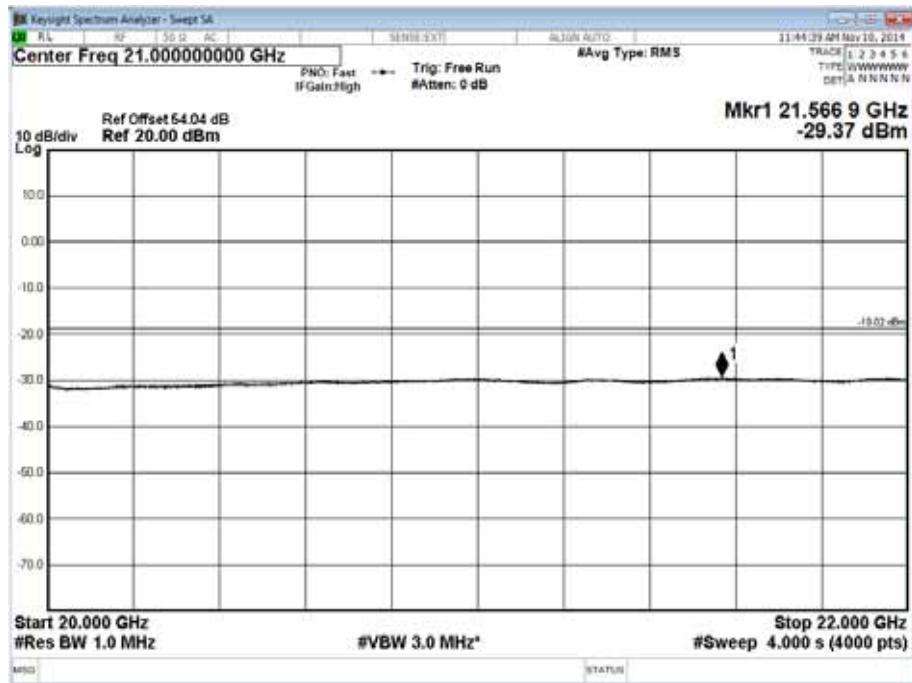
Channel Position T - Band 2 - Range 3500 to 12000 MHz - Antenna A



Channel Position T - Band 3 - Range 12000 to 20000 MHz - Antenna A



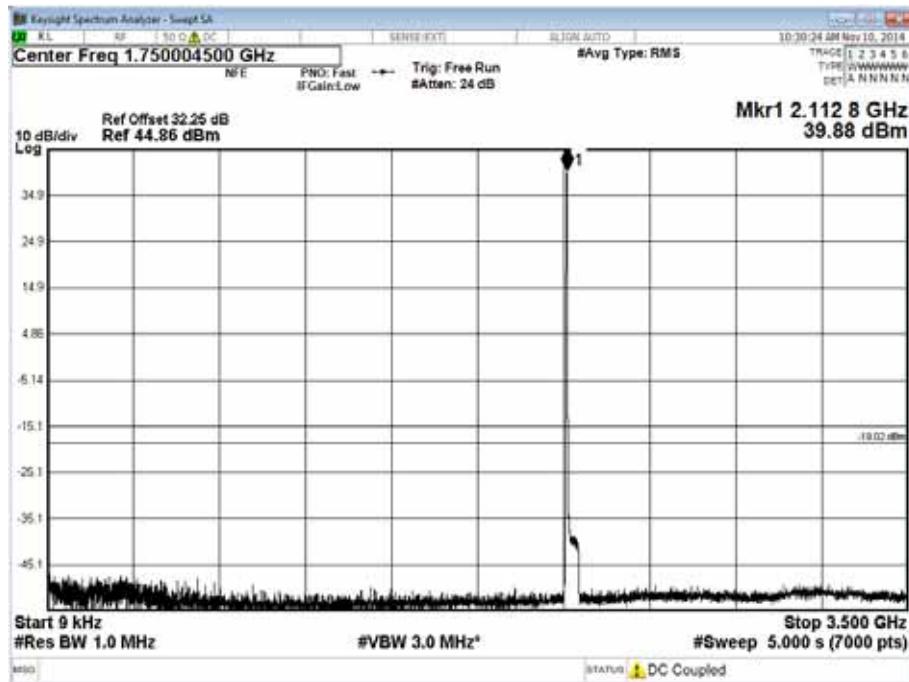
Channel Position T - Band 4 - Range 20000 to 22000 MHz - Antenna A



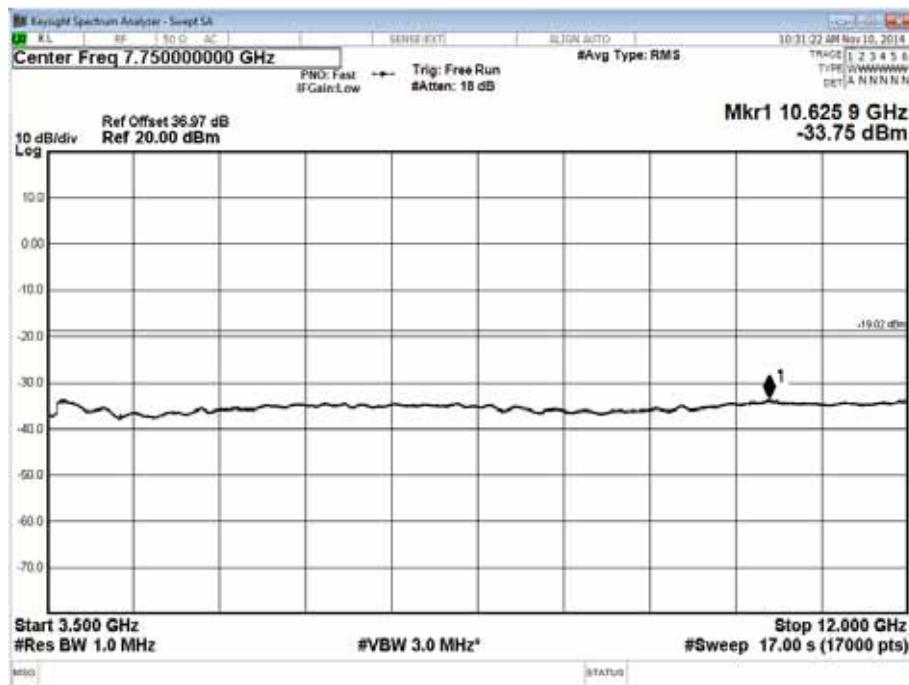
Configuration WCDMA SC (see Table 1 for carrier frequency)

Maximum Output Power 44.77 dBm per carrier, TM5, Antenna Port B

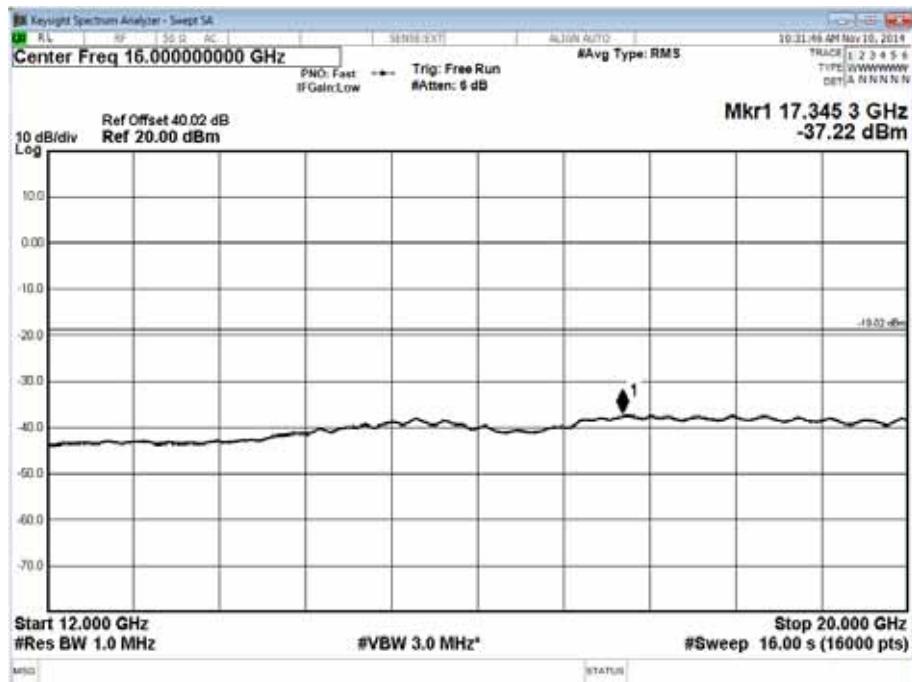
Channel Position B - Band 1 - Range 0.009 to 3500 MHz - Antenna B



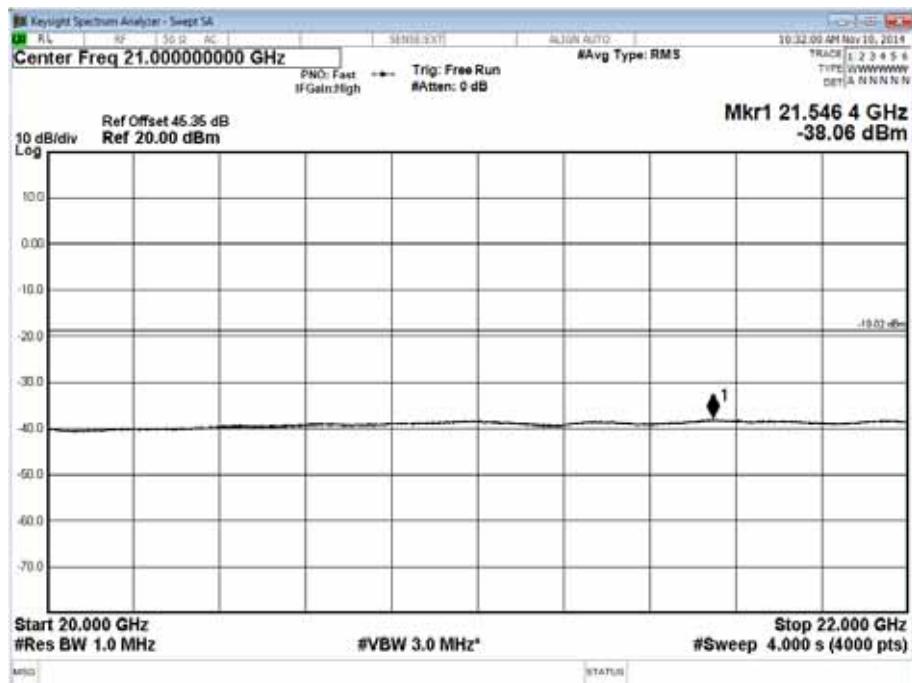
Channel Position B - Band 2 - Range 3500 to 12000 MHz - Antenna B



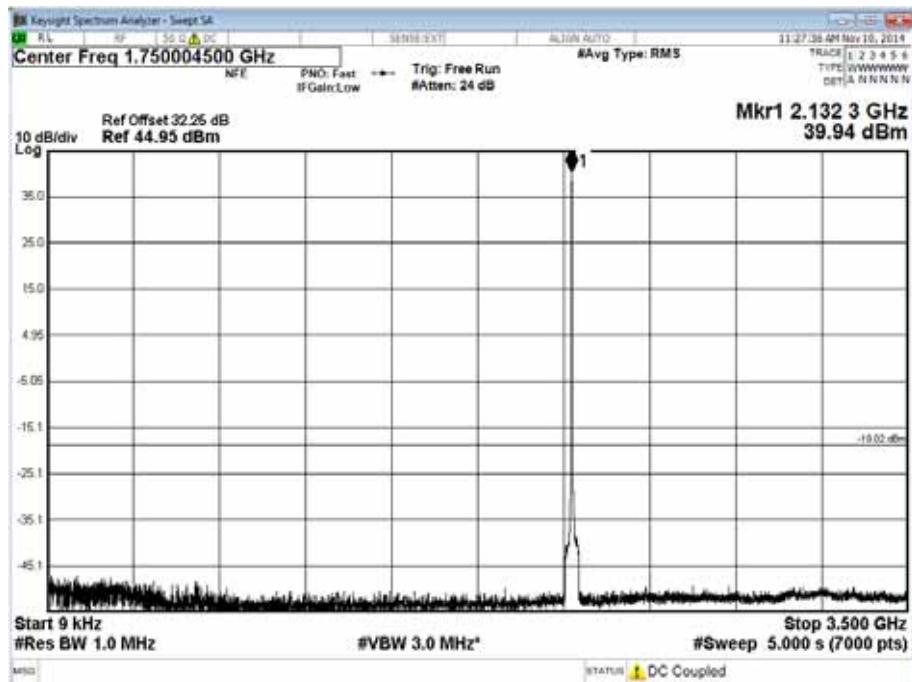
Channel Position B - Band 3 - Range 12000 to 20000 MHz - Antenna B



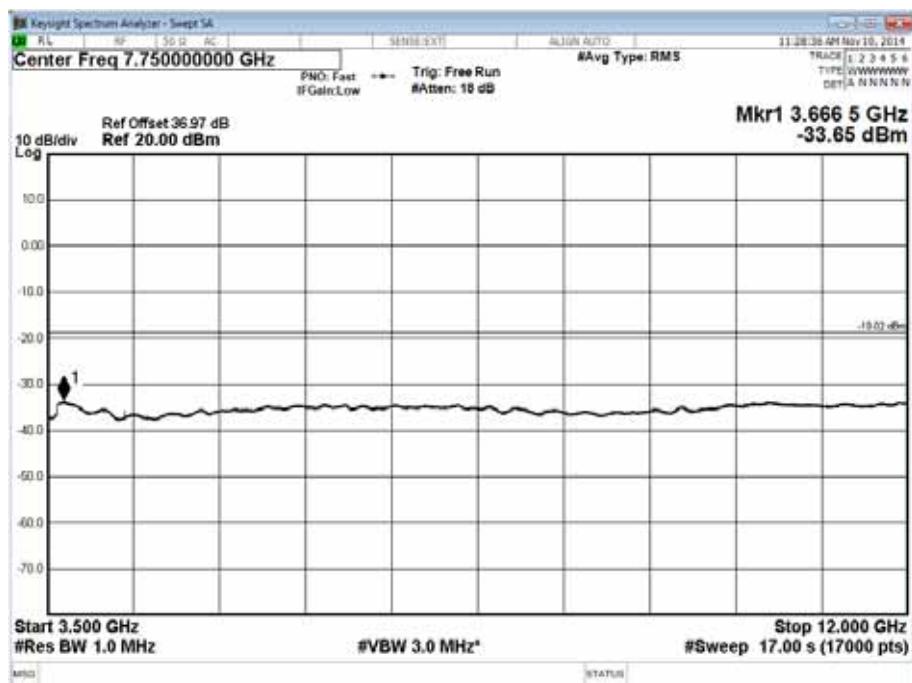
Channel Position B - Band 4 - Range 20000 to 22000 MHz - Antenna B



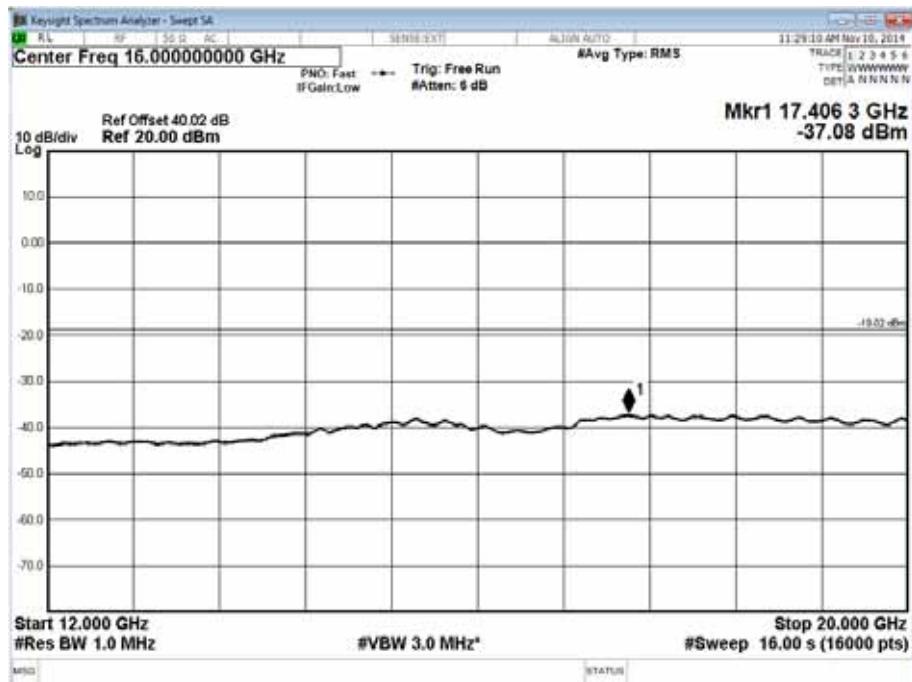
Channel Position M - Band 1 - Range 0.009 to 3500 MHz - Antenna B



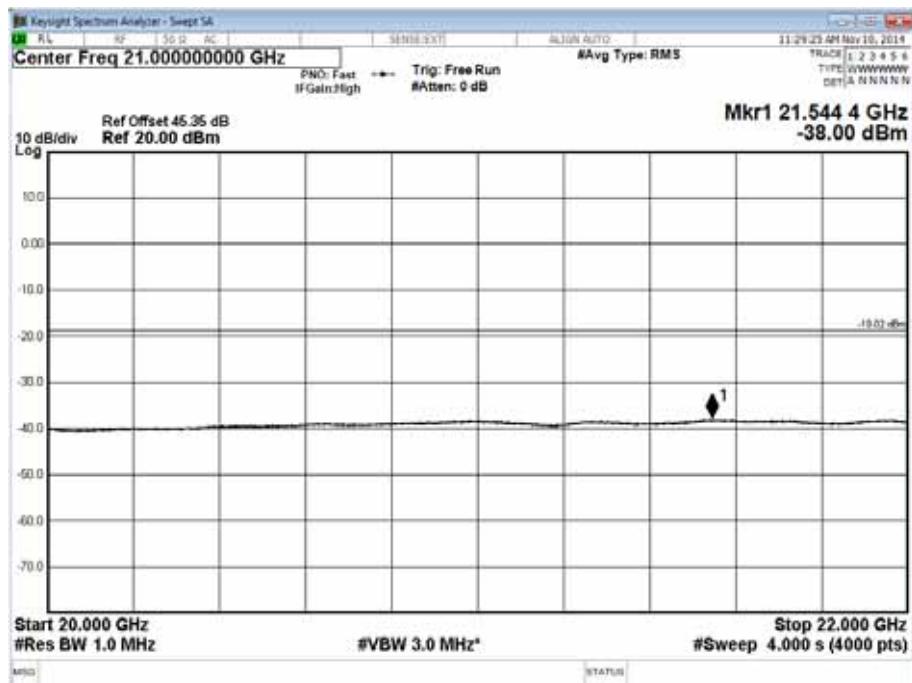
Channel Position M - Band 2 - Range 3500 to 12000 MHz - Antenna B



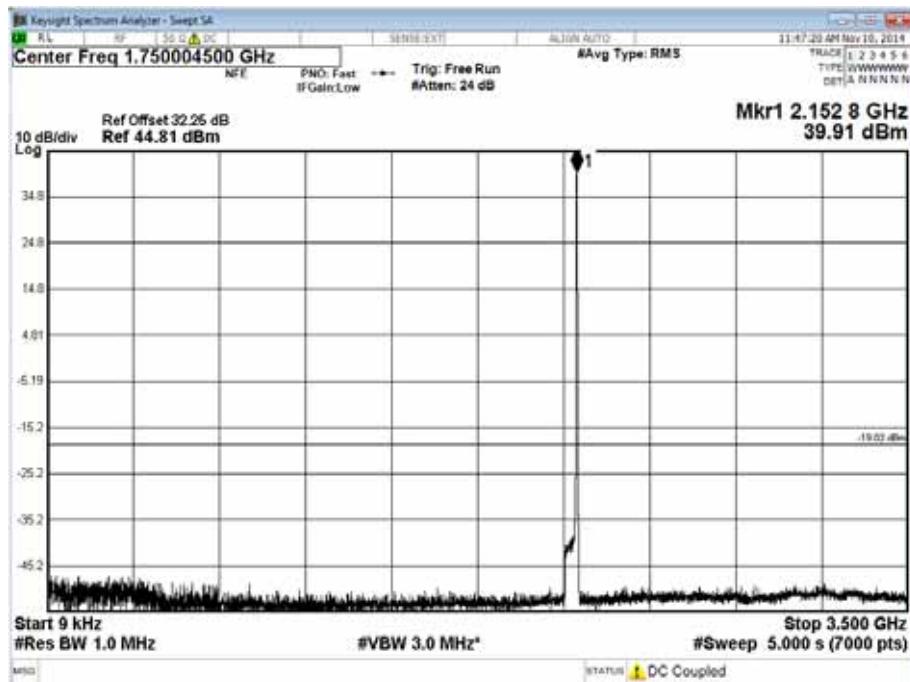
Channel Position M - Band 3 - Range 12000 to 20000 MHz - Antenna B



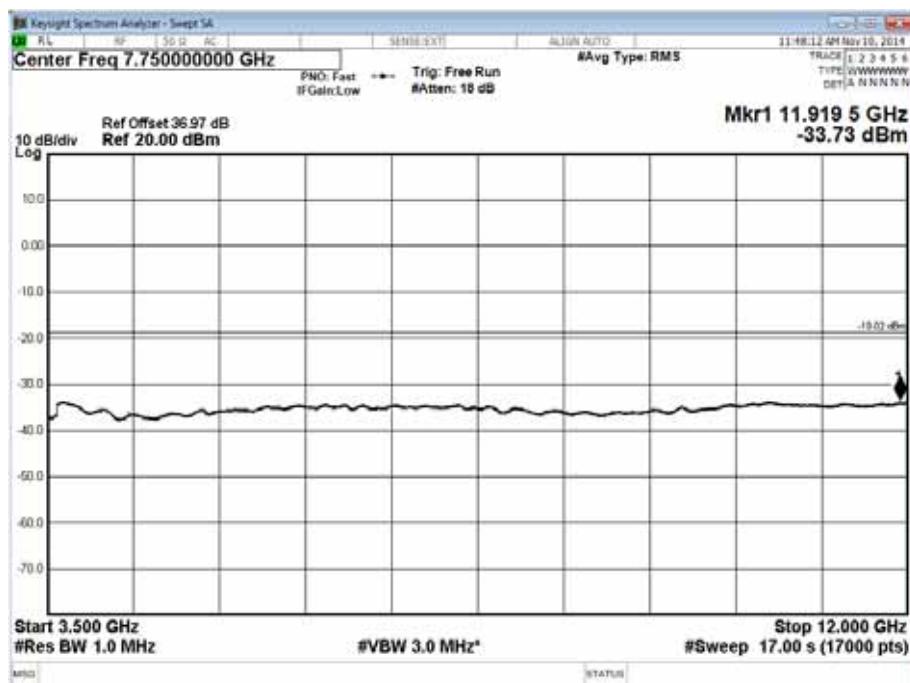
Channel Position M - Band 4 - Range 20000 to 22000 MHz - Antenna B



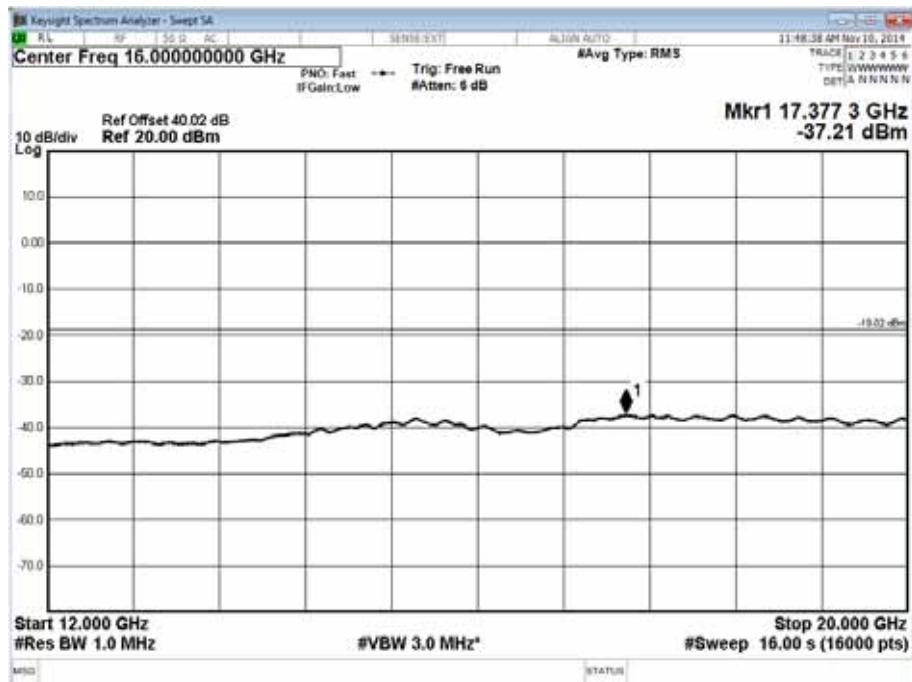
Channel Position T - Band 1 - Range 0.009 to 3500 MHz - Antenna B



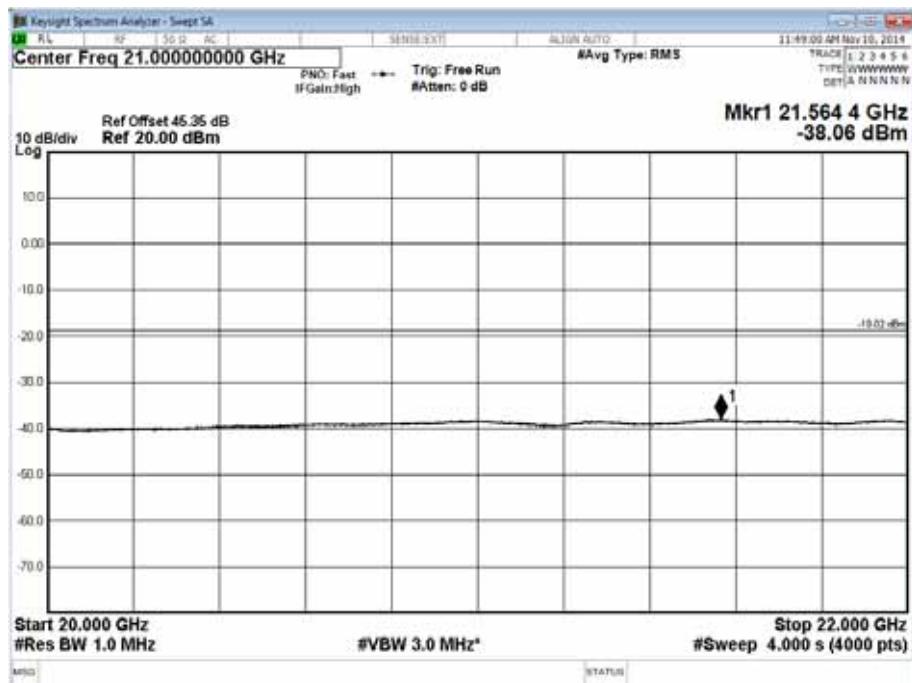
Channel Position T - Band 2 - Range 3500 to 12000 MHz - Antenna B



Channel Position T - Band 3 - Range 12000 to 20000 MHz - Antenna B



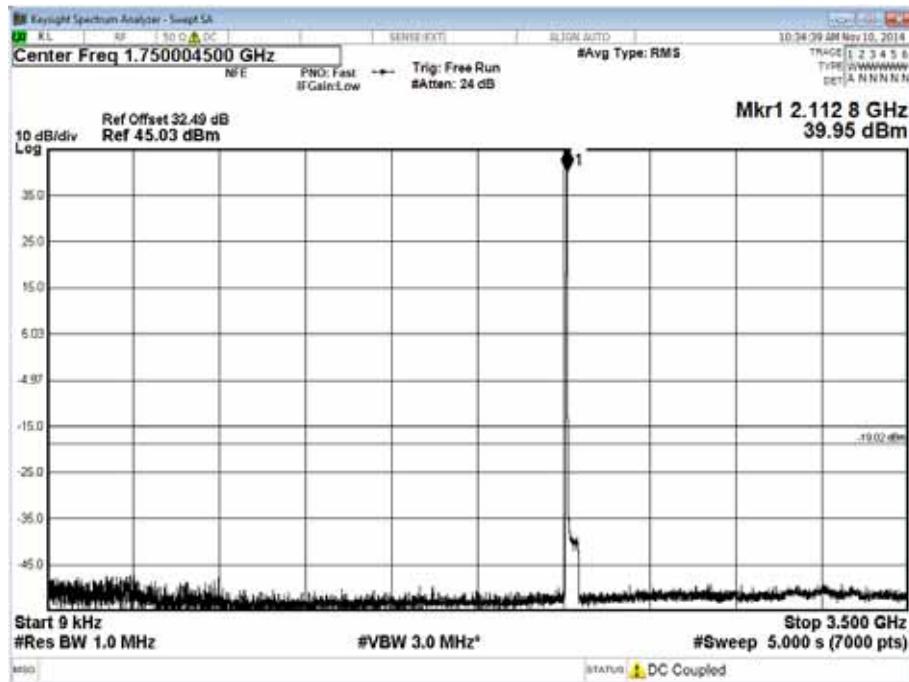
Channel Position T - Band 4 - Range 20000 to 22000 MHz - Antenna B



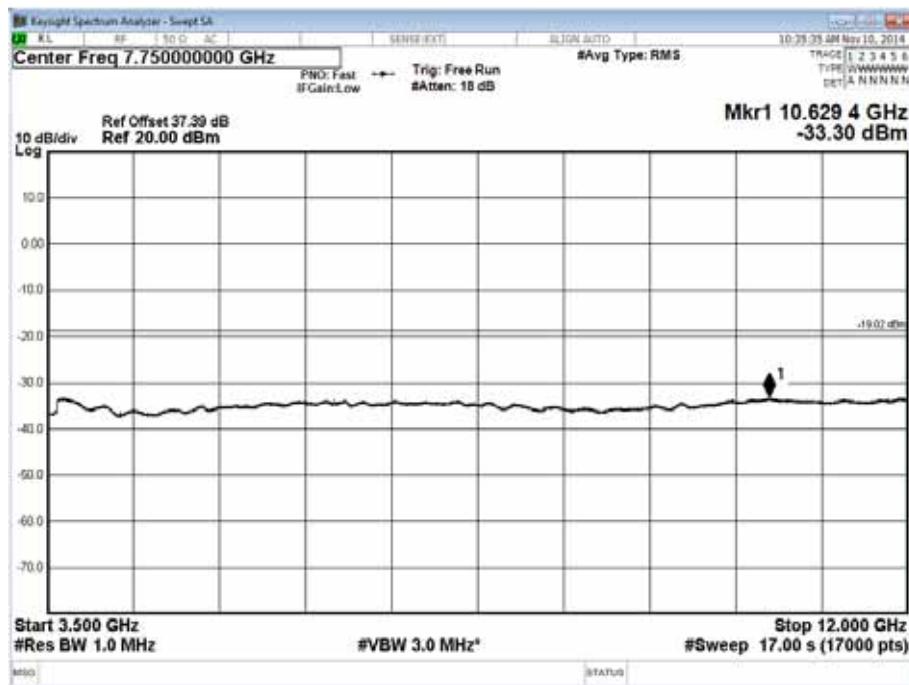
Configuration WCDMA SC (see Table 1 for carrier frequency)

Maximum Output Power 44.77 dBm per carrier, TM5, Antenna Port C

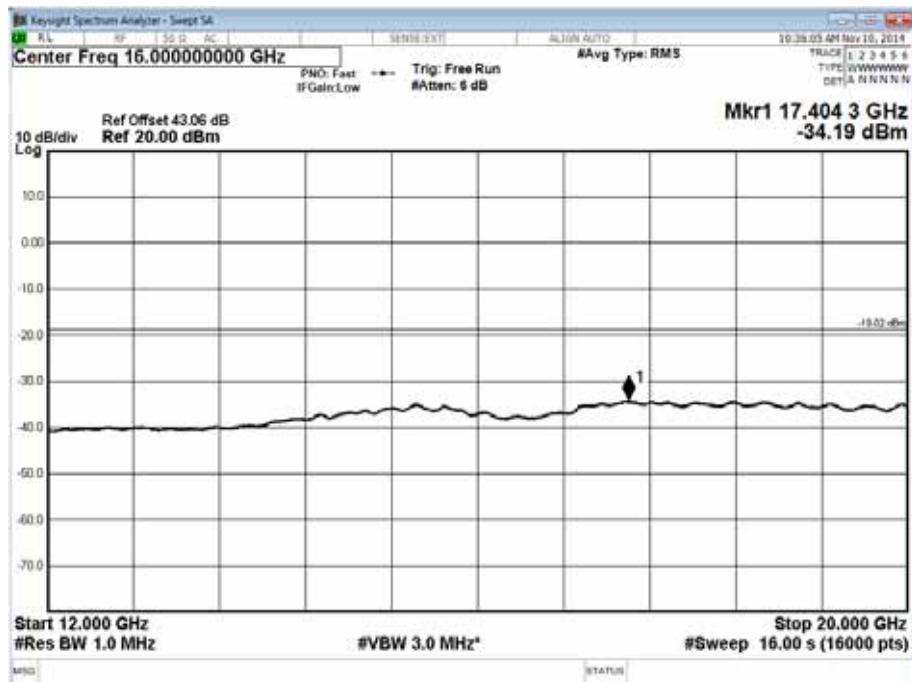
Channel Position B - Band 1 - Range 0.009 to 3500 MHz - Antenna C



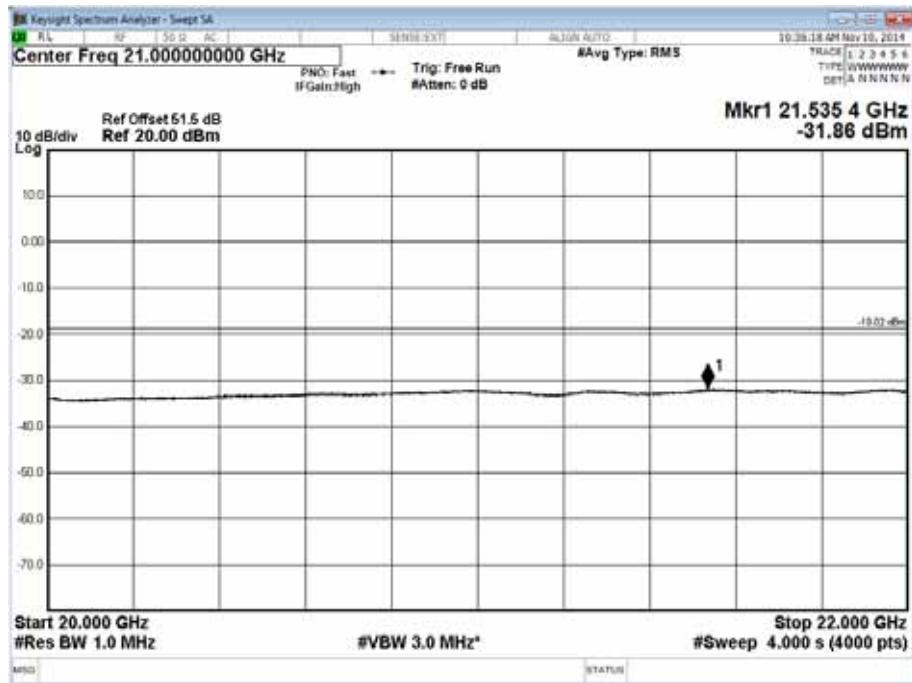
Channel Position B - Band 2 - Range 3500 to 12000 MHz - Antenna C



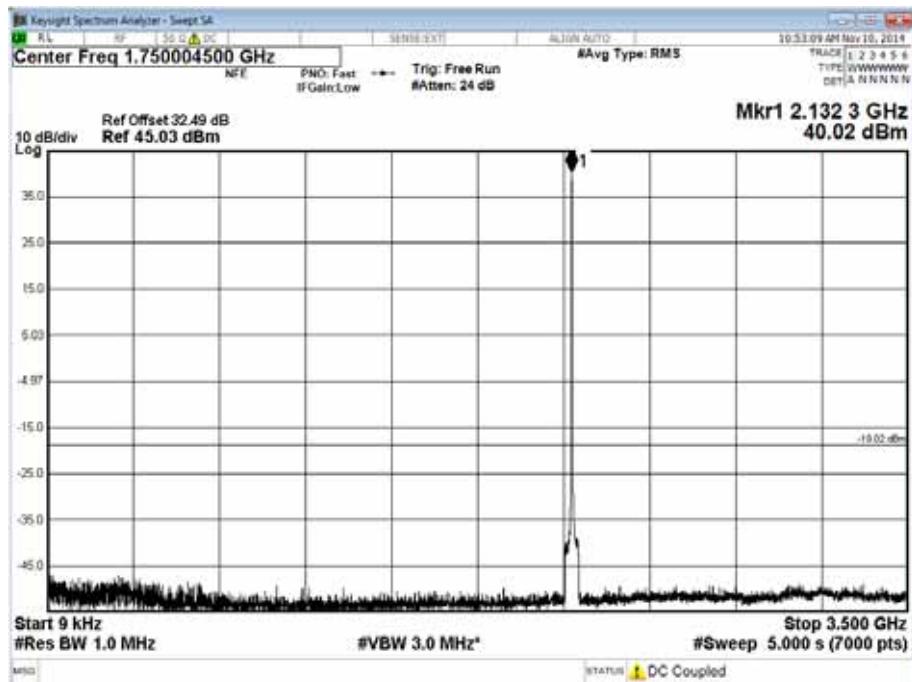
Channel Position B - Band 3 - Range 12000 to 20000 MHz - Antenna C



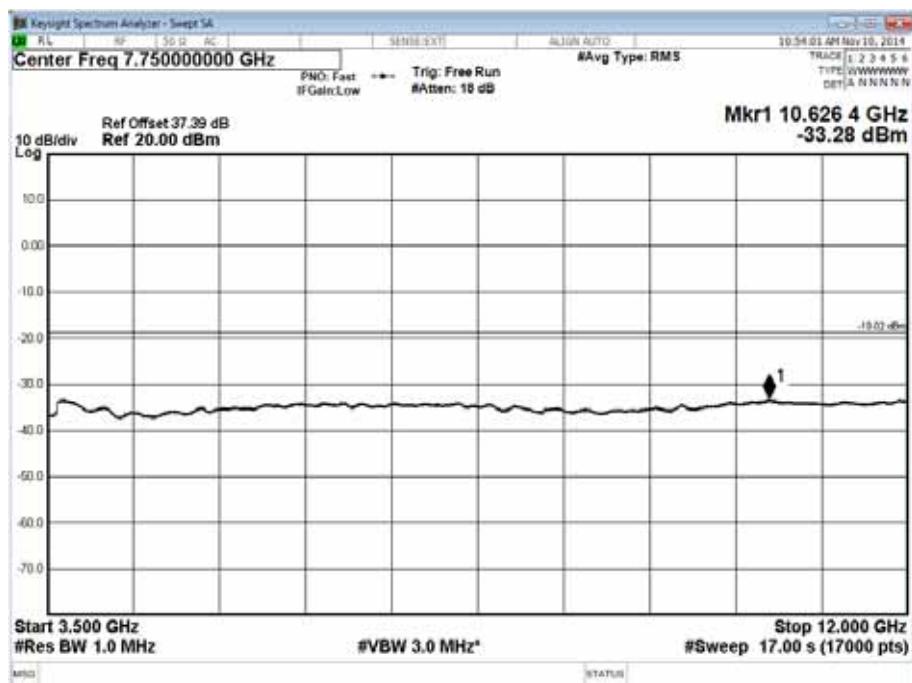
Channel Position B - Band 4 - Range 20000 to 22000 MHz - Antenna C



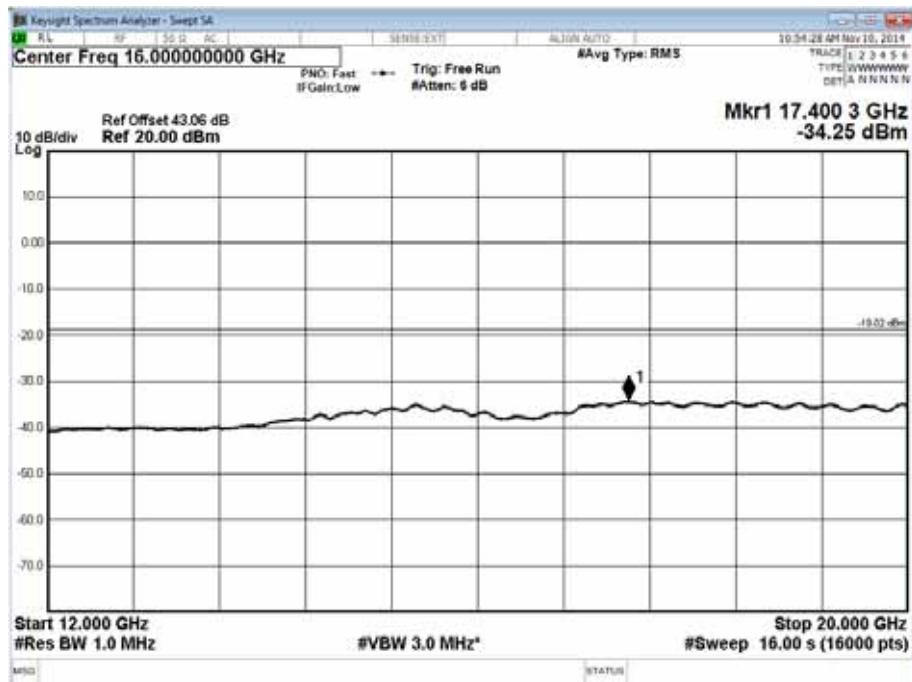
Channel Position M - Band 1 - Range 0.009 to 3500 MHz - Antenna C



Channel Position M - Band 2 - Range 3500 to 12000 MHz - Antenna C



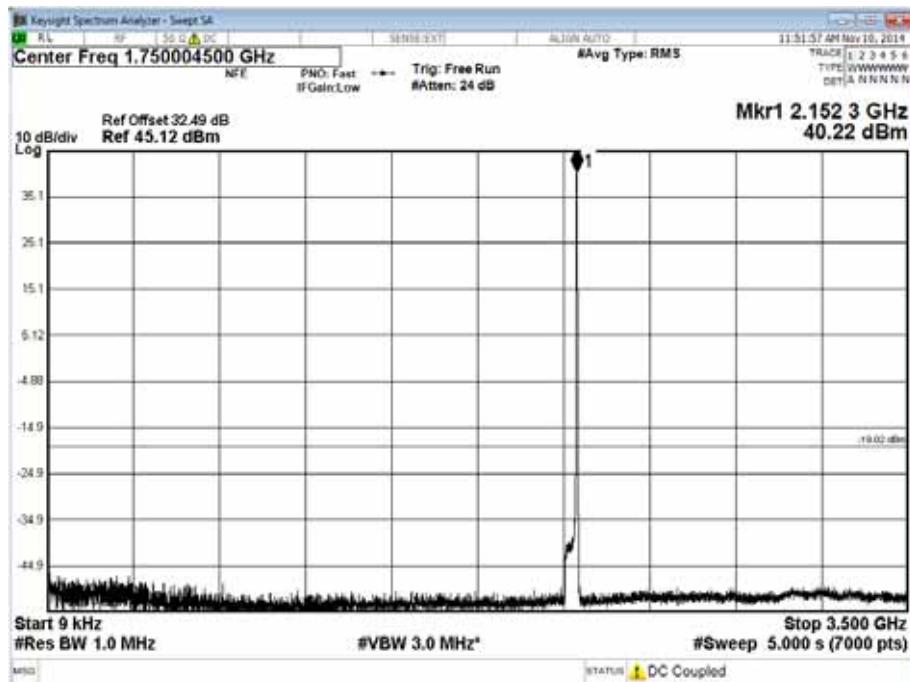
Channel Position M - Band 3 - Range 12000 to 20000 MHz - Antenna C



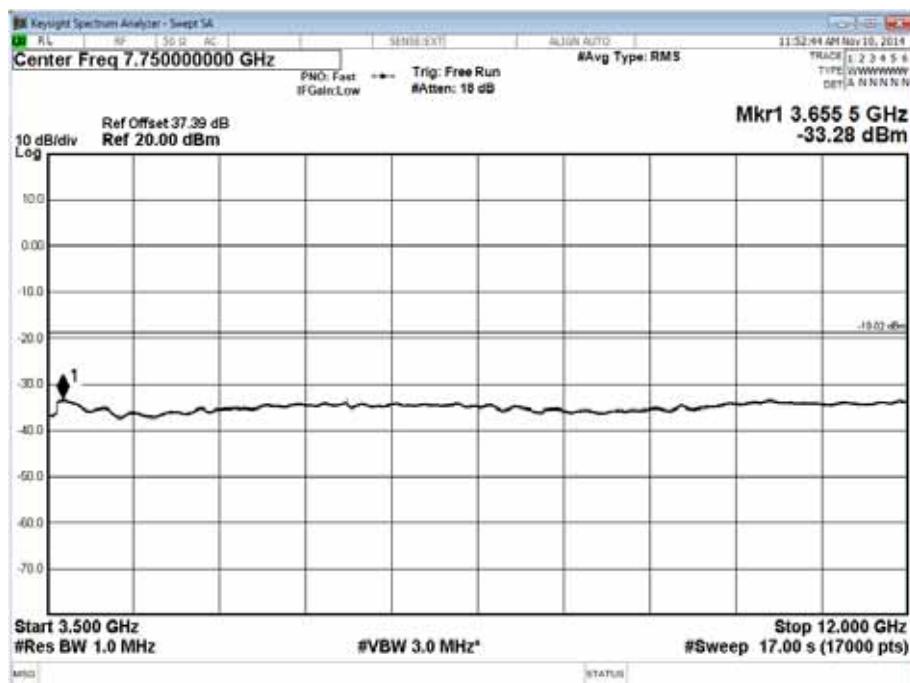
Channel Position M - Band 4 - Range 20000 to 22000 MHz - Antenna C



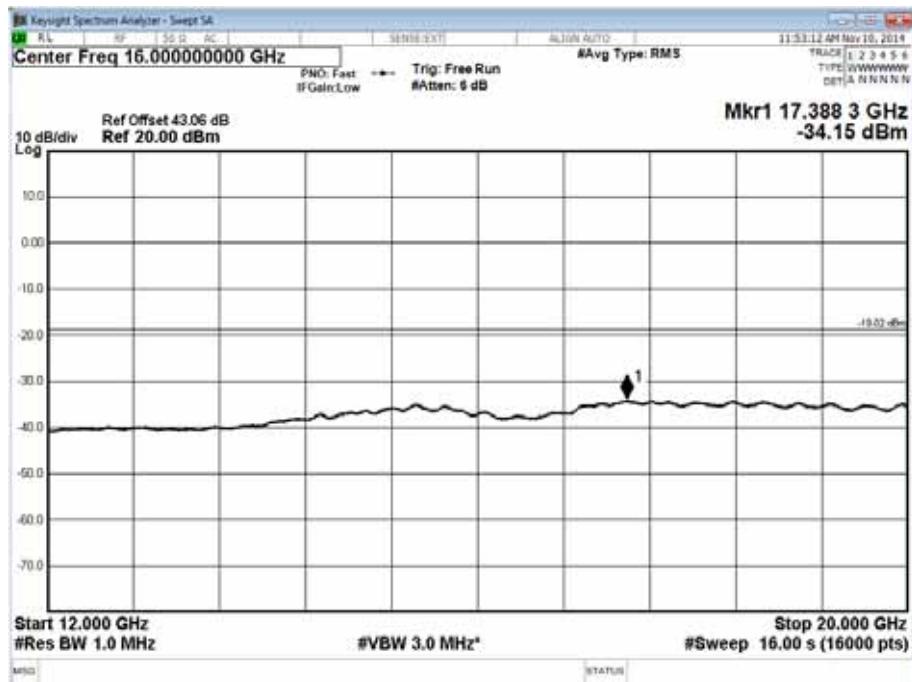
Channel Position T - Band 1 - Range 0.009 to 3500 MHz - Antenna C



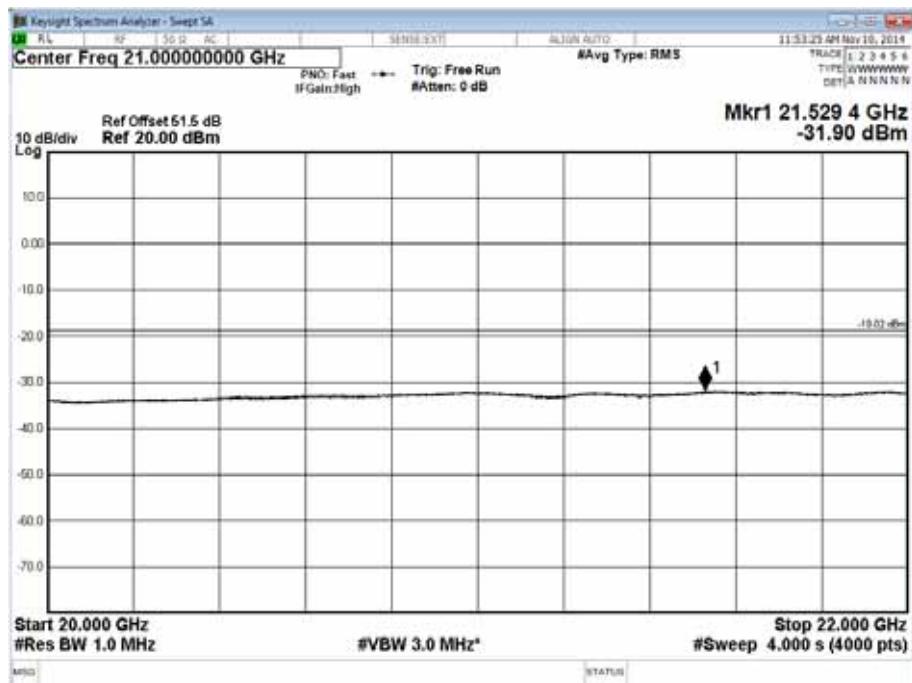
Channel Position T - Band 2 - Range 3500 to 12000 MHz - Antenna C



Channel Position T - Band 3 - Range 12000 to 20000 MHz - Antenna C



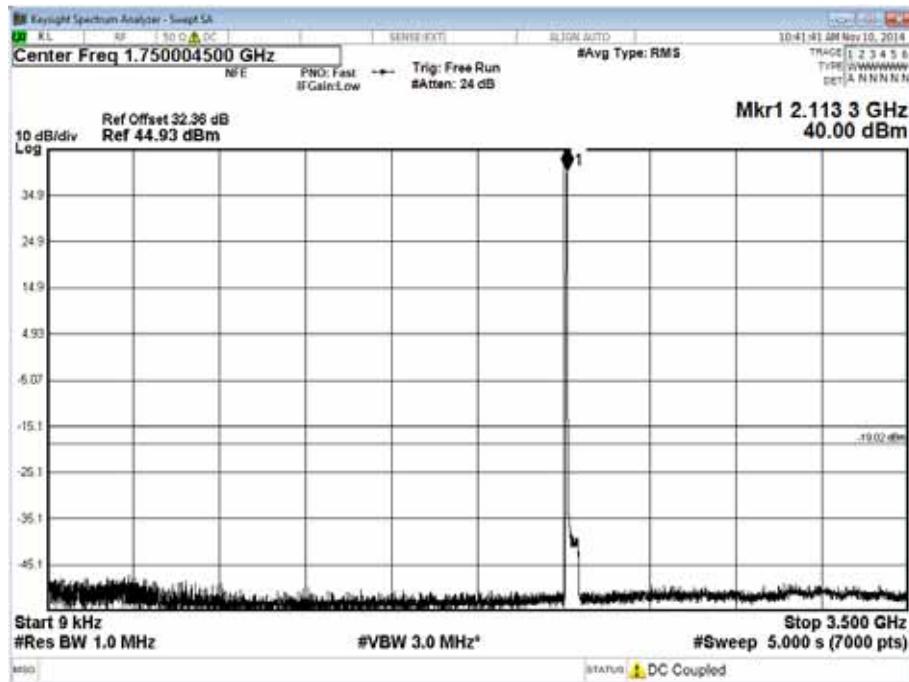
Channel Position T - Band 4 - Range 20000 to 22000 MHz Antenna C



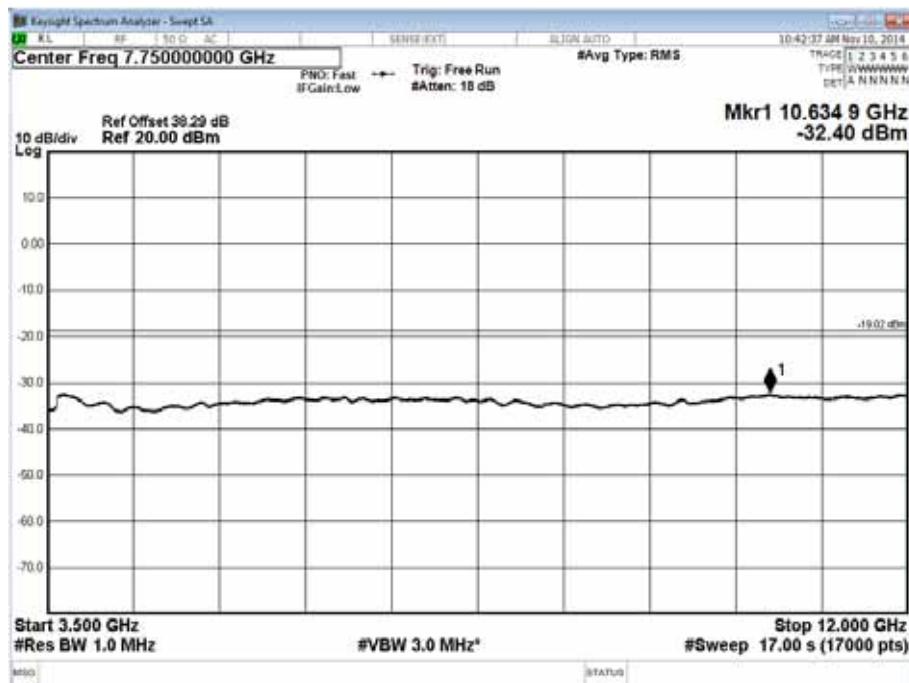
Configuration WCDMA SC (see Table 1 for carrier frequency)

Maximum Output Power 44.77 dBm per carrier, TM5, Antenna Port D

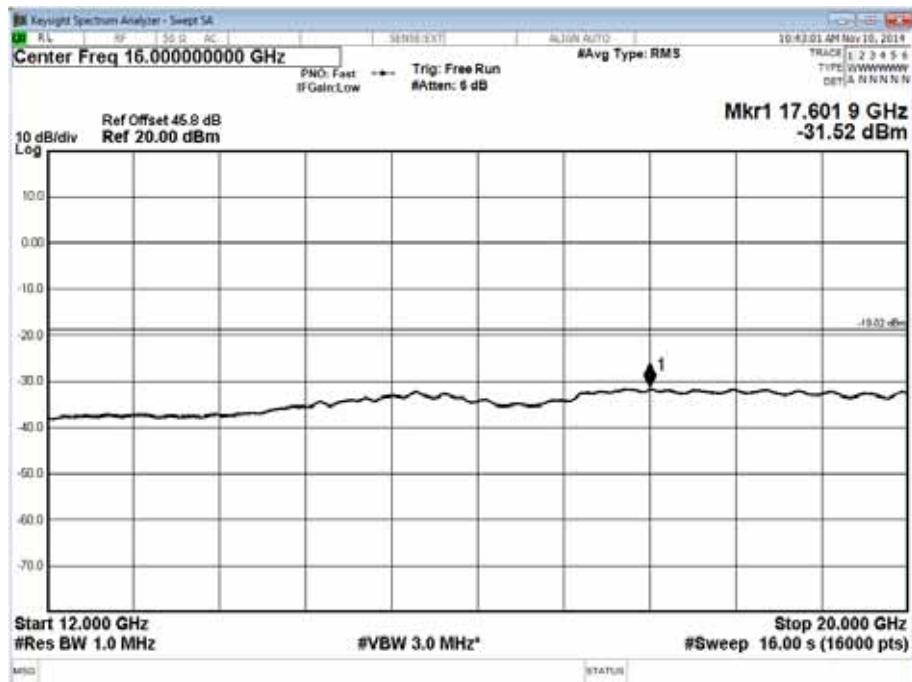
Channel Position B - Band 1 - Range 0.009 to 3500 MHz - Antenna D



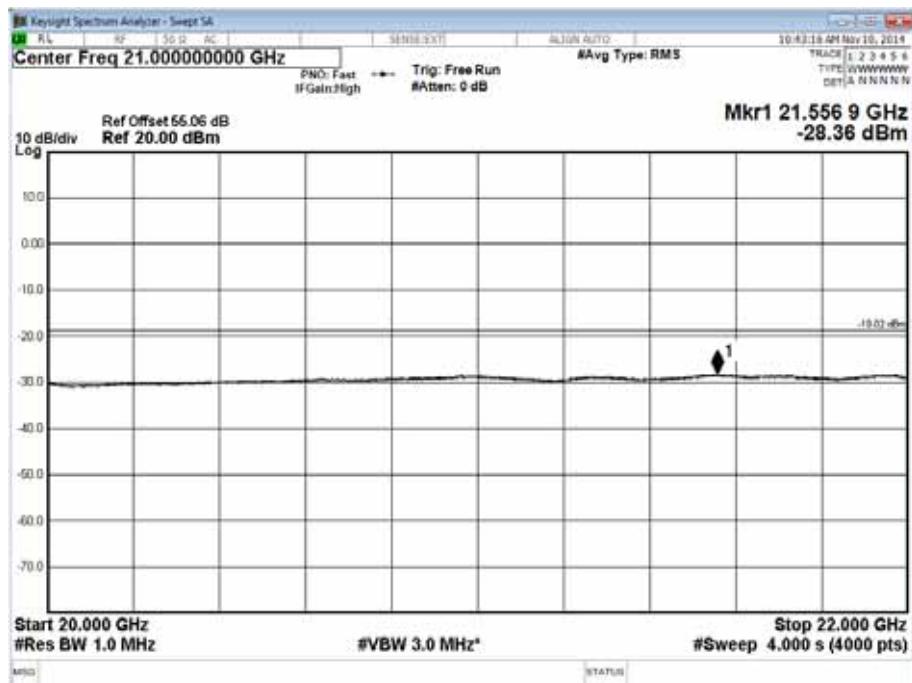
Channel Position B - Band 2 - Range 3500 to 12000 MHz - Antenna D



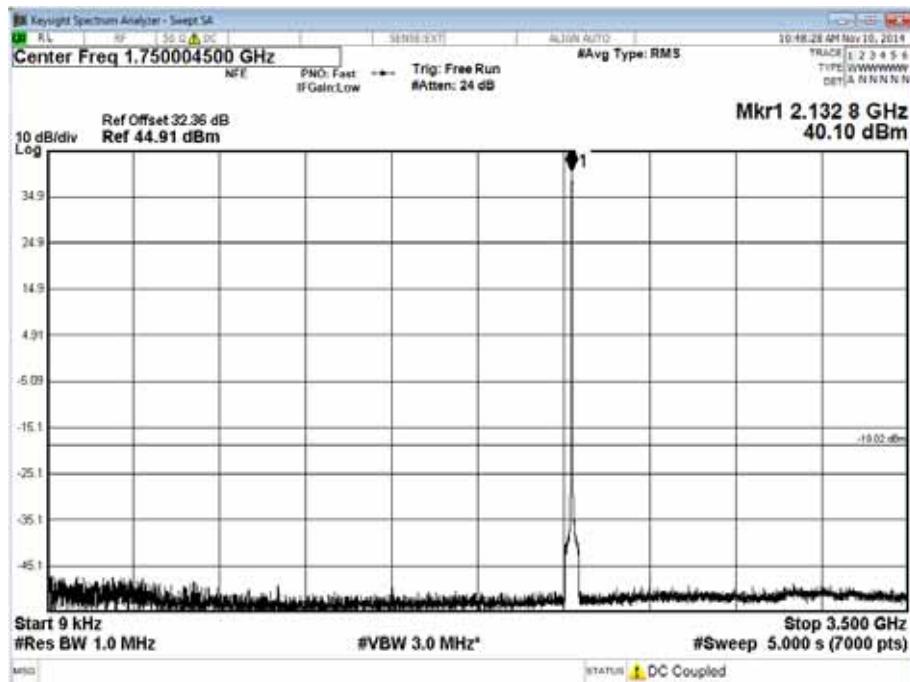
Channel Position B - Band 3 - Range 12000 to 20000 MHz - Antenna D



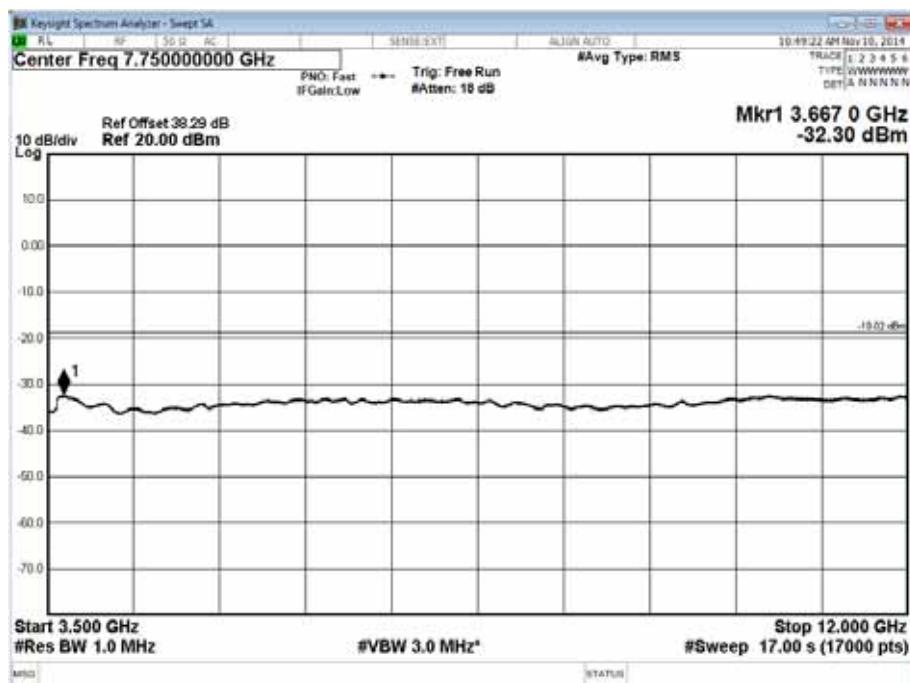
Channel Position B - Band 4 - Range 20000 to 22000 MHz - Antenna D



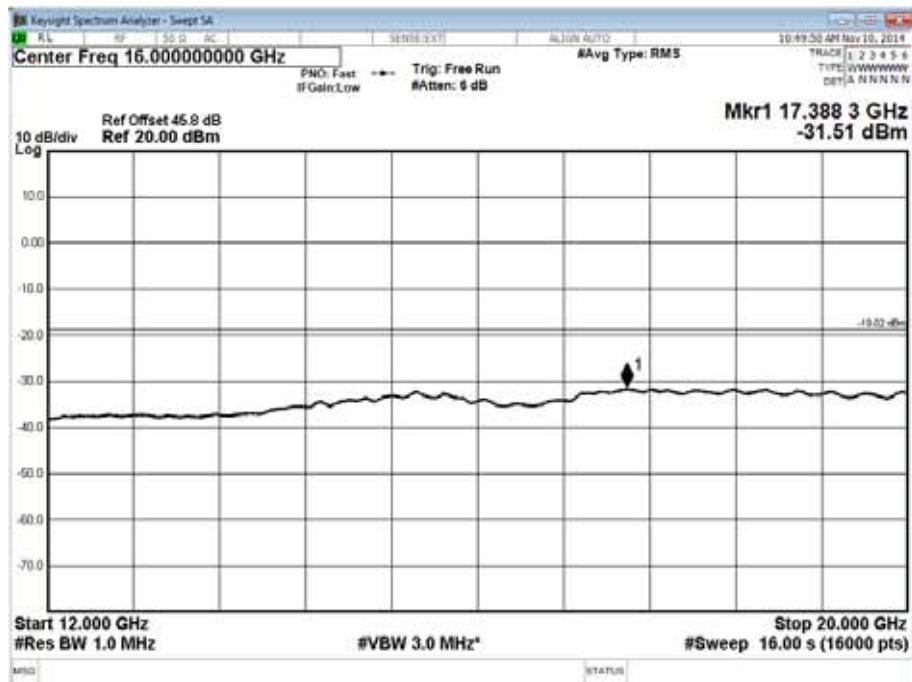
Channel Position M - Band 1 - Range 0.009 to 3500 MHz - Antenna D



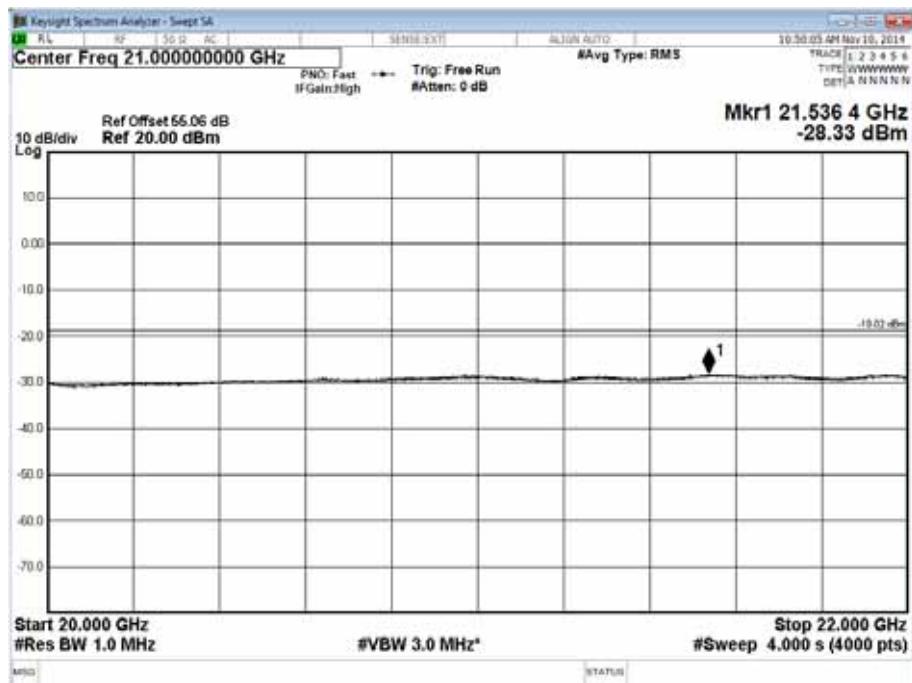
Channel Position M - Band 2 - Range 3500 to 12000 MHz - Antenna D



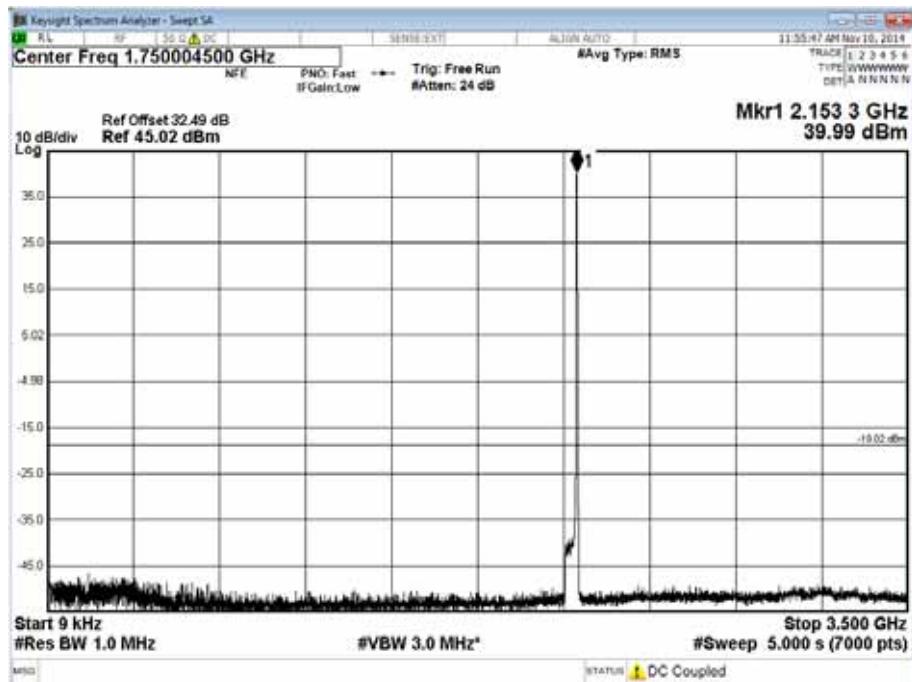
Channel Position M - Band 3 - Range 12000 to 20000 MHz - Antenna D



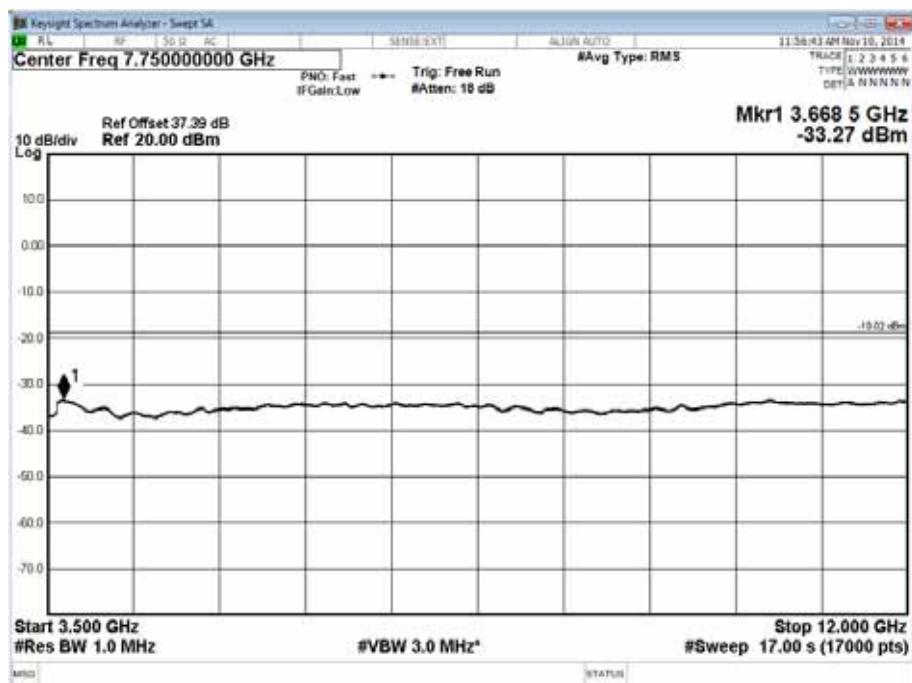
Channel Position M - Band 4 - Range 20000 to 22000 MHz - Antenna D



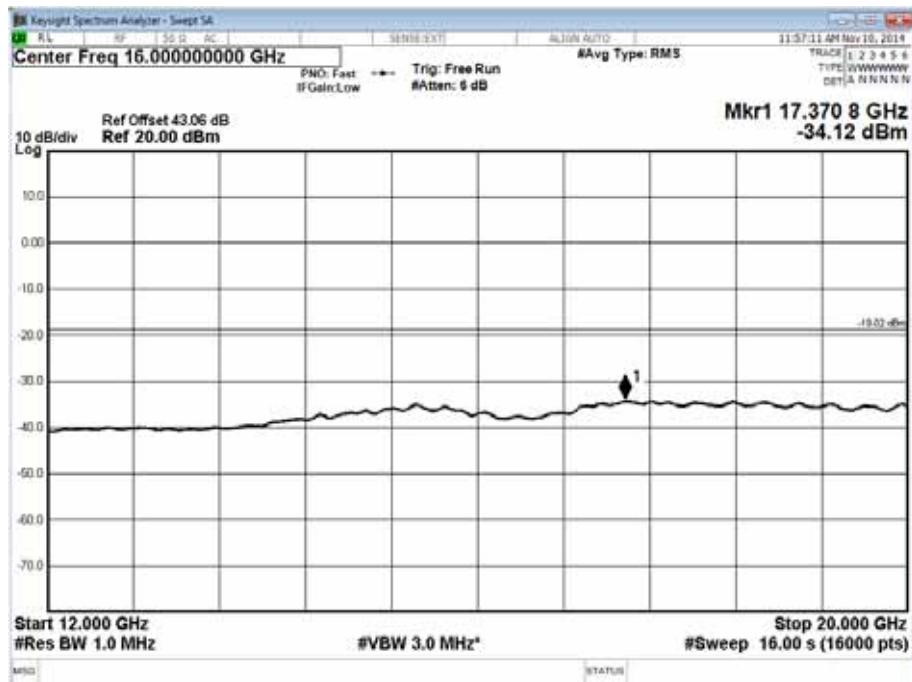
Channel Position T - Band 1 - Range 0.009 to 3500 MHz - Antenna D



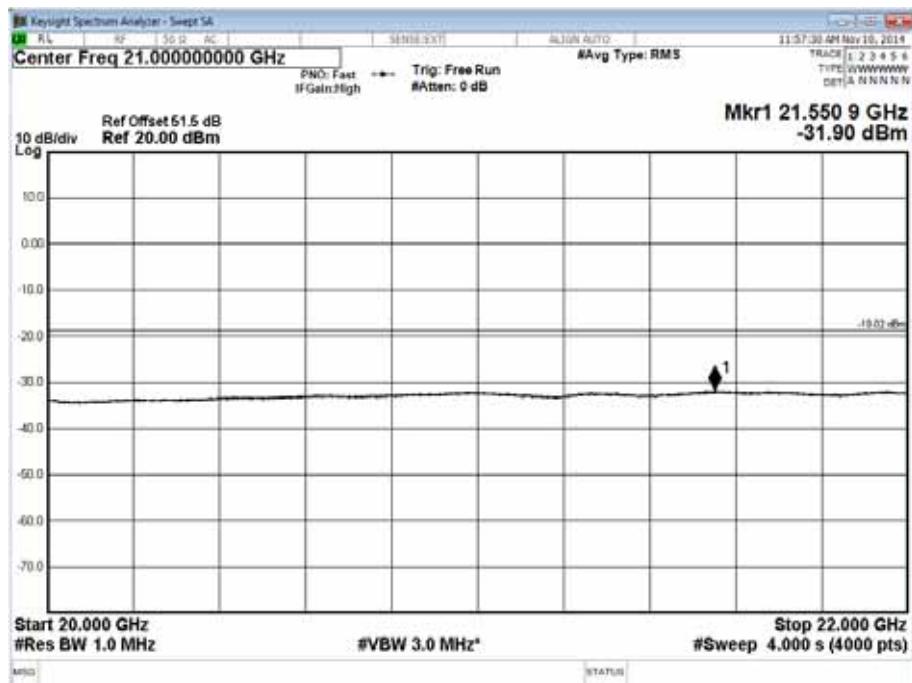
Channel Position T - Band 2 - Range 3500 to 12000 MHz - Antenna D



Channel Position T - Band 3 - Range 12000 to 20000 MHz - Antenna D



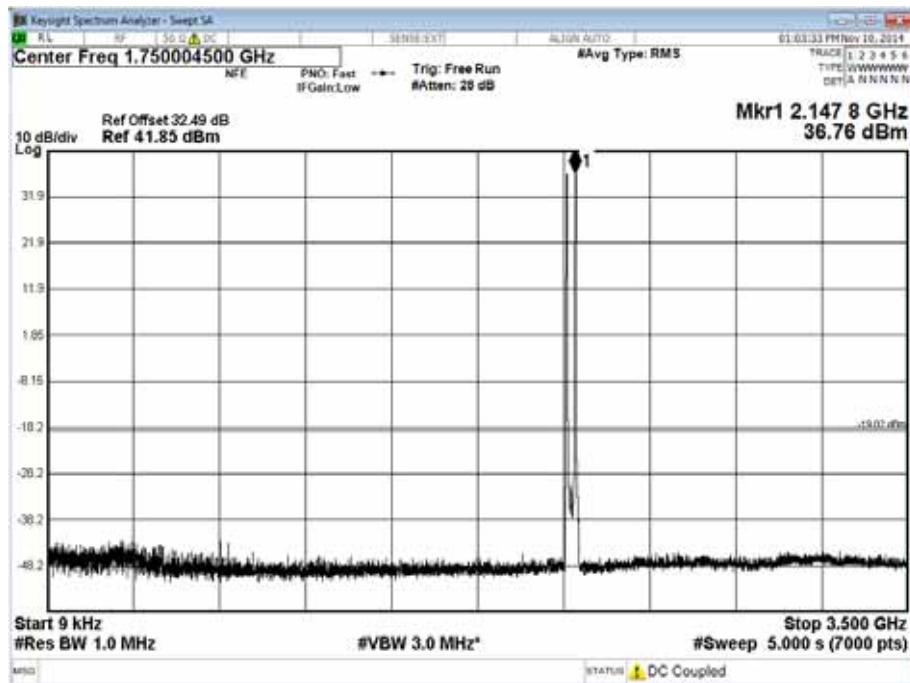
Channel Position T - Band 4 - Range 20000 to 22000 MHz - Antenna D



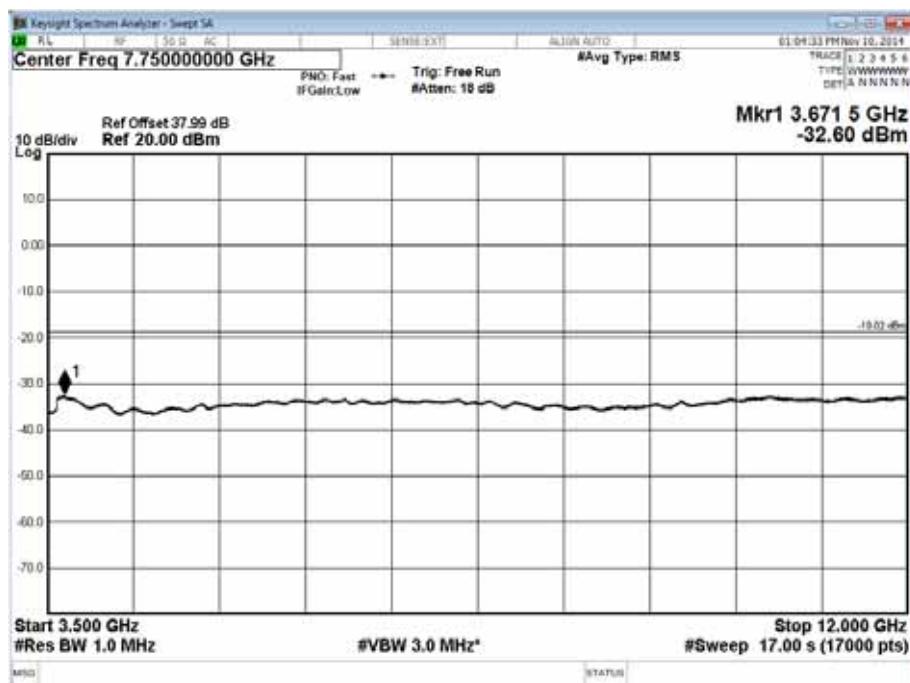
Configuration 2 WCDMA-MC1 (See Table 1 for carrier frequency)

Maximum Output Power 41.76 dBm per carrier, TM5 (2 Carrier), Antenna Port A

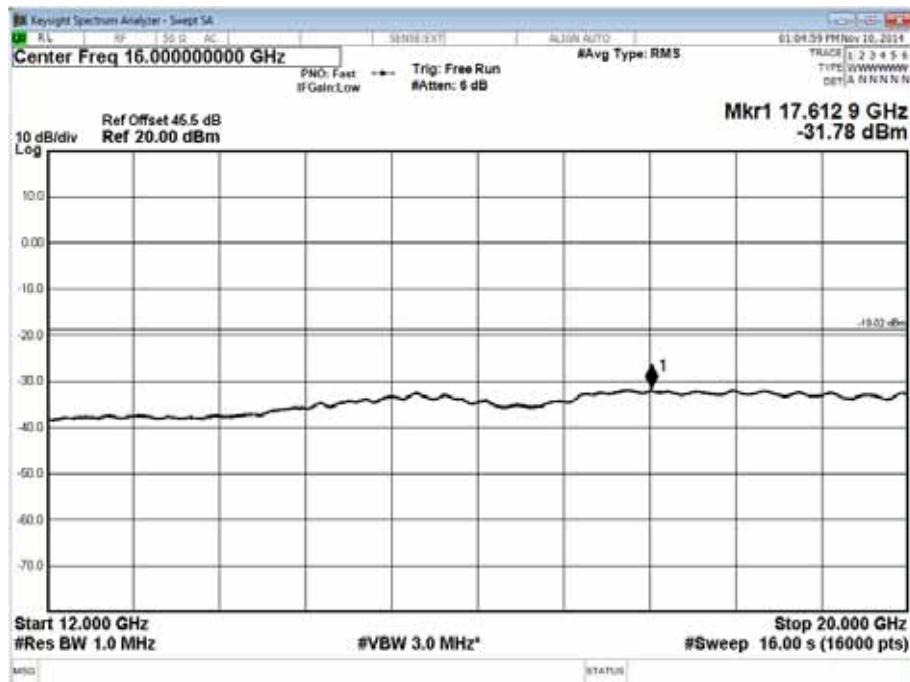
Channel Position B - Band 1 - Range 0.009 to 3500 MHz - Antenna A



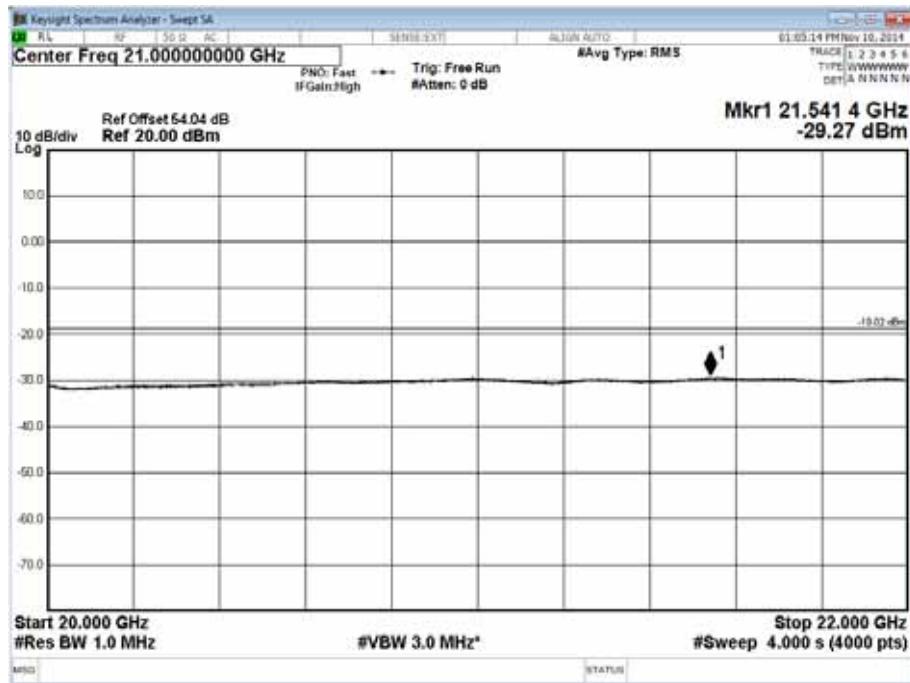
Channel Position B - Band 2 - Range 3500 to 12000 MHz - Antenna A



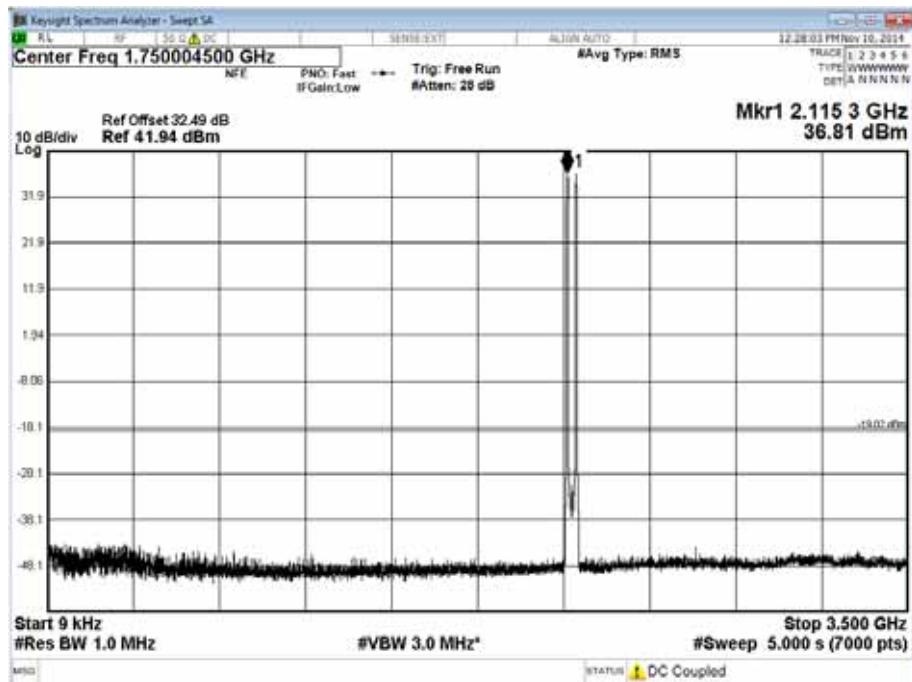
Channel Position B - Band 3 - Range 12000 to 20000 MHz - Antenna A



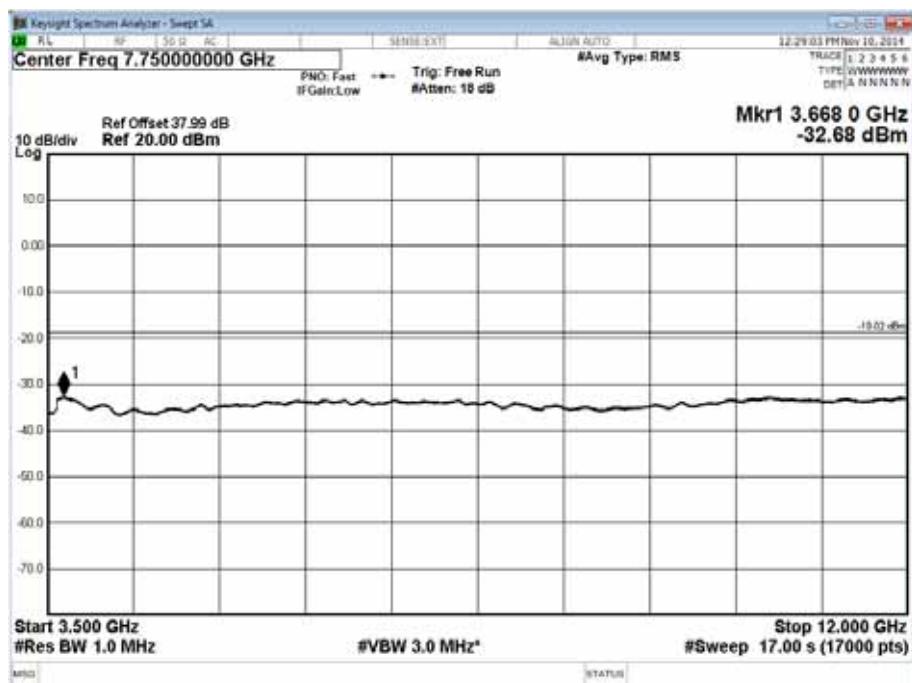
Channel Position B - Band 4 - Range 20000 to 22000 MHz - Antenna A



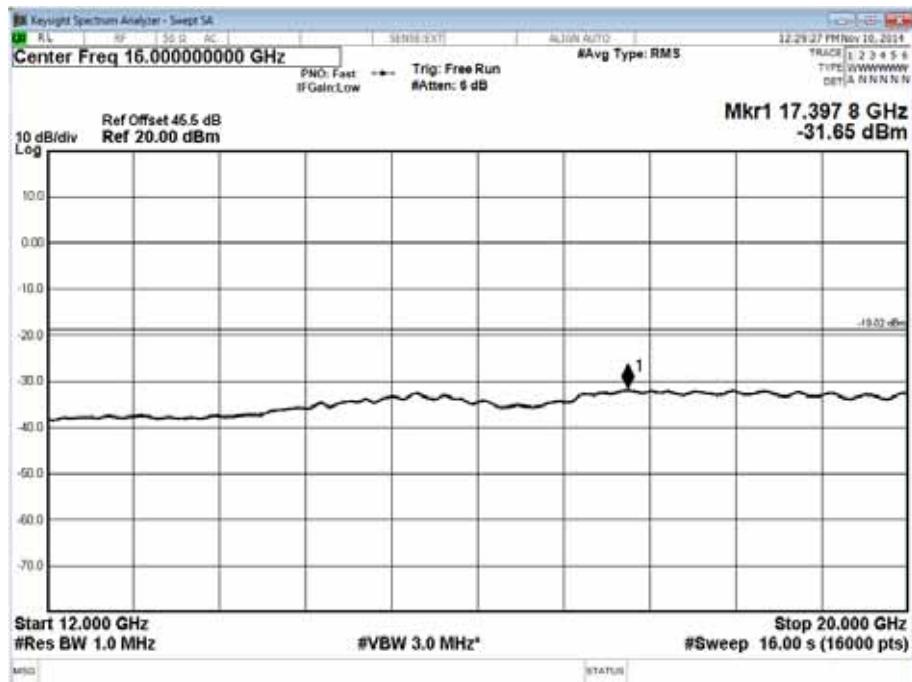
Channel Position M - Band 1 - Range 0.009 to 3500 MHz - Antenna A



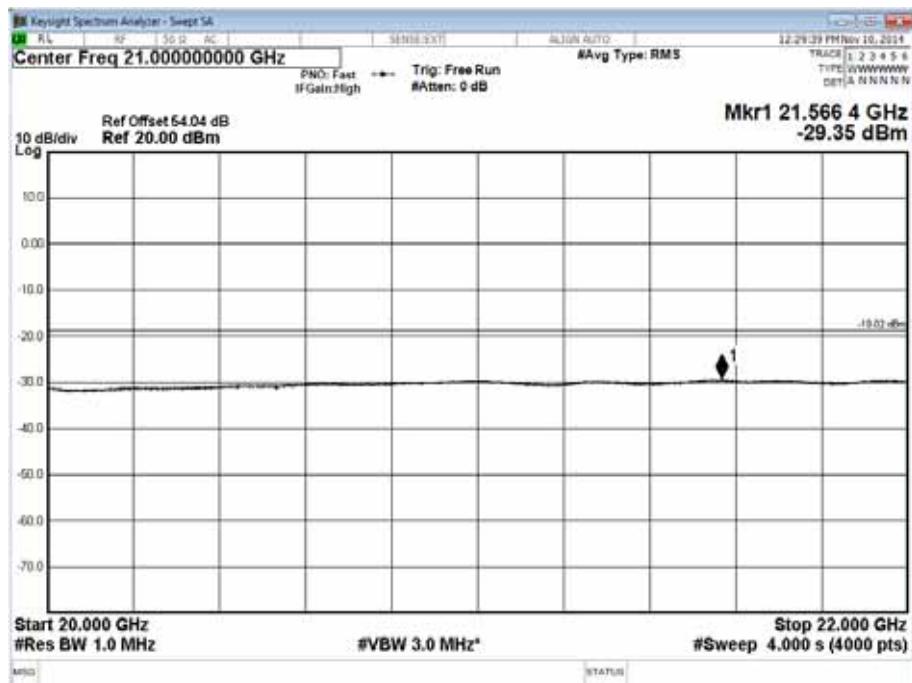
Channel Position M - Band 2 - Range 3500 to 12000 MHz - Antenna A



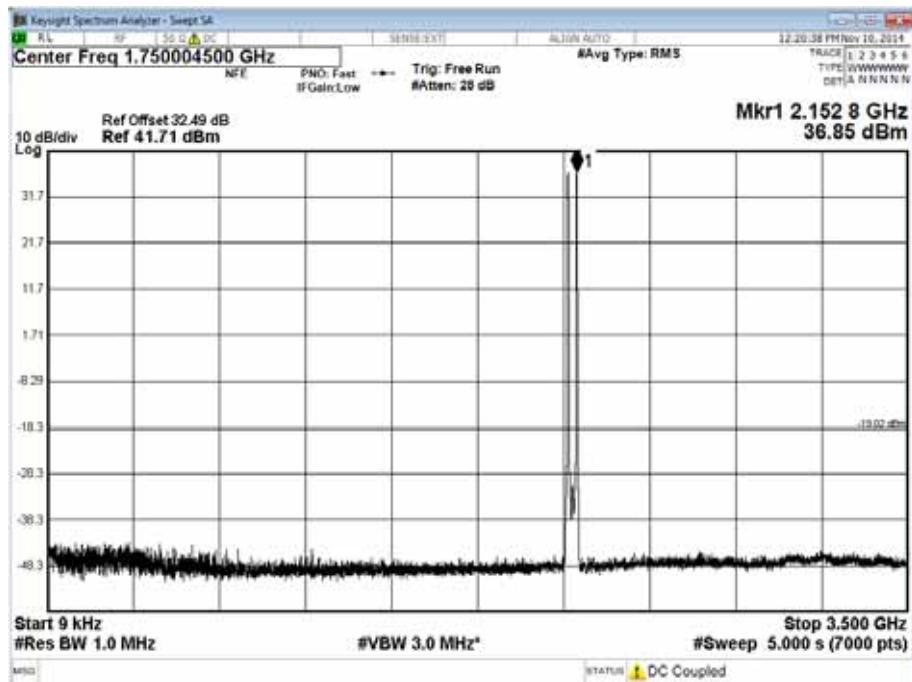
Channel Position M - Band 3 - Range 12000 to 20000 MHz - Antenna A



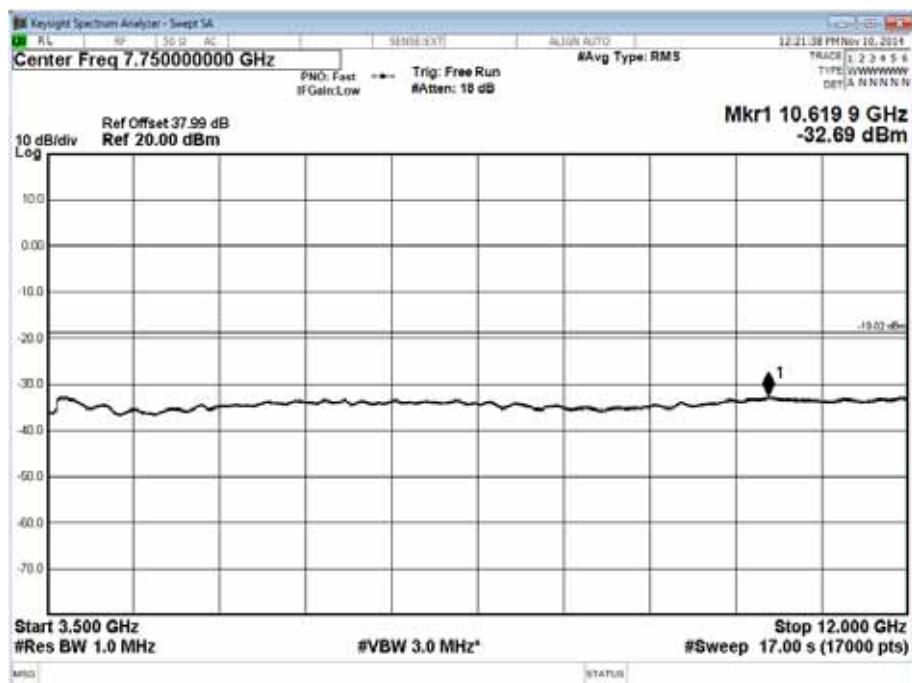
Channel Position M - Band 4 - Range 20000 to 22000 MHz - Antenna A



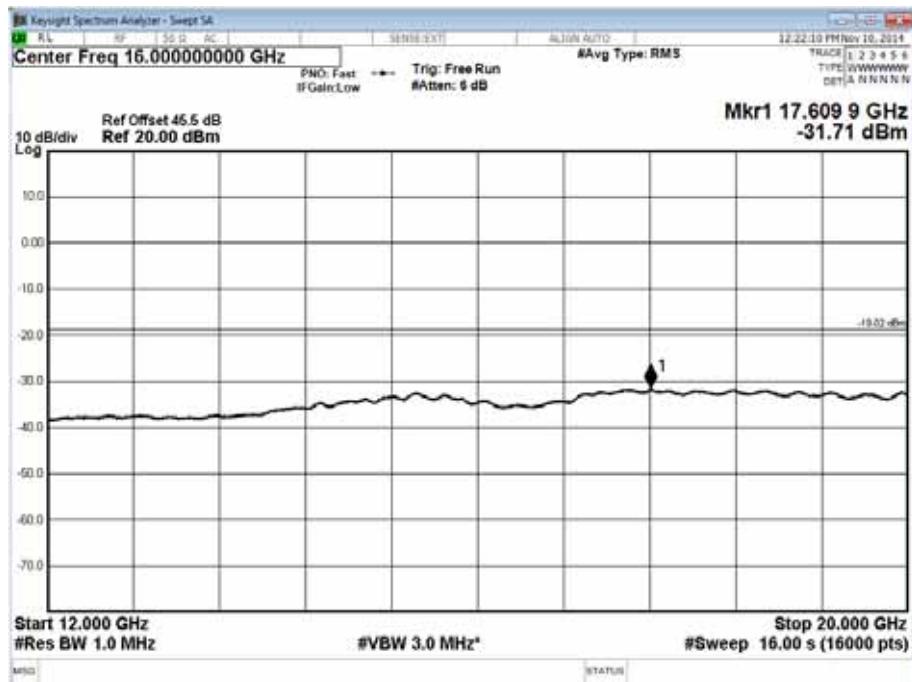
Channel Position T - Band 1 - Range 0.009 to 3500 MHz - Antenna A



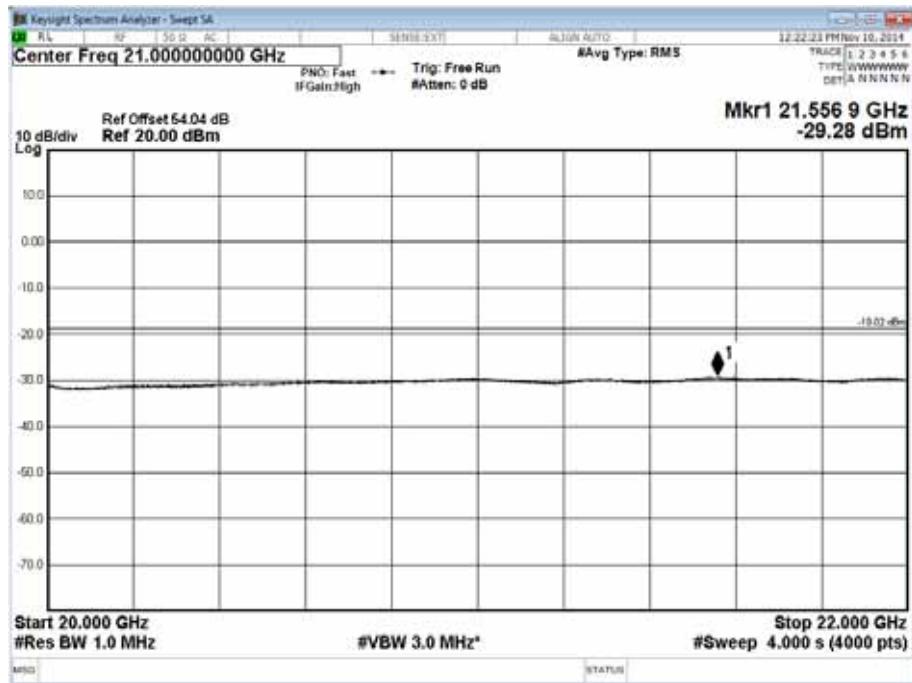
Channel Position T - Band 2 - Range 3500 to 12000 MHz - Antenna A



Channel Position T - Band 3 - Range 12000 to 20000 MHz - Antenna A



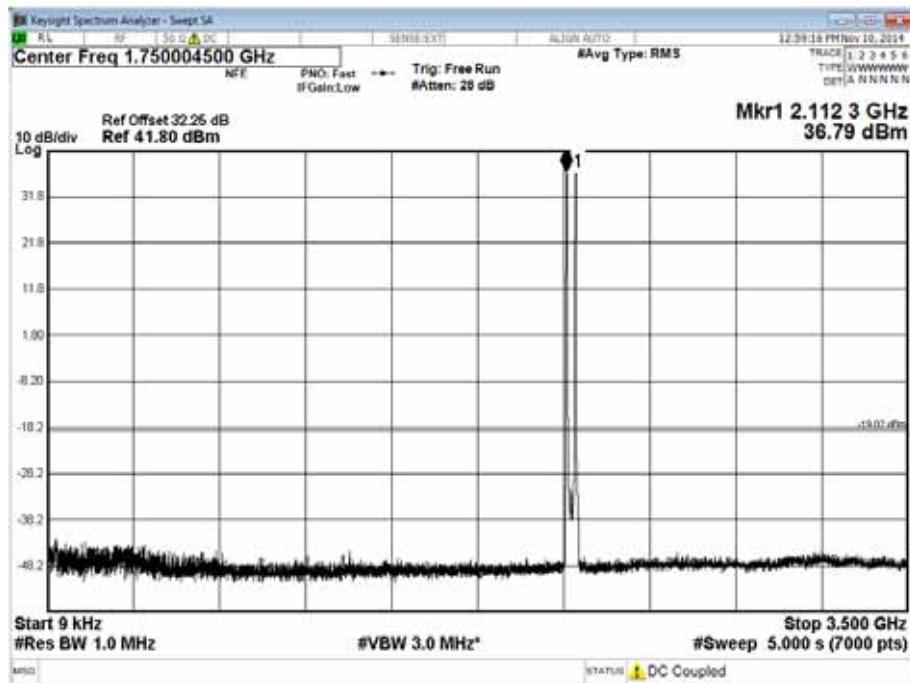
Channel Position T - Band 4 - Range 20000 to 22000 MHz - Antenna A



Configuration 2 WCDMA-MC1 (See Table 1 for carrier frequency)

Maximum Output Power 41.76 dBm per carrier, TM5 (2 Carrier), Antenna Port B

Channel Position B - Band 1 - Range 0.009 to 3500 MHz - Antenna B



Channel Position B - Band 2 - Range 3500 to 12000 MHz - Antenna B

