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Report On

FCC and IC Testing of the
Ericsson 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	APPROVED BY	DATED
Simon Bennett Senior Engineer	Steve Scarfe Authorised Signatory	15 September 2014

Document 75927178 Report 01 Issue 1 **September 2014**

CONTENTS

SECTION 1

REPORT INFORMATION

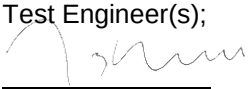
1.1 REPORT DETAILS

Manufacturer	Ericsson
Address	349 Terry Fox Drive Ottawa Ontario K2K 2V6 Canada
Product Name	ARUS 32 B4 (ARUS 32 B4)
Product Number	KRC 118 050/1
IC Model Name	AS1180501
Serial Number(s)	C828074982 (General Measurements) C828116765 (Frequency Stability)
Software Version	CXP9017316/5 R59AE
Hardware Version	R1A
Test Specification/Issue/Date	FCC CFR 47 Part 2: 2013 FCC CFR 47 Part 27: 2013 RSS-139 Issue 2: 2009
Start of Test	24 July 2014
Finish of Test	30 July 2014
Name of Engineer(s)	Neil Rousell
Related Document(s)	Industry Canada RSS-GEN Issue 3: 2010

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 2, FCC CFR 47 Part 27, Industry Canada RSS-139 and RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);



Neil Rousell

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)(1)	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 test report from Flextronics Design Validation Centre, Canada Report Reference Number K0002479-TR-RAD-01-01 .

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. A pre-test was performed 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 Test Models E-TM1.1, E-TM3.2 and E-TM3.1 at 2110 – 2155 MHz. The following test models were used as defined in 3GPP TS 36.141. Test Model E-TM1.1 was used to represent QPSK modulation only, Test Model E-TM3.2 was used to represent 16QAM modulation, and Test Model E-TM3.1 was used to represent 64QAM modulation.

An initial evaluation was performed to determine the worst case scenario between 2 and 3 carrier operation. 2 carrier was deemed worst and was tested as well as single and 4 carrier operation.

LTE: Test Model E-TM1.1 in channel bandwidths between 1.4 MHz and 20 MHz

For TX test cases: Maximum Conducted Output Power, Spurious Emissions at Antenna Terminals (±1MHz) and Conducted Spurious Emissions, measurements were performed on all RF Ports using a test limit accounting for MIMO operation with 4 ports at 1.4 MHz and 20 MHz bandwidths. 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

2110 MHz - 2155 MHz

All tests except Band Edge Emissions

Mode Description	RAT	Number of Carriers	Bandwidth	Carrier Frequency Configuration (MHz)		
				Bottom	Middle	Top
LTE-SC	LTE	1	1.4 MHz	2110.7	2132.5	2154.3
LTE-SC	LTE	1	3 MHz	2111.5	2132.5	2153.5
LTE-SC	LTE	1	5 MHz	2112.5	2132.5	2152.5
LTE-SC	LTE	1	10 MHz	2115.0	2132.5	2150.0
LTE-SC	LTE	1	15 MHz	2117.5	2132.5	2147.5
LTE-SC	LTE	1	20 MHz	2120.0	2132.5	2145.0
LTE-MC1	LTE	2	1.4 MHz	-	2110.7 + 2154.3	-
LTE-MC1	LTE	2	3 MHz	-	2111.5 + 2153.5	-
LTE-MC1	LTE	2	5 MHz	-	2112.5 + 2152.5	-
LTE-MC1	LTE	2	10 MHz	-	2115.0 + 2150.0	-
LTE-MC1	LTE	2	15 MHz	-	2117.5 + 2147.5	-
LTE-MC1	LTE	2	20 MHz	-	2120.0 + 2145.0	-
LTE-MC2	LTE	4	1.4 MHz	-	2110.7 + 2112.1 + 2152.9 + 2154.3	-
LTE-MC2	LTE	4	3 MHz	-	2111.5 + 2114.5 + 2150.5 + 2153.5	-
LTE-MC2	LTE	4	5 MHz	-	2112.5 + 2117.5 + 2147.5 + 2152.5	-
LTE-MC2	LTE	4	10 MHz	-	2115 + 2125 + 2140 + 2150	-

Table 1

Band Edge Emissions

Mode Description	RAT	Number of Carriers	Bandwidth	Carrier Frequency Configuration (MHz)	
				BRFBW (Bottom Edge)	TRFBW (Top Edge)
LTE-SC	LTE	1	1.4 MHz	2110.7	2154.3
LTE-SC	LTE	1	3 MHz	2111.5	2153.5
LTE-SC	LTE	1	5 MHz	2112.5	2152.5
LTE-SC	LTE	1	10 MHz	2115.0	2150.0
LTE-SC	LTE	1	15 MHz	2117.5	2147.5
LTE-SC	LTE	1	20 MHz	2120.0	2145.0
LTE-MC1	LTE	2	1.4 MHz	2110.7 + 2112.1	2152.9 + 2154.3
LTE-MC1	LTE	2	3 MHz	2111.5 + 2114.5	2150.5 + 2153.5
LTE-MC1	LTE	2	5 MHz	2112.5 + 2117.5	2147.5 + 2152.5
LTE-MC1	LTE	2	10 MHz	2115.0 + 2125.0	2140.0 + 2150.0
LTE-MC1	LTE	2	15 MHz	2117.5 + 2132.5	2132.5 + 2147.5
LTE-MC1	LTE	2	20 MHz	2120.0 + 2140.0	2125.0 + 2145.0

Table 2

1.4 DECLARATION OF BUILD STATUS

MAIN EUT	
MANUFACTURING DESCRIPTION	AIR Radio Unit (Multi-Standard)
MANUFACTURER	Ericsson
PRODUCT NAME	ARUS 32 B4
PART NUMBER	KRC 118 050/1
IC Model Name	AS1180501
SERIAL NUMBER	C828074982 C828116765
HARDWARE VERSION	R1A
SOFTWARE VERSION	CXP9017316/5 R59AE
TRANSMITTER OPERATING RANGE	2110 - 2155MHz
MODULATIONS	QPSK, 16QAM, 64QAM
INTERMEDIATE FREQUENCIES	Direct Conversion
ITU DESIGNATION OF EMISSION	LTE: 1M40 W7D 3M00 W7D 5M00 W7D 10M0 W7D 15M0 W7D 20M0 W7D
OUTPUT POWER (RMS) (W or dBm)	4 x 30W (44.77dBm)
OUTPUT POWER TOLERANCE	+/-0.3dB (23° C), +/-0.6dB (-40° C to +55° C)
FCC ID	TA8AKRC118050-1
IC 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 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. 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.

Signature	Held on File at TUV SUD Product Service Ltd
Date	09 September 2014
D of B S Serial No	C828074982, C828116765, C828074984

No responsibility will be accepted by TÜV SÜD Product Service as to the accuracy of the information declared in this document by the manufacturer.

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 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.

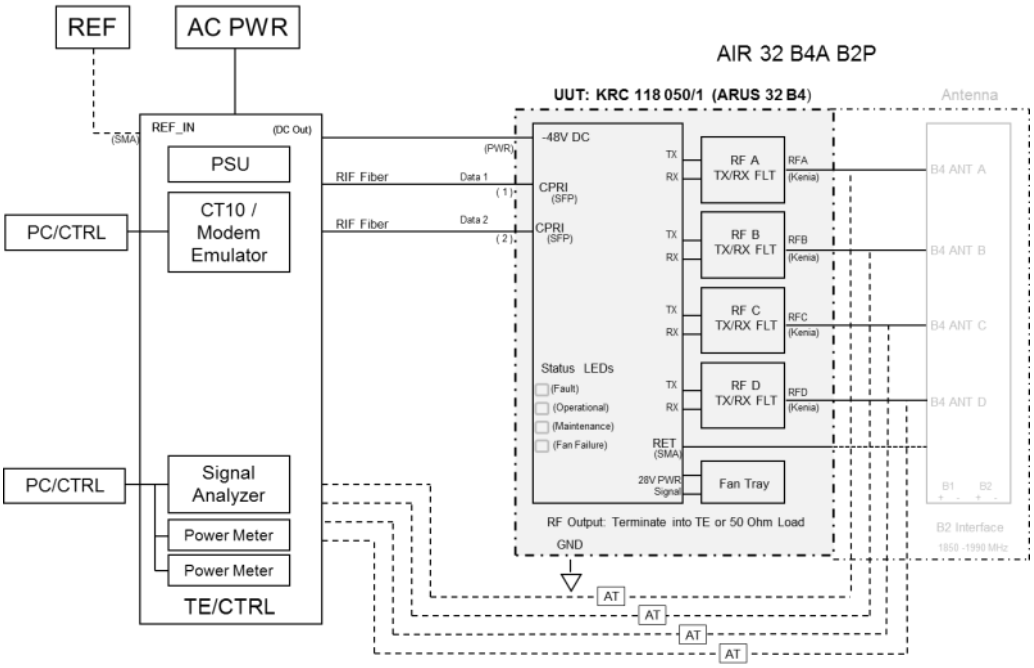
For directional optimization, the ARUS product has an active RET (Remote Electronic Tilt) function. Power for this option is provided via the ARUS RET interface (30V @ < 2A).

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-01-01 .

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 -48V 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 testing was performed at Flextronics. Reference report Flextronics K0002479-TR-RAD-01-01

Flextronics Canada Design Services Inc.
1280 Teron 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 and ILAC 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.

SECTION 2

TEST DETAILS

2.1 MAXIMUM 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

28 and 29 July 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	21.3 - 21.8°C
Relative Humidity	52.5 - 60%

2.1.5 Test Method

Measurements were performed with a Spectrum Analyser using the Band Power measurement function in accordance with FCC KDB 971168 D01 v02r01. 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 LTE (See Table 1 for carrier frequency)

Maximum Output Power 44.77 dBm per carrier, Test Model 1.1

Antenna	Carrier Bandwidth (MHz)	Channel Position B					
		PAR (dB)	Conducted Average Power (dBm)	Antenna Gain (dBi)	Average EIRP (dBm)	Average EIRP (dBm/MHz)	Average EIRP (W/MHz)
A	1.4	7.15	44.64	18.40	63.04	61.58	1438.37
B		7.16	44.65	18.40	63.05	61.59	1441.69
C		7.17	44.59	18.40	62.99	61.53	1421.91
D		7.18	44.58	18.40	62.98	61.52	1418.64
A	3	7.10	44.75	18.40	63.15	58.38	688.46
B		7.09	44.74	18.40	63.14	58.37	686.88
C		7.10	44.64	18.40	63.04	58.27	671.24
D		7.10	44.57	18.40	62.97	58.20	660.51
A	5	7.08	44.72	18.40	63.12	56.13	410.23
B		7.08	44.64	18.40	63.04	56.05	402.74
C		7.08	44.67	18.40	63.07	56.08	405.54
D		7.09	44.70	18.40	63.10	56.11	408.35
A	10	7.10	44.80	18.40	63.20	53.20	208.93
B		7.10	44.68	18.40	63.08	53.08	203.24
C		7.10	44.73	18.40	63.13	53.13	205.59
D		7.10	44.68	18.40	63.08	53.08	203.24
A	15	7.07	44.74	18.40	63.14	51.38	137.38
B		7.07	44.66	18.40	63.06	51.30	134.87
C		7.06	44.73	18.40	63.13	51.37	137.06
D		7.07	44.67	18.40	63.07	51.31	135.18
A	20	7.15	44.69	18.40	63.09	50.08	101.85
B		7.14	44.62	18.40	63.02	50.01	100.22
C		7.15	44.66	18.40	63.06	50.05	101.15
D		7.15	44.56	18.40	62.96	49.95	98.85

Antenna	Carrier Bandwidth (MHz)	Channel Position M					
		PAR (dB)	Conducted Average Power (dBm)	Antenna Gain (dB)	Average EIRP (dBm)	Average EIRP (dBm/MHz)	Average EIRP (W/MHz)
A	1.4	7.15	44.55	18.40	62.95	61.49	1408.87
B		7.16	44.51	18.40	62.91	61.45	1395.96
C		7.17	44.55	18.40	62.95	61.49	1408.87
D		7.18	44.47	18.40	62.87	61.41	1383.16
A	3	7.10	44.60	18.40	63.00	58.23	665.09
B		7.09	44.56	18.40	62.96	58.19	658.99
C		7.10	44.60	18.40	63.00	58.23	665.09
D		7.10	44.51	18.40	62.91	58.14	651.45
A	5	7.08	44.62	18.40	63.02	56.03	400.89
B		7.08	44.58	18.40	62.98	55.99	397.22
C		7.08	44.61	18.40	63.01	56.02	399.97
D		7.09	44.52	18.40	62.92	55.93	391.77
A	10	7.10	44.69	18.40	63.09	53.09	203.70
B		7.10	44.66	18.40	63.06	53.06	202.30
C		7.10	44.67	18.40	63.07	53.07	202.77
D		7.10	44.50	18.40	62.90	52.90	194.98
A	15	7.07	44.64	18.40	63.04	51.28	134.25
B		7.07	44.62	18.40	63.02	51.26	133.63
C		7.06	44.64	18.40	63.04	51.28	134.25
D		7.07	44.57	18.40	62.97	51.21	132.10
A	20	7.15	44.63	18.40	63.03	50.02	100.45
B		7.14	44.61	18.40	63.01	50.00	99.99
C		7.15	44.66	18.40	63.06	50.05	101.15
D		7.15	44.53	18.40	62.93	49.92	98.17

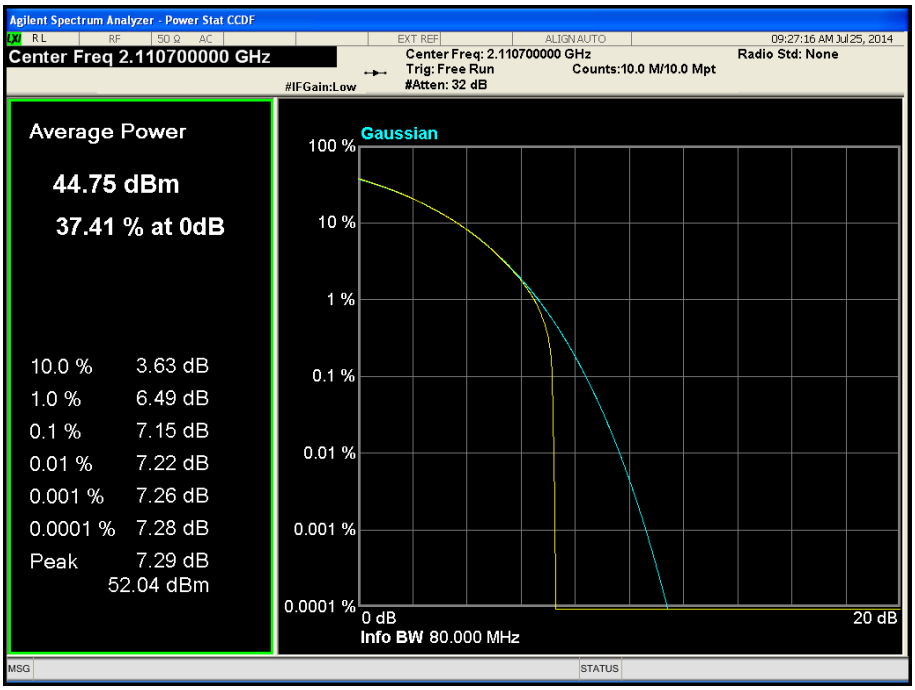
Antenna	Carrier Bandwidth (MHz)	Channel Position T					
		PAR (dB)	Conducted Average Power (dBm)	Antenna Gain (dB)	Average EIRP (dBm)	Average EIRP (dBm/MHz)	Average EIRP (W/MHz)
A	1.4	7.15	44.57	18.40	62.97	61.51	1415.38
B		7.16	44.58	18.40	62.98	61.52	1418.64
C		7.17	44.44	18.40	62.84	61.38	1373.64
D		7.18	44.47	18.40	62.87	61.41	1383.16
A	3	7.10	44.59	18.40	62.99	58.22	663.56
B		7.09	44.54	18.40	62.94	58.17	655.96
C		7.10	44.45	18.40	62.85	58.08	642.51
D		7.10	44.56	18.40	62.96	58.19	658.99
A	5	7.08	44.56	18.40	62.96	55.97	395.39
B		7.08	44.66	18.40	63.06	56.07	404.60
C		7.08	44.54	18.40	62.94	55.95	393.58
D		7.09	44.64	18.40	63.04	56.05	402.74
A	10	7.10	44.65	18.40	63.05	53.05	201.84
B		7.10	44.66	18.40	63.06	53.06	202.30
C		7.10	44.56	18.40	62.96	52.96	197.70
D		7.10	44.57	18.40	62.97	52.97	198.15
A	15	7.07	44.64	18.40	63.04	51.28	134.25
B		7.07	44.58	18.40	62.98	51.22	132.41
C		7.06	44.72	18.40	63.12	51.36	136.74
D		7.07	44.63	18.40	63.03	51.27	133.94
A	20	7.15	44.67	18.40	63.07	50.06	101.38
B		7.14	44.60	18.40	63.00	49.99	99.76
C		7.15	44.66	18.40	63.06	50.05	101.15
D		7.15	44.53	18.40	62.93	49.92	98.17

Worst Case/Maximum EIRP Calculation:

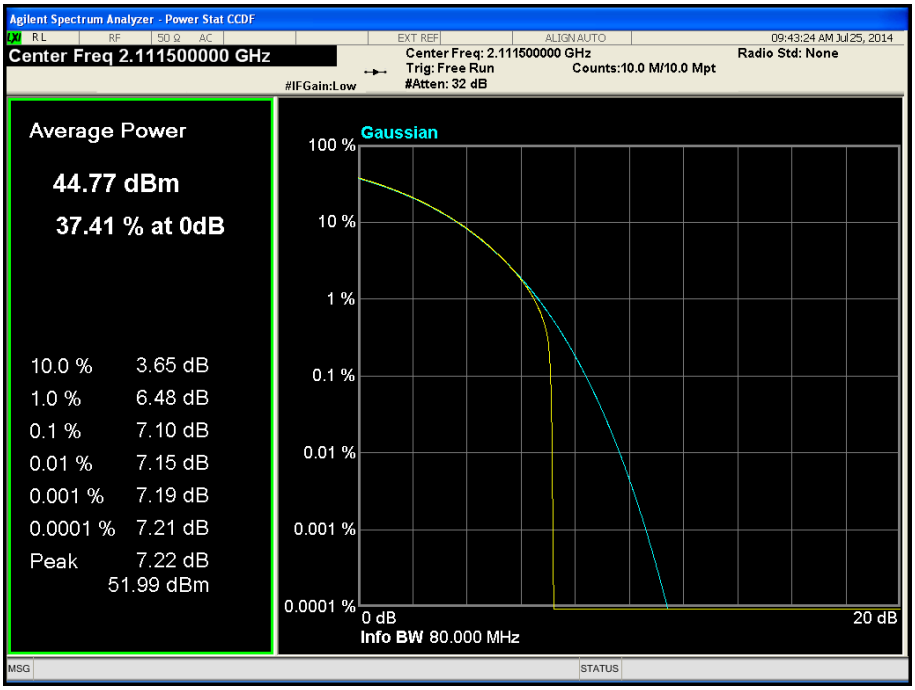
BW=1.4MHz EIRP = PT + G_{ANT} + G_{MIMO} = 44.65 + 18.4 + 3.0 = 66.05dBm = 2876.55W/MHz
*G_{MIMO} : Based on 18.4dBi antenna gain, dual cross polarized antenna technology and 2 un-correlated spatial streams (10log 2)

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. Licensee's are required to consider all necessary operational parameters to maintain EIRP compliance limits.

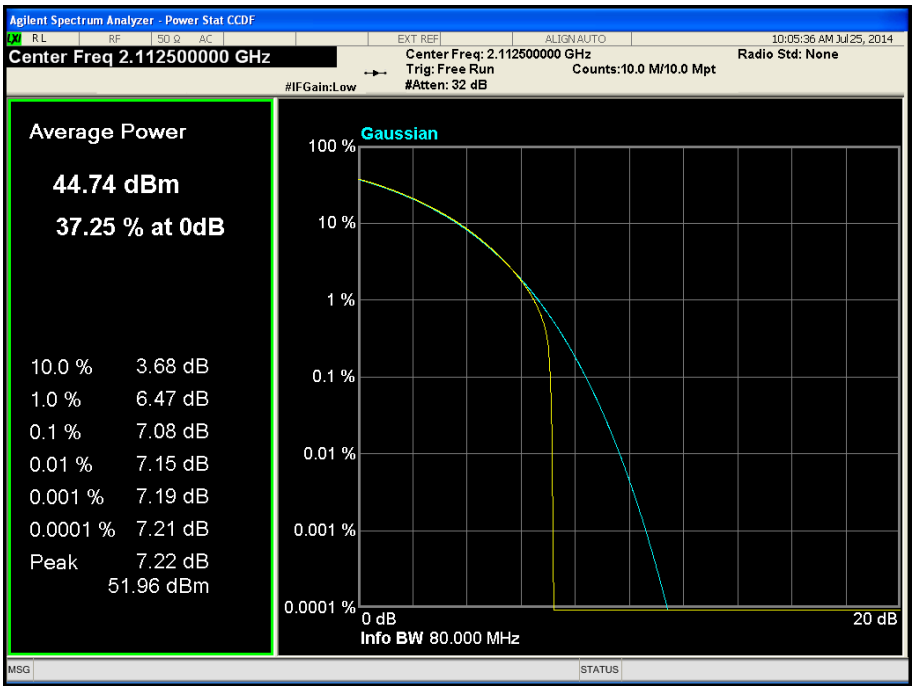
Channel Position B - Bandwidth 1.4 MHz - Antenna Port A



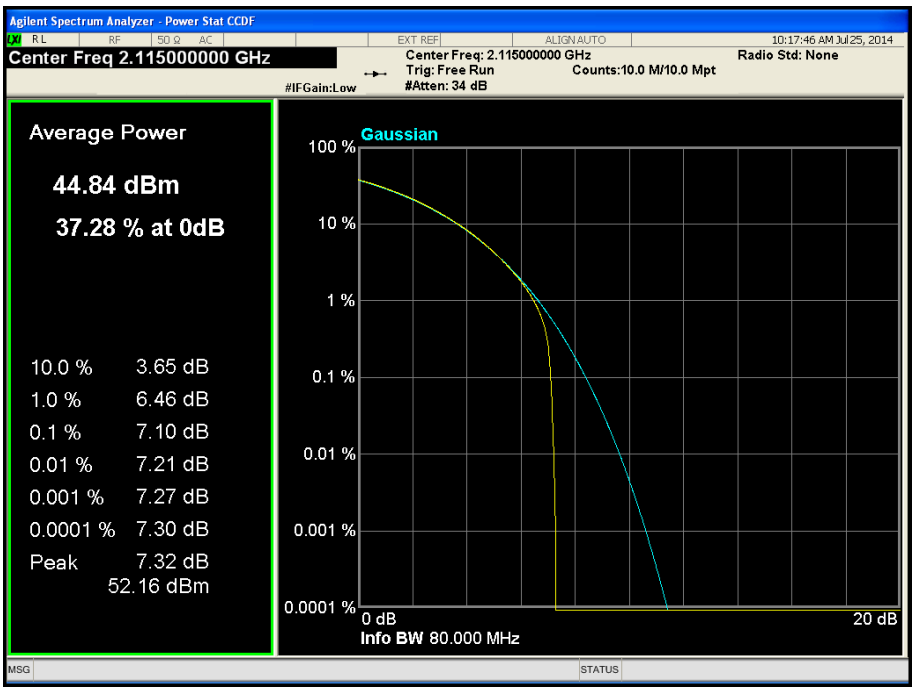
Channel Position B - Bandwidth 3.0 MHz - Antenna Port A



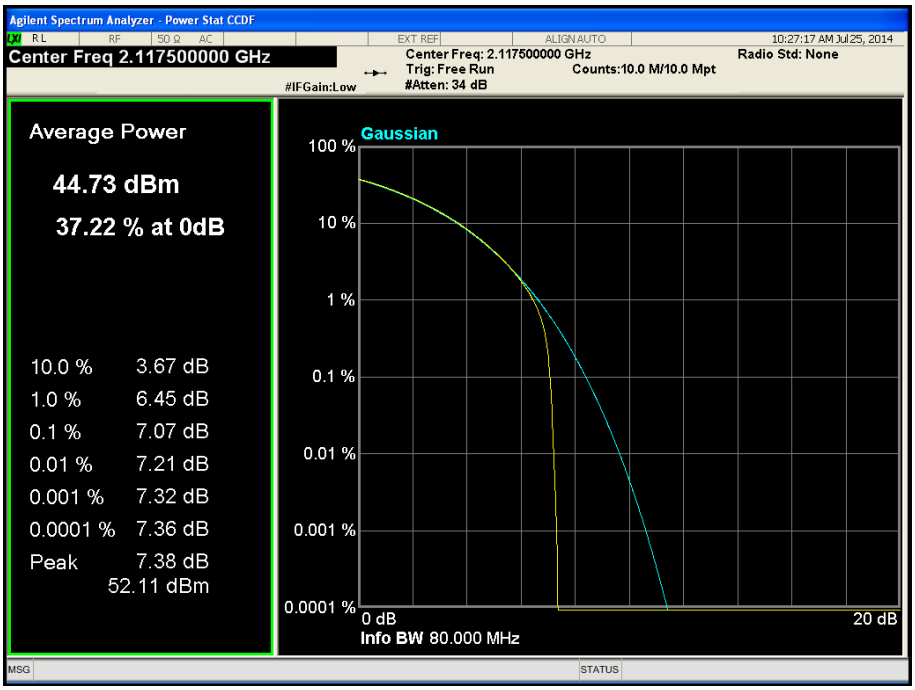
Channel Position B - Bandwidth 5.0 MHz - Antenna Port A



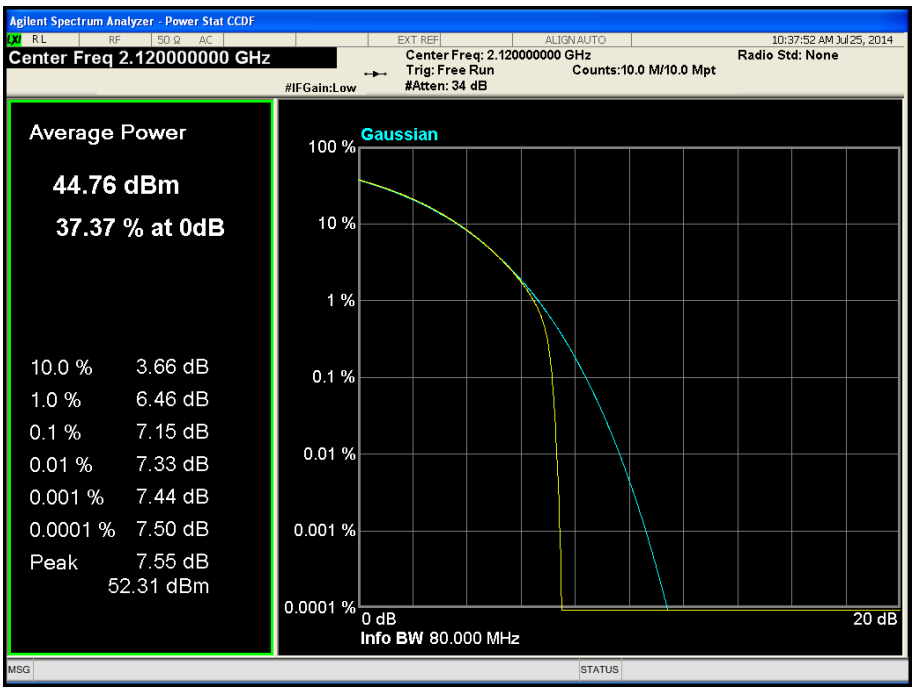
Channel Position B - Bandwidth 10.0 MHz - Antenna Port A



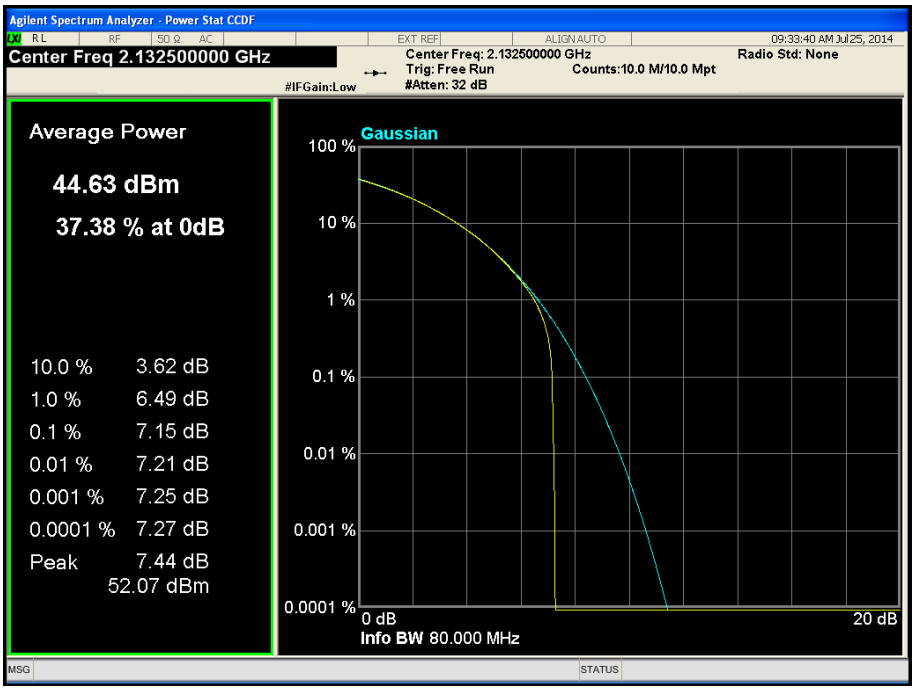
Channel Position B - Bandwidth 15.0 MHz - Antenna Port A



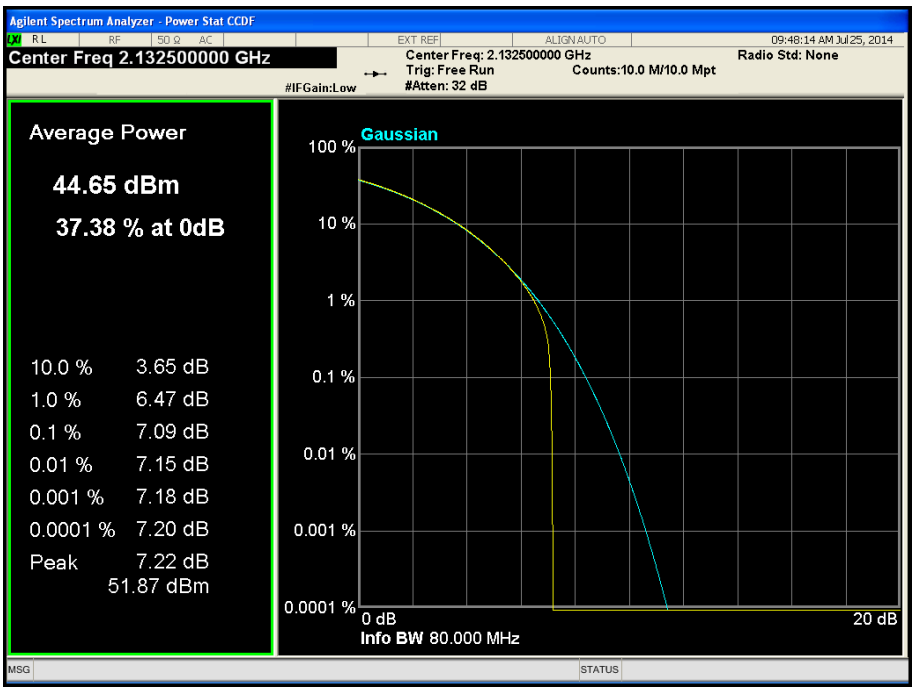
Channel Position B - Bandwidth 20.0 MHz - Antenna Port A



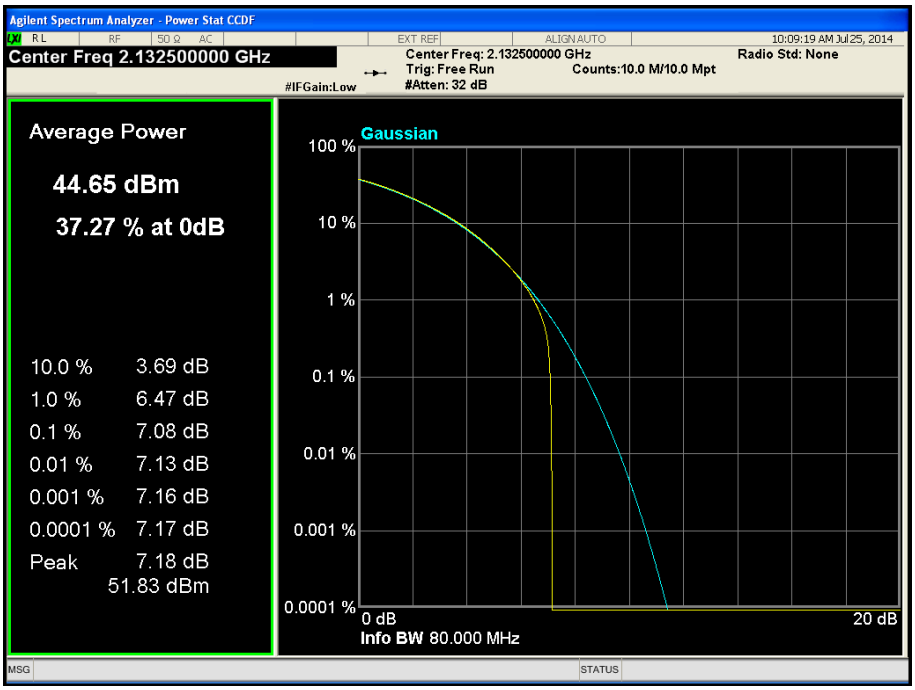
Channel Position M - Bandwidth 1.4 MHz - Antenna Port A



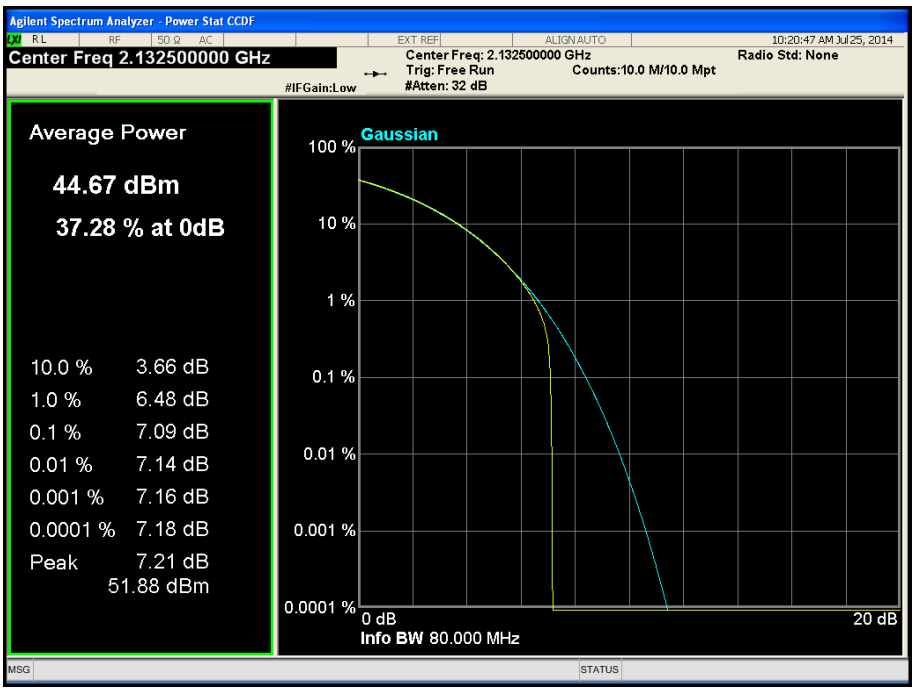
Channel Position M - Bandwidth 3.0 MHz - Antenna Port A



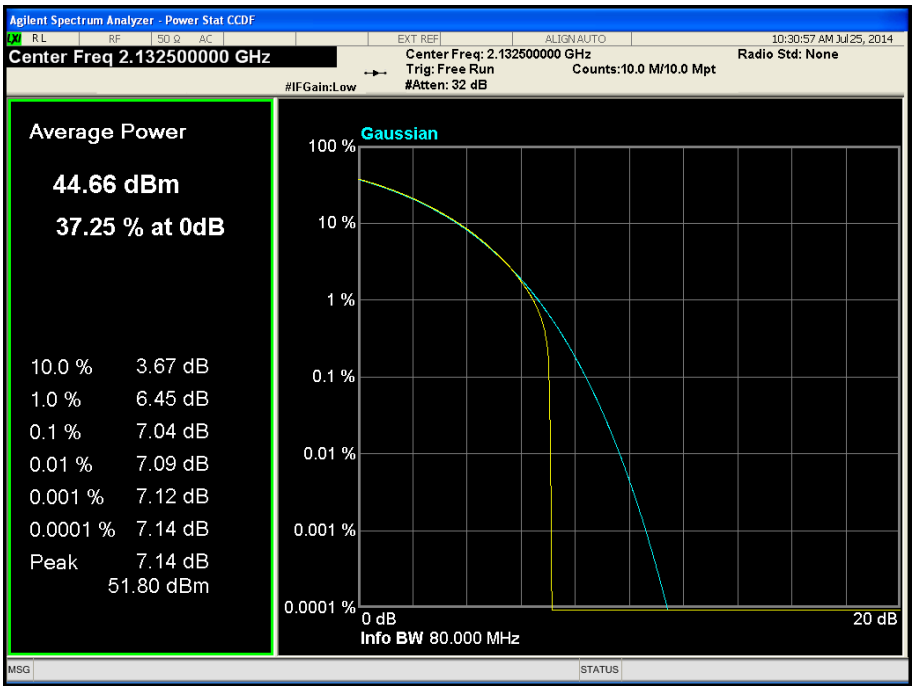
Channel Position M - Bandwidth 5.0 MHz - Antenna Port A



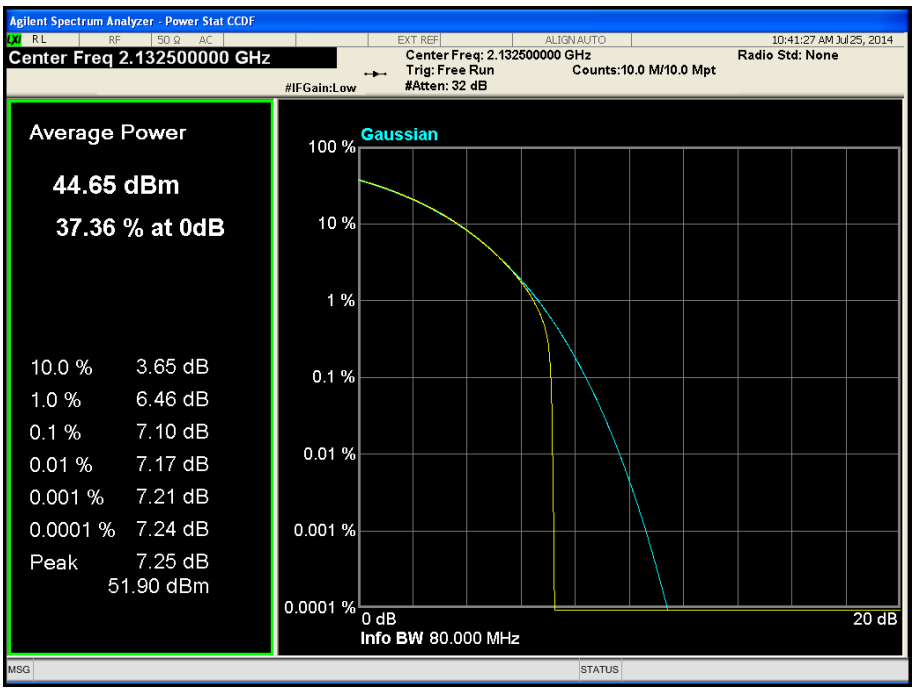
Channel Position M - Bandwidth 10.0 MHz - Antenna Port A



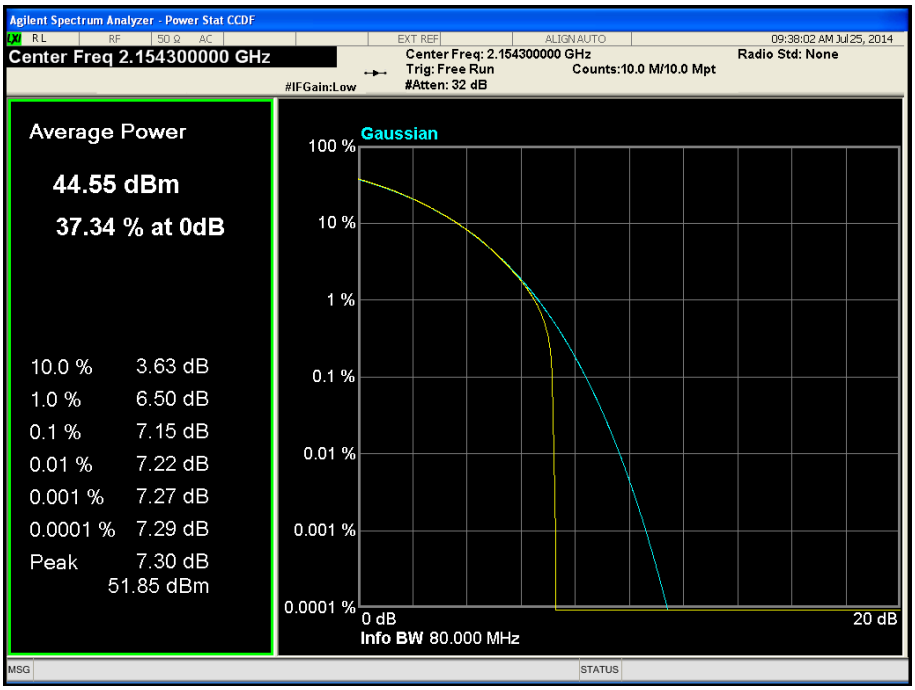
Channel Position M - Bandwidth 15.0 MHz - Antenna Port A



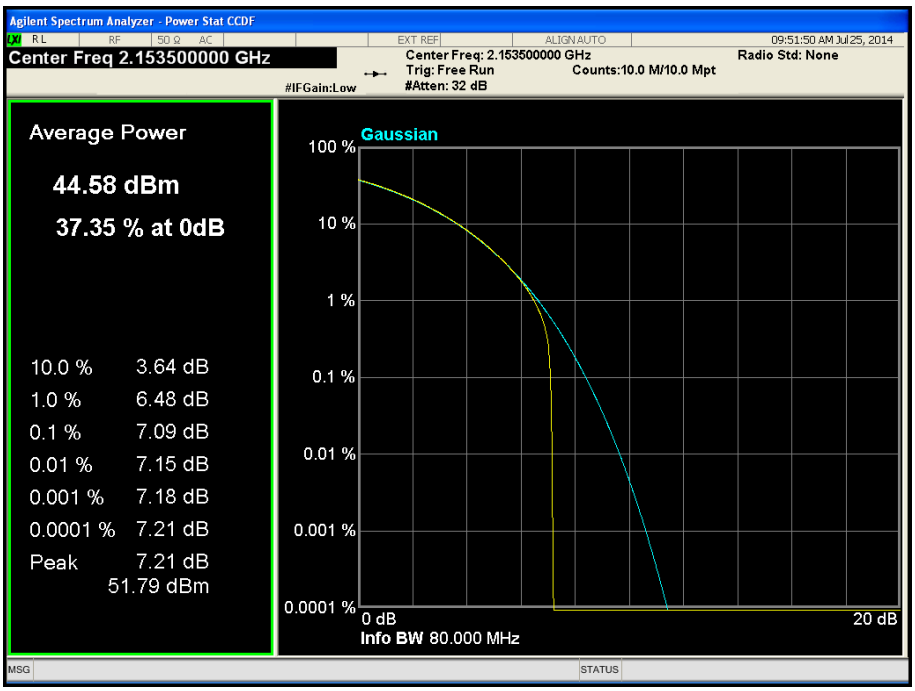
Channel Position M - Bandwidth 20.0 MHz - Antenna Port A



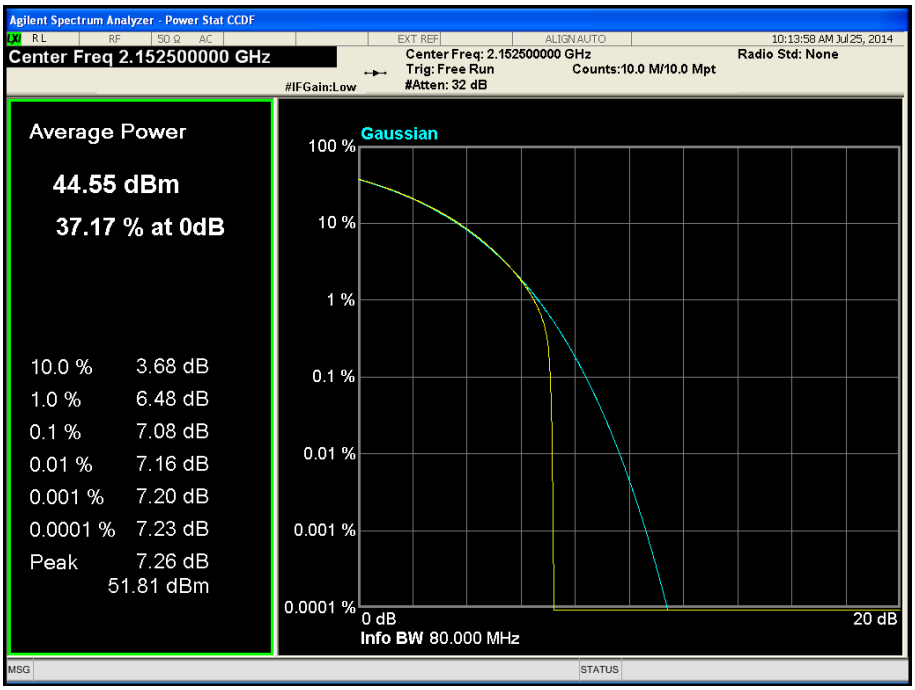
Channel Position T - Bandwidth 1.4 MHz - Antenna Port A



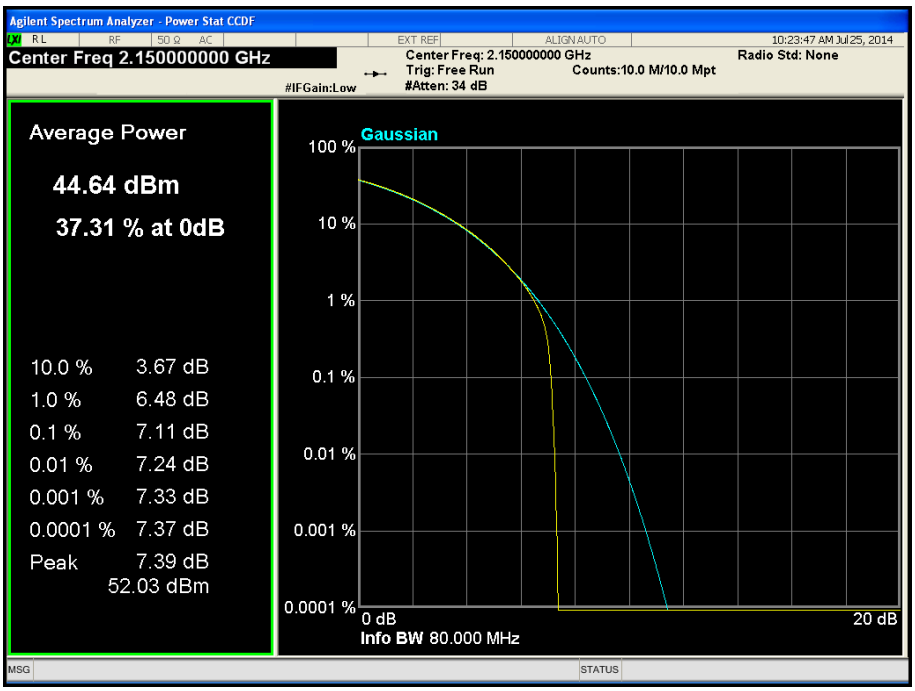
Channel Position T - Bandwidth 3.0 MHz - Antenna Port A



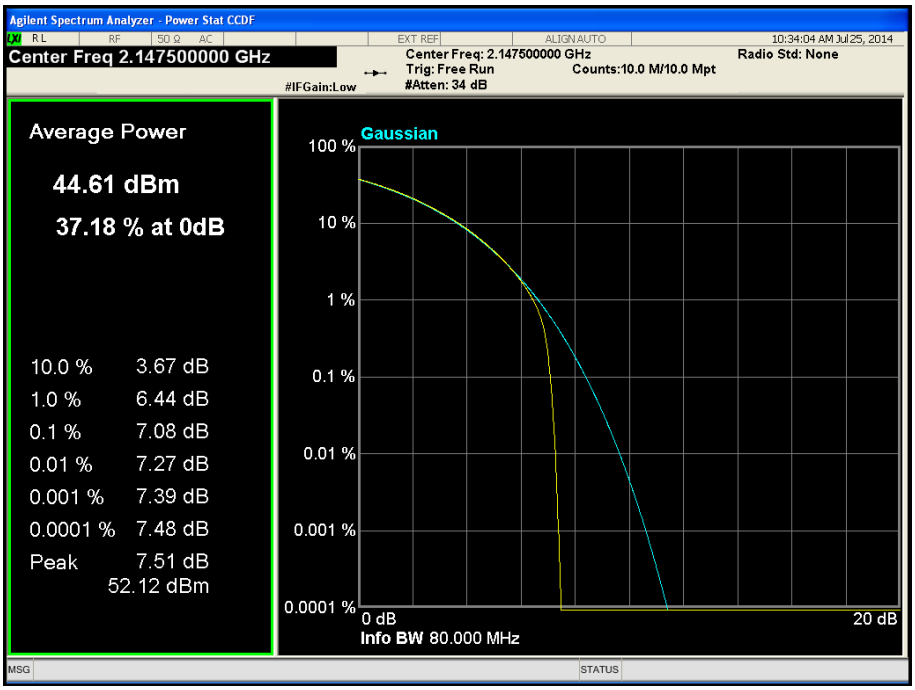
Channel Position T - Bandwidth 5.0 MHz - Antenna Port A



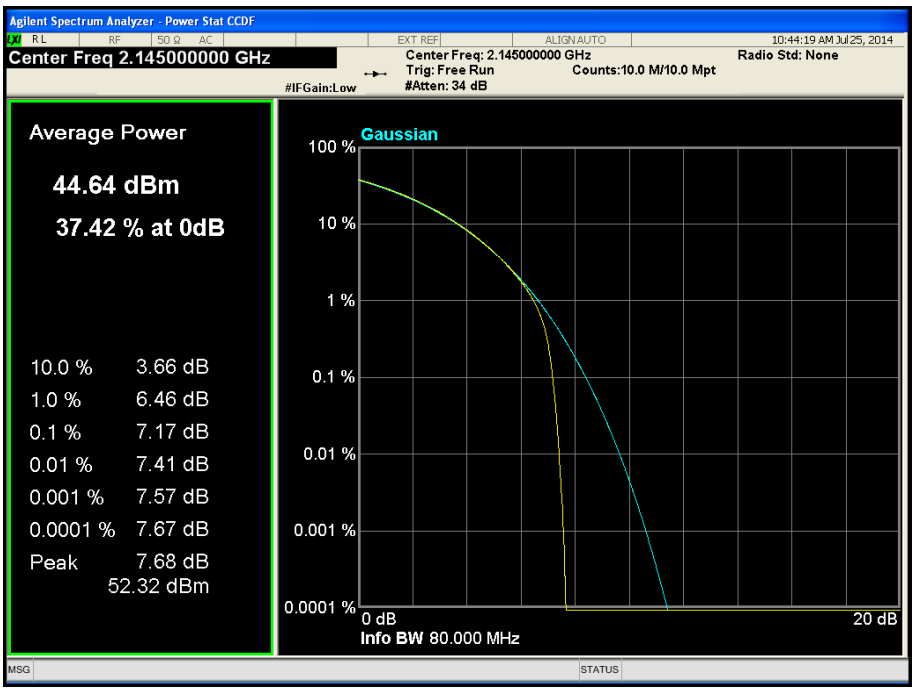
Channel Position T - Bandwidth 10.0 MHz - Antenna Port A



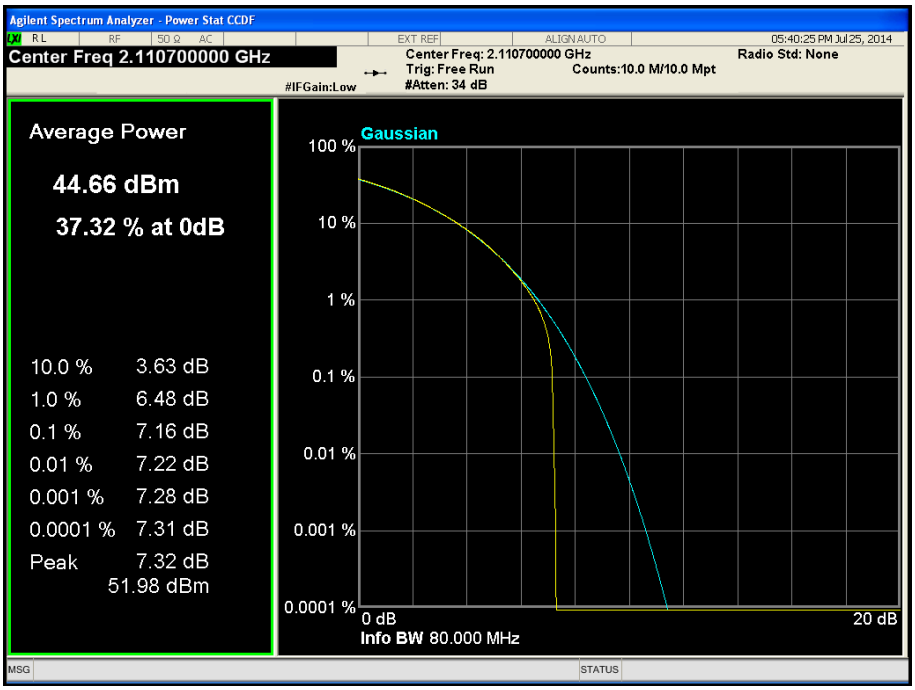
Channel Position T - Bandwidth 15.0 MHz - Antenna Port A



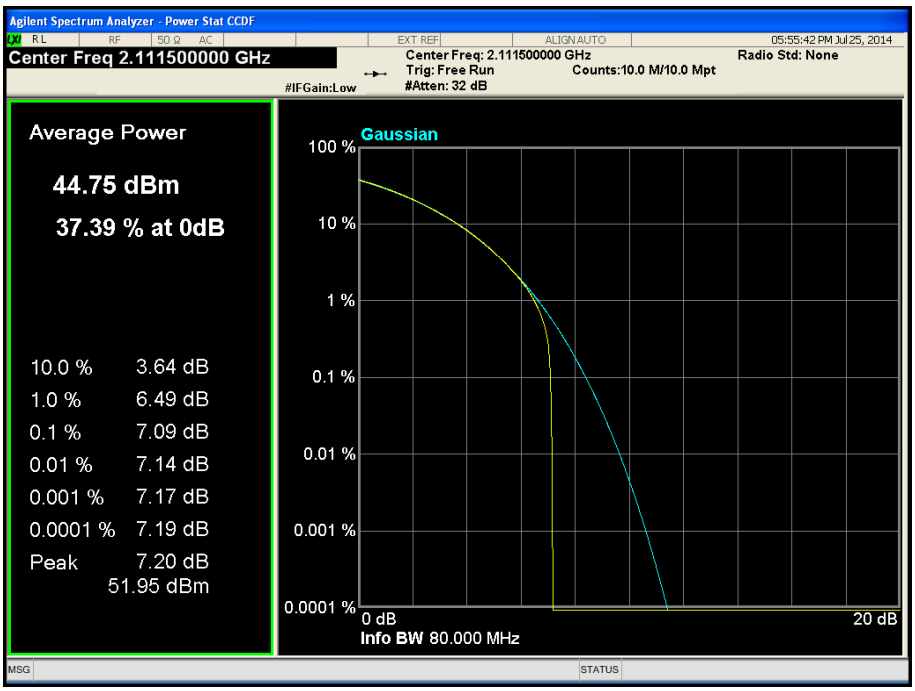
Channel Position T - Bandwidth 20.0 MHz - Antenna Port A



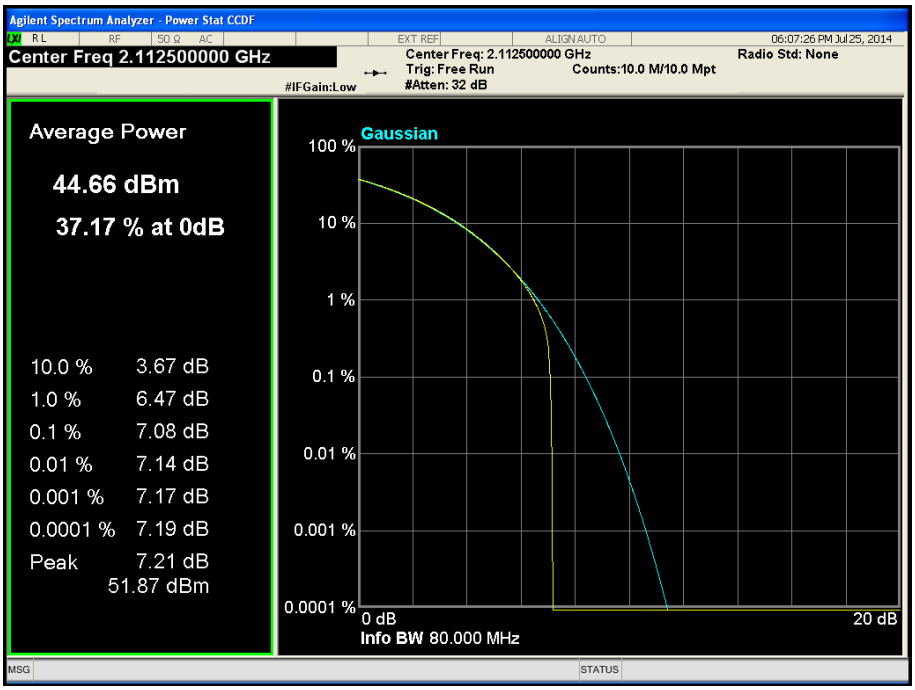
Channel Position B - Bandwidth 1.4 MHz - Antenna Port B



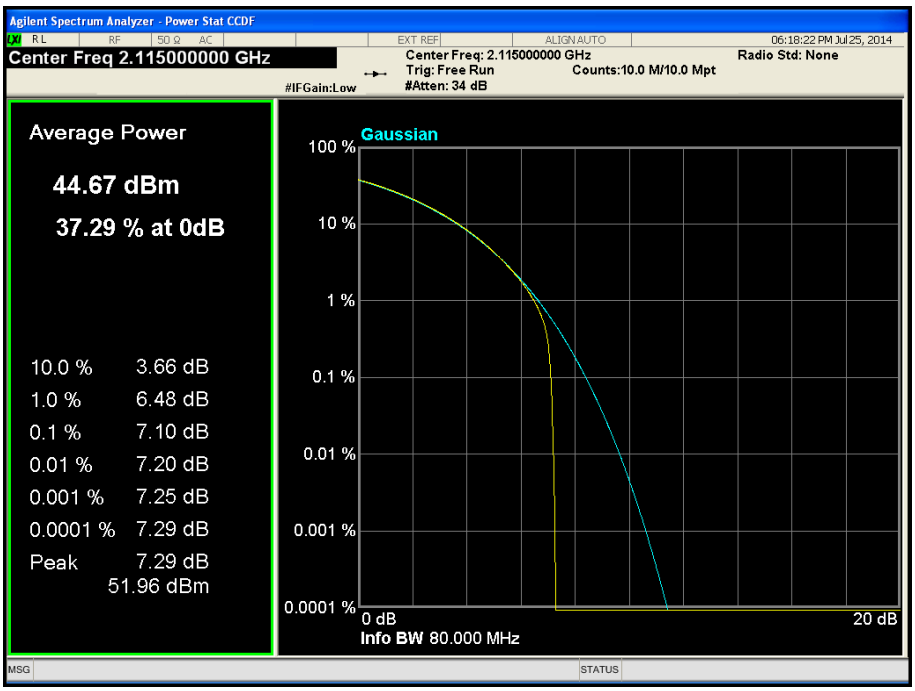
Channel Position B - Bandwidth 3.0 MHz - Antenna Port B



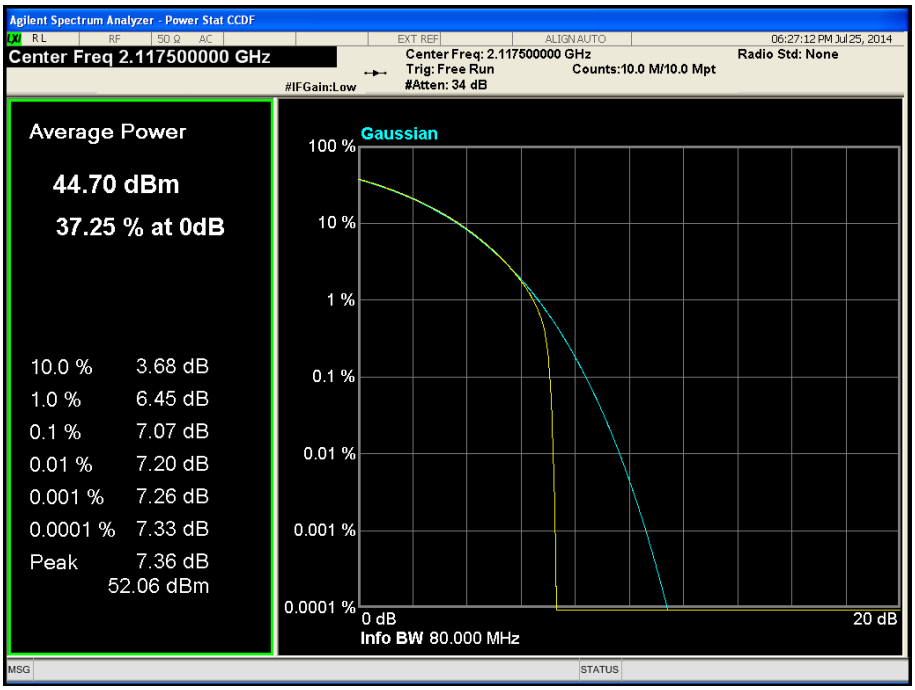
Channel Position B - Bandwidth 5.0 MHz - Antenna Port B



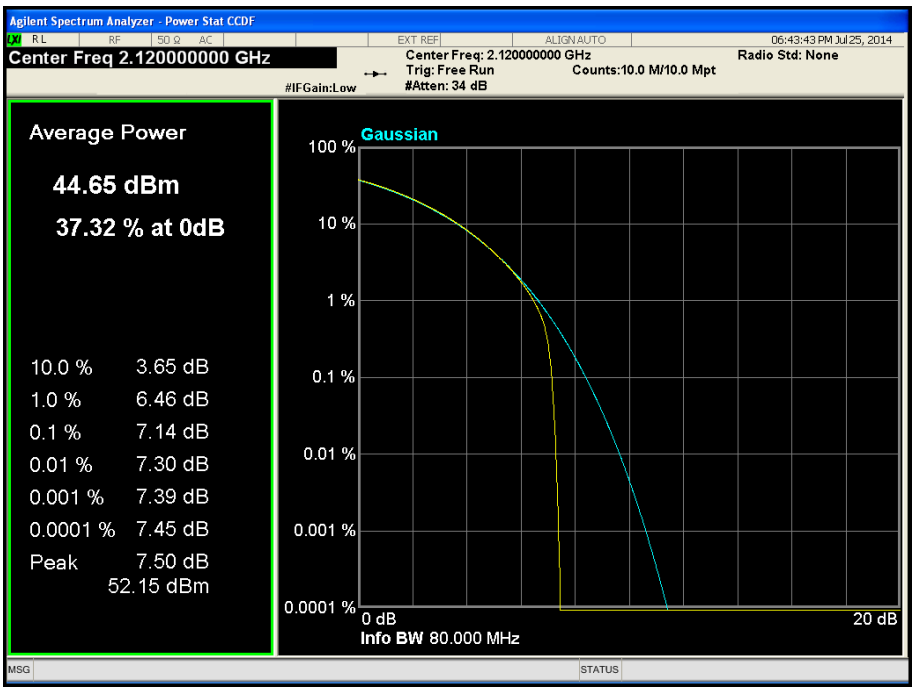
Channel Position B - Bandwidth 10.0 MHz - Antenna Port B



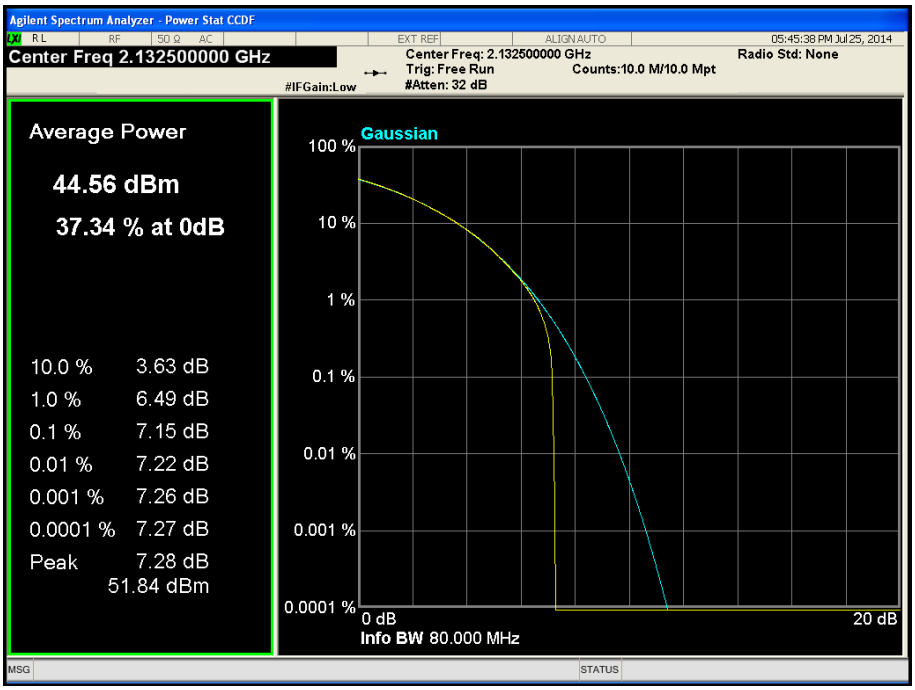
Channel Position B - Bandwidth 15.0 MHz - Antenna Port B



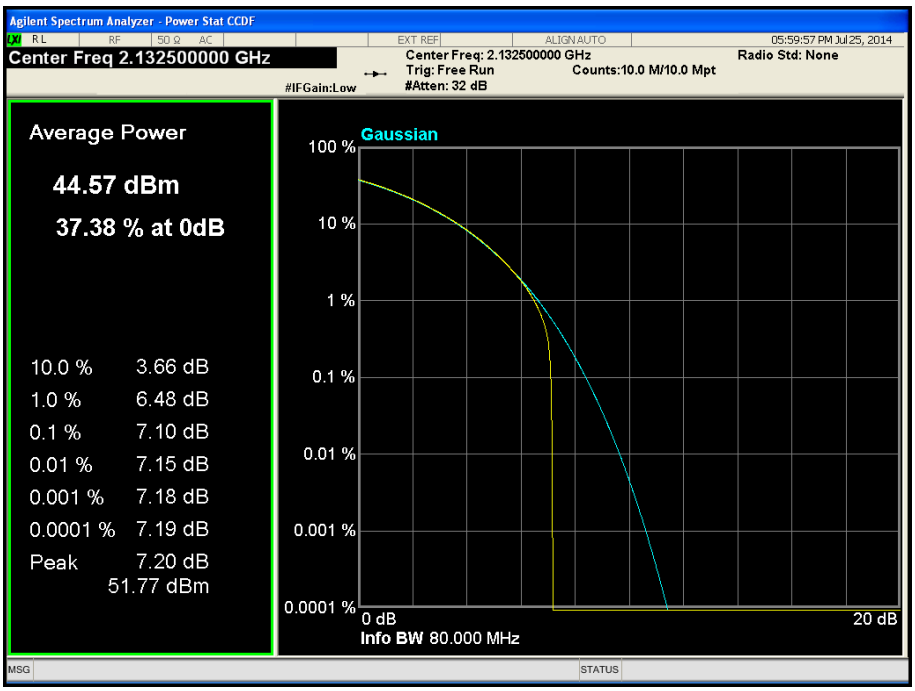
Channel Position B - Bandwidth 20.0 MHz - Antenna Port B



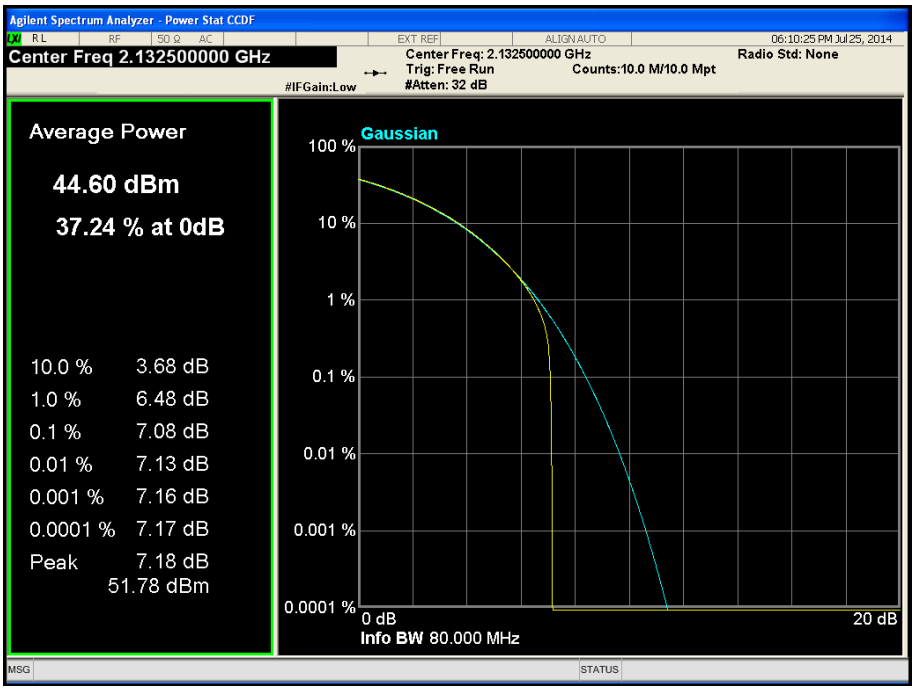
Channel Position M - Bandwidth 1.4 MHz - Antenna Port B



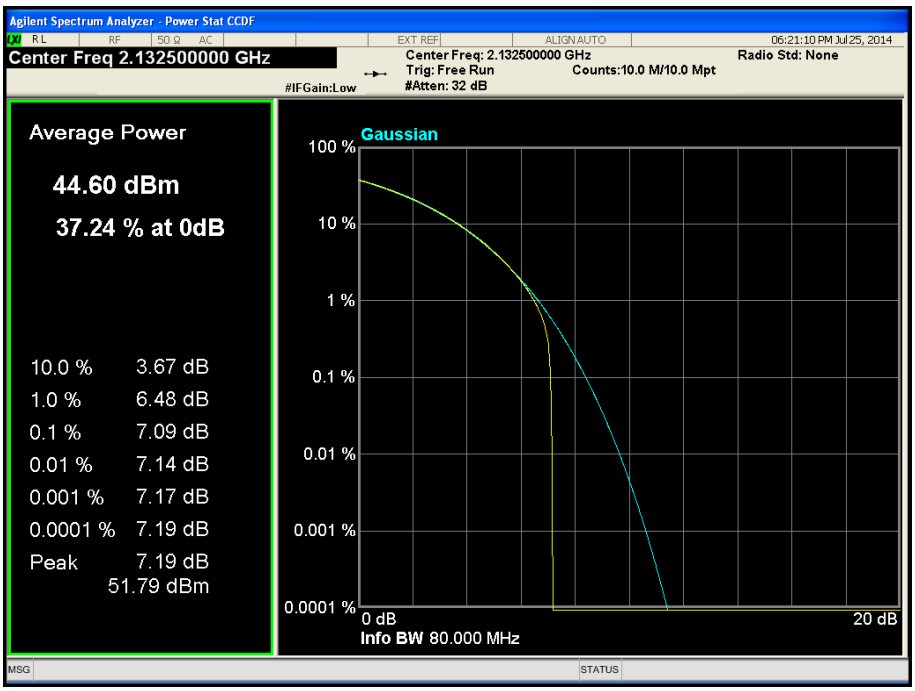
Channel Position M - Bandwidth 3.0 MHz - Antenna Port B



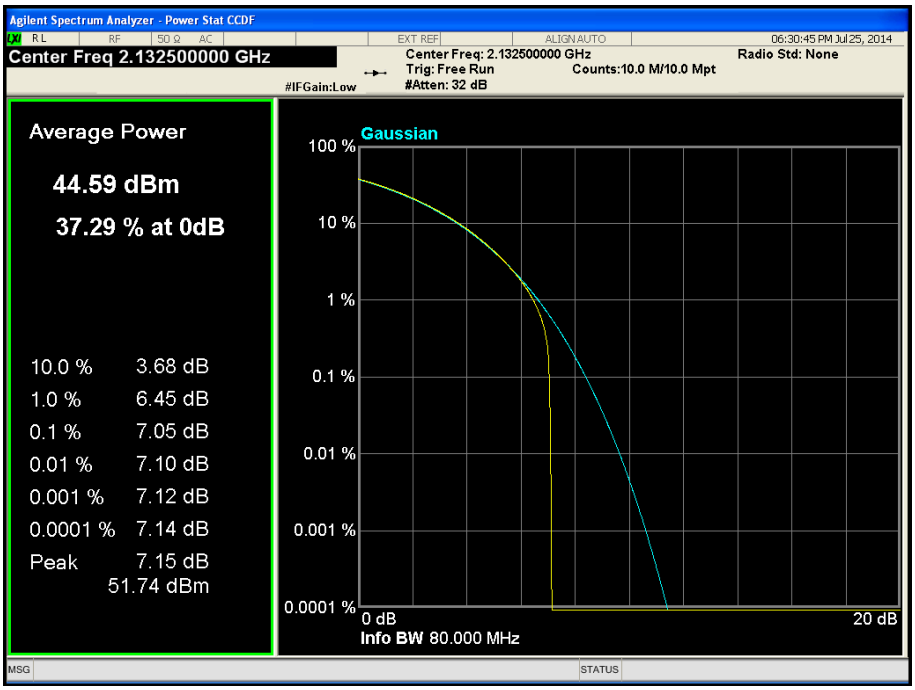
Channel Position M - Bandwidth 5.0 MHz - Antenna Port B



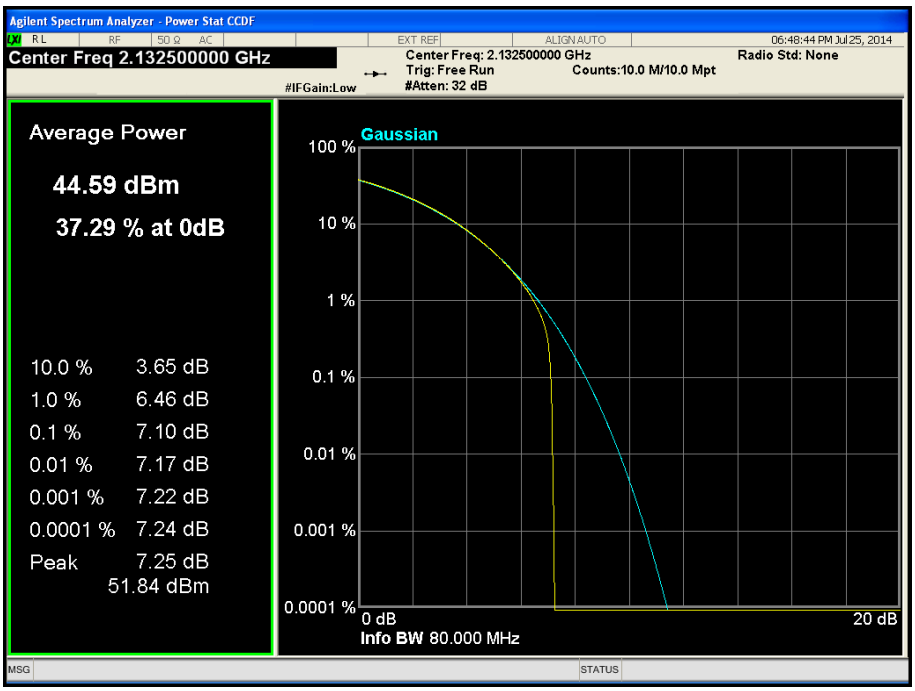
Channel Position M - Bandwidth 10.0 MHz - Antenna Port B



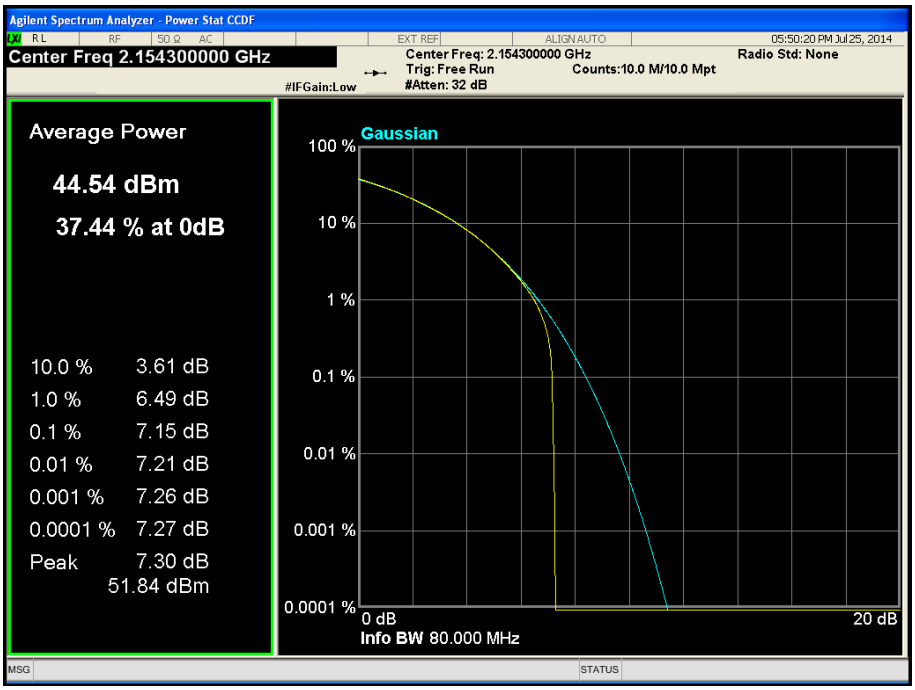
Channel Position M - Bandwidth 15.0 MHz - Antenna Port B



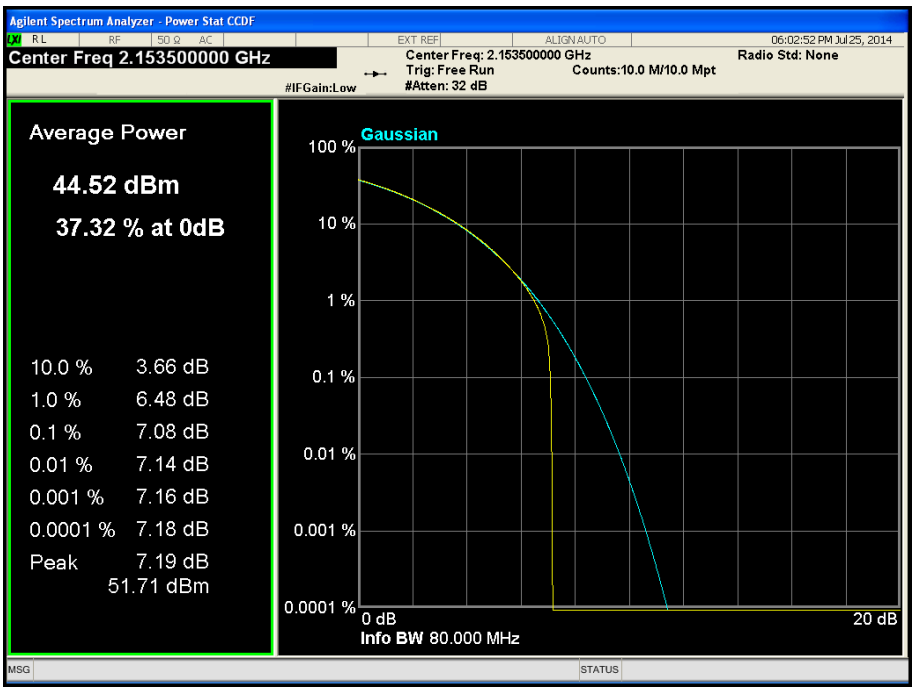
Channel Position M - Bandwidth 20.0 MHz - Antenna Port B



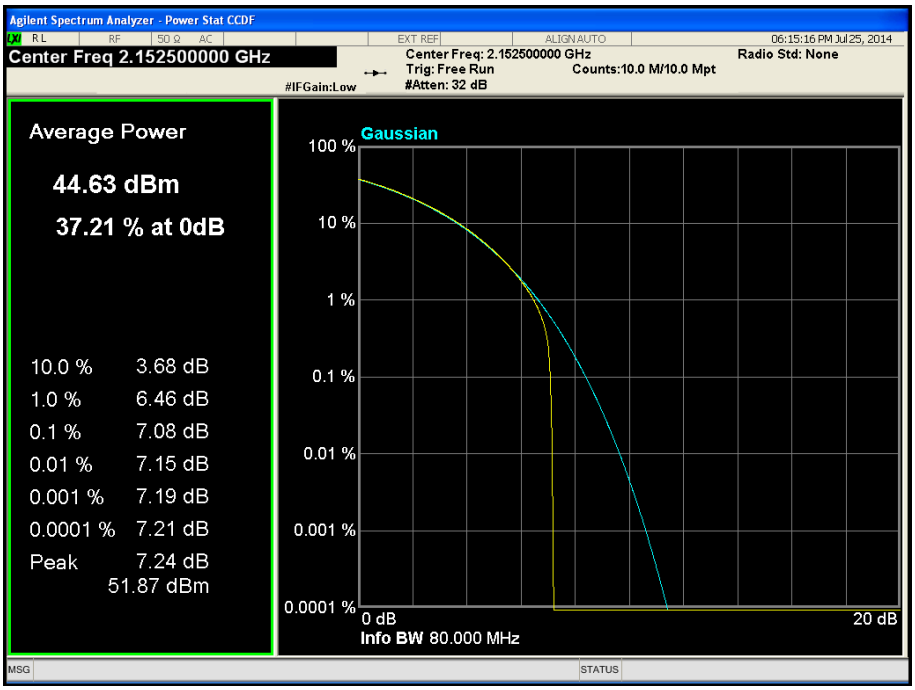
Channel Position T - Bandwidth 1.4 MHz - Antenna Port B



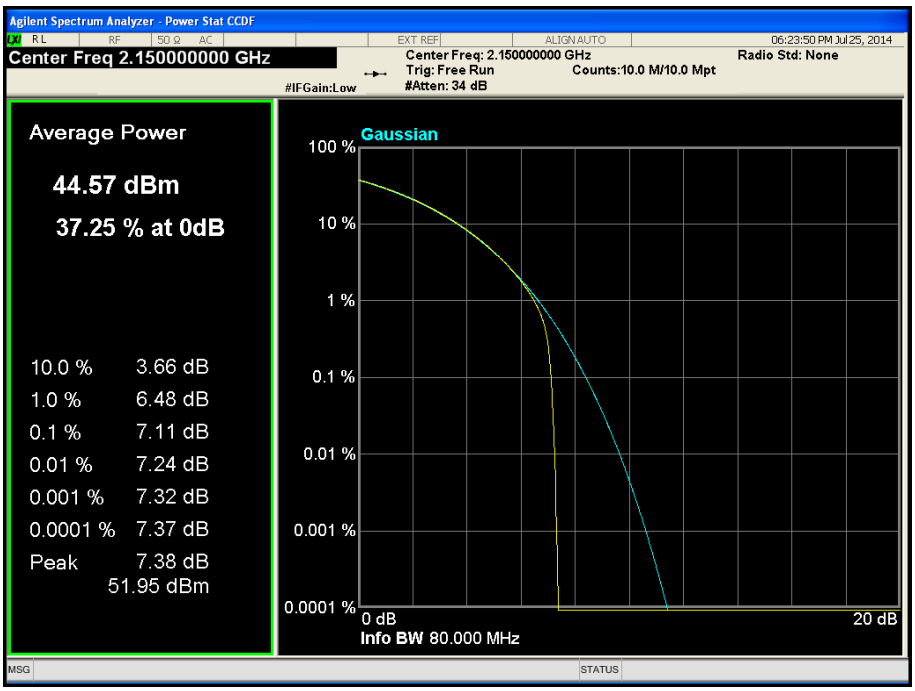
Channel Position T - Bandwidth 3.0 MHz - Antenna Port B



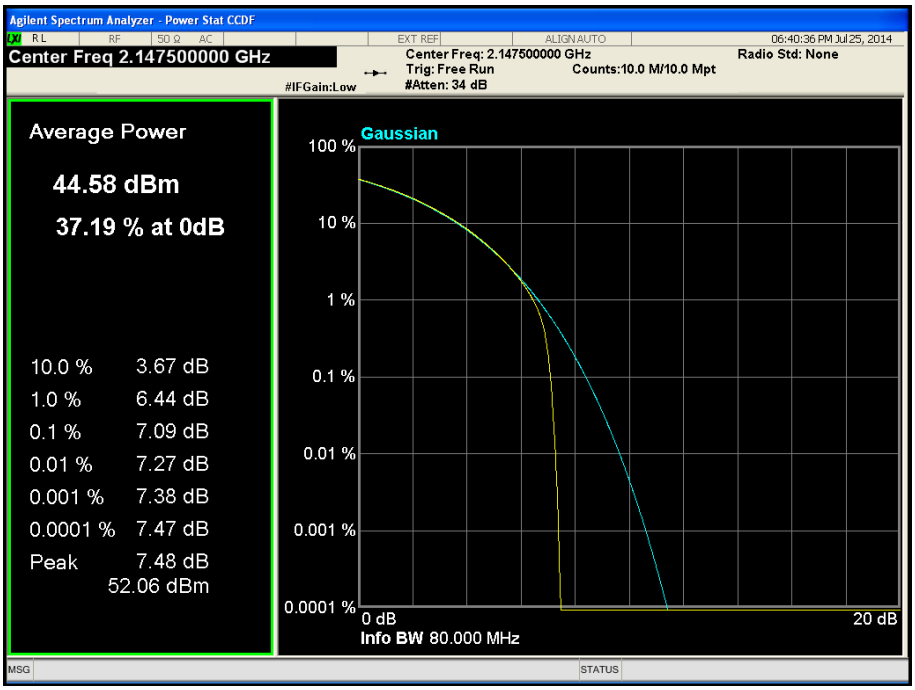
Channel Position T - Bandwidth 5.0 MHz - Antenna Port B



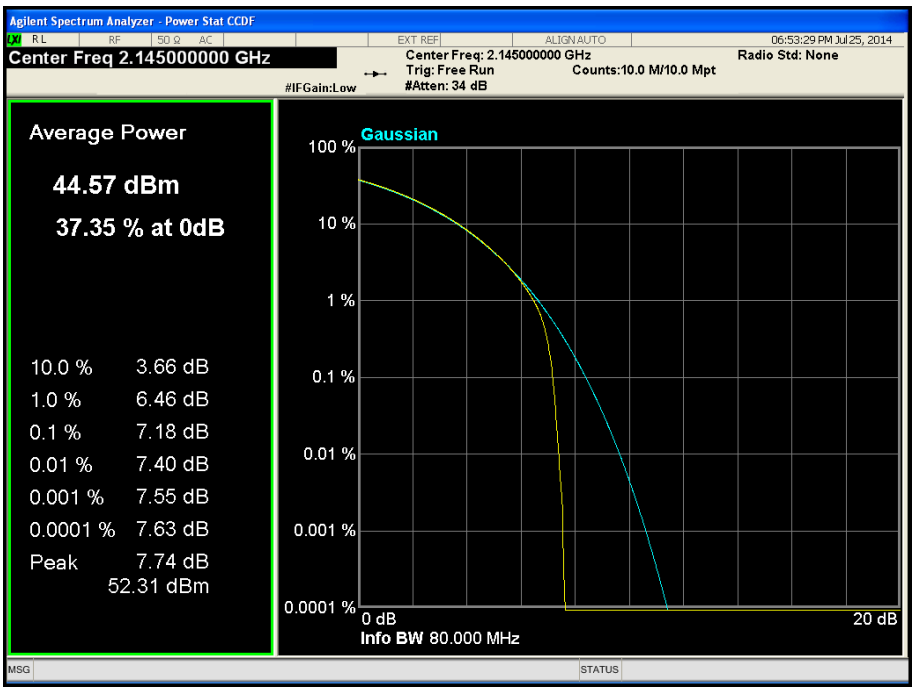
Channel Position T - Bandwidth 10.0 MHz - Antenna Port B



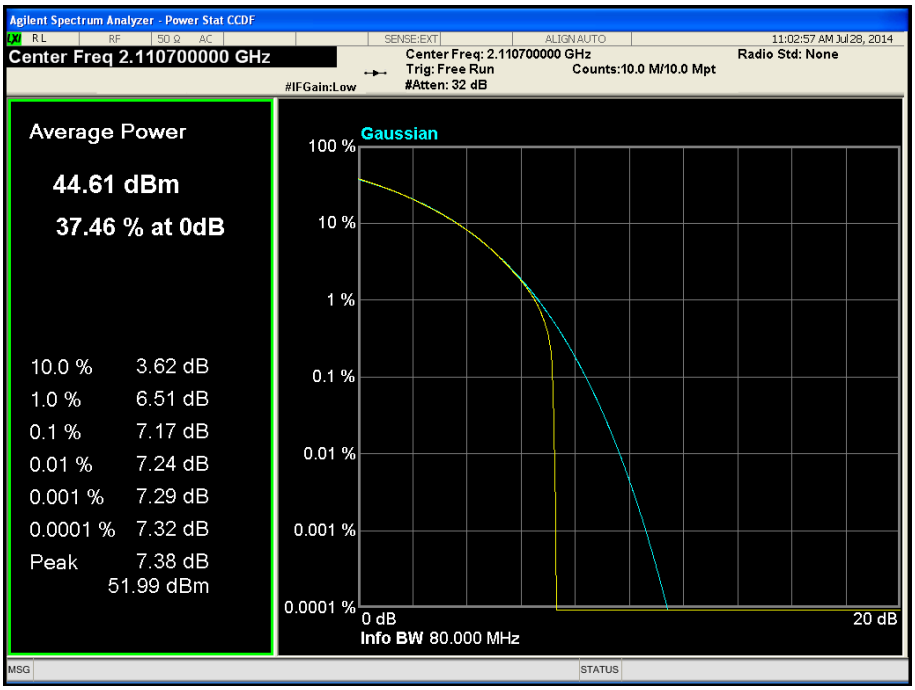
Channel Position T - Bandwidth 15.0 MHz - Antenna Port B



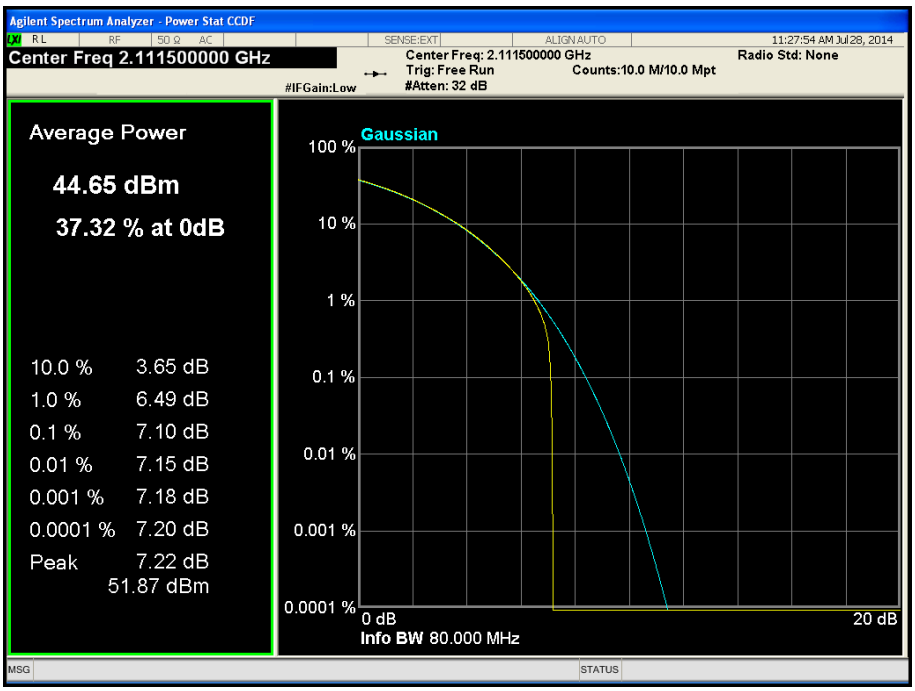
Channel Position T - Bandwidth 20.0 MHz - Antenna Port B



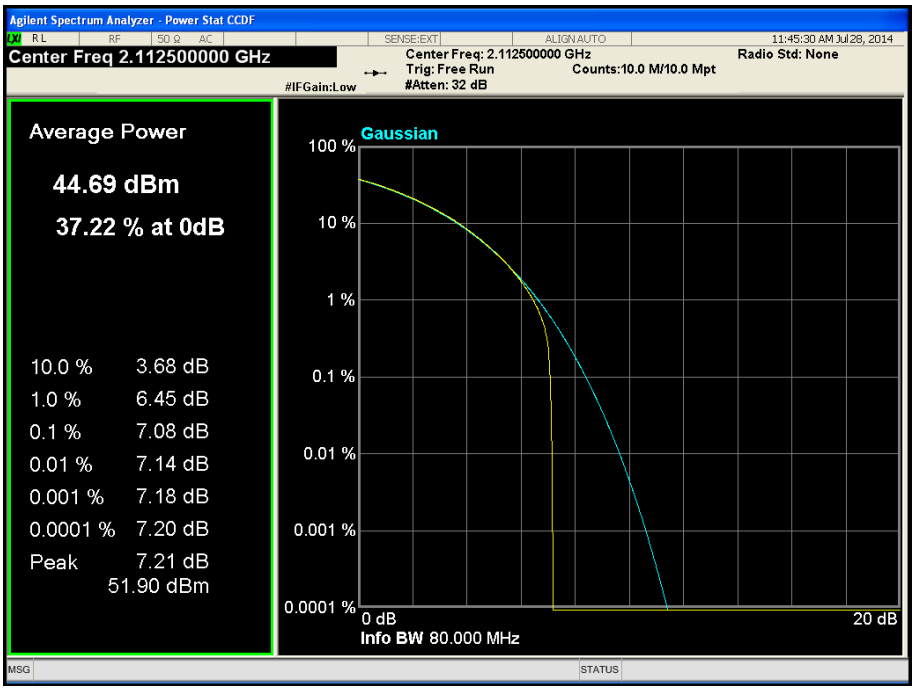
Channel Position B - Bandwidth 1.4 MHz - Antenna Port C



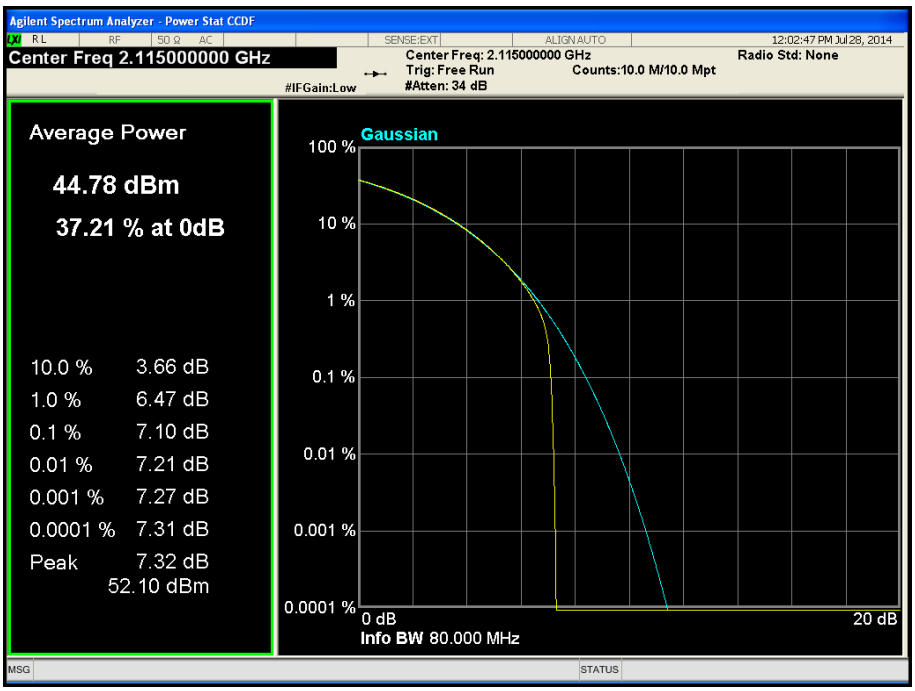
Channel Position B - Bandwidth 3.0 MHz - Antenna Port C



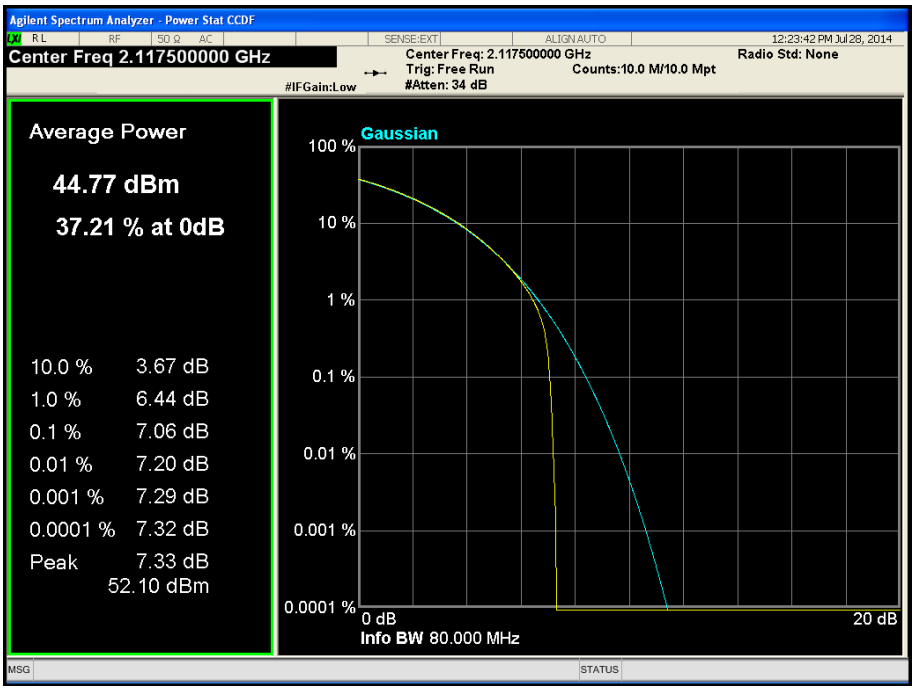
Channel Position B - Bandwidth 5.0 MHz - Antenna Port C



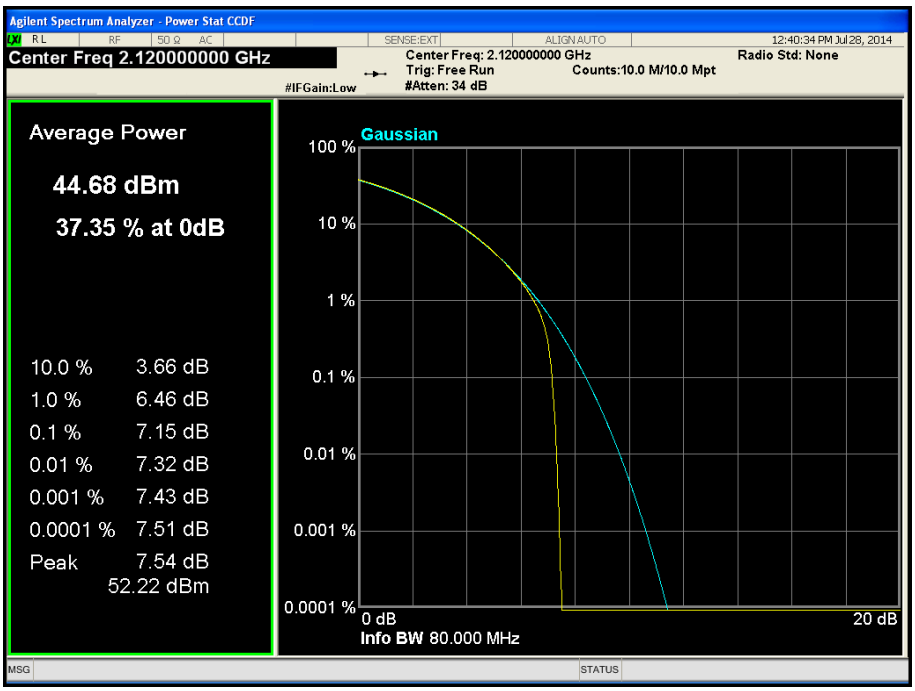
Channel Position B - Bandwidth 10.0 MHz - Antenna Port C



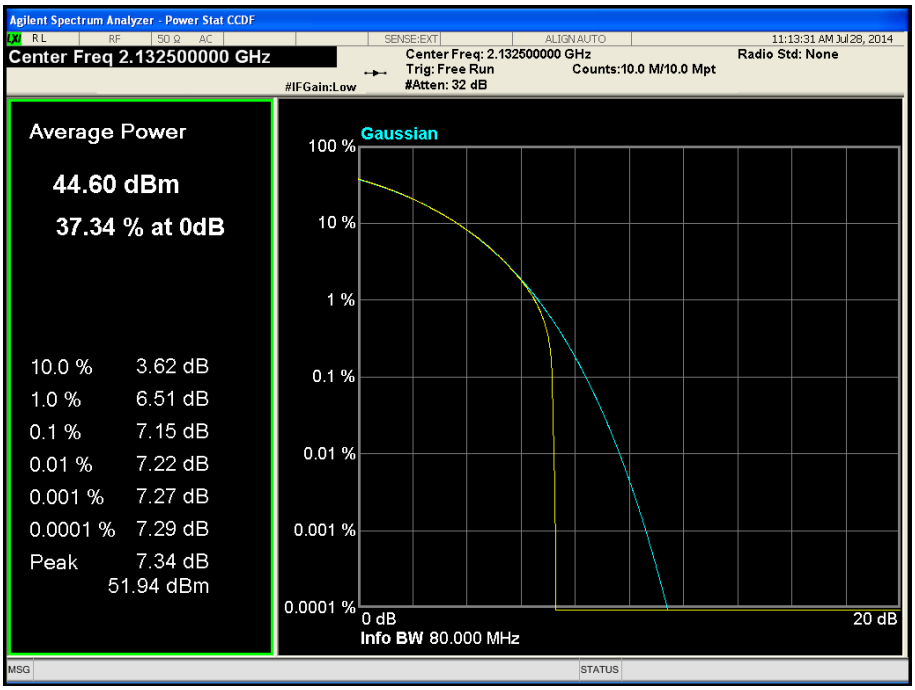
Channel Position B - Bandwidth 15.0 MHz - Antenna Port C



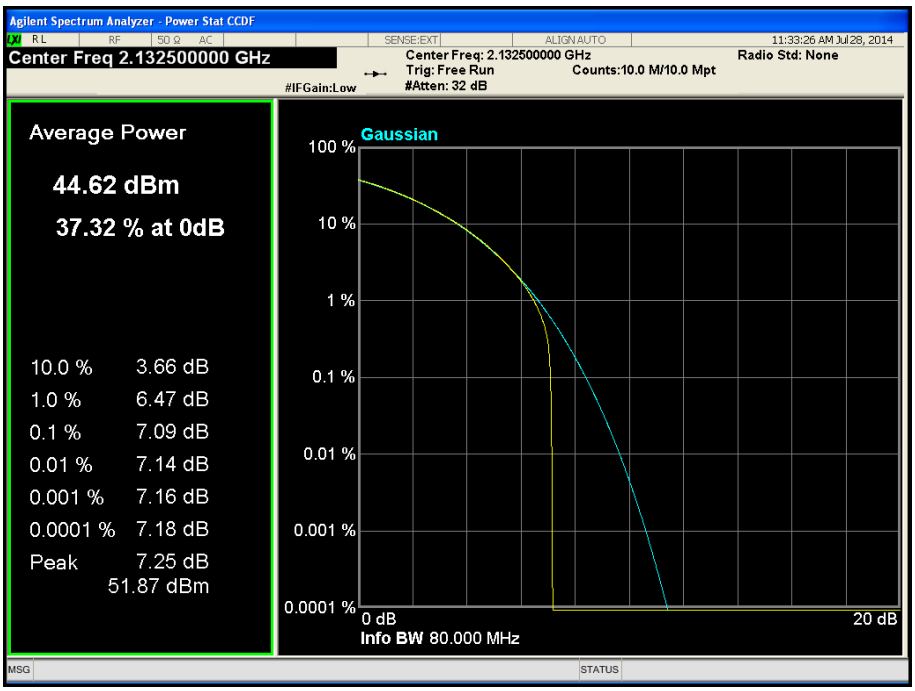
Channel Position B - Bandwidth 20.0 MHz - Antenna Port C



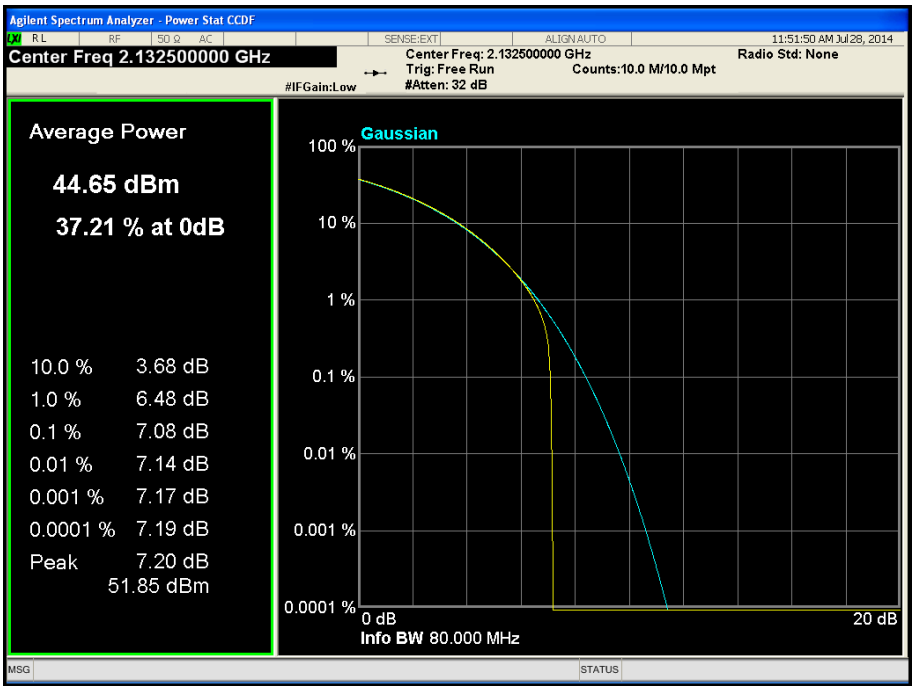
Channel Position M - Bandwidth 1.4 MHz - Antenna Port C



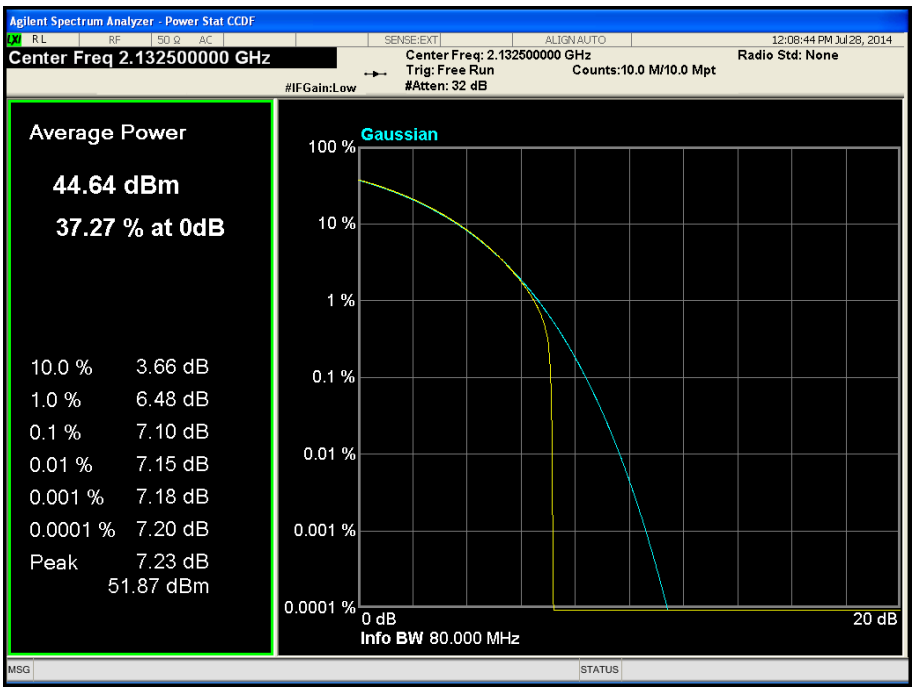
Channel Position M - Bandwidth 3.0 MHz - Antenna Port C



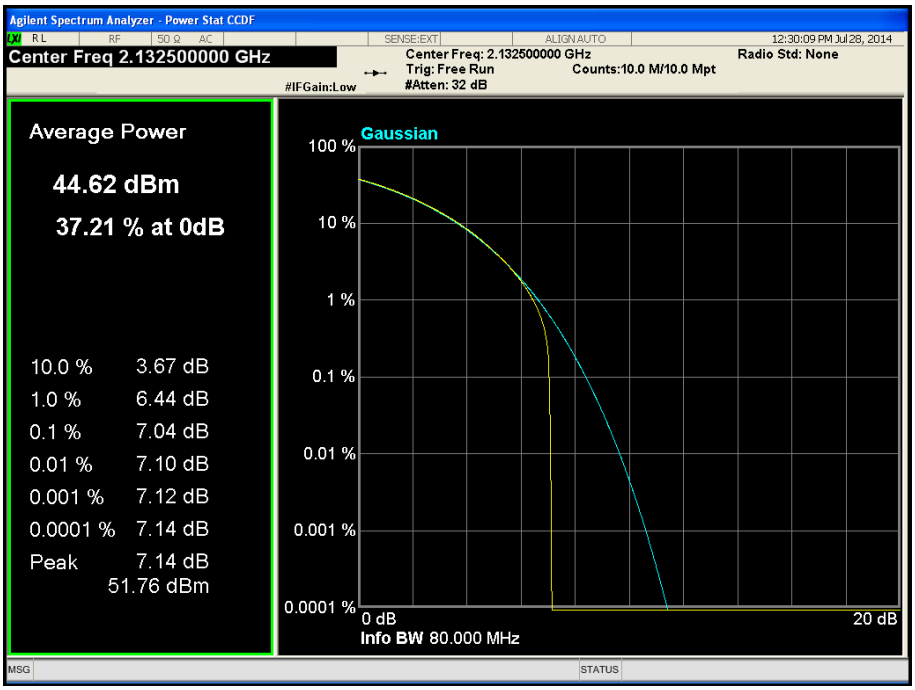
Channel Position M - Bandwidth 5.0 MHz - Antenna Port C



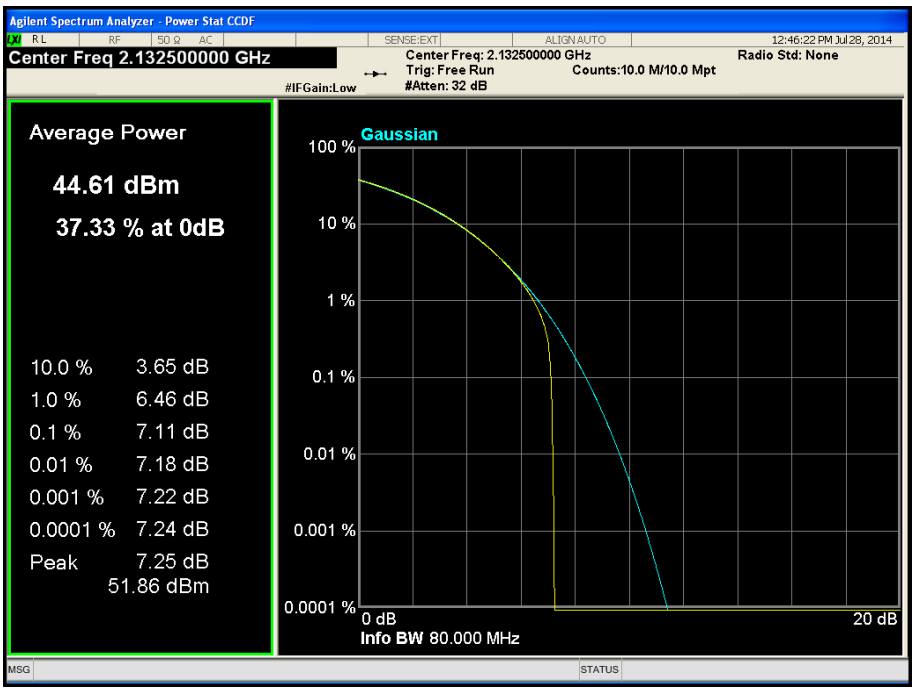
Channel Position M - Bandwidth 10.0 MHz - Antenna Port C



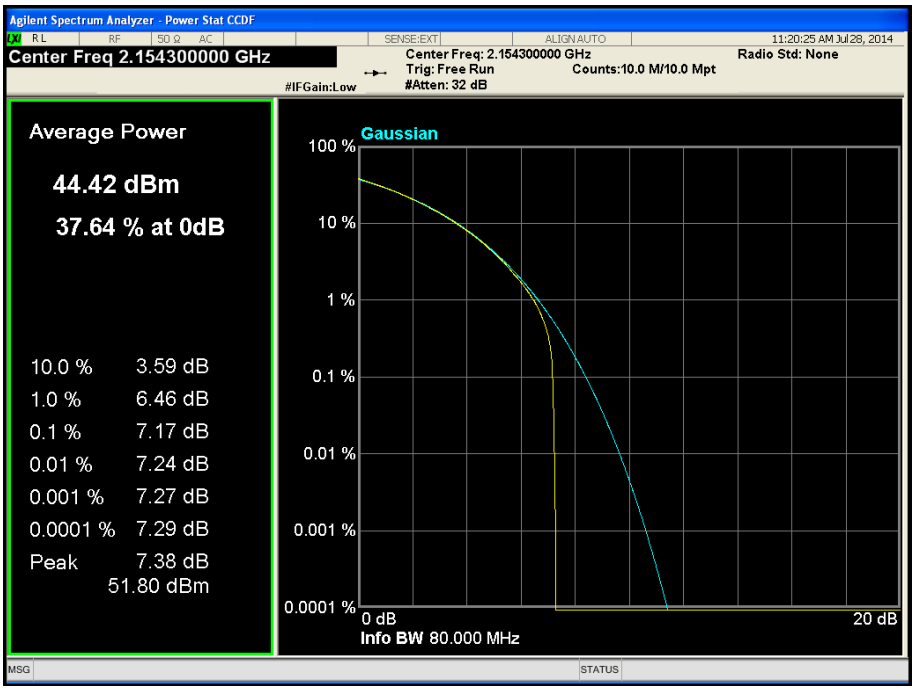
Channel Position M - Bandwidth 15.0 MHz - Antenna Port C



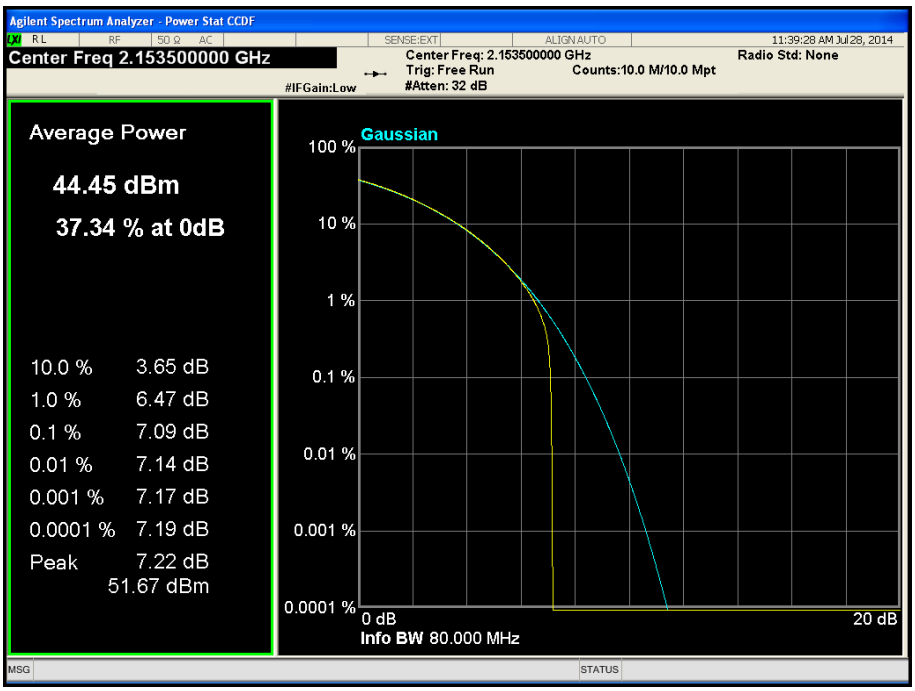
Channel Position M - Bandwidth 20.0 MHz - Antenna Port C



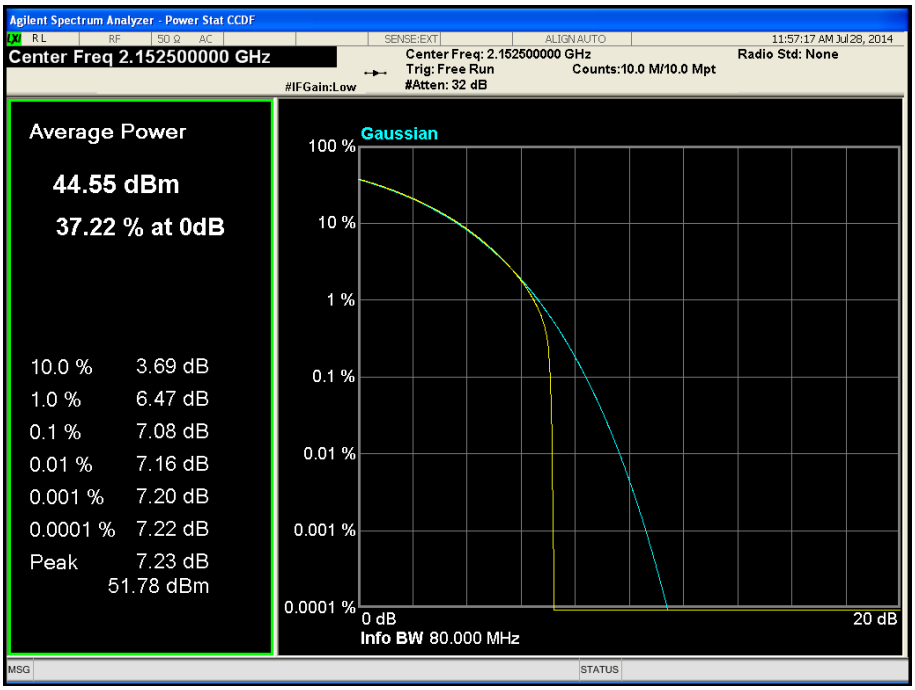
Channel Position T - Bandwidth 1.4 MHz - Antenna Port C



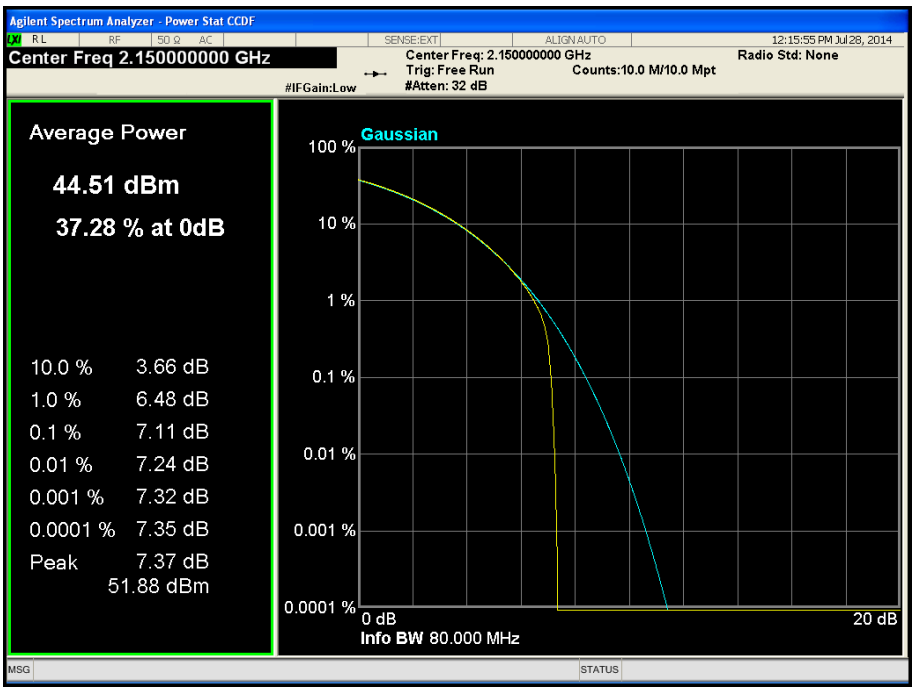
Channel Position T - Bandwidth 3.0 MHz - Antenna Port C



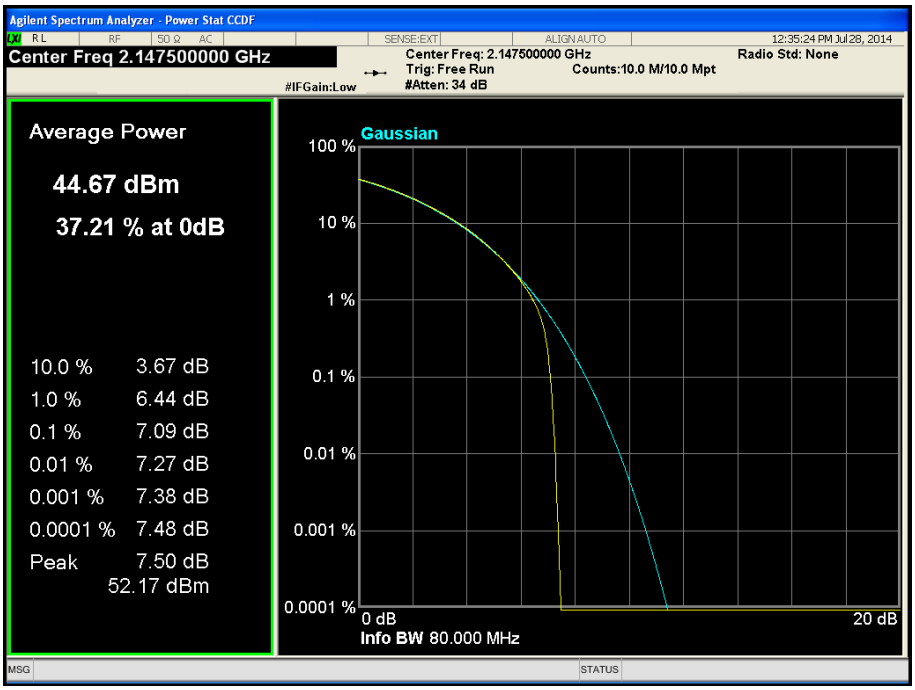
Channel Position T - Bandwidth 5.0 MHz - Antenna Port C



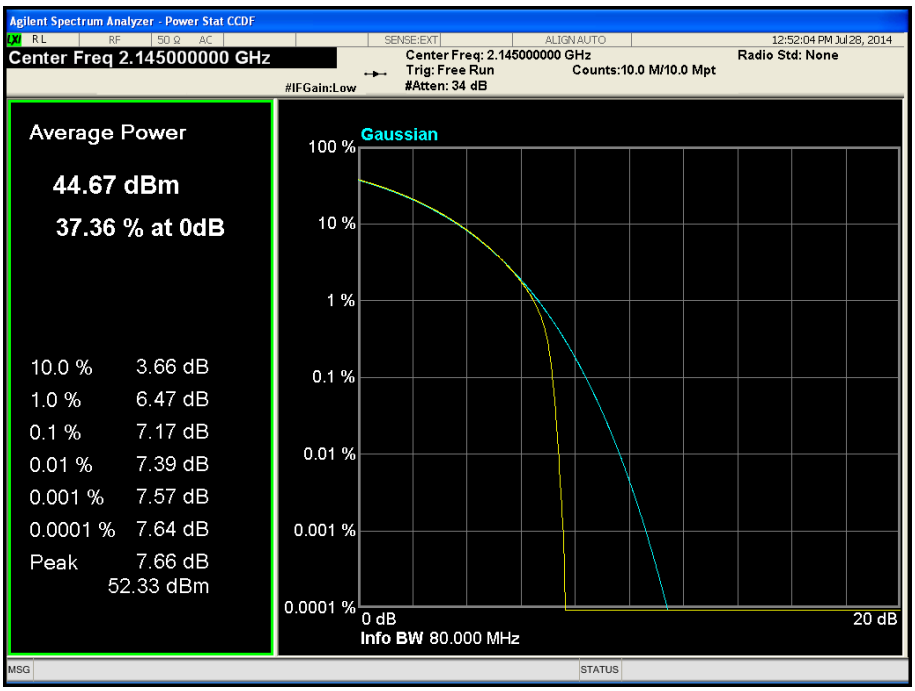
Channel Position T - Bandwidth 10.0 MHz - Antenna Port C



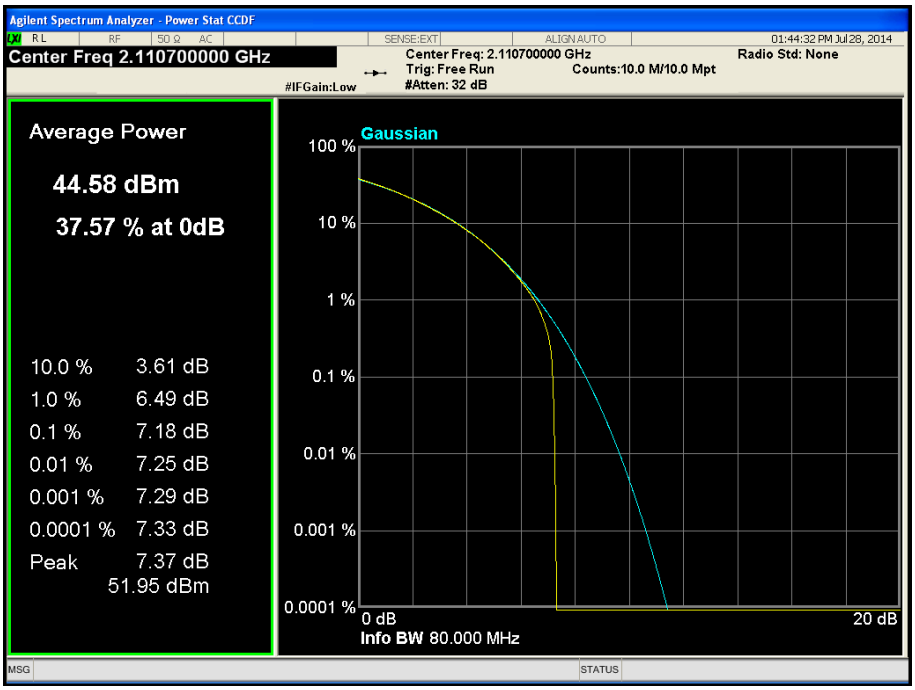
Channel Position T - Bandwidth 15.0 MHz - Antenna Port C



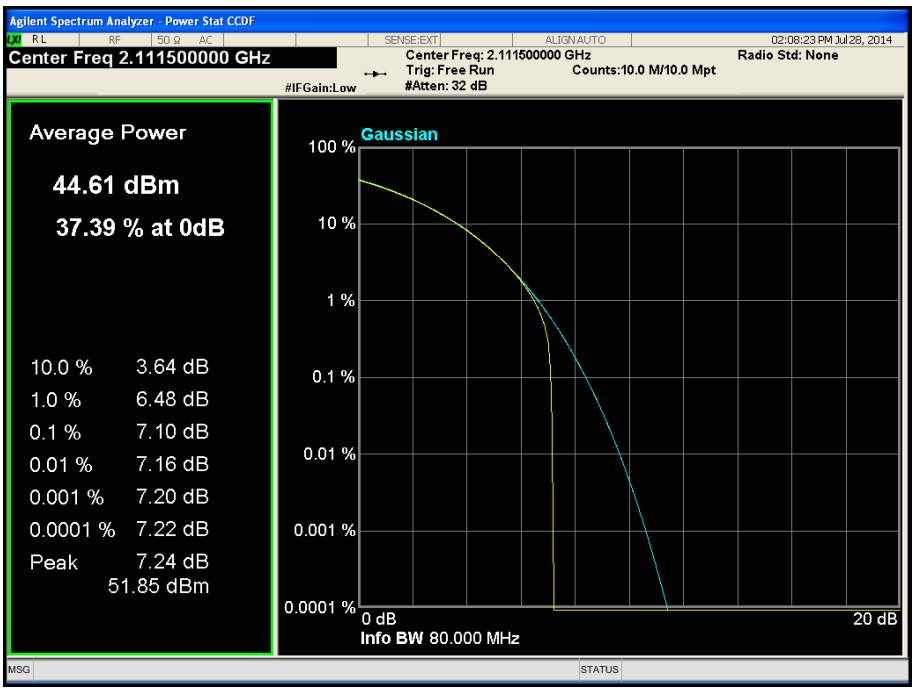
Channel Position T - Bandwidth 20.0 MHz - Antenna Port C



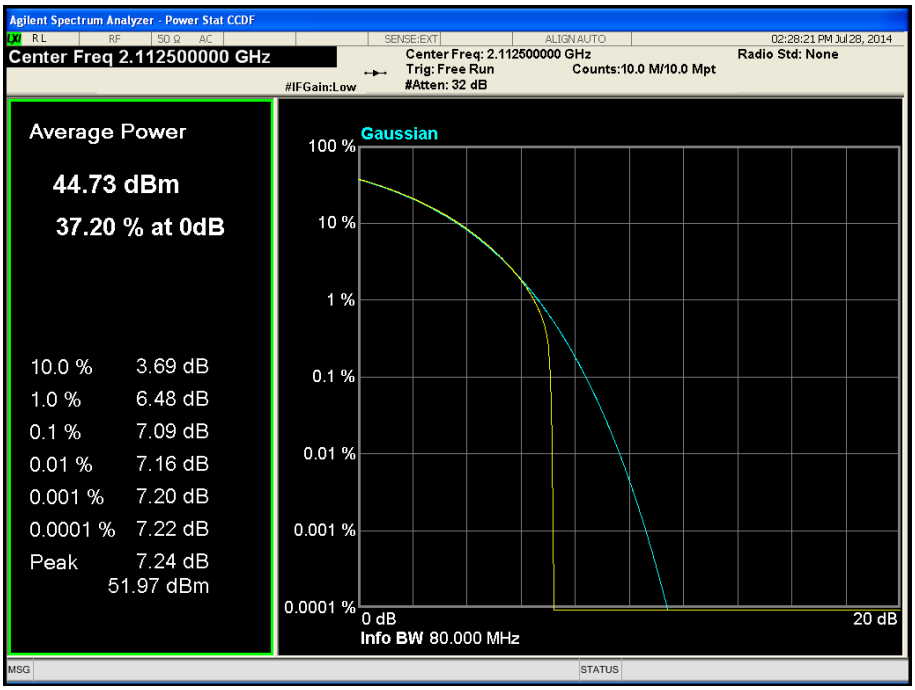
Channel Position B - Bandwidth 1.4 MHz - Antenna Port D



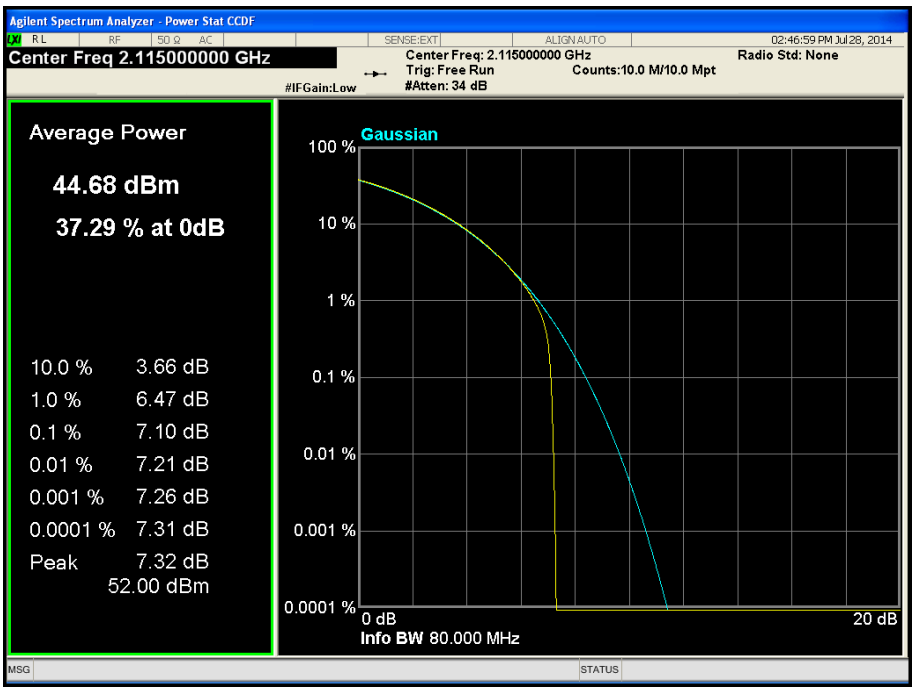
Channel Position B - Bandwidth 3.0 MHz - Antenna Port D



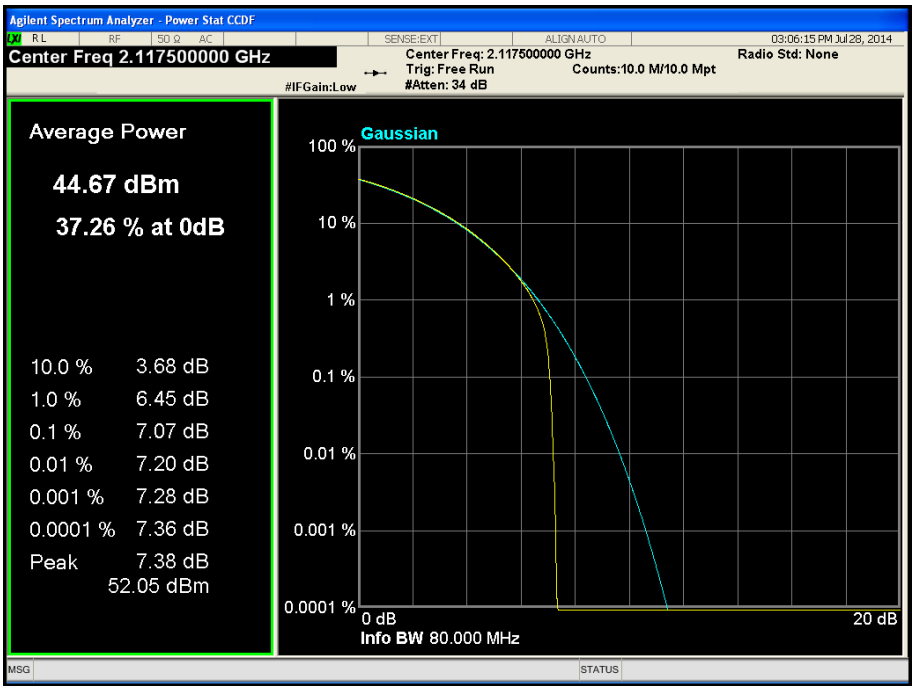
Channel Position B - Bandwidth 5.0 MHz - Antenna Port D



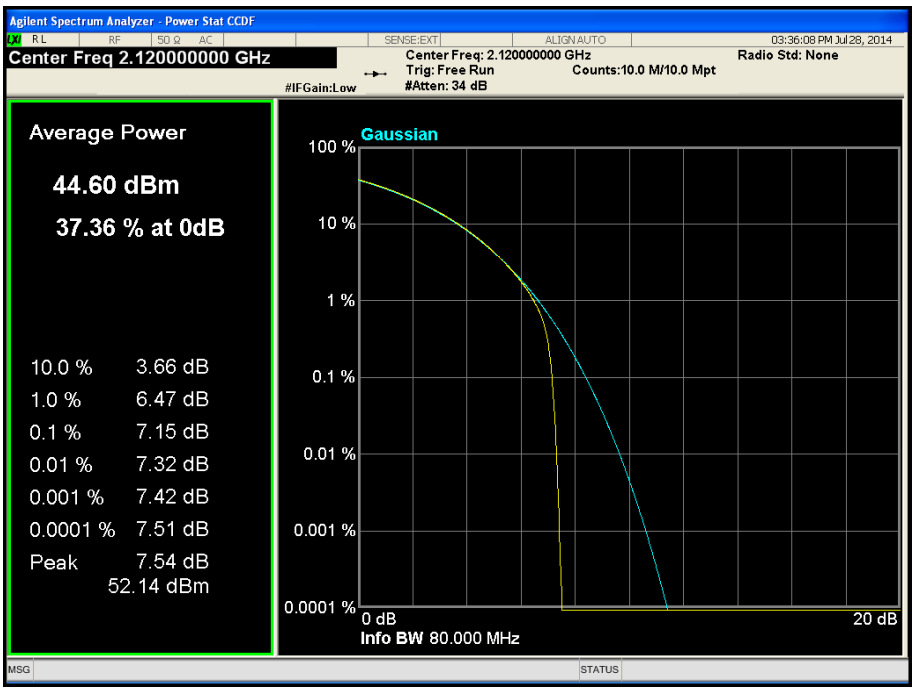
Channel Position B - Bandwidth 10.0 MHz - Antenna Port D



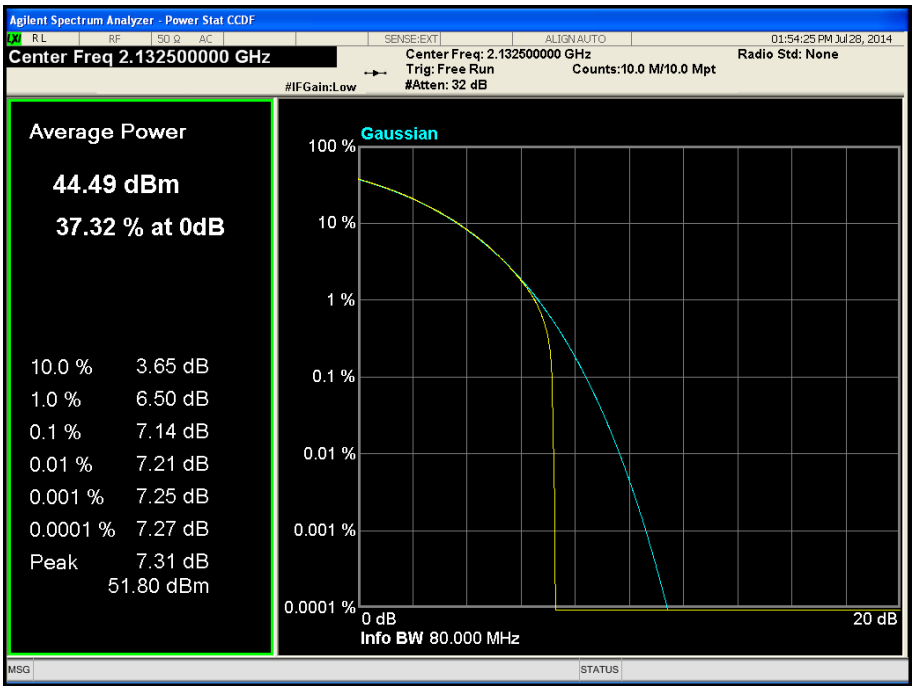
Channel Position B - Bandwidth 15.0 MHz - Antenna Port D



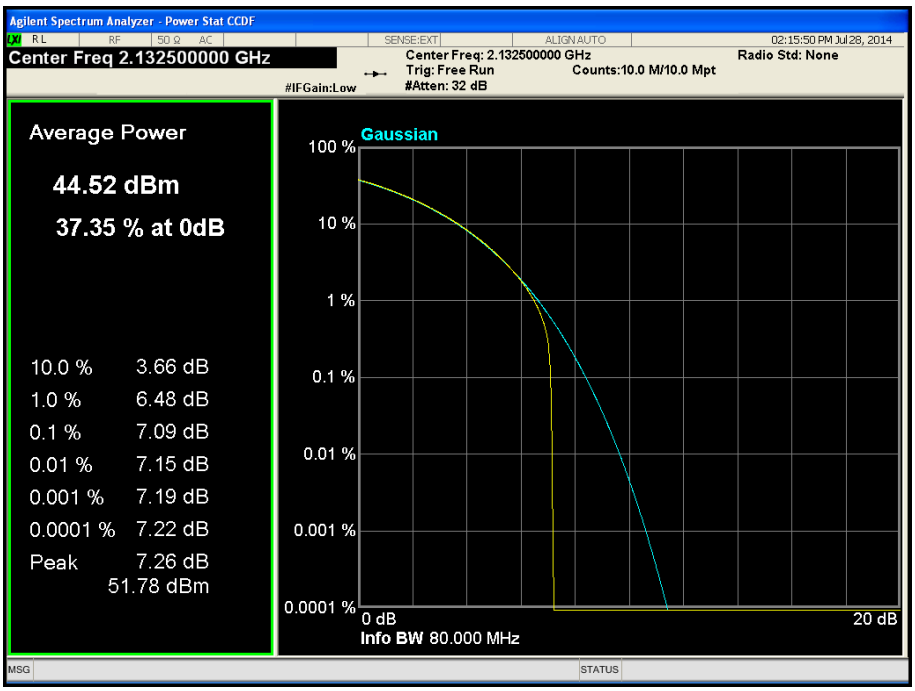
Channel Position B - Bandwidth 20.0 MHz - Antenna Port D



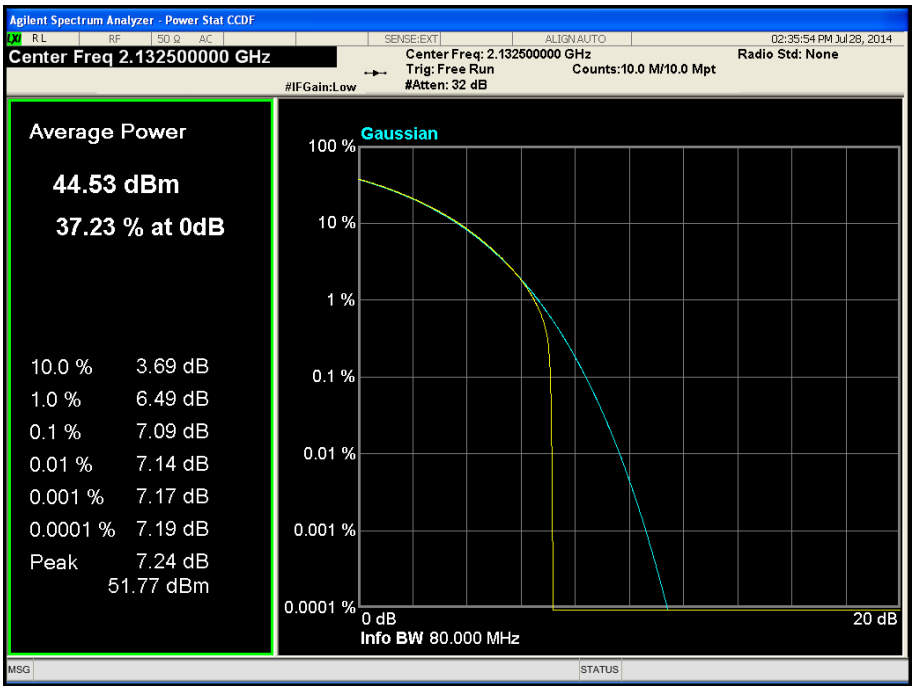
Channel Position M - Bandwidth 1.4 MHz - Antenna Port D



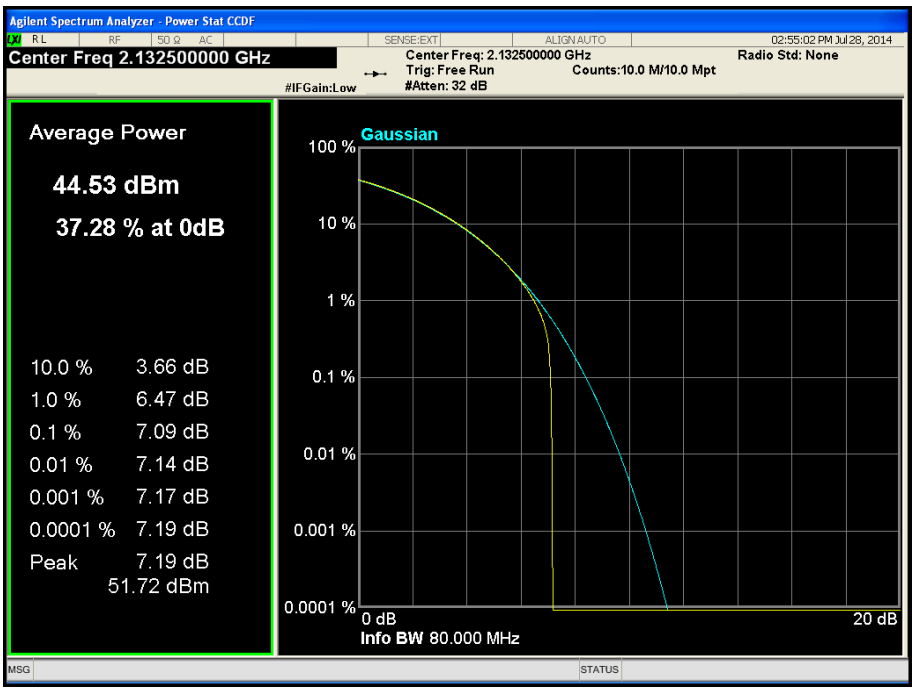
Channel Position M - Bandwidth 3.0 MHz - Antenna Port D



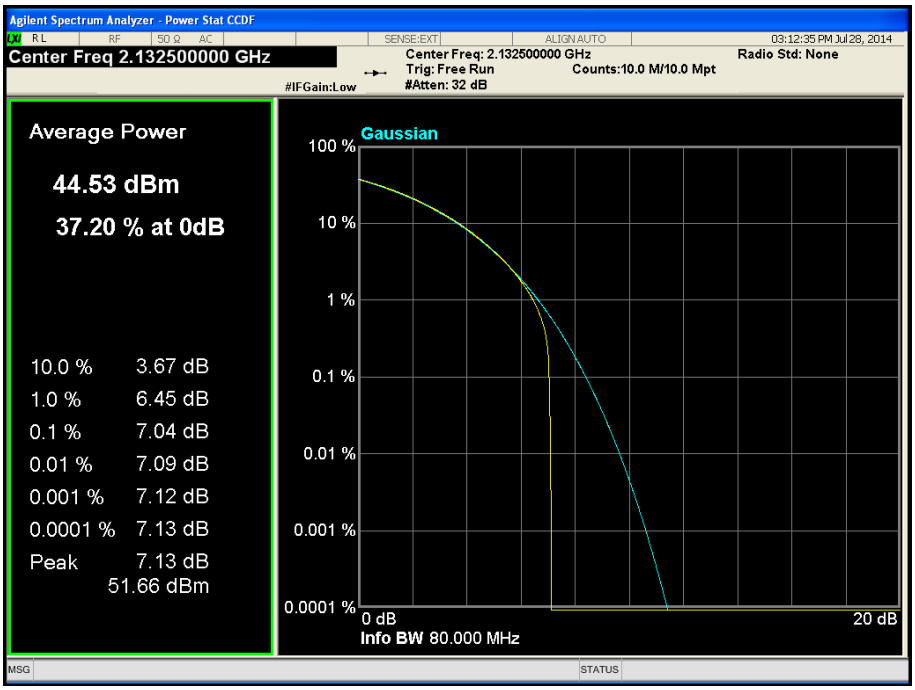
Channel Position M - Bandwidth 5.0 MHz - Antenna Port D



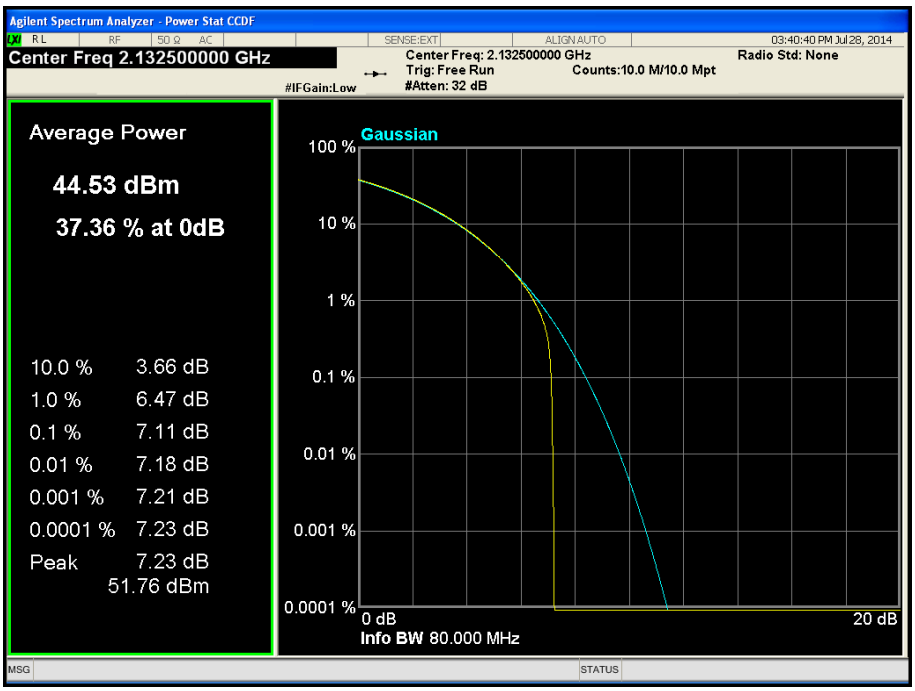
Channel Position M - Bandwidth 10.0 MHz - Antenna Port D



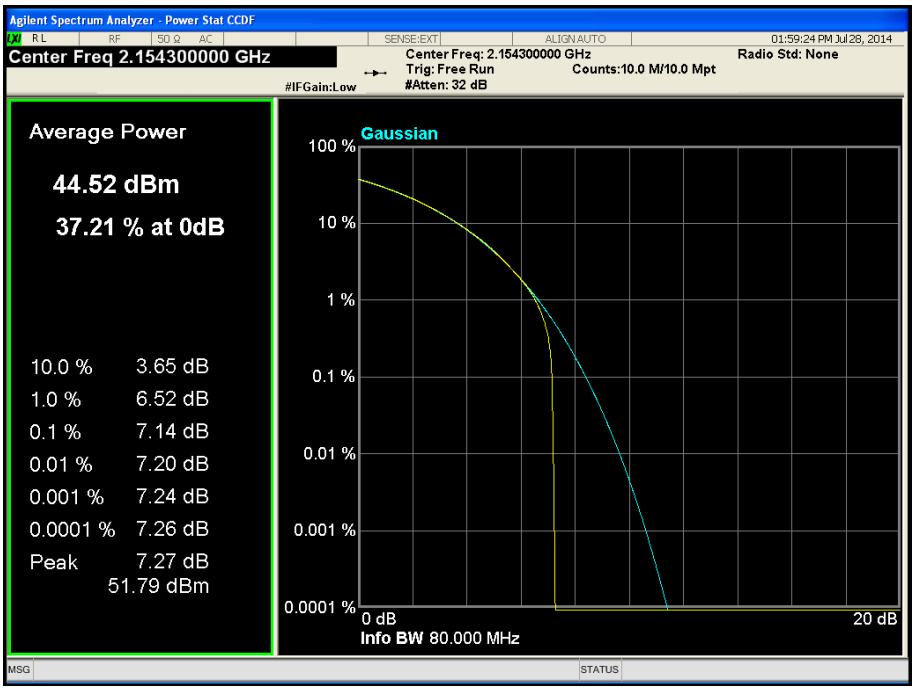
Channel Position M - Bandwidth 15.0 MHz - Antenna Port D



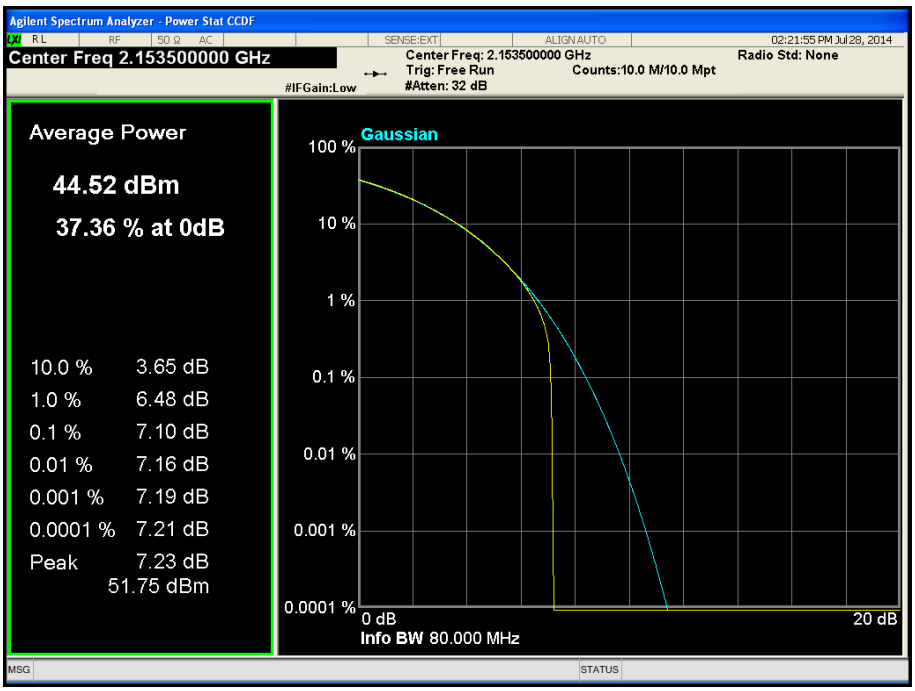
Channel Position M - Bandwidth 20.0 MHz - Antenna Port D



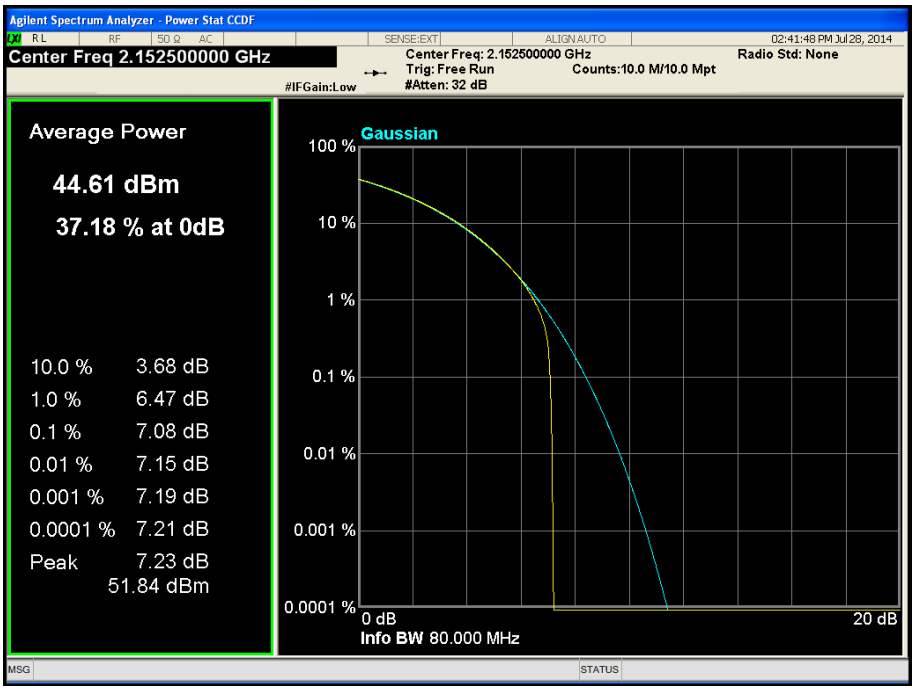
Channel Position T - Bandwidth 1.4 MHz - Antenna Port D



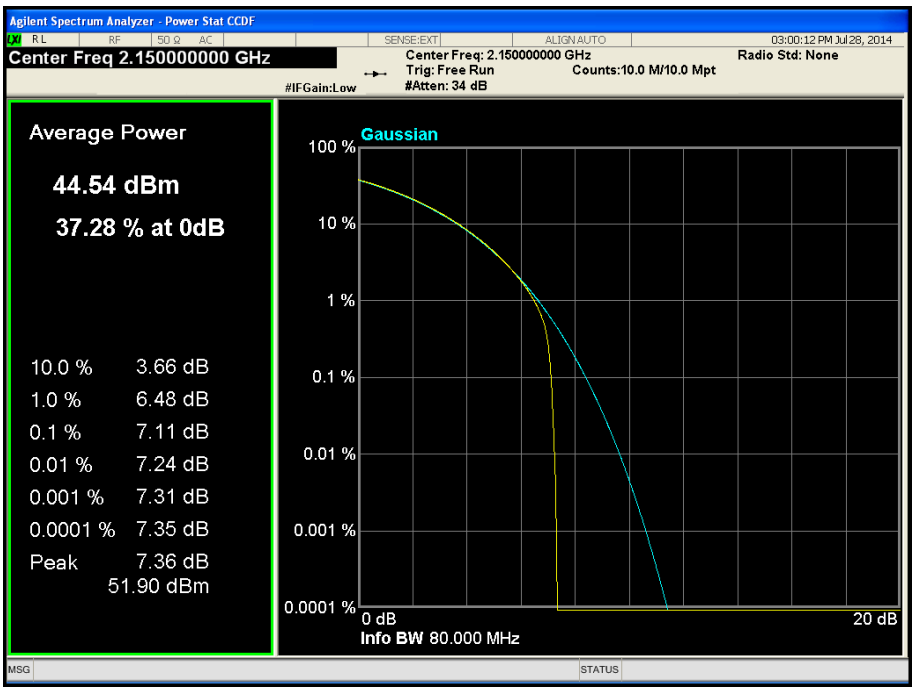
Channel Position T - Bandwidth 3.0 MHz - Antenna Port D



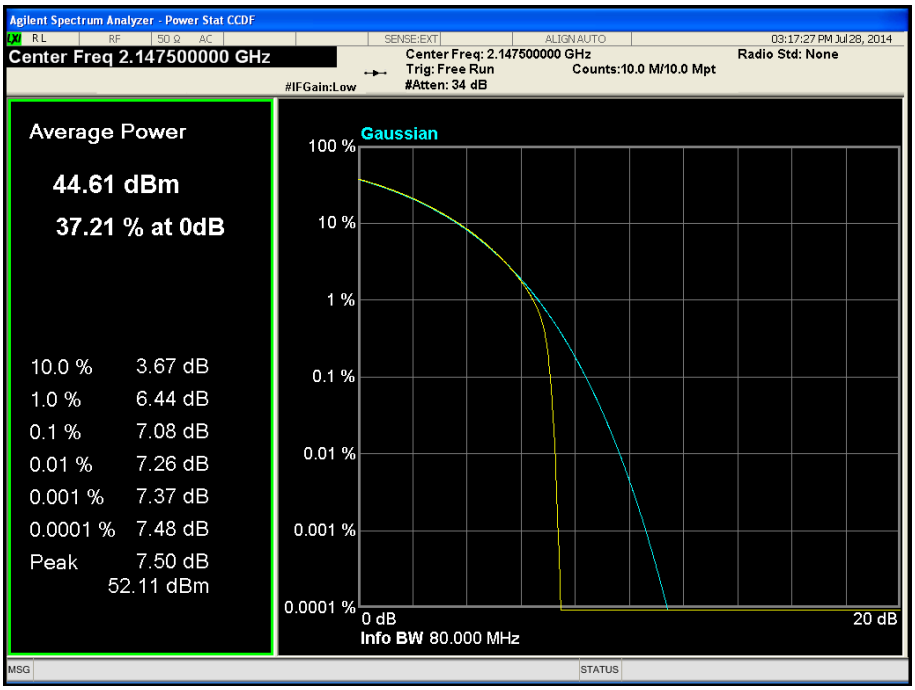
Channel Position T - Bandwidth 5.0 MHz - Antenna Port D



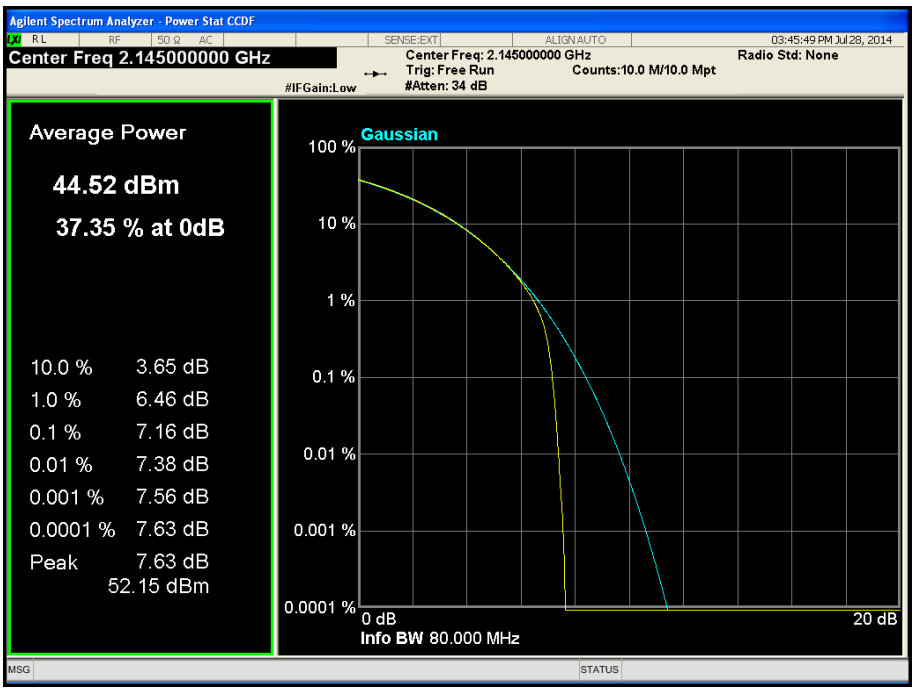
Channel Position T - Bandwidth 10.0 MHz - Antenna Port D



Channel Position T - Bandwidth 15.0 MHz - Antenna Port D



Channel Position T - Bandwidth 20.0 MHz - Antenna Port D



Configuration LTE-MC1 (See Table 1 for carrier frequency)

Maximum Output Power 41.76 dBm per carrier, Test Model 1.1 (2 Carrier)

Antenna	Carrier Bandwidth (MHz)	Channel Position M					
		PAR (dB)	Conducted Average Power (dBm)	Antenna Gain (dB)	Average EIRP (dBm)	Average EIRP (dBm/MHz)	Average EIRP (W/MHz)
A	1.4	7.15	44.50	18.40	62.90	61.44	1392.75
B		7.16	44.37	18.40	62.77	61.31	1351.67
C		7.17	44.25	18.40	62.65	61.19	1314.84
D		7.18	44.19	18.40	62.59	61.13	1296.80
A	3	7.10	44.53	18.40	62.93	58.16	654.45
B		7.09	44.44	18.40	62.84	58.07	641.03
C		7.10	44.37	18.40	62.77	58.00	630.78
D		7.10	44.31	18.40	62.71	57.94	622.13
A	5	7.08	44.55	18.40	62.95	55.96	394.48
B		7.08	44.50	18.40	62.90	55.91	389.97
C		7.08	44.41	18.40	62.81	55.82	381.97
D		7.09	44.37	18.40	62.77	55.78	378.47
A	10	7.10	44.59	18.40	62.99	52.99	199.07
B		7.10	44.52	18.40	62.92	52.92	195.88
C		7.10	44.48	18.40	62.88	52.88	194.09
D		7.10	44.46	18.40	62.86	52.86	193.20
A	15	7.07	44.61	18.40	63.01	51.25	133.32
B		7.07	44.56	18.40	62.96	51.20	131.80
C		7.06	44.52	18.40	62.92	51.16	130.59
D		7.07	44.47	18.40	62.87	51.11	129.09
A	20	7.15	44.62	18.40	63.02	50.01	100.22
B		7.14	44.52	18.40	62.92	49.91	97.94
C		7.15	44.52	18.40	62.92	49.91	97.94
D		7.15	44.48	18.40	62.88	49.87	97.04

Configuration LTE-MC2 (See Table 1 for carrier frequency)

Maximum Output Power 38.75 dBm* per carrier, Test Model 1.1 (4 Carrier)

Antenna	Carrier Bandwidth (MHz)	Channel Position M					
		PAR (dB)	Conducted Average Power (dBm)	Antenna Gain (dB)	Average EIRP (dBm)	Average EIRP (dBm/MHz)	Average EIRP (W/MHz)
A	1.4	7.15	43.56	18.40	61.96	60.50	1121.69
B		7.16	43.38	18.40	61.78	60.32	1076.15
C		7.17	43.36	18.40	61.76	60.30	1071.20
D		7.18	43.36	18.40	61.76	60.30	1071.20
A	3	7.10	44.58	18.40	62.98	58.21	662.03
B		7.09	44.41	18.40	62.81	58.04	636.62
C		7.10	44.40	18.40	62.80	58.03	635.15
D		7.10	44.37	18.40	62.77	58.00	630.78
A	5	7.08	44.60	18.40	63.00	56.01	399.05
B		7.08	44.47	18.40	62.87	55.88	387.28
C		7.08	44.45	18.40	62.85	55.86	385.50
D		7.09	44.38	18.40	62.78	55.79	379.34
A	10	7.10	44.62	18.40	63.02	53.02	200.45
B		7.10	44.50	18.40	62.90	52.90	194.98
C		7.10	44.47	18.40	62.87	52.87	193.64
D		7.10	44.45	18.40	62.85	52.85	192.75

* Note: In 1.4 MHz configuration, power is reduced by 1 dB to 37.75 dBm

Limits	
27.50 (d):	The maximum EIRP limit must not exceed 3280 / 1640W / MHz The maximum Peak to Average Ratio shall not exceed 13dB
RSS-139 6.4:	The maximum EIRP limit must not exceed 3280 / 1640W / MHz The maximum Peak to Average Ratio shall not exceed 13dB

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

25 and 28 July 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	21.3 - 21.6°C
Relative Humidity	52.6 - 60%

2.2.5 Test Method

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 on all LTE Bandwidths.

The results are shown in the plots below.

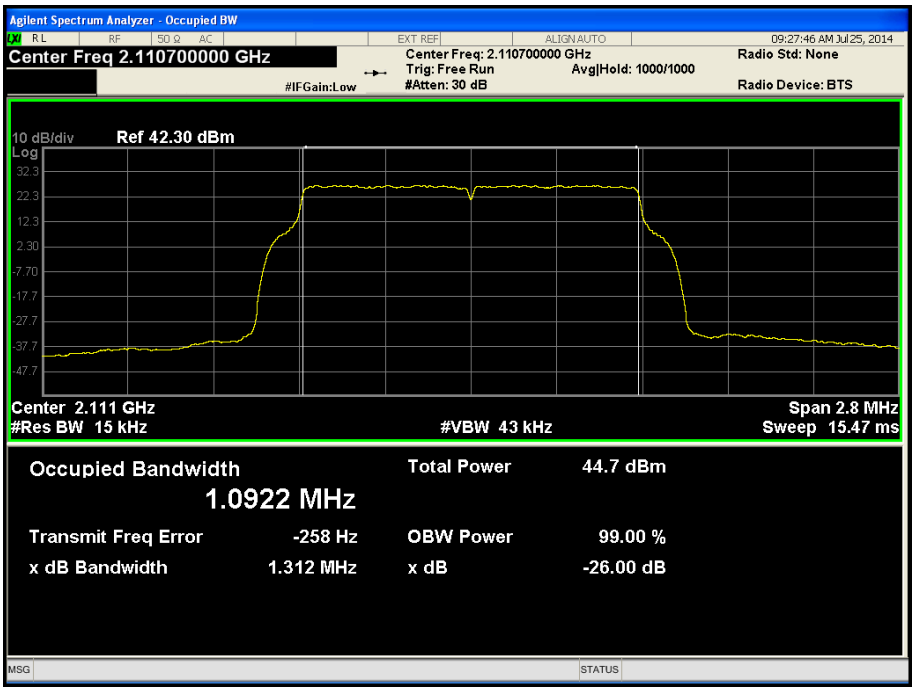
2.2.6 Test Results

Configuration LTE (See Table 1 for carrier frequency)

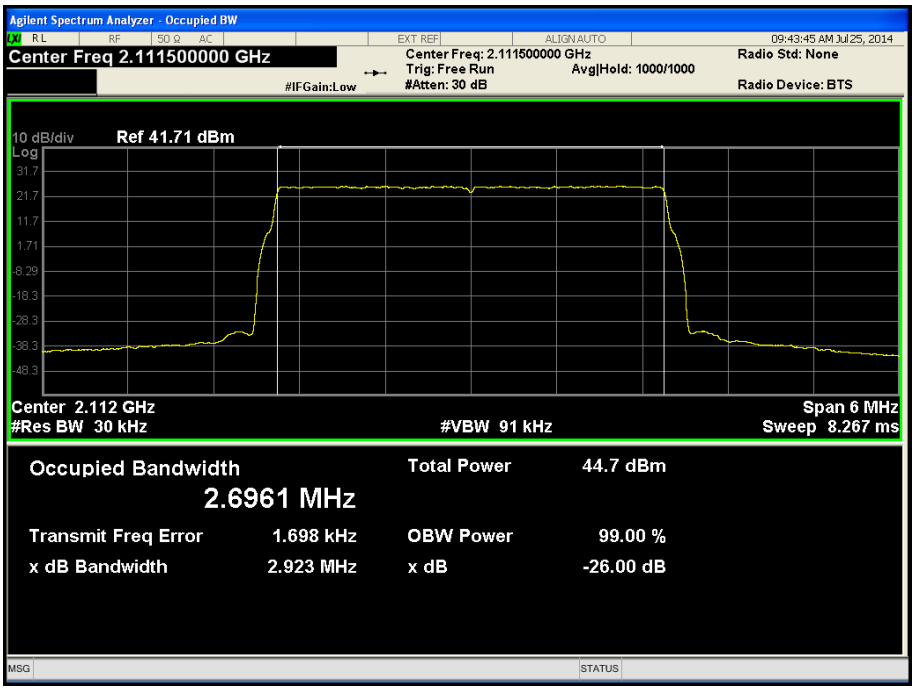
Maximum Output Power 44.77 dBm per carrier, Test Model 1.1- Antenna Port A

Carrier 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
1.4 MHz	1.09223	1.31180	1.09260	1.31171	1.09223	1.30961
3.0 MHz	2.69609	2.92309	2.69601	2.92452	2.69606	2.92357
5.0 MHz	4.47609	4.74084	4.47850	4.73691	4.47710	4.73756
10.0 MHz	8.93831	9.38997	8.93779	9.41137	8.93970	9.39521
15.0 MHz	13.39653	14.01058	13.39622	13.97171	13.39704	13.96634
20.0 MHz	17.85353	18.56773	17.85624	18.57901	17.85720	18.57226

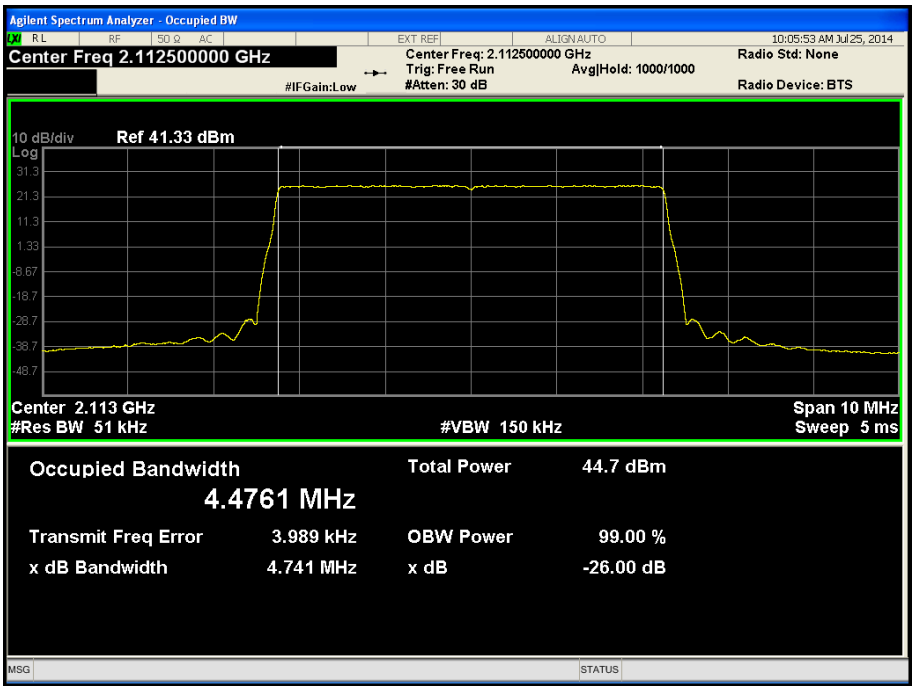
Channel Position B - Carrier Bandwidth 1.4 MHz – Antenna Port A



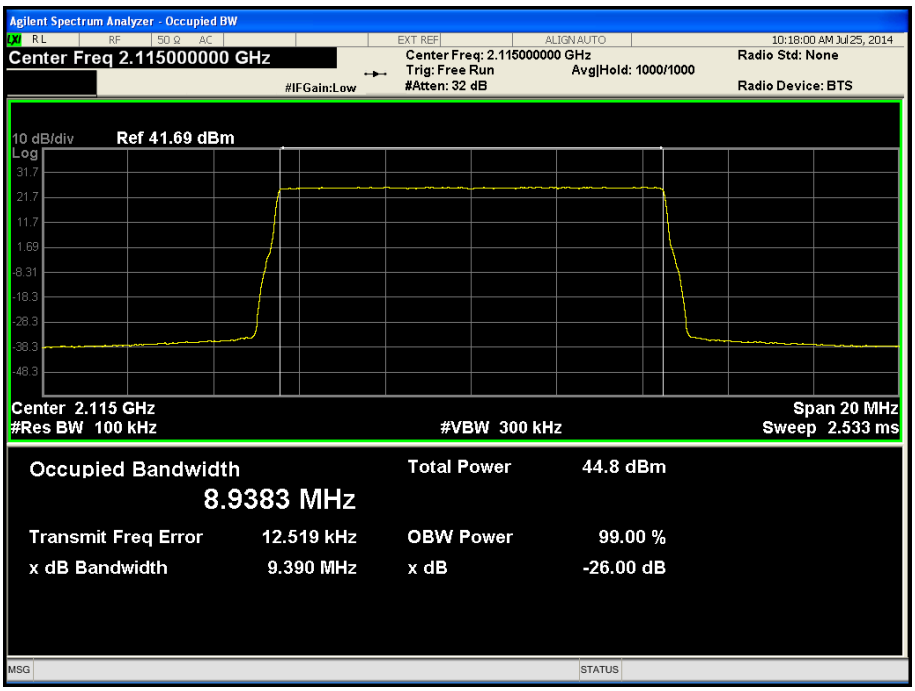
Channel Position B - Carrier Bandwidth 3.0 MHz – Antenna Port A



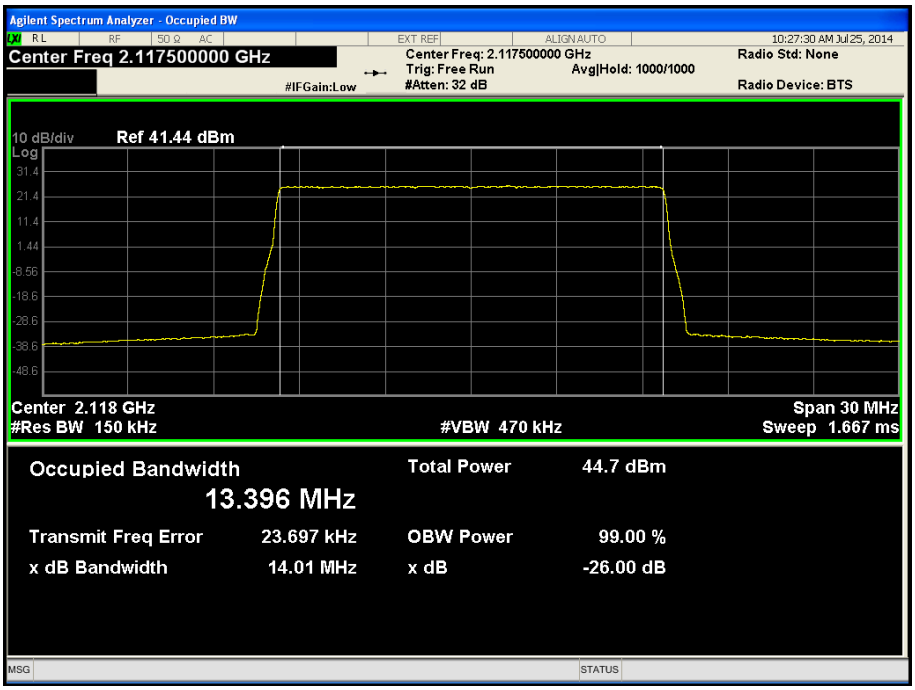
Channel Position B - Carrier Bandwidth 5.0 MHz – Antenna Port A



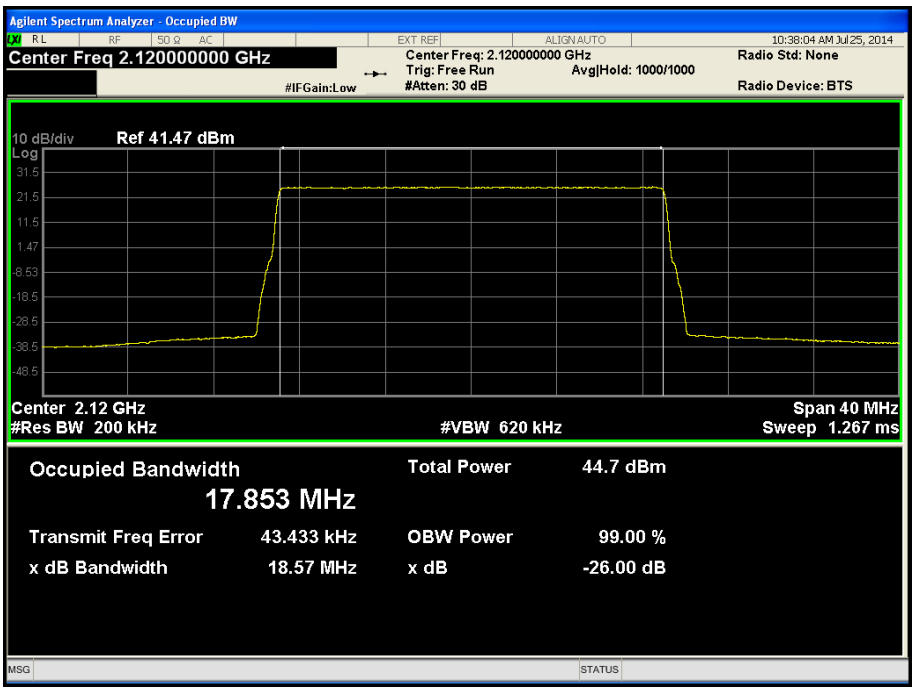
Channel Position B - Carrier Bandwidth 10.0 MHz – Antenna Port A



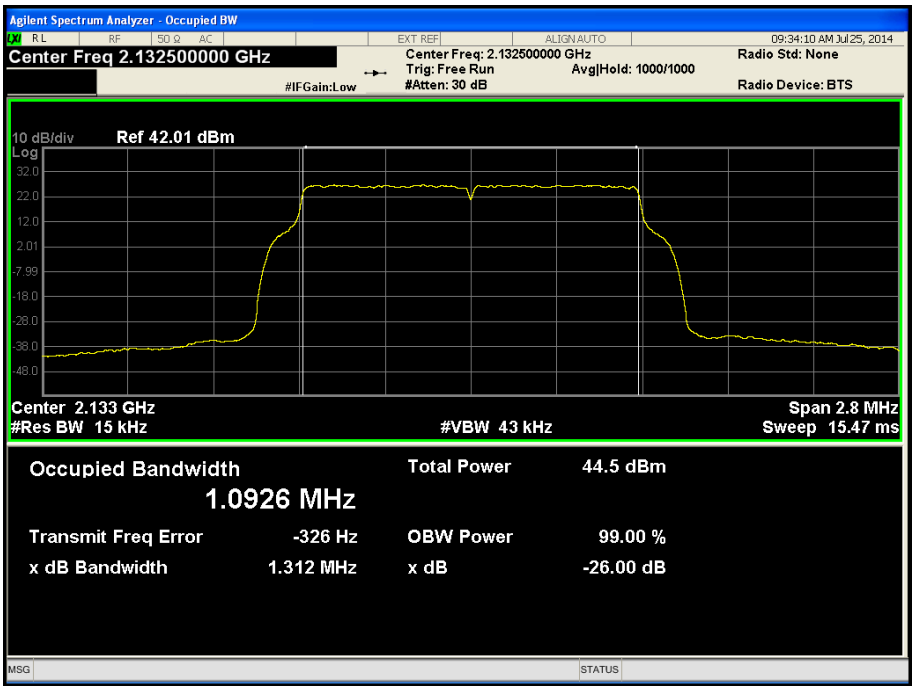
Channel Position B - Carrier Bandwidth 15.0 MHz – Antenna Port A



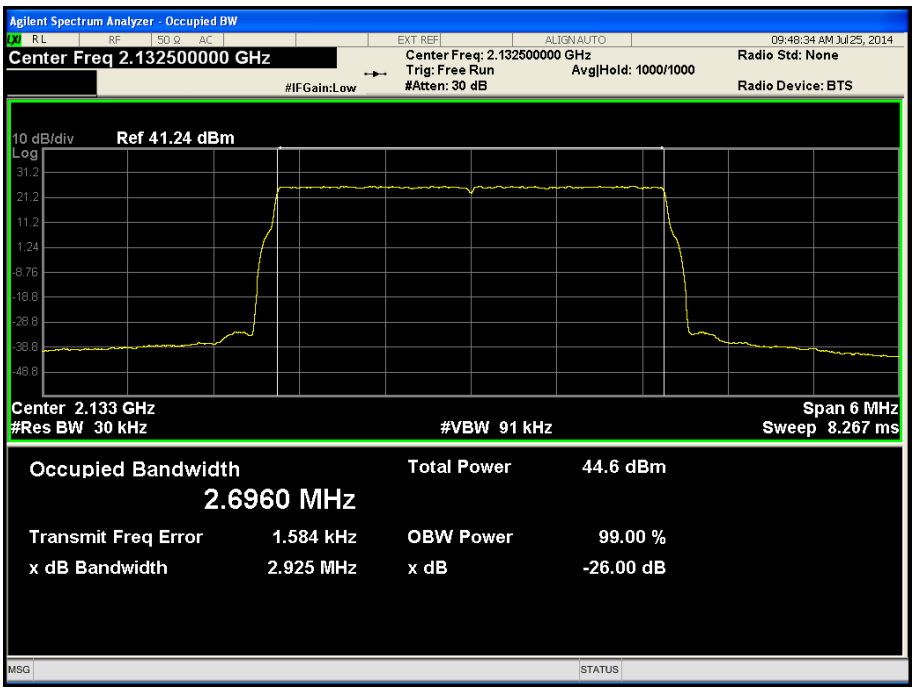
Channel Position B - Carrier Bandwidth 20.0 MHz – Antenna Port A



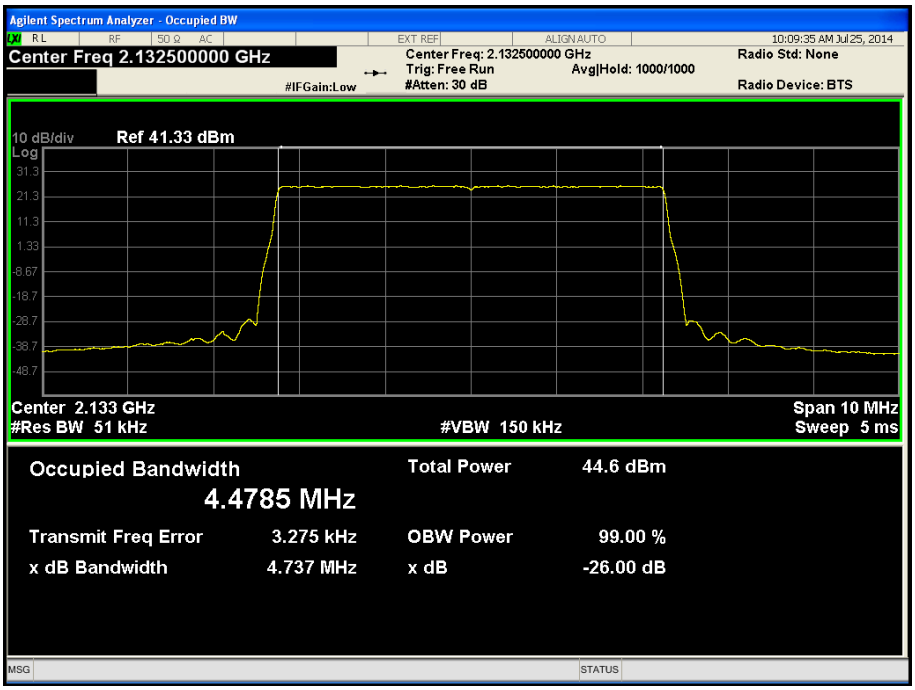
Channel Position M - Carrier Bandwidth 1.4 MHz – Antenna Port A



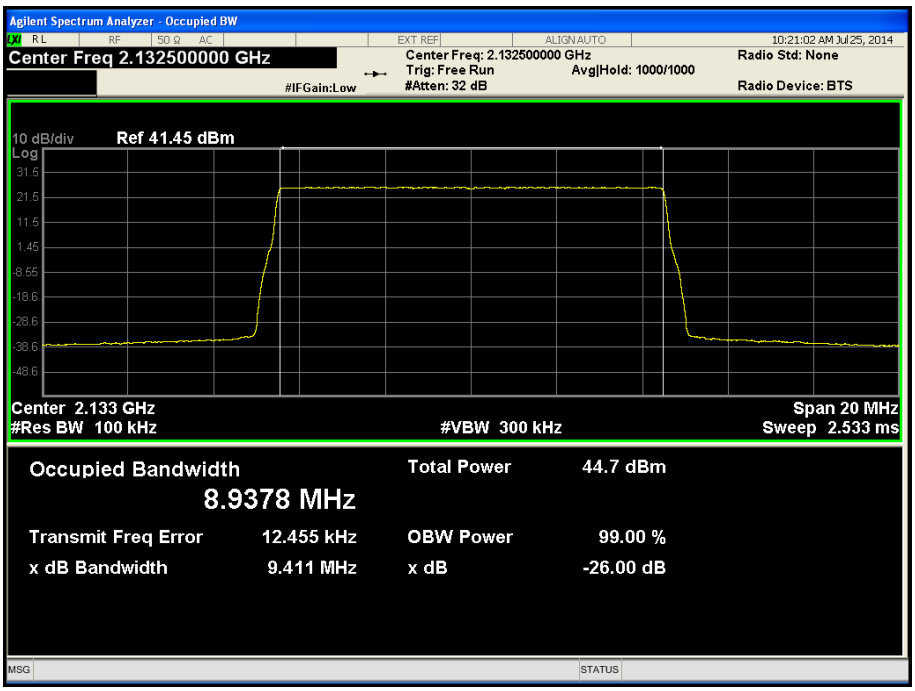
Channel Position M - Carrier Bandwidth 3.0 MHz – Antenna Port A



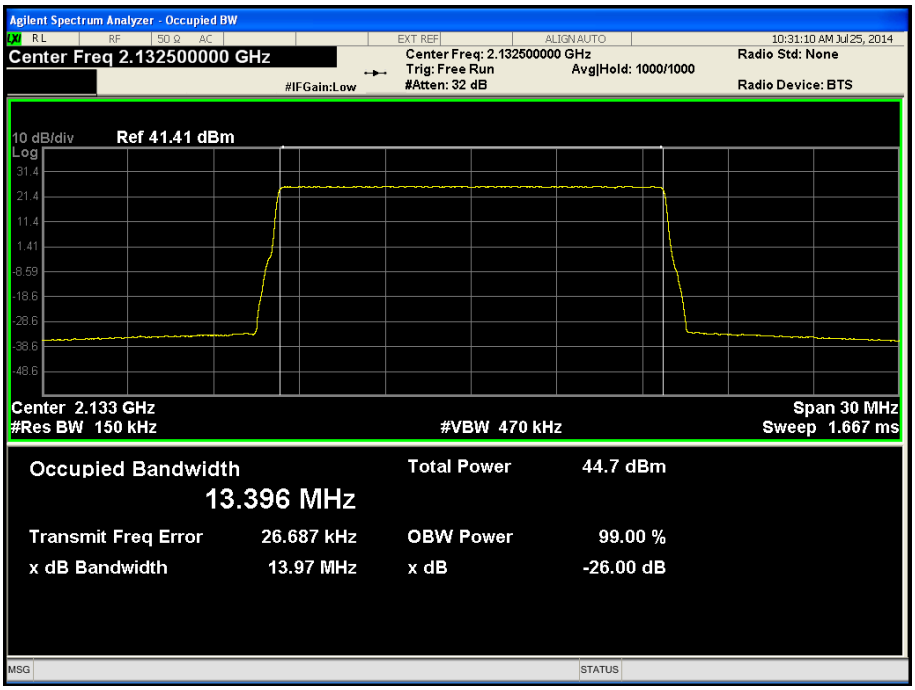
Channel Position M - Carrier Bandwidth 5.0 MHz – Antenna Port A



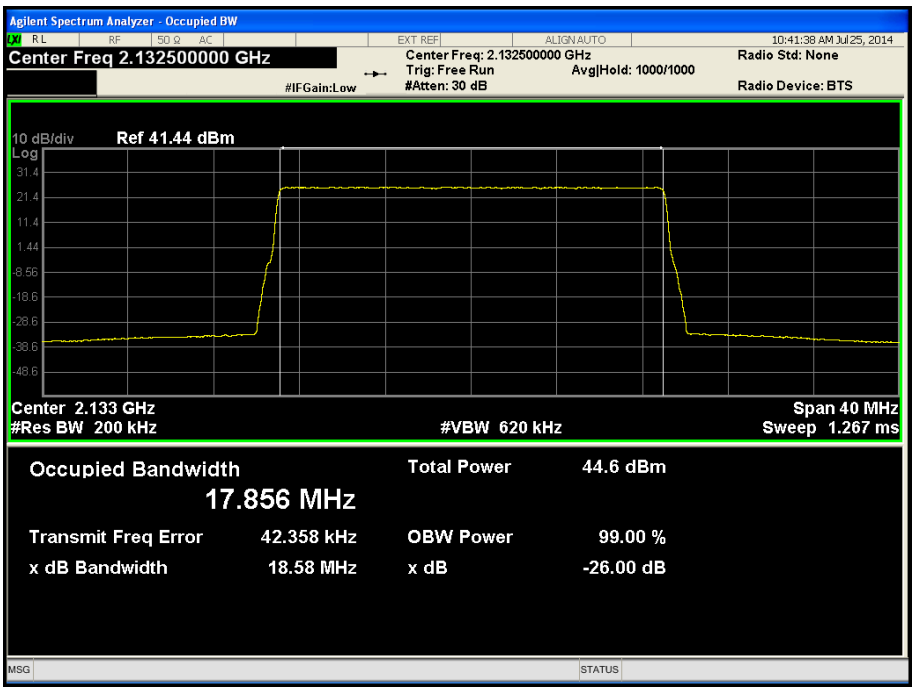
Channel Position M - Carrier Bandwidth 10.0 MHz – Antenna Port A



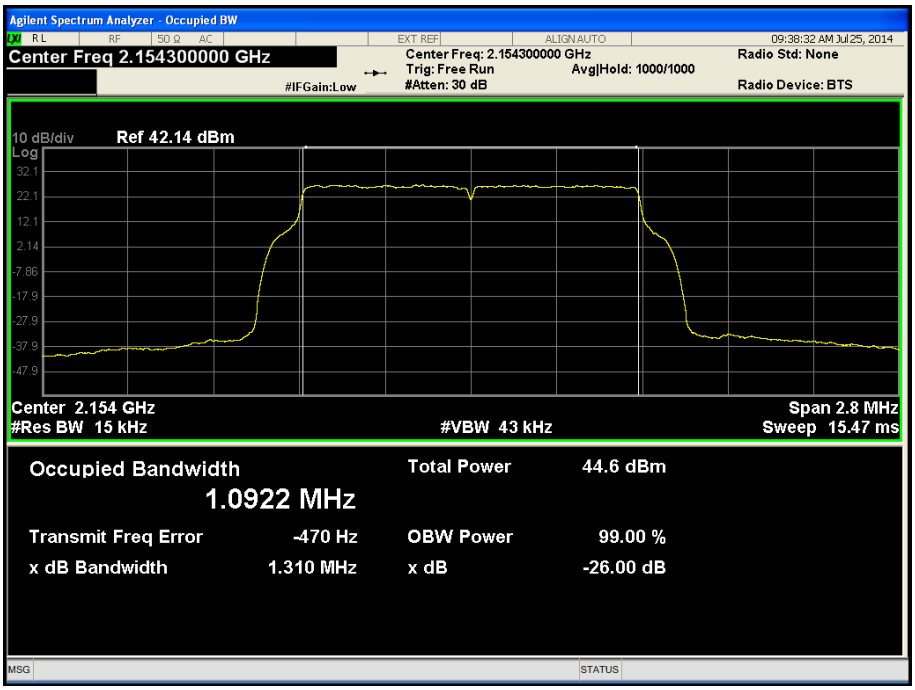
Channel Position M - Carrier Bandwidth 15.0 MHz – Antenna Port A



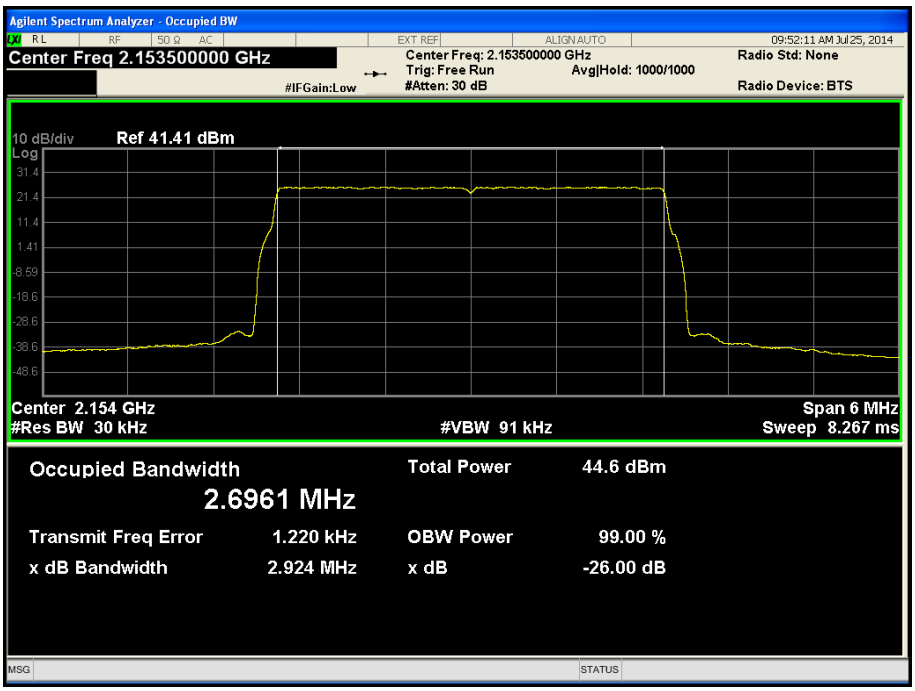
Channel Position M - Carrier Bandwidth 20.0 MHz – Antenna Port A



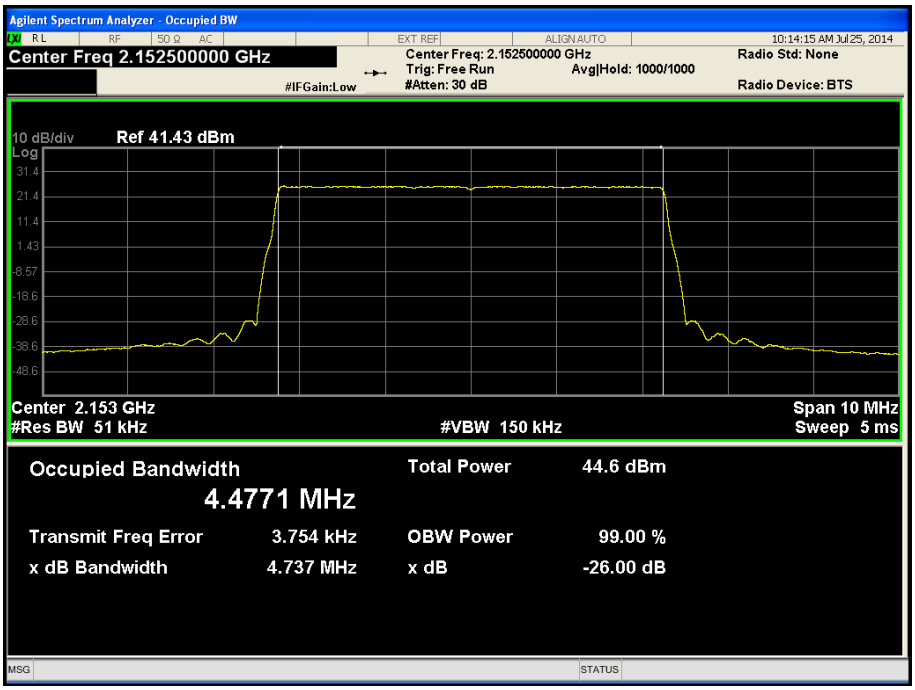
Channel Position T - Carrier Bandwidth 1.4 MHz – Antenna Port A



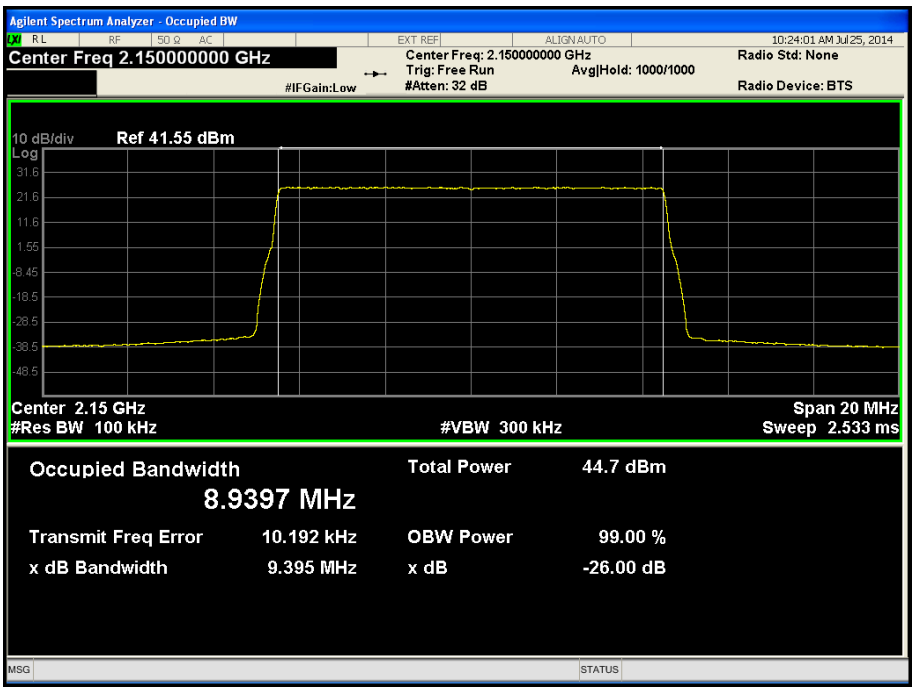
Channel Position T - Carrier Bandwidth 3.0 MHz – Antenna Port A



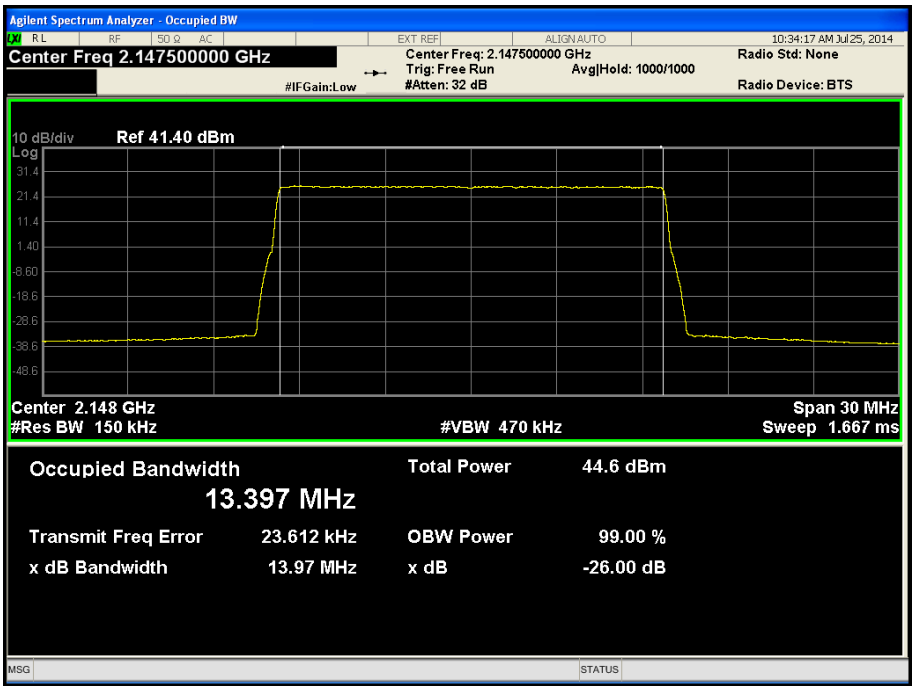
Channel Position T - Carrier Bandwidth 5.0 MHz – Antenna Port A



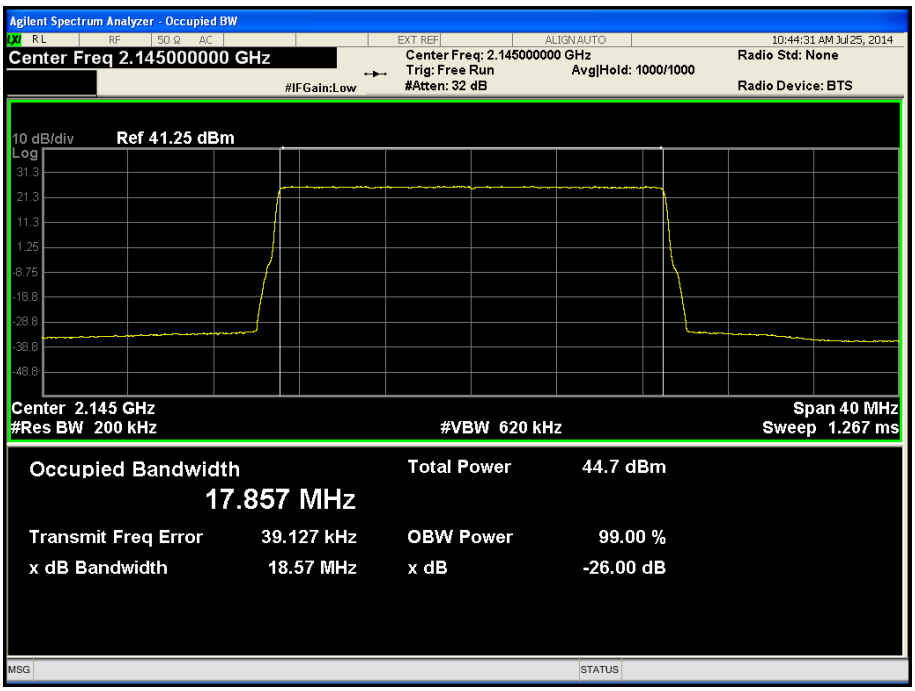
Channel Position T - Carrier Bandwidth 10.0 MHz – Antenna Port A



Channel Position T - Carrier Bandwidth 15.0 MHz – Antenna Port A



Channel Position T - Carrier Bandwidth 20.0 MHz – Antenna Port A

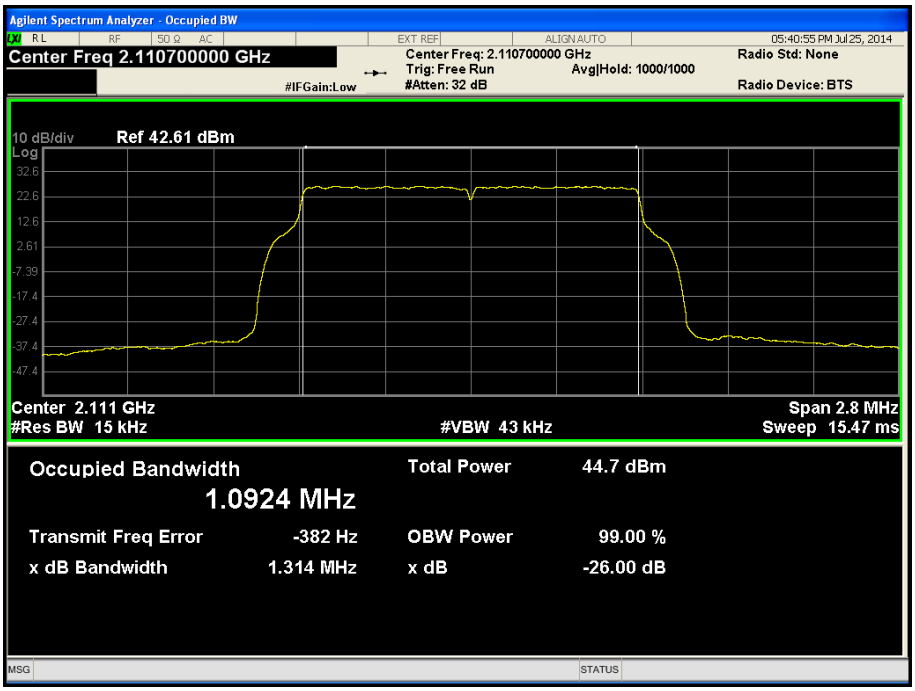


Configuration LTE (See Table 1 for carrier frequency)

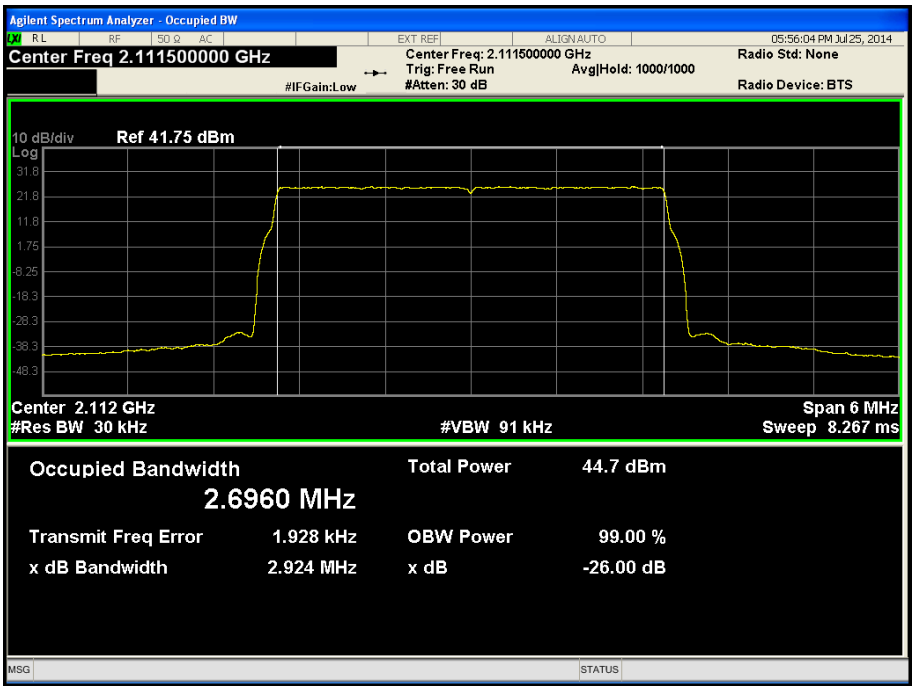
Maximum Output Power 44.77 dBm per carrier, Test Model 1.1 - Antenna Port B

Carrier 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
1.4 MHz	1.09244	1.31388	1.09256	1.31271	1.09276	1.31331
3.0 MHz	2.69598	2.92379	2.69642	2.92647	2.69581	2.92225
5.0 MHz	4.47709	4.74034	4.47805	4.73505	4.47689	4.73459
10.0 MHz	8.93850	9.39552	8.93587	9.39384	8.93413	9.40084
15.0 MHz	13.39728	13.98092	13.39967	14.00000	13.39583	13.98308
20.0 MHz	17.84822	18.58673	17.85856	18.54258	17.85161	18.58785

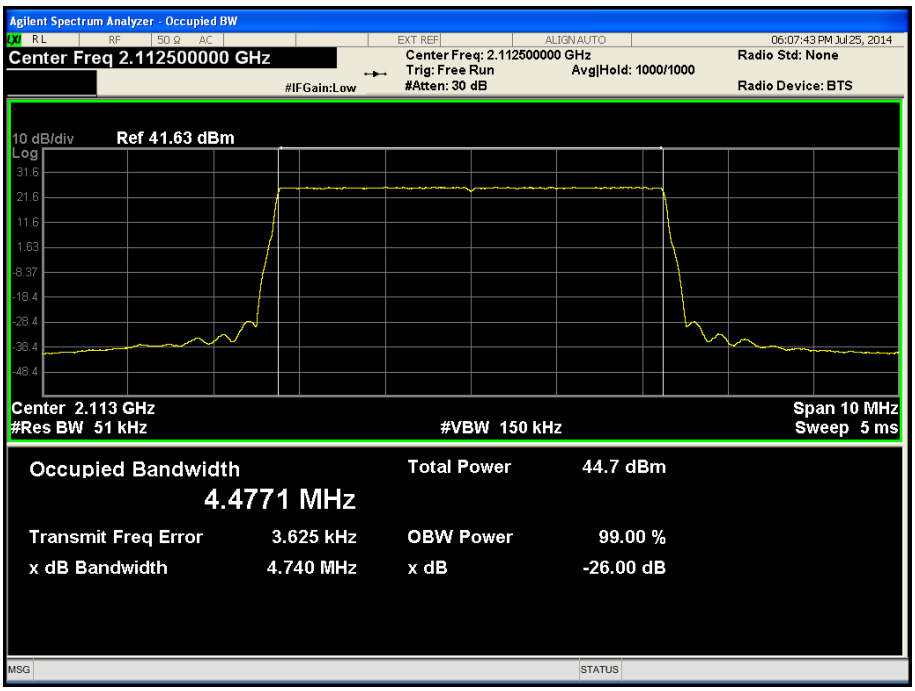
Channel Position B - Carrier Bandwidth 1.4 MHz – Antenna Port B



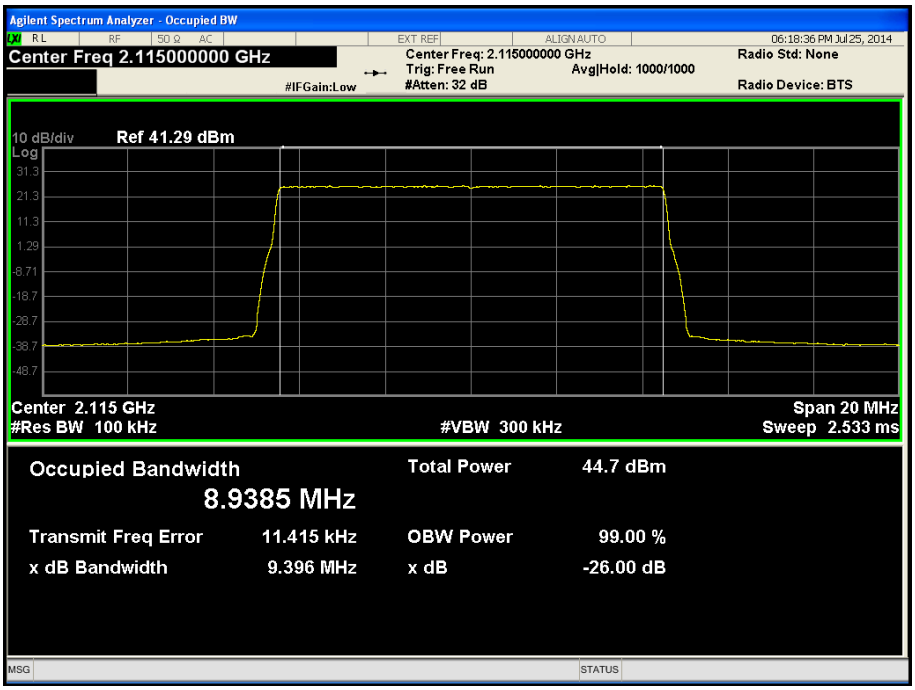
Channel Position B - Carrier Bandwidth 3.0 MHz – Antenna Port B



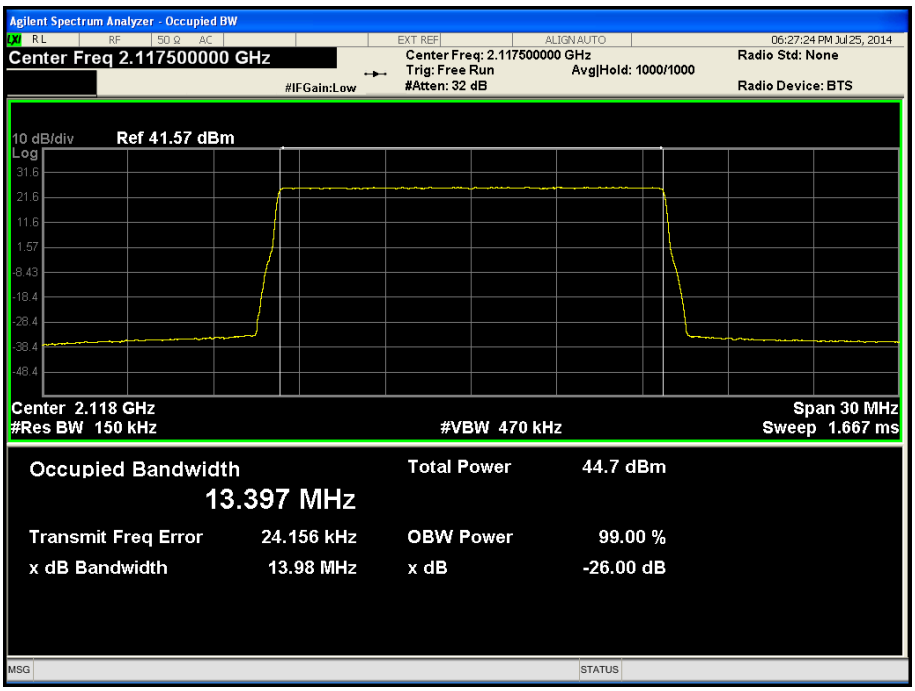
Channel Position B - Carrier Bandwidth 5.0 MHz – Antenna Port B



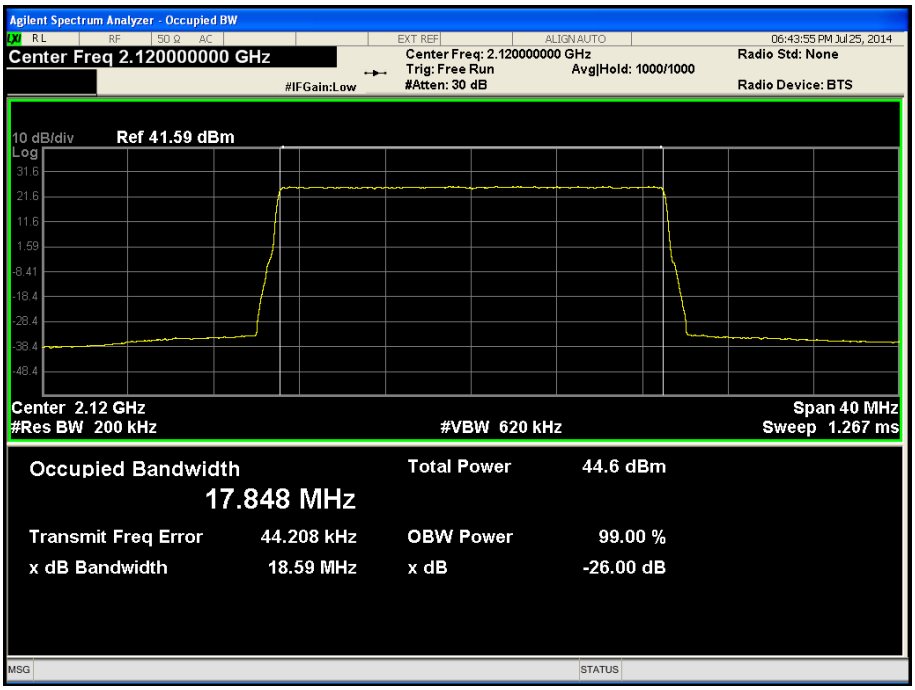
Channel Position B - Carrier Bandwidth 10.0 MHz – Antenna Port B



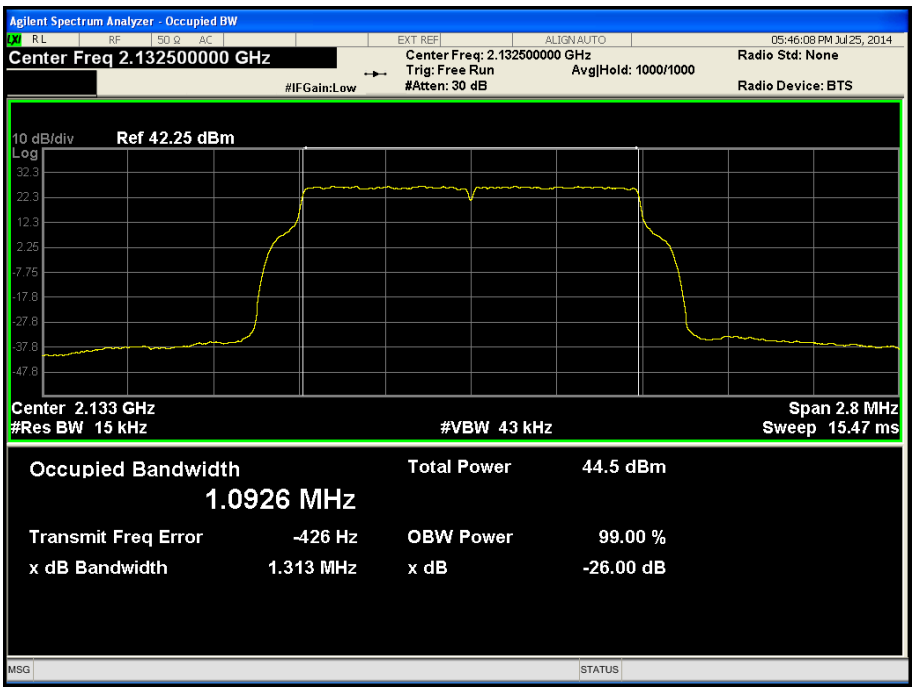
Channel Position B - Carrier Bandwidth 15.0 MHz – Antenna Port B



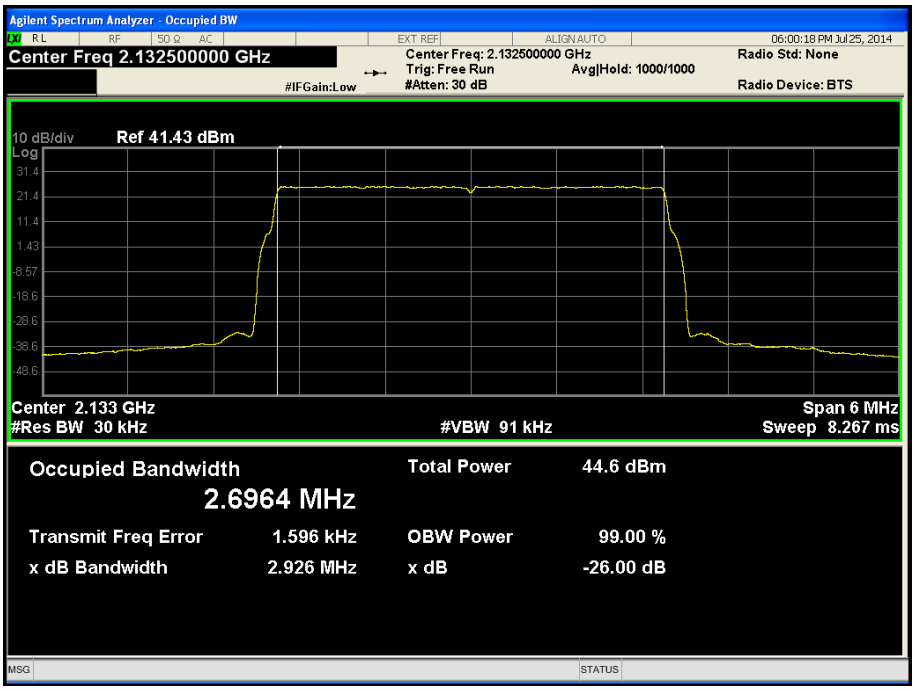
Channel Position B - Carrier Bandwidth 20.0 MHz – Antenna Port B



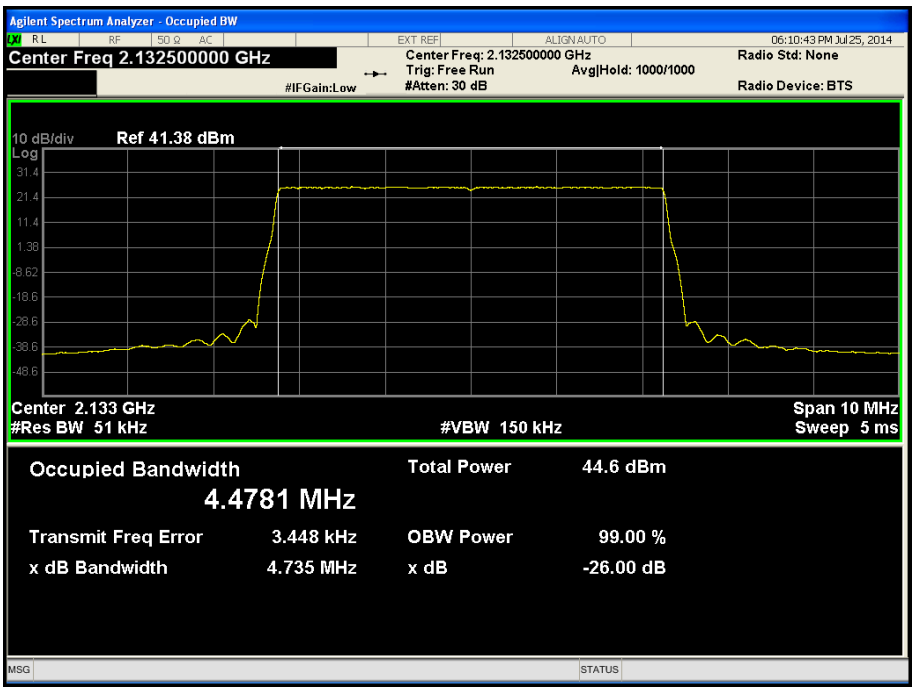
Channel Position M - Carrier Bandwidth 1.4 MHz – Antenna Port B



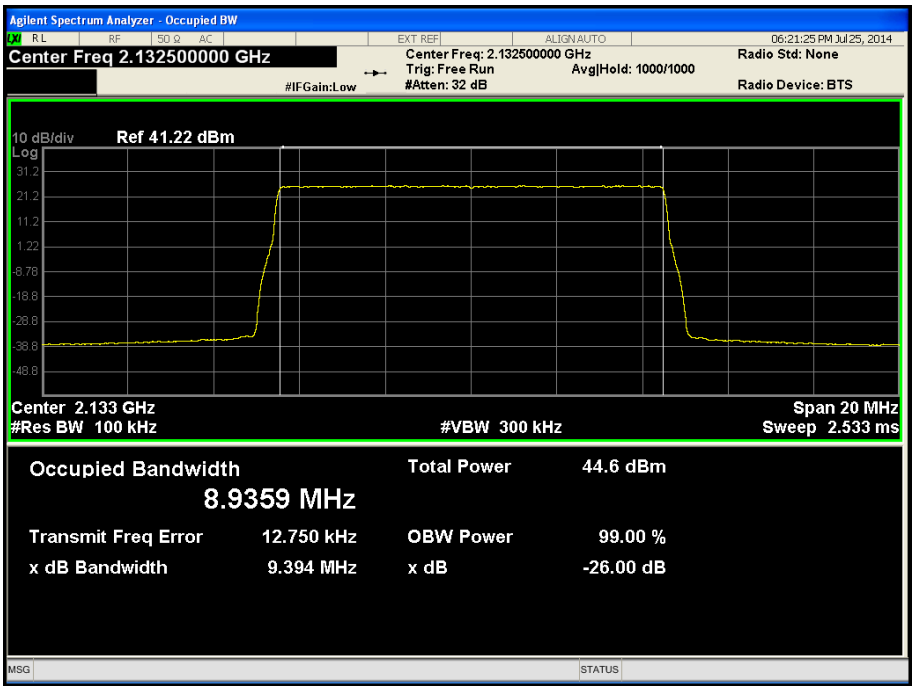
Channel Position M - Carrier Bandwidth 3.0 MHz – Antenna Port B



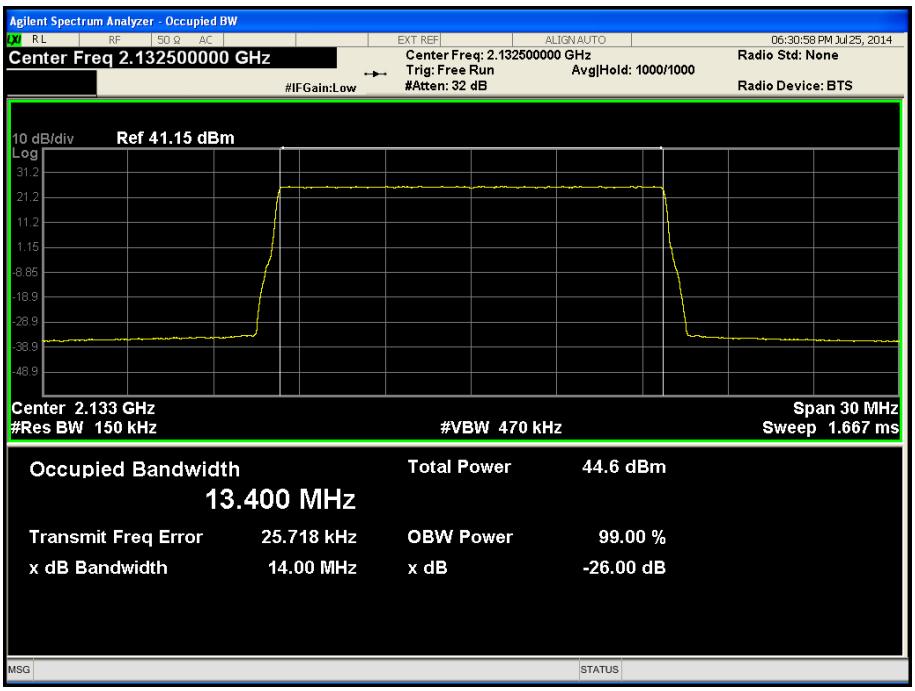
Channel Position M - Carrier Bandwidth 5.0 MHz – Antenna Port B



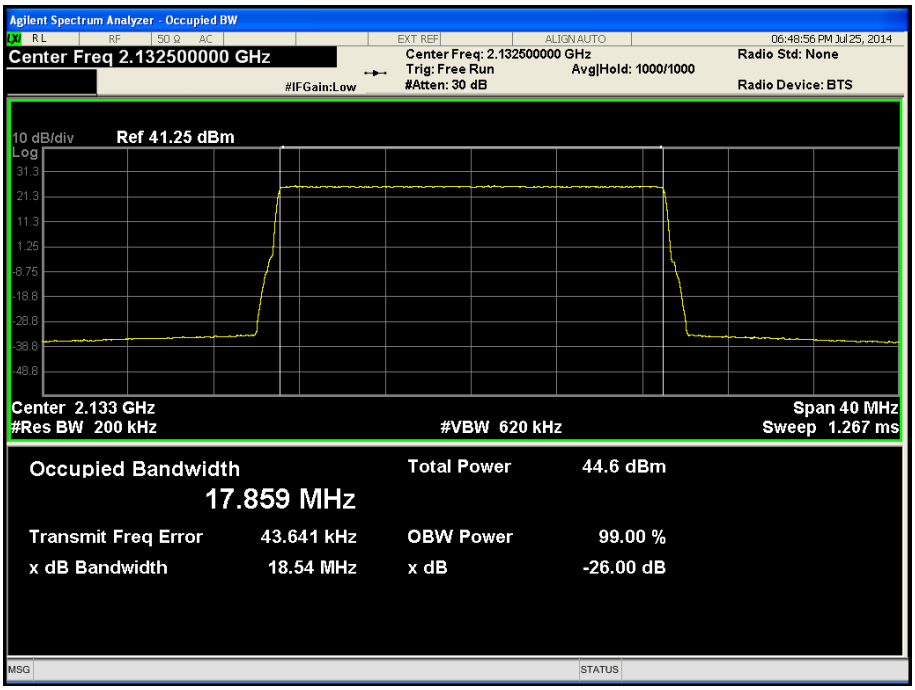
Channel Position M - Carrier Bandwidth 10.0 MHz – Antenna Port B



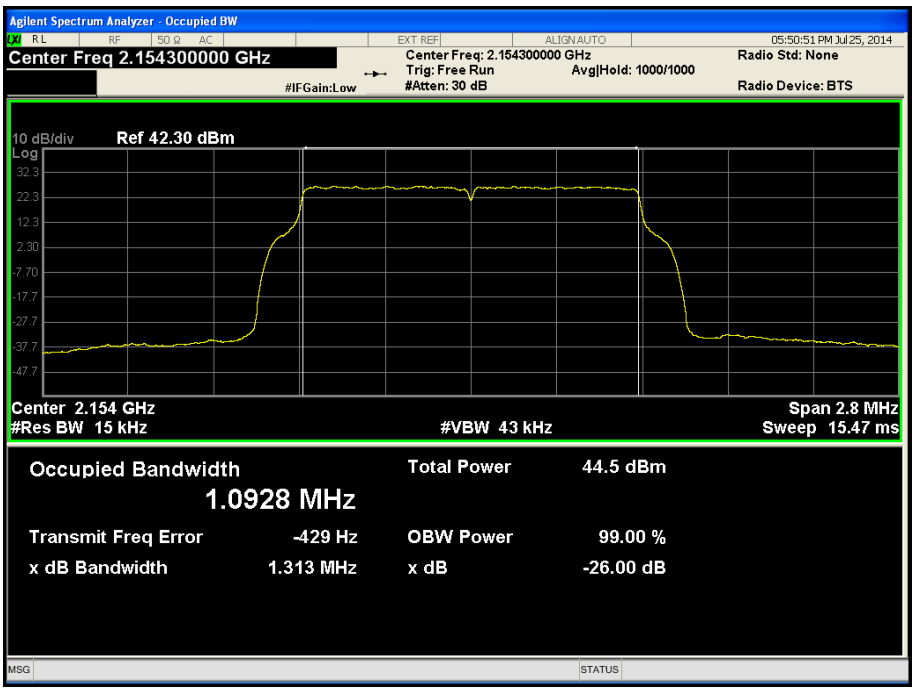
Channel Position M - Carrier Bandwidth 15.0 MHz – Antenna Port B



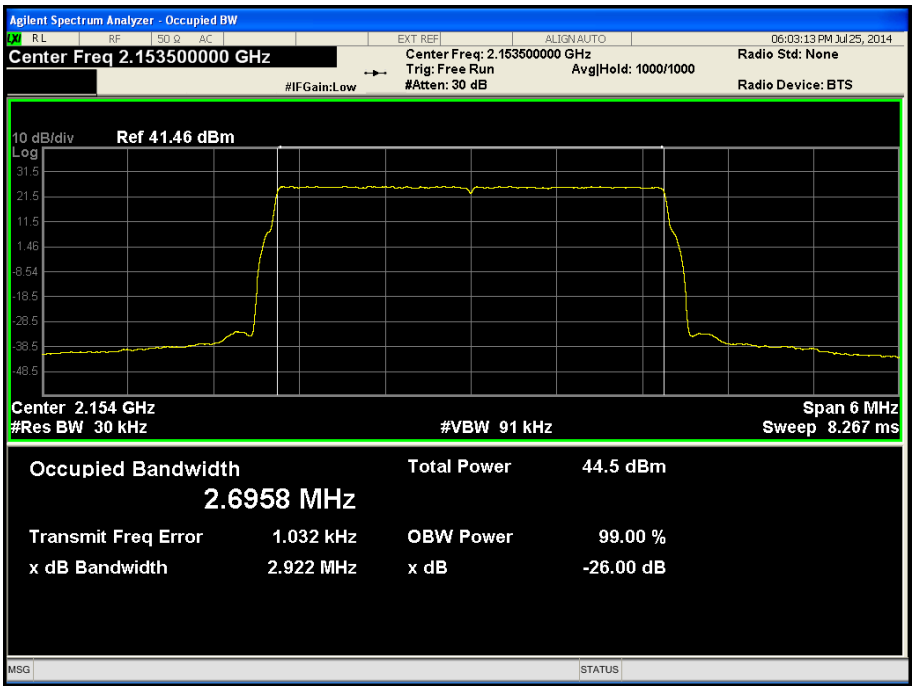
Channel Position M - Carrier Bandwidth 20.0 MHz – Antenna Port B



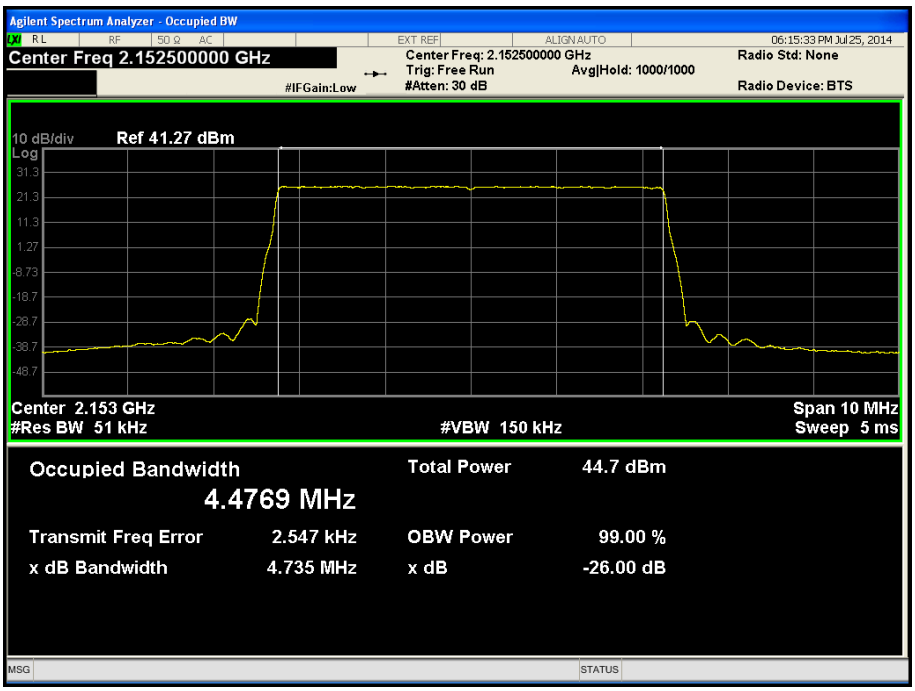
Channel Position T - Carrier Bandwidth 1.4 MHz – Antenna Port B



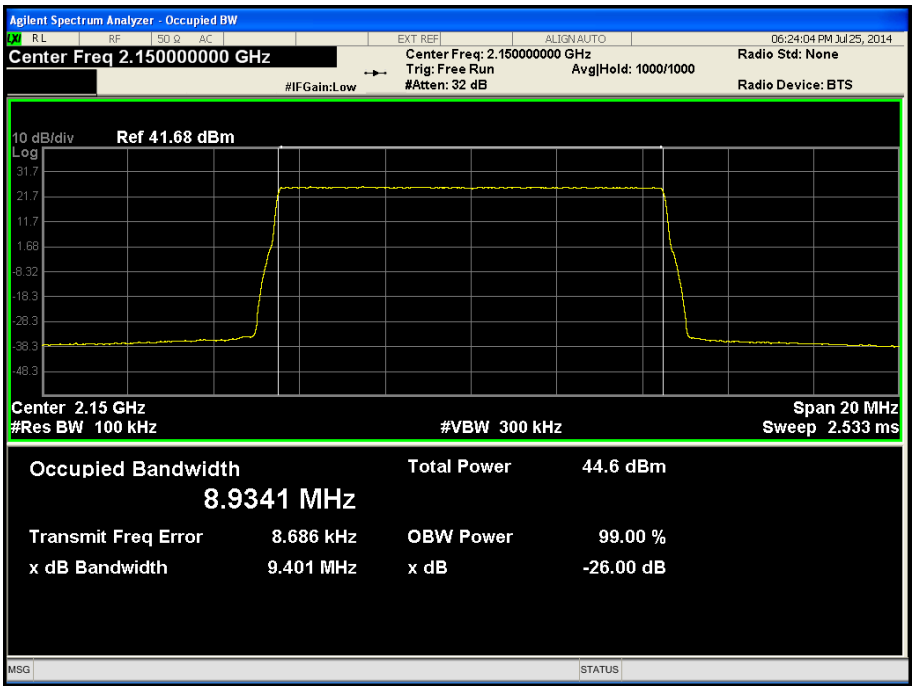
Channel Position T - Carrier Bandwidth 3.0 MHz – Antenna Port B



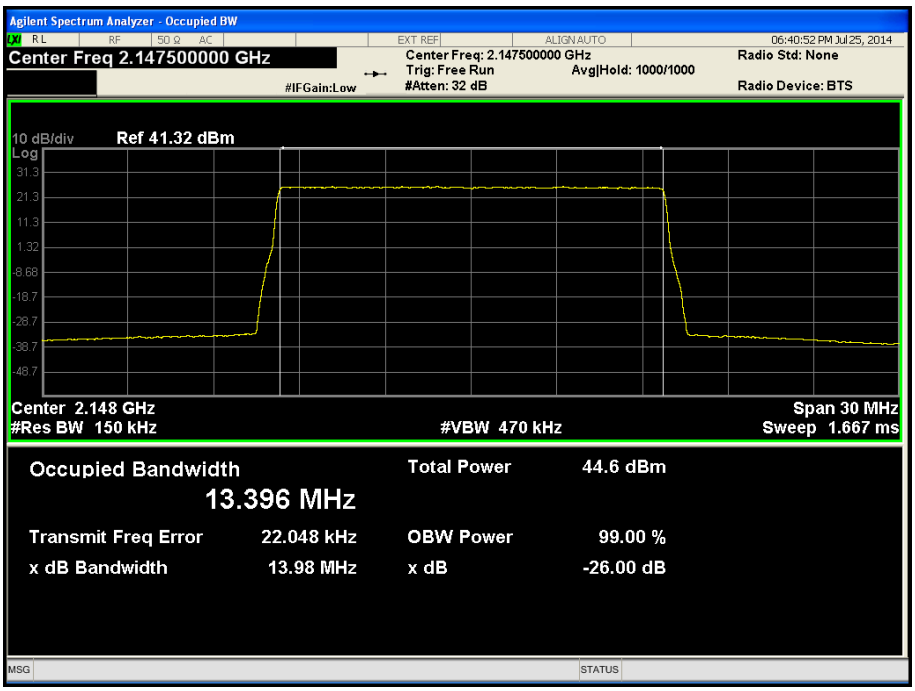
Channel Position T - Carrier Bandwidth 5.0 MHz – Antenna Port B



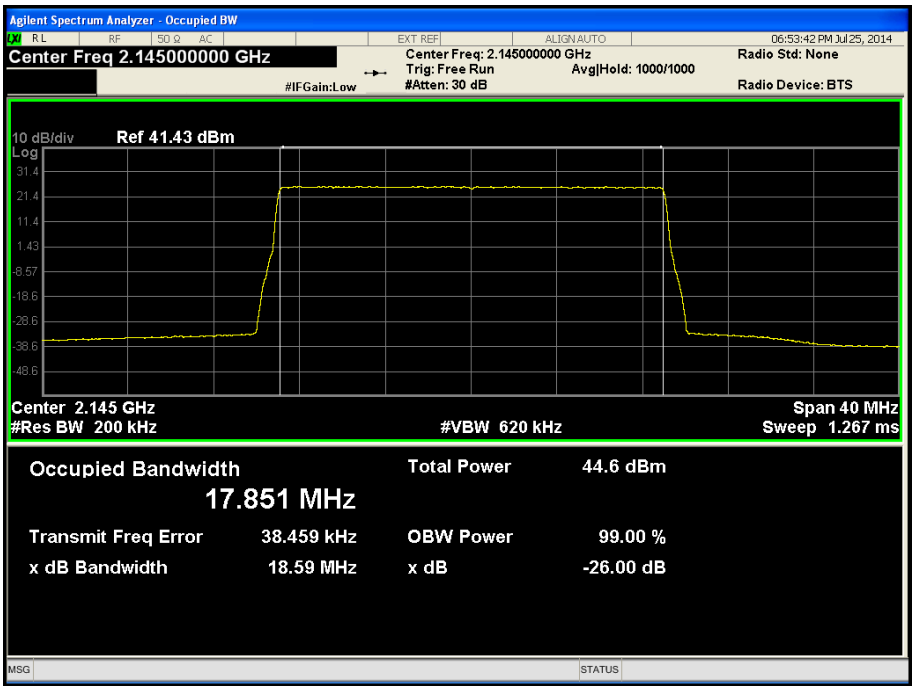
Channel Position T - Carrier Bandwidth 10.0 MHz – Antenna Port B



Channel Position T - Carrier Bandwidth 15.0 MHz – Antenna Port B



Channel Position T - Carrier Bandwidth 20.0 MHz – Antenna Port B

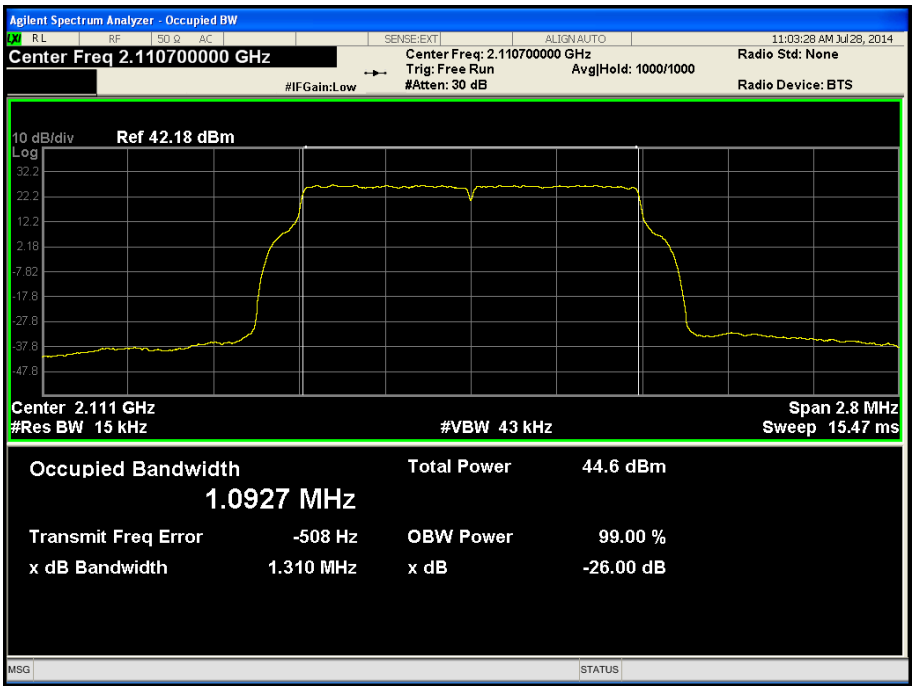


Configuration LTE (See Table 1 for carrier frequency)

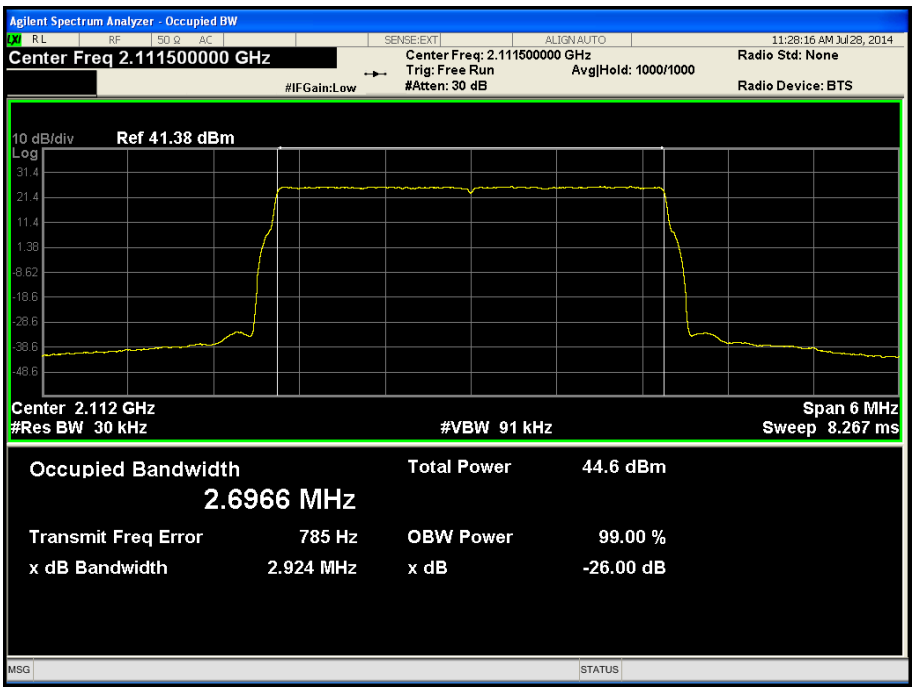
Maximum Output Power 44.77 dBm per carrier, Test Model 1.1 - Antenna Port C

Carrier 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
1.4 MHz	1.09273	1.31025	1.09239	1.30996	1.09230	1.31264
3.0 MHz	2.69661	2.92437	2.69605	2.92321	2.69663	2.92598
5.0 MHz	4.47859	4.74437	4.47767	4.73851	4.47812	4.74365
10.0 MHz	8.93675	9.38785	8.93991	9.40823	8.93873	9.38961
15.0 MHz	13.39616	14.00018	13.39468	14.01554	13.39524	13.96545
20.0 MHz	17.85647	18.61174	17.85398	18.58773	17.84991	18.55358

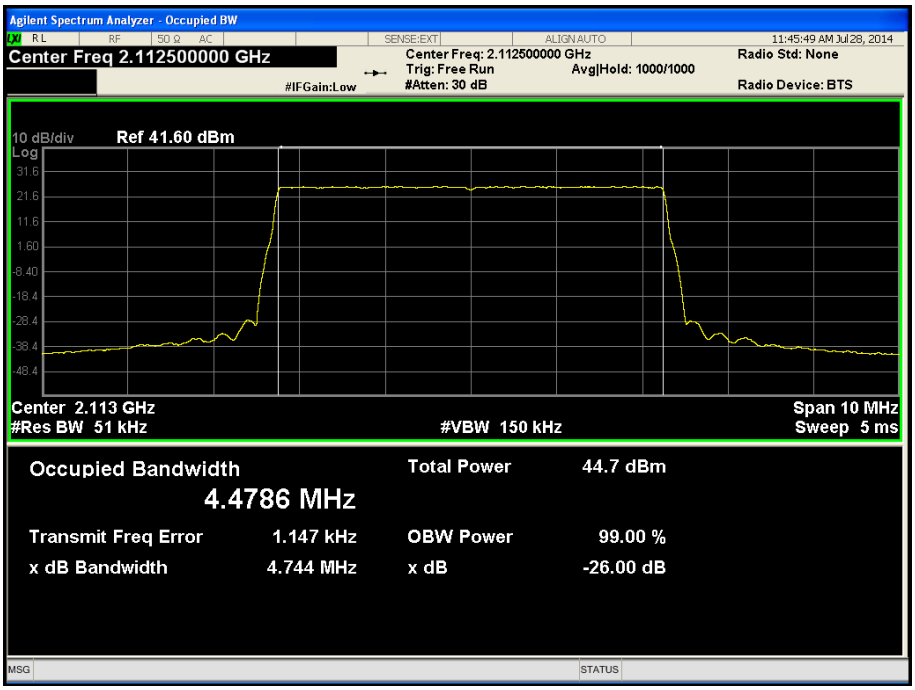
Channel Position B - Carrier Bandwidth 1.4 MHz – Antenna Port C



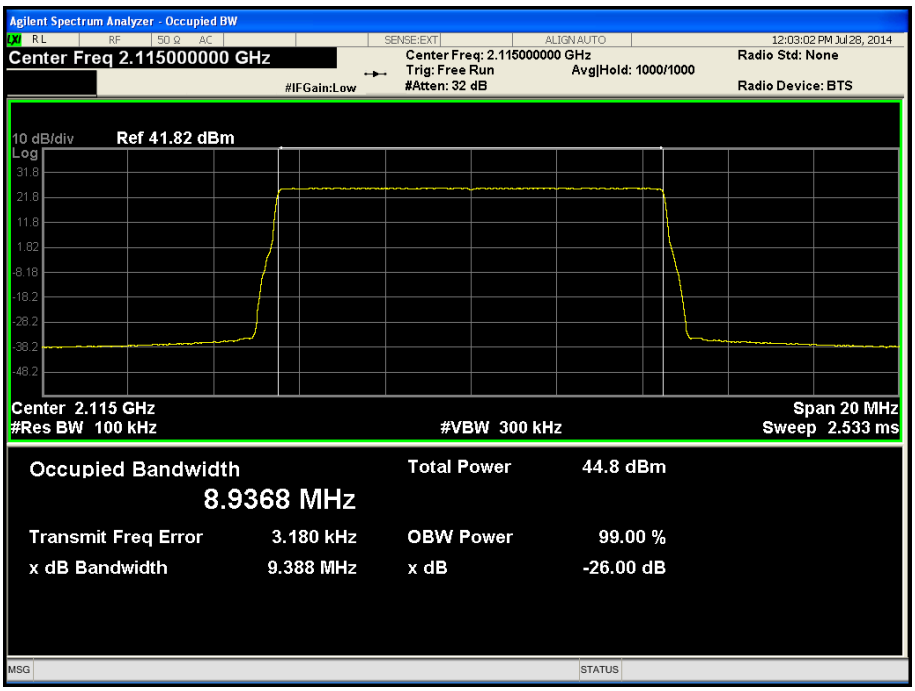
Channel Position B - Carrier Bandwidth 3.0 MHz – Antenna Port C



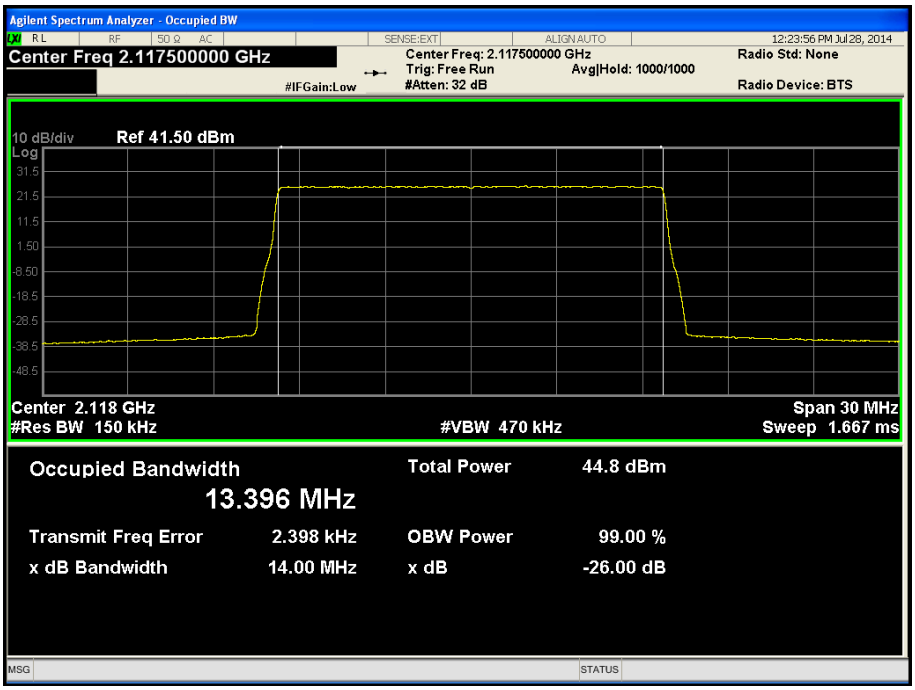
Channel Position B - Carrier Bandwidth 5.0 MHz – Antenna Port C



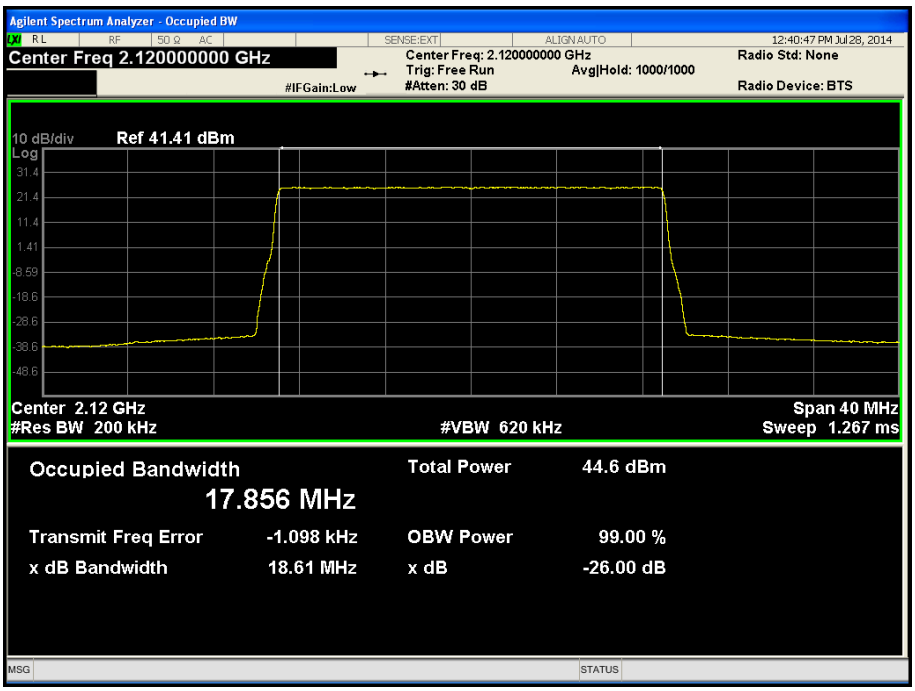
Channel Position B - Carrier Bandwidth 10.0 MHz – Antenna Port C



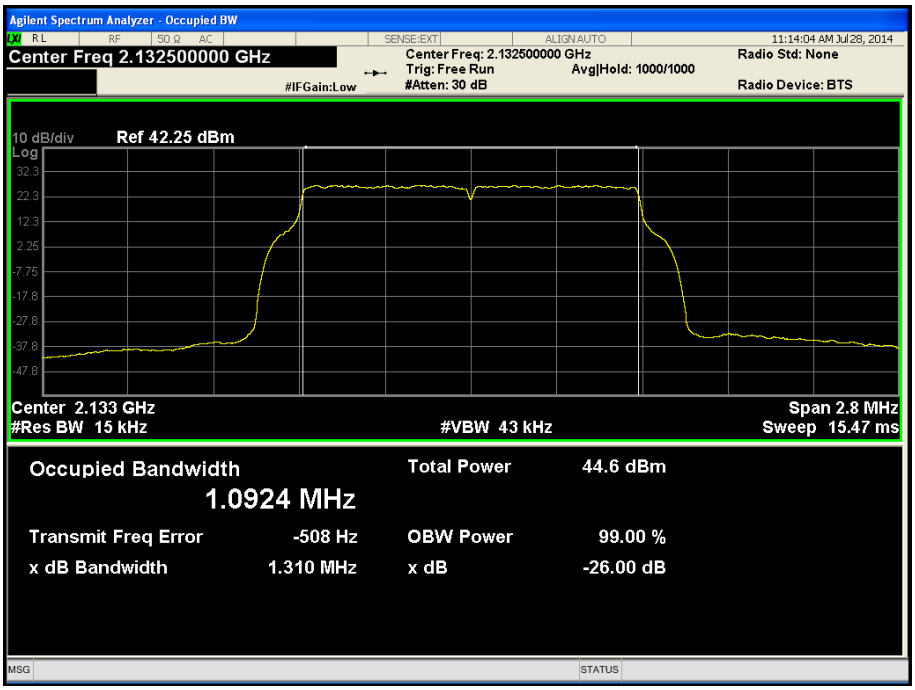
Channel Position B - Carrier Bandwidth 15.0 MHz – Antenna Port C



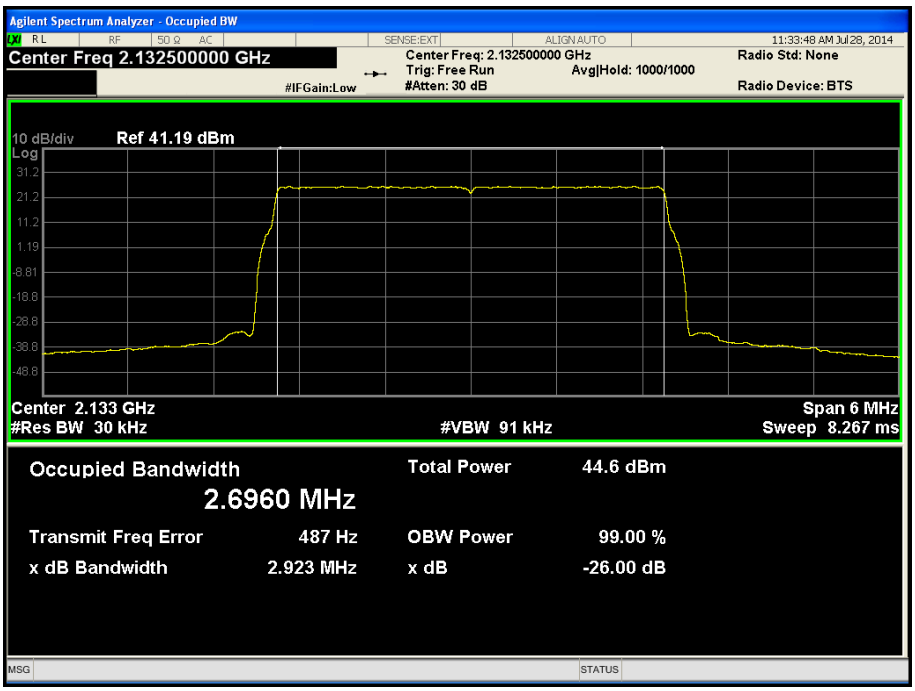
Channel Position B - Carrier Bandwidth 20.0 MHz – Antenna Port C



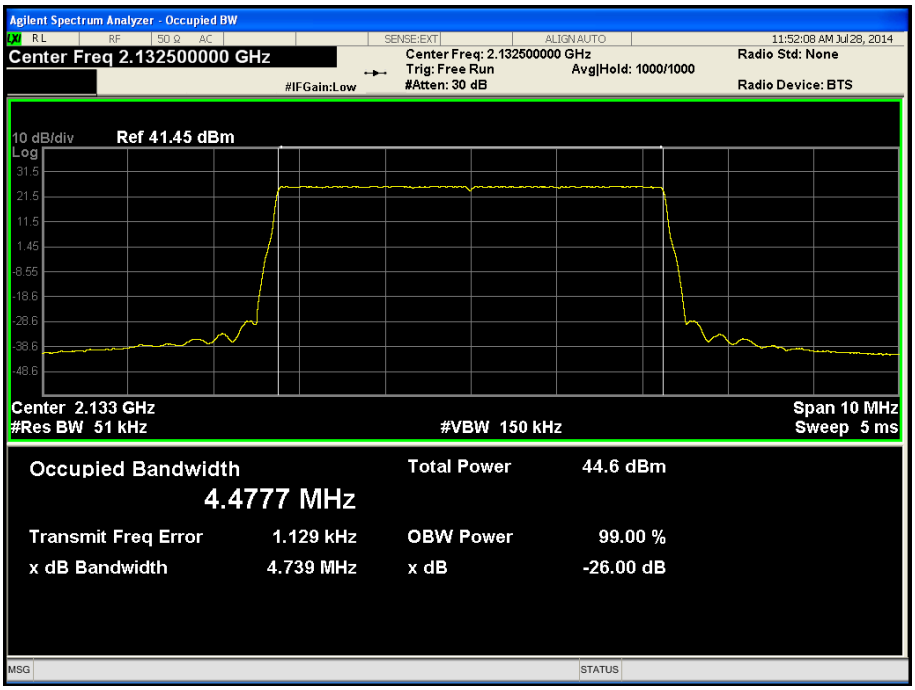
Channel Position M - Carrier Bandwidth 1.4 MHz – Antenna Port C



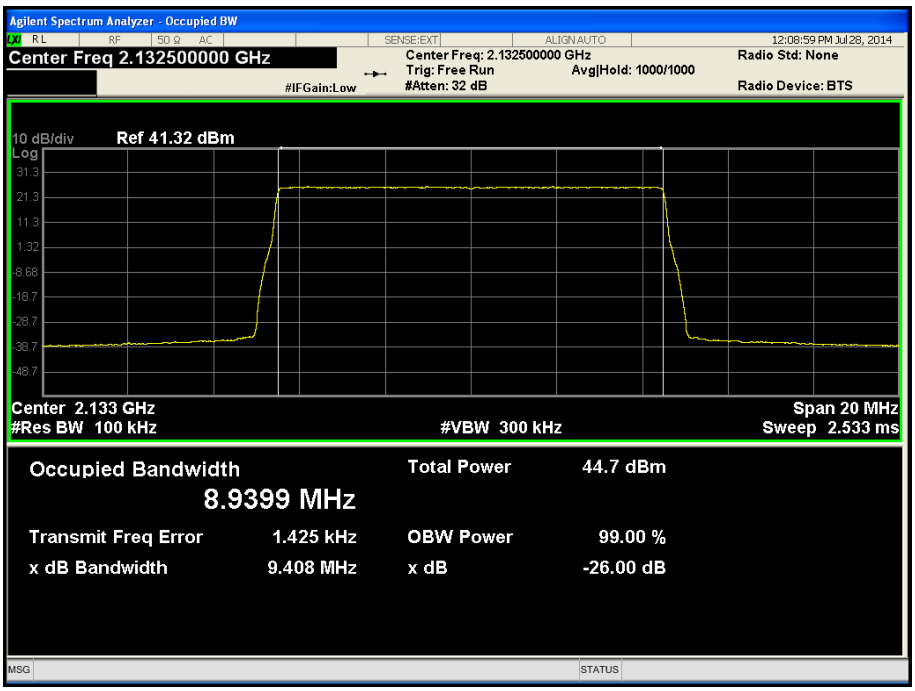
Channel Position M - Carrier Bandwidth 3.0 MHz – Antenna Port C



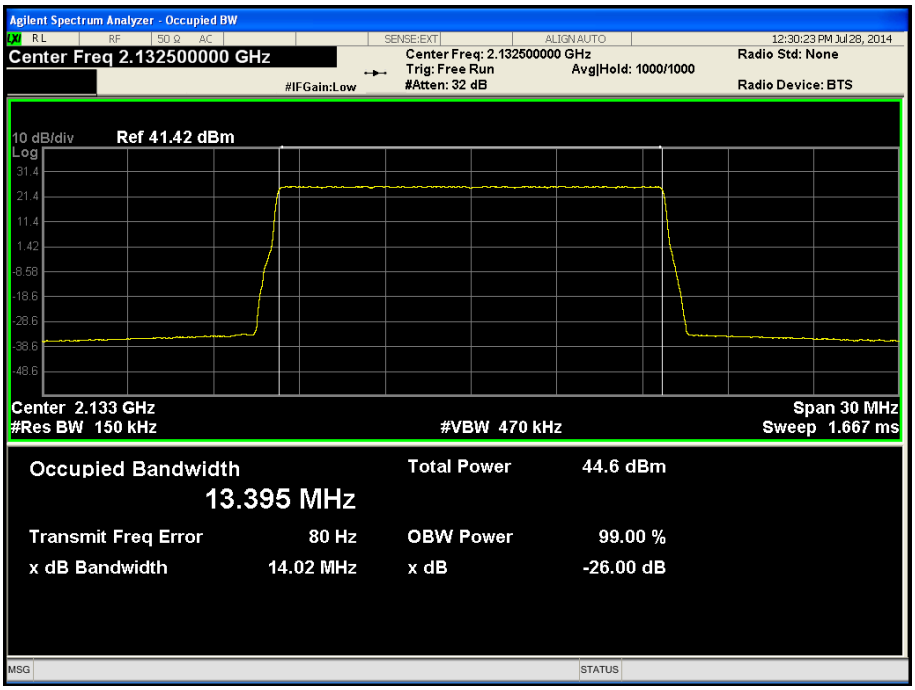
Channel Position M - Carrier Bandwidth 5.0 MHz – Antenna Port C



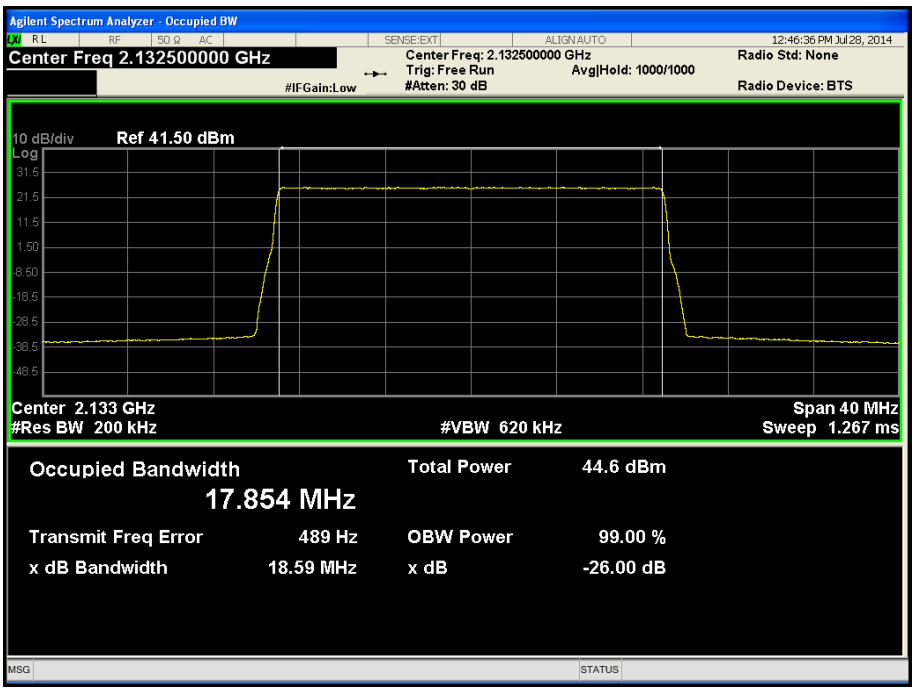
Channel Position M - Carrier Bandwidth 10.0 MHz – Antenna Port C



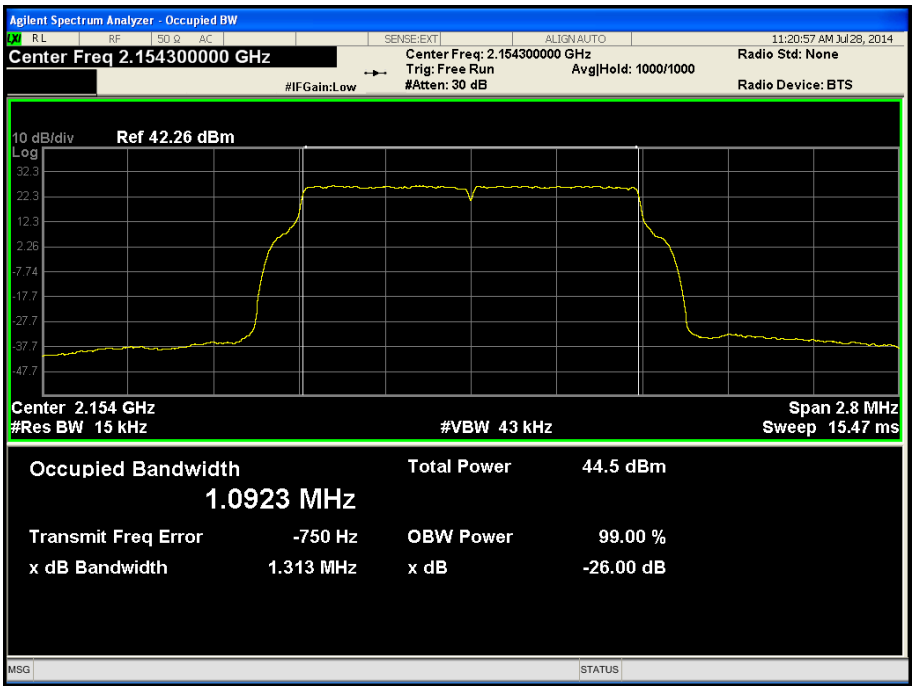
Channel Position M - Carrier Bandwidth 15.0 MHz – Antenna Port C



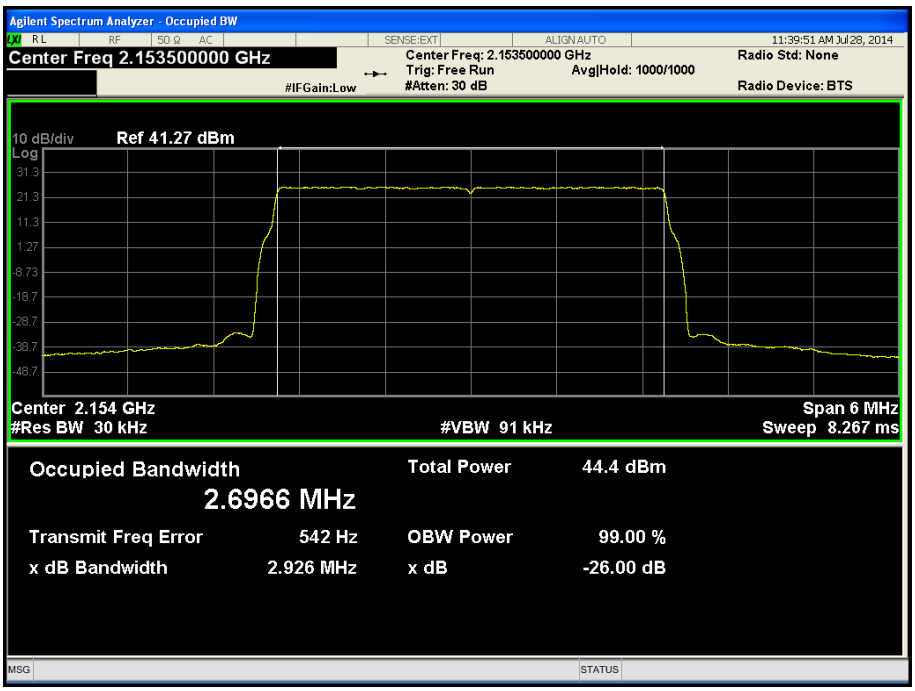
Channel Position M - Carrier Bandwidth 20.0 MHz – Antenna Port C



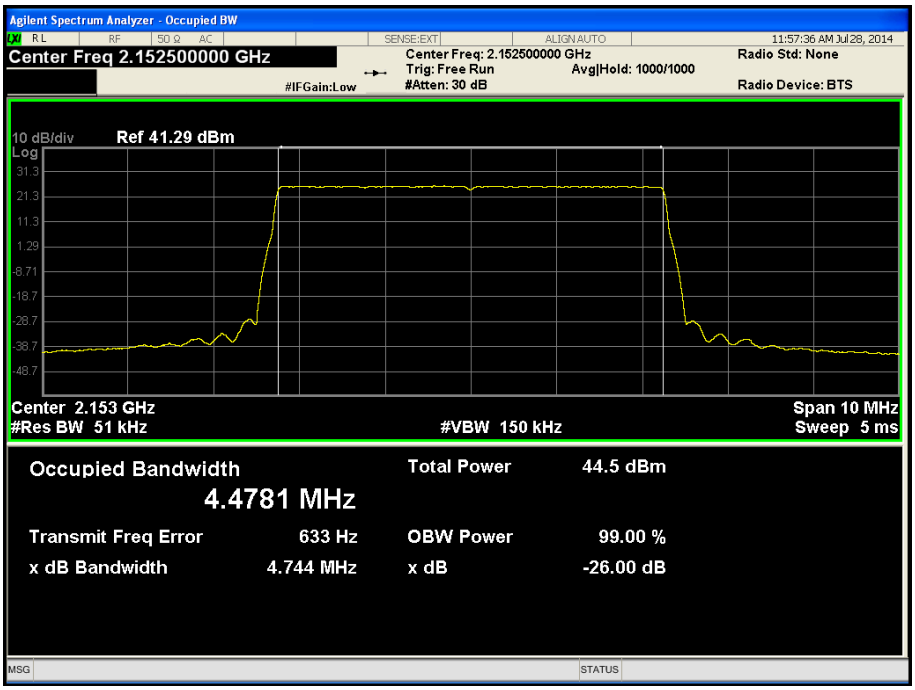
Channel Position T - Carrier Bandwidth 1.4 MHz – Antenna Port C



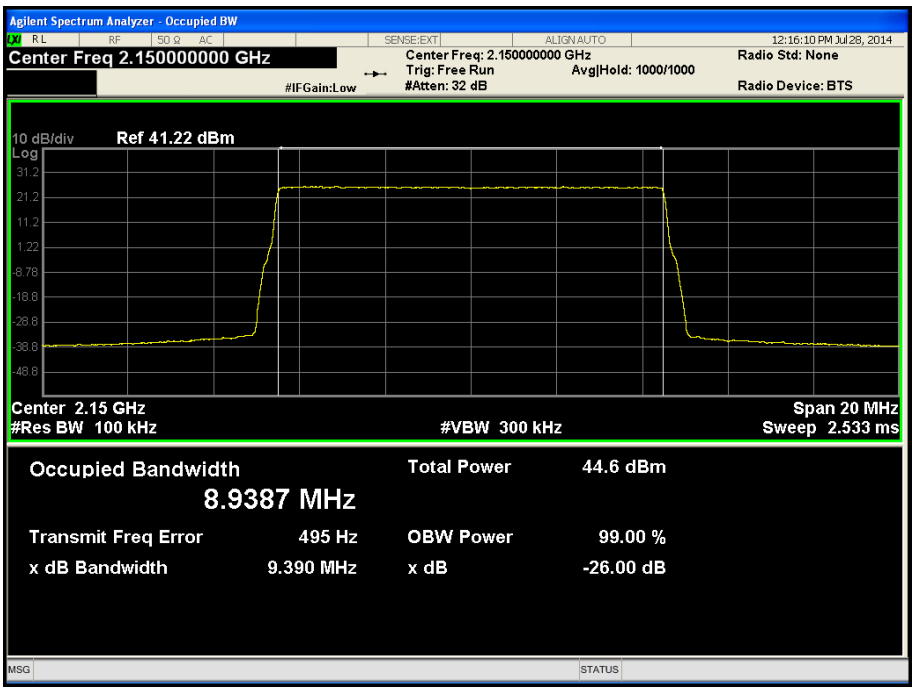
Channel Position T - Carrier Bandwidth 3.0 MHz – Antenna Port C



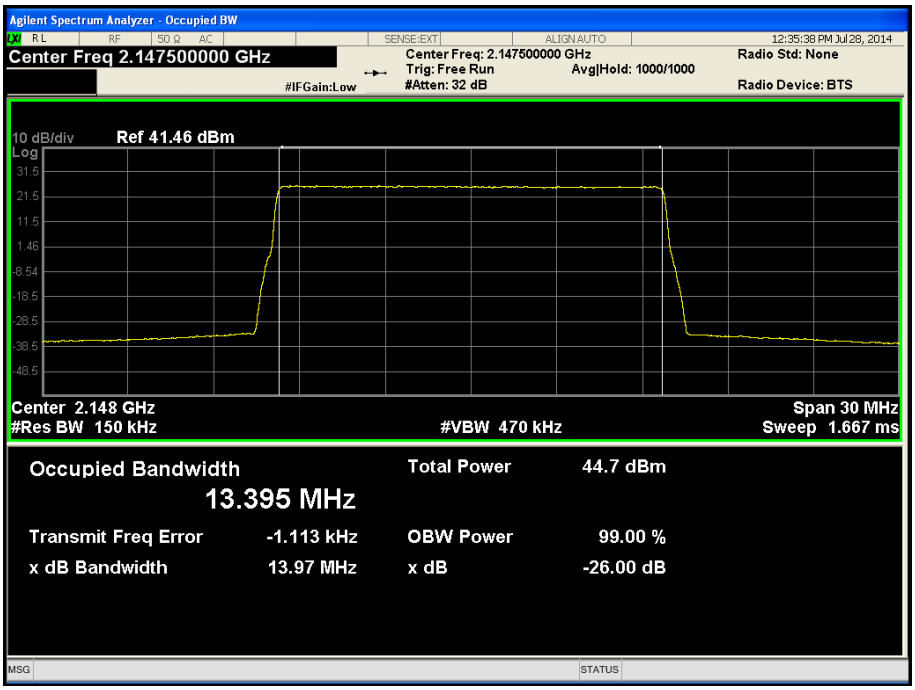
Channel Position T - Carrier Bandwidth 5.0 MHz – Antenna Port C



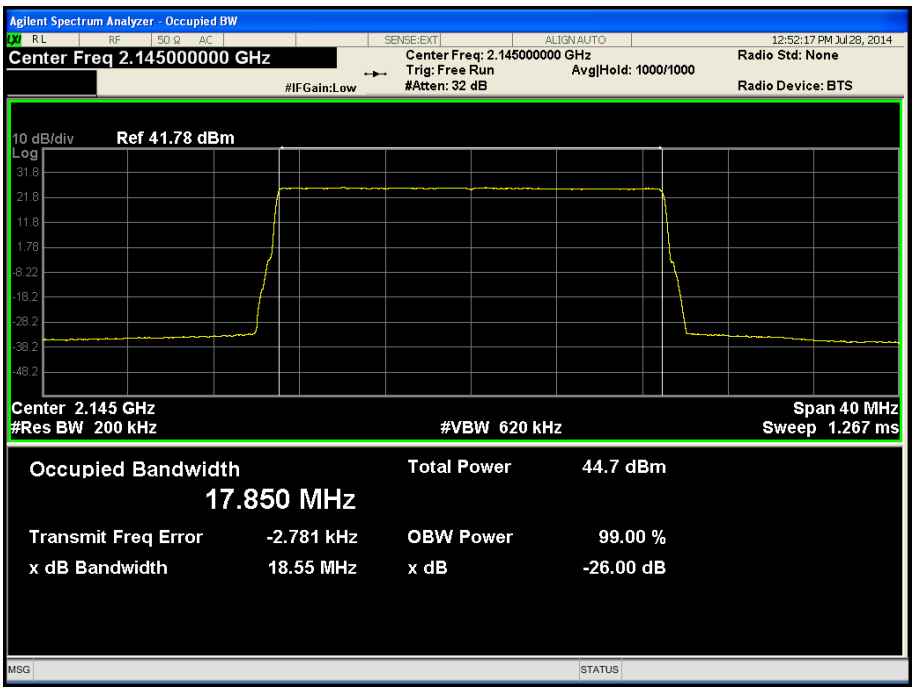
Channel Position T - Carrier Bandwidth 10.0 MHz – Antenna Port C



Channel Position T - Carrier Bandwidth 15.0 MHz – Antenna Port C



Channel Position T - Carrier Bandwidth 20.0 MHz – Antenna Port C

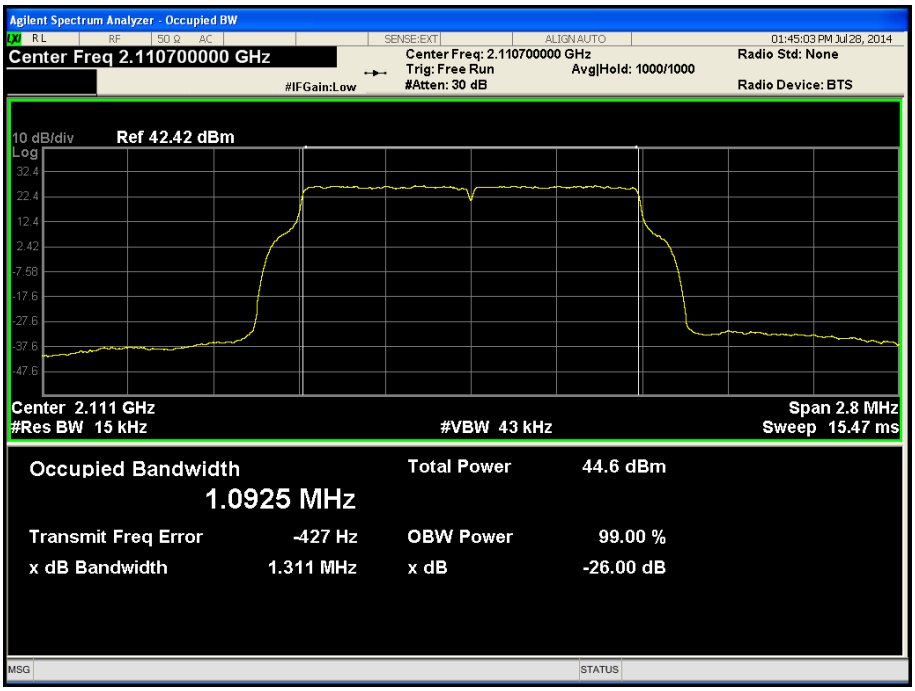


Configuration LTE (See Table 1 for carrier frequency)

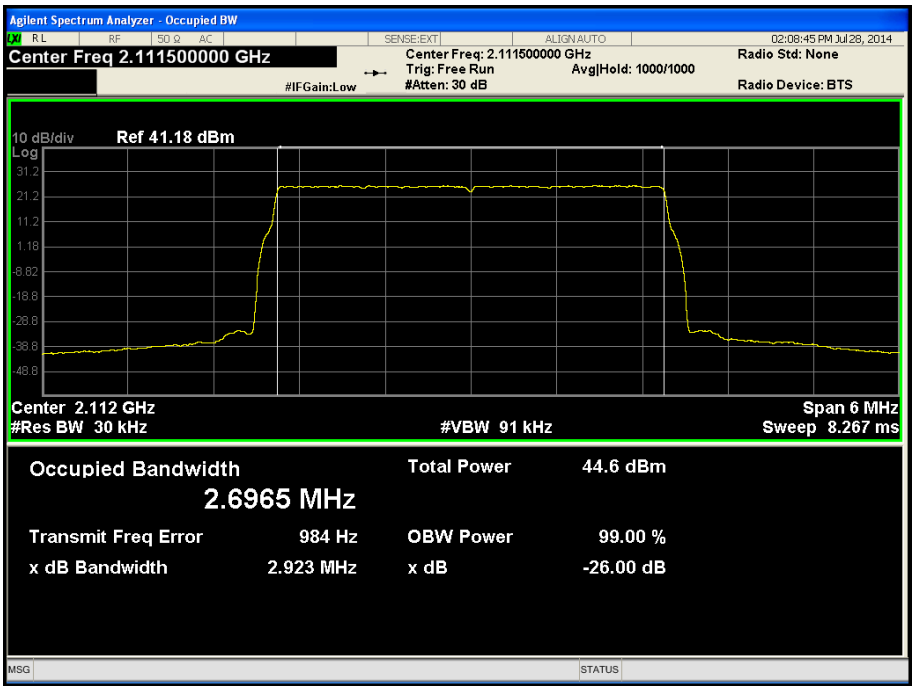
Maximum Output Power 44.77 dBm per carrier, Test Model 1.1 - Antenna Port D

Carrier 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
1.4 MHz	1.09247	1.31146	1.09264	1.30980	1.09246	1.31269
3.0 MHz	2.69653	2.92278	2.69655	2.92722	2.69583	2.92606
5.0 MHz	4.47798	4.73680	4.47873	4.74599	4.47901	4.73686
10.0 MHz	8.93884	9.39152	8.93863	9.39801	8.93804	9.38980
15.0 MHz	13.39431	13.96415	13.39587	14.00135	13.39409	13.99916
20.0 MHz	17.84712	18.55616	17.85803	18.57682	17.85395	18.56471

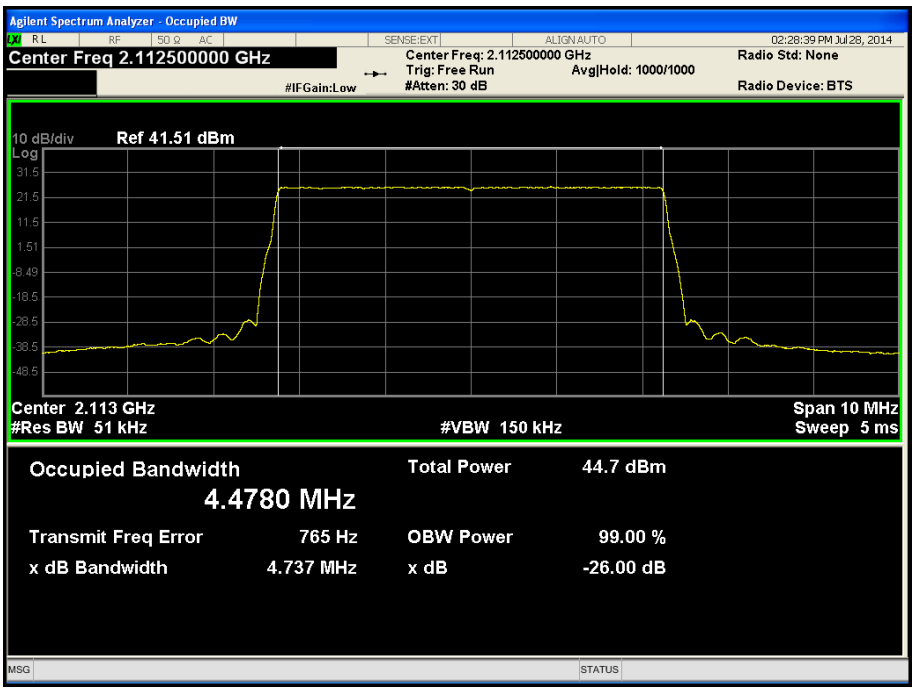
Channel Position B - Carrier Bandwidth 1.4 MHz – Antenna Port D



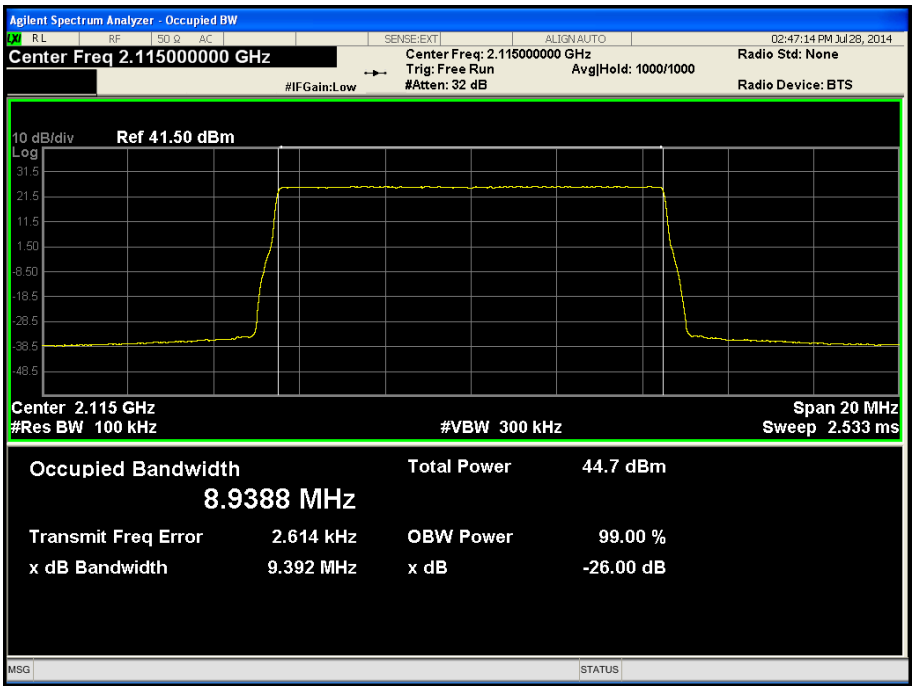
Channel Position B - Carrier Bandwidth 3.0 MHz – Antenna Port D



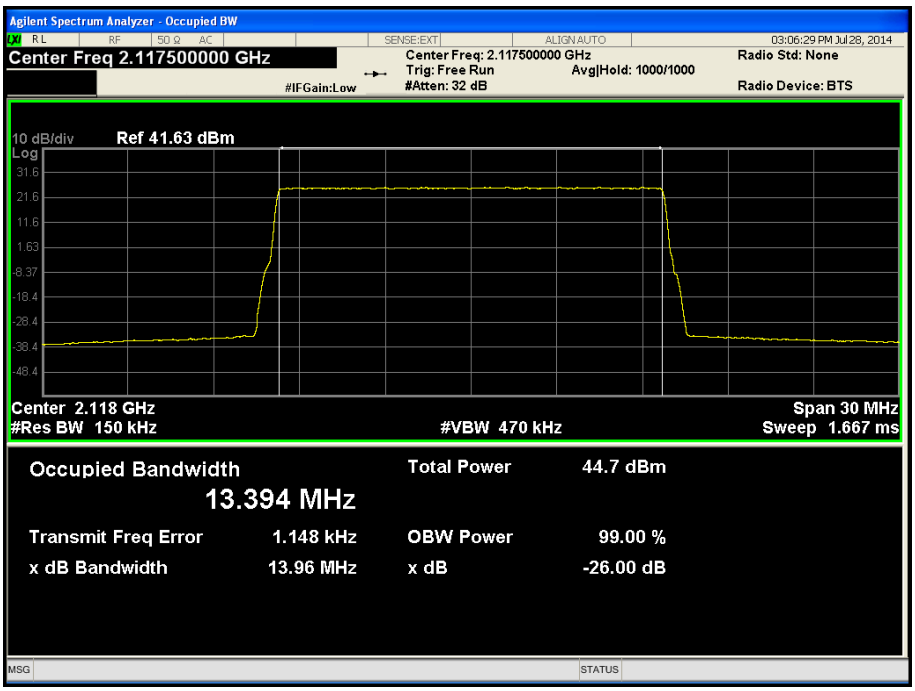
Channel Position B - Carrier Bandwidth 5.0 MHz – Antenna Port D



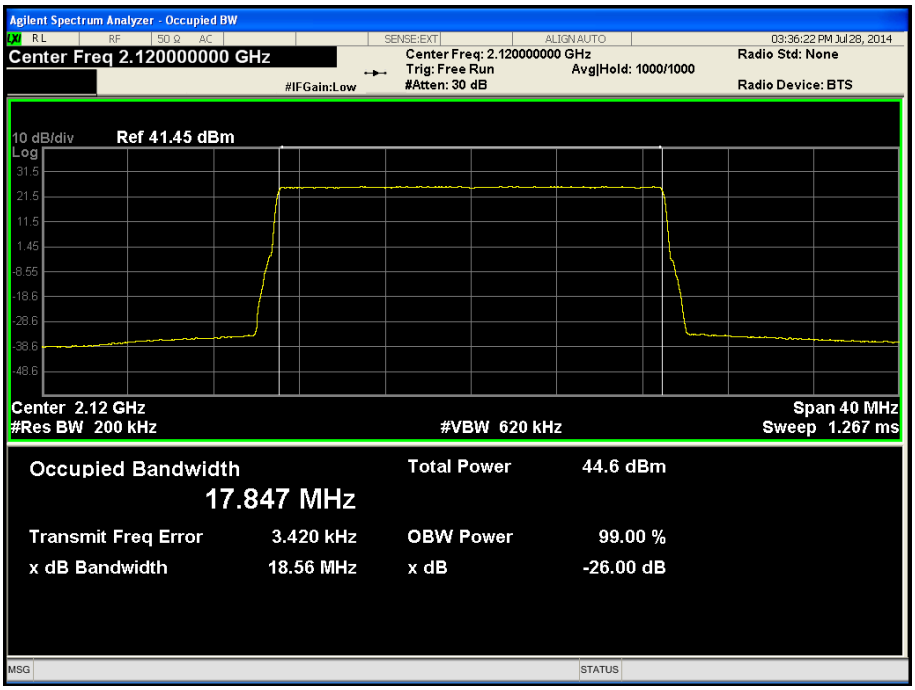
Channel Position B - Carrier Bandwidth 10.0 MHz – Antenna Port D



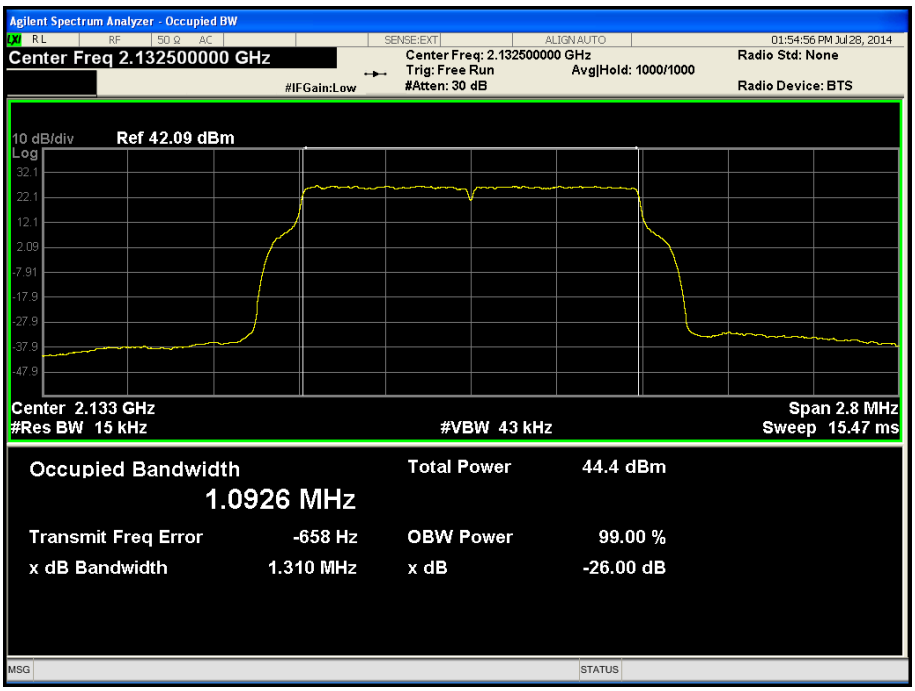
Channel Position B - Carrier Bandwidth 15.0 MHz – Antenna Port D



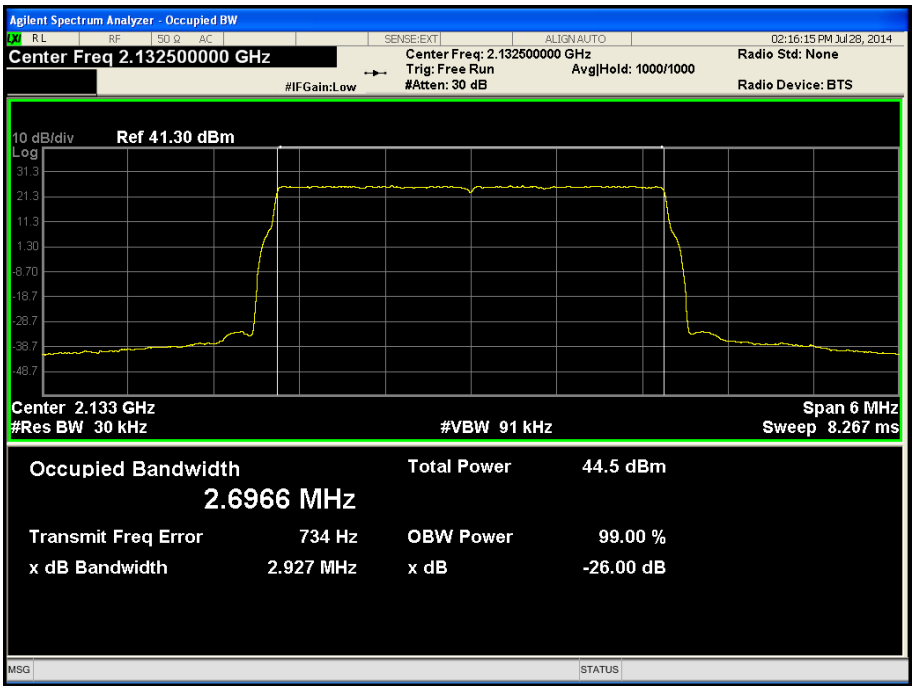
Channel Position B - Carrier Bandwidth 20.0 MHz – Antenna Port D



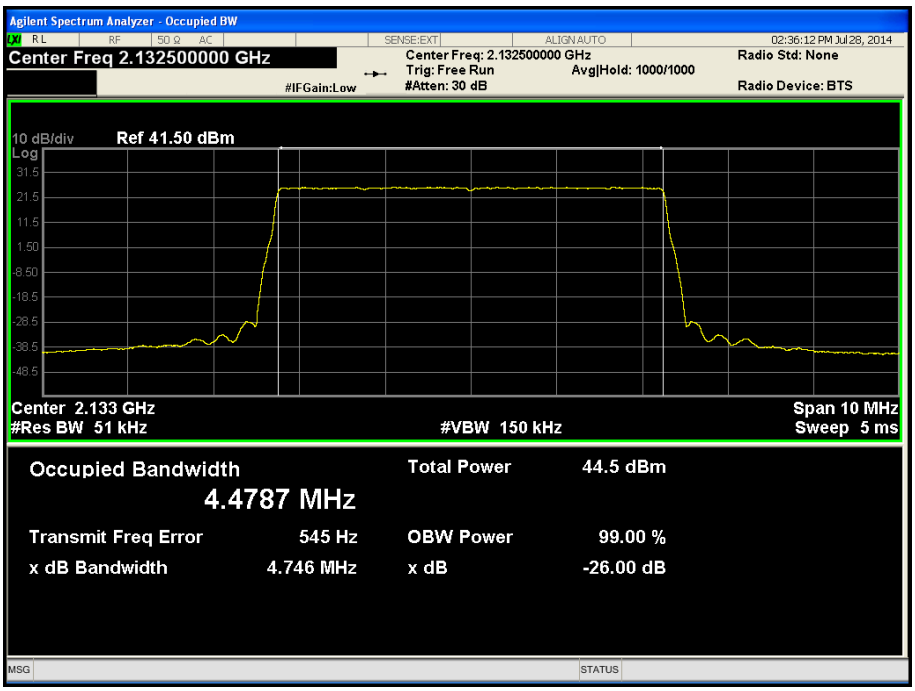
Channel Position M - Carrier Bandwidth 1.4 MHz – Antenna Port D



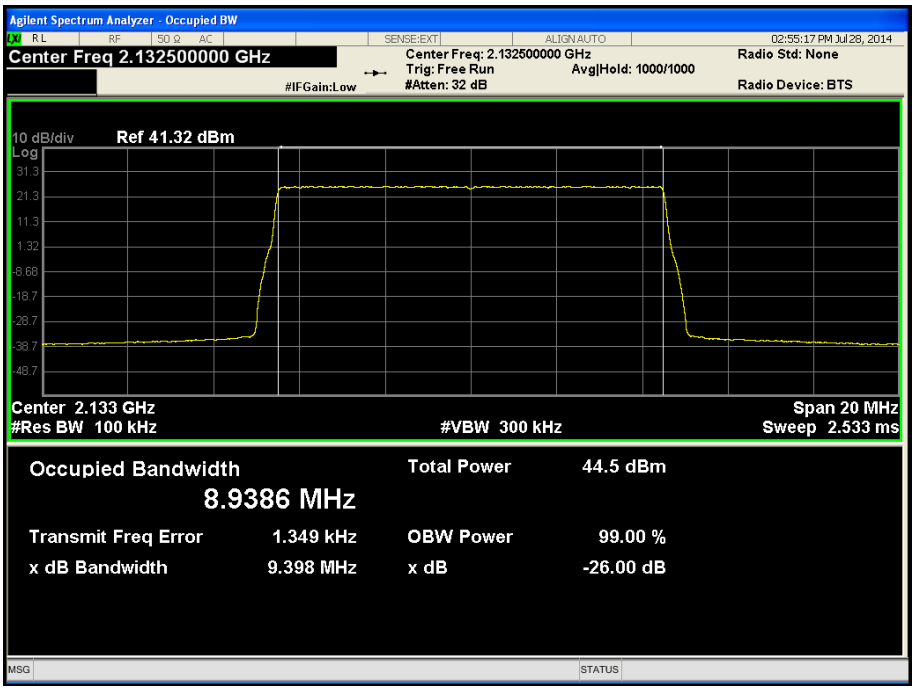
Channel Position M - Carrier Bandwidth 3.0 MHz – Antenna Port D



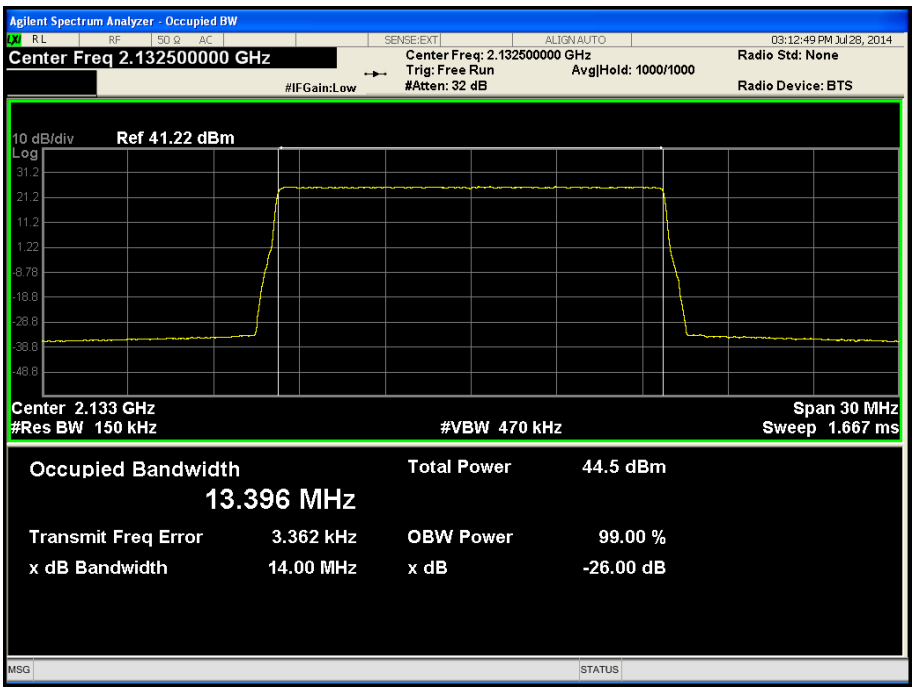
Channel Position M - Carrier Bandwidth 5.0 MHz – Antenna Port D



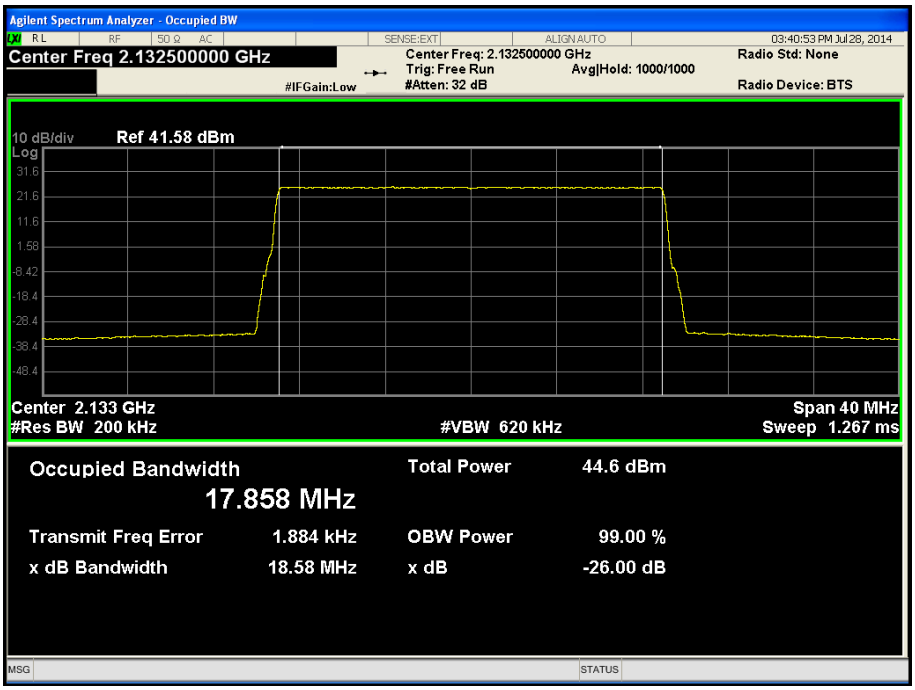
Channel Position M - Carrier Bandwidth 10.0 MHz – Antenna Port D



Channel Position M - Carrier Bandwidth 15.0 MHz – Antenna Port D



Channel Position M - Carrier Bandwidth 20.0 MHz – Antenna Port D



Channel Position T - Carrier Bandwidth 1.4 MHz – Antenna Port D