Radio Test Report

Application for Grant of Equipment Authorization

FCC Part 24 & IC RSS-133
1930MHz – 1995MHz

FCC ID:	**2AD8UFZMFWFJ01**
IC:	**109D-FZMFWFJ01**
Product Name:	**Flexi Zone Micro BTS**
Model(s):	**FWFJ**
APPLICANT:	**Nokia Solutions and Networks** **1455 Shure Drive** **Il75-Room 400B**
TEST SITE(S):	**National Technical Systems - Plano** **1701 E Plano Pkwy #150** **Plano, TX 75074**
REPORT DATE:	**September 14, 2016**
FINAL TEST DATES:	**September 1, 2016**
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REVISION HISTORY

Rev#	Date	Comments	Modified By
0	9/14/16	Draft	Armando Del Angel
1	9/22/16	Corrections per customer comments	Armando Del Angel

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SCOPE

Tests have been performed on Nokia Solutions and Networks product Flexi Zone Micro BTS FDD Model FWFJ, pursuant to the relevant requirements of the following standard(s) in order to obtain device certification against the regulatory requirements of the Federal Communications Commission and Industry Canada.

- Code of Federal Regulations (CFR) Title 47 Part 2
- Industry Canada RSS-Gen Issue 4, November 2014
- CFR 47 Part 24 Subpart E – Broadband PCS
- RSS-133 Issue 6, January 2013 (2GHz Personal Communications Services)

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards:

ANSI C63.4-2009
ANSI TIA-603-C
FCC KDB 971168 D01 v02r02

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC and Industry Canada performance and procedural standards.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of Nokia Solutions and Networks product Flexi Zone Micro BTS Model FWFJ and therefore apply only to the tested sample. The sample was selected and prepared by Terry Schwenk of Nokia Solutions and Networks.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, the device requires certification.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

Testing was performed only on Model FWFJ. No additional models were described or supplied for testing.

STATEMENT OF COMPLIANCE

The tested sample of Nokia Solutions and Networks product FlexiZone Micro BTS Model FWFJ complied with the requirements of the standards and frequency bands declared in the scope of this test report.

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS

FCC Part 24 & IC RSS-133 (Base Stations Operating in 1930MHz-1995MHz band)

FCC	Canada	Description	Measured	Limit	Result
Transmitter Modulation, output power and other characteristics					
§24.229	RSS-133 Section 6.1	Frequency range(s)	1932.5-1992.5 (5M-LTE) 1935-1990 (10M-LTE) 1937.5-1987.5 (15M-LTE) 1940-1985 (20M-LTE) 1932.5-1992.5 (WCDMA)	1930-1995 MHz	Pass
§2.1047	RSS-133 Section 6.2	Modulation Type	QPSK, 16QAM, 64QAM (5M, 10M, 15M, 20M for each) WCDMA (5MHz)	Digital	Pass
§24.232	RSS-133 Section 6.4	Output Power	Conducted Output Power (Highest on Main Port) RMS: 36.75dBm ERP will depend on antenna gain (unknown)	FCC: 1640W EIRP IC: 100W	Pass
§24.232	RSS-133 Section 6.4	Peak to Average Ratio	8.26dB highest	<= 13 dB	Pass
§24.238	-	Emission Bandwidth (26dB)	4.989MHz (5M-LTE) 9.988MHz (10M-LTE) 14.91MHz (15M-LTE) 19.938MHz (20M-LTE) 4.659MHz (5MHz-WCDMA)	Remain in Block	Pass
-	RSS-133 Section 2.3	Emission Bandwidth (99%)	4.508MHz (5M-LTE) 9.005MHz (10M-LTE) 14.784MHz (15M-LTE) 18.023MHz (20M-LTE) 4.661MHz (5MHz-WCDMA)	Remain in Block	Pass
Transmitter spurious emissions[2]					
§24.238	RSS-133 Section 6.5.1	At the antenna terminals	< -16.03dBm	-16.03 dBm (per TX chain)	Pass
		Field strength	58.587dBuV/m at 3m Eq. to -36.343dBm EIRP	-13 dBm EIRP	Pass
Other details					
§24.235	RSS-133 Section 6.3	Frequency stability	Stays within block	N/A[1]	Pass
§2.1093	RSS-102	RF Exposure	N/A		Pass[2]

Notes

Note 1 – The requirement for frequency stability is that the signal remains within the authorized frequency block.
Note 2 – The measurement at the channel edge is made with a resolution bandwidth of at least 1% of the emission bandwidth. For measurements more than 1MHz from the edge of the channel, the measurement bandwidth is 1MHz.
Note 3 – Applicant's declaration on a separate exhibit based on hypothetical antenna gains.

	Emission Designators					
	QPSK		16QAM		64QAM	
	FCC	IC	FCC	IC	FCC	IC
5M-LTE	4M93D7W	4M50D7W	4M95D7W	4M49D7W	4M99D7W	4M51D7W
10M-LTE	9M99D7W	8M99D7W	9M94D7W	9M01D7W	9M99D7W	9M00D7W
15M-LTE	14M91D7W	13M50D7W	14M77D7W	14M79D7W	14M91D7W	13M50D7W
20M-LTE	19M94D7W	17M97D7W	19M78D7W	18M03D7W	19M91D7W	17M97D7W
5M-WCDMA	4M65F9W	4M13F9W	4M66F9W	4M13F9W	4M66F9W	4M67F9W

Note: FCC based on 26dB emissions bandwidth, IC based on 99% emissions bandwidth

EXTREME CONDITIONS

Frequency stability is determined over extremes of temperature and voltage. The extremes of voltage were 85 to 115 percent of the nominal value.

MEASUREMENT UNCERTAINTIES

Measurement uncertainties of the test facility based on a 95% confidence level are as follows,

Test	**Uncertainty**
Radio frequency	± 0.2ppm
RF power conducted	±1.2 dB
RF power radiated	±3.3 dB
RF power density conducted	±1.2 dB
Spurious emissions conducted	±1.2 dB
Adjacent channel power	±0.4 dB
Spurious emissions radiated	±4 dB
Temperature	±1°C
Humidity	±1.6 %
Voltage (DC)	±0.2 %
Voltage (AC)	±0.3 %

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The equipment under test is a Nokia Solutions and Networks Flexi Multiradio BTS (base transceiver station) Radio Frequency Module (RFM), model FWFJ, which operates over 3GPP frequency band 2 (BTS Transmit: 1930-1995MHz). The FWFJ has two co-located transmitters, with the option of being operated in a 2X2 MIMO configuration; with each transmit port supporting 5 watts maximum rated RF output power. Multi-carrier operation is supported.

The FWFJ is dual-standard capable (WCDMA/LTE). Both WCDMA and LTE mode will be tested. The FWFJ supports three downlink modulation types for LTE and WCDMA (QPSK, 16QAM and 64QAM). The FWFJ supports four LTE channel bandwidths (5, 10, 15, and 20 MHz) and one for WCDMA (5MHz).

FWFJ has external interfaces including AC power, ground, antennas (TX/RX), Bluetooth, and GPS antenna. The RFM with applicable installation kits may be pole or wall mounted.

The FWFJ channel numbers and frequencies are as follows:

		Channel Bandwidth	Single Carrier	
Downlink				
Frequency	5 MHz	10 MHz	15 MHz	20 MHz
(MHz)				
1930.0	Bandedge	Bandedge	Bandedge	Bandedge
1932.5	Bottom Channel			
1935.0		Bottom Channel		
1937.5			Bottom Channel	
1940.0				Bottom Channel
1962.5	Middle Channel	Middle Channel	Middle Channel	Middle Channel
1985.0				Top Channel
1987.5			Top Channel	
1990.0		Top Channel		
1992.5	Top Channel			
1995.0	Bandedge	Bandedge	Bandedge	Bandedge

Table 1 FWFJ Downlink Band Edge LTE Frequency Channels

		Channel Bandwidth	Dual Carrier	
Downlink				
Frequency	5 MHz			
(MHz)				
1930.0	Bandedge			
1932.5	Bottom Channel	Carrier 1		
1937.5	Bottom Channel	Carrier2		
1962.5	Middle Channel	Carrier 1		
1967.5	Middle Channel	Carrier2		
1987.5	Top Channel	Carrier 2		
1992.5	Top Channel	Carrier 1		
1995.0	Bandedge			

Table 2 FWFJ Downlink Band Edge WCDMA Frequency Channels

The sample was received on August 23 2016 and tested on August 23 – September 2, 2016. The EUT consisted of the following component(s):

Company	Model	Description	Serial/Part Number	FCC ID / IC#
Nokia Solutions and Networks	FWFJ (LTE)	Flexi Zone Micro BTS	Part# 473772A.X11 Serial# EB161990023	FCC ID: 2AD8UFZMFWFJ01 IC: 109D-FZMFWFJ01
Nokia Solutions and Networks	FWFJ (WCDMA)	Flexi Zone Micro BTS	Part# 473772A.X11 Serial# EB163190025	FCC ID: 2AD8UFZMFWFJ01 IC: 109D-FZMFWFJ01

ENCLOSURE

The EUT enclosure is made of heavy duty aluminum and measures approximately 447(W) x 422(D) x 133(H) mm.

ENCLOSURE

The EUT enclosure is made of heavy duty aluminum and measures approximately 12(W) x 4(D) x 12(H) inches.

AUXILLARY EQUIPMENT

Company	Model	Description	Part/Serial Number	FCC ID/IC Number
N/A	N/A	N/A	N/A	N/A

SUPPORT EQUIPMENT

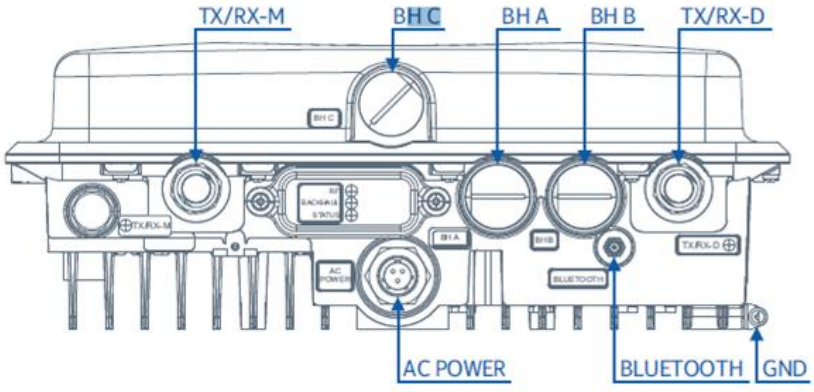
Company	Model	Description	Part/Serial Number	FCC ID/IC Number
Nokia Solutions and Networks	086479A. X31	Nokia Argon HDMI	RY134602016	N/A
HP	Elite Book 8530w	Laptop PC	2CE918Bk1Q	N/A

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Cable	Type	Shield	Length	Used in Test	Quantity	Termination
AC Power	Power	No	~ 3 m	Yes	1	Power Supply
Earth	Earth	No	~ 1 m	Yes	1	Lab earth ground
TX/RD D	RF	Yes	~ 1 m	Yes	1	50Ω Load
TX/RD M	RF	Yes	~ 1 m	Yes	1	50Ω Load
BH B	Signal	Yes	> 6 m	Yes	1	Laptop
BH C	Signal	Yes	> 6 m	Yes	1	Laptop

The connector layout for FWFJ is provided below:



FWFJ External Interfaces:

Interface	Description
AC POWER	MIL-C-38999 standard size 9 shell power connector
BH A	Fiber-only backhaul interface
BH B	Copper-only backhaul interface
BH C	Unused backhaul interface
BLUETOOTH	SMA Bluetooth antenna connector
GND	Grounding
GPS	Type N GPS antenna connector
TX/RX-D	Type N antenna connector (diversity)
TX/RX-M	Type N antenna connector (main)

EUT OPERATION

During testing, the EUT was transmitting continuously with 100% duty-cycle at full power on all ports.

EUT FIRMWARE/SOFTWARE

EUT Firmware for LTE unit: FB_FZM_PS_LFS_OS_2015_03_80-01-0-gbcedd0c

EUT Firmware for WCDMA unit: FB_FZM_PS_LFS_OS_2014_05_102-0-gb723a75

List of Known Clock Frquencies

Flexi Zone Micro BTS Internal Operating Frequencies are as follows:

Frequency	Description	Frequency	Description
32.768 kHz	BT Module Clock	122.8 MHz	K2-Sys, Alt, Arm, TS Ref Clocks
0.35 MHz	Digital Power Switcher	153.6 MHz	FPGA Internal Clock
0.5 MHz	AVS DSP Switcher	156.25 MHz	K2 SGMII Clock
10 MHz	Ref A and Ref B Port Clocks	245.76 MHz	TX/RX Clock
11 MHz	USB full speed Clock	307.2 MHz	FPGA RP 1 Interface Clock
20 MHz	eUSB Clock	480 MHz	USB Flash Data Rate
25 MHz	ENET PHYs and CPLD Clocks	491.52 MHz	TX/RX Data Rate
26 MHz	GPS Module Clock	800 MHz	DDR Clock
30.72 MHz	OCXO Main Ref Clock	1250 MHz	SGMII eNet Clock
38.4 MHz	Catalina TRX Section Ref Clock	1600 MHz	DDR Data Rate
100 MHz	DDRA and DDRB Clocks	3072 MHz	AIF and LMTS Clocks

MODIFICATIONS

No modifications were made to the EUT during testing.

TESTING

GENERAL INFORMATION

Antenna port measurements were taken at NTS Plano branch located at 1701 E Plano Pkwy #150 Plano, TX 75074.

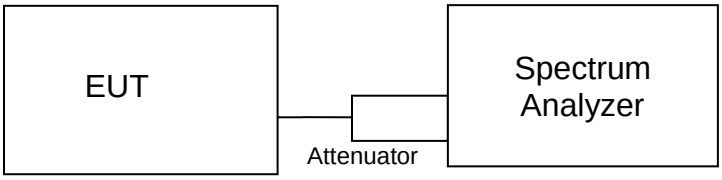
Radiated spurious emissions measurements were taken at the NTS Plano Anechoic Chamber listed below. The sites conform to the requirements of ANSI C63.4-2009 *American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz* and CISPR 16-1-4:2007 - *Specification for radio disturbance and immunity measuring apparatus and methods Part 1-4: Radio disturbance and immunity measuring apparatus Ancillary equipment Radiated disturbances*. They are on file with the FCC and industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 1	A2LA Accredited Designation Number US1077	IC 4319A	1701 E Plano Pkwy #150 Plano, TX 75074.

Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements.

MEASUREMENT PROCEDURES

Output power, emission bandwidth, conducted spurious, conducted bandedge and carrier frequency stability measurements were all performed via a spectrum analyzer connected to the individual RF chains via a 40dB attenuator and an RF cable. The EUT was operating in 2x2 MIMO configuration at full power for all tests. While measuring one transmit chain, others were terminated with termination blocks. All measurements were corrected for the insertion loss of the attenuator and cable inserted between the RF port of the EUT and the spectrum analyzer. Simple test diagram is shown below.



Test Configuration for Antenna Port Measurements

26dB emission bandwidth was measured in accordance with Section 4.1 of FCC KDB 971168 D01 v02r02. 99% occupied bandwidth was measured in accordance with Section 6.6 of RSS-Gen Issue 4. For both measurements an NTS custom software tool was used. Spectrum analyzer settings are shown on their corresponding plots in test results section.

Emissions at the band-edges were also captured with an NTS custom software tool with settings described in the corresponding sections of the FCC and IC rules. Spectrum analyzer settings are shown on their corresponding plots in test results section.

Peak and average output power measurements were performed in accordance with FCC KDB 971168 D01 v02r02. An NTS custom software tool was used for power integration to compensate for resolution bandwidth limitations of the spectrum analyzer and settings are shown on their corresponding plots in test results section.

Peak to average power ratio was calculated in accordance with Section 5.7.2 of FCC KDB 971168 D01 v02r02.

Conducted spurious emissions were captured with TILE6 software which corrected the readings for cable loss and attenuator loss across the 9kHz-20GHz frequency span. Settings of the spectrum analyzer are described in the corresponding test result section.

Transmitter radiated spurious emissions measurements were made in accordance with ANSI C63.4-2009 by measuring the field strength of the emissions from the device at 3m test distance. The eirp limit as specified in the relevant rule part(s) is converted to a field strength at the test distance and the emissions from the EUT are then compared to that limit. Only emissions within 20dB of this limit are subjected to a substitution measurement in accordance with TIA-603-C-2004. Both preliminary and final measurements were performed at the same FCC listed test chamber. Preliminary scans were performed with TILE6 software. This software corrected the measurements for antenna factors, cable losses and pre-amplifier gains. Both polarizations of the receiving

antenna were scanned from 30MHz to 20GHz with a peak detector (RBW=1MHz, VBW=3MHz, with trace max hold over multiple sweeps). Based on the preliminary scan results, frequencies of interest have been maximized via rotating the EUT 360 degrees and varying the height of the test antenna (1m to 4m). Final measurements were also taken with the peak detector as described above. A biconilog antenna was used for 30MHz-1GHz range. A double ridged waveguide horn antenna was used for 1-18GHz range and a smaller double ridged waveguide horn antenna was used for 18-20GHz range. The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. EUT was placed on a non-conductive RF transparent structure to provide 80cm height from the ground floor. A motorized turntable allowed it to be rotated during testing to determine the angle with the highest level of emissions.

Test Equipment

NTS Equipment #	Description	Manufacturer	Model	Calibration Duration	Calibration Due Date
E1345P	PSA	Agilent	E4440A	12 Months	12/30/2016
E1554P	PreAmp (1GHz-40GHz)	MITEQ	JS32-00104000-62-5P	12 Months	1/27/2017
E1148P	PreAmp (30MHz-1GHz)	MITEQ	AM-1431-N-1179WP	12 Months	9/29/2016
E1524P	Biconilog Antenna (30MHz-1GHz)	ETS Lindgren	3142D	12 Months	10/28/2016
E1149P	Horn Antenna (1GHz-18GHz)	EMCO	3115	12 Months	12/16/2016

Appendix A LTE Test Data

RF Output Power

RF output power has been measured in both Peak and RMS Average terms for each transmit chain at center channel for all modulations and bandwidth modes.. Peak to average ratio (PAR) has been calculated as described in Section 5.7.2 of KDB971168 D01 v02r02 and all results are presented in tabular form below.

		LTE - QPSK			LTE - 16QAM			LTE - 64QAM		
		Peak (dBm)	Average (dBm)	PAR (dB)	Peak (dBm)	Average (dBm)	PAR (dB)	Peak (dBm)	Average (dBm)	PAR (dB)
M Port Center Channel	5M	44.28	36.34	7.94	44.29	36.48	7.81	44.3	36.55	7.75
	10M	44.51	36.5	8.01	44.52	36.47	8.05	44.49	36.54	7.95
	15M	44.62	36.57	8.05	44.59	36.52	8.07	44.53	36.55	7.98
	20M	44.63	36.58	8.05	44.68	36.63	8.05	44.63	36.57	8.06
D Port Center Channel	5M	44.3	36.23	8.07	44.23	36.48	7.75	44.34	36.43	7.91
	10M	44.55	36.49	8.06	44.58	36.56	8.02	44.51	36.56	7.95
	15M	44.59	36.45	8.14	44.7	36.59	8.11	44.6	36.5	8.1
	20M	44.65	36.64	8.01	44.77	36.68	8.09	44.64	36.66	7.98
Combined Center Channel	5M	47.3	39.3	8	47.27	39.49	7.78	47.33	39.5	7.83
	10M	47.54	39.51	8.03	47.56	39.53	8.03	47.51	39.56	7.95
	15M	47.62	39.52	8.1	47.66	39.57	8.09	47.58	39.54	8.04
	20M	47.65	39.62	8.03	47.74	39.67	8.07	47.65	39.63	8.02

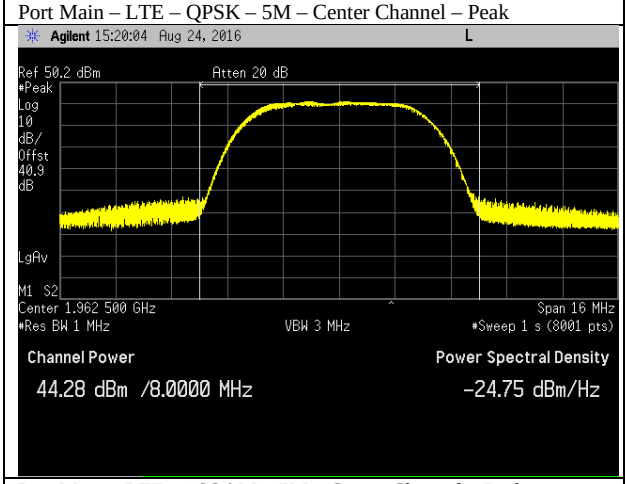
Based on the results above, Diversity Port had the highest RMS average power and therefore it was selected for all the remaining LTE mode antenna port tests on the product.

Subsequently output power levels on lowest and highest channels were tested only on Diversity Port and results presented below.

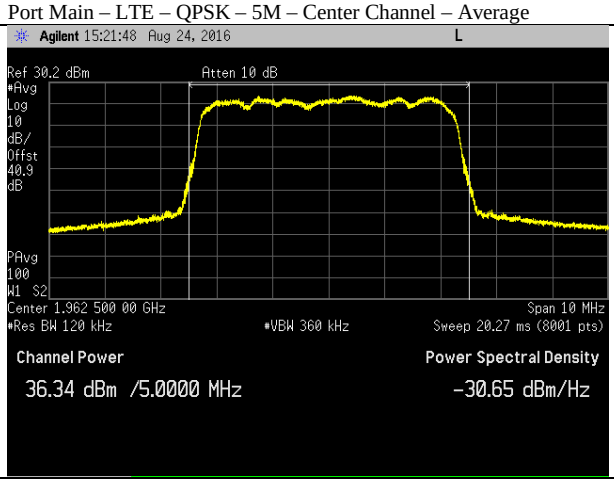
		LTE - QPSK			LTE - 16QAM			LTE - 64QAM		
		Peak (dBm)	Average (dBm)	PAR (dB)	Peak (dBm)	Average (dBm)	PAR (dB)	Peak (dBm)	Average (dBm)	PAR (dB)
D Port Low Channel	5M	44	36.35	7.65	44.05	36.49	7.56	44.16	36.39	7.77
	10M	44.51	36.46	8.05	44.5	36.5	8	44.41	36.54	7.87
	15M	44.76	36.6	8.16	44.88	36.79	8.09	44.83	36.81	8.02
	20M	44.94	36.91	8.03	44.96	36.93	8.03	44.96	36.87	8.09
D Port High Channel	5M	43.97	36.2	7.77	44.08	36.59	7.49	44.18	36.39	7.79
	10M	44.5	36.4	8.1	44.41	36.5	7.91	44.41	36.49	7.92
	15M	44.55	36.54	8.01	44.73	36.67	8.06	44.67	36.6	8.07
	20M	44.69	36.56	8.13	44.61	36.51	8.1	44.58	36.59	7.99

All corresponding plots included on the following pages. Total path loss of 40.9dB accounted in via reference level offset to the spectrum analyzer.

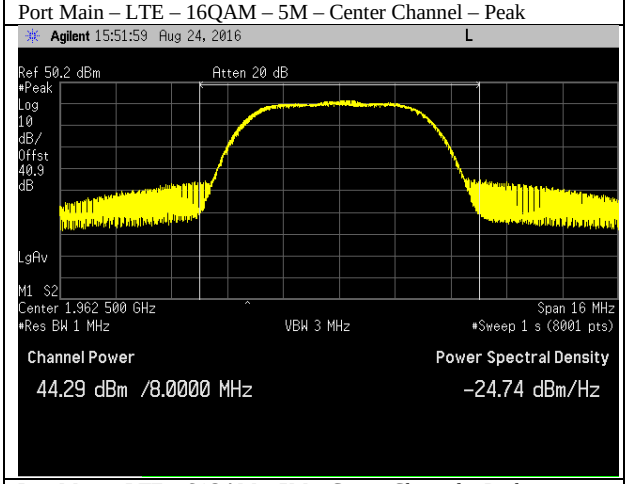
Port Main – LTE – QPSK – 5M – Center Channel – Peak



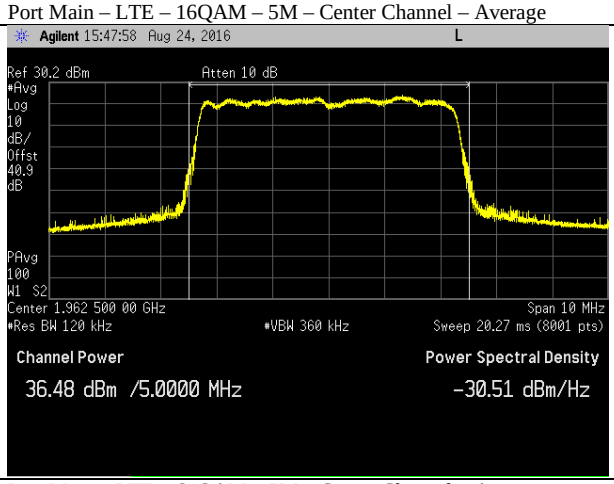
Port Main – LTE – QPSK – 5M – Center Channel – Average



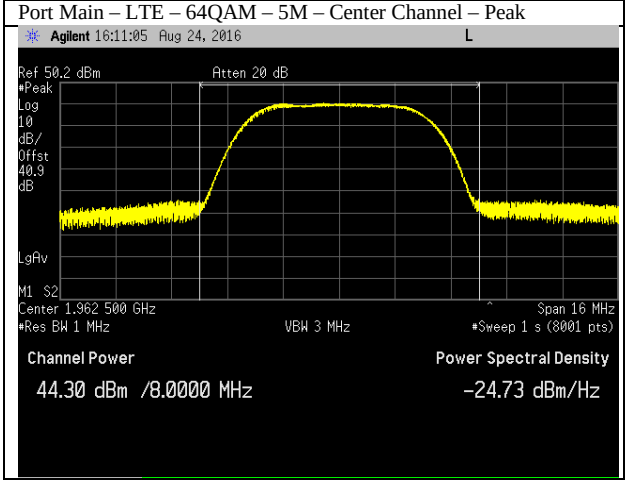
Port Main – LTE – 16QAM – 5M – Center Channel – Peak



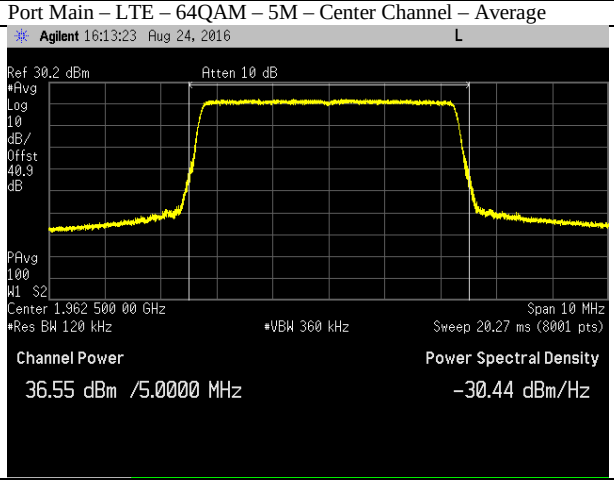
Port Main – LTE – 16QAM – 5M – Center Channel – Average



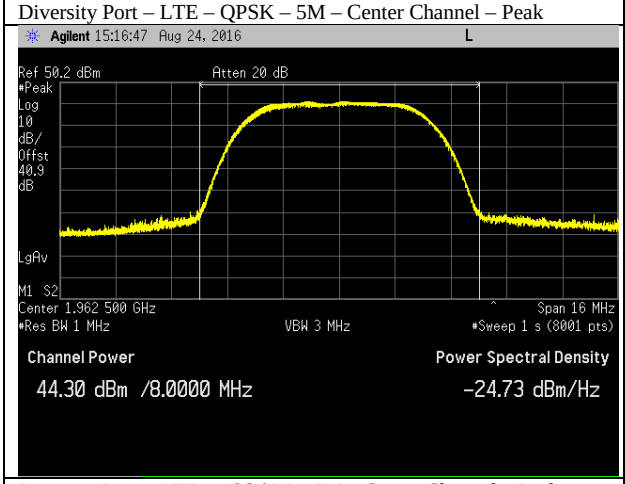
Port Main – LTE – 64QAM – 5M – Center Channel – Peak



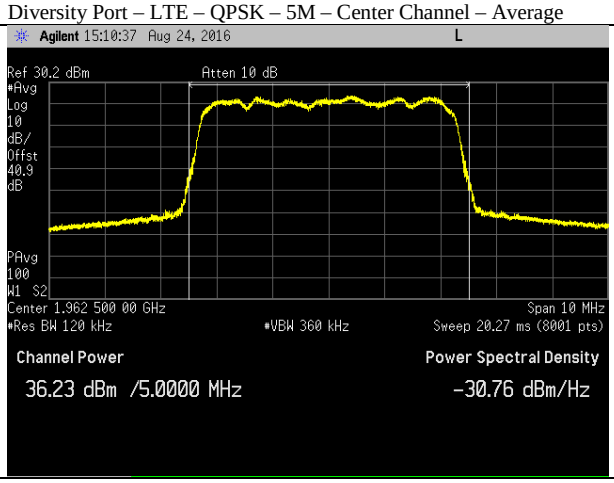
Port Main – LTE – 64QAM – 5M – Center Channel – Average



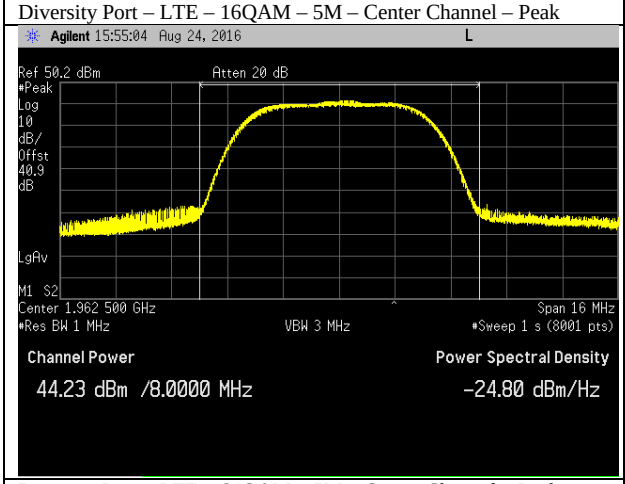
Diversity Port – LTE – QPSK – 5M – Center Channel – Peak



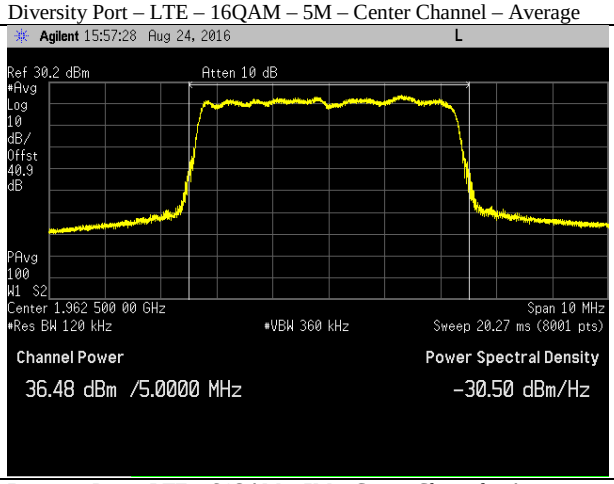
Diversity Port – LTE – QPSK – 5M – Center Channel – Average



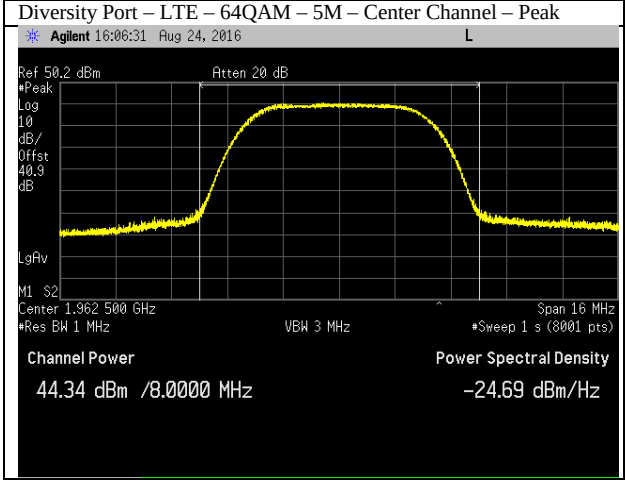
Diversity Port – LTE – 16QAM – 5M – Center Channel – Peak



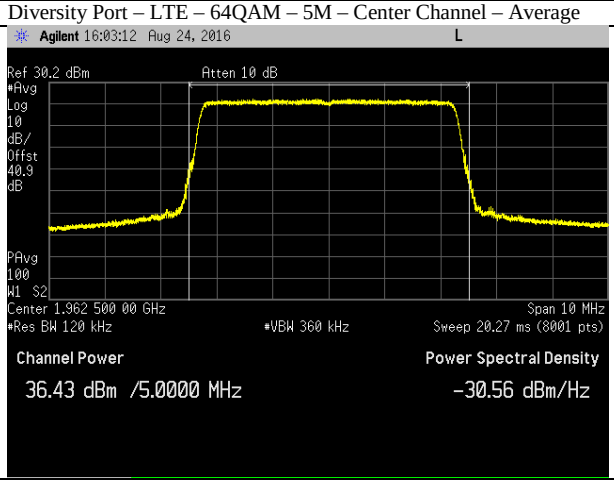
Diversity Port – LTE – 16QAM – 5M – Center Channel – Average



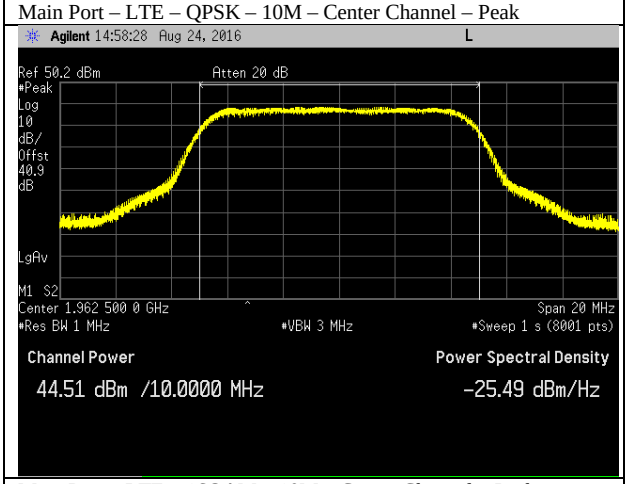
Diversity Port – LTE – 64QAM – 5M – Center Channel – Peak



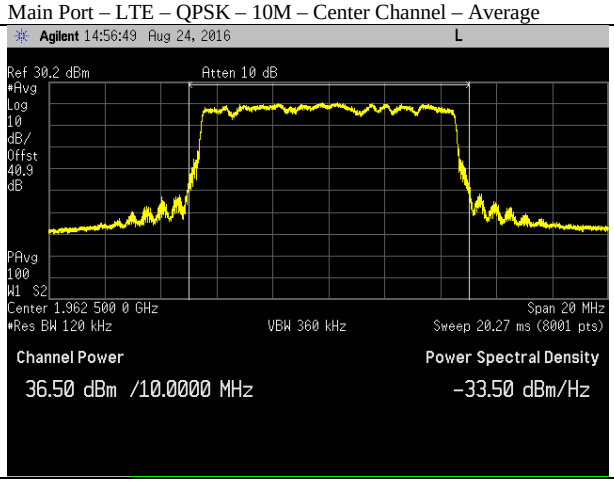
Diversity Port – LTE – 64QAM – 5M – Center Channel – Average



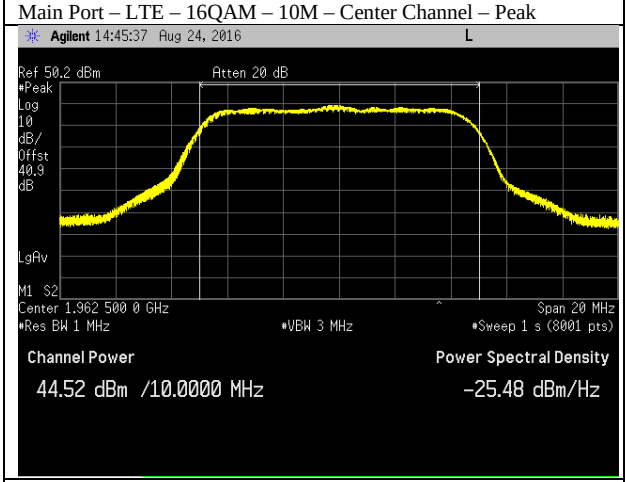
Main Port – LTE – QPSK – 10M – Center Channel – Peak



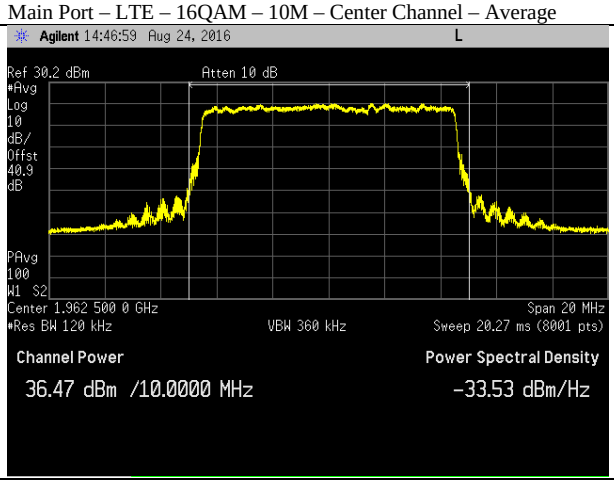
Main Port – LTE – QPSK – 10M – Center Channel – Average



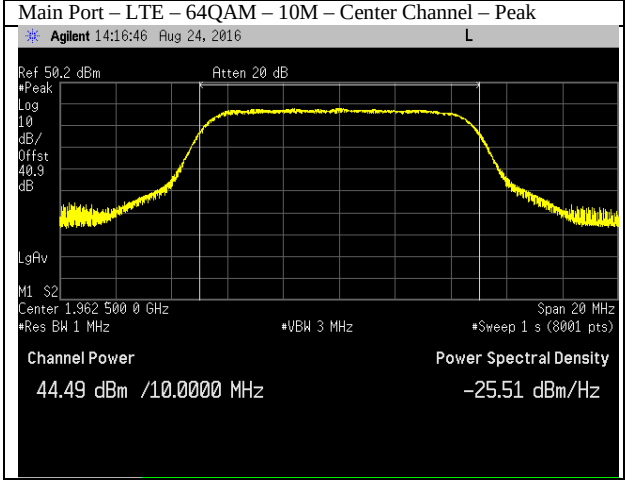
Main Port – LTE – 16QAM – 10M – Center Channel – Peak



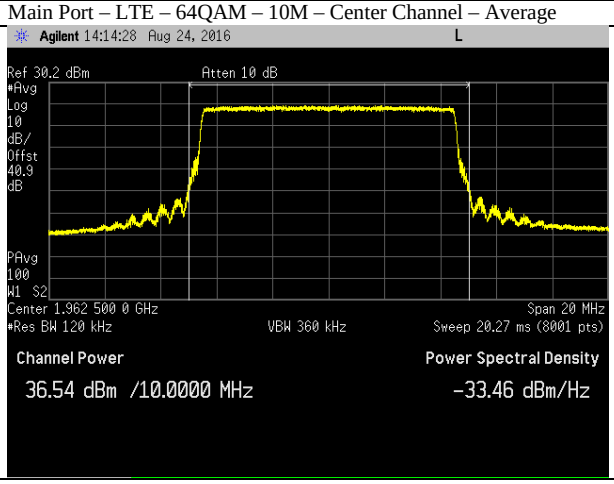
Main Port – LTE – 16QAM – 10M – Center Channel – Average



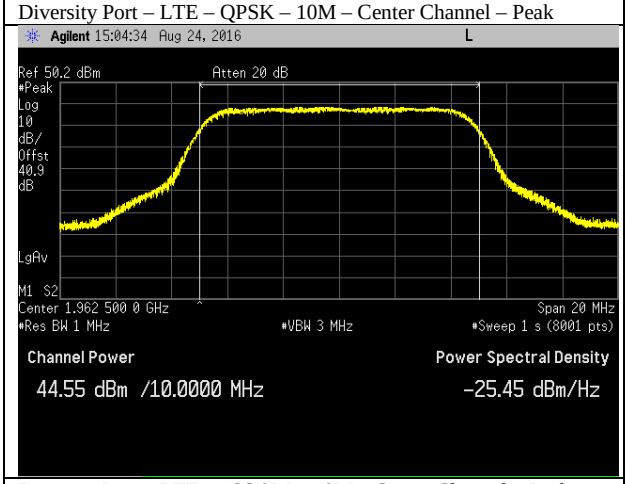
Main Port – LTE – 64QAM – 10M – Center Channel – Peak



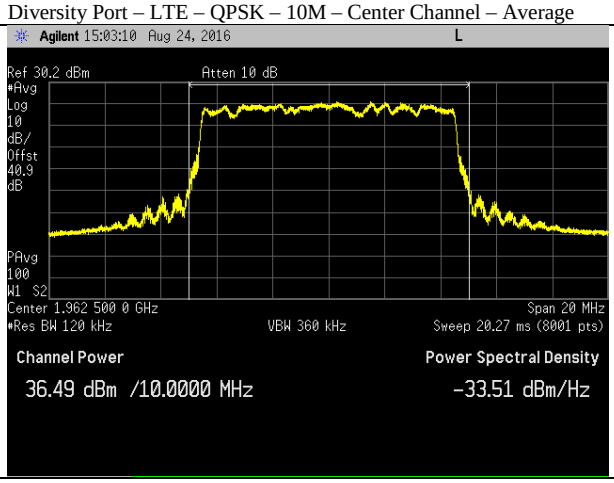
Main Port – LTE – 64QAM – 10M – Center Channel – Average



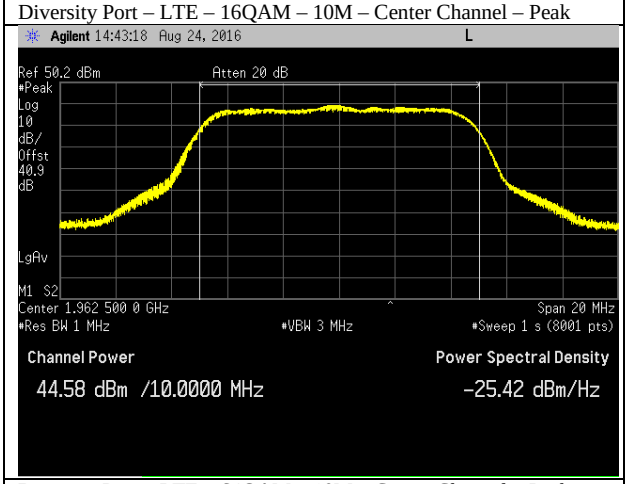
Diversity Port – LTE – QPSK – 10M – Center Channel – Peak



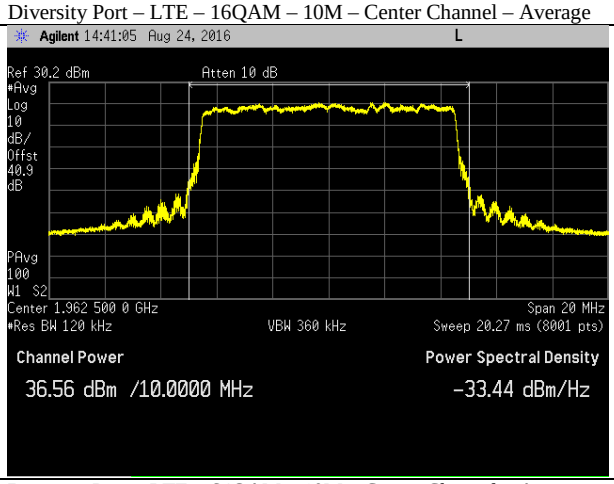
Diversity Port – LTE – QPSK – 10M – Center Channel – Average



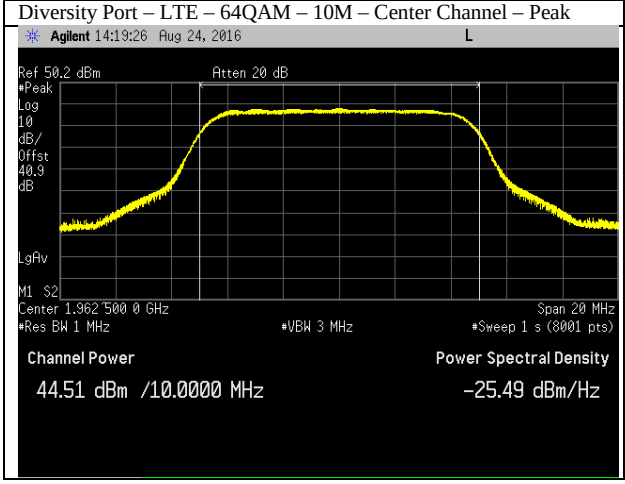
Diversity Port – LTE – 16QAM – 10M – Center Channel – Peak



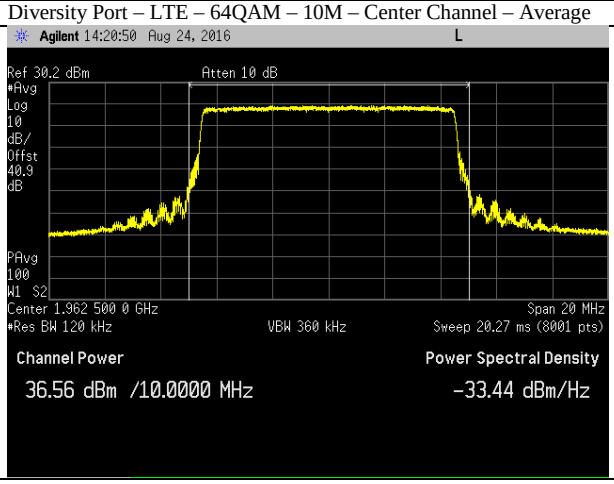
Diversity Port – LTE – 16QAM – 10M – Center Channel – Average



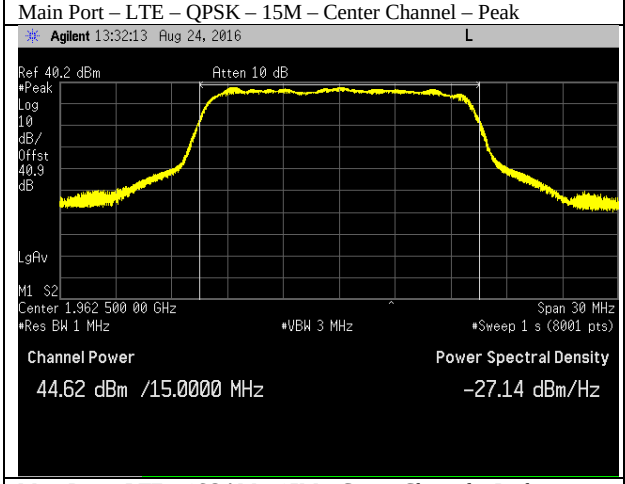
Diversity Port – LTE – 64QAM – 10M – Center Channel – Peak



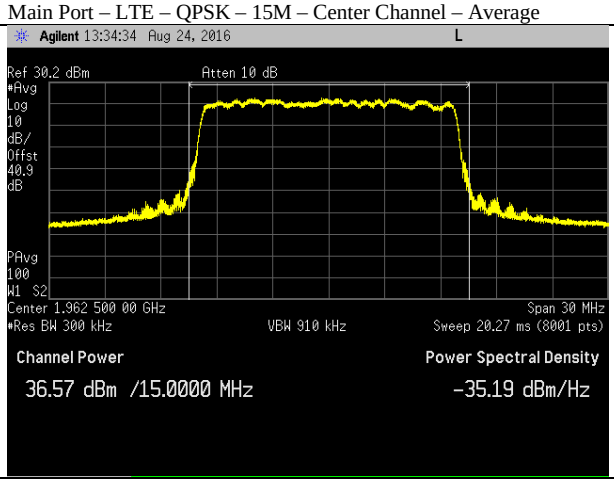
Diversity Port – LTE – 64QAM – 10M – Center Channel – Average



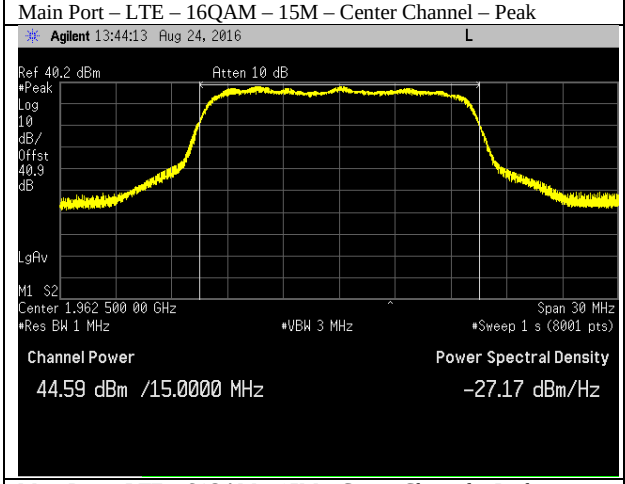
Main Port – LTE – QPSK – 15M – Center Channel – Peak



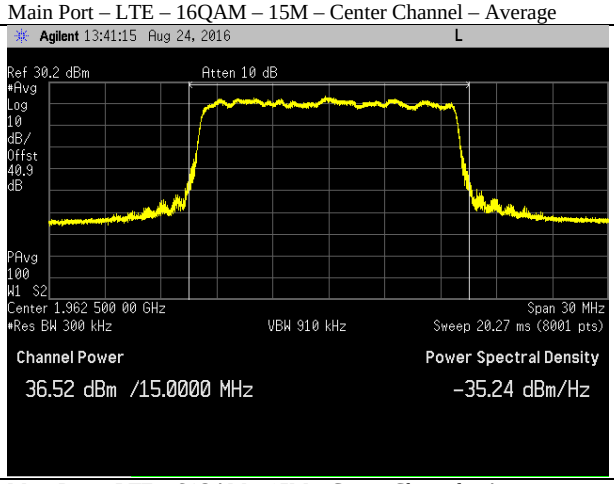
Main Port – LTE – QPSK – 15M – Center Channel – Average



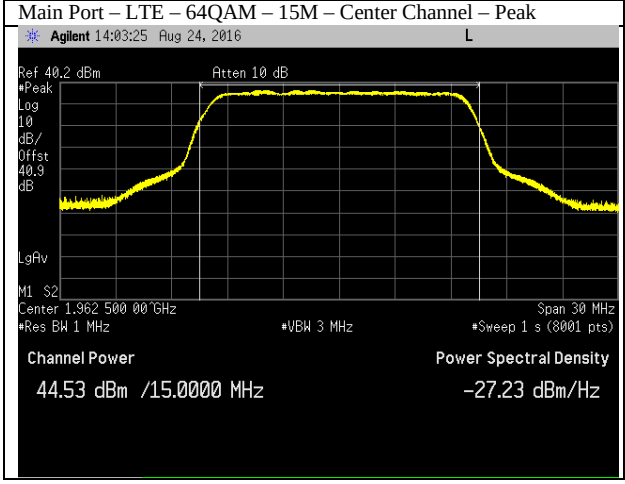
Main Port – LTE – 16QAM – 15M – Center Channel – Peak



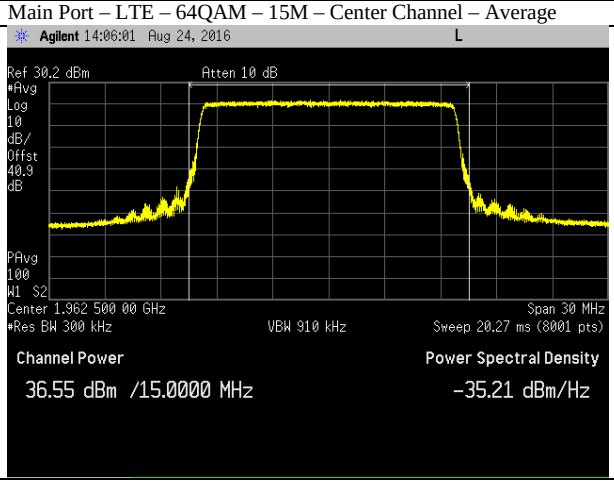
Main Port – LTE – 16QAM – 15M – Center Channel – Average



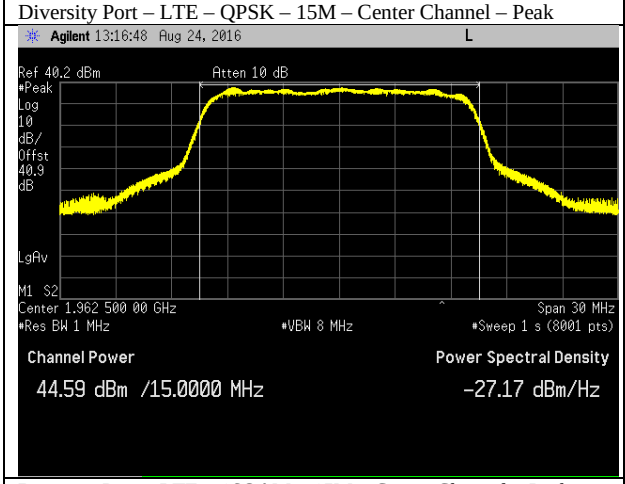
Main Port – LTE – 64QAM – 15M – Center Channel – Peak



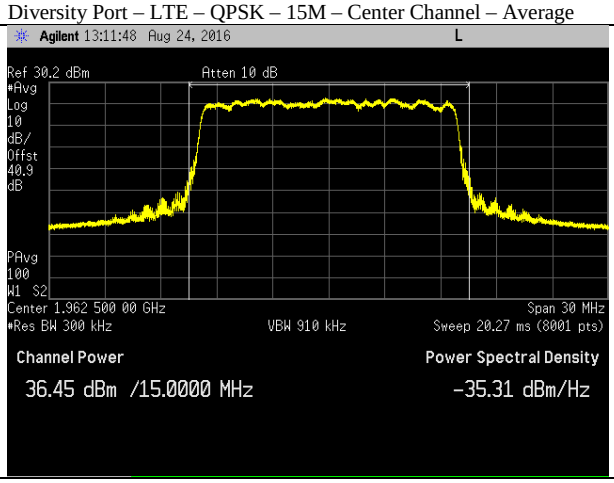
Main Port – LTE – 64QAM – 15M – Center Channel – Average



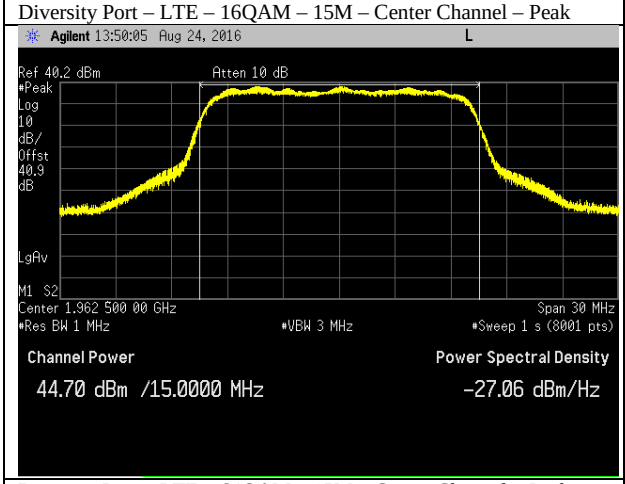
Diversity Port – LTE – QPSK – 15M – Center Channel – Peak



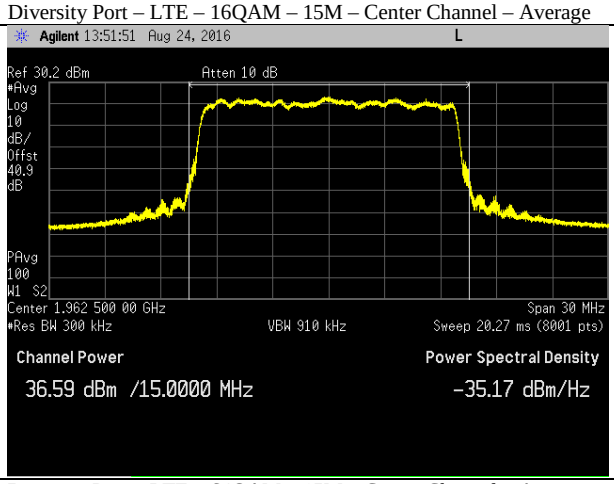
Diversity Port – LTE – QPSK – 15M – Center Channel – Average



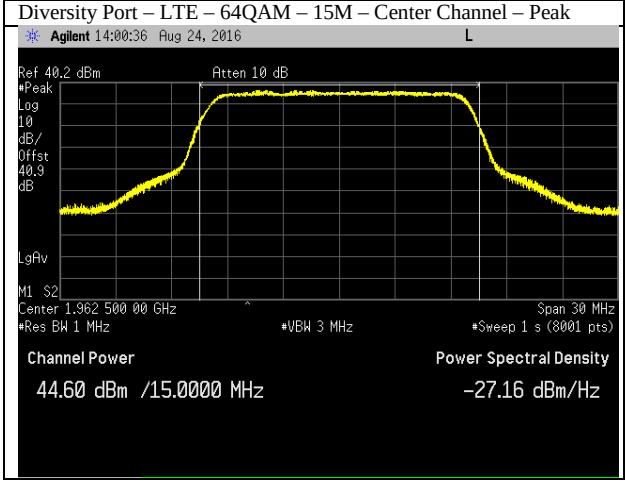
Diversity Port – LTE – 16QAM – 15M – Center Channel – Peak



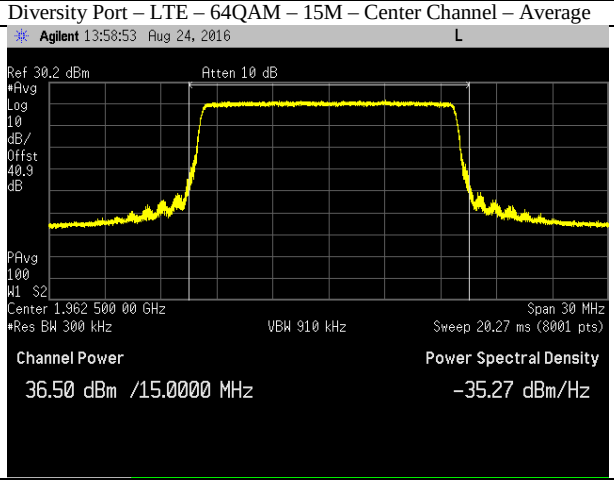
Diversity Port – LTE – 16QAM – 15M – Center Channel – Average



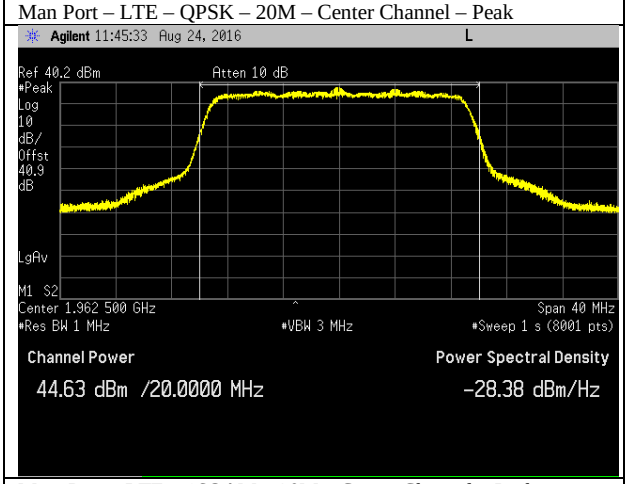
Diversity Port – LTE – 64QAM – 15M – Center Channel – Peak



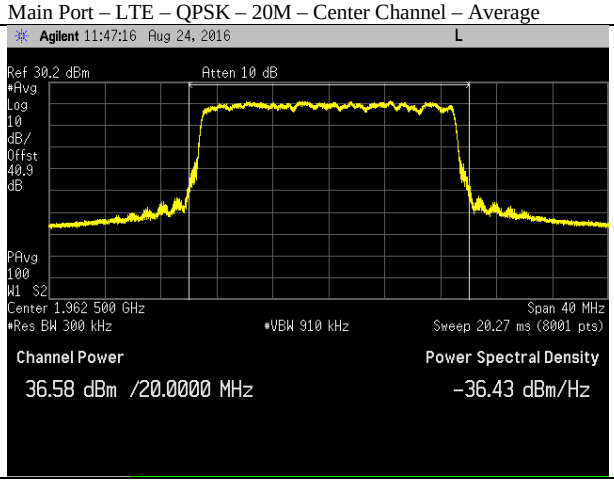
Diversity Port – LTE – 64QAM – 15M – Center Channel – Average



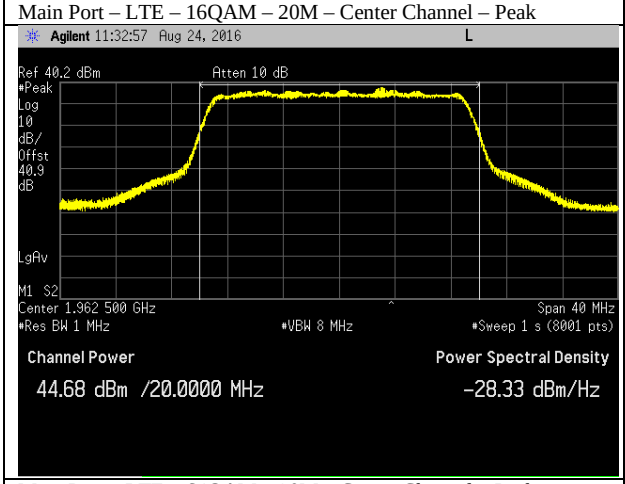
Man Port – LTE – QPSK – 20M – Center Channel – Peak



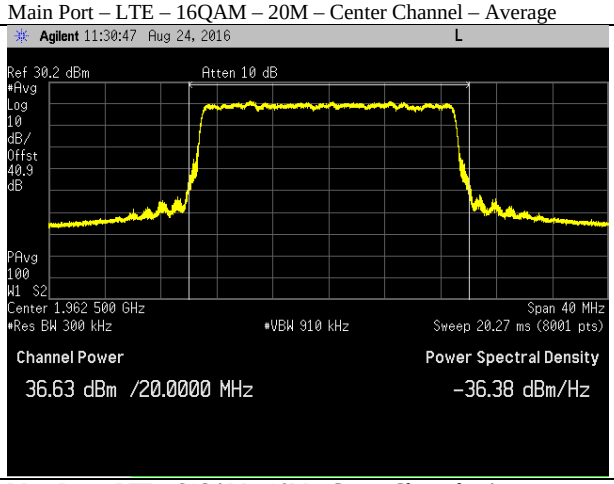
Main Port – LTE – QPSK – 20M – Center Channel – Average



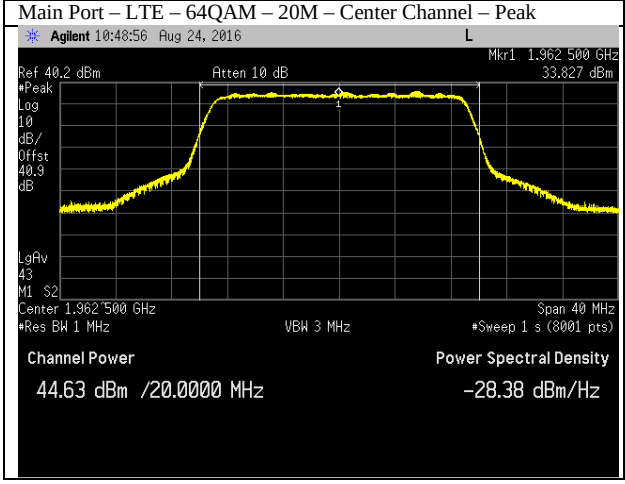
Main Port – LTE – 16QAM – 20M – Center Channel – Peak



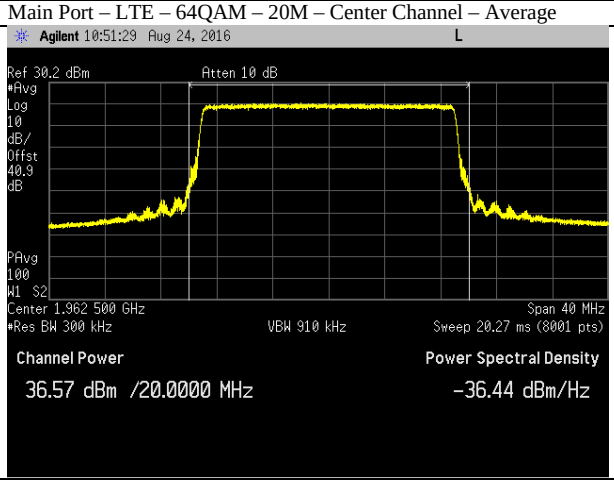
Main Port – LTE – 16QAM – 20M – Center Channel – Average



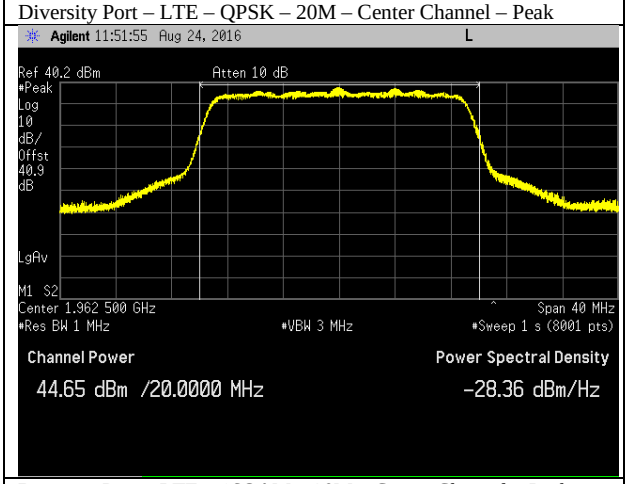
Main Port – LTE – 64QAM – 20M – Center Channel – Peak



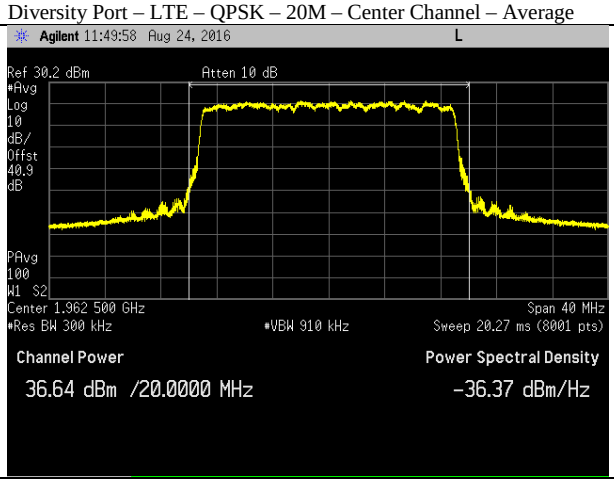
Main Port – LTE – 64QAM – 20M – Center Channel – Average



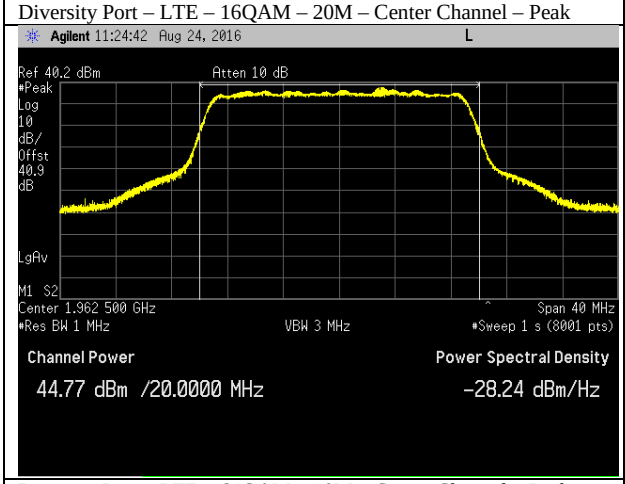
Diversity Port – LTE – QPSK – 20M – Center Channel – Peak



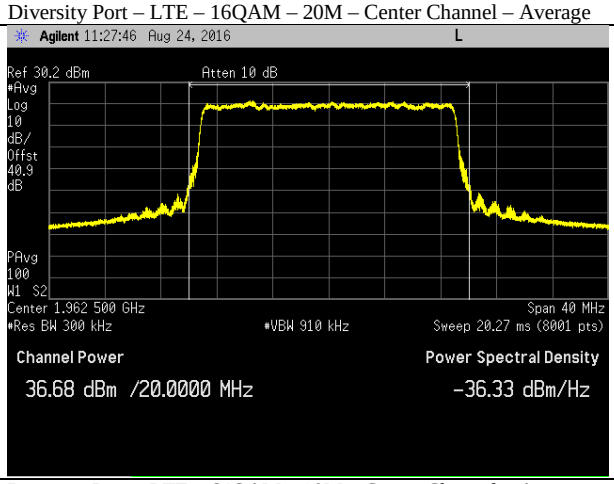
Diversity Port – LTE – QPSK – 20M – Center Channel – Average



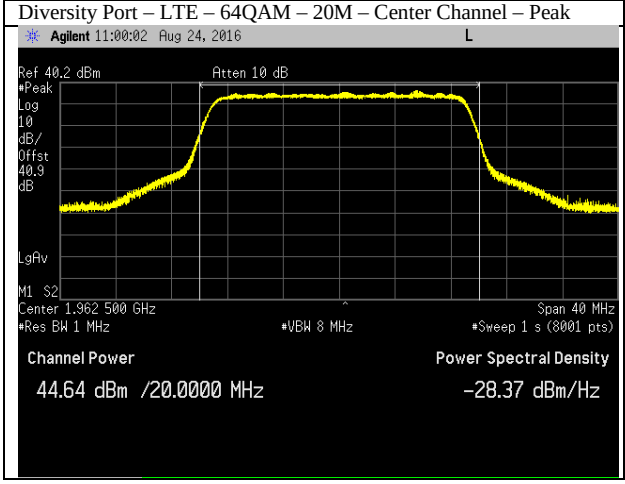
Diversity Port – LTE – 16QAM – 20M – Center Channel – Peak



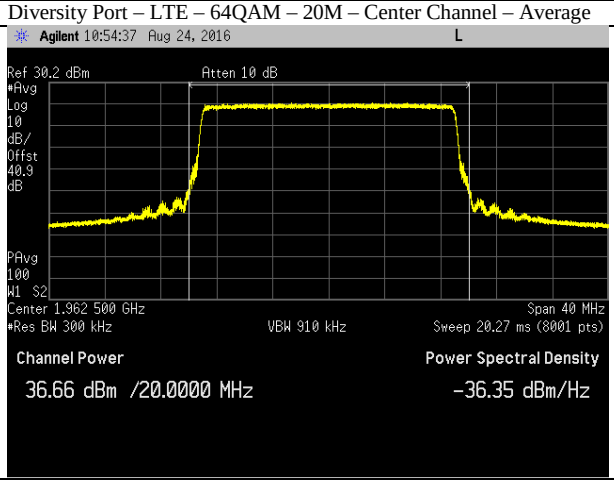
Diversity Port – LTE – 16QAM – 20M – Center Channel – Average



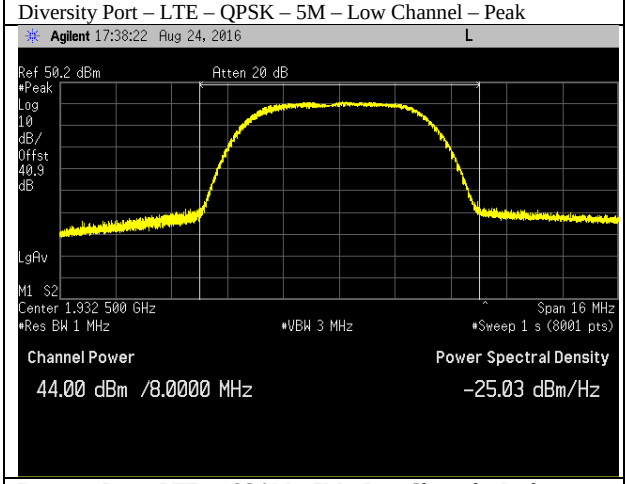
Diversity Port – LTE – 64QAM – 20M – Center Channel – Peak



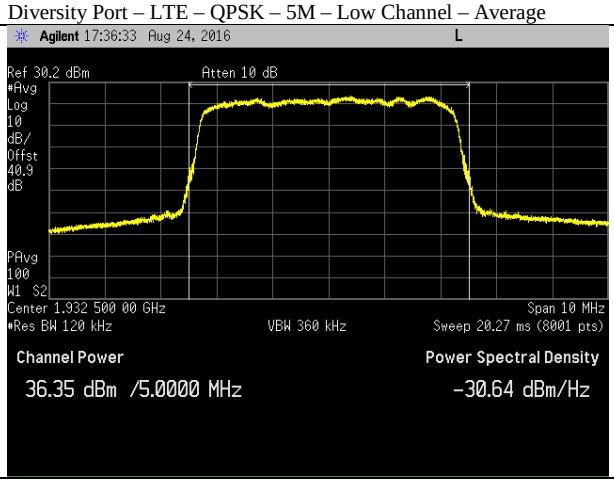
Diversity Port – LTE – 64QAM – 20M – Center Channel – Average



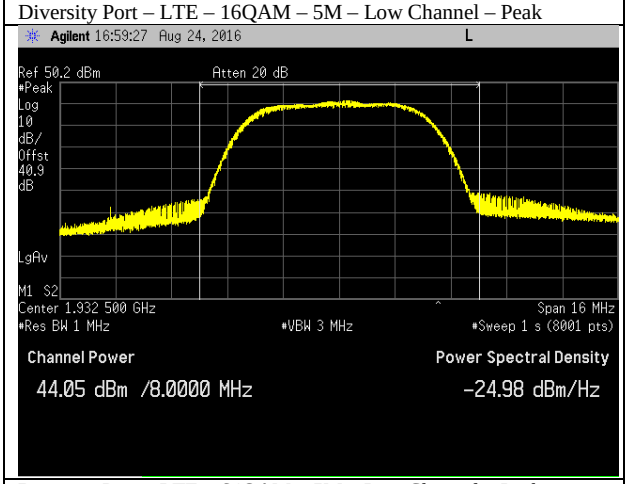
Diversity Port – LTE – QPSK – 5M – Low Channel – Peak



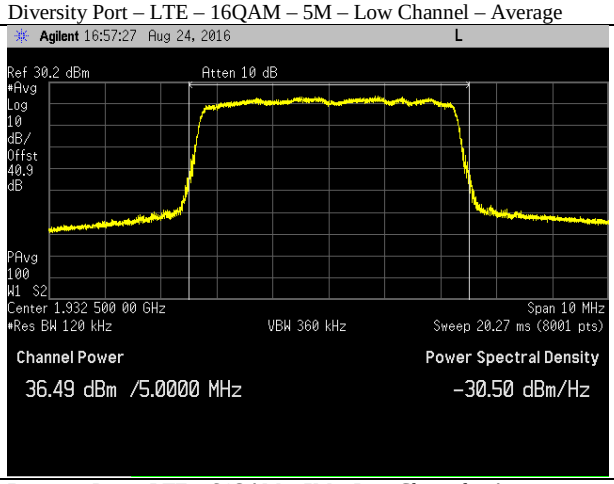
Diversity Port – LTE – QPSK – 5M – Low Channel – Average



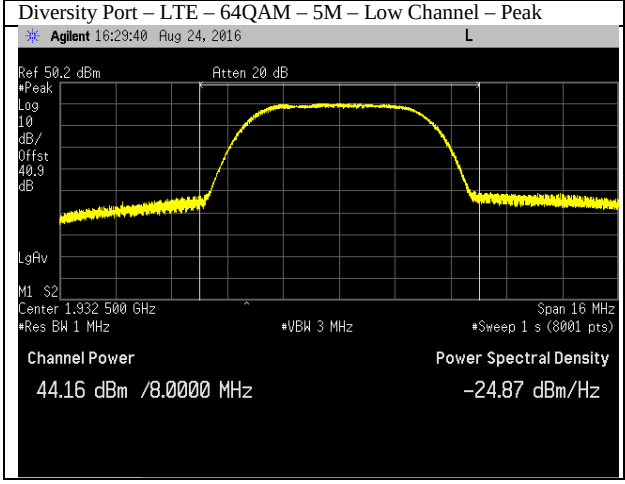
Diversity Port – LTE – 16QAM – 5M – Low Channel – Peak



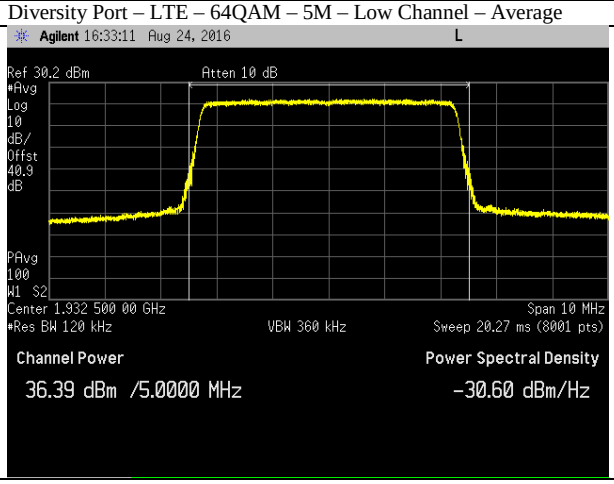
Diversity Port – LTE – 16QAM – 5M – Low Channel – Average



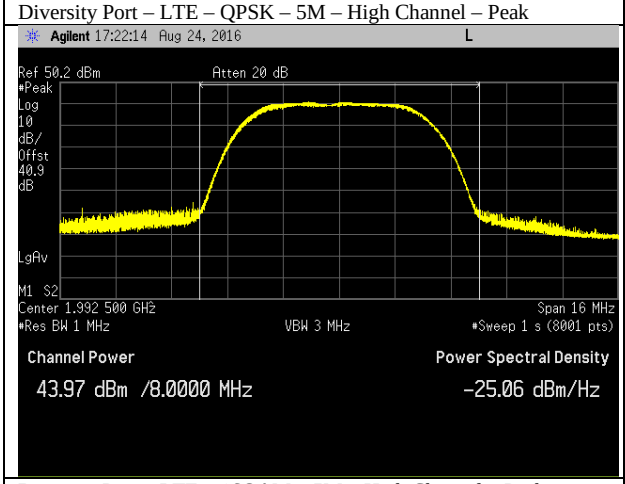
Diversity Port – LTE – 64QAM – 5M – Low Channel – Peak



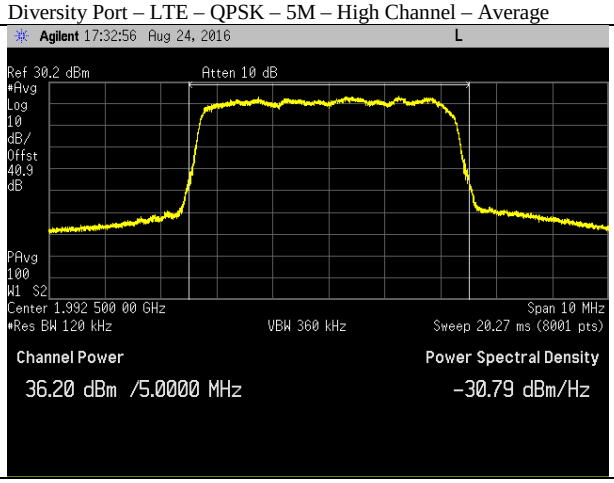
Diversity Port – LTE – 64QAM – 5M – Low Channel – Average



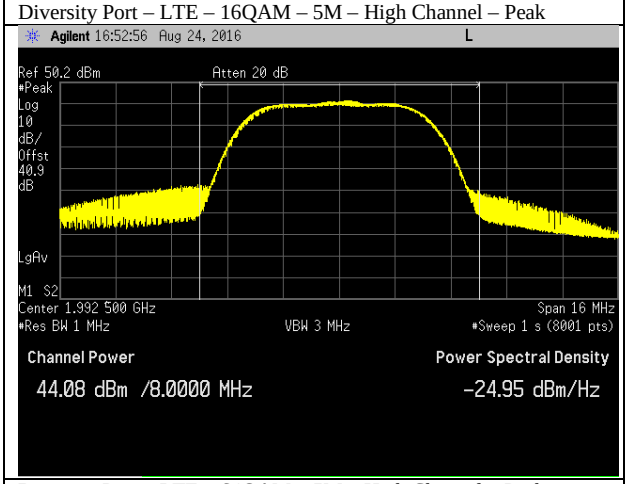
Diversity Port – LTE – QPSK – 5M – High Channel – Peak



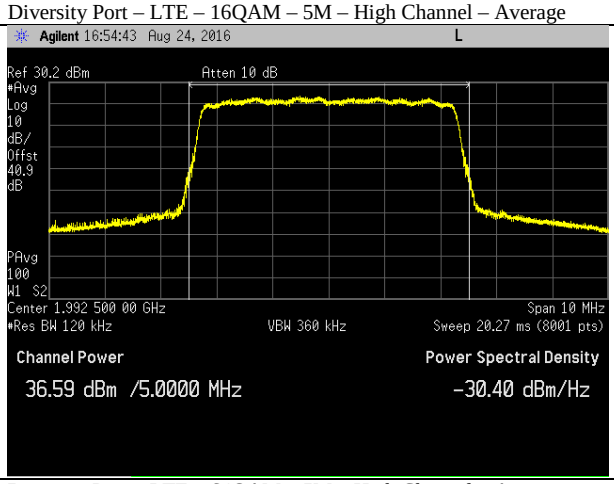
Diversity Port – LTE – QPSK – 5M – High Channel – Average



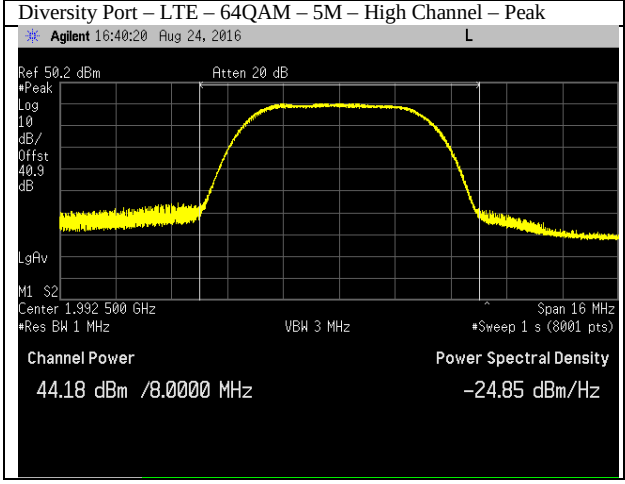
Diversity Port – LTE – 16QAM – 5M – High Channel – Peak



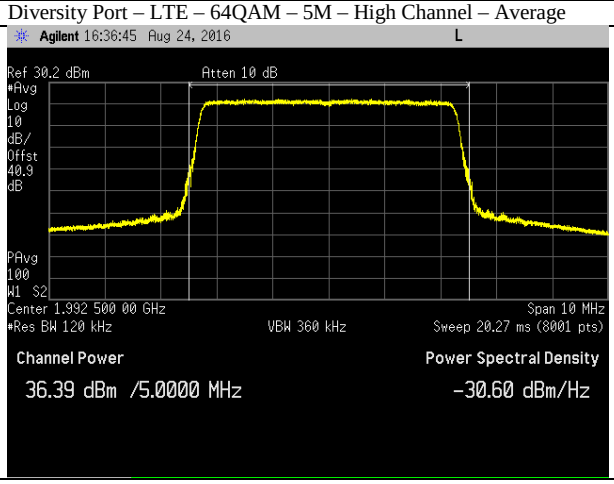
Diversity Port – LTE – 16QAM – 5M – High Channel – Average



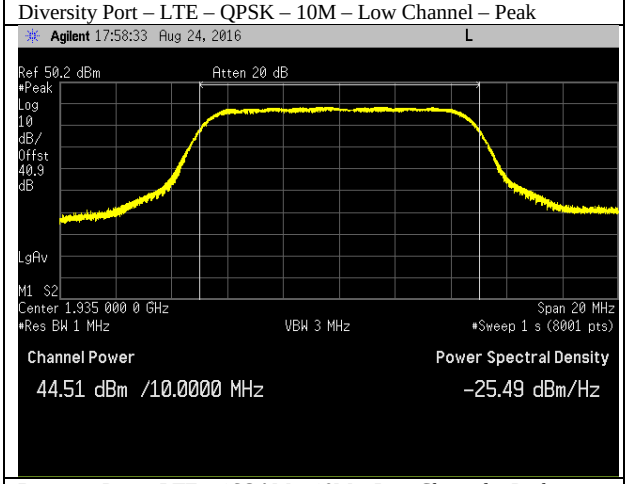
Diversity Port – LTE – 64QAM – 5M – High Channel – Peak



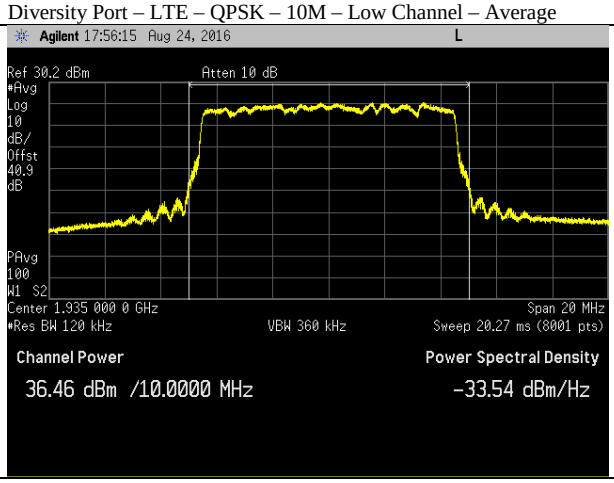
Diversity Port – LTE – 64QAM – 5M – High Channel – Average



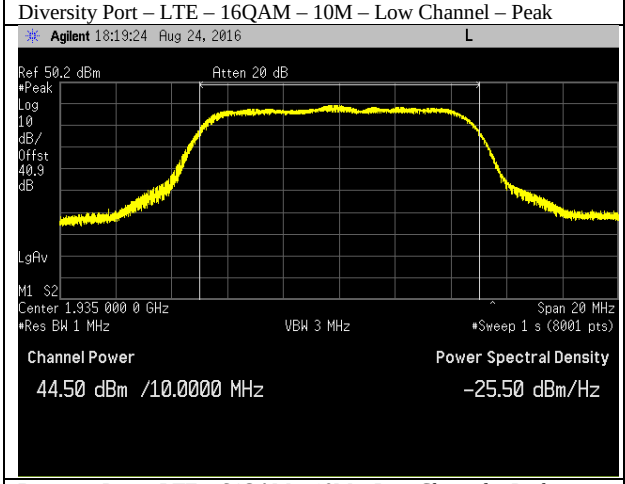
Diversity Port – LTE – QPSK – 10M – Low Channel – Peak



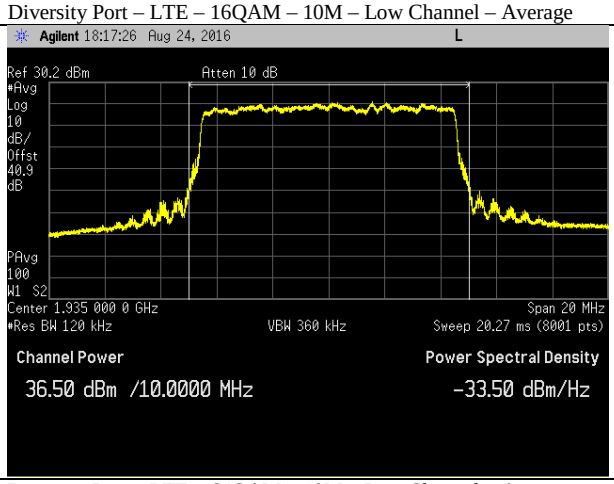
Diversity Port – LTE – QPSK – 10M – Low Channel – Average



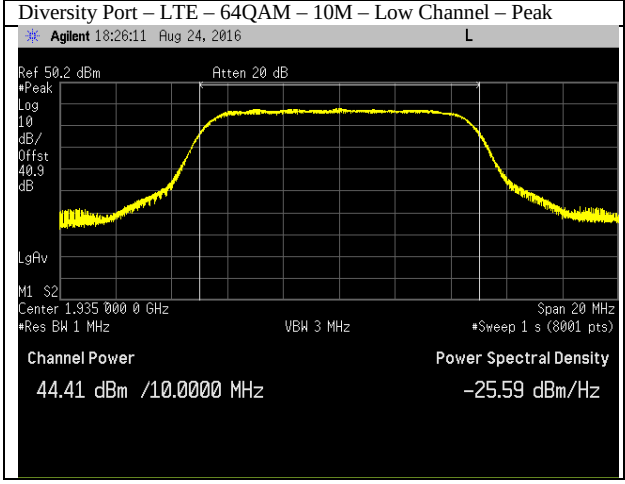
Diversity Port – LTE – 16QAM – 10M – Low Channel – Peak



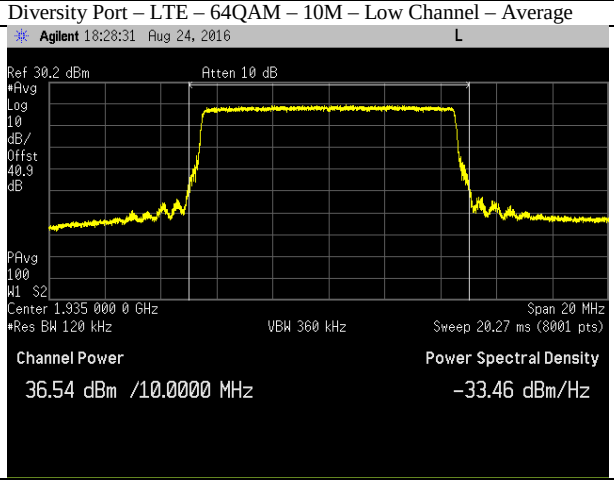
Diversity Port – LTE – 16QAM – 10M – Low Channel – Average



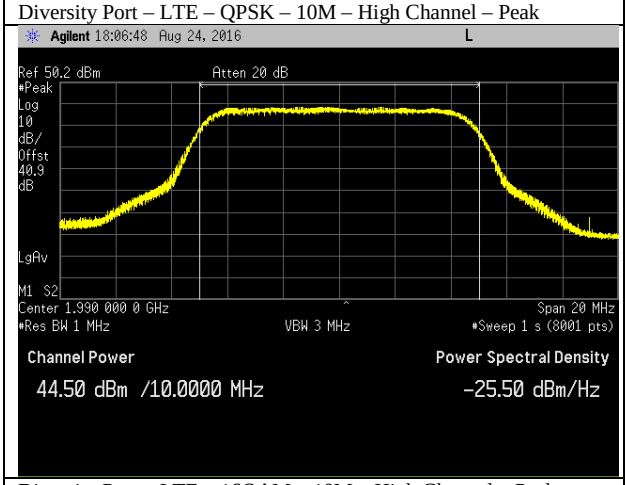
Diversity Port – LTE – 64QAM – 10M – Low Channel – Peak



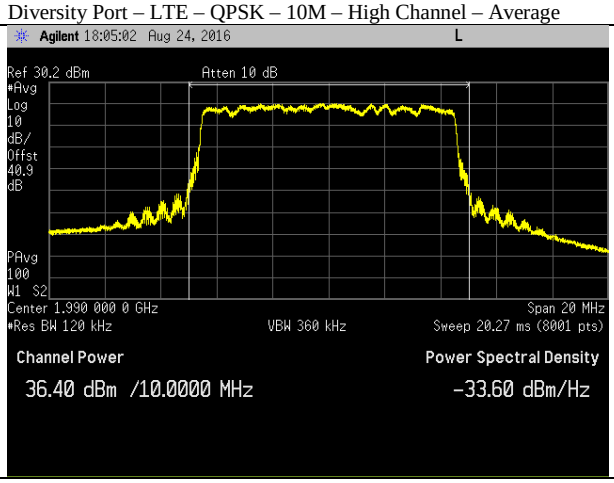
Diversity Port – LTE – 64QAM – 10M – Low Channel – Average



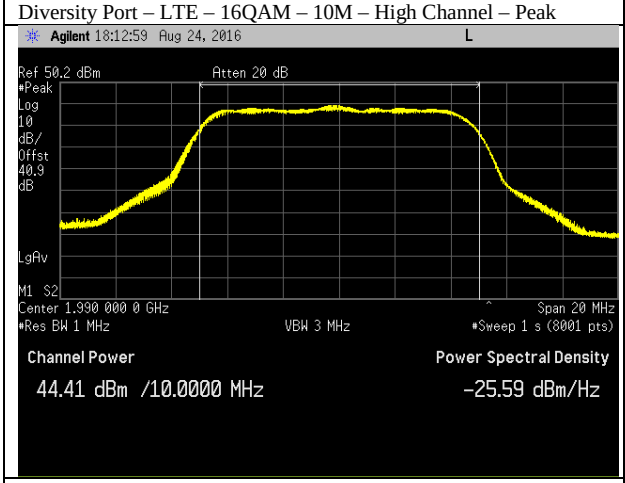
Diversity Port – LTE – QPSK – 10M – High Channel – Peak



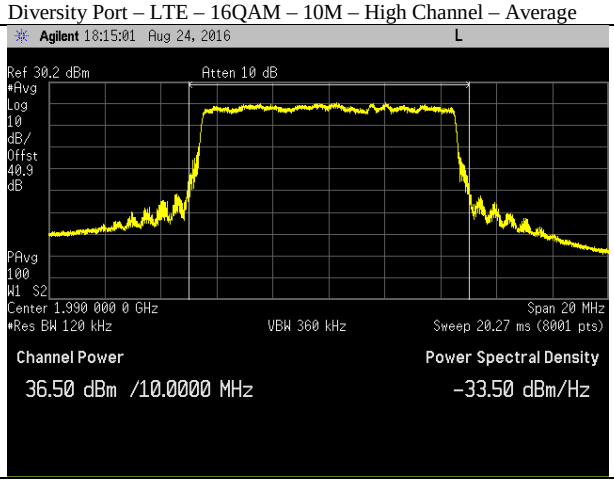
Diversity Port – LTE – QPSK – 10M – High Channel – Average



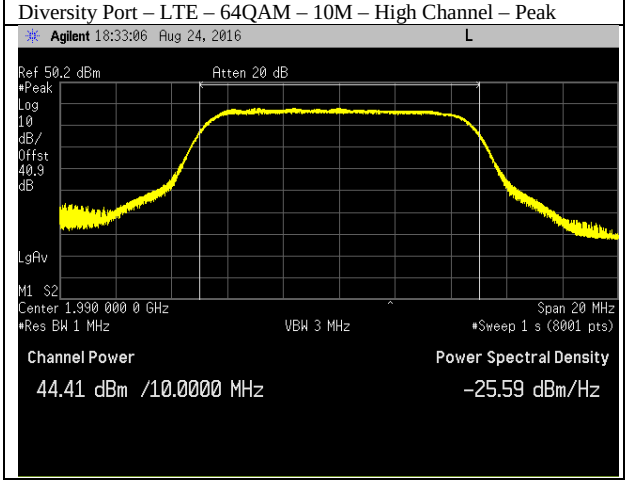
Diversity Port – LTE – 16QAM – 10M – High Channel – Peak



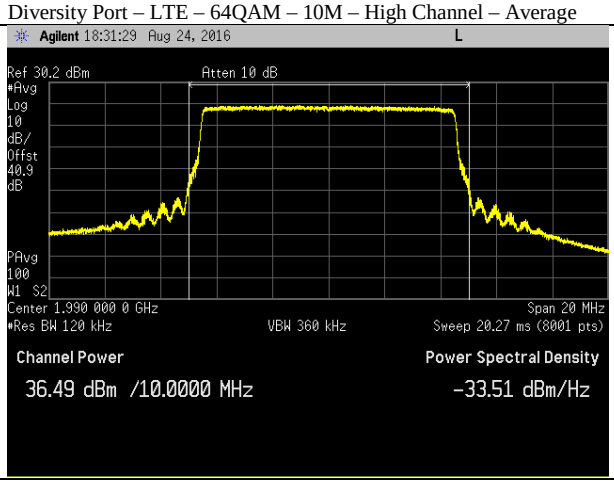
Diversity Port – LTE – 16QAM – 10M – High Channel – Average



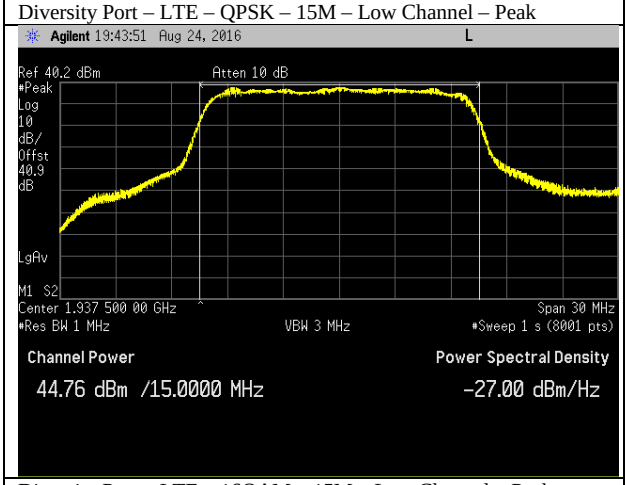
Diversity Port – LTE – 64QAM – 10M – High Channel – Peak



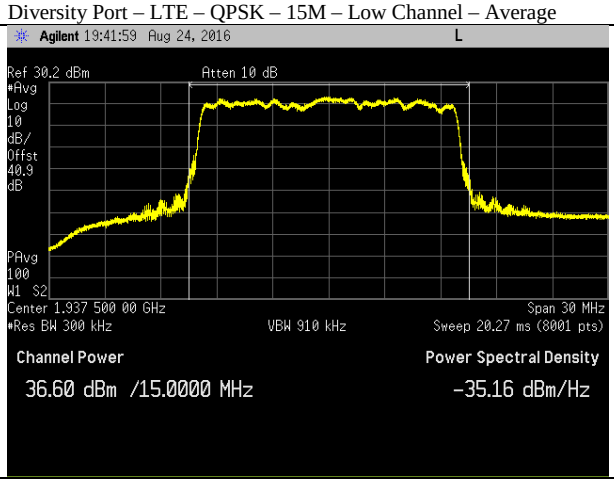
Diversity Port – LTE – 64QAM – 10M – High Channel – Average



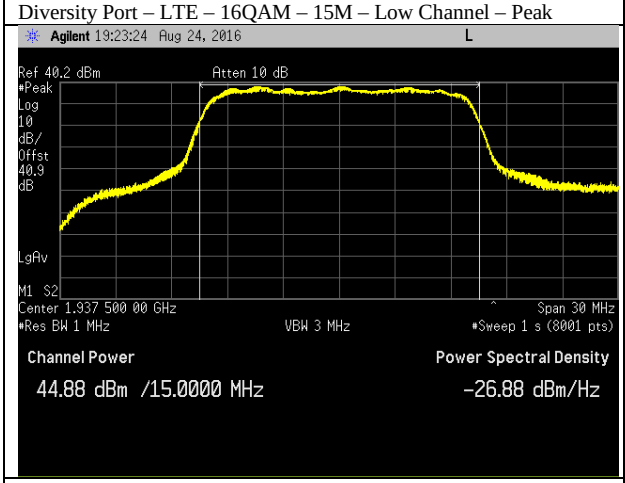
Diversity Port – LTE – QPSK – 15M – Low Channel – Peak



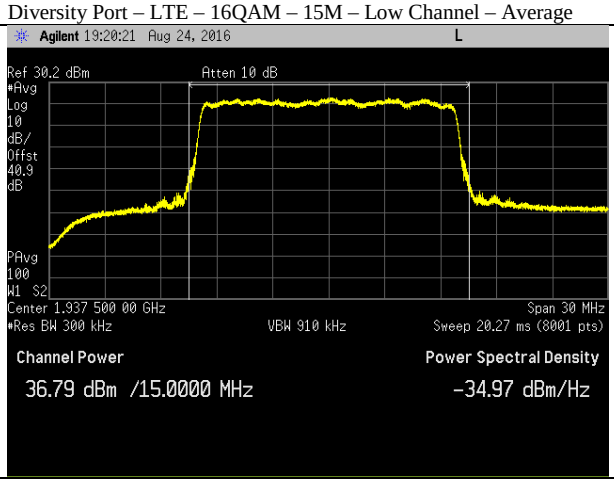
Diversity Port – LTE – QPSK – 15M – Low Channel – Average



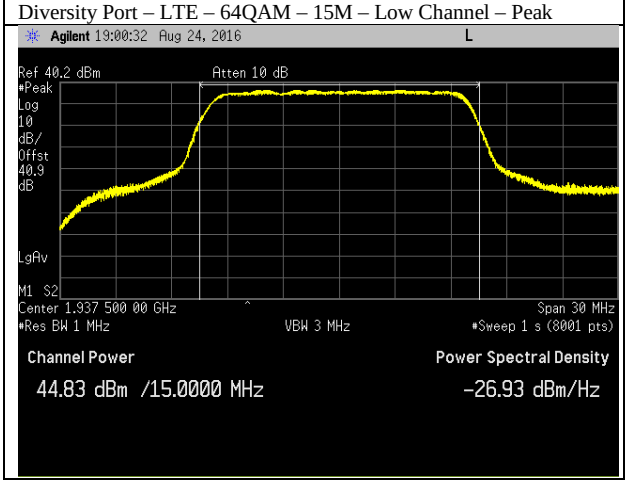
Diversity Port – LTE – 16QAM – 15M – Low Channel – Peak



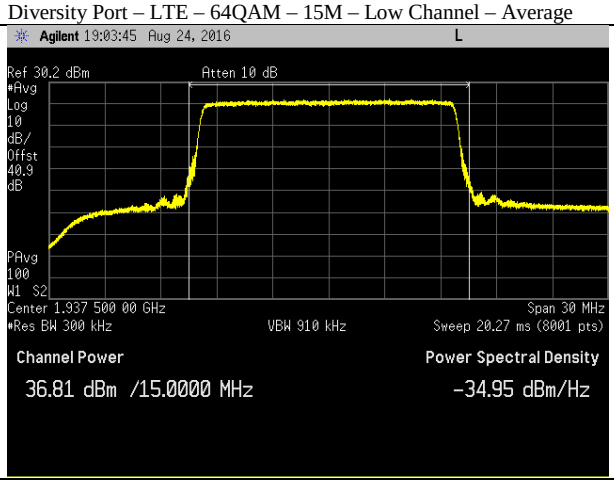
Diversity Port – LTE – 16QAM – 15M – Low Channel – Average



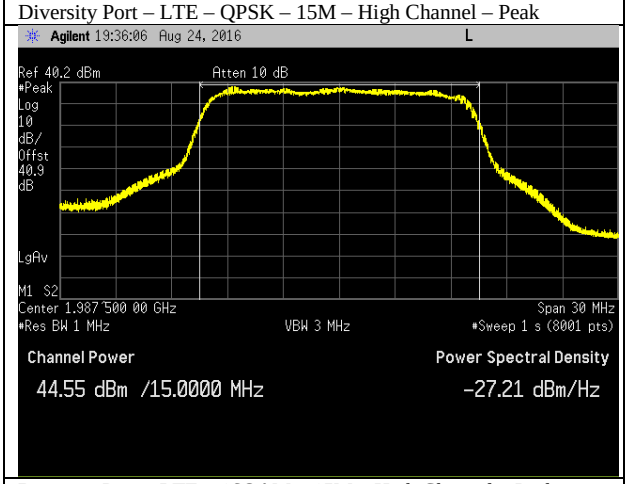
Diversity Port – LTE – 64QAM – 15M – Low Channel – Peak



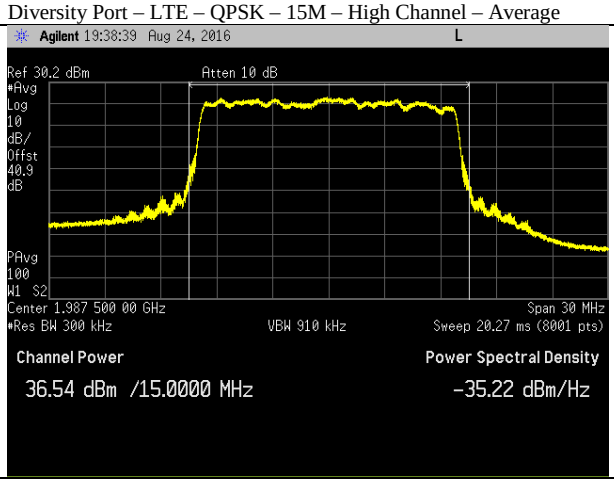
Diversity Port – LTE – 64QAM – 15M – Low Channel – Average



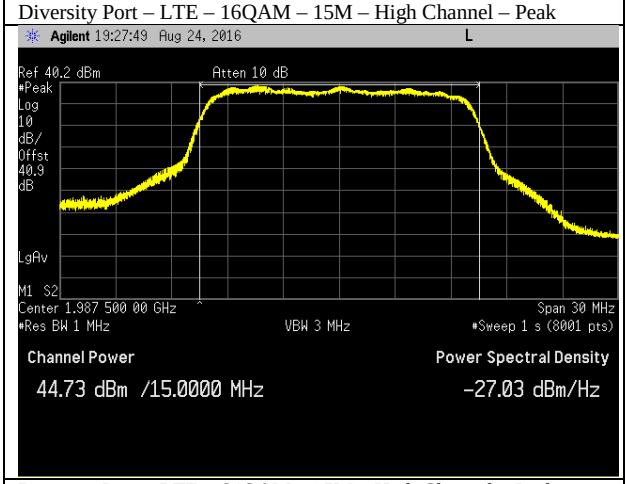
Diversity Port – LTE – QPSK – 15M – High Channel – Peak



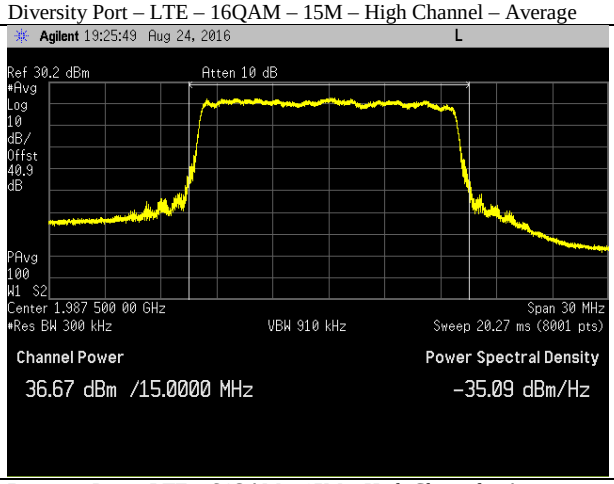
Diversity Port – LTE – QPSK – 15M – High Channel – Average



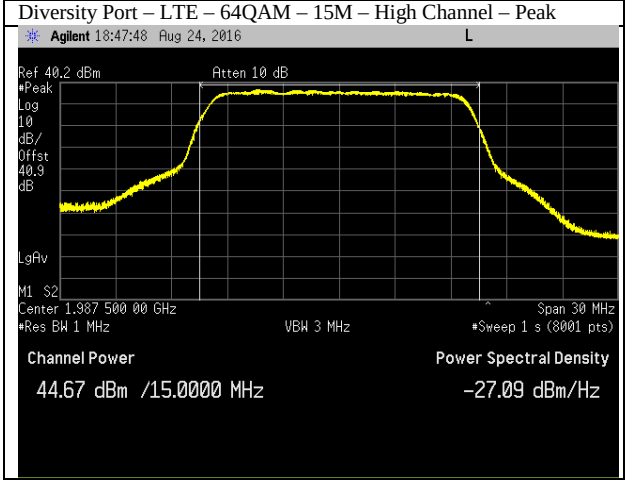
Diversity Port – LTE – 16QAM – 15M – High Channel – Peak



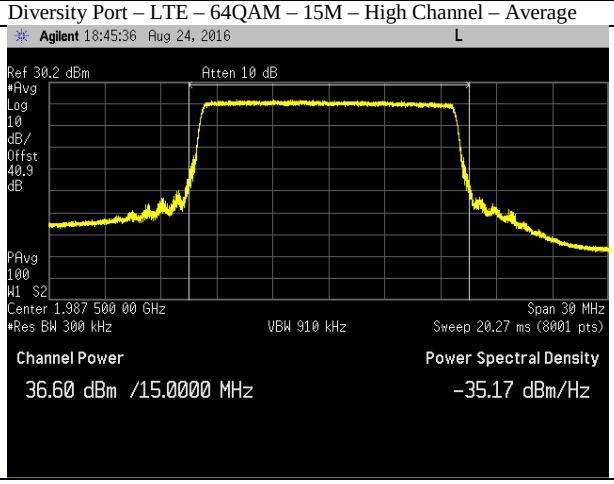
Diversity Port – LTE – 16QAM – 15M – High Channel – Average



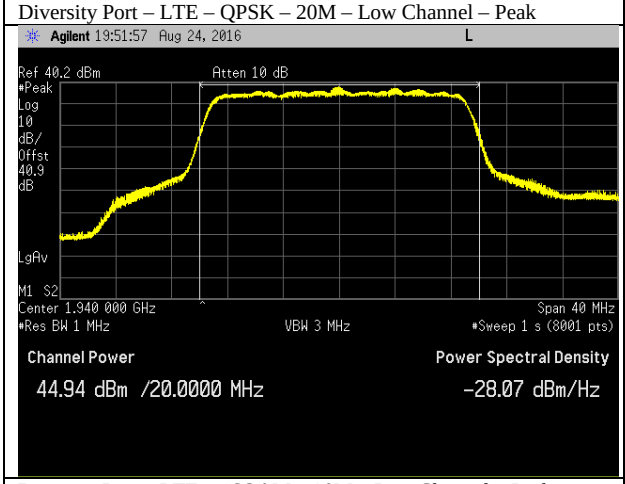
Diversity Port – LTE – 64QAM – 15M – High Channel – Peak



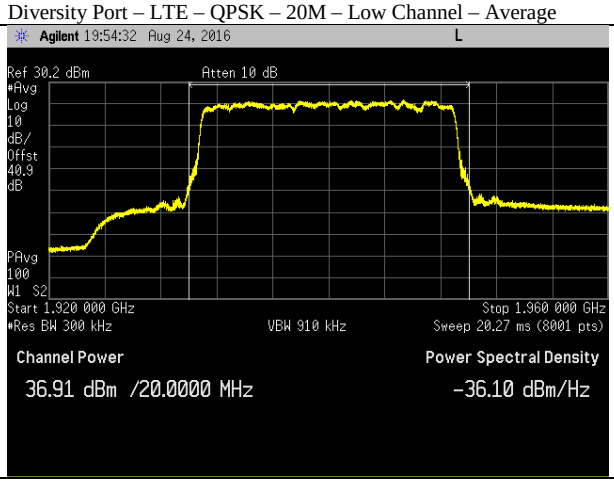
Diversity Port – LTE – 64QAM – 15M – High Channel – Average



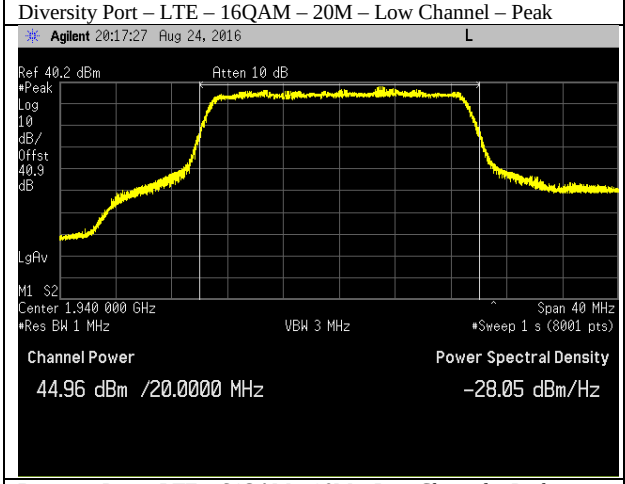
Diversity Port – LTE – QPSK – 20M – Low Channel – Peak



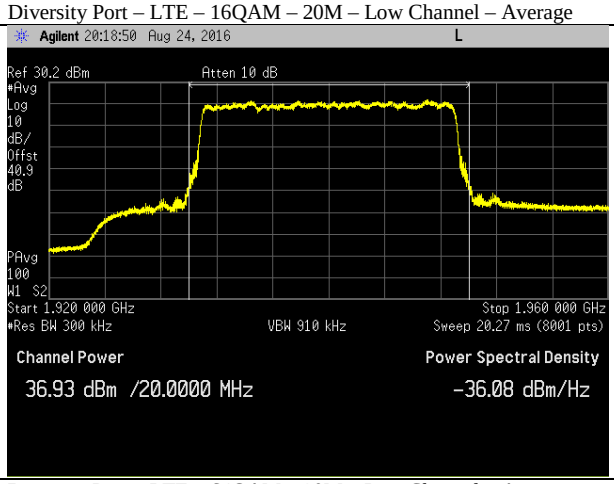
Diversity Port – LTE – QPSK – 20M – Low Channel – Average



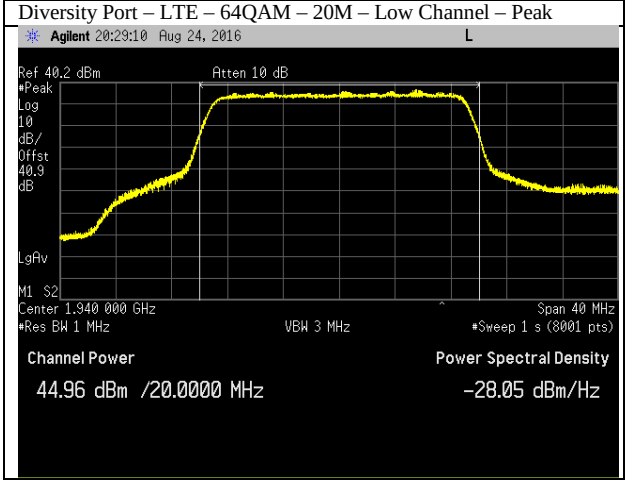
Diversity Port – LTE – 16QAM – 20M – Low Channel – Peak



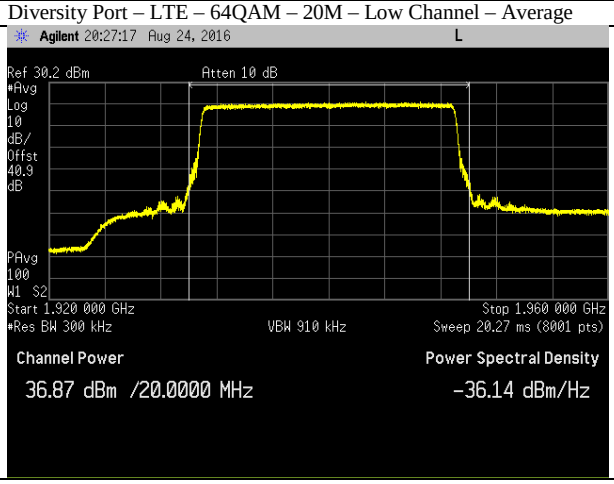
Diversity Port – LTE – 16QAM – 20M – Low Channel – Average



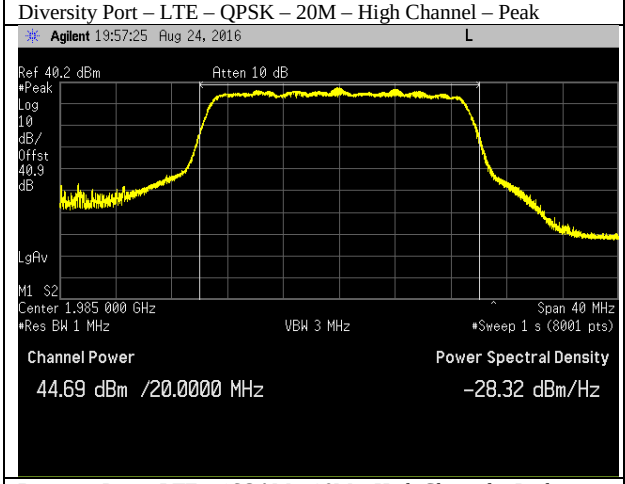
Diversity Port – LTE – 64QAM – 20M – Low Channel – Peak



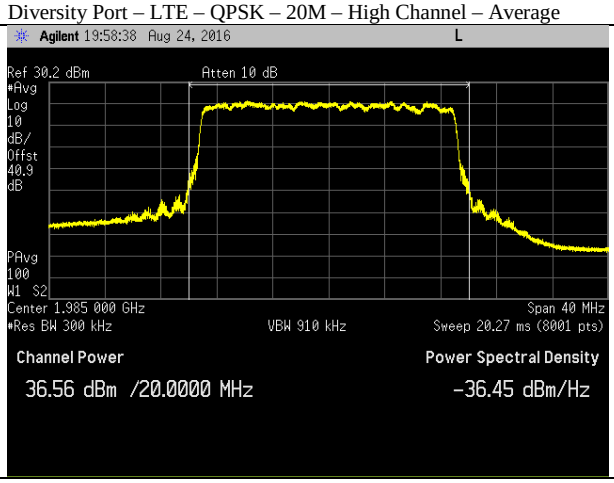
Diversity Port – LTE – 64QAM – 20M – Low Channel – Average



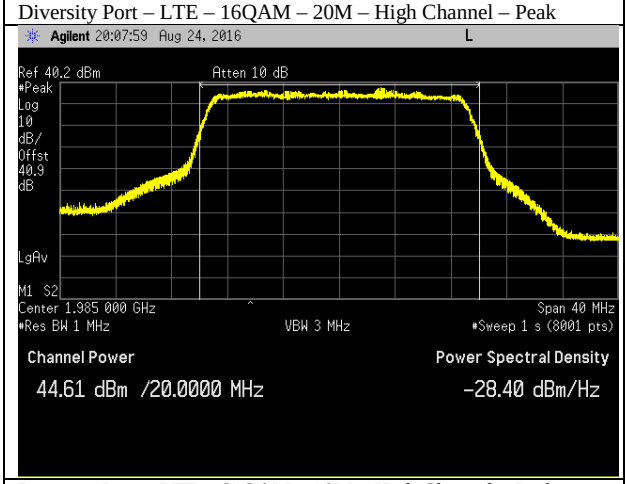
Diversity Port – LTE – QPSK – 20M – High Channel – Peak



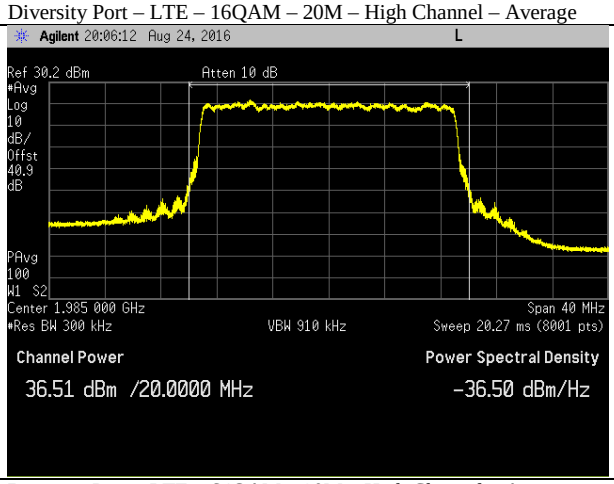
Diversity Port – LTE – QPSK – 20M – High Channel – Average



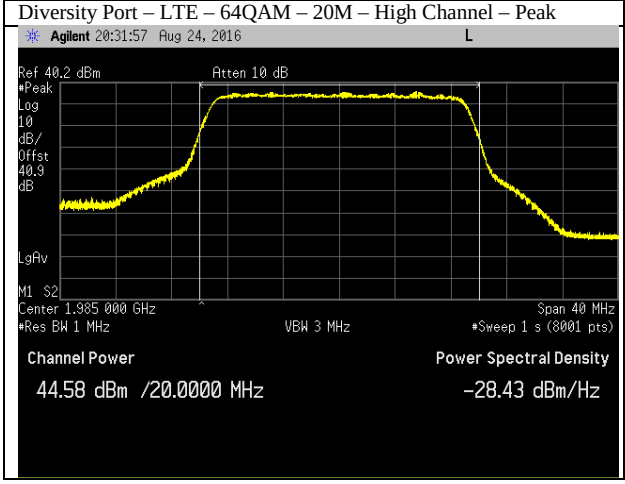
Diversity Port – LTE – 16QAM – 20M – High Channel – Peak



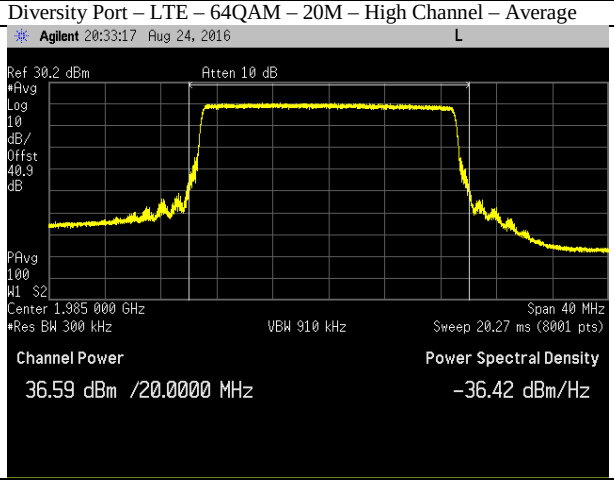
Diversity Port – LTE – 16QAM – 20M – High Channel – Average



Diversity Port – LTE – 64QAM – 20M – High Channel – Peak



Diversity Port – LTE – 64QAM – 20M – High Channel – Average



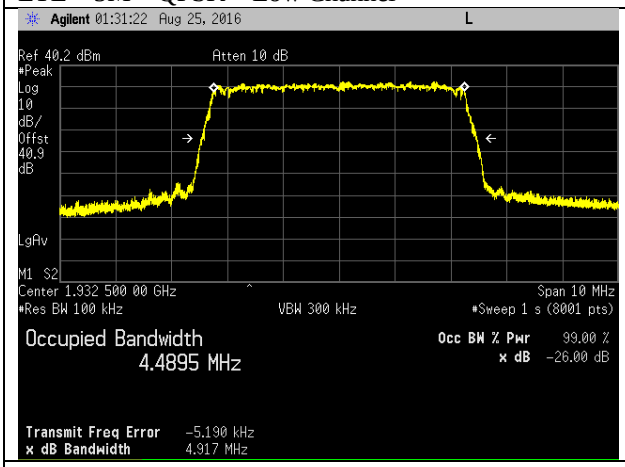
Emission Bandwidths (26dB and 99%)

Emissions bandwidths were measured on bottom and top channels for all modulations and bandwidth modes on Main Port and results presented below.

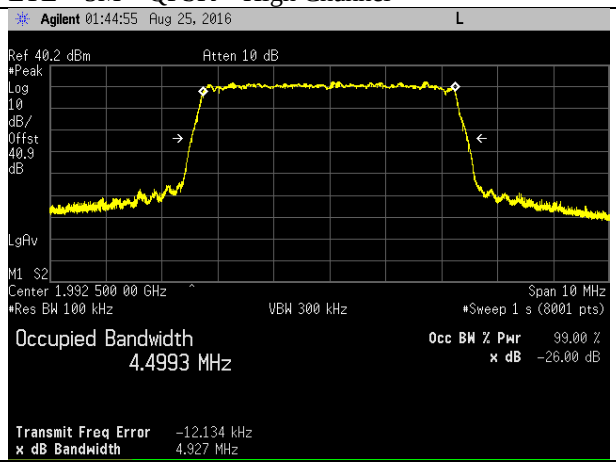
	LTE - QPSK				LTE - 16QAM				LTE - 64QAM			
	Low		High		Low		High		Low		High	
	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)
5M	4.917	4.4895	4.927	4.4993	4.934	4.4799	4.943	4.4841	4.989	4.5078	4.989	4.5063
10M	9.984	8.987	9.964	8.9864	9.937	9.0045	9.878	9.0046	9.986	8.9882	9.988	8.9906
15M	14.91	13.4813	14.874	13.4913	13.4916	14.784	14.77	13.4893	14.903	13.4923	14.907	13.4912
20M	19.938	17.964	19.9	17.9542	19.778	18.023	19.766	18.0106	19.907	17.966	19.9	17.9551

Corresponding plots included on the following pages.

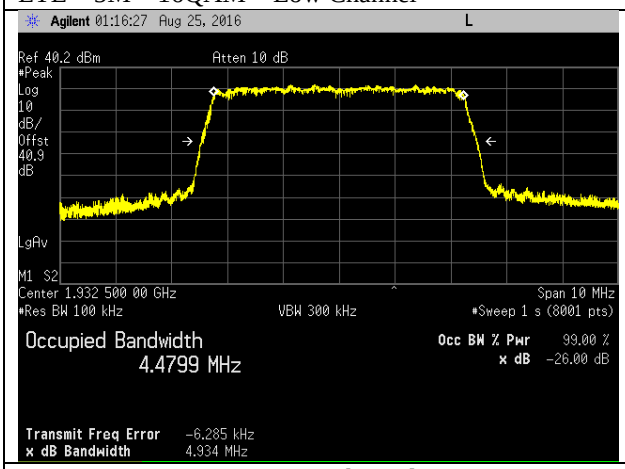
LTE – 5M – QPSK – Low Channel



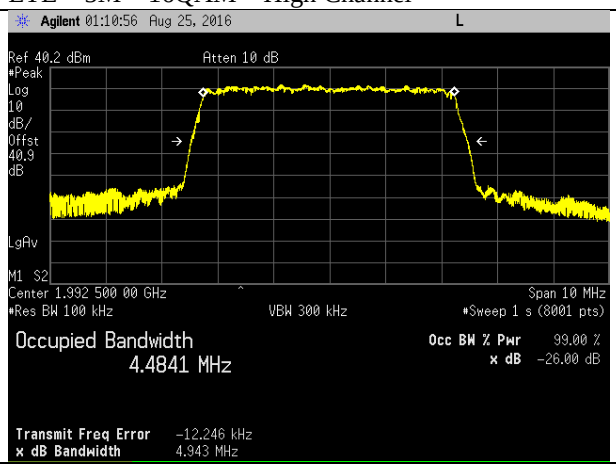
LTE – 5M – QPSK – High Channel



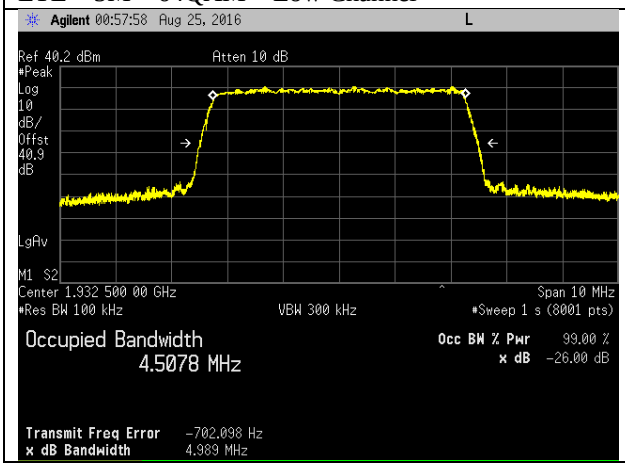
LTE – 5M – 16QAM – Low Channel



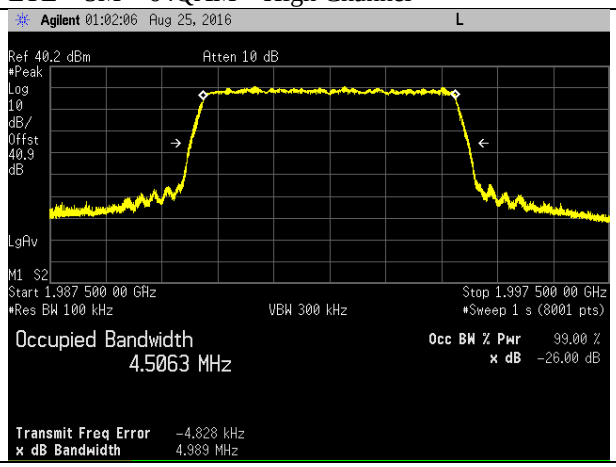
LTE – 5M – 16QAM – High Channel



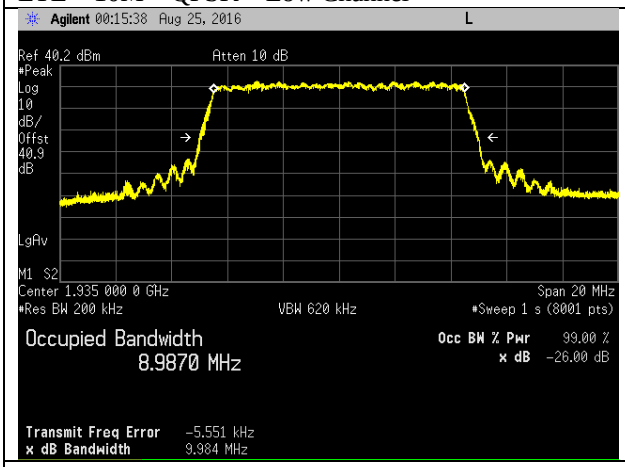
LTE – 5M – 64QAM – Low Channel



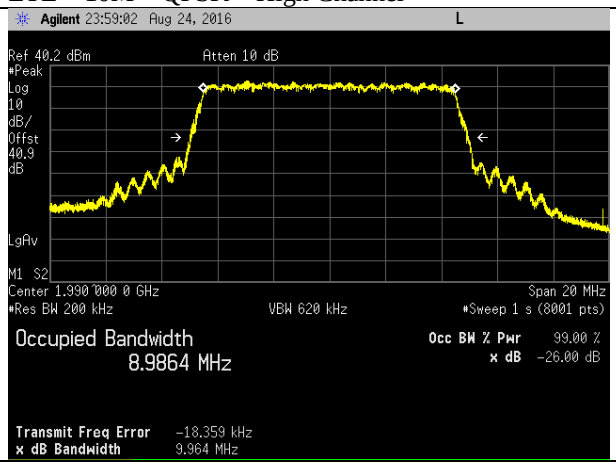
LTE – 5M – 64QAM – High Channel



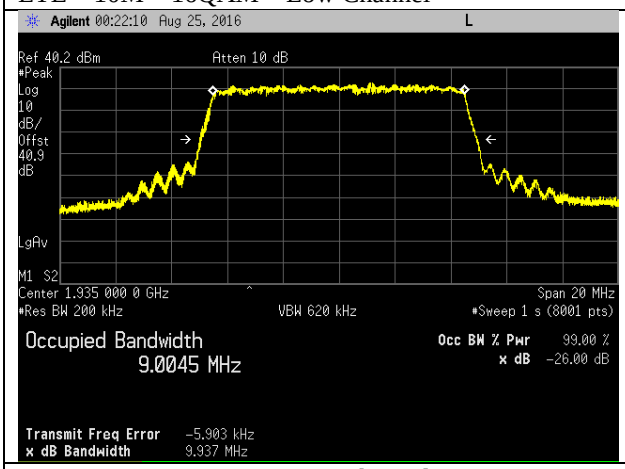
LTE – 10M – QPSK – Low Channel



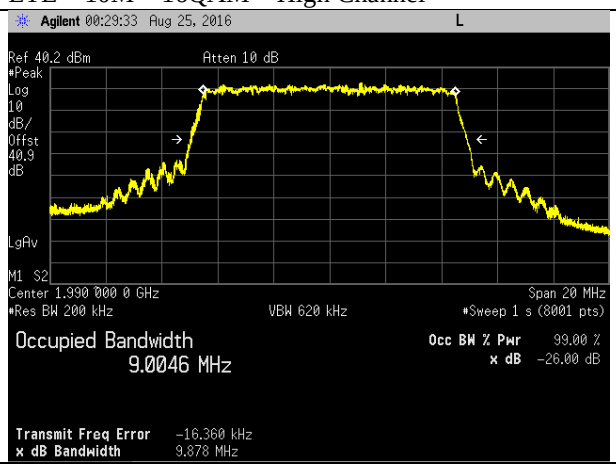
LTE – 10M – QPSK – High Channel



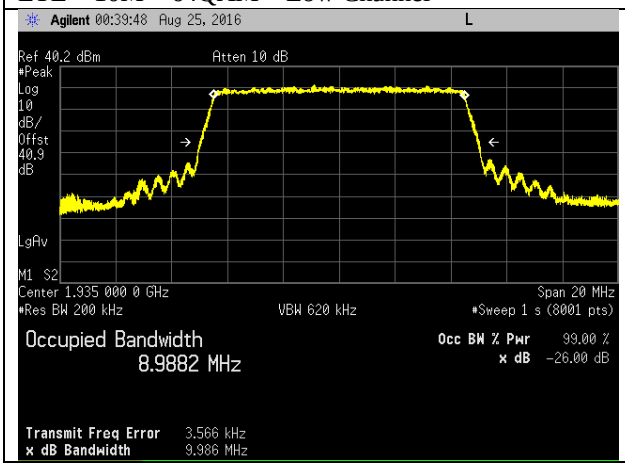
LTE – 10M – 16QAM – Low Channel



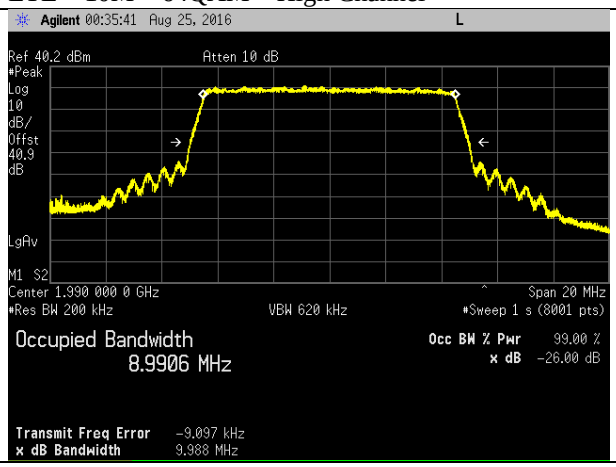
LTE – 10M – 16QAM – High Channel



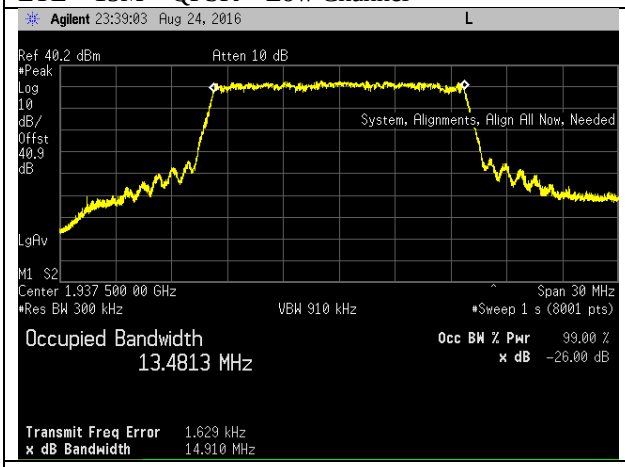
LTE – 10M – 64QAM – Low Channel



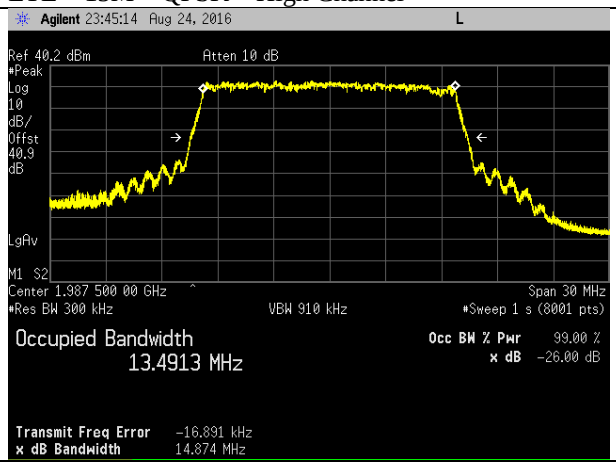
LTE – 10M – 64QAM – High Channel



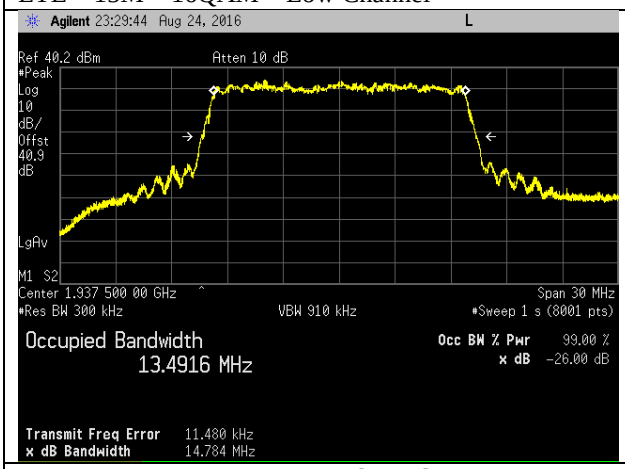
LTE – 15M – QPSK – Low Channel



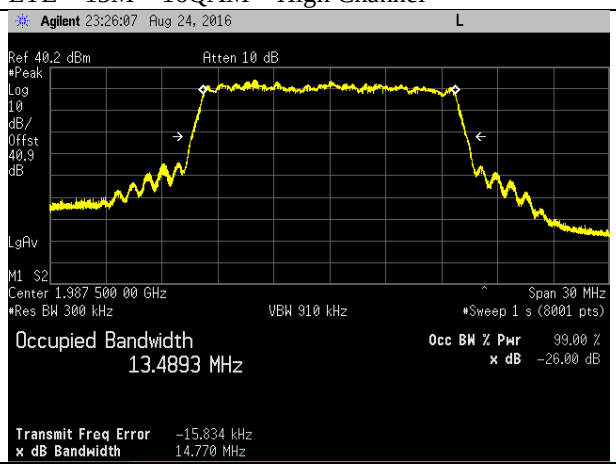
LTE – 15M – QPSK – High Channel



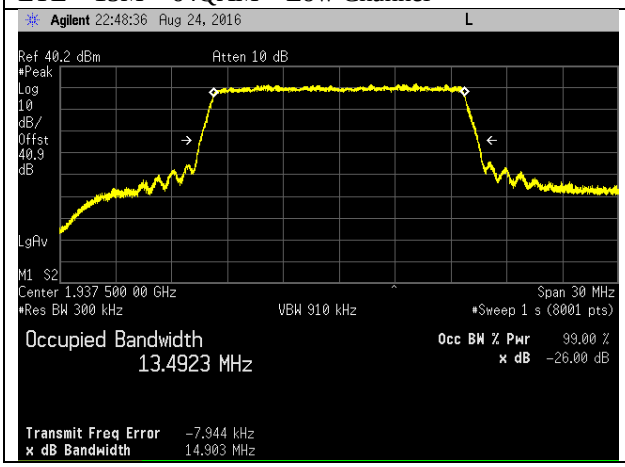
LTE – 15M – 16QAM – Low Channel



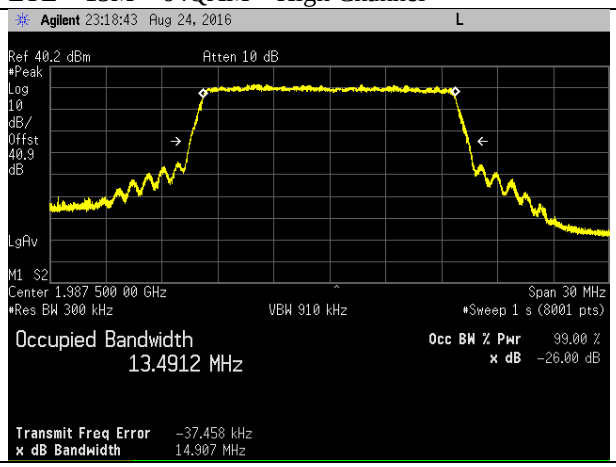
LTE – 15M – 16QAM – High Channel



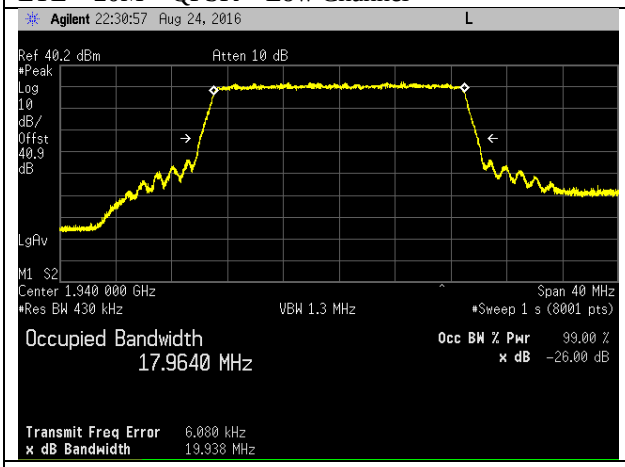
LTE – 15M – 64QAM – Low Channel



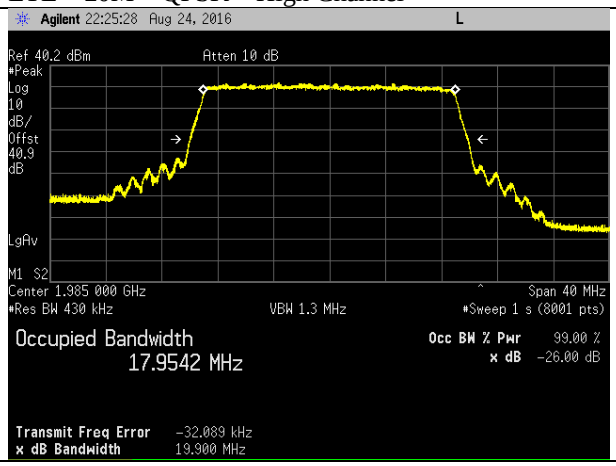
LTE – 15M – 64QAM – High Channel



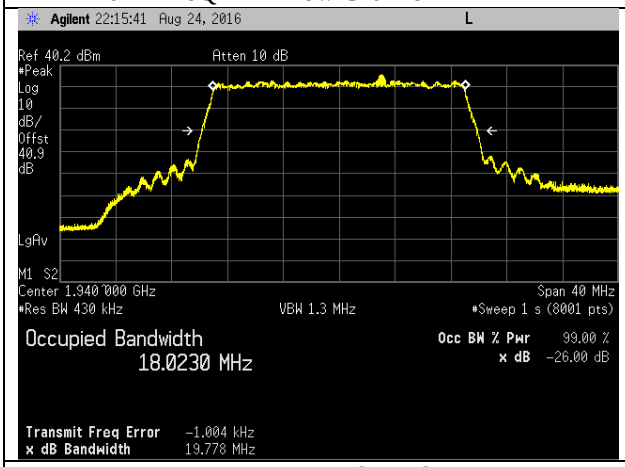
LTE – 20M – QPSK – Low Channel



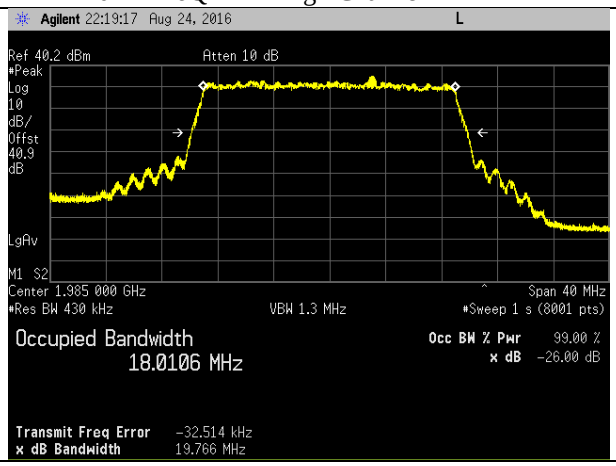
LTE – 20M – QPSK – High Channel



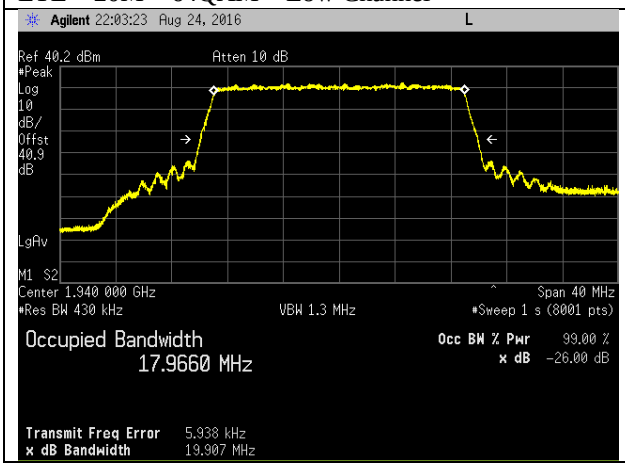
LTE – 20M – 16QAM – Low Channel



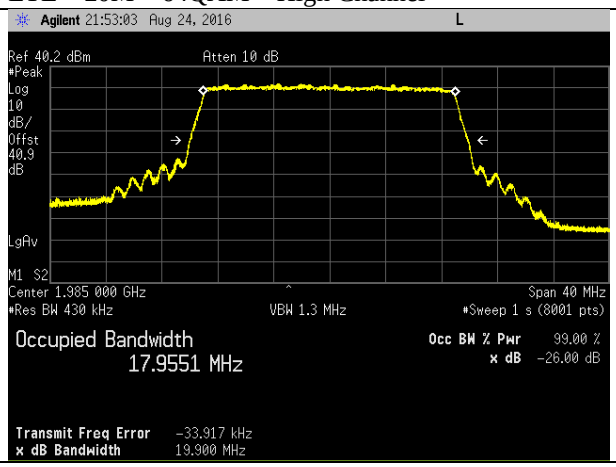
LTE – 20M – 16QAM – High Channel



LTE – 20M – 64QAM – Low Channel



LTE – 20M – 64QAM – High Channel



Antenna Port Conducted Bandedge

Limit is -13dBm and is further reduced by 10*log(2) per FCC KDB 662911D01 v02r01 due to 2x2 MIMO operation, which brings it down to -16.03dBm.

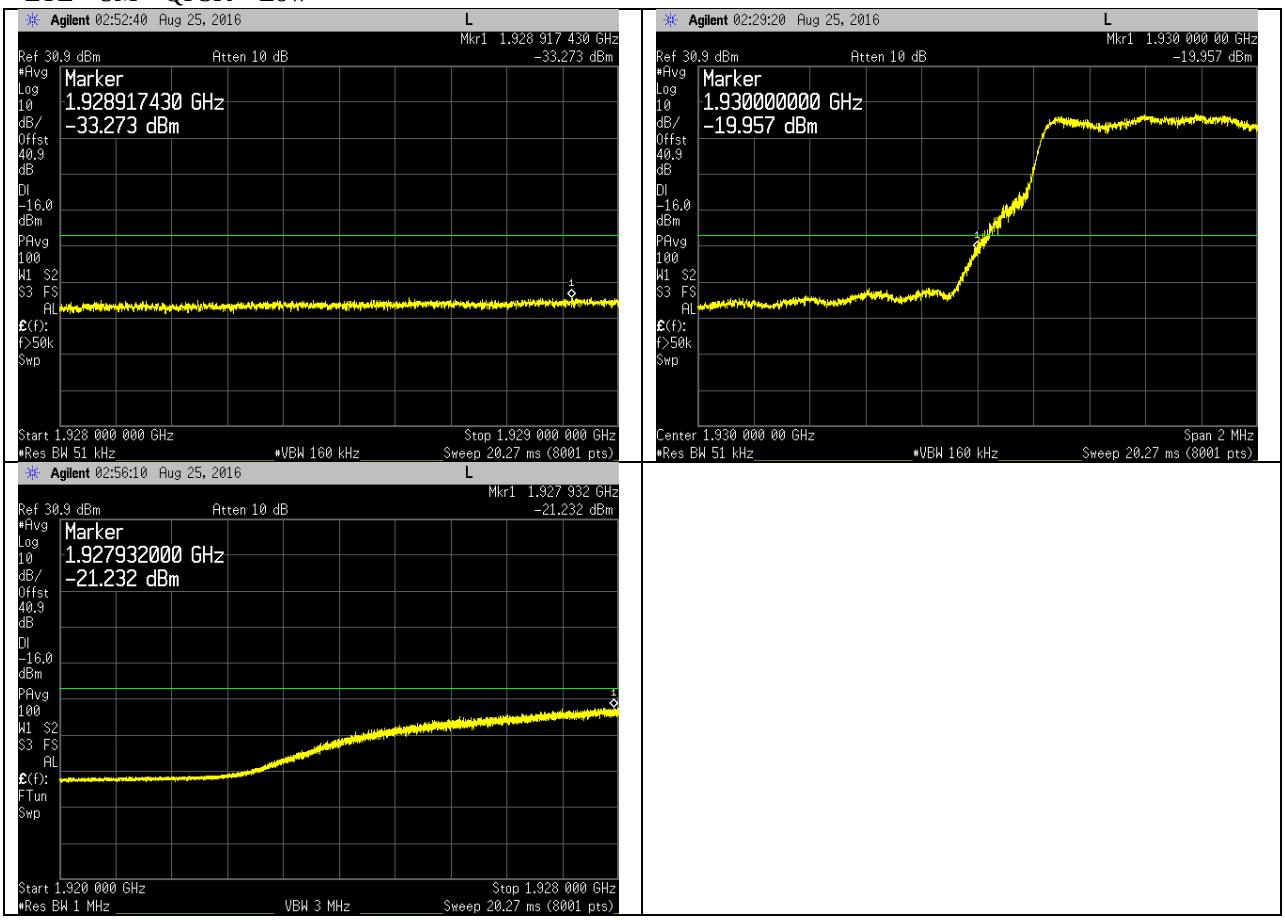
Tests performed at Main Port on lowest and highest channels for all modulations and channel bandwidth modes.

Measurements were performed in RMS average mode with 1MHz RBW and 3MHz VBW over 100 traces. In 1MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 1% of the emission bandwidth has been used.

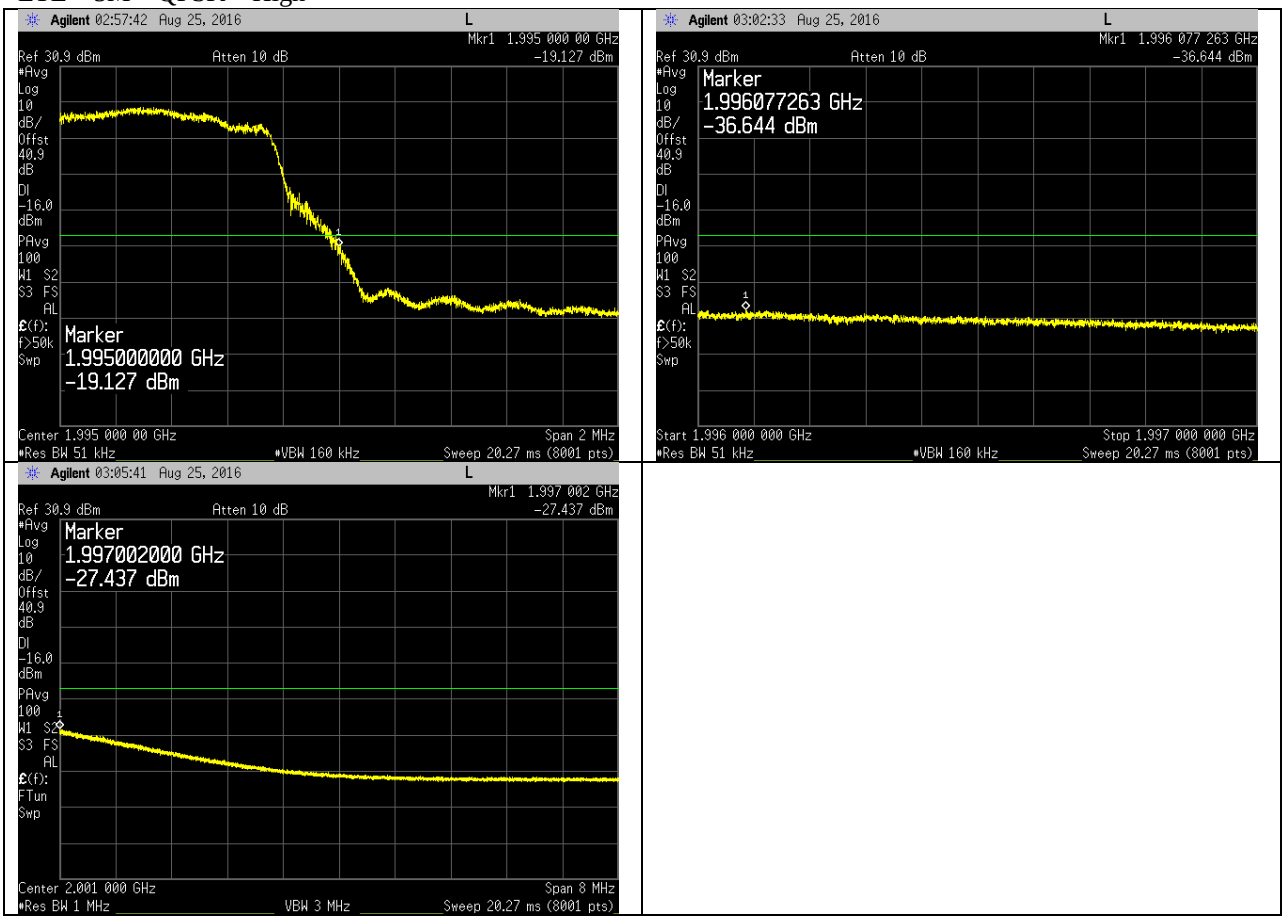
Total path loss of 40.9dB accounted in via reference level offset to the spectrum analyzer.

All corresponding plots are included on the following pages.

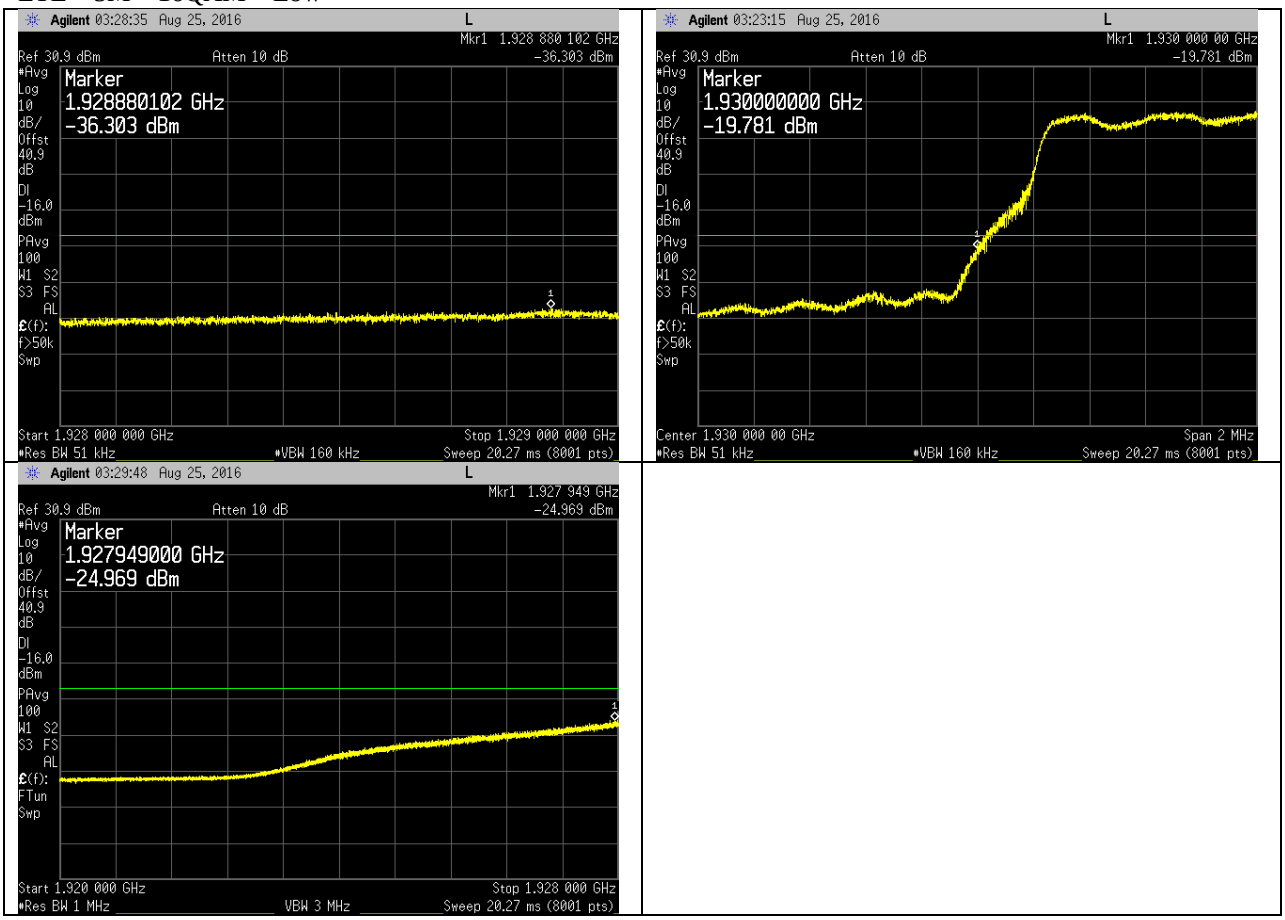
LTE – 5M – QPSK – Low



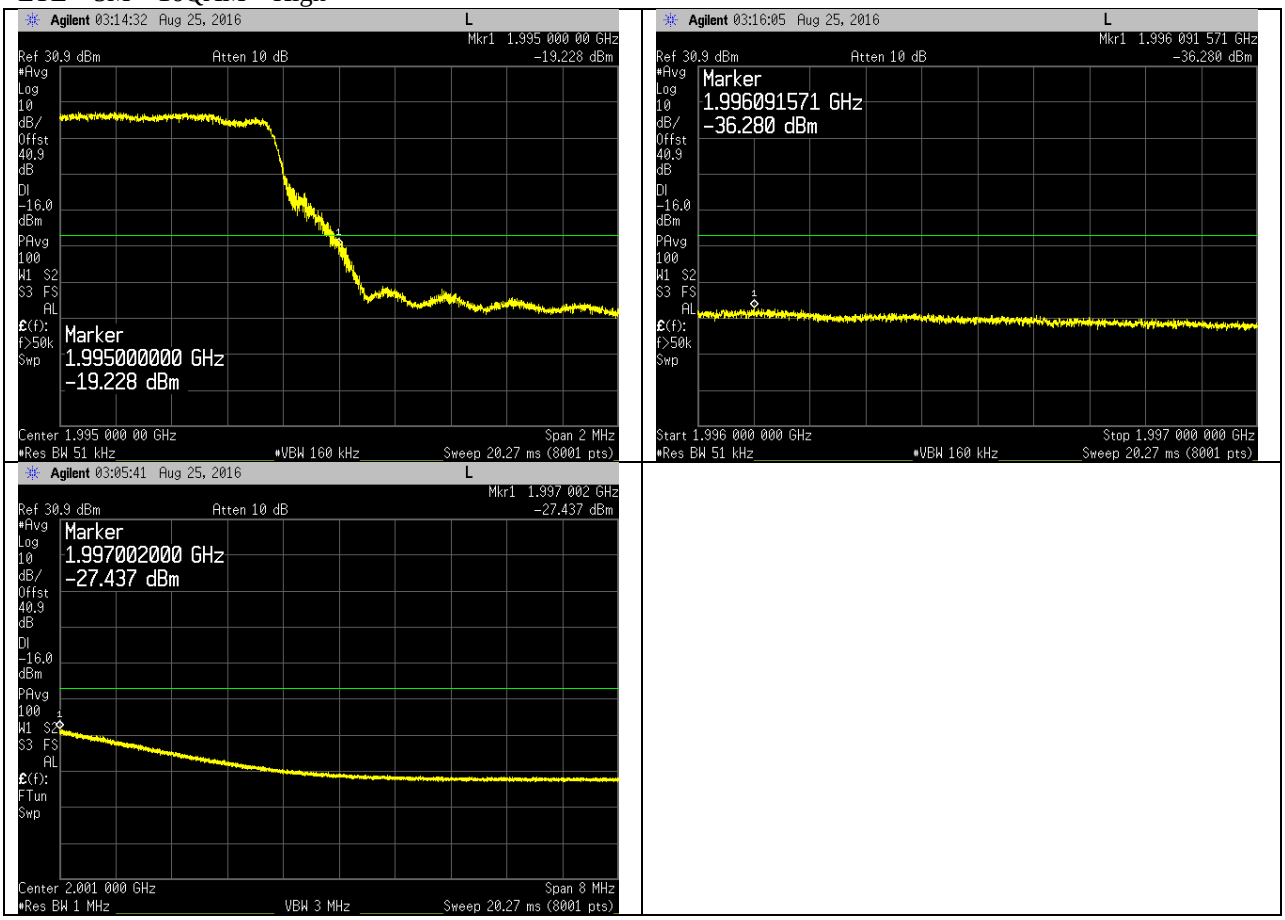
LTE – 5M – QPSK – High



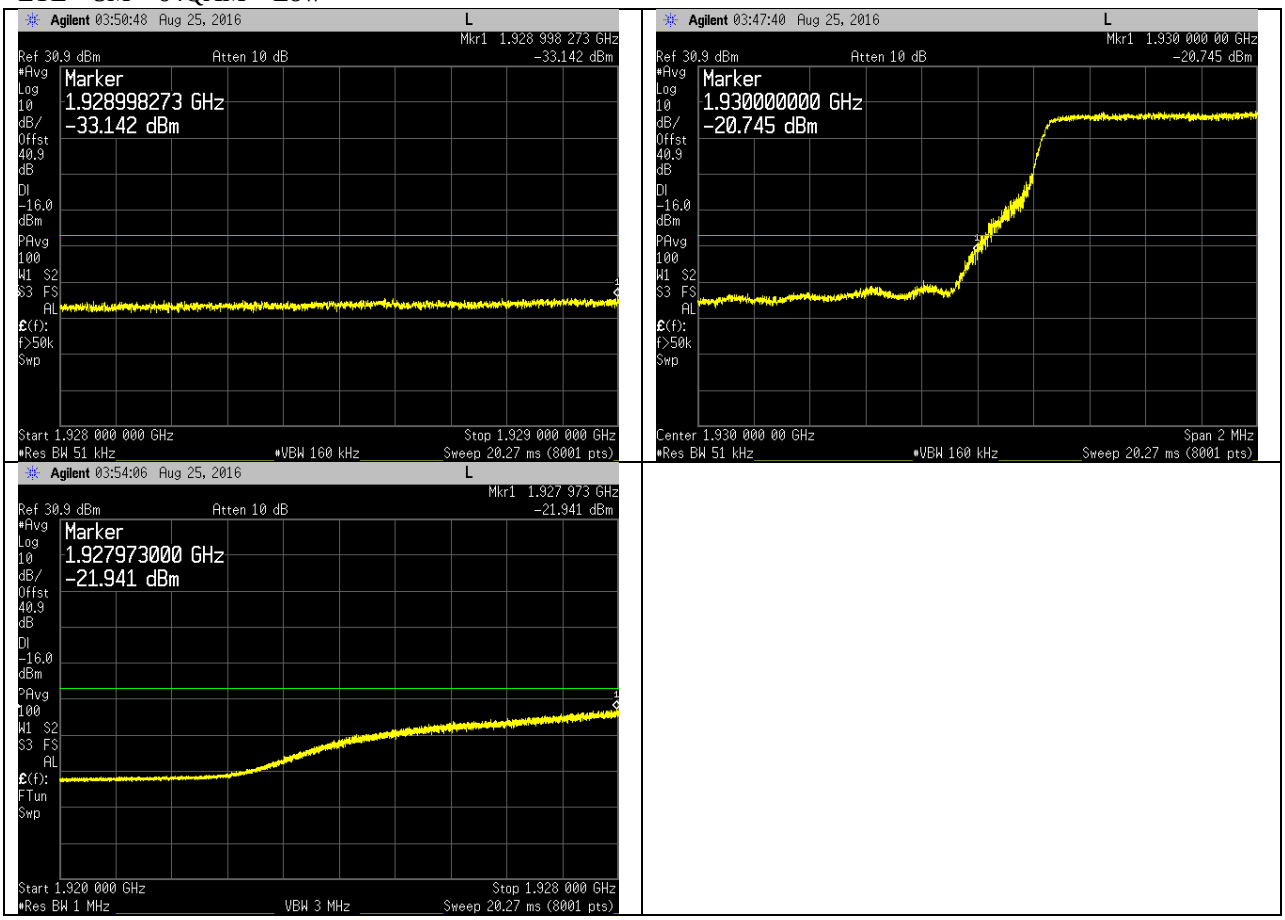
LTE – 5M – 16QAM – Low



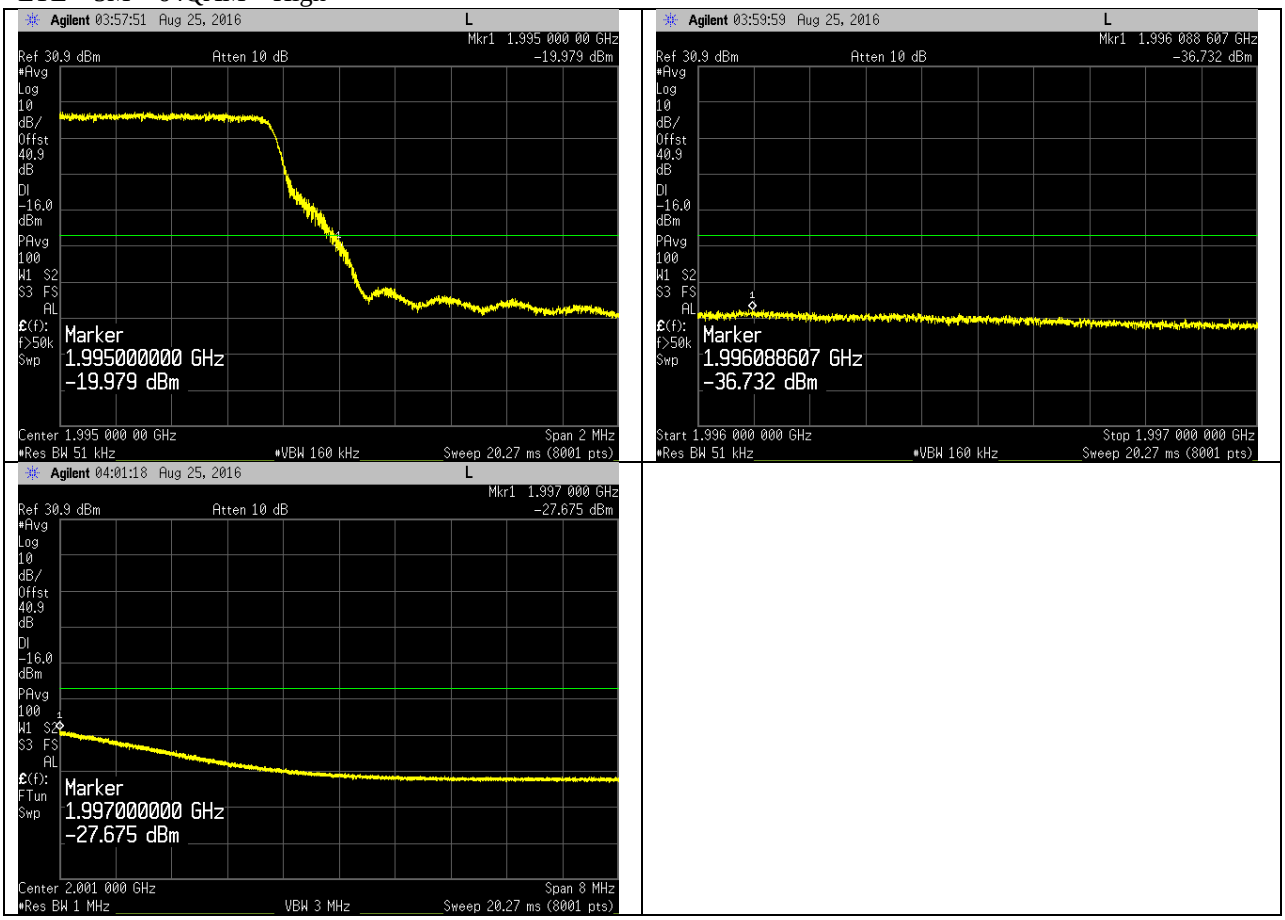
LTE – 5M – 16QAM – High



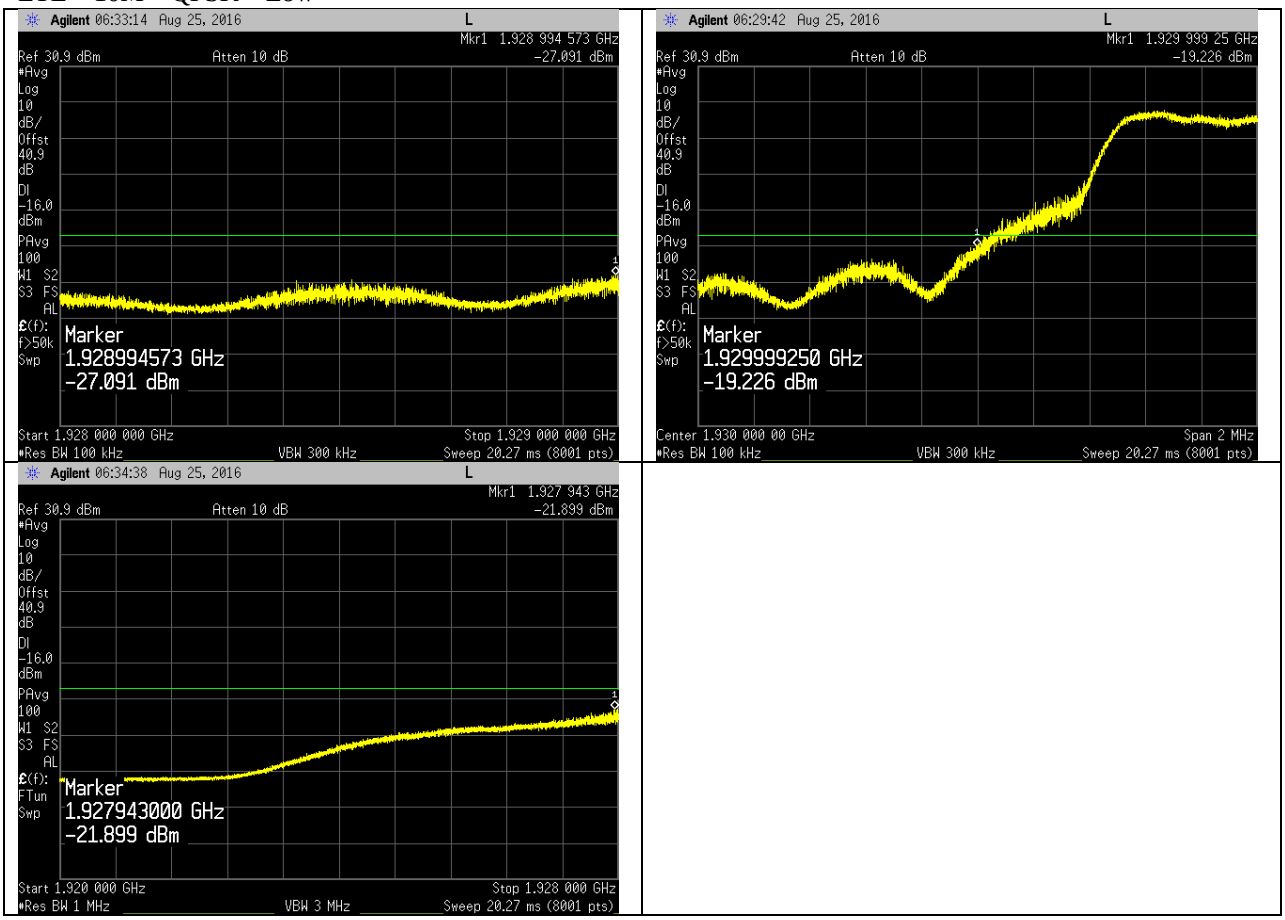
LTE – 5M – 64QAM – Low



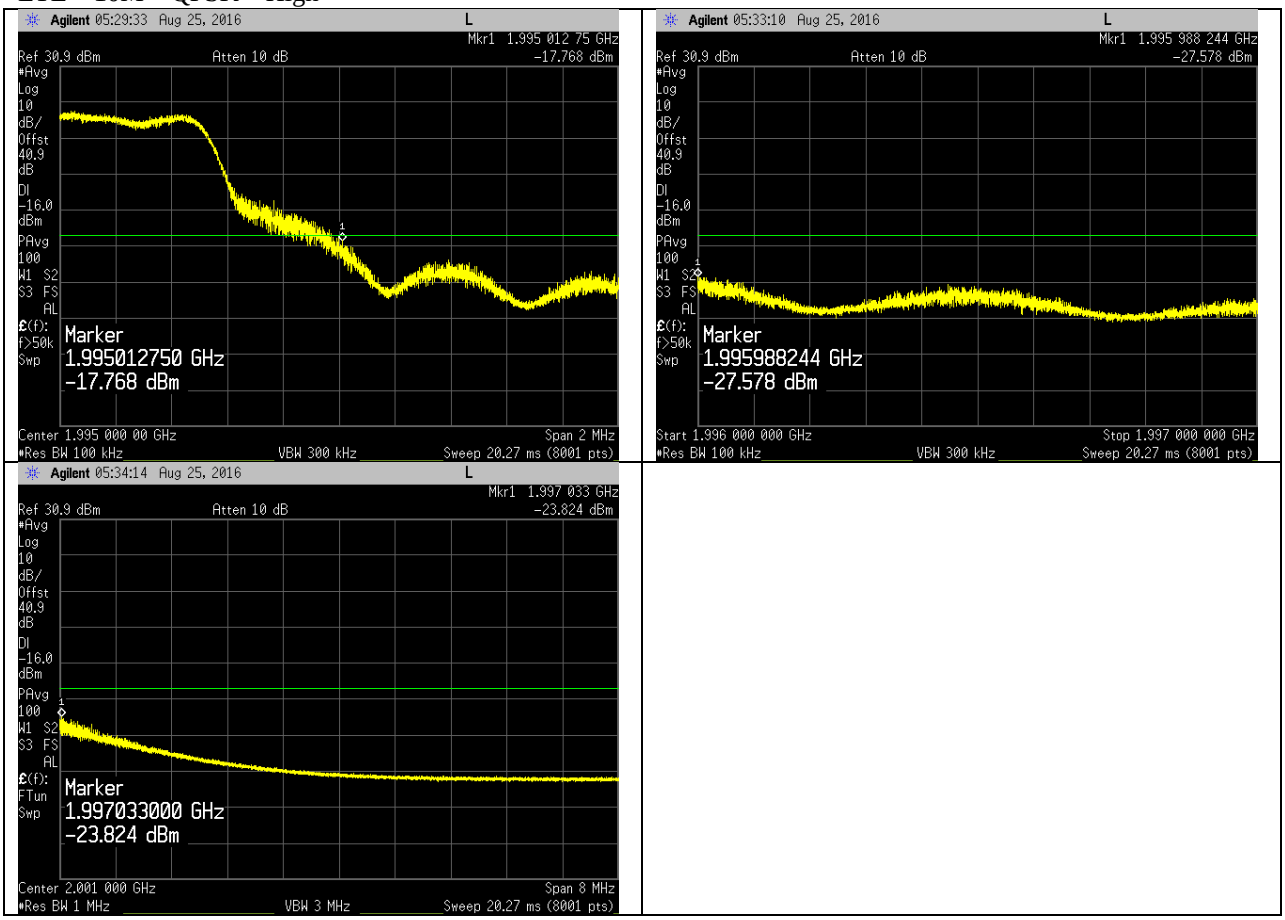
LTE – 5M – 64QAM – High



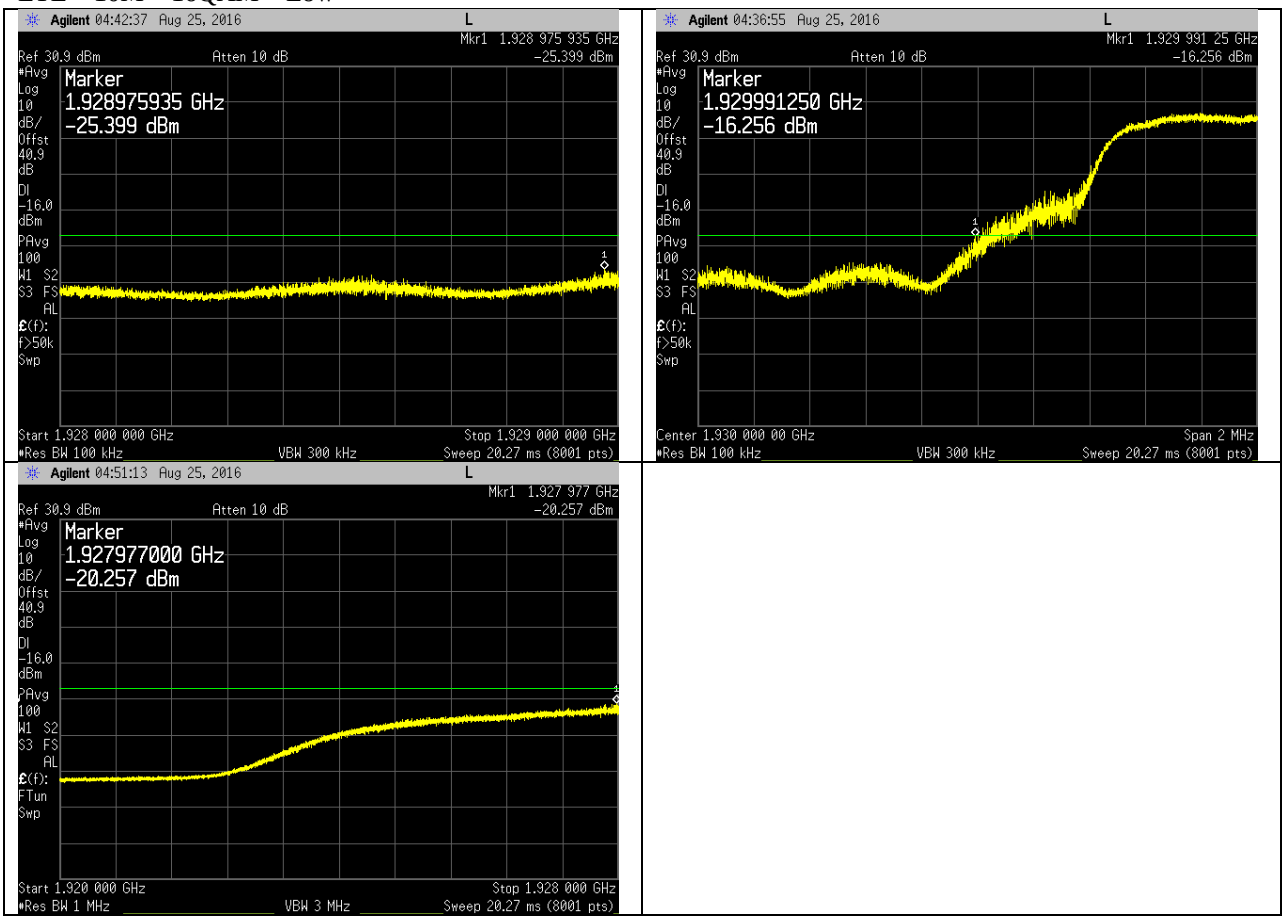
LTE – 10M – QPSK – Low



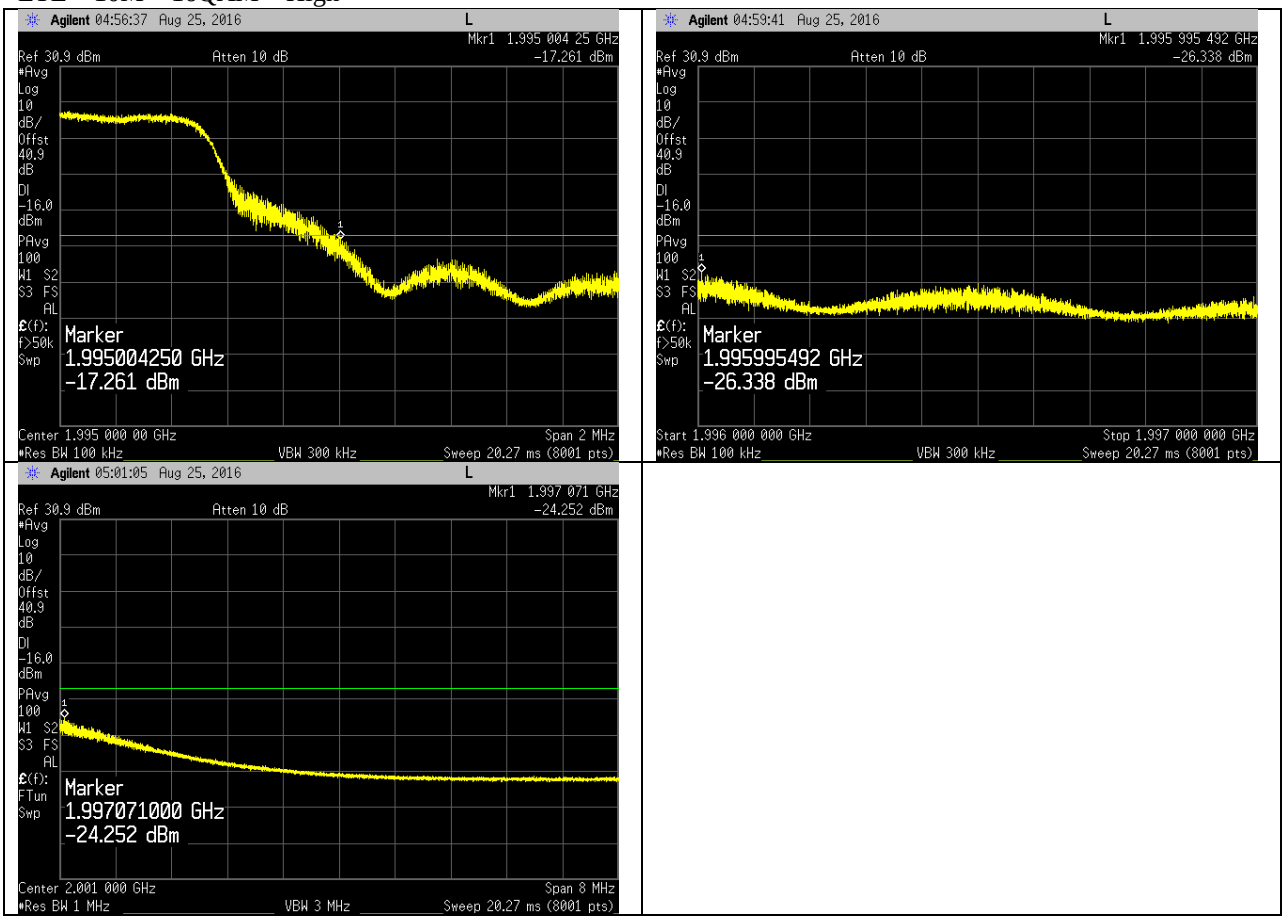
LTE – 10M – QPSK – High



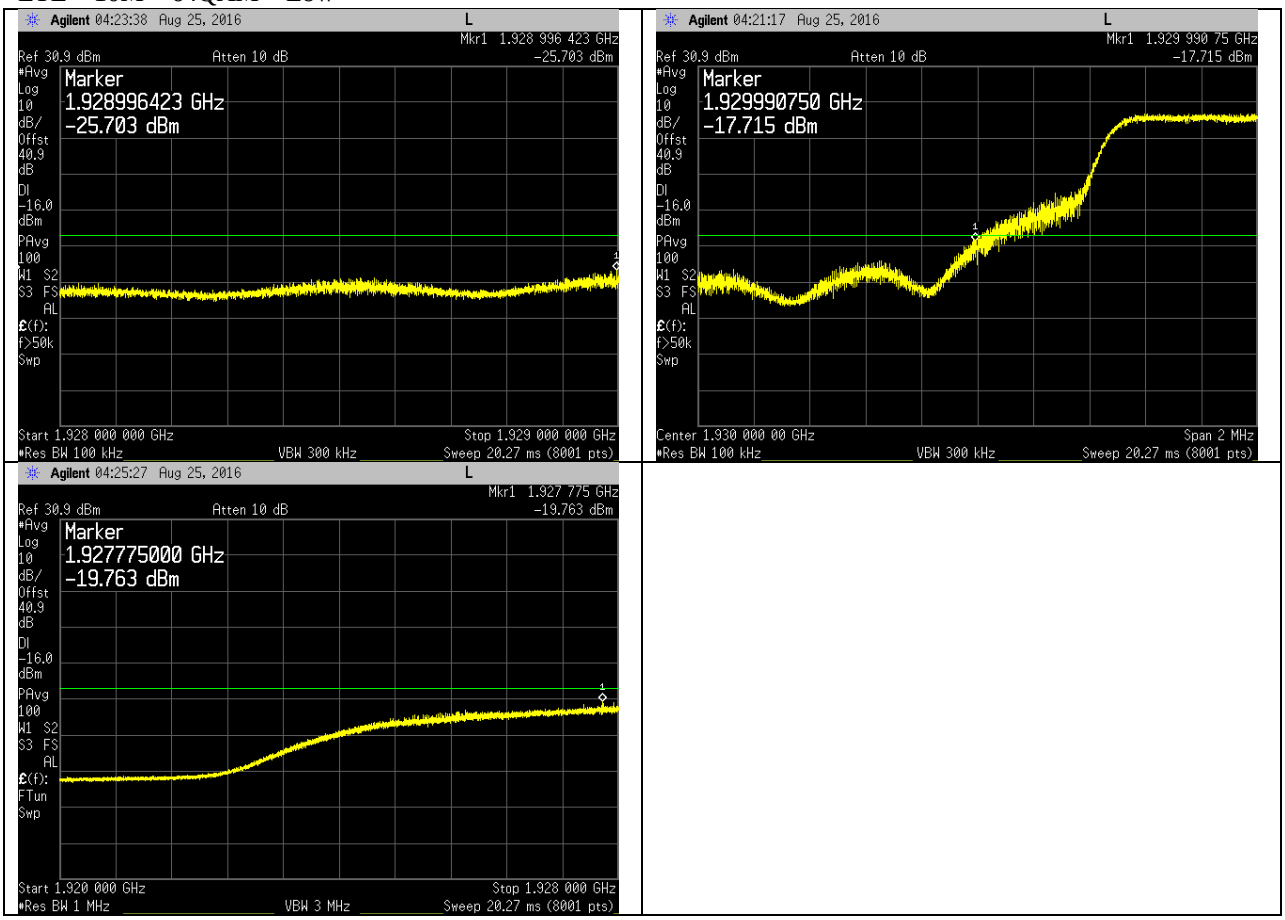
LTE – 10M – 16QAM – Low



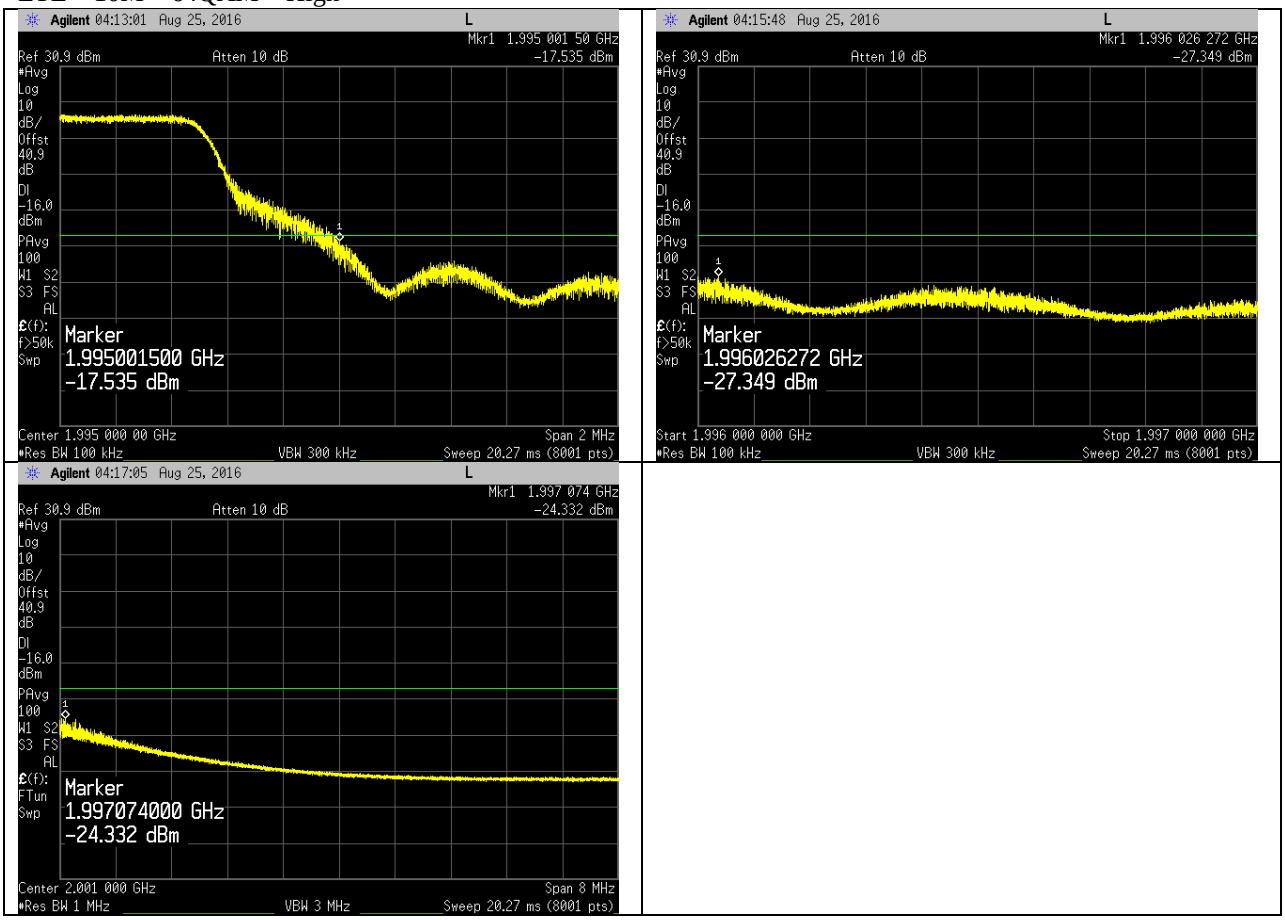
LTE – 10M – 16QAM – High



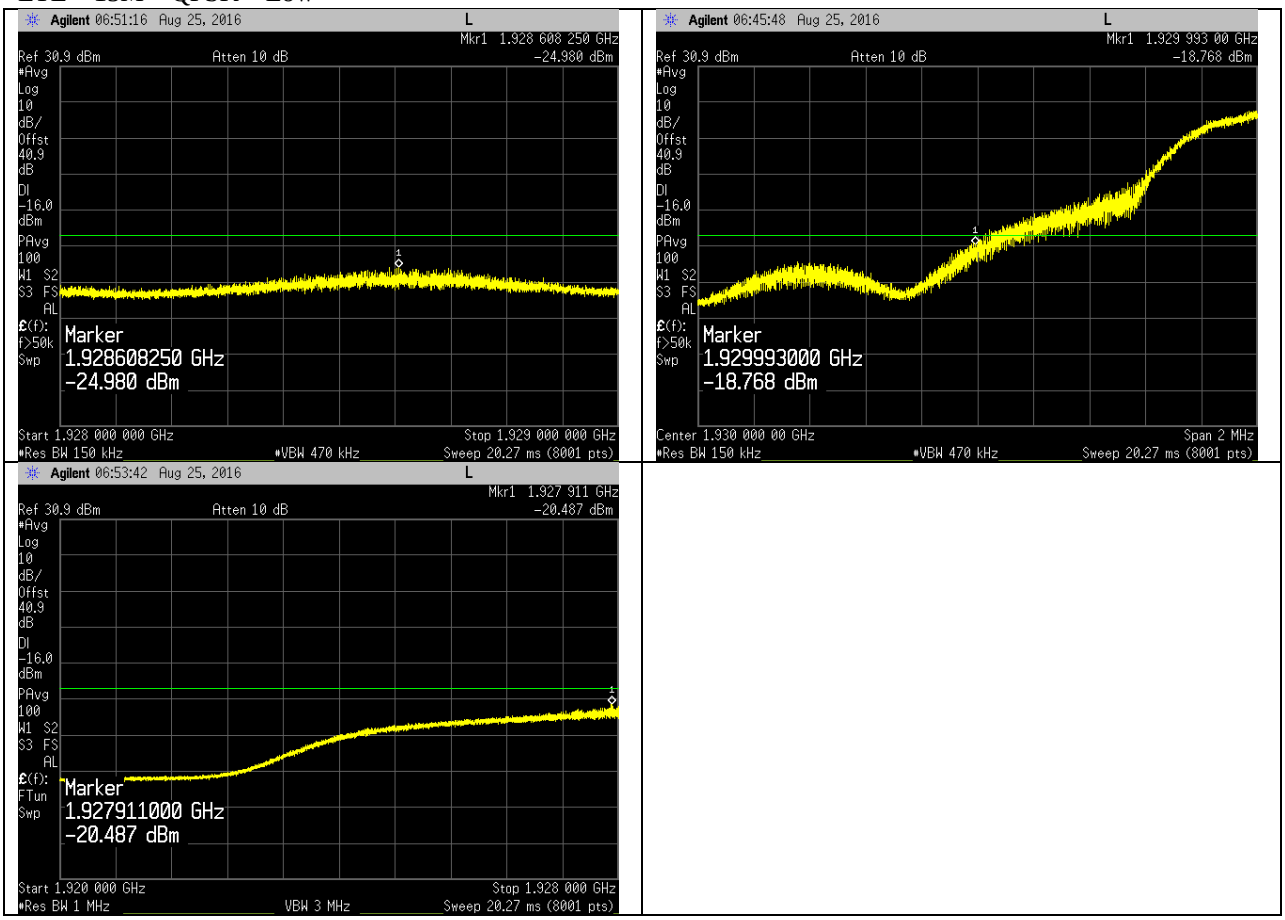
LTE – 10M – 64QAM – Low



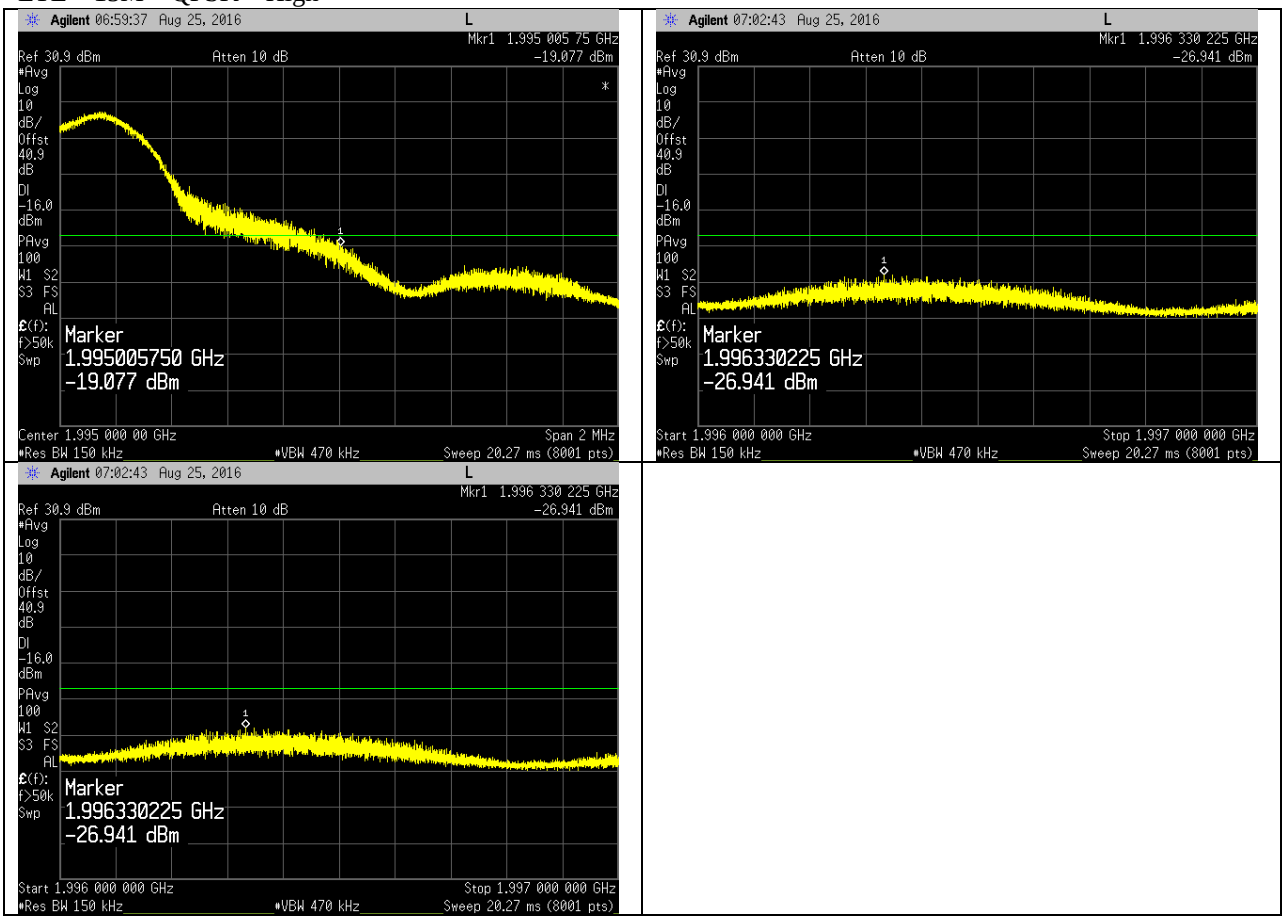
LTE – 10M – 64QAM – High



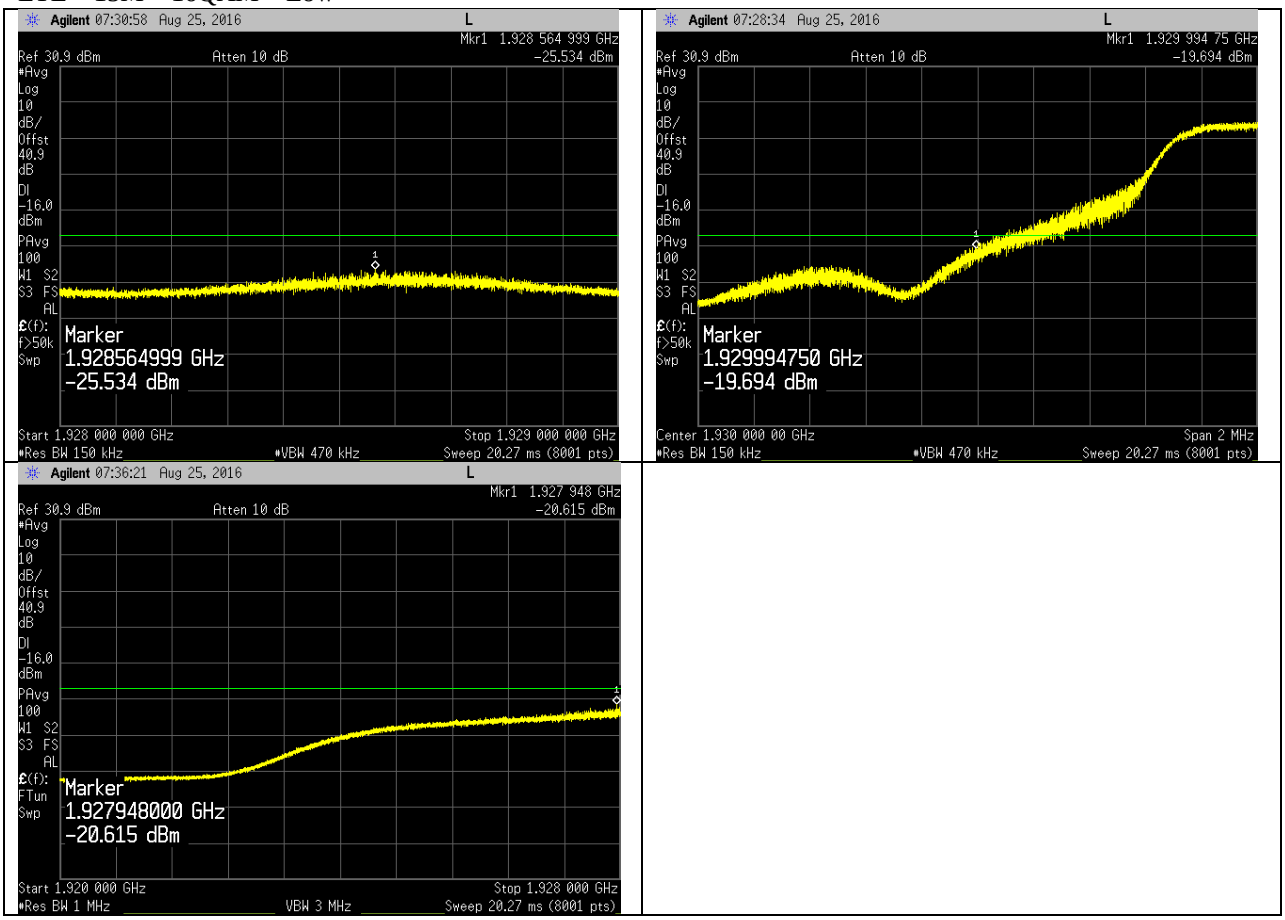
LTE – 15M – QPSK – Low



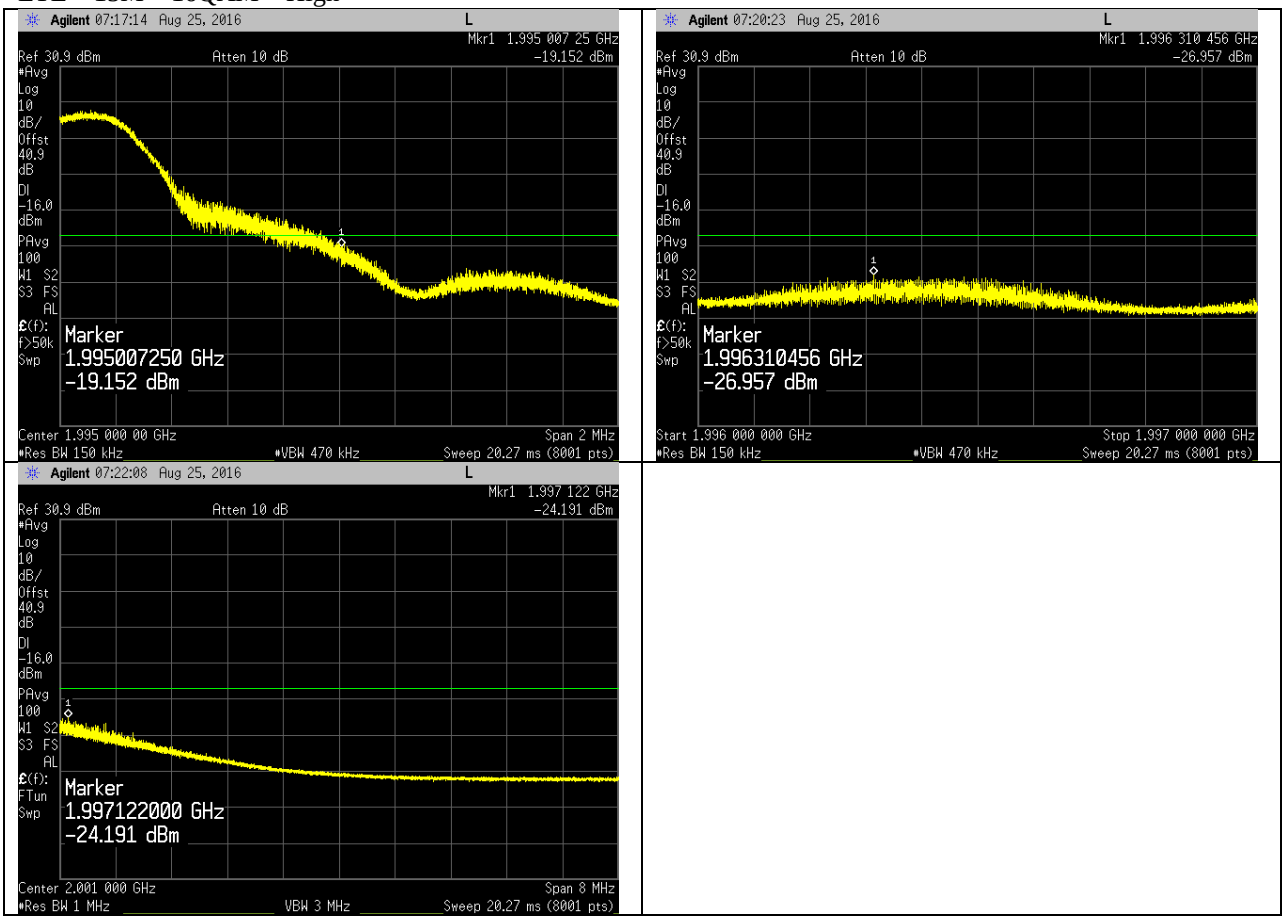
LTE – 15M – QPSK – High



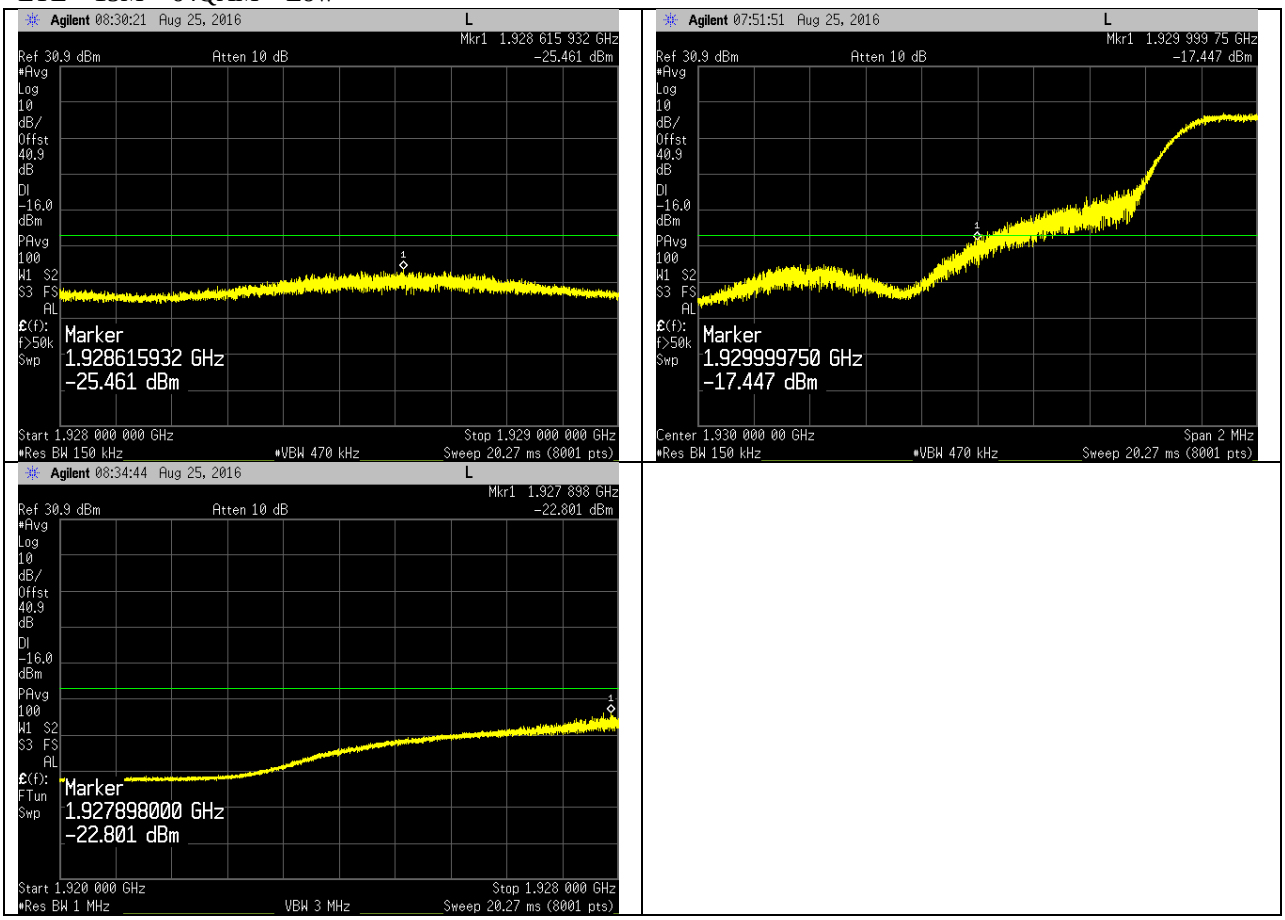
LTE – 15M – 16QAM – Low



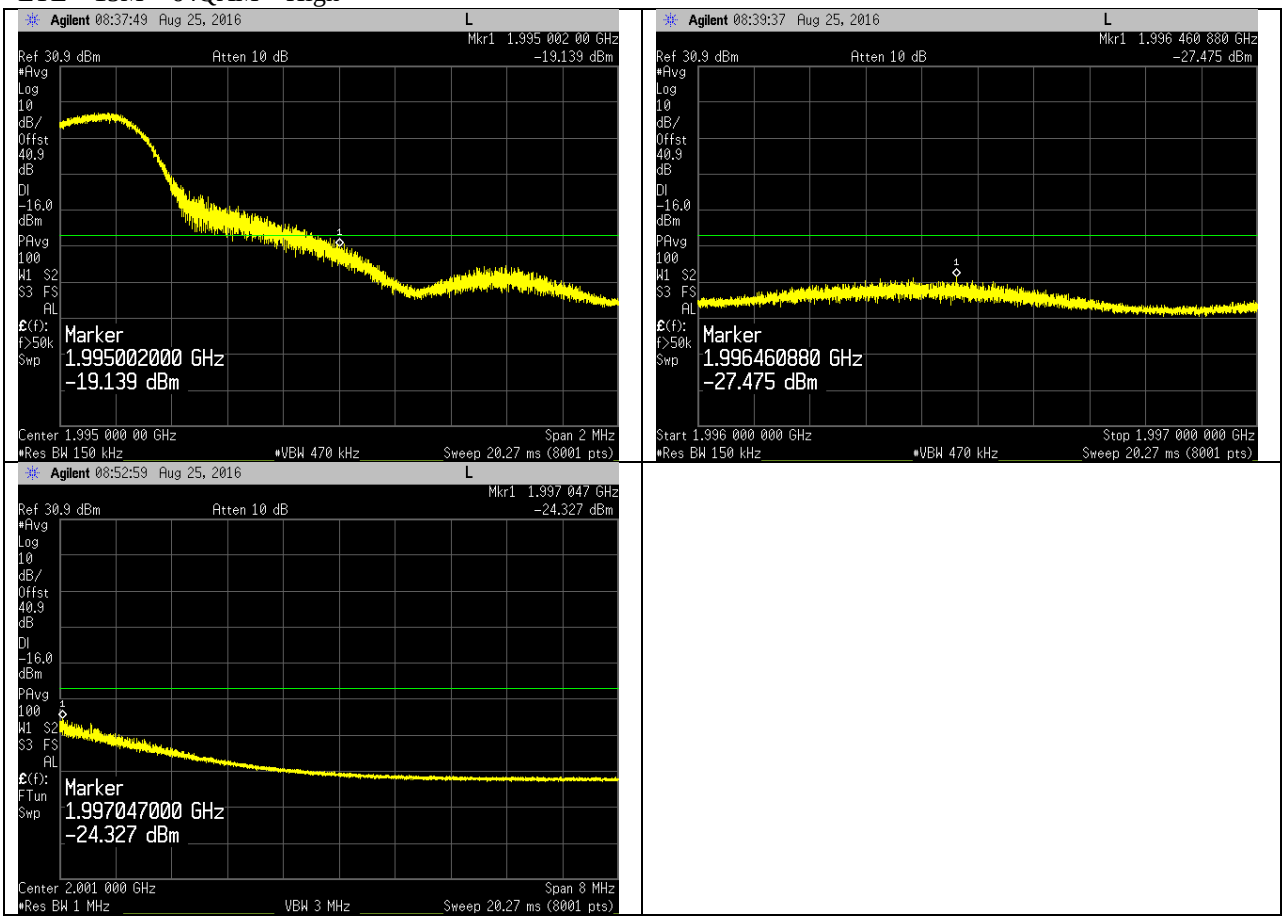
LTE – 15M – 16QAM – High



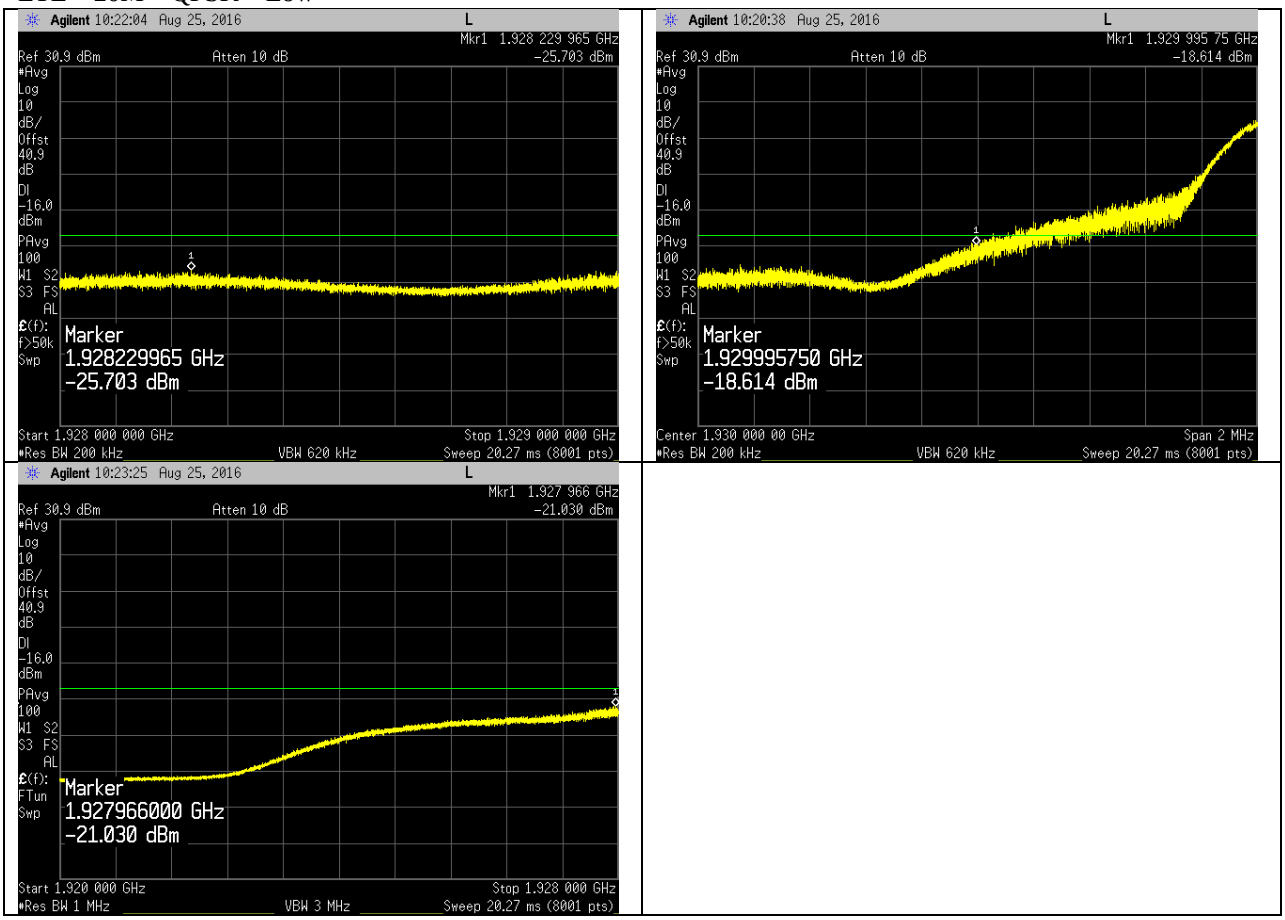
LTE – 15M – 64QAM – Low



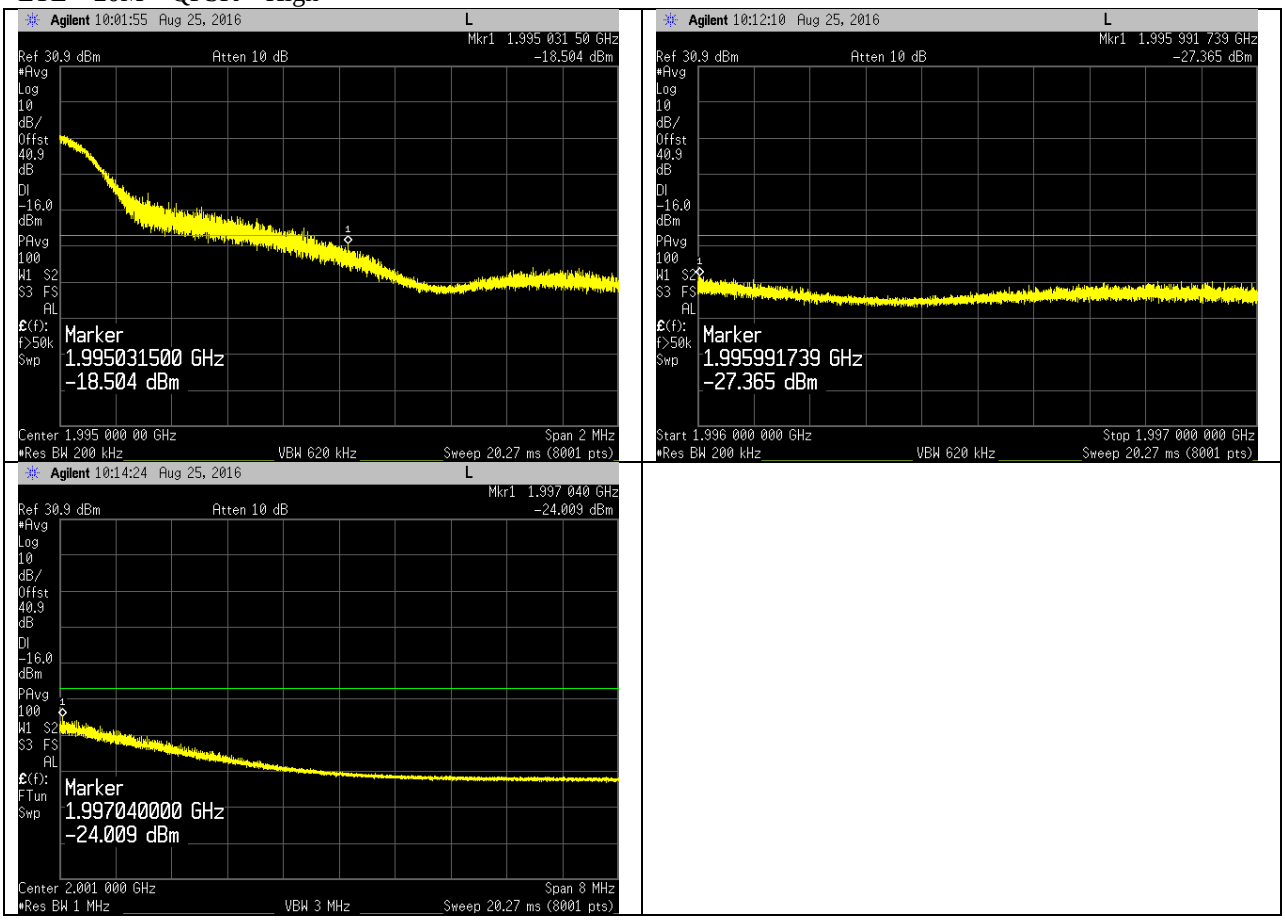
LTE – 15M – 64QAM – High



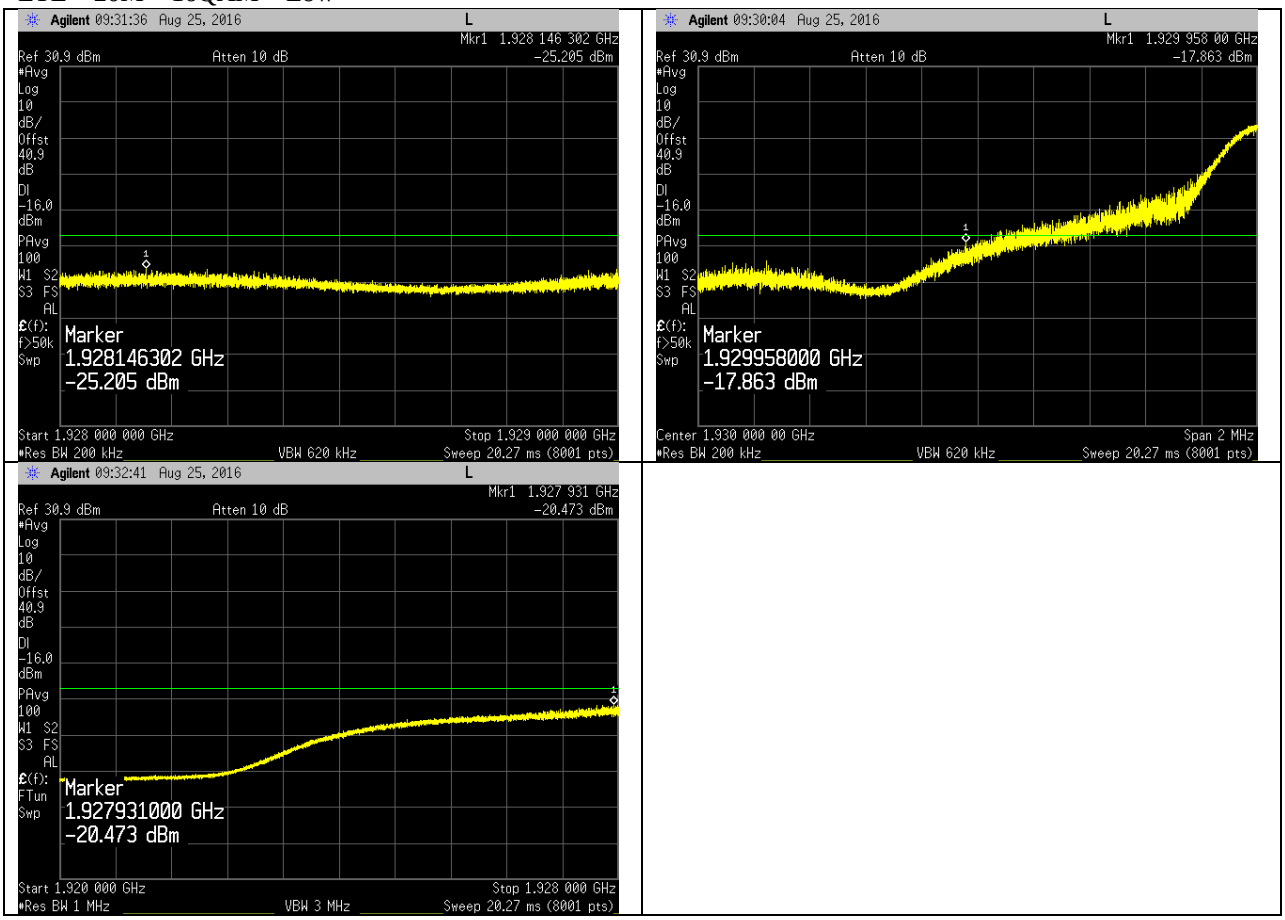
LTE – 20M – QPSK – Low



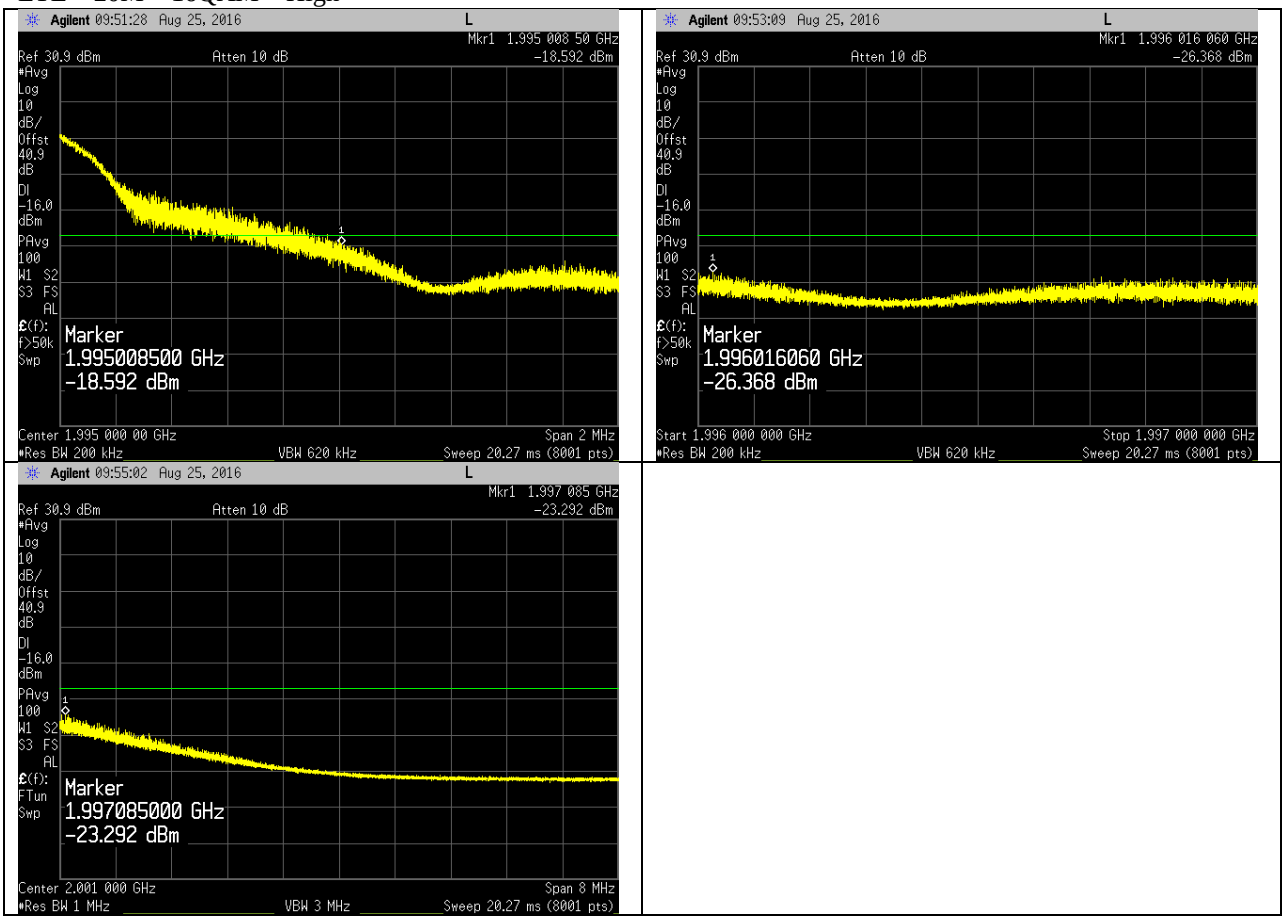
LTE – 20M – QPSK – High



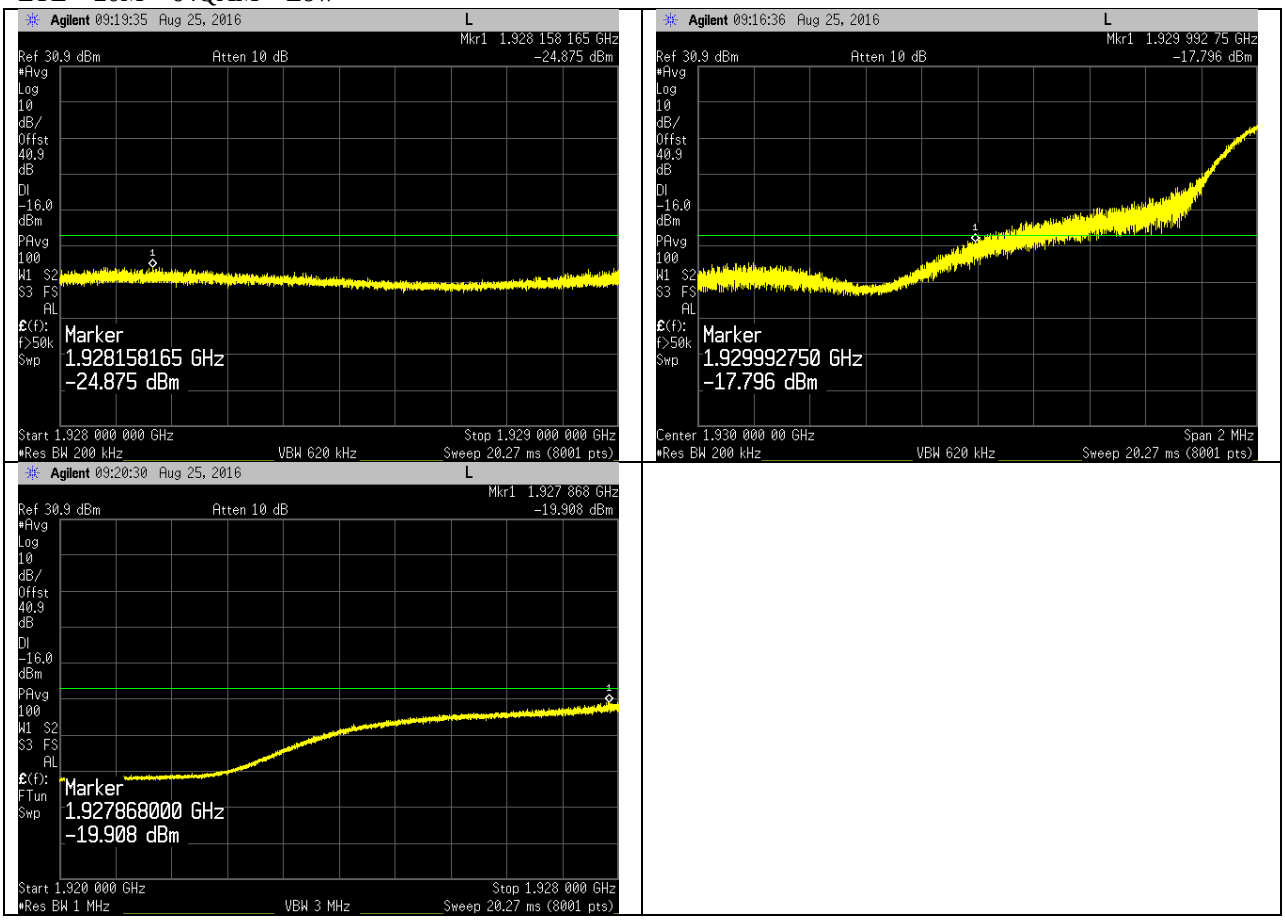
LTE – 20M – 16QAM – Low



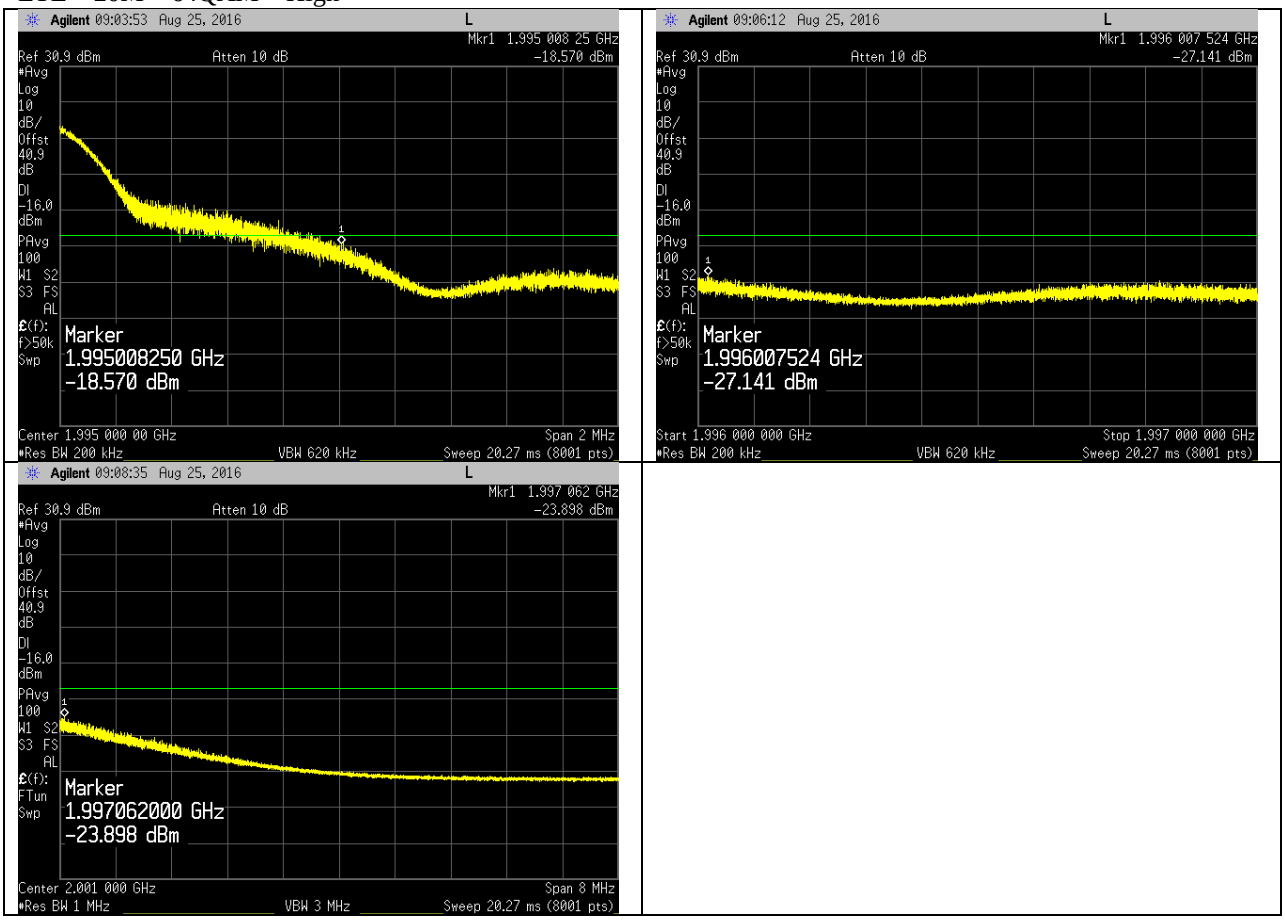
LTE – 20M – 16QAM – High



LTE – 20M – 64QAM – Low



LTE – 20M – 64QAM – High



Transmitter Antenna Port Conducted Spurious Emissions

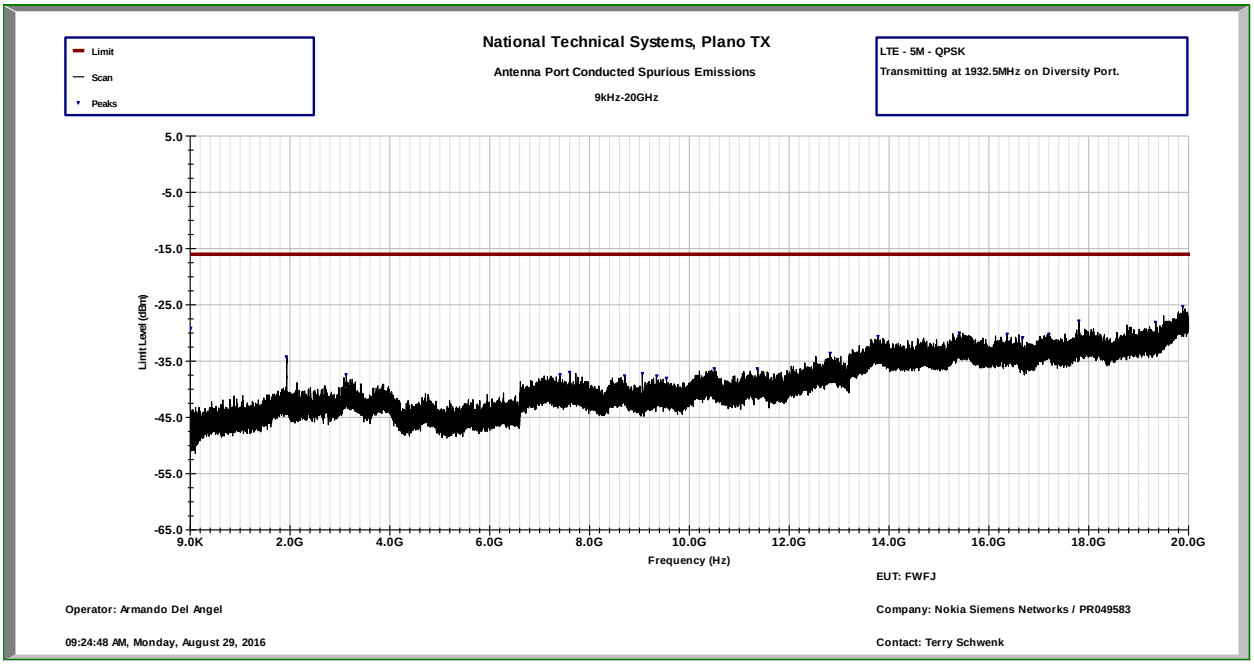
Tests performed at Main Port on center channel for all modulations and bandwidth modes. Due to 2x2 MIMO operation, limit is -16.03dBm (-13dBm – 10*log(2)) per FCC KDB 662911D01 v02r01.

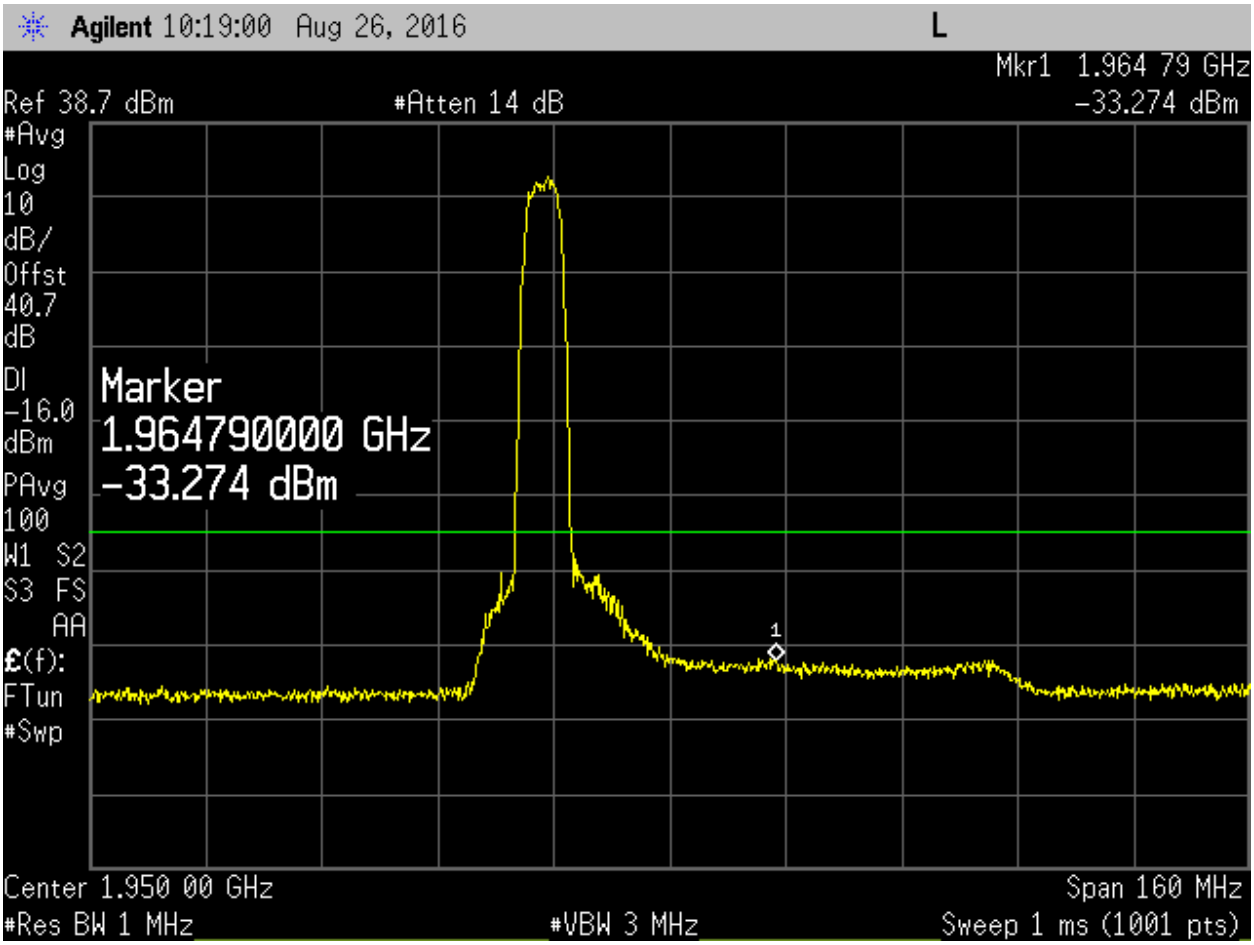
TILE6 measurement software was used during testing with the following settings:

Frequency Range	**RBW**	**VBW**	**Number of data points**	**Divided into**	**Detector**	**Sweep Time**	**Max hold over**
9kHz-150kHz	1kHz	3kHz	8000	1 segment	Peak	Auto	50 sweeps
150kHz-1.5MHz	100kHz	300kHz	8000	1 segment	Peak	Auto	50 sweeps
1.5MHz-20GHz	1MHz	3MHz	8000	10 segments	Peak	Auto	50 sweeps

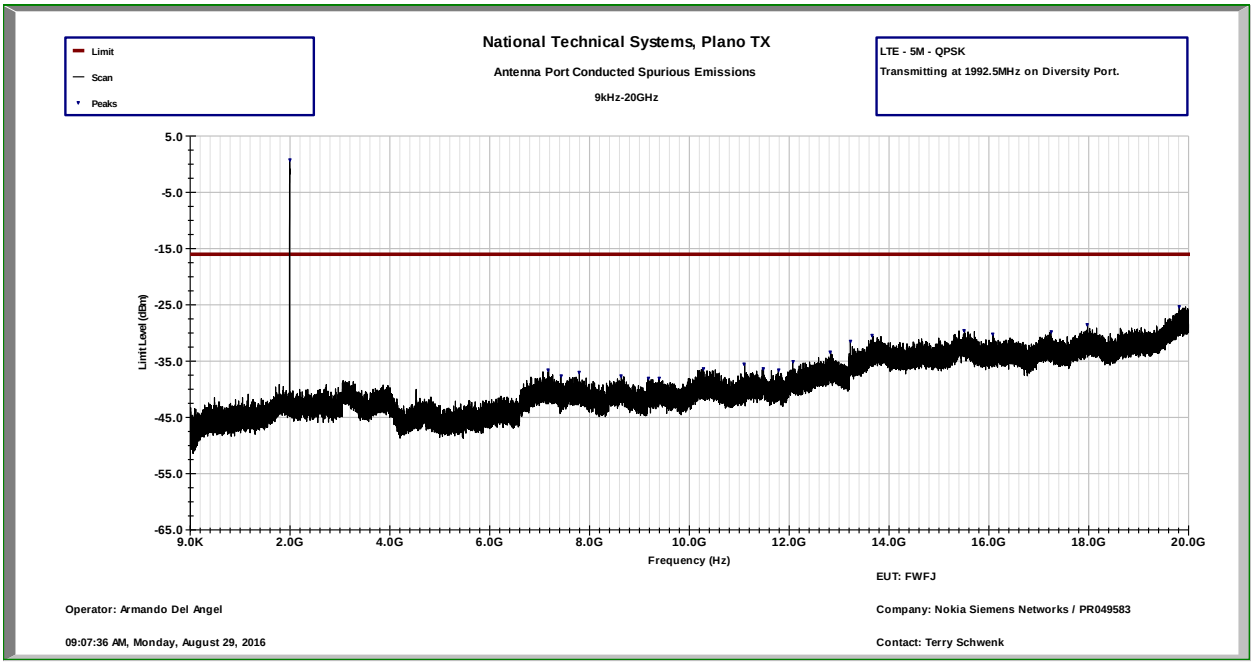
Corresponding plots are included on the following pages. 1st Plot was taken with a notch filter. The notch filter was used from 9kHz-4GHz with a stop-band of 1870-2030MHz. The 2nd plot was taken with no filter in order to measure the stop-band of the notch filter 1870-2030MHz. This was accomplished with internal and external attenuation. The external attenuation was corrected through the PSA's reference offset, attenuator + cables = 40.7dB.

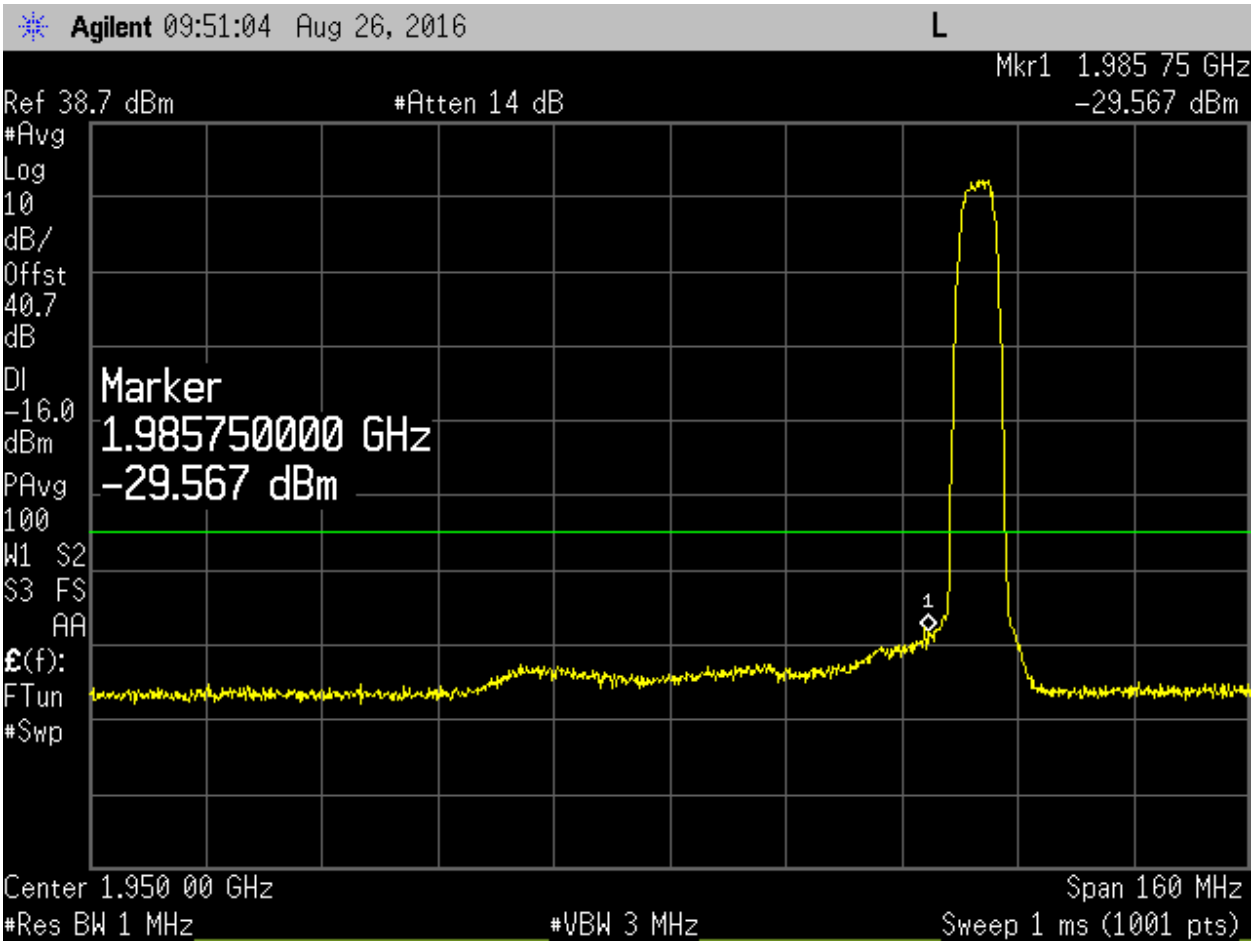
5M – LTE – QPSK – Low Channel



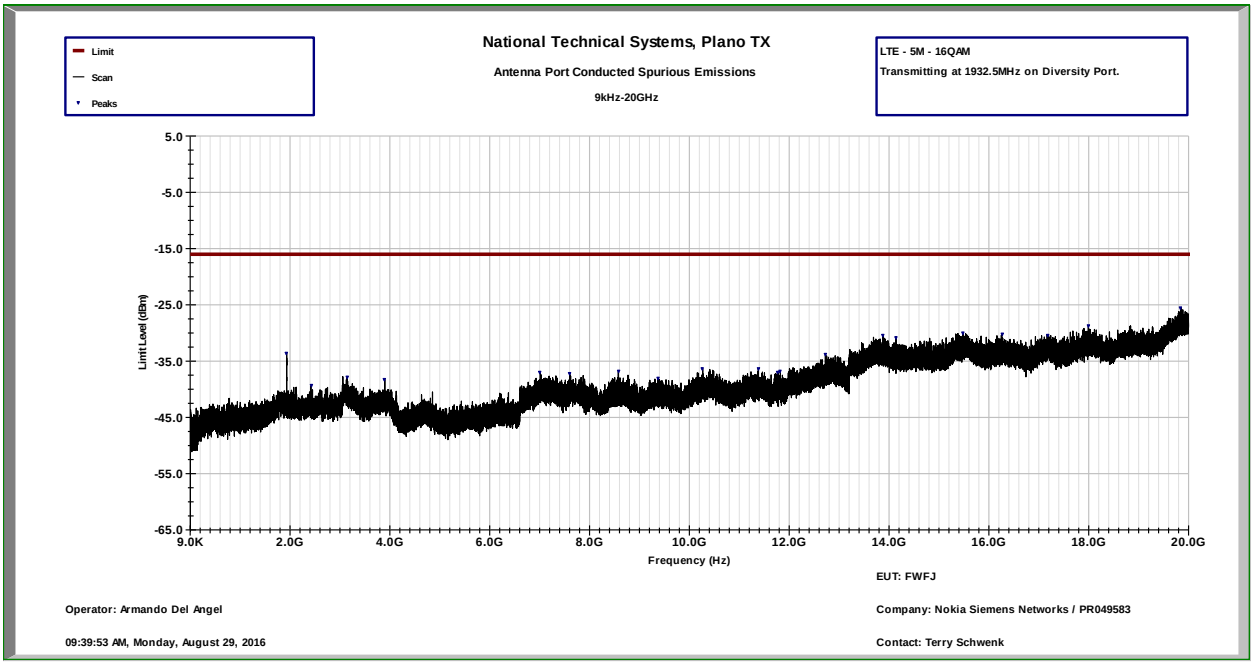


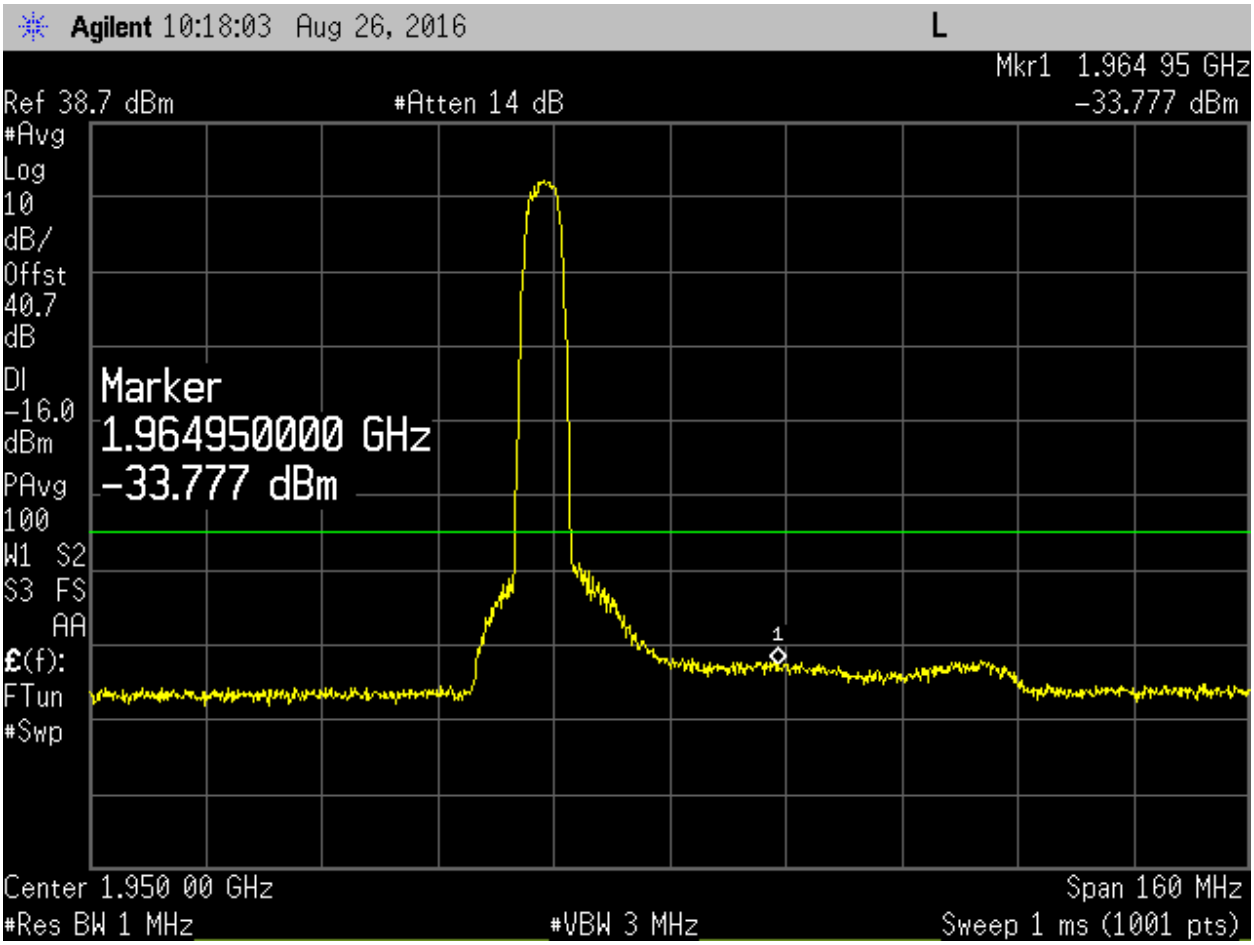
5M – LTE – QPSK – High Channel



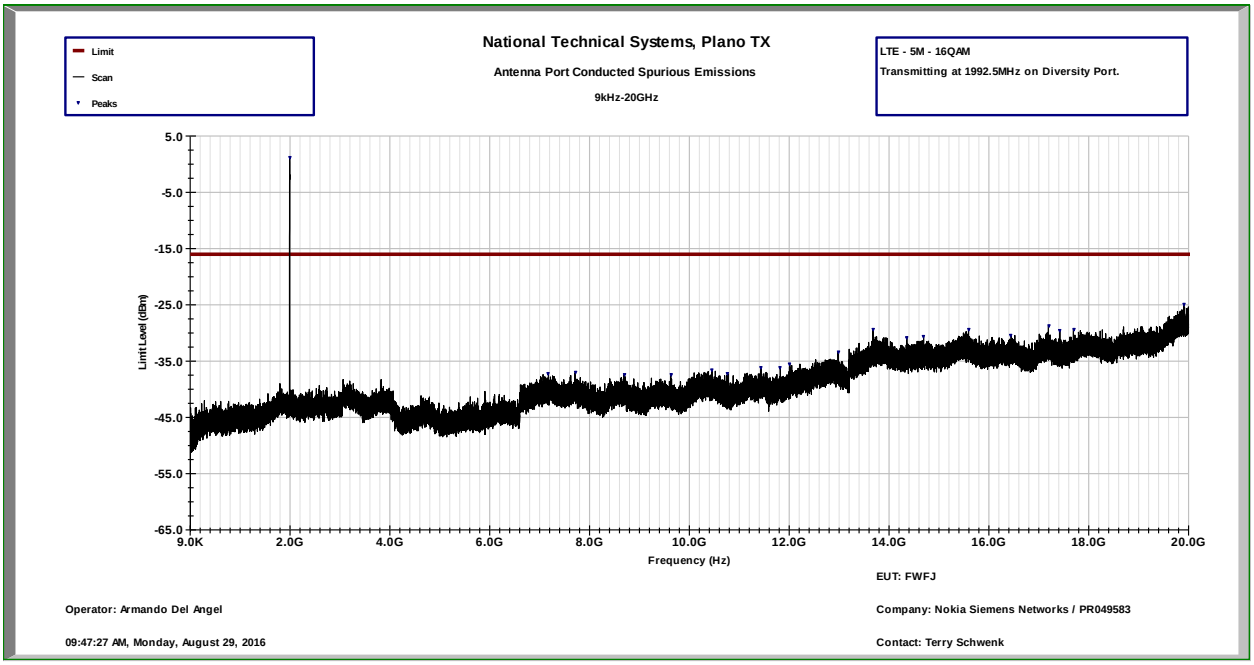


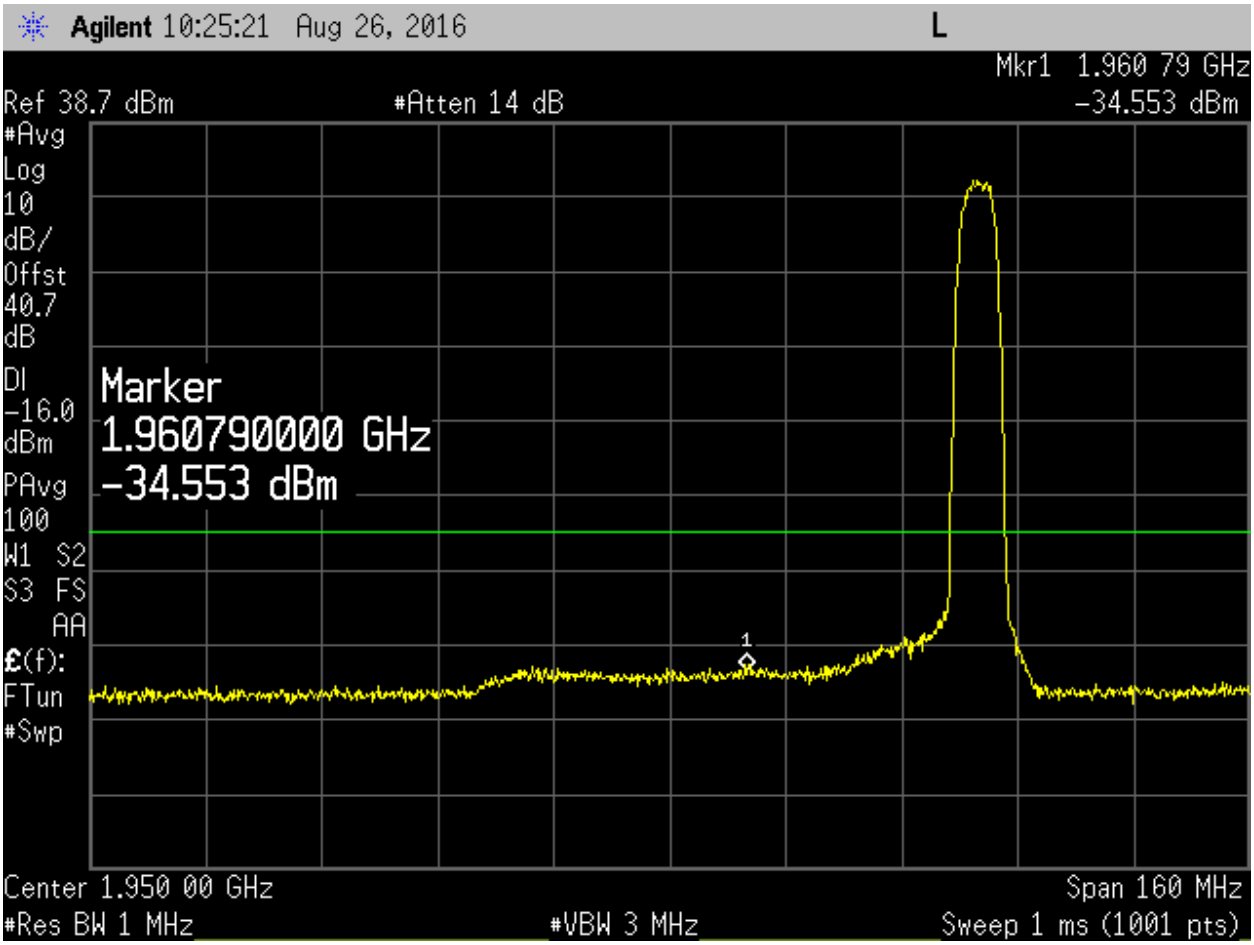
5M – LTE – 16QAM – Low Channel





5M – LTE – 16QAM – High Channel





5M – LTE – 64QAM – Low Channel