Radio Test Report

Application for a Class II Permissive Change of Equipment Authorization

FCC Part 22 Subpart H
IC RSS-132 Issue 3
869MHz – 894MHz

FCC ID:	**VBNFXCB-01**
IC:	**661W-FXCB**
Model:	**FXCB**
Product Name:	**Flexi Multiradio BTS**
APPLICANT:	**Nokia Solutions and Networks** **6000 Connection Drive** **Irving, TX 75039**
TEST SITE(S):	**National Technical Systems - Plano** **1701 E Plano Pkwy #150** **Plano, TX 75074**
REPORT DATE:	**3/29/16**
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REVISION HISTORY

Rev#	Date	Comments	Modified By
0	3/25/16	Draft	AD
1	4/27/16	Changes per customer comments	AD

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SCOPE

Tests have been performed on Nokia Solutions and Networks product Flexi Multiradio BTS RFM Model FXCB, pursuant to the relevant requirements of the following standard(s) in order to obtain a Class II permissive change certification against the regulatory requirements of the Federal Communications Commission and Industry Canada.

- Code of Federal Regulations (CFR) Title 47 Part 2
- CFR Title 47 Part 22 Subpart H
- RSS-Gen Issue 4 November 2014
- RSS-132 Issue 3 January 2013

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 requirements.

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 Multiradio BTS RFM Model FXCB and therefore apply only to the tested sample. The sample was selected and prepared by Hobert Smith of Nokia Solutions and Networks.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section. This Testing was performed in order to obtain a Class II permissive change to add LTE modulation Types.

Prior to marketing in the USA, the device requires certification. Prior to marketing in Canada, Class I transmitters, receivers and transceivers require 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 FXCB. No additional models were described or supplied for testing.

STATEMENT OF COMPLIANCE

The tested sample of Nokia Solutions and Networks product Flexi Multiradio BTS RFM Model FXCB 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 22 Subpart H and RSS-132 Issue 3 (Base Stations Operating in 869MHz-894MHz band)

FCC	Canada	Description	Measured	Limit	Result
Transmitter Modulation, output power and other characteristics					
§22.905	RSS-132 Section 5.1	Frequency range(s)	869.7-893.3 (1.4M-LTE) 870.5-892.5 (3M-LTE) 871.5-891.5 (5M-LTE) 874.0-889.0 (10M-LTE)	869-894 MHz	Pass
§2.1047	RSS-132 Section 5.2	Modulation Type	QPSK, 16QAM, 64QAM (1.4M, 3M, 5M, 10M for each)	Digital	Pass
§22.913	RSS-132 Section 5.4	Output Power	Conducted Output Power (Highest on Port 5) RMS: 49.21Bm ERP will depend on antenna gain (unknown)	1000W ERP	Pass
N/A Informational	RSS-132 Section 5.4	Peak to Average Ratio	9.08dB highest	<= 13 dB	Pass
§22.917(b)	-	Emission Bandwidth (26dB)	1.282MHz (1.4M-LTE) 2.924MHz (3M-LTE) 4.866MHz (5M-LTE) 9.73MHz (10M-LTE)	Remain in Block	Pass
-	RSS-Gen Section 6.6	Emission Bandwidth (99%)	1.12MHz (1.4M-LTE) 2.712MHz (3M-LTE) 4.503MHz (5M-LTE) 9.006MHz (10M-LTE)	Remain in Block	Pass
Transmitter spurious emissions[1]					
§22.917	RSS-132 Section 5.5	At the antenna terminals	< -19.03dBm	-19.03 dBm (per TX chain)	Pass
		Field strength	36.742dBuV/m at 3m Eq. to -58.458dBm EIRP	-13 dBm EIRP	Pass
Other details					
§2.1057	RSS-132 Section 5.3	Frequency stability	N/A	1.5ppm	Pass[2]
§1.1310	RSS-102 Issue 5	RF Exposure	N/A		Pass[3]

Notes

Note 1 – Based on 100kHz RBW. In 1MHz bands immediately outside and adjacent to the frequency block an RBW of at least 1% of the emission bandwidth has been used.
Note 2 – Not Required per TCB guidance. Testing Performed in the original FXCB certification.
Note 3 – Applicant’s declaration on a separate exhibit based on hypothetical antenna gains.

	Emission Designators					
	LTE-QPSK		LTE-16QAM		LTE-64QAM	
	FCC	IC	FCC	IC	FCC	IC
1.4M	1M29F9W	1M12F9W	1M27F9W	1M12F9W	1M27F9W	1M11F9W
3M	2M93F9W	2M71F9W	2M92F9W	2M71F9W	2M92F9W	2M72F9W
5M	4M87F9W	4M50F9W	4M85F9W	4M48F9W	4M87F9W	4M51F9W
10M	9M71F9W	9M00F9W	9M69F9W	9M01F9W	9M73F9W	9M00F9W

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.

Extreme Temperature was not tested per TCB Guidance. Testing for frequency stability was performed in the original FXCB certification.

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 (EUT) is a Nokia Solutions and Networks Flexi Multiradio Base Transceiver Station (BTS) Radio Frequency Module (RFM) module, model FXCB which operates over 3GPP frequency band 5 (869 - 894 MHz). The FXCB has three co-located transmitters, with the option of being operated in a 4X4 MIMO configuration; with each transmit port supporting 80 watts maximum rated RF output power. The FXCB can be operated as MIMO or as non-MIMO. Multi-carrier operation is supported.

The FXCB is multi-standard capable (GSM/EDGE/WCDMA/LTE), but for this effort only the LTE mode will be tested. The FXCB supports three downlink modulation types for LTE (QPSK, 16QAM and 64QAM). The FXCB supports four LTE channel bandwidths (1.4, 3, 5, and 10 MHz). FXCB Certification testing is required because of added LTE bandwidths from the original certification testing.

The FXCB has external interfaces including DC power, ground, TX/RX (Ant), RX monitor (RXO), external alarm (EAC), optical OBSAI (OPT) and remote electrical tilt (RET).

The FXCB channel numbers and frequencies are as follows:

	Downlink EARFCN Band 5	Downlink Frequency (MHz)	LTE Channel Bandwidth			
			1.4 MHz	3.0 MHz	5 MHz	10 MHz
Band 5 (Ant 1, 3, 5)	2400	869.0	Bandedge	Bandedge	Bandedge	Bandedge
	……					
	2407	869.7	Bottom Ch			
	……					
	2415	870.5		Bottom Ch		
	……					
	2425	871.5			Bottom Ch	
	……					
	2450	874.0				Bottom Ch
	……					
	2475	876.5				
	……					
	2500	879.0				
	……					
	2525	881.5	Middle Ch	Middle Ch	Middle Ch	Middle Ch
	……					
	2550	884.0				
	……					
	2575	886.5				
	……					
	2600	889.0				Top Channel
	……					
	2625	891.5			Top Channel	
	……					
	2635	892.5		Top Channel		
	……					
	2643	893.3	Top Channel			
	……					
	2650	894.0	Bandedge	Bandedge	Bandedge	Bandedge

FXCB Downlink LTE Frequency Channels

The sample was received on Feb 29, 2016 and tested on March 1st – March 25th, 2016. The EUT consisted of the following component(s):

Company	Model	Description	Part/Serial Number	FCC ID/IC Number
Nokia Solutions and Networks	FXCB	Flexi Multiradio BTS RFM	Part#: 472678A.101 Serial#: 1M152319526	FCC ID: VBNFXCB-01 IC: 661W-FXCB

ENCLOSURE

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

AUXILLARY EQUIPMENT

Company	Model	Description	Part/Serial Number	FCC ID/IC Number
Nokia Solutions and Networks	FOSH	SFP Optical Module (Plugs into RFM Opt Ports 1, 2 & 3)	Part#: 472579A.101 (3 units per RFM) Serial#: FR151400271, FR151400272, and FR151400275	N/A

SUPPORT EQUIPMENT

Company	Model	Description	Part/Serial Number	FCC ID/IC Number
Nokia Solutions and Networks	FSMF	Flexi System Module	Part#: 472181A.103	N/A
Nokia Solutions and Networks	FBBC	Baseband Extension Module	Part#: 472797A.101 (2 units per FSMF)	N/A
HP	Elite Book 6930p	Laptop PC	N/A	N/A

EUT INTERFACE PORTS

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

Cable	Type	Shield	Length	Used in Test	Quantity	Termination
Power Input	Power	No	~ 3 m	Yes	1	Power Supply
Earth	Earth	No	~ 1 m	Yes	1	Lab earth ground
Antenna	RF	Yes	~ 3 m	Yes	3	50Ω Load
Multimode Optical	Optical	No	>6 m	Yes	3	System Module

The connector layout for FXCB is provided below:

FXCB External Interfaces:

Name	Qty	Connector Type	Purpose (and Description)
DC In	1	Screw Terminal	Power Input -48 VDC
GND	1	Screw lug (2xM5)	Ground
ANT	6	7/16	RF signal for three Transmitter/Receiver (50 Ohm) and three Receive Only (50 Ohm)
RXO	6	QMA	RX output for monitoring/location services
Unit	1	LED	Unit Status LED
EAC	1	RJ45	External Alarm Interface (4 alarms)
RET	1	8-pin circular	AISG 2.0 to external devices
OPT	3	SFP+ cage	Optical OBSAI Interface (3 Gbps)

EUT OPERATION

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

EUT FIRMWARE/SOFTWARE

The laptop PC connects to the FSMF System Module over the LMP (Ethernet) port. The system module controls the FXCB RFM via the optical (OBSAI) interface. The laptop is used for changing configuration settings, monitoring tests and controlling the BTS. The following software versions are used for the FXCB testing:

(1) RFM Unit Software: VEG 26.02.R01
(2) System Module Software: FL16A_FSM3_9999_160112_027599

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.

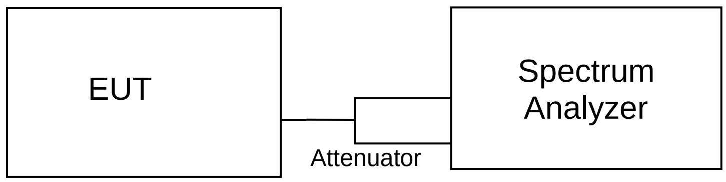
Radiated spurious emissions measurements were taken at the NTS Plano Anechoic Chamber listed below. The sites conform to the requirements of ANSI C63.4-2009 *American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range 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 46dB attenuator and an RF cable. The EUT was operating in 4x4 MIMO configuration at full power for all tests. 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-9GHz 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 9GHz with a peak detector (RBW=100kHz, VBW=300kHz, 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 1-9GHz 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 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)
Port 1 Center Channel	1.4M	55.66	48.9	6.76	55.86	48.77	7.09	55.58	48.88	6.7
	3M	56.52	48.96	7.56	56.76	48.98	7.78	56.76	48.96	7.8
	5M	57.01	48.96	8.05	57.65	48.96	8.69	56.94	49	7.94
	10M	57.22	49	8.22	57.84	49.11	8.73	57.06	48.99	8.07
Port 3 Center Channel	1.4M	55.79	49.06	6.73	55.95	49.04	6.91	55.66	48.98	6.68
	3M	56.7	49.04	7.66	56.86	49.12	7.74	56.84	49.04	7.8
	5M	57.19	49.13	8.06	57.75	49.15	8.6	57.01	49.12	7.89
	10M	57.34	49.11	8.23	57.91	49.08	8.83	57.14	49.06	8.08
Port 5 Center Channel	1.4M	55.8	49.11	6.69	55.97	49.2	6.77	55.7	49	6.7
	3M	56.71	49.06	7.65	56.91	49.03	7.88	56.87	49.07	7.8
	5M	57.25	49.21	8.04	57.8	49.14	8.66	56.98	49.08	7.9
	10M	57.36	49.14	8.22	57.97	49.19	8.78	57.23	49.14	8.09
Combined Center Channel	1.4M	60.52	53.8	6.72	60.7	53.78	6.92	60.42	53.72	6.7
	3M	61.42	53.79	7.63	61.61	53.81	7.8	61.59	53.79	7.8
	5M	61.92	53.87	8.05	62.5	53.86	8.64	61.75	53.84	7.91
	10M	62.08	53.85	8.23	62.68	53.9	8.78	61.92	53.83	8.09

Based on the results above, Port 5 had the highest RMS average power and therefore it was selected for all the remaining LTE mode antenna port tests on the product.

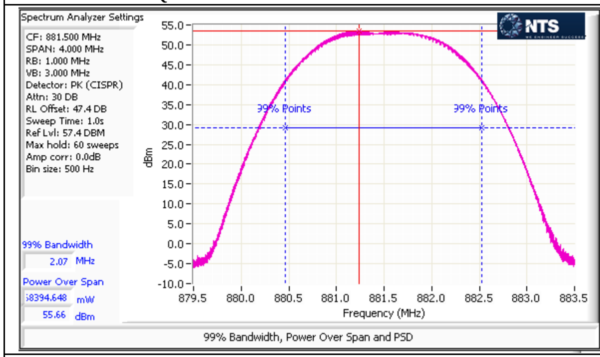
Subsequently output power levels on lowest and highest channels were tested only on Port 5 and results presented below.

		LTE - QPSK			LTE - 16QAM			LTE - 64QAM		
		Peak (dBm)	Average (dBm)	PAR (dB)	Peak (dBm)	Average (dBm)	PAR (dB)	Peak (dBm)	Average (dBm)	PAR (dB)
Port 5 Low Channel	1.4M	55.8	49.05	6.75	55.97	48.8	7.17	55.7	48.97	6.73
	3M	56.03	47.87	8.16	55.94	47.91	8.03	55.96	47.88	8.08
	3M+1	56.73	49.04	7.69	56.89	49.04	7.85	56.85	49.04	7.81
	5M	56.17	47.92	8.25	56.93	47.95	8.98	56.04	47.94	8.1
	5M+1	57.09	49.1	7.99	57.77	49.21	8.56	56.99	48.27	8.72
	10M	56.36	48.01	8.35	56.93	47.97	8.96	56.12	47.95	8.17
	10M+1	57.34	49.11	8.23	57.95	49.17	8.78	57.19	49.11	8.08
Port 5 High Channel	1.4M	55.63	48.85	6.78	55.81	48.83	6.98	55.52	48.82	6.7
	3M	55.86	47.79	8.07	55.87	47.84	8.03	55.79	47.74	8.05
	3M-1	56.58	48.9	7.68	56.72	48.96	7.76	56.7	48.91	7.79
	5M	56.12	47.87	8.25	56.87	47.79	9.08	55.9	47.83	8.07
	5M-1	57.03	49.05	7.98	57.68	48.96	8.72	56.88	48.98	7.9
	10M	56.29	47.88	8.41	56.92	47.88	9.04	56.07	47.85	8.22
	10M-1	57.33	49.04	8.29	57.92	49.01	8.91	57.15	49.04	8.11

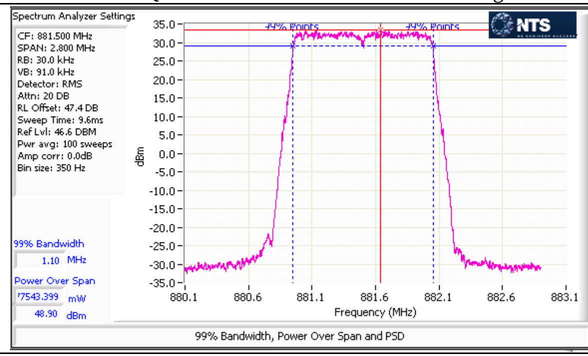
Note * = Power Reduced to 60Watts in order to meet the Bandedge Requirements.

All corresponding plots included on the following pages. Total path loss of 47.4dB accounted in via reference level offset to the spectrum analyzer.

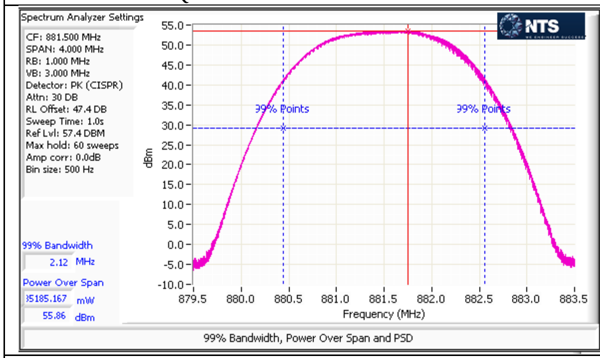
Port 1 – LTE – QPSK – 1.4M – Center Channel – Peak



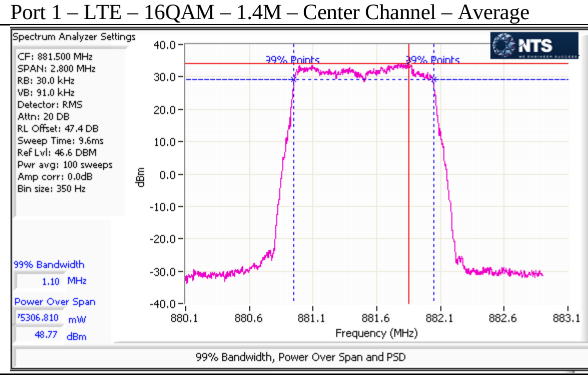
Port 1 – LTE – QPSK – 1.4M – Center Channel – Average



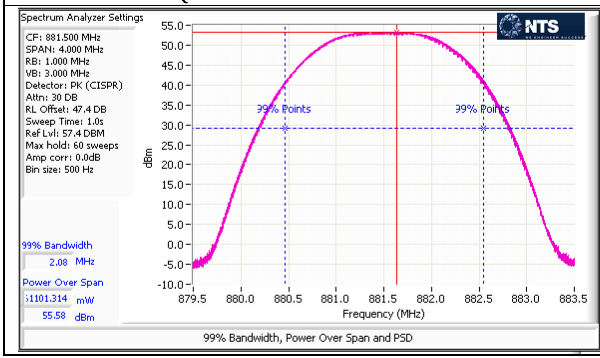
Port 1 – LTE – 16QAM – 1.4M – Center Channel – Peak



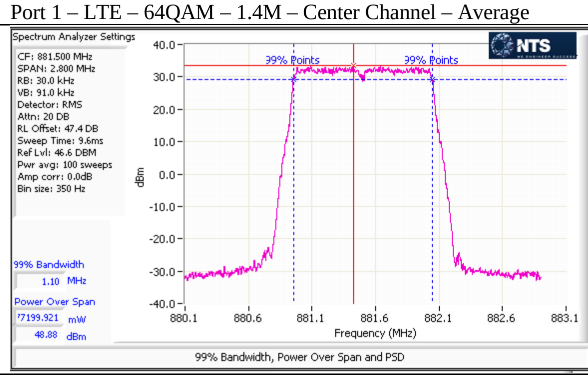
Port 1 – LTE – 16QAM – 1.4M – Center Channel – Average



Port 1 – LTE – 64QAM – 1.4M – Center Channel – Peak

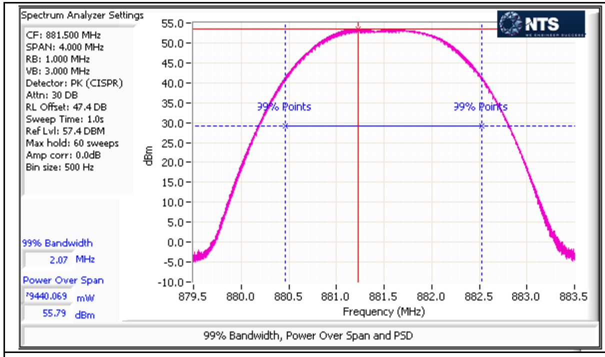


Port 1 – LTE – 64QAM – 1.4M – Center Channel – Average

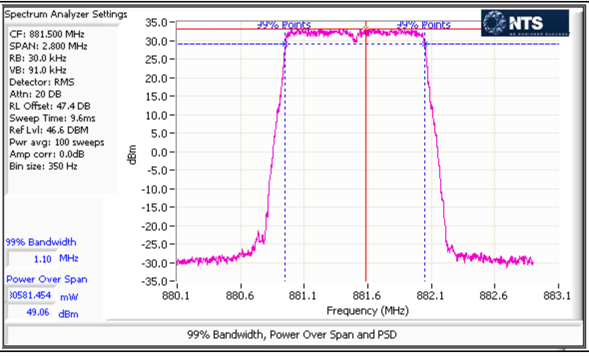


Port 3 – LTE – QPSK – 1.4M – Center Channel – Peak

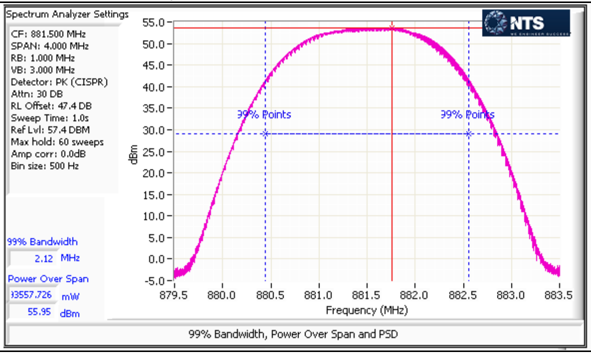
Port 3 – LTE – QPSK – 1.4M – Center Channel – Average



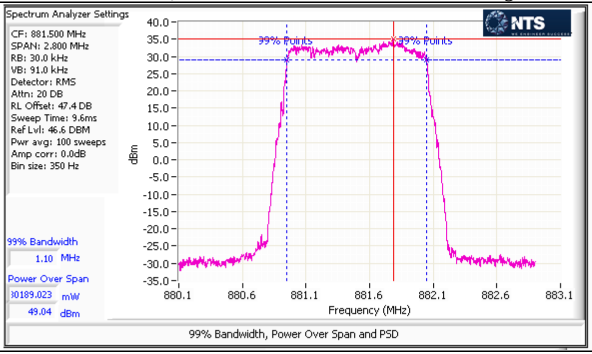
Port 3 – LTE – 16QAM – 1.4M – Center Channel – Peak



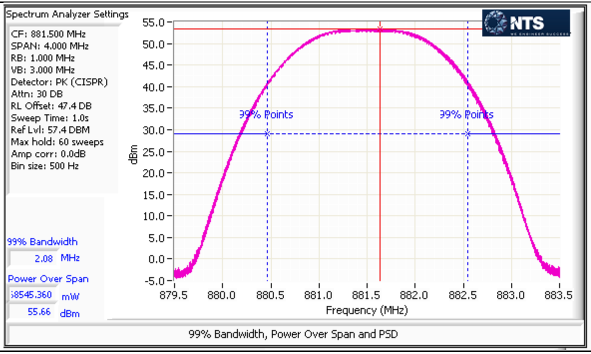
Port 3 – LTE – 16QAM – 1.4M – Center Channel – Average

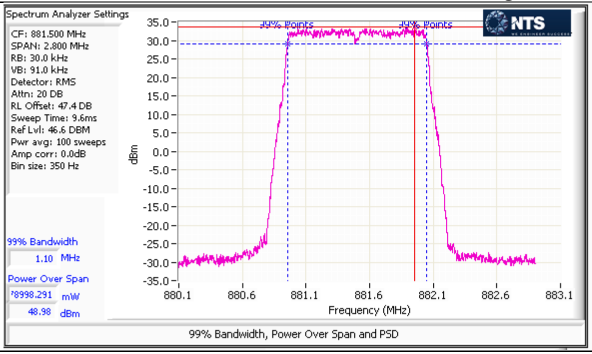


Port 3 – LTE – 64QAM – 1.4M – Center Channel – Peak



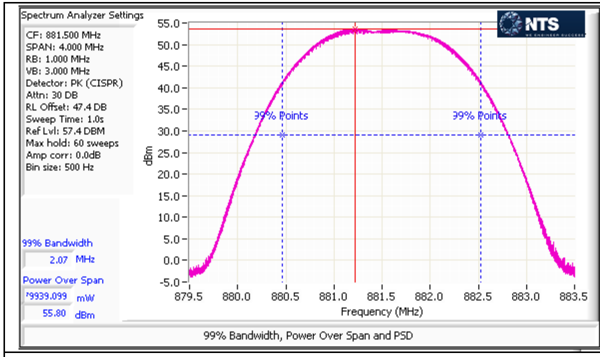
Port 3 – LTE – 64QAM – 1.4M – Center Channel – Average

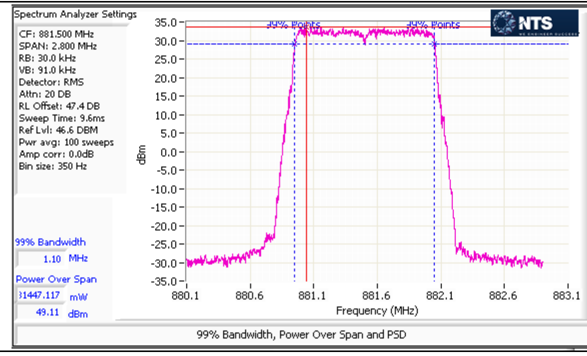




Port 5 – LTE – QPSK – 1.4M – Center Channel – Peak

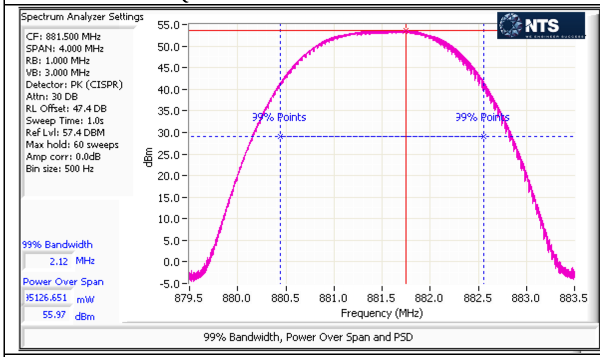
Port 5 – LTE – QPSK – 1.4M – Center Channel – Average

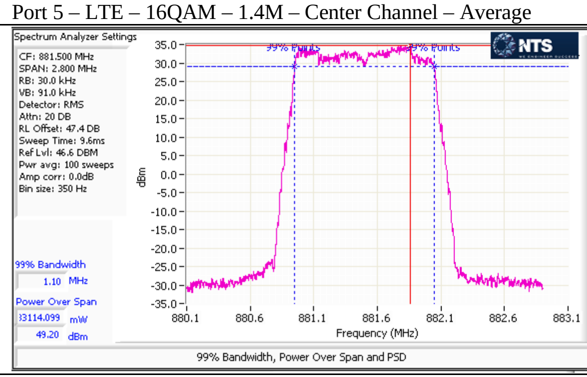




Port 5 – LTE – 16QAM – 1.4M – Center Channel – Peak

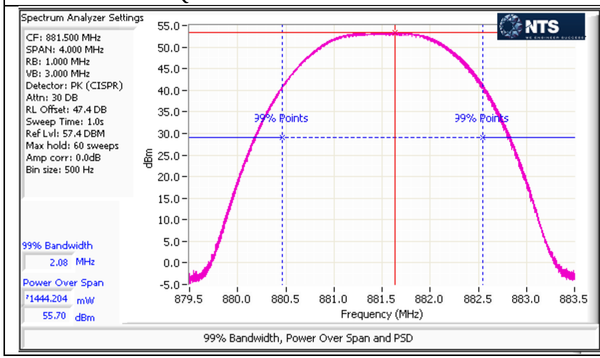
Port 5 – LTE – 16QAM – 1.4M – Center Channel – Average

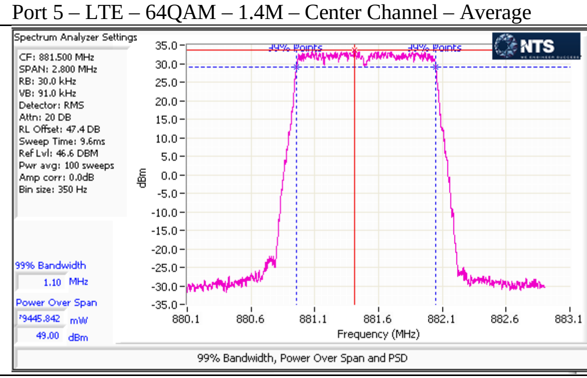




Port 5 – LTE – 64QAM – 1.4M – Center Channel – Peak

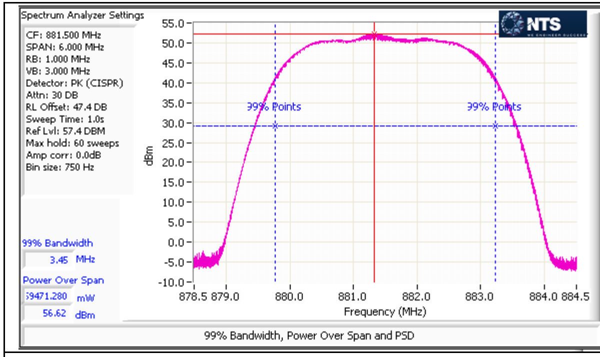
Port 5 – LTE – 64QAM – 1.4M – Center Channel – Average



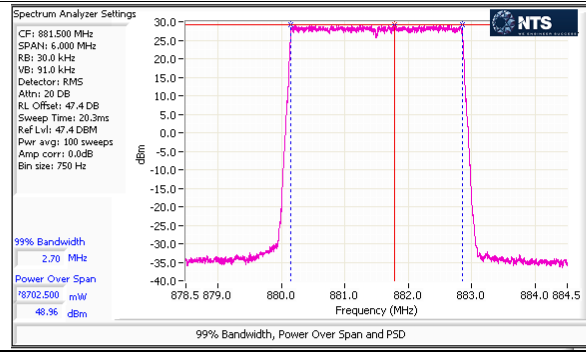


Port 1 – LTE – QPSK – 3M – Center Channel – Peak

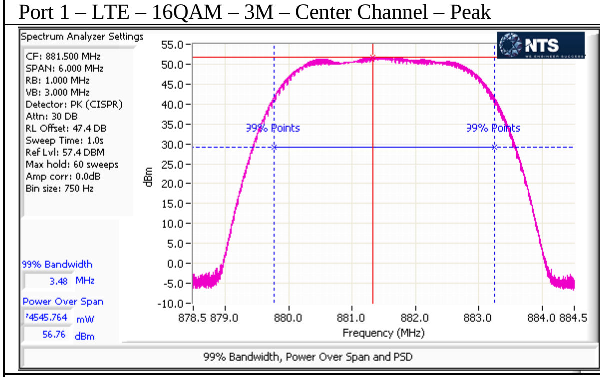
Port 1 – LTE – QPSK – 3M – Center Channel – Average



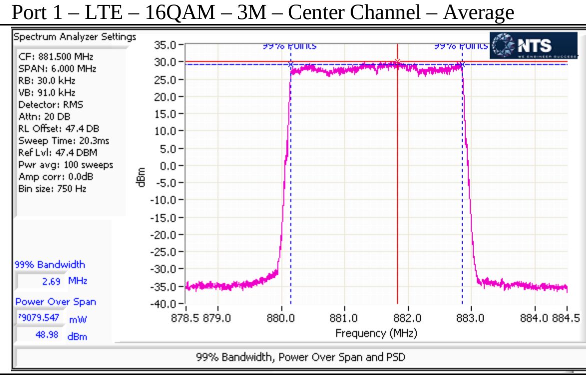
Port 1 – LTE – 16QAM – 3M – Center Channel – Peak



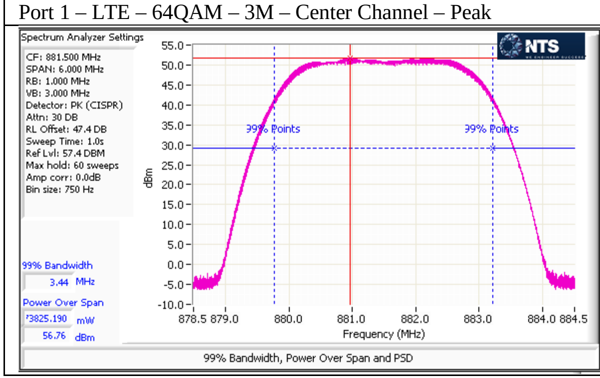
Port 1 – LTE – 16QAM – 3M – Center Channel – Average

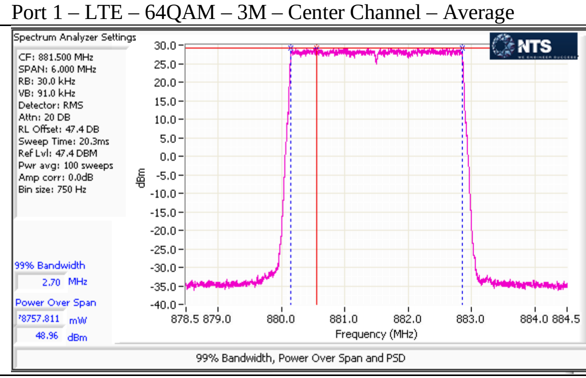


Port 1 – LTE – 64QAM – 3M – Center Channel – Peak



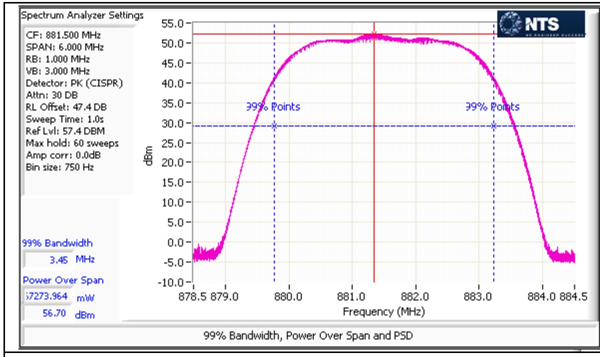
Port 1 – LTE – 64QAM – 3M – Center Channel – Average

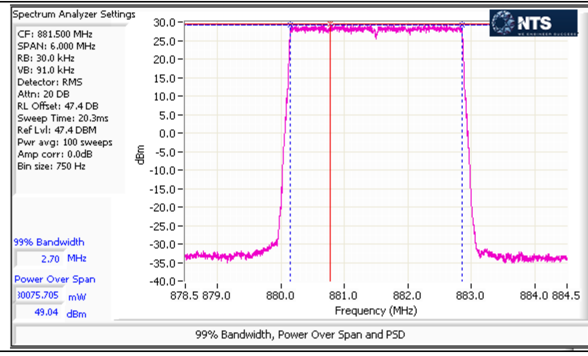




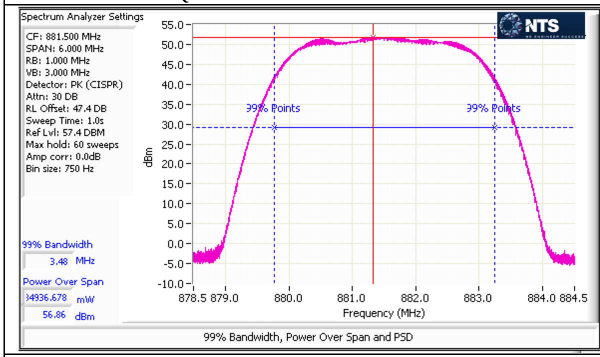
Port 3 – LTE – QPSK – 3M – Center Channel – Peak

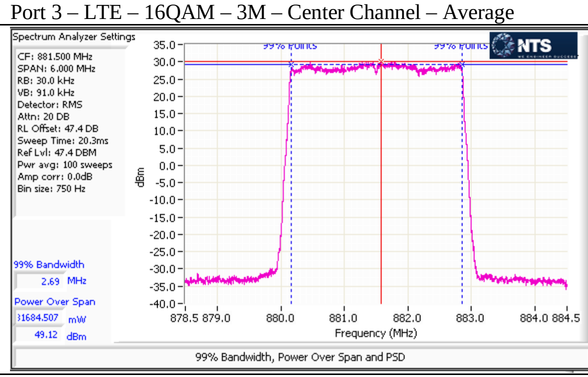
Port 3 – LTE – QPSK – 3M – Center Channel – Average



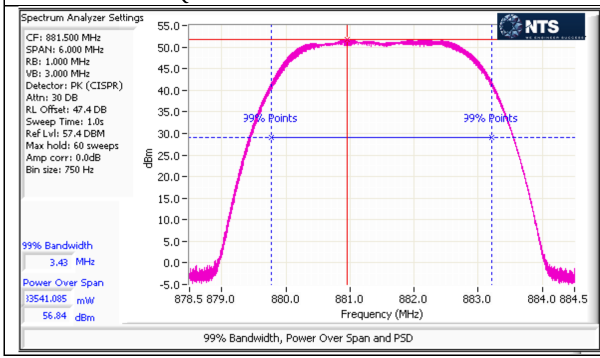


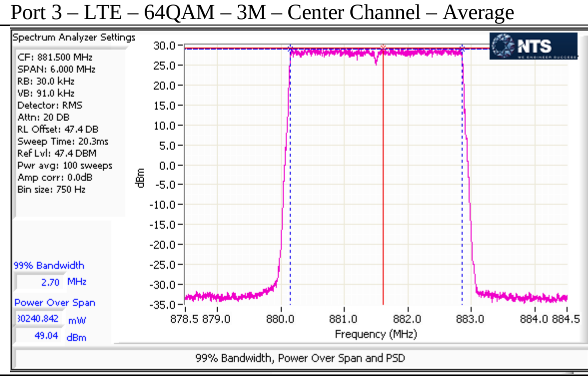
Port 3 – LTE – 16QAM – 3M – Center Channel – Peak | Port 3 – LTE – 16QAM – 3M – Center Channel – Average



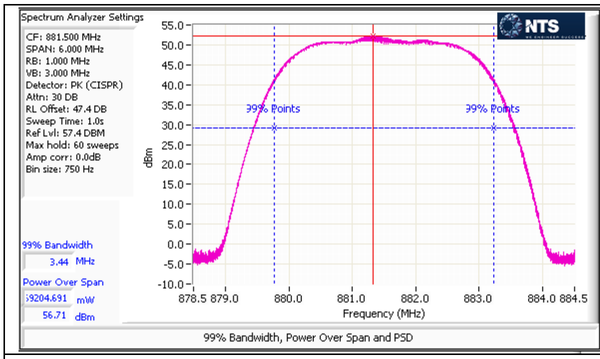


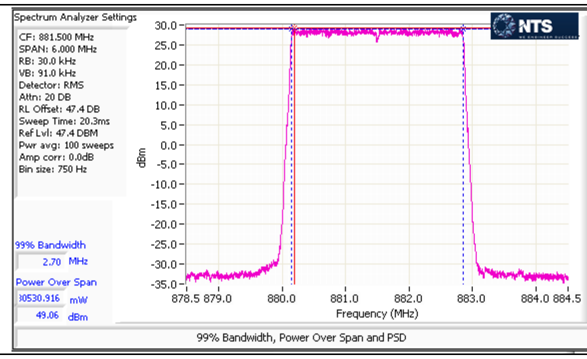
Port 3 – LTE – 64QAM – 3M – Center Channel – Peak | Port 3 – LTE – 64QAM – 3M – Center Channel – Average



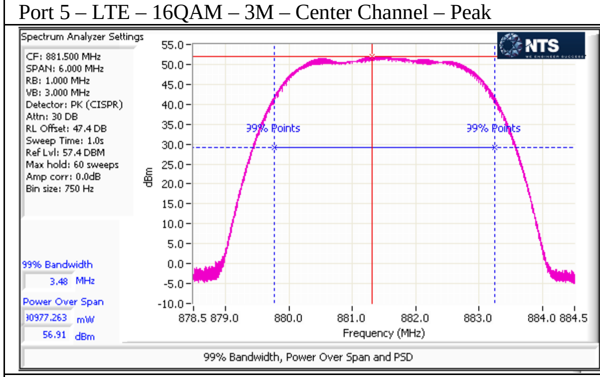


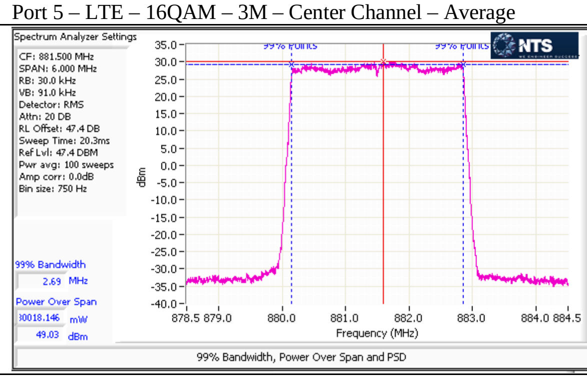
Port 5 – LTE – QPSK – 3M – Center Channel – Peak | Port 5 – LTE – QPSK – 3M – Center Channel – Average



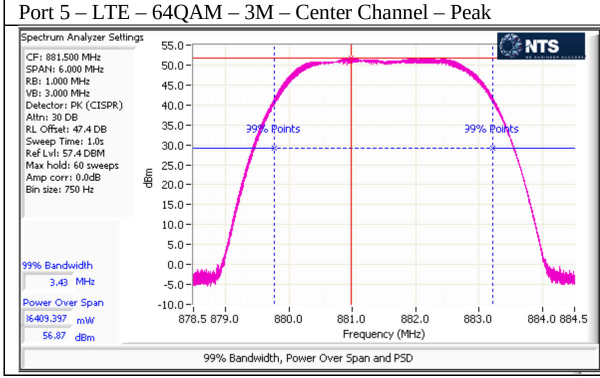


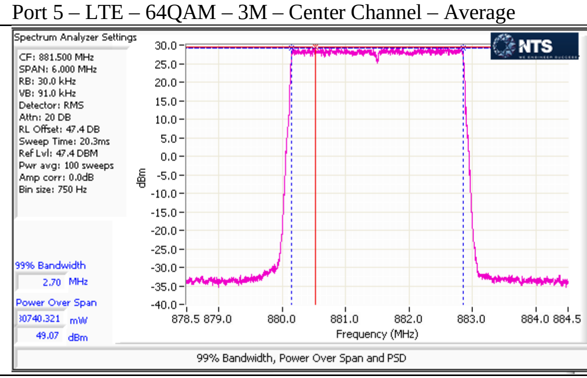
Port 5 – LTE – 16QAM – 3M – Center Channel – Peak	Port 5 – LTE – 16QAM – 3M – Center Channel – Average



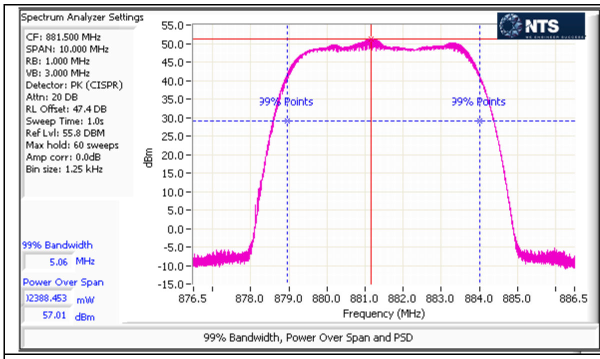


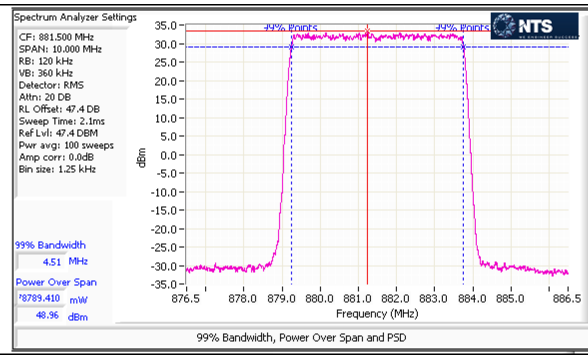
Port 5 – LTE – 64QAM – 3M – Center Channel – Peak	Port 5 – LTE – 64QAM – 3M – Center Channel – Average



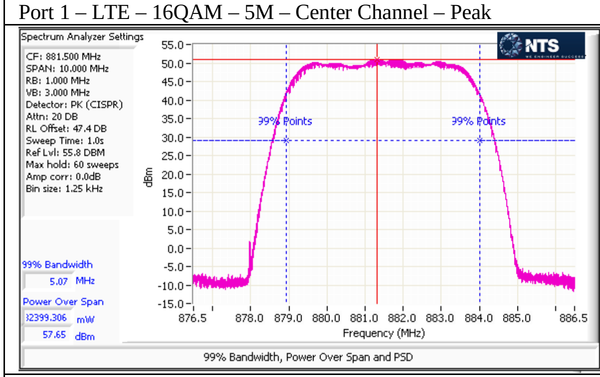


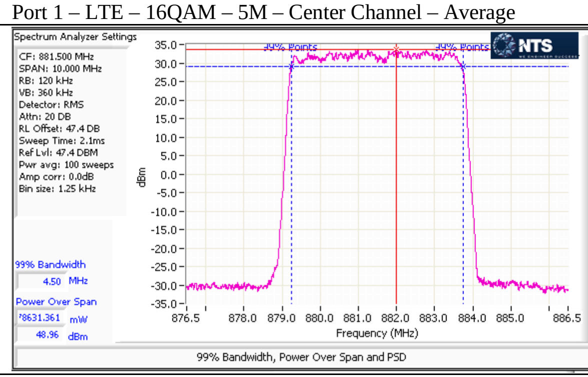
Port 1 – LTE – QPSK – 5M – Center Channel – Peak	Port 1 – LTE – QPSK – 5M – Center Channel – Average



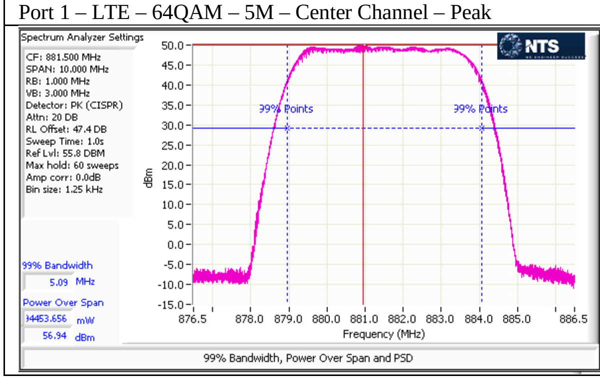


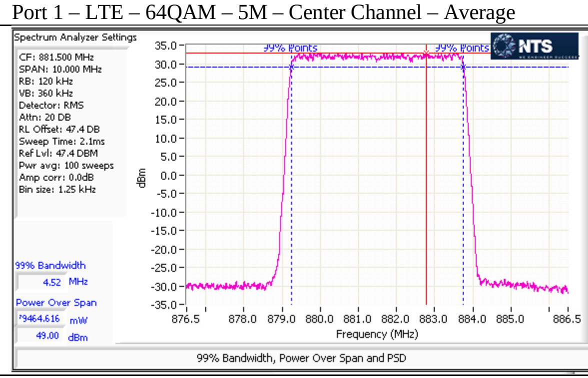
Port 1 – LTE – 16QAM – 5M – Center Channel – Peak	Port 1 – LTE – 16QAM – 5M – Center Channel – Average



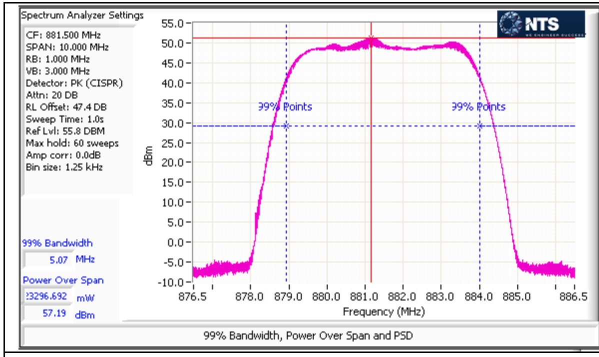


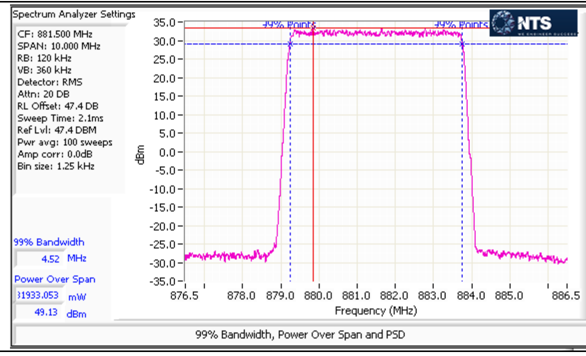
Port 1 – LTE – 64QAM – 5M – Center Channel – Peak	Port 1 – LTE – 64QAM – 5M – Center Channel – Average





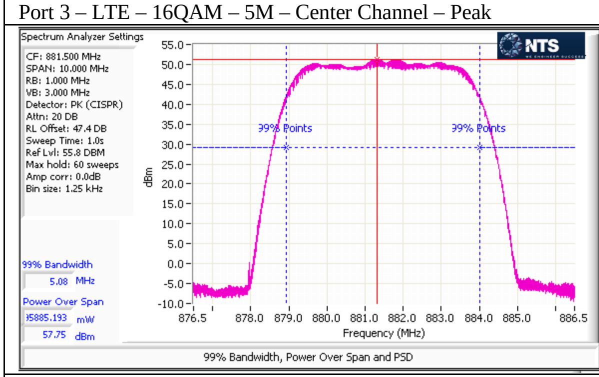
Port 3 – LTE – QPSK – 5M – Center Channel – Peak	Port 3 – LTE – QPSK – 5M – Center Channel – Average

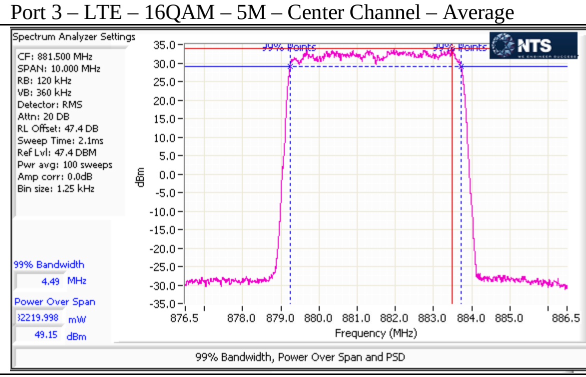




Port 3 – LTE – 16QAM – 5M – Center Channel – Peak

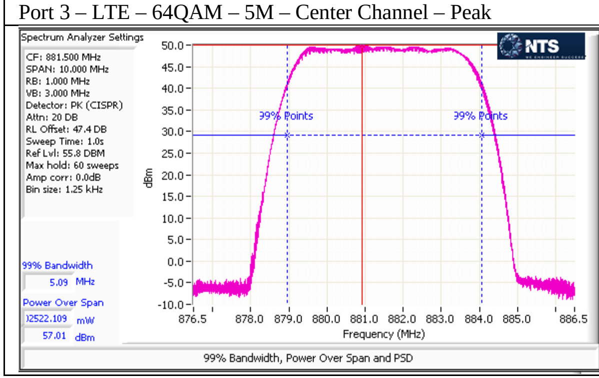
Port 3 – LTE – 16QAM – 5M – Center Channel – Average

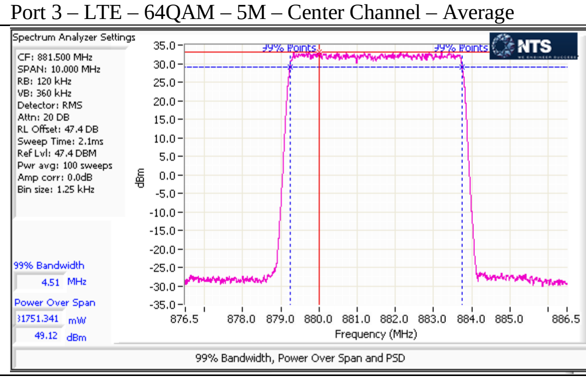




Port 3 – LTE – 64QAM – 5M – Center Channel – Peak

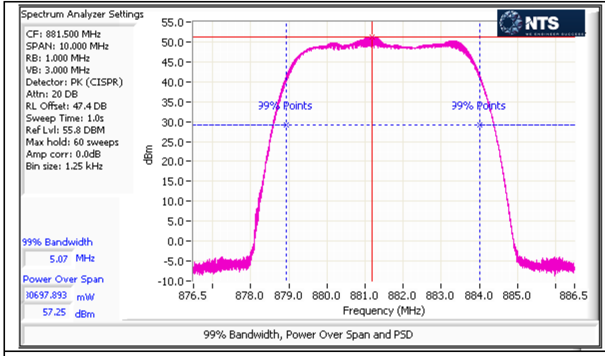
Port 3 – LTE – 64QAM – 5M – Center Channel – Average

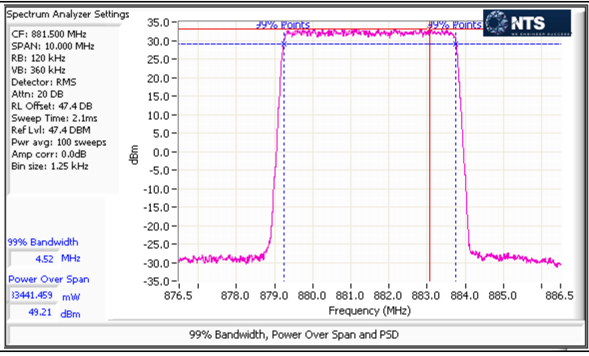




Port 5 – LTE – QPSK – 5M – Center Channel – Peak

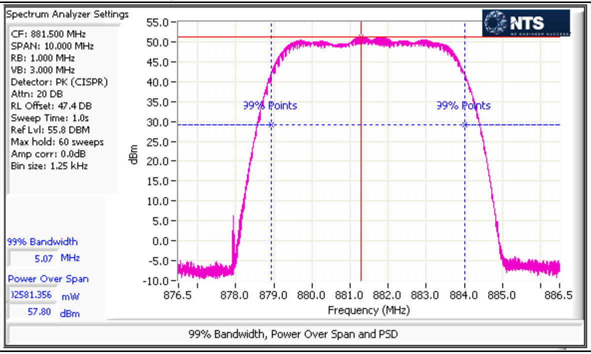
Port 5 – LTE – QPSK – 5M – Center Channel – Average

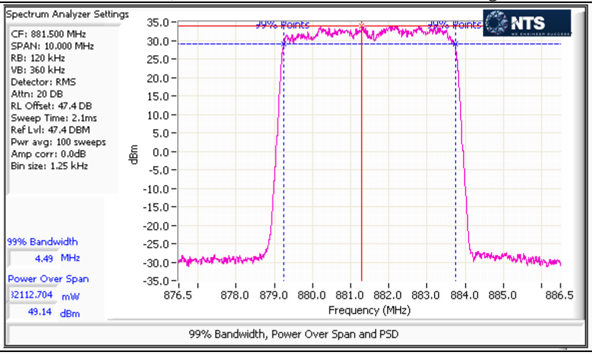




Port 5 – LTE – 16QAM – 5M – Center Channel – Peak

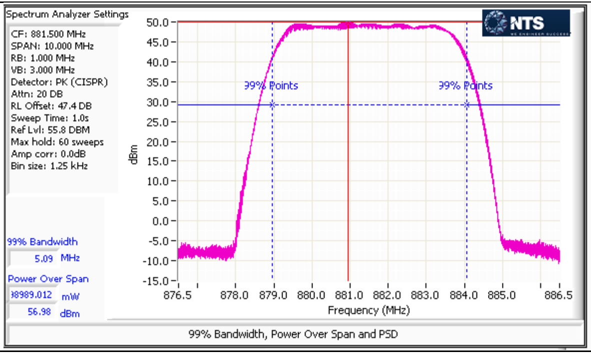
Port 5 – LTE – 16QAM – 5M – Center Channel – Average

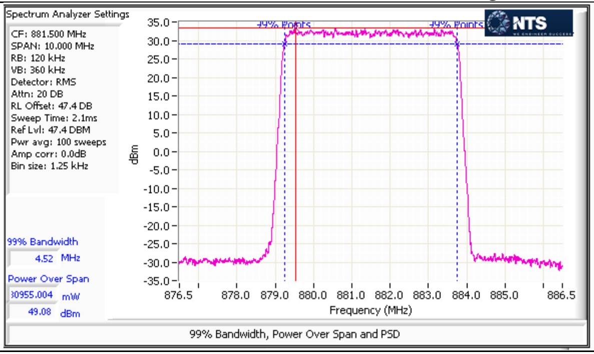




Port 5 – LTE – 64QAM – 5M – Center Channel – Peak

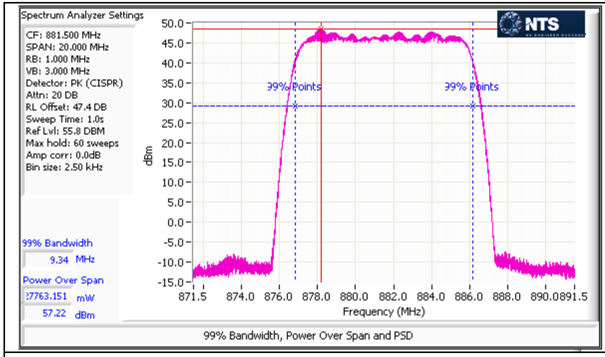
Port 5 – LTE – 64QAM – 5M – Center Channel – Average



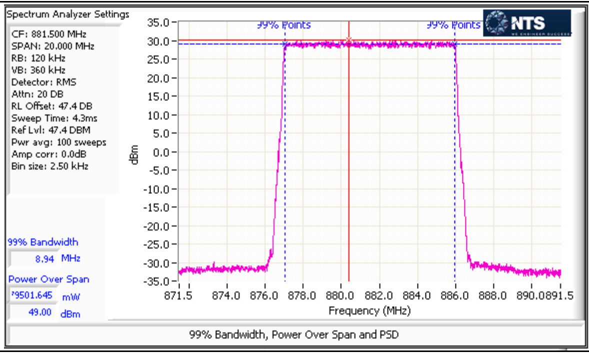


Port 1 – LTE – QPSK – 10M – Center Channel – Peak

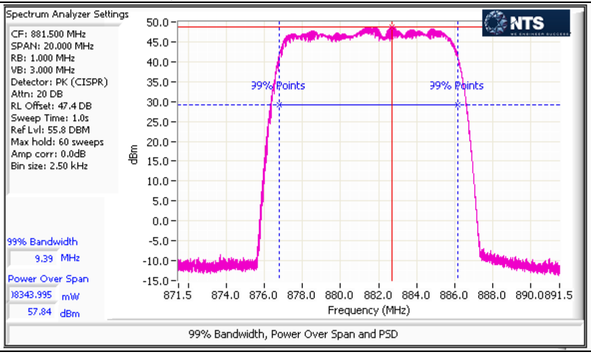
Port 1 – LTE – QPSK – 10M – Center Channel – Average



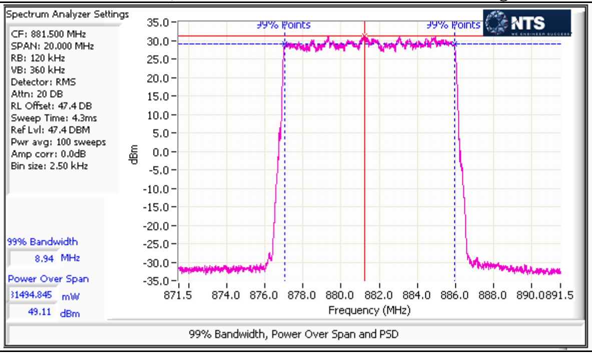
Port 1 – LTE – 16QAM – 10M – Center Channel – Peak



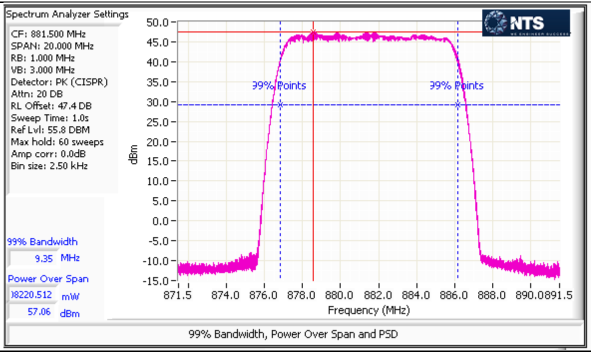
Port 1 – LTE – 16QAM – 10M – Center Channel – Average

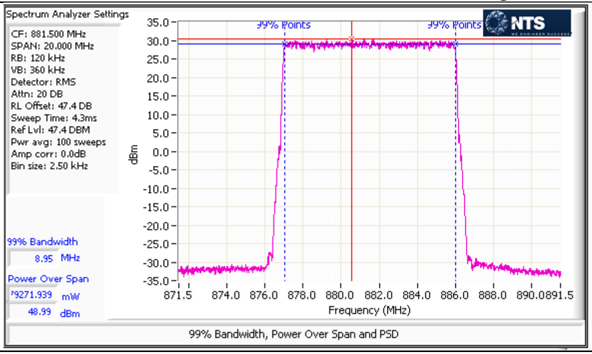


Port 1 – LTE – 64QAM – 10M – Center Channel – Peak



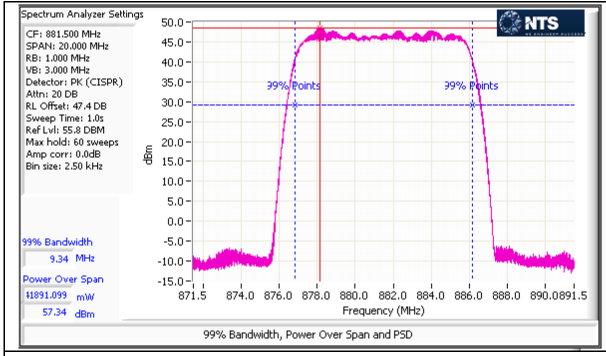
Port 1 – LTE – 64QAM – 10M – Center Channel – Average

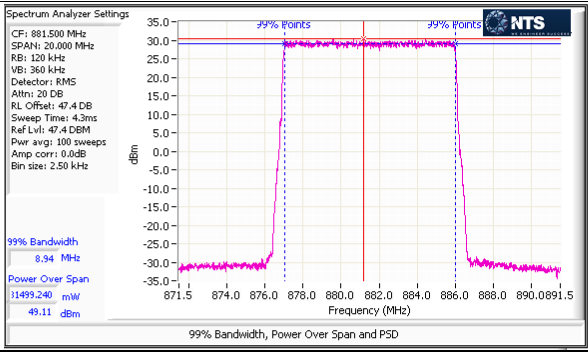




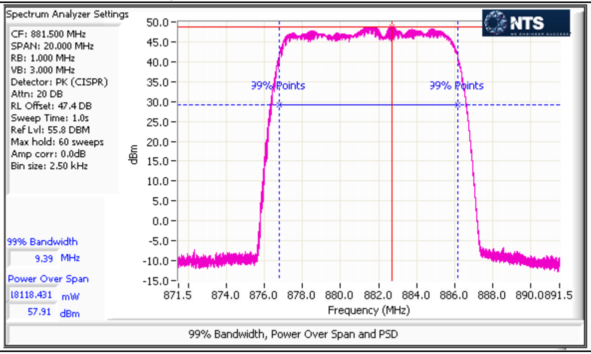
Port 3 – LTE – QPSK – 10M – Center Channel – Peak

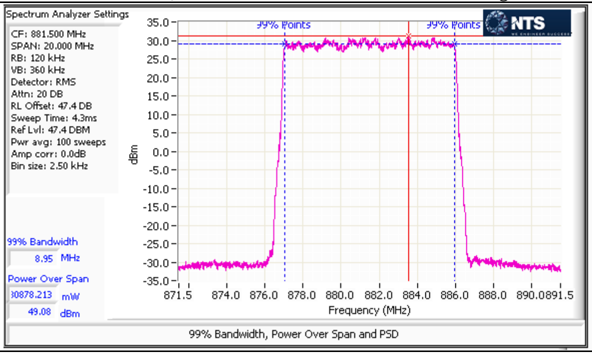
Port 3 – LTE – QPSK – 10M – Center Channel – Average



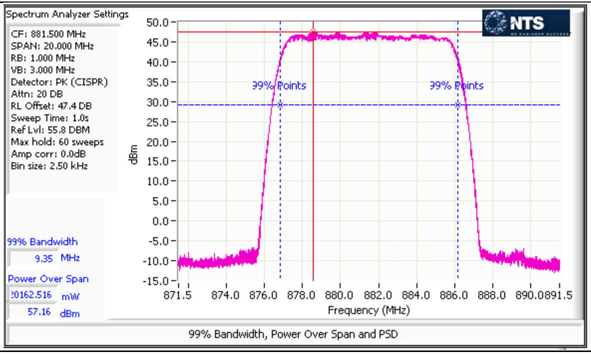


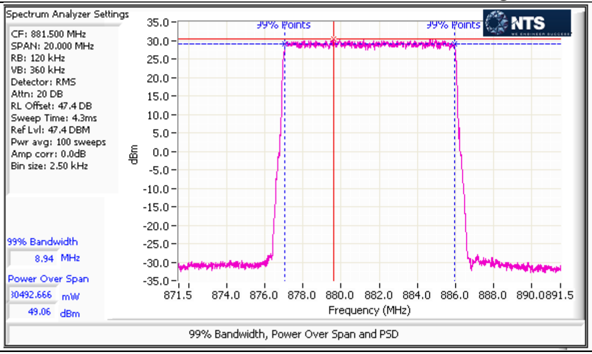
Port 3 – LTE – 16QAM – 10M – Center Channel – Peak	Port 3 – LTE – 16QAM – 10M – Center Channel – Average



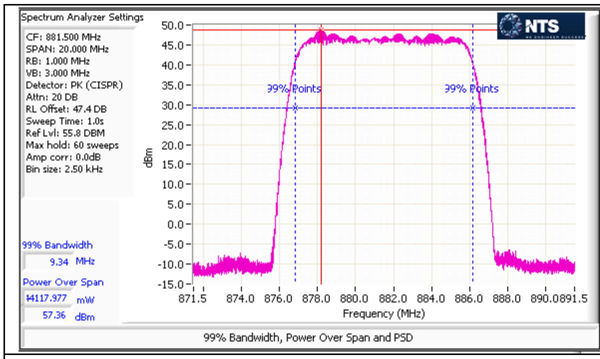


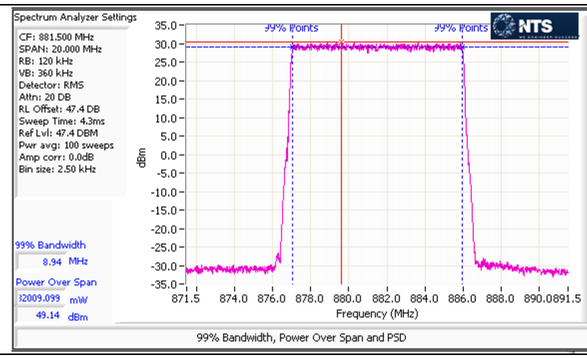
Port 3 – LTE – 64QAM – 10M – Center Channel – Peak	Port 3 – LTE – 64QAM – 10M – Center Channel – Average





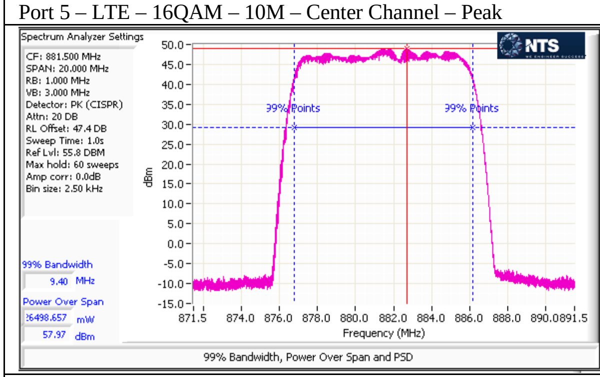
Port 5 – LTE – QPSK – 10M – Center Channel – Peak	Port 5 – LTE – QPSK – 10M – Center Channel – Average

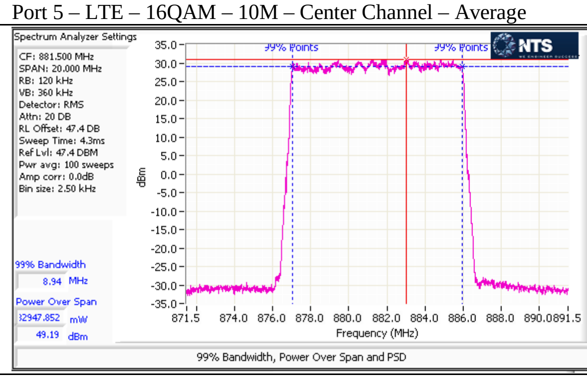




Port 5 – LTE – 16QAM – 10M – Center Channel – Peak

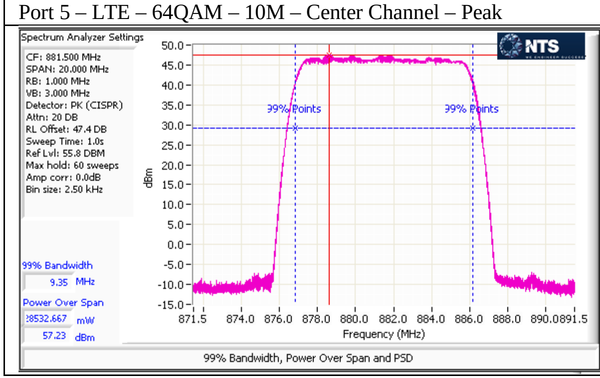
Port 5 – LTE – 16QAM – 10M – Center Channel – Average

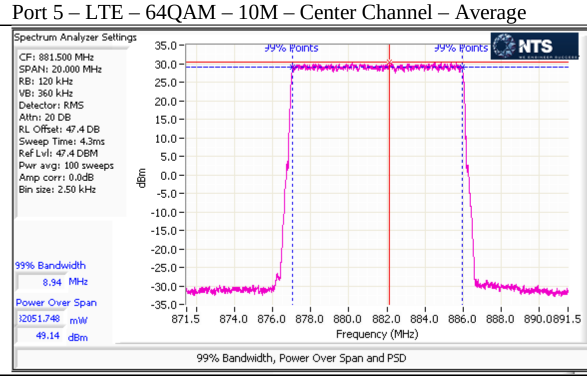




Port 5 – LTE – 64QAM – 10M – Center Channel – Peak

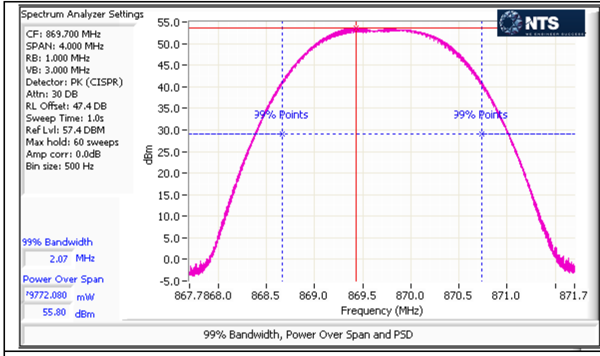
Port 5 – LTE – 64QAM – 10M – Center Channel – Average

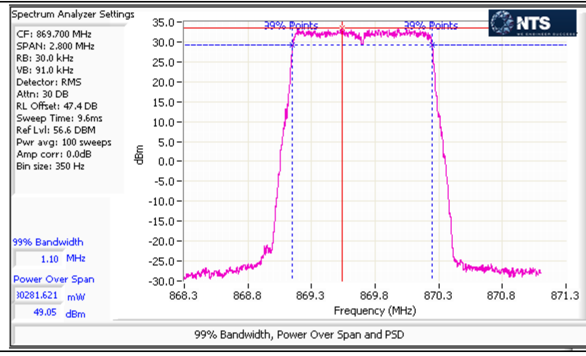




Port 5 – LTE – QPSK – 1.4M – Low Channel – Peak

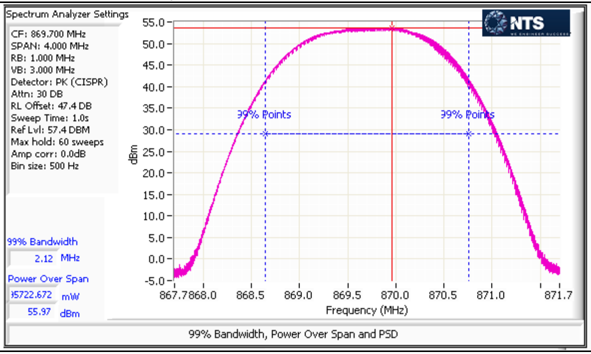
Port 5 – LTE – QPSK – 1.4M – Low Channel – Average

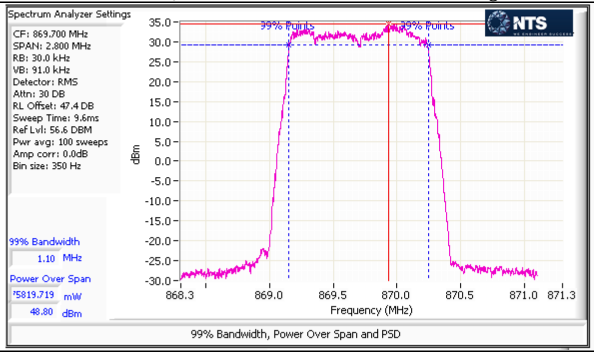




Port 5 – LTE – 16QAM – 1.4M – Low Channel – Peak

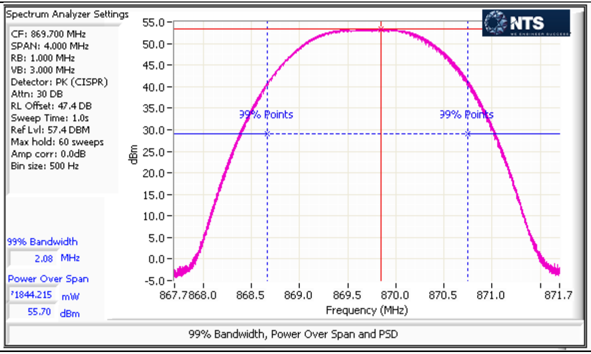
Port 5 – LTE – 16QAM – 1.4M – Low Channel – Average

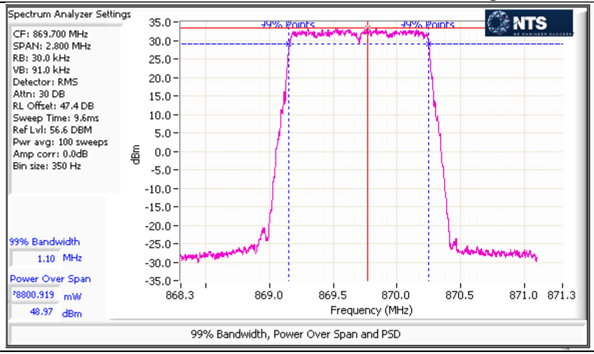




Port 5 – LTE – 64QAM – 1.4M – Low Channel – Peak

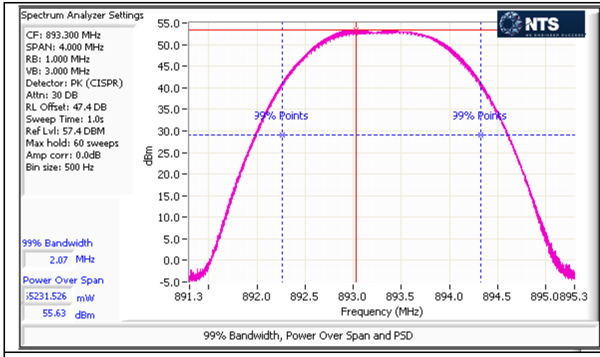
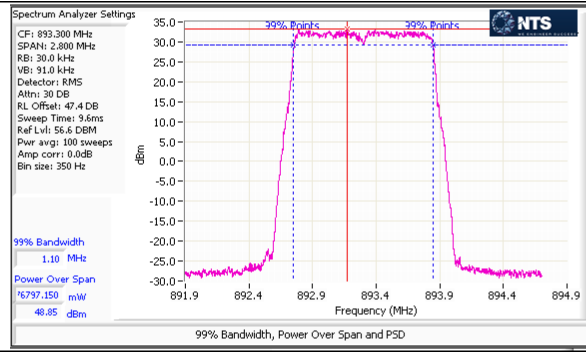
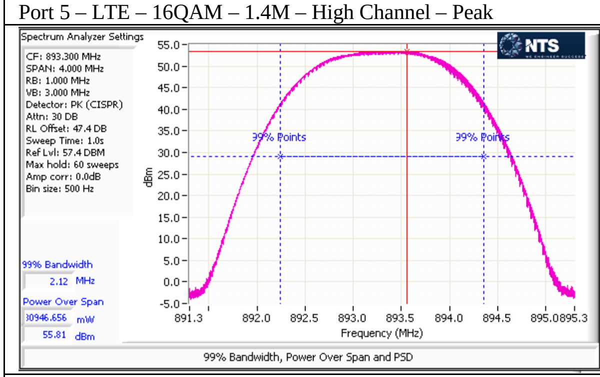
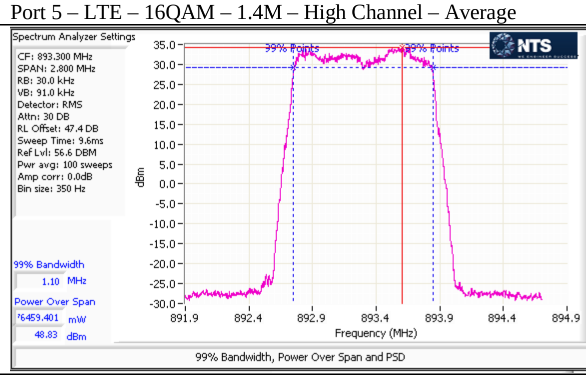
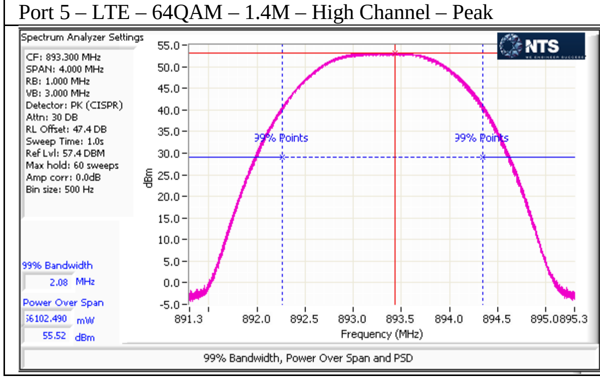
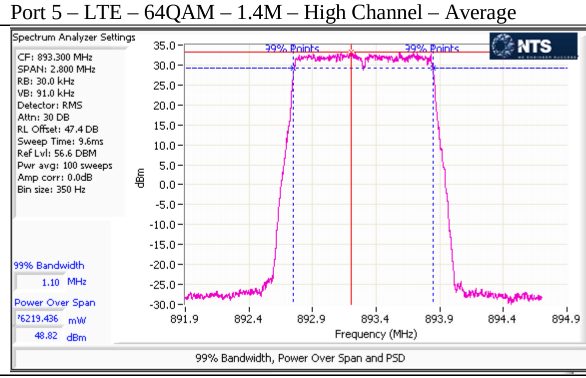
Port 5 – LTE – 64QAM – 1.4M – Low Channel – Average



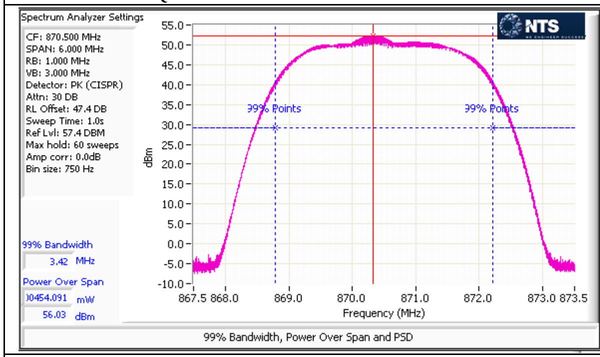


Port 5 – LTE – QPSK – 1.4M – High Channel – Peak

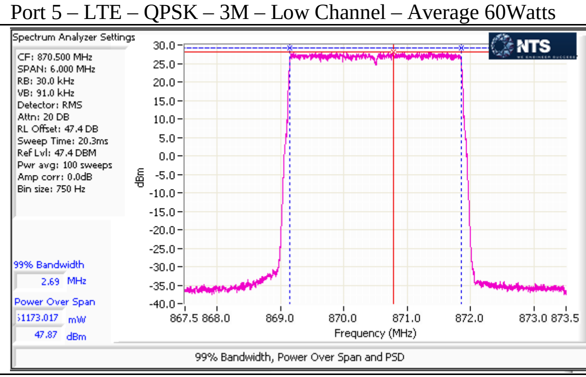
Port 5 – LTE – QPSK – 1.4M – High Channel – Average

	
Port 5 – LTE – 16QAM – 1.4M – High Channel – Peak	Port 5 – LTE – 16QAM – 1.4M – High Channel – Average
	
Port 5 – LTE – 64QAM – 1.4M – High Channel – Peak	Port 5 – LTE – 64QAM – 1.4M – High Channel – Average
	

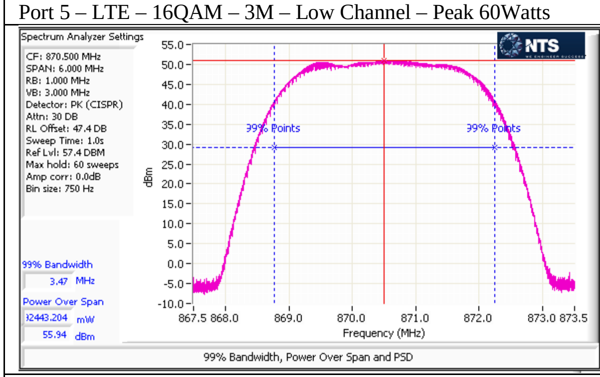
Port 5 – LTE – QPSK – 3M – Low Channel – Peak 60Watts



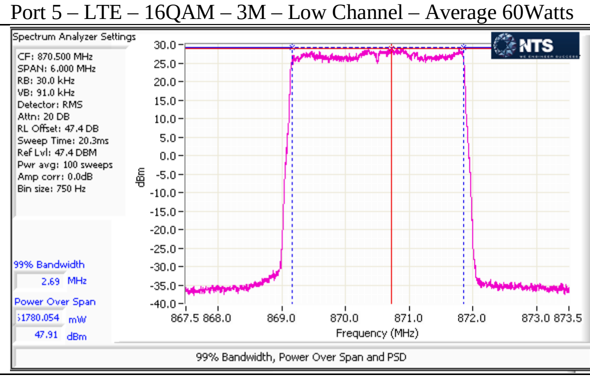
Port 5 – LTE – QPSK – 3M – Low Channel – Average 60Watts



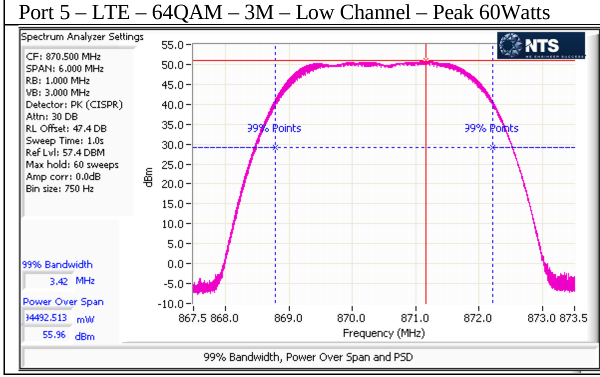
Port 5 – LTE – 16QAM – 3M – Low Channel – Peak 60Watts



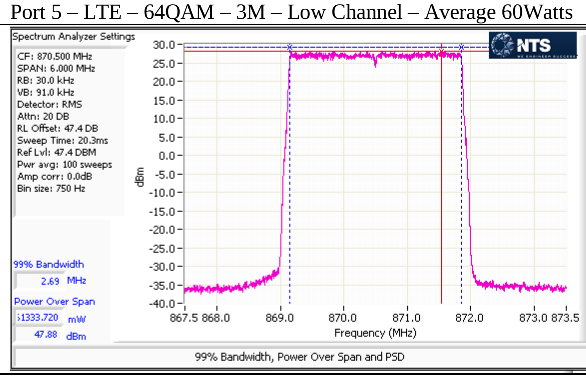
Port 5 – LTE – 16QAM – 3M – Low Channel – Average 60Watts



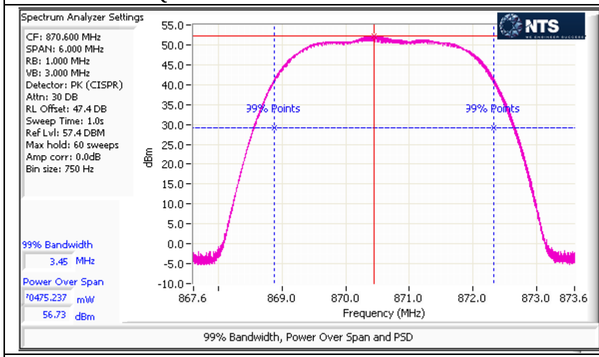
Port 5 – LTE – 64QAM – 3M – Low Channel – Peak 60Watts



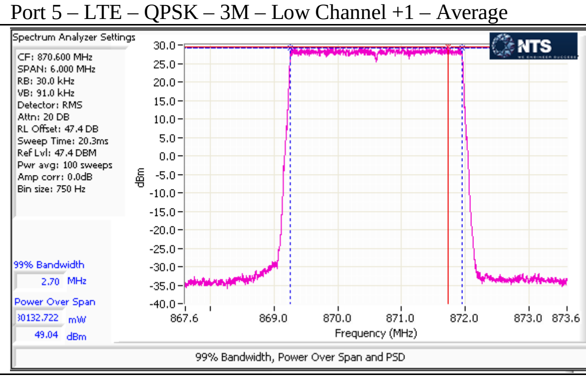
Port 5 – LTE – 64QAM – 3M – Low Channel – Average 60Watts



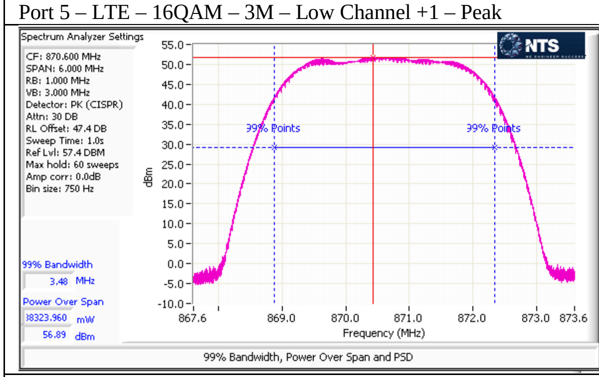
Port 5 – LTE – QPSK – 3M – Low Channel +1 – Peak



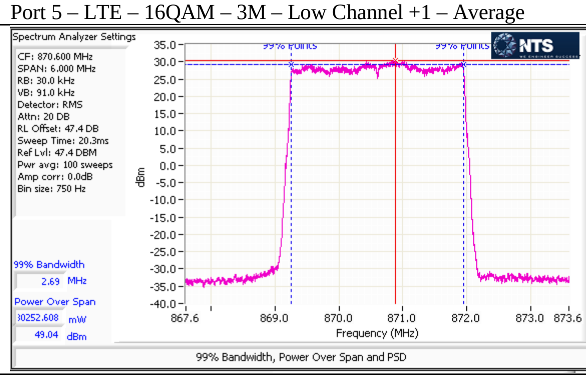
Port 5 – LTE – QPSK – 3M – Low Channel +1 – Average



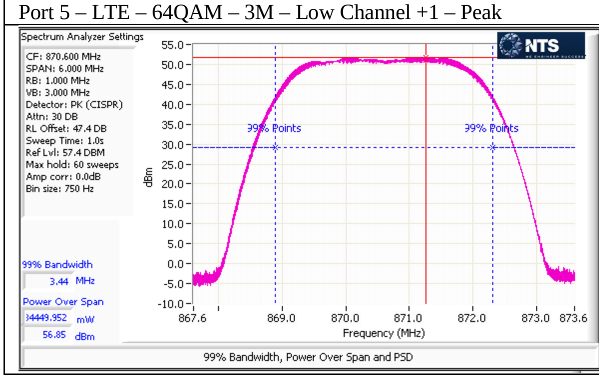
Port 5 – LTE – 16QAM – 3M – Low Channel +1 – Peak



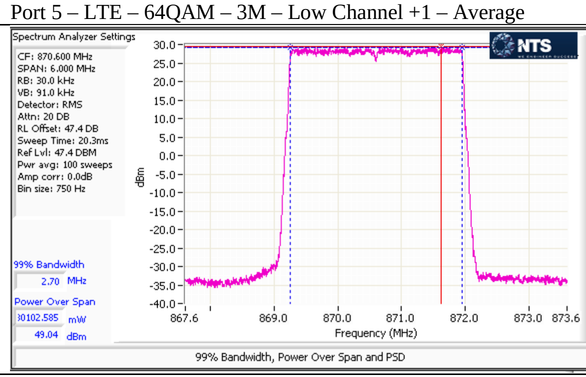
Port 5 – LTE – 16QAM – 3M – Low Channel +1 – Average



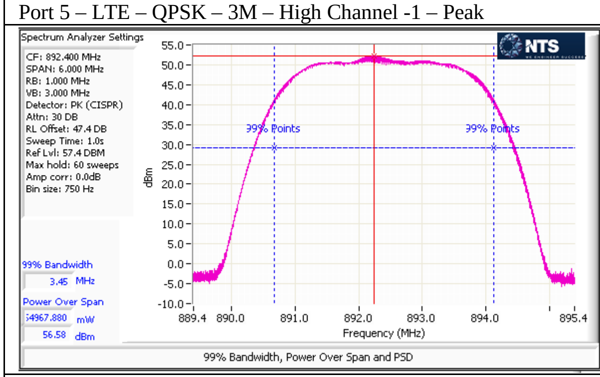
Port 5 – LTE – 64QAM – 3M – Low Channel +1 – Peak



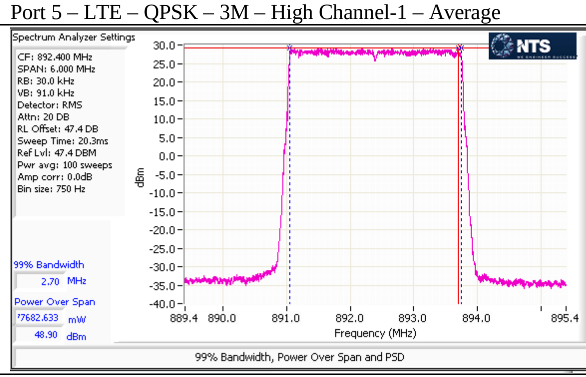
Port 5 – LTE – 64QAM – 3M – Low Channel +1 – Average



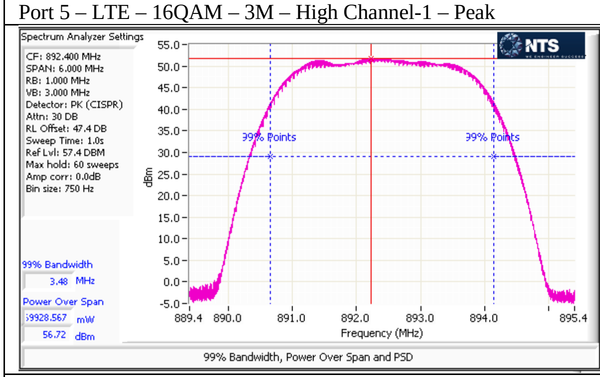
Port 5 – LTE – QPSK – 3M – High Channel -1 – Peak



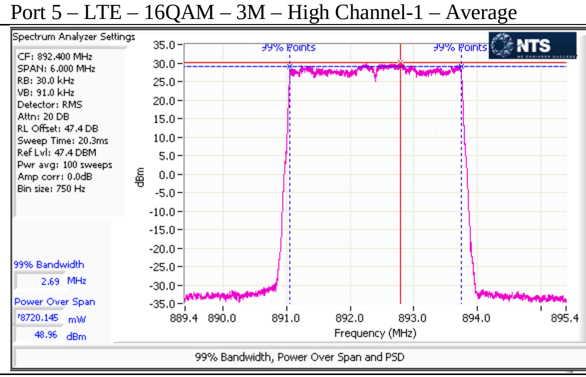
Port 5 – LTE – QPSK – 3M – High Channel-1 – Average



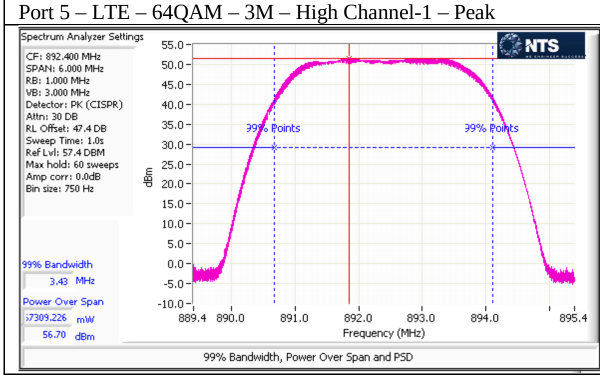
Port 5 – LTE – 16QAM – 3M – High Channel-1 – Peak



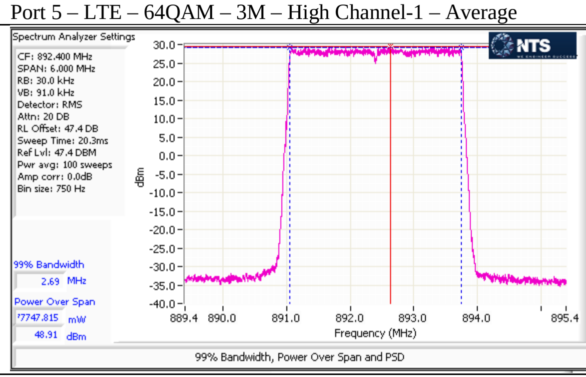
Port 5 – LTE – 16QAM – 3M – High Channel-1 – Average



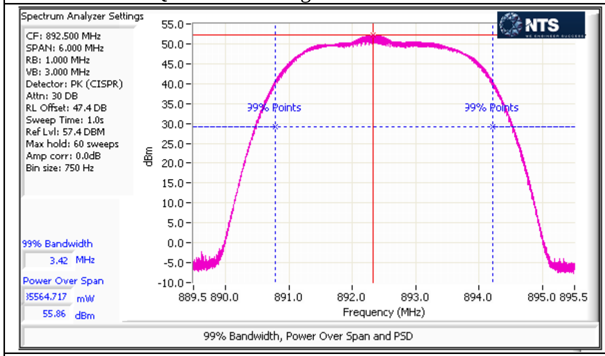
Port 5 – LTE – 64QAM – 3M – High Channel-1 – Peak



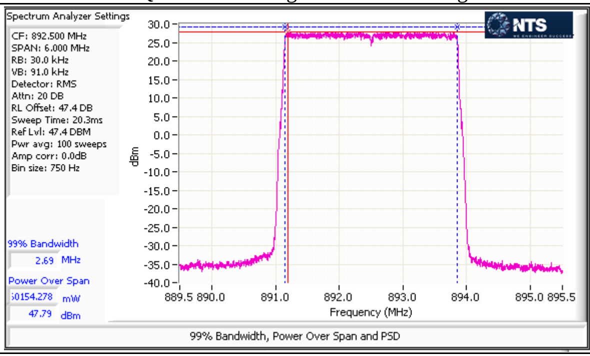
Port 5 – LTE – 64QAM – 3M – High Channel-1 – Average



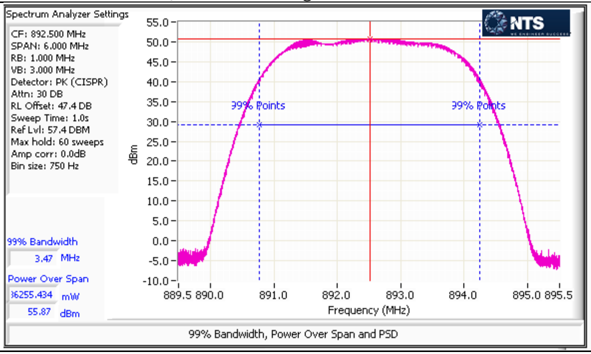
Port 5 – LTE – QPSK – 3M – High Channel – Peak 60Watts



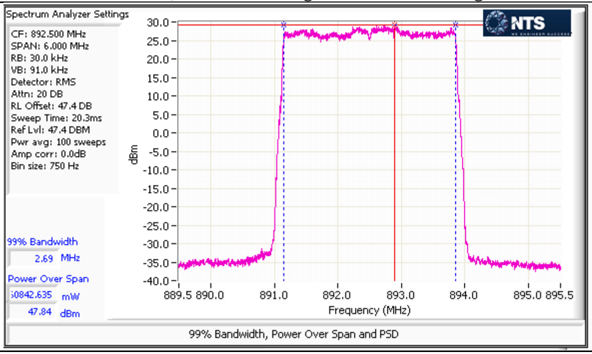
Port 5 – LTE – QPSK – 3M – High Channel – Average 60Watts



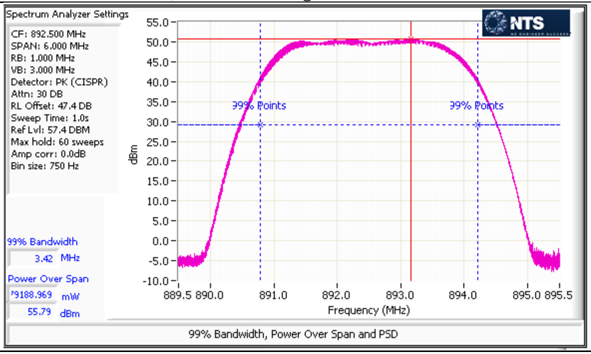
Port 5 – LTE – 16QAM – 3M – High Channel – Peak 60Watts



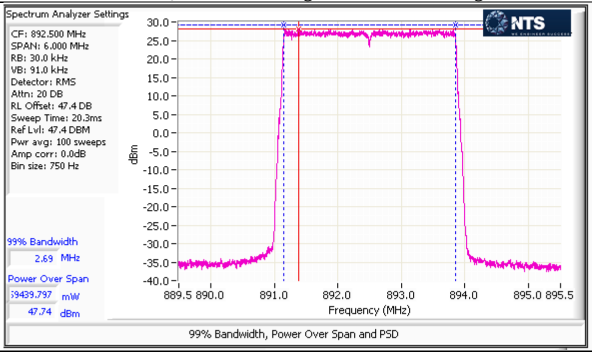
Port 5 – LTE – 16QAM – 3M – High Channel – Average 60Watts



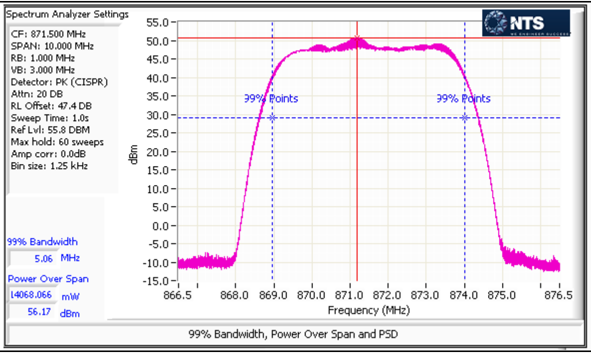
Port 5 – LTE – 64QAM – 3M – High Channel – Peak 60Watts



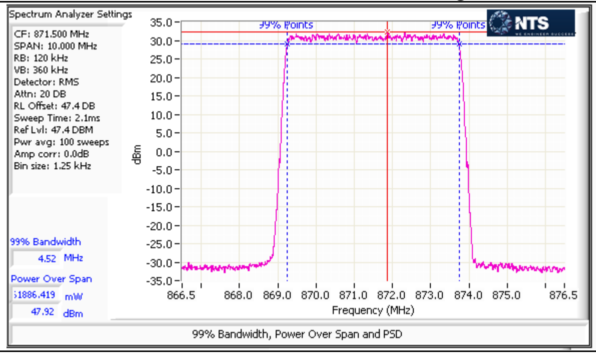
Port 5 – LTE – 64QAM – 3M – High Channel – Average 60Watts



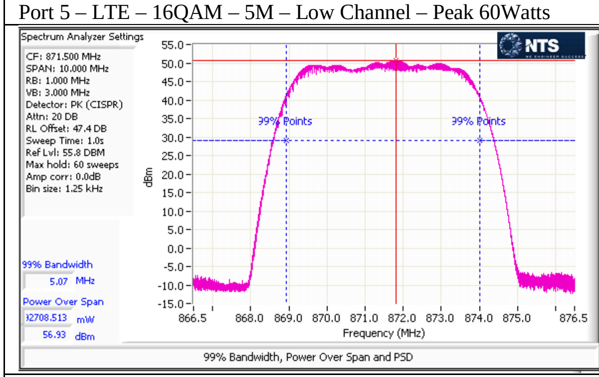
Port 5 – LTE – QPSK – 5M – Low Channel – Peak 60Watts



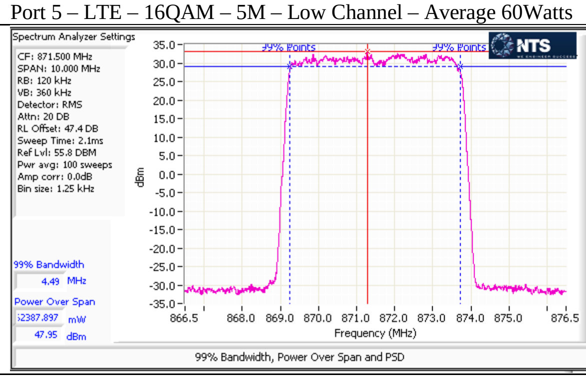
Port 5 – LTE – QPSK – 5M – Low Channel – Average 60Watts



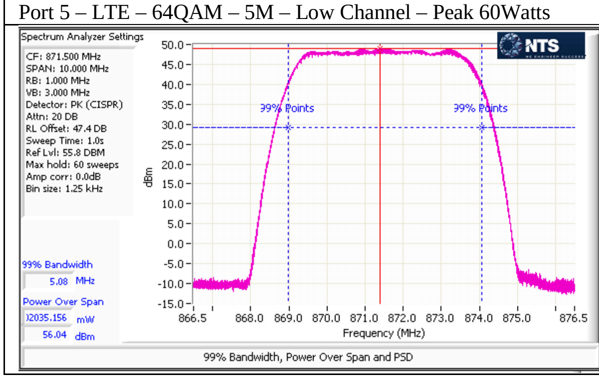
Port 5 – LTE – 16QAM – 5M – Low Channel – Peak 60Watts



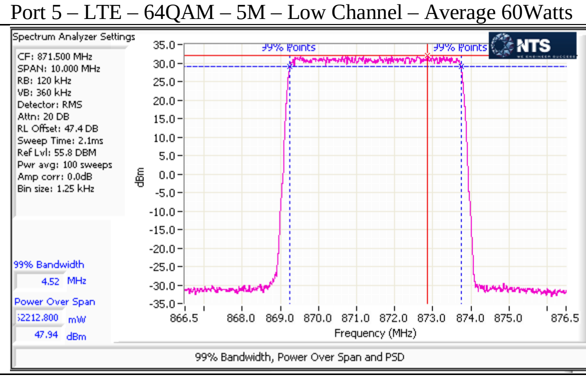
Port 5 – LTE – 16QAM – 5M – Low Channel – Average 60Watts



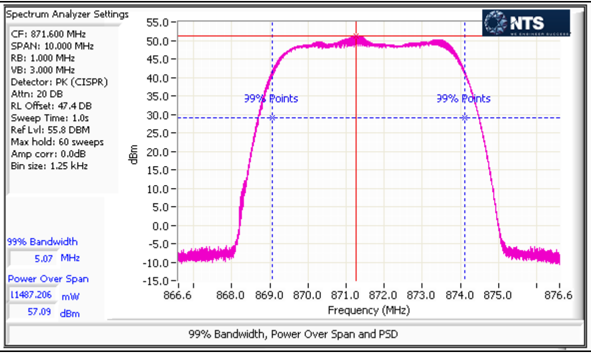
Port 5 – LTE – 64QAM – 5M – Low Channel – Peak 60Watts



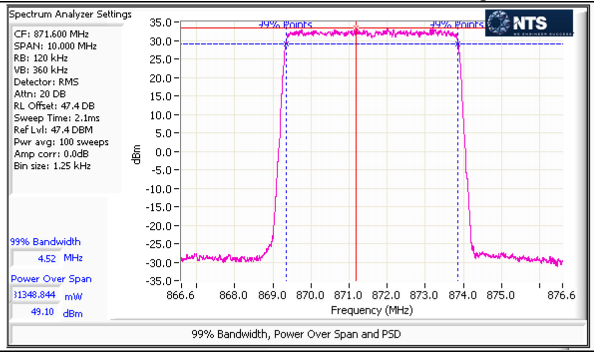
Port 5 – LTE – 64QAM – 5M – Low Channel – Average 60Watts



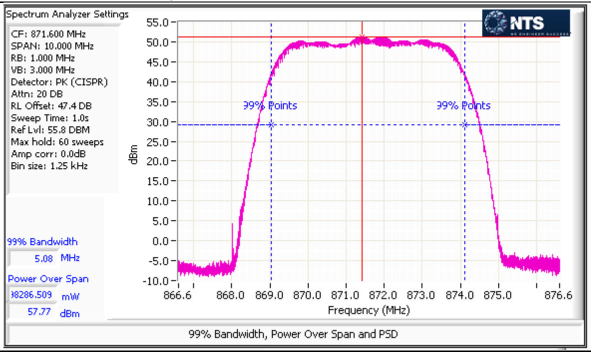
Port 5 – LTE – QPSK – 5M – Low Channel+1 – Peak



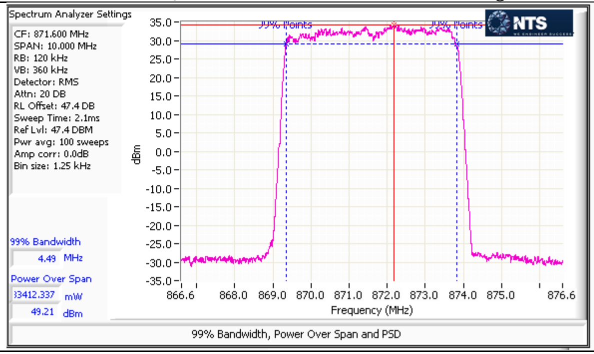
Port 5 – LTE – QPSK – 5M – Low Channel+1 – Average



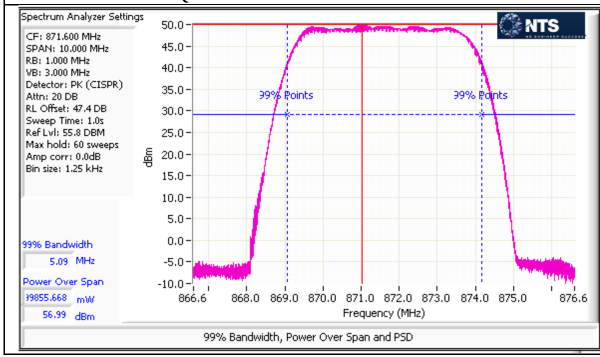
Port 5 – LTE – 16QAM – 5M – Low Channel+1 – Peak



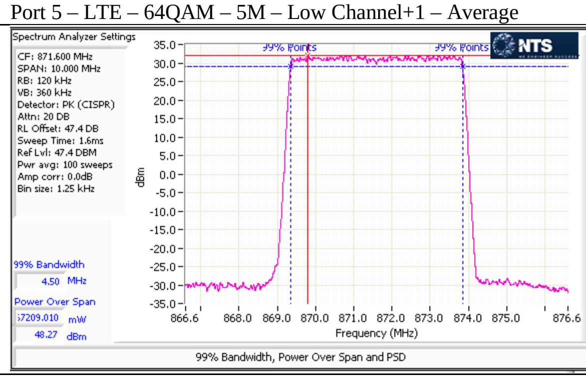
Port 5 – LTE – 16QAM – 5M – Low Channel+1 – Average



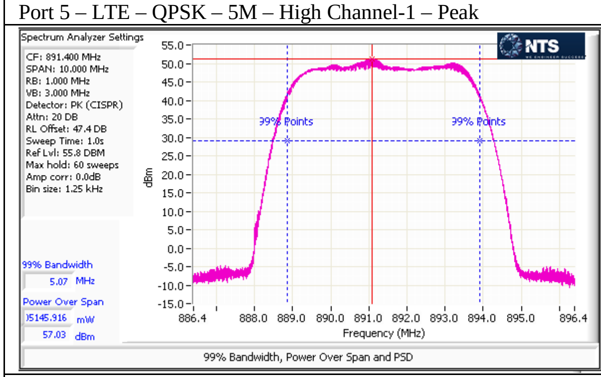
Port 5 – LTE – 64QAM – 5M – Low Channel+1 – Peak



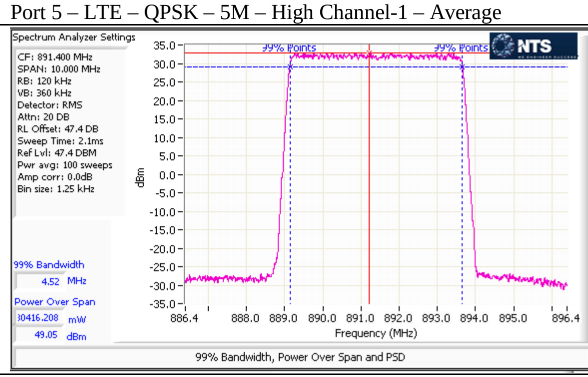
Port 5 – LTE – 64QAM – 5M – Low Channel+1 – Average



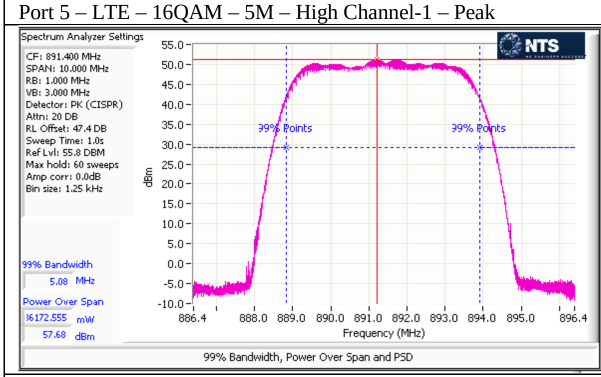
Port 5 – LTE – QPSK – 5M – High Channel-1 – Peak



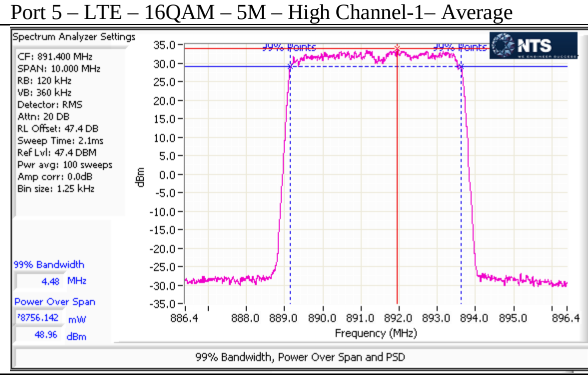
Port 5 – LTE – QPSK – 5M – High Channel-1 – Average



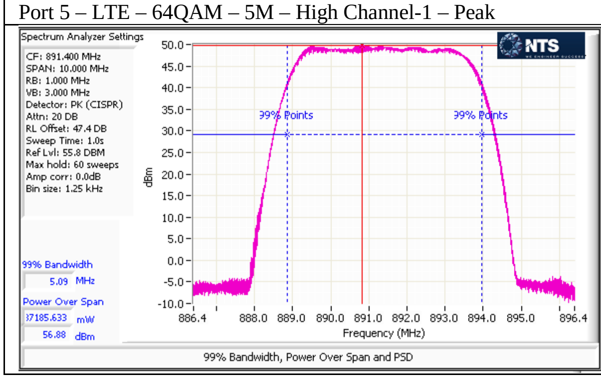
Port 5 – LTE – 16QAM – 5M – High Channel-1 – Peak



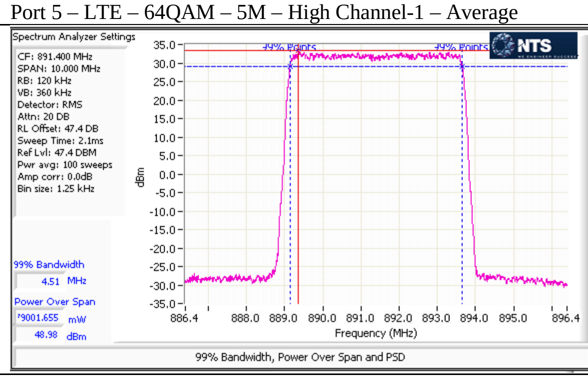
Port 5 – LTE – 16QAM – 5M – High Channel-1– Average



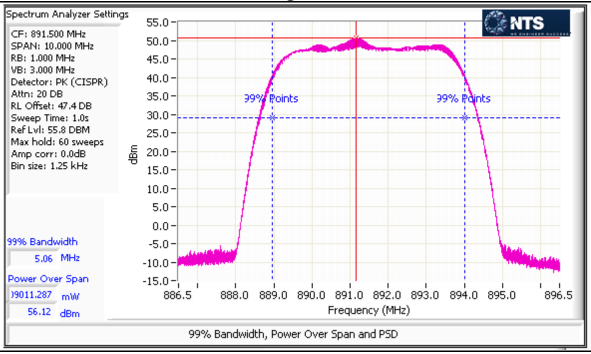
Port 5 – LTE – 64QAM – 5M – High Channel-1 – Peak



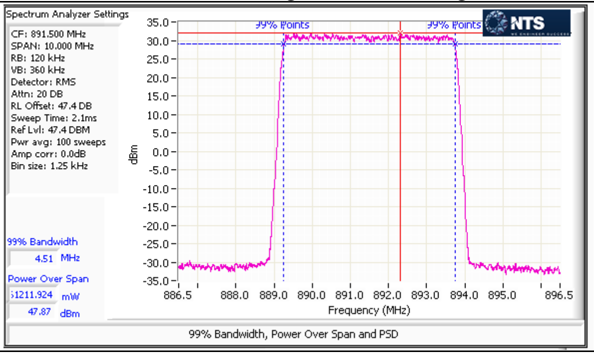
Port 5 – LTE – 64QAM – 5M – High Channel-1 – Average



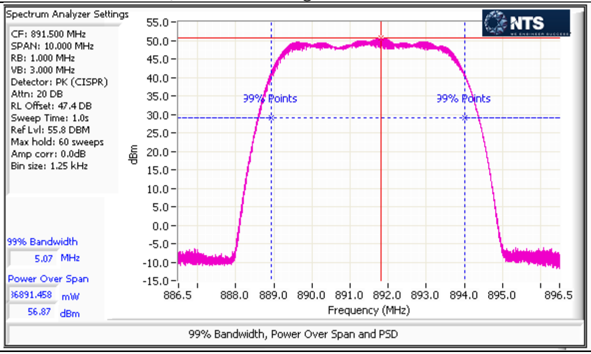
Port 5 – LTE – QPSK – 5M – High Channel – Peak 60Watts



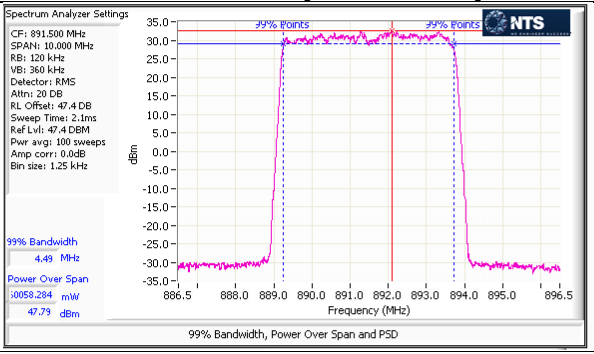
Port 5 – LTE – QPSK – 5M – High Channel – Average 60Watts



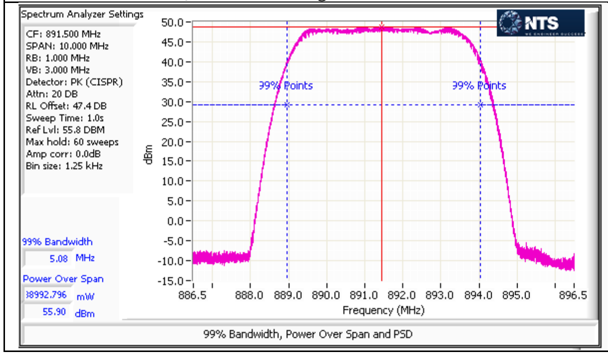
Port 5 – LTE – 16QAM – 5M – High Channel – Peak 60Watts



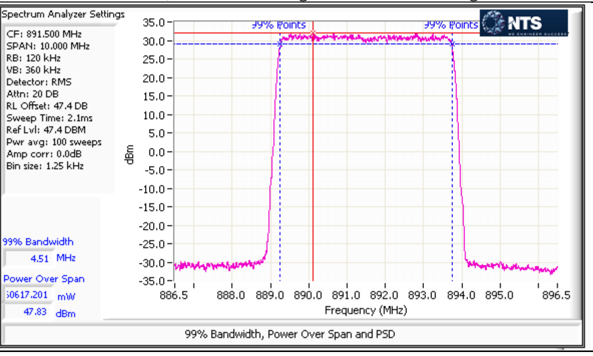
Port 5 – LTE – 16QAM – 5M – High Channel – Average 60Watts

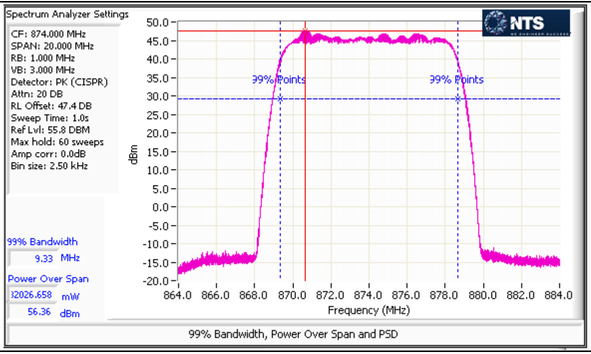
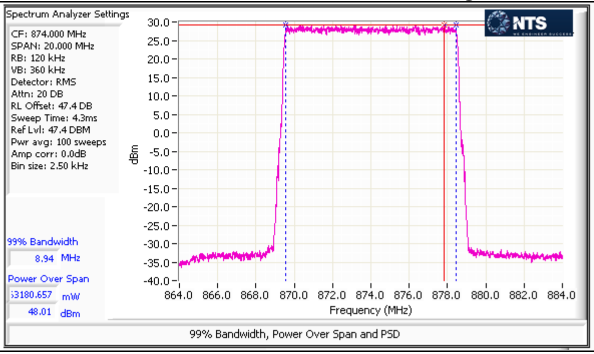
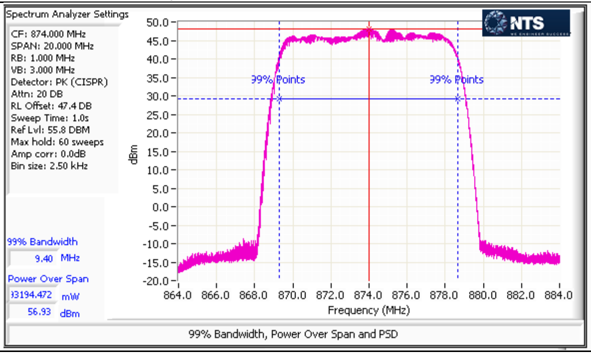
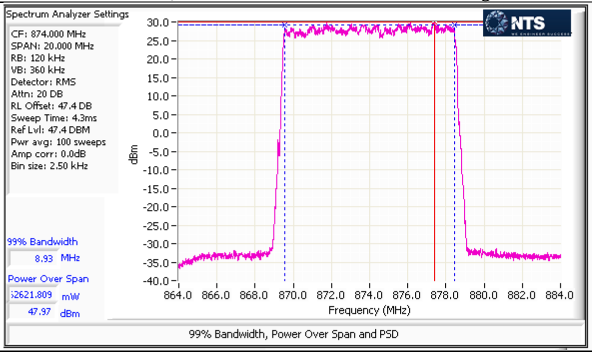
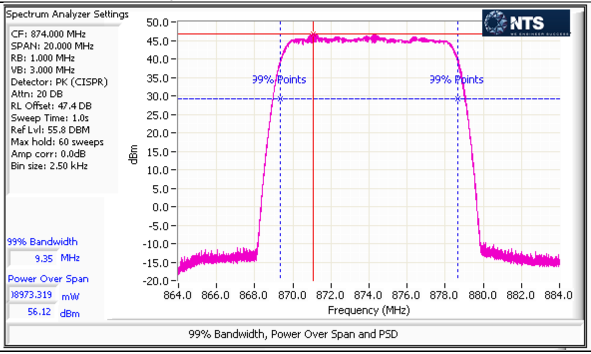
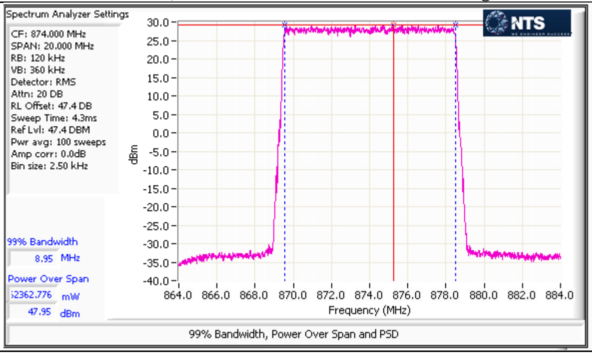


Port 5 – LTE – 64QAM – 5M – High Channel – Peak 60Watts

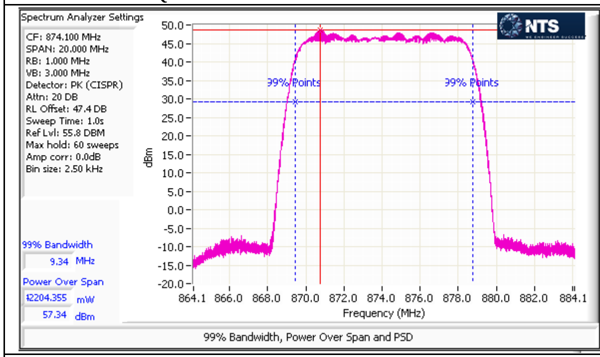


Port 5 – LTE – 64QAM – 5M – High Channel – Average 60Watts

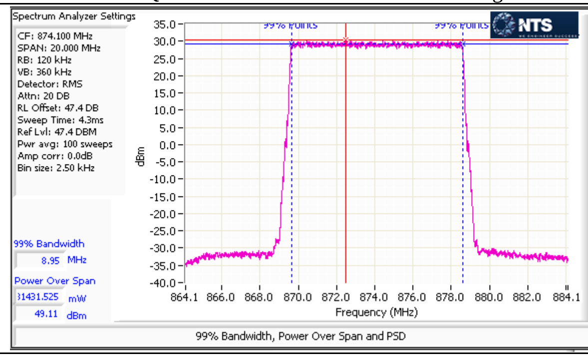


Port 5 – LTE – QPSK – 10M – Low Channel – Peak 60Watts	Port 5 – LTE – QPSK – 10M – Low Channel – Average 60Watts
	
Port 5 – LTE – 16QAM – 10M – Low Channel – Peak 60Watts	**Port 5 – LTE – 16QAM – 10M – Low Channel – Average 60Watts**
	
Port 5 – LTE – 64QAM – 10M – Low Channel – Peak 60Watts	**Port 5 – LTE – 64QAM – 10M – Low Channel – Average 60Watts**
	

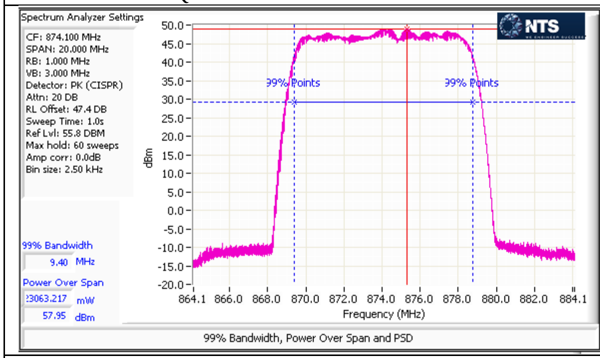
Port 5 – LTE – QPSK – 10M – Low Channel+1 – Peak



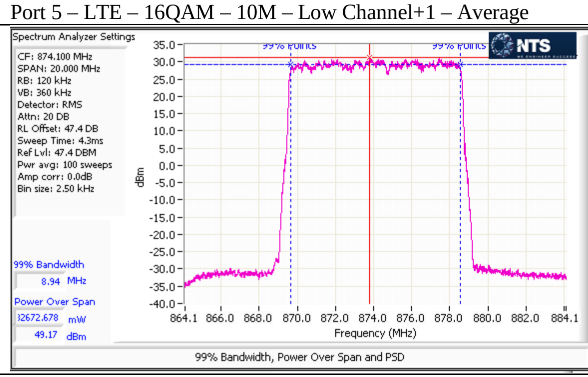
Port 5 – LTE – QPSK – 10M – Low Channel+1 – Average



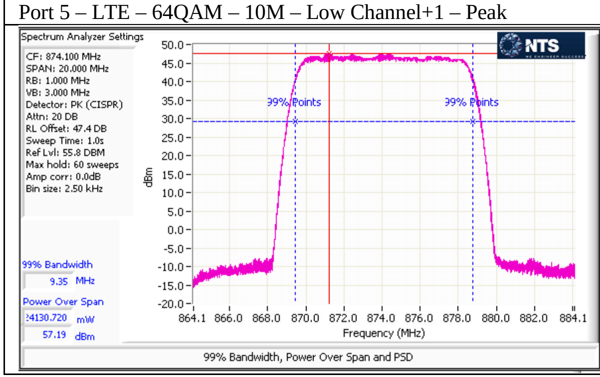
Port 5 – LTE – 16QAM – 10M – Low Channel+1 – Peak



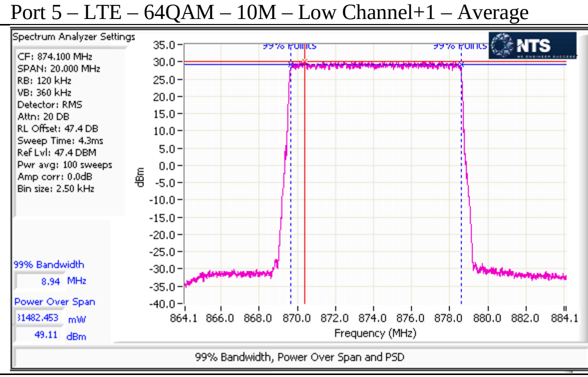
Port 5 – LTE – 16QAM – 10M – Low Channel+1 – Average



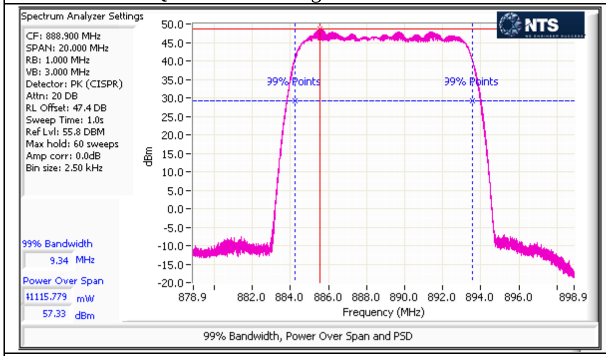
Port 5 – LTE – 64QAM – 10M – Low Channel+1 – Peak



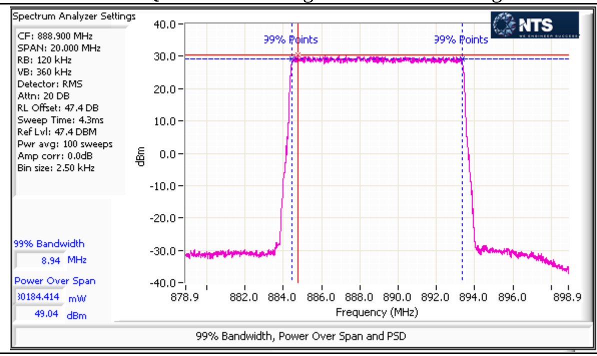
Port 5 – LTE – 64QAM – 10M – Low Channel+1 – Average



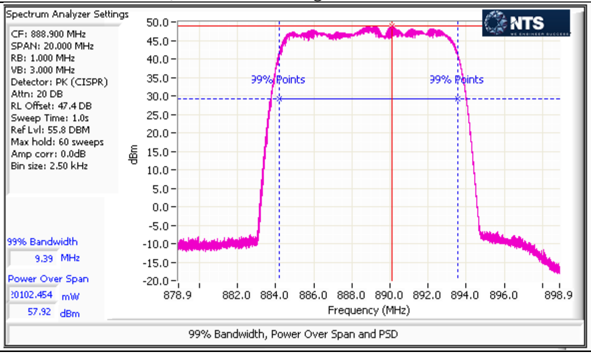
Port 5 – LTE – QPSK – 10M – High Channel-1 – Peak



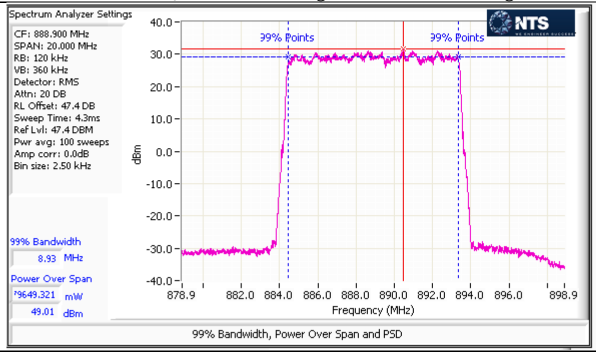
Port 5 – LTE – QPSK – 10M – High Channel-1 – Average



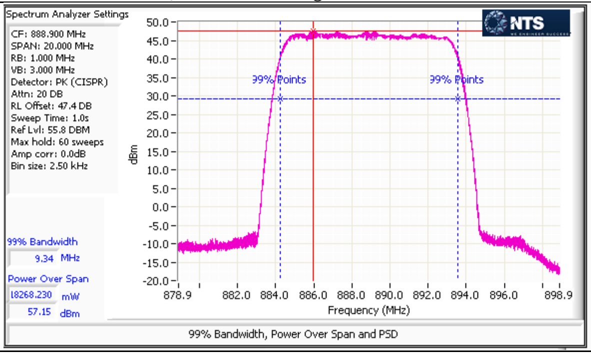
Port 5 – LTE – 16QAM – 10M – High Channel-1 – Peak



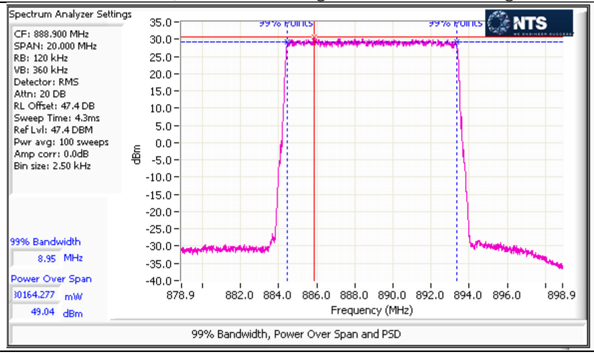
Port 5 – LTE – 16QAM – 10M – High Channel-1 – Average



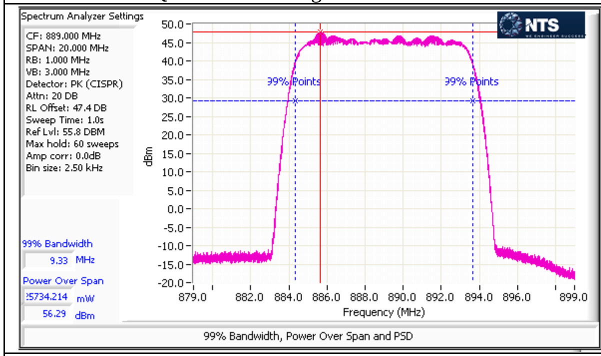
Port 5 – LTE – 64QAM – 10M – High Channel-1 – Peak



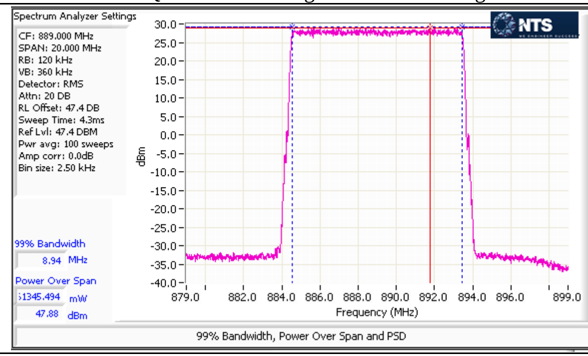
Port 5 – LTE – 64QAM – 10M – High Channel-1 – Average



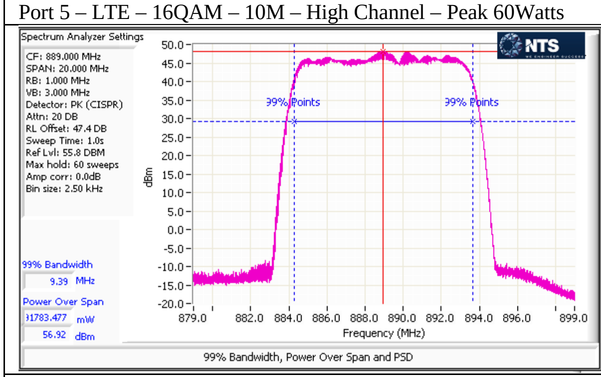
Port 5 – LTE – QPSK – 10M – High Channel – Peak 60Watts



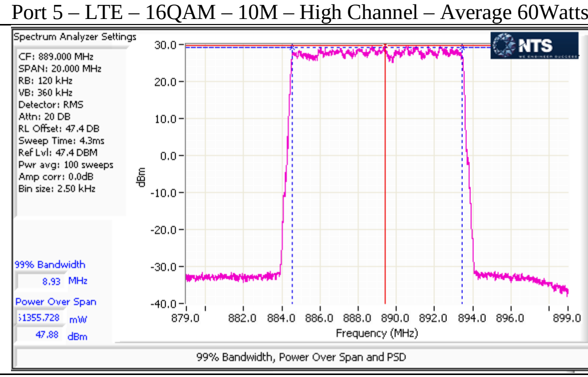
Port 5 – LTE – QPSK – 10M – High Channel – Average 60Watts



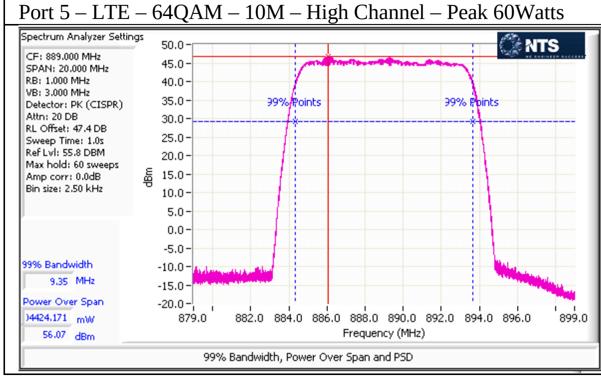
Port 5 – LTE – 16QAM – 10M – High Channel – Peak 60Watts



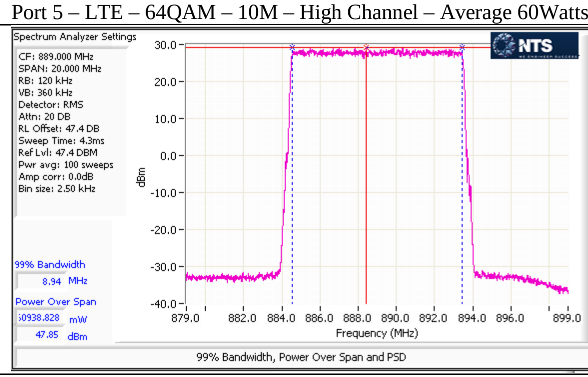
Port 5 – LTE – 16QAM – 10M – High Channel – Average 60Watts



Port 5 – LTE – 64QAM – 10M – High Channel – Peak 60Watts



Port 5 – LTE – 64QAM – 10M – High Channel – Average 60Watts



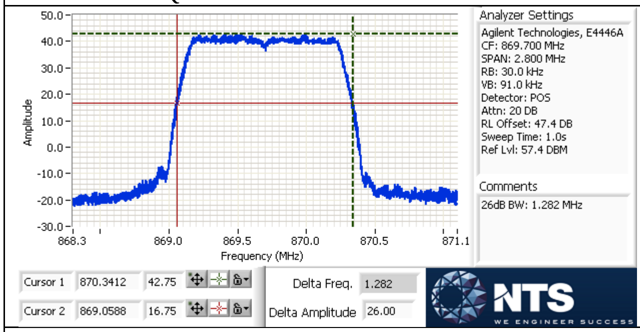
Emission Bandwidths (26dB and 99%)

Emissions bandwidths were measured at Port 5 on low and high channels for all modulations and bandwidth modes and results presented below.

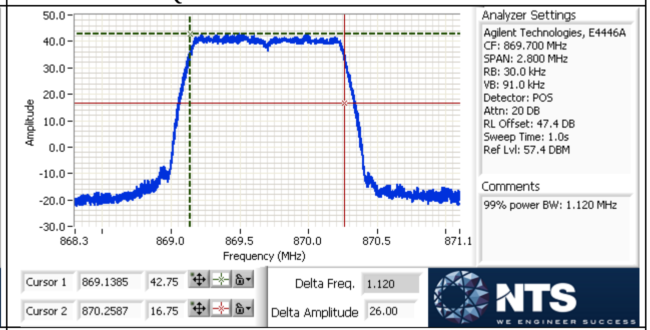
	LTE - QPSK				LTE - 16QAM				LTE - 64QAM			
	Low		High		Low		High		Low		High	
	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)	26dB (MHz)	99% (MHz)
1.4M	1.282	1.12	1.282	1.117	1.262	1.112	1.261	1.111	1.262	1.11	1.262	1.11
3M	2.921	2.709	2.924	2.707	2.912	2.709	2.92	2.708	2.914	2.712	2.918	2.712
5M	4.866	4.492	4.856	4.492	4.836	4.479	4.842	4.477	4.865	4.503	4.855	4.502
10M	9.707	8.991	9.692	8.991	9.668	9.006	9.69	8.994	9.73	8.996	9.727	8.999

Corresponding plots included on the following pages.

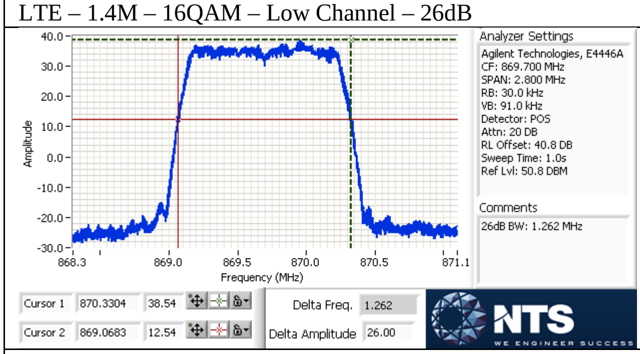
LTE – 1.4M – QPSK – Low Channel – 26dB



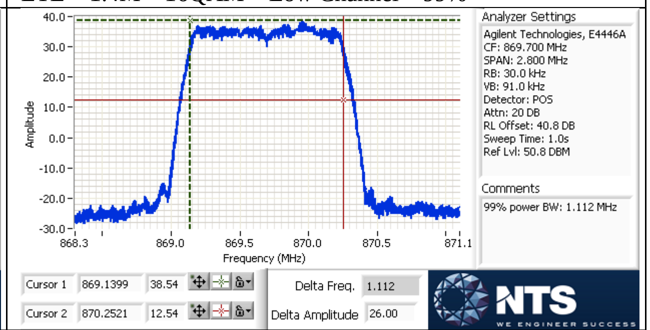
LTE – 1.4M – QPSK – Low Channel – 99%



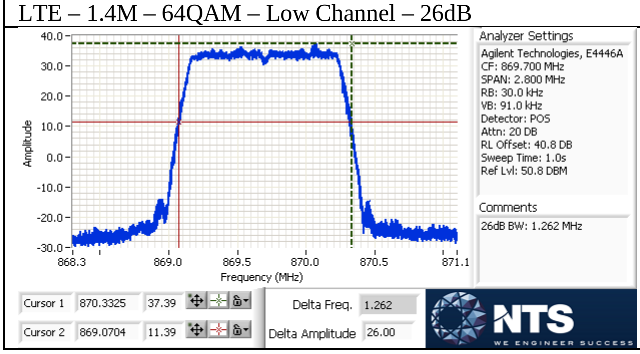
LTE – 1.4M – 16QAM – Low Channel – 26dB



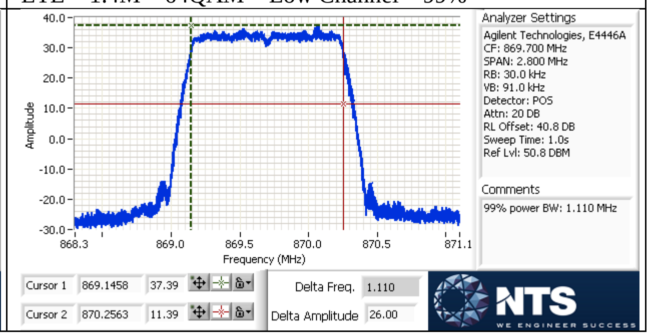
LTE – 1.4M – 16QAM – Low Channel – 99%



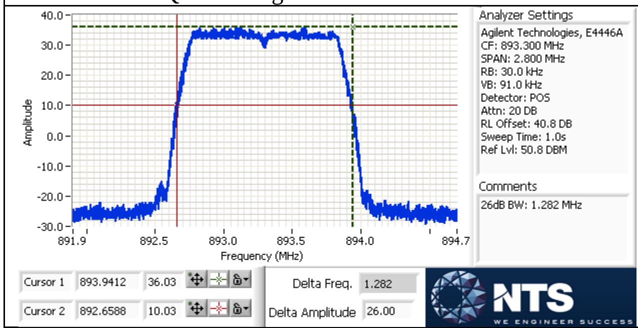
LTE – 1.4M – 64QAM – Low Channel – 26dB



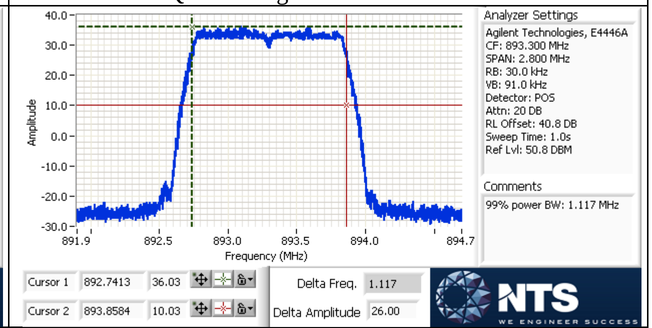
LTE – 1.4M – 64QAM – Low Channel – 99%



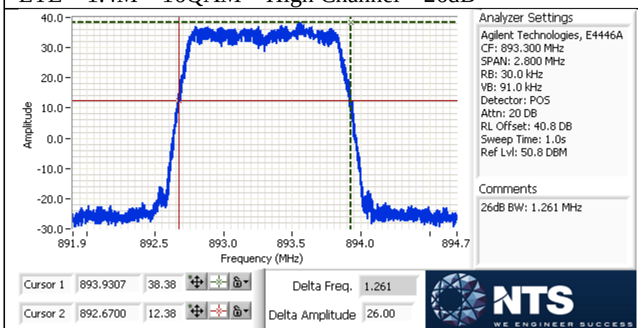
LTE – 1.4M – QPSK – High Channel – 26dB



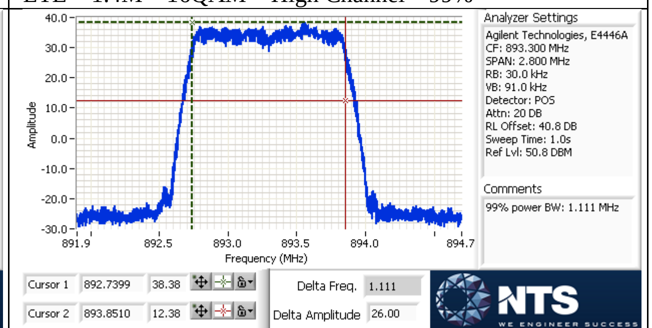
LTE – 1.4M – QPSK – High Channel – 99%



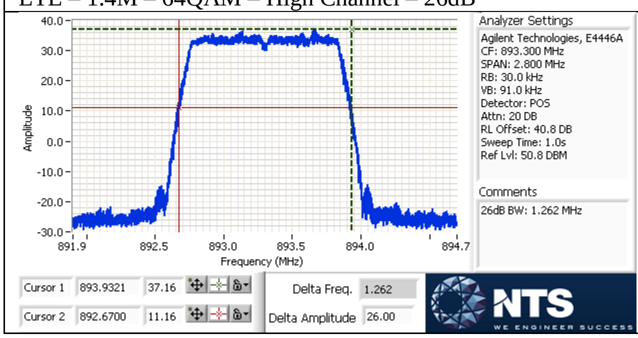
LTE – 1.4M – 16QAM – High Channel – 26dB



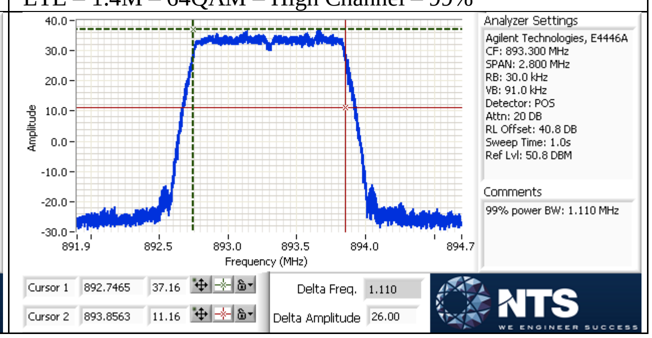
LTE – 1.4M – 16QAM – High Channel – 99%



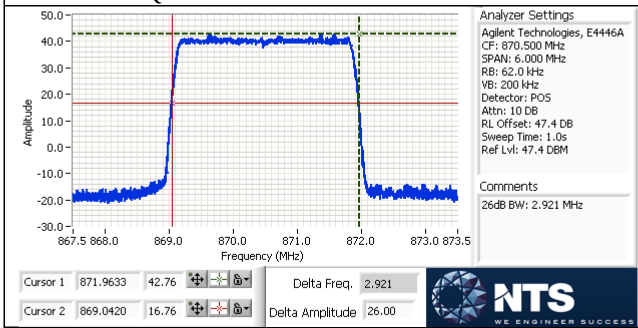
LTE – 1.4M – 64QAM – High Channel – 26dB



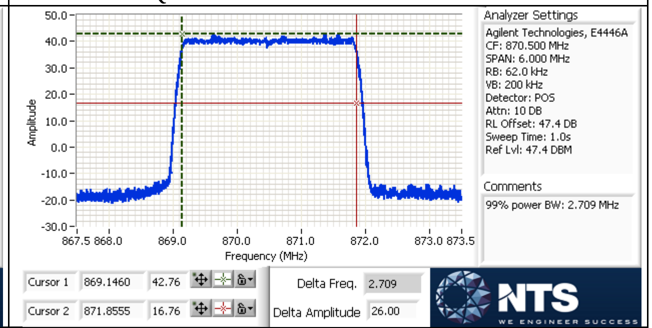
LTE – 1.4M – 64QAM – High Channel – 99%



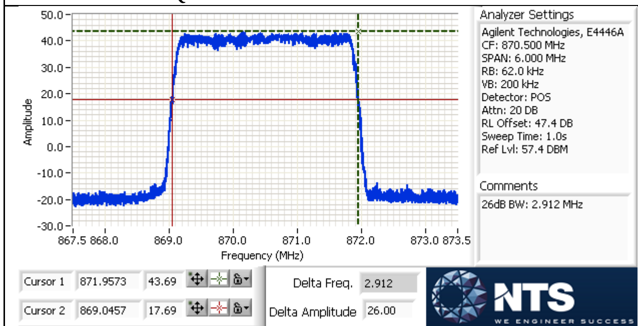
LTE – 3M – QPSK – Low Channel – 26dB



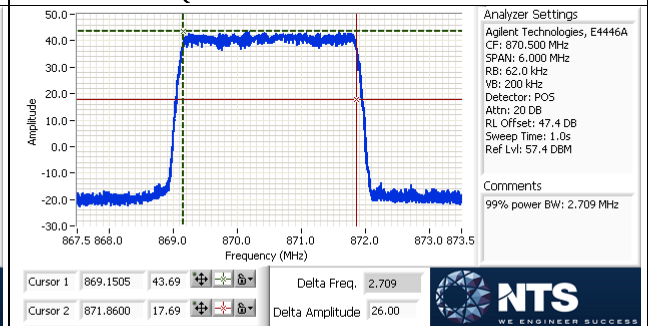
LTE – 3M – QPSK – Low Channel – 99%



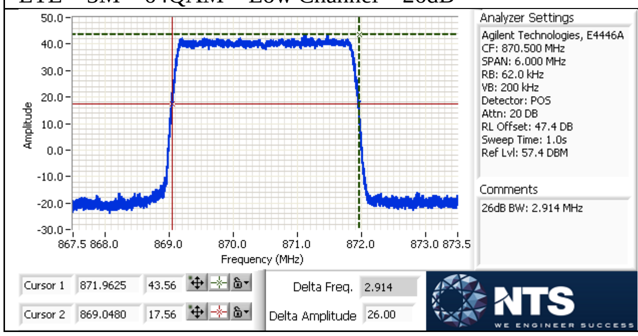
LTE – 3M – 16QAM – Low Channel – 26dB



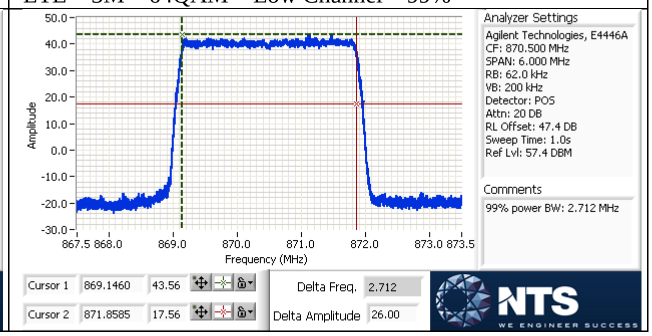
LTE – 3M – 16QAM – Low Channel – 99%



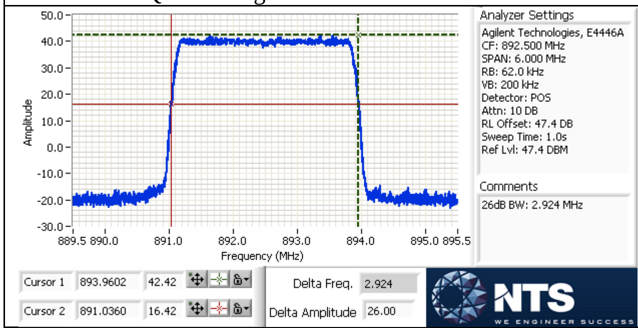
LTE – 3M – 64QAM – Low Channel – 26dB



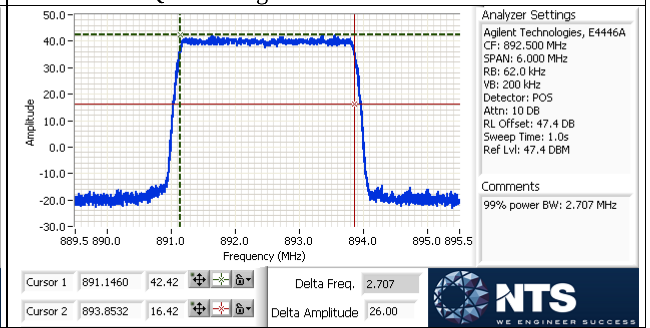
LTE – 3M – 64QAM – Low Channel – 99%



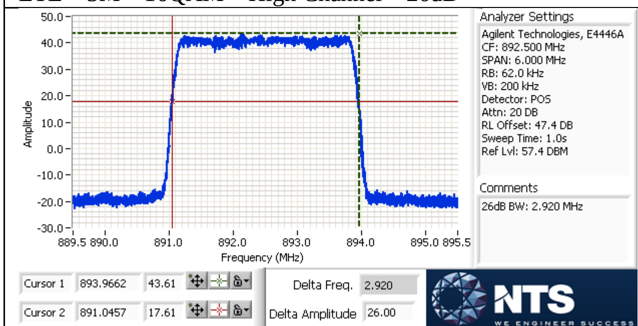
LTE – 3M – QPSK – High Channel – 26dB



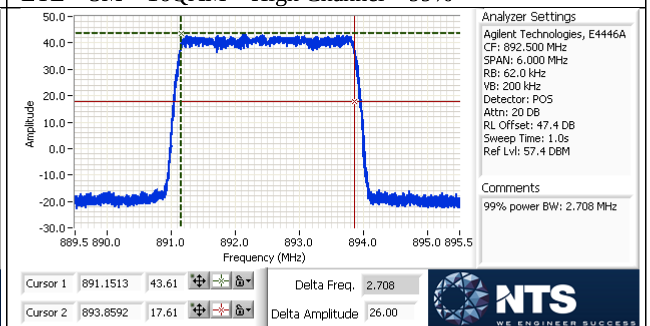
LTE – 3M – QPSK – High Channel – 99%



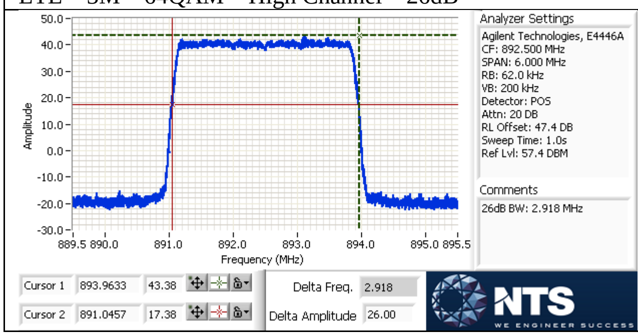
LTE – 3M – 16QAM – High Channel – 26dB



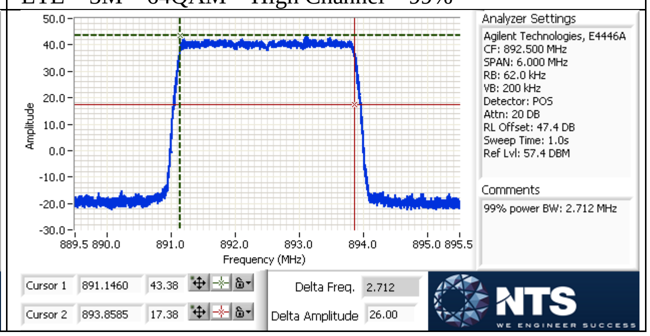
LTE – 3M – 16QAM – High Channel – 99%



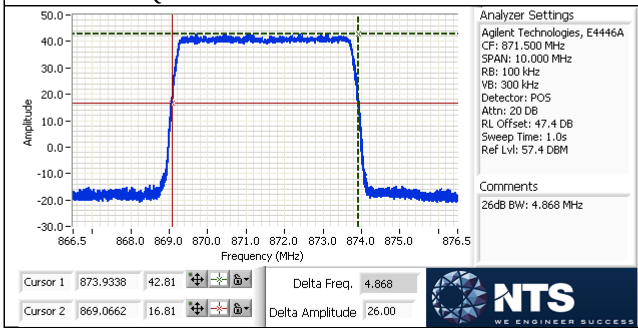
LTE – 3M – 64QAM – High Channel – 26dB



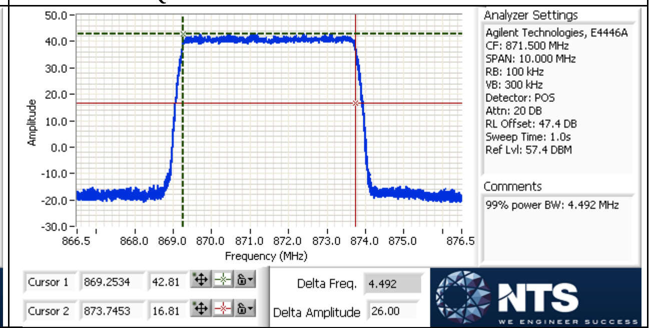
LTE – 3M – 64QAM – High Channel – 99%



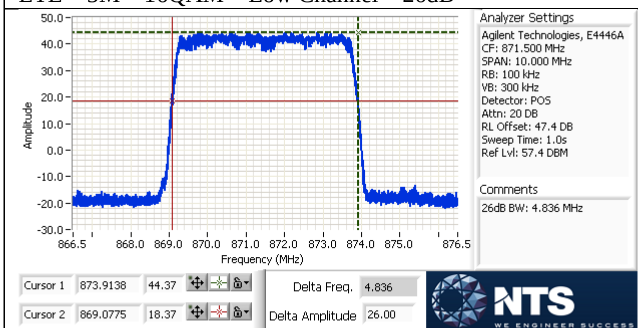
LTE – 5M – QPSK – Low Channel – 26dB



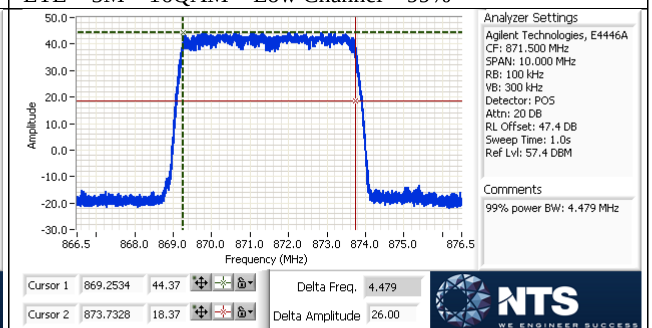
LTE – 5M – QPSK – Low Channel – 99%



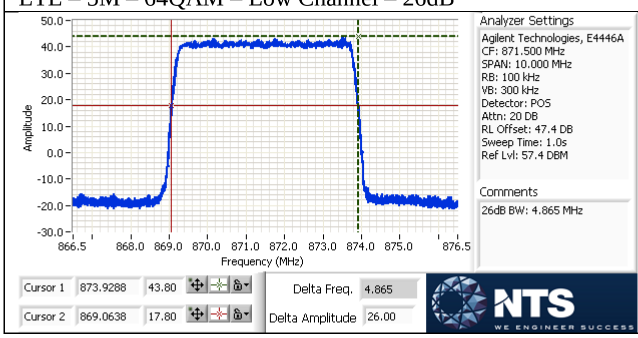
LTE – 5M – 16QAM – Low Channel – 26dB



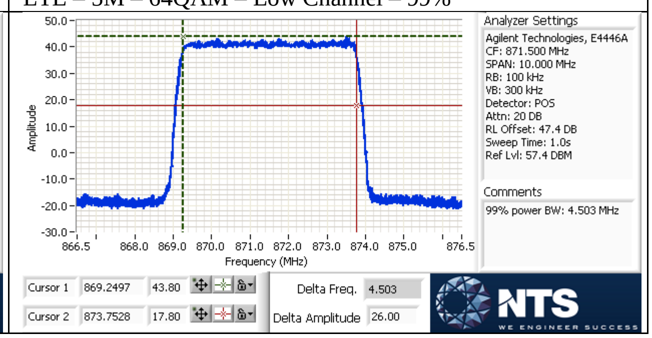
LTE – 5M – 16QAM – Low Channel – 99%



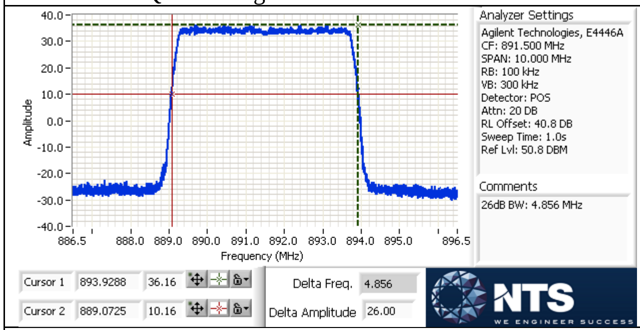
LTE – 5M – 64QAM – Low Channel – 26dB



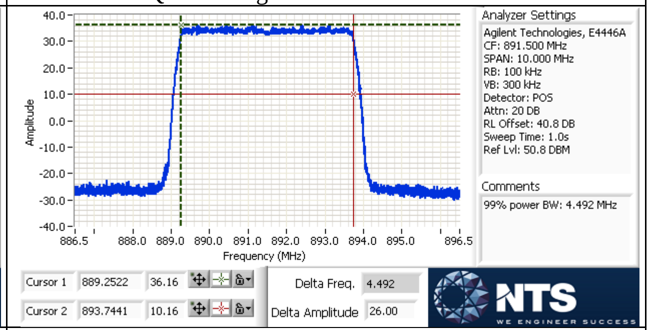
LTE – 5M – 64QAM – Low Channel – 99%



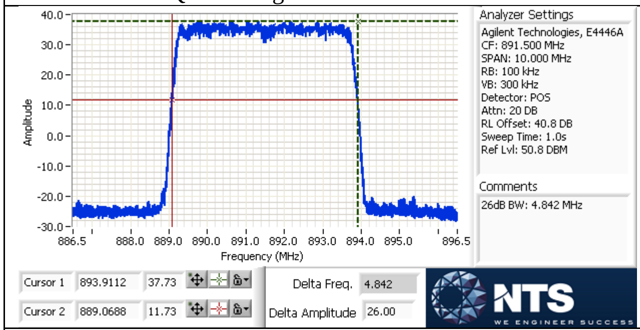
LTE – 5M – QPSK – High Channel – 26dB



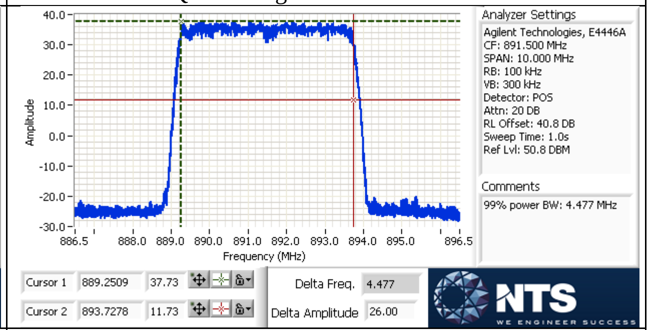
LTE – 5M – QPSK – High Channel – 99%



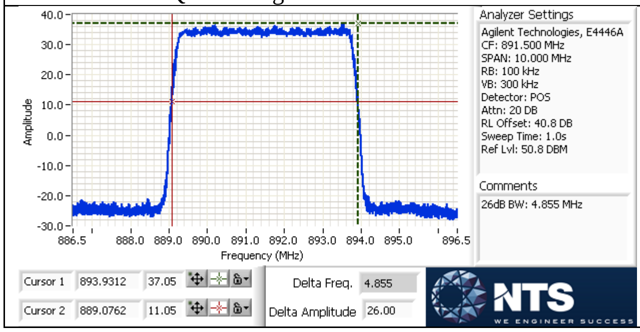
LTE – 5M – 16QAM – High Channel – 26dB



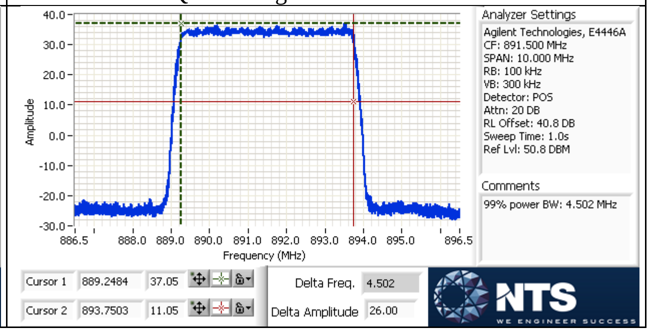
LTE – 5M – 16QAM – High Channel – 99%



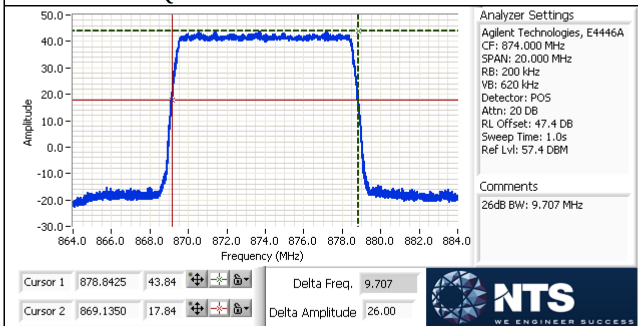
LTE – 5M – 64QAM – High Channel – 26dB



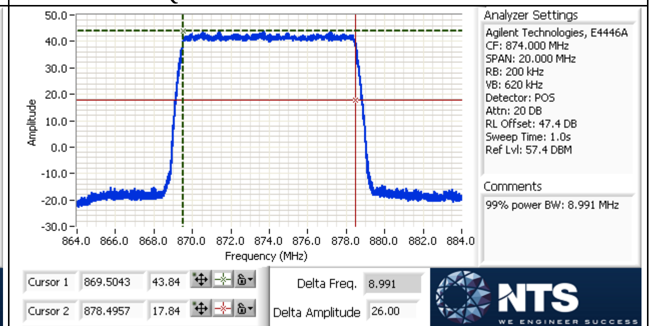
LTE – 5M – 64QAM – High Channel – 99%



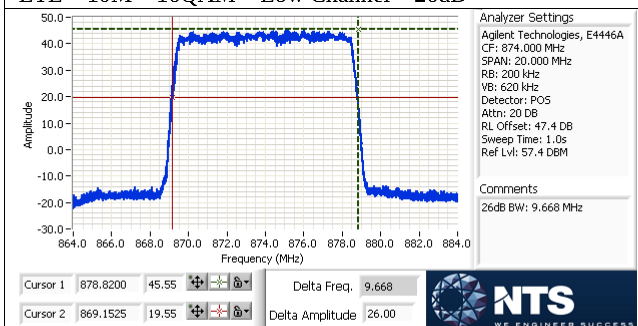
LTE – 10M – QPSK – Low Channel – 26dB



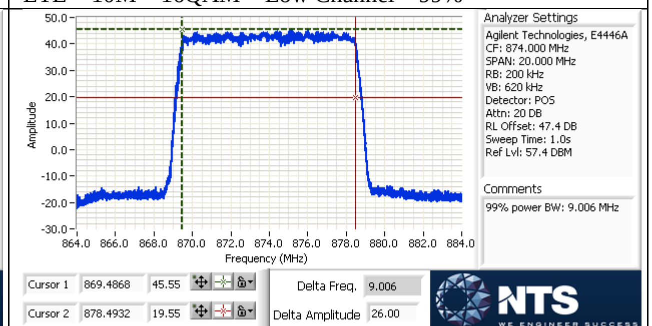
LTE – 10M – QPSK – Low Channel – 99%



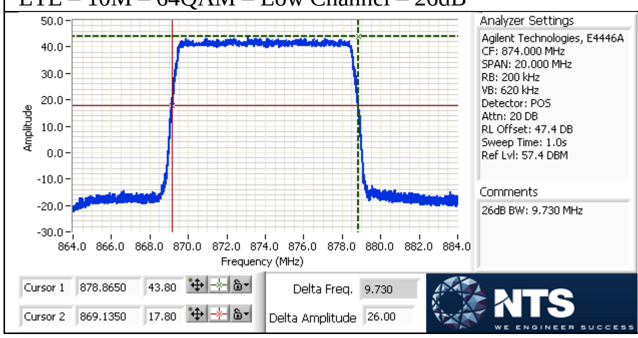
LTE – 10M – 16QAM – Low Channel – 26dB



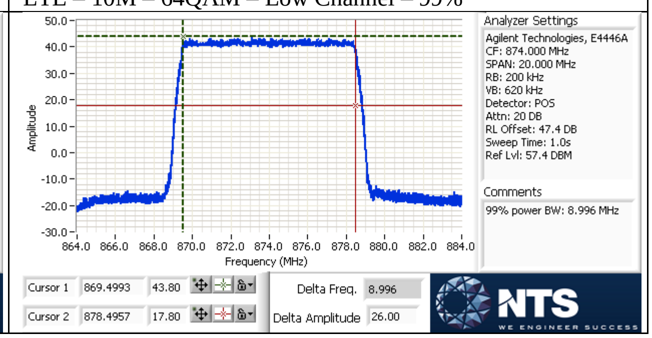
LTE – 10M – 16QAM – Low Channel – 99%



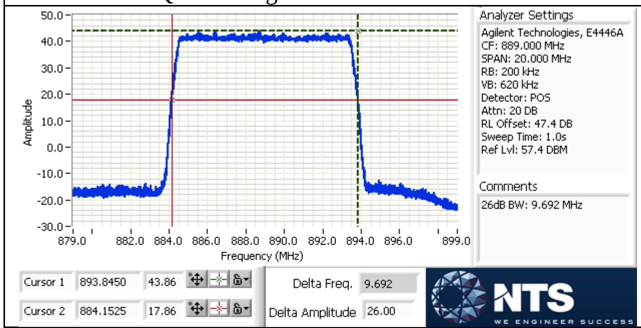
LTE – 10M – 64QAM – Low Channel – 26dB



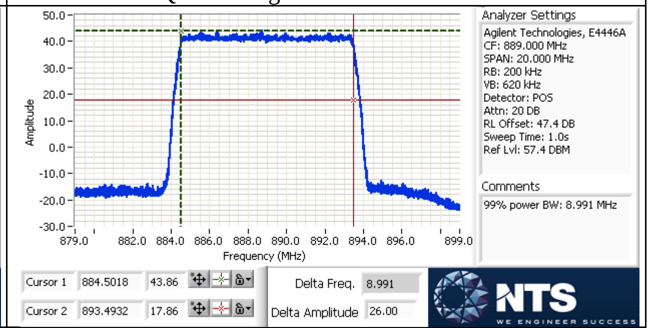
LTE – 10M – 64QAM – Low Channel – 99%



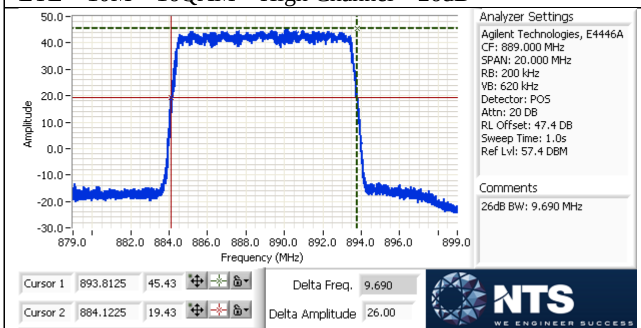
LTE – 10M – QPSK – High Channel – 26dB



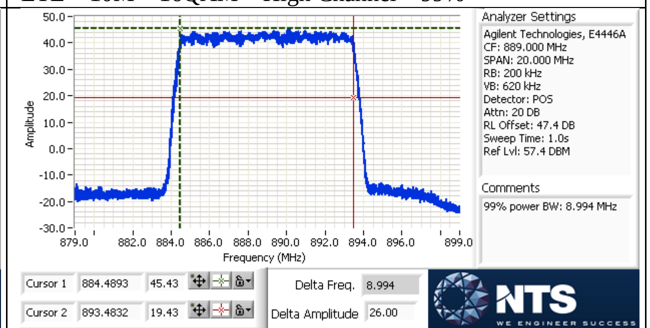
LTE – 10M – QPSK – High Channel – 99%



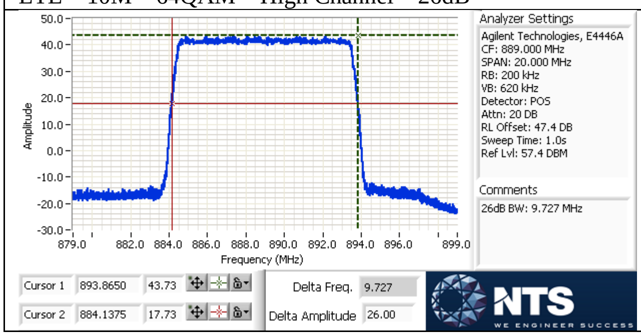
LTE – 10M – 16QAM – High Channel – 26dB



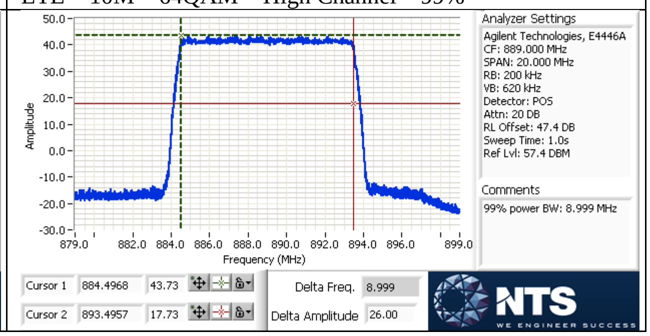
LTE – 10M – 16QAM – High Channel – 99%



LTE – 10M – 64QAM – High Channel – 26dB



LTE – 10M – 64QAM – High Channel – 99%



Antenna Port Conducted Bandedge

Limit is -13dBm and is further reduced by 10*log(4) per FCC KDB 662911D01 v02r01 due to 4x4 MIMO operation, which brings it down to -19.03dBm.

Tests performed at Port 5 on lowest and highest channels for all modulations and channel bandwidth modes.

	LTE - QPSK		LTE - 16QAM		LTE - 64QAM	
	Low	High	Low	High	Low	High
1.4M	-21.28dBm	-21.07dBm	-22.2dBm	-21.47dBm	-20.79dBm	-21.92dBm
3M	-23.99dBm*	-23.54dBm*	-24.39dBm*	-21.95dBm*	-24.60dBm*	-23.31dBm*
3M±1	-26.16dBm	-29.01dBm	-26.17dBm	-28.88dBm	-26.10dBm	-28.63dBm
5M	-22.82dBm*	-24.26dBm*	-23.68dBm*	-23.59dBm*	-23.89dBm*	-24.28dBm*
5M±1	-23.78dBm	-28.04dBm	-25.02dBm	-27.82dBm	-23.98dBm	-27.72dBm
10M	-24.35dBm*	-22.43dBm*	-24.96dBm*	-25.23dBm*	-23.36dBm*	-23.16dBm*
10M±1	-25.44dBm	-27.24dBm	-24.50dBm	-26.49dBm	-24.88dBm	-26.79dBm
1.4M Dual	-21.36dBm*	-21.56dBm*	-22.81dBm*	-22.11dBm*	-22.61dBm*	-22.03dBm*
1.4M Dual±1	-24.66dBm	-28.73dBm	-24.41dBm	-28.55dBm	-24.87dBm	-28.49dBm

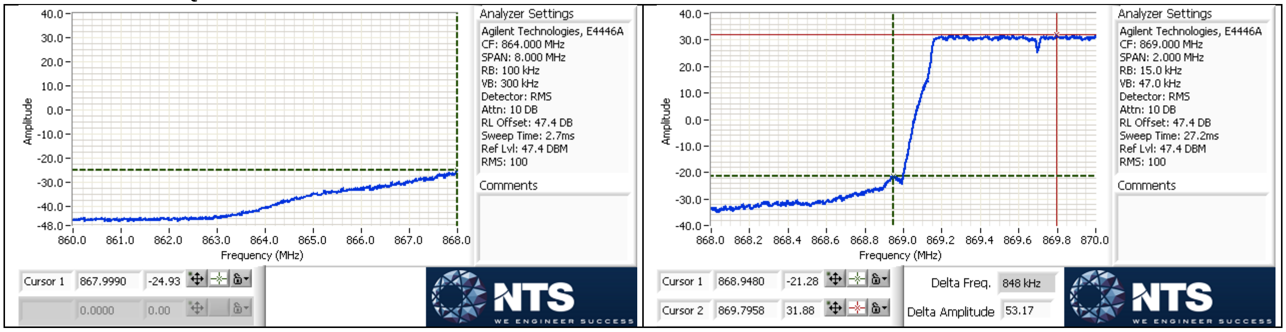
Note * = Power Reduced to 60Watts

Measurements were performed in RMS average mode with 100kHz RBW and 300kHz 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.
In some bandwidths the power had to be reduced to 60 watts at the bandedge channel in order to meet the requirement. In such cases the channel was moved in a 100kHz steps towards the center channel at full power until the requirement was met.

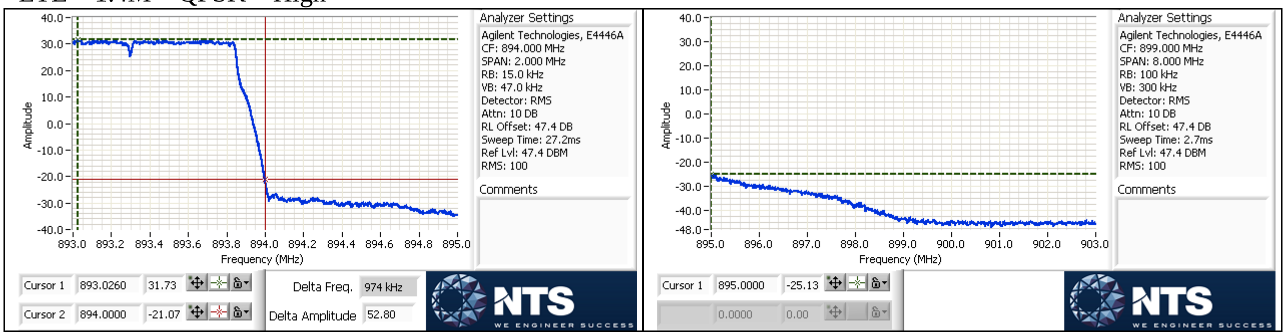
Total path loss of 47.4dB accounted in via reference level offset to the spectrum analyzer.

All corresponding plots are included on the following pages.

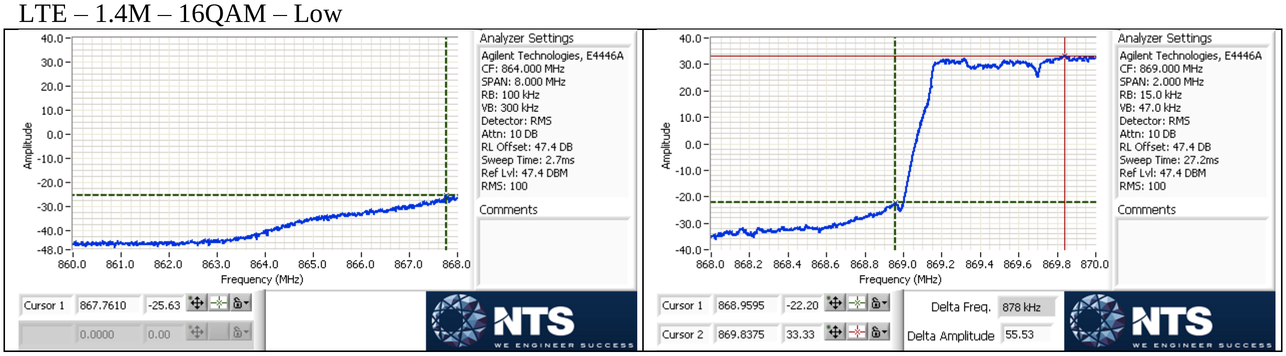
LTE – 1.4M – QPSK – Low



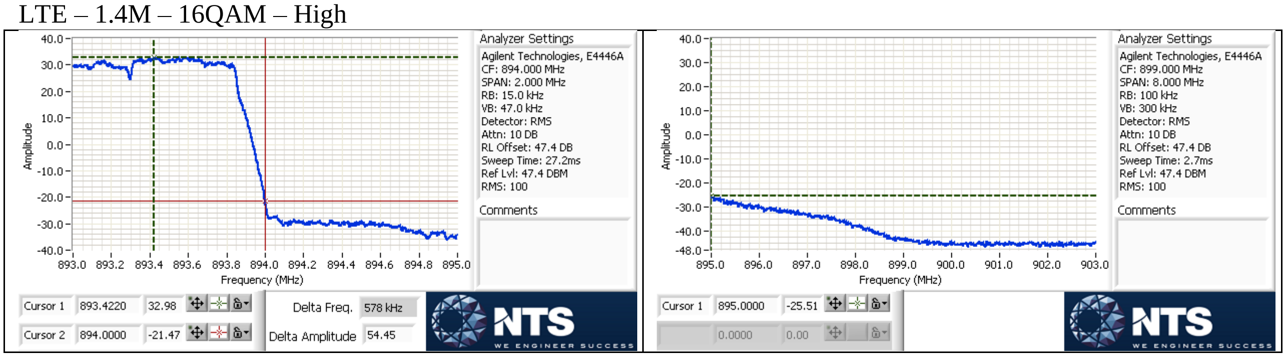
LTE – 1.4M – QPSK – High



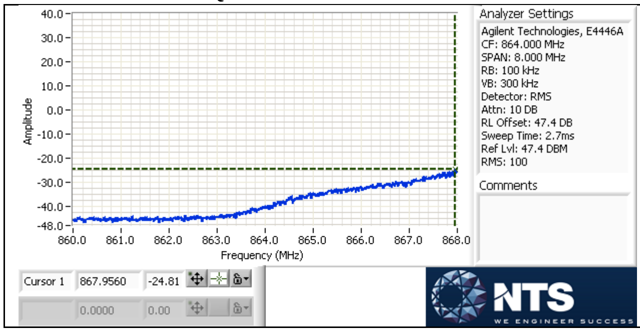
LTE – 1.4M – 16QAM – Low

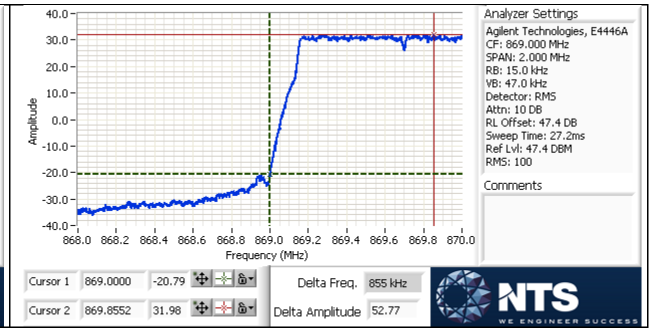


LTE – 1.4M – 16QAM – High

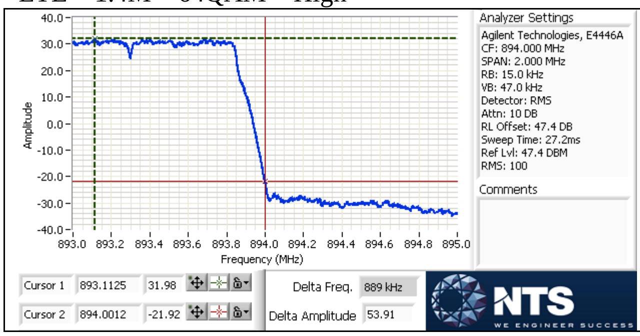


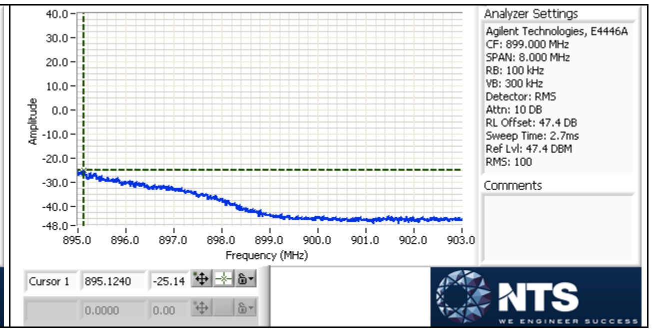
LTE – 1.4M – 64QAM – Low



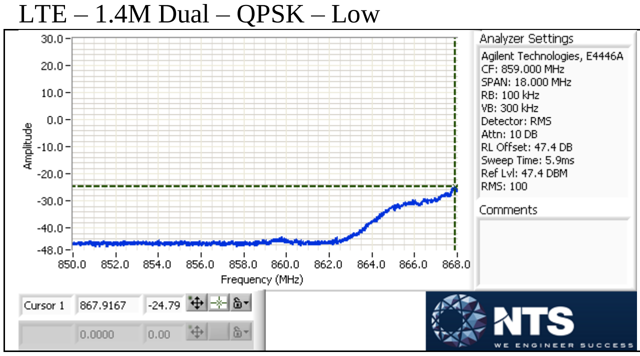


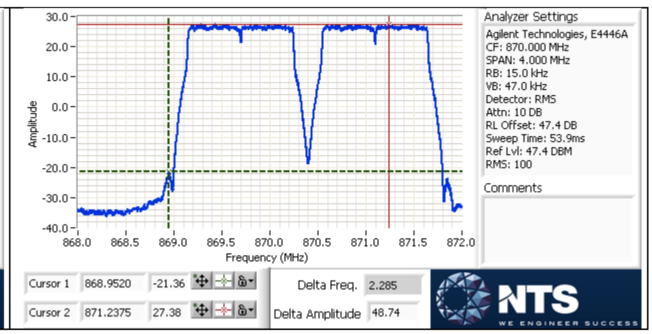
LTE – 1.4M – 64QAM – High



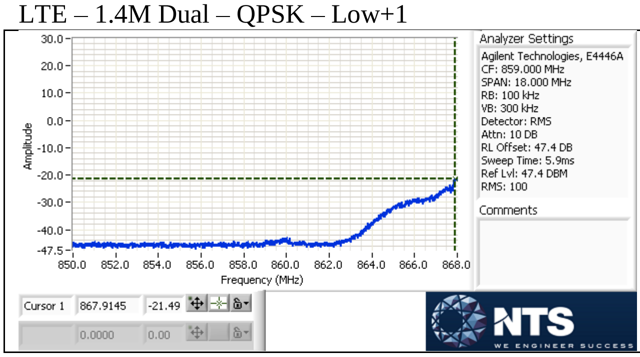


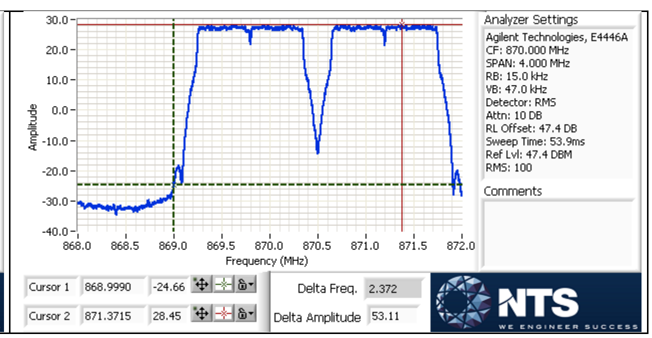
LTE – 1.4M Dual – QPSK – Low



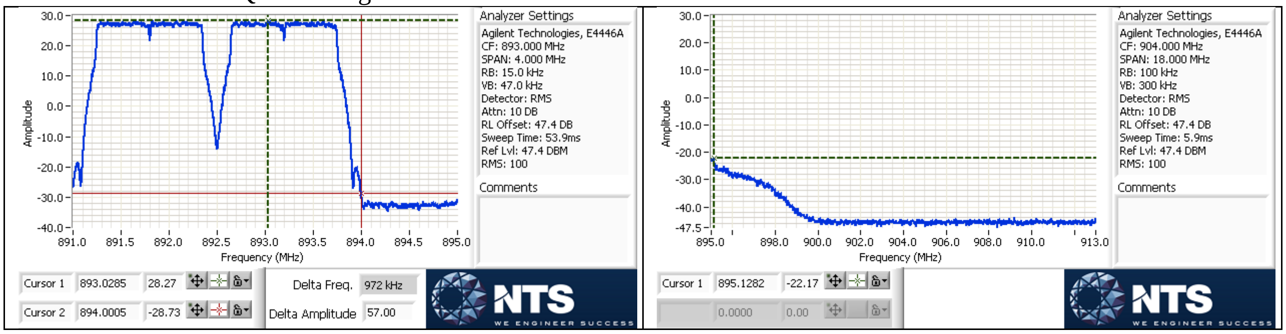


LTE – 1.4M Dual – QPSK – Low+1

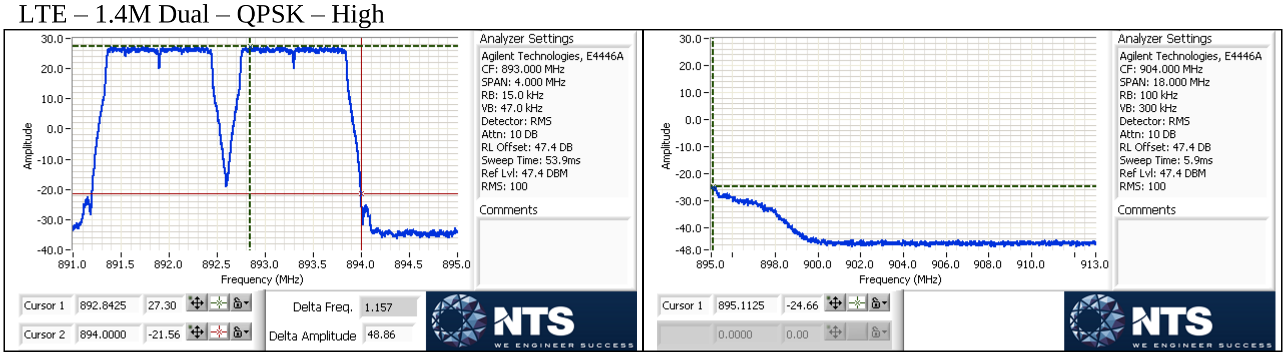




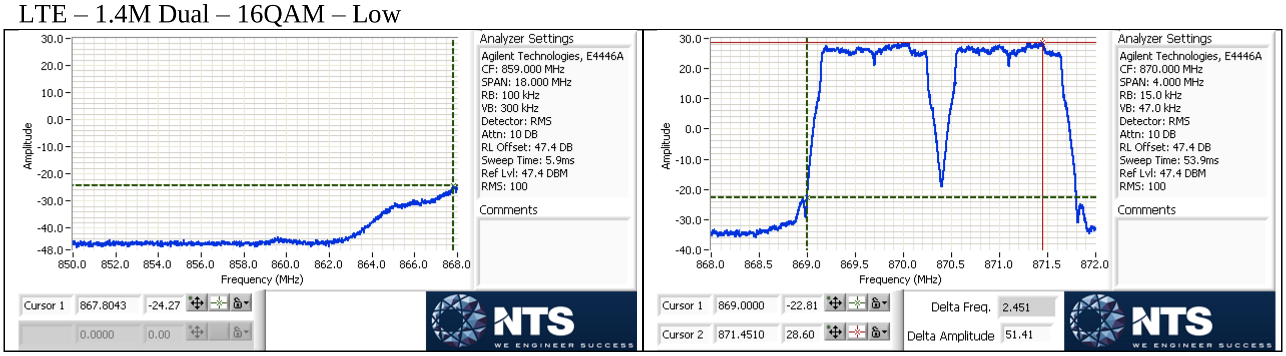
LTE – 1.4M Dual – QPSK – High-1



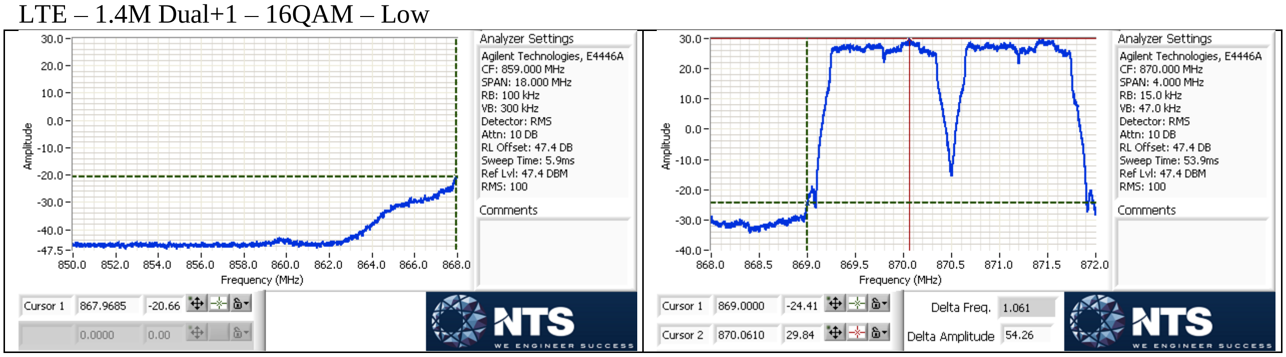
LTE – 1.4M Dual – QPSK – High



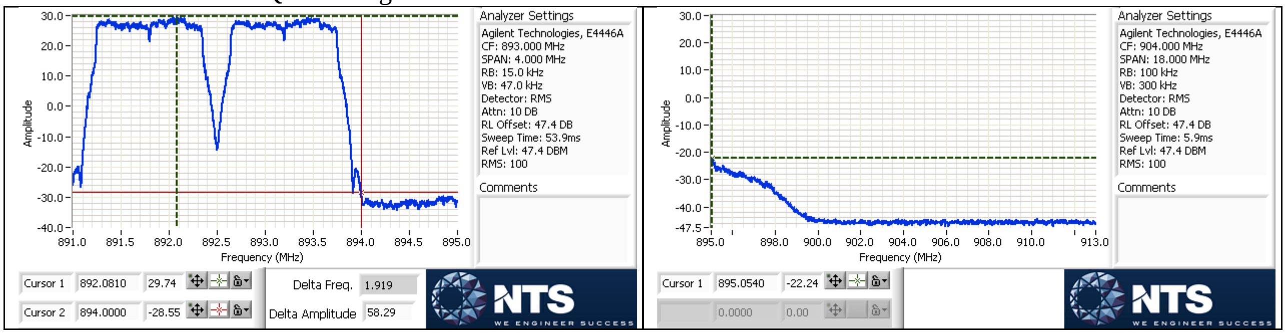
LTE – 1.4M Dual – 16QAM – Low



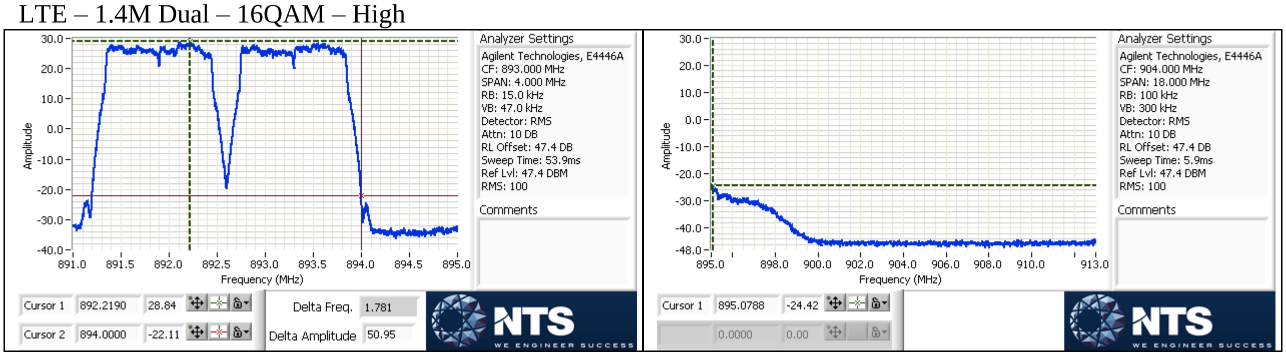
LTE – 1.4M Dual+1 – 16QAM – Low



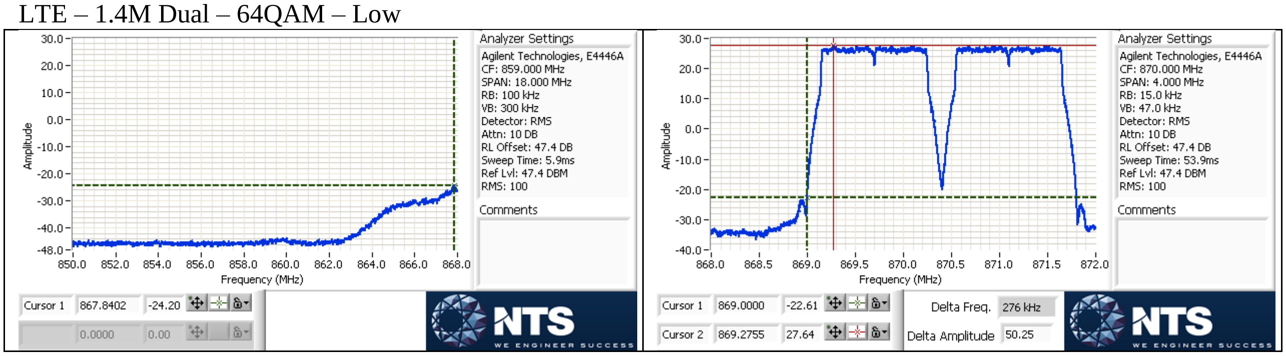
LTE – 1.4M Dual – 16QAM – High-1



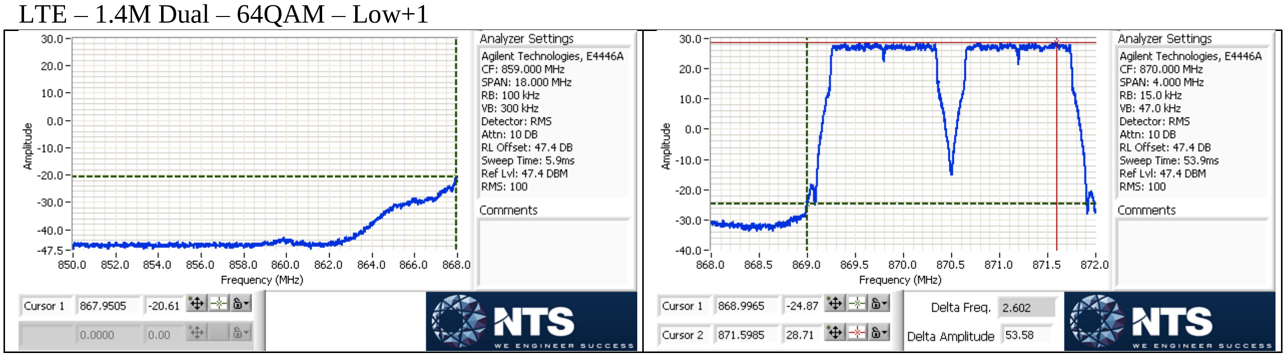
LTE – 1.4M Dual – 16QAM – High



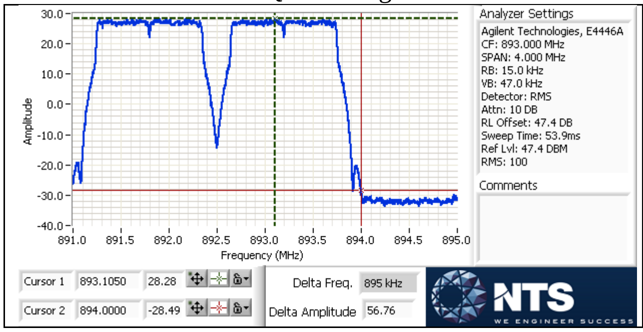
LTE – 1.4M Dual – 64QAM – Low

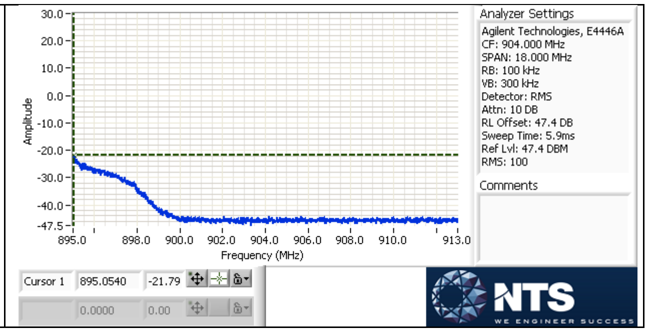


LTE – 1.4M Dual – 64QAM – Low+1



LTE – 1.4M Dual – 64QAM – High-1





LTE – 1.4M Dual – 64QAM – High