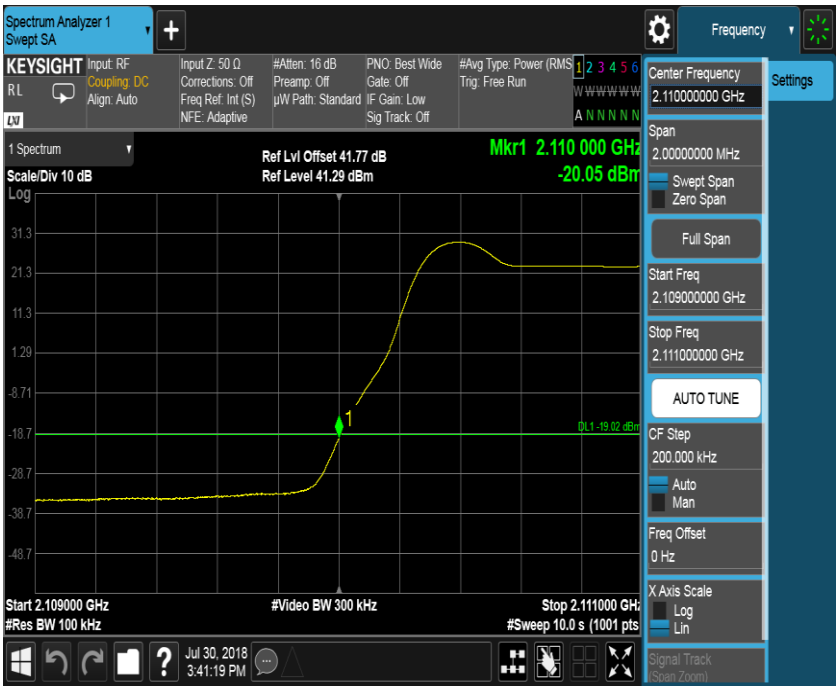
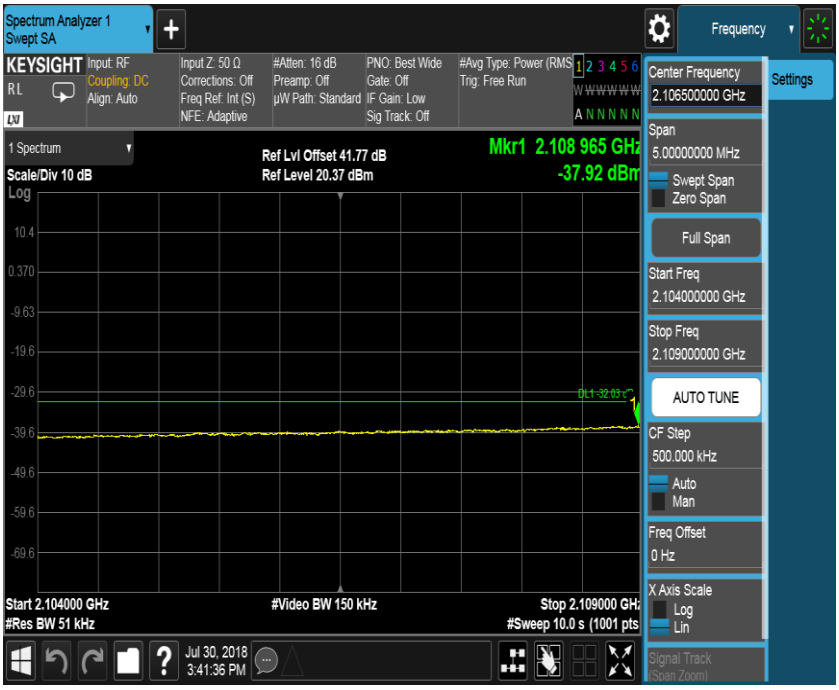
Configuration NB-IoT-GB+LTE-MIMO -MC-1-BE, (1GB, QPSK +1LTE, QPSK)

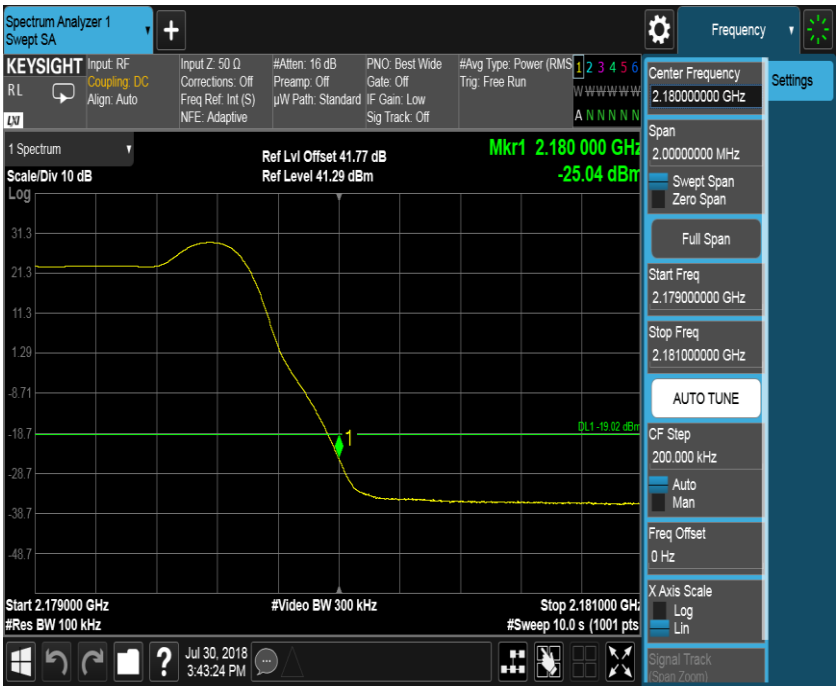
Band Edge Frequency	Channel Bandwidth	RBW (KHz)	Limit (dBm)
Channel Position B 2110.0MHz	(GB) 10.0MHz, (L) 10.0MHz	100	-19.02
Channel Position T 2180.0MHz	(GB) 10.0MHz, (L) 10.0MHz	100	-19.02

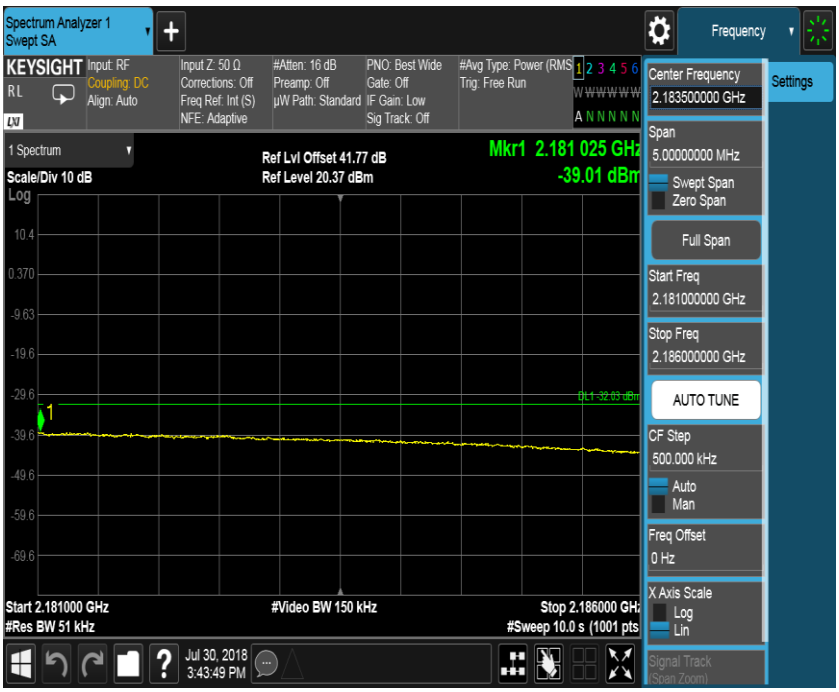
Port D, Channel Position B





Port D, Channel Position T

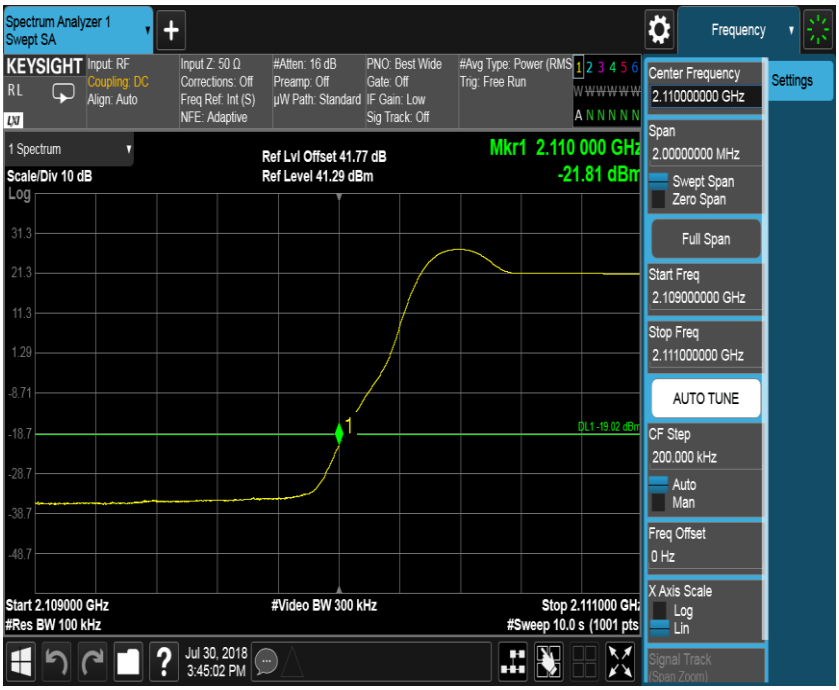


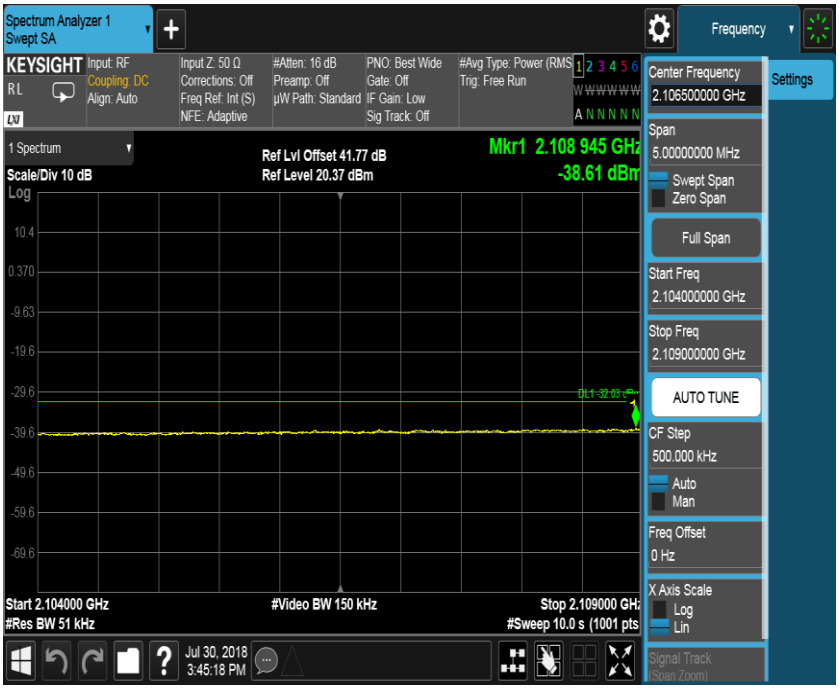


Configuration NB-IoT-GB+LTE-MIMO-MC-2-BE, (1GB, QPSK +2LTE, QPSK)

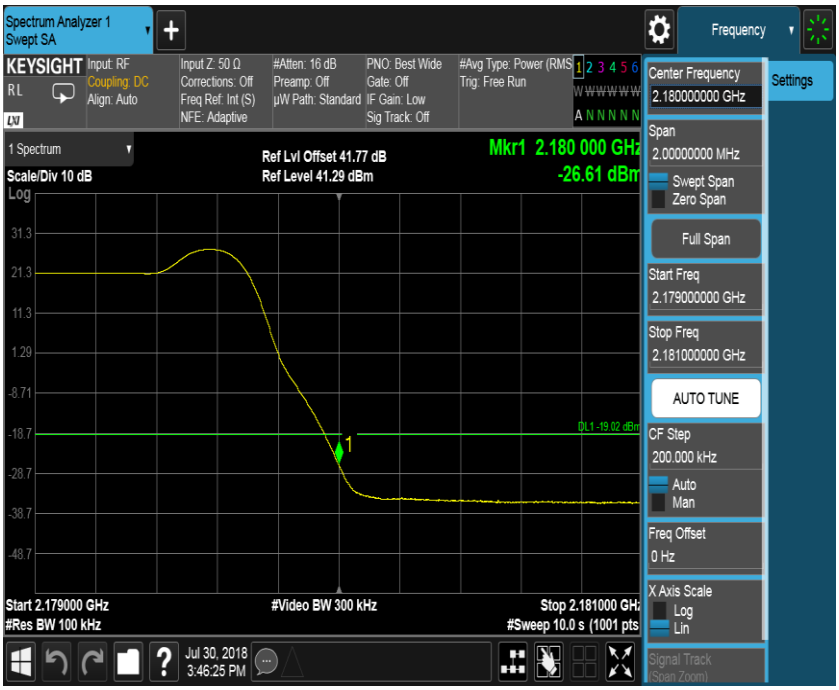
Band Edge Frequency	Channel Bandwidth	RBW (KHz)	Limit (dBm)
Channel Position B 2110.0MHz	(GB) 10.0MHz, (L) 10.0MHz	100	-19.02
Channel Position T 2180.0MHz	(GB) 10.0MHz, (L) 10.0MHz	100	-19.02

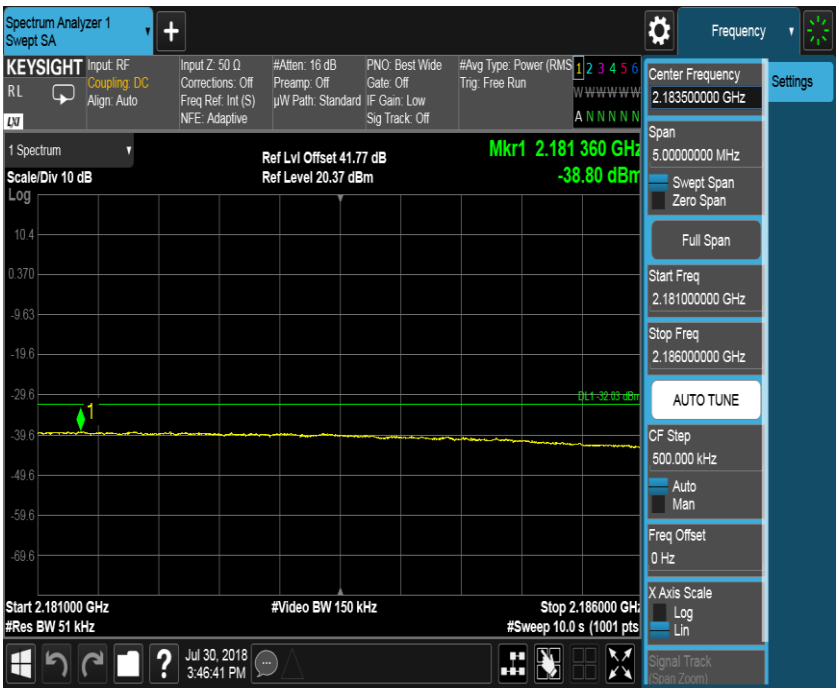
Port D, Channel Position B





Port D, Channel Position T





A.4 Conducted Spurious Emission

A.4.1 Reference

FCC CFR 47 Part 27, Clause 27.53(h)
RSS-139, Clause 6.6

A.4.2 Method of measurement

In accordance with FCC rules, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
The spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using an attenuator and the frequency spectrum investigated from 3KHz to 22GHz. The resolution bandwidth of 1MHz was employed for frequency band 3KHz to 22GHz. The spectrum analyzer detector was set to RMS.
For MIMO mode configurations, the limit was adjusted with a correction of -6.02dB [10Log4] by using the Measure and Add 10Log(N) dB technique according to FCC KDB 662911 D01 accounting for simultaneous transmission from all antenna ports. Then the limit was adjusted to -19.02dBm.

A.4.3 Measurement limit

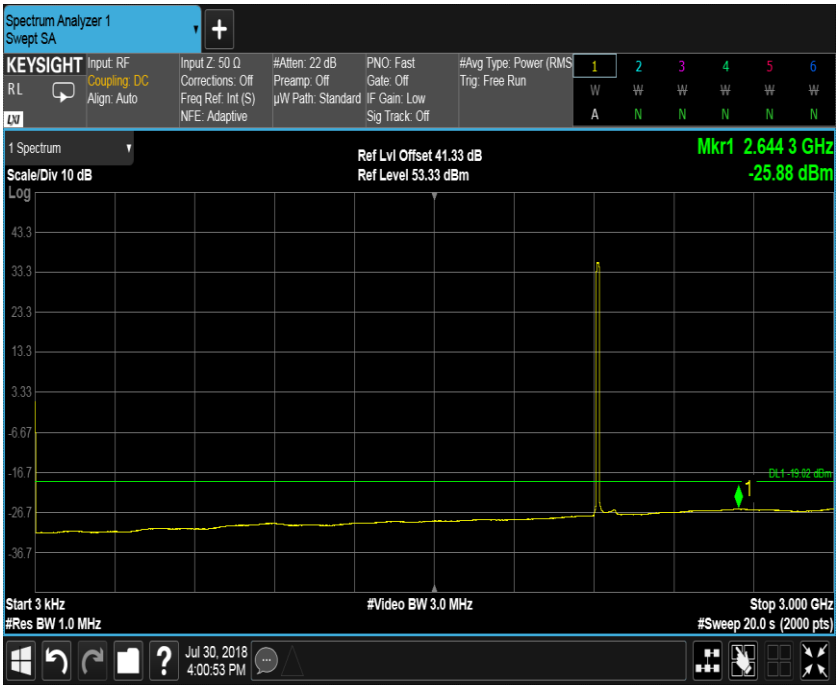
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB.

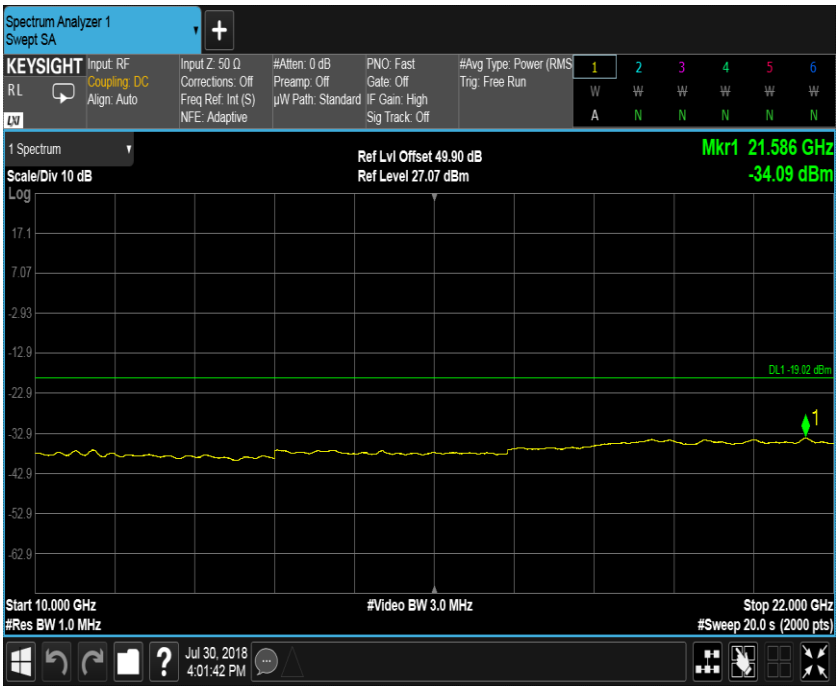
A.4.4 Measurement results

Configuration NB-IoT-GuardBand-1C, QPSK

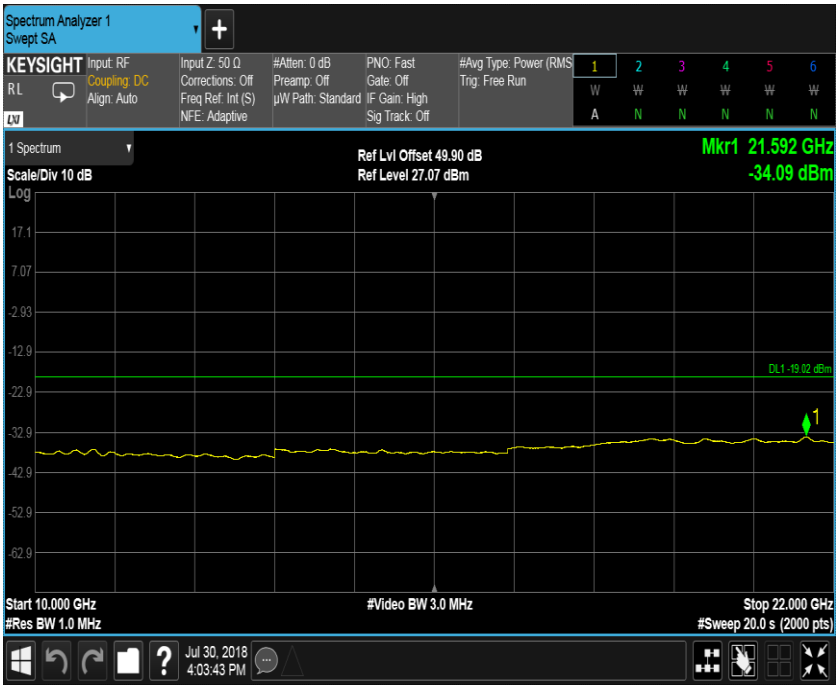
Channel Bandwidth	RBW (MHz)	Limit (dBm)
10.0 MHz	1.0	-19.02
15.0 MHz	1.0	-19.02
20.0 MHz	1.0	-19.02

Port D, Channel Position B 10.0 MHz

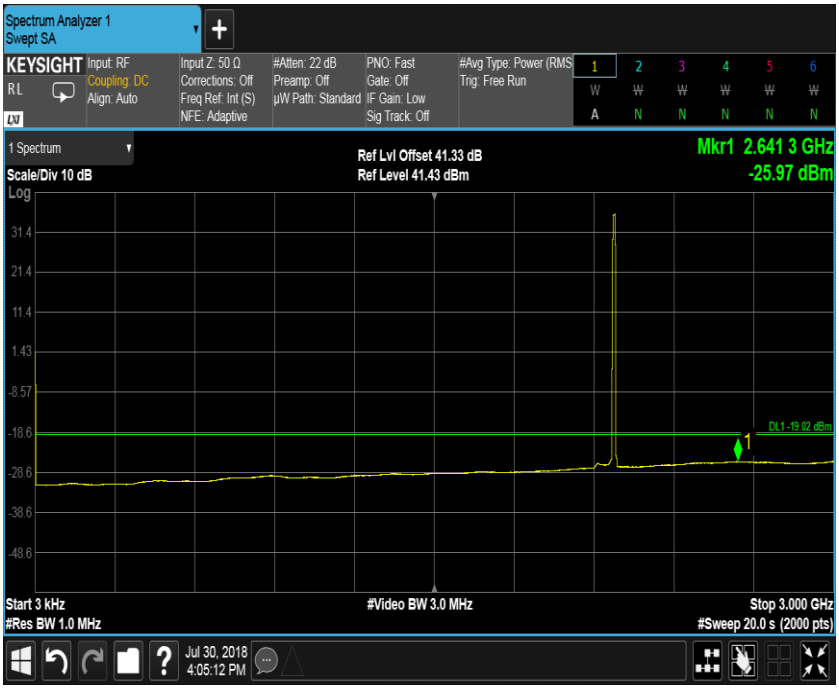


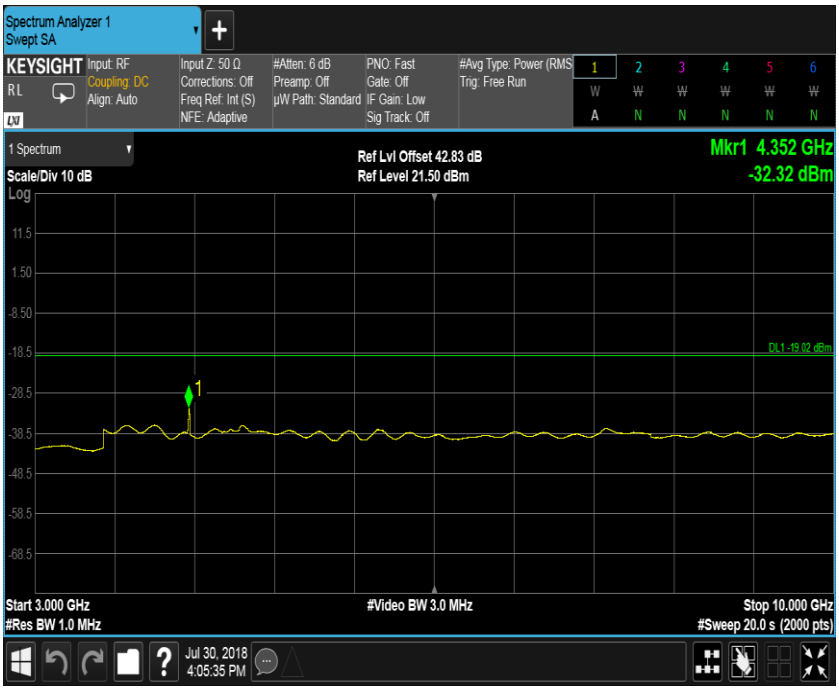


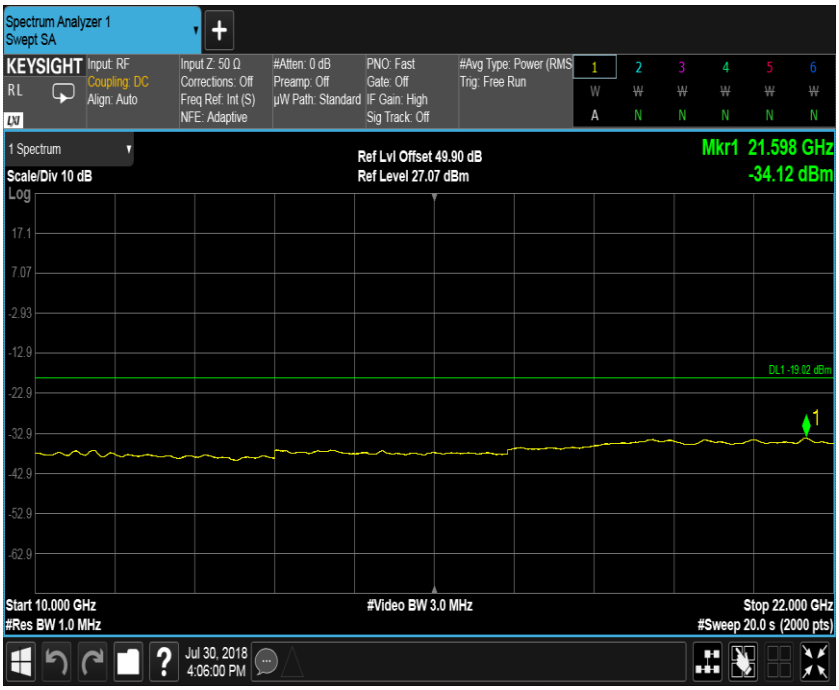
Port D, Channel Position M 10.0 MHz



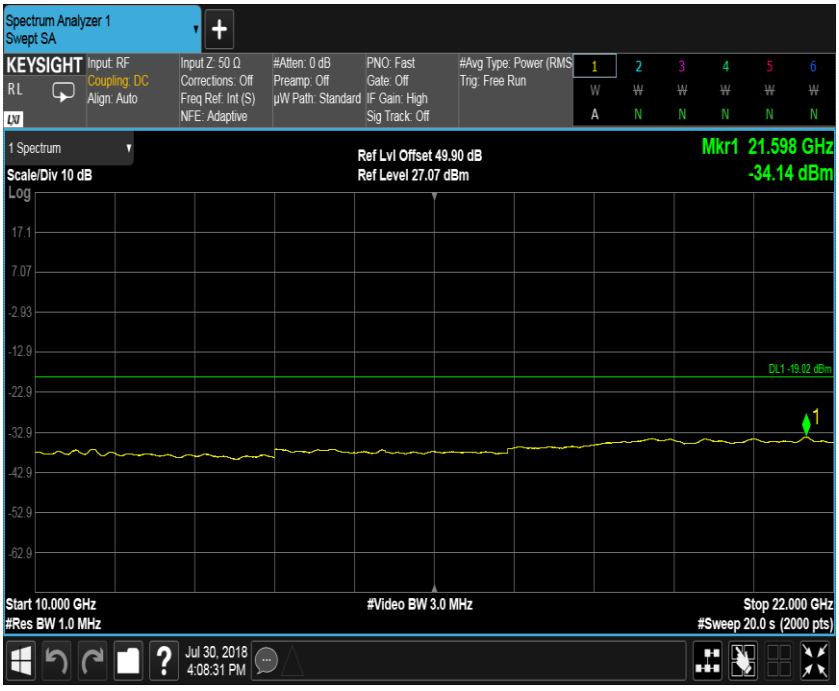
Port D, Channel Position T 10.0 MHz



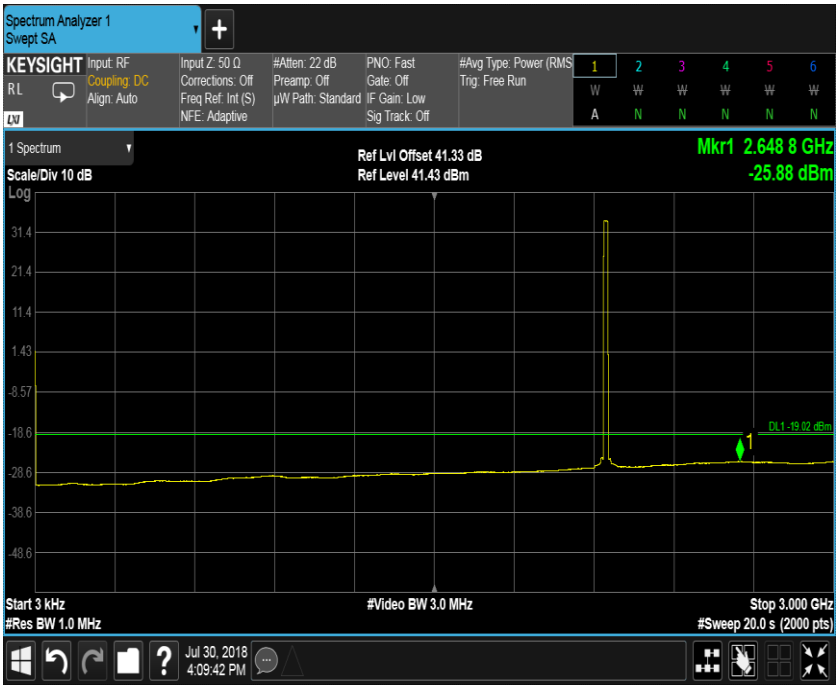


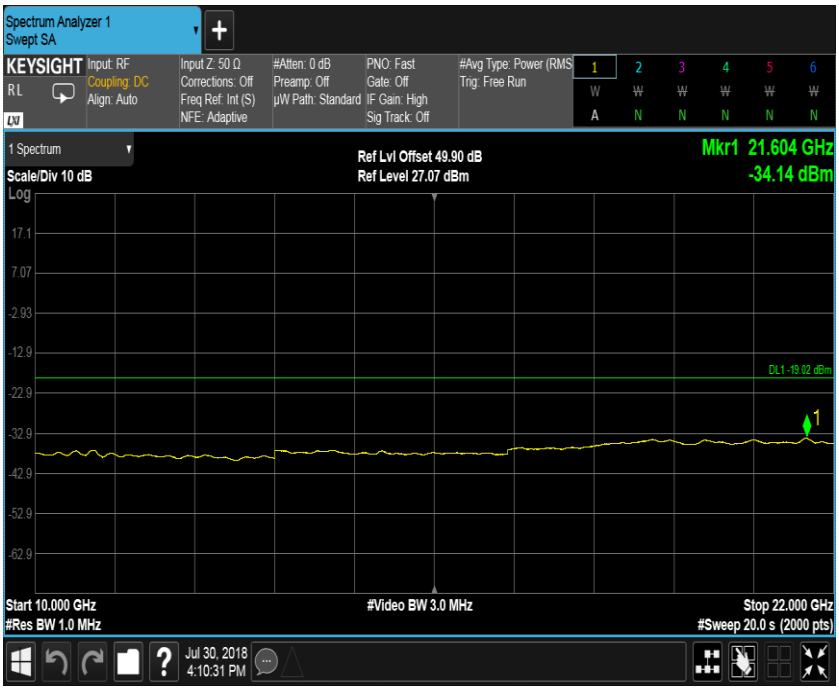


Port D, Channel Position B 15.0 MHz

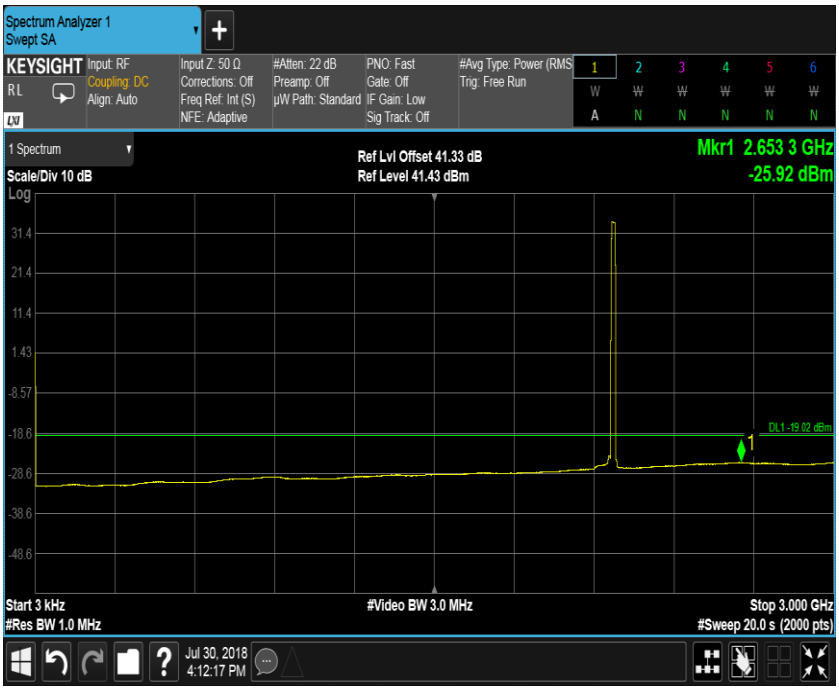


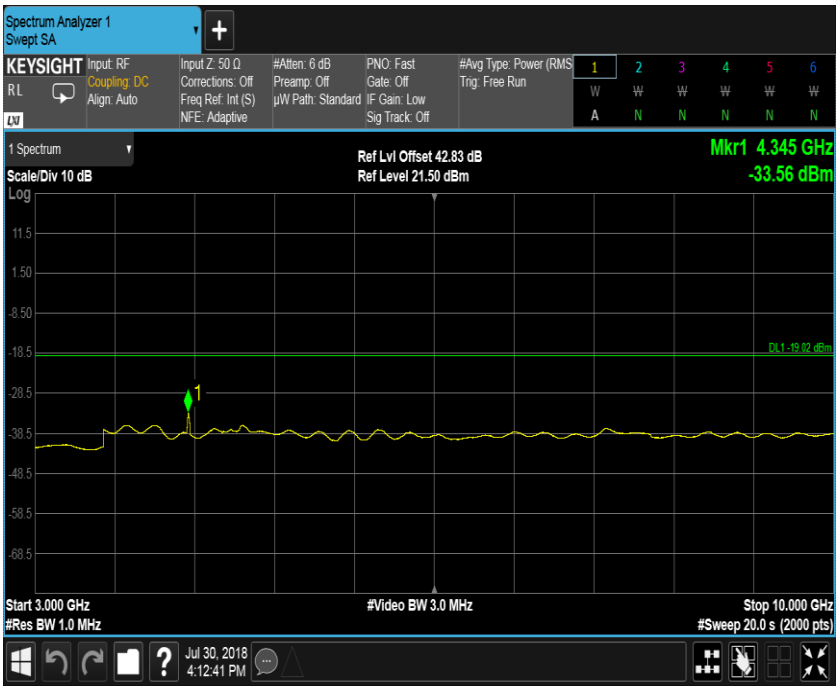
Port D, Channel Position M 15.0 MHz

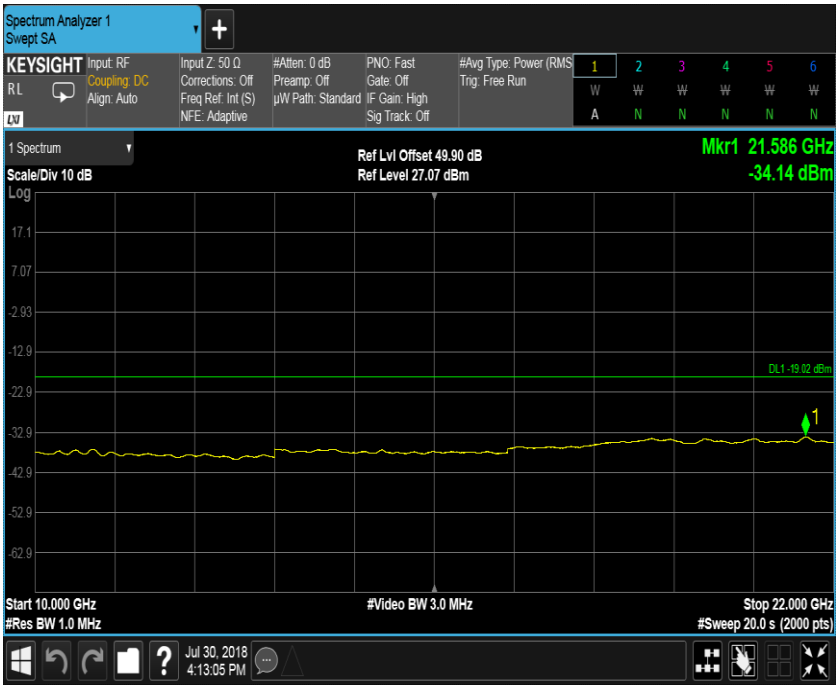




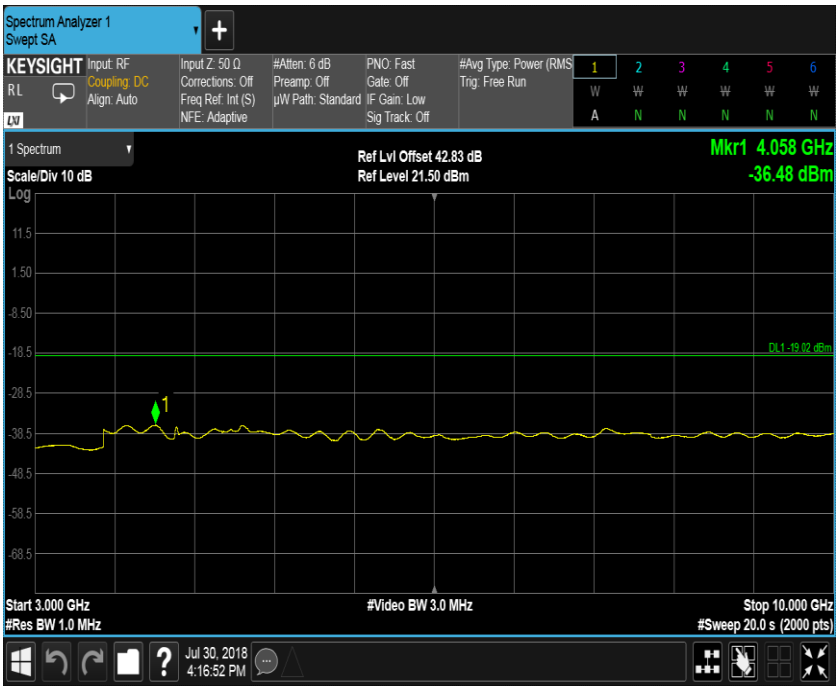
Port D, Channel Position T 15.0 MHz

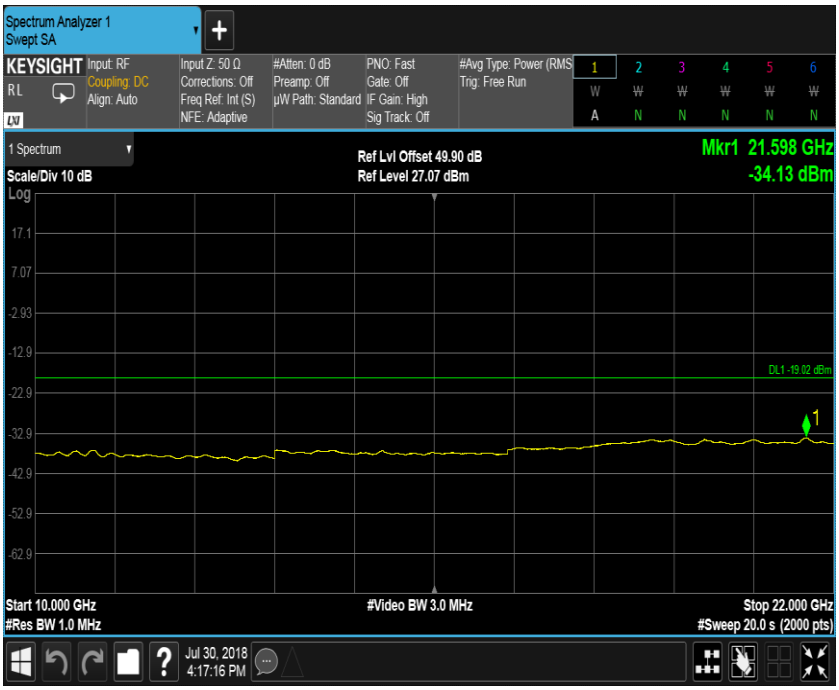




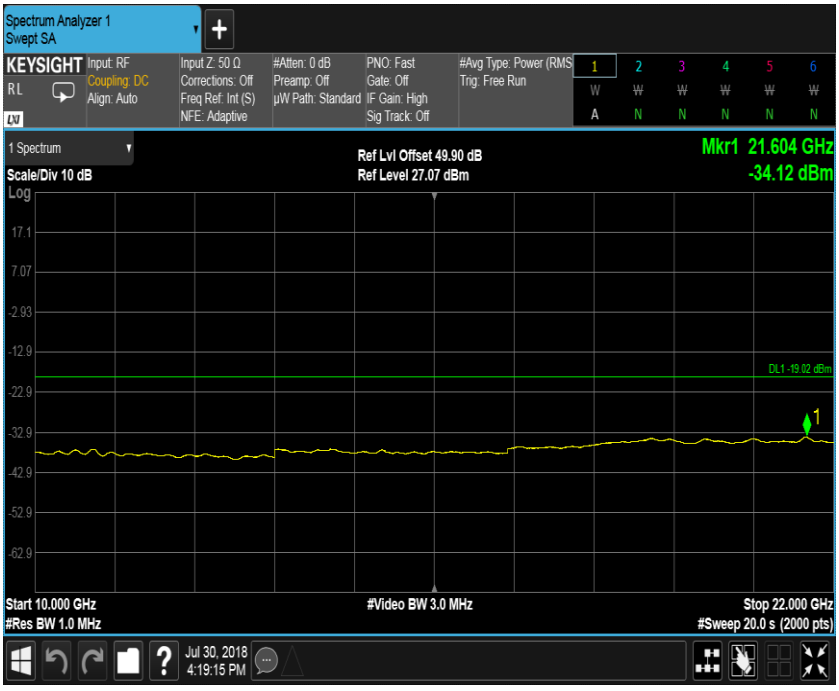


Port D, Channel Position B 20.0 MHz

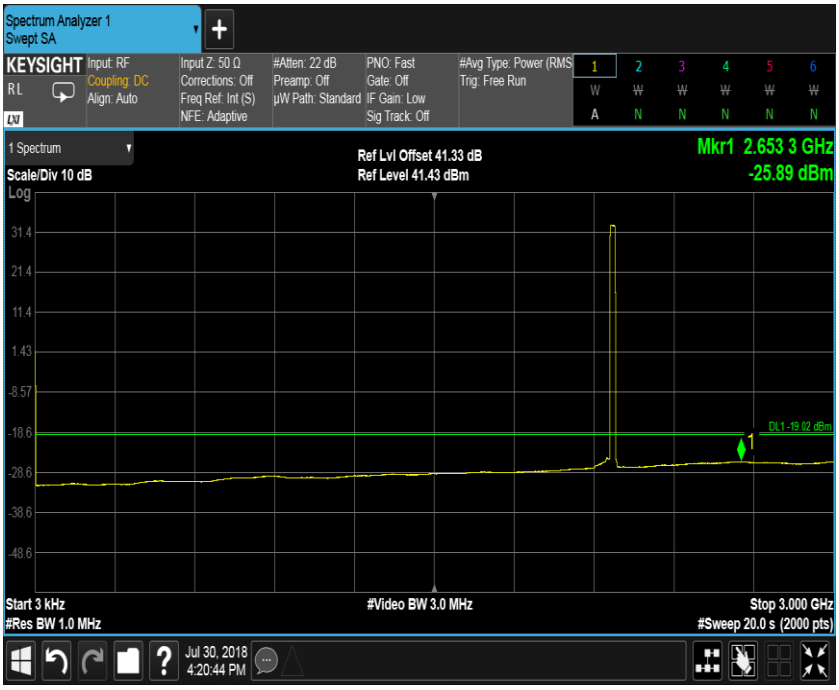


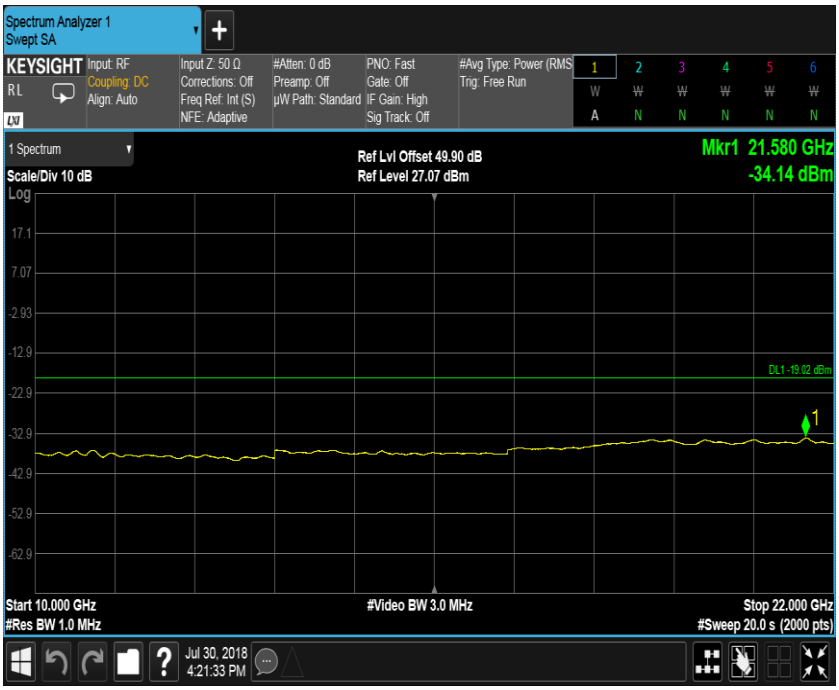


Port D, Channel Position M 20.0 MHz



Port D, Channel Position T 20.0 MHz

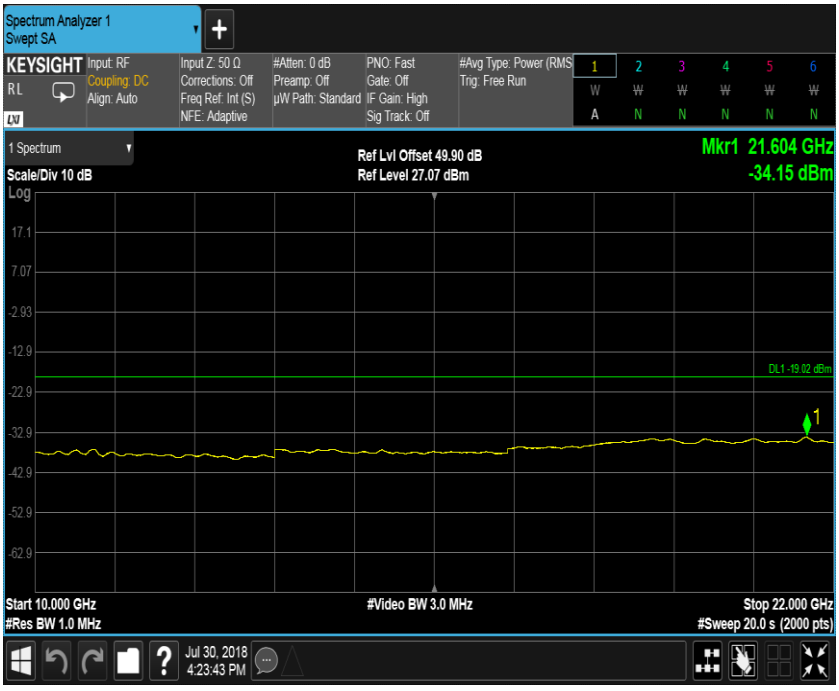




Configuration NB-IoT-IB+WCDMA-MIMO-MC-1 (1IB QPSK +1WCDMA 16QAM)

Channel Bandwidth	RBW (MHz)	Limit (dBm)
IB: 5.0 MHz W: 5.0 MHz	1.0	-19.02

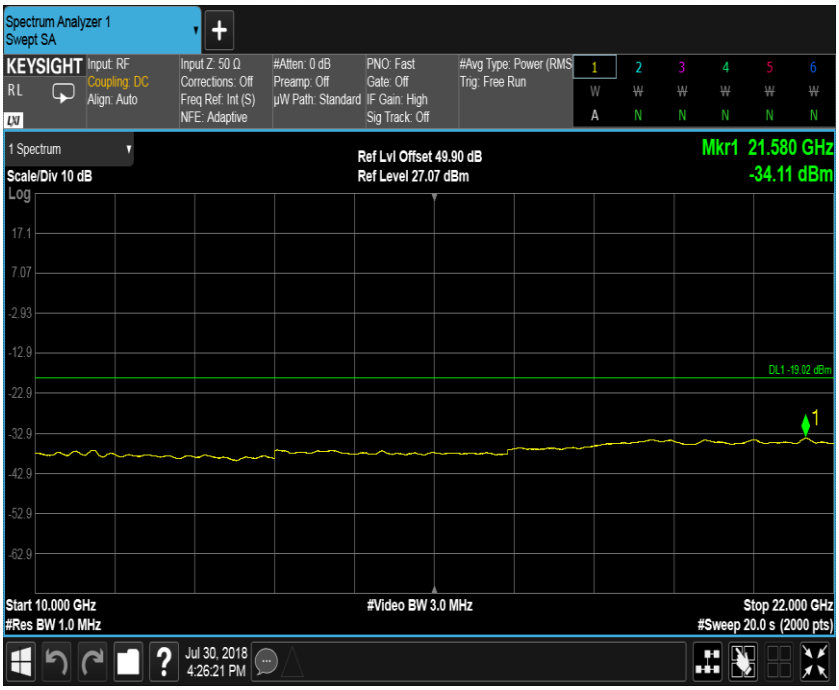
Port D, Channel Position M



Configuration NB-IoT-GB+WCDMA-MIMO-MC-1 (1GB QPSK +1WCDMA 16QAM)

Channel Bandwidth	RBW (MHz)	Limit (dBm)
GB:10.0 MHz W: 5.0 MHz	1.0	-19.02

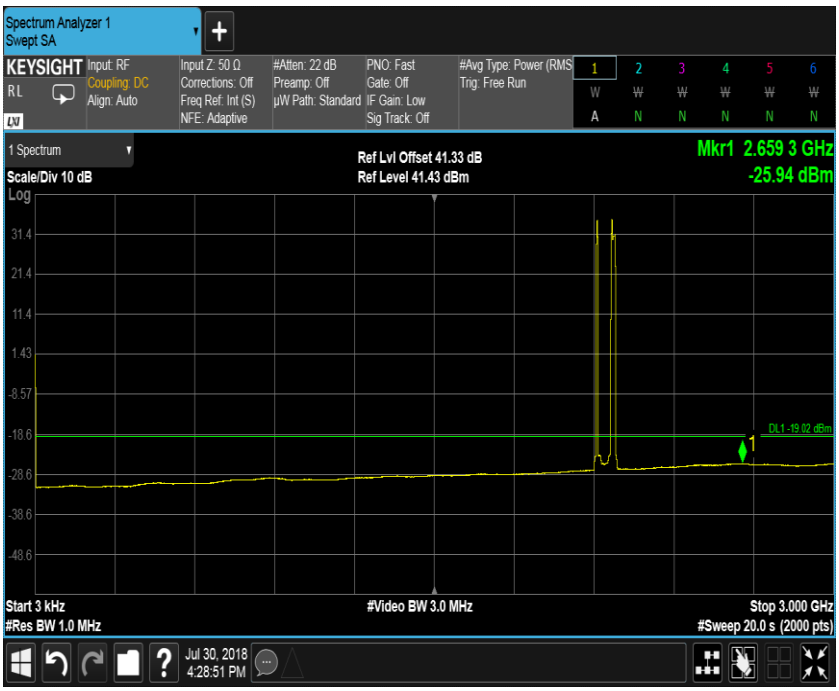
Port D, Channel Position M

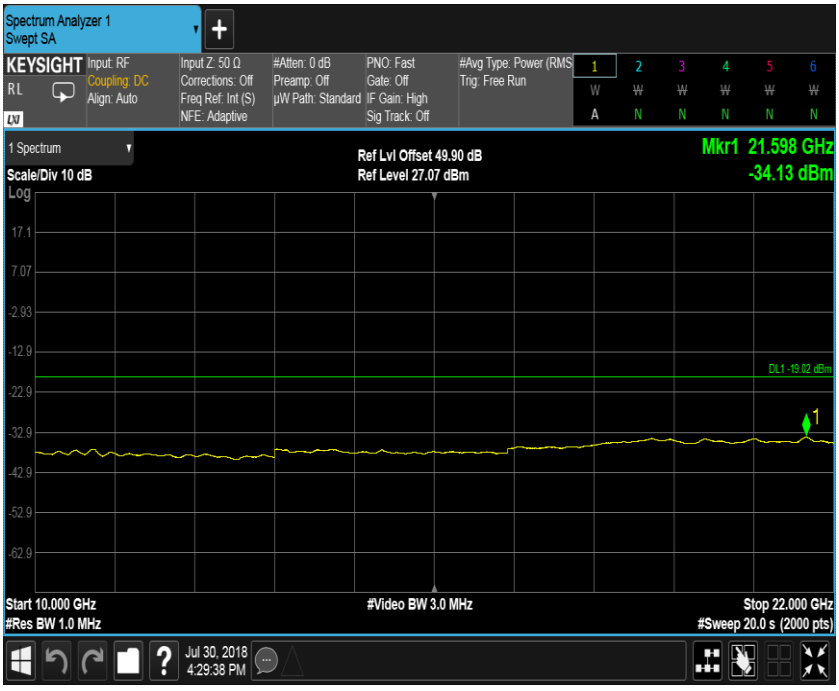


Configuration NB-IoT-GB+WCDMA-MIMO-MC-2 (1GB QPSK +2WCDMA 16QAM)

Channel Bandwidth	RBW (MHz)	Limit (dBm)
GB:10.0 MHz W: 5.0 MHz	1.0	-19.02

Port D, Channel Position M

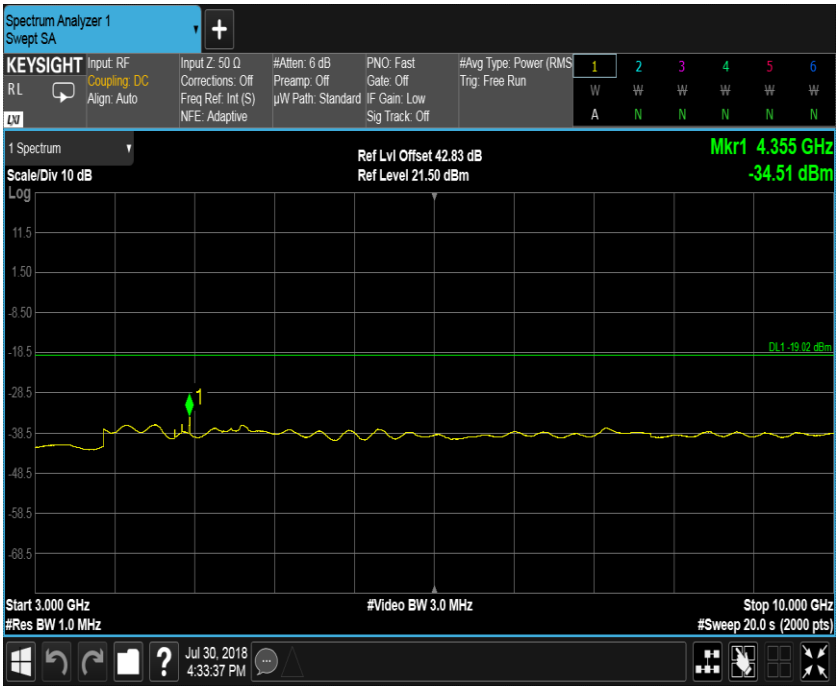


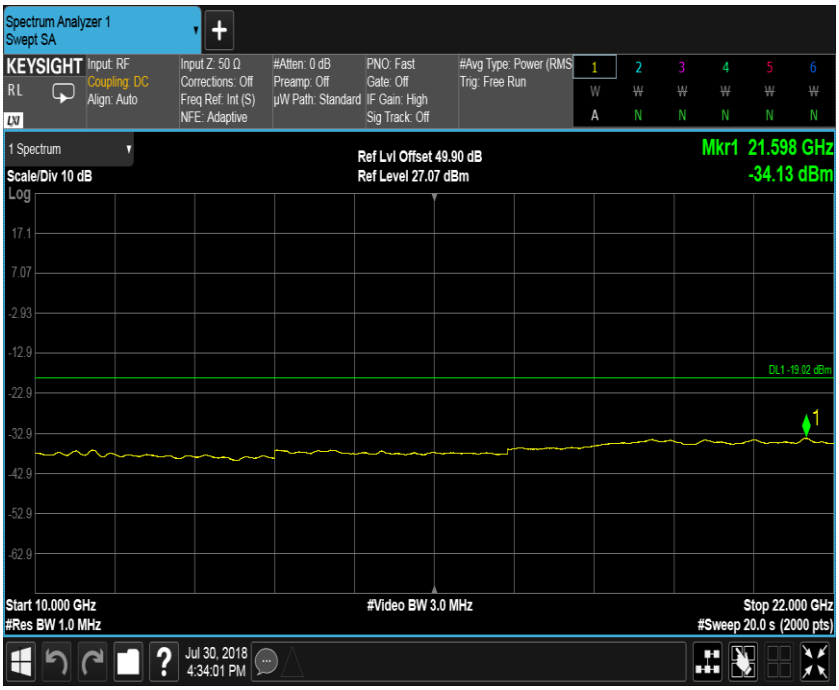


Configuration NB-IoT-IB+LTE-MIMO-MC-1 (1IB QPSK +1LTE QPSK)

Channel Bandwidth	RBW (MHz)	Limit (dBm)
IB:5.0 MHz L: 5.0 MHz	1.0	-19.02

Port D, Channel Position M

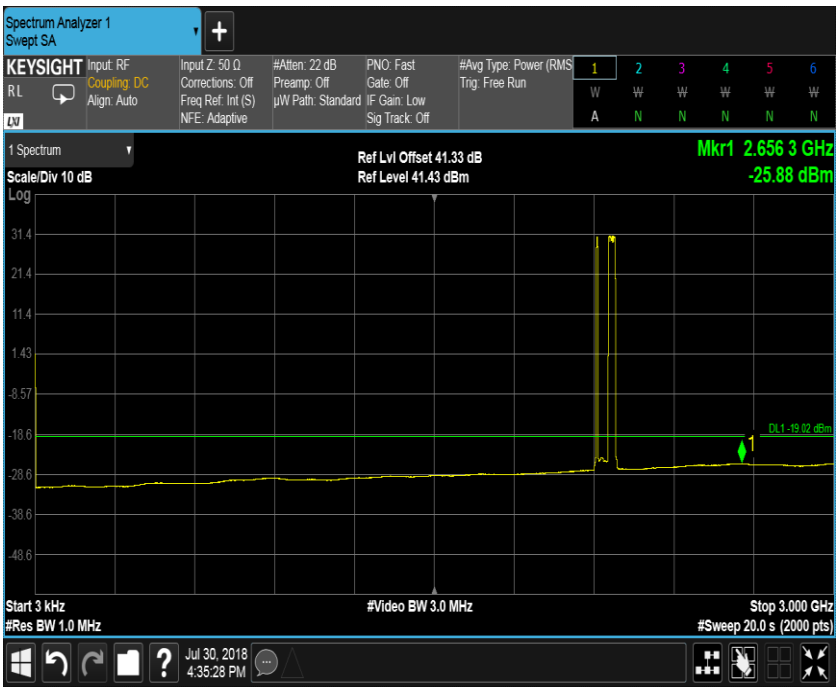


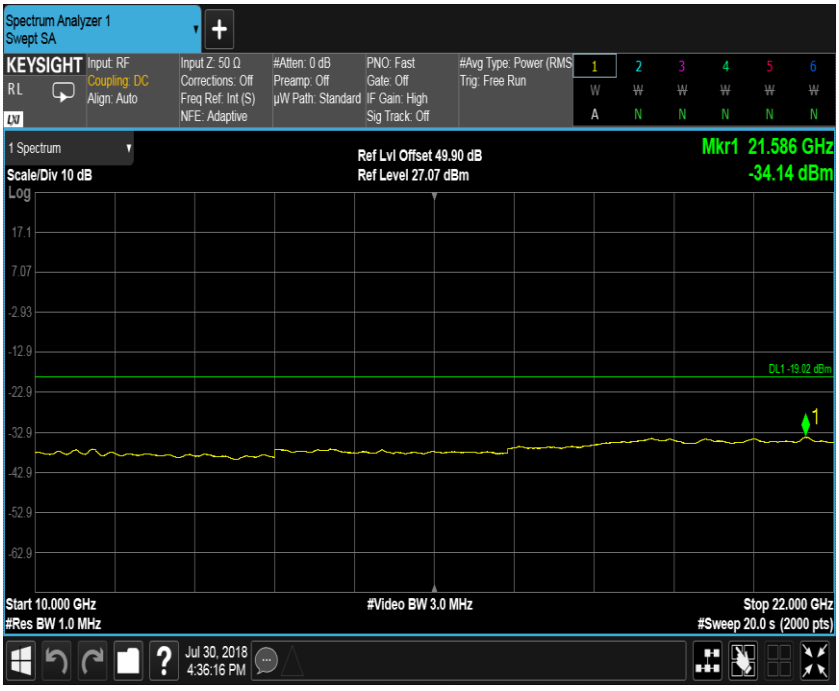


Configuration NB-IoT-IB+LTE-MIMO-MC-2 (1IB QPSK +5LTE QPSK)

Channel Bandwidth	RBW (MHz)	Limit (dBm)
IB:5.0 MHz L:5.0 MHz	1.0	-19.02

Port D, Channel Position M

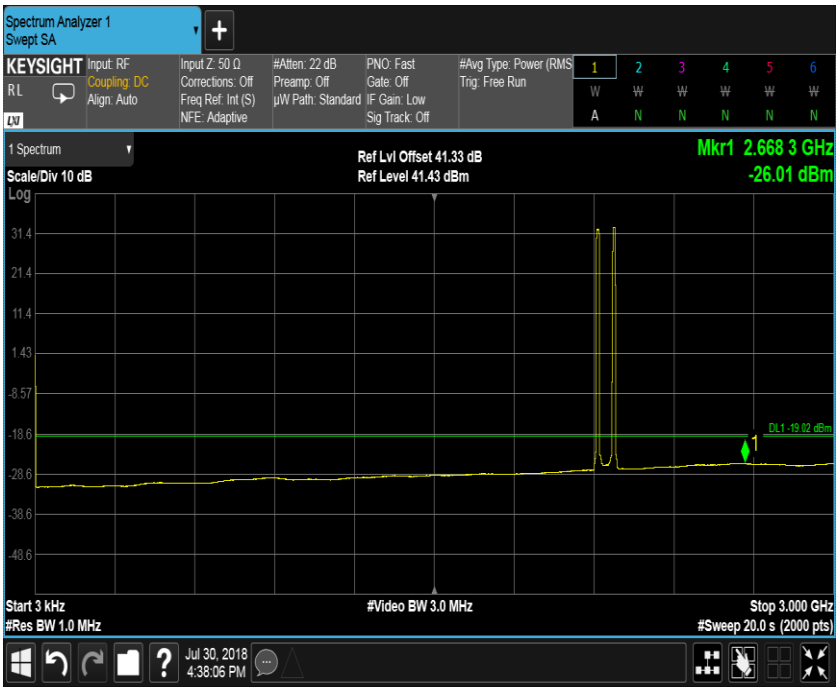


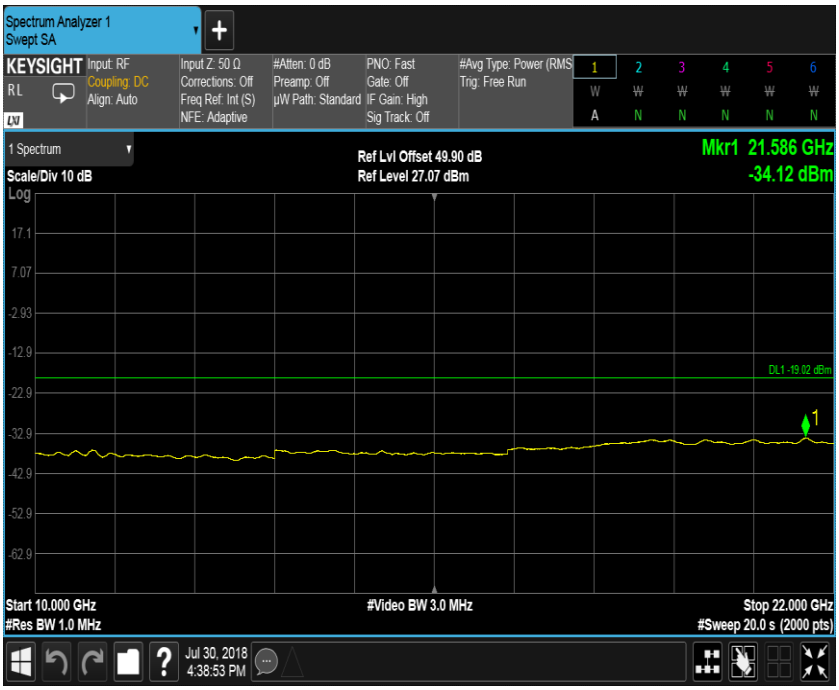


Configuration NB-IoT-GB+LTE-MIMO-MC-1 (1GB QPSK +1LTE QPSK)

Channel Bandwidth	RBW (MHz)	Limit (dBm)
GB:10.0 MHz L: 10.0 MHz	1.0	-19.02

Port D, Channel Position M

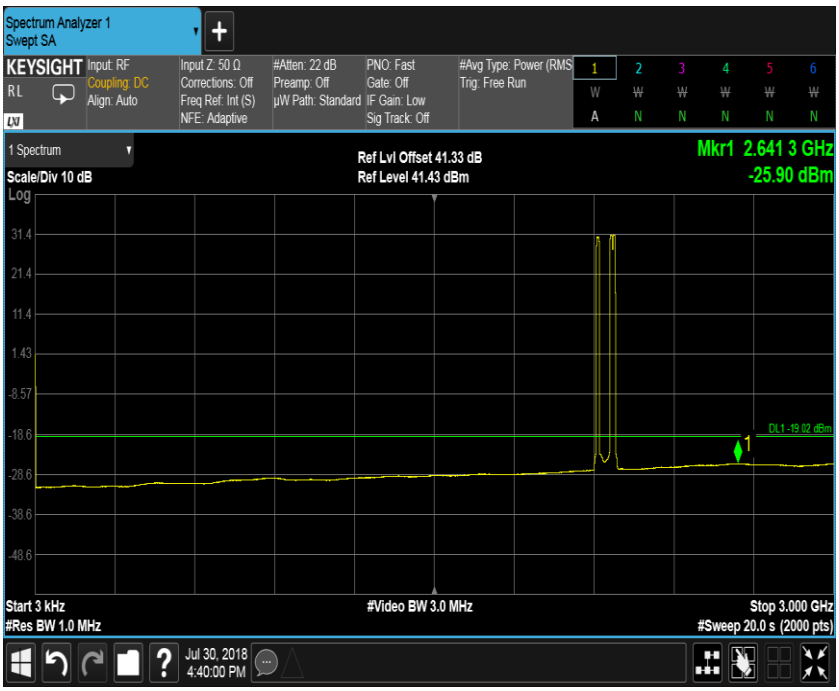


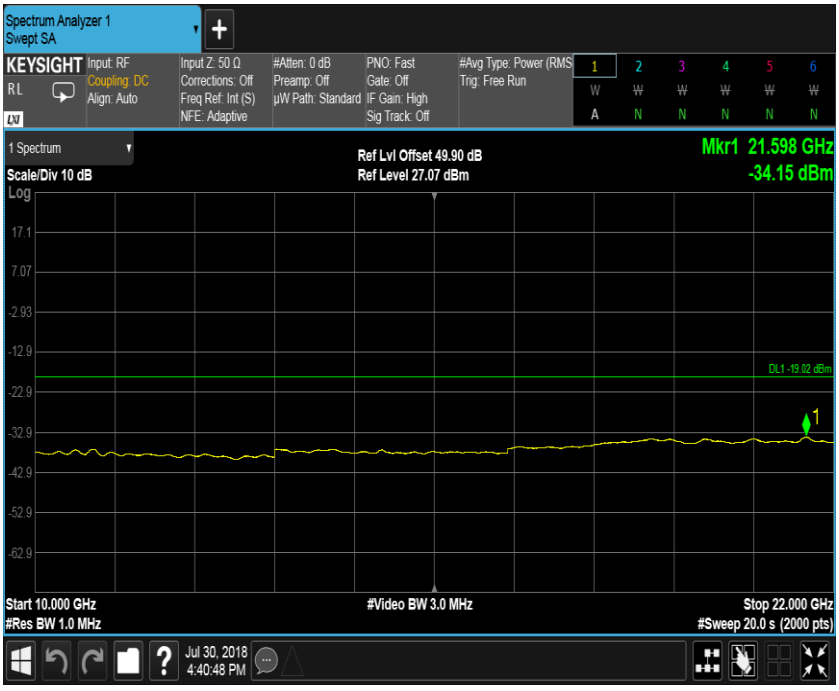


Configuration NB-IoT-GB+LTE-MIMO-MC-2 (1GB QPSK +2LTE QPSK)

Channel Bandwidth	RBW (MHz)	Limit (dBm)
GB:10.0 MHz L: 10.0 MHz	1.0	-19.02

Port D, Channel Position M

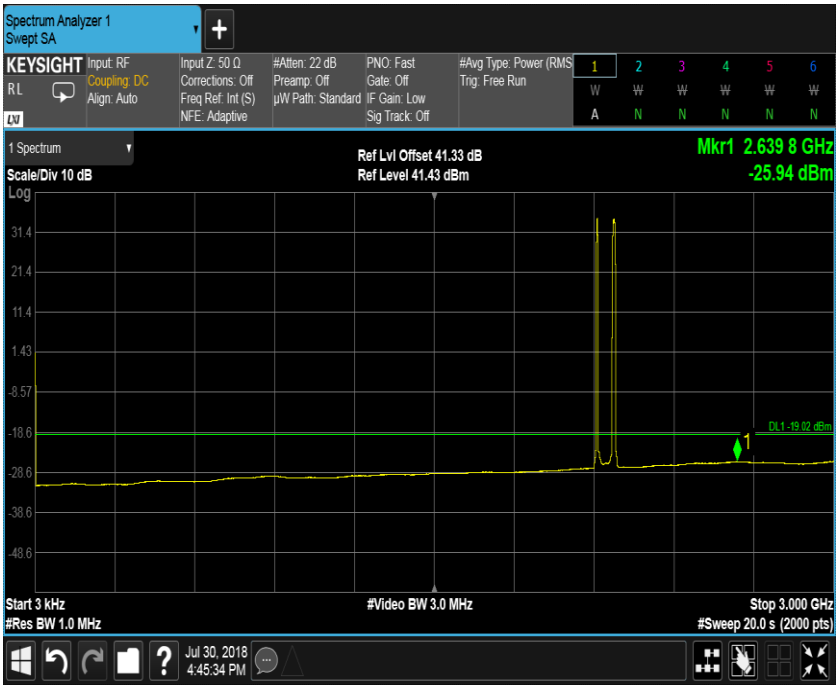


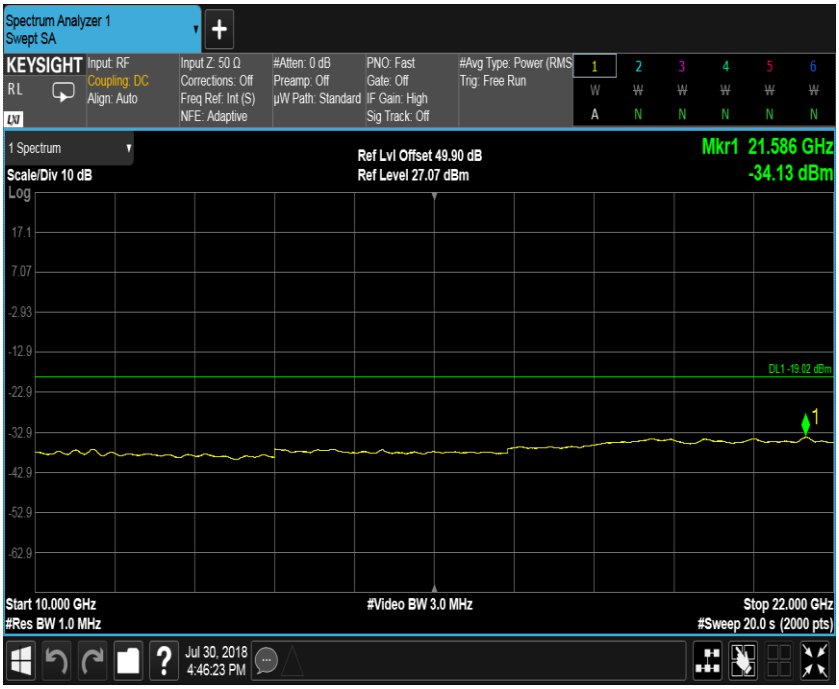


Configuration NB-IoT-IB+WCDMA+LTE-MIMO-MC-1(1IB QPSK +1WCDMA 16QAM +1LTE QPSK)

Channel Bandwidth	RBW (MHz)	Limit (dBm)
IB: 5.0 MHz W: 5.0 MHz L:5.0 MHz	1.0	-19.02

Port D, Channel Position M





A.5 Radiated Spurious Emission

A.5.1 Reference

FCC CFR 47 Part 2, Clause 2.1046
FCC CFR 47 Part 27, Clause 27.53 (h)
RSS-139, Clause 6.6

A.5.2 Method of measurement

The measurements procedures in TIA-603-E: 2016 are used. This measurement is carried out in semi-anechoic chamber.
A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within the chamber. Measurements of emissions from the EUT were obtained with the measurement antenna in both horizontal and vertical polarisations.
Emissions identified within the range 30MHz to 20GHz were then formally measured using a peak detector as the worst case.
The limits for outside a licensee's frequency band(s) of operation the power of the spurious emissions have been calculated, as shown below using the following formula:

Field Strength of Carrier - (43 + 10Log (P)) dB

Where:

Field Strength is measured in dBμV/m

P is measured Transmitter Power in Watts

The EUT was measured with the antenna height varied between 1 and 4 m with the turntable rotated between 0 and 360 degrees. The emission of any outside a licensee's frequencies within 20dB of the limit were measured with the substitution method used according to the standard.
The measurements were performed at a 3m distance unless otherwise stated.

A.5.3 Measurement limit

The field strength of the carrier has been calculated assuming that the power is to be fed to a half-wave tuned dipoles as per 2.1053 (a).

$E_{(v/m)}=(30 \times G_i \times P_o)^{0.5} / d$

Where

G_i is the antenna gain of ideal half-wave dipoles,

P_o is the power out of the transceiver in W,

d is the measurement distance in meter.

Therefore at 3m measurement distance the field strength using the lowest transceiver output power would be:

$E_{(v/m)}=(30 \times 1.64 \times 16.56)^{0.5} / 3 = 9.51V/m = 139.57 dB\mu V/m$

As per 24.238 (a) the spurious emission must be attenuated by 43 + 10log (Po) dB this gives:
43 + 10log(16.56) = 55.19 dB
Therefore the limit at 3m measurement distance is:
139.57 – 55.19 = 84.4 dBμV/m
These limits have been used to determine Pass or Fail for the harmonics measured and detailed in the following results.

A.5.4 Measurement results

Configuration NB-IoT-GuardBand-1C

Maximum Output Power 52.0dBm

Channel Position	Channel Frequencies
Channel Position B	2115.0MHz
Channel Position M	2145.0MHz
Channel Position T	2175.0MHz

Channel Position B

No emissions were detected within 20dB of the limit.

Channel Position M

No emissions were detected within 20dB of the limit.

Channel Position T

No emissions were detected within 20dB of the limit.

Configuration NB-IoT-GB+WCDMA-MIMO-MC-1

Maximum Output Power 46.0dBm

Channel Position	Channel Frequencies
Channel Position M	(W)2112.4 MHz + (GB)2175.0 MHz

Channel Position M

No emissions were detected within 20dB of the limit.

Configuration NB-IoT-GB+LTE-MIMO-MC-1

Maximum Output Power 46.0dBm;

Channel Position	Channel Frequencies
Channel Position M	(L)2115.0 MHz + (GB)2175.0 MHz

Channel Position M

No emissions were detected within 20dB of the limit.

Configuration NB-IoT-GB+WCDMA-MIMO-MC-3

Maximum Output Power 46.0dBm

Channel Position	Channel Frequencies
Channel Position M	(W)2112.4 MHz +2137.4 MHz +2142.4 MHz +2147.4 MHz + 2152.4 MHz + (GB)2175.0 MHz

Channel Position M

No emissions were detected within 20dB of the limit.

Configuration NB-IoT-GB+LTE-MIMO-MC-3
Maximum Output Power 46.0dBm

Channel Position	Channel Frequencies
Channel Position M	(L)2135.0 MHz +2145.0 MHz +2155.0 MHz +2165.0 MHz + 2175.0 MHz + (GB)2115.0 MHz

Channel Position M
No emissions were detected within 20dB of the limit.

Configuration NB-IoT-IB+WCDMA-MIMO-MC-1
Maximum Output Power 46.0dBm

Channel Position	Channel Frequencies
Channel Position M	(W)2112.4 MHz + (IB)2177.5 MHz

Channel Position M
No emissions were detected within 20dB of the limit.

Configuration NB-IoT-IB+WCDMA+LTE-MIMO-MC-1
Maximum Output Power 46.0dBm

Channel Position	Channel Frequencies
Channel Position M	(W)2112.4 MHz +(L)2172.5 MHz + (IB)2177.5 MHz

Channel Position M
No emissions were detected within 20dB of the limit.

Configuration NB-IoT-IB+LTE-MIMO-MC-1
Maximum Output Power 46.0dBm

Channel Position	Channel Frequencies
Channel Position M	(L)2177.5 MHz + (IB)2112.5 MHz

Channel Position M
No emissions were detected within 20dB of the limit.

Configuration NB-IoT-IB+LTE-MIMO-MC-3

Maximum Output Power 46.0dBm

Channel Position	Channel Frequencies
Channel Position M	(L)2157.5MHz +2162.5MHz +2167.5MHz +2172.5MHz + 2177.5MHz+ (IB)2112.5 MHz

Channel Position M

No emissions were detected within 20dB of the limit.

Configuration NB-IoT-GB+LTE-MIMO-MC-2

Maximum Output Power 52.0dBm;

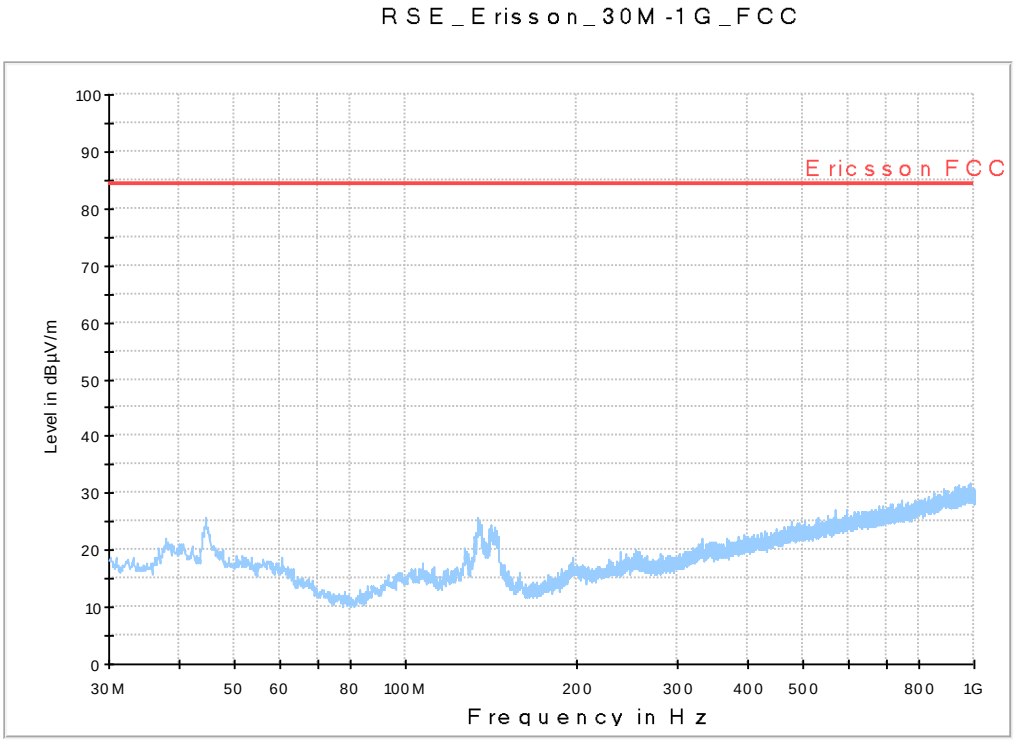
Channel Position	Channel Frequencies
Channel Position M	(L)2165.0 MHz + 2175.0 MHz + (GB)2115.0 MHz

Channel Position M

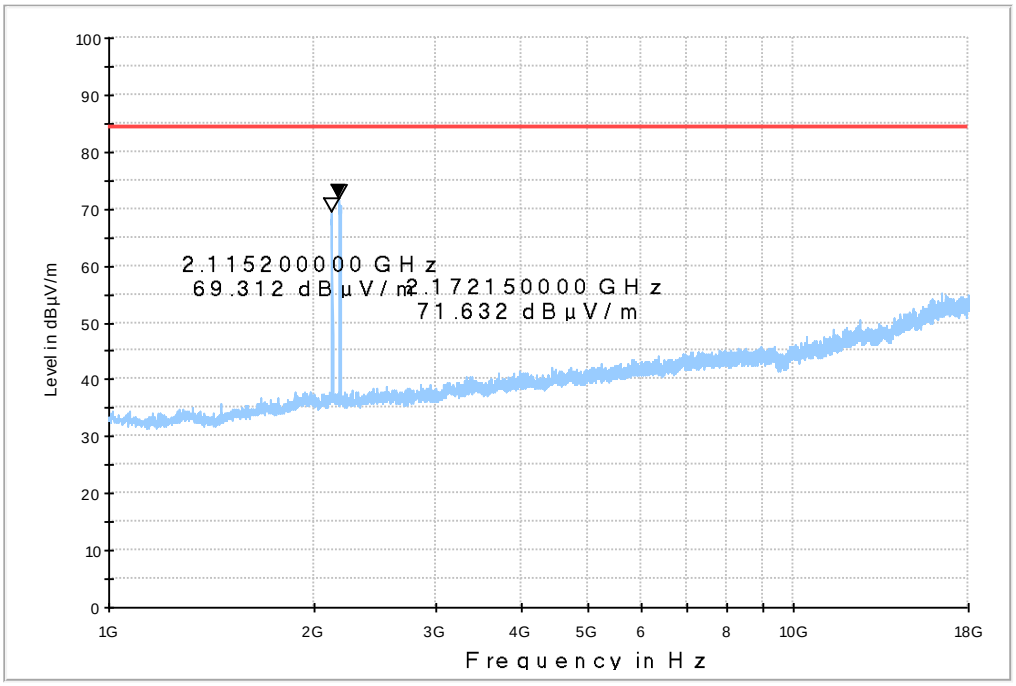
No emissions were detected within 20dB of the limit.

Final Results

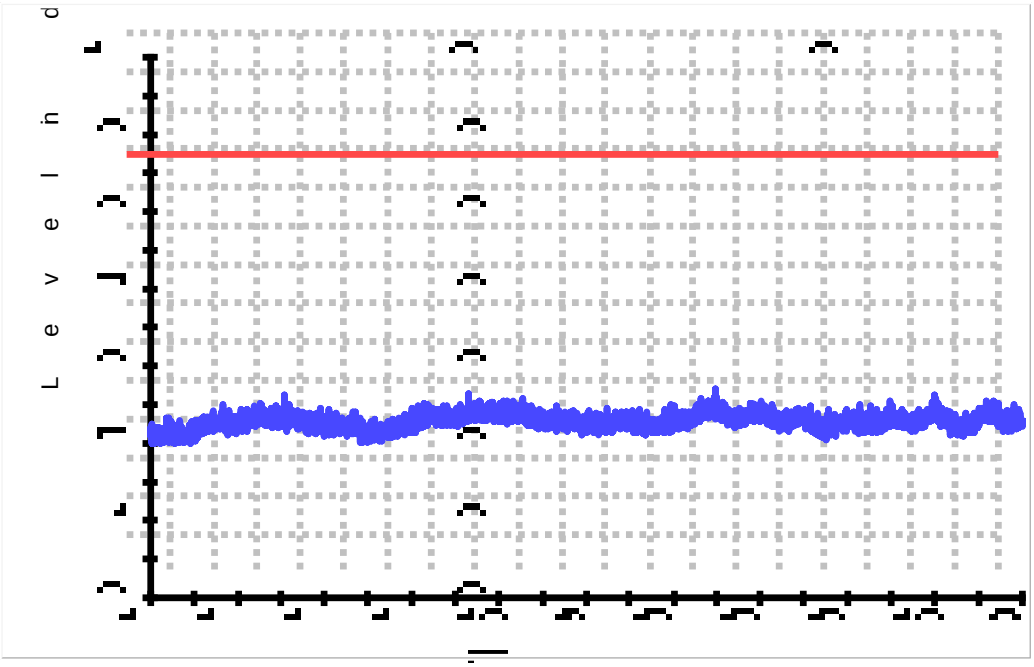
1、Channel Position M –30MHz-1GHz



2、Channel Position M –1GHz-18GHz



3、Channel Position M –18GHz-20GHz



A.6 Frequency Stability

A.6.1 Reference

FCC CFR 47 Part 27, Clause 27.54
RSS-139, Clause 6.4

A.6.2 Method of measurement

Temperature Variation
The EUT was tested over the temperature range -30°C to +50°C in 10°C steps with -48 VDC Power Supply. At each temperature step, the Base Station was configured to transmit a [RAT]* at maximum power on the middle channel of the operating band. After achieving thermal balance, the averages of 200 transmission bursts were measured and the result recorded.

Voltage Variation
The EUT was tested at the supplied voltages varied from 85 to 115 percent of the nominal value of -48 VDC. At +20°C, the Base Station was configured to transmit a [RAT]* at maximum power on the bottom, middle and top channel of the operating band. The average of 200 transmission bursts was measured and the result recorded.

[RAT]*:
NB-IoT - QPSK modulation

A.6.3 Measurement limit

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

A.6.4 Measurement results

Frequency Error – Temperature Variation

Configuration NB-IoT-GuardBand-1C

Maximum Output Power 46.02dBm per port, Channel Bandwidth 10MHz

Supply Voltage DC(V)	Temperature	Frequency Stability (Hz)		
		Channel position B	Channel position M	Channel position T
-48	-30	1.45	-1.52	-1.14
	-20	1.46	-1.19	1.24
	-10	-1.97	1.17	1.88
	0	1.02	1.58	1.18
	10	-1.47	1.48	-1.23
	20	1.22	-1.22	1.34
	30	1.39	1.11	-1.31
	40	1.78	-1.64	1.36
	50	-1.12	1.39	-1.37

Frequency Error – Voltage Variation

Configuration NB-IoT-GuardBand-1C

Maximum Output Power 46.02dBm per port, Channel Bandwidth 10MHz

Supply Voltage DC(V)	Temperature(°C)	Frequency Stability (Hz)		
		Channel position B	Channel position M	Channel position T
-40.8	20	1.05	1.47	-1.26
-48	20	-1.17	-1.64	1.26
-55.2	20	1.40	-1.18	1.66

ANNEX B: Accreditation Certificate

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2017-08-22 through 2018-09-30
Effective Dates

DEPARTMENT OF COMMERCE · UNITED STATES OF AMERICA

For the National Voluntary Laboratory Accreditation Program

*****END OF REPORT*****