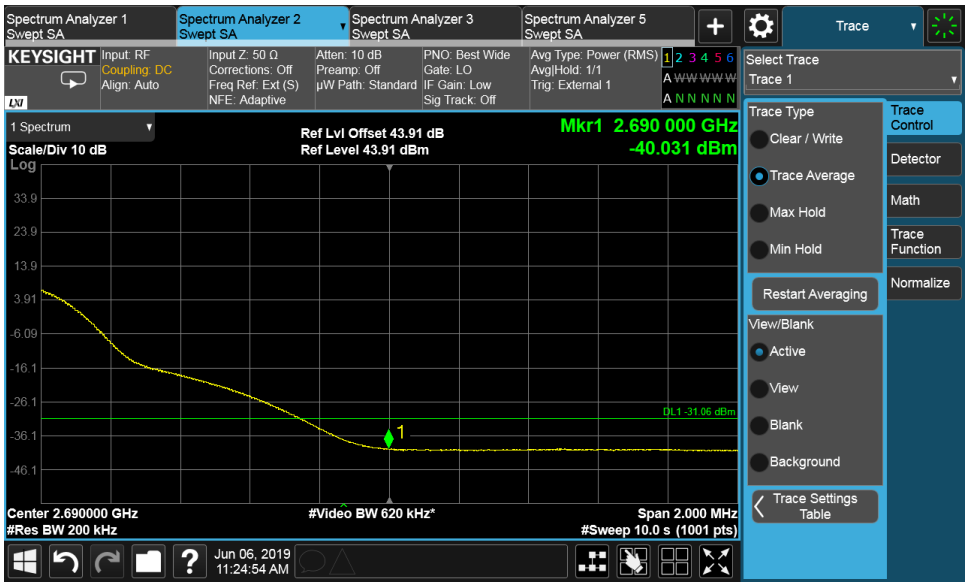
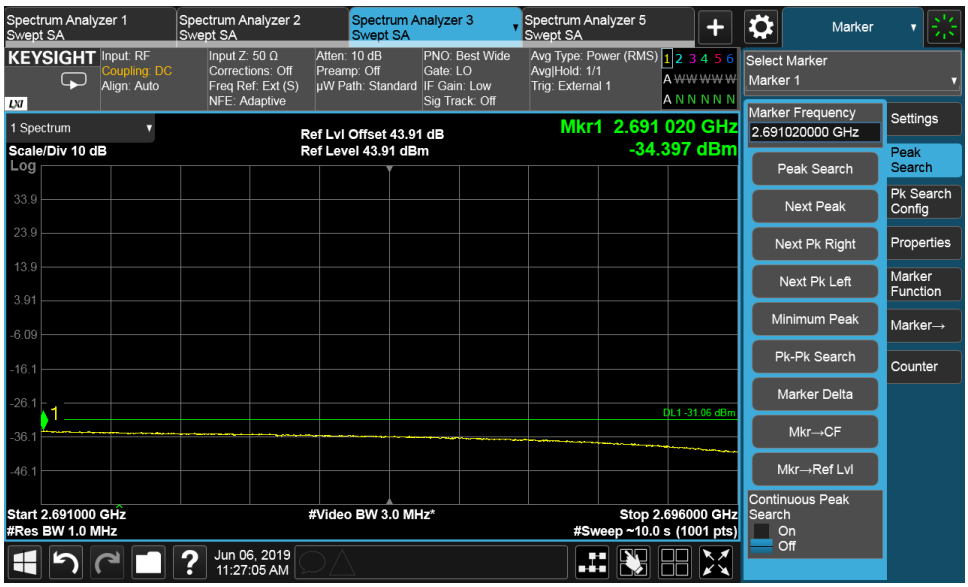
Channel Position T





6 Conducted Unwanted Emission

Test result: **Pass**

6.1 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.

6.2 Measurement Procedure

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 9kHz to 27GHz. The resolution bandwidth of 1MHz was employed for frequency band 9kHz to 27GHz. The spectrum analyzer detector was set to RMS.

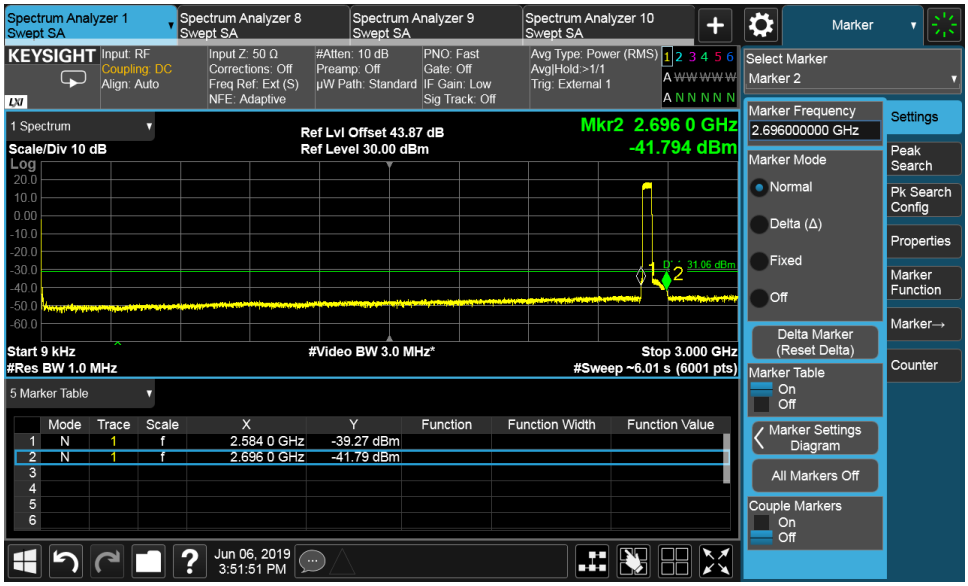
For MIMO mode configurations, the limit was adjusted with a correction of -18.06dB [10Log(1/64)] by using the Measure and Add 10Log(N) dB technique according to KDB 662911 D01 Multiple Transmitter Output accounting for simultaneous transmission from antenna ports. Then the limit was adjusted to -31.06dBm.

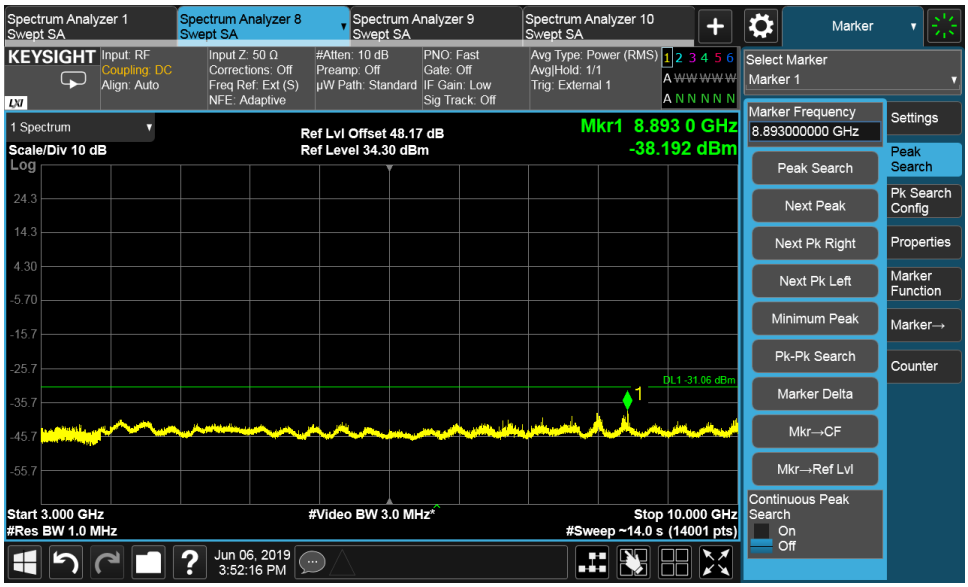
6.3 Measurement result

Configuration NR-MIMO-1C-40

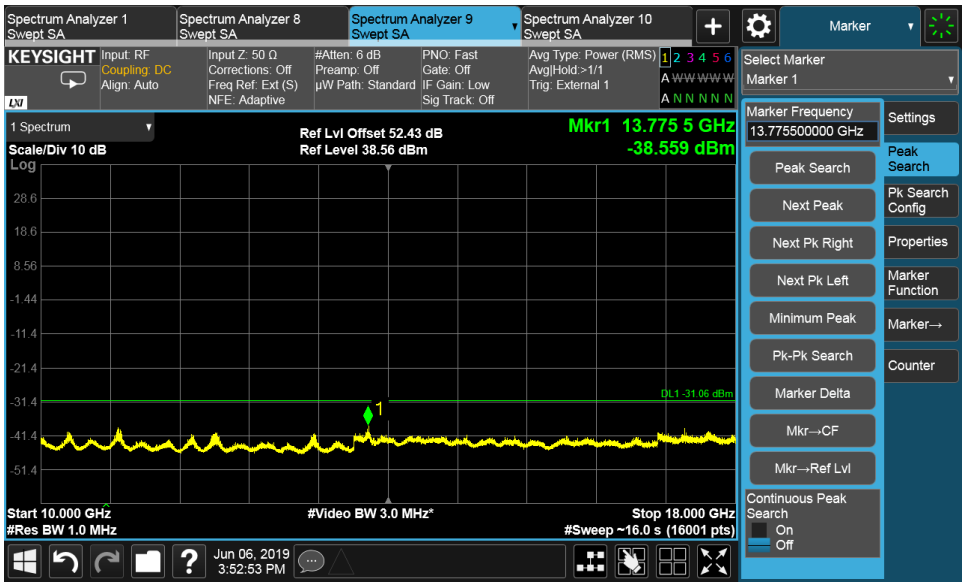
Antenna Port	Channel Position	Modulation	Channel Bandwidth (MHz)	RBW (kHz)	Limit (dBm)
20	B	256QAM	40	1000	-31.06
20	M	256QAM	40	1000	-31.06
20	T	256QAM	40	1000	-31.06

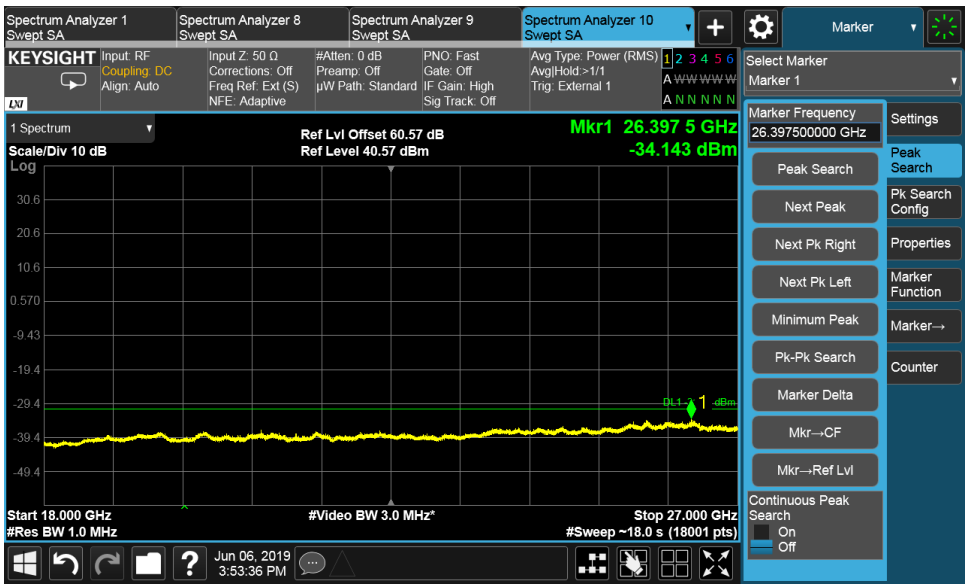
Channel Position B





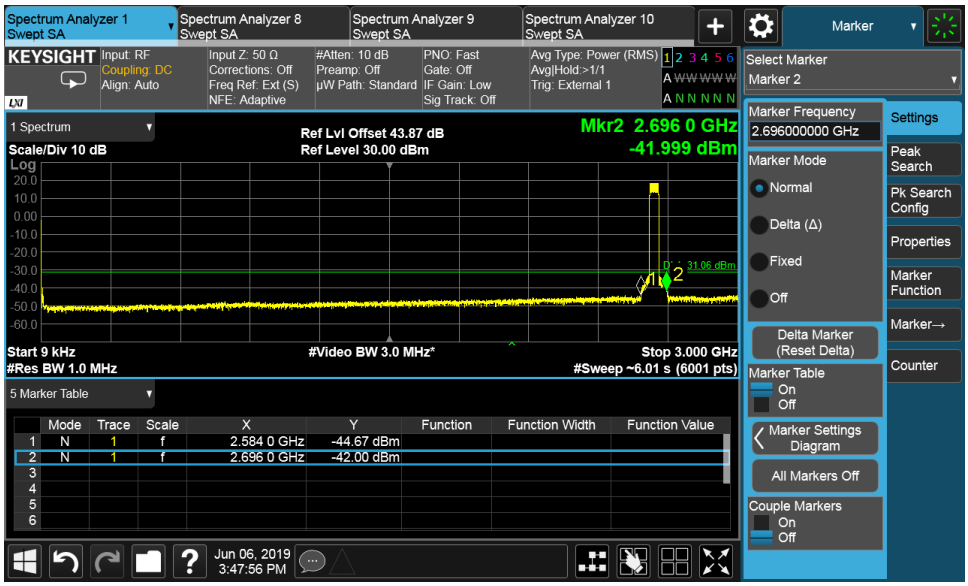
TEST REPORT

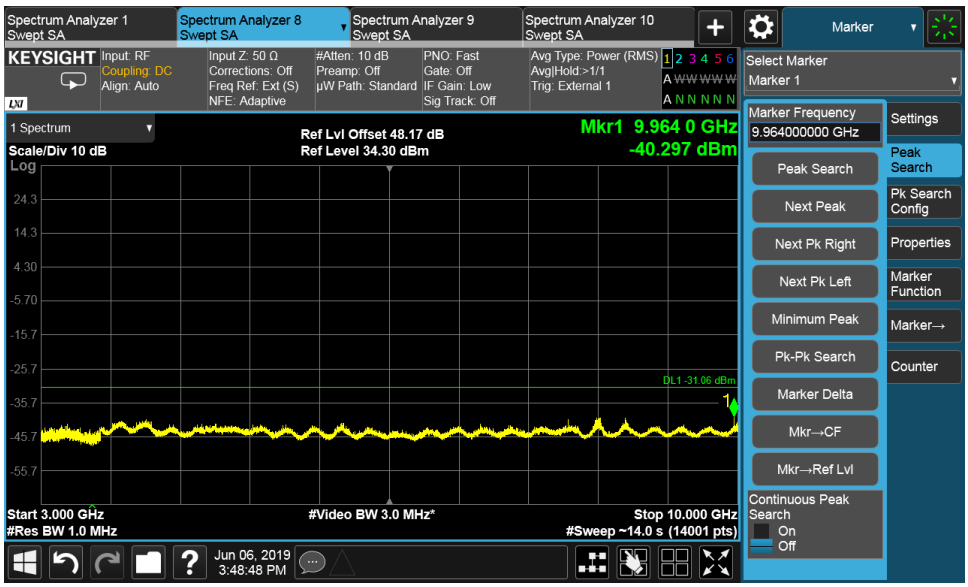

Spectrum Analyzer 1
Swept SA
Spectrum Analyzer 8
Swept SA
Spectrum Analyzer 9
Swept SA
Spectrum Analyzer 10
Swept SA
Marker
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Ext (S)
NFE: Adaptive
#Atten: 6 dB
Preamp: Off
µW Path: Standard
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Power (RMS)
Avg|Hold:>1/1
Trig: External 1
Select Marker
Marker 1
1 Spectrum
Ref Lvl Offset 52.43 dB
Ref Level 38.56 dBm
Mkr1 13.775 5 GHz
-38.559 dBm
Scale/Div 10 dB
Log
28.6
18.6
8.56
-1.44
-11.4
-21.4
-31.4
-41.4
-51.4
DL1 -31.06 dBm
Start 10.000 GHz
#Res BW 1.0 MHz
#Video BW 3.0 MHz*
Stop 18.000 GHz
#Sweep ~16.0 s (16001 pts)
Marker Frequency
13.775500000 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Pk Search Config
Properties
Marker Function
Marker→
Counter
Jun 06, 2019
3:52:53 PM


Spectrum Analyzer 1
Swept SA
Spectrum Analyzer 8
Swept SA
Spectrum Analyzer 9
Swept SA
Spectrum Analyzer 10
Swept SA
Marker
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Ext (S)
NFE: Adaptive
#Atten: 0 dB
Preamp: Off
µW Path: Standard
PNO: Fast
Gate: Off
IF Gain: High
Sig Track: Off
Avg Type: Power (RMS)
Avg|Hold:>1/1
Trig: External 1
Select Marker
Marker 1
1 Spectrum
Ref Lvl Offset 60.57 dB
Ref Level 40.57 dBm
Mkr1 26.397 5 GHz
-34.143 dBm
Scale/Div 10 dB
Log
30.6
20.6
10.6
0.570
-9.43
-19.4
-29.4
-39.4
-49.4
Start 18.000 GHz
#Res BW 1.0 MHz
#Video BW 3.0 MHz*
Stop 27.000 GHz
#Sweep ~18.0 s (18001 pts)
Marker Frequency
26.397500000 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Pk Search Config
Properties
Marker Function
Marker→
Counter
Jun 06, 2019
3:53:36 PM

TEST REPORT

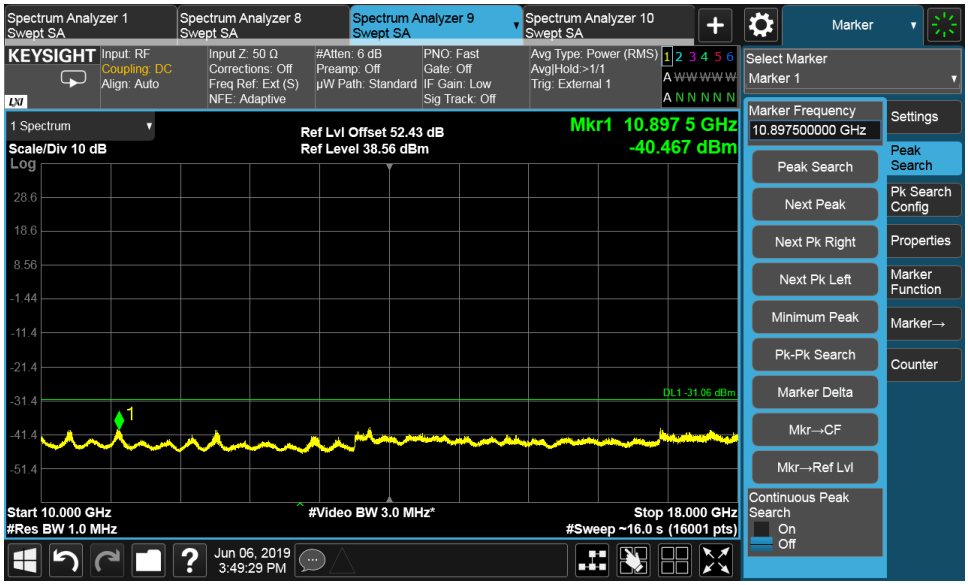
Channel Position M

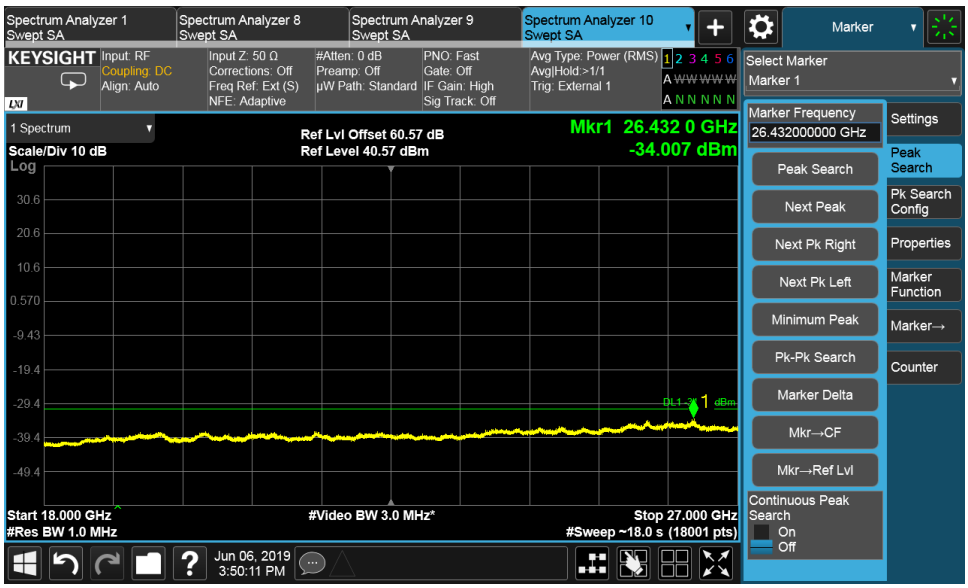




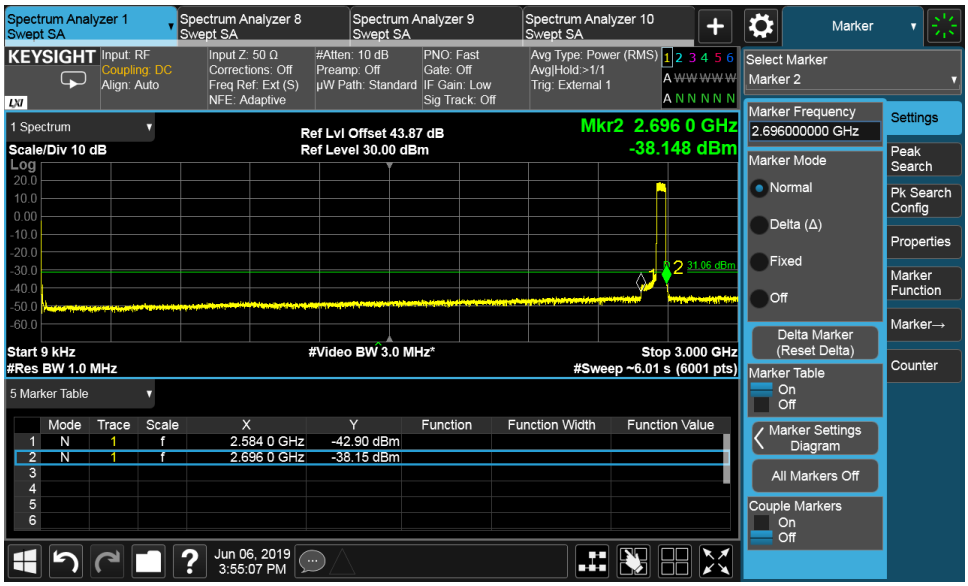
Total Quality. Assured.

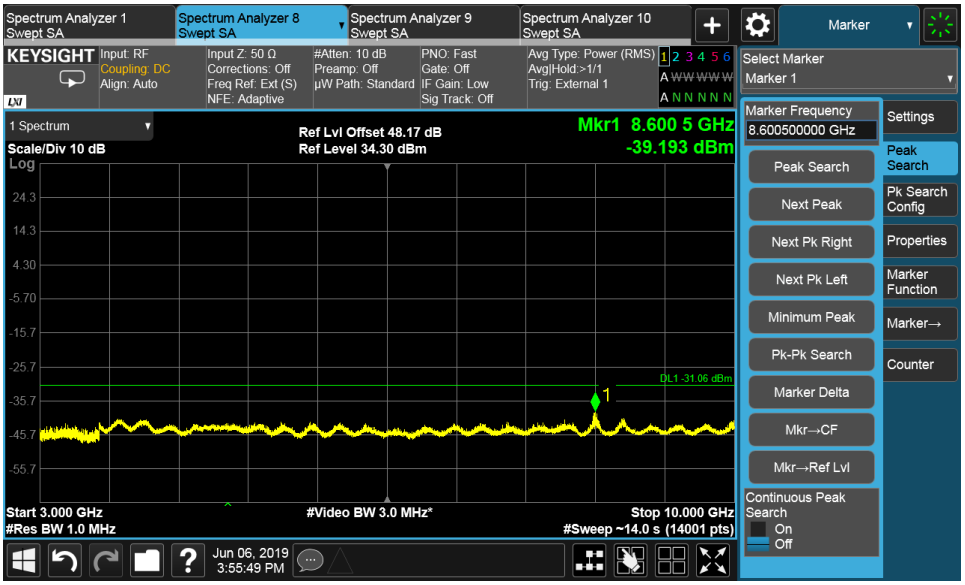
TEST REPORT





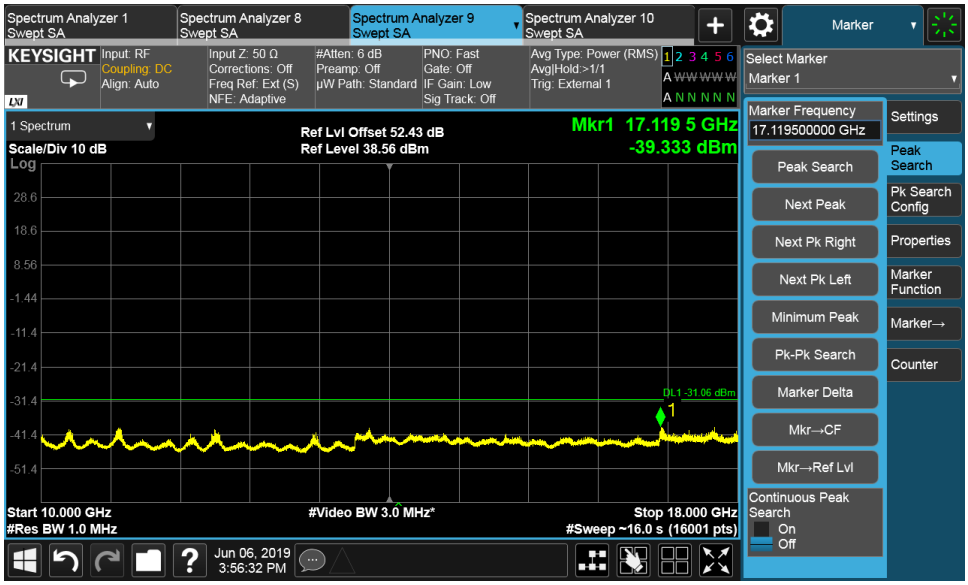
Channel Position T

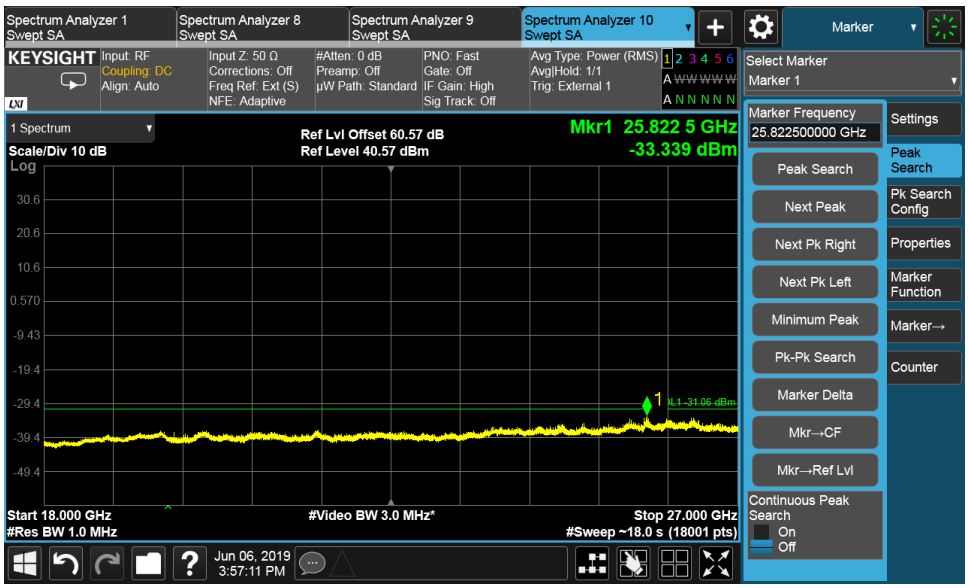




Total Quality. Assured.

TEST REPORT



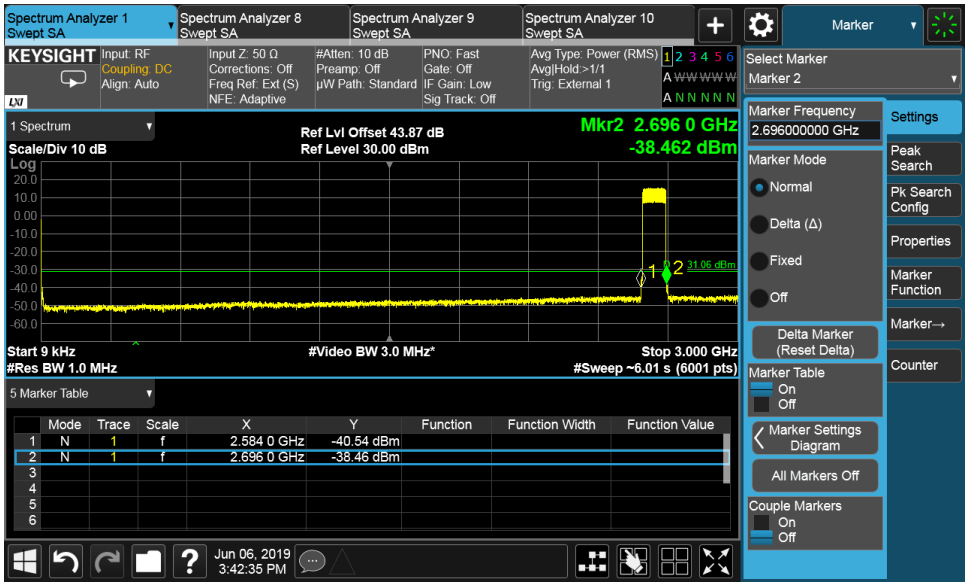


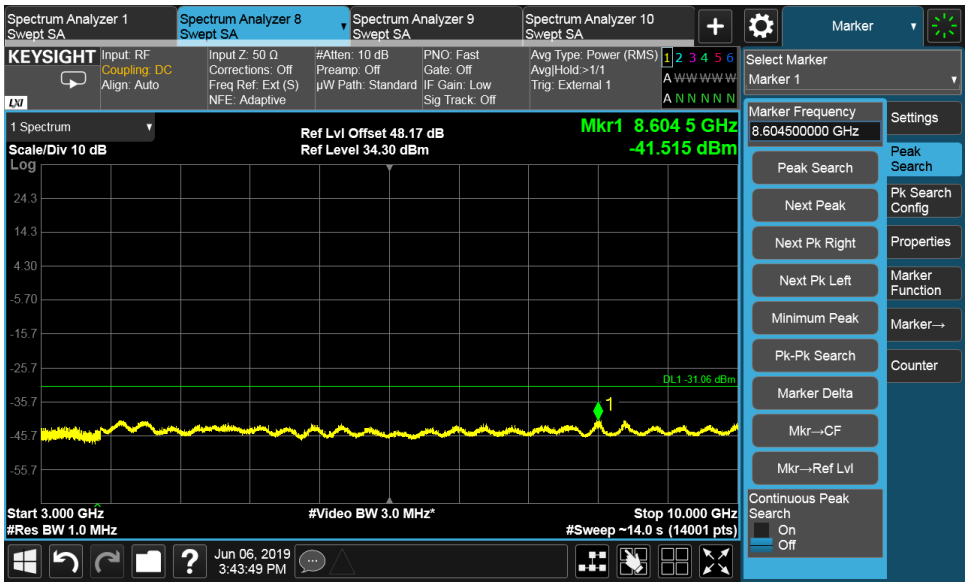
TEST REPORT

Configuration NR-MIMO-1C-100

Antenna Port	Channel Position	Modulation	Channel Bandwidth (MHz)	RBW (kHz)	Limit (dBm)
20	M	256QAM	100	1000	-31.06

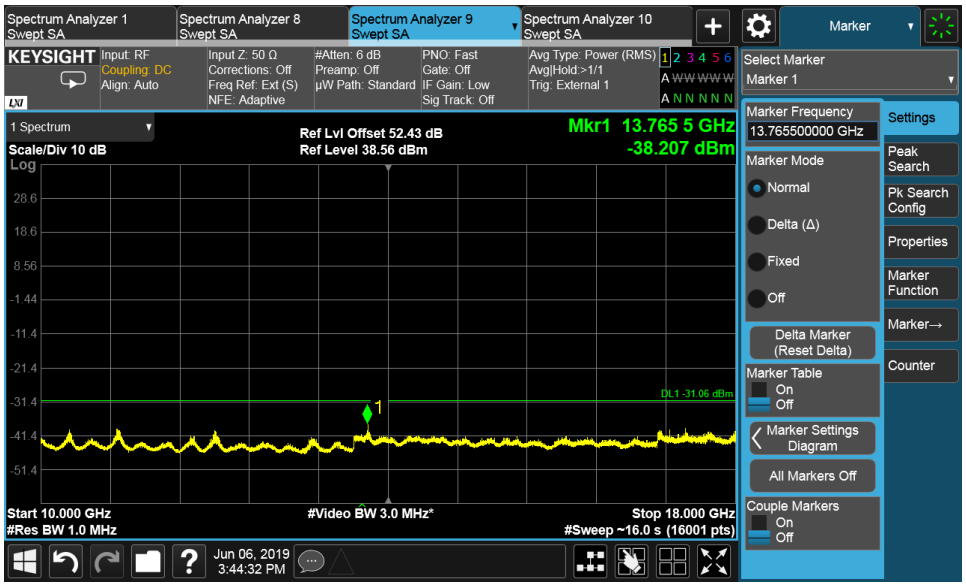
Channel Position M

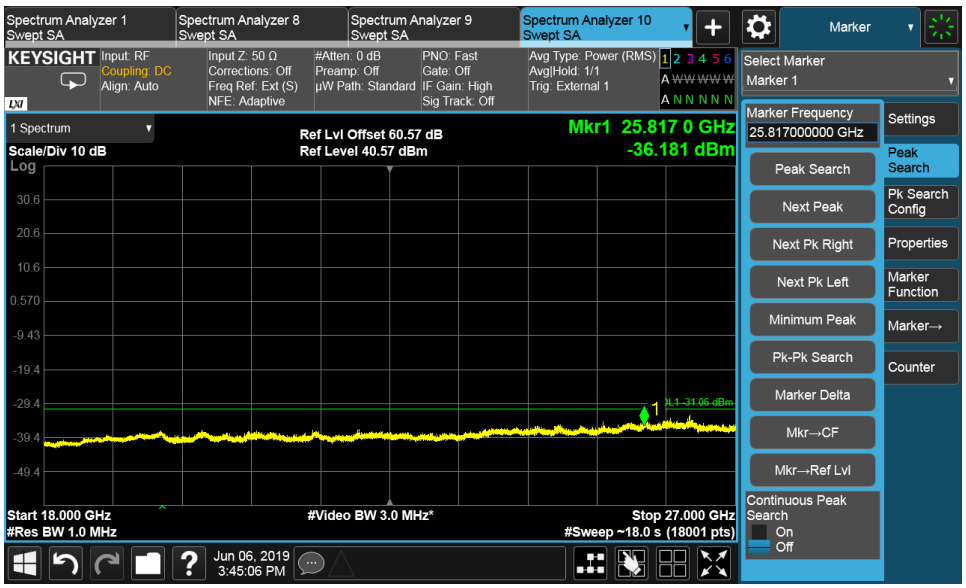




Total Quality. Assured.

TEST REPORT



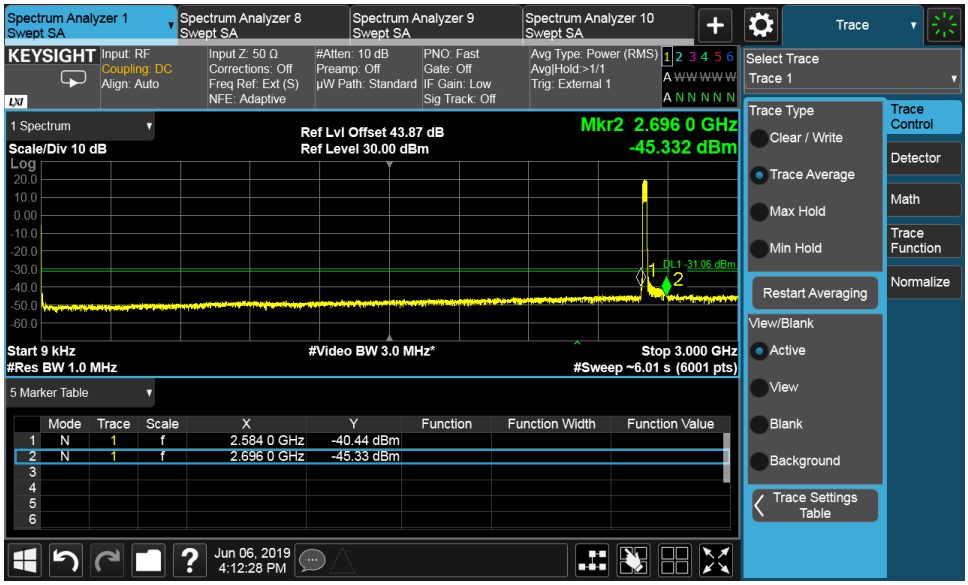


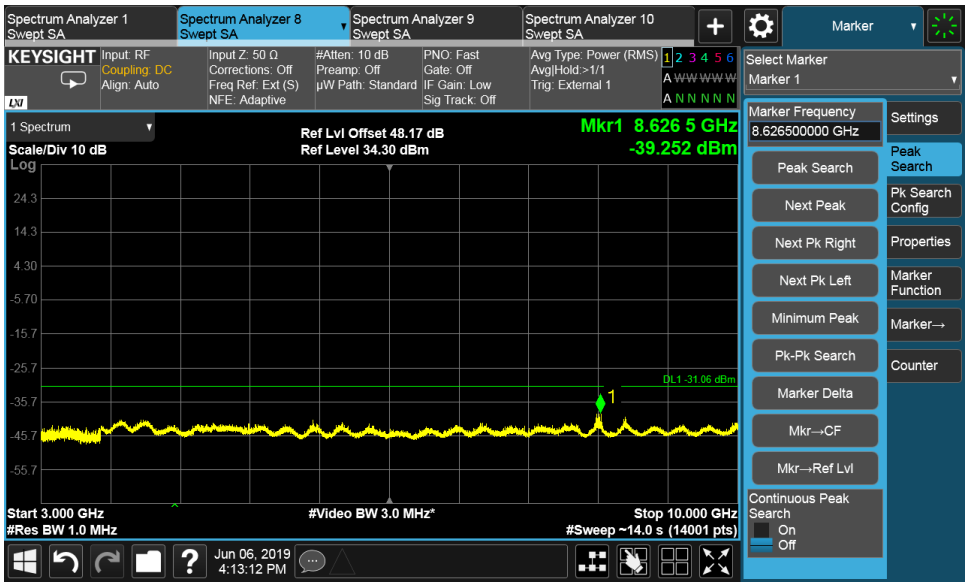
TEST REPORT

Configuration LTE+NR-MIMO-MC-4-UE (1LTE+1NR)

Antenna Port	Channel Position	Modulation	Channel Bandwidth (MHz)	RBW (kHz)	Limit (dBm)
32	B	16QAM	20	1000	-31.06
32	M	16QAM	20	1000	-31.06
32	T	16QAM	20	1000	-31.06

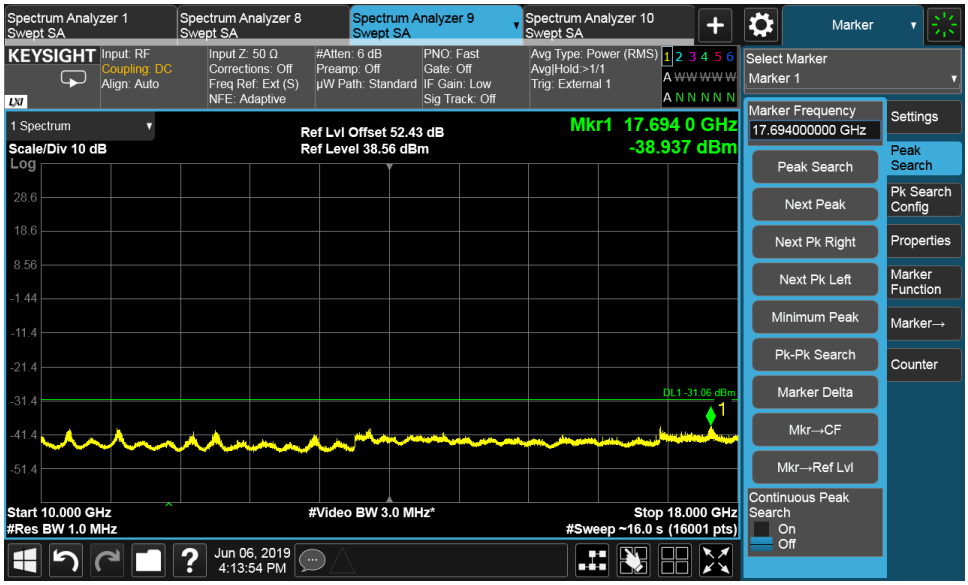
Channel Position B

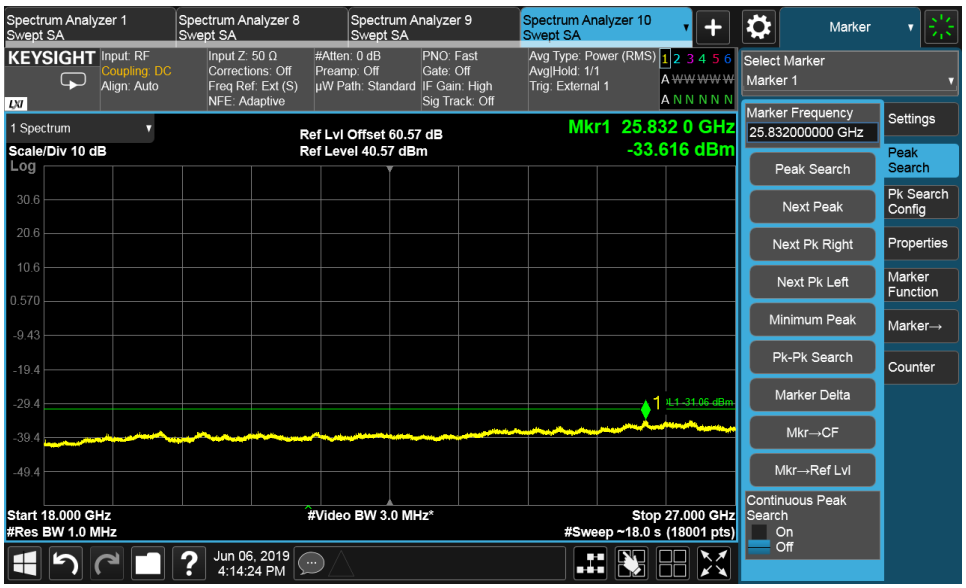




Total Quality. Assured.

TEST REPORT

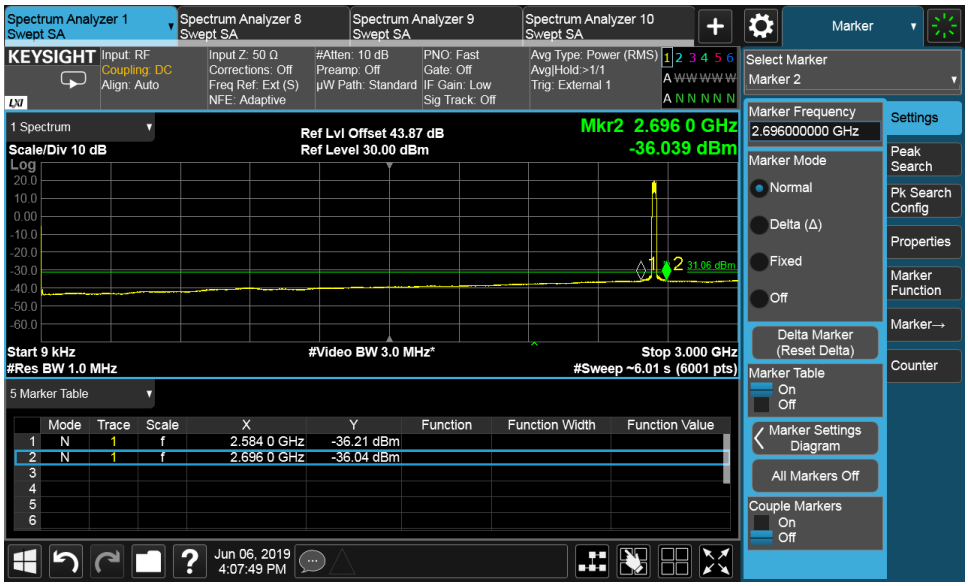


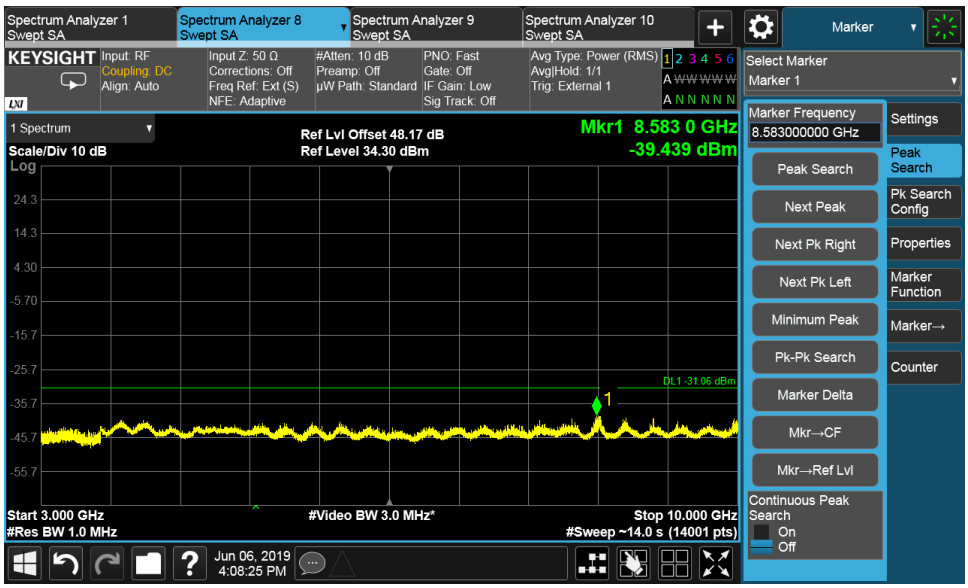


Total Quality. Assured.

TEST REPORT

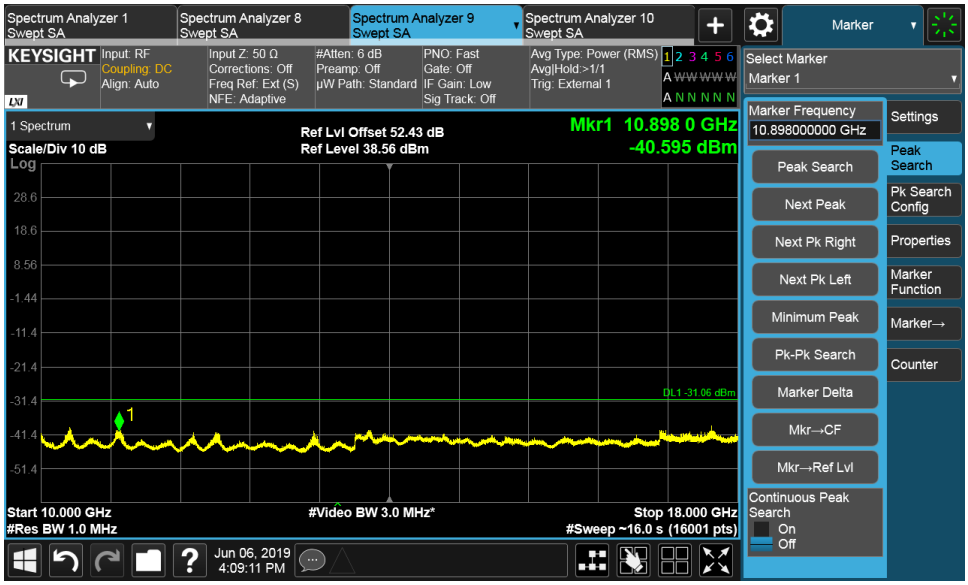
Channel Position M

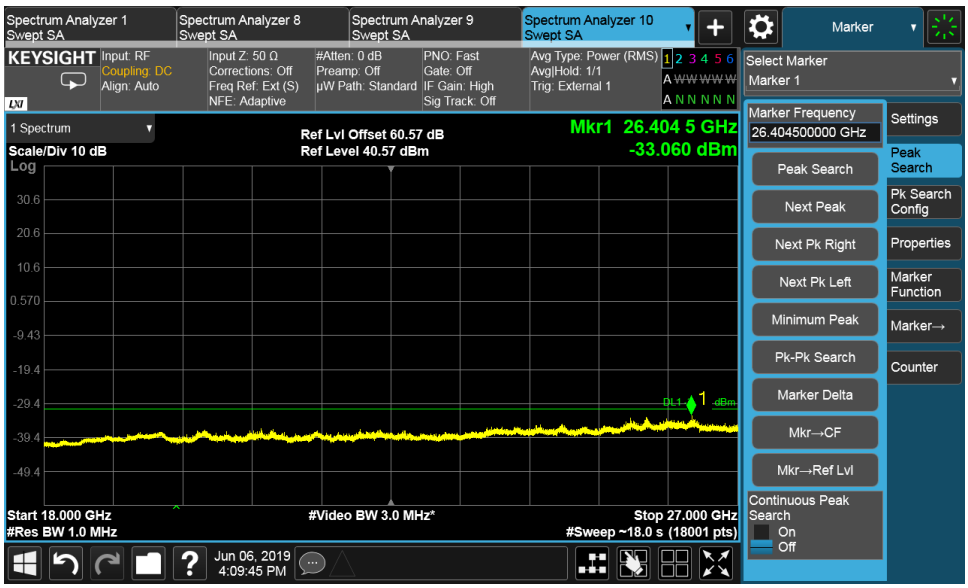




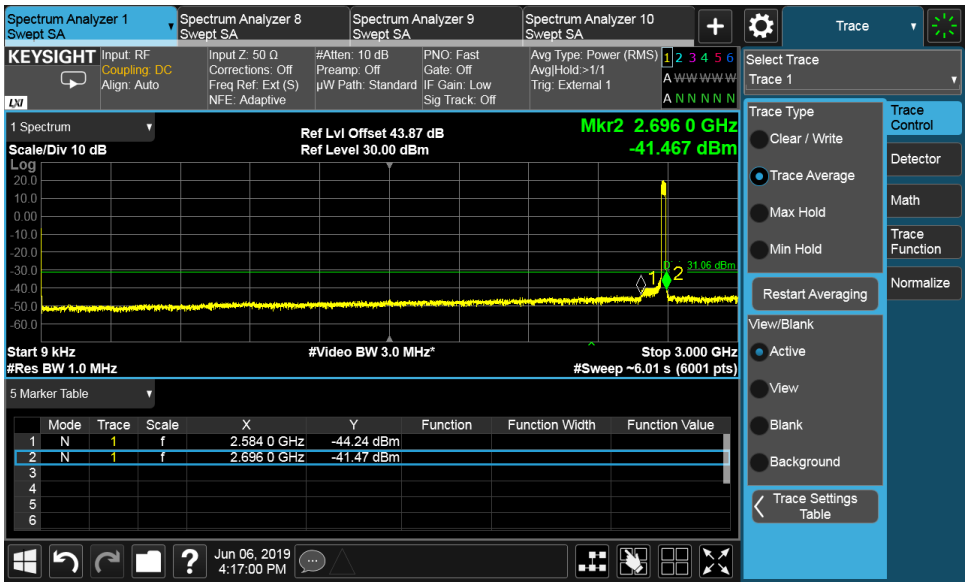
Total Quality. Assured.

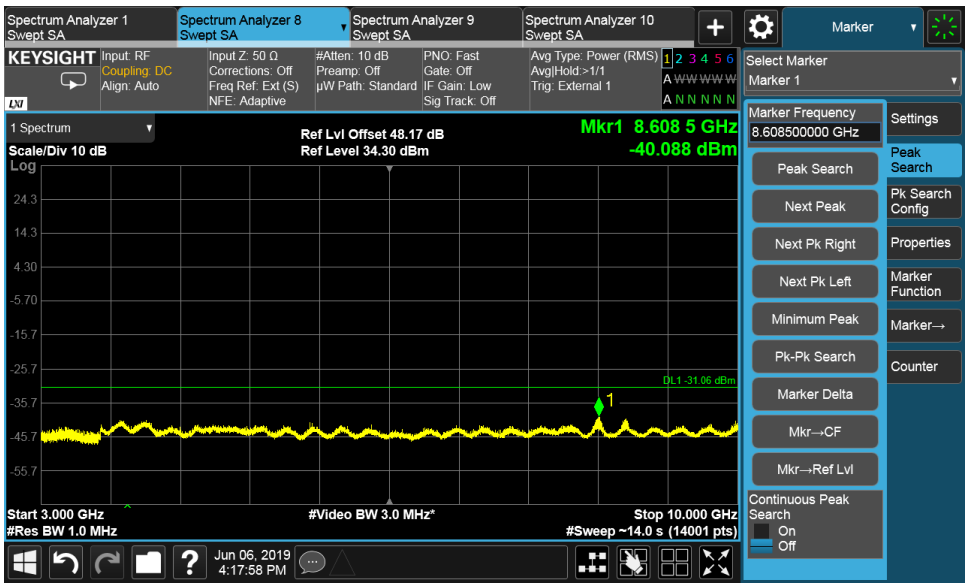
TEST REPORT





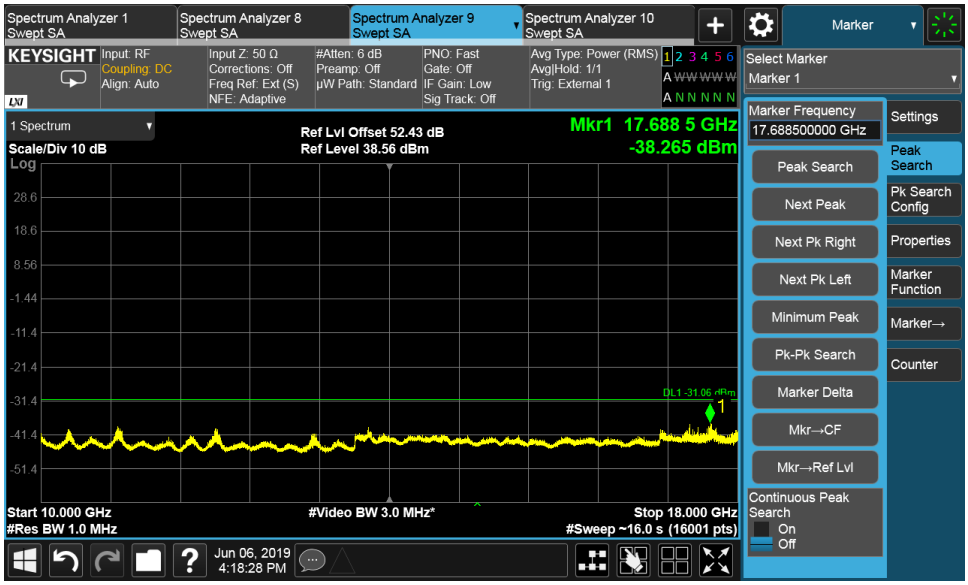
Channel Position T

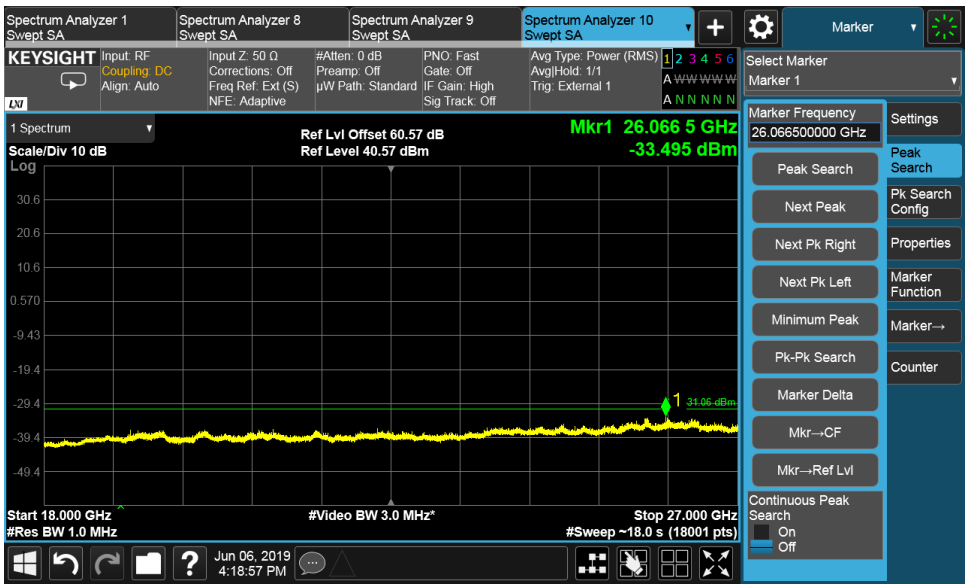




Total Quality. Assured.

TEST REPORT

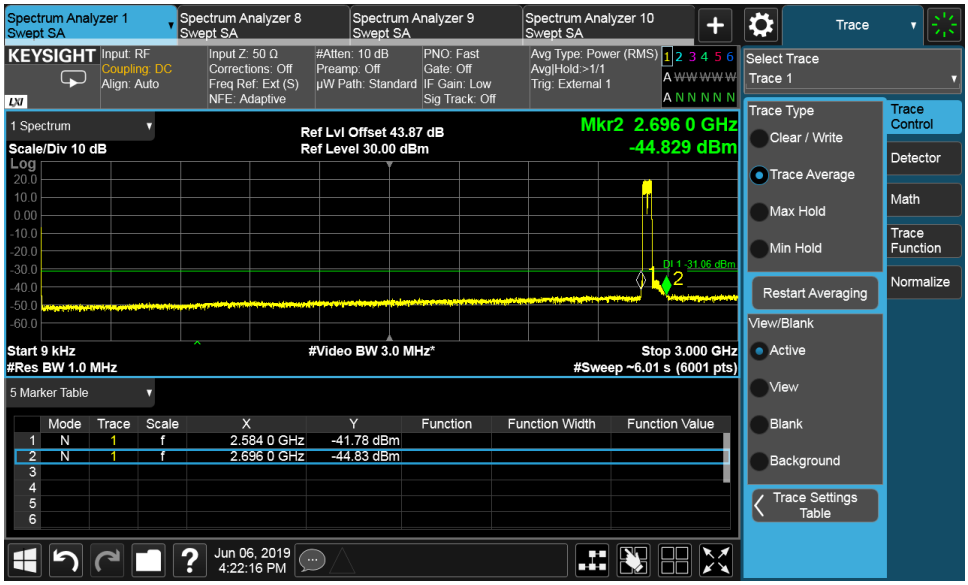


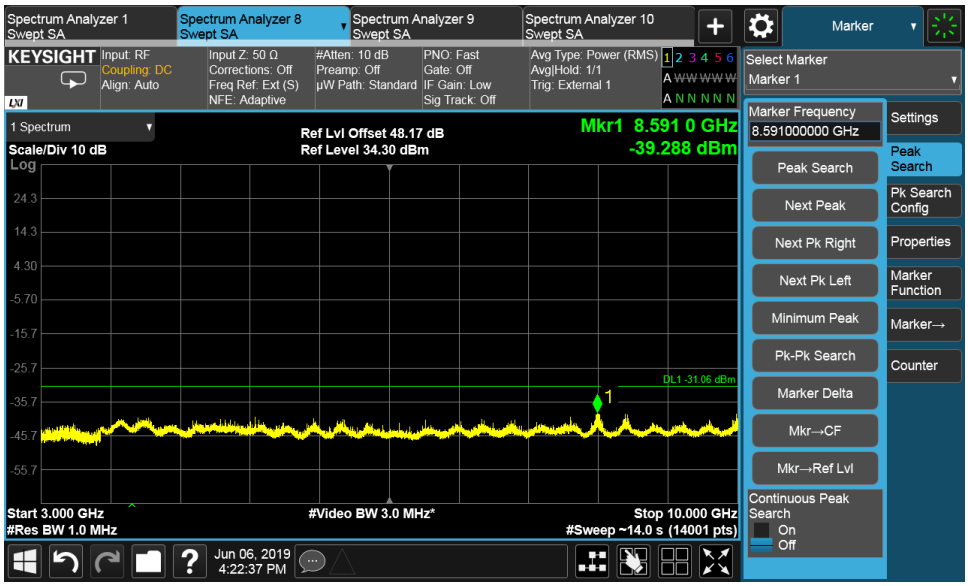


Configuration LTE+NR-MIMO-MC-5-UE (2LTE+1NR)

Antenna Port	Channel Position	Modulation	Channel Bandwidth (MHz)	RBW (kHz)	Limit (dBm)
32	B	16QAM	20	1000	-31.06
32	M	16QAM	20	1000	-31.06
32	T	16QAM	20	1000	-31.06

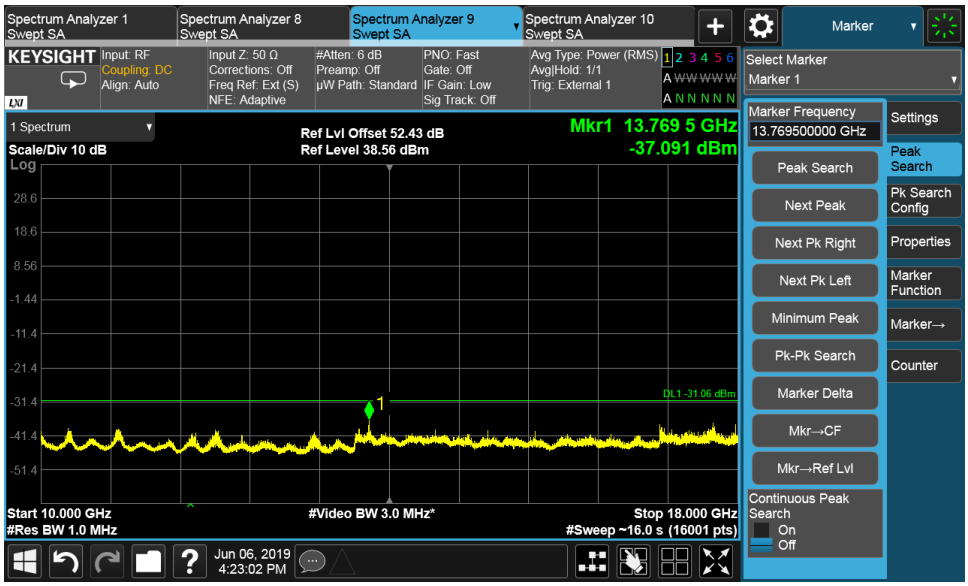
Channel Position B

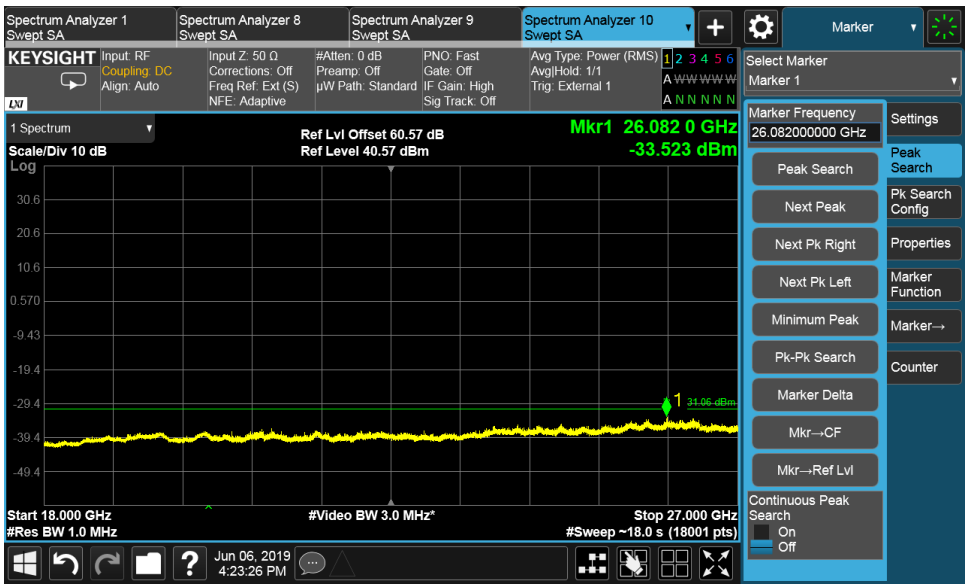




Total Quality. Assured.

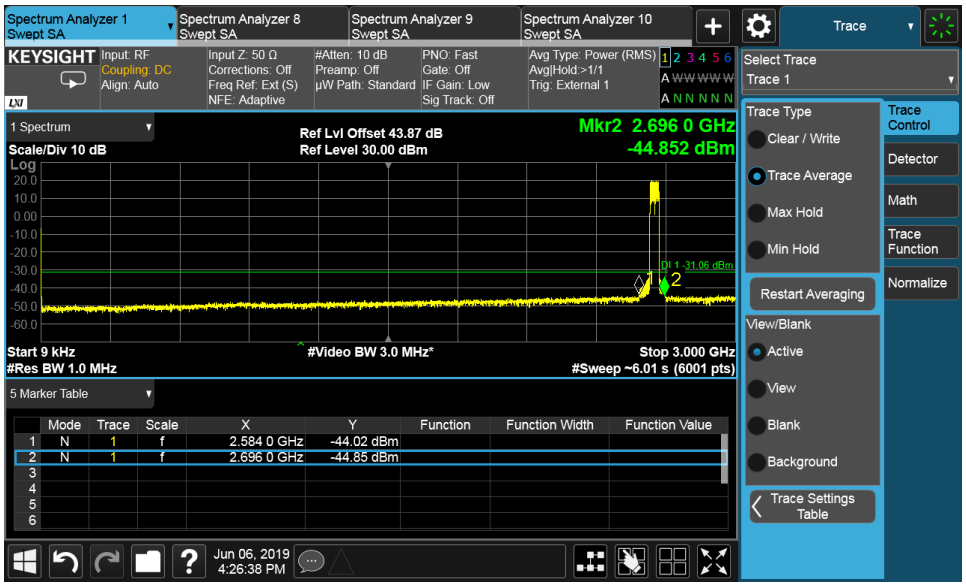
TEST REPORT

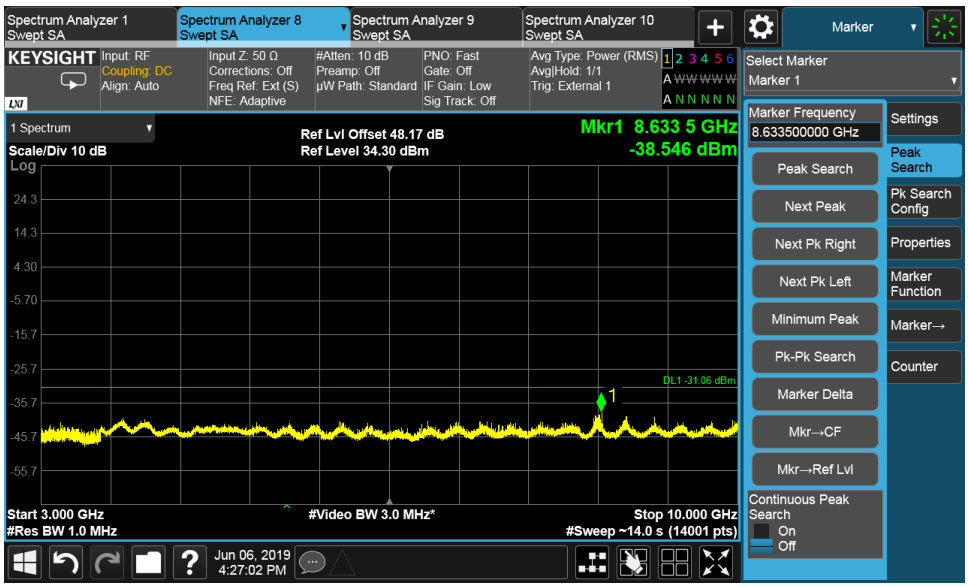




TEST REPORT

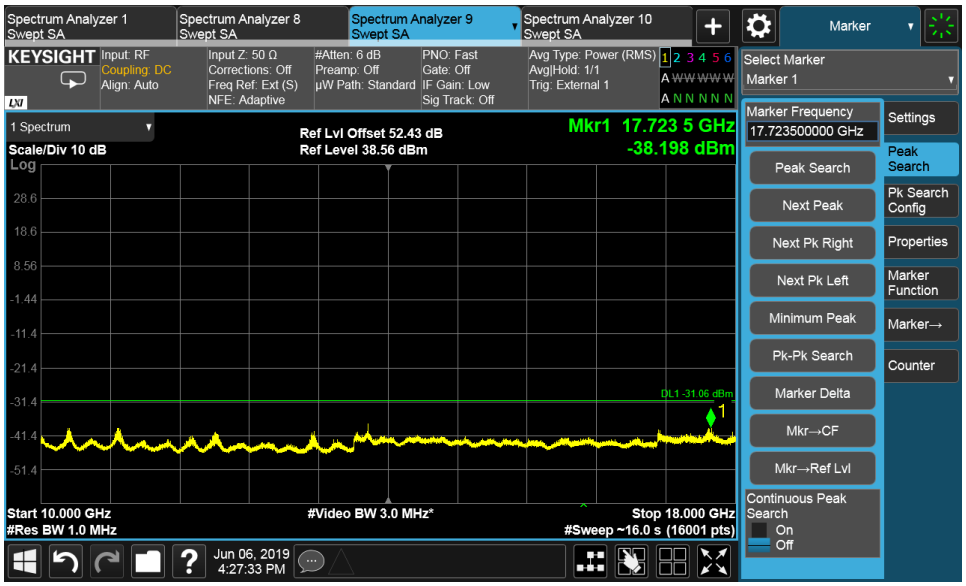
Channel Position M

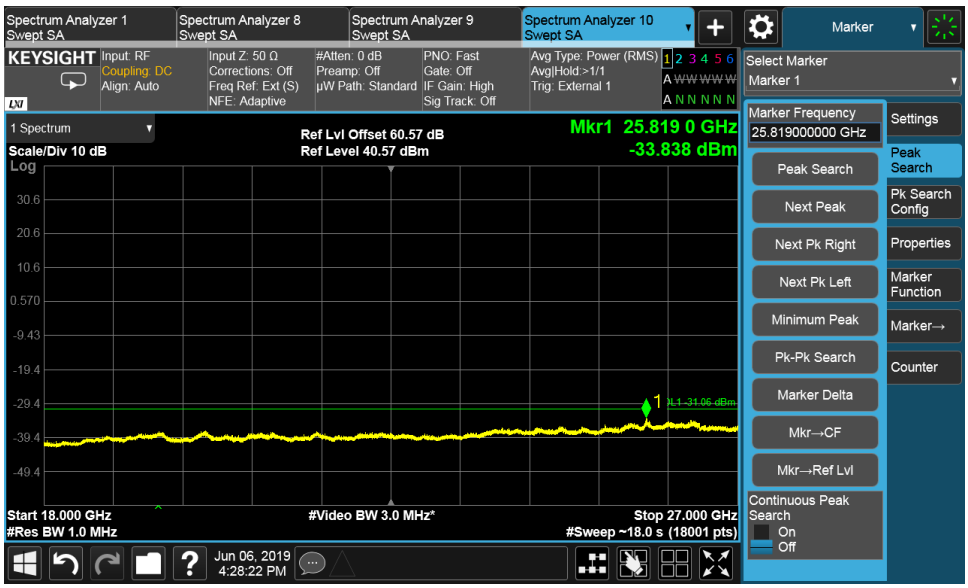




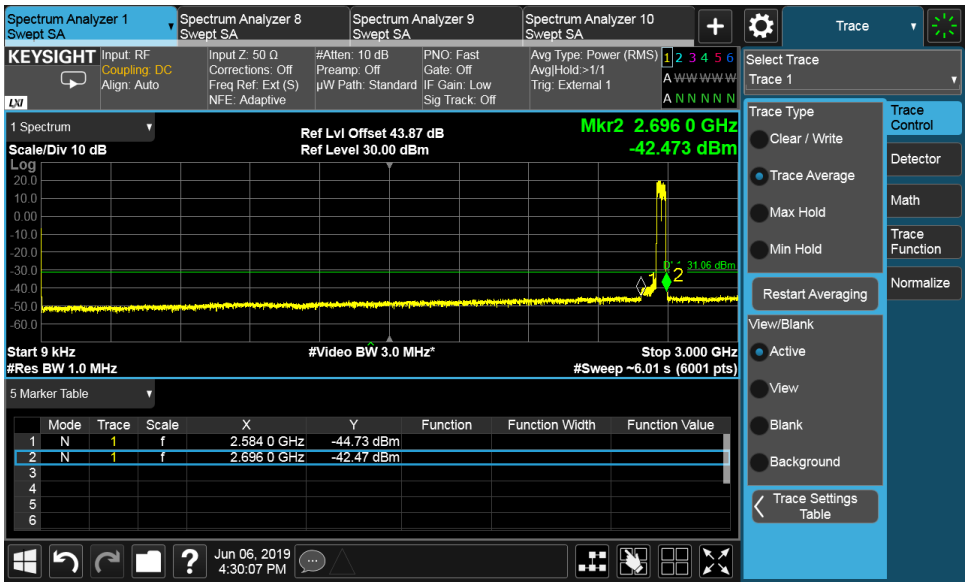
Total Quality. Assured.

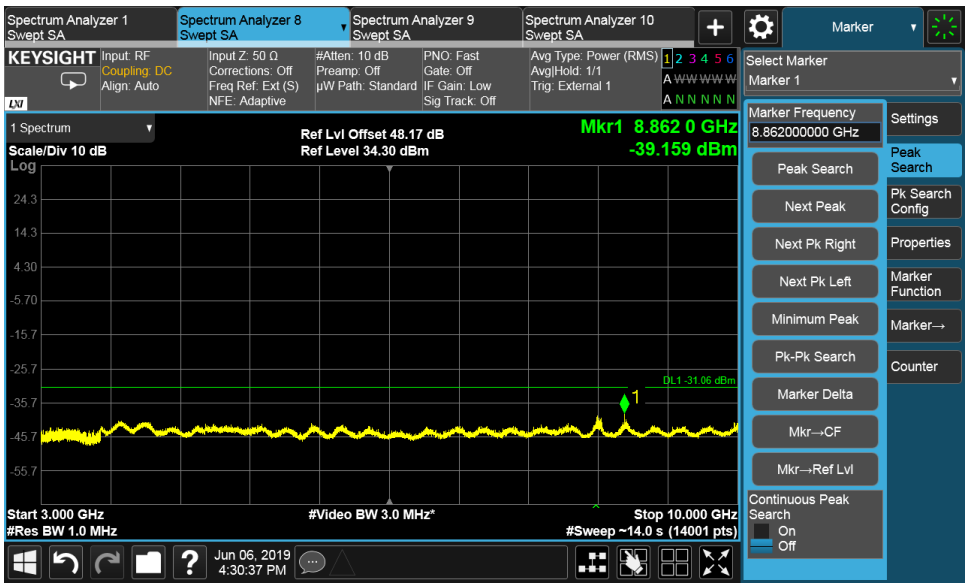
TEST REPORT



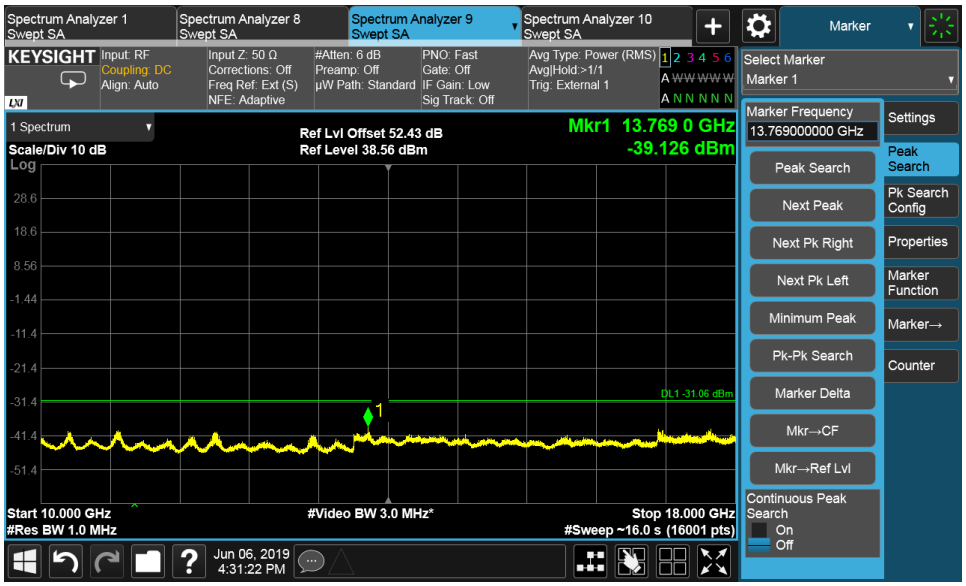


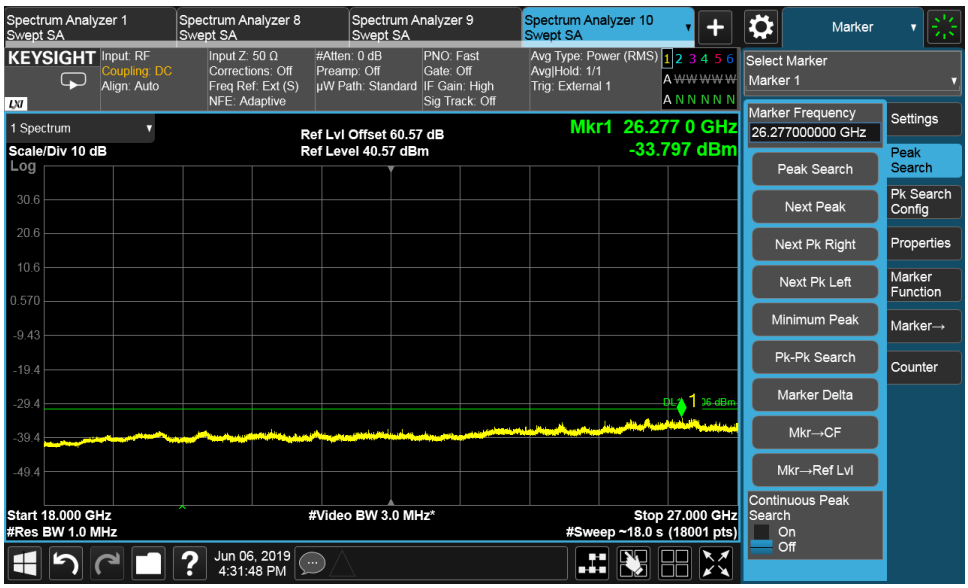
Channel Position T





TEST REPORT


Spectrum Analyzer 1
Swept SA
Spectrum Analyzer 8
Swept SA
Spectrum Analyzer 9
Swept SA
Spectrum Analyzer 10
Swept SA
Marker
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Ext (S)
NFE: Adaptive
#Atten: 6 dB
Preamp: Off
µW Path: Standard
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Power (RMS)
Avg|Hold:>1/1
Trig: External 1
Select Marker
Marker 1
1 Spectrum
Ref Lvl Offset 52.43 dB
Ref Level 38.56 dBm
Mkr1 13.769 0 GHz
-39.126 dBm
Scale/Div 10 dB
Log
28.6
18.6
8.56
-1.44
-11.4
-21.4
-31.4
-41.4
-51.4
DL1 -31.06 dBm
Start 10.000 GHz
#Res BW 1.0 MHz
#Video BW 3.0 MHz*
Stop 18.000 GHz
#Sweep ~16.0 s (16001 pts)
Marker Frequency
13.769000000 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Pk Search Config
Properties
Marker Function
Marker→
Counter
Jun 06, 2019
4:31:22 PM

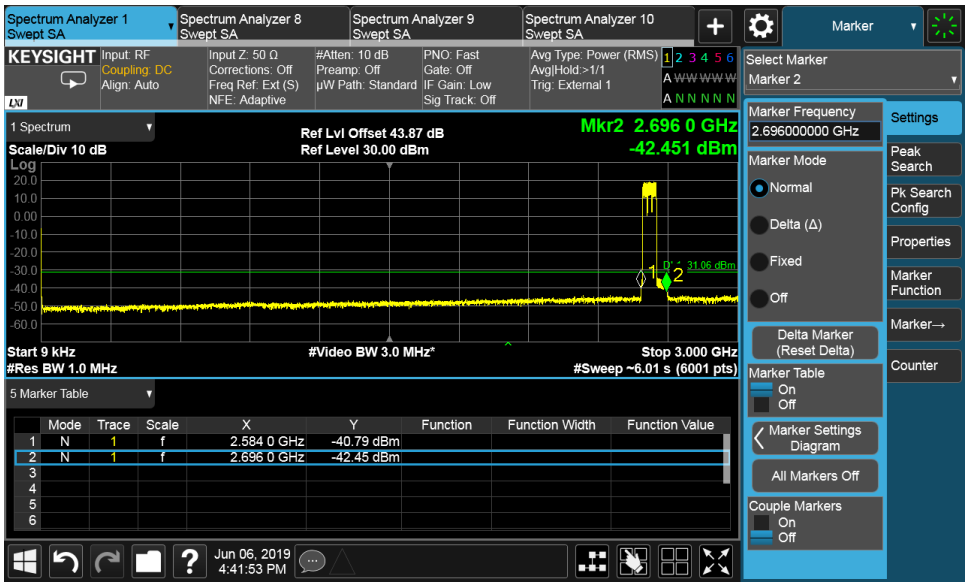

Spectrum Analyzer 1
Swept SA
Spectrum Analyzer 8
Swept SA
Spectrum Analyzer 9
Swept SA
Spectrum Analyzer 10
Swept SA
Marker
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Ext (S)
NFE: Adaptive
#Atten: 0 dB
Preamp: Off
µW Path: Standard
PNO: Fast
Gate: Off
IF Gain: High
Sig Track: Off
Avg Type: Power (RMS)
Avg|Hold: 1/1
Trig: External 1
Select Marker
Marker 1
1 Spectrum
Ref Lvl Offset 60.57 dB
Ref Level 40.57 dBm
Mkr1 26.277 0 GHz
-33.797 dBm
Scale/Div 10 dB
Log
30.6
20.6
10.6
0.570
-9.43
-19.4
-29.4
-39.4
-49.4
Start 18.000 GHz
#Res BW 1.0 MHz
#Video BW 3.0 MHz*
Stop 27.000 GHz
#Sweep ~18.0 s (18001 pts)
Marker Frequency
26.277000000 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Pk Search Config
Properties
Marker Function
Marker→
Counter
Jun 06, 2019
4:31:48 PM

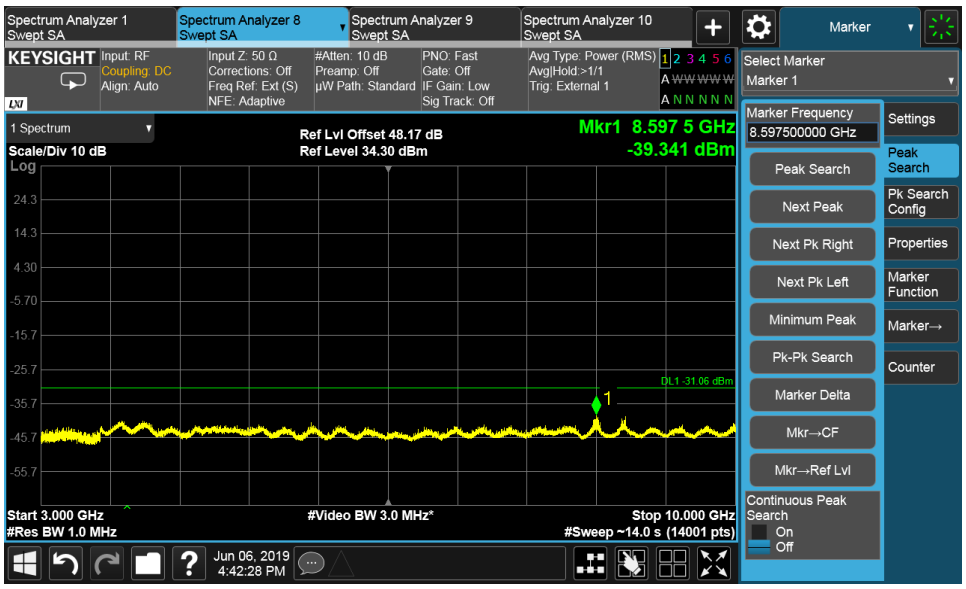
TEST REPORT

Configuration LTE+NR-MIMO-MC-6-UE (3LTE+1NR)

Antenna Port	Channel Position	Modulation	Channel Bandwidth (MHz)	RBW (kHz)	Limit (dBm)
32	B	16QAM	20	1000	-31.06
32	T	16QAM	20	1000	-31.06

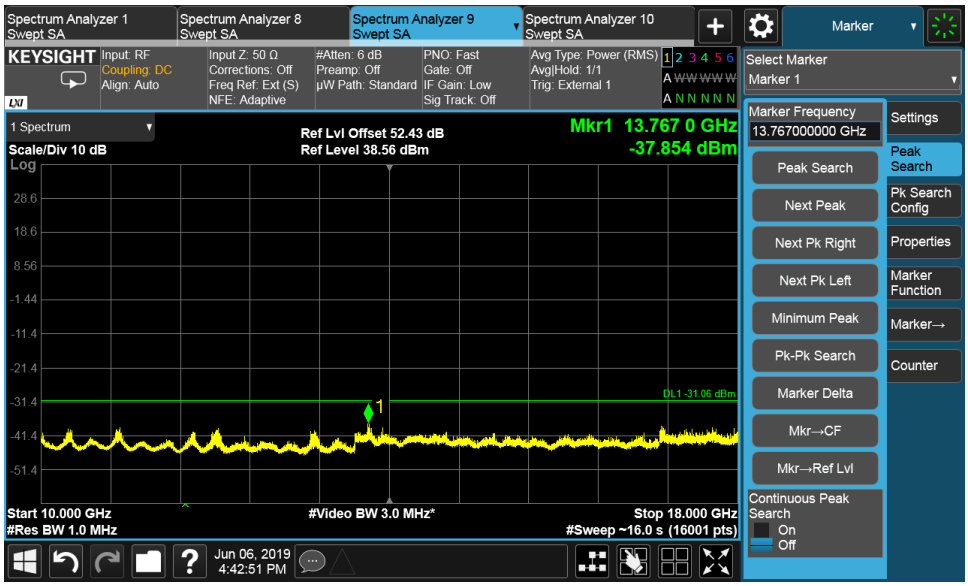
Channel Position B

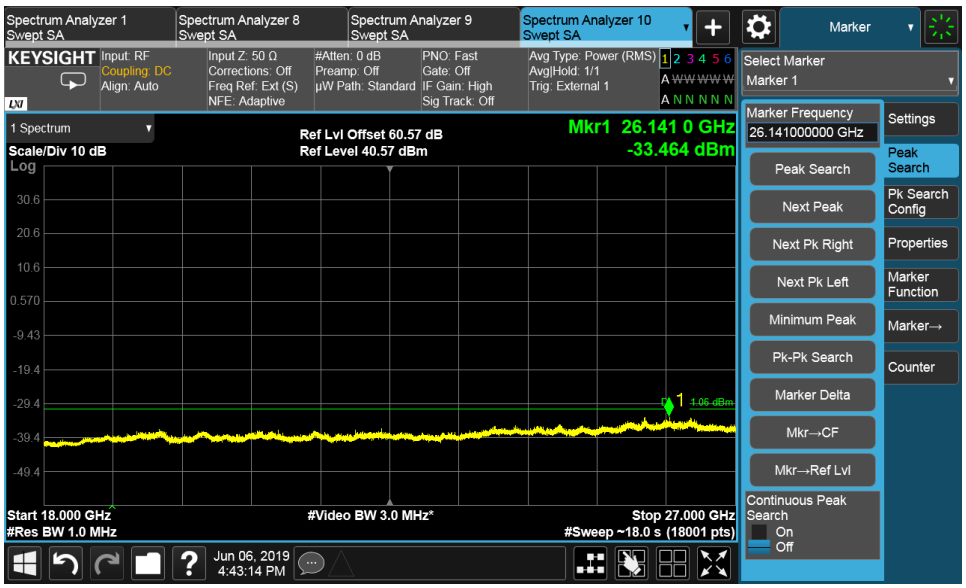




Total Quality. Assured.

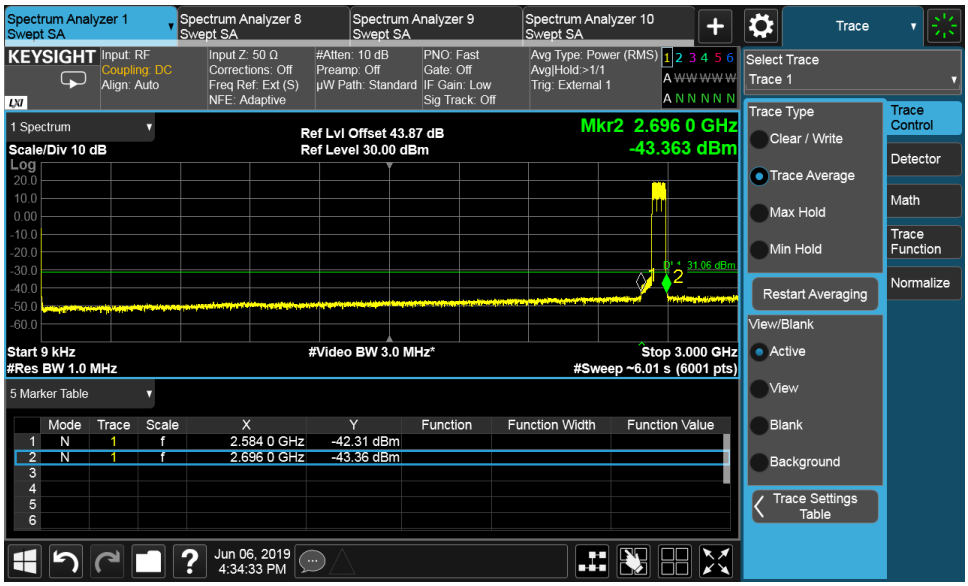
TEST REPORT

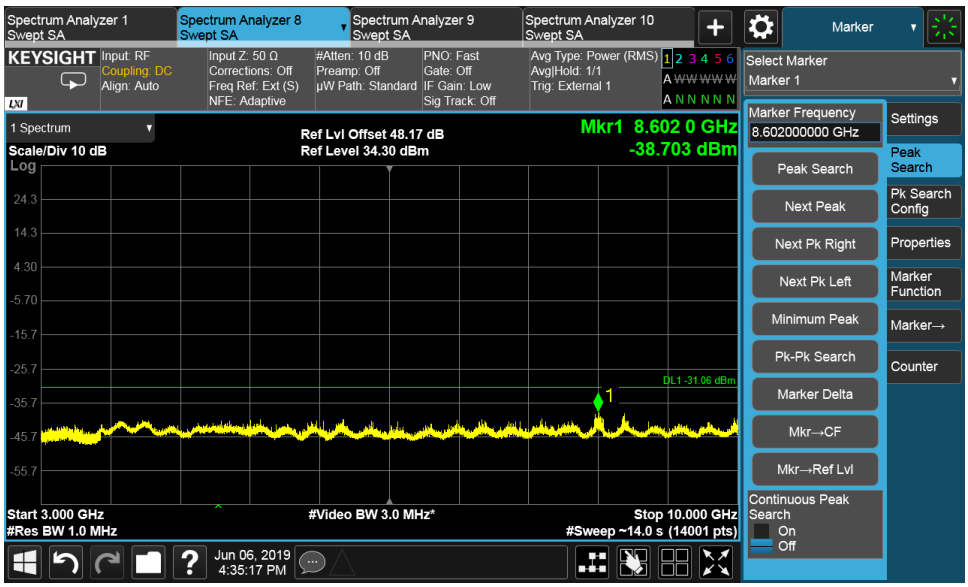




TEST REPORT

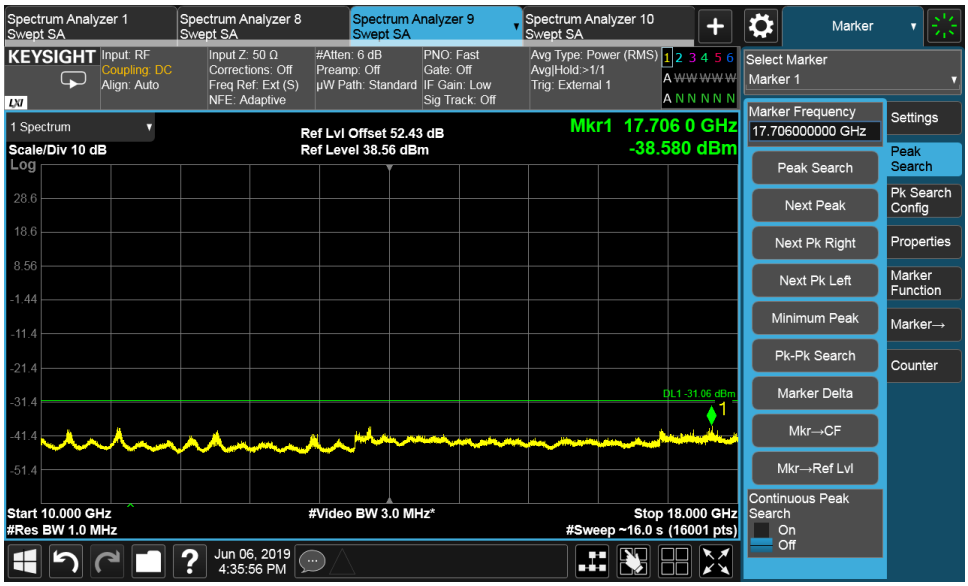
Channel Position T

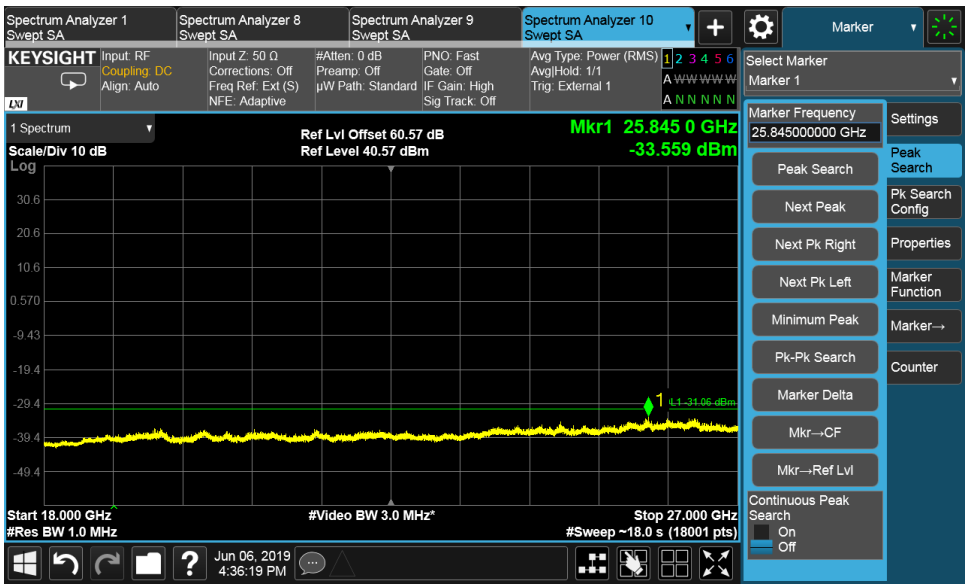




Total Quality. Assured.

TEST REPORT





7 Radiated Unwanted Emission

Test result: **Pass**

7.1 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).

$E(V/m) = (30 \times Gi \times Po)^{0.5} / d$

Where

Gi is the antenna gain of ideal half-wave dipoles,
Po is the power out of the transceiver in W,
d is the measurement distance in meter.

As per FCC Part 27, 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.
Therefore, the limit at 3m measurement distance is:
E(V/m) = 84.4 dBµV/m
These limits have been used to determine Pass or Fail for the harmonics measured and detailed in the following results.

7.2 Measurement Procedure

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 polarizations.
Emissions identified within the range 30MHz to 27GHz 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

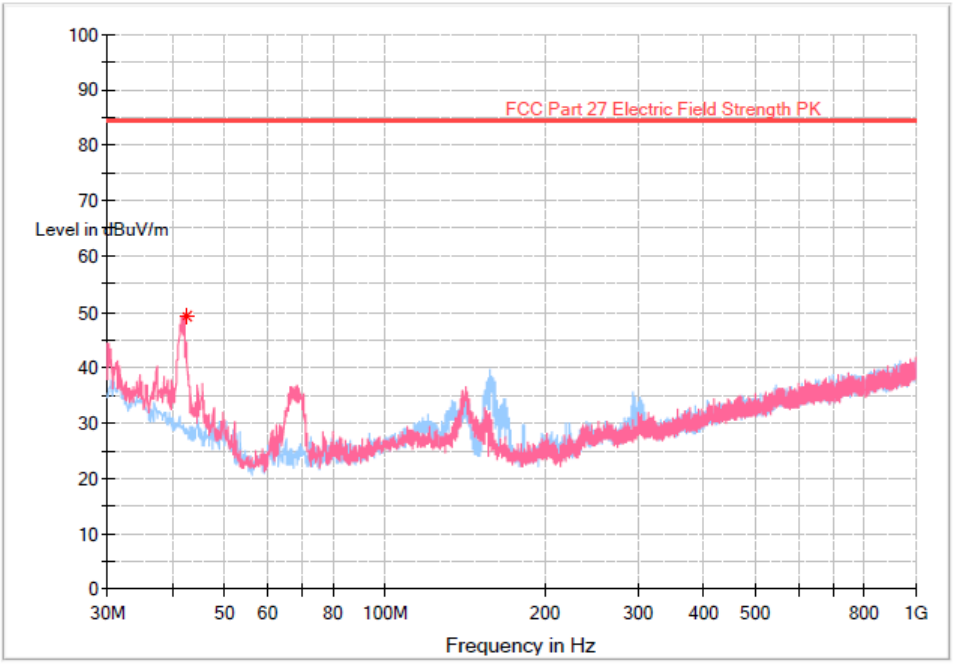
The EUT was measured with the antenna height varied between 1 and 4 m with the turntable rotated between 0 and 360 degrees. The emission of any outside a licensee's frequencies within 20dB of the limit were measured with the substitution method used according to the standard.
The measurements were performed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

7.3 Measurement result

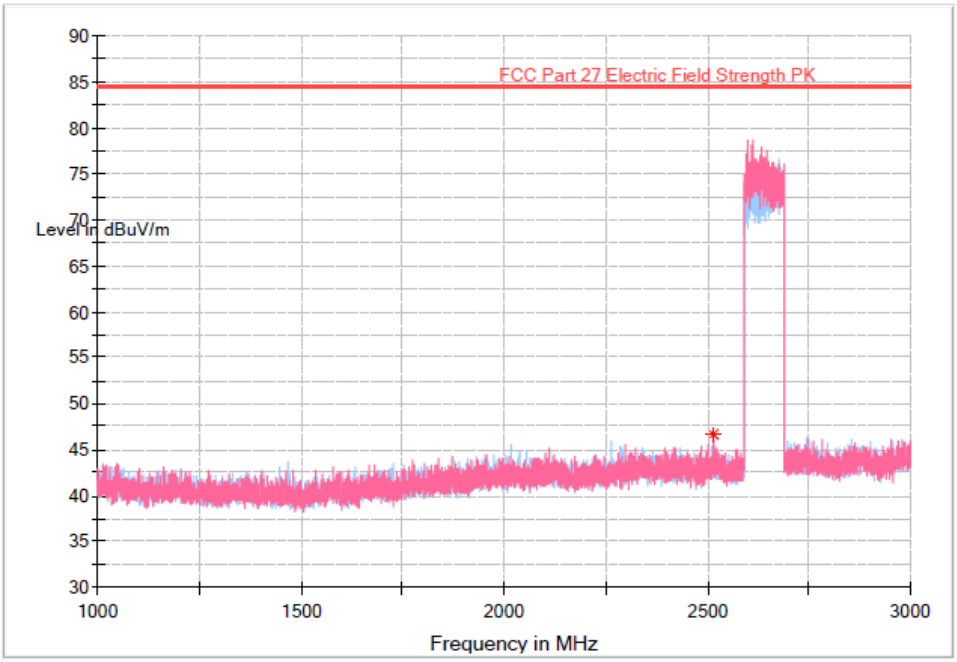
Configuration	Channel Position	Carrier	Carrier Bandwidth	Modulation
NR-MIMO-1C-100	M	1 Carrier	100MHz	256QAM

No emissions were detected within 20dB of the limit.

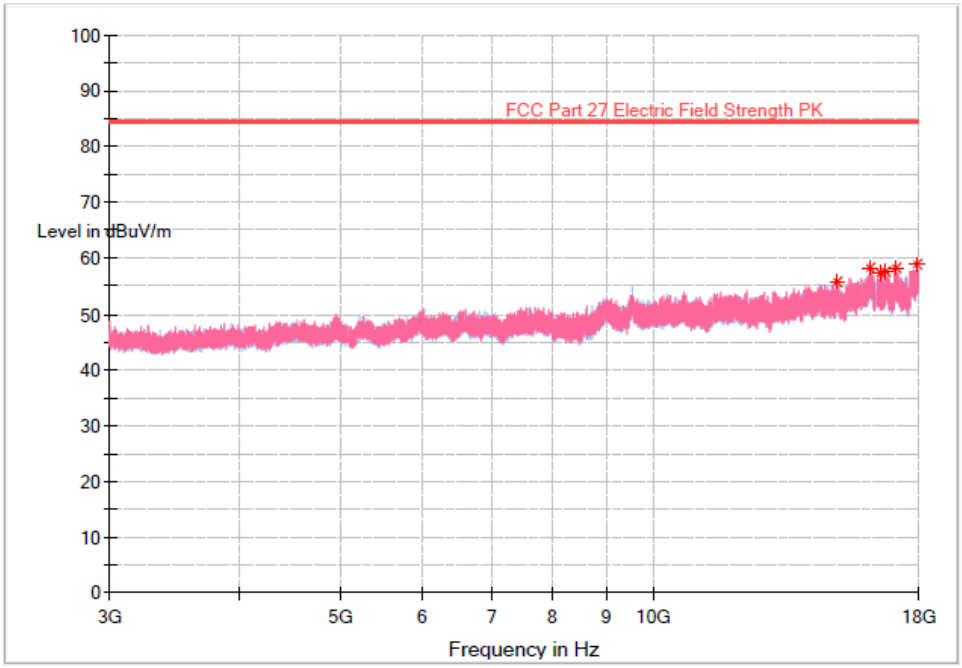
30-1000MHz, Horizontal and Vertical



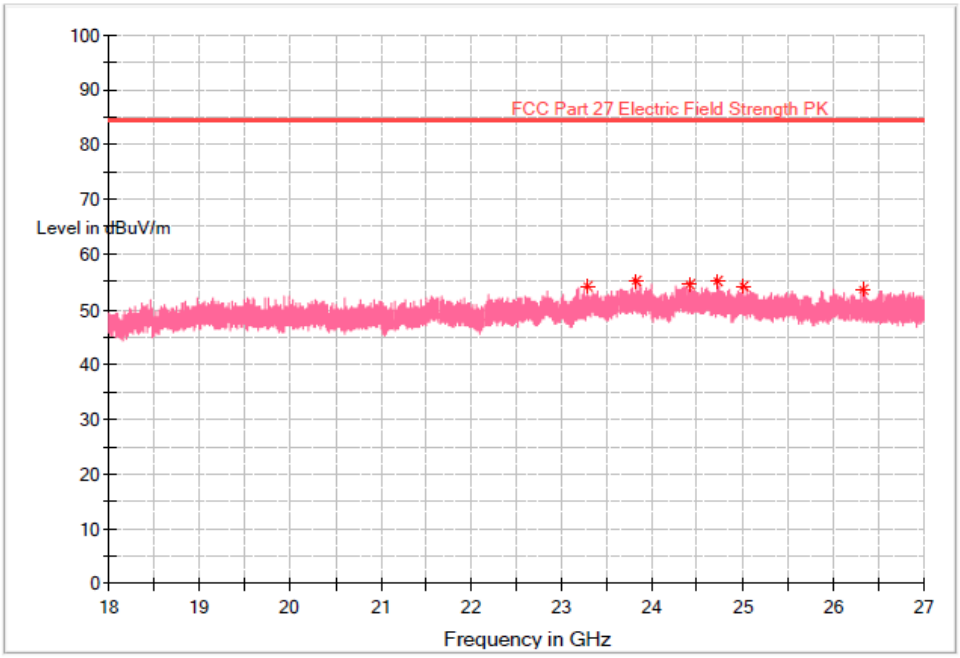
1-3GHz, Horizontal and Vertical



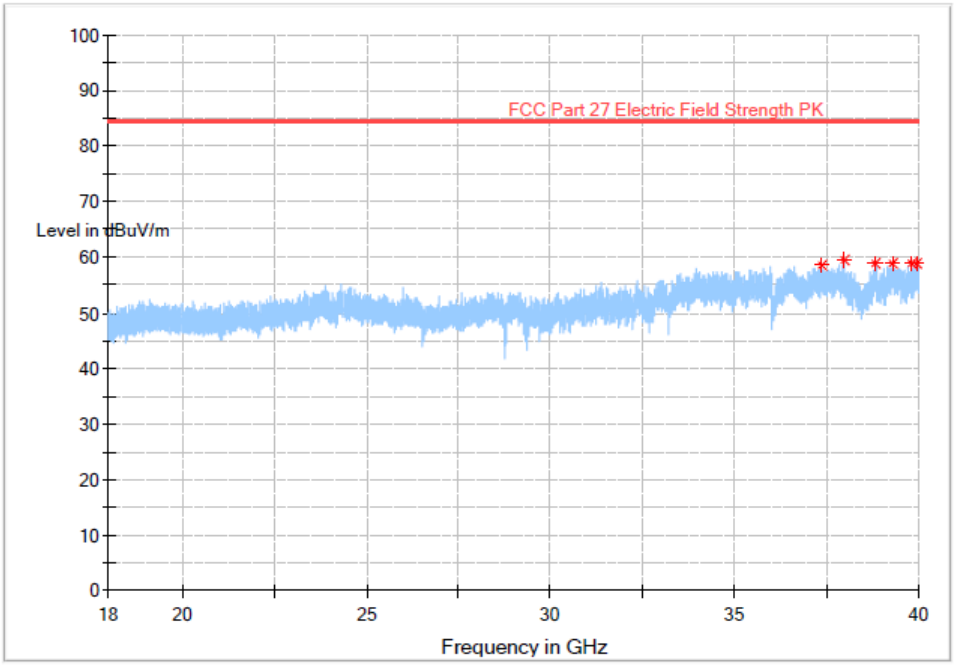
3-18GHz, Horizontal and Vertical



18-27GHz, Vertical



18-27GHz, Horizontal



Configuration	Channel Position	Carrier	Carrier Bandwidth	Modulation
NR-MIMO-1C-40	B	1 Carrier	40MHz	256QAM

No emissions were detected within 20dB of the limit.

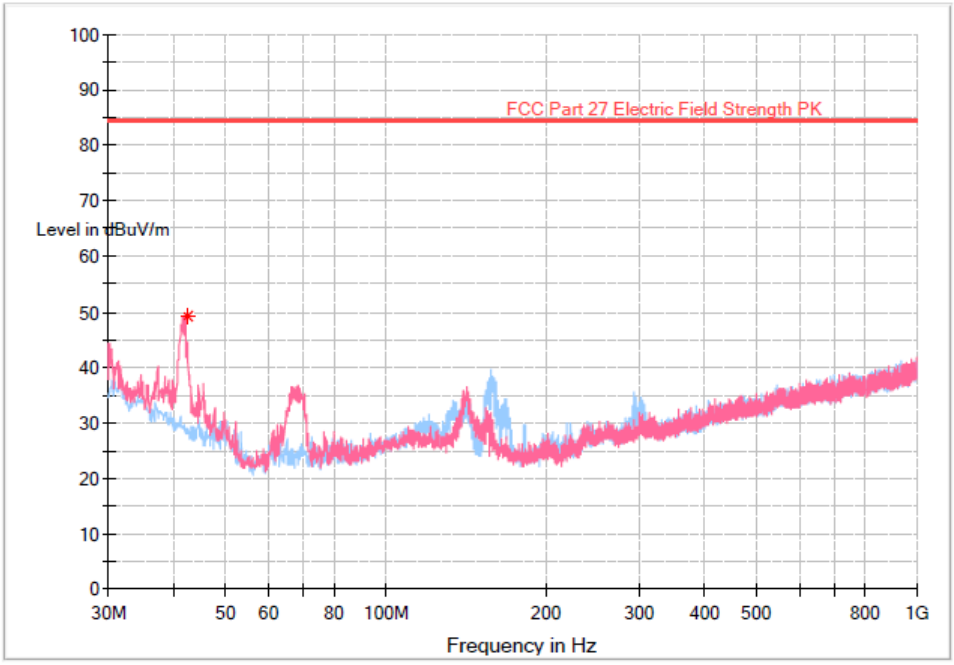
Configuration	Channel Position	Carrier	Carrier Bandwidth	Modulation
NR-MIMO-1C-40	T	1 Carrier	40MHz	256QAM

No emissions were detected within 20dB of the limit.

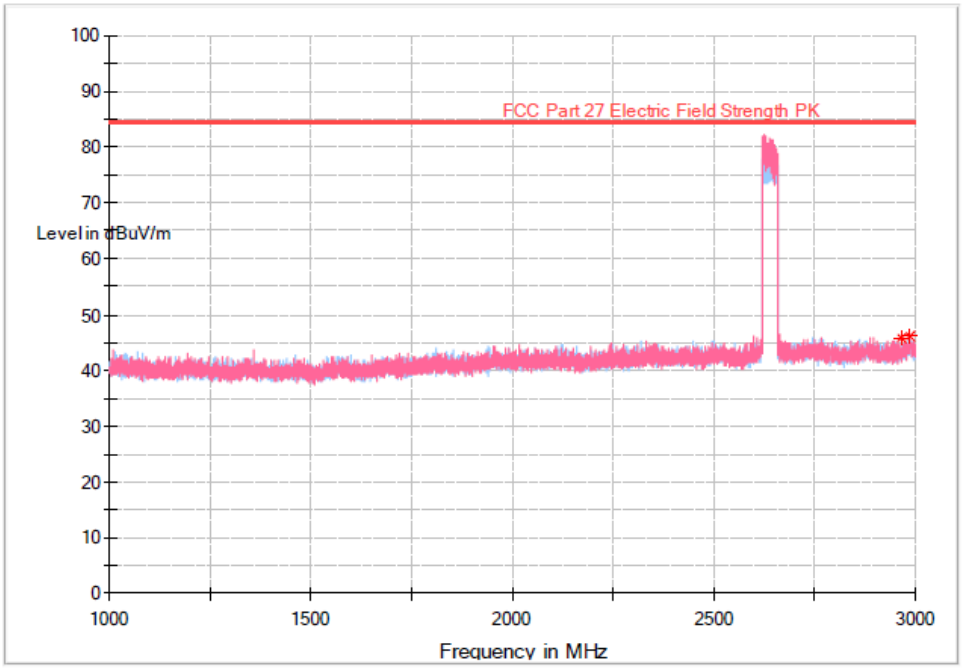
Configuration	Channel Position	Carrier	Carrier Bandwidth	Modulation
NR-MIMO-1C-40	M	1 Carrier	40MHz	256QAM

No emissions were detected within 20dB of the limit.

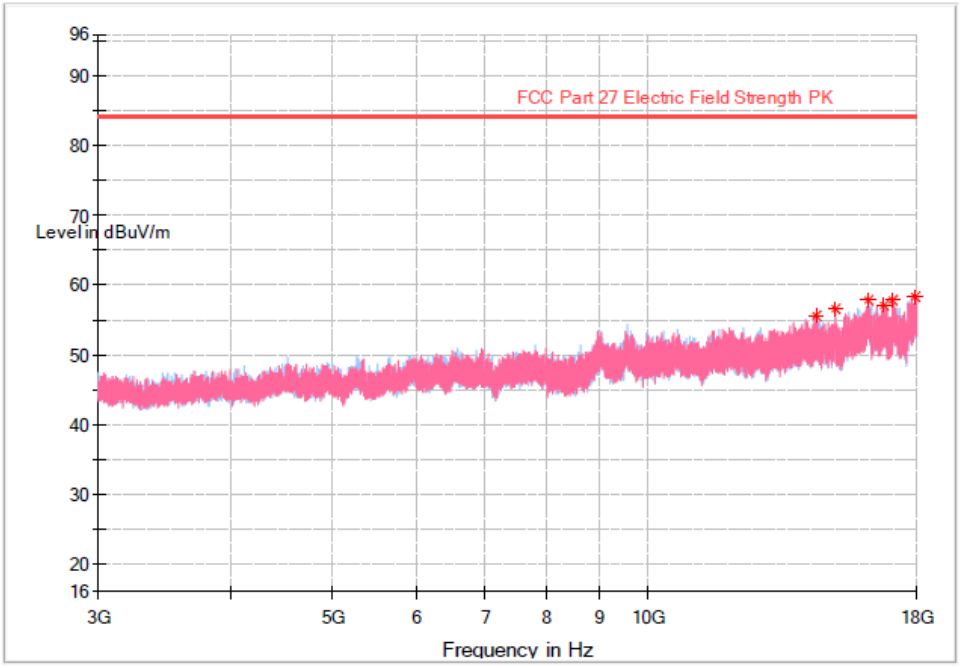
30-1000MHz, Horizontal and Vertical



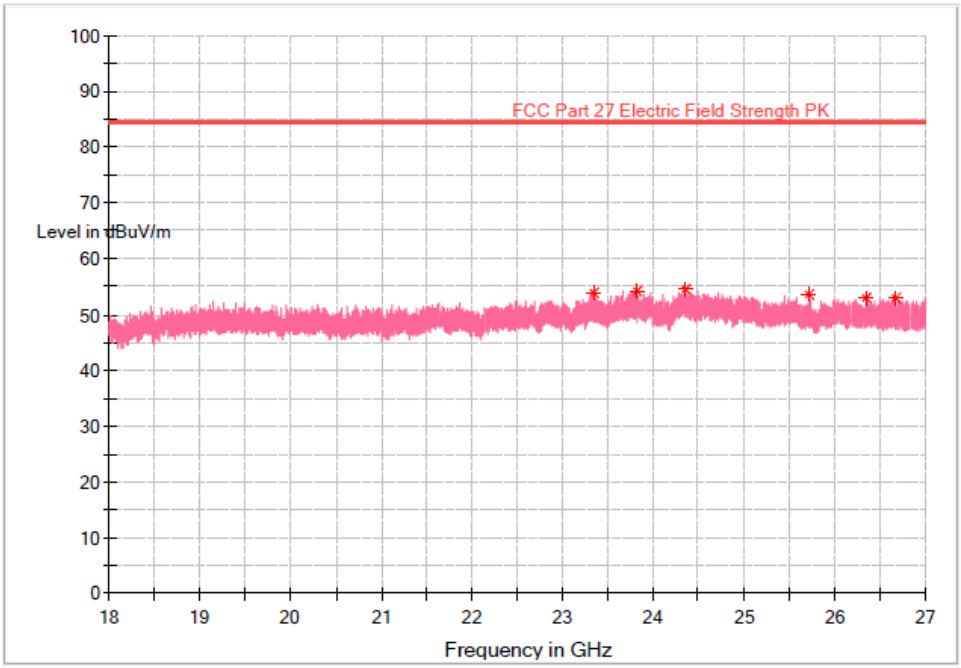
1-3GHz, Horizontal and Vertical



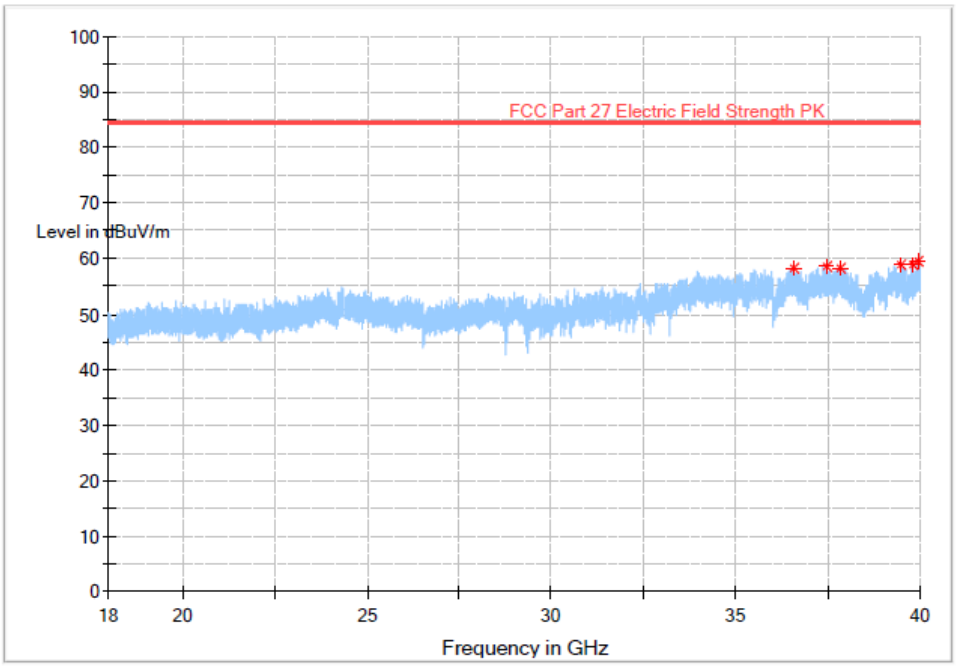
3-18GHz, Horizontal and Vertical



18-27GHz, Vertical



18-27GHz, Horizontal



Configuration	Channel Position	Carrier	Carrier Bandwidth	Modulation
LTE+NR-MIMO-MC-4-UE	M	LTE:1C NR:1C	20MHz	16QAM

No emissions were detected within 20dB of the limit.

Configuration	Channel Position	Carrier	Carrier Bandwidth	Modulation
LTE+NR-MIMO-MC-5-UE	M	LTE:2C NR:1C	20MHz	16QAM

No emissions were detected within 20dB of the limit.

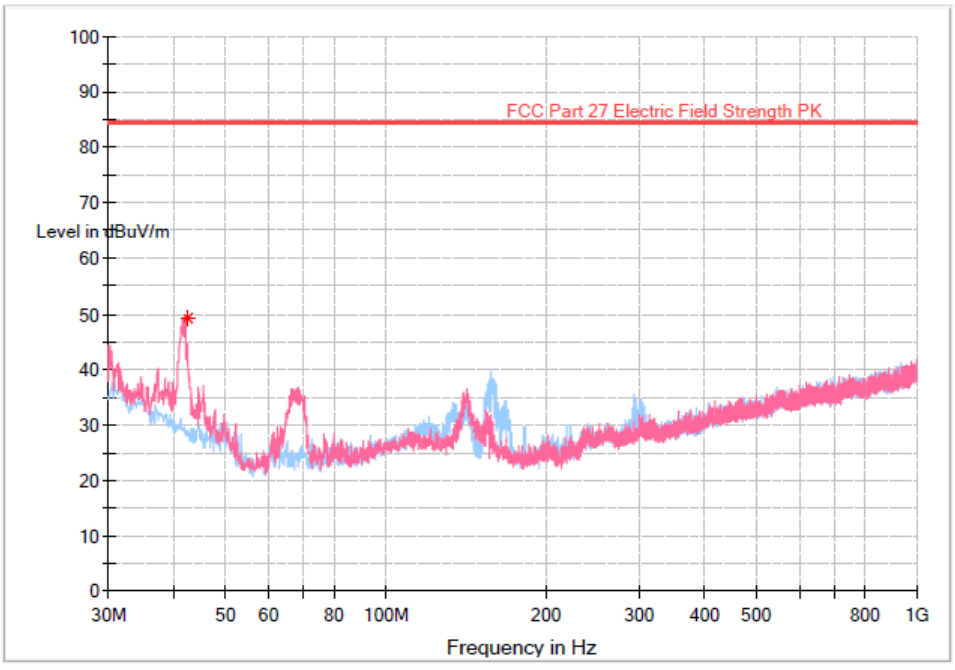
Configuration	Channel Position	Carrier	Carrier Bandwidth	Modulation
LTE+NR-MIMO-MC-6-UE	B	LTE:3C NR:1C	20MHz	16QAM

No emissions were detected within 20dB of the limit.

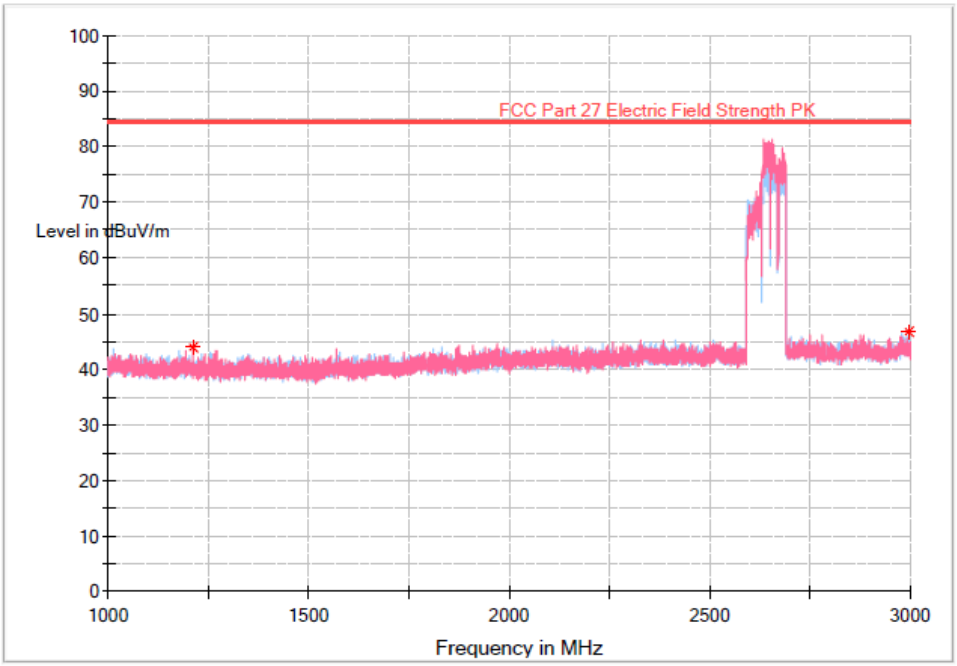
Configuration	Channel Position	Carrier	Carrier Bandwidth	Modulation
LTE+NR-MIMO-MC-6-UE	T	LTE:3C NR:1C	20MHz	16QAM

No emissions were detected within 20dB of the limit.

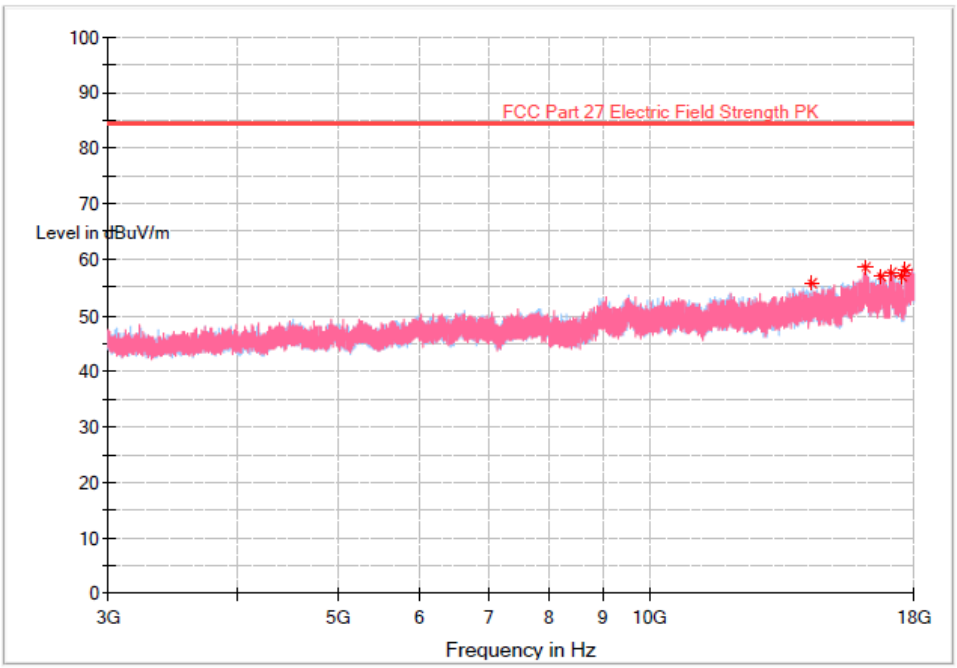
30-1000MHz, Horizontal and Vertical



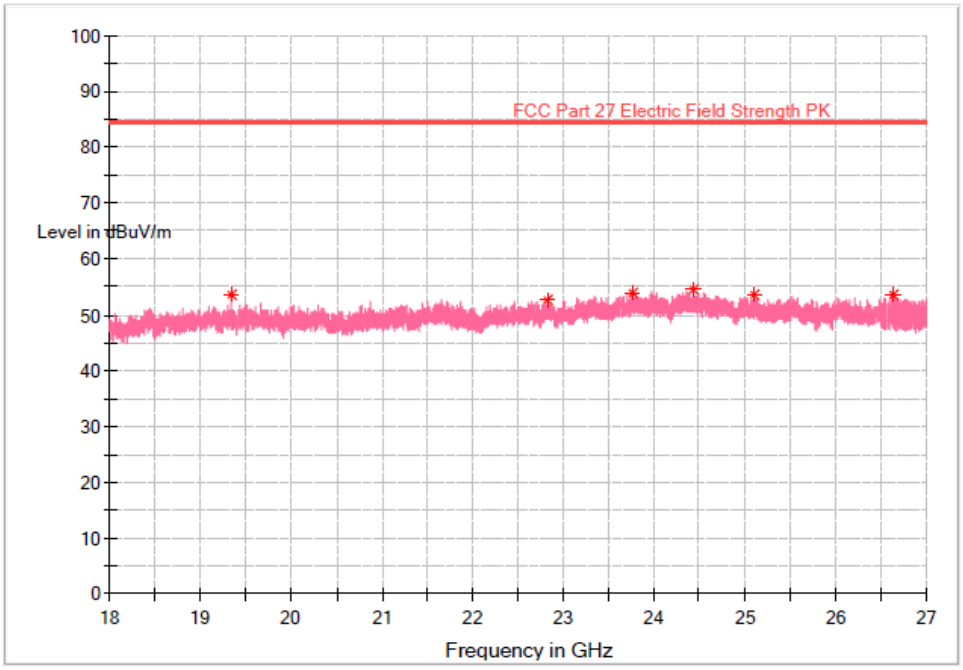
1-3GHz, Horizontal and Vertical



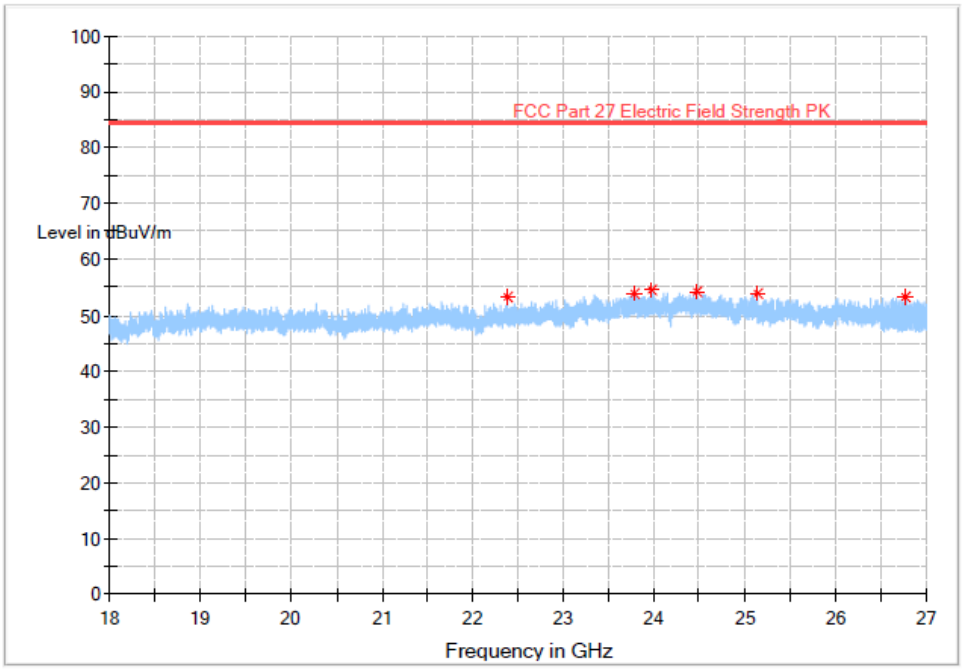
3-18GHz, Horizontal and Vertical



18-27GHz, Vertical



18-27GHz, Horizontal



8 Frequency Stability

Test result: **Tested**

8.1 Limit

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

8.2 Measurement Procedure

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 at maximum power on the middle channel of the operating band.

Voltage Variation
The EUT was tested at the supplied voltages varied from 85 to 115 percent of the nominal values of -48 VDC. At +20°C, the Base Station was configured to transmit at maximum power on the middle channel of the frequency block.

8.3 Measurement result

Frequency Error – Temperature Variation

Configuration NR-MIMO-1C-40

Antenna Port	Modulation	Temperature (°C)	Frequency Stability (Hz)		
			Channel Position B	Channel Position M	Channel Position T
20	256QAM	-30	8.11	-8.81	-9.33
		-20	10.51	-10.82	-9.66
		-10	-9.39	8.68	-8.97
		0	-9.21	-8.86	9.09
		10	8.70	-10.34	-10.02
		20	8.15	-10.46	-9.95
		30	-10.95	-10.75	-9.38
		40	-10.22	-9.81	-10.28
		50	-9.64	15.85	9.37

Configuration NR-MIMO-1C-100

Antenna Port	Modulation	Temperature (°C)	Frequency Stability (Hz)		
			Channel Position B	Channel Position M	Channel Position T
20	256QAM	-30	-	-8.50	-
		-20	-	-8.36	-
		-10	-	-9.39	-
		0	-	-8.71	-
		10	-	-10.42	-
		20	-	14.31	-
		30	-	11.03	-
		40	-	-10.43	-
		50	-	-11.43	-

Configuration LTE+NR-MIMO-MC-1 (1LTE+1NR)

Antenna Port	Modulation	Temperature (°C)	Frequency Stability (Hz)		
			Channel Position B	Channel Position M	Channel Position T
32	256QAM	-30	8.52	15.94	-17.48
		-20	19.03	9.81	-8.63
		-10	9.17	10.14	-9.80
		0	8.63	17.56	13.98
		10	9.09	10.13	-10.24
		20	12.47	14.31	15.34
		30	-13.56	16.91	10.78
		40	14.5	-14.83	18.45
		50	-9.01	-10.25	12.64

Frequency Error – Voltage Variation

Configuration NR-MIMO-1C-40

Antenna Port	Modulation	Temperature (°C)	Supply Voltage (V)	Frequency Stability (Hz)		
				Channel Position B	Channel Position M	Channel Position T
20	256QAM	20	-40.8	-11.92	13.05	-11.47
			-48.0	14.78	10.57	-13.16
			-55.2	8.15	-10.46	-9.95

Configuration NR-MIMO-1C-100

Antenna Port	Modulation	Temperature (°C)	Supply Voltage (V)	Frequency Stability (Hz)		
				Channel Position B	Channel Position M	Channel Position T
20	256QAM	20	-40.8	-	9.86	-
			-48.0	-	-12.99	-
			-55.2	-	14.31	-

Configuration LTE+NR-MIMO-MC-1 (1LTE+1NR)

Antenna Port	Modulation	Temperature (°C)	Supply Voltage (V)	Frequency Stability (Hz)		
				Channel Position B	Channel Position M	Channel Position T
20	256QAM	20	-40.8	9.85	-12.57	-16.14
			-48.0	14.79	11.70	-16.50
			-55.2	12.47	14.31	15.34

********** END **********