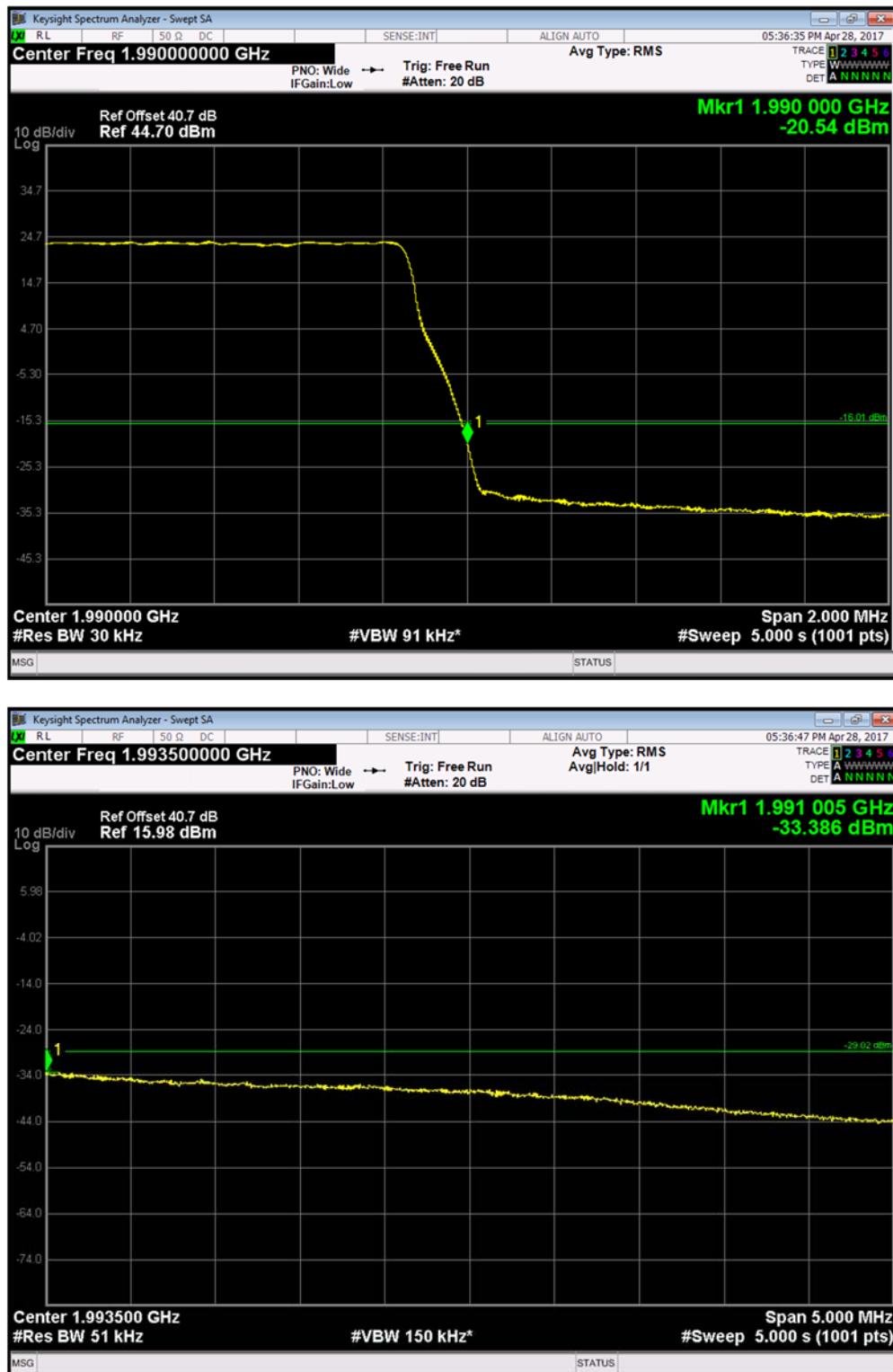
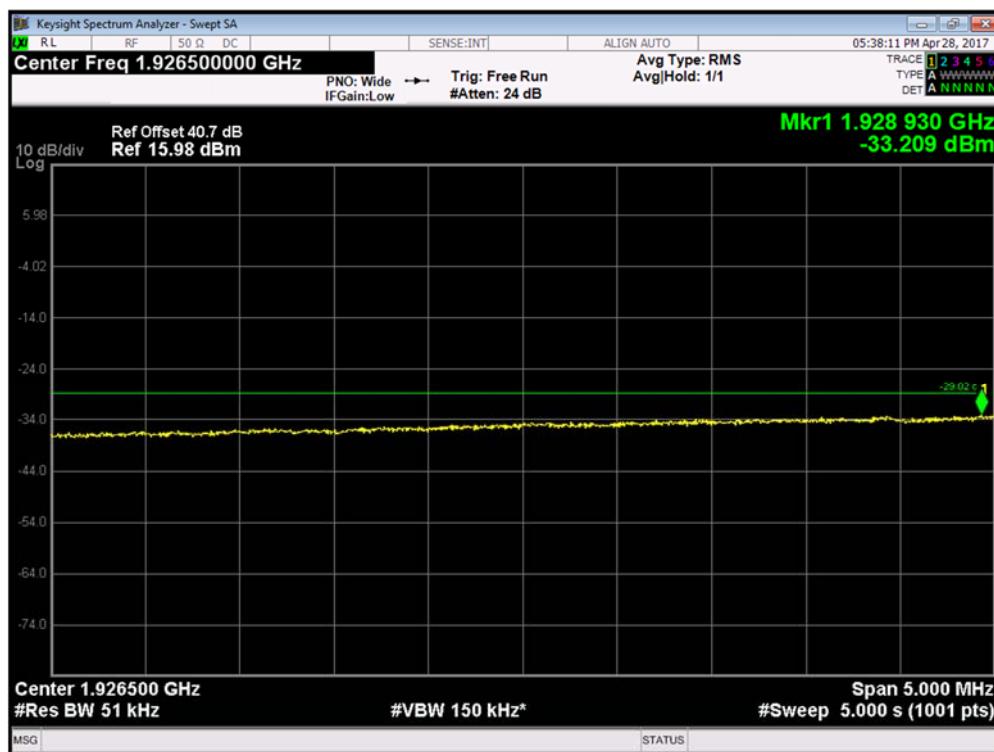
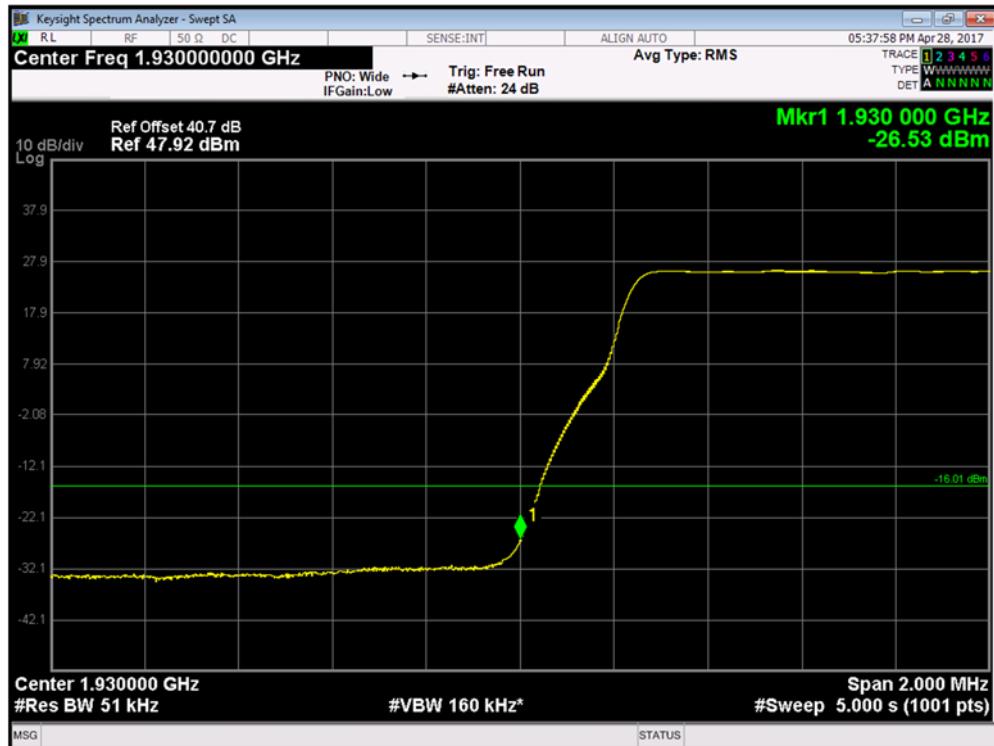
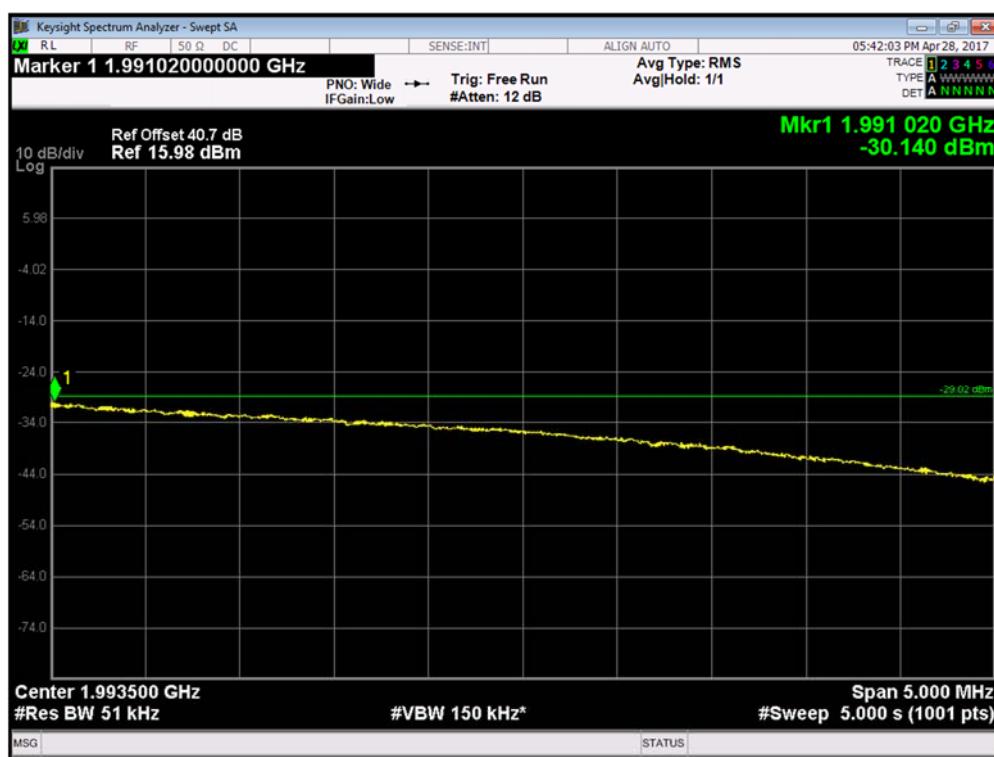
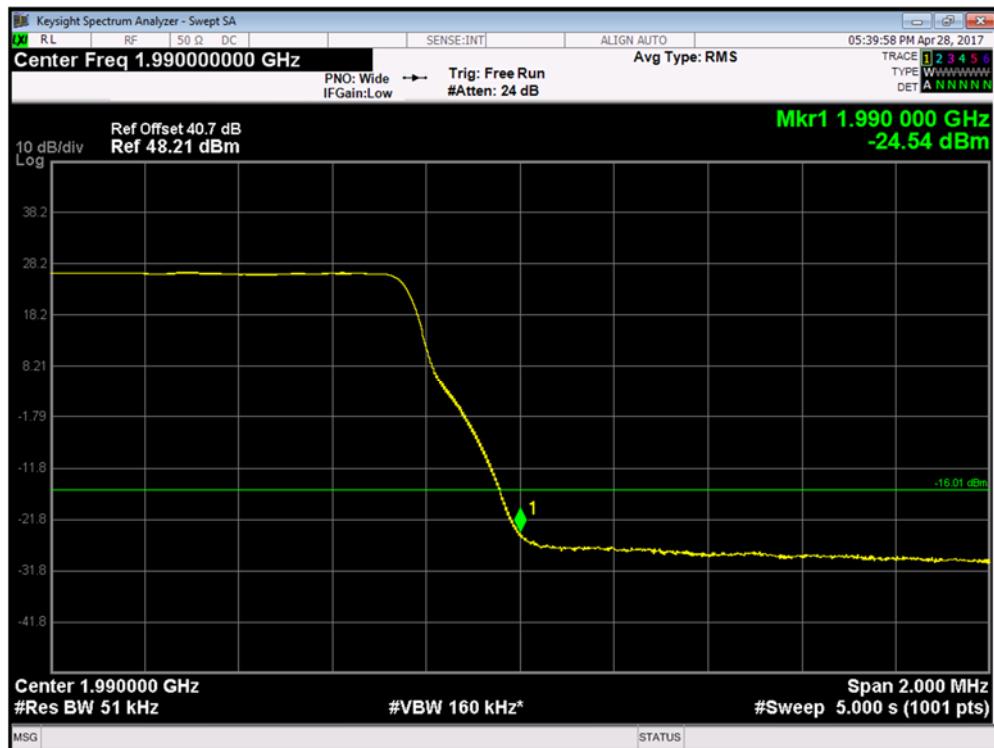
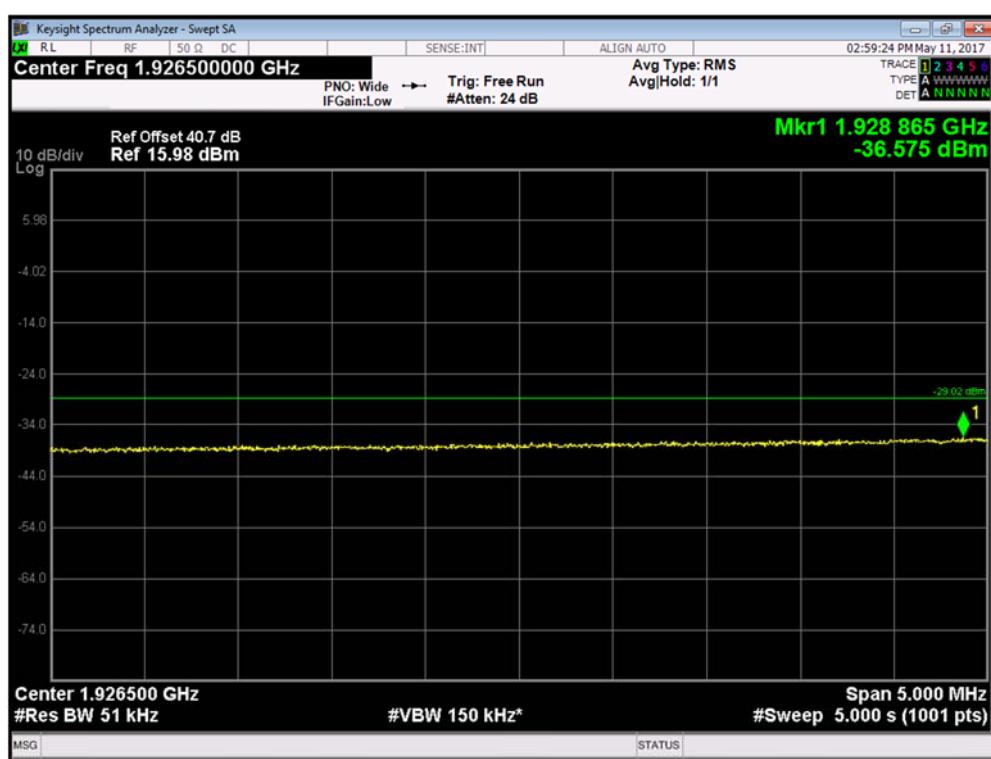
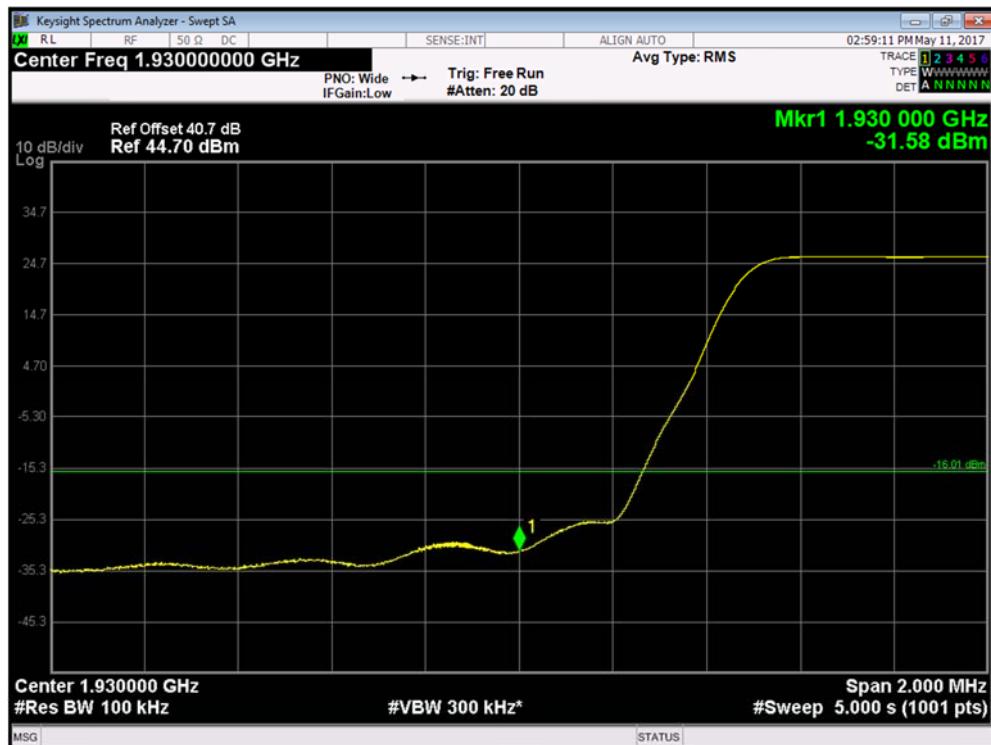


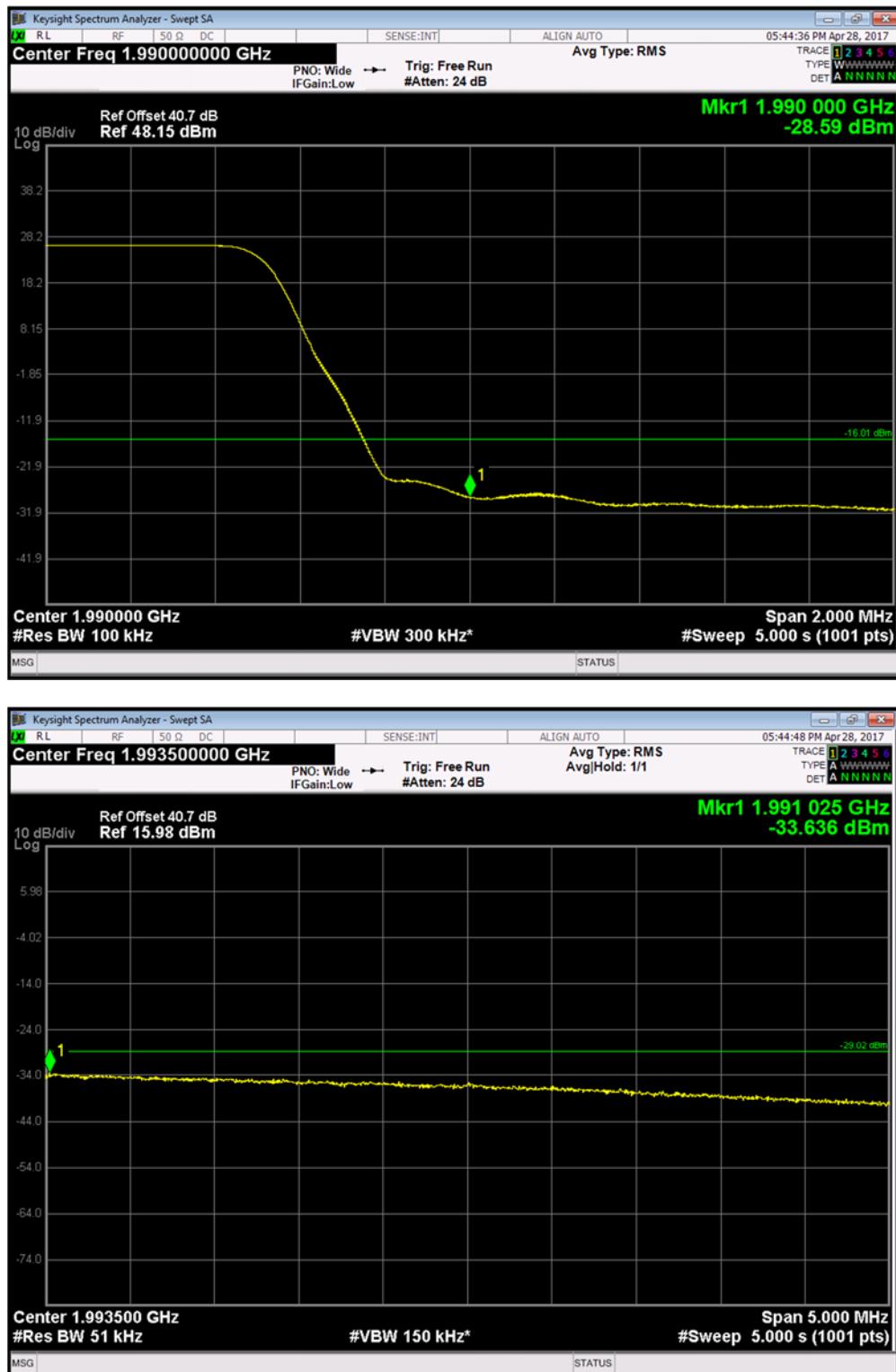
Channel Position B_{RFBW} - QPSK / Bandwidth 3.0 MHz

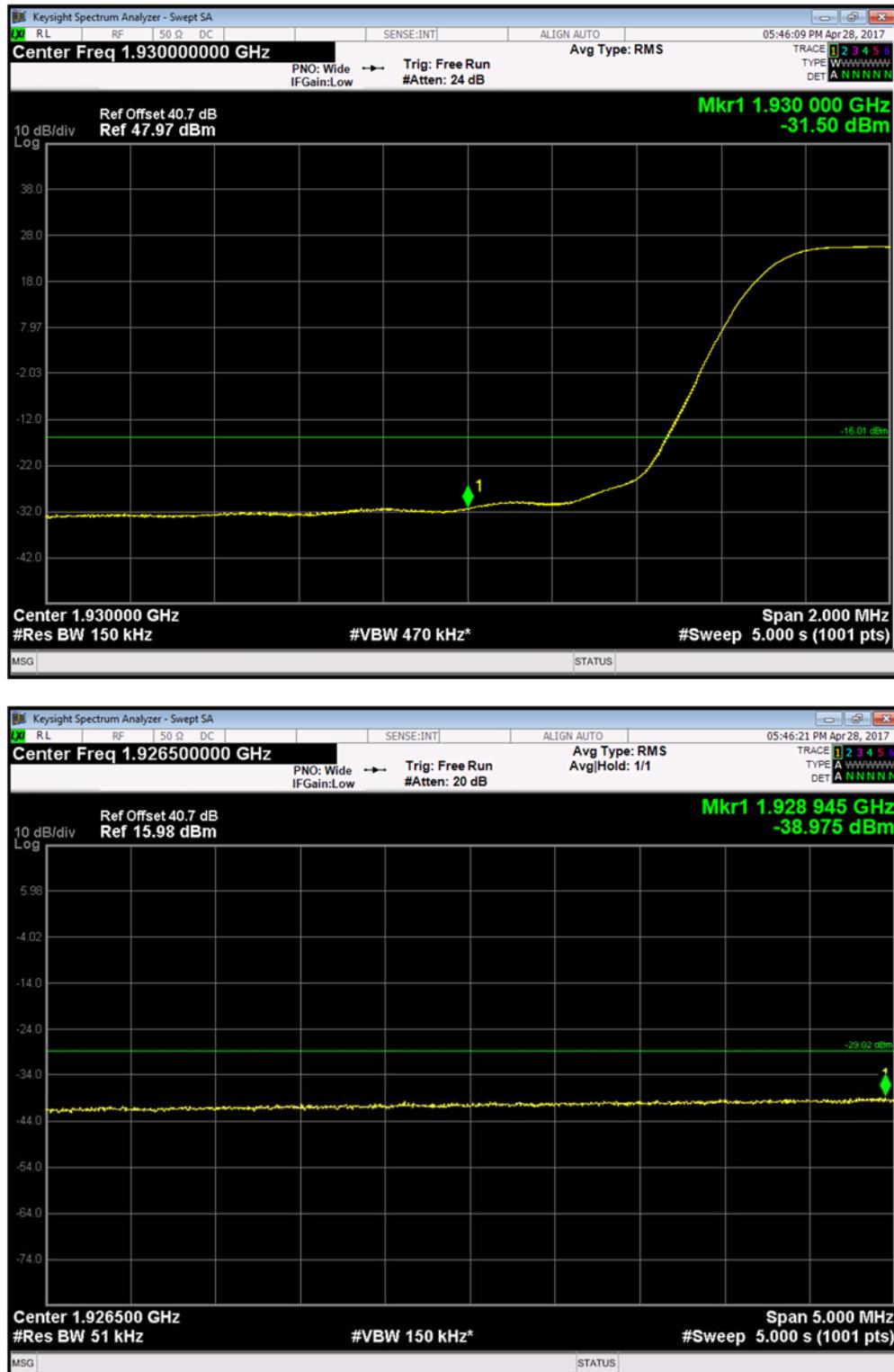

Channel Position T_{RFBW} - QPSK / Bandwidth 3.0 MHz


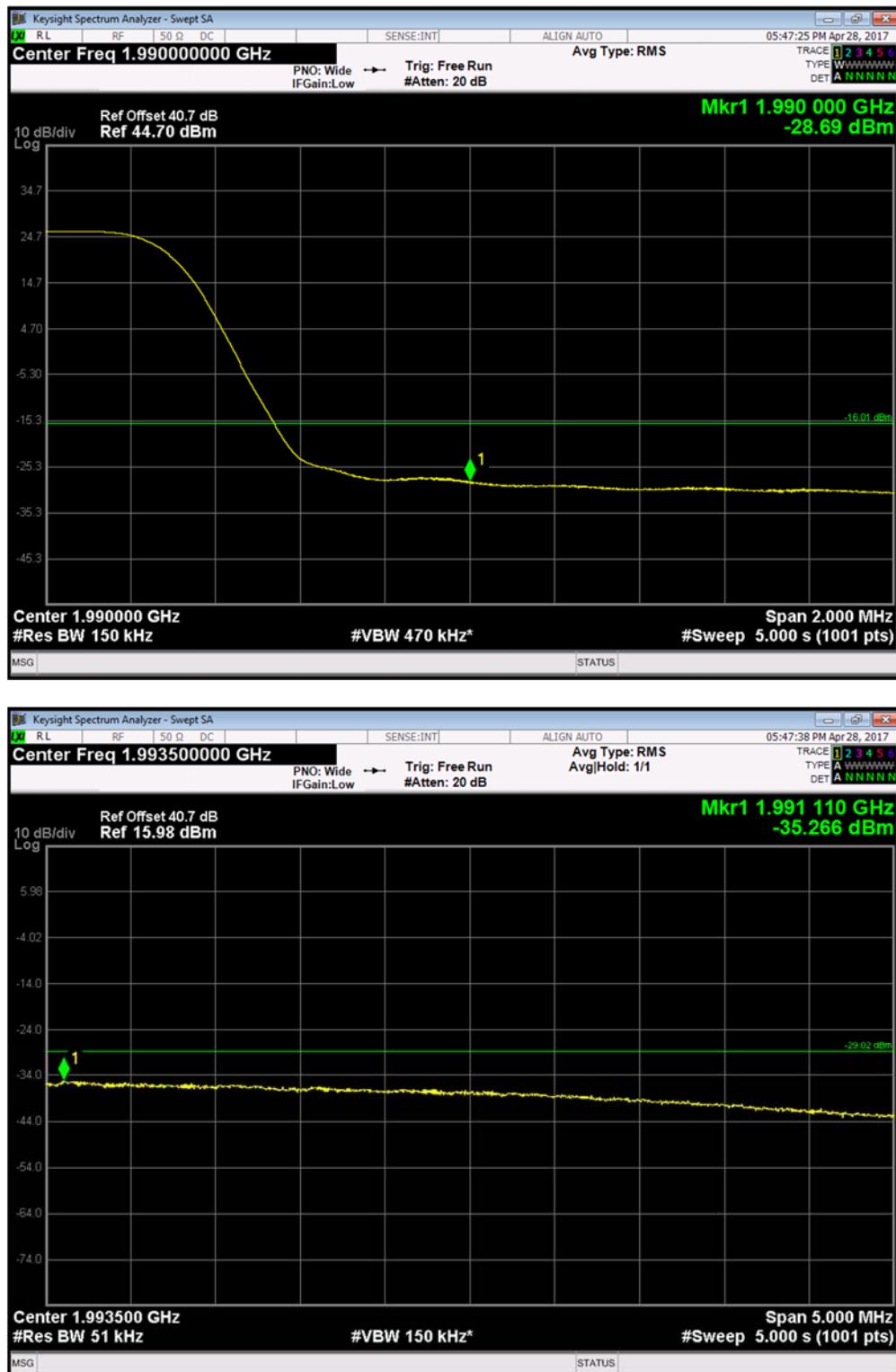
Channel Position B_{RFBW} - QPSK / Bandwidth 5.0 MHz


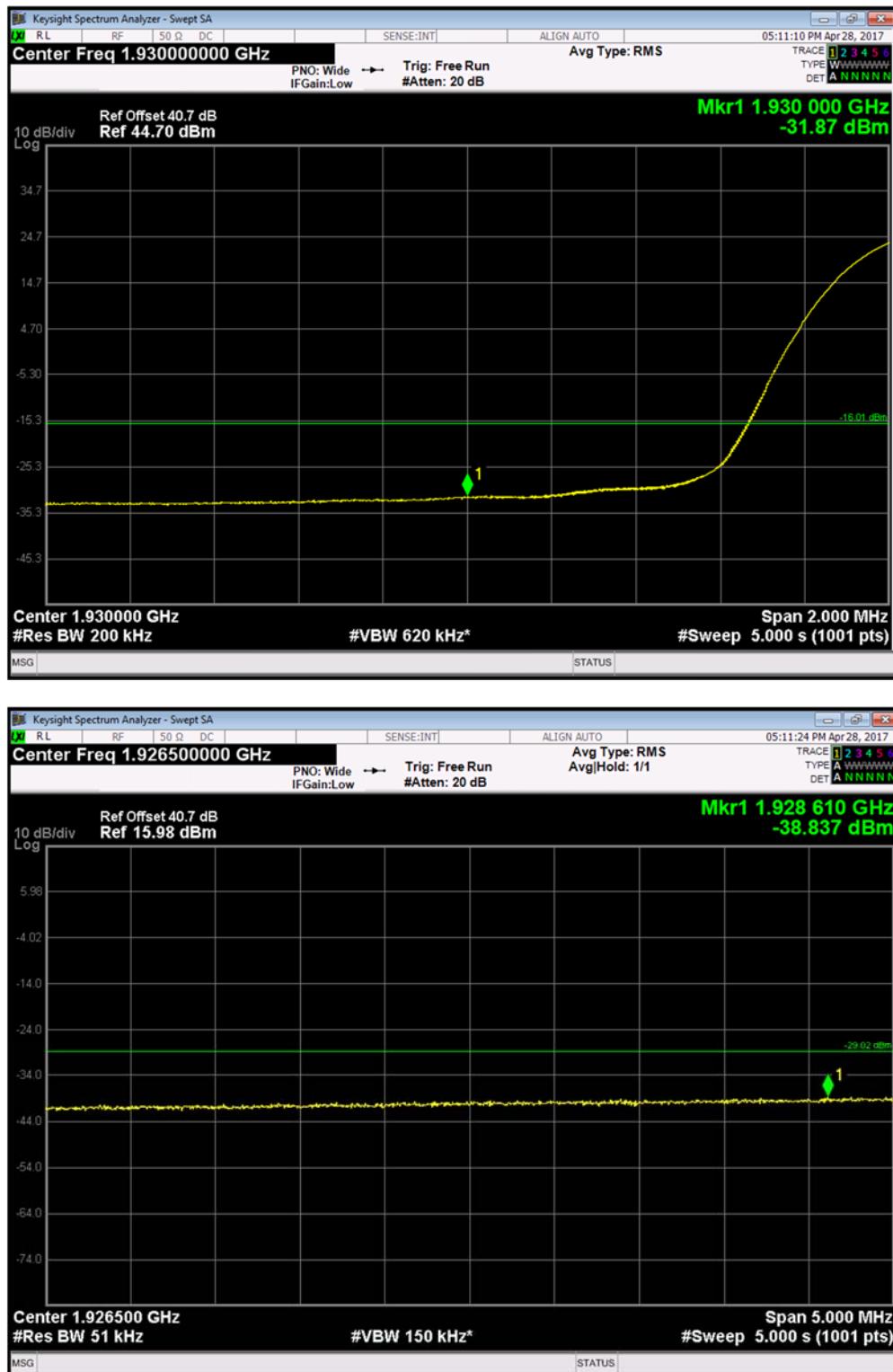
Channel Position T_{RFBW} - QPSK / Bandwidth 5.0 MHz


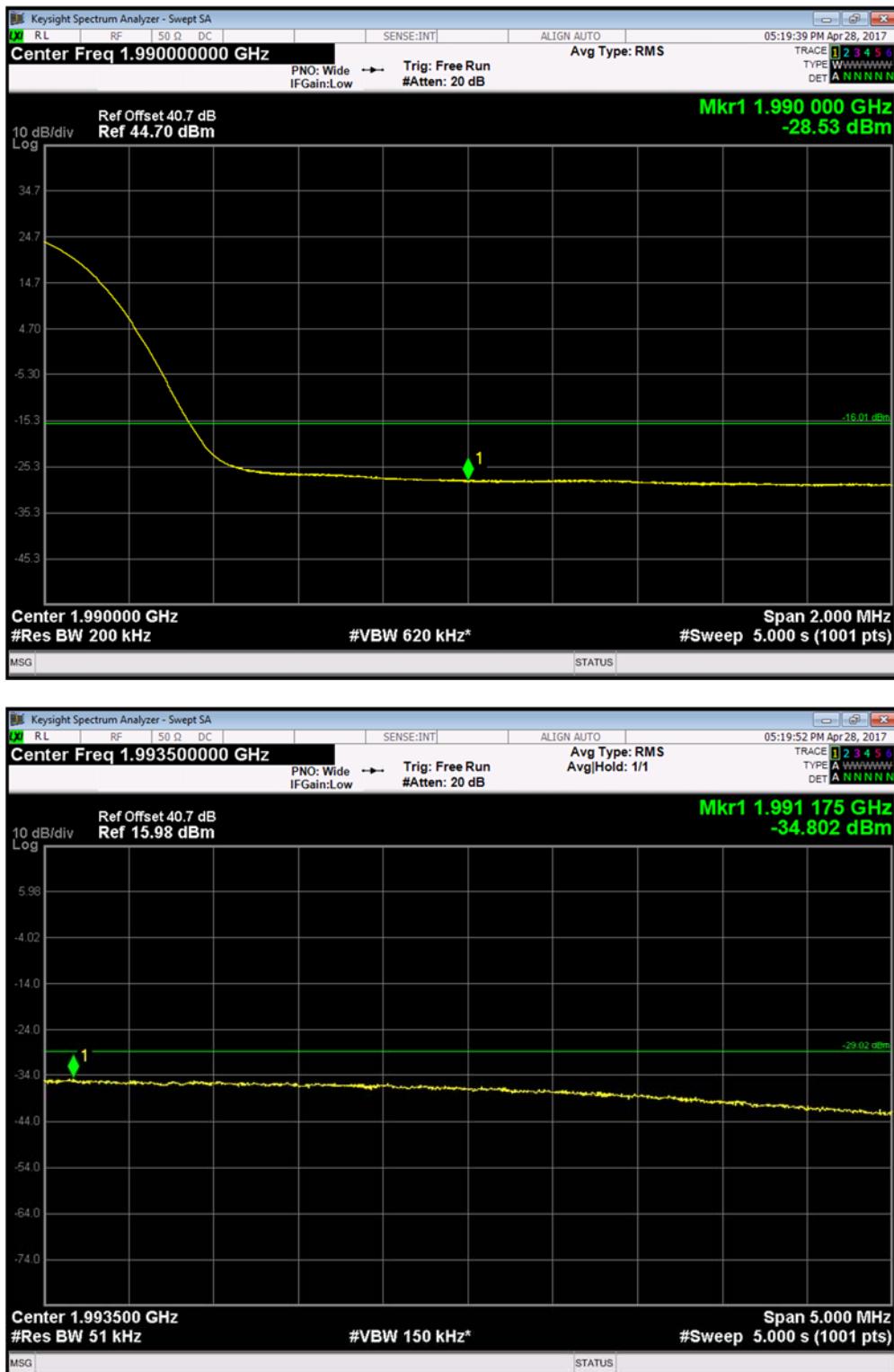
Channel Position B_{RFBW} - QPSK / Bandwidth 10.0 MHz


Channel Position T_{RFBW} - QPSK / Bandwidth 10.0 MHz


Channel Position B_{RFBW} - QPSK / Bandwidth 15.0 MHz


Channel Position T_{RFBW} - QPSK / Bandwidth 15.0 MHz


Channel Position B_{RFBW} - QPSK / Bandwidth 20.0 MHz


Channel Position T_{RFBW} - QPSK / Bandwidth 20.0 MHz




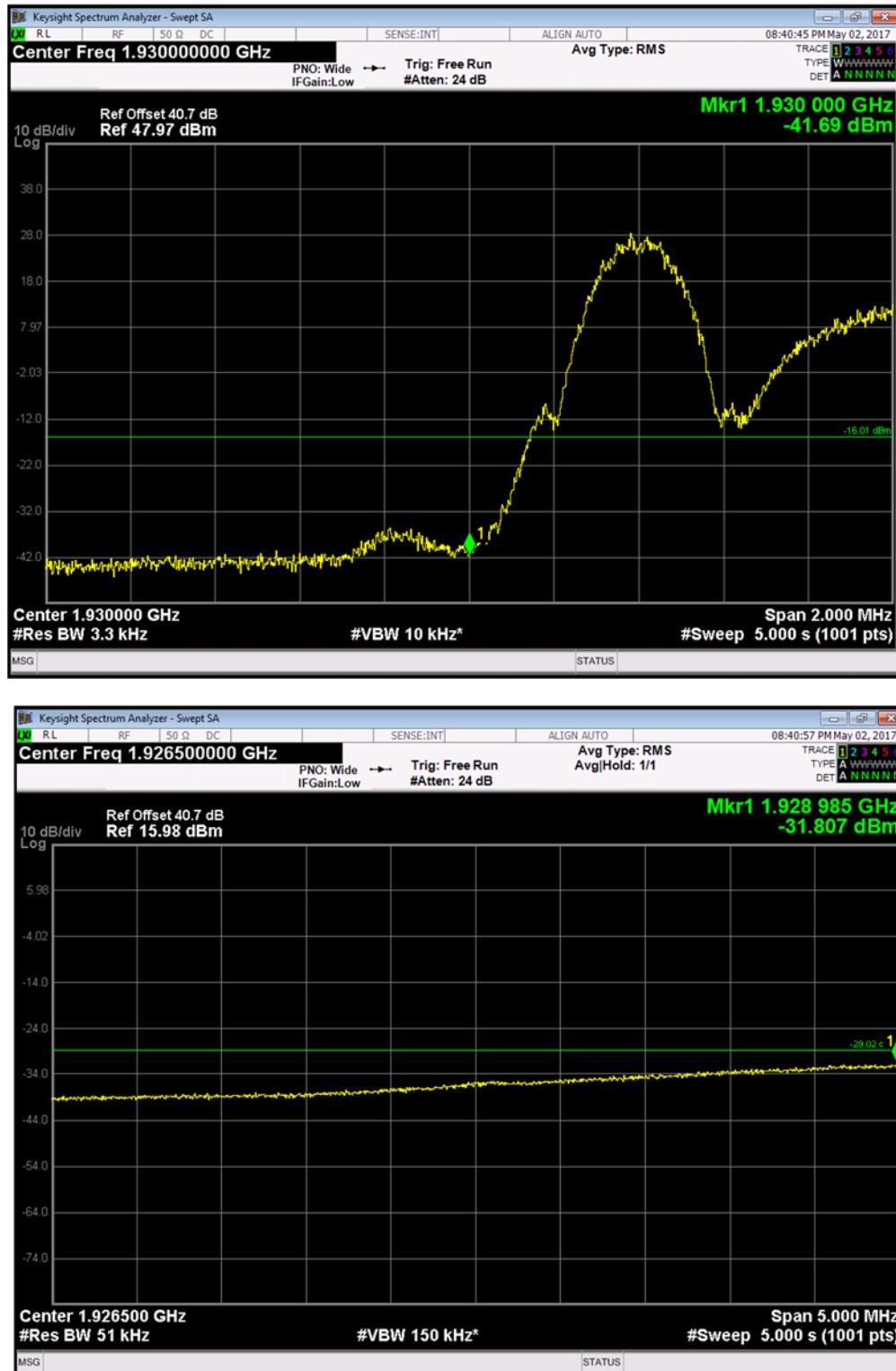
Product Service

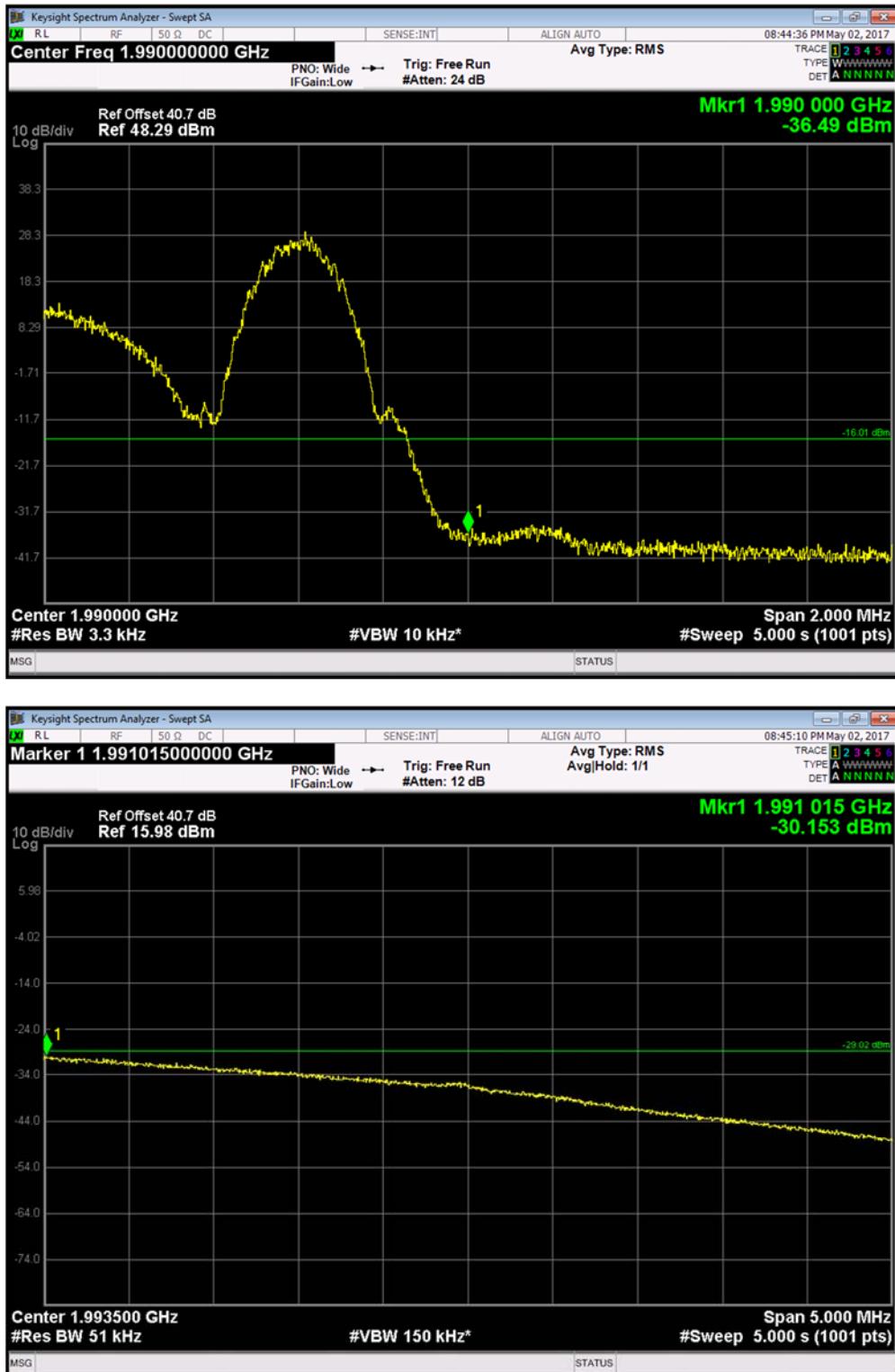
Configuration G+W-MIMO-MC 1 (1G+1W)

Maximum Output Power 48.5dBm per port

Band Edge Frequency	Channel Bandwidth	Edge Test with modulation (G) GMSK + (W) 16QAM Channel Frequencies	RBW (kHz)	Limit (dBm)
Channel Position B_{RFBW} 1930.0 MHz	G: 250 kHz W: 5.0 MHz	(G) 1930.4MHz + (W) 1933.0MHz	3.3	-16.01
Channel Position T_{RFBW} 1990.0 MHz	G: 250 kHz W: 5.0 MHz	(W) 1987.0MHz + (G) 1989.6MHz	3.3	-16.01

Note: For MIMO mode configurations, the limit was adjusted with a correction of -3.01dB [10Log(2)] to -13dBm.

Channel Position B_{RFBW} - GSM GMSK / WCDMA 16QAM: Bandwidth 5.0 MHz


Channel Position T_{RFBW} - GSM GMSK / WCDMA 16QAM: Bandwidth 5.0 MHz




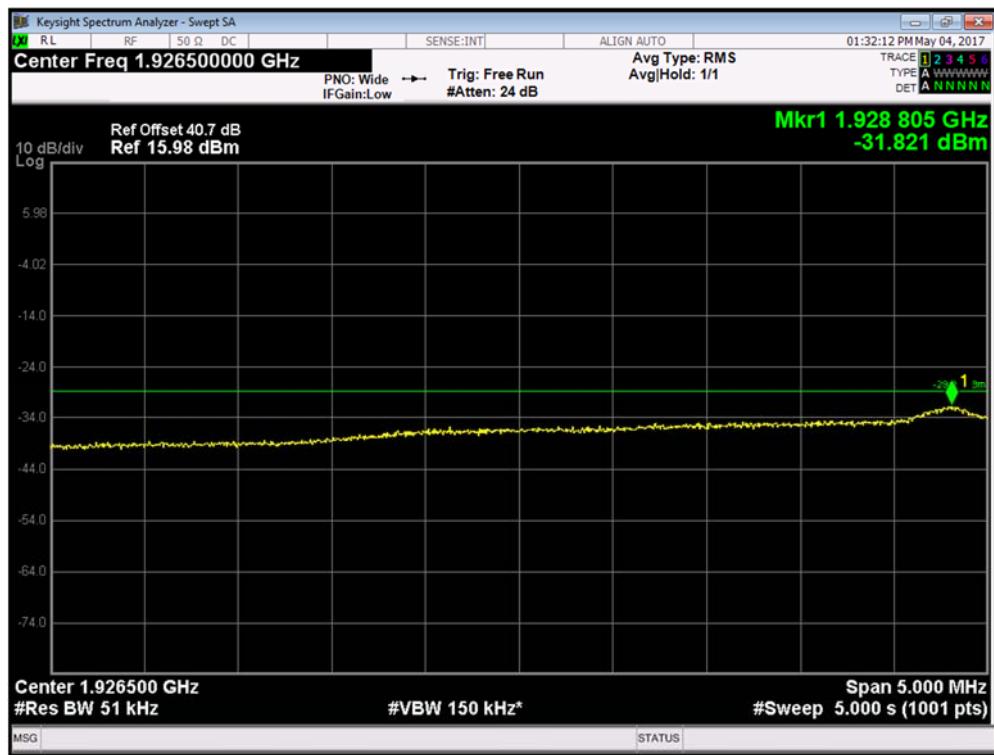
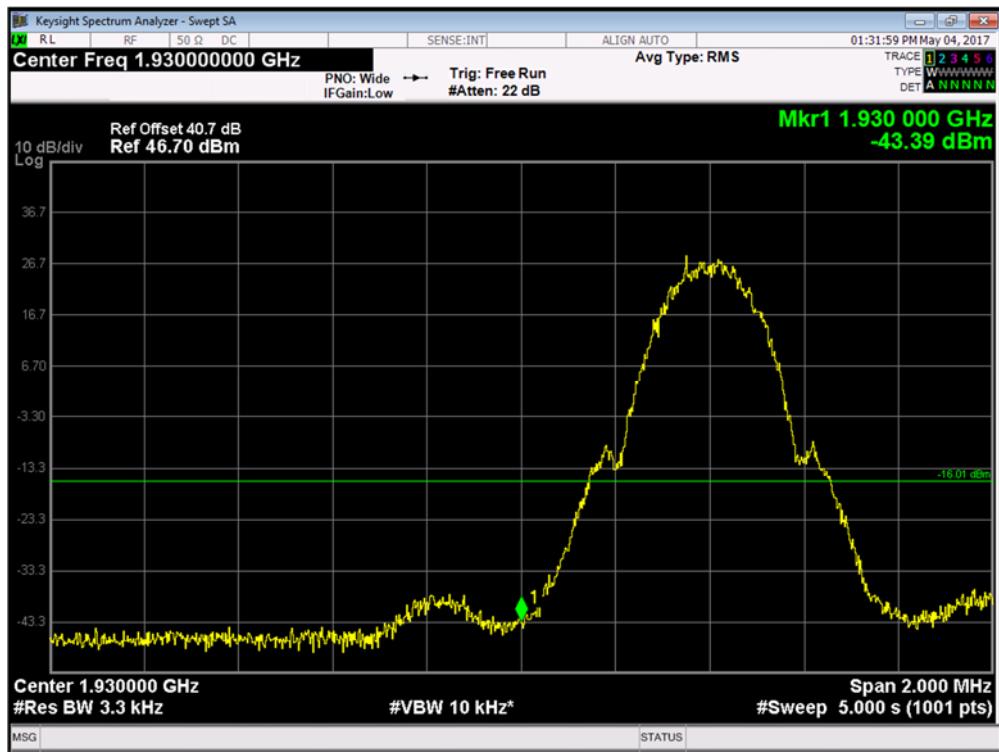
Product Service

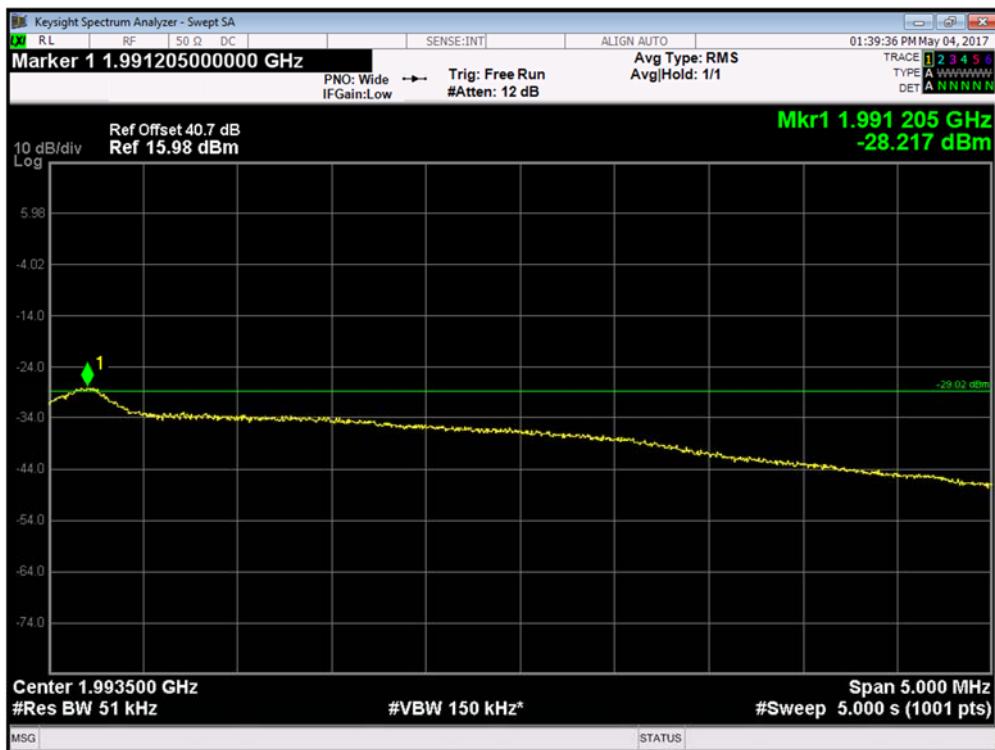
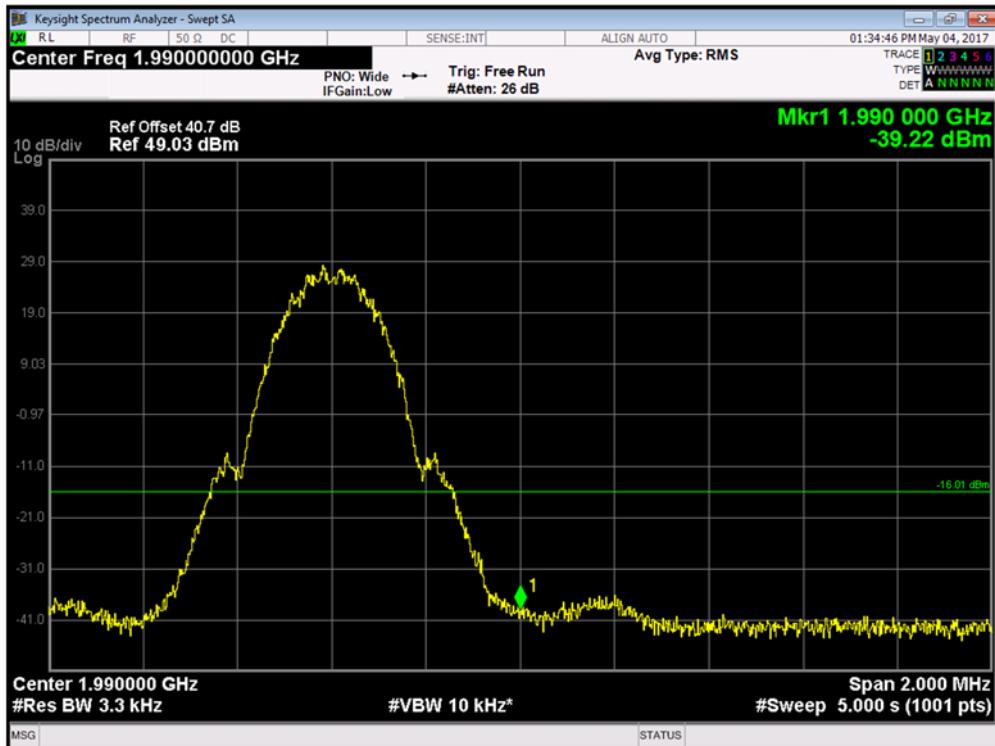
Configuration G+W-MIMO-MC 3 (2G+1W)

Maximum Output Power 49.0dBm per port

Band Edge Frequency	Channel Bandwidth	Edge Test with modulation (G) GMSK + (W) 16QAM Channel Frequencies	RBW (kHz)	Limit (dBm)
Channel Position B_{RFBW} 1930.0 MHz	G: 250 kHz W: 5.0 MHz	(G) 1930.4MHz + (G) 1932.0MHz + (W) 1934.8MHz	3.3	-16.01
Channel Position T_{RFBW} 1990.0 MHz	G: 250 kHz W: 5.0 MHz	(W) 1985.2MHz + (G) 1988.0MHz + (G) 1989.6MHz	3.3	-16.01

Note: For MIMO mode configurations, the limit was adjusted with a correction of -3.01dB [10Log(2)] to -13dBm.

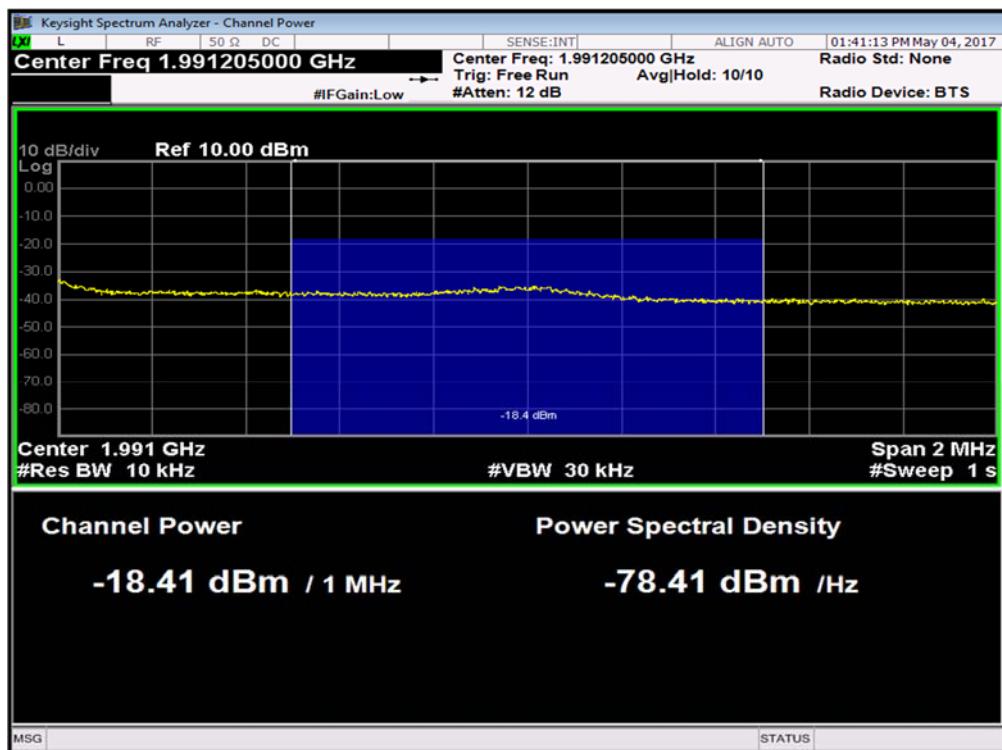
Channel Position B_{RFBW} - GSM GMSK / WCDMA 16QAM: Bandwidth 5.0 MHz


Channel Position T_{RFBW} - GSM GMSK / WCDMA 16QAM: Bandwidth 5.0 MHz




Product Service

The channel power of 1MHz for 1991.205MHz is -18.41dBm, which is within the limit of -16.01dBm.





Product Service

Configuration G+L-MIMO-MC 1 (1G+1L)

Maximum Output Power 49.0dBm per port

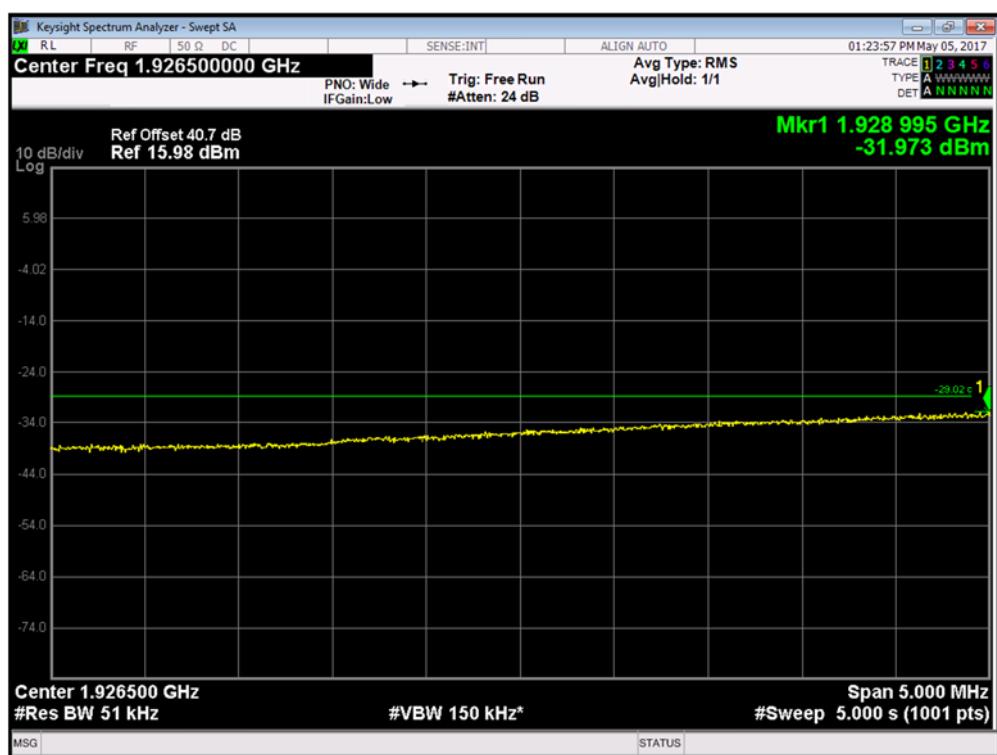
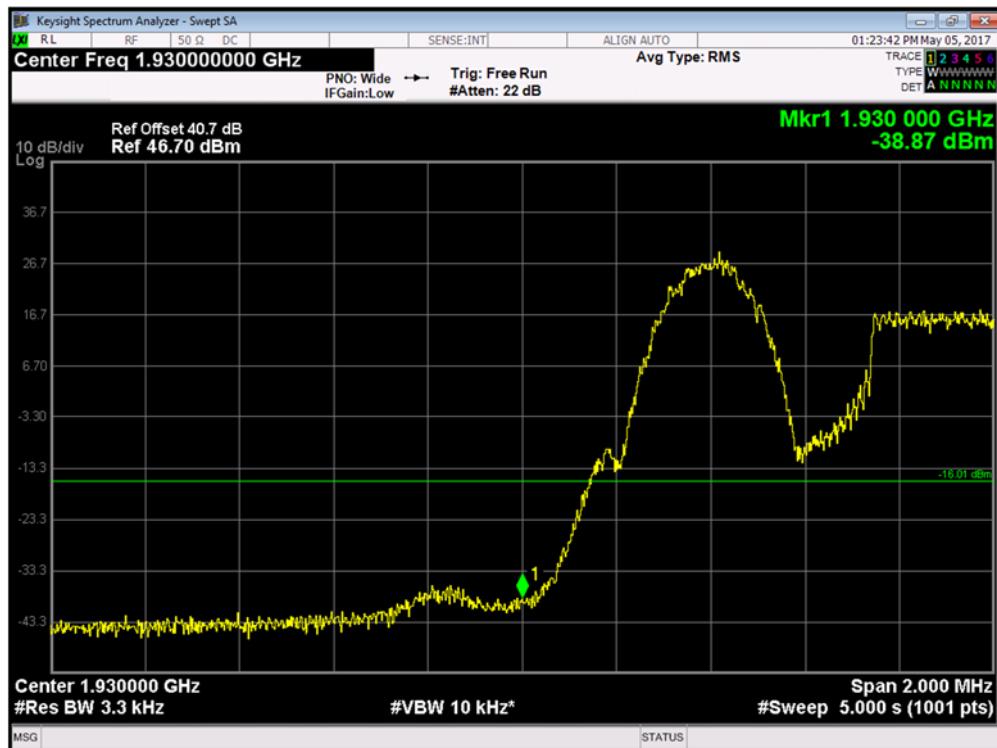
Band Edge Frequency	Channel Bandwidth	Edge Test with modulation (G) GMSK + (L) QPSK Channel Frequencies	RBW (kHz)	Limit (dBm)
Channel Position B_{RFBW} 1930.0 MHz	G: 250 kHz L: 5.0 MHz	(G) 1930.4MHz + (L) 1933.0MHz	3.3	-16.01
Channel Position T_{RFBW} 1990.0 MHz	G: 250 kHz L: 5.0 MHz	(L) 1987.0MHz + (G) 1989.6MHz	3.3	-16.01

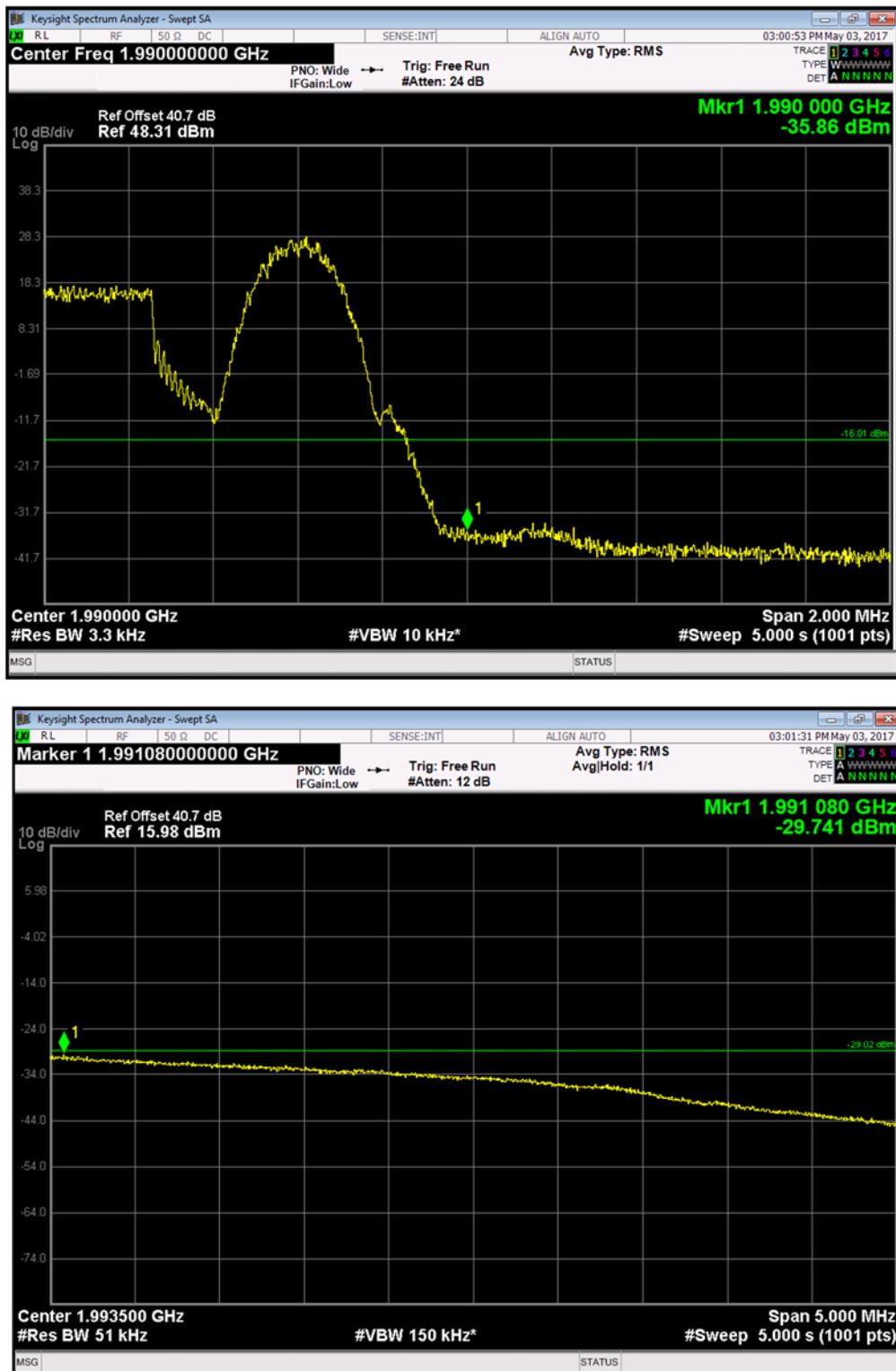
Note: For MIMO mode configurations, the limit was adjusted with a correction of -3.01dB [10Log(2)] to -13dBm.



Product Service

Channel Position B_{RFBW} - GSM GMSK / LTE QPSK: Bandwidth 5.0 MHz



Channel Position T_{RFBW} - GSM GMSK / LTE QPSK: Bandwidth 5.0 MHz




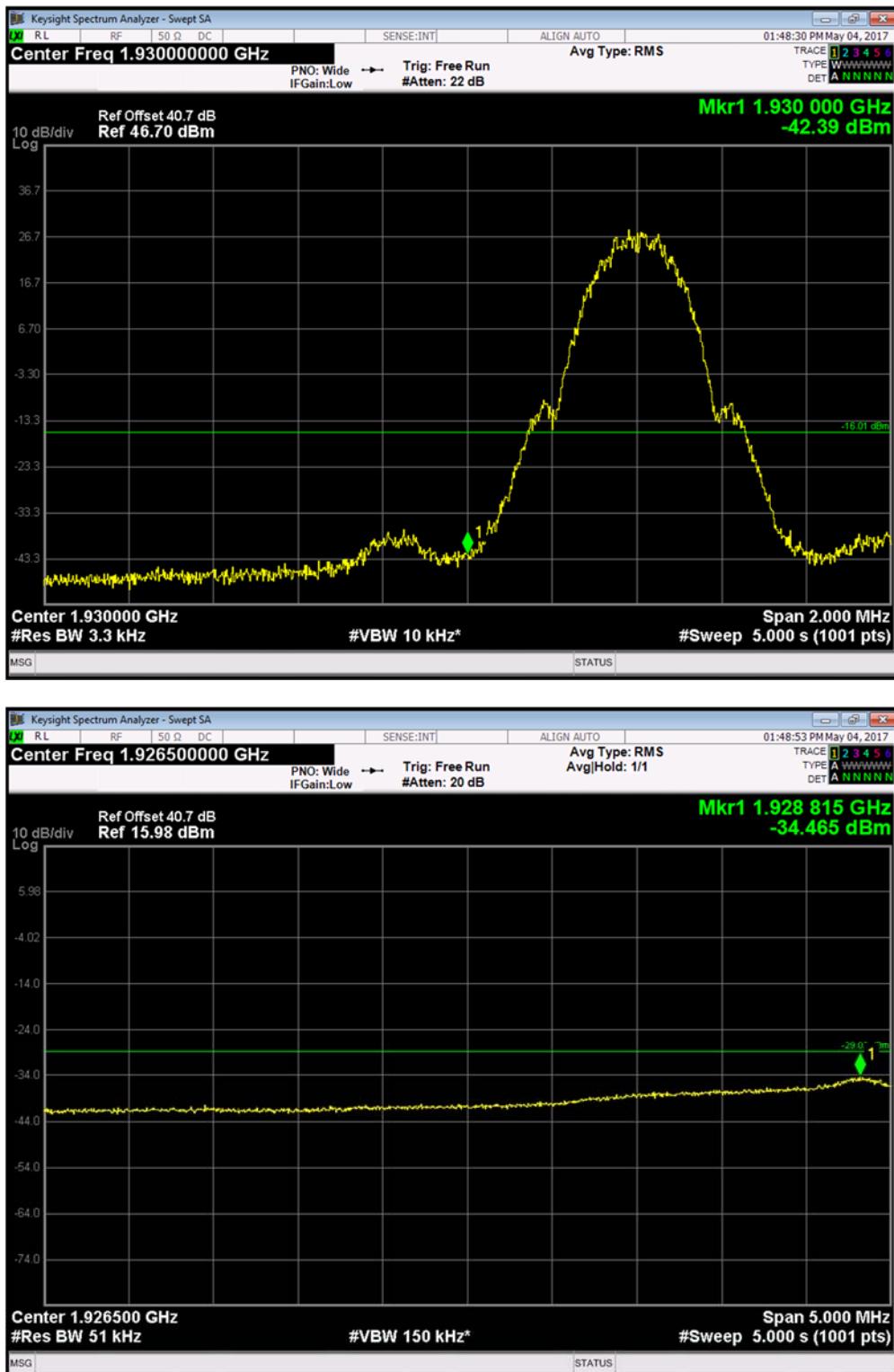
Product Service

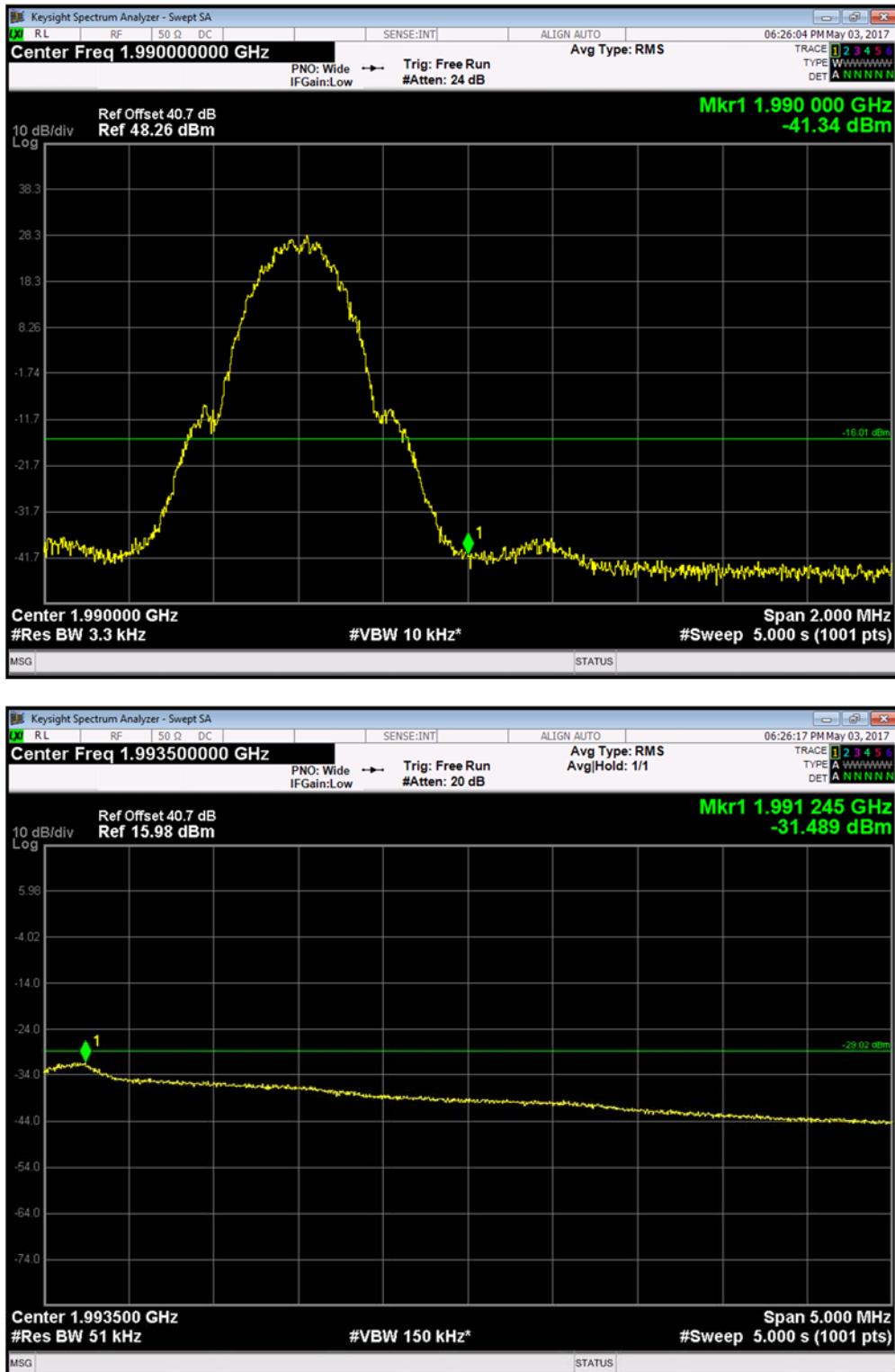
Configuration G+L-MIMO-MC 4 (2G+1L)

Maximum Output Power 47.8dBm per port

Band Edge Frequency	Channel Bandwidth	Edge Test with modulation (G) GMSK + (L) QPSK Channel Frequencies	RBW (kHz)	Limit (dBm)
Channel Position B_{RFBW} 1930.0 MHz	G: 250 kHz L: 3.0 MHz	(G) 1930.4MHz + (G) 1932.0MHz + (L) 1933.7MHz	3.3	-16.01
Channel Position T_{RFBW} 1990.0 MHz	G: 250 kHz L: 3.0 MHz	(L) 1986.3MHz + (G) 1988.0MHz + (G) 1989.6MHz	3.3	-16.01

Note: For MIMO mode configurations, the limit was adjusted with a correction of -3.01dB [10Log(2)] to -13dBm.

Channel Position B_{RFBW} - GSM GMSK / LTE QPSK: Bandwidth 3.0 MHz


Channel Position T_{RFBW} - GSM GMSK / LTE QPSK: Bandwidth 3.0 MHz




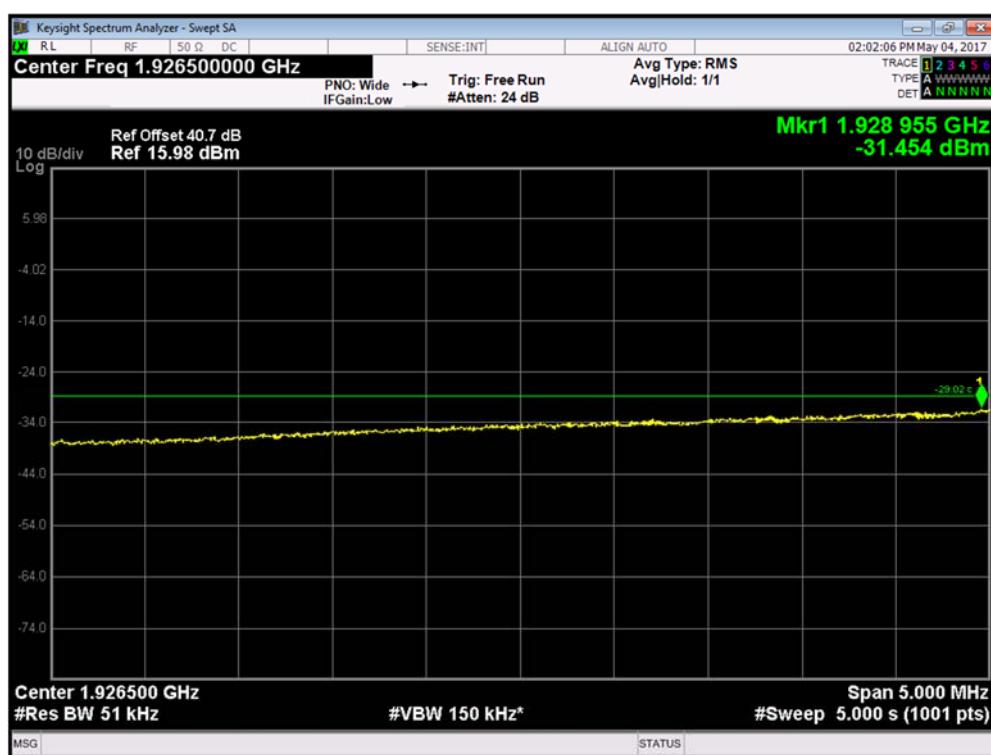
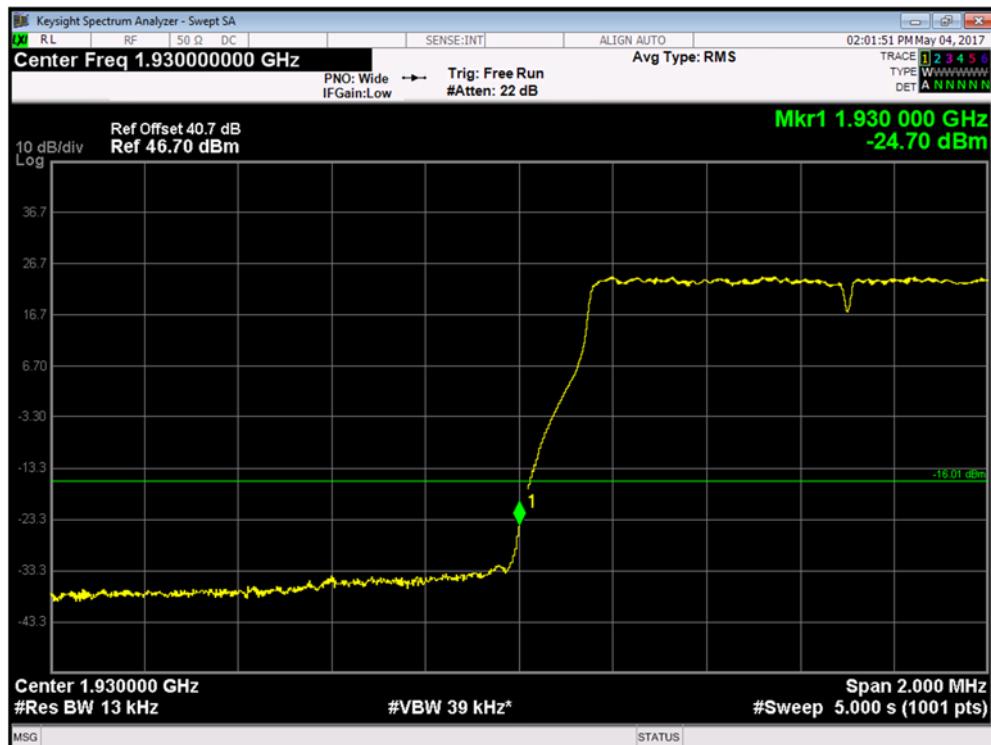
Product Service

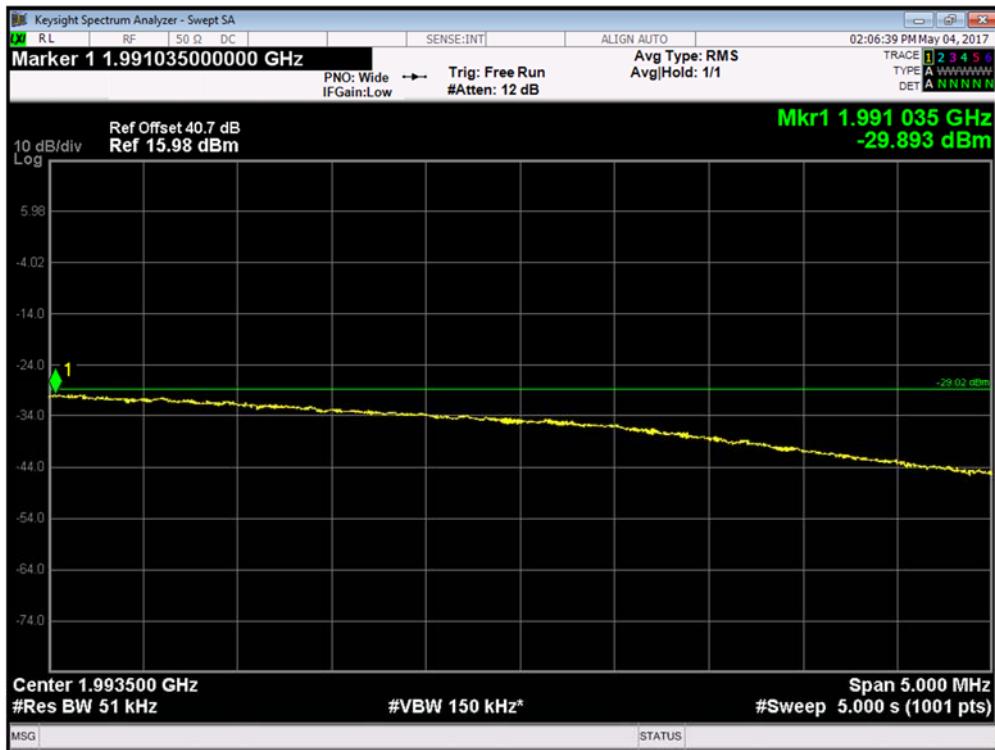
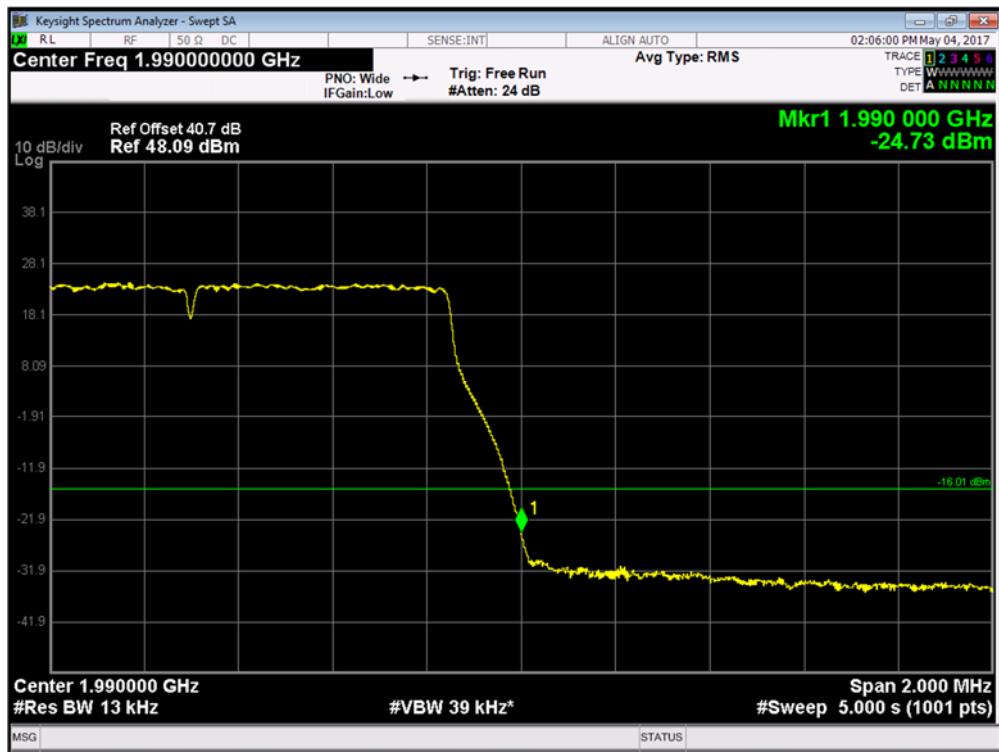
Configuration W+L-MIMO-MC 1 (1W+1L)

Maximum Output Power 48.5dBm per port

Band Edge Frequency	Channel Bandwidth	Edge Test with modulation (W)16QAM + (L) QPSK Channel Frequencies	RBW (kHz)	Limit (dBm)
Channel Position B_{RFBW} 1930.0 MHz	W: 5.0 MHz L: 1.4 MHz	(L) 1930.7MHz + (W) 1934.0MHz	13	-16.0
Channel Position T_{RFBW} 1990.0 MHz	W: 5.0 MHz L: 1.4 MHz	(W) 1986.0MHz + (L) 1989.3MHz	13	-16.0

Note: For MIMO mode configurations, the limit was adjusted with a correction of -3.01dB [10Log(2)] to -13dBm.

Channel Position B_{RFBW} - WCDMA 16QAM / LTE QPSK: Bandwidth 1.4 MHz


Channel Position T_{RFBW} - WCDMA 16QAM / LTE QPSK: Bandwidth 1.4 MHz




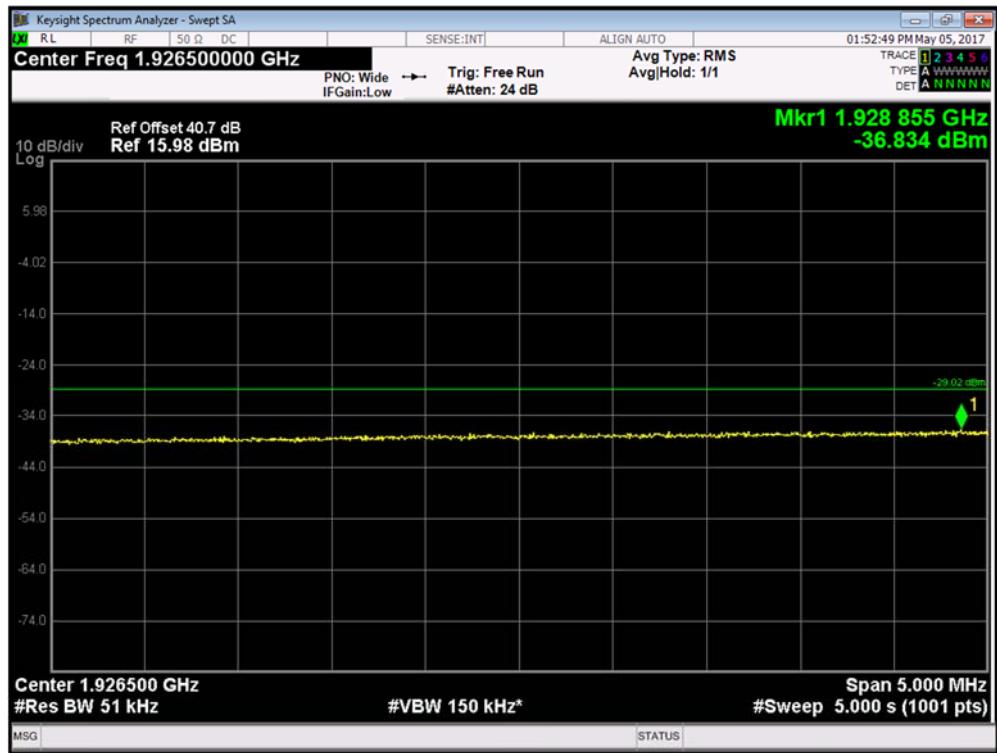
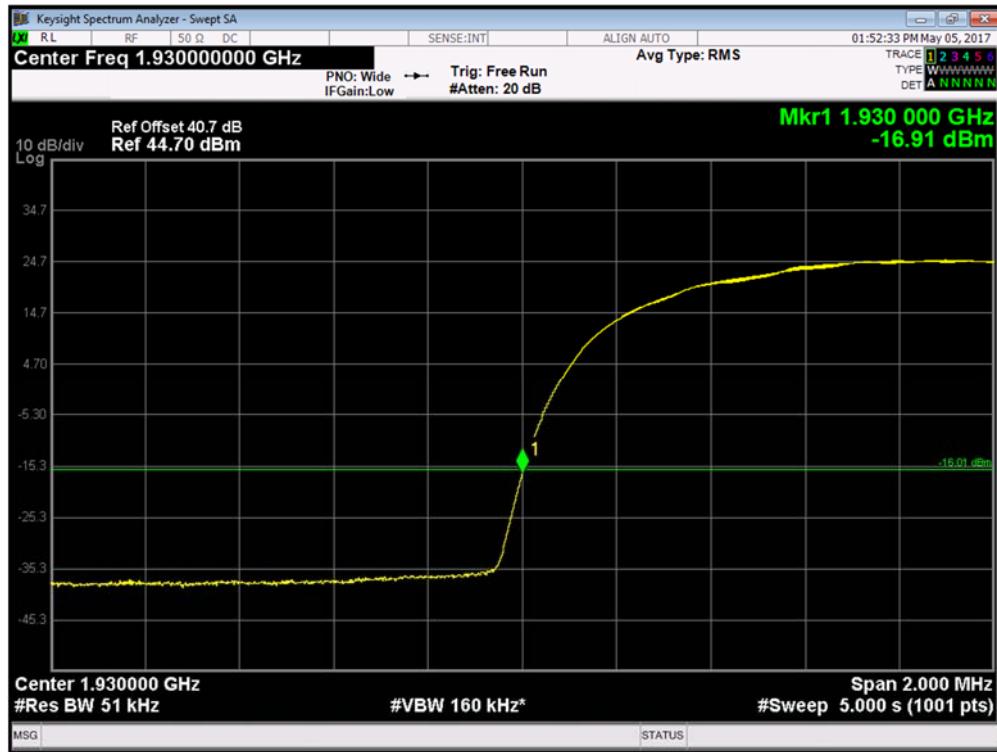
Product Service

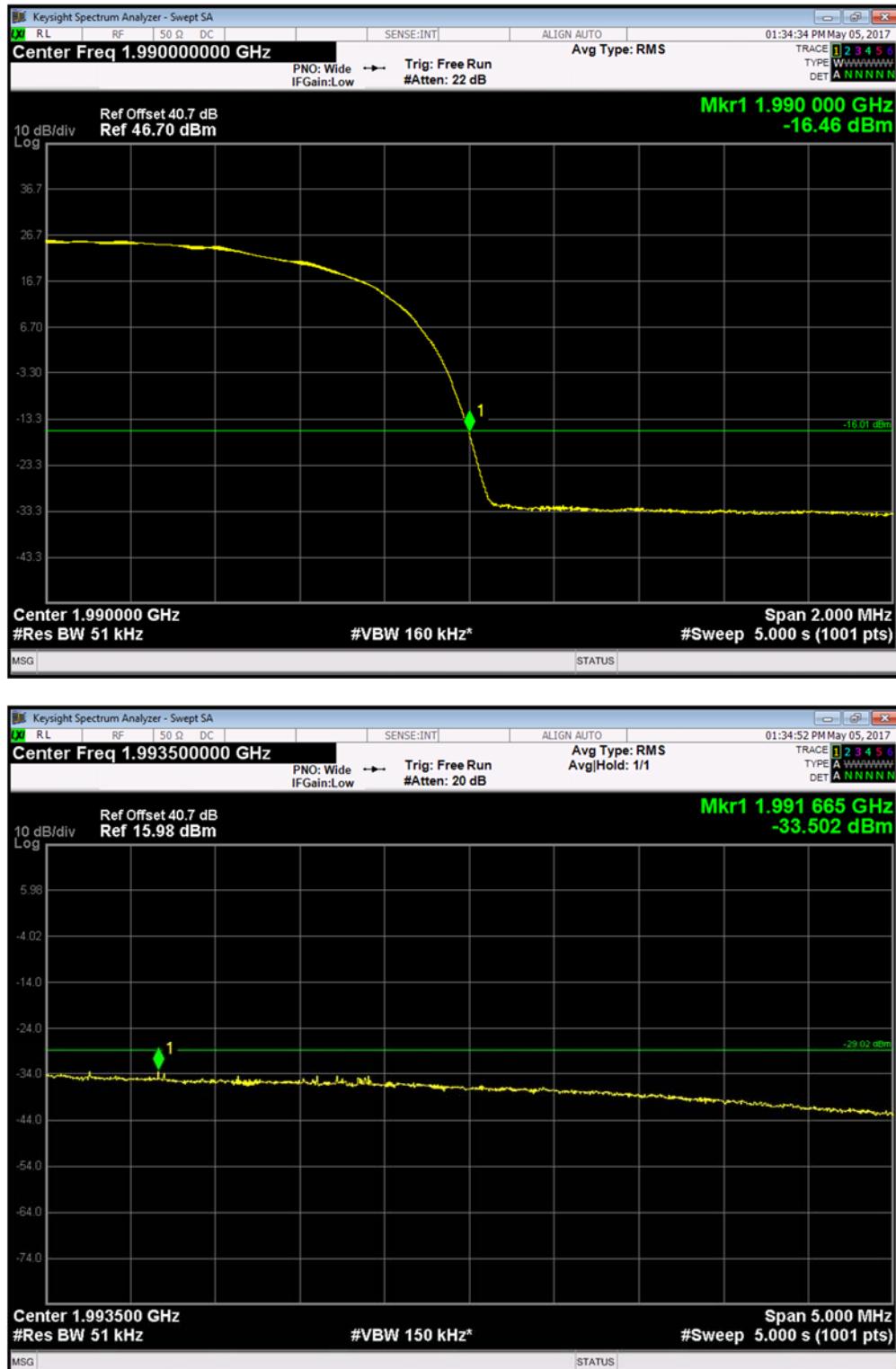
Configuration W+L-MIMO-MC 4 (2W+1L)

Maximum Output Power 49.0dBm per port

Band Edge Frequency	Channel Bandwidth	Edge Test with modulation (W) 16QAM + (L) QPSK Channel Frequencies	RBW (kHz)	Limit (dBm)
Channel Position B_{RFBW} 1930.0 MHz	W: 5.0 MHz L: 10.0 MHz	(W) 1932.4MHz + (W) 1937.4MHz + (L) 1945.0MHz	51	-16.01
Channel Position T_{RFBW} 1990.0 MHz	W: 5.0 MHz L: 10.0 MHz	(L) 1975.0MHz + (W) 1982.6MHz + (W) 1987.6MHz	51	-16.01

Note: For MIMO mode configurations, the limit was adjusted with a correction of -3.01dB [10Log(2)] to -13dBm.

Channel Position B_{RFBW} - WCDMA 16QAM / LTE QPSK: Bandwidth 10.0 MHz


Channel Position T_{RFBW} - WCDMA 16QAM / LTE QPSK: Bandwidth 10.0 MHz

Limit

The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least $43 + 10\log P$ dB.



Product Service

2.4 RADIATED SPURIOUS EMISSIONS

2.4.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1053
FCC CFR 47 Part 24, Clause 24.238 (a)
Industry Canada RSS-133, Clause 6.5

2.4.2 Equipment Under Test

Radio 2219 B2, KRC 161 627/1, S/N: D825544531

2.4.3 Date of Test and Modification State

26, 28 April and 02 May 2017 - Modification State 0

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Environmental Conditions

Ambient Temperature	21.5 - 22.1°C
Relative Humidity	22.0 - 39.0%

2.4.6 Test Method

The test was applied in accordance with test method requirements of FCC Part 24 and RSS-133 and ANSI/TIA-603-D:2010.

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 - $(43 + 10\log(P))$ dB

Where:

Field Strength is measured in dB μ V/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.



Product Service

Determination of Spurious Emission 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:

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

As per 24.238 (a) the spurious emission must be attenuated by $43 + 10\log(P_o)$ dB this gives:

$$43 + 10\log(16.56) = 55.19 \text{ dB}$$

Therefore the limit at 3m measurement distance is:

$$139.57 - 55.19 = 84.4 \text{ dB}\mu\text{V/m}$$

These limits have been used to determine Pass or Fail for the harmonics measured and detailed in the following results.

The results are shown in the plots below.



Product Service

2.4.7 Test Results

Note: Only the worst case results plots have been included as all of the emissions are greater than 20dB below the limit. A set of plots have been included to show the measurement system noise floor.

Configuration G-SC

Maximum Output Power 43.0dBm per port

Channel Position	Channel Frequencies
Channel Position M	1960.0MHz

Channel Position M – 8PSK

No emissions were detected within 20dB of the limit.

Configuration W-SC

Maximum Output Power 49.0dBm per port, WCDMA Bandwidth 5.0MHz

Channel Position	Channel Frequencies
Channel Position M	1960.0MHz

Channel Position M - QPSK

No emissions were detected within 20dB of the limit.

Configuration W-MIMO-SC

Maximum Output Power 47.0dBm per port, WCDMA Bandwidth 5.0MHz

Channel Position	Channel Frequencies
Channel Position M	1960.0MHz

Channel Position M - 16QAM

No emissions were detected within 20dB of the limit.



Product Service

Configuration L-MIMO-SC

Maximum Output Power 49.0dBm per port, LTE Bandwidth 5.0MHz

Channel Position	Channel Frequencies
Channel Position B	1932.5MHz
Channel Position M	1960.0MHz
Channel Position T	1987.5MHz

Channel Position B - QPSK

No emissions were detected within 20dB of the limit.

Channel Position M – QPSK/16QAM/64QAM/256QAM

No emissions were detected within 20dB of the limit.

Channel Position T - QPSK

No emissions were detected within 20dB of the limit.

Configuration L-MIMO-MC 2 (3C)

Maximum Output Power 49.0dBm per port, LTE Bandwidth 5.0MHz

Channel Position	Channel Frequencies
Channel Position M _{RFBW}	1942.5MHz + 1972.5MHz + 1977.5MHz

Channel Position M_{RFBW} - QPSK

No emissions were detected within 20dB of the limit.

Configuration G+W-MIMO-MC 1 (1G+1W)

Maximum Output Power 48.5dBm per port, WCDMA Bandwidth 5.0MHz

Channel Position	Channel Frequencies
Channel Position M _{RFBW}	(G) 1940.2MHz + (W) 1977.6MHz

Channel Position M_{RFBW} – GSM GMSK / WCDMA 16QAM

No emissions were detected within 20dB of the limit.



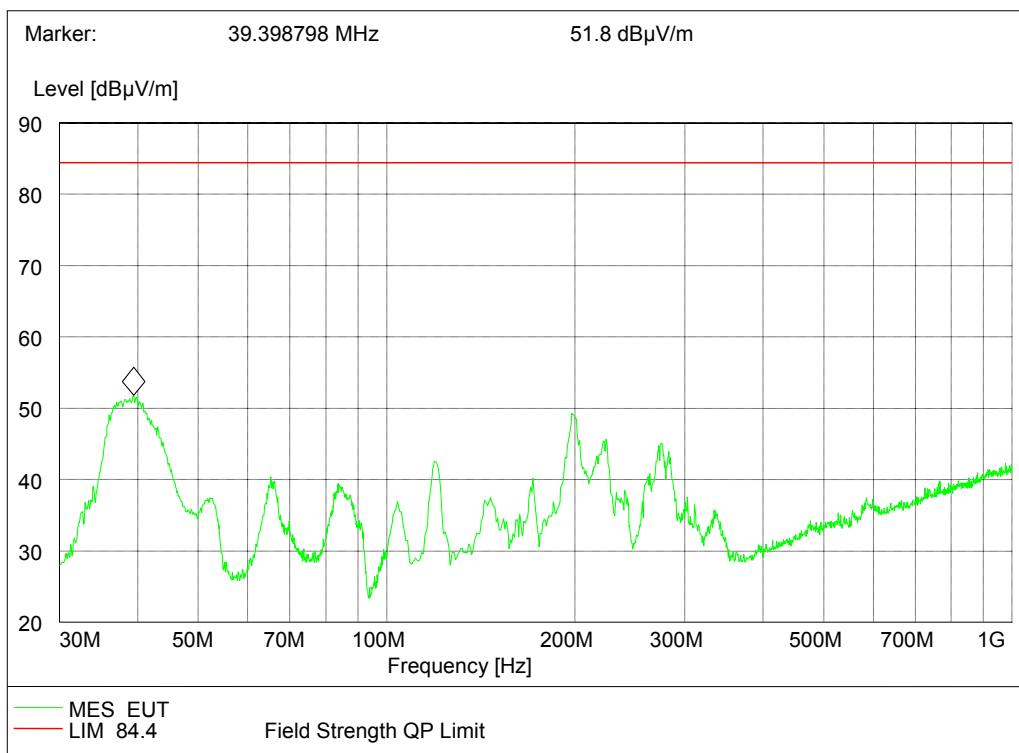
Product Service

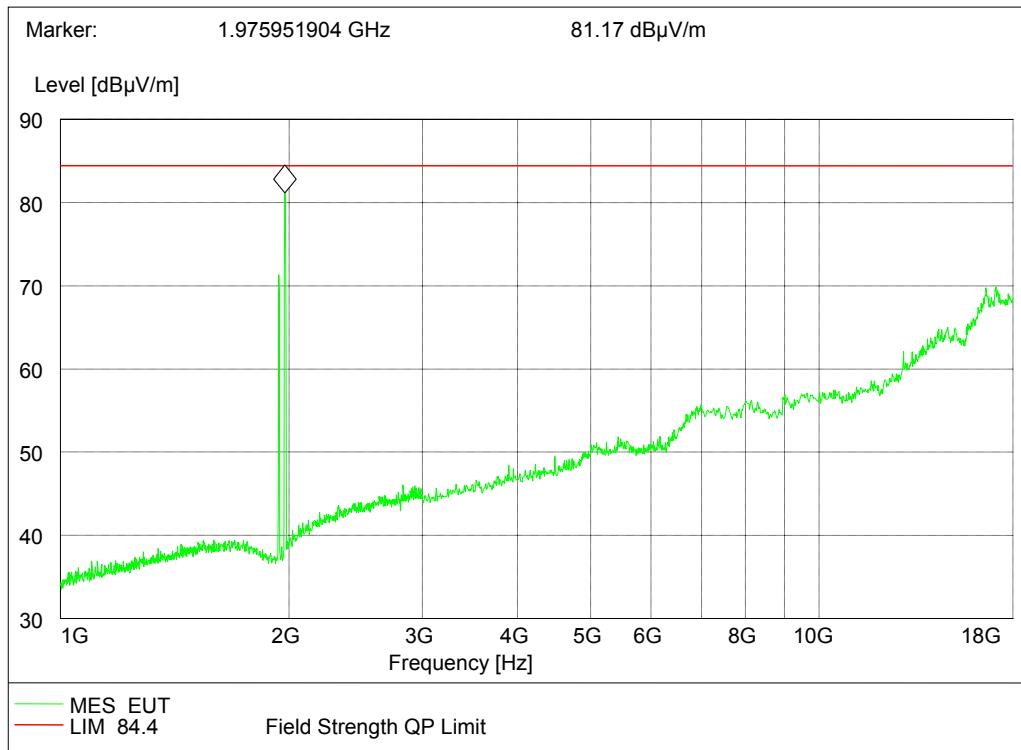
Configuration G+L-MIMO-MC 1 (1G+1L)

Maximum Output Power 49.0dBm per port, LTE Bandwidth 5.0MHz

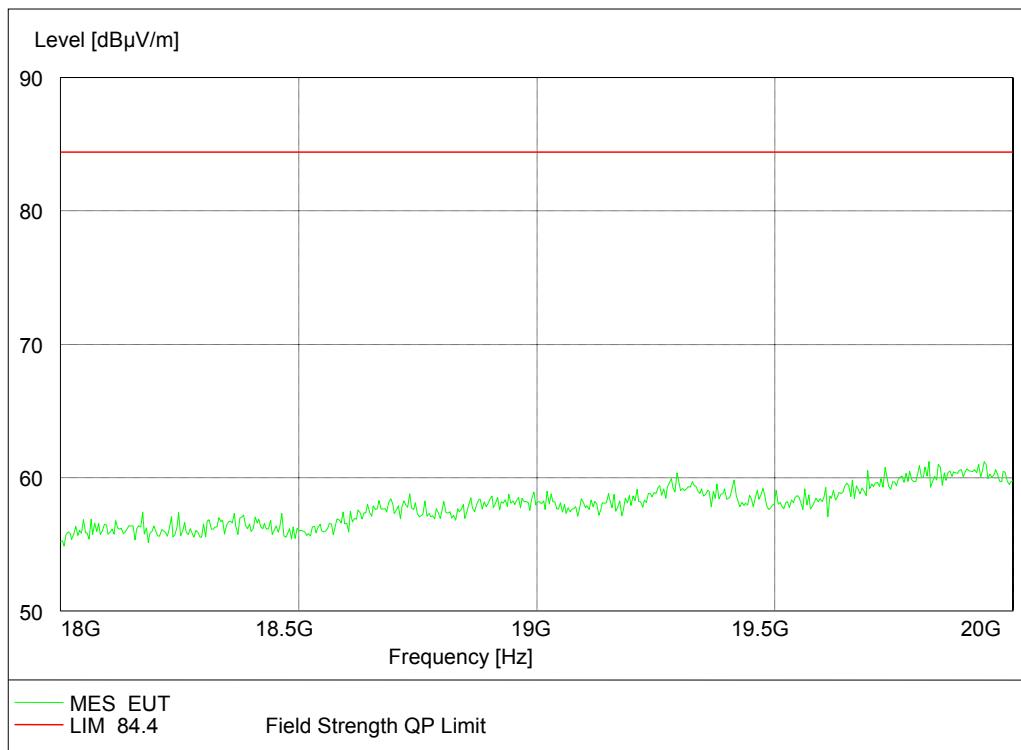
Channel Position	Channel Frequencies
Channel Position M_{RFBW}	(G) 1940.2MHz + (L) 1977.5MHz

Channel Position M_{RFBW} – GSM GMSK / LTE QPSK 5.0MHz - 30MHz - 1GHz



Channel Position M_{RFBW} – GSM GMSK / LTE QPSK 5.0MHz - 1GHz - 18GHz


Note: The emission close to the limit is the operating frequency.

Channel Position M_{RFBW} – GSM GMSK / LTE QPSK 5.0MHz - 18GHz - 20GHz




Product Service

Configuration W+L-MIMO-MC 2 (3W+3L)

Maximum Output Power 49.0dBm per port, WCDMA Bandwidth 5.0MHz, LTE Bandwidth 1.4MHz

Channel Position	Channel Frequencies
Channel Position M _{RFBW}	(W) 1942.4MHz + (W) 1947.4MHz + (W) 1952.4MHz + (L) 1976.5MHz + (L) 1977.9MHz + (L) 1979.3MHz

Channel Position M_{RFBW} – WCDMA 16QAM / LTE QPSK

No emissions were detected within 20dB of the limit.

Limit	-13dBm / 84.4dB μ V/m.
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Remarks

The EUT does not exceed -13dBm / 84.4dB μ V/m at the measured frequencies.



Product Service

2.5 CONDUCTED SPURIOUS EMISSIONS

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1051
FCC CFR 47 Part 24, Clause 24.238 (a)
Industry Canada RSS-133, Clause 6.5

2.5.2 Equipment Under Test

Radio 2219 B2, KRC 161 627/1, S/N: D825490218

2.5.3 Date of Test and Modification State

26 April to 04 May 2017 - Modification State 0

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Environmental Conditions

Ambient Temperature	21.5 - 22.3°C
Relative Humidity	22.0 - 38.0%

2.5.6 Test Method

The test was applied in accordance with test method requirements of FCC Part 24 and RSS-133.

In accordance with FCC CFR 47 Part 24, Clause 24.238 (a), any emissions outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB, and the measurement should be performed with a resolution bandwidth of 1MHz.

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 20GHz. The resolution bandwidth of 1MHz was employed for frequency band 9kHz to 20GHz. The spectrum analyzer detector was set to RMS.

For MIMO mode configurations, the limit was adjusted with a correction of -3.01dB [10Log2] by using the Measure and Add 10Log(N) dB technique according to FCC KDB 662911 D01 Multiple Transmitter Output v02r01 accounting for simultaneous transmission from antenna ports RF A and RF B. Then the limit was adjust to -16.01dBm.

The measurements were performed on the output connector RF A. Limited complementary measurement were done at output connector RF B to verify identical performance for both transmitter chains in MIMO mode.

The maximum path loss across the measurement band was used as the reference level offset to ensure worst case.

The worst results are shown in the plots below.



Product Service

2.5.7 Test Results

Remark:

The emissions at 9kHz on the plots was not generated by the test object.

Configuration G-SC

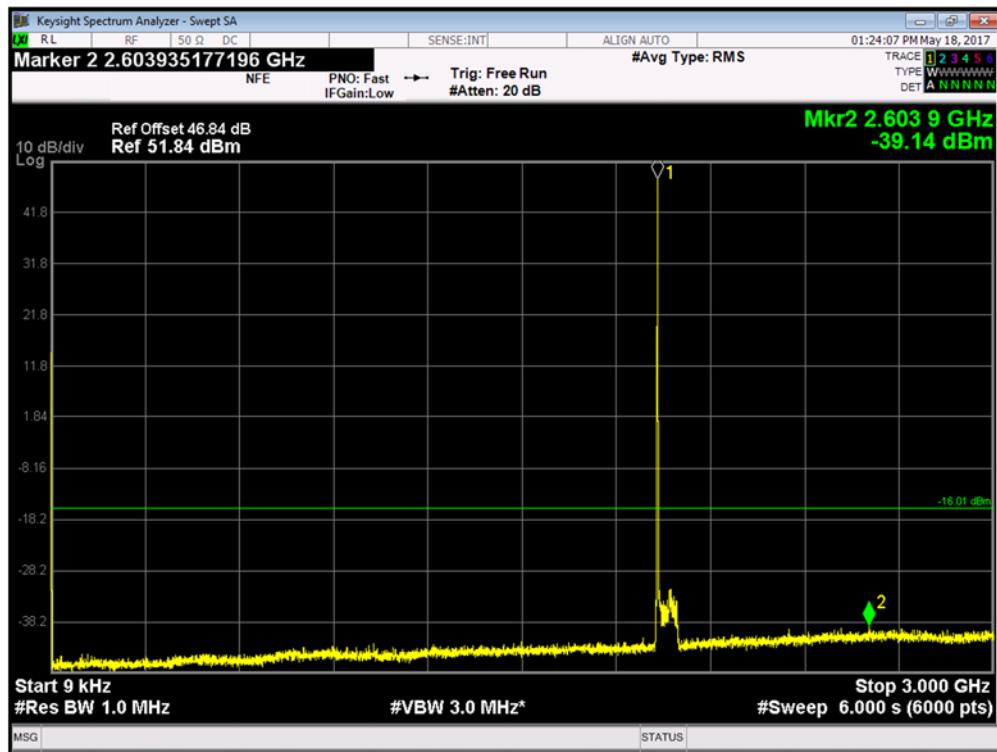
Maximum Output Power 43.0dBm per port

Channel Position	Bandwidth	Channel Frequency
Channel Position B	250 kHz	1930.4MHz
Channel Position M	250 kHz	1960.0MHz
Channel Position T	250 kHz	1989.6MHz

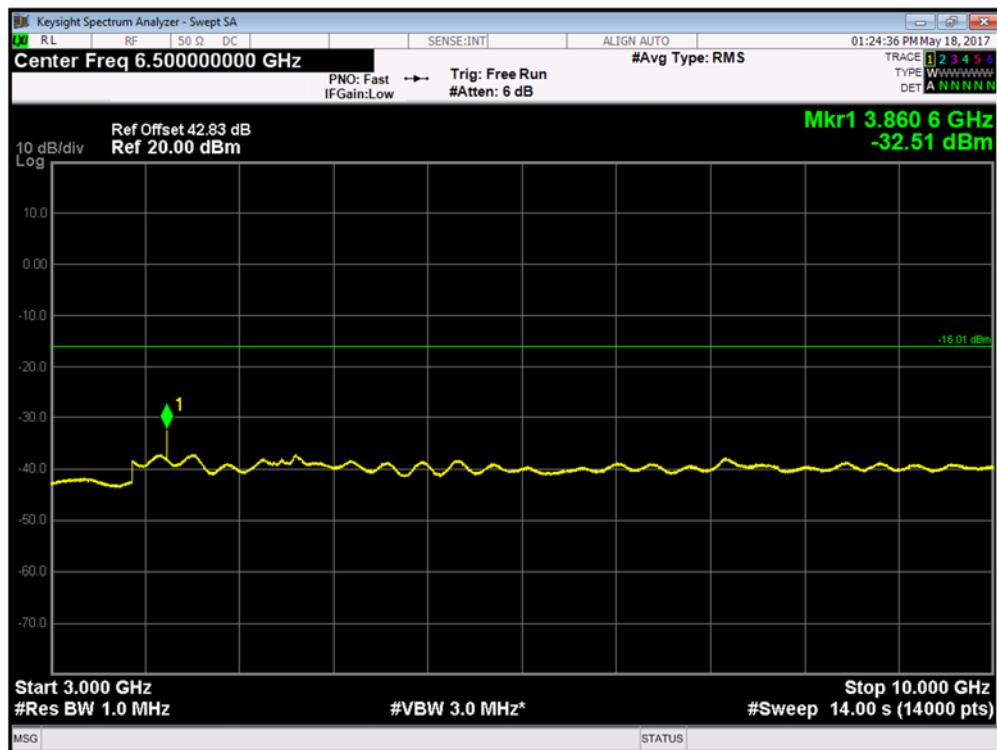


Product Service

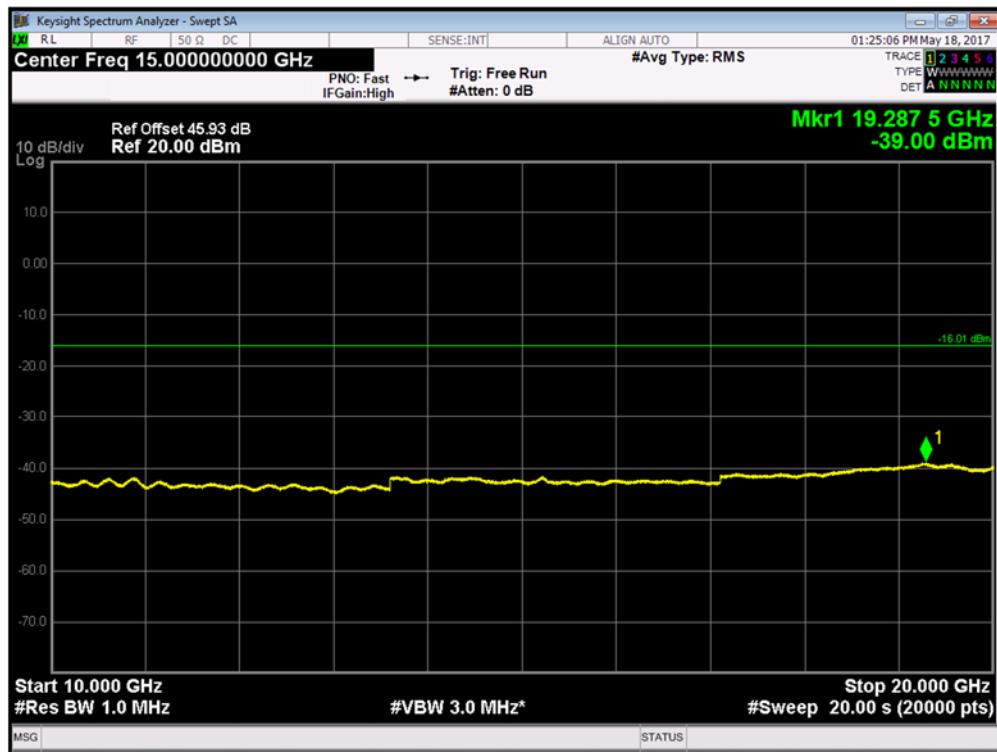
Channel Position B - GMSK - 9kHz - 3GHz



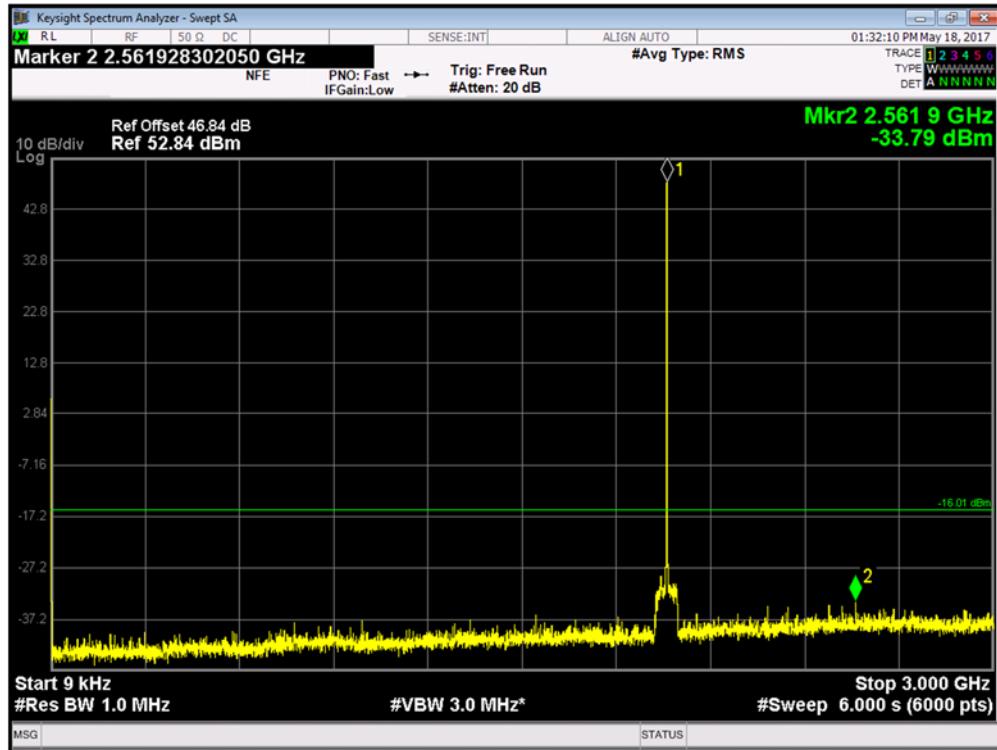
Channel Position B - GMSK - 3GHz - 10GHz

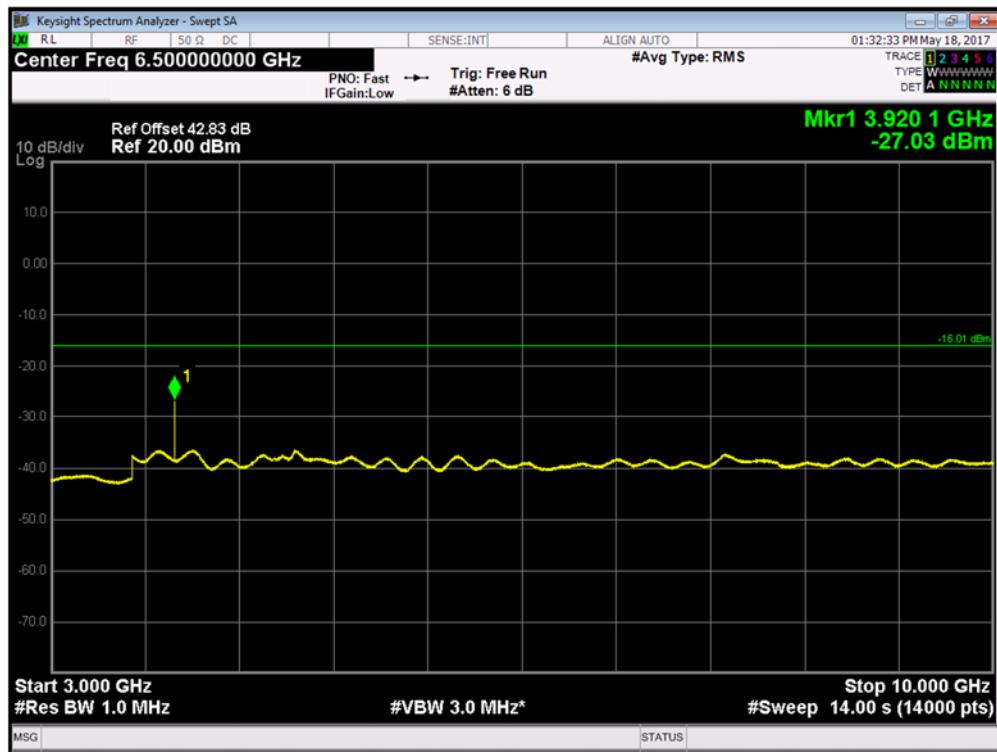
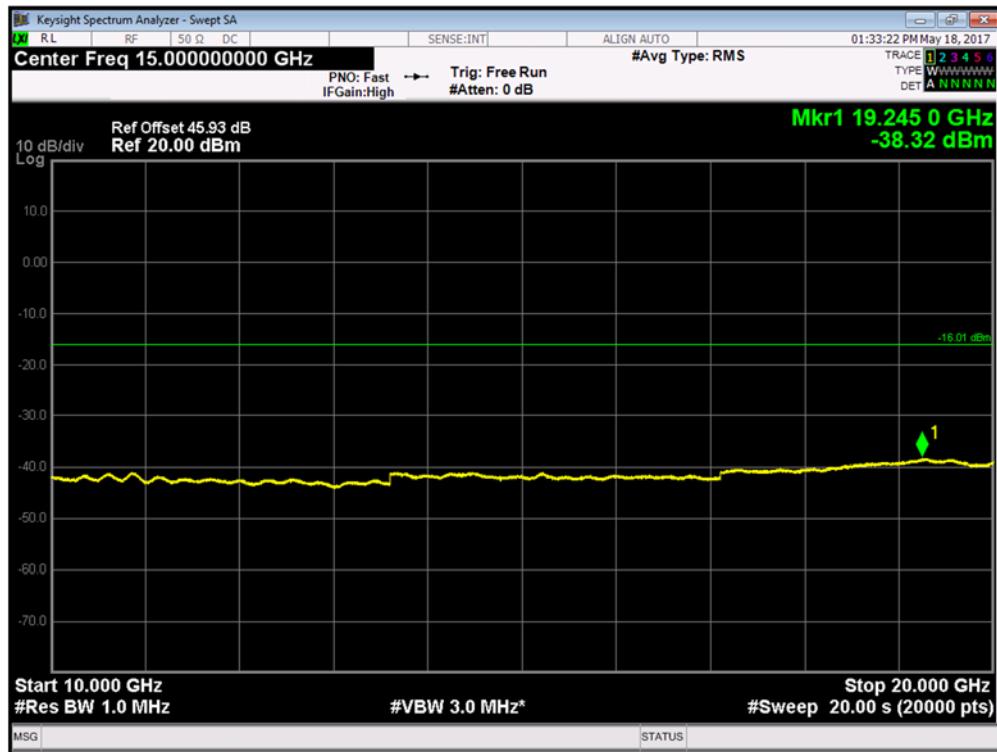


Channel Position B - GMSK - 10GHz - 20GHz

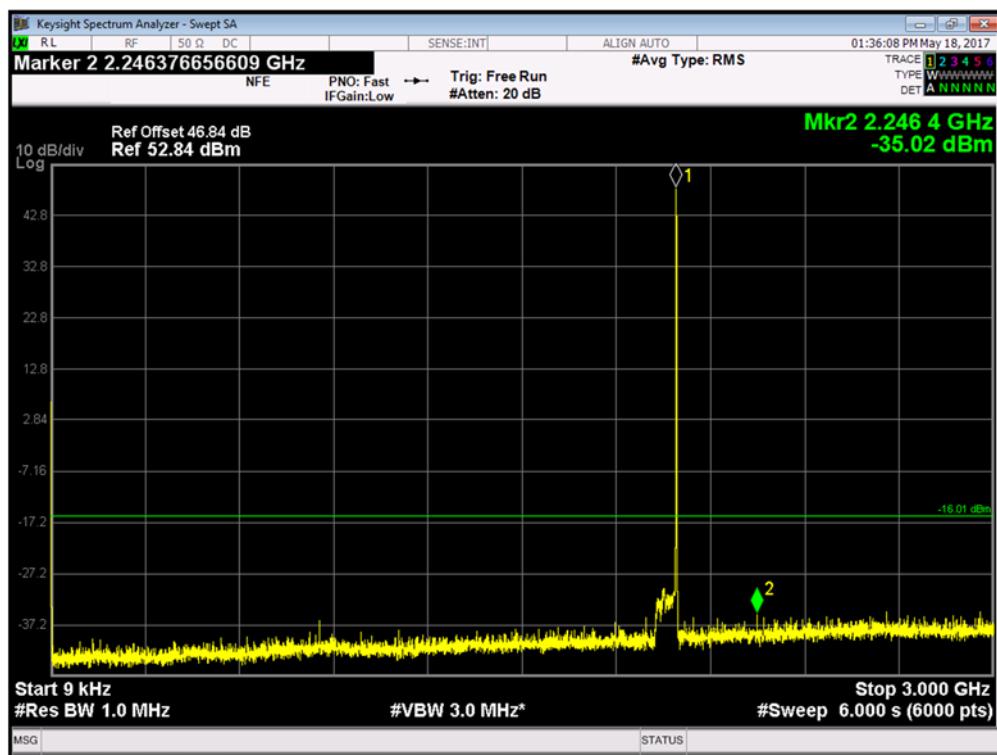


Channel Position M - GMSK - 9kHz - 3GHz

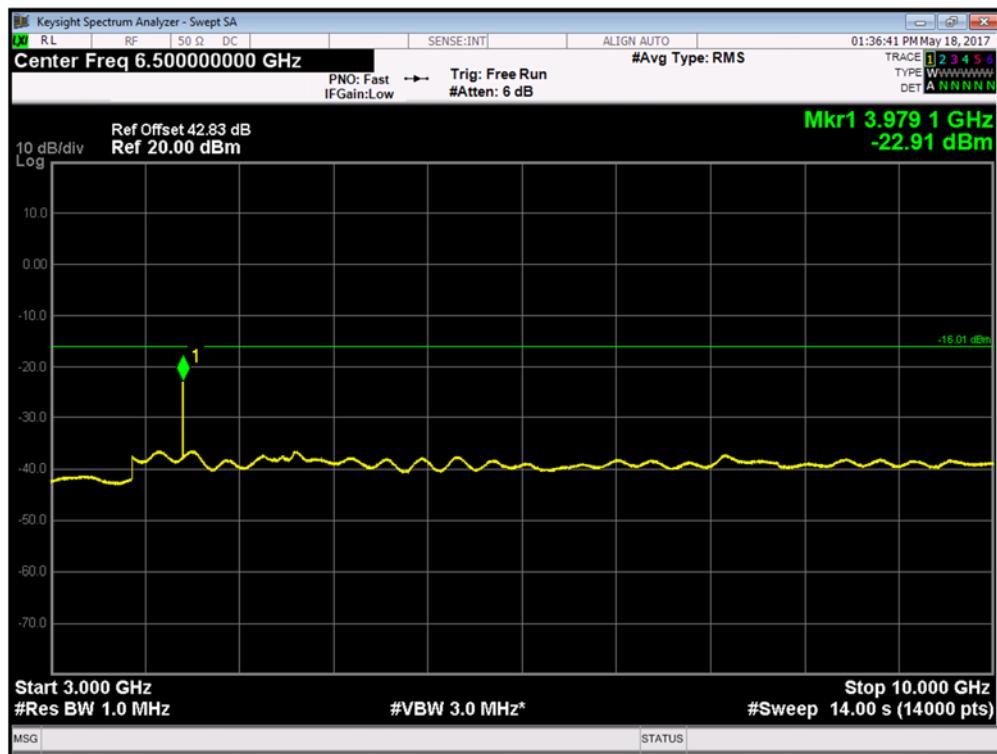


Channel Position M - GMSK - 3GHz - 10GHz

Channel Position M - GMSK - 10GHz - 20GHz


Channel Position T - GMSK - 9kHz - 3GHz



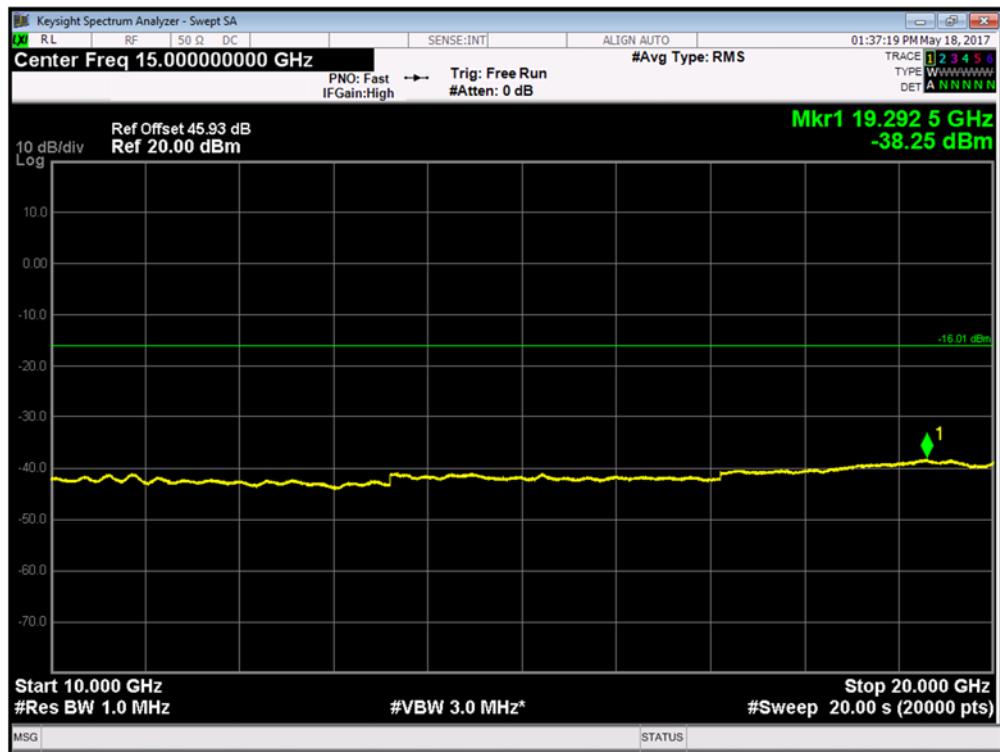
Channel Position T - GMSK - 3GHz - 10GHz





Product Service

Channel Position T - GMSK - 10GHz - 20GHz



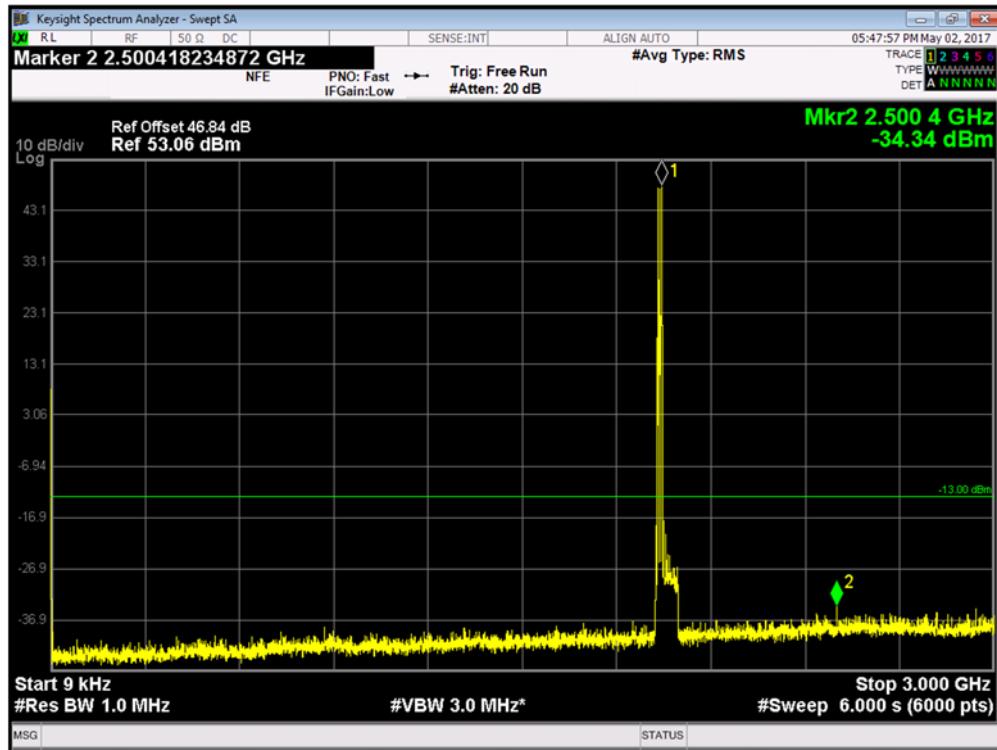
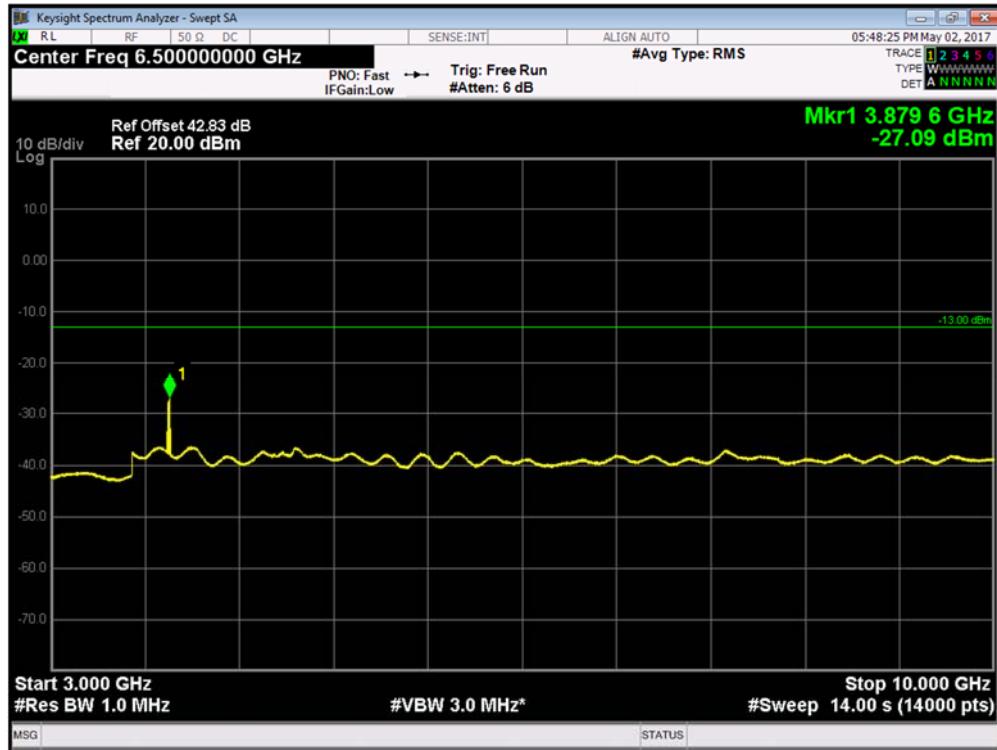


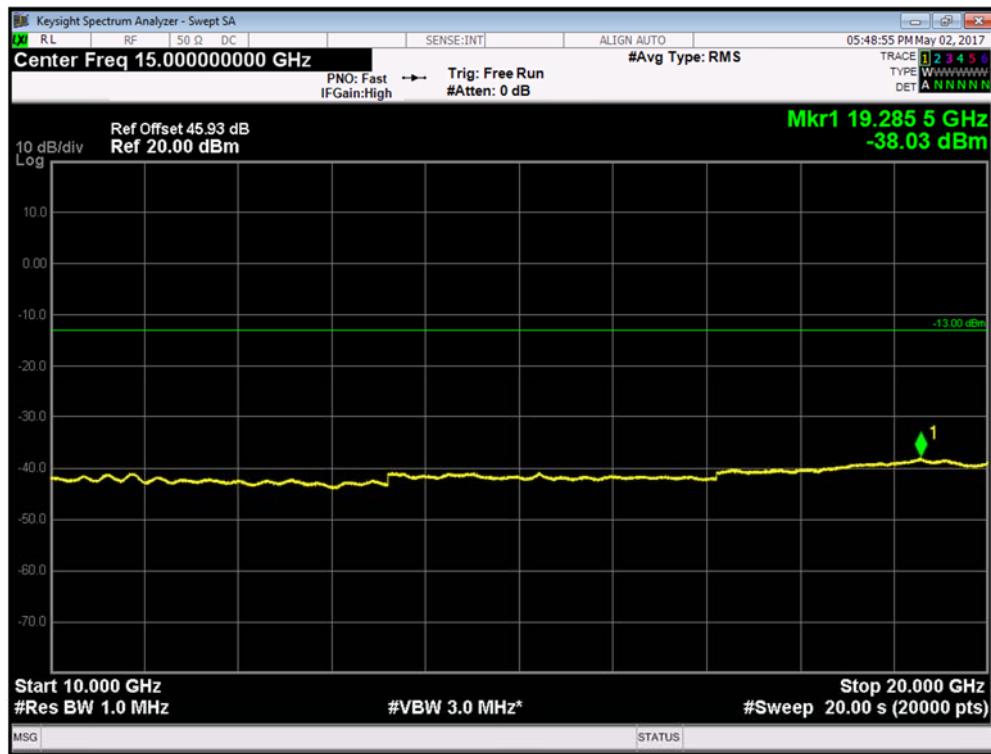
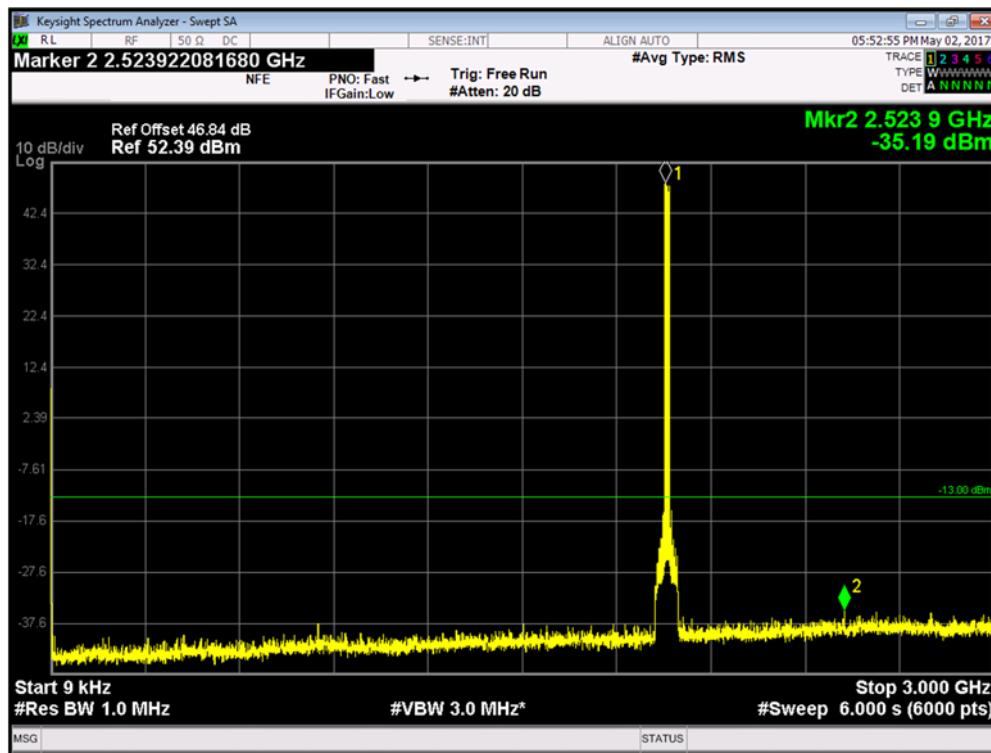
Product Service

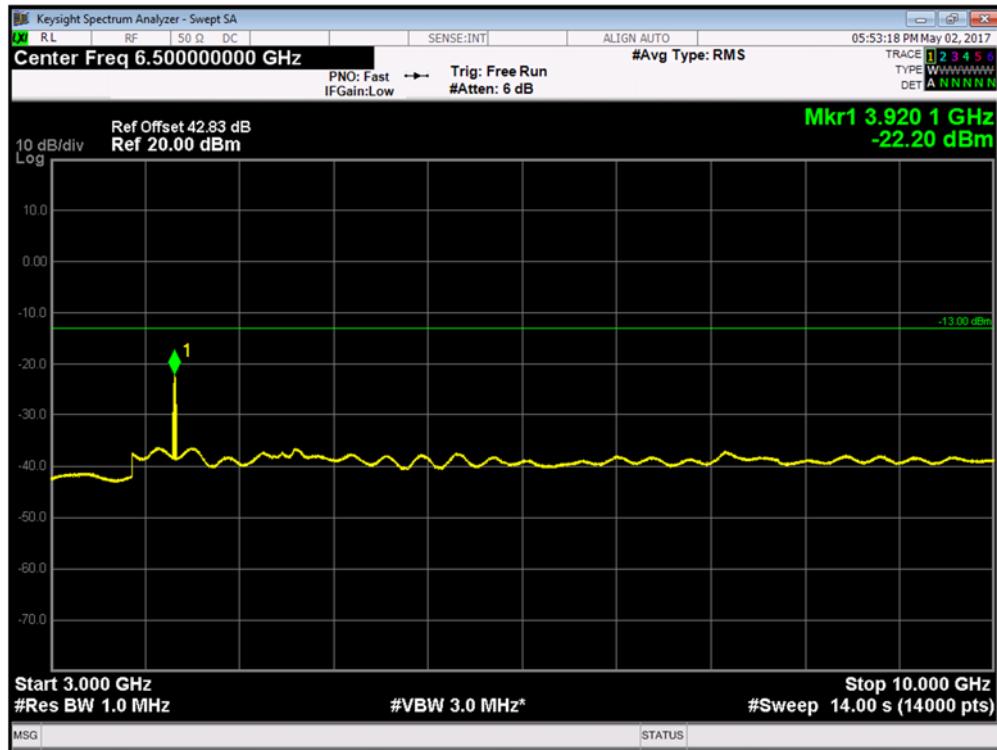
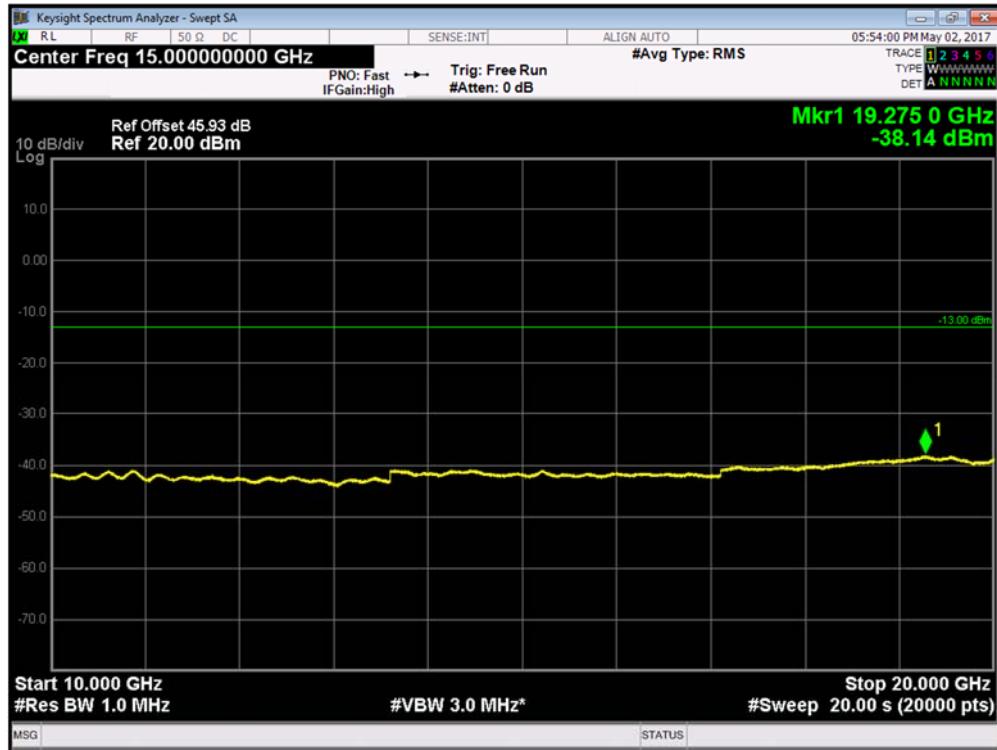
Configuration G-MC 2 (3C)

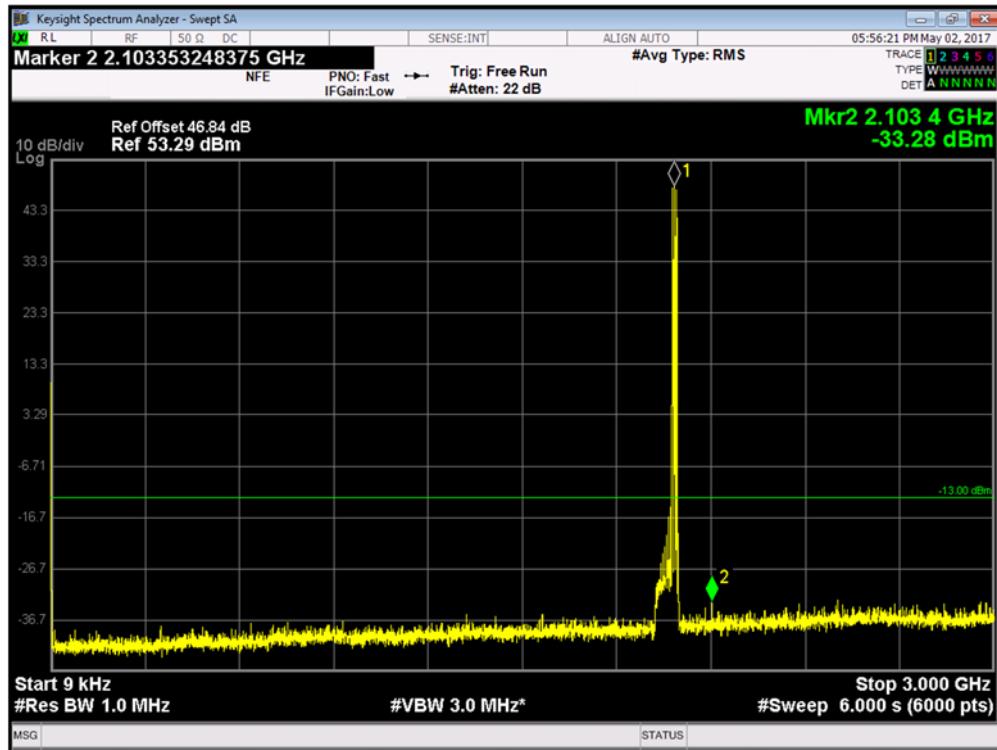
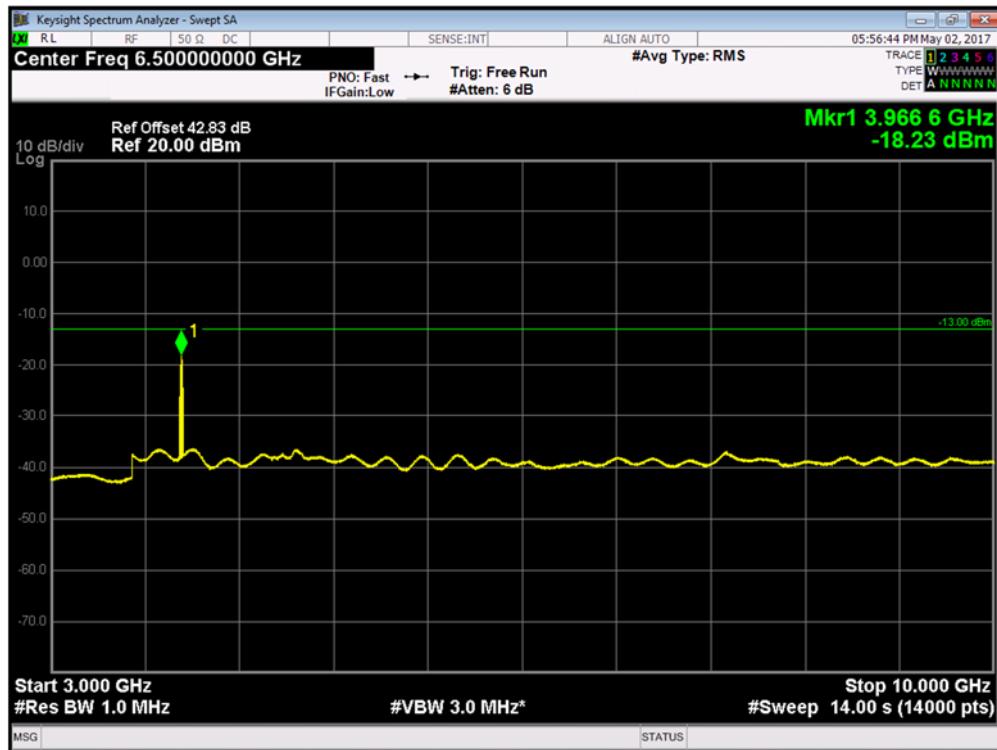
Maximum Output Power 47.8dBm per port

Channel Position	Bandwidth	Channel Frequency
Channel Position B _{RFBW}	250 kHz	1930.4MHz +1936.6MHz + 1942.8MHz
Channel Position M _{RFBW}	250 kHz	1953.8MHz + 1960.0MHz + 1966.2MHz
Channel Position T _{RFBW}	250 kHz	1977.2MHz + 1983.4MHz + 1989.6MHz

Channel Position B_{RFBW} - GMSK - 9kHz - 3GHz

 Channel Position B_{RFBW} - GMSK - 3GHz - 10GHz


Channel Position B_{RFBW} - GMSK - 10GHz - 20GHz

 Channel Position M_{RFBW} - GMSK - 9kHz - 3GHz


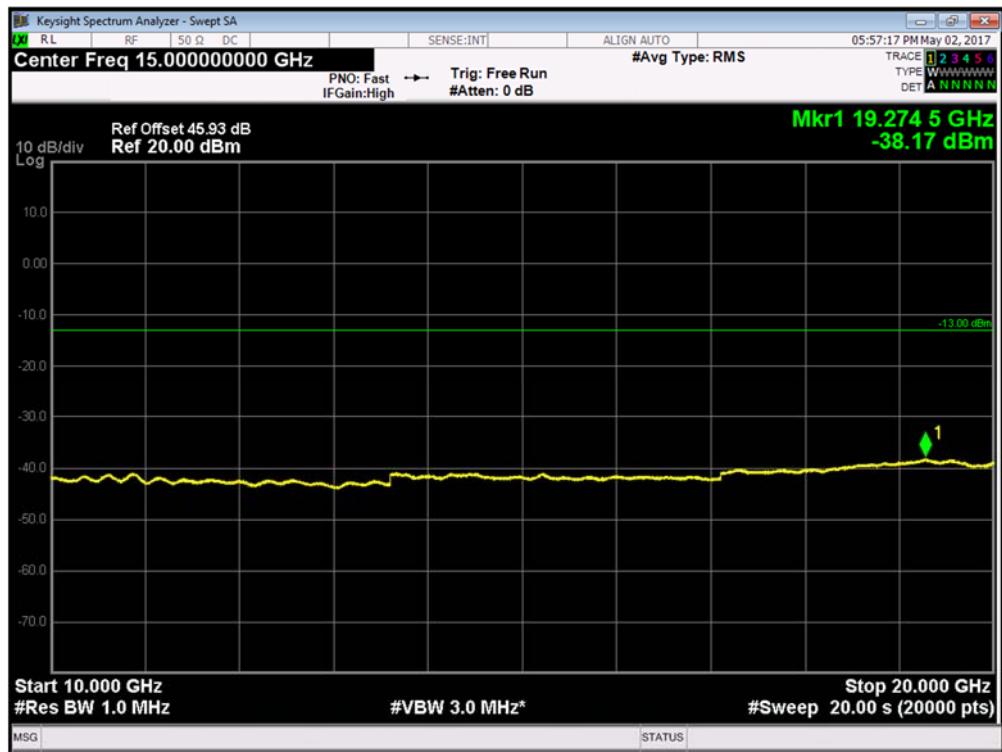
Channel Position M_{RFBW} - GMSK - 3GHz - 10GHz

 Channel Position M_{RFBW} - GMSK - 10GHz - 20GHz


Channel Position T_{RFBW} - GMSK - 9kHz - 3GHz

 Channel Position T_{RFBW} - GMSK - 3GHz - 10GHz




Product Service

Channel Position T_{RFBW} - GMSK - 10GHz - 20GHz





Product Service

Configuration G-MC 3 (4C)

Maximum Output Power 49.0dBm per port

Channel Position	Bandwidth	Channel Frequency
Channel Position B _{RFBW}	250 kHz	1930.4MHz + 1934.4MHz + 1938.4MHz + 1942.8MHz
Channel Position M _{RFBW}	250 kHz	1956.0MHz + 1960.0MHz + 1964.0MHz + 1968.0MHz
Channel Position T _{RFBW}	250 kHz	1977.2MHz + 1982.0MHz + 1986.0MHz + 1989.6MHz