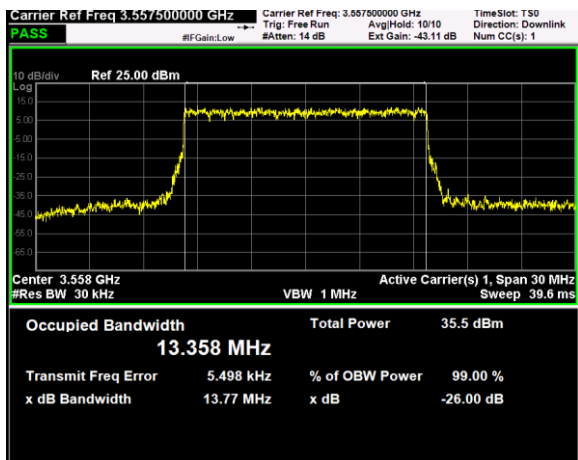
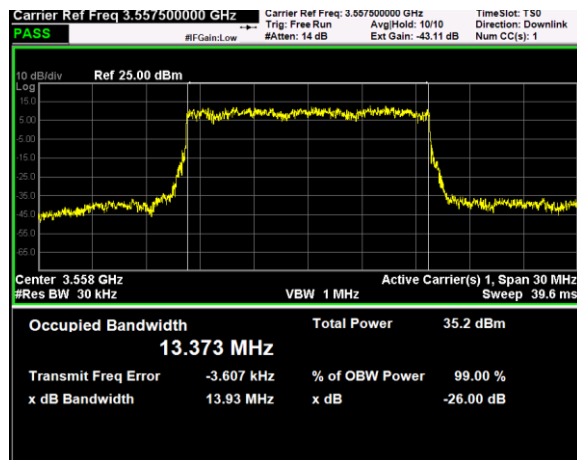
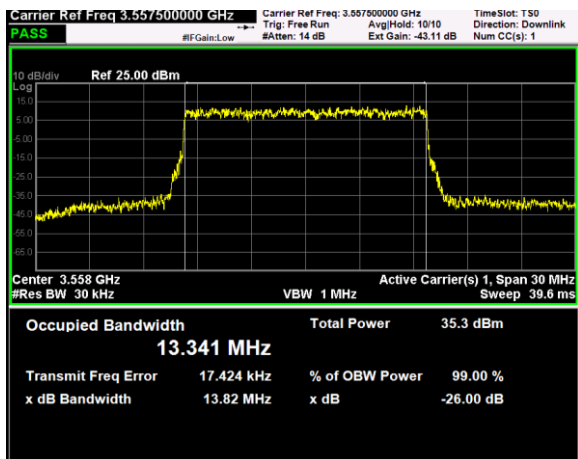
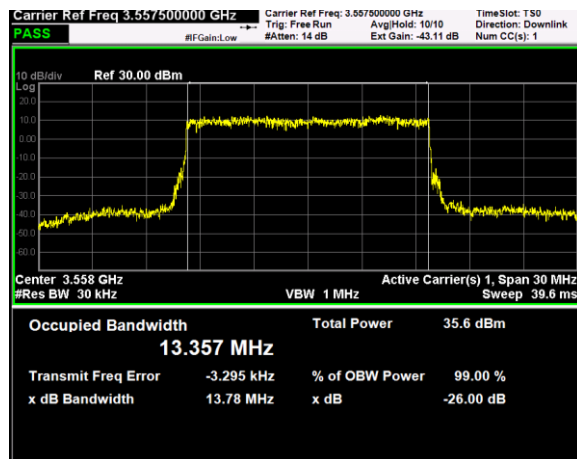
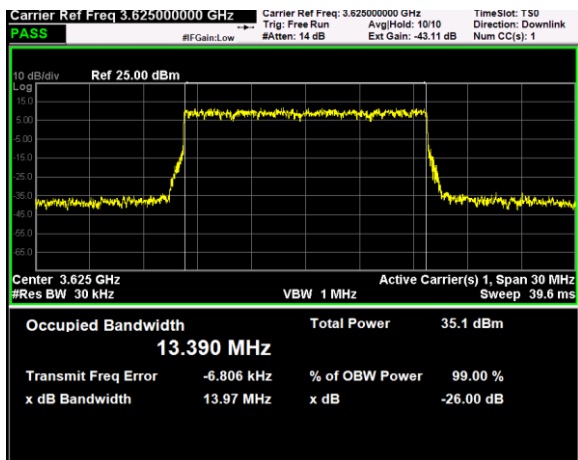
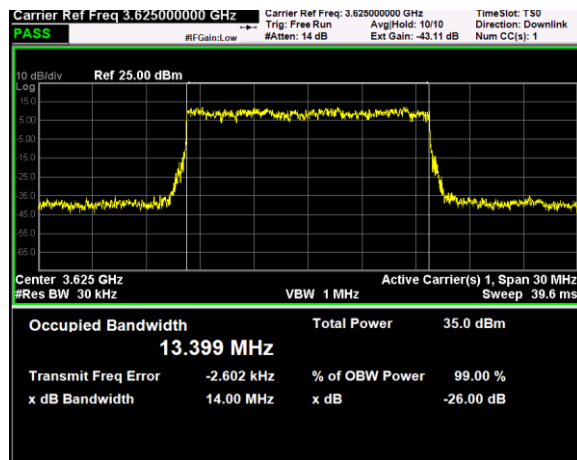


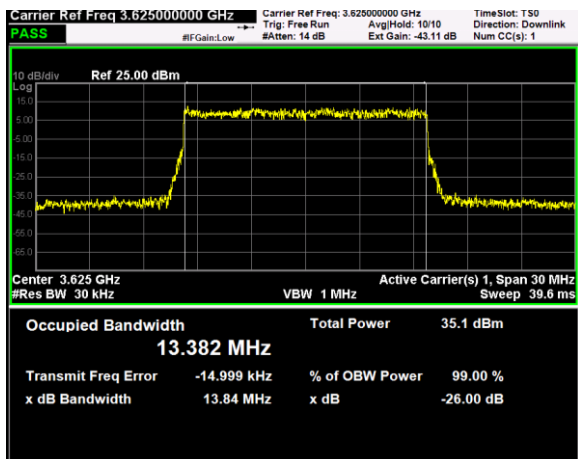

Channel: BOTTOM, Modulation: QPSK,
BW=15MHz

Channel: BOTTOM, Modulation: 16QAM,
BW=15MHz

Channel: BOTTOM, Modulation: 64QAM,
BW=15MHz

Channel: BOTTOM, Modulation: 256QAM,
BW=15MHz



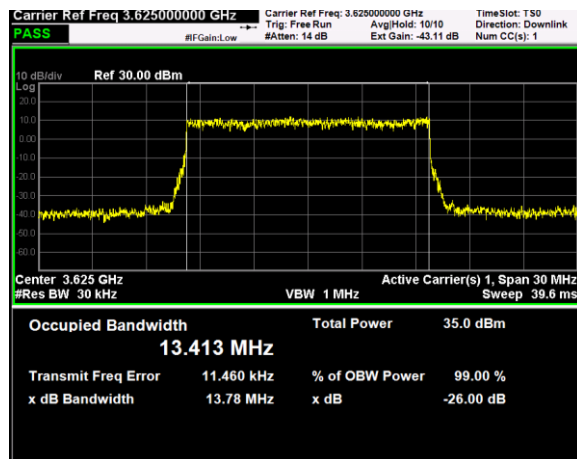
Channel: MIDDLE, Modulation: QPSK,
BW=15MHz



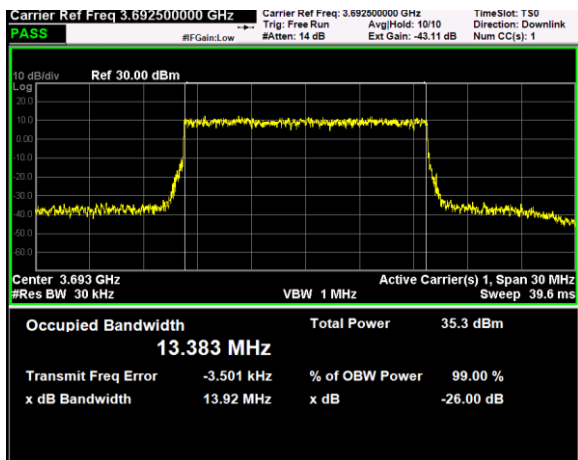
Channel: MIDDLE, Modulation: 16QAM,
BW=15MHz



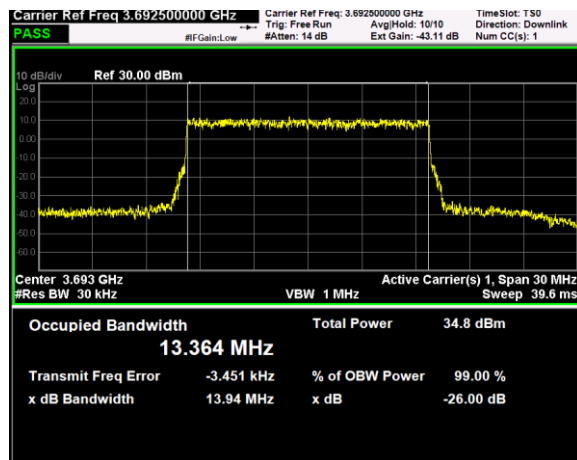
Channel: MIDDLE, Modulation: 64QAM,
BW=15MHz



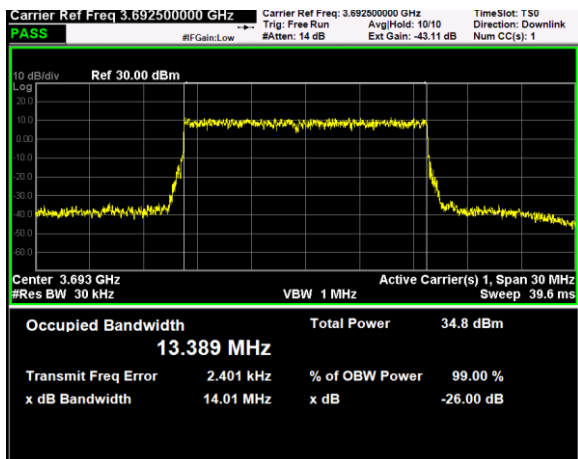
Channel: MIDDLE, Modulation: 256QAM,
BW=15MHz



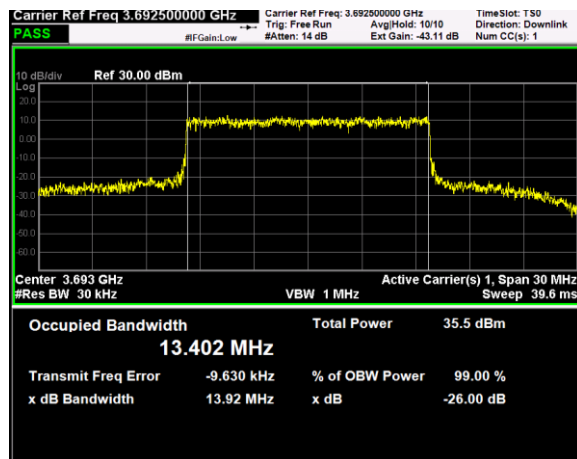
Channel: TOP, Modulation: QPSK,
BW=15MHz



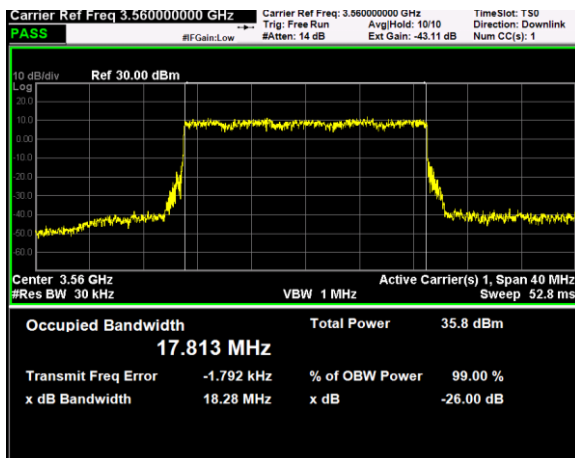
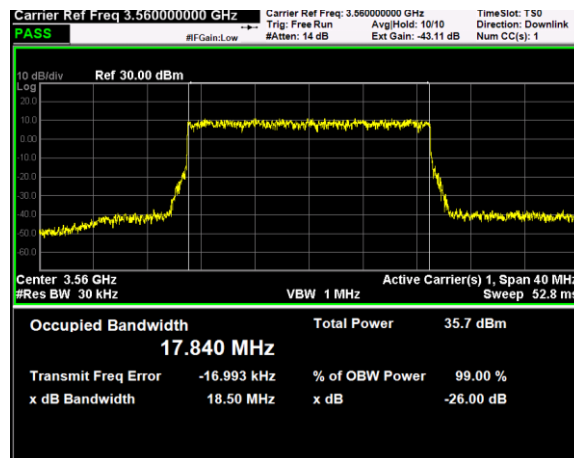
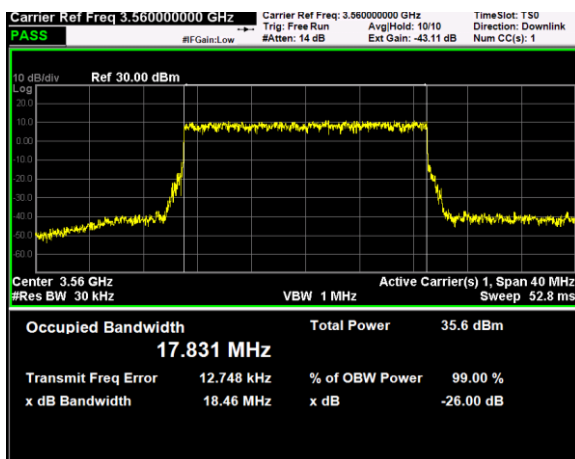
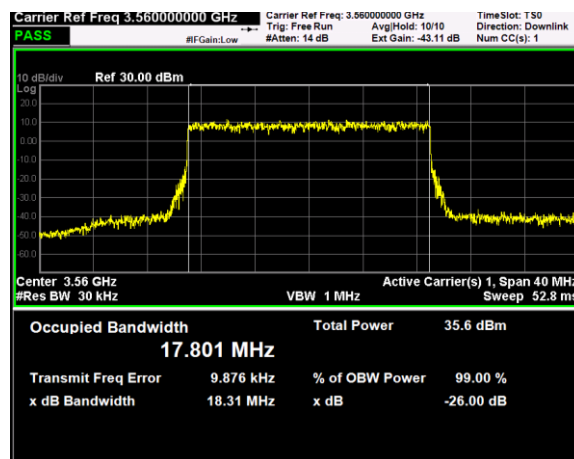
Channel: TOP, Modulation: 16QAM,
BW=15MHz

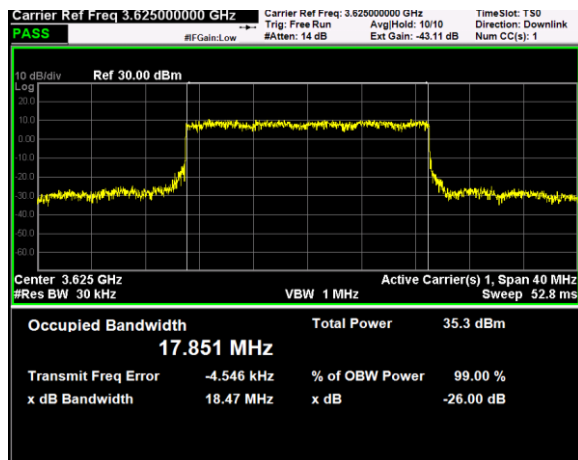
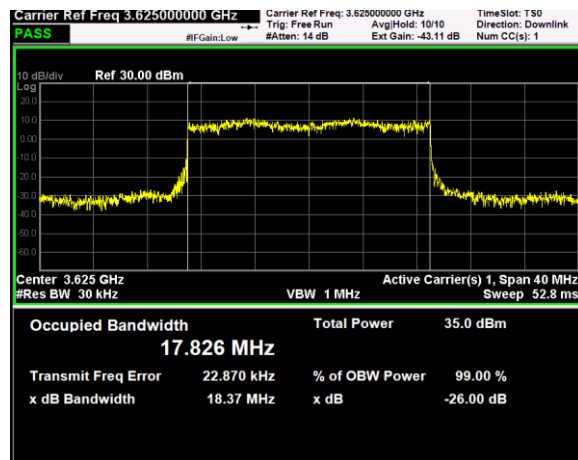
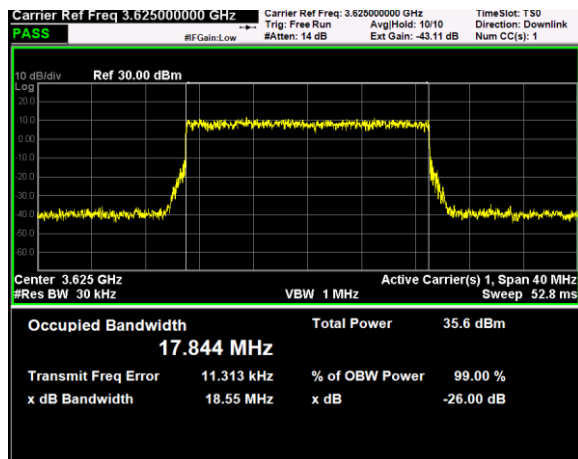
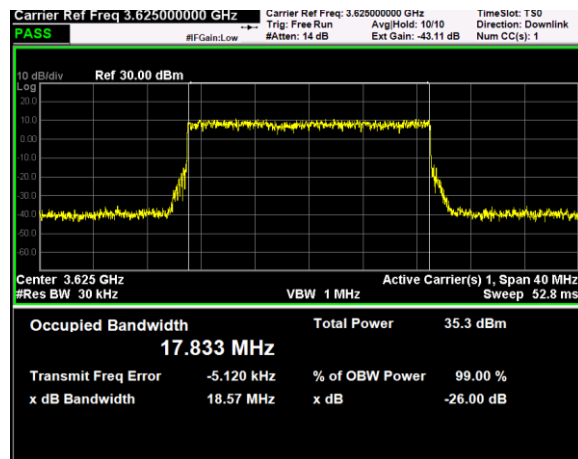


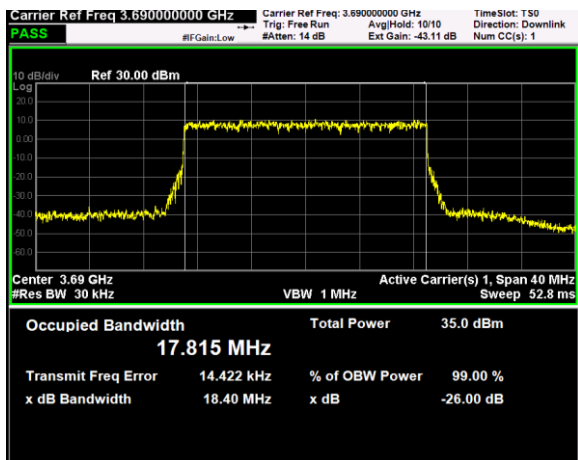
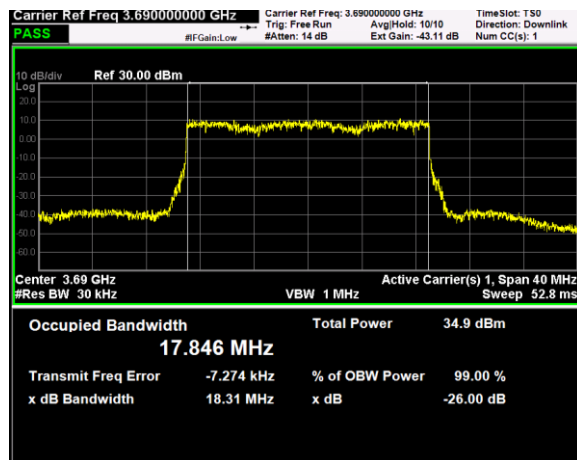
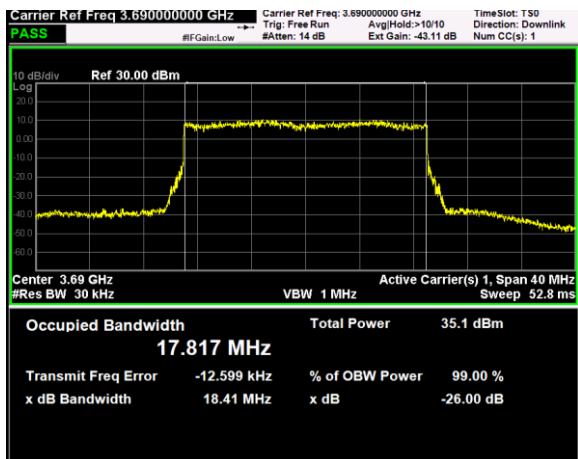
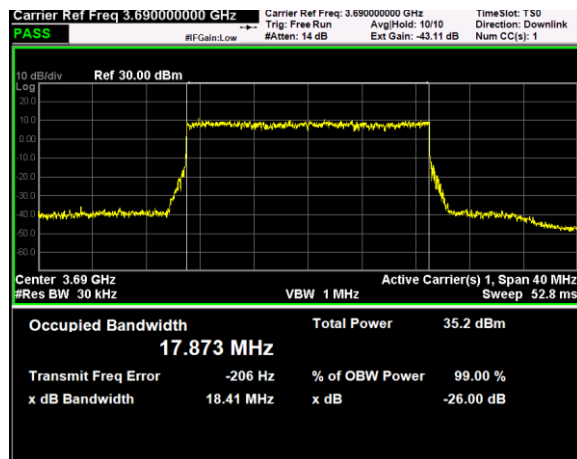
Channel: TOP, Modulation: 64QAM,
BW=15MHz



Channel: TOP, Modulation: 256QAM,
BW=15MHz


Channel: BOTTOM, Modulation: QPSK,
BW=20MHz

Channel: BOTTOM, Modulation: 16QAM,
BW=20MHz

Channel: BOTTOM, Modulation: 64QAM,
BW=20MHz

Channel: BOTTOM, Modulation: 256QAM,
BW=20MHz


Channel: MIDDLE, Modulation: QPSK,
BW=20MHz

Channel: MIDDLE, Modulation: 16QAM,
BW=20MHz

Channel: MIDDLE, Modulation: 64QAM,
BW=20MHz

Channel: MIDDLE, Modulation: 256QAM,
BW=20MHz


Channel: TOP, Modulation: QPSK,
BW=20MHz

Channel: TOP, Modulation: 16QAM,
BW=20MHz

Channel: TOP, Modulation: 64QAM,
BW=20MHz

Channel: TOP, Modulation: 256QAM,
BW=20MHz

Clause 96.41(b)(g) Peak output power at RF antenna connector

(b) *Power limits.* Unless otherwise specified in this section, the maximum effective isotropic radiated power (EIRP) and maximum Power Spectral Density (PSD) of any CBSD and End User Device must comply with the limits shown in the table in this paragraph (b):

Device	Maximum EIRP (dBm/10 megahertz)	Maximum PSD (dBm/MHz)
End User Device	23	n/a
Category A CBSD	30	20
Category B CBSD ¹	47	37

(g) *Power measurement.* The peak-to-average power ratio (PAPR) of any CBSD transmitter output power must not exceed 13 dB. PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities or another Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

Test date: 09/28/2020 to 10/09/2020

Test results: Pass

Special notes

-

Clause 96.41(b)(d) Peak output power at RF antenna connector

Test data

RF PORT 1 (BW = 5 MHz)

Test data							
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	PSD (dBm/Hz)	PSD (dBm/MHz)	PAR (dB)
Down-link	LTE 5MHz (QPSK)	3552.5	37.0	5.000	-30.0	30.0	10.1
Down-link	LTE 5MHz (QPSK)	3625.0	37.0	4.966	-30.0	30.0	10.7
Down-link	LTE 5MHz (QPSK)	3697.5	37.8	4.753	-30.2	29.8	9.5
Down-link	LTE 5MHz (16QAM)	3552.5	37.0	4.966	-30.0	30.0	10.0
Down-link	LTE 5MHz (16QAM)	3625.0	36.8	4.742	-30.2	29.8	10.7
Down-link	LTE 5MHz (16QAM)	3697.5	36.8	4.808	-30.2	29.8	10.0
Down-link	LTE 5MHz (64QAM)	3552.5	37.1	5.117	-29.9	30.1	10.0
Down-link	LTE 5MHz (64QAM)	3625.0	36.7	4.677	-30.3	29.7	10.2
Down-link	LTE 5MHz (64QAM)	3697.5	37.0	4.955	-30.0	30.0	9.9
Down-link	LTE 5MHz (256QAM)	3552.5	36.9	4.898	-30.1	29.9	10.1
Down-link	LTE 5MHz (256QAM)	3625.0	37.0	5.012	-30.0	30.0	11.2
Down-link	LTE 5MHz (256QAM)	3697.5	37.0	4.955	-30.0	30.0	10.3

RF PORT 2 (BW = 5 MHz)

Test data							
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	PSD (dBm/Hz)	PSD (dBm/MHz)	PAR (dB)
Down-link	LTE 5MHz (QPSK)	3552.5	36.7	4.688	-30.3	29.7	10.4
Down-link	LTE 5MHz (QPSK)	3625.0	36.8	4.797	-30.2	29.8	9.9
Down-link	LTE 5MHz (QPSK)	3697.5	36.7	4.667	-30.3	29.7	10.0
Down-link	LTE 5MHz (16QAM)	3552.5	36.7	4.688	-30.3	29.7	10.1
Down-link	LTE 5MHz (16QAM)	3625.0	36.8	4.819	-30.2	29.8	9.8
Down-link	LTE 5MHz (16QAM)	3697.5	36.7	4.634	-30.3	29.7	10.0
Down-link	LTE 5MHz (64QAM)	3552.5	36.7	4.699	-30.3	29.7	9.7
Down-link	LTE 5MHz (64QAM)	3625.0	36.8	4.775	-30.2	29.8	10.0
Down-link	LTE 5MHz (64QAM)	3697.5	36.8	4.786	-30.2	29.8	9.8
Down-link	LTE 5MHz (256QAM)	3552.5	36.7	4.721	-30.3	29.8	10.6
Down-link	LTE 5MHz (256QAM)	3625.0	36.7	4.710	-30.3	29.7	10.1
Down-link	LTE 5MHz (256QAM)	3697.5	36.8	4.764	-30.2	29.8	10.5

Special notes

Remark: MIMO application where only cross-polarized antennas are allowed (KDB "662911 D01 Multiple Transmitter Output v02r01", chapter F, paragraph 2), letter c), item (i)).

Please note that the case with cross-polarized antennas (the only allowed, as stated in the User Manual), with a pair of antennas ($N_{ANT} = 2$) and two outputs ports driving the antennas, has been considered as worst case; therefore the directional gain is the gain of an individual antenna.

Compliance to Category A limits (BW = 5 MHz):

Maximum EIRP ≤ 30 dBm/10MHz

Maximum PSD eirp ≤ 20 dBm/1MHz

PSD eirp (in 1 MHz) = $PSD_{max} - N + G_{max} = 30^* - N + G_{max} \leq 20$

The allowed max antenna gain is calculated as: $G_{max} \leq (20-30+N) = N - 10$ dBi

Compliance to Category B limits (BW = 5 MHz):

Maximum EIRP ≤ 47 dBm/10MHz

Maximum PSD eirp ≤ 37 dBm/1MHz

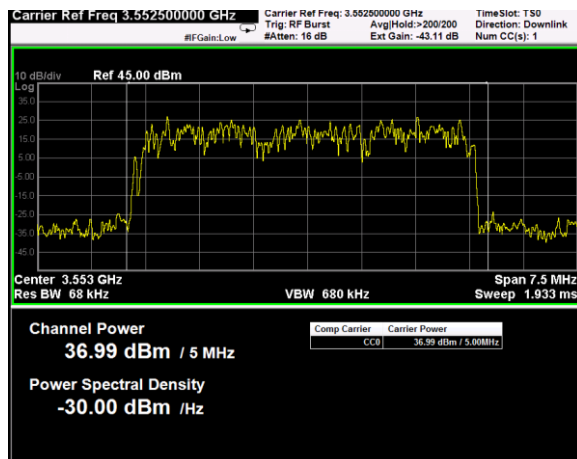
$$\text{PSD eirp (in 1 MHz)} = \text{PSD}_{\text{max}} - N + G_{\text{max}} = 30^* - N + G_{\text{max}} \leq 37$$

The allowed max antenna gain is calculated as: $G_{\text{max}} \leq (37 - 30 + N) = N + 7 \text{ dBi}$

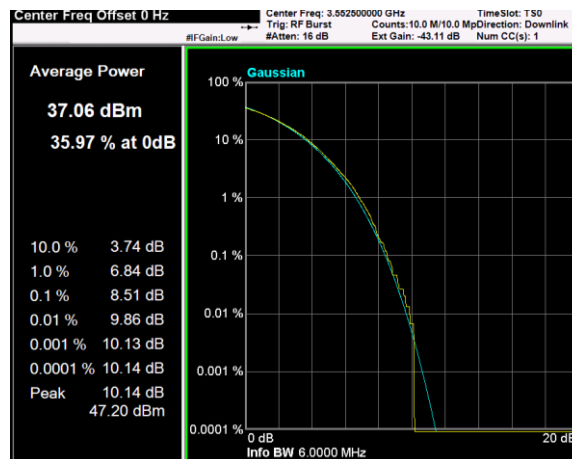
Where:

- PSD_{max} is the maximum PSD value measured on the antenna connector of the equipment and it depends on the LTE bandwidth signal (*: 37 dBm, that is the measured value at antenna port, with a 5 MHz band matches up $37 + 10 \cdot \log(1/5) = 30 \text{ dBm/1MHz}$)
- N is system path loss (in dB) due to cable insertion, splitter, etc....
- G_{max} is the maximum antenna gain allowed (in dBi)

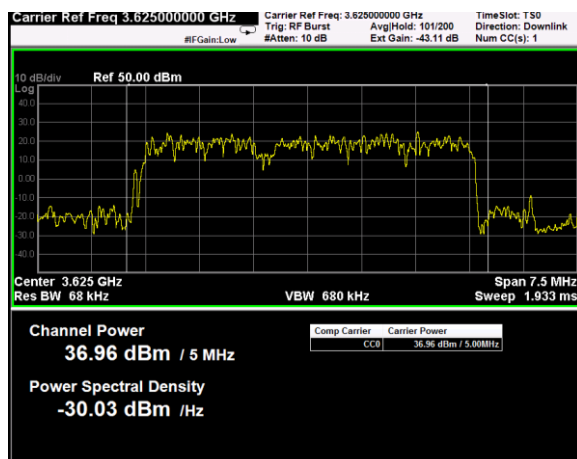
RF PORT 1 PLOT



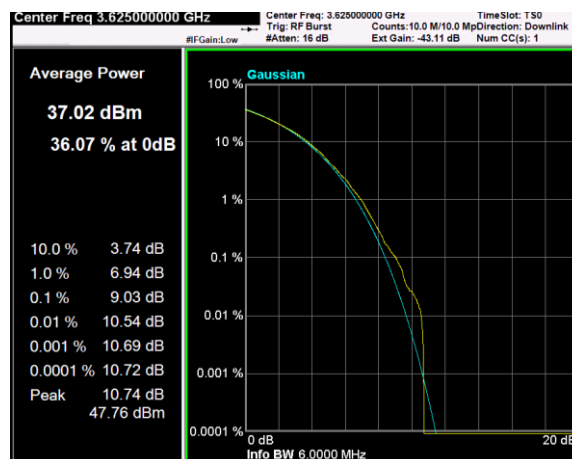
Channel: BOTTOM, Modulation: QPSK,
BW=5MHz, Channel Power



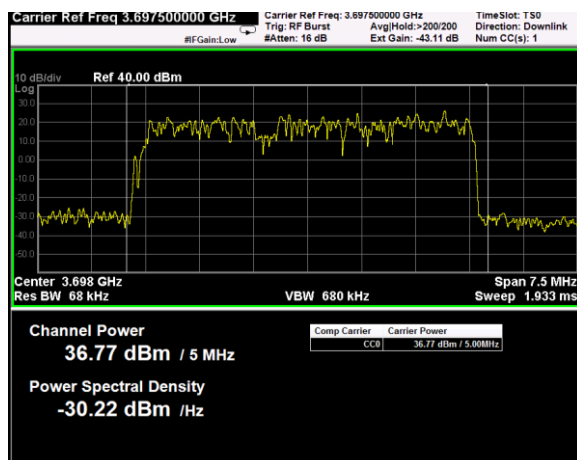
Channel: BOTTOM, Modulation: QPSK,
BW=5MHz, CCDF



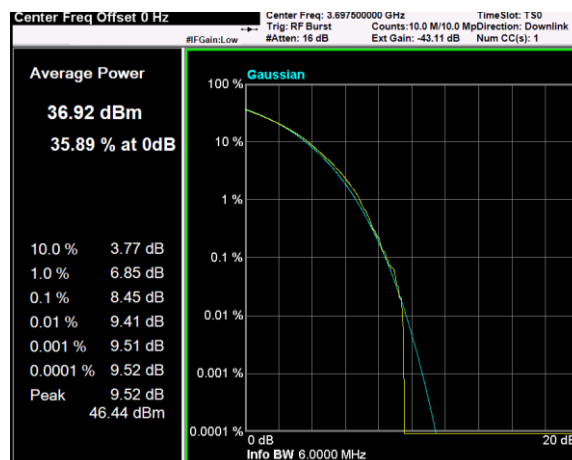
Channel: MIDDLE, Modulation: QPSK,
BW=5MHz, Channel Power



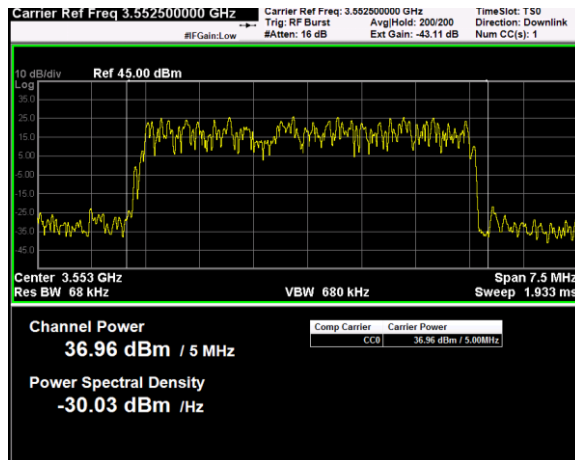
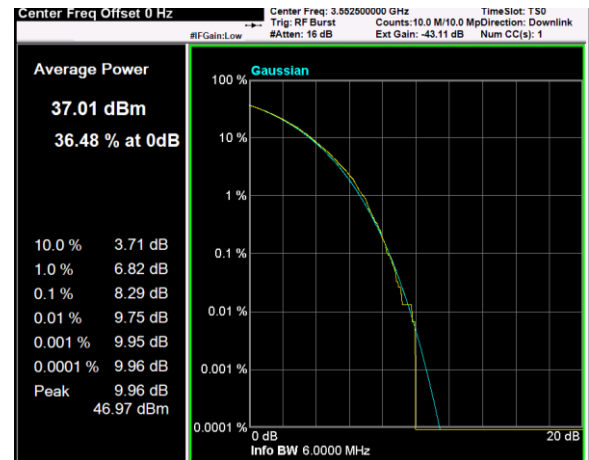
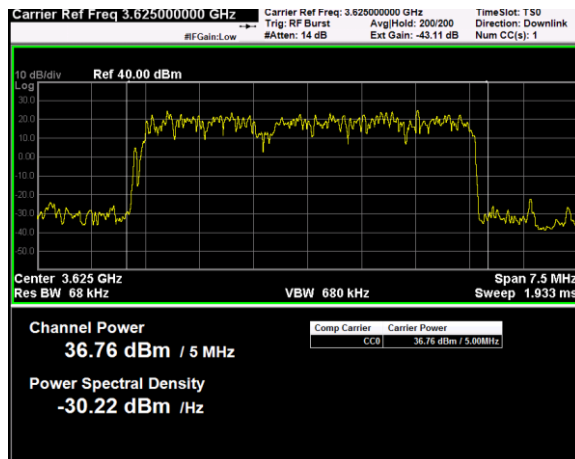
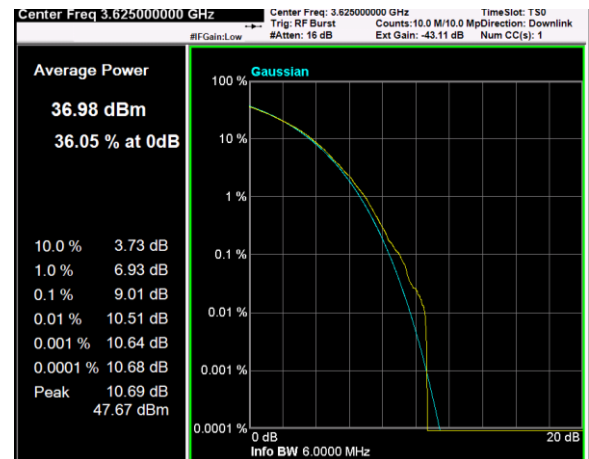
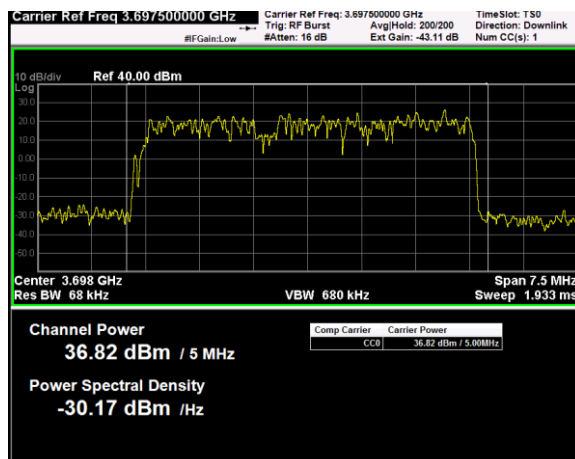
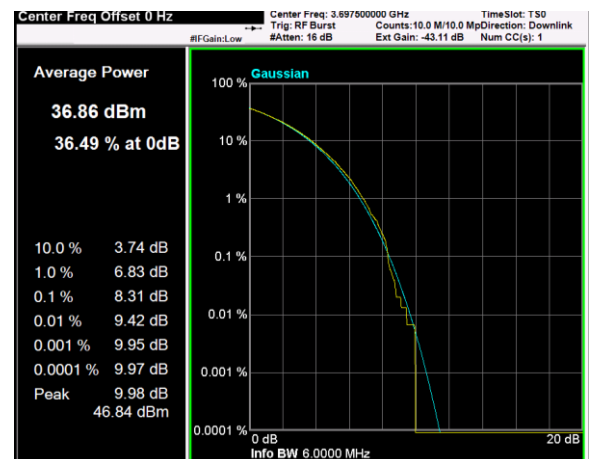
Channel: MIDDLE, Modulation: QPSK,
BW=5MHz, CCDF

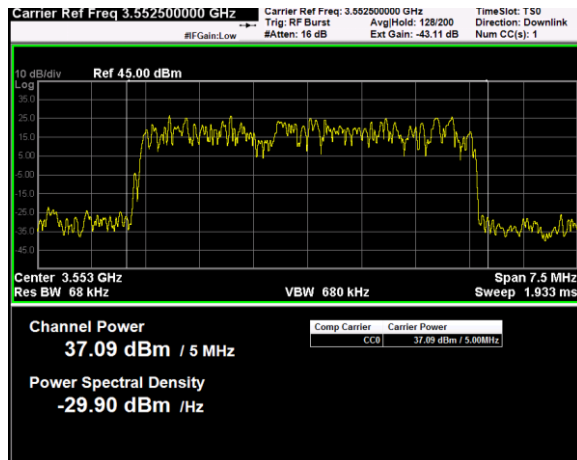
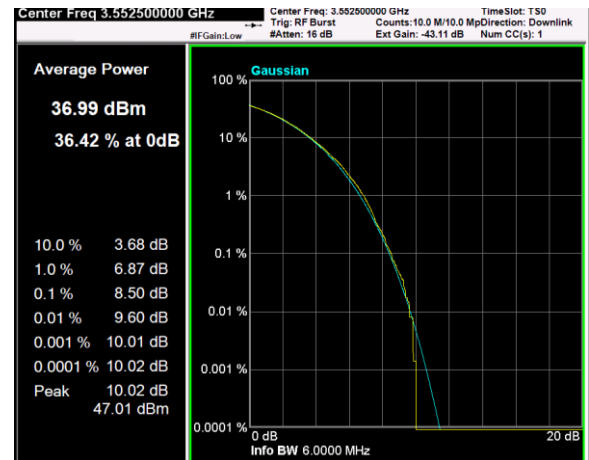
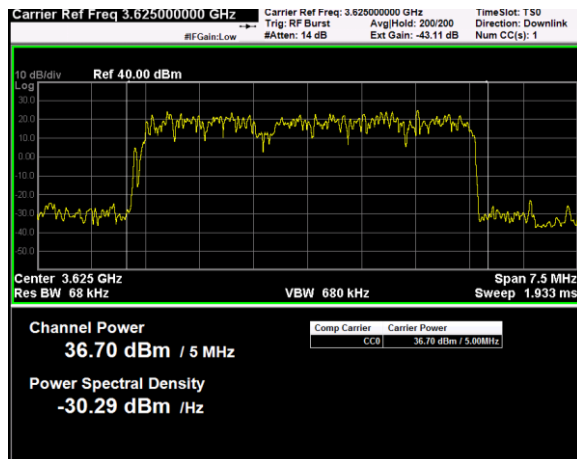
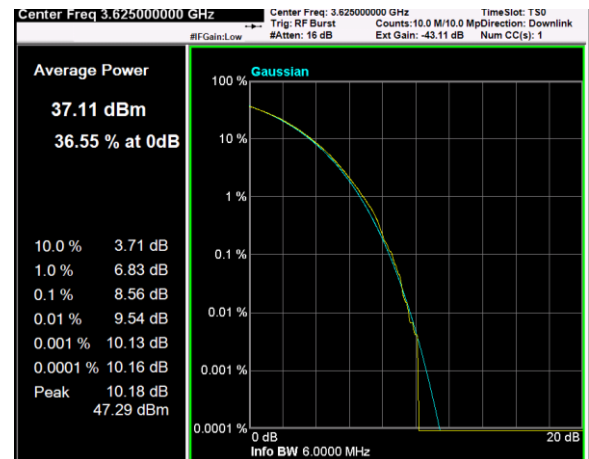
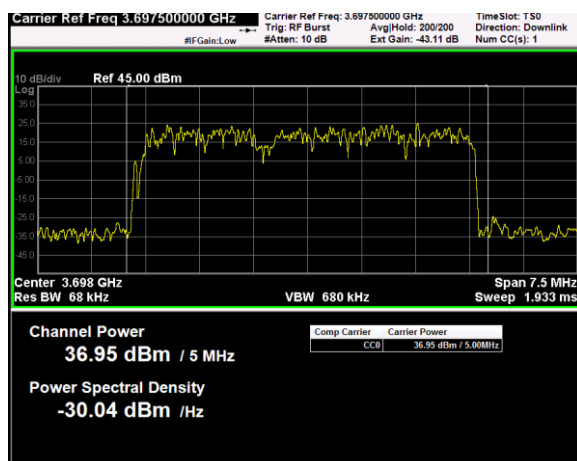
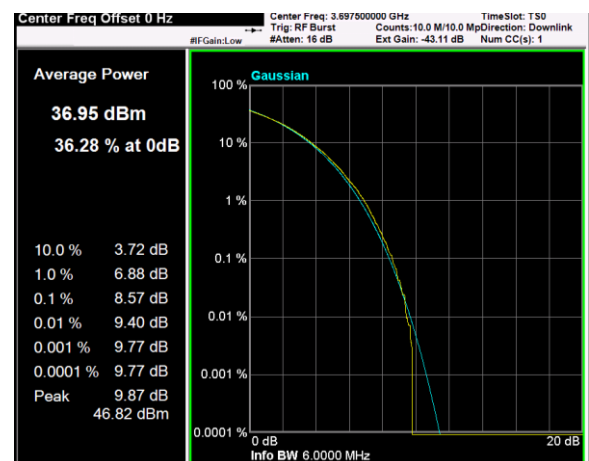


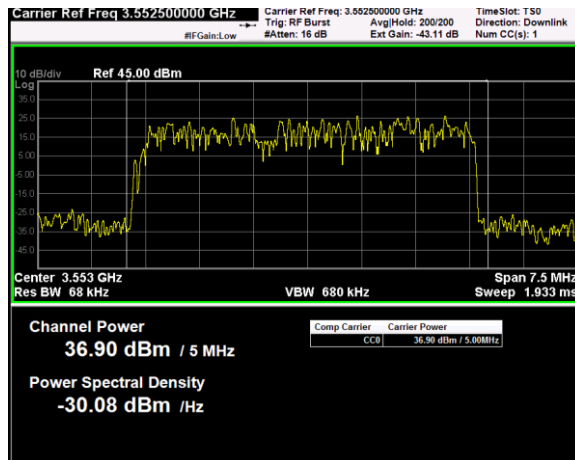
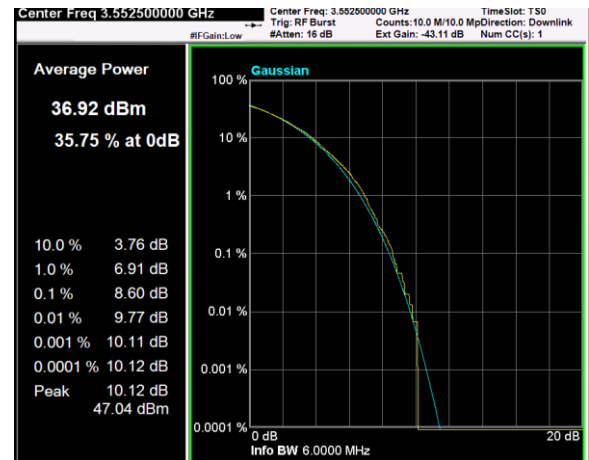
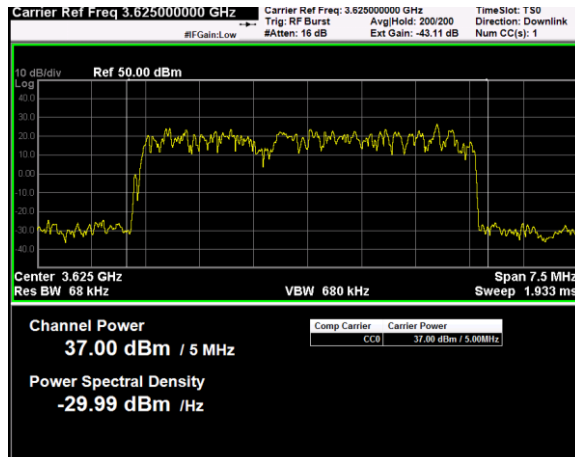
Channel: TOP, Modulation: QPSK,
BW=5MHz, Channel Power

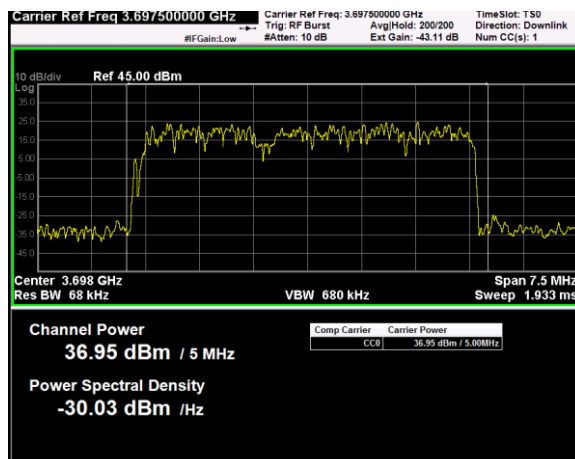


Channel: TOP, Modulation: QPSK,
BW=5MHz, CCDF


Channel: BOTTOM, Modulation: 16QAM,
BW=5MHz, Channel Power

Channel: BOTTOM, Modulation: 16QAM,
BW=5MHz, CCDF

Channel: MIDDLE, Modulation: 16QAM,
BW=5MHz, Channel Power

Channel: MIDDLE, Modulation: 16QAM,
BW=5MHz, CCDF

Channel: TOP, Modulation: 16QAM,
BW=5MHz, Channel Power

Channel: TOP, Modulation: 16QAM,
BW=5MHz, CCDF

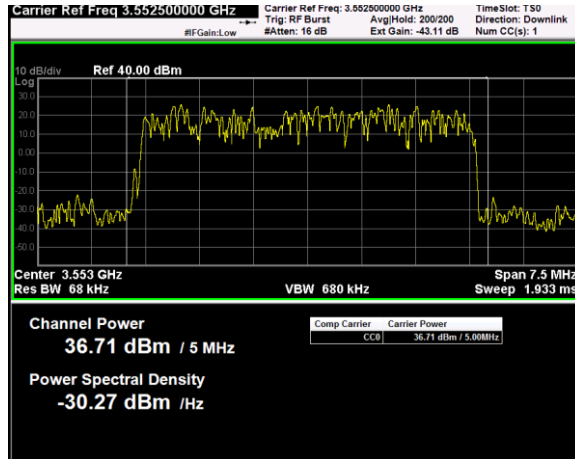

Channel: BOTTOM, Modulation: 64QAM,
BW=5MHz, Channel Power

Channel: BOTTOM, Modulation: 64QAM,
BW=5MHz, CCDF

Channel: MIDDLE, Modulation: 64QAM,
BW=5MHz, Channel Power

Channel: MIDDLE, Modulation: 64QAM,
BW=5MHz, CCDF

Channel: TOP, Modulation: 64QAM,
BW=5MHz, Channel Power

Channel: TOP, Modulation: 64QAM,
BW=5MHz, CCDF


Channel: BOTTOM, Modulation: 256QAM,
BW=5MHz, Channel Power

Channel: BOTTOM, Modulation: 256QAM,
BW=5MHz, CCDF

Channel: MIDDLE, Modulation: 256QAM,
BW=5MHz, Channel Power

Channel: MIDDLE, Modulation: 256QAM,
BW=5MHz, CCDF

Channel: TOP, Modulation: 256QAM,
BW=5MHz, Channel Power

Channel: TOP, Modulation: 256QAM,
BW=5MHz, CCDF

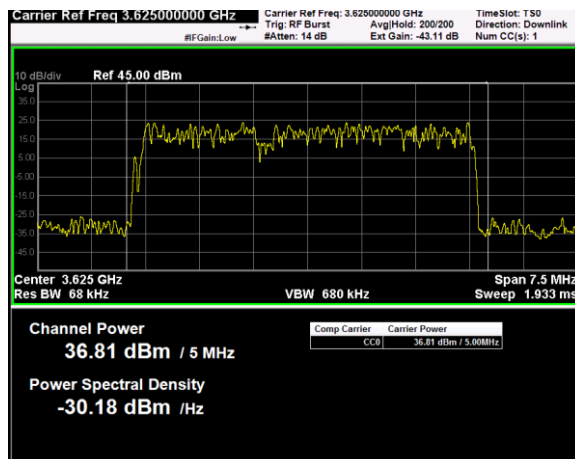
RF PORT 2 PLOT



Channel: BOTTOM, Modulation: QPSK,
BW=5MHz, Channel Power



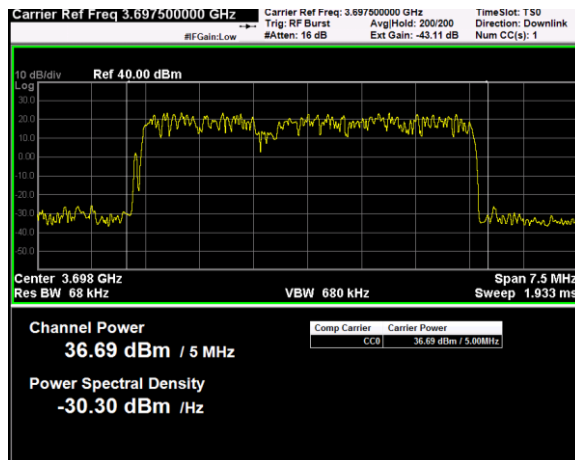
Channel: BOTTOM, Modulation: QPSK,
BW=5MHz, CCDF



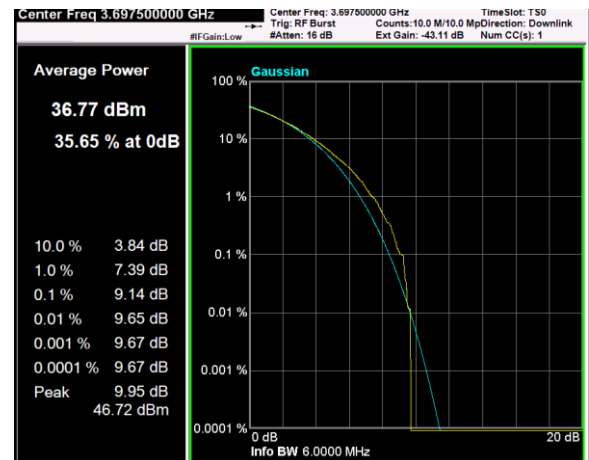
Channel: MIDDLE, Modulation: QPSK,
BW=5MHz, Channel Power



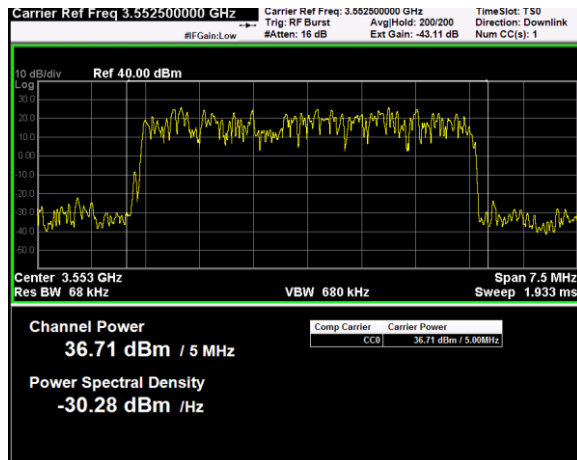
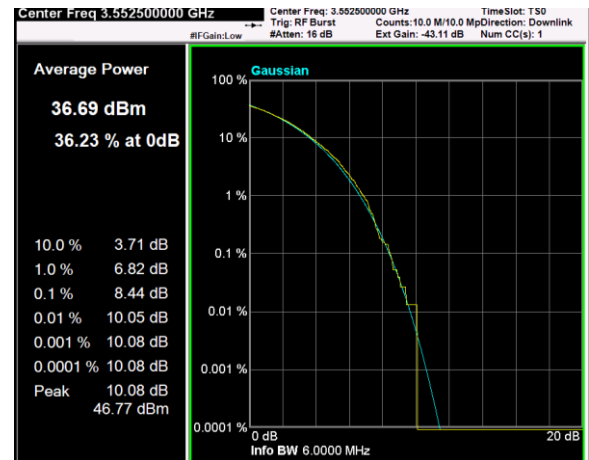
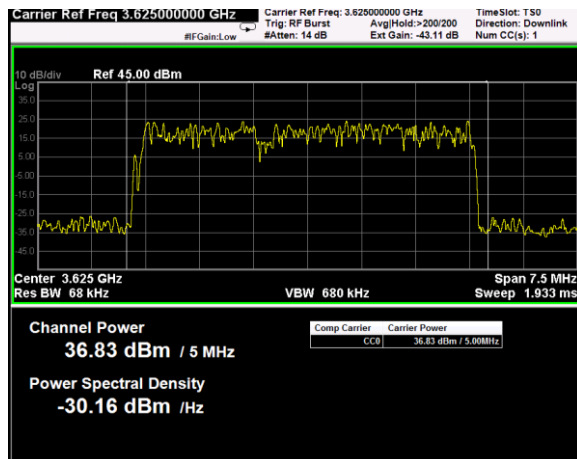
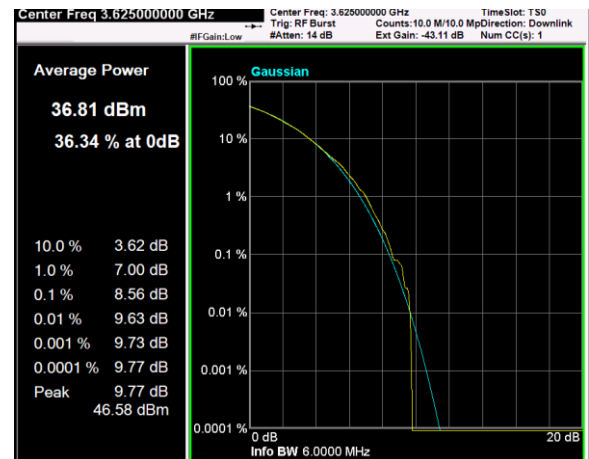
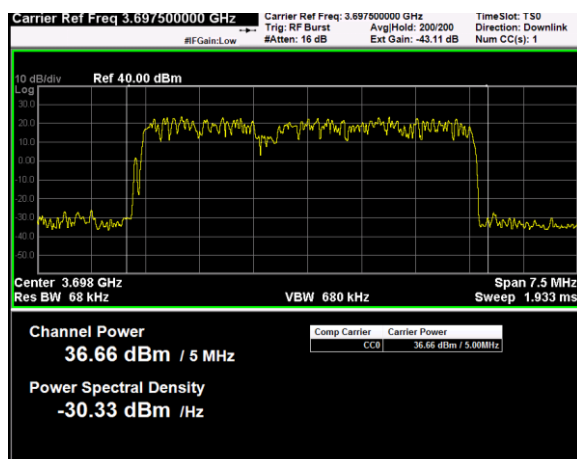
Channel: MIDDLE, Modulation: QPSK,
BW=5MHz, CCDF



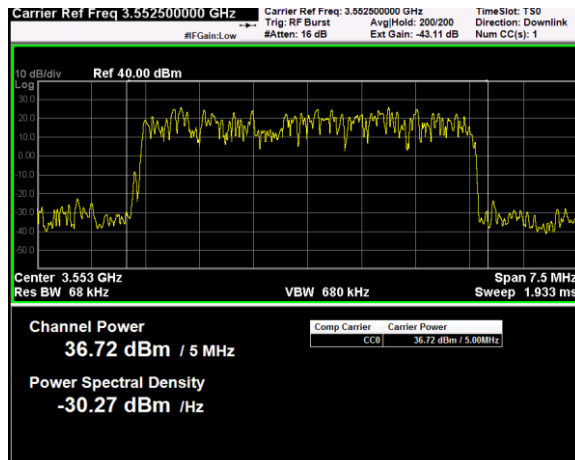
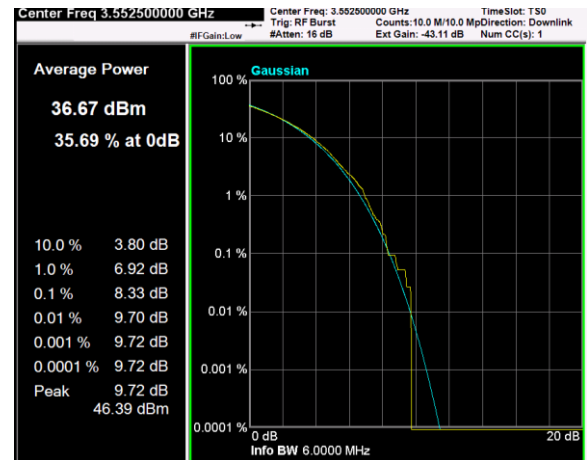
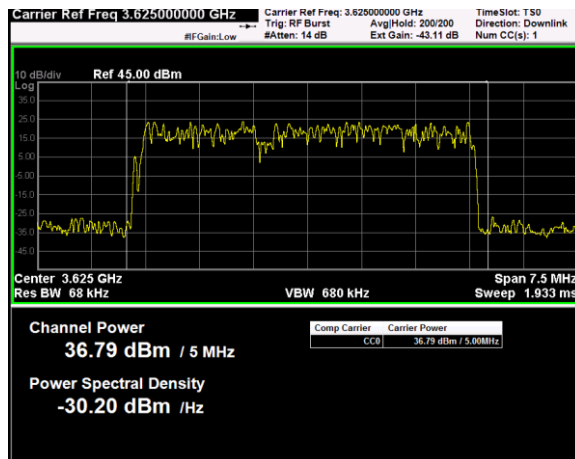
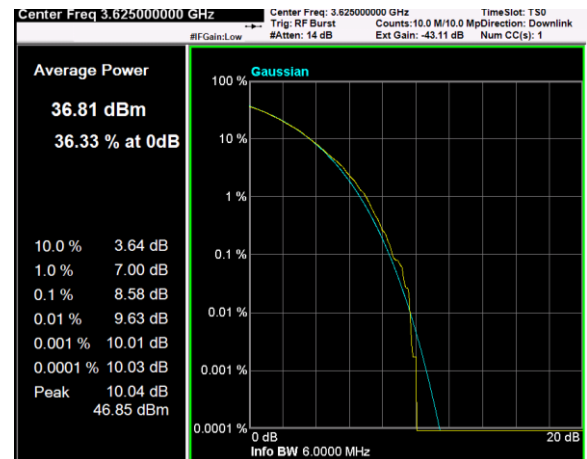
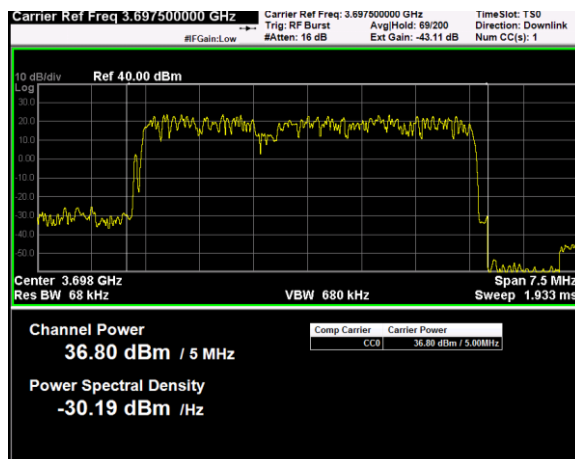
Channel: TOP, Modulation: QPSK,
BW=5MHz, Channel Power



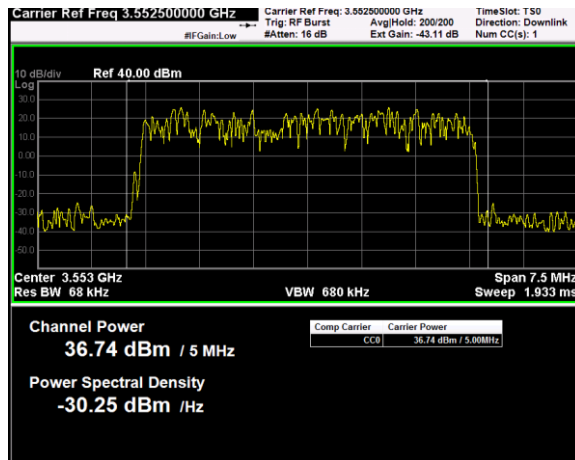
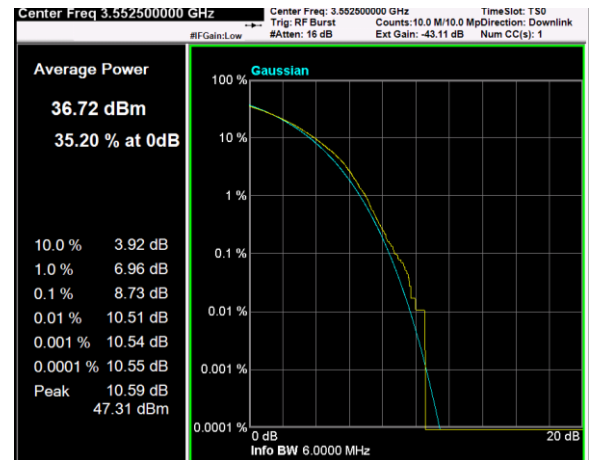
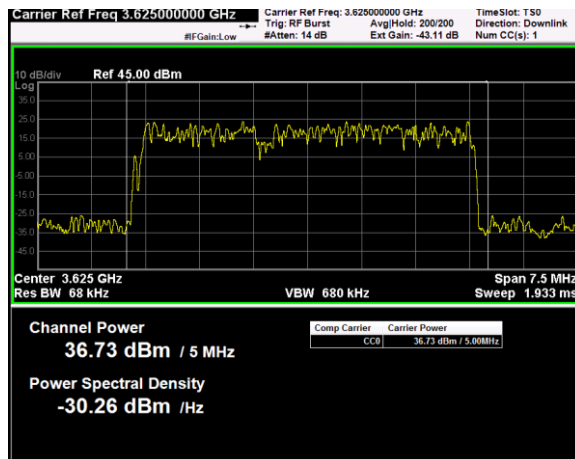
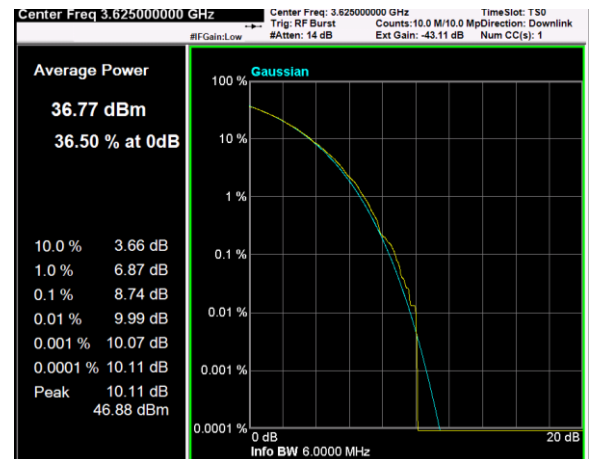
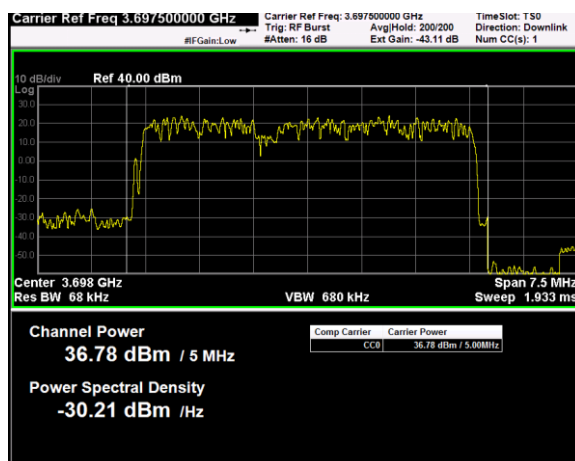
Channel: TOP, Modulation: QPSK,
BW=5MHz, CCDF


Channel: BOTTOM, Modulation: 16QAM,
BW=5MHz, Channel Power

Channel: BOTTOM, Modulation: 16QAM,
BW=5MHz, CCDF

Channel: MIDDLE, Modulation: 16QAM,
BW=5MHz, Channel Power

Channel: MIDDLE, Modulation: 16QAM,
BW=5MHz, CCDF

Channel: TOP, Modulation: 16QAM,
BW=5MHz, Channel Power

Channel: TOP, Modulation: 16QAM,
BW=5MHz, CCDF


Channel: BOTTOM, Modulation: 64QAM,
BW=5MHz, Channel Power

Channel: BOTTOM, Modulation: 64QAM,
BW=5MHz, CCDF

Channel: MIDDLE, Modulation: 64QAM,
BW=5MHz, Channel Power

Channel: MIDDLE, Modulation: 64QAM,
BW=5MHz, CCDF

Channel: TOP, Modulation: 64QAM,
BW=5MHz, Channel Power

Channel: TOP, Modulation: 64QAM,
BW=5MHz, CCDF


Channel: BOTTOM, Modulation: 256QAM,
BW=5MHz, Channel Power

Channel: BOTTOM, Modulation: 256QAM,
BW=5MHz, CCDF

Channel: MIDDLE, Modulation: 256QAM,
BW=5MHz, Channel Power

Channel: MIDDLE, Modulation: 256QAM,
BW=5MHz, CCDF

Channel: TOP, Modulation: 256QAM,
BW=5MHz, Channel Power

Channel: TOP, Modulation: 256QAM,
BW=5MHz, CCDF

RF PORT 1 (BW = 10 MHz)

Test data							
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	PSD (dBm/Hz)	PSD (dBm/MHz)	PAR (dB)
Down-link	LTE 10MHz (QPSK)	3555	36.9	4.887	-33.1	26.9	9.4
Down-link	LTE 10MHz (QPSK)	3625	36.9	4.920	-33.1	26.9	9.4
Down-link	LTE 10MHz (QPSK)	3695	36.8	4.819	-33.2	26.8	9.4
Down-link	LTE 10MHz (16QAM)	3555	36.9	4.864	-33.1	26.9	9.4
Down-link	LTE 10MHz (16QAM)	3625	37.2	5.260	-32.8	27.2	9.4
Down-link	LTE 10MHz (16QAM)	3695	36.9	4.864	-33.1	26.9	9.4
Down-link	LTE 10MHz (64QAM)	3555	36.9	4.887	-33.1	26.9	9.4
Down-link	LTE 10MHz (64QAM)	3625	37.1	5.070	-33.0	27.1	9.4
Down-link	LTE 10MHz (64QAM)	3695	36.8	4.732	-33.3	26.8	9.4
Down-link	LTE 10MHz (256QAM)	3555	36.8	4.732	-33.3	26.8	9.4
Down-link	LTE 10MHz (256QAM)	3625	37.1	5.117	-32.9	27.1	9.4
Down-link	LTE 10MHz (256QAM)	3695	36.7	4.721	-33.3	26.7	9.4

RF PORT 2 (BW = 10 MHz)

Test data							
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	PSD (dBm/Hz)	PSD (dBm/MHz)	PAR (dB)
Down-link	LTE 10MHz (QPSK)	3555	36.9	4.887	-33.1	26.9	9.4
Down-link	LTE 10MHz (QPSK)	3625	37.0	4.955	-33.1	27.0	9.3
Down-link	LTE 10MHz (QPSK)	3695	37.1	5.176	-32.9	27.1	9.4
Down-link	LTE 10MHz (16QAM)	3555	36.9	4.909	-33.1	26.9	9.3
Down-link	LTE 10MHz (16QAM)	3625	36.7	4.721	-33.3	26.7	9.4
Down-link	LTE 10MHz (16QAM)	3695	36.9	4.943	-33.1	26.9	9.5
Down-link	LTE 10MHz (64QAM)	3555	36.9	4.875	-33.1	26.9	9.4
Down-link	LTE 10MHz (64QAM)	3625	37.1	5.164	-32.9	27.1	9.4
Down-link	LTE 10MHz (64QAM)	3695	37.0	4.966	-33.0	27.0	9.4
Down-link	LTE 10MHz (256QAM)	3555	37.1	5.105	-32.9	27.1	9.3
Down-link	LTE 10MHz (256QAM)	3625	37.1	5.105	-32.9	27.1	9.3
Down-link	LTE 10MHz (256QAM)	3695	37.0	4.989	-33.0	27.0	9.4

Special notes

Remark: MIMO application where only cross-polarized antennas are allowed (KDB "662911 D01 Multiple Transmitter Output v02r01", chapter F, paragraph 2), letter c), item (i)).

Please note that the case with cross-polarized antennas (the only allowed, as stated in the User Manual), with a pair of antennas ($N_{ANT} = 2$) and two outputs ports driving the antennas, has been considered as worst case; therefore the directional gain is the gain of an individual antenna.

Compliance to Category A limits (BW = 10 MHz):

Maximum EIRP ≤ 30 dBm/10MHz

Maximum PSD eirp ≤ 20 dBm/1MHz

PSD eirp (in 1 MHz) = $PSD_{max} - N + G_{max} = 27^* - N + G_{max} \leq 20$

The allowed max antenna gain is calculated as: $G_{max} \leq (20-27+N) = N - 7$ dBi

Compliance to Category B limits (BW = 10 MHz):

Maximum EIRP ≤ 47 dBm/10MHz

Maximum PSD eirp ≤ 37 dBm/1MHz

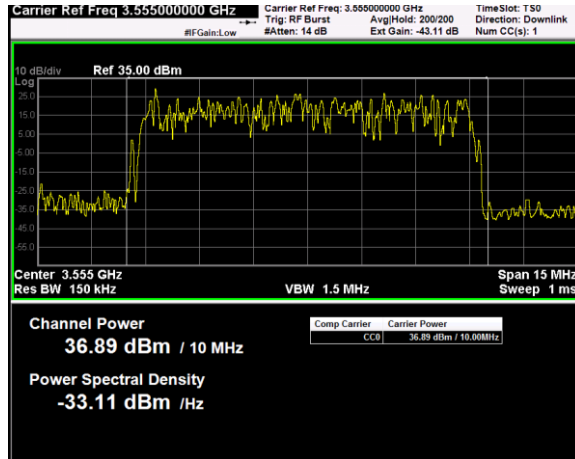
$$\text{PSD eirp (in 1 MHz)} = \text{PSD}_{\text{max}} - N + G_{\text{max}} = 27^* - N + G_{\text{max}} \leq 37$$

The allowed max antenna gain is calculated as: $G_{\text{max}} \leq (37 - 27 + N) = N + 10 \text{ dBi}$

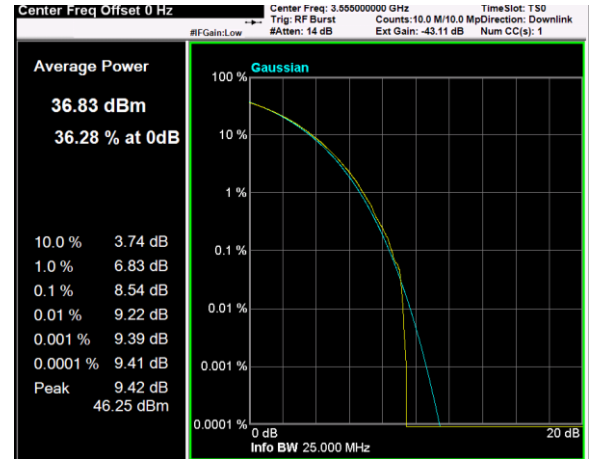
Where:

- PSD_{max} is the maximum PSD value measured on the antenna connector of the equipment and it depends on the LTE bandwidth signal (*: 37 dBm, that is the measured value at antenna port, with a 10 MHz band matches up $37 + 10 \cdot \log(1/10) = 27 \text{ dBm/1MHz}$)
- N is system path loss (in dB) due to cable insertion, splitter, etc....
- G_{max} is the maximum antenna gain allowed (in dBi)

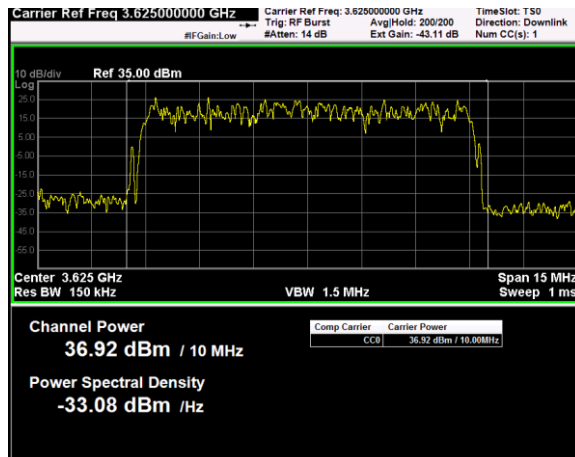
RF PORT 1 PLOT



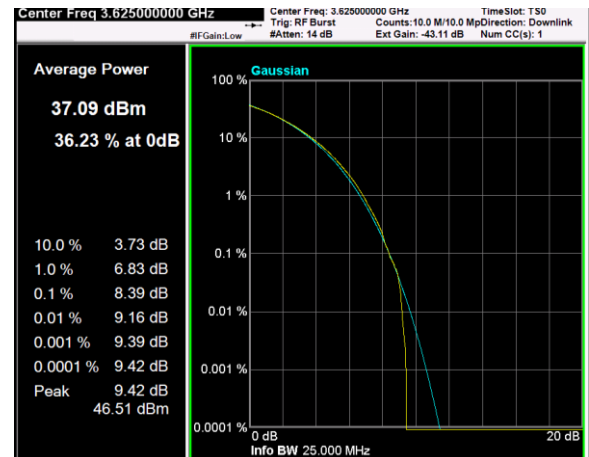
Channel: BOTTOM, Modulation: QPSK, BW=10MHz, Channel Power



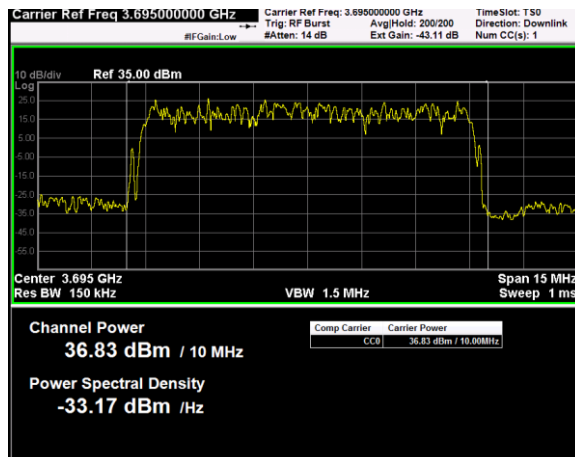
Channel: BOTTOM, Modulation: QPSK, BW=10MHz, CCDF



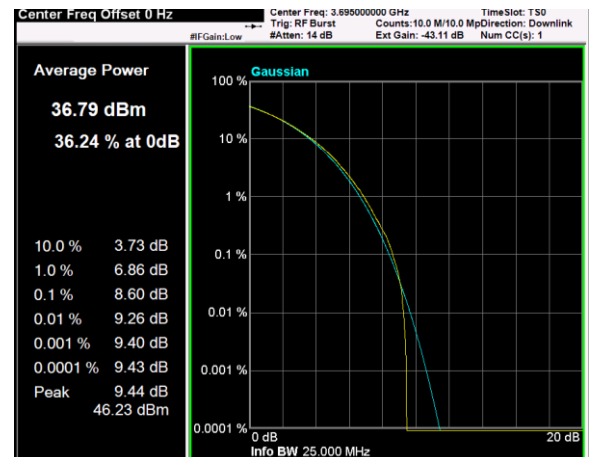
Channel: MIDDLE, Modulation: QPSK, BW=10MHz, Channel Power



Channel: MIDDLE, Modulation: QPSK, BW=10MHz, CCDF



Channel: TOP, Modulation: QPSK, BW=10MHz, Channel Power



Channel: TOP, Modulation: QPSK, BW=10MHz, CCDF