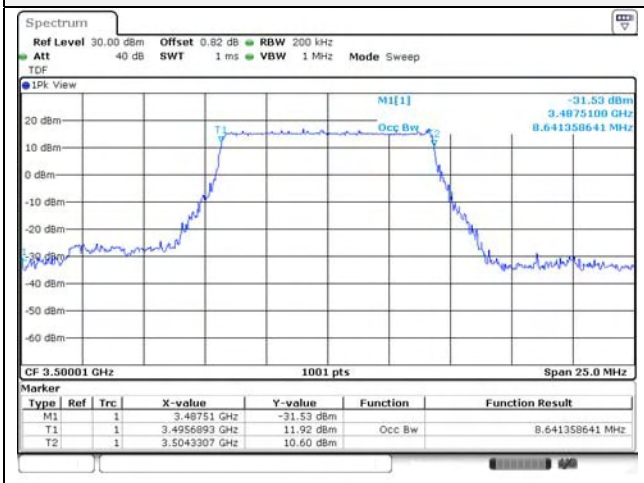
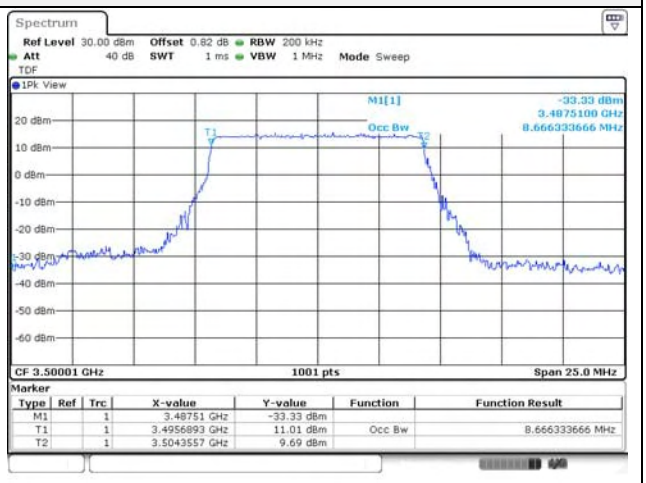
Test mode: NR n77 (Lower) (PC3)

10M BW QPSK Mid ch.

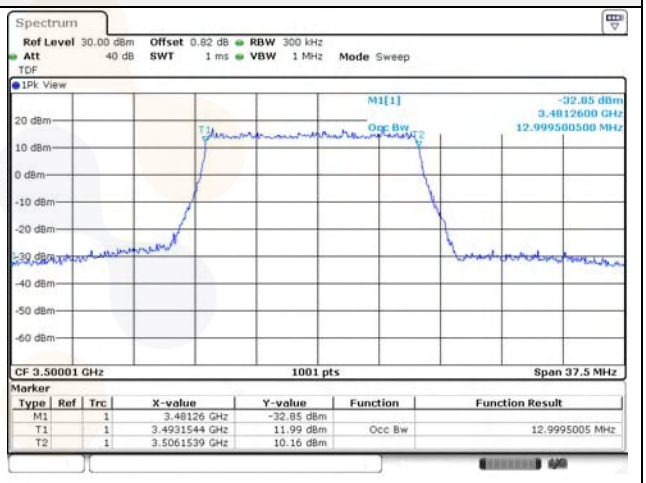


10M BW 16QAM Mid ch.

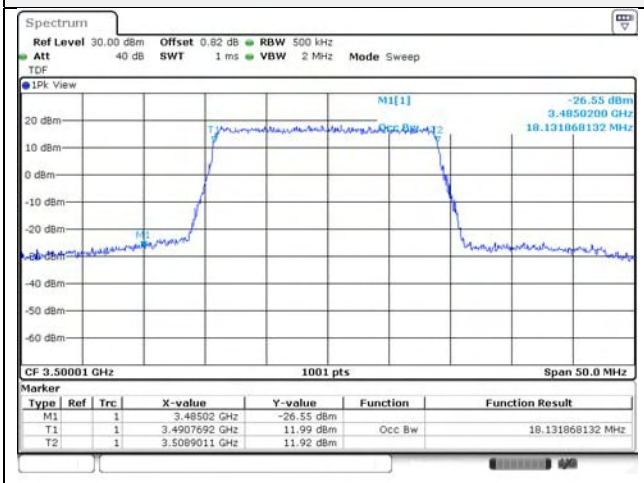


15M BW QPSK Mid ch.

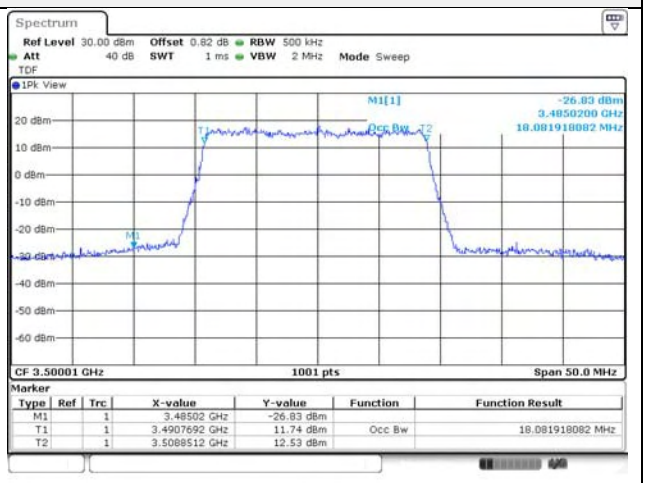
15M BW 16QAM Mid ch.



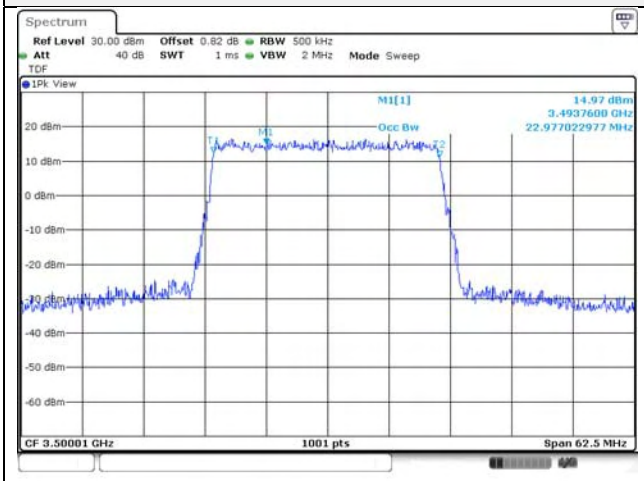
20M BW QPSK Mid ch.



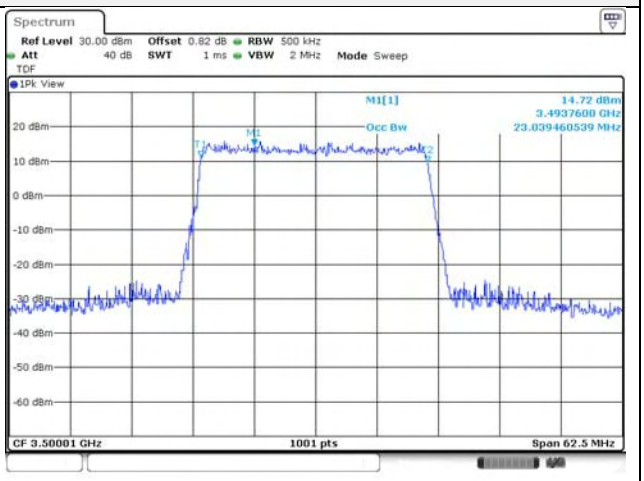
20M BW 16QAM Mid ch.



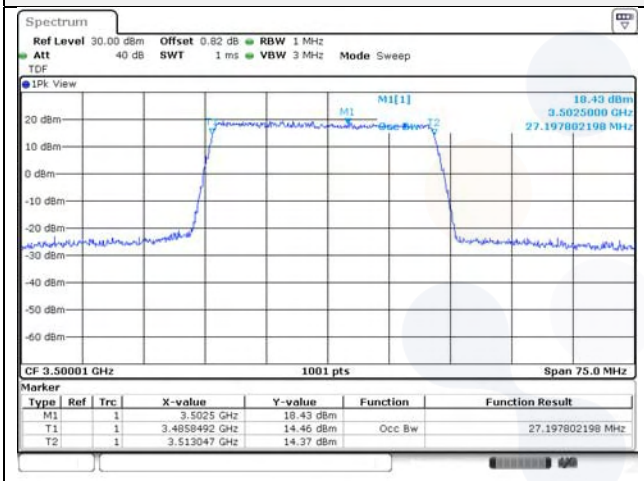
25M BW QPSK Mid ch.



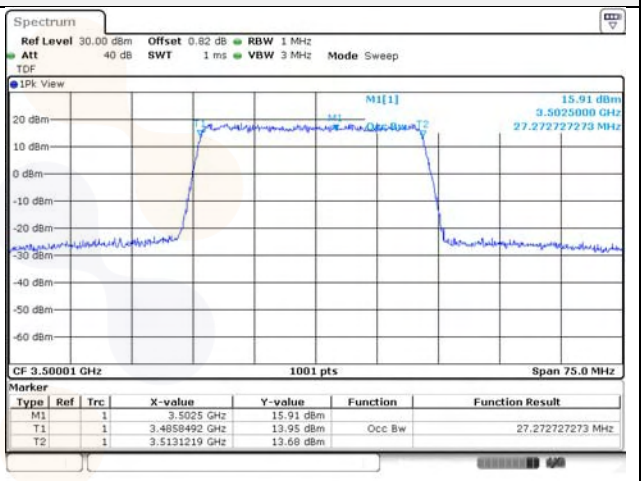
25M BW 16QAM Mid ch.



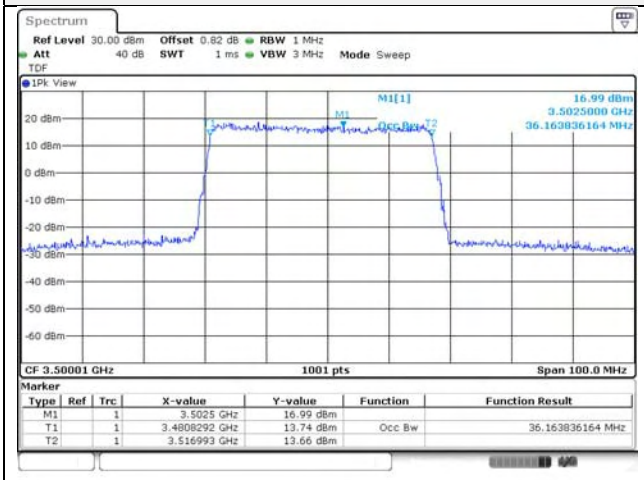
30M BW QPSK Mid ch.



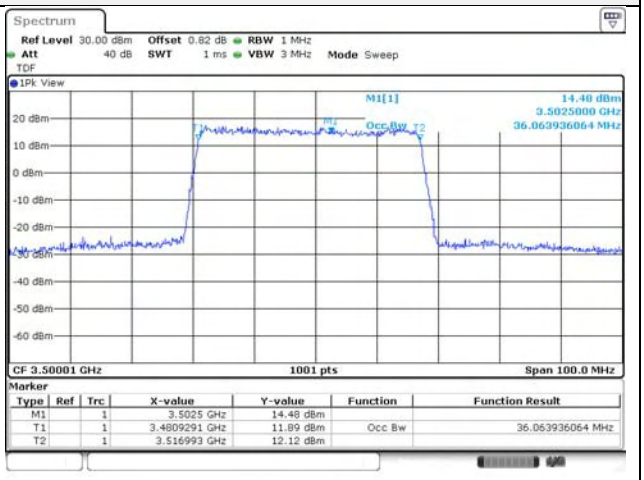
30M BW 16QAM Mid ch.



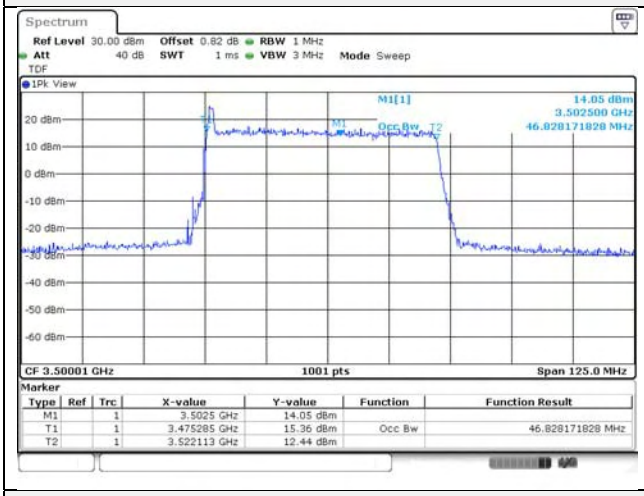
40M BW QPSK Mid ch.



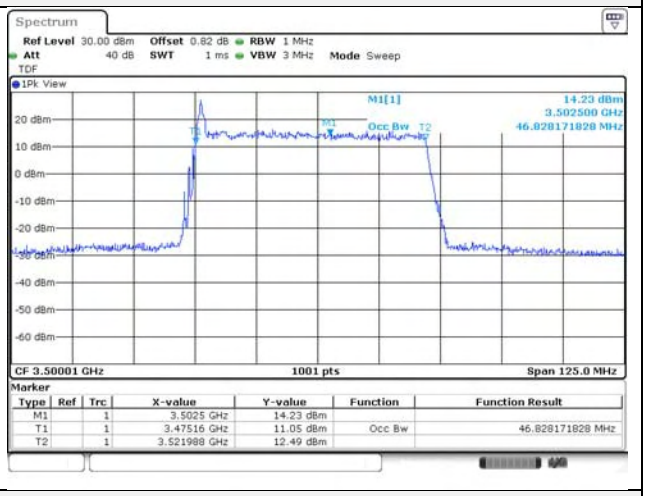
40M BW 16QAM Mid ch.



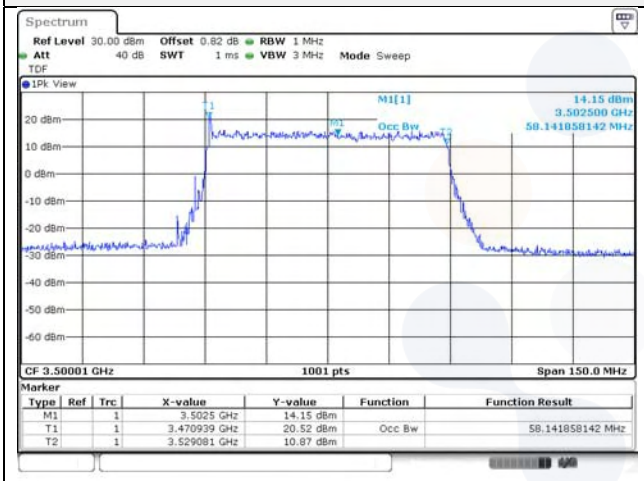
50M BW QPSK Mid ch.



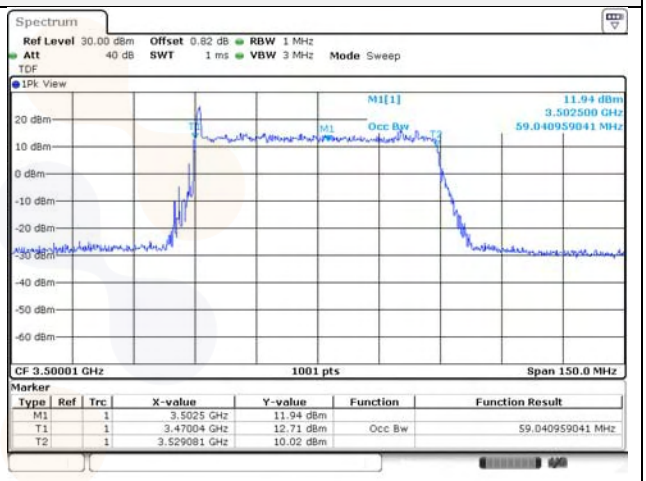
50M BW 16QAM Mid ch.



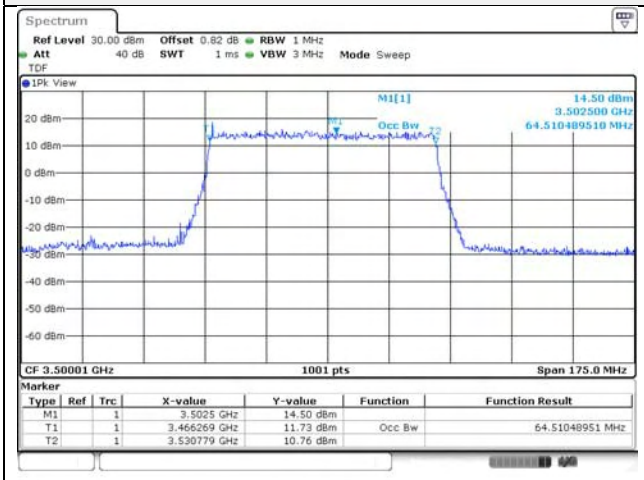
60M BW QPSK Mid ch.



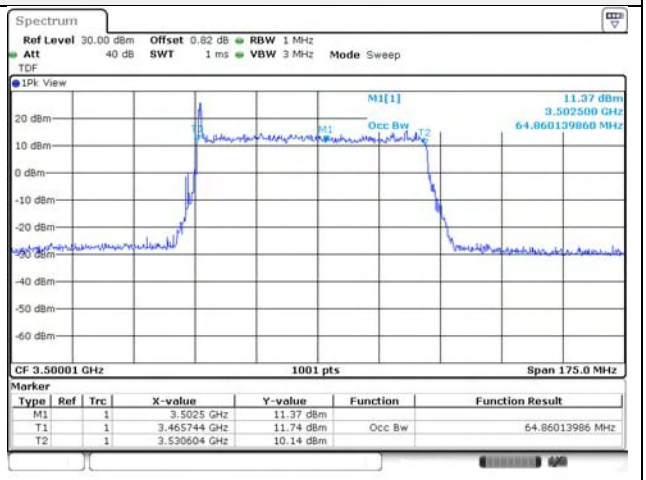
60M BW 16QAM Mid ch.



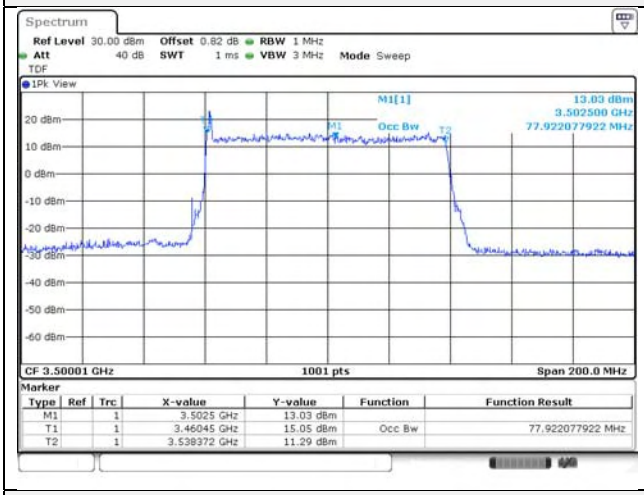
70M BW QPSK Mid ch.



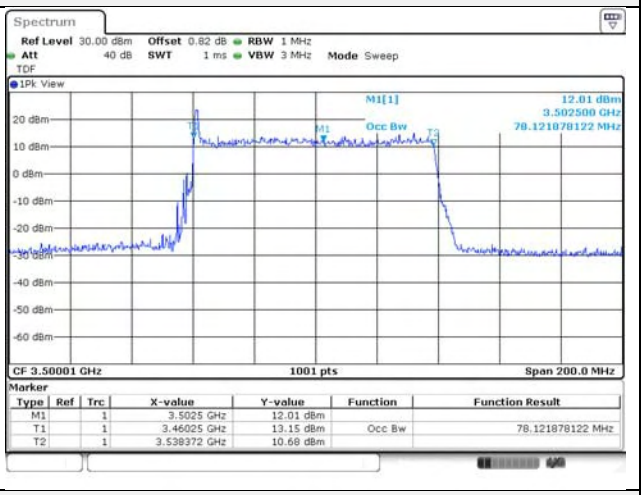
70M BW 16QAM Mid ch.



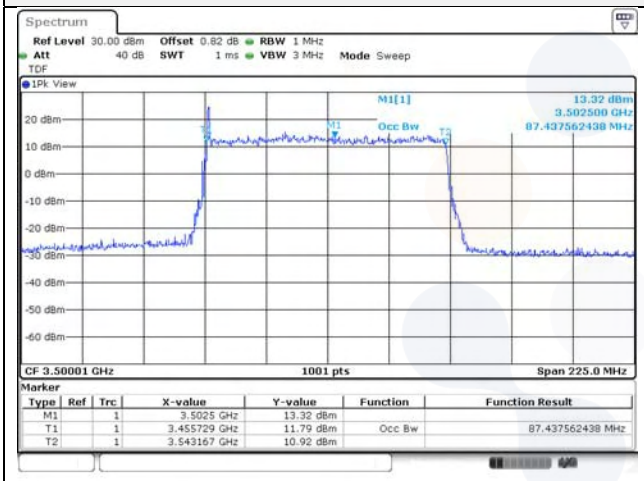
80M BW QPSK Mid ch.



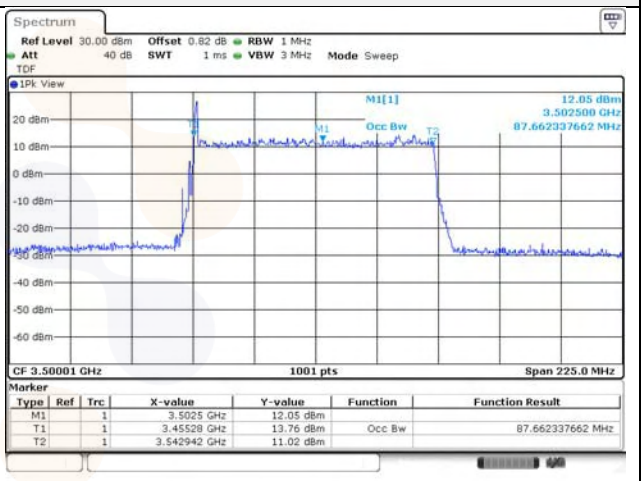
80M BW 16QAM Mid ch.



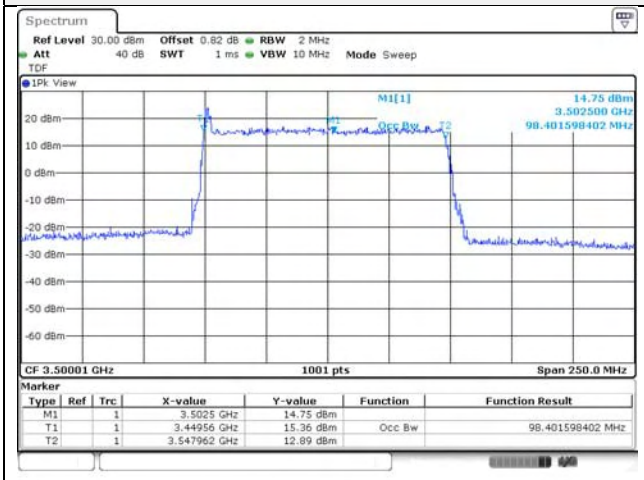
90M BW QPSK Mid ch.



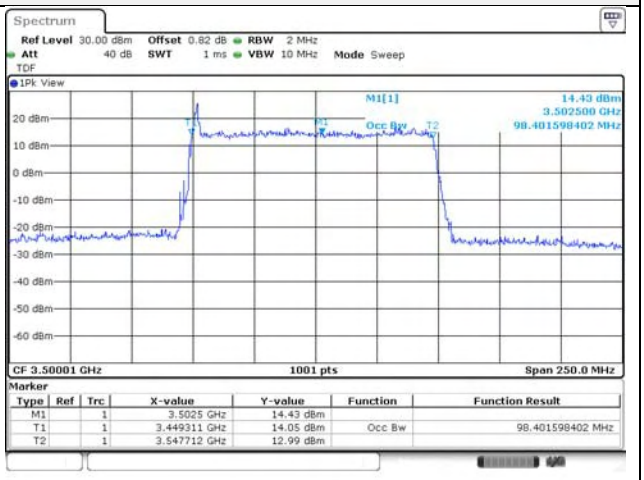
90M BW 16QAM Mid ch.



100M BW QPSK Mid ch.

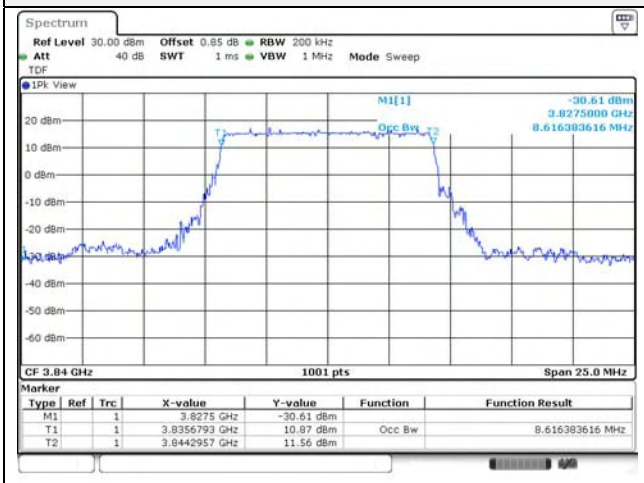


100M BW 16QAM Mid ch.

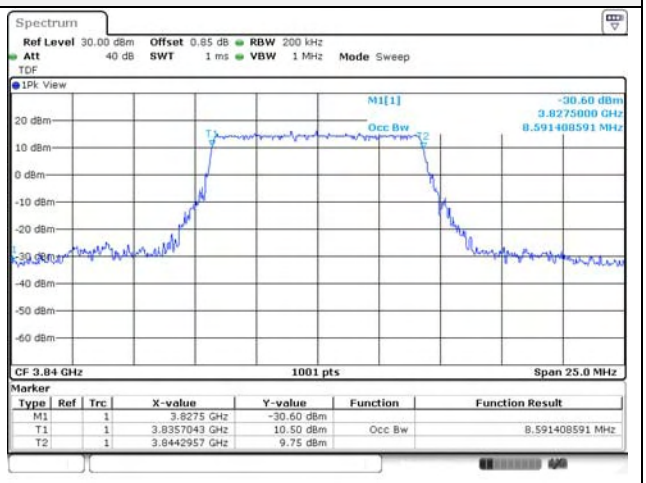


Test mode: NR n77 (Upper) (PC3)

10M BW QPSK Mid ch.

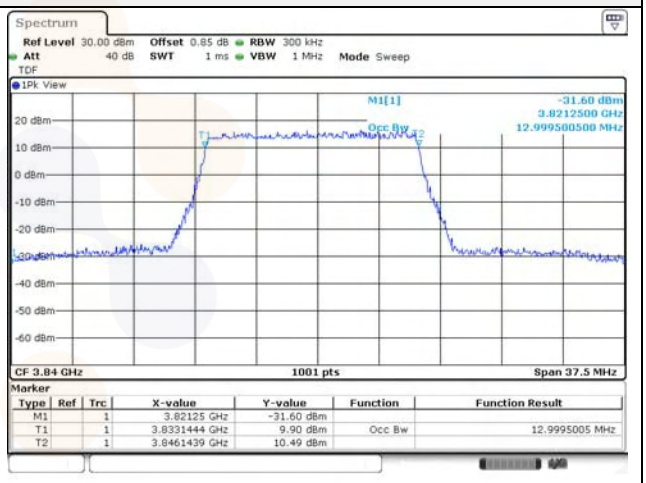


10M BW 16QAM Mid ch.

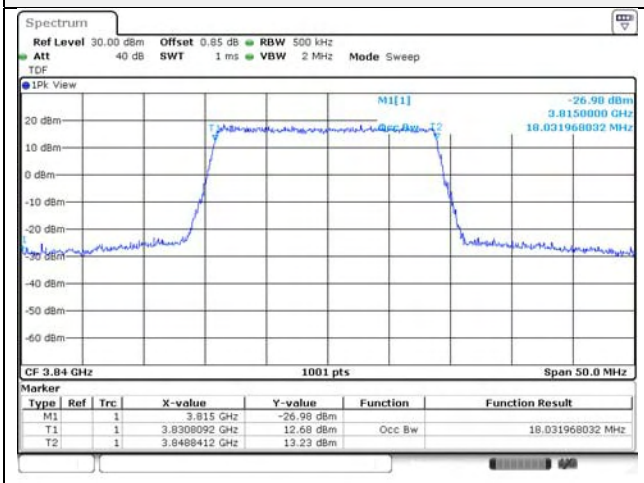


15M BW QPSK Mid ch.

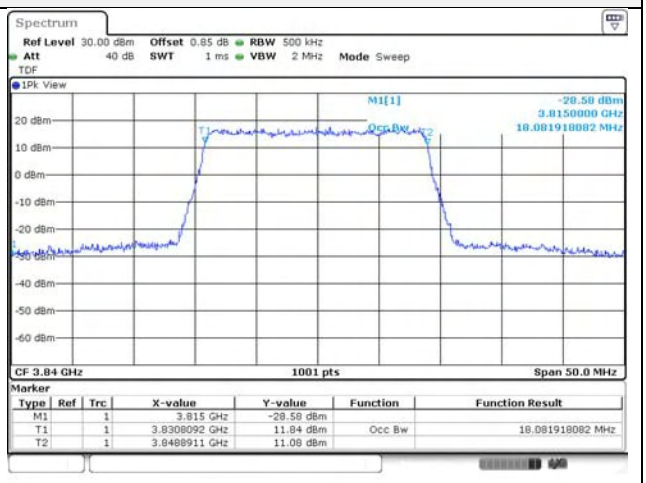
15M BW 16QAM Mid ch.



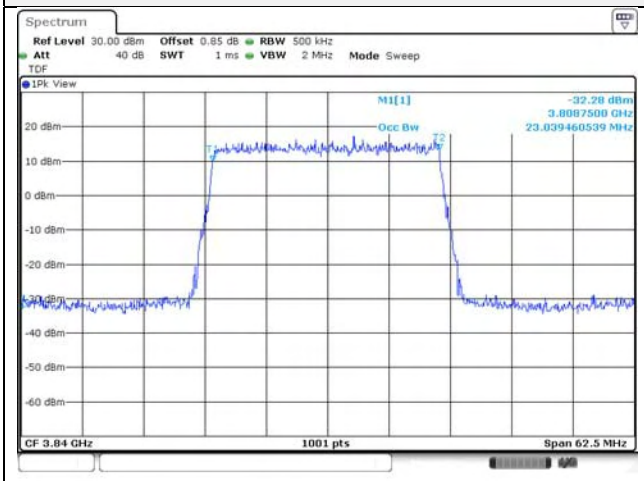
20M BW QPSK Mid ch.



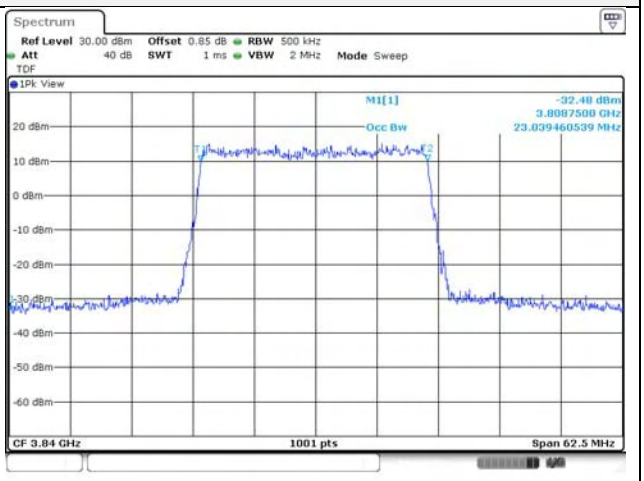
20M BW 16QAM Mid ch.



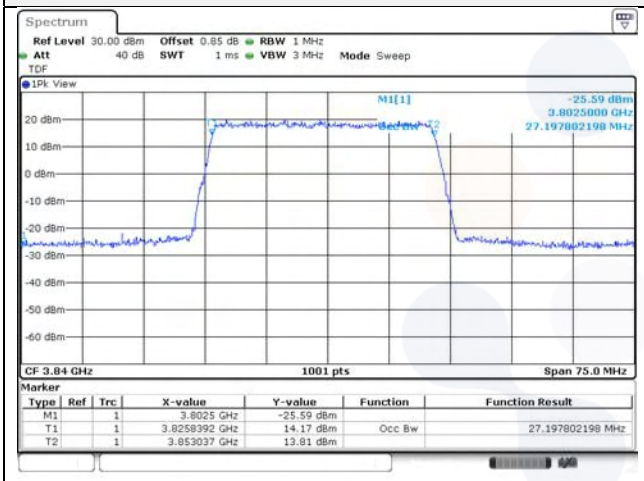
25M BW QPSK Mid ch.



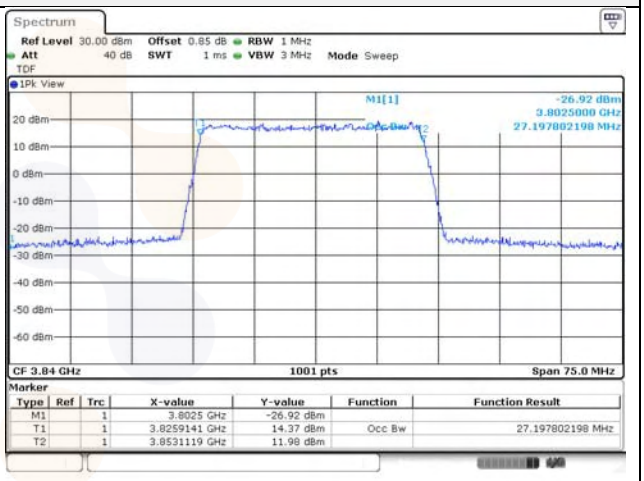
25M BW 16QAM Mid ch.



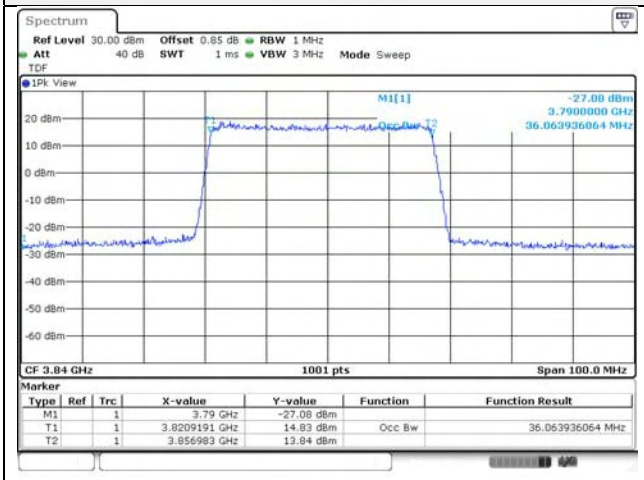
30M BW QPSK Mid ch.



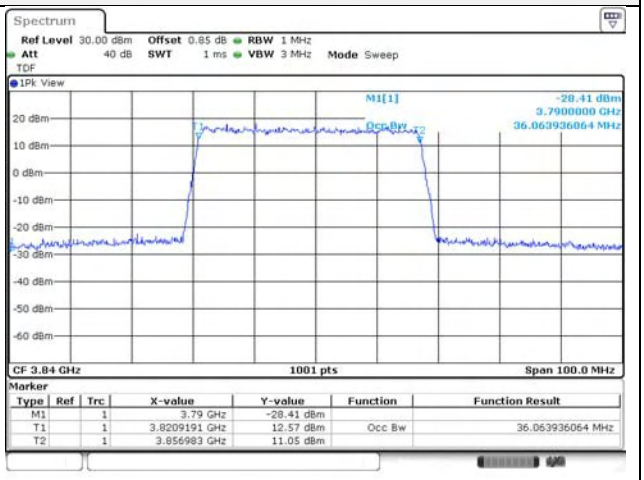
30M BW 16QAM Mid ch.



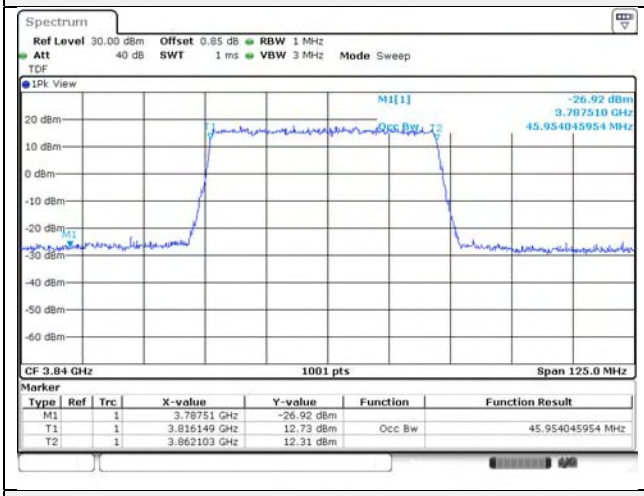
40M BW QPSK Mid ch.



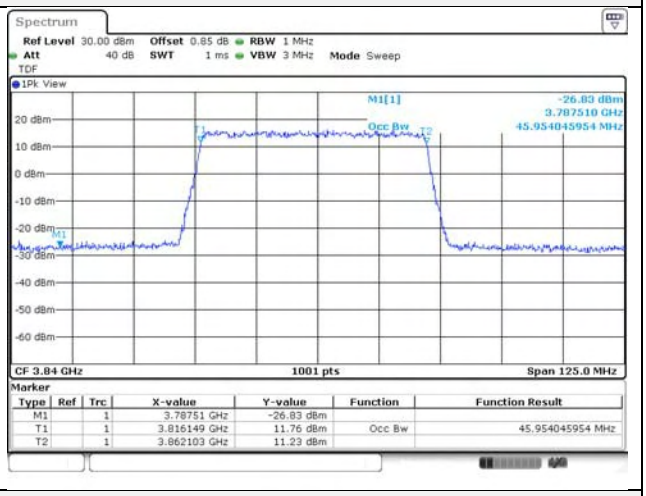
40M BW 16QAM Mid ch.



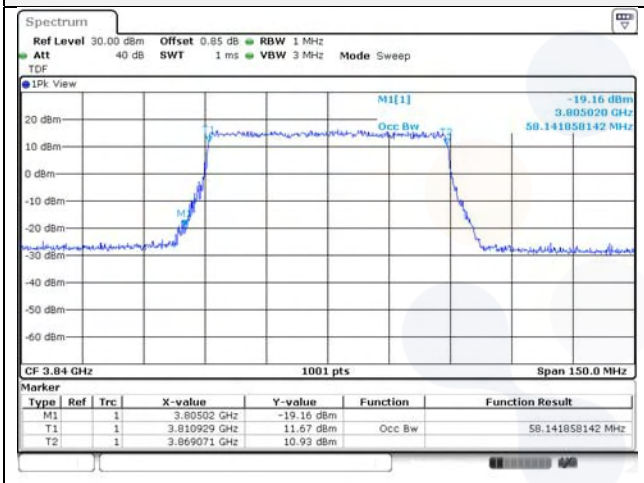
50M BW QPSK Mid ch.



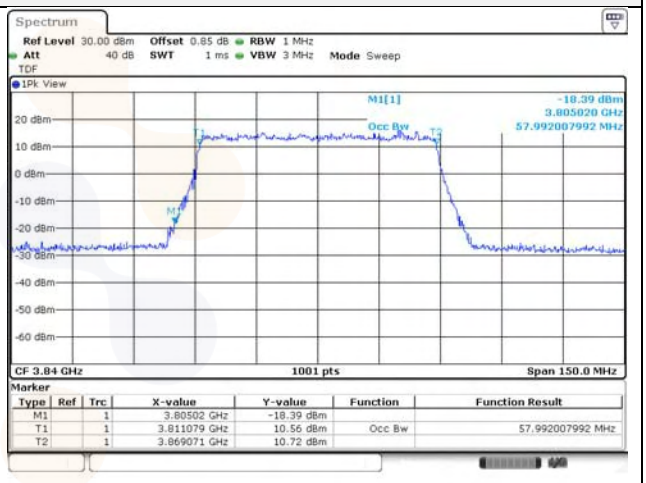
50M BW 16QAM Mid ch.



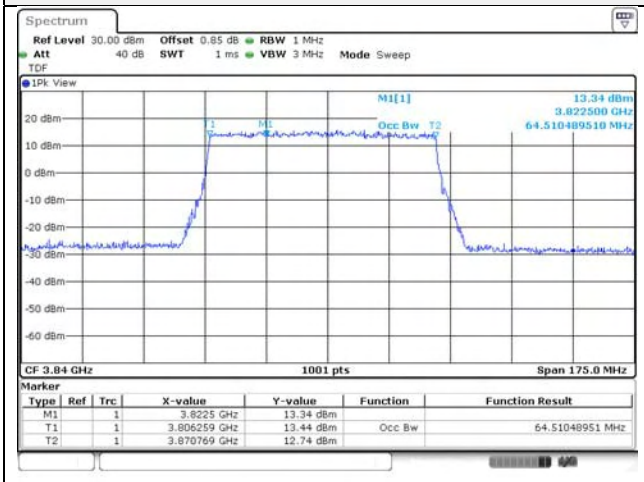
60M BW QPSK Mid ch.



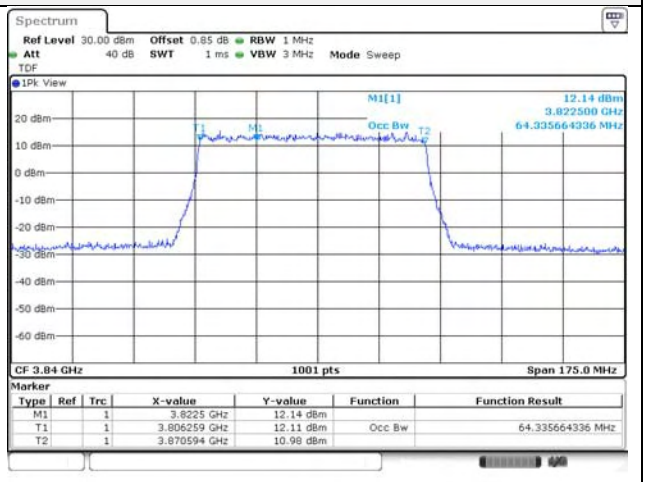
60M BW 16QAM Mid ch.



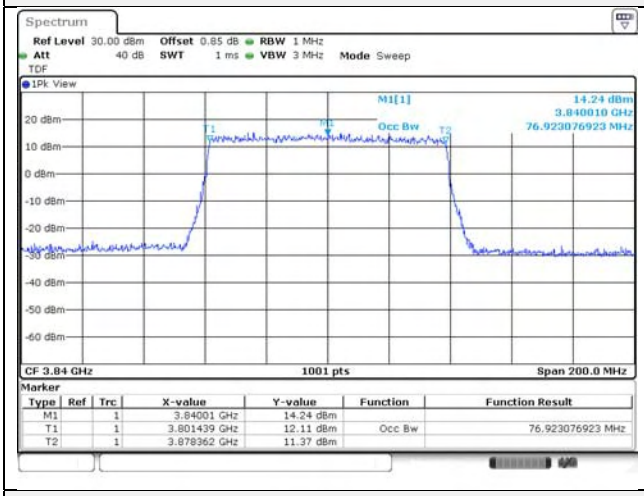
70M BW QPSK Mid ch.



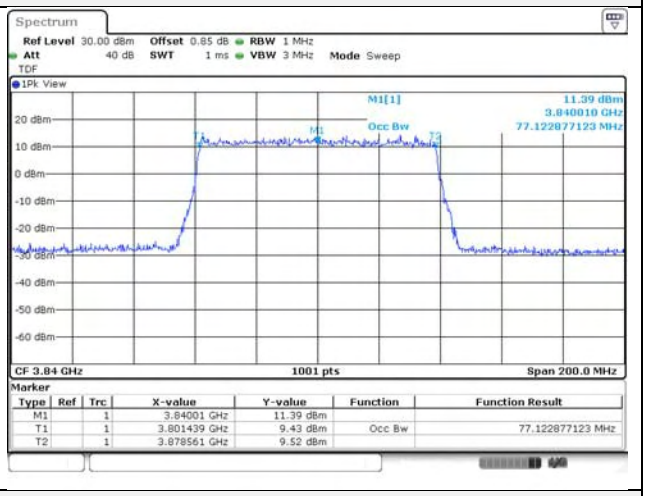
70M BW 16QAM Mid ch.



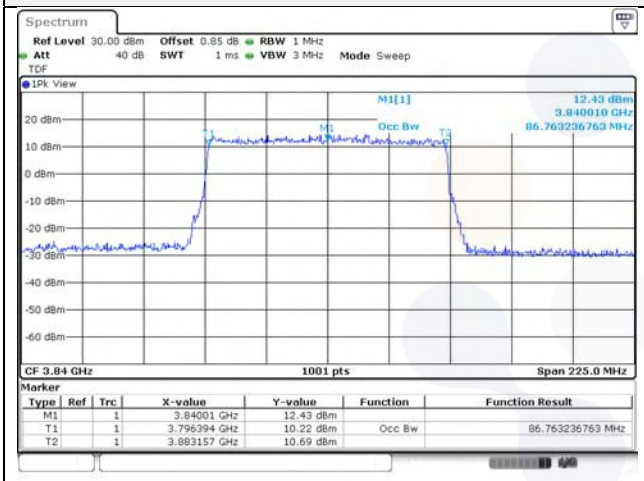
80M BW QPSK Mid ch.



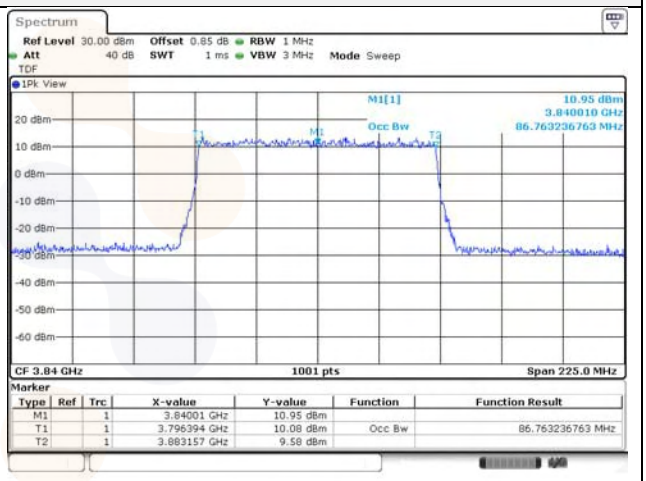
80M BW 16QAM Mid ch.



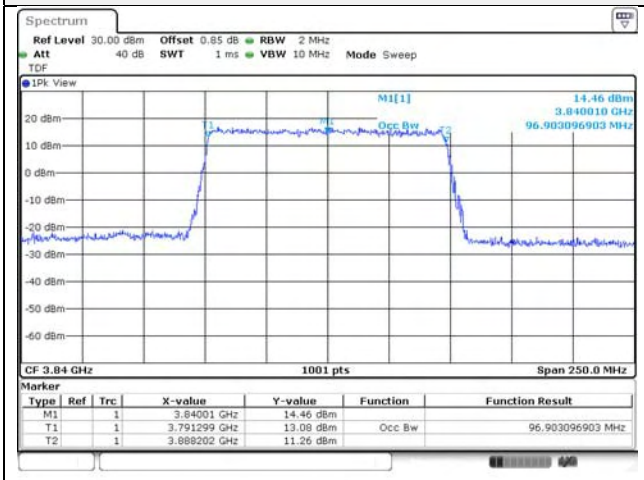
90M BW QPSK Mid ch.



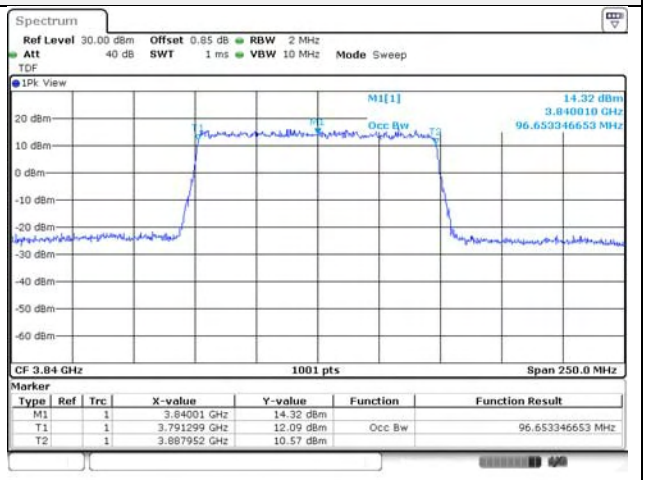
90M BW 16QAM Mid ch.



100M BW QPSK Mid ch.



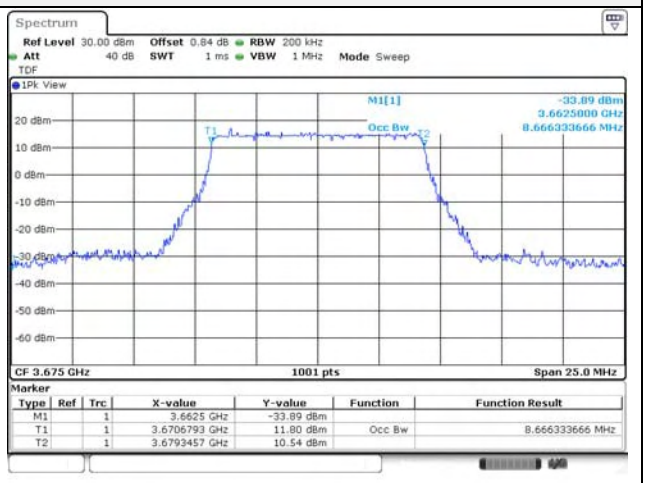
100M BW 16QAM Mid ch.



Test mode: NR n77 (PC3 - IC)

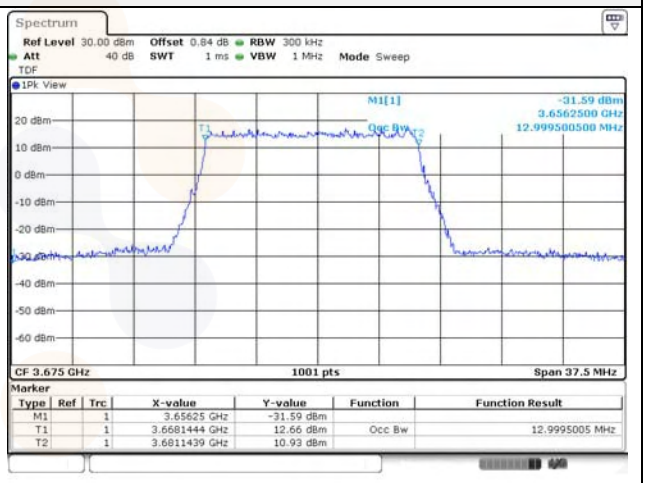
10M BW QPSK Mid ch.

10M BW 16QAM Mid ch.



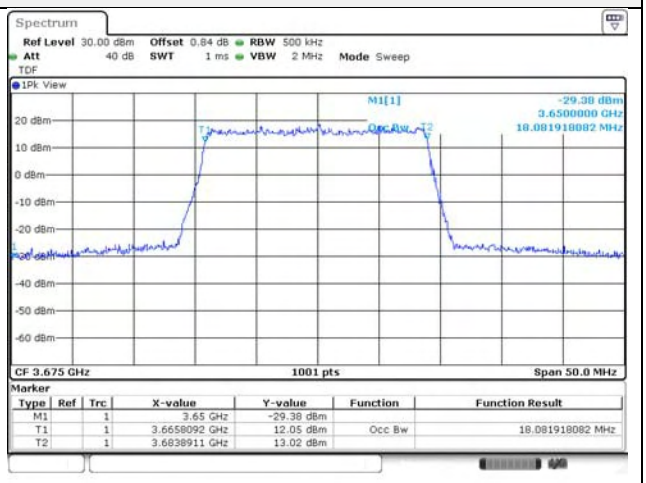
15M BW QPSK Mid ch.

15M BW 16QAM Mid ch.

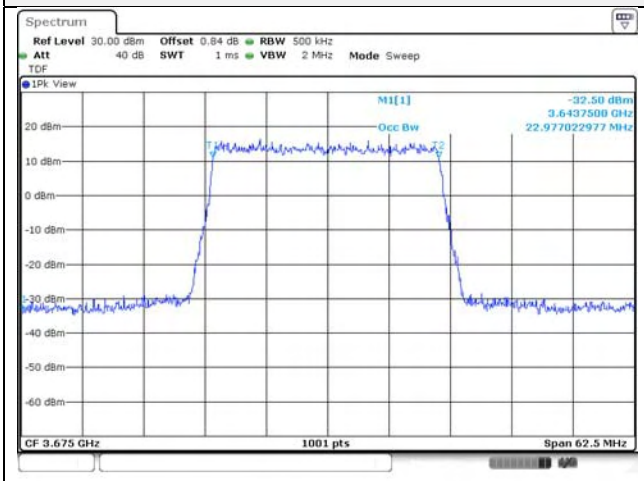


20M BW QPSK Mid ch.

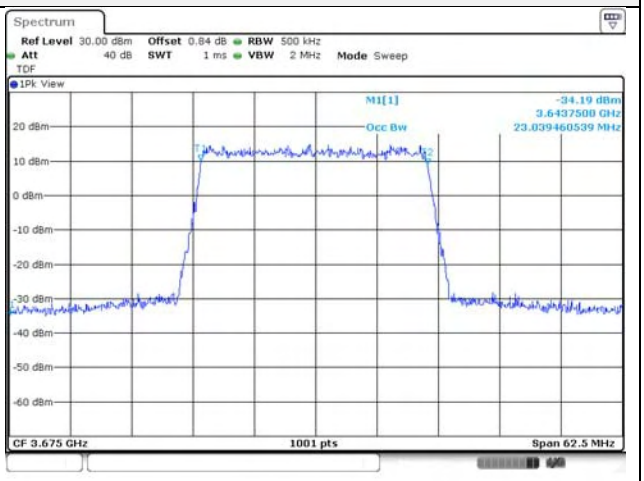
20M BW 16QAM Mid ch.



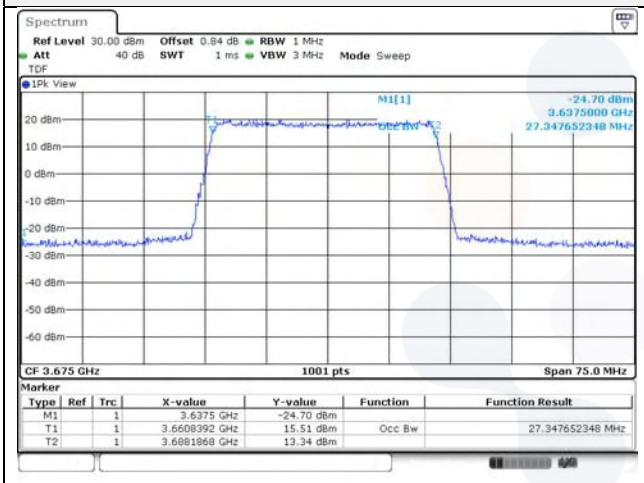
25M BW QPSK Mid ch.



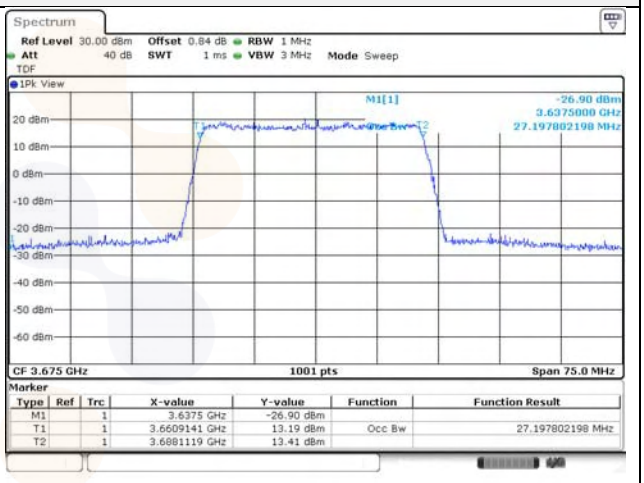
25M BW 16QAM Mid ch.



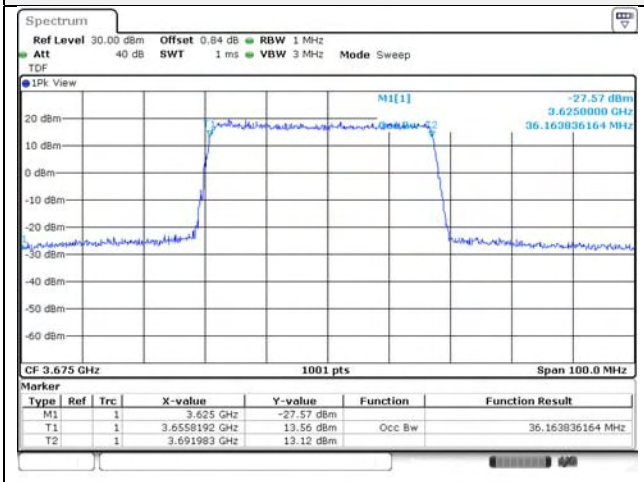
30M BW QPSK Mid ch.



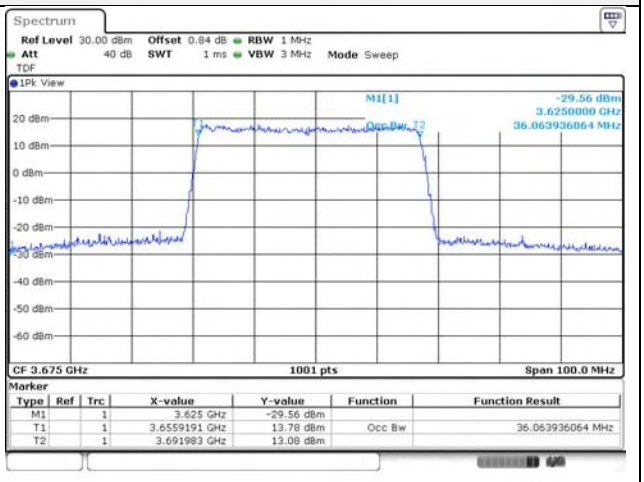
30M BW 16QAM Mid ch.



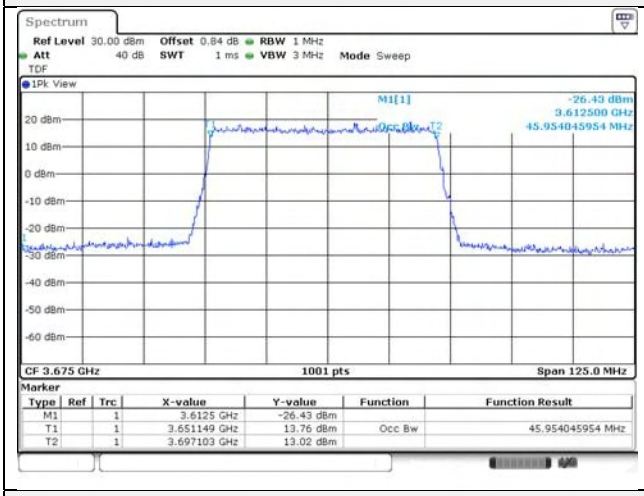
40M BW QPSK Mid ch.



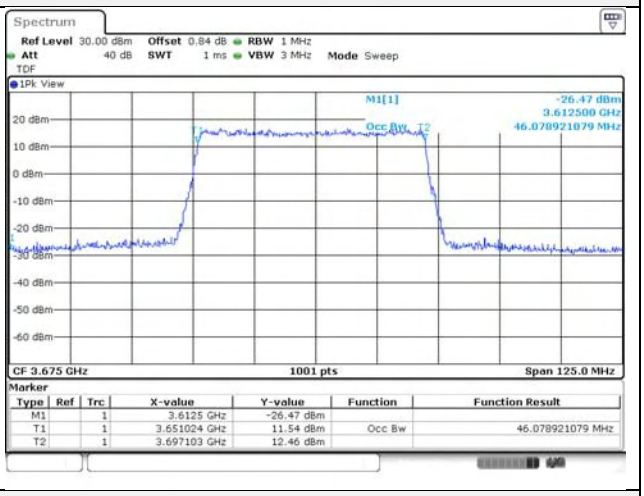
40M BW 16QAM Mid ch.



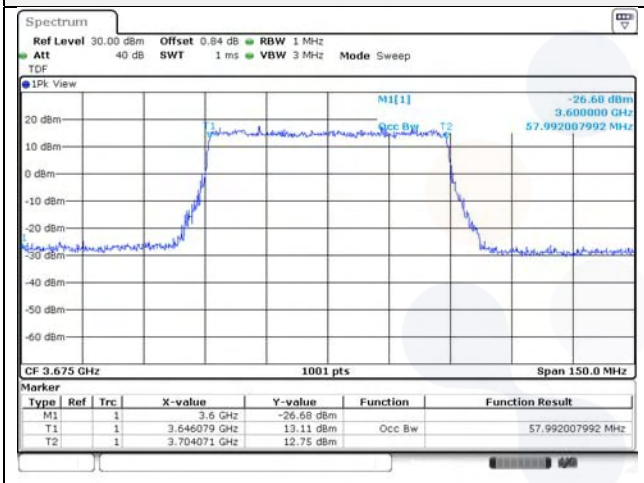
50M BW QPSK Mid ch.



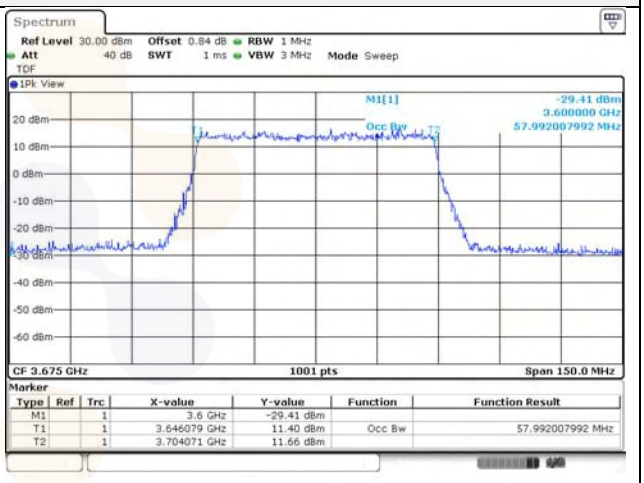
50M BW 16QAM Mid ch.



60M BW QPSK Mid ch.



60M BW 16QAM Mid ch.



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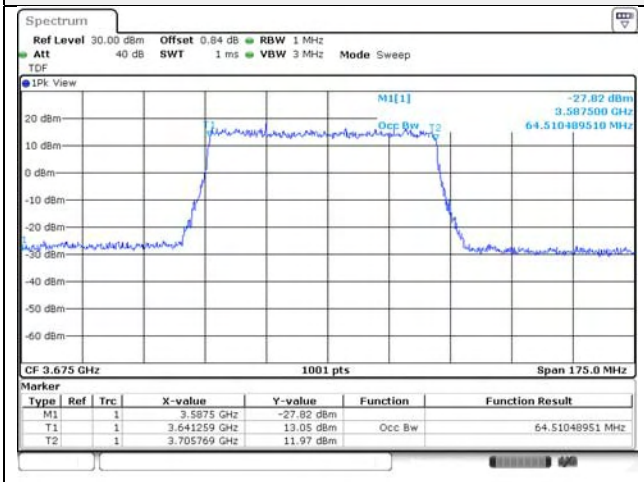

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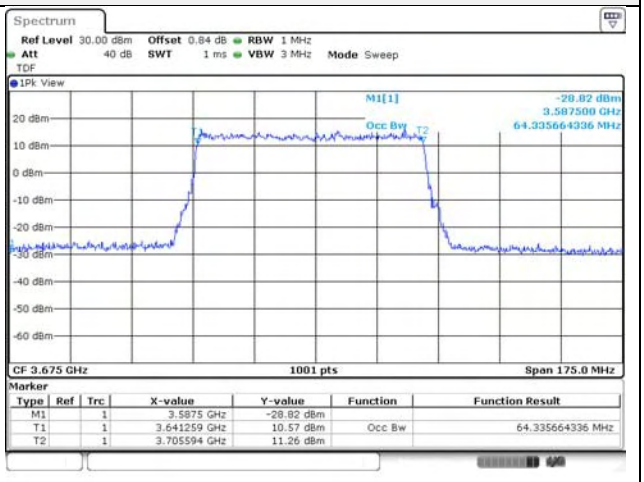
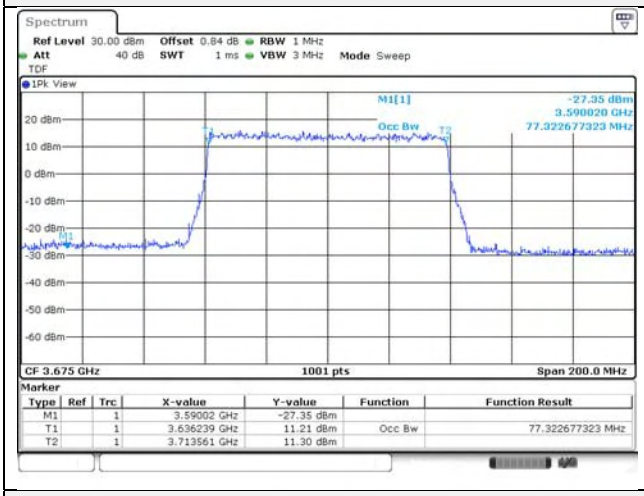


80M BW QPSK Mid ch.



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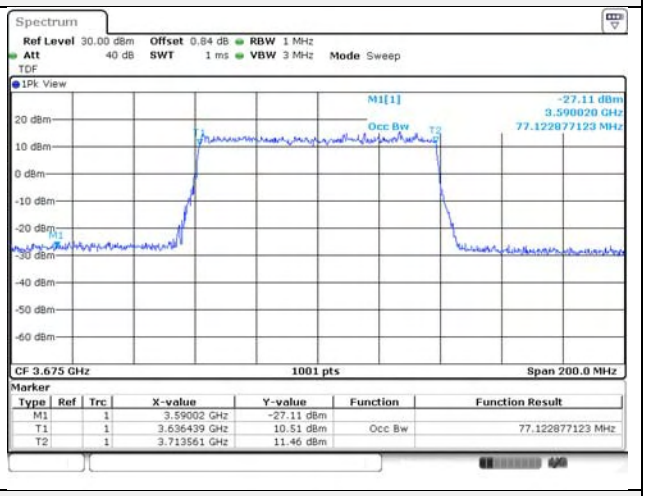

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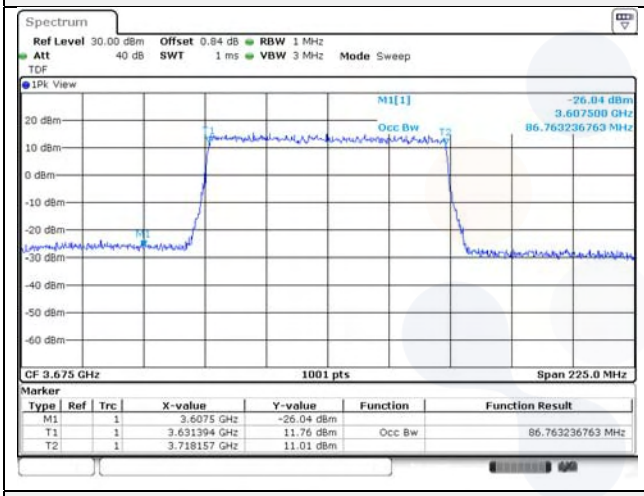
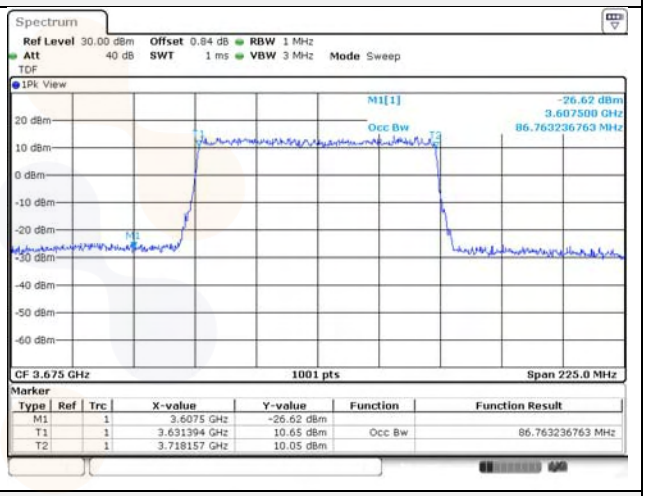
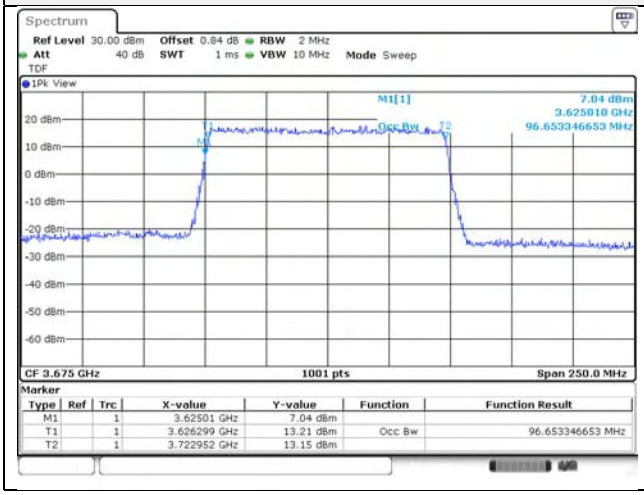


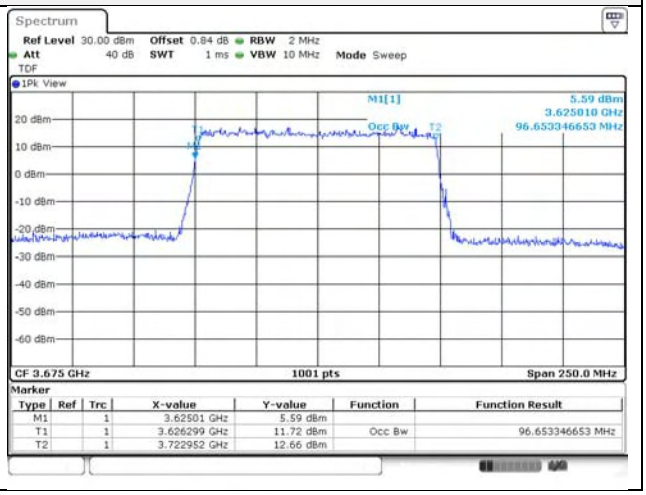
90M BW 16QAM Mid ch.



100M BW QPSK Mid ch.

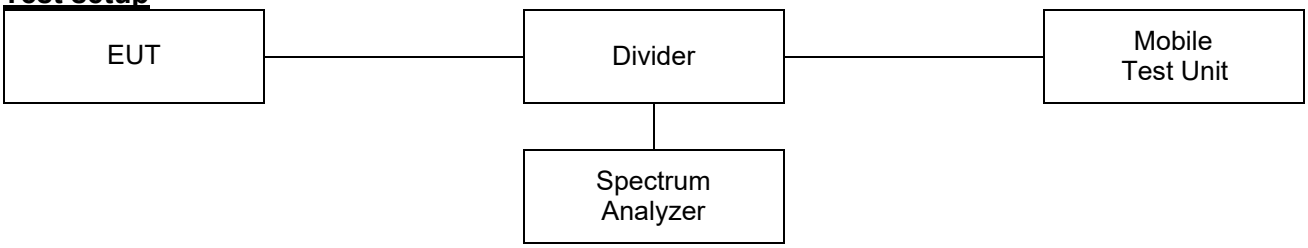


100M BW 16QAM Mid ch.



7.3. Band Edge Emissions at Antenna Terminal

Test setup



Limit

According to §22.917(a), §24.238(a) and RSS-132(5.5), RSS-133(6.5),

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($P_{[Watts]}$) ㏈.

According to §27.53(a),

For operations in the 2305–2320 ㎒ band and the 2345–2360 ㎒ band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power P (with averaging performed only during periods of transmission) within the licensed band(s) of operation, in watts, by the following amounts:

(4) For mobile and portable stations operating in the 2305–2315 ㎒ and 2350–2360 ㎒ bands:

(i) By a factor of not less than: 43 + 10 log (P) ㏈ on all frequencies between 2305 and 2320 ㎒ and on all frequencies between 2345 and 2360 ㎒ that are outside the licensed band(s) of operation, not less than 55 + 10 log (P) ㏈ on all frequencies between 2320 and 2324 ㎒and on all frequencies between 2341 and 2345 ㎒ , not less than 61 + 10 log (P) ㏈ on all frequencies between 2324 and 2328 ㎒ and on all frequencies between 2337 and 2341 ㎒ , and not less than 67 + 10 log (P) ㏈ on all frequencies between 2328 and 2337 ㎒ ;

(ii) By a factor of not less than 43 + 10 log (P) ㏈ on all frequencies between 2300 and 2305 ㎒, 55 + 10 log (P) ㏈ on all frequencies between 2296 and 2300 ㎒, 61 + 10 log (P) ㏈ on all frequencies between 2292 and 2296 ㎒ , 67 + 10 log (P) ㏈ on all frequencies between 2288 and 2292 ㎒, and 70 + 10 log (P) ㏈ below 2288 ㎒;

(iii) By a factor of not less than 43 + 10 log (P) ㏈ on all frequencies between 2360 and 2365 ㎒, and not less than 70 + 10 log (P) ㏈ above 2365 ㎒.

According to §27.53(g), and RSS-130(4.7)

For operations in the 600 ㎒ band and the 698-746 ㎒ band, the power of any emission 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 + 10log($P_{[Watts]}$) ㏈.

According to §27.53(h) and RSS-139(5.6),

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10log($P_{[Watts]}$) ㏈.

According to §27.53(l)(2),

The following emission limits apply to stations transmitting in the 3700-3980 ㎒ band:

(2) For mobile operations in the 3700-3980 ㎒ band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed -13 ㏈m/㎒.

According to §27.53(n)(2),

The following emission limits apply to stations transmitting in the 3450-3550 ㎒ band:

(2) For mobile operations in the 3450-3550 ㎒ band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed -13 ㏈m/㎒.

According to RSS-192(5.6)
Subscriber equipment shall have the TRP or conducted power (per antenna), where applicable, of unwanted emission not exceeding the following:

a. The limits in table 6
b. a limit of -30 dBm/MHz in the frequency range greater than (B+5) MHz from the edge of the frequency band

Table 6: Unwanted emission limits for subscriber equipment

Frequency block group (B)	Offset frequency from the edge of the frequency block group (MHz)			
	0 to 1	1 to 5	5 to B	>B
10MHz, 20MHz, 30MHz and 40MHz	-13 dBm/1% of B	-10 dBm/MHz	-13 dBm/MHz	-25 dBm/MHz
>40MHz	-13 dB m/400 kHz	-10 dBm/MHz	-13 dBm/MHz	-25 dBm/MHz

According to §27.53(m)(4),
The attenuation factor shall be not less than 40 + 10log($P_{[Watts]}$) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10log($P_{[Watts]}$) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10log($P_{[Watts]}$) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10log($P_{[Watts]}$) dB on all frequencies between 2490.5 MHzand 2496 MHz and 55 + 10log($P_{[Watts]}$) dB at or below 2490.5 MHz .

According to RSS-199 (5.6),
Table 5: Unwanted emission limits for subscriber equipment other than fixed subscriber equipment

Offset from the edge of the frequency block or frequency block group (MHz)	Unwanted emission limits
0-1	-10 dBm/(2% of OB*)
1-5	-10 dBm/MHz
5-X**	-13 dBm/MHz
≥X	-25 dBm/MHz

*OB is the occupied bandwidth
** X is 6 MHz or the equipment occupied bandwidth, whichever is greater
In additions to complying with the limits in table 5, subscriber equipment other than fixed subscriber equipment shall not exceed -13 dB m/ MHz on all frequencies between 2490.5 MHz and 2496 MHz , and -25 dBm/MHz at or below 2490.5 MHz.

Test procedure

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ANSI C63.26-2015 – Section 5.7

Test settings

1) Start frequency was set to 30 ㎒ and stop frequency was set to at least 10th the fundamental frequency.
2) Span was set large enough so as to capture all out of band emissions near the band edge.
3) Set the RBW > 1% of the emission bandwidth.
4) Set the VBW ≥ 3 x RBW.
5) Set the number of sweep points ≥ 2 x Span/RBW
6) Detector = RMS
7) Trace mode = trace average
8) Sweep time should be auto for peak detection. For RMS detection the sweep time should be set as follows:
    a) If the device can be configured to transmit continuously (duty cycle ≥ 98%), set the (sweep time) > (number of points in sweep) x (symbol period) (e.g., by a factor of 10 x symbol period x number of points) Increasing the sweep time (i.e., slowing the sweep speed) will allow for averaging over multiple symbols.
    b) If the device cannot transmit continuously (duty cycle < 98%), a gated sweep shall be used when possible (i.e., gate triggered such that the analyzer only sweeps when the device is transmitting at full power), set the sweep time > (number of points in sweep) x (symbol period) but the sweep time shall always be maintained at a value that is less than or equal to the minimum transmission time
    c) If the device cannot be configured to transmit continuously (duty cycle > 98%), and a free-running sweep must be used, set the sweep time so that the averaging is performed over multiple on/off cycles by setting the sweep time > (number of points in sweep) × (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by [10 log (1/duty cycle)]. This assumes that the transmission period and duty cycle is relatively constant (duty cycle variation ≤ ±2%).
    d) If the device cannot be configured to transmit continuously and a free-running sweep must be used, and if the transmissions exhibit a non-constant duty cycle (duty cycle variations > ±2%), set the sweep time so that the averaging is performed over the on-period by setting the sweep time > (symbol period) × (number of points), while also maintaining the sweep time < (transmitter on-time). The trace mode shall be set to max hold, since not every display point will be averaged only over just the on-time. Thus, multiple sweeps (e.g., 100) in maximum hold art necessary to ensure that the maximum power is measured.
9) Allow trace to fully stabilize.

Notes:

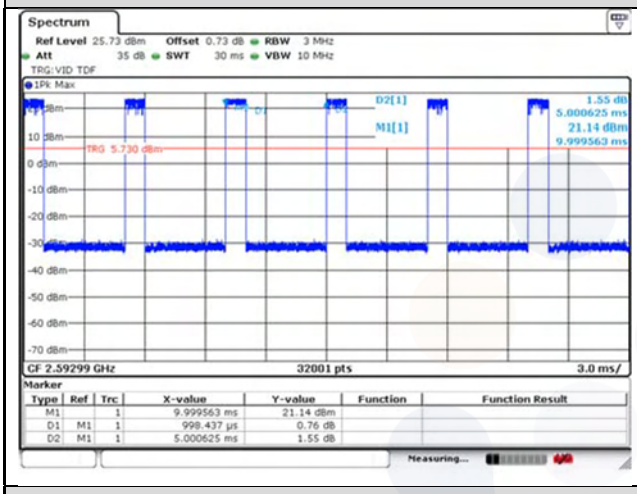
1. Per 22.917(b), 24.238(b), 27.53(a)(5), 27.53(h)(3) and RSS-132(5.5), RSS-133(6.5), RSS-139(5.6), RSS-195(5.6), compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 ㎒ or greater. however in the 1 ㎒ bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㏈ below the transmitter power.
2. Per 27.25(g) and RSS-130(4.7), compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 ㎑ may be employed.
3. Per 27.53(l)(2) and RSS-192(5.6), Compliance with this paragraph (l)(2) is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be either one percent of the emission bandwidth of the fundamental emission of the transmitter or 350 ㎑. In the bands between 1 and 5 ㎒ removed from the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be 500 ㎑ . The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㏈ below the transmitter power.
4. Per 27.53(n)(2) and RSS-192(5.6), Compliance with this paragraph (n)(2) is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed, but limited to a maximum of 200 ㎑ . In the bands between 1 and 5 ㎒ removed from the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be 500 ㎑ . The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㏈ below the transmitter power.
5. Per 27.53(m)(6) in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed, except when the 1 megahertz band is 2495-2496 ㎒, in which case a resolution bandwidth of at least one percent may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 megahertz or 1 percent of emission bandwidth, as specified; or 1 megahertz or 2 percent for mobile digital stations, except in the band 2495-2496 ㎒).
6. The EUT was setup to maximum output power as its lowest and highest channel with all bandwidth, modulation and RB configurations.
7. The measurement bandwidth is less than the reference bandwidth of 1MHz no additional correction to be applied as ANSI C63.26 section 4.2.3 only requires the correction to be applied when the OBW of the emission being measured is wider than the measurement bandwidth (Where the OBW of the signal under measurement is less than the RBW of the measuring instrument, no bandwidth correction or integration will be required). Plots for low and high channels show the level of the emission measured with the reduced bandwidth and the level of the emission measured with the reduced bandwidth and the level of the same emission measured using the integration method over the 1MHz reference bandwidth are very close, indicating the emissions are narrowband.

8. Duty cycle factor

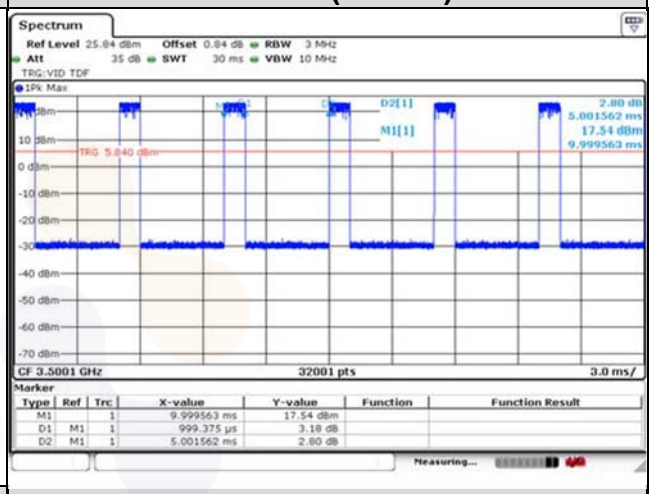
Band	Period (ms)	On time (ms)	Duty cycle		Duty Cycle Factor (dB)
			(Linear)	(%)	
NR n41	5.000 625	0.998 437	0.199 624	19.96	7.00
NR n77 (Lower)	5.001 562	0.999 375	0.199 813	19.98	6.99
NR n77 (Upper)	5.000 625	0.999 375	0.199 850	19.99	6.99
NR n77 (IC)	5.000 625	1.208 438	0.241 657	24.17	6.17

1) Duty cycle (Linear) = Ton time / Period
2) DCF (Duty cycle factor) = 10log(1/duty cycle)
3) Offset (dB) = RF cable loss (dB) + Divider (dB) + Duty Cycle Factor (dB)

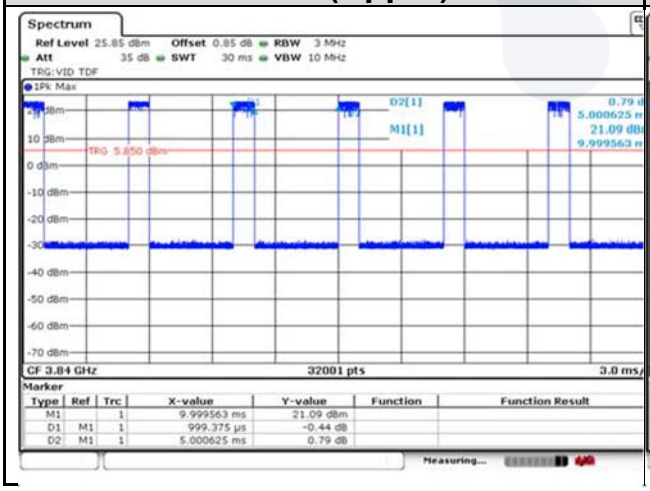
NR n41



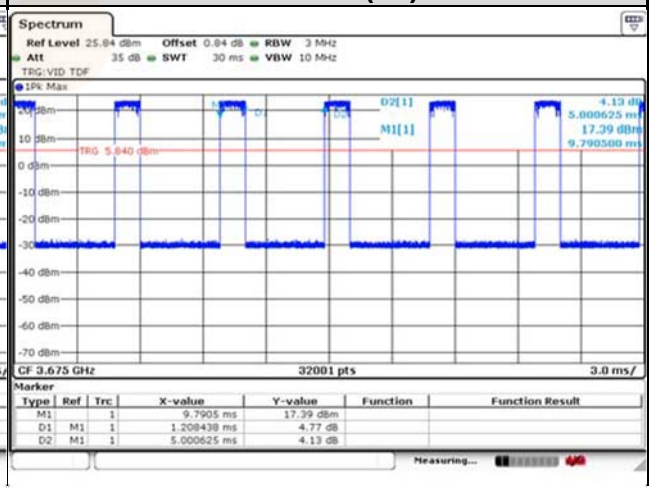
NR n77 (Lower)



NR n77 (Upper)

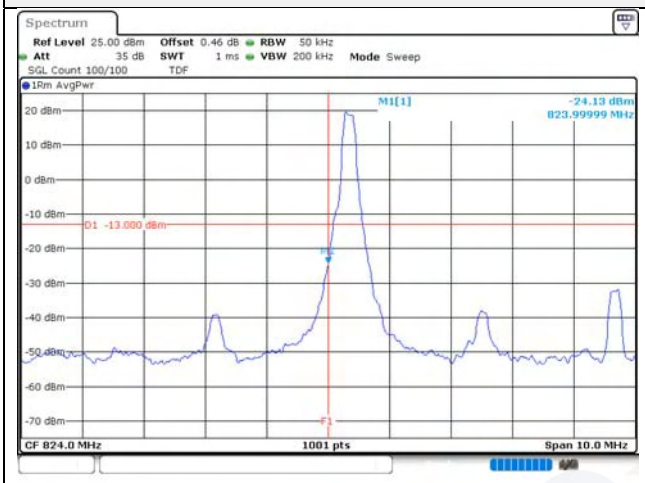
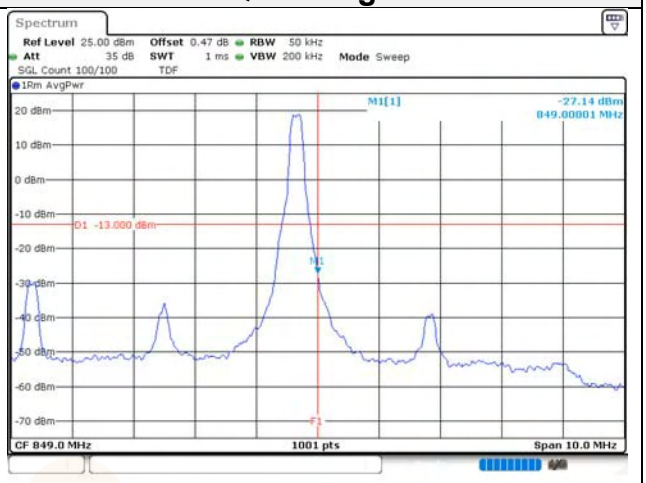
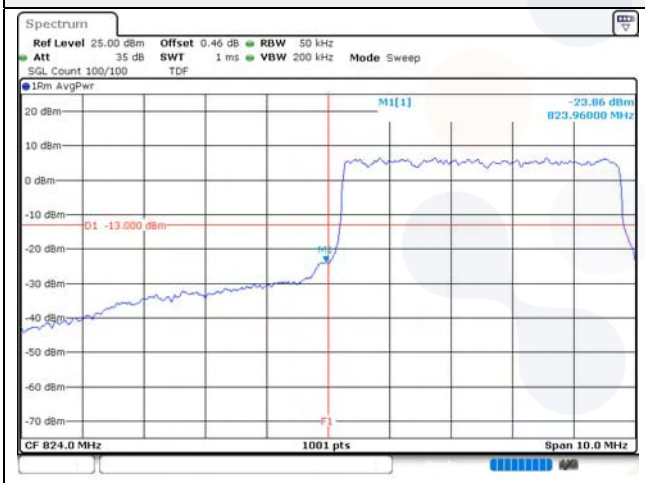


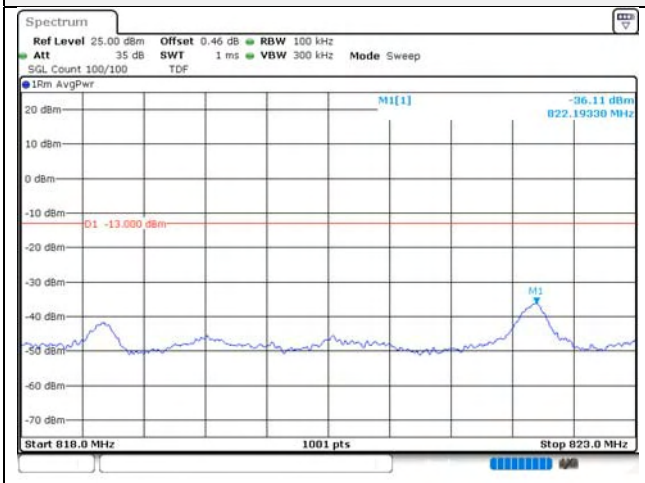
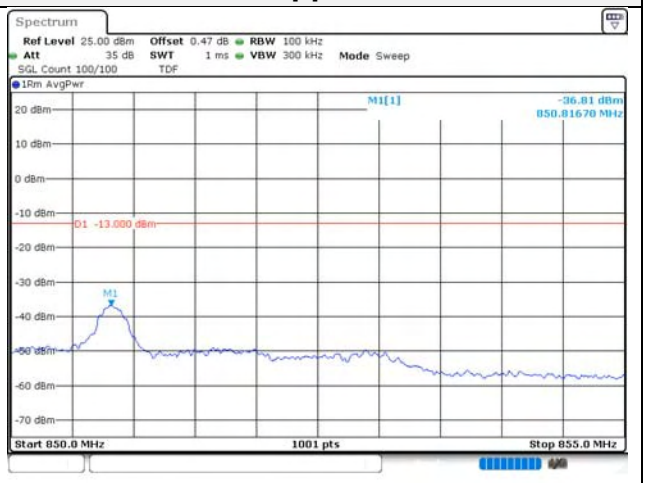
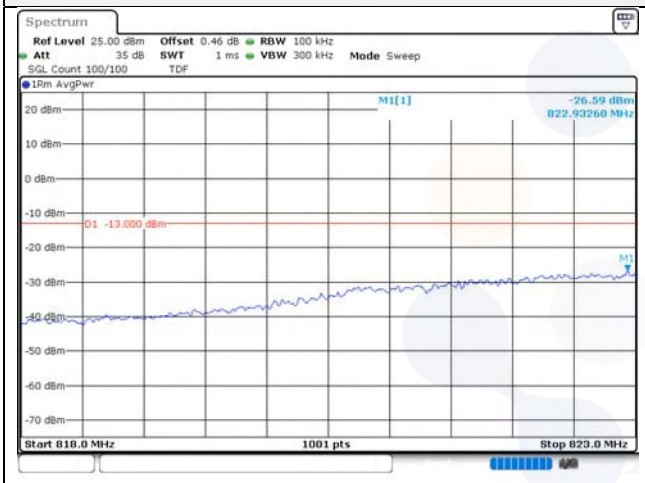
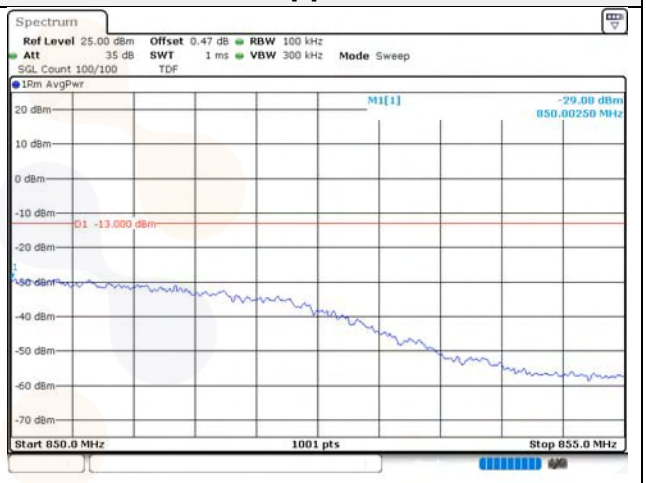
NR n77 (IC)

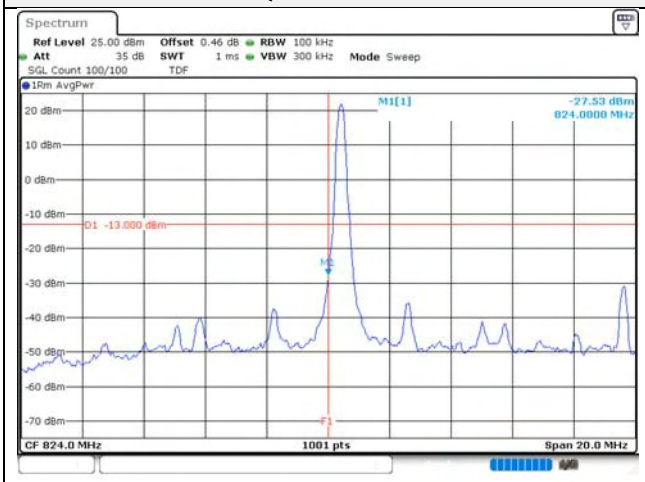
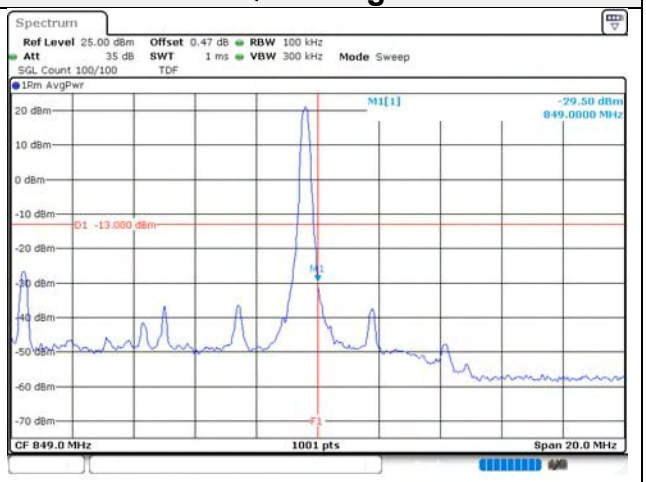
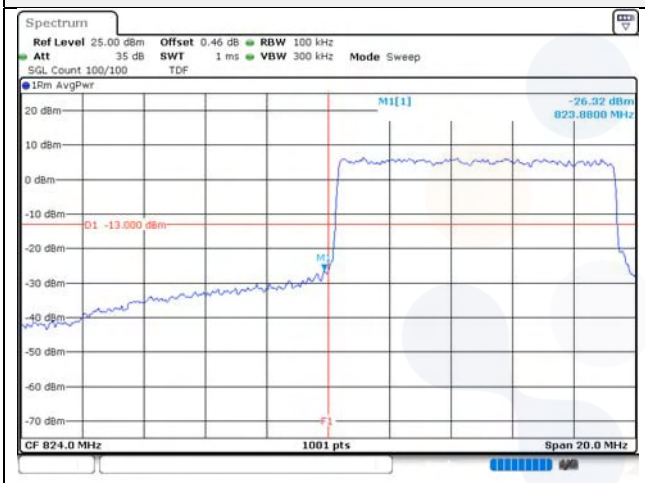
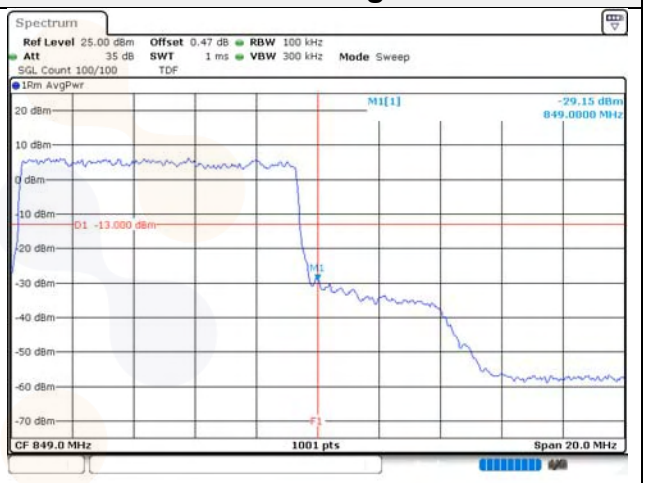


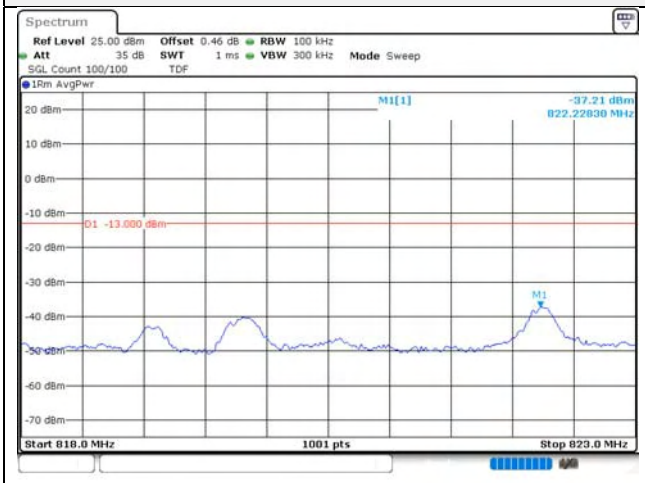
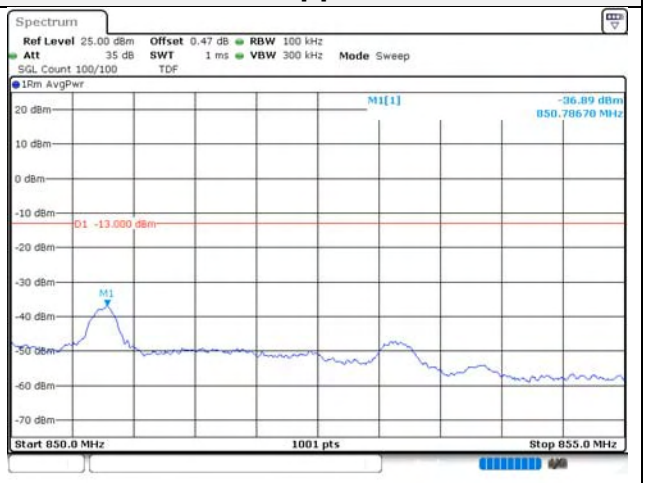
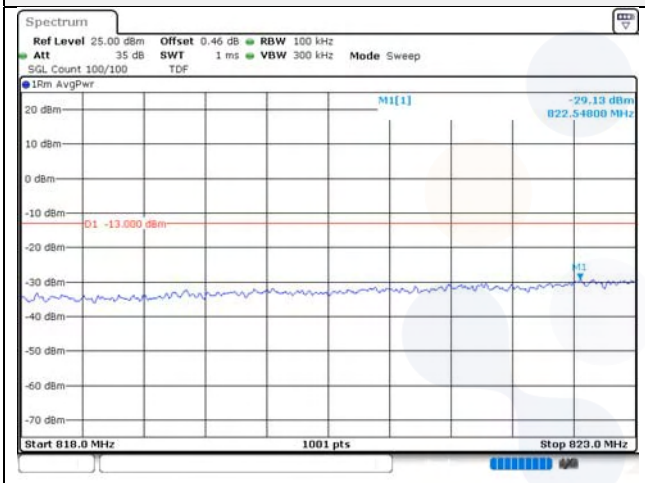
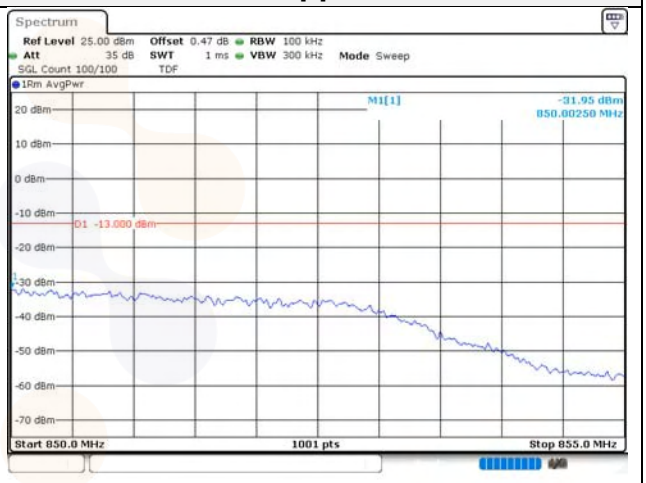
Test results

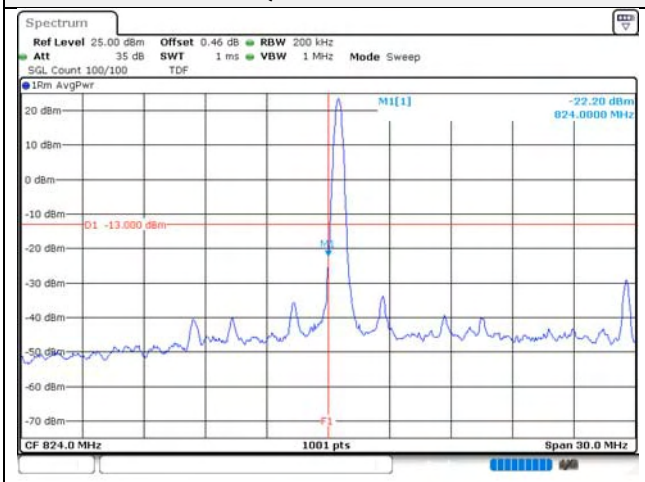
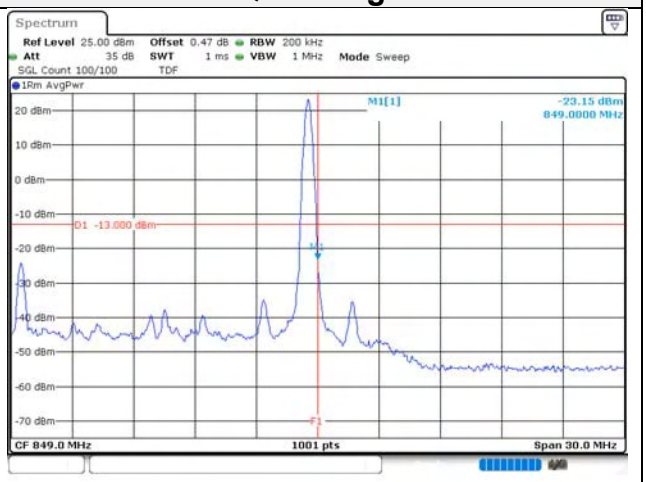
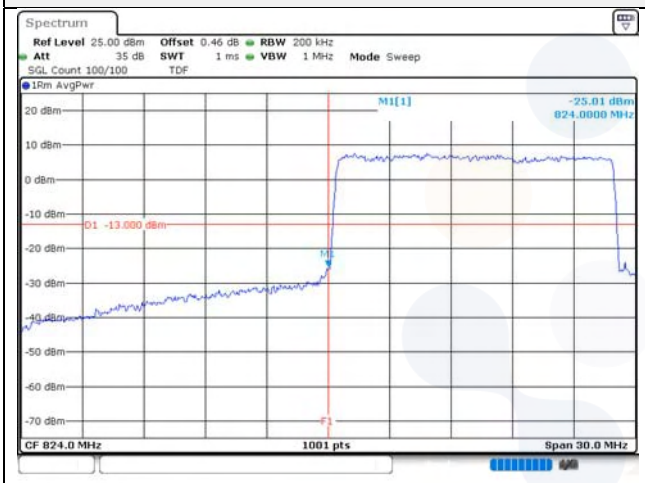
Test mode: NR n5

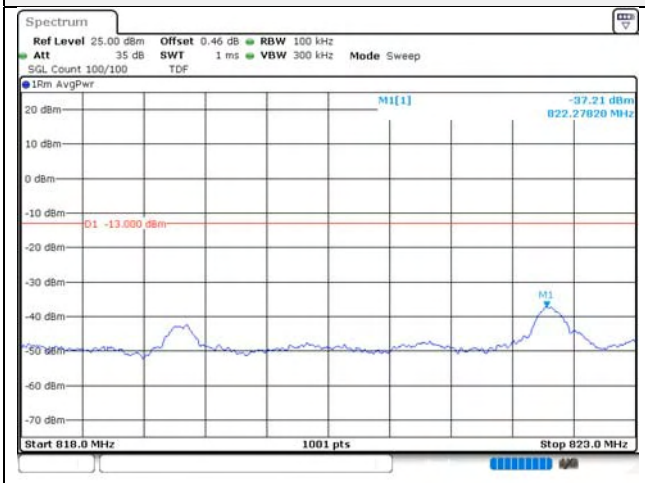
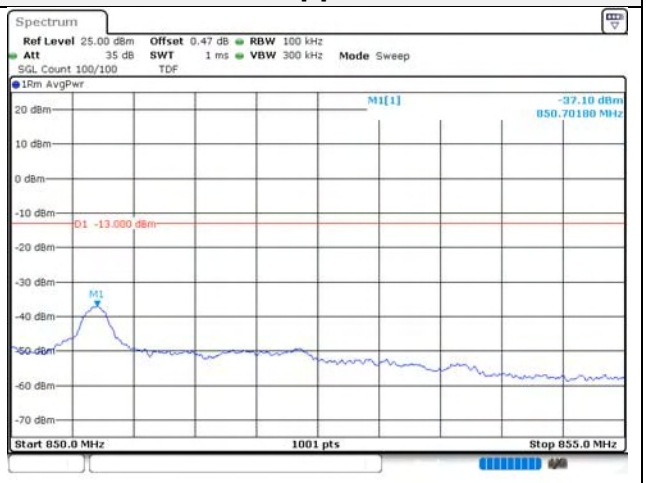
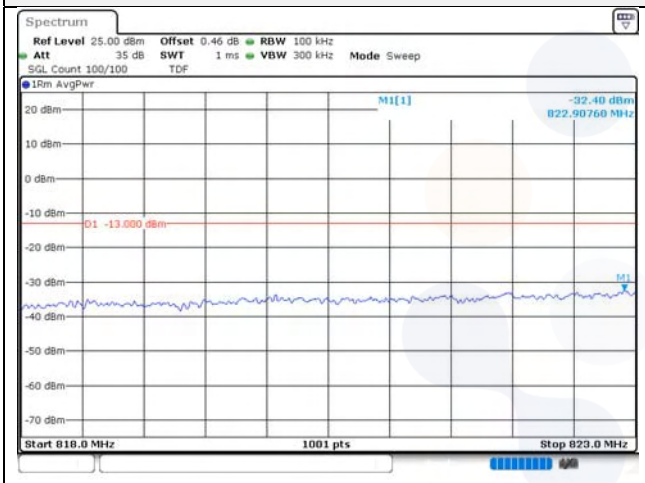
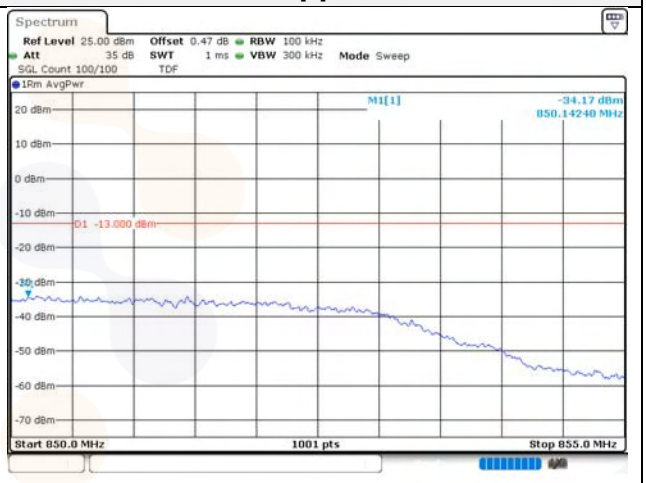
5M BW QPSK Low ch. 1RB	5M BW QPSK High ch. 1RB
	
5M BW QPSK Low ch. FRB	**5M BW QPSK High ch. FRB**
	

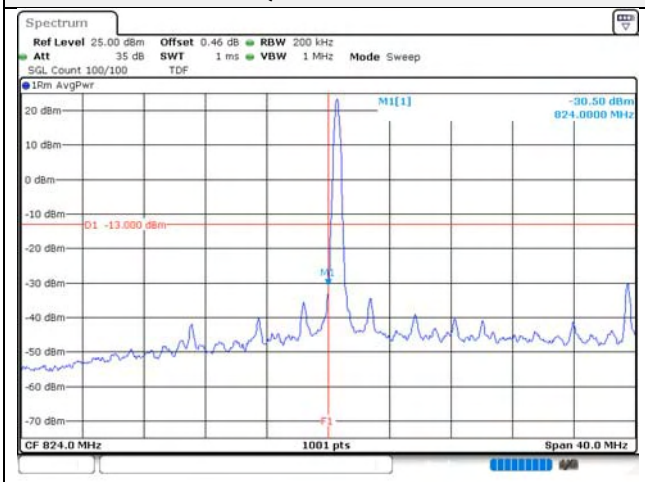
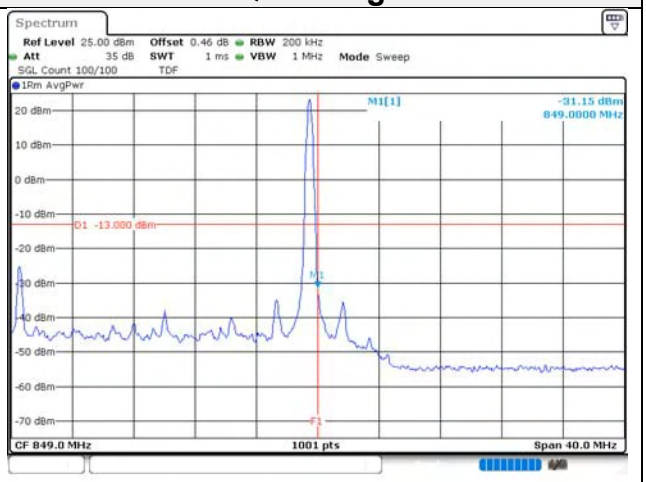
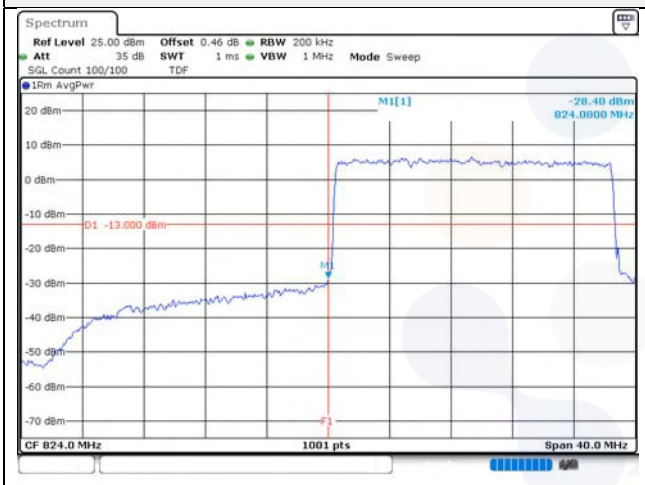
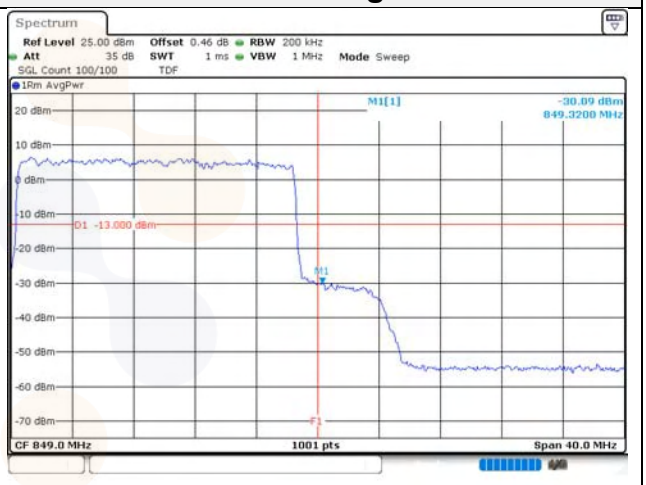
5M BW QPSK Lower extended 1RB	5M BW QPSK Upper extended 1RB
	
5M BW QPSK Lower extended FRB	**5M BW QPSK Upper extended FRB**
	

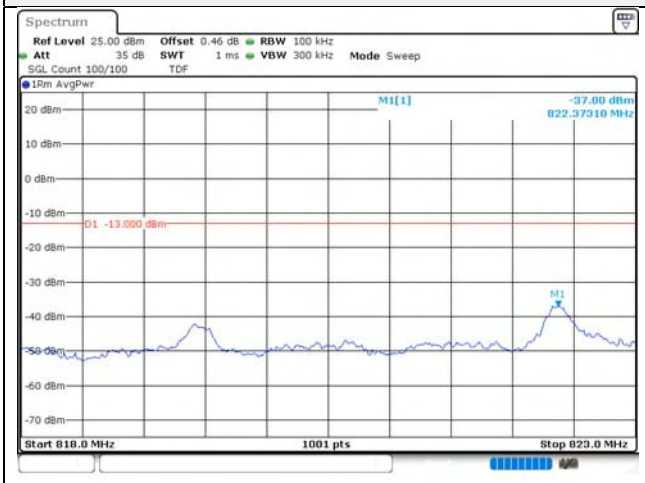
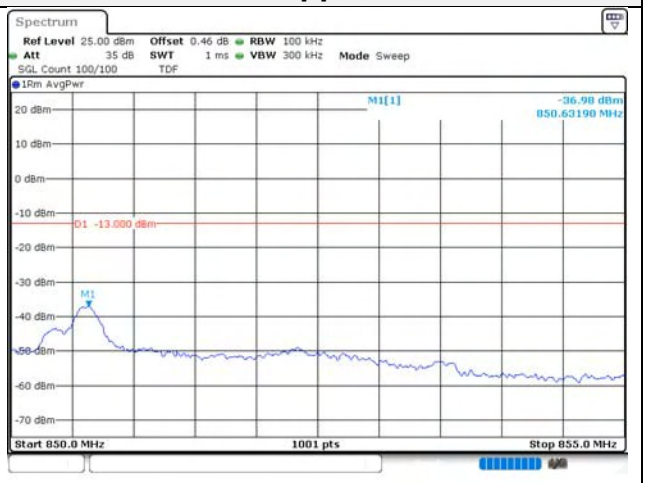
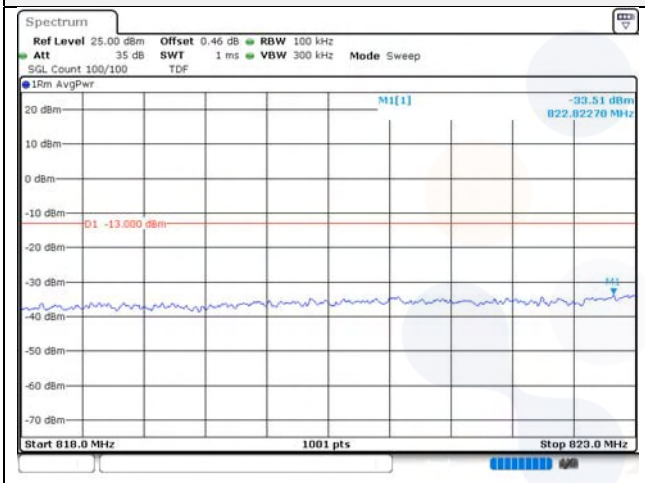
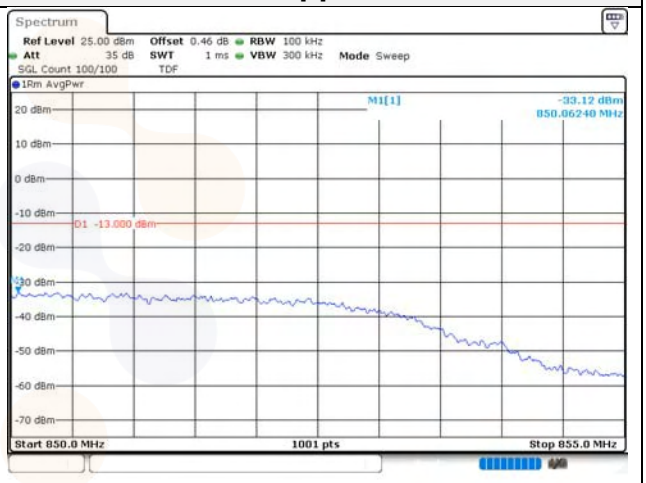
10M BW QPSK Low ch. 1RB	10M BW QPSK High ch. 1RB
	
10M BW QPSK Low ch. FRB	**10M BW QPSK High ch. FRB**
	

10M BW QPSK Lower extended 1RB	10M BW QPSK Upper extended 1RB
	
10M BW QPSK Lower extended FRB	**10M BW QPSK Upper extended FRB**
	

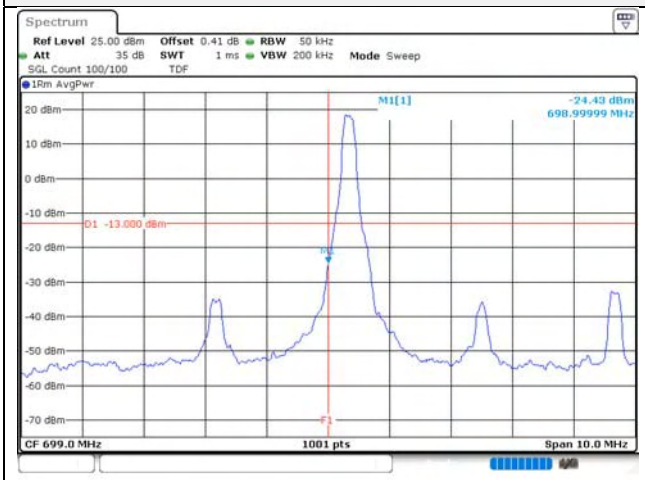
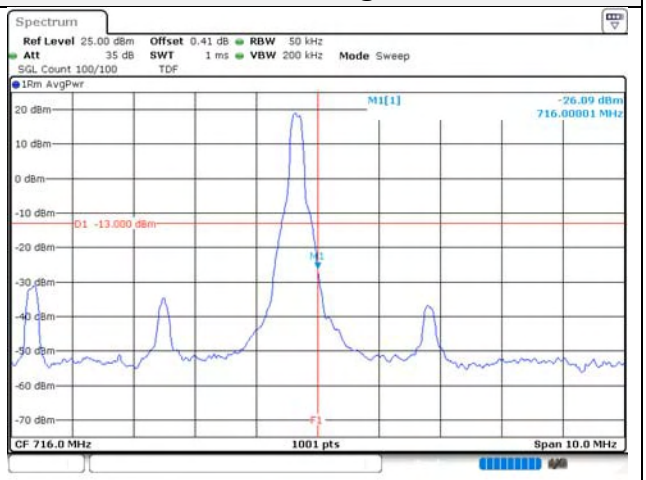
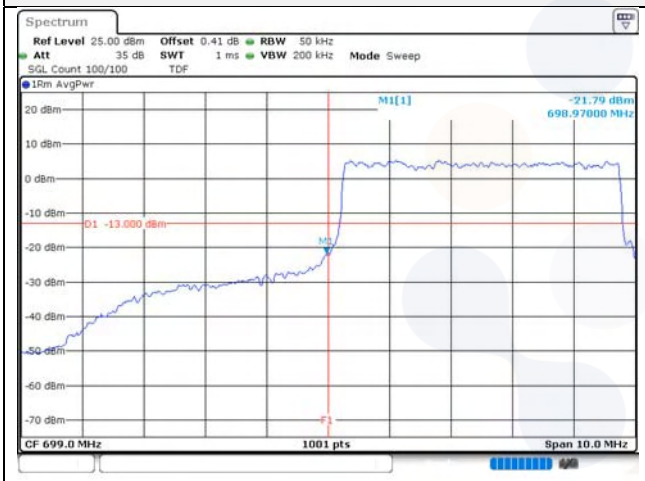
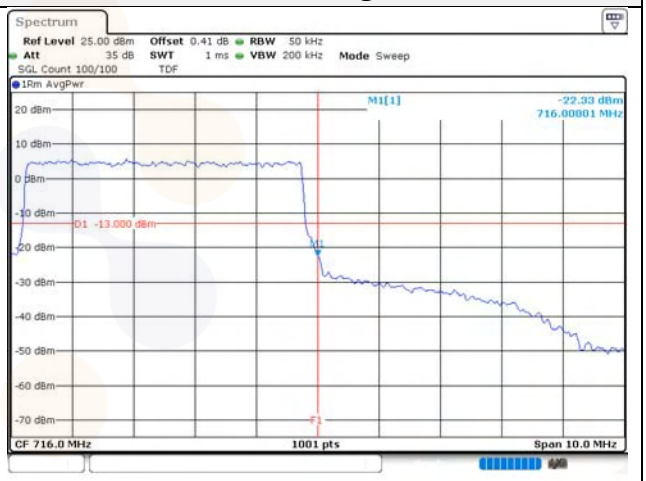
15M BW QPSK Low ch. 1RB	15M BW QPSK High ch. 1RB
	
15M BW QPSK Low ch. FRB	**15M BW QPSK High ch. FRB**
	

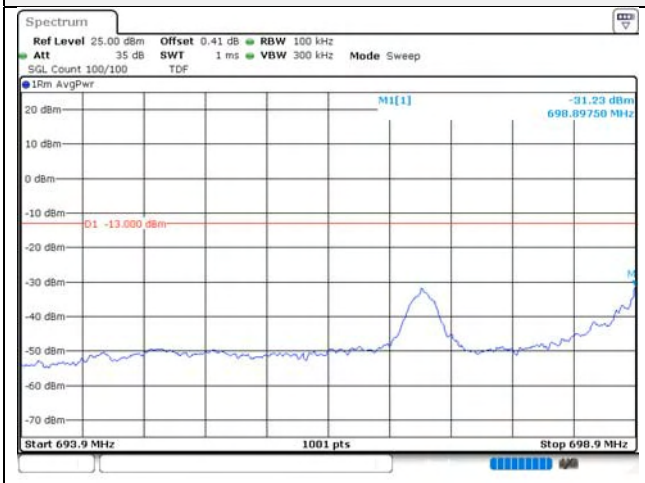
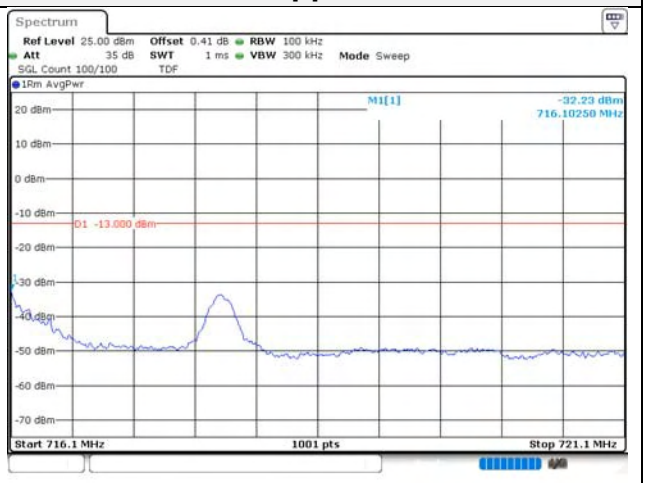
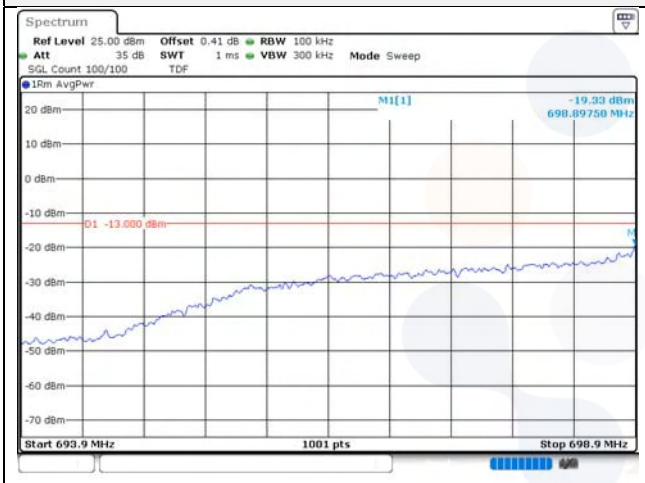
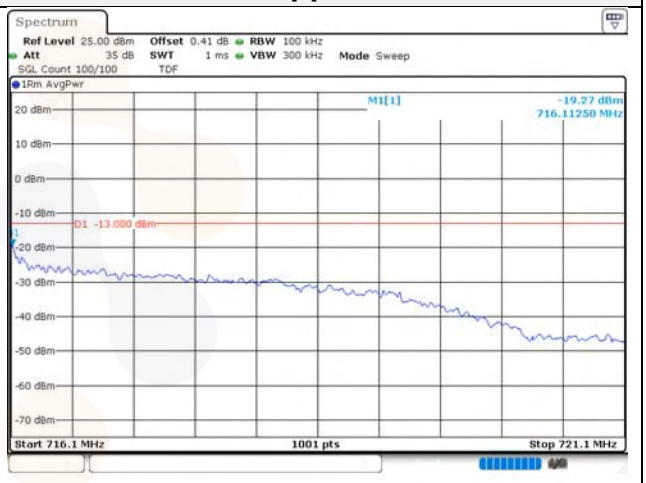
15M BW QPSK Lower extended 1RB	15M BW QPSK Upper extended 1RB
	
15M BW QPSK Lower extended FRB	**15M BW QPSK Upper extended FRB**
	

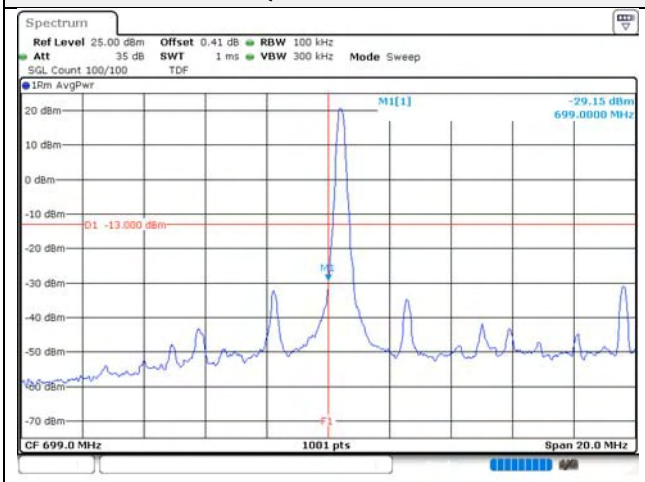
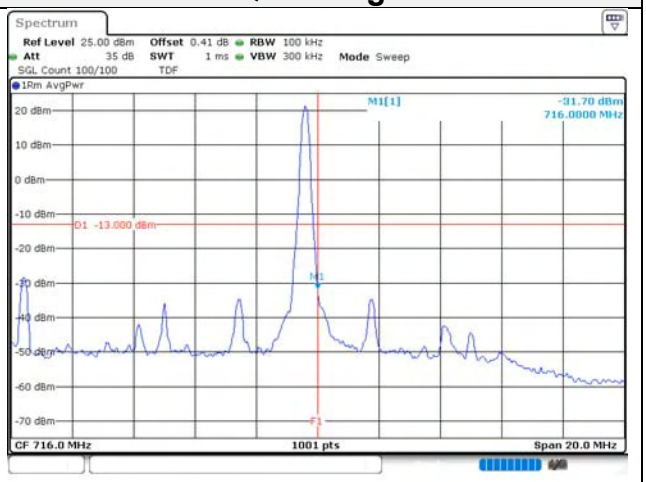
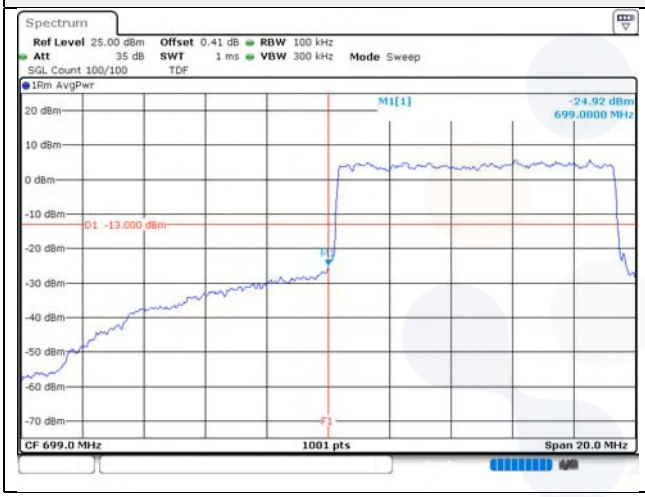
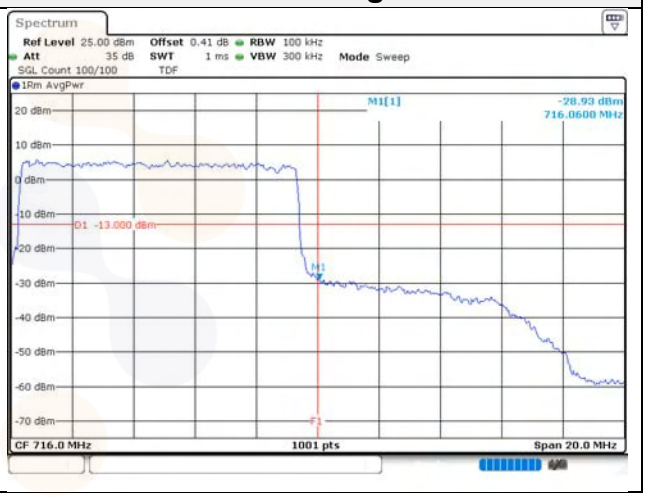
20M BW QPSK Low ch. 1RB	20M BW QPSK High ch. 1RB
	
20M BW QPSK Low ch. FRB	**20M BW QPSK High ch. FRB**
	

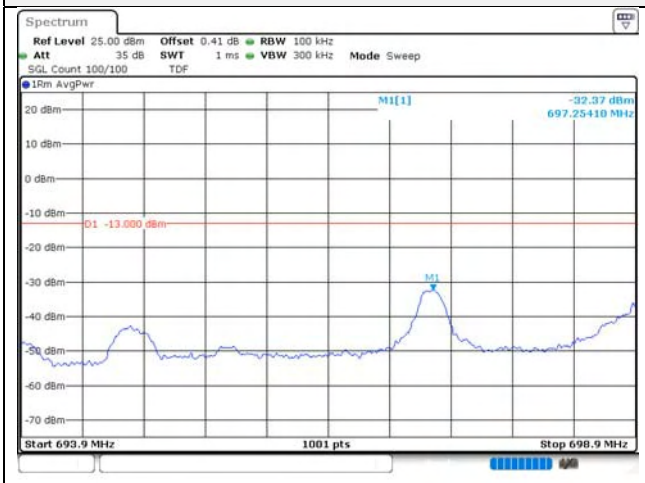
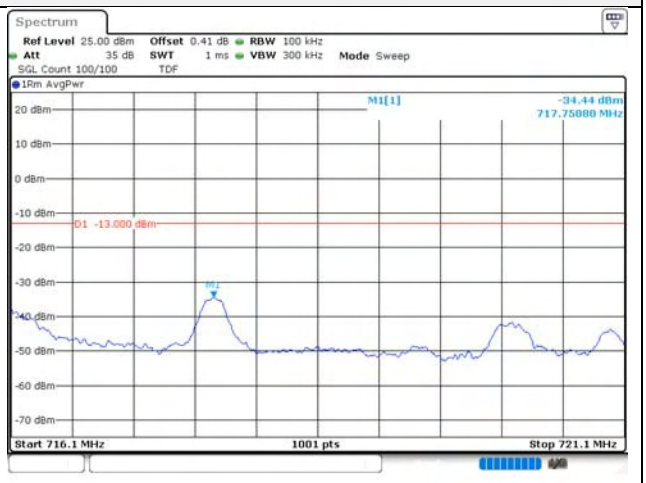
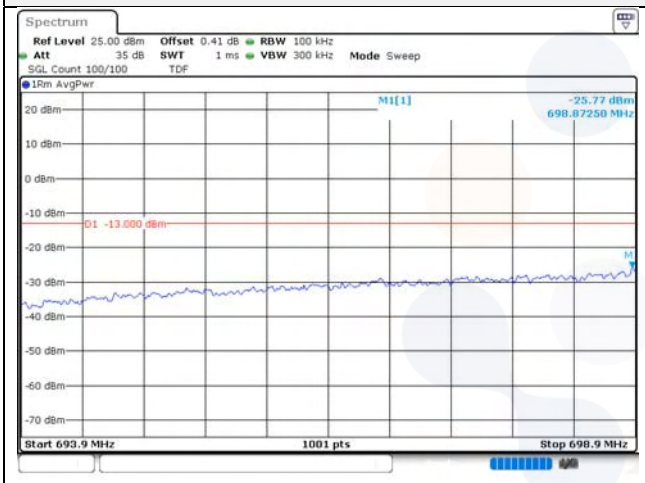
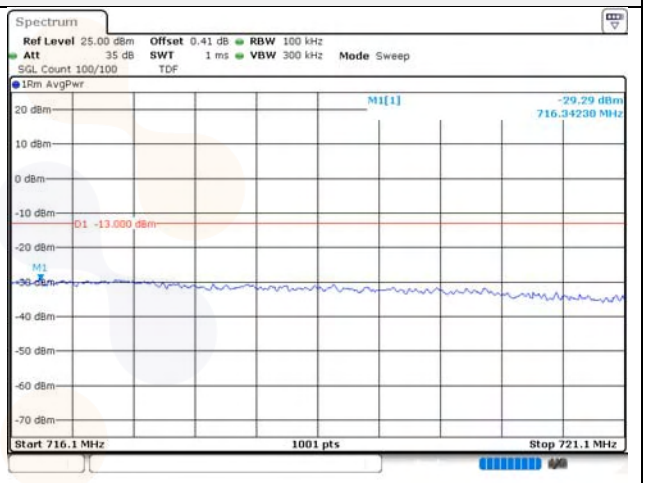
20M BW QPSK Lower extended 1RB	20M BW QPSK Upper extended 1RB
	
20M BW QPSK Lower extended FRB	**20M BW QPSK Upper extended FRB**
	

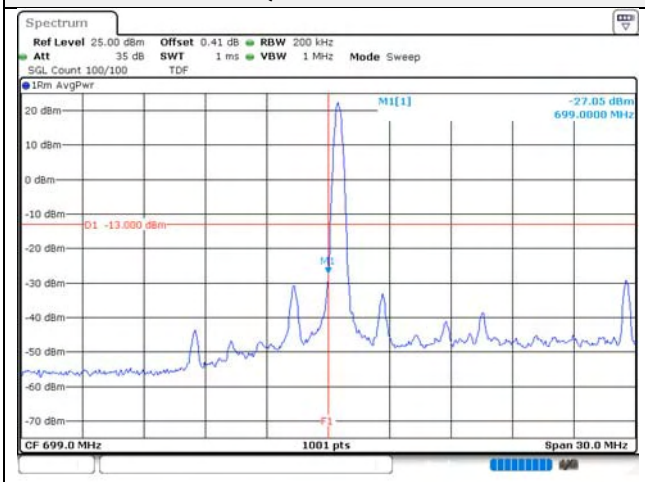
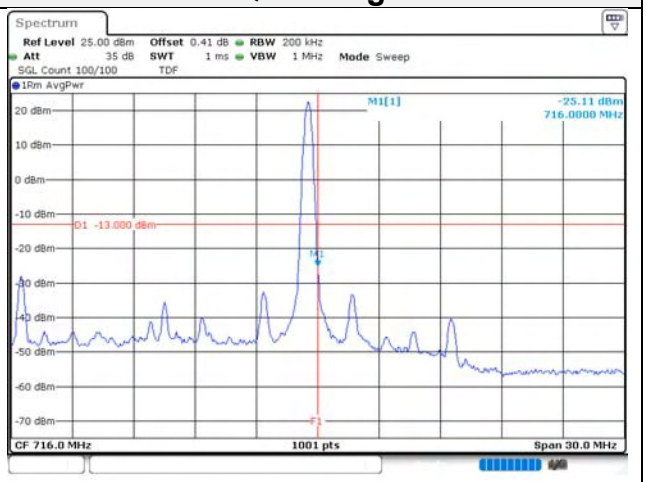
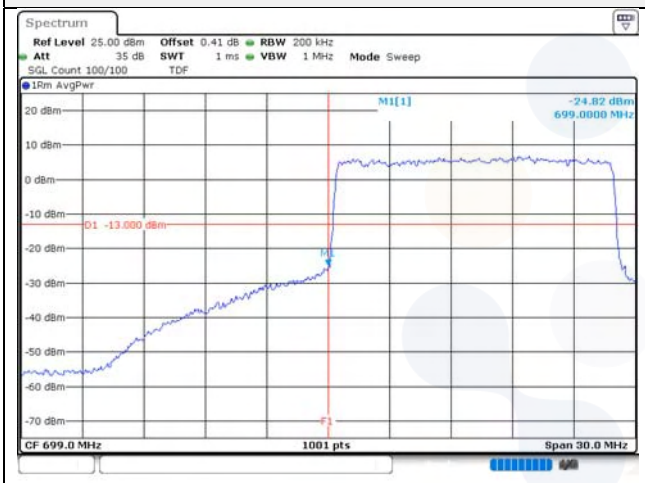
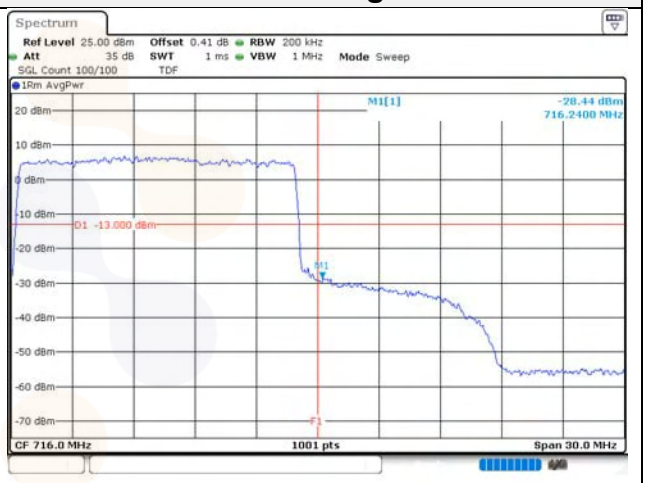
Test mode: NR n12

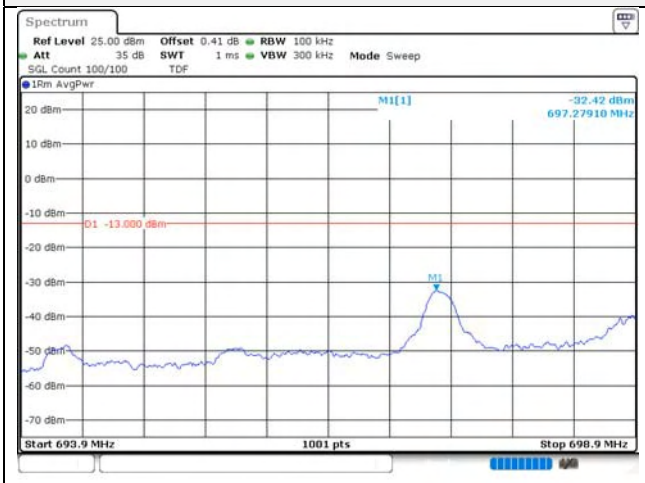
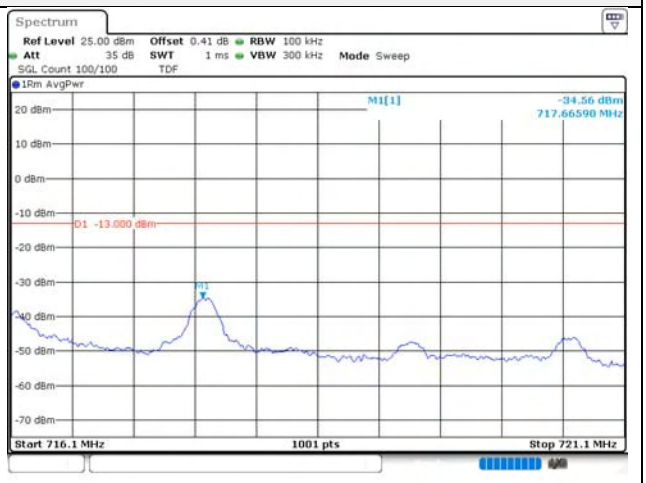
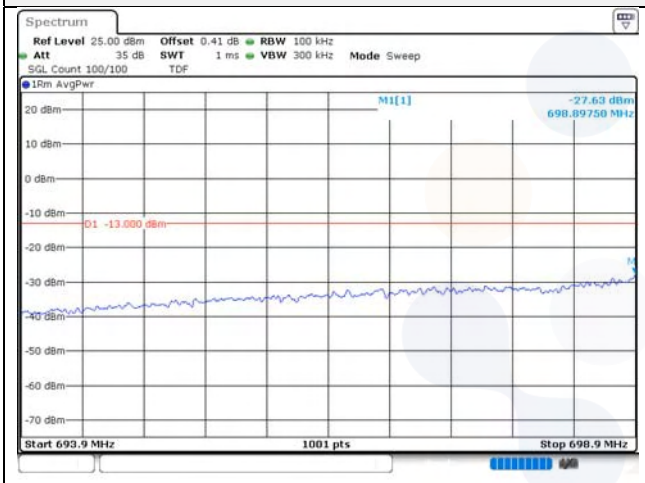
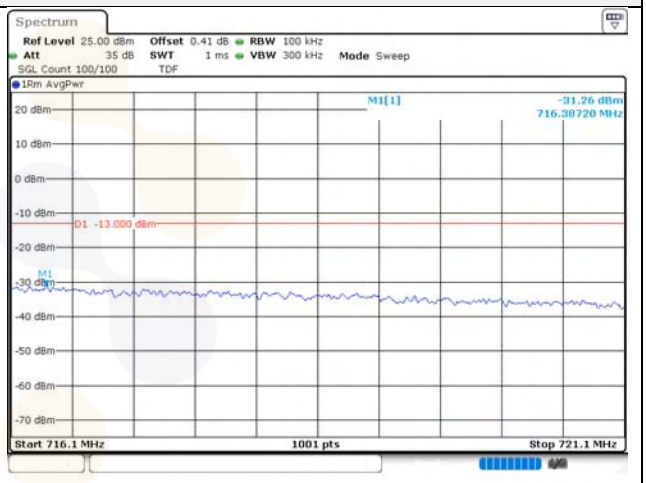
5M BW QPSK Low ch. 1RB	5M BW QPSK High ch. 1RB
	
5M BW QPSK Low ch. FRB	**5M BW QPSK High ch. FRB**
	

5M BW QPSK Lower extended 1RB	5M BW QPSK Upper extended 1RB
	
5M BW QPSK Lower extended FRB	**5M BW QPSK Upper extended FRB**
	

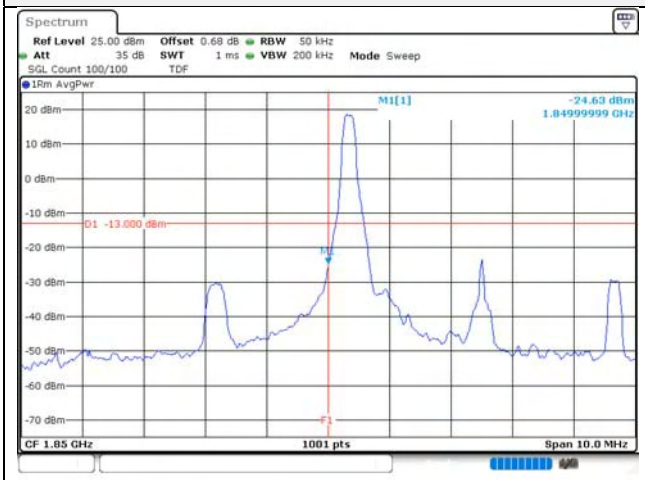
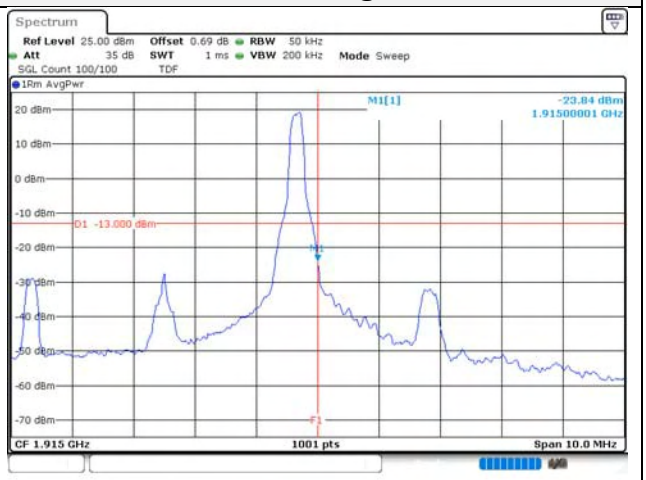
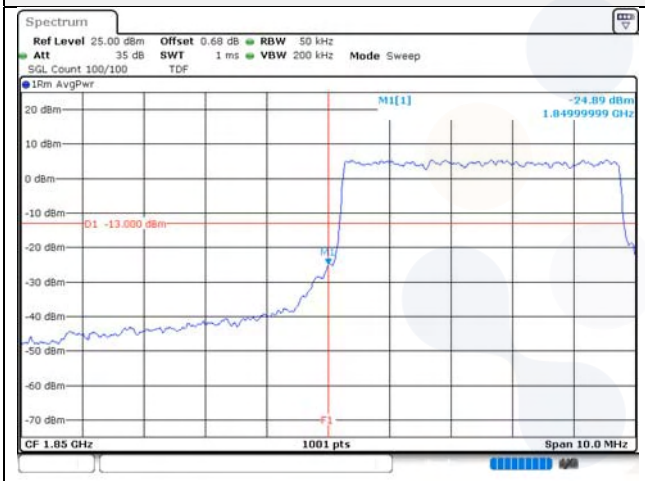
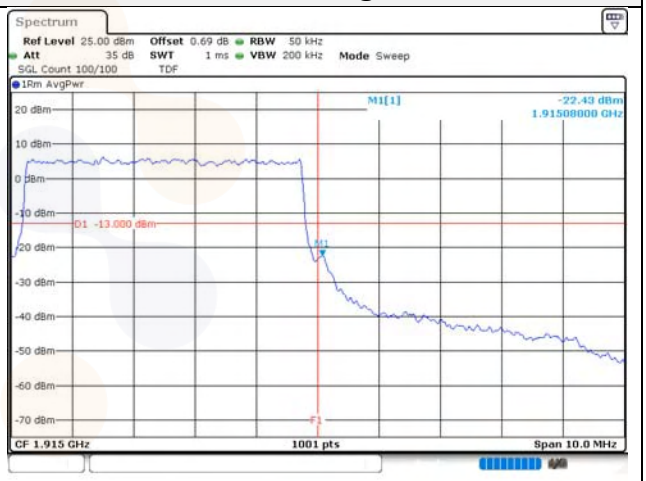
10M BW QPSK Low ch. 1RB	10M BW QPSK High ch. 1RB
	
10M BW QPSK Low ch. FRB	**10M BW QPSK High ch. FRB**
	

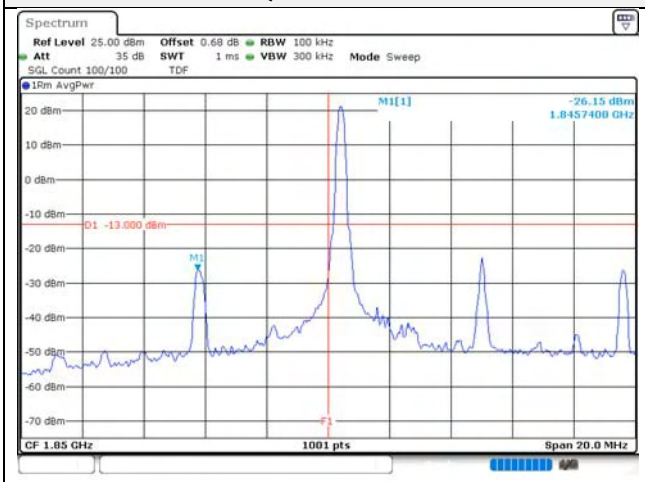
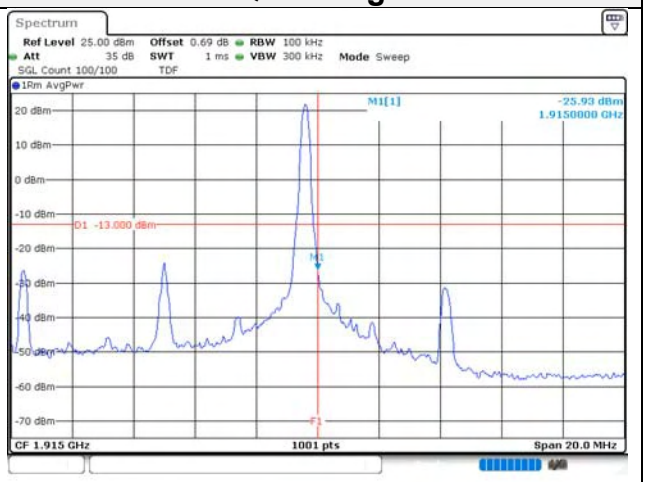
10M BW QPSK Lower extended 1RB	10M BW QPSK Upper extended 1RB
	
10M BW QPSK Lower extended FRB	**10M BW QPSK Upper extended FRB**
	

15M BW QPSK Low ch. 1RB	15M BW QPSK High ch. 1RB
	
15M BW QPSK Low ch. FRB	**15M BW QPSK High ch. FRB**
	

15M BW QPSK Lower extended 1RB	15M BW QPSK Upper extended 1RB
	
15M BW QPSK Lower extended FRB	**15M BW QPSK Upper extended FRB**
	

Test mode: NR n25/2

5M BW QPSK Low ch. 1RB	5M BW QPSK High ch. 1RB
	
5M BW QPSK Low ch. FRB	**5M BW QPSK High ch. FRB**
	

10M BW QPSK Low ch. 1RB	10M BW QPSK High ch. 1RB
	
10M BW QPSK Low ch. FRB	**10M BW QPSK High ch. FRB**