

6.4. Band Edge Emissions at Antenna Terminal §2.1051 §22.917(a) §24.238(a)

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is $43 + \log_{10}(P_{\text{[Watts]}})$, where P is the transmitter power in Watts. Limit equivalent to -13dBm, calculation shown below.

$$\begin{aligned}43 + 10 \log_{10}(1.567\text{W}) &= 44.95 \text{ dB} \\1.567\text{W} &= 31.95 \text{ dBm} \\31.95 \text{ dBm} - 44.95 \text{ dB} &= -13 \text{ dBm}\end{aligned}$$

Test Procedure Used

KDB 971168 v02r02 – Section 6.0

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot.
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW $\geq$ 1% of the emission bandwidth
4. VBW $\geq$ 3 x RBW
5. Detector = RMS
6. Number of sweep points $\geq$ 2 x Span/RBW
7. Trace mode = max hold
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

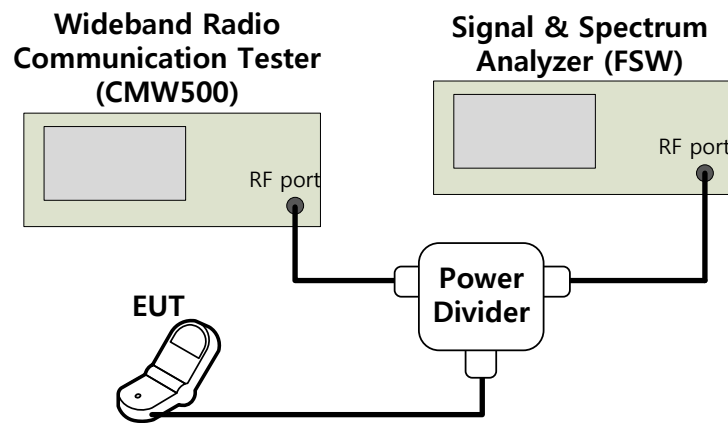


Figure 6-3. Test Instruments & Measurement Setup

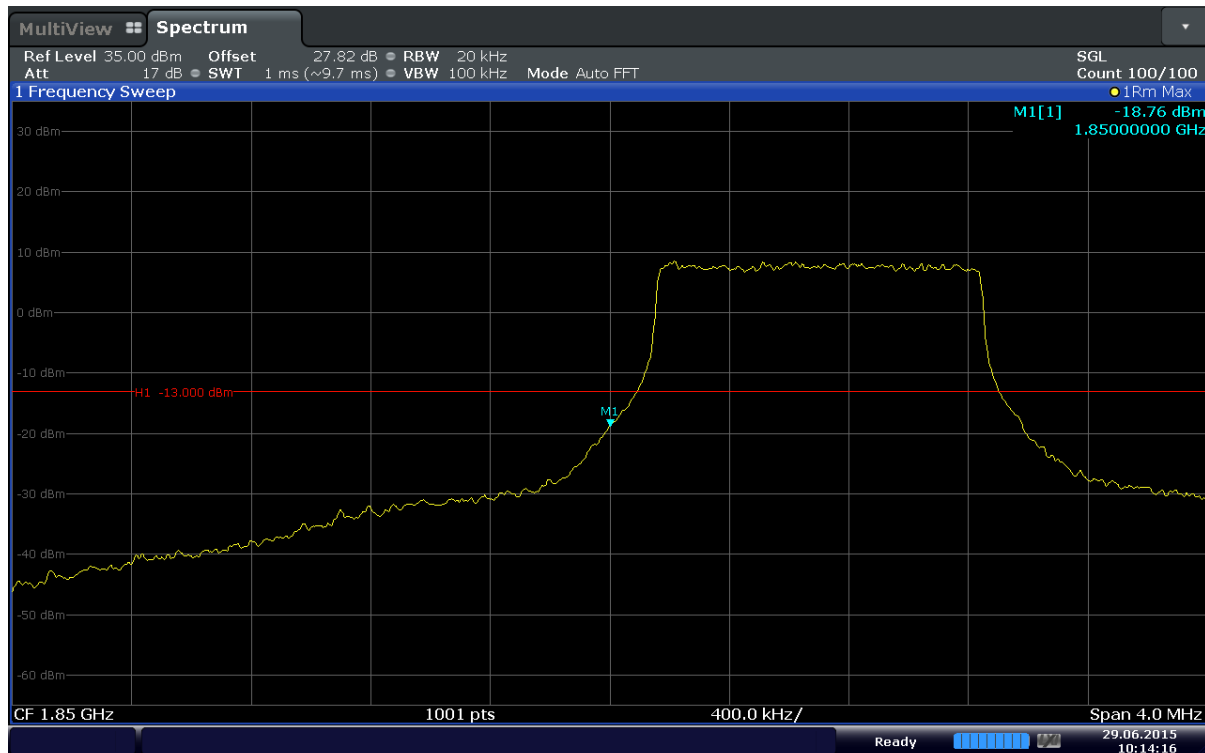
Test Notes

1. Per 22.917(b) and 24.238(b), in the 1 MHz 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 employed to demonstrate compliance with the out-of-band emissions limit.

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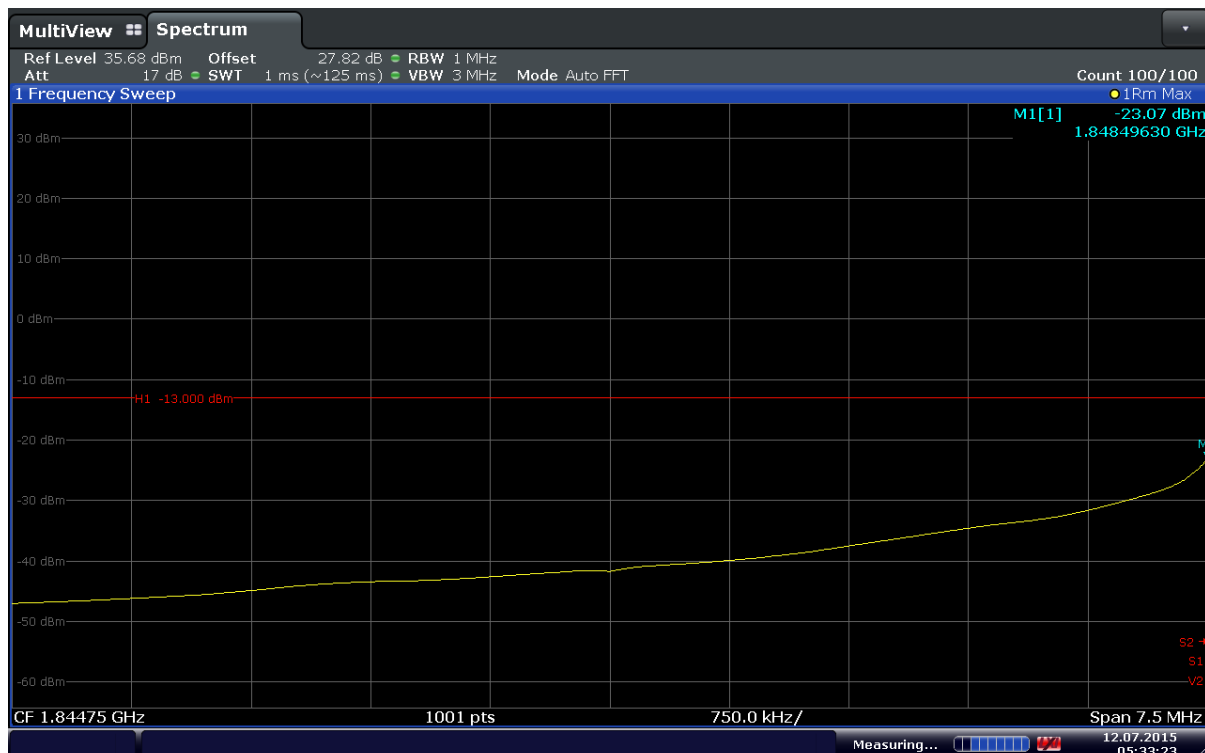


Test Plots



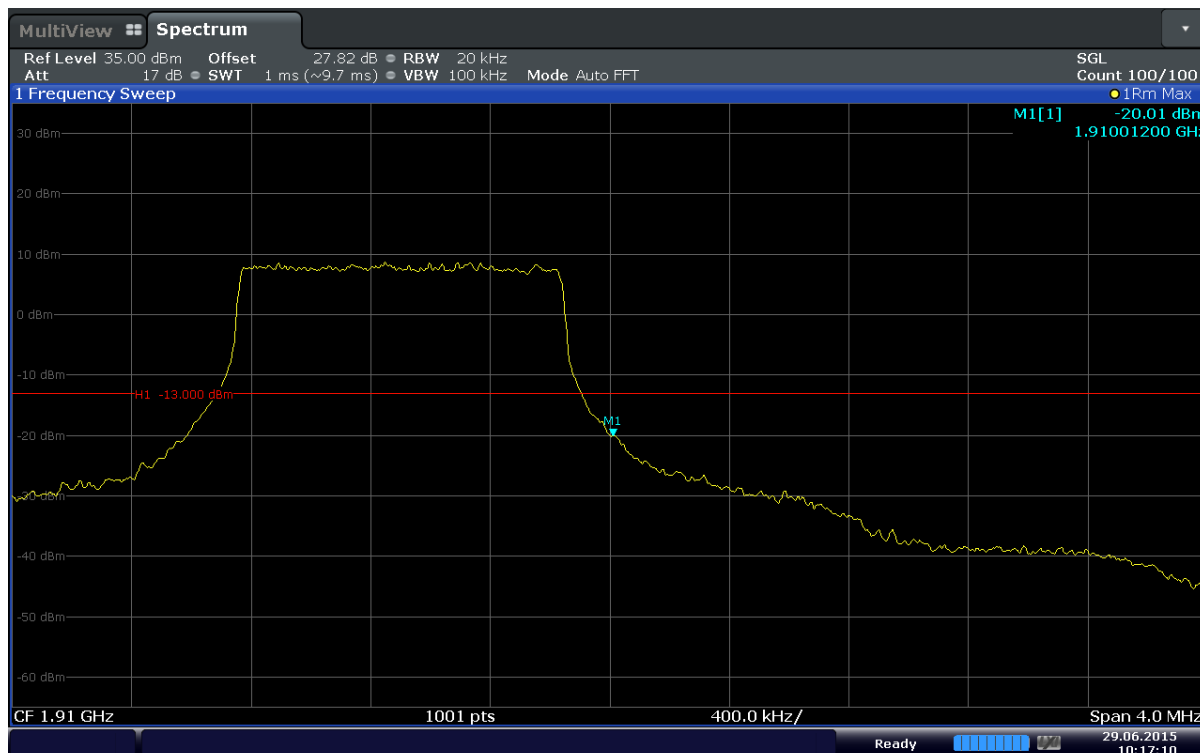
Date: 29 JUN.2015 10:14:16

Plot 6-107. Lower Band Edge Plot (Band2 – 1.4MHz – QPSK – RB Size 6)



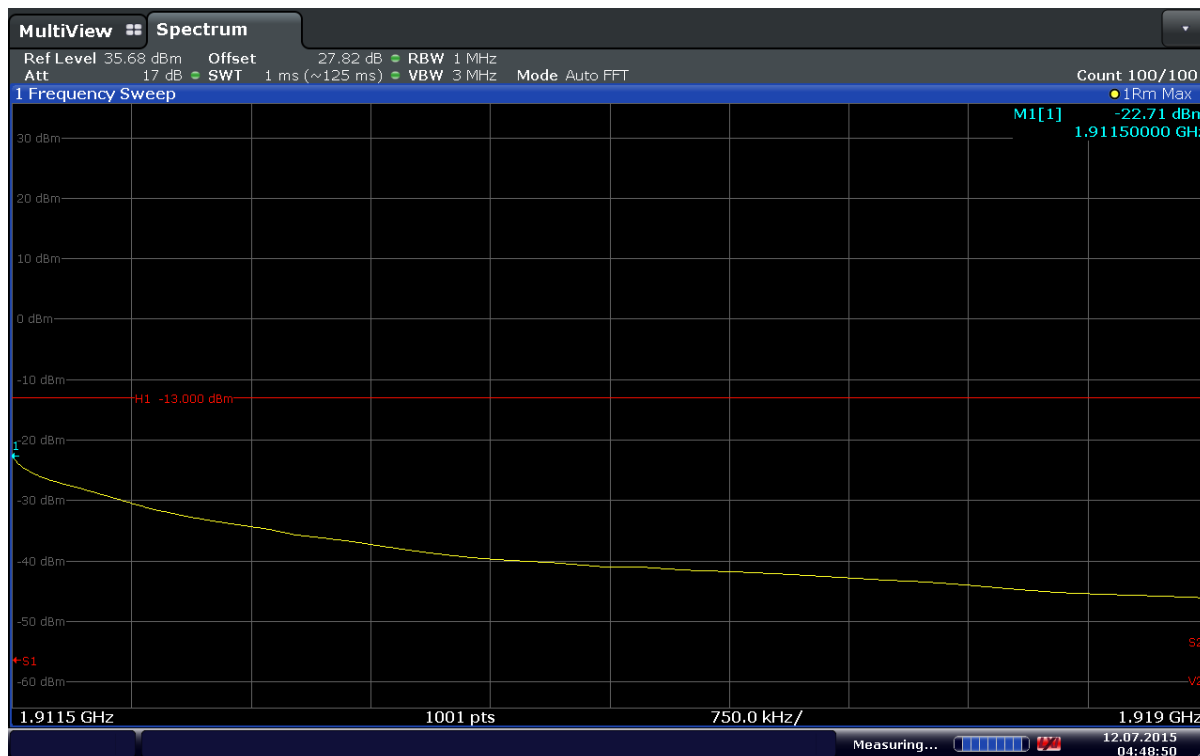
Date: 12 JUL.2015 05:33:24

Plot 6-108. Extended Lower Band Edge Plot (Band2 – 1.4MHz – QPSK – RB Size 6)



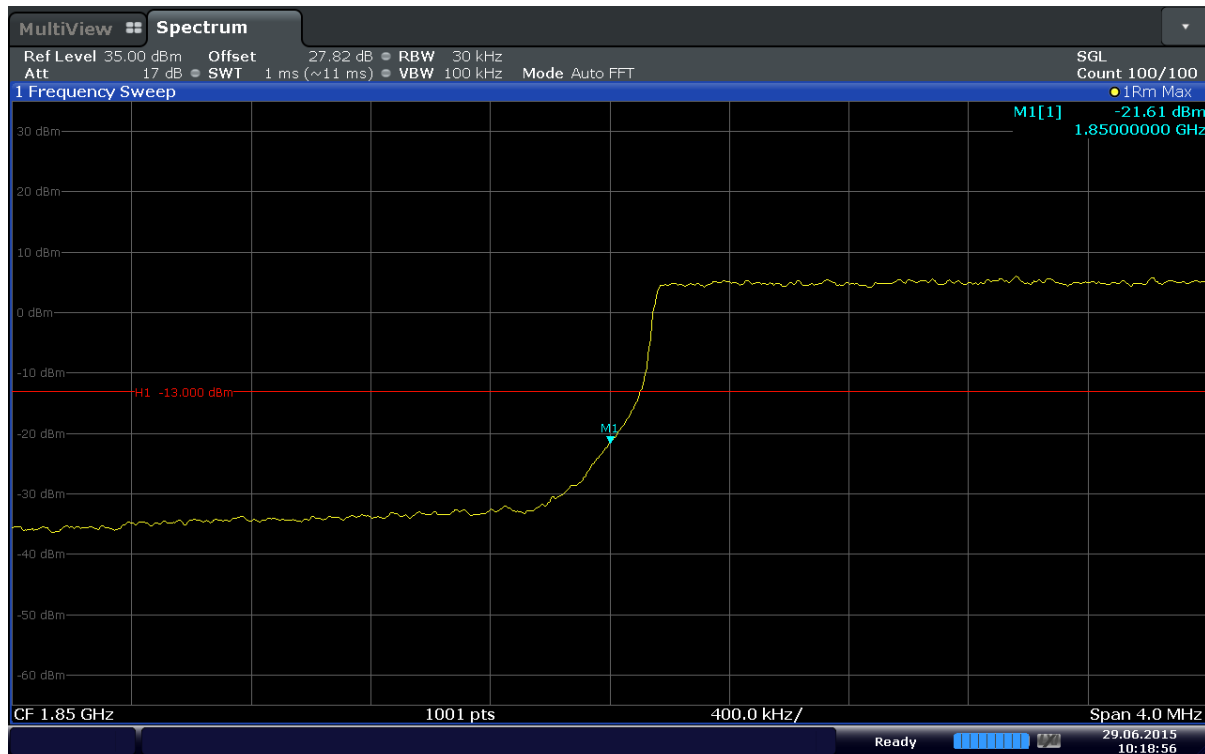
Date: 29 JUN 2015 10:17:11

Plot 6-109. Upper Band Edge Plot (Band2 – 1.4MHz – QPSK – RB Size 6)



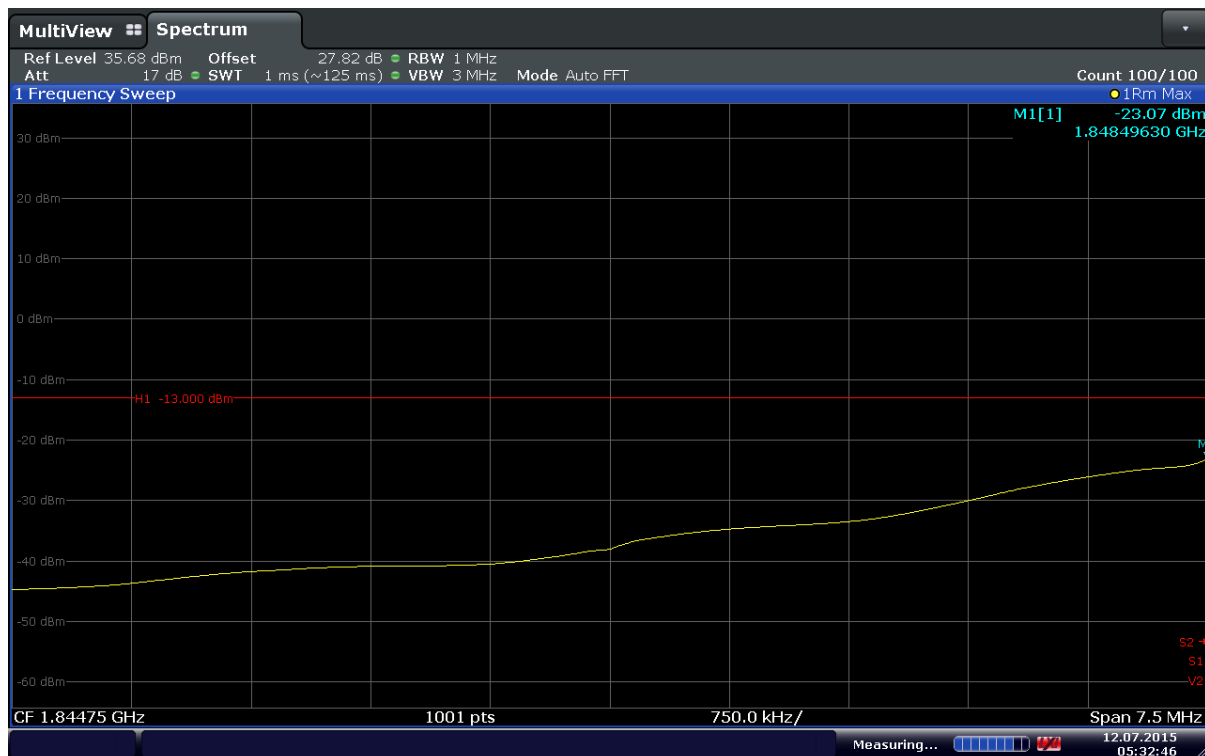
Date: 12 JUL 2015 04:48:50

Plot 6-110. Extended Upper Band Edge Plot (Band2 – 1.4MHz – QPSK – RB Size 6)



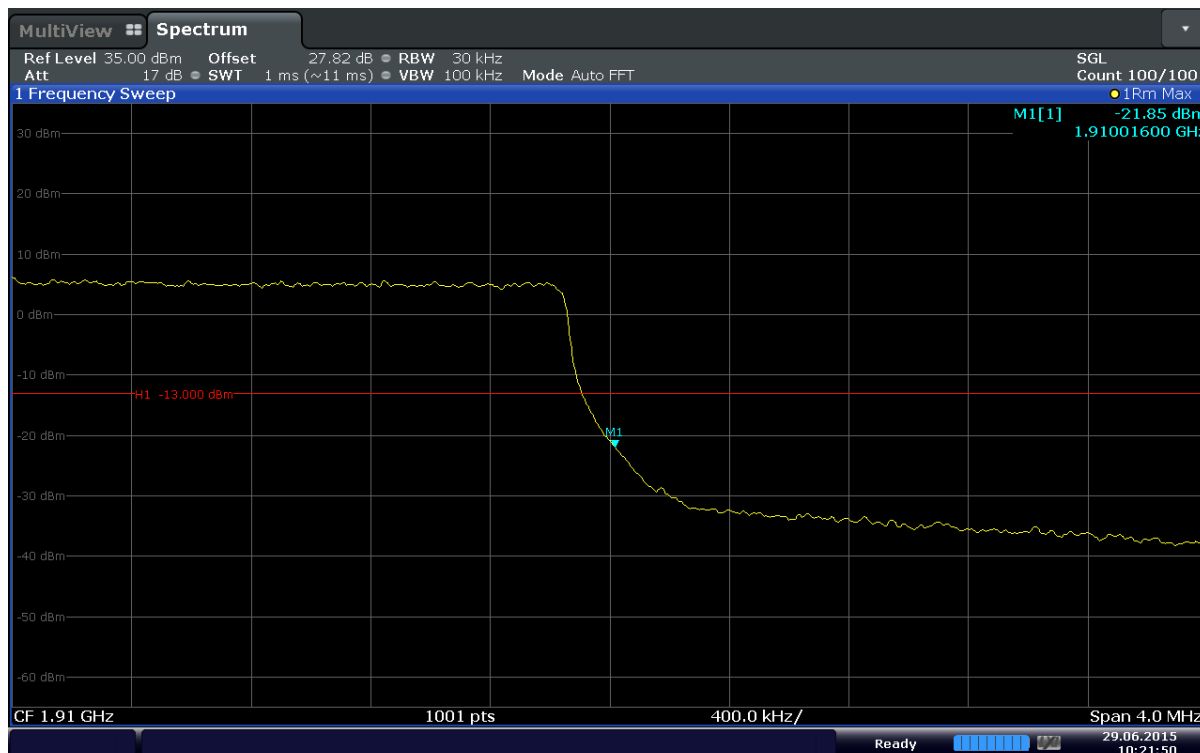
Date: 29 JUN 2015 10:18:56

Plot 6-111. Lower Band Edge Plot (Band2 – 3.0MHz – QPSK – RB Size 15)



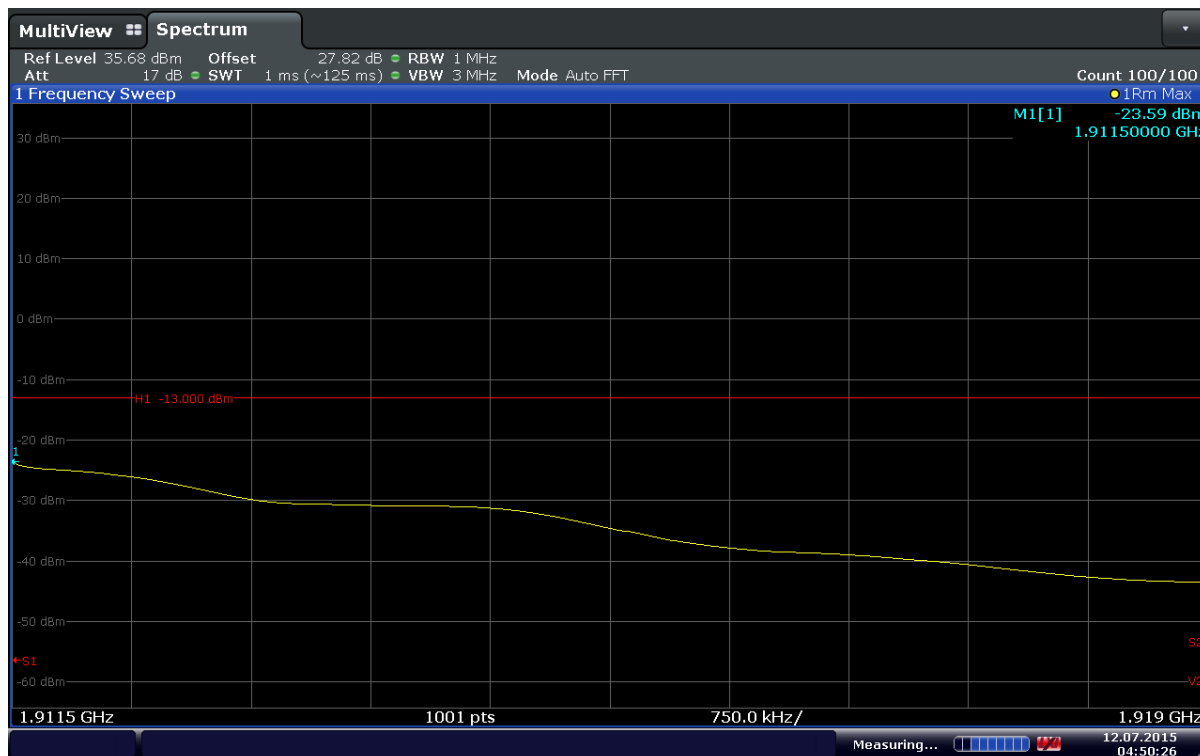
Date: 12 JUL 2015 05:32:45

Plot 6-112. Extended Lower Band Edge Plot (Band2 – 3.0MHz – QPSK – RB Size 15)



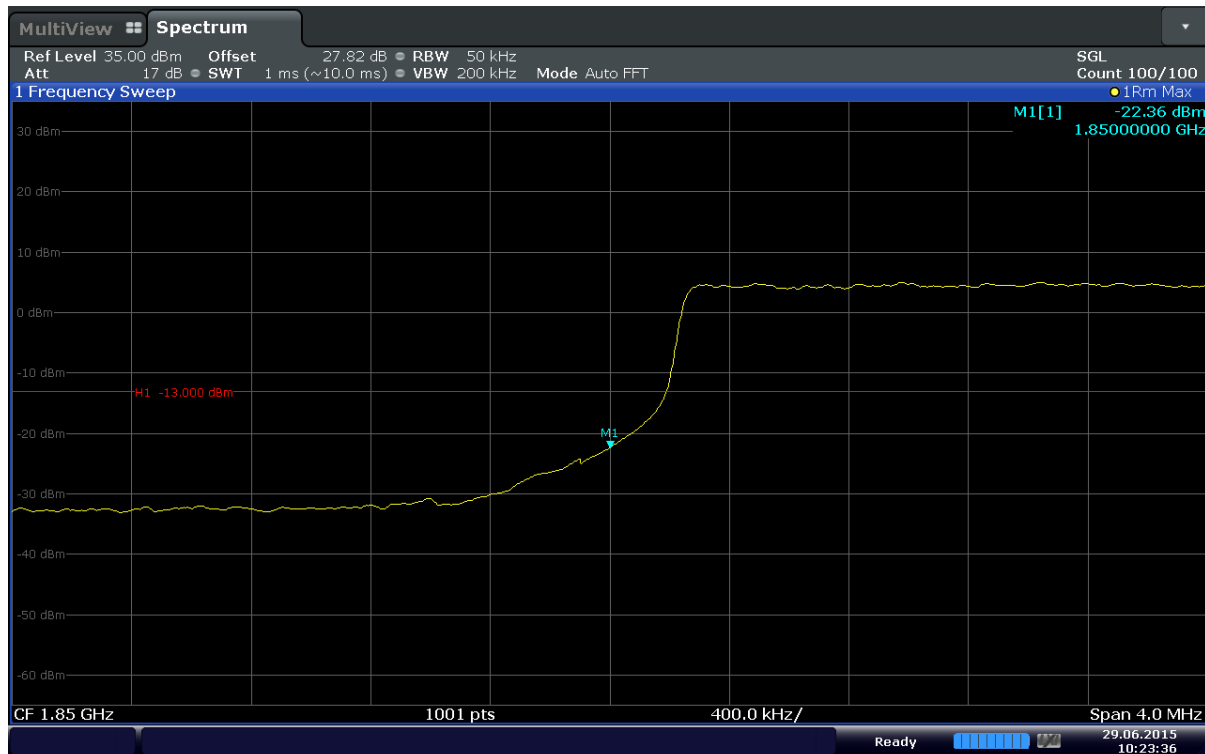
Date: 29 JUN 2015 10:21:50

Plot 6-113. Upper Band Edge Plot (Band2 – 3.0MHz – QPSK – RB Size 15)



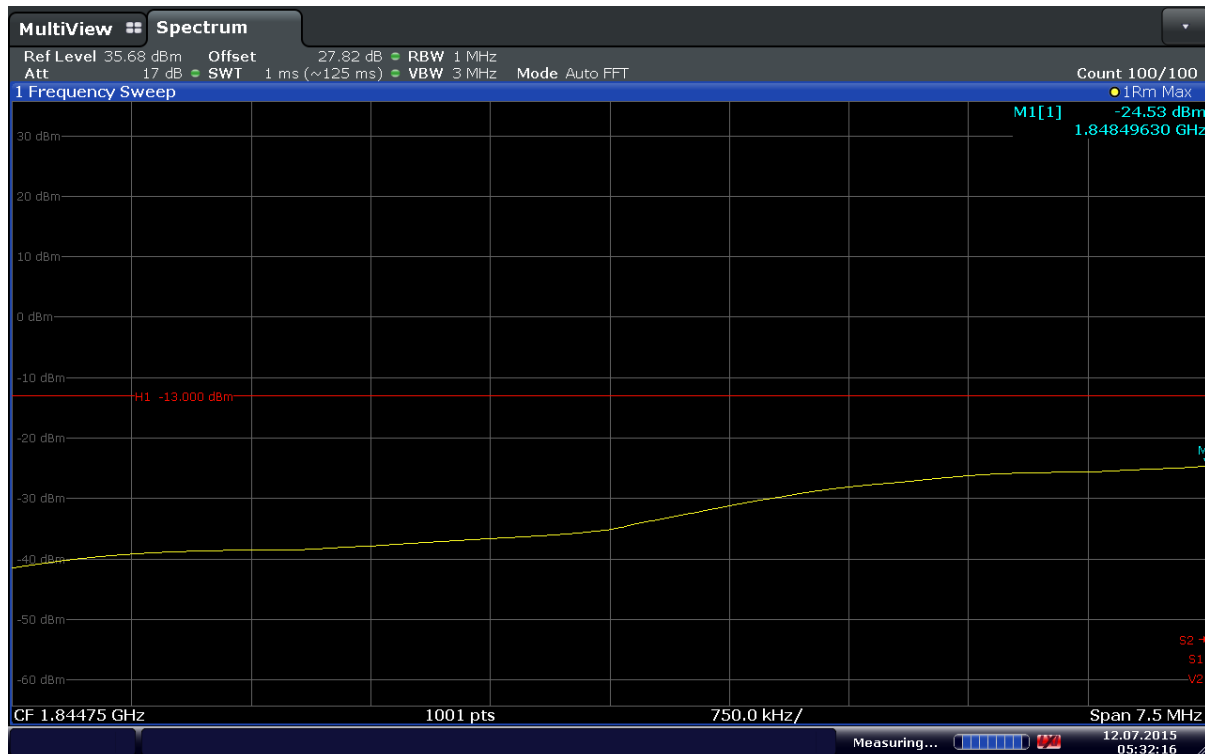
Date: 12 JUL 2015 04:50:27

Plot 6-114. Extended Upper Band Edge Plot (Band2 – 3.0MHz – QPSK – RB Size 15)



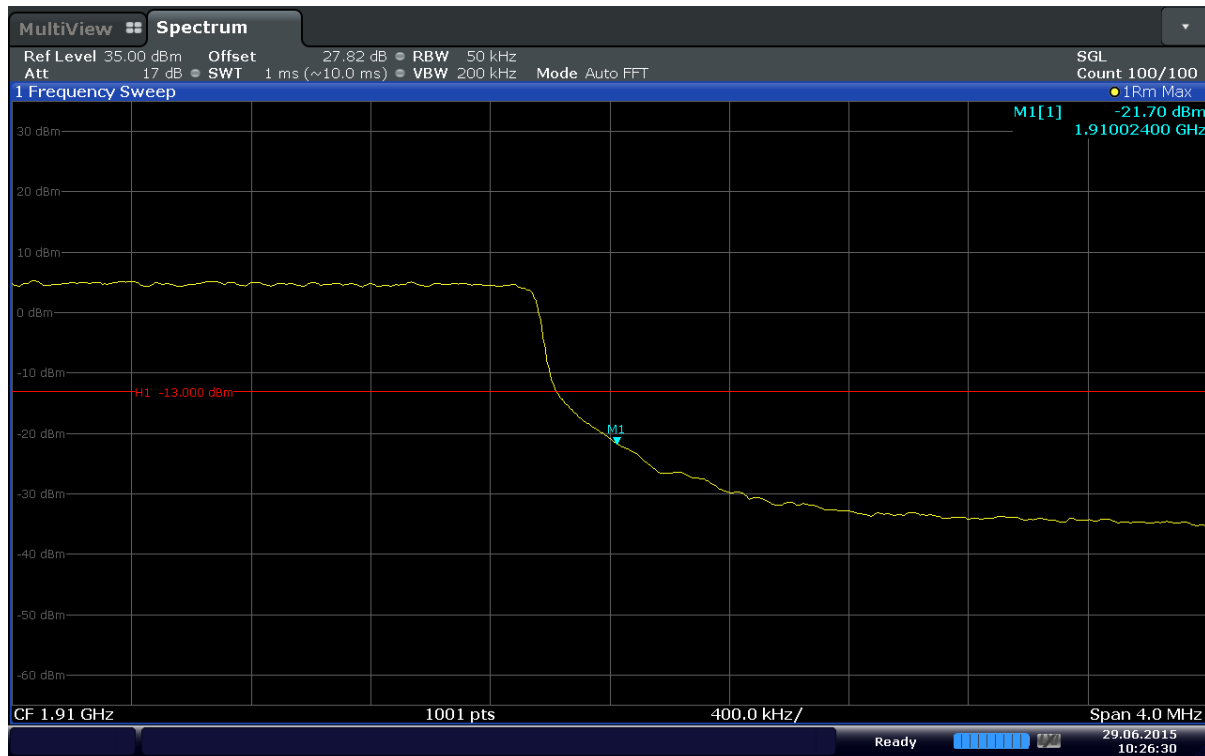
Date: 29 JUN 2015 10:23:35

Plot 6-115. Lower Band Edge Plot (Band2 – 5.0MHz – QPSK – RB Size 25)



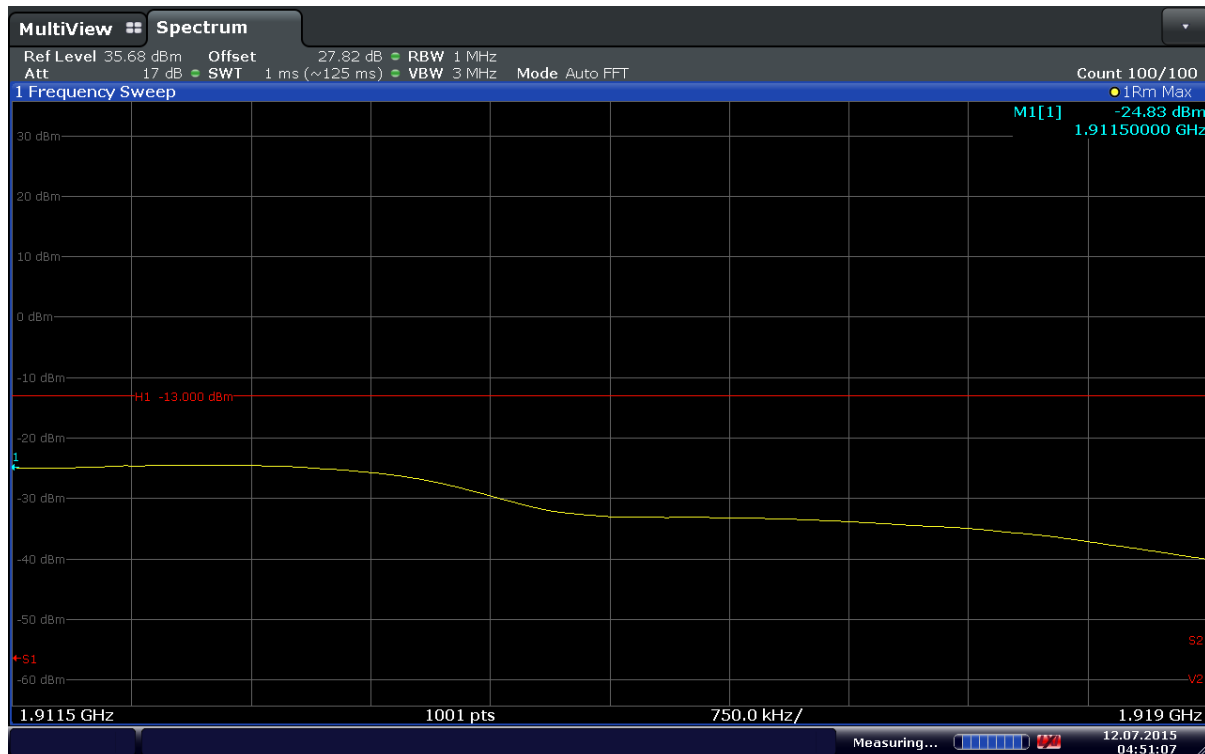
Date: 12 JUL 2015 05:32:16

Plot 6-116. Extended Lower Band Edge Plot (Band2 – 5.0MHz – QPSK – RB Size 25)



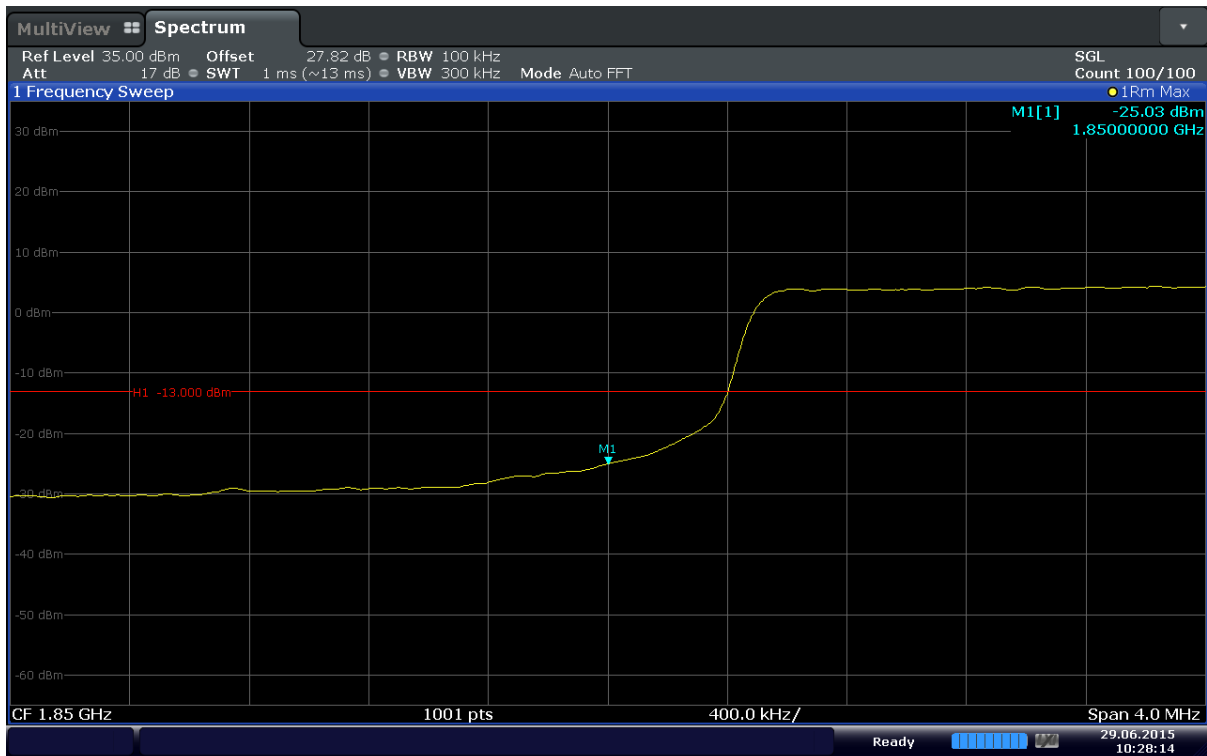
Date: 29 JUN 2015 10:26:30

Plot 6-117. Upper Band Edge Plot (Band2 – 5.0MHz – QPSK – RB Size 25)



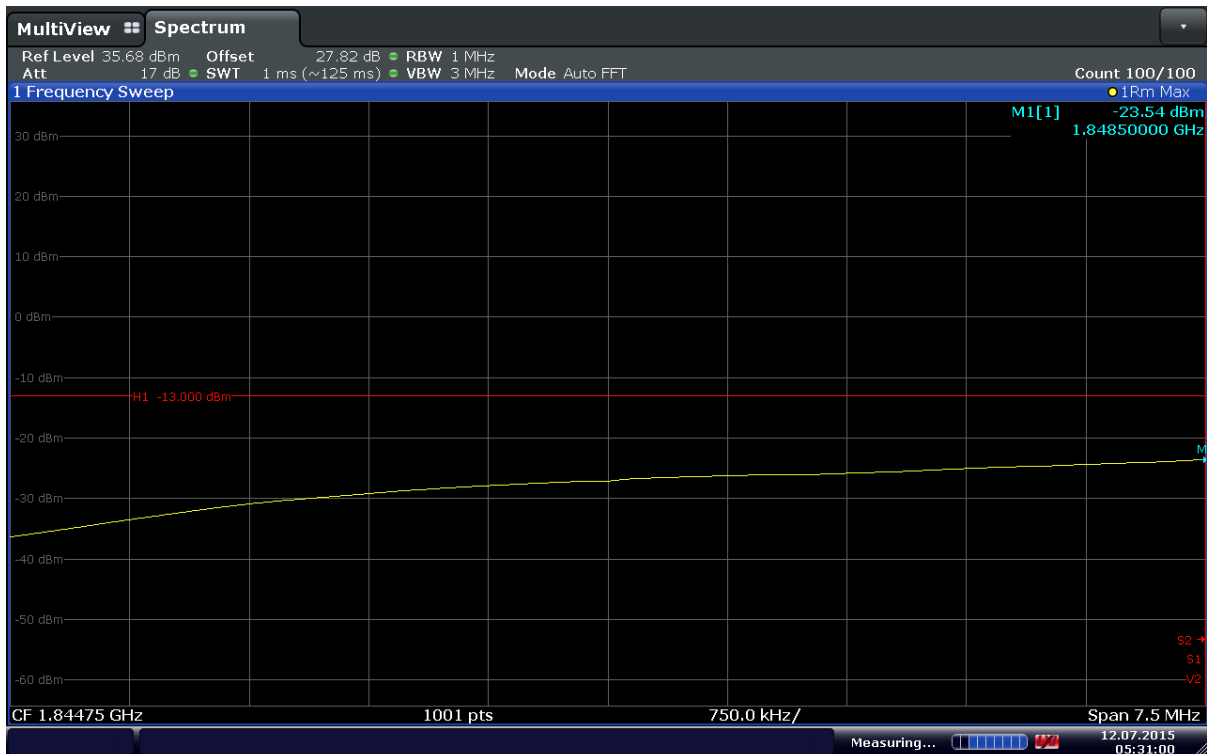
Date: 12 JUL 2015 04:51:07

Plot 6-118. Extended Upper Band Edge Plot (Band2 – 5.0MHz – QPSK – RB Size 25)



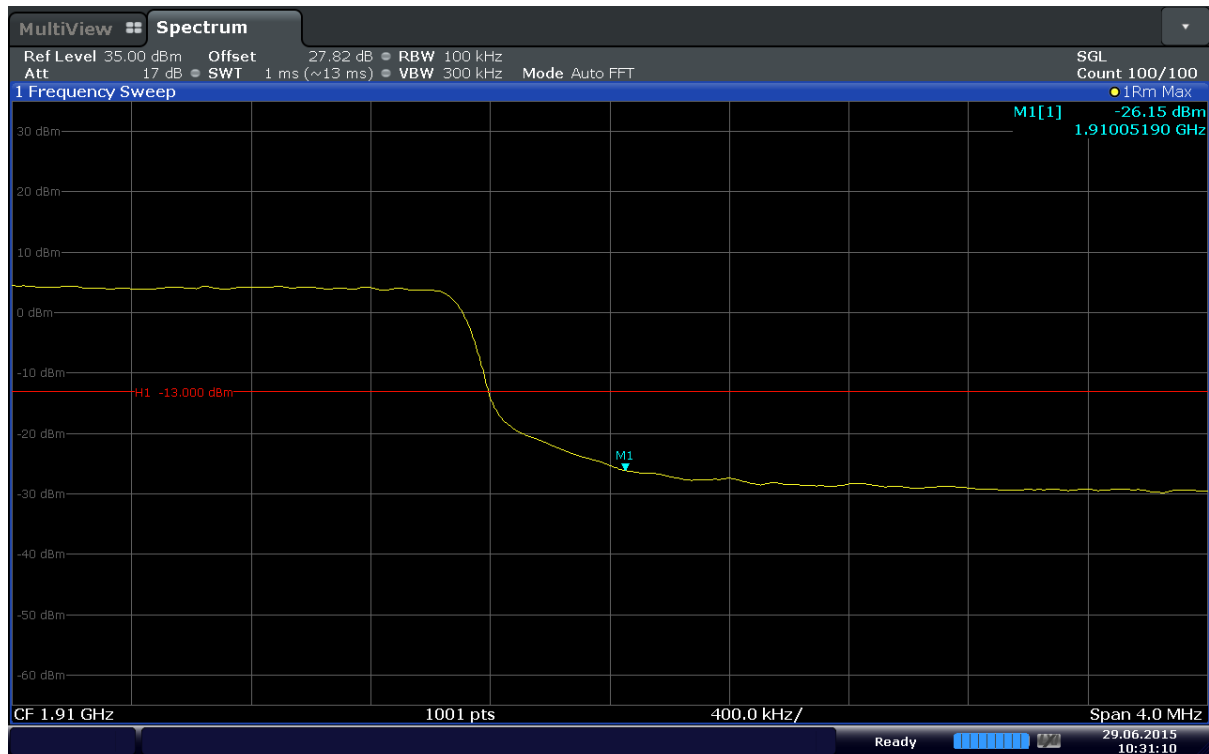
Date: 29 JUN 2015 10:28:15

Plot 6-119. Lower Band Edge Plot (Band2 – 10.0MHz – QPSK – RB Size 50)



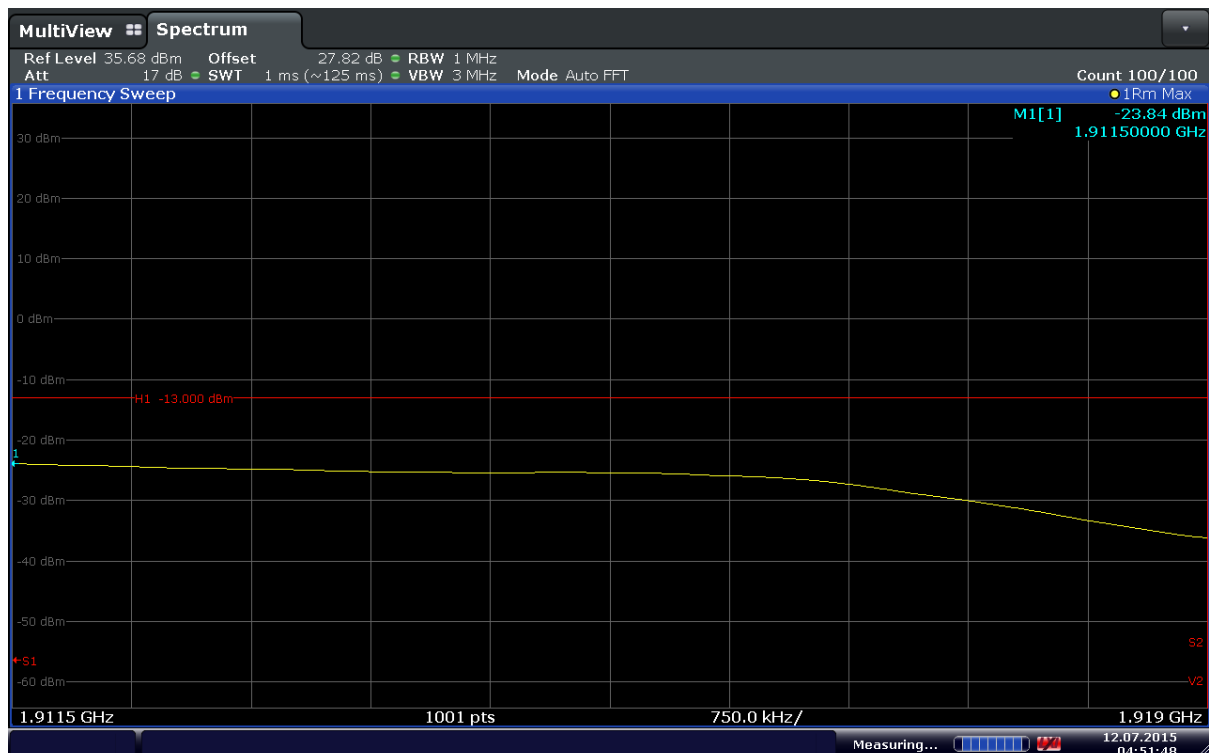
Date: 12 JUL 2015 05:31:00

Plot 6-120. Extended Lower Band Edge Plot (Band2 – 10.0MHz – QPSK – RB Size 50)



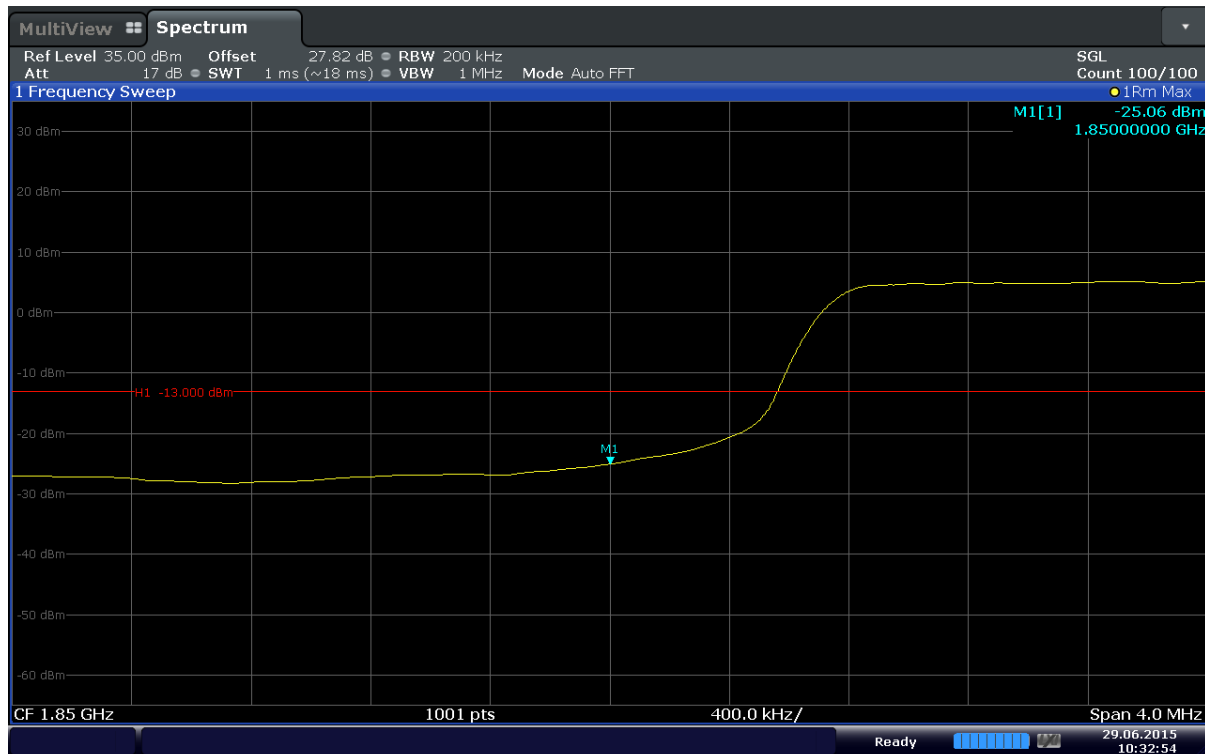
Date: 29 JUN 2015 10:31:10

Plot 6-121. Upper Band Edge Plot (Band2 – 10.0MHz – QPSK – RB Size 50)



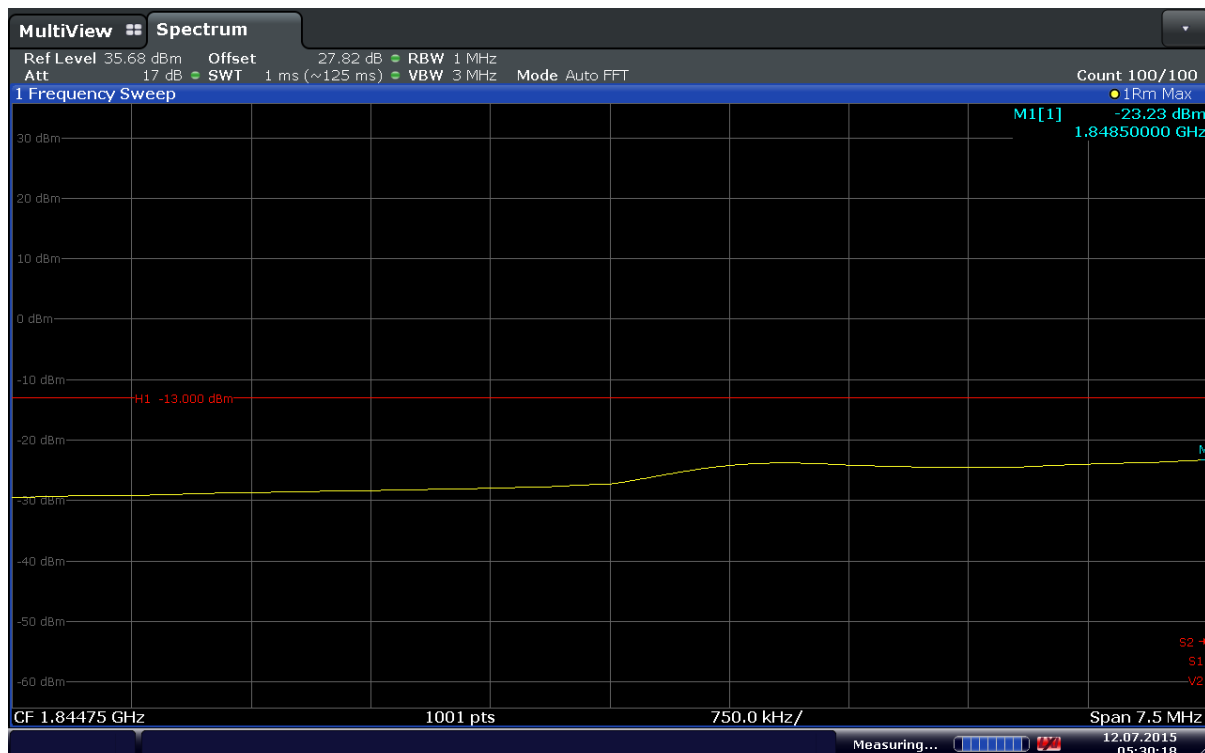
Date: 12 JUL 2015 04:51:48

Plot 6-122. Extended Upper Band Edge Plot (Band2 – 10.0MHz – QPSK – RB Size 50)



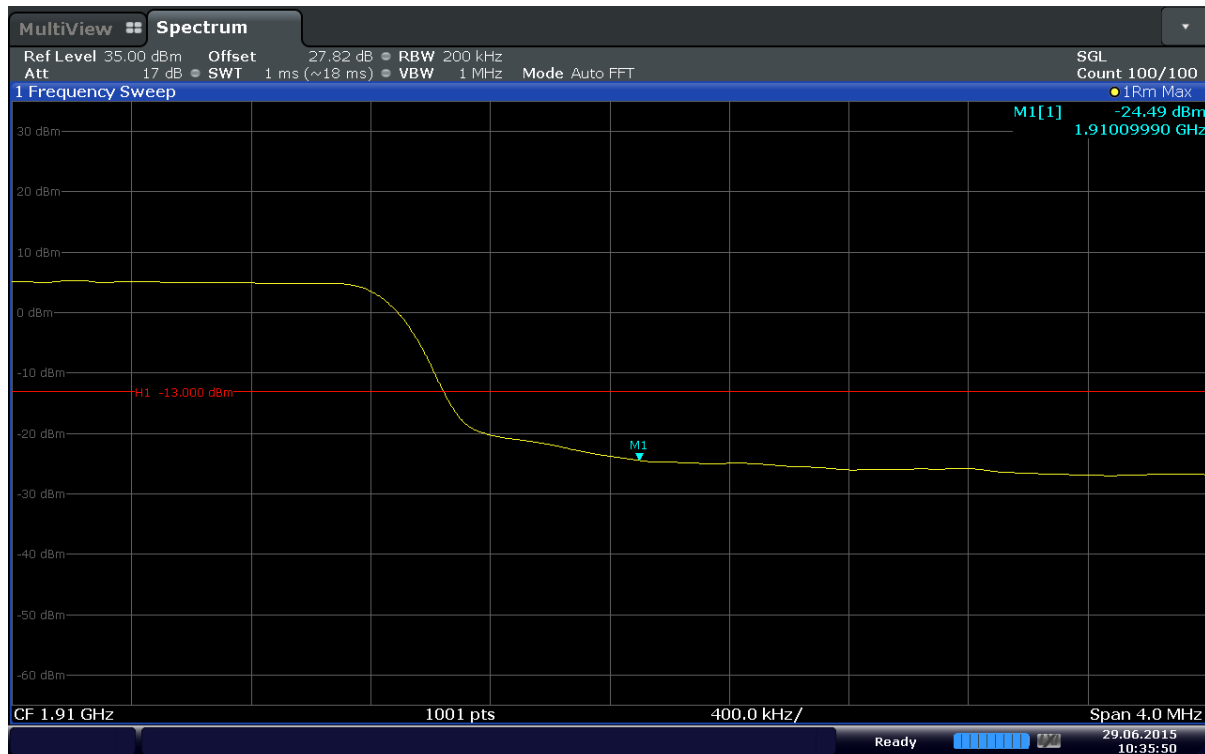
Date: 29 JUN 2015 10:32:55

Plot 6-123. Lower Band Edge Plot (Band2 – 15.0MHz – QPSK – RB Size 75)



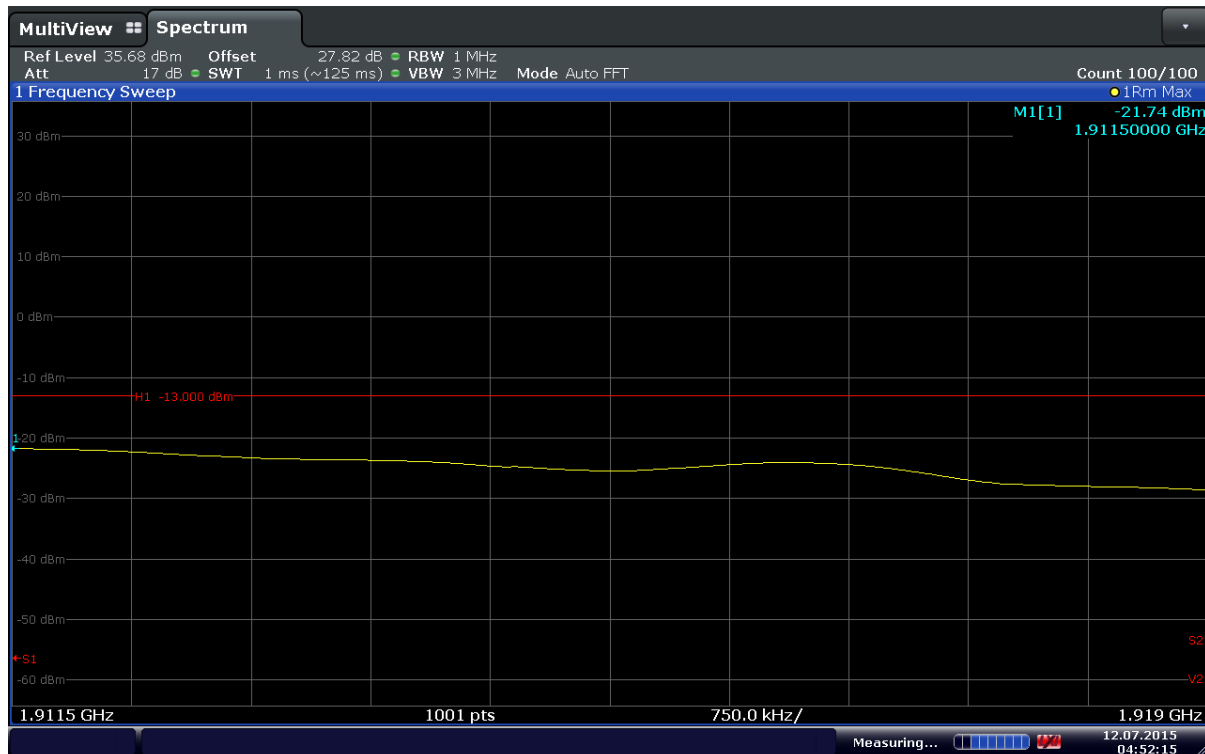
Date: 12 JUL 2015 05:30:19

Plot 6-124. Extended Lower Band Edge Plot (Band2 – 15.0MHz – QPSK – RB Size 75)



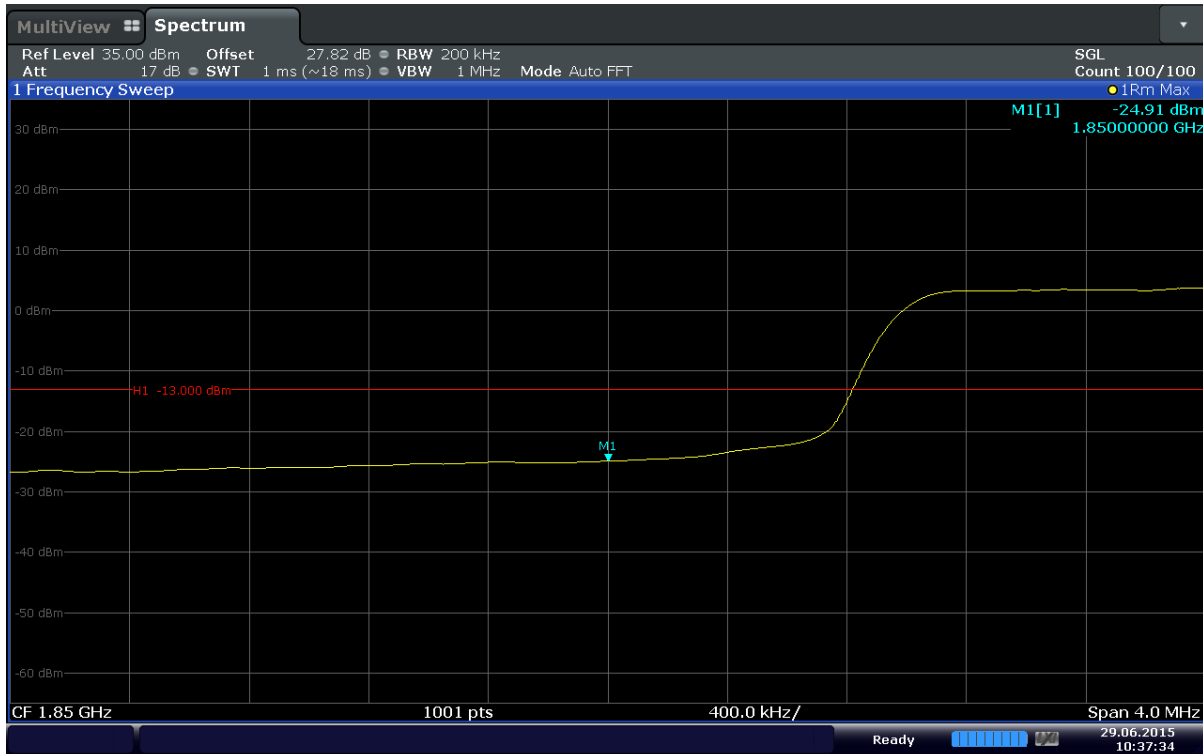
Date: 29 JUN 2015 10:35:50

Plot 6-125. Upper Band Edge Plot (Band2 – 15.0MHz – QPSK – RB Size 75)



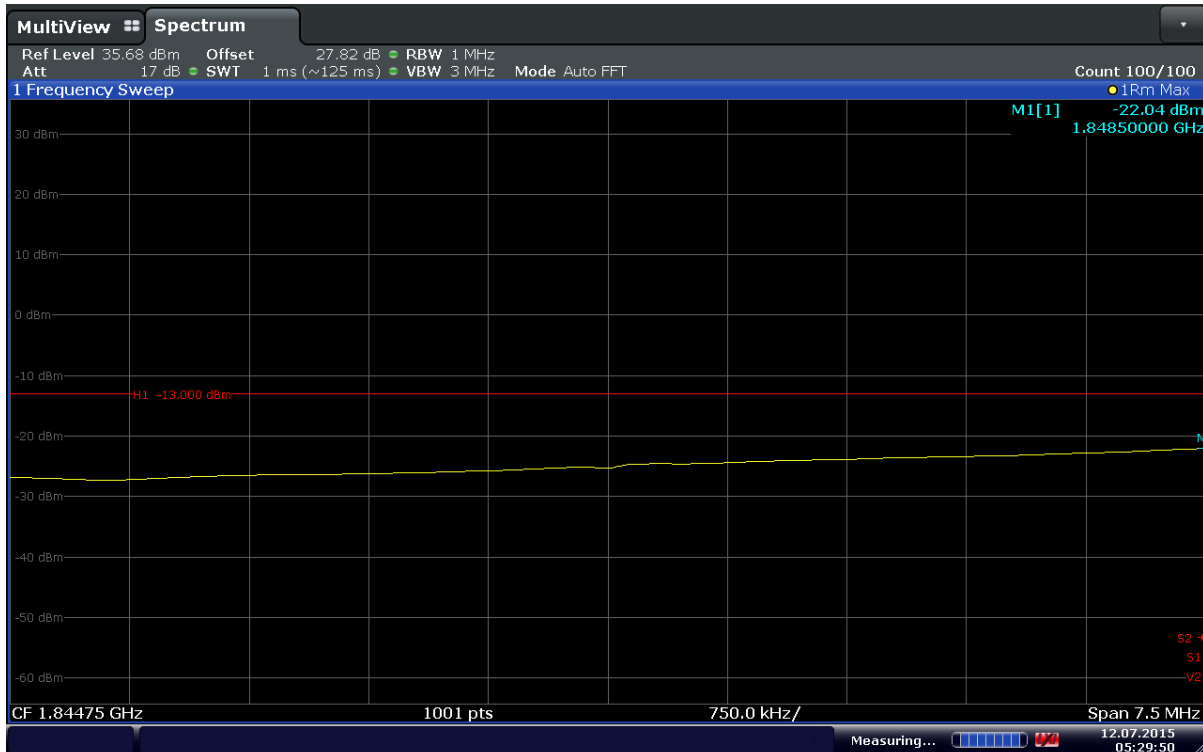
Date: 12 JUL 2015 04:52:15

Plot 6-126. Extended Upper Band Edge Plot (Band2 – 15.0MHz – QPSK – RB Size 75)



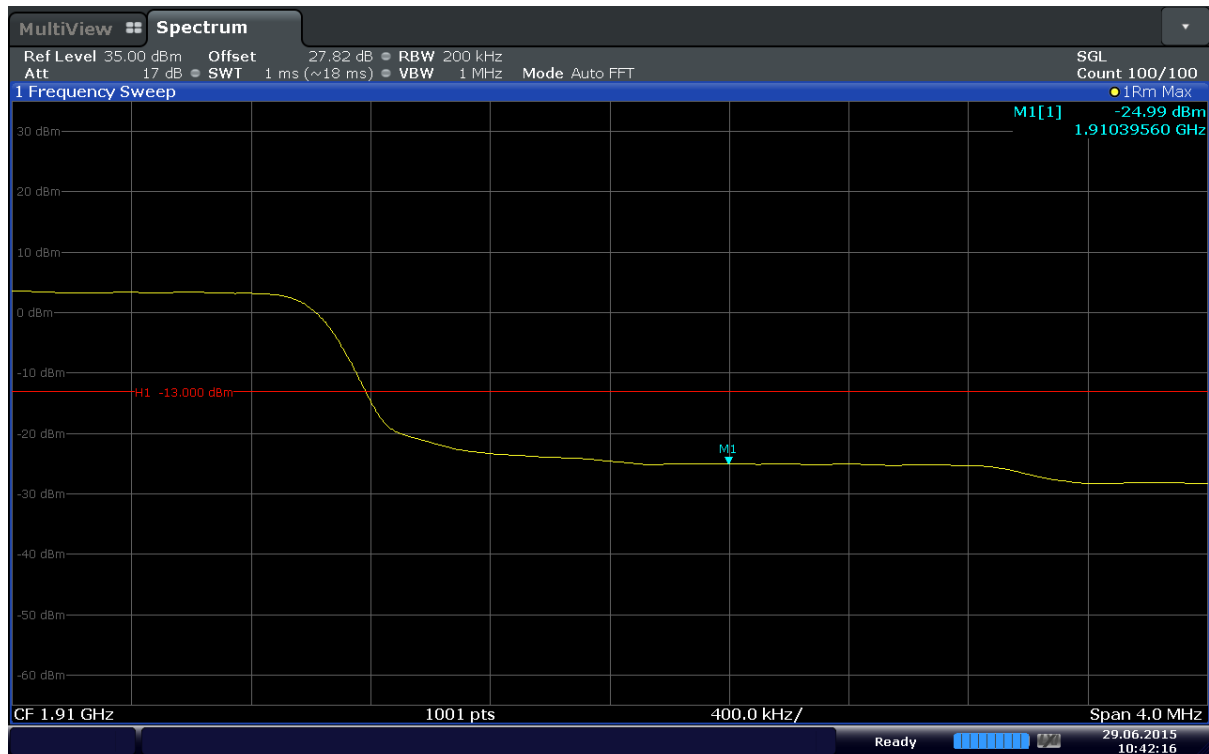
Date: 29 JUN 2015 10:37:35

Plot 6-127. Lower Band Edge Plot (Band2 – 20.0MHz – QPSK – RB Size 100)



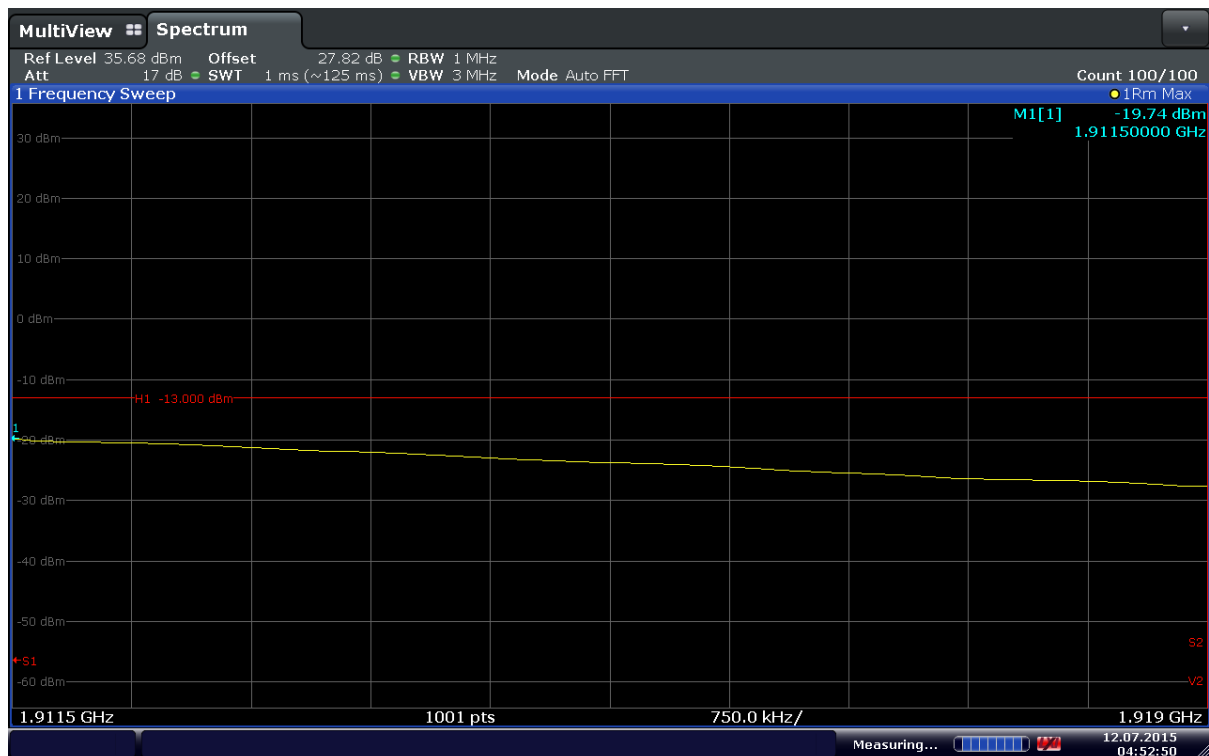
Date: 12 JUL 2015 05:29:50

Plot 6-128. Extended Lower Band Edge Plot (Band2 – 20.0MHz – QPSK – RB Size 100)



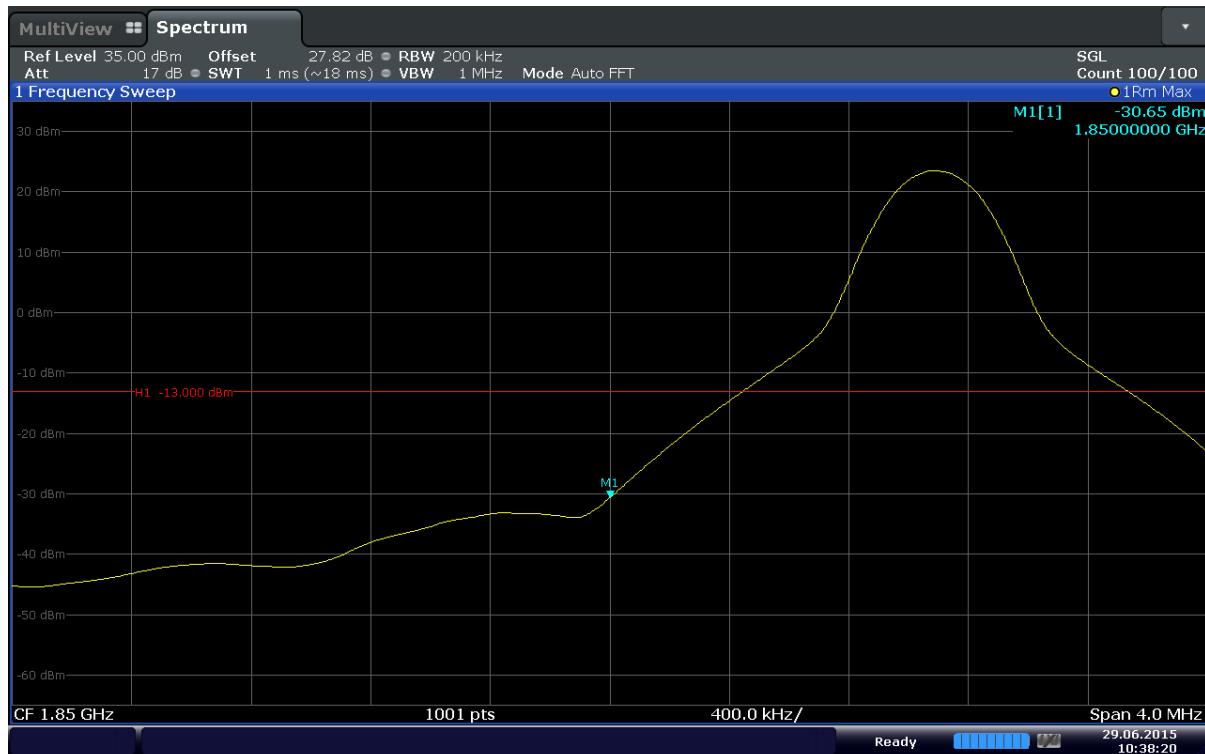
Date: 29 JUN 2015 10:42:17

Plot 6-129. Upper Band Edge Plot (Band2 – 20.0MHz – QPSK – RB Size 100)



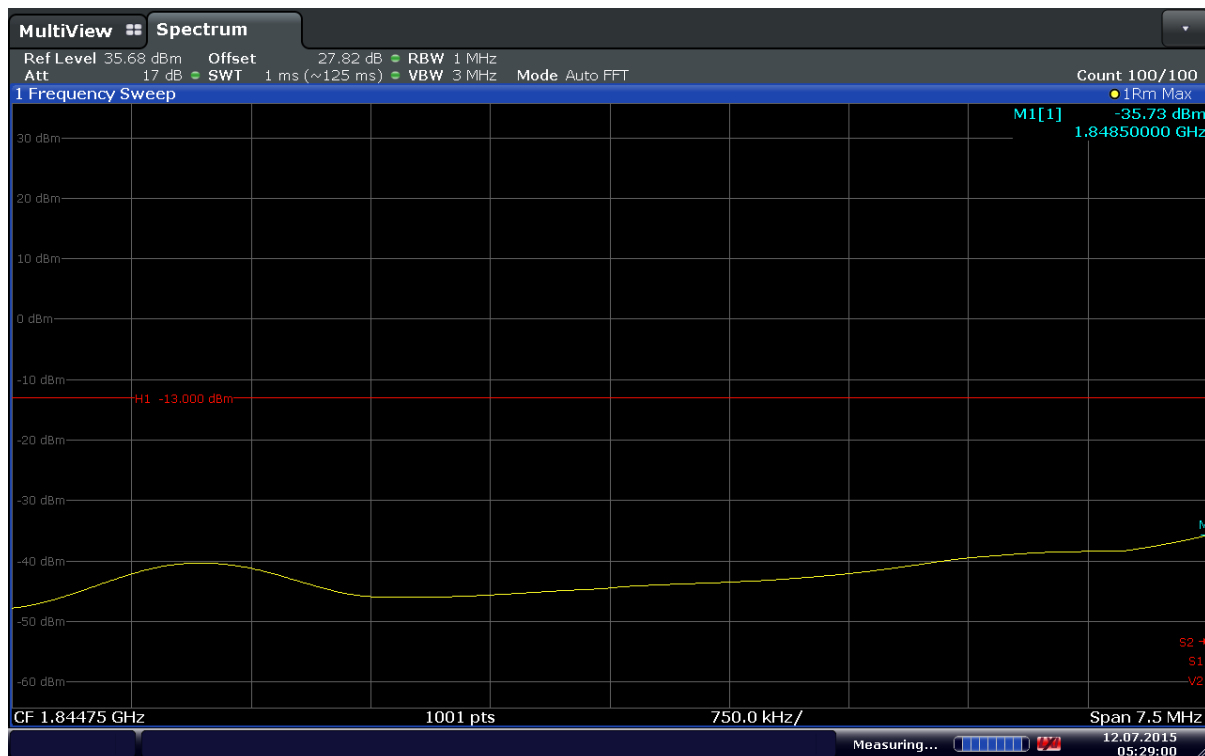
Date: 12 JUL 2015 04:52:50

Plot 6-130. Extended Upper Band Edge Plot (Band2 – 20.0MHz – QPSK – RB Size 100)



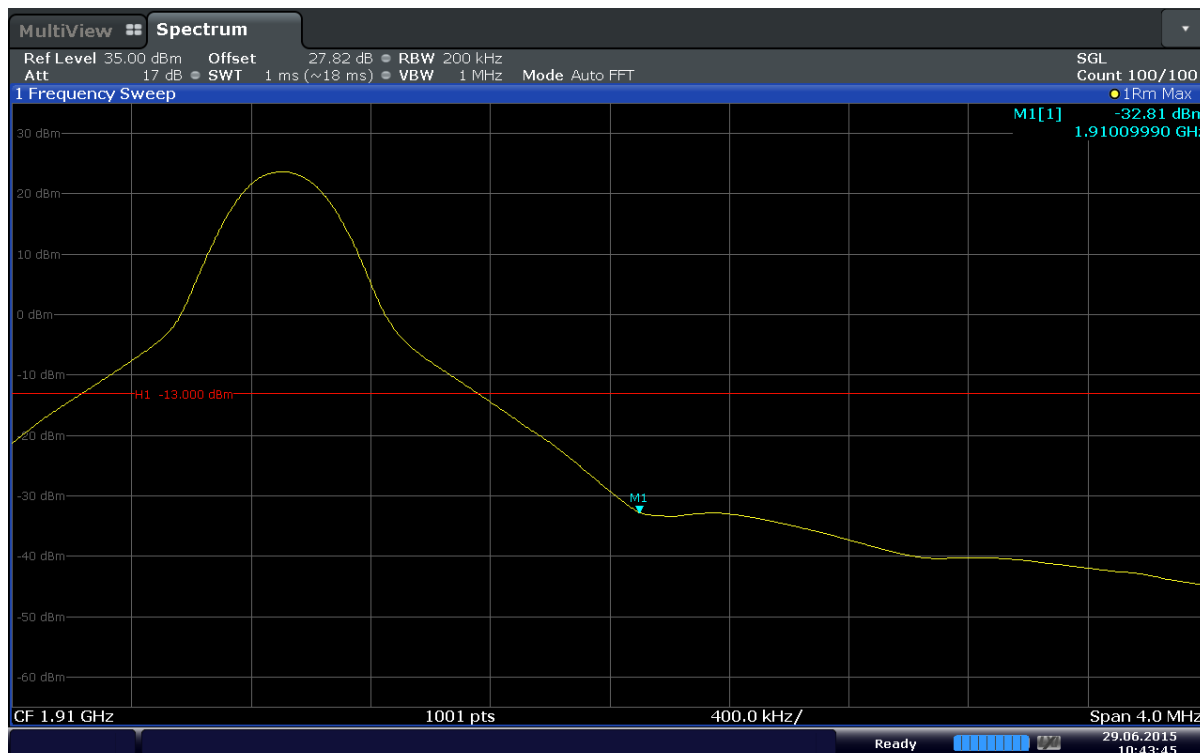
Date: 29 JUN 2015 10:38:20

Plot 6-131. Lower Band Edge Plot (Band2 – 20.0MHz – QPSK – RB Size 1 – RB Offset 0)



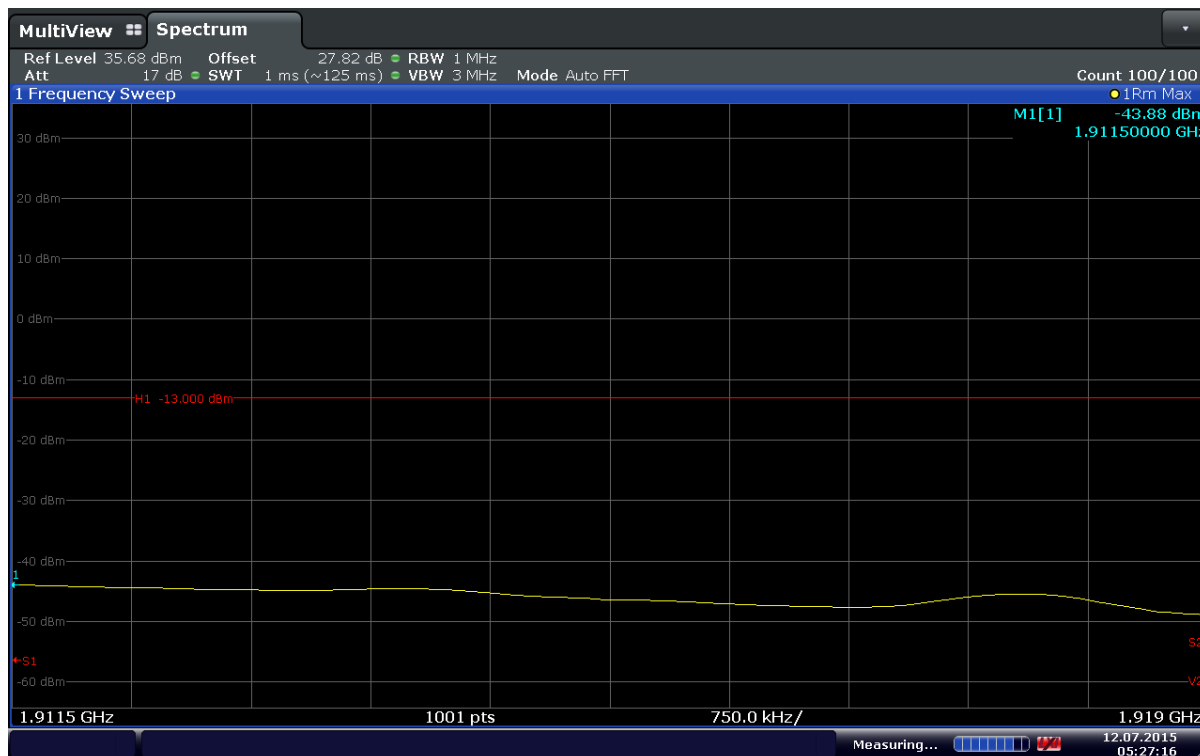
Date: 12 JUL 2015 05:29:00

Plot 6-132. Extended Lower Band Edge Plot (Band2 – 20.0MHz – QPSK – RB Size 1 – RB Offset 0)



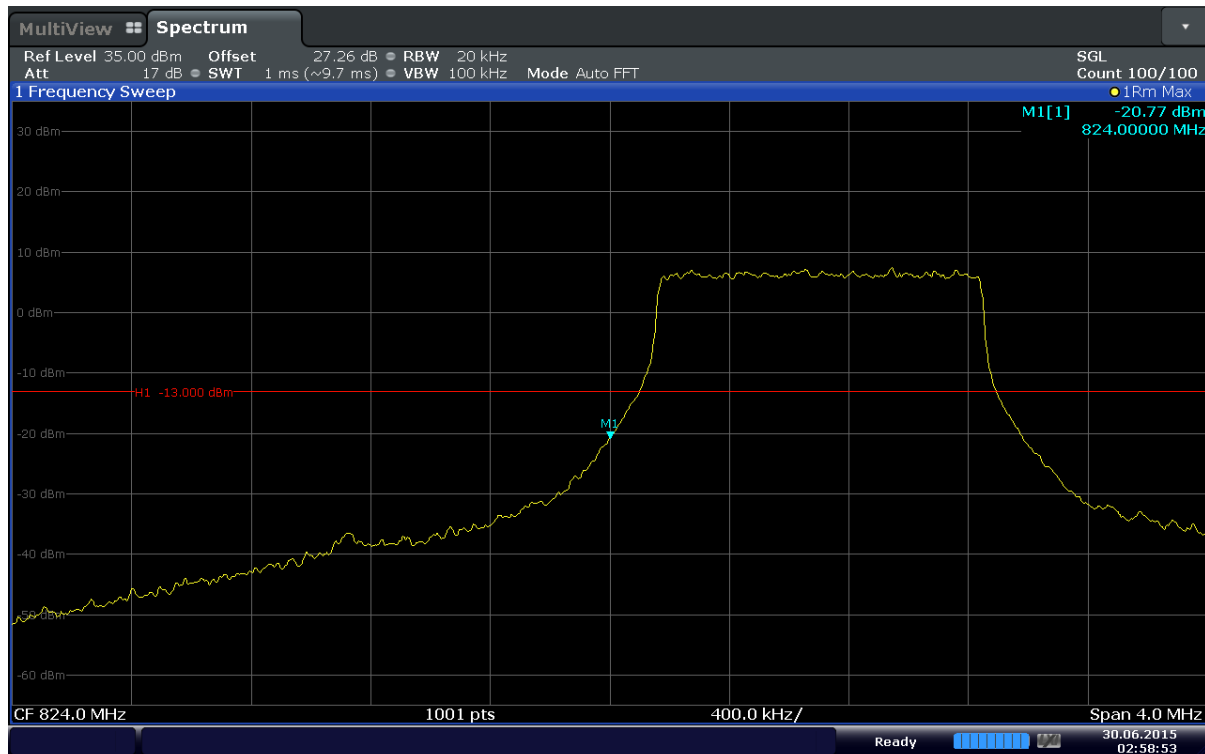
Date: 29 JUN 2015 10:43:46

Plot 6-133. Upper Band Edge Plot (Band2 – 20.0MHz – QPSK – RB Size 1 – RB Offset 99)



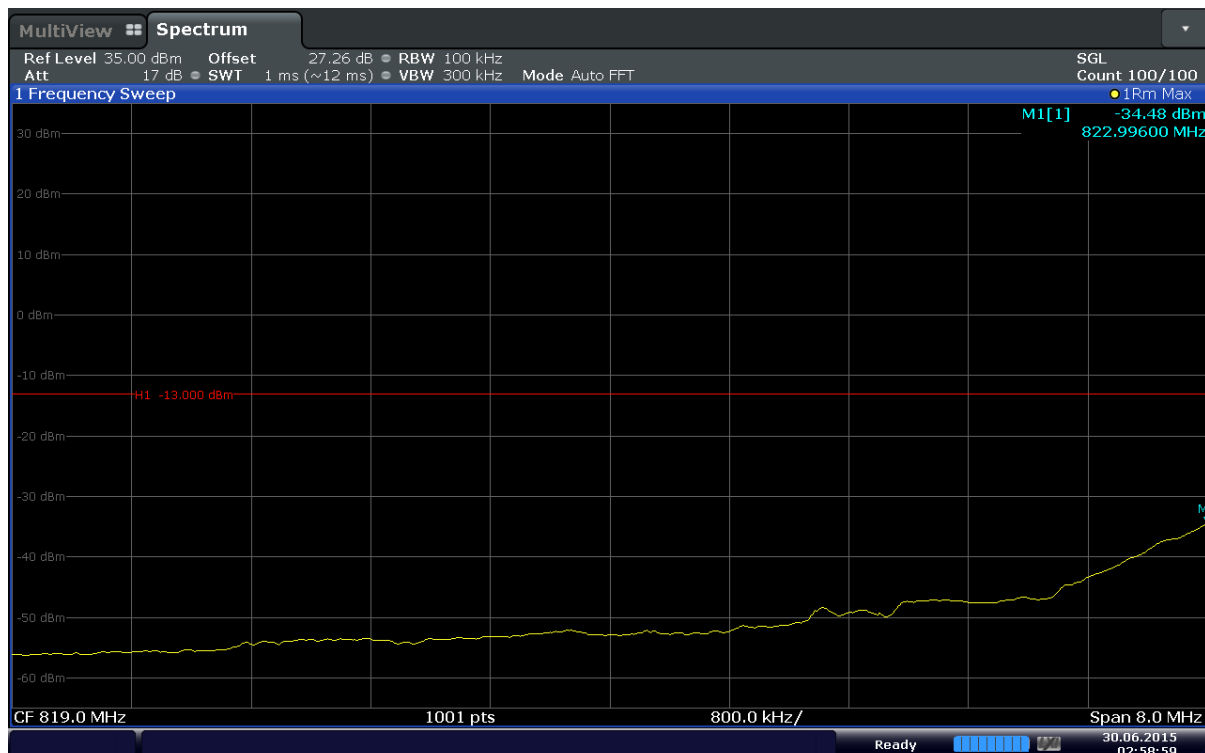
Date: 12 JUL 2015 05:27:17

Plot 6-134. Extended Upper Band Edge Plot (Band2 – 20.0MHz – QPSK – RB Size 1 – RB Offset 99)



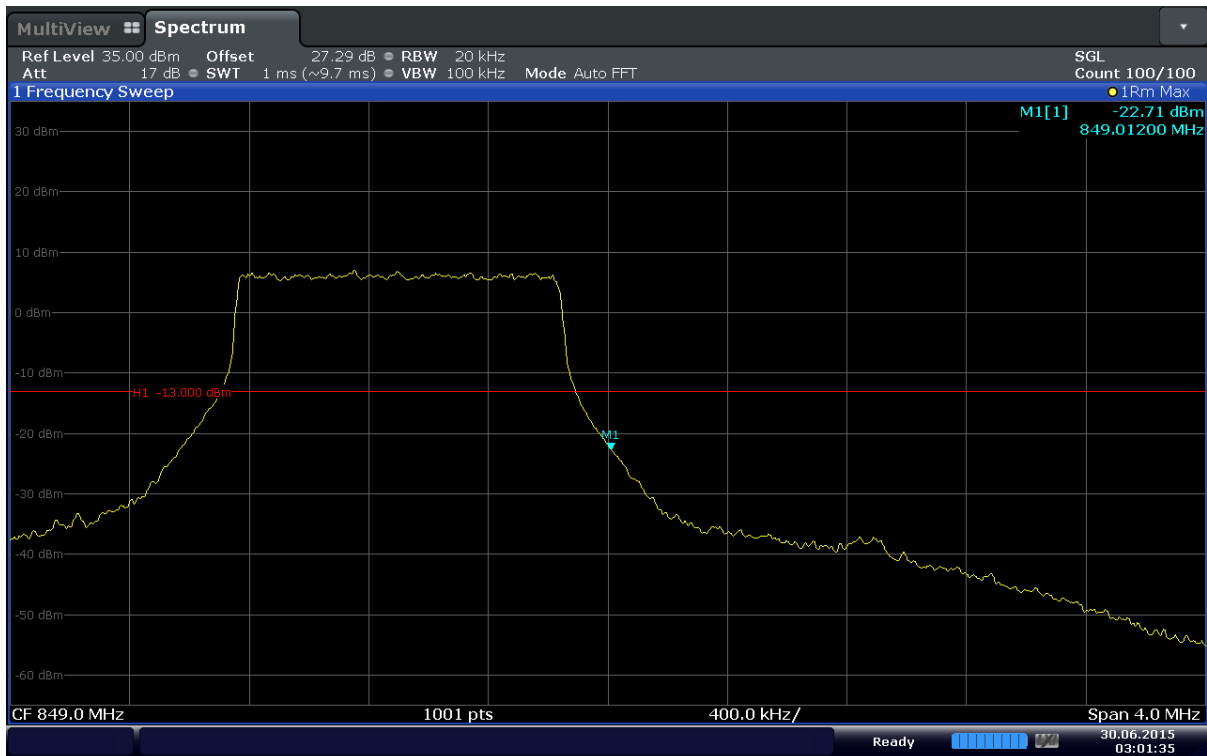
Date: 30 JUN 2015 02:58:53

Plot 6-135. Lower Band Edge Plot (Band26 – 1.4MHz – QPSK – RB Size 6)



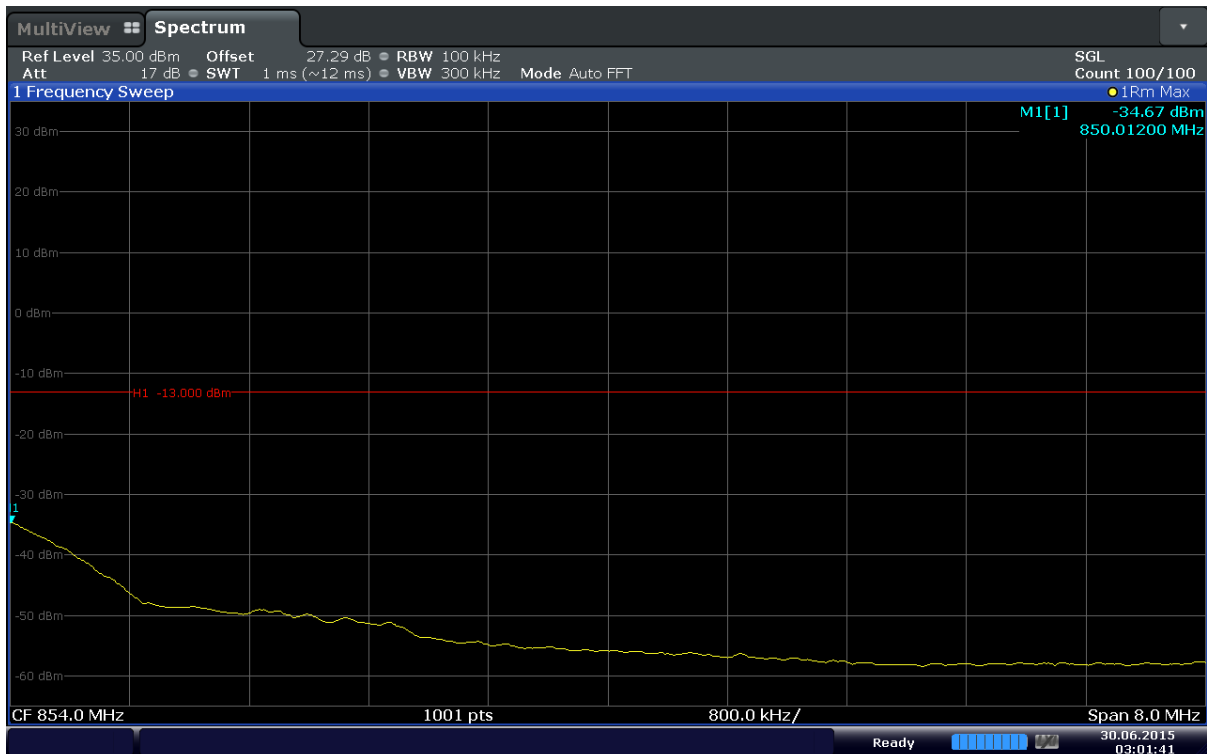
Date: 30 JUN 2015 02:58:59

Plot 6-136. Extended Lower Band Edge Plot (Band26 – 1.4MHz – QPSK – RB Size 6)



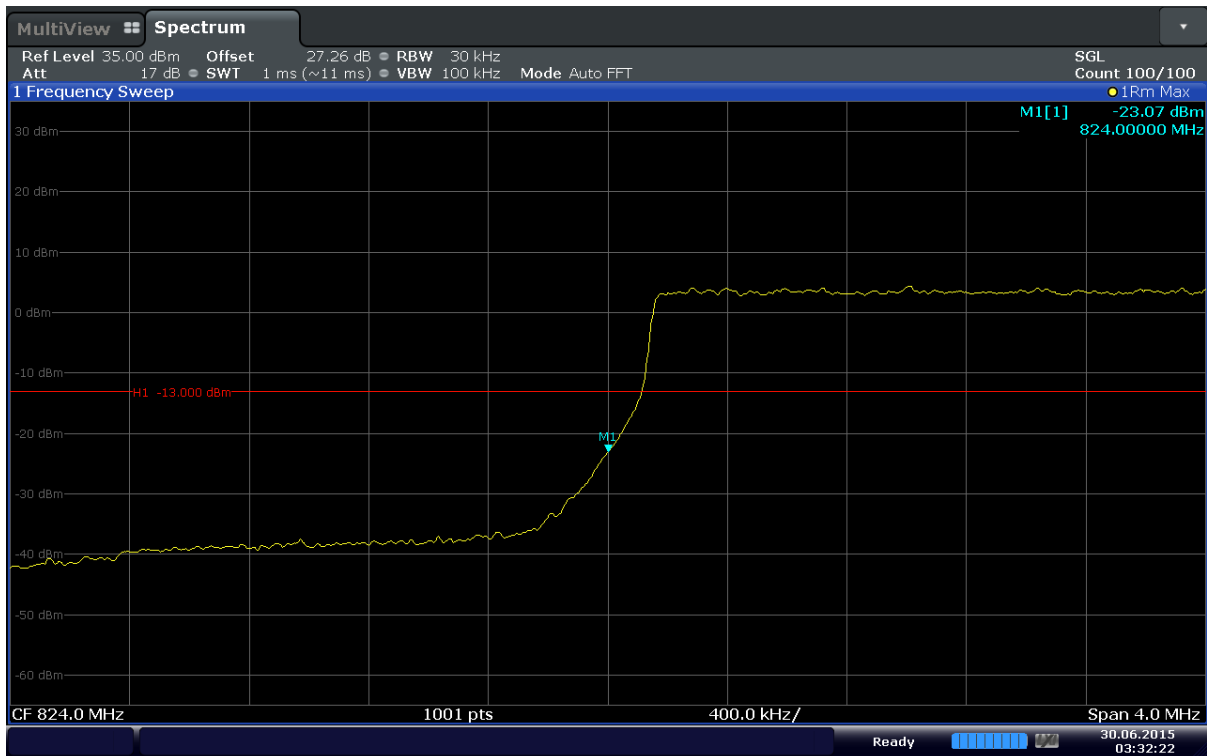
Date: 30 JUN.2015 03:01:36

Plot 6-137. Upper Band Edge Plot (Band26 – 1.4MHz – QPSK – RB Size 6)



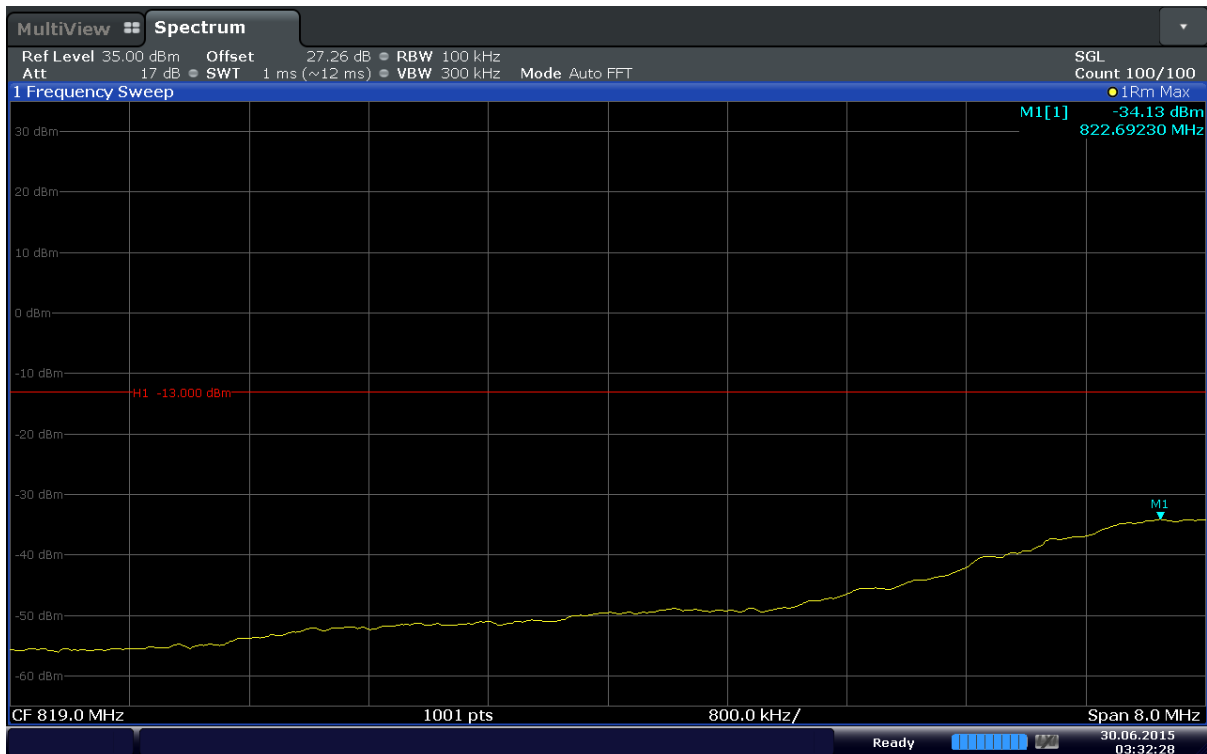
Date: 30 JUN.2015 03:01:42

Plot 6-138. Extended Upper Band Edge Plot (Band26 – 1.4MHz – QPSK – RB Size 6)



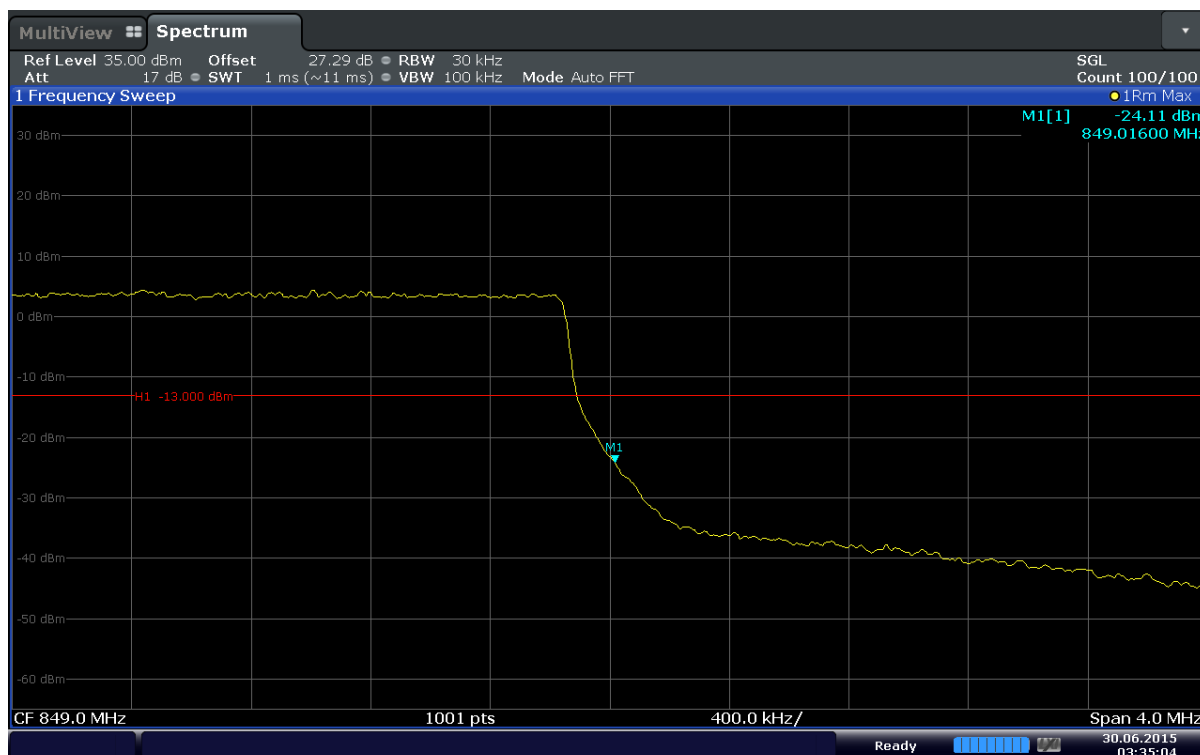
Date: 30 JUN 2015 03:32:22

Plot 6-139. Lower Band Edge Plot (Band26 – 3.0MHz – QPSK – RB Size 15)



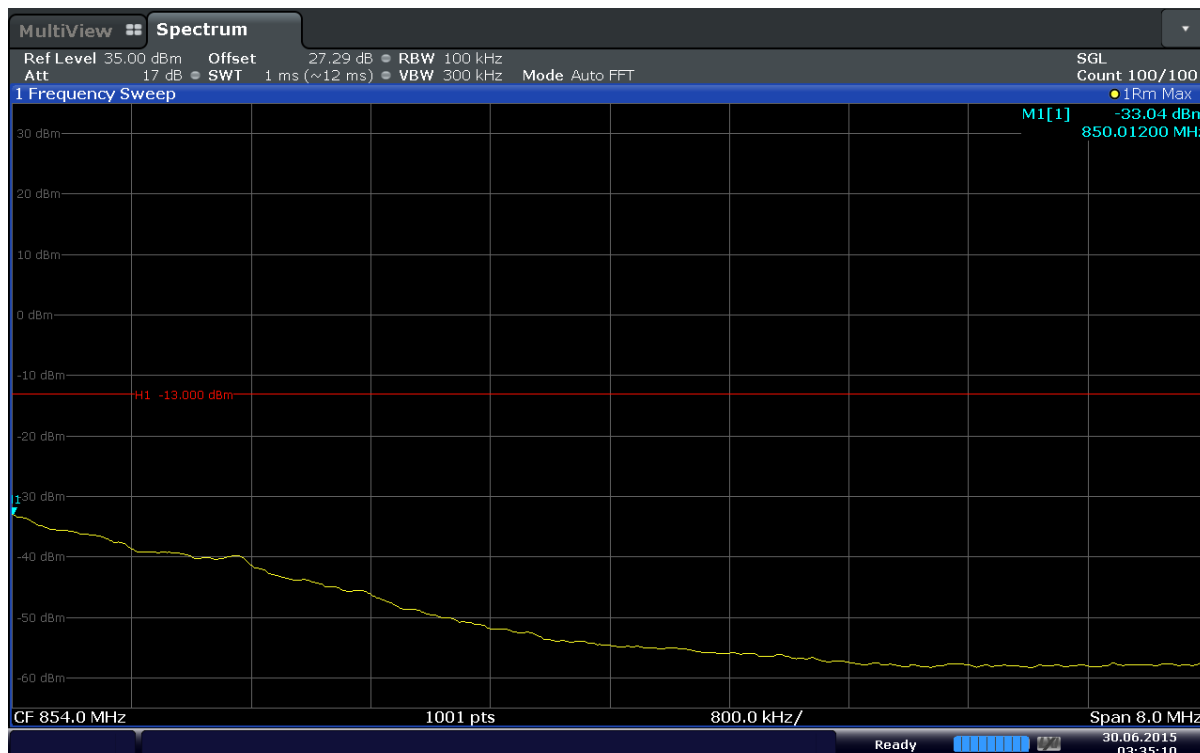
Date: 30 JUN 2015 03:32:28

Plot 6-140. Extended Lower Band Edge Plot (Band26 – 3.0MHz – QPSK – RB Size 15)



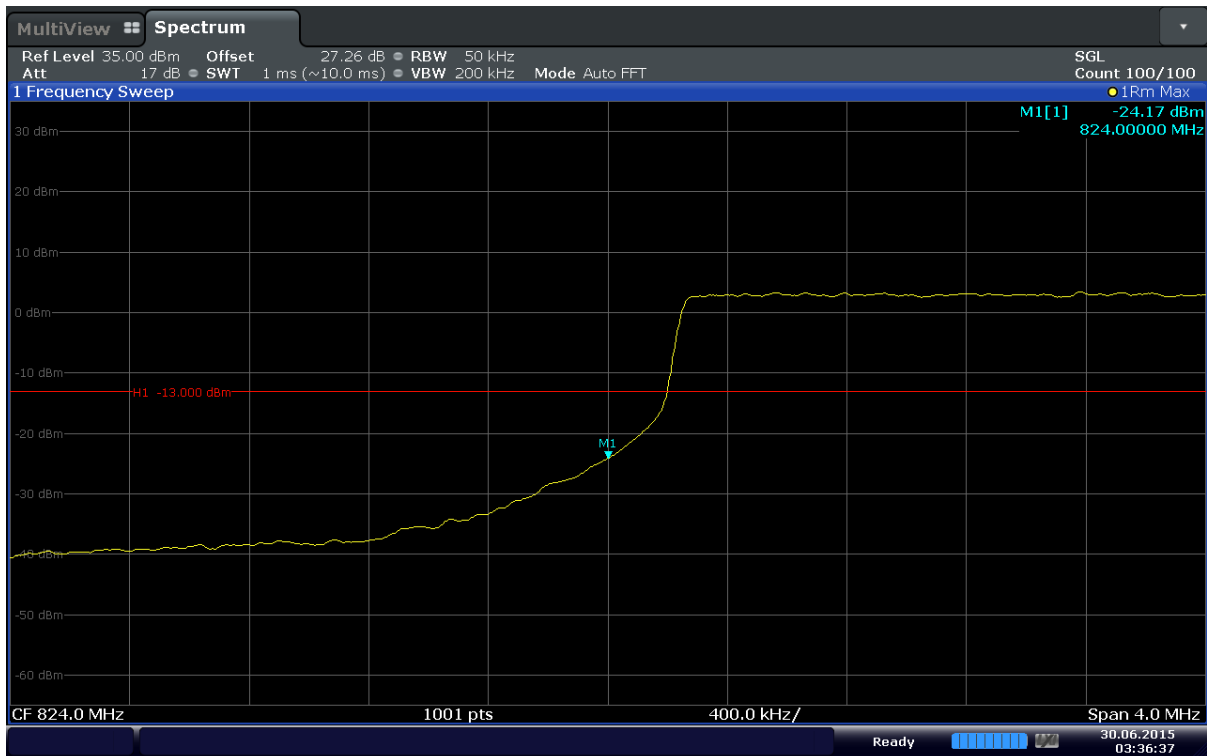
Date: 30 JUN 2015 03:35:04

Plot 6-141. Upper Band Edge Plot (Band26 – 3.0MHz – QPSK – RB Size 15)



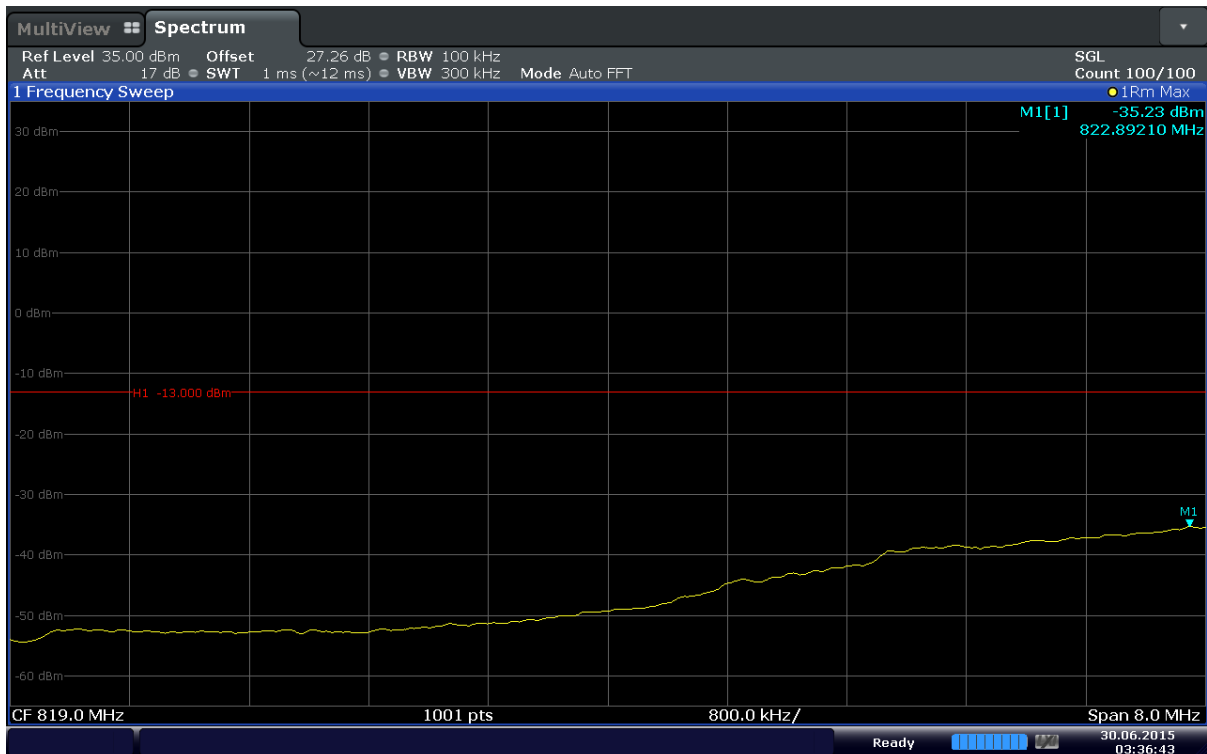
Date: 30 JUN 2015 03:35:10

Plot 6-142. Extended Upper Band Edge Plot (Band26 – 3.0MHz – QPSK – RB Size 15)



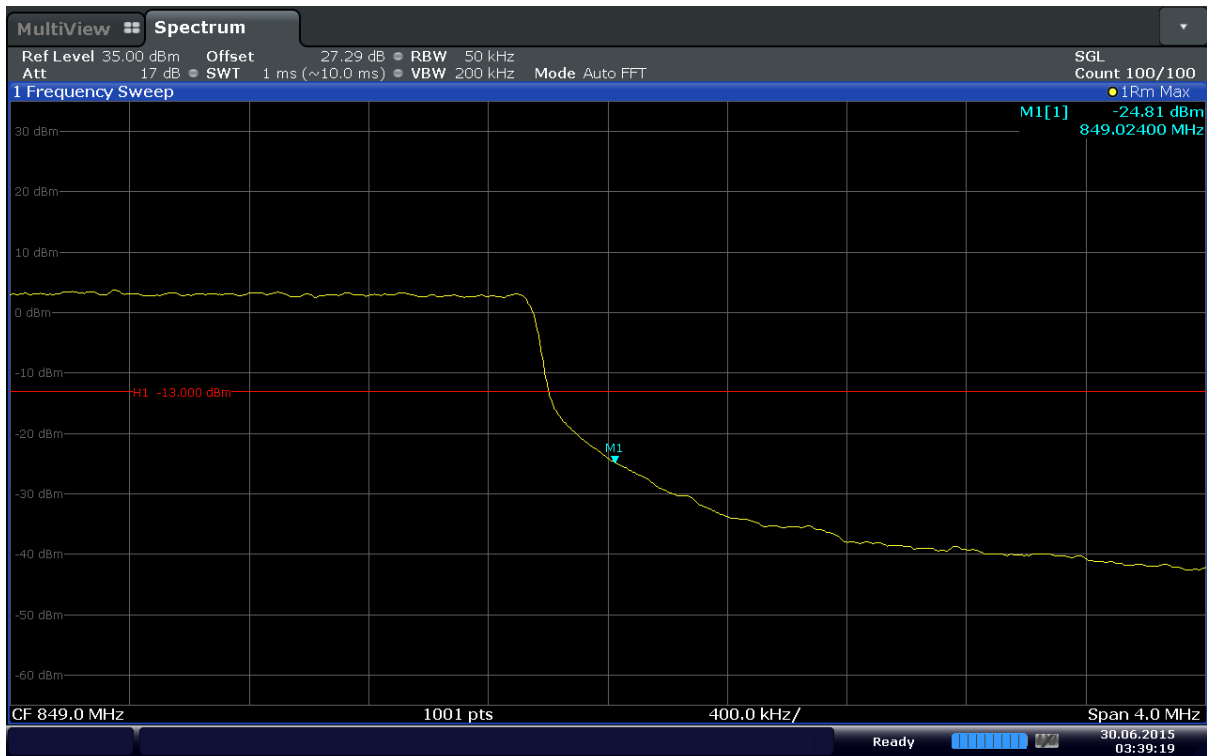
Date: 30 JUN 2015 03:36:37

Plot 6-143. Lower Band Edge Plot (Band26 – 5.0MHz – QPSK – RB Size 25)



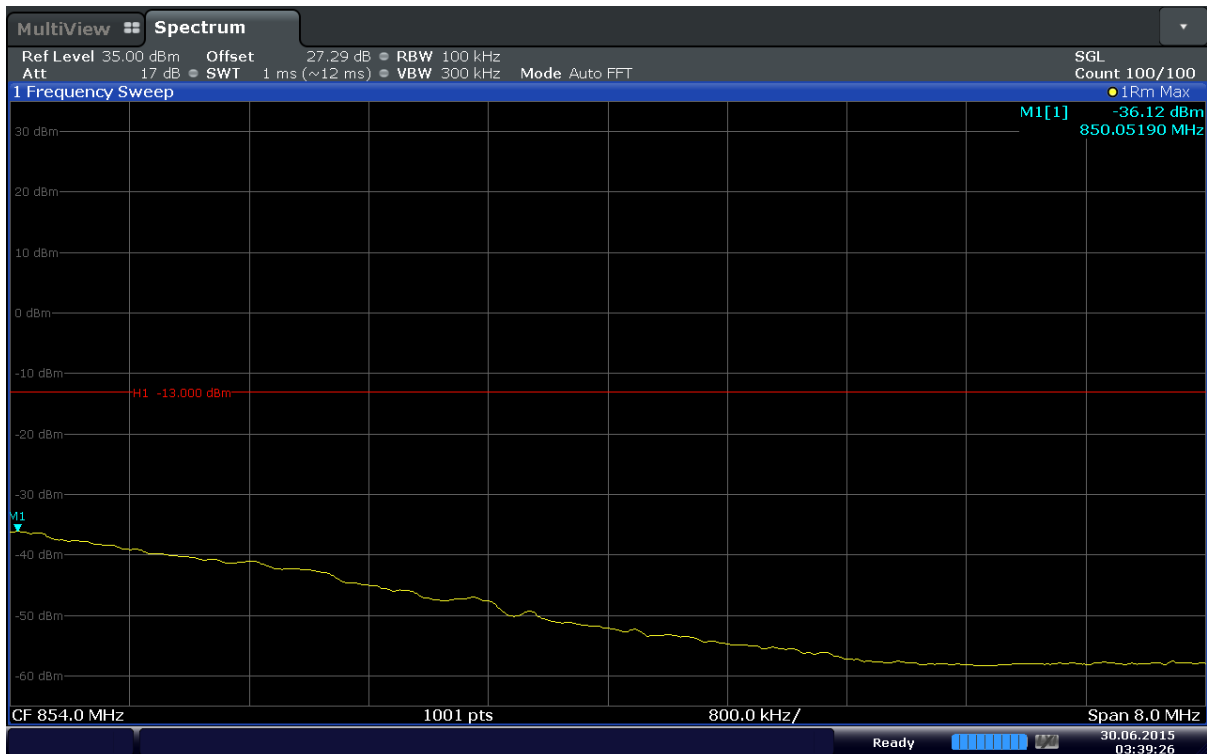
Date: 30 JUN 2015 03:36:43

Plot 6-144. Extended Lower Band Edge Plot (Band26 – 5.0MHz – QPSK – RB Size 25)



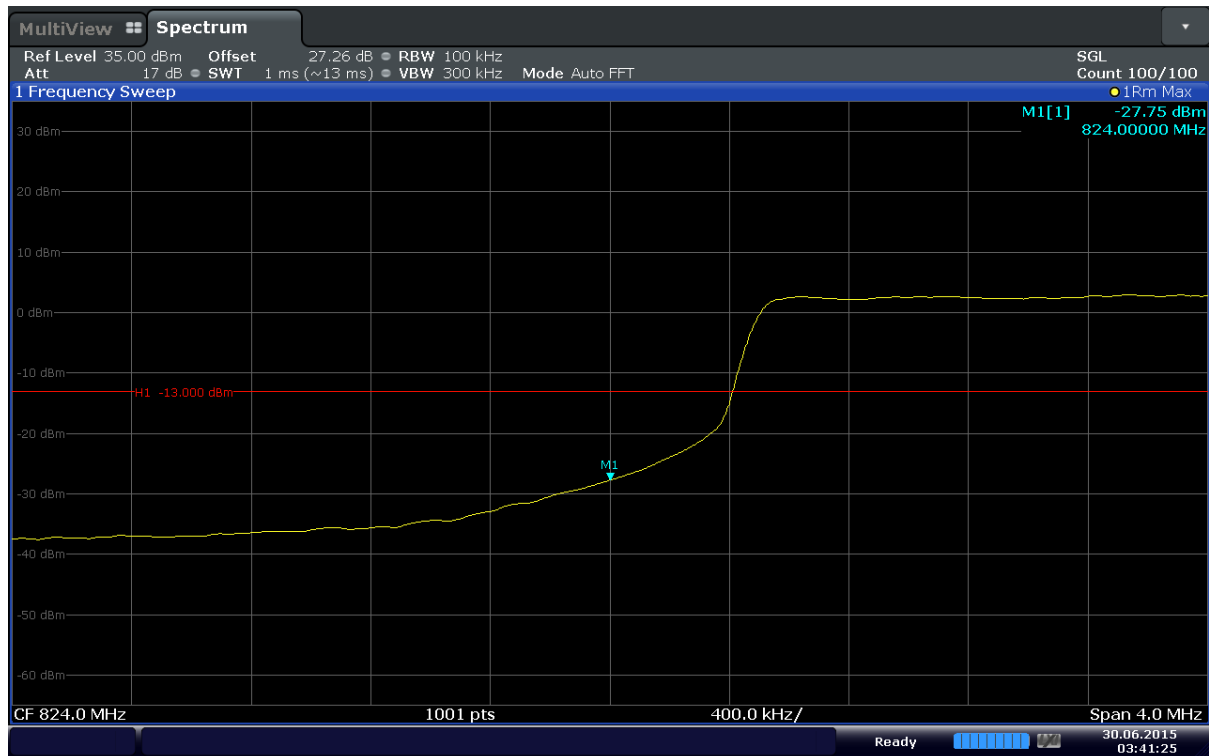
Date: 30 JUN 2015 03:39:20

Plot 6-145. Upper Band Edge Plot (Band26 – 5.0MHz – QPSK – RB Size 25)



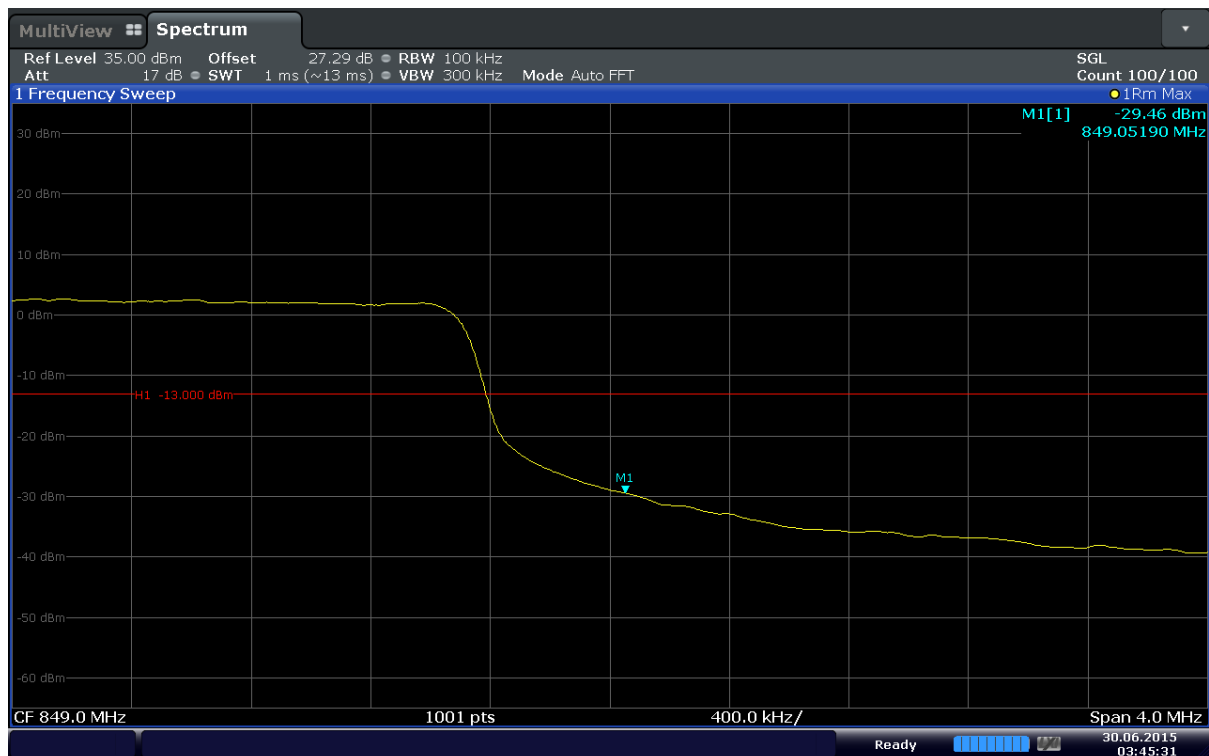
Date: 30 JUN 2015 03:39:26

Plot 6-146. Extended Upper Band Edge Plot (Band26 – 5.0MHz – QPSK – RB Size 25)



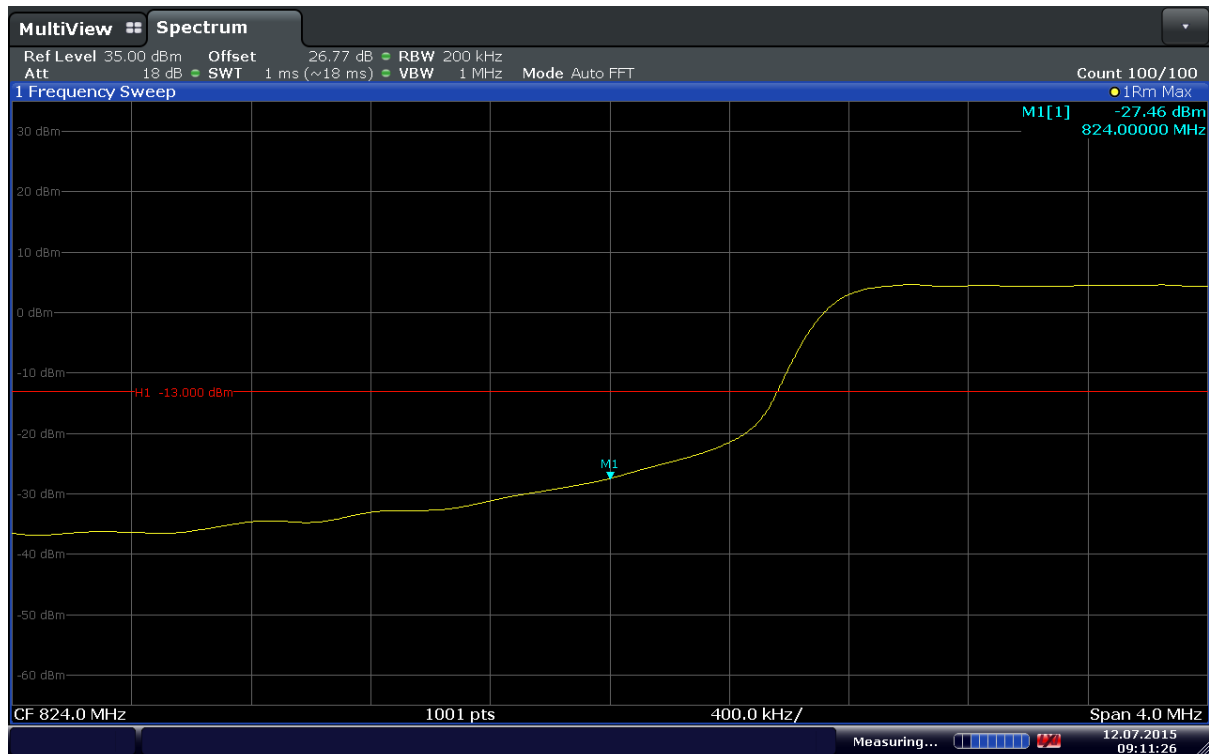
Date: 30 JUN 2015 03:41:26

Plot 6-147. Lower Band Edge Plot (Band26 – 10.0MHz – QPSK – RB Size 50)



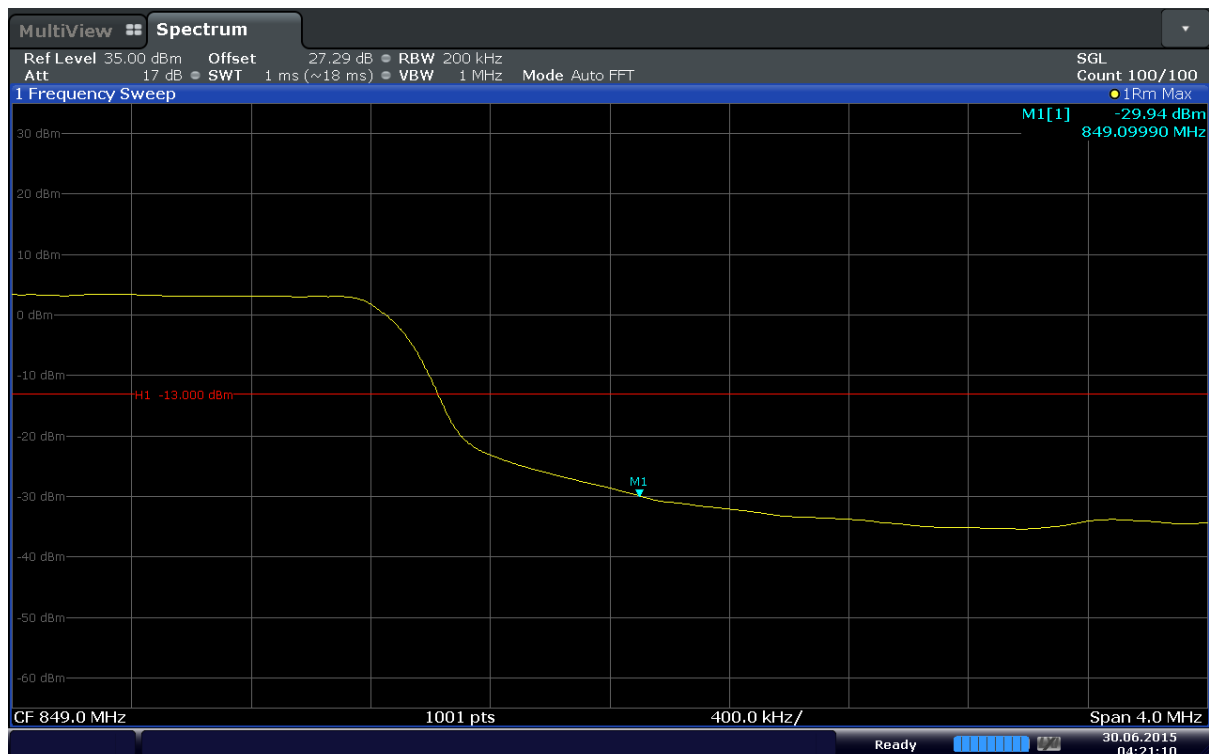
Date: 30 JUN 2015 03:45:31

Plot 6-148. Upper Band Edge Plot (Band26 – 10.0MHz – QPSK – RB Size 50)



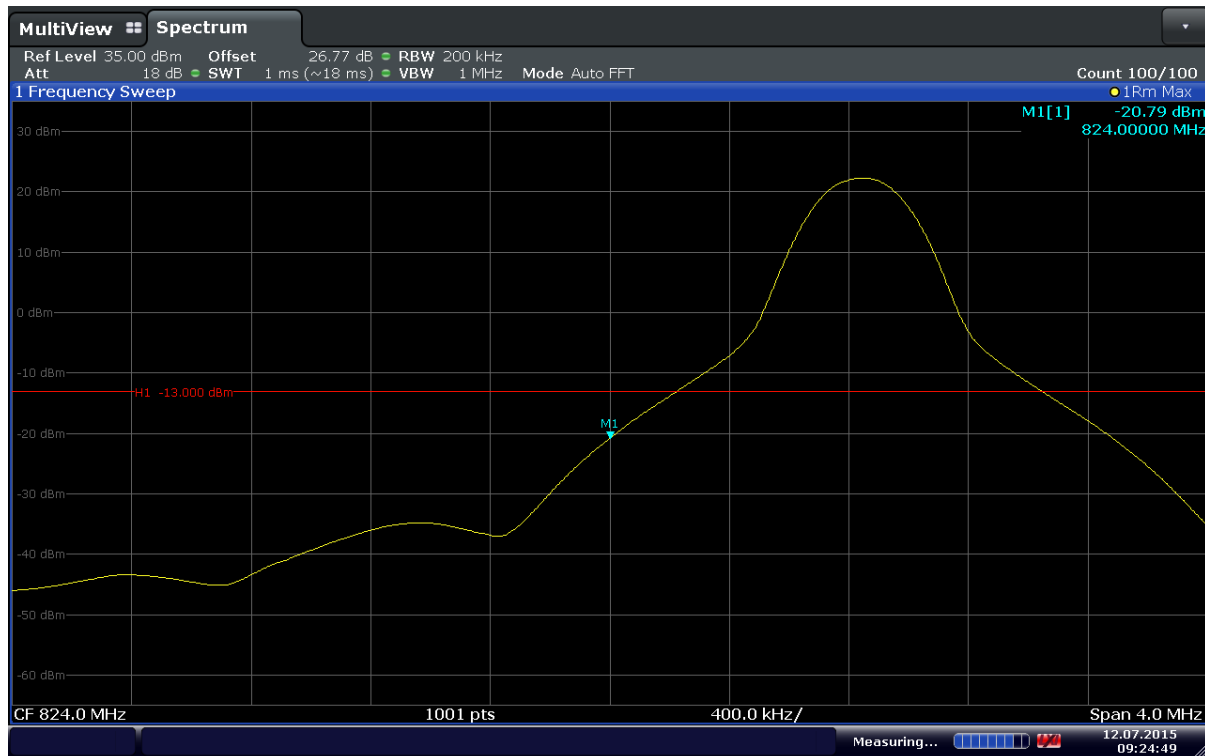
Date: 12.JUL.2015 09:11:26

Plot 6-149. Lower Band Edge Plot (Band26 – 15.0MHz – QPSK – RB Size 75)



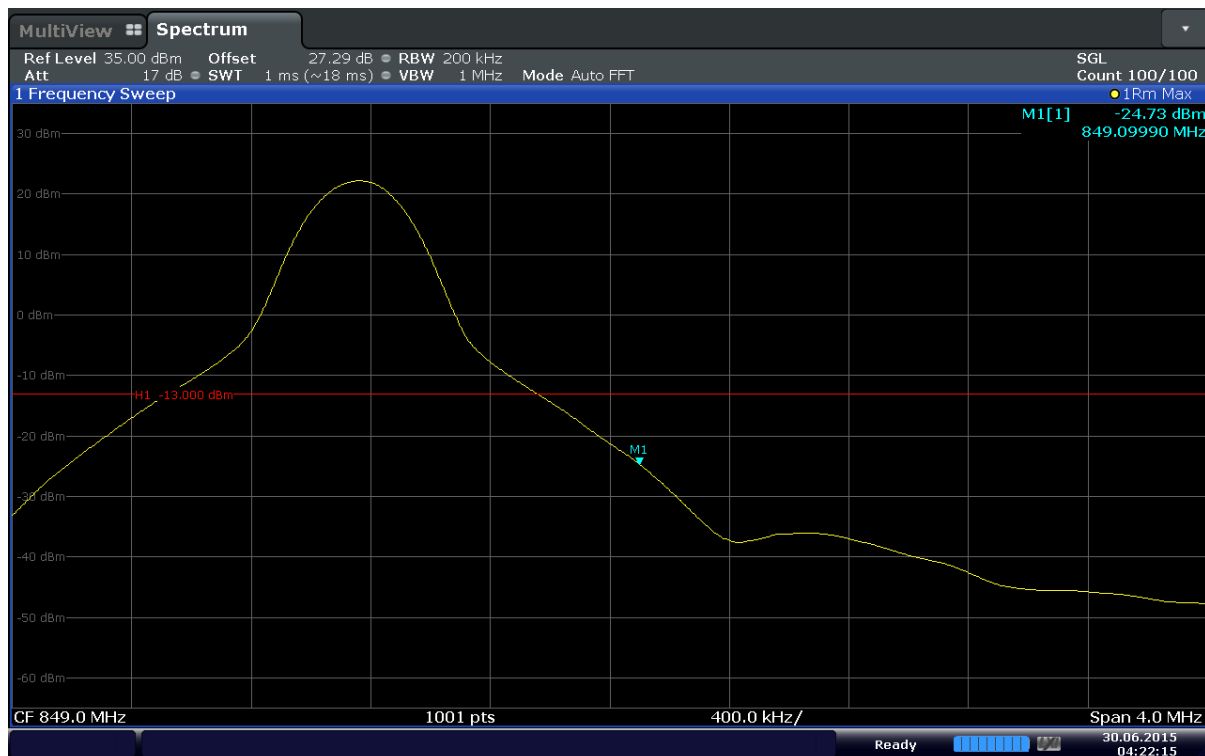
Date: 30.JUN.2015 04:21:10

Plot 6-150. Upper Band Edge Plot (Band26 – 15.0MHz – QPSK – RB Size 75)



Date: 12.JUL.2015 09:24:49

Plot 6-151. Lower Band Edge Plot (Band26 – 15.0MHz – QPSK – RB Size 1 – RB Offset 0)



Date: 30.JUN.2015 04:22:16

Plot 6-152. Upper Band Edge Plot (Band26 – 15.0MHz – QPSK – RB Size 1 – RB Offset 74)

6.5. Peak-Average Ratio §24.232(d)

Test Overview

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

Test Procedure Used

KDB 971168 v02r02 – Section 5.7.1

Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
4. The signal analyzer was set to collect 1 million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer was set to use an interval "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

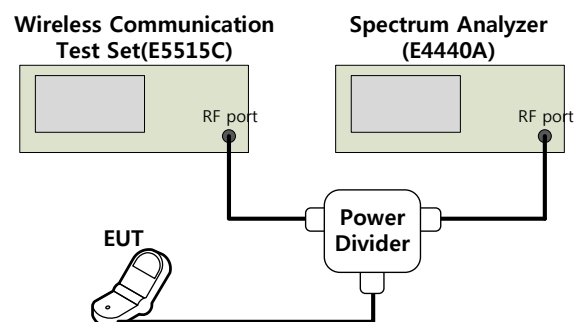


Figure 6-4. Test Instruments & Measurement Setup

Test Plots



Date: 12. JUL. 2015 08:43:49

Plot 6-153. Peak-Average Ratio Plot (Band 2 – 1.4MHz QPSK - RB Size 6)



Date: 12. JUL. 2015 08:43:56

Plot 6-154. Peak-Average Ratio Plot (Band 2 – 1.4MHz 16QAM - RB Size 6)



Date: 12 JUL 2015 08:45:14

Plot 6-155. Peak-Average Ratio Plot (Band 2 – 3.0MHz QPSK - RB Size 15)



Date: 12 JUL 2015 08:45:20

Plot 6-156. Peak-Average Ratio Plot (Band 2 – 3.0MHz 16QAM - RB Size 15)



Date: 12. JUL. 2015 08:46:36

Plot 6-157. Peak-Average Ratio Plot (Band 2 – 5.0MHz QPSK - RB Size 25)



Date: 12. JUL. 2015 08:46:42

Plot 6-158. Peak-Average Ratio Plot (Band 2 – 5.0MHz 16QAM - RB Size 25)



Date: 12 JUL 2015 08:47:58

Plot 6-159. Peak-Average Ratio Plot (Band 2 – 10.0MHz QPSK - RB Size 50)



Date: 12 JUL 2015 08:48:04

Plot 6-160. Peak-Average Ratio Plot (Band 2 – 10.0MHz 16QAM - RB Size 50)



Date: 12. JUL. 2015 08:49:20

Plot 6-161. Peak-Average Ratio Plot (Band 2 – 15.0MHz QPSK - RB Size 75)



Date: 12. JUL. 2015 08:49:26

Plot 6-162. Peak-Average Ratio Plot (Band 2 – 15.0MHz 16QAM - RB Size 75)



Date: 12. JUL. 2015 08:50:41

Plot 6-163. Peak-Average Ratio Plot (Band 2 – 20.0MHz QPSK - RB Size 100)



Date: 12. JUL. 2015 08:50:47

Plot 6-164. Peak-Average Ratio Plot (Band 2 – 20.0MHz 16QAM - RB Size 100)

6.6. Frequency Stability / Temperature Variation

§2.1055 §22.355 §24.235

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-C-2004. The frequency stability of the transmitter is measured by:

1. Temperature: The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
2. Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the nominal value for other than hand carried battery equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point(=Batt.End) which shall be specified by the manufacturer.

For part 22, the frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency. For part 24, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure Used

ANSI/TIA-603-C-2004

Test Settings

1. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
2. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of time sufficient to stabilize EUT at each temperature level shall be allowed prior to frequency measurement.

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

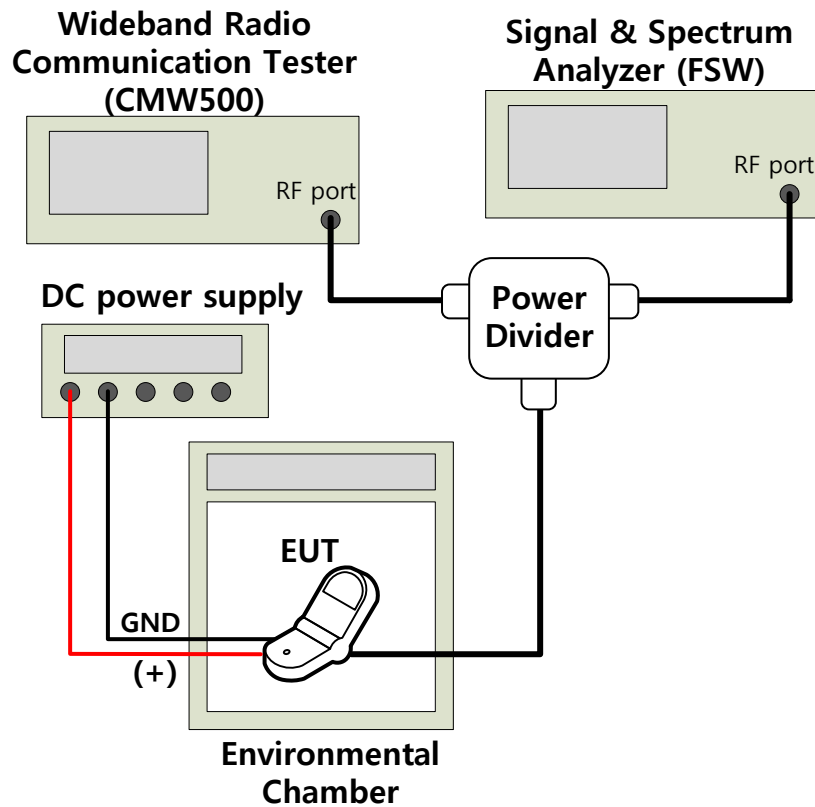


Figure 6-5. Test Instruments & Measurement Setup

Test Notes

1. MCF is the Measured Carrier Frequency
ACF is the Assigned Carrier Frequency
2. Calculate the ppm frequency error by the following:

$$\text{ppm error} = \left(\frac{\text{MCF}_{[\text{MHz}]} - \text{ACF}_{[\text{MHz}]}}{\text{ACF}_{[\text{MHz}]}} \right) \times 10^6$$

3. For part 24, the fundamental emission should stay within the authorized frequency block. But, based on the results of the frequency stability test at the center channel, the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

Mode : LTE Band 2
Channel : 18900
Operating Frequency : 1880 MHz
Reference Voltage : 3.85 VDC

Voltage [%]	Power [VDC]	Temp [°C]	ACF [MHz]	MCF [MHz]	Freq. Dev. [Hz]	ppm error
100 %	3.85	-30	1880.0	1,879.999995	-5.48	-0.003
		-20	1880.0	1,880.000005	5.04	0.003
		-10	1880.0	1,880.000007	6.51	0.003
		0	1880.0	1,880.000004	4.18	0.002
		+10	1880.0	1,880.000007	7.28	0.004
		+20	1880.0	1,880.000004	4.49	0.002
		+30	1880.0	1,880.000007	6.97	0.004
		+40	1880.0	1,879.999997	-3.35	-0.002
		+50	1880.0	1,880.000005	4.55	0.002
Batt.End	3.40	+20	1880.0	1,880.000006	5.95	0.003

Table 6-2. Frequency Stability Data (LTE Band 2)

Mode : LTE Band 26
Channel : 26797
Operating Frequency : 824.7 MHz
Reference Voltage : 3.85 VDC

Voltage [%]	Power [VDC]	Temp [°C]	ACF [MHz]	MCF [MHz]	Freq. Dev. [Hz]	ppm error	Limit [ppm]
100 %	3.85	-30	824.7	824.699996	-4.22	-0.005	±2.5
		-20	824.7	824.699996	-3.85	-0.005	
		-10	824.7	824.699994	-6.21	-0.008	
		0	824.7	824.699999	-1.42	-0.002	
		+10	824.7	824.700001	0.65	0.001	
		+20	824.7	824.700001	1.25	0.002	
		+30	824.7	824.700000	0.41	0.000	
		+40	824.7	824.700002	1.77	0.002	
		+50	824.7	824.699997	-2.53	-0.003	
Batt.End	3.40	+20	824.7	824.700001	1.07	0.001	

Table 6-3. Frequency Stability Data (LTE Band 26)



6.7. Radiated Power (ERP/EIRP)
§24.232(c) §22.913(a.2)

Test Overview

Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-C-2004 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using dipole antennas. Measurements on signals operating above 1GHz are performed using broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedure Used

KDB 971168 v02r02 – Section 5.2.1

ANSI/TIA-603-C-2004 – Section 2.2.17

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW $\geq 3 \times$ RBW
4. Span = 1.5 times the OBW
5. No. of sweep points $\geq 2 \times$ span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto"
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

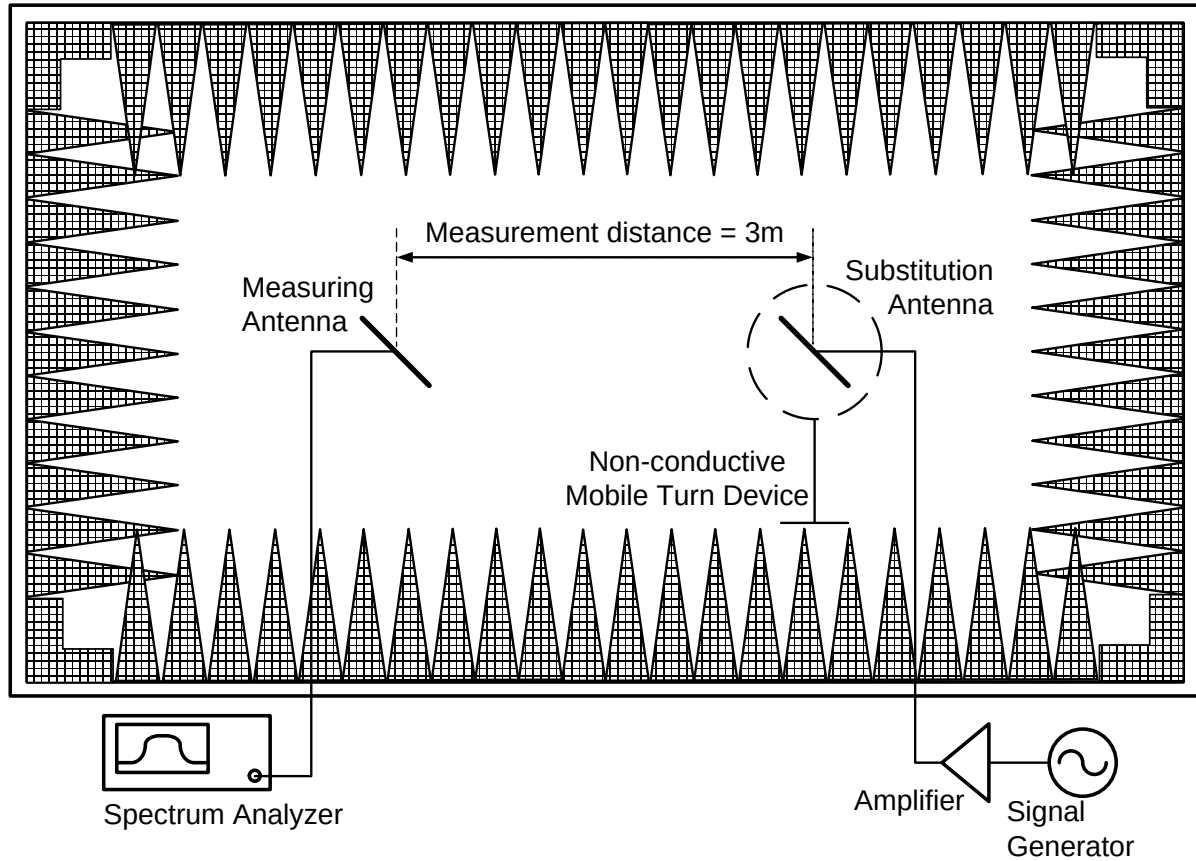


Figure 6-7. Test Instruments & Measurement Setup

Test Notes

1. The EUT was tested with Turn Device and the worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
2. This unit was tested with its embedded battery.



Test Results

Channel	Channel BW [MHz]	Mod.	RB Size /Offset	Ant Pol (H/V)	EUT POL [degree]		S/A Reading [dBm]	S/G Level [dBm]	Tx C/L [dB]	Ant. Gain [dBi]	EIRP [dBm]	Margin [dB]
					Azimuth	Elevation						
18607	1.4	QPSK	1 / 2	V	136	102	-21.81	17.12	4.75	10.26	22.63	10.38
18607	1.4	16QAM	1 / 5	V	118	109	-23.28	15.65	4.75	10.26	21.16	11.85
18900	1.4	QPSK	1 / 5	V	129	98	-21.69	17.28	4.80	10.33	22.81	10.20
18900	1.4	16QAM	1 / 5	V	135	102	-22.66	16.31	4.80	10.33	21.84	11.17
19193	1.4	QPSK	1 / 0	V	135	95	-21.74	17.37	4.84	10.38	22.91	10.10
19193	1.4	16QAM	1 / 0	V	140	100	-22.77	16.34	4.84	10.38	21.88	11.13
18615	3	QPSK	1 / 14	V	144	105	-21.66	17.27	4.75	10.27	22.79	10.22
18615	3	16QAM	1 / 7	V	140	100	-22.82	16.11	4.75	10.27	21.63	11.38
18900	3	QPSK	1 / 14	V	140	98	-21.12	17.85	4.80	10.33	23.38	9.63
18900	3	16QAM	1 / 0	V	135	100	-21.98	16.99	4.80	10.33	22.52	10.49
19185	3	QPSK	1 / 0	V	142	100	-22.07	17.03	4.84	10.38	22.57	10.44
19185	3	16QAM	1 / 0	V	140	95	-22.98	16.12	4.84	10.38	21.66	11.35
18625	5	QPSK	1 / 24	V	140	105	-21.23	17.70	4.75	10.27	23.22	9.79
18625	5	16QAM	1 / 12	V	130	110	-21.97	16.96	4.75	10.27	22.48	10.53
18900	5	QPSK	1 / 12	V	135	100	-21.42	38.97	4.80	10.33	23.08	9.93
18900	5	16QAM	1 / 0	V	138	104	-21.79	38.97	4.80	10.33	22.71	10.30
19175	5	QPSK	1 / 12	V	260	100	-22.42	16.67	4.84	10.38	22.21	10.80
19175	5	16QAM	1 / 24	V	269	87	-23.05	16.04	4.84	10.38	21.58	11.43
18675	10	QPSK	1 / 24	V	263	78	-21.53	17.41	4.76	10.27	22.92	10.09
18675	10	16QAM	1 / 49	V	265	82	-22.41	16.53	4.76	10.27	22.04	10.97
18900	10	QPSK	1 / 0	V	255	94	-21.33	17.64	4.80	10.33	23.17	9.84
18900	10	16QAM	1 / 24	V	260	80	-21.72	17.25	4.80	10.33	22.78	10.23
19150	10	QPSK	1 / 24	V	255	85	-21.55	17.51	4.84	10.37	23.05	9.96
19150	10	16QAM	1 / 24	V	260	90	-22.44	16.62	4.84	10.37	22.16	10.85
18675	15	QPSK	1 / 37	V	240	0	-22.48	16.46	4.76	10.28	21.98	11.03
18675	15	16QAM	1 / 37	V	240	0	-23.36	15.58	4.76	10.28	21.10	11.91
18900	15	QPSK	1 / 0	V	120	121	-21.94	17.03	4.80	10.33	22.56	10.45
18900	15	16QAM	1 / 37	V	125	115	-22.32	16.65	4.80	10.33	22.18	10.83
19125	15	QPSK	1 / 37	V	138	100	-21.60	17.43	4.83	10.37	22.97	10.04
19125	15	16QAM	1 / 74	V	141	106	-22.43	16.60	4.83	10.37	22.14	10.87
18700	20	QPSK	1 / 49	V	244	105	-22.00	16.94	4.77	10.28	22.46	10.55
18700	20	16QAM	1 / 49	V	240	100	-22.70	16.24	4.77	10.28	21.76	11.25
18900	20	QPSK	1 / 49	V	240	100	-21.66	38.97	4.80	10.33	22.84	10.17
18900	20	16QAM	1 / 49	V	238	110	-21.87	38.97	4.80	10.33	22.63	10.38
19100	20	QPSK	1 / 49	V	258	78	-21.64	17.36	4.83	10.37	22.90	10.12
19100	20	16QAM	1 / 49	V	250	82	-21.77	17.23	4.83	10.37	22.77	10.25

Table 6-4. EIRP Data (LTE Band 2)

Channel	Channel BW [MHz]	Mod.	RB Size /Offset	Ant Pol (H/V)	EUT POL [degree]		S/A Reading [dBm]	S/G Level [dBm]	Tx C/L [dB]	Ant. Gain [dBd]	ERP [dBm]	Margin [dB]
					Azimuth	Elevation						
26797	1.4	QPSK	1 / 2	H	283	360	-16.07	22.00	3.10	-0.75	18.15	20.30
26797	1.4	16QAM	1 / 5	H	290	0	-16.46	21.61	3.10	-0.75	17.76	20.69
26915	1.4	QPSK	1 / 2	H	285	360	-16.48	21.63	3.12	-0.77	17.73	20.72
26915	1.4	16QAM	1 / 5	H	290	0	-16.88	21.23	3.12	-0.77	17.33	21.12
27033	1.4	QPSK	1 / 0	H	291	360	-16.75	21.40	3.15	-0.80	17.45	21.00
27033	1.4	16QAM	1 / 0	H	284	0	-17.04	21.11	3.15	-0.80	17.16	21.29
26805	3	QPSK	1 / 0	H	290	0	-16.34	21.73	3.10	-0.75	17.88	20.57
26805	3	16QAM	1 / 7	H	294	360	-17.19	20.88	3.10	-0.75	17.03	21.42
26915	3	QPSK	1 / 7	H	298	360	-16.26	21.85	3.12	-0.77	17.95	20.50
26915	3	16QAM	1 / 0	H	288	346	-16.78	21.33	3.12	-0.77	17.43	21.02
27025	3	QPSK	1 / 0	H	290	336	-16.23	21.92	3.15	-0.80	17.97	20.48
27025	3	16QAM	1 / 0	H	290	360	-16.82	21.33	3.15	-0.80	17.38	21.07
26815	5	QPSK	1 / 12	H	322	0	-16.96	21.12	3.10	-0.75	17.26	21.19
26815	5	16QAM	1 / 0	H	315	360	-17.06	21.02	3.10	-0.75	17.16	21.29
26915	5	QPSK	1 / 0	H	315	0	-16.69	21.42	3.12	-0.77	17.52	20.93
26915	5	16QAM	1 / 12	H	320	350	-16.82	21.29	3.12	-0.77	17.39	21.06
27015	5	QPSK	1 / 0	H	290	360	-16.12	22.02	3.14	-0.80	18.08	20.37
27015	5	16QAM	1 / 0	H	295	0	-16.43	21.71	3.14	-0.80	17.77	20.68
26840	10	QPSK	1 / 0	H	288	360	-15.86	22.23	3.11	-0.76	18.36	20.09
26840	10	16QAM	1 / 24	H	290	10	-16.42	21.67	3.11	-0.76	17.80	20.65
26915	10	QPSK	1 / 0	H	300	355	-15.79	22.32	3.12	-0.77	18.42	20.03
26915	10	16QAM	1 / 0	H	300	360	-16.24	21.87	3.12	-0.77	17.97	20.48
26990	10	QPSK	1 / 0	H	290	0	-16.48	21.66	3.14	-0.79	17.73	20.73
26990	10	16QAM	1 / 0	H	298	355	-17.29	20.85	3.14	-0.79	16.92	21.54
26865	15	QPSK	1 / 0	H	290	0	-18.18	19.91	3.11	-0.76	16.04	22.41
26865	15	16QAM	1 / 0	H	300	360	-18.29	19.80	3.11	-0.76	15.93	22.52
26915	15	QPSK	1 / 0	H	293	360	-18.23	19.88	3.12	-0.77	15.98	22.47
26915	15	16QAM	1 / 0	H	281	350	-18.43	19.68	3.12	-0.77	15.78	22.67
26965	15	QPSK	1 / 0	H	304	355	-18.67	19.46	3.13	-0.79	15.54	22.91
26965	15	16QAM	1 / 0	H	297	360	-18.76	19.37	3.13	-0.79	15.45	23.00

Table 6-5. ERP Data (LTE Band 26)



6.8. Radiated Spurious Emissions Measurements

§2.1051 §22.917(a) §24.238(a)

Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-C-2004 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using dipole antennas. Measurements on signals operating above 1GHz are performed using broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedure Used

KDB 971168 v02r02 – Section 5.8

ANSI/TIA-603-C-2004 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW $\geq 3 \times$ RBW
3. Span = 1.5 times the OBW
4. No. of sweep points $\geq 2 \times$ span / RBW
5. Detector = Max Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

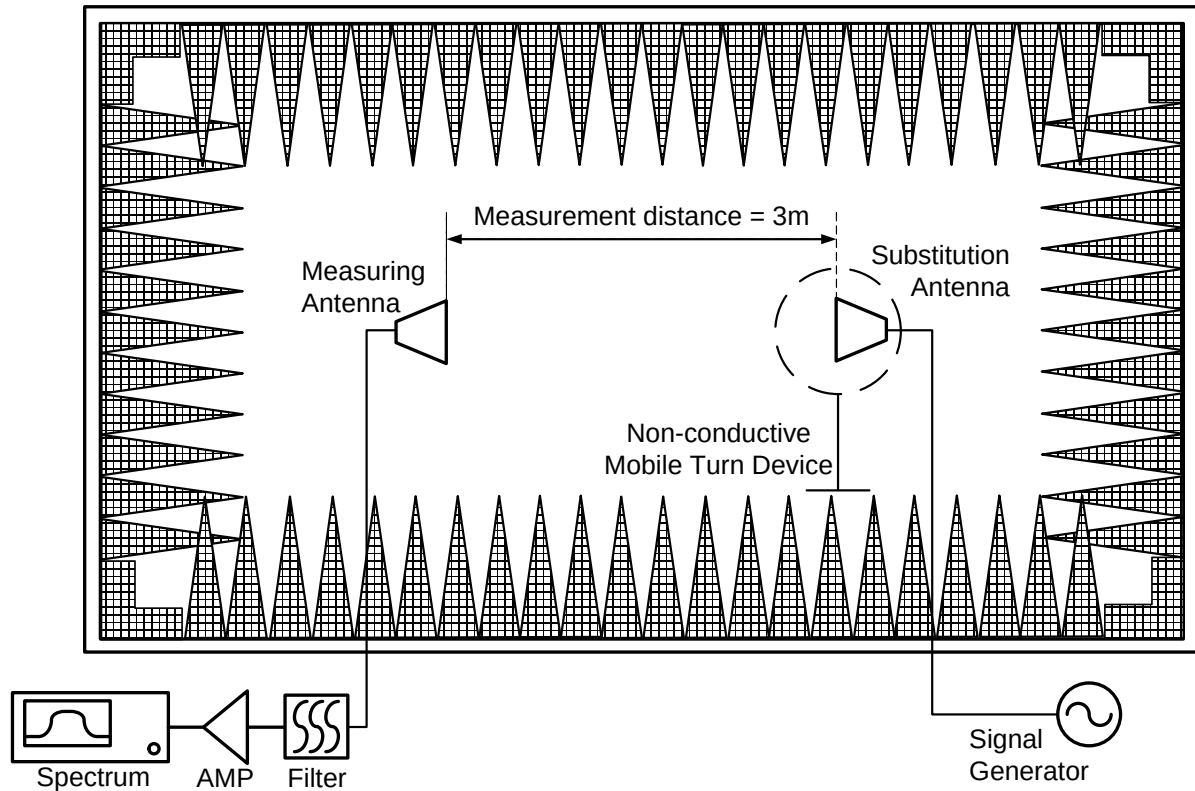


Figure 6-8. Test Instruments & Measurement Setup

Test Notes

1. The EUT was tested with Turn Device and the worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
2. This unit was tested with its embedded battery.
3. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

Test Results

Operating Frequency : 1852.5 MHz
 Channel : 18625
 Measured Output Power : 23.22 dBm = 0.210 Watt
 Modulation Signal : QPSK
 Band Width : 5 MHz
 RB Size / Offset : 1 / 24
 Distance : 3 Meters
 Limit : $43 + 10 \log_{10}(W)$ = 36.22 dBc
 RSE Limit : -13 dBm

Freq. [MHz]	Ant Pol (H/V)	EUT Pol [degree]		S/A reading [dBm]	S/G Level [dBm]	Tx C/L [dB]	Ant. Gain [dBi]	RSE Level [dBm]
		Azimuth	Elevation					
3705.3	H	140	0	-71.48	-59.85	6.93	12.46	-54.31
5558.0	V	250	238	-70.72	-51.85	8.53	12.94	-47.45
7410.6	V	250	52	-70.24	-43.35	9.96	10.34	-42.96
9263.3	H	140	0	-76.80	-45.34	11.35	11.12	-45.57

Table 6-6. Radiated Spurious Data (LTE Band 2 – Low Channel)

Operating Frequency : 1880.0 MHz
 Channel : 18900
 Measured Output Power : 23.38 dBm = 0.218 Watt
 Modulation Signal : QPSK
 Band Width : 3 MHz
 RB Size / Offset : 1 / 14
 Distance : 3 Meters
 Limit : $43 + 10 \log_{10}(W)$ = 36.38 dBc
 RSE Limit : -13 dBm

Freq. [MHz]	Ant Pol (H/V)	EUT Pol [degree]		S/A reading [dBm]	S/G Level [dBm]	Tx C/L [dB]	Ant. Gain [dBi]	RSE Level [dBm]
		Azimuth	Elevation					
3760.4	H	100	360	-73.86	-61.81	6.93	12.44	-56.30
5640.6	V	90	140	-76.32	-57.04	8.61	13.14	-52.51
7520.8	H	130	30	-76.85	-49.18	10.02	10.67	-48.53
9401.0	H	100	360	-77.10	-45.58	11.43	11.09	-45.92

Table 6-7. Radiated Spurious Data (LTE Band 2 – Mid Channel)

Operating Frequency : 1905.0 MHz
 Channel : 19150
 Measured Output Power : 23.05 dBm = 0.202 Watt
 Modulation Signal : QPSK
 Band Width : 10 MHz
 RB Size / Offset : 1 / 24
 Distance : 3 Meters
 Limit : $43 + 10 \log_{10}(W)$ = 36.05 dBc
 RSE Limit : -13 dBm

Freq. [MHz]	Ant Pol (H/V)	EUT Pol [degree]		S/A reading [dBm]	S/G Level [dBm]	Tx C/L [dB]	Ant. Gain [dBi]	RSE Level [dBm]
		Azimuth	Elevation					
3810.0	V	360	0	-72.36	-60.67	6.97	12.36	-55.28
5715.0	V	245	285	-71.85	-52.18	8.68	13.13	-47.73
7620.0	V	245	217	-74.14	38.97	10.14	11.17	-45.63
9525.0	V	258	242	-75.33	38.97	11.56	11.78	-45.49
11430.0	V	360	0	-76.32	-44.99	12.57	11.49	-46.08

Table 6-8. Radiated Spurious Data (LTE Band 2 – High Channel)

Operating Frequency : 829.0 MHz
 Channel : 26840
 Measured Output Power : 18.36 dBm = 0.069 Watt
 Modulation Signal : QPSK
 Band Width : 10 MHz
 RB Size / Offset : 1 / 0
 Distance : 3 Meters
 Limit : $43 + 10 \log_{10}(W)$ = 31.36 dBc
 RSE Limit : -13 dBm

Freq. [MHz]	Ant Pol (H/V)	EUT Pol [degree]		S/A reading [dBm]	S/G Level [dBm]	Tx C/L [dB]	Ant. Gain [dBd]	RSE Level [dBm]
		Azimuth	Elevation					
1649.4	V	216	48	-69.28	-67.94	4.49	7.52	-64.92
2474.1	H	298	74	-59.02	-52.66	5.58	8.35	-49.89
3298.8	H	295	92	-68.72	-59.25	6.52	10.32	-55.45
4123.5	H	290	0	-77.24	-62.94	7.34	10.55	-59.74

Table 6-9. Radiated Spurious Data (LTE Band 26 – Low Channel)

Operating Frequency : 836.5 MHz
 Channel : 26915
 Measured Output Power : 18.42 dBm = 0.070 Watt
 Modulation Signal : QPSK
 Band Width : 10 MHz
 RB Size / Offset : 1 / 0
 Distance : 3 Meters
 Limit : $43 + 10 \log_{10}(W)$ = 31.42 dBc
 RSE Limit : -13 dBm

Freq. [MHz]	Ant Pol (H/V)	EUT Pol [degree]		S/A reading [dBm]	S/G Level [dBm]	Tx C/L [dB]	Ant. Gain [dBd]	RSE Level [dBm]
		Azimuth	Elevation					
1673.2	H	142	126	-69.31	-67.77	4.51	7.58	-64.70
2509.8	H	140	100	-67.27	-60.90	5.61	8.37	-58.15
3346.4	H	120	107	-66.45	-56.91	6.56	10.50	-52.97
4183.0	H	120	360	-76.35	-62.04	7.43	10.63	-58.84

Table 6-10. Radiated Spurious Data (LTE Band 26 – Mid Channel)

Operating Frequency : 846.5 MHz
 Channel : 27015
 Measured Output Power : 18.08 dBm = 0.064 Watt
 Modulation Signal : QPSK
 Band Width : 5 MHz
 RB Size / Offset : 1 / 0
 Distance : 3 Meters
 Limit : $43 + 10 \log_{10}(W)$ = 31.08 dBc
 RSE Limit : -13 dBm

Freq. [MHz]	Ant Pol (H/V)	EUT Pol [degree]		S/A reading [dBm]	S/G Level [dBm]	Tx C/L [dB]	Ant. Gain [dBd]	RSE Level [dBm]
		Azimuth	Elevation					
1697.3	V	242	90	-64.47	-63.19	4.54	7.67	-60.06
2546.0	H	0	277	-66.48	-60.18	5.64	8.38	-57.44
3394.6	H	315	40	-73.84	39.04	6.59	10.54	-60.21
4243.3	H	250	360	-76.48	39.04	7.50	10.74	-59.11

Table 6-11. Radiated Spurious Data (LTE Band 26 – High Channel)



7. CONCLUSION

The data collected relate only the item(s) tested and show that the Samsung Portable Handset FCC ID: A3LSMG928KOR compliance with all the requirements of Parts 2, 22 and 24 of the FCC rules.

– End of this report –