9 CONDUCTED SPURIOUS EMISSION FROM ANTENNA PORT

Date of test:	2017-12-7	Test location:	Wireless centre
EUT Serial:	999895	Ambient temp.	21˚C
Tested by:	MTV	Relative humidity	37 %
Test result:	Pass	Margin:	0.6 dB

9.1 Requirement

§24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, 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. 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 MHz or 1 percent of emission bandwidth, as specified). 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 dB below the transmitter power.

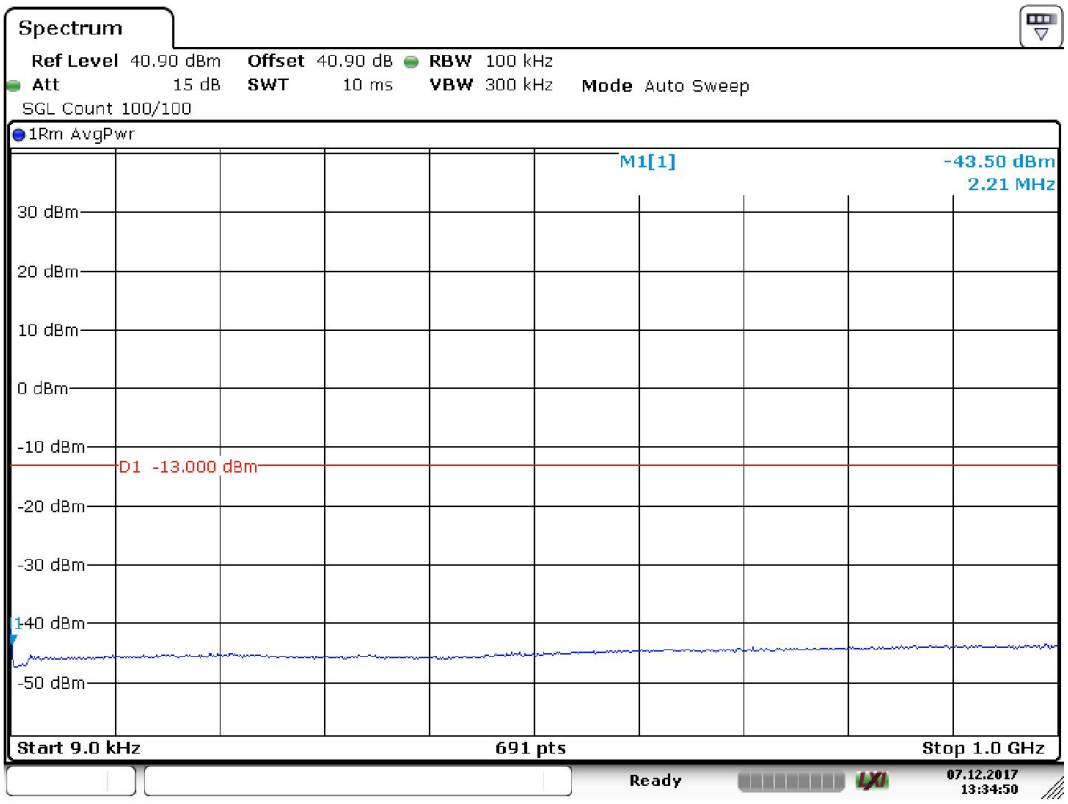
RSS-133 6.5

Equipment shall comply with the limits in (i) and (ii) below.
In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 $\log_{10}$p(watts).
After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 $\log_{10}$p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

9.2 Test set-up

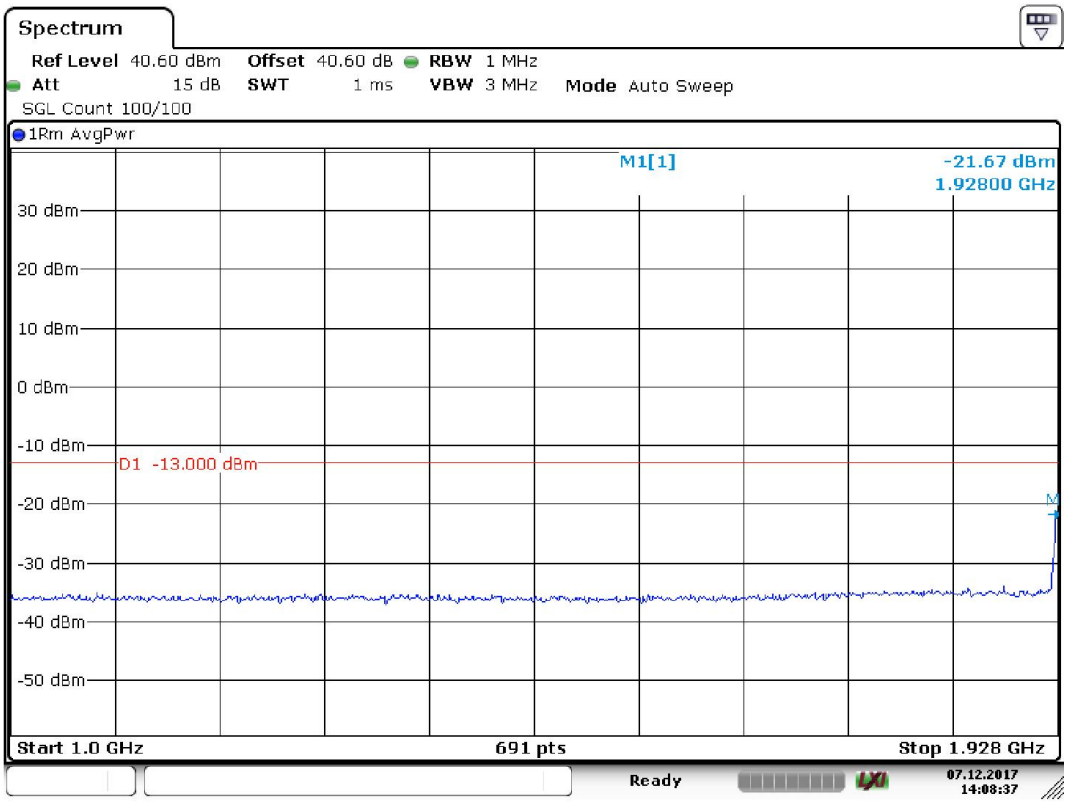
Signal generator was connected to the FOI unit which converted rf signal to optical signal. The optical signal was then fed via fibre to the EUT.
The EUT's output port was connected to spectrum analyser via rf cables and band reject or high pass filter.
A PC was connected to FOI via Ethernet hub. The PC was then used to control the EUT.

9.3 Test data



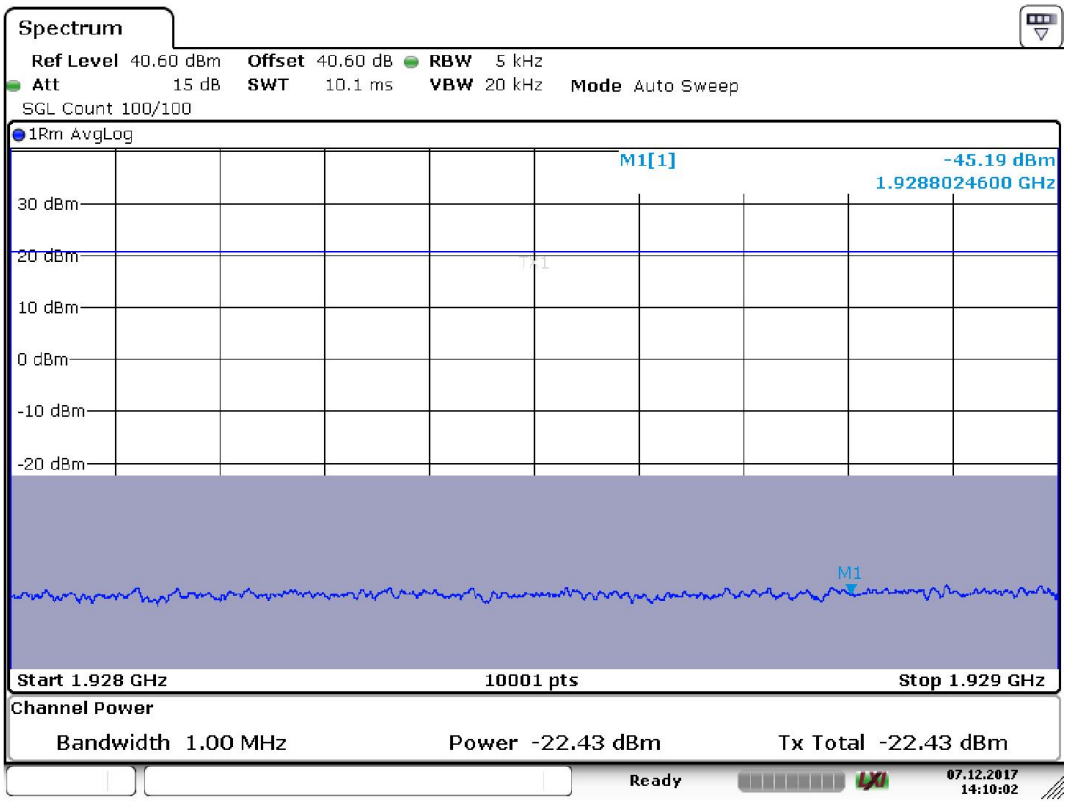
Date: 7.DEC.2017 13:34:50

GSM Low channel 9 kHz – 1 GHz



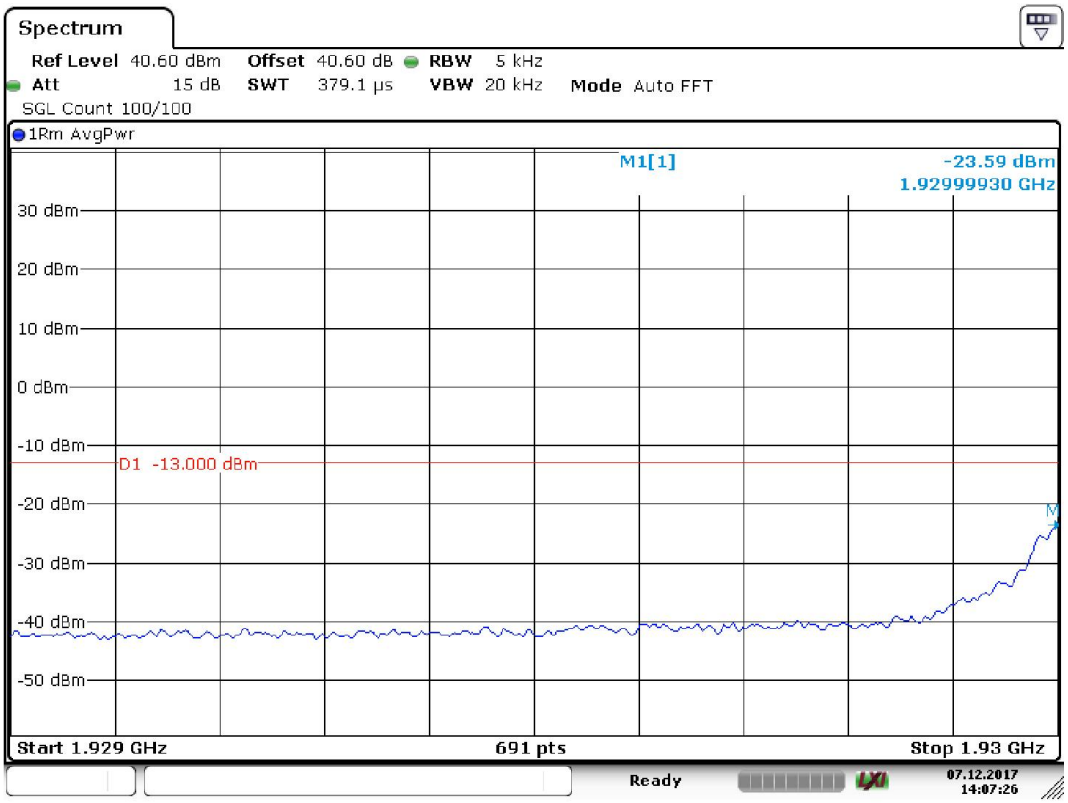
Date: 7.DEC.2017 14:08:37

GSM Low channel 1 GHz – 1928 MHz



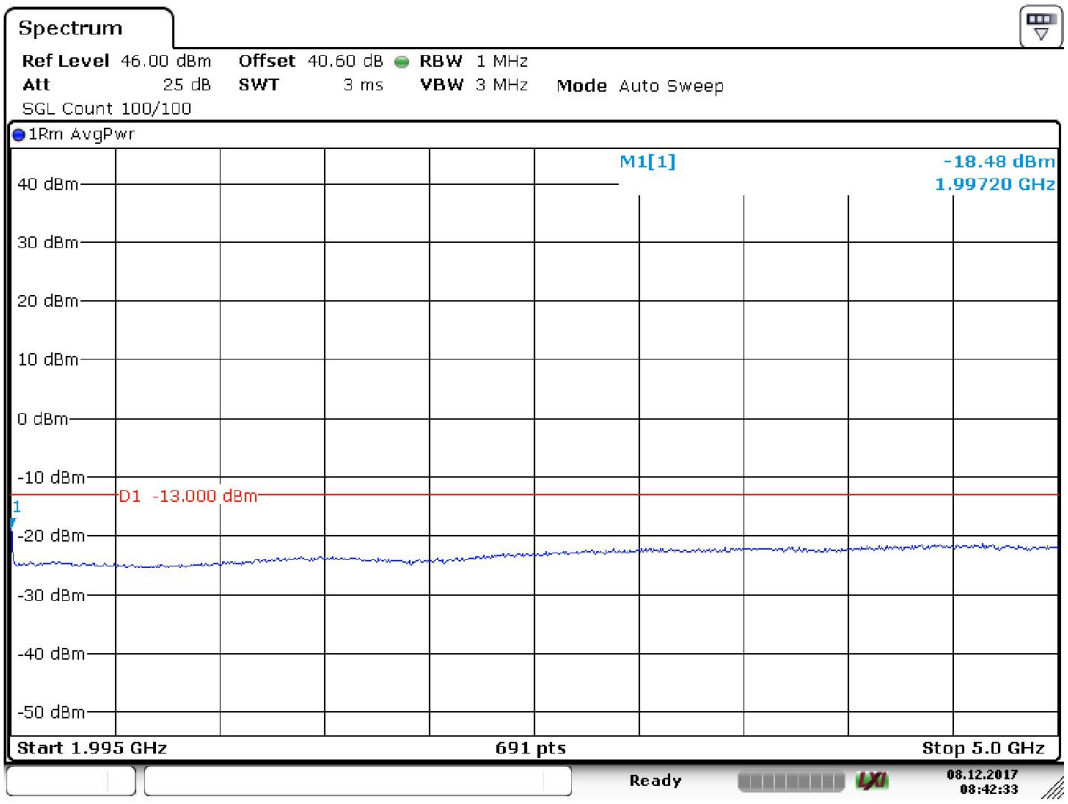
Date: 7.DEC.2017 14:10:02

GSM Low channel 1928 – 1929 MHz



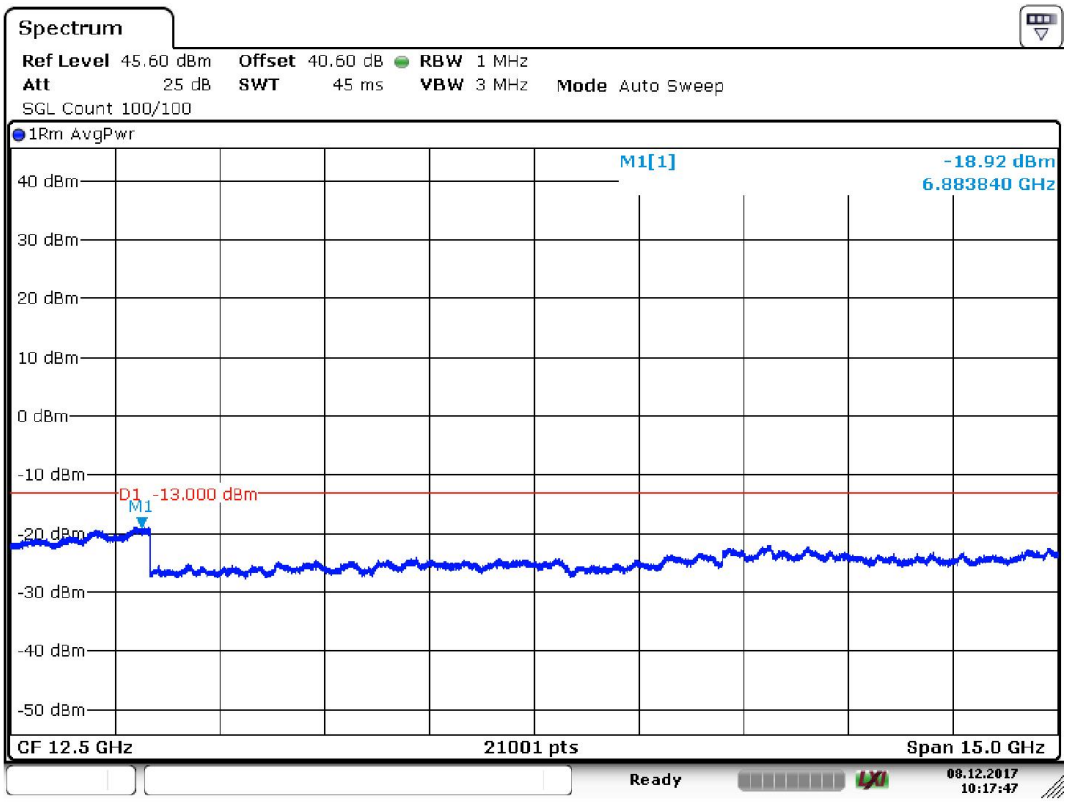
Date: 7.DEC.2017 14:07:26

GSM Low channel 1929 – 1930 MHz



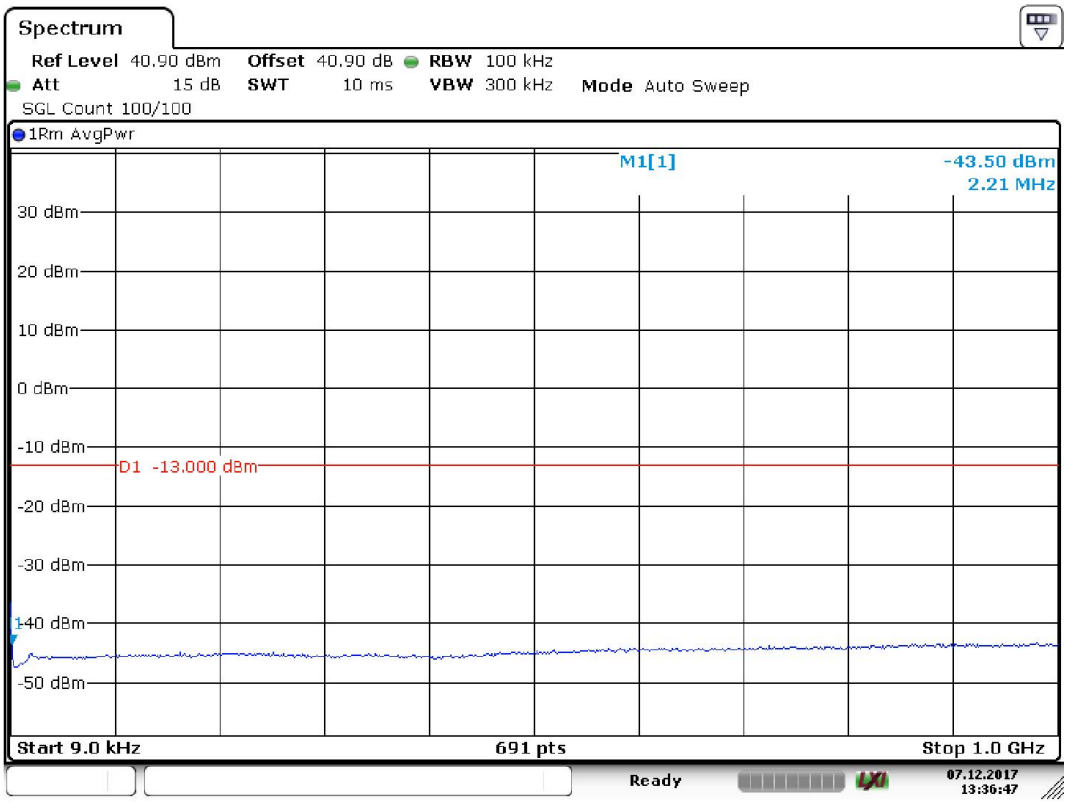
Date: 8.DEC.2017 08:42:33

GSM Low channel 1995 – 5000 MHz



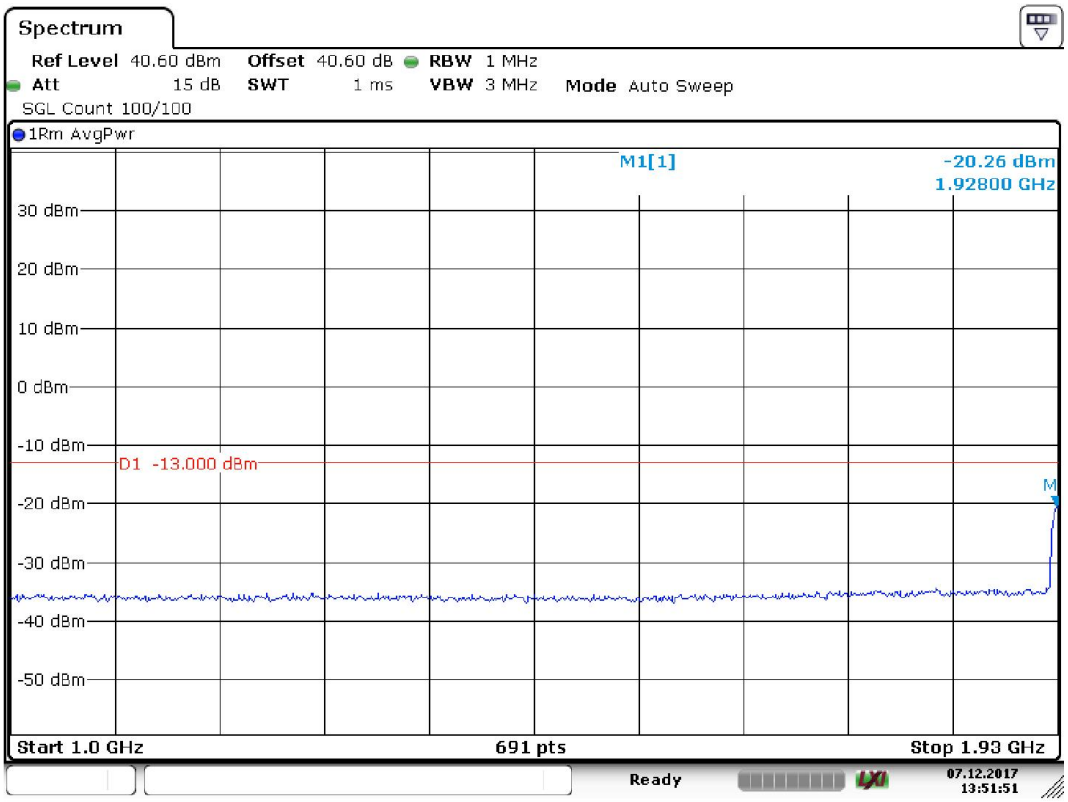
Date: 8.DEC.2017 10:17:47

GSM Low channel 5000 – 20000 MHz



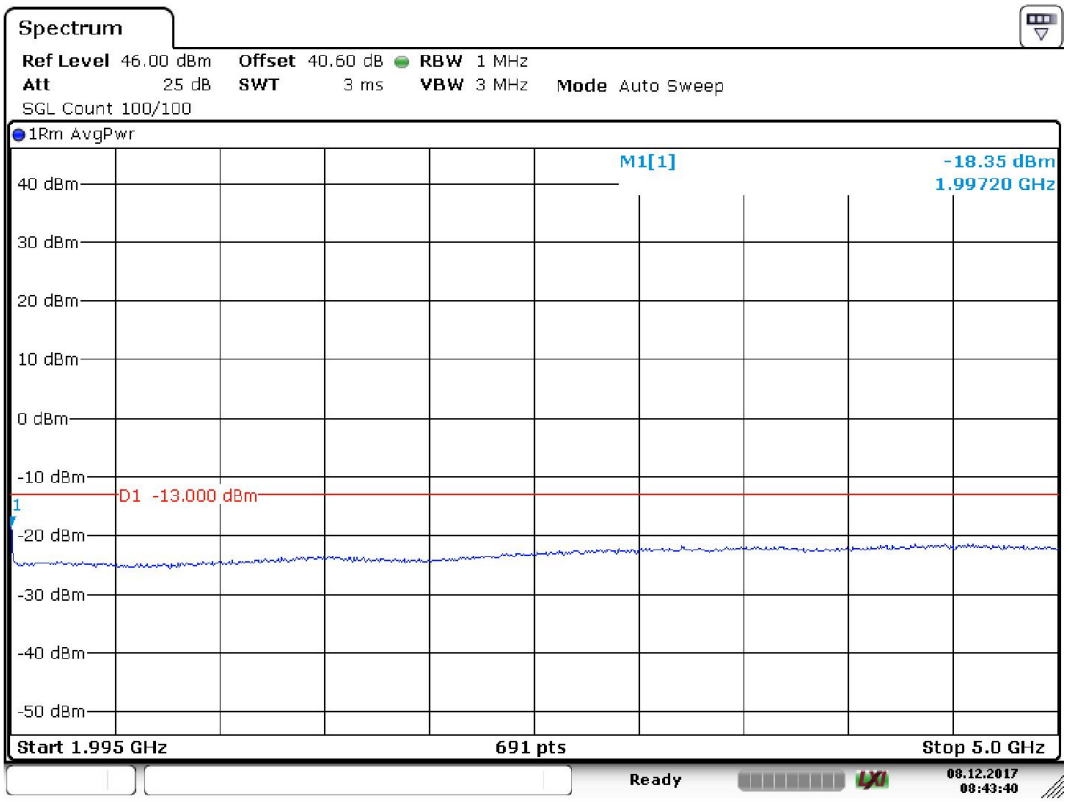
Date: 7.DEC.2017 13:36:47

GSM Middle channel 9 kHz – 1 GHz



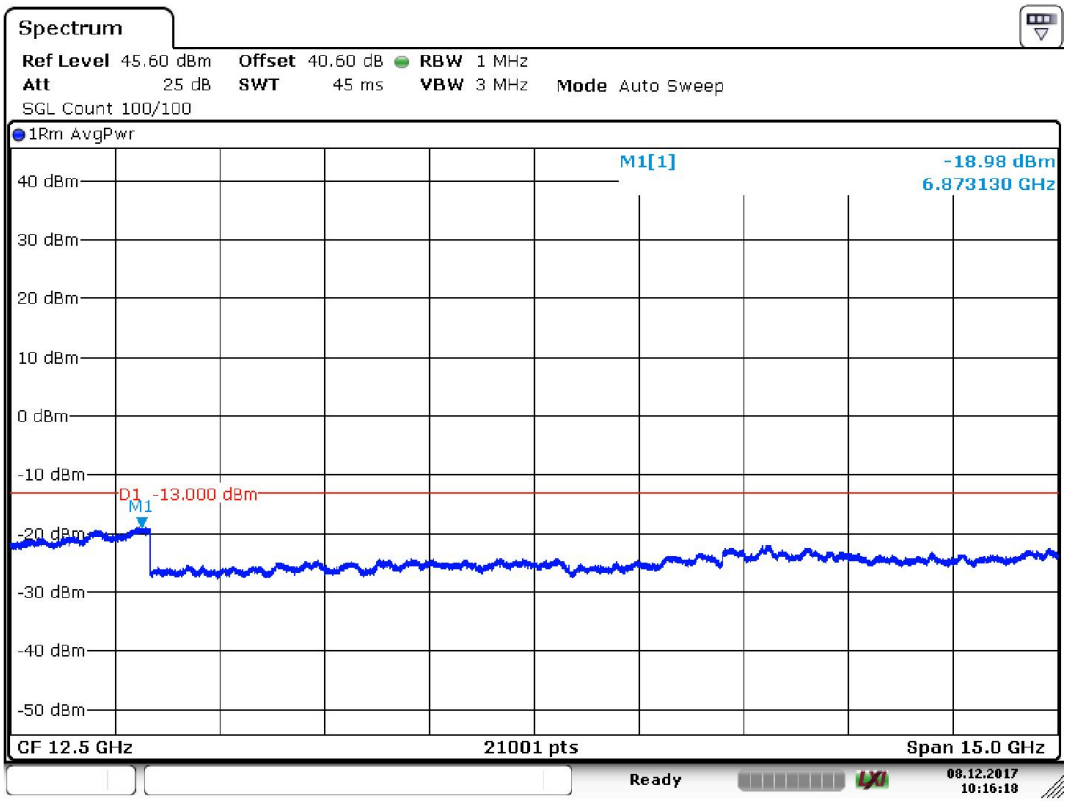
Date: 7.DEC.2017 13:51:51

GSM middle channel 1 GHz – 1930 MHz



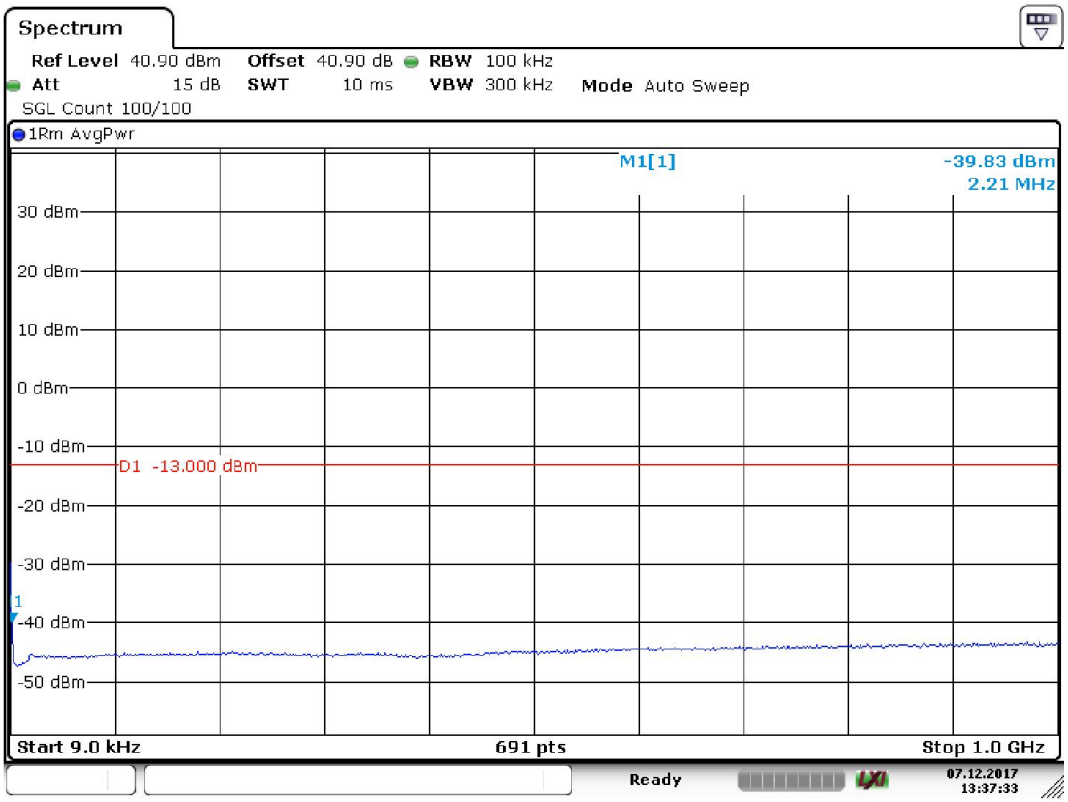
Date: 8.DEC.2017 08:43:40

GSM middle channel 1995 – 5000 MHz



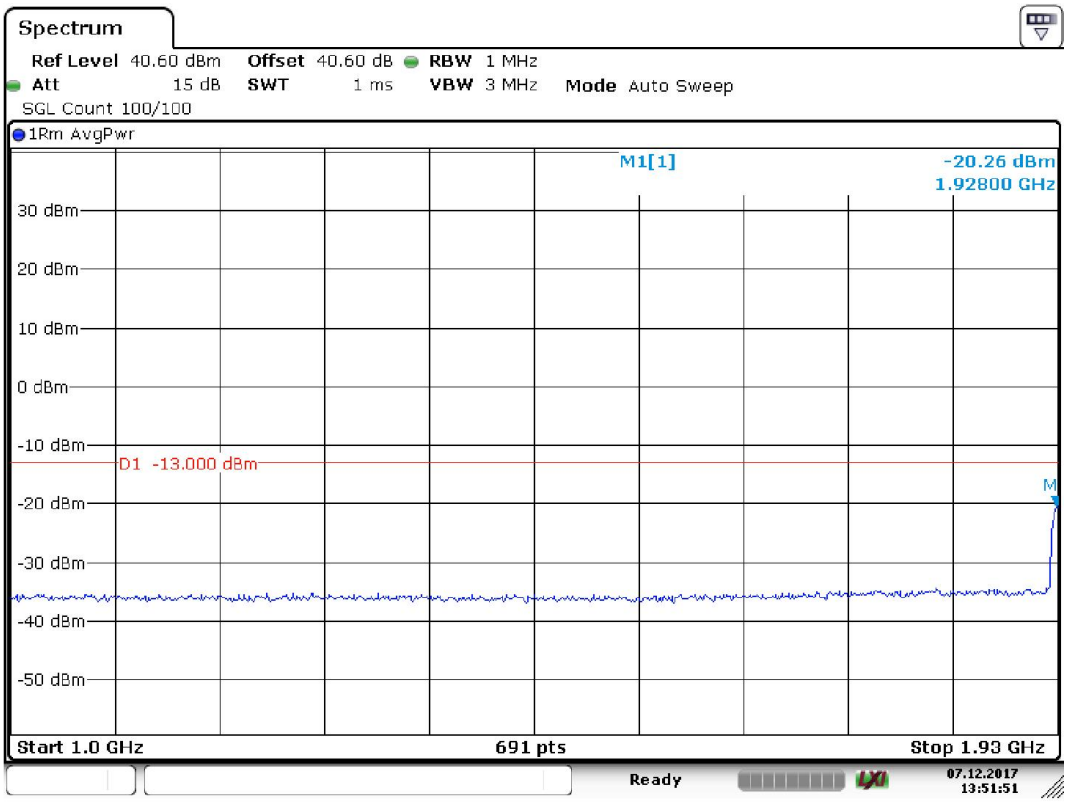
Date: 8.DEC.2017 10:16:18

GSM middle channel 5000 – 20000 MHz



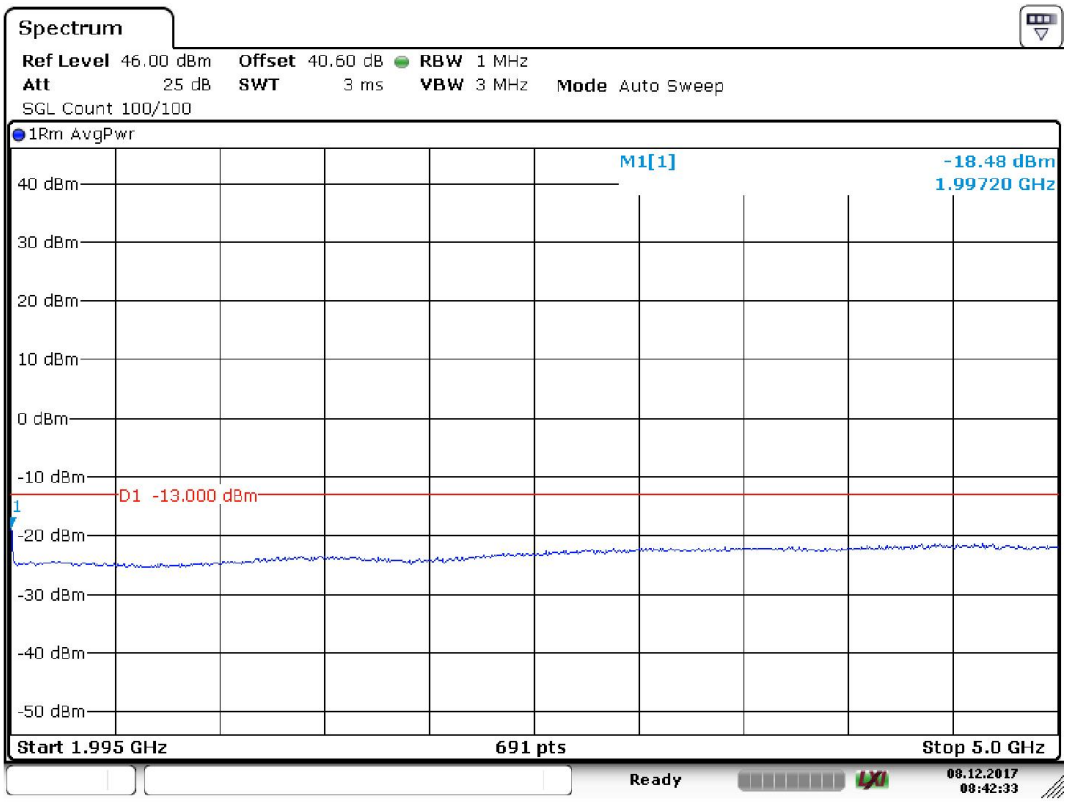
Date: 7.DEC.2017 13:37:33

GSM high channel 9 kHz – 1 GHz



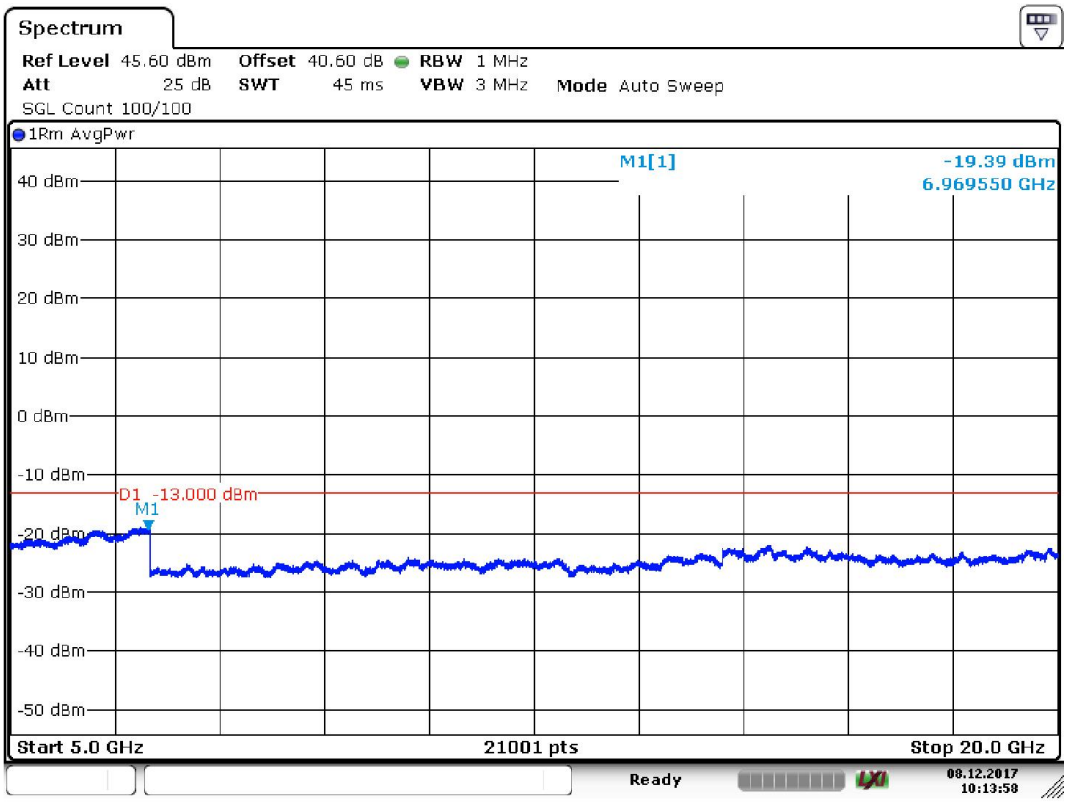
Date: 7.DEC.2017 13:51:51

GSM high channel 1000 – 1930 MHz



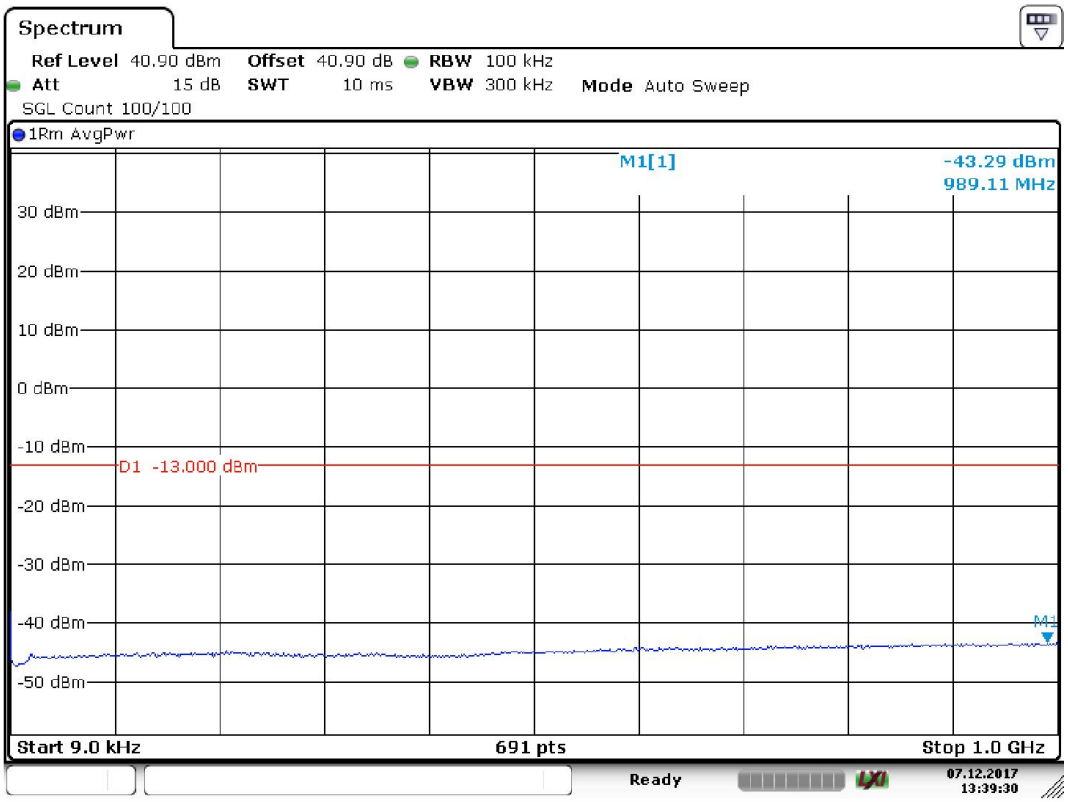
Date: 8.DEC.2017 08:42:33

GSM high channel 1995 – 5000 MHz



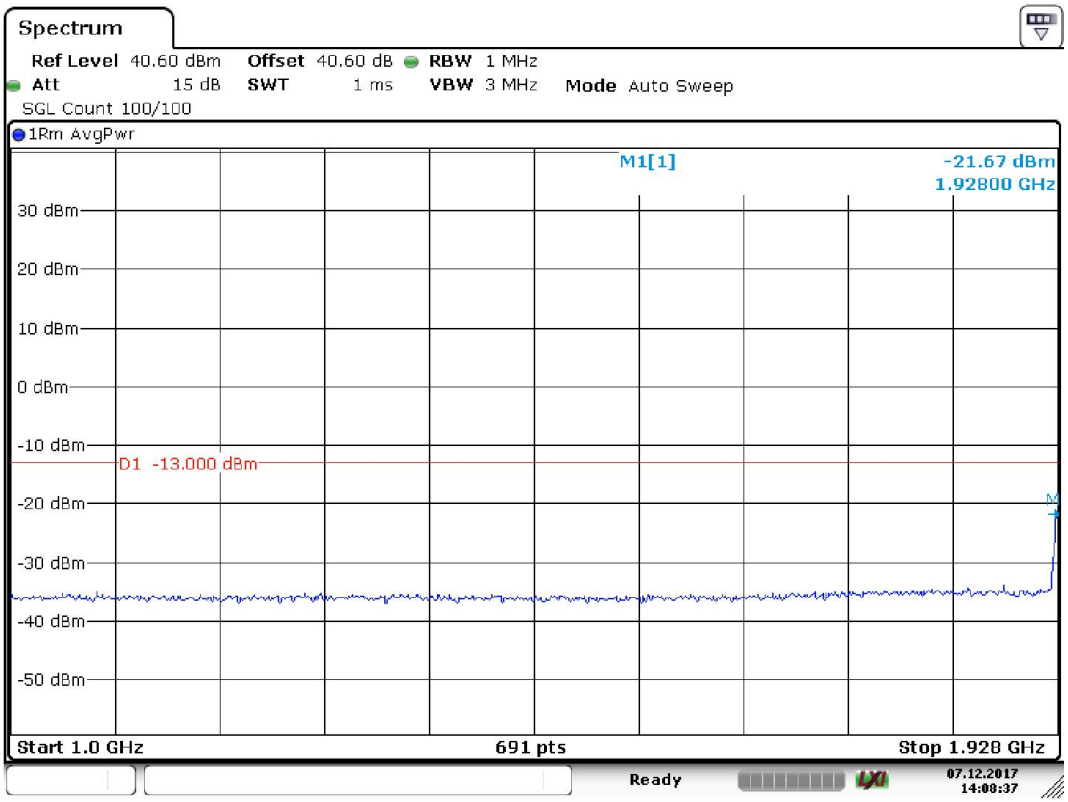
Date: 8.DEC.2017 10:13:58

GSM high channel 5 – 20 GHz



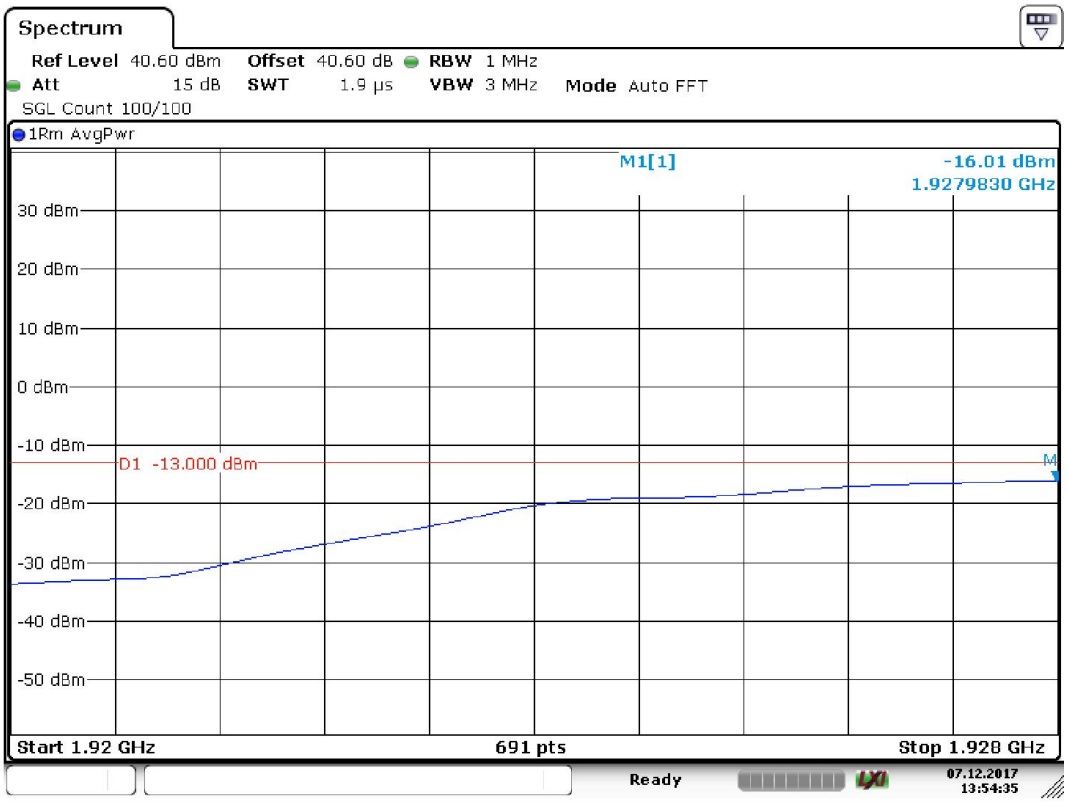
Date: 7.DEC.2017 13:39:30

WCDMA low channel 9 kHz – 1 GHz



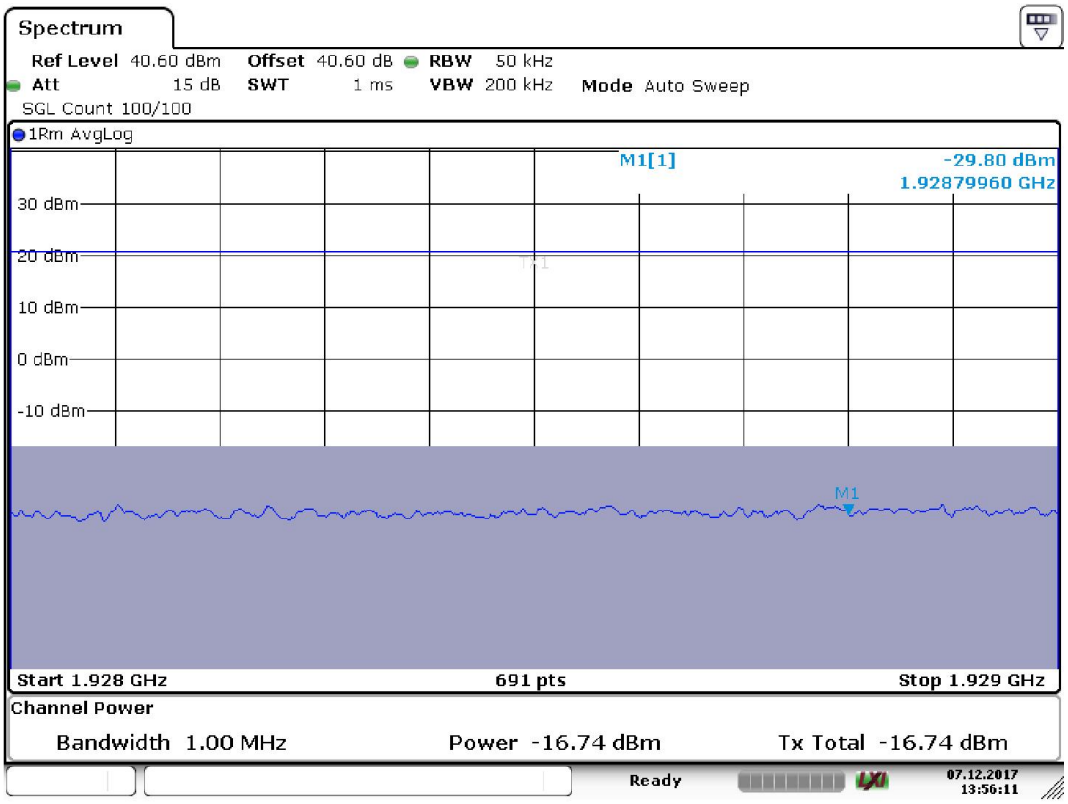
Date: 7.DEC.2017 14:08:37

WCDMA low channel 1000 – 1928 MHz



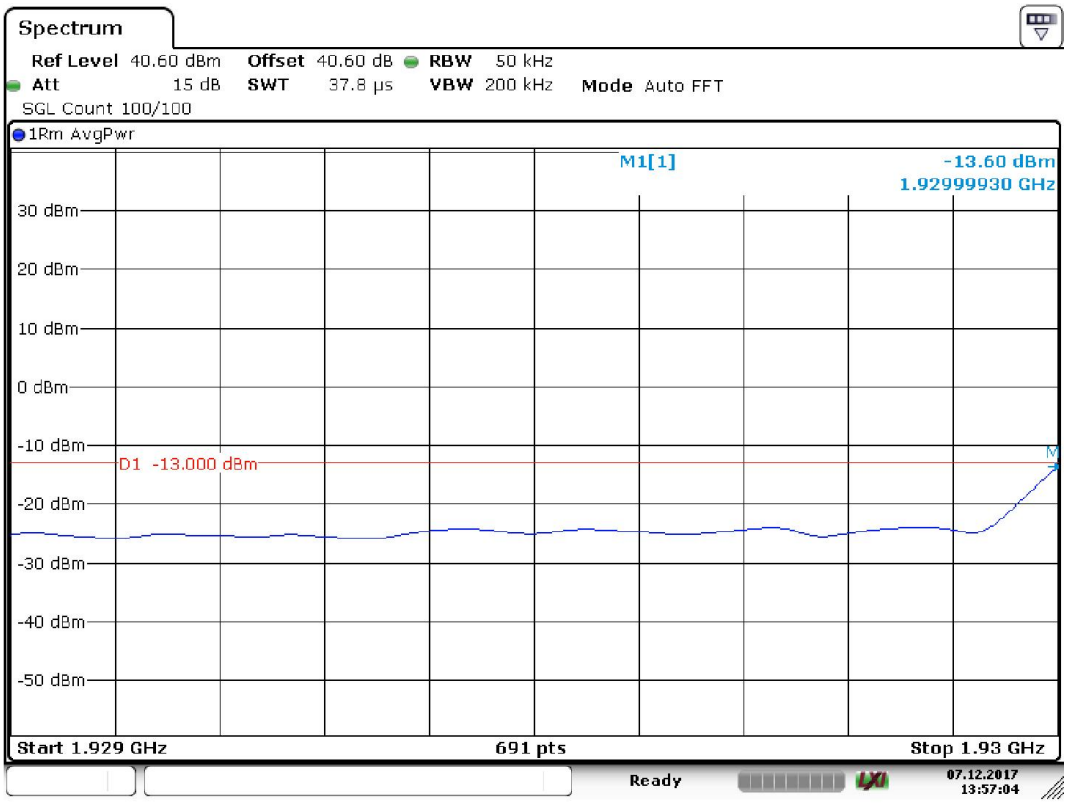
Date: 7.DEC.2017 13:54:35

WCDMA low channel 1920 – 1928 MHz



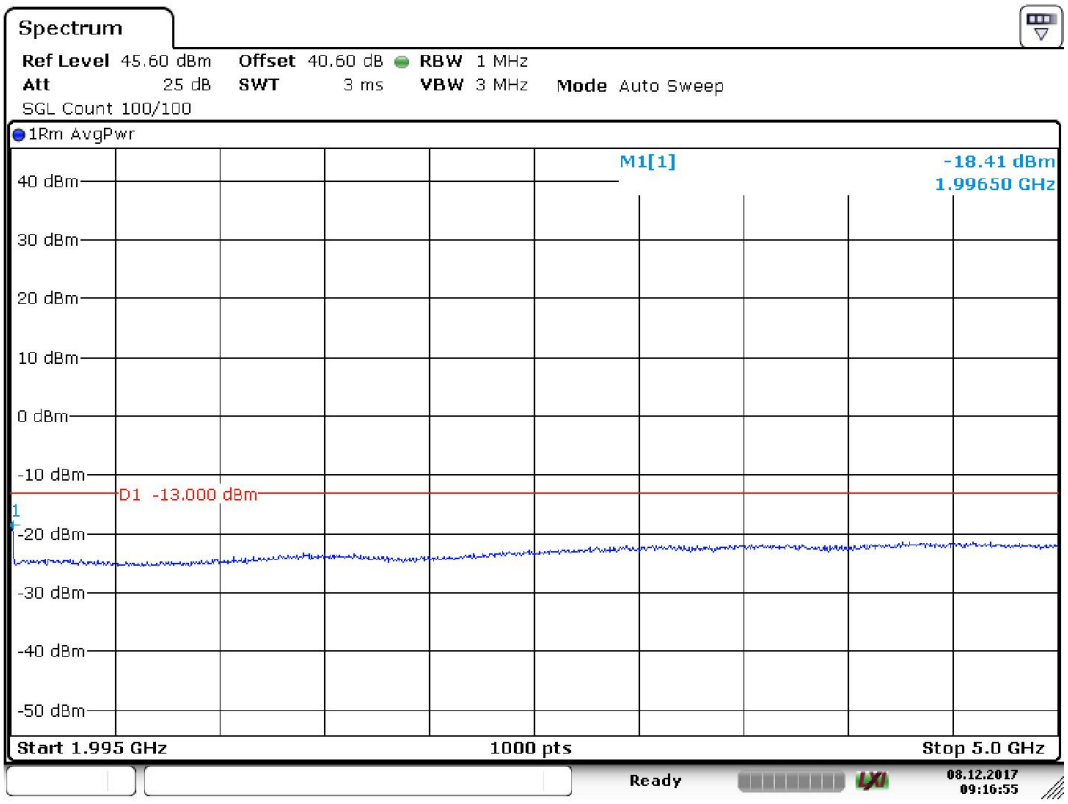
Date: 7.DEC.2017 13:56:12

WCDMA low channel 1928 – 1929 MHz



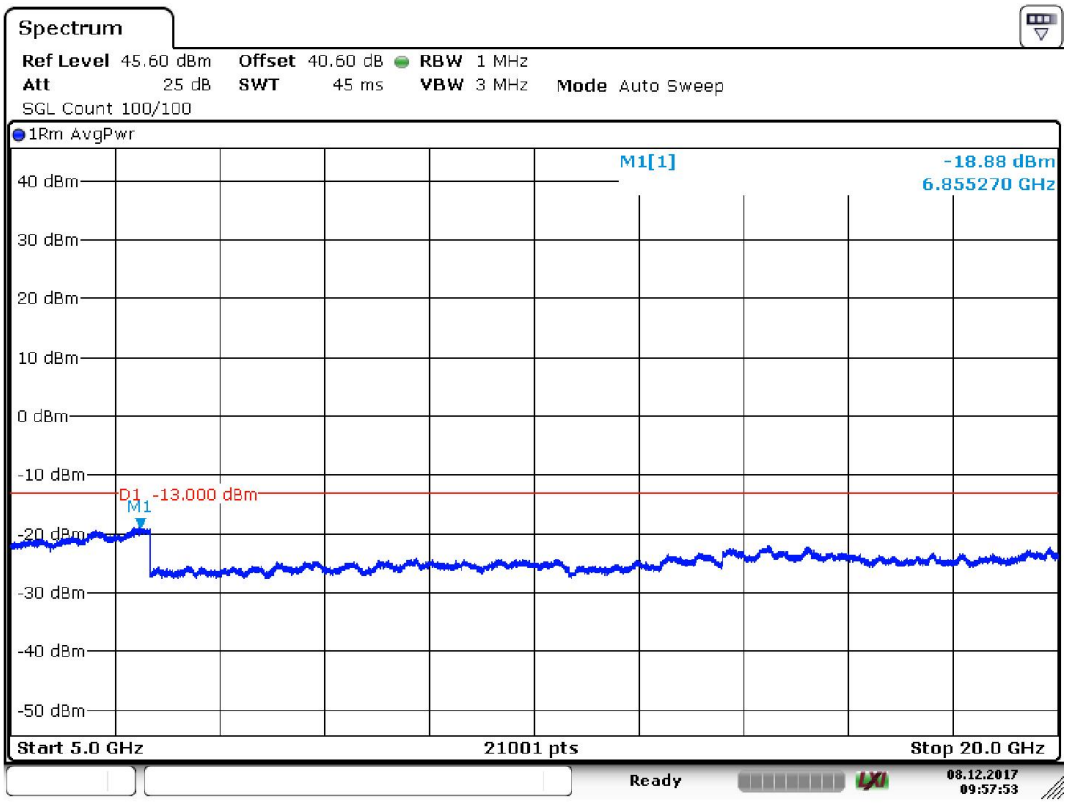
Date: 7.DEC.2017 13:57:04

WCDMA low channel 1929 – 1930 MHz



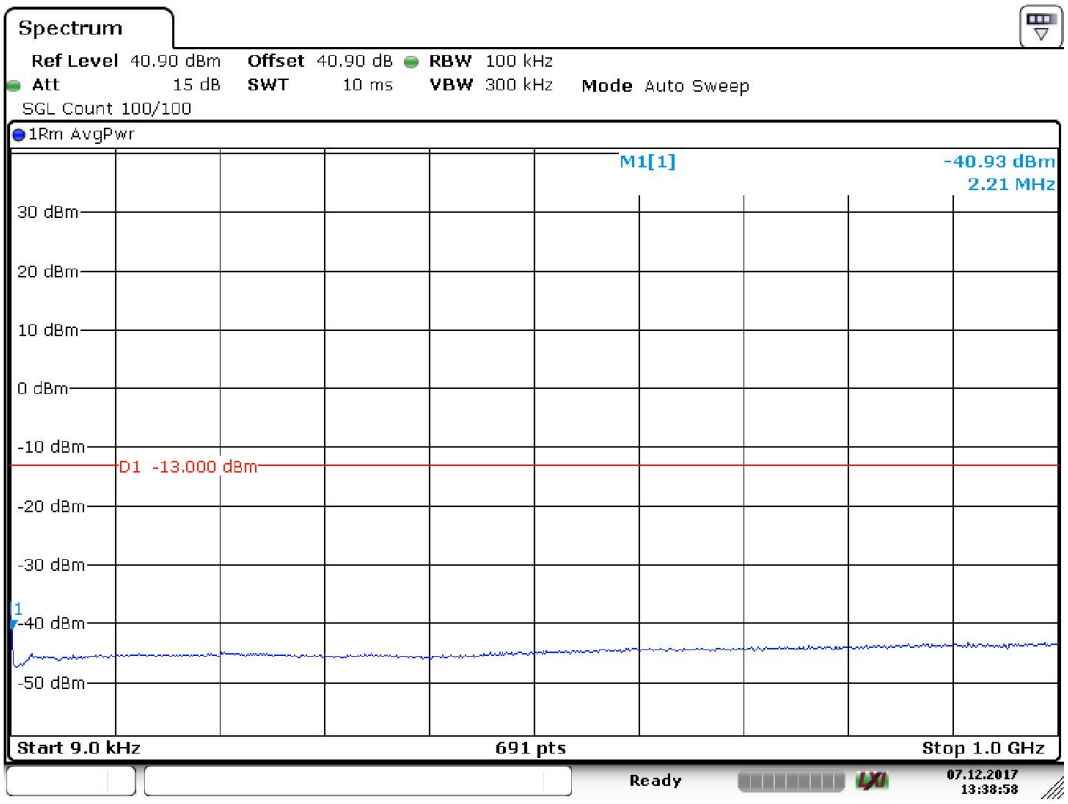
Date: 8.DEC.2017 09:16:55

WCDMA low channel 1995 – 5000 MHz



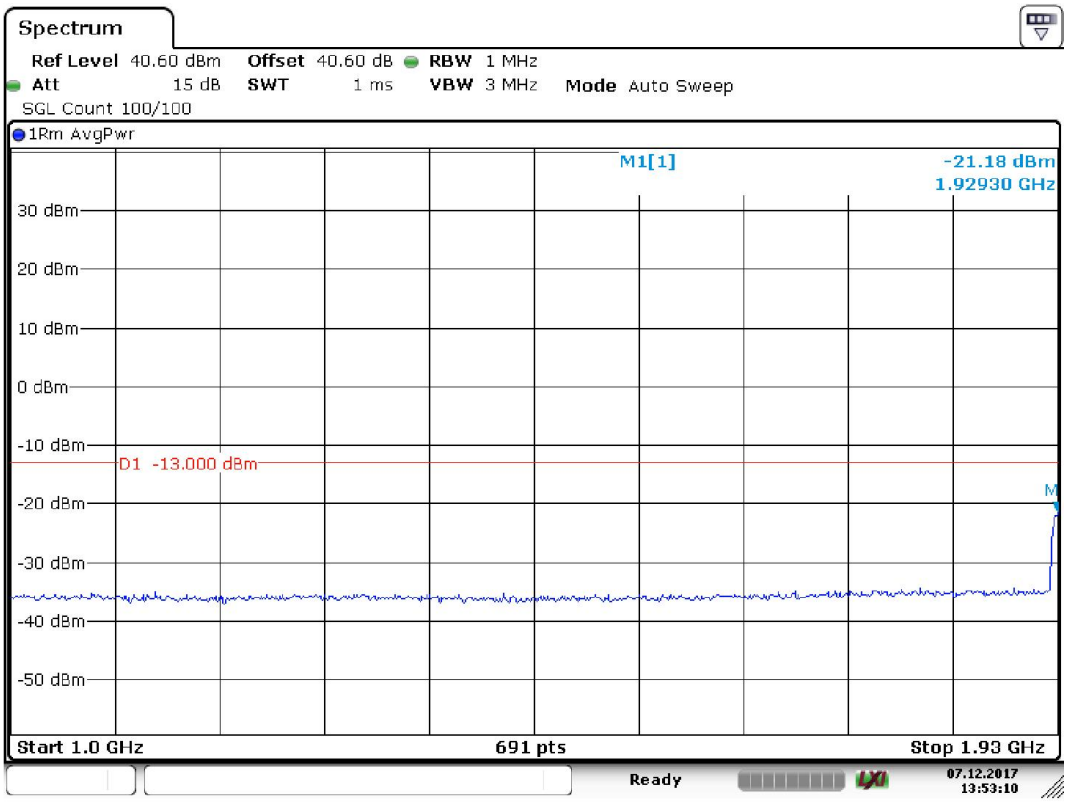
Date: 8.DEC.2017 09:57:53

WCDMA low channel 5 – 20 GHz



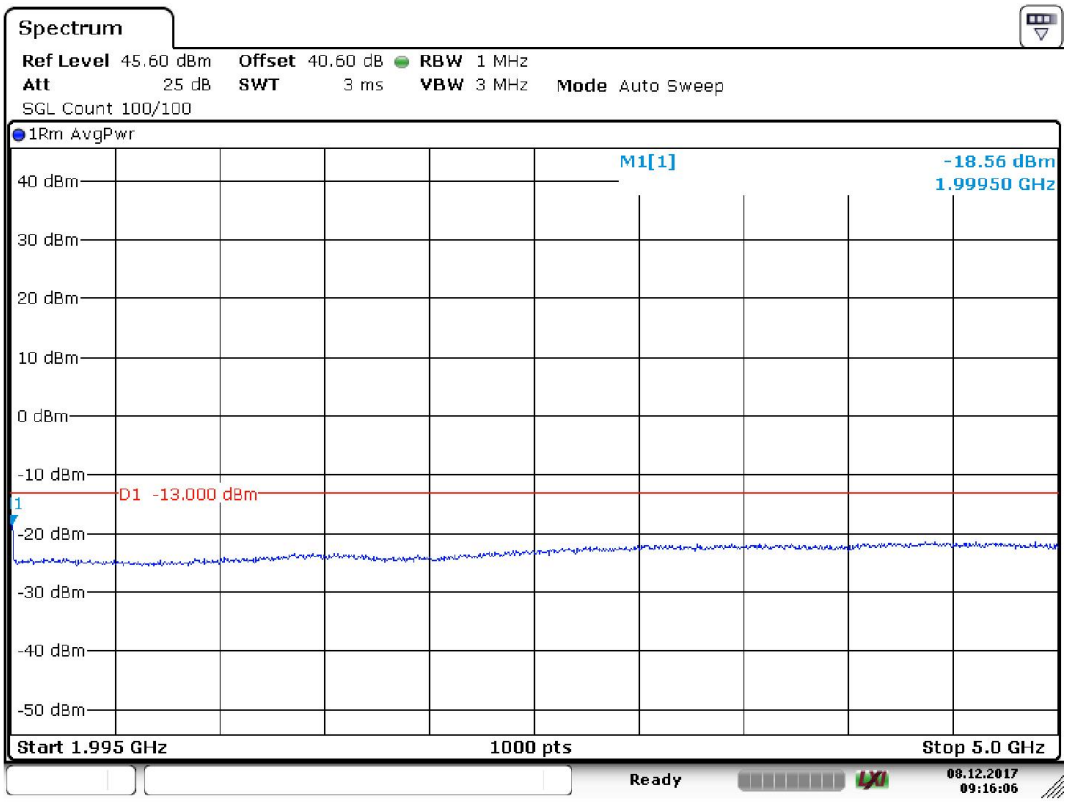
Date: 7.DEC.2017 13:38:58

WCDMA middle channel 9 kHz – 1 GHz



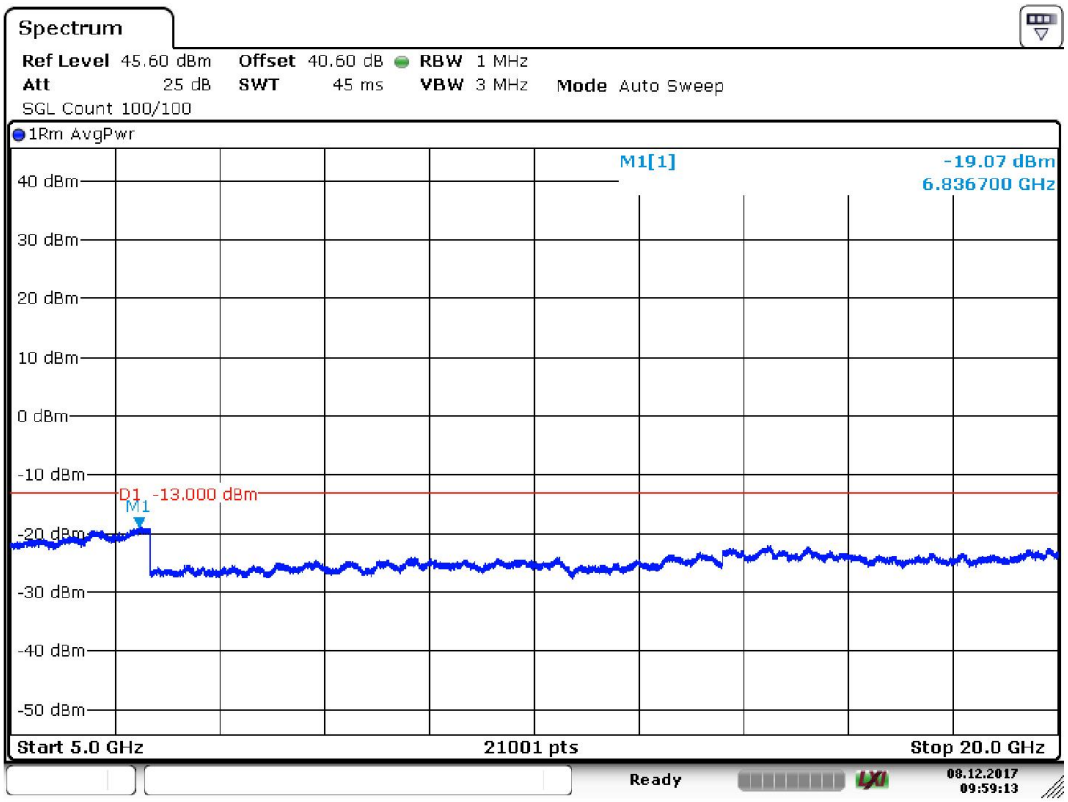
Date: 7.DEC.2017 13:53:10

WCDMA middle channel 1000 – 1930 MHz



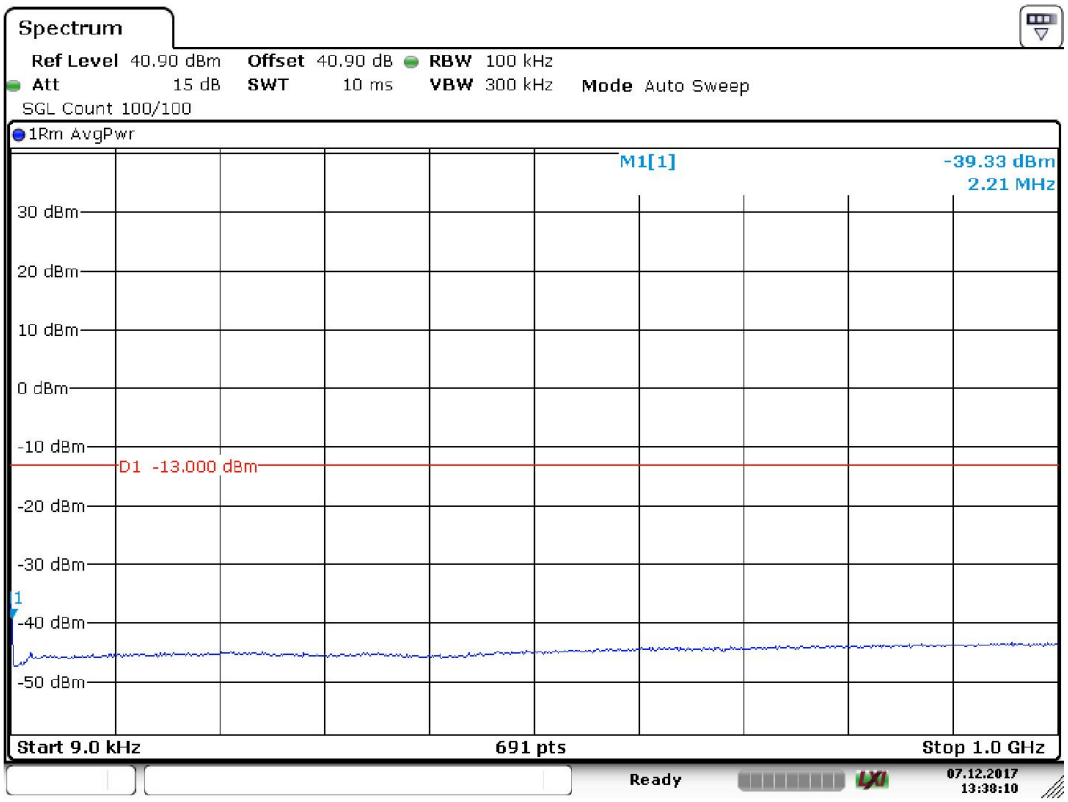
Date: 8.DEC.2017 09:16:06

WCDMA middle channel 1995 – 5000 MHz



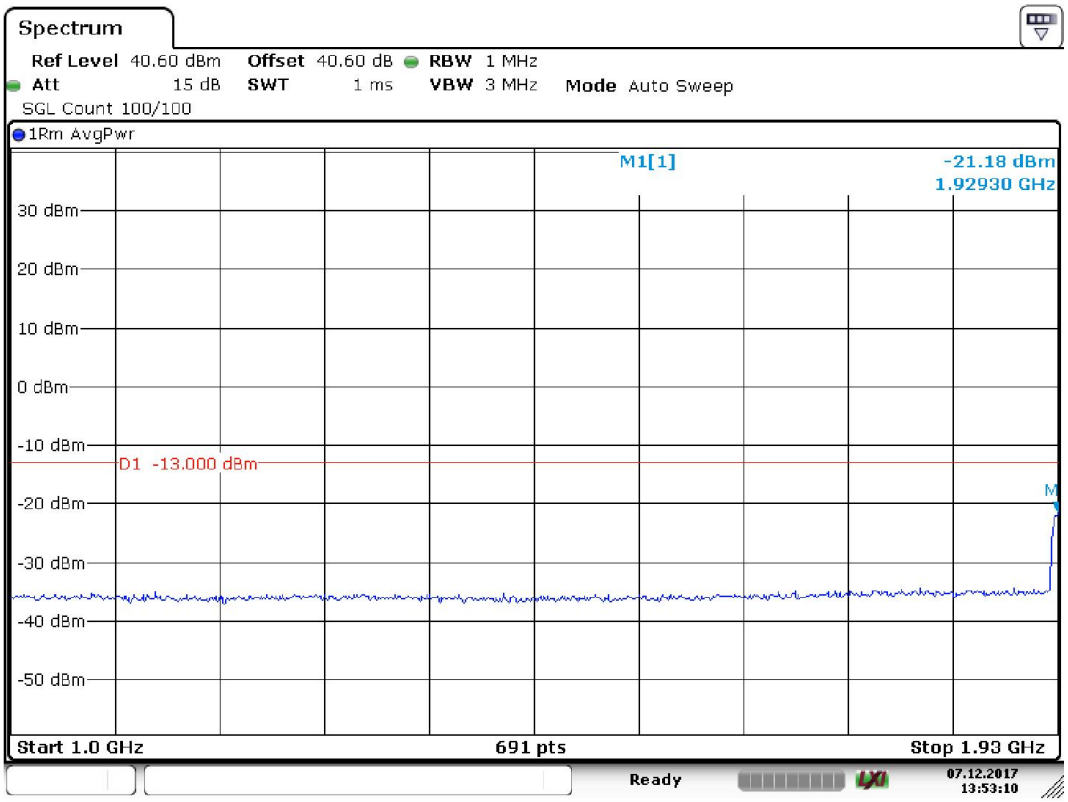
Date: 8.DEC.2017 09:59:13

WCDMA middle channel 5 – 20 GHz



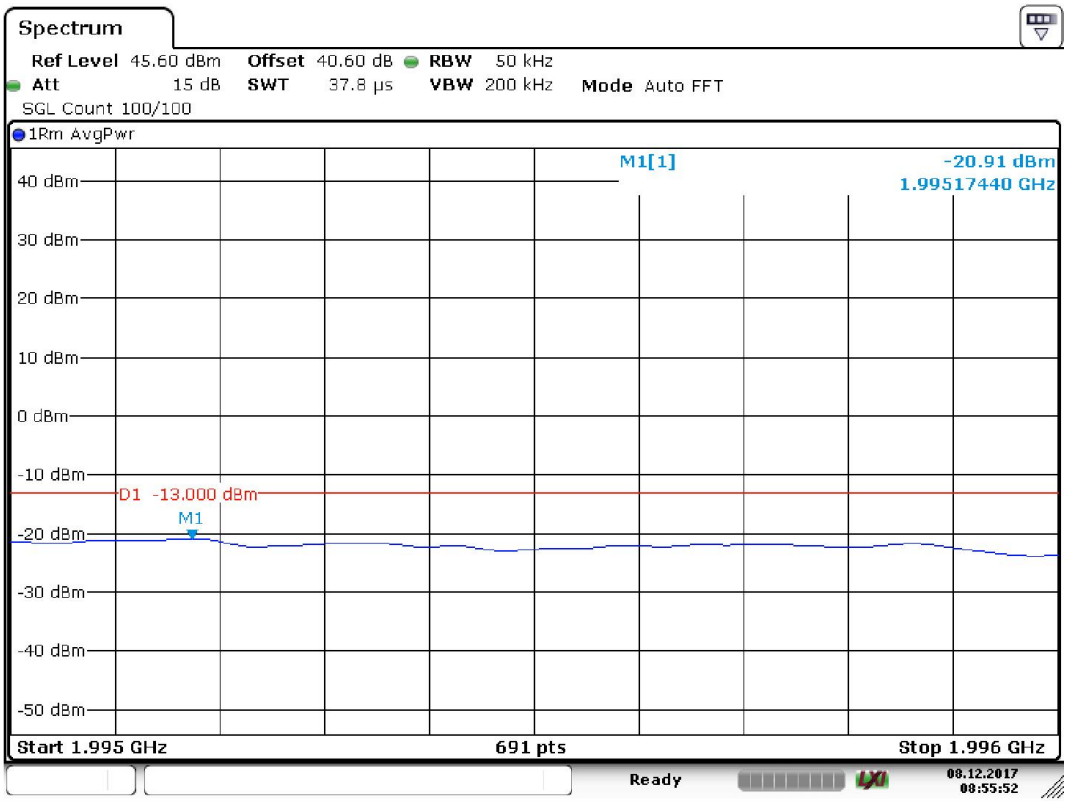
Date: 7.DEC.2017 13:38:11

WCDMA high channel 9 kHz – 1 GHz



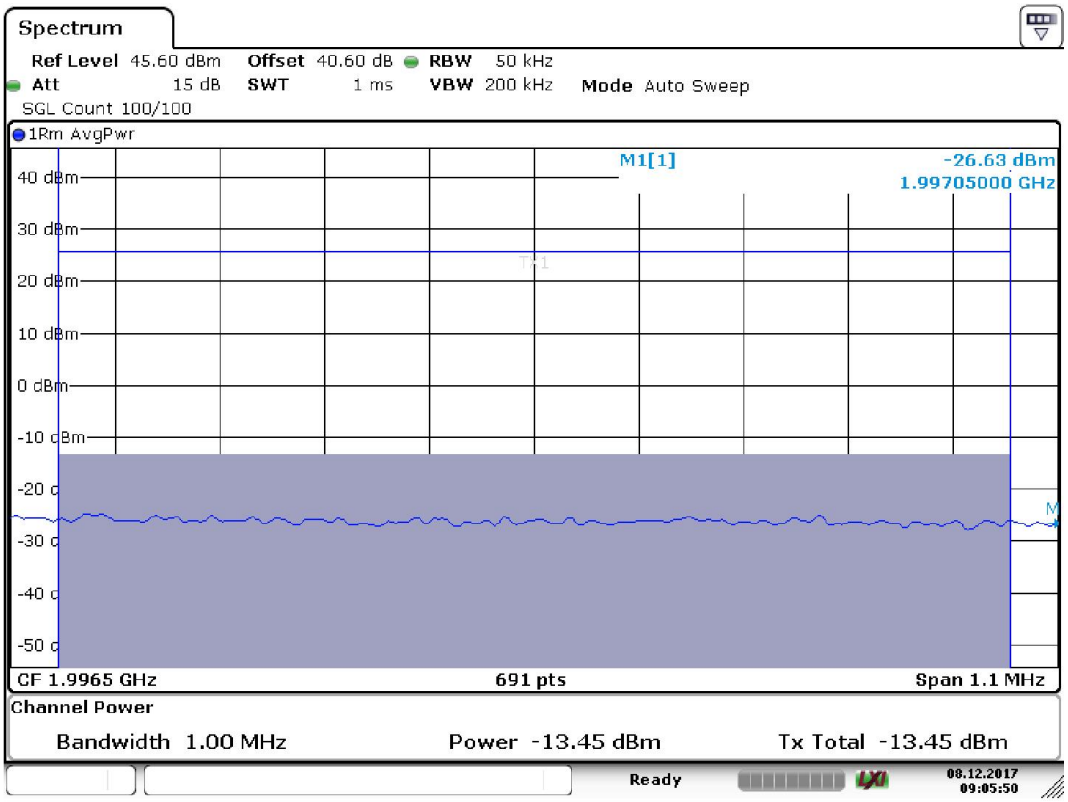
Date: 7.DEC.2017 13:53:10

WCDMA high channel 1000 – 1930 MHz



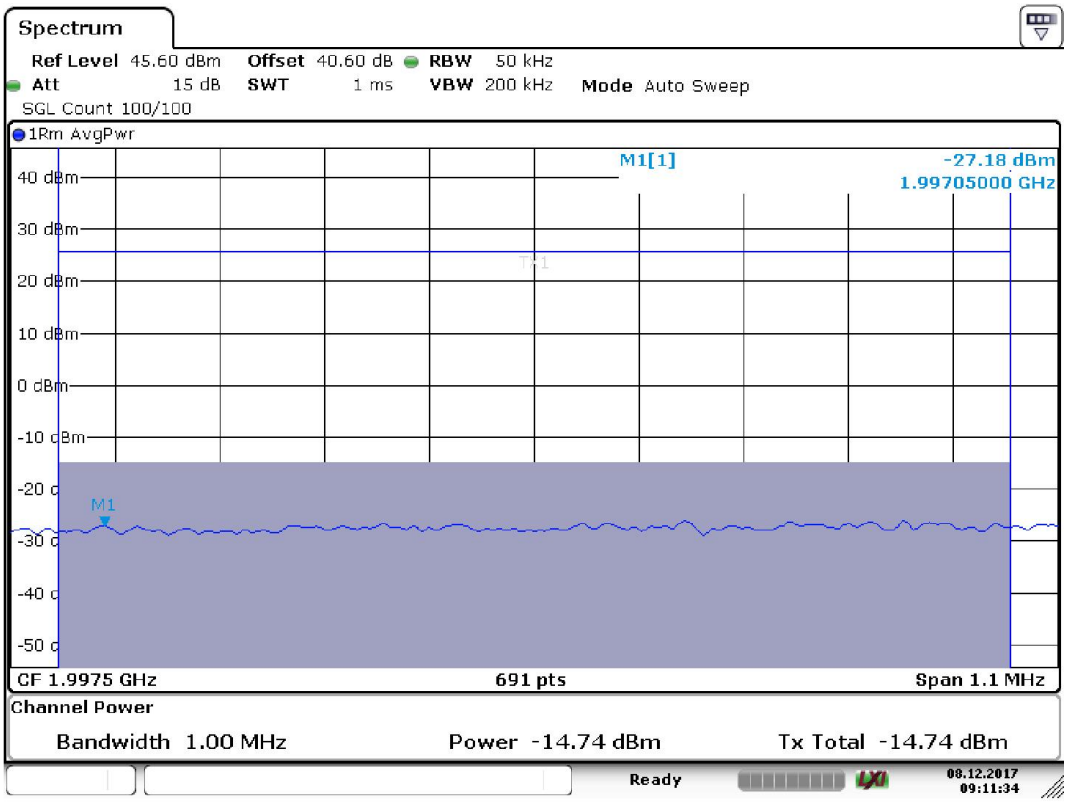
Date: 8.DEC.2017 08:55:52

WCDMA high channel 1995 MHz



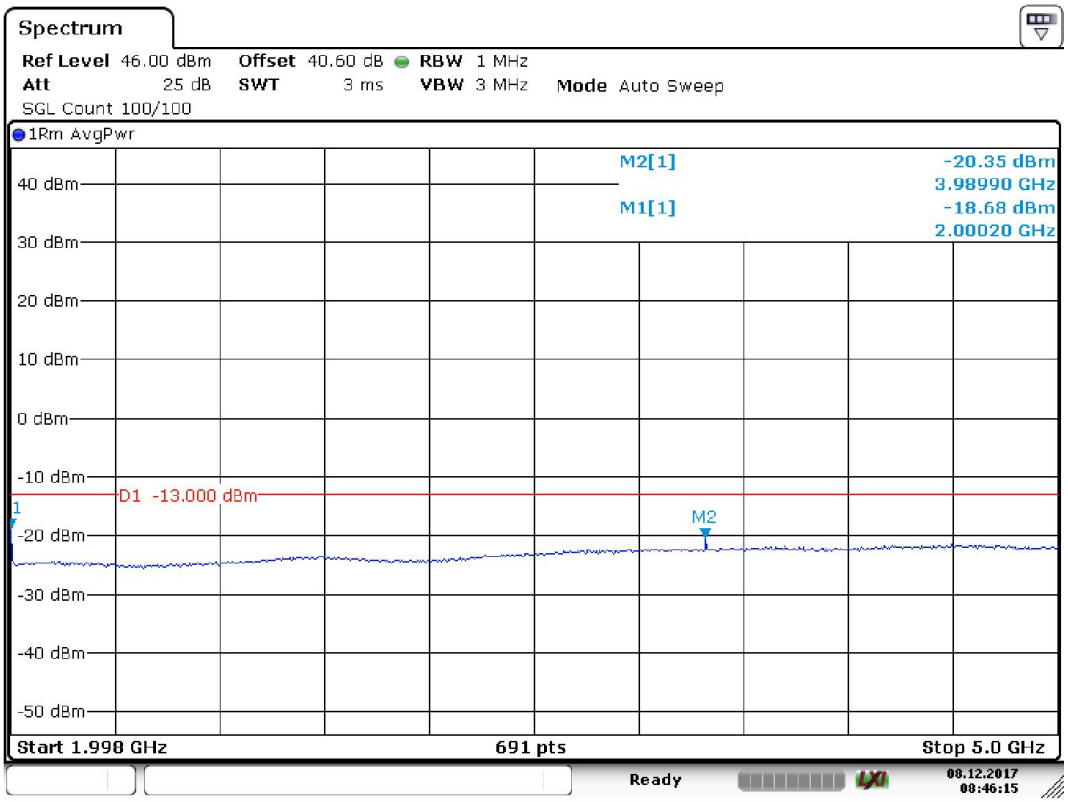
Date: 8.DEC.2017 09:05:50

WCDMA high channel 1996 MHz



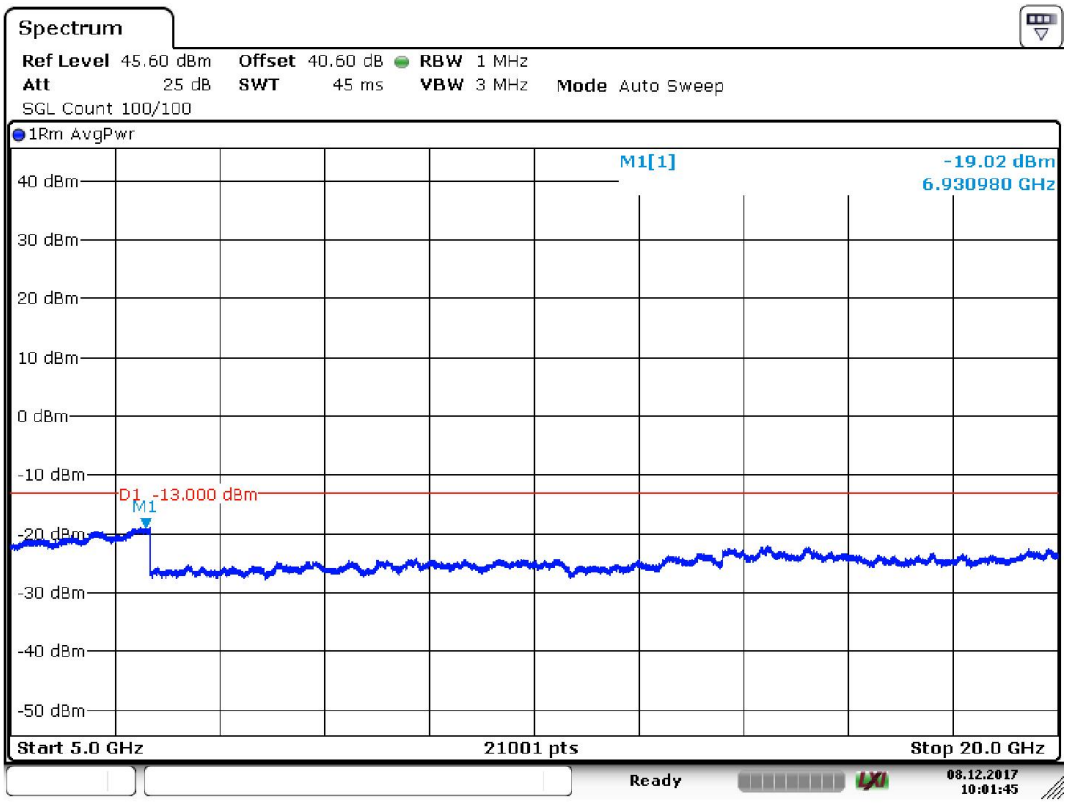
Date: 8.DEC.2017 09:11:34

WCDMA high channel 1997 MHz



Date: 8.DEC.2017 08:46:16

WCDMA high channel 1999 – 5000 MHz



Date: 8.DEC.2017 10:01:46

WCDMA high channel 5 – 20 GHz

9.4 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Spectrum analyser	Rohde & Schwarz	FSV	32594	7/2018
Rf-attenuator	Narda	776B-10	8337	7/2018
Rf-attenuator	Huber Suhner	5920_N-50-010/199_N	32697	7/2018
Rf cable	Huber Suhner	Sucoflex 104PE	39076	7/2018
Rf cable	Huber Suhner	Sucoflex 104PE	39077	7/2018
Rf cable	Huber Suhner	Sucoflex 104PE	39079	7/2018
Signal generator	Rohde & Schwarz	SMIQ03B	12792	7/2018
Signal generator	Rohde & Schwarz	SMBV100	32593	7/2018

10 RADIATED SPURIOUS EMISSION

Date of test:	2017-11-07	Test location:	Björk hallen
EUT Serial:	999895	Ambient temp.	21ºC
Tested by:	MTV	Relative humidity	32 %
Test result:	Pass	Margin:	> 20 dB

10.1 Test set-up

The test method is in accordance with ANSI C63.26 and ANSI-TIA-603-D-2010.
Both receiver and transmitter are active during the tests.
The EUT was placed on an insulating support above the turntable which is part of the reference ground plane.

Overview sweeps were performed with the measurement receiver in max-hold mode and the peak detector activated. Above 1 GHz both peak and average detector is activated.

Signal generator was connected to the FOI unit which converted rf signal to optical signal. The optical signal was then fed via fibre to the EUT.
The EUT's output port was terminated to the 50 Ω terminator.

A PC was connected to FOI via Ethernet hub. The PC was then used to control the EUT.

10.2 Test conditions

Test set-up: **30 MHz to 1000 MHz**
Test receiver set-up:
Preview test: Peak, RBW 120 kHz, VBW 1 MHz
Final test: Quasi-Peak, RBW 120 kHz, VBW 1 MHz
Measuring distance: 3 m
EUT height above ground plane: 0.8 m
Measuring angle: 0 – 359□
Antenna
Height above ground plane: 1 – 4 m
Polarisation: Vertical and Horizontal
Type: Bilog

Test set-up: **1 GHz – 22 GHz**
Test receiver set-up:
Preview test: Peak, RBW 1 MHz, VBW 3 MHz
Average, RBW 1 MHz, VBW 3 MHz
Final test: Average, RBW 1 MHz, VBW 3 MHz
Peak, RBW 1 MHz, VBW 3 MHz
Measuring distance: 3 m
EUT height above ground plane: 1.5 m
Measuring angle: 0 – 359□
Antenna
Height above ground plane: 1 – 4 m
Polarisation: Vertical and Horizontal
Type: Horn
Antenna tilt: Activated

10.3 Requirement

§24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, 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. 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 MHz or 1 percent of emission bandwidth, as specified). 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 dB below the transmitter power.

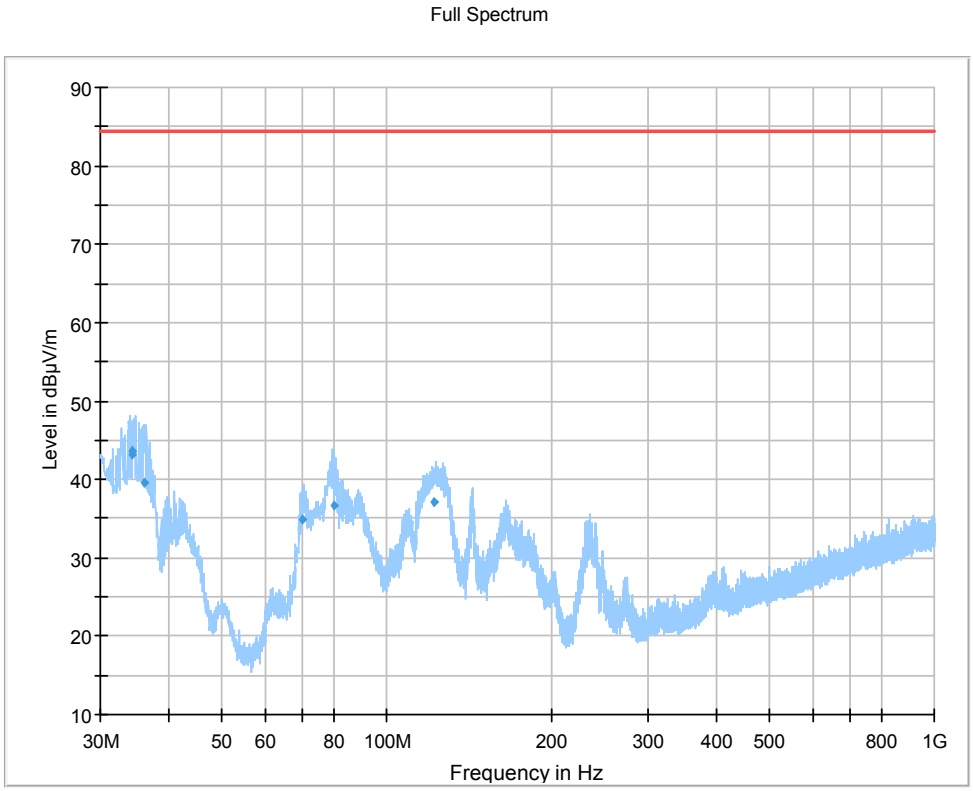
RSS-133 6.5

Equipment shall comply with the limits in (i) and (ii) below.
In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 $\log_{10}$p(watts).
After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 $\log_{10}$p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

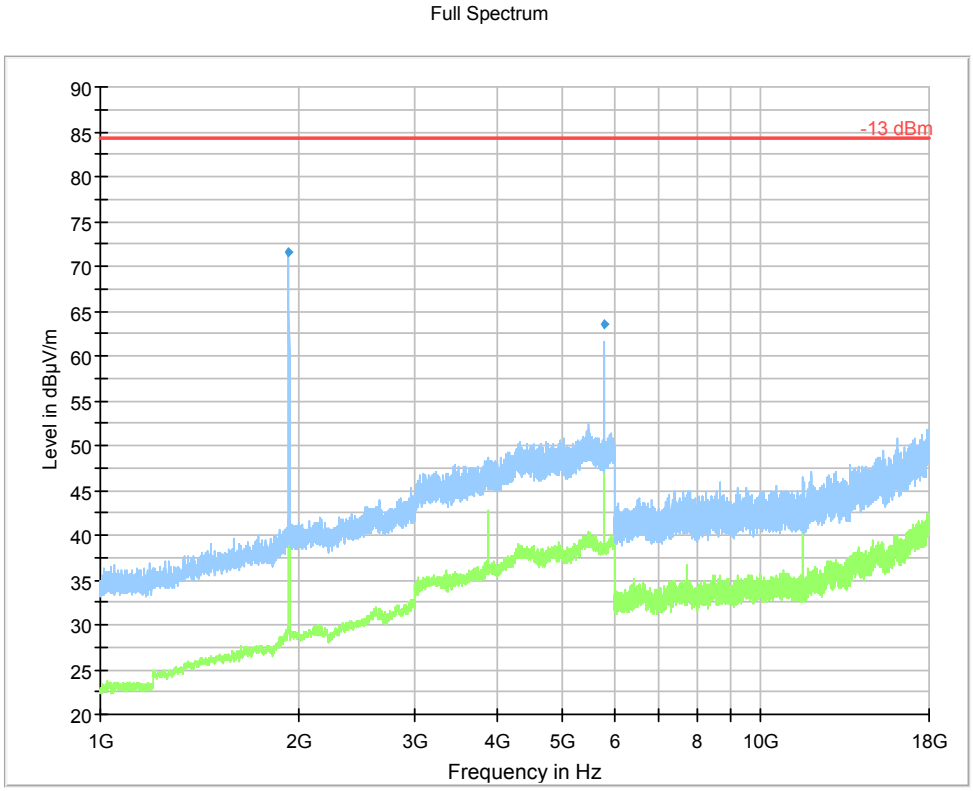
The frequency range to be inspected is up to the tenth harmonics of the highest fundamental frequency according to 47 CFR 2.1057 and RSS-Gen Section 6.13.
The field strength limit is calculated using the plane wave relation.
$GP/4\pi R^2 = E^2 / 120\pi$

G: antenna gain
P: power (W)
R: measurement distance (m)

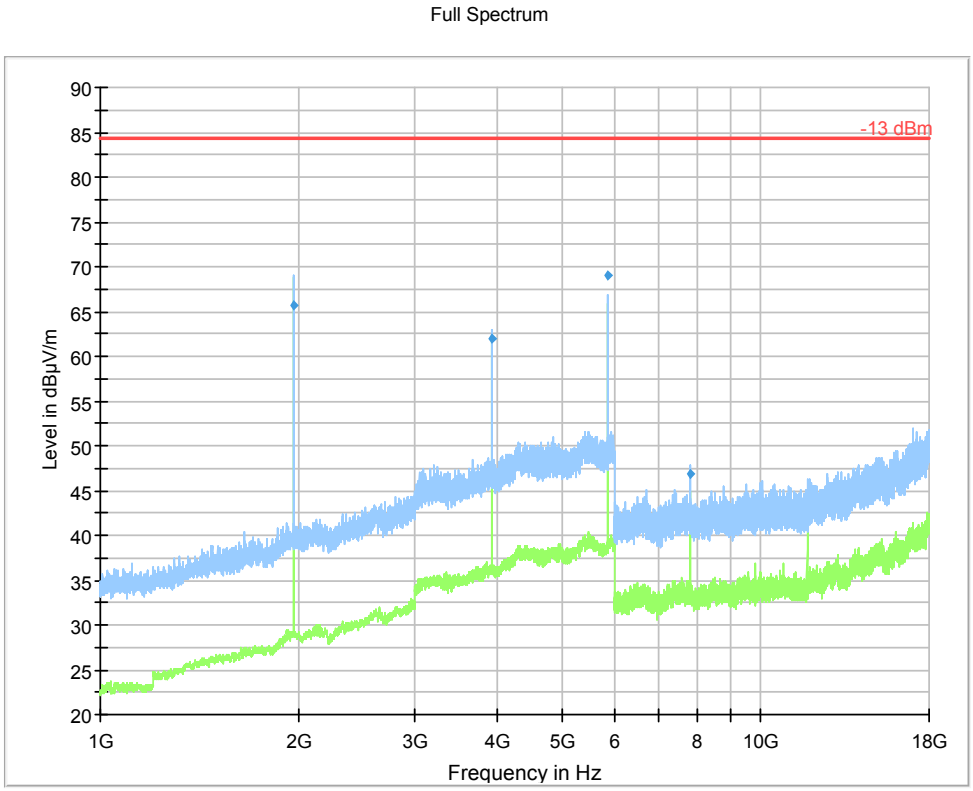
10.4 Test results



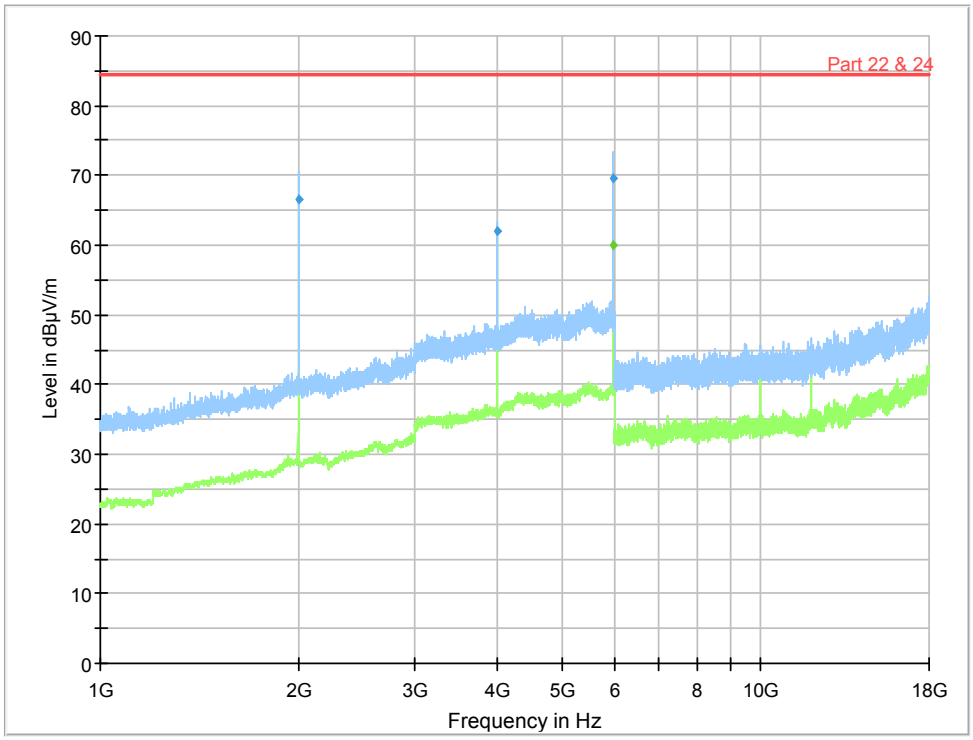
30 MHz – 1000 MHz



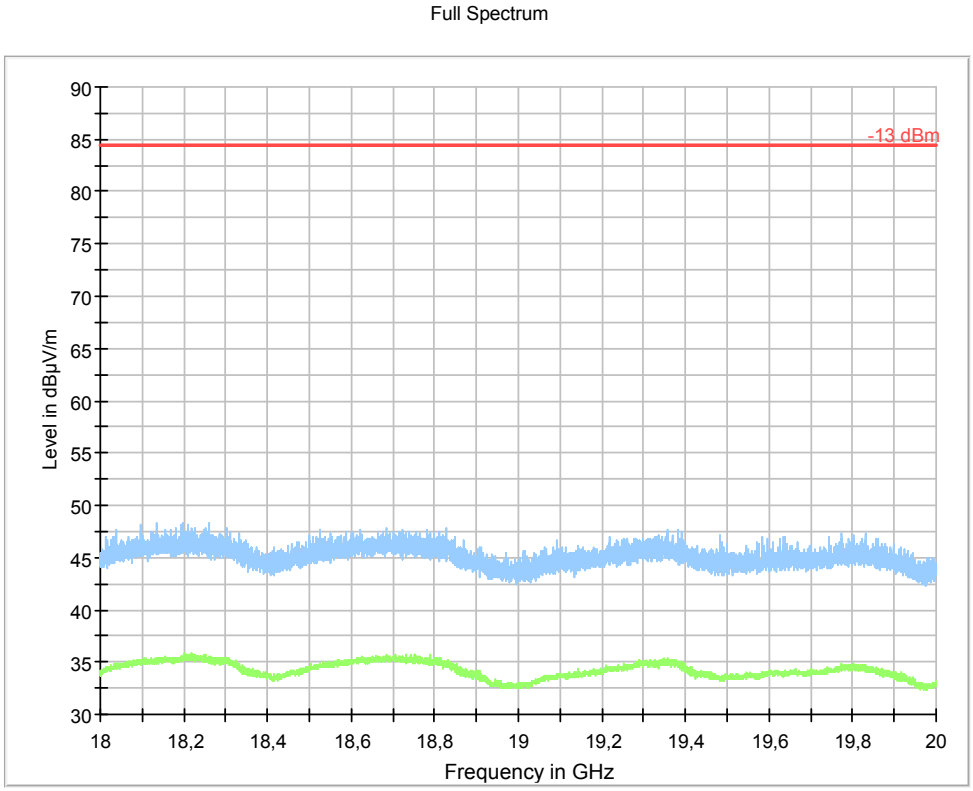
1-18 GHz low channel



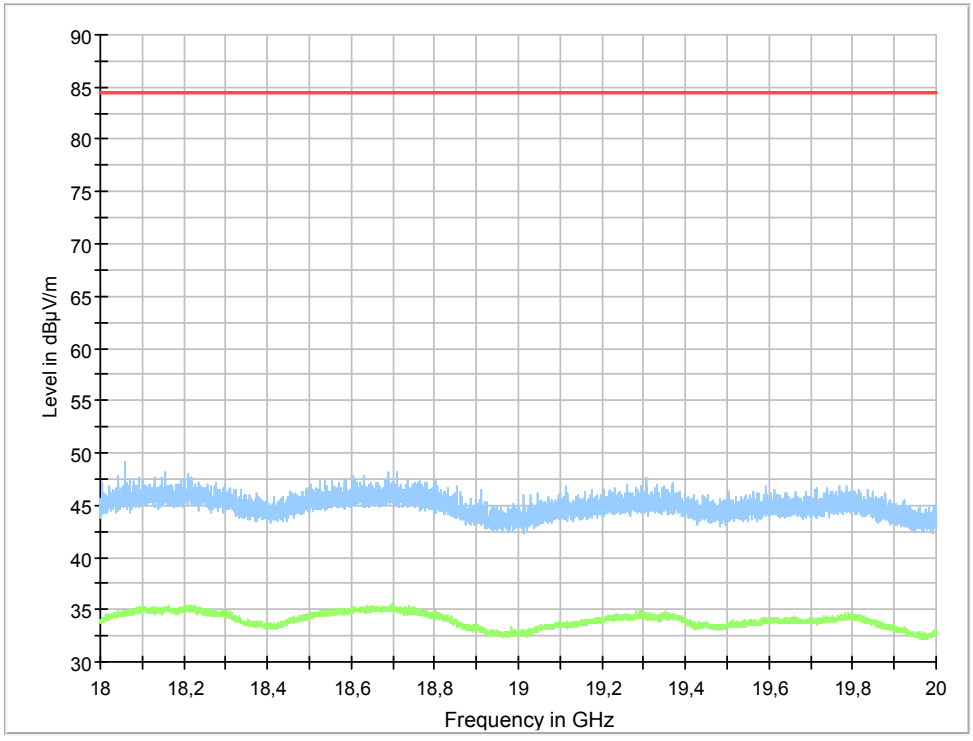
1-18 GHz middle channel



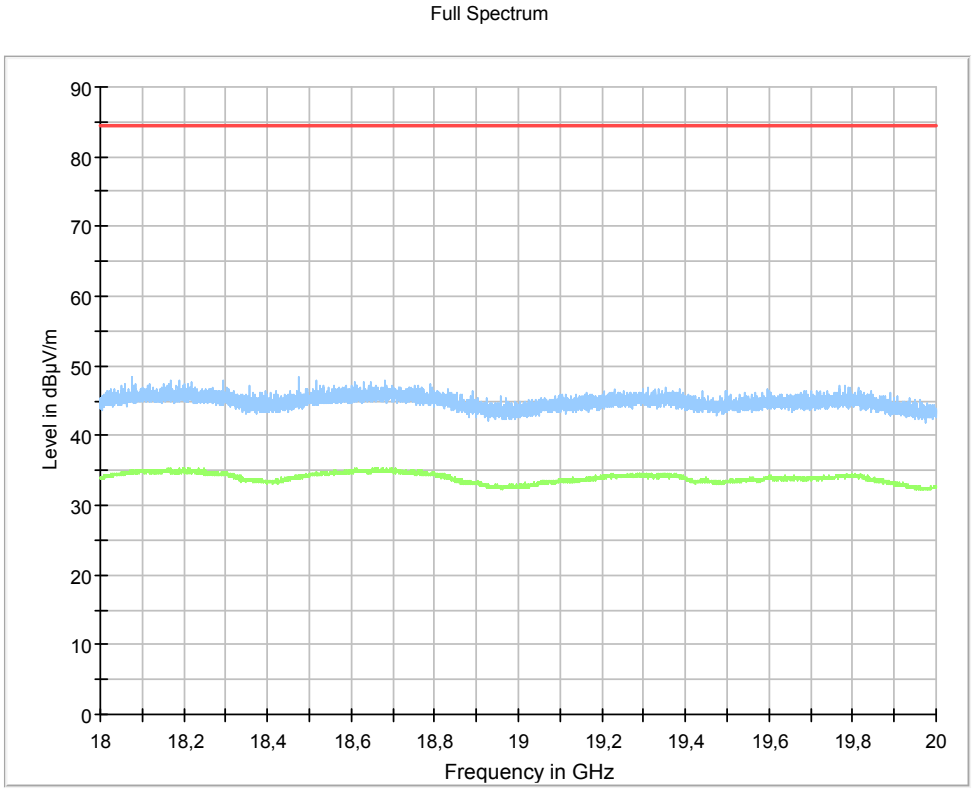
1-18 GHz high channel



18-20 GHz low channel



18-20 GHz middle channel



18-22 GHz high channel

10.5 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Measurement receiver	Rohde & Schwarz	ESI 26	32291	7/2018
Measurement receiver	Rohde & Schwarz	ESU 40	13178	7/2018
UltraLog antenna	Rohde & Schwarz	HL562	30711	12/2018
Horn antenna	Rohde & Schwarz	HF907	32307	7/2018
Pre amplifier	Rohde & Schwarz	TS-pre1	32306	7/2018
Horn antenna + preamp	Bonn	BLMA 1826-5A	31247	1/2020
Rf cable	Megaphase	GC12-K1K1-315	39127	7/2018

11 MEASUREMENT UNCERTAINTY

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 0.09 to 30 MHz at 10 m	± 3.2 dB
Uncertainty for the frequency range 30 to 1000 MHz at 3 m	± 5.1 dB
Uncertainty for the frequency range 30 to 1000 MHz at 10 m	± 5.0 dB
Uncertainty for the frequency range 1.0 to 18 GHz at 3 m	± 4.7 dB
Uncertainty for the frequency range 18 to 26 GHz at 3 m	± 4.8 dB
Uncertainty for the frequency range 26 to 40 GHz at 3 m	± 5.7 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.
The measurement uncertainty is given with a confidence of 95 %.

Measurement uncertainty for antenna port measurements

Uncertainty for conducted spurious emission	± 2,5 dB
Uncertainty for carrier power	± 1,3 dB

Frequency error

Frequency to be measured [MHz]	Expanded (k=1,96) Measurement Uncertainty [Hz]	Expanded (k=1,96) Measurement Uncertainty [%]
25	0,34	$1,36 \times 10^{-8}$
433	3,40	$7,90 \times 10^{-9}$
868	3,40	$3,91 \times 10^{-9}$
1900	33,95	$1,79 \times 10^{-8}$
2483,5	33,96	$1,37 \times 10^{-8}$
5850	34,00	$5,81 \times 10^{-9}$

Measurement uncertainty is calculated in accordance with ETSI TS 100028.
The measurement uncertainty is given with a confidence of 95 %.

12 TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 1713846STO-001 Annex 1.
Test set up photos are in separate document 1718386STO-01 Annex 2.