TEST REPORT

No. I19Z62374-WMD19

for

SAMSUNG Electronics Co., Ltd.

Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN

Model Name: SM-A215U1

FCC ID: ZCASMA215U

with

Hardware Version: REV1.0

Software Version: A215U1.001

Issued Date: 2020-04-17

Note:

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I19Z62374-WMD19	Rev.0	1st edition	2020-03-20
I19Z62374-WMD19	Rev.1	Changed the Client Information and EUT Software version	2020-04-17

Note: the latest revision of the test report supersedes all previous version.

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1. Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2005 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (CN0066). The detail accreditation scope can be found on NVLAP website.

1.2. Testing Location

Location 1: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191

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1.3. Testing Environment

Normal Temperature: 15-35℃

Relative Humidity: 20-80%

1.4. Project data

Testing Start Date: 2020-01-15

Testing End Date: 2020-03-17

1.5. Signature

Dong Yuan

(Prepared this test report)

Zhang Yufeng

(Reviewed this test report)

Zhao Hui Lin

Deputy Director of the laboratory

(Approved this test report)

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2. Client Information

2.1. Applicant Information

Company Name:	SAMSUNG Electronics Co., Ltd.
Address /Post:	19 Chapin Road, Building D, Pine Brook New Jersey United States, 07058
Contact:	Jenni Chun
Email:	j1.chun@samsung.com
Telephone:	1-973-808-6375
Fax:	NA

2.2. Manufacturer Information

Company Name:	SAMSUNG Electronics Co., Ltd.
Address /Post:	19 Chapin Road, Building D, Pine Brook New Jersey United States, 07058
Contact:	Jenni Chun
Email:	j1.chun@samsung.com
Telephone:	1-973-808-6375
Fax:	NA

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3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN
Model	SM-A215U1
FCC ID	ZCASMA215U
Frequency	CDMA800MHz(BC0);CDMA1900MHz(BC1)
Antenna	Embedded
Extreme vol. Limits	3.5VDC to 4.4VDC (nominal: 3.8VDC)
Extreme temp. Tolerance	-10°C to +55°C

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of CTTL.

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version	Date of receipt
UT07a	354230110026502	REV1.0	A215U1.001	2019-12-27

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE used during the test

AE ID*	Description
AE1	Battery

AE1

Model	NVT-WT-N6
Manufacturer	Dongguan NVT Technology Co., Ltd.
Capacitance	3900mAh

*AE ID: is used to identify the test sample in the lab internally.

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4. Reference Documents

4.1. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	10-1-19 Edition
FCC Part 22	PUBLIC MOBILE SERVICES	10-1-19 Edition
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS;GENERAL RULES AND REGULATIONS	10-1-19 Edition
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v03r01

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5. LABORATORY ENVIRONMENT

Shielding chamber did not exceed following limits along the RF testing:

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. =20 %, Max. = 80 %

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6. SUMMARY OF TEST RESULTS

6.1. Summary of test results

Items	List	Clause in FCC rules	Verdict
1	Output Power	22.913(a)/24.232(c)	BR
2	Frequency Stability	2.1055/22.355/24.235	BR
3	Occupied Bandwidth	2.1049(h)(i)	BR
4	Emission Bandwidth	22.917(b)/24.238(b)	BR
5	Band Edge Compliance	22.917(b)/24.238(b)	BR
6	Conducted Spurious Emission	2.1057/22.917/24.238	BR
7	Peak to Average Power Ratio	24.232(d)	BR

BR: Re-use test data from basic model report.

6.2. Explanation of re-use of test data

The Equipment Under Test (EUT) model SM-A215U1 (FCC ID: ZCASMA215U) is a variant product of SM-A215U (FCC ID: ZCASMA215U). According to the declaration of changes provided by the applicant and FCC KDB publication 484596 D01, all the test results are derived from test report No. I19Z62374-WMD04.

For detail differences between two models please refer the Declaration of Changes document.

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7. Test Equipments Utilized

NO.	NAME	TYPE	SERIES NUMBER	PRODUCER	CALIBRATION INTERVAL	CAL DUE DATE
1	Spectrum Analyzer	FSV30	101576	R&S	1 Year	2020-05-03
2	Wireless Communications Test Set	8960(E5515C)	MY48360950	Agilent	2 Years	2020-08-29
3	Climatic chamber	SH-641	92009050	ESPEC	3 Years	2020-12-21

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ANNEX A: MEASUREMENT RESULTS

A.1 OUTPUT POWER

A.1.1 Summary

During the process of testing, the EUT was controlled via Agilent Wireless Communications Test Set (8960(E5515C)) to ensure max power transmission and proper modulation.
This result is max output power conducted measurements for the EUT.
In all cases, output power is within the specified limits.

A.1.2 Method of Measurements

The EUT was set up for the max output power with pseudo random data modulation.
The power was measured with Rhode & Schwarz Spectrum Analyzer FSV30 (average).
These measurements were done at 3 frequencies, 1851.25 MHz, 1880.0 MHz and 1908.75 MHz for PCS CDMA band, 824.7MHz, 836.52MHz and 848.31MHz for CDMA 800 band (bottom, middle and top of operational frequency range) for 1x RTT and 1xEVDO .
a) Set span to at least 1.5 times the OBW.
b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
c) Set VBW ≥ 3 × RBW.
d) Set number of points in sweep ≥ 2 × span / RBW.
e) Sweep time = auto-couple.
f) Detector = RMS (power averaging).
g) If the EUT can be configured to transmit continuously (i.e., burst duty cycle ≥ 98%), then set the trigger to free run.
h) If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle < 98 %), then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Ensure that the sweep time is less than or equal to the transmission burst duration.
i) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with the band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

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A1.3 Measurement results

CDMA 800

Measurement result

Channel	Frequency(MHz)	Channel power(dBm)		
		1x RTT	1xEVDO	
			Rel0	RevA
1013	824.70	23.90	24.14	24.15
384	836.52	24.02	24.46	24.47
777	848.31	23.92	24.36	24.24

CDMA 1900

Measurement result

Channel	Frequency(MHz)	Channel power(dBm)		
		1x RTT	1xEVDO	
			Rel0	RevA
25	1851.25	24.05	23.90	24.00
600	1880.00	23.97	23.96	24.02
1175	1908.75	23.95	24.01	24.21

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A.2 FREQUENCY STABILITY

A.2.1 Method of Measurement

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of Agilent 8960(E5515C) Wireless Communications Test Set.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30℃.
3. With the EUT, powered via nominal voltage, connected to the 8960(E5515C) and in a simulated call on channel 384 for CDMA 800 and channel 600 for 1900 measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments remeasuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the 8960(E5515C) and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10℃ decrements from +50℃ to -30℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

A.2.2 Measurement Limit

A.2.2.1 For Hand carried battery powered equipment

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.5VDC and 4.4VDC, with a nominal voltage of 3.8VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress.

For CDMA800, according to section. 22.355, frequency tolerance cab be maintained within 2.5ppm.

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A.2.2.2 For equipment powered by primary supply voltage

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

For CDMA800, according to section. 22.355, frequency tolerance cab be maintained within 2.5ppm.

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A.2.3 Measurement results

CDMA 800

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.8	824.013	848.999		
50				0.57	0.0007
40				1.81	0.0022
30				0.93	0.0011
10				-0.98	0.0012
0				-0.32	0.0004
-10				1.32	0.0016
-20				0.24	0.0003
-30				2.33	0.0028

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
3.5	20	824.013	848.999	0.87	0.0010
4.4				2.12	0.0025

CDMA 1900

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.8	1850.562	1909.439		
50				0.67	0.0004
40				2.10	0.0011
30				0.38	0.0002
10				1.59	0.0008
0				-1.58	0.0008
-10				-0.06	0.0000
-20				0.27	0.0001
-30				0.71	0.0004

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
3.5	20	1850.562	1909.439	2.71	0.0014
4.4				4.06	0.0022

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A.3 OCCUPIED BANDWIDTH

A.3.1 Occupied Bandwidth Results

Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.

The measurement method is from ANSI C63.26:

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts.

b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.

d) Set the detection mode to peak, and the trace mode to max-hold.

CDMA 800 (99% BW)

Channel	Occupied Bandwidth (99% BW)(MHz)
1013	1.267
384	1.267
777	1.267

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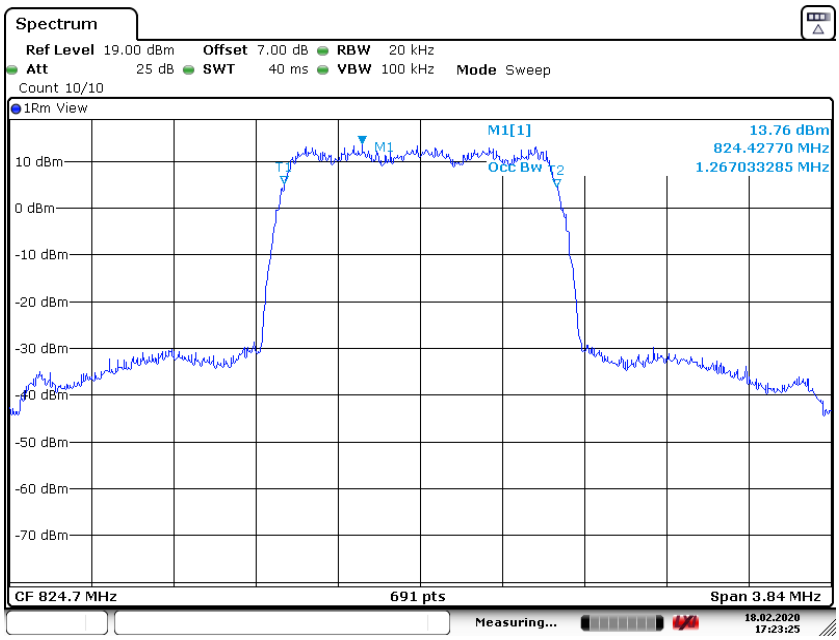
CDMA 800

Channel 1013-Occupied Bandwidth (99% BW)



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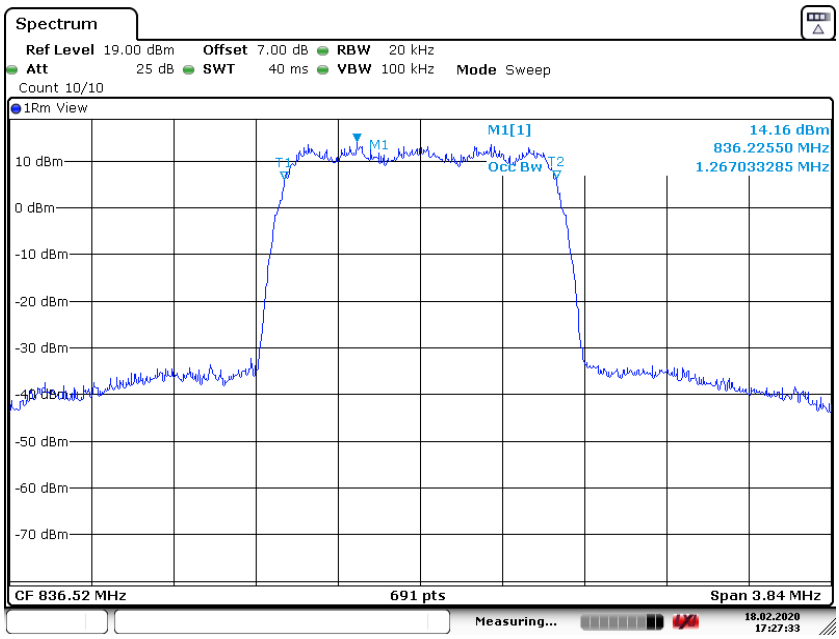
Channel 384-Occupied Bandwidth (99% BW)



Date: 18.FEB.2020 17:27:33

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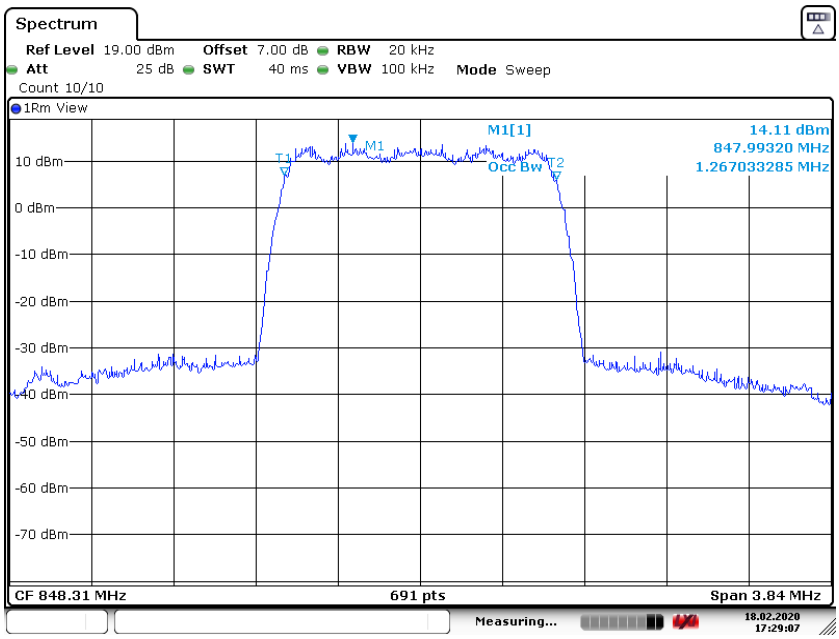
Channel 777-Occupied Bandwidth (99% BW)



Date: 18.FEB.2020 17:29:06

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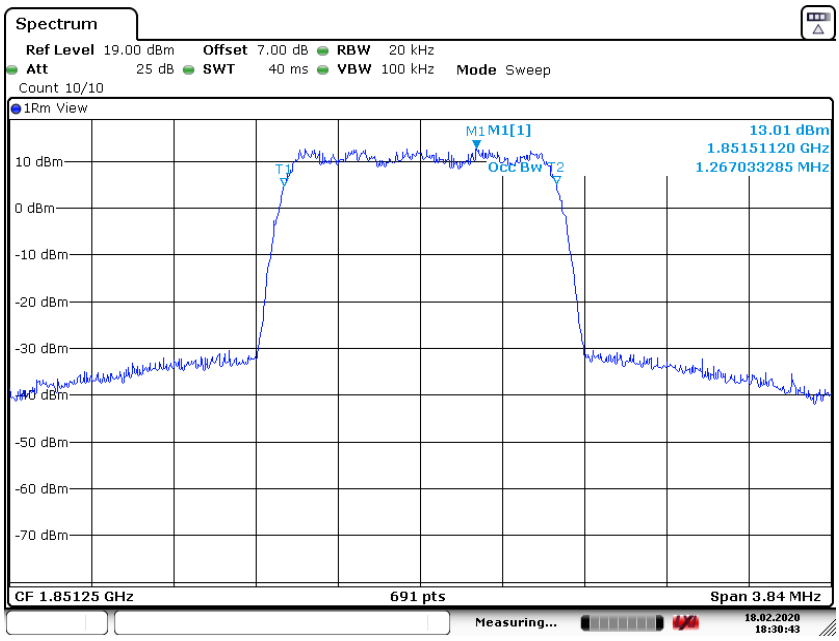
CDMA 1900 (99% BW)

Channel	Occupied Bandwidth (99% BW)(MHz)
25	1.267
600	1.267
1175	1.273

CDMA 1900

Channel 25-Occupied Bandwidth (99% BW)



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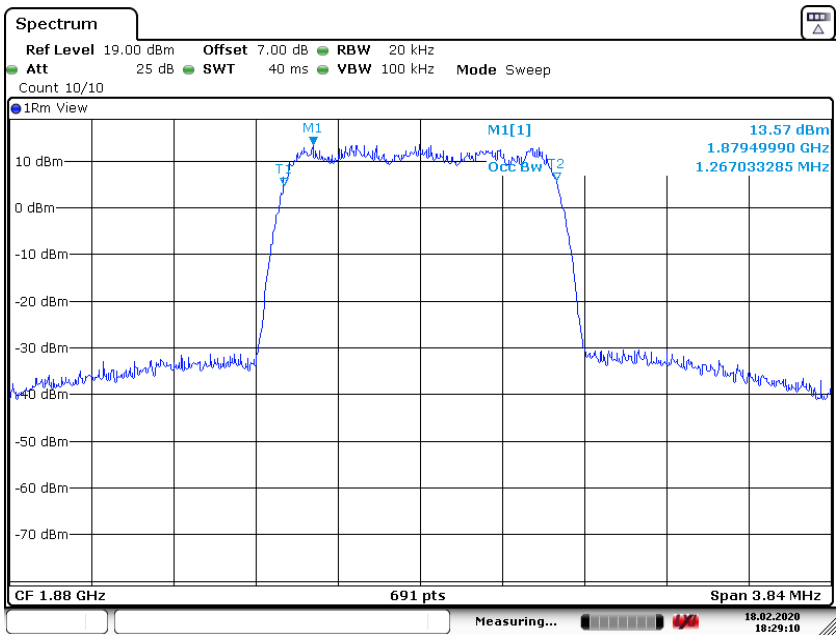
Channel 600-Occupied Bandwidth (99% BW)



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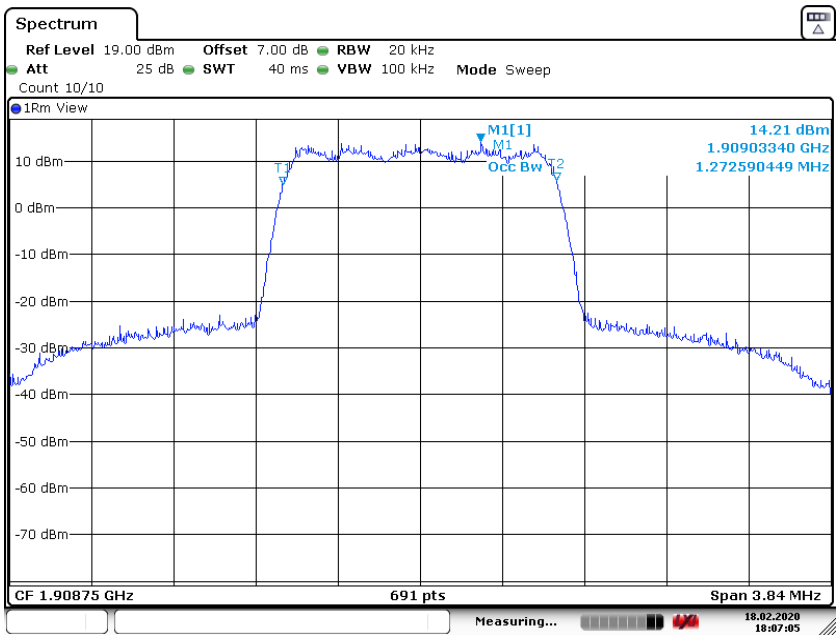
Channel 1175-Occupied Bandwidth (99% BW)



Date: 18.FEB.2020 18:07:05

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A.4 EMISSION BANDWIDTH

A.4.1Emission Bandwidth Results

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.

Similar to conducted emissions; Emission bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies. Table below lists the measured 100% BW. Spectrum analyzer plots are included on the following pages.

The measurement method is from ANSI C63.26:

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts.

b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.

c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.

d) Set the detection mode to peak, and the trace mode to max-hold.

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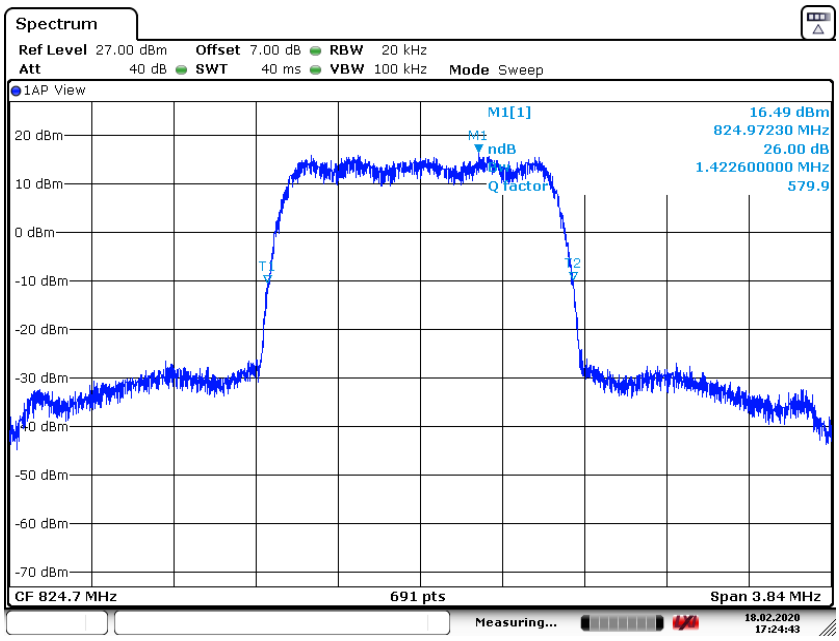
CDMA 800 (100% BW)

Channel	Emission Bandwidth (100% BW)(MHz)
1013	1.423
384	1.423
777	1.434

CDMA 800

Channel 1013-Emission Bandwidth (100% BW)



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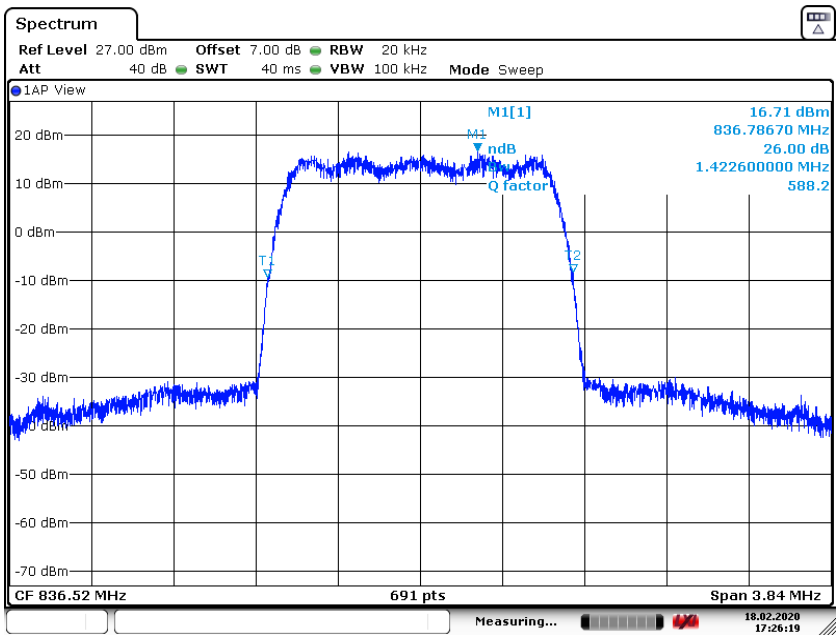
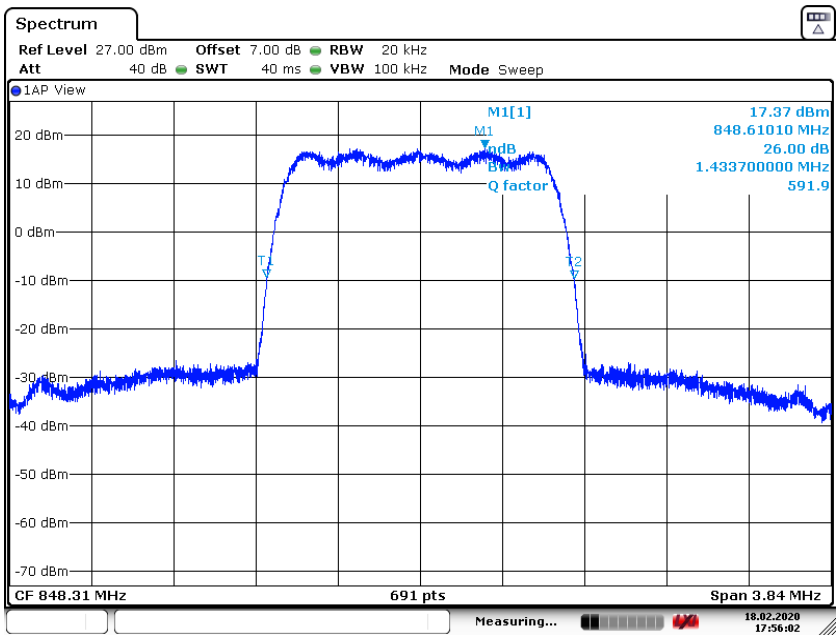
Channel 384-Emission Bandwidth (100% BW)



Date: 18.FEB.2020 17:26:19

Channel 777-Emission Bandwidth (100% BW)



Date: 18.FEB.2020 17:56:02

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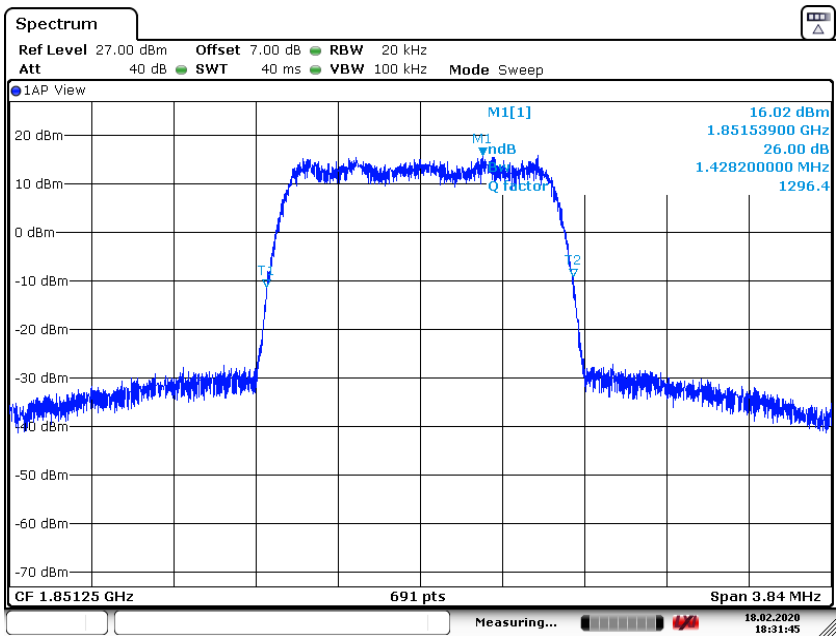
CDMA 1900 (100% BW)

Channel	Emission Bandwidth (100% BW)(MHz)
25	1.428
600	1.428
1175	1.428

CDMA 1900

Channel 25-Emission Bandwidth (100% BW)



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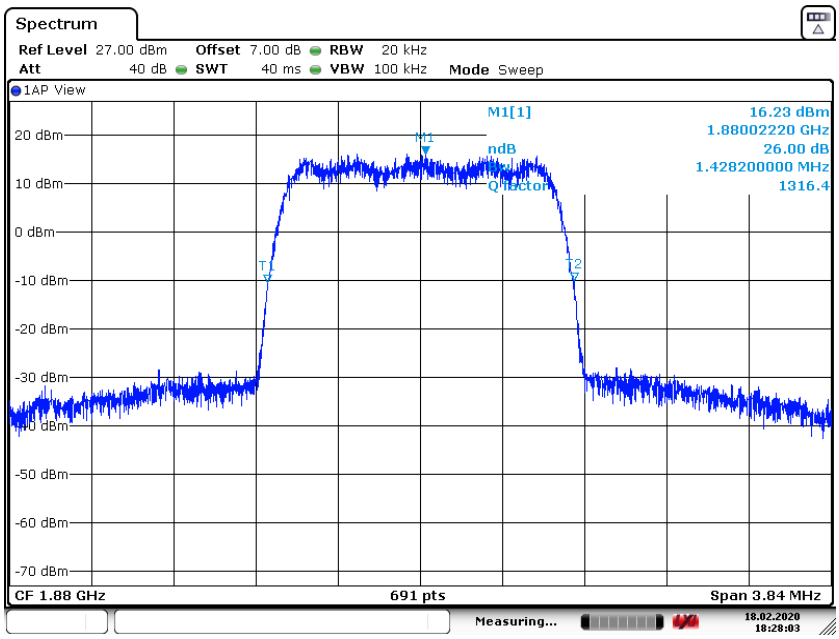
Channel 600-Emission Bandwidth (100% BW)



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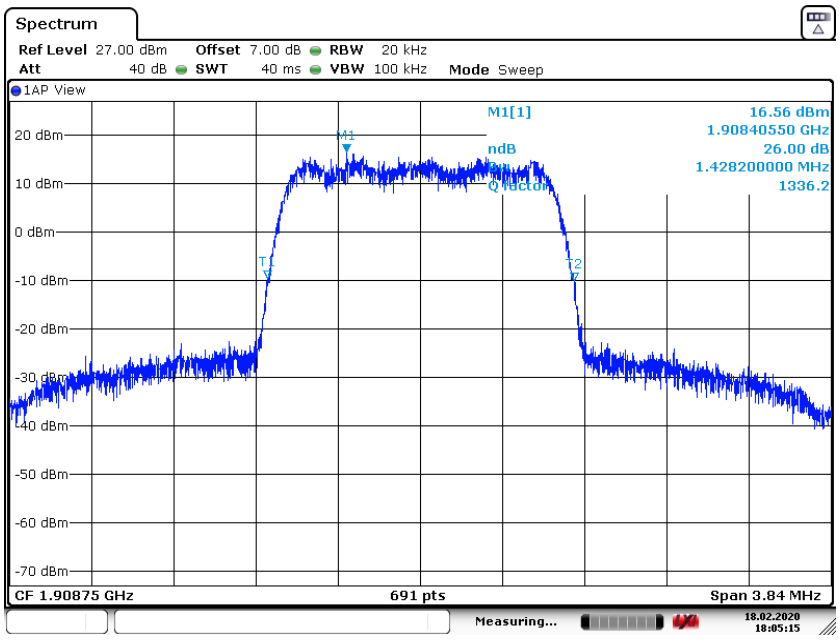
Channel 1175-Emission Bandwidth (100% BW)



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A.5 BAND EDGE COMPLIANCE

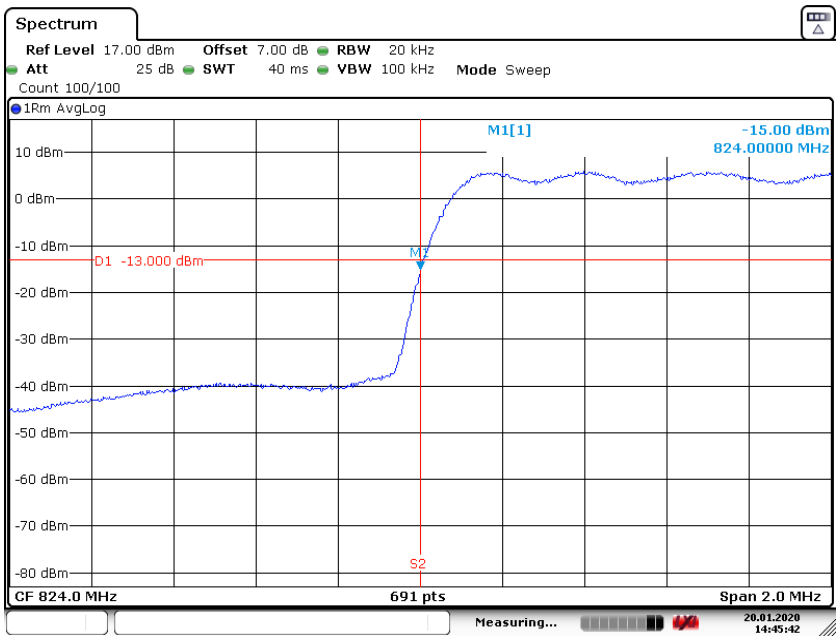
A.5.1 Measurement limit

On any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log (P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm. According to KDB 971168, a relaxation of the reference bandwidth is often provided for measurements within a specified frequency range at the edge of the authorized frequency block/band. This is often implemented by permitting the use of a narrower RBW (typically limited to a minimum RBW of 1% of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

A.5.2 Measurement result

CDMA 800

BAND EDGE BLOCK-Channel 1013



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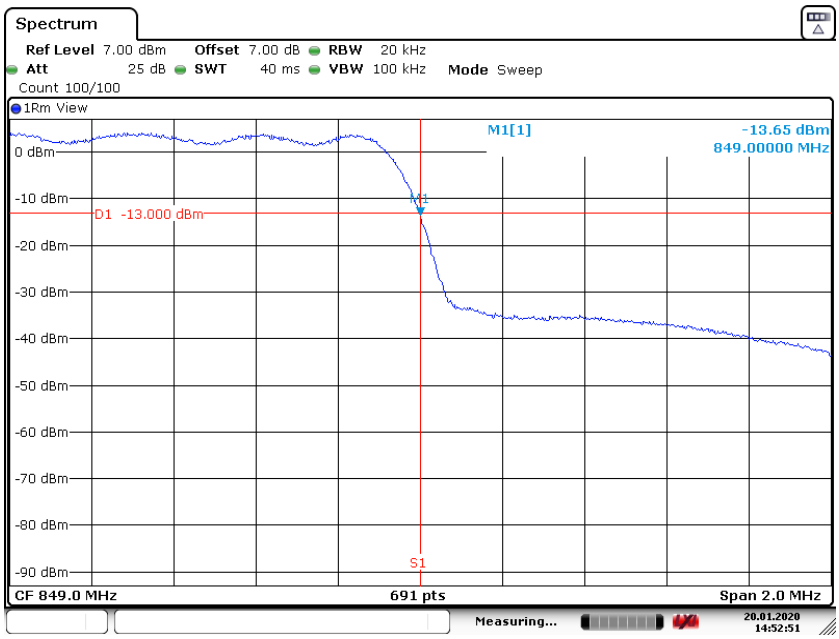
HIGH BAND EDGE BLOCK-Channel 777



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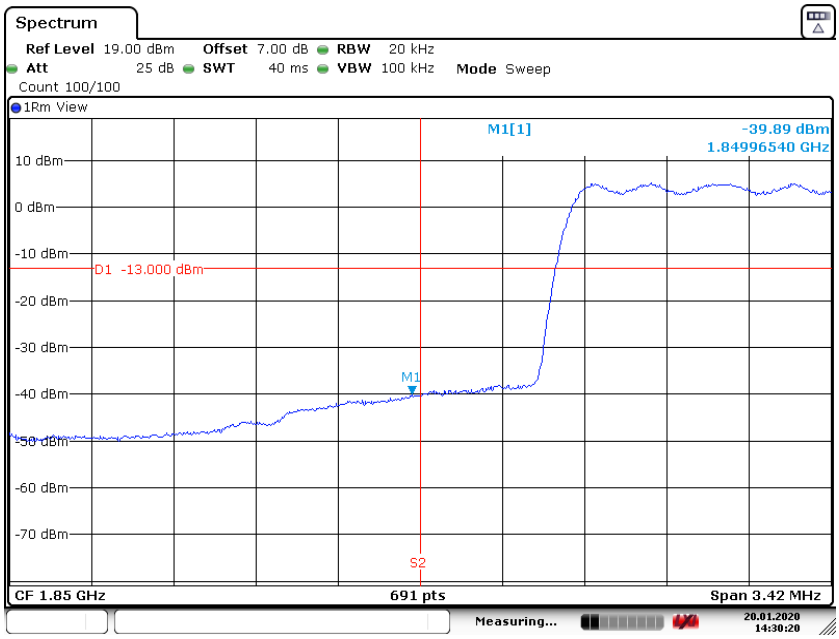
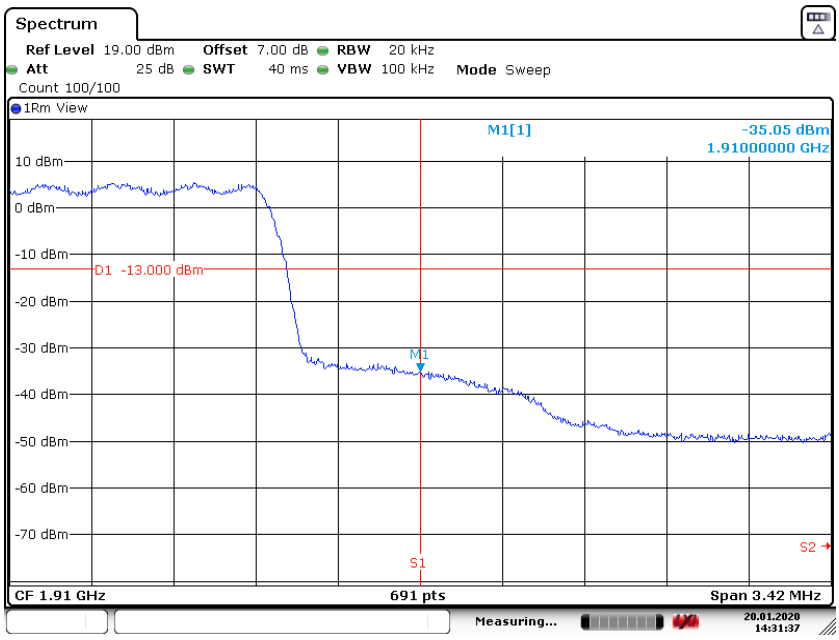
CDMA 1900

BAND EDGE BLOCK-Channel 25



Date: 20.JAN.2020 14:30:21

HIGH BAND EDGE BLOCK-Channel 1175



Date: 20.JAN.2020 14:31:37

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A.6 CONDUCTED SPURIOUS EMISSION

A.6.1 Measurement Method

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 25 GHz.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.
3. According to KDB 971168 v02r01 6.0, the applicable rule part specifies the reference bandwidth for measuring unwanted emission levels (typically, 100 kHz if the authorized frequency band/block is at or below 1 GHz and 1 MHz if the authorized frequency band/block is above 1 GHz)

CDMA 800 Transmitter

Channel	Frequency (MHz)
1013	824.70
384	836.52
777	848.31

CDMA 1900 Transmitter

Channel	Frequency (MHz)
25	1851.25
600	1880.00
1175	1908.75

A.6.2 Measurement Limit

Part 24.238 and Part 22.917 specify that 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.

The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

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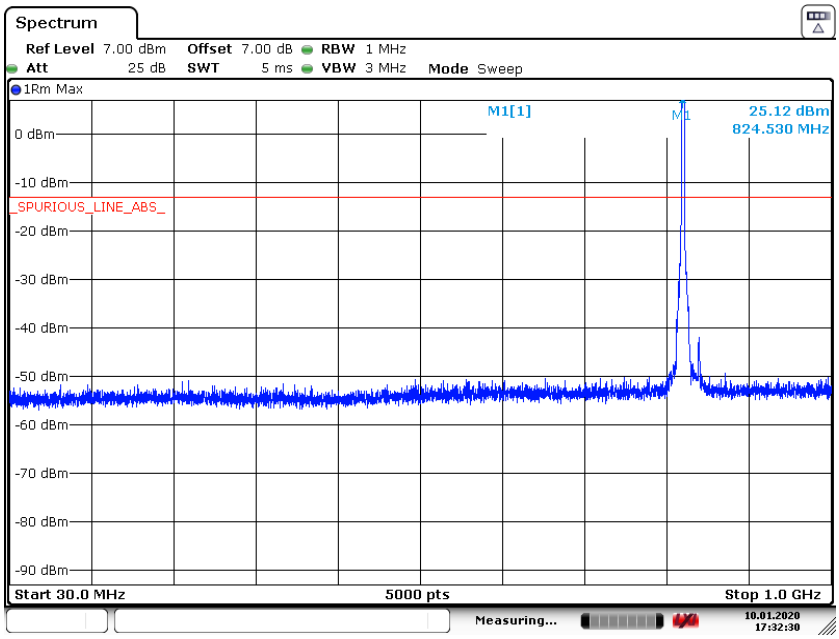
A.6.3 Measurement result

CDMA 800

Channel 1013: 30MHz –1GHz

Spurious emission limit –13dBm.

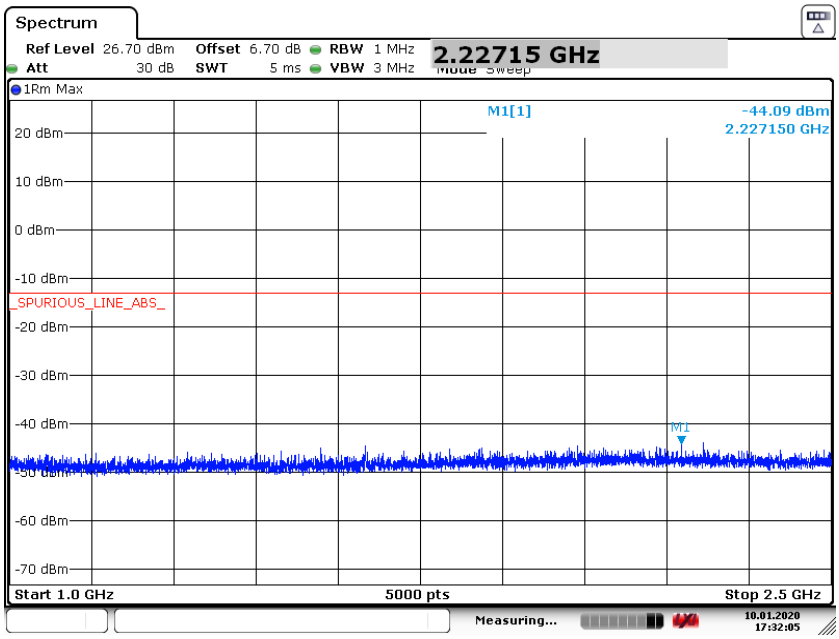
NOTE: peak above the limit line is the carrier frequency.



Date: 10.JAN.2020 17:32:30

Channel 1013: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



Date: 10.JAN.2020 17:32:05

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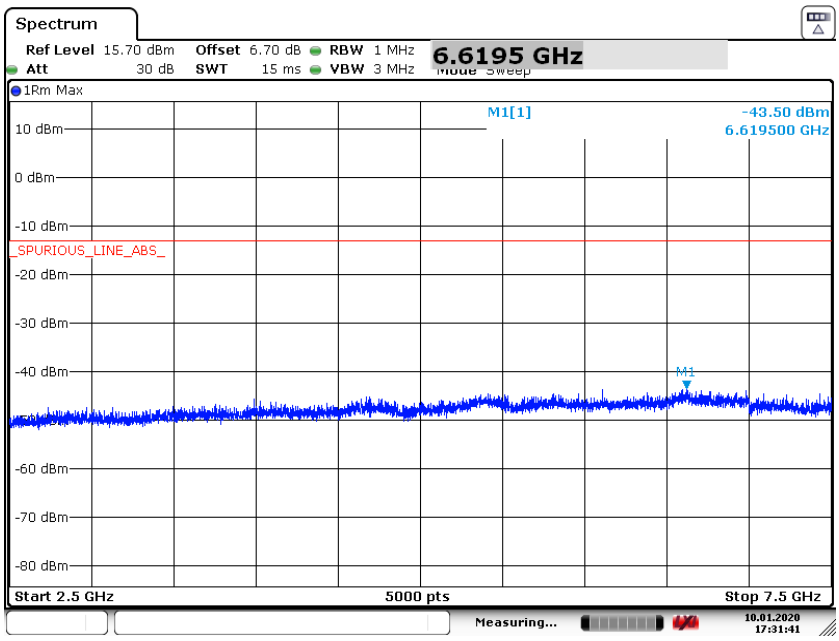
Channel 1013: 2.5GHz –7.5GHz

Spurious emission limit –13dBm.

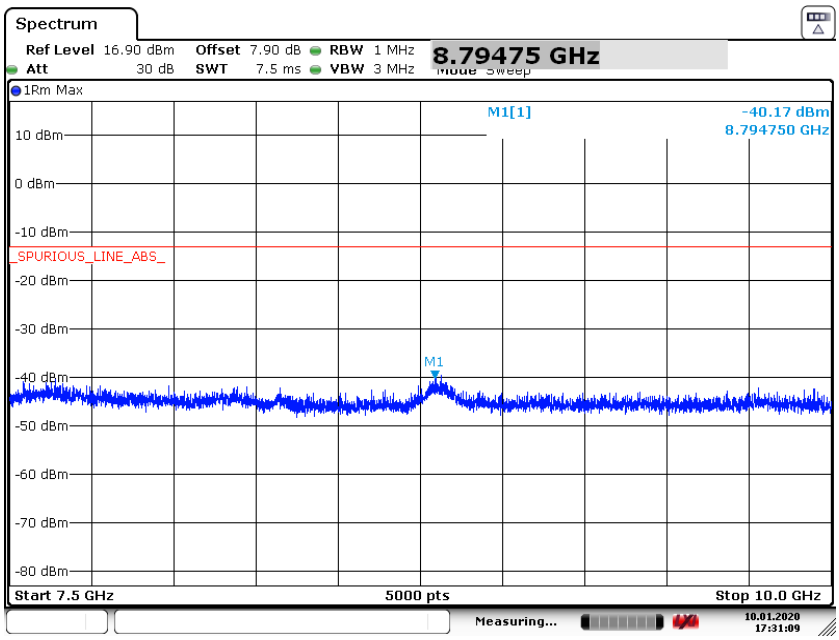
NOTE: peak above the limit line is the carrier frequency.



Date: 10.JAN.2020 17:31:42

Channel 1013: 7.5GHz – 10GHz

Spurious emission limit –13dBm.



Date: 10.JAN.2020 17:31:10

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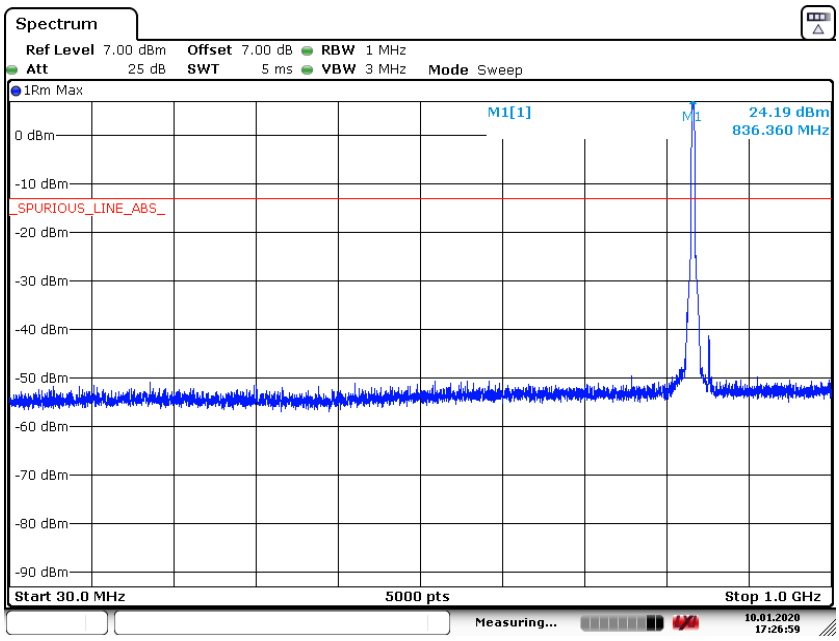
Channel 384: 30MHz –1GHz

Spurious emission limit –13dBm.

NOTE: peak above the limit line is the carrier frequency.



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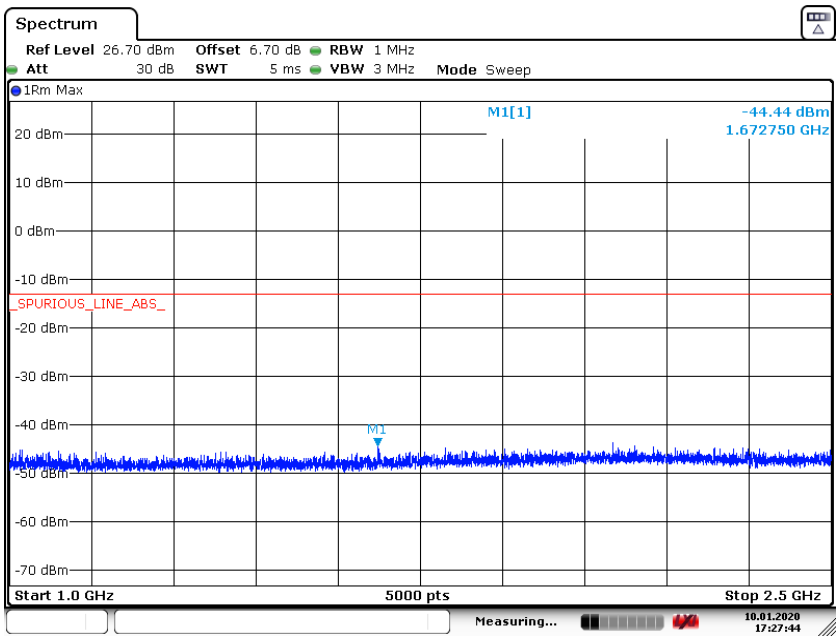
Channel 384: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



Date: 10.JAN.2020 17:27:44

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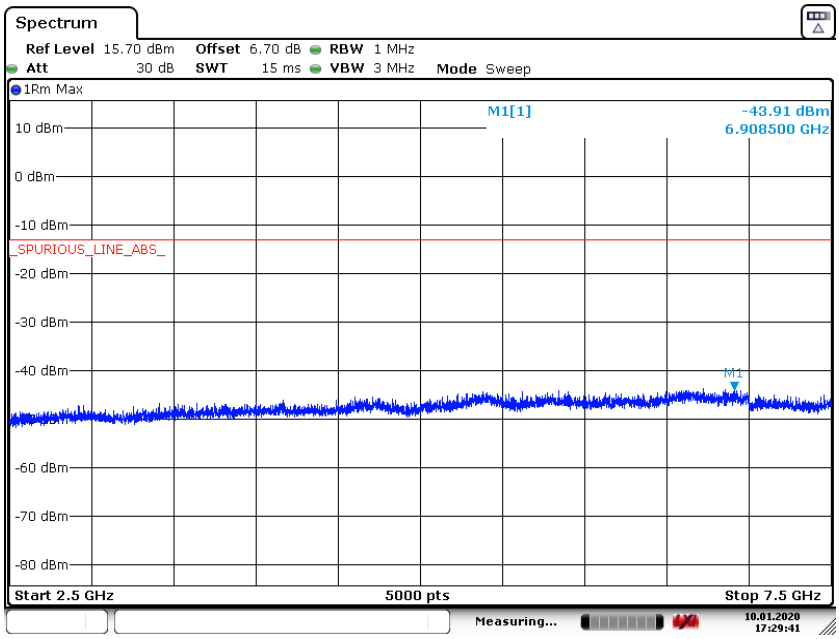
Channel 384: 2.5GHz –7.5GHz

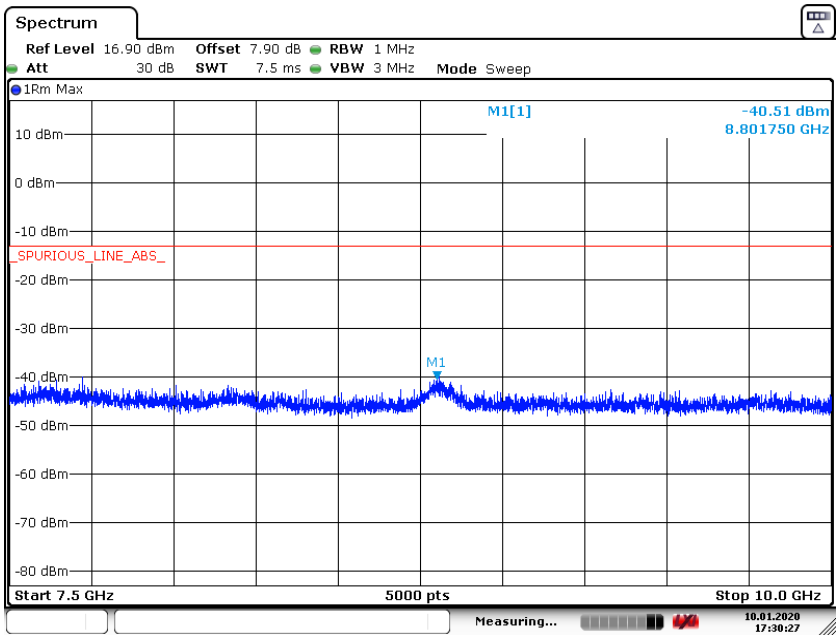
Spurious emission limit –13dBm.



Date: 10.JAN.2020 17:29:41

Channel 384: 7.5GHz – 10GHz

Spurious emission limit –13dBm.



Date: 10.JAN.2020 17:30:27

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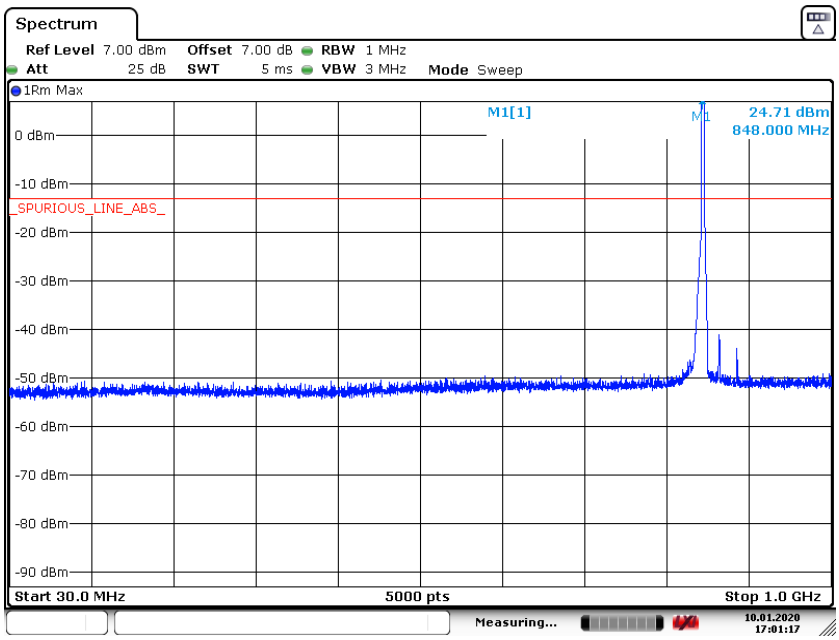
Channel 777: 30MHz –1GHz

Spurious emission limit –13dBm.

NOTE: peak above the limit line is the carrier frequency.



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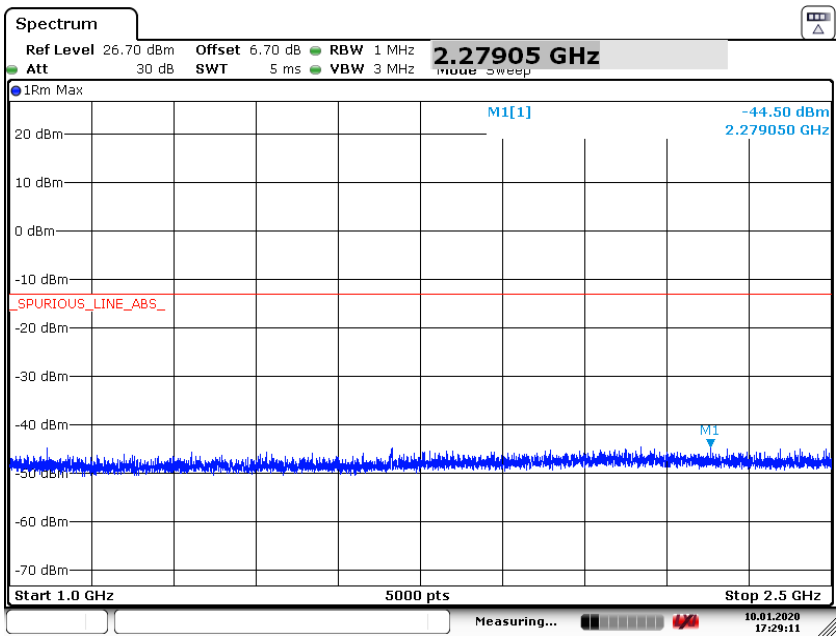
Channel 777: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



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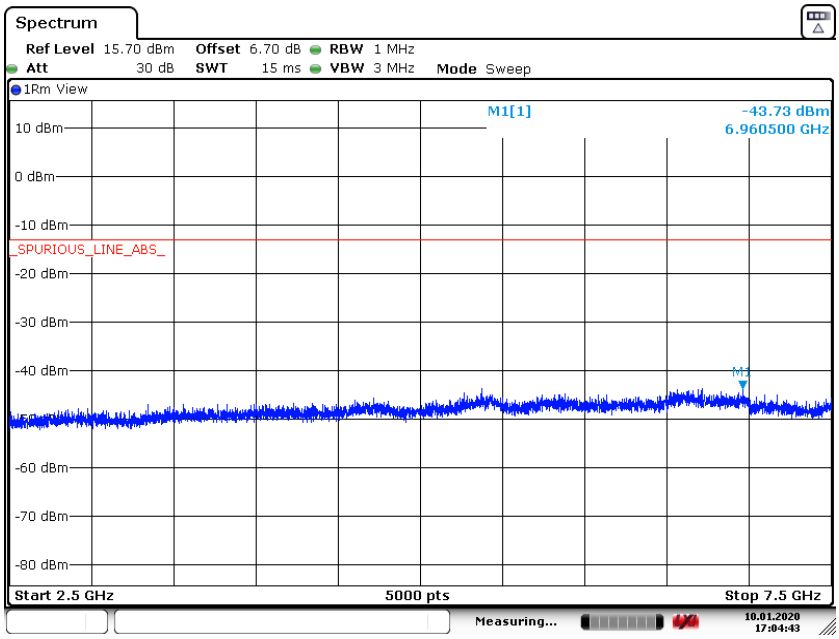
Channel 777: 2.5GHz –7.5GHz

Spurious emission limit –13dBm.



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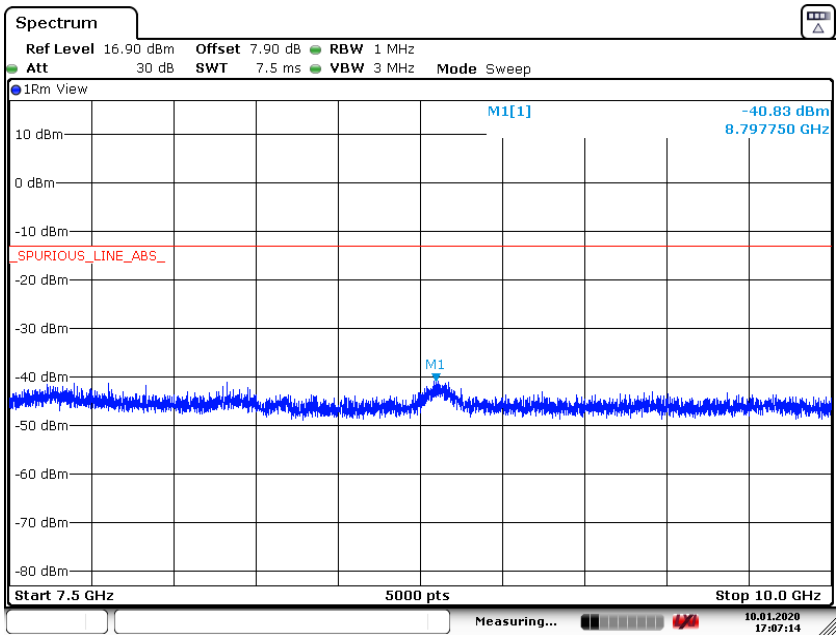
Channel 777: 7.5GHz – 10GHz

Spurious emission limit –13dBm.



Date: 10.JAN.2020 17:07:13

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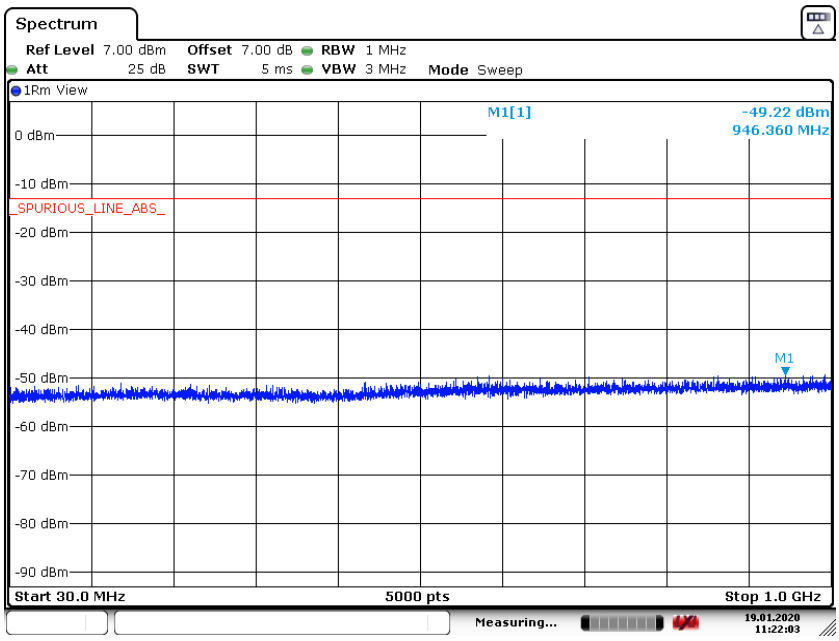
CDMA 1900

Channel 25: 30MHz –1GHz

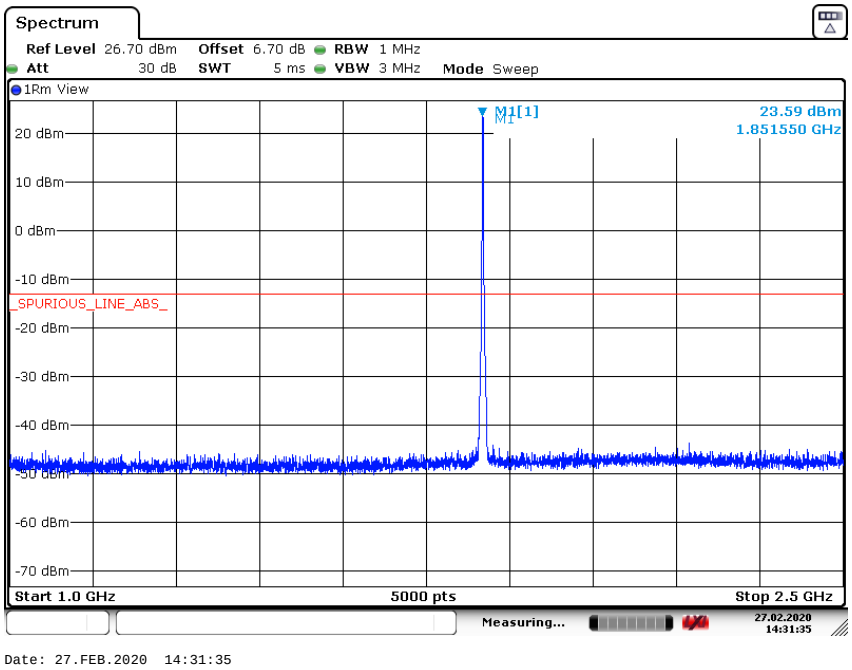
Spurious emission limit –13dBm.



Channel 25: 1GHz –2.5GHz

Spurious emission limit –13dBm.

NOTE: peak above the limit line is the carrier frequency.



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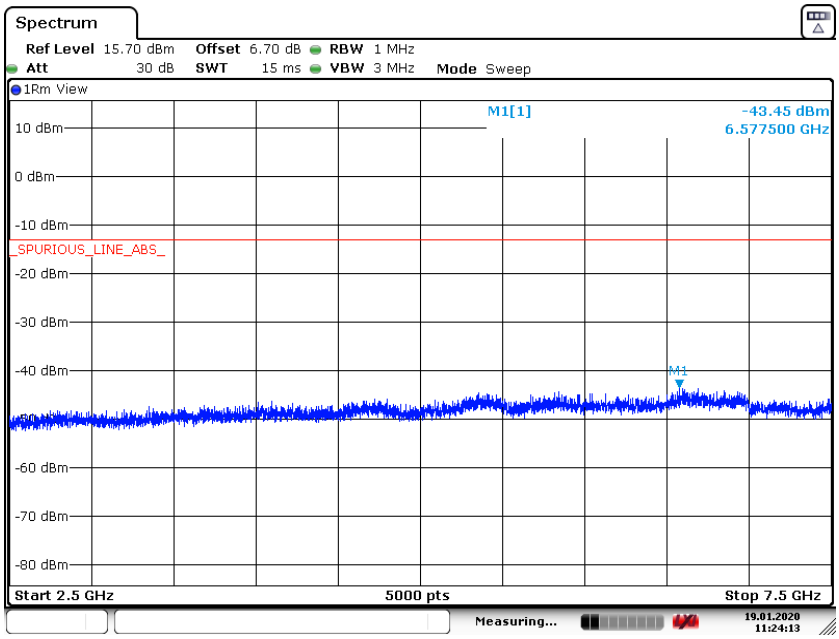
Channel 25: 2.5GHz –7.5GHz

Spurious emission limit –13dBm.



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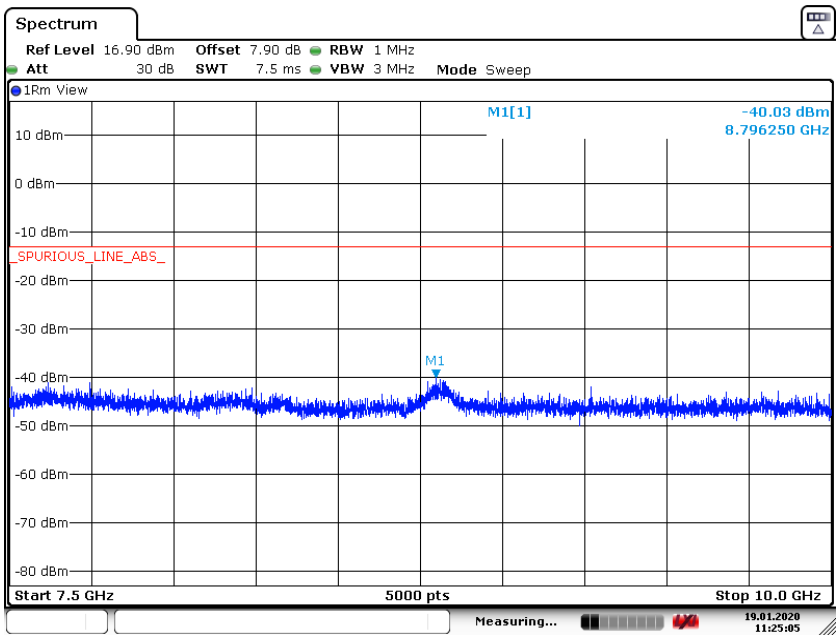
Channel 25: 7.5GHz –10GHz

Spurious emission limit –13dBm.



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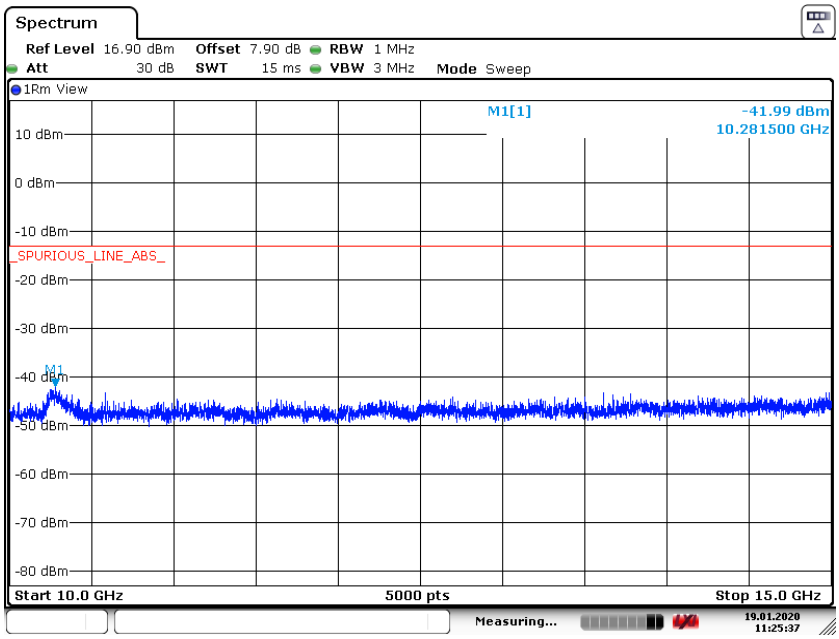
Channel 25: 10GHz –15GHz

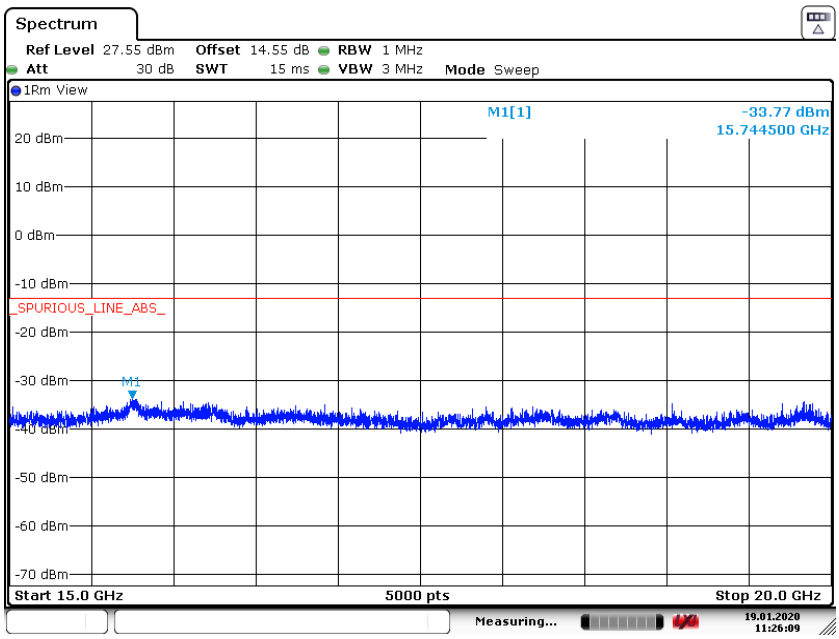
Spurious emission limit –13dBm.



Date: 19.JAN.2020 11:25:38

Channel 25: 15GHz –20GHz

Spurious emission limit –13dBm.



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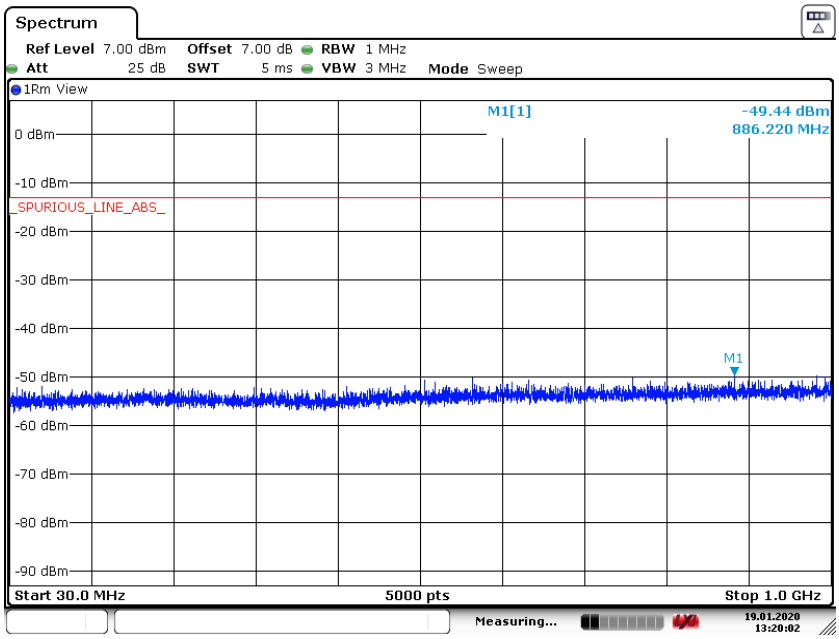
Channel 600: 30MHz –1GHz

Spurious emission limit –13dBm.



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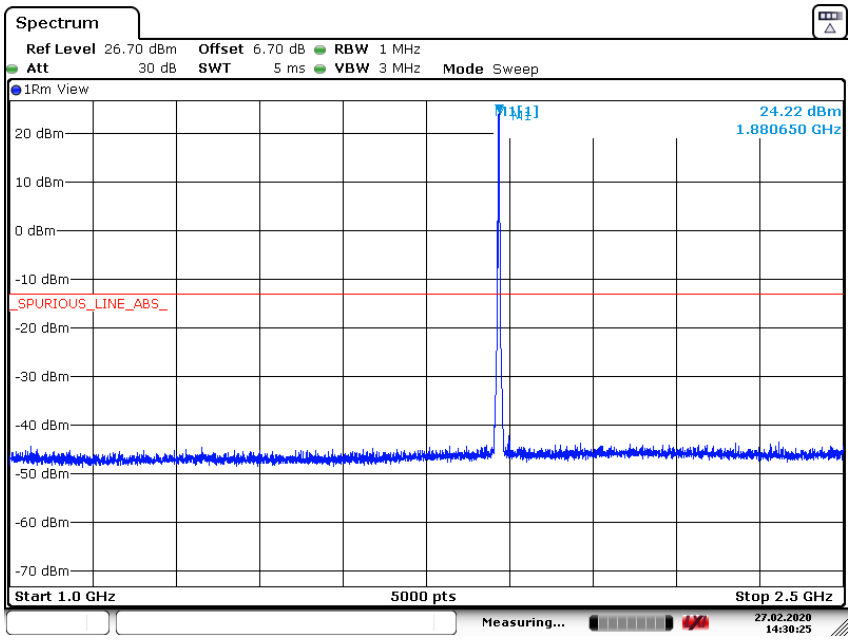
Channel 600: 1GHz –2.5GHz

Spurious emission limit –13dBm.

NOTE: peak above the limit line is the carrier frequency.



Date: 27.FEB.2020 14:30:24

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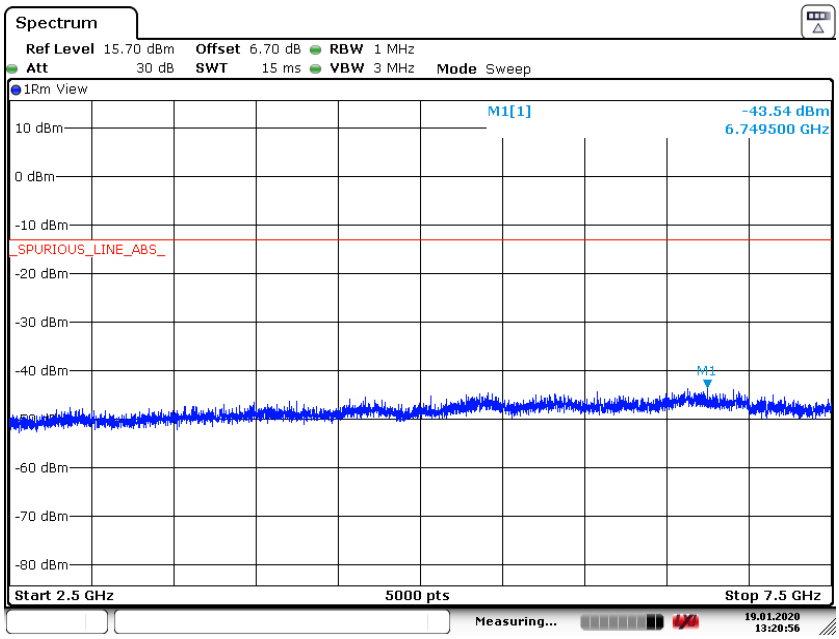
Channel 600: 2.5GHz –7.5GHz

Spurious emission limit –13dBm.



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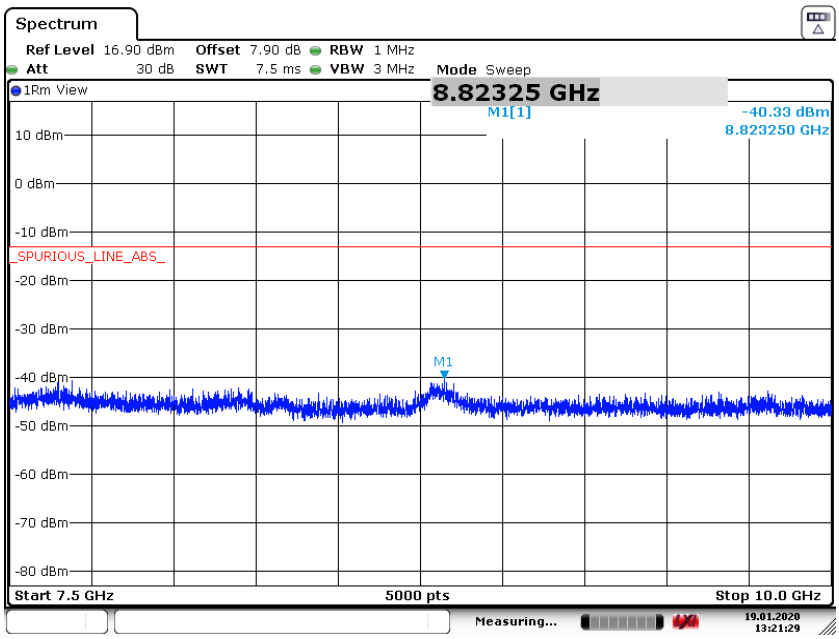
Channel 600: 7.5GHz –10GHz

Spurious emission limit –13dBm.



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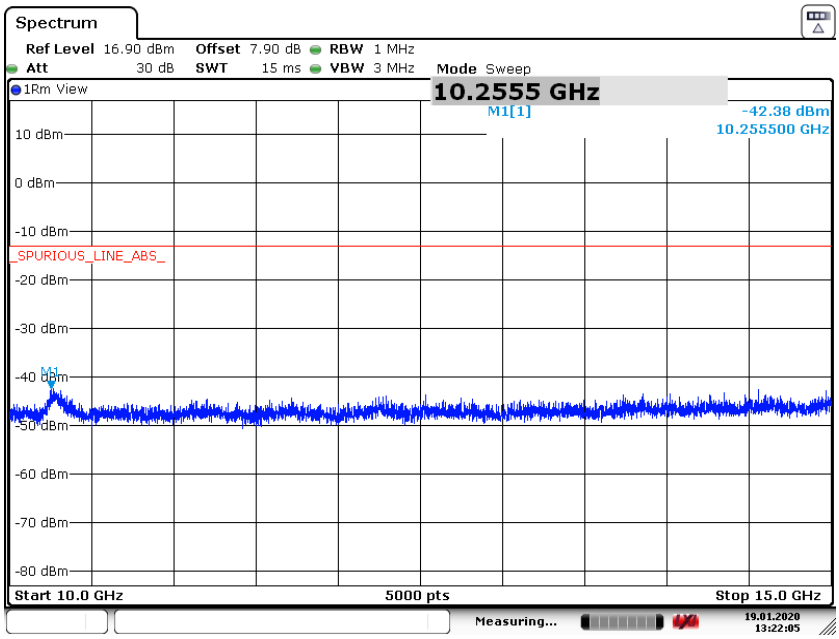
Channel 600: 10GHz –15GHz

Spurious emission limit –13dBm.



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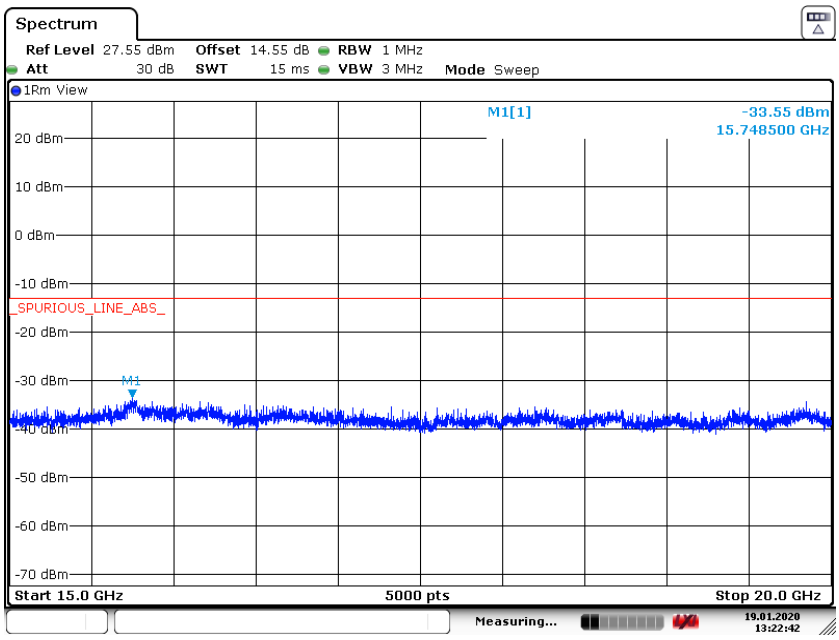
Channel 600: 15GHz –20GHz

Spurious emission limit –13dBm.



Date: 19.JAN.2020 13:22:42

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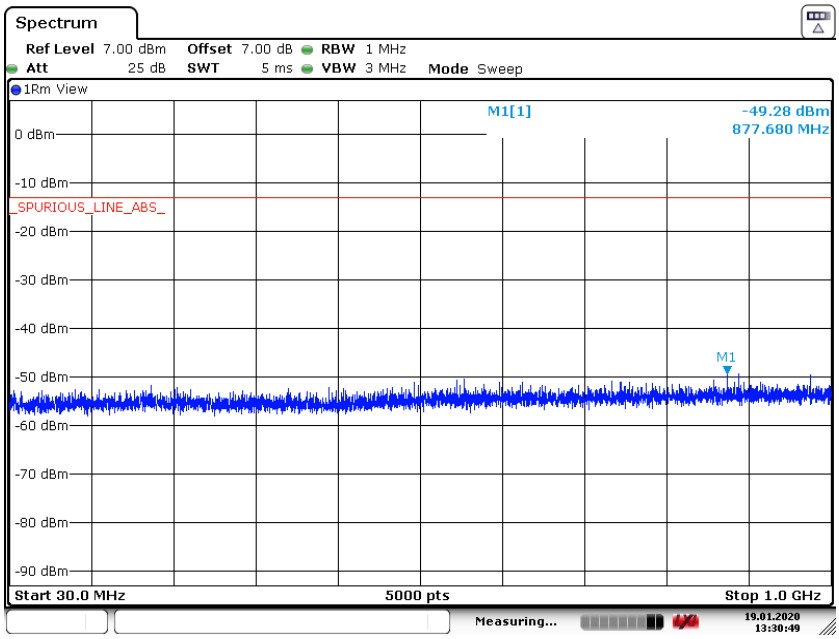
Channel 1175: 30MHz –1GHz

Spurious emission limit –13dBm.

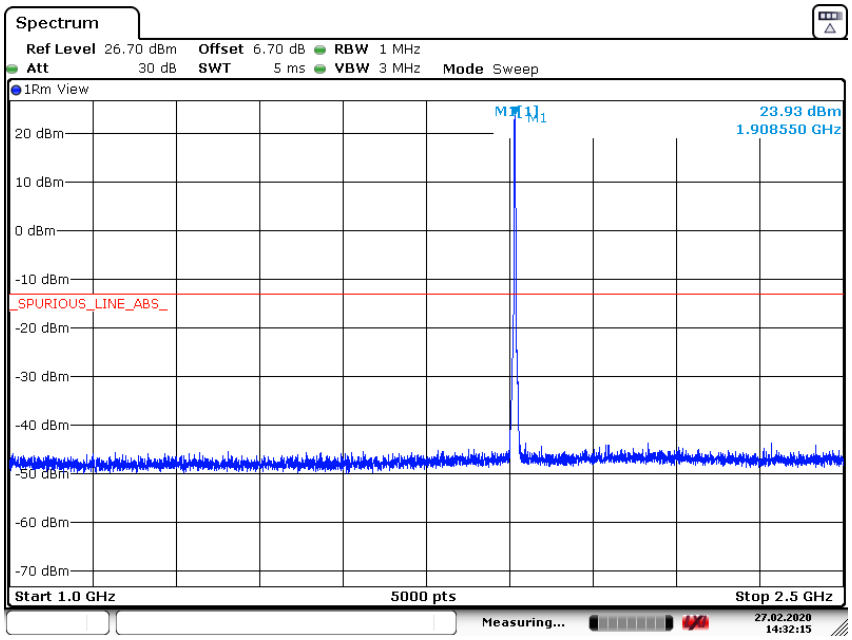


Date: 19.JAN.2020 13:30:48

Channel 1175: 1GHz –2.5GHz

Spurious emission limit –13dBm.

NOTE: peak above the limit line is the carrier frequency.



Date: 27.FEB.2020 14:32:15

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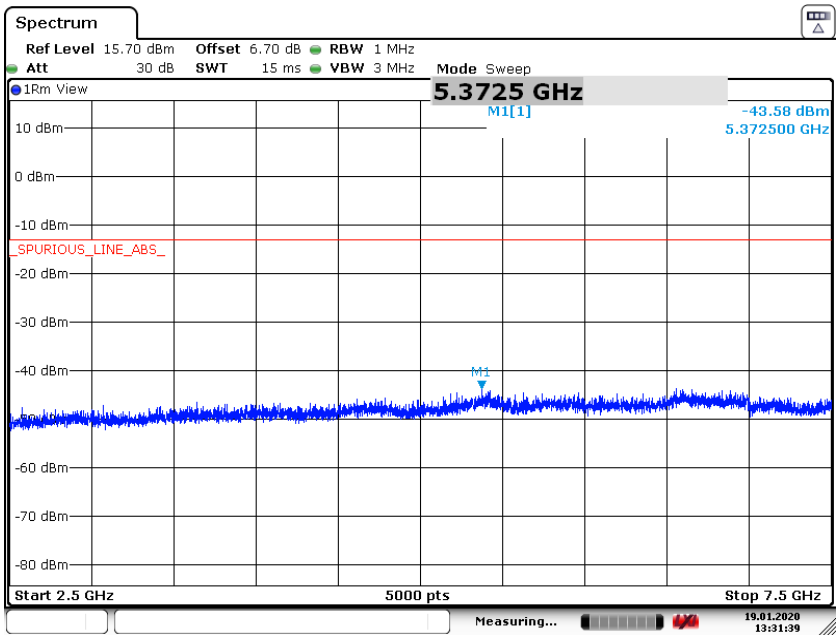
Channel 1175: 2.5GHz –7.5GHz

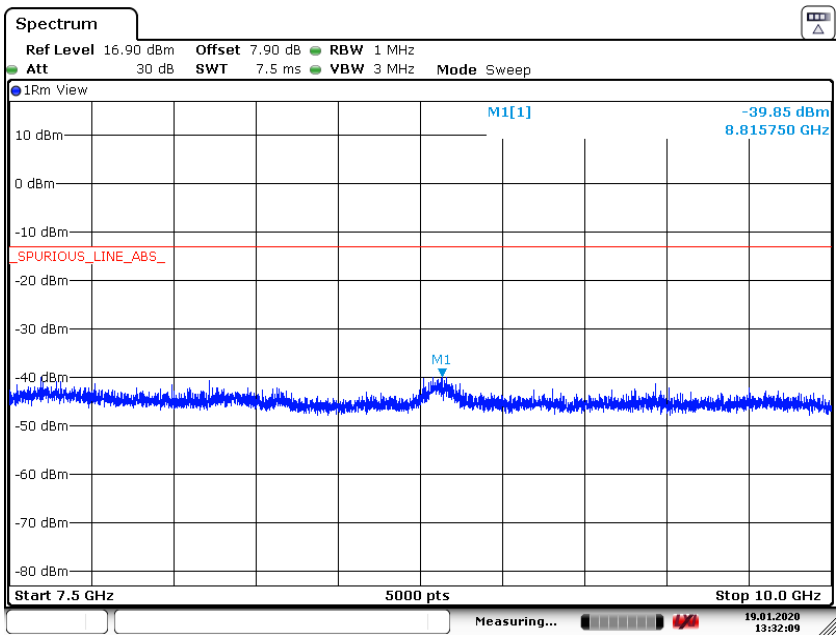
Spurious emission limit –13dBm.



Date: 19.JAN.2020 13:31:39

Channel 1175: 7.5GHz –10GHz

Spurious emission limit –13dBm.



Date: 19.JAN.2020 13:32:10

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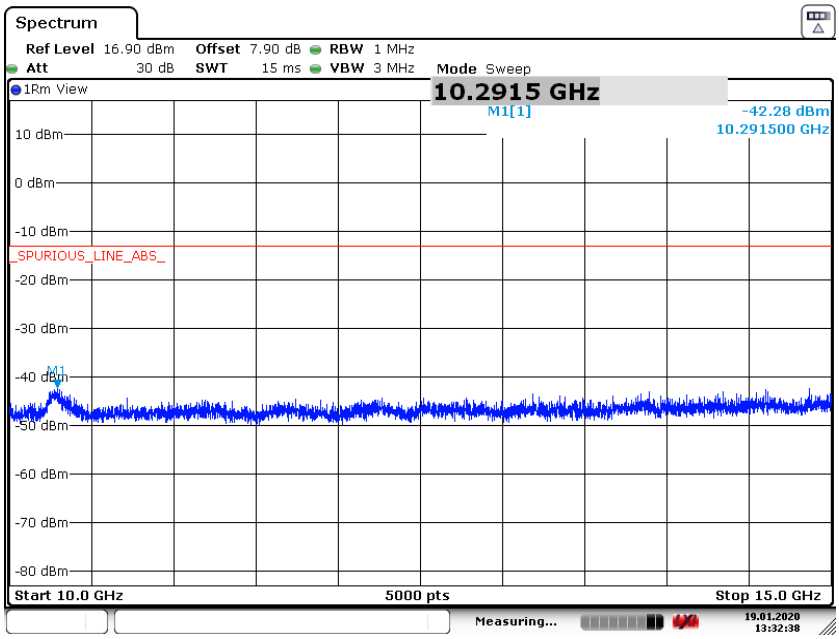
Channel 1175: 10GHz –15GHz

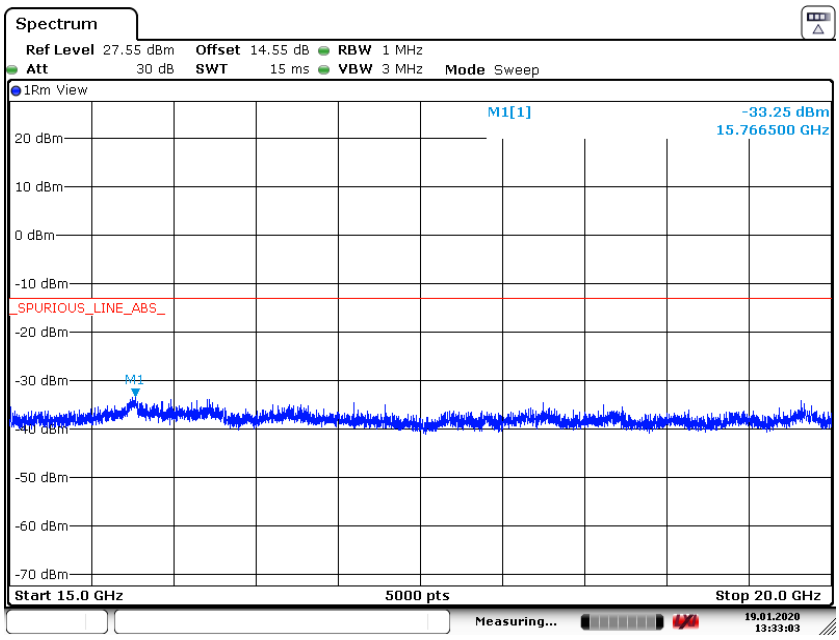
Spurious emission limit –13dBm.



Date: 19.JAN.2020 13:32:38

Channel 1175: 15GHz –20GHz

Spurious emission limit –13dBm.



Date: 19.JAN.2020 13:33:04

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A.7 PEAK-TO-AVERAGE POWER RATIO

Reference

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

a)Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;

b) Set resolution/measurement bandwidth ⩾ signal' s occupied bandwidth;

c) Set the number of counts to a value that stabilizes the measured CCDF curve;

d) Set the measurement interval to 1 ms

e)Record the maximum PAPR level associated with a probability of 0.1%

A.7.1 Measurement limit

not exceed 13 dB

A.7.2 Measurement results

CDMA 1900

Measurement result

Channel	Frequency(MHz)	PAPR(dB)		
		1x RTT	1xEVDO	
			Rel0	RevA
600	1880.00	3.42	4.35	4.29

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ANNEX B: Accreditation Certificate

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2019-09-26 through 2020-09-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

*****END OF REPORT*****

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