



2.5 BAND EDGE

2.5.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 24, Clause 24.238(a)(b)
FCC 47 CFR Part 27, Clause 27.53(h)(1)(3)
FCC 47 CFR Part 27, Clause 27.53(c)(2)(5)
RSS-133, Clause 6.5
RSS-139, Clause 6.6
RSS-130, Clause 4.6

2.5.2 Standard Applicable

FCC 47 CFR Part 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 megahertz or greater. However, in the 1 megahertz 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.

FCC 47 CFR Part 27.53:

(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB

(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.

(c)(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;

(c)(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

- (i) 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 $43 + 10 \log_{10} p(\text{watts})$.
- (ii) 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 $43 + 10 \log_{10} p(\text{watts})$. If the



measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS-139, Clause 6.6

- (i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.
- (ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.

RSS-130, Clause 4.6.1

The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

2.5.3 Equipment Under Test and Modification State

Serial No: AZ280418A00044 / Test Configuration A

2.5.4 Date of Test/Initial of test personnel who performed the test

July 03, 2018 / XYZ

2.5.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

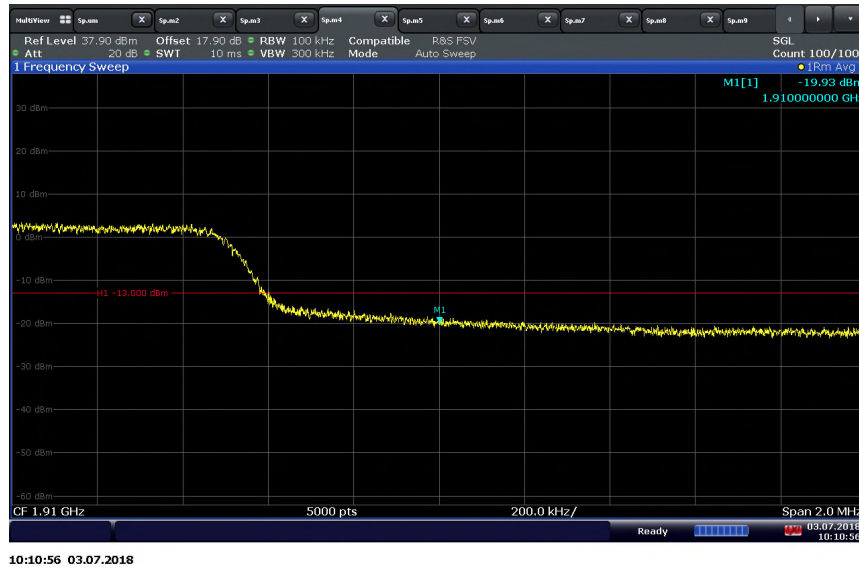
Ambient Temperature	25.8 °C
Relative Humidity	49.4 %
ATM Pressure	98.9 kPa

2.5.7 Additional Observations

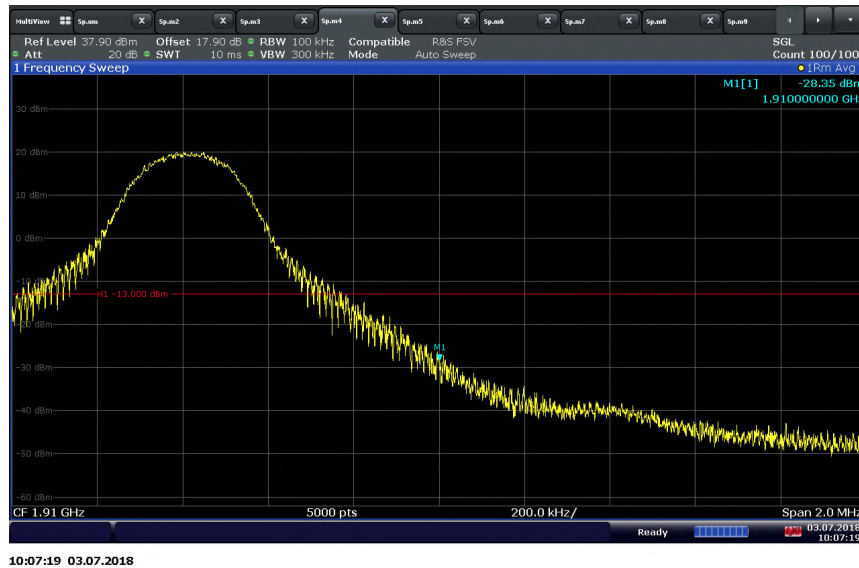
- This is a conducted test.
- The path loss were measured and entered as a level offset.
- RBW is set to at least 1% of emission bandwidth for Band 2, Band 4 and Band 66, and 30 kHz for Band 13. VBW is set to 3X RBW.
- For emissions more than 100 kHz (for Band 13) outside the equipment's operating frequency block, the limit is set to:
 $-13 + 10 \lg (RBW_{used}/1 \text{ MHz}) \text{ dBm}$.
- Only worst case configuration for all technologies presented in this test report.

2.5.8 Test Results

CA_2A-13A_10+10 MHz Bandwidth_PCC_Band 2_1905 MHz_Full RB_QPSK / High Edge



CA_2A-13A_10+10 MHz Bandwidth_PCC_Band 2_1905 MHz_1 RB_QPSK / High Edge

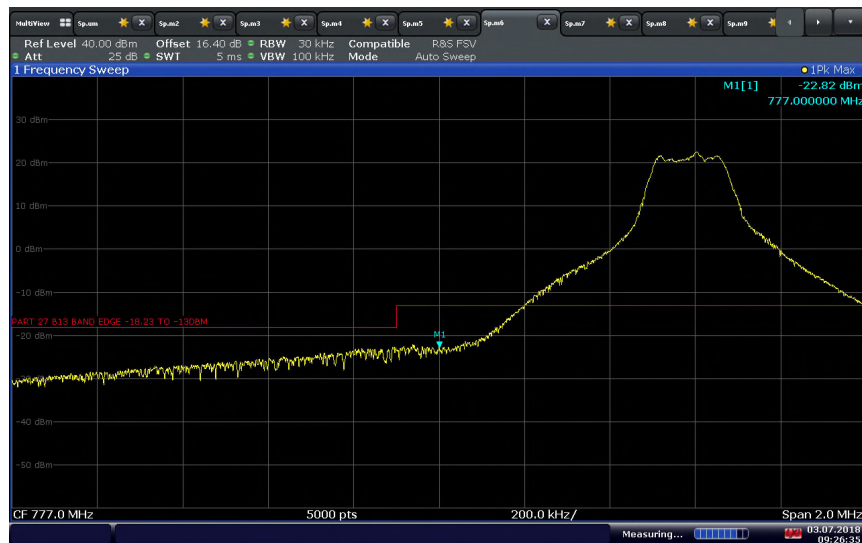


CA_2A-13A_10+10 MHz Bandwidth_SCC_Band 13_782 MHz_Full RB_QPSK / Low Edge



09:29:01 03.07.2018

CA_2A-13A_10+10 MHz Bandwidth_SCC_Band 13_782 MHz_1-0 RB_QPSK / Low Edge



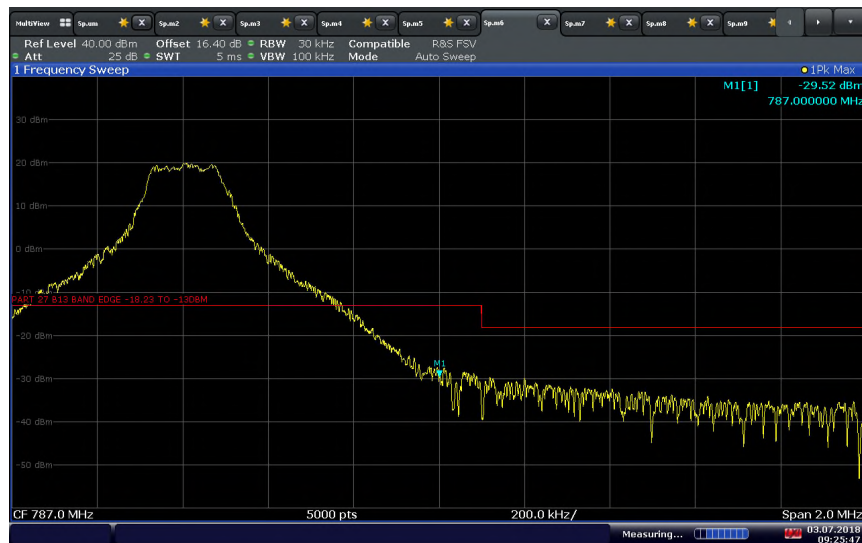
09:26:36 03.07.2018

CA_2A-13A_10+10 MHz Bandwidth_SCC_Band 13_782 MHz_Full RB_QPSK / High Edge



09:21:54 03.07.2018

CA_2A-13A_10+10 MHz Bandwidth_SCC_Band 13_782 MHz_1-49 RB_QPSK / High Edge

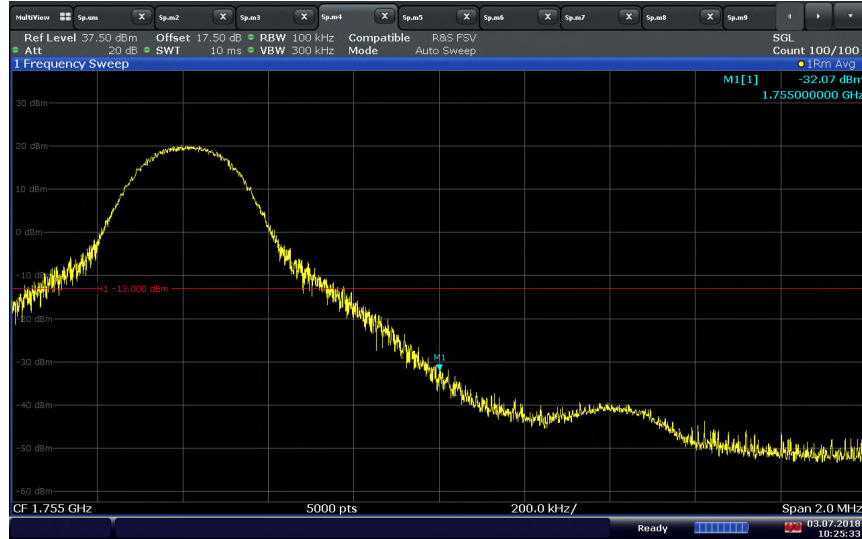


09:25:48 03.07.2018

CA_4A-13A_10+10 MHz Bandwidth_PCC_Band 4_1750 MHz_Full RB_QPSK / High Edge



CA_4A-13A_10+10 MHz Bandwidth_PCC_Band 4_1750 MHz_1-49 RB_QPSK / High Edge

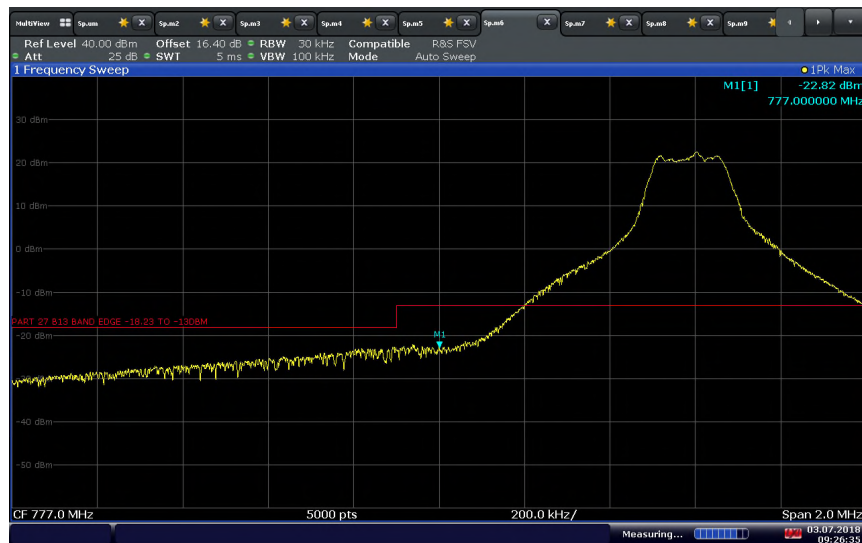


CA_4A-13A_10+10 MHz Bandwidth_SCC_Band 13_782 MHz_Full RB_QPSK / Low Edge



09:29:01 03.07.2018

CA_4A-13A_10+10 MHz Bandwidth_SCC_Band 13_782 MHz_1-0 RB_QPSK / Low Edge



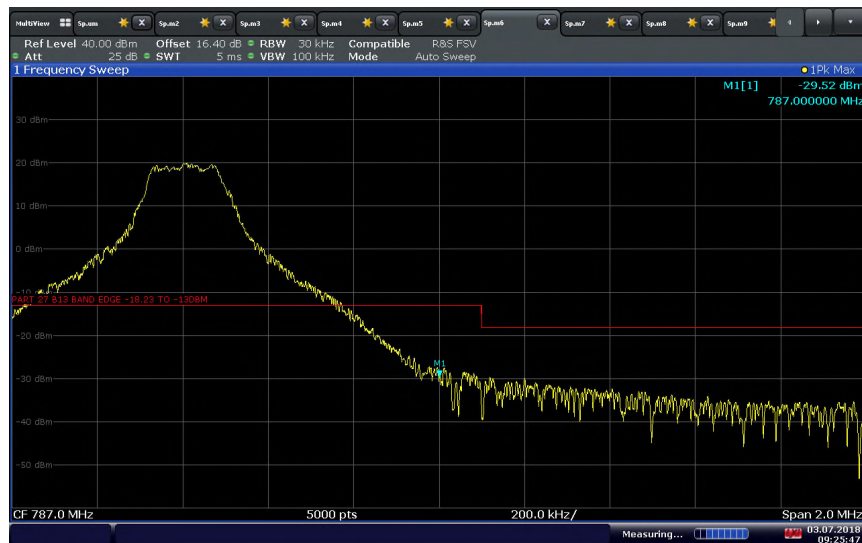
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CA_4A-13A_10+10 MHz Bandwidth_SCC_Band 13_782 MHz_Full RB_QPSK / High Edge



09:21:54 03.07.2018

CA_4A-13A_10+10 MHz Bandwidth_SCC_Band 13_782 MHz_1-49 RB_QPSK / High Edge



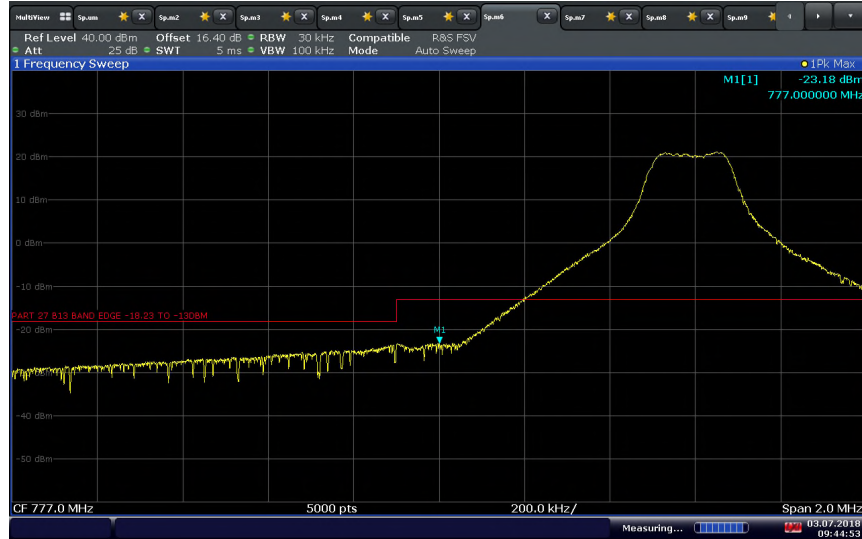
09:25:48 03.07.2018

CA_13A-66A_10+10 MHz Bandwidth_PCC_Band 13_782 MHz_Full RB_QPSK / Low Edge



09:47:09 03.07.2018

CA_13A-66A_10+10 MHz Bandwidth_PCC_Band 13_782 MHz_1-0 RB_QPSK / Low Edge



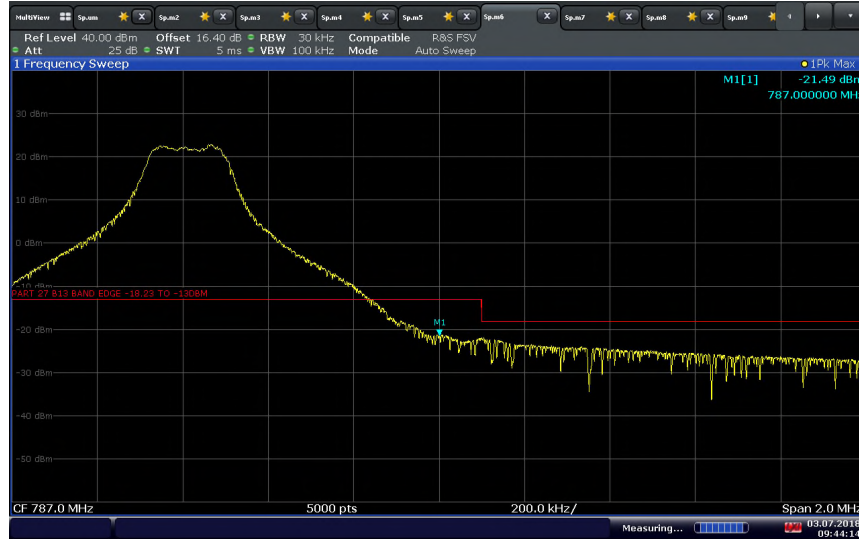
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CA_13A-66A_10+10 MHz Bandwidth_PCC_Band 13_782 MHz_Full RB_QPSK / High Edge



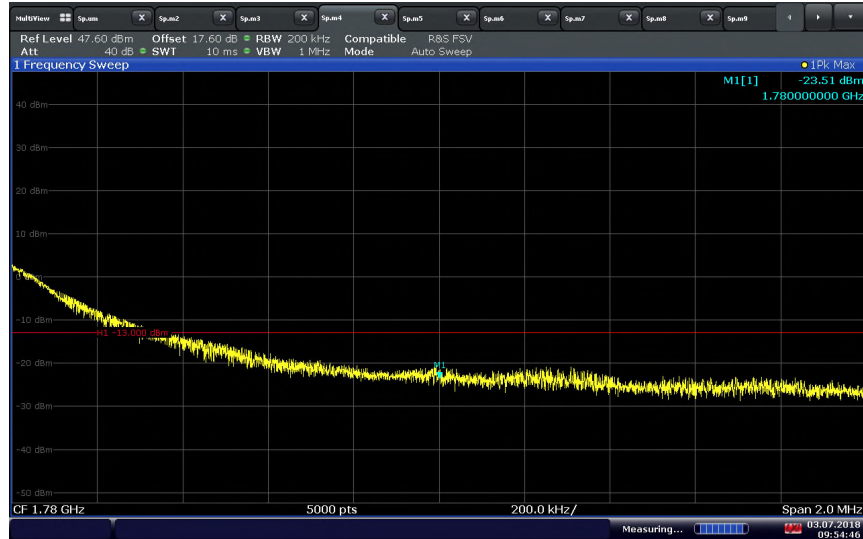
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CA_13A-66A_10+10 MHz Bandwidth_PCC_Band 13_782 MHz_1-49 RB_QPSK / High Edge



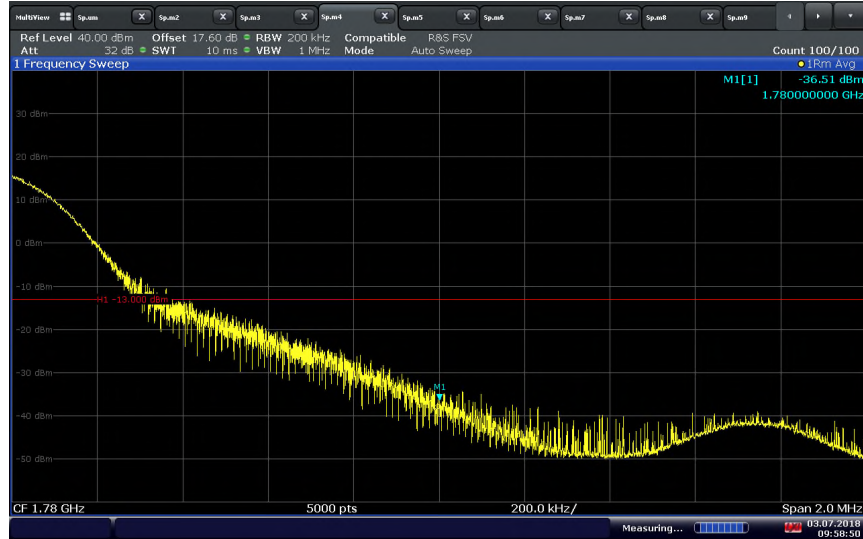
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CA_13A-66A_10+20 MHz Bandwidth_SCC_Band 66_1770 MHz_Full RB_QPSK / High Edge



09:54:47 03.07.2018

CA_13A-66A_10+20 MHz Bandwidth_SCC_Band 66_1770 MHz_1-99 RB_QPSK / High Edge



09:58:50 03.07.2018

2.6 CONDUCTED SPURIOUS EMISSIONS

2.6.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 22, Clause 22.917(b)
FCC 47 CFR Part 24, Clause 24.238(a)(b)
FCC 47 CFR Part 27, Clause 27.53(h)(1)(3)
FCC 47 CFR Part 27, Clause 27.53(m)(4)(6)
FCC 47 CFR Part 27, Clause 27.53(g)
FCC 47 CFR Part 27, Clause 27.53(c)(2)(4)(5)(f)
RSS-132, Clause 5.5
RSS-133, Clause 6.5
RSS-139, Clause 6.6
RSS-130, Clause 4.7
RSS-199, Clause 4.5

2.6.2 Standard Applicable

FCC 47 CFR Part 22.917(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.

FCC 47 CFR Part 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.

FCC 47 CFR Part 27.53:
(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\log_{10}(P)$ dB

FCC 47 CFR Part 27.53 (m):
(4) For mobile digital stations, the attenuation factor shall be not less than $40 + 10\log(P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10\log(P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10\log(P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section.
In addition, the attenuation factor shall not be less than $43 + 10\log(P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10\log(P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

FCC 47 CFR Part 27.53 (g):
For operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10\log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of



100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

(c)(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;

(c)(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-132, Clause 5.5:

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

- i. In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).
- ii. After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz 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 occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

- (i) 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).
- (ii) 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.

RSS-139, Clause 6.6

- (i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.
- (ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.



RSS-130, Clause 4.7

4.7.1 The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

4.7.2 In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

a. the power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

- i. $76 + 10 \log_{10} p$ (watts), dB, for base and fixed equipment and
- ii. $65 + 10 \log_{10} p$ (watts), dB, for mobile and portable equipment
- b. the e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and -80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-199, Clause 4.5

For mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:

- i. $40 + 10 \log_{10} p$ from the channel edges to 5 MHz away
- ii. $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and
- iii. $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges

In addition, the attenuation shall not be less than $43 + 10 \log_{10} p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log_{10} p$ at or below 2490.5 MHz.

2.6.3 Equipment Under Test and Modification State

Serial No: AZ280418A00044 / Test Configuration A

2.6.4 Date of Test/Initial of test personnel who performed the test

July 02, 2018, October 22 and 23, 2019/ ZXY

2.6.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.



2.6.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

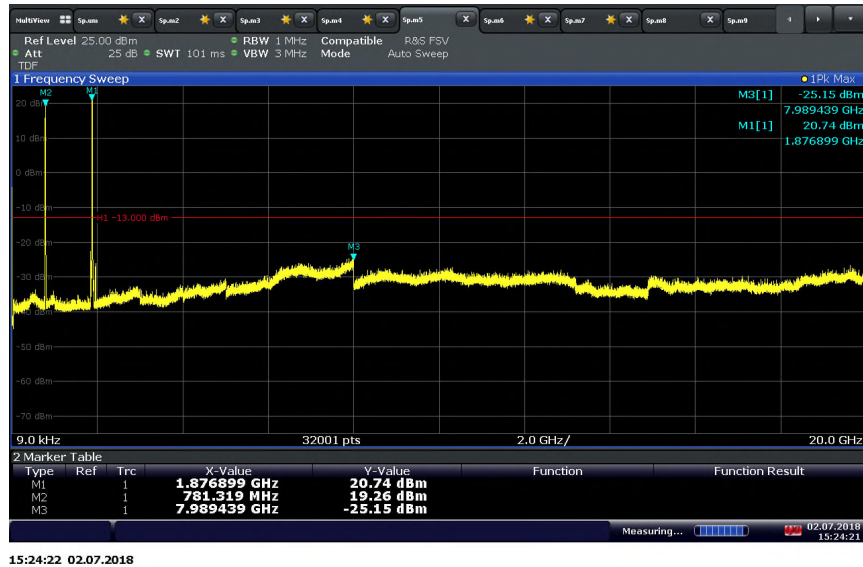
Ambient Temperature	25.1 - 25.5°C
Relative Humidity	25.8 - 52.1 %
ATM Pressure	98.8 - 99.0 kPa

2.6.7 Additional Observations

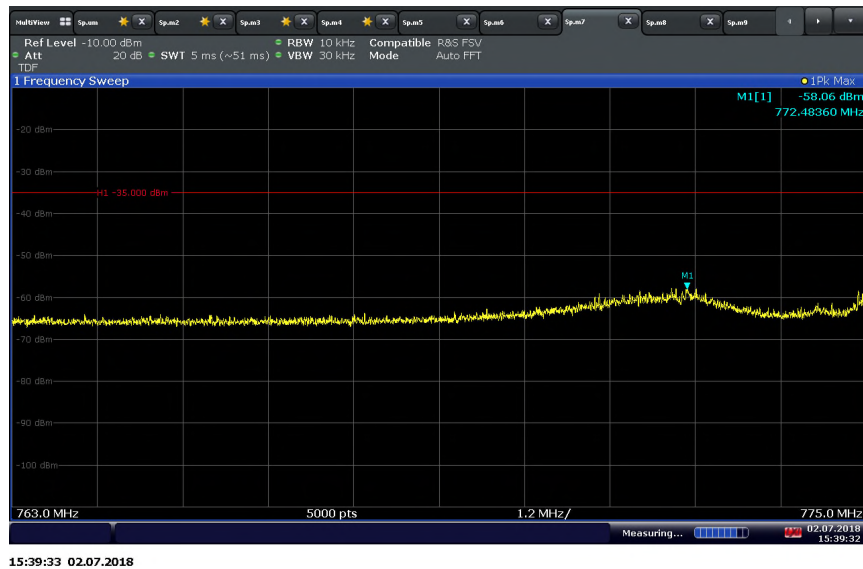
- This is a conducted test.
- The spectrum was searched from 9 kHz to the 10th harmonic.
- The path loss was measured and entered as a transducer factor (TDF).
- Low, Middle and High channels on all channel bandwidth and modulation are verified. Only worst case configuration for all technologies presented in this test report.

2.6.8 Test Results

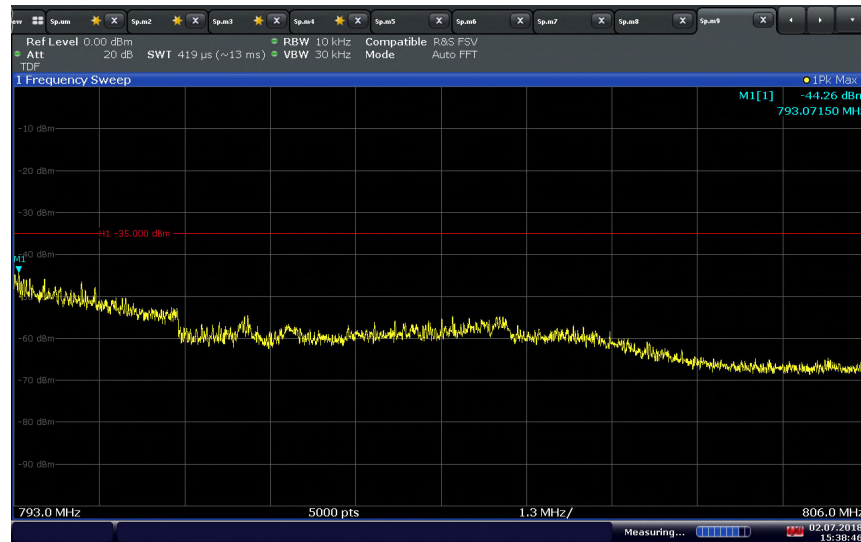
CA_2A-13A_10+10 MHz Bandwidth_1880 MHz & 782 MHz_Full RB_QPSK / Conducted Spurious Emissions



CA_2A-13A_10+10 MHz Bandwidth_1880 MHz & 782 MHz_Full RB_QPSK / Conducted Spurious Emissions (763-775 MHz)

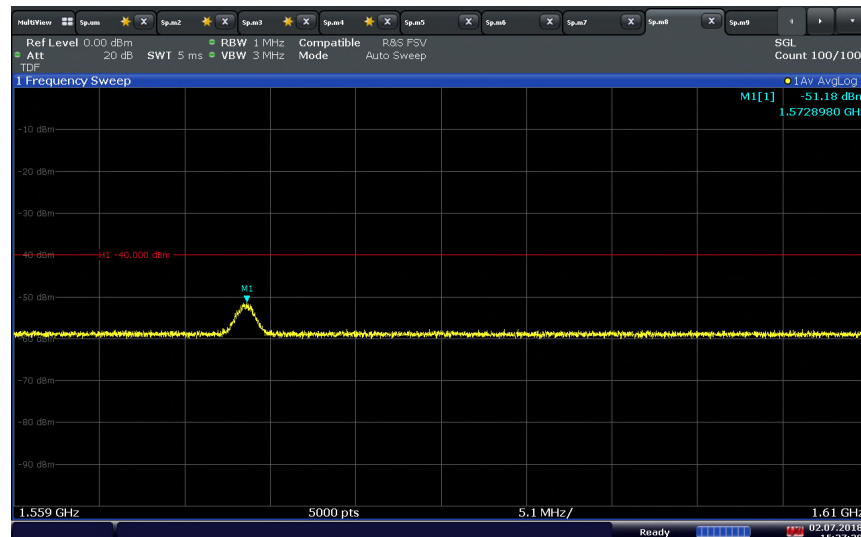


CA_2A-13A_10+10 MHz Bandwidth_1880 MHz & 782 MHz_ Full RB_QPSK / Conducted Spurious Emissions (793-806 MHz)



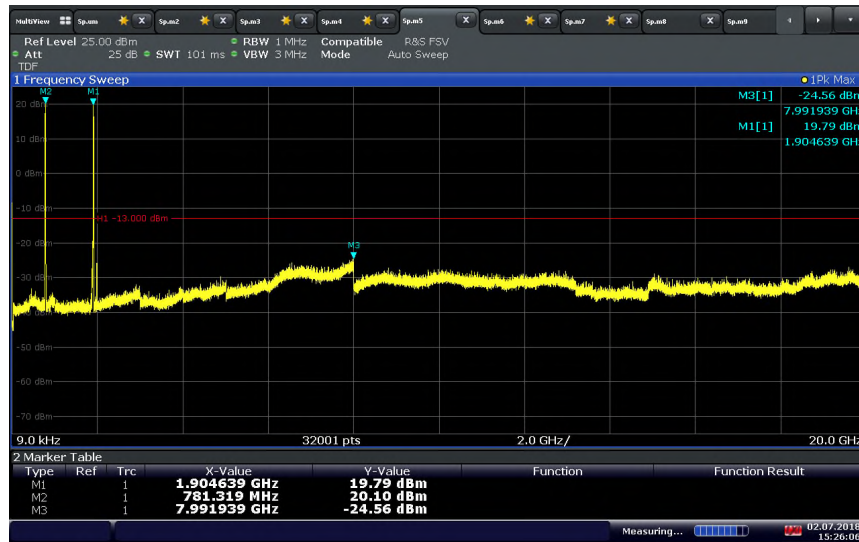
15:38:46 02.07.2018

CA_2A-13A_10+10 MHz Bandwidth_1880 MHz & 782 MHz_ 1 RB_QPSK / Conducted Spurious Emissions (1559-1610 MHz)



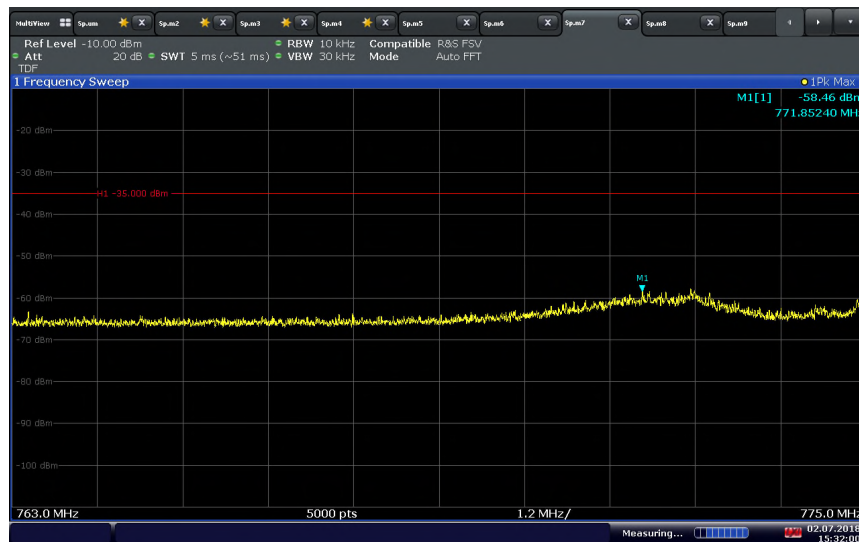
15:37:40 02.07.2018

CA_2A-13A_10+10 MHz Bandwidth_1905 MHz & 782 MHz_ Full RB_QPSK / Conducted Spurious Emissions



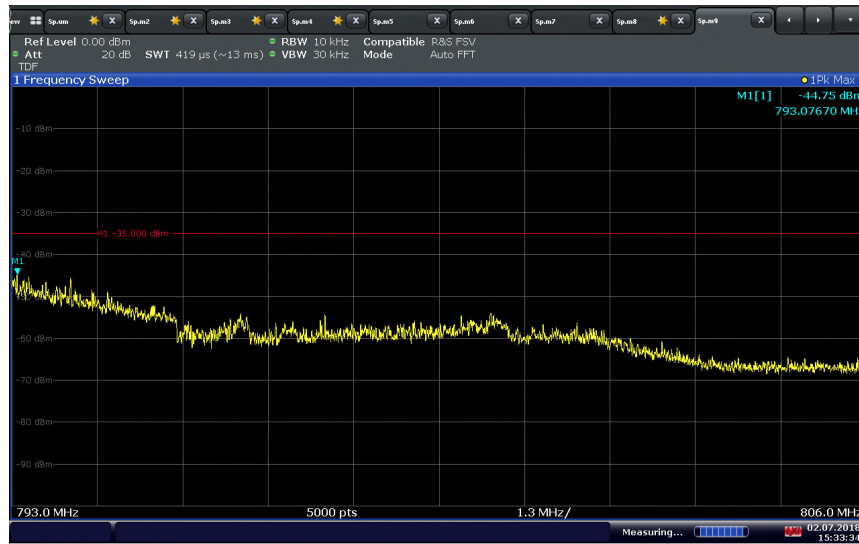
15:26:07 02.07.2018

CA_2A-13A_10+10 MHz Bandwidth_1905 MHz & 782 MHz_ Full RB_QPSK / Conducted Spurious Emissions (763-775 MHz)



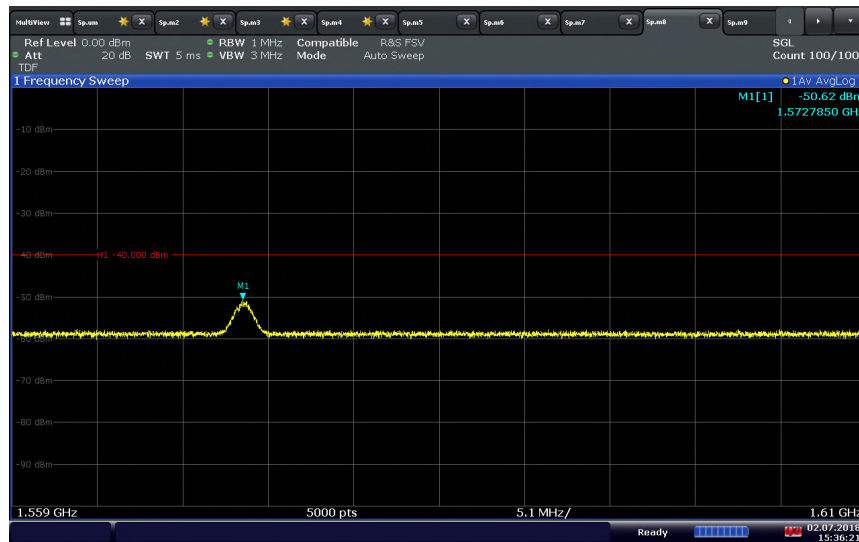
15:32:01 02.07.2018

CA_2A-13A_10+10 MHz Bandwidth_1905 MHz & 782 MHz_ Full RB_QPSK / Conducted Spurious Emissions (793-806 MHz)



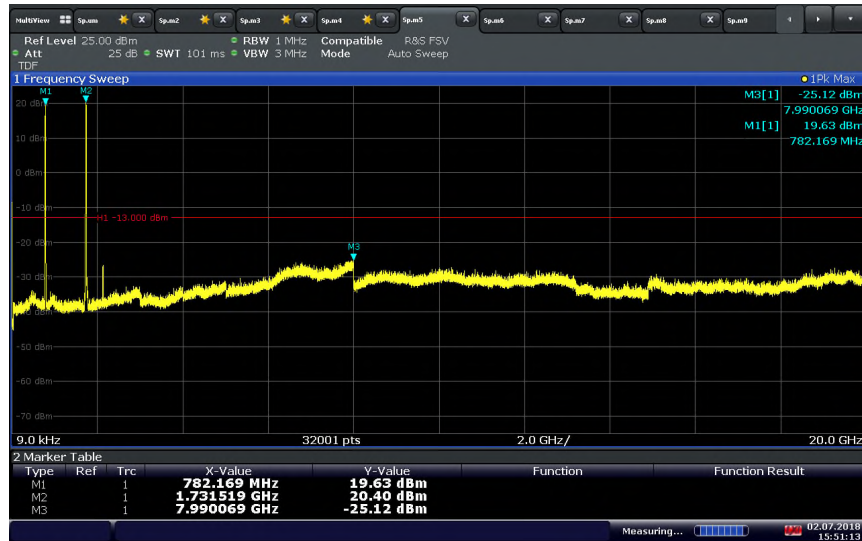
15:33:35 02.07.2018

CA_2A-13A_10+10 MHz Bandwidth_1905 MHz & 782 MHz_ 1 RB_QPSK / Conducted Spurious Emissions (1559-1610 MHz)



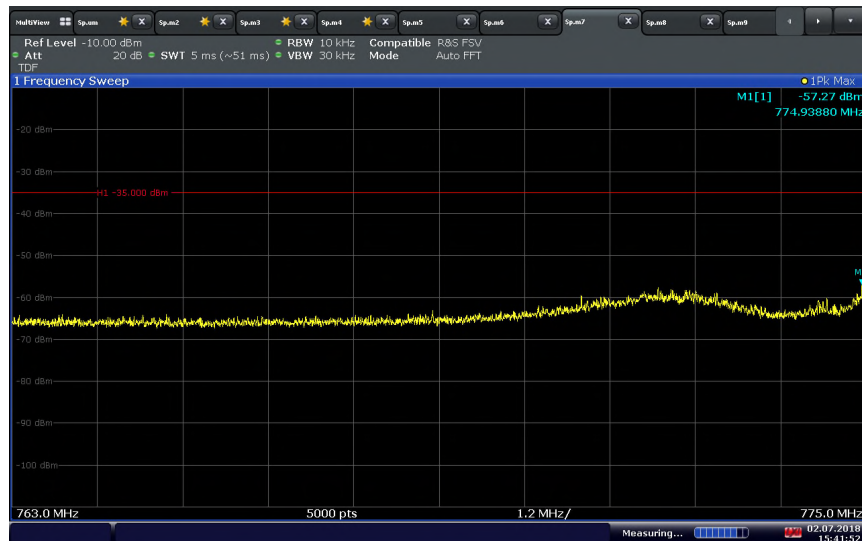
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CA_4A-13A_10+10 MHz Bandwidth_1732.5 MHz & 782 MHz_Full RB_QPSK / Conducted Spurious Emissions



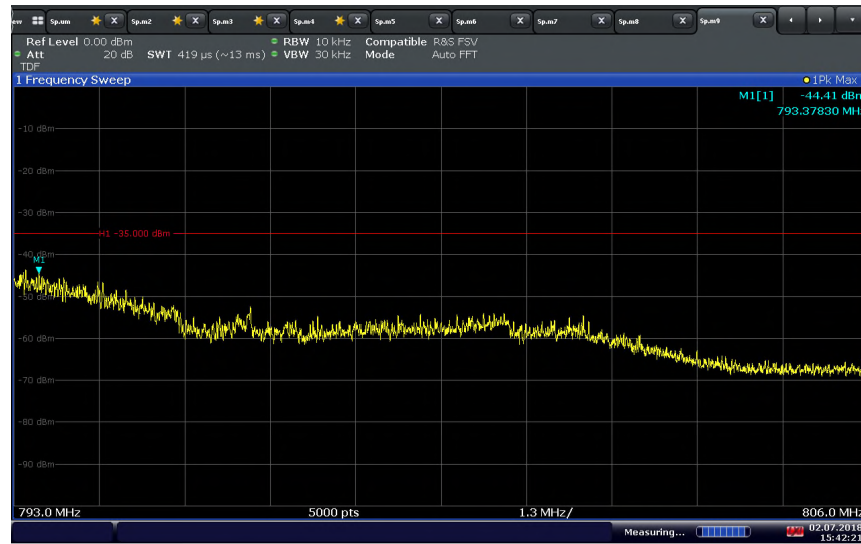
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CA_4A-13A_10+10 MHz Bandwidth_1732.5 MHz & 782 MHz_Full RB_QPSK / Conducted Spurious Emissions (763-775 MHz)



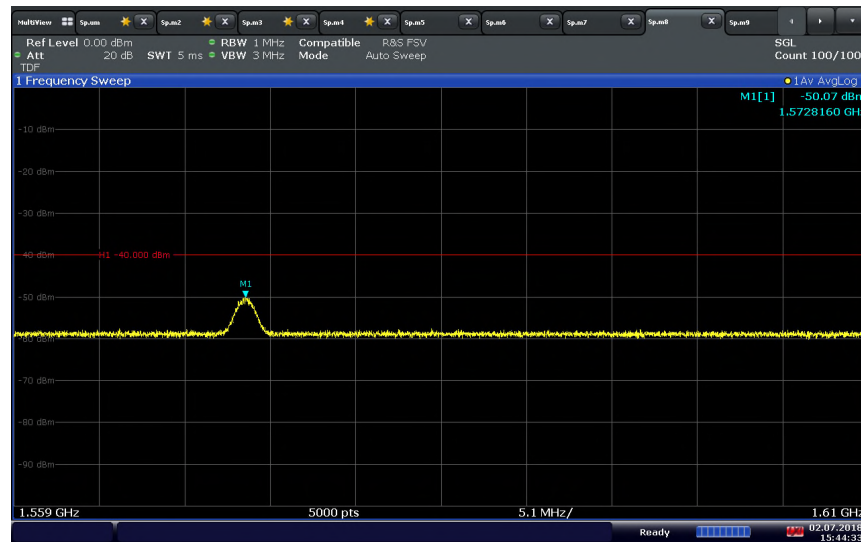
15:41:53 02.07.2018

CA_4A-13A_10+10 MHz Bandwidth_1732.5 MHz & 782 MHz_ Full RB_QPSK / Conducted Spurious Emissions (793-806 MHz)



15:42:21 02.07.2018

CA_4A-13A_10+10 MHz Bandwidth_1732.5 MHz & 782 MHz_1 RB_QPSK / Conducted Spurious Emissions (1559-1610 MHz)



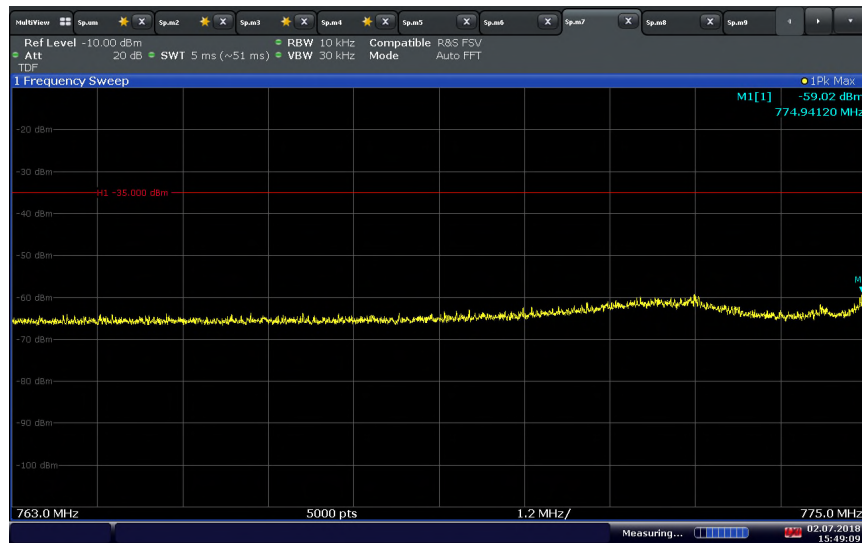
15:44:33 02.07.2018

CA_4A-13A_10+10 MHz Bandwidth_1750 MHz & 782 MHz_Full RB_QPSK / Conducted Spurious Emissions



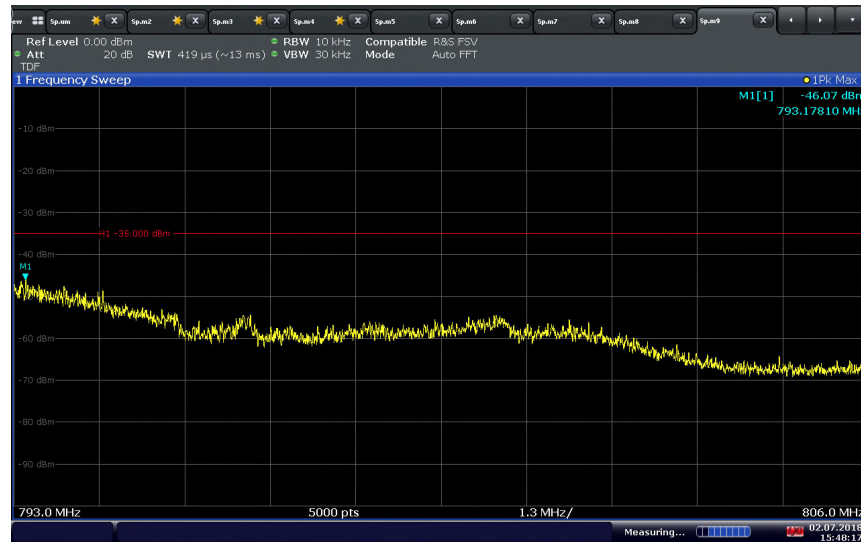
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CA_4A-13A_10+10 MHz Bandwidth_1750 MHz & 782 MHz_Full RB_QPSK / Conducted Spurious Emissions (763-775 MHz)



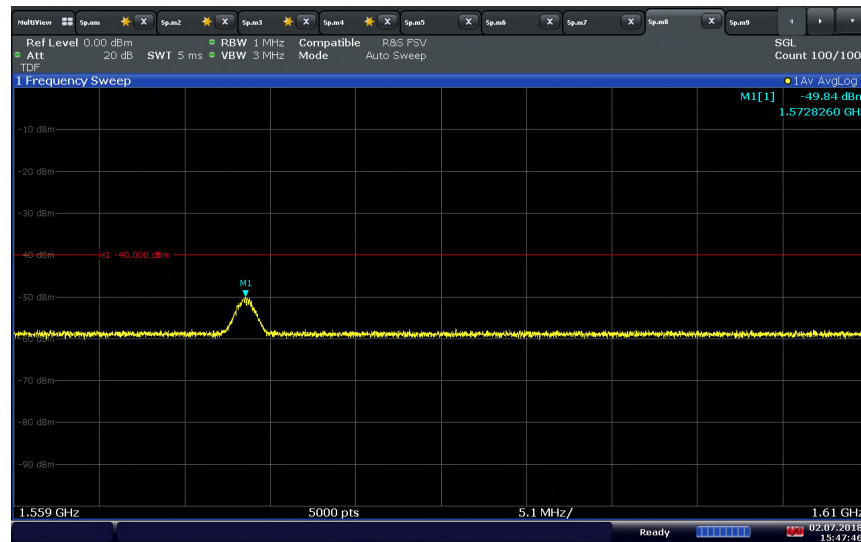
15:49:10 02.07.2018

CA_4A-13A_10+10 MHz Bandwidth_1750 MHz & 782 MHz_Full RB_QPSK / Conducted Spurious Emissions (793-806 MHz)



15:48:17 02.07.2018

CA_4A-13A_10+10 MHz Bandwidth_1750 MHz & 782 MHz_1 RB_QPSK / Conducted Spurious Emissions (1559-1610 MHz)



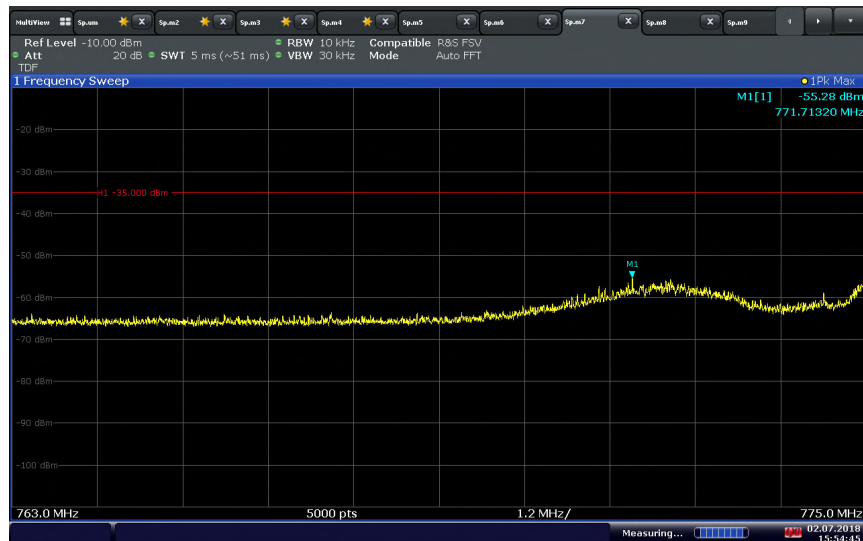
15:47:46 02.07.2018

CA_13A-66A_10+20 MHz Bandwidth_782 MHz & 1755 MHz_Full RB_QPSK / Conducted Spurious Emissions



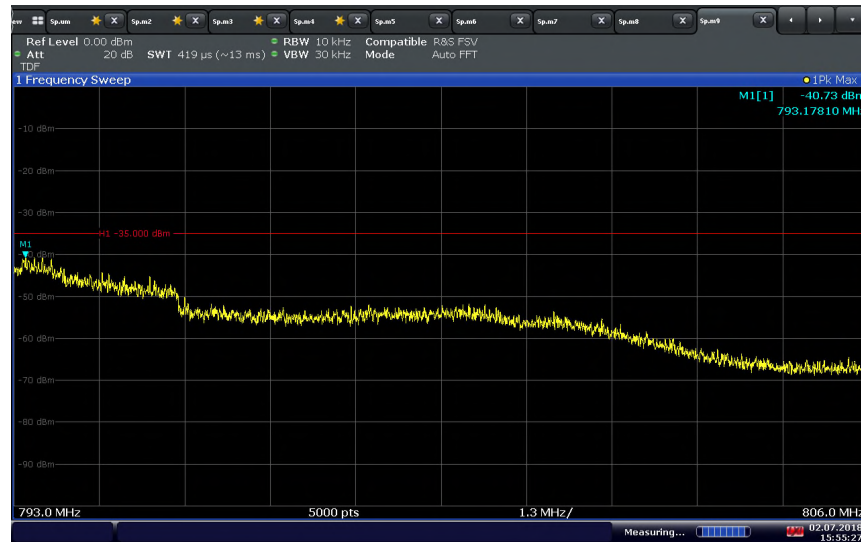
15:54:01 02.07.2018

CA_13A-66A_10+20 MHz Bandwidth_782 MHz & 1755 MHz_Full RB_QPSK / Conducted Spurious Emissions (763-775 MHz)



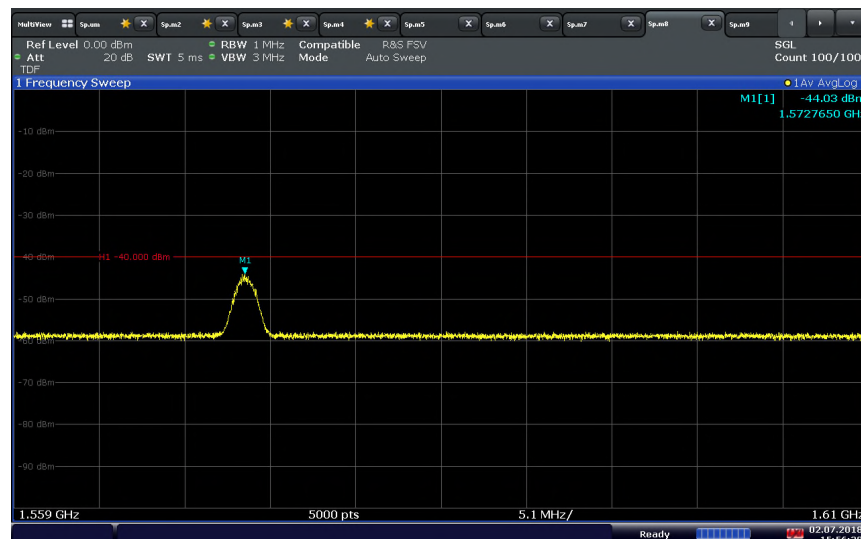
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CA_13A-66A_10+20 MHz Bandwidth_782 MHz & 1755 MHz_Full RB_QPSK / Conducted Spurious Emissions (793-806 MHz)



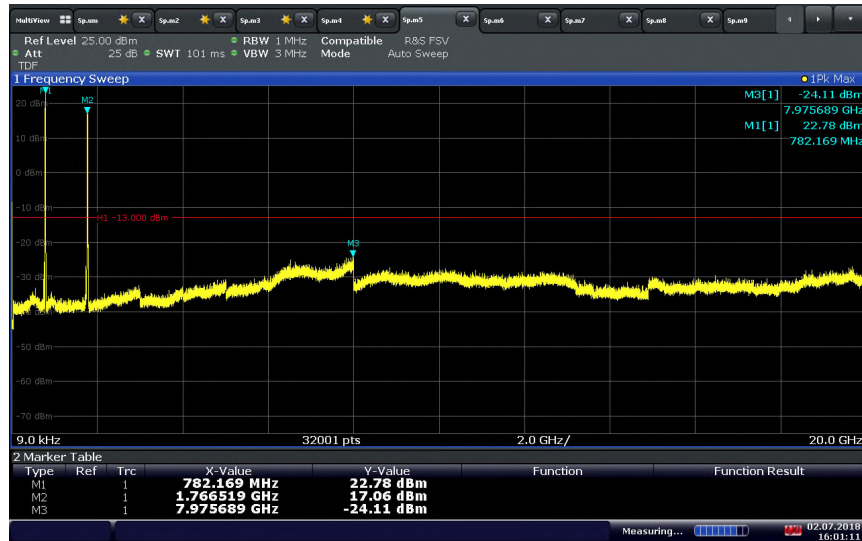
15:55:28 02.07.2018

CA_13A-66A_10+20 MHz Bandwidth_782 MHz & 1755 MHz_1 RB_QPSK / Conducted Spurious Emissions (1559-1610 MHz)



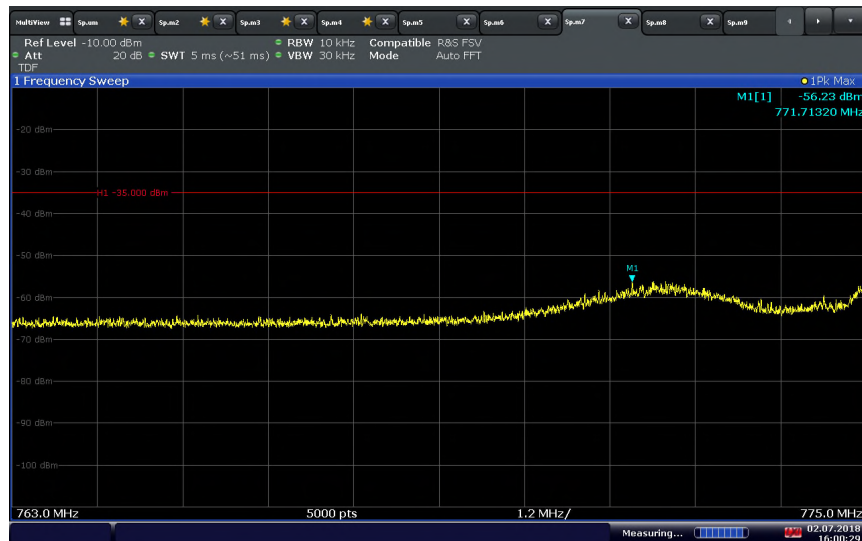
15:56:21 02.07.2018

CA_13A-66A_10+20 MHz Bandwidth_782 MHz & 1770 MHz_Full RB_QPSK / Conducted Spurious Emissions



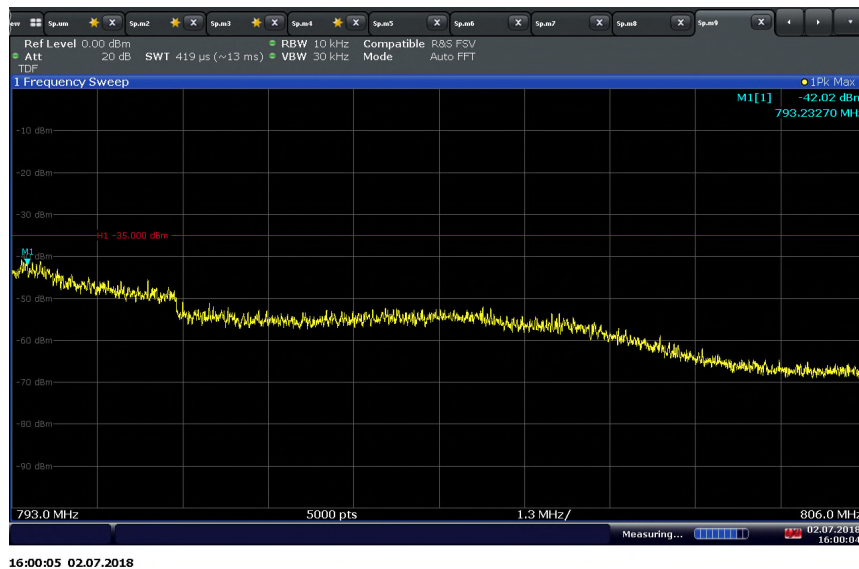
16:01:12 02.07.2018

CA_13A-66A_10+20 MHz Bandwidth_782 MHz & 1770 MHz_Full RB_QPSK / Conducted Spurious Emissions (763-775 MHz)

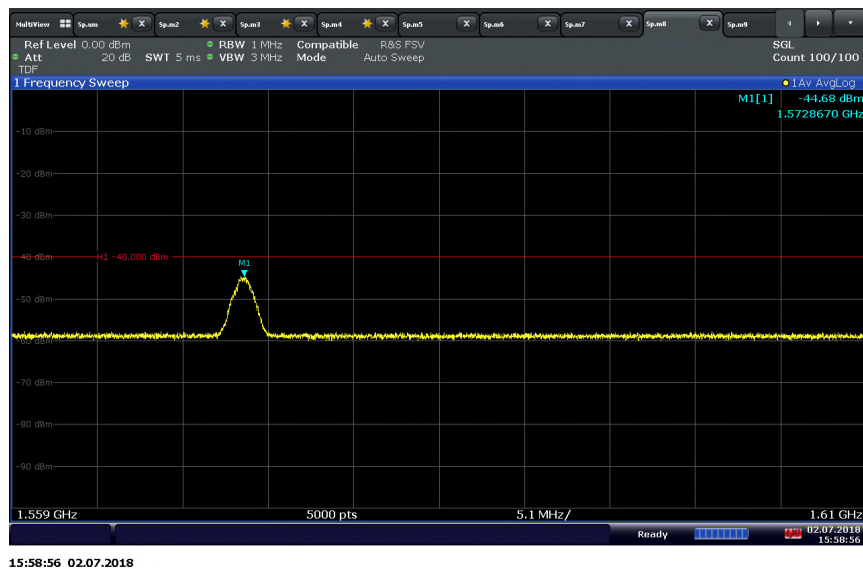


16:00:29 02.07.2018

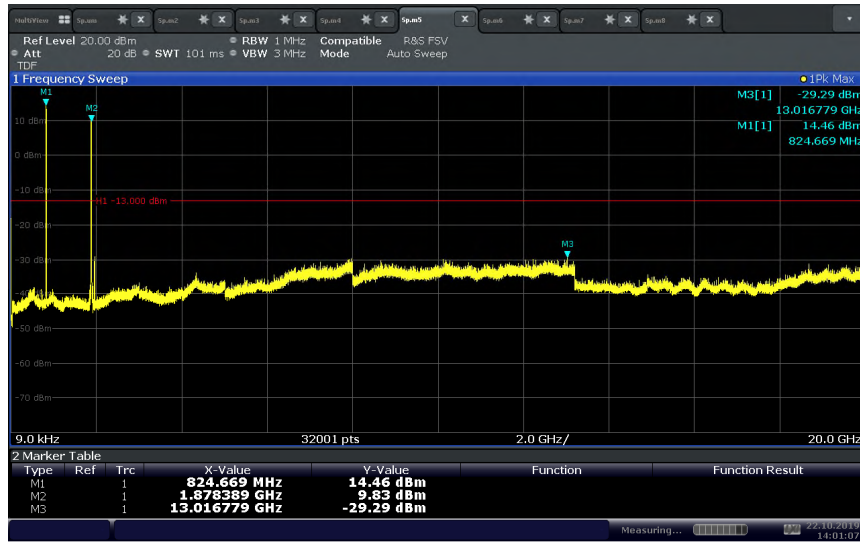
CA_13A-66A_10+20 MHz Bandwidth_782 MHz & 1770 MHz_Full RB_QPSK / Conducted Spurious Emissions (793-806 MHz)



CA_13A-66A_10+20 MHz Bandwidth_782 MHz & 1770 MHz_1 RB_QPSK / Conducted Spurious Emissions (1559-1610 MHz)

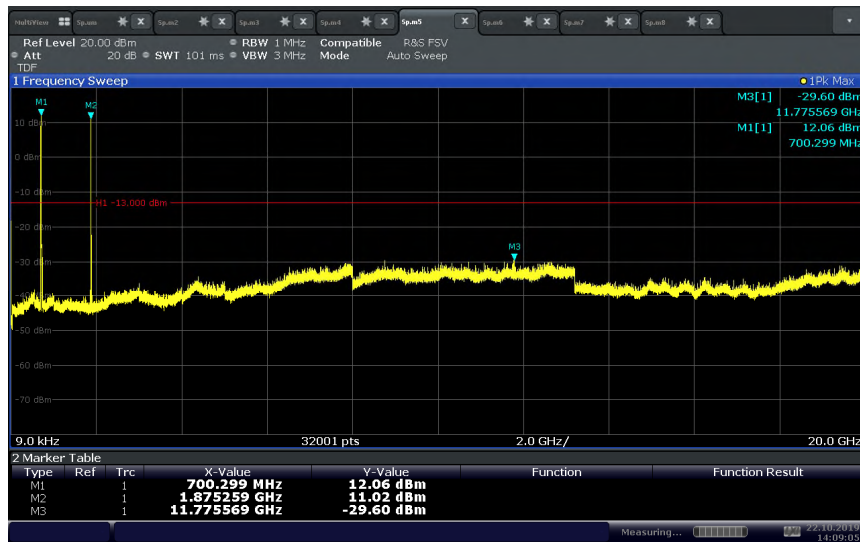


CA_2A-5A 10 MHz BW 1880 MHz 1RB49 and 10 MHz BW 829 MHz 1RB0 QPSK
Conducted Spurious Emissions



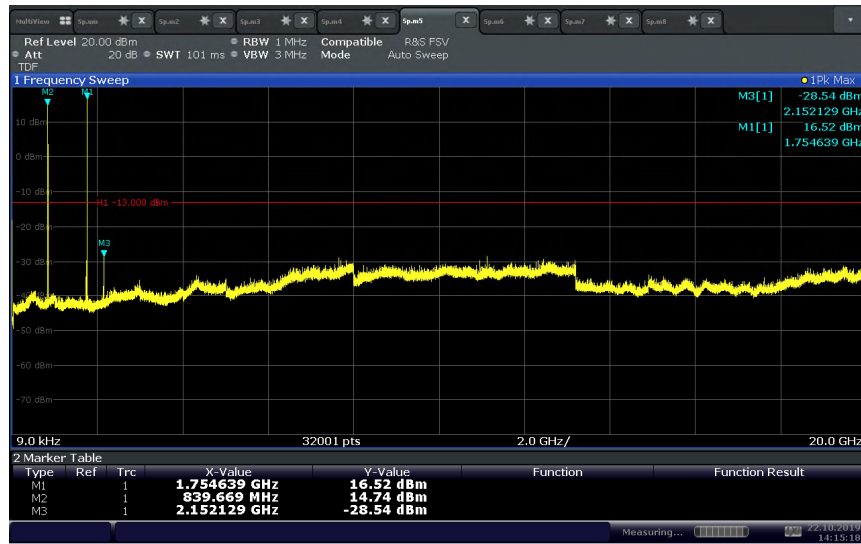
14:01:08 22.10.2019

CA_2A-12A 10 MHz BW 704 MHz 1RB49 and 10 MHz BW 1880 MHz 1RB0 QPSK
Conducted Spurious Emissions



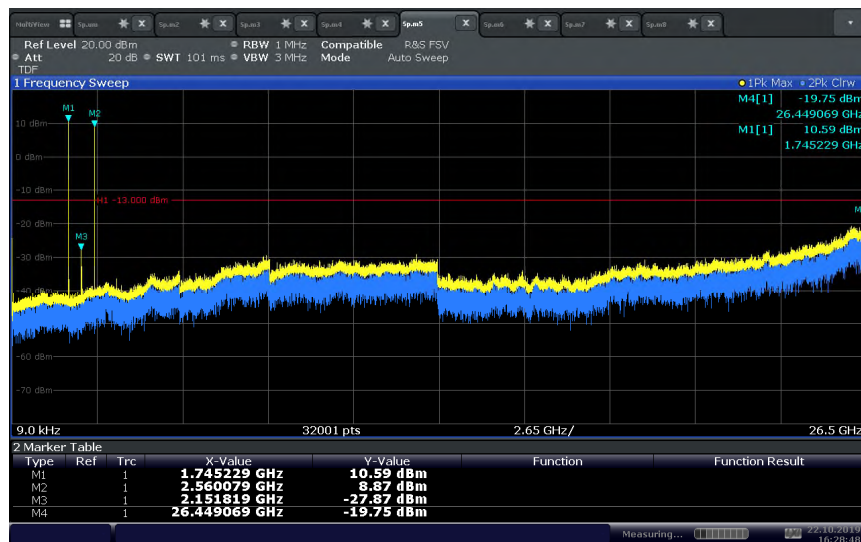
14:09:05 22.10.2019

CA_4A-5A 10 MHz BW 1750 MHz 1RB49 and 10 MHz BW 844 MHz 1RB0 16QAM
Conducted Spurious Emissions



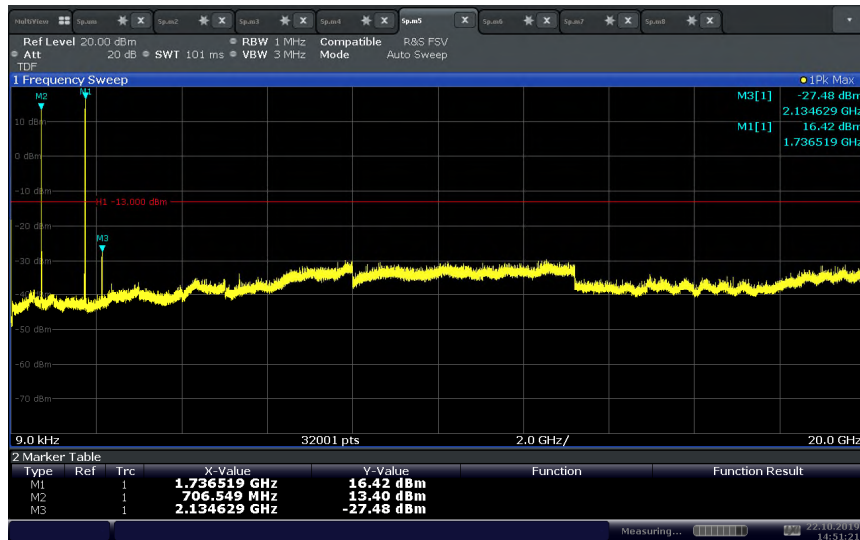
14:15:18 22.10.2019

CA_4A-7A 10 MHz BW 1750 MHz 1RB49 and 10 MHz BW 2565 MHz 1RB0 QPSK
Conducted Spurious Emissions



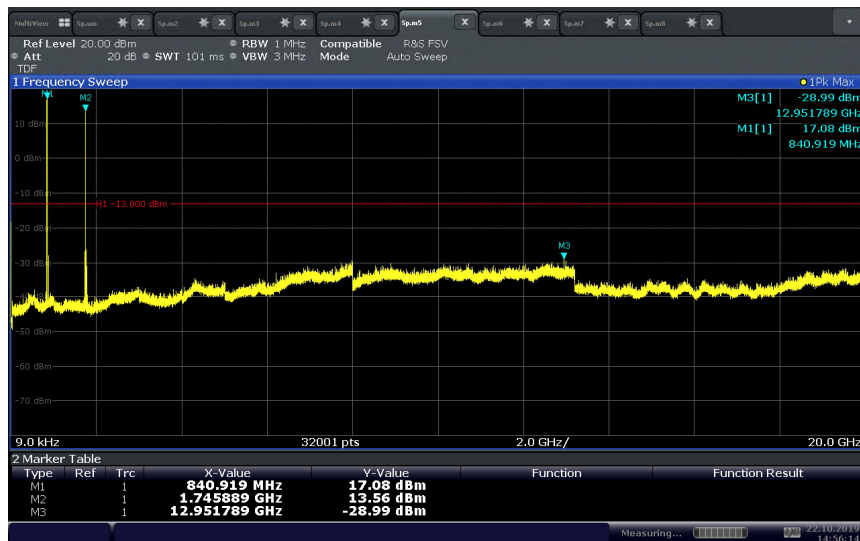
16:28:48 22.10.2019

CA_4A-12A 10 MHz BW 1732.5 MHz 1RB49 and 10 MHz BW 711 MHz 1RB0 16QAM
Conducted Spurious Emissions



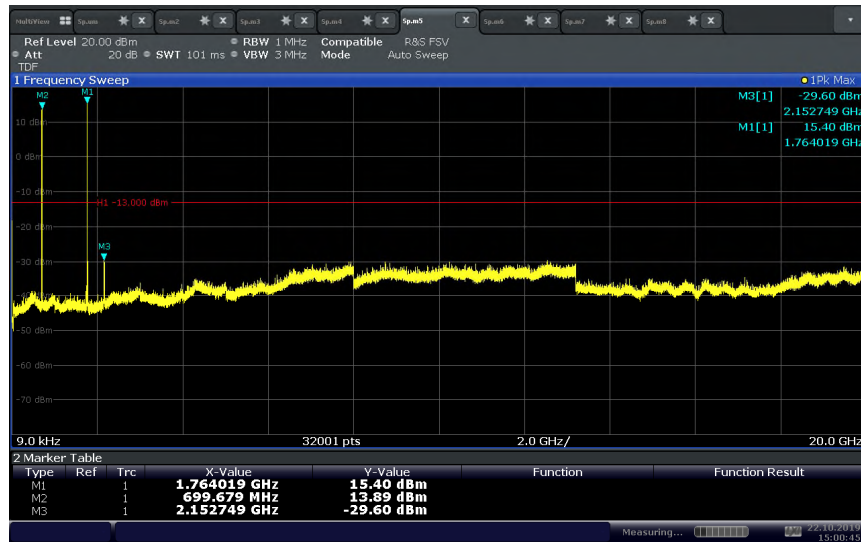
14:51:22 22.10.2019

CA_5A-66A 10 MHz BW 836.5 MHz 1RB49 and 20 MHz BW 1755 MHz 1RB0 16QAM
Conducted Spurious Emissions



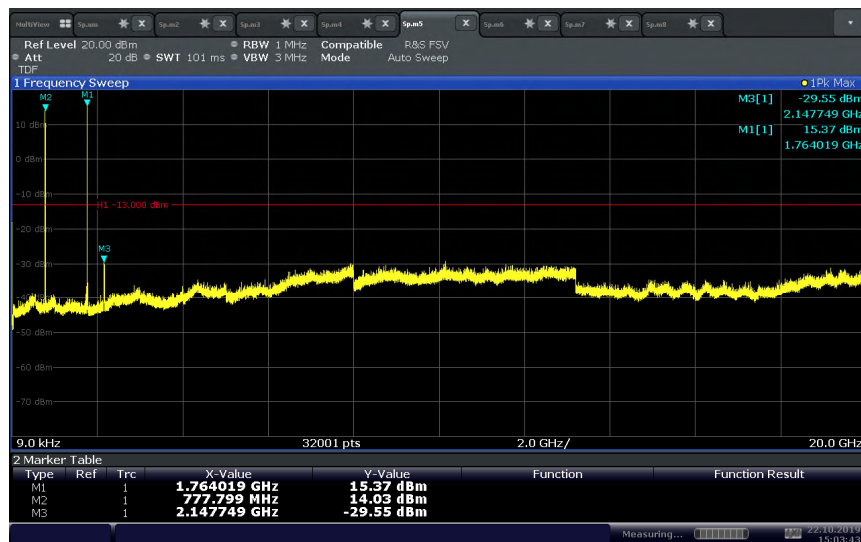
14:56:14 22.10.2019

CA_12A-66A 20 MHz BW 1755 MHz 1RB99 and 10 MHz BW 704 MHz 1RB0 QPSK
Conducted Spurious Emissions



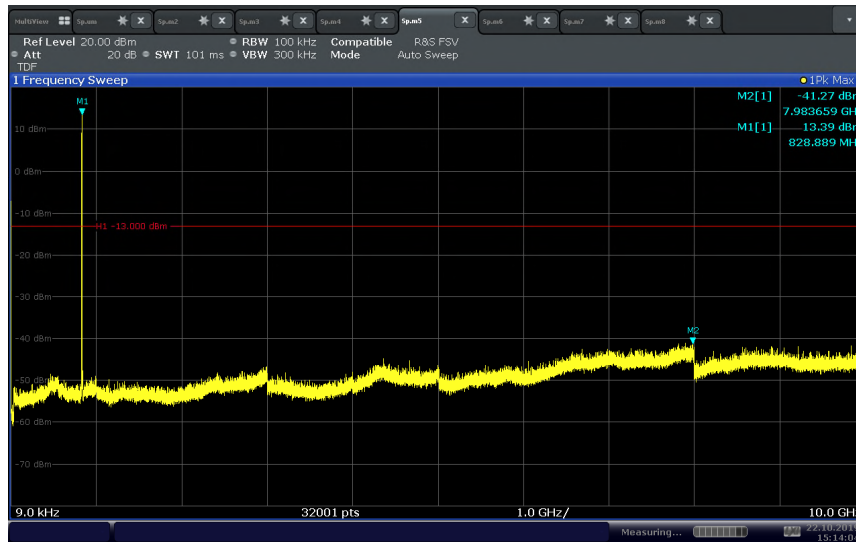
15:00:46 22.10.2019

CA_13A-66A 20 MHz BW 1755 MHz 1RB99 and 10 MHz BW 782 MHz 1RB0 QPSK
Conducted Spurious Emissions



15:03:43 22.10.2019

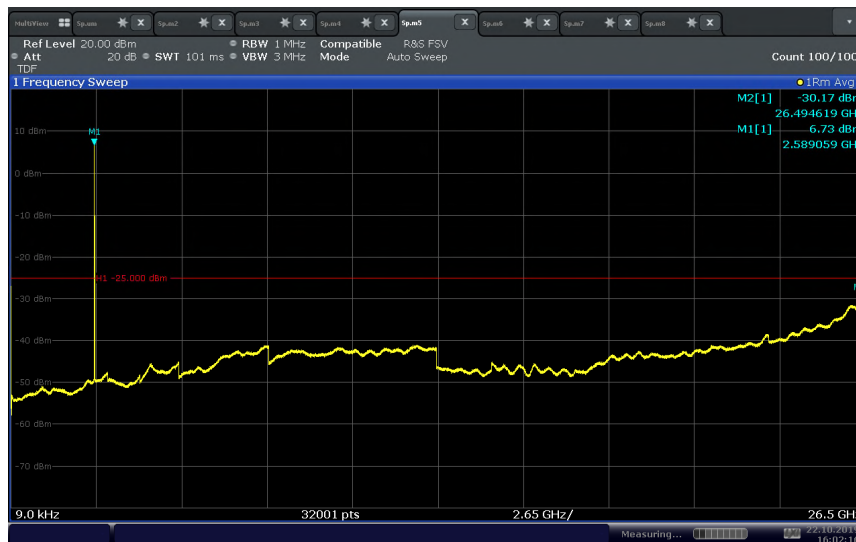
CA_5B 5 MHz BW 826.8 MHz 1RB24 and 10 MHz BW 834 MHz 1RB0 QPSK
Conducted Spurious Emissions



CA_7C 20 MHz BW 2550.1 MHz 1RB99 and 10 MHz BW 2564.5 MHz 1RB0 QPSK
Conducted Spurious Emissions

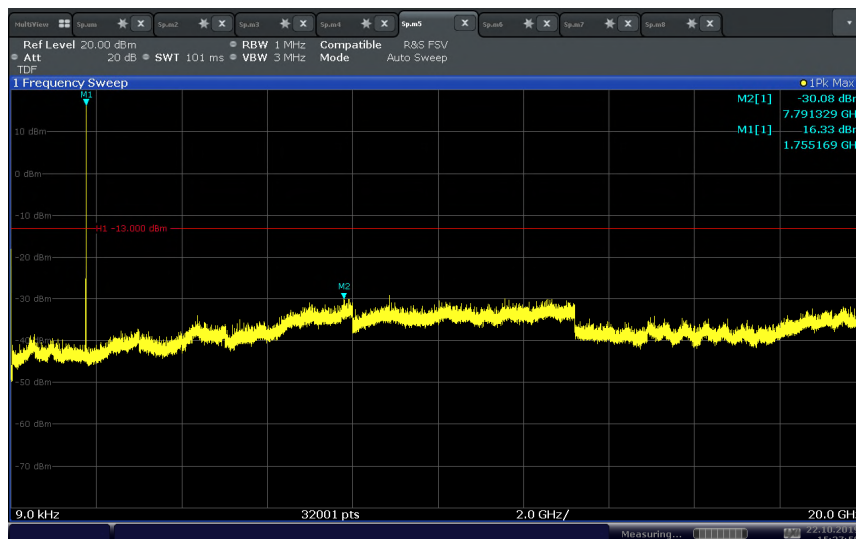


**CA_38C 20 MHz BW 2580 MHz 1RB99 and 20 MHz BW 2599.8 MHz 1RB0 QPSK
 Conducted Spurious Emissions**



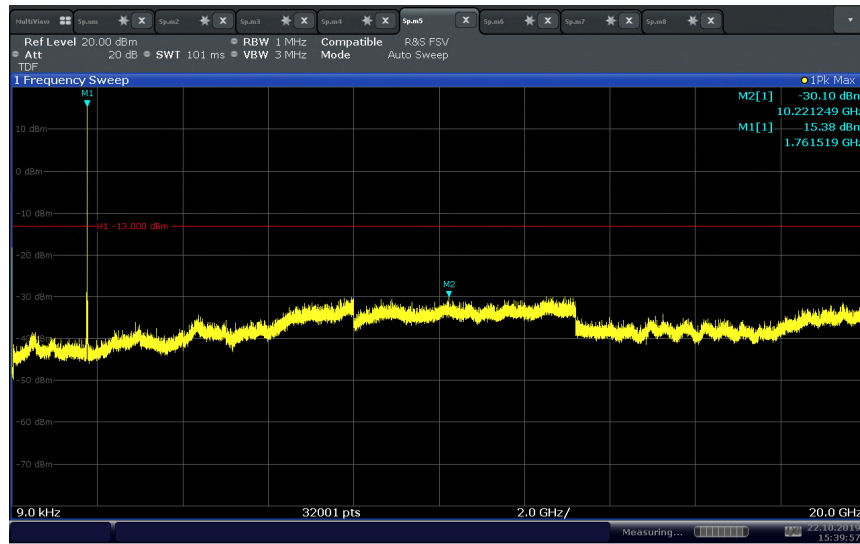
16:02:17 22.10.2019

**CA_66B 5 MHz BW 1752.6 MHz 1RB24 and 5 MHz BW 1757.4 MHz 1RB0
 QPSK Conducted Spurious Emissions**



15:27:58 22.10.2019

CA_66C 20 MHz BW 1752.5 MHz 1RB99 and 5 MHz BW 1764.2 MHz 1RB0 QPSK
Conducted Spurious Emissions



15:39:57 22.10.2019

2.7 FIELD STRENGTH OF SPURIOUS RADIATION

2.7.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1053
FCC 47 CFR Part 22, Clause 22.917(b)
FCC 47 CFR Part 24, Clause 24.238(a)
FCC 47 CFR Part 27, Clause 27.53(h)
FCC 47 CFR Part 27, Clause 27.53(m)
FCC 47 CFR Part 27, Clause 27.53(g)
FCC 47 CFR Part 27, Clause 27.53(c)
RSS-132, Clause 5.5
RSS-133, Clause 6.5
RSS-139, Clause 6.6
RSS-130, Clause 4.7
RSS-199, Clause 4.5

2.7.2 Standard Applicable

FCC 47 CFR Part 22.917(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.

FCC 47 CFR Part 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.

FCC 47 CFR Part 27.53:

(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\log_{10}(P)$ dB

FCC 47 CFR Part 27.53 (m):

(4) For mobile digital stations, the attenuation factor shall be not less than $40 + 10\log(P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10\log(P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10\log(P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section.

In addition, the attenuation factor shall not be less than $43 + 10\log(P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10\log(P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

FCC 47 CFR Part 27.53 (g):

For operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10\log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.



(c)(2) On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;

(c)(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-132, Clause 5.5:

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

- iii. In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).
- iv. After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz 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 occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

- (i) 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).
- (ii) 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.

RSS-139, Clause 6.6

- (i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the quipment's occupied bandwidth, the emisison power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.
- (ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the quipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts) dB.



RSS-130, Clause 4.7

4.7.1 The power of any unwanted emissions in any 100 kHz bandwidth on any frequency outside the frequency range(s) within which the equipment is designed to operate shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside the equipment's operating frequency range, a resolution bandwidth of 30 kHz may be employed.

4.7.2 In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746-756 MHz and 777-787 MHz shall also comply with the following restrictions:

a. the power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

- iv. $76 + 10 \log_{10} p$ (watts), dB, for base and fixed equipment and
- v. $65 + 10 \log_{10} p$ (watts), dB, for mobile and portable equipment
- c. the e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and -80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-199, Clause 4.5

For mobile subscriber equipment, the power of any unwanted emissions measured as above shall be attenuated (in dB) below the transmitter power, P (dBW), by at least:

- i. $40 + 10 \log_{10} p$ from the channel edges to 5 MHz away
- ii. $43 + 10 \log_{10} p$ between 5 MHz and X MHz from the channel edges, and
- iii. $55 + 10 \log_{10} p$ at X MHz and beyond from the channel edges

In addition, the attenuation shall not be less than $43 + 10 \log_{10} p$ on all frequencies between 2490.5 MHz and 2496 MHz, and $55 + 10 \log_{10} p$ at or below 2490.5 MHz.

2.7.3 Equipment Under Test and Modification State

Serial No: AS190818B00021 / Test Configuration B

2.7.4 Date of Test/Initial of test personnel who performed the test

July 05, 06, 2018 and October 23, 2019 / XYZ

2.7.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.2 - 25.7 °C
Relative Humidity	25.8 - 52.3 %
ATM Pressure	98.7 - 99.1 kPa



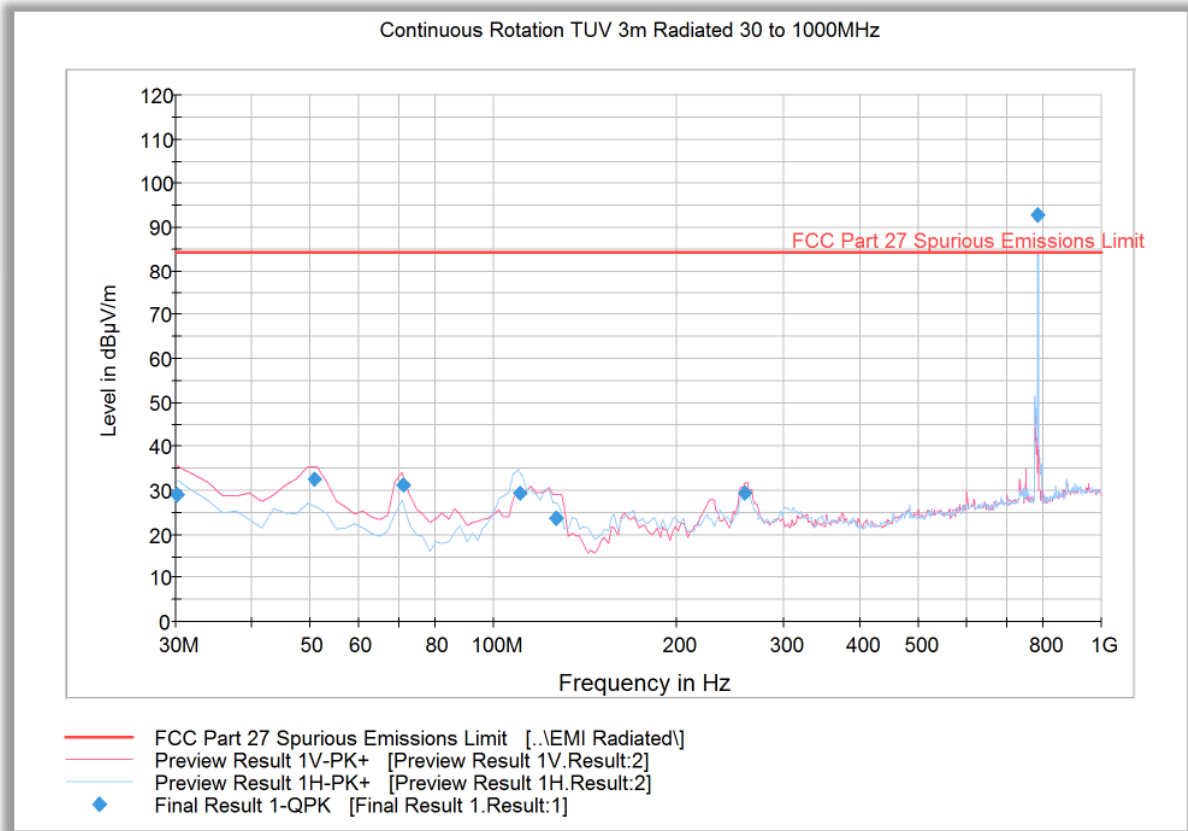
2.7.7 Additional Observations

- This is a radiated test using substitution method as per Unwanted Emissions: Radiated Spurious method of measurement of ANSI/TIA/EIA-603-C 2004, August 17, 2004.
- Emissions within 6dB of the limit will be proven by substitution method.
- This is cabinet spurious emissions testing. Main antenna port was terminated during the test. Fundamental frequency measurement will be ignored for this test.
- Only the worst case configuration presented in this test report.
- Only noise floor measurements observed above 18GHz.
- Measurement was done using EMC32 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only.

2.7.8 Test Results

Compliant. See attached plots.

2.7.9 Radiated Emission Test Results Below 1GHz – Worst Case CA_2A-13A QPSK

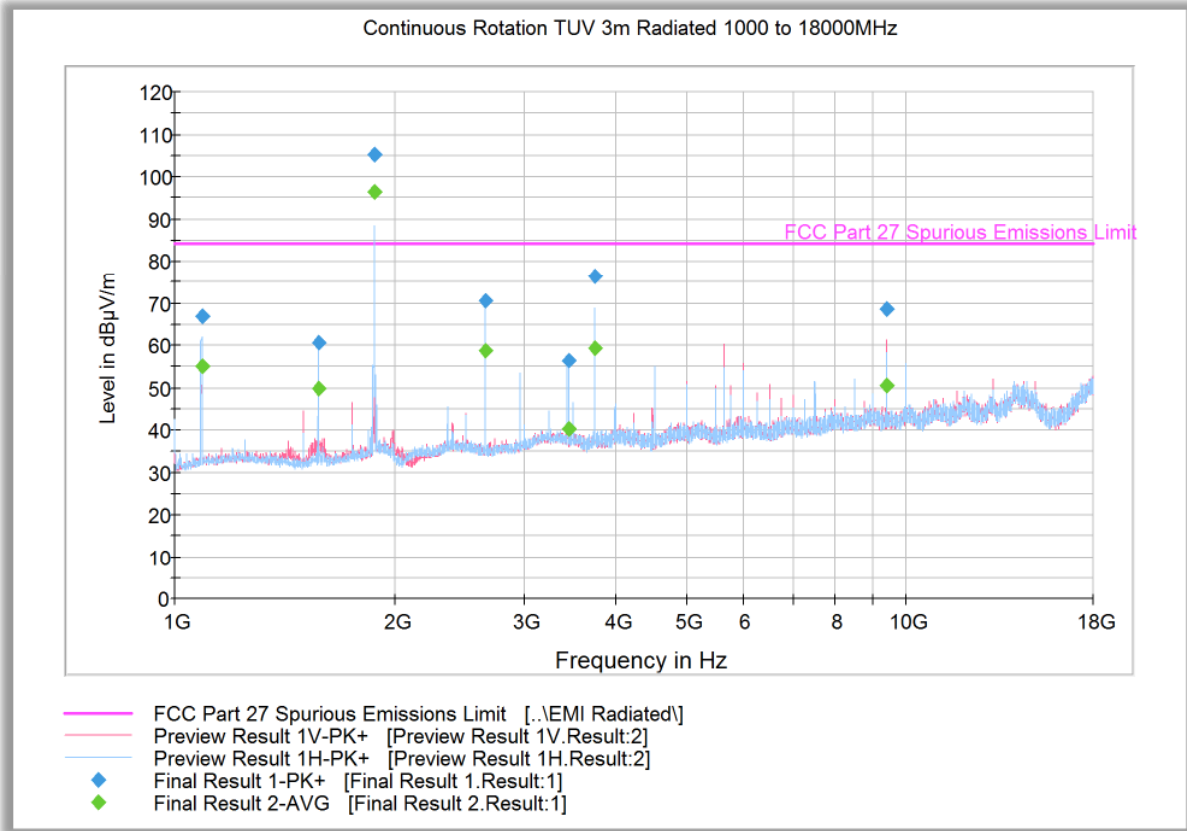


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.200000	29.2	1000.0	120.000	105.0	V	310.0	-6.5	55.2	84.4
50.782766	32.7	1000.0	120.000	100.0	V	173.0	-14.9	51.7	84.4
70.901643	31.2	1000.0	120.000	105.0	V	243.0	-17.2	53.2	84.4
110.739399	29.3	1000.0	120.000	195.0	H	15.0	-15.6	55.1	84.4
126.874389	23.6	1000.0	120.000	100.0	V	207.0	-16.1	60.8	84.4
259.162645	29.3	1000.0	120.000	100.0	V	44.0	-9.2	55.1	84.4
786.372345	92.9	1000.0	120.000	159.0	V	249.0	4.4	Fundamental Carrier*	

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

2.7.10 Radiated Emission Test Results Above 1GHz – Worst Case CA_2A-13A QPSK



Peak Data

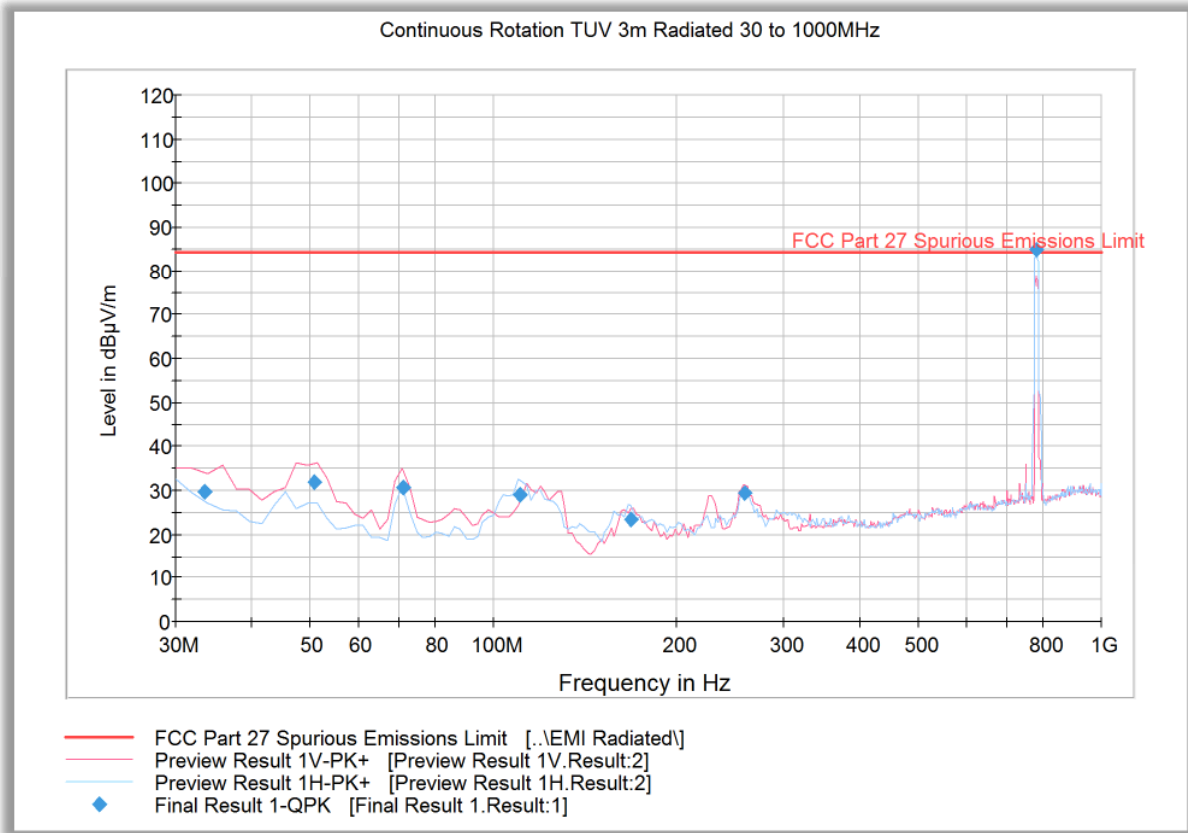
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1089.166667	66.8	1000.0	1000.000	99.7	H	209.0	-10.0	17.6	84.4
1572.733333	60.6	1000.0	1000.000	102.7	H	189.0	-8.5	23.8	84.4
1875.700000	105.3	1000.0	1000.000	151.2	H	208.0	-6.6	Fundamental Carrier*	
2661.866667	70.5	1000.0	1000.000	186.5	H	211.0	-4.0	13.9	84.4
3448.200000	56.3	1000.0	1000.000	103.7	H	199.0	-0.8	28.1	84.4
3751.000000	76.3	1000.0	1000.000	119.7	H	14.0	0.8	8.2	84.4
9377.800000	68.4	1000.0	1000.000	144.7	V	189.0	9.8	16.0	84.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1089.166667	55.1	1000.0	1000.000	99.7	H	209.0	-10.0	29.3	84.4
1572.733333	49.9	1000.0	1000.000	102.7	H	189.0	-8.5	34.5	84.4
1875.700000	96.3	1000.0	1000.000	151.2	H	208.0	-6.6	Fundamental Carrier*	
2661.866667	58.6	1000.0	1000.000	186.5	H	211.0	-4.0	25.8	84.4
3448.200000	40.4	1000.0	1000.000	103.7	H	199.0	-0.8	44.0	84.4
3751.000000	59.3	1000.0	1000.000	119.7	H	14.0	0.8	25.1	84.4
9377.800000	50.5	1000.0	1000.000	144.7	V	189.0	9.8	33.9	84.4

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

2.7.11 Radiated Emission Test Results Below 1GHz – Worst Case CA_4A-13A QPSK

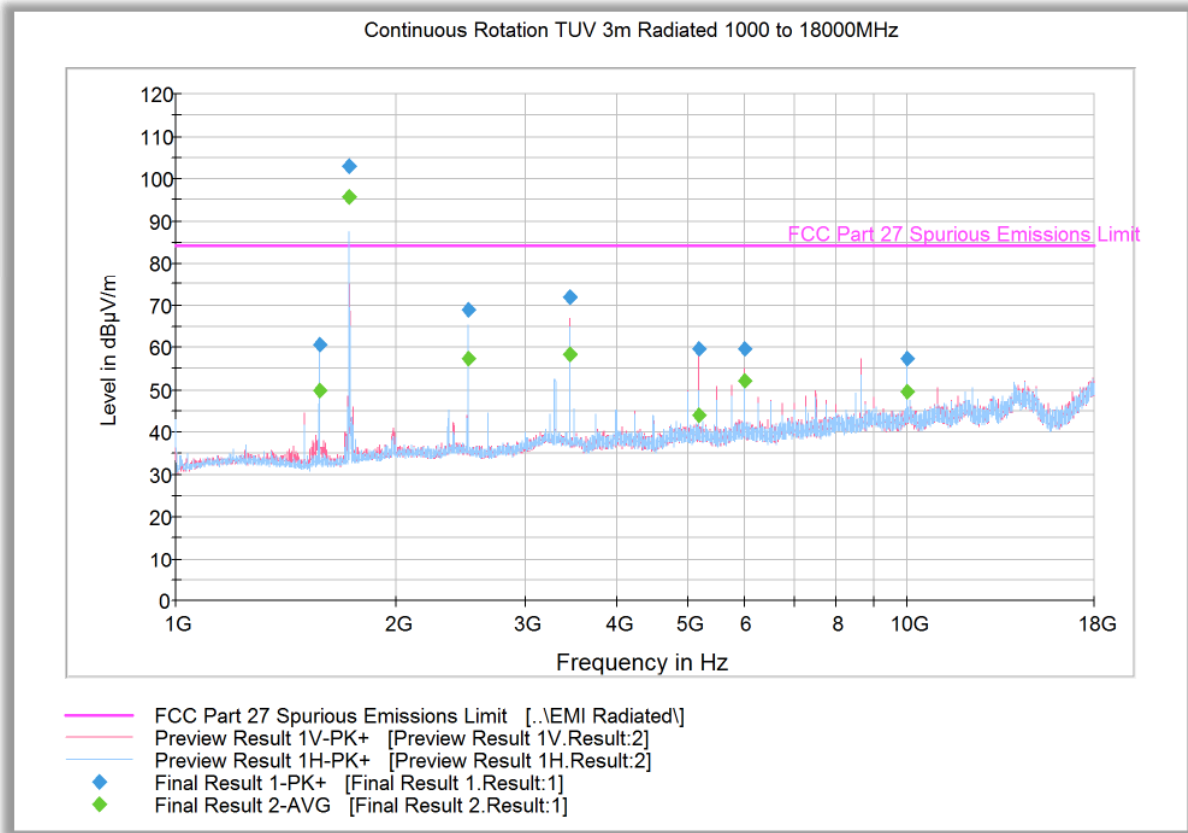


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
33.511663	29.7	1000.0	120.000	100.0	V	198.0	-9.1	54.7	84.4
50.654990	32.0	1000.0	120.000	100.0	V	15.0	-14.9	52.4	84.4
70.941643	30.6	1000.0	120.000	127.0	V	245.0	-17.2	53.8	84.4
110.659399	29.1	1000.0	120.000	183.0	H	177.0	-15.6	55.3	84.4
168.359920	23.3	1000.0	120.000	100.0	H	133.0	-12.4	61.1	84.4
259.458758	29.5	1000.0	120.000	100.0	V	31.0	-9.2	54.9	84.4
781.500681	85.0	1000.0	120.000	100.0	H	192.0	4.4	Fundamental Carrier*	

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

2.7.12 Radiated Emission Test Results Above 1GHz – Worst Case CA_4A-13A QPSK



Peak Data

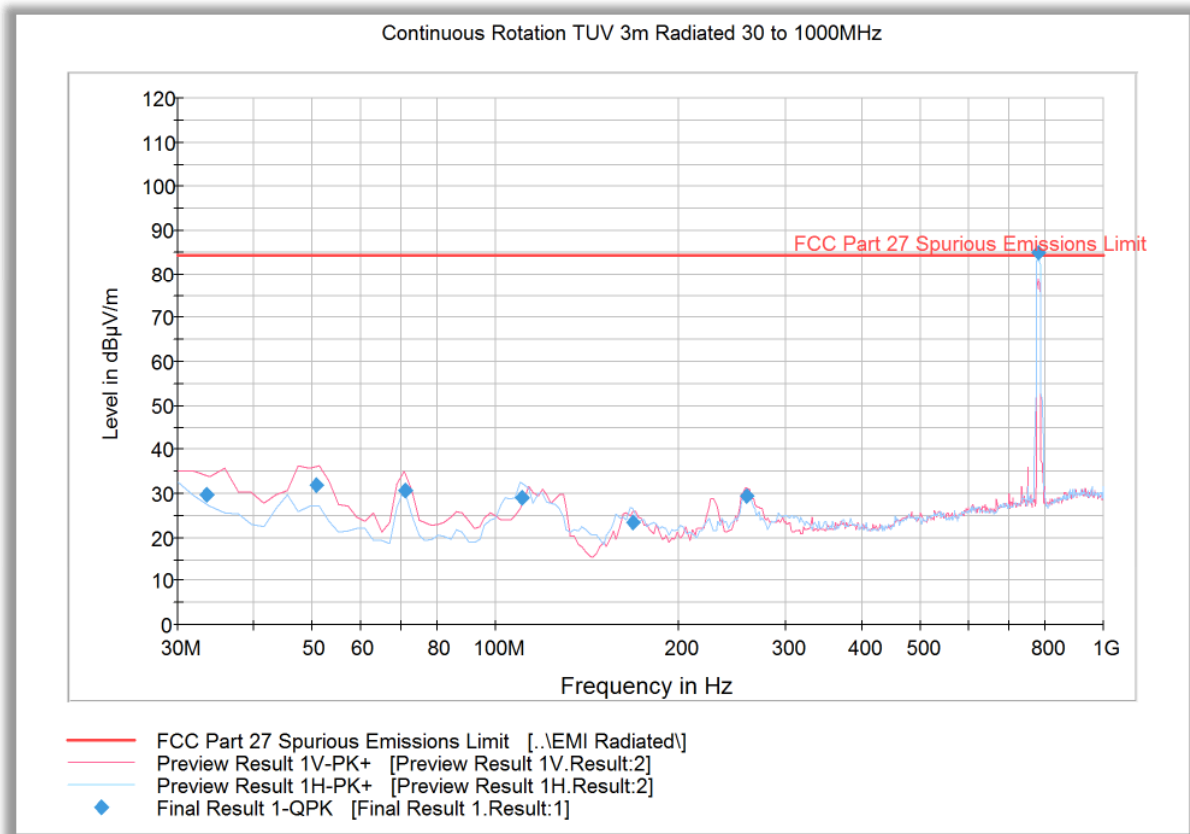
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1572.733333	60.7	1000.0	1000.000	103.7	H	195.0	-8.5	23.7	84.4
1728.000000	103.0	1000.0	1000.000	282.2	V	277.0	-7.4	Fundamental Carrier*	
2514.333333	68.9	1000.0	1000.000	152.2	H	218.0	-4.6	15.5	84.4
3456.133333	71.8	1000.0	1000.000	187.5	V	130.0	-0.8	12.6	84.4
5184.466667	59.8	1000.0	1000.000	296.2	V	174.0	3.4	24.6	84.4
5999.666667	59.7	1000.0	1000.000	223.4	V	201.0	4.5	24.7	84.4
10000.000000	57.4	1000.0	1000.000	311.2	H	185.0	10.3	27.0	84.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1572.733333	50.0	1000.0	1000.000	103.7	H	195.0	-8.5	34.4	84.4
1728.000000	95.6	1000.0	1000.000	282.2	V	277.0	-7.4	Fundamental Carrier*	
2514.333333	57.4	1000.0	1000.000	152.2	H	218.0	-4.6	27.0	84.4
3456.133333	58.4	1000.0	1000.000	187.5	V	130.0	-0.8	26.0	84.4
5184.466667	43.8	1000.0	1000.000	296.2	V	174.0	3.4	40.6	84.4
5999.666667	52.1	1000.0	1000.000	223.4	V	201.0	4.5	32.3	84.4
10000.000000	49.6	1000.0	1000.000	311.2	H	185.0	10.3	34.8	84.4

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

2.7.13 Radiated Emission Test Results Below 1GHz – Worst Case CA_13A-66A

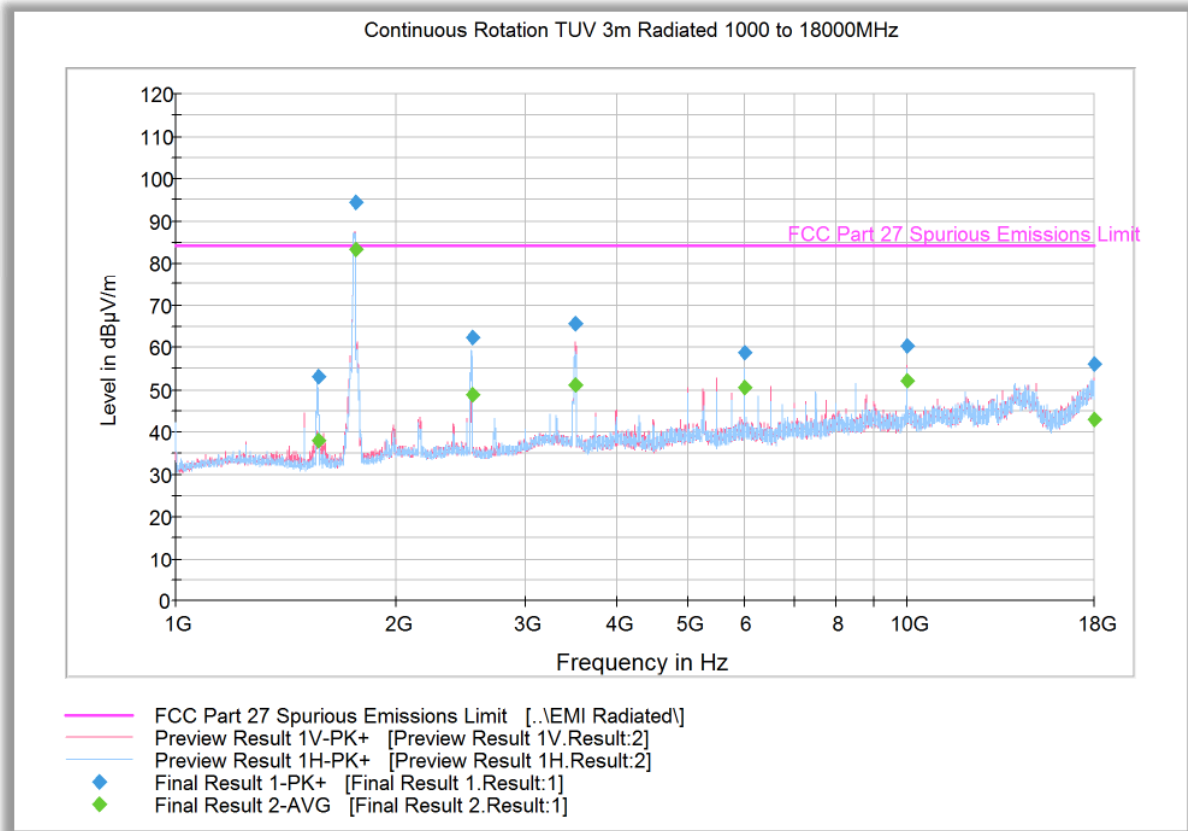


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
33.511663	29.7	1000.0	120.000	100.0	V	198.0	-9.1	54.7	84.4
50.654990	32.0	1000.0	120.000	100.0	V	15.0	-14.9	52.4	84.4
70.941643	30.6	1000.0	120.000	127.0	V	245.0	-17.2	53.8	84.4
110.659399	29.1	1000.0	120.000	183.0	H	177.0	-15.6	55.3	84.4
168.359920	23.3	1000.0	120.000	100.0	H	133.0	-12.4	61.1	84.4
259.458758	29.5	1000.0	120.000	100.0	V	31.0	-9.2	54.9	84.4
781.500681	85.0	1000.0	120.000	100.0	H	192.0	4.4	Fundamental Carrier*	

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

2.7.14 Radiated Emission Test Results Above 1GHz – Worst Case CA_13A-66A QPSK



Peak Data

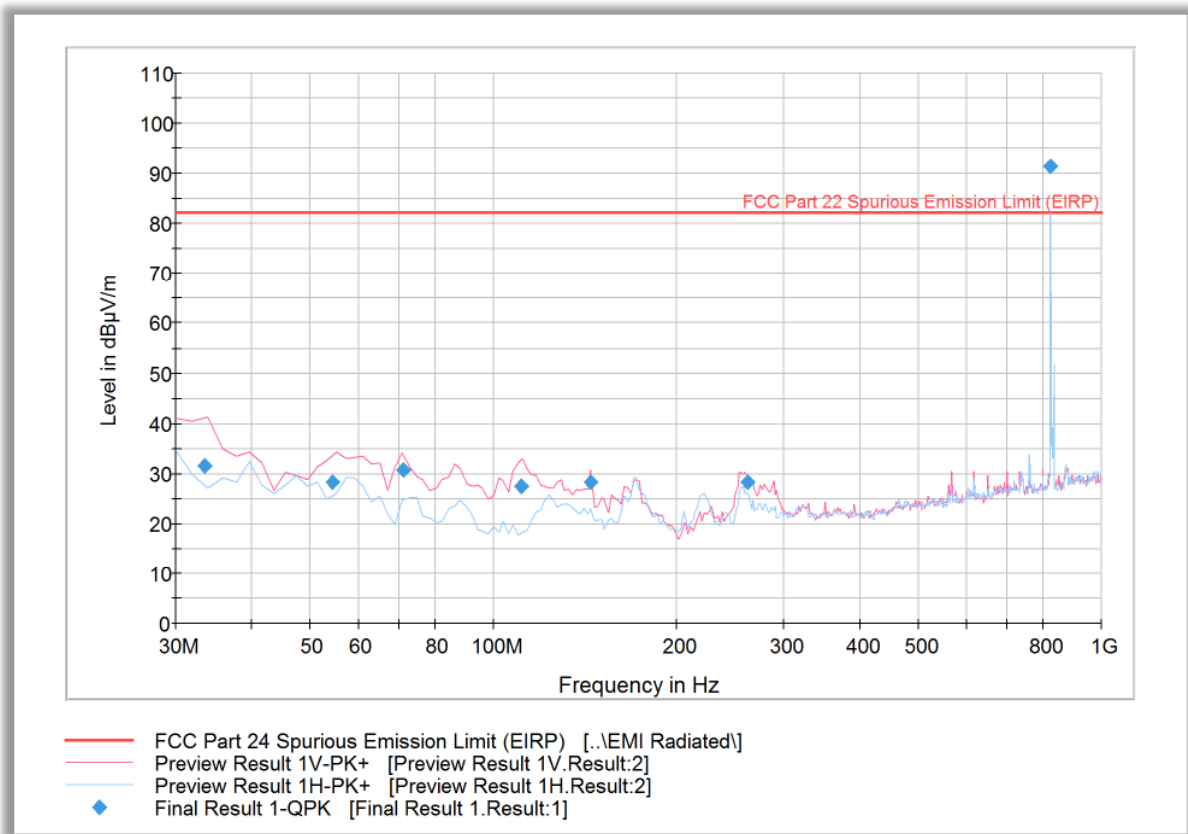
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1569.166667	53.2	1000.0	1000.000	103.7	H	197.0	-8.5	31.2	84.4
1762.933333	94.3	1000.0	1000.000	132.7	V	55.0	-6.9	Fundamental Carrier*	
2540.033333	62.2	1000.0	1000.000	99.7	H	202.0	-4.5	22.2	84.4
3522.233333	65.5	1000.0	1000.000	208.4	V	316.0	-0.6	18.9	84.4
5999.900000	58.8	1000.0	1000.000	352.7	H	122.0	4.5	25.6	84.4
10000.000000	60.3	1000.0	1000.000	296.2	V	187.0	10.3	24.1	84.4
17997.700000	56.0	1000.0	1000.000	280.2	V	5.0	21.4	28.4	84.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1569.166667	38.1	1000.0	1000.000	103.7	H	197.0	-8.5	46.3	84.4
1762.933333	83.3	1000.0	1000.000	132.7	V	55.0	-6.9	Fundamental Carrier*	
2540.033333	48.8	1000.0	1000.000	99.7	H	202.0	-4.5	35.6	84.4
3522.233333	51.0	1000.0	1000.000	208.4	V	316.0	-0.6	33.4	84.4
5999.900000	50.6	1000.0	1000.000	352.7	H	122.0	4.5	33.8	84.4
10000.000000	52.2	1000.0	1000.000	296.2	V	187.0	10.3	32.2	84.4
17997.700000	42.9	1000.0	1000.000	280.2	V	5.0	21.4	41.5	84.4

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

2.7.15 Radiated Emission Test Results Below 1GHz – Worst Case CA_2A-5A QPSK

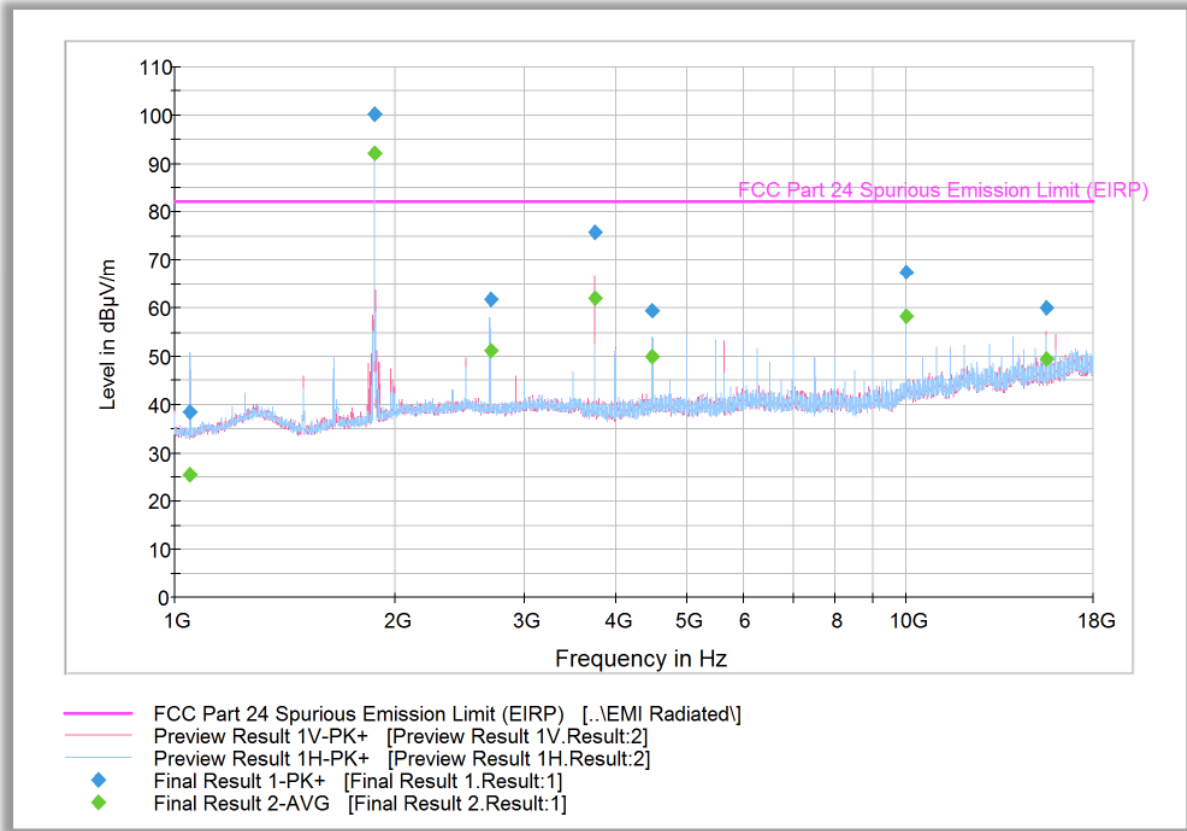


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
33.447776	31.7	1000.0	120.000	100.0	V	190.0	-10.9	50.5	82.2
54.310541	28.2	1000.0	120.000	100.0	V	174.0	-16.2	54.1	82.2
71.141643	30.8	1000.0	120.000	159.0	V	162.0	-18.0	51.4	82.2
111.363287	27.4	1000.0	120.000	100.0	V	193.0	-15.3	54.8	82.2
144.489379	28.3	1000.0	120.000	100.0	V	160.0	-14.9	53.9	82.2
262.266533	28.2	1000.0	120.000	100.0	V	98.0	-9.2	54.0	82.2
824.570100	91.4	1000.0	120.000	178.0	H	40.0	2.9	Fundamental Carrier*	

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

2.7.16 Radiated Emission Test Results Above 1GHz – Worst Case CA_2A-5A QPSK



Peak Data

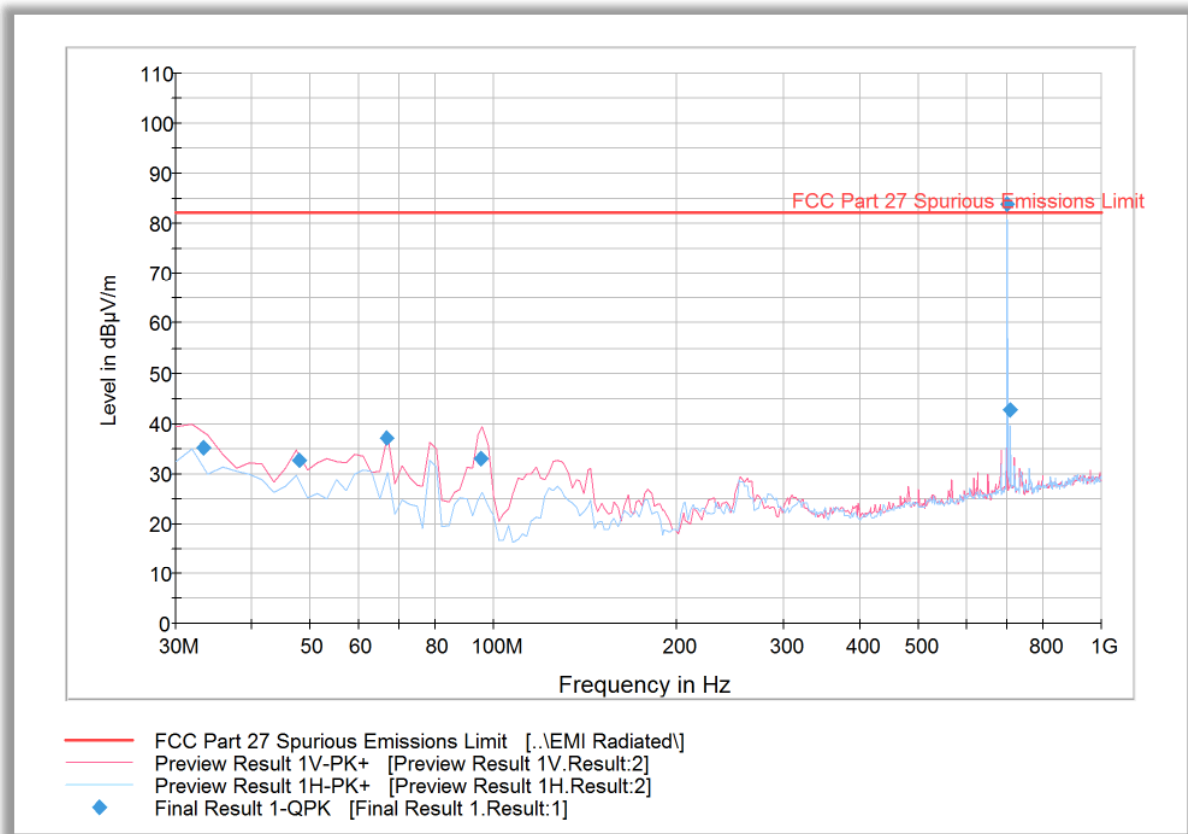
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1050.833333	38.6	1000.0	1000.000	136.0	V	6.0	-7.9	43.6	82.2
1875.700000	100.2	1000.0	1000.000	294.0	H	20.0	-2.7	Fundamental Carrier*	
2700.200000	61.7	1000.0	1000.000	186.0	H	172.0	-0.1	20.5	82.2
3751.366667	75.8	1000.0	1000.000	100.0	V	17.0	2.0	6.4	82.2
4499.933333	59.5	1000.0	1000.000	100.0	H	76.0	3.7	22.7	82.2
10000.000000	67.5	1000.0	1000.000	100.0	H	151.0	9.6	14.7	82.2
15500.066667	60.2	1000.0	1000.000	100.0	V	61.0	16.1	22.1	82.2

Average Data

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1050.833333	25.5	1000.0	1000.000	136.0	V	6.0	-7.9	56.7	82.2
1875.700000	92.1	1000.0	1000.000	294.0	H	20.0	-2.7	Fundamental Carrier*	
2700.200000	51.0	1000.0	1000.000	186.0	H	172.0	-0.1	31.2	82.2
3751.366667	62.0	1000.0	1000.000	100.0	V	17.0	2.0	20.3	82.2
4499.933333	50.1	1000.0	1000.000	100.0	H	76.0	3.7	32.2	82.2
10000.000000	58.2	1000.0	1000.000	100.0	H	151.0	9.6	24.1	82.2
15500.066667	49.5	1000.0	1000.000	100.0	V	61.0	16.1	32.7	82.2

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

2.7.17 Radiated Emission Test Results Below 1GHz – Worst Case CA_12A-66A QPSK

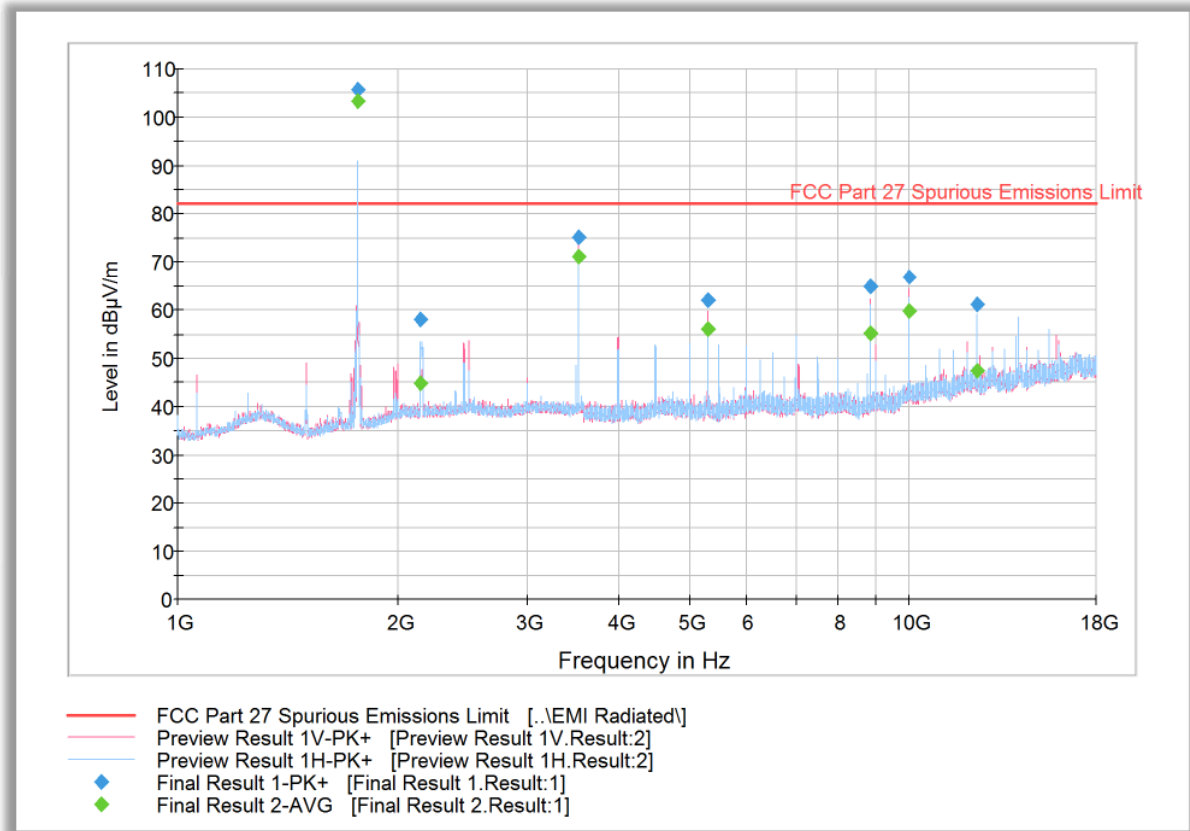


Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
33.400000	35.1	1000.0	120.000	100.0	V	176.0	-10.9	47.1	82.2
47.974990	32.8	1000.0	120.000	100.0	V	73.0	-15.1	49.4	82.2
66.533868	37.2	1000.0	120.000	164.0	V	190.0	-18.4	45.0	82.2
95.452184	33.0	1000.0	120.000	100.0	V	133.0	-14.0	49.2	82.2
699.601283	84.1	1000.0	120.000	110.0	H	-8.0	1.5	-1.9	82.2
708.416834	42.7	1000.0	120.000	111.0	H	328.0	1.7	Fundamental Carrier*	

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

2.7.18 Radiated Emission Test Results Above 1GHz – Worst Case CA_12A-66A QPSK



Peak Data

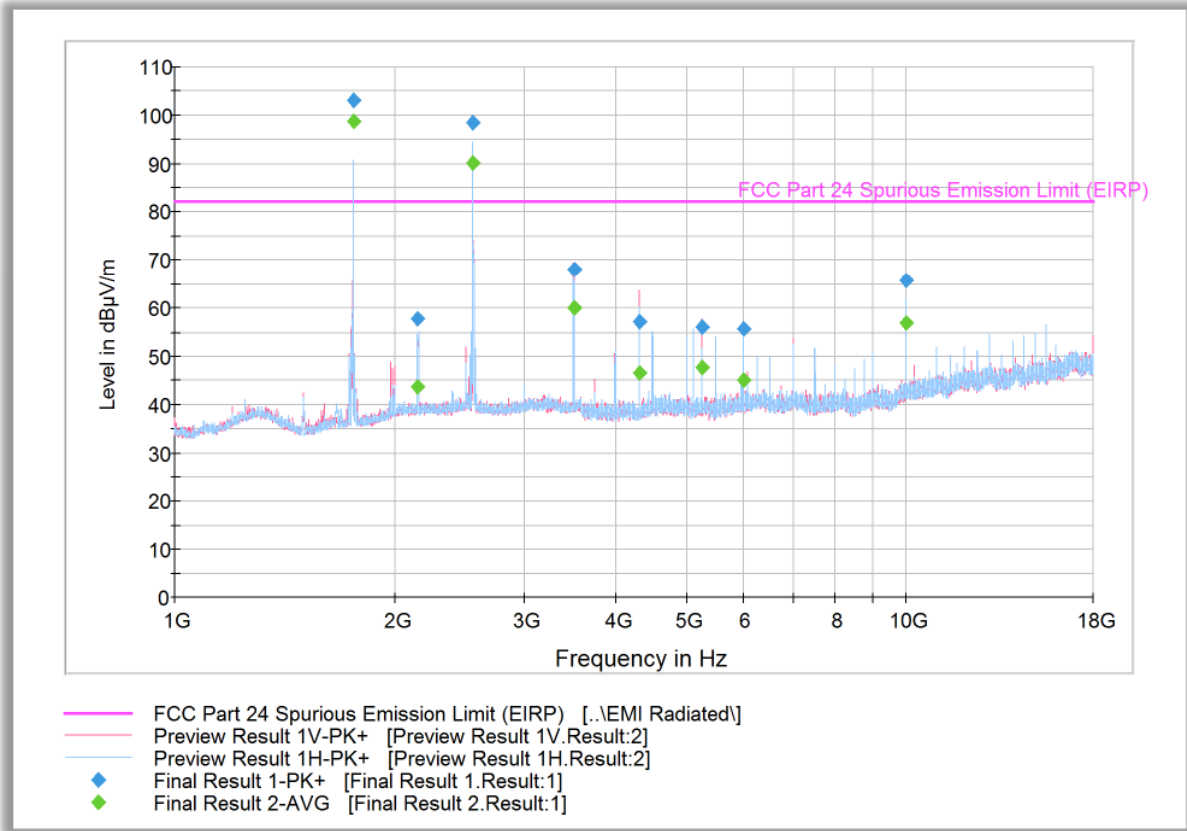
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1763.666667	105.8	1000.0	1000.000	243.0	H	233.0	-4.0	Fundamental Carrier*	
2147.366667	58.1	1000.0	1000.000	100.0	H	171.0	-2.2	24.2	82.2
3527.733333	75.3	1000.0	1000.000	100.0	V	343.0	1.3	6.9	82.2
5291.566667	62.0	1000.0	1000.000	100.0	V	301.0	4.6	20.2	82.2
8819.633333	65.0	1000.0	1000.000	100.0	V	240.0	7.5	17.2	82.2
9999.766667	66.9	1000.0	1000.000	100.0	V	128.0	9.6	15.4	82.2
12347.300000	61.1	1000.0	1000.000	100.0	H	-11.0	13.7	21.1	82.2

Average Data

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1763.666667	103.3	1000.0	1000.000	243.0	H	233.0	-4.0	Fundamental Carrier*	
2147.366667	44.7	1000.0	1000.000	100.0	H	171.0	-2.2	37.6	82.2
3527.733333	71.2	1000.0	1000.000	100.0	V	343.0	1.3	11.0	82.2
5291.566667	56.0	1000.0	1000.000	100.0	V	301.0	4.6	26.2	82.2
8819.633333	55.2	1000.0	1000.000	100.0	V	240.0	7.5	27.0	82.2
9999.766667	59.7	1000.0	1000.000	100.0	V	128.0	9.6	22.6	82.2
12347.300000	47.4	1000.0	1000.000	100.0	H	-11.0	13.7	34.9	82.2

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

2.7.19 Radiated Emission Test Results Above 1GHz – Worst Case CA_4A-7A QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1754.433333	103.0	1000.0	1000.000	129.0	H	173.0	-4.2	Fundamental Carrier*	
2151.100000	57.7	1000.0	1000.000	100.0	V	137.0	-2.1	24.6	82.2
2560.400000	98.4	1000.0	1000.000	100.0	H	208.0	-0.4	Fundamental Carrier*	
3508.833333	67.9	1000.0	1000.000	100.0	V	349.0	1.2	14.3	82.2
4315.200000	57.2	1000.0	1000.000	150.0	V	317.0	2.9	25.0	82.2
5263.233333	55.9	1000.0	1000.000	117.0	V	26.0	4.4	26.4	82.2
5999.900000	55.6	1000.0	1000.000	129.0	H	56.0	5.7	26.6	82.2
10000.166667	65.7	1000.0	1000.000	100.0	H	149.0	9.6	16.5	82.2

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1754.433333	98.8	1000.0	1000.000	129.0	H	173.0	-4.2	Fundamental Carrier*	
2151.100000	43.6	1000.0	1000.000	100.0	V	137.0	-2.1	38.7	82.2
2560.400000	90.3	1000.0	1000.000	100.0	H	208.0	-0.4	Fundamental Carrier*	
3508.833333	60.0	1000.0	1000.000	100.0	V	349.0	1.2	22.2	82.2
4315.200000	46.4	1000.0	1000.000	150.0	V	317.0	2.9	35.8	82.2
5263.233333	47.6	1000.0	1000.000	117.0	V	26.0	4.4	34.7	82.2
5999.900000	45.1	1000.0	1000.000	129.0	H	56.0	5.7	37.1	82.2
10000.166667	56.7	1000.0	1000.000	100.0	H	149.0	9.6	25.5	82.2

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.

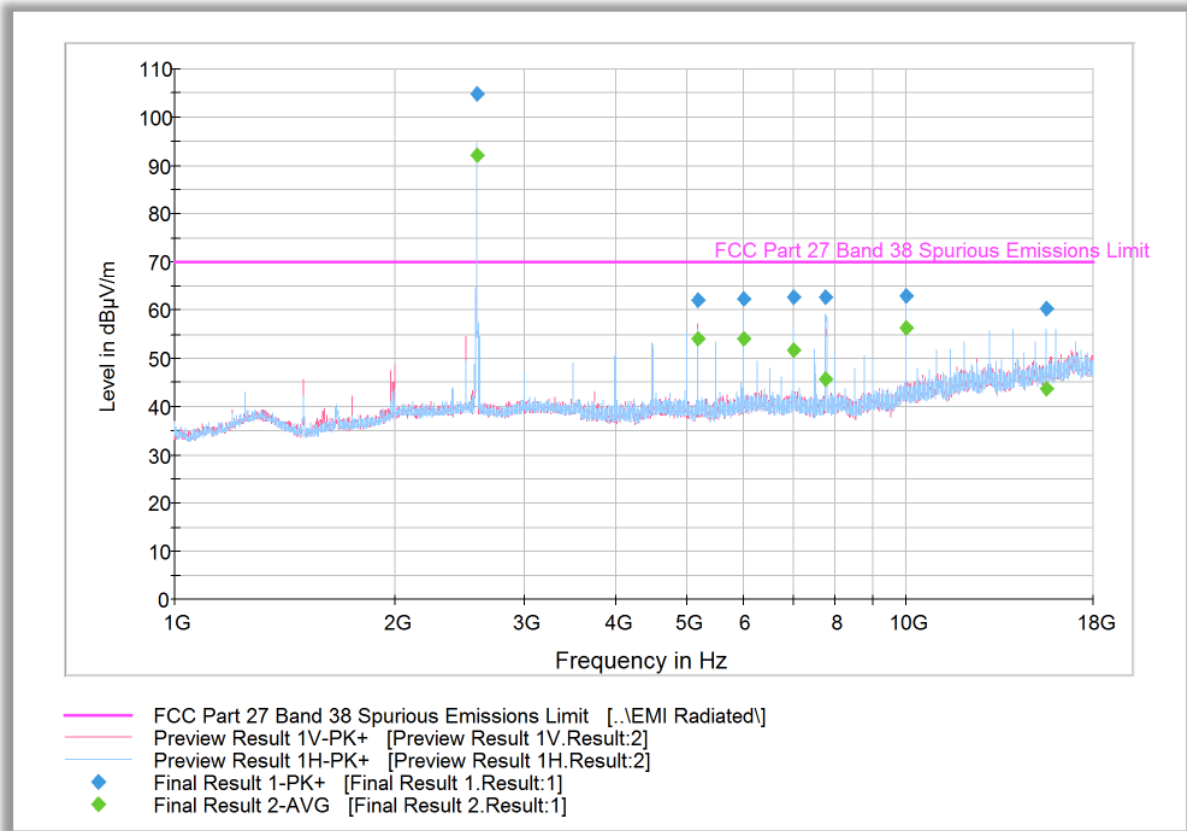
2.7.20 Radiated Emission Test Results Below 1GHz – Worst Case CA_38C QPSK



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
33.400000	36.8	1000.0	120.000	100.0	V	102.0	-10.9	33.4	70.2
56.438317	27.0	1000.0	120.000	100.0	V	151.0	-16.1	43.2	70.2
87.308858	34.9	1000.0	120.000	105.0	V	-2.0	-16.7	35.3	70.2
88.980521	37.3	1000.0	120.000	100.0	V	185.0	-16.1	32.9	70.2
107.931623	31.9	1000.0	120.000	100.0	V	208.0	-14.8	38.3	70.2
700.001283	36.8	1000.0	120.000	100.0	V	236.0	1.6	33.4	70.2

2.7.21 Radiated Emission Test Results Above 1GHz – Worst Case CA_38C QPSK



Peak Data

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2588.733333	104.9	1000.0	1000.000	243.0	H	267.0	-0.3	Fundamental Carrier*	
5177.666667	62.2	1000.0	1000.000	100.0	V	94.0	4.3	8.0	70.2
5999.900000	62.4	1000.0	1000.000	100.0	H	1.0	5.7	7.8	70.2
7000.066667	62.5	1000.0	1000.000	100.0	H	88.0	6.7	7.7	70.2
7766.766667	62.5	1000.0	1000.000	123.0	H	272.0	7.1	7.7	70.2
10000.000000	62.9	1000.0	1000.000	130.0	H	70.0	9.6	7.3	70.2
15537.466667	60.4	1000.0	1000.000	100.0	H	316.0	16.2	9.8	70.2

Average Data

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2588.733333	92.3	1000.0	1000.000	243.0	H	267.0	-0.3	Fundamental Carrier*	
5177.666667	54.0	1000.0	1000.000	100.0	V	94.0	4.3	16.2	70.2
5999.900000	53.9	1000.0	1000.000	100.0	H	1.0	5.7	16.3	70.2
7000.066667	51.8	1000.0	1000.000	100.0	H	88.0	6.7	18.4	70.2
7766.766667	45.7	1000.0	1000.000	123.0	H	272.0	7.1	24.5	70.2
10000.000000	56.3	1000.0	1000.000	130.0	H	70.0	9.6	13.9	70.2
15537.466667	43.6	1000.0	1000.000	100.0	H	316.0	16.2	26.6	70.2

* This is the fundamental frequency not part of spurious emission evaluation. Data provided for information purpose only.



2.8 FREQUENCY STABILITY

2.8.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1055
FCC 47 CFR Part 24, Clause 24.235
FCC 47 CFR Part 27, Clause 27.54
RSS-133, Clause 6.3
RSS-139, Clause 6.4
RSS-130, Clause 4.3

2.8.2 Standard Applicable

FCC 47 CFR Part 24.235 and FCC 47 CFR Part 27.54:

The frequency stability shall be sufficient to ensure the fundamental emissions stays within the authorized frequency block.

RSS-133, Clause 6.3

The carrier frequency shall not depart from the reference frequency, in excess of ± 2.5 ppm for mobile stations and ± 1.0 ppm for base station.

RSS-139, Clause 6.4

The frequency shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-GEN.

RSS-130, Clause 4.3

(a) The frequency offset shall be measured according to the procedure described in RSS-Gen and recorded;

(b) Using a resolution bandwidth of 1% of the occupied bandwidth, a reference point at the unwanted emission level which complies with the attenuation of $43 + 10 \log_{10} p$ (watts) on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as f_L and f_H respectively.

The applicant shall ensure frequency stability by showing that f_L minus the frequency offset and f_H plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

2.8.3 Equipment Under Test and Modification State

Serial No: AZ280418A00044 / Test Configuration A

2.8.4 Date of Test/Initial of test personnel who performed the test

June 26 and July 03, 2018 / XYZ



2.8.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	25.8 - 28.3 °C
Relative Humidity	47.3 - 49.4 %
ATM Pressure	98.7 - 98.9 kPa

2.8.7 Additional Observations

- This is a conducted test. The EUT was operated at 3.7 VDC nominal voltage and was placed in the temperature chamber for this evaluation. The EUT was controlled by a CMW500 and utilizing a spectrum analyser for measurement.
- Measurement was done using the CMW 500 measurement function.
- The EUT was tested over the temperature -30°C to +50°C in 10°C steps and allowed to sit for 1 hour to allow the equipment and chamber temperature to stabilize. The measurements were then performed.
- Voltage variation was also performed at voltage 3.3VDC and higher 4.3VDC of the nominal voltage at 20°C.
- The maximum frequency deviation for LTE Band 13 was verified against the frequency band edges using reference points F_L and F_H at the unwanted emission level which complies with the attenuation of $43 + 10 \log_{10} p$ (watts) on the emission mask of the lowest and highest channel.

2.8.8 Test Results

CA_2A_13A – QPSK 10 MHz & 10 MHz BW- Channel 1880 + 782 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz) LTE Band 2 / Band 13	Frequency Error (ppm) LTE Band 2 / Band 13	Limit (ppm)*
3.7	-30	17.6/-10.0	0.009/-0.013	±2.5 / ±0.1
	-20	17.71/-10.3	0.009/-0.013	±2.5 / ±0.1
	-10	16.51/-11.24	0.009/-0.014	±2.5 / ±0.1
	0	16.31/-9.9	0.009/-0.013	±2.5 / ±0.1
	+10	15.81/-10.77	0.008/-0.014	±2.5 / ±0.1
	+20	15.31/-11.22	0.008/-0.014	±2.5 / ±0.1
	+30	14.89/-10.34	0.008/-0.013	±2.5 / ±0.1
	+40	15.18/-10.76	0.008/-0.014	±2.5 / ±0.1
	+50	16.68/-10.26	0.009/-0.013	±2.5 / ±0.1
3.3	20	14.36/-11.32	0.008/-0.014	±2.5 / ±0.1
4.3		16.45/-10.24	0.009/-0.013	±2.5 / ±0.1

CA_2A_13A – QPSK 10 MHz & 10 MHz BW- Channel 1880 + 782 MHz LTE Band 13						
Voltage (VDC)	Temperature (°C)	F _L (MHz)	F _L – Freq Error (MHz)	F _H (MHz)	F _L + Freq Error (MHz)	Compliance
3.7	-30	777.209	777.209	786.779	786.779	Yes
	+20	777.245	777.245	786.773	786.773	Yes
	+50	777.281	777.281	786.749	786.749	Yes
3.3	20	777.215	777.215	786.767	786.767	Yes
4.3		777.221	777.221	786.779	786.779	Yes

*Limit for LTE Band 13 is according to 3GPP TS 36 010 V14.4.0

The frequency stability of the EUT is sufficient to keep it within the authorised frequency ranges at any temperature interval and voltage variations across the measured range.

CA_4A_13A – QPSK 10 MHz & 10 MHz BW- Channel 1732.5 + 782 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz) LTE Band 4 / Band 13	Frequency Error (ppm) LTE Band 4 / Band 13	Limit (ppm)*
3.7	-30	18.07/-10.3	0.01/-0.013	±0.1
	-20	16.34/-11.43	0.009/-0.015	±0.1
	-10	18.17/-10.26	0.01/-0.013	±0.1
	0	17.97/-9.9	0.01/-0.013	±0.1
	+10	16.89/-10.1	0.01/-0.013	±0.1
	+20	16.29/-10.13	0.009/-0.013	±0.1
	+30	14.61/-11.67	0.008/-0.015	±0.1
	+40	16.31/-10.1	0.009/-0.013	±0.1
	+50	16.06/-11.04	0.009/-0.014	±0.1
3.3	20	17.58 / -10.61	0.01/-0.014	±0.1
4.3		17.47 / -11.43	0.01/-0.015	±0.1

CA_4A_13A – QPSK 10 MHz & 10 MHz BW- Channel 1732.5 + 782 MHz LTE Band 13						
Voltage (VDC)	Temperature (°C)	F _L (MHz)	F _L – Freq Error (MHz)	F _H (MHz)	F _L + Freq Error (MHz)	Compliance
3.7	-30	777.251	777.251	786.809	786.809	Yes
	+20	777.251	777.251	786.773	786.773	Yes
	+50	777.221	777.221	786.779	786.779	Yes
3.3	20	77.257	77.257	786.767	786.767	Yes
4.3		777.251	777.251	786.773	786.773	Yes

*Limit according to 3GPP TS 36 010 V14.4.0

The frequency stability of the EUT is sufficient to keep it within the authorised frequency ranges at any temperature interval and voltage variations across the measured range.

CA_13A_66A – QPSK 10 MHz & 20 MHz BW- Channel 782 + 1755 MHz				
Voltage (VDC)	Temperature (°C)	Frequency Error (Hz) LTE Band 13 / Band 66	Frequency Error (ppm) LTE Band 13 / Band 66	Limit (ppm)*
3.7	-30	-10.29/-19.45	-0.013/-0.011	±0.1
	-20	-9.73/-20.43	-0.012/-0.012	±0.1
	-10	-9.81/18.54	-0.013/0.011	±0.1
	0	-9.31/17.48	-0.012/0.010	±0.1
	+10	-10.93/16.67	-0.014/0.009	±0.1
	+20	-9.78/16.84	-0.013/0.01	±0.1
	+30	-11.06/16.52	-0.014/0.009	±0.1
	+40	-9.44/18.01	-0.012/0.01	±0.1
	+50	-11.4/17.08	-0.015/0.01	±0.1
3.3	20	-12.9 / 16.55	-0.017/0.009	±0.1
4.3		-11.72 / 16.22	-0.015/0.009	±0.1

CA_13A_66A – QPSK 10 MHz & 10 MHz BW- Channel 782 + 1755 MHz LTE Band 13						
Voltage (VDC)	Temperature (°C)	F _L (MHz)	F _L – Freq Error (MHz)	F _H (MHz)	F _L + Freq Error (MHz)	Compliance
3.7	-30	777.161	777.161	786.833	786.833	Yes
	+20	777.137	777.137	786.863	786.863	Yes
	+50	777.203	777.203	786.803	786.803	Yes
3.3	20	777.149	777.149	786.833	786.833	Yes
4.3		777.155	777.155	786.839	786.839	Yes

*Limit according to 3GPP TS 36 010 V14.4.0

The frequency stability of the EUT is sufficient to keep it within the authorised frequency ranges at any temperature interval and voltage variations across the measured range.



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Antenna Conducted Port Setup						
7662	P-Series Power Meter	N1911A	MY45100951	Agilent	06/28/19	06/28/20
7605	50MHz-18GHz Wideband Power Sensor	N1921A	MY51100054	Agilent	07/24/19	07/24/20
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	01/07/19	01/07/20
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	10/10/19	10/10/21
40813	Wideband Radio Communication Tester	CMW500	145913-RH	Rhode & Schwarz	04/22/19	04/22/20
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 7608 and 7582	
-	10dB Attenuator	VAT-10W2+2W	N/A	MCL	Verified by 7608 and 7582	
Radiated Test Setup						
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	01/07/19	01/07/20
7608	Vector Signal Generator	SMBV100A	259021	Rhode & Schwarz	10/10/19	10/10/21
1033	Bilog Antenna	3142C	00044556	EMCO	09/05/19	09/05/21
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	06/16/18	06/16/20
1016	Pre-amplifier	PAM-0202	187	PAM	03/08/19	03/08/20
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	10/11/19	10/11/20
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	03/07/19	03/07/20
-	Power Splitter	ZN2PD-63-S+	UU74001429	Mini-Circuits	Verified by 7608 and 7582	
40813	Wideband Radio Communication Tester	CMW500	145913-RH	Rhode & Schwarz	04/22/19	04/22/20
Miscellaneous						
43003	True RMS Multimeter	85 III	96880143	Fluke	10/07/19	10/07/20
7579	Temperature Chamber	115	151617	TestQuity	09/09/19	09/09/20
7619	Temp & Humidity Sensor	iBTHX-W	15050268	Omega	06/18/19	06/18/20
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Conducted Antenna Port Measurement

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Cable attenuation	1.00 dB	Normal, k=2	2.000	0.50	0.25
3	Receiver sinewave accuracy	0.08 dB	Normal, k=2	2.000	0.04	0.00
4	Receiver pulse amplitude	0.00 dB	Rectangular	1.732	0.00	0.00
5	Receiver pulse repetition rate	0.00 dB	Rectangular	1.732	0.00	0.00
6	Noise floor proximity	0.00 dB	Rectangular	1.732	0.00	0.00
7	Frequency interpolation	0.10 dB	Rectangular	1.732	0.06	0.00
8	Mismatch	0.07 dB	U-shaped	1.414	0.05	0.00
Combined standard uncertainty			Normal		0.52 dB	
Expanded uncertainty			Normal, k=2		1.03 dB	

3.2.2 Radiated Emission Measurements (Below 1GHz)

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20 dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.75 dB	Normal, k=2	2.000	0.38	0.14
4	Receiver sinewave accuracy	1.10 dB	Normal, k=2	2.000	0.55	0.30
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50 dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95 dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10 dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 3 m	3.12 dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 3 m	1.00 dB	Rectangular	1.732	0.58	0.33
13	Cross-polarisation	0.90 dB	Rectangular	1.732	0.52	0.27
14	Balance	0.00 dB	Rectangular	1.732	0.00	0.00
15	Site imperfections	3.91 dB	Triangular	2.449	1.60	2.55
16	Separation distance at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03
17	Effect of setup table material	0.21 dB	Rectangular	1.732	0.12	0.01
18	Table height at 3 m	0.10 dB	Normal, k=2	2.000	0.05	0.00
19	Near-field effects	0.00 dB	Triangular	2.449	0.00	0.00
20	Effect of ambient noise on OATS	0.00 dB				0.00
Combined standard uncertainty			Normal		3.0 dB	
Expanded uncertainty			Normal, k=2		5.99 dB	

3.2.3 Radiated Emission Measurements (Above 1GHz)

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.30 dB	Normal, k=2	2.000	0.15	0.02
3	Preamplifier Gain	0.20 dB	Normal, k=2	2.000	0.10	0.01
4	Antenna factor AF	0.37 dB	Normal, k=2	2.000	0.19	0.03
5	Sinewave accuracy	0.57 dB	Normal, k=2	2.000	0.29	0.08
6	Instability of preamp gain	1.21 dB	Rectangular	1.732	0.70	0.49
7	Noise floor proximity	0.70 dB	Rectangular	1.732	0.40	0.16
8	Mismatch: antenna-preamplifier	1.41 dB	U-shaped	1.414	1.00	0.99
9	Mismatch: preamplifier-receiver	1.30 dB	U-shaped	1.414	0.92	0.85
10	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03
11	Directivity difference at 3 m	1.50 dB	Rectangular	1.732	0.87	0.75
12	Phase center location at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03
13	Cross-polarisation	0.90 dB	Rectangular	1.732	0.52	0.27
14	Site imperfections VSWR (Method 2)	5.48 dB	Triangular	2.449	2.24	5.01
15	Effect of setup table material	0.95 dB	Rectangular	1.732	0.55	0.30
16	Separation distance at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03
17	Table height at 3 m	0.00 dB	Normal, k=2	2.000	0.00	0.00
Combined standard uncertainty				Normal	3.01 dB	
Expanded uncertainty				Normal, k=2	6.02 dB	

3.2.4 Conducted Measurements

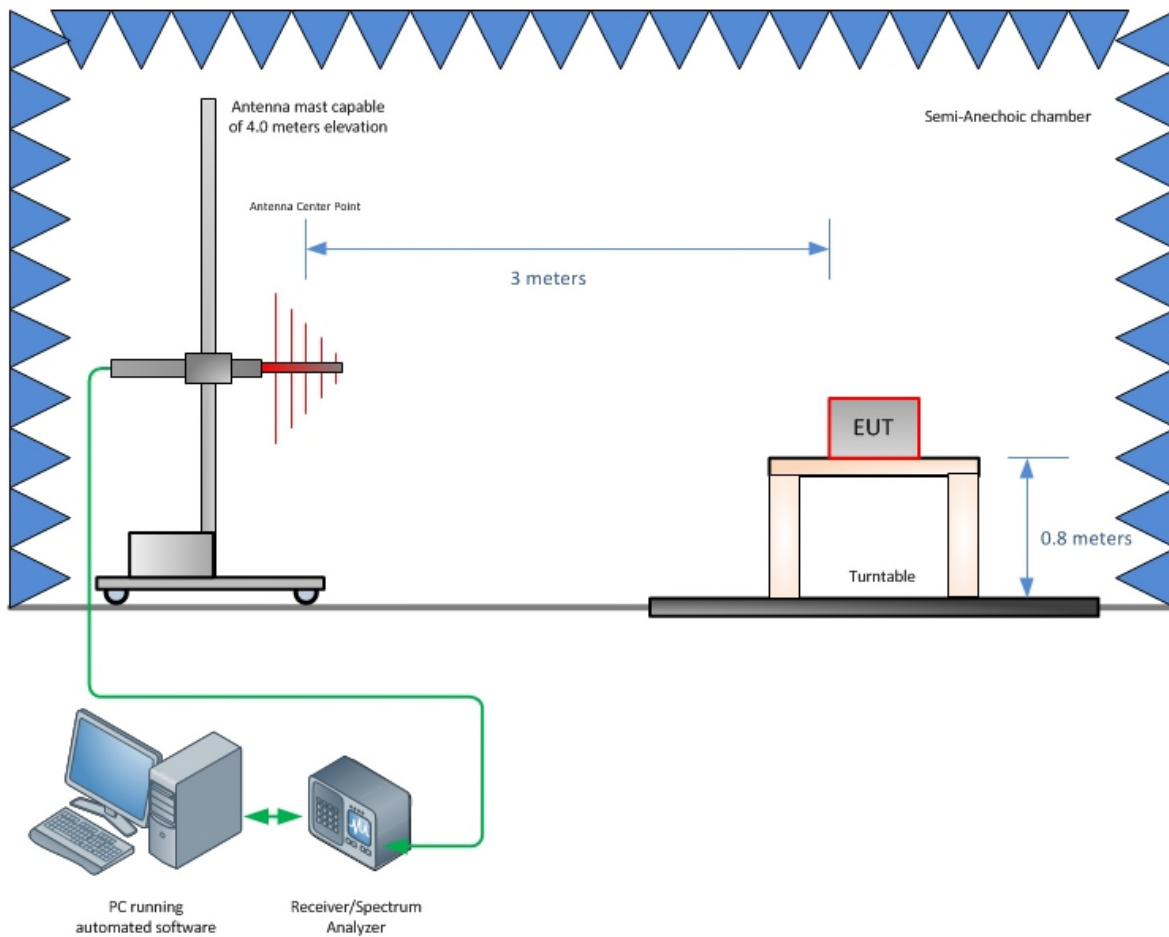
	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	LISN-receiver attenuation	0.10 dB	Normal, k=2	2.000	0.05	0.00
3	LISN voltage division factor	0.30 dB	Normal, k=2	2.000	0.15	0.02
4	Receiver sinewave accuracy	0.36 dB	Normal, k=2	2.000	0.18	0.03
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.00 dB	Rectangular	1.732	0.00	0.00
8	AMN VDF frequency interpolation	0.10 dB	Rectangular	1.732	0.06	0.00
9	Mismatch	0.07 dB	U-shaped	1.414	0.05	0.00
10	LISN impedance	2.65 dB	Triangular	2.449	1.08	1.17
11	Effect of mains disturbance	0.00 dB			0.00	0.00
12	Effect of the environment					
Combined standard uncertainty				Normal	1.66 dB	
Expanded uncertainty				Normal, k=2	3.31 dB	



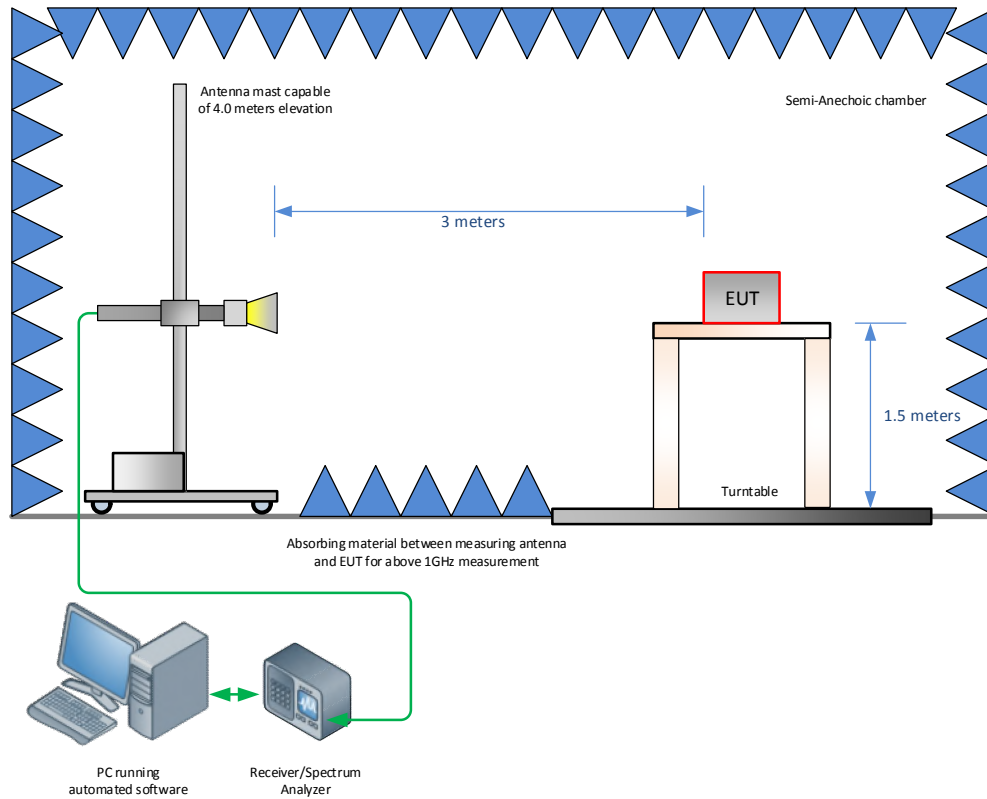
SECTION 4

DIAGRAM OF TEST SETUP

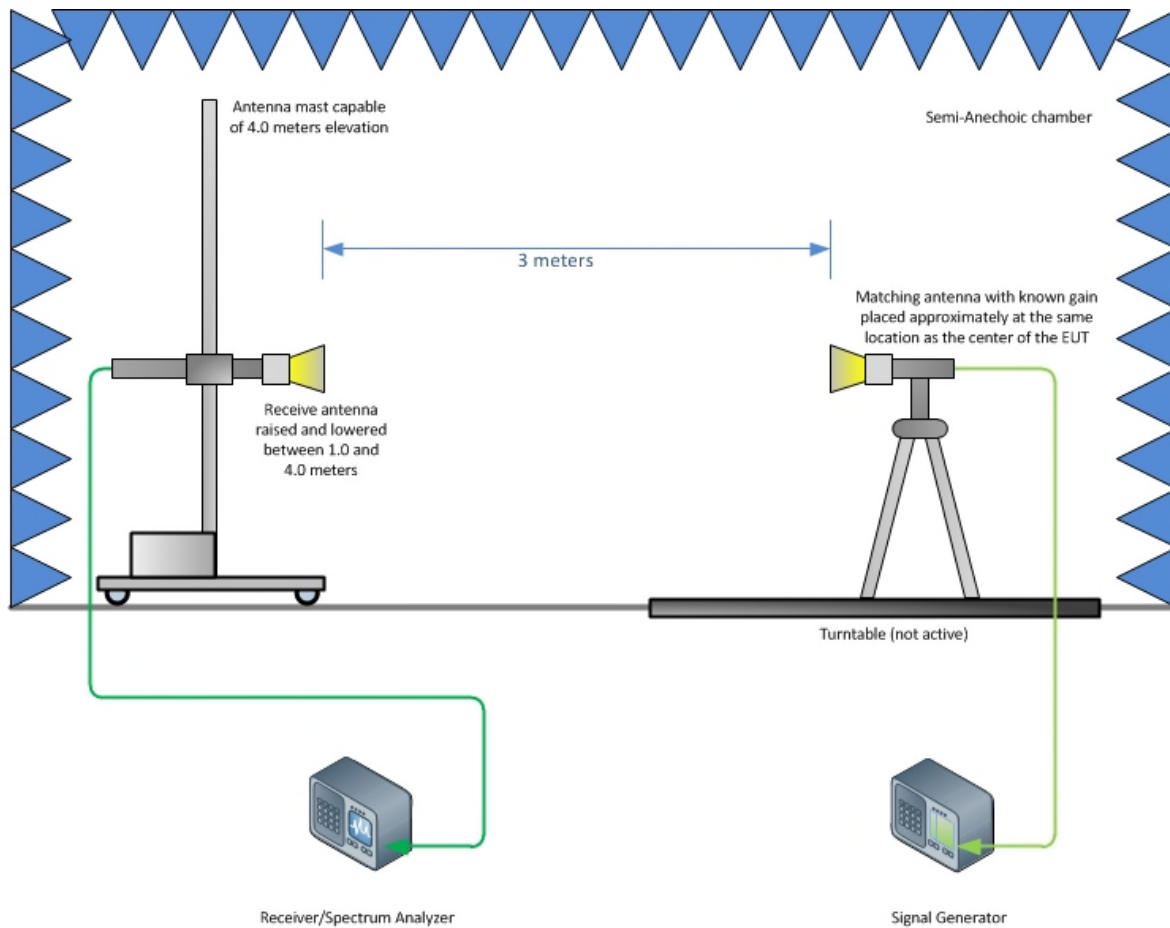
4.1 TEST SETUP DIAGRAM



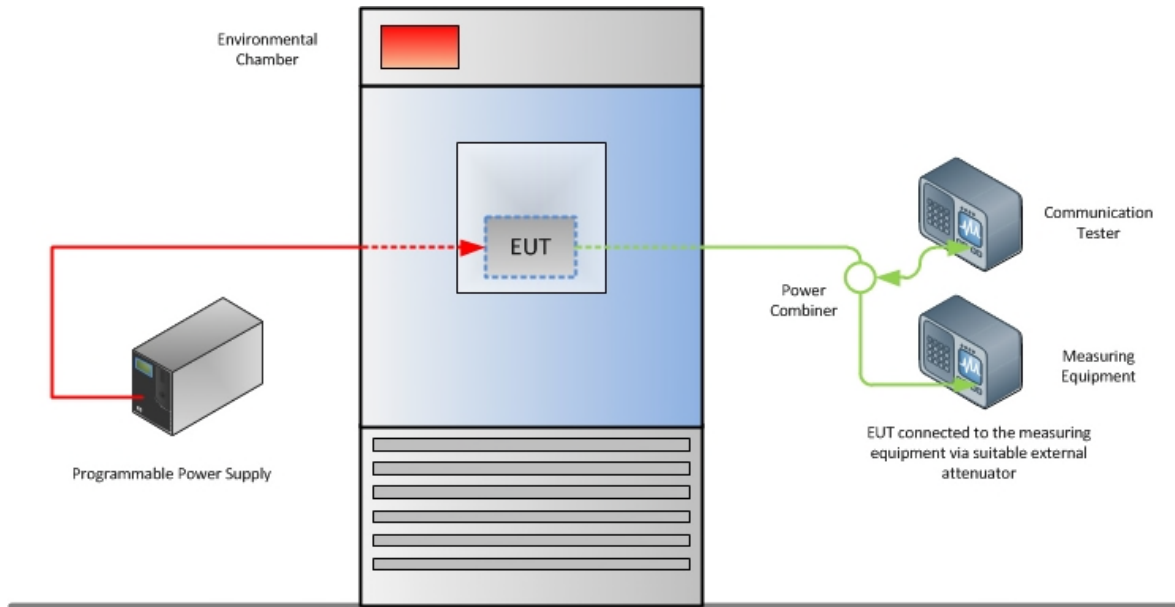
Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



Substitution Test Method (Above 1GHz)



Frequency Stability Test Configuration



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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