

YMit 2019 09 05

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-19	19-Mar-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in the available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet. For Multiband operation, measurements were taken at the lower band edge of the lower band and the upper band edge of the upper band.

The spectrum was scanned below the lower band edge and above the higher band edge.

All limits were adjusted by a factor of [-10*log((N)] to account for the device operation as a N port MIMO transmitter, as per FCC KDB 622911.

For Bands 12 and 14, the adjustment factor is -10*log(4) = -6 dB. The Bands 12 and 14 adjusted limit is -19 dBm. For Band 29, the adjustment factor is -10*log(2) = -3 dB. The Band 29 adjusted limit is -16 dBm.

For Band 14 band edge measurements from 769MHz-775MHz and 799MHz-807MHz, reference level offset corrections were applied to the spectrum analyzer, according to the following table:

Frequency									
(MHz)	769	769.05	769.1	769.15	769.2	769.25	769.3	769.35	769.4
Correction									
Factor (dB)	50.1	49.2	48.4	47.8	47.3	46.9	46.5	46.2	45.9
Frequency									
(MHz)	769.45	769.5	769.55	769.6	769.65	769.7	769.75	769.8	769.85
Correction									
Factor (dB)	45.7	45.4	45.2	45.1	44.9	44.7	44.6	44.5	44.4
Frequency									
(MHz)	769.9	769.95	770	770.5	771	775	776	798	805
Correction			-				-		
Factor (dB)	44.3	4.2	44.1	43.3	42.9	41.9	41.8	41.1	41.1

Per FCC section 27.53(g), the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the RRH may operate as a 4 port MIMO transmitter for Band 12.

FCC 27.53(g) requires a >100 kHz measurement bandwidth for emissions 100 kHz outside of the RRH operating frequency range. FCC 27.53(g) requires a >30 kHz measurement bandwidth for emissions between 100 kHz outside of the RRH operating frequency range and band edge of the operating frequency range.

Per section 90.543(e)(3), the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the RRH may operate as a 4 port MIMO transmitter for Band 14.

FCC 90.543(e)(5) requires a >100 kHz measurement bandwidth for emissions 100 kHz outside of the RRH operating frequency range. FCC 90.543(e)(5) requires a >30 kHz measurement bandwidth for emissions between 100 kHz outside of the RRH operating frequency range and band edge of the operating frequency range.

FCC 90.543(e)(1) requires an emission limit of -46dBm for any 6.25 kHz bandwidth between frequency bands 769-775 MHz and 799-805 MHz. The limit is adjusted to -52 dBm per 6.25kHz bandwidth [-46 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

Report No. NOKI0004.1

Measurement 4



EUT: AHLBBA RRH
Serial Number: K9193514835
Customer: Nokia Solutions and Networks Work Order: NOKI0004 Date: 19-Nov-19 Temperature: 22.8 °C Humidity: 30.9% RH Barometric Pres.: 1017 mbar Project: None
Tested by: Jonathan Kiefer
TEST SPECIFICATIONS Power: 54VDC Test Method Job Site: TX09 FCC 27:2019 FCC 901:2019 COMMENTS Band 12 Multicarrier and Band 14 Multicarrier band edge measurements. Tested on highest power antenna port (Port 1). EUT is operated at 100% duty cycle. DEVIATIONS FROM TEST STANDARD Jonathan Kiefer Configuration # 2, 3 Signature Value Limit Result Band 12 Multicarrier **QPSK Modulation** Lower Band Edge -19 -19 Measurement 1 -30,101 Pass Measurement 2 -28.441 Pass Upper Band Edge Measurement 1 -30.016 -19 Pass Measurement 2 -28.313 -19 Pass 16QAM Modulation Lower Band Edge Measurement 1 -30.611 -19 Pass Measurement 2 -28.649 -19 Pass Upper Band Edge Measurement 1 -30 544 -19 Pass -19 Measurement 2 -28.267 Pass 64QAM Modulation Lower Band Edge Measurement 1 Measurement 2 -30.701 -28.533 -19 -19 Pass Pass Upper Band Edge Measurement 1 -30.731 Pass -19 Measurement 2 -28.269 -19 Pass 256QAM Modulation Lower Band Edge Measurement 1 -30.57 -19 Pass Measurement 2 -28.385 -19 Pass Upper Band Edge Measurement 1 Measurement 2 -30.413 -28.098 -19 -19 Pass Pass Band 14 Multicarrier QPSK Modulation Lower Band Edge Measurement 1 Pass -26.892 -19 Measurement 2 -24 633 -19 Pass Upper Band Edge Measurement 1 -30.36 -19 Pass -19 Measurement 2 -27.882 Pass Measurement 3 Measurement 4 -58.786 -69.812 -52 -52 Pass Pass 16QAM Modulation Lower Band Edge -19 -19 Measurement 1 -27.403 Pass Measurement 2 -24.361 Pass Upper Band Edge Measurement 1 -30.276 -19 Pass Measurement 2 -28.022 -19 Pass -58.411 -52 Pass Measurement 3 Measurement 4 -69.97 -52 Pass 64QAM Modulation Lower Band Edge -27.146 -19 Pass Measurement 1 Measurement 2 -24.5 -19 Pass Upper Band Edge Measurement 1 -30 601 -19 Pass -19 Measurement 2 -27.781 Pass -52 -52 Measurement 3 -58 997 Pass Measurement 4 -70.058 Pass 256QAM Modulation Lower Band Edge -27.256 -24.498 -19 -19 Measurement 1 Pass Measurement 2 Pass Upper Band Edge Measurement 1 -30.318 -19 Pass Measurement 2 -28 034 -19 Pass Measurement 3 -58.896 -52 Pass

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-69.988

-52

Pass

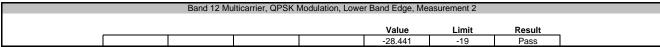


Band 12 Multicarrier, QPSK Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-30.101 -19 Pass







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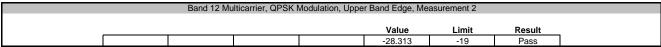


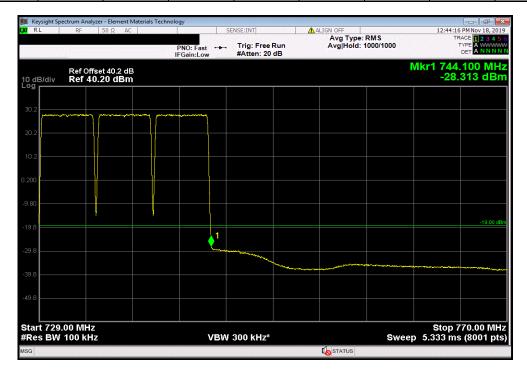
Band 12 Multicarrier, QPSK Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-30.016 -19 Pass







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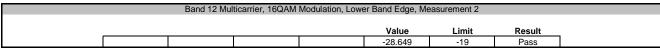


Band 12 Multicarrier, 16QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-30.611 -19 Pass







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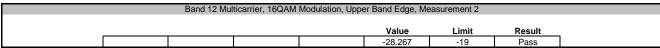


Band 12 Multicarrier, 16QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-30.544 -19 Pass







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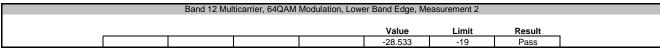


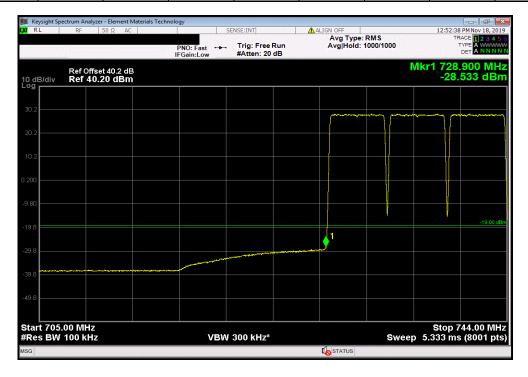
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Value Limit Result

-30.701 -19 Pass







Report No. NOKI0004.1 308/574

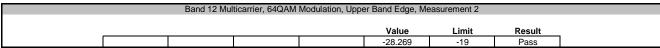


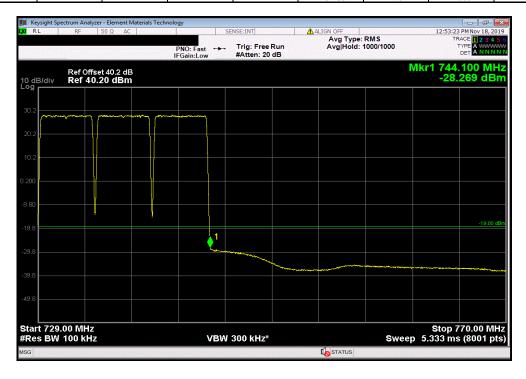
Band 12 Multicarrier, 64QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-30.731 -19 Pass







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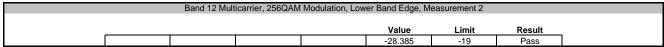


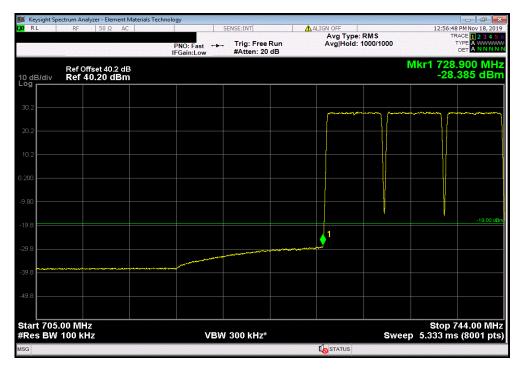
Band 12 Multicarrier, 256QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-30.57 -19 Pass







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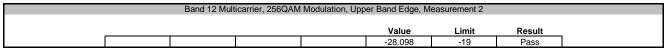


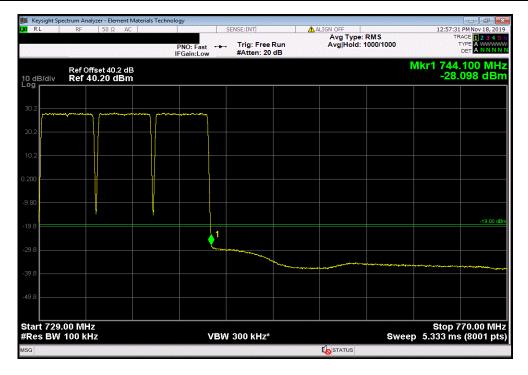
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Value Limit Result

-30.413 -19 Pass







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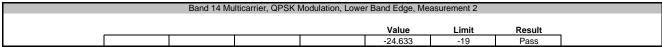


Band 14 Multicarrier, QPSK Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-26.892 -19 Pass







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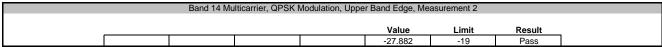


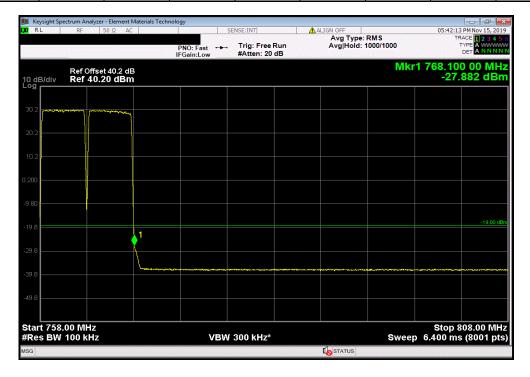
Band 14 Multicarrier, QPSK Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-30.36 -19 Pass







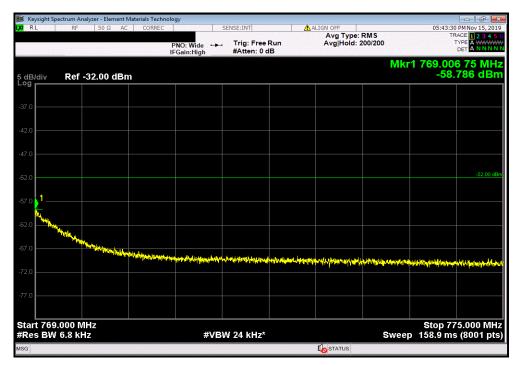
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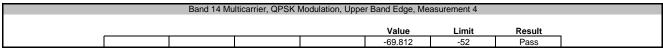


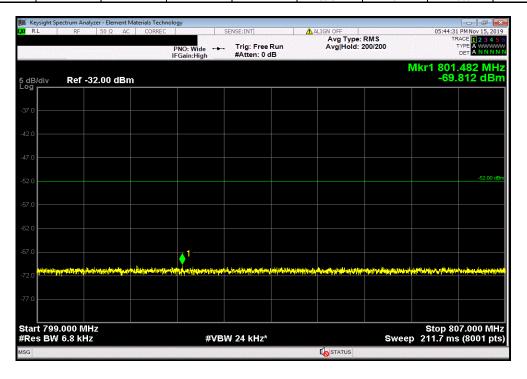
Band 14 Multicarrier, QPSK Modulation, Upper Band Edge, Measurement 3

Value Limit Result

-58.786 -52 Pass







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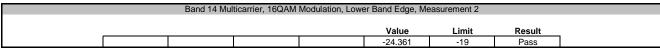


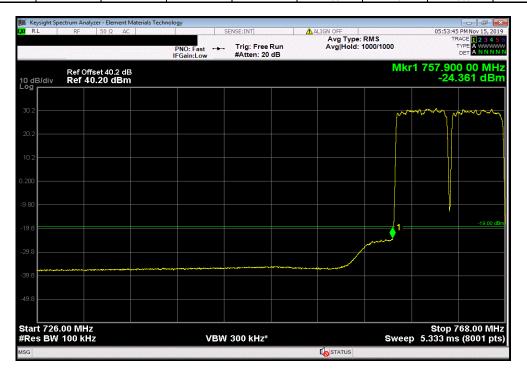
Band 14 Multicarrier, 16QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-27.403 -19 Pass







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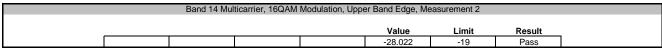


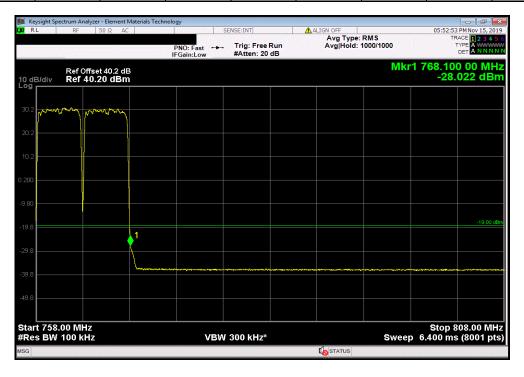
Band 14 Multicarrier, 16QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-30.276 -19 Pass







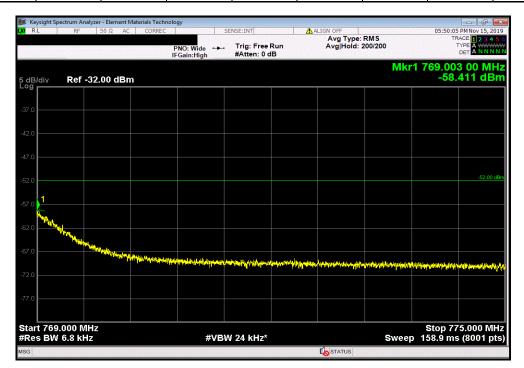
Report No. NOKI0004.1 316/574

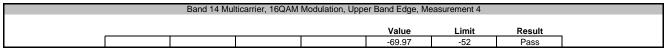


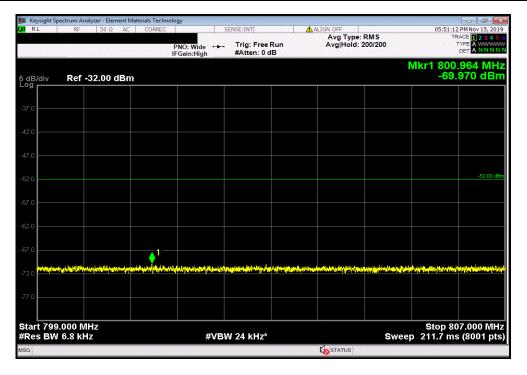
Band 14 Multicarrier, 16QAM Modulation, Upper Band Edge, Measurement 3

Value Limit Result

-58.411 -52 Pass







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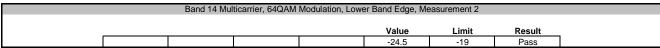


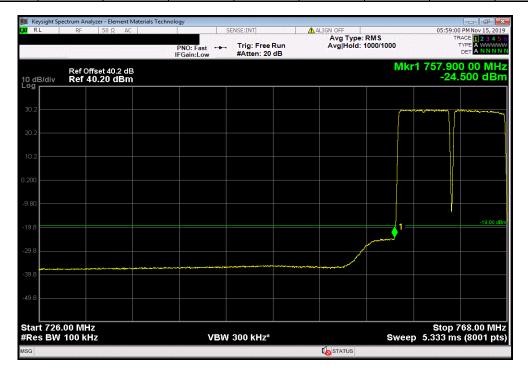
Band 14 Multicarrier, 64QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-27.146 -19 Pass







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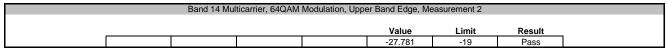


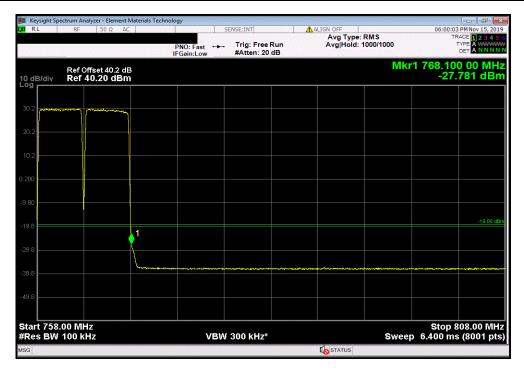
Band 14 Multicarrier, 64QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-30.601 -19 Pass







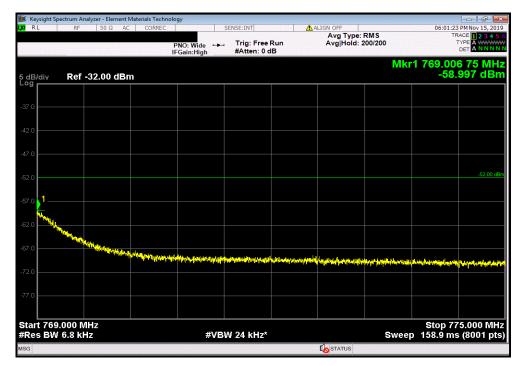
Report No. NOKI0004.1 319/574

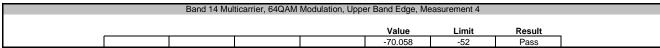


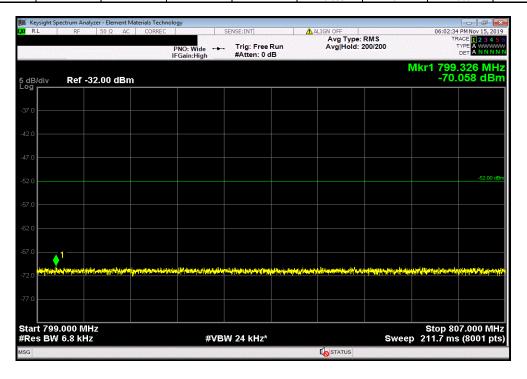
Band 14 Multicarrier, 64QAM Modulation, Upper Band Edge, Measurement 3

Value Limit Result

-58.997 -52 Pass







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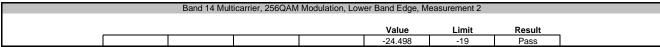


Band 14 Multicarrier, 256QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-27.256 -19 Pass







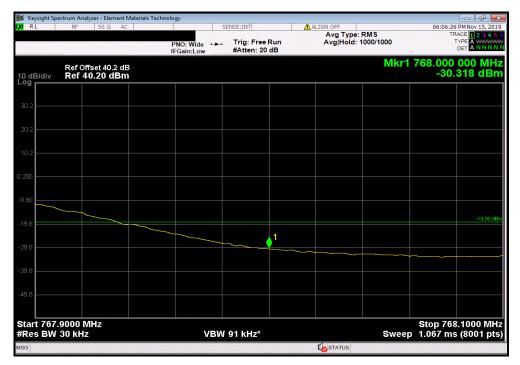
Report No. NOKI0004.1 321/574

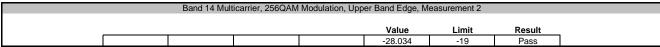


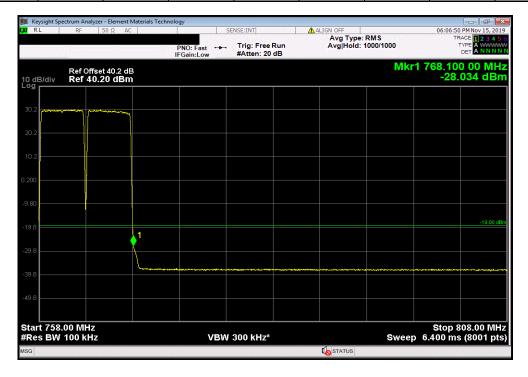
Band 14 Multicarrier, 256QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-30.318 -19 Pass







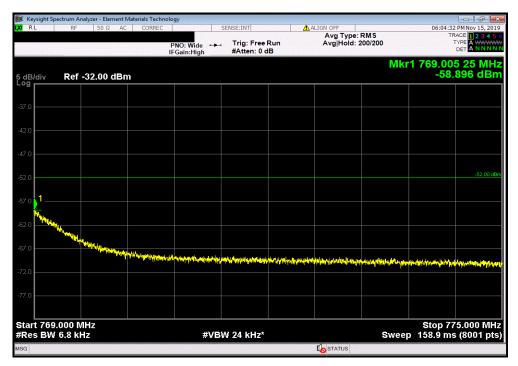
Report No. NOKI0004.1 322/574

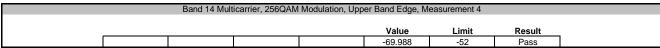


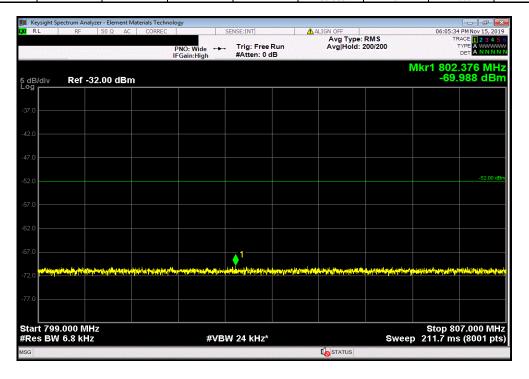
Band 14 Multicarrier, 256QAM Modulation, Upper Band Edge, Measurement 3

Value Limit Result

-58.896 -52 Pass







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Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-19	19-Mar-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in the available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet. For Multiband operation, measurements were taken at the lower band edge of the lower band and the upper band edge of the upper band.

The spectrum was scanned below the lower band edge and above the higher band edge.

All limits were adjusted by a factor of [-10*log((N)] to account for the device operation as a N port MIMO transmitter, as per FCC KDB 622911.

For Bands 12 and 14, the adjustment factor is $-10*\log(4) = -6$ dB. The Bands 12 and 14 adjusted limit is -19 dBm. For Band 29, the adjustment factor is $-10*\log(2) = -3$ dB. The Band 29 adjusted limit is -16 dBm.

For Band 14 band edge measurements from 769MHz-775MHz and 799MHz-807MHz, reference level offset corrections were applied to the spectrum analyzer, according to the following table:

Frequency									
(MHz)	769	769.05	769.1	769.15	769.2	769.25	769.3	769.35	769.4
Correction									
Factor (dB)	50.1	49.2	48.4	47.8	47.3	46.9	46.5	46.2	45.9
Frequency									
(MHz)	769.45	769.5	769.55	769.6	769.65	769.7	769.75	769.8	769.85
Correction									
Factor (dB)	45.7	45.4	45.2	45.1	44.9	44.7	44.6	44.5	44.4
Frequency									
(MHz)	769.9	769.95	770	770.5	771	775	776	798	805
Correction									
Factor (dB)	44.3	4.2	44.1	43.3	42.9	41.9	41.8	41.1	41.1

Per FCC section 27.53(g), the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the RRH may operate as a 4 port MIMO transmitter for Band 12.

FCC 27.53(g) requires a >100 kHz measurement bandwidth for emissions 100 kHz outside of the RRH operating frequency range. FCC 27.53(g) requires a >30 kHz measurement bandwidth for emissions between 100 kHz outside of the RRH operating frequency range and band edge of the operating frequency range.

Per section 90.543(e)(3), the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the RRH may operate as a 4 port MIMO transmitter for Band 14.

FCC 90.543(e)(5) requires a >100 kHz measurement bandwidth for emissions 100 kHz outside of the RRH operating frequency range. FCC 90.543(e)(5) requires a >30 kHz measurement bandwidth for emissions between 100 kHz outside of the RRH operating frequency range and band edge of the operating frequency range.

FCC 90.543(e)(1) requires an emission limit of -46dBm for any 6.25 kHz bandwidth between frequency bands 769-775 MHz and 799-805 MHz. The limit is adjusted to -52 dBm per 6.25kHz bandwidth [-46 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter.

Report No. NOKI0004.1

Measurement 3

Measurement 4



EUT: AHLBBA RRH
Serial Number: K9193514835
Customer: Nokia Solutions and Networks Work Order: NOKI0004 Date: 19-Nov-19 Temperature: 22.8 °C Humidity: 30.9% RH Barometric Pres.: 1017 mbar Project: None
Tested by: Jonathan Kiefer
TEST SPECIFICATIONS Power: 54VDC Test Method Job Site: TX09 FCC 27:2019 FCC 901:2019 COMMENTS Band 12 Multicarrier and Band 14 Multicarrier band edge measurements. Tested on highest power antenna port (Port 2). EUT is operated at 100% duty cycle. DEVIATIONS FROM TEST STANDARD Jonathan Kiefer Configuration # 2, 3 Signature Value Limit Result Band 12 Multicarrier **QPSK Modulation** Lower Band Edge -19 -19 Measurement 1 -26.185 Pass Measurement 2 -25.003 Pass Upper Band Edge Measurement 1 -25.563 -19 Pass Measurement 2 -23.951 -19 Pass 16QAM Modulation Lower Band Edge Measurement 1 -26.322 -19 Pass Measurement 2 -25.356 -19 Pass Upper Band Edge Measurement 1 -26 151 -19 Pass -24.018 -19 Measurement 2 Pass 64QAM Modulation Lower Band Edge Measurement 1 Measurement 2 -26.825 -24.665 -19 -19 Pass Pass Upper Band Edge Measurement 1 -26.254 Pass -19 Measurement 2 -23.841 -19 Pass 256QAM Modulation Lower Band Edge Measurement 1 -26.726 -19 Pass Measurement 2 -25.111 -19 Pass Upper Band Edge Measurement 1 Measurement 2 -26.16 -23.682 -19 -19 Pass Pass Band 14 Multicarrier QPSK Modulation Lower Band Edge Measurement 1 -23.594 Pass -19 Measurement 2 -23 283 -19 Pass Upper Band Edge Measurement 1 -26.524 -19 Pass -19 Measurement 2 -26.325 Pass Measurement 3 Measurement 4 -52 -52 -58.956 Pass Pass -69.775 16QAM Modulation Lower Band Edge -19 -19 Measurement 1 -24.369 Pass Measurement 2 -23.253 Pass Upper Band Edge -26.384 Measurement 1 -19 Pass Measurement 2 -26.482 -19 Pass -59.095 -52 Pass Measurement 3 Measurement 4 -69.932 -52 Pass 64QAM Modulation Lower Band Edge -24.32 -19 Pass Measurement 1 Measurement 2 -22.885 -19 Pass Upper Band Edge Measurement 1 -26 976 -19 Pass -19 Measurement 2 -26.11 Pass -52 -52 Measurement 3 -58 854 Pass Measurement 4 -69.938 Pass 256QAM Modulation Lower Band Edge -19 -19 Measurement 1 -24.697 Pass Measurement 2 -22.973 Pass Upper Band Edge Measurement 1 -26.593 Pass -19 Measurement 2 -26 235 -19 Pass

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-58.682

-69.69

-52

-52

Pass

Pass

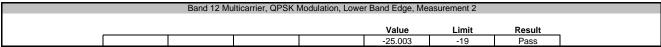


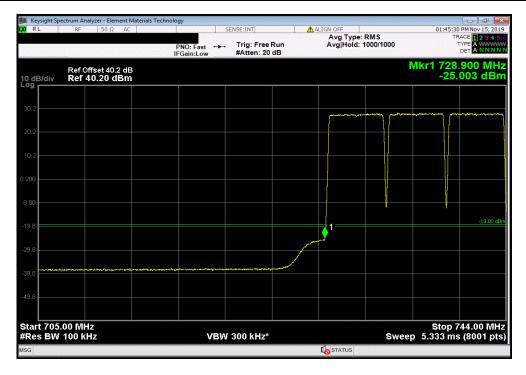
Band 12 Multicarrier, QPSK Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-26.185 -19 Pass







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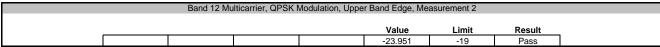


Band 12 Multicarrier, QPSK Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-25.563 -19 Pass







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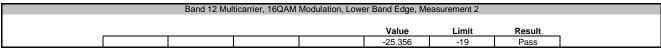


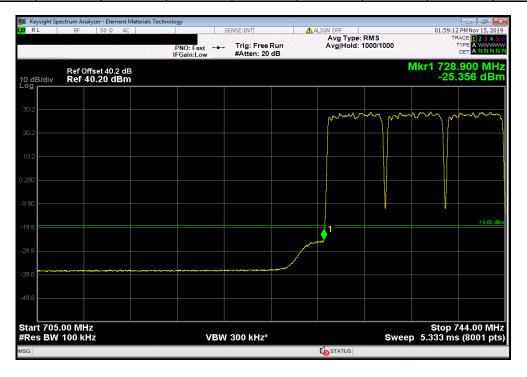
Band 12 Multicarrier, 16QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-26.322 -19 Pass







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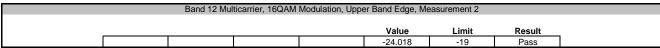


Band 12 Multicarrier, 16QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-26.151 -19 Pass







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Mit 2019.09.0

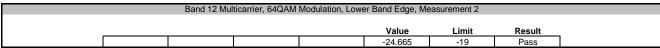


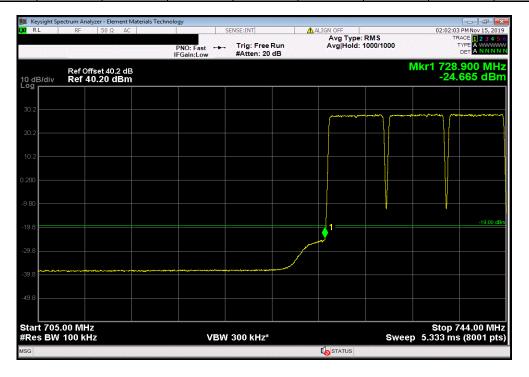
Band 12 Multicarrier, 64QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-26.825 -19 Pass







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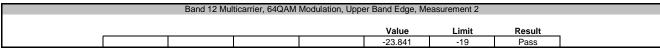


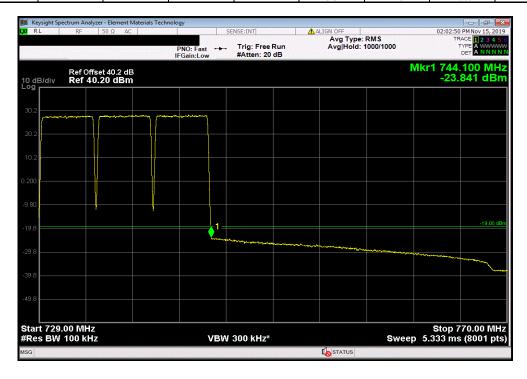
Band 12 Multicarrier, 64QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-26.254 -19 Pass







Report No. NOKI0004.1 331/574

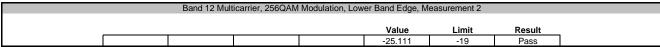


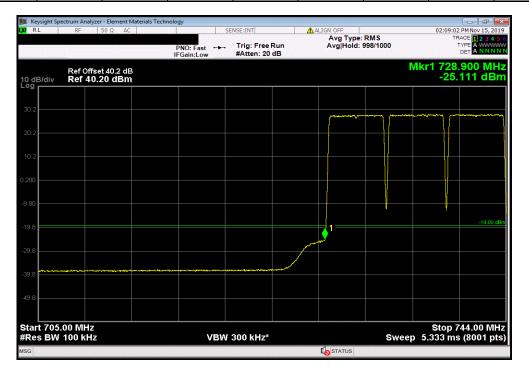
Band 12 Multicarrier, 256QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-26.726 -19 Pass







Report No. NOKI0004.1 332/574

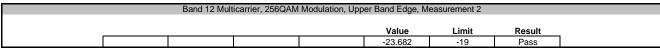


Band 12 Multicarrier, 256QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-26.16 -19 Pass







Report No. NOKI0004.1 333/574

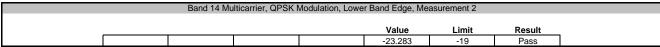


Band 14 Multicarrier, QPSK Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-23.594 -19 Pass







Report No. NOKI0004.1 334/574

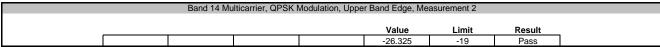


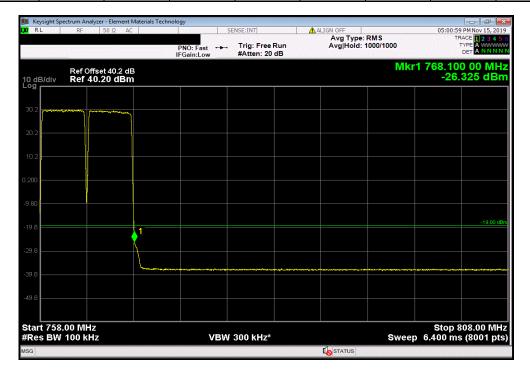
Band 14 Multicarrier, QPSK Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-26.524 -19 Pass







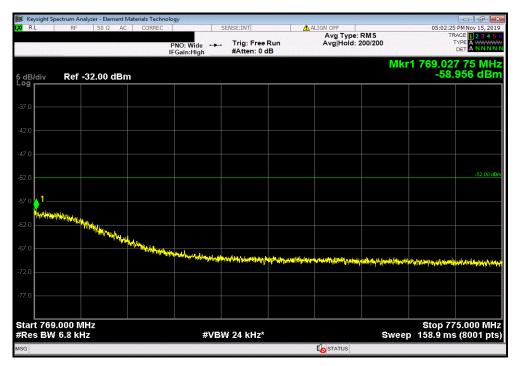
Report No. NOKI0004.1 335/574

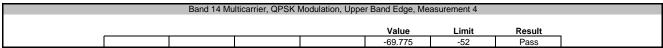


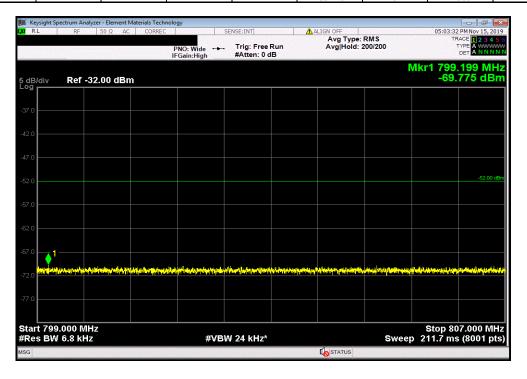
Band 14 Multicarrier, QPSK Modulation, Upper Band Edge, Measurement 3

Value Limit Result

-58.956 -52 Pass







Report No. NOKI0004.1 336/574

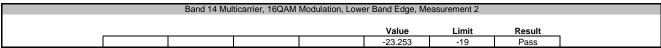


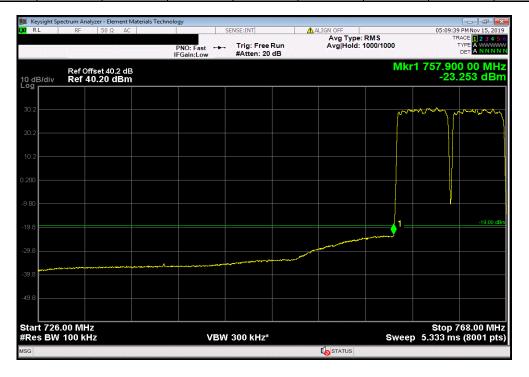
Band 14 Multicarrier, 16QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-24.369 -19 Pass







Report No. NOKI0004.1 337/574

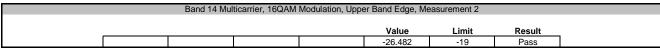


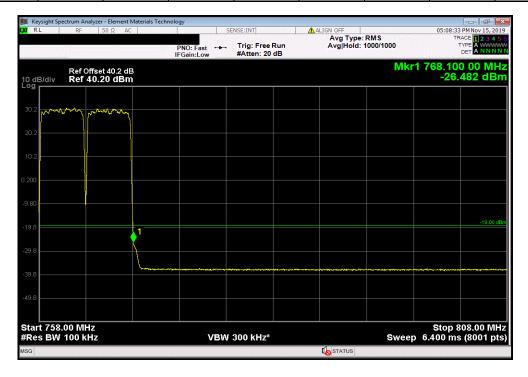
Band 14 Multicarrier, 16QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-26.384 -19 Pass







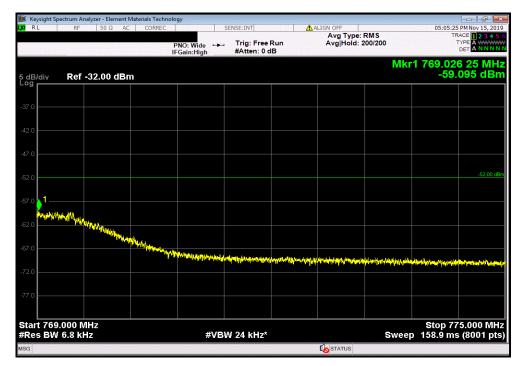
Report No. NOKI0004.1 338/574

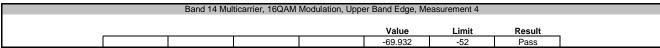


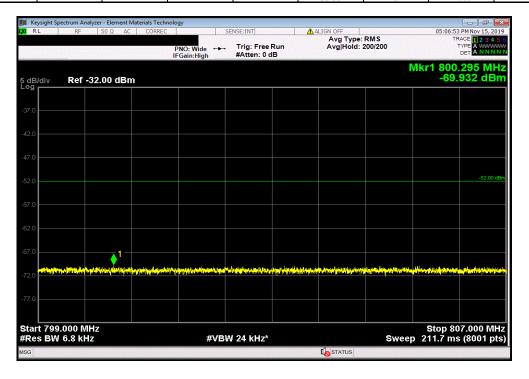
Band 14 Multicarrier, 16QAM Modulation, Upper Band Edge, Measurement 3

Value Limit Result

-59.095 -52 Pass







Report No. NOKI0004.1 339/574

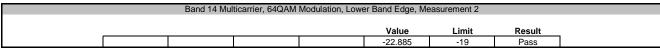


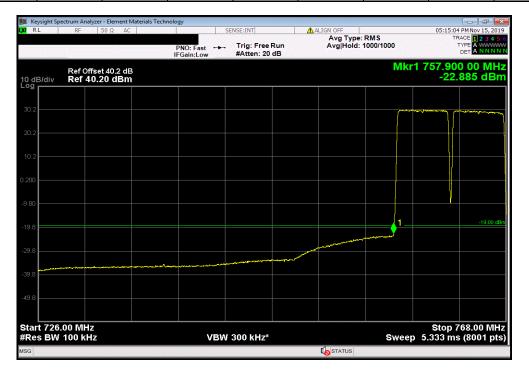
Band 14 Multicarrier, 64QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-24.32 -19 Pass







Report No. NOKI0004.1 340/574

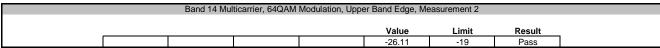


Band 14 Multicarrier, 64QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-26.976 -19 Pass







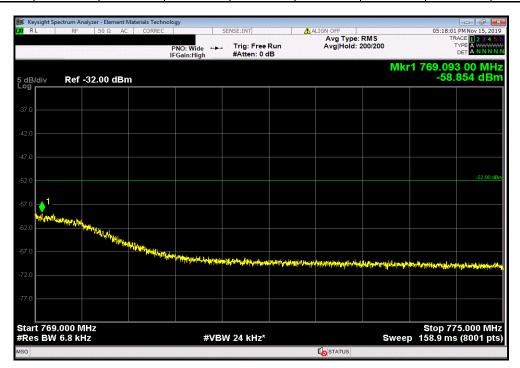
Report No. NOKI0004.1 341/574

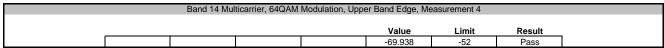


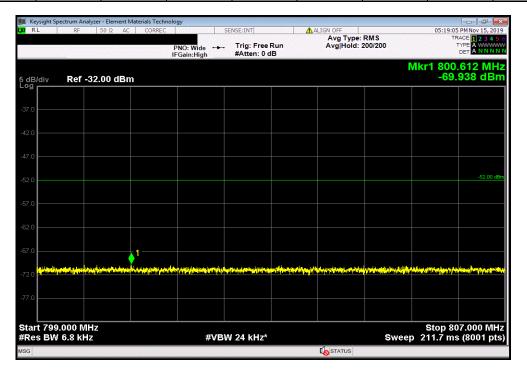
Band 14 Multicarrier, 64QAM Modulation, Upper Band Edge, Measurement 3

Value Limit Result

-58.854 -52 Pass







Report No. NOKI0004.1 342/574

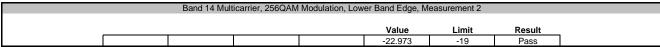


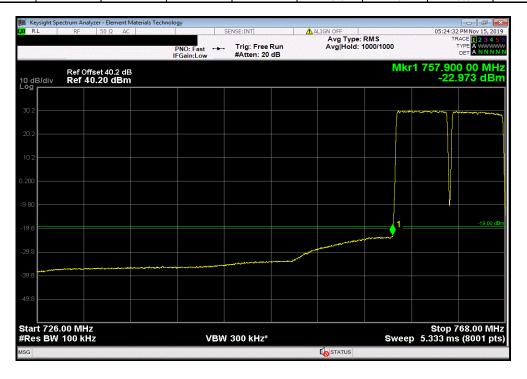
Band 14 Multicarrier, 256QAM Modulation, Lower Band Edge, Measurement 1

Value Limit Result

-24.697 -19 Pass







Report No. NOKI0004.1 343/574

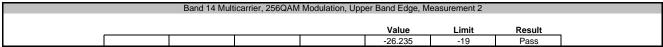


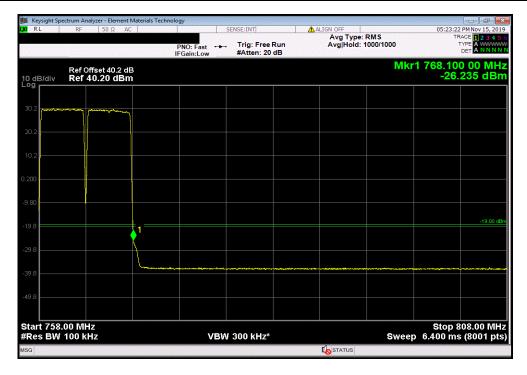
Band 14 Multicarrier, 256QAM Modulation, Upper Band Edge, Measurement 1

Value Limit Result

-26.593 -19 Pass







Report No. NOKI0004.1 344/574

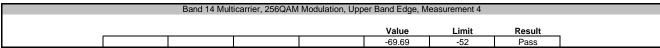


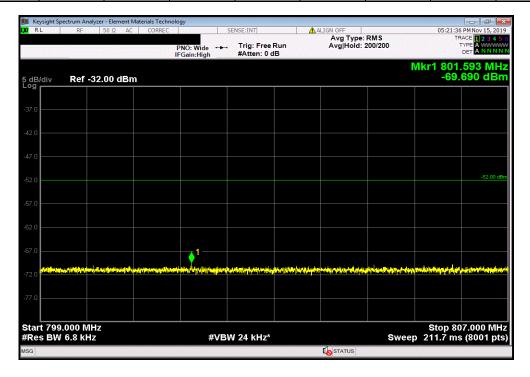
Band 14 Multicarrier, 256QAM Modulation, Upper Band Edge, Measurement 3

Value Limit Result

-58.682 -52 Pass







Report No. NOKI0004.1 345/574