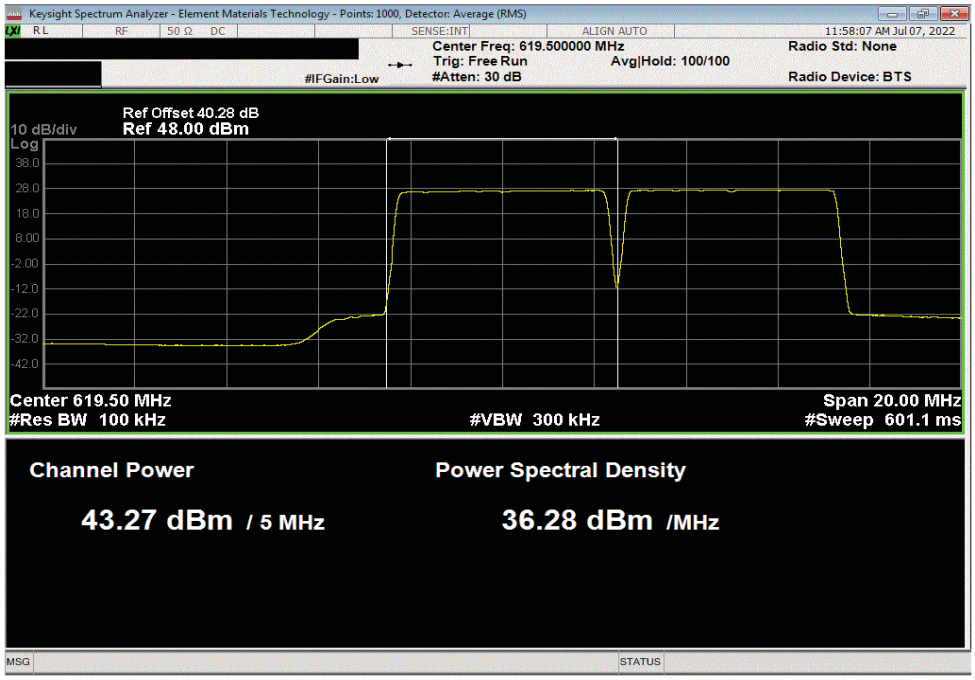
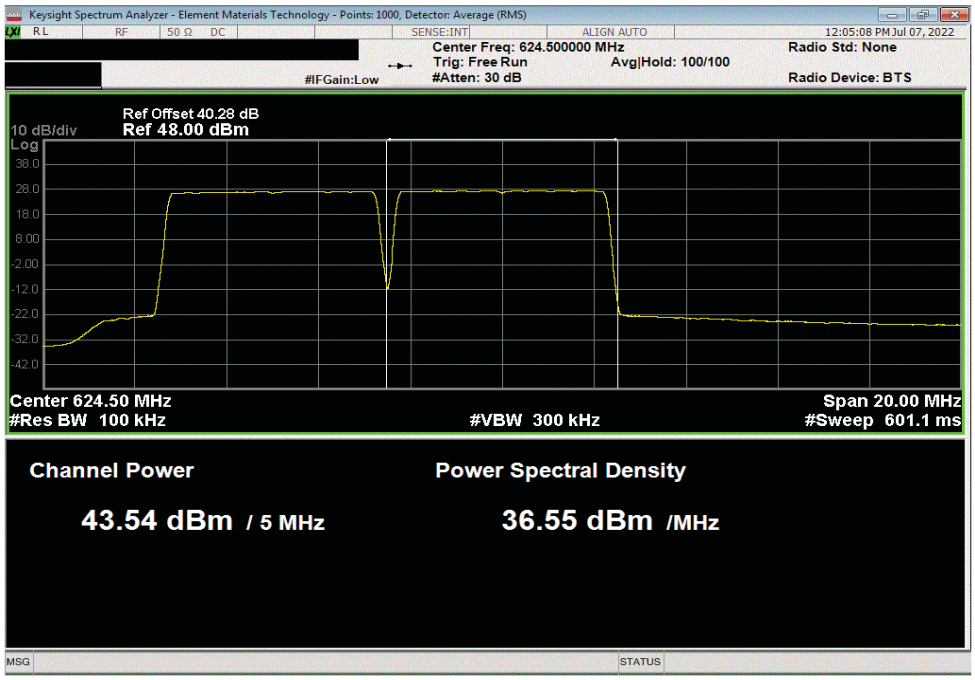
OUTPUT POWER - MULTIBAND MULTICARRIER

TbtTx 2022.05.02.0 XMit 2022.02.07.0

LTE Multicarrier Multiband, Port 2, QPSK Modulation, Test Case 4, LTE5 n71 Carrier 1, 619.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Limit (dBm)	Results
	43.266	0	43.3	N/A	Within Tolerance	Pass



LTE Multicarrier Multiband, Port 2, QPSK Modulation, Test Case 4, LTE5 n71 Carrier 2, 624.5 MHz						
	Avg Cond Pwr (dBm)	Duty Cycle Factor (dB)	Avg Cond Carrier Pwr (dBm)	Avg Cond Band Pwr (dBm)	Limit (dBm)	Results
	43.543	0	43.5	N/A	Within Tolerance	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 LTE

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed the rule part defined limit.

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.
The PAPR was measured using the CCDF function of the spectrum analyzer.

Per FCC part 27.50(d)(5) and RSS-130 section 4.6.1, the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHLOB) as the original certification test. The AHLOB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification testing) and antenna port 2 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLOB	Work Order:	NOKI0043
Serial Number:	YK220900029	Date:	11-Jul-22
Customer:	Nokia Solutions and Networks	Temperature:	21.4 °C
Attendees:	Mitchell Hill, John Rattanavong	Humidity:	57% RH
Project:	None	Barometric Pres.:	1015 mbar
Tested by:	Marty Martin	Power: 54 VDC	Job Site: TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. The carriers were enabled at maximum power

DEVIATIONS FROM TEST STANDARD

None

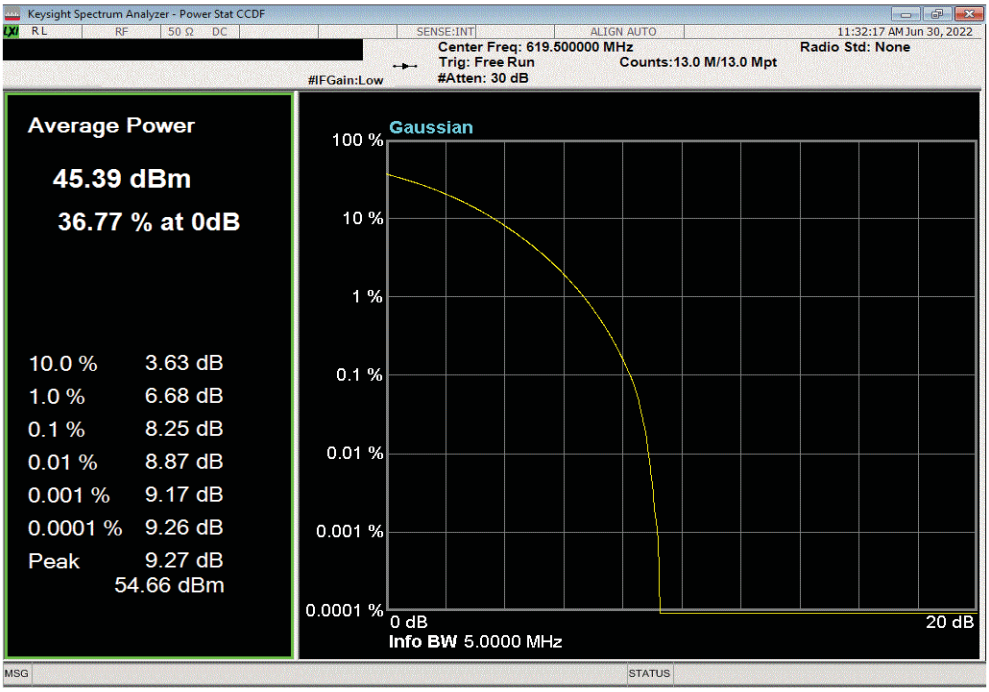
Configuration #	2	Signature

	PAPR Value (dB)	PAPR Limit (dB)	Results
Port 2, LTE, Band 71, 617 MHz - 652 MHz			
5 MHz Bandwidth			
256-QAM Modulation			
Low Ch. 619.5 MHz	8.25	13	Pass
Mid Ch. 634.5 MHz	8.23	13	Pass
High Ch. 649.5 MHz	8.19	13	Pass
10 MHz Bandwidth			
256-QAM Modulation			
Low Ch. 622 MHz	8.01	13	Pass
Mid Ch. 634.5 MHz	8.11	13	Pass
High Ch. 647 MHz	8.01	13	Pass
15 MHz Bandwidth			
QPSK Modulation			
Mid Ch. 634.5 MHz	7.2	13	Pass
16-QAM Modulation			
Mid Ch. 634.5 MHz	7.2	13	Pass
64-QAM Modulation			
Mid Ch. 634.5 MHz	7.21	13	Pass
256-QAM Modulation			
Low Ch. 624.5 MHz	7.52	13	Pass
Mid Ch. 634.5 MHz	7.22	13	Pass
High Ch. 644.5 MHz	7.56	13	Pass
20 MHz Bandwidth			
256-QAM Modulation			
Low Ch. 627 MHz	7.52	13	Pass
Mid Ch. 634.5 MHz	7.19	13	Pass
High Ch. 642 MHz	7.62	13	Pass

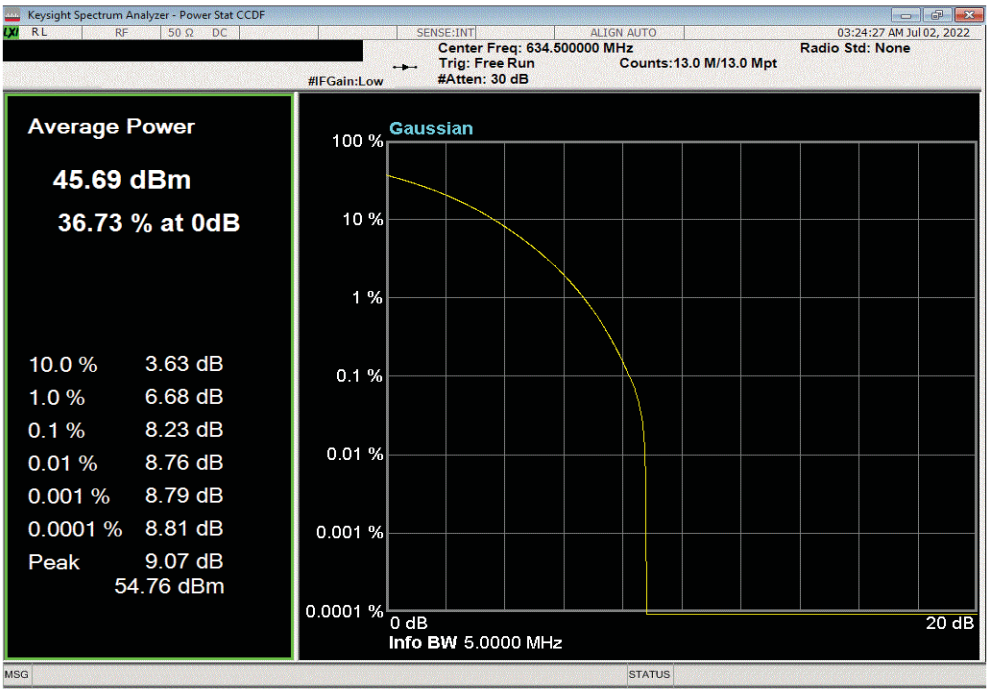
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 256-QAM Modulation, Low Ch. 619.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				8.25	13	Pass



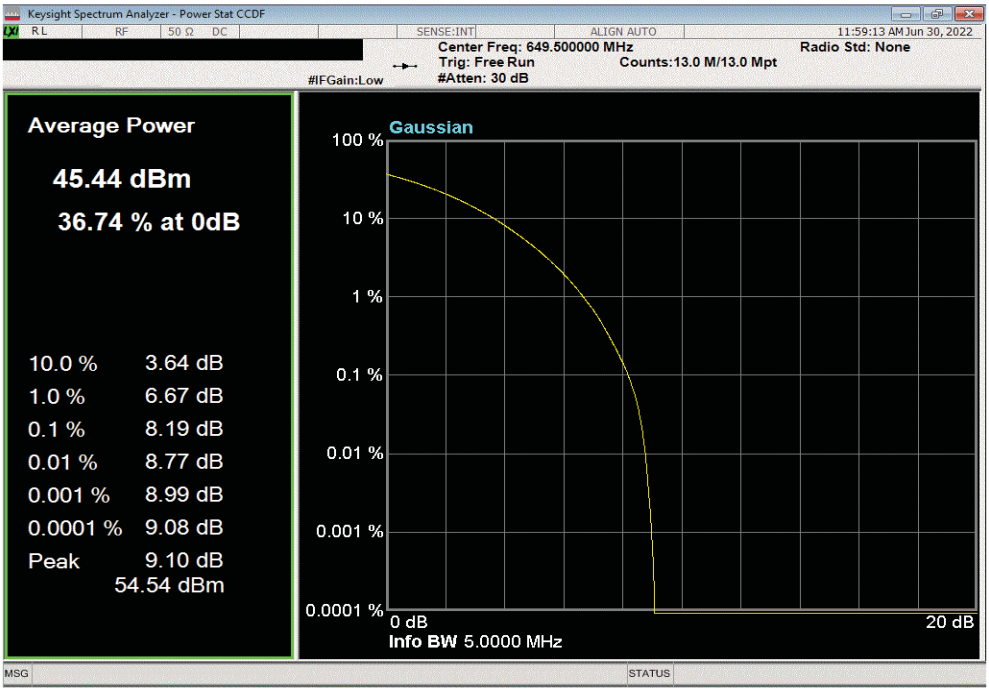
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				8.23	13	Pass



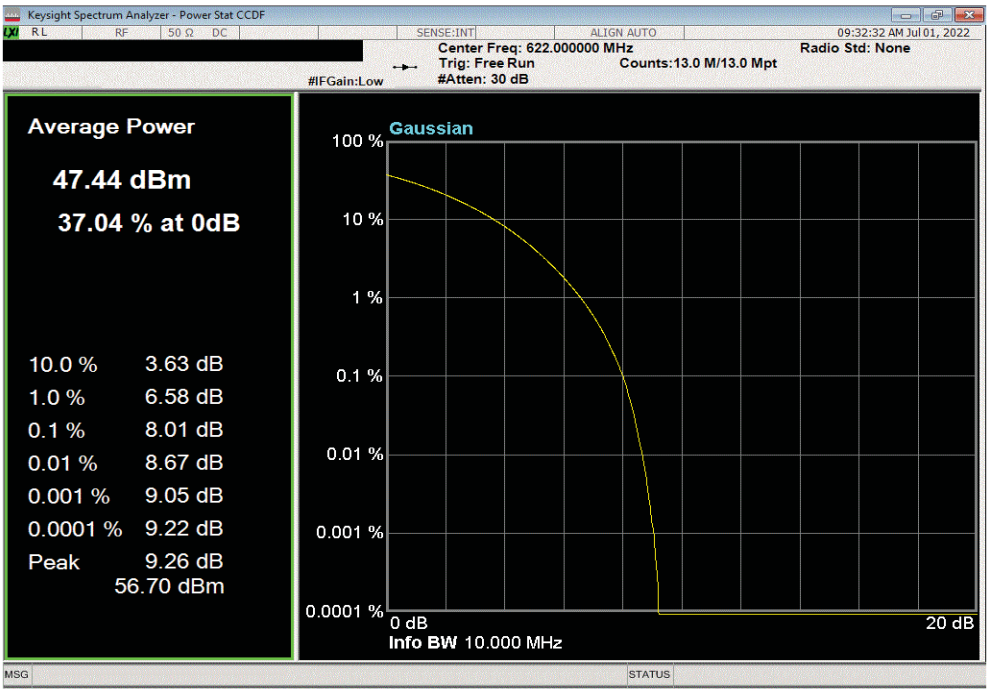
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 256-QAM Modulation, High Ch. 649.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				8.19	13	Pass



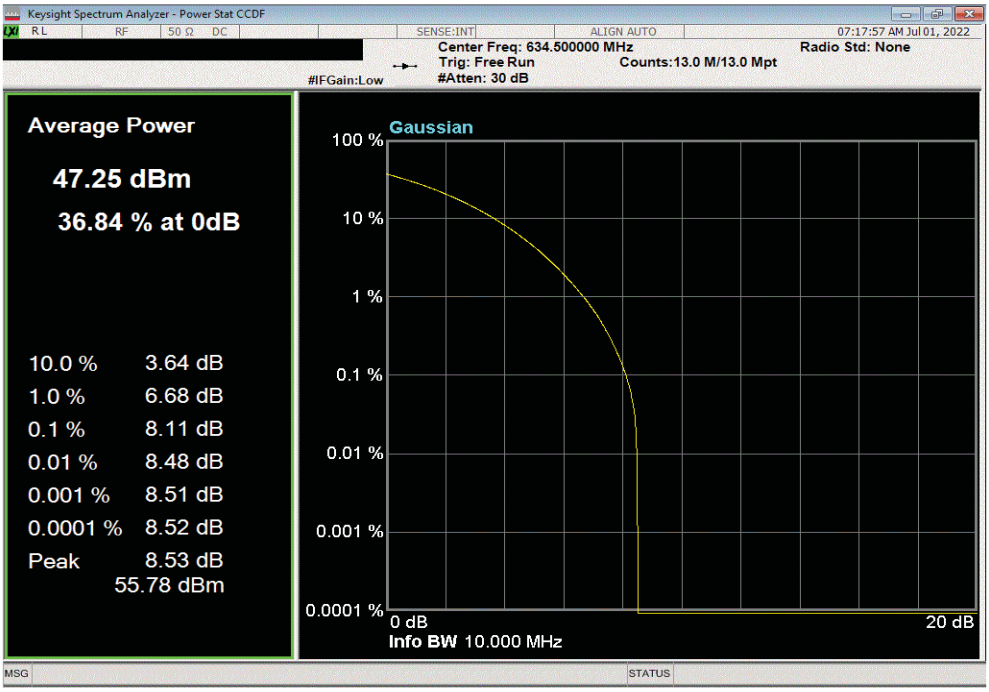
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 10 MHz Bandwidth, 256-QAM Modulation, Low Ch. 622 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				8.01	13	Pass



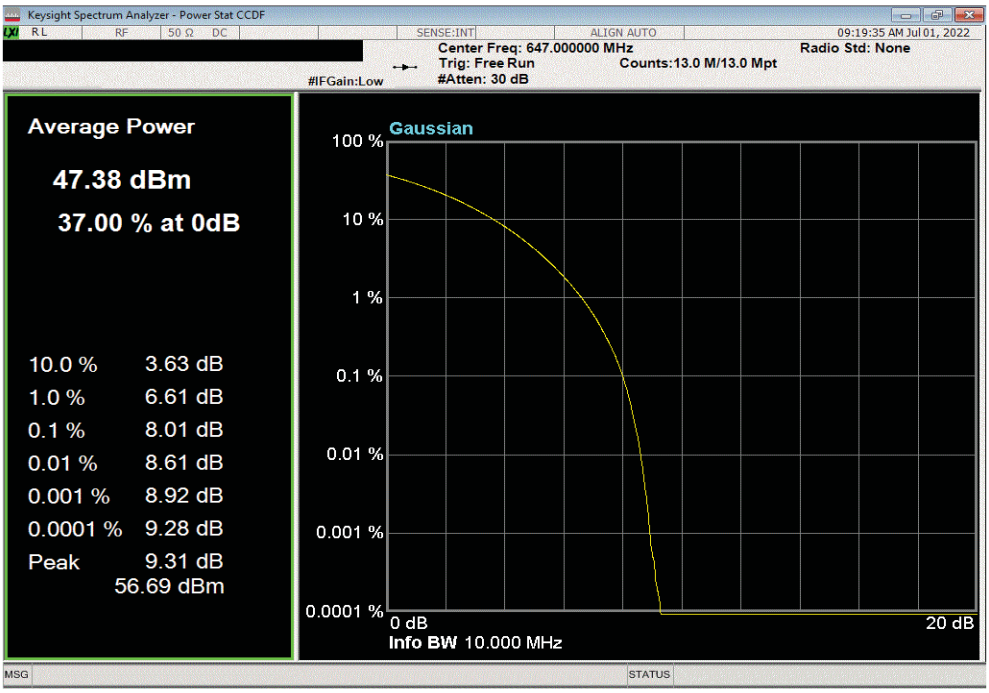
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 10 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				8.11	13	Pass



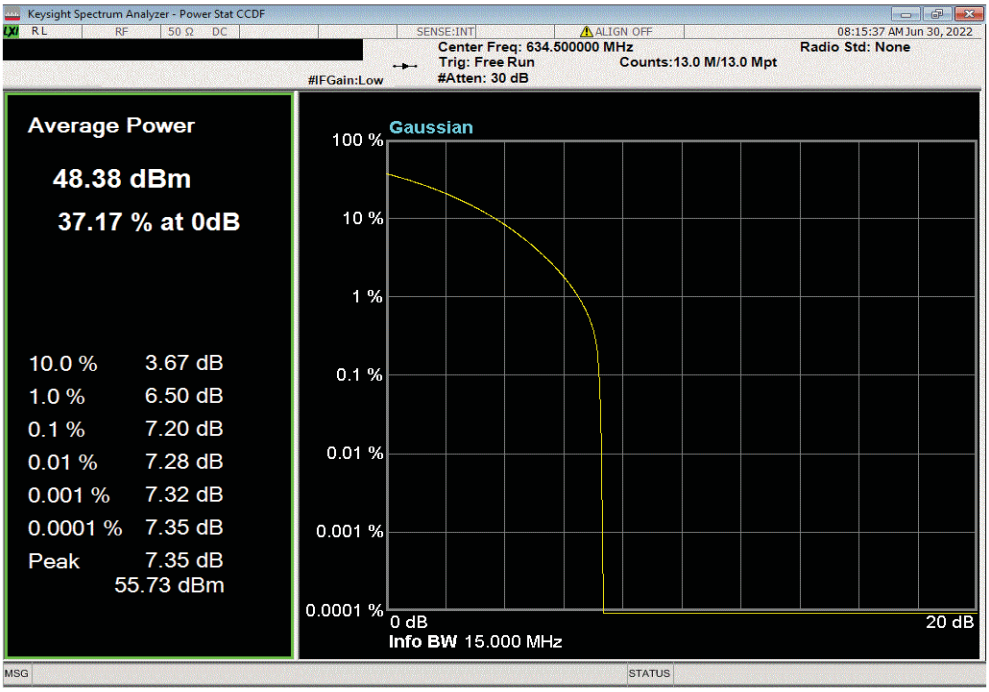
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 10 MHz Bandwidth, 256-QAM Modulation, High Ch. 647 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				8.01	13	Pass



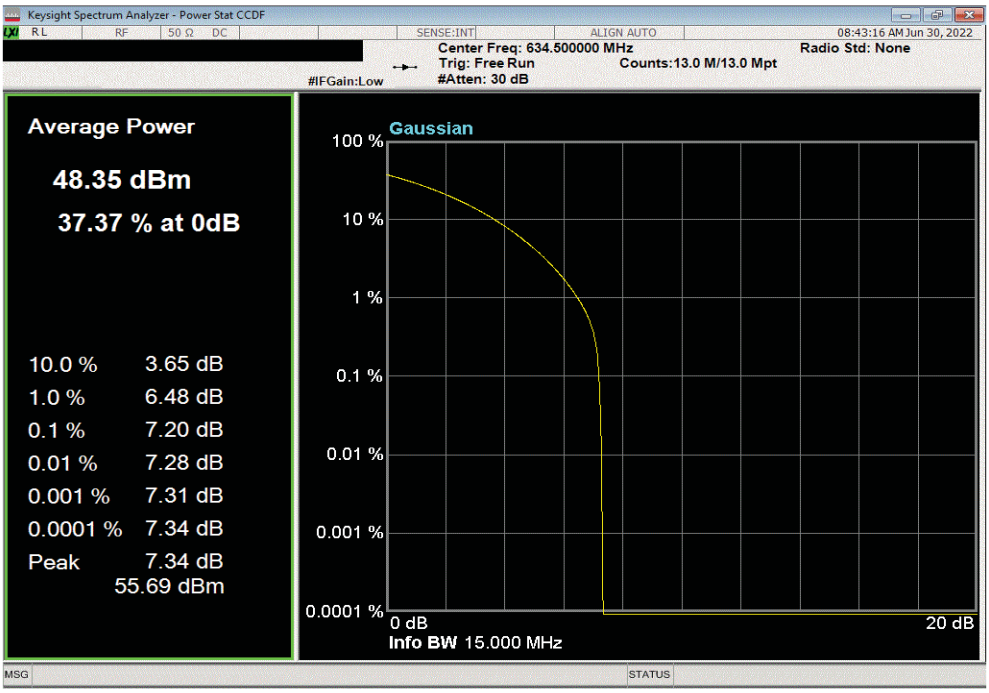
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, QPSK Modulation, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.2	13	Pass



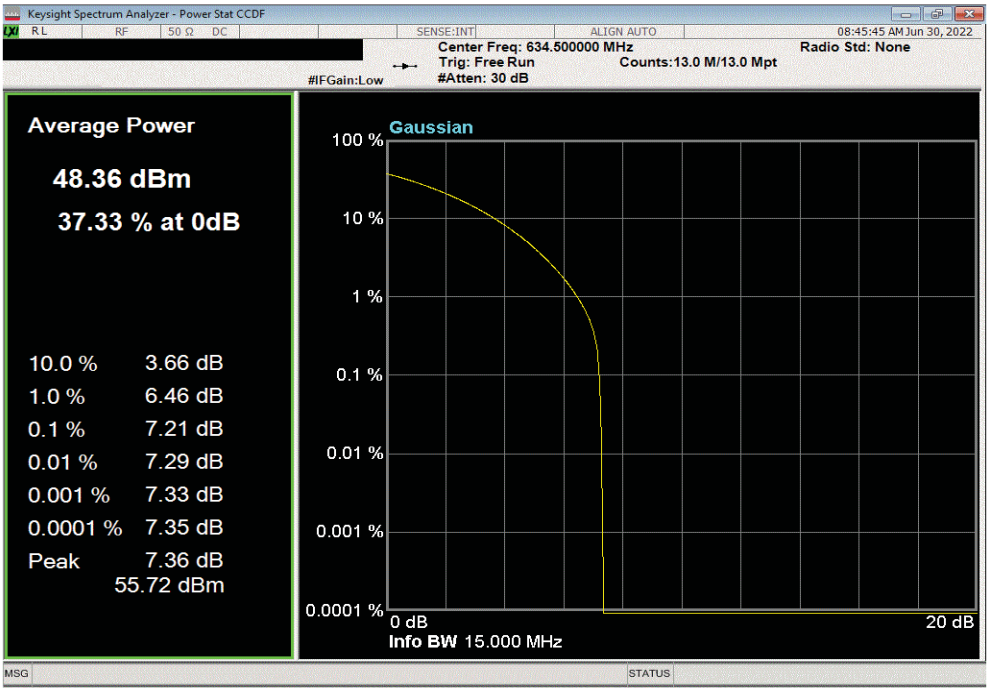
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, 16-QAM Modulation, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.2	13	Pass



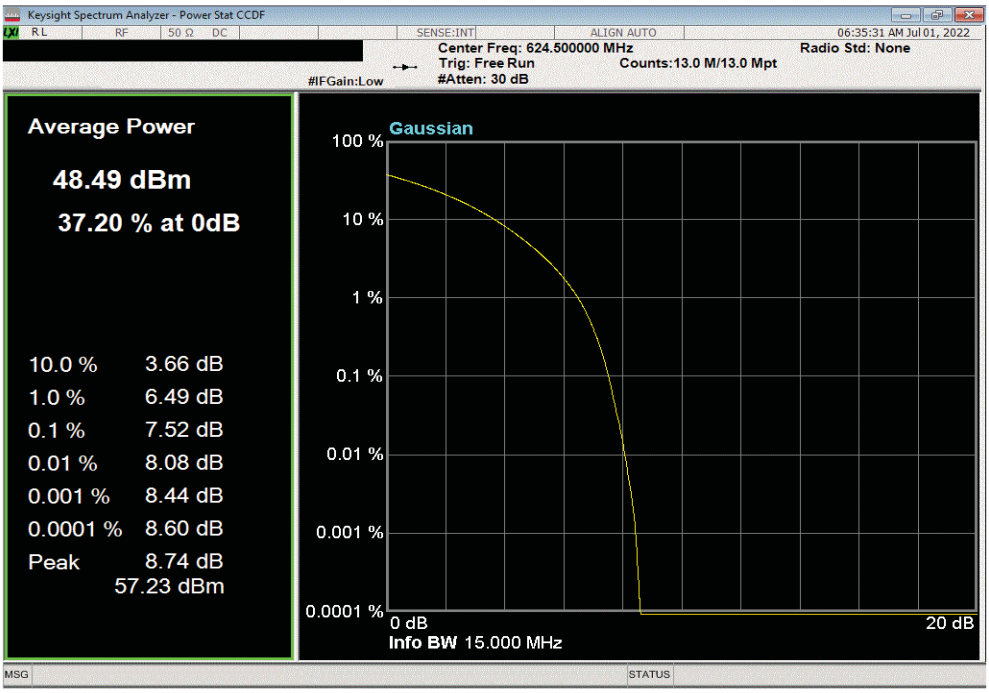
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, 64-QAM Modulation, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.21	13	Pass



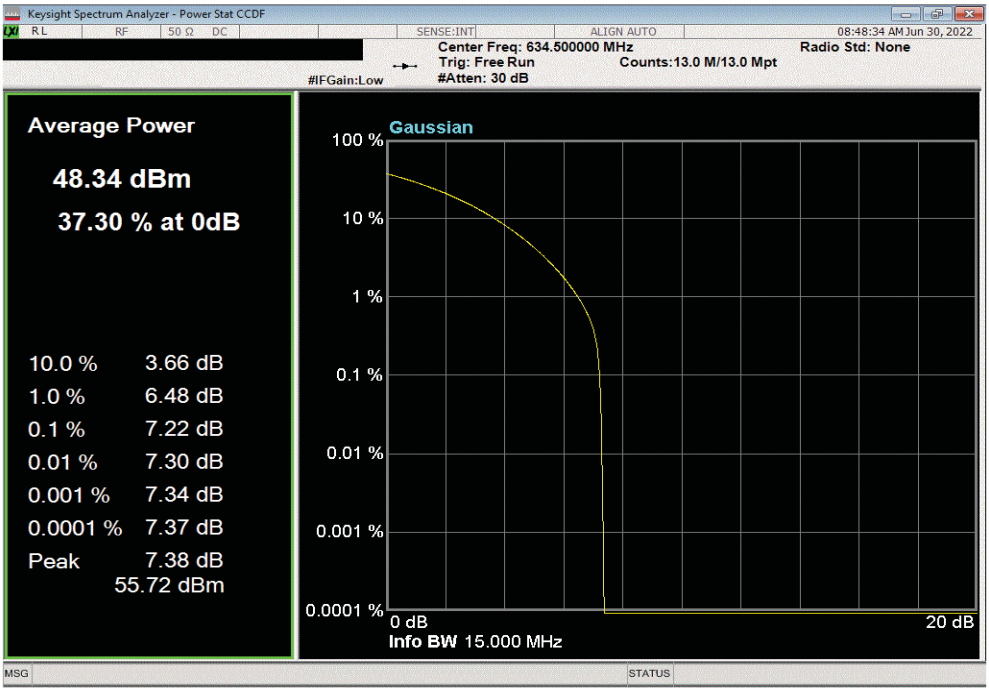
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, 256-QAM Modulation, Low Ch. 624.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.52	13	Pass



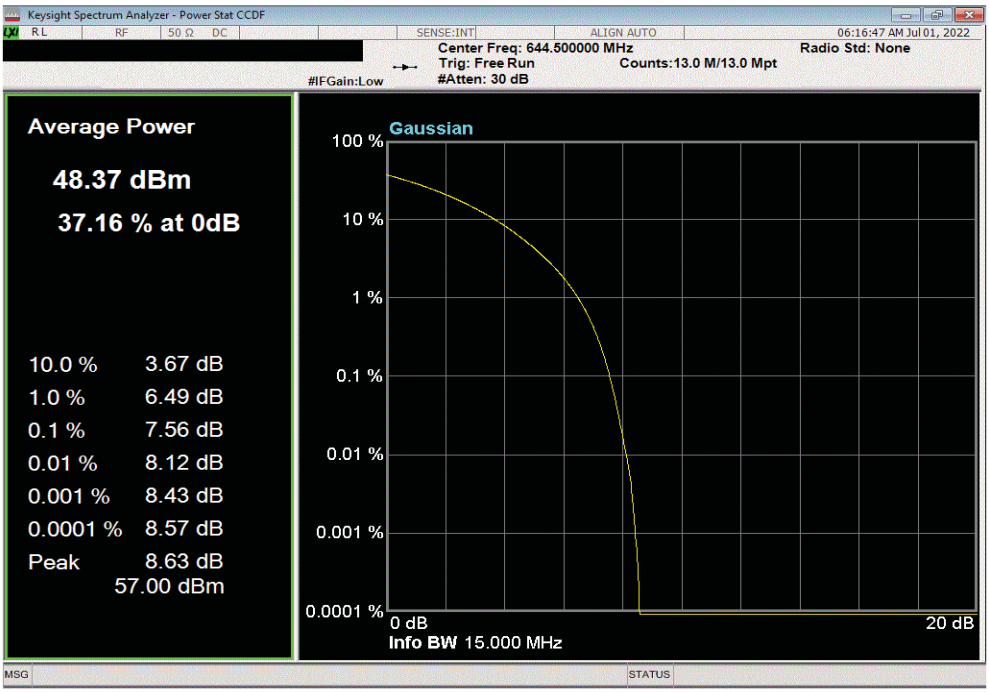
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.22	13	Pass

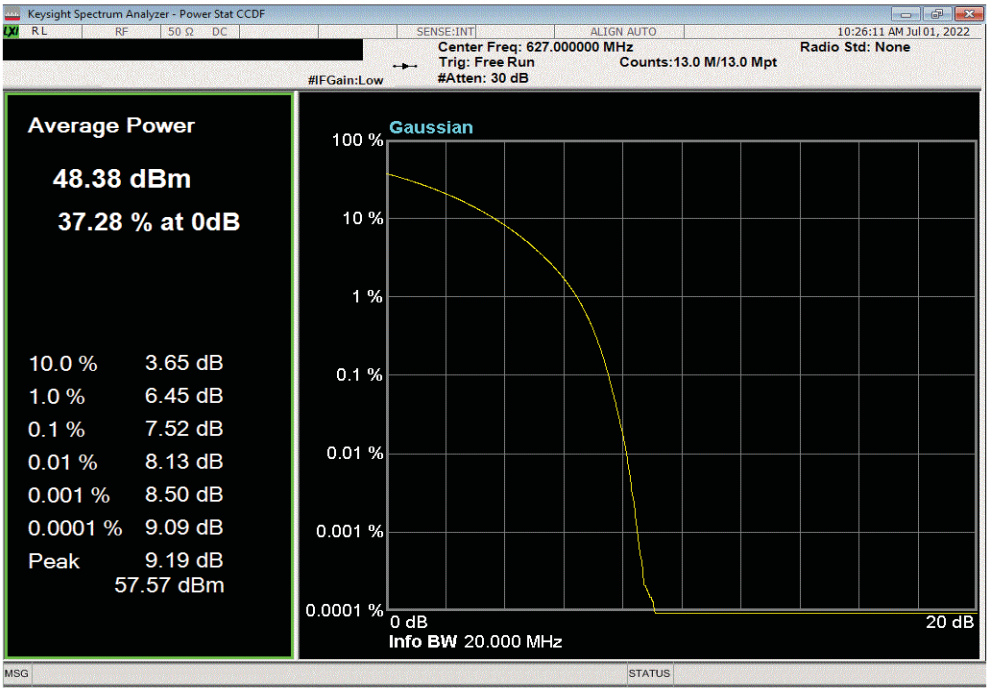


Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, 256-QAM Modulation, High Ch. 644.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.56	13	Pass

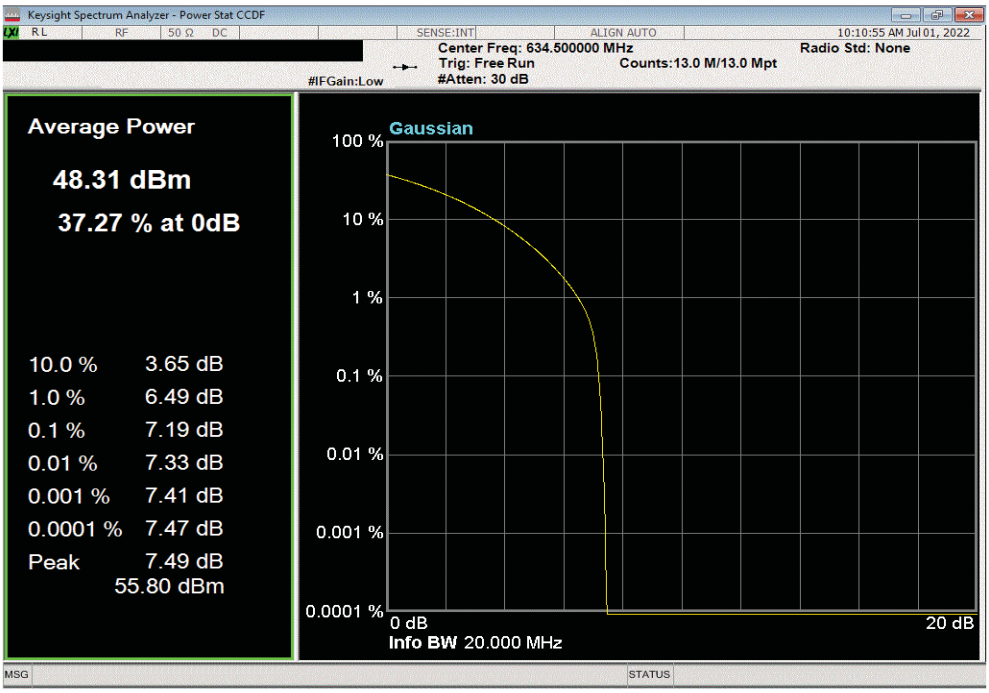


PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 LTE

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 20 MHz Bandwidth, 256-QAM Modulation, Low Ch. 627 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.52	13	Pass



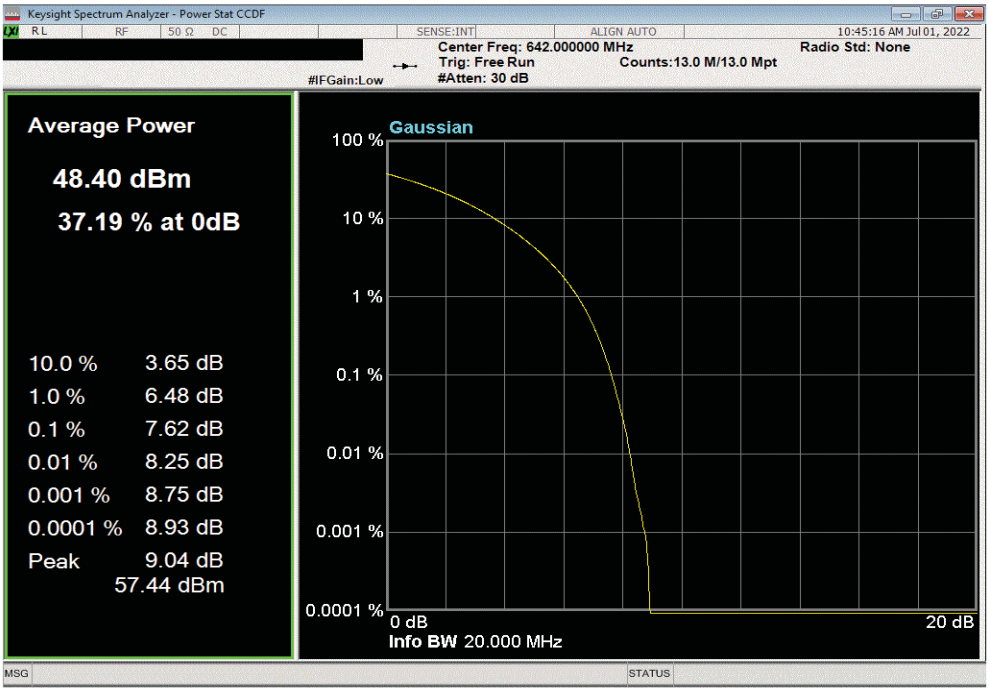
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 20 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.19	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 20 MHz Bandwidth, 256-QAM Modulation, High Ch. 642 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.62	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 LTE

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed the rule part defined limit.

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.
The PAPR was measured using the CCDF function of the spectrum analyzer.

Per FCC part 27.50(d)(5) and RSS-130 section 4.6.1, the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHLOB) as the original certification test. The AHLOB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification testing) and antenna port 2 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLOB	Work Order:	NOKI0043
Serial Number:	YK220900029	Date:	11-Jul-22
Customer:	Nokia Solutions and Networks	Temperature:	21.2 °C
Attendees:	Mitchell Hill, John Rattanavong	Humidity:	53.9% RH
Project:	None	Barometric Pres.:	1013 mbar
Tested by:	Marty Martin	Power: 54 VDC	Job Site: TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All loses in the measurment path were accounted for: attenuators, cables, DC block and filter when in use. The carriers were enabled at maximum power.

DEVIATIONS FROM TEST STANDARD

None

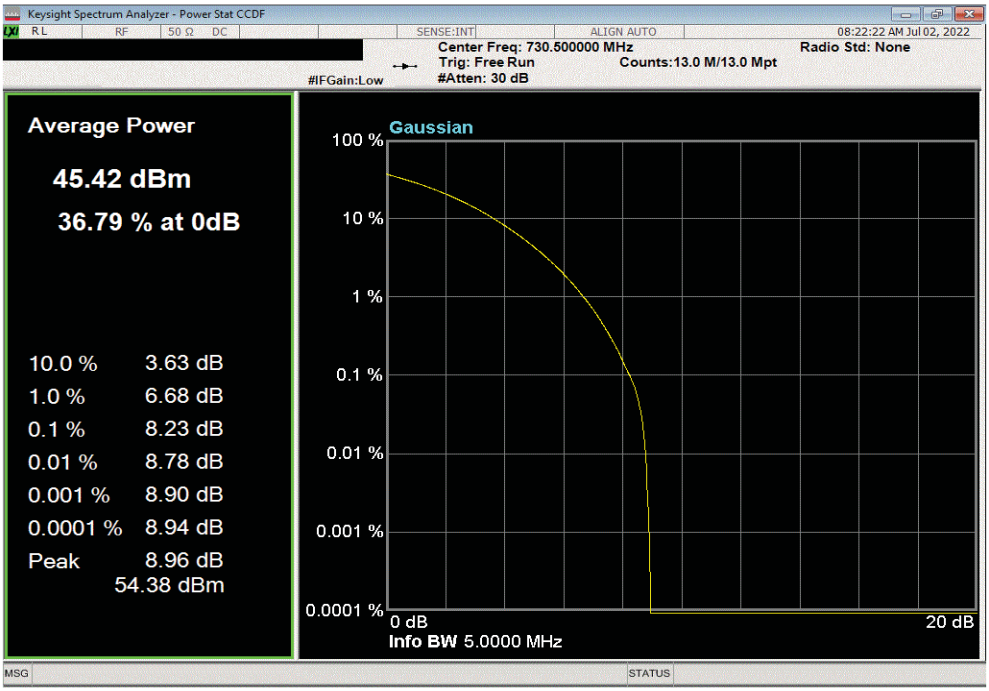
Configuration #	2	Signature

	PAPR Value (dB)	PAPR Limit < (dB)	Results
Port 1, LTE, Band 85, 728 MHz - 746 MHz			
5 MHz Bandwidth			
256-QAM Modulation			
Low Ch. 730.5 MHz	8.23	13	Pass
Mid Ch. 737 MHz	8.22	13	Pass
High Ch. 743.5 MHz	8.21	13	Pass
10 MHz Bandwidth			
256-QAM Modulation			
Low Ch. 733 MHz	8.08	13	Pass
Mid Ch. 737 MHz	8.09	13	Pass
High Ch. 741 MHz	8.11	13	Pass
15 MHz Bandwidth			
QPSK Modulation			
Mid Ch. 737 MHz	7.23	13	Pass
16-QAM Modulation			
Mid Ch. 737 MHz	7.23	13	Pass
64-QAM Modulation			
Mid Ch. 737 MHz	7.23	13	Pass
256-QAM Modulation			
Low Ch. 735.5 MHz	7.31	13	Pass
Mid Ch. 737 MHz	7.24	13	Pass
High Ch. 738.5 MHz	7.26	13	Pass

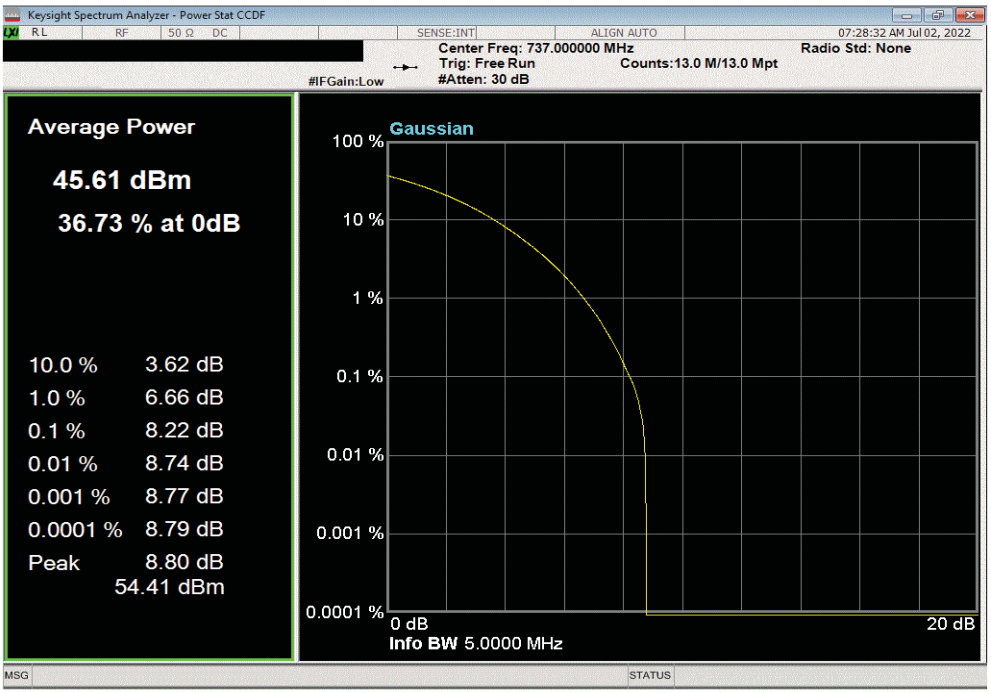
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 1, LTE, Band 85, 728 MHz - 746 MHz, 5 MHz Bandwidth, 256-QAM Modulation, Low Ch. 730.5 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				8.23	13	Pass



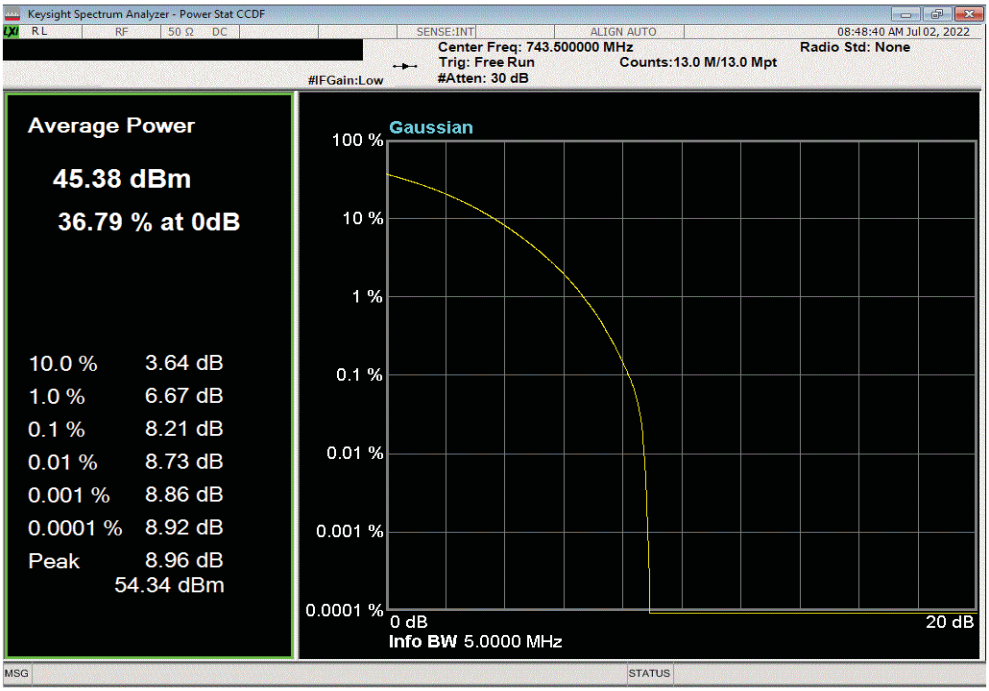
Port 1, LTE, Band 85, 728 MHz - 746 MHz, 5 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 737 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				8.22	13	Pass



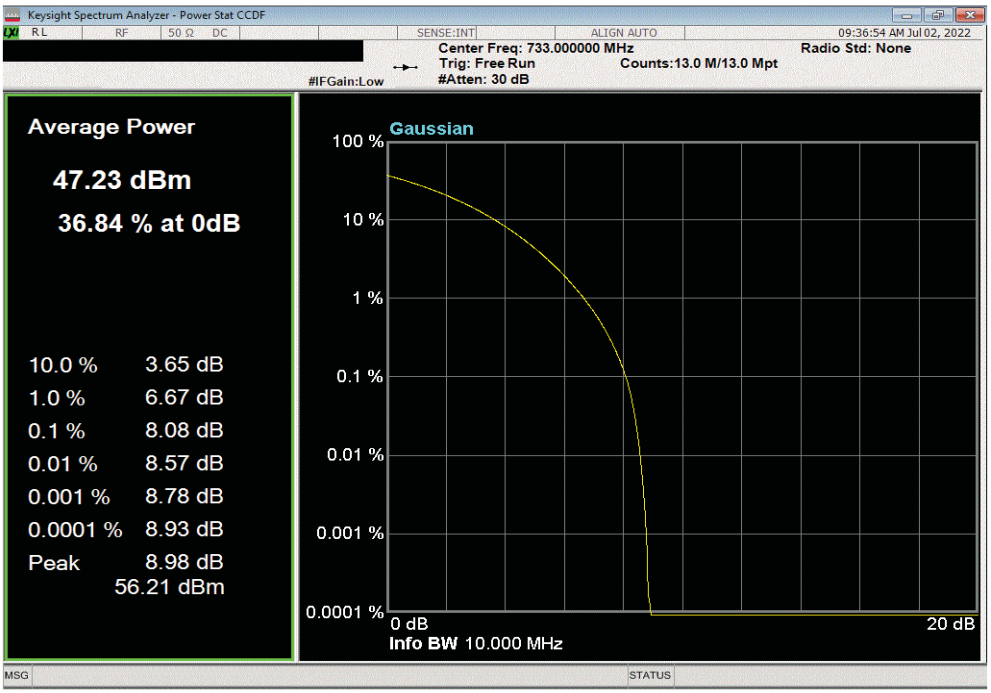
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 1, LTE, Band 85, 728 MHz - 746 MHz, 5 MHz Bandwidth, 256-QAM Modulation, High Ch. 743.5 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				8.21	13	Pass



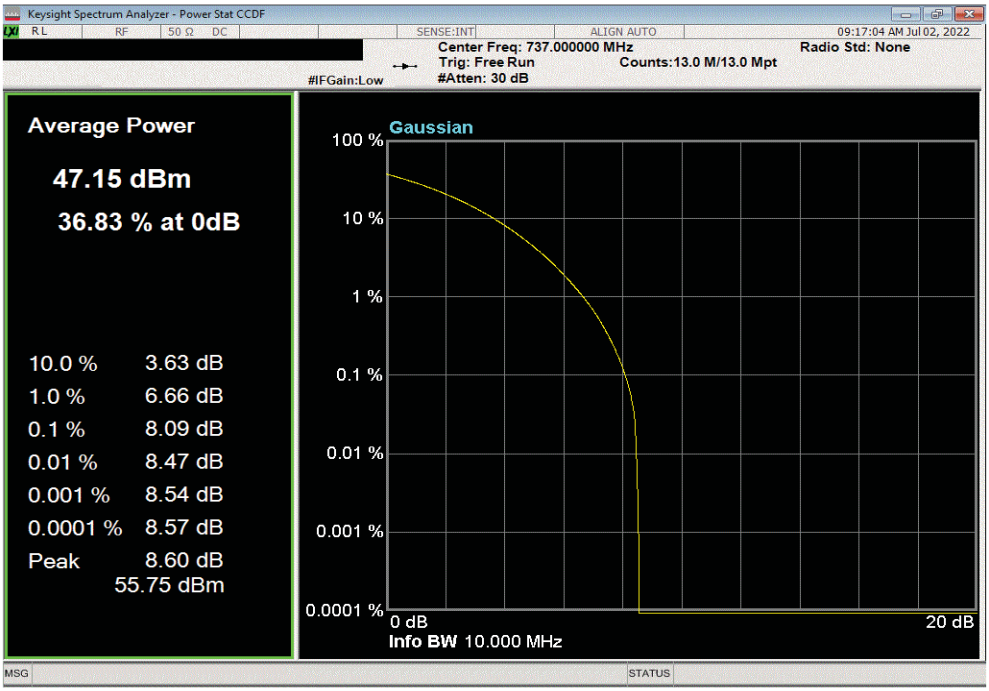
Port 1, LTE, Band 85, 728 MHz - 746 MHz, 10 MHz Bandwidth, 256-QAM Modulation, Low Ch. 733 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				8.08	13	Pass



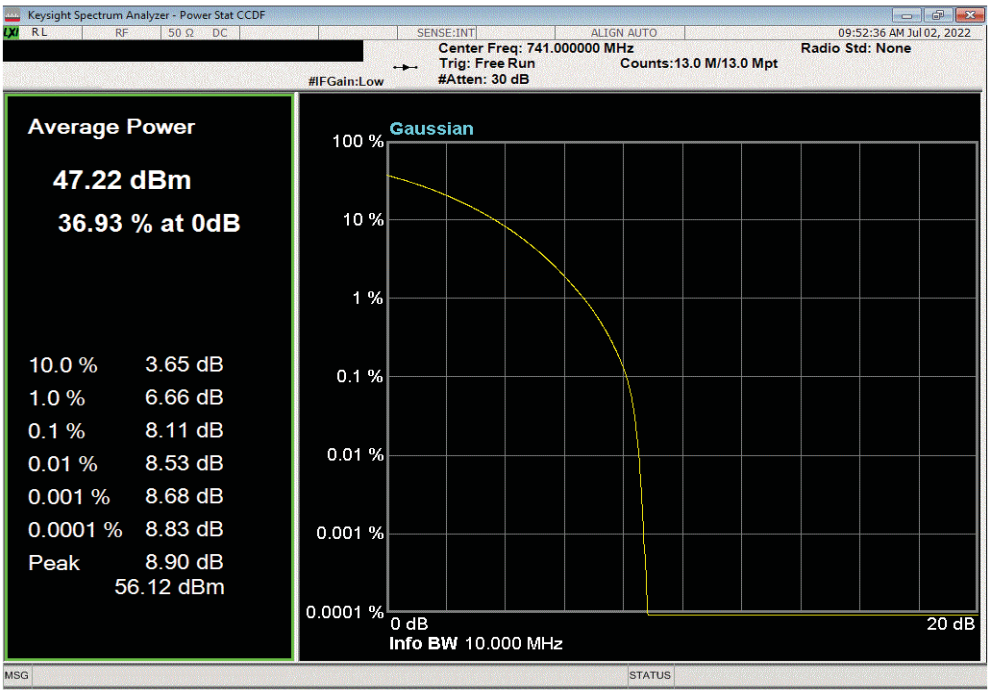
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 1, LTE, Band 85, 728 MHz - 746 MHz, 10 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 737 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				8.09	13	Pass



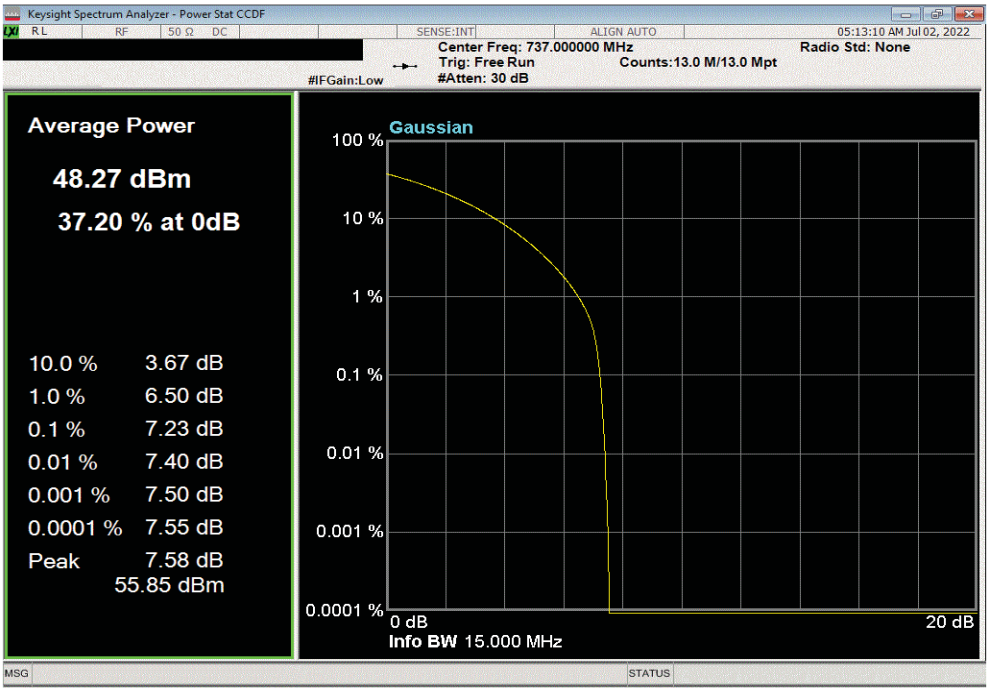
Port 1, LTE, Band 85, 728 MHz - 746 MHz, 10 MHz Bandwidth, 256-QAM Modulation, High Ch. 741 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				8.11	13	Pass



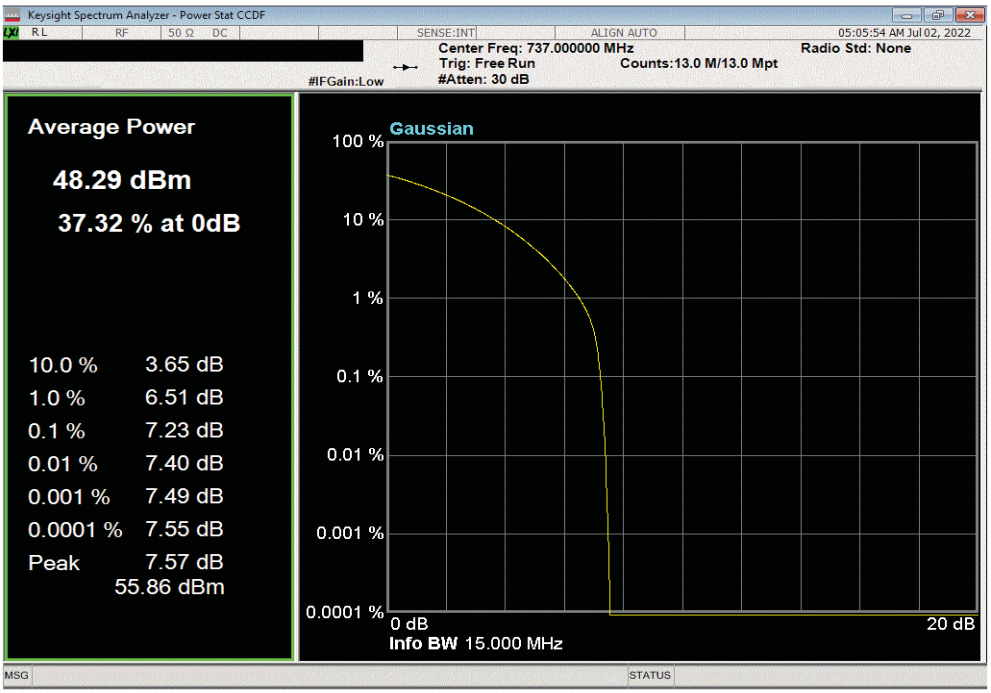
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 1, LTE, Band 85, 728 MHz - 746 MHz, 15 MHz Bandwidth, QPSK Modulation, Mid Ch. 737 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				7.23	13	Pass



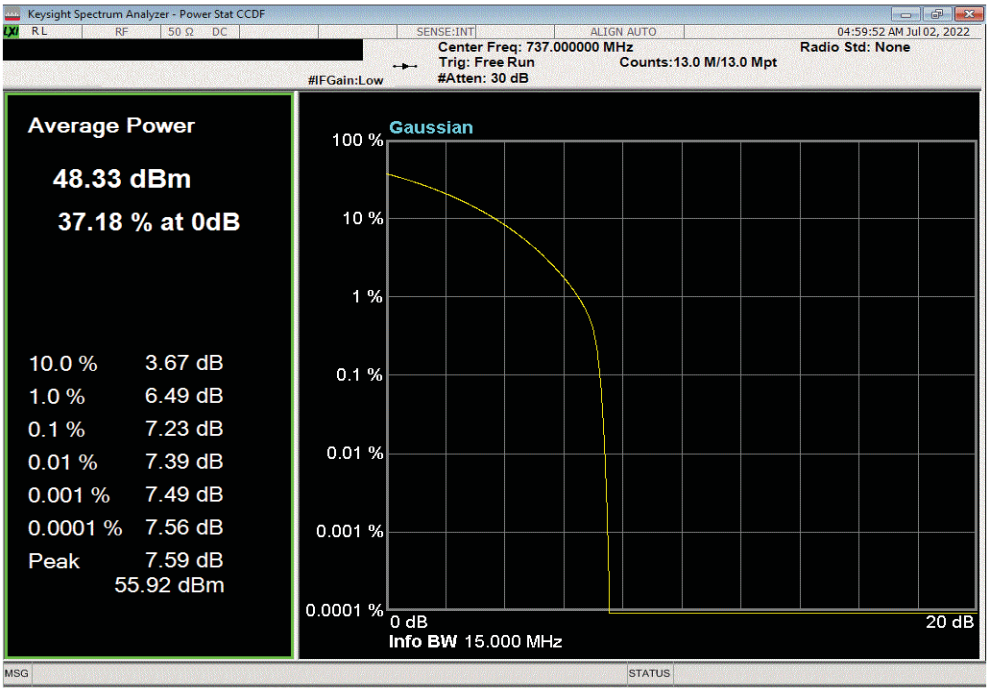
Port 1, LTE, Band 85, 728 MHz - 746 MHz, 15 MHz Bandwidth, 16-QAM Modulation, Mid Ch. 737 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				7.23	13	Pass



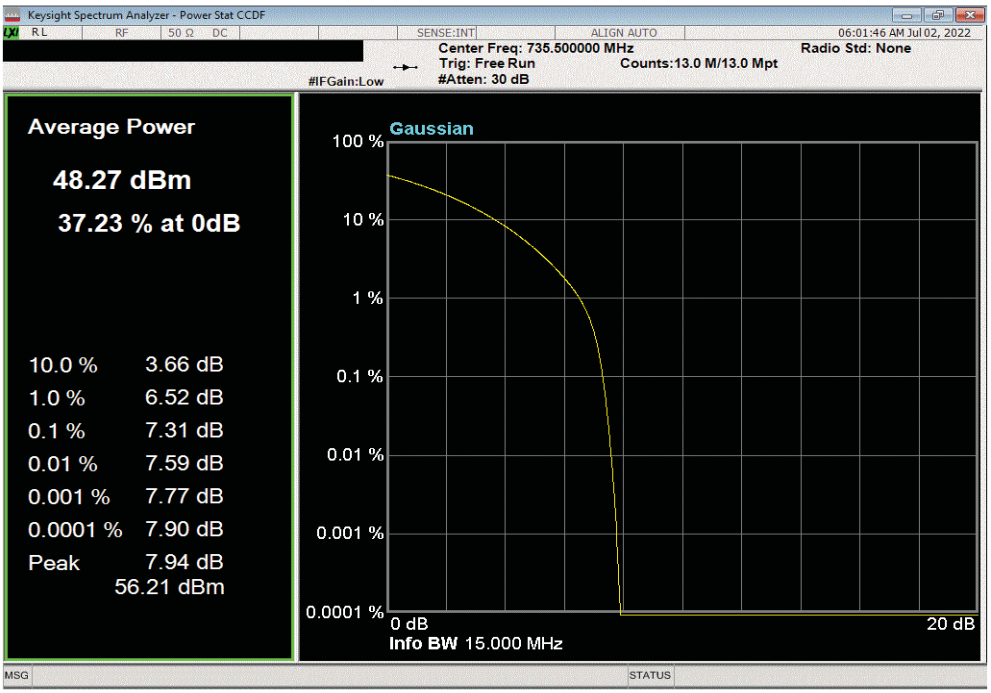
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 1, LTE, Band 85, 728 MHz - 746 MHz, 15 MHz Bandwidth, 64-QAM Modulation, Mid Ch. 737 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				7.23	13	Pass



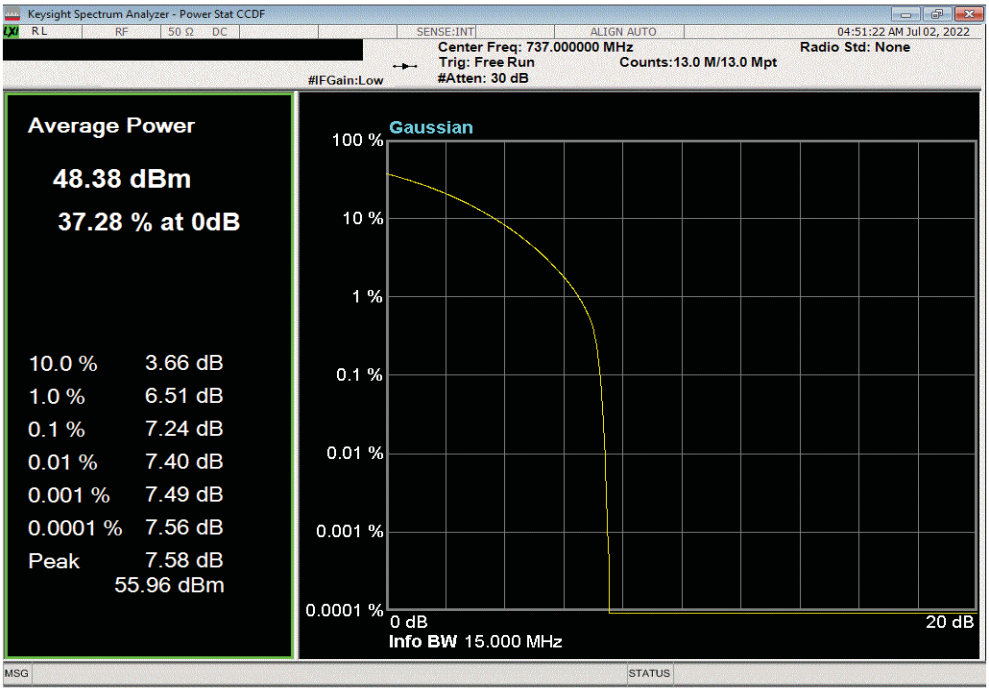
Port 1, LTE, Band 85, 728 MHz - 746 MHz, 15 MHz Bandwidth, 256-QAM Modulation, Low Ch. 735.5 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				7.31	13	Pass



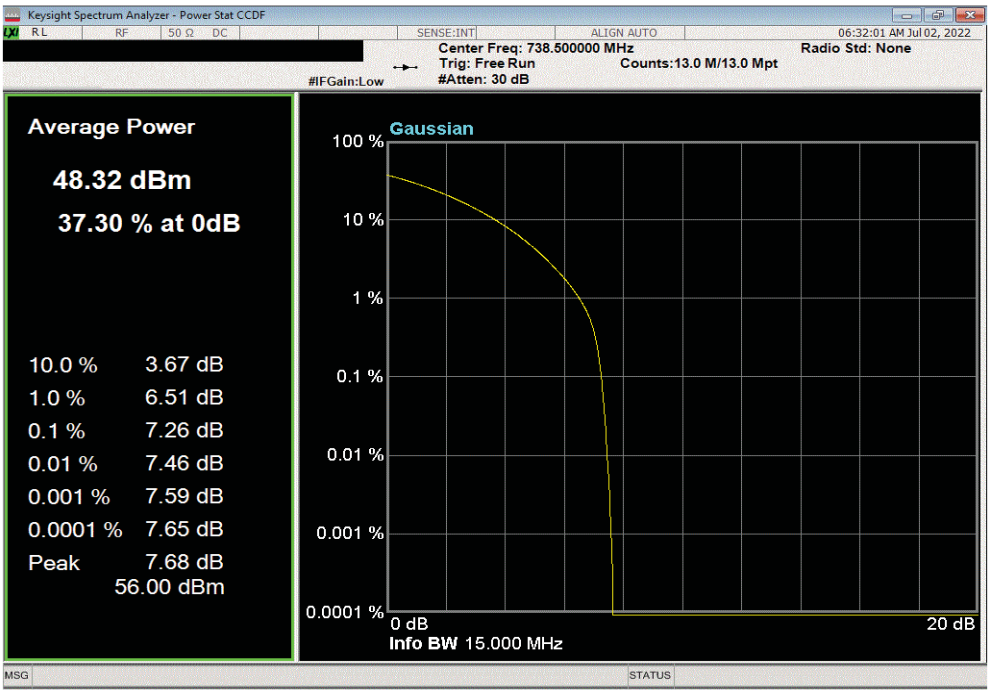
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 1, LTE, Band 85, 728 MHz - 746 MHz, 15 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 737 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				7.24	13	Pass



Port 1, LTE, Band 85, 728 MHz - 746 MHz, 15 MHz Bandwidth, 256-QAM Modulation, High Ch. 738.5 MHz						
				PAPR Value (dB)	PAPR Limit < (dB)	Results
				7.26	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT GB

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed the rule part defined limit.

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.
The PAPR was measured using the CCDF function of the spectrum analyzer.

Per FCC part 27.50(d)(5) and RSS-130 section 4.6.1, the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

RF conducted emissions testing was performed only on one port. The AHLOB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification testing) and antenna port 2 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT GB

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLOB			Work Order:	NOKI0043
Serial Number:	YK220900029			Date:	13-Jul-22
Customer:	Nokia Solutions and Networks			Temperature:	20.9 °C
Attendees:	Mitchell Hill, John Rattanavong			Humidity:	55.1% RH
Project:	None			Barometric Pres.:	1018 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. The carriers were enabled at maximum power.

DEVIATIONS FROM TEST STANDARD

None

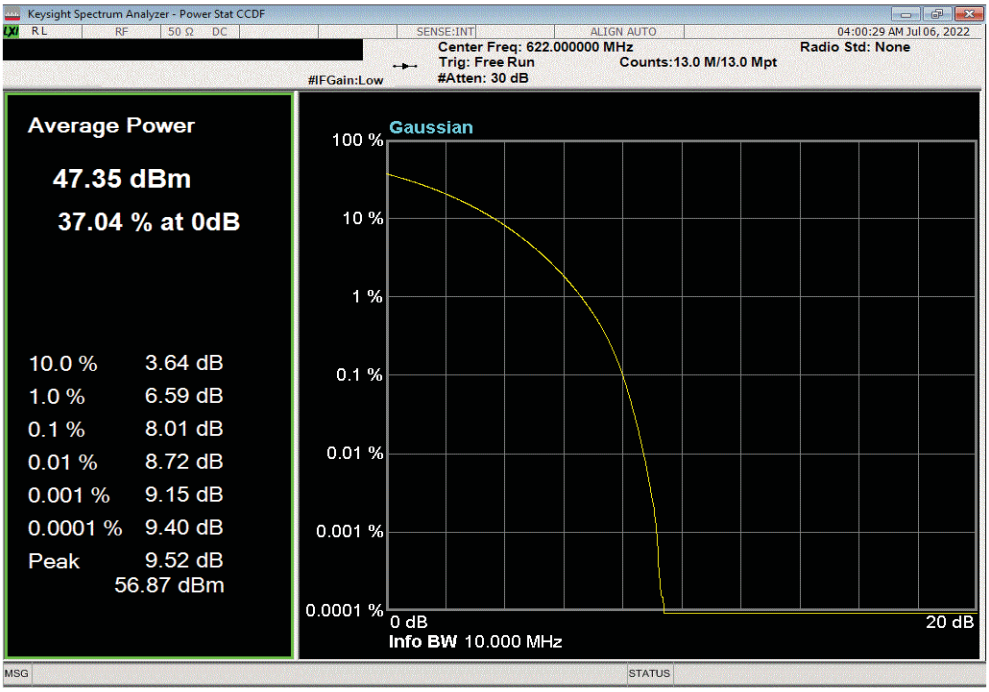
Configuration #	2	Signature

	PAPR Value (dB)	PAPR Limit (dB)	Results
Port 2, LTE, Band 71, 617 MHz - 652 MHz			
10 MHz Bandwidth			
NB IoT GB Modulation			
Low Ch. 622 MHz	8.01	13	Pass
Mid Ch. 634.5 MHz	7.99	13	Pass
High Ch. 647 MHz	8	13	Pass
15 MHz Bandwidth			
NB IoT GB Modulation			
Low Ch. 624.5 MHz	7.38	13	Pass
Mid Ch. 634.5 MHz	6.86	13	Pass
High Ch. 644.5 MHz	7.44	13	Pass
20 MHz Bandwidth			
NB IoT GB Modulation			
Low Ch. 627 MHz	7.57	13	Pass
Mid Ch. 634.5 MHz	7.12	13	Pass
High Ch. 642 MHz	7.65	13	Pass

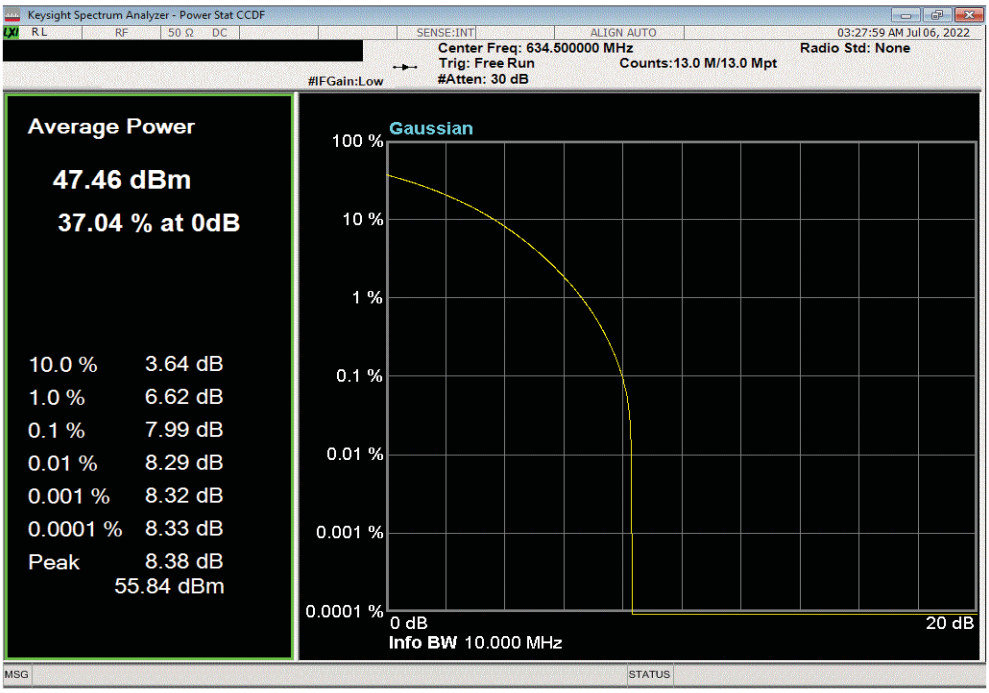
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT GB

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 10 MHz Bandwidth, NB IoT GB Modulationn, Low Ch. 622 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				8.01	13	Pass

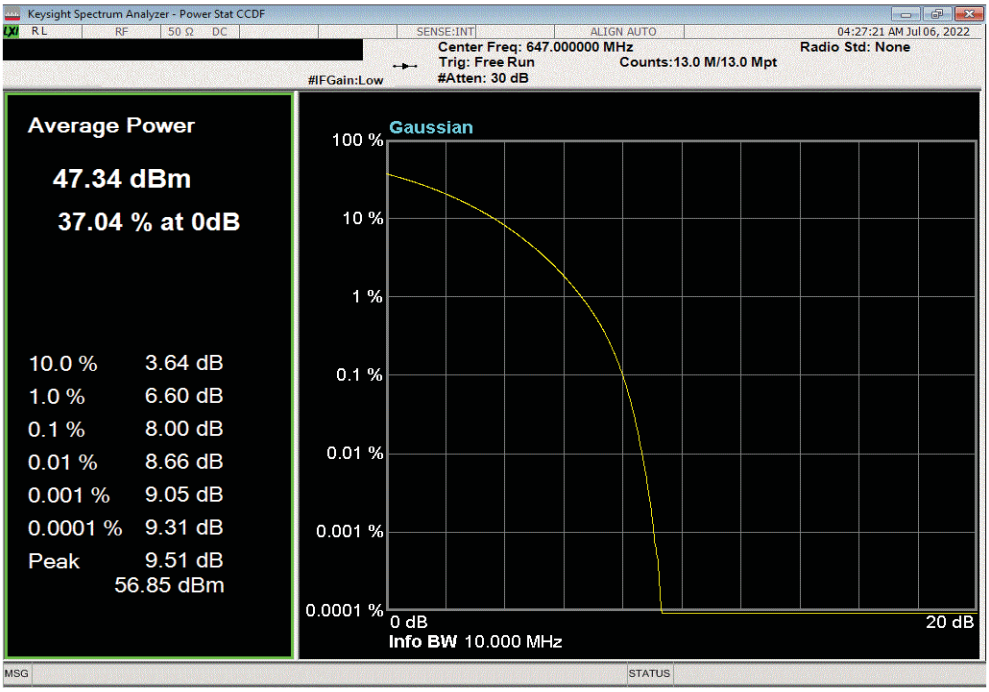


Port 2, LTE, Band 71, 617 MHz - 652 MHz, 10 MHz Bandwidth, NB IoT GB Modulation, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.99	13	Pass

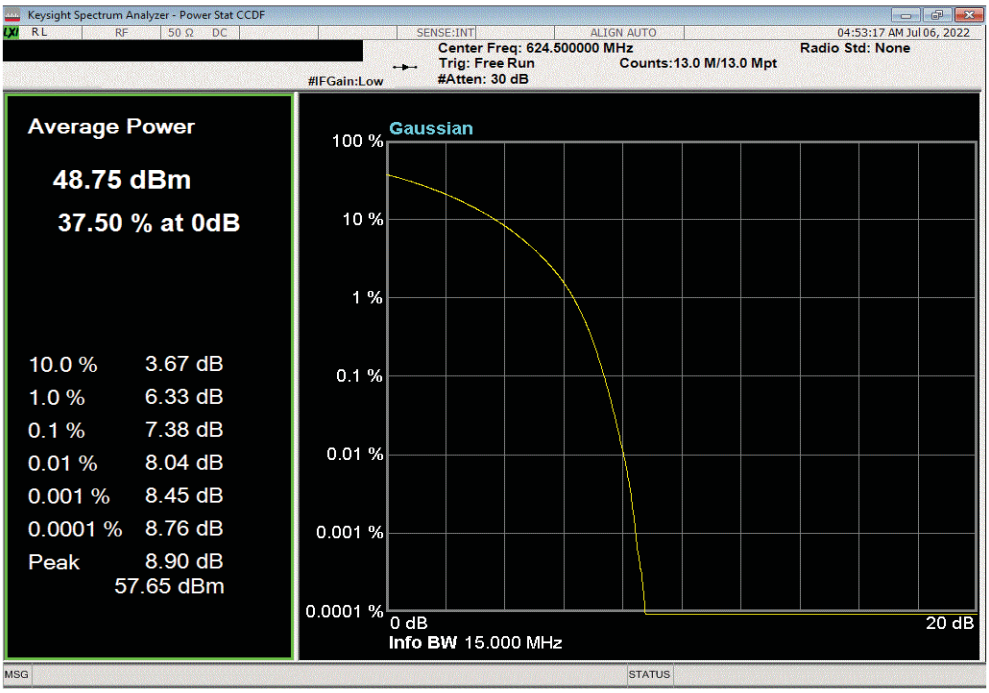


PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT GB

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 10 MHz Bandwidth, NB IoT GB Modulation, High Ch. 647 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				8	13	Pass



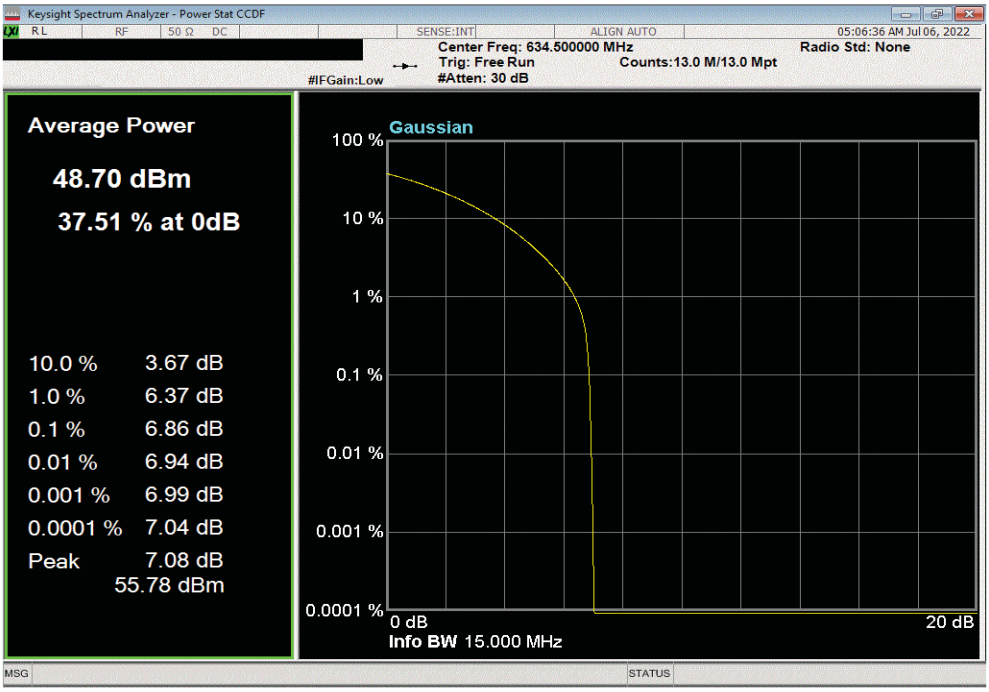
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, NB IoT GB Modulation, Low Ch. 624.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.38	13	Pass



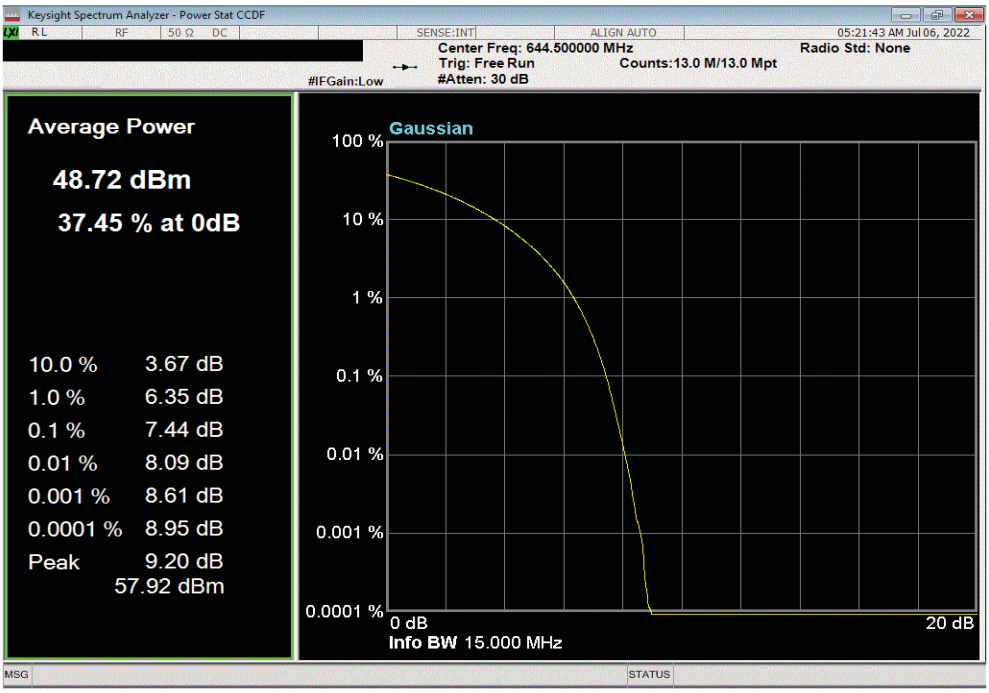
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT GB

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth,NB IoT GB Modulation, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				6.86	13	Pass



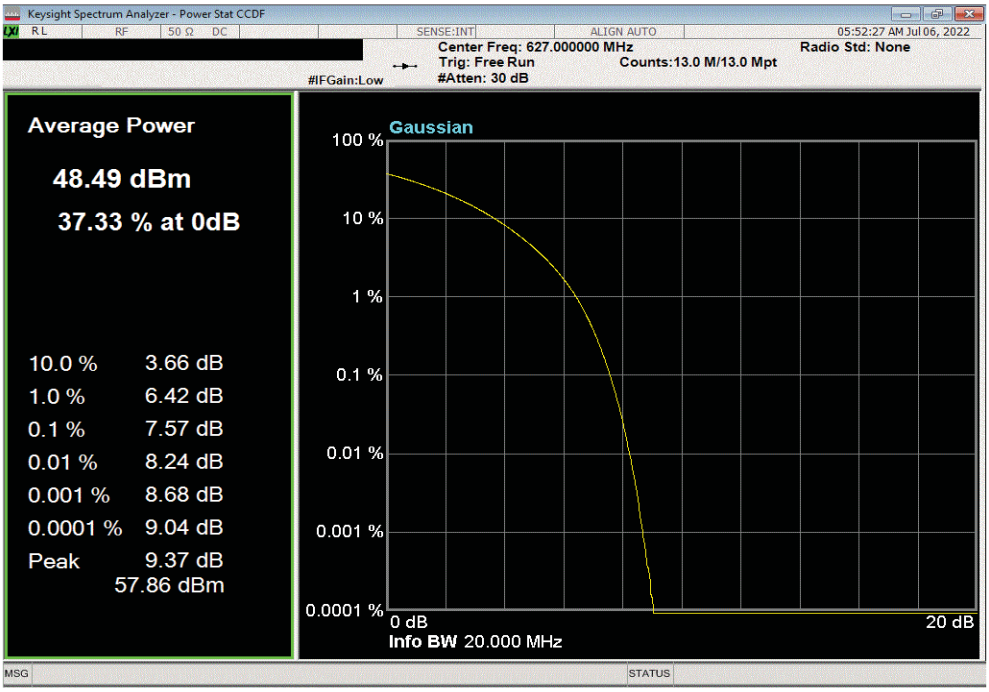
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, NB IoT GB Modulation, High Ch. 644.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.44	13	Pass



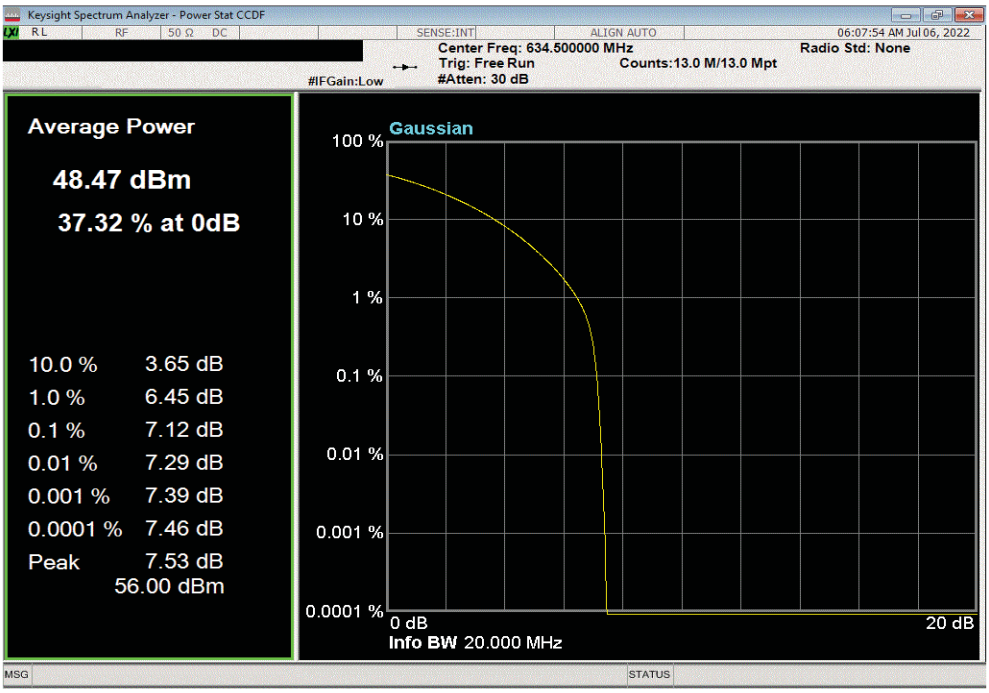
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT GB

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 20 MHz Bandwidth, NB IoT GB Modulation, Low Ch. 627 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.57	13	Pass



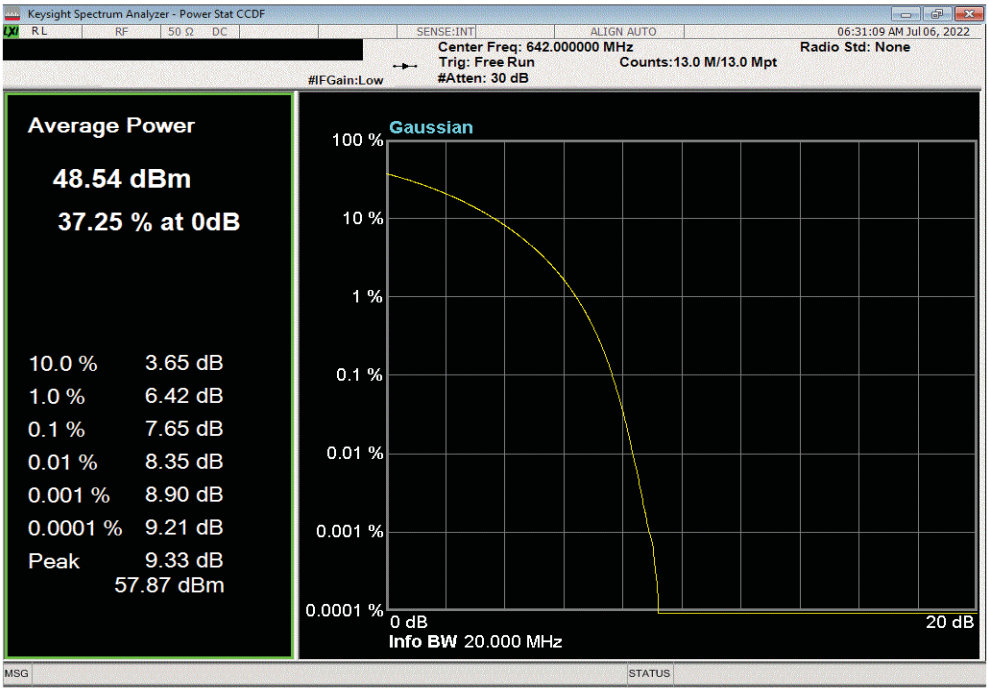
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 20 MHz Bandwidth, NB IoT GB Modulation, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.12	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT GB

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 20 MHz Bandwidth, NB IoT GB Modulation, High Ch. 642 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.65	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 NB IoT GB

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed the rule part defined limit.

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.
The PAPR was measured using the CCDF function of the spectrum analyzer.

Per FCC part 27.50(d)(5) and RSS-130 section 4.6.1, the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

RF conducted emissions testing was performed only on one port. The AHLOB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification testing) and antenna port 2 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 NB IoT GB

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLOB			Work Order:	NOKI0043
Serial Number:	YK220900029			Date:	13-Jul-22
Customer:	Nokia Solutions and Networks			Temperature:	21 °C
Attendees:	Mitchell Hill, John Rattanavong			Humidity:	54.1% RH
Project:	None			Barometric Pres.:	1018 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. The carriers were enabled at maximum power.

DEVIATIONS FROM TEST STANDARD

None

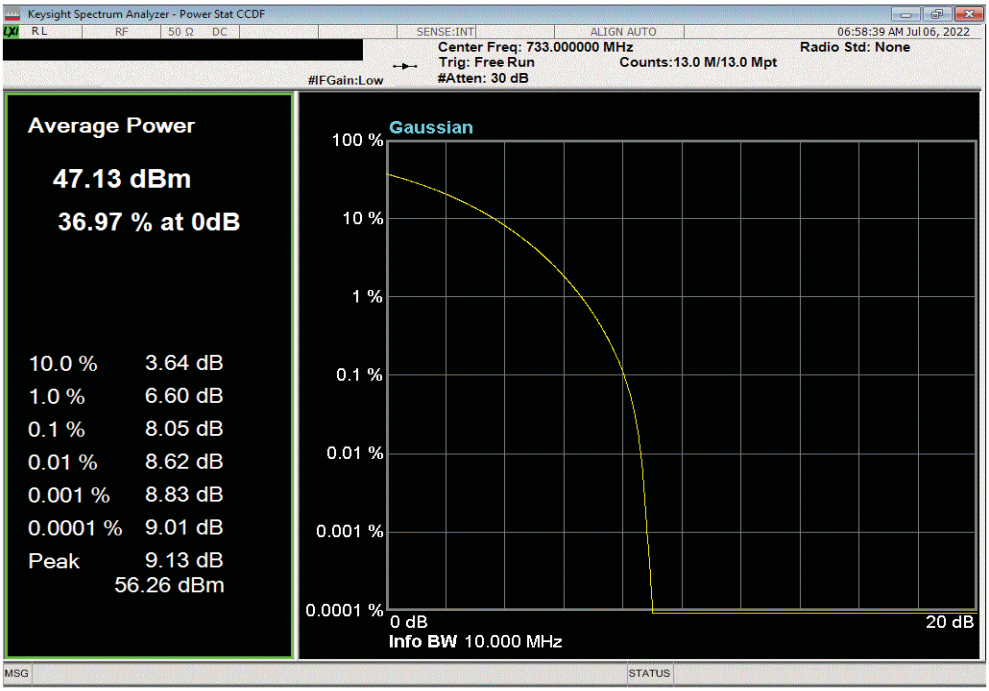
Configuration #	2	Signature

	PAPR Value (dB)	PAPR Limit (dB)	Results
Port 2, LTE, Band 85, 728 MHz - 746 MHz			
10MHz Bandwidth			
NB IoT GB			
Low Ch. 733 MHz	8.05	13	Pass
Mid Ch. 737 MHz	7.97	13	Pass
High Ch. 741 MHz	7.95	13	Pass
Port 2, LTE, Band 85, 728 MHz - 746 MHz			
15MHz Bandwidth			
NB IoT GB			
Low Ch. 735.5 MHz	7.02	13	Pass
Mid Ch. 737 MHz	6.92	13	Pass
High Ch. 738.5 MHz	6.97	13	Pass

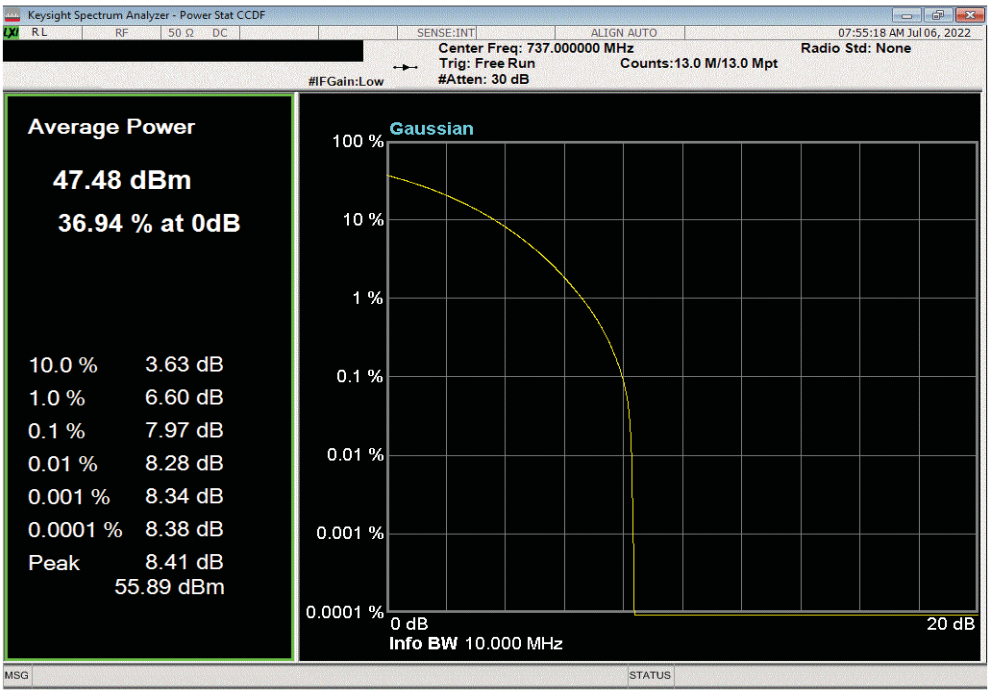
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 NB IoT GB

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 85, 728 MHz - 746 MHz, 10MHz Bandwidth,NB IoT GB, Low Ch. 733 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				8.05	13	Pass



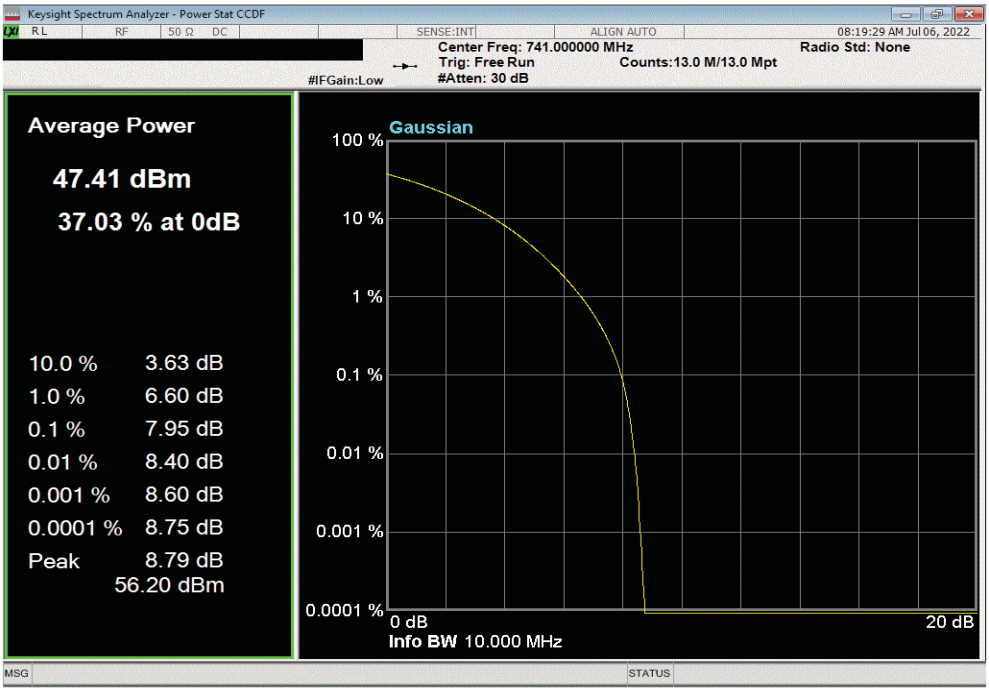
Port 2, LTE, Band 85, 728 MHz - 746 MHz, 10MHz Bandwidth,NB IoT GB, Mid Ch. 737 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.97	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 NB IoT GB

TbtTx 2022.05.02.0 XMit 2022.02.07.0

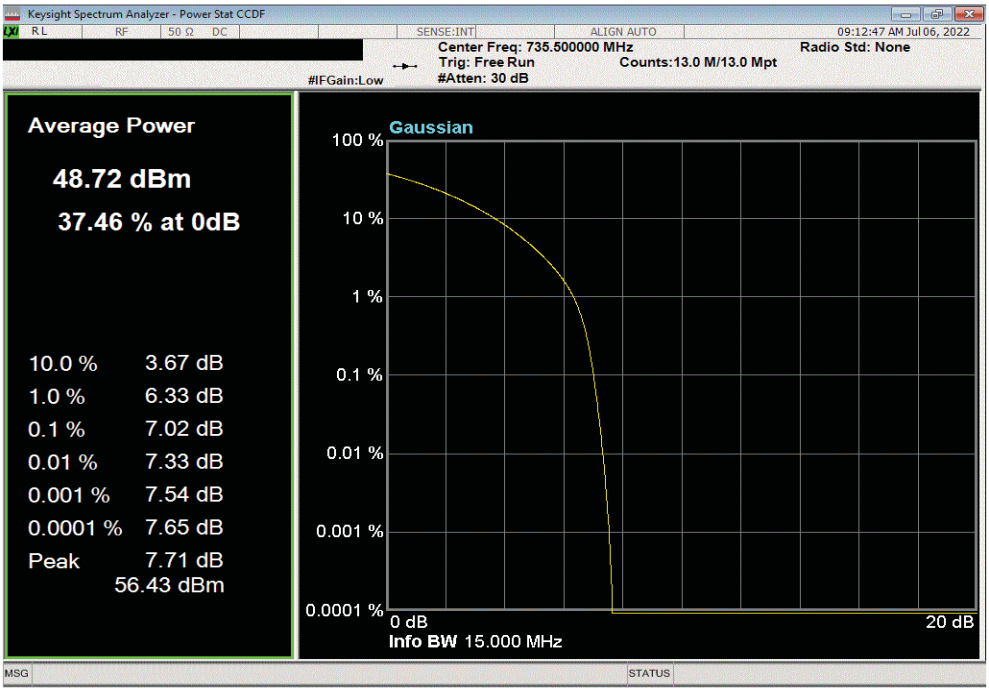
Port 2, LTE, Band 85, 728 MHz - 746 MHz, 10MHz Bandwidth,NB IoT GB, High Ch. 741 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.95	13	Pass



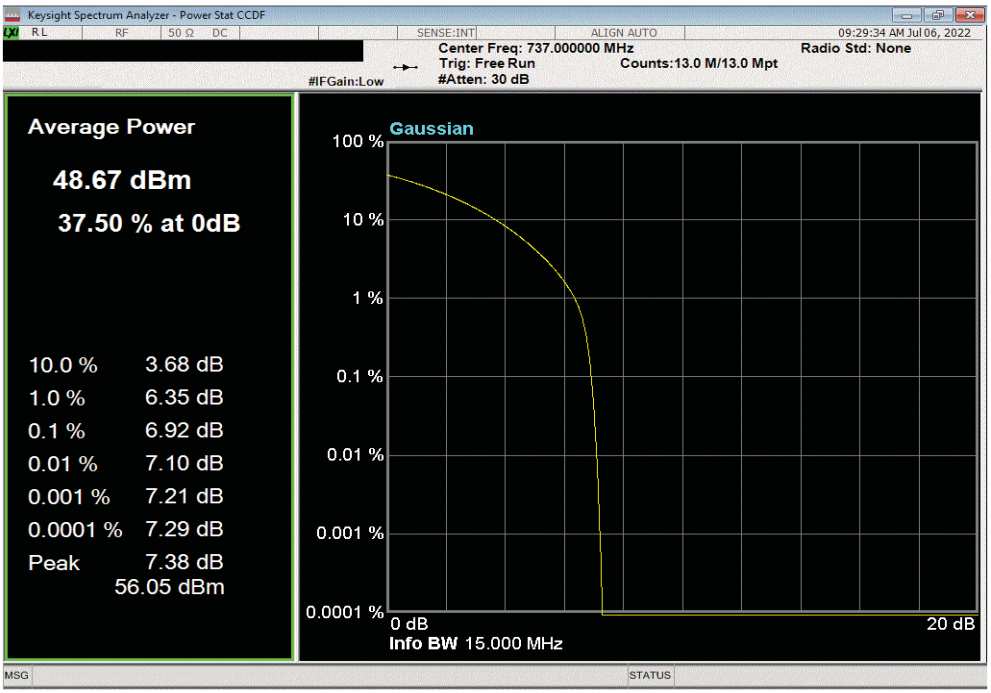
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 NB IoT GB

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 85, 728 MHz - 746 MHz, 15 MHz Bandwidth, NB IoT GB, Low Ch. 735.5 MHz						
				Value (dB)	Limit < (dB)	Results
				7.02	13	Pass



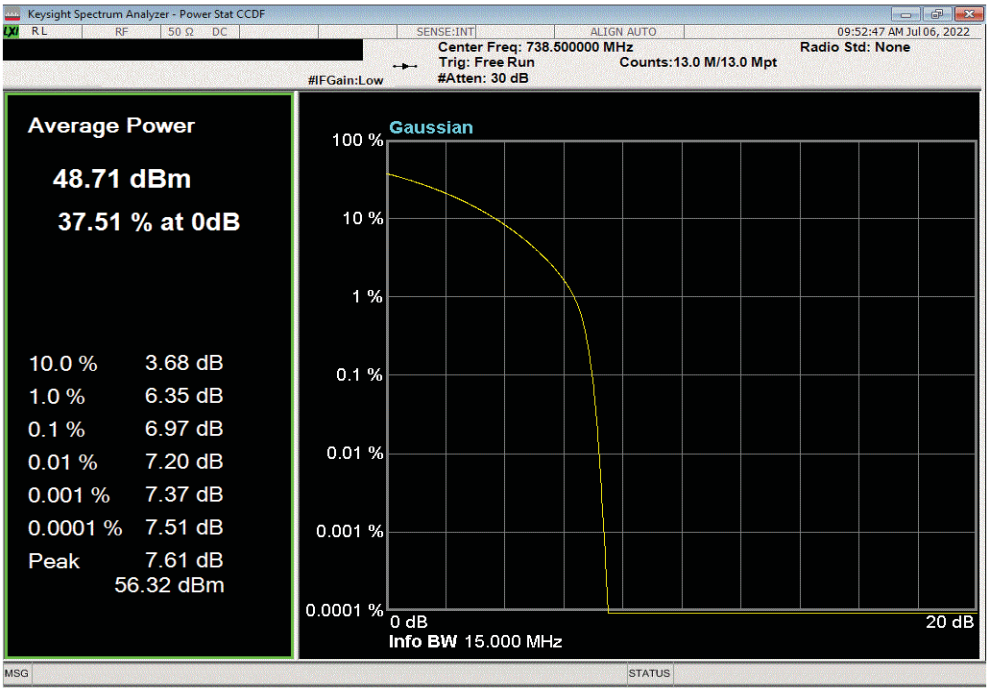
Port 2, LTE, Band 85, 728 MHz - 746 MHz, 15 MHz Bandwidth, NB IoT GB, Mid Ch. 737 MHz						
				Value (dB)	Limit < (dB)	Results
				6.92	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 NB IoT GB

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 85, 728 MHz - 746 MHz, 15 MHz Bandwidth, NB IoT GB, High Ch. 738.5 MHz						
				Value (dB)	Limit < (dB)	Results
				6.97	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT SA

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed the rule part defined limit.

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.
The PAPR was measured using the CCDF function of the spectrum analyzer.

Per FCC part 27.50(d)(5) and RSS-130 section 4.6.1, the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHLOB) as the original certification test. The AHLOB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification testing) and antenna port 2 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT SA

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLOB			Work Order:	NOKI0043
Serial Number:	YK220900029			Date:	11-Jul-22
Customer:	Nokia Solutions and Networks			Temperature:	21.4 °C
Attendees:	Mitchell Hill, John Rattanavong			Humidity:	53.6% RH
Project:	None			Barometric Pres.:	1013 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. The carriers were enabled at maximum power.

DEVIATIONS FROM TEST STANDARD

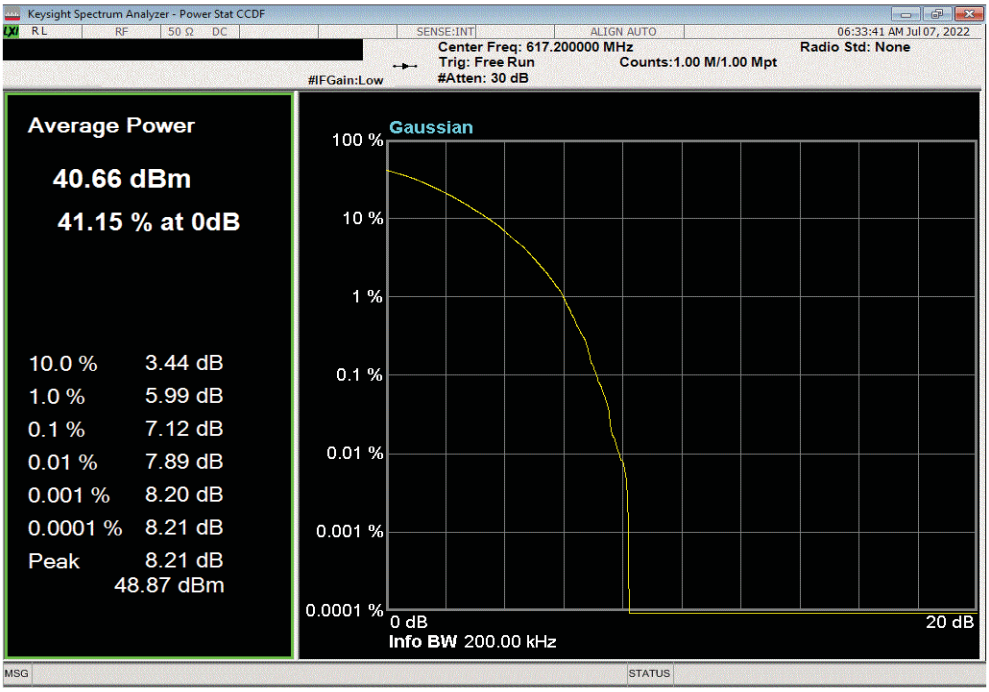
None

Configuration #	2	Signature

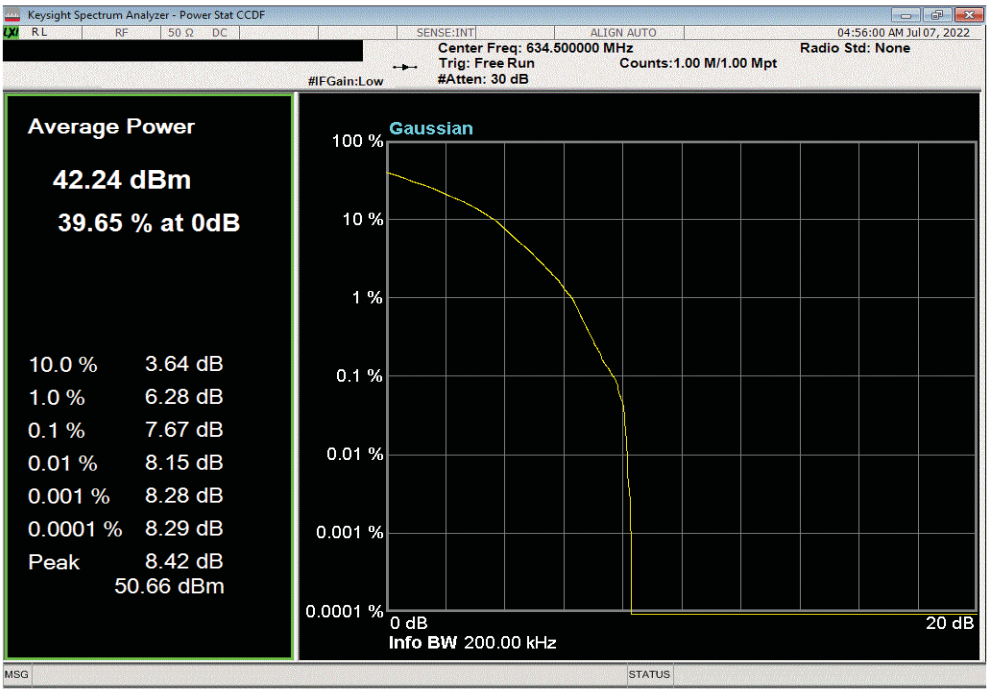
	PAPR Value (dB)	PAPR Limit (dB)	Results
Port 2, LTE, Band 71, 617 MHz - 652 MHz			
200 kHz Bandwidth			
Standalone NB IoT			
Low Ch. 617.2 MHz	7.12	13	Pass
Mid Ch. 634.5 MHz	7.67	13	Pass
High Ch. 651.8 MHz	7.11	13	Pass

PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT SA

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 200 kHz Bandwidth, Standalone NB IoT, Low Ch. 617.2 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.12	13	Pass



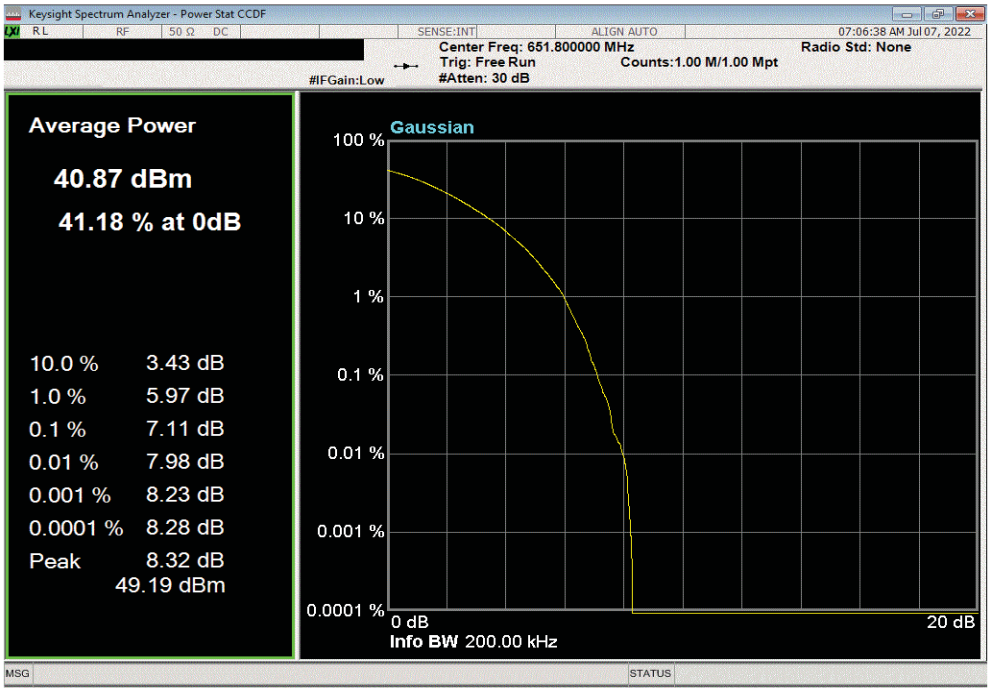
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 200 kHz Bandwidth, Standalone NB IoT, Mid Ch. 634.5 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.67	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 71 NB IoT SA

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 200 kHz Bandwidth, Standalone NB IoT, High Ch. 651.8 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.11	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 NB IoT SA

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

Because the conducted Output Power was measured using a RMS Average detector, the Peak to Average Power Ratio (PAPR) was measured to show that the maximum peak-max-hold spectrum to the maximum of the average spectrum does not exceed the rule part defined limit.

The PAPR measurement method is described in ANSI C63.26 section 5.2.3.4.
The PAPR was measured using the CCDF function of the spectrum analyzer.

Per FCC part 27.50(d)(5) and RSS-130 section 4.6.1, the PAPR limit shall not exceed 13 dB for more than the ANSI described 0.1% of the time.

RF conducted emissions testing was performed only on one port. The testing was performed on the same version of hardware (AHLOB) as the original certification test. The AHLOB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in this certification testing) and antenna port 2 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 NB IoT SA

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLOB			Work Order:	NOKI0043
Serial Number:	YK220900029			Date:	13-Jul-22
Customer:	Nokia Solutions and Networks			Temperature:	21 °C
Attendees:	Mitchell Hill, John Rattanavong			Humidity:	53.2% RH
Project:	None			Barometric Pres.:	1016 mbar
Tested by:	Marty Martin	Power:	54 VDC	Job Site:	TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All losses in the measurement path were accounted for: attenuators, cables, DC block and filter when in use. The carriers were enabled at maximum power.

DEVIATIONS FROM TEST STANDARD

None

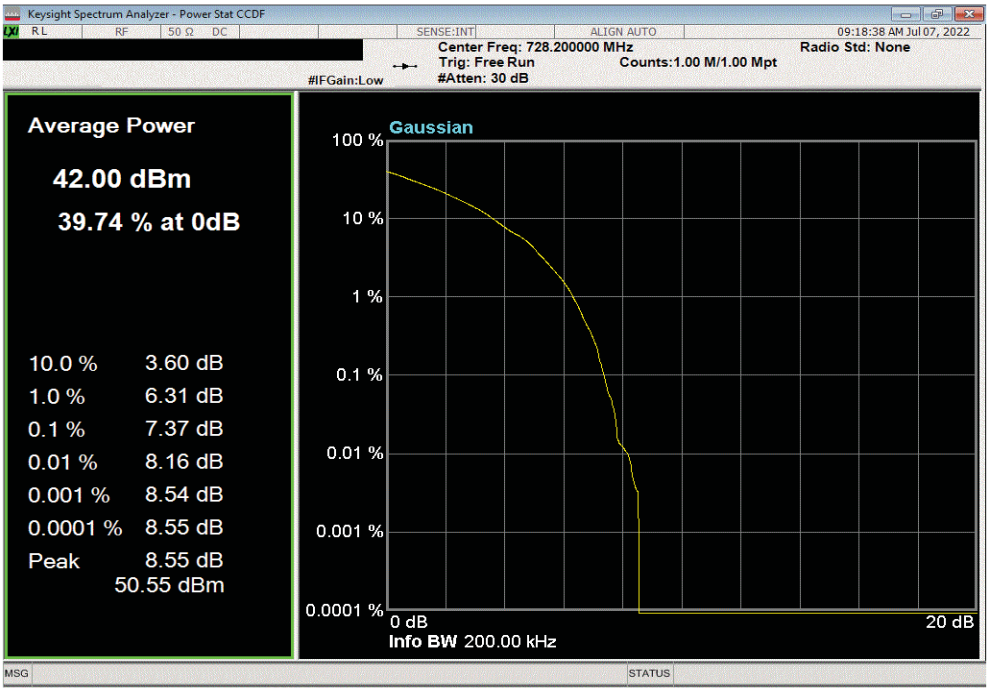
Configuration #	2	Signature

	PAPR Value (dB)	PAPR Limit (dB)	Results
Port 2, LTE, Band 85, 728 MHz - 746 MHz			
200 kHz Bandwidth			
Standalone NB IoT			
Low Ch. 728.2 MHz	7.37	13	Pass
Mid Ch. 737 MHz	7.41	13	Pass
High Ch. 745.8 MHz	7.4	13	Pass

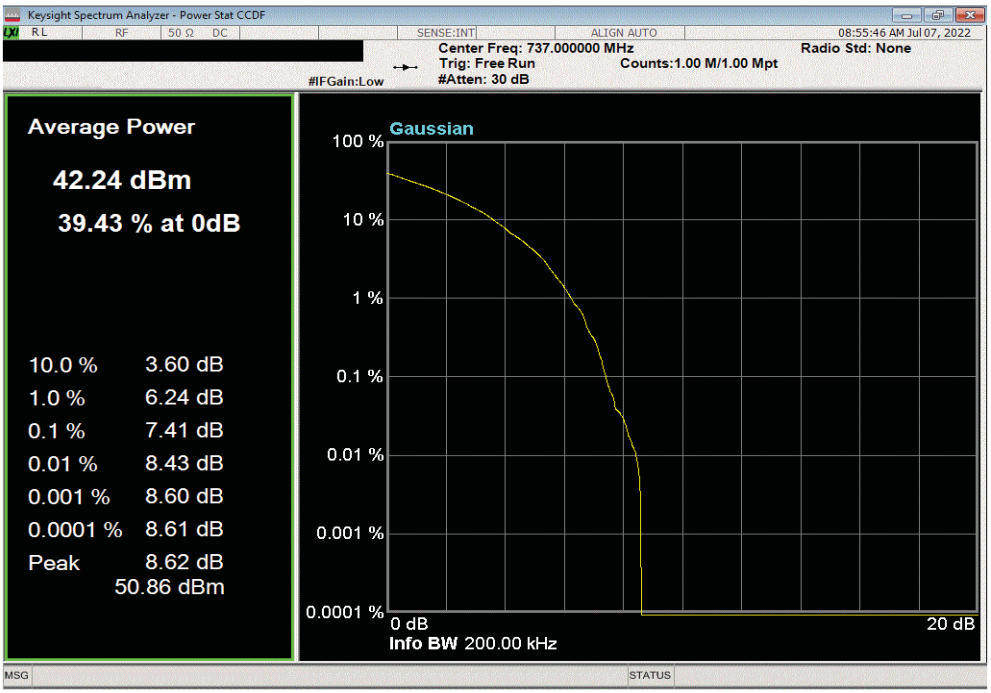
PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 NB IoT SA

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 85, 728 MHz - 746 MHz, 200 kHz Bandwidth, Standalone NB IoT, Low Ch. 728.2 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.37	13	Pass



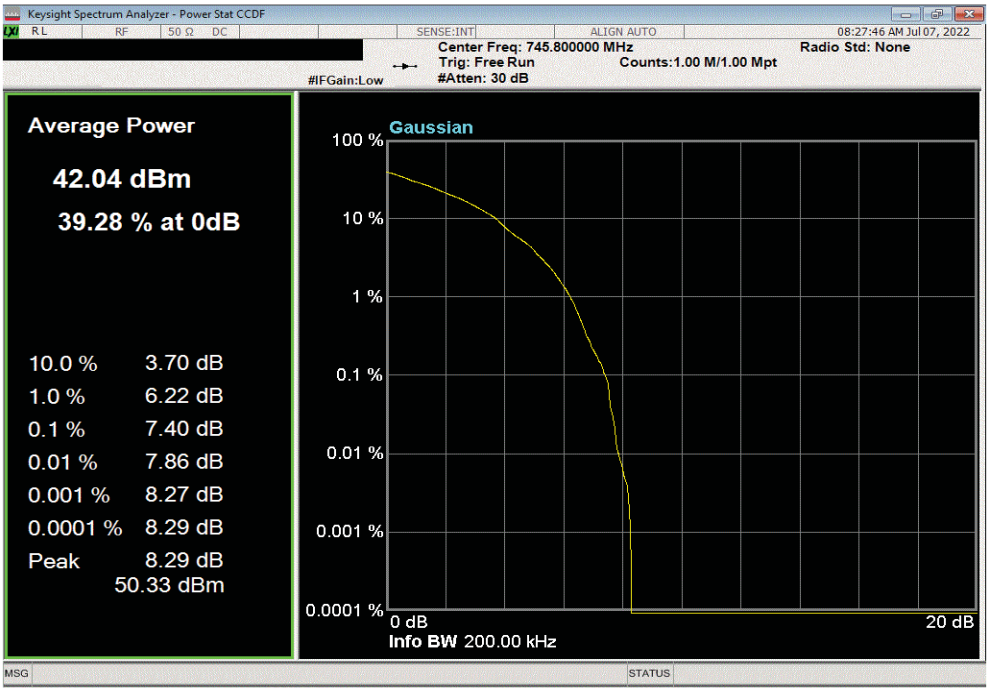
Port 2, LTE, Band 85, 728 MHz - 746 MHz, 200 kHz Bandwidth, Standalone NB IoT, Mid Ch. 737 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.41	13	Pass



PEAK TO AVERAGE POWER (PAPR) CCDF - Band 85 NB IoT SA

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 85, 728 MHz - 746 MHz, 200 kHz Bandwidth, Standalone NB IoT, High Ch. 745.8 MHz						
				PAPR Value (dB)	PAPR Limit (dB)	Results
				7.4	13	Pass



POWER SPECTRAL DENSITY AND EIRP CALCULATION - Band 71 LTE

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission power spectral density was measured using the channels and modes as called out on the following data sheets.

The method of ANSI C63.26-2015 section 5.2.4.5 was used to make this measurement.

The RF conducted emission testing was performed on one port. The AHLOB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the “Output Power - All Ports” report section) and antenna port 2 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

The total PSD for all antenna ports (at the radio output) were determined per ANSI C63.26-2015 paragraph 6.4.3.2.4.
The EIRP calculations are based upon ANSI C63.26-2015 paragraphs 6.4 for a four port MIMO base station.

FCC Requirements:
FCC 27.50(c) (3) Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section;
FCC 27.50(c) (4) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with Table 4 of this section;

Note: EIRP = ERP + 2.15dB
1000 watts = 60.00 dBm, EIRP = (60 dBm + 2.15dB) /MHz = 62.15dBm/MHz or 1640W/MHz
2000 watts = 63.01 dBm, EIRP = (63 dBm + 2.15dB) /MHz = 65.16dBm/MHz or 3280W/MHz

ISED Requirements RSS-130 Section 4.6/SRSP-518 section 5.1:
SRSP-518 section 5.1 Radiated power and antenna height limits for fixed and base stations
21. For fixed and base stations transmitting in accordance with section 4, the maximum permissible equivalent isotropically radiated power (e.i.r.p.) is 1640 watts and 1640 watts/MHz for a channel bandwidth less than or equal to 1 MHz and greater than 1 MHz, respectively. These e.i.r.p. limits apply for stations with an antenna height above average terrain (HAAT) up to 305 metres.
22. Fixed and base stations located in geographical areas at a distance greater than 26 km from large or medium population centres and transmitting in accordance with section 4, may increase their e.i.r.p. up to a maximum of 3280 watts/MHz (i.e. no more than 3280 watts e.i.r.p. in any 1 MHz band segment), with an antenna HAAT up to 305 metres.

POWER SPECTRAL DENSITY AND EIRP CALCULATION - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLOB	Work Order:	NOKI0043
Serial Number:	YK220900029	Date:	11-Jul-22
Customer:	Nokia Solutions and Networks	Temperature:	20.9 °C
Attendees:	Mitchell Hill, John Rattanavong	Humidity:	57.2% RH
Project:	None	Barometric Pres.:	1015 mbar
Tested by:	Marty Martin	Job Site:	TX07
Power:	54 VDC		

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. The PSD was measured while transmitting one carrier on Port 2. The total PSD for multiport (2x2, 4x4 MIMO) operation was determinded based upon ANSI 63.26 clause 6.4.3.2.4 (10 Log Nout). The total PSD for two port operation is single port PSD +3dB [i.e. 10 Log(2)]. The total PSD for four port operation is single port PSD +6dB [i.e. 10 Log(4)]. The carriers are enabled at maximum power.

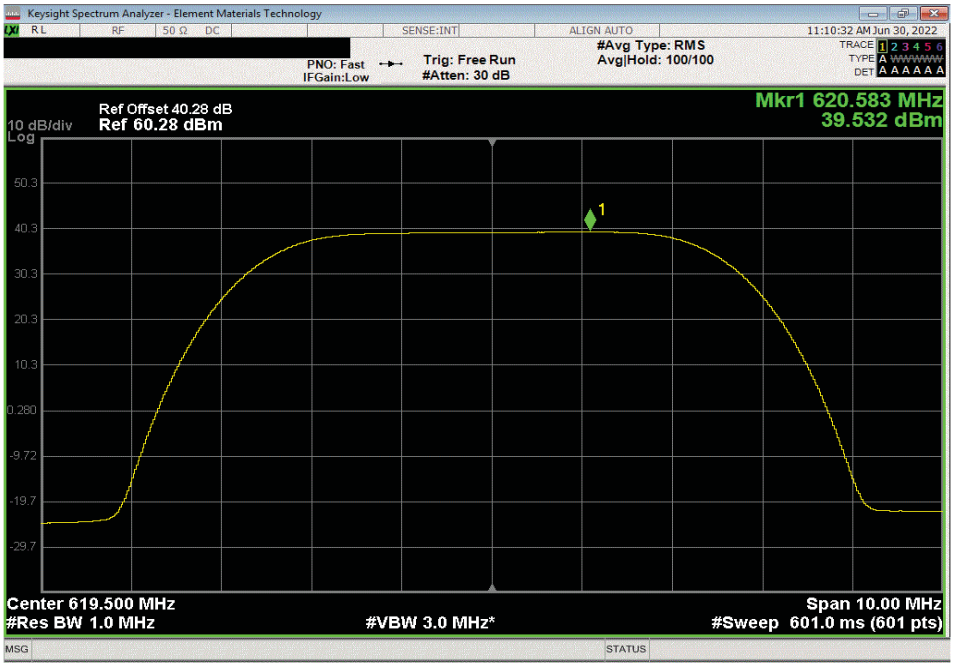
DEVIATIONS FROM TEST STANDARD

None

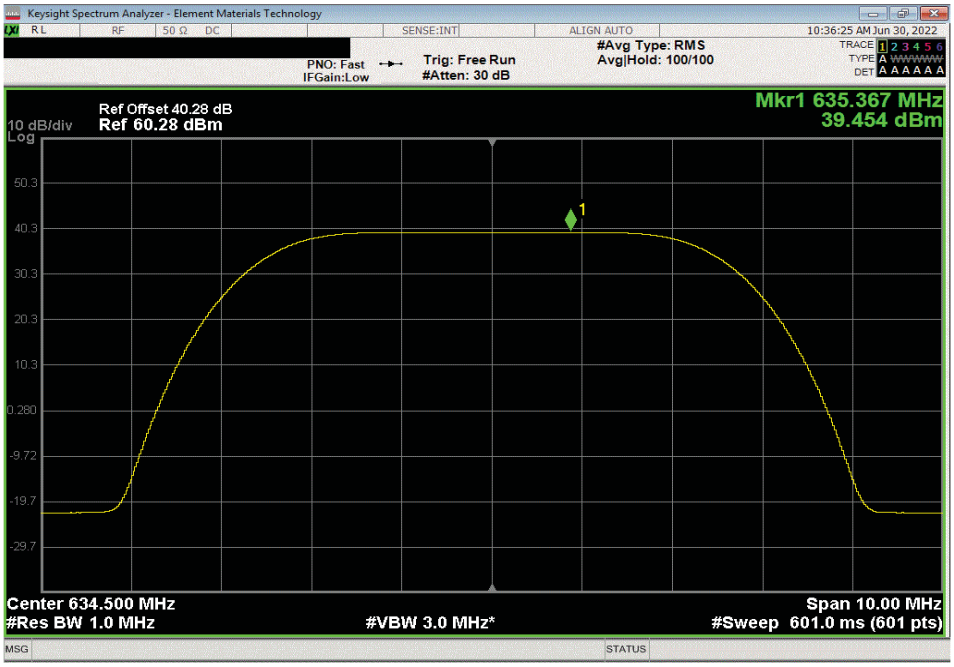
Configuration #	2	Signature

	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD
Port 2, LTE, Band 71, 617 MHz - 652 MHz					
5 MHz Bandwidth					
QPSK Modulation					
Low Ch. 619.5 MHz	39.532	0	39.5	42.5	45.2
Mid Ch. 634.5 MHz	39.454	0	39.5	42.5	45.2
High Ch. 649.5 MHz	39.713	0	39.7	42.7	45.7
16-QAM Modulation					
Low Ch. 619.5 MHz	39.85	0	39.9	42.9	45.9
Mid Ch. 634.5 MHz	39.845	0	39.8	42.8	45.9
High Ch. 649.5 MHz	39.896	0	39.9	42.9	45.9
64-QAM Modulation					
Low Ch. 619.5 MHz	39.409	0	39.4	42.4	45.4
Mid Ch. 634.5 MHz	39.26	0	39.3	42.3	45.3
High Ch. 649.5 MHz	39.532	0	39.5	42.5	45.5
256-QAM Modulation					
Low Ch. 619.5 MHz	39.351	0	39.4	42.4	45.4
Mid Ch. 634.5 MHz	39.2	0	39.2	42.2	45.2
High Ch. 649.5 MHz	39.305	0	39.3	42.3	45.3
10 MHz Bandwidth					
QPSK Modulation					
Mid Ch. 634.5 MHz	38.325	0	38.3	41.3	44.3
16-QAM Modulation					
Mid Ch. 634.5 MHz	38.614	0	38.6	41.6	44.6
64-QAM Modulation					
Mid Ch. 634.5 MHz	38.141	0	38.1	41.1	44.1
256-QAM Modulation					
Mid Ch. 634.5 MHz	38.092	0	38.1	41.1	44.1
15 MHz Bandwidth					
QPSK Modulation					
Mid Ch. 634.5 MHz	37.356	0	37.4	40.4	43.4
16-QAM Modulation					
Mid Ch. 634.5 MHz	38.457	0	38.5	41.5	44.5
64-QAM Modulation					
Mid Ch. 634.5 MHz	37.351	0	37.4	40.4	43.4
256-QAM Modulation					
Mid Ch. 634.5 MHz	37.376	0	37.4	40.4	43.4
20 MHz Bandwidth					
QPSK Modulation					
Mid Ch. 634.5 MHz	36.178	0	36.2	39.2	42.2
16-QAM Modulation					
Mid Ch. 634.5 MHz	36.606	0	36.6	39.6	42.6
64-QAM Modulation					
Mid Ch. 634.5 MHz	36.1	0	36.1	39.1	42.1
256-QAM Modulation					
Mid Ch. 634.5 MHz	36.078	0	36.1	39.1	42.1

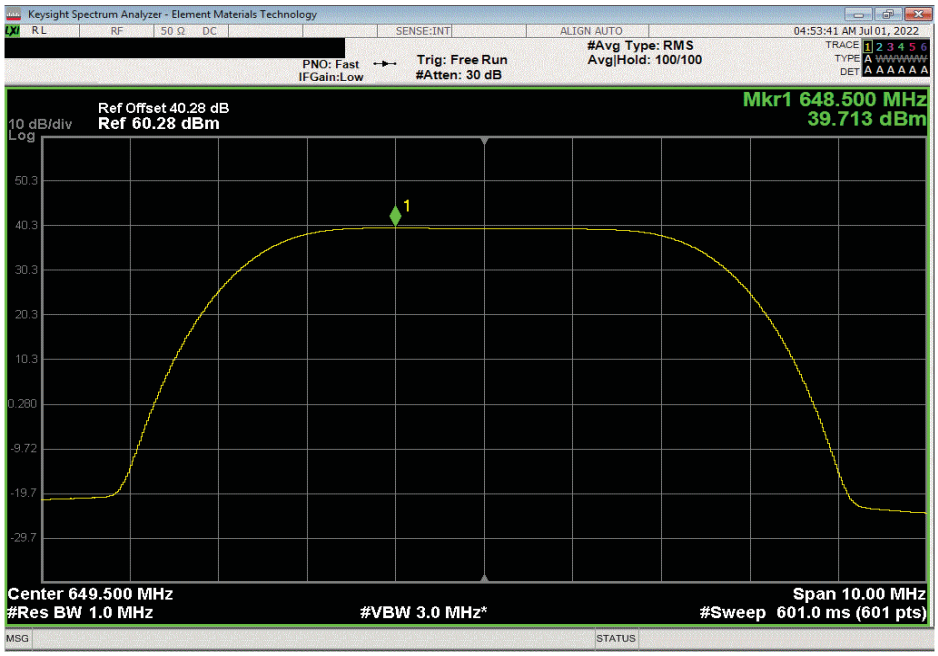
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, QPSK Modulation, Low Ch. 619.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.532	0	39.5	42.5	45.5	



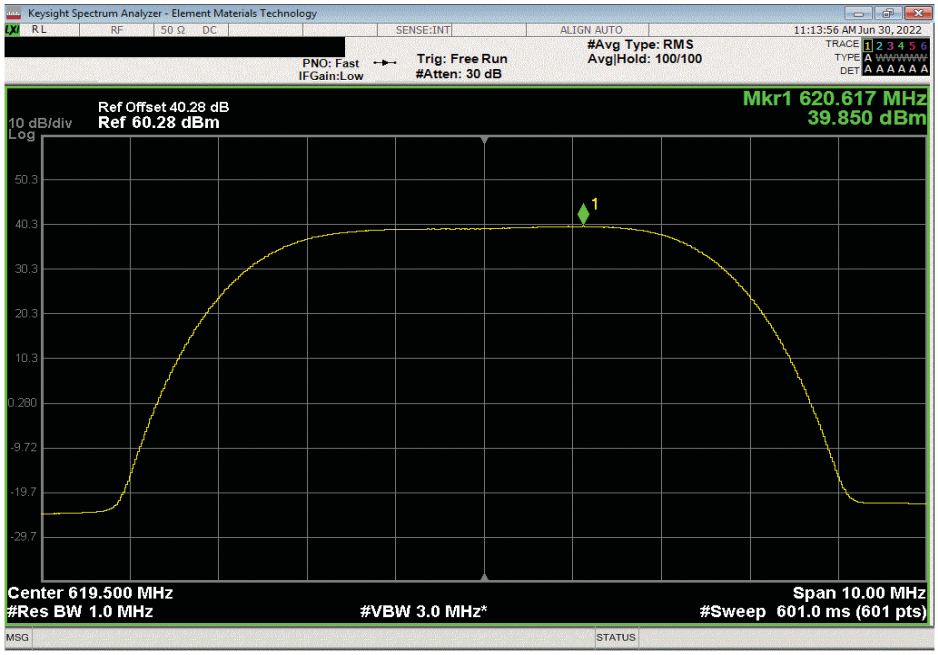
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, QPSK Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.454	0	39.5	42.5	45.5	



Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, QPSK Modulation, High Ch. 649.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.713	0	39.7	42.7	45.7	



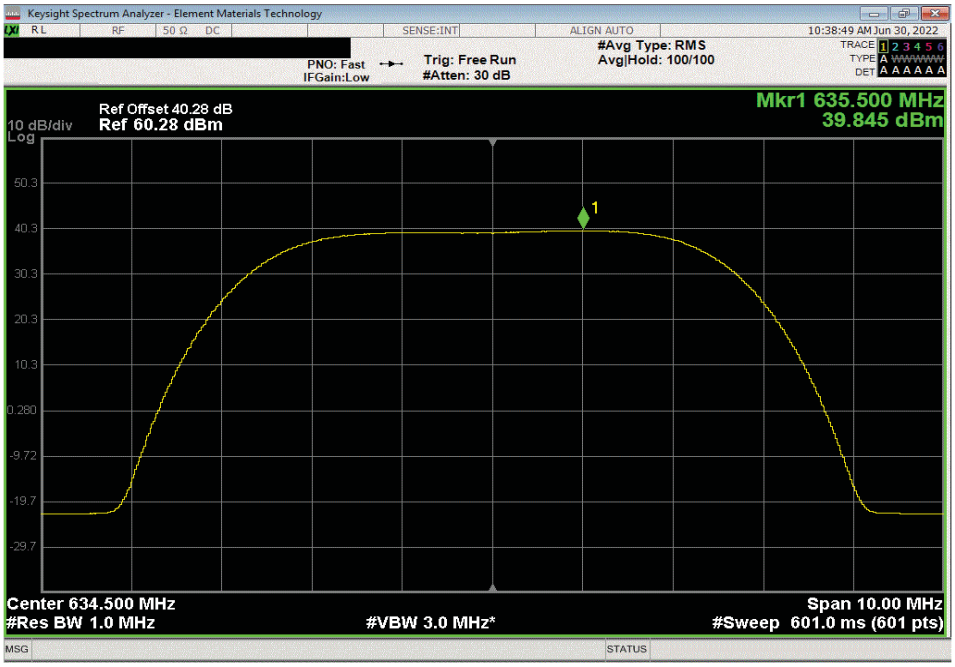
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 16-QAM Modulation, Low Ch. 619.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.85	0	39.9	42.9	45.9	



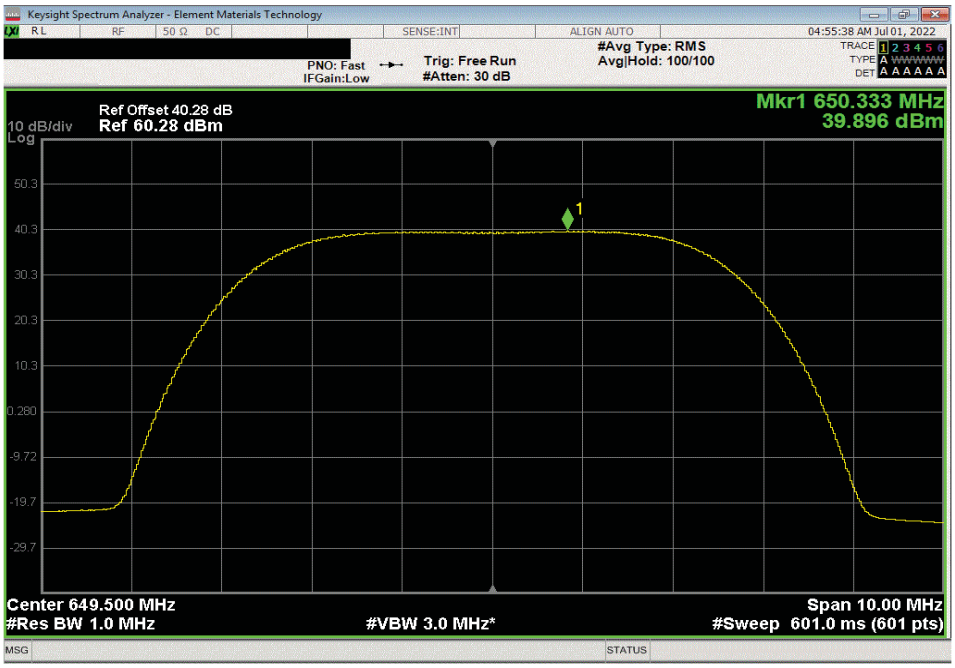
POWER SPECTRAL DENSITY AND EIRP CALCULATION - Band 71 LTE

TbTx 2022.05.02.0 XMit 2022.02.07.0

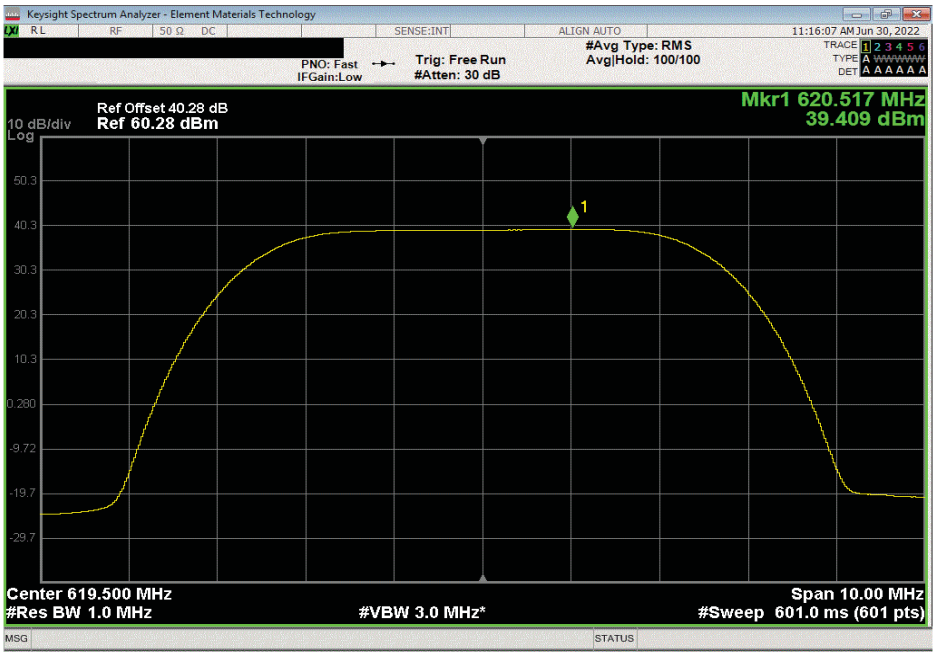
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 16-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.845	0	39.8	42.8	45.8	



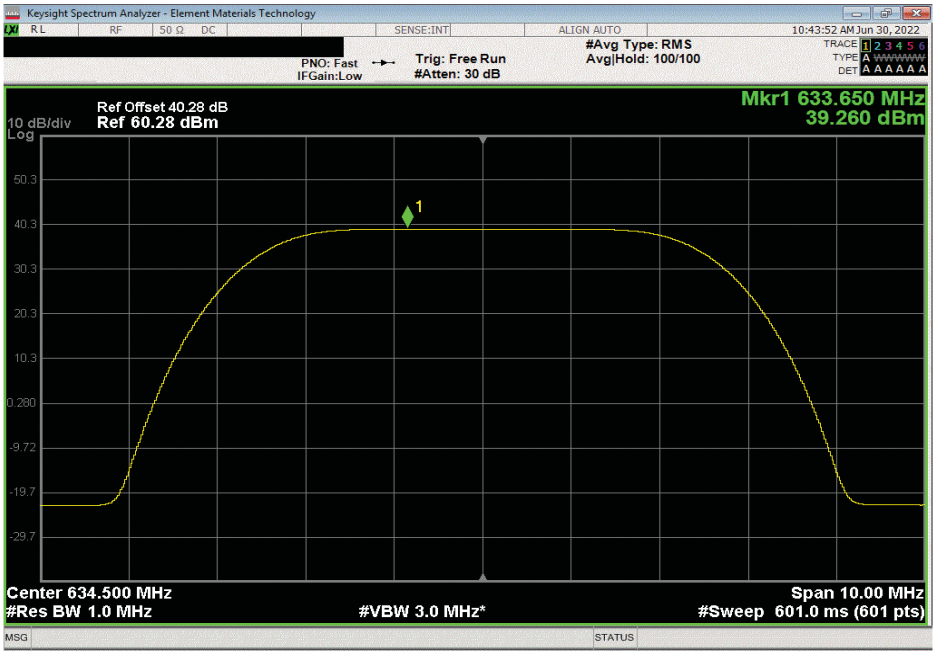
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 16-QAM Modulation, High Ch. 649.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.896	0	39.9	42.9	45.9	



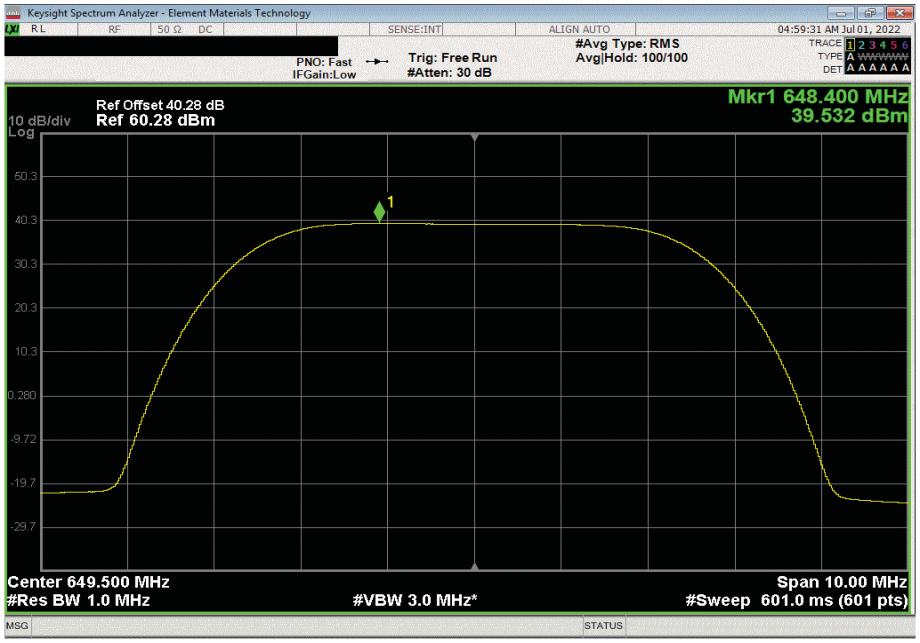
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 64-QAM Modulation, Low Ch. 619.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.409	0	39.4	42.4	45.4	



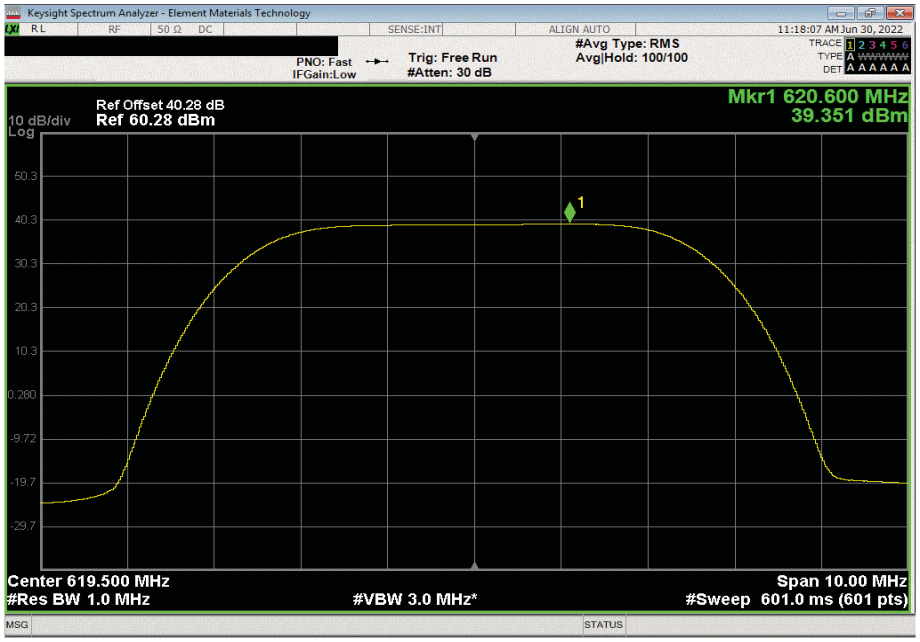
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 64-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.26	0	39.3	42.3	45.3	



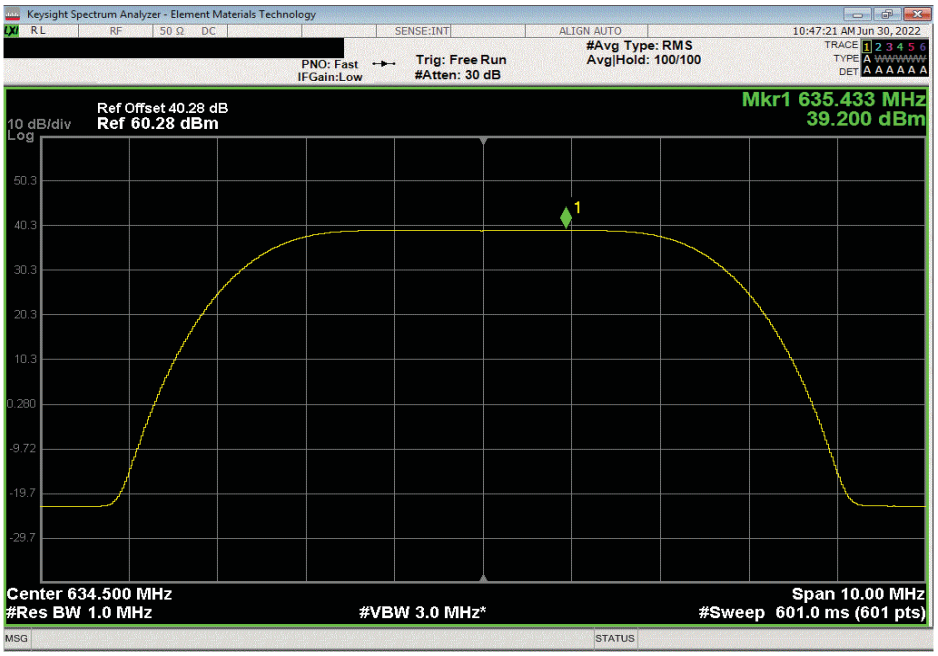
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 64-QAM Modulation, High Ch. 649.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.532	0	39.5	42.5	45.5	



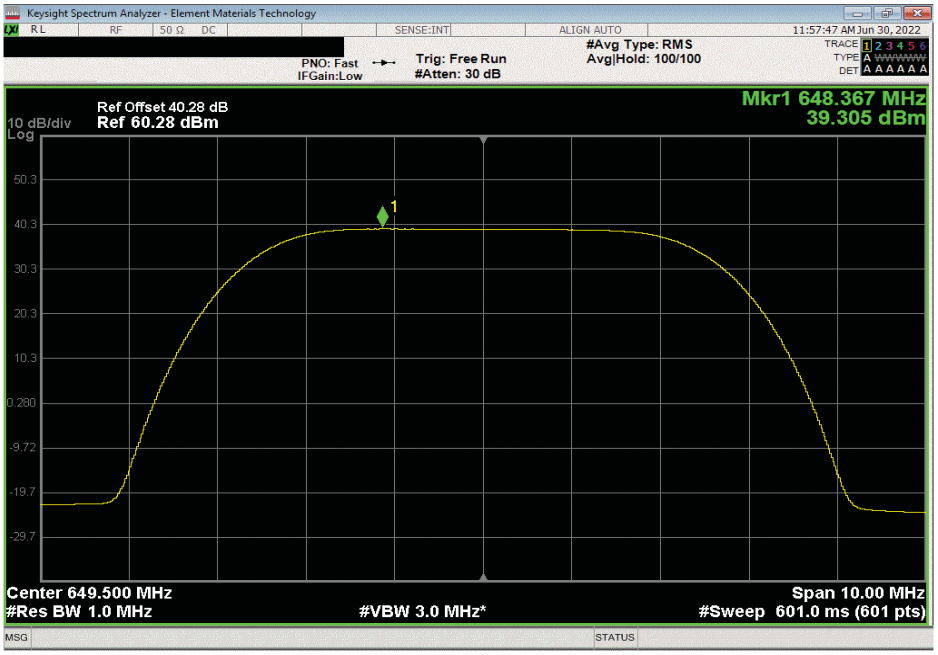
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 256-QAM Modulation, Low Ch. 619.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.351	0	39.4	42.4	45.4	



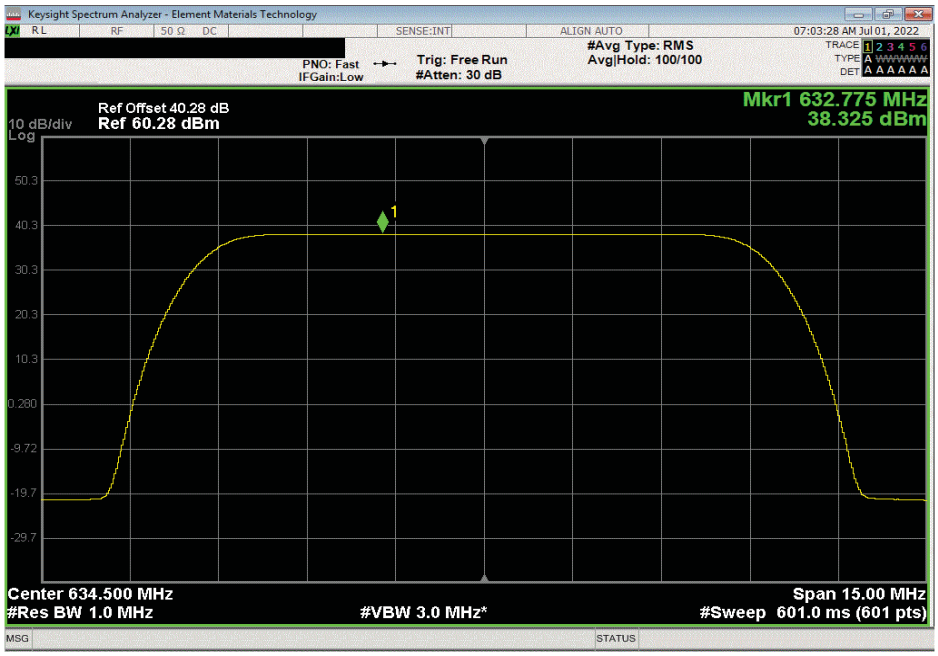
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.2	0	39.2	42.2	45.2	



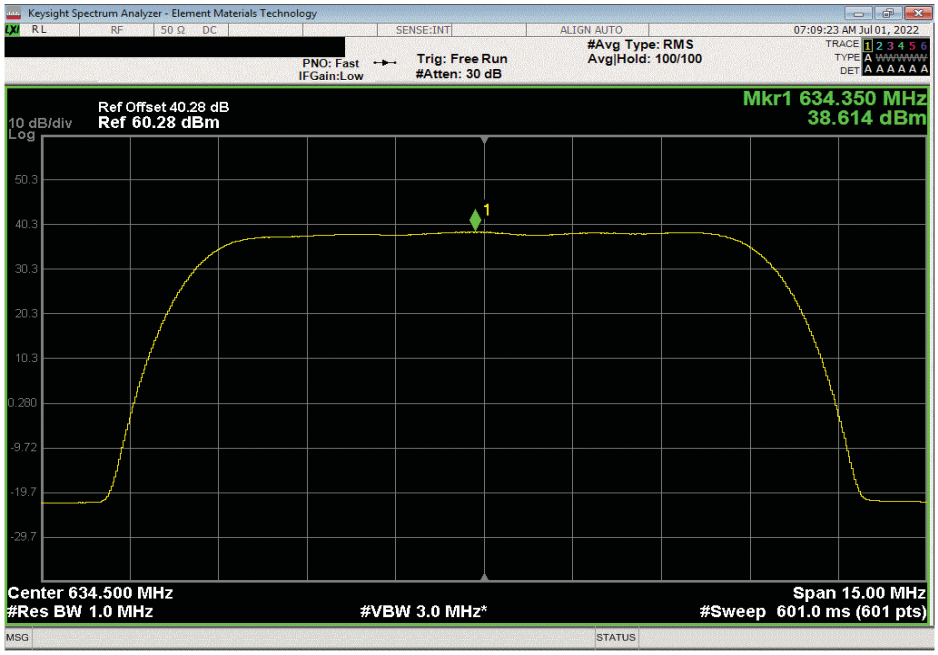
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 5 MHz Bandwidth, 256-QAM Modulation, High Ch. 649.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	39.305	0	39.3	42.3	45.3	



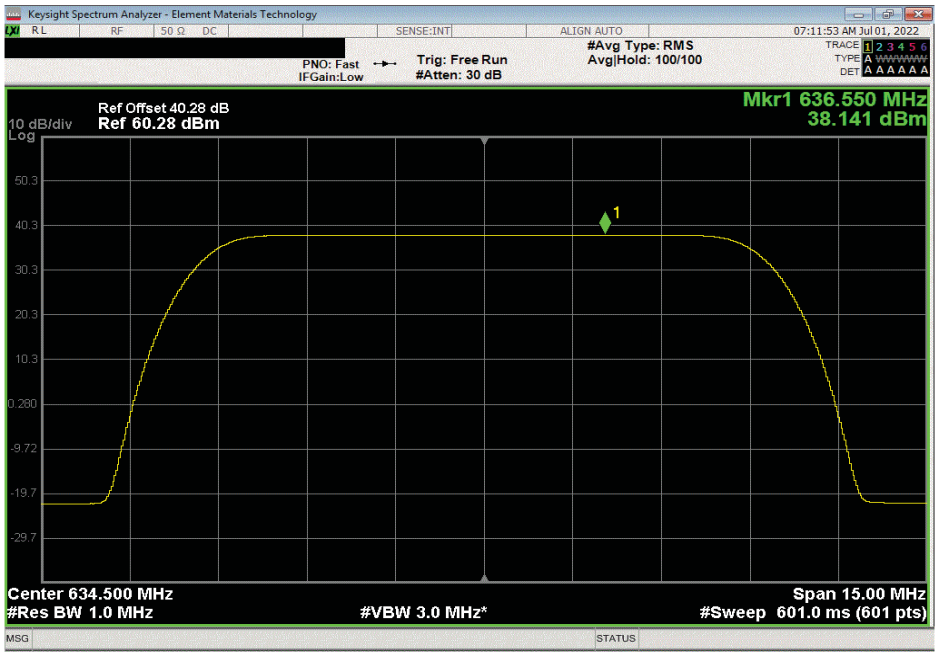
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 10 MHz Bandwidth, QPSK Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	38.325	0	38.3	41.3	44.3	



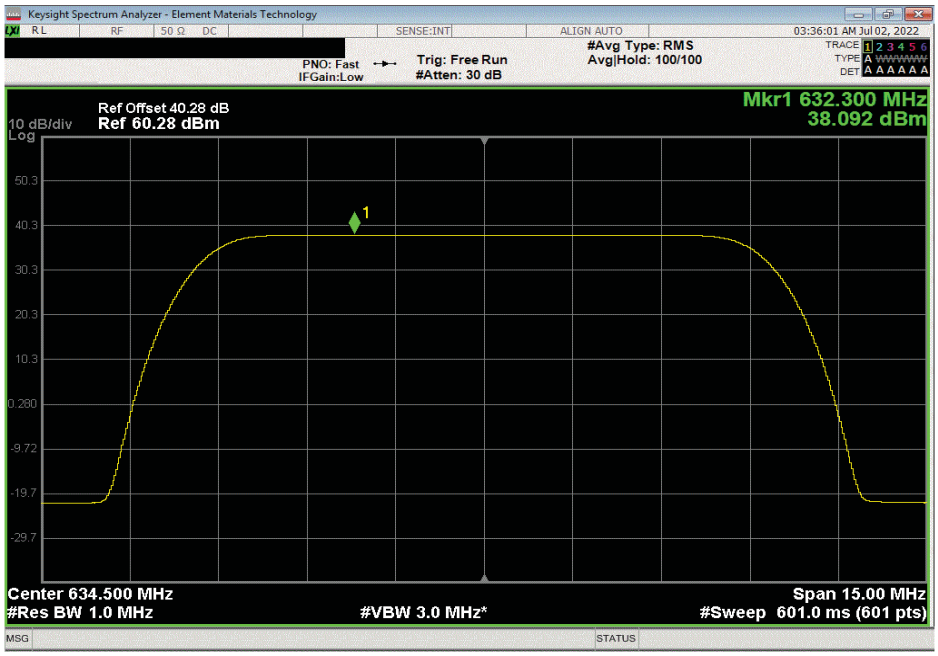
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 10 MHz Bandwidth, 16-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	38.614	0	38.6	41.6	44.6	



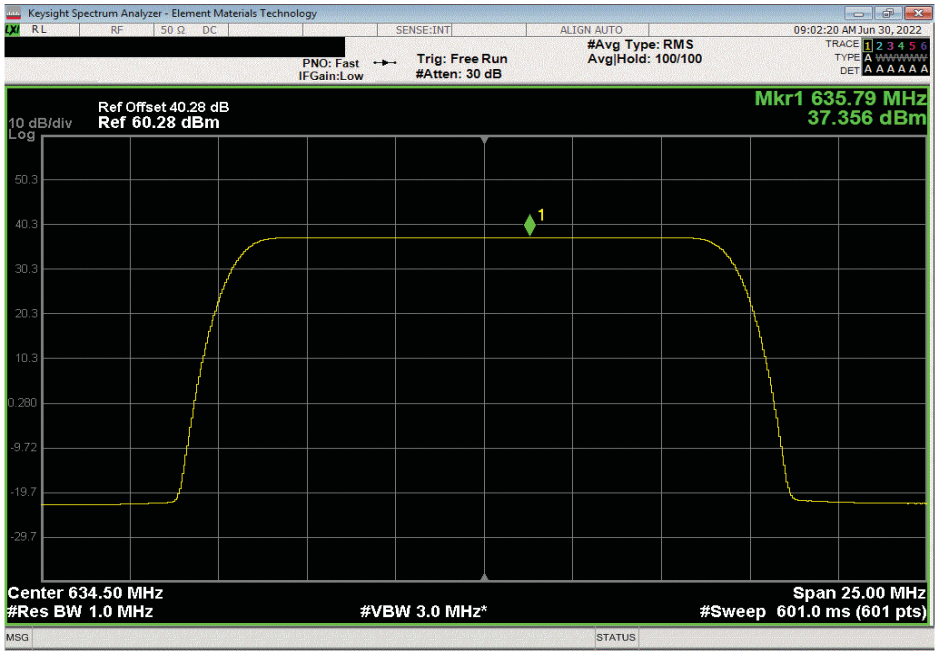
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 10 MHz Bandwidth, 64-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	38.141	0	38.1	41.1	44.1	



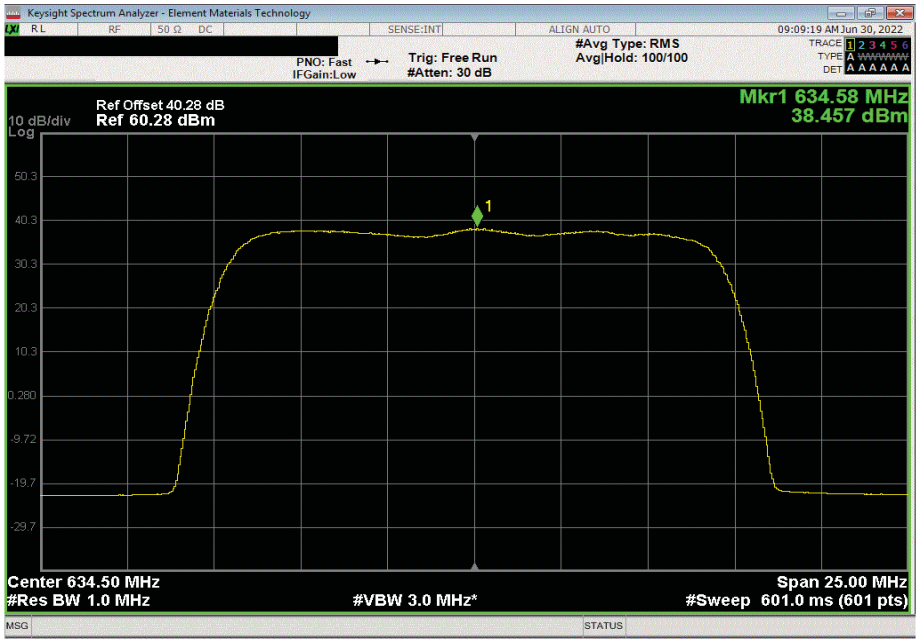
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 10 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	38.092	0	38.1	41.1	44.1	



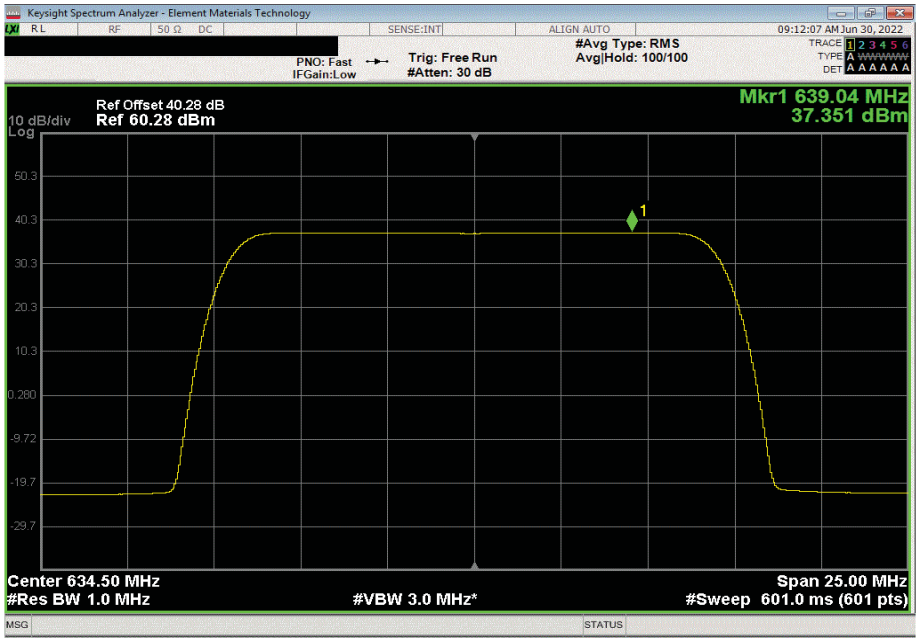
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, QPSK Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	37.356	0	37.4	40.4	43.4	



Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, 16-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	38.457	0	38.5	41.5	44.5	



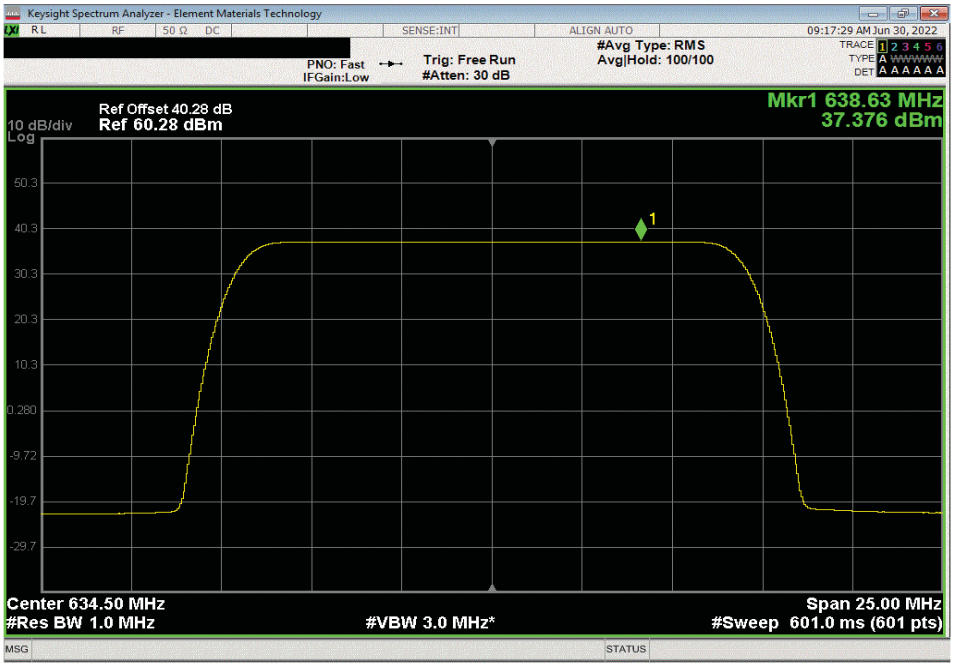
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, 64-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	37.351	0	37.4	40.4	43.4	



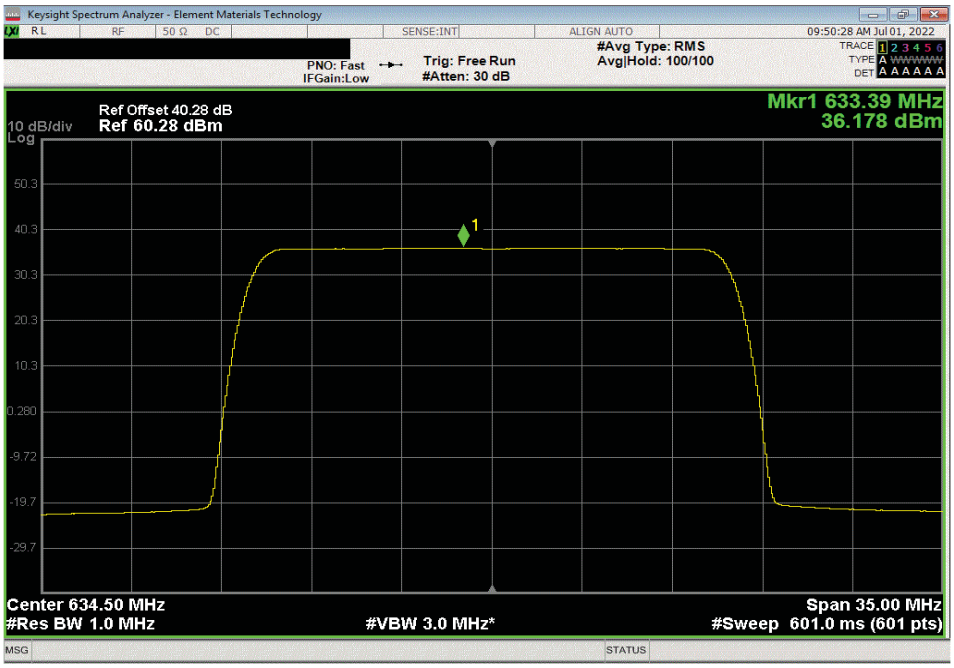
POWER SPECTRAL DENSITY AND EIRP CALCULATION - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 15 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	37.376	0	37.4	40.4	43.4	



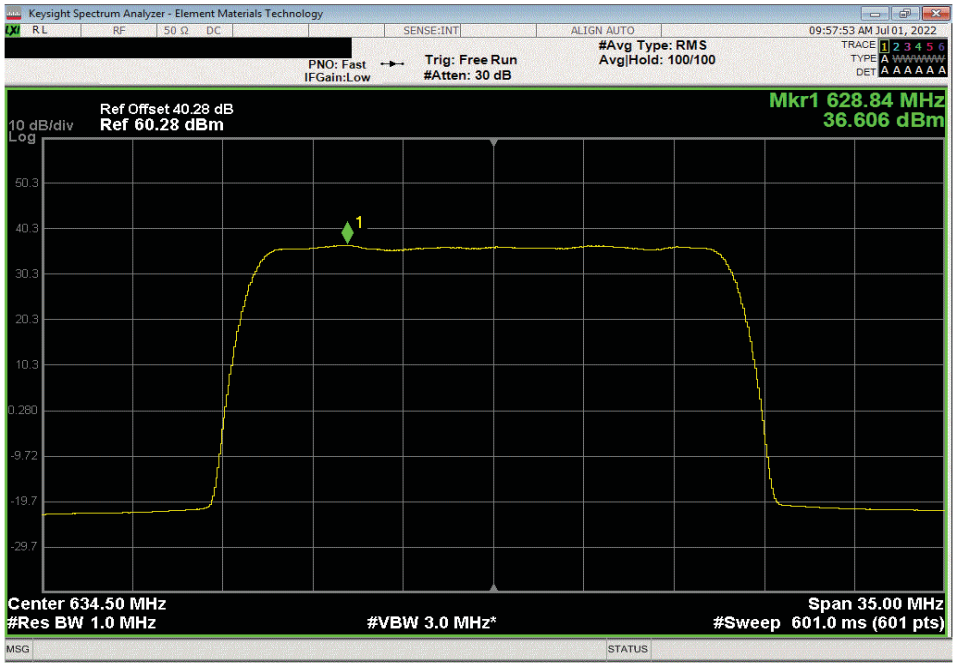
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 20 MHz Bandwidth, QPSK Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	36.178	0	36.2	39.2	42.2	



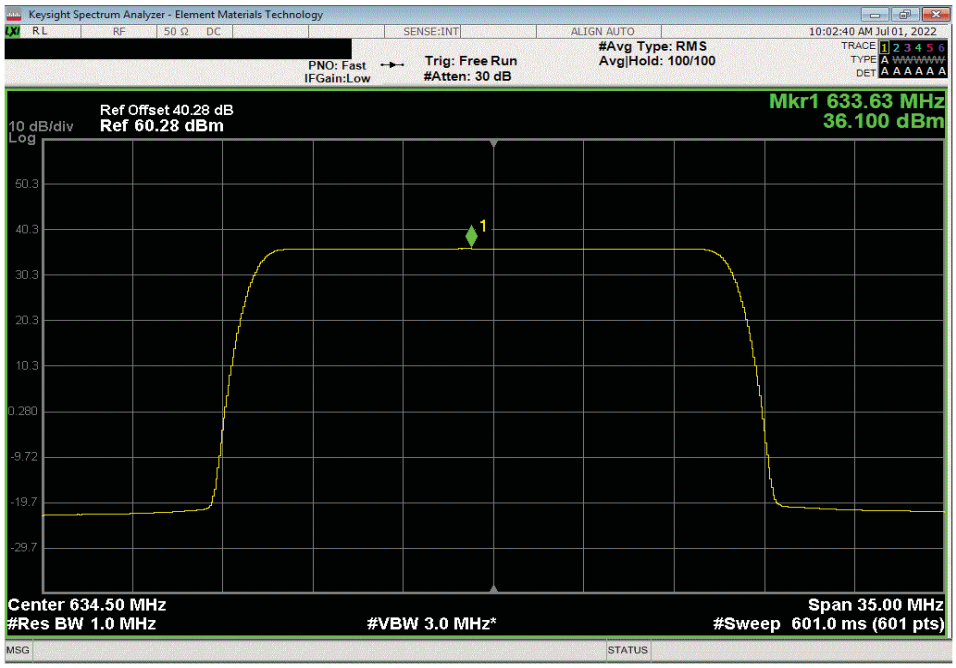
POWER SPECTRAL DENSITY AND EIRP CALCULATION - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 20 MHz Bandwidth, 16-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	36.606	0	36.6	39.6	42.6	



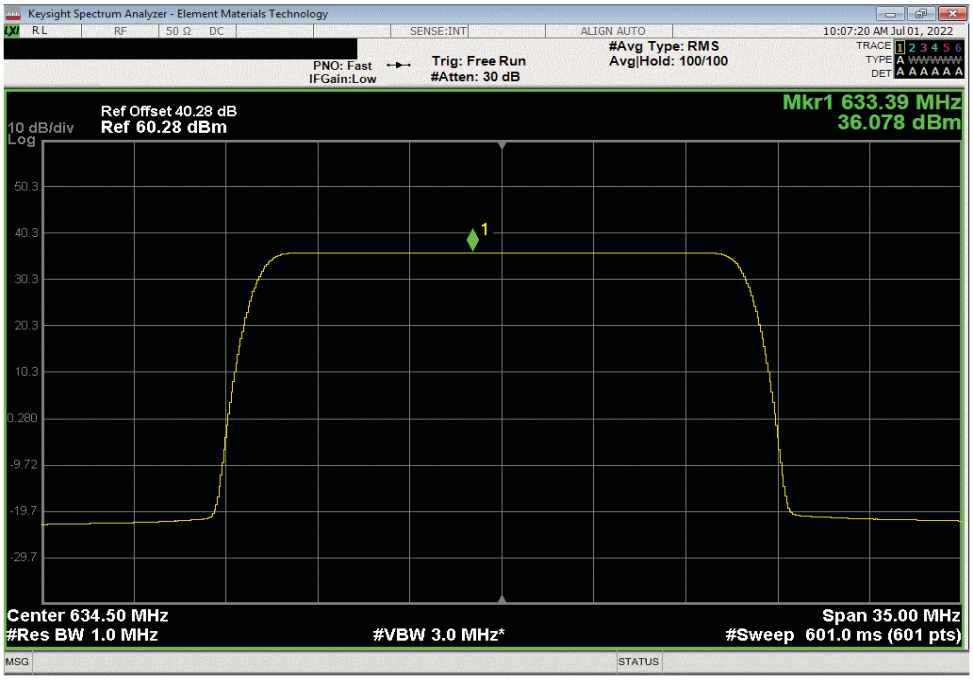
Port 2, LTE, Band 71, 617 MHz - 652 MHz, 20 MHz Bandwidth, 64-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	36.1	0	36.1	39.1	42.1	



POWER SPECTRAL DENSITY AND EIRP CALCULATION - Band 71 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

Port 2, LTE, Band 71, 617 MHz - 652 MHz, 20 MHz Bandwidth, 256-QAM Modulation, Mid Ch. 634.5 MHz						
	Value dBm/MHz	Duty Cycle factor (dB)	Single Port dBm/MHz == PSD	Two Port (2x2 MIMO) dBm/MHz == PSD	Two Port (4x4 MIMO) dBm/MHz == PSD	
	36.078	0	36.1	39.1	42.1	



EIRP Calculations

EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regulatory requirements. Each cell site installation needs to consider the power measurements in the radio certification report as well as site specific regulatory requirements (such as antenna height, population density, etc.), site installation parameters (line loss between antenna and radio, antenna parameters, etc.) and base station operational parameters (MIMO operational setup, carrier power level, channel bandwidth, modulation type, etc.) to optimize performance. Transmitter output power may be reduced (from maximum) by base station setup parameters. Base station antennas are selected by the customer.

The base station antenna is selected by the customer and this EIRP calculation is based upon a sample worst case antenna. The EIRP calculation is based upon Commscope antenna assembly model "FF-65C-R1". The maximum Band 71 gain (15.7dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of ±45° cross-polarized radiators. The four antenna RF inputs on the antenna assembly are labeled as R1 +45°, R1 -45°, R2 +45° and R2 -45°. The four AHLOB transmitter outputs are connected to the antenna assembly RF inputs.

Equivalent Isotropically Radiated Power (EIRP) is calculated for four port MIMO (as specified in ANSI C63.26-2015 section 6.4 for uncorrelated output signals) from the results of power measurements (highest measured PSD for each channel bandwidth type). The maximum antenna gain was used for this calculation. The cable loss between the antenna and transmitter is site dependent (will not be 0 dB) but for this worst case EIRP calculation 0 dB was used. Calculations of worst-case EIRP for four port MIMO are as follows:

Parameter	5 MHz Ch BW	10 MHz Ch BW	15 MHz Ch BW	20 MHz Ch BW
Worst Case PSD/Antenna Port	39.9 dBm/MHz	38.6 dBm/MHz	38.5 dBm/MHz	36.6 dBm/MHz
Number of Ant Ports per Polarization	2	2	2	2
Total PSD per Polarization	42.9	41.6	41.5	39.6
Cable Loss (site dependent)	0 dB	0 dB	0 dB	0 dB
Dir Gain = Maximum Antenna Gain (G_{Ant}) See Note 1	15.7 dBi	15.7 dBi	15.7 dBi	15.7 dBi
EIRP per Polarization	58.6 dBm/MHz or 724 Watts/MHz	57.3 dBm/MHz or 537 Watts/MHz	57.2 dBm/MHz or 525 Watts/MHz	55.3 dBm/MHz or 339 Watts/MHz
Number of Polarizations	2	2	2	2
EIRP Total = R1 ±45°and R2 ±45° See Note 2	58.6 dBm/MHz or 724 Watts/MHz	57.3 dBm/MHz or 537 Watts/MHz	57.2 dBm/MHz or 525 Watts/MHz	55.3 dBm/MHz or 339 Watts/MHz

Note 1: The directional gain is equal to antenna gain since the transmit signals are completely uncorrelated. See ANSI C63.26 sections 6.4.5.2.3b) and 6.4.5.3.1b) for guidance.
Note 2: The EIRP per antenna polarity is required to be below the regulatory limit as described in ANSI C63.26-2015 section 6.4.6.3 b)2) and KDB 662911 D02v01 page 3 example (2) since the two transmitter outputs to each antenna are 90 degree-phase shifted relative to each other (cross-polarized radiators).

EIRP Calculation Summary

The worst case AHLOB Band 71 four port MIMO EIRP levels using antenna assembly model "FF-65C-R1" are less than the FCC and ISED (65.16 dBm/MHz and 62.15 dBm/MHz) EIRP Regulatory Limits for all (5, 10, 15 & 20MHz) channel bandwidths.

POWER SPECTRAL DENSITY AND EIRP CALCULATION - Band 85 LTE

XMit 2022.02.07.0

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
Block - DC	Fairview Microwave	SD3239	ANE	2022-03-02	2023-03-02
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2022-01-17	2023-01-17

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The fundamental emission power spectral density was measured using the channels and modes as called out on the following data sheets.

The method of ANSI C63.26-2015 section 5.2.4.5 was used to make this measurement.

The RF conducted emission testing was performed on one port. The AHLOB antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the “Output Power - All Ports” report section) and antenna port 2 was selected to perform the testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i, and 6.4.

The total PSD for all antenna ports (at the radio output) were determined per ANSI C63.26-2015 paragraph 6.4.3.2.4.
The EIRP calculations are based upon ANSI C63.26-2015 paragraphs 6.4 for a four port MIMO base station.

FCC Requirements:
FCC 27.50(c) (3) Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section;
FCC 27.50(c) (4) Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with Table 4 of this section;

Note: EIRP = ERP + 2.15dB
1000 watts = 60.00 dBm, EIRP = (60 dBm + 2.15dB) /MHz = 62.15dBm/MHz or 1640W/MHz
2000 watts = 63.01 dBm, EIRP = (63 dBm + 2.15dB) /MHz = 65.16dBm/MHz or 3280W/MHz

ISED Requirements RSS-130 Section 4.6/SRSP-518 section 5.1:
SRSP-518 section 5.1 Radiated power and antenna height limits for fixed and base stations
21. For fixed and base stations transmitting in accordance with section 4, the maximum permissible equivalent isotropically radiated power (e.i.r.p.) is 1640 watts and 1640 watts/MHz for a channel bandwidth less than or equal to 1 MHz and greater than 1 MHz, respectively. These e.i.r.p. limits apply for stations with an antenna height above average terrain (HAAT) up to 305 metres.
22. Fixed and base stations located in geographical areas at a distance greater than 26 km from large or medium population centres and transmitting in accordance with section 4, may increase their e.i.r.p. up to a maximum of 3280 watts/MHz (i.e. no more than 3280 watts e.i.r.p. in any 1 MHz band segment), with an antenna HAAT up to 305 metres.

POWER SPECTRAL DENSITY AND EIRP CALCULATION - Band 85 LTE

element

TbtTx 2022.05.02.0 XMit 2022.02.07.0

EUT:	AHLOB	Work Order:	NOKI0043
Serial Number:	YK220900029	Date:	13-Jul-22
Customer:	Nokia Solutions and Networks	Temperature:	21.5 °C
Attendees:	Mitchell Hill, John Rattanavong	Humidity:	53.1% RH
Project:	None	Barometric Pres.:	1018 mbar
Tested by:	Marty Martin	Power: 54 VDC	Job Site: TX07

TEST SPECIFICATIONS	Test Method
FCC 27:2022	ANSI C63.26:2015
RSS-130 Issue 2:2019	ANSI C63.26:2015

COMMENTS

All measurement path losses were accounted for in the reference level offest including any attenuators, filters and DC blocks. The PSD was measured while transmitting one carrier on Port 2. The total PSD for multiport (2x2, 4x4 MIMO) operation was determinded based upon ANSI 63.26 clause 6.4.3.2.4 (10 Log Nout). The total PSD for two port operation is single port PSD +3dB [i.e. 10 Log(2)]. The total PSD for four port operation is single port PSD +6dB [i.e. 10 Log(4)]. The carriers are enabled at maximum power.

DEVIATIONS FROM TEST STANDARD

None

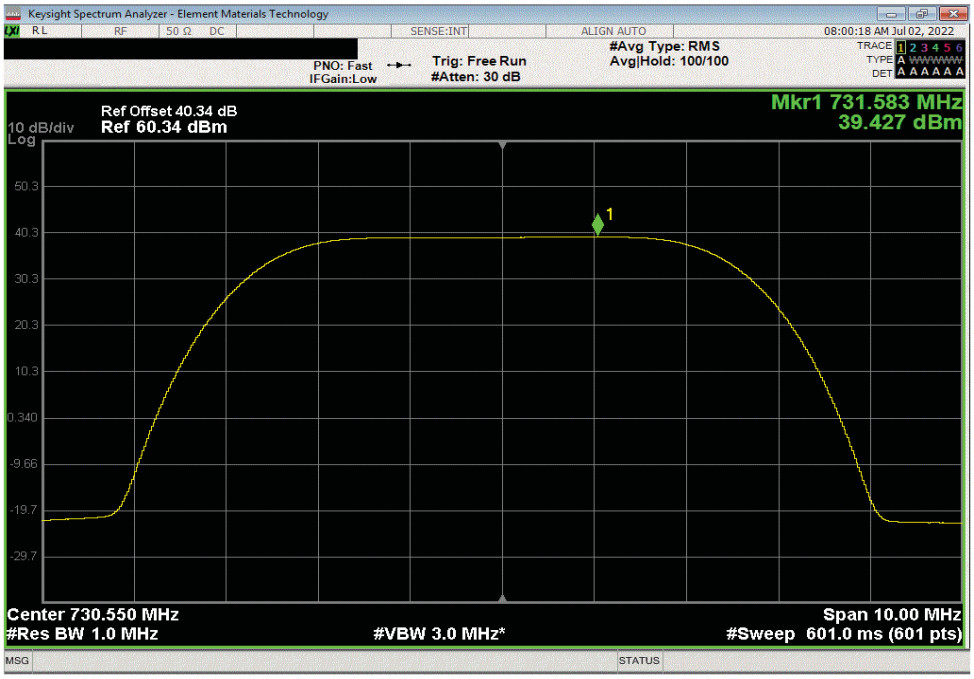
Configuration #	2	Signature Marty Martin

	Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz==PSD	Two Port (2x2 MIMO) dBm/MHz==PSD	Four Port (4x4 MIMO) dBm/MHz==PSD
Port 2, LTE, Band 85, 728 MHz - 746 MHz					
5 MHz Bandwidth					
QPSK Modulation					
Low Ch. 730.5 MHz	39.427	0	39.4	42.4	45.4
Mid Ch. 737 MHz	39.211	0	39.2	42.2	45.2
High Ch. 743.5 MHz	39.355	0	39.4	42.4	45.4
16-QAM Modulation					
Low Ch. 730.5 MHz	39.791	0	39.8	42.8	45.8
Mid Ch. 737 MHz	39.752	0	39.8	42.8	45.8
High Ch. 743.5 MHz	39.795	0	39.8	42.8	45.8
64-QAM Modulation					
Low Ch. 730.5 MHz	39.323	0	39.3	42.3	45.3
Mid Ch. 737 MHz	39.38	0	39.4	42.4	45.4
High Ch. 743.5 MHz	39.345	0	39.3	42.3	45.3
256-QAM Modulation					
Low Ch. 730.5 MHz	39.237	0	39.2	42.2	45.2
Mid Ch. 737 MHz	39.363	0	39.4	42.4	45.4
High Ch. 743.5 MHz	39.149	0	39.1	42.1	45.1
10 MHz Bandwidth					
QPSK Modulation					
Mid Ch. 737 MHz	38.312	0	38.3	41.3	44.3
16-QAM Modulation					
Mid Ch. 737 MHz	39.865	0	39.9	42.9	45.9
64-QAM Modulation					
Mid Ch. 737 MHz	38.211	0	38.2	41.2	44.2
256-QAM Modulation					
Mid Ch. 737 MHz	38.164	0	38.2	41.2	44.2
15 MHz Bandwidth					
QPSK Modulation					
Mid Ch. 737 MHz	37.279	0	37.3	40.3	43.3
16-QAM Modulation					
Mid Ch. 737 MHz	38.299	0	38.3	41.3	44.3
64-QAM Modulation					
Mid Ch. 737 MHz	37.401	0	37.4	40.4	43.4
256-QAM Modulation					
Mid Ch. 737 MHz	37.458	0	37.5	40.5	43.5

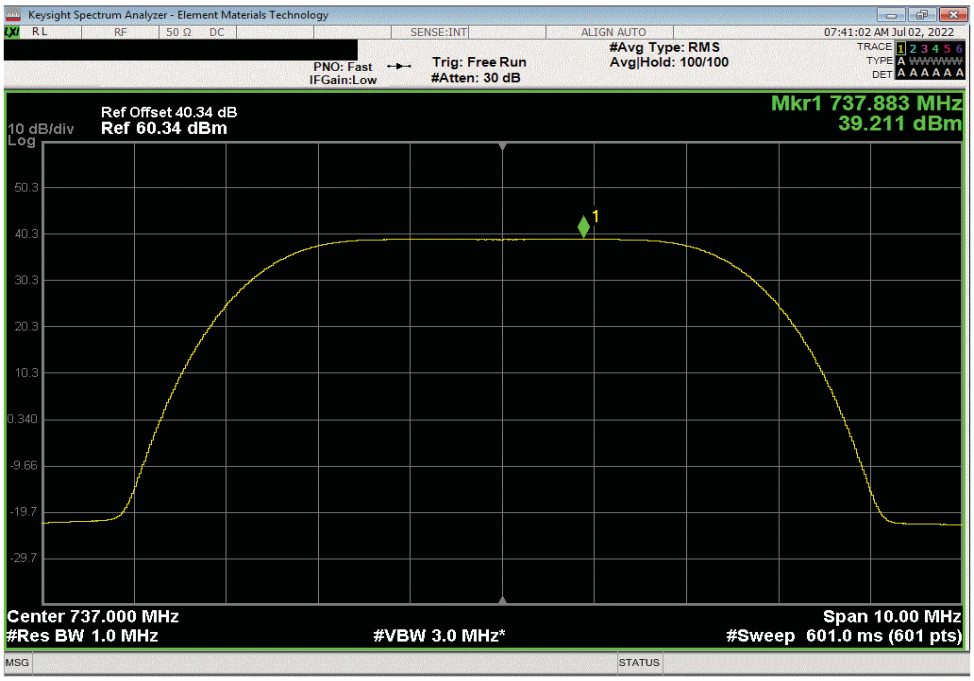
POWER SPECTRAL DENSITY AND EIRP CALCULATION - Band 85 LTE

TbtTx 2022.05.02.0 XMit 2022.02.07.0

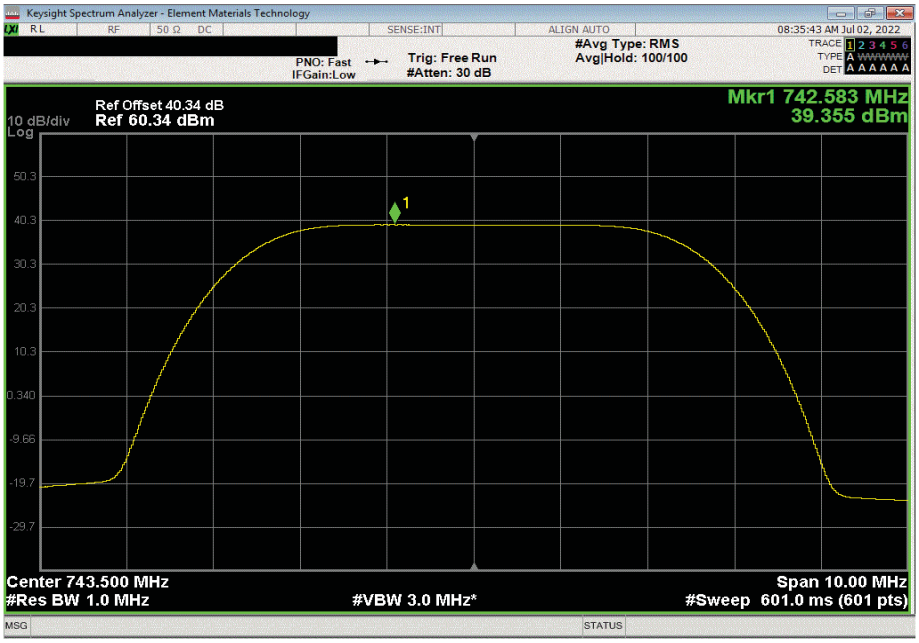
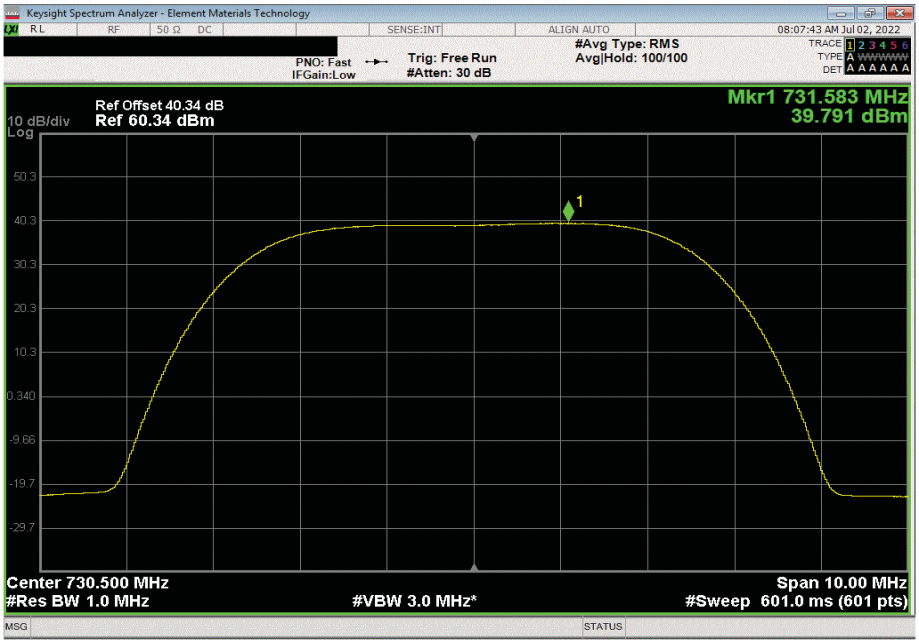
Port 2, LTE, Band 85, 728 MHz - 746 MHz, 5 MHz Bandwidth, QPSK Modulation, Low Ch. 730.5 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz==PSD	Two Port (2x2 MIMO) dBm/MHz==PSD	Four Port (4x4 MIMO) dBm/MHz==PSD
		39.427	0	39.4	42.4	45.4



Port 2, LTE, Band 85, 728 MHz - 746 MHz, 5 MHz Bandwidth, QPSK Modulation, Mid Ch. 737 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz==PSD	Two Port (2x2 MIMO) dBm/MHz==PSD	Four Port (4x4 MIMO) dBm/MHz==PSD
		1	0	39.2	42.2	45.2



Port 2, LTE, Band 85,, 728 MHz - 746 MHz, 5 MHz Bandwidth, QPSK Modulation, High Ch. 743.5 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz==PSD	Two Port (2x2 MIMO) dBm/MHz==PSD	Four Port (4x4 MIMO) dBm/MHz==PSD
		39.355	0	39.4	42.4	45.4



Port 2, LTE, Band 85, 728 MHz - 746 MHz, 5 MHz Bandwidth, 16-QAM Modulation, Low Ch. 730.5 MHz						
		Initial Value dBm/MHz	Duty Cycle Factor (dB)	Single Port dBm/MHz==PSD	Two Port (2x2 MIMO) dBm/MHz==PSD	Four Port (4x4 MIMO) dBm/MHz==PSD
		39.791	0	39.8	42.8	45.8