

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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

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.

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(4)] dB to account for the device operation as a 4 port MIMO transmitter, as per FCC KDB 622911.

Per section 27.53(h)(1) and RSS-139 6.6, 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 BTS may operate as a 4 port MIMO transmitter.

Per 27.53(h)(3) and RSS-139 6.6. emissions seen up to 1 MHz outside of authorized operating frequency range band edges shell be measured with a RBW of 1% of the measured emission bandwidth. Any emission seen to be > 1 MHz further outside the band edges shall be measured with a RBW of 1 MHz. However, a narrower RBW of at least 1% of the emission bandwidth is still allowed provided that the measured power is integrated over the full reference bandwidth of 1 MHz.

RF conducted emissions testing was performed on one port. The testing was performed on the same version of hardware (AHFII) as the original certification test. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification testing) and antenna port 1 was selected to perform testing under this effort as allowed by ANSI C63.26-2015 paragraphs 5.2.5.3, 5.7.2i and 6.4.

Report No. NOKI0054.0 138/197



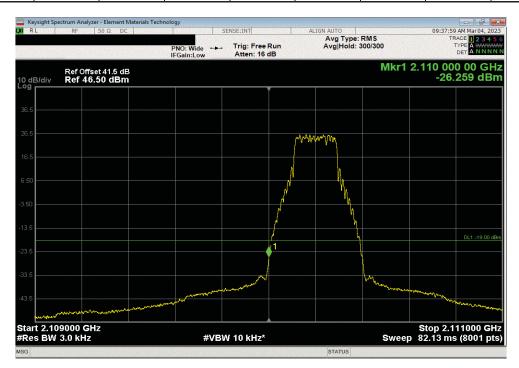
EUT:	Airscale Base Transceive	er Station Remote Radio Head Model	AHFII	Work Order:	NOKI0054	
Serial Number:	BL2235N41PG			Date:	03/03/2023	
Customer:	Nokia of America Corpor	ration		Temperature:	26.3°C	
Attendees:	John Rattanavong, David	d Le		Humidity:	30.5%	
Project:				Barometric Pres.:		
	Brandon Hobbs and Jarr	od Brenden	Power: 54 VDC	Job Site:	TX07	
EST SPECIFICATION	ONS		Test Method			
CC 27:2023			ANSI C63.26:2015			
RSS-139 Issue 4:20	22		ANSI C63.26:2015			
COMMENTS			<u> </u>			
All measurment pat	th losses were accounted	for in the reference level offset inclu	ding any attenuators, filters, and DC blocks.	The NB IoT SA carriers are ena	abled at maximum i	oower (20
vatts/carrier).			,,			•
rattorcarrierj.						
DEVIATIONS FROM	I TEST STANDARD					
DEVIATIONS FROM	I TEST STANDARD					
DEVIATIONS FROM None	I TEST STANDARD					
None	NOKI0054-2		2-11-1			
		Signature	Z J A			
None		Signature	Frequency	Max Value	Limit	
None		Signature	Frequency Range	Max Value (dBm)	Limit (dBm)	Result
None	NOKI0054-2	Signature				Result
Configuration # Band 66 2110 MHz	NOKI0054-2	Signature				Result
Configuration # Band 66 2110 MHz	NOKI0054-2 - 2200 MHz, NB-IoT					Result
None Configuration # Band 66 2110 MHz	NOKI0054-2 - 2200 MHz, NB-IoT Port 1 200 KHz Ban					Result
Configuration # Band 66 2110 MHz	NOKI0054-2 - 2200 MHz, NB-IoT Port 1 200 KHz Ban	ndwidth				Result
Configuration # Band 66 2110 MHz	NOKI0054-2 - 2200 MHz, NB-IoT Port 1 200 KHz Ban	ndwidth NTM Modulation		(dBm)	(dBm)	
Configuration # Band 66 2110 MHz	NOKI0054-2 - 2200 MHz, NB-IoT Port 1 200 KHz Ban	ndwidth NTM Modulation Low Channel 2110.2 MHz		(dBm) -26.3	(dBm) -19	Pass
Configuration # Band 66 2110 MHz	NOKI0054-2 - 2200 MHz, NB-IoT Port 1 200 KHz Ban	ndwidth NTM Modulation Low Channel 2110.2 MHz Low Channel 2110.2 MHz Low Channel 2110.2 MHz		(dBm) -26.3 -27.1	(dBm) -19 -19	Pass Pass
None Configuration # Band 66 2110 MHz	NOKI0054-2 - 2200 MHz, NB-IoT Port 1 200 KHz Ban	ndwidth NTM Modulation Low Channel 2110.2 MHz Low Channel 2110.2 MHz Low Channel 2110.2 MHz High Channel 2199.8 MH;		-26.3 -27.1 -27.9	-19 -19 -19 -19	Pass Pass Pass
Configuration # Band 66 2110 MHz	NOKI0054-2 - 2200 MHz, NB-IoT Port 1 200 KHz Ban	ndwidth NTM Modulation Low Channel 2110.2 MHz Low Channel 2110.2 MHz Low Channel 2110.2 MHz		-26.3 -27.1 -27.9 -25.8	-19 -19 -19 -19	Pass Pass Pass Pass

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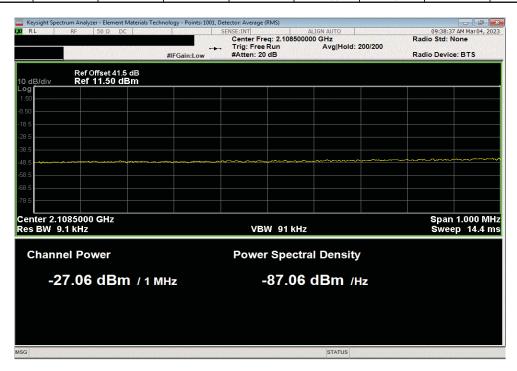


Band 66 2110 MHz - 2200 MHz, NB-IoT, Port 1, 200 KHz Bandwidth, NTM Modulation, Low Channel 2110.2 MHz

Frequency
Max Value
Limit
Range
(dBm)
(dBm)
Result
1 -26.26 -19 Pass



	Band 66 2110) MHz - 2200 MH	z, NB-IoT, Port 1,	200 KHz Bandw	idth, NTM Modula	ation, Low Chann	el 2110.2 MHz
		Frequency			Max Value	Limit	
		Range			(dBm)	(dBm)	Result
I		2			-27.06	-19	Pass



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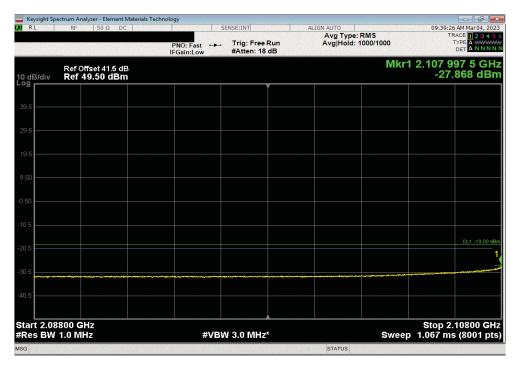


 Band 66 2110 MHz - 2200 MHz, NB-IoT, Port 1, 200 KHz Bandwidth, NTM Modulation, Low Channel 2110.2 MHz

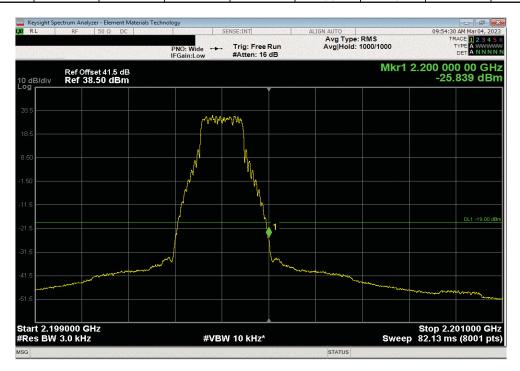
 Frequency
 Max Value
 Limit

 Range
 (dBm)
 (dBm)
 Result

 3
 -27.87
 -19
 Pass



Band 66 2110) MHz - 2200 MHz	z, NB-IoT, Port 1,	200 KHz Bandwi	idth, NTM Modula	ation, High Chann	el 2199.8 MHz
	Frequency			Max Value	Limit	
	Range			(dBm)	(dBm)	Result
	1			-25.84	-19	Pass



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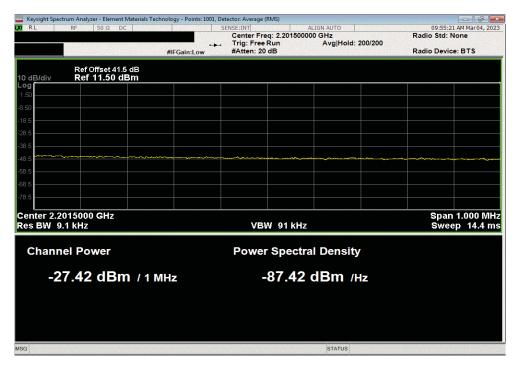


 Band 66 2110 MHz - 2200 MHz, NB-IoT, Port 1, 200 KHz Bandwidth, NTM Modulation, High Channel 2199.8 MHz

 Frequency
 Max Value
 Limit

 Range
 (dBm)
 (dBm)
 Result

 2
 -27.42
 -19
 Pass



	Band 66 2110) MHz - 2200 MH:	z, NB-IoT, Port 1,	200 KHz Bandwi	idth, NTM Modula	ation, High Chann	el 2199.8 MHz
		Frequency			Max Value	Limit	
		Range			(dBm)	(dBm)	Result
i		3			-29.03	-19	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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3379	AMM	2022-09-09	2023-09-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

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

The antenna port spurious emissions were measured at the RF output terminal of the EUT through 4 different attenuation configurations which continues through to the RF input of the spectrum analyzer. Analyzer plots utilizing a resolution bandwidth called out by the client's test plan were made for each modulation type from 9 KHz to 22 GHz. The peak conducted power of spurious emissions, up to the 10th harmonic of the transmit frequency, were investigated to ensure they were less than the limits also called out by the client's test plan shown below.

The measurement methods are detailed in KDB971168 D01v03 section 6 and ANSI C63.26-2015.

Per FCC 2.1057(a)(1) and RSS Gen 6.13, the upper level of measurement is the 10th harmonic of the highest fundamental frequency.

These measurements are for frequency band after the first 1.0 MHz bands immediately outside and adjacent to the frequency block.

Per section FCC 24.238(a), FCC 27.53(h)(1), RSS-133 6.5 (ii) and RSS-139 6.6 the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm for a 1 MHz measurement bandwidth. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter. RF conducted emissions testing was performed on one port. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification report) and port 1 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 limit for the 9kHz to 150kHz frequency range was adjusted to -49dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 1MHz [i.e.: -49dBm = -19dBm -10log(1MHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to -39dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 1MHz [i.e.: -39dBm = -19dBm -10log(1MHz/10kHz)]. The required limit of -19dBm with a RBW of > 1MHz was used for all other frequency ranges.

The spurious emission testing was performed using only one modulation type because the Occupied Bandwidth variation between modulation types is small, the average output power variation between modulation types is small, and there is significant/good passing margin. The highest rate modulation type (256QAM) was used. (See ANSI C63.26. clause 5.7.2e).

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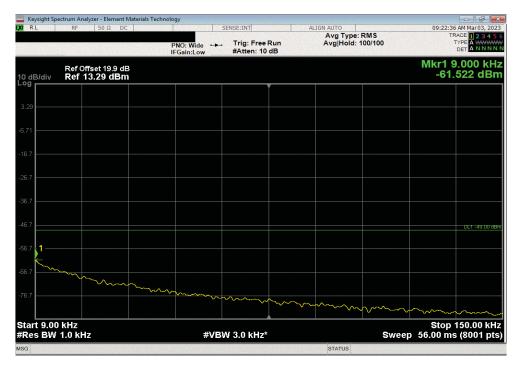


	Airscale Base Transceiver Station Remote Radio Head Mod	lel AHFII	Work Order:		
Serial Number:				03/03/2023	
	Nokia of America Corporation		Temperature:		
	John Rattanavong, David Le		Humidity:		
Project:			Barometric Pres.:		
	Brandon Hobbs and Jarrod Brenden	Power: 54 VDC	Job Site:	TX07	
EST SPECIFICATI	IONS	Test Method			
CC 24E:2022		ANSI C63.26:2015			
CC 27:2023		ANSI C63.26:2015			
SS-133 Issue 6:20	013+A1:2018	ANSI C63.26:2015			
SS-139 Issue 4:20	022	ANSI C63.26:2015	·		
OMMENTS		•			
atts/carrier). The	Band n66 carrier was enabled on the middle channel (2155.		dwidth and modulation type as	the Band n25 carrie	er. The port
ower was set at th	Band n66 carrier was enabled on the middle channel (2155. he maximum level of 120 Watts [Band n25 carrier 80W) and M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature		uwiuth and modulation type as	the Band n25 carrie	er. The port
vatts/carrier). The lower was set at the EVIATIONS FROM lone	he maximum level of 120 Watts [Band n25 carrier 80W) and WITEST STANDARD NOK10054-2 NOK10054-1 NOK10054-3 NOK10054-4	Band n66 carrier (40W)]. Frequency			
atts/carrier). The ower was set at the EVIATIONS FROM one onfiguration #	he maximum level of 120 Watts [Band n25 carrier 80W) and M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature	Band n66 carrier (40W)].	Value (dBm)	Limit (dBm)	Result
atts/carrier). The ower was set at the EVIATIONS FROM one onfiguration #	he maximum level of 120 Watts [Band n25 carrier 80W) and with TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature z - 1995 MHz, 5G NR	Band n66 carrier (40W)]. Frequency			
atts/carrier). The ower was set at the EVIATIONS FROM one onfiguration #	he maximum level of 120 Watts [Band n25 carrier 80W) and WITEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature 2 - 1995 MHz, 5G NR Port 1	Band n66 carrier (40W)]. Frequency			
atts/carrier). The bower was set at the EVIATIONS FROM one onfiguration #	he maximum level of 120 Watts [Band n25 carrier 80W) and M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature z - 1995 MHz, 5G NR Port 1 25 MHz Bandwidth	Band n66 carrier (40W)]. Frequency			
atts/carrier). The lower was set at the EVIATIONS FROM one on figuration #	he maximum level of 120 Watts [Band n25 carrier 80W) and M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-4 Signature z - 1995 MHz, 5G NR Port 1 25 MHz Bandwidth 256-QAM Modulation	Frequency Range	Value (dBm)	Limit (dBm)	Result
atts/carrier). The lower was set at the EVIATIONS FROM one on figuration #	NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-1 NOKI0054-3 NOKI0054-4 Z - 1995 MHz, 5G NR Port 1 25 MHz Bandwidth 256-QAM Modulation Mid Channel 1962.5 MHz	Frequency Range 9 kHz - 150 kHz	Value (dBm)	Limit (dBm)	Result
atts/carrier). The lower was set at the EVIATIONS FROM one on figuration #	he maximum level of 120 Watts [Band n25 carrier 80W) and witest standard NOK10054-2 NOK10054-1 NOK10054-3 NOK10054-4 Z - 1995 MHz, 5G NR Port 1 25 MHz Bandwidth 256-QAM Modulation Mid Channel 1962.5 MI Mid Channel 1962.5 MI	Frequency Range 4z 9 kHz - 150 kHz 4z 150 kHz - 20 MHz	Value (dBm) -61.5 -53.4	Limit (dBm) -49 -39	Result Pass Pass
atts/carrier). The ower was set at the EVIATIONS FROM one onfiguration #	he maximum level of 120 Watts [Band n25 carrier 80W) and M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Z - 1995 MHz, 5G NR Port 1 25 MHz Bandwidth 256-QAM Modulation Mid Channel 1962.5 M	Frequency Range 1z 9 kHz - 150 kHz 1z 150 kHz - 20 MHz 1z 20 MHz - 3.5 GHz	Value (dBm) -61.5 -53.4 -25.1	Limit (dBm) -49 -39 -19	Result Pass Pass Pass Pass
vatts/carrier). The lower was set at the DEVIATIONS FROM Jone Configuration #	he maximum level of 120 Watts [Band n25 carrier 80W) and witest standard NOK10054-2 NOK10054-1 NOK10054-3 NOK10054-4 Z - 1995 MHz, 5G NR Port 1 25 MHz Bandwidth 256-QAM Modulation Mid Channel 1962.5 MI Mid Channel 1962.5 MI	Frequency Range 12 9 kHz - 150 kHz 150 kHz - 20 MHz 12 20 MHz - 3.5 GHz 12 1.9 GHz - 2.2 GHz	Value (dBm) -61.5 -53.4	Limit (dBm) -49 -39	Result Pass Pass

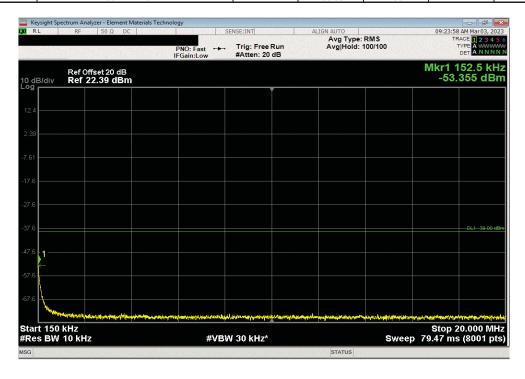
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Band n25 1930 MHz - 1995 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 1962.5 MHz
Frequency
Range Value (dBm) Limit (dBm) Result
9 kHz - 150 kHz -61.52 -49 Pass



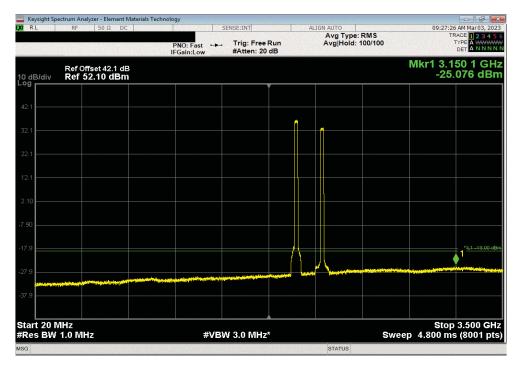
	Band n25 1930 MHz - 1995 MHz, 5G NR, Port 1,	25 MHz Bandwid	th, 256-QAM Mod	lulation, Mid Chai	nnel 1962.5 MHz
	Frequency				
	Range		Value (dBm)	Limit (dBm)	Result
1	150 kHz - 20 MHz		-53.36	-39	Pass



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Band n25 1930 MHz - 1995 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 1962.5 MHz
Frequency
Range Value (dBm) Limit (dBm) Result
20 MHz - 3.5 GHz -25.08 -19 Pass



Band n25 1930 MHz - 1995 MHz, 5G NR , Port 1, 25	5 MHz Bandwidth, 256-QAM Mod	lulation, Mid Chai	nnel 1962.5 MHz
Frequency			
Range	Value (dBm)	Limit (dBm)	Result
1.9 GHz - 2.2 GHz	-28.85	-19	Pass



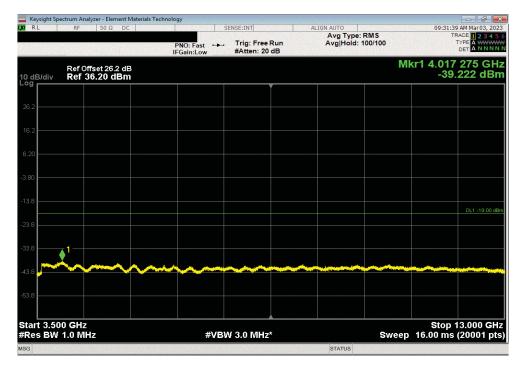
Report No. NOKI0054.0 146/197



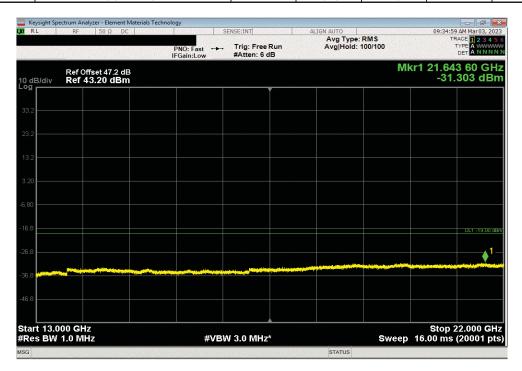
Band n25 1930 MHz - 1995 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 1962.5 MHz

Frequency
Range Value (dBm) Limit (dBm) Result

3.5 GHz - 13 GHz - 39.22 -19 Pass



Band n25 1930 MHz - 1995 MHz, 5G NR, Port 1,	25 MHz Bandwid	th, 256-QAM Mod	lulation, Mid Chai	nnel 1962.5 MHz
Frequency				
Range		Value (dBm)	Limit (dBm)	Result
13 GHz - 22 GHz		-31.3	-19	Pass



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Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

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

The antenna port spurious emissions were measured at the RF output terminal of the EUT through 4 different attenuation configurations which continues through to the RF input of the spectrum analyzer. Analyzer plots utilizing a resolution bandwidth called out by the client's test plan were made for each modulation type from 9 kHz to 22 GHz. The peak conducted power of spurious emissions, up to the 10th harmonic of the transmit frequency, were investigated to ensure they were less than the limits also called out by the client's test plan shown below.

The measurement methods are detailed in KDB971168 D01v03 section 6 and ANSI C63.26-2015.

Per FCC 2.1057(a)(1) and RSS Gen 6.13, the upper level of measurement is the 10th harmonic of the highest fundamental frequency.

These measurements are for frequency band after the first 1.0 MHz bands immediately outside and adjacent to the frequency block.

Per section FCC 24.238(a), FCC 27.53(h)(1), RSS-133 6.5 (ii) and RSS-139 6.6 the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm for a 1 MHz measurement bandwidth. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter. RF conducted emissions testing was performed on one port. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification report) and port 1 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 limit for the 9kHz to 150kHz frequency range was adjusted to -49dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 1MHz [i.e.: -49dBm = -19dBm -10log(1MHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to -39dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 1MHz [i.e.: -39dBm = -19dBm -10log(1MHz/10kHz)]. The required limit of -19dBm with a RBW of > 1MHz was used for all other frequency ranges.

The spurious emission testing was performed using only one modulation type because the Occupied Bandwidth variation between modulation types is small, the average output power variation between modulation types is small, and there is significant/good passing margin. The highest rate modulation type (256QAM) was used. (See ANSI C63.26. clause 5.7.2e).

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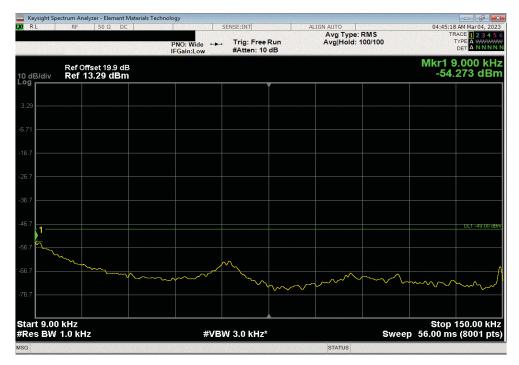
		er Station Remote Radio Head Model AHFII		Work Order:		
	: BL2235N41PG				03/03/2023	
Customer:	: Nokia of America Corpo	ration		Temperature:	23.9°C	
Attendees:	: John Rattanavong, Davi	d Le		Humidity:		
Project:				Barometric Pres.:	983.2 mbar	
	: Brandon Hobbs and Jar	rod Brenden	Power: 54 VDC	Job Site:	TX07	
TEST SPECIFICAT	TIONS		Test Method			
FCC 24E:2022			ANSI C63.26:2015			
CC 27:2023			ANSI C63.26:2015			
RSS-133 Issue 6:2	2013+A1:2018		ANSI C63.26:2015			
RSS-139 Issue 4:20	2022		ANSI C63.26:2015			
COMMENTS						
ai inicusui ment pe		d for in the reference level offset including any attenua	nors, micro, and Do blocks. The ETE 1.4 mir	z curriers are chabica at zo n	attorounner on the	Dana 20 illiaale
channel (1962.5 M	IHz) and Band 66 middle c	hannel (2155 MHz), simultaneously.				
`	·	hannel (2155 MHz), simultaneously.				
`	IHz) and Band 66 middle c	hannel (2155 MHz), simultaneously.				
DEVIATIONS FROM	·	hannel (2155 MHz), simultaneously. Signature	J			
DEVIATIONS FROM	M TEST STANDARD NOKI0054-2 NOKI0054-1		Frequency	Value	Limit	
DEVIATIONS FROM	M TEST STANDARD NOKI0054-2 NOKI0054-1		Frequency Range	Value (dBm)	Limit (dBm)	Result
DEVIATIONS FROM None Configuration #	M TEST STANDARD NOKI0054-2 NOKI0054-1	Signature				Result
DEVIATIONS FROM	M TEST STANDARD NOK10054-2 NOK10054-1 NOK10054-3 NOK10054-4	Signature				Result
DEVIATIONS FROM None Configuration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 66 LTE Carriers Transmittir	Signature				Result
DEVIATIONS FROM	NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 66 LTE Carriers Transmittir Port 1	Signature				Result
DEVIATIONS FROM	NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 66 LTE Carriers Transmittir Port 1	Signature 99 Indwidth 256-QAM Modulation Mid Channels 1962.5 MHz and 2155 MHz				Result
DEVIATIONS FROM	NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 66 LTE Carriers Transmittir Port 1	Signature Signature Signature Mid Channels 1962.5 MHz and 2155 MHz Mid Channels 1962.5 MHz and 2155 MHz	Range 9 kHz - 150 kHz 150 kHz - 20 MHz	(dBm) -54.3 -52.3	(dBm) -49 -39	Pass Pass
DEVIATIONS FROM	NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 66 LTE Carriers Transmittir Port 1	Signature 99 Indwidth 256-QAM Modulation Mid Channels 1962.5 MHz and 2155 MHz	Range - 9 kHz - 150 kHz	(dBm)	(dBm) -49	Pass
DEVIATIONS FROM None Configuration #	NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 66 LTE Carriers Transmittir Port 1	Signature Signature Signature Mid Channels 1962.5 MHz and 2155 MHz Mid Channels 1962.5 MHz and 2155 MHz	Range 9 kHz - 150 kHz 150 kHz - 20 MHz	(dBm) -54.3 -52.3	(dBm) -49 -39	Pass Pass
DEVIATIONS FROM None Configuration #	NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 66 LTE Carriers Transmittir Port 1	Signature Signature Signature Signature Mid Channels 1962.5 MHz and 2155 MHz Mid Channels 1962.5 MHz and 2155 MHz Mid Channels 1962.5 MHz and 2155 MHz	Range 9 kHz - 150 kHz 150 kHz - 20 MHz 20 MHz - 3.5 GHz	-54.3 -52.3 -25.3	-49 -39 -19	Pass Pass Pass

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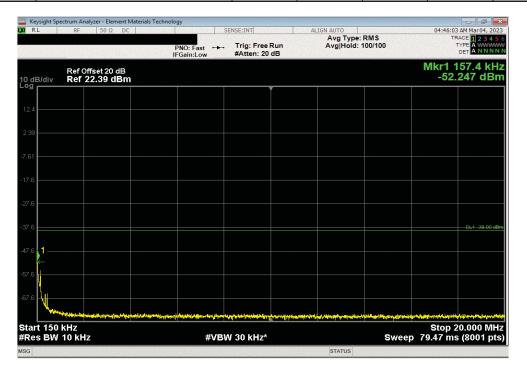


Both Band 25 and 66 LTE Carriers Transmitting, Port 1, 1.4 MHz Bandwidth, 256-QAM Modulation, Mid Channels 1962.5 MHz and 2155 MHz

Frequency
Value
Limit
Range
(dBm)
(dBm)
Result
9 kHz - 150 kHz
-54.27
-49
Pass



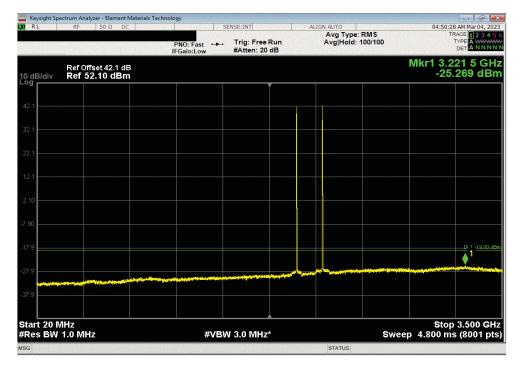
Both Band 25 and 66 LTE Carriers Transmitting, Port 1, 1.4 MHz	z Bandwidth, 256-QAM Modulati	on, Mid Channels	1962.5 MHz and	2155 MHz
Frequency	Value	Limit		
Range	(dBm)	(dBm)	Result	
150 kHz - 20 MHz	-52.25	-39	Pass	



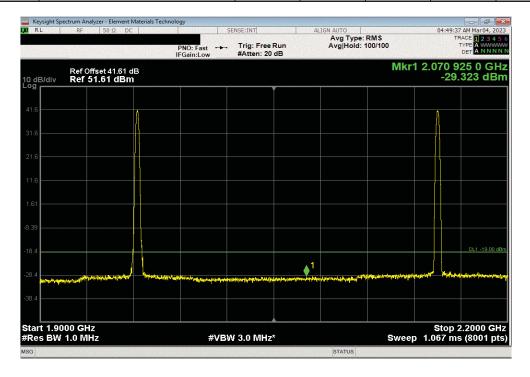
Report No. NOKI0054.0 150/197



Both Band 25 and 66 LTE Carriers Transmitting, Port 1, 1.4 MI	Hz Bandwidth, 256-QAM Modulati	on, Mid Channels	1962.5 MHz and	I 2155 MHz
Frequency	Value	Limit		
Range	(dBm)	(dBm)	Result	
20 MHz - 3.5 GHz	-25.269	-19	Pass	



Both Band 25 and 66 LTE Carriers Transmitting, Port 1, 1.4 Mi	Hz Bandwidth, 256-Q	AM Modulation	on, Mid Channels	1962.5 MHz and	2155 MHz
Frequency		Value	Limit		
Range		(dBm)	(dBm)	Result	
1.9 GHz - 2.2 GHz		-29.32	-19	Pass	

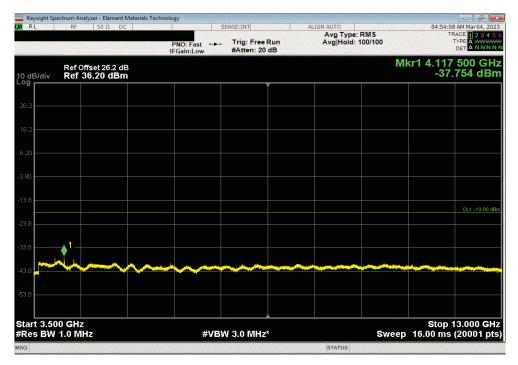


Report No. NOKI0054.0 151/197

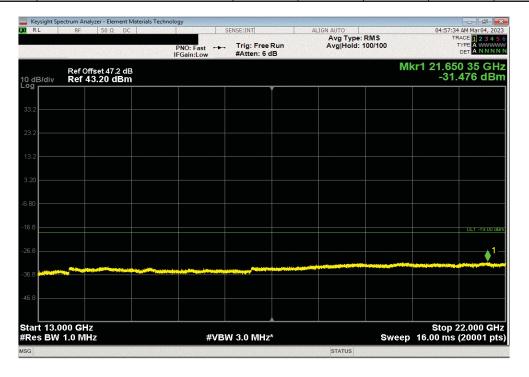


Both Band 25 and 66 LTE Carriers Transmitting, Port 1, 1.4 MHz Bandwidth, 256-QAM Modulation, Mid Channels 1962.5 MHz and 2155 MHz

Frequency
Value
Limit
Range
(dBm)
(dBm)
Result
3.5 GHz - 13 GHz
-37.75
-19
Pass



Both Band 25 and 66 LTE Carriers Transmitting, Port 1, 1.4 Mi	Hz Bandwidth, 256-QAM Modulati	on, Mid Channels	1962.5 MHz and	2155 MHz
Frequency	Value	Limit		
Range	(dBm)	(dBm)	Result	
13 GHz - 22 GHz	-31.48	-19	Pass	



Report No. NOKI0054.0 152/197



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
	Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
_	Block - DC	Fairview Microwave	SD3379	AMM	2022-09-09	2023-09-09
_	Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
	Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

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

The antenna port spurious emissions were measured at the RF output terminal of the EUT through 4 different attenuation configurations which continues through to the RF input of the spectrum analyzer. Analyzer plots utilizing a resolution bandwidth called out by the client's test plan were made for each modulation type from 9 KHz to 22 GHz. The peak conducted power of spurious emissions, up to the 10th harmonic of the transmit frequency, were investigated to ensure they were less than the limits also called out by the client's test plan shown below.

The measurement methods are detailed in KDB971168 D01v03 section 6 and ANSI C63.26-2015.

Per FCC 2.1057(a)(1) and RSS Gen 6.13, the upper level of measurement is the 10th harmonic of the highest fundamental frequency.

These measurements are for frequency band after the first 1.0 MHz bands immediately outside and adjacent to the frequency block.

Per section FCC 24.238(a), FCC 27.53(h)(1), RSS-133 6.5 (ii) and RSS-139 6.6 the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm for a 1 MHz measurement bandwidth. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter. RF conducted emissions testing was performed on one port. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification report) and port 1 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 limit for the 9kHz to 150kHz frequency range was adjusted to -49dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 1MHz [i.e.: -49dBm = -19dBm -10log(1MHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to -39dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 1MHz [i.e.: -39dBm = -19dBm -10log(1MHz/10kHz)]. The required limit of -19dBm with a RBW of > 1MHz was used for all other frequency ranges.

Report No. NOKI0054.0



EUT:	: Airscale Base Transceiver	Station Remote Radio Head Model	AHFII	Work Order:	NOKI0054	
Serial Number:	: BL2235N41PG			Date:	03/03/2023	
Customer	: Nokia of America Corpora	ition		Temperature:	26.9°C	
Attendees	: John Rattanavong, David	Le		Humidity:		
Project:				Barometric Pres.:	983.9 mbar	
	: Brandon Hobbs and Jarro	d Brenden	Power: 54 VDC	Job Site:	TX07	
ST SPECIFICAT	TIONS		Test Method			
C 24E:2022			ANSI C63.26:2015			
C 27:2023			ANSI C63.26:2015			
SS-133 Issue 6:20	013+A1:2018	·	ANSI C63.26:2015	·		
SS-139 Issue 4:20	022	·	ANSI C63.26:2015	·		
OMMENTS						
measurment pa	ath losses were accounted	for in the reference level offset inclu-	ding any attenuators, filters, and DC blocks. The N	NB IoT SA carriers are enabled maximum (20	watts/carrier) on the	he Band 25
EVIATIONS FROI	M TEST STANDARD					
eVIATIONS FROI	M TEST STANDARD NOKI0054-2 NOKI0054-1		2-1			
EVIATIONS FROI	M TEST STANDARD	Signature	J. J.M			
EVIATIONS FROI	M TEST STANDARD NOKI0054-2 NOKI0054-1		Frequency	Value	Limit	
EVIATIONS FROI one configuration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4	Signature	Frequency Range	Value (dBm)	Limit (dBm)	Result
EVIATIONS FROI one configuration #	M TEST STANDARD NOK10054-2 NOK10054-1 NOK10054-3 NOK10054-4 Band 66 Carriers Transmitting	Signature				Result
EVIATIONS FROI one configuration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Band 66 Carriers Transmitting Port 1	Signature 3, NB-IoT				Result
EVIATIONS FROI one configuration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Band 66 Carriers Transmitting Port 1 200 KHz Band	Signature 3, NB-IoT width				Result
EVIATIONS FROI one onfiguration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Band 66 Carriers Transmitting Port 1 200 KHz Band	Signature 3, NB-IoT twidth utM Modulation	Range	(dBm)	(dBm)	
EVIATIONS FROI one onfiguration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Band 66 Carriers Transmitting Port 1 200 KHz Band	Signature 3, NB-IoT Iwidth IVIM Modulation Mid Channels 1962.5 MHz	Range 9 kHz - 150 kHz	(dBm) -61.5	(dBm) -49	Pass
EVIATIONS FROI one configuration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Band 66 Carriers Transmitting Port 1 200 KHz Band	Signature g, NB-IoT twidth MIM Modulation Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz	Range 9 kHz - 150 kHz 150 kHz - 20 MHz	(dBm) -61.5 -53.2	(dBm) -49 -39	Pass Pass
EVIATIONS FROI one configuration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Band 66 Carriers Transmitting Port 1 200 KHz Band	Signature 3, NB-IoT twidth ITM Modulation Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz	Range 9 kHz - 150 kHz 150 kHz - 20 MHz 20 MHz - 3.5 GHz	-61.5 -53.2 -25.5	-49 -39 -19	Pass Pass Pass
EVIATIONS FROI one configuration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Band 66 Carriers Transmitting Port 1 200 KHz Band	Signature 3, NB-IoT Iwidth ITM Modulation Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz	Range 9 kHz - 150 kHz 150 kHz - 20 MHz 20 MHz - 3.5 GHz 1.9 GHz - 2.2 GHz	-61.5 -53.2 -25.5 -29.5	-49 -39 -19	Pass Pass Pass Pass
EVIATIONS FROI one configuration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Band 66 Carriers Transmitting Port 1 200 KHz Band	Signature 3, NB-IoT Iwidth ITM Modulation Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz	9 kHz - 150 kHz 150 kHz - 20 MHz 20 MHz - 3.5 GHz 1.9 GHz - 2.2 GHz 3.5 GHz - 13 GHz	-61.5 -53.2 -25.5 -29.5 -39.3	-49 -39 -19 -19 -19	Pass Pass Pass Pass Pass
EVIATIONS FROI one configuration #	M TEST STANDARD NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Band 66 Carriers Transmitting Port 1 200 KHz Band	Signature 3, NB-IoT Iwidth ITM Modulation Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz Mid Channels 1962.5 MHz	9 kHz - 150 kHz 150 kHz - 20 MHz 20 MHz - 3.5 GHz 1.9 GHz - 2.2 GHz 3.5 GHz - 13 GHz	-61.5 -53.2 -25.5 -29.5	-49 -39 -19	Pass Pass Pass Pass

Report No. NOKI0054.0 154/197



Both Band 25 and Band 66 Carriers Transmitting, NB-IoT, Port 1, 200 KHz Bandwidth, NTM Modulation, Mid Channels 1962.5 MHz and 2155 MHz

Frequency

Range

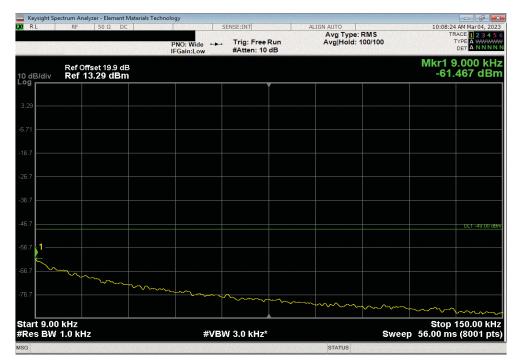
(dBm)

9 kHz - 150 kHz

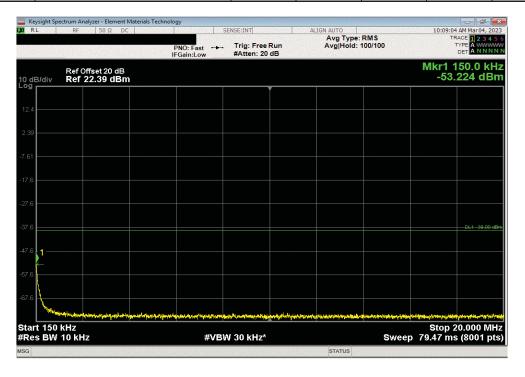
-61.47

-49

Pass

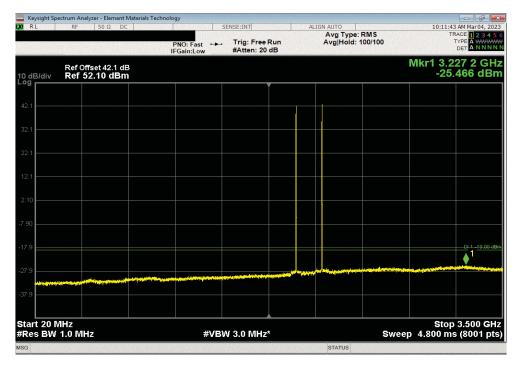


	Both Band 25 and Band 66 Carriers Transmitting, NB-IoT, Po	rt 1, 200 KHz Bandv	vidth, NTM Modul	lation, Mid Chann	els 1962.5 MHz a	and 2155 MHz
	Frequency		Value	Limit		
1	Range		(dBm)	(dBm)	Result	_
	150 kHz - 20 MHz		-53.22	-39	Pass	

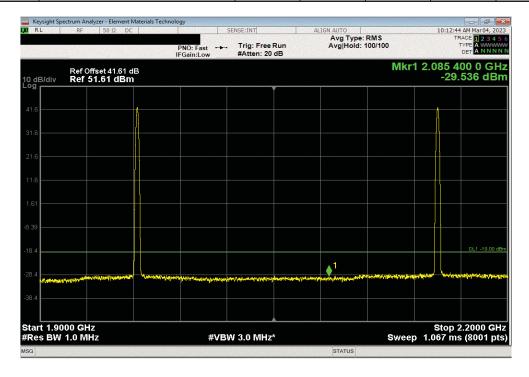


Report No. NOKI0054.0 155/197





Both Band 25 and Band 66 Carriers Transmitting, NB-IoT, Port 1	, 200 KHz Bandwi	dth, NTM Modul	ation, Mid Chann	els 1962.5 MHz a	and 2155 MHz
Frequency		Value	Limit		
Range		(dBm)	(dBm)	Result	
1.9 GHz - 2.2 GHz		-29.54	-19	Pass	

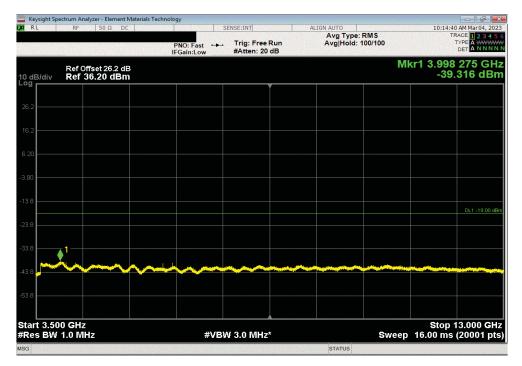


Report No. NOKI0054.0 156/197

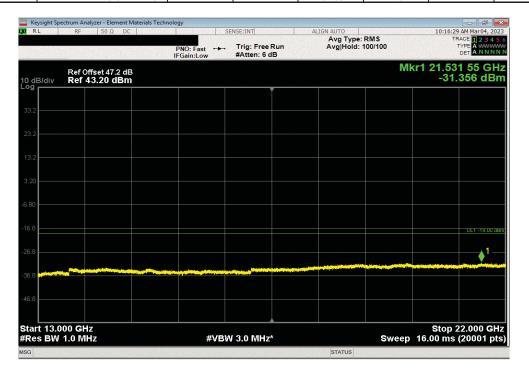


Both Band 25 and Band 66 Carriers Transmitting, NB-IoT, Port 1, 200 KHz Bandwidth, NTM Modulation, Mid Channels 1962.5 MHz and 2155 MHz

Frequency
Value
Limit
Range
(dBm)
(dBm)
Result
3.5 GHz - 13 GHz
-39.32
-19
Pass



Both Band 25 and Band 66 Carriers Transmitting, NB-loT, Port 1, 200	KHz Bandwidth, NTM Modul	ation, Mid Chann	els 1962.5 MHz a	ind 2155 MHz
Frequency	Value	Limit		
Range	(dBm)	(dBm)	Result	
13 GHz - 22 GHz	-31.36	-19	Pass	ļ



Report No. NOKI0054.0 157/197



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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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3379	AMM	2022-09-09	2023-09-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

TEST DESCRIPTION

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

The antenna port spurious emissions were measured at the RF output terminal of the EUT through 4 different attenuation configurations which continues through to the RF input of the spectrum analyzer. Analyzer plots utilizing a resolution bandwidth called out by the client's test plan were made for each modulation type from 9 KHz to 22 GHz. The peak conducted power of spurious emissions, up to the 10th harmonic of the transmit frequency, were investigated to ensure they were less than the limits also called out by the client's test plan shown below.

The measurement methods are detailed in KDB971168 D01v03 section 6 and ANSI C63.26-2015.

Per FCC 2.1057(a)(1), FCC 24.238a, and RSS Gen 6.13, the upper level of measurement is the 10th harmonic of the highest fundamental frequency.

These measurements are for frequency band after the first 1.0 MHz bands immediately outside and adjacent to the frequency block.

Per section FCC 27.53(h)(1), FCC 24.238a, RSS-133 6.5(ii) and RSS-139 6.6 the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm for a 1 MHz measurement bandwidth. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the BTS may operate as a 4 port MIMO transmitter. RF conducted emissions testing was performed on one port. The AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification report) and port 1 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 limit for the 9kHz to 150kHz frequency range was adjusted to -49dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 1MHz [i.e.: -49dBm = -19dBm -10log(1MHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to -39dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 1MHz [i.e.: -39dBm = -19dBm -10log(1MHz/10kHz)]. The required limit of -19dBm with a RBW of > 1MHz was used for all other frequency ranges.

The spurious emission testing was performed using only one modulation type because the Occupied Bandwidth variation between modulation types is small, the average output power variation between modulation types is small, and there is significant/good passing margin. The highest rate modulation type (256QAM) was used. (See ANSI C63.26. clause 5.7.2e).

Report No. NOKI0054.0

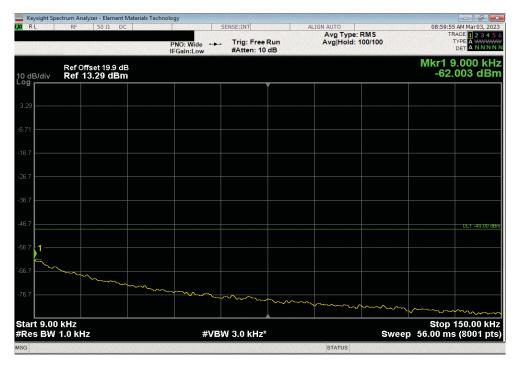


Serial Number: BL2235N41PG Customer: Nokia of America Corporation Nokia of America Corporation Attendees: John Rattanavong, David Le Project: None Project:
Customer: Nokia of America Corporation Attendees: John Rattanavong, David Le Project: None Barometric Pres:: 984 mbar Tested by: Brandon Hobbs and Jarrod Brenden Power: 54 VDC Job Site: TX07 TEST SPECIFICATIONS Test Method FCC 24E:2022 ANSI C63.26:2015 FCC 27:2023 ANSI C63.26:2015 RSS-133 Issue 6:2013+A1:2018 ANSI C63.26:2015 RSS-139 Issue 4:2022 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The Band n66 carrier was enabled at maximum power (80 watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts (Band n66 carrier 80W) and Band n25 carrier (40W)). DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-1 NOKI0054-1 NOKI0054-3 NOKI0054-1 NOKI0054-3 NOKI0054-4 NOKI0054-3 NOKI0054-1 NOKI0054-1 NOKI0054-1 NOKI0054-3 NOKI0054-4 NOKI0054-3 NOKI0054-4 NOKI0054-3 NOKI0054-4 NOKI0054-3 NOKI0054-1 NOKI0054-1 NOKI0054-1 NOKI0054-3 NOKI0054-4
Attendees: John Rattanavong, David Le Project: None Barometric Pres.: 984 mbar Tested by: Brandon Hobbs and Jarrod Brenden Test Method FCC 24E:2022 ANSI C63.26:2015 FCC 27:2023 ANSI C63.26:2015 RSS-139 Issue 6:2013+A1:2018 ANSI C63.26:2015 RSS-139 Issue 4:2022 ANSI C63.26:2015 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The Band n66 carrier was enabled at maximum power (80 watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts [Band n66 carrier 80W) and Band n25 carrier (40W)]. DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-1 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature
Project: None Tested by: Brandon Hobbs and Jarrod Brenden Power: 54 VDC Job Site: TX07 TEST SPECIFICATIONS Test Method FCC 24E:2022 ANSI C63.26:2015 FCC 27:2023 ANSI C63.26:2015 FSS-133 Issue 6:2013+A1:2018 RSS-133 Issue 4:2022 ANSI C63.26:2015 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The Band n66 carrier was enabled at maximum power (80 watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts [Band n66 carrier 80W) and Band n25 carrier (40W)]. DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-1 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature Barometric Pres.: 984 mbar TX07 TANOT ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 COMMENTS ANSI C63.26:2015 ANSI C63.26:2015 COMMENTS ANSI C63.26:2015 ANSI C63.26:2015 COMMENTS ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 COMMENTS ANSI C63.26:2015
Tested by: Brandon Hobbs and Jarrod Brenden Power: 54 VDC Job Site: TX07 TEST SPECIFICATIONS Test Method FCC 24E:2022 ANSI C63.26:2015 FCC 27:2023 ANSI C63.26:2015 RSS-133 Issue 6:2013+A1:2018 ANSI C63.26:2015 RSS-139 Issue 4:2022 ANSI C63.26:2015 RSS-139 Issue 4:2022 ANSI C63.26:2015 RSS-179 Issue 4:2022 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:
TEST SPECIFICATIONS Test Method ANSI C63.26:2015 FCC 27:2023 ANSI C63.26:2015 RSS-133 Issue 6:2013+A1:2018 ANSI C63.26:2015 RSS-139 Issue 4:2022 ANSI C63.26:2015 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The Band n66 carrier was enabled at maximum power (80 watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts [Band n66 carrier 80W) and Band n25 carrier (40W)]. DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature
ANSI C63.26:2015 FCC 27:2023 ANSI C63.26:2015 RSS-133 Issue 6:2013+A1:2018 ANSI C63.26:2015 RSS-133 Issue 4:2022 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The Band n66 carrier was enabled at maximum power (80 watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts [Band n66 carrier 80W) and Band n25 carrier (40W)]. DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI C63.26:2015 ANSI
ANSI C63.26:2015 RSS-133 Issue 6:2013+A1:2018 ANSI C63.26:2015 RSS-139 Issue 4:2022 ANSI C63.26:2015 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The Band n66 carrier was enabled at maximum power (80 watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts [Band n66 carrier 80W) and Band n25 carrier (40W)]. DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature Signature
RSS-133 Issue 6:2013+A1:2018 RSS-139 Issue 4:2022 ANSI C63.26:2015 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The Band n66 carrier was enabled at maximum power (80 watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts [Band n66 carrier 80W) and Band n25 carrier (40W)]. DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature
ANSI C63.26:2015 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The Band n66 carrier was enabled at maximum power (80 watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts [Band n66 carrier 80W) and Band n25 carrier (40W)]. DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature
All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The Band n66 carrier was enabled at maximum power (80 watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts [Band n66 carrier 80W) and Band n25 carrier (40W)]. DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature
All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The Band n66 carrier was enabled at maximum power (80 watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts [Band n66 carrier 80W) and Band n25 carrier (40W)]. DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-3 NOKI0054-4 Signature
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watts/carrier). The Band n25 carrier was enabled on the middle channel (1962.5 MHz) at 40 watts with the same channel bandwidth and modulation type as the Band n66 carrier. The port power was set at the maximum level of 120 Watts [Band n66 carrier 80W) and Band n25 carrier (40W)]. DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-4 Signature NOKI0054-3 NOKI0054-4 Signature
DEVIATIONS FROM TEST STANDARD None Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-4 Signature Signature
None Configuration # Noki0054-2 Noki0054-1 Noki0054-4 Signature Signature
Configuration # NOKI0054-2 NOKI0054-1 NOKI0054-4 Signature Signature
Configuration # NOKI0054-3 NOKI0054-4 Signature
Frequency
Range Value (dBm) Limit (dBm) Result
Band n66 2110 MHz - 2200 MHz, 5G NR
Port 1
25 MHz Bandwidth
256-QAM Modulation
Mid Channel 2155 MHz 9 kHz - 150 kHz -62.0 -49 Pass
Mid Channel 2155 MHz 150 kHz - 20 MHz -52.8 -39 Pass
Mid Channel 2155 MHz 20 MHz - 3.5 GHz -25.5 -19 Pass
Mid Channel 2155 MHz 1.9 GHz - 2.2 GHz -29.1 -19 Pass

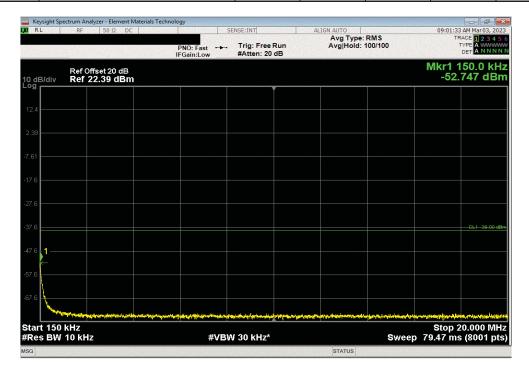
Report No. NOKI0054.0 159/197



Band n66 2110 MHz - 2200 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 2155 MHz
Frequency
Range Value (dBm) Limit (dBm) Result
9 kHz - 150 kHz -62 -49 Pass



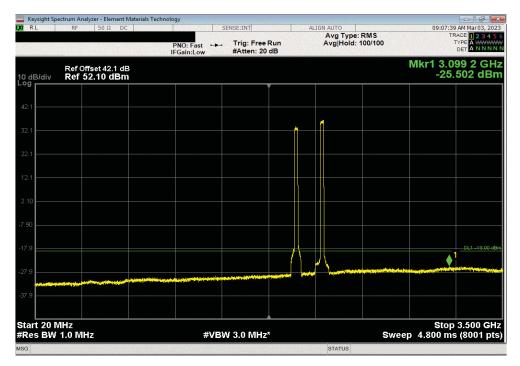
	Band n66 2110 MHz - 2200 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 2155 MHz				
	Frequency				
	Range		Value (dBm)	Limit (dBm)	Result
i	150 kHz - 20 MHz		-52.75	-39	Pass



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Band n66 2110 MHz - 2200 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 2155 MHz
Frequency
Range Value (dBm) Limit (dBm) Result
20 MHz - 3.5 GHz -25.5 -19 Pass



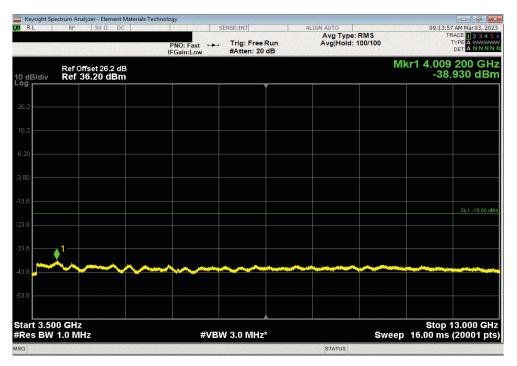
Band n66 2110 MHz - 2200 MHz, 5G NR , Port 1, 2	25 MHz Bandwidth, 256-QAM Mo	dulation, Mid Cha	annel 2155 MHz
Frequency			
Range	Value (dBm)	Limit (dBm)	Result
1.9 GHz - 2.2 GHz	-29.1	-19	Pass



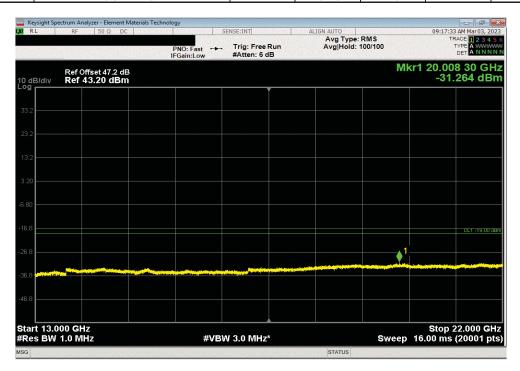
Report No. NOKI0054.0 161/197



Band n66 2110 MHz - 2200 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 256-QAM Modulation, Mid Channel 2155 MHz
Frequency
Range Value (dBm) Limit (dBm) Result
3.5 GHz - 13 GHz - 38.93 -19 Pass



	Band n66 2110 MHz - 2200 MHz, 5G NR , Port 1,	25 MHz Bandwid	dth, 256-QAM Mo	dulation, Mid Cha	annel 2155 MHz
	Frequency				
	Range		Value (dBm)	Limit (dBm)	Result
1	13 GHz - 22 GHz		-31.26	-19	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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

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 AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in original certification report) and antenna port 1 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.

EIRP Requirements:

FCC Requirements: Part 24.232 Power and antenna height limits.

(a)(2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

a)(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; see Tables 1 and 2 of this section.

b)(2) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, with an emission bandwidth greater than 1 MHz are limited to 3280 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

ISED Requirements RSS-133 Section 6.4/SRSP-510 section 5.1.1:

SRSP-510 section 5.1 Radiated power and antenna height limits for base stations

For base stations with a channel bandwidth greater than 1 MHz, the maximum e.i.r.p. is limited to 3280 watts/MHz e.i.r.p. (i.e., no more than 3280 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 meters. Fixed or base stations operating in urban areas are limited to a maximum allowable e.i.r.p. of 1640 watts/MHz e.i.r.p. Base station antenna heights above average terrain may exceed 300 meters with a corresponding reduction in e.i.r.p. according to the following table:

Report No. NOKI0054.0



							TbtTx 2022.05.02.0 fit 2022.12
		er Station Remote Radio Head Model	AHFII			Work Order:	NOKI0054
Serial Number:	BL2235N41PG				03/02/2023		
Customer:	Nokia of America Corpo	ration		Temperature:	23.7°C		
	John Rattanavong, Davi	d Le		Humidity:			
Project:	None				Barometric Pres.:	977.1 mbar	
	Brandon Hobbs and Jar	rod Brenden	Power: 54 VDC			Job Site:	TX07
TEST SPECIFICAT	TONS		Test Method				
FCC 24E:2022			ANSI C63.26:2015				
RSS-133 Issue 6:2	013+A1:2018		ANSI C63.26:2015				
COMMENTS			·				
All measurment pa	ath losses were accounte	d for in the reference level offset incl	uding any attenuators, filte	rs, and DC blo	ocks. Band n25 carri	ers are enabled as maxir	mum power (80 watts/carrier).
		ed while transmitting one carrier on P					
		o port operation is the single port po					
	,	- pp	[9(-/]				
DEVIATIONS FROM	M TEST STANDARD						
None							
			- /·				
Configuration #	NOKI0054-2	/-	7.1	1			
Configuration #	NOKI0054-2	Signature	2.1	1			
Configuration #	NOKI0054-2	Signature	Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)
Configuration #	NOKI0054-2	Signature	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
	NOKI0054-2 z - 1995 MHz, 5G NR	Signature					
		Signature					
	z - 1995 MHz, 5G NR						
	z - 1995 MHz, 5G NR Port 1 25 MHz Ban						
	z - 1995 MHz, 5G NR Port 1 25 MHz Ban	dwidth					
	z - 1995 MHz, 5G NR Port 1 25 MHz Ban	dwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation	dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD
	z - 1995 MHz, 5G NR Port 1 25 MHz Ban	dwidth QPSK Modulation Mid Channel 1962.5 MHz	dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD
	z - 1995 MHz, 5G NR Port 1 25 MHz Ban	dwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation	dBm/MHz 35.214	Factor (dB)	dBm/MHz == PSD 35.2	dBm/MHz == PSD 35.2	dBm/MHz == PSD
	z - 1995 MHz, 5G NR Port 1 25 MHz Ban	dwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation Mid Channel 1962.5 MHz	dBm/MHz 35.214	Factor (dB)	dBm/MHz == PSD 35.2	dBm/MHz == PSD 35.2	dBm/MHz == PSD
	z - 1995 MHz, 5G NR Port 1 25 MHz Ban	dwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation Mid Channel 1962.5 MHz 64-QAM Modulation	35.214 36.544	O 0	35.2 36.5	35.2 36.5	35.2 36.5
	z - 1995 MHz, 5G NR Port 1 25 MHz Ban	dwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation Mid Channel 1962.5 MHz 64-QAM Modulation Mid Channel 1962.5 MHz	35.214 36.544 35.346	O 0	35.2 36.5	35.2 36.5	35.2 36.5
	z - 1995 MHz, 5G NR Port 1 25 MHz Ban	dwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation Mid Channel 1962.5 MHz 64-QAM Modulation Mid Channel 1962.5 MHz 256-QAM Modulation	35.214 36.544 35.346	0 0 0	35.2 36.5 35.3	35.2 36.5 35.3	35.2 36.5 35.3

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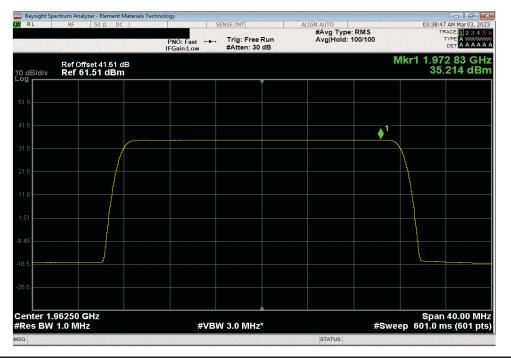


Band n25 1930 MHz - 1995 MHz, 5G NR , Port 1, 25 MHz Bandwidth, QPSK Modulation, Mid Channel 1962.5 MHz

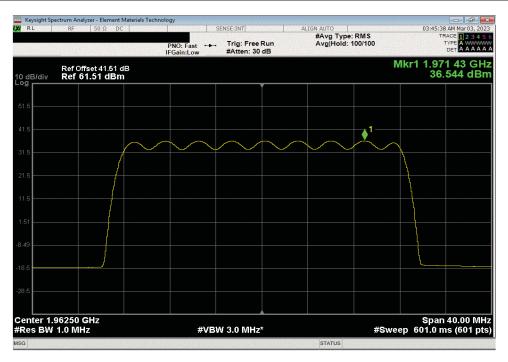
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz == PSD dBm/MHz == PSD dBm/MHz == PSD

35.214 0 35.21 35.21 35.21



Band n25 1930 MHz - 1995 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 16-QAM Modulation, Mid Channel 1962.5 MHz									
	Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)								
	dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD				
	36.544	0	36.54	36.54	36.54				



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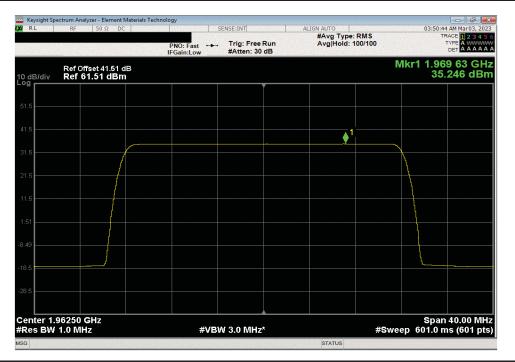


Band n25 1930 MHz - 1995 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 64-QAM Modulation, Mid Channel 1962.5 MHz

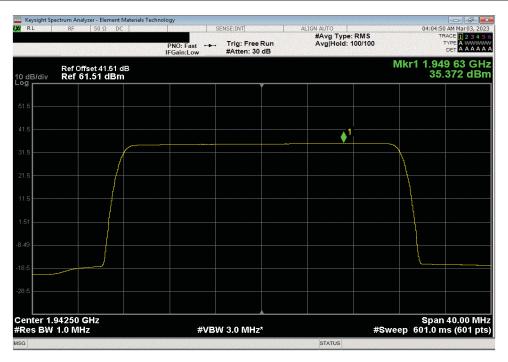
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz == PSD dBm/MHz == PSD dBm/MHz == PSD

35.346 0 35.35 35.35 35.35

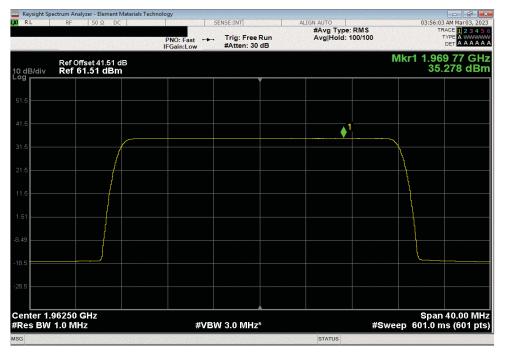


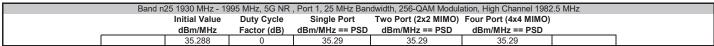
Band n25 1930 MHz - 1995 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 256-QAM Modulation, Low Channel 1942.5 MHz										
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)										
	dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD					
	35.372	0	35.37	35.37	35.37					

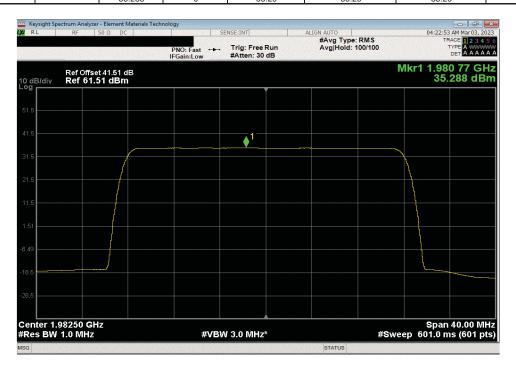


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Report No. NOKI0054.0 167/197



XMit 2022.12.28.0

EIRP Calculations for Four Port MIMO Operations for Band n25 Single NR Carriers

EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regu latory 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 a ntenna and radio, antenna parameters, etc.) and base station operational parameters (MIMO operational setup, carrier power level, channel bandw idth, 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 Kathrein antenna assembly model "80011867". The maximum Band n25 gain (17.9dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of ±45° cross-polarized radiators used for Band n25. The four antenna RF inputs (used for Band n25) on the antenna assembly are as follows: Y1+ L5 (+45°), Y1- L6 (-45°), Y2+ R7 (+45°) and Y2- R8 (-45°). Four AHFII transmitter outputs are connected to the antenna assembly RF inputs.

Equivalent Isotropically Radiated Power (EIRP) is calculated (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 f or 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	5G NR 25 MHz Channel Bandwidth
Worst Case PSD/Antenna Port	36.5 dBm/MHz
Number of Ant Ports per Polarization	2
Total PSD per Polarization 10Log 2 = + 3dB	39.5 dBm/MHz
Cable Loss (site dependent)	0 dB
Dir Gain = Max Ant Gain (G _{Ant}) See Note 1	17.9 dBi
EIRP per Polarization	57.4 dBm/MHz
Number of Polarizations	2
EIRP Total = Y1 <u>+</u> 45° and Y2 <u>+</u> 45° See Note 2	57.4 dBm/MHz
Passing FCC & ISED EIRP Limit	62.15 & 65.16 dBm/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 AHFII Band n25 four port MIMO EIRP levels using antenna assembly model "80011867" are less than the FCC and ISED (65.16 dBm/MHz and 62.15 dBm/MHz) EIRP Regulatory Limits.

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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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

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 AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification report) and antenna port 1 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.

EIRP Requirements:

FCC Requirements: Part 24.232 Power and antenna height limits.

(a)(2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

(a)(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; see Tables 1 and 2 of this section.

(b)(2) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, with an emission bandwidth greater than 1 MHz are limited to 3280 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

ISED Requirements RSS-133 Section 6.4/SRSP-510 section 5.1.1: SRSP-510 section 5.1 Radiated power and antenna height limits for base stations

For base stations with a channel bandwidth greater than 1 MHz, the maximum e.i.r.p. is limited to 3280 watts/MHz e.i.r.p. (i.e., no more than 3280 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 meters. Fixed or base stations operating in urban areas are limited to a maximum allowable e.i.r.p. of 1640 watts/MHz e.i.r.p. Base station antenna heights above average terrain may exceed 300 meters with a corresponding reduction in e.i.r.p. according to the following table:

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ANSI C63.26:2015 COMMENTS Spectral Density (PSD) was measured while transmitting one carrier on Port 1. The PSD for multiport (2x2 MIMO, 4x4 MIMO) operation was determined based upon ANSI C63.26 clause 6.4.3.2.4 (10 log Nout). The total PSD for two port operation is the single port power +3 dB [i.e. 10*log(2)]. The total PSD for four port operations is single port power +6 dB [i.e. 10*log(4)]. DEVIATIONS FROM TEST STANDARD None									TbtTx 2022.05.02.0 122.12.2
Customer: Nokia of America Corporation			er Station Remote Radio Head Mode	el AHFII					
### Attendees: John Rattanavong, David Le Project: None Barometric Press: 983.8 mbar									
Project: None					Temperature: 24°C				
Tested by: Brandon Hobbs and Jarrod Brenden			d Le						
TEST SPECIFICATIONS Test Method FCC 24E:2022 ANSI C63.26:2015 COMMENTS ANSI C63.26:2015 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks.THe LTE 1.4 MHz carriers are enabled at 20 watts/carrier. Power Spectral Density (PSD) was measured while transmitting one carrier on Port 1. The PSD for multiport (2x2 MIMO, 4x4 MIMO) operation was determined based upon ANSI C63.26 clause 6.4.3.2.4 (10 log Nout). The total PSD for two port operation is the single port power +3 dB [i.e. 10*log(2)]. The total PSD for four port operations is single port power +6 dB [i.e. 10*log(4)]. DEPUATIONS FROM TEST STANDARD NONE Configuration # NOKI0054-2 Signature Initial Value dBm/MHz buty Cycle dBm/MHz==PSD buty Cycle									
ANSI C63.26:2015 ANSI C63.26:2015			rod Brenden					Job Site:	TX07
ANSI C63.26:2015 ANSI C63.26:2015	TEST SPECIFICAT	TIONS			Test Method				
All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks.THe LTE 1.4 MHz carriers are enabled at 20 watts/carrier. Power Spectral Density (PSD) was measured while transmitting one carrier on Port 1. The PSD for multiport (2x2 MIMO), 4x4 MIMO) operation was determined based upon ANSI C63.26 clause 6.4.3.2.4 (10 log Nout). The total PSD for two port operation is the single port power +3 dB [i.e. 10*log(2)]. The total PSD for four port operations is single port power +6 dB [i.e. 10*log(4)]. DEVIATIONS FROM TEST STANDARD	FCC 24E:2022				ANSI C63.26:2015	i			
All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks.THe LTE 1.4 MHz carriers are enabled at 20 watts/carrier. Power Spectral Density (PSD) was measured while transmitting one carrier on Port 1. The PSD for multiport (2x2 MIMO, 4x4 MIMO) operation was determined based upon ANSI C63.26 clause 6.4.3.2.4 (10 log Nout). The total PSD for two port operation is the single port power +3 dB [i.e. 10*log(2)]. The total PSD for four port operations is single port power +6 dB [i.e. 10*log(4)]. DEVIATIONS FROM TEST STANDARD NONE Configuration # NOKI0054-2 Signature Initial Value dBm/MHz Pactor (dB) Single Port dBm/MHz=PSD Two Port (2x2 MIMO) dBm/MHz=PSD dBm/MHz=PSD dBm/MHz=PSD dBm/MHz=PSD dBm/MHz=PSD dBm/MHz=PSD 1.4 MHz Bandwidth QPSK Modulation Mid Channel 1962.5 MHz 41.577 0 41.6 44.6 47.6 16-QAM Modulation Mid Channel 1962.5 MHz 41.661 0 41.7 44.7 47.7 64-QAM Modulation Mid Channel 1962.5 MHz 41.504 0 41.5 44.5 47.5 256-QAM Modulation Mid Channel 1962.5 MHz 41.442 0 41.4 44.4 47.4 Mid Channel 1962.5 MHz 41.442 0 41.6 44.6 47.6 Mid Channel 1962.5 MHz 41.442 0 41.4 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	RSS-133 Issue 6:2	013+A1:2018			ANSI C63.26:2015	i			
Spectral Density (PSD) was measured while transmitting one carrier on Port 1. The PSD for multiport (2x2 MIMO, 4x4 MIMO) operation was determined based upon ANSI C63.26 clause 6.4.3.2.4 (10 log Nout). The total PSD for two port operation is the single port power +3 dB [i.e. 10*log(2)]. The total PSD for four port operations is single port power +6 dB [i.e. 10*log(4)].	COMMENTS								
Spectral Density (PSD) was measured while transmitting one carrier on Port 1. The PSD for multiport (2x2 MIMO, 4x4 MIMO) operation was determined based upon ANSI C63.26 clause 6.4.3.2.4 (10 log Nout). The total PSD for two port operation is the single port power +3 dB [i.e. 10*log(2)]. The total PSD for four port operations is single port power +6 dB [i.e. 10*log(4)].	All measurment pa	ath losses were accounted	d for in the reference level offset inc	luding an	y attenuators, filt	ers, and DC bloc	ks.THe LTE 1.4 MHz	carriers are enabled at 2	20 watts/carrier. Power
NOKI0054-2 Signature Initial Value Band 25 1930 MHz - 1995 MHz, LTE Port 1									
NOKI0054-2 Signature Initial Value Band Value Configuration # NOKI0054-2 Signature Initial Value Band Va									
NOKI0054-2 Signature Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO) dBm/MHz==PSD MBm/MHz==PSD dBm/MHz==PSD dBm/MHz==PS	,		3 - 1 - 1		,,		, , , , , , , , , , , , , , , , , , ,		3()2
NOKI0054-2 Signature Initial Value dBm/MHz Duty Cycle Factor (dB) dBm/MHz==PSD Two Port (2x2 MIMO) dBm/MHz==PSD dBm/MHz==									
Signature Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)									
Signature Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)									
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) dBm/MHz==PSD	Configuration #	NOKI0054-2		7	-/1	_1			
Band 25 1930 MHz - 1995 MHz, LTE Port 1 1.4 MHz Bandwidth QPSK Modulation Mid Channel 1962.5 MHz 41.577 0 41.6 44.6 47.6 16-QAM Modulation Mid Channel 1962.5 MHz 41.661 0 41.7 44.7 47.7 64-QAM Modulation Mid Channel 1962.5 MHz 41.504 0 41.5 44.5 47.5 256-QAM Modulation Low Channel 1930.7 MHz 41.442 0 41.6 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	Configuration #	NOKI0054-2	Signature	7.	7	1			
Port 1 1.4 MHz Bandwidth QPSK Modulation Mid Channel 1962.5 MHz 41.577 0 41.6 44.6 47.6 16-QAM Modulation Mid Channel 1962.5 MHz 41.661 0 41.7 44.7 47.7 64-QAM Modulation Mid Channel 1962.5 MHz 41.504 0 41.5 44.5 47.5 256-QAM Modulation Low Channel 1930.7 MHz 41.442 0 41.6 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	Configuration #	NOKI0054-2	Signature	7.	Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)
1.4 MHz Bandwidth QPSK Modulation Mid Channel 1962.5 MHz 41.577 0 41.6 44.6 47.6 16-QAM Modulation Mid Channel 1962.5 MHz 41.661 0 41.7 44.7 47.7 64-QAM Modulation Mid Channel 1962.5 MHz 41.504 0 41.5 44.5 47.5 256-QAM Modulation Low Channel 1930.7 MHz 41.442 0 41.4 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	Configuration #	NOKI0054-2	Signature	7					
QPSK Modulation Mid Channel 1962.5 MHz 41.577 0 41.6 44.6 47.6 16-QAM Modulation Mid Channel 1962.5 MHz 41.661 0 41.7 44.7 47.7 64-QAM Modulation Mid Channel 1962.5 MHz 41.504 0 41.5 44.5 47.5 256-QAM Modulation Low Channel 1930.7 MHz 41.442 0 41.4 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6			Signature	7					
Mid Channel 1962.5 MHz 41.577 0 41.6 44.6 47.6 16-QAM Modulation Mid Channel 1962.5 MHz 41.661 0 41.7 44.7 47.7 64-QAM Modulation Mid Channel 1962.5 MHz 41.504 0 41.5 44.5 47.5 256-QAM Modulation Low Channel 1930.7 MHz 41.442 0 41.4 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	Band 25 1930 MHz	- 1995 MHz, LTE	Signature	7.					
16-QAM Modulation Mid Channel 1962.5 MHz 41.661 0 41.7 44.7 47.7 64-QAM Modulation Mid Channel 1962.5 MHz 41.504 0 41.5 44.5 44.5 47.5 256-QAM Modulation Low Channel 1930.7 MHz Mid Channel 1962.5 MHz 41.42 0 41.4 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	Band 25 1930 MHz	- 1995 MHz, LTE Port 1							
Mid Channel 1962.5 MHz 41.661 0 41.7 44.7 47.7 64-QAM Modulation Mid Channel 1962.5 MHz 41.504 0 41.5 44.5 47.5 256-QAM Modulation Low Channel 1930.7 MHz 41.442 0 41.4 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	Band 25 1930 MHz	- 1995 MHz, LTE Port 1 1.4 MHz Bar	ndwidth	7.					
64-QAM Modulation Mid Channel 1962.5 MHz 41.504 0 41.5 44.5 44.5 47.5 256-QAM Modulation Low Channel 1930.7 MHz Mid Channel 1962.5 MHz 41.42 0 41.4 44.4 47.4 47.6	Band 25 1930 MHz	- 1995 MHz, LTE Port 1 1.4 MHz Bar	idwidth QPSK Modulation		dBm/MHz	Factor (dB)	dBm/MHz==PSD	dBm/MHz==PSD	dBm/MHz==PSD
Mid Channel 1962.5 MHz 41.504 0 41.5 44.5 47.5 256-QAM Modulation Low Channel 1930.7 MHz 41.442 0 41.4 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	Band 25 1930 MHz	- 1995 MHz, LTE Port 1 1.4 MHz Bar	idwidth QPSK Modulation Mid Channel 1962.5 MHz		dBm/MHz	Factor (dB)	dBm/MHz==PSD	dBm/MHz==PSD	dBm/MHz==PSD
256-QAM Modulation Low Channel 1930.7 MHz 41.442 0 41.4 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	Band 25 1930 MHz	- 1995 MHz, LTE Port 1 1.4 MHz Bar	ndwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation		dBm/MHz 41.577	Factor (dB)	dBm/MHz==PSD 41.6	dBm/MHz==PSD 44.6	dBm/MHz==PSD 47.6
Low Channel 1930.7 MHz 41.442 0 41.4 44.4 47.4 Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	Band 25 1930 MHz	- 1995 MHz, LTE Port 1 1.4 MHz Bar	ndwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation Mid Channel 1962.5 MHz		dBm/MHz 41.577	Factor (dB)	dBm/MHz==PSD 41.6	dBm/MHz==PSD 44.6	dBm/MHz==PSD 47.6
Mid Channel 1962.5 MHz 41.551 0 41.6 44.6 47.6	Band 25 1930 MHz	- 1995 MHz, LTE Port 1 1.4 MHz Bar	idwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation Mid Channel 1962.5 MHz 64-QAM Modulation		41.577 41.661	0 0	41.6 41.7	44.6 44.7	dBm/MHz==PSD 47.6 47.7
	Band 25 1930 MHz	- 1995 MHz, LTE Port 1 1.4 MHz Bar	idwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation Mid Channel 1962.5 MHz 64-QAM Modulation Mid Channel 1962.5 MHz		41.577 41.661	0 0	41.6 41.7	44.6 44.7	dBm/MHz==PSD 47.6 47.7
High Channel 1989.3 MH 41.865 0 41.9 44.9 47.9	Band 25 1930 MHz	- 1995 MHz, LTE Port 1 1.4 MHz Bar	ndwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation Mid Channel 1962.5 MHz 64-QAM Modulation Mid Channel 1962.5 MHz 256-QAM Modulation	:	41.577 41.661 41.504	0 0	41.6 41.7 41.5	44.6 44.7 44.5	47.6 47.7 47.5
	Band 25 1930 MHz	- 1995 MHz, LTE Port 1 1.4 MHz Bar	ndwidth QPSK Modulation Mid Channel 1962.5 MHz 16-QAM Modulation Mid Channel 1962.5 MHz 64-QAM Modulation Mid Channel 1962.5 MHz 256-QAM Modulation Low Channel 1930.7 MHz	: :	41.577 41.661 41.504 41.442	0 0 0	41.6 41.7 41.5 41.4	44.6 44.7 44.5 44.4	47.6 47.7 47.5

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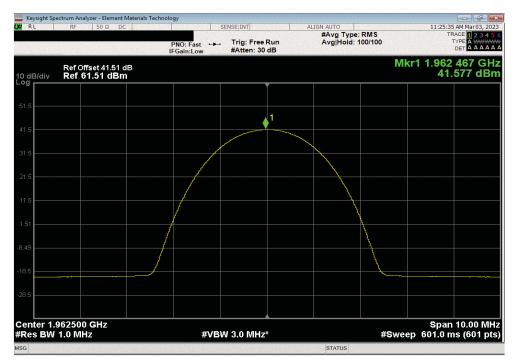


Band 25 1930 MHz - 1995 MHz, LTE, Port 1, 1.4 MHz Bandwidth, QPSK Modulation, Mid Channel 1962.5 MHz

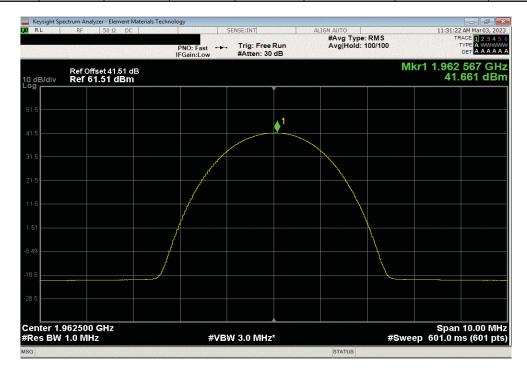
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz==PSD dBm/MHz==PSD dBm/MHz==PSD

41.577 0 41.577 44.577 47.577



	Band 25 1930 MHz - 1995 MHz, LTE, Port 1, 1.4 MHz Bandwidth, 16-QAM Modulation, Mid Channel 1962.5 MHz								
I		Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)							
ı			dBm/MHz	Factor (dB)	dBm/MHz==PSD	dBm/MHz==PSD	dBm/MHz==PSD		
ı	ĺ		41.661	0	41.661	44.661	47.661		



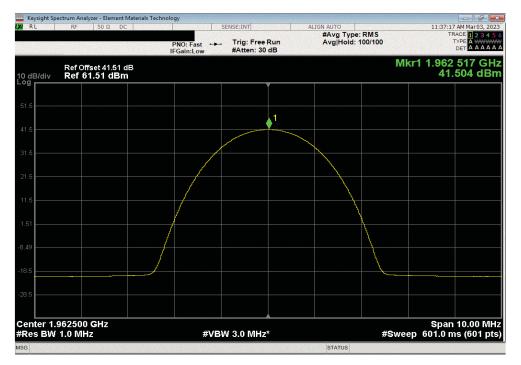
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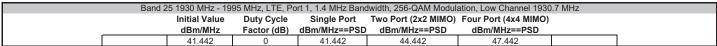


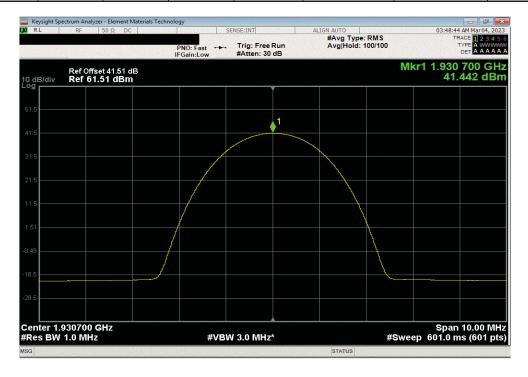
Band 25 1930 MHz - 1995 MHz, LTE, Port 1, 1.4 MHz Bandwidth, 64-QAM Modulation, Mid Channel 1962.5 MHz
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz==PSD dBm/MHz==PSD dBm/MHz==PSD

41.504 0 41.504 44.504 47.504







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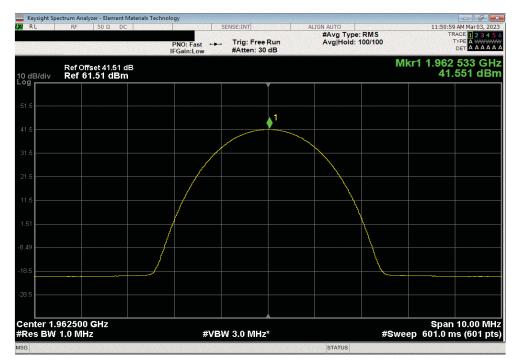


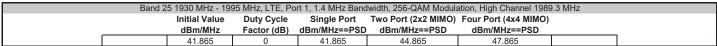
Band 25 1930 MHz - 1995 MHz, LTE, Port 1, 1.4 MHz Bandwidth, 256-QAM Modulation, Mid Channel 1962.5 MHz

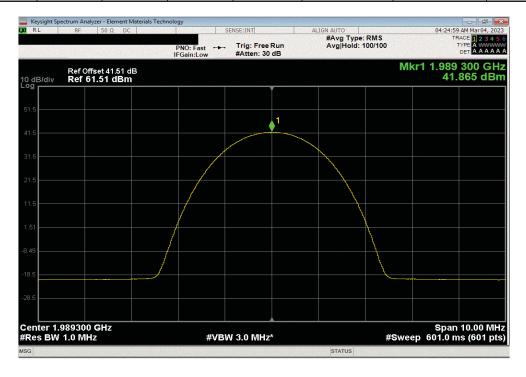
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz==PSD dBm/MHz==PSD dBm/MHz==PSD

41.551 0 41.551 44.551 47.551







Report No. NOKI0054.0 173/197



FbtTx 2022.05.02.0 XMit 2022.12.28

EIRP Calculations for Four Port MIMO Operations for Band 25 LTE Single Carriers

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 Kathrein antenna assembly model "80011867". The maximum Band n25 gain (1:9dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of ±45° cross-polarized radiators used for Band n25. The four antenna RF inputs (used for Band n25) on the antenna assembly are as follows: Y1+ L5 (+45°), Y1- L6 (-45°), Y2+ R7 (+45°) and Y2- R8 (-45°). Four AHFII transmitter outputs are connected to the antenna assembly RF inputs.

Equivalent Isotropically Radiated Power (EIRP) is calculated (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 and a typical loss of 1.0dB for this frequency range was used. Calculations of worst-case EIRP for four port MIMO are as follows:

Parameter	LTE 1.4 MHz Channel Bandwidth
Worst Case PSD/Antenna Port	41.9 dBm/MHz
Number of Ant Ports per Polarization	2
Total PSD per Polarization 10Log 2 = + 3dB	44.9 dBm/MHz
Cable Loss (1 dB)	43.9 dBm/MHz
Dir Gain = Max Ant Gain (G _{Ant}) See Note 1	17.9 dBi
EIRP per Polarization	61.8 dBm/MHz
Number of Polarizations	2
EIRP Total = Y1 <u>+</u> 45°and Y2 <u>+</u> 45° See Note 2	61.8 dBm/MHz
Passing FCC & ISED EIRP Limit	62.15 & 65.16 dBm/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 AHFII Band 25 four port MIMO EIRP levels using antenna assembly model "80011867" are less than the FCC and ISED (65.16 dBm/MHz and 62.15 dBm/MHz) EIRP Regulatory Limits.

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XMit 2022.12.28.0

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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

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 AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification test report) and antenna port 1 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.

EIRP Requirements:

FCC Requirements: Part 24.232 Power and antenna height limits.

(a)(2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below

(a)(3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; see Tables 1 and 2 of this section.

(b)(2) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, with an emission bandwidth greater than 1 MHz are limited to 3280 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.

ISED Requirements RSS-133 Section 6.4/SRSP-510 section 5.1.1:

SRSP-510 section 5.1 Radiated power and antenna height limits for base stations

For base stations with a channel bandwidth greater than 1 MHz, the maximum e.i.r.p. is limited to 3280 watts/MHz e.i.r.p. (i.e., no more than 3280 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 meters. Fixed or base stations operating in urban areas are limited to a maximum allowable e.i.r.p. of 1640 watts/MHz e.i.r.p. Base station antenna heights above average terrain may exceed 300 meters with a corresponding reduction in e.i.r.p.

Report No. NOKI0054.0



Work Order: NOKI0054 EUT: Airscale Base Transceiver Station Remote Radio Head Model AHFII Serial Number: BL2235N41PG Date: 03/03/2023 Customer: Nokia of America Corporation Temperature: 26.6°C Attendees: John Rattanavong, David Le Project: None Humidity: 30.8% Barometric Pres.: 983.9 mbar Tested by: Brandon Hobbs and Jarrod Brenden Power: 54 VDC Job Site: TX07 TEST SPECIFICATIONS **Test Method** FCC 24E:2022 ANSI C63.26:2015 RSS-133 Issue 6:2013+A1:2018 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The NB IoT SA carriers are enabled at maximum power (20 watts/carrier). Power Spectral Density (PSD) was measured while transmitting one carrier on Port 1. The PSD for multiport (2x2 MIMO, 4x4 MIMO) operation was determined based upon ANSI C63.26 clause 6.4.3.2.4 (10 log Nout). The total PSD for two port operation is the single port power +3 dB [i.e. 10*log(2)]. The total PSD for four port operations is single port power +6 dB [i.e. 10*log(4)]. The NB IoT SA carrier power level was reduced from maximum (20 watts/carrier) to meet the 1640 W/MHz EIRP limit. DEVIATIONS FROM TEST STANDARD None NOKI0054-2 Configuration # Signature Initial Value **Duty Cycle** Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO) dBm/MHz Factor (dB) dBm/MHz==PSD dBm/MHz==PSD dBm/MHz==PSD Band 25 1930 MHz - 1995 MHz, NB-IoT Port 1 200 KHz Bandwidth NTM Modulation 42.2 42.2 45.2 45.2 Low Channel 1930.2 MHz 42.188 48.2 0 Mid Channel 1962.5 MHz 42.225 48.2 42.444 High Channel 1994.8 MH: 48.4 Band 25 1930 MHz - 1995 MHz, NB-IoT - Reduced Powe Port 1 200 KHz Bandwidth NTM Modulation High Channel 1994.8 MH: 41.623 41.6 44.6 47.6

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Band 25 1930 MHz - 1995 MHz, NB-IoT, Port 1, 200 KHz Bandwidth, NTM Modulation, Low Channel 1930.2 MHz

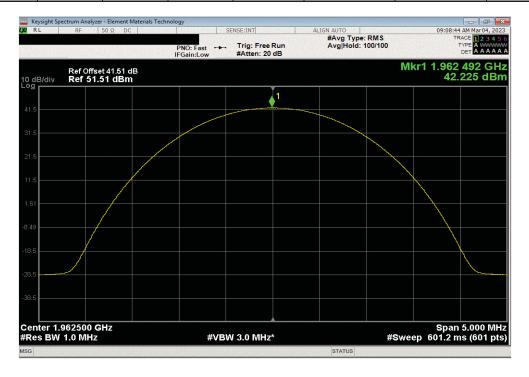
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz==PSD dBm/MHz==PSD dBm/MHz==PSD

42.188 0 42.188 45.188 48.188



Band	25 1930 MHz - 19	95 MHz, NB-IoT	, Port 1, 200 KHz B	andwidth, NTM Modula	tion, Mid Channel 1962.	5 MHz
	Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	Four Port (4x4 MIMO)	
	dBm/MHz	Factor (dB)	dBm/MHz==PSD	dBm/MHz==PSD	dBm/MHz==PSD	
	42.225	Ω	42.225	45.225	48.225	



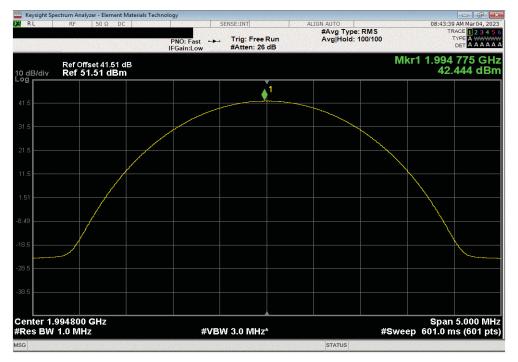
Report No. NOKI0054.0 177/197

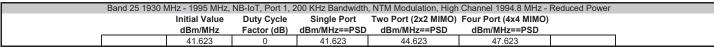


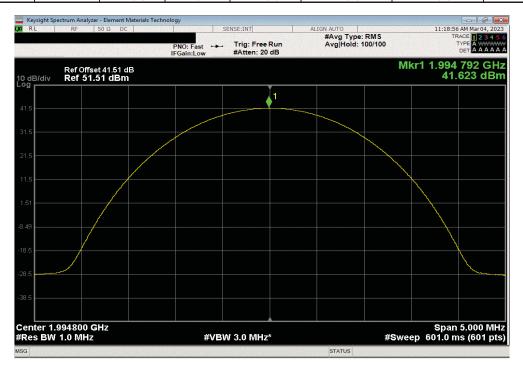
Band 25 1930 MHz - 1995 MHz, NB-IoT, Port 1, 200 KHz Bandwidth, NTM Modulation, High Channel 1994.8 MHz
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz==PSD dBm/MHz==PSD dBm/MHz==PSD

42.444 0 42.444 45.444 48.444







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EIRP calculations are needed at each transmitter location to optimize base station operational performance while meeting regu latory 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 a ntenna height, population density, etc.), site installation parameters (line loss between antenna and radio, antenna parameters, etc.) and base station operational parameters (MIMO oper ational 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 Kathrein antenna assembly model "80011867". The maximum Band n25 gain (17.9dBi) for this antenna was used for the EIRP calculation. This anten na assembly has a pair of ±45° cross-polarized radiators used for Band n25. The four antenna RF inputs (used for Band n25) on the antenna assembly are as follows: Y1+ L5 (+ 45°), Y1- L6 (-45°), Y2+ R7 (+45°) and Y2- R8 (-45°). Four AHFII transmitter outputs are connected to the antenna assembly RF inputs.

Equivalent Isotropically Radiated Power (EIRP) is calculated (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 los s between the antenna and transmitter is site dependent and a typical loss of 1.0dB for this frequency range was used. Calculations of worst-case EIRP for four port MIMO are as follows:

Parameter	NB IoT SA Carrier	NB IoT SA Carrier (Reduced Power)		
Worst Case PSD/Antenna Port	42.4 dBm/MHz	41.6		
Number of Ant Ports per Polarization	2	2		
Total PSD per Polarization 10Log 2 = + 3dB	45.4 dBm/MHz	44.6 dBm/MHz		
Cable Loss (1 dB)	44.4 dBm/MHz	43.6 dBm/MHz		
Dir Gain = Max Ant Gain (G _{Ant}) See Note 1	17.9 dBi	17.9 dBi		
EIRP per Polarization	62.3 dBm/MHz	61.5 dBm/MHz		
Number of Polarizations	2	2		
EIRP Total = Y1 <u>+</u> 45° and Y2 <u>+</u> 45° See Note 2	62.3 dBm/MHz	61.5 dBm/MHz		
Passing FCC & ISED EIRP Limit	65.16 dBm/MHz	62.15 & 65.16 dBm/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 AHFII Band 25 four port MIMO EIRP levels using antenna assembly model "80011867" are less than the FCC and ISED (65.16 dBm/MHz or 62.15 dBm/MHz) EIRP Regulatory Limits.

Report No. NOKI0054.0 179/197



XMit 2022.12.28.0

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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

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 AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification test report) and antenna port 1 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.

EIRP Requirements:

FCC Requirements: Part 27.50(d)

The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:

- (1) The power of each fixed or base station transmitting in the 1995-2000 MHz, 2110-2155 MHz, 2155-2180 MHz or 2180-2200 MHz band and located in any 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, is limited to:
- (ii) An EIRP of 3280 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.
- (2) The power of each fixed or base station transmitting in the 1995-2000 MHz, the 2110-2155 MHz 2155-2180 MHz band, or 2180-2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to: (ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

ISED Requirements RSS-139 Section 5.5/SRSP-513 Section 6.1.2/SRSP-519 Section 6.1.2 SRSP-513 6.1.3 E.i.r.p. limits and antenna height limits for non-AAS systems

- 21. For fixed and base stations operating in the band 2110-2180 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 62 dBm/MHz (i.e. no more than 62 dBm e.i.r.p. in any 1 MHz band segment), with an antenna HAAT of up to 300 m
- 22. Fixed and base stations operating in the band 2110-2180 MHz and located in geographic areas at a distance greater than 26 km from large or medium population centers may increase their e.i.r.p. to a maximum of 65 dBm/MHz (i.e. no more than 65 dBm e.i.r.p. in any 1 MHz band segment), with an antenna HAAT of up to 300 m.

SRSP-519 6.1.3 Radiated power and antenna height limits for base stations using non-AAS systems

- 22. For base stations operating in the bands 2000-2020 MHz and 2180-2200 MHz with an antenna HAAT of up to 300 m, the e.i.r.p. shall not exceed 62 dBm/MHz when transmitting with an emission bandwidth greater than 1 MHz.
- 23. Base stations located in geographic areas at a distance greater than 26 km from large or medium population centers may increase their e.i.r.p. to a maximum of 65 dBm when transmitting with an emission bandwidth of 1 MHz or less, and 65 dBm/MHz when transmitting with an emission bandwidth greater than 1 MHz, with an antenna HAAT of up to 300 m.

SRSP-519 6.1.3 Radiated power and antenna height limits for base stations using non-AAS systems

- 22. For base stations operating in the bands 2000-2020 MHz and 2180-2200 MHz with an antenna HAAT of up to 300 m, the e.i.r.p. shall not exceed 62 dBm/MHz when transmitting with an emission bandwidth greater than 1 MHz.
- 23. Base stations located in geographic areas at a distance greater than 26 km from large or medium population centres may increase their e.i.r.p. to a maximum of 65 dBm when transmitting with an emission bandwidth of 1 MHz or less, and 65 dBm/MHz when transmitting with an emission bandwidth greater than 1 MHz, with an antenna HAAT of up to 300 m.

Report No. NOKI0054.0 180/197



EUT: Airscale Base Transceiver Station Remote Radio Head Model AHFII Work Order: NOKI0054 Serial Number: BL2235N41PG Date: 03/02/2023 Customer: Nokia of America Corporation Temperature: 23.6°C Attendees: John Rattanavong, David Le Project: None Humidity: 42.3%
Barometric Pres.: 977.4 mbar
Job Site: TX07 Tested by: Brandon Hobbs and Jarrod Brenden Power: 54 VDC TEST SPECIFICATIONS Test Method FCC 27:2023 ANSI C63.26:2015 RSS-139 Issue 4:2022 COMMENTS All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. Band n66 carriers are enabled as maximum power (80 watts/carrier). Power Spectral Density (PSD) was measured while transmitting one carrier on Port 1. The PSD for multiport (2x2 MIMO, 4x4 MIMO) operation was determined based upon ANSI C63.26 clause 6.4.3.2.4 (10 log Nout). The total PSD for two port operation is the single port power +3 dB [i.e. 10*log(2)]. The total PSD for four port operations is single port power +6 dB [i.e. 10*log(4)]. DEVIATIONS FROM TEST STANDARD None NOKI0054-2 Configuration # 1 Signature Initial Value Singel Port Two Prot (2x2 MIMO) Four Port (4x4) MIMO dBm/MHz == PSD dBm/MHz == PSD dBm/MHz == PSD Duty Cycle Factor (dB) dBm/MHz Band n66 2110 MHz - 2200 MHz, 5G NR Port 1 25 MHz Bandwidth QPSK Modulation Mid Channel 2155 MHz 35 236 0 35.2 35.2 35.2 16-QAM Modulation Mid Channel 2155 MHz 36.583 36.6 36.6 36.6 64-QAM Modulation Mid Channel 2155 MHz 35.287 0 35.3 35.3 35.3 256-QAM Modulation Low Channel 2122 5 MHz 35 621 0 35.6 35.6 35.6 Mid Channel 2155 MHz 35.309 0 35.3 35.3 35.3 High Channel 2187.5 MH: 35.487 0 35.5 35.5 35.5

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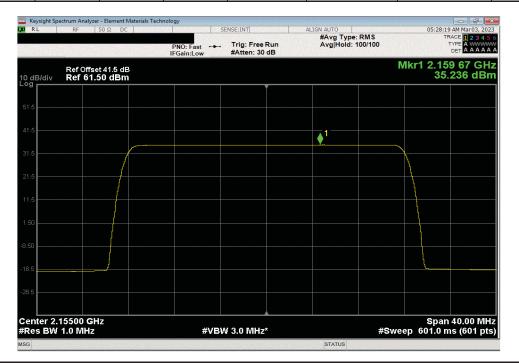


Band n66 2110 MHz - 2200 MHz, 5G NR , Port 1, 25 MHz Bandwidth, QPSK Modulation, Mid Channel 2155 MHz

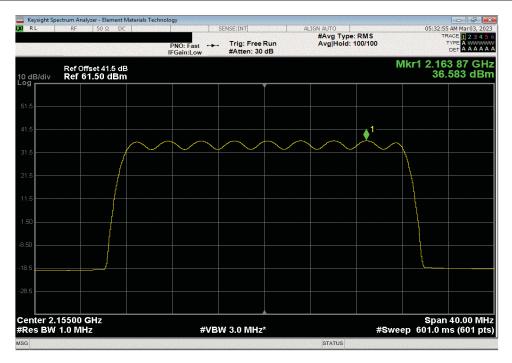
Initial Value Duty Cycle Singel Port Two Prot (2x2 MIMO) Four Port (4x4) MIMO

dBm/MHz Factor (dB) dBm/MHz == PSD dBm/MHz == PSD

35.236 0 35.24 35.24 35.24



Band n66 2110 MHz - 2200 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 16-QAM Modulation, Mid Channel 2155 MHz									
	Initial Value	Duty Cycle	Singel Port	Two Prot (2x2 MIMO)	Four Port (4x4) MIMO				
	dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD				
·	36.583	0	36.58	36.58	36.58				



Report No. NOKI0054.0 182/197

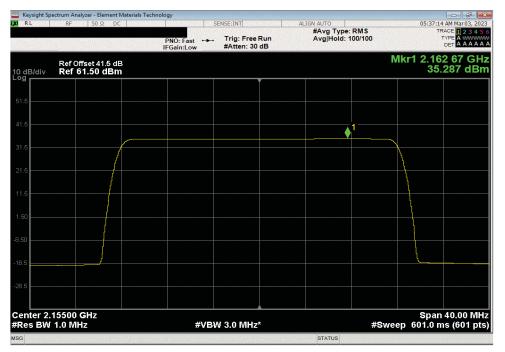


Band n66 2110 MHz - 2200 MHz, 5G NR , Port 1, 25 MHz Bandwidth, 64-QAM Modulation, Mid Channel 2155 MHz

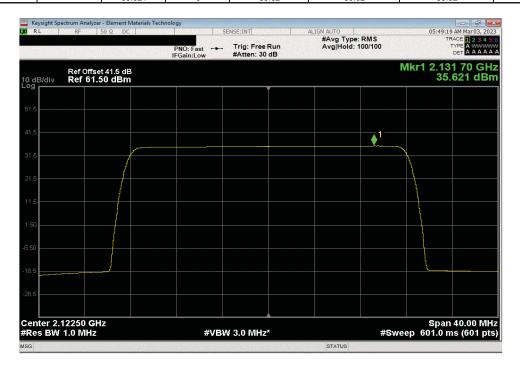
Initial Value Duty Cycle Singel Port Two Prot (2x2 MIMO) Four Port (4x4) MIMO

dBm/MHz Factor (dB) dBm/MHz == PSD dBm/MHz == PSD dBm/MHz == PSD

35.287 0 35.29 35.29 35.29



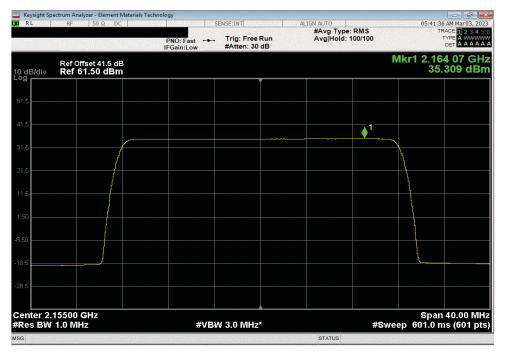
Band n66 2110 MHz	- 2200 MHz, 5G NF	R , Port 1, 25 MHz Bar	ndwidth, 256-QAM Modul	ation, Low Channel 2122.	5 MHz
Initial Value	Duty Cycle	Singel Port	Two Prot (2x2 MIMO)	Four Port (4x4) MIMO	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
35 621	0	35 62	35 62	35.62	



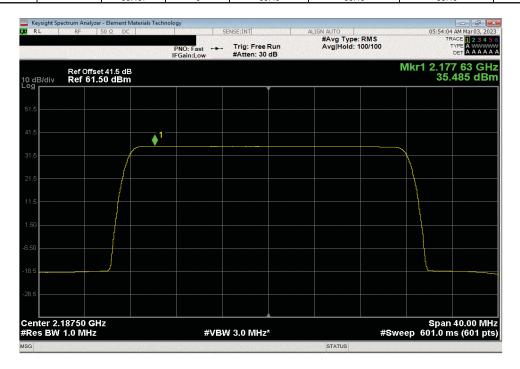
Report No. NOKI0054.0 183/197



Band	n66 2110 MHz -	2200 MHz, 5G N	R , Port 1, 25 MHz Ba	andwidth, 256-QAM Modu	ulation, Mid Channel 2155	5 MHz	
	Initial Value	Duty Cycle		,	Four Port (4x4) MIMO		
	dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD		_
	35.309	0	35.31	35.31	35.31		



Band n66 2110 MHz - 2	2200 MHz, 5G NR	, Port 1, 25 MHz Ban	dwidth, 256-QAM Modula	ation, High Channel 2187	.5 MHz
Initial Value	Duty Cycle	Singel Port	Two Prot (2x2 MIMO)	Four Port (4x4) MIMO	
dBm/MHz	Factor (dB)	dBm/MHz == PSD	dBm/MHz == PSD	dBm/MHz == PSD	
35 487	0	35 49	35 49	35 49	



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EIRP Calculations for Four Port MIMO Operations for Band n66 Single NR Carriers

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 Kathrein antenna assembly model "80011867". The maximum Band n66 gain (18.2dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of +45° cross-polarized radiators used for Band n66. The four antenna RF inputs (used for Band n66) on the antenna assembly are as follows: Y1+ L5 (+45°), Y1- L6 (-45°), Y2+ R7 (+45°) and Y2- R8 (-45°). Four AHFII 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. EIRP was calculated as described in SRSP 513 clause 6.1.2 and SRSP 519 clause 6.1.2 "EIRP for non-AAS uncorrelated transmission". Calculations of worst-case EIRP for four port MIMO are as follows:

Parameter	5G NR 25 MHz Channel Bandwidth			
Worst Case PSD/Antenna Port	36.6 dBm/MHz			
Number of Ant Ports per Polarization	2			
Total PSD per Polarization 10Log 2 = + 3dB	39.6 dBm/MHz			
Cable Loss (site dependent)	0 dB			
Dir Gain = Max Ant Gain (G _{Ant}) See Note 1	18.2 dBi			
EIRP per Polarization	57.8 dBm/MHz			
Number of Polarizations	2			
EIRP Total = Y1 <u>+</u> 45°and Y2 <u>+</u> 45° See Note 2	57.8 dBm/MHz			
Passing FCC EIRP Limit	62.15 & 65.16 dBm/MHz			
Passing ISED EIRP Limit	62 & 65 dBm/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 AHFII Band n66 four port MIMO EIRP levels using antenna assembly model "80011867" are less than the FCC (65.16 dBm/MHz and 62.15 dBm/MHz) and ISED (65 dBm/MHz and 62 dBm/MHz) EIRP Regulatory Limits.

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XMit 2022.12.28.0

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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

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 AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification test report) and antenna port 1 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.

EIRP Requirements:

FCC Requirements: Part 27.50(d)

The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:

- (1) The power of each fixed or base station transmitting in the 1995-2000 MHz, 2110-2155 MHz, 2155-2180 MHz or 2180-2200 MHz band and located in any 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, is limited to:
- (ii) An EIRP of 3280 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.
- (2) The power of each fixed or base station transmitting in the 1995-2000 MHz, the 2110-2155 MHz 2155-2180 MHz band, or 2180-2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:
- (ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

ISED Requirements RSS-139 Section 5.5/SRSP-513 Section 6.1.2/SRSP-519 Section 6.1.2 SRSP-513 6.1.3 E.i.r.p. limits and antenna height limits for non-AAS systems

- 21. For fixed and base stations operating in the band 2110-2180 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 62 dBm/MHz (i.e. no more than 62 dBm e.i.r.p. in any 1 MHz band segment), with an antenna HAAT of up to 300 m
- 22. Fixed and base stations operating in the band 2110-2180 MHz and located in geographic areas at a distance greater than 26 km from large or medium population centers may increase their e.i.r.p. to a maximum of 65 dBm/MHz (i.e. no more than 65 dBm e.i.r.p. in any 1 MHz band segment), with an antenna HAAT of up to 300 m.
- SRSP-519 6.1.3 Radiated power and antenna height limits for base stations using non-AAS systems
- 22. For base stations operating in the bands 2000-2020 MHz and 2180-2200 MHz with an antenna HAAT of up to 300 m, the e.i.r.p. shall not exceed 62 dBm/MHz when transmitting with an emission bandwidth greater than 1 MHz.
- 23. Base stations located in geographic areas at a distance greater than 26 km from large or medium population centers may increase their e.i.r.p. to a maximum of 65 dBm when transmitting with an emission bandwidth of 1 MHz or less, and 65 dBm/MHz when transmitting with an emission bandwidth greater than 1 MHz, with an antenna HAAT of up to 300 m.

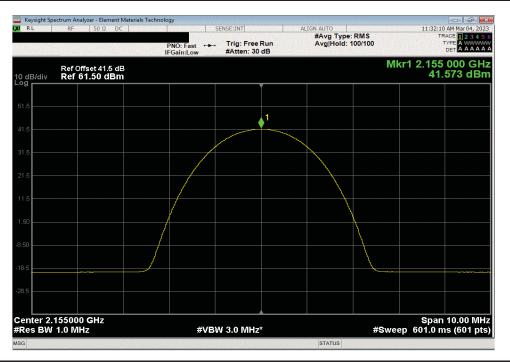
Report No. NOKI0054.0 186/197



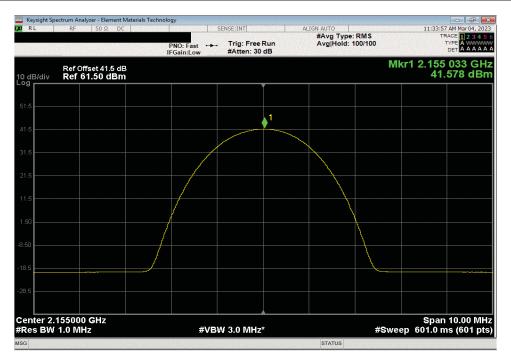
							TbtTx 2022.05.02.0 XMit 2022.12
EUT:	Airscale Base Transceiv	er Station Remote Radio Head Model	AHFII			Work Order:	NOKI0054
Serial Number:	BL2235N41PG					Date:	03/03/2023
Customer:	Nokia of America Corpo	ration				Temperature:	26.8°C
Attendees:	John Rattanavong, Davi	id Le				Humidity:	30%
Project:						Barometric Pres.:	984 mbar
	Brandon Hobbs and Jar	rrod Brenden	Power: 54 VDC			Job Site:	TX07
TEST SPECIFICAT	IONS		Test Method				
FCC 27:2023			ANSI C63.26:2015				
RSS-139 Issue 4:20)22		ANSI C63.26:2015				
COMMENTS			•				
All measurment pa	th losses were accounte	d for in the reference level offset inclu	ding any attenuators, filters, a	nd DC blocks.Th	ne LTE 1.4 MHz carı	iers are anabled at 20	watts/carrier. Power Spectral
Density (PSD) was	measured while transmit	tting one carrier on Port 1. The PSD fo	or multiport (2x2 MIMO, 4x4 MIN	(IO) operation wa	as determined base	d upon ANSI C63.26 c	lause 6.4.3.2.4 (10 log Nout). The
total PSD for two p	ort operation is the singl	le port power +3 dB [i.e. 10*log(2)]. The	e total PSD for four port operat	ions is single po	ort power +6 dB [i.e	. 10*log(4)].	
DEVIATIONS FROM	I TEST STANDARD						
None							
			(·				
Configuration #	NOKI0054-2	/-	1.11	1			
		Signature		-			
			Initial Value	Duty Cycle	Single Port	Two Port (2x2 MIMO)	
			dBm/MHz	Factor (dB)	dBm/MHz==PSD	dBm/MHz==PSD	dBm/MHz==PSD
Band 66 2110 MHz							
	Port 1						
	1.4 MHz Bar						
		QPSK Modulation					
		Mid Channel 2155 MHz	41.573	0	41.6	44.6	47.6
		16-QAM Modulation					
		Mid Channel 2155 MHz	41.578	0	41.6	44.6	47.6
		64-QAM Modulation					
		Mid Channel 2155 MHz	41.542	0	41.5	44.5	47.5
		256-QAM Modulation					
		Low Channel 2110.7 MHz	41.508	0	41.5	44.5	47.5
		Mid Channel 2155 MHz High Channel 2199.3 MH	41.534 41.633	0	41.5 41.6	44.5 44.6	47.5 47.6

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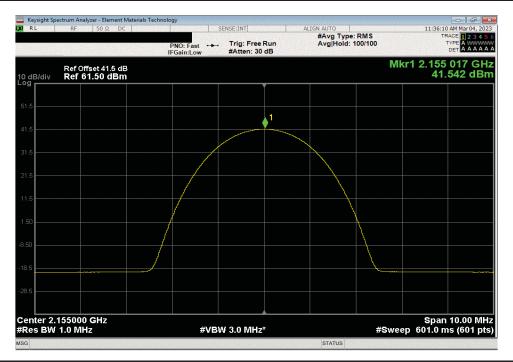


Band 66 2110 MHz - 2200 MHz, LTE , Port 1, 1.4 MHz Bandwidth, 64-QAM Modulation, Mid Channel 2155 MHz

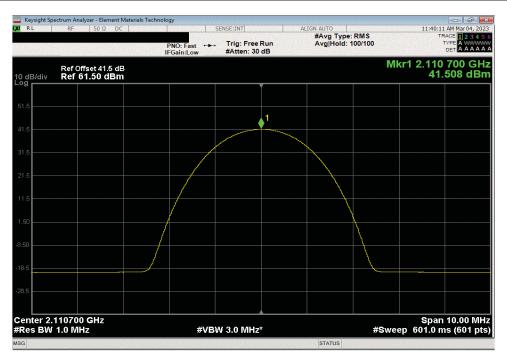
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz==PSD dBm/MHz==PSD

41.542 0 41.542 44.542 47.542







Report No. NOKI0054.0 189/197

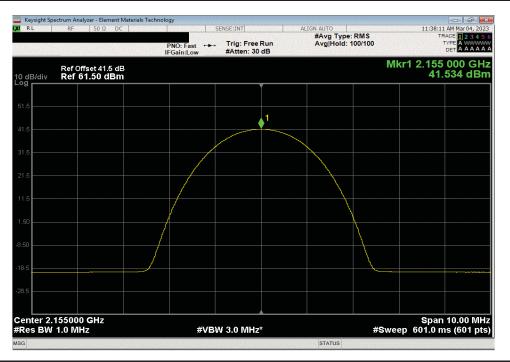


Band 66 2110 MHz - 2200 MHz, LTE , Port 1, 1.4 MHz Bandwidth, 256-QAM Modulation, Mid Channel 2155 MHz

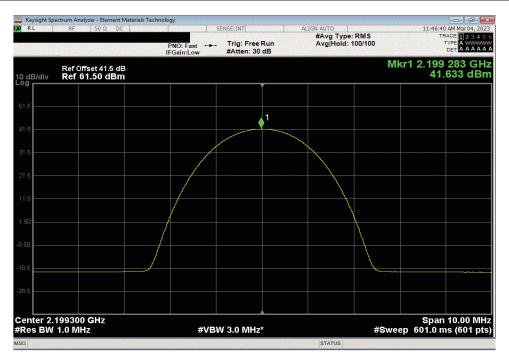
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz==PSD dBm/MHz==PSD

41.534 0 41.534 44.534 47.534







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EIRP Calculations for Four Port MIMO Operations for Band 66 Single LTE Carriers

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 Kathrein antenna assembly model "80011867". The maximum Band n66 gain (18.2dBi) for this antenna was used for the EIRP calculation. This antenna assembly has a pair of ±45° cross-polarized radiators used for Band n66. The four antenna RF inputs (used for Band n66) on the antenna assembly are as follows: Y1+ L5 (+45°), Y1- L6 (-45°), Y2+ R7 (+45°) and Y2- R8 (-45°). Four AHFII 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 and a typical loss of 1.0dB for this frequency range was used. EIRP was calculated as described in SRSP 513 clause 6.1.2 and SRSP 519 clause 6.1.2 "EIRP for non-AAS uncorrelated transmission". Calculations of worst-case EIRP for four port MIMO are as follows:

Parameter	LTE 1.4 MHz Channel Bandwidth	
Worst Case PSD/Antenna Port	41.6 dBm/MHz	
Number of Ant Ports per Polarization	2	
Total PSD per Polarization 10Log 2 = + 3dB	44.6 dBm/MHz	
Cable Loss (1dB)	43.6 dBm/MHz	
Dir Gain = Max Ant Gain (G _{Ant}) See Note 1	18.2 dBi	
EIRP per Polarization	61.8 dBm/MHz	
Number of Polarizations	2	
EIRP Total = Y1 <u>+</u> 45°and Y2 <u>+</u> 45° See Note 2	61.8 dBm/MHz	
Passing FCC EIRP Limit	62.15 & 65.16 dBm/MHz	
Passing ISED EIRP Limit	62 & 65 dBm/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 AHFII Band 66 four port MIMO EIRP levels using antenna assembly model "80011867" are less than the FCC (65.16 dBm/MHz and 62.15 dBm/MHz) and ISED (65 dBm/MHz and 62 dBm/MHz) EIRP Regulatory Limits.

Report No. NOKI0054.0 191/197



XMit 2022 12 28 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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFQ	2023-02-09	2024-02-09
Block - DC	Fairview Microwave	SD3239	ANE	2023-02-16	2024-02-16
Generator - Signal	Agilent	N5173B	TIW	2020-07-17	2023-07-17

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 AHFII antenna ports are essentially electrically identical (the RF power variation between antenna ports is small as shown in the original certification test report) and antenna port 1 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.

EIRP Requirements:

FCC Requirements: Part 27.50(d)

The following power and antenna height requirements apply to stations transmitting in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz and 2180-2200 MHz bands:

- (1) The power of each fixed or base station transmitting in the 1995-2000 MHz, 2110-2155 MHz, 2155-2180 MHz or 2180-2200 MHz band and located in any 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, is limited to:
- (ii) An EIRP of 3280 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.
- (2) The power of each fixed or base station transmitting in the 1995-2000 MHz, the 2110-2155 MHz 2155-2180 MHz band, or 2180-2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:
- (ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

ISED Requirements RSS-139 Section 5.5/SRSP-513 Section 6.1.2/SRSP-519 Section 6.1.2

SRSP-513 6.1.3 E.i.r.p. limits and antenna height limits for non-AAS systems

- 21. For fixed and base stations operating in the band 2110-2180 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 62 dBm/MHz (i.e. no more than 62 dBm e.i.r.p. in any 1 MHz band segment), with an antenna HAAT of up to
- 22. Fixed and base stations operating in the band 2110-2180 MHz and located in geographic areas at a distance greater than 26 km from large or medium population centers may increase their e.i.r.p. to a maximum of 65 dBm/MHz (i.e. no more than 65 dBm e.i.r.p. in any 1 MHz band segment), with an antenna HAAT of up to 300 m.
- SRSP-519 6.1.3 Radiated power and antenna height limits for base stations using non-AAS systems 22. For base stations operating in the bands 2000-2020 MHz and 2180-2200 MHz with an antenna HAAT of up to 300 m, the e.i.r.p. shall not exceed 62 dBm/MHz when transmitting with an emission bandwidth greater than 1 MHz.
- 23. Base stations located in geographic areas at a distance greater than 26 km from large or medium population centers may increase their e.i.r.p. to a maximum of 65 dBm when transmitting with an emission bandwidth of 1 MHz or less, and 65 dBm/MHz when transmitting with an emission bandwidth greater than 1 MHz, with an antenna HAAT of up to 300 m.

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							TbtTx 2022.05.02.0 XMit 2022	
	F: Airscale Base Transceiver Station Remote Radio Head Model AHFII				Work Order:			
	BL2235N41PG					03/03/2023		
	: Nokia of America Corporation				Temperature:			
	endees: John Rattanavong, David Le				Humidity:			
Project:					Barometric Pres.:			
	: Brandon Hobbs and Jarrod Brenden Power: 54 VDC				Job Site:	TX07		
TEST SPECIFICAT	ST SPECIFICATIONS Test Method							
FCC 27:2023			ANSI C63.26:2015					
RSS-139 Issue 4:20	022		ANSI C63.26:2015	5				
COMMENTS								
All measurment path losses were accounted for in the reference level offset including any attenuators, filters, and DC blocks. The NB IoT SA carriers are enabled at maximum power (20 watts/carrier). Power Spectral Density (PSD) was measured while transmitting one carrier on Port 1. The PSD for multiport (2x2 MIMO, 4x4 MIMO) operation was determined based upon ANSI C63.26 clause 6.4.3.2.4 (10 log Nout). The total PSD for two port operation is the single port power +3 dB [i.e. 10*log(2)]. The total PSD for four port operations is single port power +6 dB [i.e. 10*log(4)]. The NB IoT SA carrier power level was reduced from maximum power (20 watts/carrier) to meet the 62.15 and 62 dBm/MHz EIRP limits.								
DEVIATIONS FROM TEST STANDARD								
None								
None Configuration #	NOKI0054-2	Signature	2.1.	1				
	NOKI0054-2	Signature	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	
Configuration #	NOKI0054-2 - 2200 MHz, NB-IoT	Signature						
Configuration # Band 66 2110 MHz	- 2200 MHz, NB-IoT Port 1							
Configuration # Band 66 2110 MHz	- 2200 MHz, NB-IoT Port 1 200 KHz Ban	dwidth						
Configuration # Band 66 2110 MHz	- 2200 MHz, NB-IoT Port 1 200 KHz Ban	dwidth NTM Modulation	dBm/MHz	Factor (dB)	dBm/MHz==PSD	dBm/MHz==PSD	dBm/MHz==PSD	
Configuration # Band 66 2110 MHz	- 2200 MHz, NB-IoT Port 1 200 KHz Ban	dwidth NTM Modulation Low Channel 2110.2 MHz	dBm/MHz 42.185	Factor (dB)	dBm/MHz==PSD	dBm/MHz==PSD	dBm/MHz==PSD 48.2	
Configuration # Band 66 2110 MHz	- 2200 MHz, NB-IoT Port 1 200 KHz Ban	dwidth NTM Modulation Low Channel 2110.2 MHz Mid Channel 2155 MHz	dBm/MHz 42.185 42.217	Factor (dB) 0 0	42.2 42.2	dBm/MHz==PSD 45.2 45.2 45.2	48.2 48.2	
Configuration # Band 66 2110 MHz	- 2200 MHz, NB-IoT Port 1 200 KHz Ban	dwidth NTM Modulation Low Channel 2110.2 MHz Mid Channel 2155 MHz High Channel 2199.8 MH:	dBm/MHz 42.185	Factor (dB)	dBm/MHz==PSD	dBm/MHz==PSD	dBm/MHz==PSD 48.2	
Band 66 2110 MHz	- 2200 MHz, NB-IoT Port 1 200 KHz Ban - 2200 MHz, NB-IoT - Red Port 1 200 KHz Ban	dwidth NTM Modulation Low Channel 2110.2 MHz Mid Channel 2155 MHz High Channel 2199.8 MH: uced Power	dBm/MHz 42.185 42.217	Factor (dB) 0 0	42.2 42.2	dBm/MHz==PSD 45.2 45.2 45.2	48.2 48.2	
Band 66 2110 MHz	- 2200 MHz, NB-IoT Port 1 200 KHz Ban - 2200 MHz, NB-IoT - Red Port 1 200 KHz Ban	dwidth NTM Modulation Low Channel 2110.2 MHz Mid Channel 2155 MHz High Channel 2199.8 MH: uced Power	dBm/MHz 42.185 42.217	Factor (dB) 0 0	42.2 42.2	dBm/MHz==PSD 45.2 45.2 45.2	48.2 48.2	

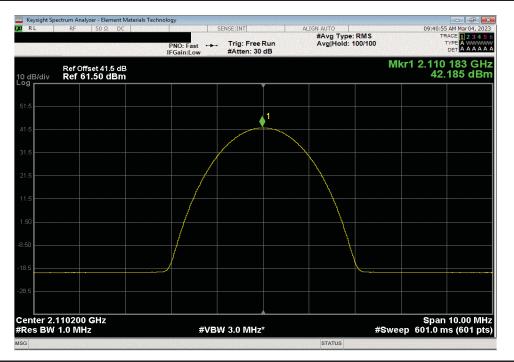
Report No. NOKI0054.0 193/197



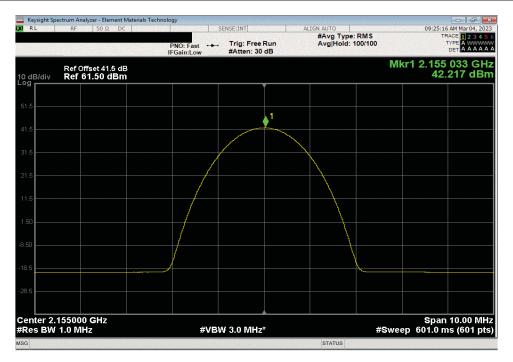
Band 66 2110 MHz - 2200 MHz, NB-IoT, Port 1, 200 KHz Bandwidth, NTM Modulation, Low Channel 2110.2 MHz
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz==PSD dBm/MHz==PSD dBm/MHz==PSD

42.185 0 42.185 45.185 48.185







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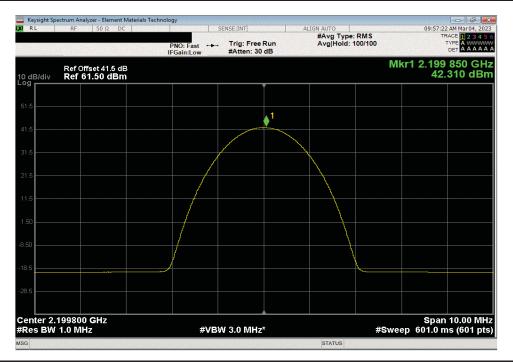


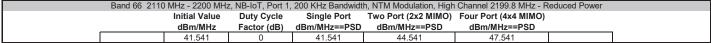
Band 66 2110 MHz - 2200 MHz, NB-IoT, Port 1, 200 KHz Bandwidth, NTM Modulation, High Channel 2199.8 MHz

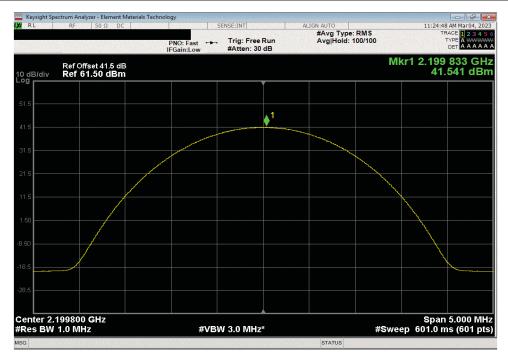
Initial Value Duty Cycle Single Port Two Port (2x2 MIMO) Four Port (4x4 MIMO)

dBm/MHz Factor (dB) dBm/MHz==PSD dBm/MHz==PSD dBm/MHz==PSD

42.31 0 42.31 45.31 48.31







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tTx 2022.05.02.0 XMit 2022.12.3

EIRP Calculations for Four Port MIMO Operations for Band 66 Single NB-IoT SA Carriers

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 Kathrein antenna assembly model "80011867". The maximum Band n66 gain (18.2dBi) for this antenna was used for the EIRP calculation. This anten na assembly has a pair of ±45° cross-polarized radiators used for Band n66. The four antenna RF inputs (used for Band n66) on the antenna assembly are as follows: Y1+ L5 (+45°), Y1- L6 (-45°), Y2+ R7 (+45°) and Y2- R8 (-45°). Four AHFII 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 and a typical loss of 1.0dB for this frequency range was used. EIRP was calculated as described in SRSP 513 clause 6.1.2 and SRSP 519 clause 6.1.2 "EIRP for non-AAS uncorrelated transmission". Calculations of worst-case EIRP for four port MIMO are as follows:

Parameter	NB IoT SA Carrier	NB IoT SA Carrier (Reduced Power)
Worst Case PSD/Antenna Port	42.3 dBm/MHz	41.5 dBm/MHz
Number of Ant Ports per Polarization	2	2
Total PSD per Polarization 10Log 2 = + 3dB	45.3 dBm/MHz	44.5 dBm/MHz
Cable Loss (1dB)	44.3 dBm/MHz	43.5 dBm/MHz
Dir Gain = Max Ant Gain (G _{Ant}) See Note 1	18.2 dBi	18.2 dBi
EIRP per Polarization	62.5 dBm/MHz	61.7 dBm/MHz
Number of Polarizations	2	2
EIRP Total = Y1 <u>+</u> 45° and Y2 <u>+</u> 45° See Note 2	62.5 dBm/MHz	61.7 dBm/MHz
Passing FCC EIRP Limit	65.16 dBm/MHz	62.15 & 65.16 dBm/MHz
Passing ISED EIRP Limit	65 dBm/MHz	62 & 65 dBm/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 AHFII Band 66 four port MIMO EIRP levels using antenna assembly model "80011867" are less than the FCC (65.16 dBm/MHz or 62.15 dBm/MHz) and ISED (65 dBm/MHz) EIRP Regulatory Limits.

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End of Test Report

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