

Bell Labs

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NVLAP LAB CODE: 100275-0

Title 47 Code of Federal Regulations Test Report

Regulation: FCC Part 2 and 27

Client: Nokia Solutions and Networks US LLC

Product Evaluated: AAHJ Small Band 60MHz 5G NR at 120W and 40MHz 5G NR 60W/LTE 60W

> Report Number: TR-2019-0166-FCC2-27

Date Issued: November 04, 2019

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Revisions

Date	Revision	Section	Change
11/04/2019	0		Initial Release

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1. System Information and Requirements

Report copies and other information not contained in this report are held by either the product engineer or in an identified file at the Global Product Compliance Laboratory in Murray-Hill, NJ.

Equipment Under Test (EUT):	AAHJ Small Band 40/60MHz			
FCC ID:	VBNAAHJ-01			
Serial Number:	See Section 1.3			
Hardware Version:	See Section 1.3			
Software Version:	FL19A			
Frequency Range:	2590 – 2690 MHz			
GPCL Project Number:	2019-0166			
Manufacturer:	NOKIA SOLUTIONS AND NETWORKS OY			
	KARAPORTTI 3, FI-02610 ESPOO			
	FINLAND			
Test Requirement(s):	Title 47 CFR Parts 2 and 27			
Test Standards:	Title 47 CFR Parts 2 and 27			
	KDB 971168 D01 Power Measurement License Digital Systems			
	v03r01 April 9, 2018.			
	KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013			
	• ANSI C63.26 (2015)			
	• ANSI C63.4 (2014)			
Measurement Procedure(s):	FCC-IC-OB - GPCL Occupied Bandwidth and Power Measurement			
	Test Procedure 12-4-2017			
	FCC-IC-SE - GPCL Spurious Emissions Test Procedure 12-4-2017			
Test Date(s):	September 2019			
Test Performed By:	Nokia			
	Global Product Compliance Laboratory			
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not contained in this report are held by either the product engineer or in an identified file at the Global				
Product Compliance Laboratory in	Product Compliance Laboratory in New Providence, NJ.			

1.1 Introduction

This Conformity test report applies to the AAHJ Small Band 40MHz/60MHz, hereinafter referred to as the Equipment Under Test (EUT).

1.2 Purpose and Scope

The purpose of this testing is to demonstrate compliance for the 60MHz and 40MHz 5G-NR Carrier. A Class II Permissive Change will be submitted to add the 40M0G7W and 60M0G7W emission designators at 120 W to the existing Grant for FCC ID: VBNAAHJ-01.

The product may operate with a 40 MHz 32T32R 5g-NR Carrier (1.875 W/port or 60 W) along with 32T32R LTE (1.875 W/port or 60 W), or 60MHz Carrier 64T64R 5g-NR (1.875 W per port or 120W).

The report documents testing data required for qualifying the EUT in compliance with FCC Parts 2 and 27 measured in accordance with the procedures set out in Section 2.1033 (c) (14) of the Rules.

1.3 EUT Details

The Nokia AirScale AAHJ mMIMO Radio Head is a 64 port radio head over the Band 41 spectrum of 2590 - 2690 MHz. Each of the 64 transmit ports generates 32.73dBm/1.875W for a total of 120W.

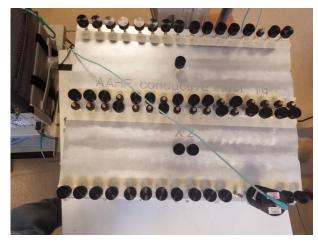
Nokia's AirScale massive MIMO Adaptive Antenna deploys 64 transmit and 64 receive streams,16-layer Massive MIMO, and Carrier Aggregation with broad range of customized variants to deliver up to five times more network capacity, high peak downlink throughput, significantly improved uplink, and greater coverage.

Specification Items	Description	
Radio Access Technology	E-UTRA	
Duplex Mode	Frequency Division Duplex (FDD)	
Modulation Type(s)	QPSK, 16QAM, 64QAM, 256QAM	
Operation Frequency Range	2590-2690MHz	
Channel Bandwidth	5, 10, 15, 20, 40 and 60MHz	
Supply Voltage	-48.0 VDC	
Number of Antenna Ports	64Tx/64Rx	
MiMo	Yes	

Global Product Compliance Laboratory

Report No: TR-2019-0166-FCC2-27 Product: AAHJ Small Band 40/60 MHz





1.4 Test Requirements

Each required measurement is listed below:

47 CFR FCC Sections	Description of Tests	Test Required
2.1046, 27.53	2.1046, 27.53 RF Power Output	
2.1047, 27.53	2.1047, 27.53 Modulation Characteristics	
2.1049, 27.53	(a) Occupied Bandwidth	Yes
	(b) Out-of-Band Emissions	
2.1051, 27.53	Spurious Emissions at Antenna Terminals	Yes
2.1053, 27.53	Field Strength of Spurious Radiation	Yes

1.5 Standards & Procedures

1.5.1 Standards

- Title 47 Code of Federal Regulations, Federal Communications Commission Part 2.
- Title 47 Code of Federal Regulations, Federal Communications Commission Part 27.
- ANSI C63.26, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

1.5.2 Procedures

- 1. FCC-IC-OB and FCC-IC-SE
- ANSI C63.4 (2014) entitled: "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz", American National Standards Institute, Institute of Electrical and Electronic Engineers, Inc., New York, NY 10017-2394, USA.
- 3. FCC KDB 971168 D01 Power Measurement License Digital Systems v03r01 April 9, 2018. FCC KDB 662911 D01 Multiple Transmitter Output v02r01 Oct 2013

1.5.3 MEASUREMENT UNCERTAINTY

The results of the calculations to estimate uncertainties for the several test methods and standards are shown in the Table below. These are the worst-case values.

worst-case Estimated Pleasurement oncertainties				
Standard, Method or Procedure		Condition	Frequency MHz	Expanded Uncertainty (k=2)
a.	Classical Emissions, (<i>e.g.</i> , ANSI C63.4, CISPR 11, 14, 22, <i>etc.</i> , using ESHS 30,		0.009 - 30	±3.5 dB
		Radiated Emissions	30 MHz – 200MHz H	±5.1 dB
		(AR-6 Semi-Anechoic	30 MHz – 200 MHz V	±5.1 dB
		Chamber)	200 MHz – 1000 MHz H	±4.7 dB
			200 MHz – 1000 MHz V	±4.7 dB
			1 GHz - 18 GHz	±3.3 dB

Worst-Case Estimated Measurement Uncertainties

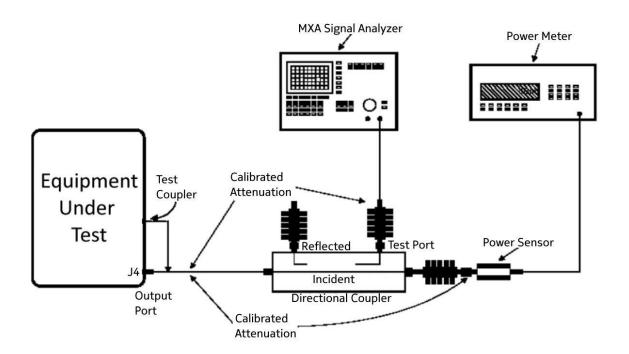
Antenna Port Test	Signal Bandwidth	Frequency Range	Expanded Uncertainty (k=2), Amplitude
	10 Hz	9 kHz to 20 MHz	
Occupied Bandwidth, Edge of Band,	100 Hz	20 MHz to 1 GHz	1.78 dB
Conducted Spurious Emissions	10 kHz to 1 MHz	1 GHz to 10 GHz	1.70 UD
	1MHz	10 GHz to 40 GHz:	
RF Power	10 Hz to 20 MHz	50 MHz to 18 GHz	0.5 dB

1.6 Executive Summary

Requirement	Description	Result
47 CFR FCC Parts 2 and 27		
2.1046, 27.53	RF Power Output	COMPLIES
2.1047, 27.53	Modulation Characteristics	COMPLIES
2.1049, 27.53	(a) Occupied Bandwidth	COMPLIES
	(b) Edge of Band Emissions	
2.1051, 27.53	Spurious Emissions at Antenna	COMPLIES
	Terminals	
2.1053, 27.53	Field Strength of Spurious Radiation	COMPLIES

- 1. **COMPLIES -** Passed all applicable tests.
- 2. N/A Not Applicable.
- 3. **NT –** Not Tested.

1.7 Test Configuration for all Antenna Port Measurements.



2. FCC Section 2.1046 - RF Power Output

2.1 RF Power Output

This test is a measurement of the total RF power level transmitted at the antenna-transmitting terminal. The product was configured for test as shown in section above and allowed to warm up and stabilize per KDB 971168 D01 and ANSI C63.26.

Power measurements were made with an MXA Signal Analyzer.

Tabular Data – Channel RF Fower, 60MHz BW				
Modulation	Channel Power			
	dBm			
256QAM	32.82			
QPSK+16QAM	33.00			
64QAM	32.82			
	Modulation 256QAM QPSK+16QAM			

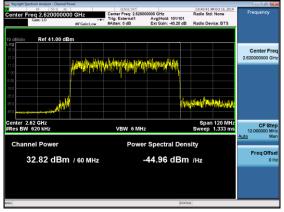
Tabular Data –	Channel RF Power,	60MHz BW
	Channel KF FOwer,	

Channel Frequency	Modulation	Channel Power		
MHz		dBm		
2610	256QAM	33.02		
2640	QPSK+16QAM	32.86		
2670	64QAM	32.74		

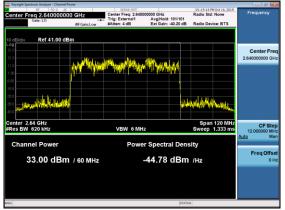
Tabular Data – Channel RF Power, 40MHz BW

2.1.1 Channel RF Power - Plots.

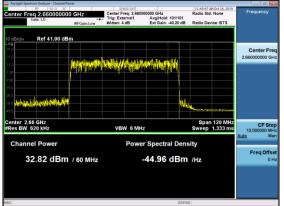




Ch Power, QPSK+16QAM, 60MHz BW, 2640MHz, TX1



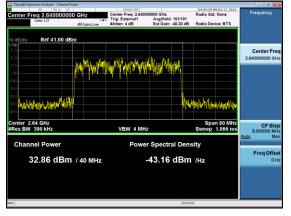
Ch Power, 64QAM, 60MHz BW, 2660MHz, TX1

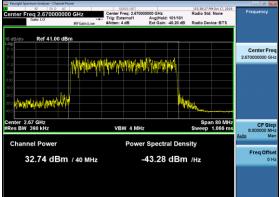




Ch Power, 256QAM, 40MHz BW, 2610MHz, TX1

Ch Power, QPSK+16QAM, 40MHz BW, 2640MHz, TX1





Ch Power, 64QAM, 40MHz BW, 2670MHz, TX1

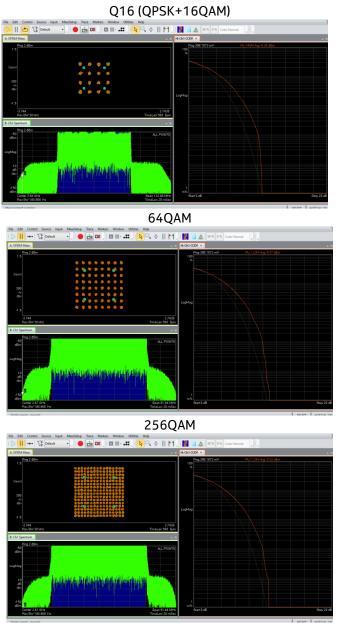
3. FCC Section 2.1047 - Modulation Characteristics

3.1 Modulation Characteristics

The RF signal at the antenna port was demodulated and verified for correctness of the modulation signal used before each test was performed. For these products the operation with QPSK, 16QAM, 64QAM and 256QAM modulation was evaluated and verified to demonstrate proper operation before testing.

3.1.1 Modulation Characteristics – Plots.

NOTE: Only a sample of the plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.



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4. FCC Section 2.1049 – Occupied Bandwidth/Edge of Band Emissions

4.1 Occupied Bandwidth

In 47CFR 2.1049 the FCC requires:

"The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable."

This required measurement is the 99% Occupied Bandwidth, also called the designated signal bandwidth and needs to be within the parameters of the products specified emissions designator. During these measurements it is customary to evaluate the Edge of Band emissions at block/band edges.

The transmitted signal occupied bandwidth was measured using a Keysight MXA Signal Analyzer. All emissions were within the parameters as required.

Id	rabular Data – Occupied Bandwidth, oomne Bw				
Chann	el Frequency	Modulation	Occupied BW		
	MHz		MHz		
	2620	256QAM	57.687		
	2640	QPSK+16QAM	57.727		
	2660	64QAM	57.858		

Tabular Data – Occupied Bandwidth, 60MHz BW

Tabular Data – Occupied Bandwidth, 40MHz BW

Channel Frequency MHz	Modulation	Occupied BW MHz
2610	256QAM	37.726
2640	QPSK+16QAM	37.486
2670	64QAM	37.816

4.1.1 Occupied Bandwidth – Plots.

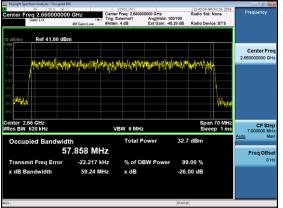
OBW, 256QAM, 60MHz BW, 2	2620MHz, TX1
--------------------------	--------------

Keysight Spectrum Analyzer - Occup		SENSE:INT		10:41:08 AM Oct 16, 2019	
Gate: LO	#FGain:Low	Center Freq: 2.62000	00000 GHz Avg Hold: 100/100 Ext Gain: -40.20 dB	Radio Std: None Radio Device: BTS	Attenuation Mech Atter
dB/div Ref 41.00		Printin 400	Ext Gall. 40.10 GD	Radio Device. DTS	4 de
9 0					
- And And And	homest of the other the state	rikhindarijates)und	hingeling in the state	ngthallight they have	
<u>mini</u>				- WIN	Adjust Atter for Min Cli
nter 2.62 GHz es BW 620 kHz		VBW 6 MHz	:	Span 70 MHz Sweep 1 ms	
Occupied Bandw	vidth 57.687 MI	Total F 1 Z	ower 32.	6 dBm	Mech Atten Ster
Transmit Freq Erro				9.00 %	2 dB 10 dE
x dB Bandwidth	59.48 N	IHz xdB	-26	.00 dB	
File <obw 1a<="" td="" tm3=""><td>1C 60MBW/ 2620 T</td><td>¥1, 2620 ppg3 eaued</td><td>STAT</td><td>16</td><td></td></obw>	1C 60MBW/ 2620 T	¥1, 2620 ppg3 eaued	STAT	16	

OBW, QPSK+16QAM, 60MHz BW, 2640MHz, TX1

Keysight Spectrum Analyzer - Occupied	18W	SENSE:INT		01:12:34 PM Oc		0 4 0
Gate: LO	#FGain:Low	stessenni enter Freq: 2.640000 ig: External1 ttten: 4 dB	000 GHz Avg Hold: 100/100 Ext Gain: -40.20 dB	Radio Std: No Radio Device:	ne Fre	quency
10 dB/div Ref 41.00 dB 31.0 2.0 10.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0	am Ny Alburt Martin	ppidip ^{isi} nterpp	nof appropriate the second	ngelekpergent		enter Freq 000000 GHz
490 Center 2.64 GHz #Res BW 620 kHz		VBW 6 MHz	22.0	Span 7 Sweep		CF Step 000000 MHz Man
Occupied Bandwid f Transmit Freq Error x dB Bandwidth	dth 5 7.727 MHz 365.15 kHz 59.30 MHz	% of OB	W Power 99	9 dBm 9.00 % 00 dB	F	ireq Offset 0 Hz
MSG			STATU	s		

OBW, 64QAM, 60MHz BW, 2660MHz, TX1



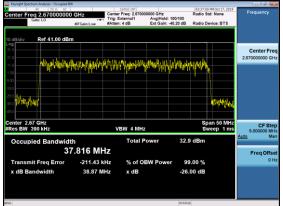
OBW, 256QAM, 40MHz BW, 2610MHz, TX1

a Keysight Spectrum Analyzer - Occupie	ed 8W				🗗 🛋
RF 50 Ω A	c	SENSE:INT Center Freg: 2.6100		04:31:18 PM Oct 17, 2019 Radio Std: None	Frequency
Center Freq 2.610000	00 GHZ	Trig: External1	AvgiHold: 100/100	Radio Sta: None	
Gale: LO	#FGain:Low	Atten: 4 dB	Ext Gain: -40.20 dB	Radio Device: BTS	
	-				
10 dB/div Ref 41.00 d	BM				
31.0					Center Freq
21.0					2.61000000 GHz
a the set of the set o	and desided a later	to dia dia dia 1	Automatical Contraction	h and h dis	2.51000000 GHZ
11.0	THOMAS TO P	THE PROPERTY OF THE	ALC: NO WARK WARKS	NY Y YR	
1.00					
9.00				• • •	
-19.0					
29.0					
and a state				ي المعنا ا	
39.0				14996 1910	
-49.0					
Center 2.61 GHz				Span 50 MHz	CF Step
#Res BW 390 kHz		VBW 4 MH	z	Sweep 1 ms	0.000000 WH2
O		Total F	201007 22	8 dBm	Auto Man
Occupied Bandwi			-Ower 52.	o ubili	
	37.726 MH	Z			Freg Offset
					0 Hz
Transmit Freq Error	38.175 kH	z % of O	BW Power 99	9.00 %	0112
x dB Bandwidth	39.01 MH	z xdB	-26	.00 dB	
	00.01 1111		-20		
MSG			STATU	IS	

OBW, QPSK+16QAM, 40MHz BW, 2640MHz, TX1



OBW, 64QAM, 40MHz BW, 2670MHz, TX1



4.2 Edge of band Emissions

The Edge of Band emissions of the EUT at the external antenna connector (EAC) were measured using a Keysight MXA Signal Analyzer. The RF power level was continuously measured using a RF broadband power meter. The RF output from the EAC port to spectrum analyzer was reduced (to an amplitude usable by the spectrum analyzer) by using a calibrated attenuator and test coupler. The path attenuation was offset on the display and the signal for single carrier was adjusted to the corrected RF power level for the resolution bandwidth used for the transmit signal. All mask values were adjusted based upon the designated signal bandwidth and measurement bandwidths. The Top of Mask corresponds to the set rated power level as confirmed by the RF power meter.

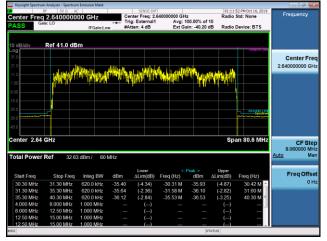
4.2.1 Edge of Band Emissions - Plots.

All of the measurements met the requirements of Part 27.53 when measured per Part 2.1049.

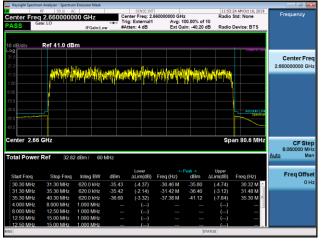
OOBE, 256QAM, 60MHz BW, 2620MHz, TX1

	RF 50 Ω A		Ca	SENSE: INT	520000000 GHz			13 AM Oct 16, 2019 Std: None	Frequency
	2.6200000 ite: LO	IFGain:Lo	Tri	g: External1 tten: 4 dB	Avg: 1	00.00% of 10 in: -40.20 dB		Device: BTS	
) d <u>B/div</u>	Ref 41.0 dB	\$m							
ng								Read / e Last	Center Fred
10									2.62000000 GHz
1.0	as lately.	Natablita	AL MARKA	and Weight	an i a stàthain	(Alan United)	i la la di		2.02000000 0112
	Hall with the	1 And the second second	- The second	Allocate Sales of	n de la desta de la desta En la desta de l	a s Markadda	ultude (A)		
00									
9.0									
9.0								Absolute Lind	
9.0								specirus	
9.0									
enter 2.62	GHZ						sp	an 80.6 MHz	CF Step
otal Power	Ref 32.7	2 dBm / 60	MHz						8.060000 MHz Auto Mar
	Ref 32.7	2 dBm / 60	MHz	Lower	<.	Peak →	Upper		<u>Auto</u> Mar
	Ref 32.7	2 dBm / 60 Integ BW	MHz dBm	Lower ∆Lim(dB)	<- F Freq (Hz)		Upper Lim(dB)	Freq (Hz)	Auto Mar Freq Offset
otal Power Start Freq 30.30 MHz	Stop Freq 31.30 MHz	Integ BW 620.0 kHz	dBm -36.76	ΔLim(dB) (-5.70)	Freq (Hz) -30.44 M	dBm ∆ -37.00	Lim(dB) (-5.94)	31.12 M 🗠	<u>Auto</u> Mar
otal Power Start Freq 30.30 MHz 31.30 MHz	Stop Freq 31.30 MHz 35.30 MHz	Integ BW 620.0 kHz 620.0 kHz	dBm -36.76 -36.97	ΔLim(dB) (-5.70) (-3.69)	Freq (Hz) -30.44 M -31.32 M	dBm ∆ -37.00 -37.72	Lim(dB) (-5.94) (-4.44)	31.12 M ^ 31.34 M	Auto Mar Freq Offse
otal Power Start Freq 30.30 MHz 31.30 MHz 35.30 MHz	Stop Freq 31.30 MHz 35.30 MHz 40.30 MHz	Integ BW 620.0 kHz 620.0 kHz 620.0 kHz	dBm -36.76	ΔLim(dB) (-5.70) (-3.69) (-7.92)	Freq (Hz) -30.44 M	dBm ∆ -37.00	Lim(dB) (-5.94)	31.12 M 🗠	Auto Mar Freq Offse
otal Power Start Freq 30.30 MHz 31.30 MHz 35.30 MHz 4.000 MHz	Stop Freq 31.30 MHz 35.30 MHz 40.30 MHz 8.000 MHz	Integ BW 620.0 kHz 620.0 kHz 620.0 kHz 620.0 kHz 1.000 MHz	dBm -36.76 -36.97 -41.20	ΔLim(dB) (-5.70) (-3.69) (-7.92) ()	Freq (Hz) -30.44 M -31.32 M	dBm ∆ -37.00 -37.72	Lim(dB) (-5.94) (-4.44) (-4.72) ()	31.12 M ^ 31.34 M	Auto Mar Freq Offse
otal Power Start Freq 30.30 MHz 31.30 MHz 35.30 MHz 4.000 MHz 8.000 MHz	Stop Freq 31.30 MHz 35.30 MHz 40.30 MHz 8.000 MHz 12.50 MHz	Integ BW 620.0 kHz 620.0 kHz 620.0 kHz 1.000 MHz 1.000 MHz	dBm -36.76 -36.97 -41.20 	ΔLim(dB) (-5.70) (-3.69) (-7.92) () ()	Freq (Hz) -30.44 M -31.32 M	dBm ∆ -37.00 -37.72 -38.00 	Lim(dB) (-5.94) (-4.44) (-4.72) () ()	31.12 M ^ 31.34 M	Auto Mar Freq Offse
Start Freq 30.30 MHz 31.30 MHz 35.30 MHz 4.000 MHz	Stop Freq 31.30 MHz 35.30 MHz 40.30 MHz 8.000 MHz	Integ BW 620.0 kHz 620.0 kHz 620.0 kHz 620.0 kHz 1.000 MHz	dBm -36.76 -36.97 -41.20	ΔLim(dB) (-5.70) (-3.69) (-7.92) ()	Freq (Hz) -30.44 M -31.32 M	dBm ∆ -37.00 -37.72 -38.00	Lim(dB) (-5.94) (-4.44) (-4.72) ()	31.12 M ^ 31.34 M	Auto Mar Freq Offse

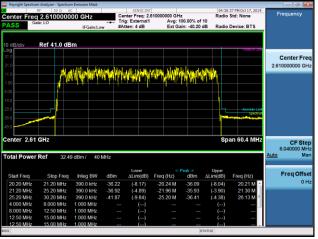
OOBE, QPSK+16QAM, 60MHz BW, 2640MHz, TX1



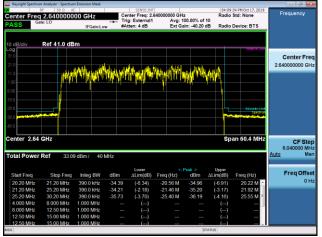
OOBE, 64QAM, 60MHz BW, 2660MHz, TX1



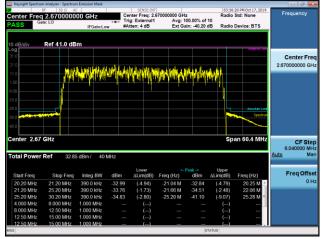
OOBE, 256QAM, 40MHz BW, 2610MHz, TX1



OOBE, QPSK+16QAM, 40MHz BW, 2640MHz, TX1



OOBE, 64QAM, 40MHz BW, 2670MHz, TX1



5. FCC Section 2.1051 - Spurious Emissions at Transmit Antenna Port

5.1 Measurement of Spurious Emissions at Transmit Antenna Port

Spurious Emissions at the transmit-antenna terminals were investigated over the frequency range of 10 MHz to beyond the 10th harmonic of the specific transmit band. For this band of operation, the measurements were performed up to 27GHz. Measurements were made using a Keysight MXA Signal Analyzer. The RF output from the transmitter was reduced (to an amplitude usable by the receivers) using calibrated attenuators. The RF power level was continuously monitored via a coupled RF Power Meter.

The required emission limitation is specified as appropriate in 27.53. The measured spurious emission levels were plotted for the frequency range as specified in 2.1057. There were no reportable emissions. Data below documents performance up to 27 GHz.

Note: The limit is set to -31 dBm, which is 18 dBm below the -13 dBm limit due to the 64X mMIMO based on 10 log (64) for mMIMO.

5.1.1 Spurious Emissions at Tx Port - Plots

NOTE: Only a sample of the plots are used in this report. The full suite of raw data resides at the MH, New Jersey location.

enter F ASS		50 Ω▲0C 0000000 GHz IEGain:	Center Fr Trig: Exte		0000 GHz Avg Hold:>28 Ext Gain: -39	Radio Sto		Frequency
dB/div	Ref -1	II-Gain:	Low #Atten: 4	65	Ext Gain: -39.	523	.26 MHz 55 dBm	
								Center Free
.0								2.64000000 GHz
.0				1				
0					************		***	
10								
art 10	MHZ					5	top 1 GHz	CF Step 12.00000 MH
Spur	Range	Frequency	Amplitude		Limit	∆ Limit		<u>Auto</u> Mar
1	1	523.3 MHz	-47.94 dBm	-	31.06 dBm	-16.88 dB	<u>^</u>	
2		941.5 MHz	-48.32 dBm		31.06 dBm	-17.26 dB		Freq Offset
3	1	937.0 MHz	-48.83 dBm		31.06 dBm	-17.77 dB		0 Ha
4	1	853.9 MHz	-49.55 dBm		31.06 dBm	-18.49 dB		
5 6	1	993.5 MHz 595.8 MHz	-49.80 dBm -49.84 dBm		31.06 dBm 31.06 dBm	-18.74 dB -18.78 dB		
7	1	984.0 MHz	-49.84 dBm		31.06 dBm	-18.85 dB		
							•	
File	<spurious 1<="" td=""><td>FM3 2 1C 60MBV</td><td>2640 TX1 10 te</td><td>1000.png</td><td>1> saved</td><td>STATUS / DC Co</td><td>upled</td><td></td></spurious>	FM3 2 1C 60MBV	2640 TX1 10 te	1000.png	1> saved	STATUS / DC Co	upled	

Spurious, QPSK+16QAM, 60MHz BW, 2640MHz, TX1

	RF	- Spurious Emissions		ie:INT		M Oct 16, 2019	equency
enter F ASS	Gate: LO	0000000 GHz IFGain	Trig: Exter			. None	
d <u>B/div</u>	Ref 0	.00 dBm				916 GHz 39 dBm	
							enter Fro
	~~~~	1 Մուսույնություն		- - 	᠕ᡶᢧᡯ᠆ᠬ᠆ᠬ	للالمند	
0							
art 2.5	9 GHz				Sto	p 2.6 GHz	CF St
Spur	Range	Frequency	Amplitude	Limit	∆ Limit	12 Auto	.000000 Mi M
1	1	2.592 GHz	-38.28 dBm	-35.04 dBm	-3.242 dB		
2		2.598 GHz	-38.58 dBm	-35.04 dBm	-3.537 dB	F	req Offs
3		2.600 GHz	-39.42 dBm	-35.04 dBm	-4.384 dB		0
4		2.596 GHz	-39.87 dBm	-35.04 dBm	-4.831 dB		
5		2.594 GHz	-39.96 dBm	-35.04 dBm	-4.919 dB		
6		2.593 GHz	-40.51 dBm	-35.04 dBm	-5.471 dB		
7	1	2.593 GHz	-41.02 dBm	-35.04 dBm	-5.981 dB		

MSG JFile <Spurious_TM3_2_1C_60MBW_2640_TX1_2590_to_2600.png> saved STATL

enter F ASS		50 Q AC   0000000 GHz IFGain:	Trig: Externa	2.640000000 GHz		Frequency
) dB/div	Ref 0.	.00 dBm			2.6900 ( -32.640 d	
						Center Free 2.640000000 GH
	~~~~~					
1.0 1.0						
1.0						
art 2.6	9 GHz				Stop 10	12.000000 MH
Spur	Range	Frequency	Amplitude	Limit	Δ Limit	Auto Mar
1		2.690 GHz	-32.25 dBm	-31.06 dBm	-1.185 dB	Freq Offse
2	1	6.426 GHz	-43.48 dBm	-31.06 dBm	-12.42 dB	OH
3	1 1	5.900 GHz 5.823 GHz	-44.04 dBm -44.43 dBm	-31.06 dBm -31.06 dBm	-12.98 dB -13.37 dB	-
4 5	1	5.823 GHZ 3.135 GHZ	-44.43 dBm -44.58 dBm	-31.06 dBm -31.06 dBm	-13.37 dB -13.52 dB	
6	1	5.833 GHz	-44.63 dBm	-31.06 dBm	-13.57 dB	
7	1	4.807 GHz	-44.69 dBm	-31.06 dBm	-13.63 dB	-

nter F		50 Q AC 0000000 GHz IFGai	n:Low	Center Free Trig: Extern #Atten: 4 db	q: 2.640000 nal1	000 GHz Avg Hold: Ext Gain:		Radio Std		Frequency
dB/div	Ref 0	.00 dBm							70 GHz 27 dBm	
									1	Center Fi 2:640000000 0
art i G	nz							atop	2.59 GH2	CF SI 12.000000 M
Spur	Range	Frequency	Am	plitude		Limit	4	Limit		Auto N
		2.587 GHz		28 dBm		1.06 dBr		217 dB	<u></u>	Eren Off
2	1	2.488 GHz		55 dBm		1.06 dBr		5.49 dB		Freq Off
3	1	2.555 GHz		64 dBm		1.06 dBr		5.58 dB	=	
4	1	2.514 GHz		77 dBm		1.06 dBr		5.71 dB		
5	1	2.448 GHz		14 dBm		1.06 dBr		6.08 dB		
6 7	1	2.341 GHz		24 dBm		1.06 dBr		6.18 dB		
1	1	2.545 GHz	-47.	36 dBm	-3	1.06 dBr	n -1	6.30 dB	-	

	reg 2.640	- Spurious Emissions 80 Ω AC 0000000 GHz	Center Freq: Trig: Extern	2.640000000 GHz	Radio Std	M Oct 16, 2019 : None	Frequency
SS	Gate: LO	IFGain:				ice: BTS	
dB/div	Ref 0.	00 dBm				75 GHz 65 dBm	
							Center Fre 2.640000000 GF
	ᠾ᠆᠆᠆᠆᠆			، مىرىمى مىرىما	↓ ¹ ∫ ¹ ~~ ¹ ~~/~/~/	᠆ᠾ᠆᠋᠘	
	8 GHz				Stop	2.69 GHz	CF Ste
Spur	Range	Frequency	Amplitude	Limit	∆ Limit		Auto M
1	1	2.688 GHz	-37.31 dBm	-35.04 dBm	-2.266 dB	<u>_</u>	
2		2.683 GHz	-38.81 dBm	-35.04 dBm	-3.771 dB		Freq Offs
3		2.689 GHz	-38.91 dBm	-35.04 dBm	-3.870 dB		01
4		2.686 GHz	-38.96 dBm	-35.04 dBm	-3.920 dB		
5	1	2.682 GHz	-39.22 dBm	-35.04 dBm	-4.183 dB		
6		2.680 GHz	-39.68 dBm	-35.04 dBm	-4.635 dB		
7	1	2.684 GHz	-39.78 dBm	-35.04 dBm	-4.744 dB		

so VFile <Spurious_TM3_2_1C_60MBW_2640_TX1_2680_to_2690.png> saved



Global Product Compliance Laboratory

Report No: TR-2019-0166-FCC2-27 Product: AAHJ Small Band 40/60 MHz

Global Product Compliance Laboratory

Report No: TR-2019-0166-FCC2-27 Product: AAHJ Small Band 40/60 MHz

Spurious, 256QAM, 40MHz BW, 2610MHz, TX1

enter F ASS		© Ω ▲ DC 0000000 GHz IFGain:	Trig: External	.610000000 GHz	04:33:32 PM Oct 17, 201 Radio Std: None 8 0 dB Radio Device: BTS	Frequency
) dB/div	Ref -1	0.00 dBm			46.518 MH -51.274 dBn	
						Center Freq 2.61000000 GHz
00						
art 10	MHz				Stop 1 GH:	5.000000 MHz
Spur	Range	Frequency	Amplitude	Limit	∆ Limit	Auto Man
1	1	46.52 MHz	-51.27 dBm	-28.06 dBm	-23.21 dB	Freq Offset 0 Hz

enter F ASS	RF 50 Ω AC ter Freq 2.610000000 GHz Gate: L0 IFGain:L0		Center Freq: 2 Trig: External	Center Freq: 2.6100000 GHz Trig: External1 Avg Hold: 25/25 #Atten: 4 dB Ext Gain: -40.20 dB		S
) dB/div ∘g	Ref 0	.00 dBm			2.6420 G -35.375 di	
						Center Free 2.61000000 GHz
- X	Խմուներ	wyhannyhay	\sim	amharther and	Mar Marian	-L.0
1.0 1.0						
0.0						
tart 2.6	4 GHz				Stop 2.69 0	5.000000 MH
Spur	Range	Frequency	Amplitude	Limit	Δ Limit	Auto Mar
1	1	2.642 GHz	-35.37 dBm	-32.04 dBm	-3.335 dB	×
		2.641 GHz	-37.03 dBm	-32.04 dBm	-4.988 dB	Freq Offse
2		2.644 GHz	-38.97 dBm	-32.04 dBm	-6.930 dB	= 0 H:
3	1					
3 4	1	2.659 GHz	-39.27 dBm	-32.04 dBm	-7.231 dB	
3 4 5	1 1	2.659 GHz 2.650 GHz	-39.30 dBm	-32.04 dBm	-7.256 dB	
3 4	1	2.659 GHz				-



RF 50 Ω AC enter Freq 2.610000000 GHz Gate: L0 IFGain:Low			Center Fr Trig: Exte	SENSE:INT Center Freq: 2.610000000 GHz Trig: External1 Avg Hold: 25/25 #Atten: 4 dB Ext Gain: -42.20 dB		Radio Std: None Radio Device: BTS		Frequency	
0 dB/div	Ref 0.	.00 dBm					35 GHz 53 dBm		
0.0 0.0								Center Free 2.610000000 GH	
	~								
1.0 1.0									
0.0									
tart 2.6	9 GHz					Sto	p 10 GHz	CF Ste 5.000000 MH Auto Ma	
Spur	Range	Frequency	Amplitude	Limit	Δ	Limit		Hato Ma	
1		2.694 GHz	-41.15 dBm	-32.06 dB	m -9.0	93 dB		Freq Offse 0 H	

Photographs



Report No: TR-2019-0166-FCC2-27 Product: AAHJ Small Band 40/60 MHz

Test Equipment

Asset ID	Manufacturer	Туре	Description	Model	Serial	Calibration Date	Calibration Due	Calibration Type	Status
E831	Agilent Technologies	MXA Signal Analyzer	20Hz-26.5GHz	N9020A	MY48011791	2018-02-15	2020-02-15	Requires Calibration	Active
E896	Agilent Technologies	Network Analyzer	10 MHz - 40 GHz	N5230C	MY49000897	2019-01-31	2021-01-31	Requires Calibration	Active
E1235	RLC Electronics Inc	High Pass Filter	High Pass filter 5GHz to 26GHz	F-19413	1446-006			Calibration Not Required, Must Be Verified	Active
E1155	Weinschel	Attenuator	10dB 25Watt 0.05GHz - 26GHz	74-10-12	1068			Calibration Not Required, Must Be Verified	Active
E1120	Extech	Data Logger	Pressure Humidity Temp Data Logger	SD700	Q673552	2019-01-16	2021-01-16	Requires Calibration	Active
E1154	Weinschel	Attenuator	30dB 25W 0.05GHz-26GHz	74-30-12	1065			Calibration Not Required, Must Be Verified	Active

Environmental Conditions: RH= 43.1%, Temp=24°C, Pressure=1006.5hPa

6. FCC Section 2.1053 - Field strength of spurious radiation.

6.1 Section 2.1053 Field Strength of Spurious Emissions

Field strength measurements of radiated spurious emissions were made in an FCC registered 3m Semi-Anechoic Chamber which is maintained by Nokia Bell Labs in Murray Hill, New Jersey. A complete description and full measurement data for the site is on file with the Commission (Site Registration Number: 515091).

The spectrum from 30 MHz to beyond the tenth harmonic of the carrier, 26 GHz, was searched for spurious radiation. Measurements were made using both horizontally and vertically polarized broadband antennas. Per FCC regulations, the comparison of out of band spurious emissions directly to the limit is appropriately made using the substitution method. However, when the emissions are more than 20 dB below the specification limit, the use of field strength measurements for compliance determination is acceptable and those emissions are considered not reportable (Section 2.1053 and the FCC Interpretive database for 2.1053). For this case the evaluation of acceptable radiated field strength is as follows.

6.2 Field Strength of Spurious Emissions - Limits

Sections 2.1053 and 27.53 contain the requirements for the levels of spurious radiation as a function of the level of the unmodulated carrier. The reference level for the unmodulated carrier is calculated as the field produced by an ideal dipole excited by the transmitter output power according to the following relation taken from Reference Data for Radio Engineers, page 676, 4th edition, IT&T Corp.

E= [(30*P)^{1/2}]/R

 $20 \log (E^{*}10^{6}) - (43 + 10 \log P) = 82.23 dB\mu V/meter$

Where:

E = Field Intensity in Volts/meter P = Transmitted Power in Watts

R = Measurement distance in meters = 3 m

The Part 27 Limit is 82.23 dBuV/m at 3m and 91.77 dBuV/m at 1m The Part 27 non-report level is 62.23 dBuV/m at 3m.

The calculated emission levels were found by:

Measured level (dB μ V) + Cable Loss(dB)+Antenna Factor(dB) = Field Strength (dB μ V/m)

RESULTS:

For compliance with 47CFR Parts 2 and 27, the field strength of any spurious radiation, measured at 3m, is required to be less than 82.23 dB μ V/meter (82.23 @ 3m). Emissions equal to or less than 62.23 dB μ V/meter at 3m are not reportable and may be verified using field strength measurements and broadband antennas. Over the out of band spectrum investigated from 30 MHz to beyond the tenth harmonic of the carrier (up to 26GHz), no reportable spurious emissions were detected.

7. NVLAP Certificate of Accreditation

