



Product Service

**Choose certainty.
Add value.**

Report On

Radio Testing of the
Nokia Solutions and Networks Oy
AirScale Base Station RRH 1.9GHz
Radio Access technology: E-UTRA (FDD)
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24

COMMERCIAL-IN-CONFIDENCE

FCC ID: VBNAHFB-01

Document 75938943 Report 01 Issue 1

May 2017



Product Service

TÜV SÜD Product Service, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuv-sud.co.uk

COMMERCIAL-IN-CONFIDENCE

REPORT ON

Radio Testing of the
Nokia Solutions and Networks Oy
AirScale Base Station RRH 1.9GHz
Radio Access technology: E-UTRA (FDD)
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24

Document 75938943 Report 01 Issue 1

May 2017

PREPARED FOR

Nokia Solutions and Networks Oy
PO Box 319
Kaapelitie 4
FI-90620
Oulu
Finland

PREPARED BY

A handwritten signature in black ink, appearing to read 'N. Bennett', written over a horizontal line.

Natalie Bennett
Senior Administrator, Project Support

APPROVED BY

A handwritten signature in black ink, appearing to read 'Nic Forsyth', written over a horizontal line.

Nic Forsyth
Authorised Signatory

DATED

10 May 2017



Product Service

CONTENTS

Section	Page No
1 REPORT SUMMARY	3
1.1 Introduction	4
2 DISCLAIMERS AND COPYRIGHT	5
2.1 Disclaimers and Copyright.....	6
ANNEX A Nokia Solutions and Networks OY Test Report No: D547351042	A.2



Product Service

SECTION 1

REPORT SUMMARY

Radio Testing of the
Nokia Solutions and Networks Oy
AirScale Base Station RRH 1.9GHz
Radio Access technology: E-UTRA (FDD)
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24



Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Radio Testing of the Nokia Solutions and Networks Oy AirScale Base Station RRH 1.9GHz Radio Access technology: E-UTRA (FDD) in accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 24.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Nokia Solutions and Networks Oy
Model Number(s)	AHFB
Serial Number(s)	EA171111489
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 2 (2016) FCC CFR 47 Part 24 (2016)
Order Number	90778514
Date	28 April 2017
Start of Test	18 April 2017
Finish of Test	02 May 2017
Name of Engineer(s)	Mika Kallankari Sami Riuttanen



Product Service

SECTION 2

DISCLAIMERS AND COPYRIGHT



Product Service

2.1 DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

This report must not be reproduced, except in its entirety, without the written permission of
TÜV SÜD Product Service

© 2017 TÜV SÜD Product Service



Product Service

ANNEX A

NOKIA SOLUTIONS AND NETWORKS OY TEST REPORT NO: D555117518



NOKIA

Nokia Networks

TEST REPORT NO: D555117518

FCC ID: VBNAHFB-01

Date:	Oulu 02. May 2017
Pages:	124
Appendices:	-

Equipment Under Test:	AirScale Base Station RRH 1.9GHz Radio Access technology: E-UTRA (FDD)
Type:	AHFB
Manufacturer:	Nokia Solutions and Networks Oy
Address:	P.O. Box 319, Kaapelitie 4, FI-90620, Oulu, Finland
Task:	Conformance test according to the specifications mentioned below
Test Specification(s):	FCC 47 CFR part 2 (2016) and FCC 47 CFR part 24 (2016)
Result:	The EUT complies with the requirements of the specification

The results relate only to the items tested as described in this test report.

Approved by:	Date	Signature
Jari Virta Product Conformity Manager Nokia Solutions and Networks Oy	02. May 2017	 _____



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

CONTENTS

1. SUMMARY4

 1.1 Time Schedule4

 1.2 Participants4

2. EQUIPMENT UNDER TEST5

 2.1 Configuration of EUT5

 2.2 Operating Conditions6

3. TEST CONFIGURATION7

 3.1 Calibration of the Test Equipment7

4. TEST RESULTS8

 4.1 Test No. 1: RF Power Output (§ 2.1046, § 24.232)8

 4.1.1. Limits8

 4.1.2. Test Procedure and Results8

 4.2 Test No. 2: Modulation Characteristics (§ 2.1047, § 2.201)13

 4.3 Test No. 3: Occupied Bandwidth (§ 2.1049)14

 4.3.1. Limits14

 4.3.2. Test Procedure and Results14

 4.4 Test No. 4: Spurious Emissions at Antenna Terminals (§ 2.1051, § 2.1057, § 24.238)18

 4.4.1. Limits18

 4.4.2. Test Procedure and Results18

 4.5 Test No. 5: Field Strength of Spurious Radiation (§ 2.1053, § 2.1057, § 24.238)26

 4.5.1. Limits26

 4.5.2. Test Configuration26

 4.5.3. Test Procedure and Results26

 4.6 Test No. 6: Frequency Stability (§ 2.1055, § 24.235)27

 4.6.1. Purpose27

FCC 47 CFR part 24
(2016)

02. May 2017

Page 2 of 124



Product Service

FCC ID:
VBNAHFB-01

Test Report No:
D555117518

4.6.2.	Limits	28
4.6.3.	Test Configuration	28
4.6.4.	Test Procedure and Results	28
5.	TEST DATA AND SCREENSHOTS	35
5.1	Part List of the RF Measurement Test Equipment	35
5.2	Spectral Plots	36
5.2.1.	Test No. 2: Modulation Characteristics	36
5.2.2.	Test No. 3: Occupied Bandwidth	41
5.2.3.	Test No. 4: Spurious Emissions at the Antenna Terminals	49
5.2.4.	Test No. 5: Field Strength of Spurious Radiation	115



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

1. SUMMARY

The following tests were performed according to the FCC rules in order to verify the compliance of the EUT with the FCC requirements:

Test No.	Measurement	FCC Rule	Page Number of this Report	Result
1	RF Power Output	§ 2.1046, § 24.232	8	compliant
2	Modulation Characteristics	§ 2.1047, § 2.201	13	compliant
3	Occupied Bandwidth	§ 2.1049	14	compliant
4	Spurious Emissions at Antenna Terminals	§ 2.1051, § 2.1057, § 24.238	18	compliant
5	Field Strength of Spurious Radiation	§ 2.1053, § 2.1057, § 24.238,	26	compliant
6	Frequency Stability	§ 2.1055, § 24.235	28	compliant

Table 1 Results – Summary

In accordance with the FCC Rule §15.3 (z) the equipment was tested with the limits that are valid for an *unintentional radiator*.

Measurements guidance: FCC OET laboratory KDB: 662911 D01 Multiple Transmitter Output v01r02 and FCC KDB 971168 D01 Power Meas License Digital Systems v02r02.

Test Laboratory:

Nokia Solutions and Networks Oy

Kaapelitie 4,

FI-90620, Oulu, Finland

Jari Virta

FCC Reg. No: 411251

Testing laboratory accreditation number: T297

1.1 Time Schedule

Test No.	1, 2, 3, 4	5	6
Start of Test:	18 Apr 2017	20 Apr 2017	20 Apr 2017
End of Test:	26 Apr 2017	2 May 2017	21 Apr 2017

1.2 Participants

Name	Function	Signature
RF Test person (Nokia) Mika Kallankari	Tests nos: 1,2,3,4,6 Setup of EUT	
EMC Test person (Nokia) Sami Riuttanen	Test no 5, Setup of EUT	



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

2. EQUIPMENT UNDER TEST

The EUT is a LTE Base transceiver station RRH 1.9GHz with 4 power amplifiers.

The BTS performs the full RAN function of LTE system (evolved UTRA). This is sometimes referred to as collapsed RAN, where equivalent functions of former 3G BTS and 3G RNC are all integrated into BTS. BTS is connected directly to the core network via S1 interface, and to mobile stations via Air interface (Uu). In addition BTS's are optionally connected directly to each other via X2 interface for handover purposes.

The tested equipment is representative for serial production.

2.1 Configuration of EUT

The used different EUT configurations are shown by the following table.

Module Type	AirScale Base Station RRH 1.9GHz	
Radio Access Technology	E-UTRA	
Duplex mode	Frequency Division Duplex (FDD)	
Channel Bandwidth	Single carrier 20MHz (Config. A), Dual carrier 10MHz+5MHz (Config. B).	
Supply Voltage	48.0 V DC	
Frequency Bands		
Channel Bandwidths	Lowest tunable freq. Single carrier	1940.0MHz
	Dual carriers	1935.0/1942.2MHz
	Middle freq. Single carrier	1962.5MHz
	Dual carriers	1958.9/1966.1MHz
	Highest tunable freq. Single carrier	1985.0MHz
	Dual carriers	1985.3/1992.5MHz
Single carrier		
Rated Output Power (Prat)	5W (37.0dBm) conducted / carrier	
Dual carrier		
Rated Output Power (Prat)	2.5W (34.0dBm) conducted / carrier	
	RX	TX
Number of Antenna Ports	4 (ANT1 to ANT4)	4 (ANT1 to ANT4)
MIMO	Yes	Yes

Table 2 Overview of EUT configuration



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

The tests were performed with one EUT at the antenna ports ANT1, ANT2, ANT3 or ANT4.

The used different EUT configurations are shown by the following table.

Module Name	Serial-No.	Module Type	Config.
AHFB	EA171111489	RRH	A, B
Other Modules	Module Type	Config.	
AMIA	AirScale Subrack	A, B	
ASIA	AirScale Common unit	A, B	
ABIA	AirScale Capacity unit	A, B	

Table 3 Configuration of EUT

For a functional description of the modules, please refer to the appropriate related parts and exhibit sections of this certification application.

2.2 Operating Conditions

The EUT supports QPSK, 16QAM, 64QAM and 256QAM modulation. If not stated otherwise, the following standard setup procedure for the EUT was used:

The transmitter was set up according to 3GPP TS 36.141 E-UTRA Test Models (E-TM) for all tests:

- E-TM 1.1: All QPSK modulation testing
- E-TM 3.1: All 64QAM modulation testing
- E-TM 3.2: All 16QAM modulation testing
- E-TM 3.1A: All 256QAM modulation testing

During the measurements, one carrier channel was tested at a time. The carrier was set to the maximum power level to ensure the maximum emission amplitudes during all measurements.

During the tests, the Flexi Multiradio BTS is transmitting a pseudo random bit pattern on the data channels. This ensures that the measurements of the emission characteristics of the transmitter are pursuant to § 2.1049.



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

3. TEST CONFIGURATION

If not stated otherwise, the following measurement configuration was used to perform all measurements (see figure below).

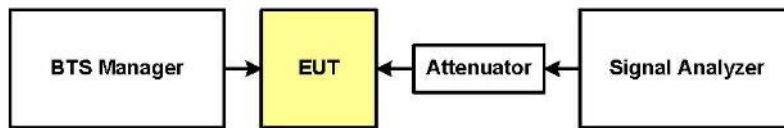


Figure 1 Test Configuration (single output)

The RF output of the transceiver (cell) under test is connected to a signal analyzer via a high power attenuator to protect the input of the signal analyzer from high RF power levels. A description of the analyzer settings is given in each of the sections describing the measurements. The other transceivers are terminated.

A complete list of the measurement equipment is included on page 35 of this measurement report.

3.1 Calibration of the Test Equipment

All relevant test equipment has a valid calibration from an external calibration laboratory. Additionally the signal analyzer has a built-in self-calibration procedure. This calibration procedure was activated prior to the measurements so that the analyzer is deemed accurate. High quality cables were used to connect the measurement equipment to the EUT. The actual loss of the attenuator and the cables was measured with a high precision network analyzer and taken into account for all measurements.



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

4. TEST RESULTS

4.1 Test No. 1: RF Power Output (§ 2.1046, § 24.232)

4.1.1. Limits

Para. No. 24.232 (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

4.1.2. Test Procedure and Results

Detachable Antenna: The maximum output power at the antenna terminals was measured using a signal analyzer.

The RF power was measured with a frequency sweep across the carrier (see screenshots). The carrier power was calculated from the signal analyzer by integration over the result. The base station maximum output power is the sum of the measured carrier power and the external attenuation (cable loss of the test set up).

For the MiMo output, RF power output was measured from each antenna port individually and the results summed mathematically in accordance to FCC KDB 662911 D01 -guidance.

Peak to average power (PAPR) was examined using CCDF method and 0.1% value recorded in dB to the tables below.



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

The following table shows the measured output powers at the antenna connector.

Measured laboratory room temperature and humidity during the tests				
Date	Temperature Min-Max:		Humidity Min-Max:	
18- 25. Apr 17	25 °C	27 °C	8 RH%	23 RH%

Config A:

Carrier Frequency [MHz]	RF Power Output		PAPR	Result
	[dBm]	[W]	[dB]	
QPSK-Modulation ANT1				
1940.0	37.23	5.28445	8.14	compliant
1962.5	37.03	5.04661	8.06	compliant
1985.0	36.98	4.98884	8.09	compliant
QPSK-Modulation ANT2				
1940.0	37.09	5.11682	8.06	compliant
1962.5	37.12	5.15229	8.12	compliant
1985.0	37.03	5.04661	8.09	compliant
QPSK-Modulation ANT3				
1940.0	37.02	5.0350	8.14	compliant
1962.5	37.09	5.11682	8.12	compliant
1985.0	37.02	5.03501	8.06	compliant
QPSK-Modulation ANT4				
1940.0	37.18	5.22396	8.09	compliant
1962.5	37.01	5.02343	8.00	compliant
1985.0	36.90	4.89779	8.09	compliant
QPSK-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
1940.0	43.15	20.66023	-	compliant
1962.5	43.08	20.33915	-	compliant
1985.0	43.00	19.96825	-	compliant
16QAM-Modulation ANT1				
1940.0	37.09	5.11682	8.12	compliant
1962.5	37.06	5.08159	8.09	compliant
1985.0	37.03	5.04661	8.03	compliant
16QAM-Modulation ANT2				
1940.0	37.05	5.06991	8.14	compliant
1962.5	37.17	5.21195	8.09	compliant
1985.0	37.07	5.09331	8.06	compliant
16QAM-Modulation ANT3				
1940.0	37.21	5.26017	8.03	compliant
1962.5	37.05	5.06991	8.09	compliant
1985.0	37.03	5.04661	8.06	compliant
16QAM-Modulation ANT4				
1940.0	37.13	5.16416	8.06	compliant
1962.5	37.05	5.06991	8.09	compliant
1985.0	36.93	4.93174	8.00	compliant
16QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
1940.0	43.14	20.61106	-	compliant
1962.5	43.10	20.43336	-	compliant
1985.0	43.04	20.11827	-	compliant
64QAM-Modulation ANT1				
1940.0	37.07	5.09331	8.12	compliant

FCC 47 CFR part 24
(2016)

02. May 2017

Page 9 of 124



Product Service

FCC ID:
VBNAHFB-01

Test Report No:
D555117518

1962.5	37.04	5.05825	8.03	compliant
1985.0	37.00	5.01187	8.09	compliant
64QAM-Modulation ANT2				
1940.0	37.07	5.09331	8.12	compliant
1962.5	37.13	5.16416	8.12	compliant
1985.0	37.08	5.10505	8.09	compliant
64QAM-Modulation ANT3				
1940.0	37.10	5.12861	8.14	compliant
1962.5	37.12	5.15229	8.03	compliant
1985.0	37.03	5.04661	8.03	compliant
64QAM-Modulation ANT4				
1940.0	37.15	5.18800	8.12	compliant
1962.5	37.04	5.05825	8.09	compliant
1985.0	36.94	4.94311	8.03	compliant
64QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
1940.0	43.12	20.50323	-	compliant
1962.5	43.10	20.43295	-	compliant
1985.0	43.03	20.10664	-	compliant
256QAM-Modulation ANT1				
1940.0	37.04	5.05825	8.06	compliant
1962.5	37.04	5.05825	8.06	compliant
1985.0	37.02	5.03501	8.03	compliant
256QAM-Modulation ANT2				
1940.0	37.08	5.10505	8.03	compliant
1962.5	37.15	5.18800	8.12	compliant
1985.0	37.07	5.09331	8.06	compliant
256QAM-Modulation ANT3				
1940.0	37.19	5.23600	8.12	compliant
1962.5	37.11	5.14044	8.09	compliant
1985.0	37.00	5.01187	8.06	compliant
256QAM-Modulation ANT4				
1940.0	37.17	5.21195	8.12	compliant
1962.5	37.04	5.05825	8.06	compliant
1985.0	36.90	4.89779	8.09	compliant
256QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
1940.0	43.14	20.61125	-	compliant
1962.5	43.11	20.44494	-	compliant
1985.0	43.02	20.03798	-	compliant

Table 4 RF Power Output (20 MHz Channel BW)

Config B:

Carrier Frequency [MHz]	RF Power Output		PAPR	Result
	[dBm]	[W]	[dB]	
QPSK-Modulation ANT1				
1935.0/1942.2	34.22/34.67	2.64241/ 2.93089	-	compliant
1958.9/1966.1	34.34/34.20	2.71644/ 2.63027	-	compliant
1985.3/1992.5	34.33/33.58	2.71019/ 2.28034	-	compliant
QPSK-Modulation ANT2				
1935.0/1942.2	34.17/34.72	2.61216/ 2.96483	-	compliant
1958.9/1966.1	34.21/34.09	2.63633/ 2.56448	-	compliant

FCC 47 CFR part 24
(2016)

02. May 2017

Page 10 of 124



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

1985.3/1992.5	34.34/33.60	2.71644/ 2.29087	-	compliant
QPSK-Modulation ANT3				
1935.0/1942.2	34.29/34.68	2.68534/ 2.93765	-	compliant
1958.9/1966.1	34.40/34.26	2.75423/ 2.66686	-	compliant
1985.3/1992.5	34.55/33.75	2.85102/ 2.37137	-	compliant
QPSK-Modulation ANT4				
1935.0/1942.2	34.22/34.61	2.64241/ 2.89068	-	compliant
1958.9/1966.1	34.39/34.27	2.74789/ 2.67301	-	compliant
1985.3/1992.5	34.36/33.49	2.72898/ 2.23357	-	compliant
QPSK-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
1935.0/1942.2	43.48	22.30637	-	compliant
1958.9/1966.1	43.30	21.38951	-	compliant
1985.3/1992.5	43.05	20.18278	-	compliant
16QAM-Modulation ANT1				
1935.0/1942.2	34.22/34.69	2.64241/ 2.94442	-	compliant
1958.9/1966.1	34.34/34.19	2.71644/ 2.62422	-	compliant
1985.3/1992.5	34.34/33.56	2.71644/2.26986	-	compliant
16QAM-Modulation ANT2				
1935.0/1942.2	34.17/34.71	2.61216/2.95801	-	compliant
1958.9/1966.1	34.22/34.08	2.64241/2.55859	-	compliant
1985.3/1992.5	34.33/33.59	2.71019/2.28560	-	compliant
16QAM-Modulation ANT3				
1935.0/1942.2	34.27/34.65	2.67301/2.91743	-	compliant
1958.9/1966.1	34.41/34.28	2.76058/2.67917	-	compliant
1985.3/1992.5	34.56/33.76	2.85759/2.37684	-	compliant
16QAM-Modulation ANT4				
1935.0/1942.2	34.22/34.60	2.64241/2.88403	-	compliant
1958.9/1966.1	34.44/34.29	2.77971/2.68534	-	compliant
1985.3/1992.5	34.35/33.51	2.72270/2.24388	-	compliant
16QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
1935.0/1942.2	43.48	22.27388	-	compliant
1958.9/1966.1	43.31	21.44646	-	compliant
1985.3/1992.5	43.05	20.18310	-	compliant
64QAM-Modulation ANT1				
1935.0/1942.2	34.26/34.67	2.66686/2.93089	-	compliant
1958.9/1966.1	34.27/34.17	2.67301/2.61216	-	compliant
1985.3/1992.5	34.36/33.54	2.72898/2.25944	-	compliant
64QAM-Modulation ANT2				
1935.0/1942.2	34.19/34.61	2.62422/2.94442	-	compliant
1958.9/1966.1	34.17/34.05	2.61216/2.54097	-	compliant
1985.3/1992.5	34.34/33.62	2.71644/2.30144	-	compliant
64QAM-Modulation ANT3				
1935.0/1942.2	34.29/34.69	2.68534/2.94442	-	compliant
1958.9/1966.1	34.36/34.28	2.72898/2.67917	-	compliant
1985.3/1992.5	34.56/33.77	2.85759/2.38232	-	compliant
64QAM-Modulation ANT4				
1935.0/1942.2	34.23/34.63	2.64850/2.90402	-	compliant
1958.9/1966.1	34.40/34.31	2.75423/2.69774	-	compliant
1985.3/1992.5	34.33/33.51	2.71019/2.24388	-	compliant
64QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
1935.0/1942.2	43.49	22.34867	-	compliant
1958.9/1966.1	43.28	21.29842	-	compliant
1985.3/1992.5	43.05	20.20028	-	compliant

FCC 47 CFR part 24
(2016)

02. May 2017

Page 11 of 124



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

256QAM-Modulation ANT1				
1935.0/1942.2	34.23/34.62	2.64850/2.89734	-	compliant
1958.9/1966.1	34.32/34.18	2.70396/2.61818	-	compliant
1985.3/1992.5	34.34/33.56	2.71644/2.26986	-	compliant
256QAM-Modulation ANT2				
1935.0/1942.2	34.20/34.67	2.63027/2.93089	-	compliant
1958.9/1966.1	34.19/34.05	2.62422/2.54097	-	compliant
1985.3/1992.5	34.35/33.57	2.72270/2.27510	-	compliant
256QAM-Modulation ANT3				
1935.0/1942.2	34.33/34.71	2.71019/2.95801	-	compliant
1958.9/1966.1	34.39/34.29	2.74789/2.68534	-	compliant
1985.3/1992.5	34.57/33.77	2.86418/2.38232	-	compliant
256QAM-Modulation ANT4				
1935.0/1942.2	34.23/34.62	2.64850/2.89734	-	compliant
1958.9/1966.1	34.42/34.28	2.76694/2.67917	-	compliant
1985.3/1992.5	34.38/33.52	2.74157/2.24905	-	compliant
256QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
1935.0/1942.2	43.49	22.32104	-	compliant
1958.9/1966.1	43.30	21.36667	-	compliant
1985.3/1992.5	43.06	20.22122	-	compliant

Table 5 RF Power Output (10 MHz /5 MHz Channel BW)

The base station maximum output power was found to be compliant with the manufacturer’s specifications and with all requirements of the FCC rules.



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

4.2 Test No. 2: Modulation Characteristics (§ 2.1047, § 2.201)

The occupied bandwidth was measured to be 18.5 MHz (Config. A) and 14.5 MHz (Config. B), which represents the -26dB power bandwidth (see the following section and screenshots on pages 41).

Therefore, the modulation characteristic of the base stations transceiver is:

Config A: 18M5D5W (Channel bandwidth 20 MHz)

Config B: 14M5D5W (Channel bandwidth 15 MHz)

No further testing is required under this section of the FCC rules. No measurements other than the occupied bandwidth are required.

Sample modulation screenshots are on page 36, in I/Q constellation diagrams and tables, showing QPSK, 16QAM, 64QAM and 256QAM–modulation generation.

The modulation characteristics were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

4.3 Test No. 3: Occupied Bandwidth (§ 2.1049)

4.3.1. Limits

Para. No 24.238(b). Emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

4.3.2. Test Procedure and Results

The 26dB occupied bandwidth of the carrier emission is measured using a signal analyzer with Resolution Bandwidth set to 200 kHz (less than 1% of bandwidth; see screenshots on page 41 for details). The following tables summarize the results:

Measured laboratory room temperature and humidity during the tests				
Date	Temperature Min-Max:		Humidity Min-Max:	
18– 25. Apr 17	25 °C	26 °C	8 RH%	17 RH%

Config A:

Carrier Frequency [MHz]	Occupied Bandwidth [MHz]	Result
QPSK-Modulation ANT1		
1940.0	18.5240	compliant
1962.5	18.5240	compliant
1985.0	18.5240	compliant
QPSK-Modulation ANT2		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
QPSK-Modulation ANT3		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
QPSK-Modulation ANT4		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
16QAM-Modulation ANT1		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
16QAM-Modulation ANT2		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
16QAM-Modulation ANT3		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.4660	compliant



Product Service

FCC ID:
VBNAHFB-01

Test Report No:
D555117518

16QAM-Modulation ANT4		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
64QAM-Modulation ANT1		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
64QAM-Modulation ANT2		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
64QAM-Modulation ANT3		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
64QAM-Modulation ANT4		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
256QAM-Modulation ANT1		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
256QAM-Modulation ANT2		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
256QAM-Modulation ANT3		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
256QAM-Modulation ANT4		
1940.0	18.5240	compliant
1965.0	18.5240	compliant
1985.0	18.5240	compliant
Measurement Uncertainty:		±48kHz

Table 6 Occupied Bandwidth (20 MHz Channel BW)

Config B:

Carrier Frequency [MHz]	Occupied Bandwidth [MHz]	Result
QPSK-Modulation ANT1		
1935.0/1942.2	14.5500	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant
QPSK-Modulation ANT2		
1935.0/1942.2	14.5500	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant
QPSK-Modulation ANT3		

FCC 47 CFR part 24
(2016)

02. May 2017

Page 15 of 124



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

1935.0/1942.2	14.5500	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant
QPSK-Modulation ANT4		
1935.0/1942.2	14.5500	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant
16QAM-Modulation ANT1		
1935.0/1942.2	14.4900	compliant
1958.9/1966.1	14.4900	compliant
1985.3/1992.5	14.4900	compliant
16QAM-Modulation ANT2		
1935.0/1942.2	14.4450	compliant
1958.9/1966.1	14.4600	compliant
1985.3/1992.5	14.4450	compliant
16QAM-Modulation ANT3		
1935.0/1942.2	14.4450	compliant
1958.9/1966.1	14.4900	compliant
1985.3/1992.5	14.4900	compliant
16QAM-Modulation ANT4		
1935.0/1942.2	14.4600	compliant
1958.9/1966.1	14.4600	compliant
1985.3/1992.5	14.4900	compliant
64QAM-Modulation ANT1		
1935.0/1942.2	14.5350	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant
64QAM-Modulation ANT2		
1935.0/1942.2	14.5350	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant
64QAM-Modulation ANT3		
1935.0/1942.2	14.5350	compliant
1958.9/1966.1	14-5500	compliant
1985.3/1992.5	14.5500	compliant
64QAM-Modulation ANT4		
1935.0/1942.2	14.5350	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant
256QAM-Modulation ANT1		
1935.0/1942.2	14.5350	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant
256QAM-Modulation ANT2		
1935.0/1942.2	14.5350	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant
256QAM-Modulation ANT3		
1935.0/1942.2	14.5350	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant



Product Service

FCC ID:
VBNAHFB-01

Test Report No:
D555117518

256QAM-Modulation ANT4		
1935.0/1942.2	14.5500	compliant
1958.9/1966.1	14.5500	compliant
1985.3/1992.5	14.5650	compliant
Measurement Uncertainty:		±48kHz

Table 7 Occupied Bandwidth (10 MHz / 5 MHz Channel BW)

The occupied bandwidth was found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

4.4 Test No. 4: Spurious Emissions at Antenna Terminals (§ 2.1051, § 2.1057, § 24.238)

4.4.1. Limits

Para. No. 24.238(a,b,c). The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

The compliance limit was calculated in the following way:

Maximum transmitter output power [W]: P
 Maximum transmitter output power [dBm]: $30 + 10 \log_{10} P$ (conversion from W to dBm)
 Attenuation required by FCC: $43 + 10 \log_{10} P$
 Compliance limit = Maximum transmitter output power - Required attenuation
 $= 30 + 10 \log_{10} P - (43 + 10 \log_{10} P) = \underline{-13 \text{ dBm}}$

For MiMo output from 4 TX -antenna connectors, each antenna connectors were measured individually and each individual limit line was reduced by $10\log(4)$. Limit line was calculated to show -19.02dB emission limit, according to FCC KDB 662911 D01 guidance.

4.4.2. Test Procedure and Results

The tests were carried out in accordance with § 24.238. For all frequency ranges except two (immediately below and above the carrier frequency block) a 1 MHz resolution bandwidth was used for the measurements.

In the 1 MHz frequency bands immediately outside and adjacent to the carrier frequency block the resolution bandwidth is lowered to 1% of the 26 dB occupied bandwidth of the transmitted carrier.

According to § 2.1057, all emissions including the fundamental frequency from the lowest radio frequency generated in the equipment, without going below 9 kHz, up to the 10th harmonic were investigated.

The following tables summarize the worst case detected emission levels (see screenshots on page 49 for details). The external attenuation (cable loss of the set up) is already added in the results. It can be seen separately as the 'Offset' value in the screenshots.



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

Measured laboratory room temperature and humidity during the tests				
Date	Temperature Min-Max:		Humidity Min-Max:	
18 – 25. Apr 17	25 °C	26 °C	RH%	17 RH%

Config A Lower band edge:

Carrier Frequency: 1940.0 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation ANT1			
	1929.72	-32.39	compliant
QPSK-Modulation ANT2			
	1929.84	-31.35	compliant
QPSK-Modulation ANT3			
	1929.86	-30.17	compliant
QPSK-Modulation ANT4			
	1929.72	-30.67	compliant
16QAM-Modulation ANT1			
	1930.00	-30.49	compliant
16QAM-Modulation ANT2			
	1929.86	-31.29	compliant
16QAM-Modulation ANT3			
	1929.86	-29.64	compliant
16QAM-Modulation ANT4			
	1929.92	-30.68	compliant
64QAM-Modulation ANT1			
	1930.00	-31.12	compliant
64QAM-Modulation ANT2			
	1929.98	-31.67	compliant
64QAM-Modulation ANT3			
	1929.96	-29.76	compliant
64QAM-Modulation ANT4			
	1930.00	-31.52	compliant
256QAM-Modulation ANT1			
	1929.84	-32.19	compliant
256QAM-Modulation ANT2			
	1929.84	-31.63	compliant
256QAM-Modulation ANT3			
	1929.68	-31.19	compliant
256QAM-Modulation ANT4			
	1929.98	-31.64	compliant

FCC 47 CFR part 24
(2016)

02. May 2017

Page 19 of 124



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

Measurement Uncertainty:	$f < 1.0\text{GHz}: \pm 1.1\text{dB},$ $1.0\text{GHz} \leq f < 3.6\text{GHz}: \pm 1.2\text{dB},$ $3.6\text{GHz} \leq f < 8.0\text{GHz}: \pm 1.6\text{dB},$ $8.0\text{GHz} \leq f: \pm 1.9\text{dB}$
--------------------------	--

Table 8 Spurious Emissions (Lower band edge) (20 MHz CH BW)

Config A Upper band edge:

Carrier Frequency: 1985.0 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation ANT1			
	1995.00	-30.39	compliant
QPSK-Modulation ANT2			
	1995.02	-30.60	compliant
QPSK-Modulation ANT3			
	1995.24	-26.55	compliant
QPSK-Modulation ANT4			
	1995.10	-27.93	compliant
16QAM-Modulation ANT1			
	1995.32	-30.88	compliant
16QAM-Modulation ANT2			
	1995.10	-30.59	compliant
16QAM-Modulation ANT3			
	1995.10	-26.24	compliant
16QAM-Modulation ANT4			
	1995.14	-27.58	compliant
64QAM-Modulation ANT1			
	1995.24	-30.70	compliant
64QAM-Modulation ANT2			
	1995.20	-30.83	compliant
64QAM-Modulation ANT3			
	1995.02	-26.52	compliant
64QAM-Modulation ANT4			
	1995.04	-27.52	compliant
256QAM-Modulation ANT1			
	1995.04	-30.42	compliant
256QAM-Modulation ANT2			
	1995.12	-31.10	compliant
256QAM-Modulation ANT3			
	1995.12	-26.40	compliant



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

256QAM-Modulation ANT4			
	1995.12	-27.30	compliant
		f < 1.0GHz: ±1.1dB, 1.0GHz ≤ f < 3.6GHz: ±1.2dB, Measurement Uncertainty: 3.6GHz ≤ f < 8.0GHz: ±1.6dB, 8.0GHz ≤ f: ±1.9dB	

Table 9 Spurious Emissions (Upper band edge) (20 MHz CH BW)

Config A Spurious emissions:

Carrier Frequency: 1962.5 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation ANT1			
0.009 – 19950	6968.60	-27.97	compliant
QPSK-Modulation ANT2			
0.009 – 19950	6985.50	-27.82	compliant
QPSK-Modulation ANT3			
0.009 – 19950	6985.50	-27.80	compliant
QPSK-Modulation ANT4			
0.009 – 19950	6994.40	-27.98	compliant
16QAM-Modulation ANT1			
0.009 – 19950	6985.50	-27.89	compliant
16QAM-Modulation ANT2			
0.009 – 19950	6985.50	-27.89	compliant
16QAM-Modulation ANT3			
0.009 – 19950	6994.40	-27.89	compliant
16QAM-Modulation ANT4			
0.009 – 19950	6994.40	-27.85	compliant
64QAM-Modulation ANT1			
0.009 – 19950	6985.50	-27.87	compliant
64QAM-Modulation ANT2			
0.009 – 19950	6985.50	-27.91	compliant
64QAM-Modulation ANT3			
0.009 – 19950	6994.40	-27.77	compliant
64QAM-Modulation ANT4			
0.009 – 19950	6994.40	-27.91	compliant
256QAM-Modulation ANT1			
0.009 – 19950	6917.70	-27.96	compliant
256QAM-Modulation ANT2			

FCC 47 CFR part 24
(2016)

02. May 2017

Page 21 of 124



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

0.009 – 19950	6994.00	-27.98	compliant
256QAM-Modulation ANT3			
0.009 – 19950	6994.40	-27.93	compliant
256QAM-Modulation ANT4			
0.009 – 19950	6960.02	-27.96	compliant
Measurement Uncertainty:		f < 1.0GHz: ±1.1dB, 1.0GHz ≤ f < 3.6GHz: ±1.2dB, 3.6GHz ≤ f < 8.0GHz: ±1.6dB, 8.0GHz ≤ f: ±1.9dB	

Table 10 Spurious Emissions (20 MHz Channel BW)

Config B Lower band edge:

Carrier Frequency: 1935.0/1942.2 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation ANT1			
	1929.93	-24.11	compliant
QPSK-Modulation ANT2			
	1929.93	-25.61	compliant
QPSK-Modulation ANT3			
	1929.93	-24.43	compliant
QPSK-Modulation ANT4			
	1929.93	-26.76	compliant
16QAM-Modulation ANT1			
	1929.93	-27.10	compliant
16QAM-Modulation ANT2			
	1929.93	-25.41	compliant
16QAM-Modulation ANT3			
	1929.93	-23.13	compliant
16QAM-Modulation ANT4			
	1929.93	-26.39	compliant
64QAM-Modulation ANT1			
	1929.93	-26.29	compliant
64QAM-Modulation ANT2			
	1929.93	-24.77	compliant
64QAM-Modulation ANT3			
	1929.93	-23.93	compliant
64QAM-Modulation ANT4			
	1929.93	-25.90	compliant
256QAM-Modulation ANT1			



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

	1929.93	-26.76	compliant
256QAM-Modulation ANT2			
	1929.93	-25.10	compliant
256QAM-Modulation ANT3			
	1929.93	-23.65	compliant
256QAM-Modulation ANT4			
	1929.93	-26.75	compliant
Measurement Uncertainty:	f < 1.0GHz: ±1.1dB, 1.0GHz ≤ f < 3.6GHz: ±1.2dB, 3.6GHz ≤ f < 8.0GHz: ±1.6dB, 8.0GHz ≤ f: ±1.9dB		

Table 11 Spurious Emissions (Lower band edge) (10 MHz/5 MHz CH BW)

Config B Upper band edge:

Carrier Frequency: 1985.3/1992.5 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation ANT1			
	1995.08	-25.67	compliant
QPSK-Modulation ANT2			
	1995.08	-23.77	compliant
QPSK-Modulation ANT3			
	1995.08	-23.19	compliant
QPSK-Modulation ANT4			
	1995.08	-24.15	compliant
16QAM-Modulation ANT1			
	1995.08	-24.84	compliant
16QAM-Modulation ANT2			
	1995.08	-25.94	compliant
16QAM-Modulation ANT3			
	1995.08	-24.93	compliant
16QAM-Modulation ANT4			
	1995.08	-25.71	compliant
64QAM-Modulation ANT1			
	1995.08	-22.76	compliant
64QAM-Modulation ANT2			
	1995.08	-26.14	compliant
64QAM-Modulation ANT3			
	1995.08	-24.25	compliant

FCC 47 CFR part 24
(2016)

02. May 2017

Page 23 of 124



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

64QAM-Modulation ANT4			
	1995.08	-22.32	compliant
256QAM-Modulation ANT1			
	1995.08	-24.88	compliant
256QAM-Modulation ANT2			
	1995.08	-24.82	compliant
256QAM-Modulation ANT3			
	1995.08	-23.81	compliant
256QAM-Modulation ANT4			
	1995.08	-26.08	compliant
Measurement Uncertainty:		f < 1.0GHz: ±1.1dB, 1.0GHz ≤ f < 3.6GHz: ±1.2dB, 3.6GHz ≤ f < 8.0GHz: ±1.6dB, 8.0GHz ≤ f: ±1.9dB	

Table 12 Spurious Emissions (Upper band edge) (10/5 MHz CH BW)

Config B Spurious emissions:

Carrier Frequency: 1958.9/1966.1 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation ANT1			
0.009 – 19950	3000.00	-29.79	compliant
QPSK-Modulation ANT2			
	3000.00	-29.76	compliant
QPSK-Modulation ANT3			
	3000.00	-29.89	compliant
QPSK-Modulation ANT4			
	3000.00	-29.84	compliant
16QAM-Modulation ANT1			
	3000.00	-29.64	compliant
16QAM-Modulation ANT2			
	3000.00	-29.79	compliant
16QAM-Modulation ANT3			
	3000.00	-29.74	compliant
16QAM-Modulation ANT4			
	3000.00	-29.66	compliant
64QAM-Modulation ANT1			
	3000.00	-29.71	compliant
64QAM-Modulation ANT2			
	3000.00	-29.71	compliant

FCC 47 CFR part 24
(2016)

02. May 2017

Page 24 of 124



Product Service

FCC ID:
VBNAHFB-01

Test Report No:
D555117518

64QAM-Modulation ANT3			
	3000.00	-29.58	compliant
64QAM-Modulation ANT4			
	3000.00	-29.61	compliant
256QAM-Modulation ANT1			
	3000.00	-29.82	compliant
256QAM-Modulation ANT2			
	3000.00	-29.74	compliant
256QAM-Modulation ANT3			
	3000.00	-29.68	compliant
256QAM-Modulation ANT4			
	3000.00	-29.73	compliant
Measurement Uncertainty:		f < 1.0GHz: ±1.1dB, 1.0GHz ≤ f < 3.6GHz: ±1.2dB, 3.6GHz ≤ f < 8.0GHz: ±1.6dB, 8.0GHz ≤ f: ±1.9dB	

Table 13 Spurious Emissions (10 MHz/5 MHz Channel BW)

The measured conducted emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

4.5 Test No. 5: Field Strength of Spurious Radiation (§ 2.1053, § 2.1057, § 24.238)

4.5.1. Limits

Para. No. 24.238(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

4.5.2. Test Configuration

The measurements were performed in an anechoic chamber. The radiated test site complies with the site attenuation requirements listed in ANSI C63.4 2003 and is listed with the FCC.

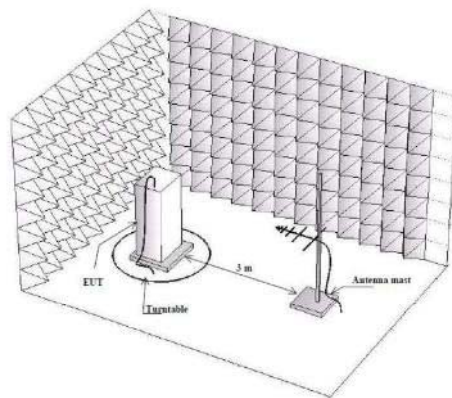


Figure 2 Test Configuration

Photographs of the EUT in the anechoic chamber are shown on page 115 of this measurement report.

4.5.3. Test Procedure and Results

TIA/EIA-603-C-2004, Section 2.2.12

The test was performed in a semi-anechoic shielded room. The EUT was placed on a non-conductive 0.8 m high table standing on the turntable. During the test in the frequency range 30 - 19950 MHz the distance from the EUT to the measuring antenna was 3 m. In order to find the maximum levels of the disturbance radiation the angle of the turntable, the height of the measuring antenna were varied during the tests. The test was performed with the measuring antenna being both in horizontal and vertical polarizations.

Vertical and horizontal polarizations in the frequency range 30 - 19950 MHz was first measured by using the peak detector. During the peak detector scan the turntable was rotated from 0° to 360° with 30° step with the antenna heights 1.0 m and 2.5 m.



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

The limit of -13 dBm has been calculated to correspond 84.4 dB (µV/m). Spurious emissions closer than 20 dB to the limit was measured with average detector.

According to § 2.1057, all emissions from the lowest radio frequency generated in the equipment, without going below 9 kHz, up to the 10th harmonic were investigated.

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The EUT was replaced with a reference substitution antenna with a known gain referenced to an isotropic radiator $G_{Antenna[dBi]}$. This antenna was fed with a signal at the spurious frequency $P_{Gen[dBm]}$. The level of the signal was adjusted to repeat the previously measured level. The resulting

EIRP is the signal level fed to the reference antenna corrected for gain referenced to an isotropic.

The formula below was used to calculate the EIRP of the EUT.

$$P_{EIRP[dBm]} = P_{Gen[dBm]} - L_{Cable[dB]} + G_{Antenna[dBi]}$$

Worst case detected emission levels are reported in the following table (refer to spectral plots included on pages 100 for details). The antenna factor and cable loss is according to the manufacturer's specification.

Measured laboratory room temperature and humidity during the tests				
Date	Temperature Min-Max:		Humidity Min-Max:	
20 Apr – 2 May 17	21.7 °C	22.9 °C	15.3 RH%	22.6 RH%

Config A, B:

Carrier Frequency ConfigA: 1940.0 MHz, 1962.5 MHz and 1985.0 MHz			
Config B: 1935.0/1942.2 MHz, 1958.9/1966.1 MHz and 1985.3/1992.5 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation TX1			
30 - 19950	5898.243334	-35.8 dBm	compliant
Measurement Uncertainty:			±5.4dB

Table 14 Field Strength of Spurious Radiation (20 MHz Channel BW)

The measured emission levels were found to be compliant with the manufacturer's specifications and with all requirements of the FCC rules.

4.6 Test No. 6: Frequency Stability (§ 2.1055, § 24.235)

4.6.1. Purpose

FCC 47 CFR part 24
(2016)

02. May 2017

Page 27 of 124



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

Frequency stability measurements were performed to verify that the frequency deviation of the emission stays within the licensee's frequency block under extreme temperature

4.6.2. Limits

Para. No. 24.235. (-30 °C to +50 °C) and supply voltage conditions according to § 2.1055.

4.6.3. Test Configuration

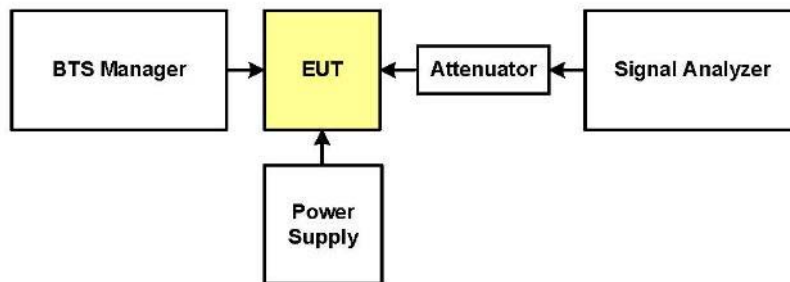


Figure 3 Test Configuration for frequency stability with voltage variation

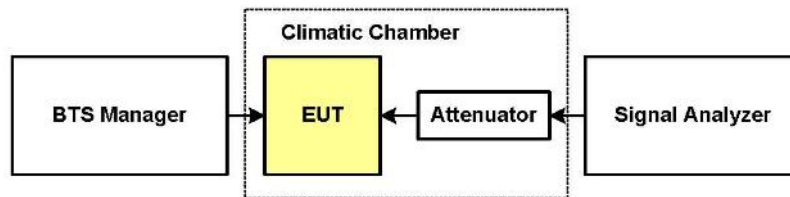


Figure 4 Test Configuration for frequency stability with temperature variation

A complete list of the measurement equipment is included on page 35 of this measurement report.

4.6.4. Test Procedure and Results

Frequency Stability with Temperature Variation:



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

The supply voltage of the EUT was set to the nominal value and the temperature of the environmental chamber was varied in 10 degree steps from -30 degrees Celsius to +50 degrees Celsius. The EUT was allowed to stabilize 60 min. at each temperature and the frequency error was measured.

Config A:

Carrier Frequency: 1962.5 MHz						
Supply Voltage (DC) [V]	Ambient Temperature [°C]	Frequency Deviation		Manufacturer's Specification		Result
		[Hz]	[ppm]	[Hz]	[ppm]	
QPSK Modulation ANT1						
-48.0	-30.0	-3.52122	-0.002	98	0.05	compliant
-48.0	-20.0	-3.37800	-0.002	98	0.05	compliant
-48.0	-10.0	1.86864	0.001	98	0.05	compliant
-48.0	0.0	-3.35713	-0.002	98	0.05	compliant
-48.0	10.0	-3.94373	-0.002	98	0.05	compliant
-48.0	30.0	-2.87785	-0.001	98	0.05	compliant
-48.0	40.0	4.77456	0.002	98	0.05	compliant
-48.0	50.0	2.17982	0.001	98	0.05	compliant
QPSK Modulation ANT2						
-48.0	-30.0	1.68034	0.001	98	0.05	compliant
-48.0	-20.0	-3.57430	-0.002	98	0.05	compliant
-48.0	-10.0	-6.93675	-0.004	98	0.05	compliant
-48.0	0.0	2.78593	0.001	98	0.05	compliant
-48.0	10.0	4.07532	0.002	98	0.05	compliant
-48.0	30.0	-2.56874	-0.001	98	0.05	compliant
-48.0	40.0	2.15787	0.001	98	0.05	compliant
-48.0	50.0	-1.97660	-0.001	98	0.05	compliant
QPSK Modulation ANT3						
-48.0	-30.0	-3.93046	-0.002	98	0.05	compliant
-48.0	-20.0	-3.24396	-0.002	98	0.05	compliant
-48.0	-10.0	2.88430	-0.001	98	0.05	compliant
-48.0	0.0	-2.76423	-0.001	98	0.05	compliant
-48.0	10.0	3.56073	0.002	98	0.05	compliant
-48.0	30.0	-3.51009	-0.002	98	0.05	compliant
-48.0	40.0	-1.97993	-0.001	98	0.05	compliant
-48.0	50.0	-4.40545	-0.002	98	0.05	compliant
QPSK Modulation ANT4						
-48.0	-30.0	-4.65274	-0.002	98	0.05	compliant



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

-48.0	-20.0	4.08529	0.002	98	0.05	compliant
-48.0	-10.0	-3.54912	-0.002	98	0.05	compliant
-48.0	0.0	-1.44202	-0.001	98	0.05	compliant
-48.0	10.0	2.90116	0.001	98	0.05	compliant
-48.0	30.0	-4.42876	-0.002	98	0.05	compliant
-48.0	40.0	2.12959	0.001	98	0.05	compliant
-48.0	50.0	-3.86517	-0.002	98	0.05	compliant
16QAM Modulation ANT1						
-48.0	-30.0	-6.18016	-0.003	98	0.05	compliant
-48.0	-20.0	-2.24039	-0.001	98	0.05	compliant
-48.0	-10.0	-3.95819	-0.002	98	0.05	compliant
-48.0	0.0	-1.69623	-0.001	98	0.05	compliant
-48.0	10.0	-3.31227	-0.002	98	0.05	compliant
-48.0	30.0	2.78634	0.001	98	0.05	compliant
-48.0	40.0	-6.08577	-0.003	98	0.05	compliant
-48.0	50.0	-2.94582	-0.002	98	0.05	compliant
16QAM Modulation ANT2						
-48.0	-30.0	-2.83044	-0.001	98	0.05	compliant
-48.0	-20.0	-3.62631	-0.002	98	0.05	compliant
-48.0	-10.0	-5.26973	-0.003	98	0.05	compliant
-48.0	0.0	-2.54088	-0.001	98	0.05	compliant
-48.0	10.0	-2.25815	-0.001	98	0.05	compliant
-48.0	30.0	-4.16972	-0.002	98	0.05	compliant
-48.0	40.0	-4.06499	-0.002	98	0.05	compliant
-48.0	50.0	-3.79171	-0.002	98	0.05	compliant
16QAM Modulation ANT3						
-48.0	-30.0	4.32380	-0.002	98	0.05	compliant
-48.0	-20.0	-2.55295	-0.001	98	0.05	compliant
-48.0	-10.0	4.08083	0.002	98	0.05	compliant
-48.0	0.0	-2.91676	-0.001	98	0.05	compliant
-48.0	10.0	-2.74511	-0.001	98	0.05	compliant
-48.0	30.0	-4.21553	-0.002	98	0.05	compliant
-48.0	40.0	-5.48549	-0.003	98	0.05	compliant
-48.0	50.0	-3.38418	-0.002	98	0.05	compliant
16QAM Modulation ANT4						
-48.0	-30.0	-3.66239	-0.002	98	0.05	compliant
-48.0	-20.0	-3.71257	-0.002	98	0.05	compliant
-48.0	-10.0	-3.22717	-0.002	98	0.05	compliant
-48.0	0.0	2.07853	-0.001	98	0.05	compliant
-48.0	10.0	-4.56676	-0.002	98	0.05	compliant
-48.0	30.0	4.99210	-0.003	98	0.05	compliant



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

-48.0	40.0	-4.06764	-0.002	98	0.05	compliant
-48.0	50.0	2.98961	-0.002	98	0.05	compliant
64QAM Modulation ANT1						
-48.0	-30.0	3.57155	0.002	98	0.05	compliant
-48.0	-20.0	-2.87384	-0.001	98	0.05	compliant
-48.0	-10.0	2.47592	0.001	98	0.05	compliant
-48.0	0.0	-2.71927	-0.001	98	0.05	compliant
-48.0	10.0	-5.03245	-0.003	98	0.05	compliant
-48.0	30.0	-2.15059	0.001	98	0.05	compliant
-48.0	40.0	6.68415	0.003	98	0.05	compliant
-48.0	50.0	-4.63445	0.002	98	0.05	compliant
64QAM Modulation ANT2						
-48.0	-30.0	-2.87553	-0.002	98	0.05	compliant
-48.0	-20.0	1.70326	0.001	98	0.05	compliant
-48.0	-10.0	-3.45269	-0.002	98	0.05	compliant
-48.0	0.0	-4.61729	-0.002	98	0.05	compliant
-48.0	10.0	-6.36988	-0.003	98	0.05	compliant
-48.0	30.0	-7.34017	-0.004	98	0.05	compliant
-48.0	40.0	2.96688	0.002	98	0.05	compliant
-48.0	50.0	2.86301	0.001	98	0.05	compliant
64QAM Modulation ANT3						
-48.0	-30.0	-4.07313	-0.003	98	0.05	compliant
-48.0	-20.0	3.91315	0.002	98	0.05	compliant
-48.0	-10.0	3.67716	0.002	98	0.05	compliant
-48.0	0.0	-3.63478	0.002	98	0.05	compliant
-48.0	10.0	-5.44036	-0.003	98	0.05	compliant
-48.0	30.0	3.07857	0.002	98	0.05	compliant
-48.0	40.0	2.26563	0.001	98	0.05	compliant
-48.0	50.0	-2.69789	-0.001	98	0.05	compliant
64QAM Modulation ANT4						
-48.0	-30.0	-6.30929	-0.003	98	0.05	compliant
-48.0	-20.0	-5.63314	-0.003	98	0.05	compliant
-48.0	-10.0	-3.02710	-0.002	98	0.05	compliant
-48.0	0.0	-3.00764	-0.002	98	0.05	compliant
-48.0	10.0	2.66115	0.001	98	0.05	compliant
-48.0	30.0	2.41279	0.001	98	0.05	compliant
-48.0	40.0	4.83152	0.002	98	0.05	compliant
-48.0	50.0	-3.40954	-0.002	98	0.05	compliant
256QAM Modulation ANT1						
-48.0	-30	-4.85063	-0.002	98	0.05	compliant
-48.0	-20	-5.65807	-0.003	98	0.05	compliant



FCC ID:
VBNAHFB-01

Test Report No:
D555117518

-48.0	-10	-4.54704	-0.002	98	0.05	compliant
-48.0	0	-3.48245	-0.002	98	0.05	compliant
-48.0	10	-4.28769	-0.002	98	0.05	compliant
-48.0	30	2.63047	0.001	98	0.05	compliant
-48.0	40	2.88480	0.001	98	0.05	compliant
-48.0	50	-2.28345	-0.001	98	0.05	compliant
256QAM Modulation ANT2						
-48.0	-30	-1.33135	-0.001	98	0.05	compliant
-48.0	-20	3.82833	0.002	98	0.05	compliant
-48.0	-10	-7.34127	-0.004	98	0.05	compliant
-48.0	0	3.69276	0.002	98	0.05	compliant
-48.0	10	-2.67310	-0.001	98	0.05	compliant
-48.0	30	-5.14513	-0.003	98	0.05	compliant
-48.0	40	-6.07315	-0.003	98	0.05	compliant
-48.0	50	-2.78919	-0.001	98	0.05	compliant
256QAM Modulation ANT3						
-48.0	-30	-4.21508	-0.002	98	0.05	compliant
-48.0	-20	-6.35217	-0.003	98	0.05	compliant
-48.0	-10	4.27024	0.002	98	0.05	compliant
-48.0	0	-5.15945	-0.003	98	0.05	compliant
-48.0	10	-2.80761	-0.001	98	0.05	compliant
-48.0	30	-2.01115	-0.001	98	0.05	compliant
-48.0	40	2.18213	0.001	98	0.05	compliant
-48.0	50	1.83512	0.001	98	0.05	compliant
256QAM Modulation ANT4						
-48.0	-30	-5.32584	-0.003	98	0.05	compliant
-48.0	-20	-5.39694	-0.003	98	0.05	compliant
-48.0	-10	-4.30201	-0.002	98	0.05	compliant
-48.0	0	-3.85060	-0.002	98	0.05	compliant
-48.0	10	-4.83933	-0.003	98	0.05	compliant
-48.0	30	-3.02324	-0.002	98	0.05	compliant
-48.0	40	2.73651	0.001	98	0.05	compliant
-48.0	50	2.27368	0.001	98	0.05	compliant
Measurement Uncertainty:					±1.0 Hz	

Table 15 Frequency stability with temp. var. (20 MHz Channel BW)