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Report On

Radio Testing of the
Nokia Solutions and Networks Oy
AirScale Base Station RRH 2.1GHz
Radio Access technology: E-UTRA (FDD)
In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 27

COMMERCIAL-IN-CONFIDENCE

FCC ID: VBNAHIB-01

Document 75938941 Report 01 Issue 1 June 2017

Product Service

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REPORT ON

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Document 75938941 Report 01 Issue 1

June 2017

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DATED 16 June 2017

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SECTION 1

REPORT SUMMARY

Radio Testing of the
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In accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 27

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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 2.1GHz, Radio Access technology: E-UTRA (FDD) in accordance with FCC CFR 47 Part 2 and FCC CFR 47 Part 27.

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)	AHIB
Serial Number(s)	EA171111529 EA171111543
Number of Samples Tested	2
Test Specification/Issue/Date	FCC CFR 47 Part 2 (2016) FCC CFR 47 Part 27 (2016)
Order Number Date	90778511 28 April 2017
Start of Test	27 April 2017
Finish of Test	01 June 2017
Name of Engineer(s)	Antero Simi Sami Riuttanen

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SECTION 2

DISCLAIMERS AND COPYRIGHT

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2.1 DISCLAIMERS AND COPYRIGHT

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

Product Service

ANNEX A

NOKIA SOLUTIONS AND NETWORKS OY TEST REPORT NO: D556049976

Product Service

Nokia Networks

TEST REPORT NO: D556049976

FCC ID: VBNAHIB-01

Date:	Oulu 16. May 2017
Pages:	189
Appendices:	-

Equipment Under Test:	AirScale Base Station RRH 2.1GHz Radio Access technology: E-UTRA (FDD)
Type:	AHIB
Manufacturer:	Nokia Solutions and Networks Oy
Address:	P.O. Box 319, Kaapelitie 4, FI-90620, Oulu, Finland
Task:	Conformance test according to the specificarions mentioned below
Test Specification(s):	FCC 47 CFR part 2 (2016) and FCC 47 CFR part 27 (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 R&D Line Manager NSN	16. May 2017	

CONTENTS

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, § 27.50	8	compliant
2	Modulation Characteristics	§ 2.1047, § 2.201	14	compliant
3	Occupied Bandwidth	§ 2.1049	15	compliant
4	Spurious Emissions at Antenna Terminals	§ 2.1051, § 2.1057, § 27.53	20	compliant
5	Field Strength of Spurious Radiation	§ 2.1053, § 2.1057, § 27.53, § 27.55	31	compliant
6	Frequency Stability	§ 2.1055, § 27.54	33	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.

1.1 Test Laboratory:

Nokia Solutions and Networks Oy

Kaapelitie 4,

FI-90620, Oulu, Finland

Jari Virta

FCC Reg. No: 411251

Testing laboratory accreditation number: T297

1.2 Time Schedule

Test No.	1, 2, 3, 4	5	6
Start of Test:	27 Apr 2017	26 May 2017	5 May 2017
End of Test:	5 May 2017	1 June 2017	11 May 2017

1.3 Participants

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

2. EQUIPMENT UNDER TEST

The EUT is a LTE Base transceiver station RRH 2.1GHz 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 2.1GHz**	
Radio Access Technology	E-UTRA	
Duplex mode	Frequency Division Duplex (FDD)	
Channel Bandwidth	Single carrier 10MHz (Config. A), Single carrier 20MHz (Config. B), Dual carrier 10MHz (Config. C).	
Supply Voltage	48.0 V DC	
Frequency Bands		
Channel Bandwidth 10MHz	**Lowest** tunable freq. Singe carrier	2115.0MHz
	Dual carriers	2115.0/2125.0MHz
	Middle freq. Single carrier	2145.0MHz
	Dual carriers	2140.0/2150.0MHz
	Highest tunable freq. Single carrier	2175.0MHz
	Dual carriers	2165.0/2175.0MHz
Channel Bandwidth 20MHz	**Lowest** tunable freq. Singe carrier	2120.0MHz
	Middle freq. Single carrier	2145.0MHz
	Highest tunable freq. Single carrier	2170.0MHz
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

The tests were performed with two 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.
AHIB	EA171111529	RRH	A, B, C
AHIB	EA171111543	RRH	A, B, C
Other Modules	**Module Type**		**Config.**
AMIA	AirScale Subrack		A, B, C
ASIA	AirScale Common unit		A, B, C
ABIA	AirScale Capacity unit		A, B, C

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.

3. TEST CONFIGURATION

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

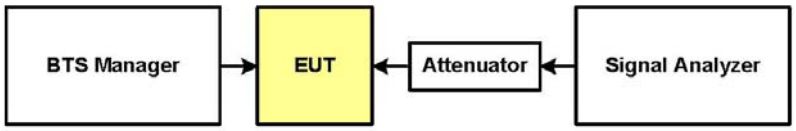

Figure 1 Test Configuration (single output)

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

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.

4. TEST RESULTS

4.1 Test No. 1: RF Power Output (§ 2.1046, § 27.50)

4.1.1. Limits

Para. No. 27.50 (h).(1) Main, booster and base stations. (i) The maximum EIRP of a main, booster or base station shall not exceed 33 dBW + 10log(X/Y) dBW, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

Sample calculation: 33dBW + 10log(10MHz/5.5MHz) dBW = 34.26 dBW = ~2667W

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.

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:	
27 Apr – 4 May 17	25 °C	27 °C	13 RH%	21 RH%

Config A:

Carrier Frequency [MHz]	RF Power Output		PAPR	Result
	[dBm]	[W]	[dB]	
QPSK-Modulation ANT1				
2115.0	36.75	4.73151	8.06	compliant
2145.0	36.81	4.79733	8.06	compliant
2175.0	36.99	5.00035	8.03	compliant

QPSK-Modulation ANT2				
2115.0	36.92	4.92040	8.06	compliant
2145.0	37.00	5.01187	8.06	compliant
2175.0	37.09	5.11682	8.03	compliant
QPSK-Modulation ANT3				
2115.0	36.98	4.98884	8.12	compliant
2145.0	37.11	5.14044	8.06	compliant
2175.0	37.18	5.22396	8.03	compliant
QPSK-Modulation ANT4				
2115.0	36.97	4.97737	8.09	compliant
2145.0	37.03	5.04661	8.06	compliant
2175.0	37.16	5.19996	8.03	compliant
QPSK-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
2115.0	42.93	19.61812	-	compliant
2145.0	43.01	19.99626	-	compliant
2175.0	43.13	20.54109	-	compliant
16QAM-Modulation ANT1				
2115.0	36.77	4.75335	8.06	compliant
2145.0	36.86	4.85289	8.03	compliant
2175.0	36.96	4.96592	8.03	compliant
16QAM-Modulation ANT2				
2115.0	36.94	4.94311	8.06	compliant
2145.0	36.94	4.94311	8.00	compliant
2175.0	37.08	5.10505	8.00	compliant
16QAM-Modulation ANT3				
2115.0	36.97	4.97737	8.09	compliant
2145.0	37.09	5.11682	8.06	compliant
2175.0	37.21	5.26017	8.03	compliant
16QAM-Modulation ANT4				
2115.0	37.02	5.03501	8.09	compliant
2145.0	37.07	5.09331	8.03	compliant
2175.0	37.15	5.18800	8.03	compliant
16QAM-Modulation ANT1+ANT2+ANT3+ANT4Calculated Total				
2115.0	42.95	19.70884	-	compliant
2145.0	43.01	20.00612	-	compliant
2175.0	43.12	20.51915	-	compliant
64QAM-Modulation ANT1				
2115.0	36.77	4.75335	8.14	compliant
2145.0	36.83	4.81948	8.09	compliant
2175.0	36.97	4.97737	8.09	compliant
64QAM-Modulation ANT2				
2115.0	36.95	4.95450	8.14	compliant
2145.0	36.97	4.97737	8.09	compliant
2175.0	37.07	5.09331	8.09	compliant
64QAM-Modulation ANT3				
2115.0	36.96	4.96592	8.14	compliant
2145.0	37.04	5.05825	8.12	compliant
2175.0	37.17	5.21195	8.09	compliant
64QAM-Modulation ANT4				
2115.0	37.01	5.02343	8.14	compliant
2145.0	37.02	5.03501	8.09	compliant
2175.0	37.13	5.16416	8.09	compliant

64QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
2115.0	42.94	19.69720	-	compliant
2145.0	42.99	19.89010	-	compliant
2175.0	43.11	20.44679	-	compliant
256QAM-Modulation ANT1				
2115.0	36.80	4.78630	8.12	compliant
2145.0	36.82	4.80839	8.09	compliant
2175.0	36.96	4.96592	8.06	compliant
256QAM-Modulation ANT2				
2115.0	36.94	4.94311	8.09	compliant
2145.0	36.91	4.90908	8.06	compliant
2175.0	37.09	5.11682	8.06	compliant
256QAM-Modulation ANT3				
2115.0	36.97	4.97737	8.12	compliant
2145.0	37.11	5.14044	8.09	compliant
2175.0	37.16	5.19996	8.03	compliant
256QAM-Modulation ANT4				
2115.0	36.98	4.98884	8.12	compliant
2145.0	37.03	5.04661	8.06	compliant
2175.0	37.14	5.17607	8.06	compliant
256QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
2115.0	42.94	19.69562	-	compliant
2145.0	42.99	19.90452	-	compliant
2175.0	43.11	20.45877	-	compliant

Table 4 RF Power Output (10 MHz Channel BW)

Config B:

Carrier Frequency [MHz]	RF Power Output		PAPR	Result
	[dBm]	[W]	[dB]	
QPSK-Modulation ANT1				
2120.0	36.83	4.81948	8.06	compliant
2145.0	36.84	4.83059	8.06	compliant
2170.0	36.93	4.93174	8.03	compliant
QPSK-Modulation ANT2				
2120.0	37.01	5.02343	8.06	compliant
2145.0	36.97	4.97737	8.06	compliant
2170.0	37.02	5.03501	8.03	compliant
QPSK-Modulation ANT3				
2120.0	37.04	5.05825	8.09	compliant
2145.0	37.05	5.06991	8.06	compliant
2170.0	37.06	5.08159	8.03	compliant
QPSK-Modulation ANT4				
2120.0	37.01	5.02343	8.09	compliant
2145.0	37.02	5.03501	8.06	compliant
2170.0	37.07	5.09331	8.03	compliant
QPSK-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
2120.0	42.99	19.92458	-	compliant
2145.0	42.99	19.91287	-	compliant
2170.0	43.04	20.14165	-	compliant
16QAM-Modulation ANT1				

2120.0	36.86	4.85289	8.06	compliant
2145.0	36.85	4.84172	8.03	compliant
2170.0	36.93	4.93174	8.03	compliant
16QAM-Modulation ANT2				
2120.0	37.04	5.05825	8.06	compliant
2145.0	36.99	5.00035	8.03	compliant
2170.0	36.98	4.98884	8.03	compliant
16QAM-Modulation ANT3				
2120.0	37.03	5.04661	8.06	compliant
2145.0	37.05	5.06991	8.03	compliant
2170.0	37.15	5.18800	8.00	compliant
16QAM-Modulation ANT4				
2120.0	37.04	5.05825	8.06	compliant
2145.0	37.02	5.03501	8.03	compliant
2170.0	37.10	5.12861	8.00	compliant
16QAM-Modulation ANT1+ANT2+ANT3+ANT4Calculated Total				
2120.0	43.01	20.01599	-	compliant
2145.0	43.00	19.94698	-	compliant
2170.0	43.06	20.23720	-	compliant
64QAM-Modulation ANT1				
2120.0	36.81	4.79733	8.03	compliant
2145.0	36.85	4.84172	8.03	compliant
2170.0	36.92	4.92040	8.00	compliant
64QAM-Modulation ANT2				
2120.0	37.01	5.02343	8.03	compliant
2145.0	36.99	5.00035	8.03	compliant
2170.0	37.00	5.01187	8.03	compliant
64QAM-Modulation ANT3				
2120.0	37.02	5.03501	8.03	compliant
2145.0	37.08	5.10505	8.06	compliant
2170.0	37.10	5.12861	8.03	compliant
64QAM-Modulation ANT4				
2120.0	37.06	5.08159	8.06	compliant
2145.0	37.05	5.06991	8.03	compliant
2170.0	37.05	5.06991	8.00	compliant
64QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
2120.0	43.00	19.93736	-	compliant
2145.0	43.01	20.01703	-	compliant
2170.0	43.04	20.13079	-	compliant
256QAM-Modulation ANT1				
2120.0	36.82	4.80839	8.09	compliant
2145.0	36.82	4.80839	8.06	compliant
2170.0	36.91	4.90908	8.06	compliant
256QAM-Modulation ANT2				
2120.0	37.03	5.04661	8.06	compliant
2145.0	36.95	4.95450	8.06	compliant
2170.0	37.01	5.02343	8.03	compliant
256QAM-Modulation ANT3				
2120.0	37.08	5.10505	8.09	compliant
2145.0	37.03	5.04661	8.09	compliant
2170.0	37.08	5.10505	8.06	compliant

256QAM-Modulation ANT4				
2120.0	37.01	5.02343	8.09	compliant
2145.0	37.03	5.04661	8.06	compliant
2170.0	37.07	5.09331	8.06	compliant
256QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
2120.0	43.01	19.98348	-	compliant
2145.0	42.98	19.85612	-	compliant
2170.0	43.04	20.13086	-	compliant

Table 5 RF Power Output (20 MHz Channel BW)

Config C:

Carrier Frequency [MHz]	RF Power Output		PAPR	Result
	[dBm]	[W]	[dB]	
QPSK-Modulation ANT1				
2115.0/2125.0	34.06/34.26	2.54480/2.66465	-	compliant
2140.0/2150.0	34.11/34.12	2.57715/2.58026	-	compliant
2165.0/2175.0	34.28/34.08	2.68069/2.55837	-	compliant
QPSK-Modulation ANT2				
2115.0/2125.0	34.03/34.17	2.52756/2.61517	-	compliant
2140.0/2150.0	34.15/34.13	2.59837/2.59107	-	compliant
2165.0/2175.0	34.32/34.14	2.70207/2.59296	-	compliant
QPSK-Modulation ANT3				
2115.0/2125.0	34.18/34.37	2.62025/2.73662	-	compliant
2140.0/2150.0	34.27/34.20	2.67470/2.63090	-	compliant
2165.0/2175.0	34.35/34.12	2.72480/2.58467	-	compliant
QPSK-Modulation ANT4				
2115.0/2125.0	34.12/34.29	2.58220/2.68676	-	compliant
2140.0/2150.0	34.29/34.24	2.68667/2.65728	-	compliant
2165.0/2175.0	34.40/34.20	2.75673/2.63033	-	compliant
QPSK-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
2115.0/2125.0	43.22	20.97801	-	compliant
2140.0/2150.0	43.22	20.99640	-	compliant
2165.0/2175.0	43.27	21.23063	-	compliant
16QAM-Modulation ANT1				
2115.0/2125.0	34.05/34.24	2.5382/2.65394	-	compliant
2140.0/2150.0	34.13/34.15	2.58834/2.60121	-	compliant
2165.0/2175.0	34.22/34.07	2.64317/2.55401	-	compliant
16QAM-Modulation ANT2				
2115.0/2125.0	34.09/34.22	2.56247/2.64472	-	compliant
2140.0/2150.0	34.17/34.13	2.60952/2.58720	-	compliant
2165.0/2175.0	34.33/34.08	2.70993/2.55749	-	compliant
16QAM-Modulation ANT3				
2115.0/2125.0	34.22/34.41	2.64041/2.75876	-	compliant
2140.0/2150.0	34.28/34.17	2.68156/2.61348	-	compliant
2165.0/2175.0	34.32/34.14	2.70589/2.59196	-	compliant
16QAM-Modulation ANT4				
2115.0/2125.0	34.11/34.29	2.57466/2.68772	-	compliant
2140.0/2150.0	34.31/34.23	2.69688/2.64765	-	compliant
2165.0/2175.0	34.41/34.19	2.75760/2.62332	-	compliant
16QAM-Modulation ANT1+ANT2+ANT3+ANT4Calculated Total				
2115.0/2125.0	43.23	21.06095	-	compliant

2140.0/2150.0	43.23	21.02583	-	compliant
2165.0/2175.0	43.25	21.14335	-	compliant
64QAM-Modulation ANT1				
2115.0/2125.0	34.06/34.24	2.54862/2.65471	-	compliant
2140.0/2150.0	34.13/34.12	2.58572/2.58256	-	compliant
2165.0/2175.0	34.26/34.07	2.66956/2.55119	-	compliant
64QAM-Modulation ANT2				
2115.0/2125.0	34.01/34.17	2.51940/2.61381	-	compliant
2140.0/2150.0	34.17/34.11	2.61075/2.57800	-	compliant
2165.0/2175.0	34.29/34.11	2.68690/2.57478	-	compliant
64QAM-Modulation ANT3				
2115.0/2125.0	34.14/34.36	2.59280/2.73089	-	compliant
2140.0/2150.0	34.23/34.20	2.65142/2.63192	-	compliant
2165.0/2175.0	34.38/34.16	2.74147/2.60768	-	compliant
64QAM-Modulation ANT4				
2115.0/2125.0	34.12/34.30	2.58291/2.69324	-	compliant
2140.0/2150.0	34.27/34.22	2.67590/2.64261	-	compliant
2165.0/2175.0	34.37/34.20	2.73619/2.63287	-	compliant
64QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
2115.0/2125.0	43.21	20.93637	-	compliant
2140.0/2150.0	43.21	20.95888	-	compliant
2165.0/2175.0	43.26	21.20062	-	compliant
256QAM-Modulation ANT1				
2115.0/2125.0	34.09/34.22	2.56420/2.64383	-	compliant
2140.0/2150.0	34.16/34.14	2.60391/2.59127	-	compliant
2165.0/2175.0	34.21/34.02	2.63654/2.52614	-	compliant
256QAM-Modulation ANT2				
2115.0/2125.0	34.00/34.18	2.51453/2.61749	-	compliant
2140.0/2150.0	34.18/34.14	2.61821/2.59495	-	compliant
2165.0/2175.0	34.29/34.10	2.68664/2.57040	-	compliant
256QAM-Modulation ANT3				
2115.0/2125.0	34.19/34.36	2.62310/2.72793	-	compliant
2140.0/2150.0	34.23/34.16	2.64669/2.60691	-	compliant
2165.0/2175.0	34.38/34.16	2.73920/2.60674	-	compliant
256QAM-Modulation ANT4				
2115.0/2125.0	34.08/34.27	2.55592/2.67066	-	compliant
2140.0/2150.0	34.27/34.20	2.67495/2.63087	-	compliant
2165.0/2175.0	34.41/34.19	2.75797/2.62153	-	compliant
256QAM-Modulation ANT1+ANT2+ANT3+ANT4 Calculated Total				
2115.0/2125.0	43.21	20.91766	-	compliant
2140.0/2150.0	43.22	20.96776	-	compliant
2165.0/2175.0	43.25	21.14517	-	compliant

Table 6 RF Power Output (10 +10 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.

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

The occupied bandwidth was measured to be 9MHz (Config. A), 18MHz (Config. A) and 19MHz (Config. C) which represents the 99% power bandwidth (see the following section and screenshots on pages 52).

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

Config A: 9M0D9W (Channel bandwidth 10 MHz)

Config B: 18M0D9W (Channel bandwidth 20 MHz)

Config C: 19M0D9W (Channel bandwidth 10 +10 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 47, 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.

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

4.3.1. Limits

Para. No. 2.1049. The 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the emitted power.

4.3.2. Test Procedure and Results

The 99% occupied bandwidth of the carrier emission is measured using a signal analyzer with Resolution Bandwidth 1-5 % of anticipated OBW, and the VBW at least 3 times the RBW; see screenshots on page 52 for details.

The following tables summarize the results:

Measured laboratory room temperature and humidity during the tests				
Date	Temperature Min-Max:		Humidity Min-Max:	
28.Apr – 15. May 17	25 °C	27 °C	13 RH%	18 RH%

Config A:

Carrier Frequency [MHz]	Occupied Bandwidth [MHz]	Result
QPSK-Modulation ANT1		
2115.0	8.9300	compliant
2145.0	8.9400	compliant
2175.0	8.9400	compliant
QPSK-Modulation ANT2		
2115.0	8.9300	compliant
2145.0	8.9400	compliant
2175.0	8.9400	compliant
QPSK-Modulation ANT3		
2115.0	8.9300	compliant
2145.0	8.9400	compliant
2175.0	8.9400	compliant
QPSK-Modulation ANT4		
2115.0	8.9400	compliant
2145.0	8.9400	compliant
2175.0	8.9400	compliant
16QAM-Modulation ANT1		
2115.0	8.9200	compliant
2145.0	8.9100	compliant
2175.0	8.9400	compliant
16QAM-Modulation ANT2		
2115.0	8.9300	compliant
2145.0	8.9300	compliant
2175.0	8.9300	compliant
16QAM-Modulation ANT3		
2115.0	8.9200	compliant
2145.0	8.9400	compliant
2175.0	8.9200	compliant

16QAM-Modulation ANT4		
2115.0	8.9300	compliant
2145.0	8.9300	compliant
2175.0	8.9100	compliant
64QAM-Modulation ANT1		
2115.0	8.9300	compliant
2145.0	8.9300	compliant
2175.0	8.9300	compliant
64QAM-Modulation ANT2		
2115.0	8.9300	compliant
2145.0	8.9300	compliant
2175.0	8.9300	compliant
64QAM-Modulation ANT3		
2115.0	8.9300	compliant
2145.0	8.9300	compliant
2175.0	8.9300	compliant
64QAM-Modulation ANT4		
2115.0	8.9300	compliant
2145.0	8.9200	compliant
2175.0	8.9300	compliant
256QAM-Modulation ANT1		
2115.0	8.9400	compliant
2145.0	8.9400	compliant
2175.0	8.9400	compliant
256QAM-Modulation ANT2		
2115.0	8.9400	compliant
2145.0	8.9400	compliant
2175.0	8.9400	compliant
256QAM-Modulation ANT3		
2115.0	8.9400	compliant
2145.0	8.9400	compliant
2175.0	8.9400	compliant
256QAM-Modulation ANT4		
2115.0	8.9300	compliant
2145.0	8.9400	compliant
2175.0	8.9400	compliant
Measurement Uncertainty:		±48kHz

Table 7 Occupied Bandwidth (10 MHz Channel BW)

Config B:

Carrier Frequency [MHz]	Occupied Bandwidth [MHz]	Result
QPSK-Modulation ANT1		
2120.0	17.8600	compliant
2145.0	17.8600	compliant
2170.0	17.8600	compliant
QPSK-Modulation ANT2		
2120.0	17.8600	compliant
2145.0	17.8600	compliant
2170.0	17.8600	compliant
QPSK-Modulation ANT3		

2120.0	17.8600	compliant
2145.0	17.8600	compliant
2170.0	17.8400	compliant
QPSK-Modulation ANT4		
2120.0	17.8600	compliant
2145.0	17.8400	compliant
2170.0	17.8400	compliant
16QAM-Modulation ANT1		
2120.0	17.8200	compliant
2145.0	17.8200	compliant
2170.0	17.8400	compliant
16QAM-Modulation ANT2		
2120.0	17.8200	compliant
2145.0	17.8200	compliant
2170.0	17.8400	compliant
16QAM-Modulation ANT3		
2120.0	17.8400	compliant
2145.0	17.8200	compliant
2170.0	17.8200	compliant
16QAM-Modulation ANT4		
2120.0	17.8200	compliant
2145.0	17.8200	compliant
2170.0	17.8200	compliant
64QAM-Modulation ANT1		
2120.0	17.8600	compliant
2145.0	17.8600	compliant
2170.0	17.8600	compliant
64QAM-Modulation ANT2		
2120.0	17.8600	compliant
2145.0	17.8600	compliant
2170.0	17.8600	compliant
64QAM-Modulation ANT3		
2120.0	17.8600	compliant
2145.0	17.8600	compliant
2170.0	17.8600	compliant
64QAM-Modulation ANT4		
2120.0	17.8600	compliant
2145.0	17.8600	compliant
2170.0	17.8600	compliant
256QAM-Modulation ANT1		
2120.0	17.8600	compliant
2145.0	17.8600	compliant
2170.0	17.8600	compliant
256QAM-Modulation ANT2		
2120.0	17.8600	compliant
2145.0	17.8400	compliant
2170.0	17.8600	compliant
256QAM-Modulation ANT3		
2120.0	17.8600	compliant
2145.0	17.8600	compliant
2170.0	17.8600	compliant

256QAM-Modulation ANT4		
2120.0	17.8600	compliant
2145.0	17.8400	compliant
2170.0	17.8600	compliant
Measurement Uncertainty:		±48kHz

Table 8 Occupied Bandwidth (20 MHz Channel BW)

Config C:

Carrier Frequency [MHz]	Occupied Bandwidth [MHz]	Result
QPSK-Modulation ANT1		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8300	compliant
QPSK-Modulation ANT2		
2115.0/2125.0	18.8400	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8300	compliant
QPSK-Modulation ANT3		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8300	compliant
QPSK-Modulation ANT4		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8300	compliant
16QAM-Modulation ANT1		
2115.0/2125.0	18.8400	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8600	compliant
16QAM-Modulation ANT2		
2115.0/2125.0	18.8400	compliant
2140.0/2150.0	18.8400	compliant
2165.0/2175.0	18.8600	compliant
16QAM-Modulation ANT3		
2115.0/2125.0	18.8400	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8400	compliant
16QAM-Modulation ANT4		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8400	compliant
64QAM-Modulation ANT1		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8600	compliant
64QAM-Modulation ANT2		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8600	compliant

2165.0/2175.0	18.8600	compliant
64QAM-Modulation ANT3		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8600	compliant
64QAM-Modulation ANT4		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8600	compliant
256QAM-Modulation ANT1		
2115.0/2125.0	18.8400	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8300	compliant
256QAM-Modulation ANT2		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8300	compliant
256QAM-Modulation ANT3		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8300	compliant
2165.0/2175.0	18.8300	compliant
256QAM-Modulation ANT4		
2115.0/2125.0	18.8600	compliant
2140.0/2150.0	18.8600	compliant
2165.0/2175.0	18.8300	compliant
Measurement Uncertainty:		±48kHz

Table 9 Occupied Bandwidth (10+10 MHz Channel BW)

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

4.4 Test No. 4: Spurious Emissions at Antenna Terminals (§ 2.1051, § 2.1057, § 27.53)

4.4.1. Limits

Para. No. 27.53(m). For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts.

(m)(2) For fixed and temporary fixed digital stations, the attenuation shall be not less than 43 + 10 log (P) dB (P = transmitter power in Watts).

The compliance limit was calculated in the following way:

Maximum transmitter output power [W]:	P
Maximum transmitter output power [dBm]:	30 + 10 log10 P (conversion from W to dBm)
Attenuation required by FCC:	43 + 10 log10 P

Compliance limit = Maximum transmitter output power - Required attenuation

= 30 + 10 log10 P - (43 + 10 log10 P) = -13 dBm

For MiMo output from 4 TX -antenna connectors, each antenna connectors were measured individually and each individual limit lime was reduced by 10log(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 § 27.53(m). For all frequency ranges except two (immediately below and above the carrier frequency block) a 1 MHz resolution bandwidth was used for the measurements.

(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

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 **Error! Bookmark not defined.** 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.

Measured laboratory room temperature and humidity during the tests				
Date	Temperature Min-Max:		Humidity Min-Max:	
2 – 5 May 17	25 °C	27 °C	13 RH%	18 RH%

Config A Lower band edge:

Carrier Frequency: 2115.0 MHz			
Frequency Range [MHz]	**Emission Frequency [MHz]**	**Maximum Emission Level [dBm]**	**Result**
QPSK-Modulation ANT1			
	2110	-30.84	compliant
QPSK-Modulation ANT2			
	2110	-30.30	compliant
QPSK-Modulation ANT3			
	2110	-30.57	compliant
QPSK-Modulation ANT4			
	2110	-30.47	compliant
16QAM-Modulation ANT1			
	2110	-30.93	compliant
16QAM-Modulation ANT2			
	2110	-29.44	compliant
16QAM-Modulation ANT3			
	2110	-29.96	compliant
16QAM-Modulation ANT4			
	2110	-30.40	compliant
64QAM-Modulation ANT1			
	2110	-31.03	compliant
64QAM-Modulation ANT2			
	2110	-30.22	compliant
64QAM-Modulation ANT3			
	2110	-31.10	compliant
64QAM-Modulation ANT4			
	2110	-30.79	compliant
256QAM-Modulation ANT1			
	2110	-30.49	compliant
256QAM-Modulation ANT2			
	2110	-30.15	compliant
256QAM-Modulation ANT3			
	2110	-30.80	compliant

256QAM-Modulation ANT4			
	2110	-30.40	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 (Lower band edge) (10 MHz Channel BW)

Config A Upper band edge:

Carrier Frequency: 2175.0 MHz			
Frequency Range [MHz]	**Emission Frequency [MHz]**	**Maximum Emission Level [dBm]**	**Result**
QPSK-Modulation ANT1			
	2180	-30.00	compliant
QPSK-Modulation ANT2			
	2180	-29.22	compliant
QPSK-Modulation ANT3			
	2180	-29.67	compliant
QPSK-Modulation ANT4			
	2180	-30.00	compliant
16QAM-Modulation ANT1			
	2180	-30.03	compliant
16QAM-Modulation ANT2			
	2180	-29.14	compliant
16QAM-Modulation ANT3			
	2180	-29.42	compliant
16QAM-Modulation ANT4			
	2180	-29.77	compliant
64QAM-Modulation ANT1			
	2180	-30.09	compliant
64QAM-Modulation ANT2			
	2180	-28.70	compliant
64QAM-Modulation ANT3			
	2180	-29.31	compliant
64QAM-Modulation ANT4			
	2180	-29.79	compliant
256QAM-Modulation ANT1			
	2180	-29.90	compliant
256QAM-Modulation ANT2			
	2180	-28.94	compliant

256QAM-Modulation ANT3			
	2180	-29.20	compliant
256QAM-Modulation ANT4			
	2180	-29.65	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 11 Spurious Emissions (Upper band edge) (10 MHz Channel BW)

Config A Spurious emissions:

Carrier Frequency: 2145.0 MHz			
Frequency Range [MHz]	**Emission Frequency [MHz]**	**Maximum Emission Level [dBm]**	**Result**
QPSK-Modulation ANT1			
0.009 – 21800	4288	-37.60	compliant
QPSK-Modulation ANT2			
0.009 – 21800	4288	-37.90	compliant
QPSK-Modulation ANT3			
0.009 – 21800	4288	-37.95	compliant
QPSK-Modulation ANT4			
0.009 – 21800	4288	-37.78	compliant
16QAM-Modulation ANT1			
0.009 – 21800	4288	-37.50	compliant
16QAM-Modulation ANT2			
0.009 – 21800	4288	-37.95	compliant
16QAM-Modulation ANT3			
0.009 – 21800	4288	-38.26	compliant
16QAM-Modulation ANT4			
0.009 – 21800	4288	-37.59	compliant
64QAM-Modulation ANT1			
0.009 – 21800	4288	-37.77	compliant
64QAM-Modulation ANT2			
0.009 – 21800	4288	-38.06	compliant
64QAM-Modulation ANT3			
0.009 – 21800	4288	-37.95	compliant
64QAM-Modulation ANT4			
0.009 – 21800	4288	-38.01	compliant
256QAM-Modulation ANT1			

0.009 – 21800	4288	-37.77	compliant
256QAM-Modulation ANT2			
0.009 – 21800	4288	-38.11	compliant
256QAM-Modulation ANT3			
0.009 – 21800	4288	-37.75	compliant
256QAM-Modulation ANT4			
0.009 – 21800	4288	-37.78	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 (10 MHz Channel BW)

Config B Lower band edge:

Carrier Frequency: 2120.0 MHz			
Frequency Range [MHz]	**Emission Frequency [MHz]**	**Maximum Emission Level [dBm]**	**Result**
QPSK-Modulation ANT1			
	2110	-31.01	compliant
QPSK-Modulation ANT2			
	2110	-30.34	compliant
QPSK-Modulation ANT3			
	2110	-30.52	compliant
QPSK-Modulation ANT4			
	2110	-30.79	compliant
16QAM-Modulation ANT1			
	2110	-31.03	compliant
16QAM-Modulation ANT2			
	2110	-30.39	compliant
16QAM-Modulation ANT3			
	2110	-30.60	compliant
16QAM-Modulation ANT4			
	2110	-30.90	compliant
64QAM-Modulation ANT1			
	2110	-30.83	compliant
64QAM-Modulation ANT2			
	2110	-30.39	compliant
64QAM-Modulation ANT3			
	2110	-30.46	compliant
64QAM-Modulation ANT4			

	2110	-30.54	compliant
256QAM-Modulation ANT1			
	2110	-31.09	compliant
256QAM-Modulation ANT2			
	2110	-30.48	compliant
256QAM-Modulation ANT3			
	2110	-30.56	compliant
256QAM-Modulation ANT4			
	2110	-30.85	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 (Lower band edge) (20 MHz Channel BW)

Config B Upper band edge:

Carrier Frequency: 2170.0 MHz			
Frequency Range [MHz]	Emission Frequency [MHz]	Maximum Emission Level [dBm]	Result
QPSK-Modulation ANT1			
	2180	-30.17	compliant
QPSK-Modulation ANT2			
	2180	-29.20	compliant
QPSK-Modulation ANT3			
	2180	-29.57	compliant
QPSK-Modulation ANT4			
	2180	-29.85	compliant
16QAM-Modulation ANT1			
	2180	-29.63	compliant
16QAM-Modulation ANT2			
	2180	-29.06	compliant
16QAM-Modulation ANT3			
	2180	-29.73	compliant
16QAM-Modulation ANT4			
	2180	-29.57	compliant
64QAM-Modulation ANT1			
	2180	-30.36	compliant
64QAM-Modulation ANT2			
	2180	-29.27	compliant
64QAM-Modulation ANT3			

	2180	-29.78	compliant
64QAM-Modulation ANT4			
	2180	-30.13	compliant
256QAM-Modulation ANT1			
	2180	-30.01	compliant
256QAM-Modulation ANT2			
	2180	-29.04	compliant
256QAM-Modulation ANT3			
	2180	-29.91	compliant
256QAM-Modulation ANT4			
	2180	-30.11	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 14 Spurious Emissions (Upper band edge) (20 MHz Channel BW)

Config B Spurious emissions:

Carrier Frequency: 2145.0 MHz			
Frequency Range [MHz]	**Emission Frequency [MHz]**	**Maximum Emission Level [dBm]**	**Result**
QPSK-Modulation ANT1			
0.009 – 21800	3000	-39.19	compliant
QPSK-Modulation ANT2			
0.009 – 21800	3000	-39.17	compliant
QPSK-Modulation ANT3			
0.009 – 21800	3000	-39.16	compliant
QPSK-Modulation ANT4			
0.009 – 21800	3000	-39.17	compliant
16QAM-Modulation ANT1			
0.009 – 21800	3000	-39.23	compliant
16QAM-Modulation ANT2			
0.009 – 21800	3000	-39.15	compliant
16QAM-Modulation ANT3			
0.009 – 21800	3000	-39.11	compliant
16QAM-Modulation ANT4			
0.009 – 21800	3000	-39.14	compliant
64QAM-Modulation ANT1			
0.009 – 21800	3000	-39.15	compliant

64QAM-Modulation ANT2			
0.009 – 21800	3000	-39.00	compliant
64QAM-Modulation ANT3			
0.009 – 21800	3000	-39.16	compliant
64QAM-Modulation ANT4			
0.009 – 21800	3000	-39.19	compliant
256QAM-Modulation ANT1			
0.009 – 21800	3000	-39.18	compliant
256QAM-Modulation ANT2			
0.009 – 21800	3000	-39.13	compliant
256QAM-Modulation ANT3			
0.009 – 21800	3000	-39.16	compliant
256QAM-Modulation ANT4			
0.009 – 21800	4288	-39.10	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 15 Spurious Emissions (20 MHz Channel BW)

Config C Lower band edge:

Carrier Frequency: 2115.0/2125 MHz			
Frequency Range [MHz]	**Emission Frequency [MHz]**	**Maximum Emission Level [dBm]**	**Result**
QPSK-Modulation ANT1			
	2110	-34.23	compliant
QPSK-Modulation ANT2			
	2110	-33.43	compliant
QPSK-Modulation ANT3			
	2110	-34.14	compliant
QPSK-Modulation ANT4			
	2110	-33.89	compliant
16QAM-Modulation ANT1			
	2110	-34.68	compliant
16QAM-Modulation ANT2			
	2110	-33.82	compliant
16QAM-Modulation ANT3			
	2110	-33.87	compliant
16QAM-Modulation ANT4			
	2110	-34.59	compliant

64QAM-Modulation ANT1			
	2110	-33.52	compliant
64QAM-Modulation ANT2			
	2110	-33.25	compliant
64QAM-Modulation ANT3			
	2110	-33.63	compliant
64QAM-Modulation ANT4			
	2110	-34.90	compliant
256QAM-Modulation ANT1			
	2110	-34.16	compliant
256QAM-Modulation ANT2			
	2110	-33.61	compliant
256QAM-Modulation ANT3			
	2110	-34.32	compliant
256QAM-Modulation ANT4			
	2110	-34.40	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 16 Spurious Emissions (Lower band edge) (10+10 MHz Channel BW)

Config C Upper band edge:

Carrier Frequency: 2165/2175.0 MHz			
Frequency Range [MHz]	**Emission Frequency [MHz]**	**Maximum Emission Level [dBm]**	**Result**
QPSK-Modulation ANT1			
	2180	-32.83	compliant
QPSK-Modulation ANT2			
	2180	-32.25	compliant
QPSK-Modulation ANT3			
	2180	-33.14	compliant
QPSK-Modulation ANT4			
	2180	-33.27	compliant
16QAM-Modulation ANT1			
	2180	-33.47	compliant
16QAM-Modulation ANT2			
	2180	-31.90	compliant
16QAM-Modulation ANT3			
	2180	-32.69	compliant

16QAM-Modulation ANT4			
	2180	-33.32	compliant
64QAM-Modulation ANT1			
	2180	-32.72	compliant
64QAM-Modulation ANT2			
	2180	-32.50	compliant
64QAM-Modulation ANT3			
	2180	-32.80	compliant
64QAM-Modulation ANT4			
	2180	-33.10	compliant
256QAM-Modulation ANT1			
	2180	-33.51	compliant
256QAM-Modulation ANT2			
	2180	-32.47	compliant
256QAM-Modulation ANT3			
	2180	-32.95	compliant
256QAM-Modulation ANT4			
	2180	-33.77	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 17 Spurious Emissions (Upper band edge) (10+10 MHz Channel BW)

Config C Spurious emissions:

Carrier Frequency: 2140/2150 MHz			
Frequency Range [MHz]	**Emission Frequency [MHz]**	**Maximum Emission Level [dBm]**	**Result**
QPSK-Modulation ANT1			
0.009 – 21800	17382	-32.14	compliant
QPSK-Modulation ANT2			
0.009 – 21800	16771	-32.12	compliant
QPSK-Modulation ANT3			
0.009 – 21800	16752	-32.30	compliant
QPSK-Modulation ANT4			
0.009 – 21800	17382	-32.29	compliant
16QAM-Modulation ANT1			
0.009 – 21800	16762	-32.25	compliant
16QAM-Modulation ANT2			

0.009 – 21800	16771	-32.21	compliant
16QAM-Modulation ANT3			
0.009 – 21800	16780	-32.26	compliant
16QAM-Modulation ANT4			
0.009 – 21800	19790	-32.27	compliant
64QAM-Modulation ANT1			
0.009 – 21800	16752	-32.24	compliant
64QAM-Modulation ANT2			
0.009 – 21800	16752	-32.28	compliant
64QAM-Modulation ANT3			
0.009 – 21800	16733	-32.27	compliant
64QAM-Modulation ANT4			
0.009 – 21800	16724	-32.26	compliant
256QAM-Modulation ANT1			
0.009 – 21800	16752	-32.27	compliant
256QAM-Modulation ANT2			
0.009 – 21800	17391	-32.22	compliant
256QAM-Modulation ANT3			
0.009 – 21800	17391	-32.25	compliant
256QAM-Modulation ANT4			
0.009 – 21800	173391	-32.23	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 18 Spurious Emissions (10+10 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.

4.5 Test No. 5: Field Strength of Spurious Radiation (§ 2.1053, § 2.1057, § 27.53)

4.5.1. Limits

Para. No. 27.53(m). For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts.

(m)(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB (P = transmitter power in Watts).

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 2014 and is listed with the FCC.

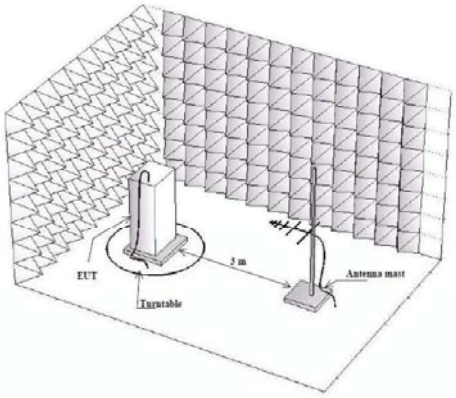

Figure 2 Test Configuration

Photographs of the EUT in the anechoic chamber are shown on page 175 of this measurement report.

4.5.3. Test Procedure and Results

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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 - 21800 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 - 21800 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.

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:	
26 May – 1 June 17	21.8 °C	22.8 °C	21.9 RH%	23..0 RH%

Config A, B, C:

Carrier Frequency: 2115 MHz, 2145 MHz and 2175 MHz			
Frequency Range [MHz]	**Emission Frequency [MHz]**	**Maximum Emission Level [dBm]**	**Result**
QPSK-Modulation TX1			
30 - 21800	5898.286523	-46.35dBm	compliant
Measurement Uncertainty:			±5.4dB

Table 19 Field Strength of Spurious Radiation (10 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, § 27.54)

4.6.1. Purpose

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. 27.54. (-30 °C to +50 °C) and supply voltage conditions according to § 2.1055.

4.6.3. Test Configuration

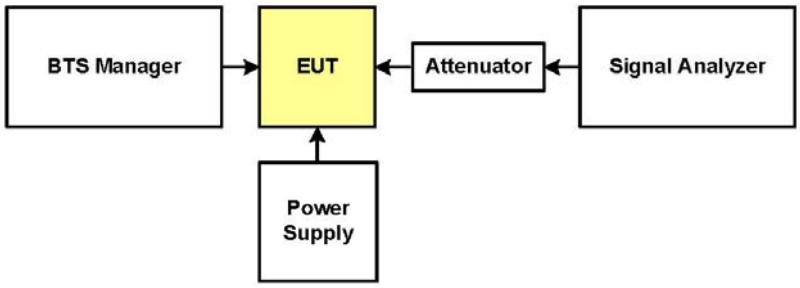

Figure 3 Test Configuration for frequency stability with voltage variation

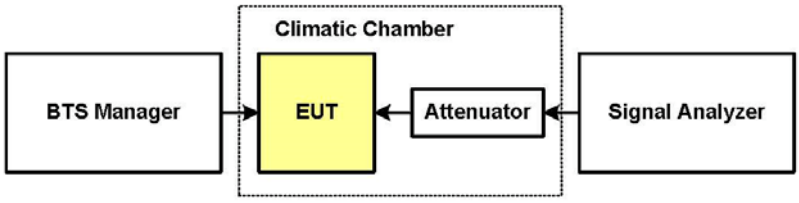

Figure 4 Test Configuration for frequency stability with temperature variation

A complete list of the measurement equipment is included on page 46 of this measurement report.

4.6.4. Test Procedure and Results

Frequency Stability with Temperature Variation:

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: 2145.0 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	-2.76809	-0.001	107	0.05	compliant
-48.0	-20.0	-3.82775	-0.002	107	0.05	compliant
-48.0	-10.0	-4.05743	-0.002	107	0.05	compliant
-48.0	0.0	-2.24613	-0.001	107	0.05	compliant
-48.0	10.0	-2.56801	-0.001	107	0.05	compliant
-48.0	30.0	-2.49271	-0.001	107	0.05	compliant
-48.0	40.0	-3.82698	-0.002	107	0.05	compliant
-48.0	50.0	2.78837	0.001	107	0.05	compliant
QPSK Modulation ANT2						
-48.0	-30.0	3.08054	0.001	107	0.05	compliant
-48.0	-20.0	-5.23464	-0.002	107	0.05	compliant
-48.0	-10.0	-4.83497	-0.002	107	0.05	compliant
-48.0	0.0	-2.87155	-0.001	107	0.05	compliant
-48.0	10.0	-4.49847	-0.002	107	0.05	compliant
-48.0	30.0	-2.04569	-0.001	107	0.05	compliant
-48.0	40.0	-2.50485	-0.001	107	0.05	compliant
-48.0	50.0	2.78131	0.001	107	0.05	compliant
QPSK Modulation ANT3						
-48.0	-30.0	-2.50394	-0.001	107	0.05	compliant
-48.0	-20.0	-4.04384	-0.002	107	0.05	compliant
-48.0	-10.0	-3.23233	-0.002	107	0.05	compliant
-48.0	0.0	-2.95550	-0.001	107	0.05	compliant
-48.0	10.0	-2.40385	-0.001	107	0.05	compliant
-48.0	30.0	-2.36419	-0.001	107	0.05	compliant
-48.0	40.0	-3.53003	-0.002	107	0.05	compliant
-48.0	50.0	-3.59311	-0.002	107	0.05	compliant

QPSK Modulation ANT4						
-48.0	-30.0	3.21778	0.002	107	0.05	compliant
-48.0	-20.0	-2.77907	-0.001	107	0.05	compliant
-48.0	-10.0	-3.47932	-0.002	107	0.05	compliant
-48.0	0.0	-4.29635	-0.002	107	0.05	compliant
-48.0	10.0	-5.75686	-0.003	107	0.05	compliant
-48.0	30.0	-4.84663	-0.002	107	0.05	compliant
-48.0	40.0	2.28301	0.001	107	0.05	compliant
-48.0	50.0	-1.74097	-0.001	107	0.05	compliant
16QAM Modulation ANT1						
-48.0	-30.0	4.91415	0.002	107	0.05	compliant
-48.0	-20.0	-5.80270	-0.003	107	0.05	compliant
-48.0	-10.0	3.40909	0.002	107	0.05	compliant
-48.0	0.0	-3.77058	-0.002	107	0.05	compliant
-48.0	10.0	-4.08895	-0.002	107	0.05	compliant
-48.0	30.0	-3.52354	-0.002	107	0.05	compliant
-48.0	40.0	-3.68472	-0.002	107	0.05	compliant
-48.0	50.0	-3.72761	-0.002	107	0.05	compliant
16QAM Modulation ANT2						
-48.0	-30.0	-6.07816	-0.003	107	0.05	compliant
-48.0	-20.0	-4.63065	-0.002	107	0.05	compliant
-48.0	-10.0	-2.60923	-0.001	107	0.05	compliant
-48.0	0.0	-4.29768	-0.002	107	0.05	compliant
-48.0	10.0	-3.46891	-0.002	107	0.05	compliant
-48.0	30.0	-2.33046	-0.001	107	0.05	compliant
-48.0	40.0	-3.15294	-0.001	107	0.05	compliant
-48.0	50.0	-2.85020	-0.001	107	0.05	compliant
16QAM Modulation ANT3						
-48.0	-30.0	-2.82918	-0.001	107	0.05	compliant
-48.0	-20.0	-2.49037	-0.001	107	0.05	compliant
-48.0	-10.0	-2.77912	-0.001	107	0.05	compliant
-48.0	0.0	-4.63978	-0.002	107	0.05	compliant
-48.0	10.0	4.19335	0.002	107	0.05	compliant
-48.0	30.0	-2.26943	-0.001	107	0.05	compliant
-48.0	40.0	-3.70321	-0.002	107	0.05	compliant
-48.0	50.0	-3.57817	-0.002	107	0.05	compliant
16QAM Modulation ANT4						
-48.0	-30.0	-3.57941	-0.002	107	0.05	compliant
-48.0	-20.0	-2.02916	-0.001	107	0.05	compliant
-48.0	-10.0	2.29507	0.001	107	0.05	compliant
-48.0	0.0	-4.21190	-0.002	107	0.05	compliant

-48.0	10.0	-3.20754	-0.002	107	0.05	compliant
-48.0	30.0	-3.73105	-0.002	107	0.05	compliant
-48.0	40.0	-3.91549	-0.002	107	0.05	compliant
-48.0	50.0	-1.58465	-0.001	107	0.05	compliant
64QAM Modulation ANT1						
-48.0	-30.0	-3.81983	-0.002	107	0.05	compliant
-48.0	-20.0	-3.50178	-0.002	107	0.05	compliant
-48.0	-10.0	-4.47245	-0.002	107	0.05	compliant
-48.0	0.0	-3.16227	-0.001	107	0.05	compliant
-48.0	10.0	-2.28717	-0.001	107	0.05	compliant
-48.0	30.0	-3.96191	-0.002	107	0.05	compliant
-48.0	40.0	-2.77999	-0.001	107	0.05	compliant
-48.0	50.0	-3.19143	-0.001	107	0.05	compliant
64QAM Modulation ANT2						
-48.0	-30.0	-4.75829	-0.002	107	0.05	compliant
-48.0	-20.0	-3.08394	-0.001	107	0.05	compliant
-48.0	-10.0	-4.06543	-0.002	107	0.05	compliant
-48.0	0.0	3.40905	0.002	107	0.05	compliant
-48.0	10.0	2.04650	0.001	107	0.05	compliant
-48.0	30.0	-3.70460	-0.002	107	0.05	compliant
-48.0	40.0	-3.01450	-0.001	107	0.05	compliant
-48.0	50.0	2.30592	0.001	107	0.05	compliant
64QAM Modulation ANT3						
-48.0	-30.0	-5.03096	0.002	107	0.05	compliant
-48.0	-20.0	-2.30741	-0.001	107	0.05	compliant
-48.0	-10.0	-2.45375	-0.001	107	0.05	compliant
-48.0	0.0	-3.09433	-0.001	107	0.05	compliant
-48.0	10.0	-5.46140	-0.003	107	0.05	compliant
-48.0	30.0	-4.05974	-0.002	107	0.05	compliant
-48.0	40.0	-2.24420	-0.001	107	0.05	compliant
-48.0	50.0	-2.09365	-0.001	107	0.05	compliant
64QAM Modulation ANT4						
-48.0	-30.0	-6.35728	-0.003	107	0.05	compliant
-48.0	-20.0	-2.34240	-0.001	107	0.05	compliant
-48.0	-10.0	-4.01565	-0.002	107	0.05	compliant
-48.0	0.0	-3.75751	0.002	107	0.05	compliant
-48.0	10.0	2.97233	-0.001	107	0.05	compliant
-48.0	30.0	-2.87642	-0.001	107	0.05	compliant
-48.0	40.0	-1.61817	-0.001	107	0.05	compliant
-48.0	50.0	-5.05676	-0.002	107	0.05	compliant
256QAM Modulation ANT1						

-48.0	-30	-6.49837	-0.003	107	0.05	compliant
-48.0	-20	-3.65969	-0.002	107	0.05	compliant
-48.0	-10	-4.66656	-0.002	107	0.05	compliant
-48.0	0	-3.81874	-0.002	107	0.05	compliant
-48.0	10	-4.09941	-0.002	107	0.05	compliant
-48.0	30	-1.72591	-0.001	107	0.05	compliant
-48.0	40	-2.19751	-0.001	107	0.05	compliant
-48.0	50	-2.20658	-0.001	107	0.05	compliant
256QAM Modulation ANT2						
-48.0	-30	-3.39068	-0.002	107	0.05	compliant
-48.0	-20	-2.94571	-0.001	107	0.05	compliant
-48.0	-10	-4.17013	-0.002	107	0.05	compliant
-48.0	0	-2.93547	-0.001	107	0.05	compliant
-48.0	10	-2.59448	-0.001	107	0.05	compliant
-48.0	30	-1.81365	-0.001	107	0.05	compliant
-48.0	40	4.68398	0.002	107	0.05	compliant
-48.0	50	2.30779	0.001	107	0.05	compliant
256QAM Modulation ANT3						
-48.0	-30	6.52811	0.003	107	0.05	compliant
-48.0	-20	-6.00887	-0.003	107	0.05	compliant
-48.0	-10	2.71502	0.001	107	0.05	compliant
-48.0	0	3.85094	0.002	107	0.05	compliant
-48.0	10	-4.16334	-0.002	107	0.05	compliant
-48.0	30	3.38902	0.002	107	0.05	compliant
-48.0	40	-2.56374	-0.001	107	0.05	compliant
-48.0	50	-4.39022	-0.002	107	0.05	compliant
256QAM Modulation ANT4						
-48.0	-30	-1.79779	-0.001	107	0.05	compliant
-48.0	-20	2.63379	0.001	107	0.05	compliant
-48.0	-10	-3.39655	-0.002	107	0.05	compliant
-48.0	0	2.53016	0.001	107	0.05	compliant
-48.0	10	-3.58979	-0.002	107	0.05	compliant
-48.0	30	2.42839	0.001	107	0.05	compliant
-48.0	40	-5.07022	-0.002	107	0.05	compliant
-48.0	50	-1.39290	-0.001	107	0.05	compliant
Measurement Uncertainty:					±1.0 Hz	

Table 20 Frequency stability with temp. var. (10 MHz Channel BW)