

Inter**Lab**[®]

Final Report on

TOBY-L200 Data Voice Module

FCC ID: XPYTOBYL200

IC: 8595A-TOBYL200

acc. to FCC Part 22 Subpart H, Part 24 Subpart E, Part 27 Subpart C

Report Reference: MDE_UBLOX_1807_FCCi

Date: February 21, 2019

Test Laboratory:

7layers GmbH
Borsigstraße 11
40880 Ratingen
Germany



Deutsche
Akkreditierungsstelle
D-PL-12140-01-00

Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

7layers GmbH
Borsigstraße 11
40880 Ratingen, Germany
T +49 (0) 2102 749 0
F +49 (0) 2102 749 350
www.7layers.com

Geschäftsführer /
Managing Directors:
Frank Spiller
Bernhard Retka
Alexandre Norré-Oudard

Registergericht registered in:
Düsseldorf, HRB 75554
USt-IdNr VAT No.:
DE203159652
TAX No. 147/5869/0385
A Bureau Veritas Group Company

1 Administrative Data

1.1 Project Data

Project Responsible: Roseelan Sathiyaseelan
Date Of Test Report: 2019/02/21
Date of first test: 2018/12/19
Date of last test: 2019/01/16

1.2 Applicant Data

Company Name: u-blox AG
Street: Zürcherstrasse 68,
 CH-8800 Thalwil
Country: Switzerland

Contact Person: Mr. Giulio Comar
Function: Certification Manager
Department: Cellular Product Certification
Phone: +41 44 722 7462
Fax: +41 44 722 7447
E-Mail: giulio.comar@u-blox.com

1.3 Test Laboratory Data

The following list shows all places and laboratories involved for test result generation:

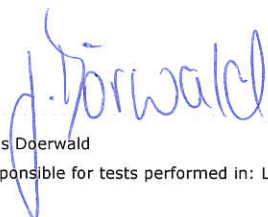
7 layers DE

Company Name : 7layers GmbH
Street : Borsigstrasse 11
City : 40880 Ratingen
Country : Germany
Contact Person : Mr. Michael Albert
Phone : +49 2102 749 201
Fax : +49 2102 749 444
E Mail : Michael.Albert@7Layers.com

Laboratory Details

Lab ID	Identification	Responsible	Accreditation Info
Lab 1	Radiated Emissions	Mr. Marco Kullik Mr. Jens Dörwald	DAkKS-Registration no. D-PL-12140-01-00 ISEDC OATS registration number 3699A-1 FCC Test firm number: 929146 FCC Designation Number: DE0015
Lab 2	Radio Lab	Mr. Dobrin Dobrinov Mr. Daniel Gall	DAkKS-Registration no. D-PL-12140-01-00 ISEDC OATS registration number 3699A-1 FCC Test firm number: 929146 FCC Designation Number: DE0015

1.4 Signature of the Testing Responsible



Jens Doerwald
responsible for tests performed in: Lab 1, Lab 2

1.5 Signature of the Accreditation Responsible



Accreditation scope responsible person
responsible for Lab 1, Lab 2



7 layers GmbH, Borsigstr. 11
40880 Ratingen, Germany
Phone +49 (0)2102 749 0

COMMENT:

On applicants demand not all applicable tests were performed.

2 Test Object Data

2.1 General OUT Description

The following section lists all OUTs (Object's Under Test) involved during testing.

OUT: TOBY-L200

Type / Model / Family: TOBY-L200 Data Voice Module
HW:192EA1
SW:16.16

Product Category: Module

Manufacturer:

Company Name: see applicant data

Contact Person: see applicant data

Parameter List:

<i>Parameter name</i>	<i>Value</i>
-----------------------	--------------

Parameter for Scope FCC_v2:

DC Power Supply	3,8 (V)
highest channel	19199 (1910 MHz) for eFDD2, 20399 (1755 MHz) for eFDD4, 20649 (849 MHz) for eFDD5, 21449 (2570 MHz) for eFDD7, 23849 (716 MHz) for eFDD17
lowest channel	18600 (1850 MHz) for eFDD2, 19950 (1710 MHz) for eFDD4, 20400 (824 MHz) for eFDD5, 20750 (2500 MHz) for eFDD7, 23010 (699 MHz) for eFDD17
mid channel	18900 (1880 MHz) for eFDD2, 20175 (1733 MHz) for eFDD4, 20525 (837 MHz) for eFDD5, 21100 (2535 MHz) for eFDD7, 23790 (710 MHz) for eFDD17

2.2 Detailed Description of OUT Samples

Sample : aa01

<i>OUT Identifier</i>	TOBY-L200		
<i>Sample Description</i>	RF sample		
<i>Serial No.</i>	352254062486276		
<i>HW Status</i>	192EA1		
<i>SW Status</i>	16.16		
<i>Nominal Voltage</i>	3.8 V	<i>Normal Temp.</i>	23 °C

Sample : ab01

<i>OUT Identifier</i>	TOBY-L200		
<i>Sample Description</i>	Standard sample		
<i>Serial No.</i>	352254062486466		
<i>HW Status</i>	192EA1		
<i>SW Status</i>	16.16		

Sample : ad01

<i>OUT Identifier</i>	TOBY-L200		
<i>Sample Description</i>	Standard sample		
<i>Serial No.</i>	352254062518722		
<i>HW Status</i>	192EA1		
<i>SW Status</i>	16.16		

2.3 Setups used for Testing

For each setup a relation is given to determine if and which samples and auxiliary equipment is used. The left side list all OUT samples and the right side lists all auxiliary equipment for the given setup.

<i>Setup No.</i>	<i>List of OUT samples</i>	<i>List of auxiliary equipment</i>
<i>Sample No.</i>	<i>Sample Description</i>	<i>AE No. AE Description</i>
S01_AA01	(AA01 TOBY-L200)	
<i>Sample:</i>	aa01 RF sample	
S01_AB01	(AB01 TOBY-L200)	
<i>Sample:</i>	ab01 Standard sample	
S01_AD01	(AD01 TOBY-L200)	
<i>Sample:</i>	ad01 Standard sample	

3 Results

3.1 General

Documentation of tested devices:

Available at the test laboratory.

Interpretation of the test results:

The results of the inspection are described on the following pages, where 'Conformity' or 'Passed' means that the certification criteria were verified and that the tested device is conform to the applied standard.

In cases where 'Declaration' is printed, the required documents are available in the manufacturers product documentation.

In cases where 'not applicable' is printed, the test case requirements are not relevant to the specific equipment implementation.

Note:

All tests are performed under environmental conditions within the requirements of the specifications. Environmental conditions are available at the laboratory.

3.2 List of Test Specification

<i>Test Specification:</i>	FCC part 2 and 22
<i>Version</i>	10-1-17 Edition
<i>Title:</i>	PART 2 - GENERAL RULES AND REGULATIONS PART 22 - Subpart H, PUBLIC MOBILE SERVICES
<i>Test Specification:</i>	FCC part 2 and 24
<i>Version</i>	10-1-17 Edition
<i>Title:</i>	PART 2 - GENERAL RULES AND REGULATIONS PART 24 - Subpart E, PERSONAL COMMUNICATIONS SERVICES
<i>Test Specification:</i>	FCC part 2 and 27
<i>Version</i>	10-1-17 Edition
<i>Title:</i>	PART 2 - GENERAL RULES AND REGULATIONS PART 27 - Subpart C, MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
<i>Applicable Errata</i>	<i>Comment</i>
ANSI C63.26 2015	KDB 971168 D01 v03r01

3.3 Summary

<i>Test Case Identifier / Name</i>	<i>Result</i>	<i>Date of Test</i>	<i>Lab Ref.</i>	<i>Setup</i>
Test Specification: FCC part 2 and 22				
22.4 Field strength of spurious radiation §2.1053, §22.917				
22.4; Field strength of spurious radiation Summary §2.1053, §22.917	Passed	2018/12/19	Lab 1	S01_AA01
Test Specification: FCC part 2 and 24				
24.4 Field strength of spurious radiation §2.1053, §24.238				
24.4; Field strength of spurious radiation Summary §2.1053, §24.238	Passed	2018/12/19	Lab 1	S01_AA01
Test Specification: FCC part 2 and 27				
27.1 RF Power Output §2.1046, §27.250				
27.1; RF Power Output Summary §2.1046, §27.250	Passed	2018/12/19	Lab 2	S01_AB01
27.3 Spurious emissions at antenna terminals §2.1051, §27.53				
27.3; Spurious emissions at antenna terminals Summary §2.1051, §27.53	Passed	2018/12/19	Lab 2	S01_AD01
27.4 Field strength of spurious radiation §2.1053, §27.53				
27.4; Field strength of spurious radiation Summary §2.1053, §27.53	Passed	2019/01/16	Lab 1	S01_AA01
27.5 Emission and Occupied Bandwidth §2.1049				
27.5; Emission and Occupied Bandwidth Summary §2.1049	Passed	2018/12/19	Lab 2	S01_AD01
27.6 Band edge compliance §2.1053, §27.53				
27.6; Band edge compliance summary §2.1053, §27.53	Passed	2018/12/19	Lab 2	S01_AD01

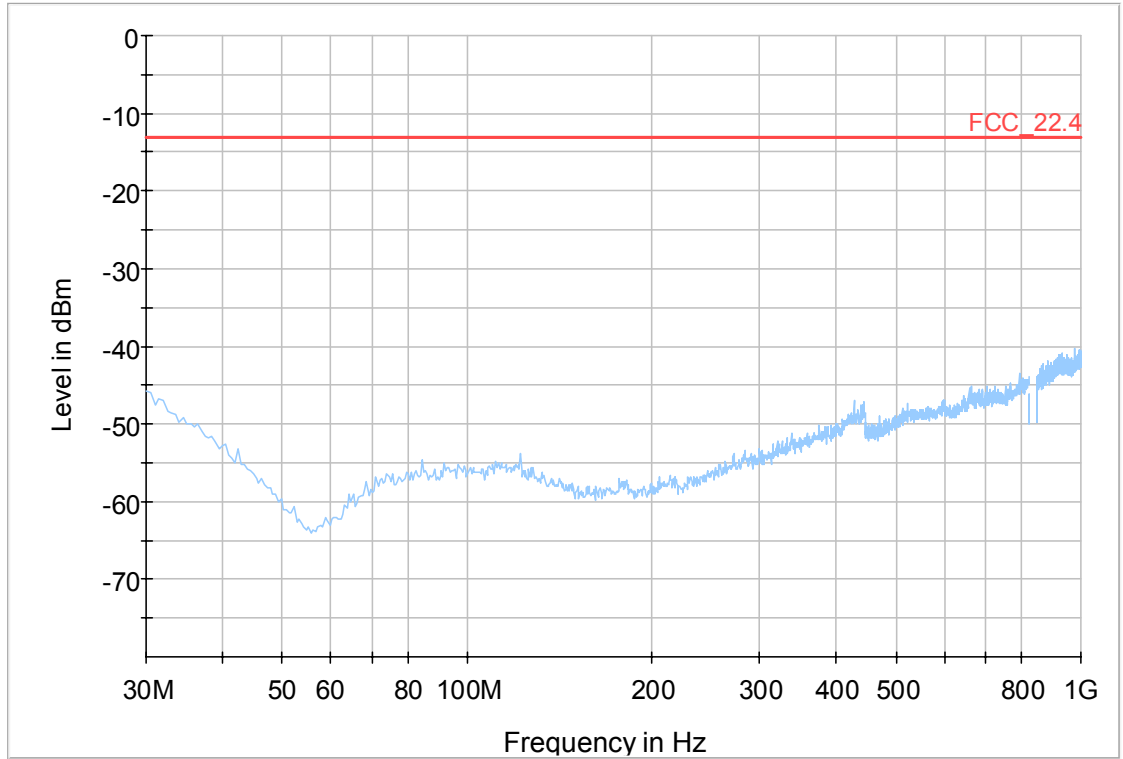
3.4 Detailed Results

3.4.1 22.4 Field strength of spurious radiation §2.1053, §22.917

Test: 22.4; Field strength of spurious radiation Summary §2.1053, §22.917

<i>Result:</i>	Passed
<i>Setup No.:</i>	S01_AA01
<i>Date of Test:</i>	2018/12/19 8:30
<i>Body:</i>	FCC47CFRChIPART22PERSONAL COMMUNICATIONS SERVICES
<i>Test Specification:</i>	FCC part 2 and 22

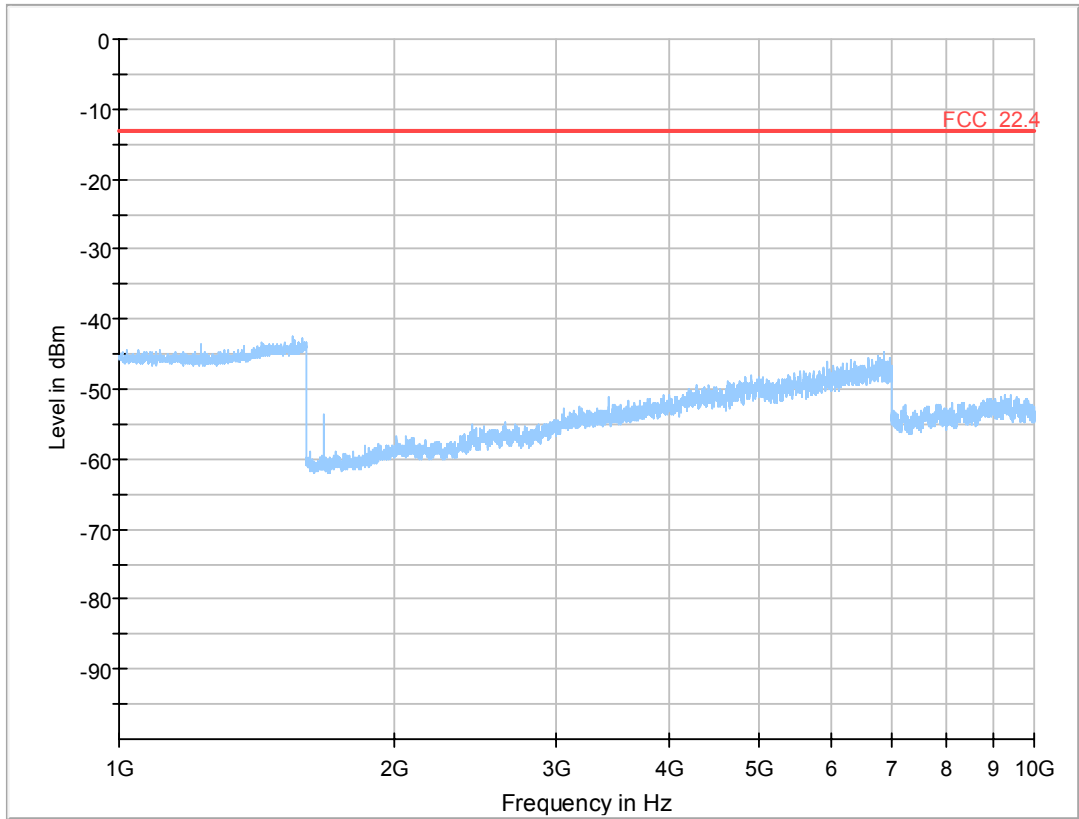
Detailed Results:



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
---	---	---	---	---	---	---	---	---	---	---

eFDD5 QPSK 5MHz 1RB Channel = mid



Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

Final Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

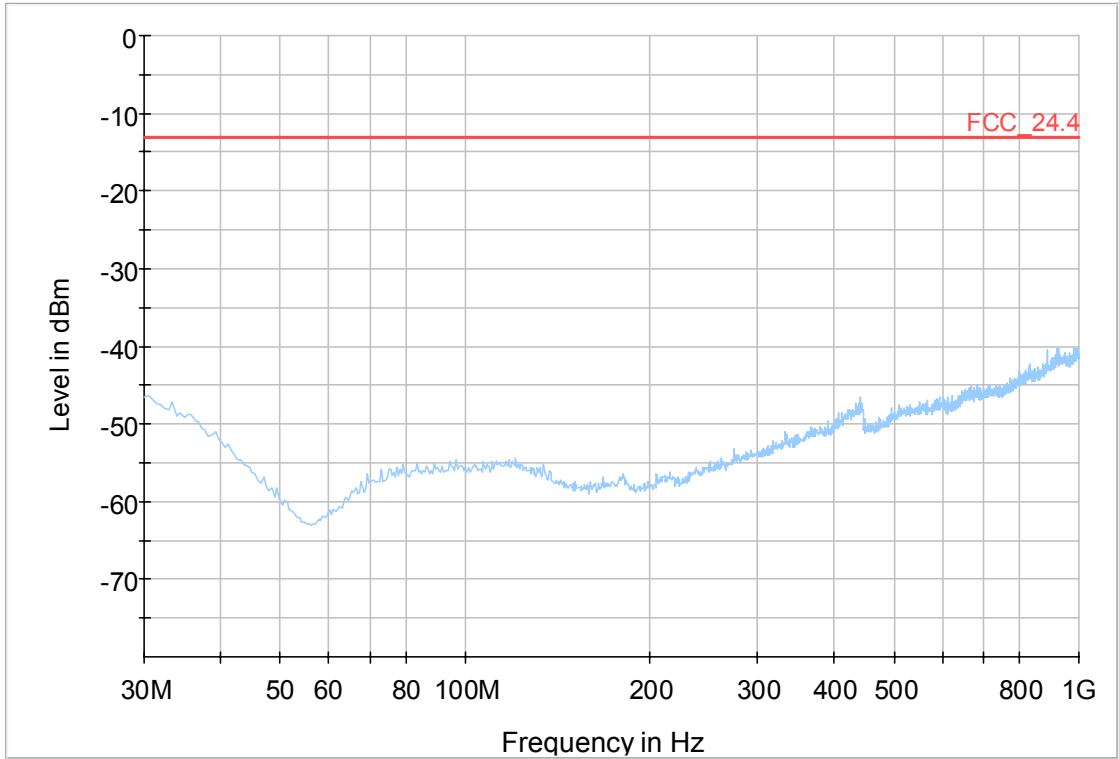
eFDD5 QPSK 5MHz 1RB Channel = mid

3.4.2 24.4 Field strength of spurious radiation §2.1053, §24.238

Test: 24.4; Field strength of spurious radiation Summary §2.1053, §24.238

<i>Result:</i>	Passed
<i>Setup No.:</i>	S01_AA01
<i>Date of Test:</i>	2018/12/19 9:16
<i>Body:</i>	FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
<i>Test Specification:</i>	FCC part 2 and 24

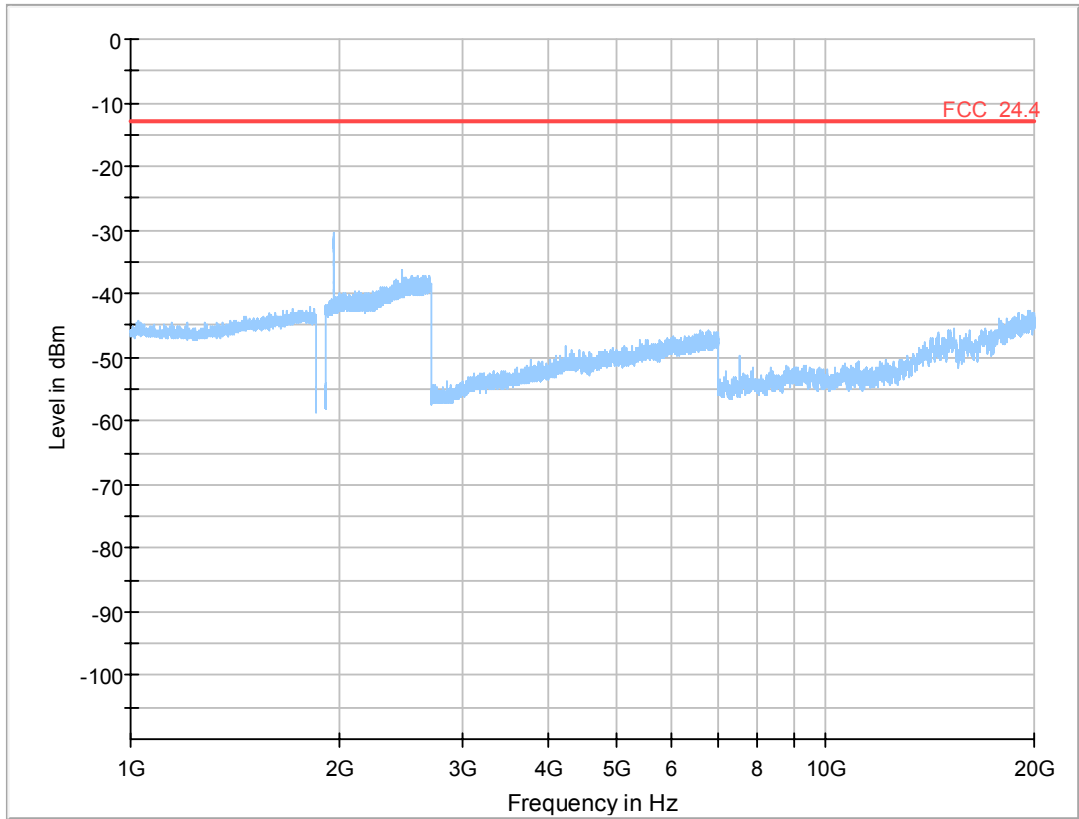
Detailed Results:



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
---	---	---	---	---	---	---		---	---	

eFDD2 QPSK 5MHz 1RB Channel = mid



Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

Final Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

eFDD2 QPSK 5MHz 1RB Channel = mid

3.4.3 27.1 RF Power Output §2.1046, §27.250

Test: 27.1; RF Power Output Summary §2.1046, §27.250

<i>Result:</i>	Passed
<i>Setup No.:</i>	S01_AB01
<i>Date of Test:</i>	2018/12/19 8:17
<i>Body:</i>	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
<i>Test Specification:</i>	FCC part 2 and 27

Detailed Results:

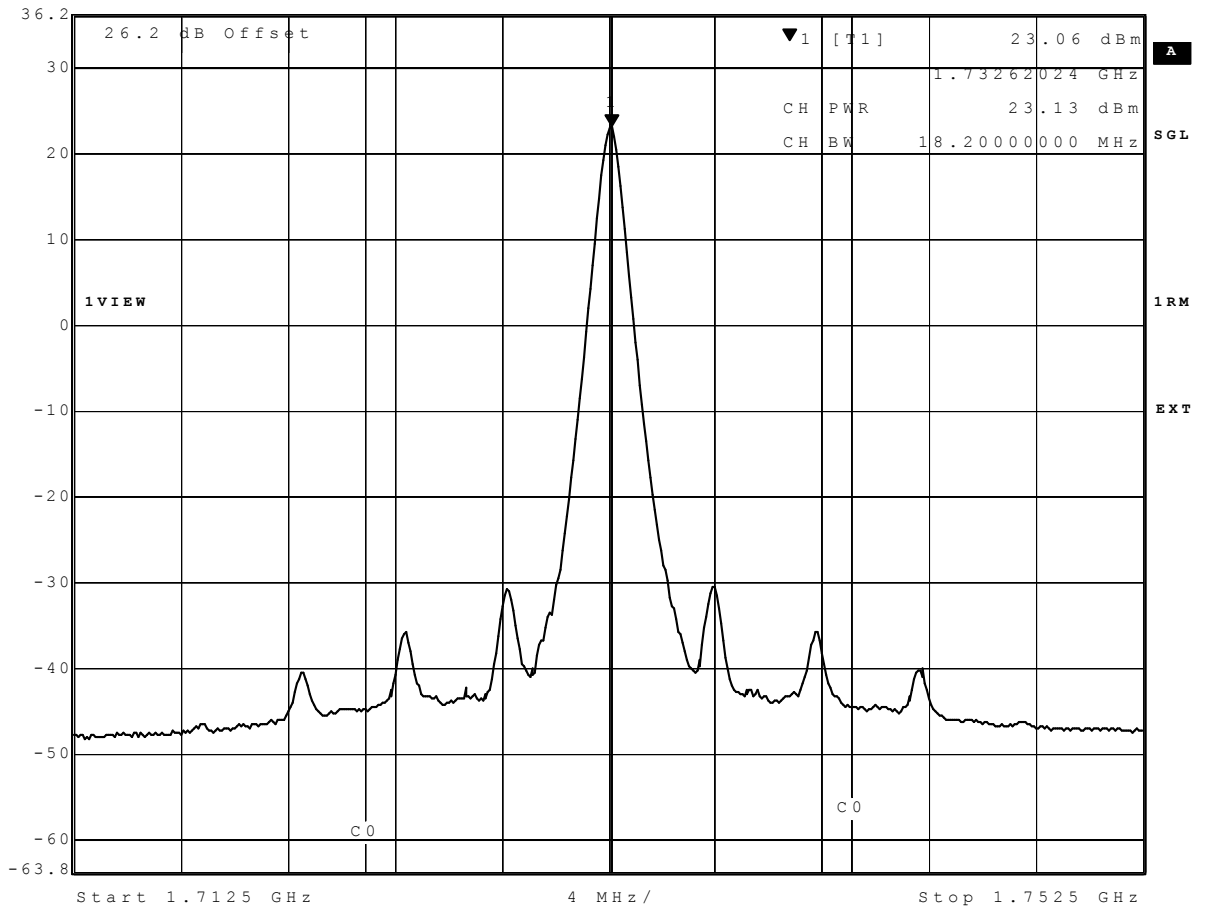
Radio Technology	Channel	Resource Blocks	Bandwidth [MHz]	RMS Cond. Power [dBm]	FCC EIRP Limit [W]	IC EIRP Limit [W]	Max. Antenna Gain [dBi]
eFDD 4 QPSK	low	1	1.4	22.35	1 W EIRP	1	7.7 dBi
eFDD 4 QPSK	low	3	1.4	22.05	1 W EIRP	1	8.0 dBi
eFDD 4 QPSK	low	6	1.4	21.12	1 W EIRP	1	8.9 dBi
eFDD 4 QPSK	mid	1	1.4	22.39	1 W EIRP	1	7.6 dBi
eFDD 4 QPSK	mid	3	1.4	22.07	1 W EIRP	1	7.9 dBi
eFDD 4 QPSK	mid	6	1.4	21.11	1 W EIRP	1	8.9 dBi
eFDD 4 QPSK	high	1	1.4	22.2	1 W EIRP	1	7.8 dBi
eFDD 4 QPSK	high	3	1.4	21.72	1 W EIRP	1	8.3 dBi
eFDD 4 QPSK	high	6	1.4	20.86	1 W EIRP	1	9.1 dBi
eFDD 4 16QAM	low	1	1.4	21.41	1 W EIRP	1	8.6 dBi
eFDD 4 16QAM	low	6	1.4	19.99	1 W EIRP	1	10.0 dBi
eFDD 4 16QAM	mid	1	1.4	21.4	1 W EIRP	1	8.6 dBi
eFDD 4 16QAM	mid	6	1.4	20.07	1 W EIRP	1	9.9 dBi
eFDD 4 16QAM	high	1	1.4	21.09	1 W EIRP	1	8.9 dBi
eFDD 4 16QAM	high	6	1.4	19.69	1 W EIRP	1	10.3 dBi
eFDD 4 QPSK	low	1	3	22.74	1 W EIRP	1	7.3 dBi
eFDD 4 QPSK	low	15	3	21.44	1 W EIRP	1	8.6 dBi
eFDD 4 QPSK	mid	1	3	22.82	1 W EIRP	1	7.2 dBi
eFDD 4 QPSK	mid	15	3	21.53	1 W EIRP	1	8.5 dBi
eFDD 4 QPSK	high	1	3	22.56	1 W EIRP	1	7.4 dBi
eFDD 4 QPSK	high	15	3	21.25	1 W EIRP	1	8.8 dBi
eFDD 4 16QAM	low	1	3	21.88	1 W EIRP	1	8.1 dBi
eFDD 4 16QAM	low	15	3	20.42	1 W EIRP	1	9.6 dBi
eFDD 4 16QAM	mid	1	3	21.74	1 W EIRP	1	8.3 dBi
eFDD 4 16QAM	mid	15	3	20.49	1 W EIRP	1	9.5 dBi
eFDD 4 16QAM	high	1	3	21.61	1 W EIRP	1	8.4 dBi
eFDD 4 16QAM	high	15	3	20.19	1 W EIRP	1	9.8 dBi
eFDD 4 QPSK	low	1	5	22.84	1 W EIRP	1	7.2 dBi
eFDD 4 QPSK	low	12	5	21.44	1 W EIRP	1	8.6 dBi
eFDD 4 QPSK	low	25	5	21.46	1 W EIRP	1	8.5 dBi
eFDD 4 QPSK	mid	1	5	22.77	1 W EIRP	1	7.2 dBi
eFDD 4 QPSK	mid	12	5	21.46	1 W EIRP	1	8.5 dBi
eFDD 4 QPSK	mid	25	5	21.53	1 W EIRP	1	8.5 dBi
eFDD 4 QPSK	high	1	5	22.62	1 W EIRP	1	7.4 dBi
eFDD 4 QPSK	high	12	5	21.18	1 W EIRP	1	8.8 dBi
eFDD 4 QPSK	high	25	5	21.2	1 W EIRP	1	8.8 dBi
eFDD 4 16QAM	low	1	5	21.74	1 W EIRP	1	8.3 dBi
eFDD 4 16QAM	low	25	5	20.36	1 W EIRP	1	9.6 dBi
eFDD 4 16QAM	mid	1	5	22.02	1 W EIRP	1	8.0 dBi
eFDD 4 16QAM	mid	25	5	20.49	1 W EIRP	1	9.5 dBi
eFDD 4 16QAM	high	1	5	21.69	1 W EIRP	1	8.3 dBi
eFDD 4 16QAM	high	25	5	20.22	1 W EIRP	1	9.8 dBi
eFDD 4 QPSK	low	1	10	23.1	1 W EIRP	1	6.9 dBi
eFDD 4 QPSK	low	50	10	21.8	1 W EIRP	1	8.2 dBi
eFDD 4 QPSK	mid	1	10	23.03	1 W EIRP	1	7.0 dBi
eFDD 4 QPSK	mid	50	10	21.89	1 W EIRP	1	8.1 dBi
eFDD 4 QPSK	high	1	10	22.85	1 W EIRP	1	7.2 dBi
eFDD 4 QPSK	high	50	10	21.68	1 W EIRP	1	8.3 dBi
eFDD 4 16QAM	low	1	10	22.14	1 W EIRP	1	7.9 dBi
eFDD 4 16QAM	low	50	10	20.77	1 W EIRP	1	9.2 dBi
eFDD 4 16QAM	mid	1	10	22.02	1 W EIRP	1	8.0 dBi
eFDD 4 16QAM	mid	50	10	20.9	1 W EIRP	1	9.1 dBi
eFDD 4 16QAM	high	1	10	21.8	1 W EIRP	1	8.2 dBi

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	RMS Cond. Power [dBm]	FCC EIRP Limit [W]	IC EIRP Limit [W]	Max. Antenna Gain [dBi]
eFDD 4 16QAM	high	50	10	20.73	1 W EIRP	1	9.3 dBi
eFDD 4 QPSK	low	1	15	23.01	1 W EIRP	1	7.0 dBi
eFDD 4 QPSK	low	36	15	21.95	1 W EIRP	1	8.1 dBi
eFDD 4 QPSK	low	75	15	21.86	1 W EIRP	1	8.1 dBi
eFDD 4 QPSK	mid	1	15	23.08	1 W EIRP	1	6.9 dBi
eFDD 4 QPSK	mid	36	15	22	1 W EIRP	1	8.0 dBi
eFDD 4 QPSK	mid	75	15	22	1 W EIRP	1	8.0 dBi
eFDD 4 QPSK	high	1	15	23.02	1 W EIRP	1	7.0 dBi
eFDD 4 QPSK	high	36	15	22.03	1 W EIRP	1	8.0 dBi
eFDD 4 QPSK	high	75	15	21.87	1 W EIRP	1	8.1 dBi
eFDD 4 16QAM	low	1	15	22.21	1 W EIRP	1	7.8 dBi
eFDD 4 16QAM	low	75	15	20.85	1 W EIRP	1	9.2 dBi
eFDD 4 16QAM	mid	1	15	22.04	1 W EIRP	1	8.0 dBi
eFDD 4 16QAM	mid	75	15	21	1 W EIRP	1	9.0 dBi
eFDD 4 16QAM	high	1	15	22.11	1 W EIRP	1	7.9 dBi
eFDD 4 16QAM	high	75	15	20.9	1 W EIRP	1	9.1 dBi
eFDD 4 QPSK	low	1	20	23.01	1 W EIRP	1	7.0 dBi
eFDD 4 QPSK	low	100	20	22.07	1 W EIRP	1	7.9 dBi
eFDD 4 QPSK	mid	1	20	23.13	1 W EIRP	1	6.9 dBi
eFDD 4 QPSK	mid	100	20	22.18	1 W EIRP	1	7.8 dBi
eFDD 4 QPSK	high	1	20	23.31	1 W EIRP	1	6.7 dBi
eFDD 4 QPSK	high	100	20	22.08	1 W EIRP	1	7.9 dBi
eFDD 4 16QAM	low	1	20	22.18	1 W EIRP	1	7.8 dBi
eFDD 4 16QAM	low	100	20	21	1 W EIRP	1	9.0 dBi
eFDD 4 16QAM	mid	1	20	22.17	1 W EIRP	1	7.8 dBi
eFDD 4 16QAM	mid	100	20	21.11	1 W EIRP	1	8.9 dBi
eFDD 4 16QAM	high	1	20	22.21	1 W EIRP	1	7.8 dBi
eFDD 4 16QAM	high	100	20	21.03	1 W EIRP	1	9.0 dBi
eFDD 17 QPSK	low	1	5	22.22	3 W ERP	5	12.6 dBd
eFDD 17 QPSK	low	12	5	20.76	3 W ERP	5	14.0 dBd
eFDD 17 QPSK	low	25	5	20.86	3 W ERP	5	13.9 dBd
eFDD 17 QPSK	mid	1	5	22.08	3 W ERP	5	12.7 dBd
eFDD 17 QPSK	mid	12	5	21.02	3 W ERP	5	13.8 dBd
eFDD 17 QPSK	mid	25	5	20.81	3 W ERP	5	14.0 dBd
eFDD 17 QPSK	high	1	5	21.59	3 W ERP	5	13.2 dBd
eFDD 17 QPSK	high	12	5	20.46	3 W ERP	5	14.3 dBd
eFDD 17 QPSK	high	25	5	20.46	3 W ERP	5	14.3 dBd
eFDD 17 16QAM	low	1	5	21.16	3 W ERP	5	13.6 dBd
eFDD 17 16QAM	low	25	5	19.7	3 W ERP	5	15.1 dBd
eFDD 17 16QAM	mid	1	5	21.35	3 W ERP	5	13.4 dBd
eFDD 17 16QAM	mid	25	5	19.61	3 W ERP	5	15.2 dBd
eFDD 17 16QAM	high	1	5	20.62	3 W ERP	5	14.2 dBd
eFDD 17 16QAM	high	25	5	19.24	3 W ERP	5	15.5 dBd
eFDD 17 QPSK	low	1	10	22.23	3 W ERP	5	12.5 dBd
eFDD 17 QPSK	low	50	10	20.93	3 W ERP	5	13.8 dBd
eFDD 17 QPSK	mid	1	10	22.21	3 W ERP	5	12.6 dBd
eFDD 17 QPSK	mid	50	10	20.9	3 W ERP	5	13.9 dBd
eFDD 17 QPSK	high	1	10	21.99	3 W ERP	5	12.8 dBd
eFDD 17 QPSK	high	50	10	20.91	3 W ERP	5	13.9 dBd
eFDD 17 16QAM	low	1	10	21.29	3 W ERP	5	13.5 dBd
eFDD 17 16QAM	low	50	10	19.92	3 W ERP	5	14.9 dBd
eFDD 17 16QAM	mid	1	10	21.1	3 W ERP	5	13.7 dBd
eFDD 17 16QAM	mid	50	10	19.93	3 W ERP	5	14.8 dBd
eFDD 17 16QAM	high	1	10	20.95	3 W ERP	5	13.8 dBd
eFDD 17 16QAM	high	50	10	19.93	3 W ERP	5	14.8 dBd



Marker 1 [T1] RBW 500 kHz RF Att 20 dB

Ref Lvl 23.06 dBm VBW 2 MHz
 36.2 dBm 1.73262024 GHz SWT 8.5 ms Unit dBm



Date: 21.DEC.2018 12:23:30

eFDD4 QPSK 20MHz RB1 Channel = mid



Marker 1 [T1]

RBW 200 kHz

RF Att 20 dB

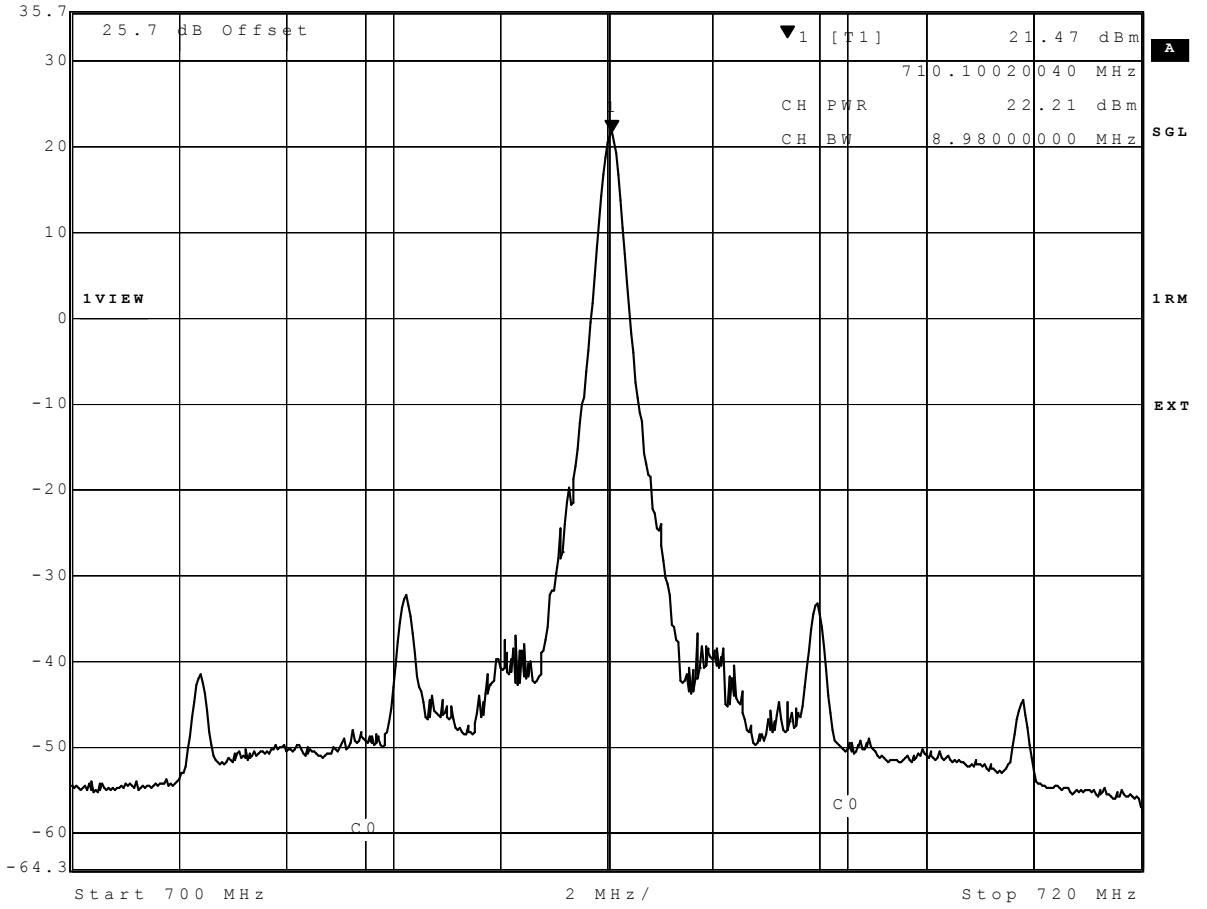
Ref Lvl 21.47 dBm

VBW 1 MHz

35.7 dBm 710.10020040 MHz

SWT 8.5 ms

Unit dBm



Date: 7.JAN.2019 12:08:15

eFDD17 QPSK 10MHz RB1 Channel = mid

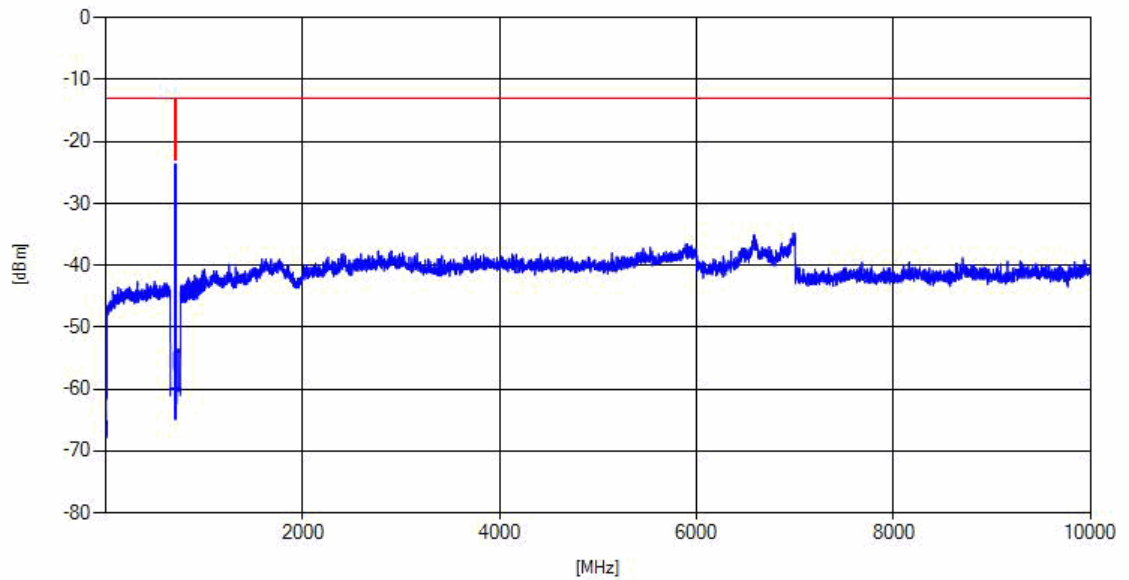
3.4.4 27.3 Spurious emissions at antenna terminals §2.1051, §27.53

Test: 27.3; Spurious emissions at antenna terminals Summary §2.1051, §27.53

Result: Passed
 Setup No.: S01_AD01
 Date of Test: 2018/12/19 8:21
 Body: FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
 Test Specification: FCC part 2 and 27

Detailed Results:

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
eFDD17	low	rms	maxhold	100	702.8	-41.9	-13	28.9
eFDD17	low	rms	maxhold	10	703.9	-23.71	-23	0.71
eFDD17	low	rms	maxhold	3	704	-23.57	-23	0.57
eFDD17	mid	rms	maxhold	-	-	-	-13	>20
eFDD17	high	rms	maxhold	3	716	-23.71	-23	0.71
eFDD17	high	rms	maxhold	10	716.1	-24.26	-23	1.26
eFDD17	high	rms	maxhold	100	717.1	-41.9	-13	28.9



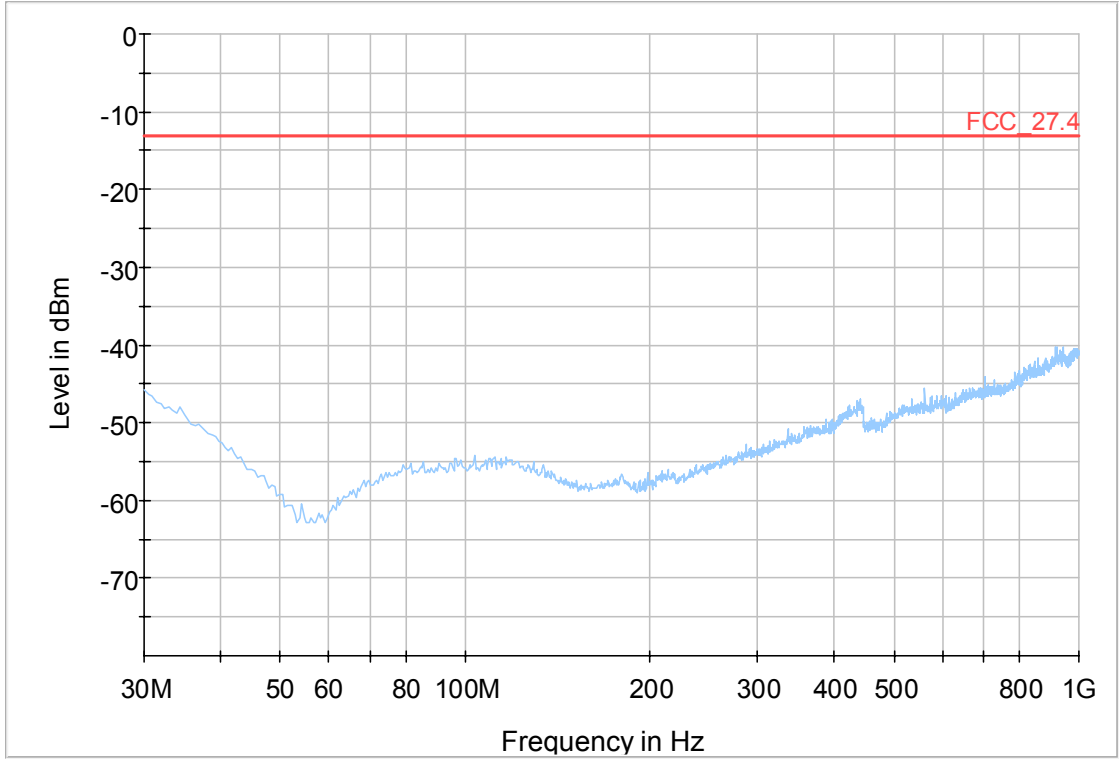
eFDD17 QPSK 5MHz RB1 Channel = low

3.4.5 27.4 Field strength of spurious radiation §2.1053, §27.53

Test: 27.4; Field strength of spurious radiation Summary §2.1053, §27.53

<i>Result:</i>	Passed
<i>Setup No.:</i>	S01_AA01
<i>Date of Test:</i>	2019/01/16 10:31
<i>Body:</i>	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
<i>Test Specification:</i>	FCC part 2 and 27

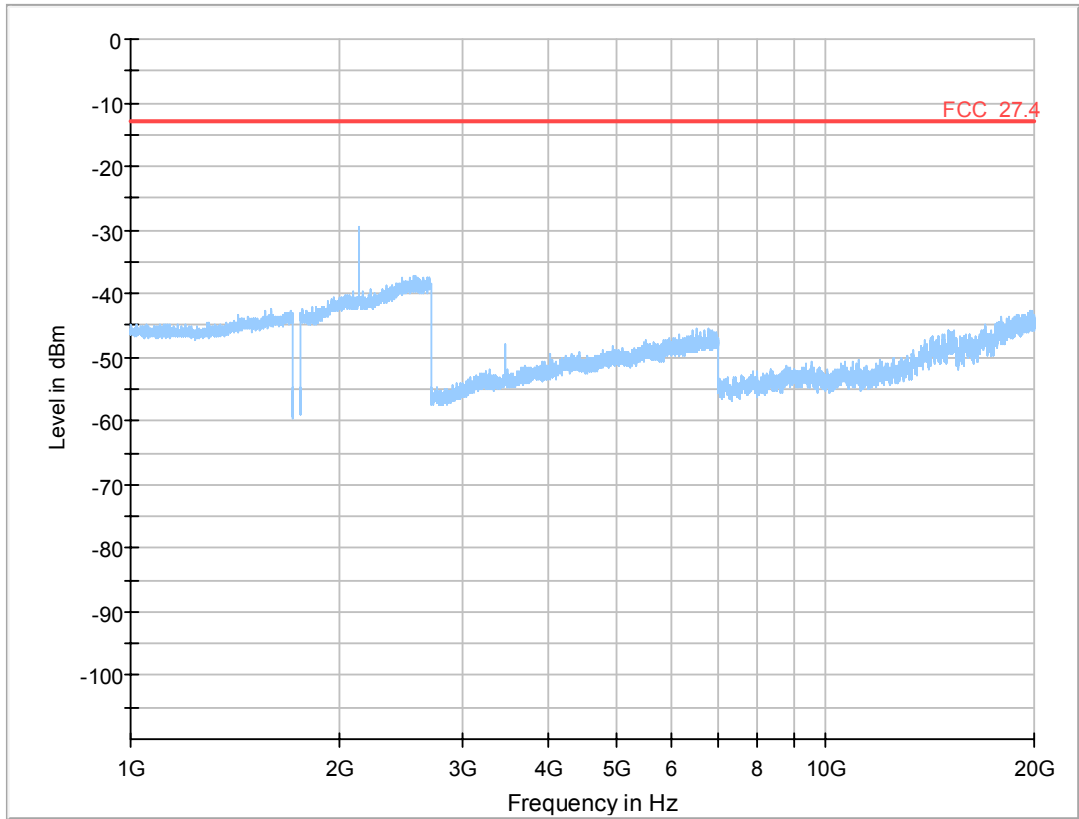
Detailed Results:



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
---	---	---	---	---	---	---	---	---	---	---

eFDD4 QPSK 5MHz RB1 Channel = mid



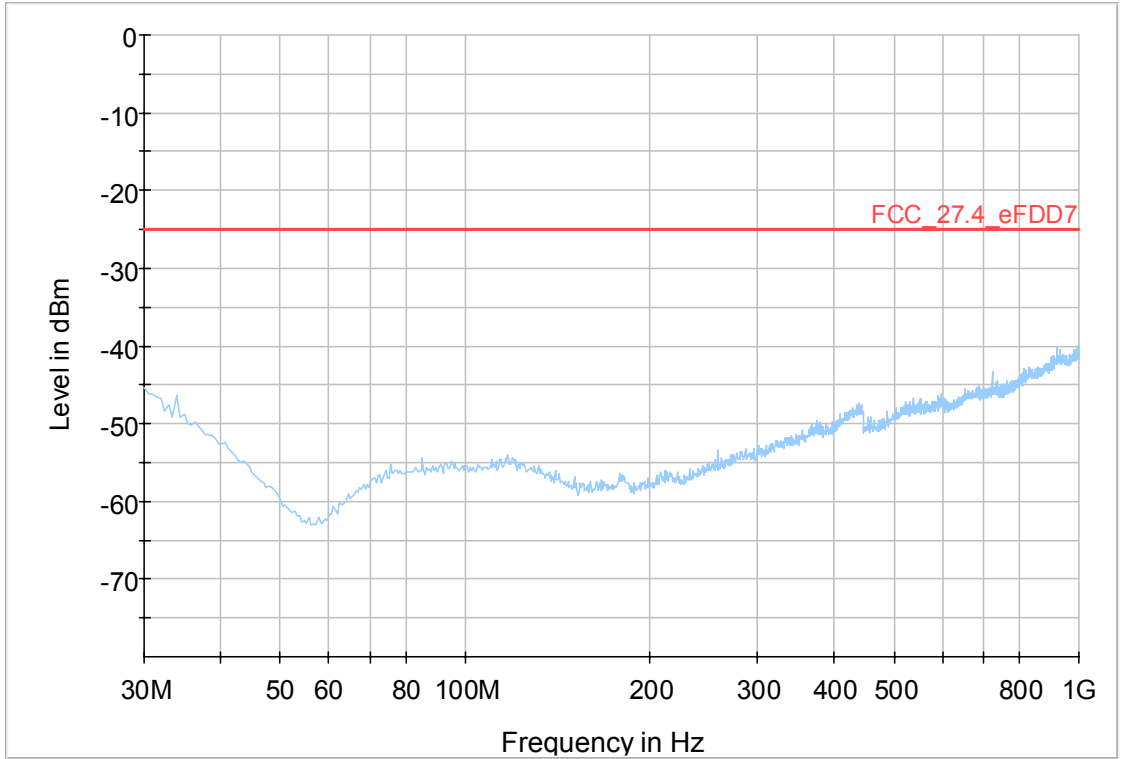
Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

Final Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

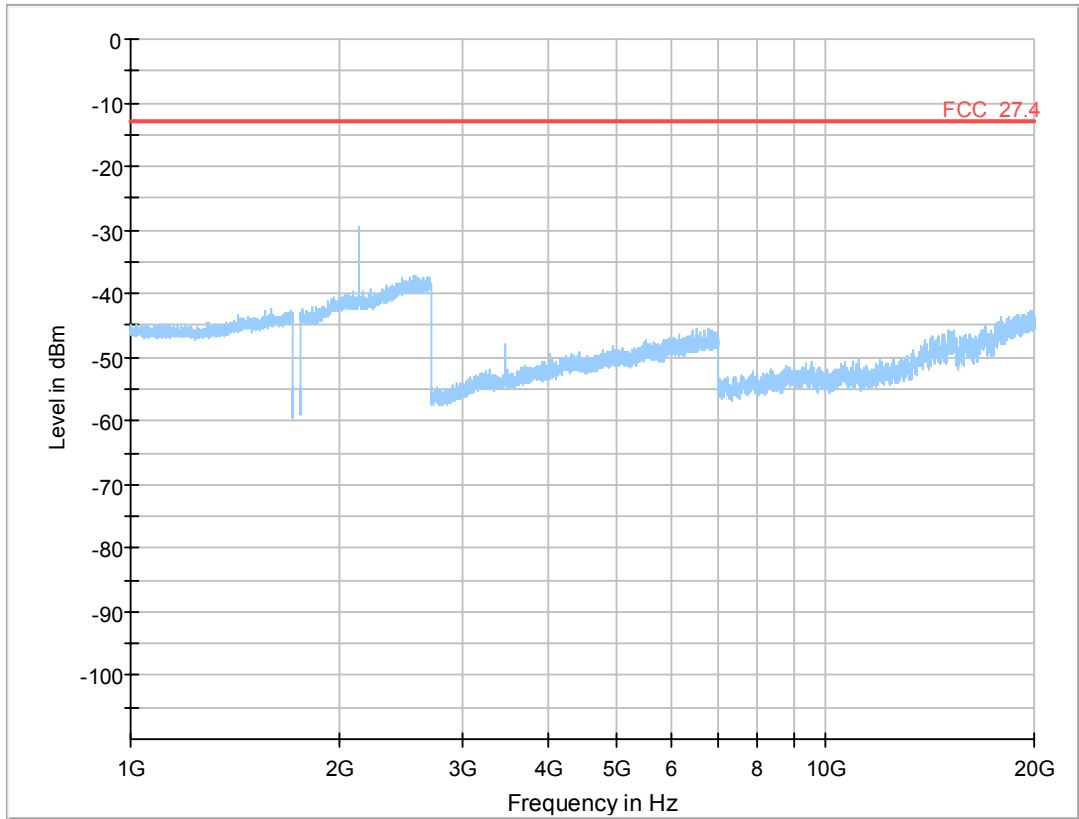
eFDD4 QPSK 5MHz RB1 Channel = mid



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
---	---	---	---	---	---	---		---	---	

eFDD7 QPSK 5MHz RB1 Channel = mid



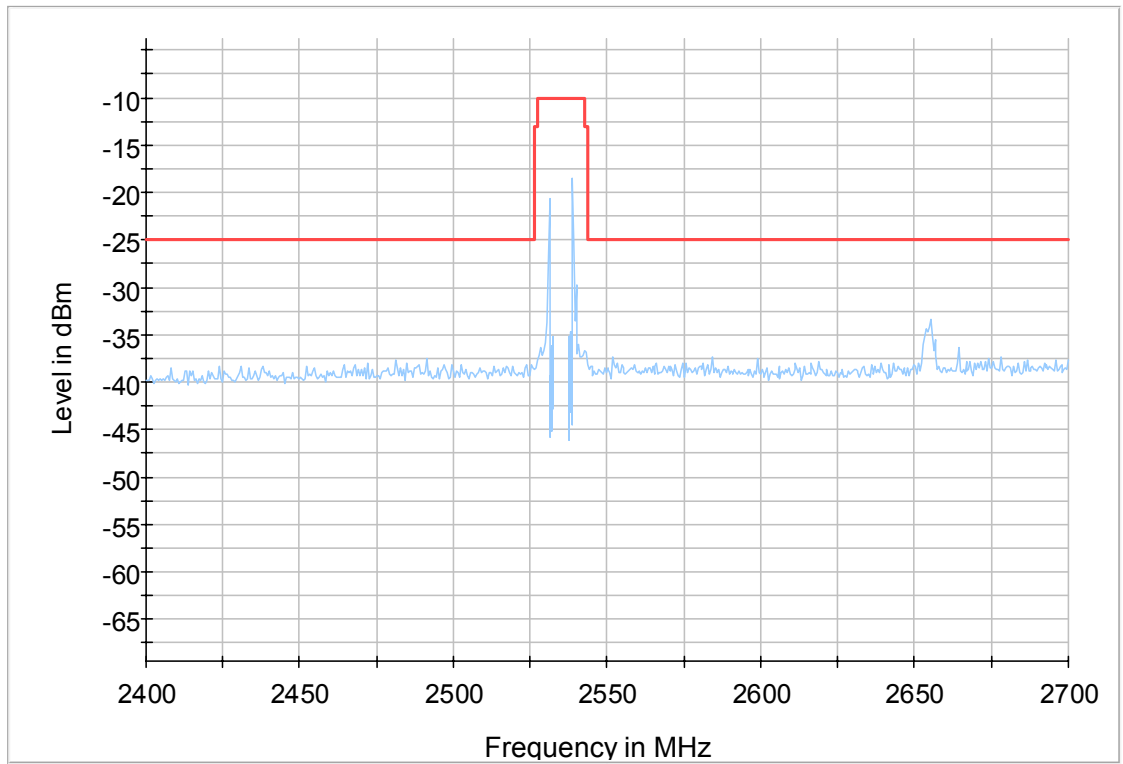
Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margi n (dB)	Meas. Time (ms)	Bandwidt h (kHz)	Heigh t (cm)	Pol	Azimet h (deg)	Elevatio n (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

Final Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margi n (dB)	Meas. Time (ms)	Bandwidt h (kHz)	Heigh t (cm)	Pol	Azimet h (deg)	Elevatio n (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

eFDD7 QPSK 5MHz RB1 Channel = mid



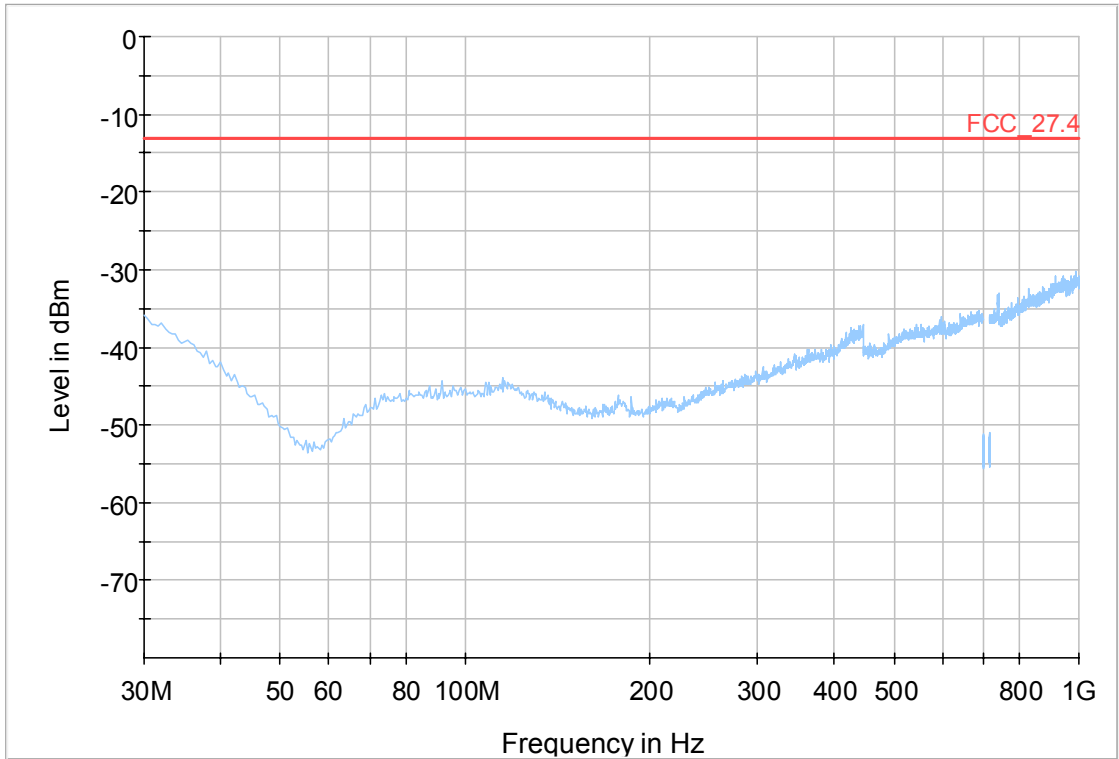
Critical_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

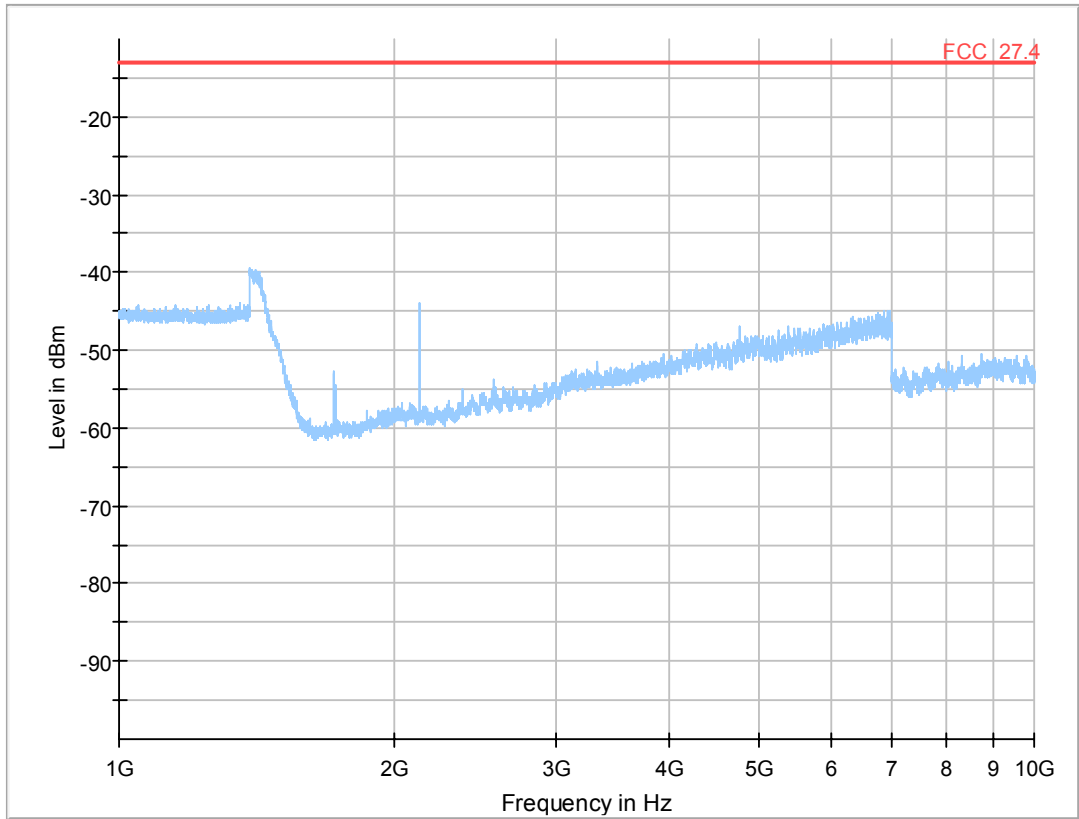
ZOOM: eFDD7 QPSK 5MHz RB1 Channel = mid



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
---	---	---	---	---	---	---		---	---	

eFDD17 QPSK 5MHz RB1 Channel = mid



Critical Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

Final Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

eFDD17 QPSK 5MHz RB1 Channel = mid

3.4.6 27.5 Emission and Occupied Bandwidth §2.1049

Test: 27.5; Emission and Occupied Bandwidth Summary §2.1049

<i>Result:</i>	Passed
<i>Setup No.:</i>	S01_AD01
<i>Date of Test:</i>	2018/12/19 8:27
<i>Body:</i>	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
<i>Test Specification:</i>	FCC part 2 and 27

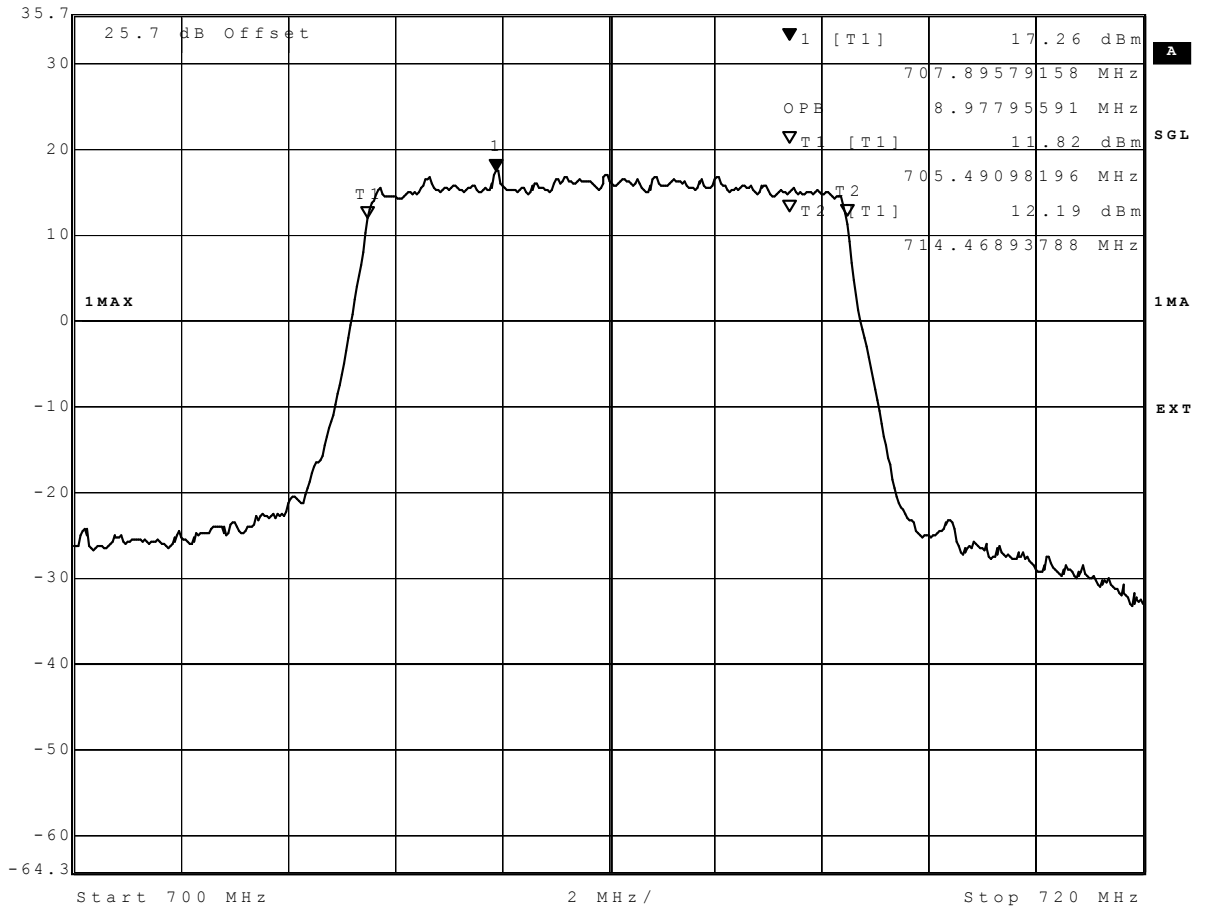
Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	99 % BW [kHz]
eFDD 17 QPSK	low	25	5	5	4549
eFDD 17 QPSK	mid	25	5	5	4529
eFDD 17 QPSK	high	25	5	5	4549
eFDD 17 16QAM	low	25	5	5	4589
eFDD 17 16QAM	mid	25	5	5	4569
eFDD 17 16QAM	high	25	5	5	4569
eFDD 17 QPSK	low	50	10	10	9018
eFDD 17 QPSK	mid	50	10	10	8978
eFDD 17 QPSK	high	50	10	10	9018
eFDD 17 16QAM	low	50	10	10	9018
eFDD 17 16QAM	mid	50	10	10	9018
eFDD 17 16QAM	high	50	10	10	9018



Marker 1 [T1] RBW 200 kHz RF Att 20 dB

Ref Lvl 35.7 dBm 17.26 dBm VBW 1 MHz
 707.89579158 MHz SWT 5 s Unit dBm



Date: 19.DEC.2018 15:59:45

eFDD17 QPSK 10MHz Channel = mid

3.4.7 27.6 Band edge compliance §2.1053, §27.53

Test: 27.6; Band edge compliance summary §2.1053, §27.53

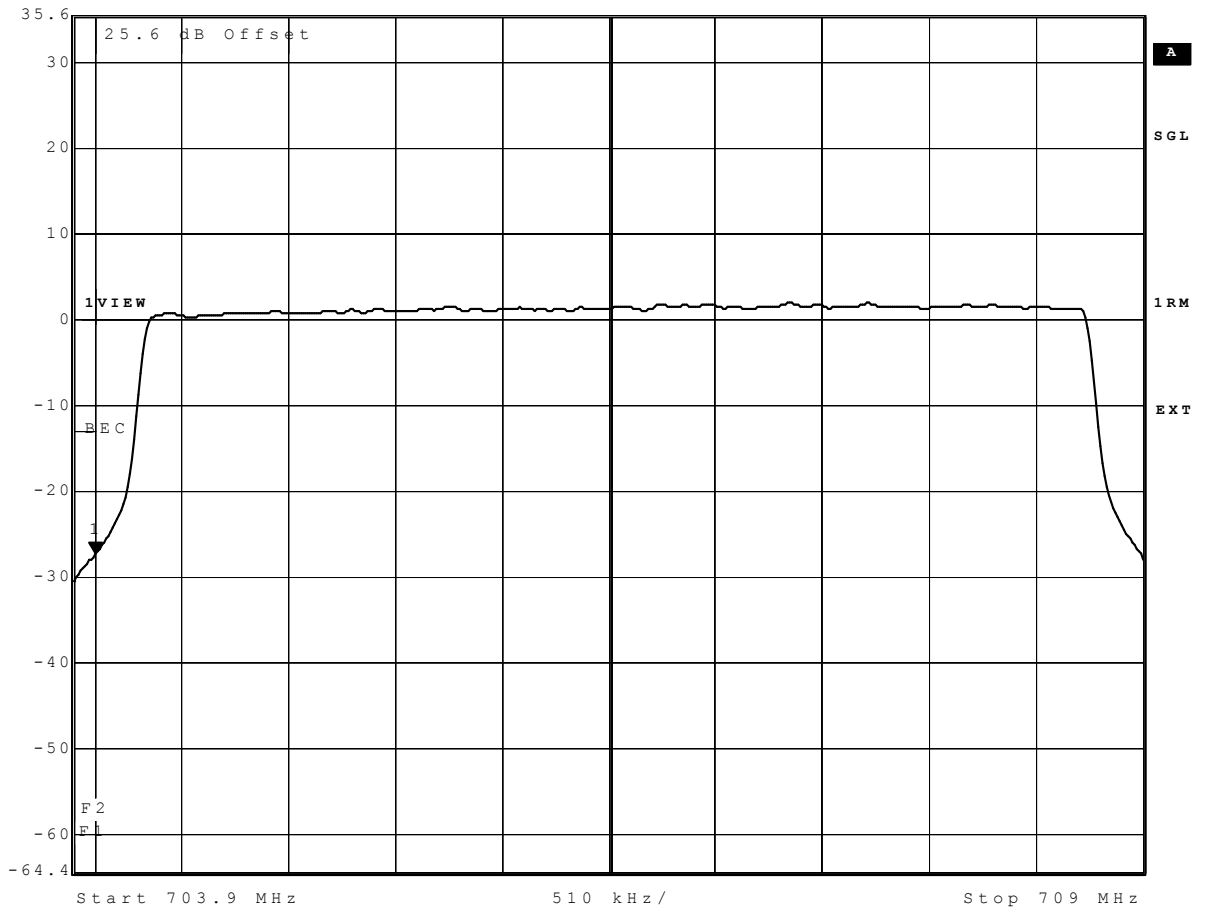
<i>Result:</i>	Passed
<i>Setup No.:</i>	S01_AD01
<i>Date of Test:</i>	2018/12/19 8:25
<i>Body:</i>	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
<i>Test Specification:</i>	FCC part 2 and 27

Detailed Results:

Radio Technology	Channel	Band Edge	Nominal BW	Ressource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
eFDD 17 QPSK	low	lower	5	1	-16.56	-31.34	-28.37	-13	15.37
eFDD 17 QPSK	high	higher	5	1	-18.9	-33.52	-30.14	-13	17.14
eFDD 17 16QAM	low	lower	5	1	-13.27	-31.34	-27.3	-13	14.3
eFDD 17 16QAM	high	higher	5	1	-17.9	-36.44	-33.12	-13	20.12
eFDD 17 QPSK	low	lower	10	1	-26.19	-39.14	-37.04	-13	24.04
eFDD 17 QPSK	high	higher	10	1	-27.2	-41.9	-39.14	-13	26.14
eFDD 17 16QAM	low	lower	10	1	-13.45	-33.12	-29.08	-13	16.08
eFDD 17 16QAM	high	higher	10	1	-17.8	-38.38	-34.86	-13	21.86



Marker 1 [T1] RBW 50 kHz RF Att 20 dB
 Ref Lvl -27.30 dBm VBW 50 kHz
 35.6 dBm 704.00000000 MHz SWT 5 s Unit dBm



Date: 11.JAN.2019 09:47:10

eFDD17 16QAM 10MHz Channel = low

4 Test Equipment Details

4.1 List of Used Test Equipment

The calibration, hardware and software states are shown for the testing period.

Test Equipment Anechoic Chamber

Lab ID: Lab 1
Description: Anechoic Chamber for radiated testing

Single Devices for Anechoic Chamber

Single Device Name	Type	Serial Number	Manufacturer
Air compressor	none	-	
Anechoic Chamber	10.58 x 6.38 x 6.00 m ³	none	
Anechoic Chamber	8.8m x 4.6m x 4.05 m	B83117-S40-X191	Albatross Projects GmbH
Controller Maturo	MCU	961208	Maturo GmbH
EMC camera	CE-CAM/1	-	
EMC camera Nr.2	CCD-400E	0005033	
Filter ISDN	B84312-C110-E1		
Filter Universal 1A	BB4312-C30-H3	-	

Test Equipment Auxiliary Equipment for Radiated emissions

Lab ID: Lab 1
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Auxiliary Equipment for Radiated emissions

Single Device Name	Type	Serial Number	Manufacturer
Antenna mast	AM 4.0	AM4.0/180/11920 513	Maturo GmbH
Biconical Broadband Antenna	SBA 9119	9119-005	
Biconical dipole	VUBA 9117	9117-108	
Broadband Amplifier 1 GHz - 4 GHz	AFS4-01000400-1Q-10P-4	-	
Broadband Amplifier 18 GHz - 26 GHz	JS4-18002600-32-5P	849785	
Broadband Amplifier 30 MHz - 18 GHz	JS4-00101800-35-5P	896037	
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01- 2+W38.01-2	
Cable "ESI to Horn Antenna"	SucoFlex	W18.02- 2+W38.02-2	
Double-ridged horn	HF 907	102444	Rohde & Schwarz GmbH & Co. KG

Calibration Details	Last Execution	Next Execution
Standard Calibration	2018/07/20	2021/07/19

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>	
Double-ridged horn-duplicated 2015-07-15 10:47:55	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	DKD-Calibration		2018/03/09	2021/03/08
High Pass Filter	4HC1600/12750-1.5-KK	9942011		
High Pass Filter	5HC2700/12750-1.5-KK	9942012		
High Pass Filter	5HC3500/18000-1.2-KK	200035008		
High Pass Filter	WHKX 7.0/18G-8SS	09		
Horn Antenna Schwarzbeck 15-26.5 GHz BBHA 9170	BBHA 9170	BBHA9170262		
Log.-per. Antenna	HL 562 Ultralog	100609	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	DKD Calibration		2018/07/05	2021/07/05
Log.-per. Antenna (upgraded)	HL 562 Ultralog new biconicals	830547/003	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	DKD-Calibration		2018/07/05	2021/07/04
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	DKD calibration		2018/01/04	2021/01/04
Standard Gain / Pyramidal Horn Antenna 40 GHz	3160-10	00086675		
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5-10kg/024/3790709	Maturo GmbH	

Test Equipment Auxiliary Test Equipment

Lab ID:	Lab 1, Lab 2
<i>Description:</i>	Single Devices for various Test Equipment
<i>Type:</i>	various
<i>Serial Number:</i>	none

Single Devices for Auxiliary Test Equipment

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>		
Broadband Power Divider N (Aux)	1506A / 93459	LM390			
Broadband Power Divider SMA	WA1515	A855			
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383			
Digital Multimeter 13 (Clamp Meter)	Fluke 325	31270091WS	FLUKE		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Execution</i>
	DAkKS-Calibration			2016/02/04	2019/02/28
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018			
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018			
Isolating Transformer	LTS 604	1888			
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24			
Signal Analyzer	FSV30	103005	Rohde & Schwarz GmbH & Co. KG		
Spectrum Analyser	FSU26	200418			
Spectrum Analyzer	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG		
Vector Signal Generator	SMIQ 03B	832492/061			

Test Equipment Digital Signalling Devices

Lab ID:	Lab 1, Lab 2
<i>Description:</i>	Signalling equipment for various wireless technologies.

Single Devices for Digital Signalling Devices

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
CMW500	CMW500	107500	
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
Vector Signal Generator	SMU200A	100912	Rohde & Schwarz GmbH & Co. KG

Test Equipment Emission measurement devices

Lab ID: Lab 1
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Emission measurement devices

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>	
EMI Receiver / Spectrum Analyzer	ESR 7	101424		
Personal Computer	Dell	30304832059		
Power Meter	NRVD	828110/016		
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	Standard calibration		2018/07/18	2019/07/17
Sensor Head A	NRV-Z1	827753/005		
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	Standard calibration		2018/07/17	2019/07/16
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG	
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG	
	<i>HW/SW Status</i>		<i>Date of Start</i>	<i>Date of End</i>
	Firmware-Update 4.34.4 from 3.45 during calibration		2009/12/03	
Spectrum Analyzer	FSW 43	103779		

Test Equipment Multimeter 03

Lab ID: Lab 1, Lab 2
Description: Fluke 177
Serial Number: 86670383

Single Devices for Multimeter 03

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	

Test Equipment Radio Lab Test Equipment

Lab ID: Lab 2
Description: Radio Lab Test Equipment

Single Devices for Radio Lab Test Equipment

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>	
Broadband Power Divider SMA	WA1515	A856		
Coax Attenuator 10dB SMA 2W	4T-10	F9401		
Coax Attenuator 10dB SMA 2W	56-10	W3702		
Coax Attenuator 10dB SMA 2W	56-10	W3711		
Coax Cable Huber&Suhner	Sucotest 2,0m		Huber&Suhner	
Coax Cable Rosenberger Micro Coax FA210A0010003030 SMA/SMA 1,0m	FA210A0010003030	54491-2		
Power Meter	NRVD	828110/016		
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	Standard calibration		2018/07/18	2019/07/17
RF Step Attenuator RSP	RSP	833695/001		
Rubidium Frequency Standard	Datum, Model: MFS	5489/001		
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	Standard calibration		2018/07/25	2019/07/24
Sensor Head A	NRV-Z1	827753/005		
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	Standard calibration		2018/07/17	2019/07/16
Signal Generator SME	SME03	827460/016		
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	Standard calibration		2018/08/01	2021/07/31
Signal Generator SMP	SMP02	833286/0014	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	Standard calibration		2016/05/24	2019/05/23
Spectrum Analyzer	FSIQ26	840061/005	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Execution</i>
	Standard calibration		2017/05/16	2021/05/16

Test Equipment T/A Logger 13

Lab ID: Lab 1, Lab 2
Description: Lufft Opus10 TPR
Type: Opus10 TPR
Serial Number: 13936

Single Devices for T/A Logger 13

Single Device Name	Type	Serial Number	Manufacturer
ThermoAirpressure Datalogger 13 (Environ)	Opus10 TPR (8253.00)	13936	
<i>Calibration Details</i>			<i>Last Execution</i>
Customized calibration			2017/04/10
			<i>Next Execution</i>
			2019/04/09

Test Equipment T/H Logger 03

Lab ID: Lab 2
Description: Lufft Opus10
Serial Number: 7482

Single Devices for T/H Logger 03

Single Device Name	Type	Serial Number	Manufacturer
ThermoHygro Datalogger 03 (Environ)	Opus10 THI (8152.00)	7482	
<i>Calibration Details</i>			<i>Last Execution</i>
Customized calibration			2017/03/30
			<i>Next Execution</i>
			2019/03/29

Test Equipment T/H Logger 12

Lab ID: Lab 1
Description: Lufft Opus10
Serial Number: 12482

Single Devices for T/H Logger 12

Single Device Name	Type	Serial Number	Manufacturer
ThermoHygro Datalogger 12 (Environ)	Opus10 THI (8152.00)	12482	
<i>Calibration Details</i>			<i>Last Execution</i>
Customized calibration			2017/03/30
			<i>Next Execution</i>
			2019/03/29

Test Equipment Temperature Chamber 05

Lab ID: Lab 2
Description: Temperature Chamber VT4002
Type: Vötsch
Serial Number: see single devices

Single Devices for Temperature Chamber 05

Single Device Name	Type	Serial Number	Manufacturer
Temperature Chamber Vötsch 05	VT 4002	58566080550010	
<i>Calibration Details</i>			<i>Last Execution</i>
Customized calibration			2018/04/27
			<i>Next Execution</i>
			2020/04/26

5 Annex

5.1 Additional Information for Report

Summary of Test Results

The EUT complied with all performed tests as listed in the summary section of this report.

Technical Report Summary

Type of Authorization :

Certification for a GSM/WCDMA/CDMA2000 cellular radiotelephone device

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 0 to 69. The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

- § 2.1046 Measurement required: RF power output
- § 2.1049 Measurement required: Occupied bandwidth
- § 2.1053 Measurement required: Field strength of spurious radiation

Part 22, Subpart C – Operational and Technical Requirements

Part 22, Subpart H – Cellular Radiotelephone Service

- § 22.913 Effective radiated power limits
- § 22.917 Emission limitations for cellular equipment

additional documents

ANSI C63.26 2015

Description of Methods of Measurements

RF Power Output

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
 - 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
 - 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Channel (Frequency): please refer to the detailed results
- 4) The transmitted power of the EUT was recorded by using a spectrum analyser.

Test Description (radiated measurement procedure)

- 1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
- 2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Output Power: Maximum
 - Channel: please refer to the detailed results
- 3) A substitution procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a $\lambda/2$ dipole).
 - 4) The output power was measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case power all orientations (X, Y, Z) of the EUT have been measured.
 - 5) The test procedure according to ANSI C63.26 2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.

§2.913 Effective radiated power limits

(a)(2) Maximum ERP. ... The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

Emission and Occupied Bandwidth

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1049

Test Description

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
- 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
- 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Output Power: Maximum
 - Channel: please refer to the detailed results
- 4) Important Analyser Settings:
 - Resolution Bandwidth: >1% of the manufacturer's stated occupied bandwidth
 - 5) The maximum spectral level of the modulated signal was recorded as the reference.
 - 6) The emission bandwidth is measured as follows: the two furthest frequencies above and below the frequency of the maximum reference level where the spectrum is -26 dB down have to be found.
 - 7) The occupied bandwidth (99% Bandwidth) is measured as follows: the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 percent of the total mean power.

Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

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

(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be

operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

Field strength of spurious radiation

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1053

Test Description

- 1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
 - 2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a $\lambda/2$ dipole).
 - 4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antennas for the frequency range of 30 MHz to 10 GHz (up to the 10th harmonic of the transmit frequency). The frequency range from 9 kHz to 30 MHz has been examined during the conducted spurious emission measurements.
 - 5) Important Analyser Settings
 - [Resolution Bandwidth / Video Bandwidth]:
 - a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the Band,
 - b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz -> 10 kHz) was used
 - c) [1 MHz / 3 MHz] otherwise
 - Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
 - 6) The spurious emissions peaks were measured in both vertical and horizontal antenna polarization during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case peaks all orientations (X, Y, Z) of the EUT have been measured.
 - 7) After this initial test, a final test according to ANSI C63.26 2015 2.2.12 Unwanted Emissions is performed on signals which are identified as being close to the limit. For any emissions found to be within 10 dB of the limit, a specific signal substitution measurement is performed at the frequency of the emission to determine the exact e.i.r.p. value.

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

- (b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:
- (2) All equipment operating on frequencies higher than 25 MHz.

§ 2.1057 Frequency spectrum to be investigated.

- (a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

- (1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- (b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.
- (c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.
- (d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 22.917 Emission limitations for cellular equipment

- (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. This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in a distance of 3 m.
- (b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The 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.
- (c) Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas [...].
- (d) If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

For reporting only spurious emission levels reaching to the 20dB margin to limit were noted.

Band edge compliance

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §22.913

Test Description

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
 - 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
 - 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 4) Important Analyser Settings:
 - Resolution Bandwidth = Video Bandwidth: >1% of the manufacturer's stated occupied bandwidth

Test Requirements / Limits

§ 22.917 Emission limitations for cellular equipment

Refer to chapter "Field strength of spurious radiation".

Summary of Test Results

The EUT complied with all performed tests as listed in the summary section of this report.

Technical Report Summary

Type of Authorization :

Certification for a GSM/WCDMA/CDMA2000 cellular radiotelephone device

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 0 to 69. The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

- § 2.1046 Measurement required: RF power output
- § 2.1049 Measurement required: Occupied bandwidth
- § 2.1053 Measurement required: Field strength of spurious radiation

Part 24, Subpart E - Broadband PCS

- § 24.232 Power and antenna height limits
- § 24.236 Field strength limits
- § 24.238 Emission limitations for Broadband PCS equipment

additional documents

ANSI C63.26 2015

Description of Methods of Measurements

RF Power Output

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
- 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
- 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
 - Channel (Frequency): please refer to the detailed results
- 4) The transmitted power of the EUT was recorded by using a spectrum analyser.

Test Description (radiated measurement procedure)

- 1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
 - 2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 3) A substitution procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a $\lambda/2$ dipole).
 - 4) The output power was measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case power all orientations (X, Y, Z) of the EUT have been measured.
 - 5) The test procedure according to ANSI C63.26 2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.

§24.232 Power and antenna height limits

(c) Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

(e) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

Emission and Occupied Bandwidth

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1049

Test Description

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
 - 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
 - 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 4) Important Analyser Settings:
 - Resolution Bandwidth: >1% of the manufacturer's stated occupied bandwidth
 - 5) The maximum spectral level of the modulated signal was recorded as the reference.
 - 6) The emission bandwidth is measured as follows:
the two furthest frequencies above and below the frequency of the maximum reference level where the spectrum is -26 dB down have to be found.
 - 7) The occupied bandwidth (99% Bandwidth) is measured as follows:
the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 percent of the total mean power.

Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

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

(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

Field strength of spurious radiation

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1053

Test Description

- 1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
 - 2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a $\lambda/2$ dipole).
 - 4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antennas for the frequency range of 30 MHz to 20 GHz (up to the 10th harmonic of the transmit frequency). The frequency range from 9 kHz to 30 MHz has been examined during the conducted spurious emission measurements.
 - 5) Important Analyser Settings
 - [Resolution Bandwidth / Video Bandwidth]:
 - a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the Band,
 - b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz -> 10 kHz) was used
 - c) [1 MHz / 3 MHz] otherwise
 - Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
 - 6) The spurious emissions peaks were measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case peaks all orientations (X, Y, Z) of the EUT have been measured.
 - 7) After this initial test, a final test according to ANSI C63.26 2015 2.2.12 Unwanted Emissions is performed on signals which are identified as being close to the limit. For any emissions found to be within 10 dB of the limit, a specific signal substitution measurement is performed at the frequency of the emission to determine the exact e.i.r.p. value.

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:
 (2) All equipment operating on frequencies higher than 25 MHz.

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

- (1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- (b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.
- (c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.
- (d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 24.238 Emission limitations for Broadband PCS equipment

(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. This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dB μ V/m (field strength) in a distance of 3 m.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The 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.

(c) Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas [...].

(d) If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

For reporting only spurious emission levels reaching to the 20dB margin to limit were noted.

Band edge compliance

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §24.238

Test Description

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
 - 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
 - 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 4) Important Analyser Settings:
 - Resolution Bandwidth = Video Bandwidth: >1% of the manufacturer's stated occupied bandwidth

Test Requirements / Limits

§ 24.238 Effective radiated power limits

Refer to chapter "Field strength of spurious radiation".

The EUT complied with all performed tests as listed in the summary section of this report.

Technical Report Summary

Type of Authorization :

Certification for a GSM cellular radiotelephone device

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 0 to 69. The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

- § 2.1046 Measurement required: RF power output
- § 2.1049 Measurement required: Occupied bandwidth
- § 2.1053 Measurement required: Field strength of spurious radiation

Part 27, Subpart C—Technical Standards

- § 27.50 Power and antenna height limits
- § 27.53 Emissions limits

additional documents

ANSI C63.26 2015

Description of Methods of Measurements

RF Power Output

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
- 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
- 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Channel (Frequency): please refer to the detailed results
- 4) The transmitted power of the EUT was recorded by using a spectrum analyser.

Test Description (radiated measurement procedure)

- 1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
- 2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Output Power: Maximum
 - Channel: please refer to the detailed results
- 3) A substitution procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a $\lambda/2$ dipole).
 - 4) The output power was measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case power all orientations (X, Y, Z) of the EUT have been measured.
 - 5) The test procedure according to ANSI C63.26-2015 has been considered.

Test Requirements / Limits**§2.1046 Measurements Required: RF Power Output**

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.

§27.50 Power and antenna height limits.

(d) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands:

- (2) Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to a peak EIRP of 1 watt. Fixed stations operating in this band are limited to a maximum antenna height of 10 meters above ground, and mobile and portable stations must employ a means for limiting power to the minimum necessary for successful communications.

Emission and Occupied Bandwidth

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1049

Test Description

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
- 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
- 3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Output Power: Maximum
 - Channel: please refer to the detailed results
- 4) Important Analyser Settings:
 - Resolution Bandwidth: >1% of the manufacturer's stated occupied bandwidth
 - 5) The maximum spectral level of the modulated signal was recorded as the reference.
 - 6) The emission bandwidth is measured as follows:
the two furthest frequencies above and below the frequency of the maximum reference level where the spectrum is –26 dB down have to be found.
 - 7) The occupied bandwidth (99% Bandwidth) is measured as follows:
the occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 percent of the total mean power.

Test Requirements / Limits**§ 2.1049 Measurements required: Occupied bandwidth**

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

- (h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any

devices used for modifying the spectrum when such devices are optional at the discretion of the user.

Field strength of spurious radiation

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1053

Test Description

- 1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
 - 2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel : please refer to the detailed results
- 3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a $\lambda/2$ dipole).
 - 4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antennas for the frequency range of 30 MHz to 18 GHz (up to the 10th harmonic of the transmit frequency). The frequency range from 9 kHz to 30 MHz has been examined during the conducted spurious emission measurements.
 - 5) Important Analyser Settings
 - [Resolution Bandwidth / Video Bandwidth]:
 - a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the Band,
 - b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz -> 10 kHz) was used
 - c) [1 MHz / 3 MHz] otherwise
 - Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
 - 6) The spurious emissions peaks were measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case peaks all orientations (X, Y, Z) of the EUT have been measured.
 - 7) After this initial test, a final test according to ANSI C63.26 2015 Unwanted Emissions is performed on signals which are identified as being close to the limit. For any emissions found to be within 10 dB of the limit, a specific signal substitution measurement is performed at the frequency of the emission to determine the exact e.i.r.p. value.

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

- (b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:
- (2) All equipment operating on frequencies higher than 25 MHz.

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

- (1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- (b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to

those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 27.53 Emission limits

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed. □□

(h) For operations in the 1710-1755 MHz and 2110-2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(10P)$ dB.

m(4) For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log(P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log(P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log(P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than $43 + 10 \log(P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log(P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees. □□

Remark of the test laboratory: This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in a distance of 3 m.

(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The 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.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(3) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

For reporting only spurious emission levels reaching to the 20dB margin to limit were noted.

Band edge compliance

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §27.53

Test Description

1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".

2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.

3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Output Power: Maximum
- Channel: please refer to the detailed results

4) Important Analyser Settings:

- Resolution Bandwidth = Video Bandwidth: >1% of the manufacturer's stated occupied bandwidth

For LTE band eFDD13 in the ranges of 765-775MHz and 793-805MHz. These frequency ranges are part of spurious conducted and measured with 10kHz RBW.

Test Requirements / Limits

§ 27.53 Effective radiated power limits

Refer to chapter "Field strength of spurious radiation"

Subtests HSDPA

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: $?_{ACK}$, $?_{NACK}$ and $?_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, $?_{ACK}$ and $?_{NACK} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$, and $?_{CQI} = 24/15$ with $\beta_{hs} = 24/15 * \beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

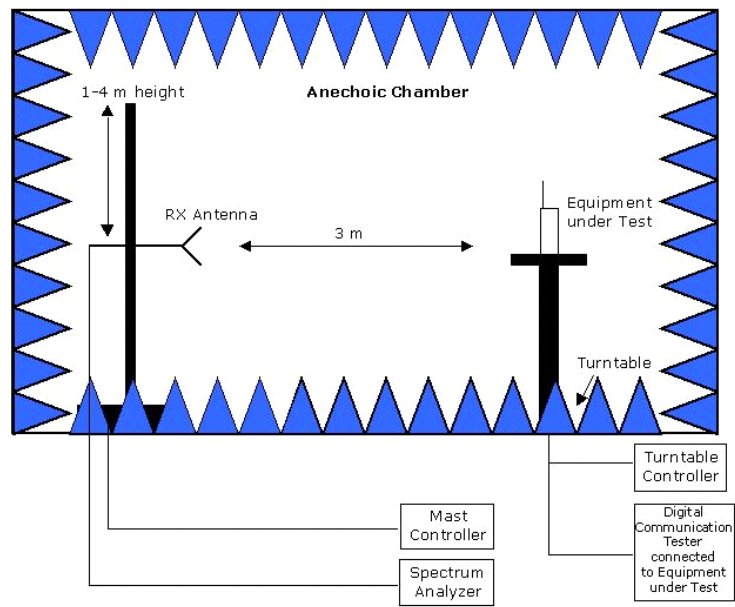
Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

Subtests HSUPA

Subtest	Mode	Loopback Mode	Rel99 RMC	HSDPA FRC	HSUPA Test	Number of E-DPDCH Channels
1	Rel6 HSUPA	Test Mode 1	12.2kbps RMC	H-Set1	HSUPA Loopback	1
2	Rel6 HSUPA	Test Mode 1	12.2kbps RMC	H-Set1	HSUPA Loopback	1
3	Rel6 HSUPA	Test Mode 1	12.2kbps RMC	H-Set1	HSUPA Loopback	2
4	Rel6 HSUPA	Test Mode 1	12.2kbps RMC	H-Set1	HSUPA Loopback	1
5	Rel6 HSUPA	Test Mode 1	12.2kbps RMC	H-Set1	HSUPA Loopback	1

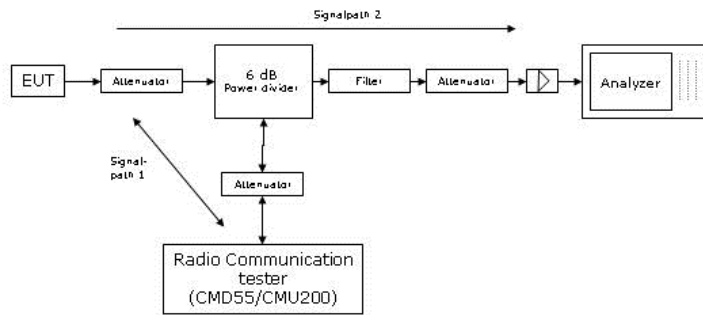
Subtest	Max UL Data Rate (kb/s)	β_c/β_d	β_{hs}	β_d	CM
1	242.1	11/15	22/15	1309/225	1
2	161.3	6/15	12/15	94/75	3
3	524.7	15/9	30/15	47/15	2
4	197.6	2/15	4/15	56/75	3
5	299.6	15/15	30/15	134/15	1

Setup Drawings



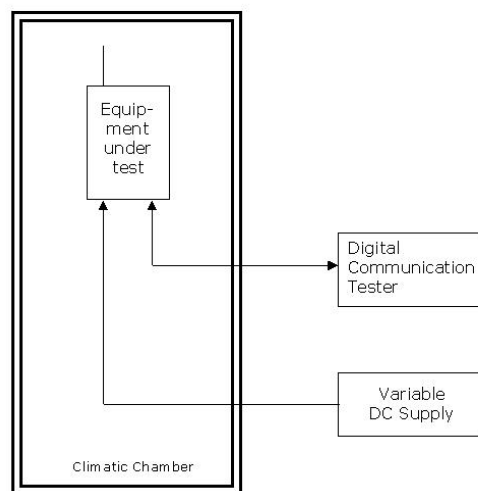
Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Principle set-up for radiated measurements



Remark: Depending on the frequency range suitable attenuators and/or filters and/or amplifiers are used.

Principle set-up for conducted measurements under nominal conditions



Principle set-up for tests under extreme test conditions



FCC Rule / IC Standard	Part 22	RSS-132	Part 24	RSS-133	Part 27	RSS-139	RSS-130	RSS-199
		Issue 3, 2013		Issue 6, 2018		Issue 3, 2015	Issue 1, 2013	Issue 32016
Effective (isotropic) Radiated Power	§2.1046 §22.913	RSS-GEN 5, §6.12 RSS-132, §5.4	§2.1046 §24.232	RSS-GEN 5, §6.12 RSS-133, §6.4	§2.1046 §27.50	RSS-GEN 5, §6.12 RSS-139; §6.5	RSS-GEN 5, §6.12 RSS-130; §4.4	RSS-GEN 5, §6.12 RSS-199; §4.4
Emission and Occupied Bandwidth	§2.1049	RSS-GEN 5 §6.7	§2.1049	RSS-GEN 5 §6.7	§2.1049	RSS-GEN 5 §6.7	RSS-GEN 5 §6.7	RSS-GEN 5 §6.7
“Spuri” at Antenna Terminal	§2.1051 §22.917	RSS-GEN 5, §6.13 RSS-132, §5.5	§2.1051 §24.238	RSS-GEN 5, §6.13 RSS-133, §6.5	§2.1051 §27.53	RSS-GEN 5, §6.13 RSS-139, §6.6	RSS-GEN 5, §6.13 RSS-130, §4.6	RSS-GEN 5, §6.13 RSS-199, §4.5
Band Edge compliance	§2.1051 §22.917	RSS-GEN 5, §6.13	§2.1051 §24.238	RSS-GEN 5, §6.13	§2.1051 §27.53	RSS-GEN 5, §6.13	RSS-GEN 5, §6.13	RSS-GEN 5, §6.13
Frequency Stability	§2.1055 §22.355	RSS-GEN 5, §6.11 RSS-132, §5.3	§2.1055 §24.235	RSS-GEN 5, §6.11 RSS-133, §6.3	§2.1055 §27.51	RSS-GEN 5, §6.11 RSS-139, §6.4	RSS-GEN 5, §6.11 RSS-130, §4.3	RSS-GEN 5, §6.11 RSS-199, §4.3
Peak to Average Ratio	N/A	RSS-GEN 5, §6.12 RSS-132, §5.4	§2.1046 §24.232	RSS-GEN 5, §6.12 RSS-133, §6.4	§2.1046 §27.50	RSS-GEN 5, §6.12 RSS-139; §6.5	RSS-GEN 5, §6.12 RSS-130; §4.4	RSS-GEN 5, §6.12 RSS-199; §4.4
Field Strength of Spurious Radiation	§2.1053 §22.917	RSS-GEN 5, §6.13 RSS-132, §5.5	§2.1053 §24.235	RSS-GEN 5, §6.13 RSS-133, §6.5	§2.1053 §27.51	RSS-GEN 5, §6.13 RSS-139, §6.6	RSS-GEN 5, §6.13 RSS-130, §4.6	RSS-GEN 5, §6.13 RSS-199, §4.5

6 Index

1	Administrative Data	2
1.1	Project Data	2
1.2	Applicant Data	2
1.3	Test Laboratory Data	2
1.4	Signature of the Testing Responsible	3
1.5	Signature of the Accreditation Responsible	3
2	Test Object Data	4
2.1	General OUT Description	4
2.2	Detailed Description of OUT Samples	5
2.3	Setups used for Testing	6
3	Results	6
3.1	General	6
3.2	List of Test Specification	6
3.3	Summary	7
3.4	Detailed Results	8
3.4.1	22.4 Field strength of spurious radiation §2.1053, §22.917	8
3.4.2	24.4 Field strength of spurious radiation §2.1053, §24.238	11
3.4.3	27.1 RF Power Output §2.1046, §27.250	14
3.4.4	27.3 Spurious emissions at antenna terminals §2.1051, §27.53	19
3.4.5	27.4 Field strength of spurious radiation §2.1053, §27.53	20
3.4.6	27.5 Emission and Occupied Bandwidth §2.1049	28
3.4.7	27.6 Band edge compliance §2.1053, §27.53	30
4	Test Equipment Details	32
4.1	List of Used Test Equipment	32
5	Annex	38
5.1	Additional Information for Report	38
6	Index	55