

# InterLab®

## Final Report on

### Bittium Tough Mobile

### FCC ID: V27SD-41

### IC: 3282B-SD41

**Report Reference:** MDE\_ELEKT\_1502\_FCCh  
according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27

**Date:** October 29, 2015

**Test Laboratory:**  
7layers GmbH  
Borsigstraße 11  
40880 Ratingen  
Germany

**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](http://www.7layers.com)

Geschäftsführer /  
Managing Director:  
Dr. Harald Ansorge



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:* Imad Hjije  
*Date Of Test Report:* 2015/10/29  
*Date of first test:* 2015/06/22  
*Date of last test:* 2015/10/27

**1.2 Applicant Data**

*Company Name:* Bittium Wireless Ltd.

*Street:* Tutkijantie 8  
*City:* 90570 Oulu  
*Country:* Finland

*Contact Person:* Mr. Jyrki Juvani

*Function:* Specialist, Test Management  
*Department:* Wireless Solutions  
*Phone:* +358 40 344 5781  
*E-Mail:* Jyrki.Juvani@bittium.com

**1.3 Test Laboratory Data**

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

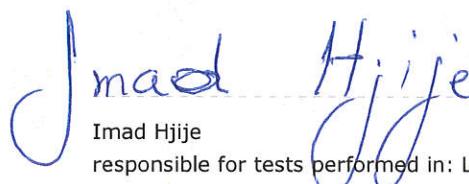
**7 layers DE**

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*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. Robert Machulec	DAkkS-Registration no. D-PL-12140-01-01
Lab 2	Radio Lab	Mr. Dobrin Dobrinov Mr. Daniel Gall	DAkkS-Registration no. D-PL-12140-01-01

**1.4 Signature of the Testing Responsible**

Imad Hjije  
responsible for tests performed in: Lab 1, Lab 2

### 1.5 Signature of the Accreditation Responsible



[M. Kullik]

Accreditation scope responsible person  
responsible for Lab 1, Lab 2



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

## 2 Test Object Data

### 2.1 General OUT Description

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

**OUT: Bittium Tough Mobile**  
**FCC ID: V27SD-41**  
**IC: 3282B-SD41**

**Manufacturer:**

Company Name:

See applicant data:

Contact Person:

-

**Parameter List:**

Parameter name

Value

## 2.2 Detailed Description of OUT Samples

### Sample : aa01

<i>OUT Identifier</i>	Bittium Tough Mobile FCC ID: V27SD-41 IC: 3282B-SD41		
<i>Sample Description</i>	Radiated Sample		
<i>Serial No.</i>	K0251300425		
<i>HW Status</i>	0302		
<i>SW Status</i>	2.6.0		
<i>Low Voltage</i>	3.6 V	<i>Low Temp.</i>	-30 °C
<i>High Voltage</i>	4.2 V	<i>High Temp.</i>	+55 °C
<i>Nominal Voltage</i>	3.8 V	<i>Normal Temp.</i>	23 °C

### Sample : ae01

<i>OUT Identifier</i>	Bittium Tough Mobile FCC ID: V27SD-41 IC: 3282B-SD41		
<i>Sample Description</i>	Conducted Sample		
<i>Serial No.</i>	K0251300433		
<i>HW Status</i>	0302		
<i>SW Status</i>	2.6.0		
<i>Low Voltage</i>	3.6 V	<i>Low Temp.</i>	-30 °C
<i>High Voltage</i>	4.2 V	<i>High Temp.</i>	+55 °C
<i>Nominal Voltage</i>	3.8 V	<i>Normal Temp.</i>	23 °C

### Sample : af01

<i>OUT Identifier</i>	Bittium Tough Mobile FCC ID: V27SD-41 IC: 3282B-SD41		
<i>Sample Description</i>	Conducted Sample		
<i>Serial No.</i>	K0251300436		
<i>HW Status</i>	0302		
<i>SW Status</i>	2.6.0		
<i>Low Voltage</i>	3.6 V	<i>Low Temp.</i>	-30 °C
<i>High Voltage</i>	4.2 V	<i>High Temp.</i>	+55 °C
<i>Nominal Voltage</i>	3.8 V	<i>Normal Temp.</i>	23 °C

## 2.3 OUT Features

**Features for OUT: Bittium Tough Mobile**
**FCC ID: V27SD-41**
**IC: 3282B-SD41**

Designation	Description	Allowed Values	Supported Value(s)
<b>Features for scope: FCC_v2</b>			
AC	The OUT is powered by or connected to AC Mains		
BT	EUT supports Bluetooth data rate of 1 Mbps with GFSK modulation in the band 2400 MHz - 2483.5 MHz		
BTLE	Support of Bluetooth Low Energy		
DC	The OUT is powered by or connected to DC		
EDGE850	EUT supports EDGE in the band 824 MHz - 849 MHz		
EDGE1900	EUT supports EDGE in the band 1850 MHz - 1910 MHz		
EDR2	EUT supports Bluetooth using data rate of 2 Mbps with PI/4 DQPSK modulation in the band 2400 MHz - 2483.5 MHz		
EDR3	EUT supports Bluetooth using data rate of 3 Mbps with 8DPSK modulation in the band 2400 MHz - 2483.5 MHz		
eFDD2	Supported bandwidth: 1.4, 3, 5, 10, 15 and 20 MHz		
eFDD4	Supported bandwidth: 1.4, 3, 5, 10, 15 and 20 MHz		
eFDD5	Supported bandwidth: 1.4, 3, 5 and 10 MHz		
efDD13	Supported bandwidth: 5 and 10 MHz		
efDD14	Supported bandwidth: 5 and 10 MHz		
efDD17	Supported bandwidth: 5 and 10 MHz		
FDD2	EUT supports UMTS FDD2 in the band 1850 MHz - 1910 MHz		
FDD5	EUT supports UMTS FDD5 in the band 824 MHz - 849 MHz		
GSM850	EUT supports GSM850 band 824MHz - 849MHz		
HSDPA-FDD2	EUT supports UMTS FDD2 HSDPA in the band 1850 MHz - 1910 MHz		
HSDPA-FDD4	EUT supports UMTS FDD4 HSDPA in the band 1710 MHz - 1755 MHz		
HSDPA-FDD5	EUT supports UMTS FDD5 HSDPA in the band 824 MHz - 849 MHz		
HSUPA-FDD2	EUT supports UMTS FDD2 HSUPA in the band 1850 MHz - 1910 MHz		
HSUPA-FDD4	EUT supports UMTS FDD4 HSUPA in the band 1710 MHz - 1755 MHz		
HSUPA-FDD5	EUT supports UMTS FDD5 HSUPA in the band 824 MHz - 849 MHz		
Iant	Integral Antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment		
PCS1900	EUT supports PCS1900 band 1850MHz - 1910MHz		
TantC	temporary antenna connector, which may be only built-in for testing, designed as an example part of the equipment		
Wa1	EUT supports WLAN in mode a in the band 5150 MHz - 5250 MHz		
Wa2	EUT supports WLAN in mode a in the band 5250 MHz - 5350 MHz		

**Features for OUT: Bittium Tough Mobile**  
**FCC ID: V27SD-41**  
**IC: 3282B-SD41**

Designation	Description	Allowed Values	Supported Value(s)
Wa3	EUT supports WLAN in mode a in the band 5470 MHz - 5725 MHz		
Wa4	EUT supports WLAN in mode a in the band 5725 MHz - 5825 MHz		
Wa5	EUT supports WLAN in mode a in the band 5725 MHz - 5875 MHz		
Wa10	EUT supports WLAN in mode a in the band 5650 MHz - 5700 MHz		
Wn	EUT supports WLAN in mode n in the band 2400 MHz - 2483.5 MHz		

## 2.4 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.

Setup No.	List of OUT samples		List of auxiliary equipment	
	Sample No.	Sample Description	AE No.	AE Description
<b>S01_AA01</b>				
	Sample: aa01	Radiated Sample		
<b>S01_AE01</b>				
	Sample: ae01	Conducted Sample		
<b>S01_AF01</b>				
	Sample: af01	Conducted Sample		

## 3 Results

### 3.1 General

<b>Documentation of tested devices:</b>	Available at the test laboratory.
<b>Interpretation of the test results:</b>	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.
<b>Note:</b>	<ol style="list-style-type: none"> <li>1. All tests are performed under environmental conditions within the requirements of the specifications. Environmental conditions are available at the laboratory.</li> <li>2. The test report covers LTE bands 2, 4, 5, 13 and 17. Other bands and technologies are reported separately</li> </ol>

### 3.2 List of the Applicable Body

(Bodies for Scope: FCC\_v2)

<i>Designation</i>	<i>Description</i>
FCC47CFRChIPART22PUBLIC MOBILE SERVICES	Part 22, Subpart H - Cellular Radiotelephone Service
FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES	Part 24, Subpart E - Broadband PCS
FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	Part 27, Subpart C - Technical Standards

### 3.3 List of Test Specification

*Test Specification:* **FCC part 2 and 22**

*Version* 10-1-13 Edition

*Title:* PART 2 - GENERAL RULES AND REGULATIONS  
PART 22 - PUBLIC MOBILE SERVICES

*Test Specification:* **FCC part 2 and 24**

*Version* 10-1-13 Edition

*Title:* PART 2 - GENERAL RULES AND REGULATIONS  
PART 24 - PERSONAL COMMUNICATIONS SERVICES

*Test Specification:* **FCC part 2 and 27**

*Version* 10-1-13 Edition

*Title:* PART 2 - GENERAL RULES AND REGULATIONS  
PART 27 - MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

### 3.4 Summary

Test Case Identifier / Name Test (condition)	Result	Date of Test	Lab Ref.	Setup
<b>Test Specification: FCC part 2 and 22</b>				
<b>22.1 RF Power Output §2.1046, §22.913</b> 22.1; RF Power Output Summary §2.1046, §22.913	Passed	2015/08/29	Lab 2	S01_AF01
<b>22.2 Frequency stability §2.1055</b> 22.2; Frequency Band = efDD5, Mode = QPSK, Channel = 20525, Frequency = 836.5MHz	Passed	2015/08/03	Lab 2	S01_AE01
<b>22.3 Spurious emissions at antenna terminals §2.1051, §22.917</b> 22.3; Spurious emissions at antenna terminals summary §2.1051, §22.917	Passed	2015/07/16	Lab 2	S01_AE01
<b>22.4 Field strength of spurious radiation §2.1053, §22.917</b> 22.4; Frequency Band = efDD5, Mode = QPSK 5MHz, Channel = 20425, Frequency = 826.5MHz, Method = radiated 22.4; Frequency Band = efDD5, Mode = QPSK 5MHz, Channel = 20525, Frequency = 836.5MHz, Method = radiated 22.4; Frequency Band = efDD5, Mode = QPSK 5MHz, Channel = 20625, Frequency = 846.5MHz, Method = radiated	Passed	2015/06/23	Lab 1	S01_AA01
<b>22.5 Emission and Occupied Bandwidth §2.1049, §22.917</b> 22.5; Emission and Occupied Bandwidth Summary §2.1049, §22.917	Passed	2015/07/16	Lab 2	S01_AE01
<b>22.6 Band edge compliance §2.1053, §22.917</b> 22.6; Band edge compliance Summary §2.1053, §22.917	Passed	2015/10/27	Lab 2	S01_AE01
<b>22.7 Peak-to-Average Ratio Summary §2.1046</b> 22.7; Peak-to-Average Ratio Summary §2.1046	Passed	2015/08/05	Lab 2	S01_AE01
<b>Test Specification: FCC part 2 and 24</b>				
<b>24.1 RF Power Output §2.1046, §24.232</b> 24.1; RF Power Output Summary §2.1046, §24.232	Passed	2015/08/29	Lab 2	S01_AF01
<b>24.2 Frequency stability §2.1055, §24.235</b> 24.2; Frequency Band = efDD2, Mode = QPSK, Channel = 18900, Frequency = 1880MHz	Passed	2015/08/03	Lab 2	S01_AE01
<b>24.3 Spurious emissions at antenna terminals §2.1051, §24.238</b> 24.3; Spurious emissions at antenna terminals Summary §2.1051, §24.238	Passed	2015/07/16	Lab 2	S01_AE01
<b>24.4 Field strength of spurious radiation §2.1053, §24.238</b> 24.4; Frequency Band = efDD2, Mode = QPSK 5MHz, Channel = 18625, Frequency = 1852.5MHz, Method = radiated 24.4; Frequency Band = efDD2, Mode = QPSK 5MHz, Channel = 18900, Frequency = 1880MHz, Method = radiated 24.4; Frequency Band = efDD2, Mode = QPSK 5MHz, Channel = 19175, Frequency = 1907.5MHz, Method = radiated	Passed	2015/06/22	Lab 1	S01_AA01
		2015/06/22	Lab 1	S01_AA01
		2015/06/22	Lab 1	S01_AA01

Reference: MDE\_ELEKT\_1502\_FCCh  
 according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27

Test Case Identifier / Name Test (condition)	Result	Date of Test	Lab Ref.	Setup
<b>24.5 Emission and Occupied Bandwidth §2.1049, §24.238</b> 24.5; Emission and Occupied Bandwidth Summary §2.1049, §24.238	Passed	2015/07/17	Lab 2	S01_AE01
<b>24.6 Band edge compliance §2.1053, §24.238</b> 24.6: Band edge compliance summary §2.1053, §24.238	Passed	2015/07/17	Lab 2	S01_AE01
<b>24.7 Peak-to-Average ratio §2.1046, §24.232</b> 24.7: Peak-to-Average Ratio Summary §2.1046, §24.232	Passed	2015/10/27	Lab 2	S01_AE01
<b>Test Specification: FCC part 2 and 27</b>				
<b>27.1 RF Power Output §2.1046, §27.250</b> 27.1; RF Power Output Summary §2.1046, §27.250	Passed	2015/08/29	Lab 2	S01_AF01
<b>27.2 Frequency stability §2.1055, §27.54</b> 27.2; Frequency Band = efDD13, Mode = QPSK, Channel = 23230, Frequency = 782MHz 27.2; Frequency Band = efDD17, Mode = QPSK, Channel = 23790, Frequency = 710MHz 27.2; Frequency Band = efDD4, Mode = QPSK, Channel = 20175, Frequency = 1732.5MHz	Passed Passed Passed	2015/08/05 2015/08/05 2015/08/04	Lab 2 Lab 2 Lab 2	S01_AE01 S01_AE01 S01_AE01
<b>27.3 Spurious emissions at antenna terminals §2.1051, §27.53</b> 27.3; Spurious emissions at antenna terminals Summary §2.1051, §27.53	Passed	2015/07/17	Lab 2	S01_AE01
<b>27.4 Field strength of spurious radiation §2.1053, §27.53</b> 27.4; Frequency Band = efDD13, Mode = QPSK 5MHz, Channel = 23205, Frequency = 779.5MHz, Method = radiated 27.4; Frequency Band = efDD13, Mode = QPSK 5MHz, Channel = 23230, Frequency = 782MHz, Method = radiated 27.4; Frequency Band = efDD13, Mode = QPSK 5MHz, Channel = 23255, Frequency = 784.5MHz, Method = radiated 27.4; Frequency Band = efDD17, Mode = QPSK 5MHz, Channel = 23755, Frequency = 706.5MHz, Method = radiated 27.4; Frequency Band = efDD17, Mode = QPSK 5MHz, Channel = 23790, Frequency = 710MHz, Method = radiated 27.4; Frequency Band = efDD17, Mode = QPSK 5MHz, Channel = 23825, Frequency = 713.5MHz, Method = radiated 27.4; Frequency Band = efDD4, Mode = QPSK 5MHz, Channel = 19975, Frequency = 1712.5MHz, Method = radiated 27.4; Frequency Band = efDD4, Mode = QPSK 5MHz, Channel = 20175, Frequency = 1732.5MHz, Method = radiated 27.4; Frequency Band = efDD4, Mode = QPSK 5MHz, Channel = 20375, Frequency = 1752.5MHz, Method = radiated	Passed Passed Passed Passed Passed Passed Passed Passed Passed Passed Passed Passed Passed Passed	2015/06/22 2015/06/22 2015/06/22 2015/06/22 2015/06/22 2015/06/22 2015/06/23 2015/06/22 2015/06/22 2015/06/23 2015/06/23 2015/06/23	Lab 1 Lab 1	S01_AA01 S01_AA01 S01_AA01 S01_AA01 S01_AA01 S01_AA01 S01_AA01 S01_AA01 S01_AA01 S01_AA01 S01_AA01 S01_AA01 S01_AA01
<b>27.5 Emission and Occupied Bandwidth §2.1049</b> 27.5; Emission and Occupied Bandwidth Summary §2.1049	Passed	2015/10/27	Lab 2	S01_AE01
<b>27.6 Band edge compliance §2.1053, §27.53</b> 27.6: Band edge compliance summary §2.1053, §27.53	Passed	2015/10/27	Lab 2	S01_AE01

## Test Case Identifier / Name

## Result

## Date of Test

## Ref.

## Setup

**27.7 Peak-to-Average ratio §2.1046, §27.50**

27.7: Peak-to-Average Ratio Summary §2.1046, §27.50	Passed	2015/08/05	Lab 2	S01_AE01
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### 3.5 Detailed Results

#### 3.5.1 22.1 RF Power Output §2.1046, §22.913

**Test: 22.1; RF Power Output Summary §2.1046, §22.913**

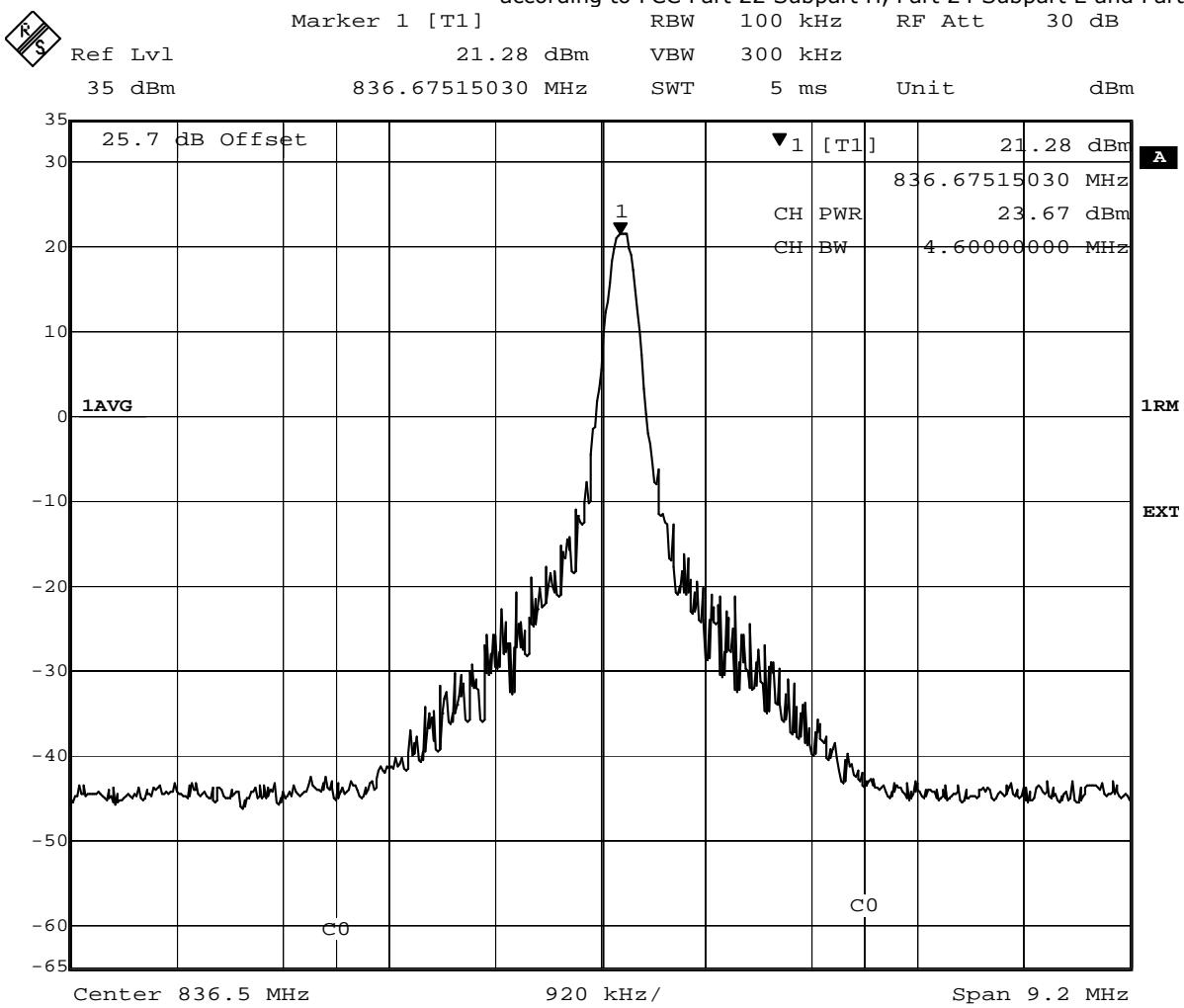
*Result:* Passed  
*Setup No.:* S01\_AF01  
*Date of Test:* 2015/08/29 20:15  
*Body:* FCC47CFRChIPART22PUBLIC MOBILE SERVICES  
*Test Specification:* FCC part 2 and 22

**Detailed Results:**

Test Band	Bandwidth (MHz)	Channel	Modulation	RB	RMS Conducted Power (dBm)	FCC EIRP Limit (W)	IC EIRP Limit (W)	Maximum Antenna Gain (dBi)	Verdict
eFDD5	1.4	20407	QPSK	RB 1	23	11.48	11.5	17.6	Passed
				RB 3	23	11.48	11.5	17.6	Passed
				RB 6	21.8	11.48	11.5	18.8	Passed
			16QAM	RB 1	22.1	11.48	11.5	18.5	Passed
				RB 6	20.8	11.48	11.5	19.8	Passed
		20525	QPSK	RB 1	22.9	11.48	11.5	17.7	Passed
				RB 3	22.8	11.48	11.5	17.8	Passed
				RB 6	21.7	11.48	11.5	18.9	Passed
			16QAM	RB 1	22.1	11.48	11.5	18.5	Passed
				RB 6	20.7	11.48	11.5	19.9	Passed
		20643	QPSK	RB 1	23	11.48	11.5	17.6	Passed
				RB 3	22.8	11.48	11.5	17.8	Passed
				RB 6	21.7	11.48	11.5	18.9	Passed
			16QAM	RB 1	21.9	11.48	11.5	18.7	Passed
				RB 6	20.6	11.48	11.5	20	Passed
	3	20415	QPSK	RB 1	23.4	11.48	11.5	17.2	Passed
				RB 15	22.2	11.48	11.5	18.4	Passed
			16QAM	RB 1	22.5	11.48	11.5	18.1	Passed
				RB 15	21.2	11.48	11.5	19.4	Passed
		20525	QPSK	RB 1	23.4	11.48	11.5	17.2	Passed
				RB 15	22.1	11.48	11.5	18.5	Passed
			16QAM	RB 1	22.6	11.48	11.5	18	Passed
				RB 15	21.2	11.48	11.5	19.4	Passed
		20635	QPSK	RB 1	23.5	11.48	11.5	17.1	Passed
				RB 15	22.1	11.48	11.5	18.5	Passed
			16QAM	RB 1	22.4	11.48	11.5	18.2	Passed
				RB 15	21.1	11.48	11.5	19.5	Passed
	5	20425	QPSK	RB 1	23.7	11.48	11.5	16.9	Passed
				RB 12	22.3	11.48	11.5	18.3	Passed
			16QAM	RB 25	22.4	11.48	11.5	18.2	Passed
				RB 1	22.6	11.48	11.5	18	Passed
		20525	QPSK	RB 1	23.7	11.48	11.5	16.9	Passed
				RB 12	22	11.48	11.5	18.6	Passed
			16QAM	RB 25	22.1	11.48	11.5	18.5	Passed
				RB 1	22.7	11.48	11.5	17.9	Passed
		20625	QPSK	RB 1	23.5	11.48	11.5	17.1	Passed
				RB 12	22.2	11.48	11.5	18.4	Passed
			16QAM	RB 25	22.1	11.48	11.5	18.5	Passed
				RB 1	22.7	11.48	11.5	17.9	Passed
	10	20450	QPSK	RB 1	23.7	11.48	11.5	17.3	Passed
				RB 50	22.1	11.48	11.5	18.5	Passed
			16QAM	RB 1	22.6	11.48	11.5	18	Passed
				RB 50	21.2	11.48	11.5	19.4	Passed
		20525	QPSK	RB 1	23.7	11.48	11.5	16.9	Passed
				RB 50	22.2	11.48	11.5	18.4	Passed
			16QAM	RB 1	22.6	11.48	11.5	18	Passed
				RB 50	21.2	11.48	11.5	19.4	Passed
		20600	QPSK	RB 1	23.5	11.48	11.5	17.1	Passed
				RB 50	22.2	11.48	11.5	18.4	Passed
			16QAM	RB 1	22.1	11.48	11.5	18.5	Passed
				RB 50	21	11.48	11.5	19.6	Passed

Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



Date: 26.AUG.2015 17:19:47

### 3.5.2 22.2 Frequency stability §2.1055

**Test: 22.2; Frequency Band = eFDD5, Mode = QPSK, Channel = 20525, Frequency = 836.5MHz**

*Result:* Passed

*Setup No.:* S01\_AE01

*Date of Test:* 2015/08/03 13:05

*Body:* FCC47CFRChIPART22PUBLIC MOBILE SERVICES

*Test Specification:* FCC part 2 and 22

**Detailed Results:**

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	2091	1	6	passed
-30	5			0	7	passed
-30	10			1	6	passed
-20	0	normal	2091	0	3	passed
-20	5			-1	-3	passed
-20	10			1	5	passed
-10	0	normal	2091	-1	-4	passed
-10	5			0	5	passed
-10	10			0	3	passed
0	0	normal	2091	0	6	passed
0	5			0	4	passed
0	10			0	-4	passed
10	0	normal	2091	0	5	passed
10	5			-1	3	passed
10	10			0	4	passed
20	0	low	2091	-1	-4	passed
20	5			0	-3	passed
20	10			-1	-3	passed
20	0	normal = high <sup>1)</sup>	2091	1	5	passed
20	5			-1	-5	passed
20	10			-2	-4	passed
20	0	high	2091	-1	-4	passed
20	5			-1	-3	passed
20	10			0	-2	passed
30	0	normal	2091	-2	-6	passed
30	5			-2	-5	passed
30	10			-2	-6	passed
40	0	normal	2091	0	-6	passed
40	5			-1	-6	passed
40	10			-2	-5	passed
50	0	normal	2091	0	-16	passed
50	5			-1	4	passed
50	10			1	-6	passed

LTE eFDD 5  
TCH: 20525  
1 RB, QPSK  
1,4 MHz BW

Battery operating end point voltage <sup>2)</sup>						
Temp. °C	Duration min	Voltage V	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
20	0	3.25	2091	-1	-4	passed
20	5			-2	-4	passed
20	10			-2	-6	passed

1) The manufacturer declared that normal voltage is equivalent with high voltage.

2) The call is established at high voltage and the voltage is then reduced to the battery operating end.

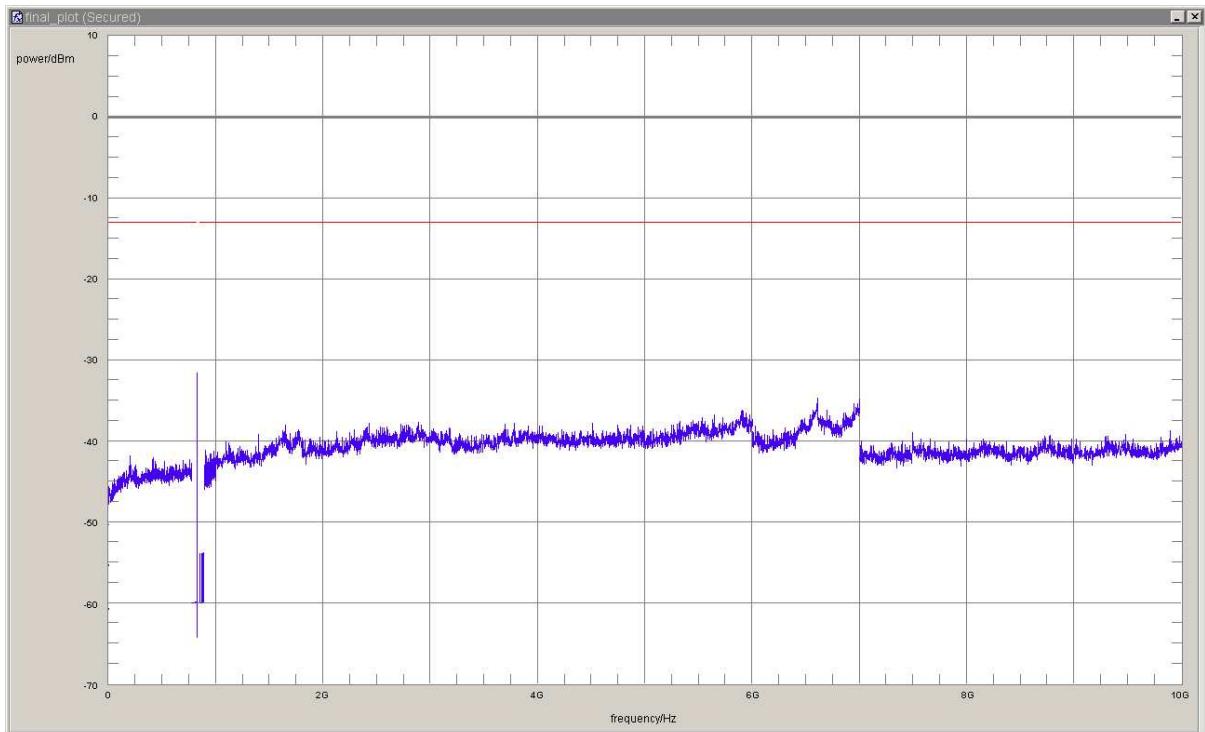
### 3.5.3 22.3 Spurious emissions at antenna terminals §2.1051, §22.917

#### Test: 22.3; Spurious emissions at antenna terminals summary §2.1051, §22.917

Result: Passed  
 Setup No.: S01\_AE01  
 Date of Test: 2015/07/16 20:21  
 Body: FCC47CFRChIPART22PUBLIC MOBILE SERVICES  
 Test Specification: FCC part 2 and 22

#### Detailed Results:

Band / Bandwidth, Resource Blocks	Modulation (MHz)	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Margin to Limit /dB	Limit /dBm	Verdict
eFDD5 / 5MHz, 1RB	QPSK	20425	rms	maxhold	5	823.998	-31.6	18.6	-13	Passed
		20525	rms	maxhold	100	#####	-34.24	21.24	-13	Passed
		20625	rms	maxhold	5	849.000	-32.4	19.4	-13	Passed
no further values have been found with a margin of less than 20 dB										



### 3.5.4 22.4 Field strength of spurious radiation §2.1053, §22.917

**Test: 22.4; Frequency Band = eFDD5, Mode = QPSK 5MHz, Channel = 20425, Frequency = 826.5MHz, Method = radiated**

*Result:* Passed

*Setup No.:* S01\_AA01

*Date of Test:* 2015/06/23 17:25

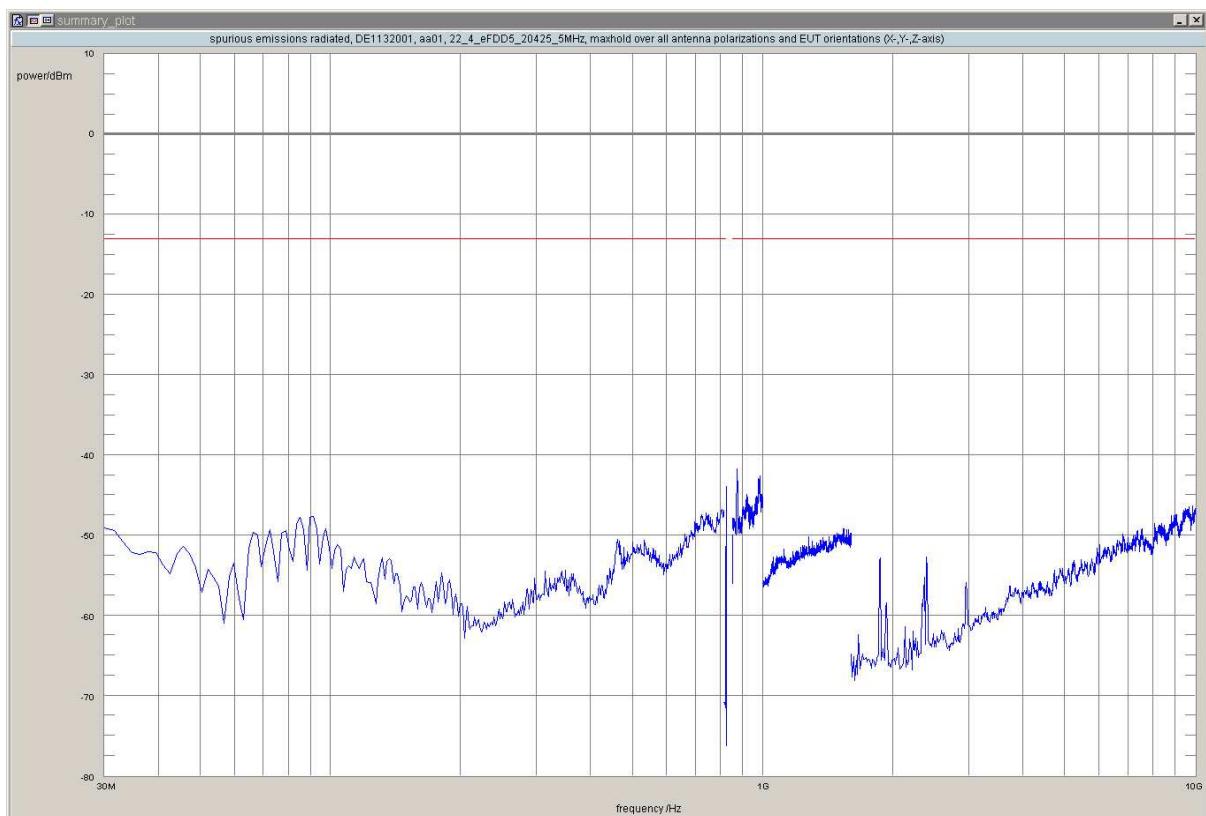
*Body:* FCC47CFRChIPART22PUBLIC MOBILE SERVICES

*Test Specification:* FCC part 2 and 22

**Detailed Results:**

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	1000	872.2	-41.68	-13.00	28.68	-180.0	horizontal	horizontal	passed

no further values have been found with a margin of less than 20 dB



**Test: 22.4; Frequency Band = eFDD5, Mode = QPSK 5MHz, Channel = 20525, Frequency = 836.5MHz, Method = radiated**

*Result:* Passed

*Setup No.:* S01\_AA01

*Date of Test:* 2015/06/22 4:54

*Body:* FCC47CFRChIPART22PUBLIC MOBILE SERVICES

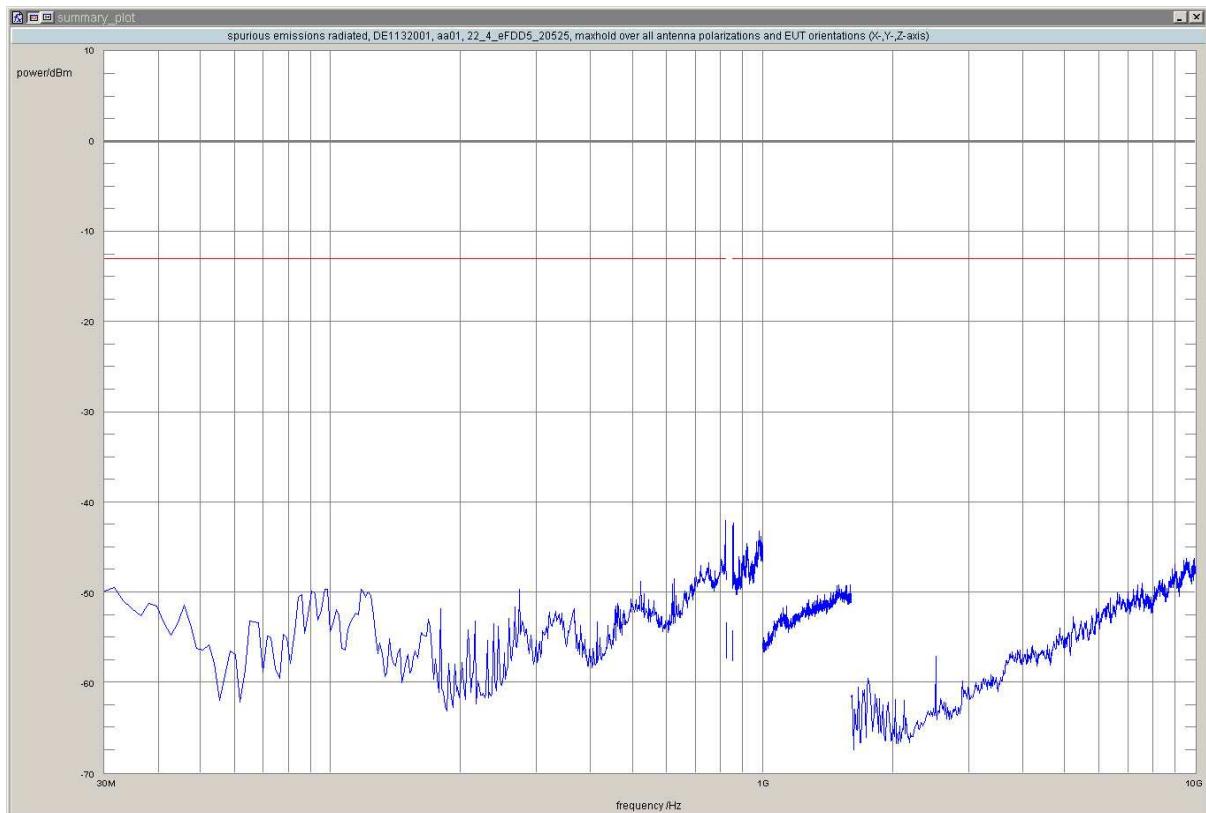
*Test Specification:* FCC part 2 and 22

**Detailed Results:**

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	1000	818.2	-42.04	-13.00	29.04	0.0	horizontal	vertical	passed

no further values have been found with a margin of less than 20 dB

added by operator

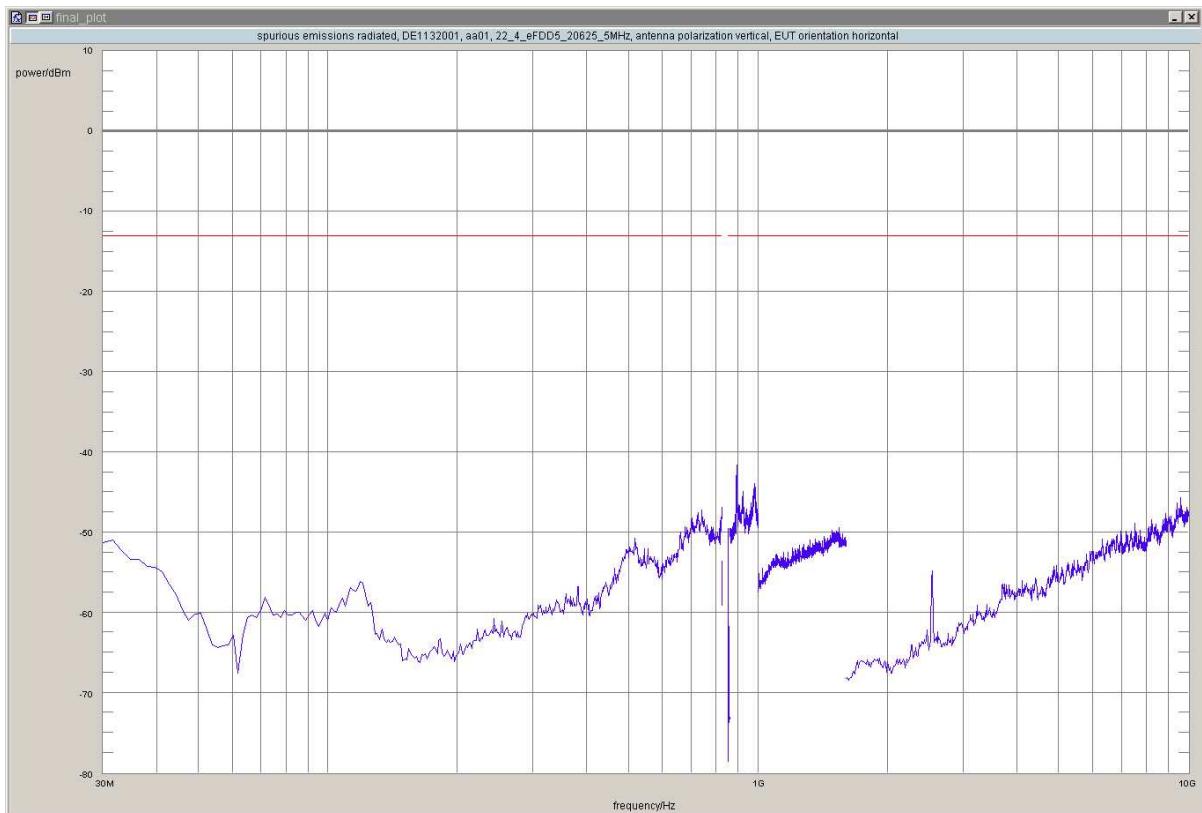


added by operator

**Test: 22.4; Frequency Band = eFDD5, Mode = QPSK 5MHz, Channel = 20625, Frequency = 846.5MHz, Method = radiated**

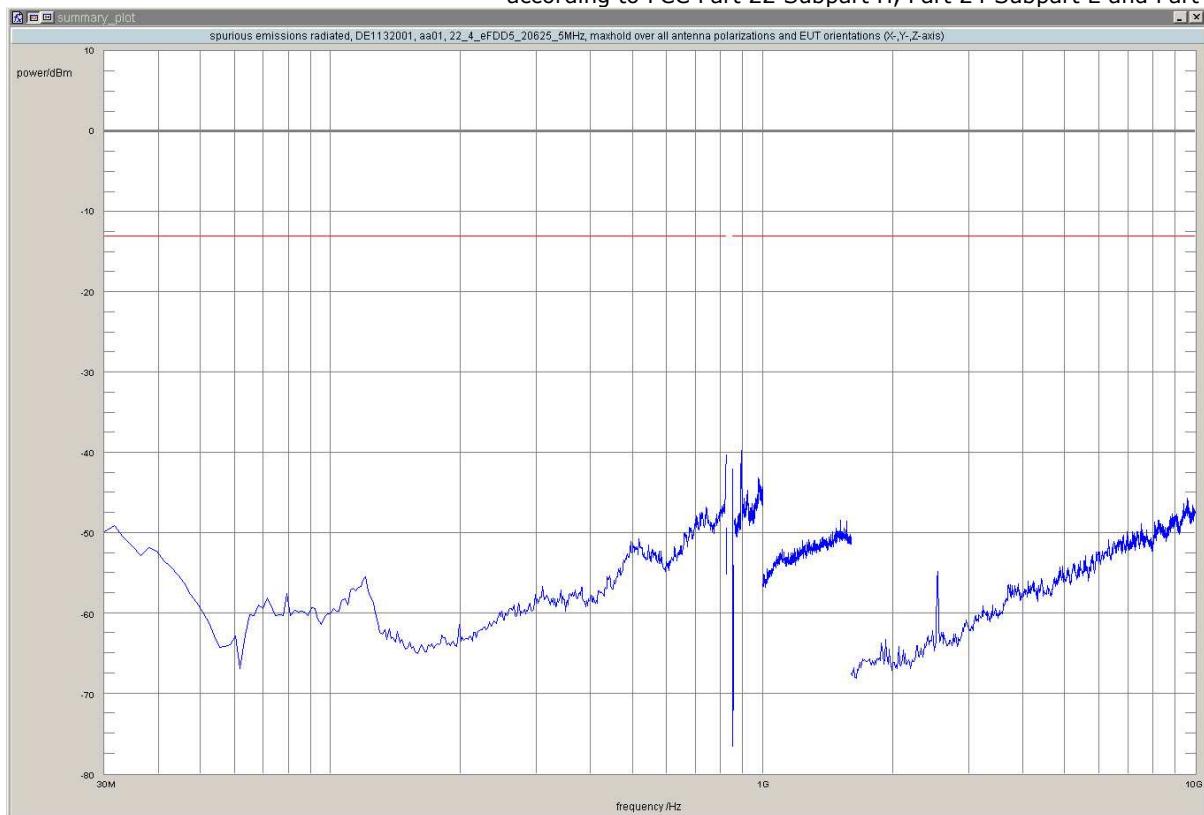
Result: Passed  
 Setup No.: S01\_AA01  
 Date of Test: 2015/06/23 17:26  
 Body: FCC47CFRChIPART22PUBLIC MOBILE SERVICES  
 Test Specification: FCC part 2 and 22

**Detailed Results:**



detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	1000	890.6	-39.71	-13.00	26.71	-180.0	horizontal	horizontal	passed

no further values have been found with a margin of less than 20 dB



**3.5.5 22.5 Emission and Occupied Bandwidth §2.1049, §22.917****Test: 22.5; Emission and Occupied Bandwidth Summary §2.1049, §22.917**

*Result:* Passed

*Setup No.:* S01\_AE01

*Date of Test:* 2015/07/16 20:29

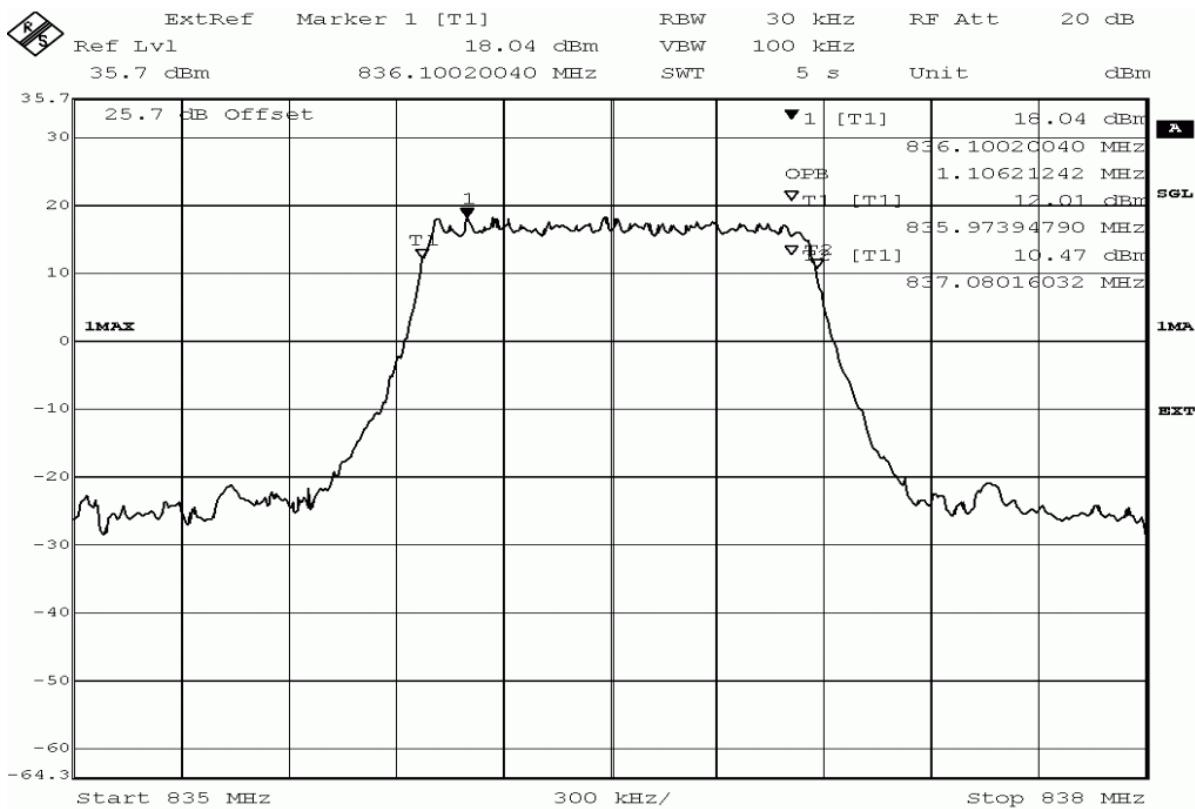
*Body:* FCC47CFRChIPART22PUBLIC MOBILE SERVICES

*Test Specification:* FCC part 2 and 22

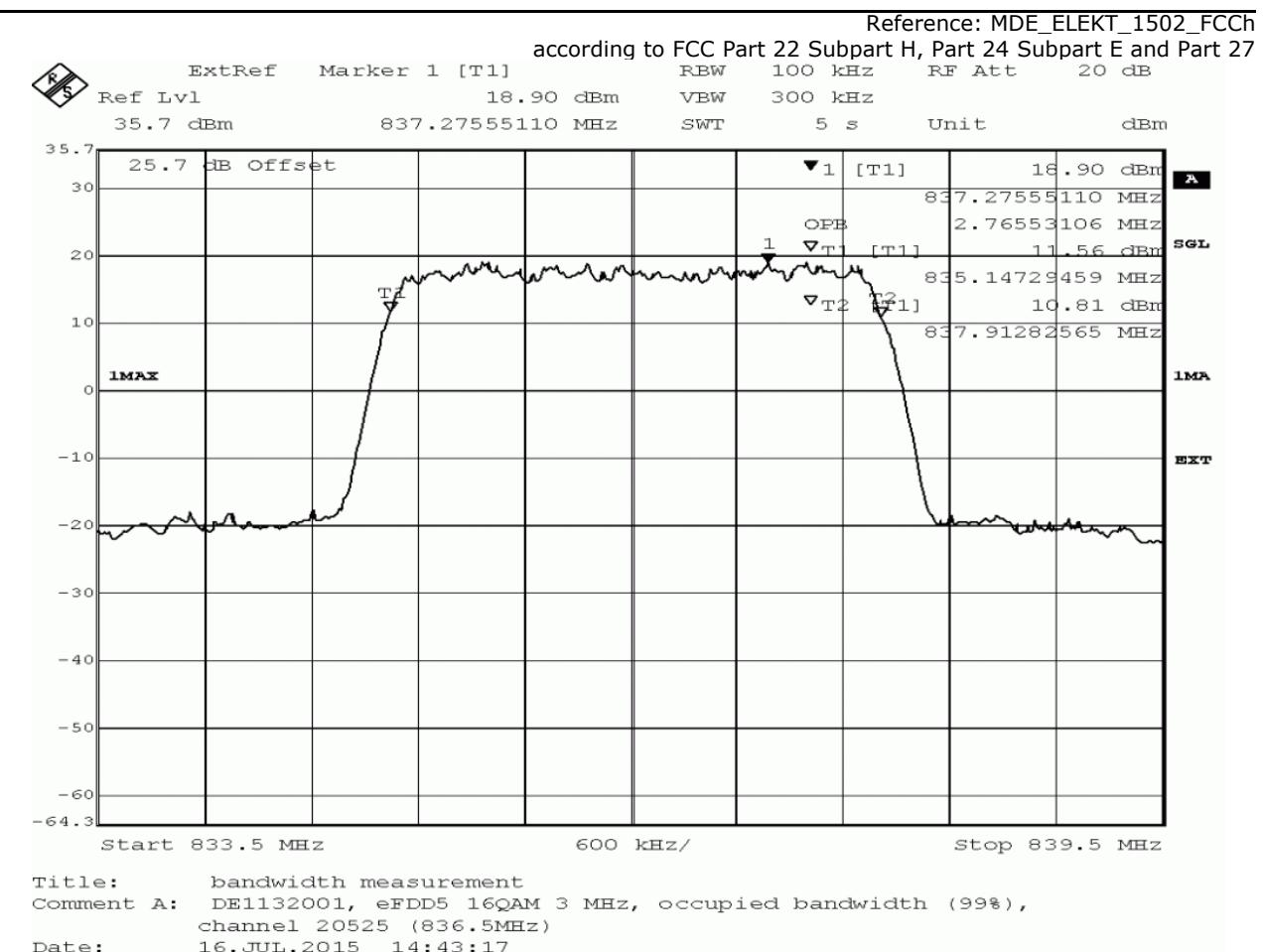
**Detailed Results:**

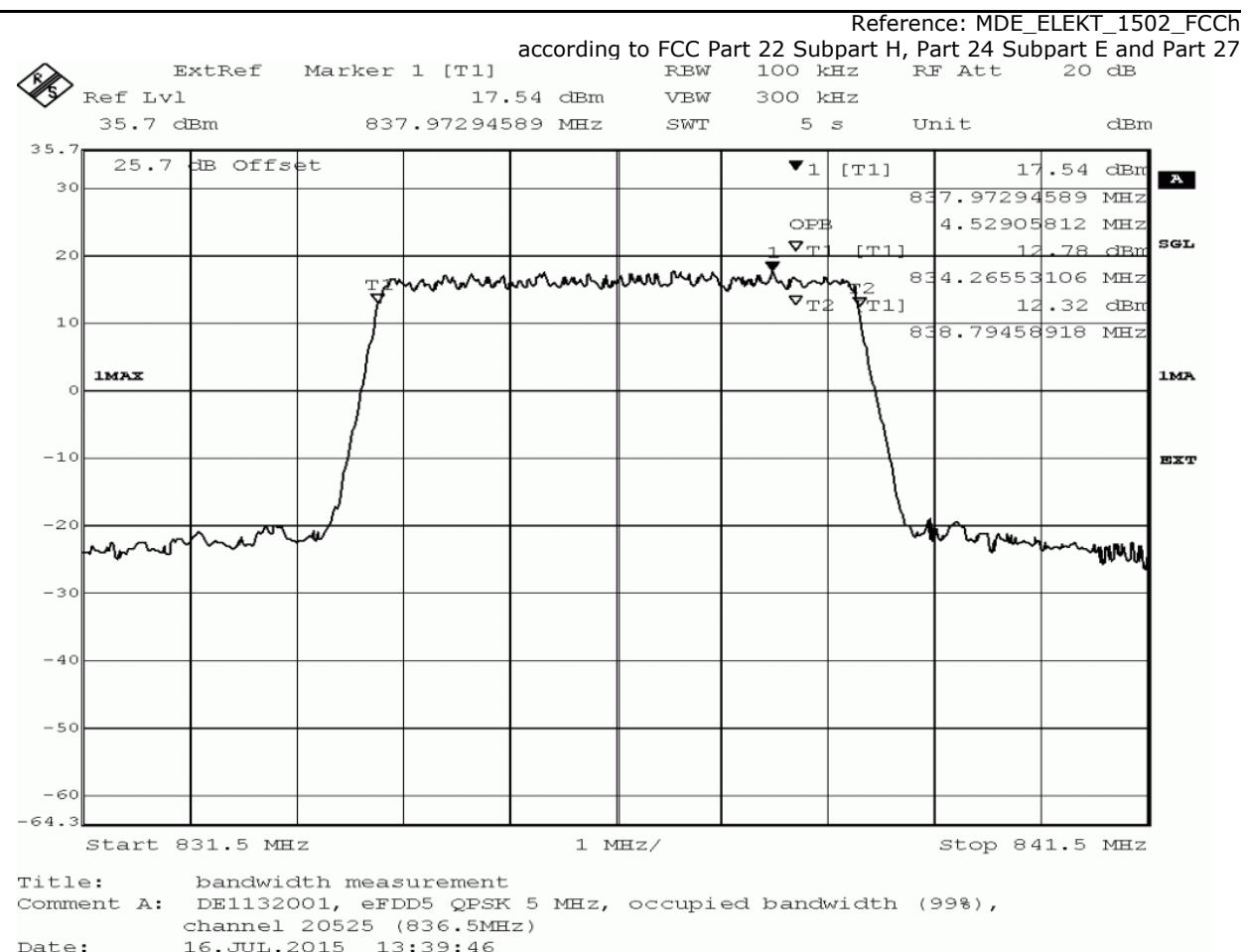
LTE Band 5							
Channel BW: 1.4 MHz				Channel BW: 3 MHz			
Channel	ncy (MHz)	99% BW (MHz)	QPSK 16QAM	Channel	ncy (MHz)	99% BW (MHz)	QPSK 16QAM
20407	824.7	1.106	1.106	20415	825.5	2.766	2.754
20525	836.5	1.106	1.106	20525	836.5	2.754	2.766
20643	848.3	1.106	1.094	20635	847.5	2.754	2.766

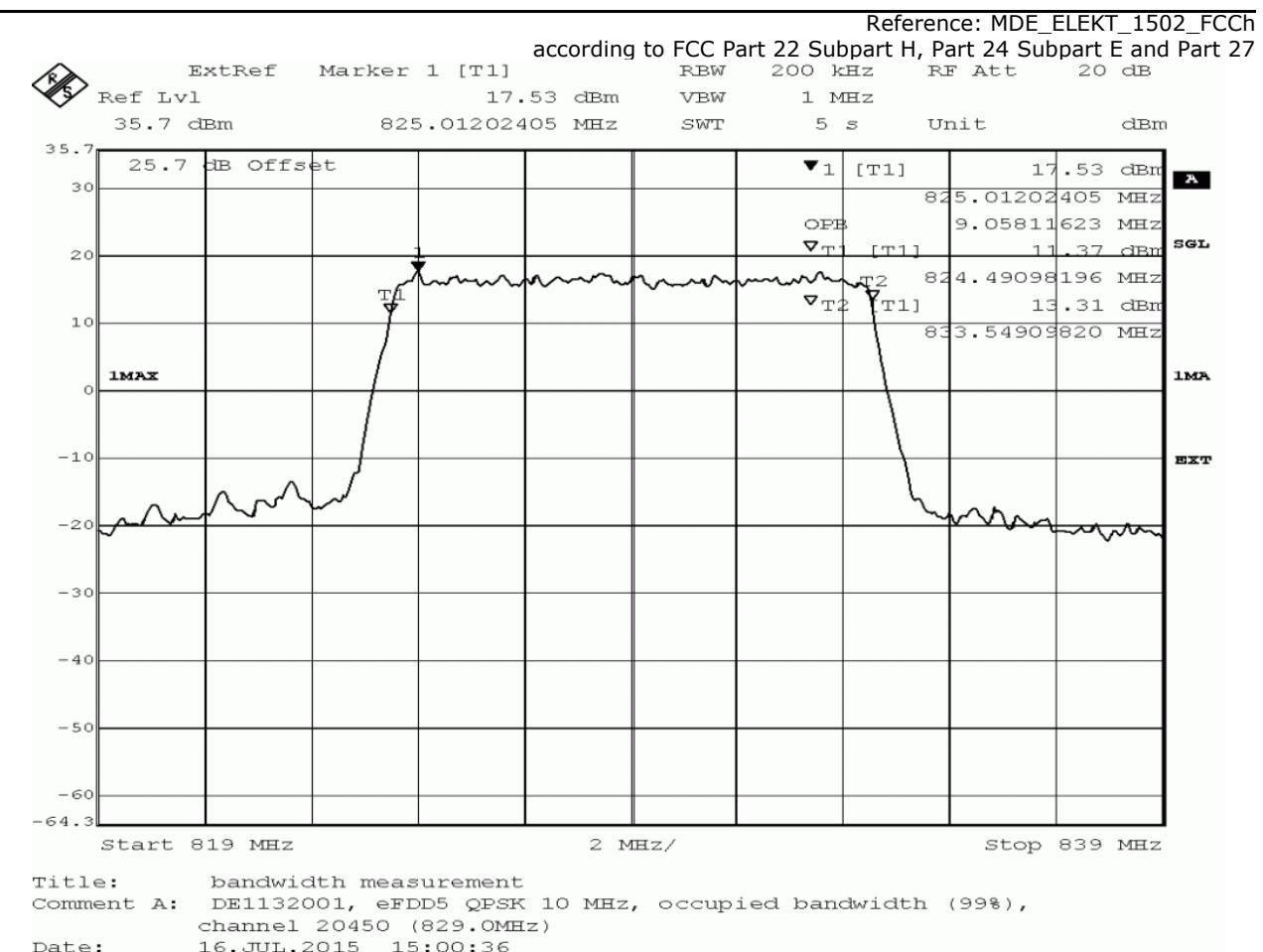
LTE Band 5							
Channel BW: 5MHz				Channel BW: 10 MHz			
Channel	ncy (MHz)	99% BW (MHz)	QPSK 16QAM	Channel	ncy (MHz)	99% BW (MHz)	QPSK 16QAM
20425	826.5	4.529	4.529	20450	829	9.058	9.018
20525	836.5	4.529	4.529	20525	836.5	9.018	9.018
20625	846.5	4.529	4.529	20600	844	9.058	9.018



Title: bandwidth measurement  
 Comment A: DE1132001, eFDD5 QPSK 1.4 MHz, occupied bandwidth (99%),  
 channel 20525 (836.5MHz)  
 Date: 16.JUL.2015 13:50:27







**3.5.6 22.6 Band edge compliance §2.1053, §22.917****Test: 22.6; Band edge compliance Summary §2.1053, §22.917***Result:*

Passed

*Setup No.:*

S01\_AE01

*Date of Test:*

2015/10/27 20:37

*Body:*

FCC47CFRChIPART22PUBLIC MOBILE SERVICES

*Test Specification:*

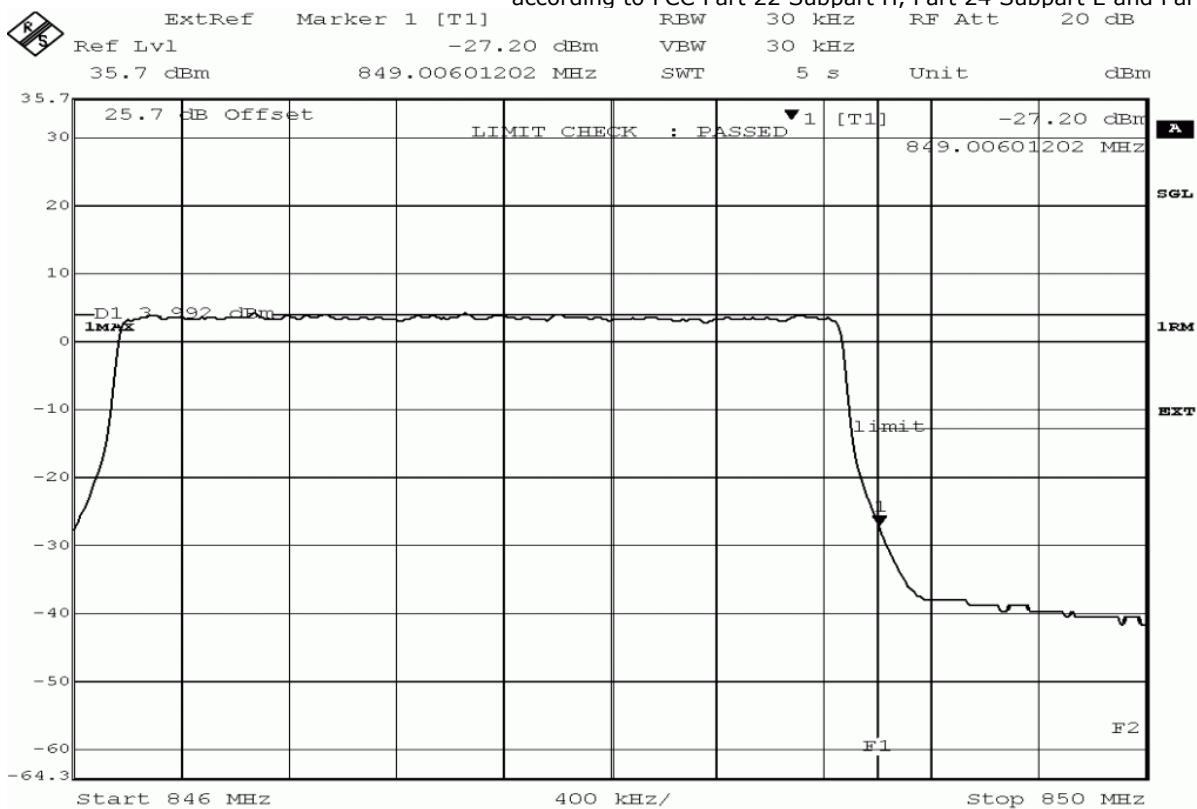
FCC part 2 and 22

**Detailed Results:**

<b>Band</b>	<b>Bandwidth (MHz)</b>	<b>Modulation</b>	<b>Resource Blocks / Offset</b>	<b>Channel</b>	<b>Detector</b>	<b>Peak Value (dBm)</b>	<b>Limit (dBm)</b>	<b>Verdict</b>
eFDD5	1.4	QPSK	6 / 0	20407	Average	-32.63	-13	Passed
					RMS	-30.92	-13	Passed
			6 / Max	20643	Average	-30.92	-13	Passed
		16QAM	6 / 0	20407	Average	-32.26	-13	Passed
					RMS	-30.62	-13	Passed
			6 / Max	20643	Average	-29.76	-13	Passed
					RMS	-28.27	-13	Passed
	3	QPSK	15 / 0	20415	Average	-30.92	-13	Passed
					RMS	-29.24	-13	Passed
		16QAM	15 / Max	20635	Average	-29.76	-13	Passed
					RMS	-27.2	-13	Passed
			15 / 0	20415	Average	-32.63	-13	Passed
					RMS	-30.62	-13	Passed
	5	QPSK	15 / Max	20635	Average	-30.92	-13	Passed
					RMS	-28.27	-13	Passed
		16QAM	25 / 0	20425	Average	-30.92	-13	Passed
					RMS	-28.98	-13	Passed
			25 / Max	20625	Average	-30.92	-13	Passed
					RMS	-28.27	-13	Passed
	10	QPSK	25 / 0	20425	Average	-33.42	-13	Passed
					RMS	-30.92	-13	Passed
		16QAM	25 / Max	20625	Average	-32.63	-13	Passed
					RMS	-29.5	-13	Passed
			50 / 0	20450	Average	-29.76	-13	Passed
					RMS	-28.27	-13	Passed
		16QAM	50 / Max	20600	Average	-34.29	-13	Passed
					RMS	-31.57	-13	Passed
			50 / 0	20450	Average	-32.26	-13	Passed
					RMS	-30.62	-13	Passed
			50 / Max	20600	Average	-35.78	-13	Passed
					RMS	-33.02	-13	Passed

Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



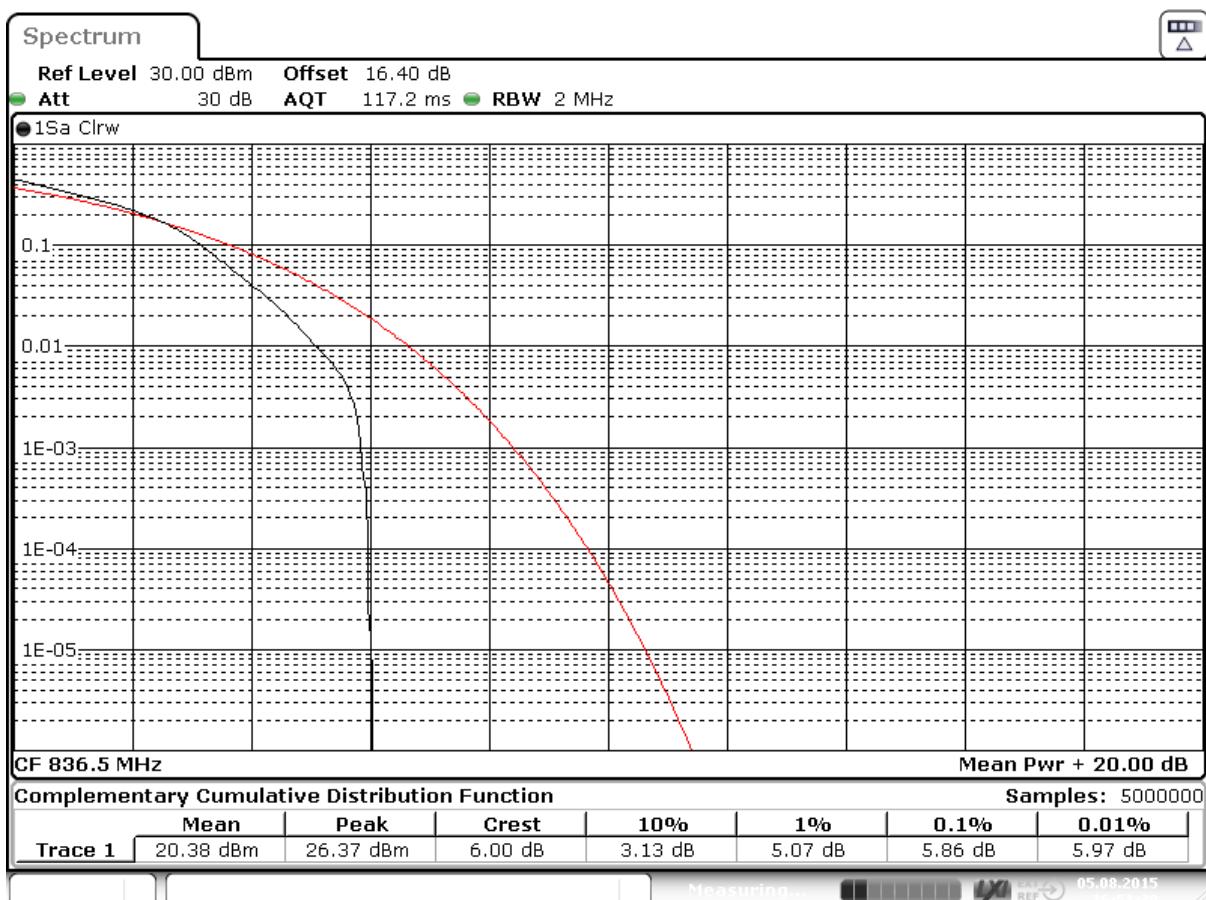
Title: band edge compliance measurement  
 Comment A: DE1132001, eFDD5 QPSK 3 MHz, band edge compliance,  
 channel 20635 (847.5MHz)  
 Date: 16.JUL.2015 14:10:04

**3.5.7 22.7 Peak-to-Average Ratio Summary §2.1046****Test: 22.7: Peak-to-Average Ratio Summary §2.1046**

*Result:* Passed  
*Setup No.:* S01\_AE01  
*Date of Test:* 2015/08/05 20:40  
*Body:* FCC47CFRChIPART22PUBLIC MOBILE SERVICES  
*Test Specification:* FCC part 2 and 22

**Detailed Results:**

Band	Bandwidth / Resource Blocks	Channel	Modulation	Measured Value (dB)	Limit (IC) (dB)	Verdict
eFDD5	1.4 MHz / 6 RB	20407	QPSK	4.46	13	Passed
		20525		4.81	13	Passed
		20643		4.58	13	Passed
		20407	16-QAM	5.42	13	Passed
		20525		5.86	13	Passed
		20643		5.54	13	Passed



Date: 5 AUG 2015 16:51:31

**3.5.8 24.1 RF Power Output §2.1046, §24.232****Test: 24.1; RF Power Output Summary §2.1046, §24.232**

*Result:* Passed  
*Setup No.:* S01\_AF01  
*Date of Test:* 2015/08/29 20:17  
*Body:* FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES  
*Test Specification:* FCC part 2 and 24

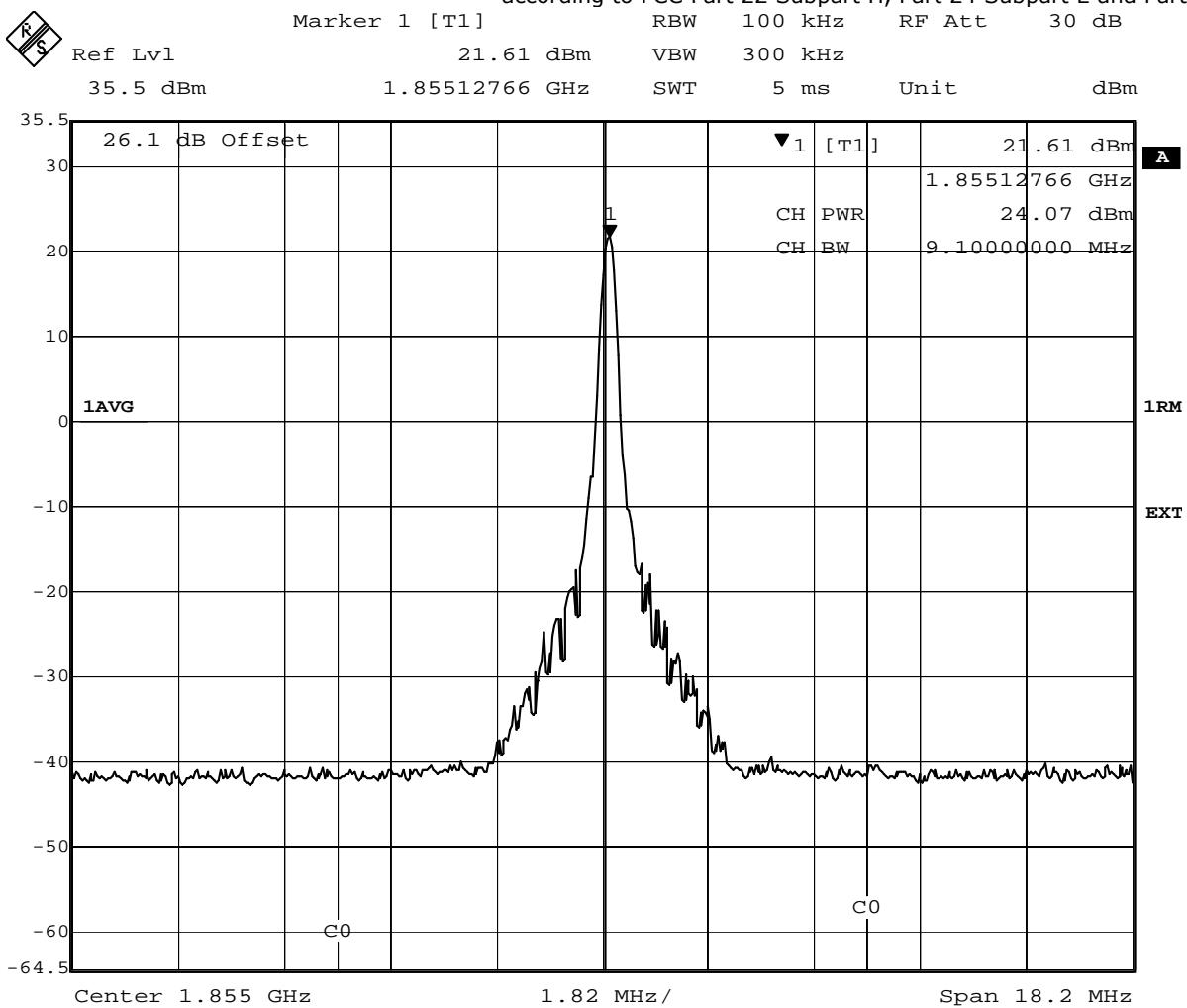
**Detailed Results:**

Test Band	Bandwidth (MHz)	Channel	Modulation	RB	RMS Conducted Power (dBm)	FCC EIRP Limit (W)	IC EIRP Limit (W)	Maximum Antenna Gain (dBi)	Verdict
eFDD2	1.4	18607	QPSK	RB 1	23.2	2	2	10	Passed
				RB 3	23	2	2	10	Passed
				RB 6	21.9	2	2	11.1	Passed
			16QAM	RB 1	22.4	2	2	10.6	Passed
				RB 6	21	2	2	12	Passed
	18900	QPSK	RB 1	23	2	2	2	10	Passed
			RB 3	22.9	2	2	2	10.1	Passed
			RB 6	21.8	2	2	2	11.2	Passed
		16QAM	RB 1	22.2	2	2	2	10.8	Passed
			RB 6	20.9	2	2	2	12.1	Passed
	19193	QPSK	RB 1	23.5	2	2	2	9.5	Passed
			RB 3	23.3	2	2	2	9.7	Passed
			RB 6	22.3	2	2	2	10.7	Passed
		16QAM	RB 1	22.6	2	2	2	10.4	Passed
			RB 6	21.3	2	2	2	11.7	Passed
	3	18615	QPSK	RB 1	23.7	2	2	9.3	Passed
				RB 15	22.4	2	2	10.6	Passed
			16QAM	RB 1	22.7	2	2	10.3	Passed
				RB 15	21.5	2	2	11.5	Passed
		18900	QPSK	RB 1	23.8	2	2	9.2	Passed
				RB 15	22.4	2	2	10.6	Passed
			16QAM	RB 1	22.8	2	2	10.2	Passed
				RB 15	21.4	2	2	11.6	Passed
		19185	QPSK	RB 1	24	2	2	9	Passed
				RB 15	22.7	2	2	10.3	Passed
			16QAM	RB 1	22.9	2	2	10.1	Passed
				RB 15	21.7	2	2	11.3	Passed
	5	18625	QPSK	RB 1	23.8	2	2	9.2	Passed
				RB 12	22.3	2	2	10.7	Passed
			16QAM	RB 25	22.4	2	2	10.6	Passed
				RB 1	22.6	2	2	10.4	Passed
				RB 25	21.5	2	2	11.5	Passed
		18900	QPSK	RB 1	23.7	2	2	9.3	Passed
				RB 12	22.4	2	2	10.6	Passed
			16QAM	RB 25	22.4	2	2	10.6	Passed
				RB 1	22.8	2	2	10.2	Passed
				RB 25	21.4	2	2	11.6	Passed
		19175	QPSK	RB 1	23.6	2	2	9.4	Passed
				RB 12	22.6	2	2	10.4	Passed
			16QAM	RB 25	22.6	2	2	10.4	Passed
				RB 1	22.9	2	2	10.1	Passed
				RB 25	21.7	2	2	11.3	Passed
	10	18650	QPSK	RB 1	24.1	2	2	8.9	Passed
				RB 50	22.5	2	2	10.5	Passed
			16QAM	RB 1	22.7	2	2	10.3	Passed
				RB 50	21.7	2	2	11.3	Passed
				RB 1	23.8	2	2	9.2	Passed
		18900	QPSK	RB 1	22.4	2	2	10.6	Passed
				RB 50	22.9	2	2	10.1	Passed
			16QAM	RB 1	21.4	2	2	11.6	Passed
				RB 50	22.7	2	2	10.3	Passed
				RB 1	22.8	2	2	10.2	Passed
		19150	QPSK	RB 1	24	2	2	9	Passed
				RB 50	22.7	2	2	10.3	Passed
			16QAM	RB 1	21.7	2	2	11.3	Passed
				RB 50	22.8	2	2	10.2	Passed
				RB 1	21.7	2	2	11.3	Passed

Test Band	Bandwidth (MHz)	Channel	Modulation	RB	RMS Conducted Power (dBm)	FCC EIRP Limit (W)	IC EIRP Limit (W)	Maximum Antenna Gain (dBi)	Verdict
eFDD2	15	18675	QPSK	RB 1	24	2	2	9	Passed
				RB 36	22.7	2	2	10.3	Passed
				RB 75	22.5	2	2	10.5	Passed
			16QAM	RB 1	23.3	2	2	9.7	Passed
				RB 75	21.8	2	2	11.2	Passed
	18900	QPSK	RB 1	24	2	2	2	9	Passed
			RB 36	22.5	2	2	10.5	Passed	
			RB 75	22.5	2	2	10.5	Passed	
		16QAM	RB 1	22.6	2	2	2	10.4	Passed
			RB 75	21.5	2	2	11.5	Passed	
	20	19125	QPSK	RB 1	24.1	2	2	8.9	Passed
				RB 36	22.7	2	2	10.3	Passed
				RB 75	22.6	2	2	10.4	Passed
			16QAM	RB 1	22.9	2	2	10.1	Passed
				RB 75	21.6	2	2	11.4	Passed
		18700	QPSK	RB 1	23.2	2	2	9.8	Passed
				RB 100	22	2	2	11	Passed
			16QAM	RB 1	22	2	2	11	Passed
				RB 100	21.1	2	2	11.9	Passed
		18900	QPSK	RB 1	22.9	2	2	10.1	Passed
				RB 100	21.9	2	2	11.1	Passed
			16QAM	RB 1	21.8	2	2	11.2	Passed
				RB 100	20.9	2	2	12.1	Passed
		19100	QPSK	RB 1	23.3	2	2	9.7	Passed
				RB 100	22	2	2	11	Passed
			16QAM	RB 1	22.2	2	2	10.8	Passed
				RB 100	21.2	2	2	11.8	Passed

Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



Date: 29.AUG.2015 15:32:29

### 3.5.9 24.2 Frequency stability §2.1055, §24.235

**Test: 24.2; Frequency Band = eFDD2, Mode = QPSK, Channel = 18900, Frequency = 1880MHz**

*Result:* Passed

*Setup No.:* S01\_AE01

*Date of Test:* 2015/08/03 15:57

*Body:* FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

*Test Specification:* FCC part 2 and 24

**Detailed Results:**

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	4700	-1	15	passed
-30	5			0	8	passed
-30	10			-1	-7	passed
-20	0	normal	4700	-1	7	passed
-20	5			1	-5	passed
-20	10			1	-7	passed
-10	0	normal	4700	-1	-7	passed
-10	5			-2	11	passed
-10	10			-2	8	passed
0	0	normal	4700	-1	-7	passed
0	5			-2	-9	passed
0	10			0	7	passed
10	0	normal	4700	-1	-10	passed
10	5			-2	-10	passed
10	10			-1	-7	passed
20	0	low	4700	-2	-9	passed
20	5			1	-8	passed
20	10			-1	-9	passed
20	0	normal = high <sup>1)</sup>	4700	0	-11	passed
20	5			-2	-9	passed
20	10			0	-12	passed
20	0	high	4700	-4	-13	passed
20	5			1	21	passed
20	10			-2	-12	passed
30	0	normal	4700	-2	-11	passed
30	5			-1	-27	passed
30	10			-4	-9	passed
40	0	normal	4700	-3	-9	passed
40	5			-2	-7	passed
40	10			-4	-10	passed
50	0	normal	4700	-3	-12	passed
50	5			-1	9	passed
50	10			-2	10	passed

LTE eFDD 2  
TCH: 18900  
1 RB, QPSK  
1,4 MHz BW

Battery operating end point voltage <sup>2)</sup>						
Temp. °C	Duration min	Voltage V	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
20	0	3.25	4700	-2	-7	passed
20	5			-2	10	passed
20	10			-4	-9	passed

1) The manufacturer declared that normal voltage is equivalent with high voltage.

2) The call is established at high voltage and the voltage is then reduced to the battery operating end.

**3.5.10 24.3 Spurious emissions at antenna terminals §2.1051, §24.238**
**Test: 24.3; Spurious emissions at antenna terminals Summary §2.1051, §24.238**

Result: Passed

Setup No.: S01\_AE01

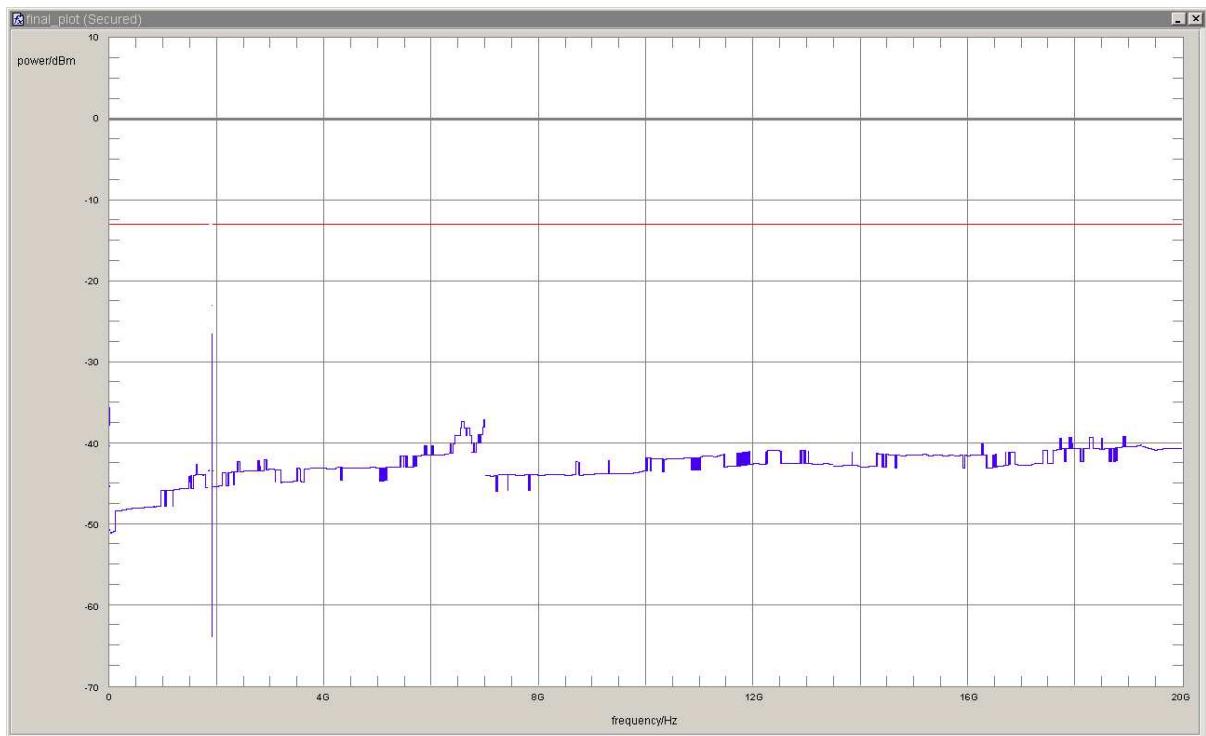
Date of Test: 2015/07/16 20:23

Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

Test Specification: FCC part 2 and 24

**Detailed Results:**

Band / Bandwidth , Resource Blocks	Modulation (MHz)	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Margin to Limit /dB	Limit /dBm	Verdict
eFDD2 / 5MHz, 1RB	QPSK	18625	rms	maxhold	100	1845.970	-24.4	11.4	-13	Passed
		18625	rms	maxhold	100	1848.240	-30.3	17.3	-13	Passed
		18625	rms	maxhold	5	1850.000	-30.4	17.4	-13	Passed
		18900	rms	maxhold	-	-	-	-	-13	Passed
		19175	rms	maxhold	5	1910.000	-30.8	17.8	-13	Passed
		19175	rms	maxhold	100	1911.820	-32.6	9.6	-23	Passed
		19175	rms	maxhold	100	1913.910	-26.5	3.5	-23	Passed
no further values have been found with a margin of less than 20 dB										



### 3.5.11 24.4 Field strength of spurious radiation §2.1053, §24.238

**Test: 24.4; Frequency Band = eFDD2, Mode = QPSK 5MHz, Channel = 18625, Frequency = 1852.5MHz, Method = radiated**

*Result:* Passed

*Setup No.:* S01\_AA01

*Date of Test:* 2015/06/22 3:49

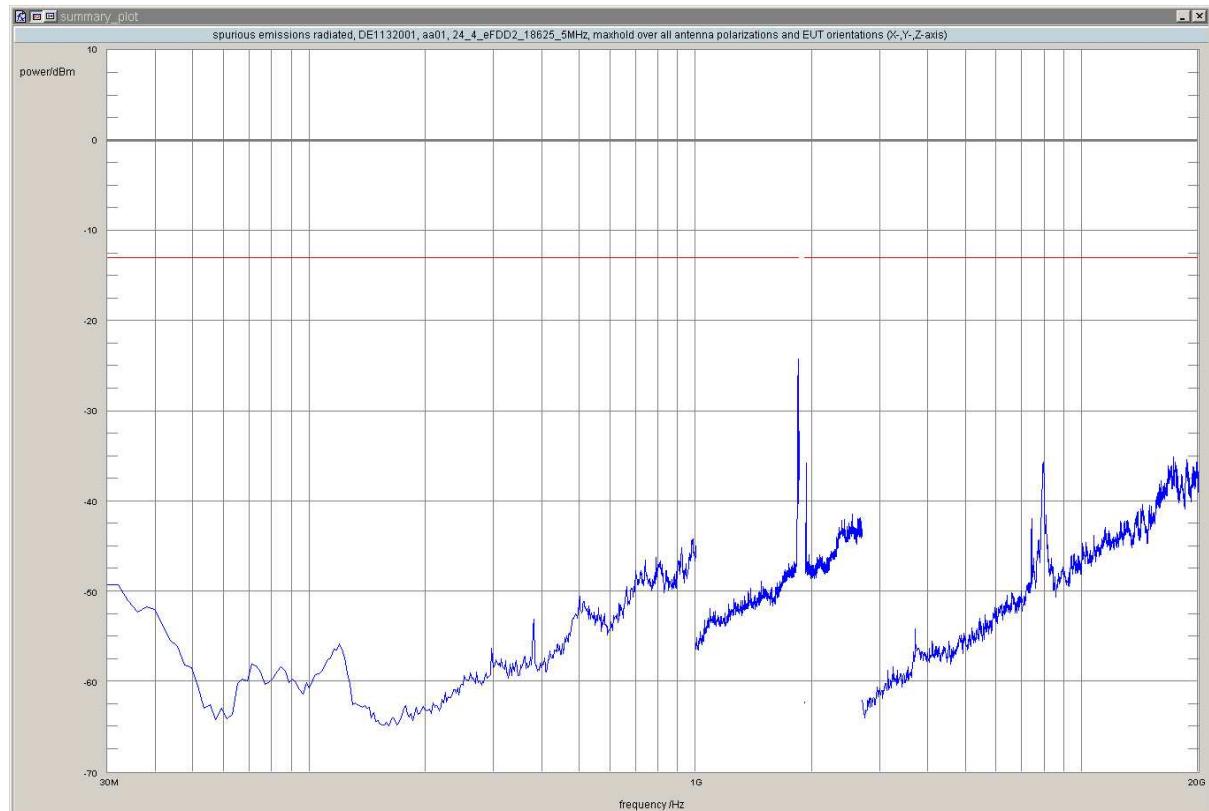
*Body:* FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

*Test Specification:* FCC part 2 and 24

#### Detailed Results:

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	1000	1838.3	-26.48	-13.00	13.48	45.0	vertical	vertical	passed
peak	maxhold	1000	1840.0	-25.74	-13.00	12.74	60.0	vertical	horizontal	passed
rms	maxhold	100	1848.53	-28.63	-13.00	15.63	-135.0	vertical	vertical	passed
rms	maxhold	100	1848.96	-24.25	-13.00	11.25	45.0	vertical	vertical	passed
rms	maxhold	50	1850.00	-32.15	-13.00	19.15	45.0	vertical	vertical	passed

no further values have been found with a margin of less than 20 dB



**Test: 24.4; Frequency Band = eFDD2, Mode = QPSK 5MHz, Channel = 18900, Frequency = 1880MHz, Method = radiated**

*Result:* Passed

*Setup No.:* S01\_AA01

*Date of Test:* 2015/06/22 3:49

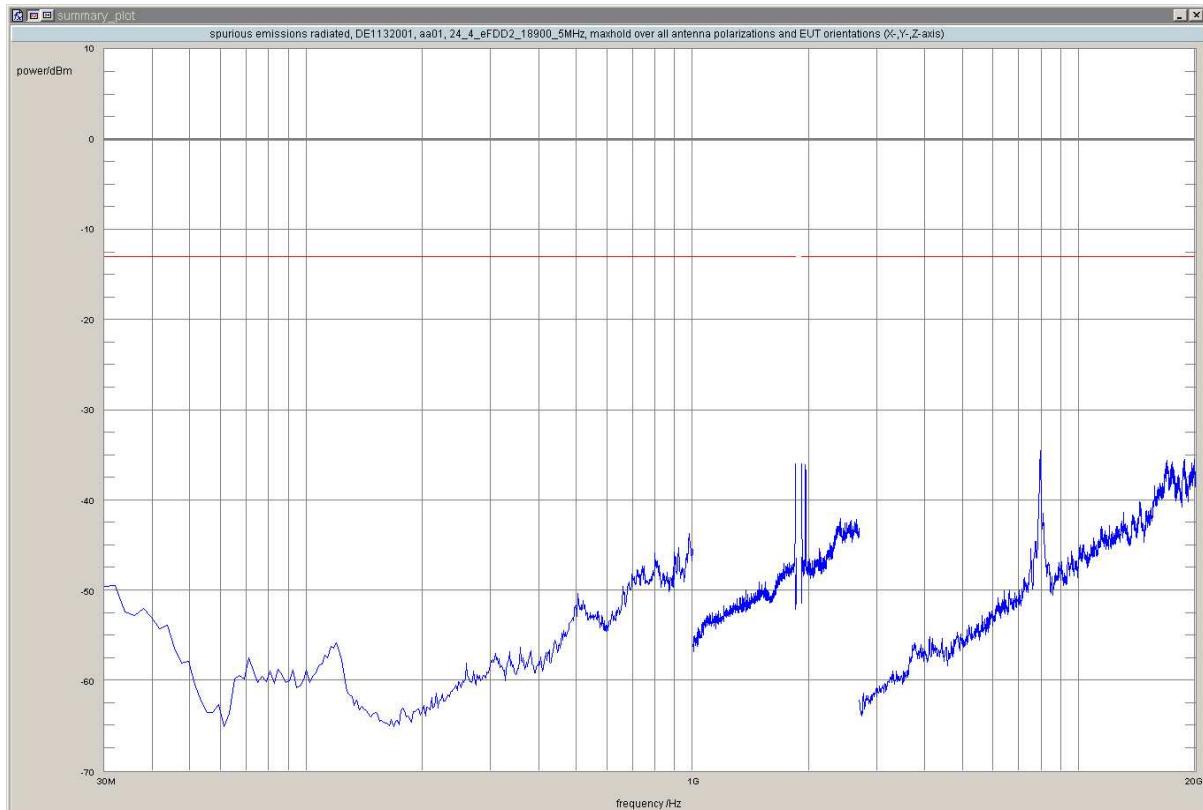
*Body:* FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

*Test Specification:* FCC part 2 and 24

**Detailed Results:**

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	1000	7937.9	-34.55	-13.00	21.55	0.0	vertical	horizontal	passed

no further values have been found with a margin of less than 20 dB



**Test: 24.4; Frequency Band = eFDD2, Mode = QPSK 5MHz, Channel = 19175, Frequency = 1907.5MHz, Method = radiated**

*Result:* Passed

*Setup No.:* S01\_AA01

*Date of Test:* 2015/06/22 3:49

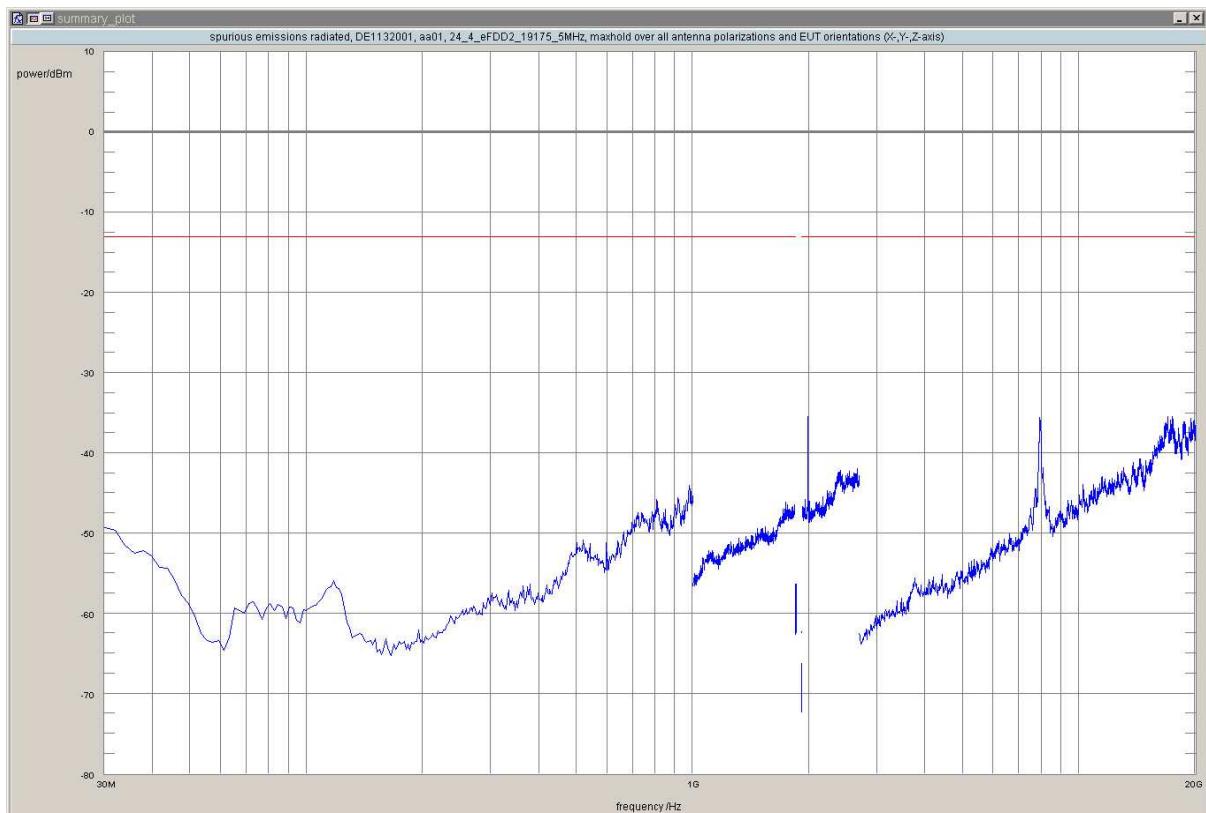
*Body:* FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

*Test Specification:* FCC part 2 and 24

**Detailed Results:**

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	1000	1987.2	-35.40	-13.00	22.40	-45.0	horizontal	vertical	passed

no further values have been found with a margin of less than 20 dB



**3.5.12 24.5 Emission and Occupied Bandwidth §2.1049, §24.238****Test: 24.5; Emission and Occupied Bandwidth Summary §2.1049, §24.238**

*Result:* Passed  
*Setup No.:* S01\_AE01  
*Date of Test:* 2015/07/17 20:54  
*Body:* FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES  
*Test Specification:* FCC part 2 and 24

**Detailed Results:**

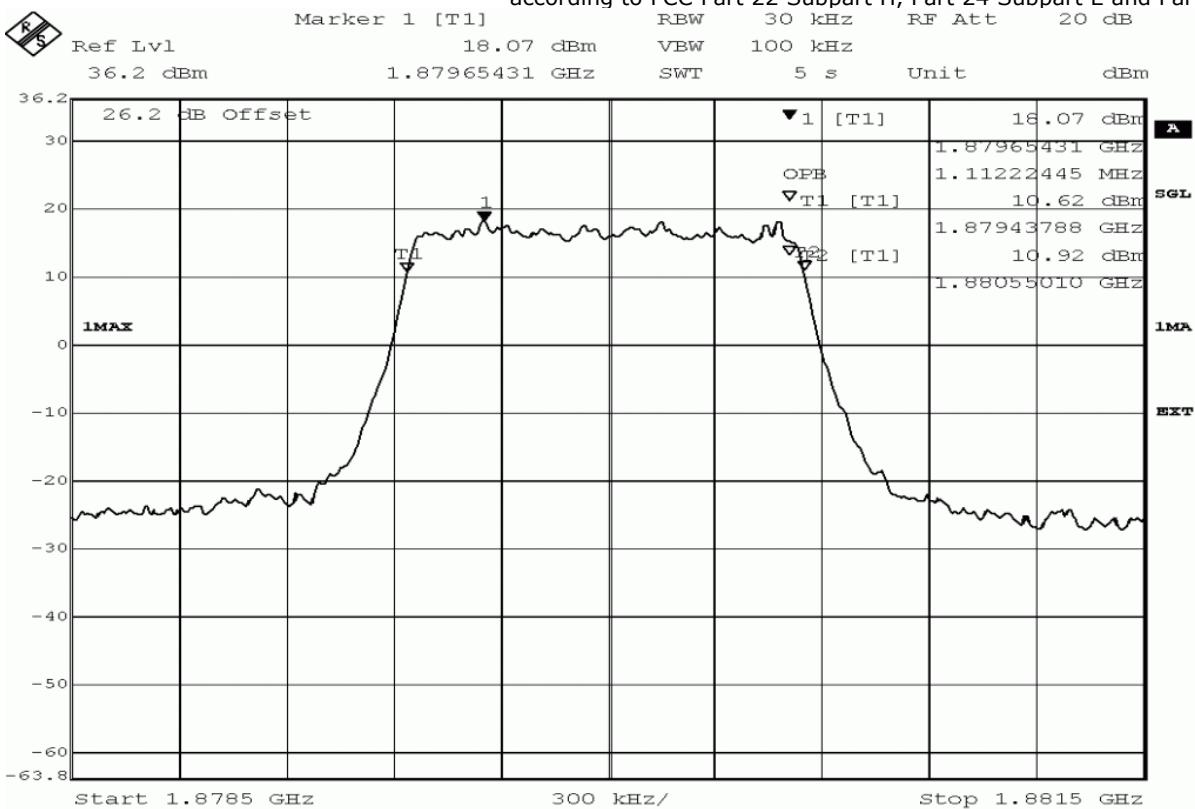
LTE Band 2							
Channel BW: 1.4 MHz				Channel BW: 3 MHz			
Channel	Frequency (MHz)	99% BW (MHz)		Channel	Frequency (MHz)	99% BW (MHz)	
		QPSK	16QAM			QPSK	16QAM
18607	1850.7	1.11	1.10	18615	1851.5	2.77	2.74
18900	1880.0	1.11	1.11	18900	1880.0	2.77	2.78
19193	1909.3	1.11	1.11	19185	1908.5	2.77	2.75

LTE Band 2							
Channel BW: 5MHz				Channel BW: 10 MHz			
Channel	Frequency (MHz)	99% BW (MHz)		Channel	Frequency (MHz)	99% BW (MHz)	
		QPSK	16QAM			QPSK	16QAM
18625	1852.5	4.53	4.55	18650	1855.0	8.98	9.06
18900	1880.0	4.53	4.53	18900	1880.0	9.02	9.02
19175	1907.5	4.53	4.55	19150	1905.0	9.06	9.02

LTE Band 2							
Channel BW: 15MHz				Channel BW: 20 MHz			
Channel	Frequency (MHz)	99% BW (MHz)		Channel	Frequency (MHz)	99% BW (MHz)	
		QPSK	16QAM			QPSK	16QAM
18675	1857.5	13.47	13.47	18700	1860.0	18.20	18.12
18900	1880.0	13.47	13.53	18900	1880.0	18.12	18.12
19125	1902.5	13.53	13.59	19100	1900.0	18.12	18.12

Reference: MDE\_ELEKT\_1502\_FCCh

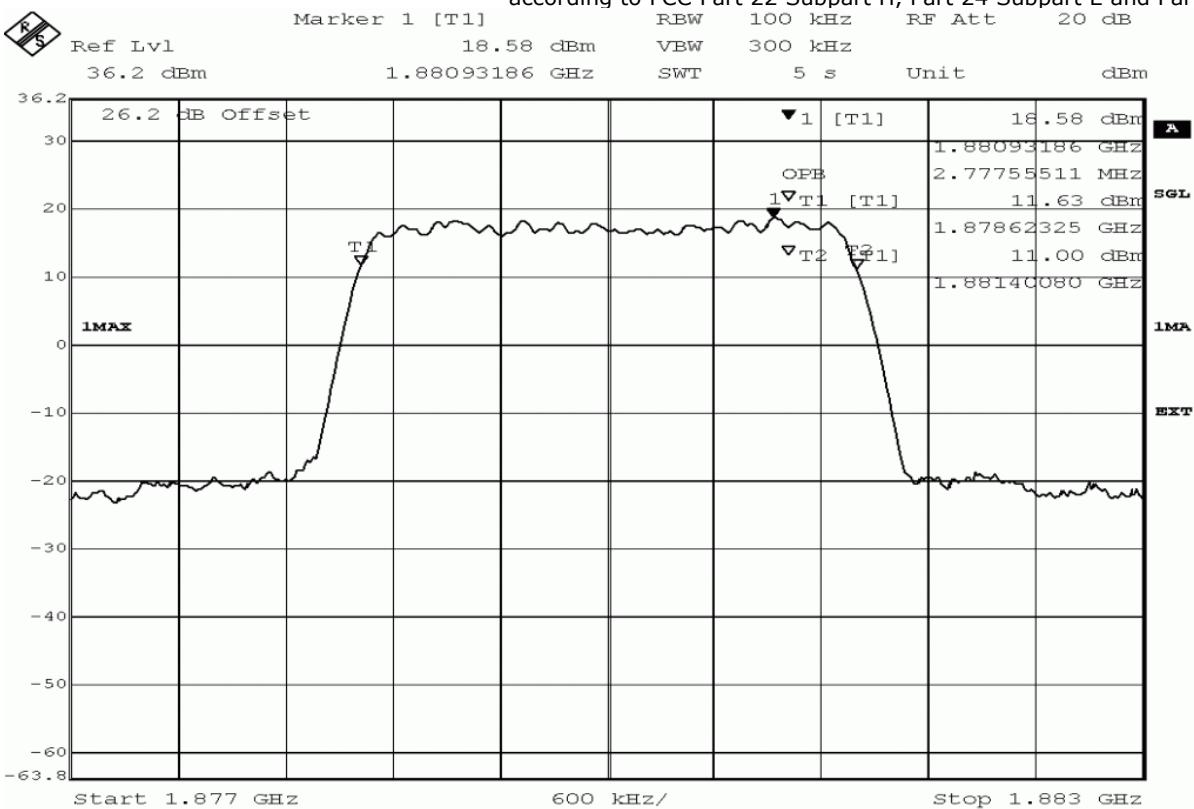
according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



Title: bandwidth measurement  
 Comment A: DE1132001, eFDD2 QPSK 1.4 MHz, occupied bandwidth (99%),  
 channel 18900 (1880.0MHz)  
 Date: 17.JUL.2015 10:45:53

Reference: MDE\_ELEKT\_1502\_FCCh

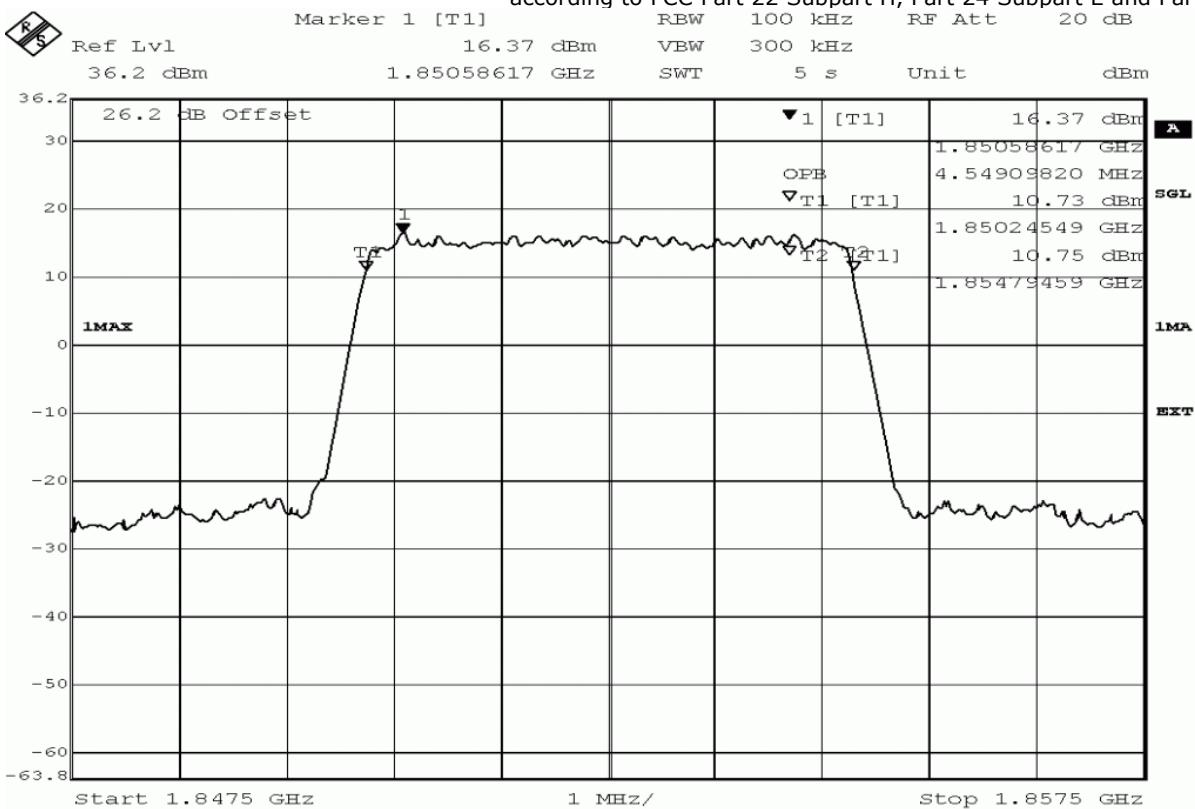
according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



Title: bandwidth measurement  
 Comment A: DE1132001, eFDD2 16QAM 3 MHz, occupied bandwidth (99%),  
 channel 18900 (1880.0MHz)  
 Date: 17.JUL.2015 12:14:43

Reference: MDE\_ELEKT\_1502\_FCCh

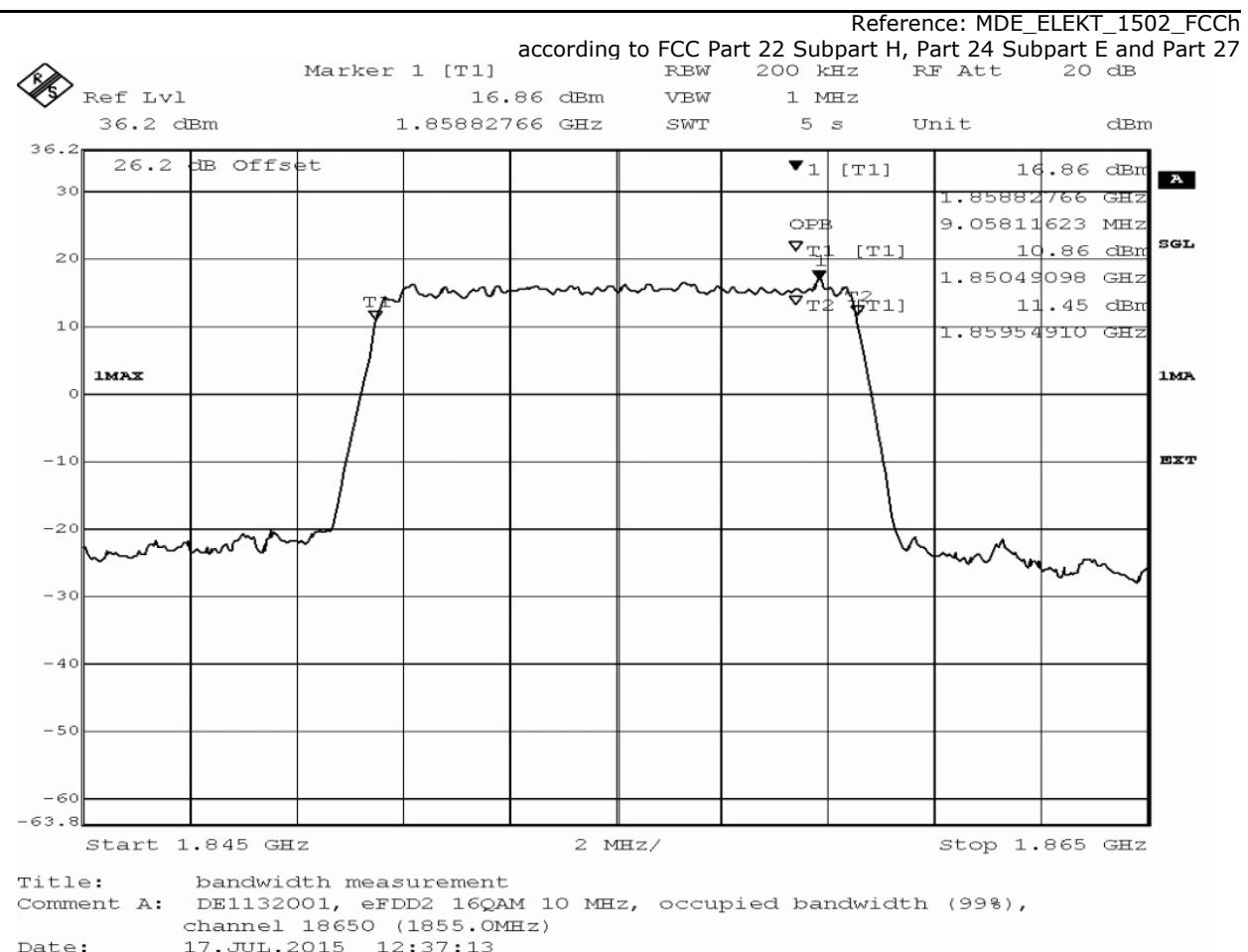
according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27

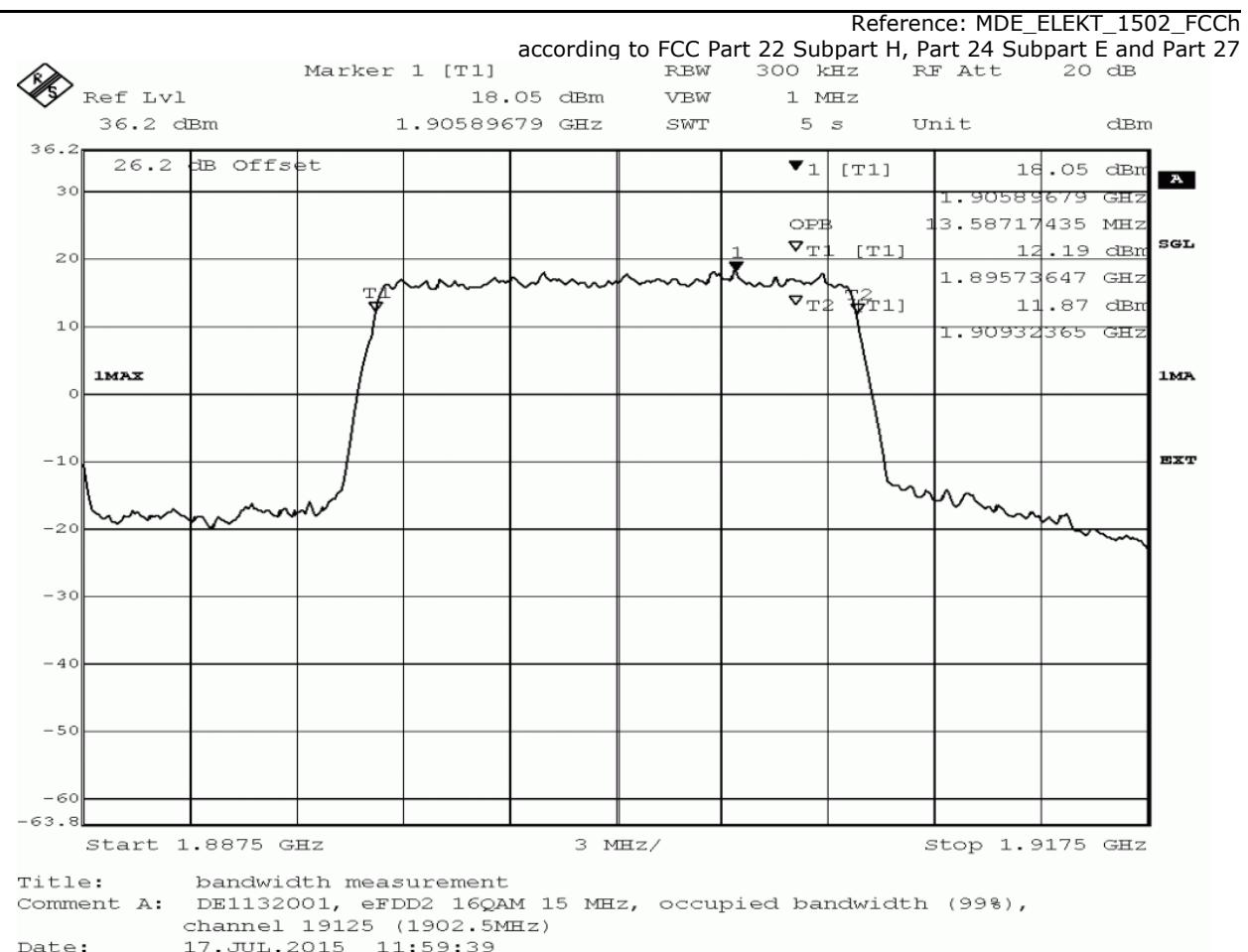


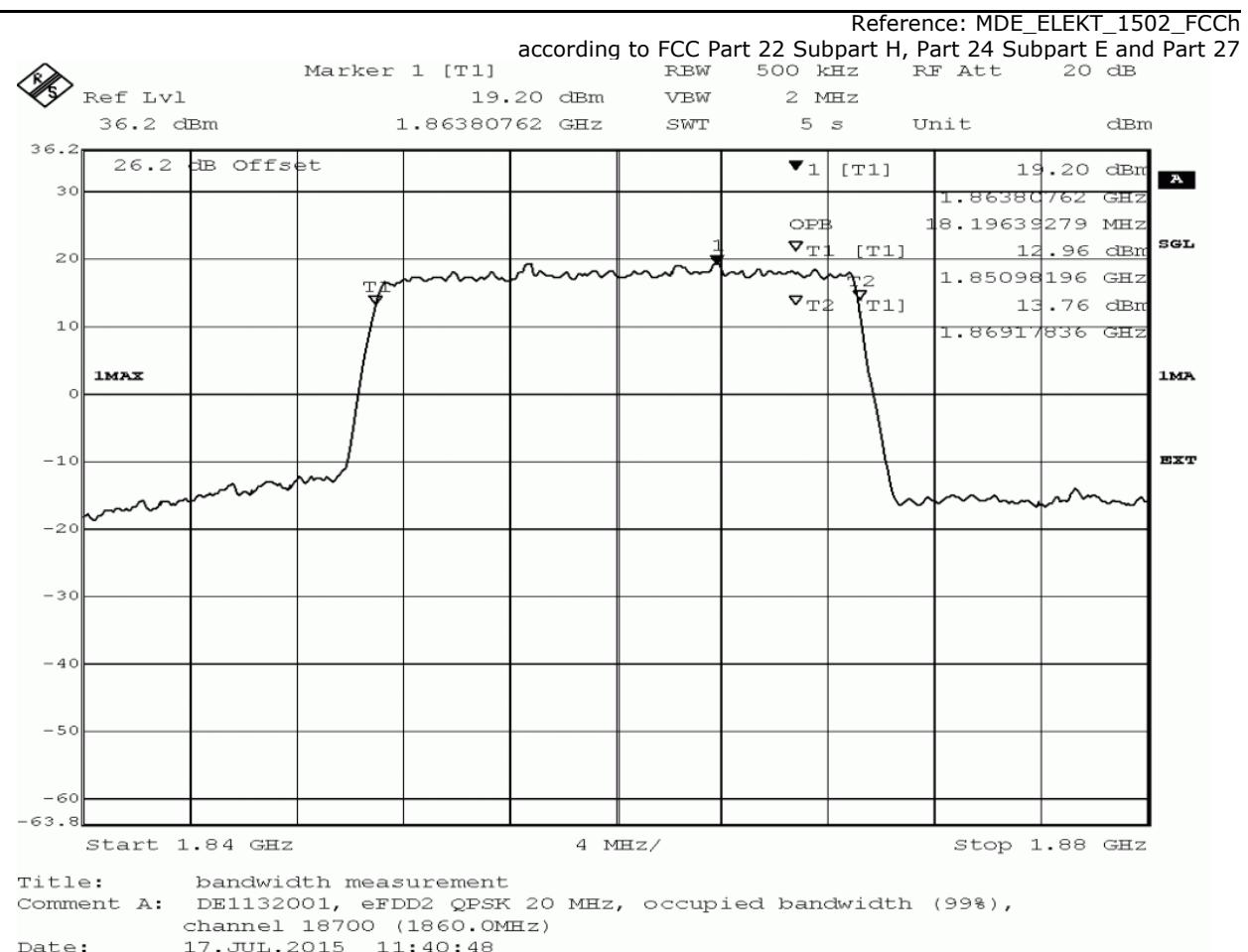
Title: bandwidth measurement

Comment A: DE1132001, eFDD2 16QAM 5 MHz, occupied bandwidth (99%), channel 18607 (1850.7MHz)

Date: 17.JUL.2015 12:30:57







**3.5.13 24.6 Band edge compliance §2.1053, §24.238****Test: 24.6: Band edge compliance summary §2.1053, §24.238**

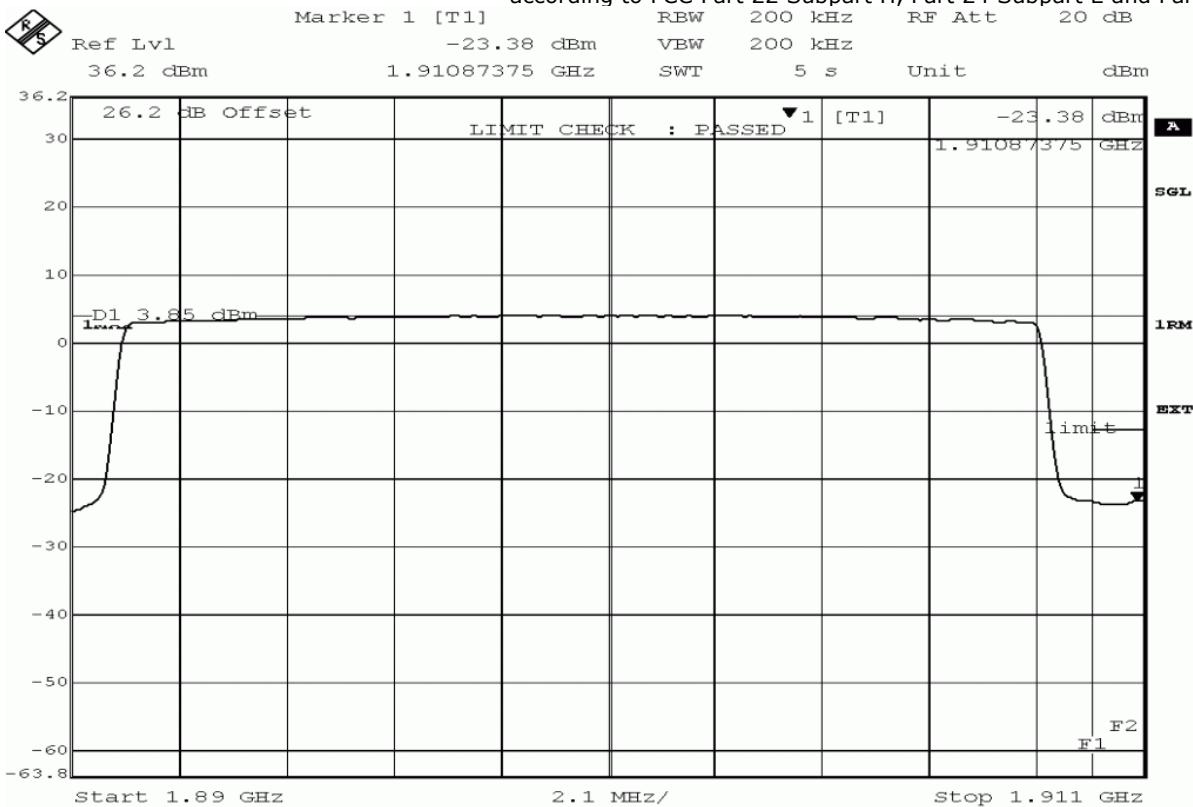
*Result:* Passed  
*Setup No.:* S01\_AE01  
*Date of Test:* 2015/07/17 20:58  
*Body:* FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES  
*Test Specification:* FCC part 2 and 24

**Detailed Results:**

<b>Band</b>	<b>Bandwidth (MHz)</b>	<b>Modulation</b>	<b>Resource Blocks / Offset</b>	<b>Channel</b>	<b>Detector</b>	<b>Frequency (MHz)</b>	<b>Peak Value (dBm)</b>	<b>Limit (dBm)</b>	<b>Verdict</b>
eFDD2	1.4	QPSK	6 / 0	18607	Average	1850	-30.74	-13	Passed
					RMS	1850	-29.26	-13	Passed
		16QAM	6 / Max	19193	Average	1910	-29.82	-13	Passed
					RMS	1910	-27.77	-13	Passed
		QPSK	6 / 0	18607	Average	1850	-32.52	-13	Passed
					RMS	1850	-30.42	-13	Passed
		16QAM	6 / Max	19193	Average	1910	-32.52	-13	Passed
					RMS	1910	-31.07	-13	Passed
	3	QPSK	15 / 0	18615	Average	1850	-30.12	-13	Passed
					RMS	1850	-27.54	-13	Passed
		16QAM	15 / Max	19185	Average	1910	-30.12	-13	Passed
					RMS	1910	-28.24	-13	Passed
		QPSK	15 / 0	18615	Average	1850	-31.41	-13	Passed
					RMS	1850	-28.48	-13	Passed
		16QAM	15 / Max	19185	Average	1910	-31.41	-13	Passed
					RMS	1910	-29.82	-13	Passed
	5	QPSK	25 / 0	18625	Average	1850	-32.13	-13	Passed
					RMS	1850	-29.54	-13	Passed
		16QAM	25 / Max	19175	Average	1910	-30.74	-13	Passed
					RMS	1910	-28.24	-13	Passed
		QPSK	25 / 0	18625	Average	1850	-33.34	-13	Passed
					RMS	1850	-30.42	-13	Passed
		16QAM	25 / Max	19175	Average	1910	-32.52	-13	Passed
					RMS	1910	-29.54	-13	Passed
	10	QPSK	50 / 0	18650	Average	1850	-32.52	-13	Passed
					RMS	1850	-30.42	-13	Passed
		16QAM	50 / Max	19150	Average	1910	-30.74	-13	Passed
					RMS	1910	-29.54	-13	Passed
		QPSK	50 / 0	18650	Average	1850	-34.76	-13	Passed
					RMS	1850	-32.92	-13	Passed
		16QAM	50 / Max	19150	Average	1910	-32.13	-13	Passed
					RMS	1910	-30.74	-13	Passed
	15	QPSK	75 / 0	18675	Average	1850	-28.24	-13	Passed
					RMS	1850	-27.11	-13	Passed
		16QAM	75 / Max	19125	Average	1910	-26.3	-13	Passed
					RMS	1910	-25.39	-13	Passed
		QPSK	75 / 0	18675	Average	1850	-28.24	-13	Passed
					RMS	1850	-26.9	-13	Passed
		16QAM	75 / Max	19125	Average	1910	-25.92	-13	Passed
					RMS	1910	-25.05	-13	Passed
	20	QPSK	100 / 0	18700	Average	1850	-28.24	-13	Passed
					RMS	1850	-27.32	-13	Passed
		16QAM	100 / Max	19100	Average	1910	-24.56	-13	Passed
					RMS	1910	-23.38	-13	Passed
		QPSK	100 / 0	18700	Average	1850	-29.82	-13	Passed
					RMS	1850	-28.74	-13	Passed
		16QAM	100 / Max	19100	Average	1910	-26.11	-13	Passed
					RMS	1910	-24.72	-13	Passed

Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



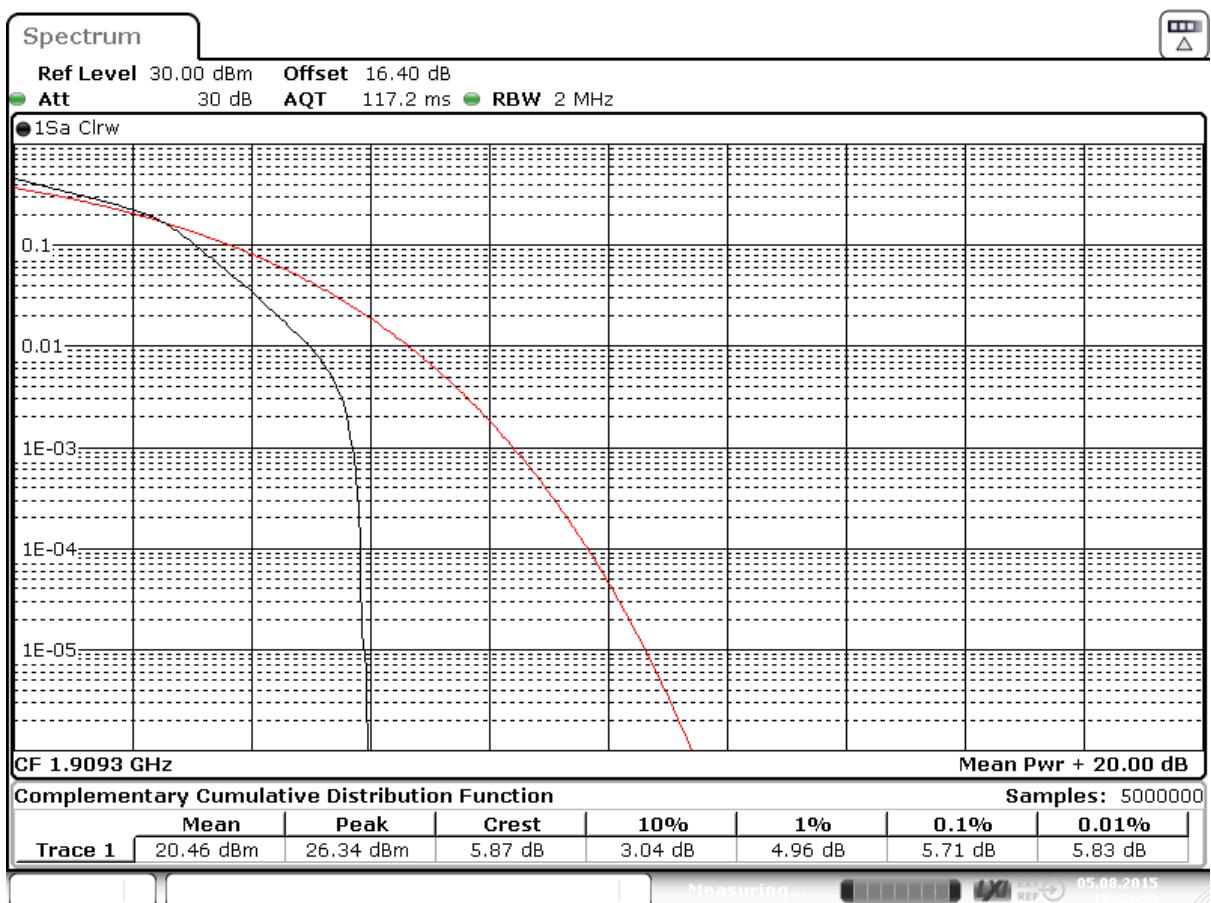
Title: band edge compliance measurement  
 Comment A: DE1132001, eFDD2 QPSK 20 MHz, band edge compliance,  
 channel 19100 (1900.0MHz)  
 Date: 17.JUL.2015 11:45:44

**3.5.14 24.7 Peak-to-Average ratio §2.1046, §24.232****Test: 24.7: Peak-to-Average Ratio Summary §2.1046, §24.232**

*Result:* Passed  
*Setup No.:* S01\_AE01  
*Date of Test:* 2015/10/27 20:43  
*Body:* FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES  
*Test Specification:* FCC part 2 and 24

**Detailed Results:**

Band	Bandwidth / Resource Blocks	Channel	Modulation	Measured Value (dB)	Limit (dB)	Verdict
eFDD2	1.4 MHz / 6 RB	18607	QPSK	4.61	13	Passed
		18900		4.67	13	Passed
		19193		4.58	13	Passed
		18607	16-QAM	5.54	13	Passed
		18900		5.68	13	Passed
		19193		5.71	13	Passed



Date: 5 AUG .2015 17:50:30

**3.5.15 27.1 RF Power Output §2.1046, §27.250****Test: 27.1; RF Power Output Summary §2.1046, §27.250**

*Result:* Passed

*Setup No.:* S01\_AF01

*Date of Test:* 2015/08/29 20:18

*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

*Test Specification:* FCC part 2 and 27

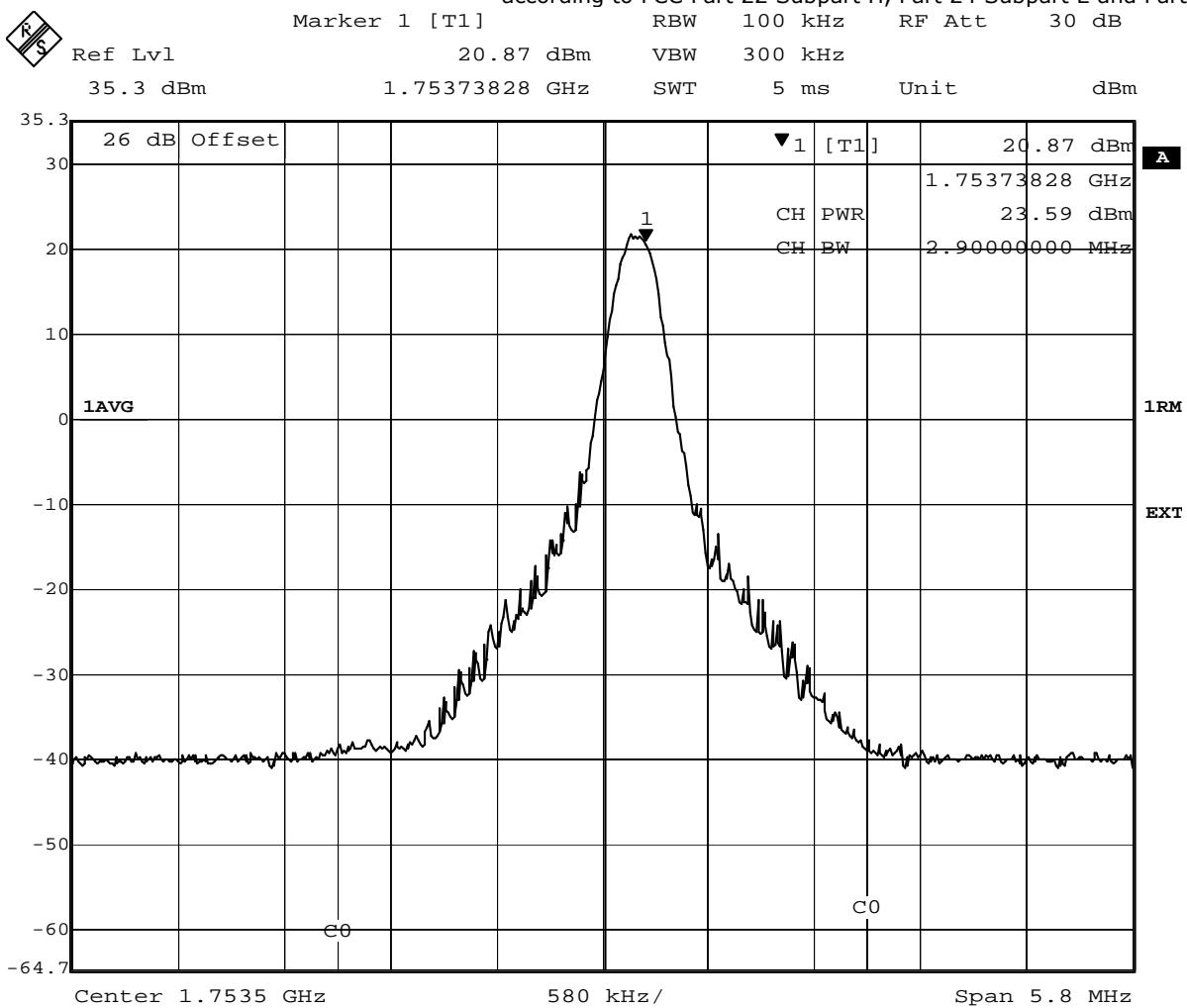
**Detailed Results:**

Test Band	Bandwidth (MHz)	Channel	Modulation	RB	RMS Conducted Power (dBm)	FCC EIRP Limit (W)	IC EIRP Limit (W)	Maximum Antenna Gain (dBi)	Verdict
eFDD4	1.4	19957	QPSK	RB 1	23.2	1	1	6.8	Passed
				RB 3	22.9	1	1	7.1	Passed
				RB 6	21.9	1	1	8.1	Passed
			16QAM	RB 1	22.4	1	1	7.6	Passed
				RB 6	20.9	1	1	9.1	Passed
		20175	QPSK	RB 1	22.4	1	1	7.6	Passed
				RB 3	22	1	1	8	Passed
			16QAM	RB 6	21.2	1	1	8.8	Passed
				RB 1	21.6	1	1	8.4	Passed
				RB 6	20.2	1	1	9.8	Passed
		20393	QPSK	RB 1	22.9	1	1	7.1	Passed
				RB 3	22.7	1	1	7.3	Passed
			16QAM	RB 6	21.7	1	1	8.3	Passed
				RB 1	22.1	1	1	7.9	Passed
				RB 6	20.8	1	1	9.2	Passed
	3	19965	QPSK	RB 1	23.5	1	1	6.5	Passed
				RB 15	22.3	1	1	7.7	Passed
			16QAM	RB 1	22.6	1	1	7.4	Passed
				RB 15	21.4	1	1	8.6	Passed
		20175	QPSK	RB 1	23	1	1	7	Passed
				RB 15	21.7	1	1	8.3	Passed
			16QAM	RB 1	22.1	1	1	7.9	Passed
				RB 15	20.7	1	1	9.3	Passed
		20385	QPSK	RB 1	23.6	1	1	6.4	Passed
				RB 15	22.4	1	1	7.6	Passed
			16QAM	RB 1	22.5	1	1	7.5	Passed
				RB 15	21.3	1	1	8.7	Passed
		5	19975	RB 1	23.5	1	1	6.5	Passed
				QPSK	RB 12	22	1	8	Passed
				RB 25	21.9	1	1	8.1	Passed
			16QAM	RB 1	22.1	1	1	7.9	Passed
				RB 25	20.9	1	1	9.1	Passed
		20175	QPSK	RB 1	23	1	1	7	Passed
				RB 12	21.5	1	1	8.5	Passed
			16QAM	RB 25	21.7	1	1	8.3	Passed
				RB 1	22.1	1	1	7.9	Passed
				RB 25	20.7	1	1	9.3	Passed
	10	20375	QPSK	RB 1	23.4	1	1	6.6	Passed
				RB 12	22.2	1	1	7.8	Passed
			16QAM	RB 25	22.1	1	1	7.9	Passed
				RB 1	22.5	1	1	7.5	Passed
				RB 25	21.1	1	1	8.9	Passed
		20000	QPSK	RB 1	23	1	1	7	Passed
				RB 50	21.6	1	1	8.4	Passed
			16QAM	RB 1	22.1	1	1	7.9	Passed
				RB 50	20.6	1	1	9.4	Passed
				RB 1	22.4	1	1	7.6	Passed
		20175	QPSK	RB 50	20.7	1	1	9.3	Passed
				RB 1	21.3	1	1	8.7	Passed
			16QAM	RB 50	19.9	1	1	10.1	Passed
				RB 1	22.7	1	1	7.3	Passed
				RB 50	21.5	1	1	8.5	Passed
		20350	QPSK	RB 1	21.8	1	1	8.2	Passed
				RB 50	20.5	1	1	9.5	Passed

Test Band	Bandwidth (MHz)	Channel	Modulation	RB	RMS Conducted Power (dBm)	FCC EIRP Limit (W)	IC EIRP Limit (W)	Maximum Antenna Gain (dBi)	Verdict
eFDD4	15	20025	QPSK	RB 1	22.8	1	1	7.2	Passed
				RB 36	21.8	1	1	8.2	Passed
				RB 75	21.4	1	1	8.6	Passed
			16QAM	RB 1	21.7	1	1	8.3	Passed
				RB 75	20.5	1	1	9.5	Passed
		20175	QPSK	RB 1	22.2	1	1	7.8	Passed
				RB 36	20.8	1	1	9.2	Passed
				RB 75	21.2	1	1	8.8	Passed
			16QAM	RB 1	21.4	1	1	8.6	Passed
				RB 75	20.2	1	1	9.8	Passed
		20325	QPSK	RB 1	22.9	1	1	7.1	Passed
				RB 36	21.6	1	1	8.4	Passed
				RB 75	21.7	1	1	8.3	Passed
			16QAM	RB 1	21.7	1	1	8.3	Passed
				RB 75	20.7	1	1	9.3	Passed
20	20050	20050	QPSK	RB 1	22.6	1	1	7.4	Passed
				RB 100	21.2	1	1	8.8	Passed
			16QAM	RB 1	21.2	1	1	8.8	Passed
				RB 100	20.2	1	1	9.8	Passed
	20175	20175	QPSK	RB 1	22.1	1	1	7.9	Passed
				RB 100	21.2	1	1	8.8	Passed
			16QAM	RB 1	21.2	1	1	8.8	Passed
				RB 100	20	1	1	10	Passed
	20300	20300	QPSK	RB 1	22.9	1	1	7.1	Passed
				RB 100	21.6	1	1	8.4	Passed
			16QAM	RB 1	22	1	1	8	Passed
				RB 100	20.7	1	1	9.3	Passed

Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27

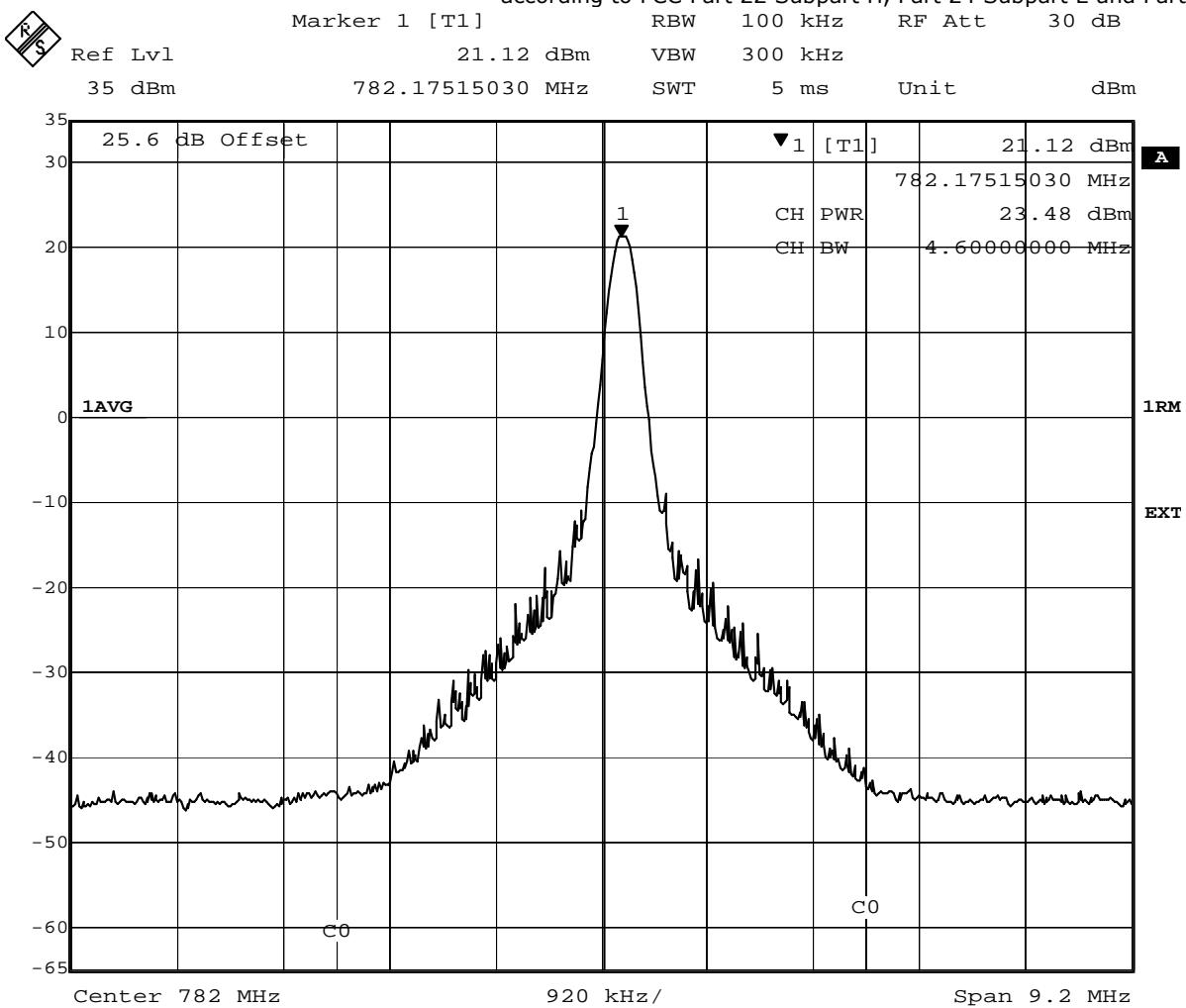


Date: 26.AUG.2015 16:23:01

Test Band	Bandwidth	Channel	Modulation	RB	RMS Conducted Power (dBm)	FCC EIRP limit (W)	IC EIRP limit per SRSP-503 (W)	Maximum antenna gain (dBi)	Verdict
eFDD13	5	23205	QPSK	RB 1	23.5	3	3	11.27	Passed
				RB 12	22.2	3	3	12.57	Passed
				RB 25	22.1	3	3	12.67	Passed
			16QAM	RB 1	22.7	3	3	12.07	Passed
				RB 25	21.1	3	3	13.67	Passed
		23230	QPSK	RB 1	23.5	3	3	11.27	Passed
				RB 12	22.2	3	3	12.57	Passed
				RB 25	22	3	3	12.77	Passed
			16QAM	RB 1	22.4	3	3	12.37	Passed
				RB 25	21	3	3	13.77	Passed
	10	23255	QPSK	RB 1	23.4	3	3	11.37	Passed
				RB 12	22	3	3	12.77	Passed
				RB 25	22.1	3	3	12.67	Passed
			16QAM	RB 1	22.3	3	3	12.47	Passed
				RB 25	21	3	3	13.77	Passed
		23230	QPSK	RB 1	23	3	3	11.77	Passed
				RB 50	21.7	3	3	13.07	Passed
			16QAM	RB 1	22.2	3	3	12.57	Passed
				RB 50	20.8	3	3	13.97	Passed

Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



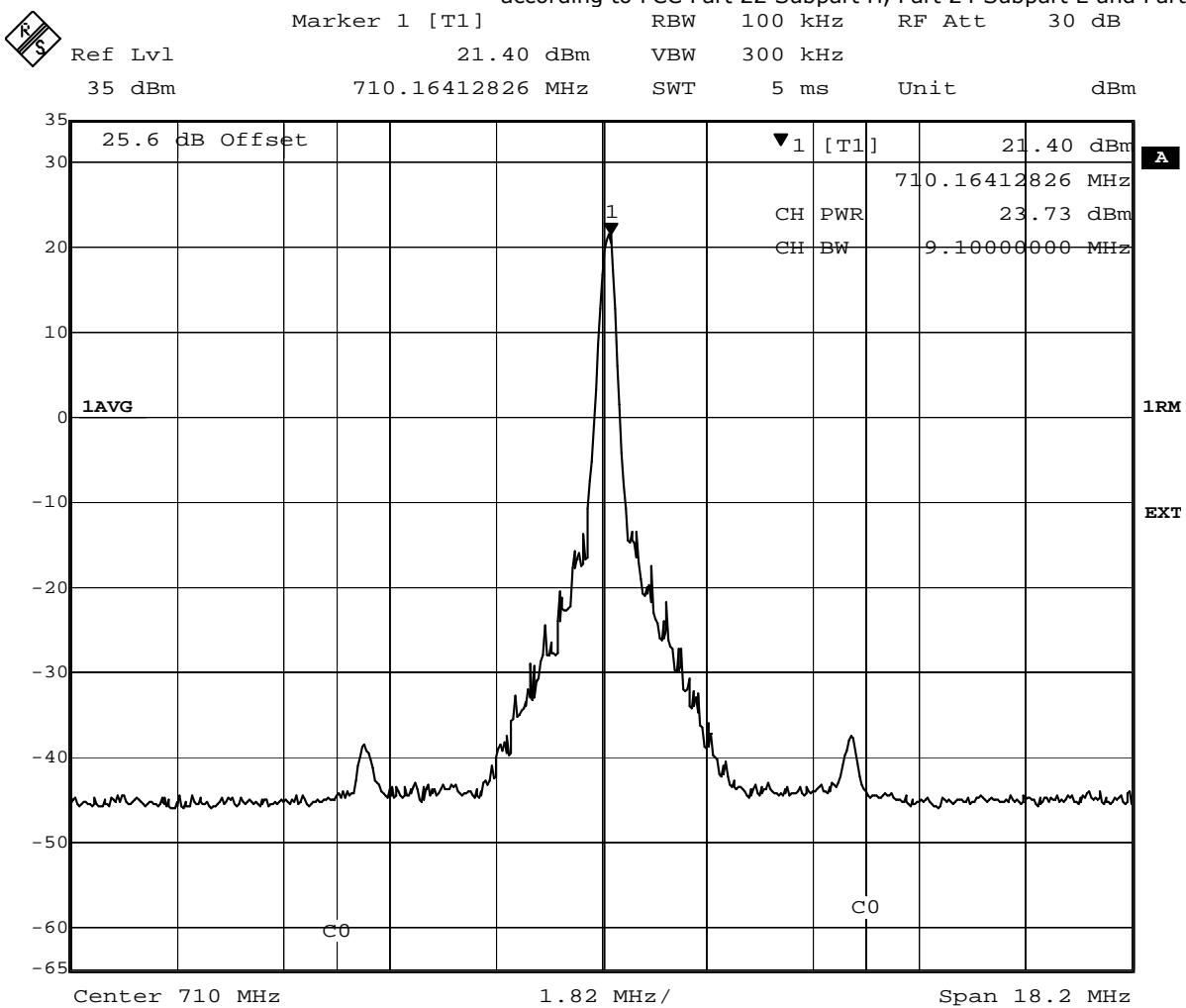
Date: 26.AUG.2015 18:29:43

Reference: MDE\_ELEKT\_1502\_FCCh  
 according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27

Test Band	Bandwidth	Channel	Modulation	RB	RMS Conducted power (dBm)	FCC ERP limit (W)	IC ERP limit per SRSP-503 (W)	Maximum antenna gain (dBD)	Verdict
eFDD17	5	23755	QPSK	RB 1	23.1	3	3	11.67	Passed
				RB 12	21.6	3	3	13.17	Passed
				RB 25	21.5	3	3	13.27	Passed
			16QAM	RB 1	22	3	3	12.77	Passed
				RB 25	20.6	3	3	14.17	Passed
		23790	QPSK	RB 1	22.9	3	3	11.87	Passed
				RB 12	21.6	3	3	13.17	Passed
				RB 25	21.6	3	3	13.17	Passed
			16QAM	RB 1	21.8	3	3	12.97	Passed
				RB 25	20.4	3	3	14.37	Passed
		23825	QPSK	RB 1	22.9	3	3	11.87	Passed
				RB 12	21.5	3	3	13.27	Passed
				RB 25	21.5	3	3	13.27	Passed
			16QAM	RB 1	21.9	3	3	12.87	Passed
				RB 25	20.4	3	3	14.37	Passed
	10	23780	QPSK	RB 1	23.6	3	3	11.17	Passed
				RB 50	22.2	3	3	12.57	Passed
			16QAM	RB 1	22.3	3	3	12.47	Passed
				RB 50	21.1	3	3	13.67	Passed
		23790	QPSK	RB 1	23.7	3	3	11.07	Passed
				RB 50	22.1	3	3	12.67	Passed
			16QAM	RB 1	23	3	3	11.77	Passed
				RB 50	21.2	3	3	13.57	Passed
	23800	QPSK	RB 1	23.5	3	3	3	11.27	Passed
			RB 50	22.1	3	3	12.67	Passed	
		16QAM	RB 1	22.5	3	3	3	12.27	Passed
			RB 50	21.1	3	3	13.67	Passed	

Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



Date: 29.AUG.2015 15:25:25

### 3.5.16 27.2 Frequency stability §2.1055, §27.54

**Test: 27.2; Frequency Band = eFDD13, Mode = QPSK, Channel = 23230, Frequency = 782MHz**

*Result:* Passed

*Setup No.:* S01\_AE01

*Date of Test:* 2015/08/05 15:20

*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

*Test Specification:* FCC part 2 and 27

**Detailed Results:**

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	1955	-1	-3	passed
-30	5			-1	-2	passed
-30	10			-1	-3	passed
-20	0	normal	1955	0	-7	passed
-20	5			0	-3	passed
-20	10			0	-5	passed
-10	0	normal	1955	-1	4	passed
-10	5			-1	-3	passed
-10	10			-1	-5	passed
0	0	normal	1955	-1	-4	passed
0	5			-1	-3	passed
0	10			0	3	passed
10	0	normal	1955	-1	-2	passed
10	5			-1	-4	passed
10	10			0	3	passed
20	0	low	1955	0	9	passed
20	5			-1	-3	passed
20	10			-1	-5	passed
20	0	normal = high <sup>1)</sup>	1955	1	3	passed
20	5			1	5	passed
20	10			0	5	passed
20	0	high	1955	-2	-3	passed
20	5			0	4	passed
20	10			0	3	passed
30	0	normal	1955	-3	-6	passed
30	5			-1	-3	passed
30	10			-2	-6	passed
40	0	normal	1955	-1	-5	passed
40	5			-2	-5	passed
40	10			-1	-4	passed
50	0	normal	1955	-3	-5	passed
50	5			-4	-6	passed
50	10			-4	-5	passed

LTE eFDD 13  
 TCH: 23230  
 1 RB, QPSK  
 5 MHz BW

Battery operating end point voltage <sup>2)</sup>						
Temp. °C	Duration min	Voltage V	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
20	0	3.25	1955	0	2	passed
20	5			-2	-4	passed
20	10			-3	-18	passed

1) The manufacturer declared that normal voltage is equivalent with high voltage.

2) The call is established at high voltage and the voltage is then reduced to the battery operating end.

**Test: 27.2; Frequency Band = eFDD17, Mode = QPSK, Channel = 23790, Frequency = 710MHz**

Result: Passed

Setup No.: S01\_AE01

Date of Test: 2015/08/05 15:21

Body: FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

Test Specification: FCC part 2 and 27

**Detailed Results:**

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	1775	1	4	passed
-30	5			2	4	passed
-30	10			1	-7	passed
-20	0	normal	1775	0	4	passed
-20	5			1	4	passed
-20	10			2	5	passed
-10	0	normal	1775	1	3	passed
-10	5			0	-3	passed
-10	10			0	3	passed
0	0	normal	1775	0	5	passed
0	5			0	-2	passed
0	10			-1	-2	passed
10	0	normal	1775	2	3	passed
10	5			0	3	passed
10	10			1	4	passed
20	0	low	1775	2	3	passed
20	5			-1	-3	passed
20	10			0	-2	passed
20	0	normal = high <sup>1)</sup>	1775	-3	-6	passed
20	5			2	4	passed
20	10			1	4	passed
20	0	high	1775	0	-3	passed
20	5			0	3	passed
20	10			1	3	passed
30	0	normal	1775	0	5	passed
30	5			0	2	passed
30	10			-1	2	passed
40	0	normal	1775	1	4	passed
40	5			-1	-2	passed
40	10			-1	-4	passed
50	0	normal	1775	2	5	passed
50	5			-1	-3	passed
50	10			-1	-3	passed

 LTE eFDD 17  
 TCH: 23790  
 1 RB, QPSK  
 5 MHz BW

**Battery operating end point voltage <sup>2)</sup>**

Temp. °C	Duration min	Voltage V	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
20	0	3.25	1775	-1	-3	passed
20	5			1	2	passed
20	10			2	5	passed

1) The manufacturer declared that normal voltage is equivalent with high voltage.

2) The call is established at high voltage and the voltage is then reduced to the battery operating end.

**Test: 27.2; Frequency Band = eFDD4, Mode = QPSK, Channel = 20175, Frequency = 1732.5MHz**

Result: Passed

Setup No.: S01\_AE01

Date of Test: 2015/08/04 17:19

Body: FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

Test Specification: FCC part 2 and 27

**Detailed Results:**

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	4331	0	8	passed
-30	5			1	6	passed
-30	10			1	7	passed
-20	0	normal	4331	2	7	passed
-20	5			-1	-6	passed
-20	10			1	7	passed
-10	0	normal	4331	1	5	passed
-10	5			0	5	passed
-10	10			1	6	passed
0	0	normal	4331	0	8	passed
0	5			-2	-8	passed
0	10			0	-7	passed
10	0	normal	4331	1	4	passed
10	5			-1	-5	passed
10	10			-4	-7	passed
20	0	low	4331	-3	-9	passed
20	5			-1	11	passed
20	10			-2	-10	passed
20	0	normal = high <sup>1)</sup>	4331	-1	-7	passed
20	5			2	-9	passed
20	10			2	8	passed
20	0	high	4331	1	-14	passed
20	5			0	8	passed
20	10			-3	6	passed
30	0	normal	4331	-3	-9	passed
30	5			-2	-8	passed
30	10			-2	-8	passed
40	0	normal	4331	1	7	passed
40	5			-2	-6	passed
40	10			0	-4	passed
50	0	normal	4331	-1	-7	passed
50	5			0	-5	passed
50	10			-3	-7	passed

 LTE eFDD 4  
 TCH: 20175  
 1 RB, QPSK  
 1,4 MHz BW

**Battery operating end point voltage <sup>2)</sup>**

Temp. °C	Duration min	Voltage V	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
20	0	3.25	4331	-1	-4	passed
20	5			2	7	passed
20	10			-1	-5	passed

1) The manufacturer declared that normal voltage is equivalent with high voltage.

2) The call is established at high voltage and the voltage is then reduced to the battery operating end.

**3.5.17 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\_AE01

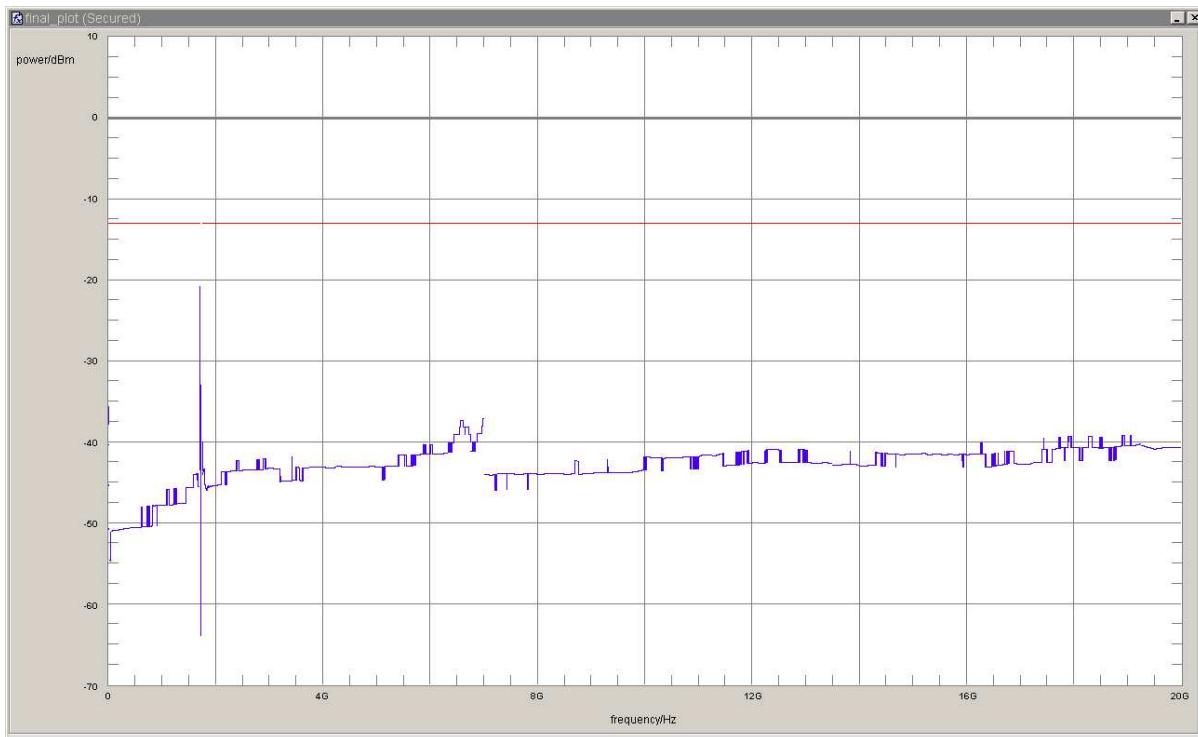
*Date of Test:* 2015/07/17 20:24

*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

*Test Specification:* FCC part 2 and 27

**Detailed Results:**

Band / Band-width	Modulation	Channel	Detector	Trace	Resolution Band-width (kHz)	Frequency (MHz)	Highest Value (dBm)	Margin to Limit /dB	Limit /dBm	Verdict
eFDD4 / 5MHz	QPSK	19975	rms	maxhold	100	1705.990	-26.5	13.5	-13	Passed
		19975	rms	maxhold	100	1708.190	-20.8	7.8	-13	Passed
		20175	rms	maxhold	-	-	-	-	-13	Passed
		20375	rms	maxhold	5	1755.002	-30	17	-13	Passed
		20375	rms	maxhold	100	1756.870	-27.9	14.9	-13	Passed
		20375	rms	maxhold	100	1758.960	-25.9	12.9	-13	Passed
eFDD13 / 5MHz	QPSK	23205	rms	maxhold	-	-	-	-	-13	Passed
		23230	rms	maxhold	-	-	-	-	-13	Passed
		23255	rms	maxhold	30	787.000	-25.3	12.3	-13	Passed
		23255	rms	maxhold	100	787.100	-26	13	-13	Passed
eFDD17 / 5MHz	QPSK	23755	rms	maxhold	100	703.900	-25.6	12.6	-13	Passed
		23755	rms	maxhold	100	703.999	-22.6	9.6	-13	Passed
		23790	rms	maxhold	-	-	-	-	-13	Passed
		23825	rms	maxhold	100	716.000	-20.9	7.9	-13	Passed
		23825	rms	maxhold	100	716.100	-25.2	12.2	-13	Passed



### 3.5.18 27.4 Field strength of spurious radiation §2.1053, §27.53

**Test: 27.4; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23205, Frequency = 779.5MHz, Method = radiated**

*Result:* Passed

*Setup No.:* S01\_AA01

*Date of Test:* 2015/06/22 3:57

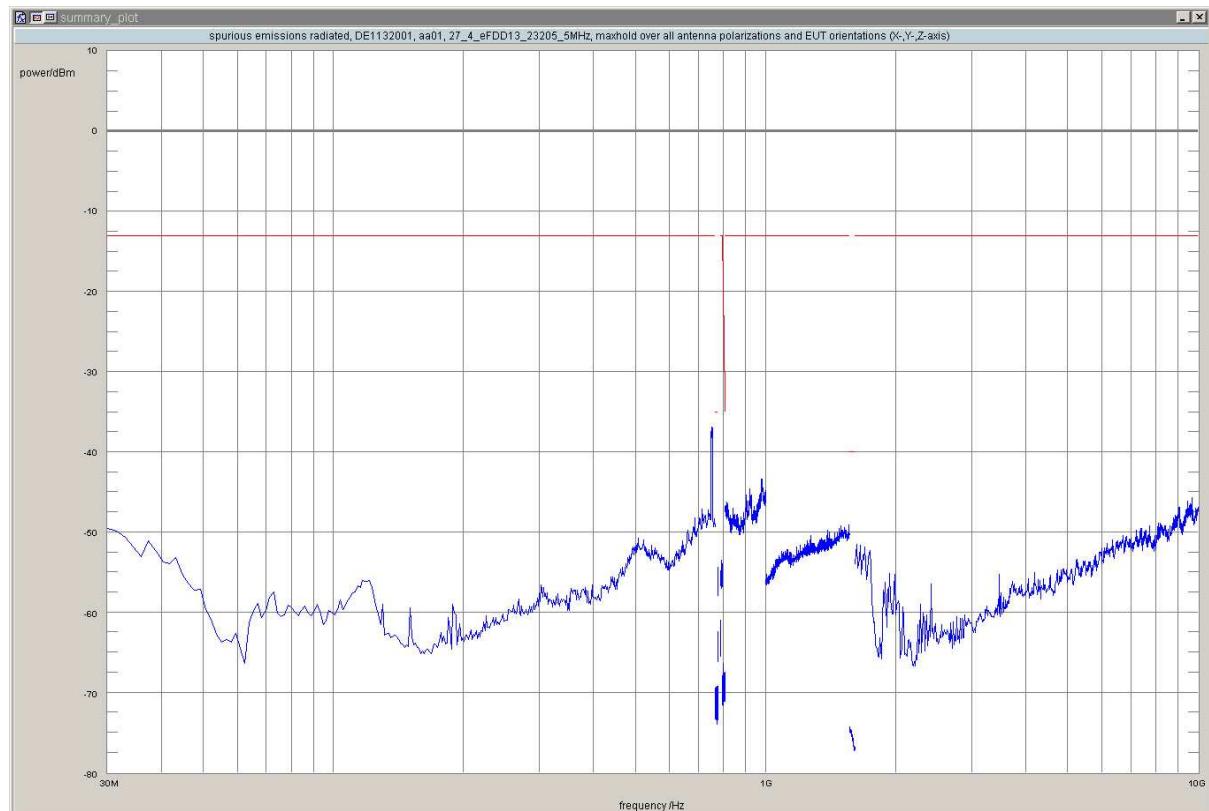
*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

*Test Specification:* FCC part 2 and 27

#### Detailed Results:

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	1000	748.3	-36.84	-13.00	23.84	90.0	horizontal	vertical	passed

no further values have been found with a margin of less than 20 dB



**Test: 27.4; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23230, Frequency = 782MHz, Method = radiated**

*Result:* Passed

*Setup No.:* S01\_AA01

*Date of Test:* 2015/06/22 3:57

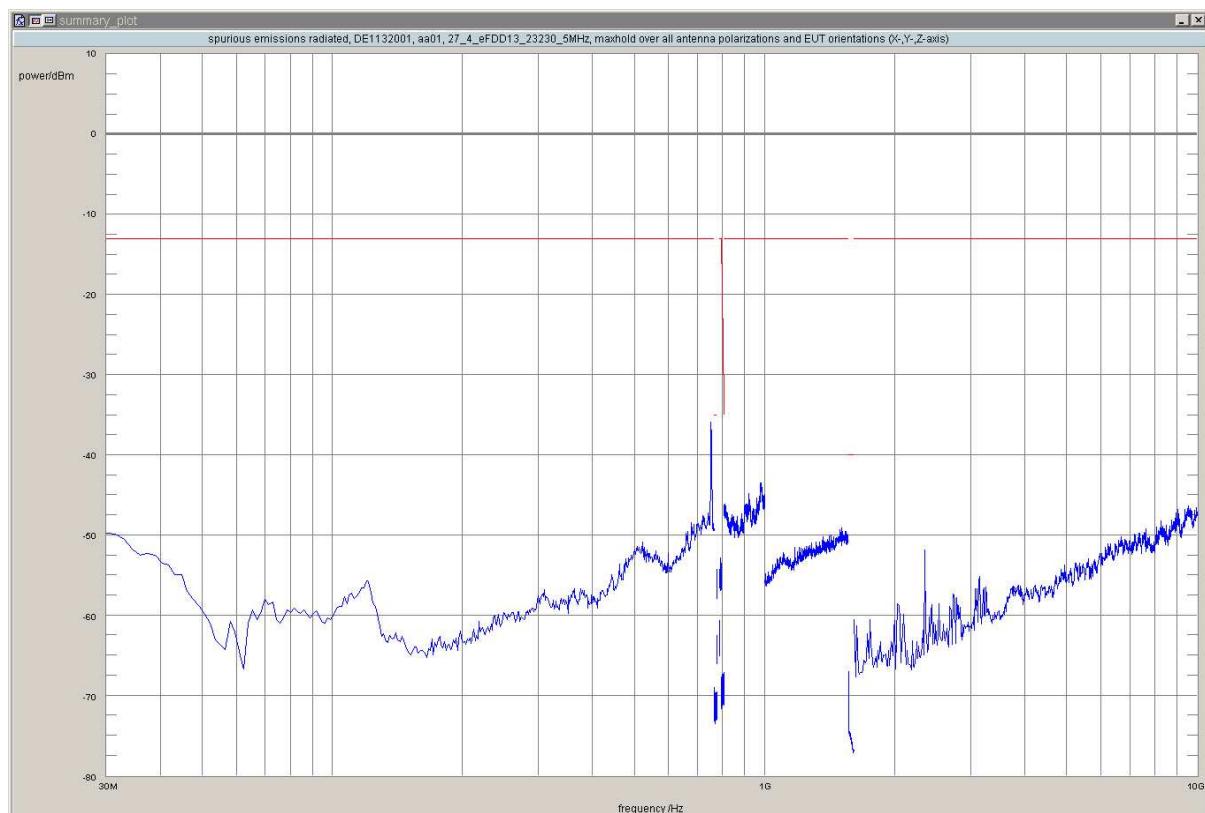
*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

*Test Specification:* FCC part 2 and 27

#### Detailed Results:

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	1000	749.8	-35.91	-13.00	22.91	-180.0	horizontal	vertical	passed

no further values have been found with a margin of less than 20 dB



**Test: 27.4; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23255, Frequency = 784.5MHz, Method = radiated**

*Result:* Passed

*Setup No.:* S01\_AA01

*Date of Test:* 2015/06/22 3:57

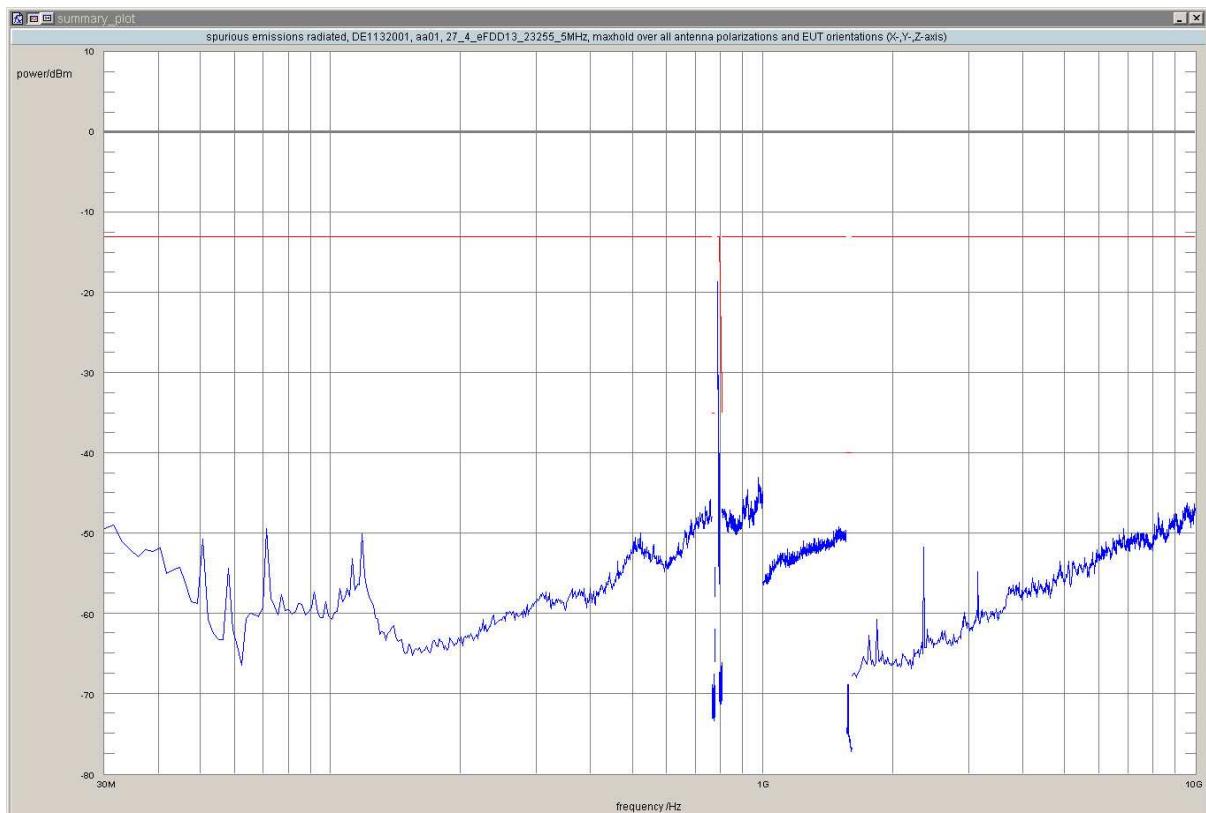
*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

*Test Specification:* FCC part 2 and 27

**Detailed Results:**

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	100	787.10	-18.65	-13.00	5.65	-90.0	horizontal	vertical	passed

no further values have been found with a margin of less than 20 dB



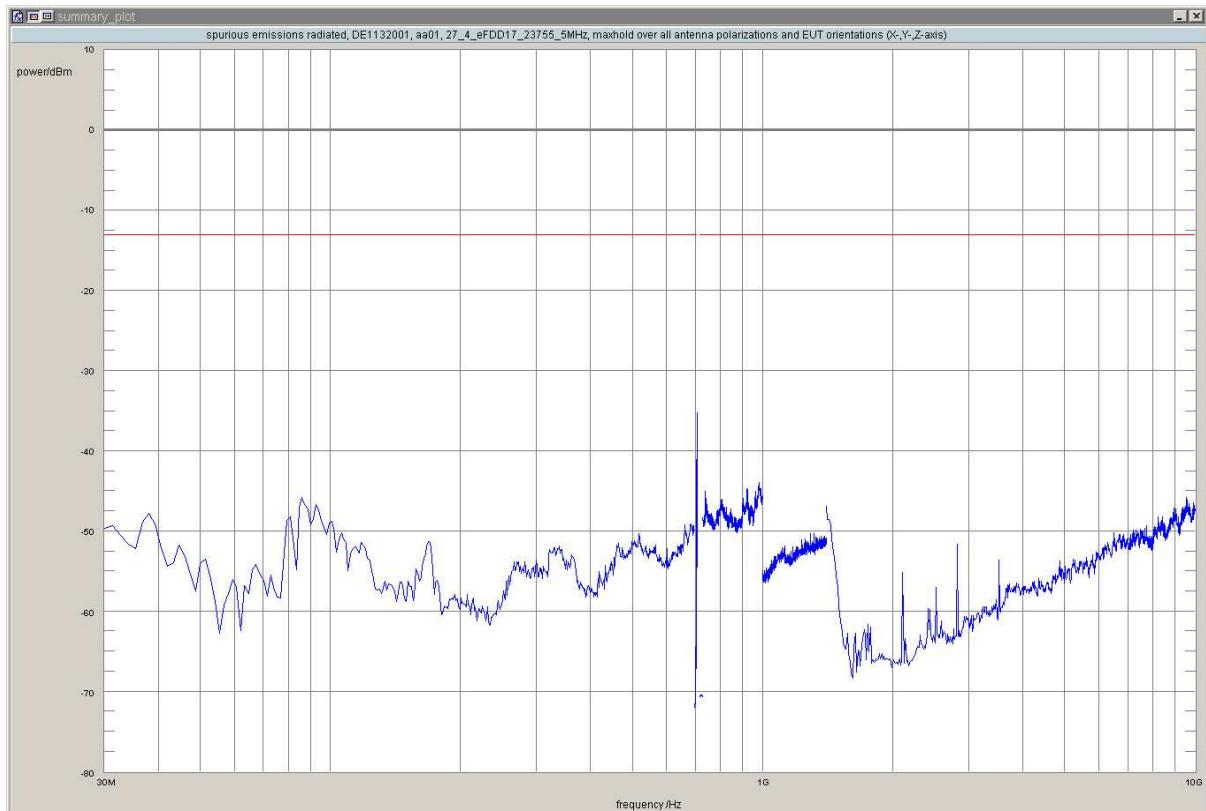
**Test: 27.4; Frequency Band = eFDD17, Mode = QPSK 5MHz, Channel = 23755, Frequency = 706.5MHz, Method = radiated**

Result: Passed  
 Setup No.: S01\_AA01  
 Date of Test: 2015/06/22 4:09  
 Body: FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV  
 Test Specification: FCC part 2 and 27

**Detailed Results:**

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
rms	maxhold	30	704.000	-35.17	-13.00	22.17	0.0	horizontal	horizontal	passed

no further values have been found with a margin of less than 20 dB



**Test: 27.4; Frequency Band = eFDD17, Mode = QPSK 5MHz, Channel = 23790, Frequency = 710MHz, Method = radiated**

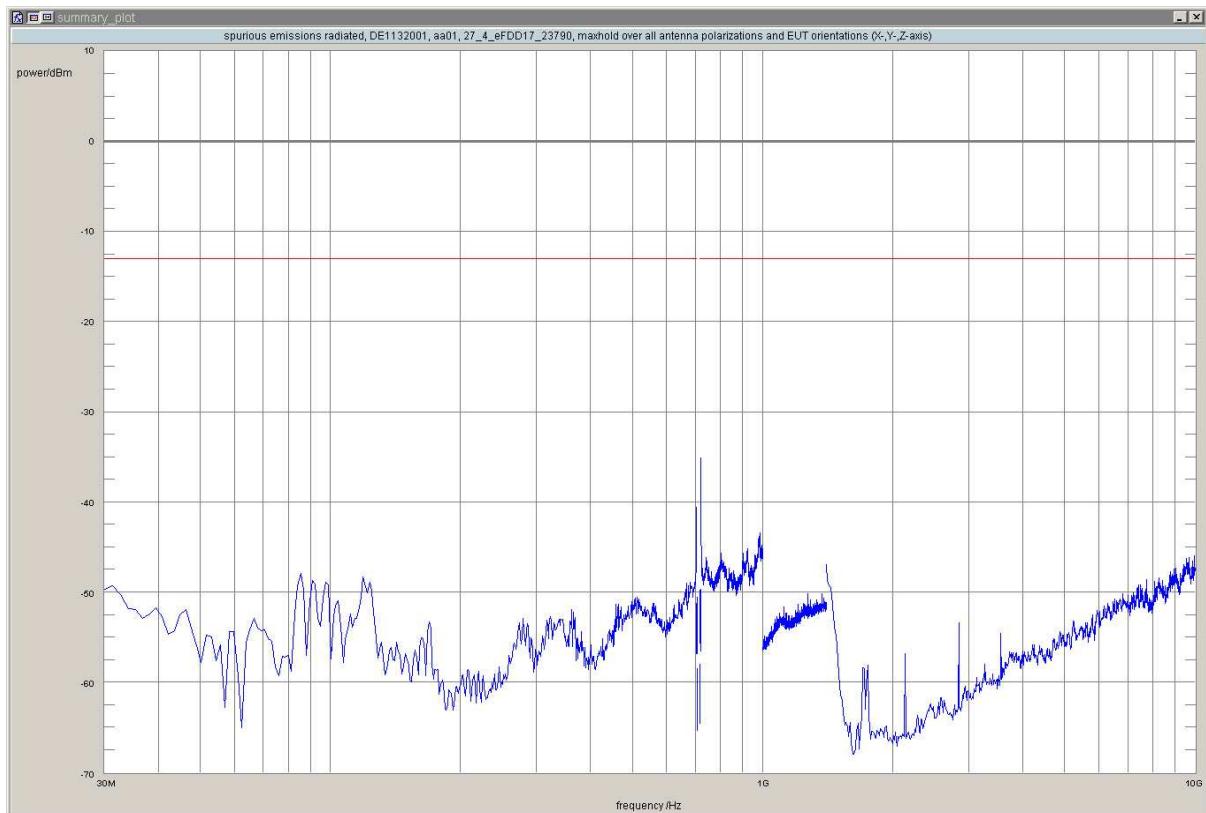
Result: Passed  
 Setup No.: S01\_AA01  
 Date of Test: 2015/06/22 4:14  
 Body: FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV  
 Test Specification: FCC part 2 and 27

**Detailed Results:**

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	1000	717.0	-35.10	-13.00	22.10	90.0	vertical	vertical	passed

no further values have been found with a margin of less than 20 dB

added by operator



added by operator

**Test: 27.4; Frequency Band = eFDD17, Mode = QPSK 5MHz, Channel = 23825, Frequency = 713.5MHz, Method = radiated**

*Result:* Passed

*Setup No.:* S01\_AA01

*Date of Test:* 2015/06/22 4:09

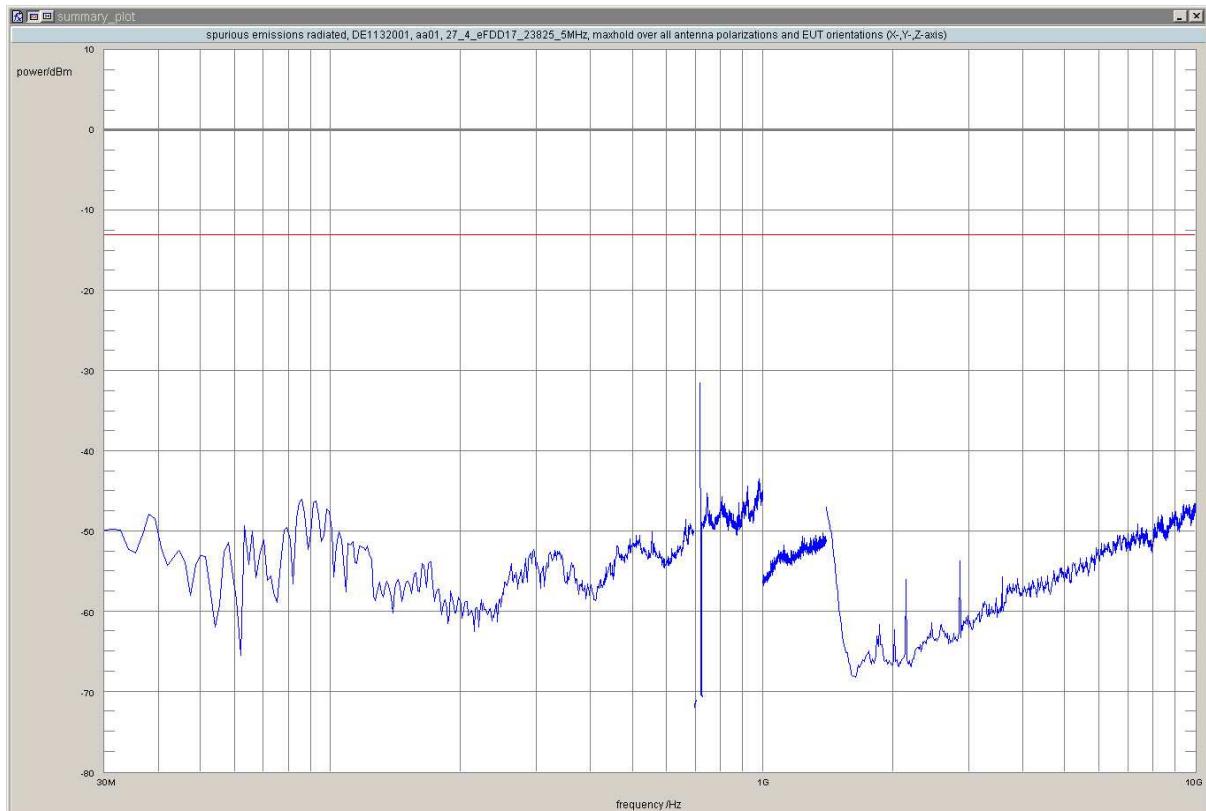
*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

*Test Specification:* FCC part 2 and 27

**Detailed Results:**

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
rms	maxhold	30	716.002	-31.52	-13.00	18.52	0.0	horizontal	horizontal	passed

no further values have been found with a margin of less than 20 dB



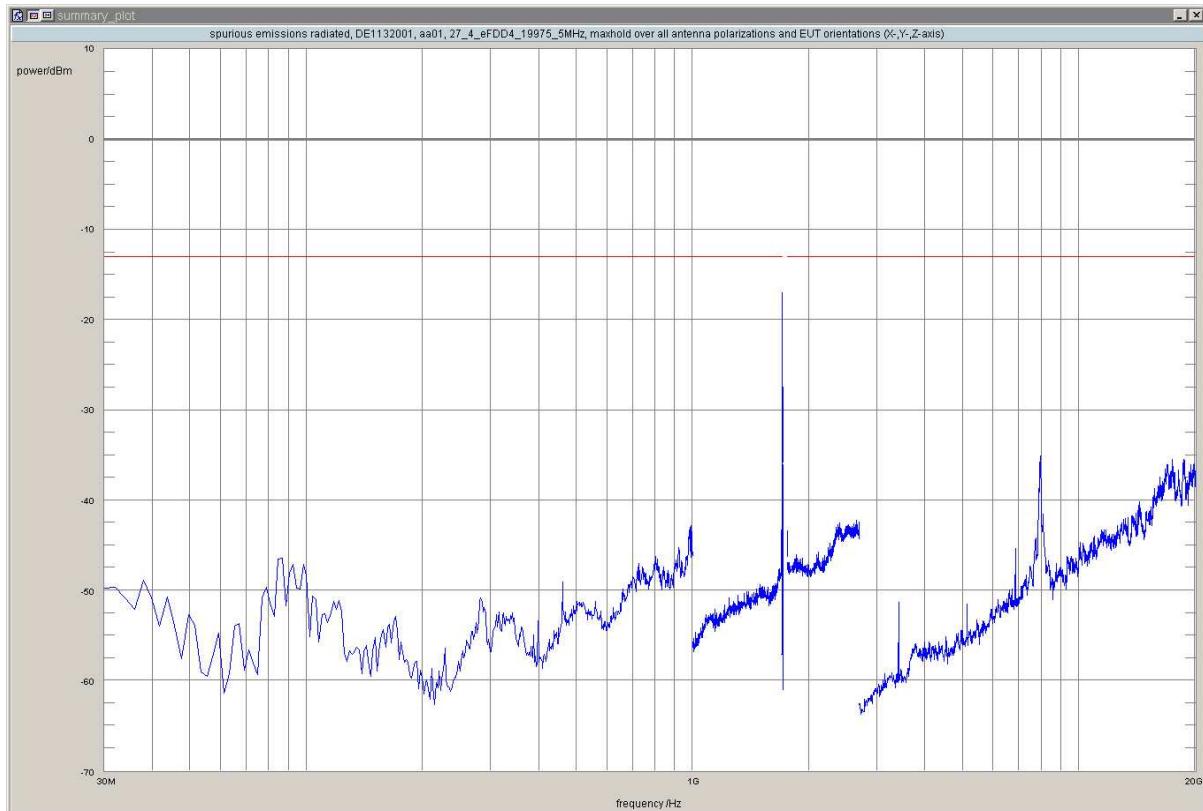
**Test: 27.4; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 19975, Frequency = 1712.5MHz, Method = radiated**

*Result:* Passed  
*Setup No.:* S01\_AA01  
*Date of Test:* 2015/06/23 11:16  
*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV  
*Test Specification:* FCC part 2 and 27

**Detailed Results:**

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
rms	maxhold	100	1706.07	-18.61	-13.00	5.61	0.0	vertical	vertical	passed
rms	maxhold	100	1708.28	-17.02	-13.00	4.02	0.0	vertical	vertical	passed

no further values have been found with a margin of less than 20 dB



**Test: 27.4; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 20175, Frequency = 1732.5MHz, Method = radiated**

*Result:* Passed

*Setup No.:* S01\_AA01

*Date of Test:* 2015/06/22 4:03

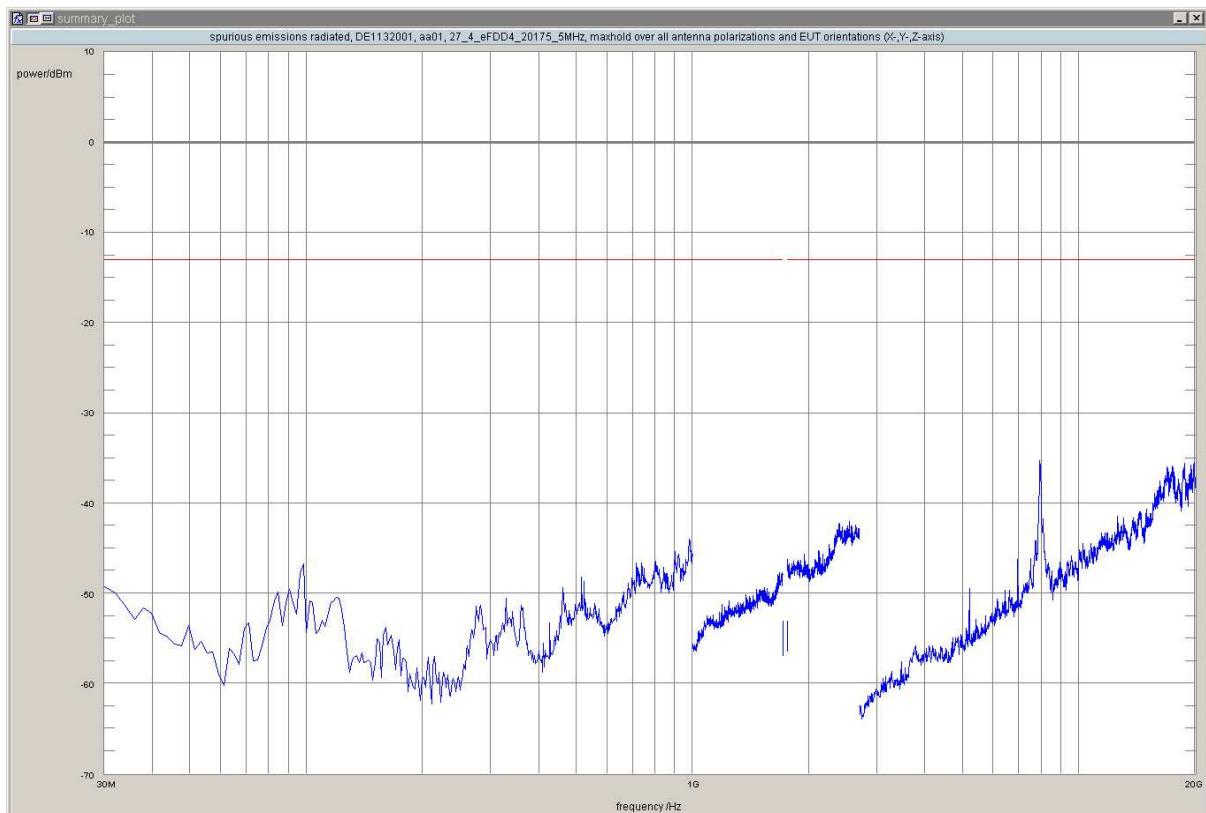
*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

*Test Specification:* FCC part 2 and 27

**Detailed Results:**

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
peak	maxhold	1000	7925.9	-35.28	-13.00	22.28	120.0	vertical	horizontal	passed

no further values have been found with a margin of less than 20 dB



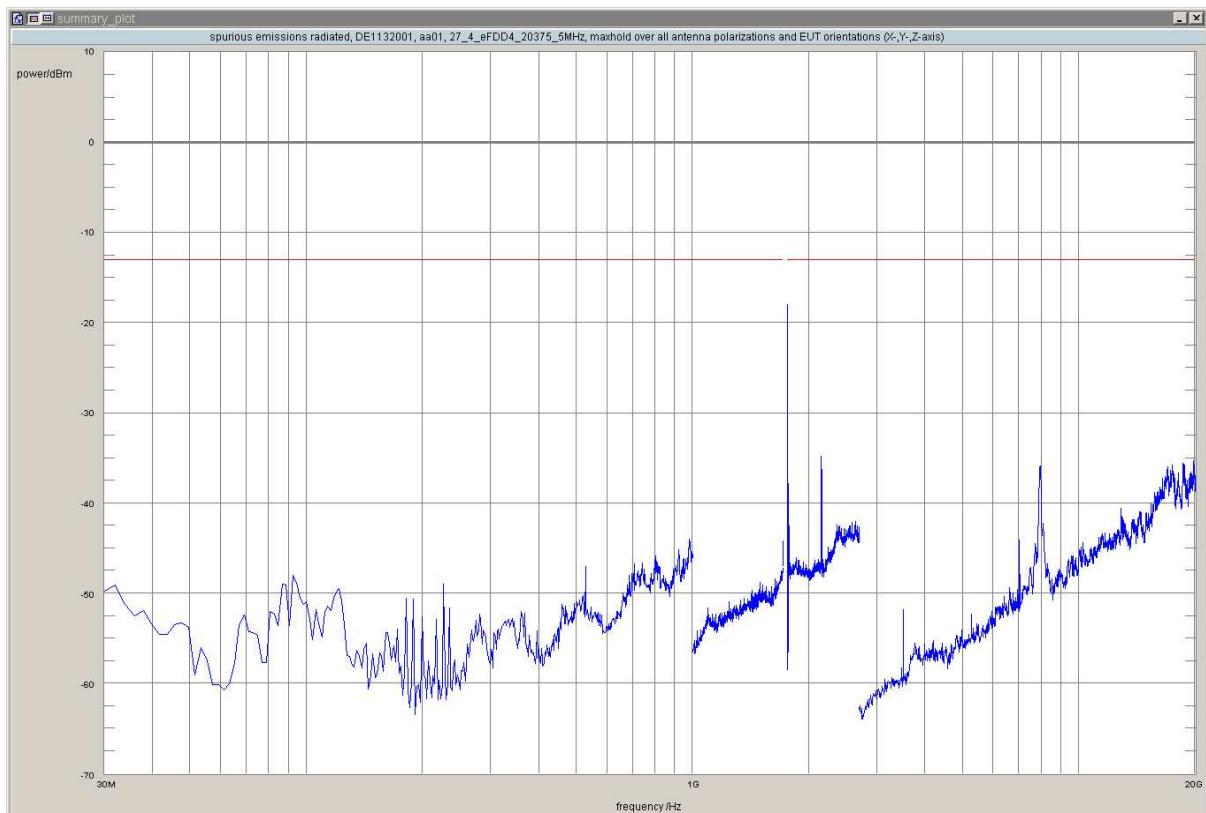
**Test: 27.4; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 20375, Frequency = 1752.5MHz, Method = radiated**

Result: Passed  
 Setup No.: S01\_AA01  
 Date of Test: 2015/06/23 17:41  
 Body: FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV.  
 Test Specification: FCC part 2 and 27

### Detailed Results:

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	limit /dBm	margin to limit /dB	azimuth /°	antenna polarization	EUT orientation	verdict
rms	maxhold	5	1755.004	-24.63	-13.00	11.63	0.0	vertical	vertical	passed
rms	maxhold	100	1756.00	-29.52	-13.00	16.52	0.0	vertical	vertical	passed
rms	maxhold	100	1756.84	-21.25	-13.00	8.25	0.0	vertical	vertical	passed
rms	maxhold	100	1759.05	-17.95	-13.00	4.95	0.0	vertical	vertical	passed

no further values have been found with a margin of less than 20 dB



**3.5.19 27.5 Emission and Occupied Bandwidth §2.1049****Test: 27.5; Emission and Occupied Bandwidth Summary §2.1049**

*Result:* Passed

*Setup No.:* S01\_AE01

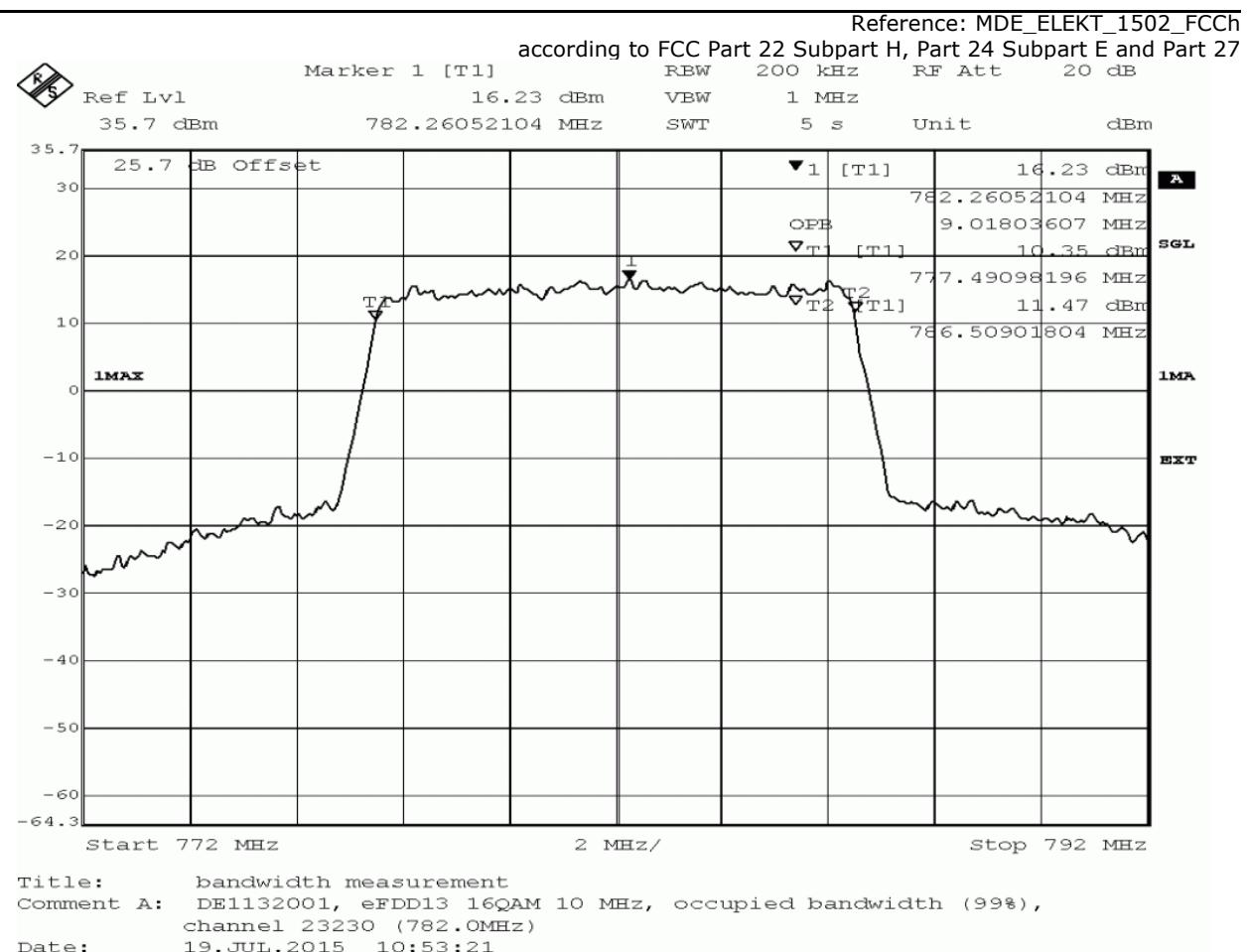
*Date of Test:* 2015/10/27 20:59

*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

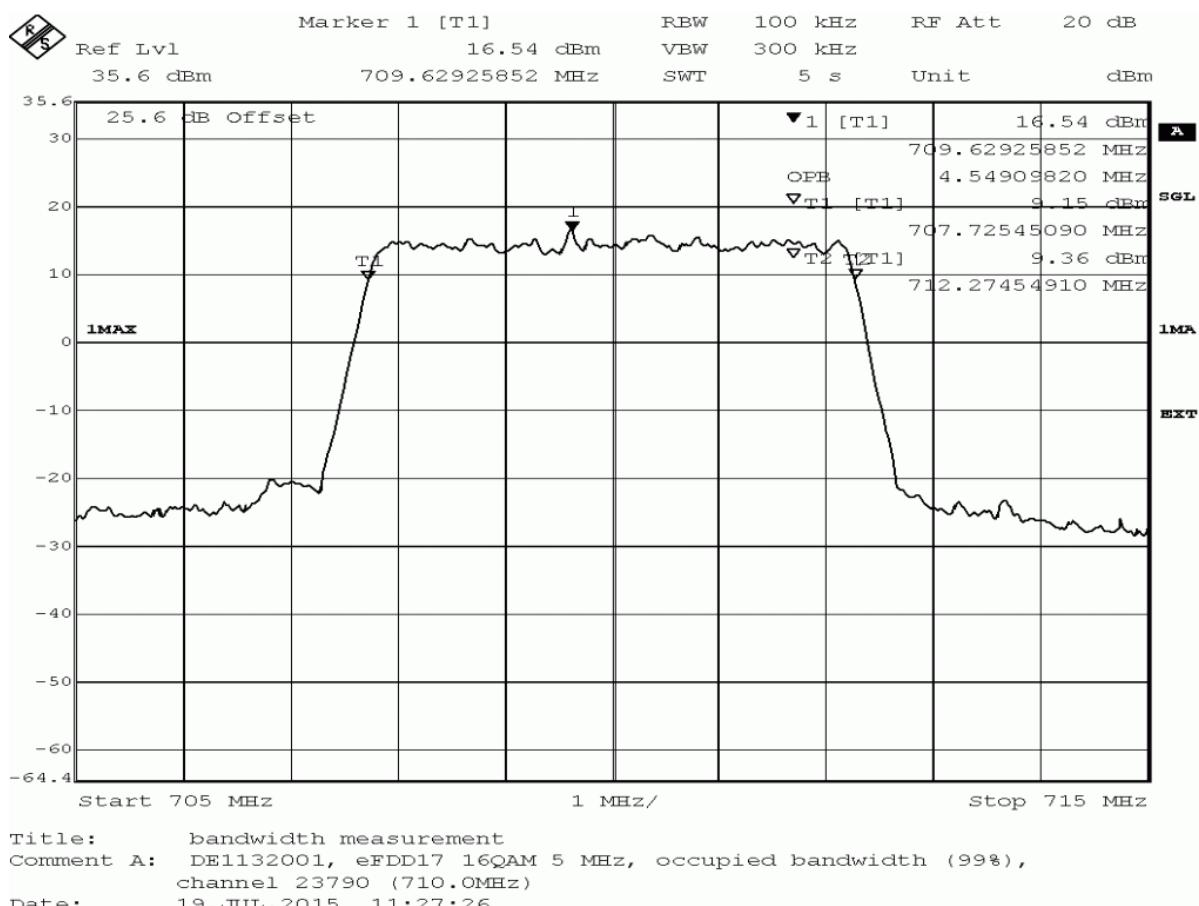
*Test Specification:* FCC part 2 and 27

**Detailed Results:**

LTE Band 4							
Channel BW: 1.4 MHz				Channel BW: 3 MHz			
Channel	Frequency (MHz)	99% BW (MHz)		Channel	Frequency (MHz)	99% BW (MHz)	
		QPSK	16QAM			QPSK	16QAM
19957	1710.7	1.1	1.1	19965	1711.5	2.8	2.8
20175	1732.5	1.1	1.1	20175	1732.5	2.8	2.8
20393	1754.3	1.1	1.1	20385	1753.5	2.8	2.8
LTE Band 4							
Channel BW: 5MHz				Channel BW: 10 MHz			
Channel	Frequency (MHz)	99% BW (MHz)		Channel	Frequency (MHz)	99% BW (MHz)	
		QPSK	16QAM			QPSK	16QAM
19975	1712.5	4.5	4.5	20000	1715.0	9.1	9.1
20175	1732.5	4.5	4.5	20175	1732.5	9.1	9.1
20375	1752.5	4.5	4.5	20350	1750.0	9.1	9.1
LTE Band 4							
Channel BW: 15MHz				Channel BW: 20 MHz			
Channel	Frequency (MHz)	99% BW (MHz)		Channel	Frequency (MHz)	99% BW (MHz)	
		QPSK	16QAM			QPSK	16QAM
20025	1717.5	13.6	13.5	20050	1720.0	18.0	18.1
20175	1732.5	13.6	13.6	20175	1732.5	18.1	18.2
20325	1747.5	13.5	13.5	20300	1745.0	18.2	18.1



LTE Band 17							
Channel BW: 5MHz				Channel BW: 10 MHz			
Channel	Frequency (MHz)	99% BW (MHz)		Channel	Frequency (MHz)	99% BW (MHz)	
		QPSK	16QAM			QPSK	16QAM
23755	706.5	4.55	4.55	23780	709.0	9.06	9.06
23790	710.0	4.55	4.55	23790	710.0	9.02	9.06
23825	709.0	4.53	4.55	23800	711.0	9.02	9.02

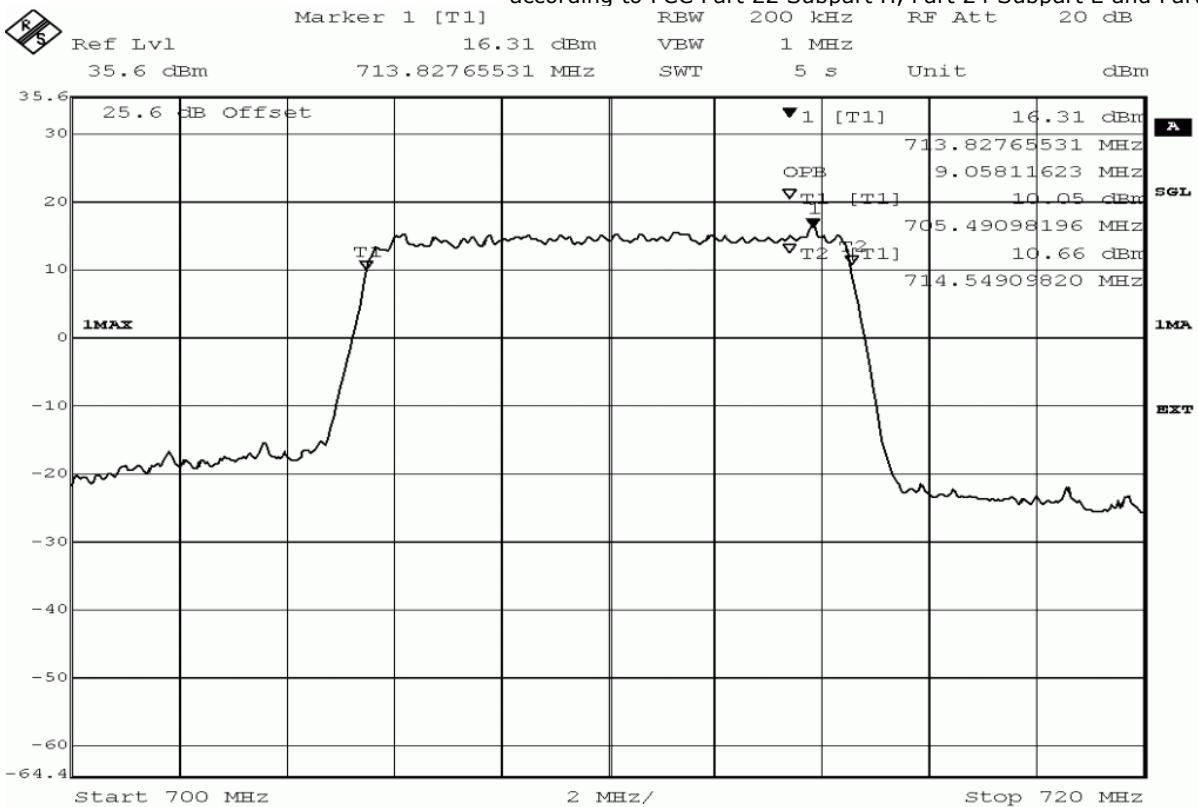




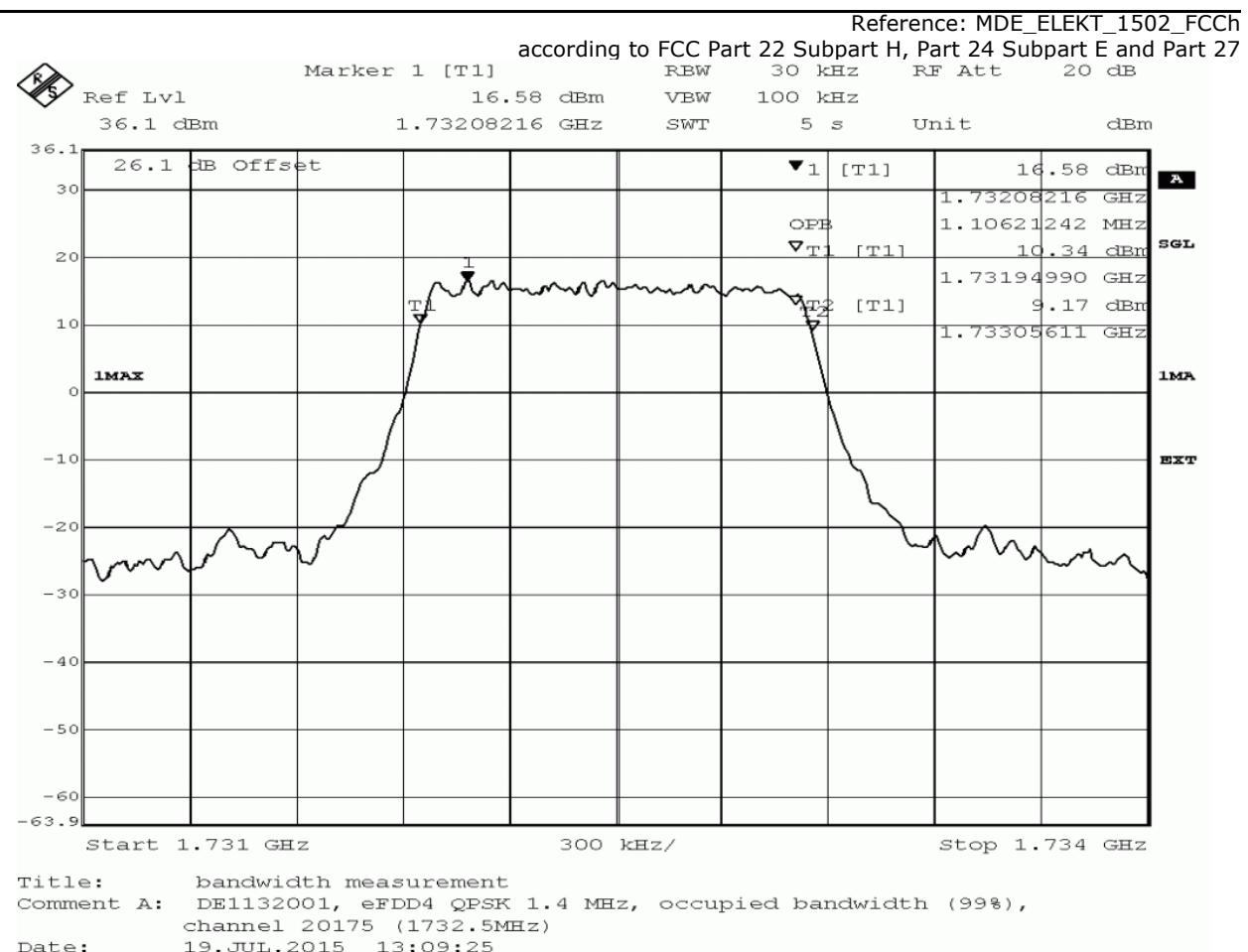
testing for a smarter world

Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27

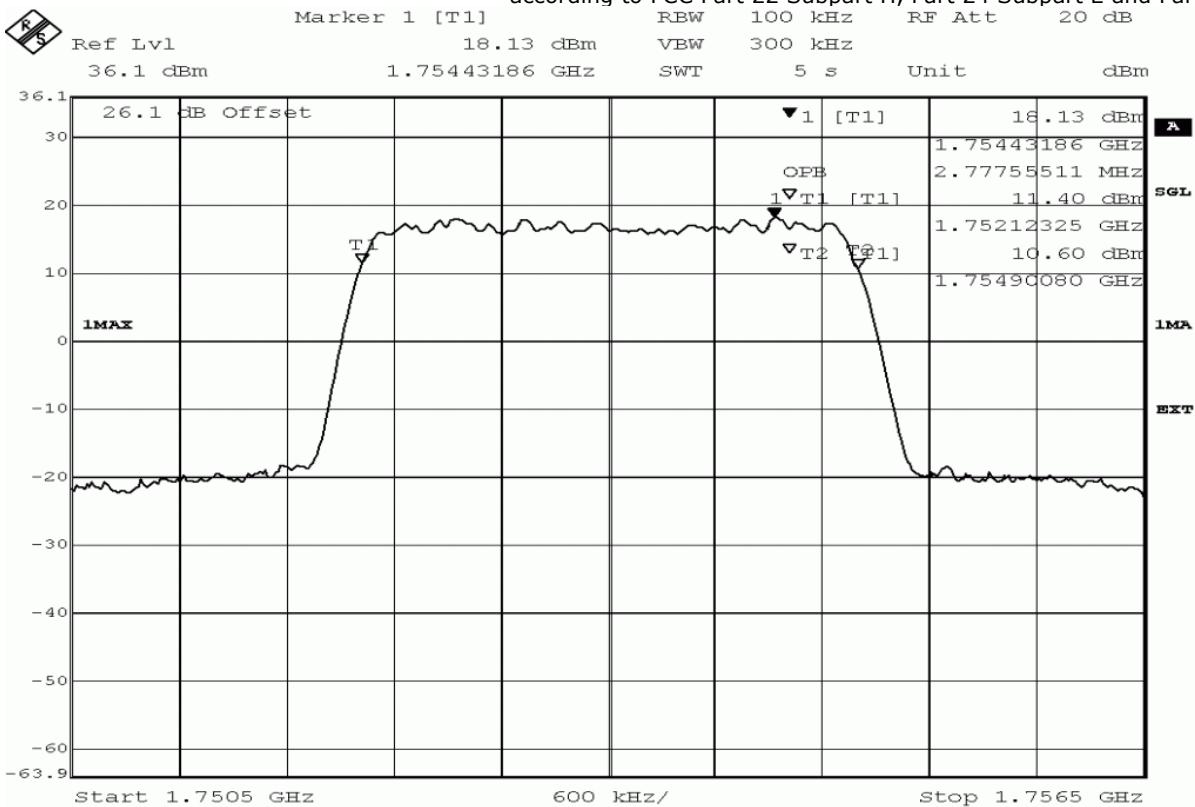


Title: bandwidth measurement  
Comment A: DE1132001, eFDD17 16QAM 10 MHz, occupied bandwidth (99%),  
channel 23790 (710.0MHz)  
Date: 19.JUL.2015 11:50:02



Reference: MDE\_ELEKT\_1502\_FCCh

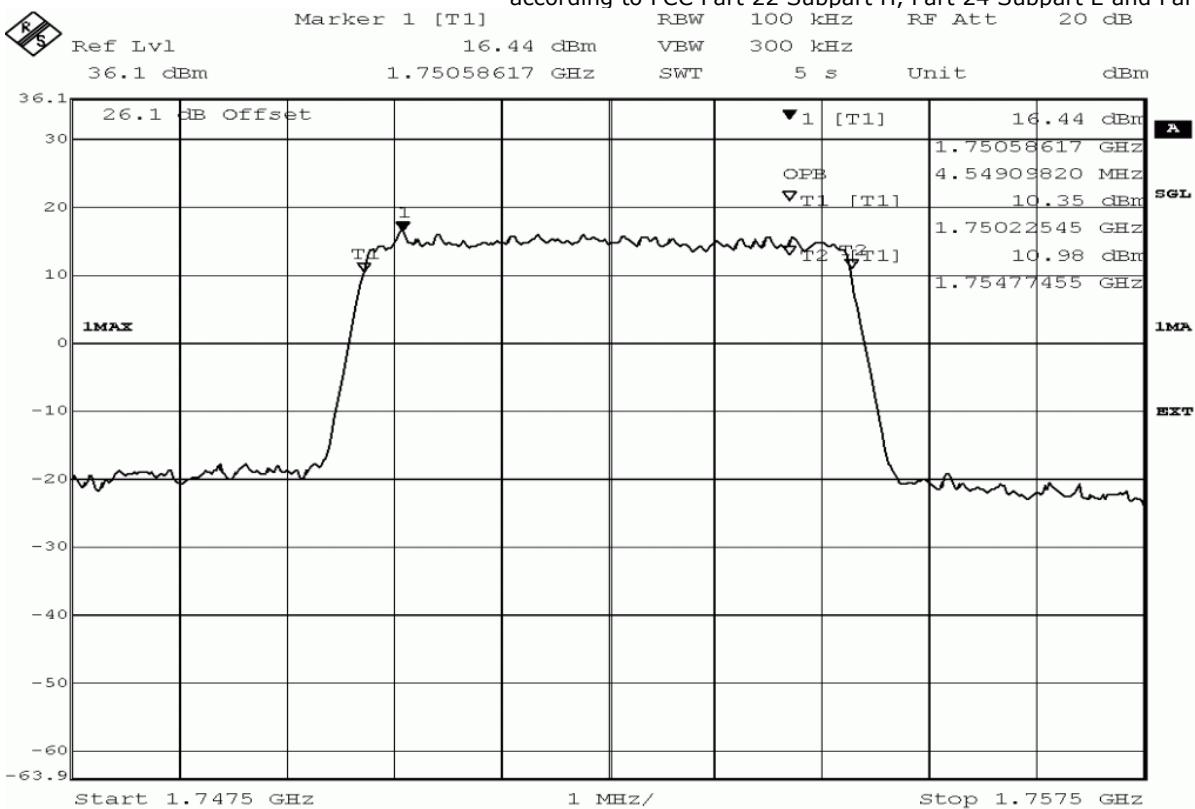
according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



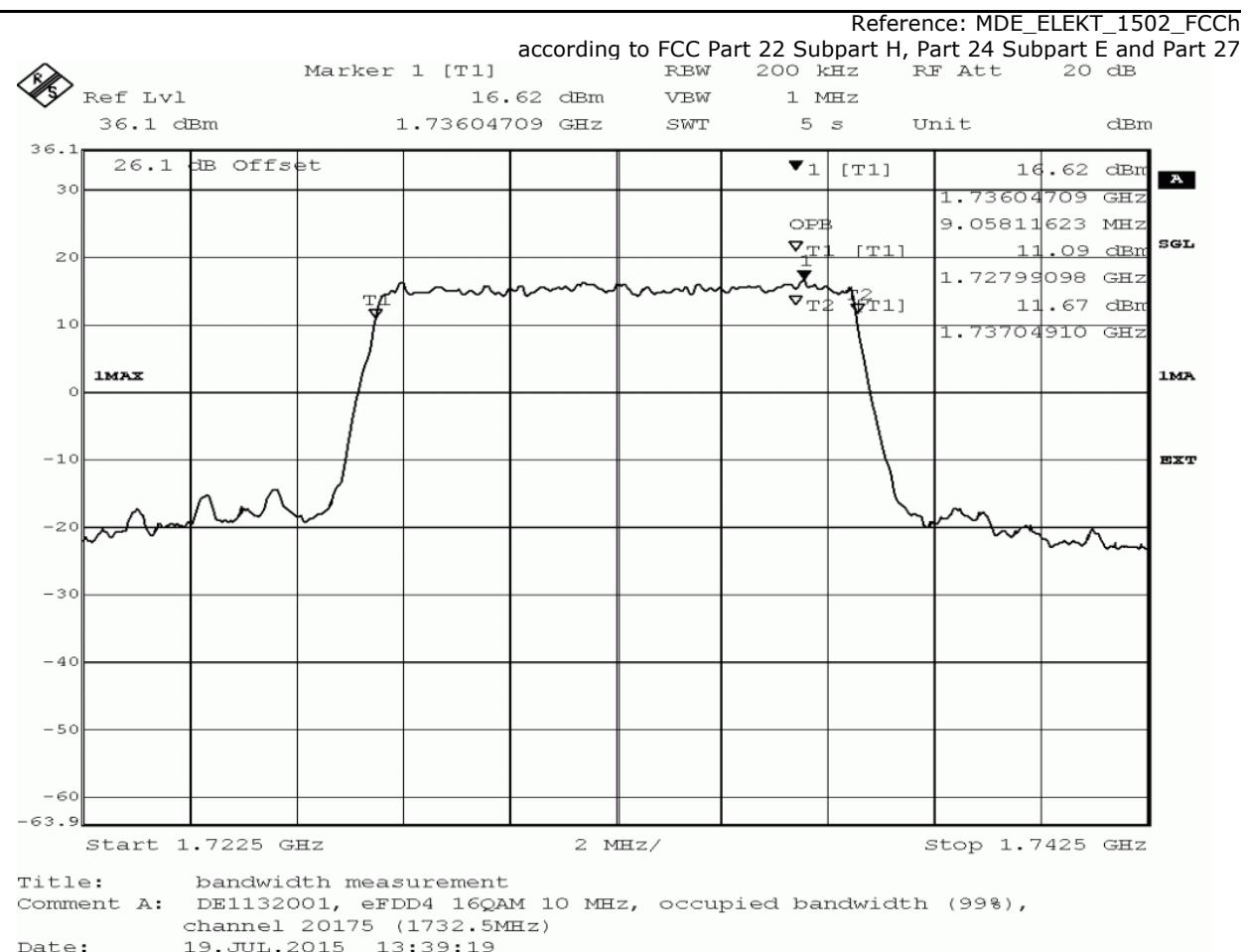
Title: bandwidth measurement  
 Comment A: DE1132001, eFDD4 16QAM 3 MHz, occupied bandwidth (99%),  
 channel 20385 (1753.5MHz)  
 Date: 19.JUL.2015 13:32:19

Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



Title: bandwidth measurement  
 Comment A: DE1132001, eFDD4 16QAM 5 MHz, occupied bandwidth (99%),  
 channel 20375 (1752.5MHz)  
 Date: 19.JUL.2015 14:13:59

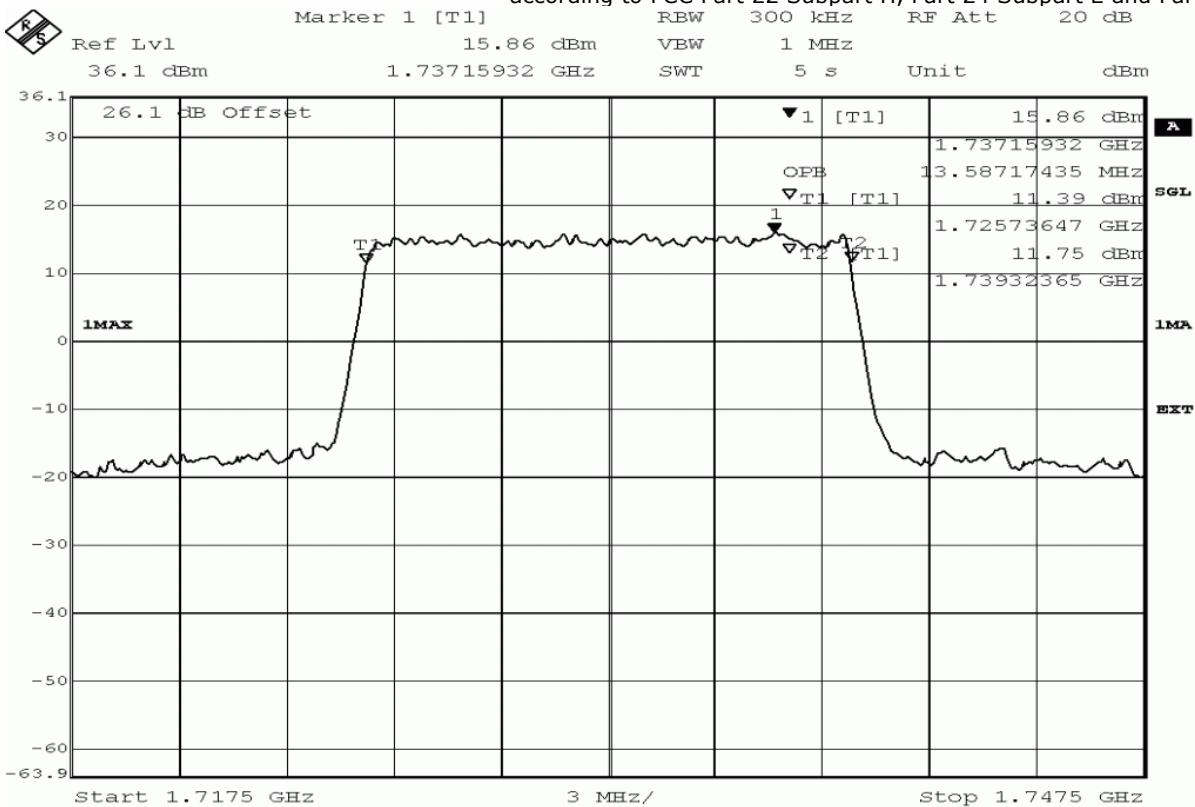




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Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



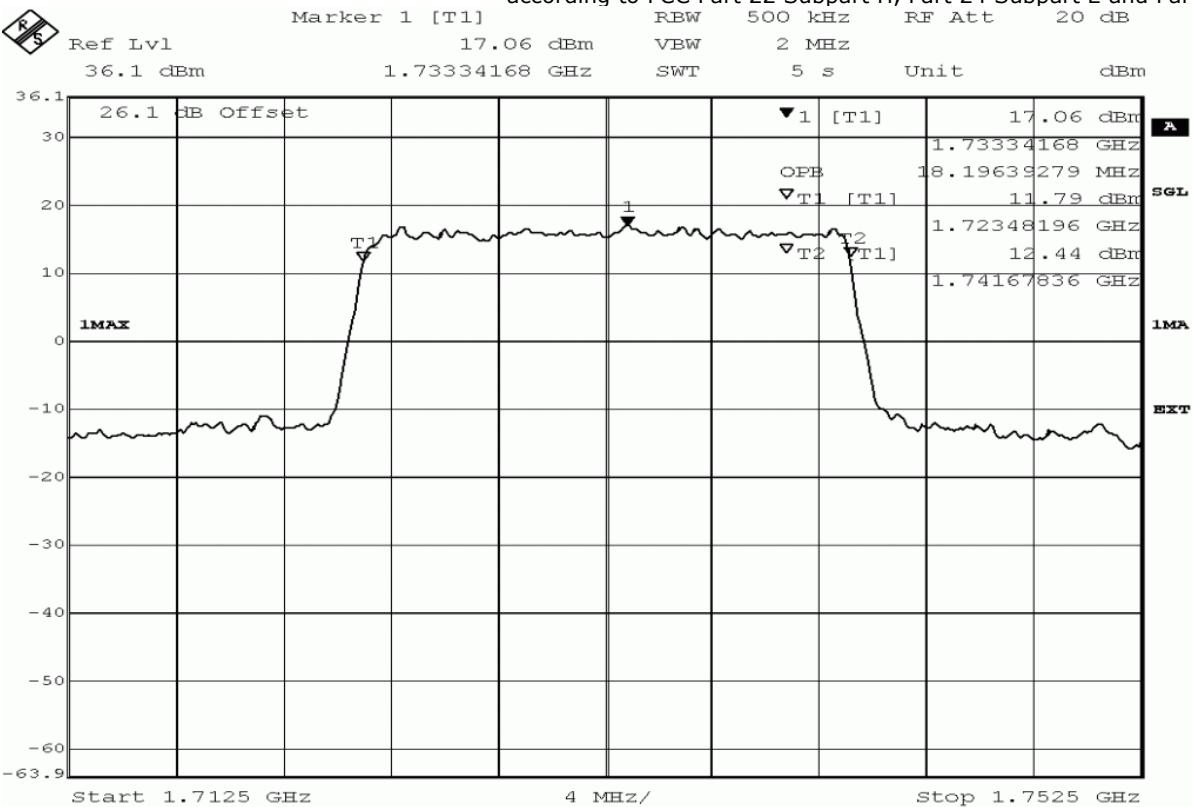
**Title:** bandwidth measurement  
**Comment A:** DE1132001, eFDD4 16QAM 15 MHz, occupied bandwidth (99%),  
channel 20175 (1732.5MHz)  
**Date:** 19.JUL.2015 13:41:56



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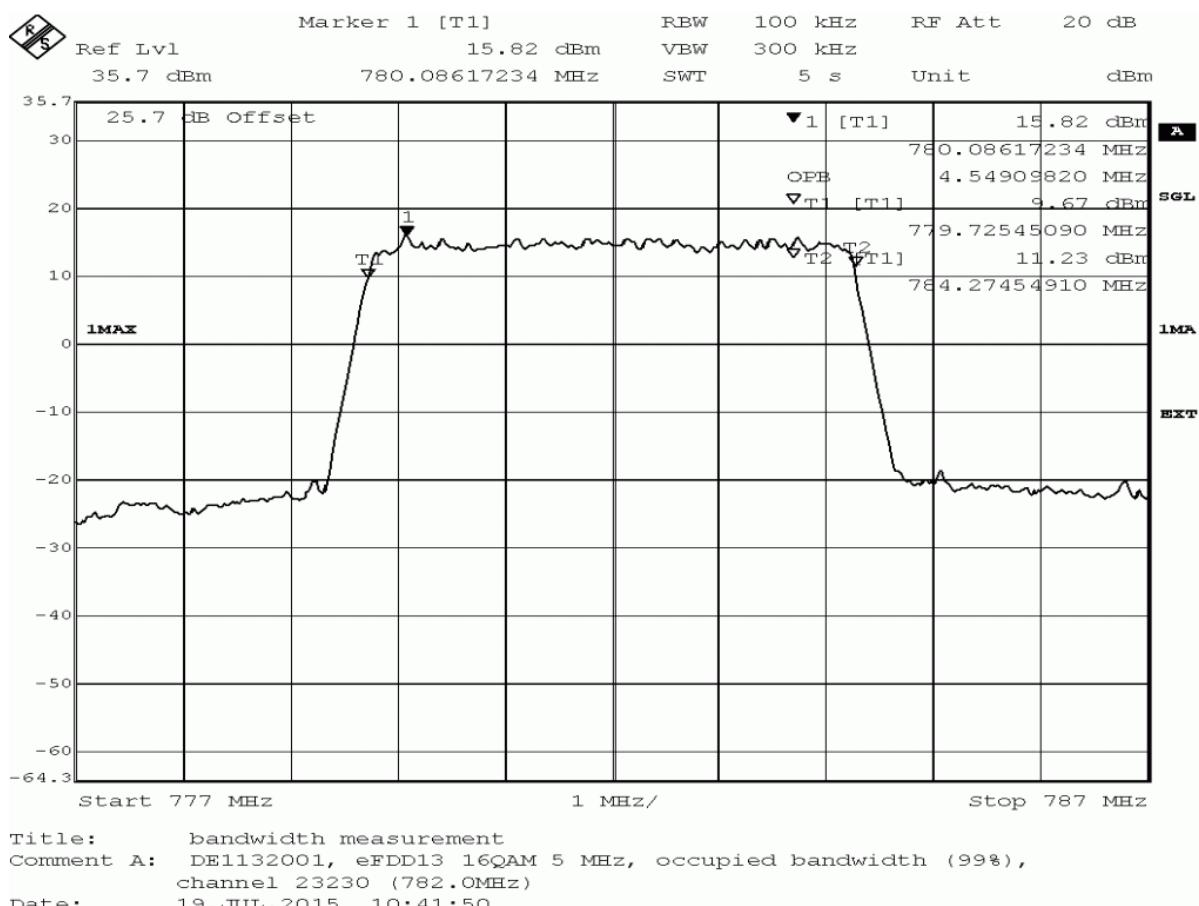
Reference: MDE\_ELEKT\_1502\_FCCh

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



**Title:** bandwidth measurement  
**Comment A:** DE1132001, eFDD4 16QAM 20 MHz, occupied bandwidth (99%),  
channel 20175 (1732.5MHz)  
**Date:** 19.JUL.2015 13:44:38

LTE Band 13							
Channel BW: 5MHz				Channel BW: 10 MHz			
Channel	Frequency (MHz)	99% BW (MHz)		Channel	Frequency (MHz)	99% BW (MHz)	
		QPSK	16QAM			QPSK	16QAM
23205	779.5	4.5	4.5	-	-	-	-
23230	782.0	4.5	4.5	23230	782.0	9.0	9.0
23255	784.5	4.5	4.5	-	-	-	-



**3.5.20 27.6 Band edge compliance §2.1053, §27.53****Test: 27.6: Band edge compliance summary §2.1053, §27.53**

*Result:* Passed

*Setup No.:* S01\_AE01

*Date of Test:* 2015/10/27 21:11

*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

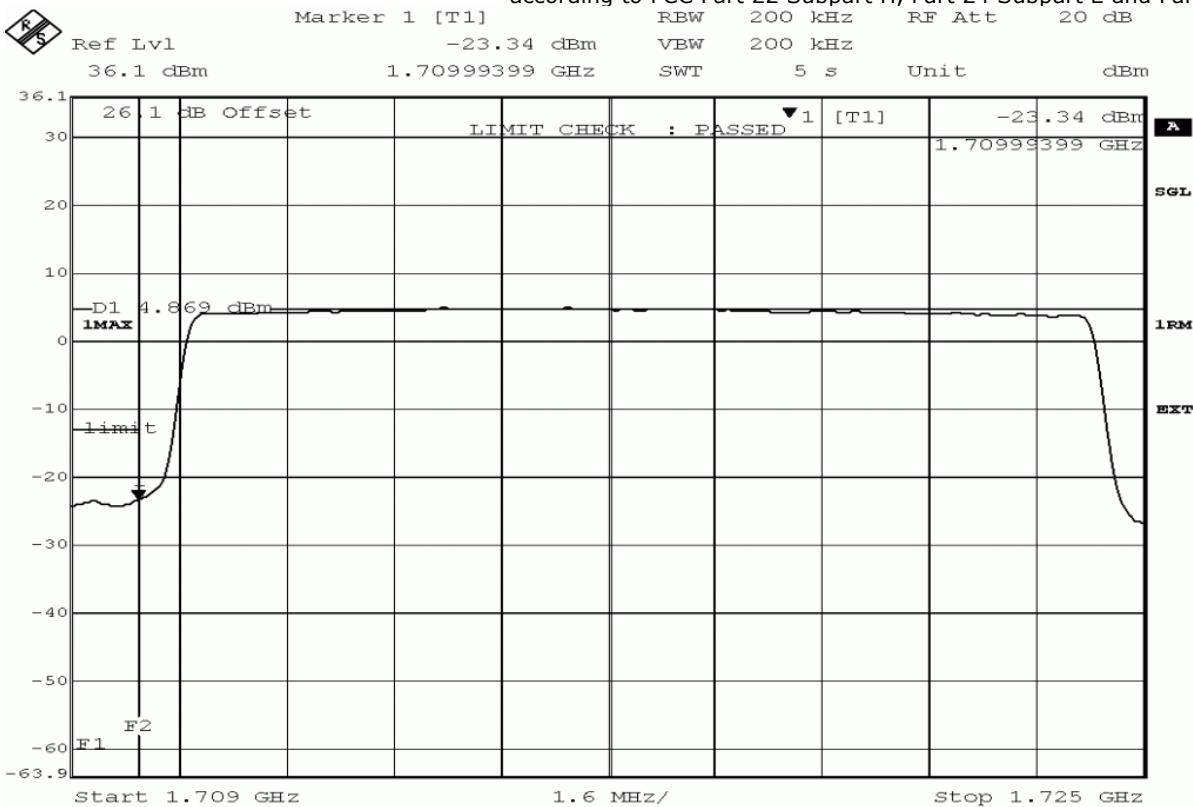
*Test Specification:* FCC part 2 and 27

**Detailed Results:**

<b>Band</b>	<b>Band width (MHz)</b>	<b>Modulation</b>	<b>Resource Blocks / Offset</b>	<b>Channel</b>	<b>Detector</b>	<b>Frequency (MHz)</b>	<b>Peak Value (dBm)</b>	<b>Limit (dBm)</b>	<b>Verdict</b>
eFDD4	1.4	QPSK	6 / 0	19957	Average	1710	-29.92	-13	Passed
					RMS		-28.58	-13	Passed
		16QAM	6 / Max	20393	Average	1755	-31.51	-13	Passed
					RMS		-29.64	-13	Passed
		QPSK	6 / 0	19957	Average	1710	-31.51	-13	Passed
					RMS		-30.22	-13	Passed
			6 / Max	20393	Average	1755	-31.51	-13	Passed
					RMS		-30.52	-13	Passed
	3	QPSK	15 / 0	19965	Average	1710	-30.22	-13	Passed
					RMS		-27.64	-13	Passed
			15 / Max	20385	Average	1755	-31.51	-13	Passed
					RMS		-29.36	-13	Passed
		16QAM	15 / 0	19965	Average	1710	-31.17	-13	Passed
					RMS		-28.58	-13	Passed
			15 / Max	20385	Average	1755	-31.86	-13	Passed
					RMS		-30.22	-13	Passed
	5	QPSK	25 / 0	19975	Average	1710	-30.84	-13	Passed
					RMS		-28.58	-13	Passed
			25 / Max	20375	Average	1755	-30.84	-13	Passed
					RMS		-28.84	-13	Passed
		16QAM	25 / 0	19975	Average	1710	-31.86	-13	Passed
					RMS		-29.36	-13	Passed
			25 / Max	20375	Average	1755	-31.51	-13	Passed
					RMS		-29.64	-13	Passed
	10	QPSK	50 / 0	20000	Average	1710	-28.1	-13	Passed
					RMS		-26.8	-13	Passed
			50 / Max	20350	Average	1755	-30.22	-13	Passed
					RMS		-28.84	-13	Passed
		16QAM	50 / 0	20000	Average	1710	-30.22	-13	Passed
					RMS		-28.84	-13	Passed
			50 / Max	20350	Average	1755	-30.84	-13	Passed
					RMS		-29.64	-13	Passed
	15	QPSK	75 / 0	20025	Average	1710	-24.35	-13	Passed
					RMS		-23.34	-13	Passed
			75 / Max	20325	Average	1755	-26.02	-13	Passed
					RMS		-24.5	-13	Passed
		16QAM	75 / 0	20025	Average	1710	-26.21	-13	Passed
					RMS		-25.15	-13	Passed
			75 / Max	20325	Average	1755	-26.8	-13	Passed
					RMS		-25.84	-13	Passed
	20	QPSK	100 / 0	20050	Average	1710	-26.4	-13	Passed
					RMS		-25.49	-13	Passed
			100 / Max	20300	Average	1755	-27.64	-13	Passed
					RMS		-26.8	-13	Passed
		16QAM	100 / 0	20050	Average	1710	-27.42	-13	Passed
					RMS		-26.4	-13	Passed
			100 / Max	20300	Average	1755	-27.87	-13	Passed
					RMS		-27	-13	Passed

Reference: MDE\_ELEKT\_1502\_FCCh

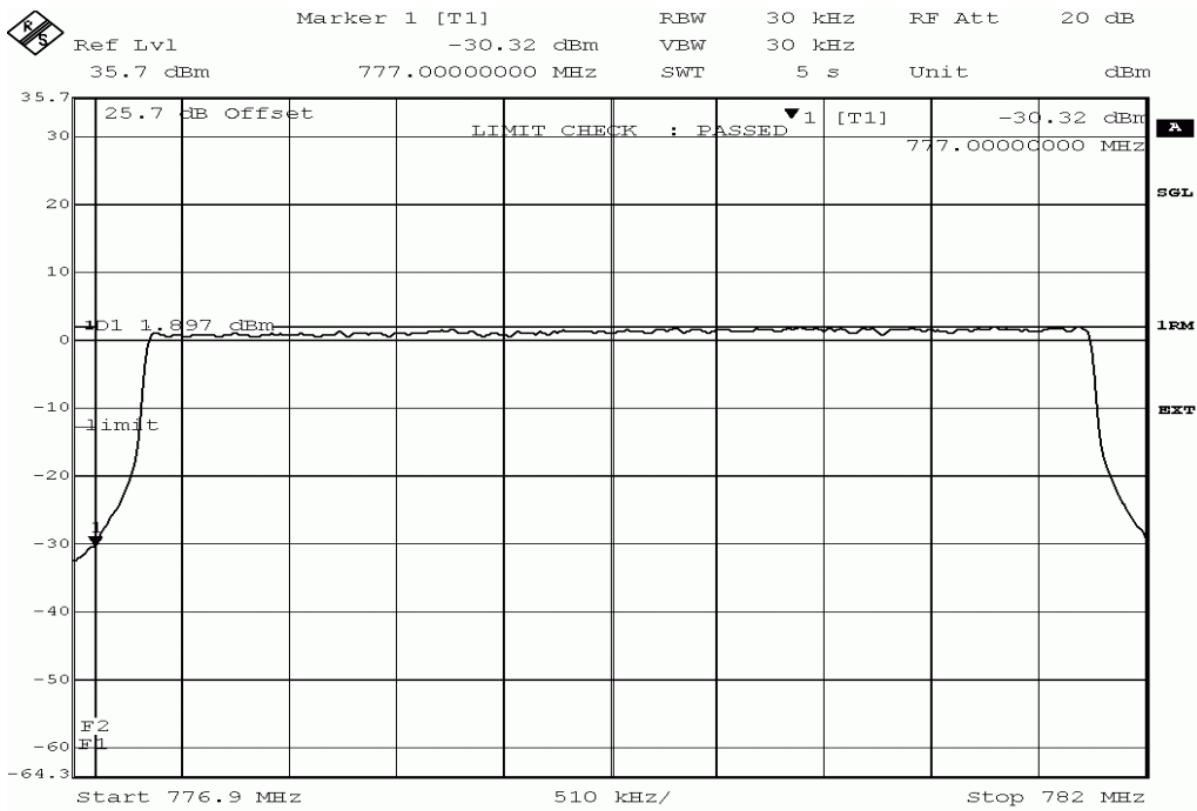
according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27



Title: band edge compliance measurement  
 Comment A: DE1132001, eFDD4 QPSK 15 MHz, band edge compliance,  
 channel 20025 (1717.5MHz)  
 Date: 19.JUL.2015 14:42:01

Reference: MDE\_ELEKT\_1502\_FCCh  
according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27

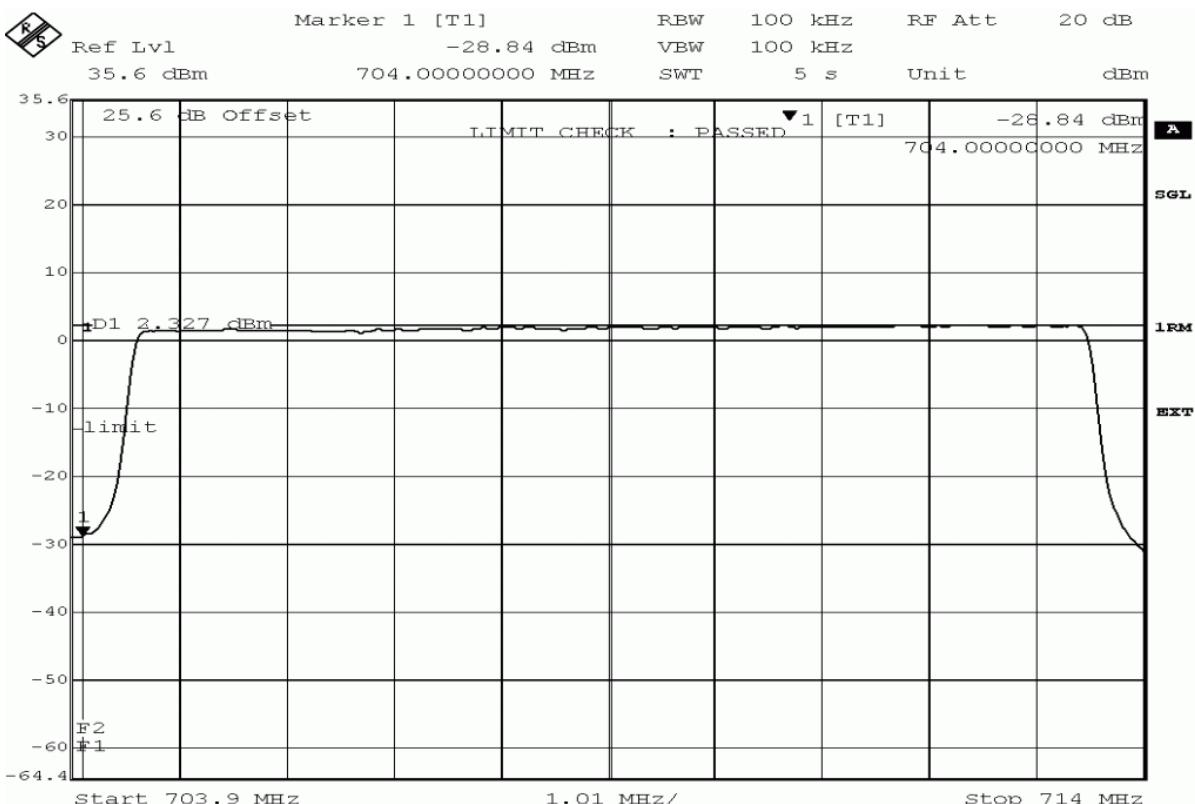
Band	Band width (MHz)	Modulation	Resource Blocks / Offset	Channel	Detector	Frequency (MHz)	Peak Value (dBm)	Limit (dBm)	Verdict
eFDD13	5	QPSK	25 / 0	23205	Average	777	-31.91	-13	Passed
					RMS		-30.32	-13	Passed
		16QAM	25 / Max	23255	Average	787	-32.26	-13	Passed
					RMS		-30.92	-13	Passed
		16QAM	25 / 0	23205	Average	777	-33.02	-13	Passed
					RMS		-31.24	-13	Passed
	10	QPSK	25 / Max	23255	Average	787	-33.02	-13	Passed
					RMS		-31.24	-13	Passed
		16QAM	50 / 0	23230	Average	777	-35.26	-13	Passed
					RMS		-33.84	-13	Passed
					Average	787	-36.94	-13	Passed
					RMS		-35.26	-13	Passed



Title: band edge compliance measurement  
 Comment A: DE1132001, eFDD13 QPSK 5 MHz, band edge compliance,  
 channel 23205 (779.5MHz)  
 Date: 19.JUL.2015 10:28:32

Reference: MDE\_ELEKT\_1502\_FCCb  
according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27

According to FCC Part 22 Subpart N, Part 21 Subpart E and Part 21 Subpart F									
Band	Band width (MHz)	Modulation	Resource Blocks / Offset	Channel	Detector	Frequency (MHz)	Peak Value (dBm)	Limit (dBm)	Verdict
eFDD17	5	QPSK	25 / 0	23755	Average	704	-33.52	-13	Passed
			RMS				-31.34	-13	Passed
		16QAM	25 / Max	23825	Average	716	-34.86	-13	Passed
			RMS				-33.12	-13	Passed
			25 / 0	23755	Average	704	-32.36	-13	Passed
			RMS				-29.6	-13	Passed
		16QAM	25 / Max	23825	Average	716	-33.52	-13	Passed
			RMS				-31.34	-13	Passed
	10	QPSK	50 / 0	23780	Average	704	-34.39	-13	Passed
			RMS				-32.73	-13	Passed
			50 / Max	23800	Average	716	-39.14	-13	Passed
			RMS				-37.69	-13	Passed
		16QAM	50 / 0	23780	Average	704	-30.72	-13	Passed
			RMS				-28.84	-13	Passed
			50 / Max	23800	Average	716	-34.39	-13	Passed
			RMS				-32.73	-13	Passed



Title: band edge compliance measurement  
Comment A: DE1132001, eFDD17 16QAM 10 MHz, band edge compliance,  
channel 23780 (709.0MHz)  
Date: 19.JUL.2015 11:48:21

**3.5.21 27.7 Peak-to-Average ratio §2.1046, §27.50****Test: 27.7: Peak-to-Average Ratio Summary §2.1046, §27.50**

*Result:* Passed

*Setup No.:* S01\_AE01

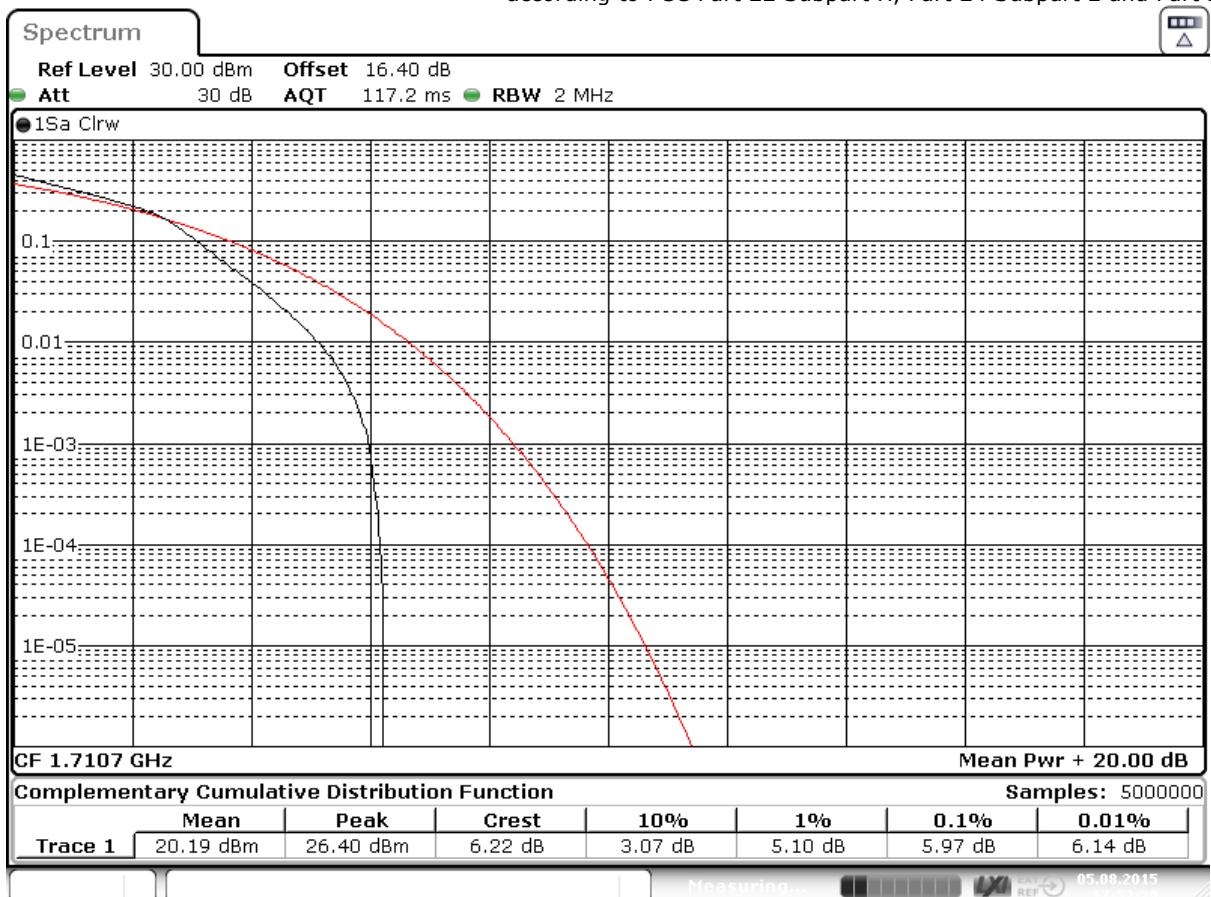
*Date of Test:* 2015/08/05 20:48

*Body:* FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV

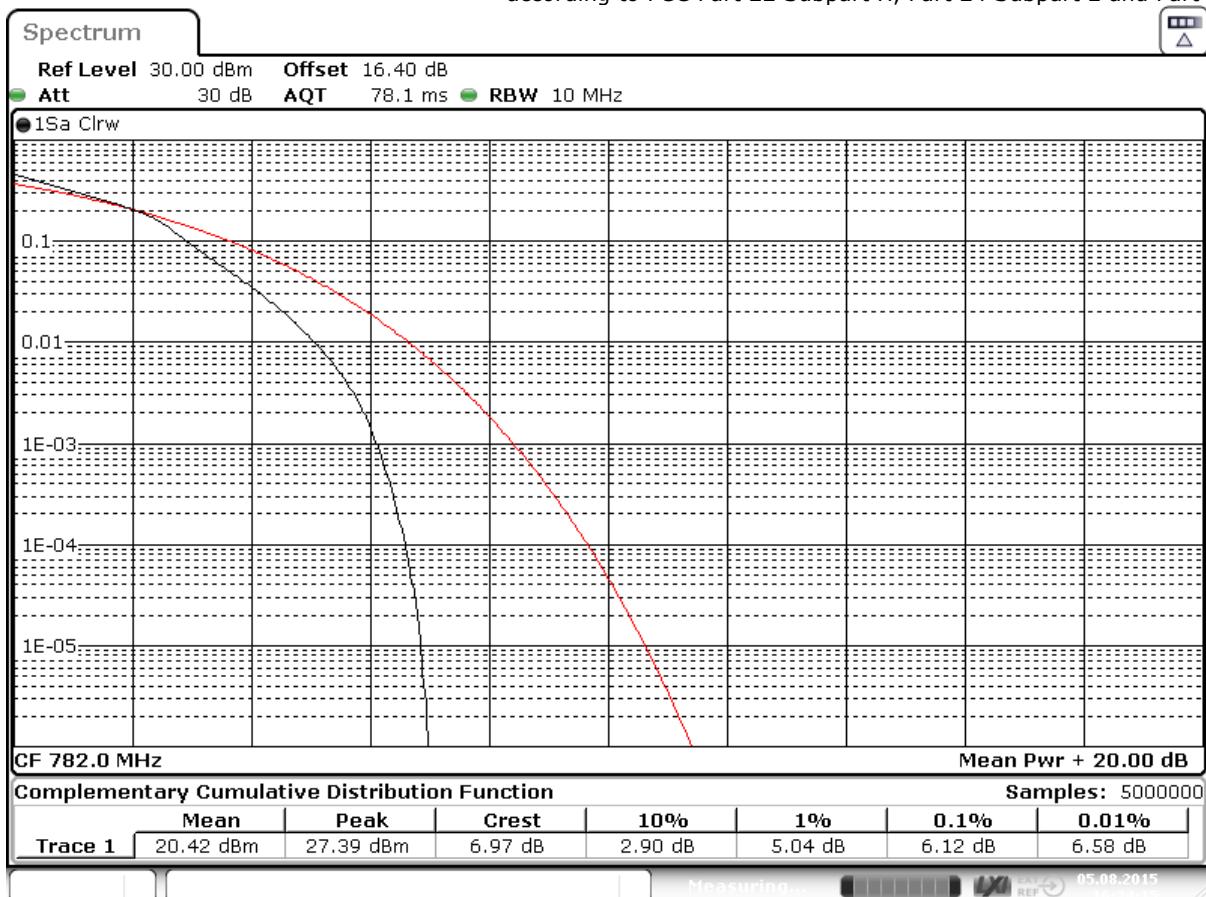
*Test Specification:* FCC part 2 and 27

**Detailed Results:**

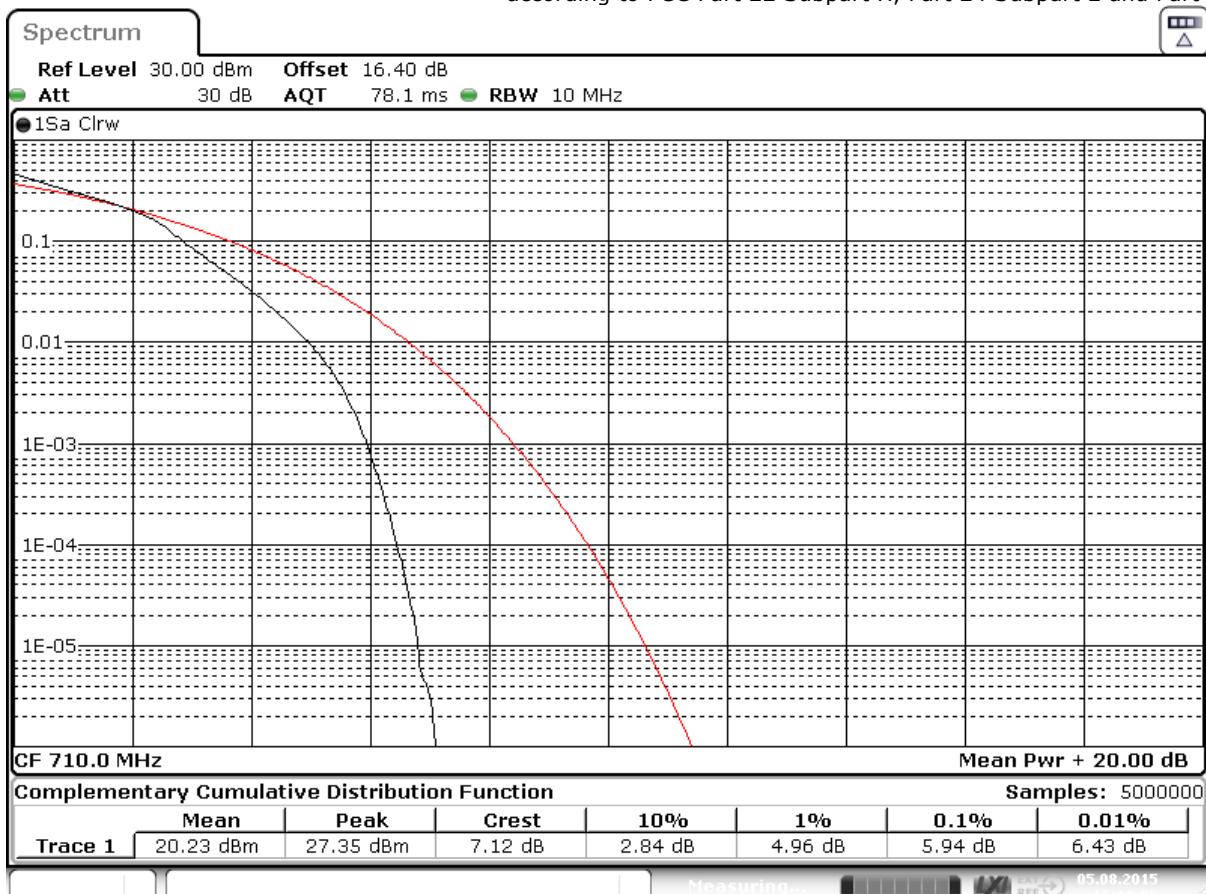
Band	Bandwidth / Resource Blocks	Channel	Modulation	Measured Value (dB)	Limit (dB)	Verdict
eFDD4	1.4 MHz / 6 RB	19957	QPSK	4.93	13	Passed
		20175		4.43	13	Passed
		20393		4.58	13	Passed
		19957	16-QAM	5.97	13	Passed
		20175		5.42	13	Passed
		20393		5.59	13	Passed
eFDD13	5 MHz / 25 RB	23205	QPSK	5.33	13	Passed
		23230		5.3	13	Passed
		23255		5.3	13	Passed
		23205	16-QAM	6.2	13	Passed
		23230		6.12	13	Passed
		23255		6.09	13	Passed
eFDD17	5 MHz / 25 RB	23755	QPSK	5.13	13	Passed
		23790		5.19	13	Passed
		23825		5.16	13	Passed
		23755	16-QAM	5.88	13	Passed
		23790		5.94	13	Passed
		23825		5.91	13	Passed



Date: 5 AUG 2015 17:52:30



Date: 5 AUG 2015 16:34:15



Date: 5 AUG 2015 16:19:56

## 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	Last Execution	Next Exec.
Manufacturer:	Frankonia		
Description:	Anechoic Chamber for radiated testing		
Type:	10.58x6.38x6.00 m <sup>3</sup>		
	<i>Calibration Details</i>		
	NSA (FCC)	2014/01/09	2017/01/09

#### Single Devices for Anechoic Chamber

Single Device Name	Type	Serial Number	Manufacturer
Air compressor	none	-	Atlas Copco
Anechoic Chamber	10.58 x 6.38 x 6.00 m <sup>3</sup>	none	Frankonia
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	FCC listing 96716 3m Part15/18		2014/01/09 2017/01/08
Controller Maturo	MCU	961208	Maturo GmbH
EMC camera	CE-CAM/1	-	CE-SYS
EMC camera Nr.2	CCD-400E	0005033	Mitsubishi
Filter ISDN	B84312-C110-E1		Siemens&Matsushita
Filter Universal 1A	BB4312-C30-H3	-	Siemens&Matsushita

**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	Schwarzbeck Mess-Elektronik OHG
Biconical dipole	VUBA 9117	9117-108	Schwarzbeck Mess-Elektronik OHG
Broadband Amplifier 1 GHz - 4 GHz	AFS4-01000400-1Q-10P-4	-	Miteq
Broadband Amplifier 18 GHz - 26 GHz	JS4-18002600-32-5P	849785	Miteq
Broadband Amplifier 30 MHz - 18 GHz	JS4-00101800-35-5P	896037	Miteq
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2+W38.01-2	Kabel Kusch
Cable "ESI to Horn Antenna"	SucoFlex	W18.02-2+W38.02-2	HUBER+SUHNER
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
			2012/06/26 2015/06/25
			2015/06/23 2018/06/22
Double-ridged horn	HF 907	102444	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
			2015/05/11 2018/05/10
Double-ridged horn-duplicated 2015-07-15 10:47:55	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
High Pass Filter	5HC3500/18000-1.2-KK	200035008	Trilithic
High Pass Filter	WHKX 7.0/18G-8SS	09	Wainwright
Horn Antenna Schwarzbeck 15-26.5 GHz BBHA 9170	BBHA 9170	BBHA9170262	Schwarzbeck Mess-Elektronik OHG
Log.-per. Antenna	HL 562 Ultralog	100609	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
			2012/12/18 2015/12/17
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 Exec.</i>
			2015/06/30 2018/06/29
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>

Reference: MDE\_ELEKT\_1502\_FCCh  
according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27

**Single Devices for Auxiliary Equipment for Radiated emissions (continued)**

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
	DKD Calibration		2014/11/27 2017/11/27
Standard Gain / Pyramidal Horn Antenna 26.5 GHz	3160-09	00083069	EMCO Elektronik GmbH
Standard Gain / Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5- 10kg/024/379070 9	Maturo GmbH

**Test Equipment Auxiliary Test Equipment**

**Lab ID:** **Lab 1, Lab 2**  
**Manufacturer:** see single devices  
**Description:** Single Devices for various Test Equipment  
**Type:** various  
**Serial Number:** none

**Single Devices for Auxiliary Test Equipment**

Single Device Name	Type	Serial Number	Manufacturer
AC Power Source	Chroma 6404	64040001304	Chroma ATE INC.
Broadband Power Divider N (Aux)	1506A / 93459	LM390	Weinschel Associates
Broadband Power Divider SMA	WA1515	A855	Weinschel Associates
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
Customized calibration		2013/12/04	2015/12/03
Digital Multimeter 13 (Clamp Meter)	Fluke 325	31270091WS	FLUKE
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	Pontis
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	Pontis
Isolating Transformer	LTS 604	1888	Thalheimer Transformatorenwerke GmbH
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright
Signal Analyzer	FSV30	103005	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
Standard		2014/02/10	2016/02/09
Spectrum Analyser	FSU26	200418	Rohde & Schwarz GmbH & Co.KG
<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
Standard calibration		2014/07/29	2015/07/28
Spectrum Analyzer	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>		<i>Last Execution</i>	<i>Next Exec.</i>
DKD calibration		2015/06/23	2018/06/22
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG

**Test Equipment Digital Signalling Devices**
**Lab ID:**
**Lab 1, Lab 2**
**Description:**

Signalling equipment for various wireless technologies.

**Single Devices for Digital Signalling Devices**

Single Device Name	Type	Serial Number	Manufacturer
Bluetooth Signalling Unit CBT	CBT	100589	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standart calibration		2015/01/21 2018/01/19
CMW500	CMW500	107500	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/01/27 2016/01/26
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	DKD calibration		2014/12/02 2017/12/01
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	Hardware:		2007/07/16
	B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04		
	Software:		
	K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22		
	Firmware:		
	$\mu$ P1 8v50 02.05.06		
	---		
Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	DKD calibration		2014/12/03 2017/12/02
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	HW options:		2007/01/02
	B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02		
	SW options:		
	K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10,		
	Firmware:		
	$\mu$ P1 8v40 01.12.05		
	---		
	SW:		2008/11/03
	K62, K69		
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**

Single Device Name	Type	Serial Number	Manufacturer
EMI Receiver / Spectrum Analyzer	ESR 7	101424	Rohde & Schwarz
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Initial Factory Calibration	2014/11/13	2016/11/12
Personal Computer	Dell	30304832059	Dell
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration	2015/05/11	2016/05/10
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration	2015/05/11	2016/05/10
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration	2014/06/24	2017/06/23
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration	2014/01/07	2016/01/31
	<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	Rohde & Schwarz
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Initial Factory Calibration	2014/11/17	2016/11/16

**Test Equipment Multimeter 03**

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

**Single Devices for Multimeter 03**

Single Device Name	Type	Serial Number	Manufacturer
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Customized calibration	2013/12/04	2015/12/03

**Test Equipment Radio Lab Test Equipment**

**Lab ID:** Lab 2  
**Description:** Radio Lab Test Equipment

**Single Devices for Radio Lab Test Equipment**

Single Device Name	Type	Serial Number	Manufacturer
Broadband Power Divider SMA	WA1515	A856	Weinschel Associates
Coax Attenuator 10dB 4T-10 SMA 2W		F9401	Weinschel Associates
Coax Attenuator 10dB 56-10 SMA 2W		W3702	Weinschel Associates
Coax Attenuator 10dB 56-10 SMA 2W		W3711	Weinschel Associates
Coax Cable Huber&Suhner	Sucotest 2,0m		Huber&Suhner
Coax Cable Rosenberger Micro Coax FA210A0010003030 SMA/SMA 1,0m	FA210A0010003030	54491-2	Rosenberger Micro-Coax
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2015/05/11 2016/05/10
RF Step Attenuator RSP	RSP	833695/001	Rohde & Schwarz GmbH & Co.KG
Rubidium Frequency Standard	Datum, Model: MFS	5489/001	Datum-Beverly
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/07/03 2015/06/24
	Standard calibration		2015/06/25 2016/06/24
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2015/05/11 2016/05/10
Signal Generator SME	SME03	827460/016	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/12/02 2017/12/01
Signal Generator SMP	SMP02	836402/008	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2013/05/06 2016/05/05
Spectrum Analyzer	FSIQ26	840061/005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Calibration after reparation		2015/04/02 2017/04/01

**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	Lufft Mess- und Regeltechnik GmbH
<i>Calibration Details</i>			
	Customized calibration	2015/02/27	2017/02/26

**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	Lufft Mess- und Regeltechnik GmbH
<i>Calibration Details</i>			
	Customized calibration	2015/02/27	2017/02/26

**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	Lufft Mess- und Regeltechnik GmbH
<i>Calibration Details</i>			
	Customized calibration	2015/03/10	2017/03/09

**Test Equipment Temperature Chamber 05**

**Lab ID:** **Lab 2**  
**Manufacturer:** see single devices  
**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	Vötsch
<i>Calibration Details</i>			
	Customized calibration	2014/03/11	2016/03/10

## **5      Annex**

### **5.1    Additional Information for Report**

## Summary of Test Results

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

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## Technical Report Summary

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### 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  
§ 2.1051 Measurement required: Spurious emissions at antenna terminals  
§ 2.1053 Measurement required: Field strength of spurious radiation  
§ 2.1055 Measurement required: Frequency stability  
§ 2.1057 Frequency spectrum to be investigated

#### Part 22, Subpart C – Operational and Technical Requirements

§ 22.355 Frequency tolerance

#### Part 22, Subpart H – Cellular Radiotelephone Service

§ 22.913 Effective radiated power limits

§ 22.917 Emission limitations for cellular equipment

### additional documents

ANSI TIA-603-C-2004

### Description of Methods of Measurements

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### RF Power Output

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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/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 TIA-603-C-2004 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.

§22.913 Effective radiated power limits

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

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**Emission and Occupied Bandwidth**

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**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.

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#### Spurious emissions at antenna terminals

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##### Standard    FCC Part 22, Subpart H

The test was performed according to FCC §2.1051

#### 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]:
  - a) [ $\geq 1\%$  of wanted signal bandwidth] in the Span of 1 MHz directly below and above the PCS-Band,
  - b) otherwise [100 kHz] (or [1 MHz] for accelerated sweep times)
  - c) [reduced resolution bandwidth] in case the curve of the analyser IF-Filter or the wanted EUT signal leads to an exceeding of the limit, in this case a correction factor was used
- Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
- 5) The spurious emissions peaks were measured in the frequency range from 9 kHz to 10 GHz (up to the 10th harmonic) during the call was established

#### Test Requirements / Limits

##### § 2.1051 Spurious emissions at antenna terminals

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in Sec. 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

##### § 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.  
Remark of the test laboratory: This is calculated to be -13 dBm.

(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.

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#### Field strength of spurious radiation

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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 TIA-603-C 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 dB $\mu$ 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 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.

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#### Frequency stability

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Standard    FCC Part 22, Subpart H

The test was performed according to FCC §2.1055

#### Test Description

- 1) The EUT was placed inside a temperature chamber.
- 2) The EUT was coupled to a Digital Communication Tester. Refer to chapter "Setup Drawings".
- 3) The climatic chamber was cycled down/up to a certain temperature, starting with the EUT minimum

temperature.

4) After the temperature was stabilized the EUT was switched on and a call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Output Power: Maximum
- Mid Channel

5) The frequency error of the EUT was recorded by using an internal measurement function of the Digital Communication Tester immediately after the call was established, five minutes after the call was established and ten minutes after the call was established.

6) This measurement procedure was performed for temperature variation from -30°C to +50°C in increments of 10°C, if not otherwise stated in the detailed results.

When the EUT did not operate at certain temperature levels, these measurements were left out.

#### Test Requirements / Limits

##### §2.1055 Measurements required: Frequency stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

##### §22.355 Frequency tolerance

...the carrier frequency of each transmitter in the Public Mobile Service must be maintained within the tolerances given in table C-1 of this section.

Table C-1.- Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency range (MHz)	Base, fixed (ppm)	Mobile up to 3 watts (ppm)	Mobile above 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929	5.0	n/a	n/a
929 to 960	1.5	n/a	n/a
2110 to 2220	10.0	n/a	n/aFor the mid channel (836.6 MHz) the frequency tolerance is 2.5 ppm (2091.5 Hz).

#### 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**

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

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**Technical Report Summary**

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**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  
§ 2.1051 Measurement required: Spurious emissions at antenna terminals  
§ 2.1053 Measurement required: Field strength of spurious radiation  
§ 2.1055 Measurement required: Frequency stability  
§ 2.1057 Frequency spectrum to be investigated

**Part 24, Subpart E - Broadband PCS**

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

**additional documents**

ANSI TIA-603-C-2004

**Description of Methods of Measurements**

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**RF Power Output**

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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 lamda/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 TIA-603-C-2004 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.

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#### Emission and Occupied Bandwidth

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#### 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:

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27  
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.

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## Spurious emissions at antenna terminals

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### Standard: FCC Part 24, Subpart E

The test was performed according to FCC §2.1051

## 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]:
  - a) [>=1% of wanted signal bandwidth] in the Span of 1 MHz directly below and above the Band,
  - b) otherwise [1 MHz]
  - c) [reduced resolution bandwidth] in case the curve of the analyser IF-Filter or the wanted EUT signal leads to an exceeding of the limit, in this case a correction factor was used
- Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
- 5) The spurious emissions peaks were measured in the frequency range from 9 kHz to 20 GHz (up to the 10th harmonic) during the call was established

## Test Requirements / Limits

### § 2.1051 Spurious emissions at antenna terminals

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in Sec. 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

### § 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

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27 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.

Remark of the test laboratory: This is calculated to be -13 dBm.

(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.

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#### Field strength of spurious radiation

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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 TIA-603-C 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 $\mu$ 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.

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**Frequency stability**

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**Standard: FCC Part 24, Subpart E**

The test was performed according to FCC §2.1055

**Test Description**

- 1) The EUT was placed inside a temperature chamber.

- 2) The EUT was coupled to a Digital Communication Tester. Refer to chapter "Setup Drawings".
- 3) The climatic chamber was cycled down/up to a certain temperature, starting with the EUT minimum temperature.
- 4) After the temperature was stabilized the EUT was switched on and a call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Output Power: Maximum
- Mid Channel

5) The frequency error of the EUT was recorded by using an internal measurement function of the Digital Communication Tester immediately after the call was established, five minutes after the call was established and ten minutes after the call was established.

6) This measurement procedure was performed for temperature variation from -30°C to +50°C in increments of 10°C, if not otherwise stated in the detailed results.

When the EUT did not operate at certain temperature levels, these measurements were left out.

#### Test Requirements / Limits

##### §2.1055 Measurements required: Frequency stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

- (1) From -30° to +50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

##### §24.235 Frequency stability

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

7Layers interpretation of limit:

To ensure that the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block following limit was used:

+/- 2.5 ppm = 4700 Hz for a frequency of 1880.0 MHz

in accordance with FCC Part 22, Subpart H, §22.355, table C-1: Frequency tolerance for the carrier frequency of mobile transmitters in the Public Mobile Service in the frequency range 821 to 896 MHz.

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#### Band edge compliance

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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".

## Summary of Test Results

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

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## Technical Report Summary

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## 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  
§ 2.1051 Measurement required: Spurious emissions at antenna terminals  
§ 2.1053 Measurement required: Field strength of spurious radiation  
§ 2.1055 Measurement required: Frequency stability  
§ 2.1057 Frequency spectrum to be investigated

## Part 27, Subpart C—Technical Standards

§ 27.50 Power and antenna height limits  
§ 27.53 Emissions limits  
§ 27.54 Frequency stability

## additional documents

ANSI TIA-603-C-2004

## Description of Methods of Measurements

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## RF Power Output

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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 lamda/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 TIA-603-C-2004 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.

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#### Emission and Occupied Bandwidth

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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.

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### Spurious emissions at antenna terminals

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#### Standard FCC Part 27, Subpart C

The test was performed according to FCC §2.1051

## 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]:
  - a) [ $>=1\%$  of wanted signal bandwidth] in the Span of 1 MHz directly below and above the Band,
  - b) otherwise [1 MHz]
- c) [reduced resolution bandwidth] in case the curve of the analyser IF-Filter or the wanted EUT signal leads to an exceeding of the limit, in this case a correction factor was used
- Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth

- 5) The spurious emissions peaks were measured in the frequency range from 9 kHz to 18 GHz (up to the 10th harmonic) during the call is established

## Test Requirements / Limits

### § 2.1051 Spurious emissions at antenna terminals

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in Sec. 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

### § 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

(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  $43 + 10 \log_{10}(P)$  dB.

Remark of the test laboratory: This is calculated to be -13 dBm.

(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.

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#### Field strength of spurious radiation

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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 TIA-603-C 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

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27 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

(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  $43 + 10 \log_{10}(P)$  dB.

Remark of the test laboratory: This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dB $\mu$ V/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.

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#### Frequency stability

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Standard    FCC Part 27, Subpart C

The test was performed according to FCC §2.1055

#### Test Description

- 1) The EUT was placed inside a temperature chamber.
- 2) The EUT was coupled to a Digital Communication Tester. Refer to chapter "Setup Drawings".
- 3) The climatic chamber was cycled down/up to a certain temperature, starting with the EUT minimum temperature.
- 4) After the temperature was stabilized the EUT was switched on and a call was established on a Traffic Channel between the EUT and the Digital Communication Tester.

Important Settings:

- Output Power: Maximum
- Mid Channel

5) The frequency error of the EUT was recorded by using an internal measurement function of the Digital Communication Tester immediately after the call was established, five minutes after the call was established and ten minutes after the call was established.

6) This measurement procedure was performed for temperature variation from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  in increments of  $10^{\circ}\text{C}$ , if not otherwise stated in the detailed results.

When the EUT did not operate at certain temperature levels, these measurements were left out.

#### Test Requirements / Limits

##### §2.1055 Measurements required: Frequency stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From  $-30^{\circ}$  to  $+50^{\circ}$  centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than  $10^{\circ}$  centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

##### §27.54 Frequency stability

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

7Layers interpretation of limit:

To ensure that the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block following limit was used:

$\pm 2.5 \text{ ppm} = 4350 \text{ Hz}$  for channel 1450, frequency  $1740.0 \text{ MHz}$   
 $\pm 2.5 \text{ ppm} = 4331 \text{ Hz}$  for channel 1412, frequency  $1732.4 \text{ MHz}$

in accordance with FCC Part 22, Subpart H, §22.355, table C-1: Frequency tolerance for the carrier frequency of mobile transmitters in the Public Mobile Service in the frequency range 821 to 896 MHz.

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#### Band edge compliance

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#### 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

**Test Requirements / Limits****§ 27.53 Effective radiated power limits**

Refer to chapter "Field strength of spurious radiation".

## Subtests HSDPA

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c/\beta_d$	$\beta_{HS}$ (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

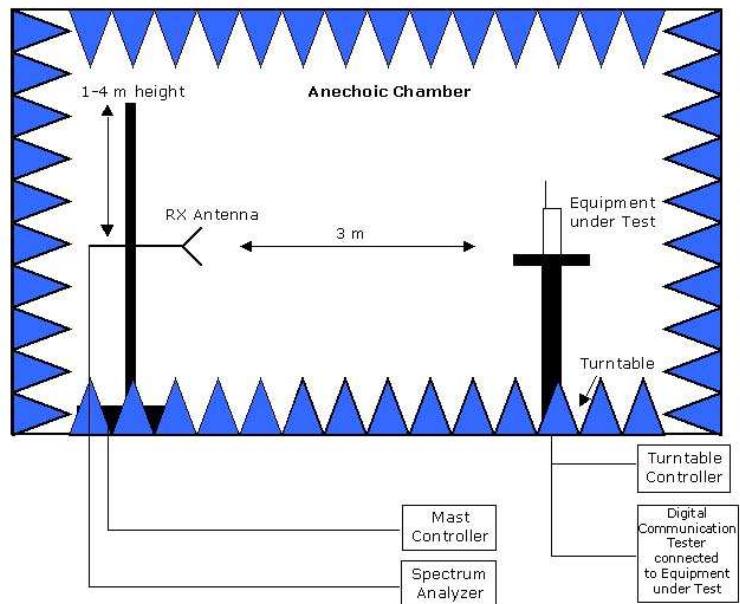
Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 30/15$  with  $\beta_{hs} = 30/15 * \beta_c$ .  
 Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA,  $\Delta_{ACK}$  and  $\Delta_{NACK} = 30/15$  with  $\beta_{hs} = 30/15 * \beta_c$ , and  $\Delta_{CQI} = 24/15$  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  $\beta_c/\beta_d$  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

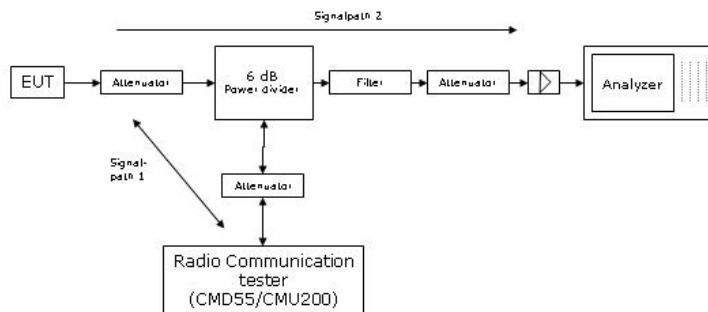
Subtest	Max UL Data Rate (kb/s)	$\beta_c/\beta_d$	$\beta_{hs}$	$\beta_{ed}$	CM
1	242.1	11/15	22/15	1309/225	1
2	161.3	6/15	12/15	94/75	3
3	524.7	15/9	30/15	47/15	2
4	197.6	2/15	4/15	56/75	3
5	299.6	15/15	30/15	134/15	1

## Setup Drawings



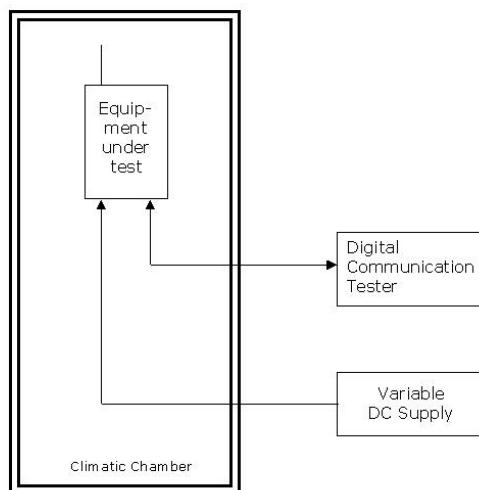
Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

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

## Measurement Uncertainties

**FCC Part 22, 24, 27, 90**
**IC RSS-132, RSS-133, RSS-139**

<b>Test Case</b>	<b>Parameter</b>	<b>Uncertainty</b>
RF Power Output	Power	± 2.2 dB
Frequency Stability	Frequency	± 25 Hz
Spurious Emissions at antenna terminal	Power	± 2.2 dB
Field strength of spurious radiation	Power	± 4.5 dB
Emission and Occupied Bandwidth	Power Frequency	± 2.9 dB GSM: ± 10.6 kHz UMTS, LTE: ± 120.0 kHz
Band Edge Compliance	Power Frequency	± 2.9 dB GSM: ± 14.6 kHz UMTS, LTE: ± 68.0 kHz

**FCC Part 15b**
**IC ICES-003**

<b>Test Case</b>	<b>Parameter</b>	<b>Uncertainty</b>
AC Power Line	Power	± 3.4 dB
Field Strength of spurious radiation	Power+	± 5.5 dB

**FCC Part 15c, 15e**
**IC RSS-210, IC RSS-247**

<b>Test Case</b>	<b>Parameter</b>	<b>Uncertainty</b>
AC Power Line	Power	± 3.4 dB
Field Strength of spurious radiation	Power	± 5.5 dB
6 dB / 26 dB / 99% Bandwidth	Power Frequency	± 2.9 dB ± 11.2 kHz
Conducted Output Power		± 2.2 dB
Spurious Emissions at antenna terminal	Power	± 2.2 dB
Band Edge Compliance	Power Frequency	± 2.2 dB ± 11.2 kHz
Frequency Stability	Frequency	± 25 Hz
Power Spectral Density	Power	± 2.2 dB

**Correlation of measurement requirements for Cellular Equipment from FCC and IC**

Test name – FCC	FCC reference CFR47				Test name – IC	IC reference			
	Part 2	Part 22	Part 24	Part 27		RSS-Gen	RSS-132 SRSP-503	RSS-133 SRSP-510	RSS-139 SRSP-513
						Issue:	4, 2014	3, 2013	6, 2013
RF power output	§ 2.1046	§ 22.913	§ 24.232	§ 27.50	Transmitter output power	6.12	5.4	6.4	6.4
Frequency stability	§ 2.1055	§ 22.355	§ 24.235	§ 27.54	Frequency stability	6.11	5.3	6.3	6.3
Spurious emissions at antenna terminals	§ 2.1051	§ 22.917	§ 24.238	§ 27.53	Transmitter unwanted emissions conducted	6.13	5.5	6.5	6.5
-	-	-	-	-	Receiver unwanted emissions conducted	5/7 *), 7.1.3	5.6	6.6	6.6
Field strength of spurious radiation	§ 2.1053	§ 22.917	§ 24.238	§ 27.53	Transmitter unwanted emissions radiated	6.13	5.5	6.5	6.5
-	-	-	-	-	Receiver unwanted emissions radiated	5/7 *), 7.1.2	5.6	6.6	6.6
Emission and Occupied Bandwidth	§ 2.1049	-	-	-	Emission and Occupied Bandwidth	6.6	5.5	2.3; 6.5	2.3; 6.5
Band edge compliance	§ 2.1053	§ 22.917	§ 24.238	§ 27.53	Band edge compliance	6.13	5.5	6.5	6.5

\*) Receivers are exempted from certification besides if operating in stand-alone mode in the frequency range 30–960 MHz or if these are scanner receivers.

## 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	2
1.5	Signature of the Accreditation Responsible	3
2	Test Object Data	3
2.1	General OUT Description	3
2.2	Detailed Description of OUT Samples	4
2.3	OUT Features	5
2.4	Setups used for Testing	6
3	Results	6
3.1	General	6
3.2	List of the Applicable Body	7
3.3	List of Test Specification	7
3.4	Summary	8
3.5	Detailed Results	11
3.5.1	22.1 RF Power Output §2.1046, §22.913	11
3.5.2	22.2 Frequency stability §2.1055	14
3.5.3	22.3 Spurious emissions at antenna terminals §2.1051, §22.917	15
3.5.4	22.4 Field strength of spurious radiation §2.1053, §22.917	16
3.5.5	22.5 Emission and Occupied Bandwidth §2.1049, §22.917	20
3.5.6	22.6 Band edge compliance §2.1053, §22.917	25
3.5.7	22.7 Peak-to-Average Ratio Summary §2.1046	28
3.5.8	24.1 RF Power Output §2.1046, §24.232	30
3.5.9	24.2 Frequency stability §2.1055, §24.235	34
3.5.10	24.3 Spurious emissions at antenna terminals §2.1051, §24.238	35
3.5.11	24.4 Field strength of spurious radiation §2.1053, §24.238	36

according to FCC Part 22 Subpart H, Part 24 Subpart E and Part 27	27
3.5.12 24.5 Emission and Occupied Bandwidth §2.1049, §24.238	39
3.5.13 24.6 Band edge compliance §2.1053, §24.238	47
3.5.14 24.7 Peak-to-Average ratio §2.1046, §24.232	50
3.5.15 27.1 RF Power Output §2.1046, §27.250	52
3.5.16 27.2 Frequency stability §2.1055, §27.54	60
3.5.17 27.3 Spurious emissions at antenna terminals §2.1051, §27.53	63
3.5.18 27.4 Field strength of spurious radiation §2.1053, §27.53	65
3.5.19 27.5 Emission and Occupied Bandwidth §2.1049	74
3.5.20 27.6 Band edge compliance §2.1053, §27.53	86
3.5.21 27.7 Peak-to-Average ratio §2.1046, §27.50	91
<b>4 Test Equipment Details</b>	<b>96</b>
4.1 List of Used Test Equipment	96
<b>5 Annex</b>	<b>104</b>
5.1 Additional Information for Report	104
<b>6 Index</b>	<b>131</b>