

InterLab®

Final Report on

SARA-N410-02B NB-IoT Module

FCC ID: XPY2AGQN4NNN

IC: 8595A-2AGQN4NNN

Report Reference: MDE_UBLOX_1818_FCCa

Date: June 05, 2018

According to:

<i>Designation</i>	<i>Description</i>
FCC47CFRChI PART22 PUBLIC MOBILE SERVICES	Part 22, Subpart H - Cellular Radiotelephone Service
FCC47CFRChI PART24 PERSONAL COMMUNICATIONS SERVICES	Part 24, Subpart E - Broadband PCS
FCC47CFRChI PART27 MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	Part 27, Subpart C - Technical Standards

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.

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Managing Directors:
Frank Spiller
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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: Patrick Lomax
Date Of Test Report: 2018/06/05
Date of first test: 2018/05/11
Date of last test: 2018/05/15

1.2 Applicant Data

Company Name: u-blox AG
Street: Zürcherstrasse 68,
 CH-8800 Thalwil
Country: Switzerland
Contact Person: Mr. Giulio Comar
Function: Certification Manager
Department: Cellular Product Certification
Phone: +41 44 722 7462
Fax: +41 44 722 7447
E-Mail: giulio.comar@u-blox.com

1.3 Test Laboratory Data

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

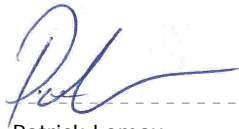
7 layers DE

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

Laboratory Details

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

1.4 Signature of the Testing Responsible



Patrick Lomax
responsible for tests performed in: Lab 1, Lab 2

1.5 Signature of the Accreditation Responsible



Accreditation scope responsible person
responsible for Lab 1, Lab 2



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

2 Test Object Data

2.1 General OUT Description

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

OUT: SARA-N410-02B

Type / Model / Family: SARA-N410-02B NB-IoT Module
FCC ID: XPY2AGQN4NNN
IC: 8595A-2AGQN4NNN

Manufacturer:
Company Name: see applicant data
Contact Person: see applicant data

Parameter List:

Parameter name	Value
AC Power Supply	120V / 60Hz (V)
DC Power Supply	12V via AC/DC Adapter (V)
LTE_Operating Frequencies	See Annex

2.2 Detailed Description of OUT Samples

Sample : AB01

OUT Identifier	SARA-N410-02B
Sample Description	RF Sample
Serial No.	357404090011357
HW Status	306BA0
SW Status	L0.0.00.00.07.01

2.3 Auxiliary Equipment

AE No.	Type Designation	Serial No.	HW Status	SW Status	Description
AE AE01	EVB-WL3		NO_EVK_CS_19 1A00		Evaluation test board
AE AE02	UUX324-1215	H05-0345103			AC/DC converter

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
ab01	(ab01)			
	Sample: AB01	RF Sample	AE AE01	Evaluation test board
			AE AE02	AC/DC converter

3 Results

3.1 General

Documentation of tested devices:

Available at the test laboratory.

Interpretation of the test results:

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

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

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

Note:

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

2. The SARA-N410-02B module is a NB-IoT module This report is related only to the NB-IoT bands 2, 4, 5, 12 and 13.

3. The SARA-N410-02B is based on the SARA-R410M-02B (FCC ID: XPY2AGQN4NNN, IC: 8595A-2AGQN4NNN) which has already been certified. The SARA-R410-02B additionally has LTE CATM1 mode enabled.

The SARA-N410-02B has LTE CATM1 disabled via a SW fuse only. As such, this is only a partial test report to show that the disabling of the CAT M1 mode as not degraded the performance of the module pursuant to a Class 2 permissive change.

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

<i>Test Specification:</i>	FCC part 2 and 22
<i>Version</i>	10-1-15 Edition
<i>Title:</i>	PART 2 - GENERAL RULES AND REGULATIONS PART 22 - PUBLIC MOBILE SERVICES
<i>Test Specification:</i>	FCC part 2 and 24
<i>Date / Version</i>	2015/10/01 Version: 10-1-15 Edition
<i>Title:</i>	PART 2 - GENERAL RULES AND REGULATIONS PART 24 - PERSONAL COMMUNICATIONS SERVICES
<i>Test Specification:</i>	FCC part 2 and 27
<i>Version</i>	10-1-13 Edition
<i>Title:</i>	PART 2 - GENERAL RULES AND REGULATIONS PART 27 - MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

3.4 Summary

<i>Test Case Identifier / Name</i> <i>Test (condition)</i>	<i>Result</i>	<i>Date of Test</i>	<i>Lab</i> <i>Ref.</i>	<i>Setup</i>
Test Specification: FCC part 2 and 22				
22.1 RF Power Output §2.1046, §22.913				
22.1; RF Power Output Summary §2.1046, §22.913	Passed	2018/05/14	Lab 2	ab01
22.4 Field strength of spurious radiation §2.1053, §22.917				
22.4; Field strength of spurious radiation Summary §2.1053, §22.917	Passed	2018/05/11	Lab 1	ab01
Test Specification: FCC part 2 and 24				
24.1 RF Power Output §2.1046, §24.232				
24.1; RF Power Output Summary §2.1046, §24.232	Passed	2018/05/15	Lab 2	ab01
24.4 Field strength of spurious radiation §2.1053, §24.238				
24.4; Field strength of spurious radiation Summary §2.1053, §24.238	Passed	2018/05/11	Lab 1	ab01
Test Specification: FCC part 2 and 27				
27.1 RF Power Output §2.1046, §27.250				
27.1; RF Power Output Summary §2.1046, §27.250	Passed	2018/05/15	Lab 2	ab01
27.4 Field strength of spurious radiation §2.1053, §27.53				
27.4; Field strength of spurious radiation Summary §2.1053, §27.53	Passed	2018/05/11	Lab 1	ab01

3.5 Detailed Results

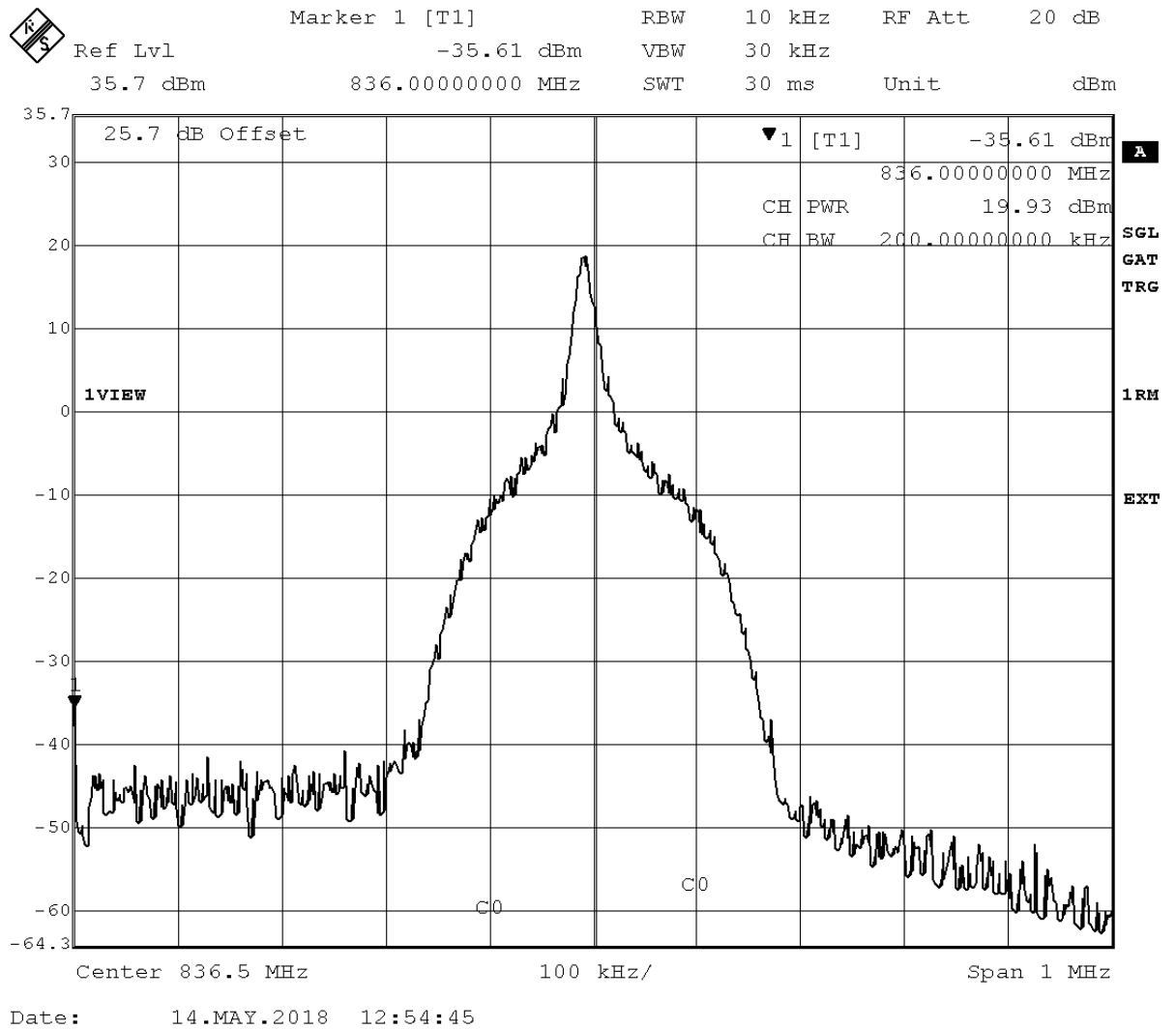
3.5.1 22.1 RF Power Output §2.1046, §22.913

Test: 22.1; _RF Power Output Summary §2.1046, §22.913

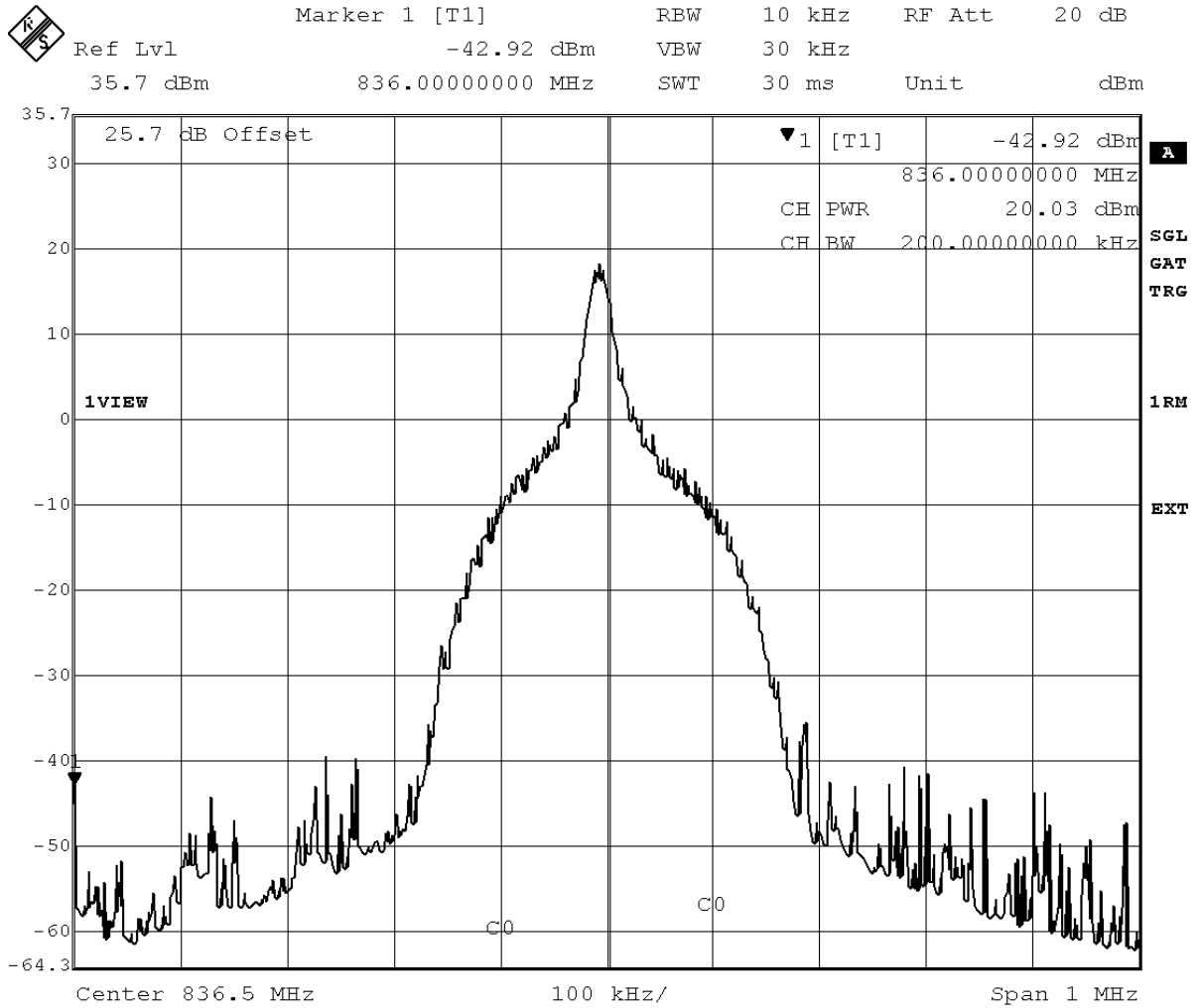
<i>Result:</i>	Passed
<i>Setup No.:</i>	ab01
<i>Date of Test:</i>	2018/05/14 12:29
<i>Body:</i>	FCC47CFRChIPART22PUBLIC MOBILE SERVICES
<i>Test Specification:</i>	FCC part 2 and 22

Detailed Results:

Radio Technology	Reference Test Frequencies	Channel	Sub-carrier	Parent product highest power Cond	N410 RMS Conducted Power (dBm)	FCC EIRP Limit (W)	IC EIRP Limit (W)	Maximum Antenna Gain (dBi)	Maximum Antenna Gain IC (dBi)
NB-IoT eFDD 5 QPSK	Standalone	20525	12	20.29	20.41	11.48	11.5	20.19	9.59
NB-IoT eFDD 5 QPSK	Standalone	20525	6	21.26	21.21	11.48	11.5	19.39	8.79
NB-IoT eFDD 5 QPSK	Standalone	20525	3	21.75	22.22	11.48	11.5	18.38	7.78
NB-IoT eFDD 5 QPSK	Standalone	20525	1	21.31	20.03	11.48	11.5	20.57	9.97
NB-IoT eFDD 5 BPSK	Standalone	20525	1	21.73	19.93	11.48	11.5	20.67	10.07

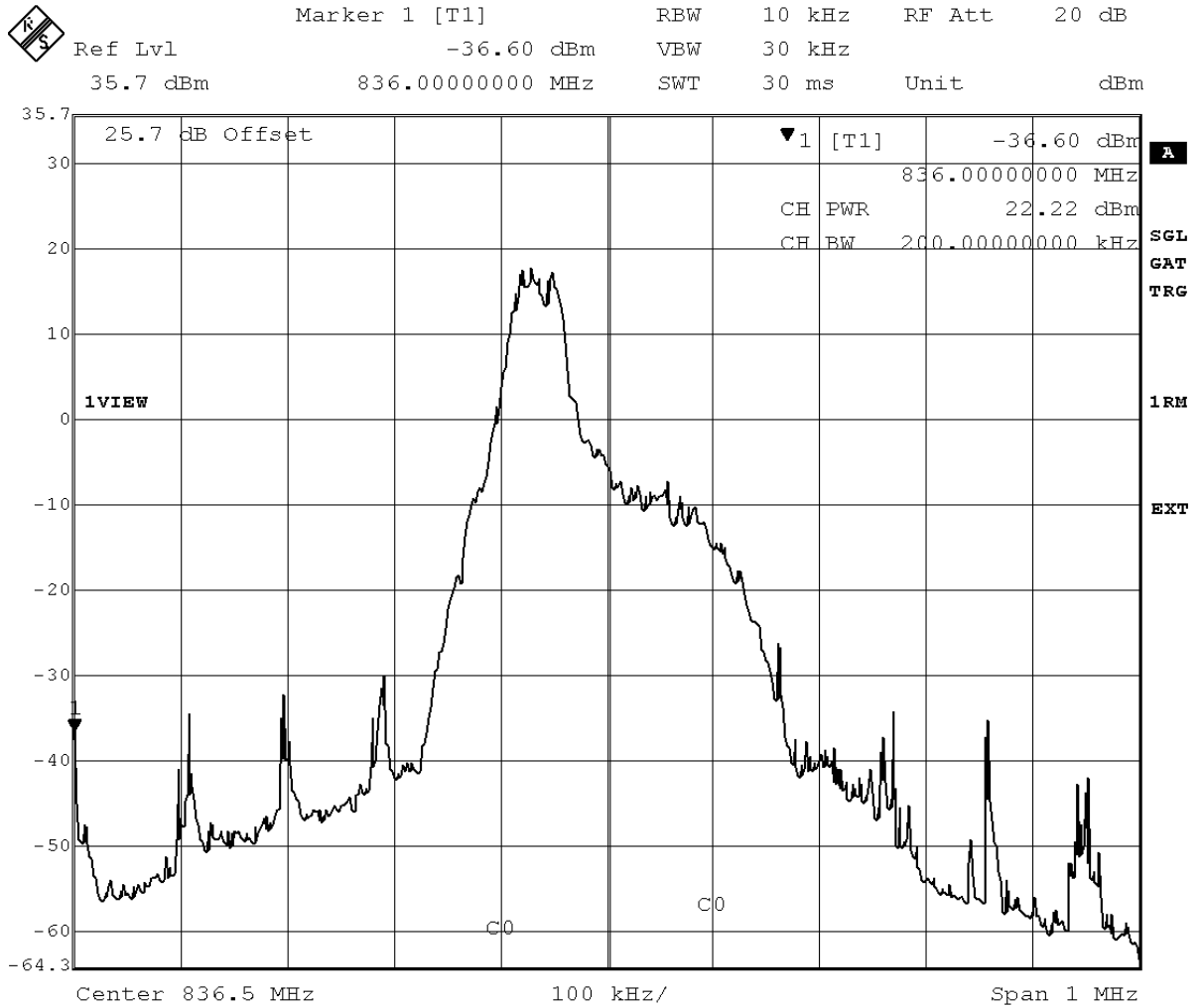


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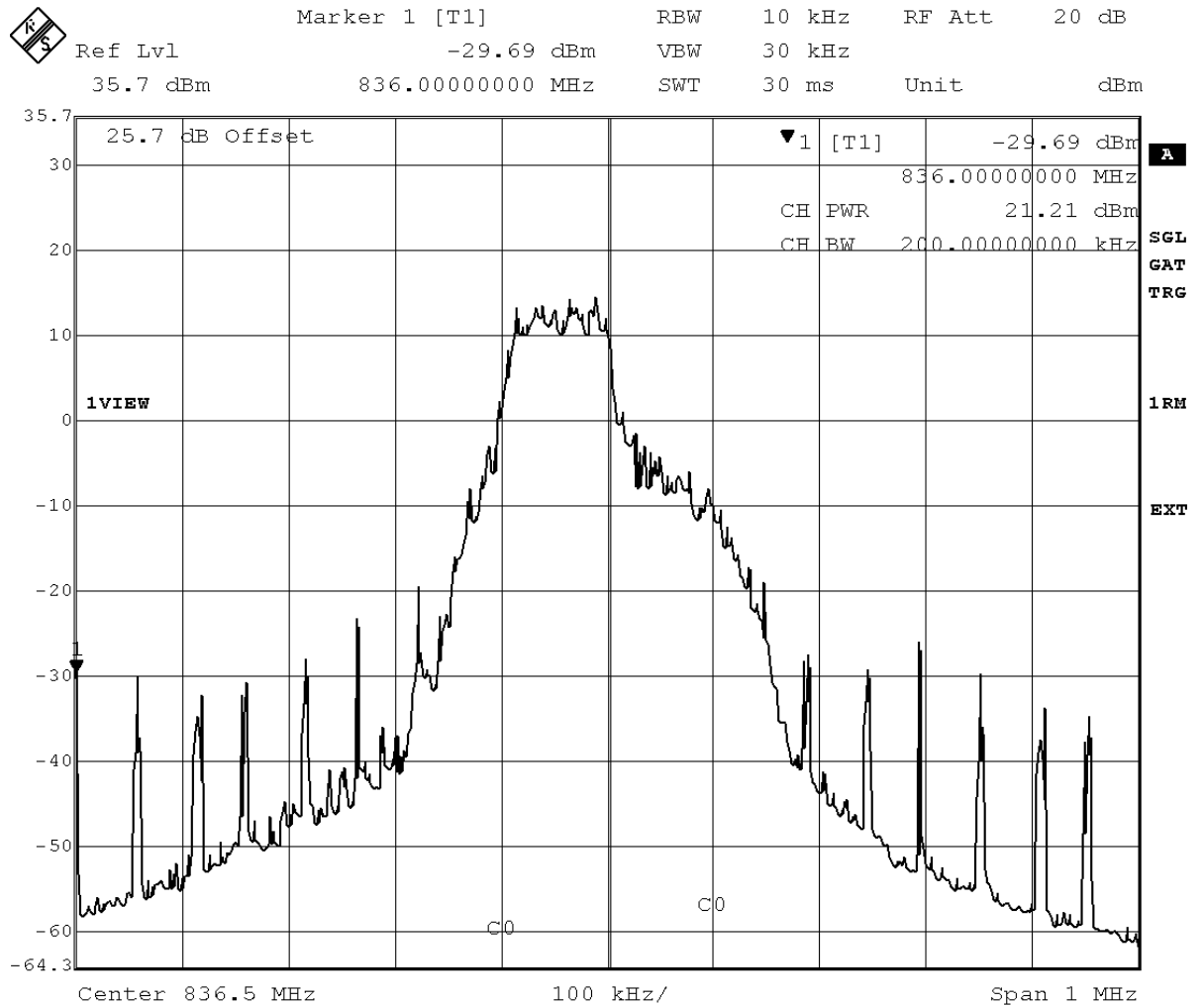


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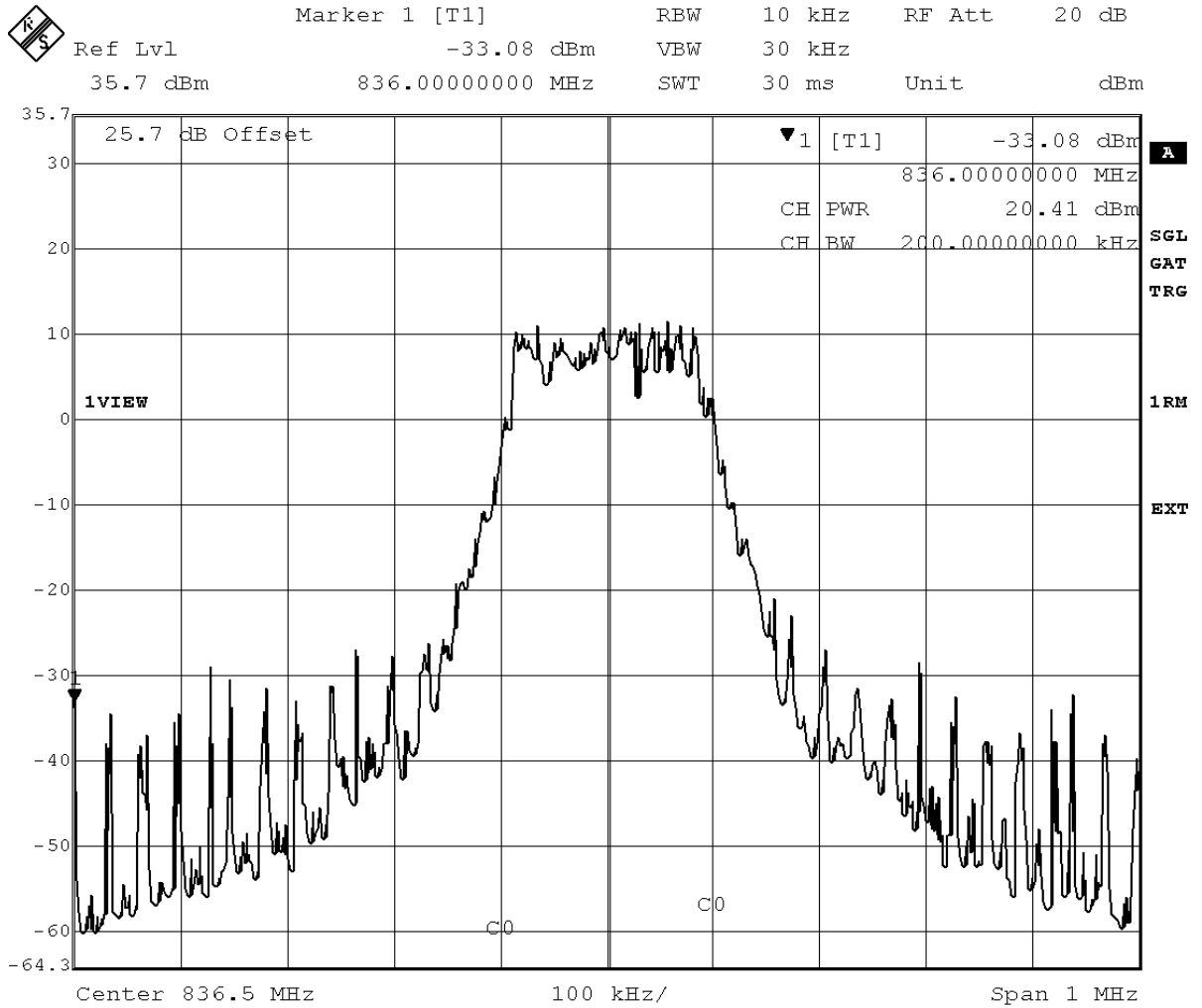


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Date: 14.MAY.2018 12:51:42

Reference: MDE_UBLOX_1818_FCCa



Date: 14.MAY.2018 12:50:32

3.5.2 22.4 Field strength of spurious radiation §2.1053, §22.917

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

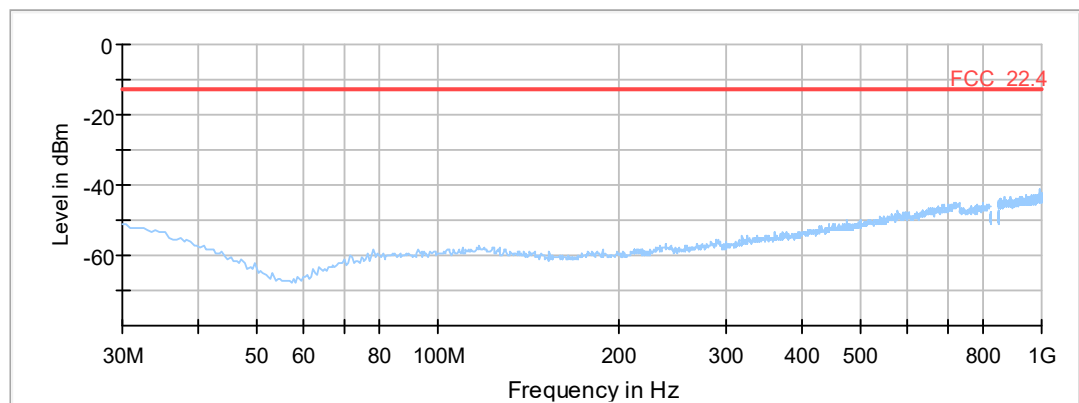
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<i>Setup No.:</i>	ab01
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<i>Body:</i>	FCC47CFRChIPART22PUBLIC MOBILE SERVICES
<i>Test Specification:</i>	FCC part 2 and 22

Detailed Results:

Test Report

Common Information

Test Description:
Test Standard
Operating Conditions:
Operator Name:
Comment:



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
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EMI Auto Test Template: FCC22_30M-1G_eFDD5_5MHz_CH20525

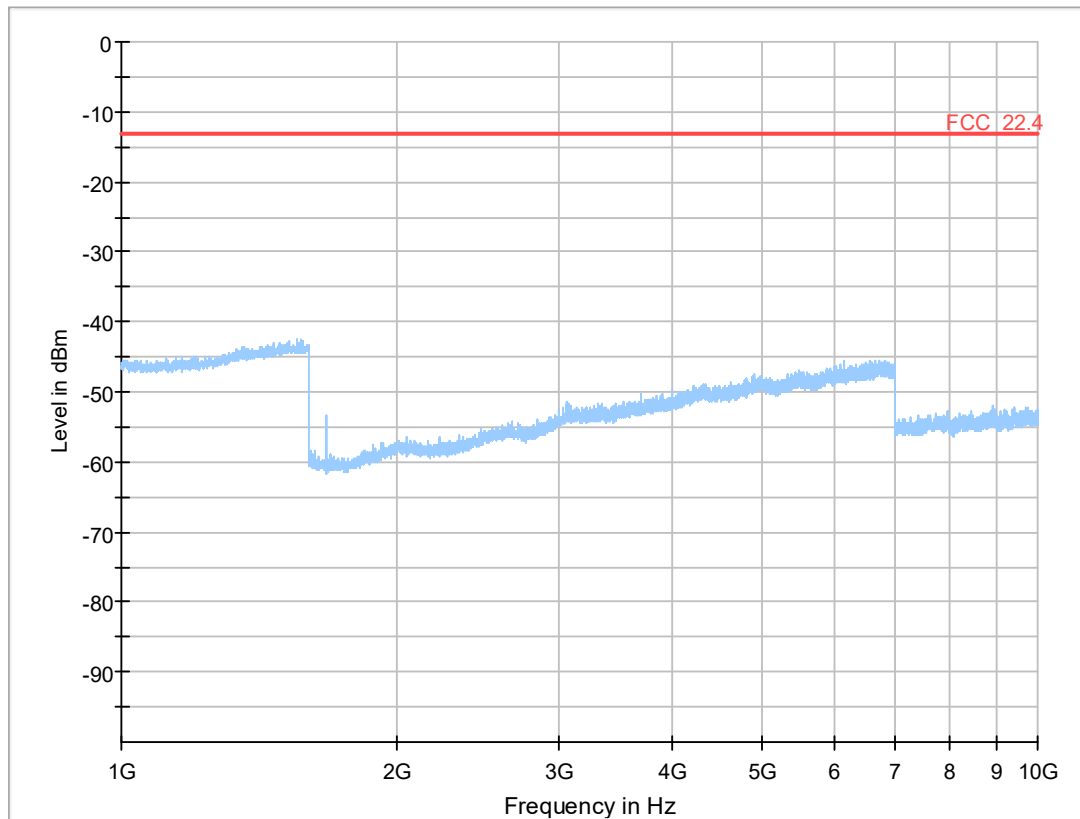
Hardware Setup: FCC_30M-1G_ERP
Measurement Type: Open-Area-Test-Site
Frequency Range: 30 MHz - 1 GHz
Graphics Level Range: -80 dBm - 0 dBm

Preview Measurements:
Sweep Test Template: FCC22.4_LTE_eFDD5_5MHz_20525_PRE

Adjustment:
Template for Single Meas.: FCC22_eFDD5_Adjustment

Final Measurements:
Template for Single Meas.: FCC22_eFDD5_Final

TCH 20525 eFDD5



Critical Freqs

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

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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TCH 20525 eFDD5

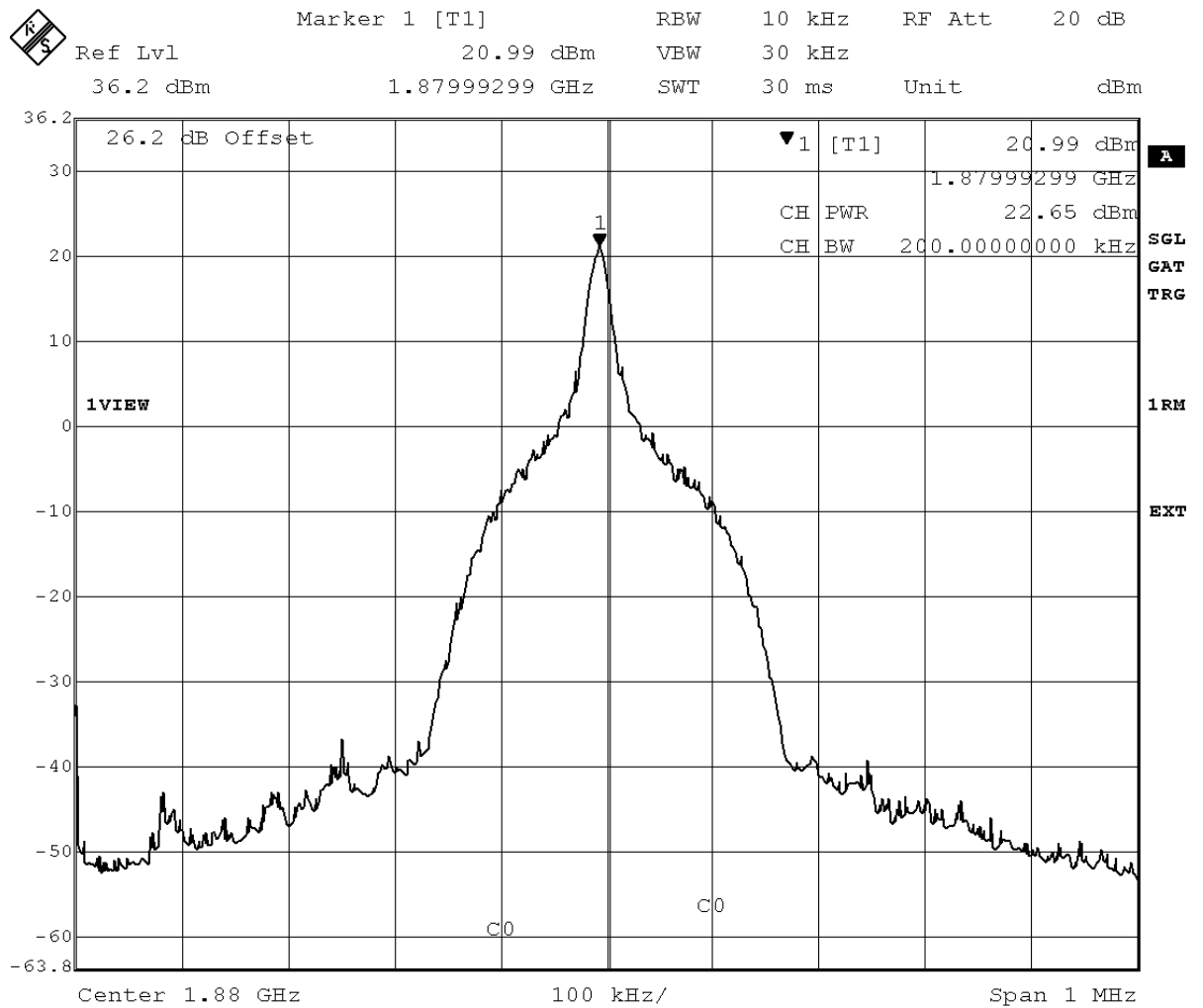
3.5.3 24.1 RF Power Output §2.1046, §24.232

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

<i>Result:</i>	Passed
<i>Setup No.:</i>	ab01
<i>Date of Test:</i>	2018/05/15 12:33
<i>Body:</i>	FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
<i>Test Specification:</i>	FCC part 2 and 24

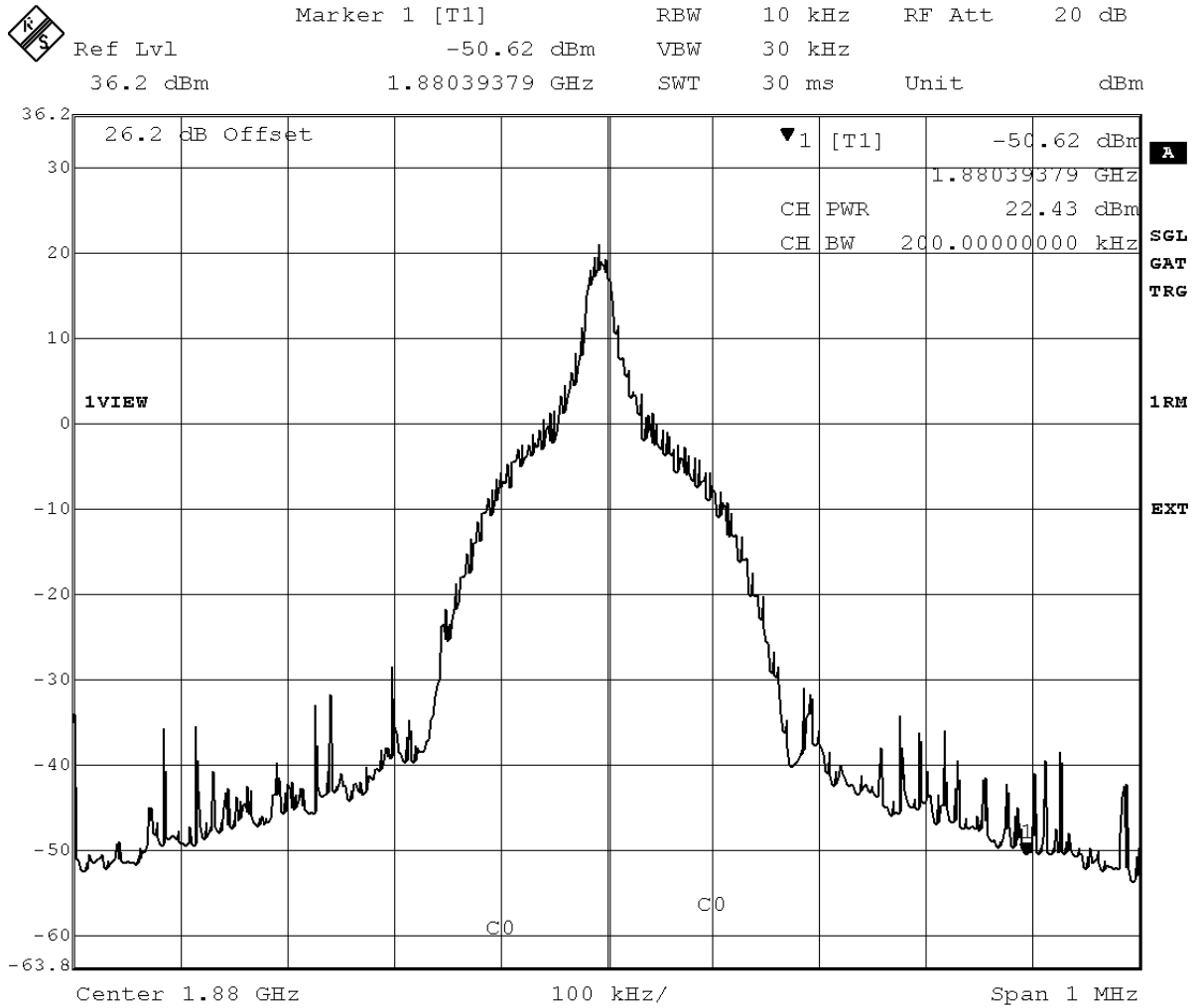
Detailed Results:

Radio Technology	Reference Test Frequencies	Channel	Sub-carrier	Parent RMS Conducted Power (dBm)	N410 RMS Conducted Power (dBm)	FCC / IC EIRP Limit (W)	Maximum Antenna Gain (dBi)
NB-IoT eFDD 2 QPSK	standalone	18900	12	20.25	20.35	2	12.65
NB-IoT eFDD 2 QPSK	standalone	18900	6	21.93	21.84	2	11.16
NB-IoT eFDD 2 QPSK	standalone	18900	3	22.87	22.48	2	10.52
NB-IoT eFDD 2 QPSK	standalone	18900	1	22.55	22.43	2	10.57
NB-IoT eFDD 2 BPSK	standalone	18900	1	22.67	22.65	2	10.35



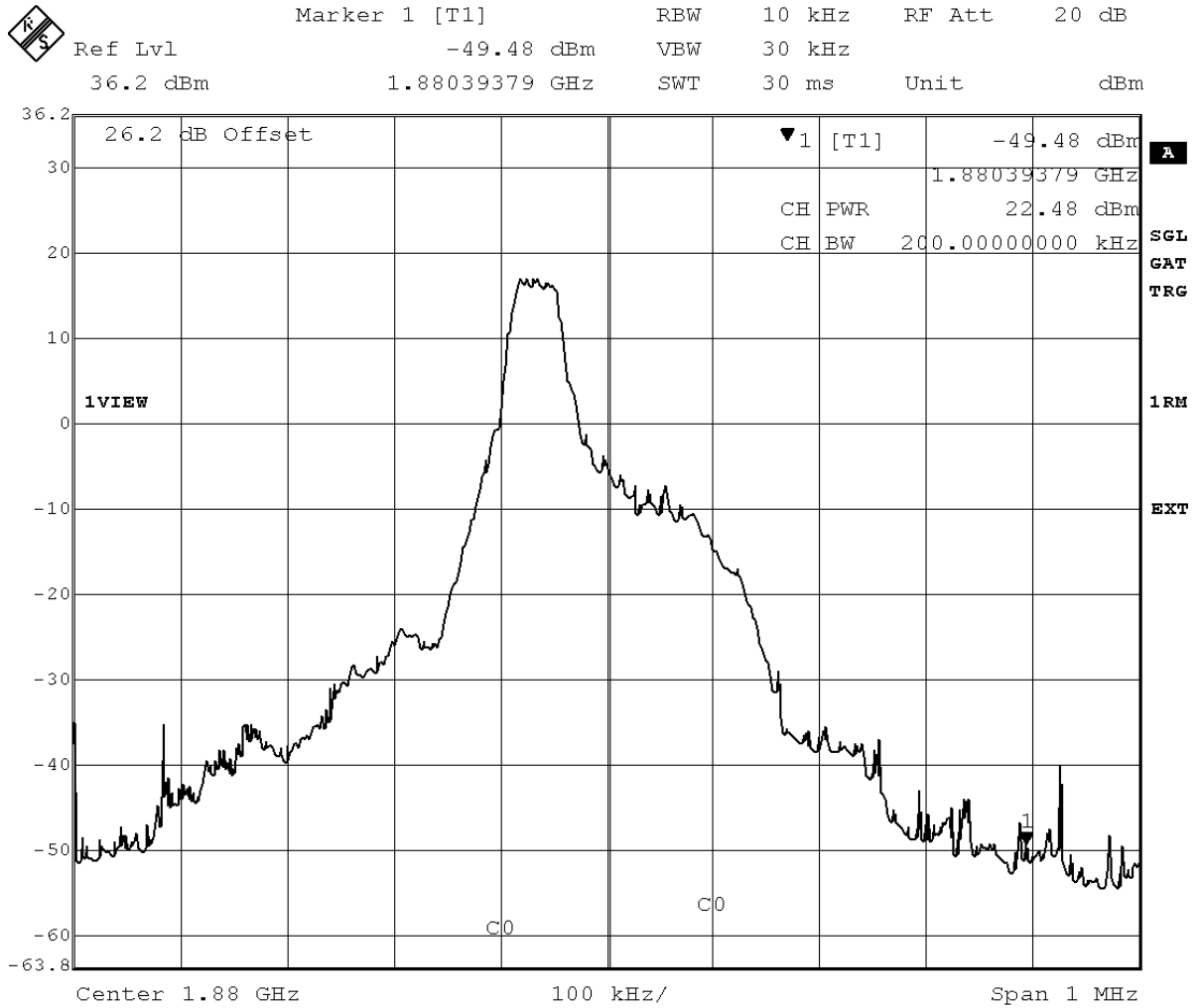
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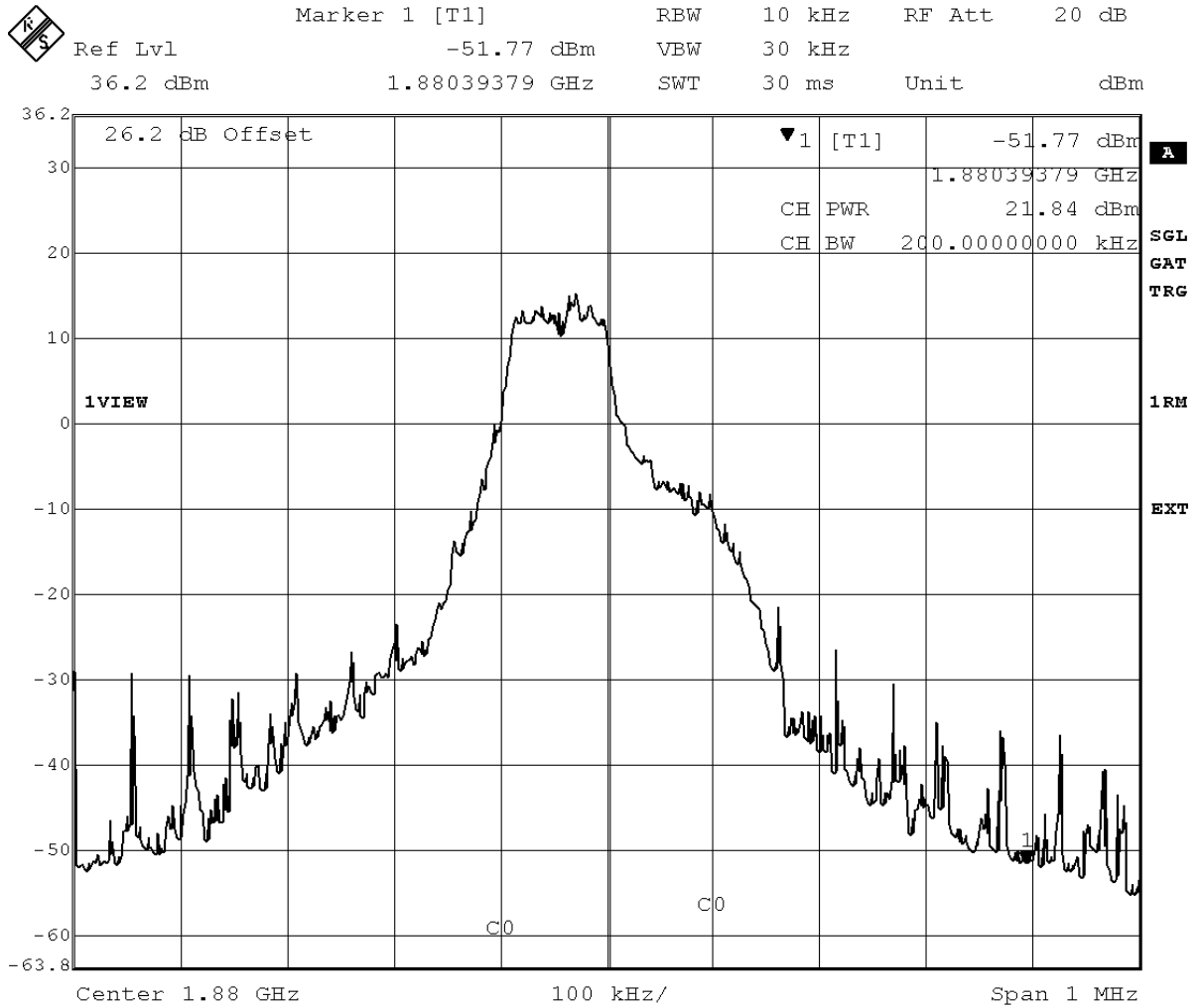
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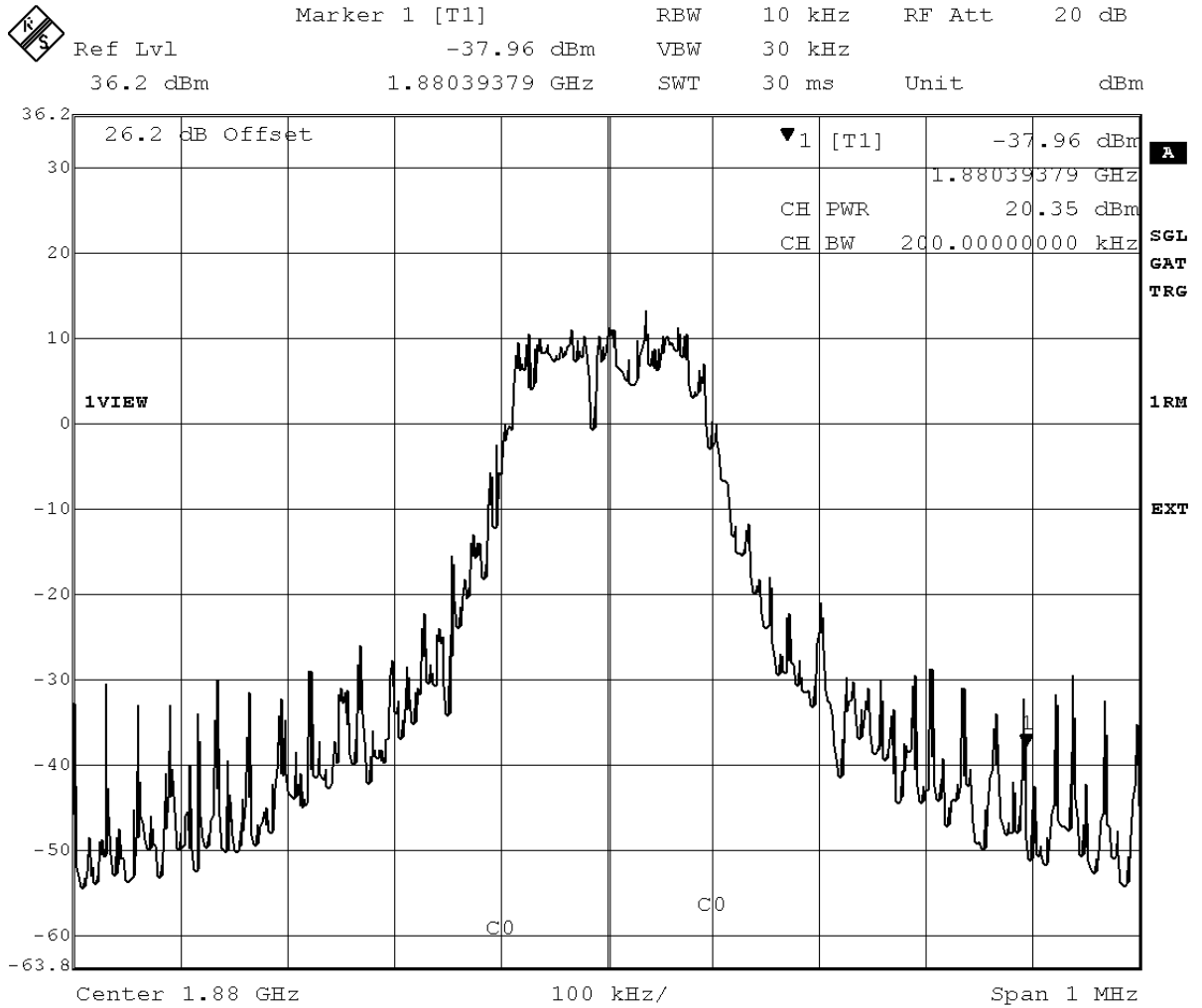
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Reference: MDE_UBLOX_1818_FCCa



Date: 14.MAY.2018 10:59:33

3.5.4 24.4 Field strength of spurious radiation §2.1053, §24.238

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

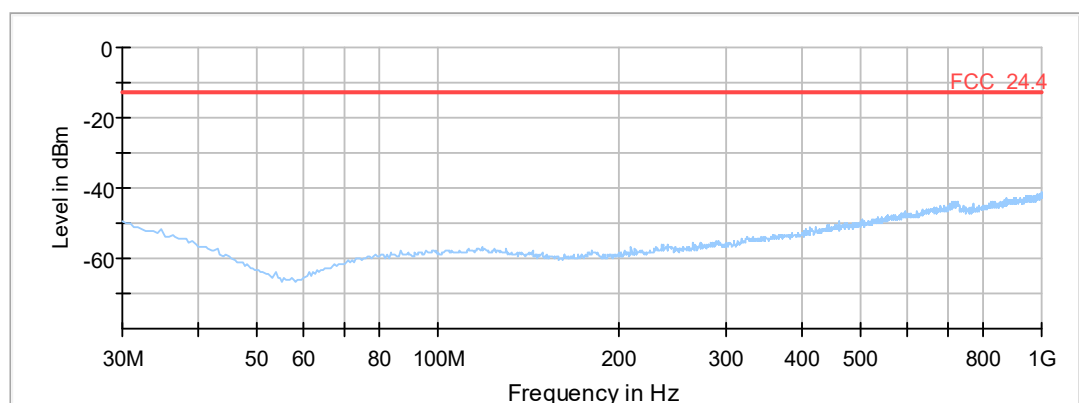
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<i>Test Specification:</i>	FCC part 2 and 24

Detailed Results:

Test Report

Common Information

Test Description:
Test Standard
Operating Conditions:
Operator Name:
Comment:



Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
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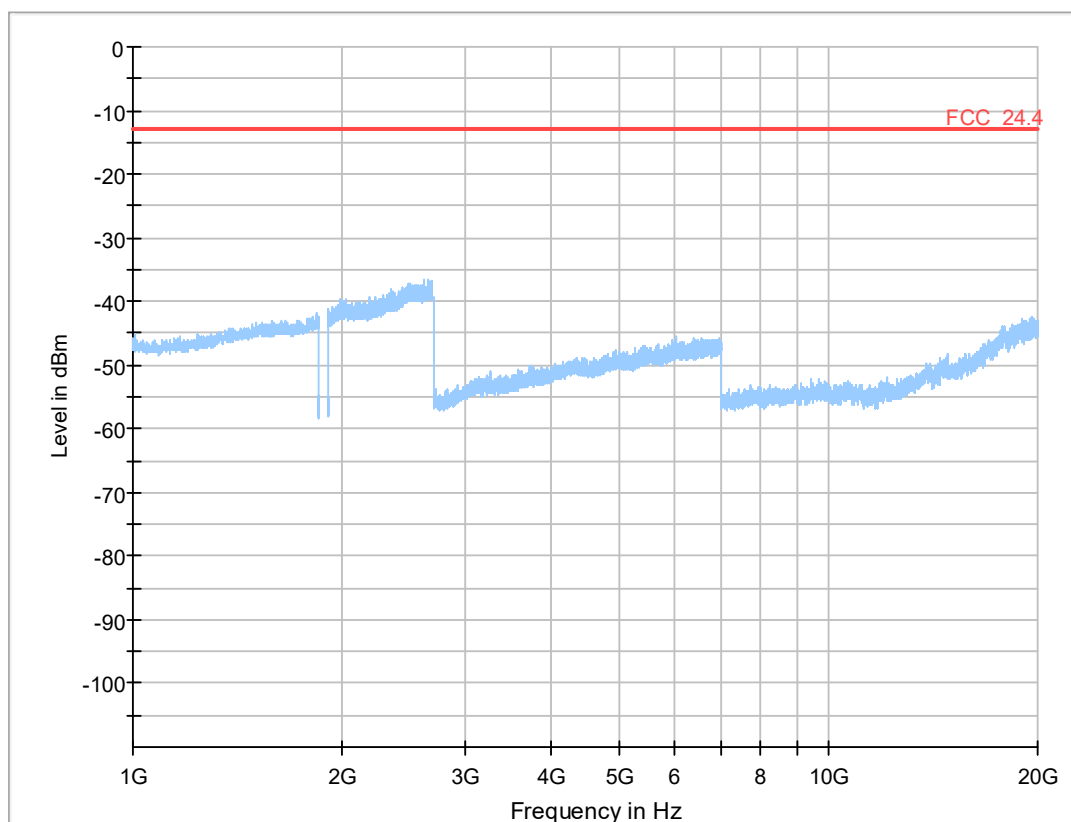
Hardware Setup: FCC_30M-1G_ERP
Measurement Type: Open-Area-Test-Site
Frequency Range: 30 MHz - 1 GHz
Graphics Level Range: -80 dBm - 0 dBm

Preview Measurements:
Sweep Test Template: FCC24.4_LTE_eFDD2_5MHz_18900_PRE

Adjustment:
Template for Single Meas.: FCC24_eFDD2_Adjustment

Final Measurements:
Template for Single Meas.: FCC24_eFDD2_Final

TCH 18900 eFDD2 QPSK



Critical Freqs

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

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
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TCH 18900 eFDD2 QPSK

3.5.5 27.1 RF Power Output §2.1046, §27.250

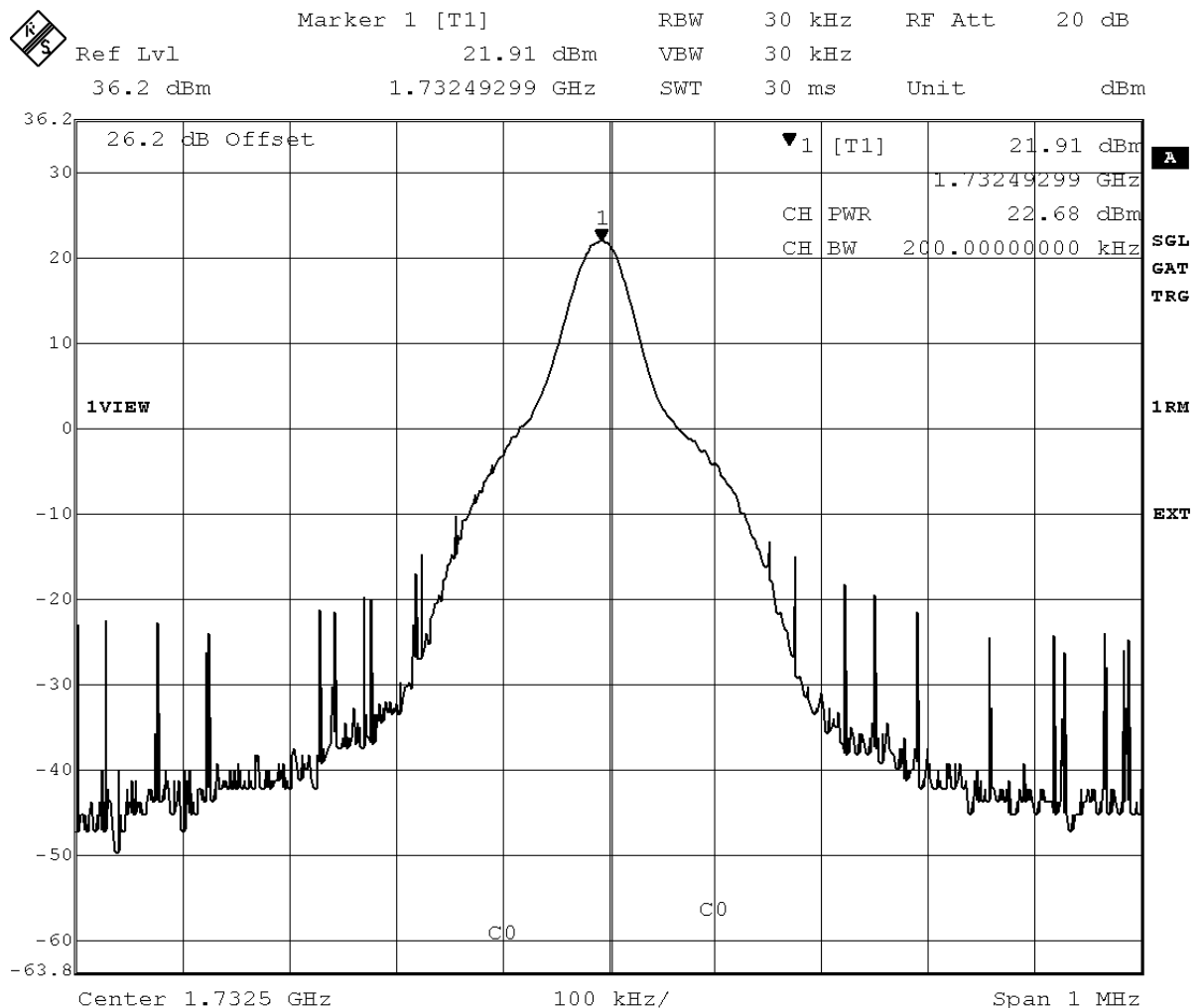
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<i>Result:</i>	Passed
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<i>Body:</i>	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV
<i>Test Specification:</i>	FCC part 2 and 27

Detailed Results:

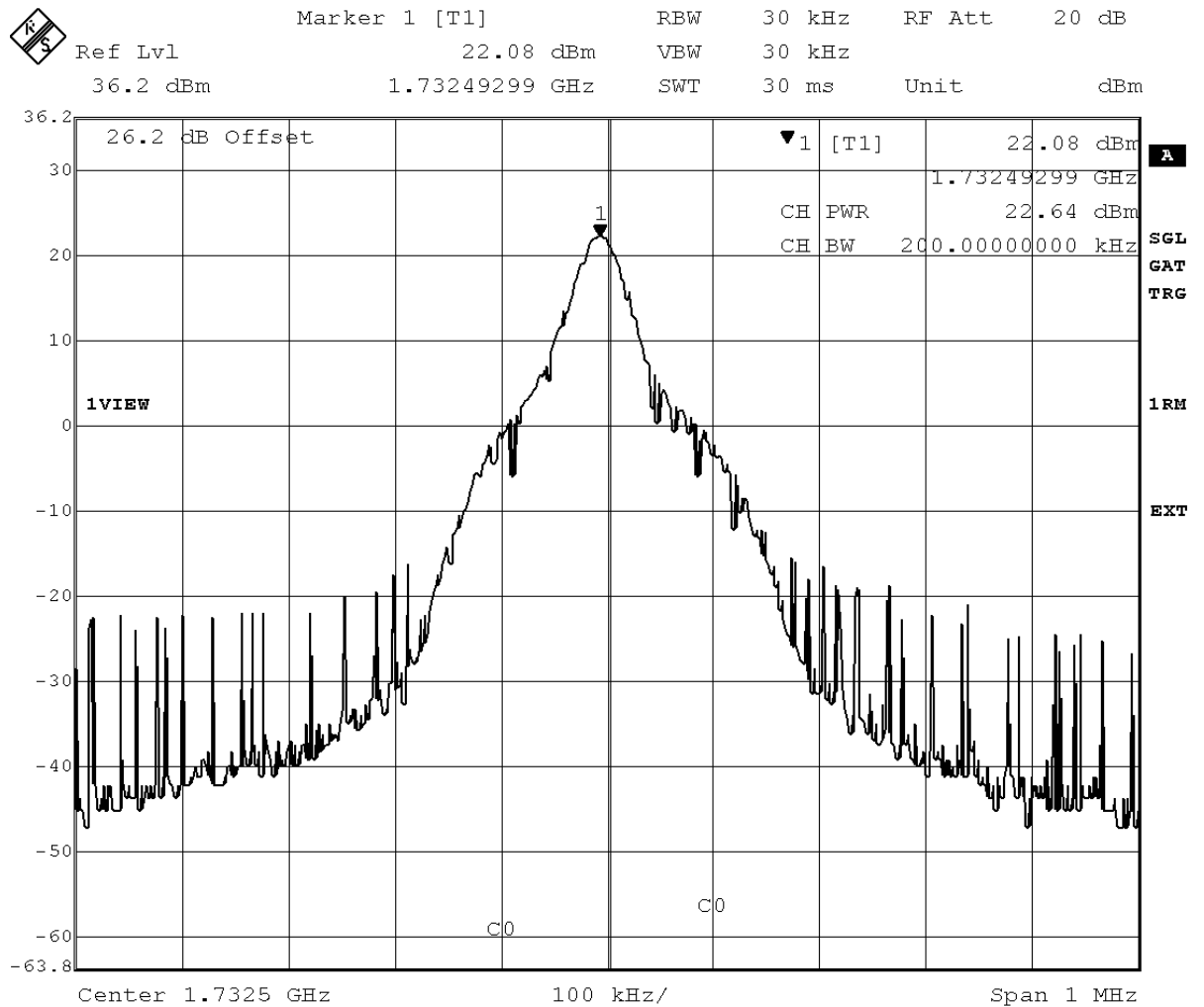
Radio Technology	Reference Test Frequencies	Channel	Sub-carrier	Parent RMS Conducted Power (dBm)	N410 RMS Conducted Power (dBm)	FCC / IC EIRP Limit (W)	Maximum Antenna Gain (dBi)
NB-IoT eFDD 12 QPSK	standalone	23095	12	21.04	20.92	1	9.08
NB-IoT eFDD 12 QPSK	standalone	23095	6	21.97	21.88	1	8.12
NB-IoT eFDD 12 QPSK	standalone	23095	3	22.39	22.1	1	7.9
NB-IoT eFDD 12 QPSK	standalone	23095	1	21.12	21.07	1	8.93
NB-IoT eFDD 12 BPSK	standalone	23095	1	21.52	21.41	1	8.59
NB-IoT eFDD 13 QPSK	standalone	23230	12	20.66	20.83	3	13.94
NB-IoT eFDD 13 QPSK	standalone	23230	6	21.52	21.71	3	13.06
NB-IoT eFDD 13 QPSK	standalone	23230	3	23.58	22.05	3	12.72
NB-IoT eFDD 13 QPSK	standalone	23230	1	22.65	20.96	3	13.81
NB-IoT eFDD 13 BPSK	standalone	23230	1	21.12	20.92	3	13.85
NB-IoT eFDD 4 QPSK	standalone	20175	12	21.04	21.03	1	8.97
NB-IoT eFDD 4 QPSK	standalone	20175	6	22.12	22.34	1	7.66
NB-IoT eFDD 4 QPSK	standalone	20175	3	22.93	22.71	1	7.29
NB-IoT eFDD 4 QPSK	standalone	20175	1	22.13	22.64	1	7.36
NB-IoT eFDD 4 BPSK	standalone	20175	1	21.86	22.68	1	7.32

Summary Table



Date: 24.MAY.2018 09:44:58

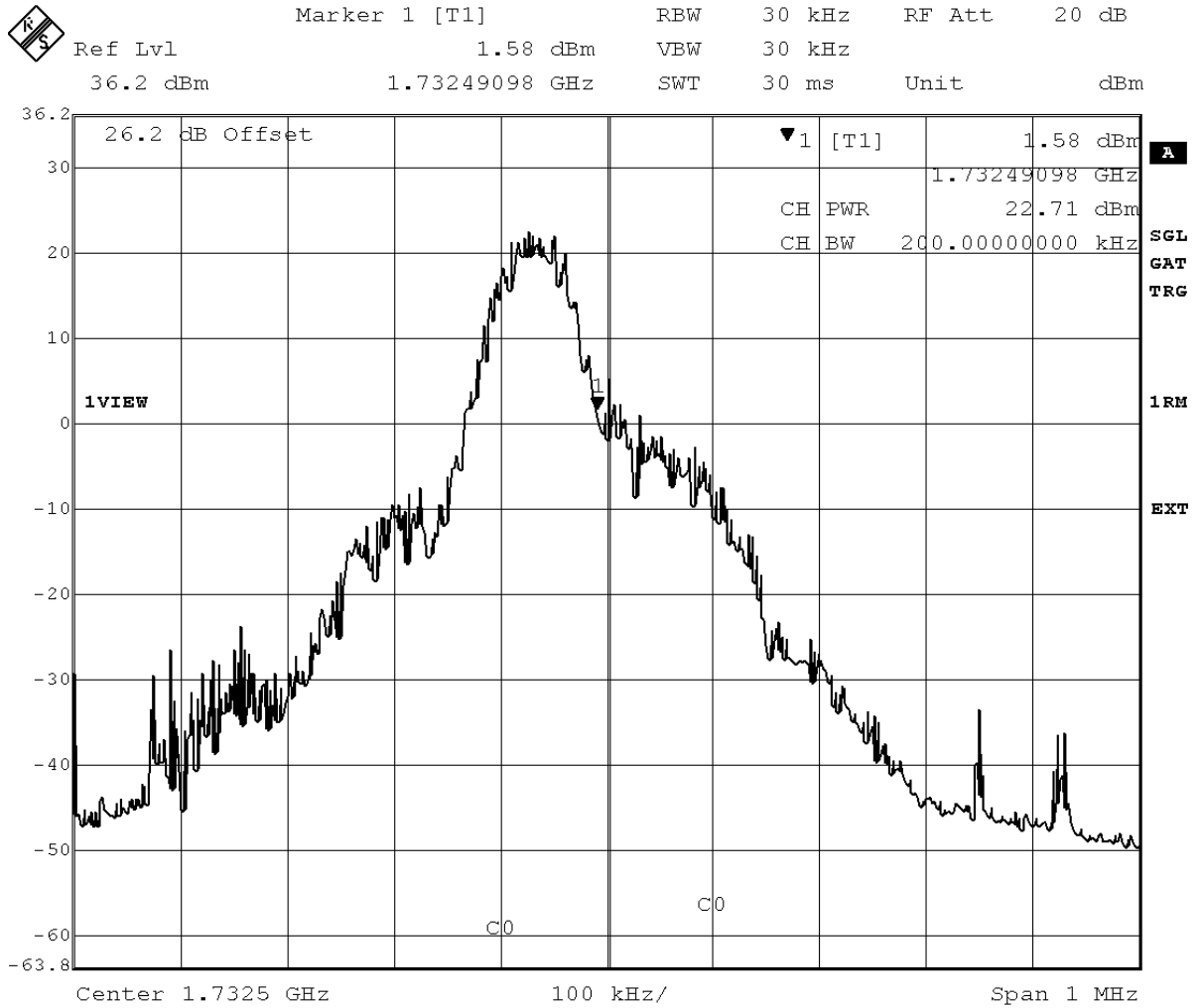
eFDD4_BPSK_STANDALONE_SUB1_CH20175



Date: 24.MAY.2018 09:47:54

eFDD4_QPSK_STANDALONE_SUB1_CH20175

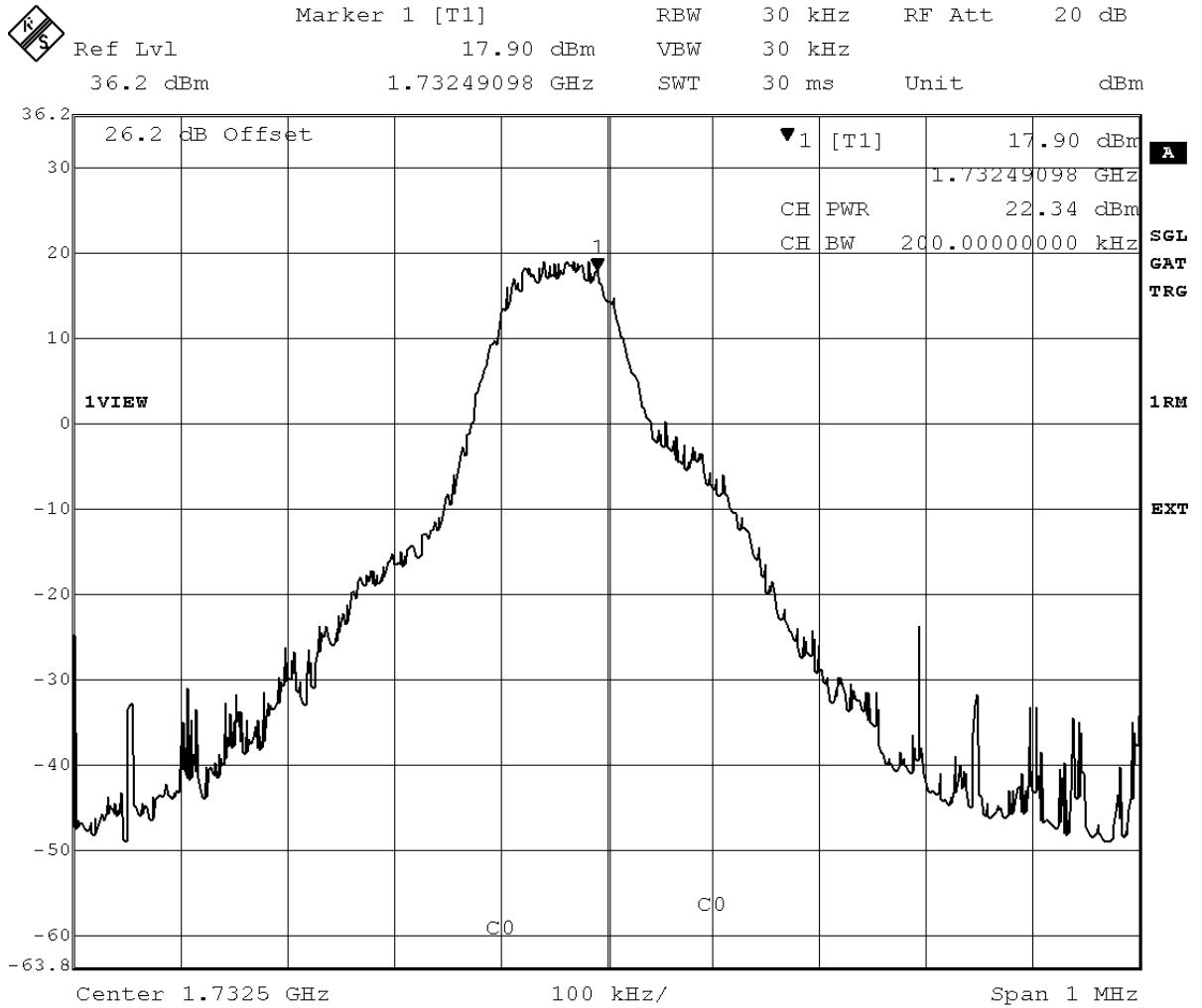
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Date: 14.MAY.2018 18:48:47

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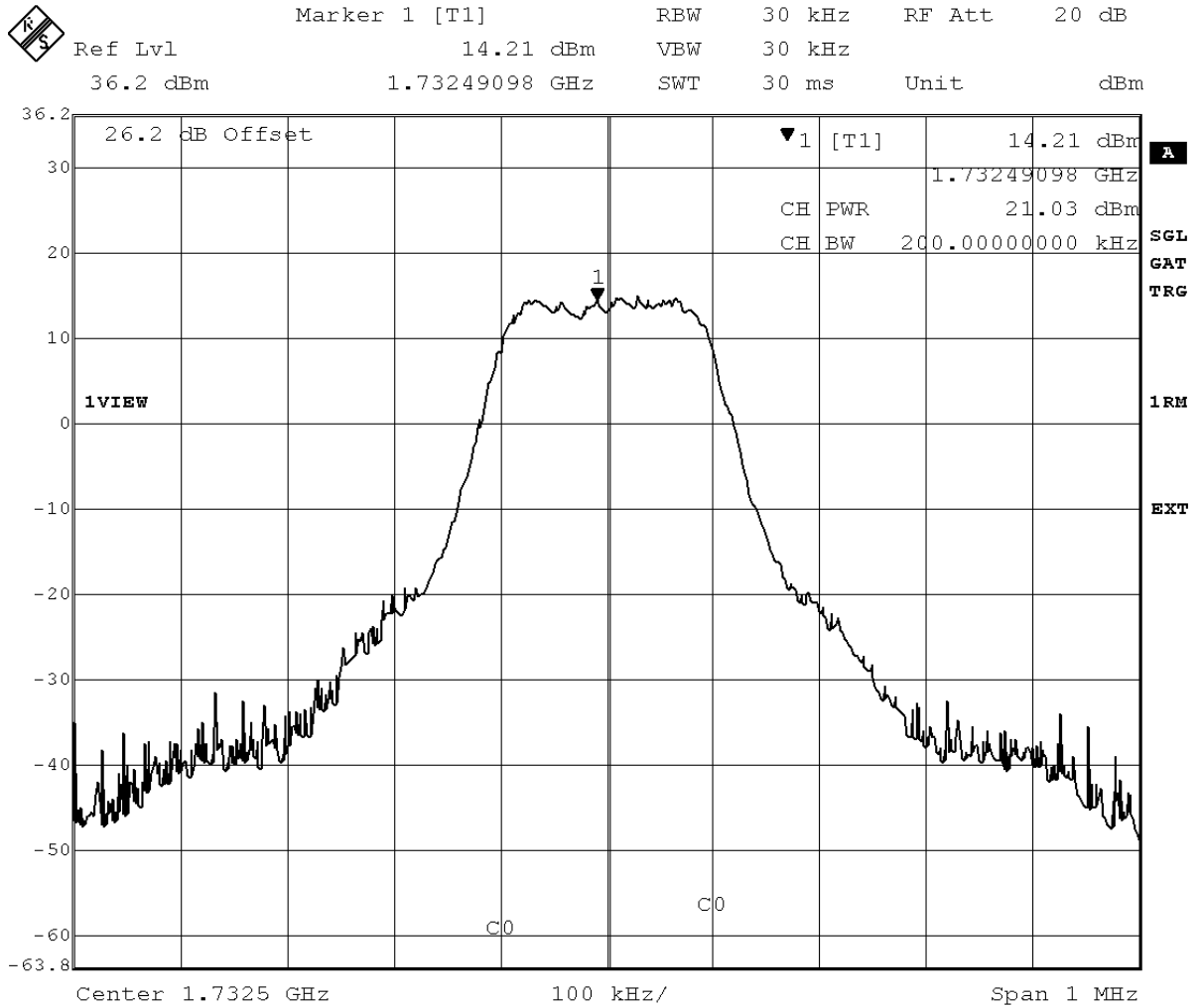
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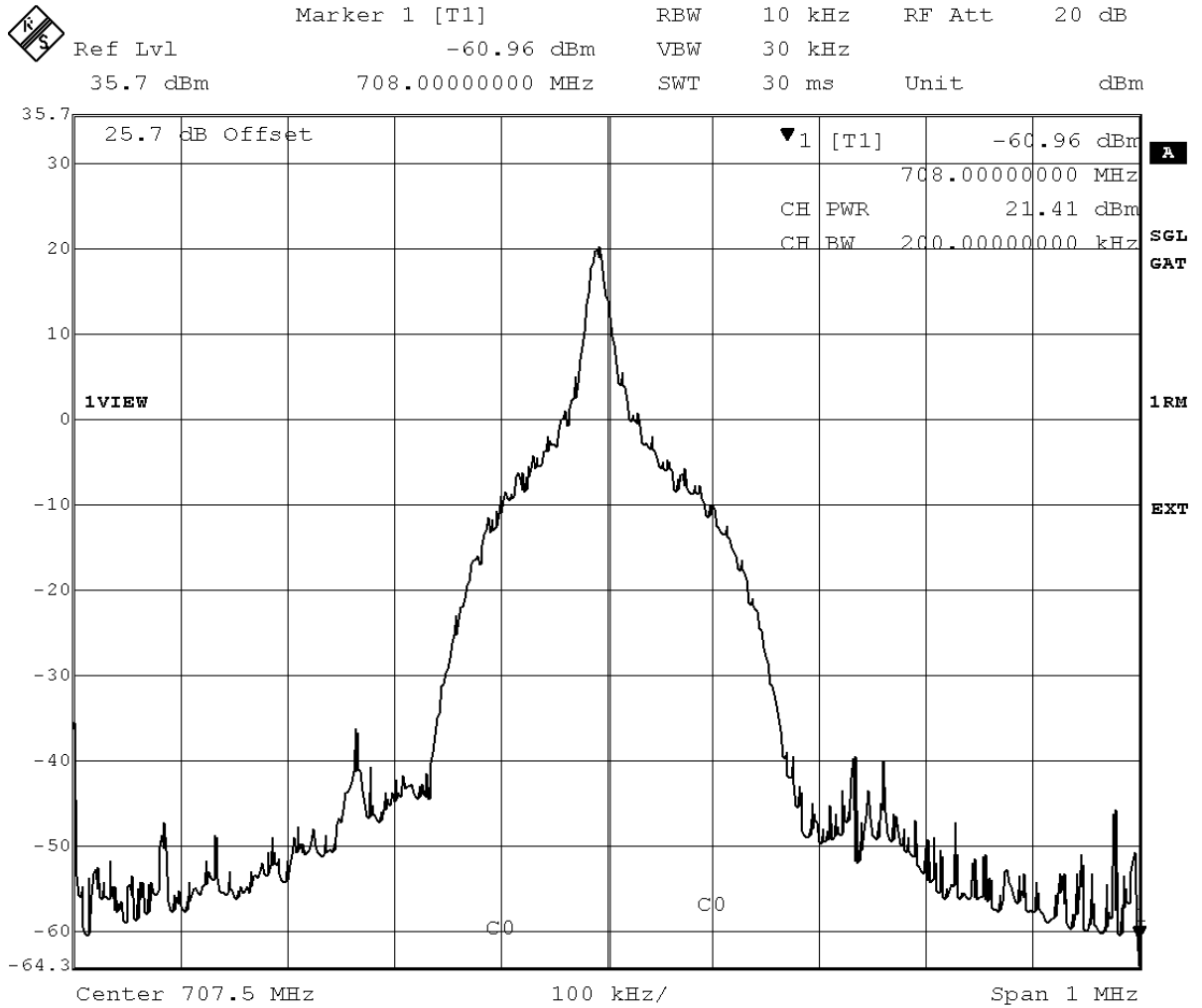
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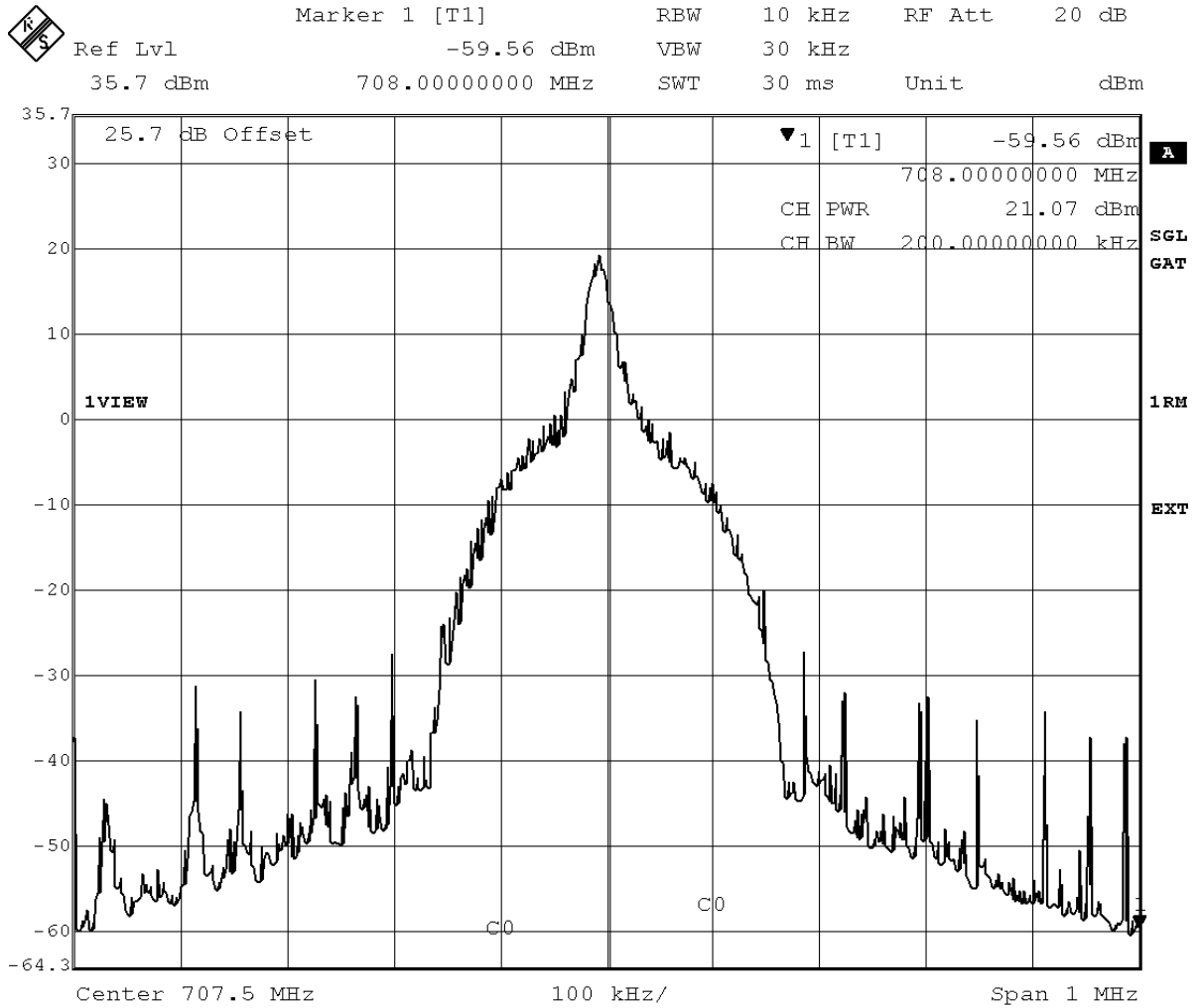
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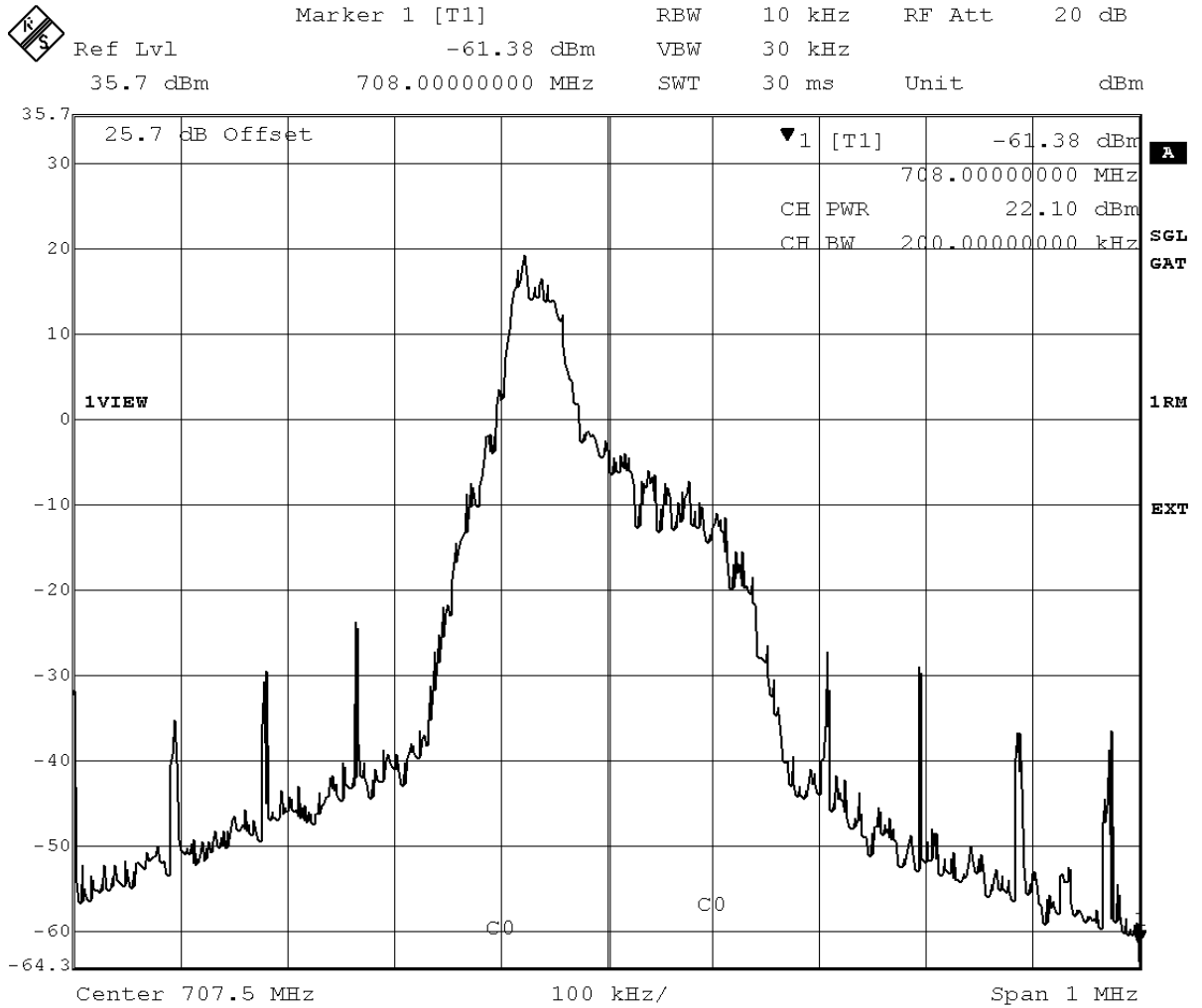
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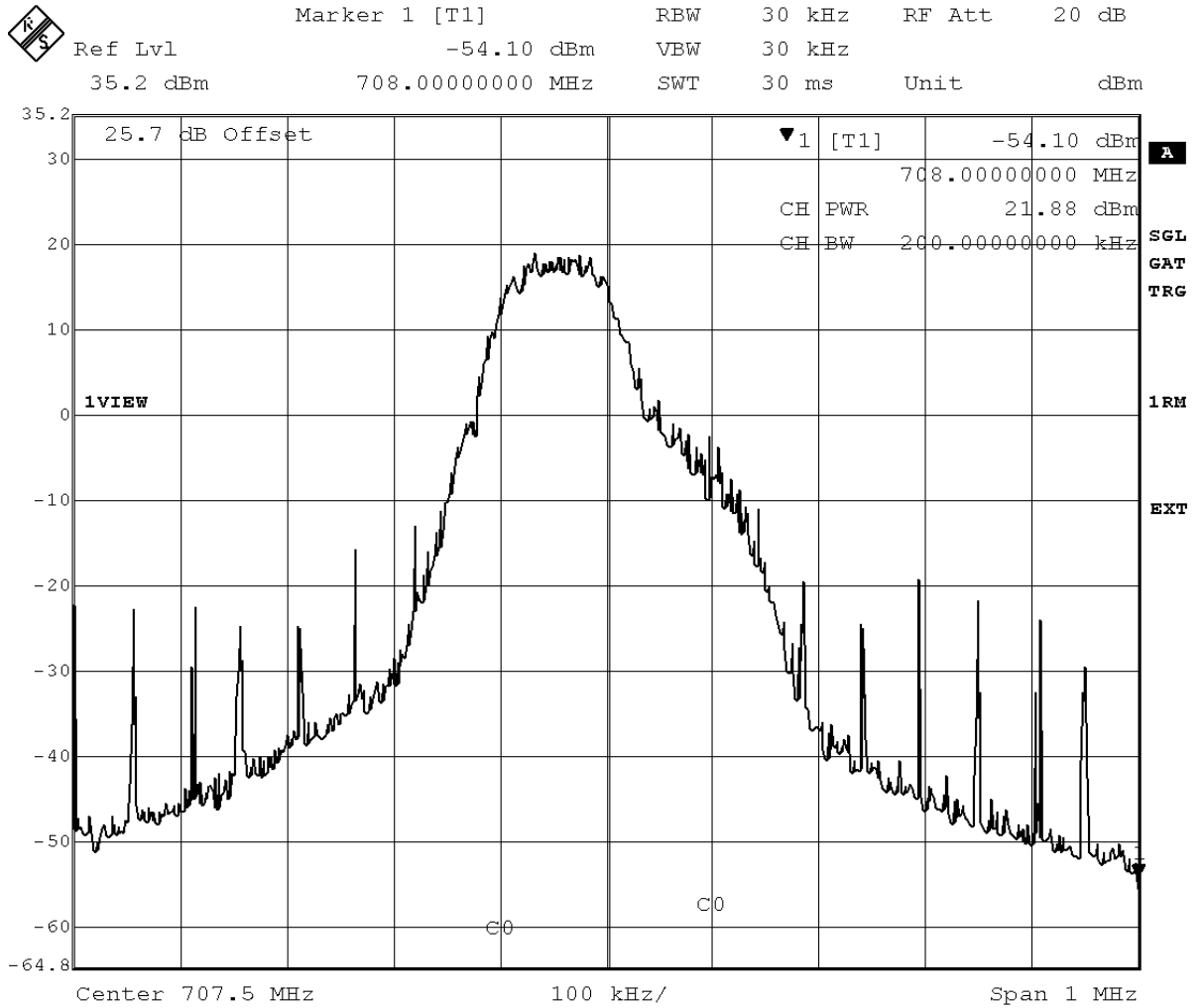
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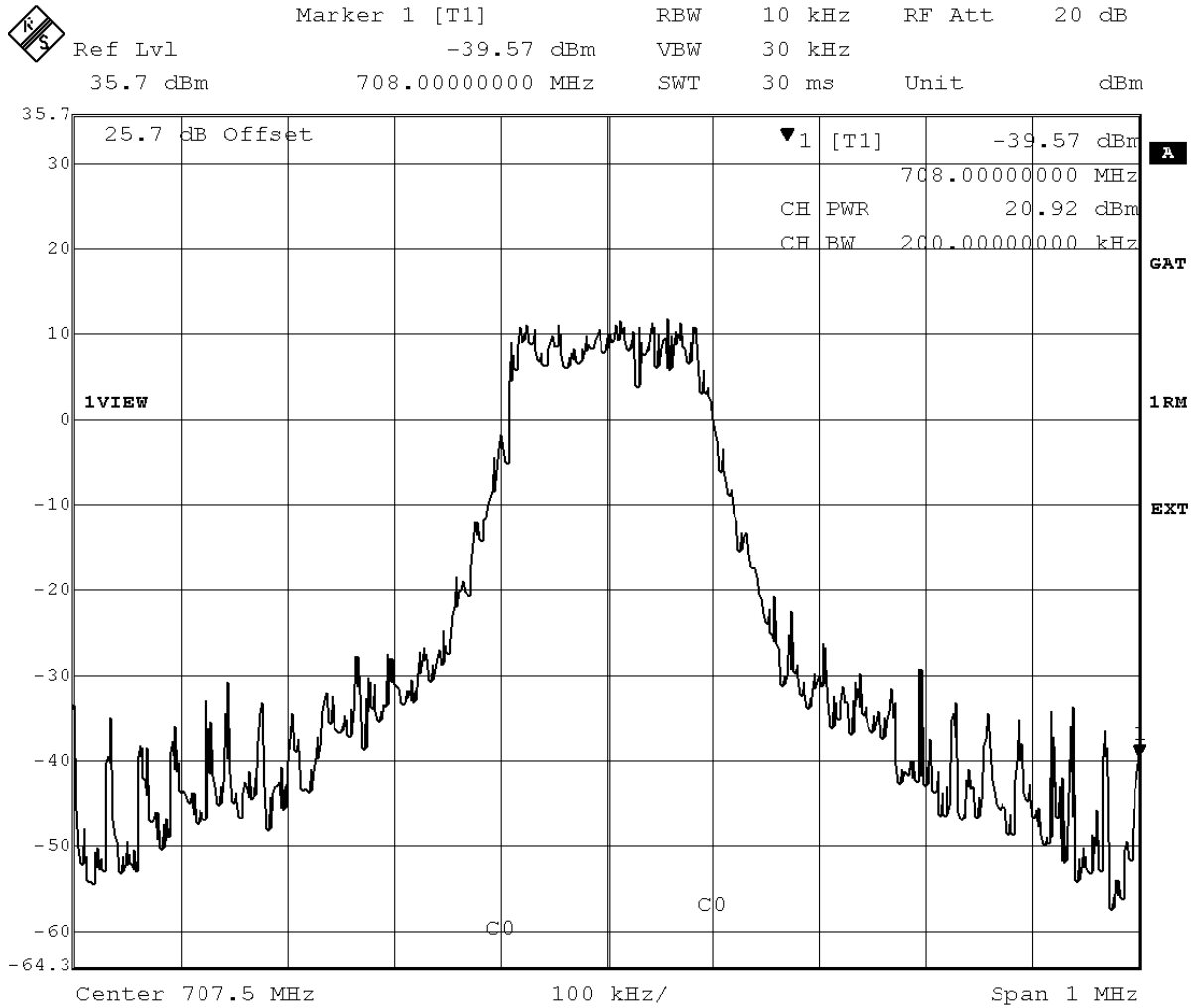
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Date: 24.MAY.2018 10:19:20

eFDD12_OPSK_STANDALONE_SUB6_CH23095

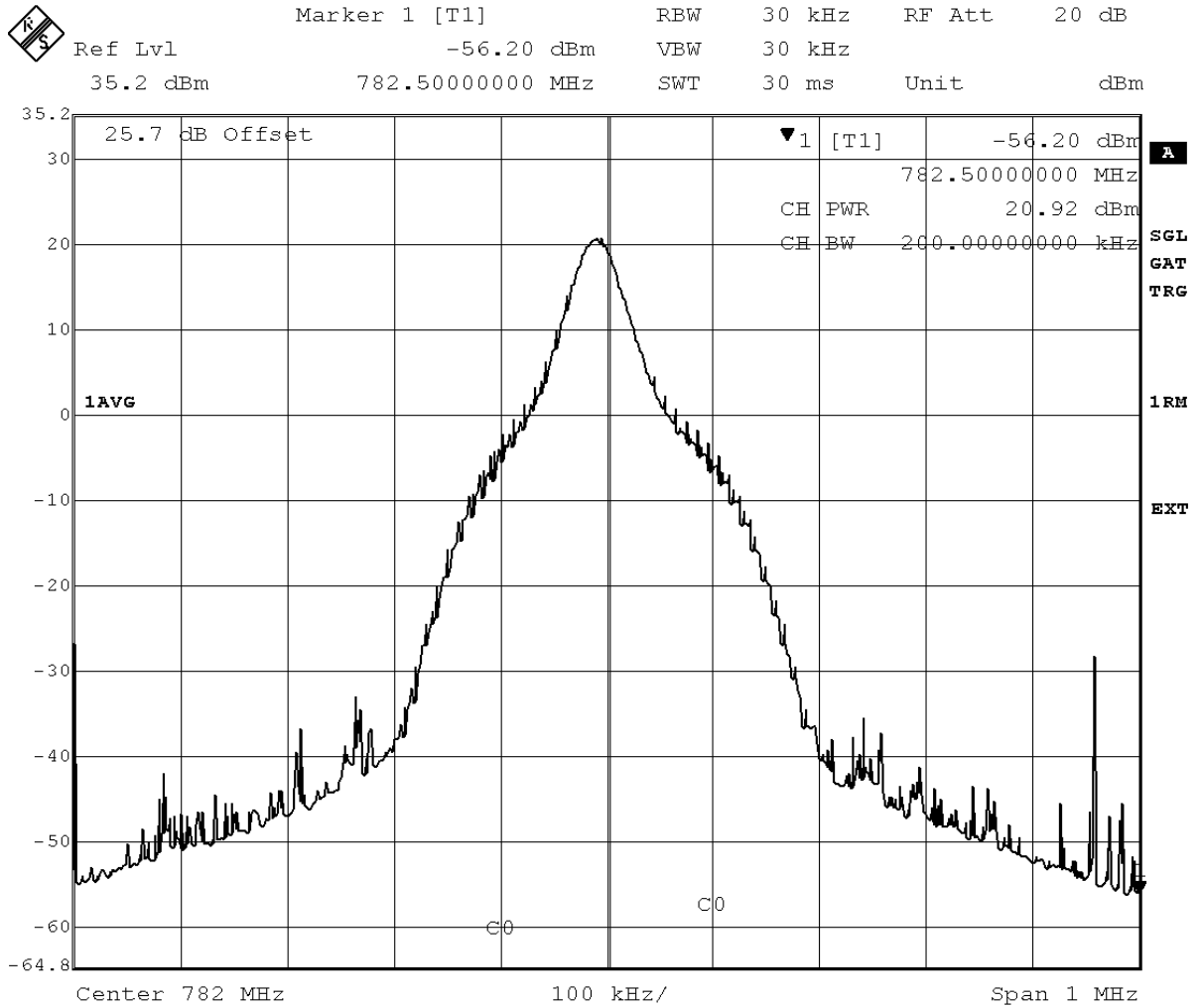
Reference: MDE_UBLOX_1818_FCCa



Date: 14.MAY.2018 18:33:03

eFDD12_OPSK_STANDALONE_SUB12_CH23095

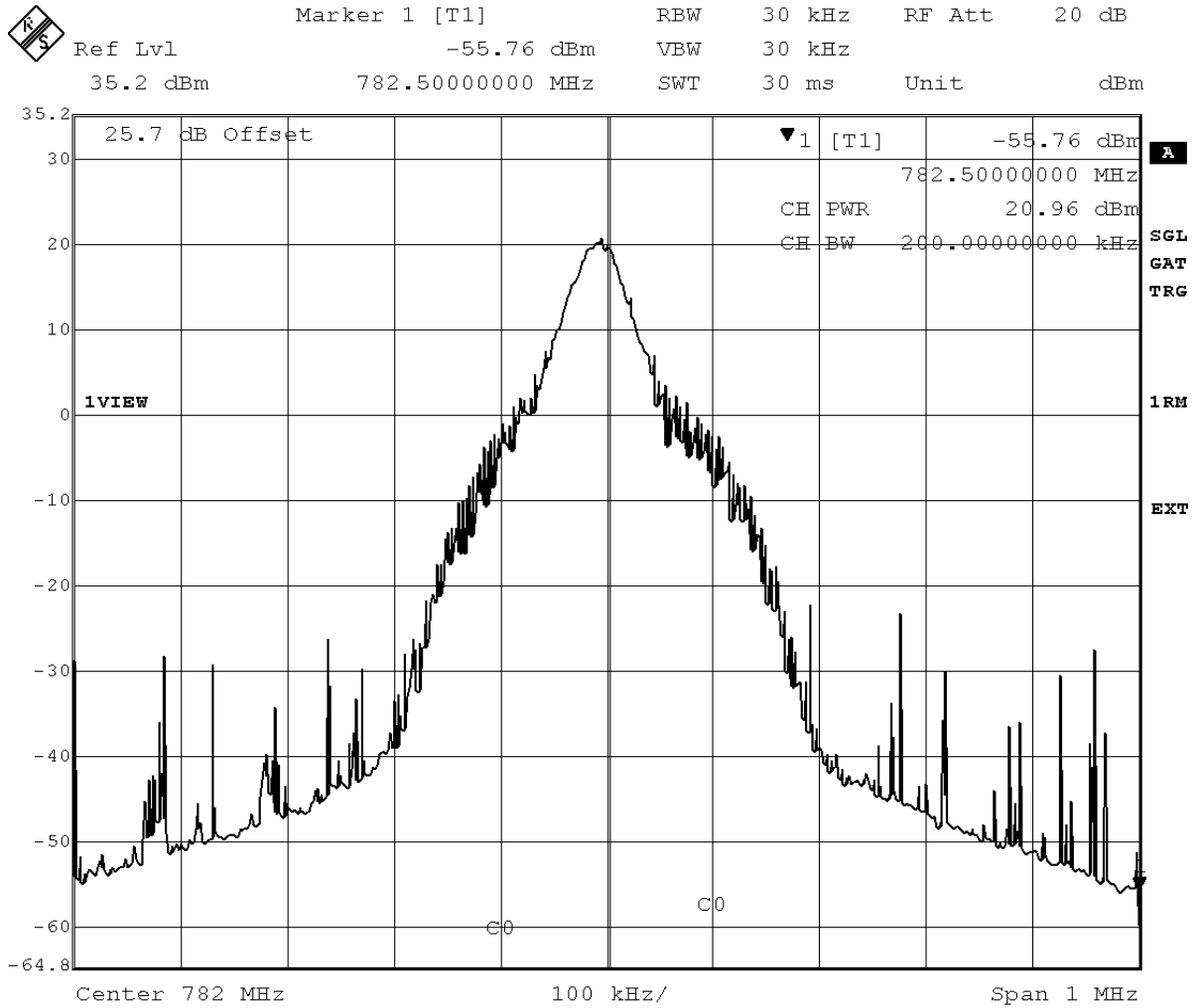
Reference: MDE_UBLOX_1818_FCCa



Date: 24.MAY.2018 09:54:35

eFDD13_BPSK_STANDALONE_SUB1_CH23230

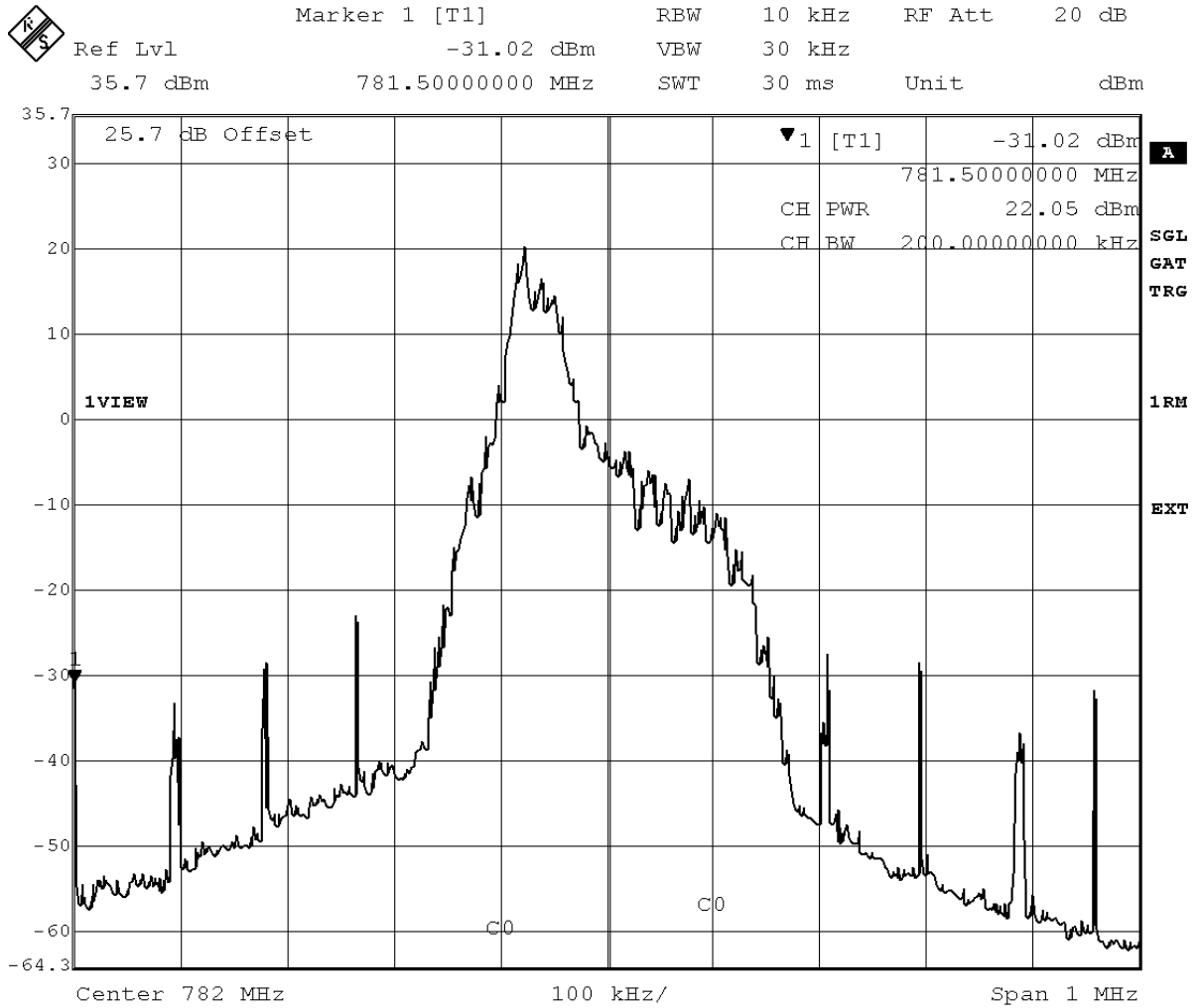
Reference: MDE_UBLOX_1818_FCCa



Date: 24.MAY.2018 09:56:33

eFDD13_OPSK_STANDALONE_SUB1_CH23230

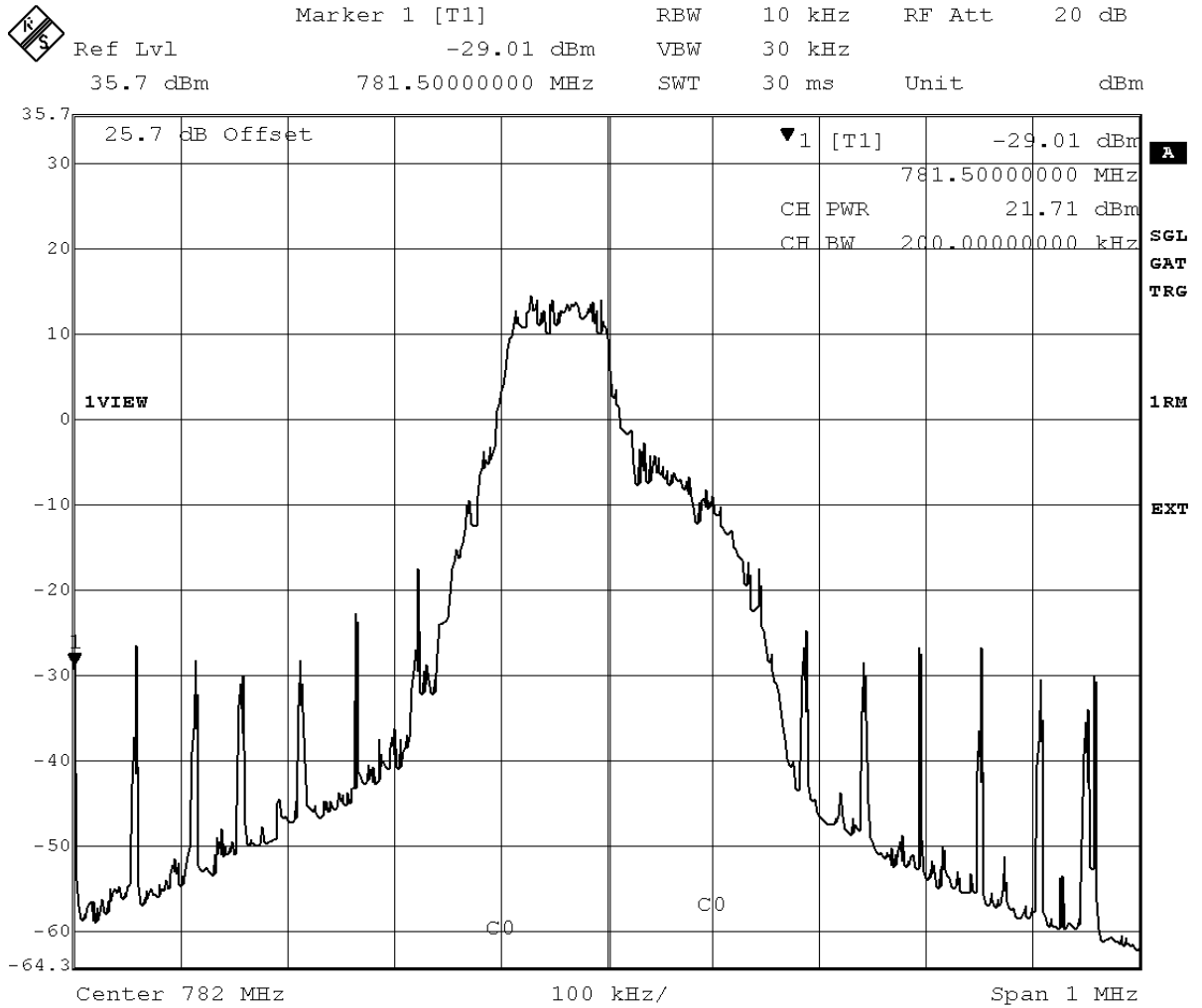
Reference: MDE_UBLOX_1818_FCCa



Date: 14.MAY.2018 16:40:03

eFDD13_OPSK_STANDALONE_SUB3_CH23230

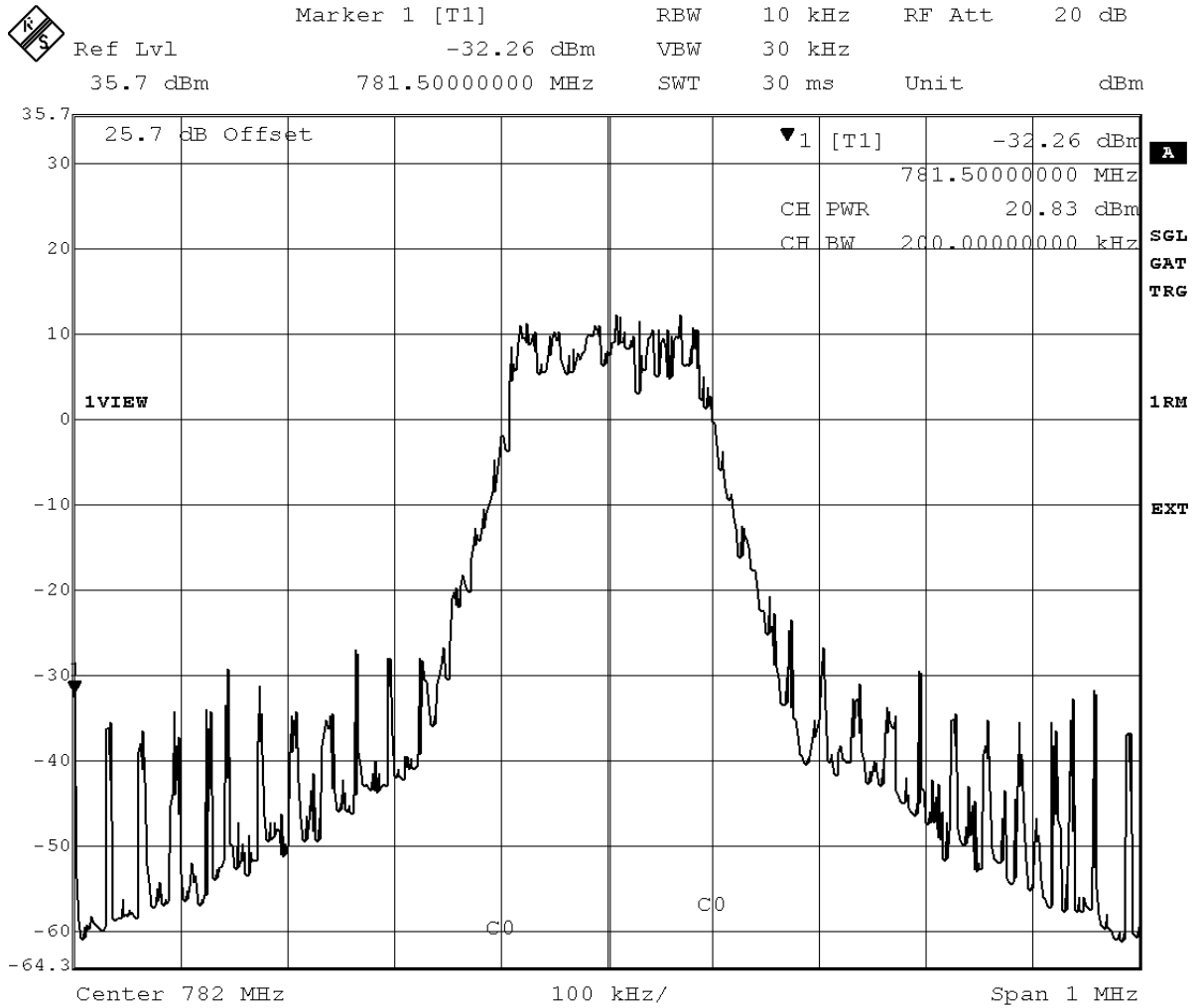
Reference: MDE_UBLOX_1818_FCCa



Date: 14.MAY.2018 16:39:01

eFDD13_OPSK_STANDALONE_SUB6_CH23230

Reference: MDE_UBLOX_1818_FCCa



Date: 14.MAY.2018 16:37:45

eFDD13_OPSK_STANDALONE_SUB12_CH23230

3.5.6 27.4 Field strength of spurious radiation §2.1053, §27.53

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

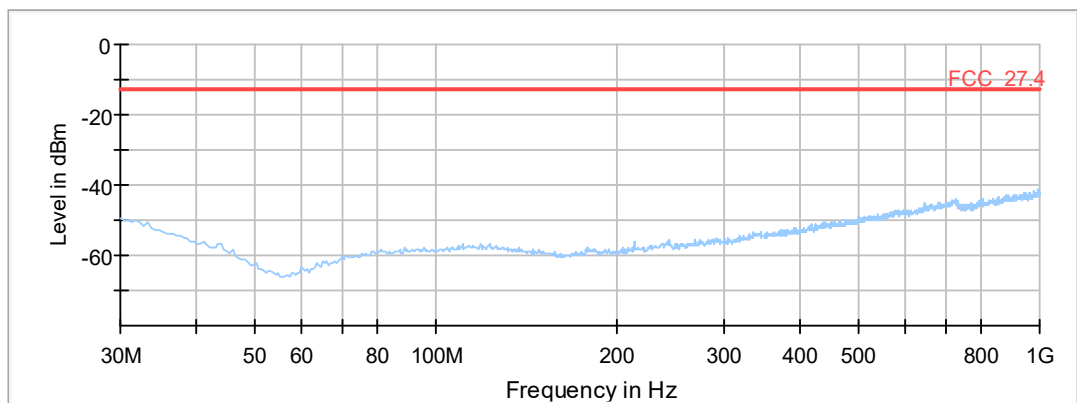
<i>Result:</i>	Passed
<i>Setup No.:</i>	ab01
<i>Date of Test:</i>	2018/05/11 15:49
<i>Body:</i>	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERV
<i>Test Specification:</i>	FCC part 2 and 27

Detailed Results:

Test Report

Common Information

Test Description:
Test Standard
Operating Conditions:
Operator Name:
Comment:



Final Result

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

EMI Auto Test Template: FCC27_30M-1G_eFDD4_5MHz_CH20175

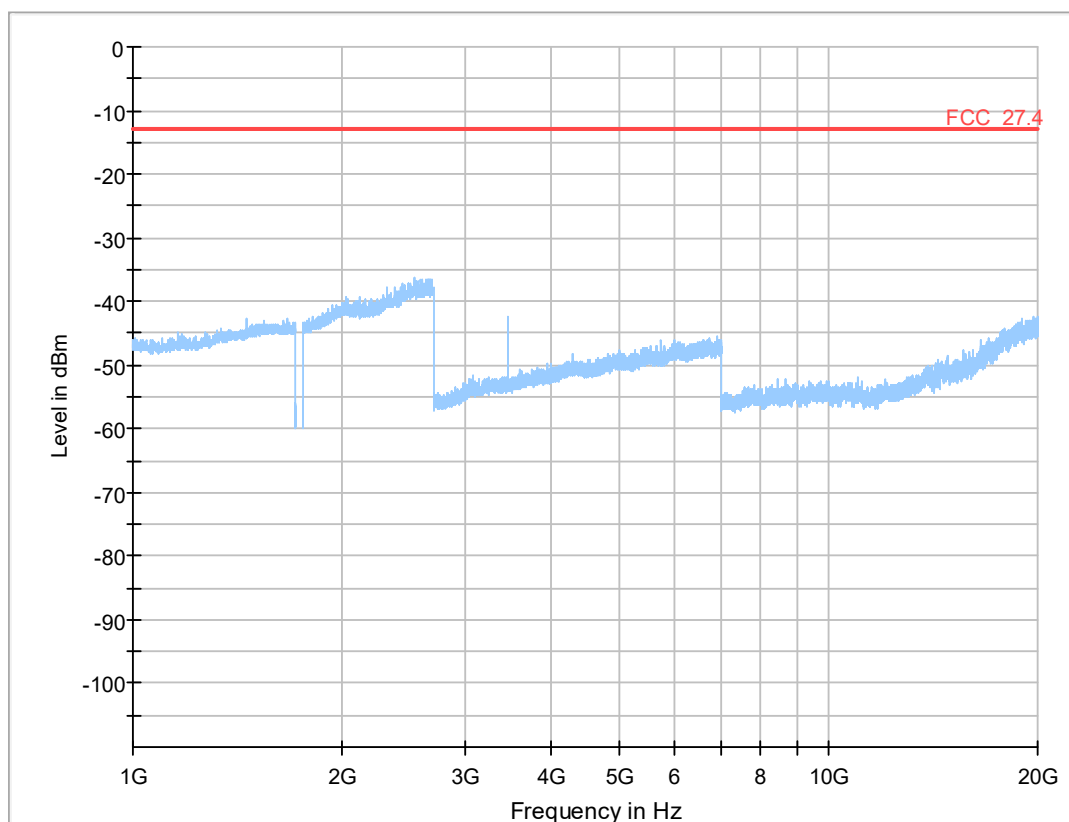
Hardware Setup: FCC_30M-1G_ERP
Measurement Type: Open-Area-Test-Site
Frequency Range: 30 MHz - 1 GHz
Graphics Level Range: -80 dBm - 0 dBm

Preview Measurements:
Sweep Test Template: FCC27.4_LTE_eFDD4_5MHz_20175_PRE

Adjustment:
Template for Single Meas.: FCC27_eFDD4_Adjustment

Final Measurements:
Template for Single Meas.: FCC27_eFDD4_Final

TCH 23095 eFDD12 QPSK



Critical Freqs

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

Final Result

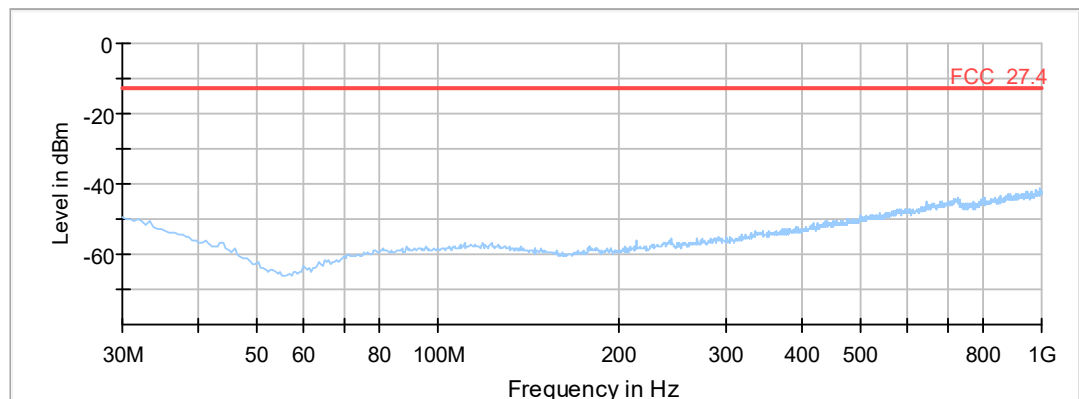
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

TCH 23095 eFDD12 QPSK

Test Report

Common Information

Test Description:
 Test Standard
 Operating Conditions:
 Operator Name:
 Comment:



Final Result

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

EMI Auto Test Template: FCC27_30M-1G_eFDD4_5MHz_CH20175

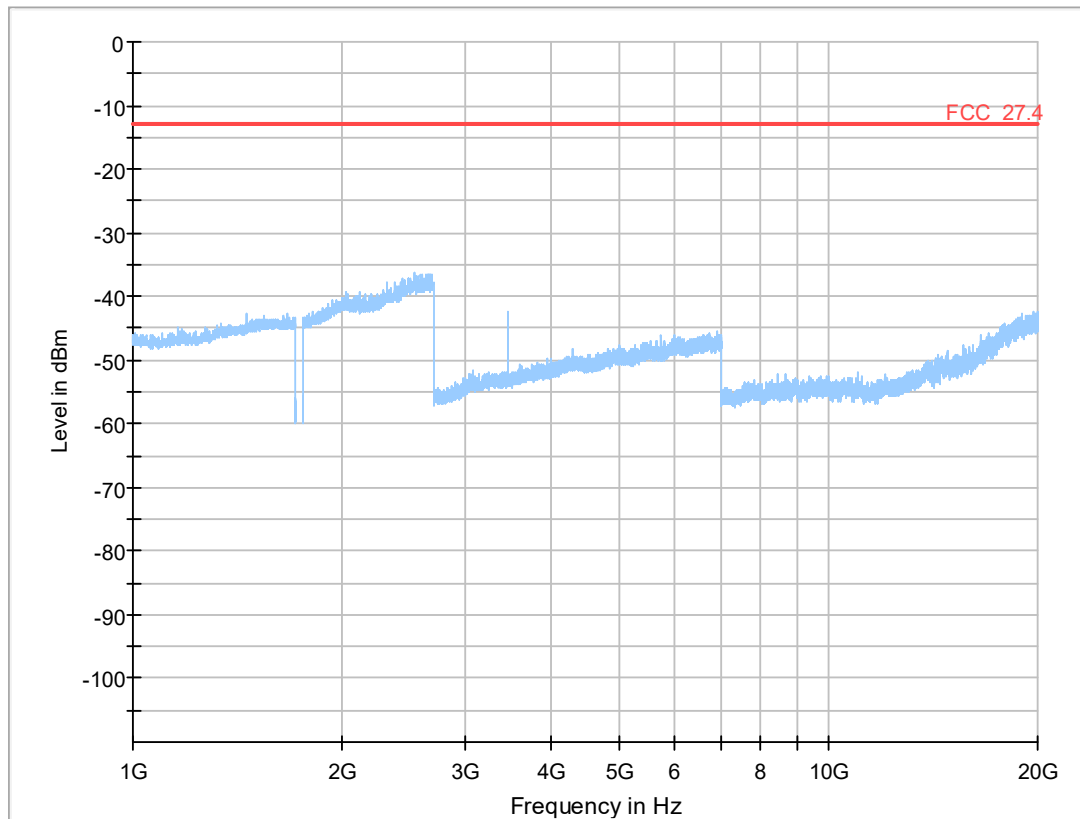
Hardware Setup: FCC_30M-1G_ERP
 Measurement Type: Open-Area-Test-Site
 Frequency Range: 30 MHz - 1 GHz
 Graphics Level Range: -80 dBm - 0 dBm

Preview Measurements:
 Sweep Test Template: FCC27.4_LTE_eFDD4_5MHz_20175_PRE

Adjustment:
 Template for Single Meas.: FCC27_eFDD4_Adjustment

Final Measurements:
 Template for Single Meas.: FCC27_eFDD4_Final

TCH 23230 eFDD13 QPSK



Critical Freqs

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

Final Result

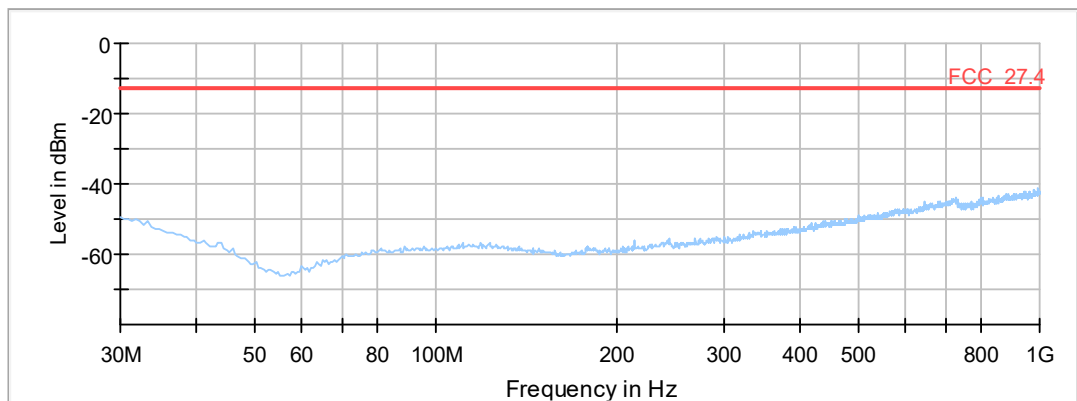
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
---	---	---	---	---	---	---		---	---	---

TCH 23230 eFDD13 QPSK

Test Report

Common Information

Test Description:
 Test Standard
 Operating Conditions:
 Operator Name:
 Comment:



Final Result

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

EMI Auto Test Template: FCC27_30M-1G_eFDD4_5MHz_CH20175

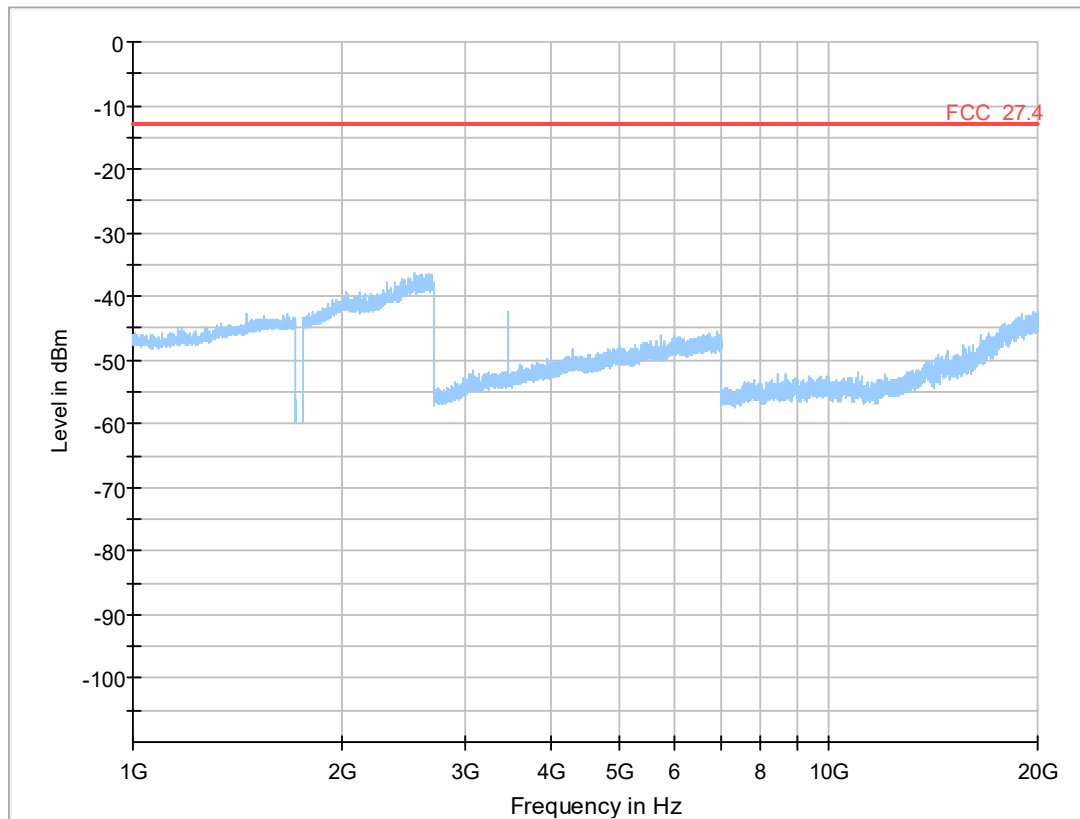
Hardware Setup: FCC_30M-1G_ERP
 Measurement Type: Open-Area-Test-Site
 Frequency Range: 30 MHz - 1 GHz
 Graphics Level Range: -80 dBm - 0 dBm

Preview Measurements:
 Sweep Test Template: FCC27.4_LTE_eFDD4_5MHz_20175_PRE

Adjustment:
 Template for Single Meas.: FCC27_eFDD4_Adjustment

Final Measurements:
 Template for Single Meas.: FCC27_eFDD4_Final

TCH 20175 eFDD4 QPSK



Critical Freqs

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

Final Result

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

TCH 20175 eFDD4 QPSK

4 Test Equipment Details

4.1 List of Used Test Equipment

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

Test Equipment Anechoic Chamber

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

Single Devices for Anechoic Chamber

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

Test Equipment Auxiliary Equipment for Radiated emissions

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

Single Devices for Auxiliary Equipment for Radiated emissions

Single Device Name	Type	Serial Number	Manufacturer
Antenna mast	AM 4.0	AM4.0/180/11920	Maturo GmbH
Biconical Broadband Antenna	SBA 9119	9119-005	
Biconical dipole	VUBA 9117	9117-108	
Broadband Amplifier 1 GHz - 4 GHz	AFS4-01000400-1Q-10P-4	-	
Broadband Amplifier 18 GHz - 26 GHz	JS4-18002600-32-5P	849785	
Broadband Amplifier 30 MHz - 18 GHz	JS4-00101800-35-5P	896037	
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2+W38.01-2	
Cable "ESI to Horn Antenna"	SucoFlex	W18.02-2+W38.02-2	
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard Calibration			2015/06/23 2018/06/22
Double-ridged horn	HF 907	102444	Rohde & Schwarz GmbH & Co. KG

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
Double-ridged horn-duplicated 2015-07-15 10:47:55	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG
High Pass Filter	4HC1600/12750-1.5-KK	9942011	
High Pass Filter	5HC2700/12750-1.5-KK	9942012	
High Pass Filter	5HC3500/18000-1.2-KK	200035008	
High Pass Filter	WHKX 7.0/18G-8SS	09	
Horn Antenna Schwarzbeck 15-26.5 GHz BBHA 9170	BBHA 9170	BBHA9170262	
Log.-per. Antenna	HL 562 Ultralog	100609	Rohde & Schwarz GmbH & Co. KG
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>
		Standard Calibration	2015/06/30 2018/06/29
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG
Standard Gain / Pyramidal Horn Antenna 40 GHz	3160-10	00086675	
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
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
Broadband Power Divider N (Aux)	1506A / 93459	LM390	
Broadband Power Divider SMA	WA1515	A855	
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	
Digital Multimeter 13 (Clamp Meter)	Fluke 325	31270091WS	FLUKE
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
DAkKS-Calibration			2016/02/04 2019/02/28
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	
Isolating Transformer	LTS 604	1888	
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	
Signal Analyzer	FSV30	103005	Rohde & Schwarz GmbH & Co. KG
Spectrum Analyser	FSU26	200418	
Spectrum Analyzer	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG
<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	

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
CMW500	CMW500	107500	
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
Vector Signal Generator	SMU200A	100912	Rohde & Schwarz GmbH & Co. KG

Test Equipment Emission measurement devices

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

Single Devices for Emission measurement devices

Single Device Name	Type	Serial Number	Manufacturer		
EMI Receiver / Spectrum Analyzer	ESR 7	101424			
	Calibration Details			Last Execution	Next Exec.
	DKD Calibration			2016/11/29	2018/11/28
Personal Computer	Dell	30304832059			
Power Meter	NRVD	828110/016			
	Calibration Details			Last Execution	Next Exec.
	Standard calibration			2017/05/17	2018/05/16
Sensor Head A	NRV-Z1	827753/005			
	Calibration Details			Last Execution	Next Exec.
	Standard calibration			2017/05/18	2018/05/17
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG		
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG		
	HW/SW Status			Date of Start	Date of End
	Firmware-Update 4.34.4 from 3.45 during calibration			2009/12/03	
Spectrum Analyzer	FSW 43	103779			
	Calibration Details			Last Execution	Next Exec.
	DKD calibration			2016/12/02	2018/12/01

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	

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	
Coax Attenuator 10dB SMA 2W	4T-10	F9401	
Coax Attenuator 10dB SMA 2W	56-10	W3702	
Coax Attenuator 10dB SMA 2W	56-10	W3711	
Coax Cable Huber&Suhner	Sucotest 2,0m		Huber&Suhner
Coax Cable Rosenberger Micro Coax FA210A0010003030 SMA/SMA 1,0m	FA210A0010003030	54491-2	
Power Meter	NRVD	828110/016	
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2017/05/17 2018/05/16
RF Step Attenuator RSP	RSP	833695/001	
Rubidium Frequency Standard	Datum, Model: MFS	5489/001	
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2017/07/11 2018/07/10
Sensor Head A	NRV-Z1	827753/005	
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2017/05/18 2018/05/17
Signal Generator SME	SME03	827460/016	
Signal Generator SMP	SMP02	833286/0014	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2016/05/24 2019/05/23
Spectrum Analyzer	FSIQ26	840061/005	Rohde & Schwarz GmbH & Co. KG

Test Equipment T/A Logger 13

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

Single Devices for T/A Logger 13

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

Test Equipment T/H Logger 03

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

Single Devices for T/H Logger 03

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

Test Equipment T/H Logger 12

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

Single Devices for T/H Logger 12

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

Test Equipment Temperature Chamber 05

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

Single Devices for Temperature Chamber 05

Single Device Name	Type	Serial Number	Manufacturer
Temperature Chamber Vötsch 05	VT 4002	58566080550010	
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Customized calibration			2018/04/26 2020/04/25

5 Annex

5.1 Additional Information for Report

Summary of Test Results

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

Technical Report Summary

Type of Authorization :

Certification for a GSM/WCDMA/CDMA2000 cellular radiotelephone device

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 0 to 64 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

§ 2.1053 Measurement required: Field strength of spurious radiation

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 C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

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

Test Description (radiated measurement procedure)

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

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output

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

§2.913 Effective radiated power limits

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

Field strength of spurious radiation

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1053

Test Description

- 1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
 - 2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent equivalent radiated power (related to a $\lambda/2$ dipole).
 - 4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antenna. The frequency range of 30 MHz to 10 GHz (up to the 10th harmonic of the transmit frequency). The frequency range 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 correction factor of 20 dB (1 MHz -> 10 kHz) was used
 - c) [1 MHz / 3 MHz] otherwise
 - Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
 - 6) The spurious emissions peaks were measured in both vertical and horizontal antenna polarization during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case peaks all orientations (X, Y, Z) of the EUT have been measured.
 - 7) After this initial test, a final test according to ANSI C63.26-2015 Unwanted Emissions is performed on signals transmitted by the EUT.

identified as being close to the limit. For any emissions found to be within 10 dB of the limit, a specific signal sub-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 leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent 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) or as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted on equipment as installed. Such measurements must be accompanied by a description of the site where the measurements are made showing the location of any possible source of reflections which might distort the field strength measurements. The measurements submitted shall include the relative radiated power of each spurious emission with reference to the rated power 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 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 4 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages shall be checked.

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

(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 power (P) by a factor of at least $43 + 10 \log(P)$ dB.

This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBμV/m (field strength) in the far field.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrow resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission limit 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 bands and 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 licensee 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.

Summary of Test Results

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

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

§ 2.1053 Measurement required: Field strength of spurious radiation

Part 24, Subpart E - Broadband PCS

§ 24.232 Power and antenna height limits

§ 24.236 Field strength limits

§ 24.238 Emission limitations for Broadband PCS equipment

additional documents

ANSI C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to "Setup Drawings".
 - 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the results 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 equivalent radiated power (related to a $\lambda/2$ dipole).
- 4) The output power was measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case power all orientations (X, Y, Z) of the EUT have been measured.
- 5) The test procedure according to ANSI C63.26-2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output

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

(e) Peak transmit power must be measured over any interval of continuous transmission using instrumentation capable of measuring the peak power 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, and so on, as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

Field strength of spurious radiation

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1053

Test Description

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.

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

Important Settings:

- Output Power: Maximum
- Channel: please refer to the detailed results
- 3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent equivalent radiated power (related to a $\lambda/2$ dipole).
- 4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antenna in the frequency range of 30 MHz to 20 GHz (up to the 10th harmonic of the transmit frequency). The frequency range 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 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) have been measured.
- 7) After this initial test, a final test according to ANSI C63.26-2015 Unwanted Emissions is performed on signals which have been 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 panel, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent

supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, and sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) or as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with a measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted on 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. Measurements submitted shall include the relative radiated power of each spurious emission with reference to the rated power 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 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 4 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages shall be checked.

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

(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 power (P) by a factor of at least $43 + 10 \log(P)$ dB.

This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in the far-field.

(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 resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission 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 bands 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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Summary of Test Results

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

Technical Report Summary

Type of Authorization :

Certification for a GSM/WCDMA/CDMA2000 cellular radiotelephone device

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 0 to 64 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

§ 2.1053 Measurement required: Field strength of spurious radiation

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 C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

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

Test Description (radiated measurement procedure)

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

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output

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

§2.913 Effective radiated power limits

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

Field strength of spurious radiation

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1053

Test Description

- 1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
 - 2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
- Important Settings:
- Output Power: Maximum
 - Channel: please refer to the detailed results
- 3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent equivalent radiated power (related to a $\lambda/2$ dipole).
 - 4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antenna in the frequency range of 30 MHz to 10 GHz (up to the 10th harmonic of the transmit frequency). The frequency range 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 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 were measured.
 - 7) After this initial test, a final test according to ANSI C63.26-2015 Unwanted Emissions is performed on signals transmitted by the EUT.

identified as being close to the limit. For any emissions found to be within 10 dB of the limit, a specific signal sub-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 leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent 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) or as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted on equipment as installed. Such measurements must be accompanied by a description of the site where the measurements are made showing the location of any possible source of reflections which might distort the field strength measurements. Submitted shall include the relative radiated power of each spurious emission with reference to the rated power 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 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 4 GHz whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages shall be checked.

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

(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 power (P) by a factor of at least $43 + 10 \log(P)$ dB.

This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBμV/m (field strength) in the far field.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission limit 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 bands and 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 licensee 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.

Summary of Test Results

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

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

§ 2.1053 Measurement required: Field strength of spurious radiation

Part 24, Subpart E - Broadband PCS

§ 24.232 Power and antenna height limits

§ 24.236 Field strength limits

§ 24.238 Emission limitations for Broadband PCS equipment

additional documents

ANSI C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to "Setup Drawings".
 - 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the results 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 equivalent radiated power (related to a $\lambda/2$ dipole).
- 4) The output power was measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case power all orientations (X, Y, Z) of the EUT have been measured.
- 5) The test procedure according to ANSI C63.26-2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure. The values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the 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 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, detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sense of the antenna as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

Field strength of spurious radiation

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1053

Test Description

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.

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

Important Settings:

- Output Power: Maximum
- Channel: please refer to the detailed results
- 3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent equivalent radiated power (related to a $\lambda/2$ dipole).
- 4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antenna in the frequency range of 30 MHz to 20 GHz (up to the 10th harmonic of the transmit frequency). The frequency range 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 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) have been measured.
- 7) After this initial test, a final test according to ANSI C63.26-2015 Unwanted Emissions is performed on signals which have been 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 panel, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent

supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, and sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) or as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with a measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted on 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. Measurements submitted shall include the relative radiated power of each spurious emission with reference to the rated power 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 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 4 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages shall be checked.

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

(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 power (P) by a factor of at least $43 + 10 \log(P)$ dB.

This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in the far-field.

(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 resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier 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 bands 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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Summary of Test Results

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

Technical Report Summary

Type of Authorization :

Certification for a GSM 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
§ 2.1053 Measurement required: Field strength of spurious radiation

Part 27, Subpart C—Technical Standards

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

additional documents

ANSI C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

- 1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to "Setup Drawings".
- 2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the results 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 equivalent radiated power (related to a $\lambda/2$ dipole).
- 4) The output power was measured in both vertical and horizontal antenna polarisation during the call. The results are 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 were measured.
- 5) The test procedure according to ANSI C63.26-2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure. The values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the 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 1755–1770 MHz bands:

(2) Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to a peak envelope power of 100 W. Fixed stations operating in this band are limited to a maximum antenna height of 10 meters above ground, and portable stations must employ a means for limiting power to the minimum necessary for successful communication.

Field strength of spurious radiation

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1053

Test Description

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a 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 equivalent radiated power (related to a $\lambda/2$ dipole).

4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antenna in the frequency range of 30 MHz to 18 GHz (up to the 10th harmonic of the transmit frequency). The frequency range 1710–1770 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 correction factor of 20 dB (1 MHz \rightarrow 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 test on the lowest channel, mid channel and on the highest channel. To find the worst case peaks all orientations (X, Y, Z) have been measured.

7) After this initial test, a final test according to ANSI C63.26-2015 Unwanted Emissions is performed on signals 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 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 this section 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 unsafe to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted if made with 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 supplied 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 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 4 GHz, whichever is lower.
- (b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages shall be checked.
- (c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be checked.
- (d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

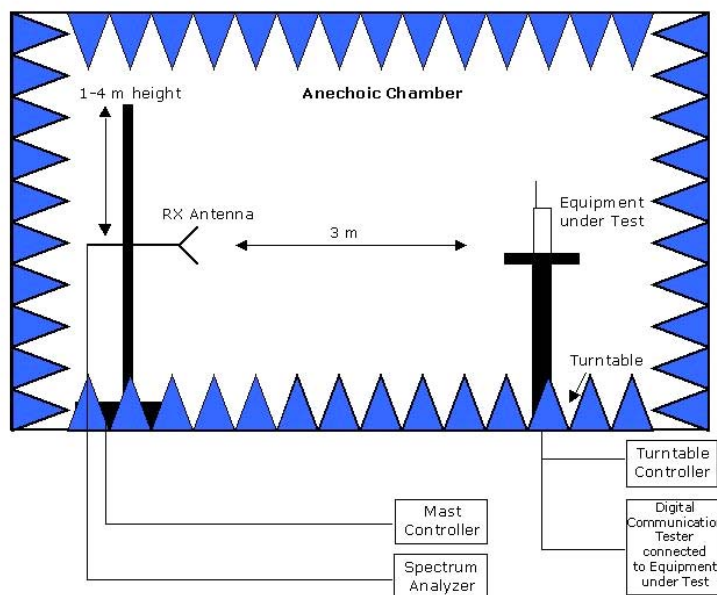
§ 27.53 Emission limits

- (h) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensed 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 0.001 V/m (field strength) in a distance of 3 m.

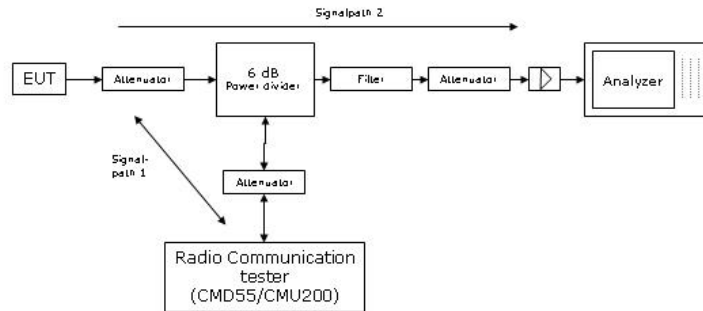
- (1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency, the resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter shall be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier 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 as possible, 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.

Setup Drawings

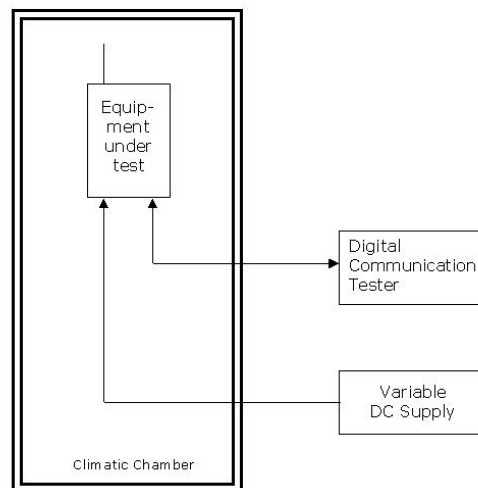


Principle set-up for radiated measurements



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

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-130 SRSP-518	RSS-132 SRSP-503	RSS-133 SRSP-510	RSS-139 SRSP-513	RSS-199 SRSP-517
					Issue:	4, 2014	1, 2013	3, 2013	6, 2013	3, 2016	3, 2016
power output	§ 2.1046	§ 22.913	§ 24.232	§ 27.50	Transmitter output power	6.12	4.4	5.4	6.4	6.5	4.4
frequency stability	§ 2.1055	§ 22.355	§ 24.235	§ 27.54	Frequency stability	6.11	4.3	5.3	6.3	6.4	4.3
unwanted emissions at antenna terminals	§ 2.1051	§ 22.917	§ 24.238	§ 27.53	Transmitter unwanted emissions conducted	6.13	4.6	5.5	6.5	6.6	4.5
	–	–	–	–	Receiver unwanted emissions conducted	5/7 *), 7.1.3	–	5.6	6.6	–	–
field strength of unwanted radiation	§ 2.1053	§ 22.917	§ 24.238	§ 27.53	Transmitter unwanted emissions radiated	6.13	4.6	5.5	6.5	6.6	4.5
	–	–	–	–	Receiver unwanted emissions radiated	5/7 *), 7.1.2	–	5.6	6.6	–	–
emission and occupied Bandwidth	§ 2.1049	–	–	–	Emission and Occupied Bandwidth	6.6	–	5.5	2.3; 6.5	–	–
band edge compliance	§ 2.1053	§ 22.917	§ 24.238	§ 27.53	Band edge compliance	6.13	4.6	5.5	6.5	6.6	4.5

*) 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.

TEST MODE	TX / RX	RF Channel			TEST MODE	TX / RX	RF Channel		
		Low	Mid	High			Low	Mid	High
LTE eFDD 2	TX (1.4M)	18607	18900	19193	LTE eFDD 4	TX (1.4M)	19957	20175	20393
		1850.7 MHz	1880 MHz	1909.3 MHz			1710.7MHz	1732.5MHz	1754.3MHz
	TX (3M)	CH 18615	CH 18900	CH 19185		TX (3M)	CH 19965	CH 20175	CH 20385
		1851.5 MHz	1880 MHz	1908.5 MHz			1711.50 MHz	1732.50 MHz	1753.50 MHz
	TX (5M)	CH 18625	CH 18900	CH 19175		TX (5M)	CH 19975	CH 20175	CH 20375
		1852.5 MHz	1880 MHz	1907.5 MHz			1712.50 MHz	1732.50 MHz	1752.50 MHz
	TX (10)	CH 18650	CH 18900	CH 19150		TX (10)	CH 20000	CH 20175	CH 20350
		1855 MHz	1880 MHz	1905 MHz			1715.00 MHz	1732.50 MHz	1750.00 MHz
	TX (15M)	CH 18675	CH 18900	CH 19125		TX (15M)	CH 20025	CH 20175	CH 20325
		1857.5 MHz	1880 MHz	1902.5 MHz			1717.50 MHz	1732.50 MHz	1747.50 MHz
	TX (20M)	CH 18700	CH 18900	CH 19100		TX (20M)	CH 20050	CH 20175	CH 20300
		1860 MHz	1880 MHz	1900 MHz			1720.00 MHz	1732.50 MHz	1745.00 MHz
	RX (1.4M)	CH 607	CH 900	CH 1193		RX (1.4M)	CH 1957	CH 2175	CH 2393
		1930.7 MHz	1960 MHz	1989.3 MHz			2110.70 MHz	2132.50 MHz	2154.30 MHz
	RX (3M)	CH 615	CH 900	CH 1185		RX (3M)	CH 1965	CH 2175	CH 2385
		1931.5 MHz	1960 MHz	1988.5 MHz			2111.50 MHz	2132.50 MHz	2153.50 MHz
	RX (5M)	CH 625	CH 900	CH 1175		RX (5M)	CH 1975	CH 2175	CH 2375
		1932.50 MHz	1880.00 MHz	1987.5 MHz			2112.50 MHz	2132.50 MHz	2152.50 MHz
	RX (10M)	CH 650	CH 900	CH 1150		RX (10M)	CH 2000	CH 2175	CH 2350
		1935.00 MHz	1960.00 MHz	1985.00 MHz			2115.00 MHz	2132.50 MHz	2150.00 MHz
	RX (15M)	CH 675	CH 900	CH 1125		RX (15M)	CH 2025	CH 2175	CH 2325
		1937.50 MHz	1960.00 MHz	1982.50 MHz			2117.50 MHz	2132.50 MHz	2147.50 MHz
	RX (20M)	CH 700	CH 900	CH 1100		RX (20M)	CH 2050	CH 2175	CH 2300
		1940.00 MHz	1960.00 MHz	1980.00 MHz			2120.00 MHz	2132.50 MHz	2145.00 MHz
TEST MODE	TX / RX	RF Channel			TEST MODE	TX / RX	RF Channel		
		Low	Mid	High			Low	Mid	High
LTE eFDD 5	TX (1.4M)	20407	20525	20643	LTE eFDD 12	TX (1.4M)	CH 23017	CH 23095	CH 23173
		824.7	836.5	848.3			699.70 MHz	707.50 MHz	715.30 MHz
	TX (3M)	CH 20415	CH 20525	CH 20635		TX (3M)	CH 23025	CH 23095	CH 23165
		825.50 MHz	836.50 MHz	847.50 MHz			700.50 MHz	707.50 MHz	714.50 MHz
	TX (5M)	CH 20425	CH 20525	CH 20625		TX (5M)	CH 23035	CH 23095	CH 23155
		826.50 MHz	836.50 MHz	846.50 MHz			701.50 MHz	707.50 MHz	713.50 MHz
	TX (10)	CH 20450	CH 20525	CH 20600		TX (10)	CH 23060	CH 23095	CH 23130
		829.00 MHz	836.50 MHz	844.00 MHz			704.00 MHz	707.50 MHz	711.00 MHz
	RX (1.4M)	CH 2407	CH 20525	CH 2643		RX (1.4M)	CH 5017	CH 5095	CH 5173
		869.70 MHz	881.50 MHz	893.70 MHz			729.70 MHz	737.50 MHz	745.30 MHz
	RX (3M)	CH 2415	CH 20525	CH 2635		RX (3M)	CH 5025	CH 5095	CH 5165
		870.50 MHz	881.50 MHz	892.50 MHz			730.50 MHz	737.50 MHz	744.50 MHz
	RX (5M)	CH 2425	CH 2525	CH 2625		RX (5M)	CH 5035	CH 5095	CH 5155
		871.50 MHz	881.50 MHz	891.50 MHz			731.50 MHz	737.50 MHz	743.50 MHz
	RX (10M)	CH 2450	CH 2525	CH 2600		RX (10M)	CH 5060	CH 5095	CH 5130
		874.00 MHz	881.50 MHz	889.00 MHz			734.00 MHz	737.50 MHz	741.00 MHz

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