InterLab

Final Report on

Cellular Module

Cinterion® ALAS66A-W Data and Voice

FCC ID: QIPALAS66A-W

according to FCC Part 22, Subpart H, Part 24, Subpart E and Part 27, Subpart C, Part 90, Subpart 1

Report Reference: MDE_GEMALTO_1802_FCCe_Rev01

Date: July 08, 2019

Test Laboratory:
7layers GmbH
Borsigstraße 11
40880 Ratingen
Germany

Deutsche Akkreditierungsstelle D-PL-12140-01-00

1 Administrative Data

1.1 Project Data

Project Responsible:	Andreas Tübel
Date Of Test Report:	2019/07/08
Date of first test:	2018/07/04
Date of last test:	2019/03/19

1.2 Applicant Data

Company Name: Gemalto M2M GmbH

Street:	Siemensdamm 50
City:	13629 Berlin
Country:	Germany

Contact Person: Mr. Axel Heike

Function:	Certification Manager
Department:	Approval Department
Phone:	+49 30 31102 8146
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Mobile:	+49 172 840 8795
E-Mail:	Axel.Heike@gemalto.com

1.3 Test Laboratory Data

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

7 layers DE

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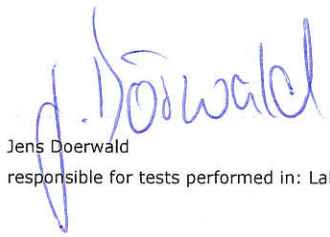
E Mail :	Michael.Albert@7Layers.com

Laboratory Details

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

1.4 Signature of the Testing Responsible



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

1.5 Signature of the Accreditation Responsible

Accreditation scope responsible person
responsible for Lab 1, Lab 2

2 Test Object Data

2.1 General OUT Description

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

OUT: Cinterion ALAS66A-W

Type / Model / Family:	Cinterion® ALAS66A-W FCC ID: QIPALAS66A-W according to FCC Part 22, Subpart H, Part 24, Subpart E and Part 27, Subpart C, Part 90, Subpart 1
Product Category:	Module
Manufacturer:	
Company Name:	see applicant data
Contact Person:	see applicant data

Parameter List:

Parameter name	*Value*
DC Power Supply	12 (V)
highest channel	251 (848.8MHz) for GSM850, 810 (1909.8MHz) for GSM1900, 4233 (846.6MHz) for FDD5, 9538 (1907.6MHz) for FDD2, 1513 (1752.6MHz) for FDD4, 20643 (848.3MHz) for eFDD5 21425 (2567.5MHz) for eFDD7, 27039 (849MHz) for eFDD26
lowest channel	128 (824.2MHz) for GSM850, 512 (1850.2MHz) for GSM1900, 4132 (826.4MHz) for FDD5, 9262 (1852.4MHz)for FDD2, 1312 (1712.4MHz) for FDD4, 20407 (824.7MHz) for eFDD5
mid channel	20775 (2502.5MHz) for eFDD7, 26690 (814MHz) for eFDD26 190 (836.6MHz) for GSM850, 661 (1880.0MHz) for GSM1900, 4183 (836.6MHz) for FDD5, 9400 (1880MHz) for FDD2, 1412 (1732.4MHz)/1450 (1740.0MHz) for FDD4, 20525 (836.5MHz) for eFDD5 21100 (2535MHz) for eFDD7, 26865 (831.5MHz) for eFDD26

2.2 Detailed Description of OUT Samples

Sample : bw03

OUT Identifier	Cinterion ALAS66A-W		
Sample Description	RF Sample FCC/ISED #02		
Serial No.	004401082632734		
HW Status	Rev. 3.1.3a		
SW Status	Rev. 00.120		
Low Voltage	3.3 V	*Low Temp.*	-20 °C
High Voltage	4.2 V	*High Temp.*	55 °C
Nominal Voltage	3.8 V	*Normal Temp.*	23 °C

Sample : bx03

OUT Identifier	Cinterion ALAS66A-W		
Sample Description	RF Sample FCC/ISED		
Serial No.	004401082626769		
HW Status	Rev. 3.1.3a		
SW Status	Rev. 00.120		
Low Voltage	3.3 V	*Low Temp.*	-20 °C
High Voltage	4.2 V	*High Temp.*	55 °C
Nominal Voltage	3.8 V	*Normal Temp.*	23 °C

Sample : by03

OUT Identifier	Cinterion ALAS66A-W		
Sample Description	Radiated Sample		
Serial No.	004401082631694		
HW Status	Rev. 3.1.3a		
SW Status	Rev. 00.120		
Low Voltage	3.3 V	*Low Temp.*	-20 °C
High Voltage	4.2 V	*High Temp.*	55 °C
Nominal Voltage	3.8 V	*Normal Temp.*	23 °C

2.3 OUT Features

Features for OUT: Cinterion ALAS66A-W Data and Voice Module

Designation	*Description*	*Allowed Values*	*Supported Value(s)*
Features for scope: FCC_v2			
DC	The OUT is powered by or connected to DC		
Eant	removable antenna supplied and type tested with the radio equipment, designed as an indispensable part of the equipment		
EDGE850	EUT supports EDGE in the band 824 MHz - 849 MHz		
EDGE1900	EUT supports EDGE in the band 1850 MHz - 1910 MHz		
eFDD5	EUT supports LTE in the band 824 MHz - 849 MHz		
eFDD7	EUT supports LTE in the band 2500 MHz - 2570 MHz (additional MIMO for carrier aggregation combinations)		
eFDD26	EUT supports LTE in the band 814 MHz - 849 MHz		
FDD5	EUT supports UMTS FDD5 in the band 824 MHz - 849 MHz		
GSM850	EUT supports GSM850 band 824MHz - 849MHz		
HSDPA-FDD5	EUT supports UMTS FDD5 HSDPA in the band 824 MHz - 849 MHz		
HSUPA-FDD5	EUT supports UMTS FDD5 HSUPA in the band 824 MHz - 849 MHz		
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		

2.4 Auxiliary Equipment

AE No.	*Type Designation*	*Serial No.*	*HW Status*	*SW Status*	*Description*
AE AE52	4 Antenna helicopter setup				4 Antenna helicopter setup
AE AE50	Audio Ethernet Adapter Board	191	Rev2		Audio Ethernet Adapter Board
AE AE51	Cui Inc Power Supply 51				Cui Inc Power Supply 51

2.5 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*
S01_BW03	**(RF Setup #02)**			
	Sample: bw03	RF Sample #02		
S01_BX03	**(RF Setup #01)**			
	Sample: bx03	RF Sample #01		
S01_BY03	**(Radiated Setup)**			
	Sample: by03	Radiated Sample	AE AE52	4 Antenna helicopter setup
			AE AE50	Audio Ethernet Adapter Board
			AE AE51	Cui Inc Power Supply 51

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.
REV01: Limits on page 117 and 131 changed; FCC/IC EIRP Limits and Antenna Gain added for Output Power on Page: 11/12/13/14/76/96/97/124/125; additional power measurement on page 98

3.2 List of the Applicable Body

(Bodies for Scope: FCC_v2)

Designation	*Description*
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
FCC47CFRChIPART90PRIVATE LAND MOBILE RADIO SERVICES	Subpart I - General Technical Standards & Subpart S - Regulations Governing Licensing and Use of Frequencies

3.3 List of Test Specification

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

Version 10-1-17 Edition

Title: PART 2 - GENERAL RULES AND REGULATIONS
PART 22 - Subpart H, PUBLIC MOBILE SERVICES

Applicable Errata	*Activate Date*	*Comment*
ANSI C63.26-2015		KDB 971168 D01 v03r01

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

Version 10-1-17 Edition

Title: PART 2 - GENERAL RULES AND REGULATIONS
PART 24 - Subpart E, PERSONAL COMMUNICATIONS SERVICES

Applicable Errata	*Activate Date*	*Comment*
ANSI C63.26-2015		KDB 971168 D01 v03r01

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

Version 10-1-17 Edition

Title: PART 2 - GENERAL RULES AND REGULATIONS
PART 27 - Subpart C, MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

Applicable Errata	*Activate Date*	*Comment*
ANSI C63.26-2015		KDB 971168 D01 v03r01

Test Specification: **FCC part 90**

Version 10-1-13 Edition

Title: PART 90 - GENERAL RULES AND REGULATIONS

3.4 Summary

Test Case Identifier / Name *Test (condition)*	*Result*	*Date of Test*	*Lab Ref.*	*Setup*
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	2018/08/10	Lab 2	S01_BX03
22.2 Frequency stability §2.1055				
22.2; _Frequency stability Summary §2.1055	Passed	2018/07/04	Lab 2	S01_BX03
22.3 Spurious emissions at antenna terminals §2.1051, §22.917				
22.3; Spurious emissions at antenna terminals summary §2.1051, §22.917	Passed	2018/08/10	Lab 2	S01_BX03
22.4 Field strength of spurious radiation §2.1053, §22.917				
22.4; Field strength of spurious radiation Summary §2.1053, §22.917	Passed	2018/08/23	Lab 1	S01_BY03
	22.4; Field strength of spurious radiation Summary §2.1053, §22.917 Worst Case Plot GSM850 & EDGE850 & eFDD5 & eFDD26 & WCDMa FDD5			
22.5 Emission and Occupied Bandwidth §2.1049, §22.917				
22.5; _Emission and Occupied Bandwidth Summary §2.1049, §22.917	Passed	2018/08/10	Lab 2	S01_BX03
22.6 Band edge compliance §2.1053, §22.917				
22.6; _Band edge compliance Summary §2.1053, §22.917	Passed	2018/08/10	Lab 2	S01_BX03
22.7 Peak-to-Average Ratio Summary §2.1046				
22.7; Peak-to-Average Ratio Summary §2.1046	Passed	2018/08/10	Lab 2	S01_BX03
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	2018/08/10	Lab 2	S01_BX03
24.2 Frequency stability §2.1055, §24.235				
24.2; Frequency stability Summary §2.1055, 24.235	Passed	2018/07/04	Lab 2	S01_BX03
24.3 Spurious emissions at antenna terminals §2.1051, §24.238				
24.3; Spurious emissions at antenna terminals Summary §2.1051, §24.238	Passed	2018/08/10	Lab 2	S01_BX03
24.4 Field strength of spurious radiation §2.1053, §24.238				
24.4; Field strength of spurious radiation Summary §2.1053, §24.238	Passed	2018/08/23	Lab 1	S01_BY03
	24.4; Field strength of spurious radiation Summary §2.1053, §24.238 Worst Case Plot GSM 1900 & EDGE 1900			
24.5 Emission and Occupied Bandwidth §2.1049, §24.238				
24.5; Emission and Occupied Bandwidth Summary §2.1049, §24.238	Passed	2018/08/10	Lab 2	S01_BX03
24.6 Band edge compliance §2.1053, §24.238				
24.6; Band edge compliance summary §2.1053, §24.238	Passed	2018/08/10	Lab 2	S01_BY03
24.7 Peak-to-Average ratio §2.1046, §24.232				
24.7; Peak-to-Average Ratio Summary §2.1046, §24.232	Passed	2018/08/18	Lab 2	S01_BX03
Test Specification: FCC part 2 and 27				

Test Case Identifier / Name Test (condition)	Result	Date of Test	Lab Ref.	Setup
27.1 RF Power Output §2.1046, §27.50				
27.1; RF Power Output Summary §2.1046, §27.50	Passed	2018/08/10	Lab 2	S01_BX03
27.2 Frequency stability §2.1055, §27.54				
27.2; Frequency stability Summary §2.1055, §27.54	Passed	2018/07/04	Lab 2	S01_BX03
27.3 Spurious emissions at antenna terminals §2.1051, §27.53				
27.3; Spurious emissions at antenna terminals Summary §2.1051, §27.53	Passed	2018/08/10	Lab 2	S01_BX03
27.4 Field strength of spurious radiation §2.1053, §27.53				
27.4; Field strength of spurious radiation Summary §2.1053, §27.53	Passed	2018/08/23	Lab 1	S01_BY03
	27.4; Field strength of spurious radiation Summary §2.1053, §27.53 Worst Case Plot eFDD7			
27.5 Emission and Occupied Bandwidth §2.1049				
27.5; Emission and Occupied Bandwidth Summary §2.1049	Passed	2018/08/10	Lab 2	S01_BX03
27.6 Band edge compliance §2.1053, §27.53				
27.6; Band edge compliance summary §2.1053, §27.53	Passed	2018/08/10	Lab 2	S01_BX03
27.7 Peak-to-Average ratio §2.1046, §27.50				
27.7; Peak-to-Average Ratio Summary §2.1046, §27.50	Passed	2018/08/10	Lab 2	S01_BX03
Test Specification: FCC part 90				
90.1 Maximum Channel Power, §2.1046, §90.205&90.635				
90.1; RF Power Output Summary §2.1046, §90.542	Passed	2018/08/10	Lab 2	S01_BX03
90.2 Occupied Bandwidth, §2.1049, §90.209				
90.2; Emission and Occupied Bandwidth Summary §2.1049	Passed	2018/08/10	Lab 2	S01_BX03
90.3 Band Edges Compliance, §2.1051, §90691				
90.3; Band edge compliance summary §2.1053, §90.543	Passed	2018/08/10	Lab 2	S01_BX03
90.4 Spurious Emissions at Antenna Terminal, §2.1051, §90.210&§90.669				
90.4; Spurious emissions at antenna terminals summary §2.1051, §90.543	Passed	2018/08/18	Lab 2	S01_BW03
90.5 Radiated Spurious Emission, §2.1055, §90.210				
90.5; Field strength of spurious radiation summary §2.1053, §90.543	Passed	2018/08/23	Lab 2	S01_BY03
	90.5; Field strength of spurious radiation summary §2.1053, §90.543 Worst Case Plot eFDD26			
90.6 Frequency Stability, §2.1055, §90.230				
90.6; Frequency Stability Summary, §2.1055, §90.230	Not tested		Lab 2	S01_BX03
	For LTE band eFDD26 Frequency Stability was tested for FCC Part 22 and not repeated for FCC Part 90, because main frequency range of LTE band eFDD26 is covered by FCC Part 22.			
90.7 Peak-to-Average Ratio §2.1046				
90.7; Peak-to-Average Ratio Summary §2.1046	Passed	2018/08/10	Lab 2	S01_BX03

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_BX03
Date of Test:	2018/08/10 18:39
Body:	FCC47CFRChIPART22PUBLIC MOBILE SERVICES
Test Specification:	FCC part 2 and 22

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak Cond. Power [dBm]	Average Cond. Power [dBm]	RMS Cond. Power [dBm]	FCC EIRP Limit [W]	IC EIRP Limit [W]	Max. Antenna Gain [dBi]
GSM 850	low	-	0.2	32.82	32.76	32.78	11.5	11.5	7.78
GSM 850	mid	-	0.2	33.04	33.03	32.98	11.5	11.5	7.56
GSM 850	high	-	0.2	32.9	32.9	32.89	11.5	11.5	7.7
GSM 850 EDGE	low	-	0.2	30.13	29.96	29.94	11.5	11.5	10.47
GSM 850 EDGE	mid	-	0.2	29.99	29.93	29.94	11.5	11.5	10.61
GSM 850 EDGE	high	-	0.2	29.99	29.97	29.94	11.5	11.5	10.61
FDD V	low	-	5	30.55	24.65	24.8	11.5	11.5	15.8
FDD V	mid	-	5	30.07	24.61	24.83	11.5	11.5	15.77
FDD V	high	-	5	30.07	24.64	24.82	11.5	11.5	15.78
FDD V HSDPA Subtest 1	low	-	5	29.21	23.72	23.89	11.5	11.5	16.71
FDD V HSDPA Subtest 1	mid	-	5	28.99	23.68	23.81	11.5	11.5	16.79
FDD V HSDPA Subtest 1	high	-	5	28.6	23.84	23.88	11.5	11.5	16.72
FDD V HSDPA Subtest 2	low	-	5	29.75	22.83	23.48	11.5	11.5	17.12
FDD V HSDPA Subtest 2	mid	-	5	29.92	22.88	23.47	11.5	11.5	17.13
FDD V HSDPA Subtest 2	high	-	5	29.36	22.86	23.41	11.5	11.5	17.19
FDD V HSDPA Subtest 3	low	-	5	29.52	22.83	23.4	11.5	11.5	17.2
FDD V HSDPA Subtest 3	mid	-	5	29.52	22.8	23.56	11.5	11.5	17.04
FDD V HSDPA Subtest 3	high	-	5	29.52	22.75	23.38	11.5	11.5	17.22
FDD V HSDPA Subtest 4	low	-	5	29.75	22.76	23.48	11.5	11.5	17.12
FDD V HSDPA Subtest 4	mid	-	5	29.75	22.73	23.52	11.5	11.5	17.08
FDD V HSDPA Subtest 4	high	-	5	29.1	22.59	23.36	11.5	11.5	17.24
FDD V HSUPA Subtest 1	low	-	5	30.63	23.32	23.68	11.5	11.5	16.92
FDD V HSUPA Subtest 1	mid	-	5	30.55	23.31	23.57	11.5	11.5	17.03
FDD V HSUPA Subtest 1	high	-	5	30.07	23.31	23.55	11.5	11.5	17.05
FDD V HSUPA Subtest 2	low	-	5	30.07	21.12	21.83	11.5	11.5	18.77
FDD V HSUPA Subtest 2	mid	-	5	30.07	21.16	21.7	11.5	11.5	18.9
FDD V HSUPA Subtest 2	high	-	5	29.21	21.12	21.92	11.5	11.5	18.68
FDD V HSUPA Subtest 3	low	-	5	30.78	22.75	23.29	11.5	11.5	17.31
FDD V HSUPA Subtest 3	mid	-	5	30.78	22.71	23.35	11.5	11.5	17.25
FDD V HSUPA Subtest 3	high	-	5	30.78	22.77	23.23	11.5	11.5	17.37
FDD V HSUPA Subtest 4	low	-	5	30.07	21.03	21.98	11.5	11.5	18.62
FDD V HSUPA Subtest 4	mid	-	5	29.21	21.05	21.79	11.5	11.5	18.81
FDD V HSUPA Subtest 4	high	-	5	29.1	21.06	21.79	11.5	11.5	18.81
FDD V HSUPA Subtest 5	low	-	5	30.63	23.38	23.77	11.5	11.5	16.83
FDD V HSUPA Subtest 5	mid	-	5	30.46	23.42	23.77	11.5	11.5	16.83
FDD V HSUPA Subtest 5	high	-	5	30.7	23.33	23.73	11.5	11.5	16.87

Detailed Results:

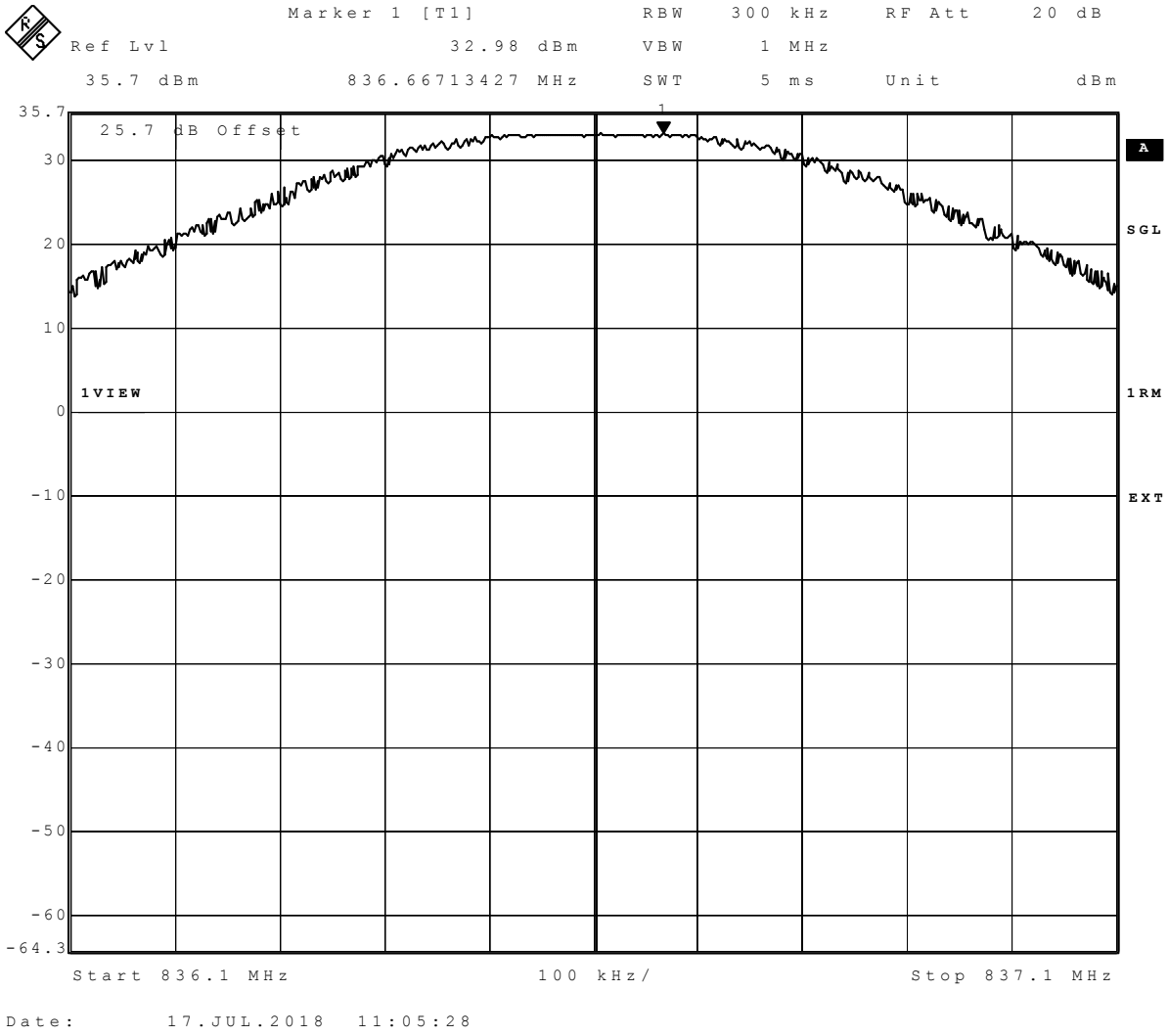
Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak Cond. Power [dBm]	Average Cond. Power [dBm]	RMS Cond. Power [dBm]	FCC EIRP Limit [W]	IC EIRP Limit [W]	Max. Antenna Gain [dBi]
eFDD 5 QPSK	low	1	1.4	-	-	23.03	11.5	11.5	17.57
eFDD 5 QPSK	low	3	1.4	-	-	22.68	11.5	11.5	17.92
eFDD 5 QPSK	low	6	1.4	-	-	21.57	11.5	11.5	19.03
eFDD 5 QPSK	mid	1	1.4	-	-	22.84	11.5	11.5	17.76
eFDD 5 QPSK	mid	3	1.4	-	-	22.49	11.5	11.5	18.11
eFDD 5 QPSK	mid	6	1.4	-	-	21.47	11.5	11.5	19.13
eFDD 5 QPSK	high	1	1.4	-	-	22.83	11.5	11.5	17.77
eFDD 5 QPSK	high	3	1.4	-	-	22.53	11.5	11.5	18.07
eFDD 5 QPSK	high	6	1.4	-	-	21.53	11.5	11.5	19.07
eFDD 5 16QAM	low	1	1.4	-	-	21.91	11.5	11.5	18.69
eFDD 5 16QAM	low	6	1.4	-	-	20.73	11.5	11.5	19.87
eFDD 5 16QAM	mid	1	1.4	-	-	21.71	11.5	11.5	18.89
eFDD 5 16QAM	mid	6	1.4	-	-	20.42	11.5	11.5	20.18
eFDD 5 16QAM	high	1	1.4	-	-	21.74	11.5	11.5	18.86
eFDD 5 16QAM	high	6	1.4	-	-	20.45	11.5	11.5	20.15
eFDD 5 QPSK	low	1	3	-	-	23.31	11.5	11.5	17.29
eFDD 5 QPSK	low	15	3	-	-	22.05	11.5	11.5	18.55
eFDD 5 QPSK	mid	1	3	-	-	23.16	11.5	11.5	17.44
eFDD 5 QPSK	mid	15	3	-	-	21.92	11.5	11.5	18.68
eFDD 5 QPSK	high	1	3	-	-	23.2	11.5	11.5	17.4
eFDD 5 QPSK	high	15	3	-	-	21.9	11.5	11.5	18.7
eFDD 5 16QAM	low	1	3	-	-	22.32	11.5	11.5	18.28
eFDD 5 16QAM	low	15	3	-	-	20.96	11.5	11.5	19.64
eFDD 5 16QAM	mid	1	3	-	-	22.28	11.5	11.5	18.32
eFDD 5 16QAM	mid	15	3	-	-	20.93	11.5	11.5	19.67
eFDD 5 16QAM	high	1	3	-	-	22.2	11.5	11.5	18.4
eFDD 5 16QAM	high	15	3	-	-	21.02	11.5	11.5	19.58
eFDD 5 QPSK	low	1	5	-	-	23.33	11.5	11.5	17.27
eFDD 5 QPSK	low	12	5	-	-	22.05	11.5	11.5	18.55
eFDD 5 QPSK	low	25	5	-	-	22.02	11.5	11.5	18.58
eFDD 5 QPSK	mid	1	5	-	-	23.19	11.5	11.5	17.41
eFDD 5 QPSK	mid	12	5	-	-	21.87	11.5	11.5	18.73
eFDD 5 QPSK	mid	25	5	-	-	21.92	11.5	11.5	18.68
eFDD 5 QPSK	high	1	5	-	-	23.23	11.5	11.5	17.37
eFDD 5 QPSK	high	12	5	-	-	21.93	11.5	11.5	18.67
eFDD 5 QPSK	high	25	5	-	-	21.97	11.5	11.5	18.63
eFDD 5 16QAM	low	1	5	-	-	22.53	11.5	11.5	18.07
eFDD 5 16QAM	low	25	5	-	-	21.08	11.5	11.5	19.52
eFDD 5 16QAM	mid	1	5	-	-	22.39	11.5	11.5	18.21
eFDD 5 16QAM	mid	25	5	-	-	20.93	11.5	11.5	19.67
eFDD 5 16QAM	high	1	5	-	-	22.35	11.5	11.5	18.25
eFDD 5 16QAM	high	25	5	-	-	20.95	11.5	11.5	19.65
eFDD 5 QPSK	low	1	10	-	-	23.45	11.5	11.5	17.15
eFDD 5 QPSK	low	50	10	-	-	22.33	11.5	11.5	18.27
eFDD 5 QPSK	mid	1	10	-	-	23.29	11.5	11.5	17.31
eFDD 5 QPSK	mid	50	10	-	-	22.26	11.5	11.5	18.34
eFDD 5 QPSK	high	1	10	-	-	23.4	11.5	11.5	17.2
eFDD 5 QPSK	high	50	10	-	-	22.33	11.5	11.5	18.27
eFDD 5 16QAM	low	1	10	-	-	22.29	11.5	11.5	18.31
eFDD 5 16QAM	low	50	10	-	-	21.37	11.5	11.5	19.23
eFDD 5 16QAM	mid	1	10	-	-	22.56	11.5	11.5	18.04
eFDD 5 16QAM	mid	50	10	-	-	21.24	11.5	11.5	19.36
eFDD 5 16QAM	high	1	10	-	-	22.36	11.5	11.5	18.24
eFDD 5 16QAM	high	50	10	-	-	21.35	11.5	11.5	19.25

Detailed Results:

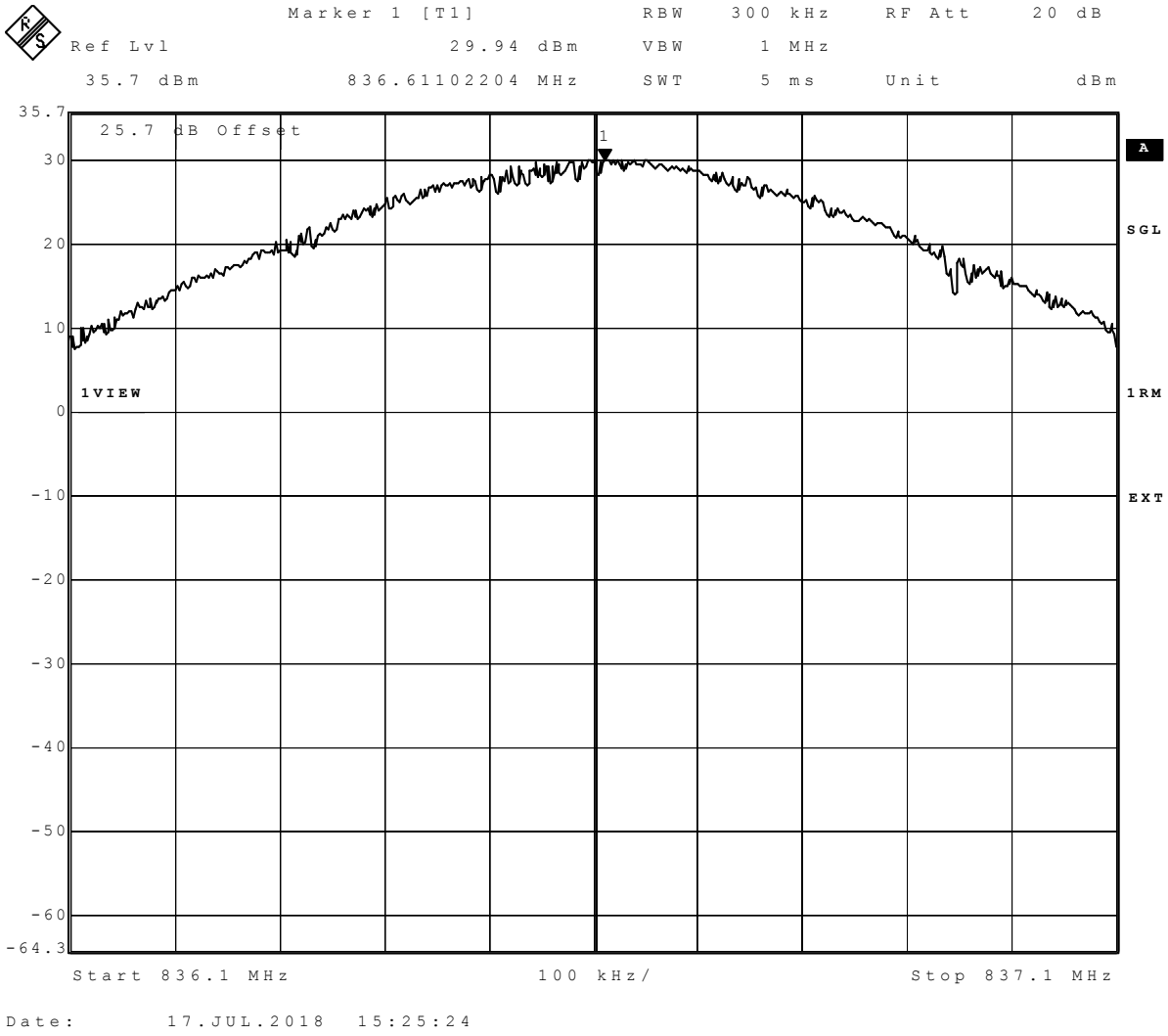
Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak Cond. Power [dBm]	Average Cond. Power [dBm]	RMS Cond. Power [dBm]	FCC EIRP Limit [W]	IC EIRP Limit [W]	Max. Antenna Gain [dBi]
eFDD 26 QPSK	low	1	1.4	-	-	22.93	11.5	11.5	17.67
eFDD 26 QPSK	low	3	1.4	-	-	22.83	11.5	11.5	17.77
eFDD 26 QPSK	low	6	1.4	-	-	21.73	11.5	11.5	18.87
eFDD 26 QPSK	mid	1	1.4	-	-	23.05	11.5	11.5	17.55
eFDD 26 QPSK	mid	3	1.4	-	-	22.69	11.5	11.5	17.91
eFDD 26 QPSK	mid	6	1.4	-	-	21.62	11.5	11.5	18.98
eFDD 26 QPSK	high	1	1.4	-	-	22.96	11.5	11.5	17.64
eFDD 26 QPSK	high	3	1.4	-	-	22.76	11.5	11.5	17.84
eFDD 26 QPSK	high	6	1.4	-	-	21.64	11.5	11.5	18.96
eFDD 26 16QAM	low	1	1.4	-	-	22.12	11.5	11.5	18.48
eFDD 26 16QAM	low	6	1.4	-	-	20.79	11.5	11.5	19.81
eFDD 26 16QAM	mid	1	1.4	-	-	22.06	11.5	11.5	18.54
eFDD 26 16QAM	mid	6	1.4	-	-	20.88	11.5	11.5	19.72
eFDD 26 16QAM	high	1	1.4	-	-	22.13	11.5	11.5	18.47
eFDD 26 16QAM	high	6	1.4	-	-	20.79	11.5	11.5	19.81
eFDD 26 QPSK	low	1	3	-	-	23.27	11.5	11.5	17.33
eFDD 26 QPSK	low	15	3	-	-	22.03	11.5	11.5	18.57
eFDD 26 QPSK	mid	1	3	-	-	23.31	11.5	11.5	17.29
eFDD 26 QPSK	mid	15	3	-	-	22.03	11.5	11.5	18.57
eFDD 26 QPSK	high	1	3	-	-	23.26	11.5	11.5	17.34
eFDD 26 QPSK	high	15	3	-	-	22.01	11.5	11.5	18.59
eFDD 26 16QAM	low	1	3	-	-	22.48	11.5	11.5	18.12
eFDD 26 16QAM	low	15	3	-	-	21.08	11.5	11.5	19.52
eFDD 26 16QAM	mid	1	3	-	-	22.45	11.5	11.5	18.15
eFDD 26 16QAM	mid	15	3	-	-	21.02	11.5	11.5	19.58
eFDD 26 16QAM	high	1	3	-	-	22.42	11.5	11.5	18.18
eFDD 26 16QAM	high	15	3	-	-	21.07	11.5	11.5	19.53
eFDD 26 QPSK	low	1	5	-	-	23.44	11.5	11.5	17.16
eFDD 26 QPSK	low	12	5	-	-	22.09	11.5	11.5	18.51
eFDD 26 QPSK	low	25	5	-	-	22	11.5	11.5	18.6
eFDD 26 QPSK	mid	1	5	-	-	23.42	11.5	11.5	17.18
eFDD 26 QPSK	mid	12	5	-	-	22.05	11.5	11.5	18.55
eFDD 26 QPSK	mid	25	5	-	-	22.09	11.5	11.5	18.51
eFDD 26 QPSK	high	1	5	-	-	23.39	11.5	11.5	17.21
eFDD 26 QPSK	high	12	5	-	-	22.03	11.5	11.5	18.57
eFDD 26 QPSK	high	25	5	-	-	22.02	11.5	11.5	18.58
eFDD 26 16QAM	low	1	5	-	-	22.42	11.5	11.5	18.18
eFDD 26 16QAM	low	25	5	-	-	21.03	11.5	11.5	19.57
eFDD 26 16QAM	mid	1	5	-	-	22.57	11.5	11.5	18.03
eFDD 26 16QAM	mid	25	5	-	-	21.06	11.5	11.5	19.54
eFDD 26 16QAM	high	1	5	-	-	22.56	11.5	11.5	18.04
eFDD 26 16QAM	high	25	5	-	-	21.02	11.5	11.5	19.58
eFDD 26 QPSK	low	1	10	-	-	23.55	11.5	11.5	17.05
eFDD 26 QPSK	low	50	10	-	-	22.39	11.5	11.5	18.21
eFDD 26 QPSK	mid	1	10	-	-	23.54	11.5	11.5	17.06
eFDD 26 QPSK	mid	50	10	-	-	22.42	11.5	11.5	18.18
eFDD 26 QPSK	high	1	10	-	-	23.56	11.5	11.5	17.04
eFDD 26 QPSK	high	50	10	-	-	22.39	11.5	11.5	18.21
eFDD 26 16QAM	low	1	10	-	-	22.7	11.5	11.5	17.9
eFDD 26 16QAM	low	50	10	-	-	21.42	11.5	11.5	19.18
eFDD 26 16QAM	mid	1	10	-	-	22.52	11.5	11.5	18.08
eFDD 26 16QAM	mid	50	10	-	-	21.38	11.5	11.5	19.22
eFDD 26 16QAM	high	1	10	-	-	22.62	11.5	11.5	17.98
eFDD 26 16QAM	high	50	10	-	-	21.4	11.5	11.5	19.2

Detailed Results:

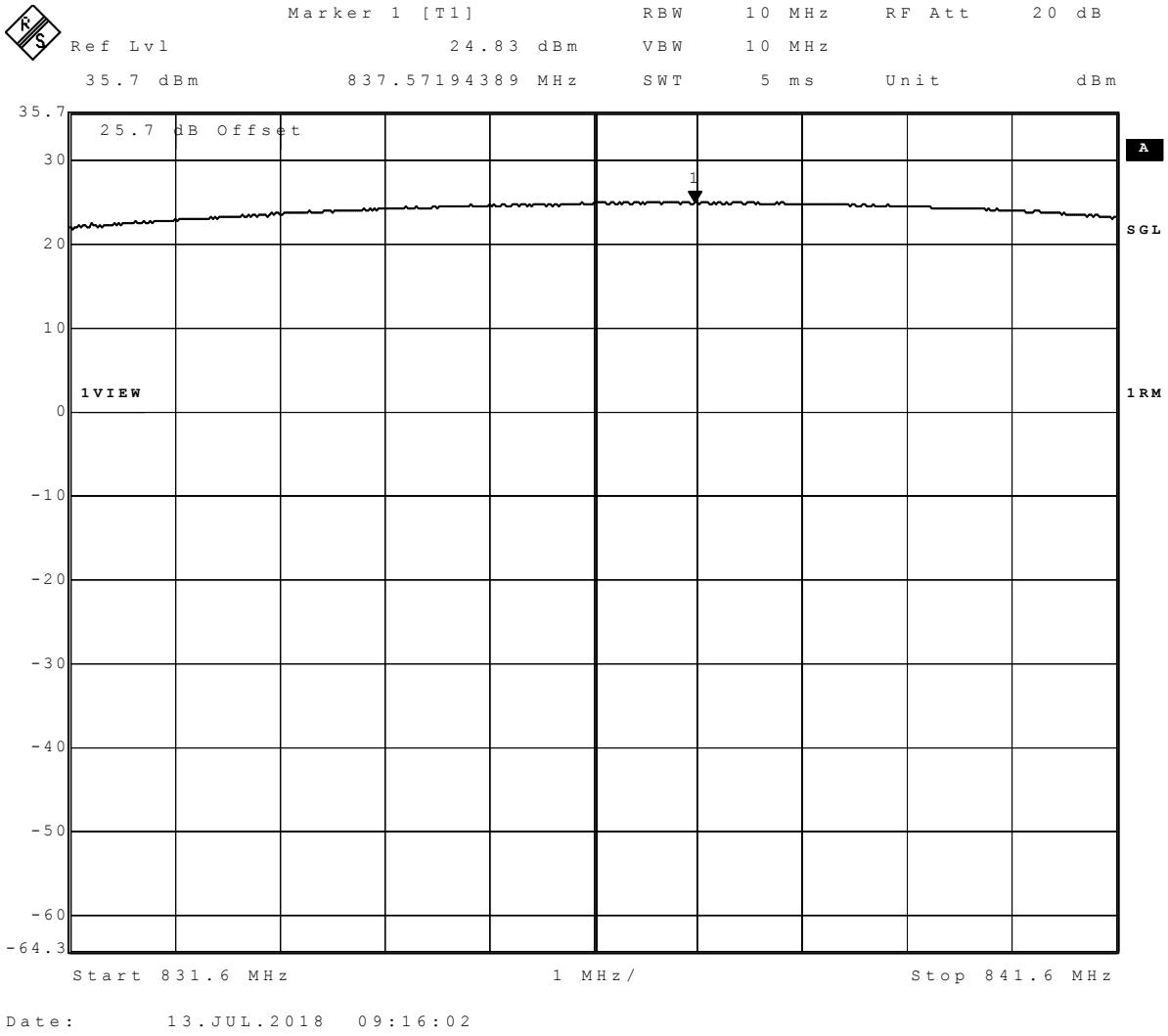
Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak Cond. Power [dBm]	Average Cond. Power [dBm]	RMS Cond. Power [dBm]	FCC EIRP Limit [W]	IC EIRP Limit [W]	Max. Antenna Gain [dBi]
eFDD 5 64QAM	low	1	1.4	-	-	21.27	11.5	11.5	19.33
eFDD 5 64QAM	low	6	1.4	-	-	19.7	11.5	11.5	20.9
eFDD 5 64QAM	mid	1	1.4	-	-	21.15	11.5	11.5	19.45
eFDD 5 64QAM	mid	6	1.4	-	-	19.73	11.5	11.5	20.87
eFDD 5 64QAM	high	1	1.4	-	-	20.72	11.5	11.5	19.88
eFDD 5 64QAM	high	6	1.4	-	-	19.57	11.5	11.5	21.03
eFDD 5 64QAM	low	1	3	-	-	21.2	11.5	11.5	19.4
eFDD 5 64QAM	low	15	3	-	-	20.05	11.5	11.5	20.55
eFDD 5 64QAM	mid	1	3	-	-	21.13	11.5	11.5	19.47
eFDD 5 64QAM	mid	15	3	-	-	20.03	11.5	11.5	20.57
eFDD 5 64QAM	high	1	3	-	-	21.43	11.5	11.5	19.17
eFDD 5 64QAM	high	15	3	-	-	19.97	11.5	11.5	20.63
eFDD 5 64QAM	low	1	5	-	-	21.5	11.5	11.5	19.1
eFDD 5 64QAM	low	25	5	-	-	20.02	11.5	11.5	20.58
eFDD 5 64QAM	mid	1	5	-	-	21.41	11.5	11.5	19.19
eFDD 5 64QAM	mid	25	5	-	-	20.04	11.5	11.5	20.56
eFDD 5 64QAM	high	1	5	-	-	21.25	11.5	11.5	19.35
eFDD 5 64QAM	high	25	5	-	-	19.96	11.5	11.5	20.64
eFDD 5 64QAM	low	1	10	-	-	21.07	11.5	11.5	19.53
eFDD 5 64QAM	low	50	10	-	-	20.22	11.5	11.5	20.38
eFDD 5 64QAM	mid	1	10	-	-	21.41	11.5	11.5	19.19
eFDD 5 64QAM	mid	50	10	-	-	20.32	11.5	11.5	20.28
eFDD 5 64QAM	high	1	10	-	-	21.41	11.5	11.5	19.19
eFDD 5 64QAM	high	50	10	-	-	20.31	11.5	11.5	20.29
eFDD 26 64QAM	low	1	1.4	-	-	21.52	11.5	11.5	19.08
eFDD 26 64QAM	low	6	1.4	-	-	20.04	11.5	11.5	20.56
eFDD 26 64QAM	mid	1	1.4	-	-	21.29	11.5	11.5	19.31
eFDD 26 64QAM	mid	6	1.4	-	-	19.95	11.5	11.5	20.65
eFDD 26 64QAM	high	1	1.4	-	-	21.27	11.5	11.5	19.33
eFDD 26 64QAM	high	6	1.4	-	-	19.9	11.5	11.5	20.7
eFDD 26 64QAM	low	1	3	-	-	21.64	11.5	11.5	18.96
eFDD 26 64QAM	low	15	3	-	-	20.44	11.5	11.5	20.16
eFDD 26 64QAM	mid	1	3	-	-	21.59	11.5	11.5	19.01
eFDD 26 64QAM	mid	15	3	-	-	20.34	11.5	11.5	20.26
eFDD 26 64QAM	high	1	3	-	-	21.37	11.5	11.5	19.23
eFDD 26 64QAM	high	15	3	-	-	20.18	11.5	11.5	20.42
eFDD 26 64QAM	low	1	5	-	-	21.82	11.5	11.5	18.78
eFDD 26 64QAM	low	25	5	-	-	20.43	11.5	11.5	20.17
eFDD 26 64QAM	mid	1	5	-	-	21.64	11.5	11.5	18.96
eFDD 26 64QAM	mid	25	5	-	-	20.3	11.5	11.5	20.3
eFDD 26 64QAM	high	1	5	-	-	21.6	11.5	11.5	19
eFDD 26 64QAM	high	25	5	-	-	20.27	11.5	11.5	20.33
eFDD 26 64QAM	low	1	10	-	-	21.78	11.5	11.5	18.82
eFDD 26 64QAM	low	50	10	-	-	20.75	11.5	11.5	19.85
eFDD 26 64QAM	mid	1	10	-	-	21.66	11.5	11.5	18.94
eFDD 26 64QAM	mid	50	10	-	-	20.53	11.5	11.5	20.07
eFDD 26 64QAM	high	1	10	-	-	21.83	11.5	11.5	18.77
eFDD 26 64QAM	high	50	10	-	-	20.55	11.5	11.5	20.05



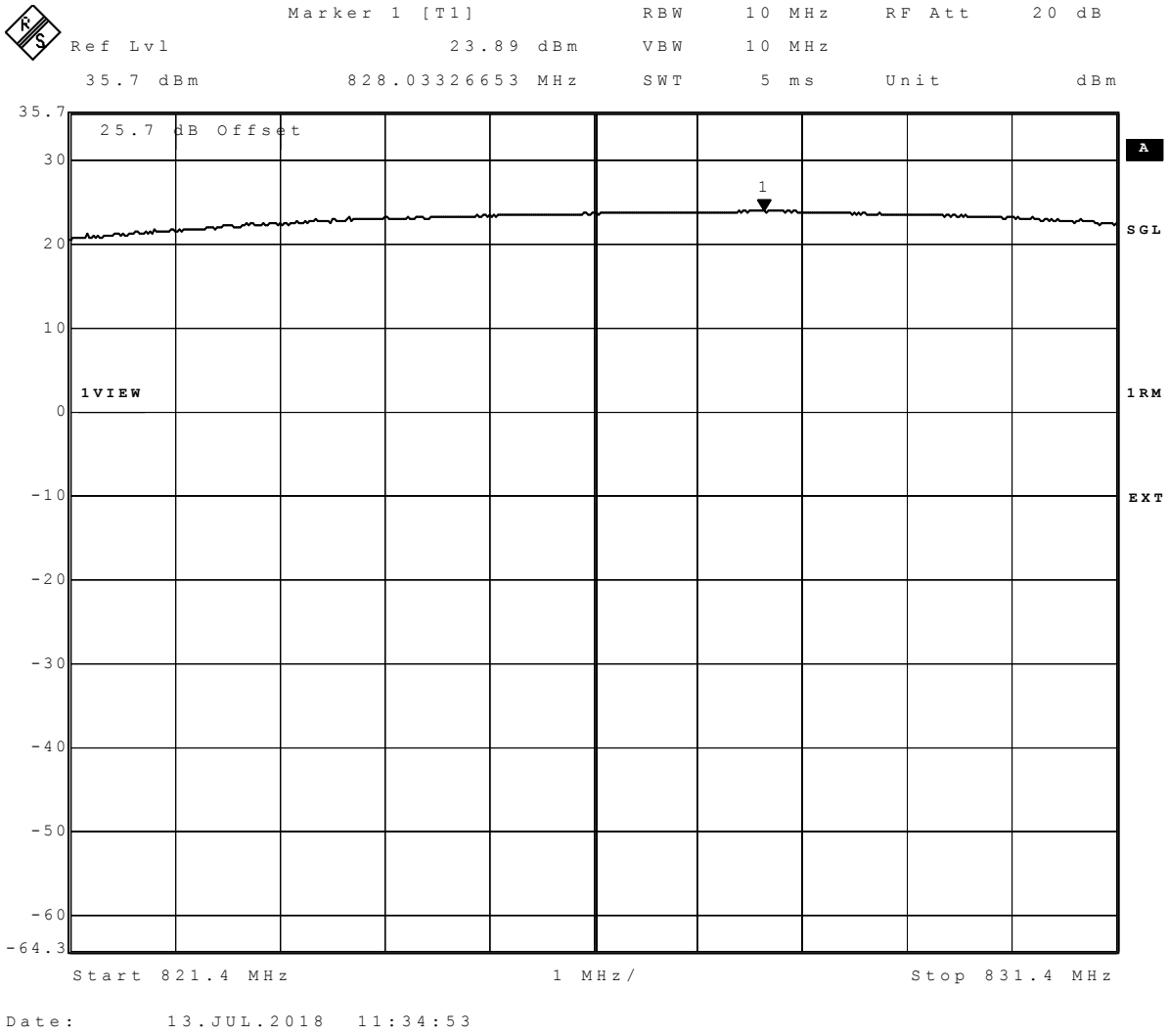
GSM850 Channel=mid



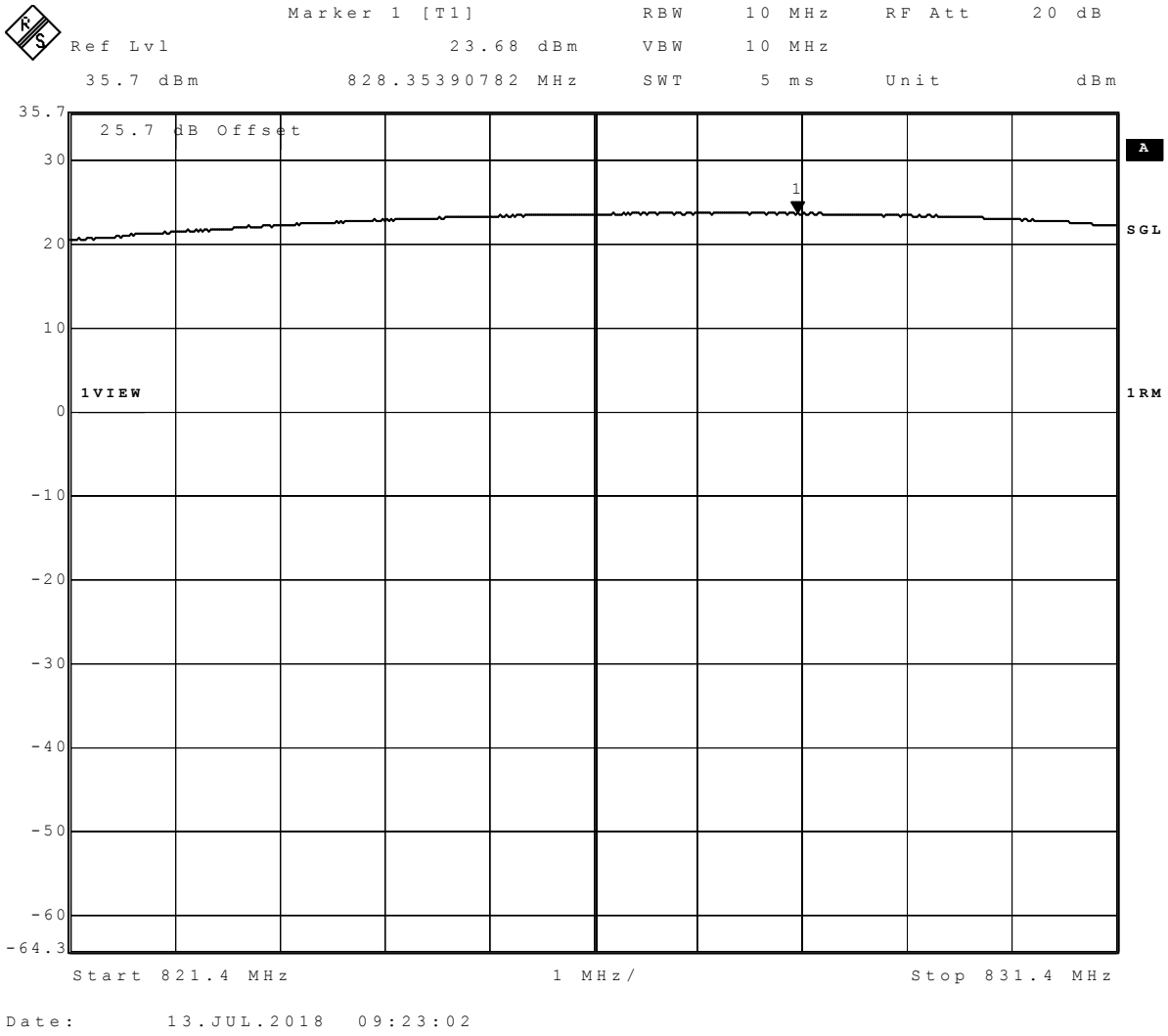
EDGE850 Channel=mid



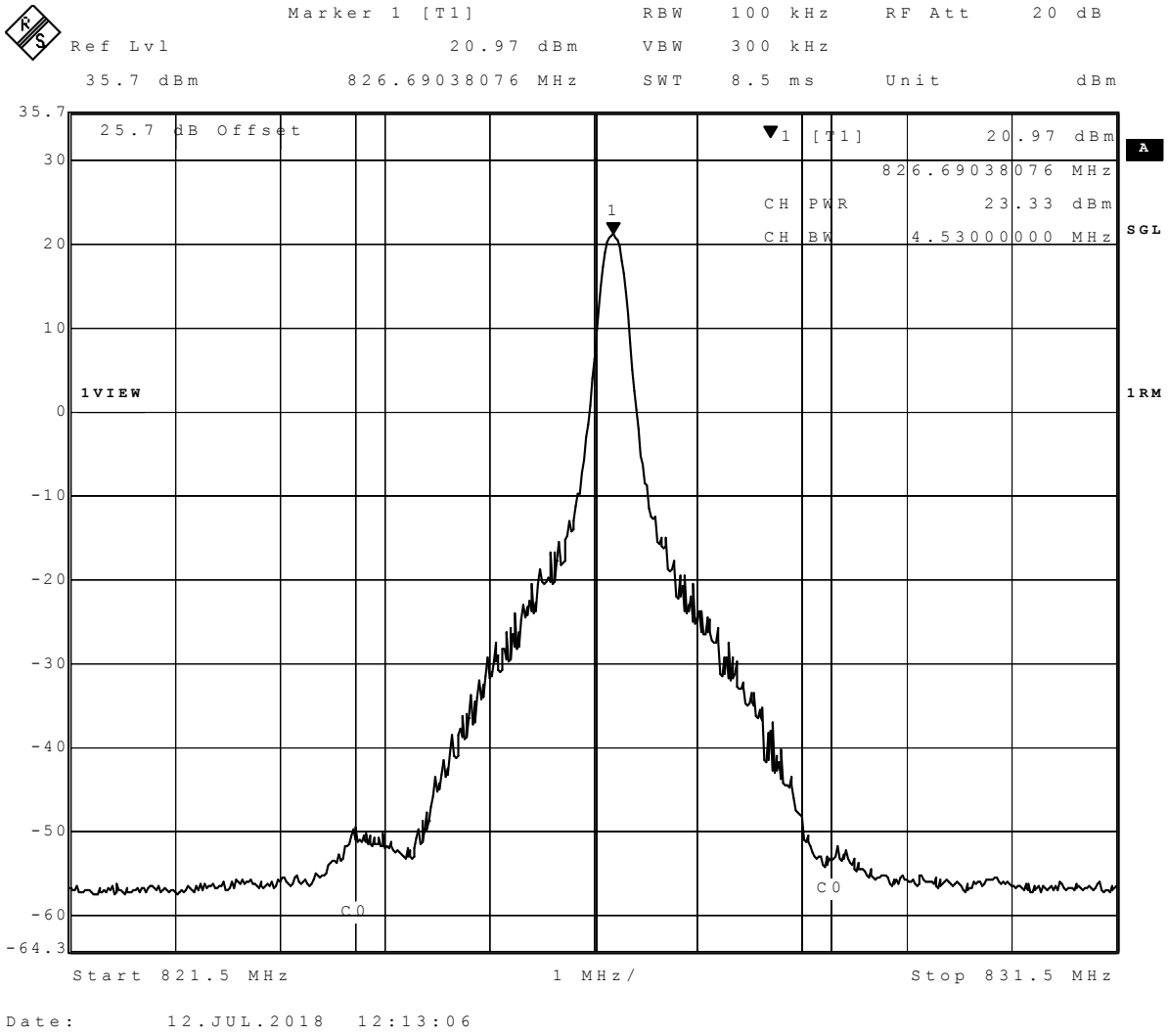
WCDMa FDD5 Channel=mid



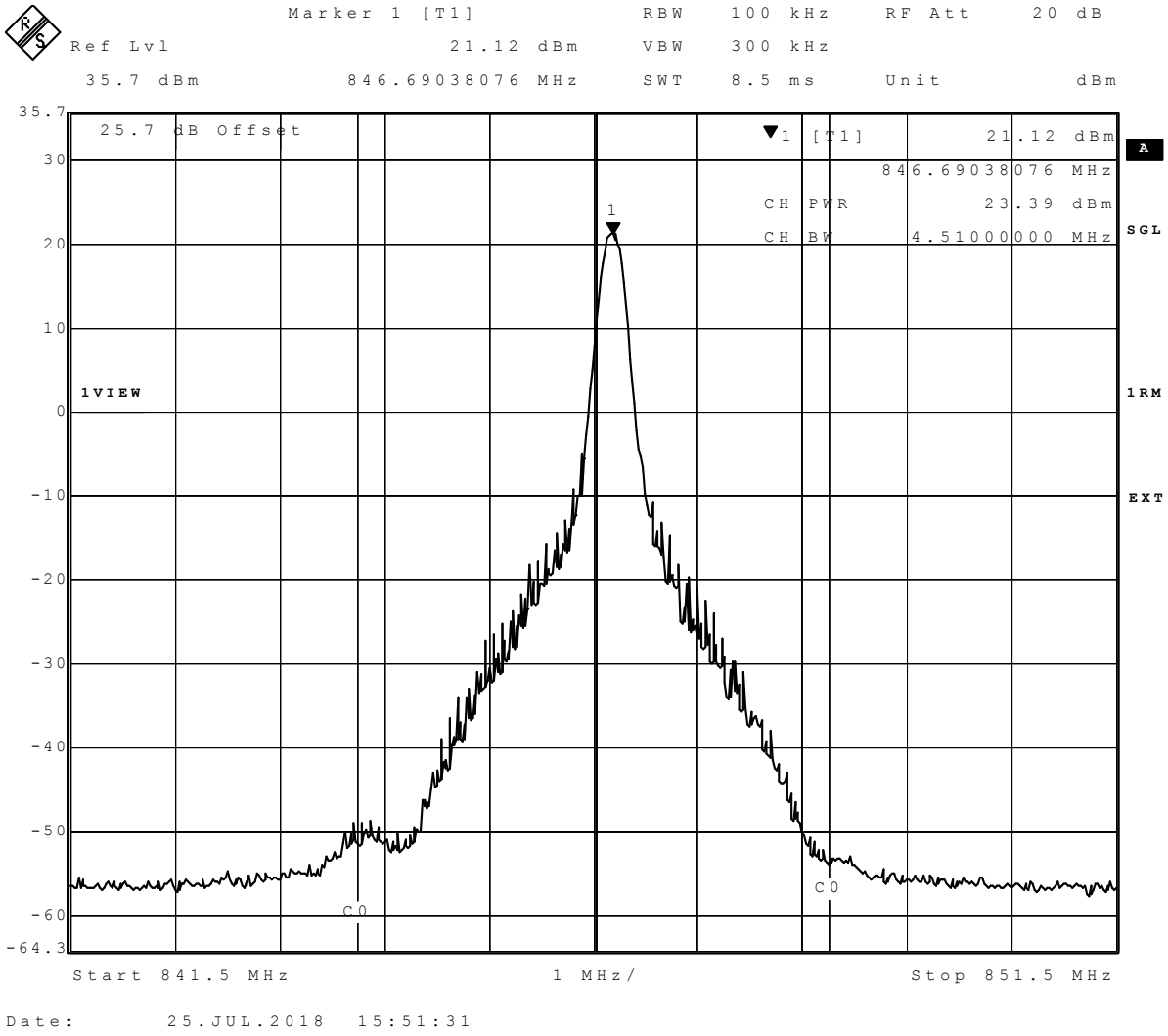
HSDPA SUBTEST1 Channel=low



HSUPA SUBTEST1 Channel=low



eFDD5 QPSK 5MHz RB1 Channel=high



eFDD26 QPSK 5MHz RB1 Channel=high

3.5.2 22.2 Frequency stability §2.1055

Test: 22.2; _Frequency stability Summary §2.1055

Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/07/04 14:20
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	2095.5	4	15	passed
-30	5			3	11	passed
-30	10			4	9	passed
-20	0	normal	2095.5	2	6	passed
-20	5			6	8	passed
-20	10			1	13	passed
-10	0	normal	2095.5	0	13	passed
-10	5			3	6	passed
-10	10			5	9	passed
0	0	normal	2095.5	4	6	passed
0	5			3	4	passed
0	10			3	11	passed
10	0	normal	2095.5	2	14	passed
10	5			4	6	passed
10	10			1	3	passed
20	0	low	2095.5	1	2	passed
20	5			0	3	passed
20	10			5	9	passed
20	0	normal	2095.5	3	17	passed
20	5			4	5	passed
20	10			6	7	passed
20	0	high	2095.5	4	11	passed
20	5			2	13	passed
20	10			2	6	passed
30	0	normal	2095.5	4	6	passed
30	5			6	-4	passed
30	10			2	9	passed
40	0	normal	2095.5	-3	-6	passed
40	5			4	-8	passed
40	10			-3	-12	passed
50	0	normal	2095.5	-4	-7	passed
50	5			-3	-6	passed
50	10			-4	-6	passed

GSM850

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	2095.5	16	18	passed
-30	5			15	19	passed
-30	10			16	21	passed
-20	0	normal	2095.5	14	20	passed
-20	5			16	19	passed
-20	10			14	19	passed
-10	0	normal	2095.5	15	18	passed
-10	5			15	20	passed
-10	10			16	16	passed
0	0	normal	2095.5	14	18	passed
0	5			13	19	passed
0	10			17	19	passed
10	0	normal	2095.5	15	17	passed
10	5			16	20	passed
10	10			16	16	passed
20	0	low	2095.5	14	22	passed
20	5			16	20	passed
20	10			16	19	passed
20	0	normal	2095.5	16	17	passed
20	5			14	17	passed
20	10			14	21	passed
20	0	high	2095.5	17	19	passed
20	5			16	22	passed
20	10			13	16	passed
30	0	normal	2095.5	14	21	passed
30	5			16	20	passed
30	10			19	19	passed
40	0	normal	2095.5	16	20	passed
40	5			18	19	passed
40	10			17	21	passed
50	0	normal	2095.5	16	21	passed
50	5			16	17	passed
50	10			16	19	passed

EDGE850

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	2095.5	0	-5	passed
-30	5			0	-4	passed
-30	10			0	-4	passed
-20	0	normal	2095.5	0	-4	passed
-20	5			0	4	passed
-20	10			0	-4	passed
-10	0	normal	2095.5	0	-5	passed
-10	5			0	-4	passed
-10	10			0	4	passed
0	0	normal	2095.5	-1	-4	passed
0	5			0	-5	passed
0	10			0	-4	passed
10	0	normal	2095.5	-1	-3	passed
10	5			0	-4	passed
10	10			0	-4	passed
20	0	low	2095.5	0	4	passed
20	5			-1	-5	passed
20	10			-1	-6	passed
20	0	normal	2095.5	-1	-4	passed
20	5			0	-4	passed
20	10			0	-5	passed
20	0	high	2095.5	0	-4	passed
20	5			0	-5	passed
20	10			-1	-3	passed
30	0	normal	2095.5	0	-4	passed
30	5			-1	-5	passed
30	10			0	-4	passed
40	0	normal	2095.5	-1	-6	passed
40	5			-1	-5	passed
40	10			-1	-5	passed
50	0	normal	2095.5	-1	-3	passed
50	5			-1	-5	passed
50	10			0	-4	passed

WCDMa FDD5

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	2095.5	-4	-4	passed
-30	5			-2	-6	passed
-30	10			-6	-10	passed
-20	0	normal	2095.5	-1	12	passed
-20	5			0	16	passed
-20	10			2	-8	passed
-10	0	normal	2095.5	-4	-4	passed
-10	5			3	15	passed
-10	10			3	11	passed
0	0	normal	2095.5	-1	-2	passed
0	5			0	-1	passed
0	10			5	9	passed
10	0	normal	2095.5	-1	-3	passed
10	5			-3	-14	passed
10	10			-2	-11	passed
20	0	low	2095.5	-1	-5	passed
20	5			-1	-8	passed
20	10			0	7	passed
20	0	normal	2095.5	-1	10	passed
20	5			3	-12	passed
20	10			6	-16	passed
20	0	high	2095.5	0	7	passed
20	5			-1	-12	passed
20	10			0	13	passed
30	0	normal	2095.5	-1	-8	passed
30	5			-1	-5	passed
30	10			-1	9	passed
40	0	normal	2095.5	-1	9	passed
40	5			-1	-4	passed
40	10			-1	-5	passed
50	0	normal	2095.5	-1	-10	passed
50	5			-1	-7	passed
50	10			-1	-6	passed

HSDPA FDD5

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	2095.5	1	10	passed
-30	5			0	5	passed
-30	10			1	-6	passed
-20	0	normal	2095.5	0	-3	passed
-20	5			0	-4	passed
-20	10			0	4	passed
-10	0	normal	2095.5	-1	5	passed
-10	5			0	-4	passed
-10	10			-1	-4	passed
0	0	normal	2095.5	0	5	passed
0	5			0	-4	passed
0	10			0	5	passed
10	0	normal	2095.5	1	4	passed
10	5			1	12	passed
10	10			1	14	passed
20	0	low	2095.5	0	4	passed
20	5			0	5	passed
20	10			0	5	passed
20	0	normal	2095.5	0	-4	passed
20	5			0	-4	passed
20	10			0	-5	passed
20	0	high	2095.5	0	4	passed
20	5			0	-4	passed
20	10			1	5	passed
30	0	normal	2095.5	0	4	passed
30	5			0	-6	passed
30	10			0	11	passed
40	0	normal	2095.5	0	-4	passed
40	5			0	12	passed
40	10			1	16	passed
50	0	normal	2095.5	0	-4	passed
50	5			0	-4	passed
50	10			0	4	passed

HSUPA FDD5

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	2091.25	2.8	10.6	passed
-30	5			2.9	11.2	passed
-30	10			1.7	11.3	passed
-20	0	normal	2091.25	3	9.4	passed
-20	5			3.4	8.9	passed
-20	10			1.6	-7.9	passed
-10	0	normal	2091.25	2.7	-5.6	passed
-10	5			1.6	-4	passed
-10	10			1.8	-3.9	passed
0	0	normal	2091.25	-2.6	1.4	passed
0	5			-5.2	5.6	passed
0	10			-1.7	-2	passed
10	0	normal	2091.25	1.4	-11.6	passed
10	5			1.9	12.4	passed
10	10			-1.4	8.7	passed
20	0	low	2091.25	0.8	8.6	passed
20	5			1.9	4.3	passed
20	10			-1.2	13.1	passed
20	0	normal	2091.25	-3.5	10.5	passed
20	5			2.7	-11.6	passed
20	10			1.6	-11.5	passed
20	0	high	2091.25	-2.3	10.5	passed
20	5			-1.4	11.3	passed
20	10			-1.5	9.4	passed
30	0	normal	2091.25	2.3	-7.6	passed
30	5			3.4	-7.8	passed
30	10			-3.1	-9.2	passed
40	0	normal	2091.25	1.6	-6.3	passed
40	5			0.7	-4.8	passed
40	10			0.8	-6.5	passed
50	0	normal	2091.25	1.6	8.4	passed
50	5			1.4	9.3	passed
50	10			1.3	13.6	passed

eFDD5

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	2091.25	0.6	3	passed
-30	5			0.4	3.6	passed
-30	10			0.5	2.5	passed
-20	0	normal	2091.25	0.3	-3.1	passed
-20	5			0.3	-3.6	passed
-20	10			0.3	2.5	passed
-10	0	normal	2091.25	0.4	6.1	passed
-10	5			0.6	-4.1	passed
-10	10			0.5	-4.8	passed
0	0	normal	2091.25	0.8	3.7	passed
0	5			0.1	3.7	passed
0	10			0.3	3.8	passed
10	0	normal	2091.25	0.1	1.6	passed
10	5			0.5	-4.5	passed
10	10			-1.6	-3.6	passed
20	0	low	2091.25	0.4	-4.6	passed
20	5			0.5	3.5	passed
20	10			-0.9	2.8	passed
20	0	normal	2091.25	-1.6	-1.9	passed
20	5			0.2	-2.2	passed
20	10			0.4	-2.6	passed
20	0	high	2091.25	1.5	-6.5	passed
20	5			-1.4	-4.3	passed
20	10			-1.3	-4.9	passed
30	0	normal	2091.25	2.5	3.9	passed
30	5			1.9	2.7	passed
30	10			-0.8	2.8	passed
40	0	normal	2091.25	0.6	2.2	passed
40	5			0.7	1.9	passed
40	10			0.8	-2.5	passed
50	0	normal	2091.25	0.1	-3.6	passed
50	5			0.3	-7.2	passed
50	10			0.9	-6.2	passed

eFDD26

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_BX03
Date of Test:	2018/08/10 21:52
Body:	FCC47CFRChIPART22PUBLIC MOBILE SERVICES
Test Specification:	FCC part 2 and 22

Detailed Results:

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
GSM850	low	rms	maxhold	3	823.93	-14.25	-13	1.25
GSM850	mid	rms	maxhold	-	-	-	-13	>20
GSM850	high	rms	maxhold	3	849.02	-15.87	-13	2.87

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
EDGE850	low	rms	maxhold	3	823.98	-21.87	-13	8.87
EDGE850	mid	rms	maxhold	-	-	-	-13	>20
EDGE850	high	rms	maxhold	-	-	-	-13	>20

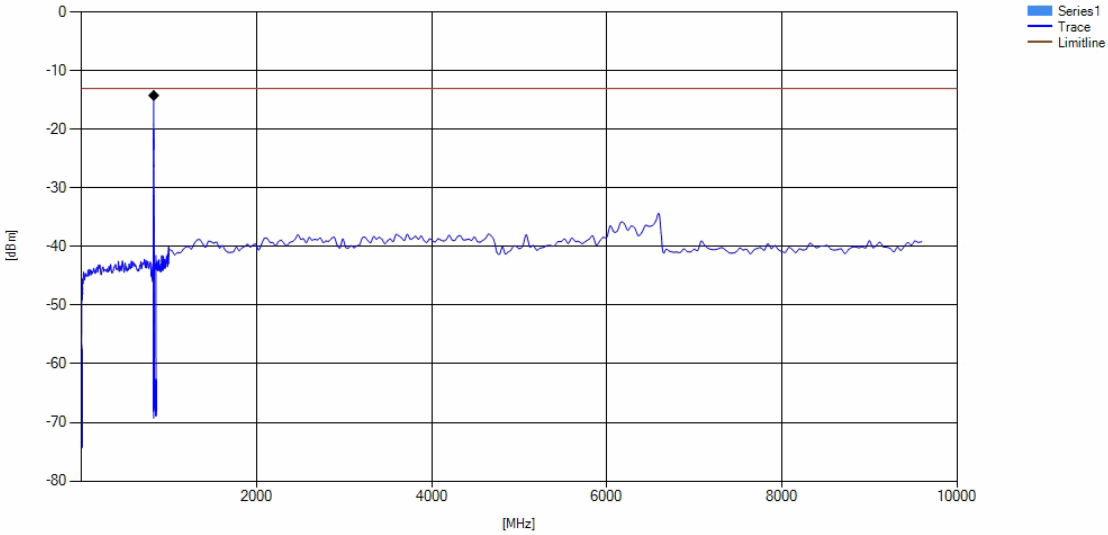
Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
WCDMa FDD5	low	rms	maxhold	-	-	-	-13	>20
WCDMa FDD5	mid	rms	maxhold	-	-	-	-13	>20
WCDMa FDD5	high	rms	maxhold	-	-	-	-13	>20

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
HSDPA FDD5	low	rms	maxhold	50	823.84	-28.74	-13	15.74
HSDPA FDD5	mid	rms	maxhold	-	-	-	-13	>20
HSDPA FDD5	high	rms	maxhold	50	849	-29.6	-13	16.6

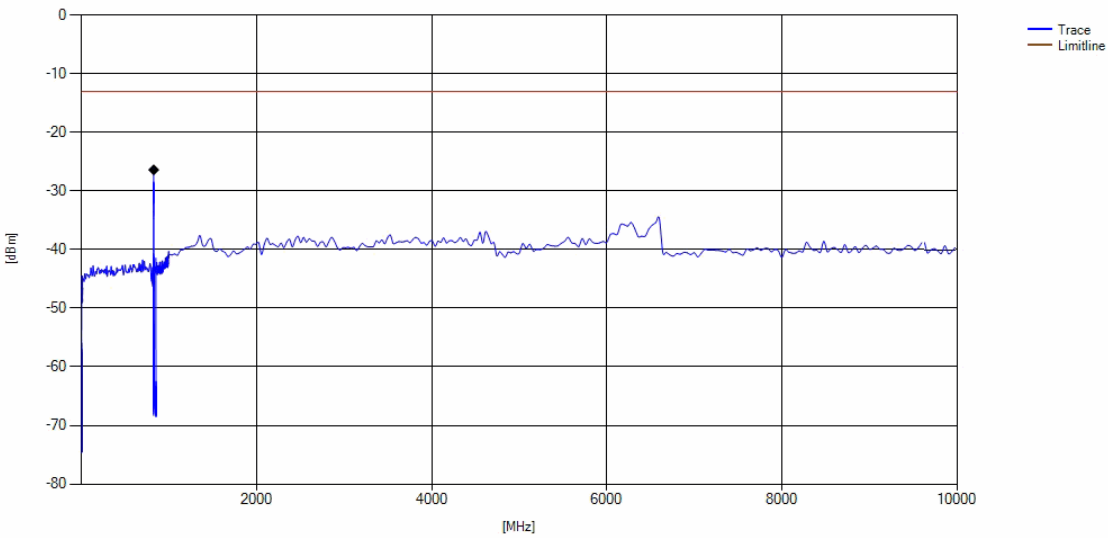
Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
HSUPA FDD5	low	rms	maxhold	50	824	-26.61	-13	13.61
HSUPA FDD5	mid	rms	maxhold	-	-	-	-13	>20
HSUPA FDD5	high	rms	maxhold	50	849	-27	-13	14

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
eFDD5	low	rms	maxhold	-	-	-	-13	>20
eFDD5	mid	rms	maxhold	-	-	-	-13	>20
eFDD5	high	rms	maxhold	-	-	-	-13	>20

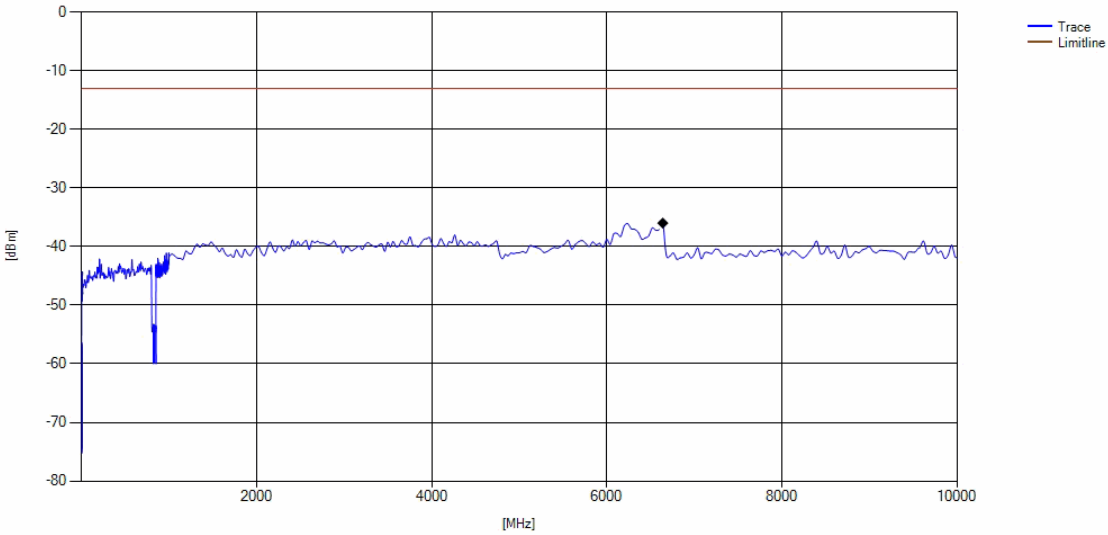
Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
eFDD26	low	rms	maxhold	-	-	-	-13	>20
eFDD26	mid	rms	maxhold	-	-	-	-13	>20
eFDD26	high	rms	maxhold	-	-	-	-13	>20



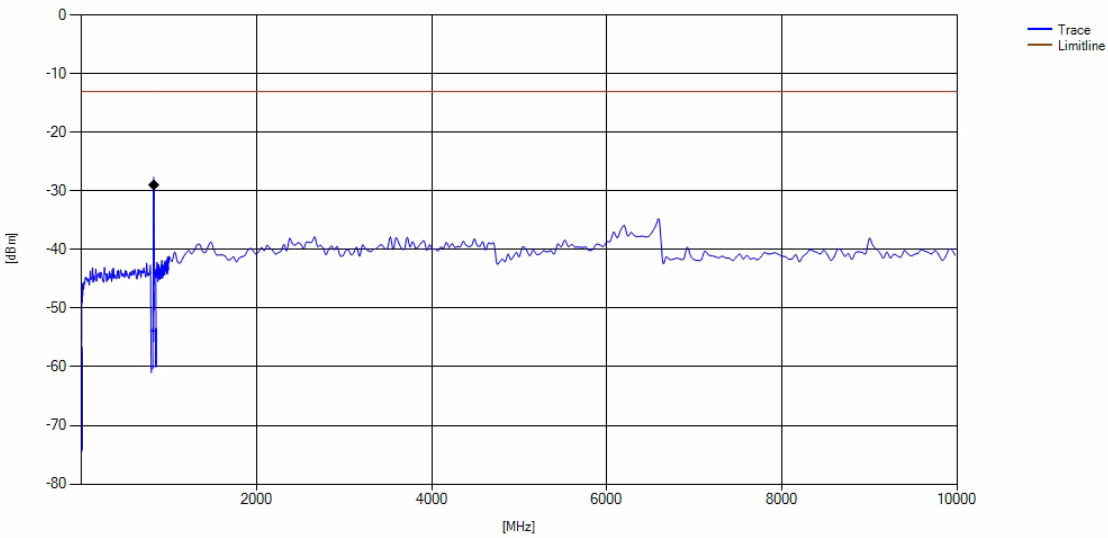
GSM850 Channel=low



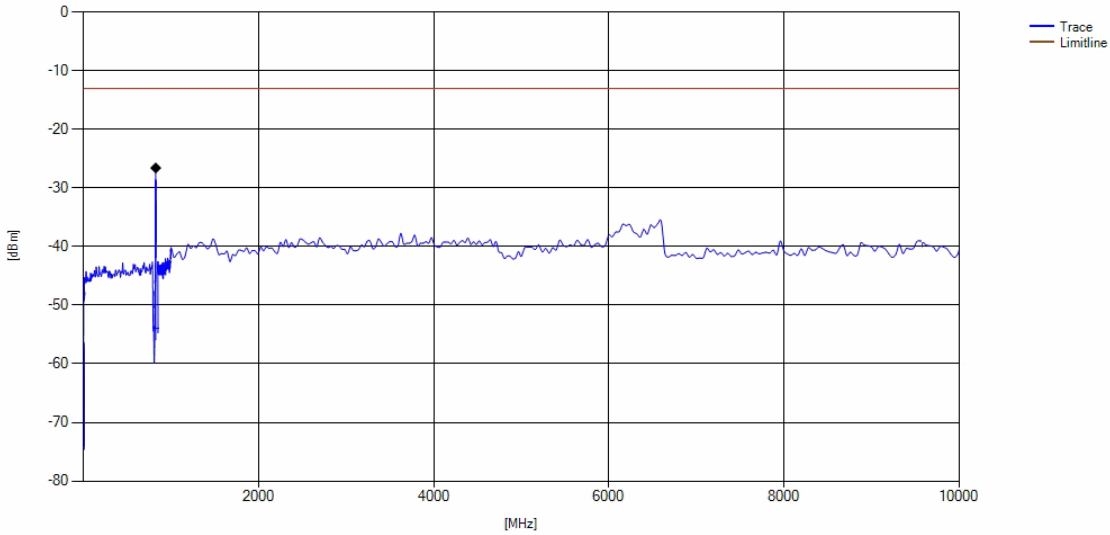
EDGE850 Channel=low



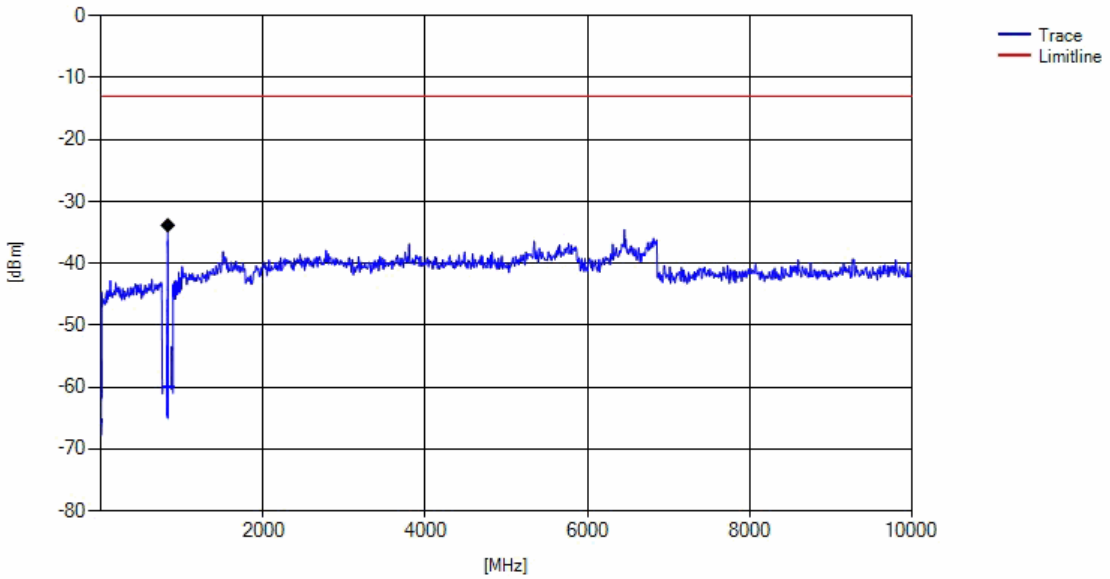
WCDMa FDD5 Channel=mid



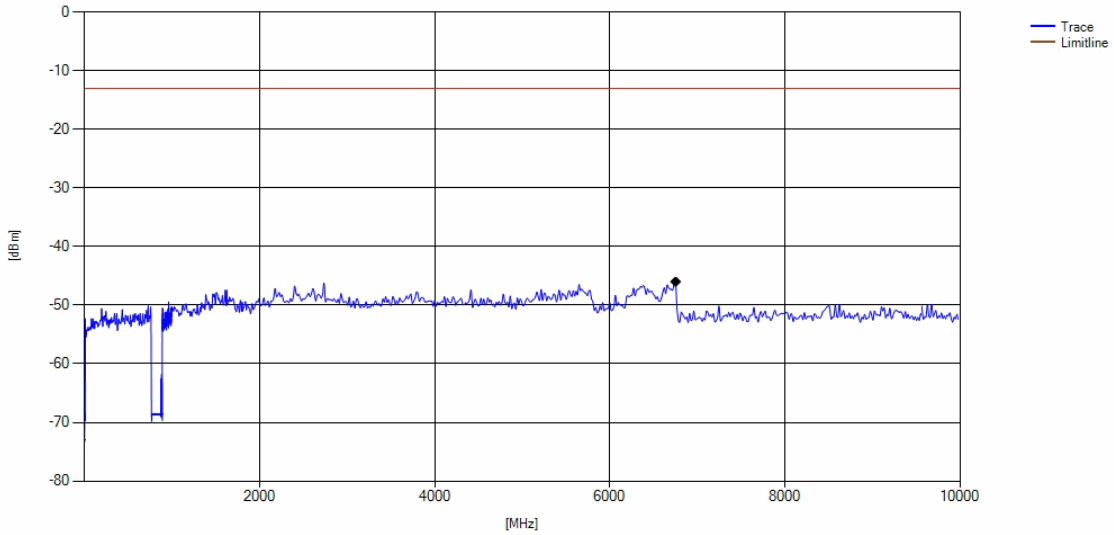
HSDPA FDD5 Channel=low



HSUPA FDD5 Channel=low



eFDD5 QPSK Channel=low



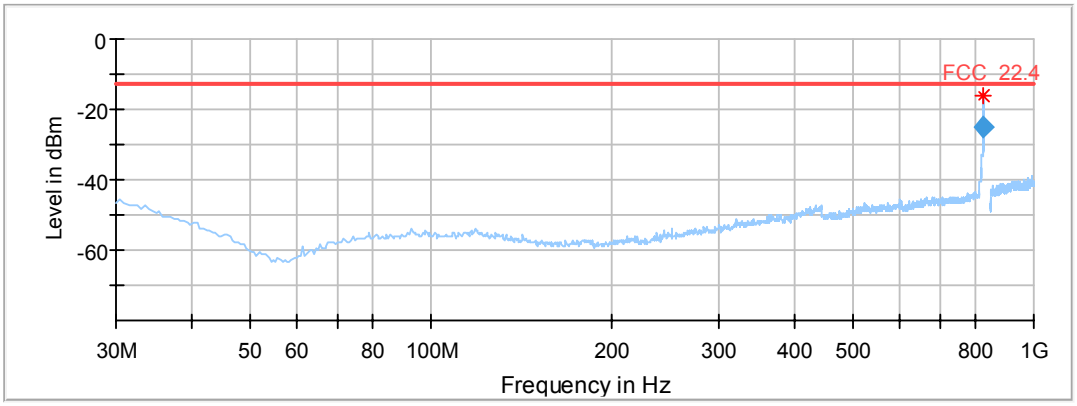
eFDD26 Channel=mid

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

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

Result:	Passed 22.4; Field strength of spurious radiation Summary §2.1053, §22.917 Worst Case Plot GSM850 & EDGE850 & eFDD5 & eFDD26 & WCDMa FDD5
Setup No.:	S01_BY03
Date of Test:	2018/08/23 15:27
Body:	FCC47CFRChIPART22PUBLIC MOBILE SERVICES
Test Specification:	FCC part 2 and 22

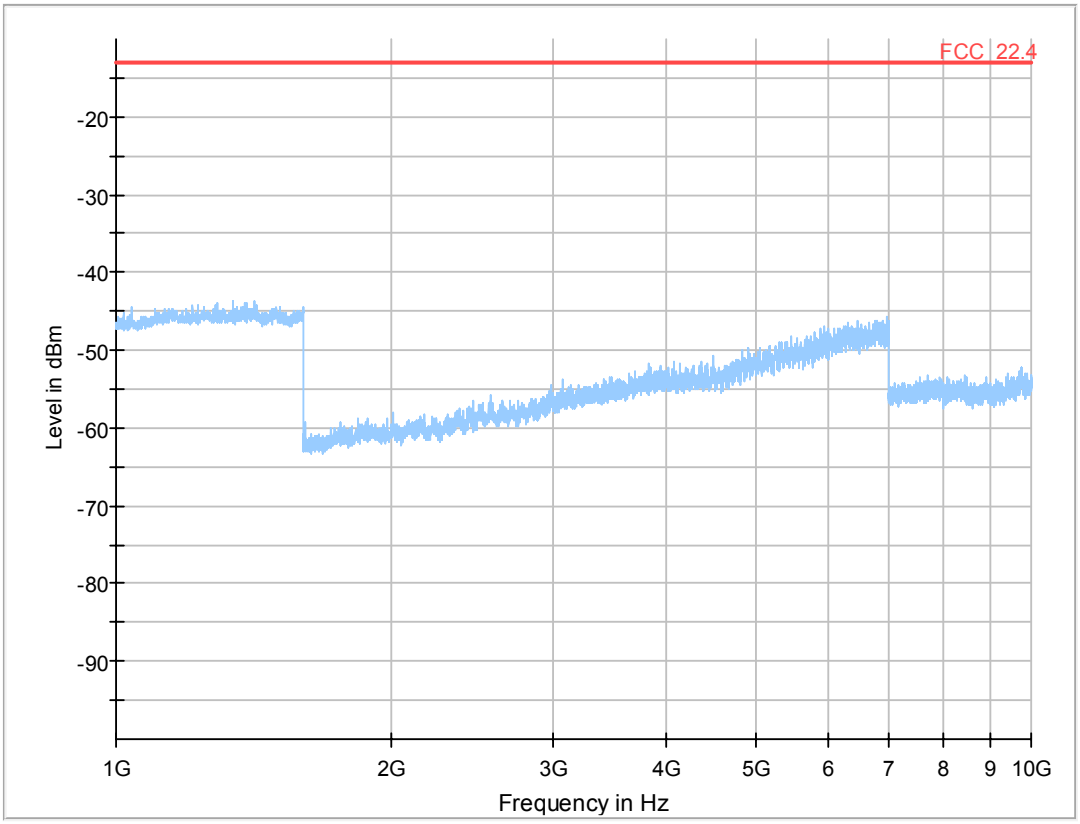
Detailed Results:



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
823.876000	-24.92	-13.00	11.92	1000.0	50.000	112.0	V	-2.0	-73.4	19:06:23 - 2018-08-05

EDGE 850 - low channel



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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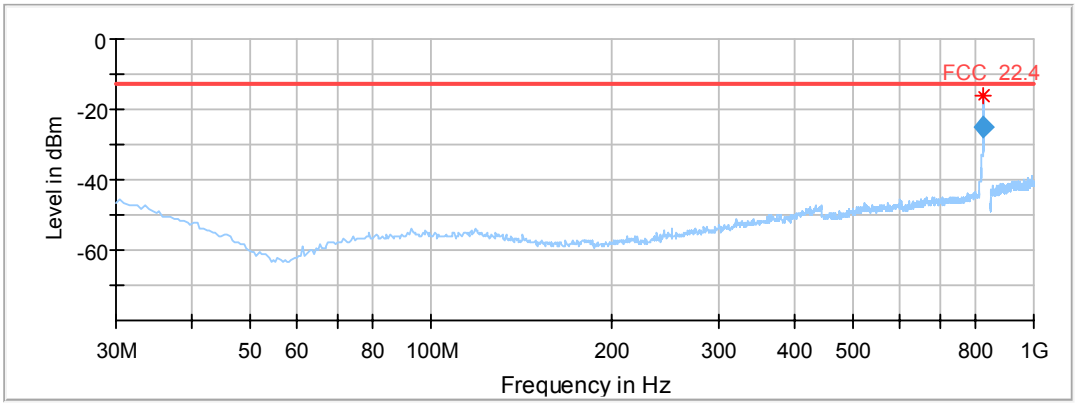
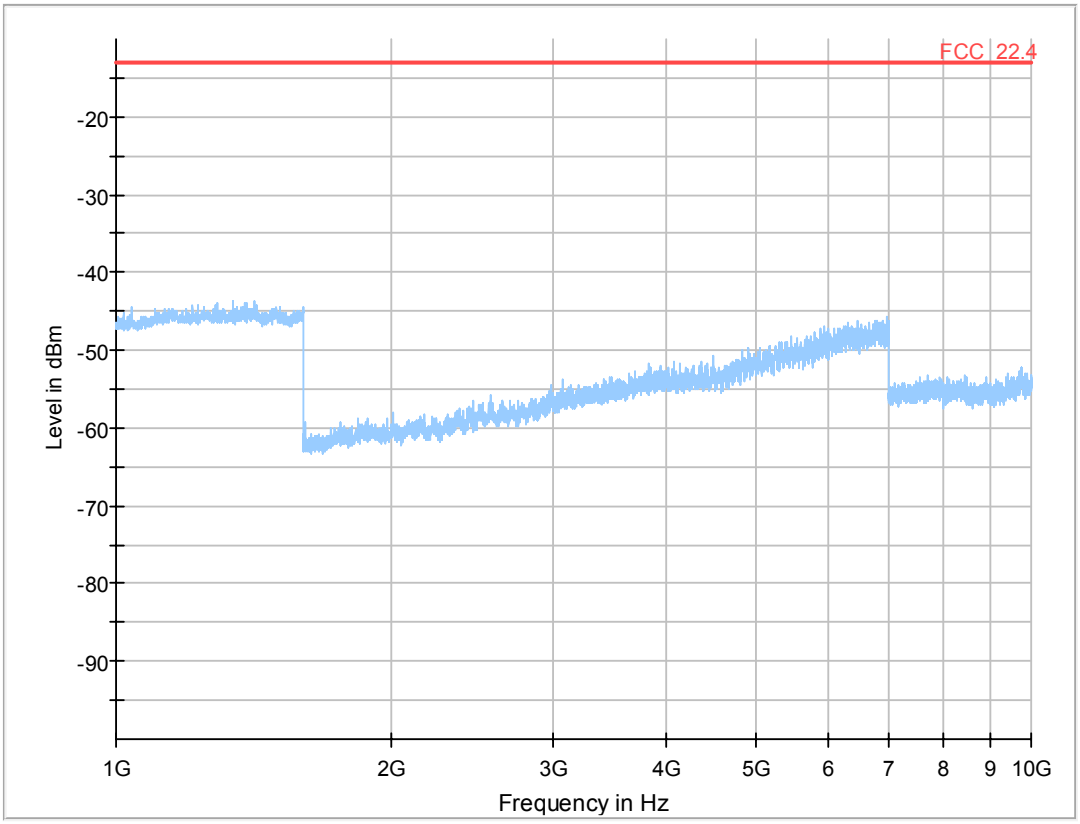
EDGE 850 - low channel



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
823.876000	-24.92	-13.00	11.92	1000.0	50.000	112.0	V	-2.0	-73.4	19:06:23 - 2018-08-05

GSM 850 - low channel



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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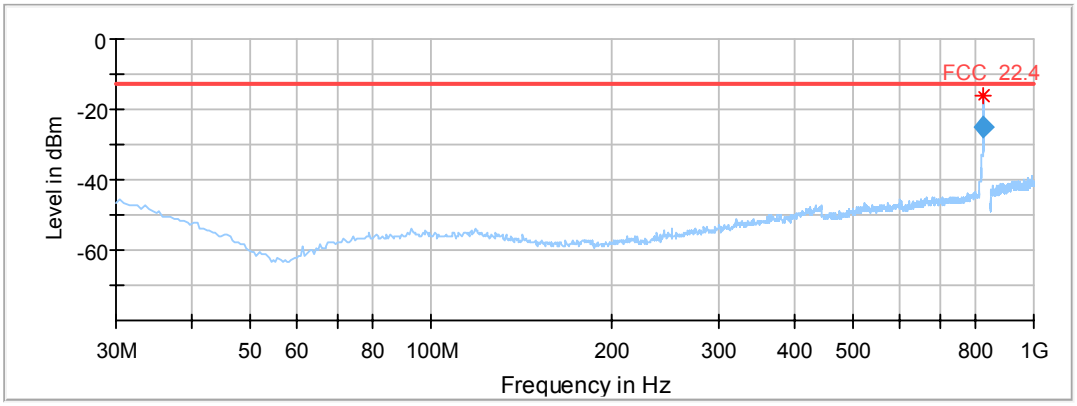
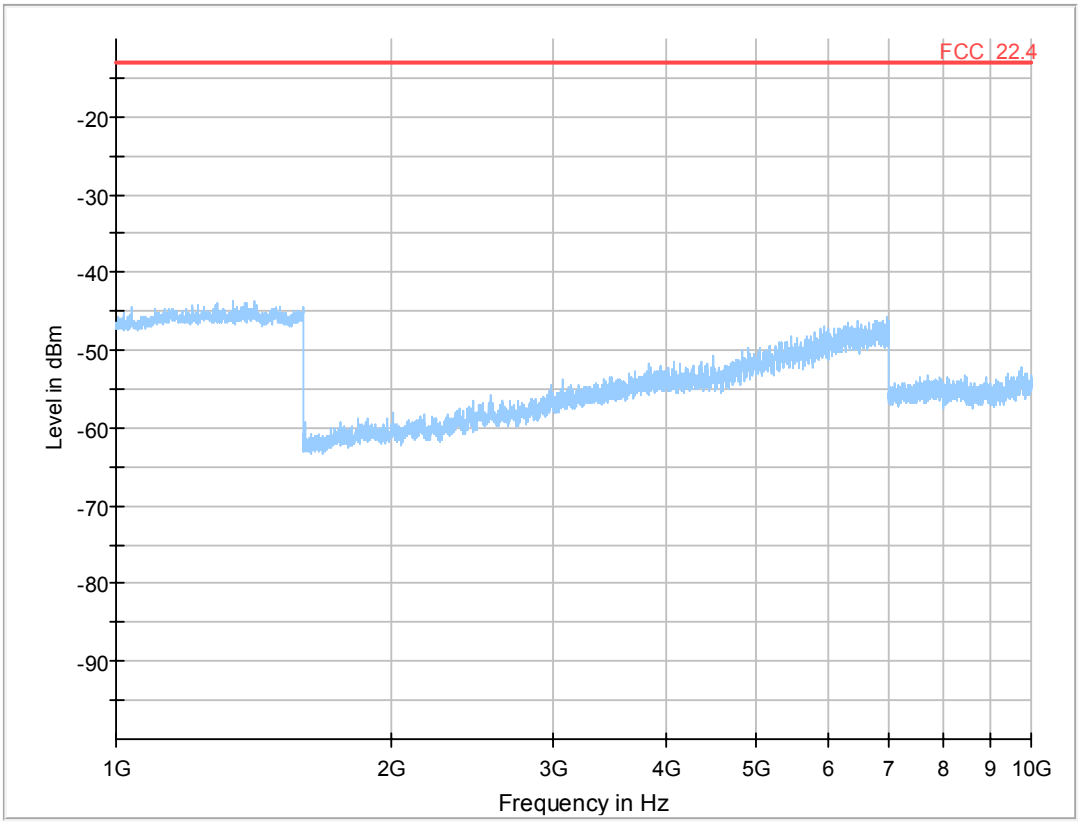
GSM 850 - low channel



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
823.876000	-24.92	-13.00	11.92	1000.0	50.000	112.0	V	-2.0	-73.4	19:06:23 - 2018-08-05

WCDMA FDD5 - low channel



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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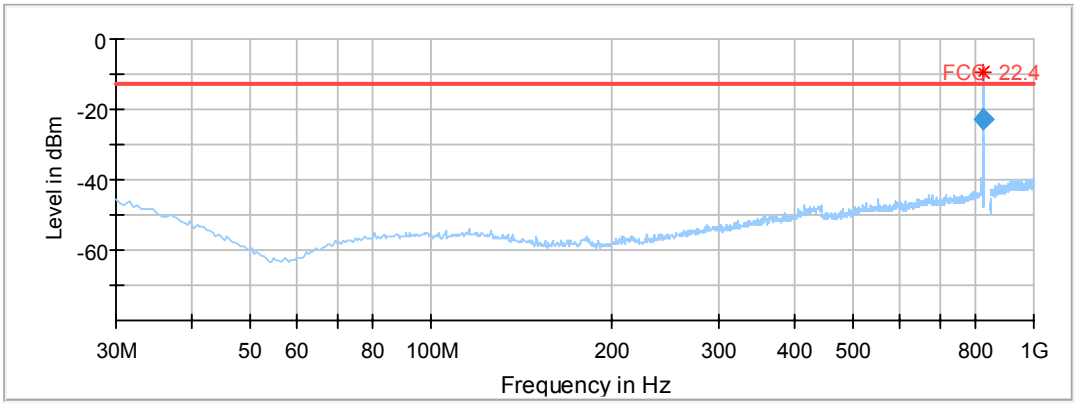
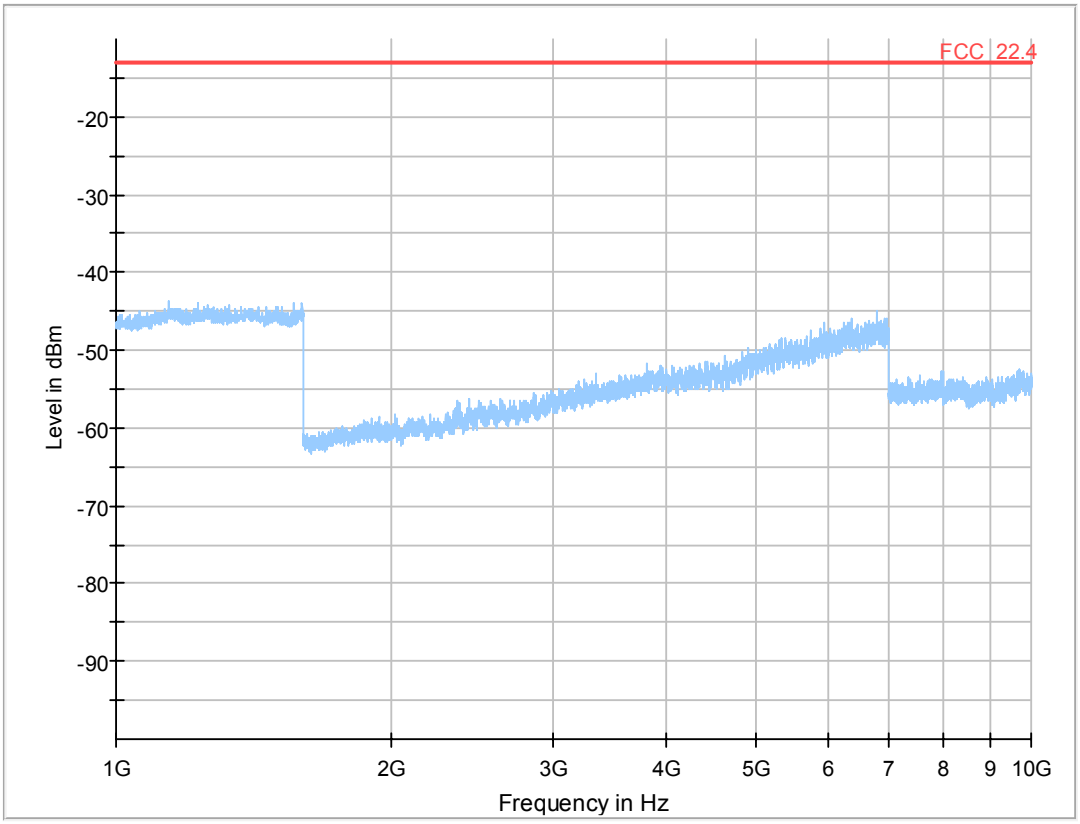
WCDMA FDD5 - low channel



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
823.999000	-22.77	-13.00	9.77	1000.0	50.000	115.0	V	-6.0	-73.4	17:51:02 - 2018-08-05

LTE eFDD5 - low channel



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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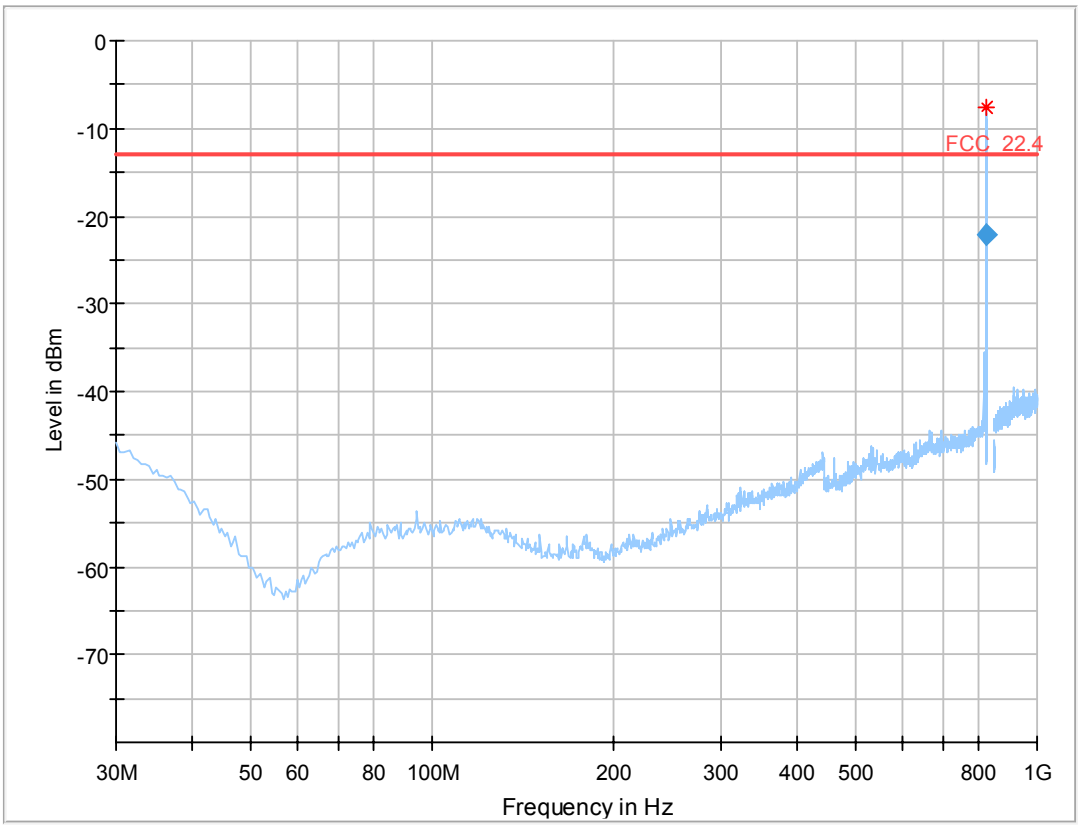
LTE eFDD5 - low channel

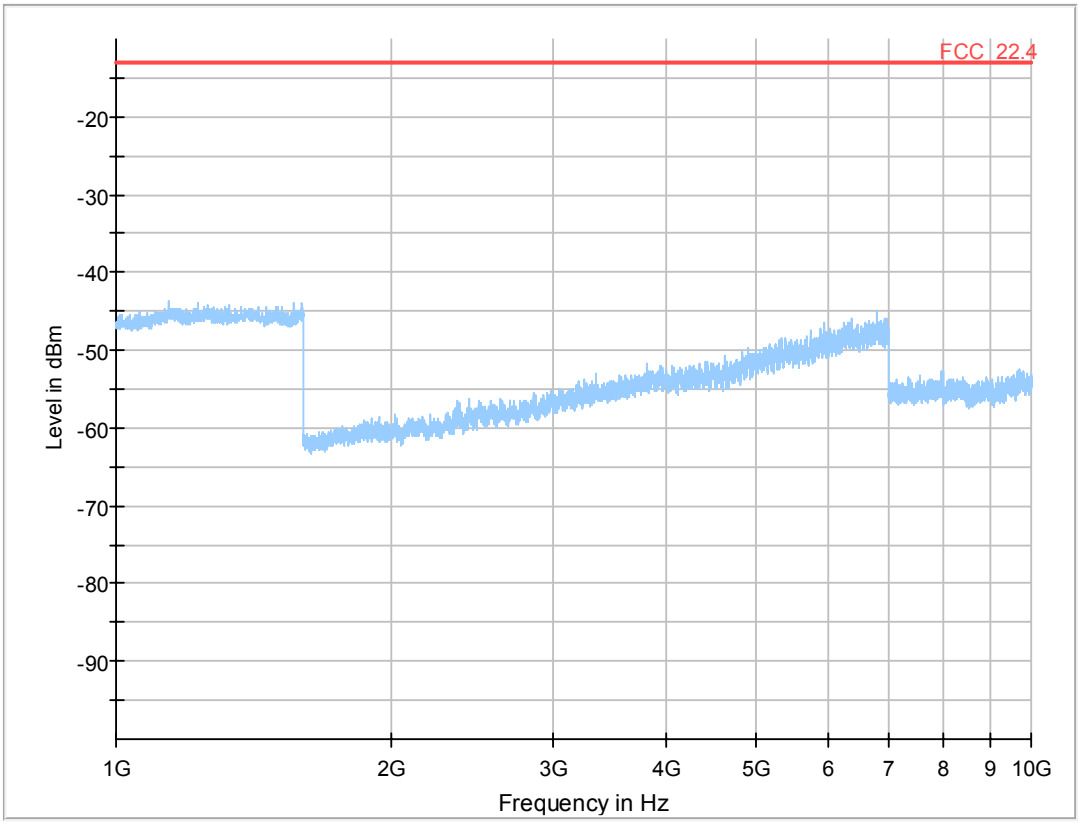
Test Report



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
824.000000	-22.05	-13.00	9.05	1000.0	50.000	176.0	V	-3.0	-73.4	16:02:34 - 2018-08-19

LTE eFDD26 - channel low



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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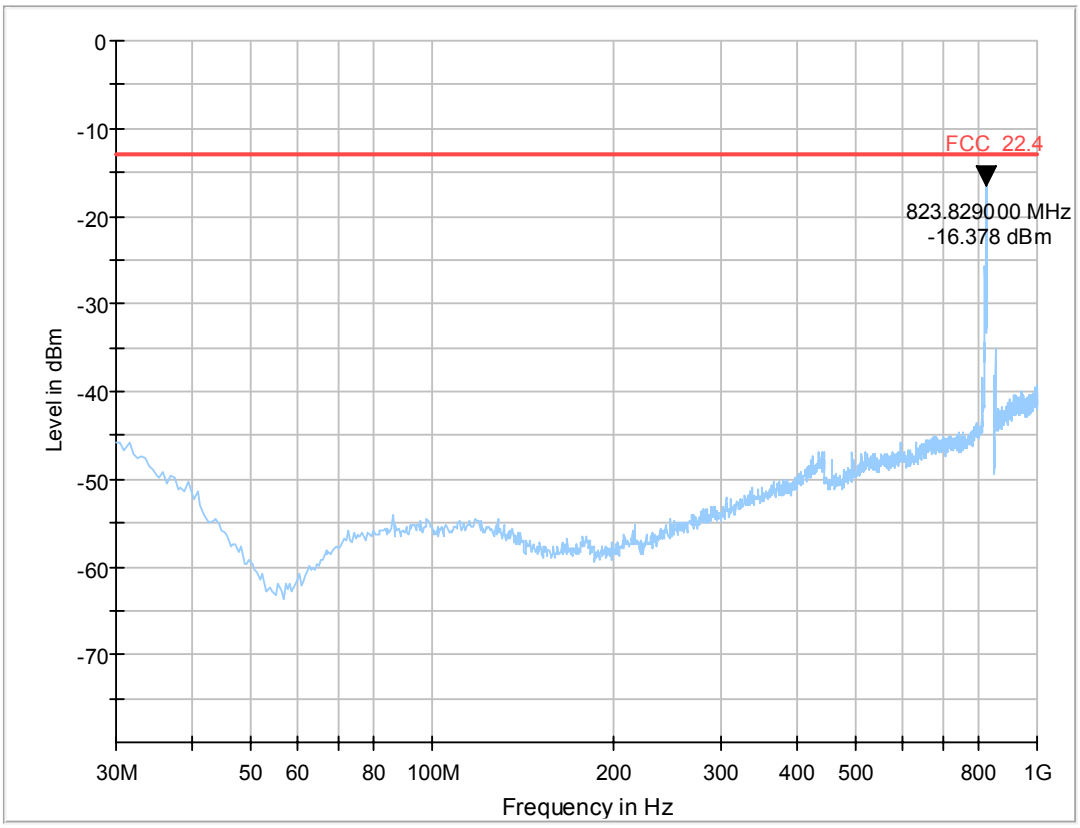
LTE eFDD26 - low channel

Test Report



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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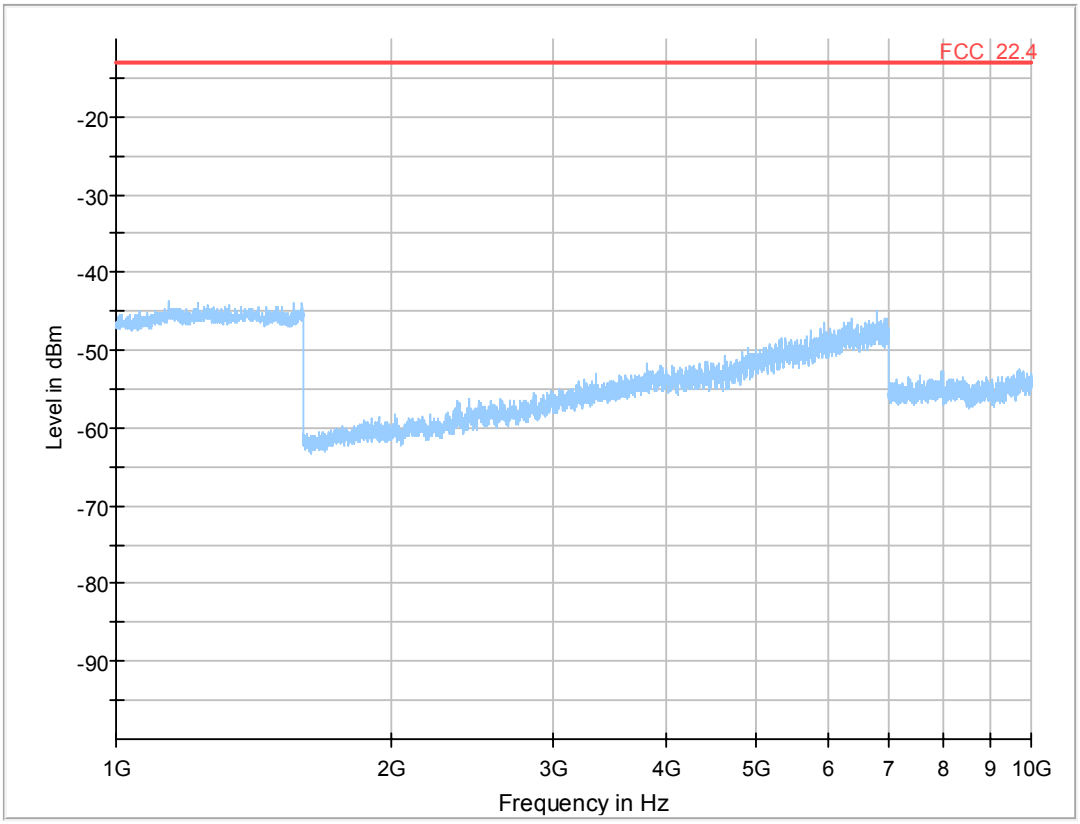
FDD5 HSDPA channel = LOW



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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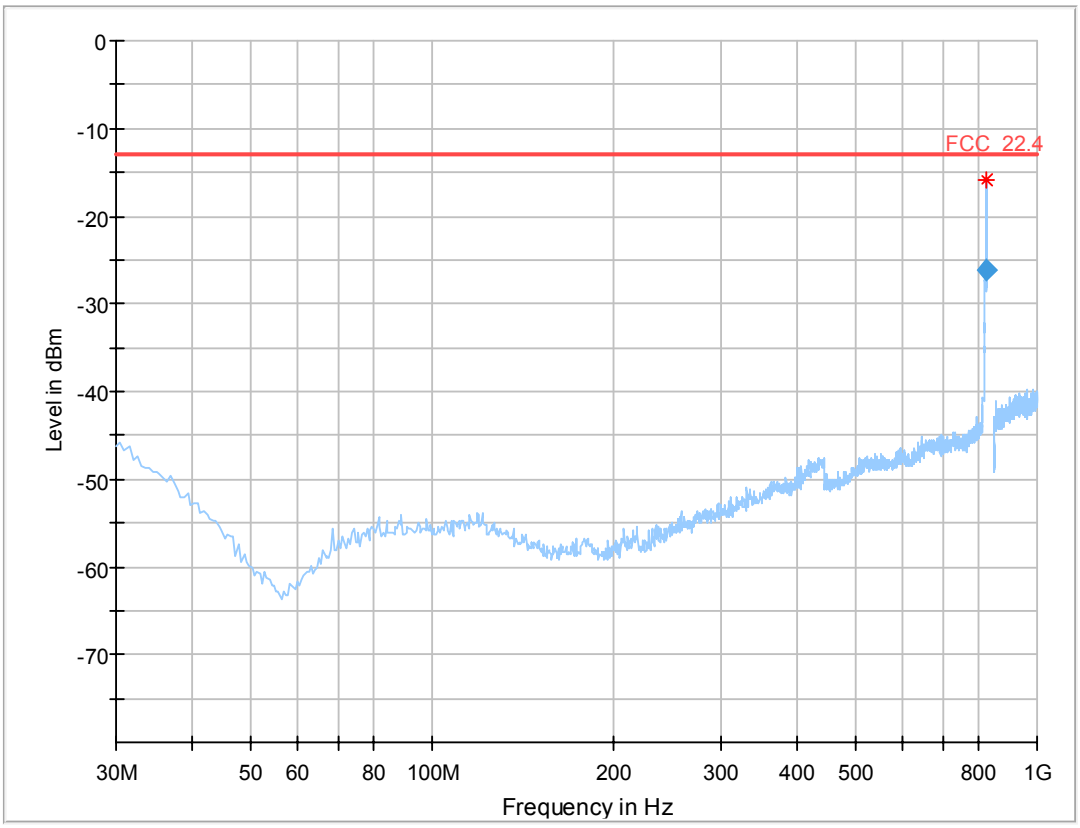
HSDPA FDD5 - channel low

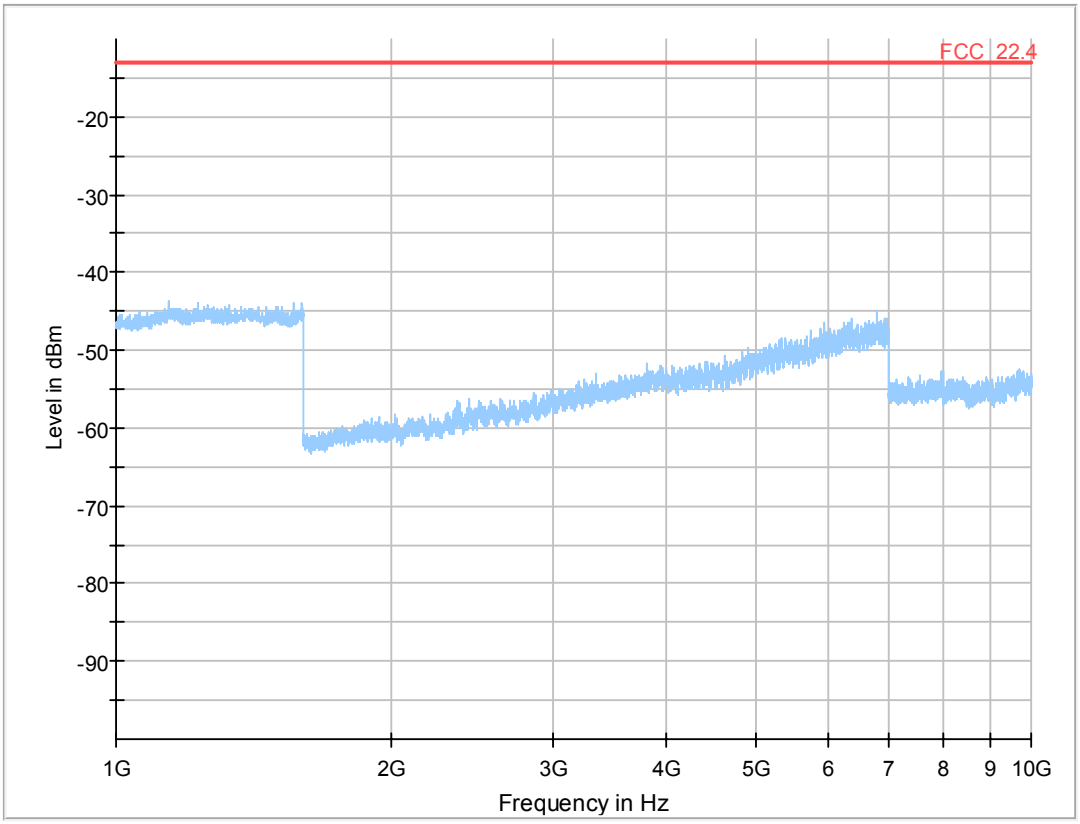
Test Report



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
823.835000	-26.15	-13.00	13.15	1000.0	50.000	167.0	V	-182.0	-73.4	14:13:40 - 2018-09-24

FDD5 HSUPA channel = LOW



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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FDD5 HSUPA channel = LOW

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

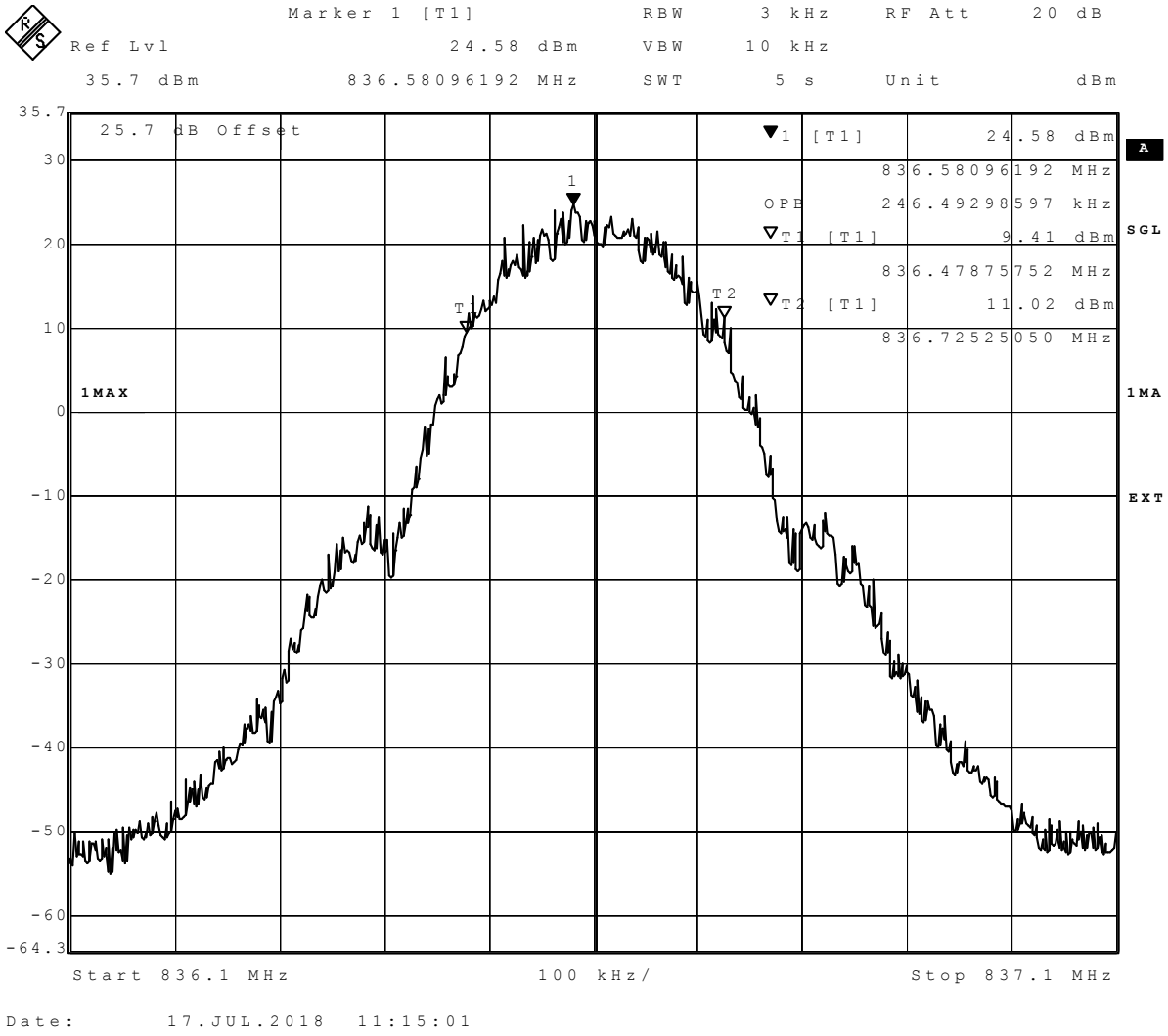
Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 17:14
Body:	FCC47CFRChIPART22PUBLIC MOBILE SERVICES
Test Specification:	FCC part 2 and 22

Detailed Results:

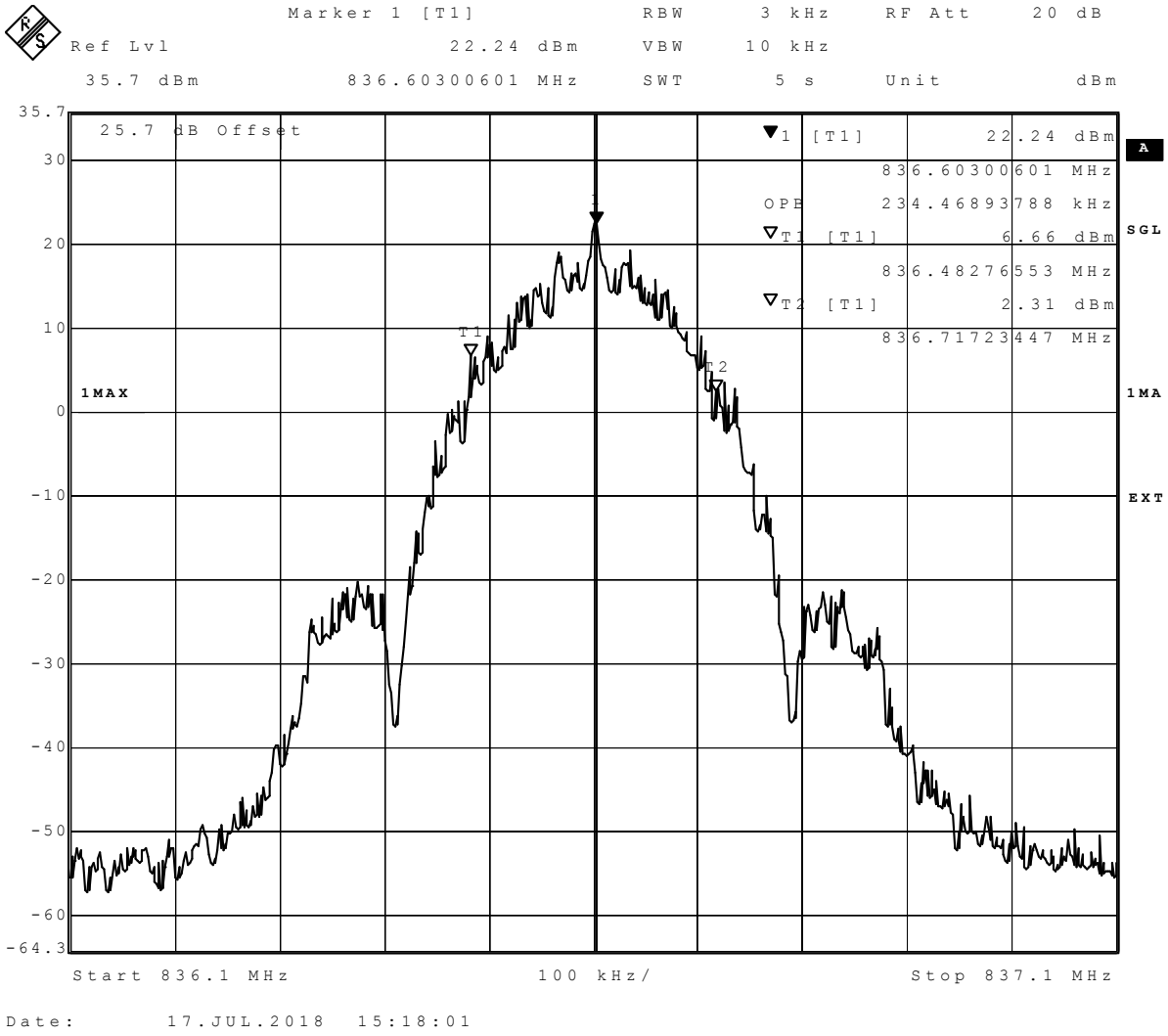
Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	26 dB BW [kHz]	99 % BW [kHz]
GSM 850	low	-	0.2	0.2	324.65	242.48
GSM 850	mid	-	0.2	0.2	310.62	246.49
GSM 850	high	-	0.2	0.2	308.62	244.49
GSM 850 EDGE	low	-	0.2	0.2	298.6	230.46
GSM 850 EDGE	mid	-	0.2	0.2	322.65	234.47
GSM 850 EDGE	high	-	0.2	0.2	296.59	236.47
FDD V	low	-	5	5	4749.5	4128.26
FDD V	mid	-	5	5	4749.5	4128.26
FDD V	high	-	5	5	4749.5	4108.22
FDD V HSDPA Subtest 1	low	-	5	5	4769.54	4128.26
FDD V HSDPA Subtest 1	mid	-	5	5	4749.5	4128.26
FDD V HSDPA Subtest 1	high	-	5	5	4749.5	4108.22
FDD V HSUPA Subtest 1	low	-	5	5	4769.54	4128.26
FDD V HSUPA Subtest 1	mid	-	5	5	4769.54	4148.3
FDD V HSUPA Subtest 1	high	-	5	5	4749.5	4128.26
FDD V HSUPA Subtest 5	low	-	5	5	4769.54	4128.26
FDD V HSUPA Subtest 5	mid	-	5	5	4769.54	4148.29
FDD V HSUPA Subtest 5	high	-	5	5	4749.49	4128.26
eFDD 5 QPSK	low	6	1.4	1.4	-	1100.2
eFDD 5 QPSK	mid	6	1.4	1.4	-	1106.21
eFDD 5 QPSK	high	6	1.4	1.4	-	1100.2
eFDD 5 16QAM	low	6	1.4	1.4	-	2975.95
eFDD 5 16QAM	mid	6	1.4	1.4	-	1100.2
eFDD 5 16QAM	high	6	1.4	1.4	-	1100.2
eFDD 5 QPSK	low	15	3	3	-	2753.51
eFDD 5 QPSK	mid	15	3	3	-	2753.51
eFDD 5 QPSK	high	15	3	3	-	2753.51
eFDD 5 16QAM	low	15	3	3	-	2789.58
eFDD 5 16QAM	mid	15	3	3	-	2741.48
eFDD 5 16QAM	high	15	3	3	-	2753.51
eFDD 5 QPSK	low	25	5	5	-	4529.06
eFDD 5 QPSK	mid	25	5	5	-	4529.06
eFDD 5 QPSK	high	25	5	5	-	4509.02
eFDD 5 16QAM	low	25	5	5	-	4509.02
eFDD 5 16QAM	mid	25	5	5	-	4529.06
eFDD 5 16QAM	high	25	5	5	-	4529.06
eFDD 5 QPSK	low	50	10	10	-	9018.04
eFDD 5 QPSK	mid	50	10	10	-	9018.04
eFDD 5 QPSK	high	50	10	10	-	9018.04
eFDD 5 16QAM	low	50	10	10	-	9018.04
eFDD 5 16QAM	mid	50	10	10	-	9018.04
eFDD 5 16QAM	high	50	10	10	-	8977.96

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	26 dB BW [kHz]	99 % BW [kHz]
eFDD 26 QPSK	low	6	1.4	1.4	-	1106.21
eFDD 26 QPSK	mid	6	1.4	1.4	-	1100.2
eFDD 26 QPSK	high	6	1.4	1.4	-	1112.22
eFDD 26 16QAM	low	6	1.4	1.4	-	1100.2
eFDD 26 16QAM	mid	6	1.4	1.4	-	1100.2
eFDD 26 16QAM	high	6	1.4	1.4	-	1100.2
eFDD 26 QPSK	low	15	3	3	-	2753.5
eFDD 26 QPSK	mid	15	3	3	-	2753.5
eFDD 26 QPSK	high	15	3	3	-	2765.53
eFDD 26 16QAM	low	15	3	3	-	2777.55
eFDD 26 16QAM	mid	15	3	3	-	2753.5
eFDD 26 16QAM	high	15	3	3	-	2753.5
eFDD 26 QPSK	low	25	5	5	-	4529.05
eFDD 26 QPSK	mid	25	5	5	-	4509.02
eFDD 26 QPSK	high	25	5	5	-	4509.02
eFDD 26 16QAM	low	25	5	5	-	4529.05
eFDD 26 16QAM	mid	25	5	5	-	4549.09
eFDD 26 16QAM	high	25	5	5	-	4529.05
eFDD 26 QPSK	low	50	10	10	-	8977.96
eFDD 26 QPSK	mid	50	10	10	-	8977.96
eFDD 26 QPSK	high	50	10	10	-	8977.96
eFDD 26 16QAM	low	50	10	10	-	9018.04
eFDD 26 16QAM	mid	50	10	10	-	9018.04
eFDD 26 16QAM	high	50	10	10	-	8977.96

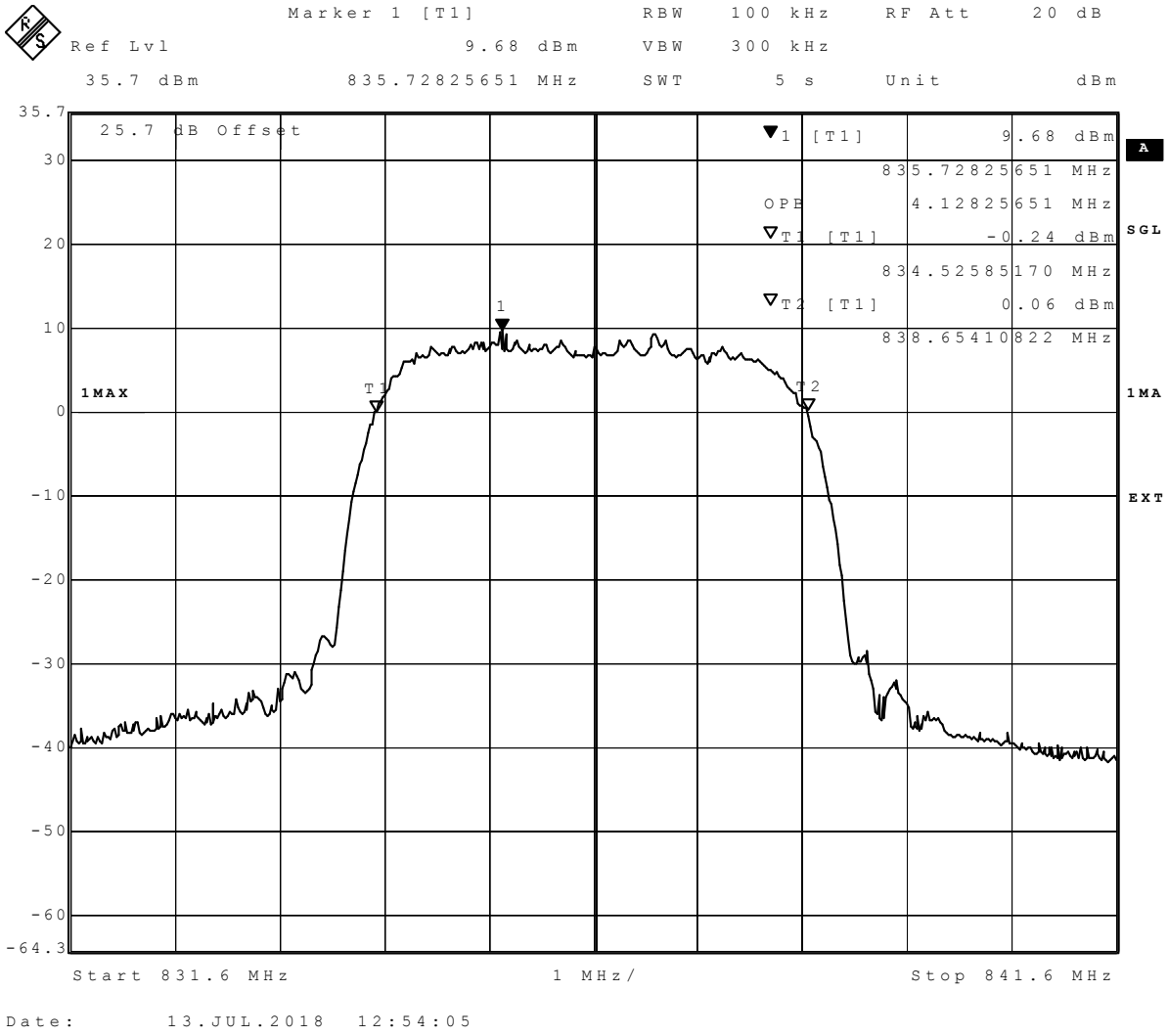
Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	26 dB BW [kHz]	99 % BW [kHz]
eFDD 5 64QAM	low	6	1.4	1.4	-	1088.18
eFDD 5 64QAM	mid	6	1.4	1.4	-	1106.21
eFDD 5 64QAM	high	6	1.4	1.4	-	1094.19
eFDD 5 64QAM	low	15	3	3	-	2753.51
eFDD 5 64QAM	mid	15	3	3	-	2753.51
eFDD 5 64QAM	high	15	3	3	-	2741.48
eFDD 5 64QAM	low	25	5	5	-	4509.02
eFDD 5 64QAM	mid	25	5	5	-	4529.06
eFDD 5 64QAM	high	25	5	5	-	4529.06
eFDD 5 64QAM	low	50	10	10	-	8977.96
eFDD 5 64QAM	mid	50	10	10	-	9018.04
eFDD 5 64QAM	high	50	10	10	-	8937.88
eFDD 26 64QAM	low	6	1.4	1.4	-	1088.18
eFDD 26 64QAM	mid	6	1.4	1.4	-	1094.19
eFDD 26 64QAM	high	6	1.4	1.4	-	1106.21
eFDD 26 64QAM	low	15	3	3	-	2753.51
eFDD 26 64QAM	mid	15	3	3	-	2741.48
eFDD 26 64QAM	high	15	3	3	-	2729.46
eFDD 26 64QAM	low	25	5	5	-	4529.06
eFDD 26 64QAM	mid	25	5	5	-	4529.06
eFDD 26 64QAM	high	25	5	5	-	4529.06
eFDD 26 64QAM	low	50	10	10	-	8977.96
eFDD 26 64QAM	mid	50	10	10	-	9058.12
eFDD 26 64QAM	high	50	10	10	-	8977.96



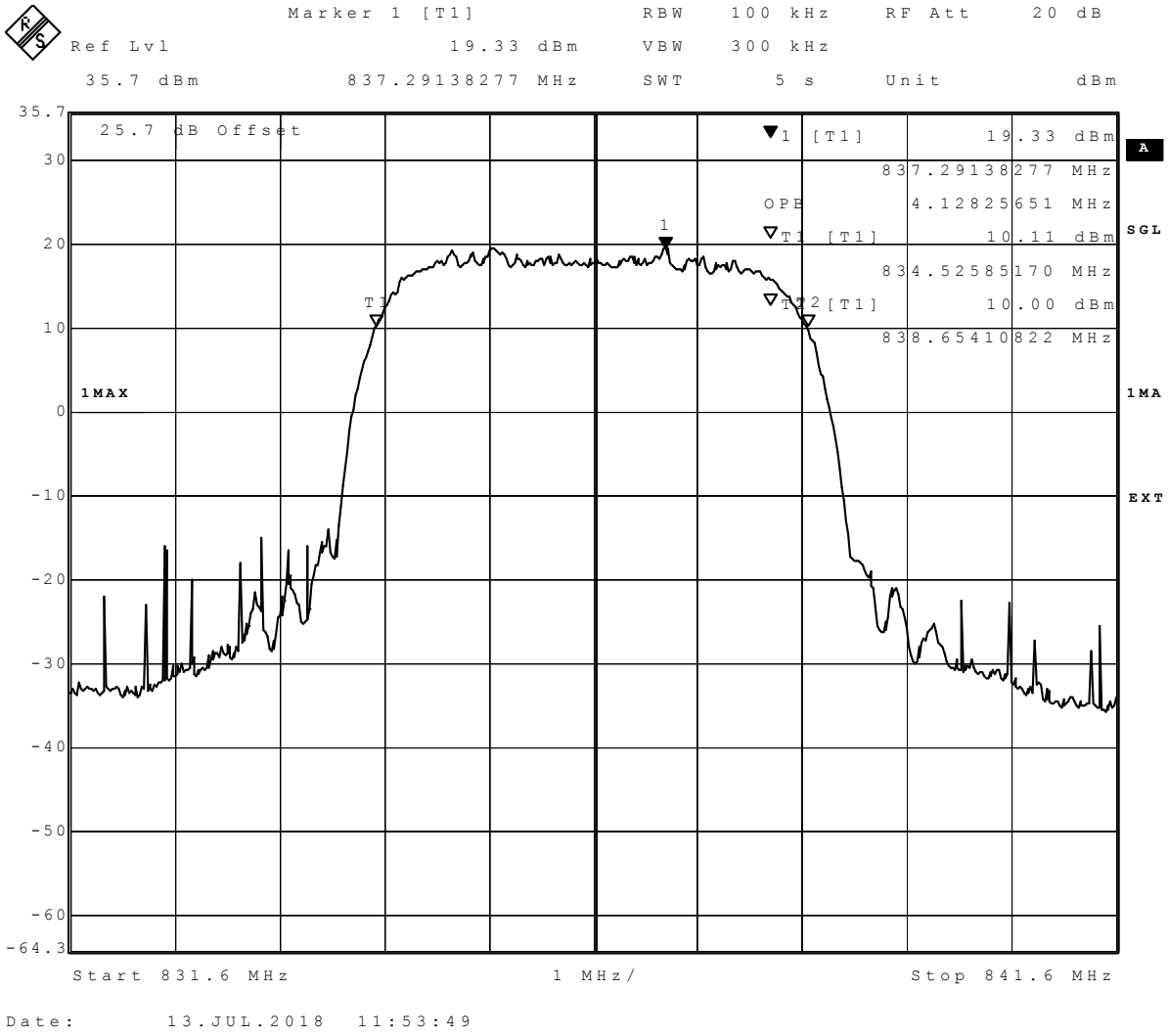
99% GSM850 Channel=mid



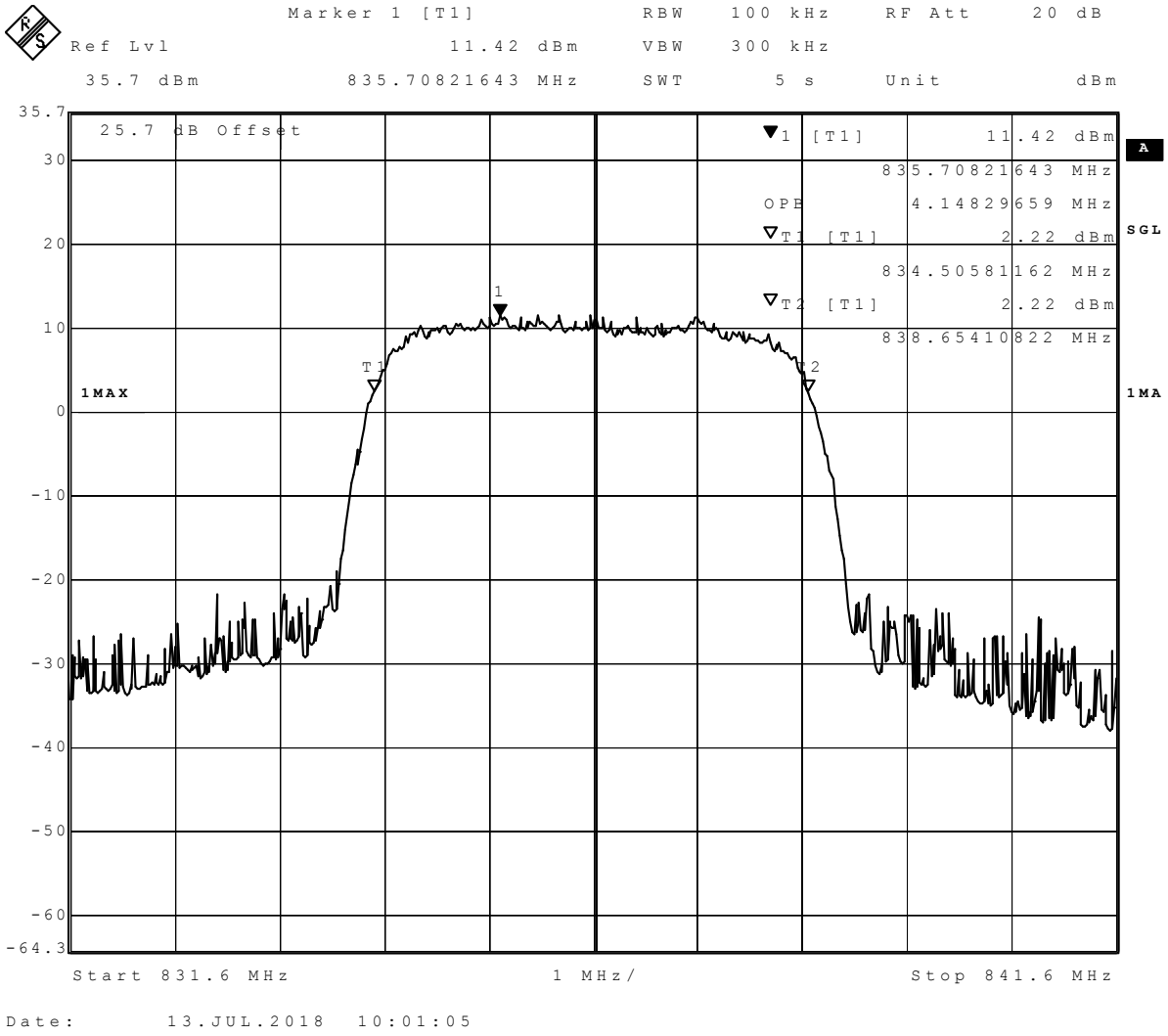
99% EDGE850 Channel=mid



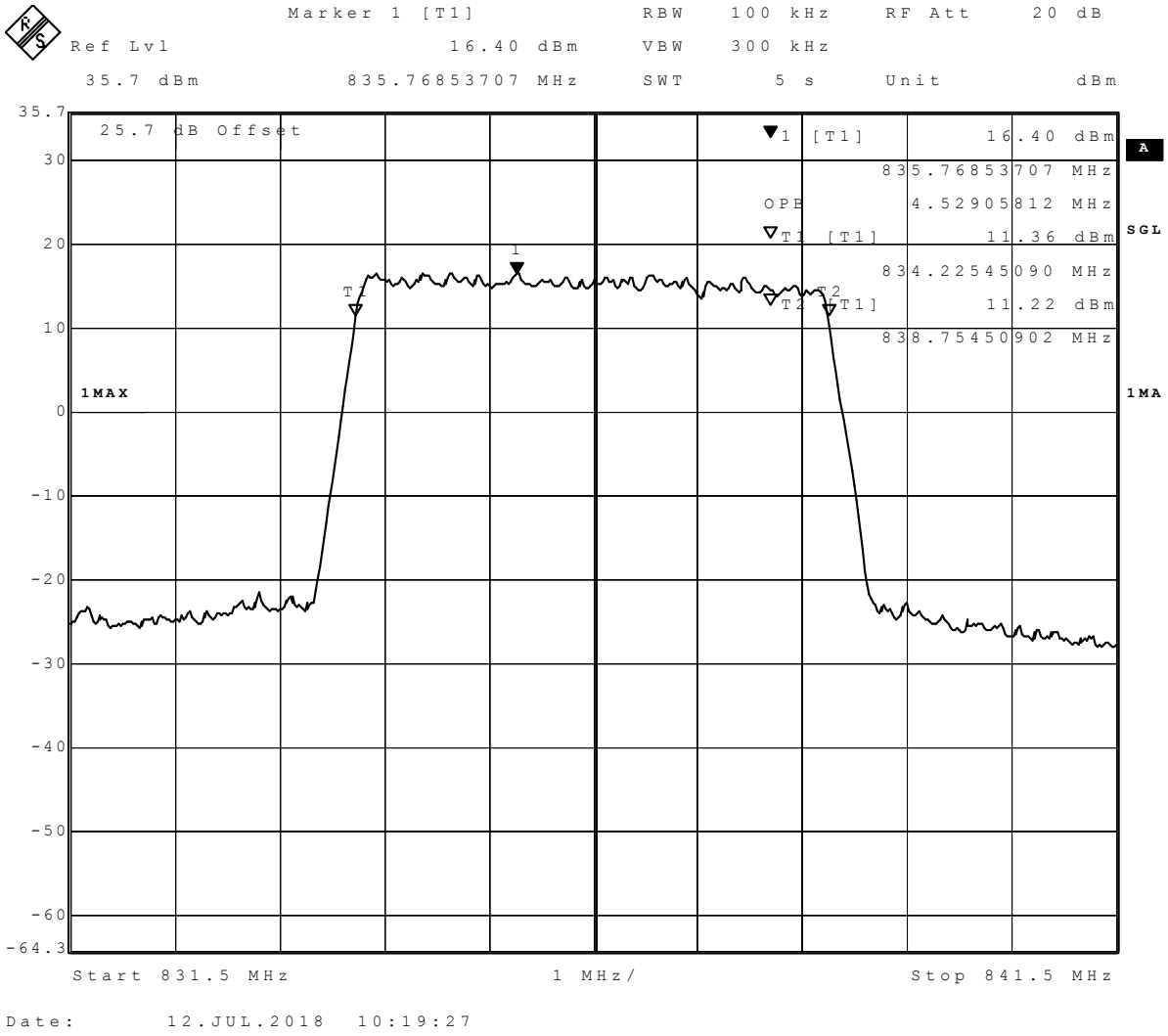
99% WCDMa FDD5 Channel=mid



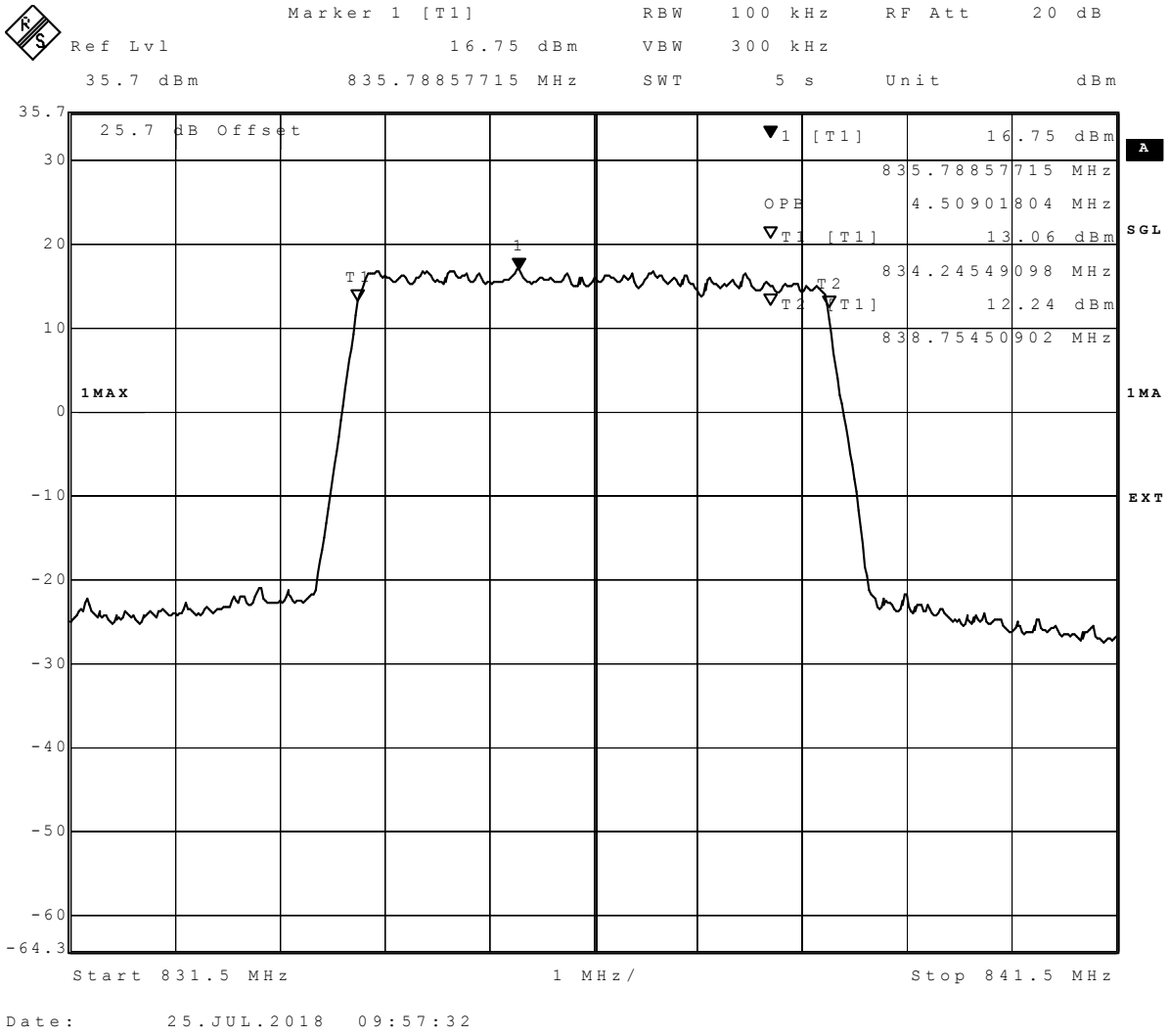
99% HSDPA FDD5 SUBTEST1 Channel=mid



99% HSUPA FDD5 SUBTEST1 Channel=mid



99% eFDD5 QPSK 5MHz Channel=mid



99% eFDD26 QPSK 5MHz Channel=mid

3.5.6 22.6 Band edge compliance §2.1053, §22.917

Test: 22.6; _Band edge compliance Summary §2.1053, §22.917

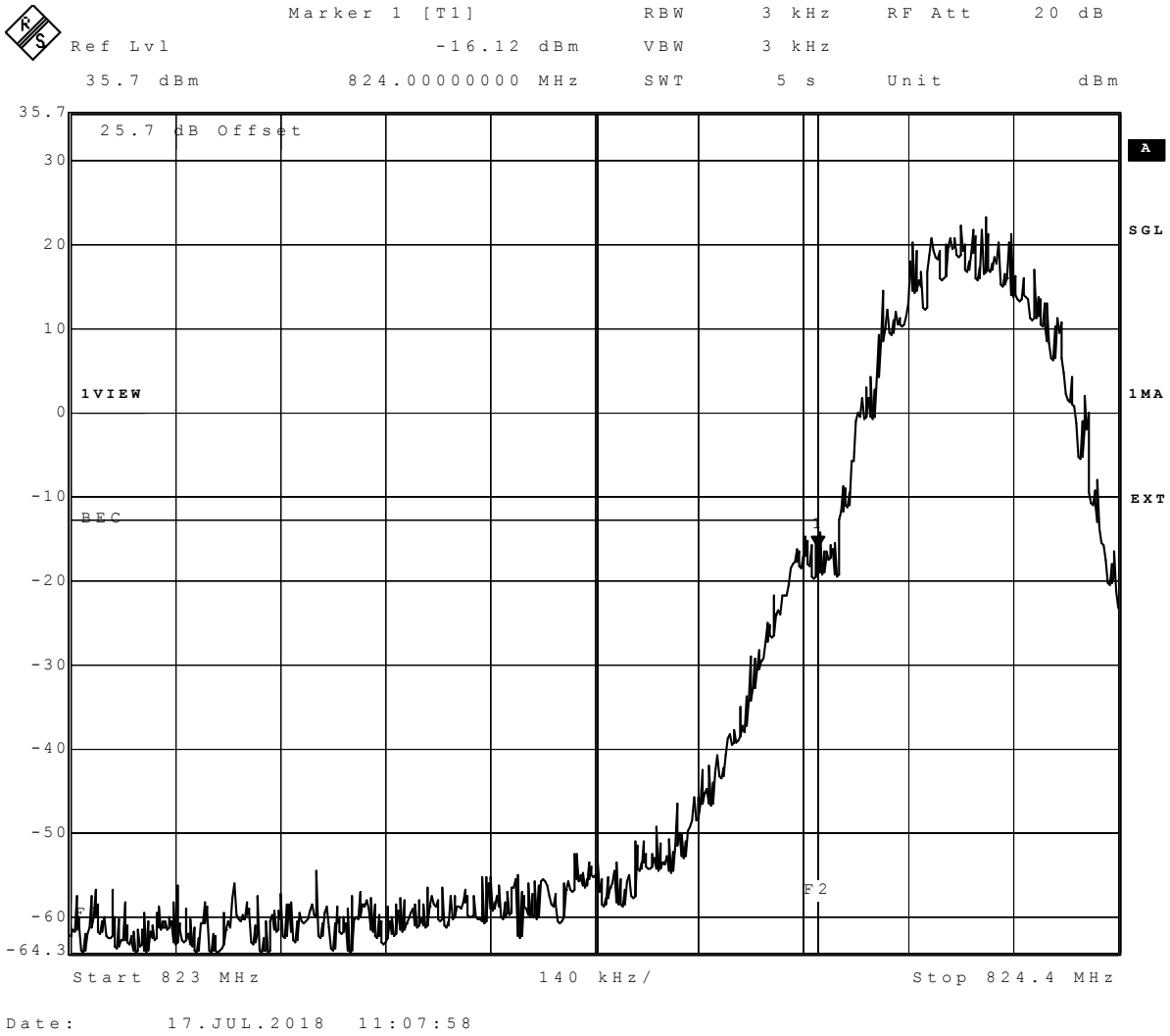
Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 14:56
Body:	FCC47CFRChIPART22PUBLIC MOBILE SERVICES
Test Specification:	FCC part 2 and 22

Detailed Results:

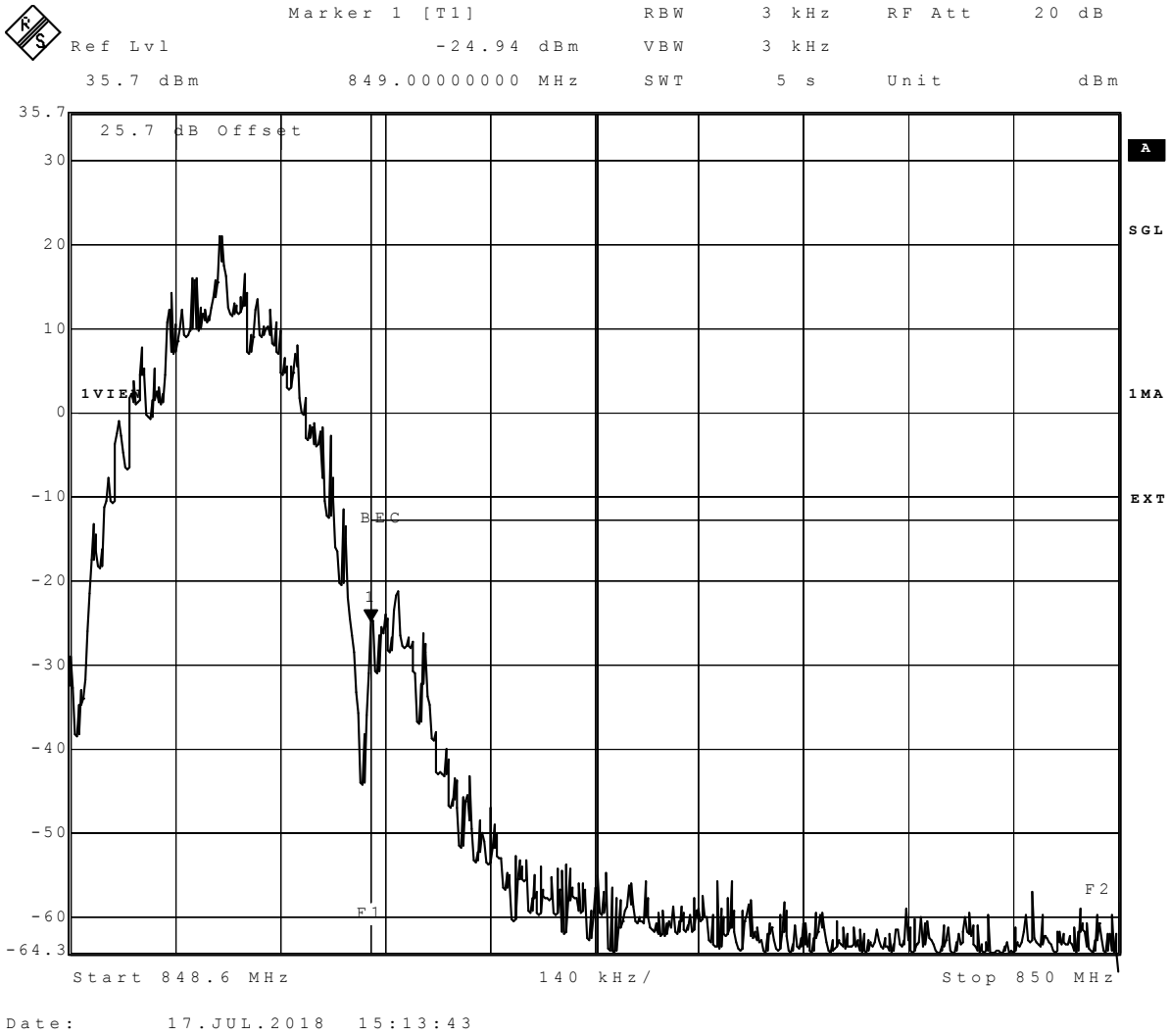
Radio Technology	Channel	Nominal BW	Ressource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
GSM 850	low	0.2	-	-16.12	-36.34	-28.27	-13	3.12
GSM 850	high	0.2	-	-20.32	-36.34	-31.24	-13	7.32
GSM 850 EDGE	low	0.2	-	-29.57	-45.89	-35.26	-13	16.57
GSM 850 EDGE	high	0.2	-	-24.94	-50.32	-39.04	-13	11.94
FDD V	low	5	-	-25.63	-36.94	-35.78	-13	22.78
FDD V	high	5	-	-29.06	-39.87	-38.28	-13	25.28
FDD V HSDPA Subtest 1	low	5	-	-17.79	-27.61	-26.8	-13	13.8
FDD V HSDPA Subtest 1	high	5	-	-18.04	-28.74	-28.04	-13	15.04
FDD V HSUPA Subtest 1	low	5	-	-16.69	-26.8	-26.06	-13	13.06
FDD V HSUPA Subtest 1	high	5	-	-18.85	-28.74	-27.61	-13	14.61
FDD V HSUPA Subtest 5	low	5	-	-16.69	-26.8	-26.06	-13	13.06
FDD V HSUPA Subtest 5	high	5	-	-18.85	-28.74	-27.61	-13	14.61
eFDD 5 QPSK	low	1.4	6	-27.33	-35.38	-34.75	-13	21.75
eFDD 5 QPSK	high	1.4	6	-23.4	-32.6	-32.72	-13	19.72
eFDD 5 16QAM	low	1.4	6	-26.99	-38.28	-36.94	-13	23.94
eFDD 5 16QAM	high	1.4	6	-25.21	-34.76	-33.42	-13	20.42
eFDD 5 QPSK	low	3	15	-14.5	-28.27	-26.24	-13	13.24
eFDD 5 QPSK	high	3	15	-16.27	-30.04	-27.82	-13	14.82
eFDD 5 16QAM	low	3	15	-16.37	-30.32	-28.04	-13	15.04
eFDD 5 16QAM	high	3	15	-17.25	-30.92	-28.98	-13	15.98
eFDD 5 QPSK	low	5	25	-17.49	-32.26	-30.32	-13	17.32
eFDD 5 QPSK	high	5	25	-17.35	-32.26	-30.62	-13	17.62
eFDD 5 16QAM	low	5	25	-18.5	-33.84	-31.57	-13	18.57
eFDD 5 16QAM	high	5	25	-18.77	-33.42	-31.57	-13	18.57
eFDD 5 QPSK	low	10	50	-19.35	-33.02	-31.57	-13	18.57
eFDD 5 QPSK	high	10	50	-20.99	-35.26	-33.84	-13	20.84
eFDD 5 16QAM	low	10	50	-21.78	-35.26	-33.84	-13	20.84
eFDD 5 16QAM	high	10	50	-21.33	-35.78	-34.76	-13	21.76

Radio Technology	Channel	Nominal BW	Ressource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
eFDD 26 QPSK	low	1.4	6	-26.76	-35.71	-34.6	-13	21.6
eFDD 26 QPSK	high	1.4	6	-23.05	-32.36	-31.48	-13	18.48
eFDD 26 16QAM	low	1.4	6	-25.22	-36.61	-35.71	-13	22.71
eFDD 26 16QAM	high	1.4	6	-24.73	-34.16	-33.22	-13	13.06
eFDD 26 QPSK	low	3	15	-14.09	-28.27	-26.06	-13	15.27
eFDD 26 QPSK	high	3	15	-16.49	-30.04	-28.27	-13	15.04
eFDD 26 16QAM	low	3	15	-16.46	-30.32	-28.04	-13	15.04
eFDD 26 16QAM	high	3	15	-16.99	-30.62	-28.74	-13	15.74
eFDD 26 QPSK	low	5	25	-17.66	-32.26	-30.32	-13	17.32
eFDD 26 QPSK	high	5	25	-17.6	-32.63	-30.62	-13	17.62
eFDD 26 16QAM	low	5	25	-17.85	-33.84	-31.24	-13	18.24
eFDD 26 16QAM	high	5	25	-18.74	-33.42	-31.57	-13	18.57
eFDD 26 QPSK	low	10	50	-18.91	-33.02	-31.57	-13	18.57
eFDD 26 QPSK	high	10	50	-21.06	-35.26	-33.42	-13	20.42
eFDD 26 16QAM	low	10	50	-21.3	-35.26	-33.42	-13	20.42
eFDD 26 16QAM	high	10	50	-22.39	-36.34	-34.76	-13	21.76
eFDD 26 QPSK	low	15	75	-26.19	-36.94	-35.78	-13	22.78
eFDD 26 QPSK	high	15	75	-26.67	-39.04	-37.59	-13	24.59
eFDD 26 16QAM	low	15	75	-27.63	-39.04	-37.59	-13	24.59
eFDD 26 16QAM	high	15	75	-29.75	-40.78	-39.87	-13	26.87

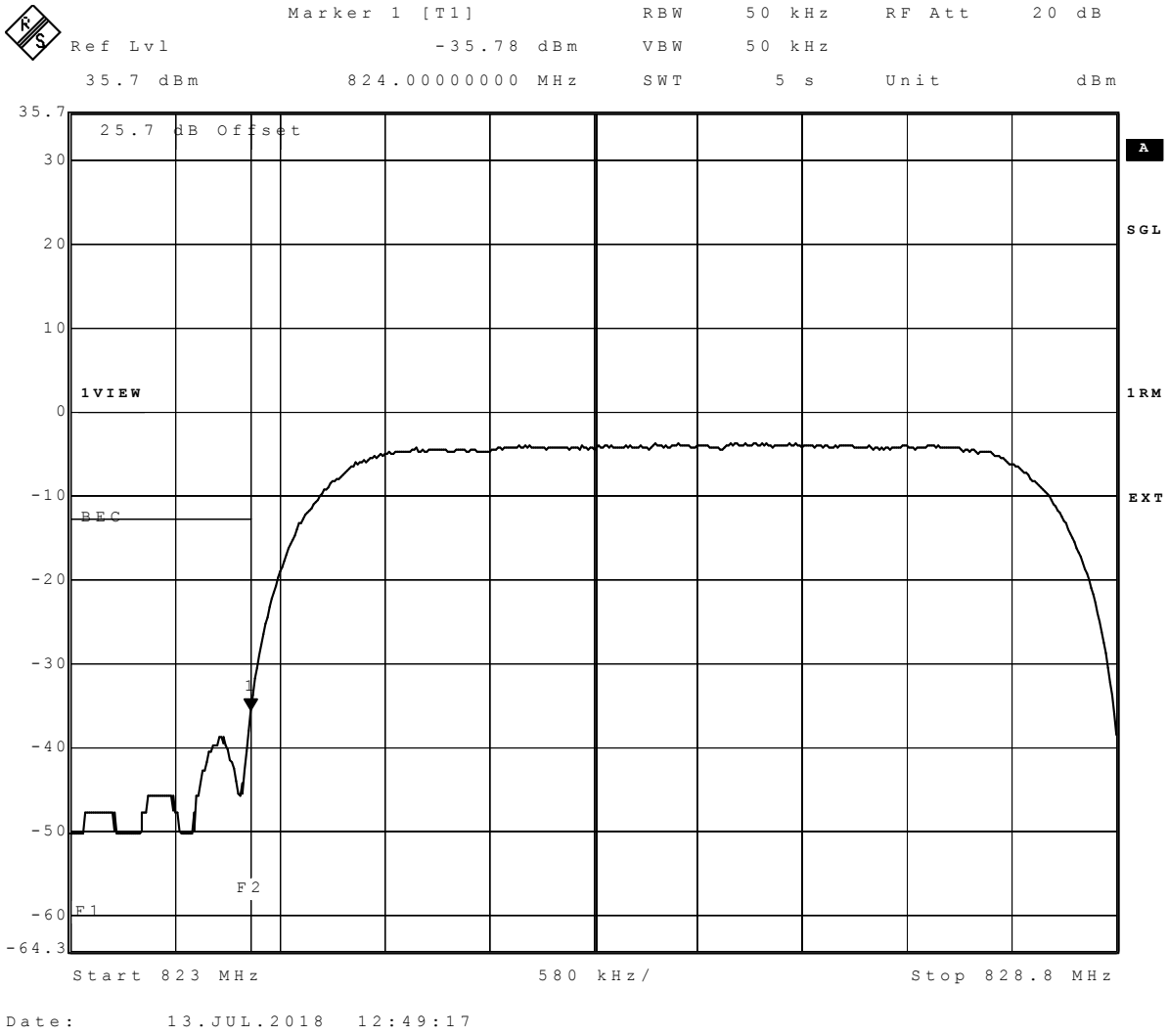
Radio Technology	Channel	Nominal BW	Ressource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
eFDD 5 64QAM	low	6	1.4	-32.73	-41.8	-40.78	-13	27.78
eFDD 5 64QAM	high	6	1.4	-31.78	-40.78	-39.04	-13	26.04
eFDD 5 64QAM	low	15	3	-18.13	-33.02	-29.5	-13	16.5
eFDD 5 64QAM	high	15	3	-19.97	-34.76	-31.91	-13	18.91
eFDD 5 64QAM	low	25	5	-18.61	-36.94	-33.84	-13	20.84
eFDD 5 64QAM	high	25	5	-22.94	-38.28	-35.78	-13	22.78
eFDD 5 64QAM	low	50	10	-21.83	-39.04	-36.94	-13	23.94
eFDD 5 64QAM	high	50	10	-23.06	-41.8	-39.87	-13	26.87
eFDD 26 64QAM	low	1.4	6	-29.37	-41.8	-40.78	-13	27.78
eFDD 26 64QAM	high	1.4	6	-30.93	-39.87	-38.28	-13	25.28
eFDD 26 64QAM	low	3	15	-17.32	-32.63	-29.5	-13	16.5
eFDD 26 64QAM	high	3	15	-19.68	-34.76	-31.91	-13	18.91
eFDD 26 64QAM	low	5	25	-19.07	-36.94	-33.42	-13	20.42
eFDD 26 64QAM	high	5	25	-23.12	-38.28	-35.78	-13	22.78
eFDD 26 64QAM	low	10	50	-21.42	-39.04	-36.94	-13	23.94
eFDD 26 64QAM	high	10	50	-23.87	-41.8	-39.87	-13	26.87



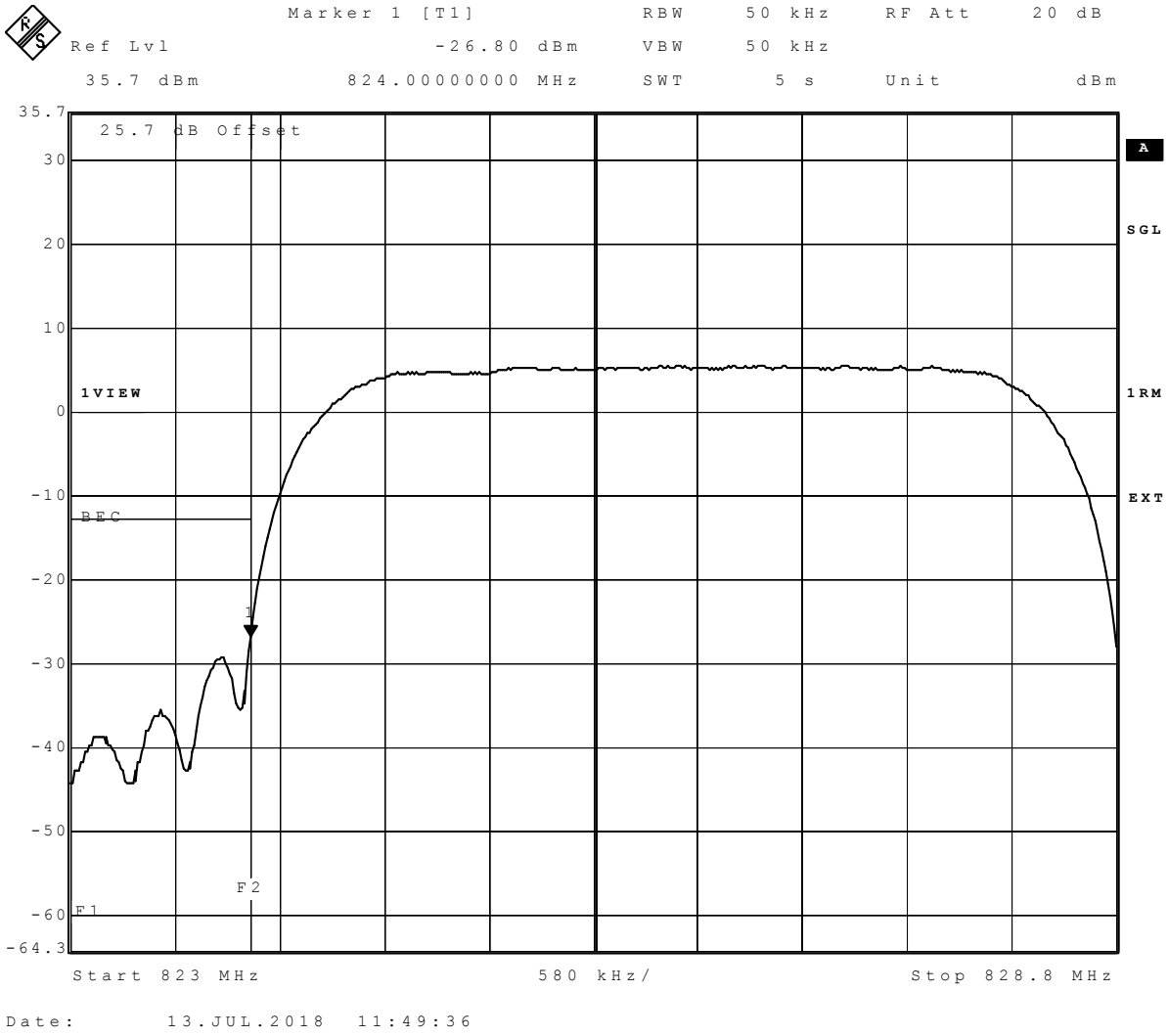
GSM850 Channel=low



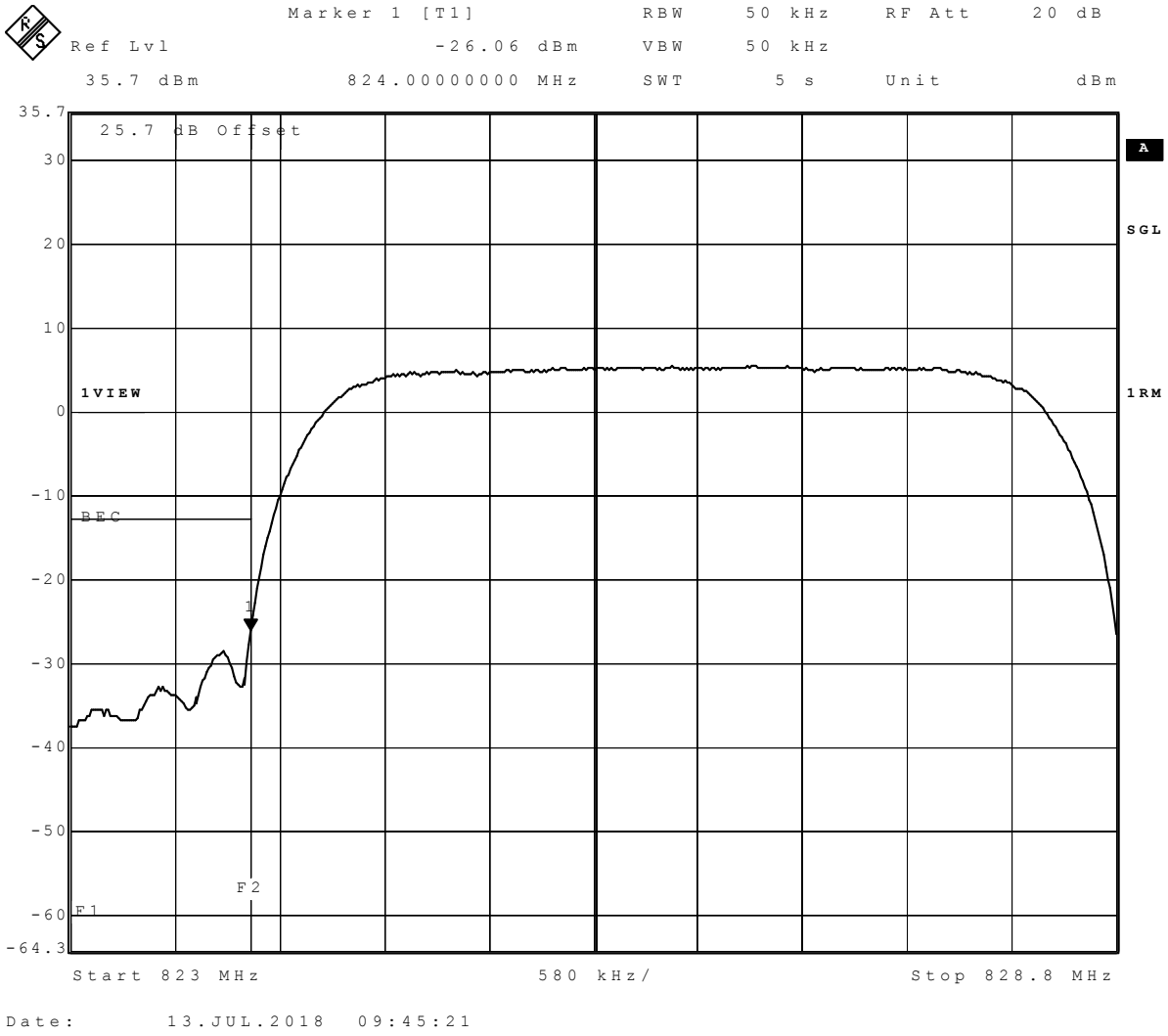
EDGE850 Channel=high



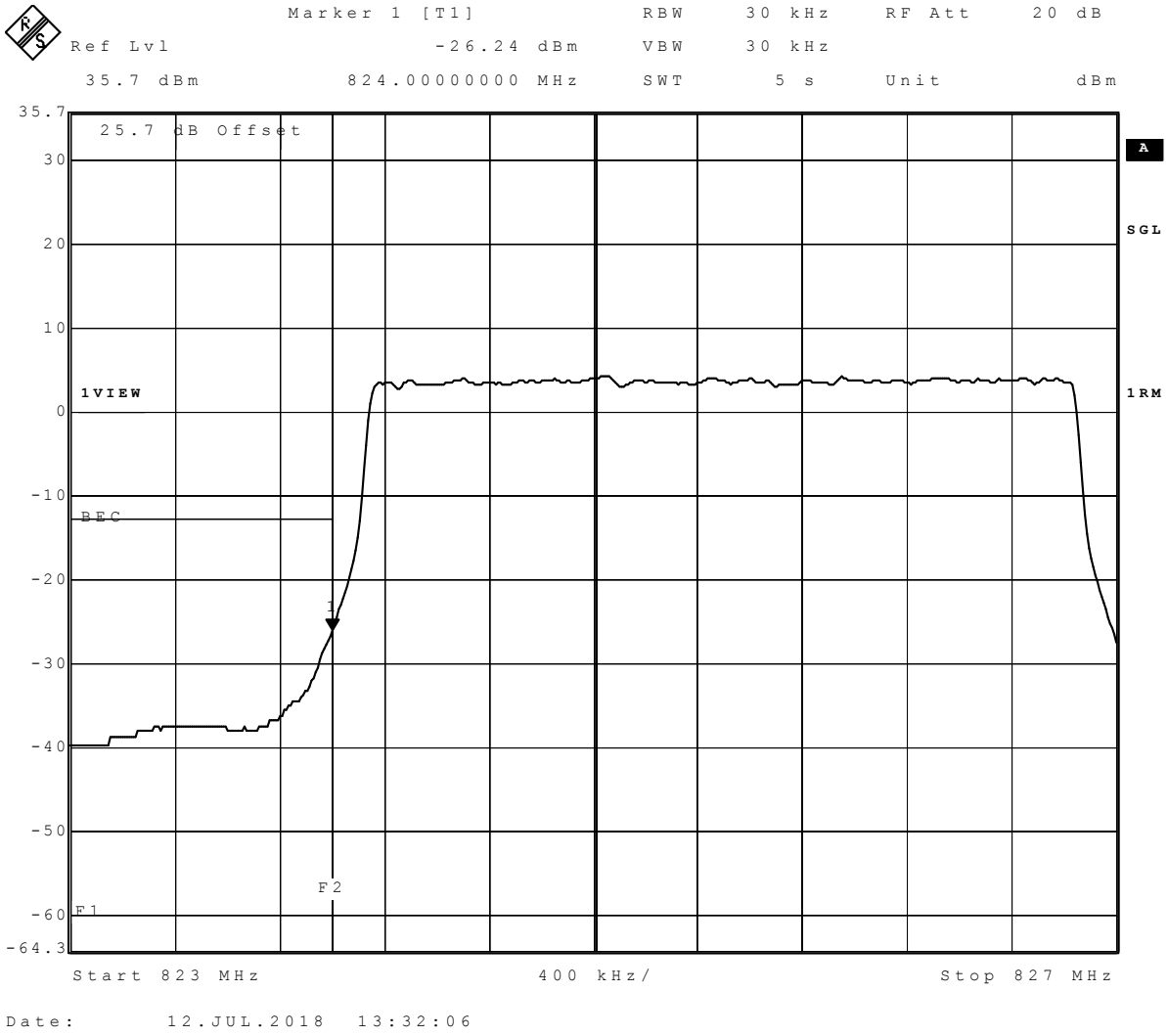
WCDMa FDD5 Channel=low



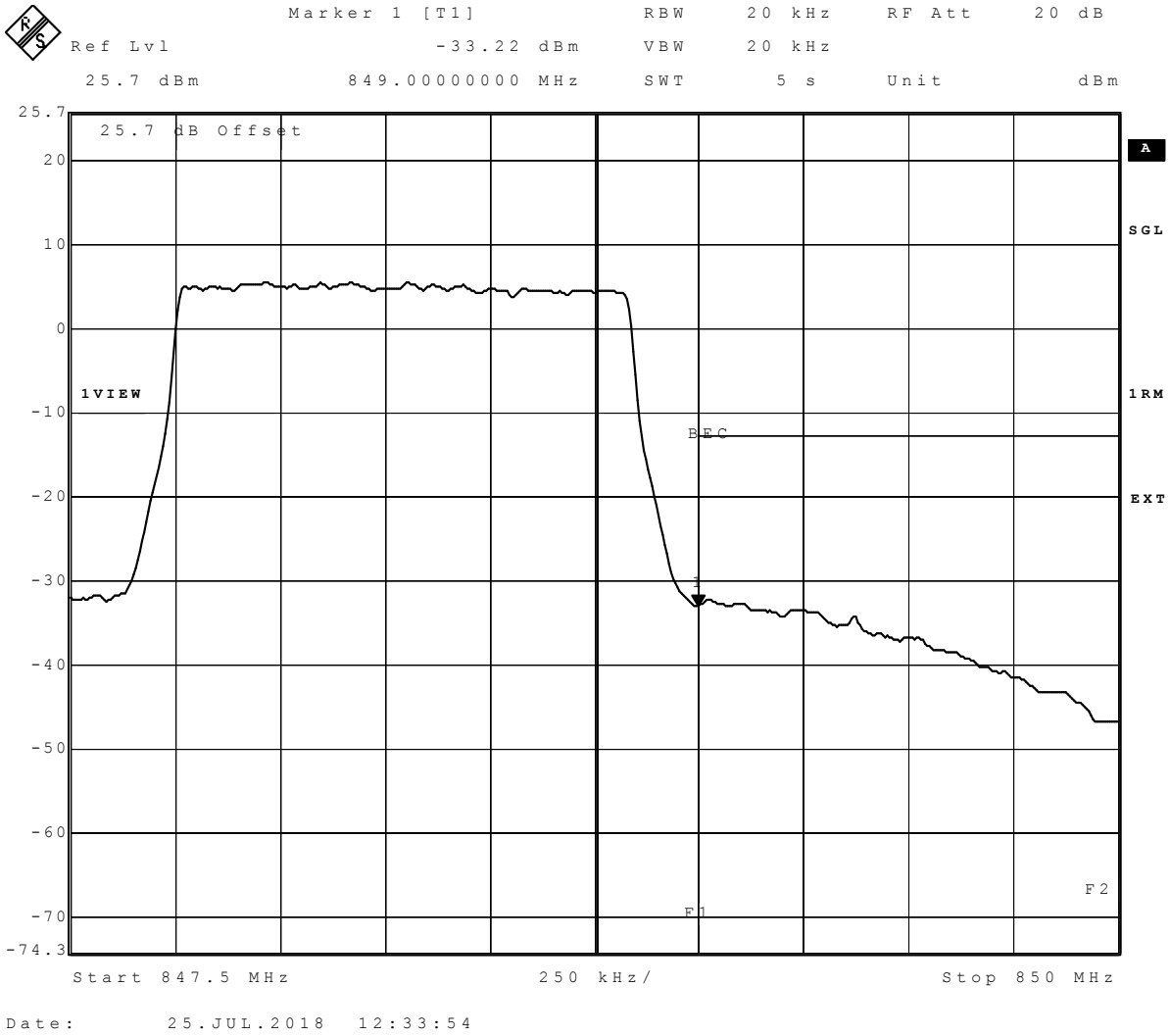
HSDPA FDD5 SUBTEST1 Channel=low



HSUPA FDD5 SUBTEST1 Channel=low



eFDD5 QPSK 3MHz Channel=low



eFDD26 16QAM 1.4MHz Channel=high

3.5.7 22.7 Peak-to-Average Ratio Summary §2.1046

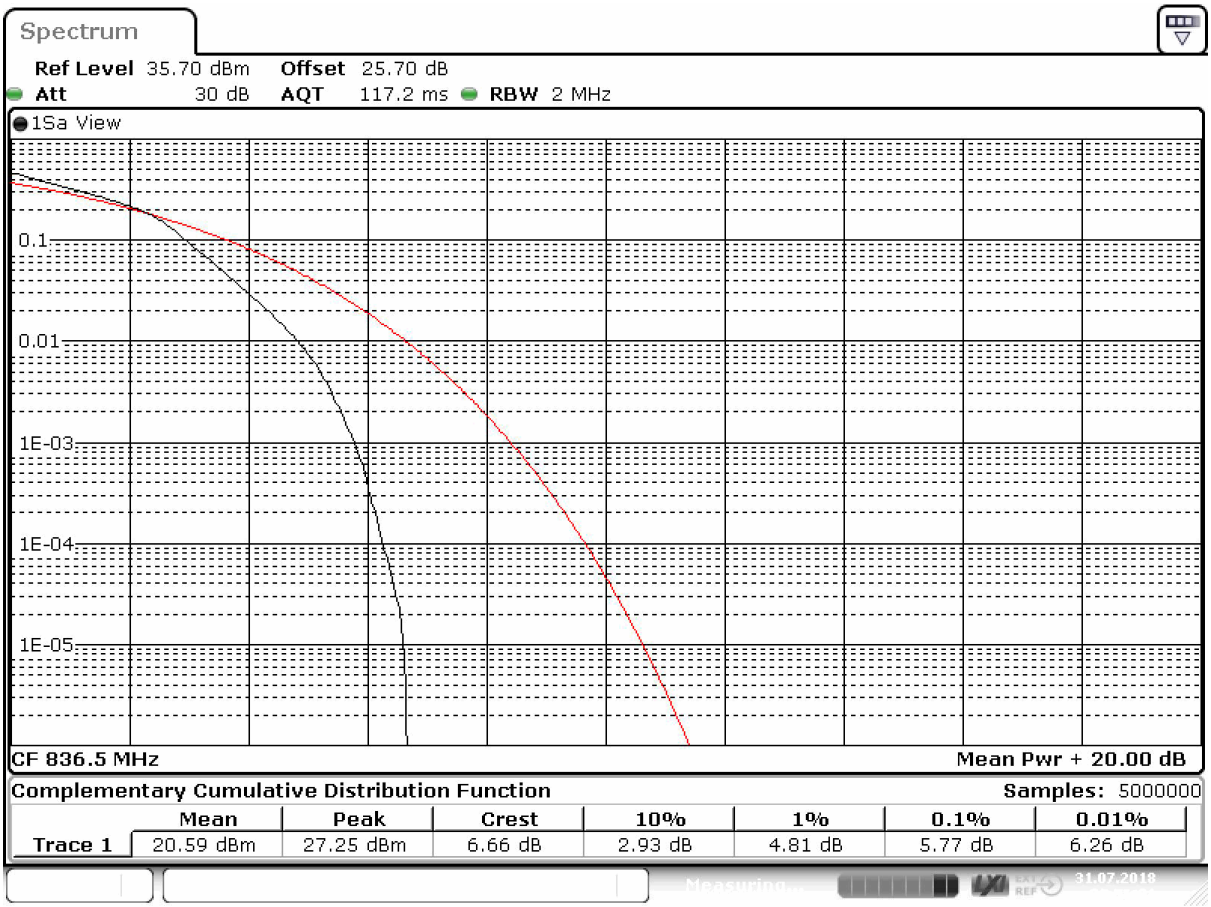
Test: 22.7; Peak-to-Average Ratio Summary §2.1046

Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 11:36
Body:	FCC47CFRChIPART22PUBLIC MOBILE SERVICES
Test Specification:	FCC part 2 and 22

Detailed Results:

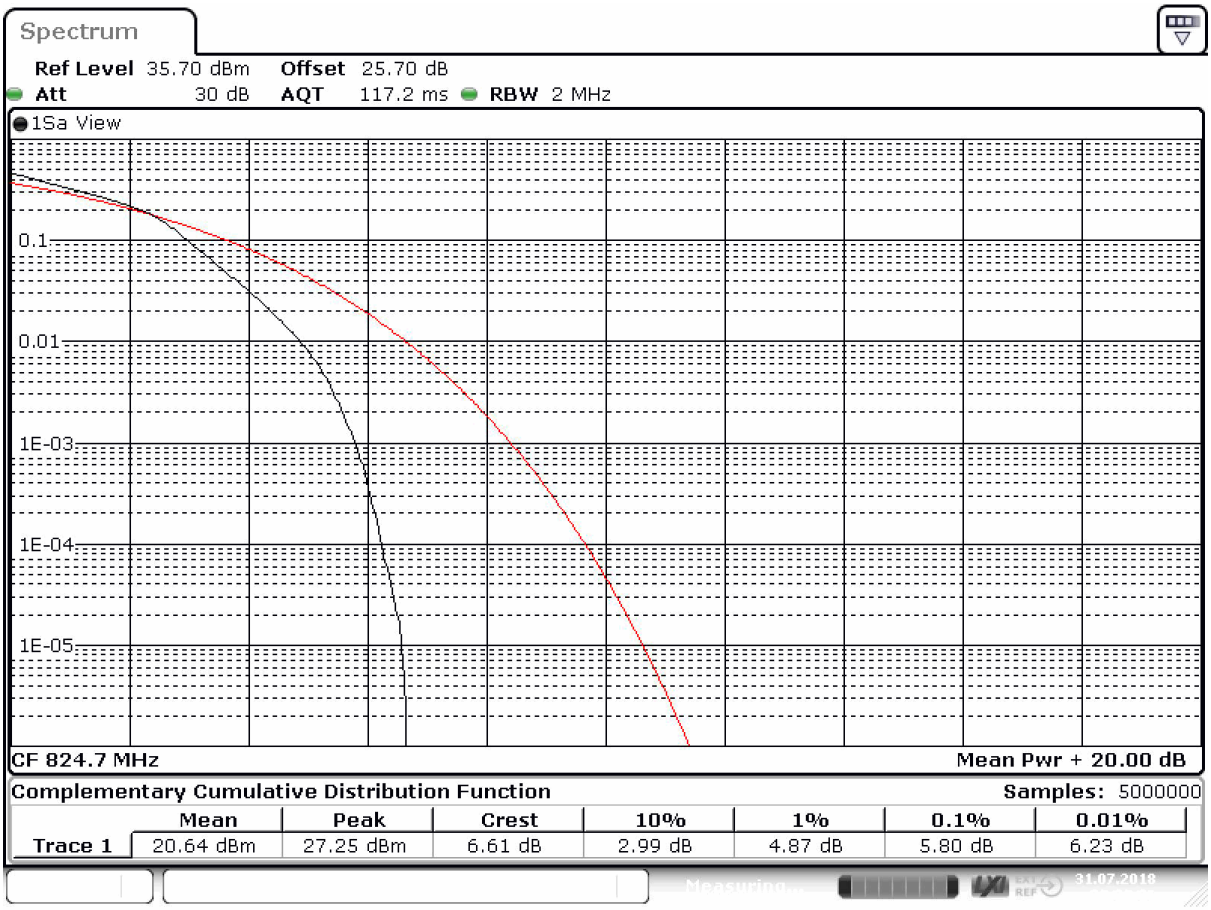
Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak to Average Ratio [dB]
GSM 850	low	-	0.2	0.06
GSM 850	mid	-	0.2	0.01
GSM 850	high	-	0.2	0
GSM 850 EDGE	low	-	0.2	0.17
GSM 850 EDGE	mid	-	0.2	0.06
GSM 850 EDGE	high	-	0.2	0.02
FDD V	low	-	5	5.9
FDD V	mid	-	5	5.46
FDD V	high	-	5	5.43
FDD V HSDPA Subtest 1	low	-	5	5.49
FDD V HSDPA Subtest 1	mid	-	5	5.31
FDD V HSDPA Subtest 1	high	-	5	4.76
FDD V HSUPA Subtest 1	low	-	5	7.31
FDD V HSUPA Subtest 1	mid	-	5	7.24
FDD V HSUPA Subtest 1	high	-	5	6.76
FDD V HSUPA Subtest 5	low	-	5	7.25
FDD V HSUPA Subtest 5	mid	-	5	7.04
FDD V HSUPA Subtest 5	high	-	5	7.37
eFDD 5 QPSK	low	6	1.4	4.9
eFDD 5 QPSK	mid	6	1.4	4.87
eFDD 5 QPSK	high	6	1.4	4.81
eFDD 5 16QAM	low	6	1.4	5.65
eFDD 5 16QAM	mid	6	1.4	5.77
eFDD 5 16QAM	high	6	1.4	5.65
eFDD 26 QPSK	low	6	1.4	4.87
eFDD 26 QPSK	mid	6	1.4	4.9
eFDD 26 QPSK	high	6	1.4	4.78
eFDD 26 16QAM	low	6	1.4	5.8
eFDD 26 16QAM	mid	6	1.4	5.71
eFDD 26 16QAM	high	6	1.4	5.62

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak to Average Ratio [dB]
eFDD 5 64QAM	low	6	1.4	6.58
eFDD 5 64QAM	mid	6	1.4	6.61
eFDD 5 64QAM	high	6	1.4	6.26
eFDD 26 64QAM	low	6	1.4	6.52
eFDD 26 64QAM	mid	6	1.4	6.55
eFDD 26 64QAM	high	6	1.4	6.26



Date: 31.JUL.2018 08:56:21

eFDD5 16QAM Channel=mid



Date: 31.JUL.2018 09:09:06

eFDD26 16QAM Channel=low

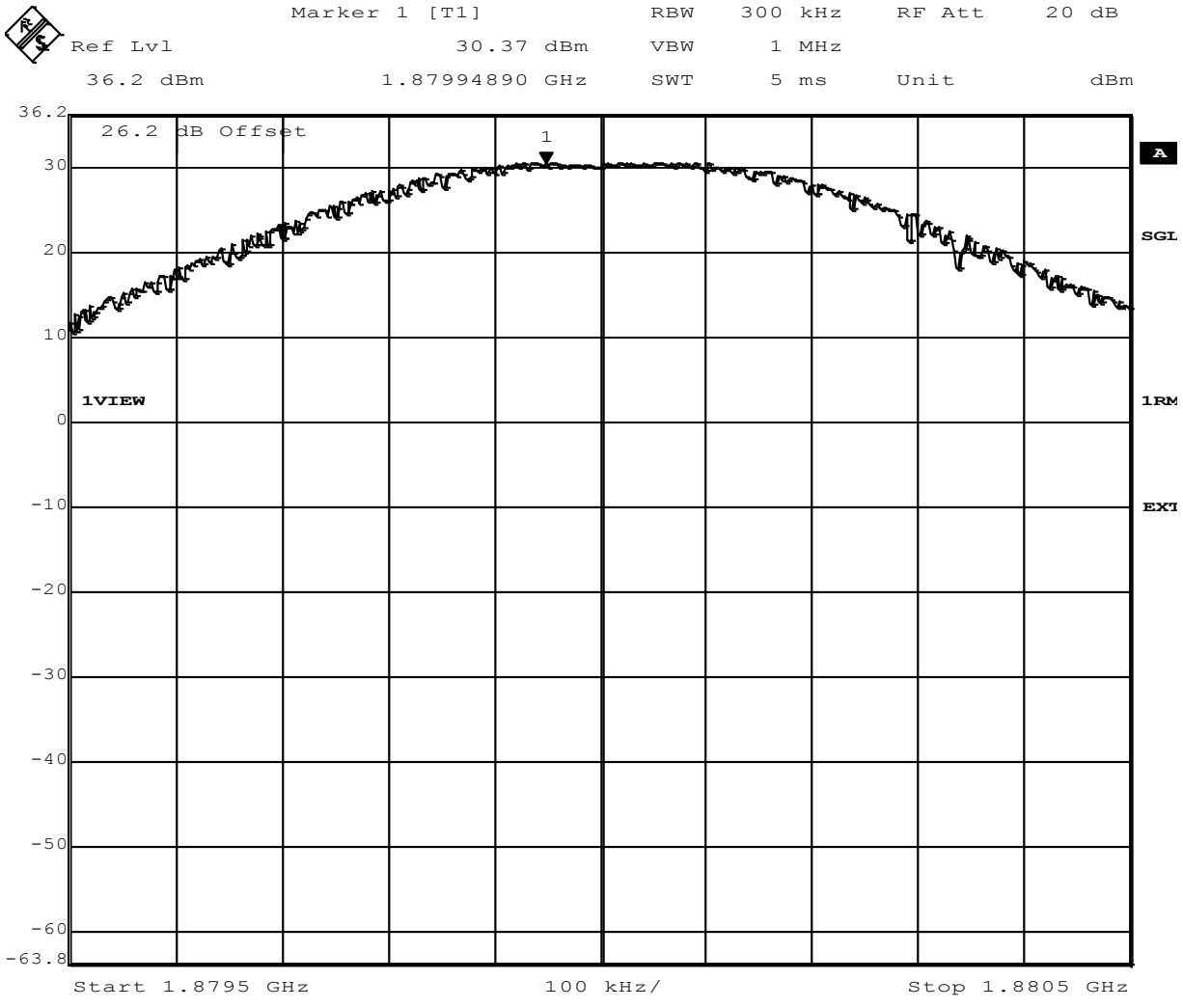
3.5.8 24.1 RF Power Output §2.1046, §24.232

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

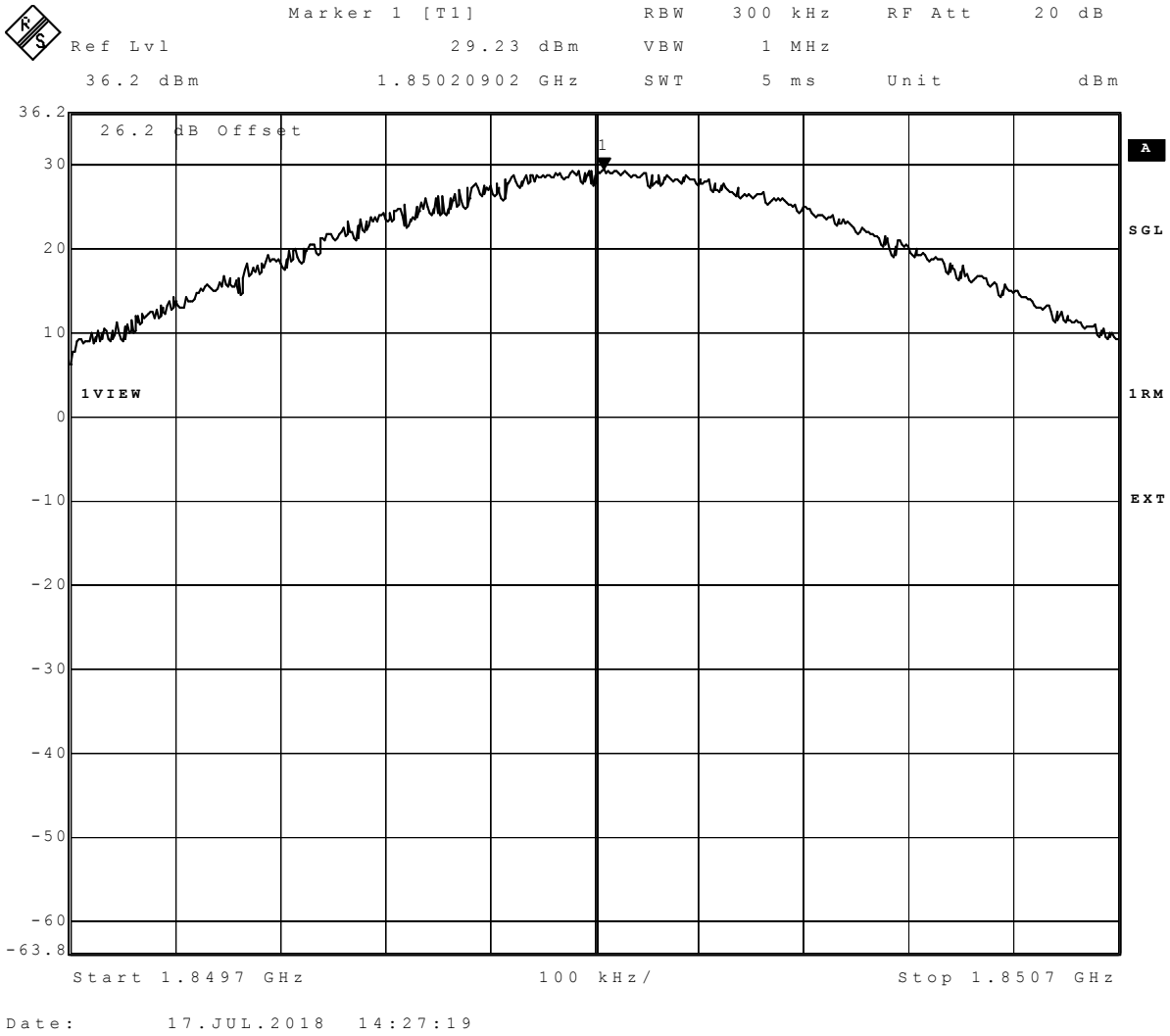
Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 18:48
Body:	FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 24

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak Cond. Power [dBm]	Average Cond. Power [dBm]	RMS Cond. Power [dBm]	FCC / IC EIRP Limit [W]	Maximum Antenna Gain [dBi]
GSM 1900	low	-	0.2	30.31	30.18	30.27	2	2.69
GSM 1900	mid	-	0.2	30.42	30.4	30.37	2	2.58
GSM 1900	high	-	0.2	30.42	30.42	30.37	2	2.58
GSM 1900 EDGE	low	-	0.2	29.33	29.19	29.23	2	3.67
GSM 1900 EDGE	mid	-	0.2	29.46	29.25	29.19	2	3.54
GSM 1900 EDGE	high	-	0.2	29.48	29.19	29.04	2	3.52



GSM1900 Channel=mid



EDGE1900 Channel=mid

3.5.9 24.2 Frequency stability §2.1055, §24.235

Test: 24.2; Frequency stability Summary §2.1055, 24.235

Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/07/04 14:32
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	0	11	passed
-30	54			2	13	passed
-30	10			1	14	passed
-20	0	normal	4700	-3	19	passed
-20	5			0	8	passed
-20	10			2	14	passed
-10	0	normal	4700	4	16	passed
-10	5			1	5	passed
-10	10			3	21	passed
0	0	normal	4700	1	3	passed
0	5			2	4	passed
0	10			2	16	passed
10	0	normal	4700	3	10	passed
10	5			2	14	passed
10	10			3	16	passed
20	0	low	4700	1	4	passed
20	5			3	-5	passed
20	10			0	16	passed
20	0	normal	4700	1	16	passed
20	5			0	5	passed
20	10			0	9	passed
20	0	high	4700	4	-14	passed
20	5			-6	12	passed
20	10			2	23	passed
30	0	normal	4700	1	-9	passed
30	5			-3	16	passed
30	10			2	11	passed
40	0	normal	4700	1	18	passed
40	5			7	10	passed
40	10			1	-6	passed
50	0	normal	4700	-1	-5	passed
50	5			-7	-14	passed
50	10			-8	-13	passed

GSM1900

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	4700	13	20	passed
-30	5			18	21	passed
-30	10			16	21	passed
-20	0	normal	4700	17	22	passed
-20	5			12	20	passed
-20	10			19	20	passed
-10	0	normal	4700	14	21	passed
-10	5			15	21	passed
-10	10			17	19	passed
0	0	normal	4700	12	23	passed
0	5			16	20	passed
0	10			14	22	passed
10	0	normal	4700	15	23	passed
10	5			12	19	passed
10	10			19	19	passed
20	0	low	4700	13	21	passed
20	5			18	19	passed
20	10			16	23	passed
20	0	normal	4700	17	21	passed
20	5			16	18	passed
20	10			18	22	passed
20	0	high	4700	18	23	passed
20	5			16	24	passed
20	10			17	26	passed
30	0	normal	4700	19	24	passed
30	5			12	19	passed
30	10			15	18	passed
40	0	normal	4700	14	34	passed
40	5			16	19	passed
40	10			11	17	passed
50	0	normal	4700	15	16	passed
50	5			13	18	passed
50	10			15	25	passed

EDGE1900

3.5.10 24.3 Spurious emissions at antenna terminals §2.1051, §24.238

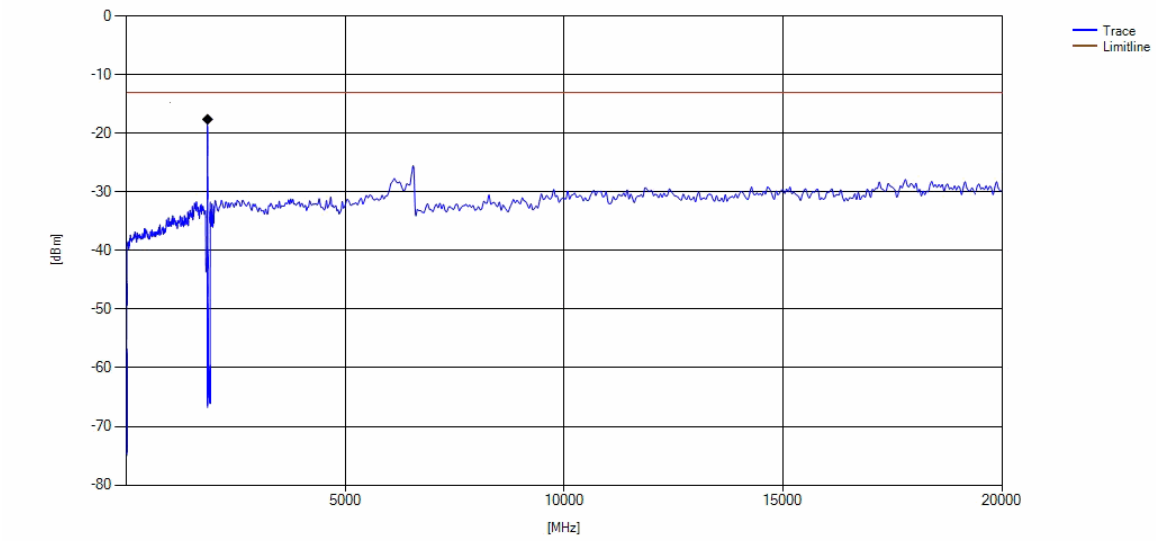
Test: 24.3; Spurious emissions at antenna terminals Summary §2.1051, §24.238

Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 22:08
Body:	FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 24

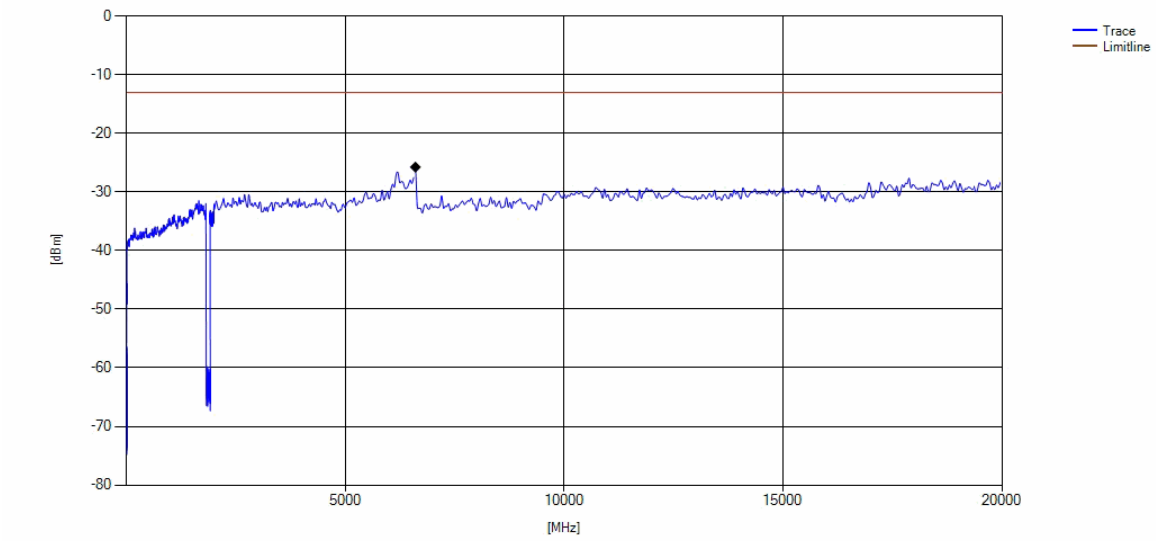
Detailed Results:

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
GSM1900	low	rms	maxhold	3	1849.9	-18.76	-13	5.76
GSM1900	mid	rms	maxhold	-	-	-	-13	>20
GSM1900	high	rms	maxhold	3	1910	-17.32	-13	4.32

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
EDGE1900	low	rms	maxhold	-	-	-	-13	>20
EDGE1900	mid	rms	maxhold	-	-	-	-13	>20
EDGE1900	high	rms	maxhold	-	-	-	-13	>20



GSM1900 Channel=low



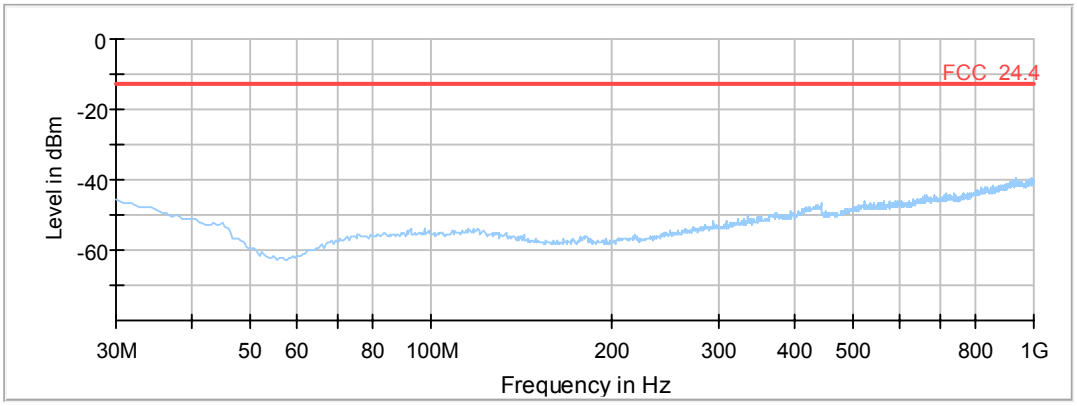
EDGE1900 Channel=mid

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

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

Result:	Passed 24.4; Field strength of spurious radiation Summary §2.1053, §24.238 Worst Case Plot GSM 1900 & EDGE 1900
Setup No.:	S01_BY03
Date of Test:	2018/08/23 15:39
Body:	FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 24

Detailed Results:



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
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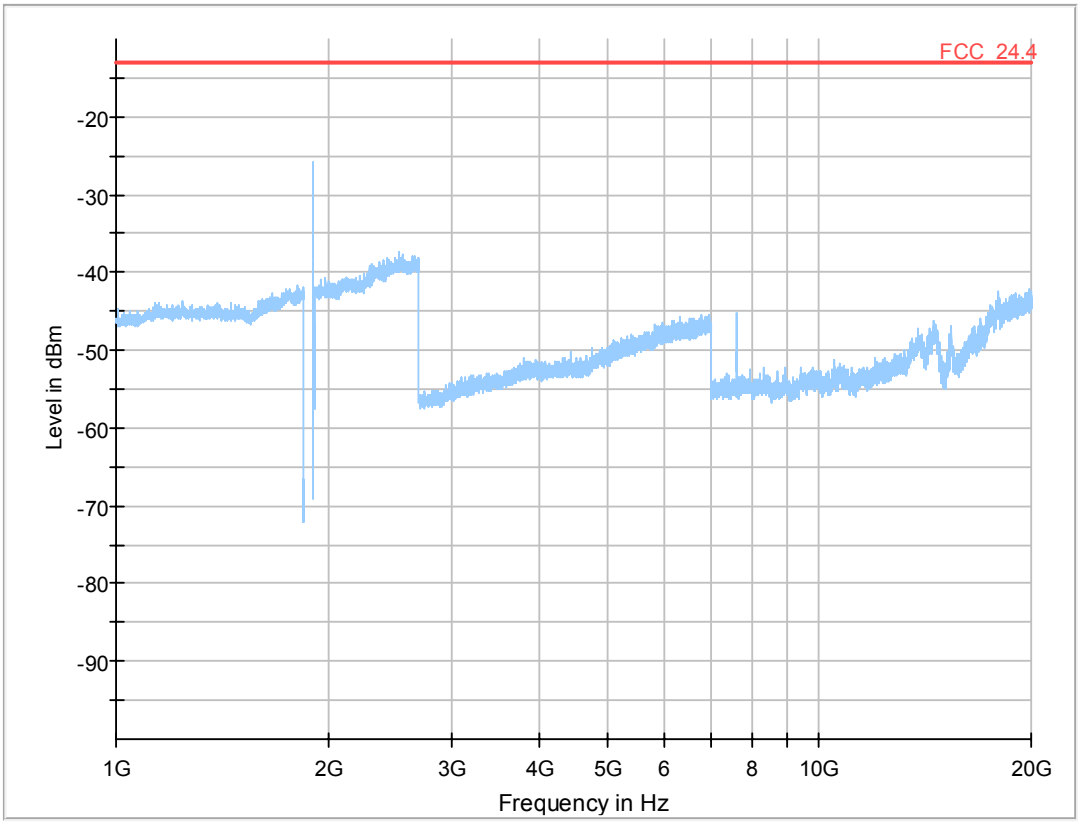
EGDE 1900 - high channel



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)
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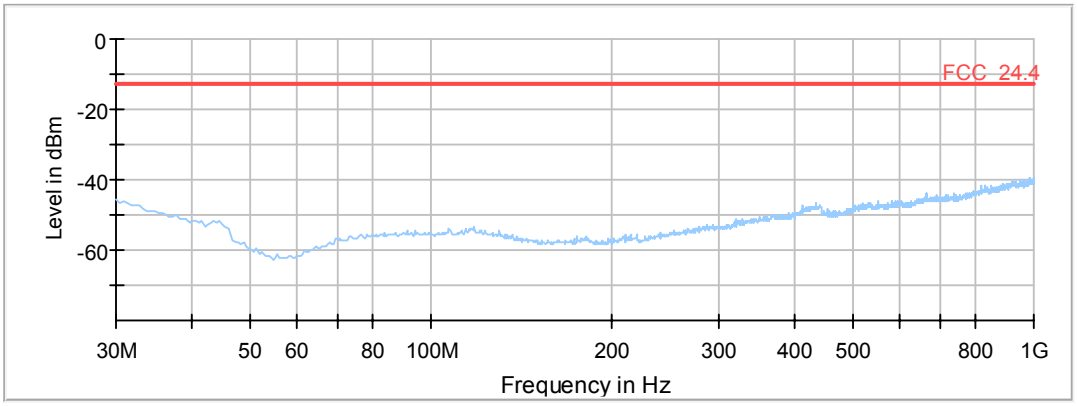
EGDE 1900 - high channel



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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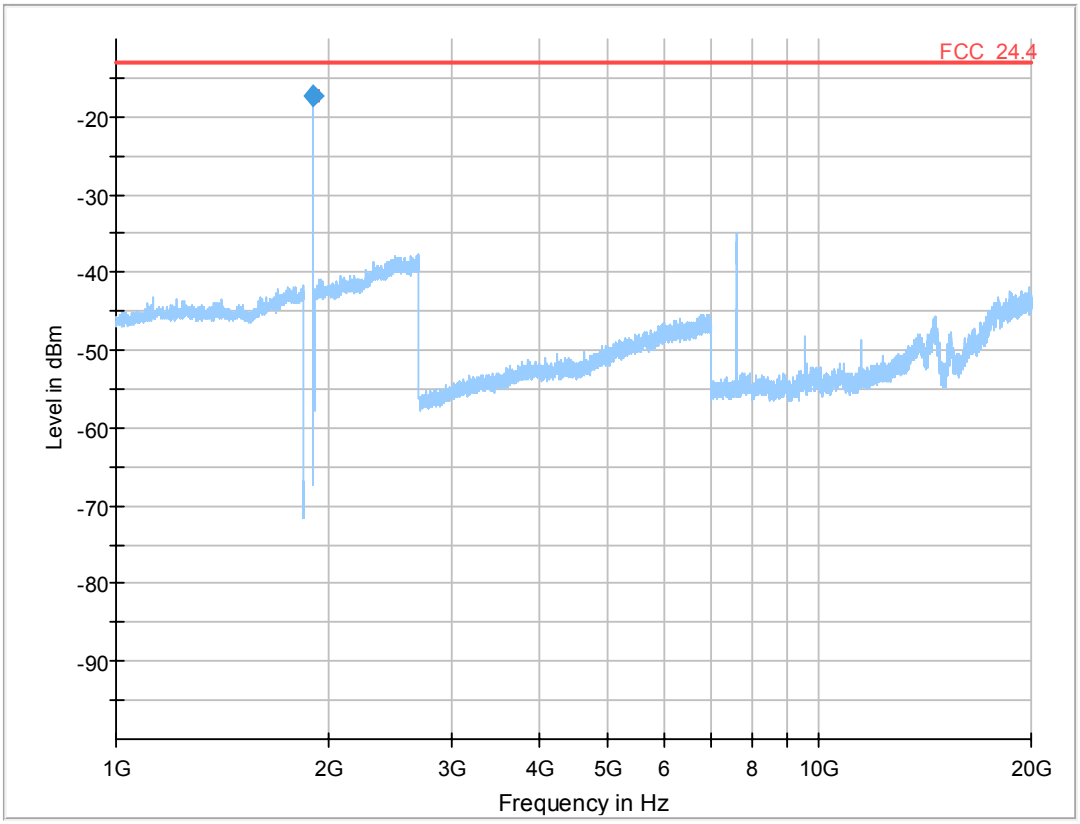
GSM 1900 - high channel



Critical_Freqs

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1910.024	-17.3	-13.00	4.30	2000.0	3.000	150.0	V	90.0	0.0	-64.9

Final_Result

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1910.024	-17.3	-13.00	4.30	2000.0	3.000	150.0	V	90.0	0.0	-64.9

GSM 1900 - high channel

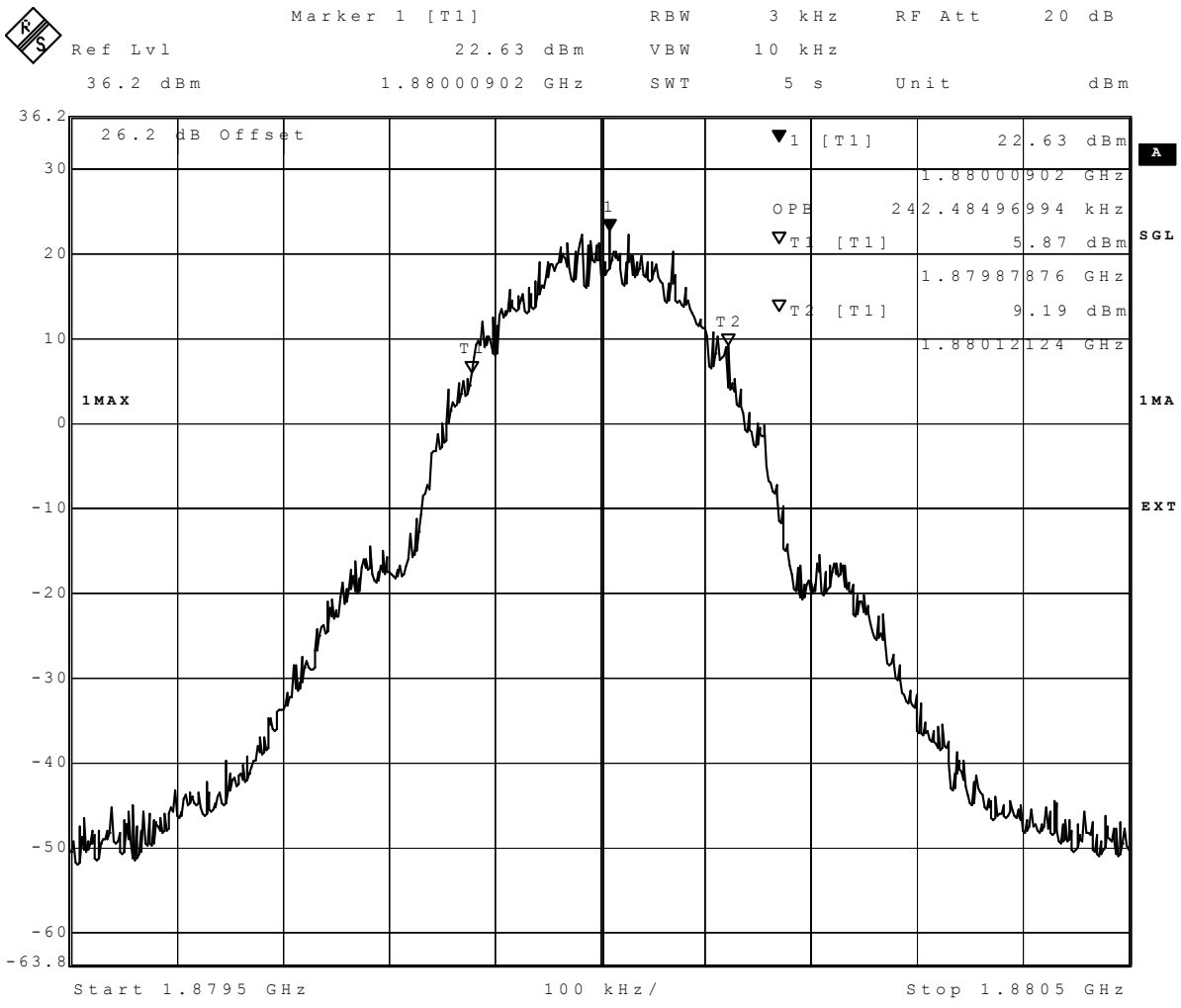
3.5.12 24.5 Emission and Occupied Bandwidth §2.1049, §24.238

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

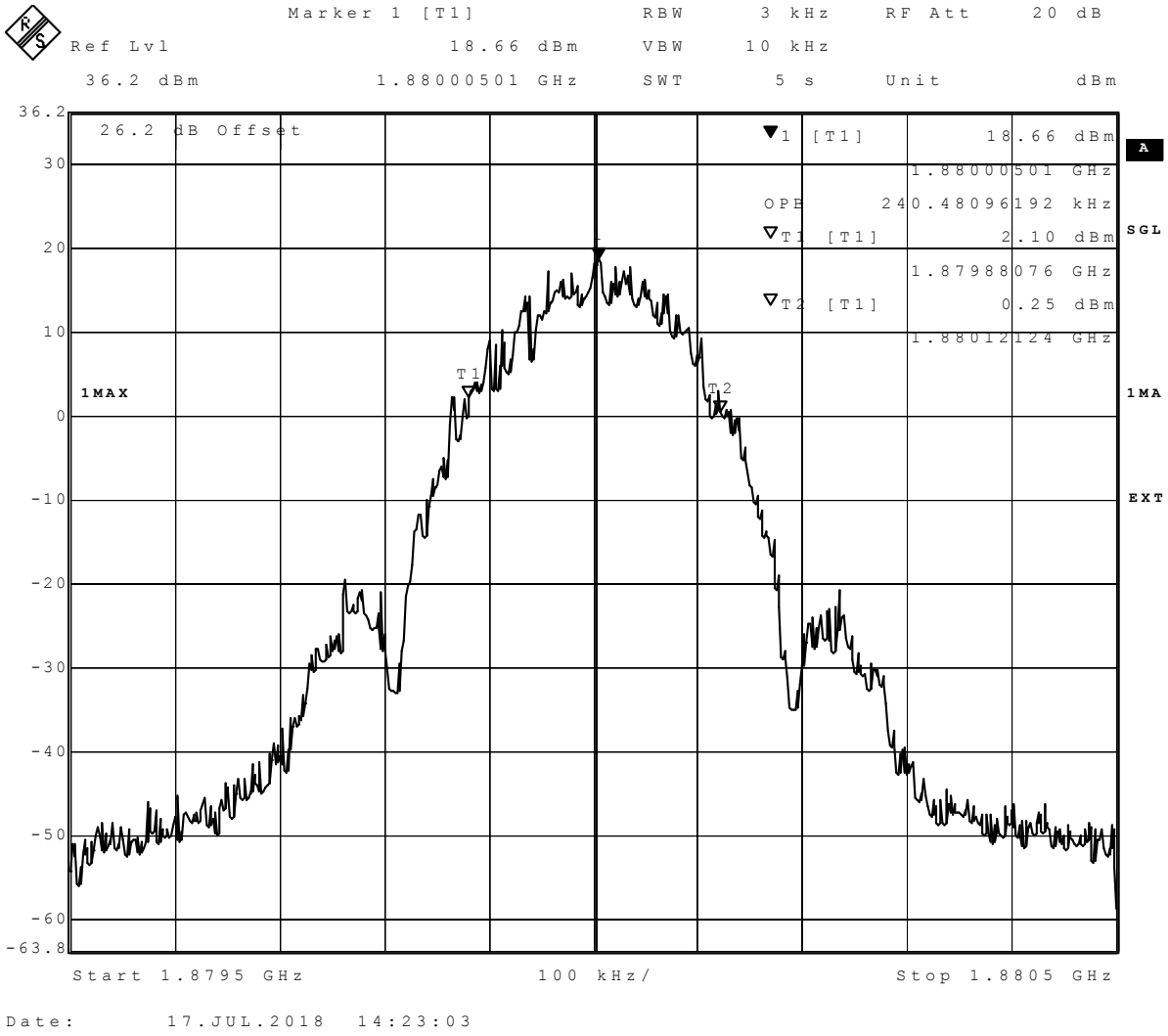
Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 17:23
Body:	FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 24

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	26 dB BW [kHz]	99 % BW [kHz]
GSM 1900	low	-	0.2	0.2	316.63	246.49
GSM 1900	mid	-	0.2	0.2	314.63	242.48
GSM 1900	high	-	0.2	0.2	318.64	244.49
GSM 1900 EDGE	low	-	0.2	0.2	300.6	246.49
GSM 1900 EDGE	mid	-	0.2	0.2	300.6	240.48
GSM 1900 EDGE	high	-	0.2	0.2	296.59	240.48



99% GSM1900 Channel=mid



99% EDGE1900 Channel=mid

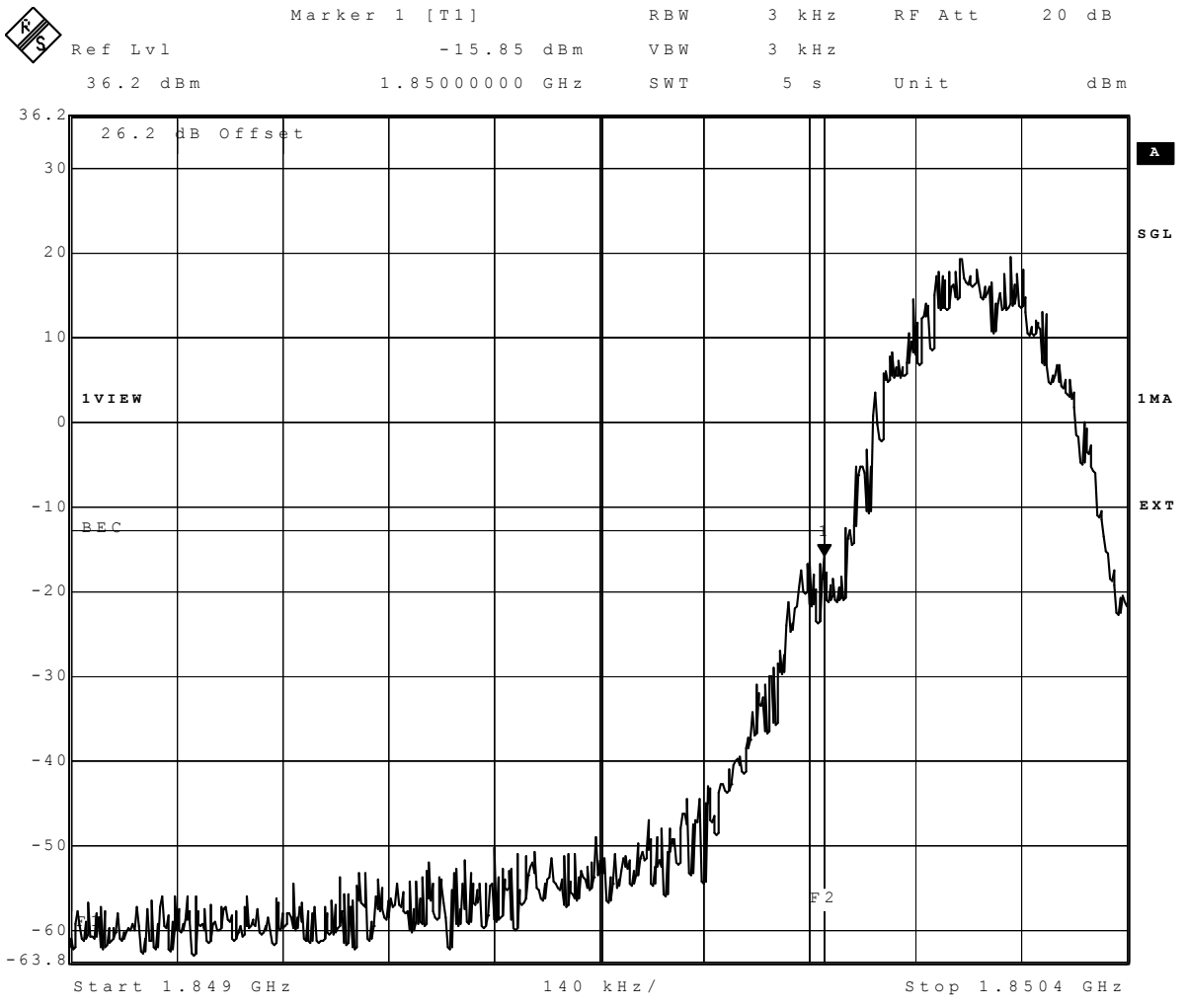
3.5.13 24.6 Band edge compliance §2.1053, §24.238

Test: 24.6; Band edge compliance summary §2.1053, §24.238

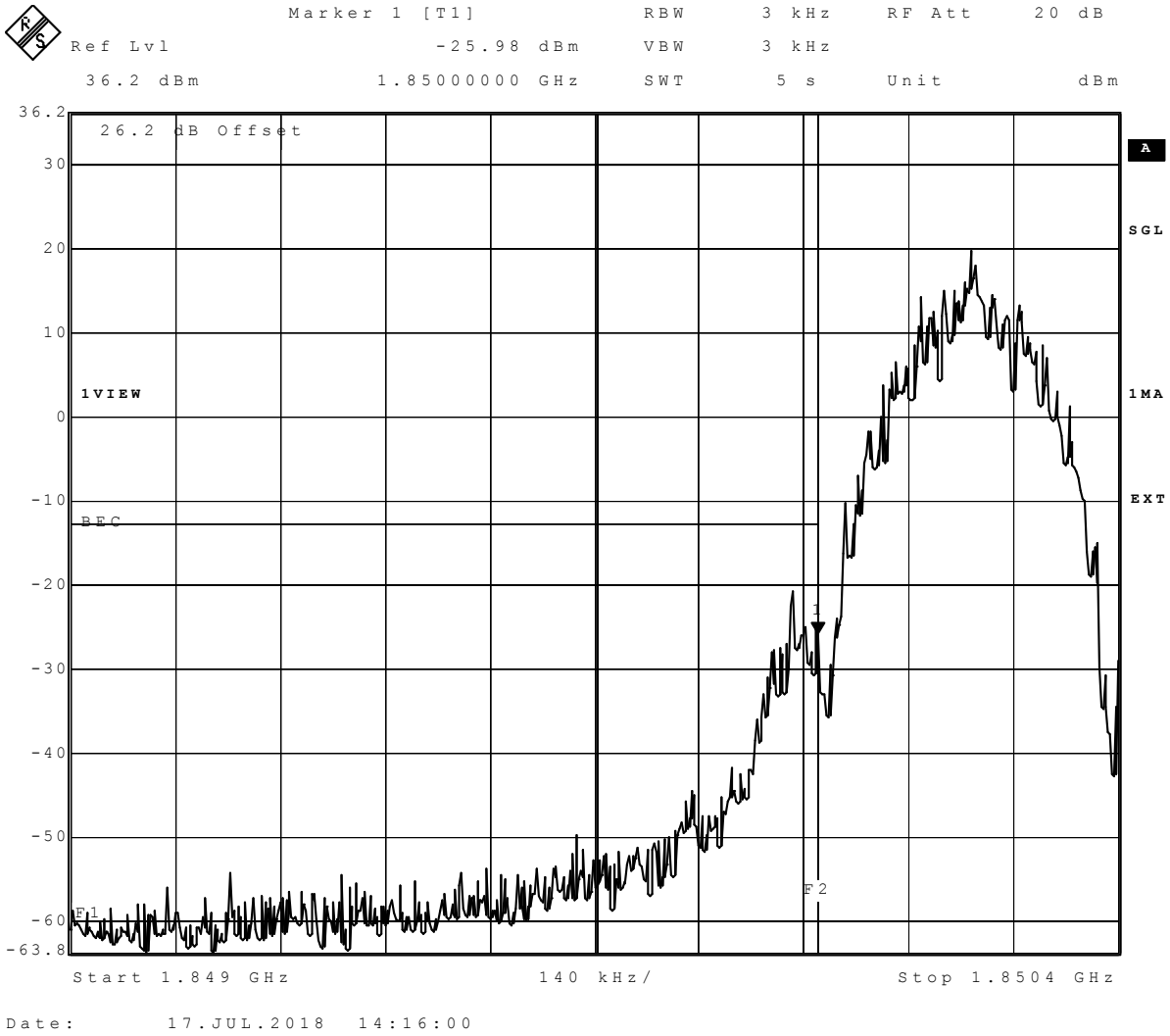
Result:	Passed
Setup No.:	S01_BY03
Date of Test:	2018/08/10 15:15
Body:	FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 24

Detailed Results:

Radio Technology	Channel	Nominal BW	Ressource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
GSM 1900	low	0.2	-	-15.85	-37.78	-29.26	-13	2.85
GSM 1900	high	0.2	-	-21.44	-41.3	-33.79	-13	8.44
GSM 1900 EDGE	low	0.2	-	-25.98	-47.32	-36.44	-13	23.44
GSM 1900 EDGE	high	0.2	-	-26.68	-49.82	-40.28	-13	27.28



GSM1900 Channel=low



EDGE1900 Channel=low

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_BX03

Date of Test: 2018/08/18 23:52

Body: FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES

Test Specification: FCC part 2 and 24

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak to Average Ratio [dB]
GSM 1900	low	-	0.2	0.13
GSM 1900	mid	-	0.2	0.02
GSM 1900	high	-	0.2	0
GSM 1900 EDGE	low	-	0.2	0.14
GSM 1900 EDGE	mid	-	0.2	0.21
GSM 1900 EDGE	high	-	0.2	0.29

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_BX03
Date of Test:	2018/08/10 20:27
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	RMS Cond. Power [dBm]	FCC EIRP Limit [W]	IC EIRP Limit [W]	Max. Antenna Gain [dBi]	Max. Antenna Gain IC [dBi]
eFDD 7 QPSK	low	1	5	23.6	1	1	6.4	6.4
eFDD 7 QPSK	low	12	5	22.2	1	1	7.8	7.8
eFDD 7 QPSK	low	25	5	22.2	1	1	7.8	7.8
eFDD 7 QPSK	mid	1	5	23.6	1	1	6.4	6.4
eFDD 7 QPSK	mid	12	5	22.18	1	1	7.82	7.82
eFDD 7 QPSK	mid	25	5	22.14	1	1	7.86	7.86
eFDD 7 QPSK	high	1	5	23.53	1	1	6.47	6.47
eFDD 7 QPSK	high	12	5	22.31	1	1	7.69	7.69
eFDD 7 QPSK	high	25	5	22.25	1	1	7.75	7.75
eFDD 7 16QAM	low	1	5	22.71	1	1	7.29	7.29
eFDD 7 16QAM	low	25	5	21.23	1	1	8.77	8.77
eFDD 7 16QAM	mid	1	5	22.42	1	1	7.58	7.58
eFDD 7 16QAM	mid	25	5	21.17	1	1	8.83	8.83
eFDD 7 16QAM	high	1	5	22.65	1	1	7.35	7.35
eFDD 7 16QAM	high	25	5	21.02	1	1	8.98	8.98
eFDD 7 QPSK	low	1	10	23.79	1	1	6.21	6.21
eFDD 7 QPSK	low	50	10	22.56	1	1	7.44	7.44
eFDD 7 QPSK	mid	1	10	23.65	1	1	6.35	6.35
eFDD 7 QPSK	mid	50	10	22.51	1	1	7.49	7.49
eFDD 7 QPSK	high	1	10	23.72	1	1	6.28	6.28
eFDD 7 QPSK	high	50	10	22.61	1	1	7.39	7.39
eFDD 7 16QAM	low	1	10	22.86	1	1	7.14	7.14
eFDD 7 16QAM	low	50	10	21.49	1	1	8.51	8.51
eFDD 7 16QAM	mid	1	10	22.46	1	1	7.54	7.54
eFDD 7 16QAM	mid	50	10	21.39	1	1	8.61	8.61
eFDD 7 16QAM	high	1	10	22.57	1	1	7.43	7.43
eFDD 7 16QAM	high	50	10	21.48	1	1	8.52	8.52
eFDD 7 QPSK	low	1	15	23.71	1	1	6.29	6.29
eFDD 7 QPSK	low	36	15	22.67	1	1	7.33	7.33
eFDD 7 QPSK	low	75	15	22.66	1	1	7.34	7.34
eFDD 7 QPSK	mid	1	15	23.69	1	1	6.31	6.31
eFDD 7 QPSK	mid	36	15	22.62	1	1	7.38	7.38
eFDD 7 QPSK	mid	75	15	22.6	1	1	7.4	7.4
eFDD 7 QPSK	high	1	15	23.74	1	1	6.26	6.26
eFDD 7 QPSK	high	36	15	22.63	1	1	7.37	7.37
eFDD 7 QPSK	high	75	15	22.68	1	1	7.32	7.32
eFDD 7 16QAM	low	1	15	22.67	1	1	7.33	7.33
eFDD 7 16QAM	low	75	15	21.61	1	1	8.39	8.39
eFDD 7 16QAM	mid	1	15	22.78	1	1	7.22	7.22
eFDD 7 16QAM	mid	75	15	21.57	1	1	8.43	8.43
eFDD 7 16QAM	high	1	15	22.73	1	1	7.27	7.27
eFDD 7 16QAM	high	75	15	21.67	1	1	8.33	8.33
eFDD 7 QPSK	low	1	20	23.45	1	1	6.55	6.55
eFDD 7 QPSK	low	100	20	23.41	1	1	6.59	6.59
eFDD 7 QPSK	mid	1	20	23.11	1	1	6.89	6.89
eFDD 7 QPSK	mid	100	20	22.56	1	1	7.44	7.44
eFDD 7 QPSK	high	1	20	23.53	1	1	6.47	6.47
eFDD 7 QPSK	high	100	20	22.53	1	1	7.47	7.47
eFDD 7 16QAM	low	1	20	22.45	1	1	7.55	7.55
eFDD 7 16QAM	low	100	20	21.51	1	1	8.49	8.49
eFDD 7 16QAM	mid	1	20	22.44	1	1	7.56	7.56
eFDD 7 16QAM	mid	100	20	21.59	1	1	8.41	8.41
eFDD 7 16QAM	high	1	20	22.46	1	1	7.54	7.54
eFDD 7 16QAM	high	100	20	21.61	1	1	8.39	8.39

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	RMS Cond. Power [dBm]	FCC EIRP Limit [W]	IC EIRP Limit [W]	Max. Antenna Gain [dBi]	Max. Antenna Gain IC [dBi]
eFDD 7 64QAM	low	1	5	21.74	1	1	8.26	8.26
eFDD 7 64QAM	low	25	5	20.19	1	1	9.81	9.81
eFDD 7 64QAM	mid	1	5	21.41	1	1	8.59	8.59
eFDD 7 64QAM	mid	25	5	20.1	1	1	9.9	9.9
eFDD 7 64QAM	high	1	5	21.61	1	1	8.39	8.39
eFDD 7 64QAM	high	25	5	20.19	1	1	9.81	9.81
eFDD 7 64QAM	low	1	10	21.44	1	1	8.56	8.56
eFDD 7 64QAM	low	50	10	20.41	1	1	9.59	9.59
eFDD 7 64QAM	mid	1	10	21.61	1	1	8.39	8.39
eFDD 7 64QAM	mid	50	10	20.31	1	1	9.69	9.69
eFDD 7 64QAM	high	1	10	21.63	1	1	8.37	8.37
eFDD 7 64QAM	high	50	10	20.39	1	1	9.61	9.61
eFDD 7 64QAM	low	1	15	21.47	1	1	8.53	8.53
eFDD 7 64QAM	low	75	15	20.42	1	1	9.58	9.58
eFDD 7 64QAM	mid	1	15	21.61	1	1	8.39	8.39
eFDD 7 64QAM	mid	75	15	20.37	1	1	9.63	9.63
eFDD 7 64QAM	high	1	15	21.66	1	1	8.34	8.34
eFDD 7 64QAM	high	75	15	20.47	1	1	9.53	9.53
eFDD 7 64QAM	low	1	20	21.42	1	1	8.58	8.58
eFDD 7 64QAM	low	100	20	20.48	1	1	9.52	9.52
eFDD 7 64QAM	mid	1	20	21.42	1	1	8.58	8.58
eFDD 7 64QAM	mid	100	20	20.35	1	1	9.65	9.65
eFDD 7 64QAM	high	1	20	21.34	1	1	8.66	8.66
eFDD 7 64QAM	high	100	20	20.31	1	1	9.69	9.69
eFDD 7 64QAM	low	1	20	21.42	1	1	8.58	8.58
eFDD 7 64QAM	low	100	20	20.48	1	1	9.52	9.52
eFDD 7 64QAM	mid	1	20	21.42	1	1	8.58	8.58
eFDD 7 64QAM	mid	100	20	20.35	1	1	9.65	9.65
eFDD 7 64QAM	high	1	20	21.34	1	1	8.66	8.66
eFDD 7 64QAM	high	100	20	20.31	1	1	9.69	9.69

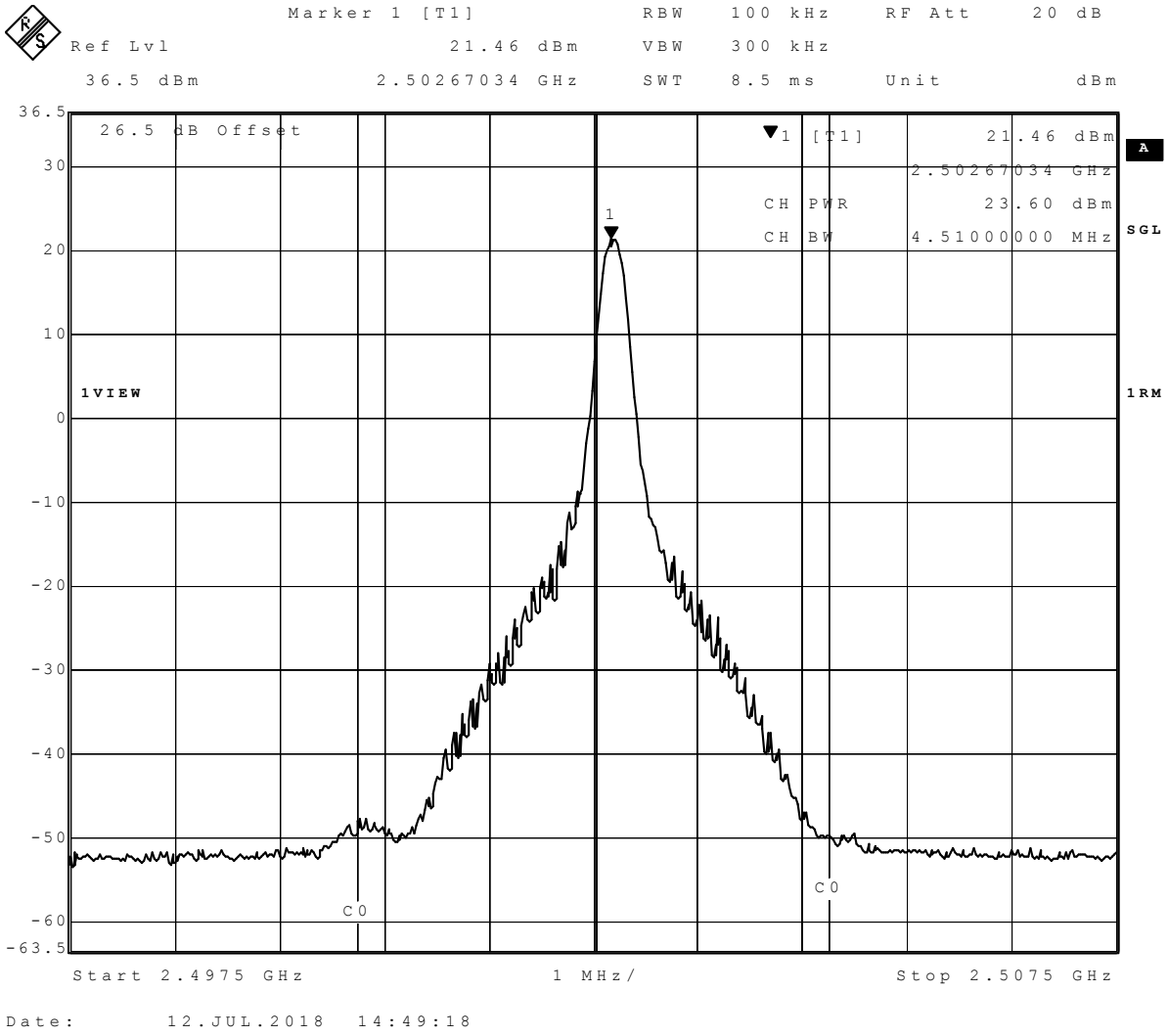
Detailed Results:

Carrier Aggregation: eFDD7

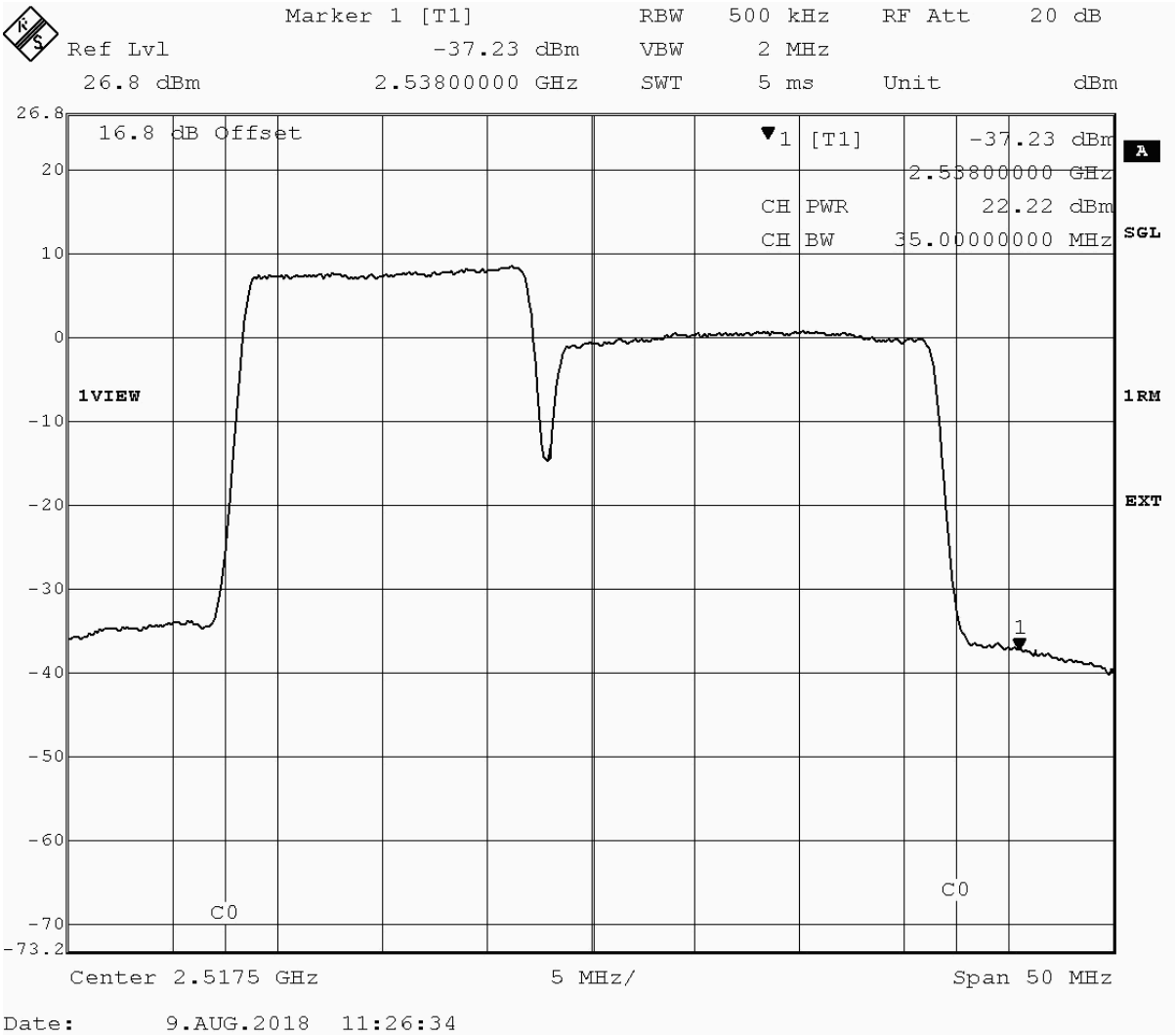
Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	Modulation	PCC RB	SCC1 RB	RMS Cond. Power [dBm]
15 MHz / 15 MHz	2507.5	2522.5	QPSK	75	75	21.67
	2507.5	2522.5	QPSK	1	1	19.25
	2507.5	2522.5	16QAM	75	75	20.7
	2507.5	2522.5	16QAM	1	1	19.15
	2507.5	2522.5	64QAM	75	75	19.91
	2507.5	2522.5	64QAM	1	1	19.68
	2527.5	2542.5	QPSK	75	75	21.76
	2527.5	2542.5	QPSK	1	1	19.26
	2527.5	2542.5	16QAM	75	75	20.74
	2527.5	2542.5	16QAM	1	1	19.17
	2527.5	2542.5	64QAM	75	75	21.05
	2527.5	2542.5	64QAM	1	1	19.35
	2547.5	2562.5	QPSK	75	75	21.7
	2547.5	2562.5	QPSK	1	1	19.3
	2547.5	2562.5	16QAM	75	75	20.73
	2547.5	2562.5	16QAM	1	1	19.12
	2547.5	2562.5	64QAM	75	75	21.18
	2547.5	2562.5	64QAM	1	1	19.42
10 MHz / 20 MHz	2505.5	2519.9	QPSK	50	100	22.27
	2505.5	2519.9	QPSK	1	1	19.77
	2505.5	2519.9	16QAM	50	100	21.19
	2505.5	2519.9	16QAM	1	1	19.73
	2505.5	2519.9	64QAM	50	100	21.23
	2505.5	2519.9	64QAM	1	1	19.53
	2525.6	2540	QPSK	50	100	22.14
	2525.6	2540	QPSK	12	18	20.45
	2525.6	2540	QPSK	1	1	19.72
	2525.6	2540	16QAM	50	100	21.25
	2525.6	2540	16QAM	12	18	20.44
	2525.6	2540	16QAM	1	1	19.44
	2525.6	2540	64QAM	50	100	21.08
	2545.6	2560	64QAM	12	18	20.43
	2525.6	2540	64QAM	1	1	19.47
	2545.6	2560	QPSK	50	100	22.24
	2545.6	2560	QPSK	1	1	19.94
	2545.6	2560	16QAM	50	100	21.28
	2545.6	2560	16QAM	1	1	19.88
	2545.6	2560	64QAM	50	100	21.27
	2545.6	2560	64QAM	1	1	19.61
15 MHz / 20 MHz	2507.8	2524.9	QPSK	75	100	22.22
	2507.8	2524.9	QPSK	1	1	19.79
	2507.8	2524.9	16QAM	75	100	21.26
	2507.8	2524.9	16QAM	1	1	19.78
	2507.8	2524.9	64QAM	75	100	21.24
	2507.8	2524.9	64QAM	1	1	19.9
	2525.3	2542.4	QPSK	75	100	22.17
	2525.3	2542.4	QPSK	1	1	19.79
	2525.3	2542.4	16QAM	75	100	21.2
	2525.3	2542.4	16QAM	1	1	19.6
	2525.3	2542.4	64QAM	75	100	21.02
	2525.3	2542.4	64QAM	1	1	19.48
	2542.9	2560	QPSK	75	100	22.31
	2542.9	2560	QPSK	1	1	19.84
	2542.9	2560	16QAM	75	100	21.3
	2542.9	2560	16QAM	1	1	19.5
	2542.9	2560	64QAM	75	100	21.3
	2542.9	2560	64QAM	1	1	19.66

Carrier Aggregation: eFDD7

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	Modulation	PCC RB	SCC1 RB	RMS Cond. Power [dBm]
20 MHz / 10 MHz	2510	2524.4	QPSK	100	50	22.06
	2510	2524.4	QPSK	1	1	19.56
	2510	2524.4	16QAM	100	50	21.05
	2510	2524.4	16QAM	1	1	19.62
	2510	2524.4	64QAM	100	50	21.14
	2510	2524.4	64QAM	1	1	19.48
	2530.1	2544.5	QPSK	100	50	22.15
	2530.1	2544.5	QPSK	1	1	19.64
	2530.1	2544.5	16QAM	100	50	21.12
	2530.1	2544.5	16QAM	1	1	19.6
	2530.1	2544.5	64QAM	100	50	21.21
	2530.1	2544.5	64QAM	1	1	19.31
	2550.1	2564.5	QPSK	100	50	22.1
	2550.1	2564.5	QPSK	1	1	19.67
	2550.1	2564.5	16QAM	100	50	21.15
	2550.1	2564.5	16QAM	1	1	19.55
	2550.1	2564.5	64QAM	100	50	21.11
	2550.1	2564.5	64QAM	1	1	19.4
20 MHz / 15 MHz	2510	2527.1	QPSK	100	75	22.17
	2510	2527.1	QPSK	1	1	19.6
	2510	2527.1	16QAM	100	75	21.1
	2510	2527.1	16QAM	1	1	19.55
	2510	2527.1	64QAM	100	75	21.21
	2510	2527.1	64QAM	1	1	19.39
	2527.6	2544.7	QPSK	100	75	22.17
	2527.6	2544.7	QPSK	1	1	19.69
	2527.6	2544.7	16QAM	100	75	21.13
	2527.6	2544.7	16QAM	1	1	19.64
	2527.6	2544.7	64QAM	100	75	21.05
	2527.6	2544.7	64QAM	1	1	19.35
	2545.1	2562.2	QPSK	100	75	22.22
	2545.1	2562.2	QPSK	1	1	19.66
	2545.1	2562.2	16QAM	100	75	21.19
	2545.1	2562.2	16QAM	1	1	19.71
	2545.1	2562.2	64QAM	100	75	21.21
	2545.1	2562.2	64QAM	1	1	19.56
20 MHz / 20 MHz	2510	2529.8	QPSK	100	100	22.22
	2510	2529.8	QPSK	1	1	19.76
	2510	2529.8	16QAM	100	100	21.44
	2510	2529.8	16QAM	1	1	19.49
	2510	2529.8	64QAM	100	100	21.14
	2510	2529.8	64QAM	1	1	19.57
	2525.1	2544.9	QPSK	100	100	22.23
	2525.1	2544.9	QPSK	1	1	19.81
	2525.1	2544.9	16QAM	100	100	21.31
	2525.1	2544.9	16QAM	1	1	19.77
	2525.1	2544.9	64QAM	100	100	21.008
	2525.1	2544.9	64QAM	1	1	19.54
	2540.2	2560	QPSK	100	100	22.39
	2540.2	2560	QPSK	1	1	19.93
	2540.2	2560	16QAM	100	100	21.22
	2540.2	2560	16QAM	1	1	19.65
	2540.2	2560	64QAM	100	100	21.11
	2540.2	2560	64QAM	1	1	19.52



eFDD7 QPSK 5MHz RB1 Channel=low



eFDD7 QPSK 15MHz/20MHz Channel=low

3.5.16 27.2 Frequency stability §2.1055, §27.54

Test: 27.2; Frequency stability Summary §2.1055, §27.54

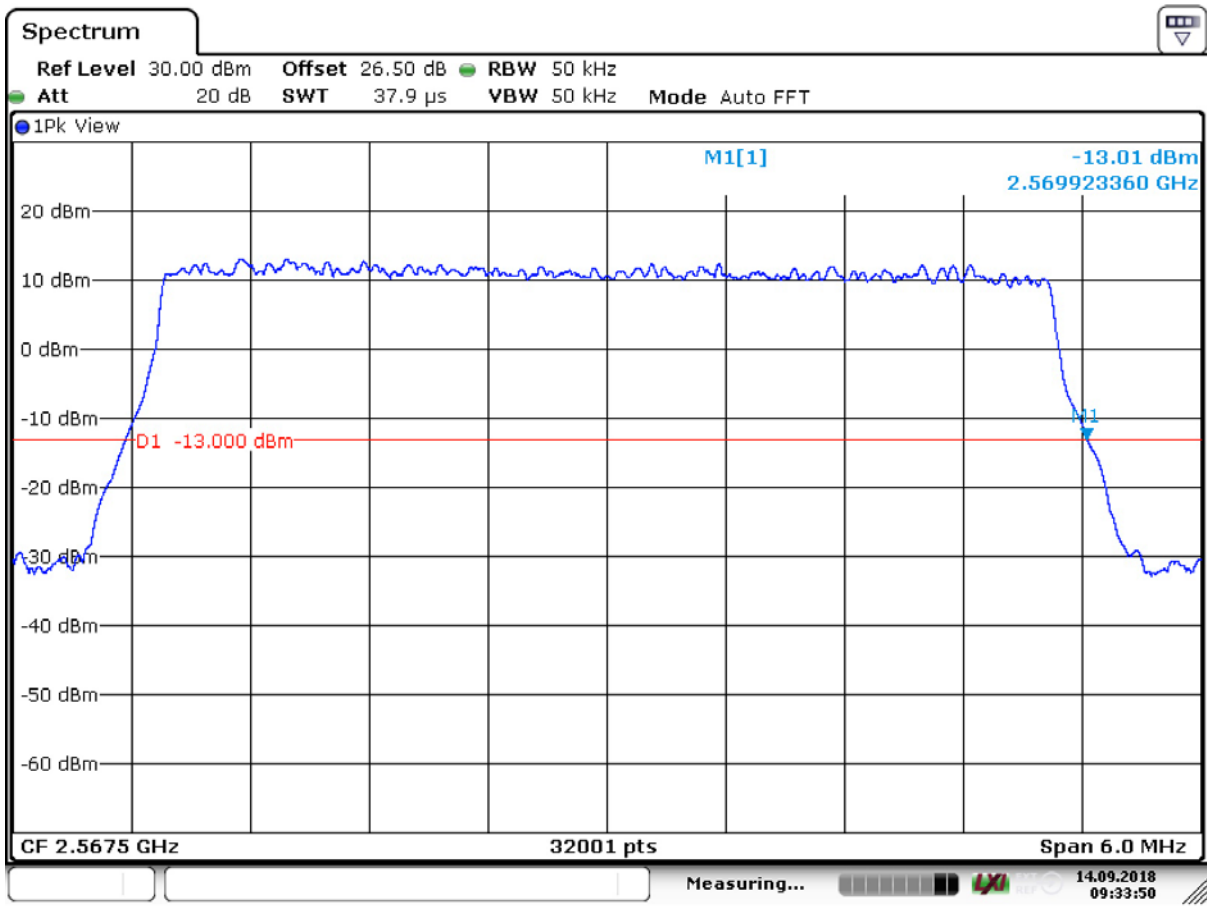
Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/07/04 14:38
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

Detailed Results:

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	6337.5	1.3	12.3	passed
-30	5			1.6	13.4	passed
-30	10			0.4	10.6	passed
-20	0	normal	6337.5	0.5	9.7	passed
-20	5			-1.3	8.5	passed
-20	10			-1.2	9.1	passed
-10	0	normal	6337.5	0.6	-3.6	passed
-10	5			-1.3	-4.9	passed
-10	10			-1.4	8.5	passed
0	0	normal	6337.5	2.3	6.4	passed
0	5			1.6	-7.6	passed
0	10			1.4	-7.1	passed
10	0	normal	6337.5	1	5.6	passed
10	5			1.6	10.9	passed
10	10			0.4	10.4	passed
20	0	low	6337.5	0.9	10.8	passed
20	5			1.3	11.2	passed
20	10			0.6	9.6	passed
20	0	normal	6337.5	1.7	10.3	passed
20	5			2.3	10.4	passed
20	10			3.1	-15.8	passed
20	0	high	6337.5	2.1	10.3	passed
20	5			3.4	-11.6	passed
20	10			1.5	-11.4	passed
30	0	normal	6337.5	1.6	12.5	passed
30	5			2.4	12.6	passed
30	10			1.7	11.6	passed
40	0	normal	6337.5	2.5	10.5	passed
40	5			2.5	9.4	passed
40	10			3.6	7.6	passed
50	0	normal	6337.5	-1.5	-13.4	passed
50	5			-2.1	-15.2	passed
50	10			-2.3	-10.1	passed

eFDD7

LTE eFDD7						
(MHz) /	f_L (MHz)	f_H (MHz)	Frequency	Resulting Freq. (MHz)	Limit (MHz)	Result
5 / 25	2500.03801	-	-15.8	2500.04	2500	Passed
	-	2569.92336	-15.8	2569.92	2570	Passed



Date: 14.SEP.2018 09:33:50

eFDD7 channel= high

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

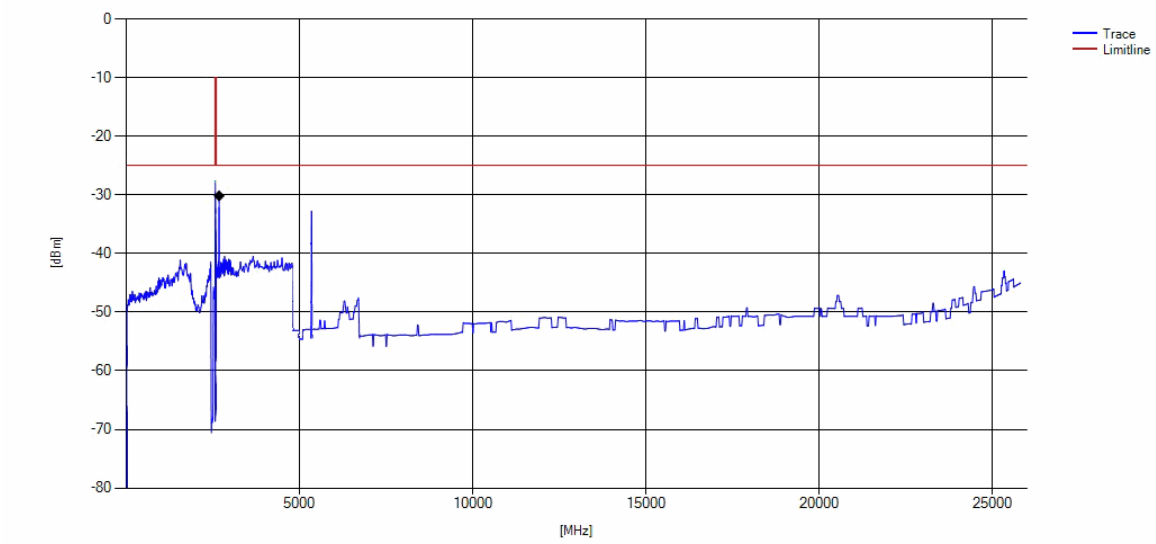
Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 22:56
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

Detailed Results:

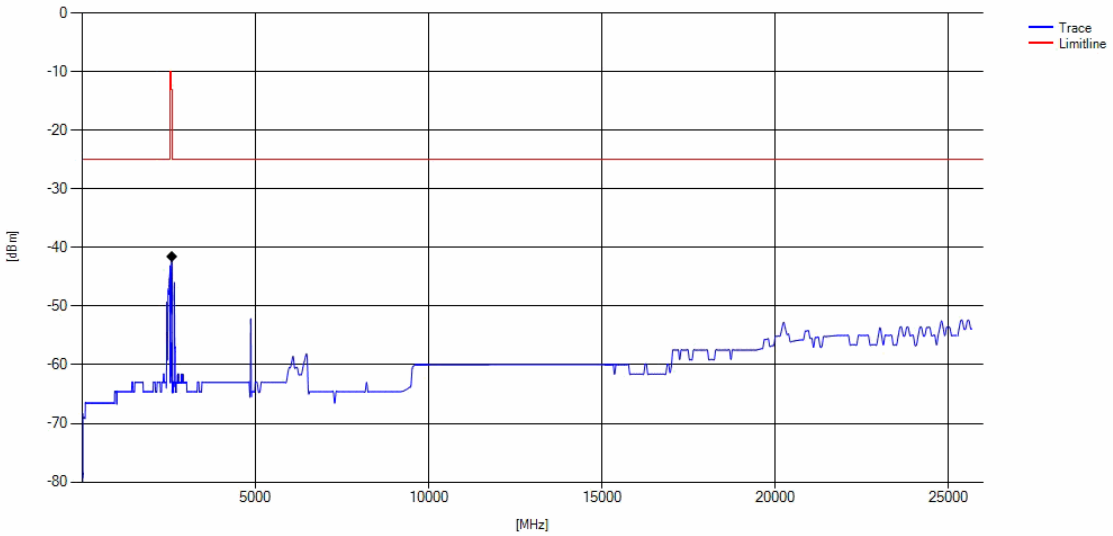
Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
eFDD7	low	rms	maxhold	50	2500	-27.43	-25	2.43
eFDD7	mid	rms	maxhold	-	-	-	-13	>20
eFDD7	high	rms	maxhold	1000	2687.2	-30.17	-25	5.17
eFDD7	high	rms	maxhold	1000	5135.3	-33.99	-25	8.99

Carrier Aggregation

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
eFDD7	low + low	rms	maxhold	-	-	-	-13	>20
eFDD7	mid + mid	rms	maxhold	-	-	-	-13	>20
eFDD7	high + high	rms	maxhold	-	-	-	-13	>20



eFDD7 Channel=high
REMARK: compliant to FCC27.53c)4) and RSS-130 4.7.1



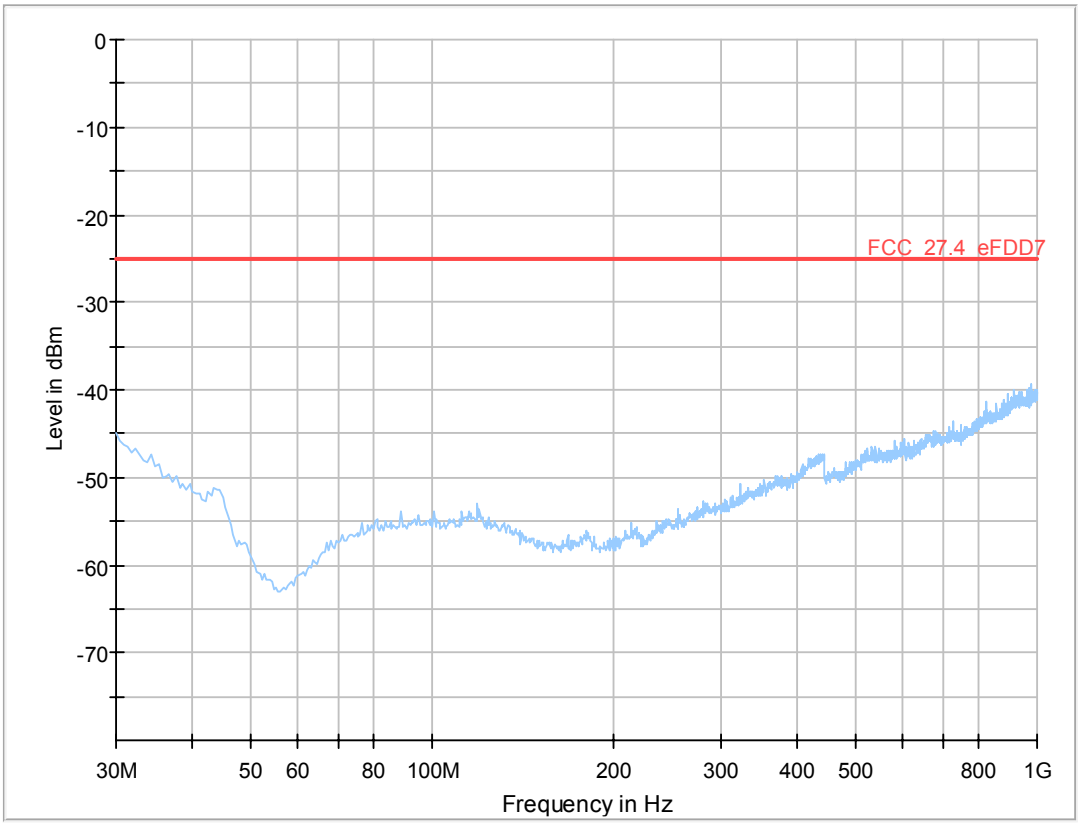
eFDD7 10MHz/20MHz Channel=high
REMARK: compliant to FCC27.53c)4) and RSS-130 4.7.1

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

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

Result:	Passed 27.4; Field strength of spurious radiation Summary §2.1053, §27.53 Worst Case Plot eFDD7
Setup No.:	S01_BY03
Date of Test:	2018/08/23 15:43
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

Detailed Results:



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
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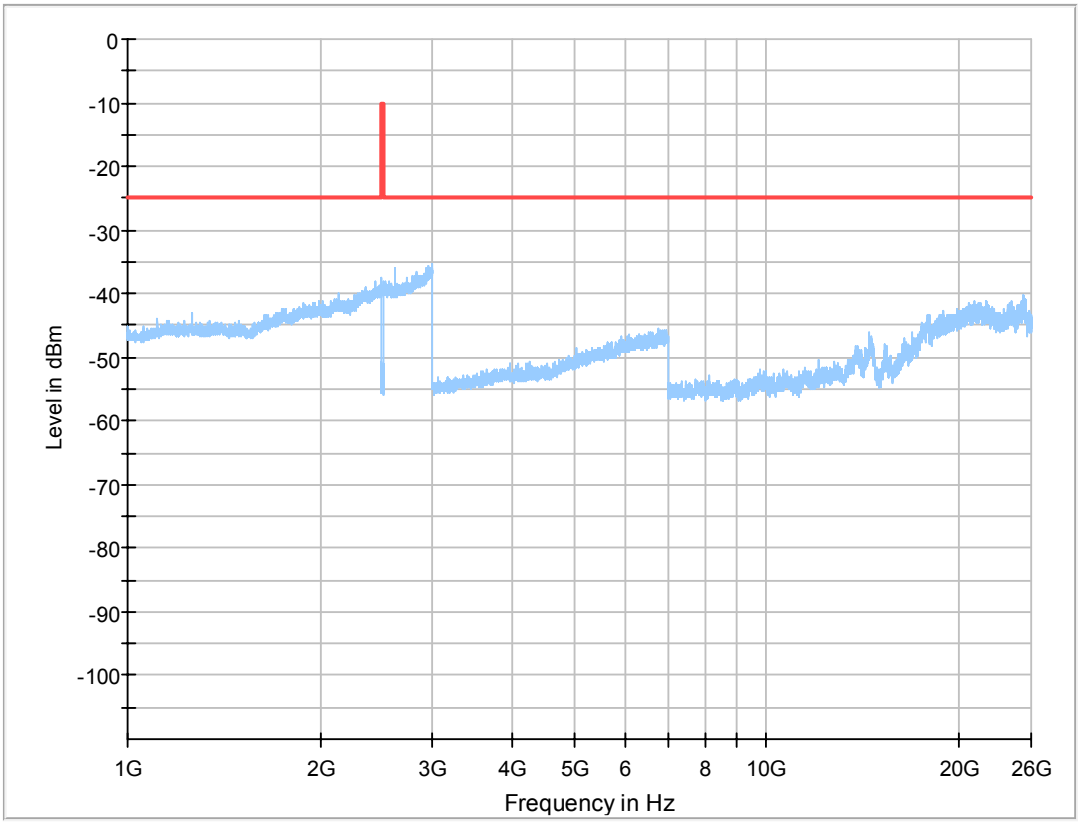
eFDD7 Channel=mid



Critical_Freqs

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

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

eFDD7 Channel=mid
REMARK: compliant to FCC27.53c)4) and RSS-130 4.7.1

3.5.19 27.5 Emission and Occupied Bandwidth §2.1049

Test: 27.5; Emission and Occupied Bandwidth Summary §2.1049

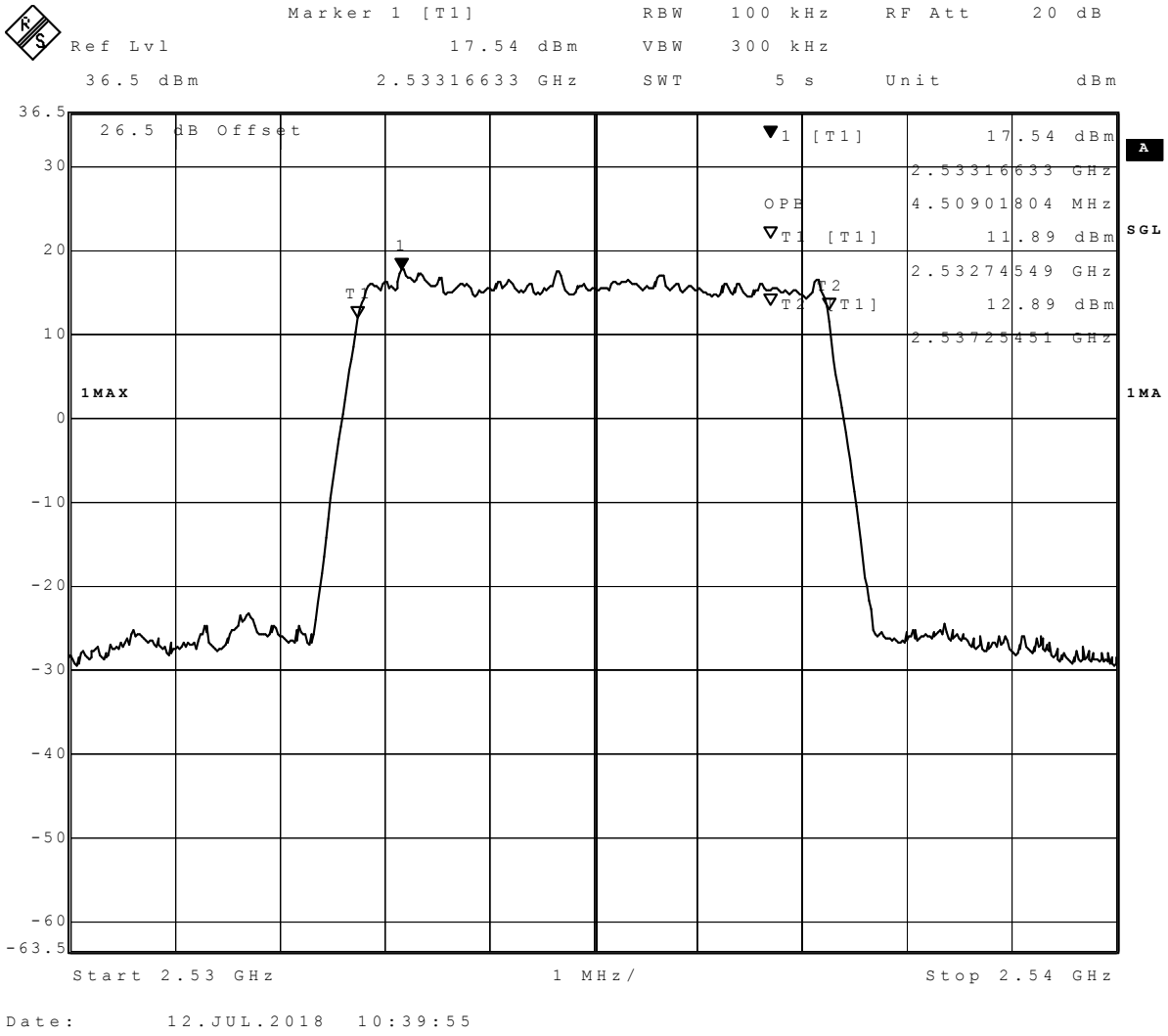
Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 18:02
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

Detailed Results:

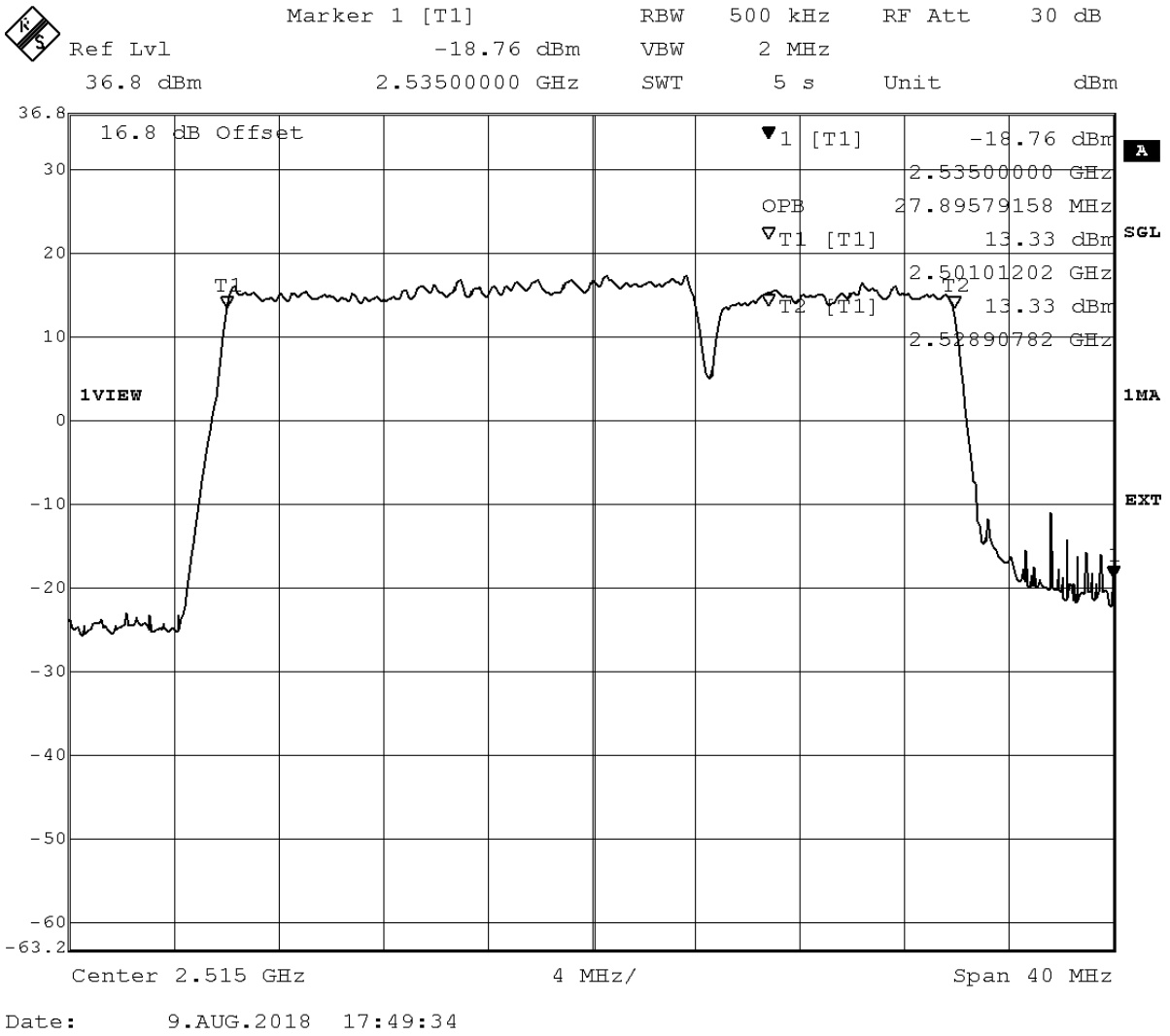
Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	99 % BW [kHz]
eFDD 7 QPSK	low	25	5	5	4509.02
eFDD 7 QPSK	mid	25	5	5	4509.02
eFDD 7 QPSK	high	25	5	5	4529.06
eFDD 7 16QAM	low	25	5	5	4549.1
eFDD 7 16QAM	mid	25	5	5	4529.06
eFDD 7 16QAM	high	25	5	5	4529.06
eFDD 7 QPSK	low	50	10	10	9058.12
eFDD 7 QPSK	mid	50	10	10	8977.96
eFDD 7 QPSK	high	50	10	10	8977.96
eFDD 7 16QAM	low	50	10	10	9058.12
eFDD 7 16QAM	mid	50	10	10	9018.04
eFDD 7 16QAM	high	50	10	10	8977.96
eFDD 7 QPSK	low	75	15	15	13587.17
eFDD 7 QPSK	mid	75	15	15	13527.05
eFDD 7 QPSK	high	75	15	15	13527.05
eFDD 7 16QAM	low	75	15	15	13587.17
eFDD 7 16QAM	mid	75	15	15	13527.05
eFDD 7 16QAM	high	75	15	15	13466.93
eFDD 7 QPSK	low	100	20	20	18116.23
eFDD 7 QPSK	mid	100	20	20	18116.23
eFDD 7 QPSK	high	100	20	20	18036.07
eFDD 7 16QAM	low	100	20	20	18196.39
eFDD 7 16QAM	mid	100	20	20	18036.07
eFDD 7 16QAM	high	100	20	20	18036.07

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	99 % BW [kHz]
eFDD 7 64QAM	low	25	5	5	4509.02
eFDD 7 64QAM	mid	25	5	5	4529.06
eFDD 7 64QAM	high	25	5	5	4509.02
eFDD 7 64QAM	low	50	10	10	9018.04
eFDD 7 64QAM	mid	50	10	10	9018.04
eFDD 7 64QAM	high	50	10	10	9018.04
eFDD 7 64QAM	low	75	15	15	13527.05
eFDD 7 64QAM	mid	75	15	15	13527.05
eFDD 7 64QAM	high	75	15	15	13466.93
eFDD 7 64QAM	low	100	20	20	18116.23
eFDD 7 64QAM	mid	100	20	20	18036.07
eFDD 7 64QAM	high	100	20	20	18036.07

Carrier Aggregation: eFDD7						
Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	Modulation	PCC RB	SCC1 RB	99% BW [kHz]
15 MHz / 15 MHz	2507.5	2522.5	QPSK	75	75	28.46
	2507.5	2522.5	16QAM	75	75	28.46
	2507.5	2522.5	64QAM	75	75	28.36
	2527.5	2542.5	QPSK	75	75	28.46
	2527.5	2542.5	16QAM	75	75	28.36
	2527.5	2542.5	64QAM	75	75	28.26
	2547.5	2562.5	QPSK	75	75	28.36
	2547.5	2562.5	16QAM	75	75	28.36
	2547.5	2562.5	64QAM	75	75	28.26
10 MHz / 20 MHz	2505.5	2519.9	QPSK	50	100	27.96
	2505.5	2519.9	16QAM	50	100	27.86
	2505.5	2519.9	64QAM	50	100	27.86
	2525.6	2540	QPSK	50	100	27.76
	2525.6	2540	16QAM	50	100	27.76
	2525.6	2540	64QAM	50	100	27.66
	2545.6	2560	QPSK	50	100	27.76
	2545.6	2560	16QAM	50	100	27.76
	2545.6	2560	64QAM	50	100	27.76
15 MHz / 20 MHz	2507.8	2524.9	QPSK	75	100	32.67
	2507.8	2524.9	16QAM	75	100	32.67
	2507.8	2524.9	64QAM	75	100	32.67
	2525.3	2542.4	QPSK	75	100	32.57
	2525.3	2542.4	16QAM	75	100	32.57
	2525.3	2542.4	64QAM	75	100	32.46
	2542.9	2560	QPSK	75	100	32.67
	2542.9	2560	16QAM	75	100	32.67
	2542.9	2560	64QAM	75	100	32.57
20 MHz / 10 MHz	2510	2524.4	QPSK	100	50	27.82
	2510	2524.4	16QAM	100	50	27.89
	2510	2524.4	64QAM	100	50	27.86
	2530.1	2544.5	QPSK	100	50	27.89
	2530.1	2544.5	16QAM	100	50	27.82
	2530.1	2544.5	64QAM	100	50	27.66
	2550.1	2564.5	QPSK	100	50	27.82
	2550.1	2564.5	16QAM	100	50	27.74
	2550.1	2564.5	64QAM	100	50	27.76
20 MHz / 15 MHz	2510	2527.1	QPSK	100	75	32.71
	2510	2527.1	16QAM	100	75	32.71
	2510	2527.1	64QAM	100	75	32.77
	2527.6	2544.7	QPSK	100	75	32.59
	2527.6	2544.7	16QAM	100	75	32.59
	2527.6	2544.7	64QAM	100	75	32.46
	2545.1	2562.2	QPSK	100	75	32.71
	2545.1	2562.2	16QAM	100	75	32.59
	2545.1	2562.2	64QAM	100	75	32.57
20 MHz / 20 MHz	2510	2529.8	QPSK	100	100	37.52
	2510	2529.8	16QAM	100	100	37.52
	2510	2529.8	64QAM	100	100	37.39
	2525.1	2544.9	QPSK	100	100	37.52
	2525.1	2544.9	16QAM	100	100	37.52
	2525.1	2544.9	64QAM	100	100	37.39
	2540.2	2560	QPSK	100	100	37.39
	2540.2	2560	16QAM	100	100	37.52
	2540.2	2560	64QAM	100	100	37.52



99% eFDD7 QPSK 5MHz Channel=mid



99% CA eFDD7 16QAM 20MHz/10MHz Channel=low

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_BX03
Date of Test:	2018/08/10 16:41
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

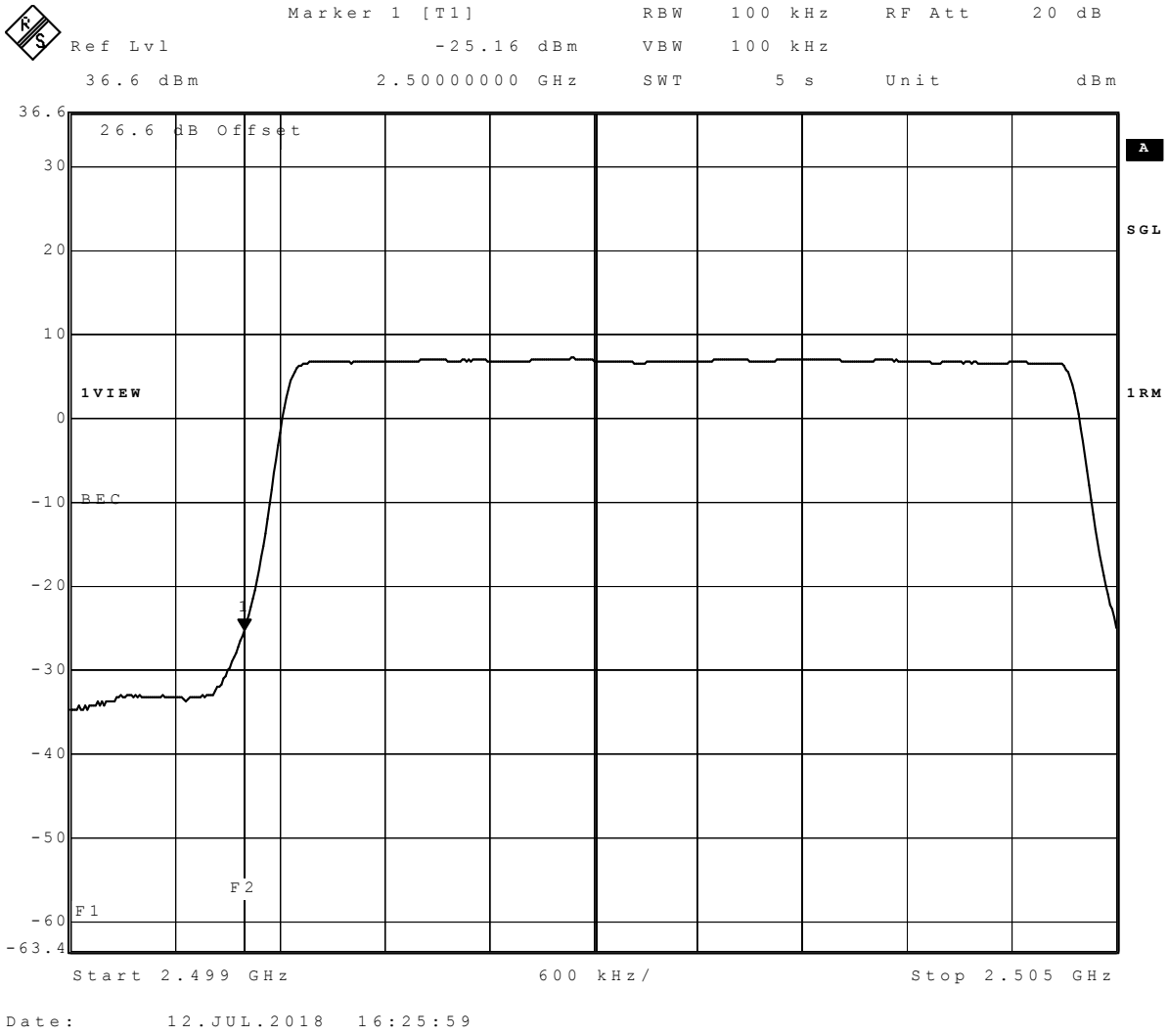
Detailed Results:

Radio Technology	Channel	Nominal BW	Ressource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
eFDD 7 QPSK	low	5	25	-10.64	-27.14	-25.16	-25	0.16
eFDD 7 QPSK	high	5	25	-10.05	-29.14	-26.71	-25	1.71
eFDD 7 16QAM	low	5	25	-12.33	-29.14	-26.5	-25	1.5
eFDD 7 16QAM	high	5	25	-10.42	-29.72	-26.5	-25	1.5
eFDD 7 QPSK	low	10	50	-12.85	-29.5	-27.82	-25	2.82
eFDD 7 QPSK	high	10	50	-13.14	-31.57	-30.04	-25	5.04
eFDD 7 16QAM	low	10	50	-15.54	-31.57	-29.76	-25	4.76
eFDD 7 16QAM	high	10	50	-14.69	-33.42	-31.91	-25	6.91
eFDD 7 QPSK	low	15	75	-11.28	-27.84	-26.71	-25	1.71
eFDD 7 QPSK	high	15	75	-13.13	-29.72	-28.34	-25	3.34
eFDD 7 16QAM	low	15	75	-14.53	-31.01	-29.42	-25	4.42
eFDD 7 16QAM	high	15	75	-13.98	-31.73	-30.67	-25	5.67
eFDD 7 QPSK	low	20	100	-10.25	-25.71	-25.38	-25	0.38
eFDD 7 QPSK	high	20	100	-10.97	-25.38	-25.06	-25	0.06
eFDD 7 16QAM	low	20	100	-12	-27	-26.06	-25	1.06
eFDD 7 16QAM	high	20	100	-11.21	-26.8	-25.71	-25	0.71

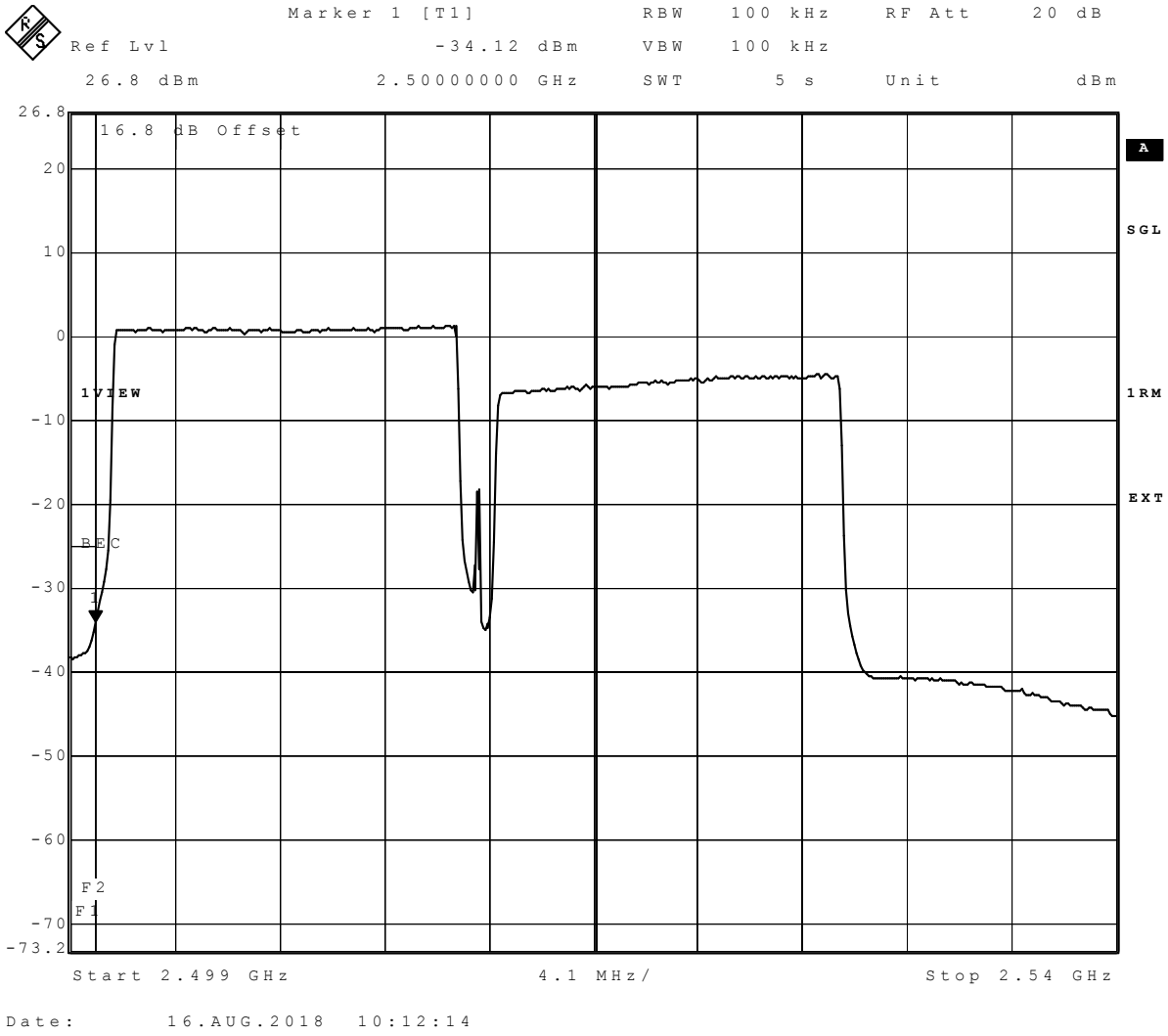
Radio Technology	Channel	Nominal BW	Ressource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
eFDD 7 64QAM	low	25	5	-11.05	-30.02	-26.71	-25	1.71
eFDD 7 64QAM	high	25	5	-11.9	-31.73	-28.6	-25	3.6
eFDD 7 64QAM	low	50	10	-14.56	-33.42	-31.57	-25	6.57
eFDD 7 64QAM	high	50	10	-16.35	-34.76	-33.02	-25	8.02
eFDD 7 64QAM	low	75	15	-13.69	-33.39	-31.73	-25	6.73
eFDD 7 64QAM	high	75	15	-14	-33.39	-32.12	-25	7.12
eFDD 7 64QAM	low	100	20	-12.31	-28.27	-27.2	-25	2.2
eFDD 7 64QAM	high	100	20	-11.08	-27.82	-27	-25	2

Carrier Aggregation: eFDD7

Bandwidth	PCC Frequency (MHz)	SCC1 Frequency (MHz)	Modulation	PCC RB	SCC1 RB	BE Peak	Limit	Margin
15 MHz / 15 MHz	2507.5	2522.5	QPSK	75	75	-34.12	-25	-9.12
	2507.5	2522.5	16QAM	75	75	-37.4	-25	-12.4
	2547.5	2562.5	QPSK	75	75	-41.92	-25	-16.92
	2547.5	2562.5	16QAM	75	75	-44.16	-25	-19.16
10 MHz / 20 MHz	2505.5	2519.9	QPSK	50	100	-39.22	-25	-14.22
	2505.5	2519.9	16QAM	50	100	-41.92	-25	-16.92
	2545.6	2560	QPSK	50	100	-43.6	-25	-18.6
	2545.6	2560	16QAM	50	100	-45.84	-25	-20.84
15 MHz / 20 MHz	2507.8	2524.9	QPSK	75	100	-39.52	-25	-14.52
	2507.8	2524.9	16QAM	75	100	-41.53	-25	-16.53
	2542.9	2560	QPSK	75	100	-42.74	-25	-17.74
	2542.9	2560	16QAM	75	100	-44.68	-25	-19.68
20 MHz / 10 MHz	2510	2524.4	QPSK	100	50	-37.4	-25	-12.4
	2510	2524.4	16QAM	100	50	-40.74	-25	-15.74
	2550.1	2564.5	QPSK	100	50	-43.66	-25	-18.66
	2550.1	2564.5	16QAM	100	50	-45.84	-25	-20.84
20 MHz / 15 MHz	2510	2527.1	QPSK	100	75	-37.4	-25	-12.4
	2510	2527.1	16QAM	100	75	-40.47	-25	-15.47
	2545.1	2562.2	QPSK	100	75	-44.16	-25	-19.16
	2545.1	2562.2	16QAM	100	75	-46.49	-25	-21.49
20 MHz / 20 MHz	2510	2529.8	QPSK	100	100	-40.14	-25	-15.14
	2510	2529.8	16QAM	100	100	-40.81	-25	-15.81
	2540.2	2560	QPSK	100	100	-42.74	-25	-17.74
	2540.2	2560	16QAM	100	100	-42.74	-25	-17.74



eFDD7 QPSK 5MHz Channel=low



eFDD7 QPSK 15MHz/15MHz Channel=low

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

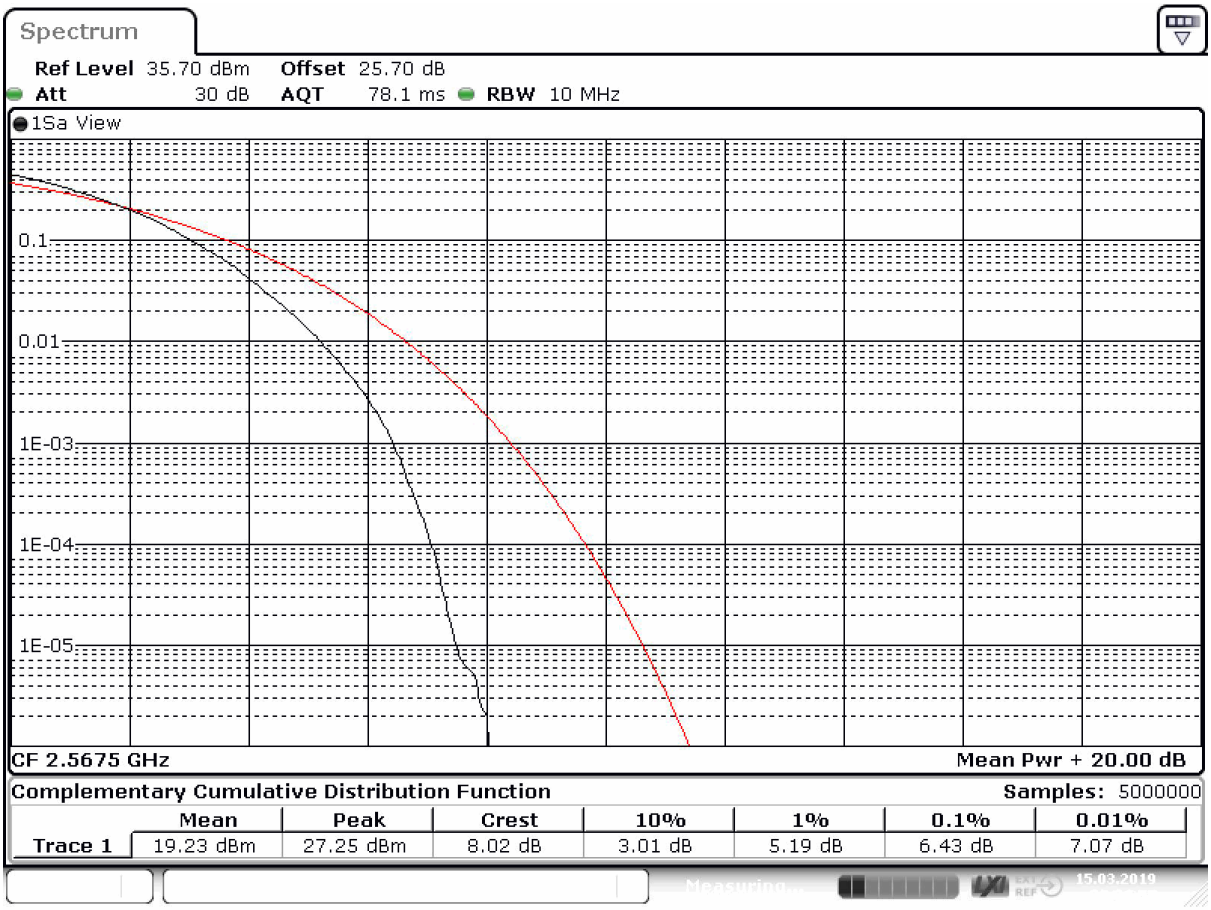
Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 23:36
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak to Average Ratio [dB]
eFDD 7 QPSK	low	6	1.4	4.96
eFDD 7 QPSK	mid	6	1.4	4.84
eFDD 7 QPSK	high	6	1.4	4.99
eFDD 7 16QAM	low	6	1.4	5.74
eFDD 7 16QAM	mid	6	1.4	5.68
eFDD 7 16QAM	high	6	1.4	5.8

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak to Average Ratio [dB]
eFDD 7 64QAM	low	25	5	6.38
eFDD 7 64QAM	mid	25	5	6.38
eFDD 7 64QAM	high	25	5	6.43

Carrier Aggregation						
Radio Technology	Channel	PCC BW	SCC1 BW	PCC RB	SCC1 RB	Peak to Average Ratio [dB]
eFDD 7 QPSK	low	10 MHz	20 MHz	50	100	7.28
eFDD 7 QPSK	mid	10 MHz	20 MHz	50	100	5.13
eFDD 7 QPSK	high	10 MHz	20 MHz	50	100	7.13
eFDD 7 16QAM	low	10 MHz	20 MHz	50	100	6
eFDD 7 16QAM	mid	10 MHz	20 MHz	50	100	7.8
eFDD 7 16QAM	high	10 MHz	20 MHz	50	100	7.62
eFDD 7 QPSK	low	15 MHz	15 MHz	75	75	6.48
eFDD 7 QPSK	mid	15 MHz	15 MHz	75	75	5.57
eFDD 7 QPSK	high	15 MHz	15 MHz	75	75	6.14
eFDD 7 16QAM	low	15 MHz	15 MHz	75	75	7.02
eFDD 7 16QAM	mid	15 MHz	15 MHz	75	75	5.43
eFDD 7 16QAM	high	15 MHz	15 MHz	75	75	6.08
eFDD 7 64QAM	low	15 MHz	15 MHz	75	75	6.65
eFDD 7 64QAM	mid	15 MHz	15 MHz	75	75	5.65
eFDD 7 64QAM	high	15 MHz	15 MHz	75	75	6.45



Date: 15.MAR.2019 08:04:56

eFDD7 64 QAM Channel=high

3.5.22 90.1 Maximum Channel Power, §2.1046, §90.205&90.635

Test: 90.1; RF Power Output Summary §2.1046, §90.542

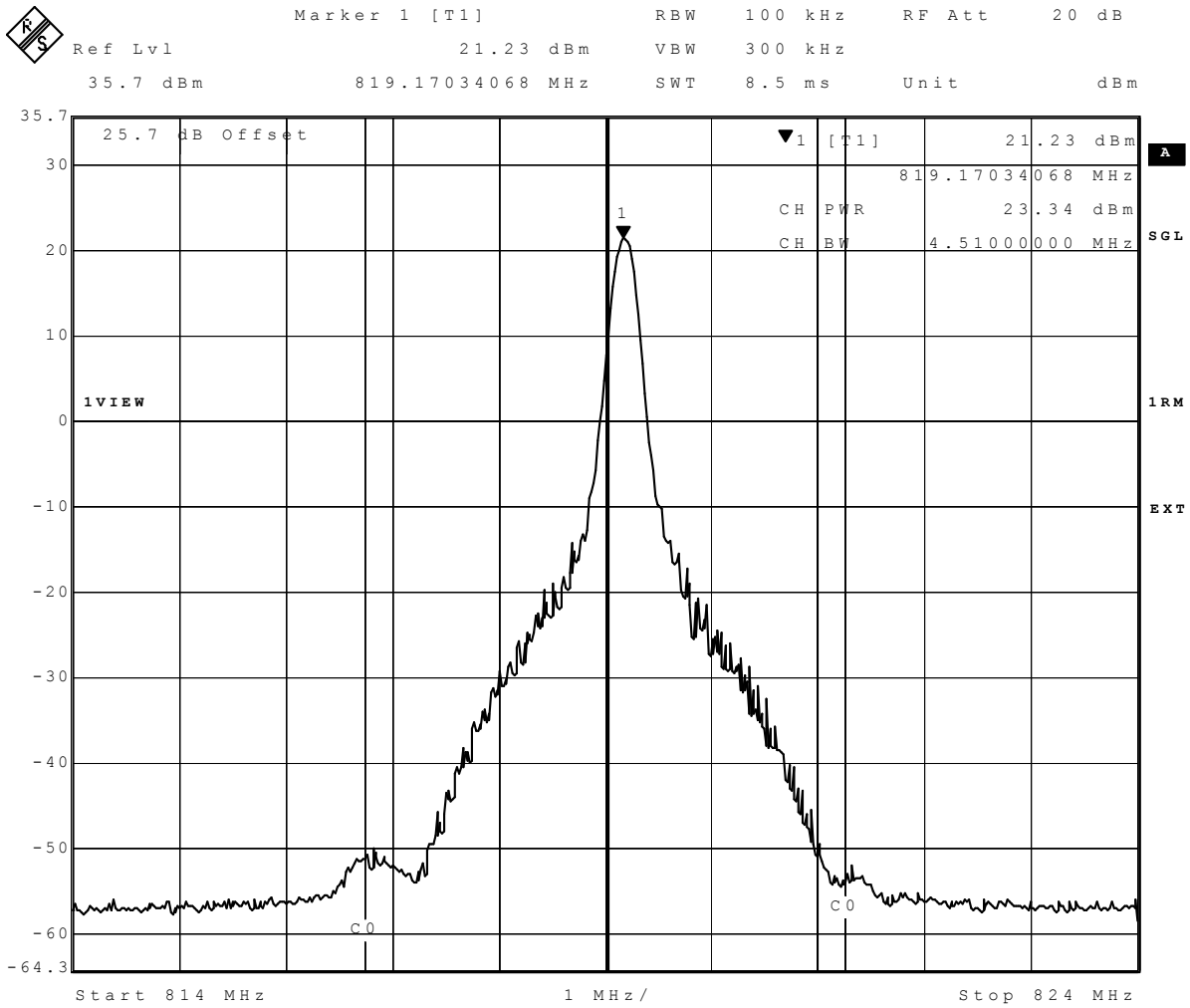
Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 20:42
Body:	FCC47CFRChIPART90PRIVATE LAND MOBILE RADIO SERVICES
Test Specification:	FCC part 90

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	RMS Cond. Power [dBm]	FCC EIRP Limit [W]	IC EIRP Limit [W]	Max. Antenna Gain [dBi]	Max. Antenna Gain IC [dBi]
eFDD 26 QPSK	low	1	1.4	23.49	1	1	6.51	6.51
eFDD 26 QPSK	low	3	1.4	23.08	1	1	6.92	6.92
eFDD 26 QPSK	low	6	1.4	22.04	1	1	7.96	7.96
eFDD 26 QPSK	mid	1	1.4	23.41	1	1	6.59	6.59
eFDD 26 QPSK	mid	3	1.4	23.07	1	1	6.93	6.93
eFDD 26 QPSK	mid	6	1.4	21.97	1	1	8.03	8.03
eFDD 26 QPSK	high	1	1.4	23.66	1	1	6.34	6.34
eFDD 26 QPSK	high	3	1.4	23.21	1	1	6.79	6.79
eFDD 26 QPSK	high	6	1.4	22.15	1	1	7.85	7.85
eFDD 26 16QAM	low	1	1.4	22.59	1	1	7.41	7.41
eFDD 26 16QAM	low	6	1.4	21	1	1	9	9
eFDD 26 16QAM	mid	1	1.4	22.46	1	1	7.54	7.54
eFDD 26 16QAM	mid	6	1.4	20.92	1	1	9.08	9.08
eFDD 26 16QAM	high	1	1.4	22.65	1	1	7.35	7.35
eFDD 26 16QAM	high	6	1.4	21.15	1	1	8.85	8.85
eFDD 26 QPSK	low	1	3	23.31	1	1	6.69	6.69
eFDD 26 QPSK	low	15	3	21.99	1	1	8.01	8.01
eFDD 26 QPSK	mid	1	3	23.31	1	1	6.69	6.69
eFDD 26 QPSK	mid	15	3	22.01	1	1	7.99	7.99
eFDD 26 QPSK	high	1	3	23.34	1	1	6.66	6.66
eFDD 26 QPSK	high	15	3	22.02	1	1	7.98	7.98
eFDD 26 16QAM	low	1	3	22.38	1	1	7.62	7.62
eFDD 26 16QAM	low	15	3	21.05	1	1	8.95	8.95
eFDD 26 16QAM	mid	1	3	22.3	1	1	7.7	7.7
eFDD 26 16QAM	mid	15	3	20.95	1	1	9.05	9.05
eFDD 26 16QAM	high	1	3	22.46	1	1	7.54	7.54
eFDD 26 16QAM	high	15	3	21.09	1	1	8.91	8.91
eFDD 26 QPSK	low	1	5	23.29	1	1	6.71	6.71
eFDD 26 QPSK	low	12	5	21.97	1	1	8.03	8.03
eFDD 26 QPSK	low	25	5	21.94	1	1	8.06	8.06
eFDD 26 QPSK	mid	1	5	23.34	1	1	6.66	6.66
eFDD 26 QPSK	mid	12	5	21.98	1	1	8.02	8.02
eFDD 26 QPSK	mid	25	5	21.99	1	1	8.01	8.01
eFDD 26 QPSK	high	1	5	23.44	1	1	6.56	6.56
eFDD 26 QPSK	high	12	5	22.04	1	1	7.96	7.96
eFDD 26 QPSK	high	25	5	22.05	1	1	7.95	7.95
eFDD 26 16QAM	low	1	5	22.29	1	1	7.71	7.71
eFDD 26 16QAM	low	25	5	21.04	1	1	8.96	8.96
eFDD 26 16QAM	mid	1	5	22.49	1	1	7.51	7.51
eFDD 26 16QAM	mid	25	5	21	1	1	9	9
eFDD 26 16QAM	high	1	5	22.64	1	1	7.36	7.36
eFDD 26 16QAM	high	25	5	21.08	1	1	8.92	8.92
eFDD 26 QPSK	mid	1	10	23.73	1	1	6.27	6.27
eFDD 26 QPSK	mid	50	10	22.49	1	1	7.51	7.51
eFDD 26 16QAM	mid	1	10	22.69	1	1	7.31	7.31
eFDD 26 16QAM	mid	50	10	21.57	1	1	8.43	8.43

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	RMS Cond. Power [dBm]	FCC EIRP Limit [W]	IC EIRP Limit [W]	Max. Antenna Gain [dBi]	Max. Antenna Gain IC [dBi]
eFDD 26 64QAM	low	1	1.4	21.15	1	1	8.85	8.85
eFDD 26 64QAM	low	6	1.4	19.64	1	1	10.36	10.36
eFDD 26 64QAM	mid	1	1.4	21.44	1	1	8.56	8.56
eFDD 26 64QAM	mid	6	1.4	19.89	1	1	10.11	10.11
eFDD 26 64QAM	high	1	1.4	21.21	1	1	8.79	8.79
eFDD 26 64QAM	high	6	1.4	19.77	1	1	10.23	10.23
eFDD 26 64QAM	low	1	3	21.35	1	1	8.65	8.65
eFDD 26 64QAM	low	15	3	20.15	1	1	9.85	9.85
eFDD 26 64QAM	mid	1	3	21.41	1	1	8.59	8.59
eFDD 26 64QAM	mid	15	3	20.14	1	1	9.86	9.86
eFDD 26 64QAM	high	1	3	21.59	1	1	8.41	8.41
eFDD 26 64QAM	high	15	3	20.22	1	1	9.78	9.78
eFDD 26 64QAM	low	1	5	21.62	1	1	8.38	8.38
eFDD 26 64QAM	low	25	5	20.13	1	1	9.87	9.87
eFDD 26 64QAM	mid	1	5	21.62	1	1	8.38	8.38
eFDD 26 64QAM	mid	25	5	20.16	1	1	9.84	9.84
eFDD 26 64QAM	high	1	5	21.58	1	1	8.42	8.42
eFDD 26 64QAM	high	25	5	20.23	1	1	9.77	9.77



eFDD26 QPSK 5MHz RB1 Channel=low

3.5.23 90.2 Occupied Bandwidth, §2.1049, §90.209

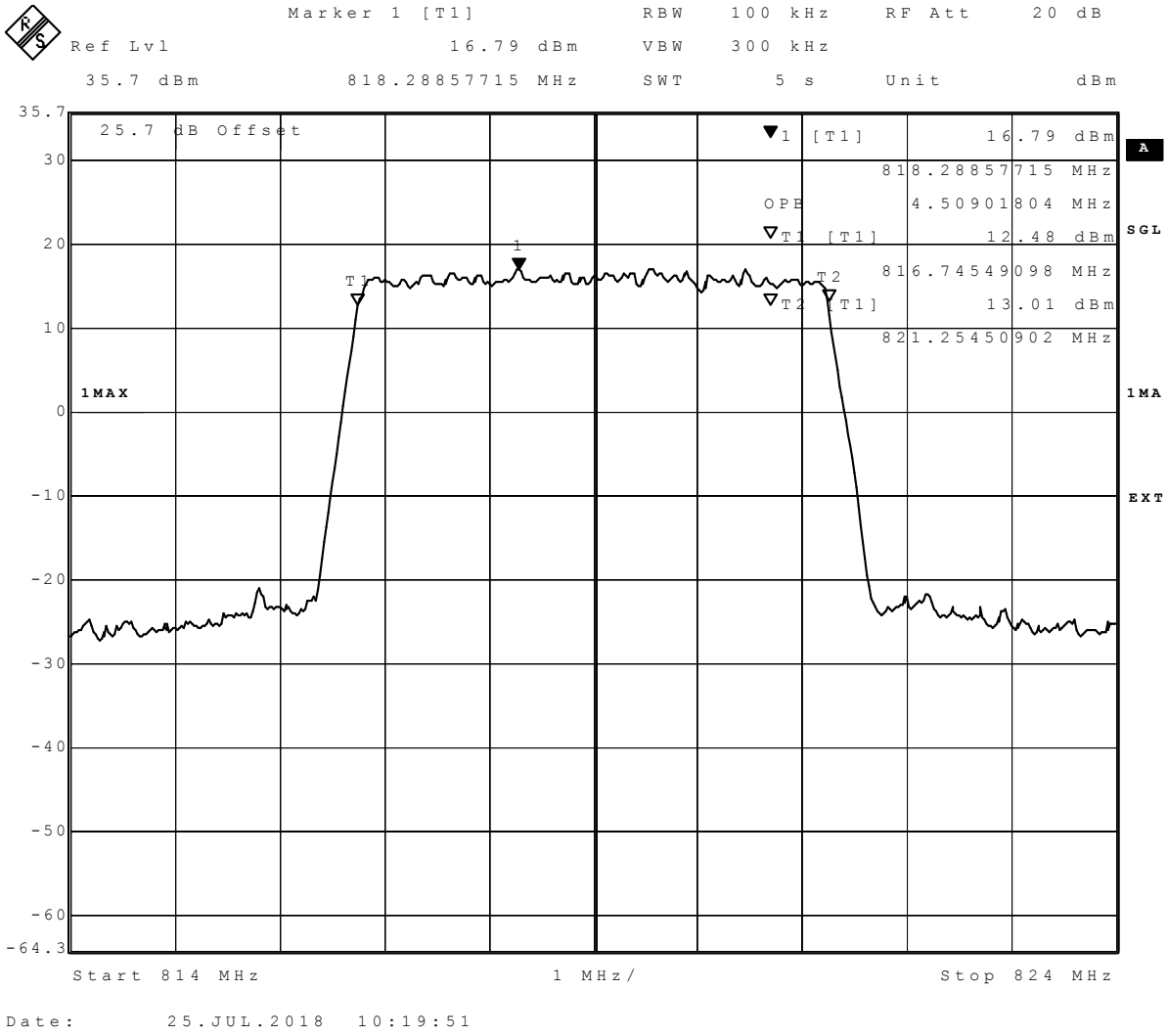
Test: 90.2; Emission and Occupied Bandwidth Summary §2.1049

Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 18:12
Body:	FCC47CFRChIPART90PRIVATE LAND MOBILE RADIO SERVICES
Test Specification:	FCC part 90

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	99 % BW [kHz]
eFDD 26 QPSK	low	6	1.4	1.4	1100.2
eFDD 26 QPSK	mid	6	1.4	1.4	1106.21
eFDD 26 QPSK	high	6	1.4	1.4	1106.21
eFDD 26 16QAM	low	6	1.4	1.4	1100.2
eFDD 26 16QAM	mid	6	1.4	1.4	1100.2
eFDD 26 16QAM	high	6	1.4	1.4	1100.2
eFDD 26 QPSK	low	15	3	3	2765.53
eFDD 26 QPSK	mid	15	3	3	2745.49
eFDD 26 QPSK	high	15	3	3	2765.53
eFDD 26 16QAM	low	15	3	3	2785.57
eFDD 26 16QAM	mid	15	3	3	2745.49
eFDD 26 16QAM	high	15	3	3	2745.49
eFDD 26 QPSK	low	25	5	5	4529.06
eFDD 26 QPSK	mid	25	5	5	4509.02
eFDD 26 QPSK	high	25	5	5	4529.06
eFDD 26 16QAM	low	25	5	5	4529.06
eFDD 26 16QAM	mid	25	5	5	4509.02
eFDD 26 16QAM	high	25	5	5	4529.06
eFDD 26 QPSK	mid	50	10	10	8977.96
eFDD 26 16QAM	mid	50	10	10	8977.96

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	99 % BW [kHz]
eFDD 26 64QAM	low	6	1.4	1.4	1094.19
eFDD 26 64QAM	mid	6	1.4	1.4	1106.21
eFDD 26 64QAM	high	6	1.4	1.4	1094.19
eFDD 26 64QAM	low	15	3	3	2765.53
eFDD 26 64QAM	mid	15	3	3	2765.63
eFDD 26 64QAM	high	15	3	3	2765.53
eFDD 26 64QAM	low	25	5	5	4529.06
eFDD 26 64QAM	mid	25	5	5	4529.06
eFDD 26 64QAM	high	25	5	5	4549.1
eFDD 26 64QAM	mid	50	10	10	8977.96



99% eFDD26 QPSK 5MHz Channel=mid

3.5.24 90.3 Band Edges Compliance, §2.1051, §90691

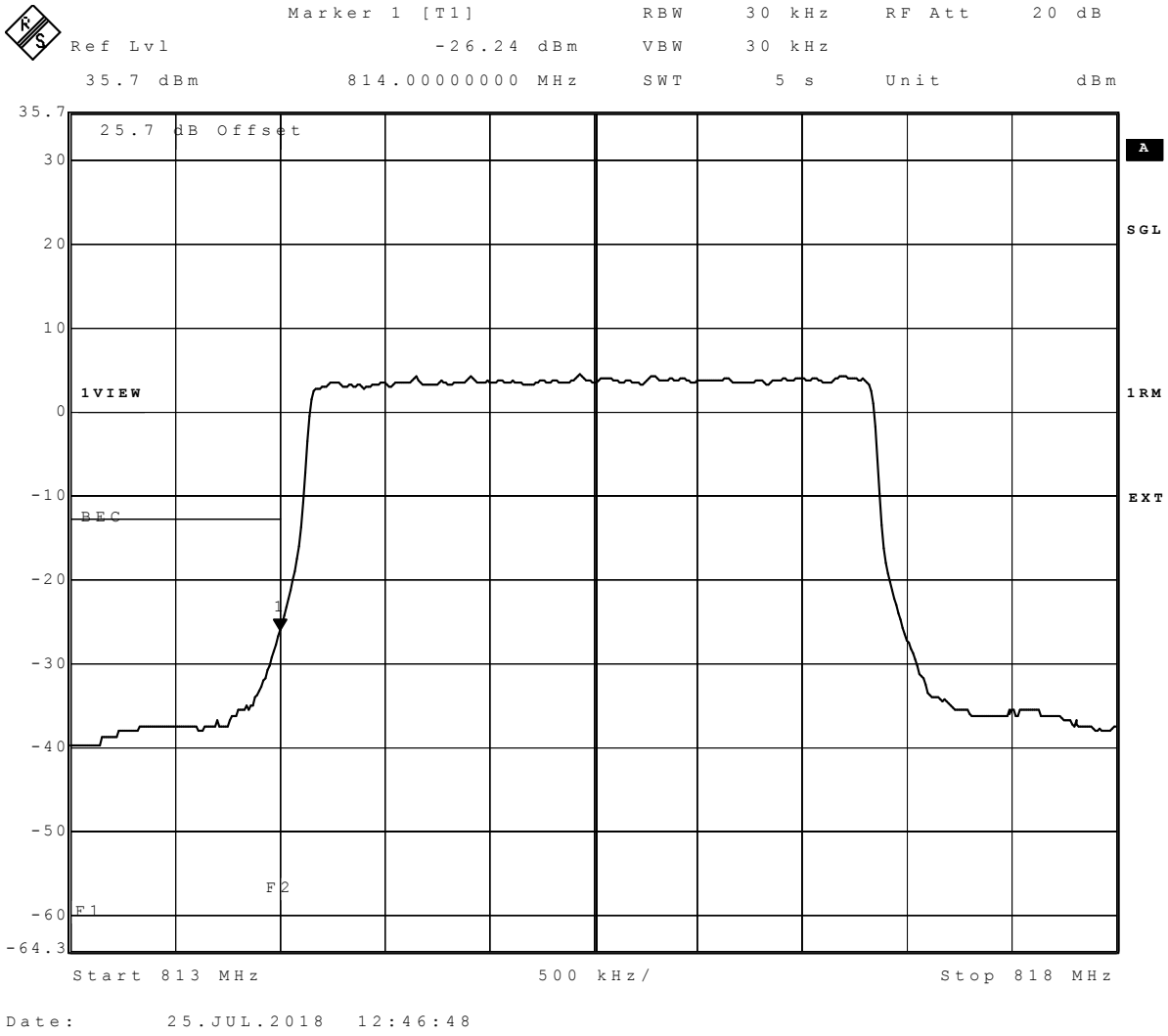
Test: 90.3; Band edge compliance summary §2.1053, §90.543

Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 16:58
Body:	FCC47CFRChIPART90PRIVATE LAND MOBILE RADIO SERVICES
Test Specification:	FCC part 90

Detailed Results:

Radio Technology	Channel	Nominal BW	Ressource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
eFDD 26 QPSK	low	1.4	1	-26.44	-34.9	-34.02	-20	14.02
eFDD 26 QPSK	high	1.4	1	-27.24	-35.71	-35.06	-20	15.06
eFDD 26 16QAM	low	1.4	1	-26.59	-36.61	-35.71	-20	15.71
eFDD 26 16QAM	high	1.4	1	-26.28	-37.2	-36.24	-20	16.24
eFDD 26 QPSK	low	3	1	-15	-28.27	-26.24	-20	6.24
eFDD 26 QPSK	high	3	1	-15.68	-30.04	-27.61	-20	7.61
eFDD 26 16QAM	low	3	1	-16.65	-30.92	-28.27	-20	8.27
eFDD 26 16QAM	high	3	1	-15.8	-30.62	-28.27	-20	8.27
eFDD 26 QPSK	low	5	1	-17.07	-32.63	-30.32	-20	10.32
eFDD 26 QPSK	high	5	1	-16.16	-32.26	-30.62	-20	10.62
eFDD 26 16QAM	low	5	1	-18.21	-34.29	-31.91	-20	11.91
eFDD 26 16QAM	high	5	1	-17.75	-33.84	-31.57	-20	11.57
eFDD 26 QPSK	mid	10	1	-18.14	-33.42	-31.91	-20	11.91
eFDD 26 16QAM	mid	10	1	-21.26	-35.78	-33.84	-20	13.84
eFDD 26 QPSK	mid	10	1	-17.7	-33.84	-31.91	-20	11.91
eFDD 26 16QAM	mid	10	1	-20.43	-36.34	-34.29	-20	14.29

Radio Technology	Channel	Nominal BW	Ressource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
eFDD 26 64QAM	low	6	1.4	-30.28	-39.87	-39.04	-20	19.04
eFDD 26 64QAM	high	6	1.4	-30.83	-41.8	-40.78	-20	20.78
eFDD 26 64QAM	low	15	3	-17.38	-32.26	-29.5	-20	9.5
eFDD 26 64QAM	high	15	3	-17.72	-33.84	-30.62	-20	10.62
eFDD 26 64QAM	low	25	5	-18.99	-36.34	-33.84	-20	13.84
eFDD 26 64QAM	high	25	5	-20.49	-38.28	-34.76	-20	14.76
eFDD 26 64QAM	low	50	10	-21.26	-38.28	-36.34	-20	16.34
eFDD 26 64QAM	high	50	10	-22.09	-40.78	-38.28	-20	18.28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35.7
30
20
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-20
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1VIEW
A
SGL
1RM
EXT
REC
1
F2
F1
Start 813 MHz
500 kHz/
Stop 818 MHz
Date: 25.JUL.2018 12:46:48

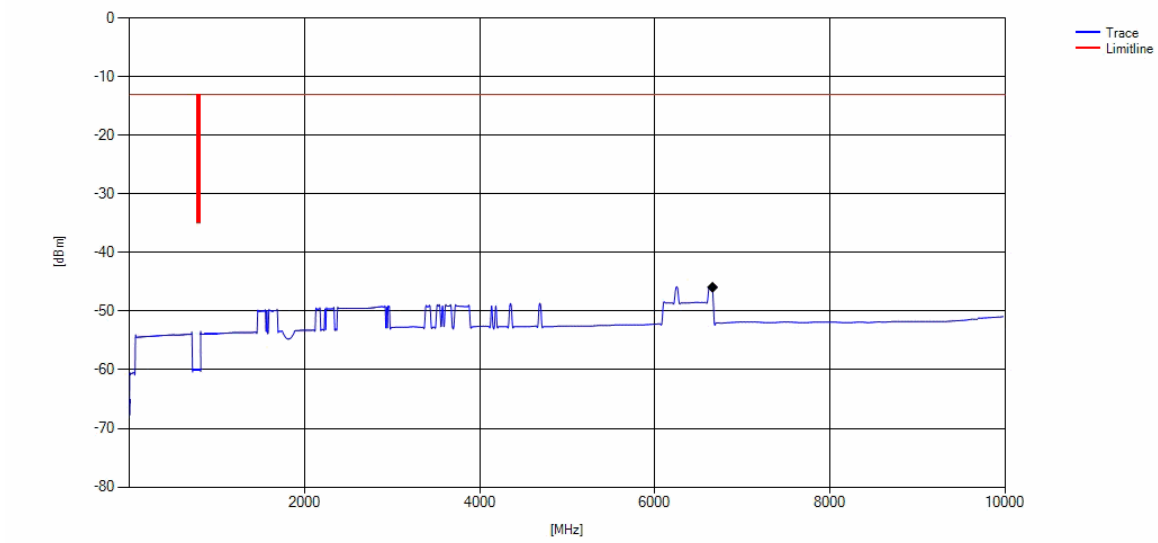
3.5.25 90.4 Spurious Emissions at Antenna Terminal, §2.1051, §90.210&§90.669

Test: 90.4; Spurious emissions at antenna terminals summary §2.1051, §90.543

Result:	Passed
Setup No.:	S01_BW03
Date of Test:	2018/08/18 23:10
Body:	FCC47CFRChIPART90PRIVATE LAND MOBILE RADIO SERVICES
Test Specification:	FCC part 90

Detailed Results:

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
eFDD26	low	rms	maxhold	-	-	-	-13	>20
eFDD26	mid	rms	maxhold	-	-	-	-13	>20
eFDD26	high	rms	maxhold	-	-	-	-13	>20



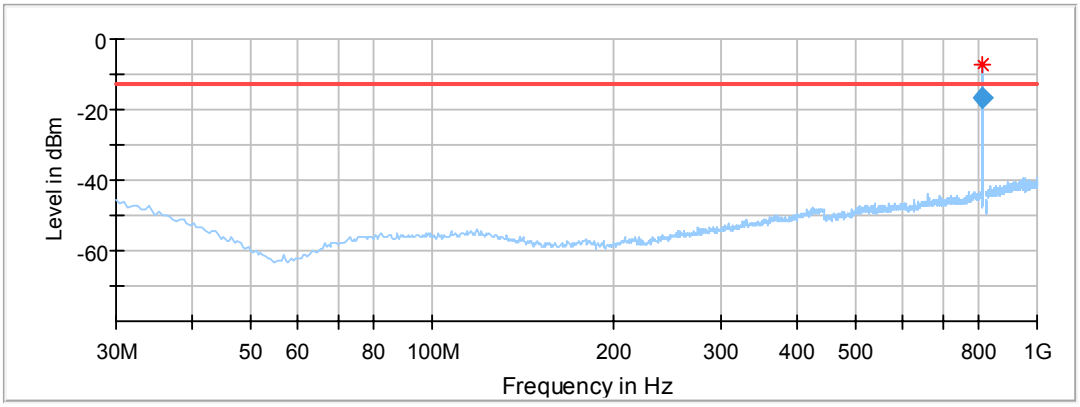
eFDD26 Channel=mid

3.5.26 90.5 Radiated Spurious Emission, $2.1055, §90.210

Test: 90.5; Field strength of spurious radiation summary §2.1053, §90.543

Result:	Passed 90.5; Field strength of spurious radiation summary §2.1053, §90.543 Worst Case Plot eFDD26
Setup No.:	S01_BY03
Date of Test:	2018/08/23 15:46
Body:	FCC47CFRChIPART90PRIVATE LAND MOBILE RADIO SERVICES
Test Specification:	FCC part 90

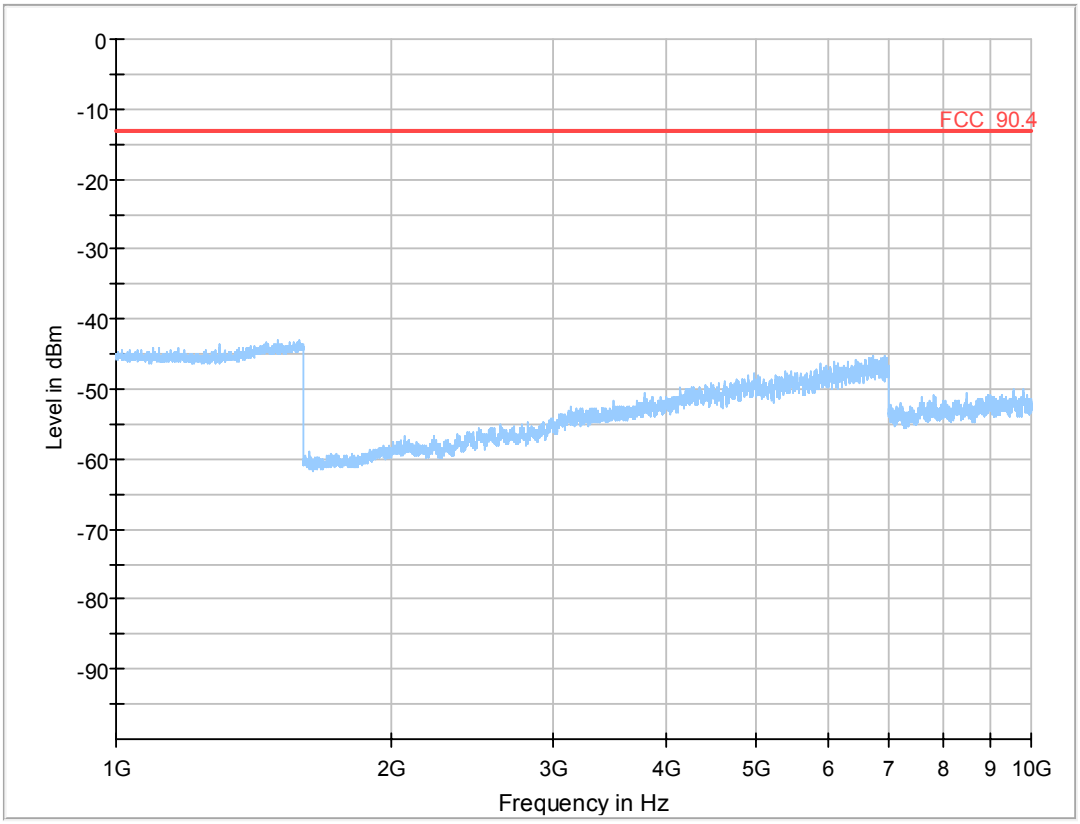
Detailed Results:



Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
813.997000	-16.61	-13.00	3.61	1000.0	100.000	111.0	V	5.0	-73.8	17:12:18 - 2018-08-19

LTE eFDD26 - low channel



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)
---	---	---	---	---	---	---		---	---	---

LTE eFDD26 - low channel

3.5.27 90.6 Frequency Stability, §2.1055, §90.230

Test: 90.6; Frequency Stability Summary, §2.1055, §90.230

Result:	Not tested For LTE band eFDD26 Frequency Stability was tested for FCC Part 22 and not repeated for FCC Part 90, because main frequency range of LTE band eFDD26 is covered by FCC Part 22.
Setup No.:	S01_BX03
Date of Test:	2018/09/13 11:39
Body:	FCC47CFRChIPART90PRIVATE LAND MOBILE RADIO SERVICES
Test Specification:	FCC part 90

3.5.28 90.7 Peak-to-Average Ratio §2.1046

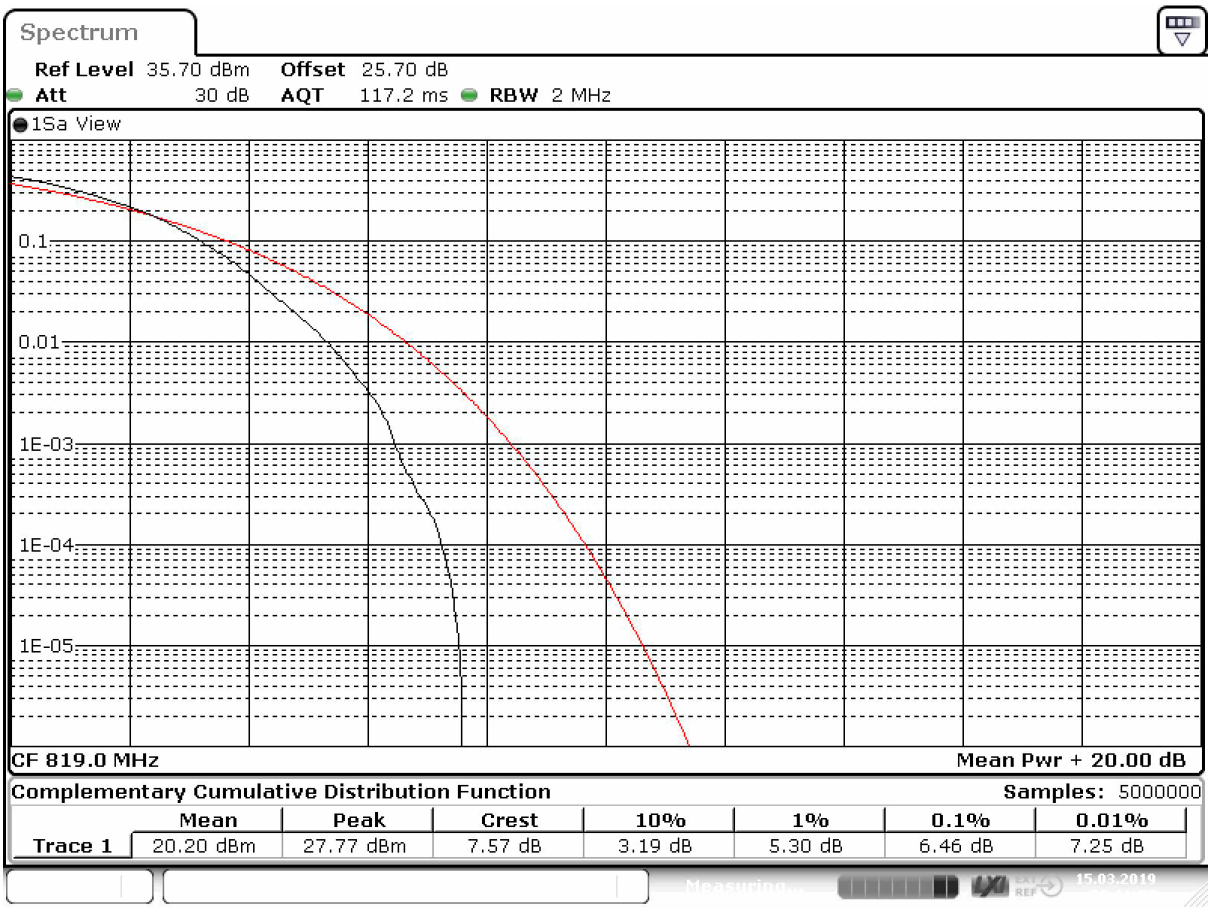
Test: 90.7; Peak-to-Average Ratio Summary §2.1046

Result:	Passed
Setup No.:	S01_BX03
Date of Test:	2018/08/10 0:03
Body:	FCC47CFRChIPART90PRIVATE LAND MOBILE RADIO SERVICES
Test Specification:	FCC part 90

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak to Average Ratio [dB]
eFDD 26 QPSK	low	6	1.4	4.78
eFDD 26 QPSK	mid	6	1.4	4.87
eFDD 26 QPSK	high	6	1.4	4.93
eFDD 26 16QAM	low	6	1.4	5.68
eFDD 26 16QAM	mid	6	1.4	5.71
eFDD 26 16QAM	high	6	1.4	5.68

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak to Average Ratio [dB]
eFDD 26 64QAM	low	6	1.4	6.35
eFDD 26 64QAM	mid	6	1.4	6.46
eFDD 26 64QAM	high	6	1.4	6.35



Date: 15.MAR.2019 08:11:55

eFDD26 64QAM Channel=mid

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 m³	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	AM4.0/180/11920513	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	
Double-ridged horn	HF 907	102444	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Execution*
	Standard Calibration		2018/07/20	2021/07/19

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

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

Test Equipment Auxiliary Test Equipment

Lab ID:	**Lab 1, Lab 2**
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	
	Calibration Details		*Last Execution*	*Next Execution*
	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		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2017/11/27	2018/11/26
Spectrum Analyzer	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG	
Vector Signal Generator	SMIQ 03B	832492/061		

Test Equipment Digital Signalling Devices

Lab ID:	**Lab 1, Lab 2**
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 Execution*
	DKD Calibration		2016/11/29	2018/11/28
Personal Computer	Dell	30304832059		
Power Meter	NRVD	828110/016		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2017/05/17	2018/07/17
	Standard calibration		2018/07/18	2019/07/17
Sensor Head A	NRV-Z1	827753/005		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2017/05/18	2018/07/16
	Standard calibration		2018/07/17	2019/07/16
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG	
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG	
	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 Execution*
	DKD calibration		2019/02	2021/02

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		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2017/05/17	2018/07/17
	Standard calibration		2018/07/18	2019/07/17
RF Step Attenuator RSP	RSP	833695/001		
Rubidium Frequency Standard	Datum, Model: MFS	5489/001		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2017/07/11	2018/07/24
	Standard calibration		2018/07/25	2019/07/24
Sensor Head A	NRV-Z1	827753/005		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2017/05/18	2018/07/16
	Standard calibration		2018/07/17	2019/07/16
Signal Generator SME	SME03	827460/016		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2018/08/01	2021/07/31
Signal Generator SMP	SMP02	833286/0014	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Execution*
	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	

Calibration Details	*Last Execution*	*Next Execution*
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	

Calibration Details	*Last Execution*	*Next Execution*
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	

Calibration Details	*Last Execution*	*Next Execution*
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	

Calibration Details	*Last Execution*	*Next Execution*
Customized calibration	2018/04/27	2020/04/26

5 Annex

5.1 Additional Information for Report

Summary of Test Results

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

Technical Report Summary

Type of Authorization :

Certification for a GSM/WCDMA/CDMA2000 cellular radiotelephone device

Applicable FCC Rules

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

Part 2, Subpart J - Equipment Authorization Procedures, Certification

§ 2.1046 Measurement required: RF power output
§ 2.1049 Measurement required: Occupied bandwidth
§ 2.1051 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 C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

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

Test Description (radiated measurement procedure)

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
3) A substitution procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a 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 ANSI C63.26-2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.
§22.913 Effective radiated power limits
(a)(2) Maximum ERP. … The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

Emission and Occupied Bandwidth

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1049

Test Description

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

Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

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

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

Spurious emissions at antenna terminals

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) [>=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.

Field strength of spurious radiation

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1053

Test Description

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

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.
(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:
(2) All equipment operating on frequencies higher than 25 MHz.

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.
(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.
(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 22.917 Emission limitations for cellular equipment

(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in a distance of 3 m.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.
(c) Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas [...].
(d) If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

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

Frequency stability

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

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

Technical Report Summary

Type of Authorization :

Certification for a GSM/WCDMA/CDMA2000 cellular radiotelephone device

Applicable FCC Rules

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

Part 2, Subpart J - Equipment Authorization Procedures, Certification

§ 2.1046 Measurement required: RF power output
§ 2.1049 Measurement required: Occupied bandwidth
§ 2.1051 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 C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

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

Test Description (radiated measurement procedure)

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
3) A substitution procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a 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 ANSI C63.26-2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.
§24.232 Power and antenna height limits
(c) Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.
(e) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

Emission and Occupied Bandwidth

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1049

Test Description

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

Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

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

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

Spurious emissions at antenna terminals

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 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.

Field strength of spurious radiation

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1053

Test Description

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a lamda/2 dipole).

4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antennas for the frequency range of 30 MHz to 20 GHz (up to the 10th harmonic of the transmit frequency). The frequency range from 9 kHz to 30 MHz has been examined during the conducted spurious emission measurements.
5) Important Analyser Settings
- [Resolution Bandwidth / Video Bandwidth]:
a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the Band,
b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz -> 10 kHz) was used
c) [1 MHz / 3 MHz] otherwise
- Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
6) The spurious emissions peaks were measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case peaks all orientations (X, Y, Z) of the EUT have been measured.
7) After this initial test, a final test according to ANSI C63.26-2015 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 dBµV/m (field strength) in a distance of 3 m.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 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.

Frequency stability

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.

Band edge compliance

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §24.238

Test Description

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

Test Requirements / Limits

§ 24.238 Effective radiated power limits

Refer to chapter "Field strength of spurious radiation".

Summary of Test Results

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

Technical Report Summary

Type of Authorization :

Certification for a GSM/WCDMA/CDMA2000 cellular radiotelephone device

Applicable FCC Rules

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

Part 2, Subpart J - Equipment Authorization Procedures, Certification

§ 2.1046 Measurement required: RF power output
§ 2.1049 Measurement required: Occupied bandwidth
§ 2.1051 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 C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

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

Test Description (radiated measurement procedure)

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
3) A substitution procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a 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 ANSI C63.26-2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.
§22.913 Effective radiated power limits
(a)(2) Maximum ERP. … The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

Emission and Occupied Bandwidth

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1049

Test Description

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

Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

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

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

Spurious emissions at antenna terminals

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) [>=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.

Field strength of spurious radiation

Standard FCC Part 22, Subpart H

The test was performed according to: FCC §2.1053

Test Description

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

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.
(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:
(2) All equipment operating on frequencies higher than 25 MHz.

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.
(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.
(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 22.917 Emission limitations for cellular equipment

(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in a distance of 3 m.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.
(c) Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas [...].
(d) If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.

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

Frequency stability

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

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

Technical Report Summary

Type of Authorization :

Certification for a GSM/WCDMA/CDMA2000 cellular radiotelephone device

Applicable FCC Rules

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

Part 2, Subpart J - Equipment Authorization Procedures, Certification

§ 2.1046 Measurement required: RF power output
§ 2.1049 Measurement required: Occupied bandwidth
§ 2.1051 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 C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

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

Test Description (radiated measurement procedure)

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
3) A substitution procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a 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 ANSI C63.26-2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.
§24.232 Power and antenna height limits
(c) Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.
(e) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

Emission and Occupied Bandwidth

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1049

Test Description

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

Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

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

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

Spurious emissions at antenna terminals

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 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.

Field strength of spurious radiation

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1053

Test Description

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a lamda/2 dipole).

4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antennas for the frequency range of 30 MHz to 20 GHz (up to the 10th harmonic of the transmit frequency). The frequency range from 9 kHz to 30 MHz has been examined during the conducted spurious emission measurements.
5) Important Analyser Settings
- [Resolution Bandwidth / Video Bandwidth]:
a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the Band,
b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz -> 10 kHz) was used
c) [1 MHz / 3 MHz] otherwise
- Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
6) The spurious emissions peaks were measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case peaks all orientations (X, Y, Z) of the EUT have been measured.
7) After this initial test, a final test according to ANSI C63.26-2015 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 dBµV/m (field strength) in a distance of 3 m.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 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.

Frequency stability

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.

Band edge compliance

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §24.238

Test Description

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

Test Requirements / Limits

§ 24.238 Effective radiated power limits

Refer to chapter "Field strength of spurious radiation".

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
§ 2.1049 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 C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

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

Test Description (radiated measurement procedure)

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
3) A substitution procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a 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 ANSI C63.26-2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone,

power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.
§27.50 Power and antenna height limits.
(d) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands:
(2) Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to a peak EIRP of 1 watt. Fixed stations operating in this band are limited to a maximum antenna height of 10 meters above ground, and mobile and portable stations must employ a means for limiting power to the minimum necessary for successful communications.

Emission and Occupied Bandwidth

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1049

Test Description

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

Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

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

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

Spurious emissions at antenna terminals

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 log10(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.

Field strength of spurious radiation

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1053

Test Description

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

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.
(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:
(2) All equipment operating on frequencies higher than 25 MHz.

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.
(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.
(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 27.53 Emission limits

(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 log10(P) dB.
Remark of the test laboratory: This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in a distance of 3 m.
(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.
(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.
(3) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

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

Frequency stability

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°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.

§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:

+/- 2.5 ppm = 4350 Hz for channel 1450, frequency 1740.0 MHz
+/- 2.5 ppm = 4331 Hz for channel 1412, frequency 1732.4 MHz

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 CDMA2000 cellular radiotelephone device

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations. 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 outpu
§ 2.1049 Measurement required: Occupied bandwidt
§ 2.1051 Measurement required: Band Edge Complianc
§ 2.1051 Measurement required: Spurious emissions at antenna terminal
§ 2.1053 Measurement required: Field strength of spurious radiatio
§ 2.1055 Measurement required: Frequency stabilit
§ 2.1057 Frequency spectrum to be investigate

Part 90, Subpart I - General Technical Standards & Subpart S - Regulations Governing Licensing
and Use of Frequencies in the 806-824, 851-869, 896-901, and 935-940 MHz Bands

§ 90.205/90.635 Maximum Channel Powe
§ 90.209 Occupied Bandwidt
§ 90.691 Band Edge Complianc
§ 90.210/90.669 Spurious Emissions At Antenna Termina
§ 90.210 Radiated Spurious Emission
§ 90.213 Frequency stabilit

additional documents

ANSI C63.26-2015

Description of Methods of Measurements

Maximum Channel Power

2) The total insertion losses for signal path 1 and signal path 2 were measure
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 Digit Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
4) Important Analyser Setting
- Resolution Bandwidth: >1% of the manufacturer’s stated occupied bandwidth
5) The maximum spectral level of the modulated signal was recorded as t reference.
6) The emission bandwidth is measured as follow
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 follow
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 bandwidt

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.

Band Edge Compliance

Standard: FCC Part 90, Subpart I & S

The test was performed according to: FCC §90.691

Test Description

1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Test through a Power Divider. Refer to chapter "Setup Drawings".
2) The total insertion losses for signal path 1 and signal path 2 were measure
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 Digit Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
4) Important Analyser Setting
- Resolution Bandwidth = Video Bandwidth: >1% of the manufacturer’s stated occupied bandwidth

Test Requirements / Limits

§ 90.691 Emission mask requirements for EA-based system
(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power
of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels
or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed
from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

Spurious Emissions At Antenna Terminal

Standard: FCC Part 90, Subpart I & S

The test was performed according to FCC §2.1051

Test Description

1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Test through a Power Divider. Refer to chapter "Setup Drawings".
2) The total insertion losses for signal path 1 and signal path 2 were measure 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 Digit Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
4) Important Analyser Settin
- [Resolution Bandwidth]:
a) [>=1% of wanted signal bandwidth] in the Span of 1 MHz directly below a above the Band,
b) otherwise [1 MH
c) [reduced resolution bandwidth] in case the curve of the analyser IF-Filter 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 k to 20 GHz (up to the 10th harmonic) during the call was established

Test Requirements / Limits

§ 2.1051 Spurious emissions at antenna terminal

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.

§ 90.691 Emission mask requirements for EA-based system

(2) For any frequency removed from the EA licensee’s frequency block greater than 37.5 kHz, the power of any
emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels,
whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in
the block in kilohertz and where f is greater than 37.5 kHz.

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

Radiated Spurious Emissions

Standard: FCC Part 90, Subpart I & S

The test was performed according to: FCC §2.1053

Test Description

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Set 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 Digit 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 spectr analyser are corrected and represent directly the equivalent radiated power (related to a lamda/2 dipole).
4) All spurious radiation measurements were made with spectrum analyser and t 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 Settin
- [Resolution Bandwidth / Video Bandwidth]:
a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the Ban
b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to 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] otherwi
- Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
6) The spurious emissions peaks were measured in both vertical and horizont 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 Unwant 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.

§ 90.210 Radiated Spurious Emission

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in a distance of 3 m.

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

Frequency stability

Standard: FCC Part 90, Subpart I & S

The test was performed according to FCC §2.1055

Test Description

1) The EUT was placed inside a temperature chambe
2) The EUT was coupled to a Digital Communication Tester. Refer to chapter "Set Drawings".

3) The climatic chamber was cycled down/up to a certain temperature, starti with the EUT minimum temperature.
4) After the temperature was stabilized the EUT was switched on and a call w 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 measureme 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 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.

§ 90.213 Frequency stabilit

According table "MINIMUM FREQUENCY STABILITY" Mobile stations, working in the frequency range 809 - 824 MHz, with an output power < 2 watts, must be within a frequency tolerance of 2.5 ppm.

Peak-to-Average Ratio

Standard: FCC §2.1049

The test was performed according to KDB 971168 v02r01 – Section 5.7.1

ANSI C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

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

Test Description (radiated measurement procedure)

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
3) A substitution procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a 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 ANSI C63.26-2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.
§24.232 Power and antenna height limits
(c) Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.
(e) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

Emission and Occupied Bandwidth

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1049

Test Description

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

Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

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

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

Spurious emissions at antenna terminals

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 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.

Field strength of spurious radiation

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §2.1053

Test Description

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a lamda/2 dipole).

4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antennas for the frequency range of 30 MHz to 20 GHz (up to the 10th harmonic of the transmit frequency). The frequency range from 9 kHz to 30 MHz has been examined during the conducted spurious emission measurements.
5) Important Analyser Settings
- [Resolution Bandwidth / Video Bandwidth]:
a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the Band,
b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz -> 10 kHz) was used
c) [1 MHz / 3 MHz] otherwise
- Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
6) The spurious emissions peaks were measured in both vertical and horizontal antenna polarisation during the call is established on the lowest channel, mid channel and on the highest channel. To find the worst case peaks all orientations (X, Y, Z) of the EUT have been measured.
7) After this initial test, a final test according to ANSI C63.26-2015 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 dBµV/m (field strength) in a distance of 3 m.

(b) Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 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.

Frequency stability

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.

Band edge compliance

Standard: FCC Part 24, Subpart E

The test was performed according to: FCC §24.238

Test Description

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

Test Requirements / Limits

§ 24.238 Effective radiated power limits

Refer to chapter "Field strength of spurious radiation".

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
§ 2.1049 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 C63.26-2015

Description of Methods of Measurements

RF Power Output

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1046

Test Description (conducted measurement procedure)

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

Test Description (radiated measurement procedure)

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to a Digital Communication Tester which was located outside the chamber via a small signalling antenna.
2) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
3) A substitution procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a 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 ANSI C63.26-2015 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone,

power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the output terminals when this test is made shall be stated.
§27.50 Power and antenna height limits.
(d) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands:
(2) Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to a peak EIRP of 1 watt. Fixed stations operating in this band are limited to a maximum antenna height of 10 meters above ground, and mobile and portable stations must employ a means for limiting power to the minimum necessary for successful communications.

Emission and Occupied Bandwidth

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1049

Test Description

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

Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

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

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

Spurious emissions at antenna terminals

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 log10(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.

Field strength of spurious radiation

Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1053

Test Description

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

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.
(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:
(2) All equipment operating on frequencies higher than 25 MHz.

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.
(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.
(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 27.53 Emission limits

(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 log10(P) dB.
Remark of the test laboratory: This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in a distance of 3 m.
(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.
(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.
(3) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

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

Frequency stability

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°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.

§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:

+/- 2.5 ppm = 4350 Hz for channel 1450, frequency 1740.0 MHz
+/- 2.5 ppm = 4331 Hz for channel 1412, frequency 1732.4 MHz

Subtests HSDPA

Sub-test	βc	βd	βd (SF)	βc/βd	βHS (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

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

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

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

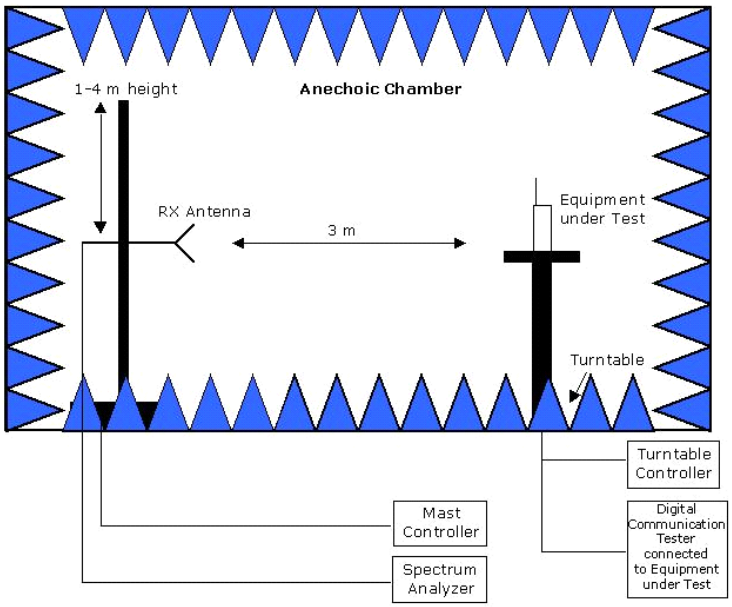
Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

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

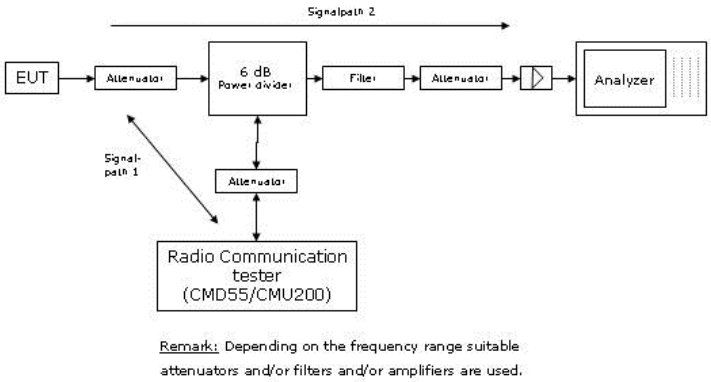
Subtest	Max UL Data Rate (kb/s)	βc/βd	βhs	βed	CM
1	242.1	11/15	22/15	1309/225	1
2	161.3	6/15	12/15	94/75	3
3	524.7	15/9	30/15	47/15	2
4	197.6	2/15	4/15	56/75	3
5	299.6	15/15	30/15	134/15	1

Setup Drawings

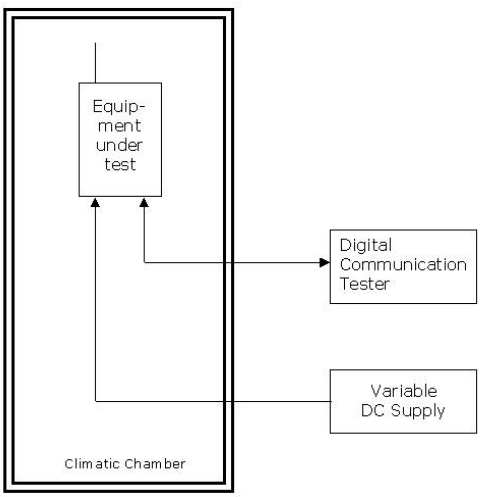


Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Principle set-up for radiated measurements



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:	5, 2014	1, 2013	3, 2013	6, 2018	3, 2016	3, 2016
RF 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
Spurious 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 spurious 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.

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