InterLab®

Final Report on

LARA-R203 LTE Single Mode
FCC ID: XPY1DIQN3NN
IC : 8595A-1DIQN3NN

according to FCC Part 24, Subpart E and Part 27, Subpart C

Report Reference:	MDE_UBLOX_1712_FCCb_rev1
Date:	July 29, 2017

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:	2017/07/29
Date of first test:	2017/05/03
Date of last test:	2017/06/26

1.2 Applicant Data

Company Name: u-blox AG

Street:	Zürcherstrasse 68, CH-8800 Thalwil
Country:	Switzerland

Contact Person: Mr. Giulio Comar

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

1.3 Test Laboratory Data

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

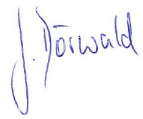
7 layers DE

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

Laboratory Details

Lab ID	*Identification*	*Responsible*	*Accreditation Info*
Lab 1	Radiated Emissions	Mr. Marco Kullik Mr. Jens Dörwald	DAkkS-Registration no. D-PL-12140-01-00 ISEDC OATS registration number 3699A-1 FCC accreditation registration number 929146
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 accreditation registration number 929146

1.4 Signature of the Testing Responsible



JENS DÖRWALD
2017.08.02
15:54:18 +02'00'

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

1.5 Signature of the Accreditation Responsible

MARCO KULLIK
2017.08.03
15:04:52 +02'00'

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: LARA-R203

Type / Model / Family:	LARA-R203 LTE Single Mode FCC ID: XPY1DIQN3NN IC : 8595A-1DIQN3NN
Product Category:	Module

Manufacturer:

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

Parameter List:

Parameter name	*Value*
AC Power Supply	120V / 60Hz (V)
DC Power Supply	12 (V)
highest channel	eFDD12 (1.4 MHz) -> CH 23173 -> 715.3 MHz, eFDD4 (1.4 MHz) -> CH 20393 -> 1754.3 MHz, eFDD2 (1.4 MHz) -> CH 19193 -> 1909.3 MHz
lowest channel	eFDD12 (1.4 MHz) -> CH 23017 -> 699.7 MHz, eFDD4 (1.4 MHz) -> CH19957 -> 1710.7 MHz, eFDD2 (1.4 MHz) -> CH 18607 -> 1850.7 MHz
mid channel	eFDD12 (1.4 MHz) -> CH 23095 -> 707.5 MHz, eFDD4 (1.4 MHz) -> CH 20175 -> 1732.5 MHz, eFDD2 (1.4 MHz) -> CH 18900 -> 1880 MHz

2.2 Detailed Description of OUT Samples

Sample : hc02

OUT Identifier	LARA-R203		
Sample Description	Protocol Sample		
Serial No.	356935080013649		
HW Status	2730A1		
SW Status	30.33		
Low Voltage	3.3 V	*Low Temp.*	-20 °C
High Voltage	4.4 V	*High Temp.*	+55 °C
Nominal Voltage	3.8 V	*Normal Temp.*	+23 °C

Sample : hd02

OUT Identifier	LARA-R203		
Sample Description	FCC Sample		
Serial No.	356935080013409		
HW Status	2730A1		
SW Status	30.33		
Low Voltage	3.3 V	*Low Temp.*	-20 °C
High Voltage	4.4 V	*High Temp.*	+55 °C
Nominal Voltage	3.8 V	*Normal Temp.*	+23 °C

Sample : ia04

OUT Identifier	LARA-R203		
Sample Description	RF Sample		
Serial No.	356935080016147		
HW Status	2730A2		
SW Status	30.34		
Low Voltage	3.3 V	*Low Temp.*	-20 °C
High Voltage	4.4 V	*High Temp.*	+55 °C
Nominal Voltage	3.8 V	*Normal Temp.*	+23 °C

2.3 OUT Features

Features for OUT: LARA-R203

Designation	*Description*	*Allowed Values*	*Supported Value(s)*
Features for scope: FCC_v2			
Eant	removable antenna supplied and type tested with the radio equipment, designed as an indispensable part of the equipment		
eFDD2			
eFDD4			
eFDD12			
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 AE01	EVB-WL3		NO_EVK_CS_191A00		Evaluation test board
AE AE02	UUX324-1215	G05-0122268			AC/DC converter

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_HC02	**(HC02)**			
	Sample: hc02	Protocol Sample	AE AE01	Evaluation test board
			AE AE02	AC/DC converter
S01_HD02	**(HD02)**			
	Sample: hd02	FCC Sample	AE AE01	Evaluation test board
			AE AE02	AC/DC converter
S01_IA04	**(IA04)**			
	Sample: ia04	RF Sample	AE AE01	Evaluation test board
			AE AE02	AC/DC converter

3 Results

3.1 General

Documentation of tested devices: Available at the test laboratory.

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

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

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

Note:

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

2. This report replace report MDE_UBLOX_1712_FCCb.
   Part 27.6 revised table with re-measured and corrected peak values at page 51 as well as part 27.1 table at page 28.

3.2 List of the Applicable Body

(Bodies for Scope: FCC_v2)

Designation	*Description*
FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES	Part 24, Subpart E - Broadband PCS
FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	Part 27, Subpart C - Technical Standards

3.3 List of Test Specification

Test Specification: **FCC part 2 and 24**
Date / Version 2015/10/01 Version: 10-1-15 Edition
Title: PART 2 - GENERAL RULES AND REGULATIONS
PART 24 - PERSONAL COMMUNICATIONS SERVICES

Applicable Errata	*Activate Date*	*Comment*
ANSI C63.4-2003	04/1/30	

Test Specification: **FCC part 2 and 27**
Version 10-1-13 Edition
Title: PART 2 - GENERAL RULES AND REGULATIONS
PART 27 - MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

Applicable Errata	*Activate Date*	*Comment*
ANSI C63.4-2003	04/1/30	

3.4 Summary

Test Case Identifier / Name Test (condition)	Result	Date of Test	Lab Ref.	Setup
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	2017/06/09	Lab 2	S01_IA04
24.2 Frequency stability §2.1055, §24.235				
24.2; Frequency stability Summary §2.1055, 24.235	Passed	2017/06/09	Lab 2	S01_IA04
24.3 Spurious emissions at antenna terminals §2.1051, §24.238				
24.3; Spurious emissions at antenna terminals Summary §2.1051, §24.238	Passed	2017/06/26	Lab 2	S01_IA04
24.4 Field strength of spurious radiation §2.1053, §24.238				
24.4; Field strength of spurious radiation Summary §2.1053, §24.238	Passed	2017/06/25	Lab 1	S01_IA04
24.5 Emission and Occupied Bandwidth §2.1049, §24.238				
24.5; Emission and Occupied Bandwidth Summary §2.1049, §24.238	Passed	2017/06/09	Lab 2	S01_IA04
24.6 Band edge compliance §2.1053, §24.238				
24.6; Band edge compliance summary §2.1053, §24.238	Passed	2017/06/09	Lab 2	S01_IA04
24.7 Peak-to-Average ratio §2.1046, §24.232				
24.7; Peak-to-Average Ratio Summary §2.1046, §24.232	Passed	2017/06/09	Lab 2	S01_IA04
Test Specification: FCC part 2 and 27				
27.1 RF Power Output §2.1046, §27.250				
27.1; RF Power Output Summary §2.1046, §27.250	Passed	2017/06/09	Lab 2	S01_IA04
27.2 Frequency stability §2.1055, §27.54				
27.2; Frequency stability Summary §2.1055, §27.54	Passed	2017/05/24	Lab 2	S01_HD02
27.3 Spurious emissions at antenna terminals §2.1051, §27.53				
27.3; Spurious emissions at antenna terminals Summary §2.1051, §27.53	Passed	2017/06/26	Lab 2	S01_HD02
27.4 Field strength of spurious radiation §2.1053, §27.53				
27.4; Field strength of spurious radiation Summary §2.1053, §27.53	Passed	2017/05/03	Lab 1	S01_HC02
27.5 Emission and Occupied Bandwidth §2.1049				
27.5; Emission and Occupied Bandwidth Summary §2.1049	Passed	2017/06/09	Lab 2	S01_HD02
27.6 Band edge compliance §2.1053, §27.53				
27.6; Band edge compliance summary §2.1053, §27.53	Passed	2017/06/09	Lab 2	S01_HD02
27.7 Peak-to-Average ratio §2.1046, §27.50				
27.7; Peak-to-Average Ratio Summary §2.1046, §27.50	Passed	2017/05/24	Lab 2	S01_HD02
27.7; Frequency Band = eFDD4, Mode = QPSK 1.4MHz, Channel = 20393, Frequency = 1754.3MHz, Method = conducted	Passed	2017/05/24	Lab 2	S01_HD02

3.5 Detailed Results

3.5.1 24.1 RF Power Output §2.1046, §24.232

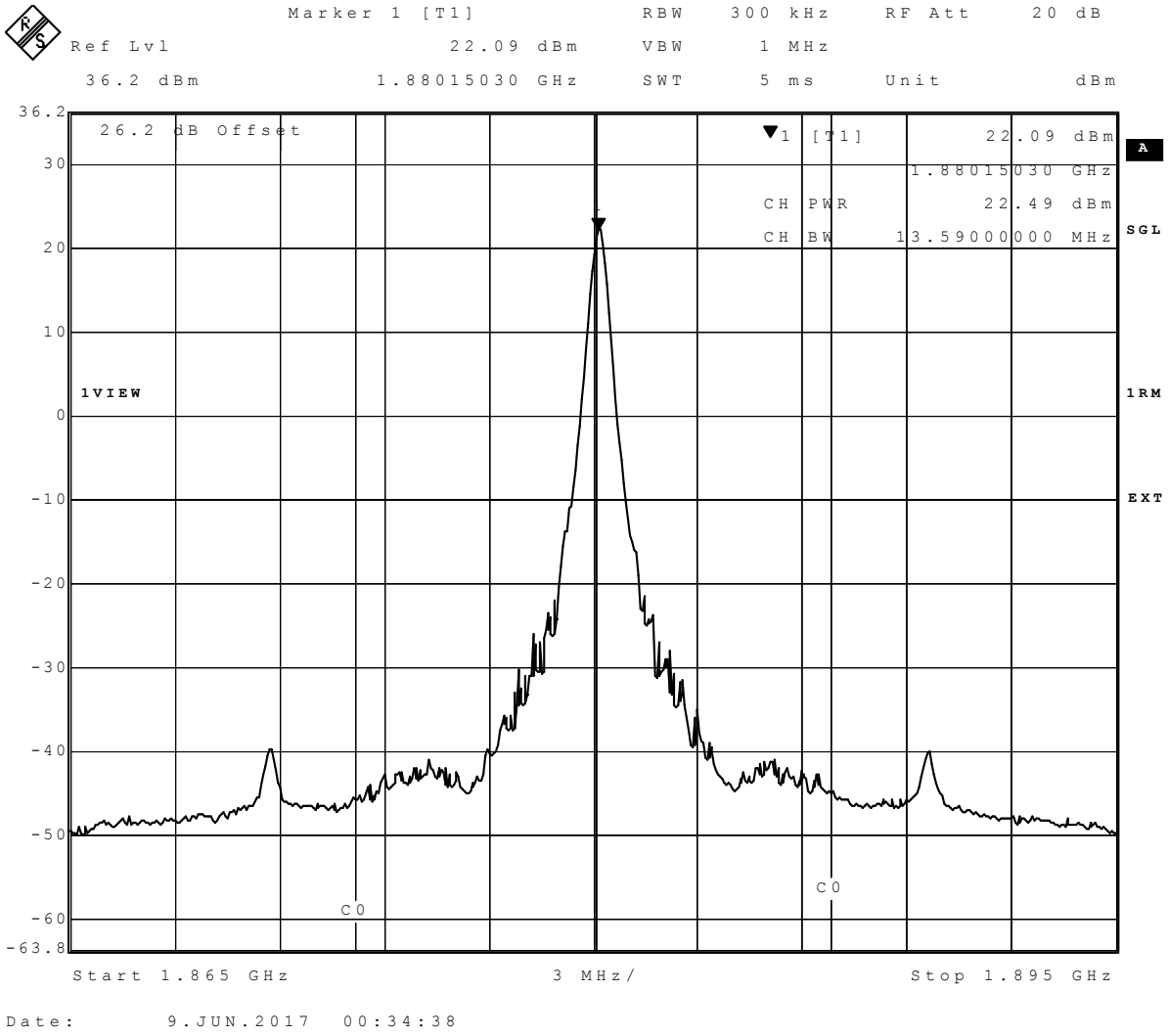
Test: 24.1; RF Power Output Summary §2.1046, §24.232

Result:	Passed
Setup No.:	S01_IA04
Date of Test:	2017/06/09 16:23
Body:	FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 24

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	RMS Cond. Power [dBm]	FCC / IC EIRP Limit [W]	Maximum Antenna Gain [dBi]
eFDD 2 QPSK	low	1	1.4	17.38	2	15.62
eFDD 2 QPSK	low	3	1.4	21.05	2	11.95
eFDD 2 QPSK	low	6	1.4	19.91	2	13.09
eFDD 2 QPSK	mid	1	1.4	21.58	2	11.42
eFDD 2 QPSK	mid	3	1.4	21.13	2	11.87
eFDD 2 QPSK	mid	6	1.4	20.22	2	12.78
eFDD 2 QPSK	high	1	1.4	21.47	2	11.53
eFDD 2 QPSK	high	3	1.4	21.04	2	11.96
eFDD 2 QPSK	high	6	1.4	19.88	2	13.12
eFDD 2 16QAM	low	1	1.4	20.28	2	12.72
eFDD 2 16QAM	low	6	1.4	18.75	2	14.25
eFDD 2 16QAM	mid	1	1.4	20.63	2	12.37
eFDD 2 16QAM	mid	6	1.4	19.06	2	13.94
eFDD 2 16QAM	high	1	1.4	20.4	2	12.6
eFDD 2 16QAM	high	6	1.4	18.71	2	14.29
eFDD 2 QPSK	low	1	3	21.68	2	11.32
eFDD 2 QPSK	low	15	3	20.37	2	12.63
eFDD 2 QPSK	mid	1	3	22.09	2	10.91
eFDD 2 QPSK	mid	15	3	20.72	2	12.28
eFDD 2 QPSK	high	1	3	21.91	2	11.09
eFDD 2 QPSK	high	15	3	20.37	2	12.63
eFDD 2 16QAM	low	1	3	20.76	2	12.24
eFDD 2 16QAM	low	15	3	19.29	2	13.71
eFDD 2 16QAM	mid	1	3	21.08	2	11.92
eFDD 2 16QAM	mid	15	3	19.59	2	13.41
eFDD 2 16QAM	high	1	3	20.93	2	12.07
eFDD 2 16QAM	high	15	3	19.3	2	13.7
eFDD 2 QPSK	low	1	5	21.89	2	11.11
eFDD 2 QPSK	low	12	5	20.43	2	12.57
eFDD 2 QPSK	low	25	5	20.34	2	12.66
eFDD 2 QPSK	mid	1	5	22.22	2	10.78
eFDD 2 QPSK	mid	12	5	20.8	2	12.2
eFDD 2 QPSK	mid	25	5	20.71	2	12.29
eFDD 2 QPSK	high	1	5	21.97	2	11.03
eFDD 2 QPSK	high	12	5	20.45	2	12.55
eFDD 2 QPSK	high	25	5	20.4	2	12.6
eFDD 2 16QAM	low	1	5	20.77	2	12.23
eFDD 2 16QAM	low	25	5	19.25	2	13.75
eFDD 2 16QAM	mid	1	5	21.22	2	11.78
eFDD 2 16QAM	mid	25	5	19.47	2	13.53
eFDD 2 16QAM	high	1	5	21.14	2	11.86
eFDD 2 16QAM	high	25	5	19.37	2	13.63

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	RMS Cond. Power [dBm]	FCC / IC EIRP Limit [W]	Maximum Antenna Gain [dBi]
eFDD 2 QPSK	low	1	10	22.17	2	10.83
eFDD 2 QPSK	low	50	10	20.86	2	12.14
eFDD 2 QPSK	mid	1	10	22.45	2	10.55
eFDD 2 QPSK	mid	50	10	21.26	2	11.74
eFDD 2 QPSK	high	1	10	22.17	2	10.83
eFDD 2 QPSK	high	50	10	20.81	2	12.19
eFDD 2 16QAM	low	1	10	21.2	2	11.8
eFDD 2 16QAM	low	50	10	19.75	2	13.25
eFDD 2 16QAM	mid	1	10	21.45	2	11.55
eFDD 2 16QAM	mid	50	10	20.07	2	12.93
eFDD 2 16QAM	high	1	10	21	2	12
eFDD 2 16QAM	high	50	10	19.83	2	13.17
eFDD 2 QPSK	low	1	15	22.16	2	10.84
eFDD 2 QPSK	low	36	15	21.22	2	11.78
eFDD 2 QPSK	low	75	15	21.03	2	11.97
eFDD 2 QPSK	mid	1	15	22.49	2	10.51
eFDD 2 QPSK	mid	36	15	21.53	2	11.47
eFDD 2 QPSK	mid	75	15	21.38	2	11.62
eFDD 2 QPSK	high	1	15	22.19	2	10.81
eFDD 2 QPSK	high	36	15	21.18	2	11.82
eFDD 2 QPSK	high	75	15	21.12	2	11.88
eFDD 2 16QAM	low	1	15	21.22	2	11.78
eFDD 2 16QAM	low	75	15	19.94	2	13.06
eFDD 2 16QAM	mid	1	15	21.51	2	11.49
eFDD 2 16QAM	mid	75	15	20.21	2	12.79
eFDD 2 16QAM	high	1	15	21.22	2	11.78
eFDD 2 16QAM	high	75	15	19.9	2	13.1
eFDD 2 QPSK	low	1	20	22.15	2	10.85
eFDD 2 QPSK	low	100	20	21.14	2	11.86
eFDD 2 QPSK	mid	1	20	22.38	2	10.62
eFDD 2 QPSK	mid	100	20	21.38	2	11.62
eFDD 2 QPSK	high	1	20	22.05	2	10.95
eFDD 2 QPSK	high	100	20	21.12	2	11.88
eFDD 2 16QAM	low	1	20	21.1	2	11.9
eFDD 2 16QAM	low	100	20	20.05	2	12.95
eFDD 2 16QAM	mid	1	20	21.28	2	11.72
eFDD 2 16QAM	mid	100	20	20.22	2	12.78
eFDD 2 16QAM	high	1	20	20.92	2	12.08
eFDD 2 16QAM	high	100	20	19.99	2	13.01



eFDD2 QPSK 15MHz RB1 Channel=MID

3.5.2 24.2 Frequency stability §2.1055, §24.235

Test: 24.2; Frequency stability Summary §2.1055, 24.235

Result:	Passed
Setup No.:	S01_IA04
Date of Test:	2017/06/09 16:18
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	-3	60	passed
-30	5			-77	12	passed
-30	10			-33	-32	passed
-20	0	normal	4700	-38	-74	passed
-20	5			-29	60	passed
-20	10			-45	7	passed
-10	0	normal	4700	-8	-12	passed
-10	5			-69	65	passed
-10	10			-40	-9	passed
0	0	normal	4700	-3	-50	passed
0	5			-77	63	passed
0	10			-33	-18	passed
10	0	normal	4700	-12	-40	passed
10	5			5	113	passed
10	10			-70	-74	passed
20	0	low	4700	-12	64	passed
20	5			-24	58	passed
20	10			-18	-42	passed
20	0	normal	4700	-14	121	passed
20	5			-28	5	passed
20	10			-11	51	passed
20	0	high	4700	8	76	passed
20	5			-22	-74	passed
20	10			-30	-82	passed
30	0	normal	4700	-17	78	passed
30	5			-65	-11	passed
30	10			-31	12	passed
40	0	normal	4700	-45	-73	passed
40	5			-18	-105	passed
40	10			26	109	passed
50	0	normal	4700	-84	-92	passed
50	5			-19	-19	passed
50	10			-50	-18	passed

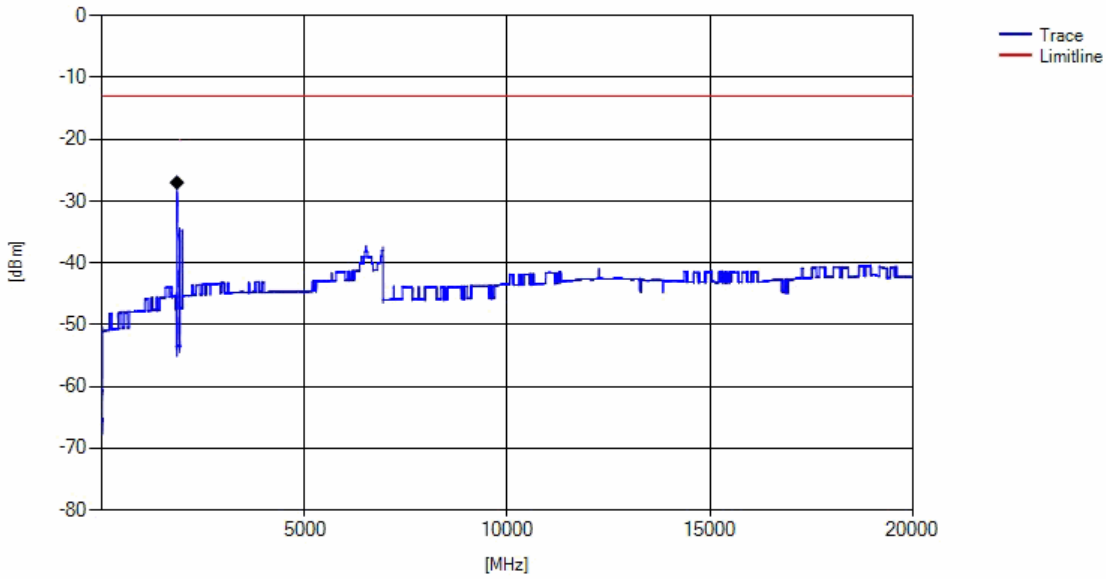
3.5.3 24.3 Spurious emissions at antenna terminals §2.1051, §24.238

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

Result:	Passed
Setup No.:	S01_IA04
Date of Test:	2017/06/26 10:27
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
eFDD 2 QPSK	low	rms	maxhold	5	1849.99	-25.56	-13	12.56
eFDD 2 QPSK	mid	rms	maxhold	-	-	-	-13	>20
eFDD 2 QPSK	high	rms	maxhold	5	1910	-25.49	-13	12.49



eFDD2 QPSK 5MHz RB1 Channel=HIGH

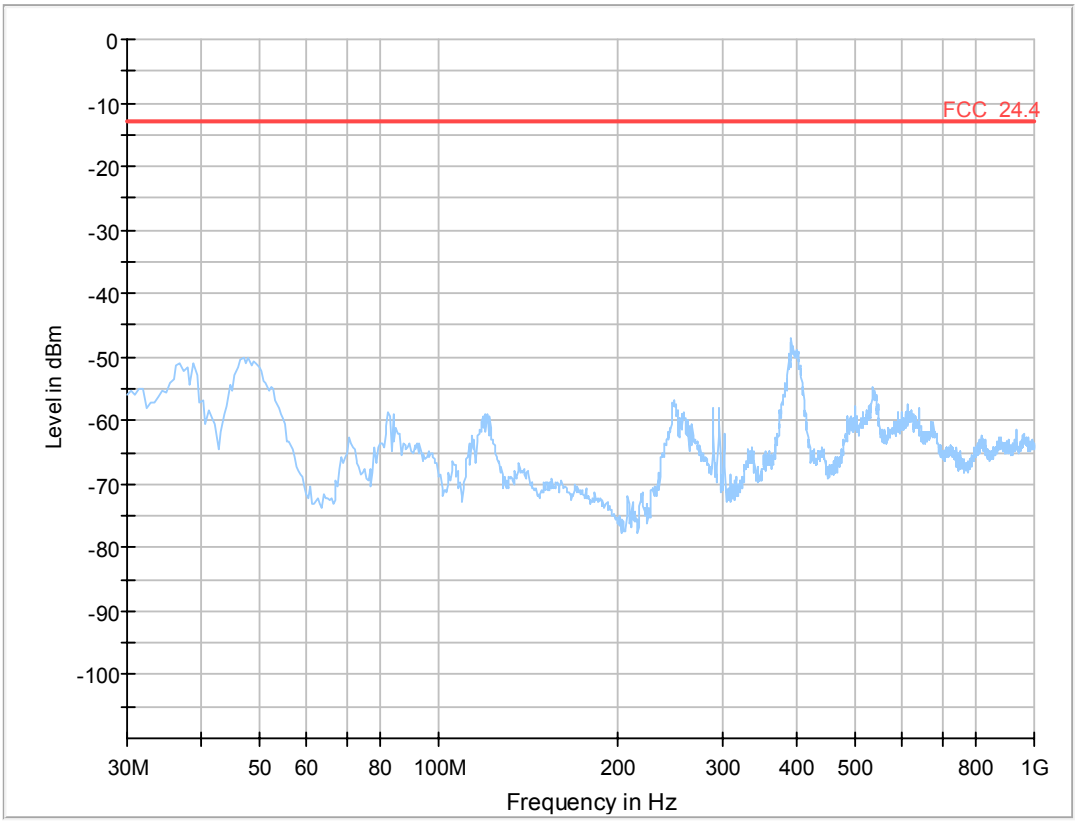
3.5.4 24.4 Field strength of spurious radiation §2.1053, §24.238

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

Result:	Passed
Setup No.:	S01_IA04
Date of Test:	2017/06/25 13:21
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
eFDD 2 QPSK	low	peak	maxhold	1000	1849	-18.94	-13	5.94
eFDD 2 QPSK	mid	rms	maxhold	-	-	-	-13	>20
eFDD 2 QPSK	high	peak	maxhold	1000	1911	4.62	-13	-17.62
eFDD 2 QPSK	high	rms	maxhold	5	1910	-27.51	-23	4.51



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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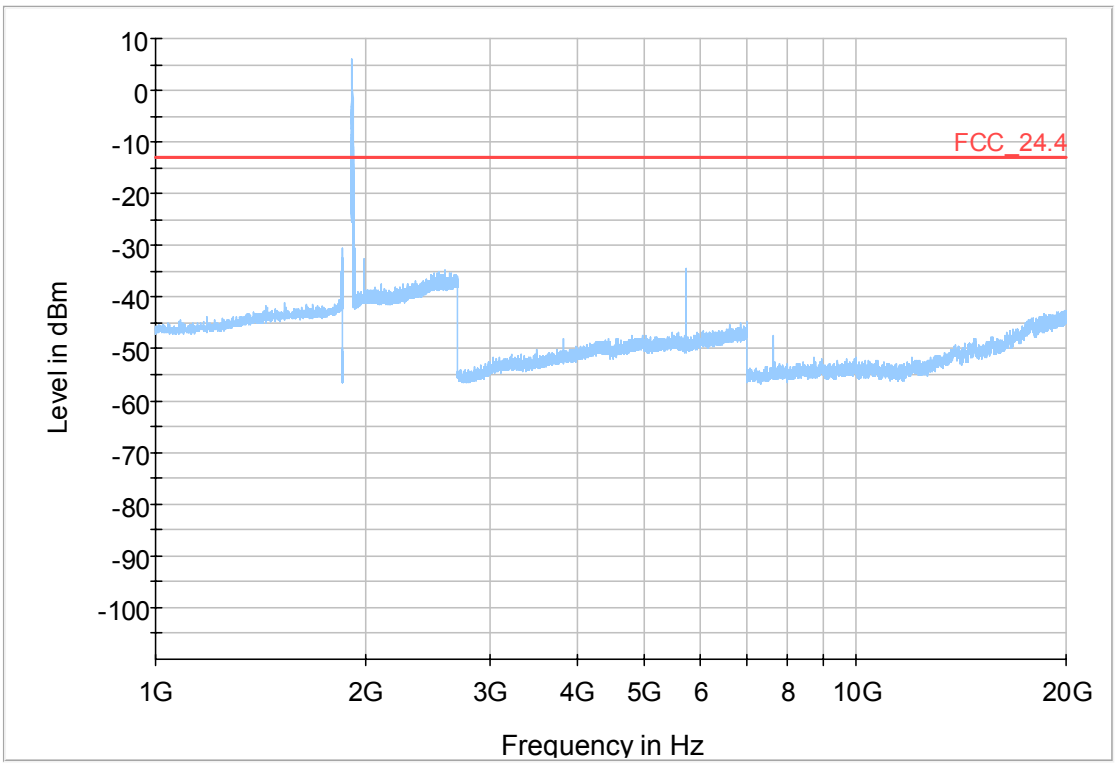
30 MHz - 1000 MHz: eFDD2 QPSK Channel = HIGH



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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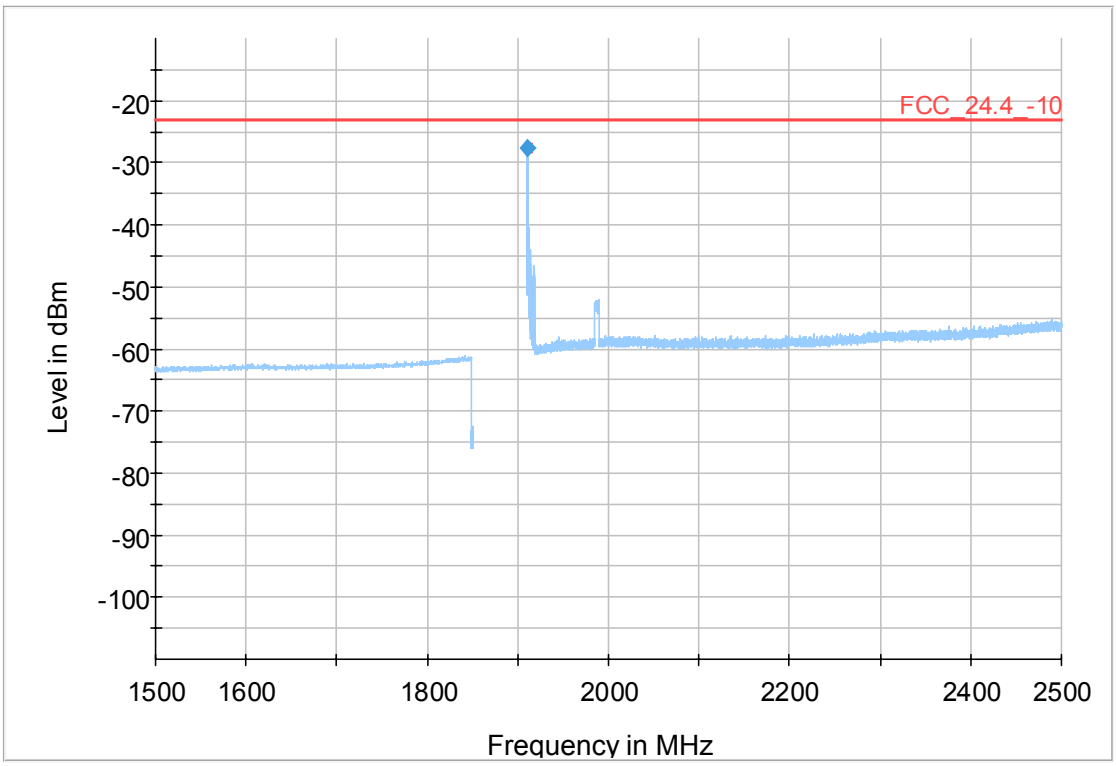
1 GHz - 20 GHz (pre-measurement with peak detector):
eFDD2 QPSK Channel = HIGH



Critical_Freqs

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1910.000000	-27.51	-23.00	4.51	3000.0	5.000	150.0	V	45.0	90.0	-63.3

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB)
1910.000000	-27.51	-23.00	4.51	3000.0	5.000	150.0	V	45.0	90.0	-63.3

1.5 GHz - 2.5 GHz (final-measurement with rms detector):
eFDD2 QPSK Channel = HIGH

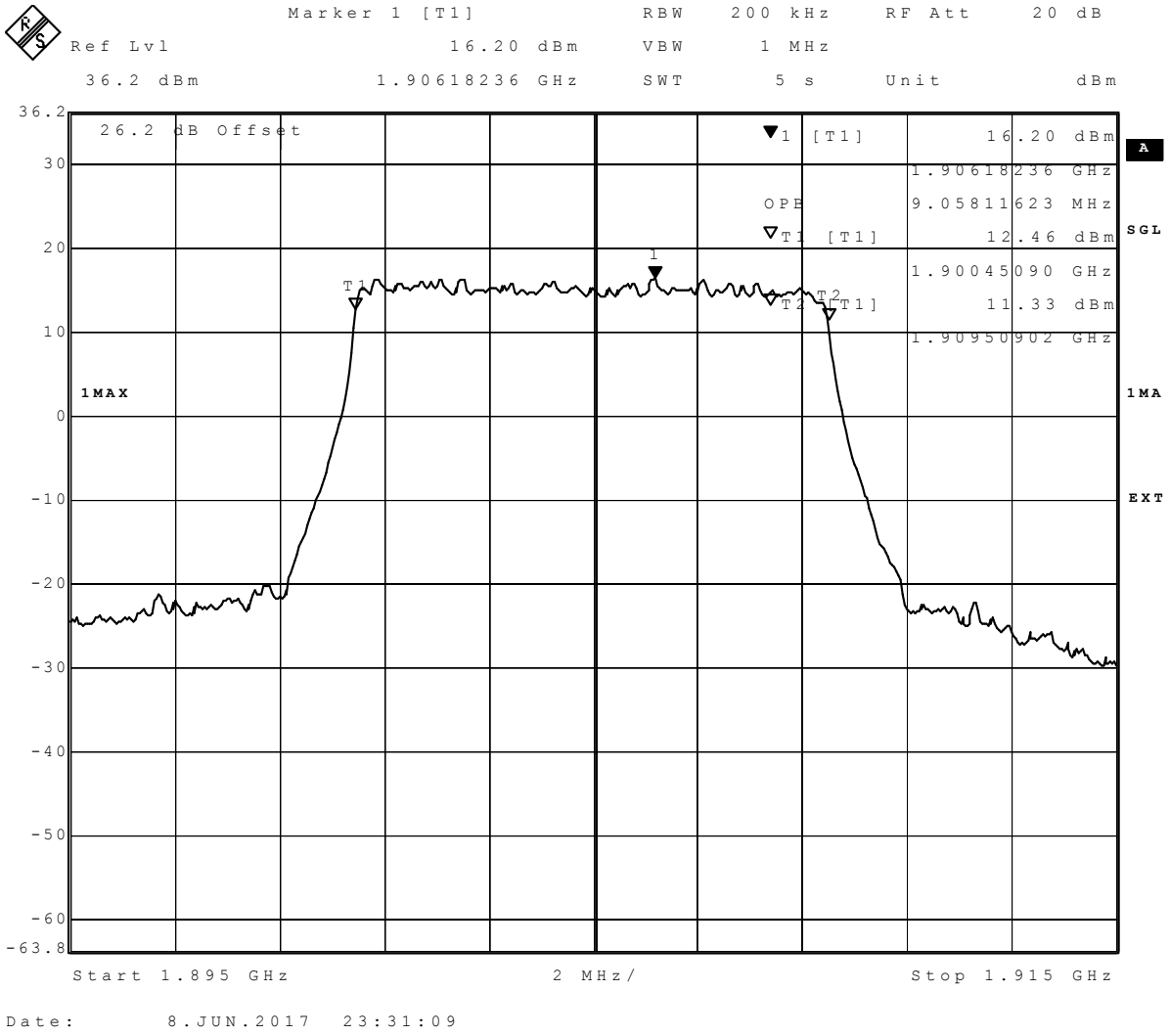
3.5.5 24.5 Emission and Occupied Bandwidth §2.1049, §24.238

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

Result:	Passed
Setup No.:	S01_IA04
Date of Test:	2017/06/09 11:10
Body:	FCC47CFRChIPART24PERSONAL COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 24

Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	99 % BW [kHz]
eFDD 2 QPSK	low	6	1.4	1118.24
eFDD 2 QPSK	mid	6	1.4	1118.24
eFDD 2 QPSK	high	6	1.4	1118.24
eFDD 2 16QAM	low	6	1.4	1106.21
eFDD 2 16QAM	mid	6	1.4	1130.26
eFDD 2 16QAM	high	6	1.4	1118.24
eFDD 2 QPSK	low	15	3	2753.51
eFDD 2 QPSK	mid	15	3	2765.53
eFDD 2 QPSK	high	15	3	2765.53
eFDD 2 16QAM	low	15	3	2765.53
eFDD 2 16QAM	mid	15	3	2765.53
eFDD 2 16QAM	high	15	3	2753.51
eFDD 2 QPSK	low	25	5	4529.06
eFDD 2 QPSK	mid	25	5	4529.06
eFDD 2 QPSK	high	25	5	4529.06
eFDD 2 16QAM	low	25	5	4529.06
eFDD 2 16QAM	mid	25	5	4549.1
eFDD 2 16QAM	high	25	5	4549.1
eFDD 2 QPSK	low	50	10	9018.04
eFDD 2 QPSK	mid	50	10	9018.04
eFDD 2 QPSK	high	50	10	9058.12
eFDD 2 16QAM	low	50	10	9058.12
eFDD 2 16QAM	mid	50	10	9058.12
eFDD 2 16QAM	high	50	10	9058.12
eFDD 2 QPSK	low	75	15	13527.1
eFDD 2 QPSK	mid	75	15	13587.2
eFDD 2 QPSK	high	75	15	13707.4
eFDD 2 16QAM	low	75	15	13587.2
eFDD 2 16QAM	mid	75	15	13647.3
eFDD 2 16QAM	high	75	15	13647.3
eFDD 2 QPSK	low	100	20	18036.1
eFDD 2 QPSK	mid	100	20	18276.6
eFDD 2 QPSK	high	100	20	18276.6
eFDD 2 16QAM	low	100	20	18116.2
eFDD 2 16QAM	mid	100	20	18196.4
eFDD 2 16QAM	high	100	20	18196.4



eFDD2 QPSK 10MHz RB50 Channel=HIGH

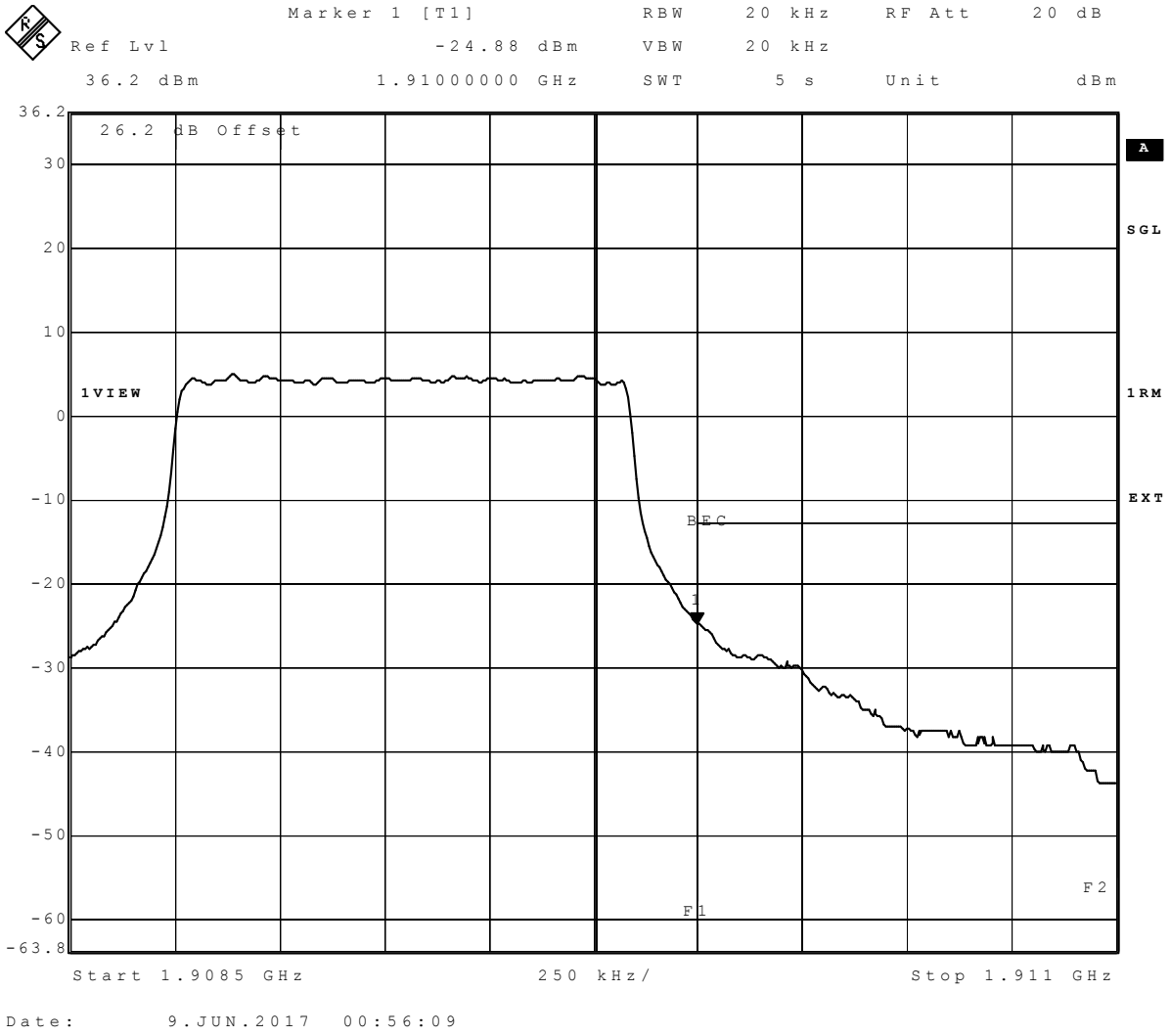
3.5.6 24.6 Band edge compliance §2.1053, §24.238

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

Result:	Passed
Setup No.:	S01_IA04
Date of Test:	2017/06/09 12:29
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]
eFDD 2 QPSK	low	1.4	6	-15.7	-26.7	-25.05	-13	12.05
eFDD 2 QPSK	high	1.4	6	-16.03	-26.5	-24.88	-13	11.88
eFDD 2 16QAM	low	1.4	6	-16.08	-28.48	-26.9	-13	13.9
eFDD 2 16QAM	high	1.4	6	-16.73	-28	-26.5	-13	13.5
eFDD 2 QPSK	low	3	15	-15.67	-29.82	-27.54	-13	14.54
eFDD 2 QPSK	high	3	15	-16.5	-30.12	-27.77	-13	14.77
eFDD 2 16QAM	low	3	15	-16.92	-31.41	-28.74	-13	15.74
eFDD 2 16QAM	high	3	15	-17.37	-31.07	-29	-13	16
eFDD 2 QPSK	low	5	25	-13.8	-31.76	-28.74	-13	15.74
eFDD 2 QPSK	high	5	25	-14.62	-31.76	-29.26	-13	16.26
eFDD 2 16QAM	low	5	25	-16.88	-34.26	-30.74	-13	17.74
eFDD 2 16QAM	high	5	25	-15.05	-32.92	-30.12	-13	17.12
eFDD 2 QPSK	low	10	50	-13.61	-34.26	-30.12	-13	17.12
eFDD 2 QPSK	high	10	50	-14.34	-33.79	-31.07	-13	18.07
eFDD 2 16QAM	low	10	50	-17.09	-36.44	-32.52	-13	19.52
eFDD 2 16QAM	high	10	50	-14.52	-34.76	-32.13	-13	19.13
eFDD 2 QPSK	low	15	75	-9.29	-33.79	-29.82	-13	16.82
eFDD 2 QPSK	high	15	75	-10.45	-32.92	-29	-13	16
eFDD 2 16QAM	low	15	75	-12.74	-35.84	-31.07	-13	18.07
eFDD 2 16QAM	high	15	75	-11.13	-33.34	-30.12	-13	17.12
eFDD 2 QPSK	low	20	100	-15.5	-36.44	-32.52	-13	19.52
eFDD 2 QPSK	high	20	100	-14.24	-33.79	-31.41	-13	18.41
eFDD 2 16QAM	low	20	100	-16.26	-38.54	-34.76	-13	21.76
eFDD 2 16QAM	high	20	100	-16.36	-34.76	-32.92	-13	19.92



eFDD2 QPSK 1.4MHz RB6 Channel=HIGH

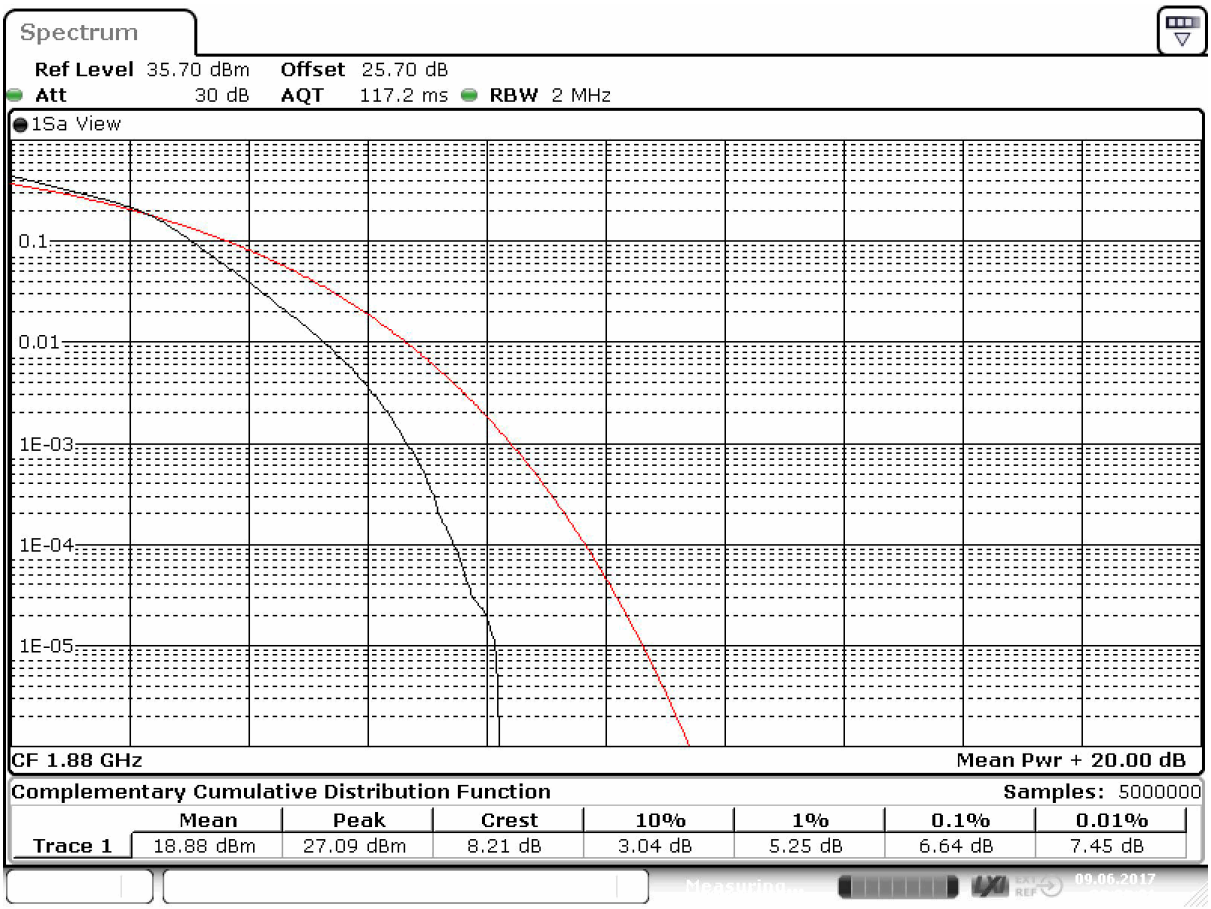
3.5.7 24.7 Peak-to-Average ratio §2.1046, §24.232

Test: 24.7; Peak-to-Average Ratio Summary §2.1046, §24.232

Result:	Passed
Setup No.:	S01_IA04
Date of Test:	2017/06/09 15:53
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]	Limit (IC) [dB]
eFDD 2 QPSK	low	6	1.4	5.39	13
eFDD 2 QPSK	mid	6	1.4	5.68	13
eFDD 2 QPSK	high	6	1.4	5.45	13
eFDD 2 16QAM	low	6	1.4	6.23	13
eFDD 2 16QAM	mid	6	1.4	6.64	13
eFDD 2 16QAM	high	6	1.4	6.38	13



Date: 9.JUN.2017 08:28:21

eFDD2 16QAM 1.4MHz RB6 Channel =MID

3.5.8 27.1 RF Power Output §2.1046, §27.250

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

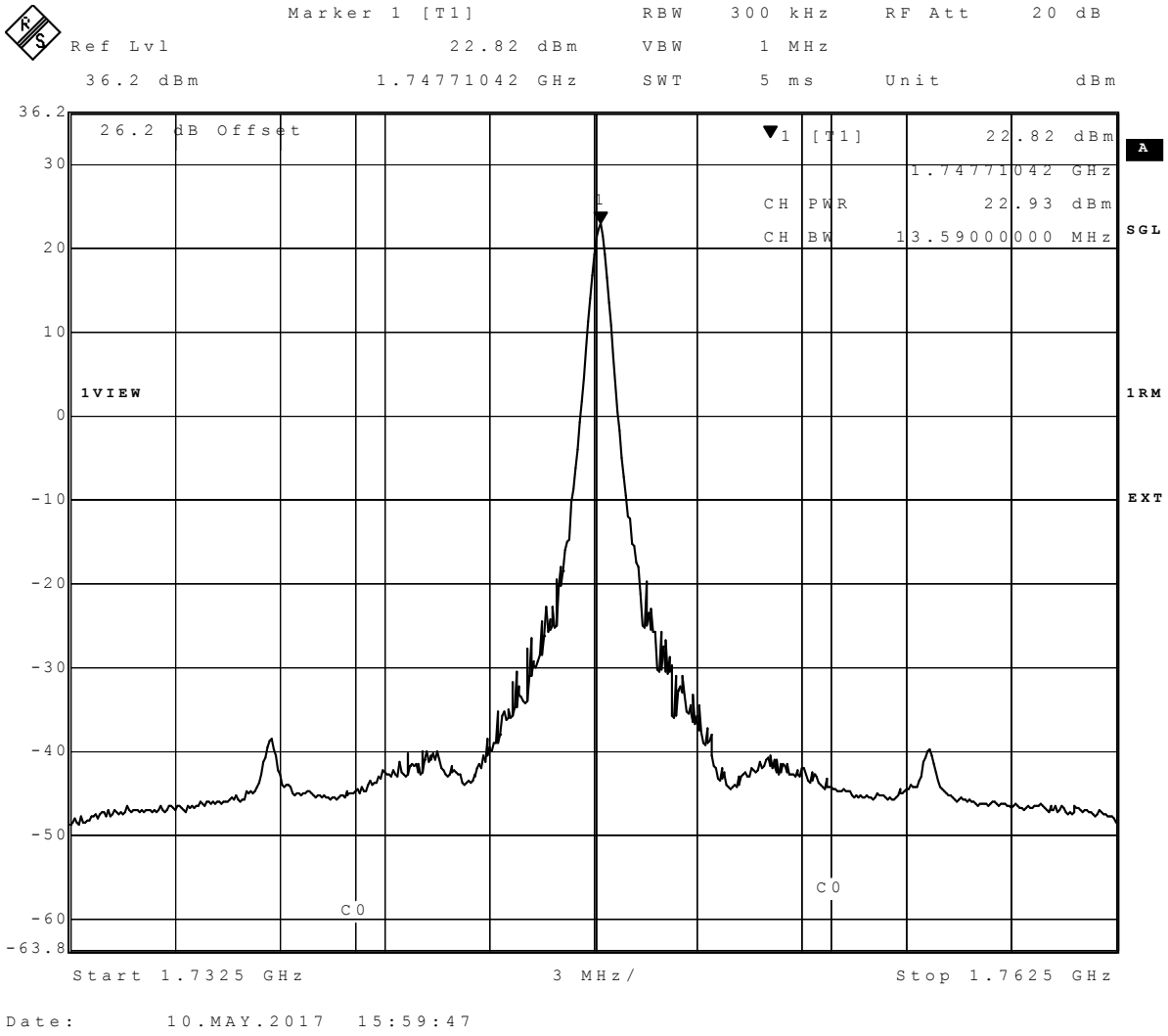
Result:	Passed
Setup No.:	S01_IA04
Date of Test:	2017/06/09 16:49
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

Detailed Results:

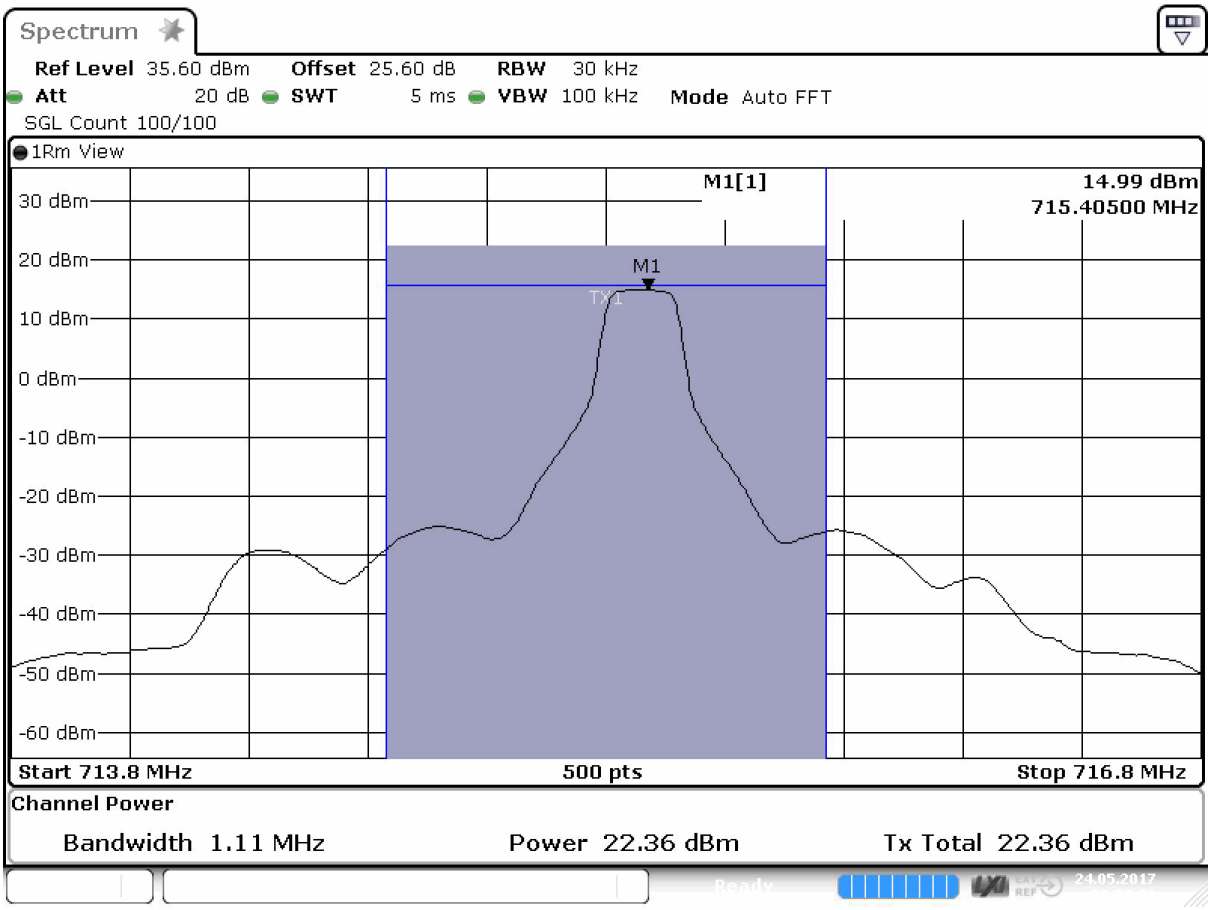
Radio Technology	Channel	Ressource Blocks	BW [MHz]	RMS Cond. Power [dBm]	FCC Limit	IC EIRP Limit [W]	Max. Antenna Gain FCC	Max. Antenna Gain IC [dBi]
eFDD 4 QPSK	low	1	1.4	21.89	1 W EIRP	1	8.1 dBi	8.1
eFDD 4 QPSK	low	3	1.4	21.7	1 W EIRP	1	8.3 dBi	8.3
eFDD 4 QPSK	low	6	1.4	20.61	1 W EIRP	1	9.4 dBi	9.4
eFDD 4 QPSK	mid	1	1.4	21.98	1 W EIRP	1	8.0 dBi	8.0
eFDD 4 QPSK	mid	3	1.4	21.44	1 W EIRP	1	8.6 dBi	8.6
eFDD 4 QPSK	mid	6	1.4	20.6	1 W EIRP	1	9.4 dBi	9.4
eFDD 4 QPSK	high	1	1.4	22.08	1 W EIRP	1	7.9 dBi	7.9
eFDD 4 QPSK	high	3	1.4	21.75	1 W EIRP	1	8.3 dBi	8.3
eFDD 4 QPSK	high	6	1.4	20.74	1 W EIRP	1	9.3 dBi	9.3
eFDD 4 16QAM	low	1	1.4	21.01	1 W EIRP	1	9.0 dBi	9.0
eFDD 4 16QAM	low	6	1.4	19.63	1 W EIRP	1	10.4 dBi	10.4
eFDD 4 16QAM	mid	1	1.4	20.81	1 W EIRP	1	9.2 dBi	9.2
eFDD 4 16QAM	mid	6	1.4	19.44	1 W EIRP	1	10.6 dBi	10.6
eFDD 4 16QAM	high	1	1.4	21.37	1 W EIRP	1	8.6 dBi	8.6
eFDD 4 16QAM	high	6	1.4	19.84	1 W EIRP	1	10.2 dBi	10.2
eFDD 4 QPSK	low	1	3	22.26	1 W EIRP	1	7.7 dBi	7.7
eFDD 4 QPSK	low	15	3	19.94	1 W EIRP	1	10.1 dBi	10.1
eFDD 4 QPSK	mid	1	3	22.21	1 W EIRP	1	7.8 dBi	7.8
eFDD 4 QPSK	mid	15	3	19.82	1 W EIRP	1	10.2 dBi	10.2
eFDD 4 QPSK	high	1	3	22.55	1 W EIRP	1	7.5 dBi	7.5
eFDD 4 QPSK	high	15	3	20.09	1 W EIRP	1	9.9 dBi	9.9
eFDD 4 16QAM	low	1	3	21.4	1 W EIRP	1	8.6 dBi	8.6
eFDD 4 16QAM	low	15	3	18.94	1 W EIRP	1	11.1 dBi	11.1
eFDD 4 16QAM	mid	1	3	21.3	1 W EIRP	1	8.7 dBi	8.7
eFDD 4 16QAM	mid	15	3	18.79	1 W EIRP	1	11.2 dBi	11.2
eFDD 4 16QAM	high	1	3	21.45	1 W EIRP	1	8.6 dBi	8.6
eFDD 4 16QAM	high	15	3	19.1	1 W EIRP	1	10.9 dBi	10.9
eFDD 4 QPSK	low	1	5	22.41	1 W EIRP	1	7.6 dBi	7.6
eFDD 4 QPSK	low	12	5	19.97	1 W EIRP	1	10.0 dBi	10.0
eFDD 4 QPSK	low	25	5	19.95	1 W EIRP	1	10.1 dBi	10.1
eFDD 4 QPSK	mid	1	5	22.24	1 W EIRP	1	7.8 dBi	7.8
eFDD 4 QPSK	mid	12	5	19.77	1 W EIRP	1	10.2 dBi	10.2
eFDD 4 QPSK	mid	25	5	19.86	1 W EIRP	1	10.1 dBi	10.1
eFDD 4 QPSK	high	1	5	22.51	1 W EIRP	1	7.5 dBi	7.5
eFDD 4 QPSK	high	12	5	20.16	1 W EIRP	1	9.8 dBi	9.8
eFDD 4 QPSK	high	25	5	20.07	1 W EIRP	1	9.9 dBi	9.9
eFDD 4 16QAM	low	1	5	21.41	1 W EIRP	1	8.6 dBi	8.6
eFDD 4 16QAM	low	25	5	18.91	1 W EIRP	1	11.1 dBi	11.1
eFDD 4 16QAM	mid	1	5	21.33	1 W EIRP	1	8.7 dBi	8.7
eFDD 4 16QAM	mid	25	5	18.81	1 W EIRP	1	11.2 dBi	11.2
eFDD 4 16QAM	high	1	5	21.77	1 W EIRP	1	8.2 dBi	8.2
eFDD 4 16QAM	high	25	5	19.09	1 W EIRP	1	10.9 dBi	10.9
eFDD 4 QPSK	low	1	10	22.53	1 W EIRP	1	7.5 dBi	7.5
eFDD 4 QPSK	low	50	10	20.36	1 W EIRP	1	9.6 dBi	9.6
eFDD 4 QPSK	mid	1	10	22.43	1 W EIRP	1	7.6 dBi	7.6

Radio Technology	Channel	Ressource Blocks	BW [MHz]	RMS Cond. Power [dBm]	FCC Limit	IC EIRP Limit [W]	Max. Antenna Gain FCC	Max. Antenna Gain IC [dBi]
eFDD 4 QPSK	mid	50	10	20.2	1 W EIRP	1	9.8 dBi	9.8
eFDD 4 QPSK	high	1	10	22.72	1 W EIRP	1	7.3 dBi	7.3
eFDD 4 QPSK	high	50	10	20.55	1 W EIRP	1	9.5 dBi	9.5
eFDD 4 16QAM	low	1	10	21.58	1 W EIRP	1	8.4 dBi	8.4
eFDD 4 16QAM	low	50	10	19.28	1 W EIRP	1	10.7 dBi	10.7
eFDD 4 16QAM	mid	1	10	21.36	1 W EIRP	1	8.6 dBi	8.6
eFDD 4 16QAM	mid	50	10	19.13	1 W EIRP	1	10.9 dBi	10.9
eFDD 4 16QAM	high	1	10	21.91	1 W EIRP	1	8.1 dBi	8.1
eFDD 4 16QAM	high	50	10	19.52	1 W EIRP	1	10.5 dBi	10.5
eFDD 4 QPSK	low	1	15	22.74	1 W EIRP	1	7.3 dBi	7.3
eFDD 4 QPSK	low	36	15	20.82	1 W EIRP	1	9.2 dBi	9.2
eFDD 4 QPSK	low	75	15	20.71	1 W EIRP	1	9.3 dBi	9.3
eFDD 4 QPSK	mid	1	15	22.52	1 W EIRP	1	7.5 dBi	7.5
eFDD 4 QPSK	mid	36	15	20.68	1 W EIRP	1	9.3 dBi	9.3
eFDD 4 QPSK	mid	75	15	20.6	1 W EIRP	1	9.4 dBi	9.4
eFDD 4 QPSK	high	1	15	22.93	1 W EIRP	1	7.1 dBi	7.1
eFDD 4 QPSK	high	36	15	20.94	1 W EIRP	1	9.1 dBi	9.1
eFDD 4 QPSK	high	75	15	20.87	1 W EIRP	1	9.1 dBi	9.1
eFDD 4 16QAM	low	1	15	21.81	1 W EIRP	1	8.2 dBi	8.2
eFDD 4 16QAM	low	75	15	19.62	1 W EIRP	1	10.4 dBi	10.4
eFDD 4 16QAM	mid	1	15	21.57	1 W EIRP	1	8.4 dBi	8.4
eFDD 4 16QAM	mid	75	15	19.52	1 W EIRP	1	10.5 dBi	10.5
eFDD 4 16QAM	high	1	15	22	1 W EIRP	1	8.0 dBi	8.0
eFDD 4 16QAM	high	75	15	19.77	1 W EIRP	1	10.2 dBi	10.2
eFDD 4 QPSK	low	1	20	22.39	1 W EIRP	1	7.6 dBi	7.6
eFDD 4 QPSK	low	100	20	20.53	1 W EIRP	1	9.5 dBi	9.5
eFDD 4 QPSK	mid	1	20	22.36	1 W EIRP	1	7.6 dBi	7.6
eFDD 4 QPSK	mid	100	20	20.47	1 W EIRP	1	9.5 dBi	9.5
eFDD 4 QPSK	high	1	20	22.73	1 W EIRP	1	7.3 dBi	7.3
eFDD 4 QPSK	high	100	20	20.77	1 W EIRP	1	9.2 dBi	9.2
eFDD 4 16QAM	low	1	20	21.44	1 W EIRP	1	8.6 dBi	8.6
eFDD 4 16QAM	low	100	20	19.42	1 W EIRP	1	10.6 dBi	10.6
eFDD 4 16QAM	mid	1	20	21.37	1 W EIRP	1	8.6 dBi	8.6
eFDD 4 16QAM	mid	100	20	19.43	1 W EIRP	1	10.6 dBi	10.6
eFDD 4 16QAM	high	1	20	21.7	1 W EIRP	1	8.3 dBi	8.3
eFDD 4 16QAM	high	100	20	19.76	1 W EIRP	1	10.2 dBi	10.2
eFDD 12 QPSK	low	1	1.4	22.29	3 W ERP	5	12.5 dBd	14.7
eFDD 12 QPSK	low	3	1.4	22.33	3 W ERP	5	12.4 dBd	14.7
eFDD 12 QPSK	low	6	1.4	21.36	3 W ERP	5	13.4 dBd	15.6
eFDD 12 QPSK	mid	1	1.4	22.35	3 W ERP	5	12.4 dBd	14.6
eFDD 12 QPSK	mid	3	1.4	22.35	3 W ERP	5	12.4 dBd	14.6
eFDD 12 QPSK	mid	6	1.4	21.35	3 W ERP	5	13.4 dBd	15.6
eFDD 12 QPSK	high	1	1.4	22.36	3 W ERP	5	12.4 dBd	14.6
eFDD 12 QPSK	high	3	1.4	22.36	3 W ERP	5	12.4 dBd	14.6
eFDD 12 QPSK	high	6	1.4	21.43	3 W ERP	5	13.3 dBd	15.6

Radio Technology	Channel	Ressource Blocks	BW [MHz]	RMS Cond. Power [dBm]	FCC Limit	IC EIRP Limit [W]	Max. Antenna Gain FCC	Max. Antenna Gain IC [dBi]
eFDD 12 16QAM	low	1	1.4	21.45	3 W ERP	5	13.3 dBd	15.5
eFDD 12 16QAM	low	6	1.4	20.39	3 W ERP	5	14.4 dBd	16.6
eFDD 12 16QAM	mid	1	1.4	21.47	3 W ERP	5	13.3 dBd	15.5
eFDD 12 16QAM	mid	6	1.4	20.34	3 W ERP	5	14.4 dBd	16.7
eFDD 12 16QAM	high	1	1.4	21.55	3 W ERP	5	13.2 dBd	15.4
eFDD 12 16QAM	high	6	1.4	20.37	3 W ERP	5	14.4 dBd	16.6
eFDD 12 QPSK	low	1	3	22.36	3 W ERP	5	12.4 dBd	14.6
eFDD 12 QPSK	low	15	3	20.32	3 W ERP	5	14.5 dBd	16.7
eFDD 12 QPSK	mid	1	3	22.22	3 W ERP	5	12.6 dBd	14.8
eFDD 12 QPSK	mid	15	3	20.32	3 W ERP	5	14.5 dBd	16.7
eFDD 12 QPSK	high	1	3	22.37	3 W ERP	5	12.4 dBd	14.6
eFDD 12 QPSK	high	15	3	20.3	3 W ERP	5	14.5 dBd	16.7
eFDD 12 16QAM	low	1	3	21.44	3 W ERP	5	13.3 dBd	15.6
eFDD 12 16QAM	low	15	3	19.39	3 W ERP	5	15.4 dBd	17.6
eFDD 12 16QAM	mid	1	3	21.37	3 W ERP	5	13.4 dBd	15.6
eFDD 12 16QAM	mid	15	3	19.36	3 W ERP	5	15.4 dBd	17.6
eFDD 12 16QAM	high	1	3	21.51	3 W ERP	5	13.3 dBd	15.5
eFDD 12 16QAM	high	15	3	19.31	3 W ERP	5	15.5 dBd	17.7
eFDD 12 QPSK	low	1	5	22.27	3 W ERP	5	12.5 dBd	14.7
eFDD 12 QPSK	low	12	5	20.34	3 W ERP	5	14.4 dBd	16.7
eFDD 12 QPSK	low	25	5	20.31	3 W ERP	5	14.5 dBd	16.7
eFDD 12 QPSK	mid	1	5	22.29	3 W ERP	5	12.5 dBd	14.7
eFDD 12 QPSK	mid	12	5	20.38	3 W ERP	5	14.4 dBd	16.6
eFDD 12 QPSK	mid	25	5	20.3	3 W ERP	5	14.5 dBd	16.7
eFDD 12 QPSK	high	1	5	22.26	3 W ERP	5	12.5 dBd	14.7
eFDD 12 QPSK	high	12	5	20.16	3 W ERP	5	14.6 dBd	16.8
eFDD 12 QPSK	high	25	5	20.28	3 W ERP	5	14.5 dBd	16.7
eFDD 12 16QAM	low	1	5	21.39	3 W ERP	5	13.4 dBd	15.6
eFDD 12 16QAM	low	25	5	19.34	3 W ERP	5	15.4 dBd	17.7
eFDD 12 16QAM	mid	1	5	21.39	3 W ERP	5	13.4 dBd	15.6
eFDD 12 16QAM	mid	25	5	19.36	3 W ERP	5	15.4 dBd	17.6
eFDD 12 16QAM	high	1	5	21.56	3 W ERP	5	13.2 dBd	15.4
eFDD 12 16QAM	high	25	5	19.39	3 W ERP	5	15.4 dBd	17.6
eFDD 12 QPSK	low	1	10	22.09	3 W ERP	5	12.7 dBd	14.9
eFDD 12 QPSK	low	50	10	19.94	3 W ERP	5	14.8 dBd	17.1
eFDD 12 QPSK	mid	1	10	22.07	3 W ERP	5	12.7 dBd	14.9
eFDD 12 QPSK	mid	50	10	19.89	3 W ERP	5	14.9 dBd	17.1
eFDD 12 QPSK	high	1	10	22.07	3 W ERP	5	12.7 dBd	14.9
eFDD 12 QPSK	high	50	10	19.95	3 W ERP	5	14.8 dBd	17.0
eFDD 12 16QAM	low	1	10	21.16	3 W ERP	5	13.6 dBd	15.8
eFDD 12 16QAM	low	50	10	19	3 W ERP	5	15.8 dBd	18.0
eFDD 12 16QAM	mid	1	10	21.08	3 W ERP	5	13.7 dBd	15.9
eFDD 12 16QAM	mid	50	10	18.95	3 W ERP	5	15.8 dBd	18.0
eFDD 12 16QAM	high	1	10	21.1	3 W ERP	5	13.7 dBd	15.9
eFDD 12 16QAM	high	50	10	18.99	3 W ERP	5	15.8 dBd	18.0



eFDD4 QPSK 15MHz RB1 Channel=HIGH



Date: 24.MAY.2017 08:08:31

eFDD12 QPSK 1.4MHz RB1 Channel=HIGH

3.5.9 27.2 Frequency stability §2.1055, §27.54

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

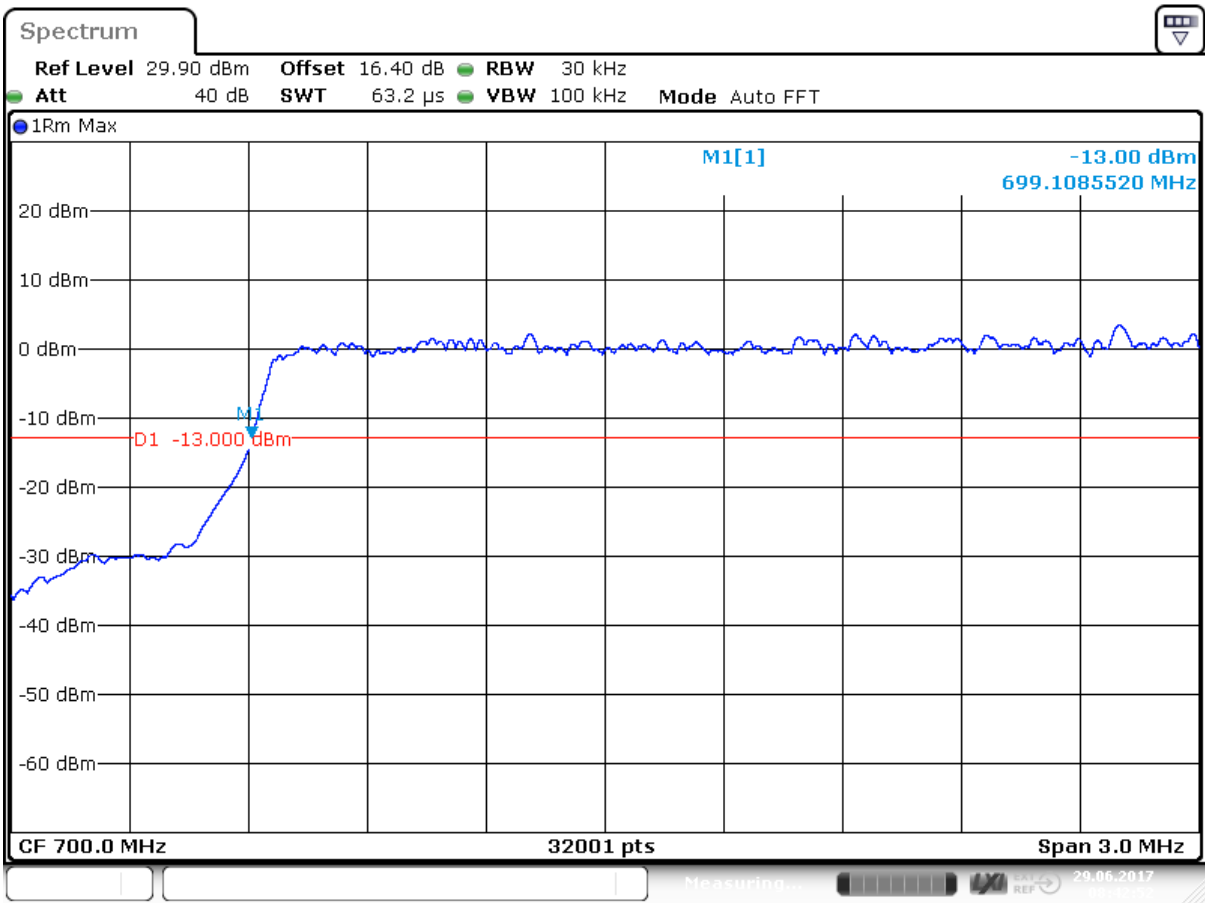
Result:	Passed
Setup No.:	S01_HD02
Date of Test:	2017/05/24 16:16
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

Detailed Results:

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	4331.25	-1.97	-10.44	passed
-30	5			-2.5	11.99	passed
-30	10			-2.34	-10.17	passed
-20	0	normal	4331.25	-1.27	-10.14	passed
-20	5			-2.52	-9.95	passed
-20	10			-2.37	-12.56	passed
-10	0	normal	4331.25	-1.9	2.15	passed
-10	5			-3.43	-7.07	passed
-10	10			-1.32	-13.52	passed
0	0	normal	4331.25	-2.85	-11.62	passed
0	5			-1.3	-10.72	passed
0	10			-1.93	-9.47	passed
10	0	normal	4331.25	-2.36	-7.45	passed
10	5			-1.83	-9.43	passed
10	10			-1.43	-10.46	passed
20	0	low	4331.25	-1.2	-0.981	passed
20	5			-2.49	-12.46	passed
20	10			-2.32	-10.49	passed
20	0	normal	4331.25	-2.85	-10.52	passed
20	5			-3	-9.54	passed
20	10			-3.81	-7.18	passed
20	0	high	4331.25	0.34	7.37	passed
20	5			-3.79	-11.64	passed
20	10			-0.21	-6.52	passed
30	0	normal	4331.25	-1.77	-8.54	passed
30	5			-1.56	-9.9	passed
30	10			-1.17	-7.18	passed
40	0	normal	4331.25	-0.51	-9.06	passed
40	5			-0.54	9.06	passed
40	10			-0.47	-9.14	passed
50	0	normal	4331.25	-2.82	-9.37	passed
50	5			-2.02	-10.34	passed
50	10			-0.8	6.67	passed

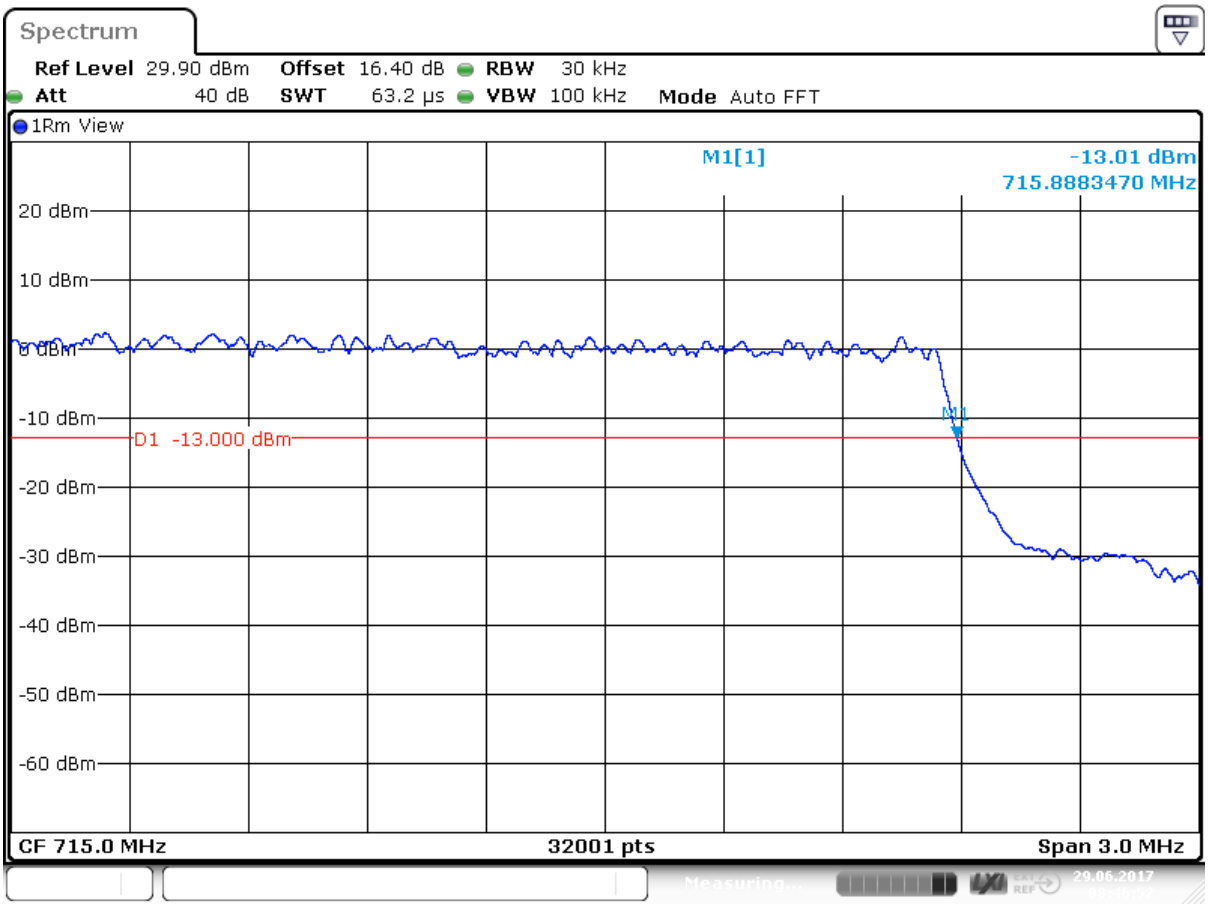
Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	1769	1.95	5.68	passed
-30	5			1.77	4.79	passed
-30	10			1.7	5.35	passed
-20	0	normal	1769	1.24	5.74	passed
-20	5			2.19	6.69	passed
-20	10			1.95	4.41	passed
-10	0	normal	1769	1.24	7.24	passed
-10	5			2.16	6.05	passed
-10	10			2.68	7.12	passed
0	0	normal	1769	2.36	5.41	passed
0	5			1.79	6.47	passed
0	10			2.16	4.56	passed
10	0	normal	1769	2.52	6.01	passed
10	5			2.45	7.61	passed
10	10			2.43	6.67	passed
20	0	low	1769	2.12	5.25	passed
20	5			2.49	6.61	passed
20	10			1.92	4.76	passed
20	0	normal	1769	1.24	5.04	passed
20	5			1.83	4.86	passed
20	10			1.47	6.78	passed
20	0	high	1769	2.69	5.02	passed
20	5			2.16	5.34	passed
20	10			1.54	5.98	passed
30	0	normal	1769	1.24	3.32	passed
30	5			2.02	5.51	passed
30	10			1.02	5.92	passed
40	0	normal	1769	2.66	7.2	passed
40	5			2.22	7.12	passed
40	10			2.2	6.04	passed
50	0	normal	1769	2.06	5.04	passed
50	5			1.85	5.62	passed
50	10			3.43	6.9	passed

LTE eFDD12						
BW (MHz) / Resource	f_L (MHz)	f_H (MHz)	Max. Frequency Error (Hz)	Resulting Freq. (MHz)	Limit (MHz)	Result
3 / 15	698.108	-	7.6	698.11	698	Passed
	-	715.888	7.6	715.89	716	Passed



Date: 29.JUN.2017 08:42:53

eFDD12 QPSK 3MHz RB15 Channel=LOW



Date: 29.JUN.2017 08:46:53

eFDD12 QPSK 3MHz RB15 Channel=HIGH

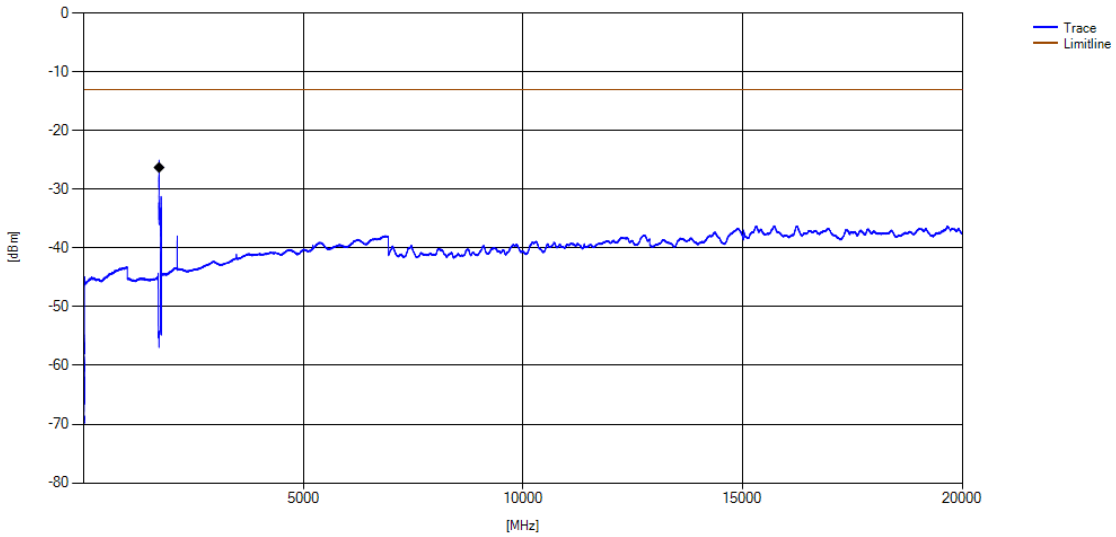
3.5.10 27.3 Spurious emissions at antenna terminals §2.1051, §27.53

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

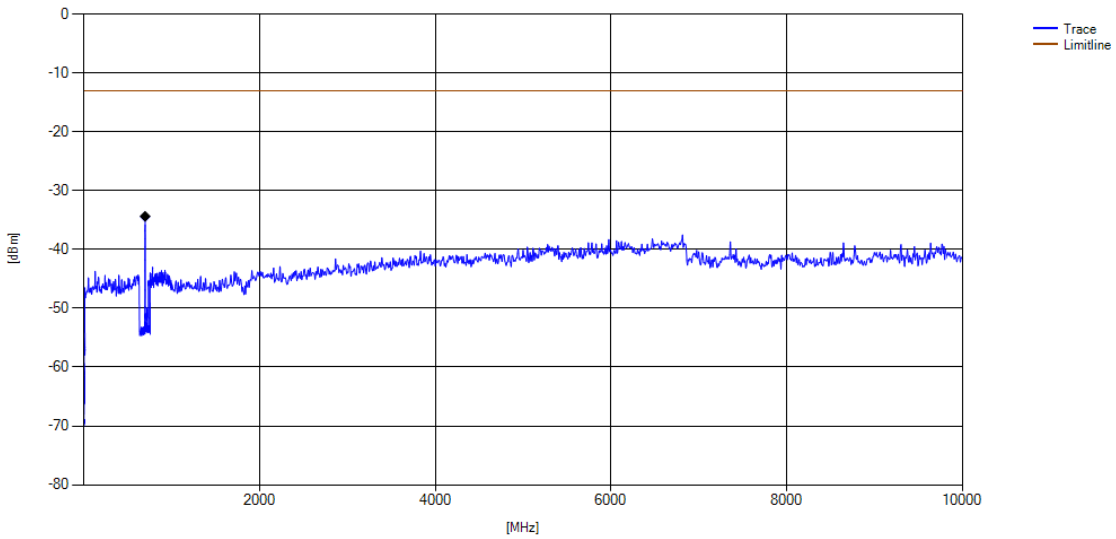
Result:	Passed
Setup No.:	S01_HD02
Date of Test:	2017/06/26 10:40
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

Detailed Results:

Radio Technology	Channel	Detector	Trace	Resolution Bandwidth /kHz	Frequency /MHz	Peak Value /dBm	Limit /dBm	Margin to Limit /dB
eFDD 4 QPSK	low	rms	maxhold	5	1709.9	-24.7	-13	11.72
eFDD 4 QPSK	mid	rms	maxhold	-	-	-	-13	>20
eFDD 4 QPSK	high	rms	maxhold	5	1755	-24	-13	10.99
eFDD 12 QPSK	low	rms	maxhold	-	-	-	-13	>20
eFDD 12 QPSK	mid	rms	maxhold	-	-	-	-13	>20
eFDD 12 QPSK	high	rms	maxhold	-	-	-	-13	>20



eFDD4 QPSK 1.4MHz 1RB Channel=HIGH



eFDD12 QPSK 5MHz 1RB Channel=HIGH

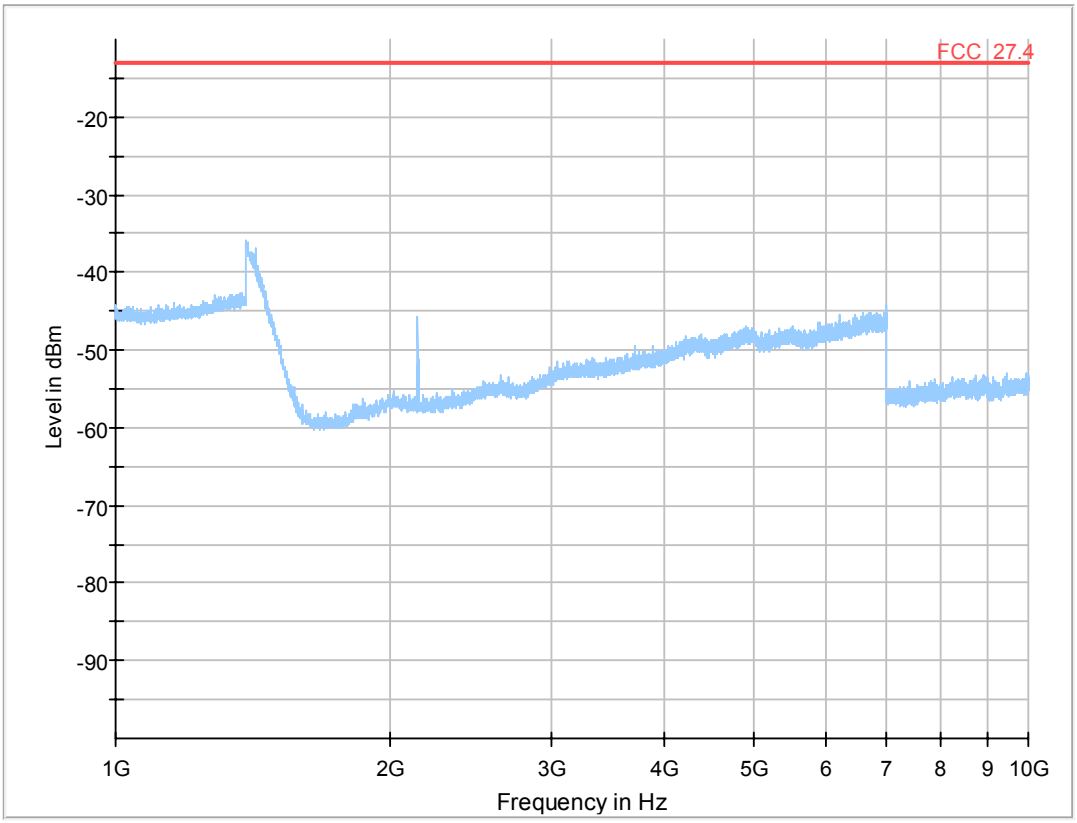
3.5.11 27.4 Field strength of spurious radiation §2.1053, §27.53

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

Result:	Passed
Setup No.:	S01_HC02
Date of Test:	2017/05/03 14:30
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
eFDD 4 QPSK	low	rms	maxhold	5	1710	-26.62	-23	3.62
eFDD 4 QPSK	mid	peak	maxhold	-	-	-	-13	>20
eFDD 4 QPSK	high	rms	maxhold	5	1755	-28.17	-23	5.17
eFDD 12 QPSK	low	peak	maxhold	30	695.1	-12.61	-13	-0.39
eFDD 12 QPSK	low	peak	maxhold	30	695	-13.85	-13	0.85
eFDD 12 QPSK	mid	peak	maxhold	-	-	-	-	>20
eFDD 12 QPSK	high	peak	maxhold	30	716	-8.05	-13	-4.95
eFDD 12 QPSK	high	rms	maxhold	30	1910	-19.79	-13	6.79



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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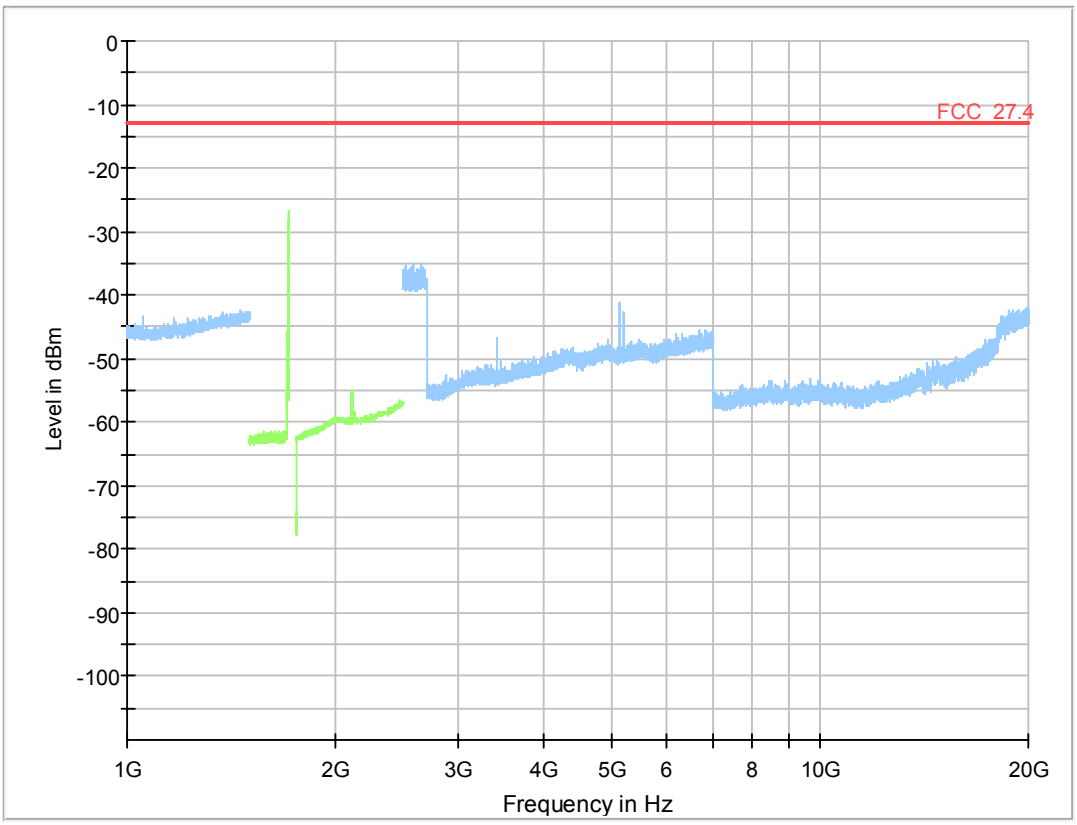
Final_Result

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

30 MHz - 1000 MHz: eFDD4 QPSK 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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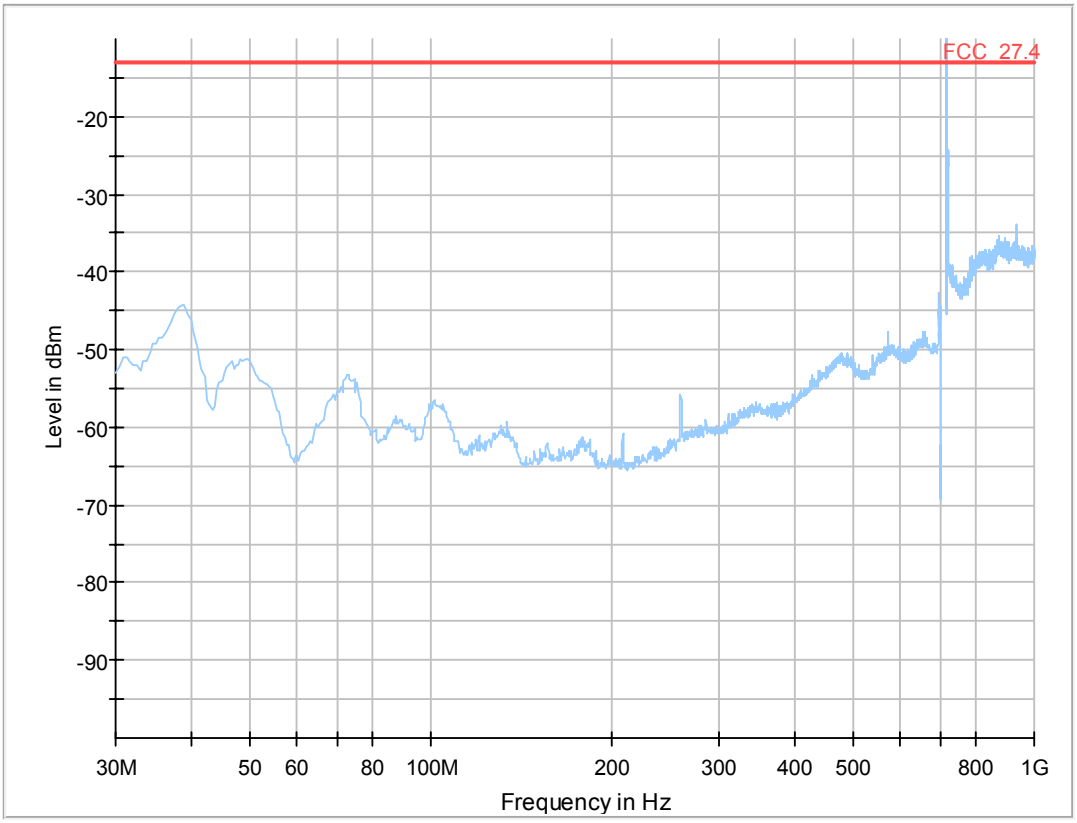
1 GHz - 20 GHz (peak & rms detector): eFDD4 QPSK Channel = LOW



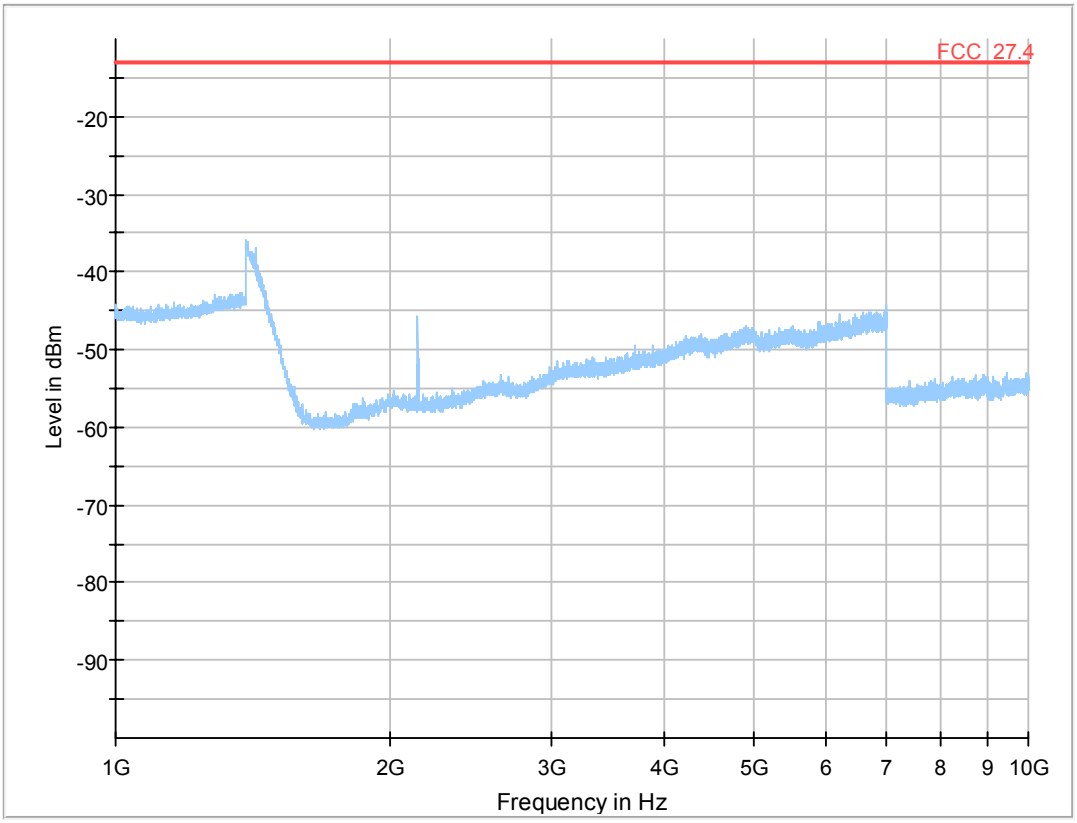
Critical_Freqs

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

Final_Result

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

30 MHz - 1000 MHz: eFDD12 QPSK Channel = HIGH



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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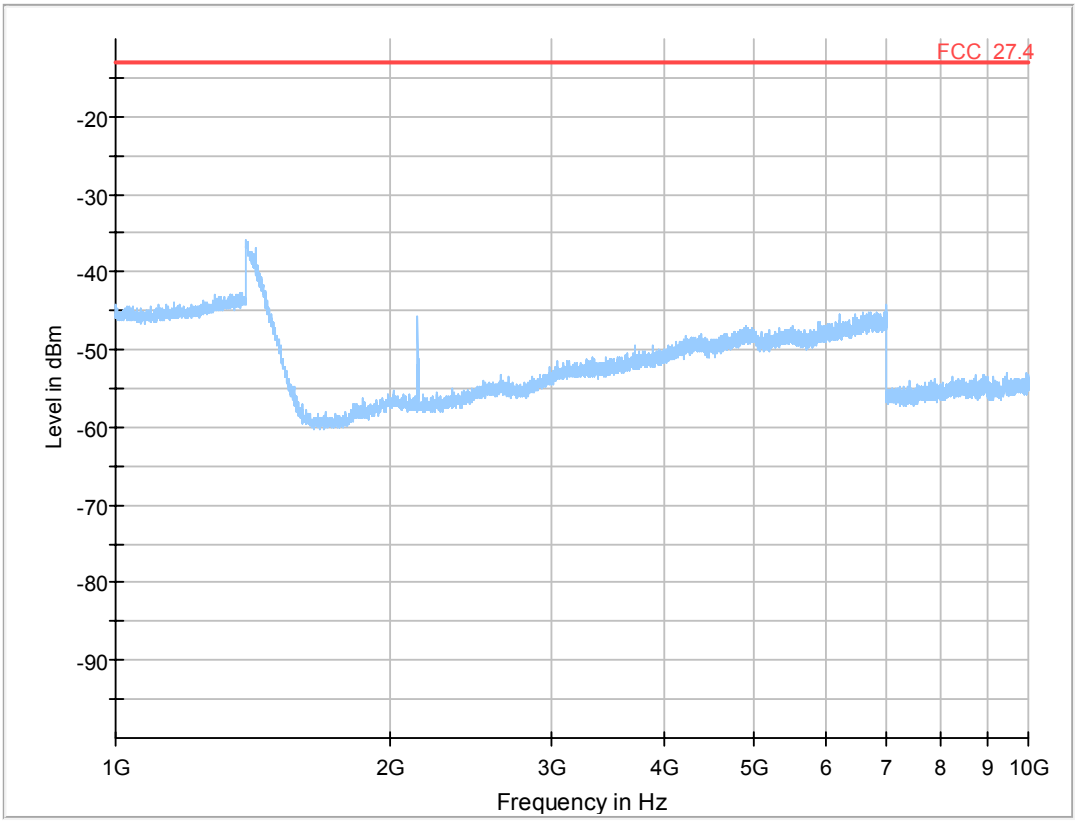
687 MHz - 726 MHz (rms detector): eFDD12 QPSK Channel = HIGH



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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1 GHz - 10 GHz: eFDD12 QPSK Channel = HIGH

3.5.12 27.5 Emission and Occupied Bandwidth §2.1049

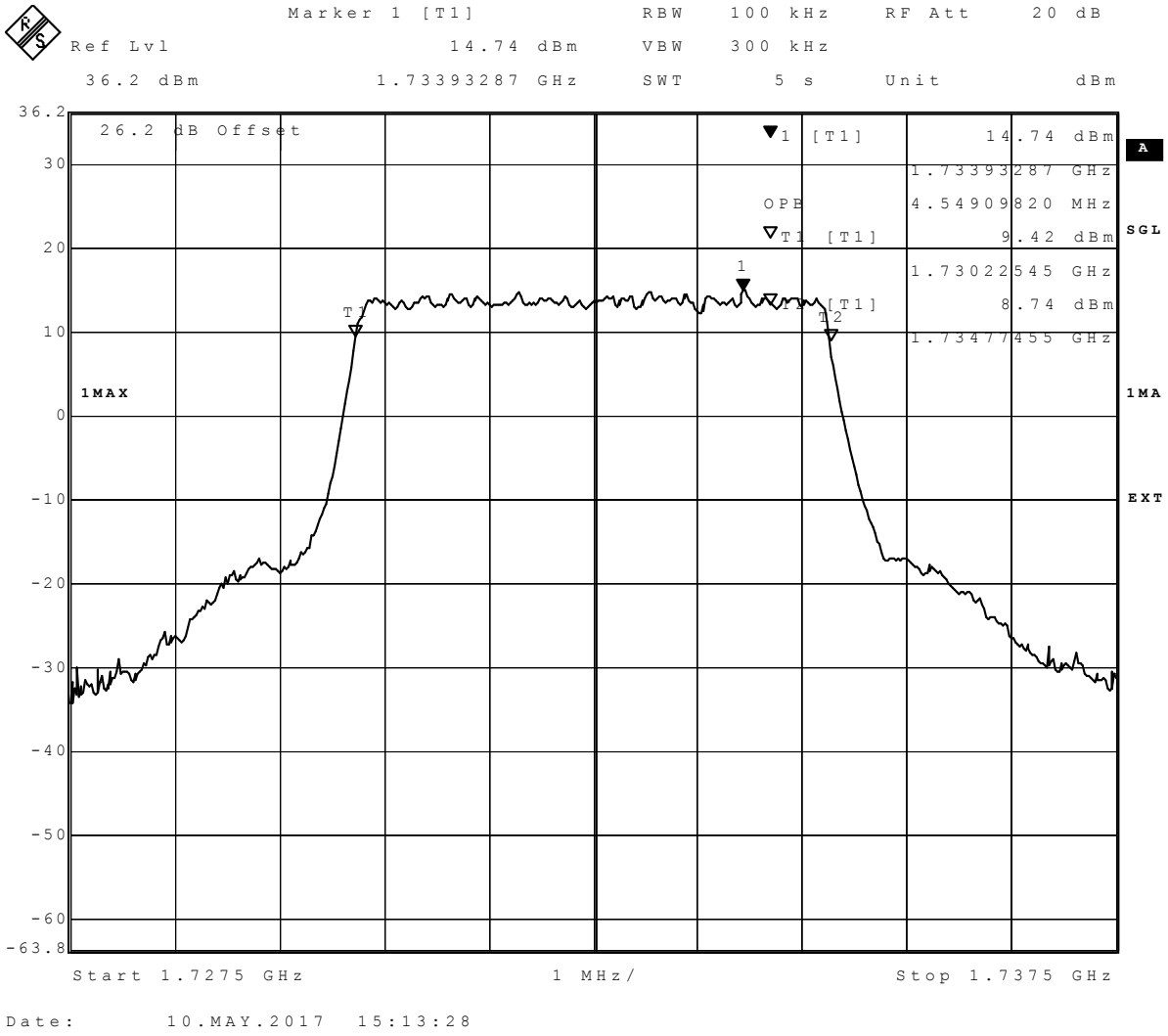
Test: 27.5; Emission and Occupied Bandwidth Summary §2.1049

Result:	Passed
Setup No.:	S01_HD02
Date of Test:	2017/06/09 15:31
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

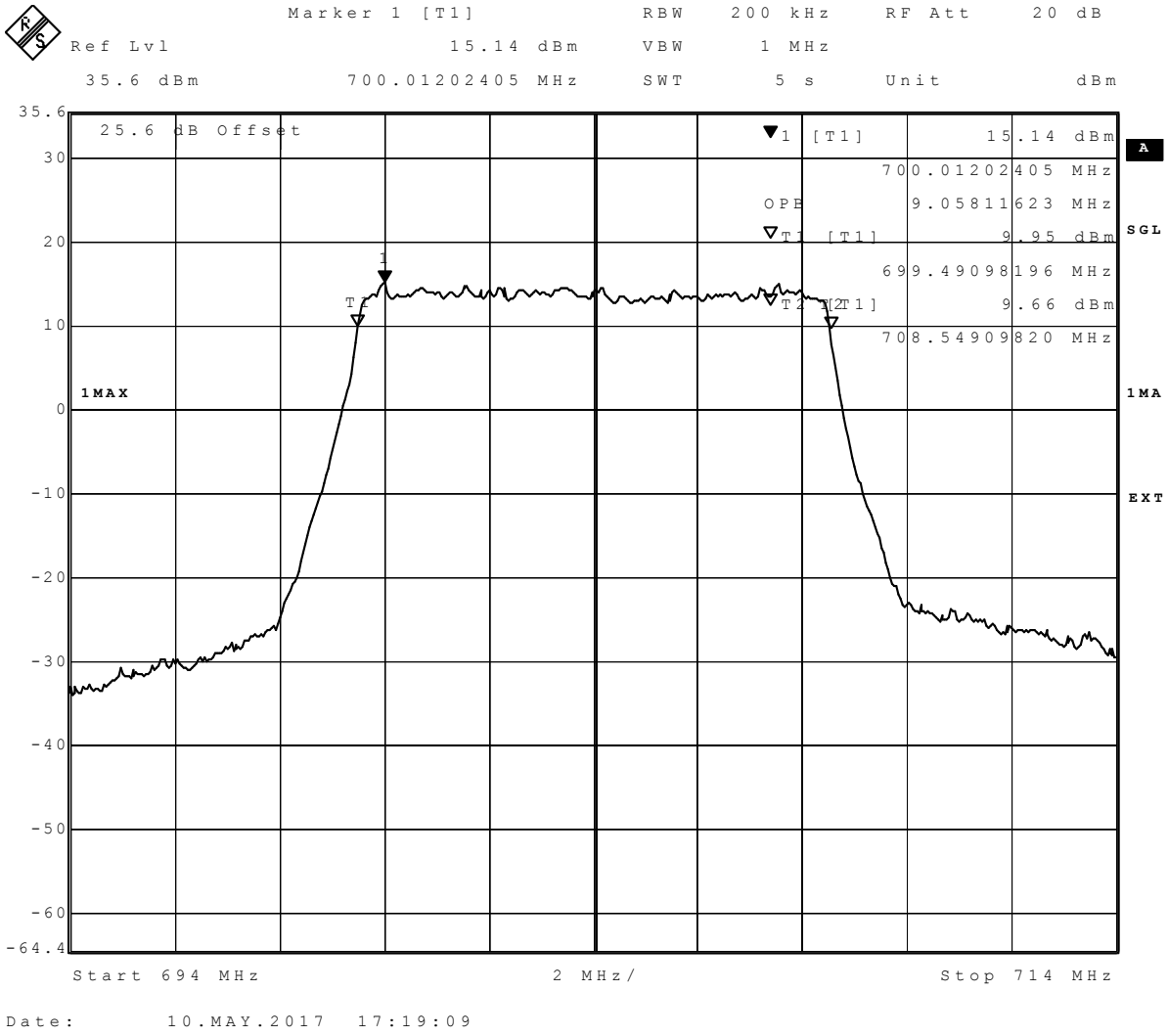
Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	99 % BW [kHz]
eFDD 4 QPSK	low	6	1.4	1.4	1112.22
eFDD 4 QPSK	mid	6	1.4	1.4	1118.24
eFDD 4 QPSK	high	6	1.4	1.4	1118.24
eFDD 4 16QAM	low	6	1.4	1.4	1112.22
eFDD 4 16QAM	mid	6	1.4	1.4	1112.22
eFDD 4 16QAM	high	6	1.4	1.4	1124.25
eFDD 4 QPSK	low	15	3	3	2753.51
eFDD 4 QPSK	mid	15	3	3	2741.48
eFDD 4 QPSK	high	15	3	3	2765.53
eFDD 4 16QAM	low	15	3	3	2777.56
eFDD 4 16QAM	mid	15	3	3	2753.51
eFDD 4 16QAM	high	15	3	3	2777.56
eFDD 4 QPSK	low	25	5	5	4549.1
eFDD 4 QPSK	mid	25	5	5	4549.1
eFDD 4 QPSK	high	25	5	5	4509.02
eFDD 4 16QAM	low	25	5	5	4529.06
eFDD 4 16QAM	mid	25	5	5	4549.1
eFDD 4 16QAM	high	25	5	5	4549.1
eFDD 4 QPSK	low	50	10	10	9058.12
eFDD 4 QPSK	mid	50	10	10	9018.04
eFDD 4 QPSK	high	50	10	10	9058.12
eFDD 4 16QAM	low	50	10	10	9058.12
eFDD 4 16QAM	mid	50	10	10	9058.12
eFDD 4 16QAM	high	50	10	10	9058.12
eFDD 4 QPSK	low	75	15	15	13707.4
eFDD 4 QPSK	mid	75	15	15	13587.2
eFDD 4 QPSK	high	75	15	15	13587.2
eFDD 4 16QAM	low	75	15	15	13647.3
eFDD 4 16QAM	mid	75	15	15	13587.2
eFDD 4 16QAM	high	75	15	15	13647.3

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Nominal BW [MHz]	99 % BW [kHz]
eFDD 4 QPSK	low	100	20	20	18116.2
eFDD 4 QPSK	mid	100	20	20	18116.2
eFDD 4 QPSK	high	100	20	20	18196.4
eFDD 4 16QAM	low	100	20	20	18196.4
eFDD 4 16QAM	mid	100	20	20	18196.4
eFDD 4 16QAM	high	100	20	20	18196.4
eFDD 12 QPSK	low	6	1.4	1.4	1118.23
eFDD 12 QPSK	mid	6	1.4	1.4	1112.22
eFDD 12 QPSK	high	6	1.4	1.4	1112.22
eFDD 12 16QAM	low	6	1.4	1.4	1106.21
eFDD 12 16QAM	mid	6	1.4	1.4	1124.24
eFDD 12 16QAM	high	6	1.4	1.4	1112.22
eFDD 12 QPSK	low	15	3	3	2753.51
eFDD 12 QPSK	mid	15	3	3	2765.53
eFDD 12 QPSK	high	15	3	3	2765.53
eFDD 12 16QAM	low	15	3	3	2777.55
eFDD 12 16QAM	mid	15	3	3	2753.5
eFDD 12 16QAM	high	15	3	3	2765.53
eFDD 12 QPSK	low	25	5	5	4549.09
eFDD 12 QPSK	mid	25	5	5	4549.09
eFDD 12 QPSK	high	25	5	5	4529.05
eFDD 12 16QAM	low	25	5	5	4509.02
eFDD 12 16QAM	mid	25	5	5	4549.09
eFDD 12 16QAM	high	25	5	5	4549.09
eFDD 12 QPSK	low	50	10	10	9058.12
eFDD 12 QPSK	mid	50	10	10	9018.04
eFDD 12 QPSK	high	50	10	10	9018.04
eFDD 12 16QAM	low	50	10	10	9058.12
eFDD 12 16QAM	mid	50	10	10	9058.12
eFDD 12 16QAM	high	50	10	10	9018.04



eFDD4 QPSK 5MHz RB25 Channel=MID



eFDD12 QPSK 10MHz RB50 Channel=LOW

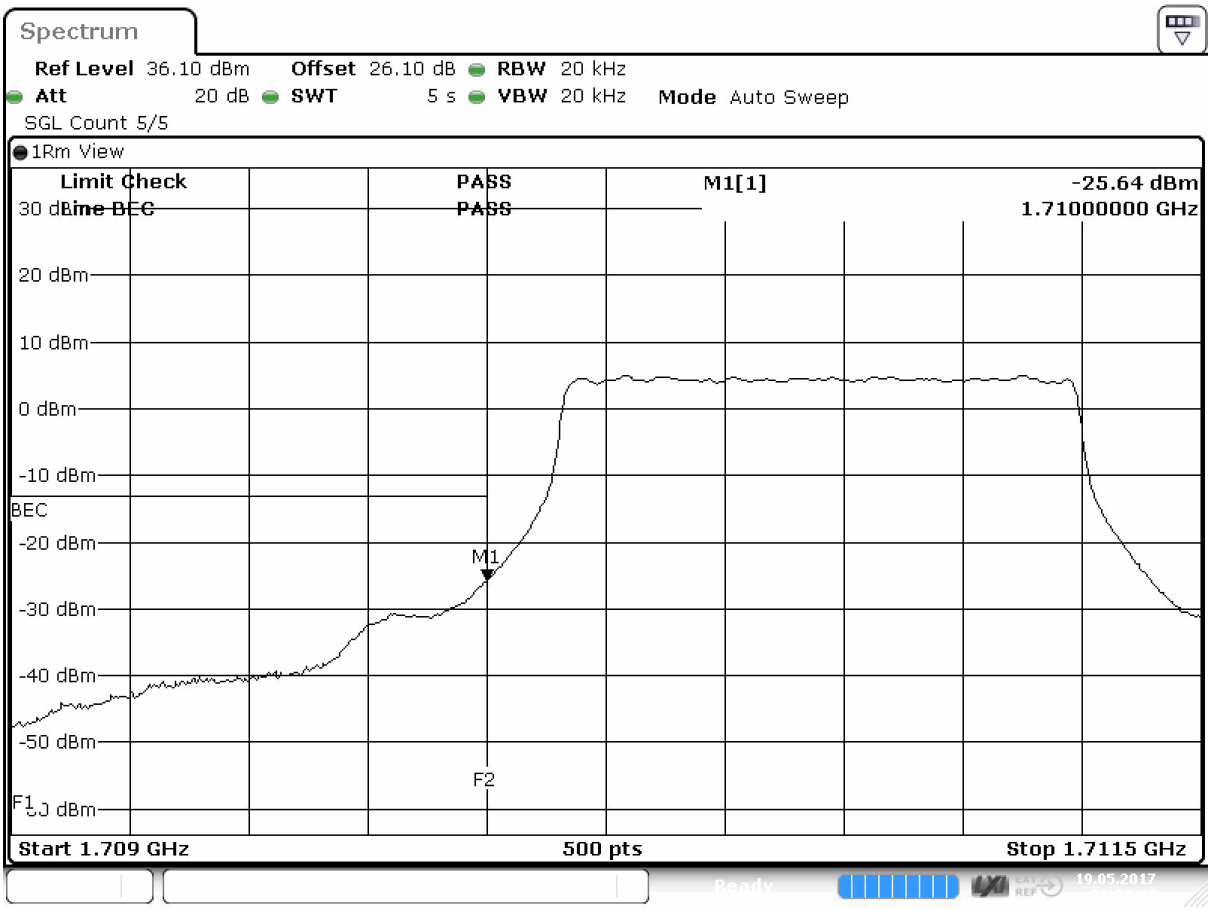
3.5.13 27.6 Band edge compliance §2.1053, §27.53

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

Result:	Passed
Setup No.:	S01_HD02
Date of Test:	2017/06/09 16:10
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

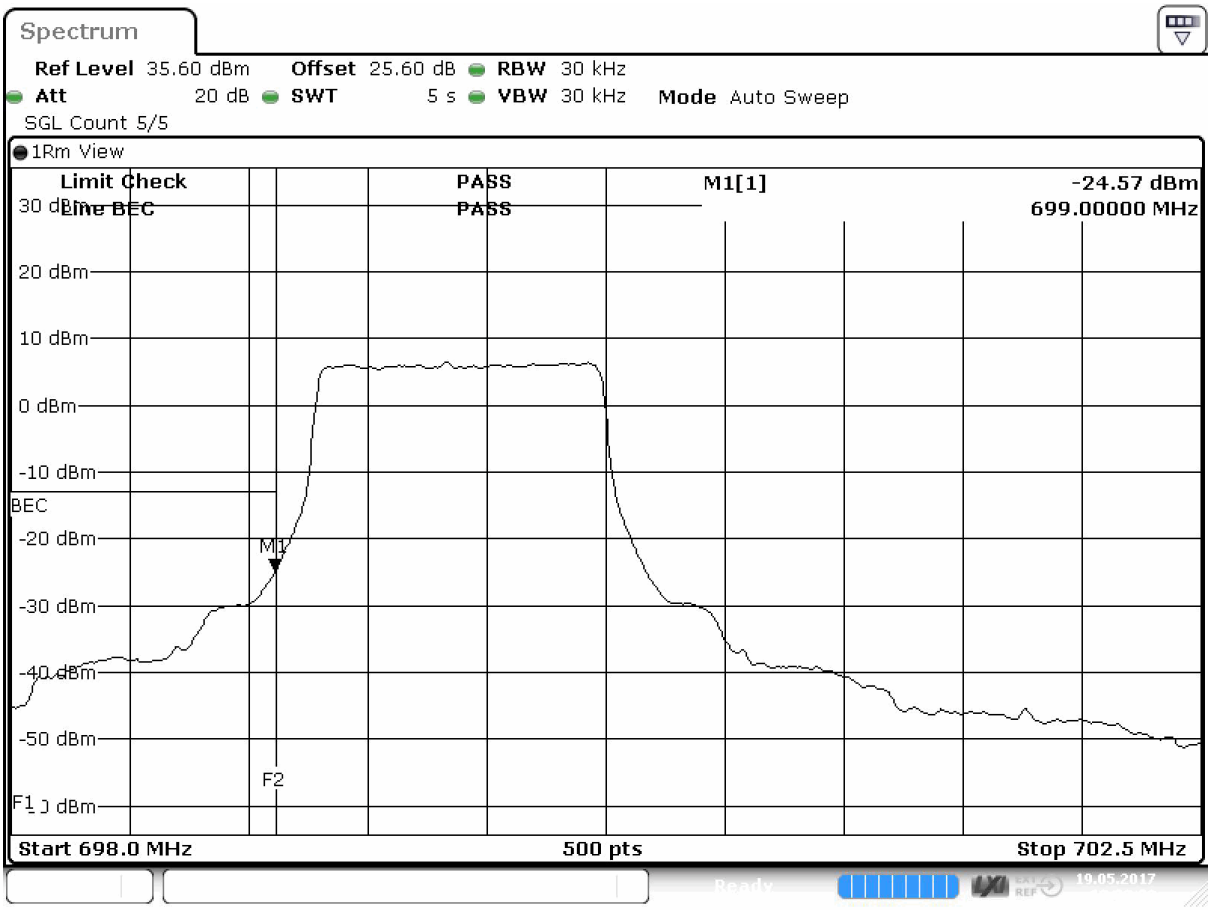
Detailed Results:

Radio Technology	Channel	Band Edge	Nominal BW	Ressource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit [dBm]	Margin to Limit [dB]
eFDD 4 QPSK	low	lower	1.4	6	-16.8	-28.36	-25.64	-13	12.64
eFDD 4 QPSK	high	higher	1.4	6	-16.8	-27.86	-25.72	-13	12.72
eFDD 4 16QAM	low	lower	1.4	6	-16.3	-29.36	-27.21	-13	14.21
eFDD 4 16QAM	high	higher	1.4	6	-16.3	-28.58	-26.8	-13	13.8
eFDD 4 QPSK	low	lower	3	15	-14.9	-32.13	-28	-13	15
eFDD 4 QPSK	high	higher	3	15	-17.7	-32.2	-29.06	-13	16.06
eFDD 4 16QAM	low	lower	3	15	-17.7	-32.62	-29.36	-13	16.36
eFDD 4 16QAM	high	higher	3	15	-18	-32.62	-30.22	-13	17.22
eFDD 4 QPSK	low	lower	5	25	-15.4	-35.14	-30.01	-13	17.01
eFDD 4 QPSK	high	higher	5	25	-16	-33.97	-29.21	-13	16.21
eFDD 4 16QAM	low	lower	5	25	-17.2	-34.86	-31.17	-13	18.17
eFDD 4 16QAM	high	higher	5	25	-16.5	-34.86	-31.51	-13	18.51
eFDD 4 QPSK	low	lower	10	50	-14.7	-37.65	-31.03	-13	18.03
eFDD 4 QPSK	high	higher	10	50	-14.5	-36.57	-31.51	-13	18.51
eFDD 4 16QAM	low	lower	10	50	-16.1	-37.88	-32.62	-13	19.62
eFDD 4 16QAM	high	higher	10	50	-15.3	-37.19	-33.44	-13	20.44
eFDD 4 QPSK	low	lower	15	75	-14.6	-36.54	-30.43	-13	17.43
eFDD 4 QPSK	high	higher	15	75	-14.9	-35.17	-29.37	-13	16.37
eFDD 4 16QAM	low	lower	15	75	-14.6	-36.54	-31.17	-13	18.17
eFDD 4 16QAM	high	higher	15	75	-15	-35.38	-30.84	-13	17.84
eFDD 4 QPSK	low	lower	20	100	-16.2	-37.32	-33.23	-13	20.23
eFDD 4 QPSK	high	higher	20	100	-14.7	-36.29	-32.51	-13	19.51
eFDD 4 16QAM	low	lower	20	100	-16.1	-38.64	-34.86	-13	21.86
eFDD 4 16QAM	high	higher	20	100	-16.3	-37.19	-33.89	-13	20.89
eFDD 12 QPSK	low	lower	1.4	1	-13	-28.14	-24.57	-13	11.57
eFDD 12 QPSK	high	higher	1.4	1	-13.1	-28.85	-25.24	-13	12.24
eFDD 12 16QAM	low	lower	1.4	1	-13.9	-28.6	-26.16	-13	13.16
eFDD 12 16QAM	high	higher	1.4	1	-14.8	-29.34	-26.52	-13	13.52
eFDD 12 QPSK	low	lower	3	1	-16.8	-32.44	-28.63	-13	15.63
eFDD 12 QPSK	high	higher	3	1	-18.1	-33.1	-30.26	-13	17.26
eFDD 12 16QAM	low	lower	3	1	-16.8	-32.73	-29.6	-13	16.6
eFDD 12 16QAM	high	higher	3	1	-18.3	-33.12	-31.02	-13	18.02
eFDD 12 QPSK	low	lower	5	1	-15.2	-34.9	-30.22	-13	17.22
eFDD 12 QPSK	high	higher	5	1	-15.3	-34.77	-30.87	-13	17.87
eFDD 12 16QAM	low	lower	5	1	-17.2	-35.36	-31.34	-13	18.34
eFDD 12 16QAM	high	higher	5	1	-18.3	-35.88	-32.36	-13	19.36
eFDD 12 QPSK	low	lower	10	1	-8.11	-34.45	-27.85	-13	14.85
eFDD 12 QPSK	high	higher	10	1	-9.6	-35.34	-30.05	-13	17.05
eFDD 12 16QAM	low	lower	10	1	-10.3	-32.36	-28.37	-13	15.37
eFDD 12 16QAM	high	higher	10	1	-10.3	-33.94	-30.42	-13	17.42



Date: 19.MAY.2017 11:33:44

eFDD4 QPSK 1.4MHz RB6 Channel=LOW



Date: 19.MAY.2017 12:03:33

eFDD12 QPSK 1.4MHz RB1 Channel=LOW

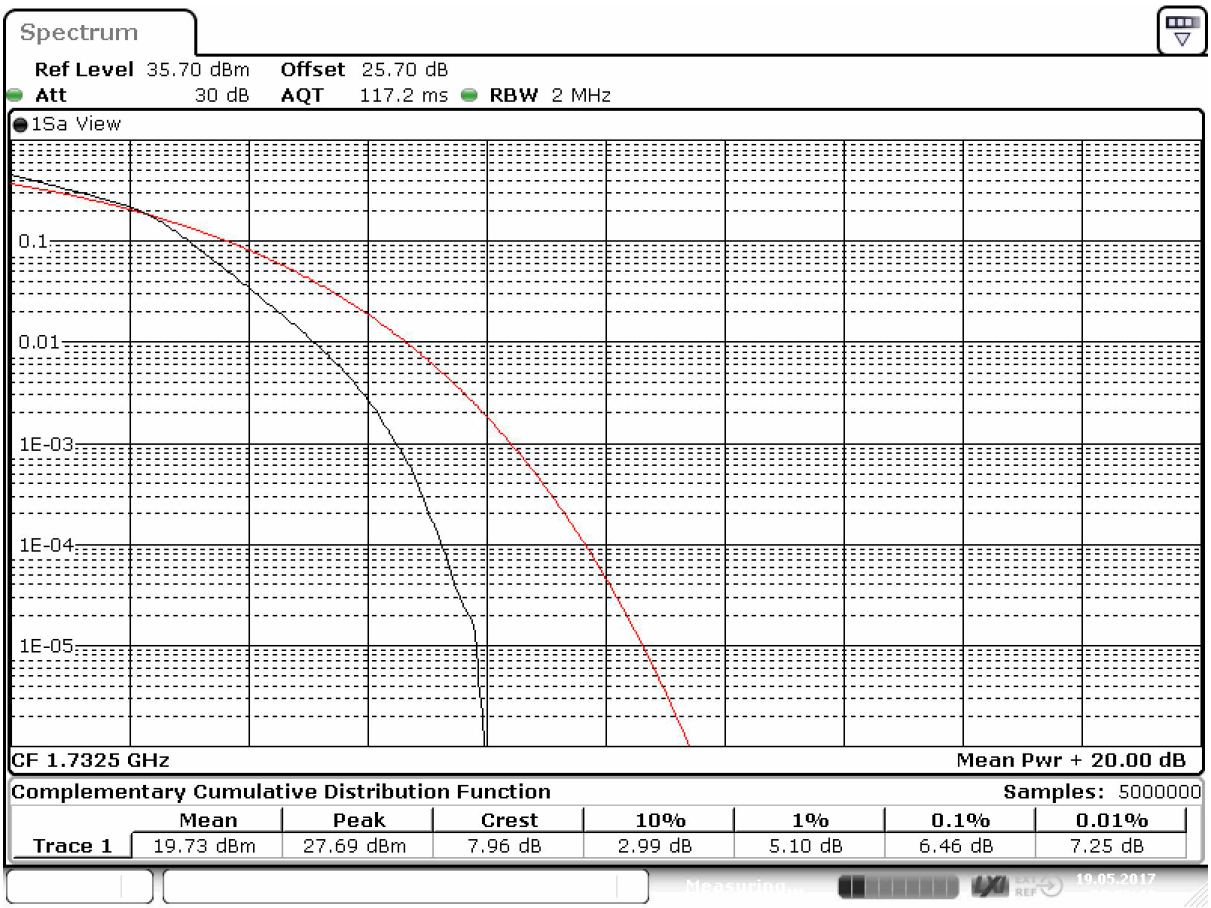
3.5.14 27.7 Peak-to-Average ratio §2.1046, §27.50

Test: 27.7; Peak-to-Average Ratio Summary §2.1046, §27.50

Result:	Passed
Setup No.:	S01_HD02
Date of Test:	2017/05/24 15:45
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

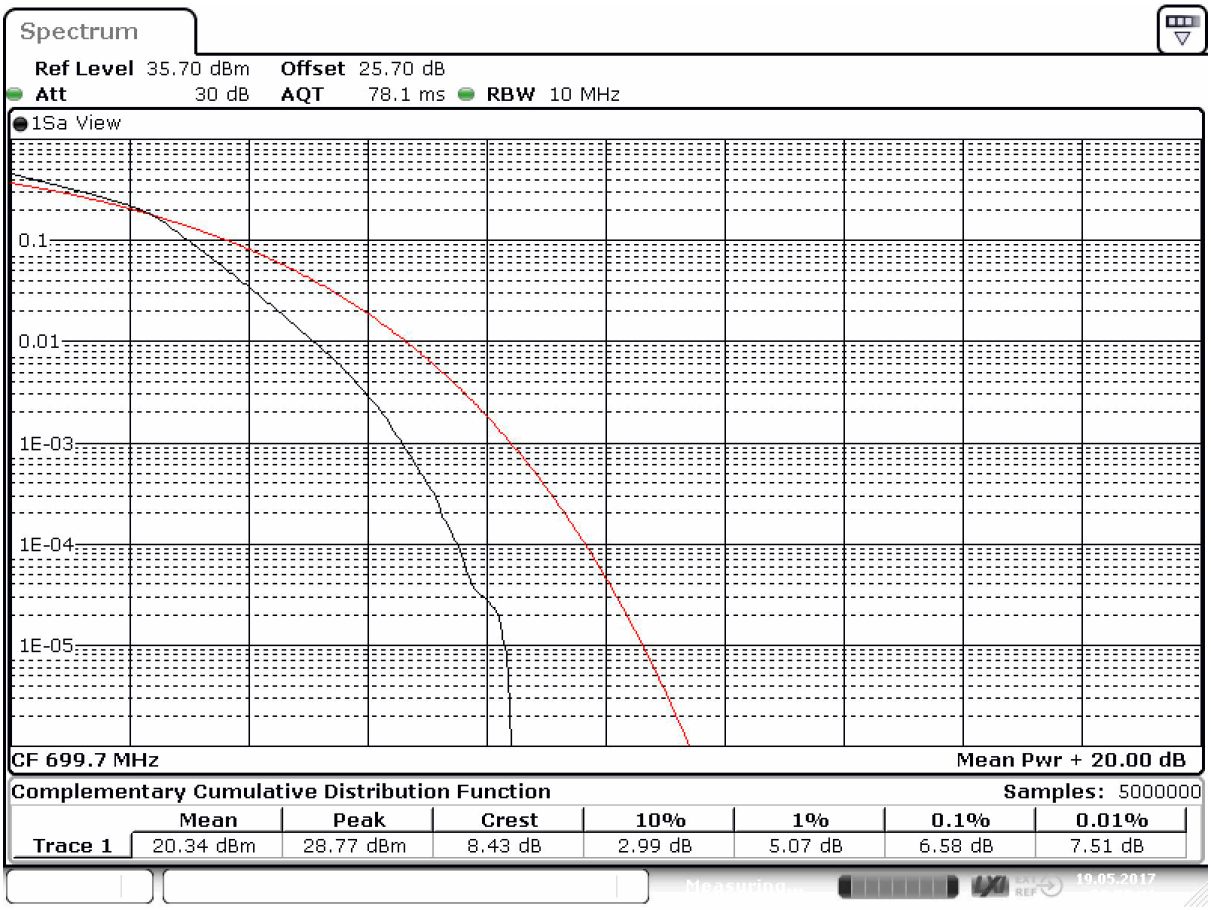
Detailed Results:

Radio Technology	Channel	Ressource Blocks	Bandwidth [MHz]	Peak to Average Ratio [dB]	Limit (FCC) [dB]	Limit (IC) [dB]
eFDD 4 QPSK	low	6	1.4	5.57	13	13
eFDD 4 QPSK	mid	6	1.4	5.54	13	13
eFDD 4 QPSK	high	6	1.4	5.59	13	13
eFDD 4 16QAM	low	6	1.4	6.29	13	13
eFDD 4 16QAM	mid	6	1.4	6.46	13	13
eFDD 4 16QAM	high	6	1.4	6.38	13	13
eFDD 12 QPSK	low	6	1.4	5.65	-	13
eFDD 12 QPSK	mid	6	1.4	5.57	-	13
eFDD 12 QPSK	high	6	1.4	5.8	-	13
eFDD 12 16QAM	low	6	1.4	6.58	-	13
eFDD 12 16QAM	mid	6	1.4	6.32	-	13
eFDD 12 16QAM	high	6	1.4	6.41	-	13



Date: 19.MAY.2017 08:56:17

eFDD4 16QAM 1.4MHz RB6 Channel=MID



Date: 19.MAY.2017 08:59:42

eFDD12 16QAM 1.4MHz RB6 Channel=LOW

Test: 27.7; Frequency Band = eFDD4, Mode = QPSK 1.4MHz, Channel = 20393, Frequency = 1754.3MHz, Method = conducted

Result:	Passed
Setup No.:	S01_HD02
Date of Test:	2017/05/24 15:37
Body:	FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES
Test Specification:	FCC part 2 and 27

Used Test Parameter:

Name	*Value*
Mode	QPSK_1_4MHz
frequency band	eFDD4
Channel	20393
Method	conducted
Frequency	1754.3 MHz

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	
	Calibration Details		*Last Execution*	*Next Execution*
	Standard Calibration		2015/06/23	2018/06/22
Double-ridged horn	HF 907	102444	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Execution*

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
	Standard Calibration		2015/05/11	2018/05/10
Double-ridged horn-duplicated 2015-07-15 10:47:55	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG	
High Pass Filter	4HC1600/12750-1.5-KK	9942011		
High Pass Filter	5HC2700/12750-1.5-KK	9942012		
High Pass Filter	5HC3500/18000-1.2-KK	200035008		
High Pass Filter	WHKX 7.0/18G-8SS	09		
Horn Antenna Schwarzbeck 15-26.5 GHz BBHA 9170	BBHA 9170	BBHA9170262		
Log.-per. Antenna	HL 562 Ultralog	100609	Rohde & Schwarz GmbH & Co. KG	
Log.-per. Antenna (upgraded)	HL 562 Ultralog new biconicals	830547/003	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Execution*
	Standard Calibration		2015/06/30	2018/06/29
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Execution*
	DKD Calibration		2014/11/27	2017/11/27
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		
	Calibration Details		*Last Execution*	*Next Execution*
	DAkkS Calibration		2016/02/04	2018/02/28
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	
	Calibration Details		*Last Execution*	*Next Execution*
	DKD calibration		2016/02/25	2018/02/24
Spectrum Analyser	FSU26	200418		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2016/11/03	2017/11/02
Spectrum Analyzer	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Execution*
	DKD calibration		2015/06/23	2018/06/22
Vector Signal Generator	SMIQ 03B	832492/061		

Test Equipment Digital Signalling Devices

Lab ID:	**Lab 1, Lab 2**
Description:	Signalling equipment for various wireless technologies.

Single Devices for Digital Signalling Devices

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
CMW500	CMW500	107500		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2015/07/13	2017/07/14
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Execution*
	DKD calibration		2014/12/02	2017/12/01
Universal Radio Communication Tester	CMU 200	837983/052		
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		2016/05/24	2017/05/16
	Standard calibration		2017/05/17	2018/05/16
Sensor Head A	NRV-Z1	827753/005		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2016/05/27	2017/05/17
	Standard calibration		2017/05/18	2018/05/17
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Execution*
	Standard Calibration		2014/06/24	2017/06/23
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Execution*
	DAkkS Calibration (DK)		2015/12/09	2017/12/08
	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		2016/12/02	2018/12/01

Test Equipment Multimeter 03

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

Single Devices for Multimeter 03

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383		
	Calibration Details		*Last Execution*	*Next Execution*
	DAkkS Calibration		2016/02/04	2018/02/28

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		2016/05/24	2017/05/16
	Standard calibration		2017/05/17	2018/05/16
RF Step Attenuator RSP	RSP	833695/001		
Rubidium Frequency Standard	Datum, Model: MFS	5489/001		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2016/06/22	2017/07/10
Sensor Head A	NRV-Z1	827753/005		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2016/05/27	2017/05/17
	Standard calibration		2017/05/18	2018/05/17
Signal Generator SME	SME03	827460/016		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2014/12/02	2017/12/01
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	2016/03/09	2018/03/08

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 TIA-603-C-2004

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 TIA-603-C-2004 has been considered.

Test Requirements / Limits

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

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 TIA-603-C 2.2.12 Unwanted Emissions is performed on signals which are identified as being close to the limit. For any emissions found to be within 10 dB of the limit, a specific signal substitution measurement is performed at the frequency of the emission to determine the exact e.i.r.p. value.

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

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

§ 2.1057 Frequency spectrum to be investigated.

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

§ 22.917 Emission limitations for cellular equipment

(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 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 TIA-603-C-2004

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 TIA-603-C-2004 has been considered.

Test Requirements / Limits

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

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 TIA-603-C 2.2.12 Unwanted Emissions is performed on signals which are identified as being close to the limit. For any emissions found to be within 10 dB of the limit, a specific signal substitution measurement is performed at the frequency of the emission to determine the exact e.i.r.p. value.

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

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

§ 2.1057 Frequency spectrum to be investigated.

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

§ 24.238 Emission limitations for Broadband PCS equipment

(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 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 TIA-603-C-2004

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 TIA-603-C-2004 has been considered.

Test Requirements / Limits

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

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 TIA-603-C 2.2.12 Unwanted Emissions is performed on signals which are identified as being close to the limit. For any emissions found to be within 10 dB of the limit, a specific signal substitution measurement is performed at the frequency of the emission to determine the exact e.i.r.p. value.

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

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

§ 2.1057 Frequency spectrum to be investigated.

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

§ 22.917 Emission limitations for cellular equipment

(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 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 TIA-603-C-2004

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 TIA-603-C-2004 has been considered.

Test Requirements / Limits

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

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 TIA-603-C 2.2.12 Unwanted Emissions is performed on signals which are identified as being close to the limit. For any emissions found to be within 10 dB of the limit, a specific signal substitution measurement is performed at the frequency of the emission to determine the exact e.i.r.p. value.

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

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

§ 2.1057 Frequency spectrum to be investigated.

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

§ 24.238 Emission limitations for Broadband PCS equipment

(a) The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 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 TIA-603-C-2004

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 TIA-603-C-2004 has been considered.

Test Requirements / Limits

§2.1046 Measurements Required: RF Power Output
(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §

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

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 TIA-603-C 2.2.12 Unwanted Emissions is performed on signals which are identified as being close to the limit. For any emissions found to be within 10 dB of the limit, a specific signal substitution measurement is performed at the frequency of the emission to determine the exact e.i.r.p. value.

Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

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

§ 2.1057 Frequency spectrum to be investigated.

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

§ 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

in

Correlation Channels and Frequencies FCC 22

TEST MODE	TX / RX	RF Channel		
		Low	Mid	High
GSM 850 + GPRS + EDGE	TX	CH 128	CH 190	CH 251
		824.2 MHz	836.6 MHz	848.8 MHz
FDD V + HSDPA + HSUPA	TX	CH 4132	CH 4183	CH 4233
		826.4 MHz	836.6 MHz	846.6 MHz
LTE eFDD 5	TX (1.4M)	CH 20407	CH 20525	CH 20643
		824.7	836.5	848.3
	TX (3M)	CH 20415	CH 20525	CH 20635
		825.50 MHz	836.50 MHz	847.50 MHz
	TX (5M)	CH 20425	CH 20525	CH 20625
		826.50 MHz	836.50 MHz	846.50 MHz
	TX (10)	CH 20450	CH 20525	CH 20600
		829.00 MHz	836.50 MHz	844.00 MHz

Correlation Channels and Frequencies FCC 24

TEST MODE	TX	RF Channel		
		Low	Mid	High
GSM 1900 + GPRS + EDGE	TX	CH 512	CH 661	CH 810
		1850.2 MHz	1880 MHz	1909.8 MHz
FDD II + HSDPA + HSUPA	TX	CH 9262	CH 9400	CH 9538
		1852.4 MHz	1880 MHz	1907.6 MHz
LTE eFDD 2	TX (1.4M)	CH 18607	CH 18900	CH 19193
		1850.7 MHz	1880 MHz	1909.3 MHz
	TX (3M)	CH 18615	CH 18900	CH 19185
		1851.5 MHz	1880 MHz	1908.5 MHz
	TX (5M)	CH 18625	CH 18900	CH 19175
		1852.5 MHz	1880 MHz	1907.5 MHz
	TX (10)	CH 18650	CH 18900	CH 19150
		1855 MHz	1880 MHz	1905 MHz
	TX (15M)	CH 18675	CH 18900	CH 19125
		1857.5 MHz	1880 MHz	1902.5 MHz
	TX (20M)	CH 18700	CH 18900	CH 19100
		1860 MHz	1880 MHz	1900 MHz

Correlation Channels and Frequencies

Correlation Channels and Frequencies FCC 27

TEST MODE	TX / RX	RF Channel			
		Low	Mid1	Mid2	High
FDD IV + HSDPA + HSUPA	TX	CH 1312	CH 1412	CH 1450	CH 1513
		1712.4 MHz	1732.4 MHz	1740 MHz	1752.6 MHz
		Low	Mid		High
LTE eFDD 4	TX (1.4M)	CH 19957	CH 20175		CH 20393
		1710.7 MHz	1732.5 MHz		1754.3 MHz
	TX (3M)	CH 19965	CH 20175		CH 20385
		1711.50 MHz	1732.50 MHz		1753.50 MHz
	TX (5M)	CH 19975	CH 20175		CH 20375
		1712.50 MHz	1732.50 MHz		1752.50 MHz
	TX (10)	CH 20000	CH 20175		CH 20350
		1715.00 MHz	1732.50 MHz		1750.00 MHz
	TX (15M)	CH 20025	CH 20175		CH 20325
		1717.50 MHz	1732.50 MHz		1747.50 MHz
	TX (20M)	CH 20050	CH 20175		CH 20300
		1720.00 MHz	1732.50 MHz		1745.00 MHz
LTE eFDD 12	TX (1.4M)	CH 23017	CH 23095		CH 23173
		699.7 MHz	707.5 MHz		715.3 MHz
	TX (3M)	CH 23025	CH 23095		CH 23165
		700.50 MHz	707.5 MHz		714.50 MHz
	TX (5M)	CH 23035	CH 23095		CH 23155
		701.50 MHz	707.5 MHz		713.50 MHz
	TX (10)	CH 23060	CH 23095		CH 23130
		704.00 MHz	707.5 MHz		711.00 MHz

Correlation of measurement requirements for Cellular Equipment from FCC and IC

FCC Rule / IC Standard	Part 22 /	RSS-132	Part 24 /	RSS-133	Part 27 /	RSS-139 /	RSS-130
Effective (isotropic) Radiated Power	§2.1046 §22.913	RSS-GEN, §6.12 RSS-132, §5.4	§2.1046 §24.232	RSS-GEN, §6.12 RSS-133, §6.4	§2.1046 §27.50	RSS-GEN, §6.12 RSS-139; §6.4	RSS-GEN, §6.12 RSS-130; §4.4
Emission and Occupied Bandwidth	§2.1049	RSS-GEN §6.6	§2.1049	RSS-GEN §6.6	§2.1049	RSS-GEN §6.6	RSS-GEN §6.6
"Spuri" at Antenna Terminal	§2.1051 §22.917	RSS-GEN, §6.13 RSS-132, §5.5	§2.1051 §24.238	RSS-GEN, §6.13 RSS-132, §6.5	§2.1051 §27.53	RSS-GEN, §6.13 RSS-139, §6.5	RSS-GEN, §6.13 RSS-130, §4.6
Band Edge compliance	§2.1051 §22.917	RSS-GEN, §6.13	§2.1051 §24.238	RSS-GEN, §6.13	§2.1051 §27.53	RSS-GEN, §6.13	RSS-GEN, §6.13
Frequency Stability	§2.1055 §22.355	RSS-GEN, §6.11	§2.1055 §24.235	RSS-GEN, §6.11 RSS-132, §6.3	§2.1055 §27.51	RSS-GEN, §6.11 RSS-139, §6.3	RSS-GEN, §6.11 RSS-130, §4.3
Peak to Average Ratio	N/A	RSS-132, §5.3	§2.1046 §24.232	RSS-133, §6.4	§2.1046 §27.50	RSS-139, §6.4	RSS-130; §4.4
Field Strength of Spurious Radiation	§2.1053 §22.917	RSS-GEN, §6.13 RSS-132, §5.2	§2.1053 §24.235	RSS-GEN, §6.13 RSS-133, §6.5	§2.1053 §27.51	RSS-GEN, §6.13 RSS-139, §6.5	RSS-GEN, §6.13 RSS-130, §4.6

*) Receivers which are part of Transceivers are exempted with respect to Notice 2012-DRS0126.

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