InterLab®

Final Report on

LARA-R204
FCC ID: XPY1EIQN2NN
IC code: 8595A-1EIQN2NN

Report Reference: MDE_UBLOX_1603_FCCa according to: FCC Part 27 Subpart C

Date: October 14, 2016

Test Laboratory:
7layers GmbH
Borsigstraße 11
40880 Ratingen
Germany

Deutsche Akkreditierungsstelle D-PL-12140-01-00

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

1 Administrative Data

1.1 Project Data

Project Responsible:	Patrick Lomax
Date Of Test Report:	2016/10/14
Date of first test:	2016/08/16
Date of last test:	2016/09/12

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

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

1.5 Signature of the Accreditation Responsible

Accreditation scope responsible person
responsible for Lab 1, Lab 2

2 Test Object Data

2.1 General OUT Description

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

OUT: LARA-R204

Type / Model / Family:	LARA-R204 FCC ID: XPY1EIQN2NN IC code: 8595A-1EIQN2NN
Product Category:	Module
Manufacturer:	
Company Name:	See applicant data
Contact Person:	-

Parameter List:

Parameter name	*Value*
Parameter for Scope FCC_v2:	
AC Power Supply	120v/60Hz via AC/DC Adapter
Antenna gain	Antenna is not sold with this module. Please refer to manufacturer documentation for information on acceptable antennas
DC Power Supply	3.8 (V)

2.2 Detailed Description of OUT Samples

Sample : AF01

OUT Identifier	LARA-R204
Sample Description	Conducted sample
Serial No.	357648070011198
HW Status	266002
SW Status	31.00

Sample : AY02

OUT Identifier	LARA-R204		
Sample Description	Radiated Sample		
Serial No.	357648070021592		
HW Status	266A00		
SW Status	31.02		
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.*	25 °C

2.3 OUT Features

Features for OUT: LARA-R204

Designation	*Description*	*Supported Value(s)*
Features for scope: FCC_v2		
AC	The OUT is powered by or connected to AC Mains	
Eant	removable antenna supplied and type tested with the radio equipment, designed as an indispensable part of the equipment	
eFDD4		
eFDD13		
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 02	EVB-WL3		NO_EVK_CS_191A00		Evaluation test board
AE 01	UUX324-1215	E09-0291984			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*
AF01	**(Conducted setup)**			
	Sample: AF01	Conducted sample	AE 02	Evaluation test board
AY02	**(Radiated Setup)**			
	Sample: AY02	Radiated Sample	AE 02	Evaluation test board
			AE 01	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.

3.2 List of the Applicable Body

(Body for Scope: FCC_v2)

Designation	*Description*
FCC47CFRChIPART27MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	Part 27, Subpart C - Technical Standards

3.3 List of Test Specification

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

3.4 Summary

Test Case Identifier / Name *Test (condition)*	*Result*	*Date of Test*	*Lab Ref.*	*Setup*
27.1 RF Power Output §2.1046, §27.250				
27.1; RF Power Output Summary §2.1046, §27.250	Passed	2016/08/21	Lab 2	AF01
27.2 Frequency stability §2.1055, §27.54				
27.2; Frequency stability Summary §2.1055, §27.54	Passed	2016/08/16	Lab 2	AF01
27.3 Spurious emissions at antenna terminals §2.1051, §27.53				
27.3; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23205, Frequency = 779.5MHz, Method = conducted	Passed	2016/08/17	Lab 2	AF01
27.3; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23230, Frequency = 782MHz, Method = conducted	Passed	2016/08/17	Lab 2	AF01
27.3; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23255, Frequency = 784.5MHz, Method = conducted	Passed	2016/08/17	Lab 2	AF01
27.3; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 19975, Frequency = 1712.5MHz, Method = conducted	Passed	2016/08/17	Lab 2	AF01
27.3; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 20175, Frequency = 1732.5MHz, Method = conducted	Passed	2016/08/17	Lab 2	AF01
27.3; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 20375, Frequency = 1752.5MHz, Method = conducted	Passed	2016/08/17	Lab 2	AF01
27.4 Field strength of spurious radiation §2.1053, §27.53				
27.4; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23205, Frequency = 779.5MHz, Method = radiated	Passed	2016/09/12	Lab 1	AY02
27.4; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23230, Frequency = 782MHz, Method = radiated	Passed	2016/09/12	Lab 1	AY02
27.4; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23255, Frequency = 784.5MHz, Method = radiated	Passed	2016/09/12	Lab 1	AY02
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27.4; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 20175, Frequency = 1732.5MHz, Method = radiated	Passed	2016/09/12	Lab 1	AY02
27.4; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 20375, Frequency = 1752.5MHz, Method = radiated	Passed	2016/09/12	Lab 1	AY02
27.5 Emission and Occupied Bandwidth §2.1049				
27.5; Emission and Occupied Bandwidth Summary §2.1049	Passed	2016/08/17	Lab 2	AF01
27.6 Band edge compliance §2.1053, §27.53				
27.6; Band edge compliance summary §2.1053, §27.53	Passed	2016/08/17	Lab 2	AF01
27.7 Peak-to-Average ratio §2.1046, §27.50				
27.7; Peak-to-Average Ratio Summary §2.1046, §27.50	Passed	2016/09/12	Lab 2	AF01

3.5 Detailed Results

3.5.1 27.1 RF Power Output §2.1046, §27.250

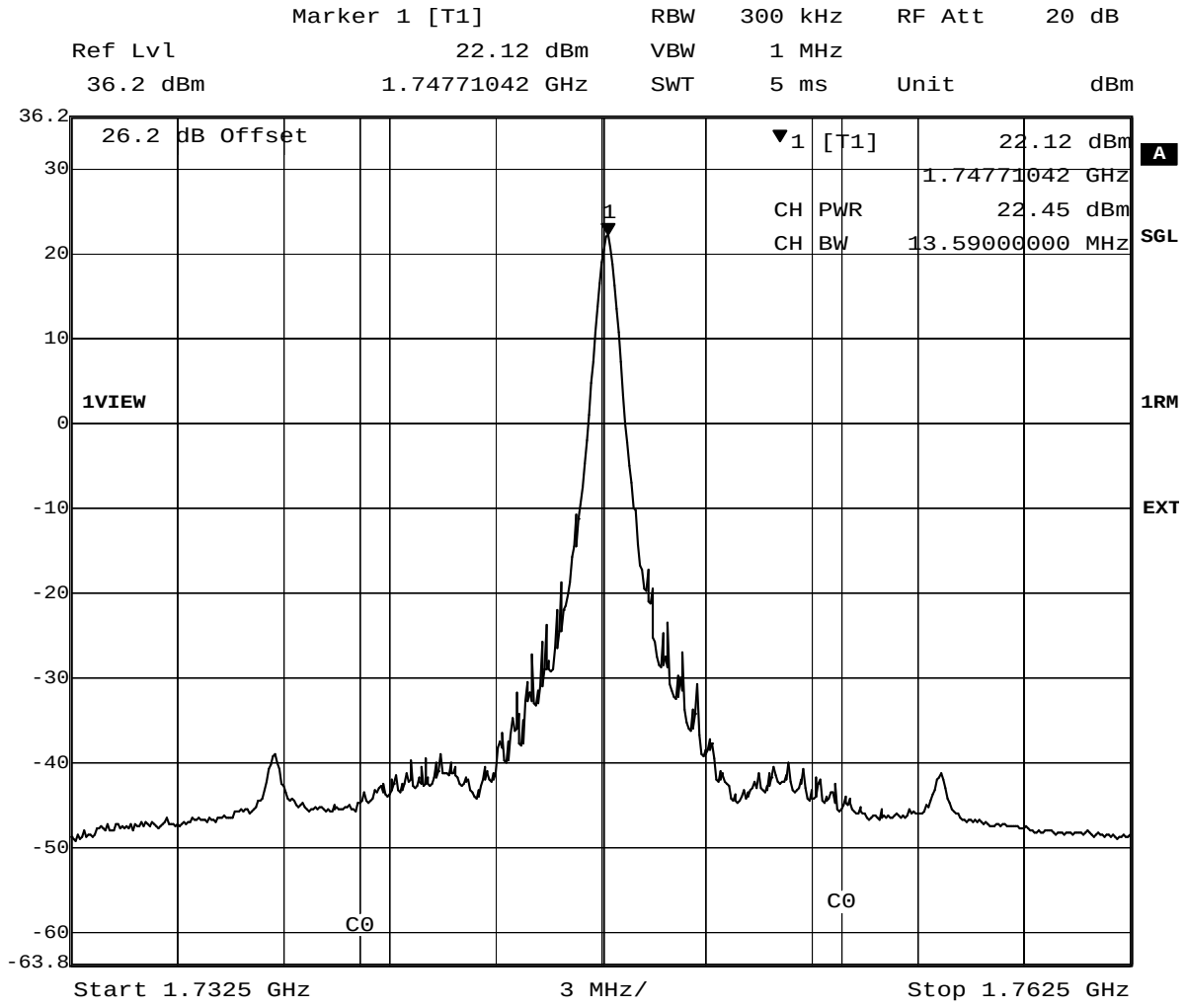
Test: 27.1; RF Power Output Summary §2.1046, §27.250

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/08/21 11:51	FCC part 2 and 27

Detailed Results:

Band	Channel	Ressource Blocks	Band - width (MHz)	RMS Cond Power (dBm)	FCC EIRP Limit (W)	IC EIRP Limit (W)
eFDD 4 QPSK	low	1	1.4	21.78	1	1
eFDD 4 QPSK	low	3	1.4	21.52	1	1
eFDD 4 QPSK	low	6	1.4	20.59	1	1
eFDD 4 QPSK	mid	1	1.4	21.92	1	1
eFDD 4 QPSK	mid	3	1.4	21.56	1	1
eFDD 4 QPSK	mid	6	1.4	20.58	1	1
eFDD 4 QPSK	high	1	1.4	21.81	1	1
eFDD 4 QPSK	high	3	1.4	21.51	1	1
eFDD 4 QPSK	high	6	1.4	20.54	1	1
eFDD 4 16QAM	low	1	1.4	20.87	1	1
eFDD 4 16QAM	low	6	1.4	19.62	1	1
eFDD 4 16QAM	mid	1	1.4	21.12	1	1
eFDD 4 16QAM	mid	6	1.4	19.7	1	1
eFDD 4 16QAM	high	1	1.4	20.8	1	1
eFDD 4 16QAM	high	6	1.4	19.66	1	1
eFDD 4 QPSK	low	1	3	22.25	1	1
eFDD 4 QPSK	low	15	3	19.99	1	1
eFDD 4 QPSK	mid	1	3	22.41	1	1
eFDD 4 QPSK	mid	15	3	20.07	1	1
eFDD 4 QPSK	high	1	3	22.36	1	1
eFDD 4 QPSK	high	15	3	19.97	1	1
eFDD 4 16QAM	low	1	3	21.31	1	1
eFDD 4 16QAM	low	15	3	19.19	1	1
eFDD 4 16QAM	mid	1	3	21.49	1	1
eFDD 4 16QAM	mid	15	3	19.27	1	1
eFDD 4 16QAM	high	1	3	21.27	1	1
eFDD 4 16QAM	high	15	3	19.15	1	1
eFDD 4 QPSK	low	1	5	22.25	1	1
eFDD 4 QPSK	low	12	5	20.03	1	1
eFDD 4 QPSK	low	25	5	20.05	1	1
eFDD 4 QPSK	mid	1	5	22.46	1	1
eFDD 4 QPSK	mid	12	5	20.79	1	1
eFDD 4 QPSK	mid	25	5	20.04	1	1
eFDD 4 QPSK	high	1	5	22.28	1	1
eFDD 4 QPSK	high	12	5	19.94	1	1
eFDD 4 QPSK	high	25	5	19.98	1	1
eFDD 4 16QAM	low	1	5	21.39	1	1
eFDD 4 16QAM	low	25	5	19.22	1	1
eFDD 4 16QAM	mid	1	5	21.33	1	1
eFDD 4 16QAM	mid	25	5	19.22	1	1
eFDD 4 16QAM	high	1	5	21.31	1	1
eFDD 4 16QAM	high	25	5	19.12	1	1

Band	Channel	Ressource Blocks	Band - width (MHz)	RMS Cond Power (dBm)	FCC EIRP Limit (W)	IC EIRP Limit (W)
eFDD 4 QPSK	low	1	10	22.28	1	1
eFDD 4 QPSK	low	50	10	20.39	1	1
eFDD 4 QPSK	mid	1	10	22.35	1	1
eFDD 4 QPSK	mid	50	10	20.28	1	1
eFDD 4 QPSK	high	1	10	22.32	1	1
eFDD 4 QPSK	high	50	10	20.27	1	1
eFDD 4 16QAM	low	1	10	21.26	1	1
eFDD 4 16QAM	low	50	10	19.5	1	1
eFDD 4 16QAM	mid	1	10	21.43	1	1
eFDD 4 16QAM	mid	50	10	19.49	1	1
eFDD 4 16QAM	high	1	10	21.18	1	1
eFDD 4 16QAM	high	50	10	19.41	1	1
eFDD 4 QPSK	low	1	15	22.5	1	1
eFDD 4 QPSK	low	36	15	20.76	1	1
eFDD 4 QPSK	low	75	15	20.63	1	1
eFDD 4 QPSK	mid	1	15	22.44	1	1
eFDD 4 QPSK	mid	36	15	20.78	1	1
eFDD 4 QPSK	mid	75	15	20.6	1	1
eFDD 4 QPSK	high	1	15	22.45	1	1
eFDD 4 QPSK	high	36	15	20.71	1	1
eFDD 4 QPSK	high	75	15	20.54	1	1
eFDD 4 16QAM	low	1	15	21.36	1	1
eFDD 4 16QAM	low	75	15	19.72	1	1
eFDD 4 16QAM	mid	1	15	21.43	1	1
eFDD 4 16QAM	mid	75	15	19.74	1	1
eFDD 4 16QAM	high	1	15	21.52	1	1
eFDD 4 16QAM	high	75	15	19.7	1	1
eFDD 4 QPSK	low	1	20	22.33	1	1
eFDD 4 QPSK	low	100	20	20.6	1	1
eFDD 4 QPSK	mid	1	20	22.36	1	1
eFDD 4 QPSK	mid	100	20	20.57	1	1
eFDD 4 QPSK	high	1	20	22.32	1	1
eFDD 4 QPSK	high	100	20	20.54	1	1
eFDD 4 16QAM	low	1	20	21.42	1	1
eFDD 4 16QAM	low	100	20	19.69	1	1
eFDD 4 16QAM	mid	1	20	21.3	1	1
eFDD 4 16QAM	mid	100	20	19.73	1	1
eFDD 4 16QAM	high	1	20	21.12	1	1
eFDD 4 16QAM	high	100	20	19.71	1	1
eFDD 13 QPSK	low	1	5	22.06	3	3
eFDD 13 QPSK	low	12	5	19.58	3	3
eFDD 13 QPSK	low	25	5	19.67	3	3
eFDD 13 QPSK	mid	1	5	22.09	3	3
eFDD 13 QPSK	mid	12	5	19.59	3	3
eFDD 13 QPSK	mid	25	5	19.75	3	3
eFDD 13 QPSK	high	1	5	21.89	3	3
eFDD 13 QPSK	high	12	5	19.78	3	3
eFDD 13 QPSK	high	25	5	19.51	3	3
eFDD 13 16QAM	low	1	5	21.25	3	3
eFDD 13 16QAM	low	25	5	18.99	3	3
eFDD 13 16QAM	mid	1	5	20.7	3	3
eFDD 13 16QAM	mid	25	5	18.82	3	3
eFDD 13 16QAM	high	1	5	20.94	3	3
eFDD 13 16QAM	high	25	5	18.79	3	3
eFDD 13 QPSK	mid	1	10	21.97	3	3
eFDD 13 QPSK	mid	50	10	20.01	3	3
eFDD 13 16QAM	mid	1	10	20.83	3	3
eFDD 13 16QAM	mid	50	10	19.05	3	3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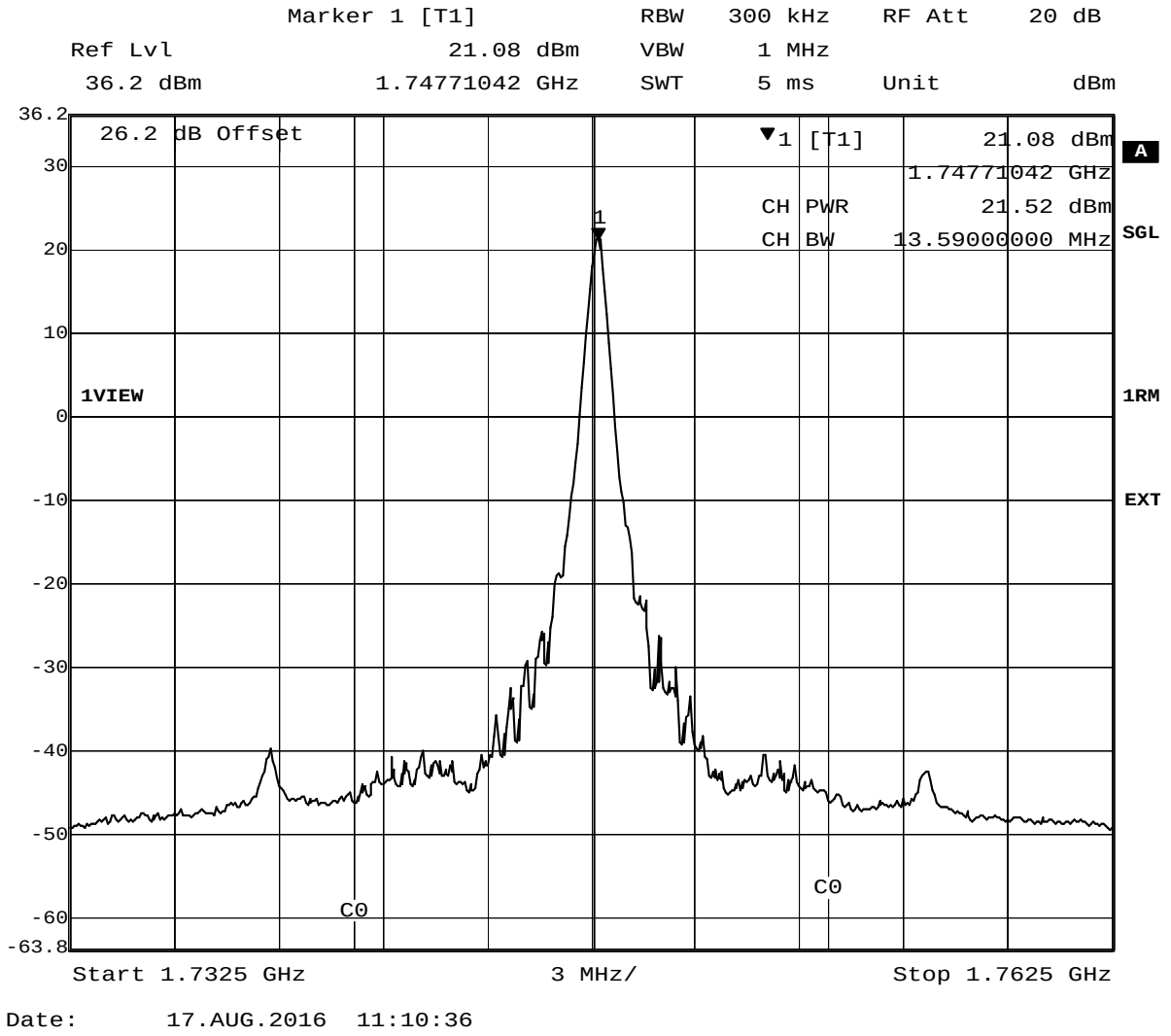
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1RM
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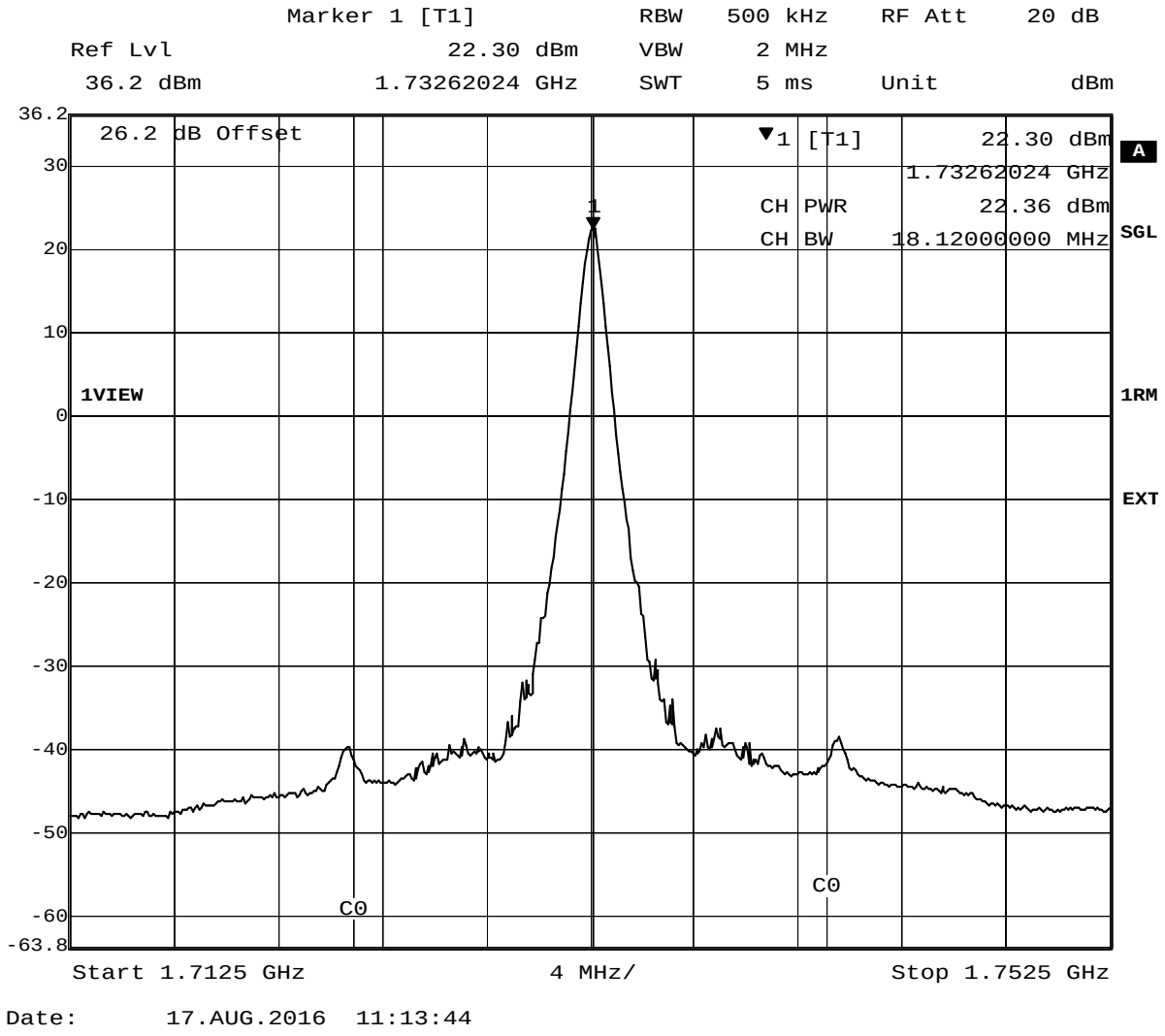
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20
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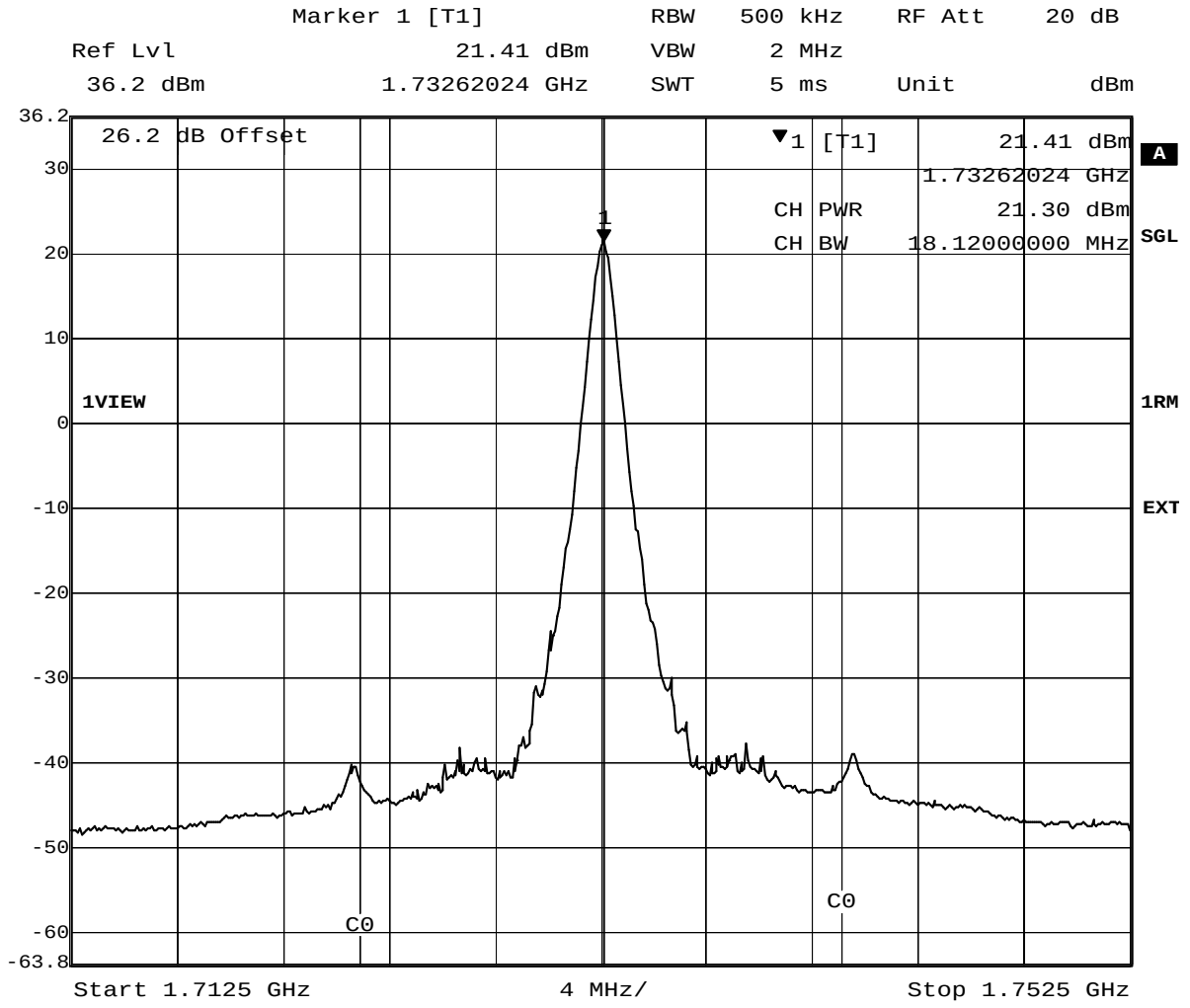
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10
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-10
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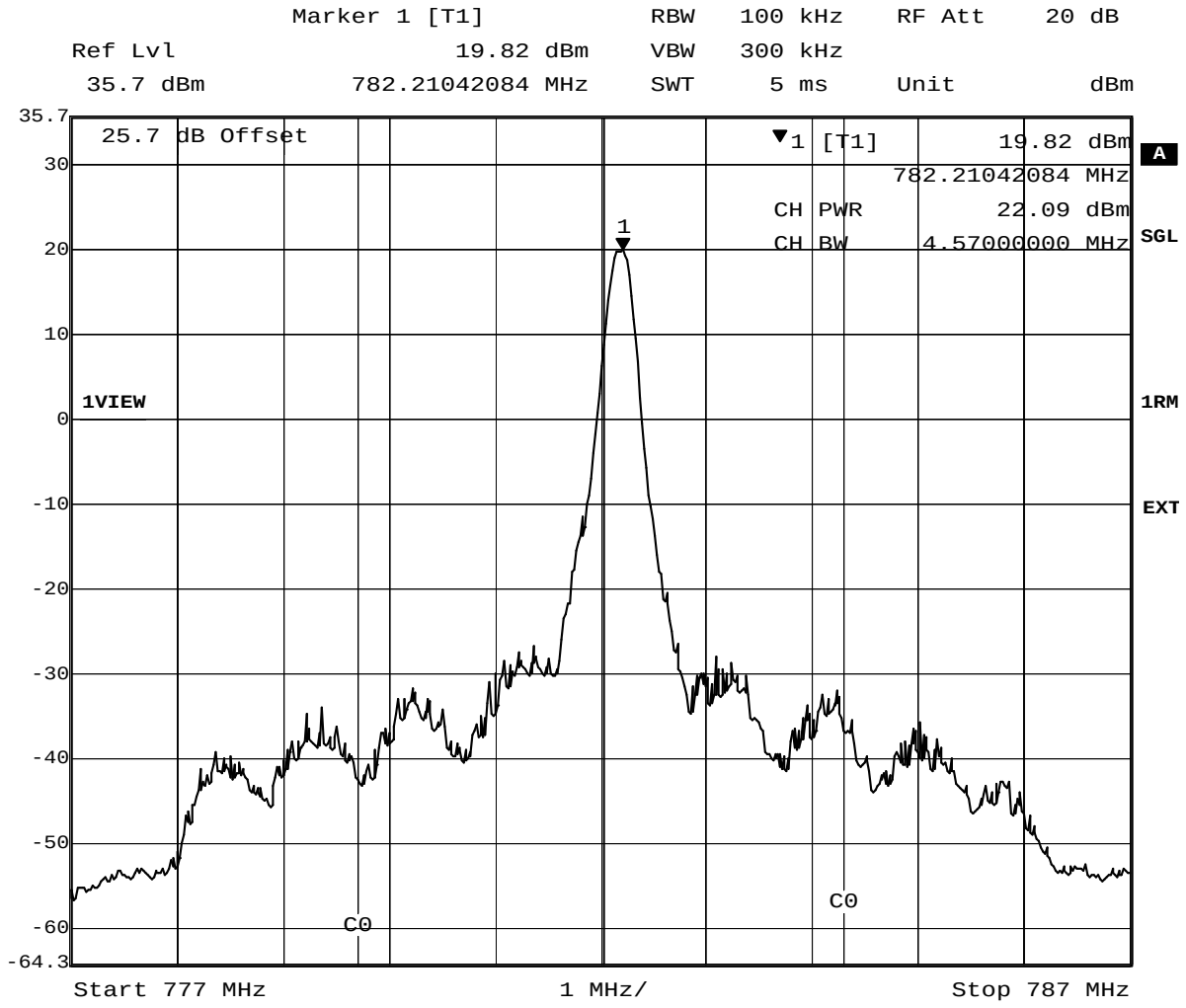
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VBW 300 kHz
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Unit dBm
25.7 dB Offset
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782.21042084 MHz
CH PWR 22.09 dBm
CH BW 4.57000000 MHz
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20
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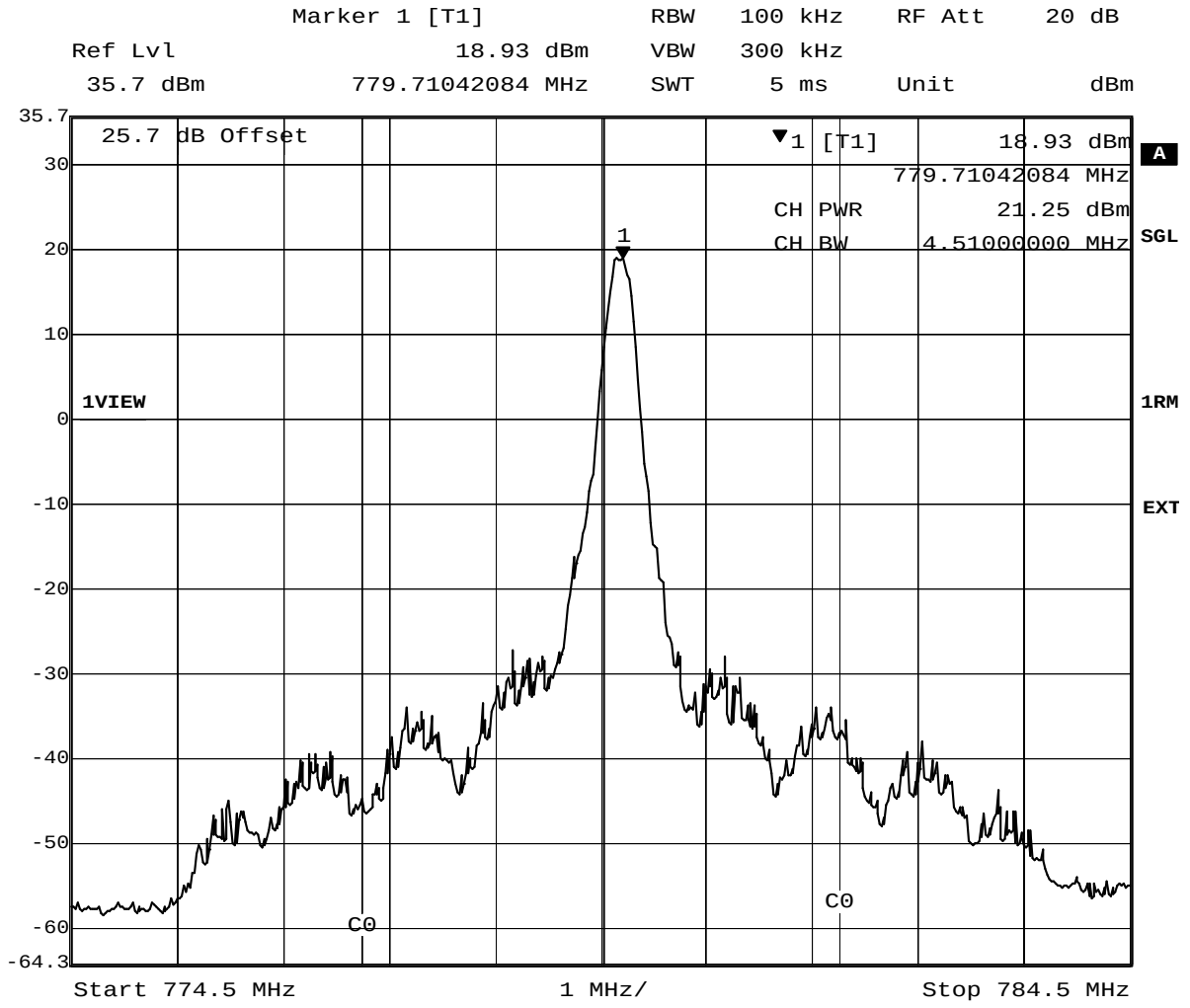
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Ref Lvl
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VBW 300 kHz
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SWT 5 ms
Unit dBm
25.7 dB Offset
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18.93 dBm
779.71042084 MHz
CH PWR
21.25 dBm
CH BW
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A
SGL
1VIEW
1RM
EXT
35.7
30
20
10
0
-10
-20
-30
-40
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C0
C0
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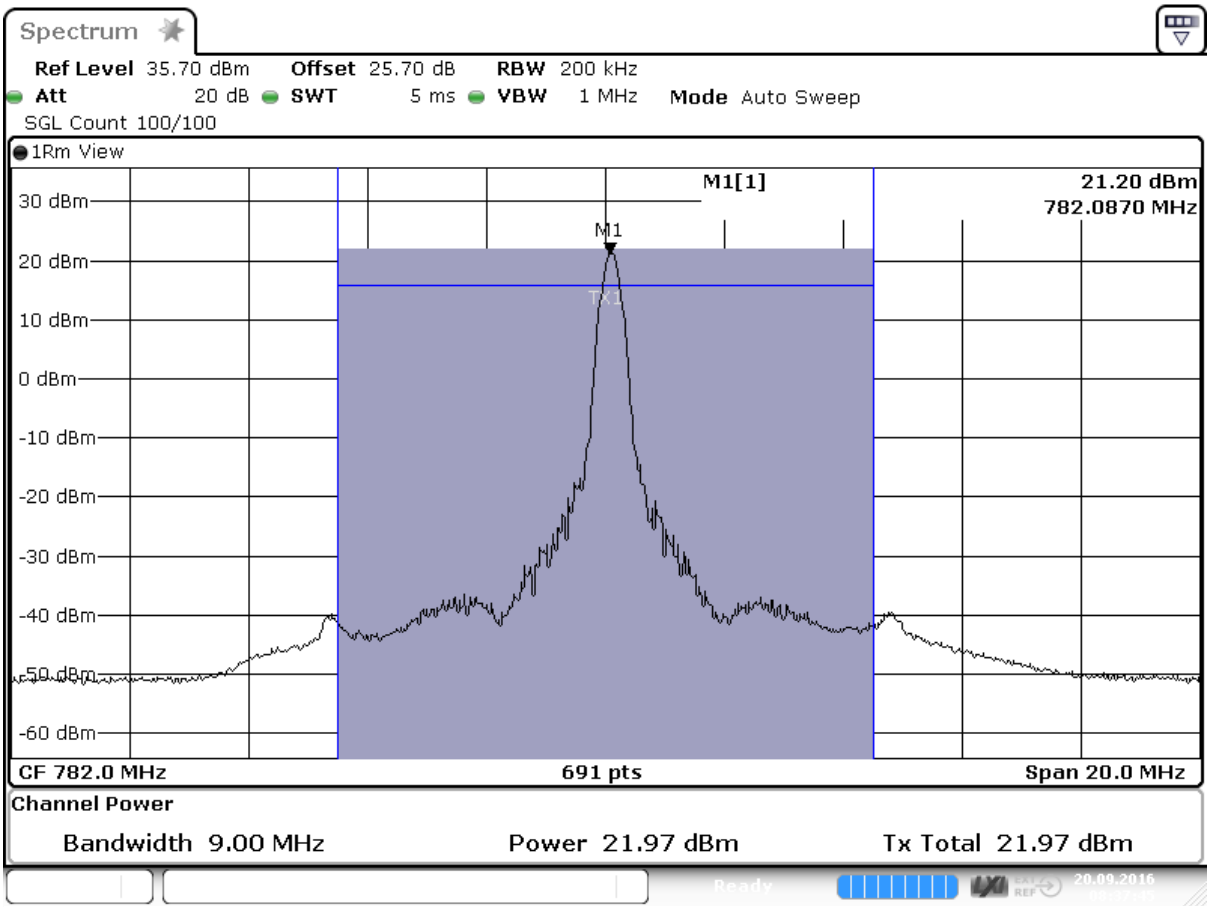

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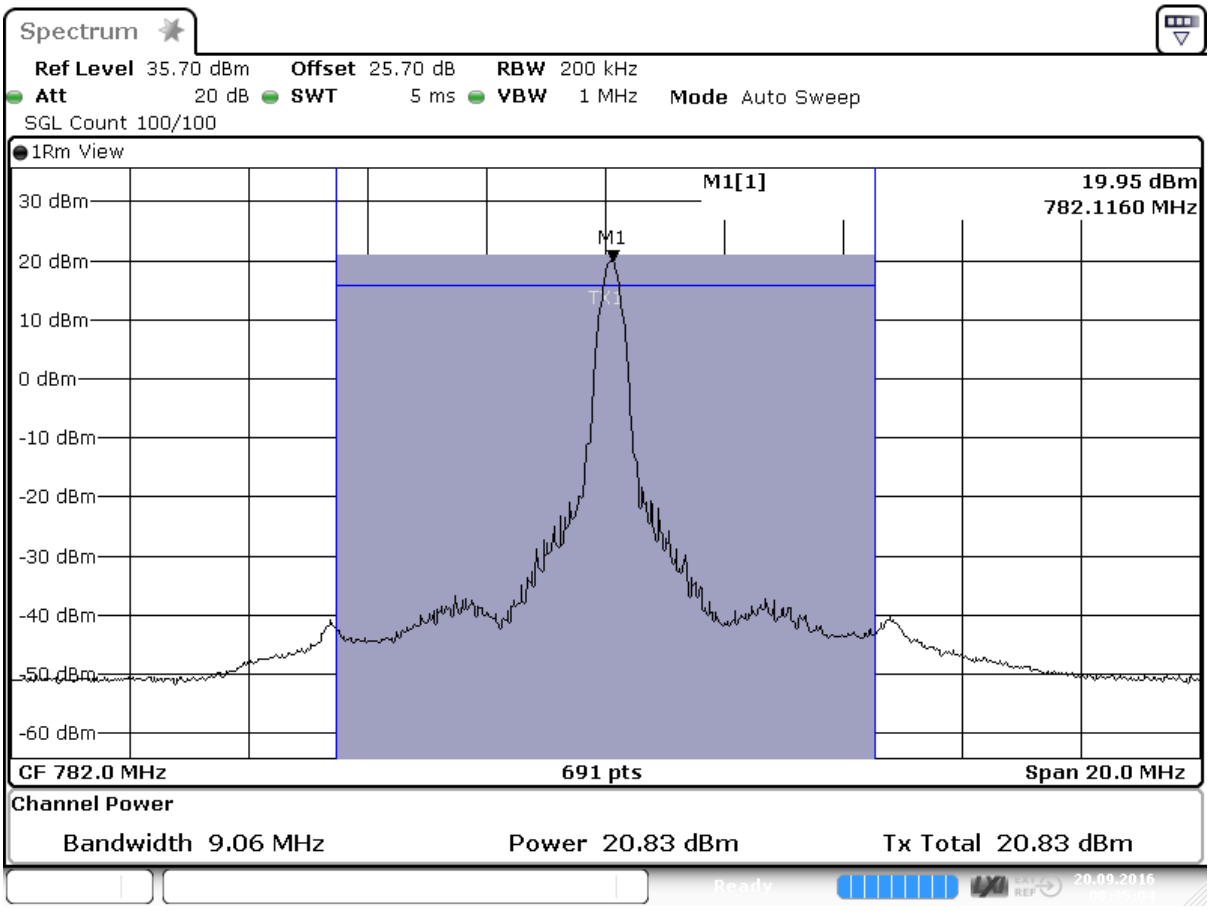

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3.5.2 27.2 Frequency stability §2.1055, §27.54

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

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/08/16 13:23	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	-10	passed
-30	5			-1	-11	passed
-30	10			-1	-5	passed
-20	0	normal	4331.25	-2	-18	passed
-20	5			-2	-10	passed
-20	10			-1	-12	passed
-10	0	normal	4331.25	-2	-16	passed
-10	5			-2	-15	passed
-10	10			-1	-7	passed
0	0	normal	4331.25	-1	-4	passed
0	5			-2	-11	passed
0	10			-1	-14	passed
10	0	normal	4331.25	-2	-8	passed
10	5			-1	-16	passed
10	10			-1	-17	passed
20	0	low	4331.25	-2	-19	passed
20	5			-1	-12	passed
20	10			-2	-9	passed
20	0	normal = high [1]	4331.25	-2	-14	passed
20	5			-2	-15	passed
20	10			-1	-19	passed
20	0	high	4331.25	-1	-17	passed
20	5			-1	-6	passed
20	10			-2	-9	passed
30	0	normal	4331.25	-1	-11	passed
30	5			-1	-15	passed
30	10			-1	-6	passed
40	0	normal	4331.25	-1	-18	passed
40	5			0	-19	passed
40	10			-1	-12	passed
50	0	normal	4331.25	-2	-13	passed
50	5			-1	-12	passed
50	10			-1	-9	passed

Center frequency: 1732.5 MHz

Battery operating end point voltage [2]						
Temp. °C	Duration min	Voltage V	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
20	0	x.xx	4331.25			passed
20	5					passed
20	10					passed

1) The manufacturer declared that normal voltage is equivalent with high voltage.
2) The call is established at high voltage and the voltage is then reduced to the battery operating end.
3) The EUT didnt work below -xx °C

eFDD4

Temp. °C	Duration min	Voltage	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
-30	0	normal	1769	2	7	passed
-30	5			1	6	passed
-30	10			1	12	passed
-20	0	normal	1769	1	10	passed
-20	5			0	6	passed
-20	10			1	13	passed
-10	0	normal	1769	1	4	passed
-10	5			1	9	passed
-10	10			1	8	passed
0	0	normal	1769	1	10	passed
0	5			1	7	passed
0	10			1	13	passed
10	0	normal	1769	2	6	passed
10	5			1	7	passed
10	10			1	-5	passed
20	0	low	1769	1	5	passed
20	5			1	6	passed
20	10			1	8	passed
20	0	normal = high [1]	1769	1	4	passed
20	5			1	12	passed
20	10			1	8	passed
20	0	high	1769	1	12	passed
20	5			2	9	passed
20	10			1	-6	passed
30	0	normal	1769	1	8	passed
30	5			1	6	passed
30	10			1	10	passed
40	0	normal	1769	1	7	passed
40	5			1	-9	passed
40	10			1	8	passed
50	0	normal	1769	1	9	passed
50	5			1	5	passed
50	10			2	13	passed

Center frequen

Battery operating end point voltage [2]						
Temp. °C	Duration min	Voltage V	Limit Hz	Freq. error Average (Hz)	Freq. error Max. (Hz)	Verdict
20	0	x.xx	1769			passed
20	5					passed
20	10					passed

1) The manufacturer declared that normal voltage is equivalent with high voltage.
2) The call is established at high voltage and the voltage is then reduced to the battery operating end.
3) The EUT didnt work below -xx °C

eFDD13

3.5.3 27.3 Spurious emissions at antenna terminals §2.1051, §27.53

Test: 27.3; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23205, Frequency = 779.5MHz, Method = conducted

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/08/17 16:04	FCC part 2 and 27

Detailed Results:

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	margin to limit /dB	limit /dBm	verdict
peak	maxhold	100	6973.948	-34.36	21.36	-13	passed

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

Test: 27.3; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23230, Frequency = 782MHz, Method = conducted

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/08/17 16:02	FCC part 2 and 27

Detailed Results:

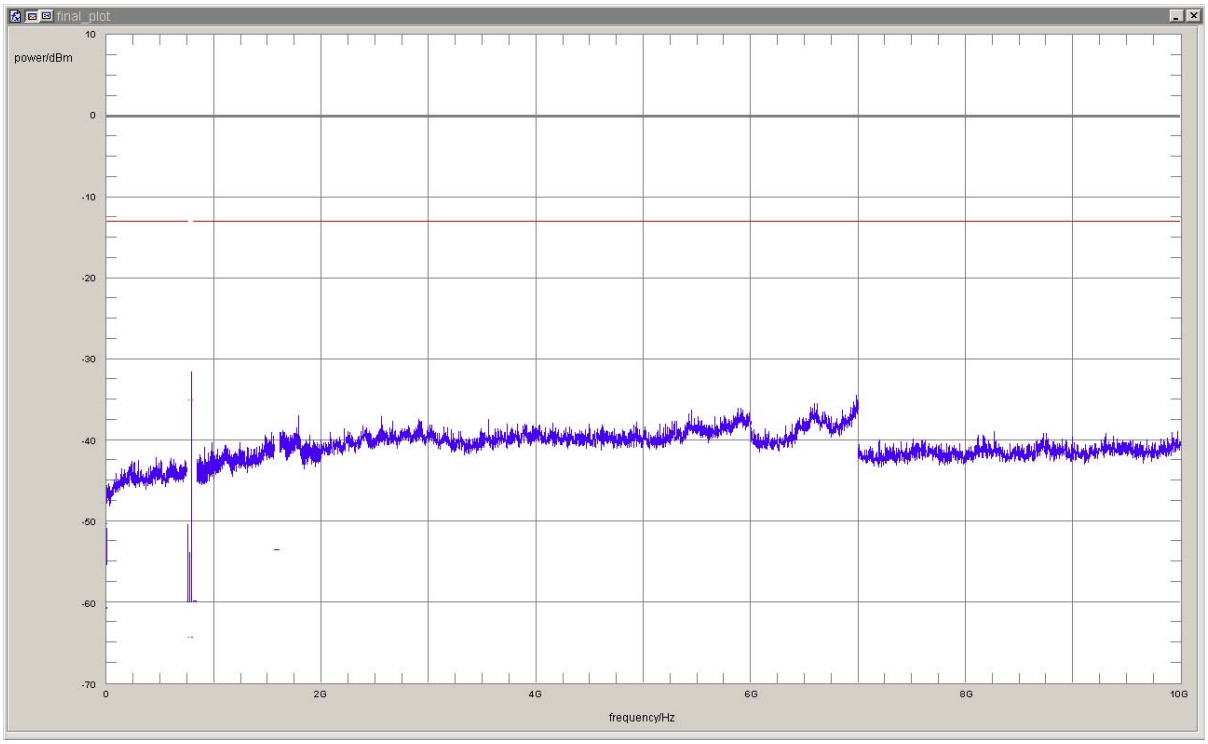
detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	margin to limit /dB	limit /dBm	verdict
peak	maxhold	100	6973.948	-33.95	20.95	-13	passed

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

Test: 27.3; Frequency Band = eFDD13, Mode = QPSK 5MHz, Channel = 23255, Frequency = 784.5MHz, Method = conducted

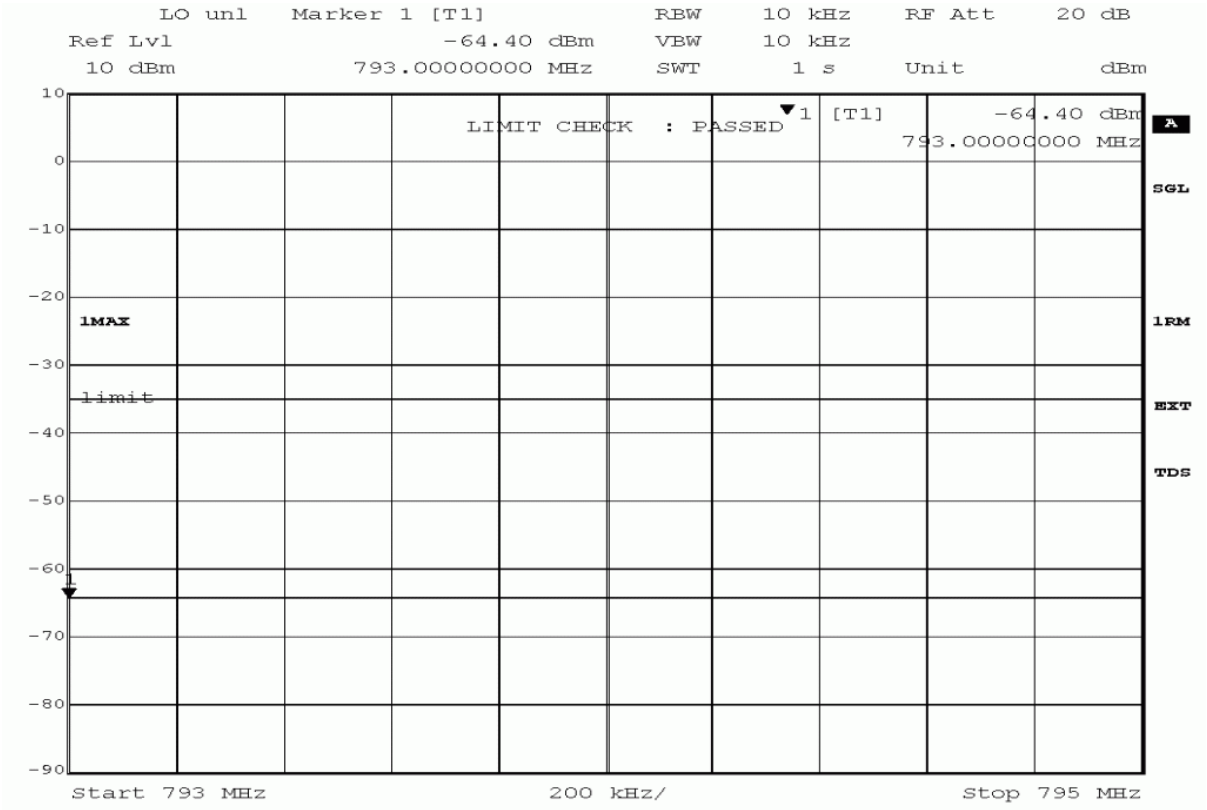
Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/08/17 16:01	FCC part 2 and 27

Detailed Results:

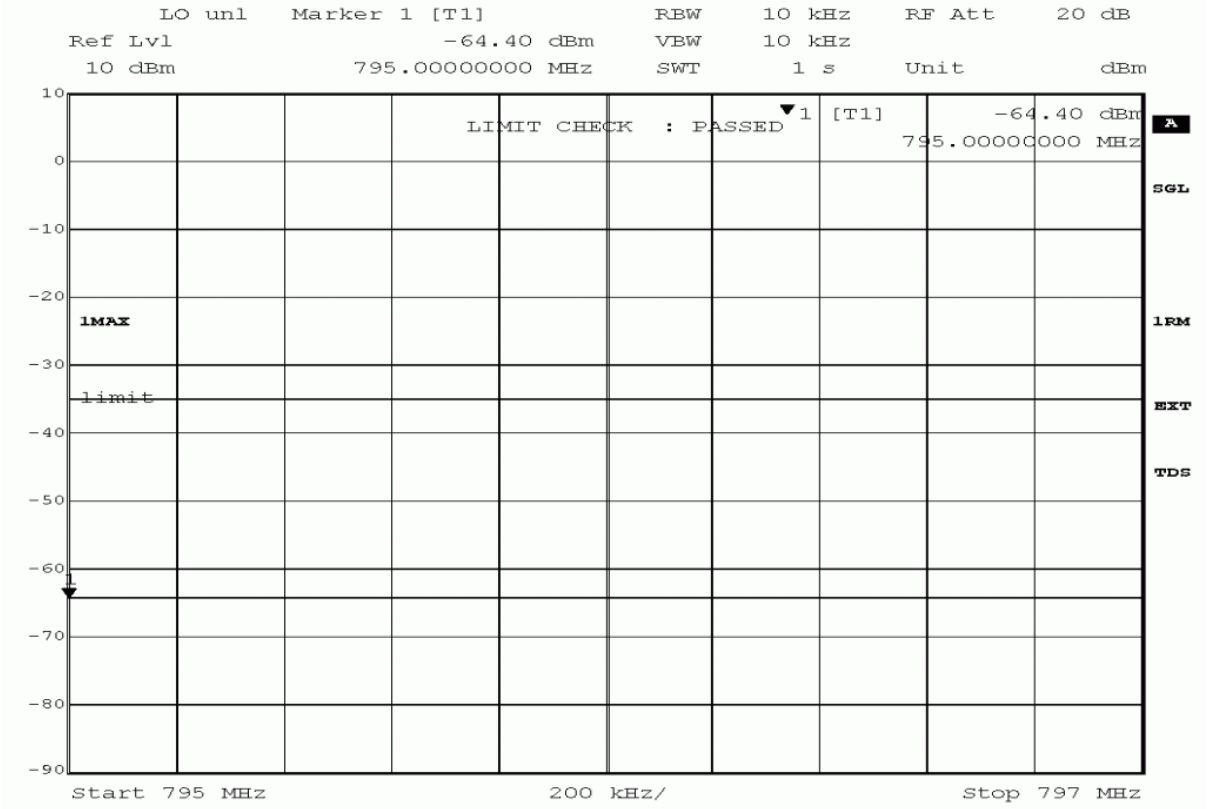


detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	margin to limit /dB	limit /dBm	verdict
rms	maxhold	100	787.12	-31.7	18.7	-13.0	passed

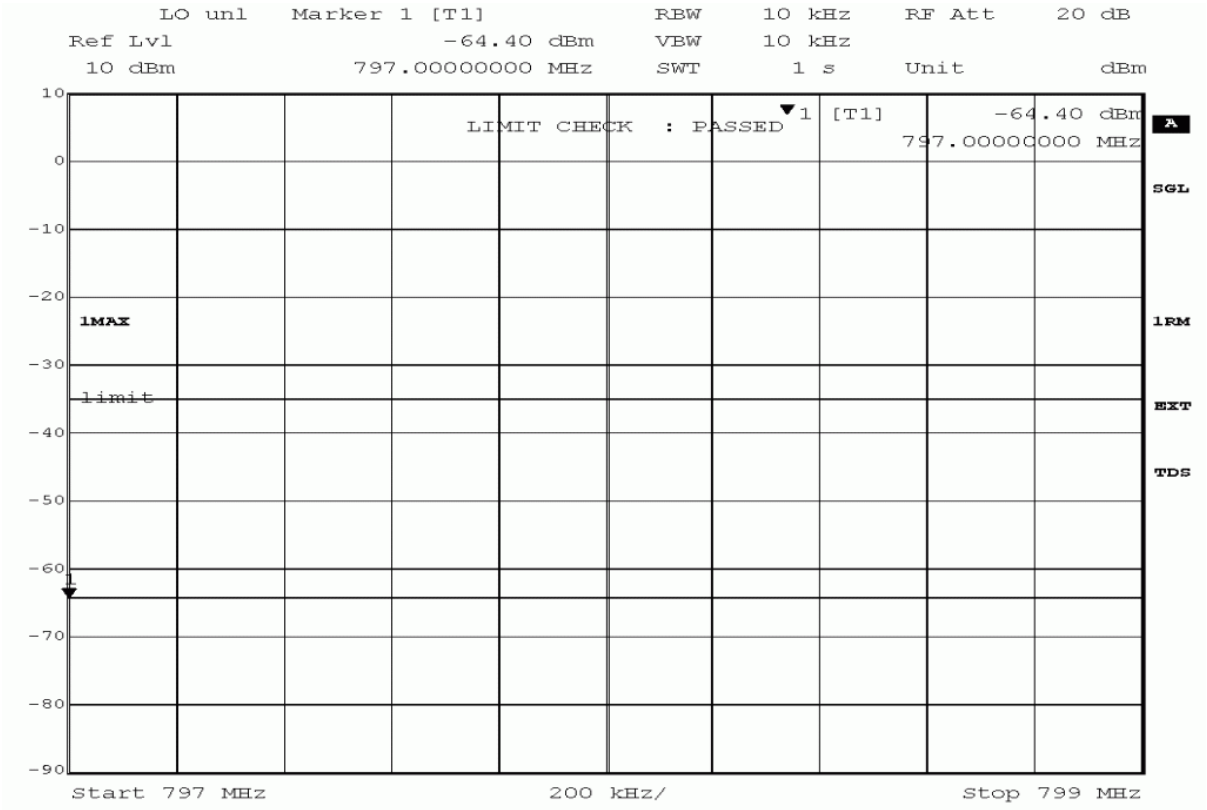
no further values have been found with a margin of less than 20 dB



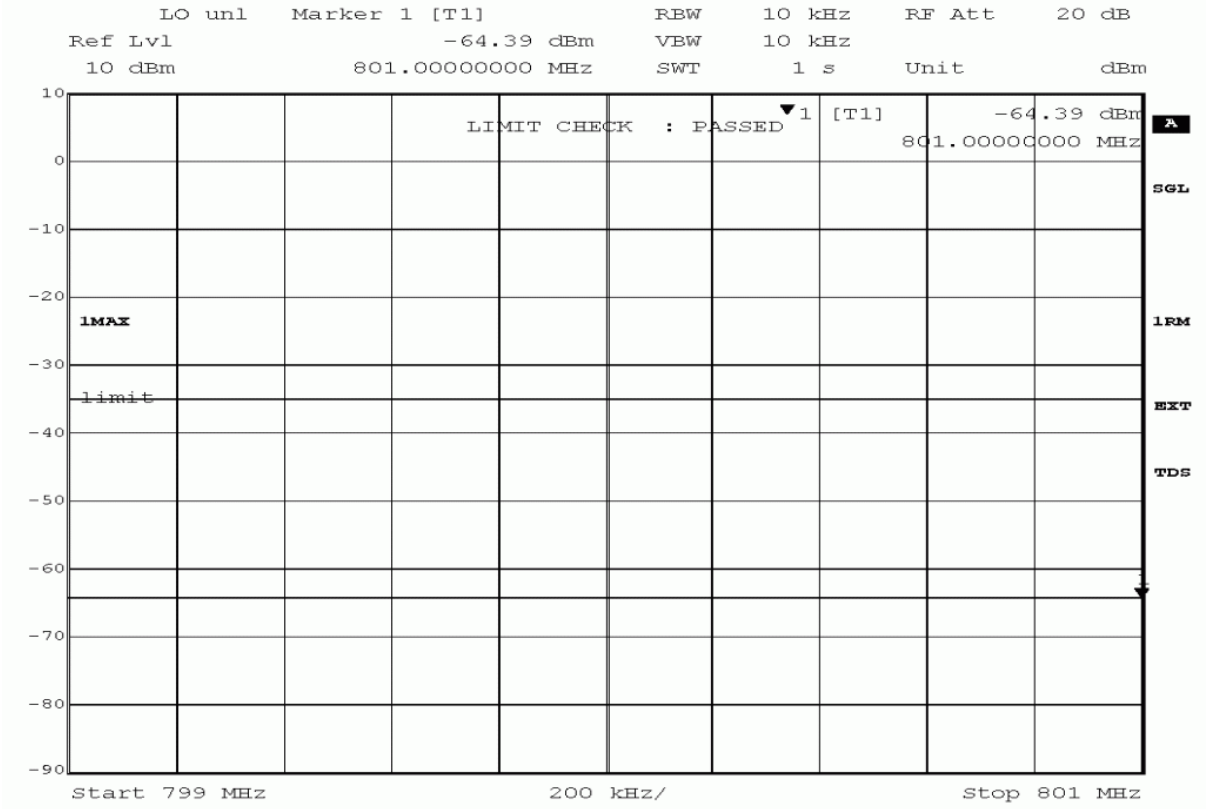
Title: spurious emissions conducted measurement
Comment A: DE1015039, spurious emissions conducted
eFDD 13 QPSK 5 MHz, ch.23255 (784.5MHz)
Date: 26.AUG.2016 17:12:23



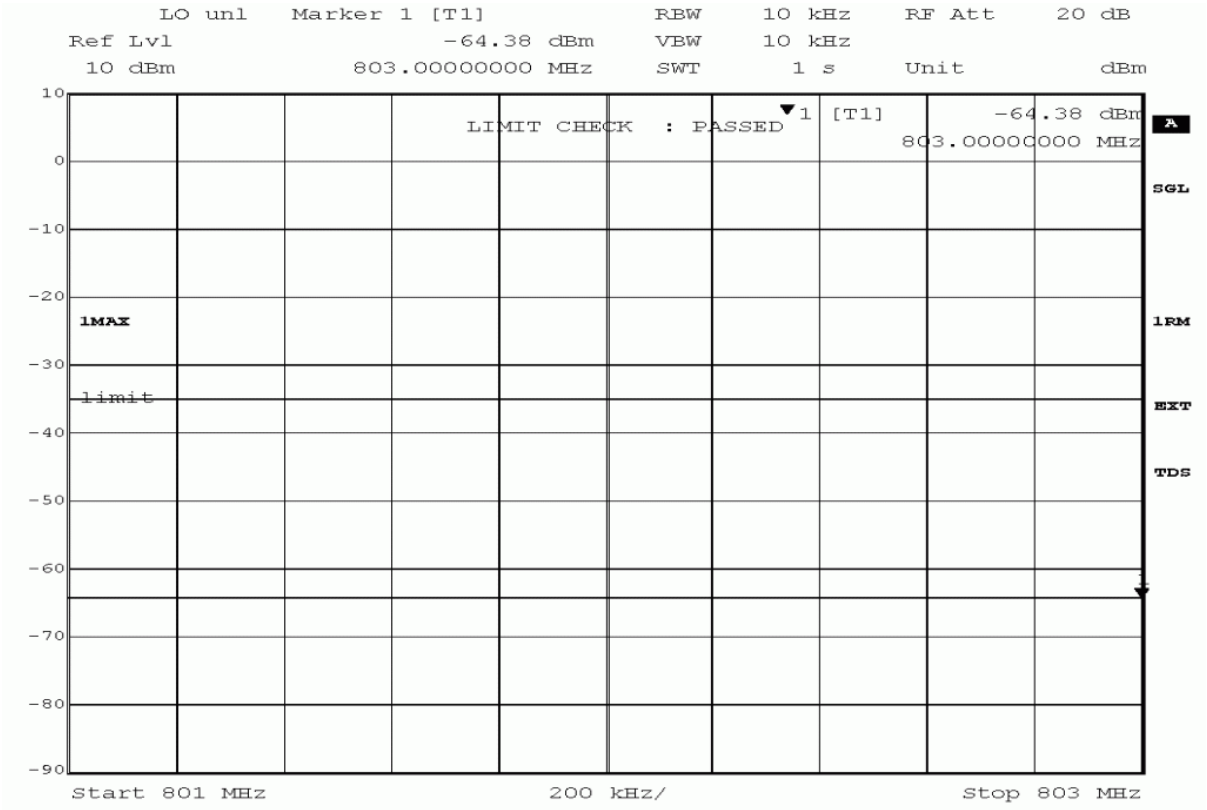
Title: spurious emissions conducted measurement
Comment A: DE1015039, spurious emissions conducted
eFDD 13 QPSK 5 MHz, ch.23255 (784.5MHz)
Date: 26.AUG.2016 17:12:30



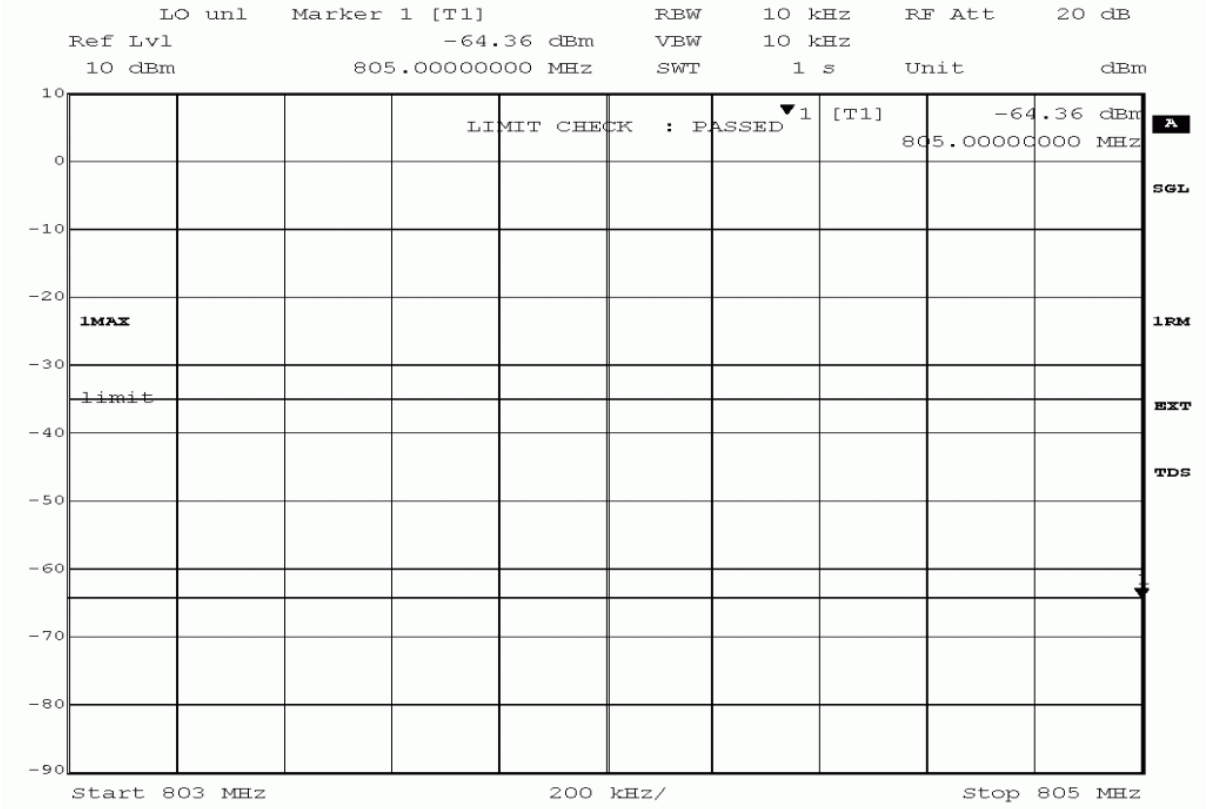
Title: spurious emissions conducted measurement
Comment A: DE1015039, spurious emissions conducted
eFDD 13 QPSK 5 MHz, ch.23255 (784.5MHz)
Date: 26.AUG.2016 17:12:37



Title: spurious emissions conducted measurement
Comment A: DE1015039, spurious emissions conducted
eFDD 13 QPSK 5 MHz, ch.23255 (784.5MHz)
Date: 26.AUG.2016 17:12:43



Title: spurious emissions conducted measurement
Comment A: DE1015039, spurious emissions conducted
eFDD 13 QPSK 5 MHz, ch.23255 (784.5MHz)
Date: 26.AUG.2016 17:12:50



Title: spurious emissions conducted measurement
Comment A: DE1015039, spurious emissions conducted
eFDD 13 QPSK 5 MHz, ch.23255 (784.5MHz)
Date: 26.AUG.2016 17:12:57

Test: 27.3; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 19975, Frequency = 1712.5MHz, Method = conducted

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/08/17 15:55	FCC part 2 and 27

Detailed Results:

detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	margin to limit /dB	limit /dBm	verdict
rms	maxhold	100	1709.00	-23.9	10.9	-13.0	passed
rms	maxhold	5	1709.988	-23.3	10.3	-13.0	passed

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

Test: 27.3; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 20175, Frequency = 1732.5MHz, Method = conducted

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/08/17 15:57	FCC part 2 and 27

Detailed Results:

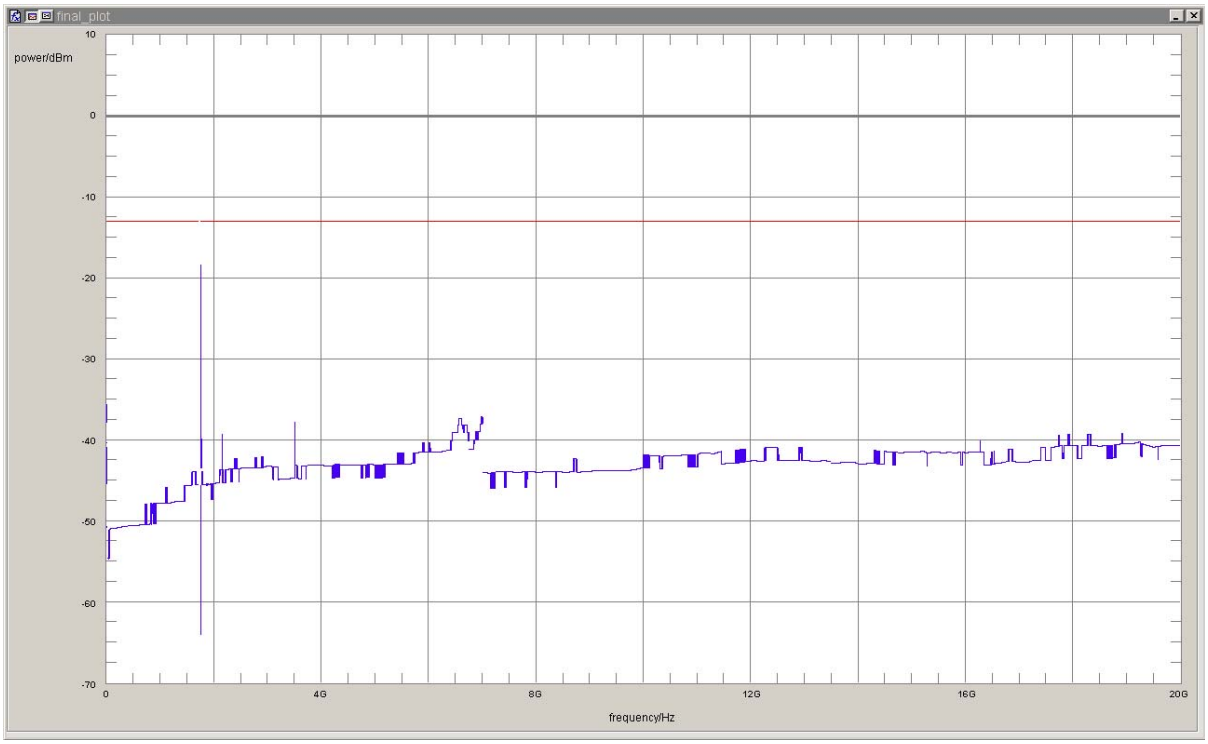
detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	margin to limit /dB	limit /dBm	verdict
rms	maxhold	1	0.030	-35.50	22.50	-13	passed

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

Test: 27.3; Frequency Band = eFDD4, Mode = QPSK 5MHz, Channel = 20375, Frequency = 1752.5MHz, Method = conducted

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/08/17 15:59	FCC part 2 and 27

Detailed Results:



detector	trace	resolution bandwidth /kHz	frequency /MHz	peak value /dBm	margin to limit /dB	limit /dBm	verdict
rms	maxhold	100	1756.07	-23.1	10.1	-13.0	passed
rms	maxhold	100	1758.92	-18.3	5.3	-13.0	passed

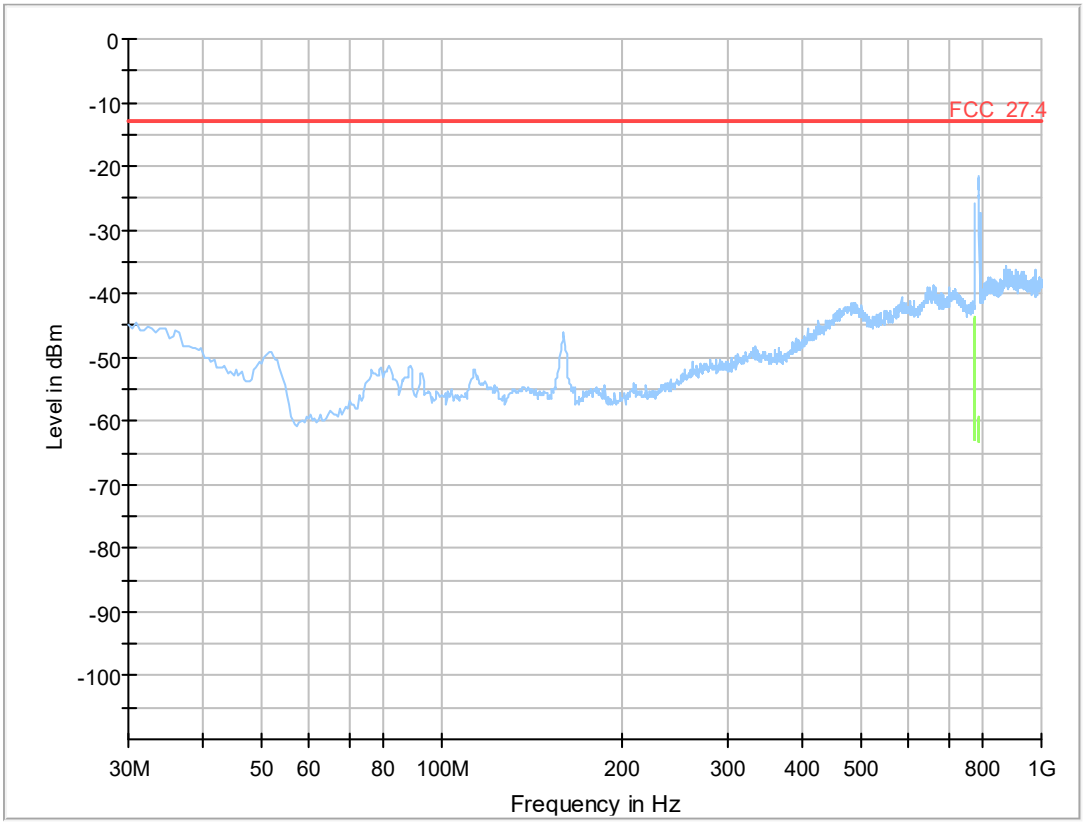
no further values have been found with a margin of less than 20 dB

3.5.4 27.4 Field strength of spurious radiation §2.1053, §27.53

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

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AY02	2016/09/12 13:39	FCC part 2 and 27

Detailed Results:



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

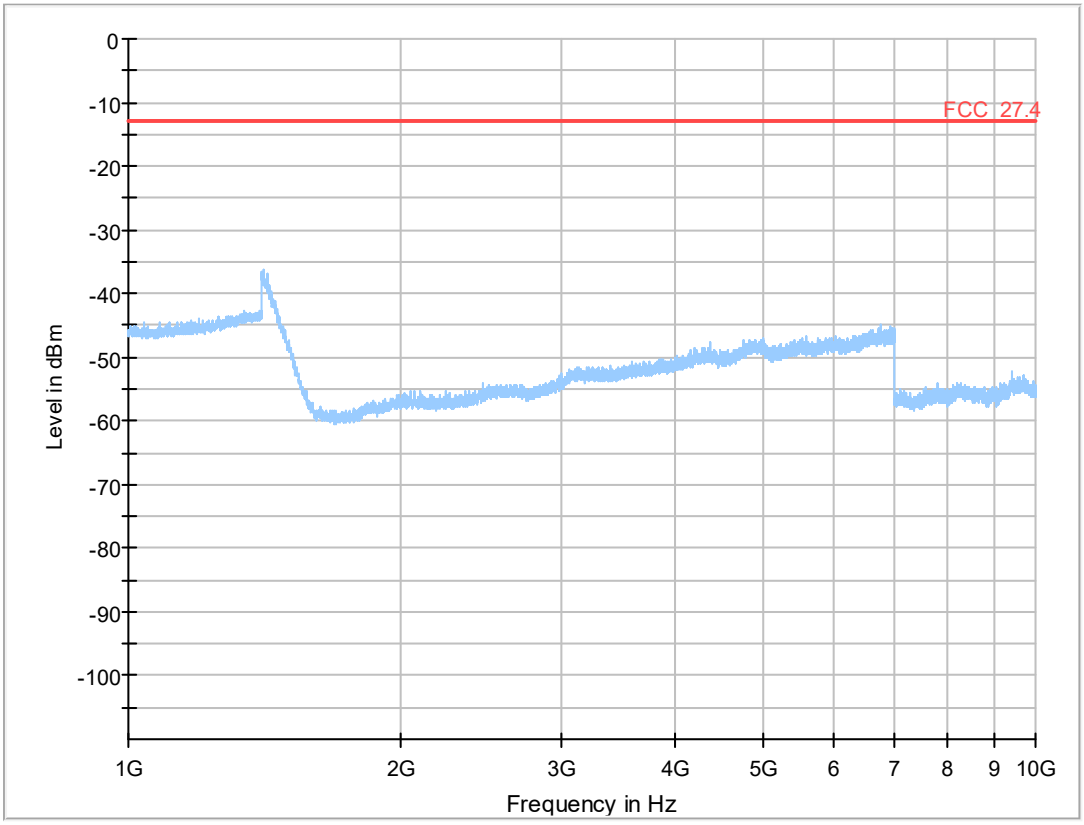
Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

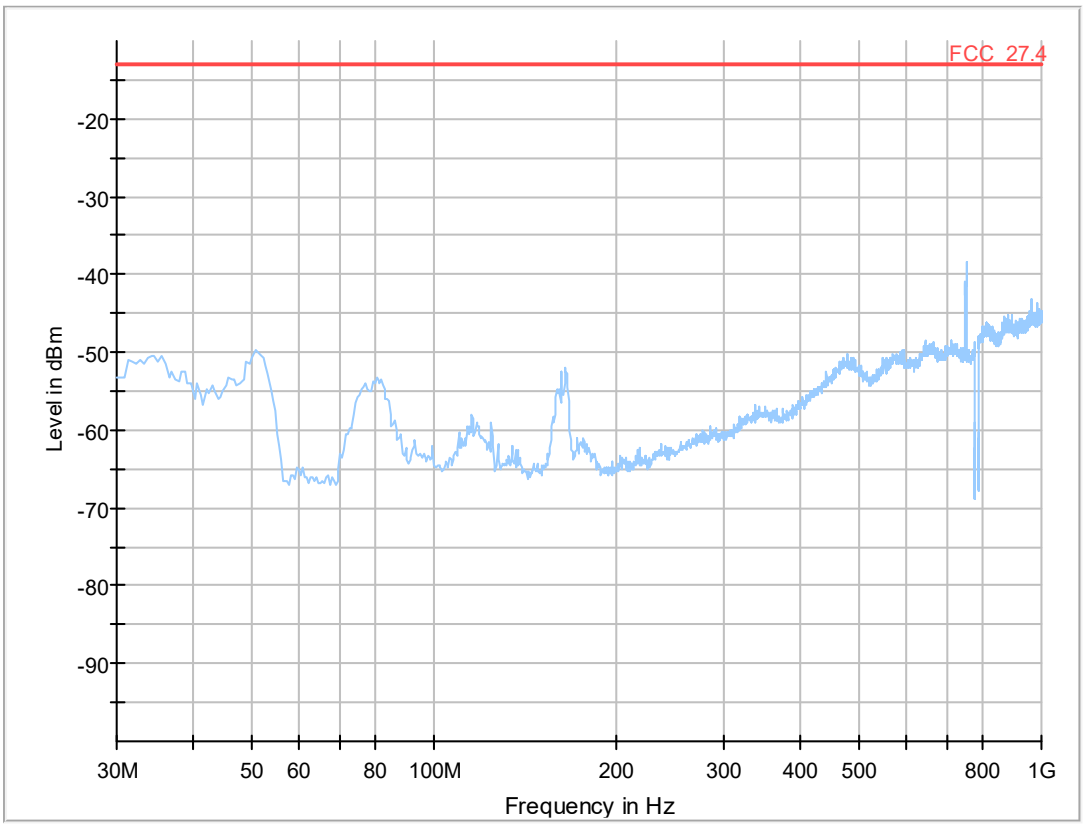
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

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

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AY02	2016/09/12 11:57	FCC part 2 and 27

Detailed Results:



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

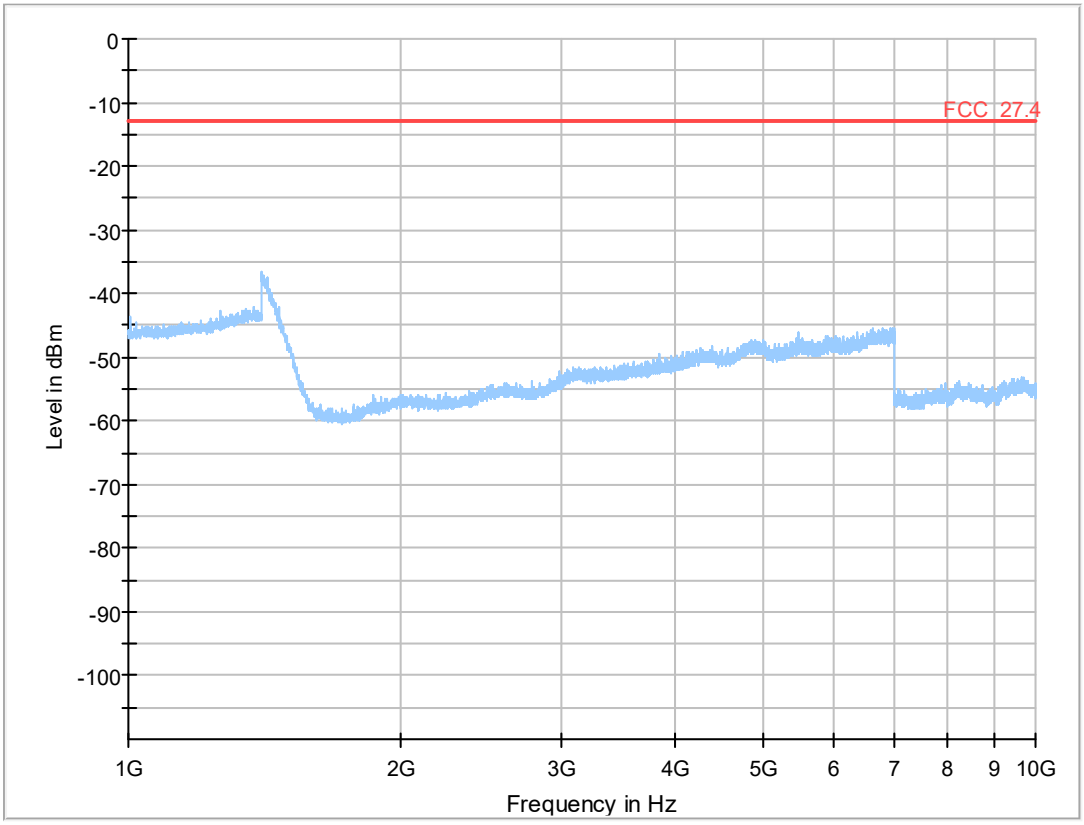
Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

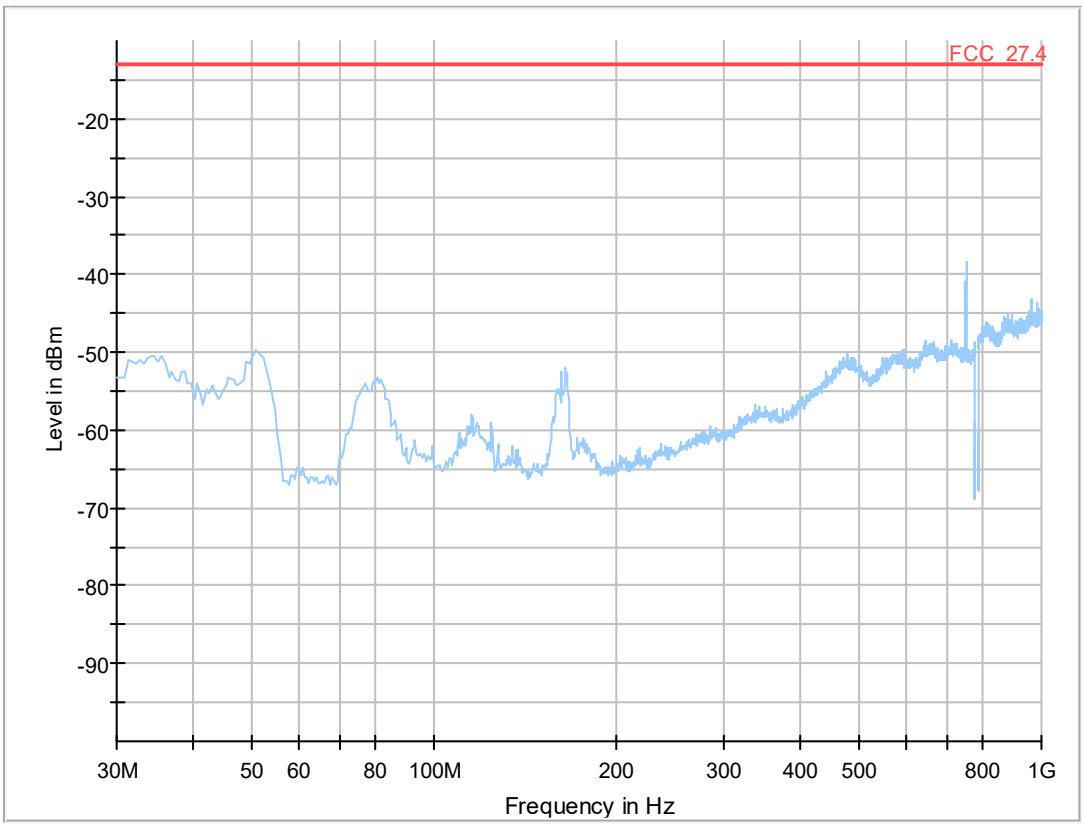
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

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

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AY02	2016/09/12 14:54	FCC part 2 and 27

Detailed Results:



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

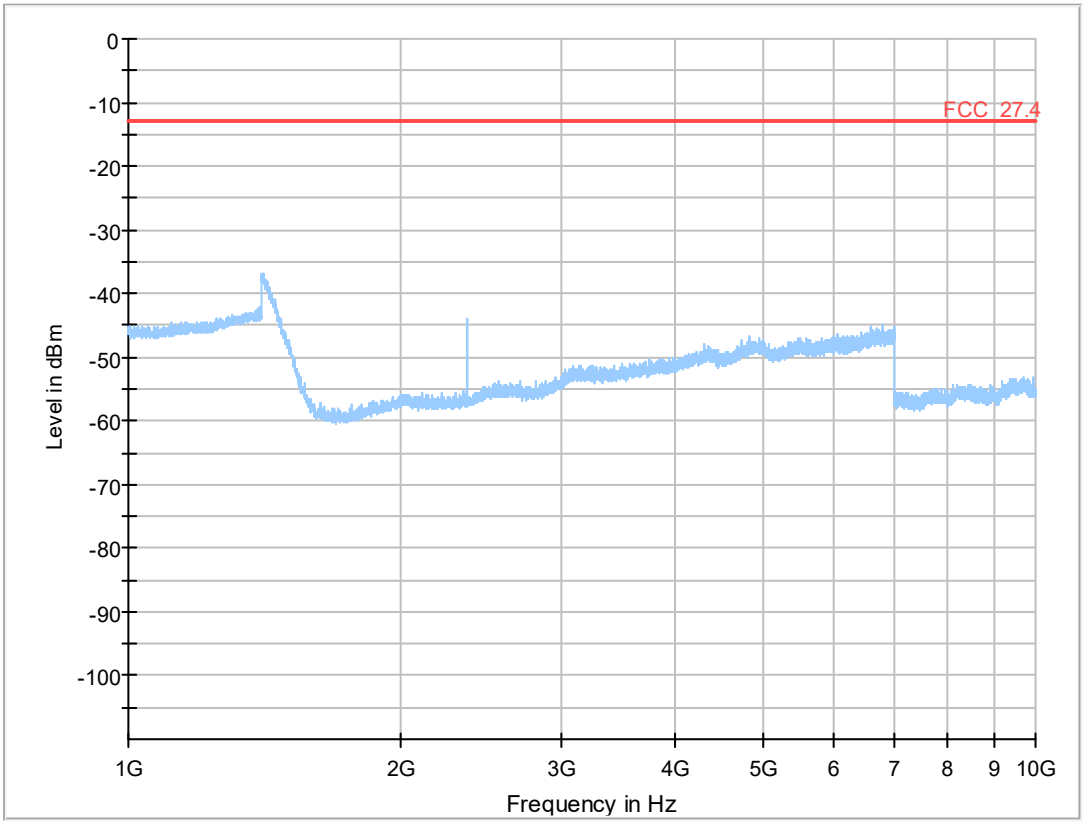
Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

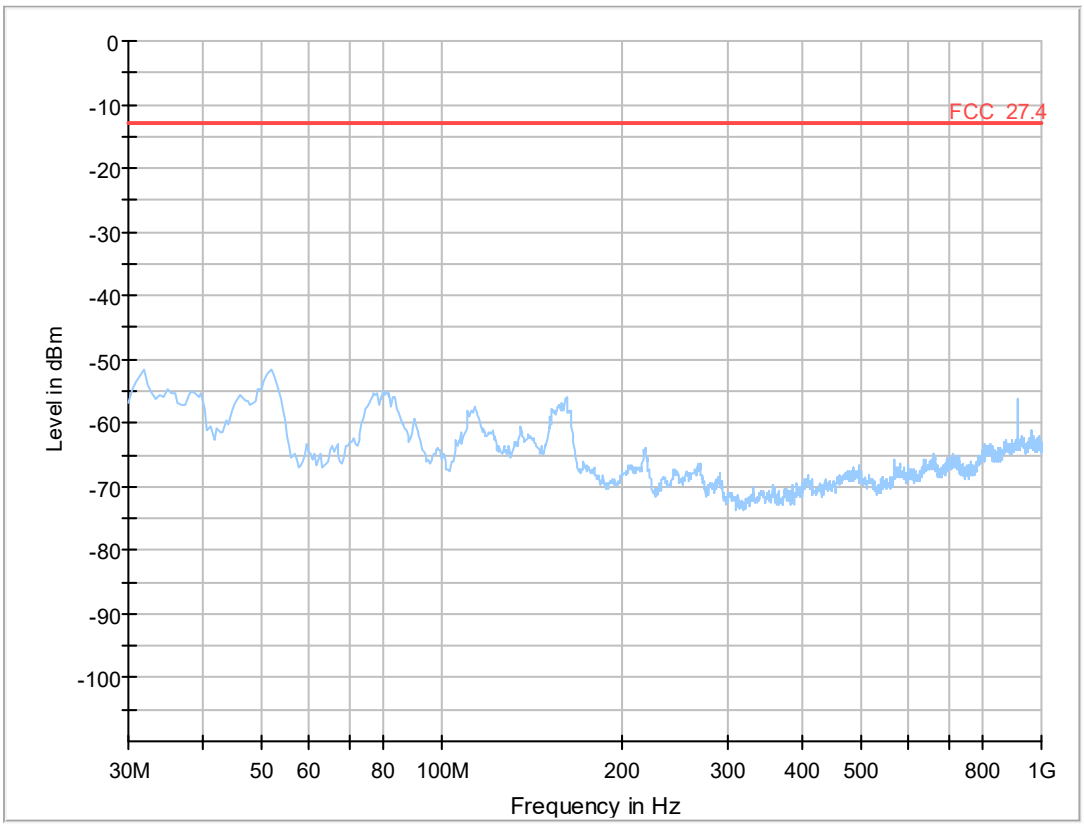
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

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

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AY02	2016/09/12 9:23	FCC part 2 and 27

Detailed Results:



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

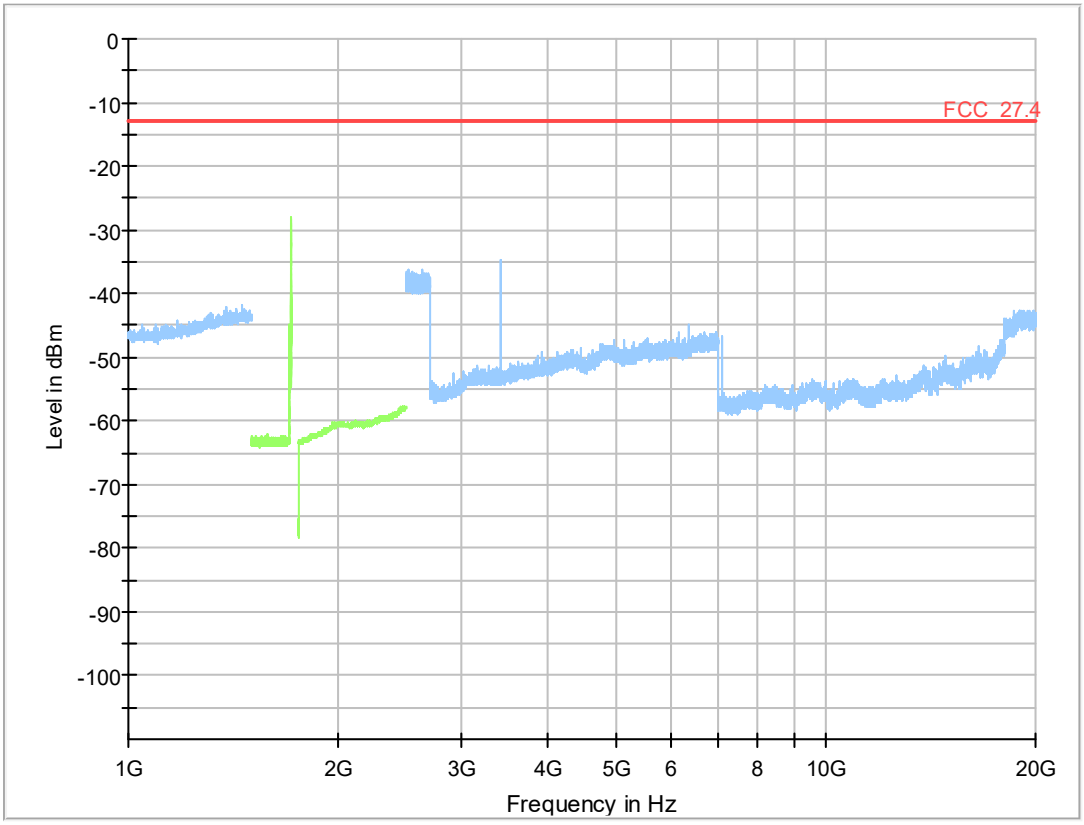
Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

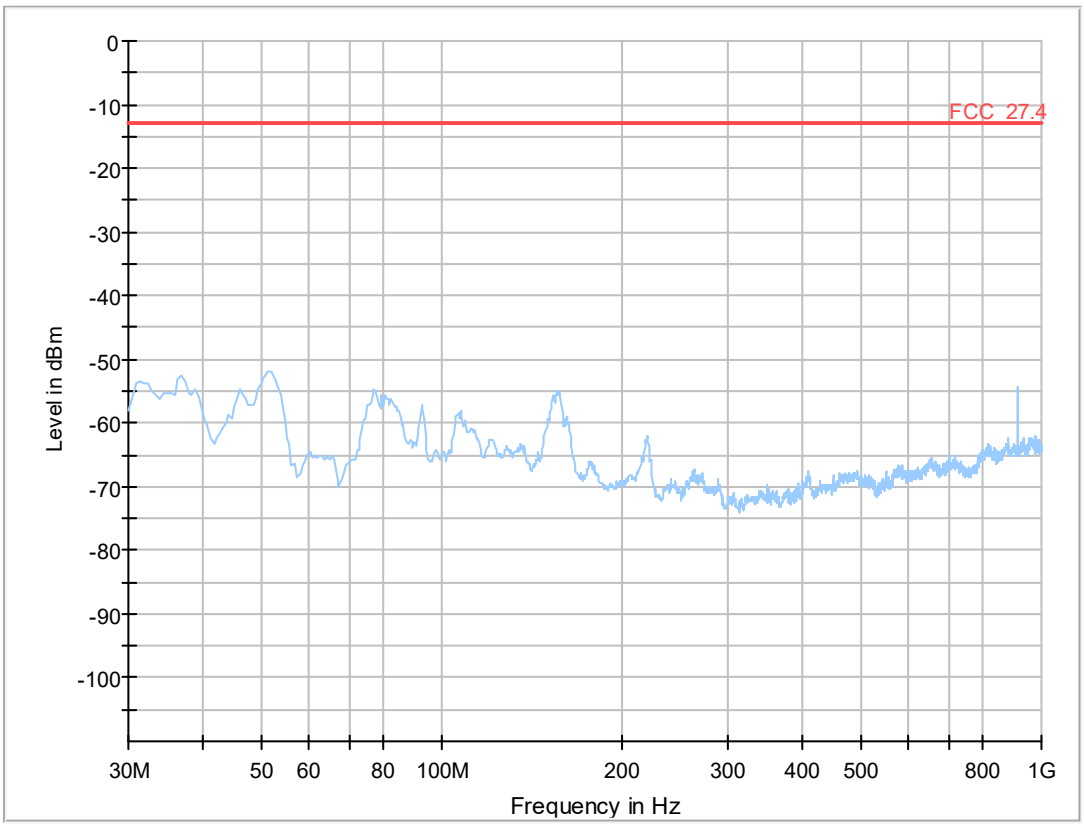
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

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

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AY02	2016/09/12 10:16	FCC part 2 and 27

Detailed Results:



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

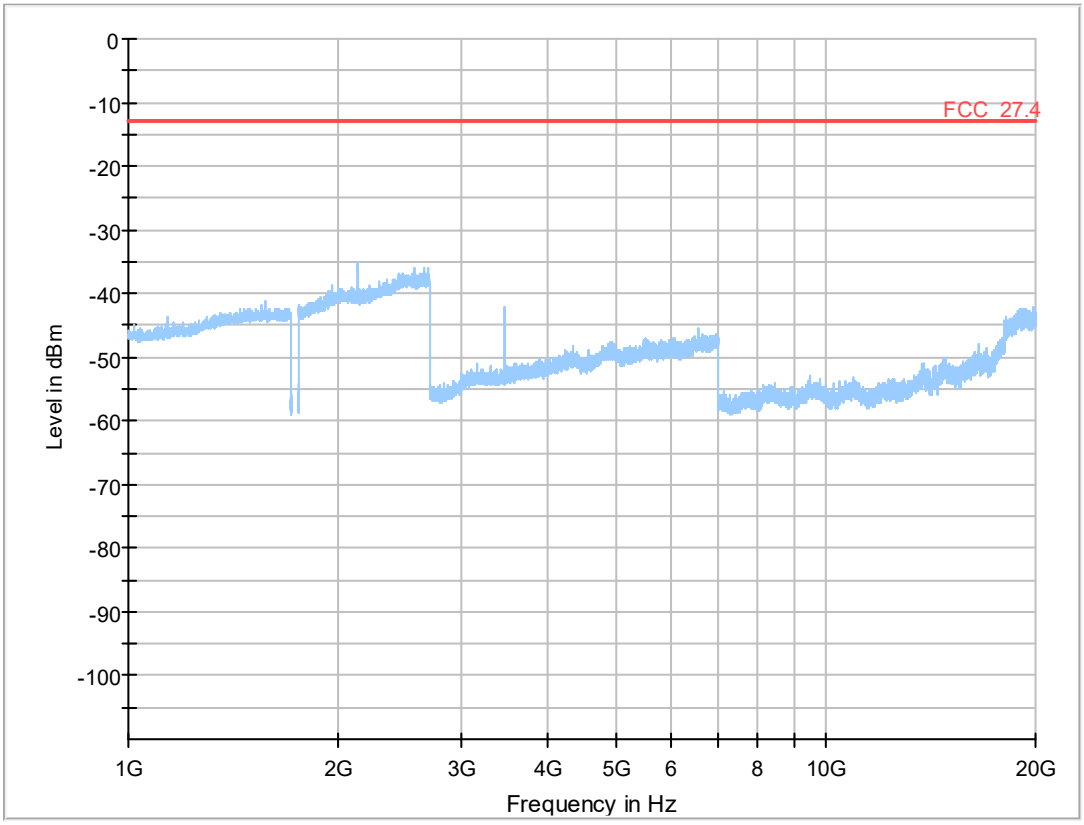
Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

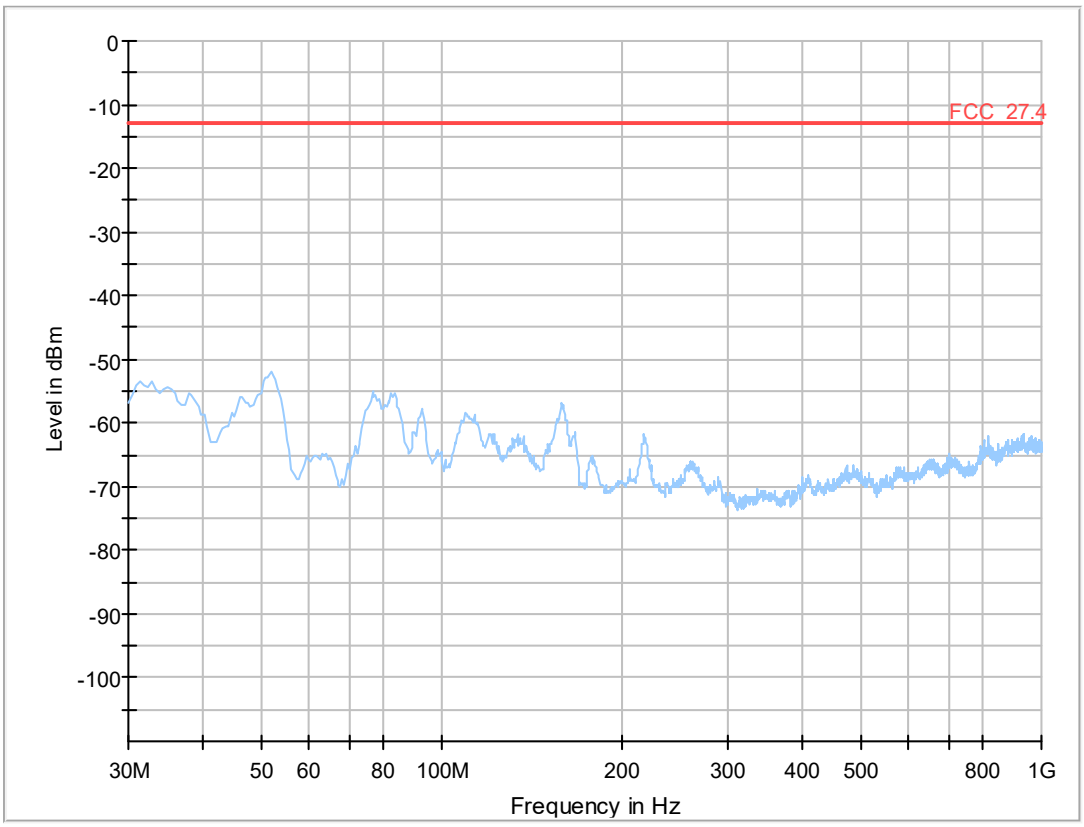
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

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

Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AY02	2016/09/12 10:17	FCC part 2 and 27

Detailed Results:



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

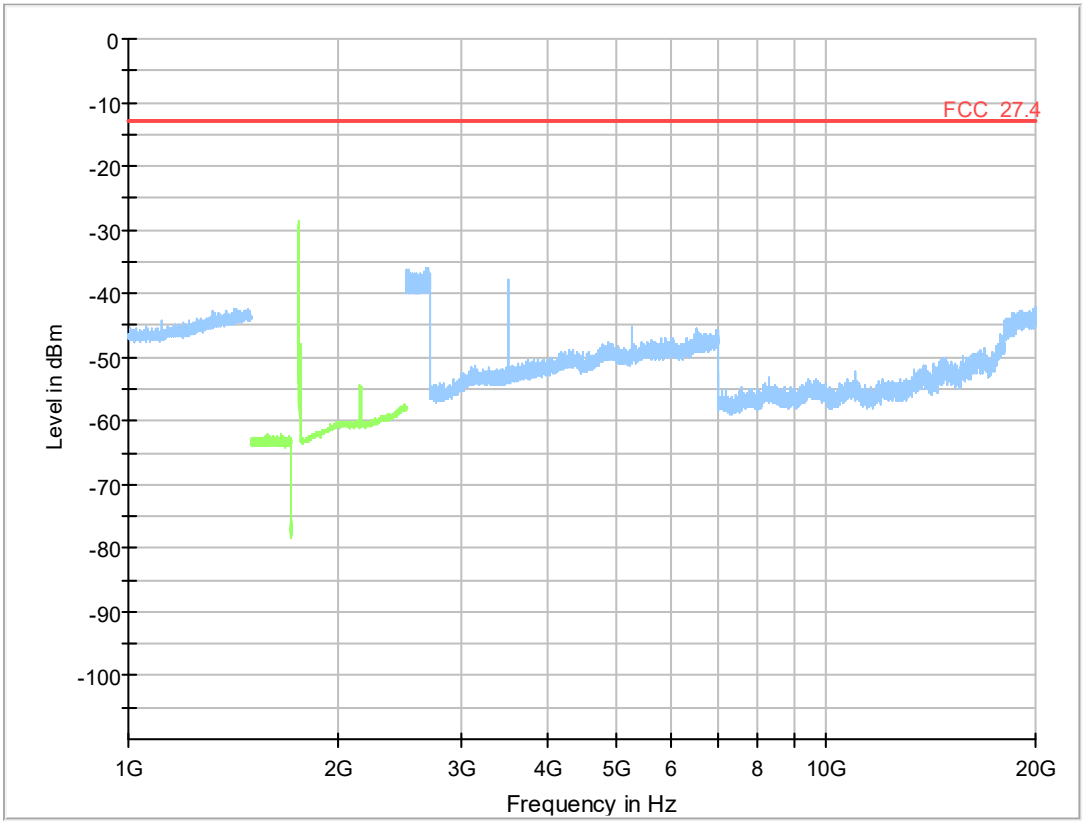
Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---



Critical_Freqs

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

(continuation of the "Critical_Freqs" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

Final_Result

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

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Corr. (dB)
---	---

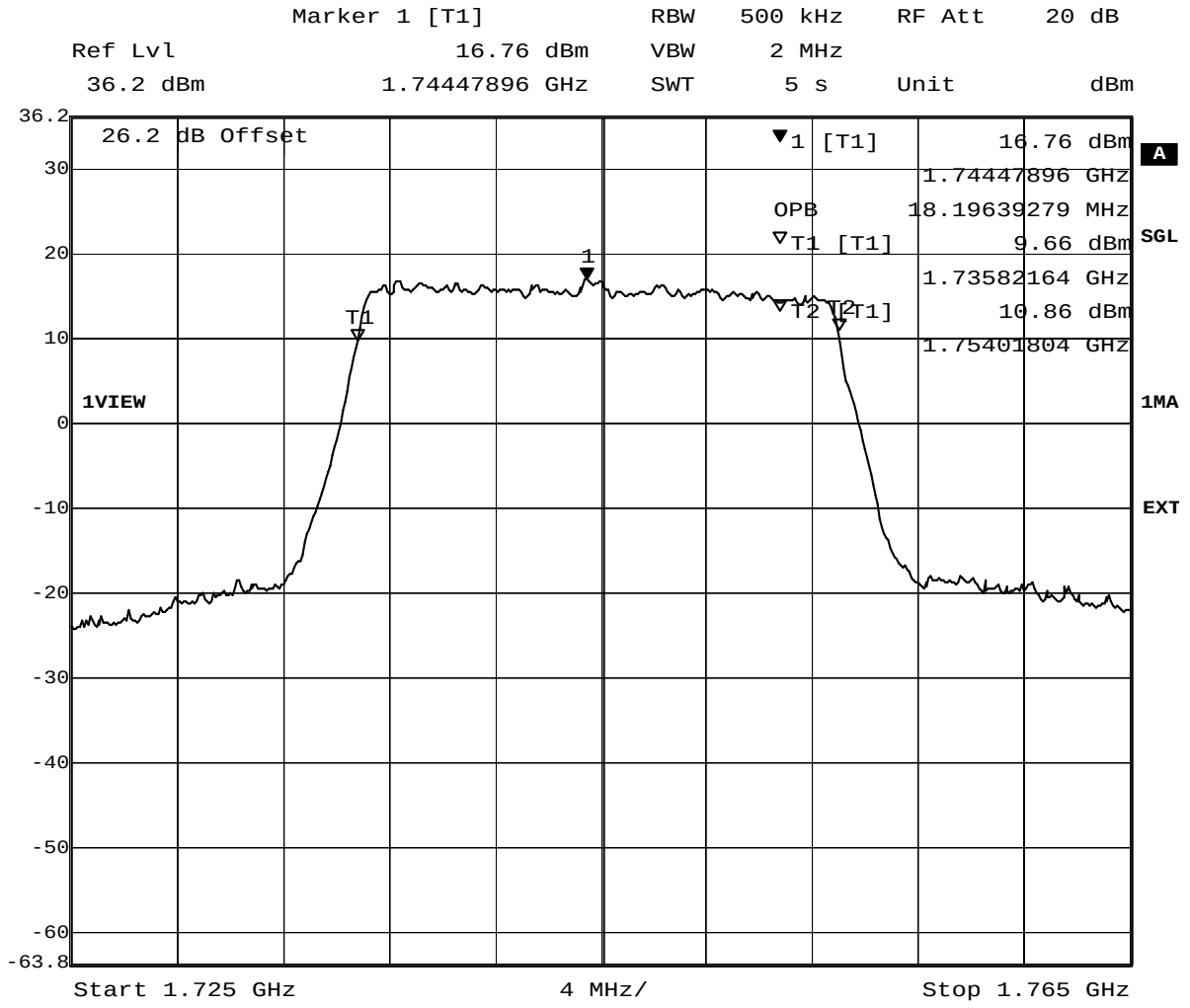
3.5.5 27.5 Emission and Occupied Bandwidth §2.1049

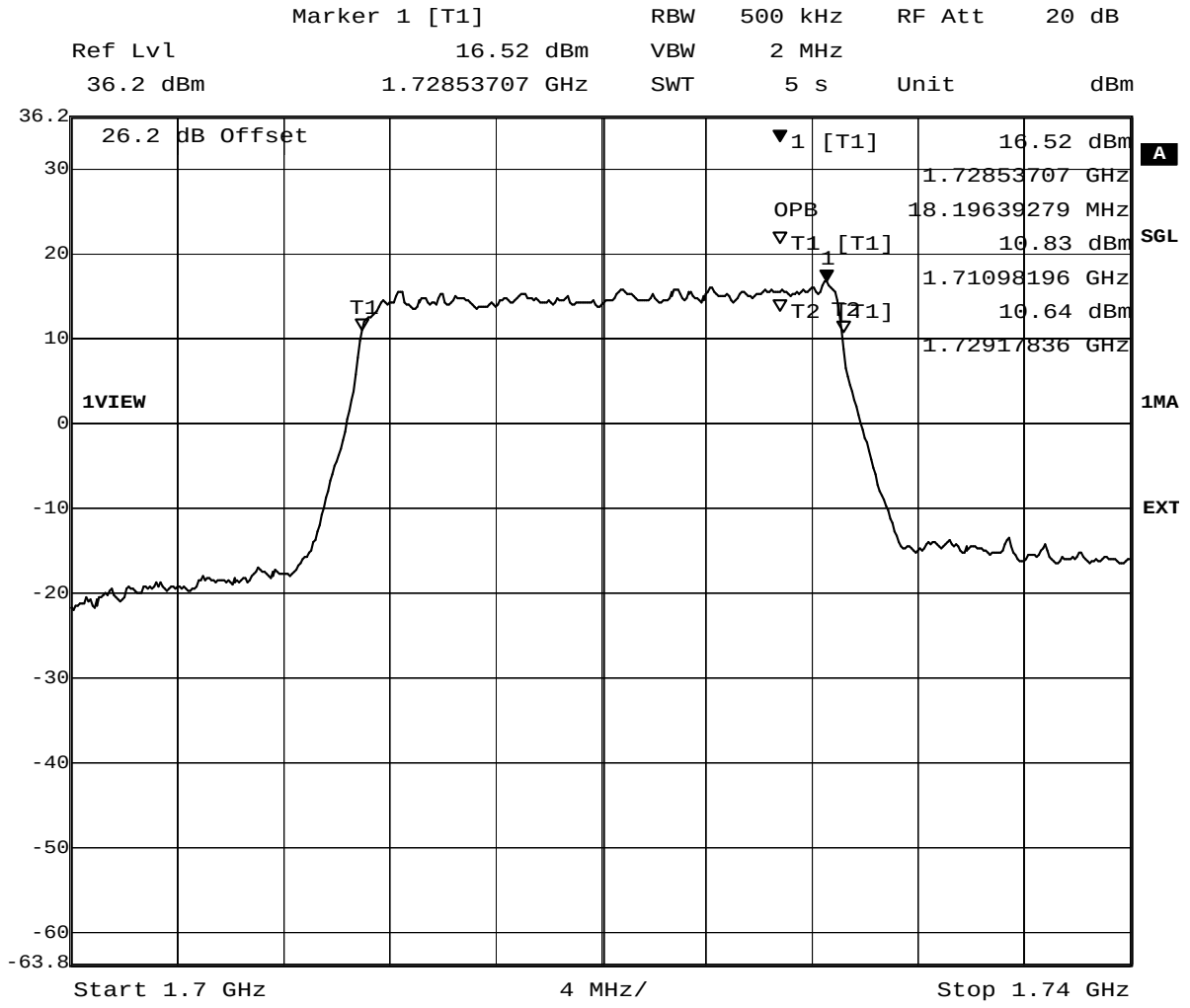
Test: 27.5; Emission and Occupied Bandwidth Summary §2.1049

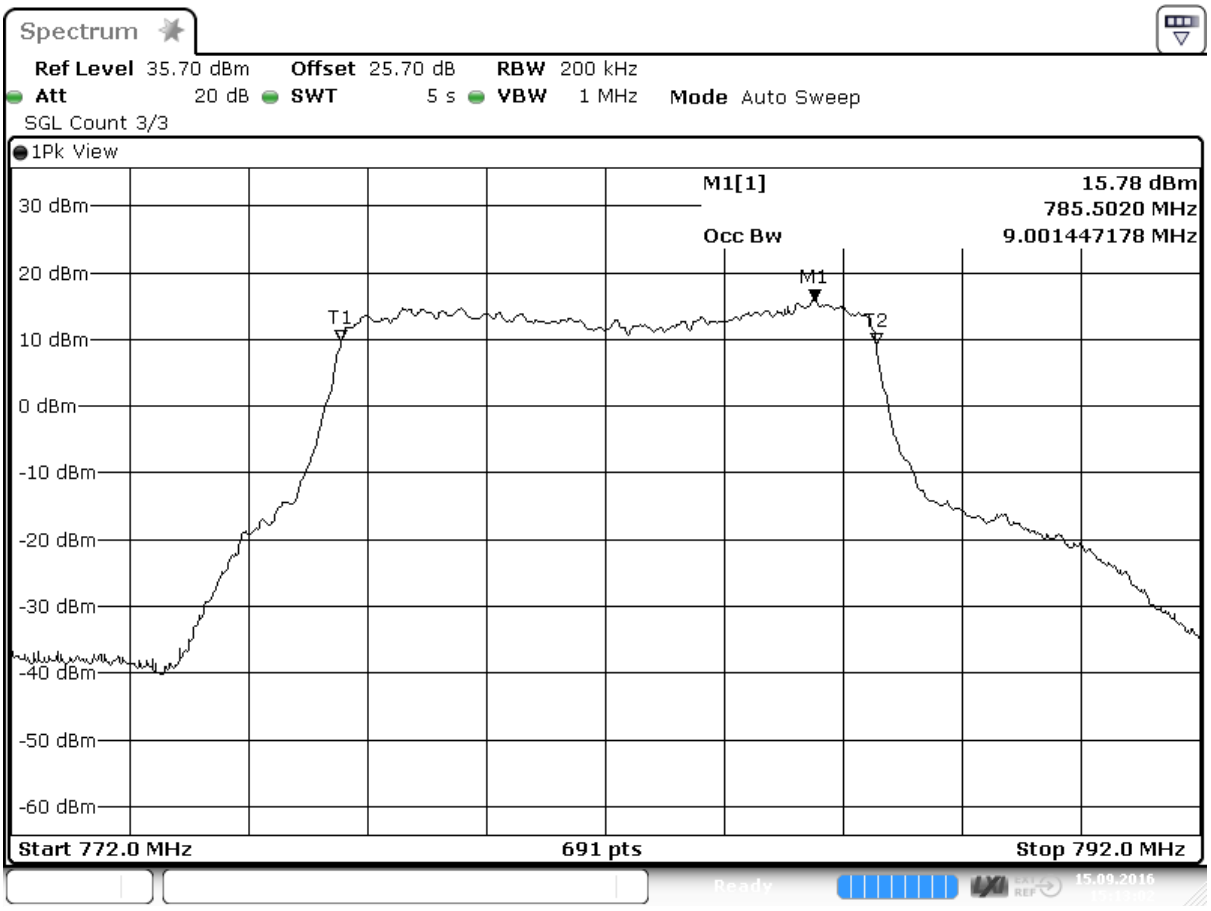
Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/08/17 15:36	FCC part 2 and 27

Detailed Results:

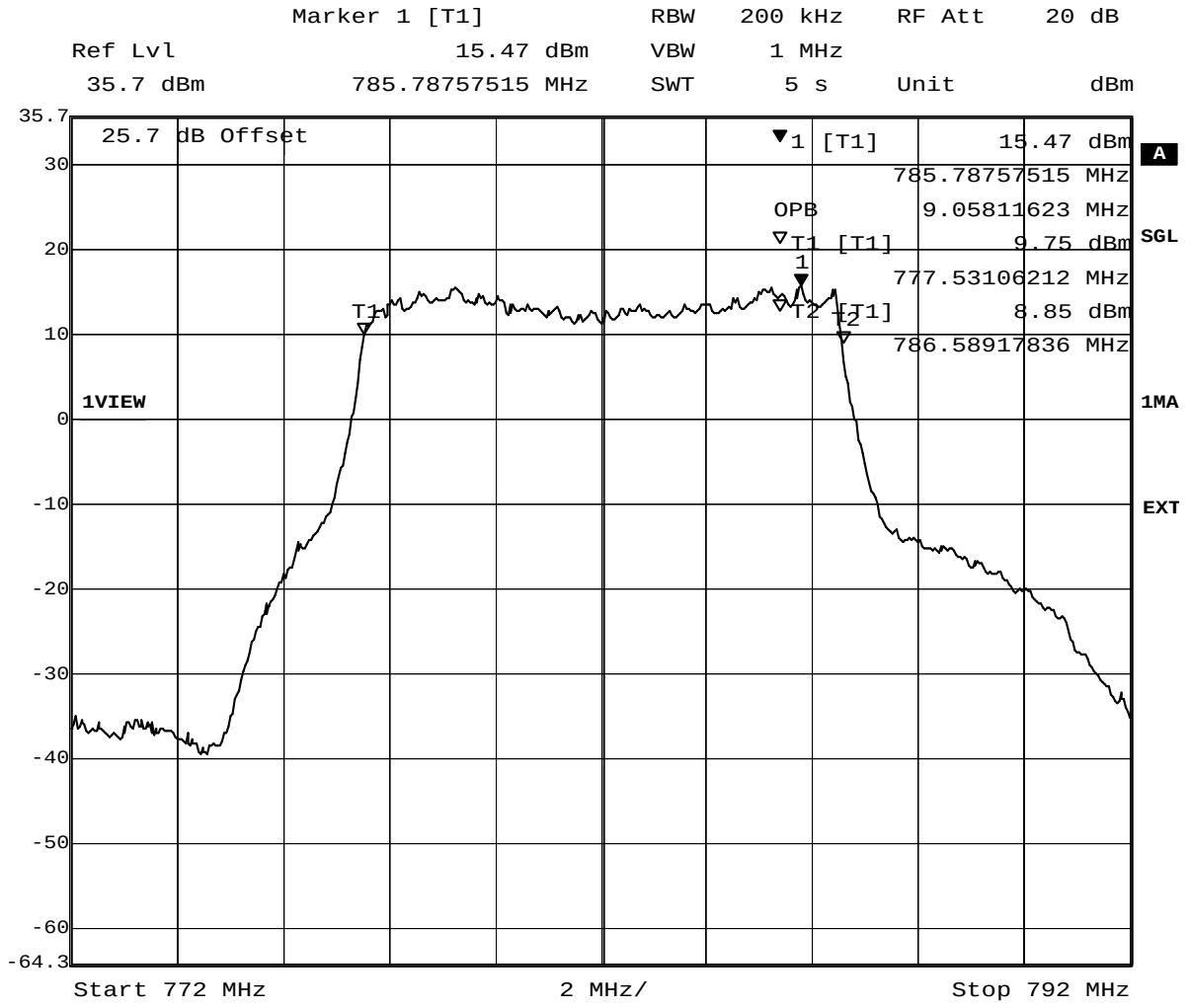
Radio Technology	Channel	Ressource Blocks	Bandwidth (MHz)	Nominal BW [MHz]	99 % BW [kHz]
eFDD 4 QPSK	low	6	1.4	1.4	1118.27
eFDD 4 QPSK	mid	6	1.4	1.4	1112.22
eFDD 4 QPSK	high	6	1.4	1.4	1118.24
eFDD 4 16QAM	low	6	1.4	1.4	1130.26
eFDD 4 16QAM	mid	6	1.4	1.4	1112.22
eFDD 4 16QAM	high	6	1.4	1.4	1106.21
eFDD 4 QPSK	low	15	3	3	2777.56
eFDD 4 QPSK	mid	15	3	3	2753.51
eFDD 4 QPSK	high	15	3	3	2753.51
eFDD 4 16QAM	low	15	3	3	2789.58
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	4529.15
eFDD 4 QPSK	mid	25	5	5	4549.1
eFDD 4 QPSK	high	25	5	5	4529.1
eFDD 4 16QAM	low	25	5	5	4529.1
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	13707.41
eFDD 4 QPSK	mid	75	15	15	13527.05
eFDD 4 QPSK	high	75	15	15	13587.17
eFDD 4 16QAM	low	75	15	15	13647.29
eFDD 4 16QAM	mid	75	15	15	13587.17
eFDD 4 16QAM	high	75	15	15	13587.17
eFDD 4 QPSK	low	100	20	20	18196.39
eFDD 4 QPSK	mid	100	20	20	18116.23
eFDD 4 QPSK	high	100	20	20	18196.39
eFDD 4 16QAM	low	100	20	20	18196.39
eFDD 4 16QAM	mid	100	20	20	18116.23
eFDD 4 16QAM	high	100	20	20	18116.23
eFDD 13 QPSK	low	25	5	5	4509.02
eFDD 13 QPSK	mid	25	5	5	4569.14
eFDD 13 QPSK	high	25	5	5	4529.06
eFDD 13 16QAM	low	25	5	5	4509.02
eFDD 13 16QAM	mid	25	5	5	4589.18
eFDD 13 16QAM	high	25	5	5	4589.18
eFDD 13 QPSK	mid	50	10	10	9001.45
eFDD 13 16QAM	mid	50	10	10	9058.12


Marker 1 [T1]
RBW 500 kHz
RF Att 20 dB
Ref Lvl 16.76 dBm
VBW 2 MHz
36.2 dBm 1.74447896 GHz
SWT 5 s
Unit dBm
26.2 dB Offset
1 [T1] 16.76 dBm
1.74447896 GHz
OPB 18.19639279 MHz
T1 [T1] 9.66 dBm
1.73582164 GHz
T2 [T1] 10.86 dBm
1.75401804 GHz
A
SGL
1MA
EXT
1VIEW
36.2
30
20
10
0
-10
-20
-30
-40
-50
-60
-63.8
Start 1.725 GHz
4 MHz/
Stop 1.765 GHz
Date: 17.AUG.2016 10:04:43


Marker 1 [T1]
RBW 500 kHz
RF Att 20 dB
Ref Lvl 16.52 dBm
VBW 2 MHz
36.2 dBm 1.72853707 GHz
SWT 5 s
Unit dBm
26.2 dB Offset
1 [T1] 16.52 dBm
1.72853707 GHz
OPB 18.19639279 MHz
T1 [T1] 10.83 dBm
1.71098196 GHz
T2 [T1] 10.64 dBm
1.72917836 GHz
1VIEW
A
SGL
1MA
EXT
36.2
30
20
10
0
-10
-20
-30
-40
-50
-60
-63.8
Start 1.7 GHz
4 MHz/
Stop 1.74 GHz
Date: 17.AUG.2016 10:23:44



Date: 15.SEP.2016 15:13:03


Marker 1 [T1]
RBW 200 kHz
RF Att 20 dB
Ref Lvl 15.47 dBm
VBW 1 MHz
35.7 dBm 785.78757515 MHz
SWT 5 s
Unit dBm
25.7 dB Offset
1 [T1] 15.47 dBm
785.78757515 MHz
OPB 9.05811623 MHz
T1 [T1] 9.75 dBm
777.53106212 MHz
T2 [T1] 8.85 dBm
786.58917836 MHz
1VIEW
A
SGL
1MA
EXT
35.7
30
20
10
0
-10
-20
-30
-40
-50
-60
-64.3
Start 772 MHz
2 MHz/
Stop 792 MHz
Date: 17.AUG.2016 11:46:32

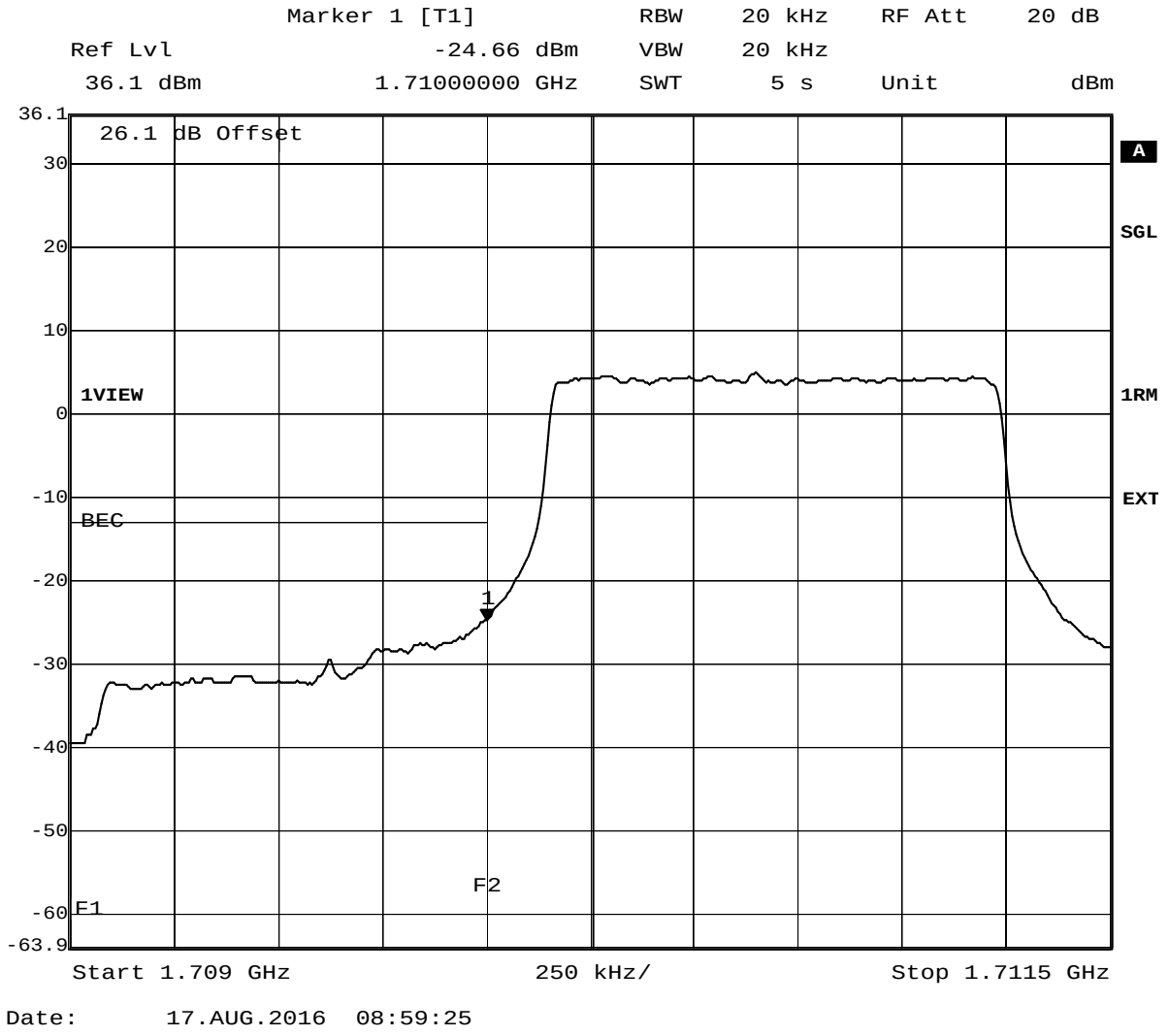
3.5.6 27.6 Band edge compliance §2.1053, §27.53

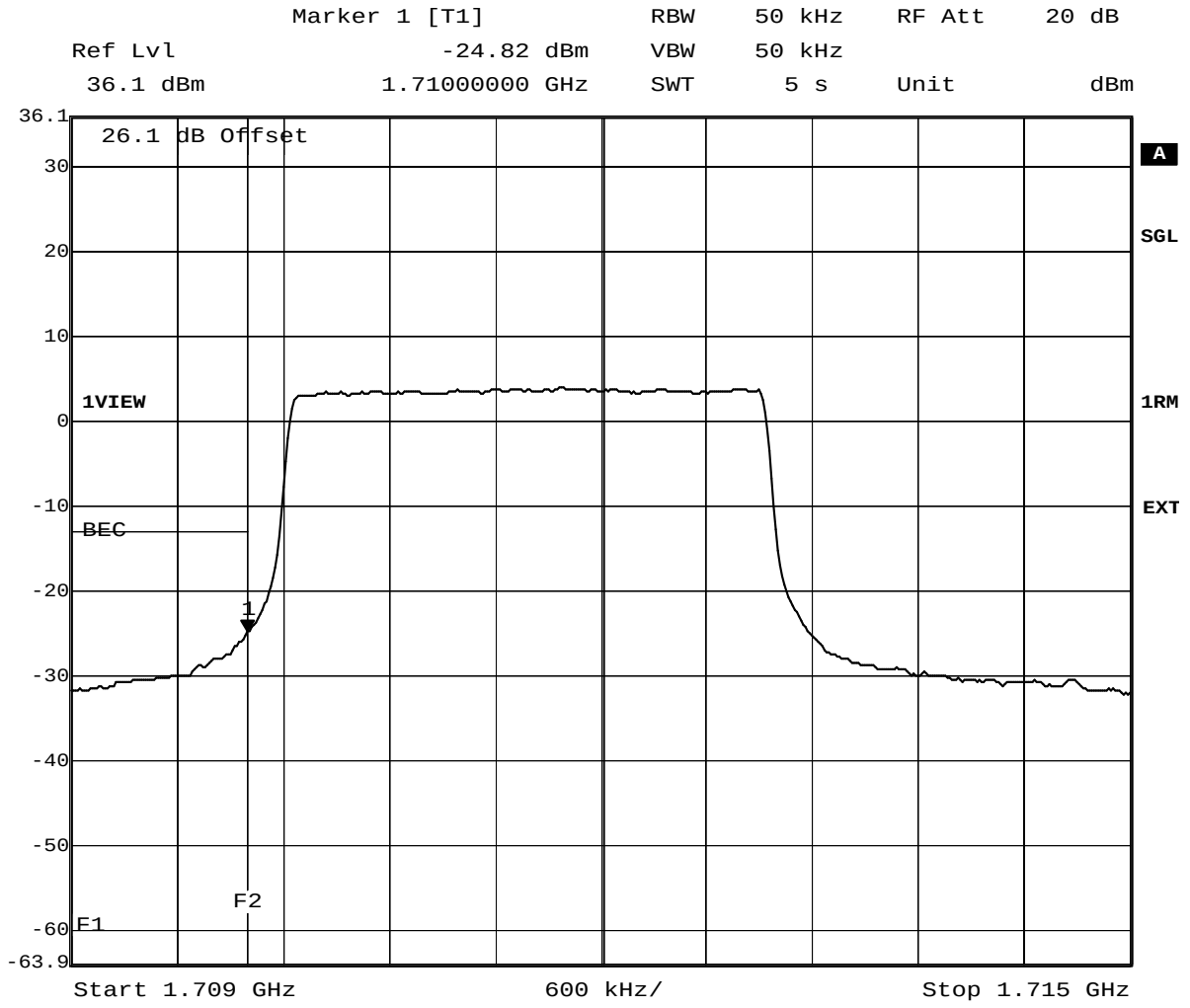
Test: 27.6; Band edge compliance summary §2.1053, §27.53

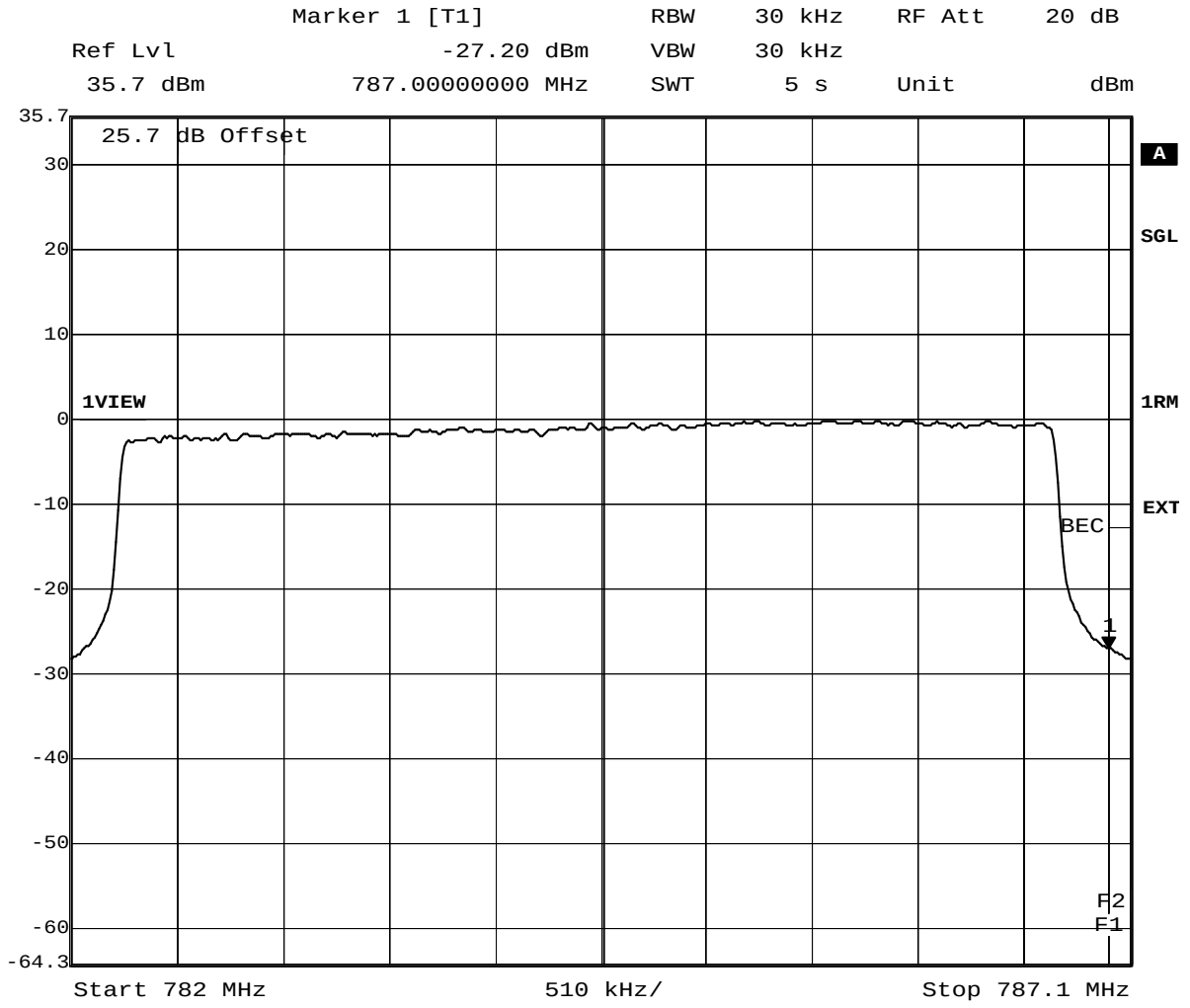
Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/08/17 14:10	FCC part 2 and 27

Detailed Results:

Radio Technology	Channel	Nominal BW	Resource Blocks	Peak [dBm]	Average [dBm]	RMS [dBm]	Limit / dBm	Margin to Limit / dB	Verdict
eFDD 4 QPSK	low	1.4	6	**-15.82**	**-25.84**	**-24.66**	-13	11.66	Passed
eFDD 4 QPSK	high	1.4	6	**-16.95**	**-27.64**	**-26.21**	-13	13.21	Passed
eFDD 4 16QAM	low	1.4	6	**-14.91**	**-26.02**	**-24.98**	-13	11.98	Passed
eFDD 4 16QAM	high	1.4	6	**-16.26**	**-27.21**	**-26.02**	-13	13.02	Passed
eFDD 4 QPSK	low	3	15	**-15.75**	**-28.34**	**-26.8**	-13	13.8	Passed
eFDD 4 QPSK	high	3	15	**-17.17**	**-30.22**	**-28.34**	-13	15.34	Passed
eFDD 4 16QAM	low	3	15	**-13.99**	**-28.1**	**-26.6**	-13	13.6	Passed
eFDD 4 16QAM	high	3	15	**-17.79**	**-29.64**	**-28.34**	-13	15.34	Passed
eFDD 4 QPSK	low	5	25	**-14.36**	**-29.64**	**-27.42**	-13	14.42	Passed
eFDD 4 QPSK	high	5	25	**-14.92**	**-30.84**	**-28.84**	-13	15.84	Passed
eFDD 4 16QAM	low	5	25	**-11.63**	**-26.8**	**-24.82**	-13	11.82	Passed
eFDD 4 16QAM	high	5	25	**-16.14**	**-28.84**	**-27.21**	-13	14.21	Passed
eFDD 4 QPSK	low	10	50	**-13.91**	**-31.17**	**-29.1**	-13	16.1	Passed
eFDD 4 QPSK	high	10	50	**-14.87**	**-31.86**	**-30.22**	-13	17.22	Passed
eFDD 4 16QAM	low	10	50	**-14.6**	**-31.17**	**-29.36**	-13	16.36	Passed
eFDD 4 16QAM	high	10	50	**-14.96**	**-31.51**	**-29.64**	-13	16.64	Passed
eFDD 4 QPSK	low	15	75	**-10.59**	**-30.52**	**-28.58**	-13	15.58	Passed
eFDD 4 QPSK	high	15	75	**-11.72**	**-30.84**	**-28.58**	-13	15.58	Passed
eFDD 4 16QAM	low	15	75	**-11.07**	**-29.92**	**-28.1**	-13	15.1	Passed
eFDD 4 16QAM	high	15	75	**-10.59**	**-30.52**	**-28.84**	-13	15.84	Passed
eFDD 4 QPSK	low	20	100	**-14.79**	**-31.17**	**-29.64**	-13	16.64	Passed
eFDD 4 QPSK	high	20	100	**-14.54**	**-31.51**	**-29.92**	-13	16.92	Passed
eFDD 4 16QAM	low	20	100	**-15.11**	**-31.17**	**-29.64**	-13	16.64	Passed
eFDD 4 16QAM	high	20	100	**-15.59**	**-31.51**	**-30.22**	-13	17.22	Passed
eFDD 13 QPSK	low	5	1	**-18.79**	**-29.76**	**-28.74**	-13	15.74	Passed
eFDD 13 QPSK	high	5	1	**-17.89**	**-28.27**	**-27.2**	-13	14.2	Passed
eFDD 13 16QAM	low	5	1	**-18.54**	**-30.62**	**-29.24**	-13	16.24	Passed
eFDD 13 16QAM	high	5	1	**-17.81**	**-28.5**	**-27.4**	-13	14.4	Passed
eFDD 13 QPSK	low	10	1	**-24.81**	**-33.84**	**-32.26**	-13	19.26	Passed
eFDD 13 QPSK	high	10	1	**-20.11**	**-31.57**	**-30.32**	-13	17.32	Passed
eFDD 13 16QAM	low	10	1	**-23.97**	**-34.29**	**-33.02**	-13	20.02	Passed
eFDD 13 16QAM	high	10	1	**-22.96**	**-31.57**	**-30.62**	-13	17.62	Passed

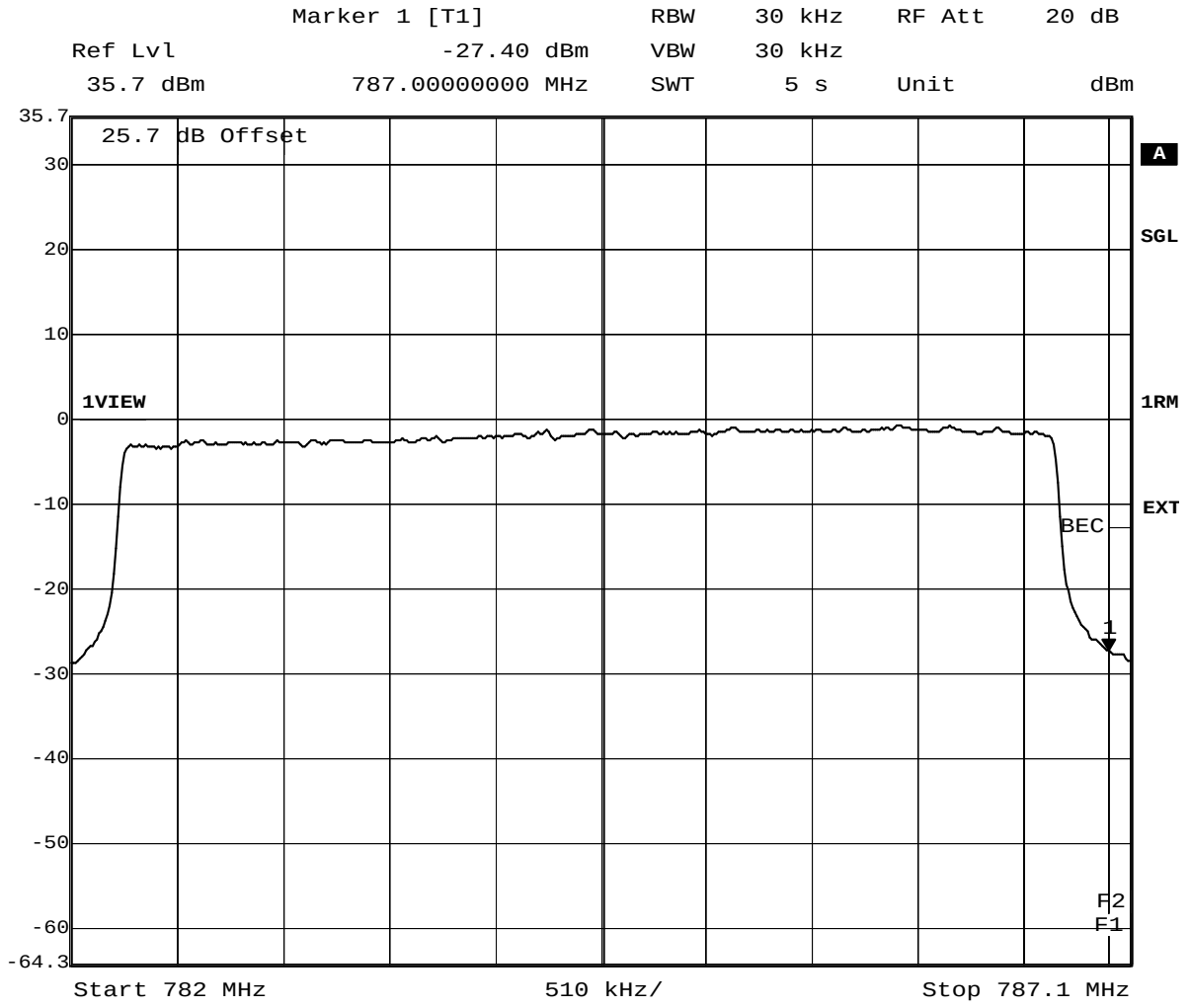

Marker 1 [T1]
RBW 20 kHz
RF Att 20 dB
Ref Lvl
-24.66 dBm
VBW 20 kHz
36.1 dBm
1.71000000 GHz
SWT 5 s
Unit dBm
26.1 dB Offset
1VIEW
BEC
SGL
1RM
EXT
F1
F2
Start 1.709 GHz
250 kHz/
Stop 1.7115 GHz
Date: 17.AUG.2016 08:59:25


Marker 1 [T1]
RBW 50 kHz
RF Att 20 dB
Ref Lvl
-24.82 dBm
VBW 50 kHz
36.1 dBm
1.71000000 GHz
SWT 5 s
Unit dBm
26.1 dB Offset
1VIEW
BEC
SGL
1RM
EXT
F1
F2
Start 1.709 GHz
600 kHz/
Stop 1.715 GHz
Date: 17.AUG.2016 09:28:30



Date: 17.AUG.2016 11:26:25

eFDD13



Date: 17.AUG.2016 11:35:39

eFDD13

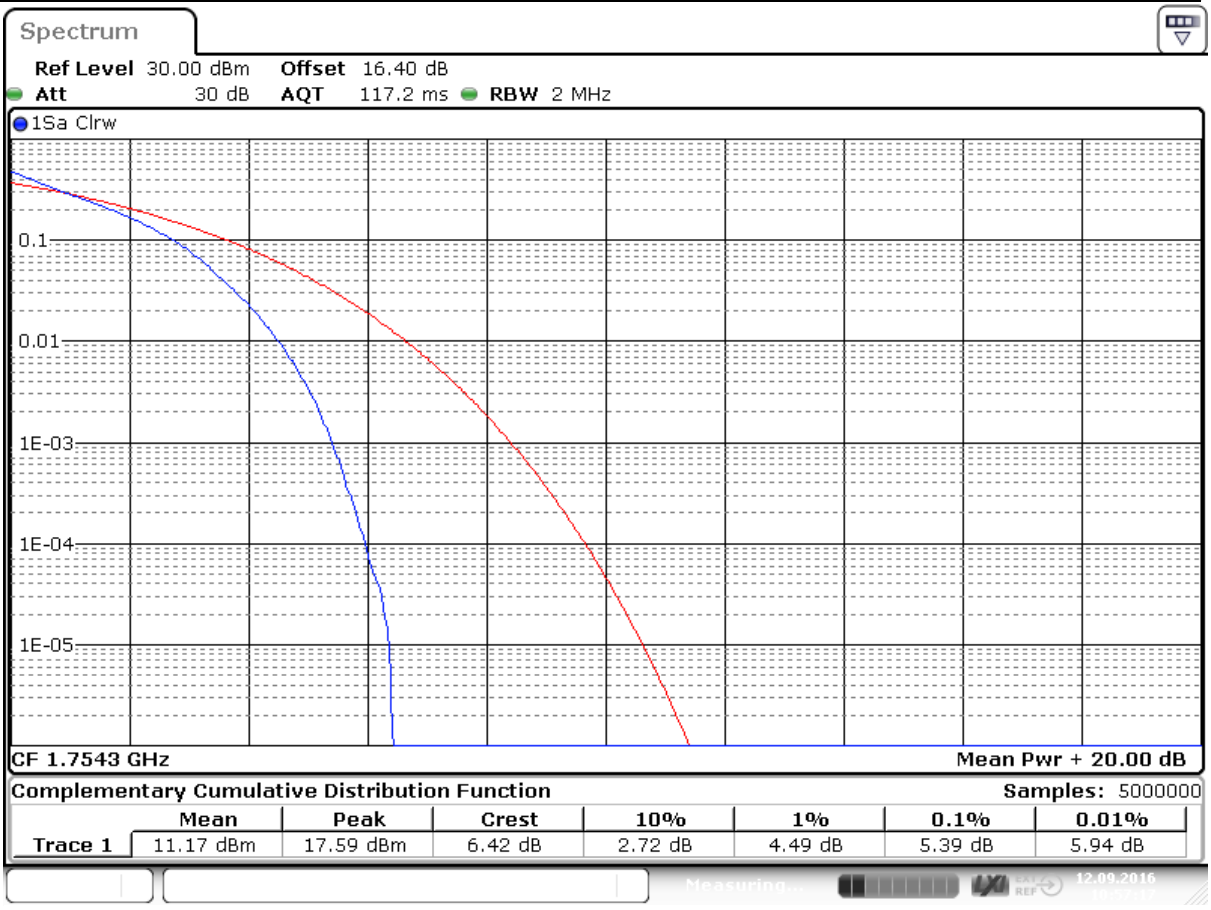
3.5.7 27.7 Peak-to-Average ratio §2.1046, §27.50

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

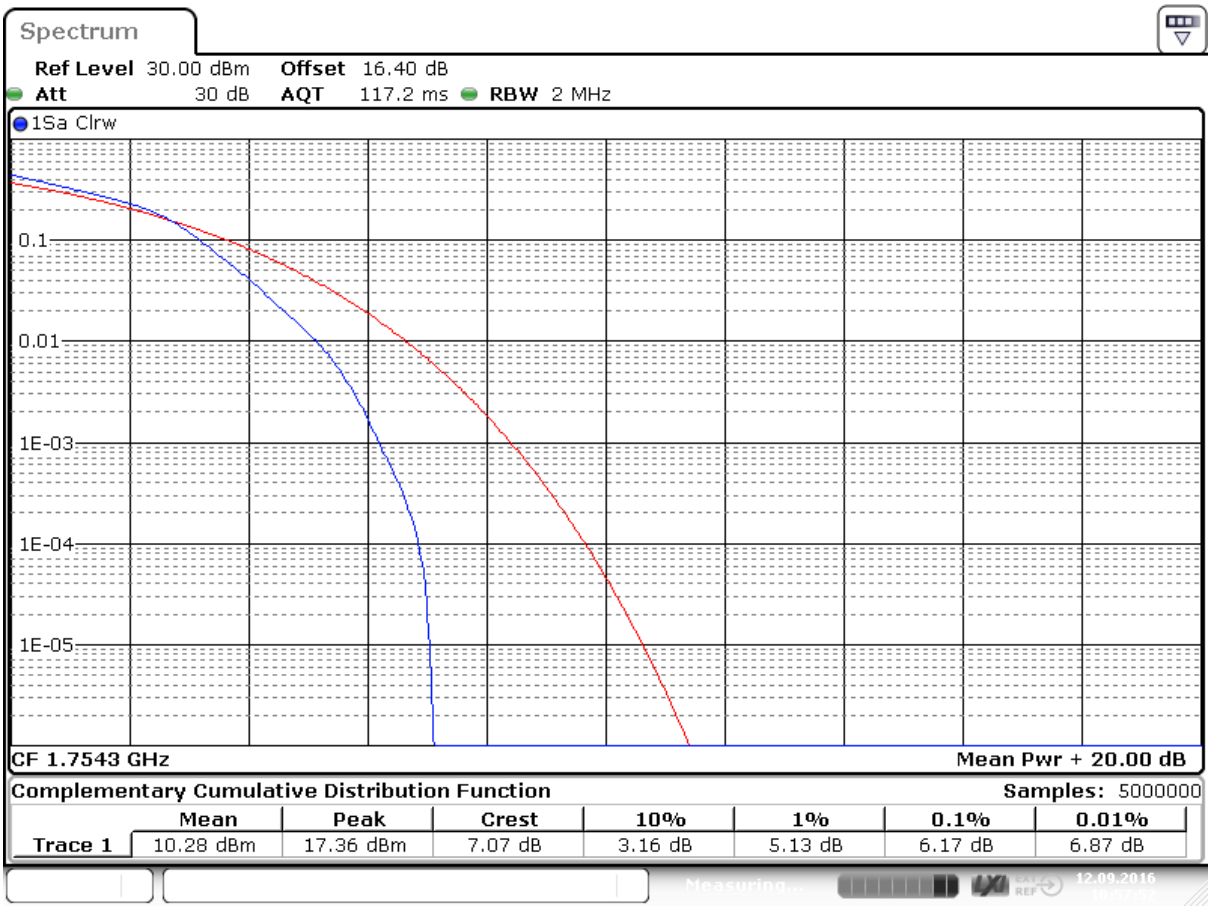
Result	*Setup No.*	*Date of Test*	*Test Specification:*
Passed	AF01	2016/09/12 14:14	FCC part 2 and 27

Detailed Results:

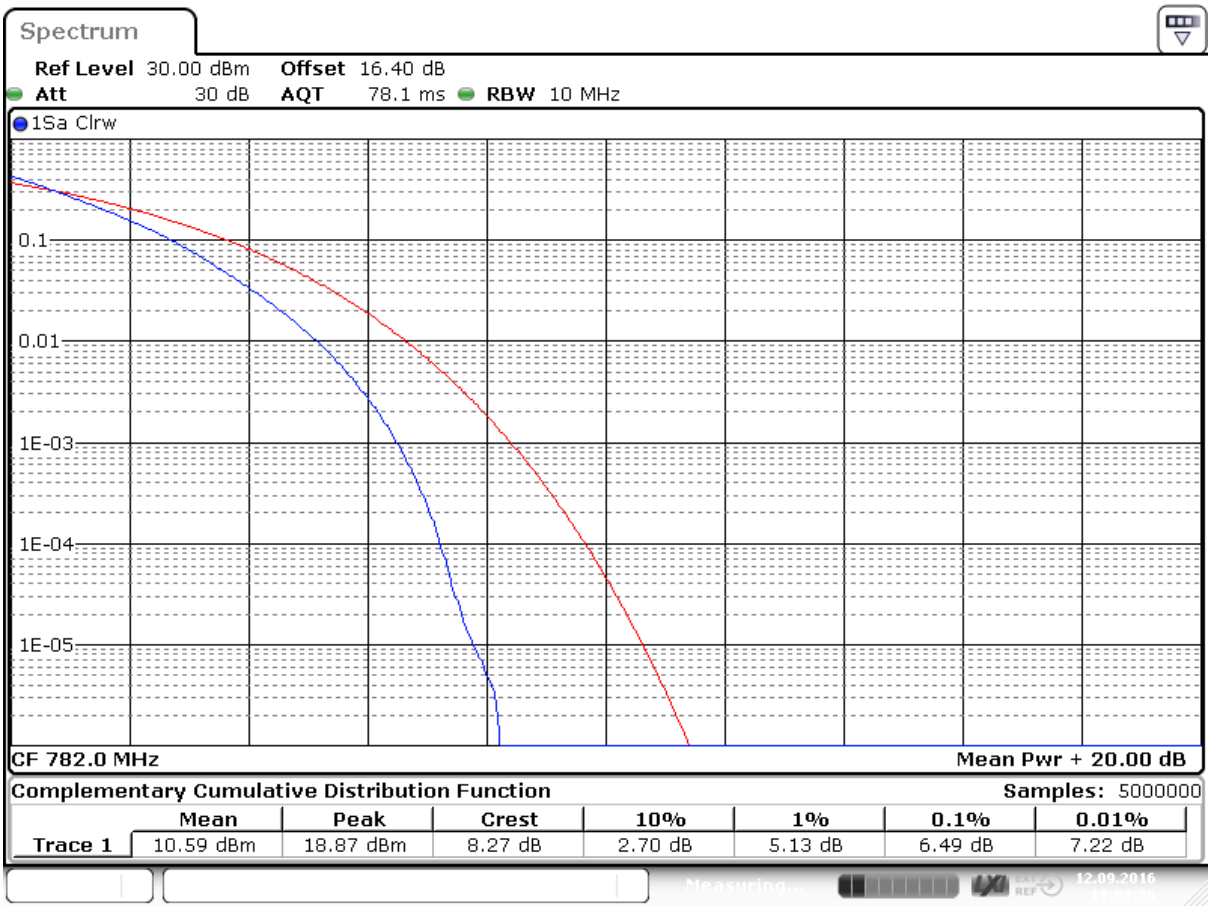
Radio Technology	Channel	Ressource Blocks	Bandwidth (MHz)	Peak to Average Ratio	Limit (IC) (dB)	Verdict
eFDD 4 QPSK	low	6	1.4	5.01	13	PASSED
eFDD 4 QPSK	mid	6	1.4	5.28	13	PASSED
eFDD 4 QPSK	high	6	1.4	5.39	13	PASSED
eFDD 4 16QAM	low	6	1.4	6	13	PASSED
eFDD 4 16QAM	mid	6	1.4	6	13	PASSED
eFDD 4 16QAM	high	6	1.4	6.17	13	PASSED
eFDD 13 QPSK	low	25	5	6.09	13	PASSED
eFDD 13 QPSK	mid	25	5	6.49	13	PASSED
eFDD 13 QPSK	high	25	5	6.23	13	PASSED
eFDD 13 16QAM	low	25	5	7.01	13	PASSED
eFDD 13 16QAM	mid	25	5	7.28	13	PASSED
eFDD 13 16QAM	high	25	5	7.13	13	PASSED



Date: 12.SEP.2016 10:57:18



Date: 12.SEP.2016 10:57:53



Date: 12.SEP.2016 11:03:25

Date: 12.SEP.2016 11:07:20

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

Calibration Details	*Last Execution*	*Next Execution*
NSA (FCC)	2014/01/09	2017/01/09

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	

Calibration Details	*Last Execution*	*Next Execution*
FCC listing 96716 3m Part15/18	2014/01/09	2017/01/08

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

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
Double-ridged horn	HF 907	102444	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Execution*
	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		2015/10/20	2016/10/19
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	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Execution*
	DKD calibration		2014/12/03	2017/12/02
	HW/SW Status		*Date of Start*	*Date of End*
	HW options: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02 SW options: K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10, Firmware: µP1 8v40 01.12.05 --- SW: K62, K69		2007/01/02 2008/11/03	
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*
	Initial Factory Calibration		2014/11/13	2016/11/12
Personal Computer	Dell	30304832059		
Power Meter	NRVD	828110/016		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2016/05/24	2017/05/23
Sensor Head A	NRV-Z1	827753/005		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2016/05/27	2017/05/26
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*
	Initial Factory Calibration		2014/11/17	2016/11/16

Test Equipment Multimeter 03

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

Single Devices for Multimeter 03

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383		
	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	2017/05/23
RF Step Attenuator RSP	RSP	833695/001		
Rubidium Frequency Standard	Datum, Model: MFS	5489/001		
	Calibration Details		*Last Execution*	*Next Execution*
	DAkks Calibration		2016/06/22	2017/06/23
Sensor Head A	NRV-Z1	827753/005		
	Calibration Details		*Last Execution*	*Next Execution*
	Standard calibration		2016/05/27	2017/05/26
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

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		2015/02/27	2017/02/26

Test Equipment T/H Logger 03

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

Single Devices for T/H Logger 03

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
ThermoHygro Datalogger 03 (Environ)	Opus10 THI (8152.00)	7482	

Calibration Details	*Last Execution*	*Next Execution*
Customized calibration	2015/02/27	2017/02/26

Test Equipment T/H Logger 12

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

Single Devices for T/H Logger 12

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
ThermoHygro Datalogger 12 (Environ)	Opus10 THI (8152.00)	12482	

Calibration Details	*Last Execution*	*Next Execution*
Customized calibration	2015/03/10	2017/03/09

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 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.

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Emission and Occupied Bandwidth

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Standard FCC Part 27, Subpart C

The test was performed according to: FCC §2.1049

Test Description

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

frequency limits, the mean powers are each equal to 0.5 percent of the total mean power.

Test Requirements / Limits

§ 2.1049 Measurements required: Occupied bandwidth

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

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

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Spurious emissions at antenna terminals

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Standard FCC Part 27, Subpart C

The test was performed according to FCC §2.1051

Test Description

1) The EUT was coupled to a Spectrum Analyser and a Digital Communication Tester through a Power Divider. Refer to chapter "Setup Drawings".
2) The total insertion losses for signal path 1 and signal path 2 were measured. The values were used to correct the readings from the Spectrum Analyser and the Digital Communication Tester.
3) A call was established on a Traffic Channel between the EUT and the Digital Communication Tester.
Important Settings:
- Output Power: Maximum
- Channel: please refer to the detailed results
4) Important Analyser Settings
- [Resolution Bandwidth]:
a) [>=1% of wanted signal bandwidth] in the Span of 1 MHz directly below and above the Band,
b) otherwise [1 MHz]
c) [reduced resolution bandwidth] in case the curve of the analyser IF-Filter or the wanted EUT signal leads to an exceeding of the limit, in this case a correction factor was used
- Sweep Time: depending on the transmitting signal, the span and the resolution bandwidth
5) The spurious emissions peaks were measured in the frequency range from 9 kHz to 18 GHz (up to the 10th harmonic) during the call is established

Test Requirements / Limits

§ 2.1051 Spurious emissions at antenna terminals

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

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.
(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value

need not be reported.
(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 27.53 Emission limits

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

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Frequency stability

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Standard FCC Part 27, Subpart C

The test was performed according to FCC §2.1055

Test Description

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

- Output Power: Maximum
- Mid Channel

5) The frequency error of the EUT was recorded by using an internal measurement function of the Digital Communication Tester immediately after the call was established, five minutes after the call was established and ten minutes after the call was established.
6) This measurement procedure was performed for temperature variation from –30°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 accordance with FCC Part 22, Subpart H, §22.355, table C-1: Frequency tolerance for the carrier frequency of mobile transmitters in the Public Mobile Service in the frequency range 821 to 896 MHz.

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Band edge compliance

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Standard FCC Part 27, Subpart C

The test was performed according to: FCC §27.53

Test Description

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

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

4) Important Analyser Settings:
- Resolution Bandwidth = Video Bandwidth: >1% of the manufacturer's stated occupied bandwidth

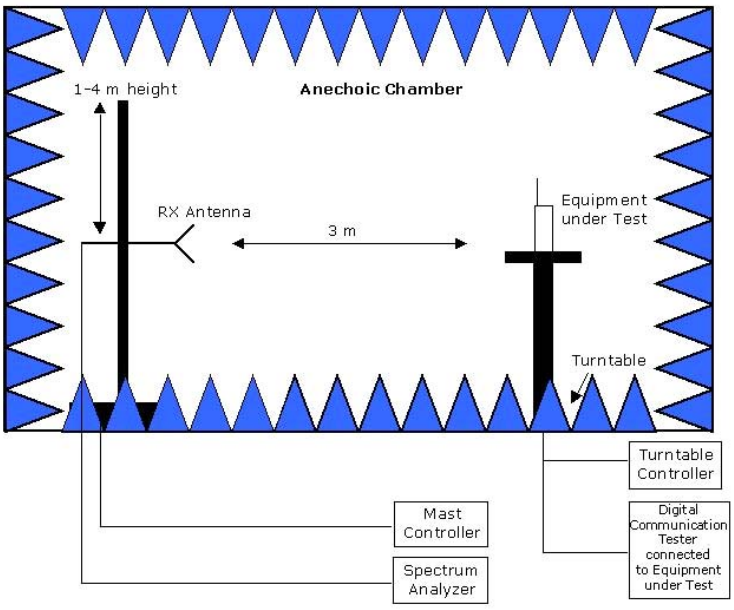
For LTE band eFDD13 in the ranges of 765-775MHz and 793-805MHz.
These frequency ranges are part of spurious conducted and measured with 10kHz RBW.

Test Requirements / Limits

§ 27.53 Effective radiated power limits

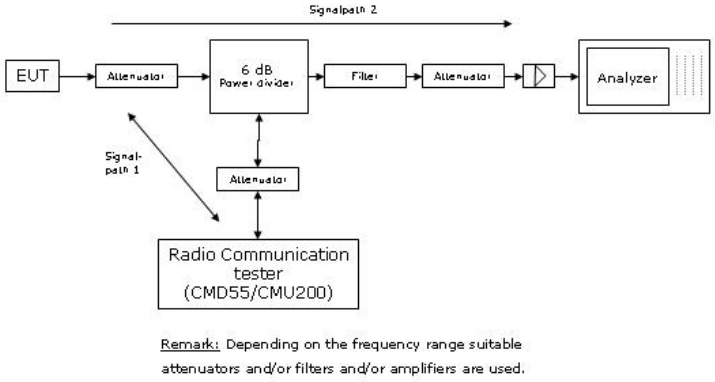
Refer to chapter "Field strength of spurious radiation".

Setup Drawings

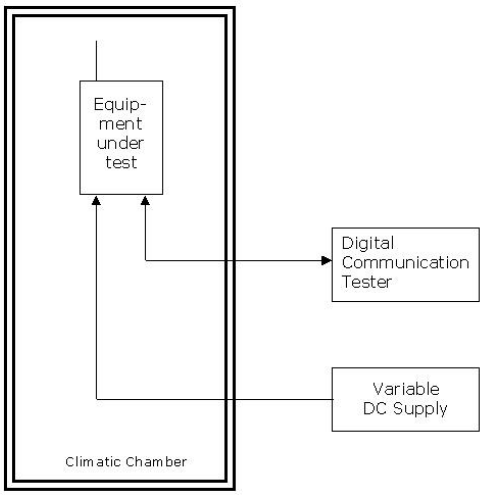


Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Principle set-up for radiated measurements



Principle set-up for conducted measurements under nominal conditions



Principle set-up for tests under extreme test conditions

TEST MODE	TX / RX	RF Channel		
		Low	Mid	High
LTE eFDD 4	TX (1.4M)	19957	20175	20393
		1710.7	1732.5	1754.3
	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
	RX (1.4M)	CH 1957	CH 2175	CH 2393
		2110.70 MHz	2132.50 MHz	2154.30 MHz
	RX (3M)	CH 1965	CH 2175	CH 2385
		2111.50 MHz	2132.50 MHz	2153.50 MHz
	RX (5M)	CH 1975	CH 2175	CH 2375
		2112.50 MHz	2132.50 MHz	2152.50 MHz
	RX (10M)	CH 2000	CH 2175	CH 2350
		2115.00 MHz	2132.50 MHz	2150.00 MHz
	RX (15M)	CH 2025	CH 2175	CH 2325
		2117.50 MHz	2132.50 MHz	2147.50 MHz
	RX (20M)	CH 2050	CH 2175	CH 2300
		2120.00 MHz	2132.50 MHz	2145.00 MHz

TEST MODE	TX / RX	RF Channel		
		Low	Mid	High
LTE eFDD 13	TX (5M)	CH 23205	CH 23230	CH 23255
		779.50 MHz	782.00 MHz	784.50 MHz
	TX (10)	CH 23230	CH 23230	CH 23230
		782.00 MHz	782.00 MHz	782.00 MHz
	RX (5M)	CH 5205	CH 5230	CH 5255
		748.50 MHz	751.00 MHz	753.50 MHz
	RX (10M)	CH 5230	CH 5230	CH 5230
		751.00 MHz	751.00 MHz	751.00 MHz

Correlation of measurement requirements for Cellular Equipment from FCC and IC

FCC Rule / IC Standard	Part 22	RSS-132 Issue 3, 2016	Part 24	RSS-133 Issue 6, 2013	Part 27	RSS-139 Issue 3, 2015	RSS-130 Issue 1, 2013
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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