

REPORTissued by an FCC listed Laboratory Reg. no93866The test site complies with RSS-Gen, IC file no. 3482A-1<br/>Contact personDateAndreas Johnson20Electronics+46 10 516 57 86andreas.johnson@ri.se

Date Reference 2017-05-16 7P01338-FG



Page

1(2)

Accred. No. 1002 Testing ISO/IEC 17025

Ericsson AB Anders Karlsson BURA DURA RP QRM Torshamnsgatan 21 164 80 Stockholm

# Radio measurements on Radio 2219 B5 radio equipment with FCC ID TA8AKRC161678-1 and IC: 287AB-AS1616781

(8 appendices)

# **Test object**

Product name: Radio 2219 B5 Product number: KRC 161 678/1

#### **Summary**

See appendix 1 for details.

Standard		Compliant	Appendix
FCC CFR 47 / IC RS			
2.1046 / RSS-132 5.4	RF power output	Yes	2
2.1049 / RSS-Gen 4.6.1	Occupied bandwidth	Yes	3
2.1051 / RSS-132 5.5	Band edge	Yes	4
2.1051 / RSS-132 5.5	Spurious emission at antenna terminals	Yes	5
2.1053 / RSS-132 5.5	Field strength of spurious radiation	Yes	6
2.1055 / RSS-132 5.3	Frequency stability	Yes	7

#### SP Technical Research Institute of Sweden

**Electronics – EMC** 

Performed by

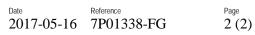
Examined by

Tomas Lennhager

Monika Fuller

#### SP Technical Research Institute of Sweden

Postal address SP Box 857 SE-501 15 BORÅS Sweden Office location Västeråsen Brinellgatan 4 SE-504 62 BORÅS Phone / Fax / E-mail +46 10 516 50 00 +46 33 13 55 02 info@sp.se Laboratories are accredited by the Swedish Board for Accreditation and Conformity Assessment (SWEDAC) under the terms of Swedish legislation. This report may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.





# Table of contents

Description of the test object	Appendix 1
Purpose of test	Appendix 1
Operation modes during measurements	Appendix 1
RF power output	Appendix 2
Occupied bandwidth	Appendix 3
Band edge	Appendix 4
Band edge Spurious emission at antenna terminals	Appendix 4 Appendix 5
Spurious emission at antenna terminals	Appendix 5



Appendix 1

Page 1 (7)

Description of the test object related to single RAT GSM mode		
Equipment:	Radio equipment Radio 2219 B5 Product number KRC 161 678/1 FCC ID TA8AKRC161678-1 IC: 287AB-AS1616781	
HVIN:	AS1616781	
Hardware revision state:	R1A	
Frequency band (3GPP B5):	TX: 869 - 894 MHz RX: 824 - 849 MHz	
IBW:	20 MHz with 20 W/ carrier 25 MHz with 13 W/ carrier	
Output power:	Max 20 W/ carrier Max output power 80 W/ antenna port	
Antenna ports:	2 TX/RX ports	
RF configurations:	Single and multi carrier, 1-4 carriers/ port Single antenna, dual TX Contigouos Spectrum (CS) and Non-Contiguous Spectrum (NCS)	
RF power Tolerance:	+0.6/ - 2.0 dB	
CPRI Speed	9.8 Gbit/s	
Channel bandwidths:	200 kHz	
Modulations :	GMSK, 8PSK and AQPSK	
Nominal power voltage:	-48VDC	

The information above is supplied by the manufacturer.

2(7)

Page



Appendix 1

# **Operation modes during measurements**

Measurements were performed with the test object transmitting following modulations: GMSK, AQPSK, 8-PSK.

Unless otherwise stated, all measurements were performed with the test object transmitting pseudorandom data in all timeslots and settings for maximum transmitter output power applicable for each configuration.

All measurements were performed with the test object configured for maximum transmit power if not otherwise noted. The measured configurations covers worst case settings. The settings below were used for all measurements if not otherwise noted.

#### **Conducted measurements**

The test object was supplied with -48 VDC by an external power supply. Additional connections are documented in the set-up drawings below.

#### **Radiated measurements**

The test object was powered with -48 VDC. All measurements were performed with the test object configured for maximum transmit power.

#### **Purpose of test**

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47 and Industry Canada RSS-132 and RSS-Gen. Test scope limited to single RAT GSM mode.

### References

Measurements were done according to relevant parts of the following standards: ANSI 63.4-2014 ANSI/TIA/EIA-603-D-2010 CFR 47 part 2, April 2017 CFR 47 part 22, April, 2017 3GPP TS 51.021, version 13.3.0 KDB 971168 D03 IM Emission Repeater Amp v01 **RSS-Gen Issue 4** RSS-132 Issue 3



Appendix 1

Page

3(7)

# Test frequencies used for conducted and radiated measurements

TX test frequencies, conducted measurements:

ARFCN	Frequency	Symbolic	Comment
Downlink	[MHz]	name	
128	869.2	В	Single carrier TX bottom frequency
129	869.4	B+1	Single carrier TX bottom frequency
129	869.4	B2	2 carrier TX bottom constellation
132	870.0		
129	869.4	B4	4 carrier TX botttom constellation
132	870.0		
135	870.6		
138	871.2		
190	881.6	М	Single carrier TX mid frequency
190	881.6	M2	2 carrier TX mid constellation
193	882.2		
190	881.6	M4	4 carrier TX mid constellation
193	882.2		
196	882.8		
199	883.4		
250	893.6	T-1	Single carrier TX top frequency
251	893.8	Т	Single carrier TX bottom frequency
247	893.0	T2	2 carrier TX top constellation
250	893.6		
241	891.8	T4	4 carrier TX top constellation
244	892.4		
247	893.0		
250	893.6		
129	869.4	B <sub>im 3</sub>	3 carrier TX bottom configuration
132	870.0		according to KDB 971168 D03
228	889.2		
151	873.8	T <sub>im 3</sub>	3 carrier TX top configuration
247	893.0		according to KDB 971168 D03
250	893.6		

TX test frequencies, radiated measurements:

ARFCN	Frequency	Symbolic	Comment
Downlink	[MHz]	name	
128	869.2	В	Single carrier TX bottom frequency
190	881.6	М	Single carrier TX mid frequency
251	893.8	Т	Single carrier TX top frequency
185	880.6	M2	2 carrier TX mid constellation
195	882.6	IVIZ	
183	880.2		
188	881.2	M4	4 carrier TX mid constellation
192	882.0	1014	
197	883.0		

All RX frequencies were configured 45 MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

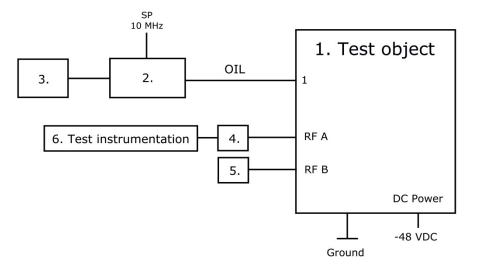


Appendix 1

Page

4(7)

# **Test setup: Conducted measurements**



#### **Test object:**

 I.
 Radio 2219 B5, KRC 161 678/1, rev. R1A, s/n: D825138266

 With Radio Software: CXP 901 7316/2, rev. R64HS. FCC ID TA8AKRC161678-1 and

 IC: 287AB-AS1616781

# Associated equipment:

2.	Testing Equipment:
	CT10, LPC 102 487/1, rev. R1C, s/n: T01F265031, BAMS – 1000797753
	with software CXA 104 446/1, rev. R8U

# **Functional test equipment:**

3.	HP EliteBook 8560w, BAMS – 1001236850
4.	RF Attenuator: SP number: 902 282
5.	Terminator, 50 ohm
6.	SP Test Instrumentation according to measurement equipment list for each test.
	The signal analyzer was connected to the SP 10 MHz reference standard during all
	measurements.

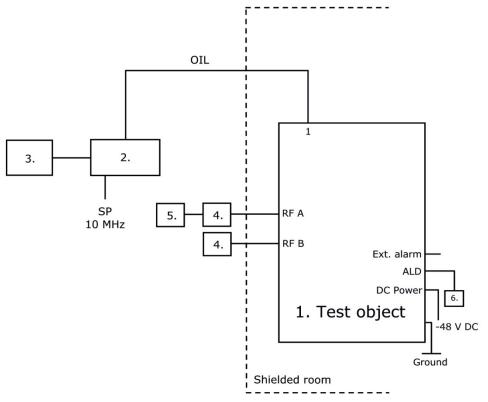


Appendix 1

Page

5(7)

# Test setup: Radiated measurements



#### **Test object:**

1. Radio 2219 B5, KRC 161 678/1, rev. R1A, s/n: D825138266 With Radio Software: CXP 901 7316/2, rev. R64HS. FCC ID TA8AKRC161678-1 and IC: 287AB-AS1616781

#### Associated equipment:

2.	Testing Equipment:
	CT10, LPC 102 467/1, rev. R1C, s/n: T01F375047, BAMS – 1001466801
	with software CXA 104 446/1, rev. R8U

#### **Functional test equipment:**

HP EliteBook 8560w, BAMS – 1001236850
 Attenuator/ Terminator
 R&S ESIB 26, SP number: 503 292, for supervision purpose only

Interfaces:	Type of port:
Power: -48VDC	DC Power
RF port A, 4.3-10 connector, combined TX/RX	Antenna
RF port B, 4.3-10 connector, combined TX/RX	Antenna
1, optical interface	Signal
2, optical interface, not used in this configuration	Signal
EXT Alarm, shielded multi-wire	Signal
ALD, shielded multi-wire	Signal
Ground wire	Ground



Appendix 1

<sup>Page</sup> 6 (7)

# Measurement equipment

	Calibration Due	SP number
Test site Tesla	2019-12	503 881
R&S ESU 40	2017-07	901 385
R&S FSQ 40	2017-07	504 143
R&S FSW 43	2017-08	902 073
Control computer with	-	503 899
R&S software EMC32 version 9.15.0		
High pass filter 1-18 GHz	2017-06	901 501
High pass filter 1-20 GHz	2017-06	901 373
RF attenuator Weinschel 6905-40-11-LIM	2018-03	902 282
Coaxial cable Sucoflex 102EA	2018-03	BX50191
Coaxial cable Sucoflex 102EA	2018-03	BX50236
ETS Lindgren BiConiLog Antenna 3142E	2019-03	BX61914
EMCO Horn Antenna 3115	2019-12	502 175
µComp Nordic, Low Noise Amplifier	2017-12	901 545
Temperature and humidity meter, Testo 635	2017-05	504 023
Temperature and humidity meter, Testo 625	2017-06	504 188

Page 7 (7)



Appendix 1

# Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation "SP-QD 10885". The uncertainties are calculated with a coverage factor k=2 (95% level of confidence). Compliance evaluation is based on a shared risk principle with respect to the measurement uncertainty.

# Reservation

The test results in this report apply only to the particular test object as declared in the report.

# **Delivery of test object**

The test object was delivered 2017-02-14.

# Manufacturer's representative

Mikael Jansson, Ericsson AB.

# **Test engineers**

Tomas Lennhager, Tomas Isbring and Andreas Johnson, RISE.

# **Test participant**

None.



Appendix 2

# RF power output measurements according to CFR 47 2.1046 / IC RSS-132 5.4

Date	Temperature	Humidity
2017-04-03	$22 \degree C \pm 3 \degree C$	36% ± 5 %
2017-05-08	$22 \degree C \pm 3 \degree C$	15% ± 5 %

#### Test set-up and procedure

The test object was connected to a signal analyzer measuring peak and RMS output power in CDF mode.

Measurement equipment	SP number
Rohde & Schwarz signal analyser FSW 43	902 073
RF attenuator	502 282
Testo 635 temperature and humidity meter	504 203

#### Measurement uncertainty: 0.7 dB

#### Results

Single carrier

Rated output power level at RF connector 1x 43 dBm/ port.

Tested modulation and Symbolic name	Port RF A [RMS dBm/ dB PAR]	Port RF B [RMS dBm/ dB PAR]
GMSK, B+1	42.75/ 0.42	42.89/ 0.38
GMSK, M	42.62/ 0.38	42.63/ 0.42
GMSK, T-1	42.66/ 0.40	42.63/ 0.42
8PSK, B+1	42.29/ 3.48	42.40/ 3.48
AQPSK, B+1	42.66/ 3.62	42.78/ 3.64

Reduced output power apply for the channel 128 and 251: 38 dBm/ port.

Tested modulation and Symbolic name	Port RF B [RMS dBm/ dB PAR]
GMSK, B	37.79/ 0.32
GMSK, T	37.63/ 0.36



Appendix 2

# Multi carrier

#### Rated output power 2x 43 dBm/ port.

Tested modulation and	Port RF A	Port RF B
Symbolic name	[RMS dBm/ dB PAR]	[RMS dBm/ dB PAR]
GMSK, B2	45.80/ 3.30	45.86/ 3.32
GMSK, M2	45.62/ 3.30	45.62/ 3.30
GMSK, T2	45.70/ 3.30	45.67/ 3.34

#### Multi carrier

#### Rated output power 4x 43 dBm/ port.

Tested modulation and	Port RF A	Port RF B
Symbolic name	[RMS dBm/ dB PAR]	[RMS dBm/ dB PAR]
GMSK, B4	48.39/ 6.18	48.47/ 6.12
GMSK, M4	48.57/ 6.16	48.58/ 6.18
GMSK, T4	48.54/ 6.12	48.48/ 6.10

#### Power Spectrum Density

Single carrier

#### Rated output power level at RF connector 1x 43 dBm/ port.

Tested modulation and	Port RF A	Port RF B
Symbolic name	[RMS dBm]	[RMS dBm]
GMSK, B+1	42.88	43.01

#### Remark

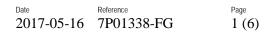
This unit is tested without antenna. ERP/EIRP compliance is addressed at the time of licensing, as required by the responsible FCC/IC Bureau(s). Licensee's are required to take into account maximum allowed antenna gain used in combination with above power settings to prevent the radiated output power to exceed the limits.

#### Limits

CFR47 § 22.913:	The effective radiated power ERP shall not exceed 1000 W or 800 W/ MHz (PSD) per sector. The PAR (0.1%) shall not exceed 13 dB.
RSS-132 5.4:	The average equivalent isotropically radiated power (e.i.r.p.) limits in SRSP-503 apply, resulting in a maximum EIRP of 1640 W. The PAR (0.1%) shall not exceed 13 dB.

Complies? Yes





Appendix 3

### Occupied bandwidth measurements according to CFR47 2.1049 / RSS-Gen 4.6.1

Date	Temperature	Humidity
2017-04-04	$22 \degree C \pm 3 \degree C$	$31\%\pm5~\%$

#### Test set-up and procedure

The measurements were made per definition in § 2.1049. The output was connected to a signal analyzer with the RMS detector activated. The signal analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
Rohde & Schwarz signal analyser FSW 43	902 073
RF attenuator	502 282
Testo 635 temperature and humidity meter	504 203

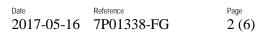
#### Measurement uncertainty: 3.7 dB

#### Results

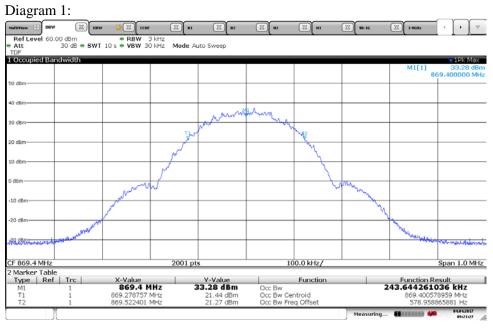
Single carrier

Diagram	Modulation	Symbolic name	Tested Port	Occupied BW (99%) [kHz]
1	GMSK	B+1	RFA	244
2	GMSK	B+1	RFB	245
3	GMSK	М	RFA	244
4	GMSK	М	RFB	245
5	8 PSK	М	RFA	245
6	8 PSK	М	RFB	245
7	AQPSK	М	RFA	241
8	AQPSK	М	RFB	239
9	GMSK	T-1	RFA	244
10	GMSK	T-1	RFB	245

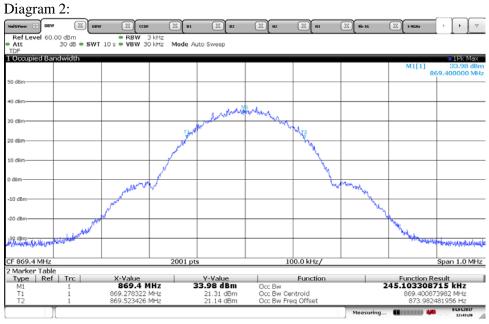
The diagrams are shown on the following pages.



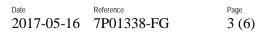
Appendix 3



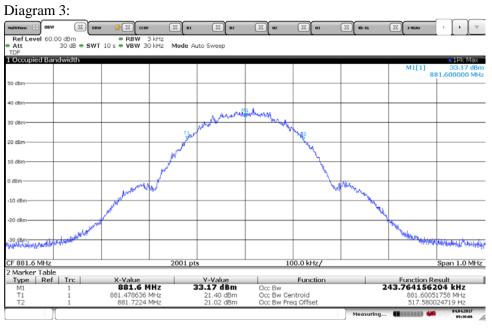
09:21:27 04.04.2017



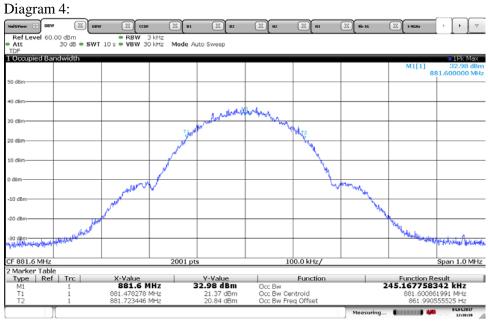
12:43:20 04.04.2017



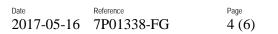
Appendix 3



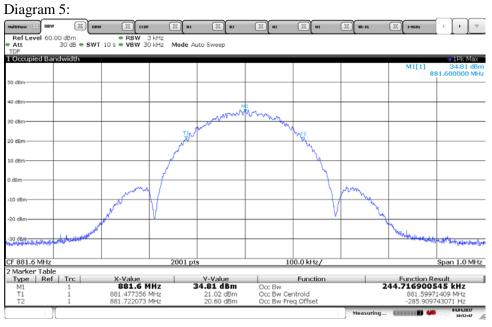
09:30:07 04.04.2017



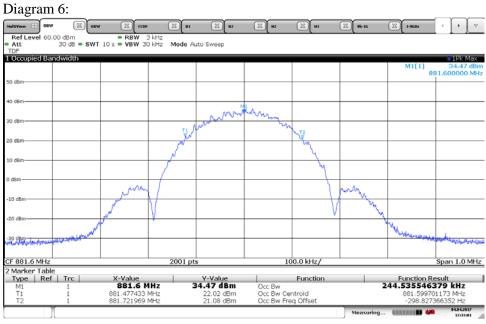
12:38:40 04.04.2017



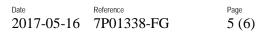
Appendix 3



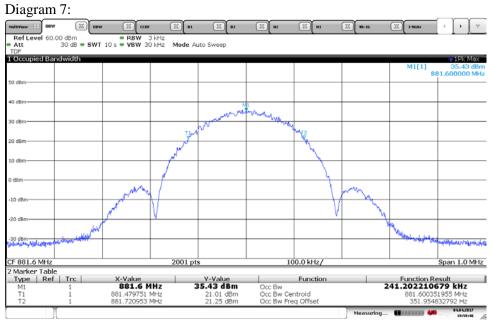
10:52:48 04.04.2017



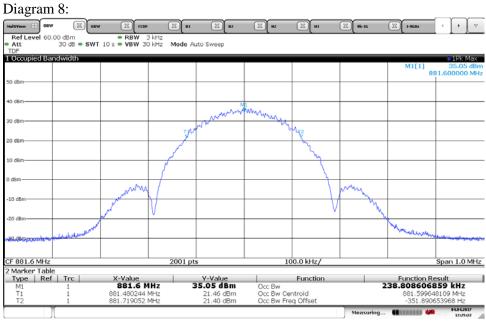
12:33:01 04.04.2017



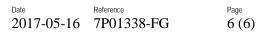
Appendix 3



10:58:47 04.04.2017

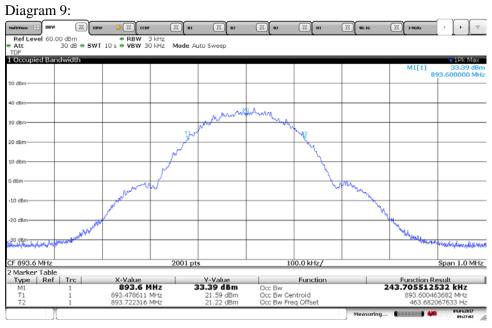


12:25:22 04.04.2017

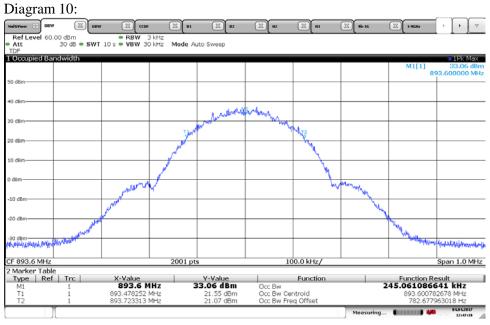


SP SP Science

Appendix 3



09:27:03 04.04.2017



12:47:19 04.04.2017



Appendix 4

# Band edge measurements according to CFR 47 §2.1051 / IC RSS-132 5.5

Date	Temperature	Humidity
2017-04-04	$22 \ ^{\circ}C \pm 3 \ ^{\circ}C$	31% ± 5 %
2017-05-08	$22 \ ^{\circ}C \pm 3 \ ^{\circ}C$	15% ± 5 %

#### Test set-up and procedure

The measurements were made per definition in § 22.917. The test object was connected to a spectrum analyzer with the RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

FCC rules specify a RBW of at least 1% of the fundamental emission bandwidth (EBW) for offsets up to 1 MHz from the band edge and a RBW of 100 kHz for measurements of emissions more than 1 MHz away from the band edges.

Measurement equipment	SP number
Rohde & Schwarz signal analyser FSW 43	902 073
RF attenuator	502 282
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

#### Results

Single carrier

Diagram	Modulation	Symbolic name	Tested Port
1 a-b	GMSK	B+1	RF B
2 a-b	8PSK	B+1	RF B
3 a-b	GMSK	T-1	RF B
4 a-b	8PSK	T-1	RF B
5 a-b	GMSK	В	RF B
6 a-b	GMSK	Т	RF B

The diagrams are shown on the following pages.

#### Remark

Where multiple requirements apply, the most stringent requirement is considered for compliance assessment.

### Limits

CFR 47 § 22.917: Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm per 100 kHz RBW below 1 GHz and 1MHz RBW above 1 GHz.

IC RSS-132 5.5.1.2: Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P) dB$  per any 100 kHz RBW.

Complies? Yes
---------------

#### SP Technical Research Institute of Sweden



Appendix 4

<sup>Page</sup> 2 (7)

#### Diagram 1 a: Multiview 🕀 DBW 🖾 EBW 🖾 CCDF 🖾 🛙 🛙 図 BZ 図 HZ 図 H1 9k-16 1-96Hz + | $\nabla$ Ref Level 50.00 dBm RBW 3 kHz Att 30 dB SWT 500 ms VBW 30 kHz Mode TDF Auto Sweep Count 100/100 1 Frequency Sweep • 1Rm Avg M1[1] -40.31 dBm 869.00000 MHz 40.4 30 dB 10 d 41 -13.000 dBr 20 d 20 40 dB 870.0 MHz 1001 pts 200.0 kHz/ 868.0 MHz Measuring. 04.04.2017 13:22:55 04.04.2017

#### Diagram 1 b:

)m				<u></u> н1	94-1G	1-96Hz	
dB 🖷 SWT 100 ms	<ul> <li>RBW 100 kHz</li> <li>VBW 1 MHz Mo</li> </ul>	de Auto Sweep				C	ount 100/100
)							1Rm Avg
						M1[1]	-25.71 dBr 867.7977 MH
3.000 dBm							
							M1
	1001 p	ts		L5 MHz/			868.0 MHz
	2.000 dBm 2.0000 dBm 2.000 dBm 2.000 dBm 2.000 dBm 2.000 dBm 2.000 dBm 2.0000 dBm 2.000 dBm 2.0000 dBm 2.00000 dBm 2.0000 dBm 2.00000 dBm 2.000000000000000000000000000000000000	3.000 dBm 2.000 dBm 2.0000 dBm 2.000 dBm 2.0000 dBm 2.00000 dBm 2.00000 dBm 2.00000 dBm 2.00000 dBm 2.000000 dBm 2.000000 dBm 2.000000000000000000000000000000000000	Image: Sector	Image: second	Image: state stat		MI(1)         MI(2)       MI(2)         MI(2)       MI(2)       MI(2)         MI(2)       MI(2)       MI(2)         MI(2)       MI(2)       MI(2)       MI(2)         MI(2)       MI(2)       MI(2)       MI(2)         MI(2)       MI(2)       MI(2)       MI(2)         MI(2)       MI(2)       MI(2)       MI(2)       MI(2)         MI(2)       MI(2)       MI(2)       MI(2)       MI(2)         MI(2)       MI(2)

13:21:36 04.04.2017



Appendix 4

<sup>Page</sup> 3 (7)

	EBW 🕅 CCI		EZ BZ	XX HZ	Ш н	W 94-16	1-96Hz	< + v
Ref Level         50.00 dBm           Att         30 dB = SV           IDF	• RB WT 500 ms • VB		Auto Sweep					Count 100/10
Frequency Sweep								• 1Rm Avç
							M1[1]	-40.65 dE 869.00000 M
) dBm								
dBm								
					ww	my		
I dBm						<u> </u>		
					1			
dBm					- (			
d8m-					1			
0 dBm								
H1 -13.000 dBm	·			, m			5	
0 dBm				5				
0 dBm					V			
0 dBm	with the stands which the re-	Name and a state of the state o	M Marine and the second	in the second			No.	
68.0 MHz		1001 pts		20	0.0 kHz/			870.0 MF

# Diagram 2 b:

Ref Level 50	-		81 100 kHz	B2	XX HZ	Ш ні	94-16	X 1-96Nz	
Att		100 ms - VBW	1 MHz Mod	e Auto Sweep				(	Count 100/100
Frequency S	weep								1Rm Avg
								M1[1]	-25.82 dBr 867.9476 MH
40 dBm									
0 dBm									
20 dBm									
0 dBm									
dêm									
10 dBm									
	H1 -13.000 dBm								
20 dBm									
30 dBm									
40 dBm									
853.0 MHz			1001 pt	5	-	1.5 MHz/	_		868.0 MHz

13:19:39 04.04.2017



<sup>Page</sup> 4 (7)



Appendix 4

NultiView 🕀 OB1		-		X BZ	Ш (нz	2X H1	9k-16	1-96Hz	<ul> <li>+ ▼</li> </ul>
Ref Level 50 Att TDF		= RBW 500 ms = VBW	/ 3 kHz / 30 kHz Mode	Auto Sweep					Count 100/100
Frequency S	weep							M1[1]	1Rm Avg -40.73 dBr 894.00000 MH
i0 dBm									+
0 dBm		<u>م</u>	rus -						
0 dBm			- Why						
0 dBm									
d8m		<u> </u>							
10 dBm				n					
20 dBm	H1 -13.000 dBm			$\mathbf{h}$					
30 dBm									
	N			L.	1				
40 dBm					a and the second second			and a second	an a
893.0 MHz			1001 pt	s	2	00.0 kHz/			895.0 MHz

### Diagram 3 b:

Ref Level 50	0.00 dBm	= RBW	/ 100 kHz				
Att TDF	30 dB 🖷 SWT	100 ms 🗢 VBW	1 MHz Mod	e Auto Sweep		c	ount 100/100
Frequency (	Sweep					M1[1]	<ul> <li>1Rm Avg</li> <li>-25.98 dBr</li> <li>909.9925 MH</li> </ul>
40 dBm							
30 dBm							
20 dBm							
10 dBm							
0 d8m							
-10 dBm	H1 -13.000 dBm-						
-20 dBm							
-30 dBm						 	
-40 dBm							
895.0 MHz			1001 pt		L.5 MHz/		910.0 MH

13:14:16 04.04.2017





Appendix 4

<sup>Page</sup> 5 (7)

Multiview 🕀 08		-		XX 8z	XX HZ	Т на	<b>%</b>	1-96Hz	< → ▼
Ref Level 50 Att TDF		• RBV 500 ms • VBV	/ 3 kHz / 30 kHz Mode	a Auto Sweep				(	Count 100/100
1 Frequency S	Sweep								1Rm Avg
								M1[1]	-41.07 dB 894.00000 Mi
40 dBm									
30 dBm									
		M	my						
20 dBm		٢	٦ ٦						
10 dBm									
10 0011									
0 d8m		1							
		1							
-10 dBm	H1 -13.000 dBm								
	H1 -13.000 08m			~					
-20 dBm									
-30 dBm		1							
-00 0011									
-40 dBm	- AND			Mun		and the second second		ملتجهر ريدمحم بعدم روحوس	and the state of the barriers of the barriers
								ALL OF BE	
893.0 MHz			1001 pt	s	2	00.0 kHz/			895.0 MH

# Diagram 4 b:

Ref Level 5	0.00 dBm	RBW	/ 100 kHz						
TDF	30 dB 🖷 SWT	100 ms 🖷 VBW	1 MHz Mod	e Auto Sweep				c	ount 100/100
Frequency	Sweep								1Rm Avg
								M1[1]	-26.01 dBr 909.8576 MH
40 dBm									
30 dBm									
20 dBm									
10 dBm									
) d8m									
GBIII									
-10 dBm	H1 -13.000 dBm								
20 dBm									
									1
30 dBm									
40 dBm									
895.0 MHz	1		1001 pt		-	1.5 MHz/	-		910.0 MH

13:15:52 04.04.2017





Appendix 4

<sup>Page</sup> 6 (7)

MultiView 🕀 B1 🛛 🗵	B2 🤾 CCDF	X					~
Ref Level 50.00 dBm Att 30 dB = SWT	● RBW 3 kHz 100 ms ● VBW 30 kHz Mode	Auto Sweep					GL ount 100/100
Frequency Sweep		_					<ul> <li>1Rm Avg</li> </ul>
						M1[1]	-13.68 dB
						8	68.97800 M
0 dBm							
) dBm							
) dBm			~~~	m -			
			M	3			
dBm			5	<u>\</u>			
			1				
dBm-			ſ				
			/	1			
10 dBm		M1 /					
41 -13.000 dBm		Ā/		<u> </u>	m		
20 dBm		^Ť			<u>h</u>		
		1					
00 dBm		(					
		1					
		1			1		
10 dBm	monor	AL AND			~~~	mmmmn	mann
68.0 MHz	1001 pts		20	0.0 kHz/			870.0 Mł
ľ					Ready	CHICK STOLEN	446 08.85.20 14:58:

#### Diagram 5 b:

Att	00 dBm 30 dB • SWT	RBW 100 ms = VBW	100 kHz 1 MHz Mod	le Auto Sweep			с	ount 100/100
TDF Frequency St	weep							1Rm Avg
rrequercy o	weep						M1[1]	-26.13 dBr
								867.9625 MF
0 dBm								
) dBm							 	
) dBm							 	
) dBm								
dBm								
GBIII								
10 dBm	H1 -13.000 dBm -							
20 dBm-								
00 dBm								
0 dBm								
53.0 MHz			1001 pt		L,	.5 MHz/		868.0 MF

15:00:41 08.05.2017



Date	Reference
2017-05-16	7P01338-FG

<sup>Page</sup> 7 (7)

Appendix 4

Multiview 🕀 81	EZ BZ	CCDF	E III	Ш нг	X				
Ref Level 50.0 Att TDF	0 dBm 30 dB • SWT	<ul> <li>RBW</li> <li>100 ms</li> <li>VBW</li> </ul>	3 kHz 30 kHz Mode	Auto Sweep				c	Count 100/100
Frequency Sw	еер								1Rm Avg
								M1[1]	-14.13 dBm 894.02000 MHa
0 dBm									
0 dBm									
0 dBm			,~	m					
			السم ا	Ψ,					
.0 dBm									
) dBm			ſ						
10 dBm	1 -13.000 dBm	٨	1		M1				
20 dBm			/	)	r\				
-30 dBm									
		7							
40 dBm	-	-					~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
893.0 MHz			1001 pt	s	20	0.0 kHz/			895.0 MHz

# Diagram 6 b:

ultiview 🕀 81		CCDF	Ш	H2	×.			~
Ref Level 5 Att IDF	30 dB • SWT	• RBW 100 ms • VBW	100 kHz 1 MHz Moo	le Auto Sweep			c	ount 100/100
Frequency	Sweep							1Rm Avg
							M1[1]	
								909.6329 MH
0 dBm								<u> </u>
0 dBm								
) dBm-								
) dBm	-				-			
dBm							 	
.0 dBm	H1 -13.000 d8m							
0 dBm					-	-		
								M1
0 dBm							 	
40 dBm								<u> </u>
95.0 MHz			1001 pt	<u> </u>		1.5 MHz/		910.0 MH
	Y		1001 pt				 	08.05.201

15:34:55 08.05.2017



Appendix 5

Page

1 (23)

# Conducted spurious emission measurements according to CFR 47 2.1051 / IC RSS-132 5.5

Date	Temperature	Humidity
2017-04-04	$22 \degree C \pm 3 \degree C$	31% ± 5 %

#### Test set-up and procedure

The measurements were made per definition in § 22.917. The output was connected to a spectrum analyzer with the RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
Rohde & Schwarz signal analyser FSW 43	902 073
RF attenuator	502 282
High pass filter	901 373
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB



Appendix 5

Page

2 (23)

# Results

Single carrier

Diagram	Modulation	Symbolic name	Tested Port
1 a+b	GMSK	B+1	RF B
2 a+b	GMSK	М	RF B
3 a+b	8PSK	М	RF B
4 a+b	GMSK	М	RF A
5 a+b	GMSK	T-1	RF B

Multi carrier

Diagram	Modulation	Symbolic name	Tested Port
6 a+b+c	GMSK	M2	RF B
7 a+b+c	8PSK	M2	RF B
8 a+b+c	GMSK	B <sub>im 3</sub>	RF B
9 a+b+c	8PSK	B <sub>im 3</sub>	RF B
10 a+b+c	GMSK	T <sub>im 3</sub>	RF B
11 a+b+c	8PSK	T <sub>im 3</sub>	RF B
12 a+b+c	GMSK	M4	RF B
13 a+b+c	8PSK	M4	RF B

### Remarks

The upper frequency boundary covers 10x the highest TX fundamental frequency.

### Limits

CFR 47 § 22.917: Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm per 100 kHz RBW below 1 GHz and 1MHz RBW above 1 GHz.

IC RSS-132 5.5.1.2: Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P) dB$  per any 100 kHz RBW.

Complies? Yes

Page 3 (23)



Appendix 5

			XX 82 (2	🕅 нг 🖾	H1 🕅 94-16	1-86Hz	
	<ul> <li>RBW 1</li> <li>20 ms</li> <li>VBW 10</li> </ul>	MHz MHz Mode Auto S	Sweep			c	Count 100/10
TDF DC Frequency Sweep							1Rm Ave
						M1[1	
						M1 N2[1	869.400 M 1 -25.51 d
0 dBm							890,469 N
0 dBm							
0 dBm							
0 dBm							
o obiii							
d8m							
10 dBm							
H1 -13.000 dBm							
20 dBm							
				-		M2	
0 dBm							
10 40 -							
40 dBm-							
9.0 kHz		6001 pts		100.0 MH	iz/	1	1.0 Gł

# Diagram 1b:

Ref Level 2	EBW	RBW		X BZ (X	К (нг 🖾)	н1 🖾	9k-1G	1-96Hz	
Att	10 dB • SWT	40 ms = VBW	10 MHz Mode	Auto Sweep				c	ount 100/10
Frequency	Sweep								1Rm Avg
								M1[1]	-25.14 dB
									8.841033 G
0 dBm									
d8m									
10 dBm									
	H1 -13.000 dBm								
20 dBm									M
30 dBm			-					1000	
			and the second se						
40 dBm									
+U dbm									
50 dBm									
60 dBm									
oo dam									
70 dBm	+								
.0 GHz			35001 p	ts	80	0.0 MHz/			9.0 GH

12:32:55 05.04.2017

Page 4 (23)



Appendix 5

sultiview 🗄 OBW 🕅 EBW		🖾 🕅 нг 🛛	14-16 X	
Ref Level 50.00 dBm Att 20 dB • SWT 2	<ul> <li>RBW 1 MHz</li> <li>20 ms</li> <li>VBW 10 MHz</li> <li>Mode Auto</li> </ul>	Sweep		Count 100/100
TDF DC Frequency Sweep				1Rm Avg
nequency sweep				M2[1] -25.36 dB
				M1 890.469 M M1 1 42.66 dB
0 dBm-				881.600 MI
10 dBm				
20 dBm				
10 dBm-				
) d9m				
10 dBm				
H1 -13.000 dBm				
20 dBm				
20 000				M2
30 dBin				
$\sim$ $ $ $ $				
40 dBm-				
9.0 kHz	6001 pts	100.0	MHz/	1.0 GH
Y	0001 pt3	100.0	Measuring	

# Diagram 2b:

Ref Level 2	EBW 20.00.dBm		1 MHz	X BZ (X	🛙 [нг 🖾	ні 🕅	9k-16	1-9GHz 🔀	<b>└   )</b>
Att DF		40 ms • VBW		Auto Sweep				0	Count 100/100
Frequency	Sweep								1Rm Avg
								M1[1]	-25.36 dB 7.991915 GF
									1.991913 0
) dBm									
d8mm8b									
0 dBm									
	H1 -13.000 dBm								
0 dBm									1
U dBm								M1	
						-			
0 dBm									
0 dBm									
0 dBm									
0 dBm									
10 dBm	-						-		+
									1
.0 GHz			35001 p	ts	80	0.0 MHz/			9.0 GH
10 01 12	Y		55001 p	10	00	0.0.0.1112/	Measuring		05.04.2017

12:28:09 05.04.2017



Page 5 (23)



# Appendix 5

Nultiview 🕀 OB1		CCDF	X 81	EZ BZ	XX Hz	Ш н1	94-16	1-96Hz	< → ▼
Ref Level 50 Att	.00 dBm 20 dB = SWT 20	<ul> <li>RBW</li> <li>ms</li> <li>VBW</li> <li>1</li> </ul>	1 MHZ D MHZ Mode	Auto Sweep				с	ount 100/100
DF DC Frequency S	ween								• 1Rm Avg
								M2[1]	-25.30 dB
								M1 1	890.469 MI 42.13 dB
0 dBm							-		881.600 M
0 dBm									
0 dBm									
10 dBm									
to dem-									
) dêm									
-10 dBm									
	H1 -13.000 dBm								
20 dBm									
								M2	
30 dBm		******							
-40 dBm									
HU UBIN									
9.0 kHz			6001 pt	s	. 1	00.0 MHz/	-		1.0 GH

#### Diagram 3b:

E osw Ref Level 2	EBW	RBW		X BZ Z	K) HZ (X)	н1 🖾	9k-16	1-9GHz 🔛	
Att DF		40 ms • VBW		Auto Sweep				0	ount 100/10
Frequency:	Sweep								1Rm Avg
								M1[1]	-25.17 dE
) dBm									1.933373 0
I dBm-									
d8m									
20111									
0 dBm									
0.0011	H1 -13.000 dBm								
0 dBm									
								M1	
0 dBm									
0 dBm									
0 dBm									
0 dBm									
0 dBm									<u> </u>
.0 GHz			35001 p	ts	80	0.0 MHz/			9.0 G

13:36:06 05.04.2017

Page 6 (23)



# Appendix 5

oultiview 🕀 OBW	EBW	200 CCDF	XX 81	EZ BZ	XX Hz	🖾 🕅 н1	91-16	1-96.Hz	V
Ref Level 50.0 Att	0 dBm 20 dB = SWT :	<ul> <li>RBW</li> <li>20 ms</li> <li>VBW</li> </ul>	1 MHz 10 MHz Mode	Auto Sweep					Count 100/100
TDF DC Frequency Sw	veen								• 1Rm Avg
in equency of	COP							M1[	<ol> <li>42.73 dB</li> </ol>
								MI	881.600 M 1] -25.42 dB
0 dBm								M2	890,469 M
0 dBm							_		
:0 dBm									
0 dBm-									
) dêm							_		
10 dBm							_		
, ,	11 -13.000 dBm								
20 dBm-									
									2
30 dBm									
30 0011									
$\sim$									
40 dBm									
9.0 kHz			6001 pt	s	· 1	00.0 MHz/			1.0 GH
- Y							Measuring		

#### Diagram 4b:

Ref Level 20	EBW		1 MHz	X BZ (X	K) HZ (X)	н1 🖾	1k-16	1-9GHz	
Att		40 ms • VBW		Auto Sweep				c	Count 100/10
Frequency :	Sweep								1Rm Avg
								M1[1]	-25.14 dB 7.966772 G
0 dBm									
d8m									
10 dBm	H1 -13.000 dBm-								
	H1 -13.000 08m								
20 dBm								MI	
30 dBm									
+0 dBm									
50 dBm									
60 dBm									
70 dBm									
1.0 GHz			35001 p	ts	80	0.0 MHz/			9.0 GH

12:38:11 05.04.2017

<sup>Page</sup> 7 (23)



# Appendix 5

oultiview 🕀 OBW	EBM	CCDF	XX 81	EX B2	XX Hz	Ш н1	94-16	1-96Hz	< + V
Ref Level 50.00 Att	) dBm 20 dB = SWT 20 m:	RBW 1N B VBW 10N	Hz Hz Mode/	Auto Sweep				c	ount 100/10
TDF DC Frequency Sw	aan								• 1Rm Avg
Trequency ow	cop							M2[1	-25.12 dB
								MIL	
0 dBm								M1[1	893.600 MI
0 dBm									
0 dBm									
10 dBm									
IU dBm-									
) dâm									
10 dBm									
	1 -13.000 dBm								
20 dBm-							-		
								1	M
30 dBit									
$ \downarrow $									
40 dBm									
9.0 kHz			6001 pts		1	00.0 MHz/			1.0 GH

# Diagram 5b:

⊞ (oew	EBW EBW	CCDF		XX Bz	🛙 🗍 нг 🛛 🕅	[ні 🕅	9k-16	1-9GHz	
Ref Level 2 Att	0.00 dBm 10 dB = SWT	• RBW 40 ms • VBW	1 MHz 10 MHz Mode	Auto Sweep				c	Count 100/10
DF	0								<ul> <li>1Rm Avg</li> </ul>
Frequency	Sweep							M1[1]	-25.21 dB
									7.964715 G
) d8m									
d8m									
0 dBm									
	H1 -13.000 dBm								
0 dBm									
								M1	
0 dBm					and the second designed to the second designed to the second designed and the				
0 dBm									
0 dBm									
0 dBm									
0 dBm									
.0 GHz			35001 p		90	0.0 MHz/			9.0 GF
.0 GHZ	¥		35001 p	La	01	0.0 WH2/	Measuring		9.0 GF

12:23:06 05.04.2017

Page 8 (23)



# Appendix 5

	OBW X EB			н 🖾 🛙 вг	XX HZ	X H1	94-16	X 1-96.Hz	< → ▼
Ref Level Att DF DC	50.00 dBm 20 dB • SW1	● RBW 1 T 20 ms ● VBW 10		de Auto Sweep				с	ount 100/100
Frequenc	y Sweep								1Rm Avg
								MAL	-25.55 dBi 889.129 MF
0 dBm								M1[1]	
2 GDIII									881.600 MF
0 dBm									
dBm									
0.0111									
dBm									
dom									
18m									
,									
) dBm									
	H1 -13.000 dBm-					_			
0 dBm									
o dom								M13	
0 dBm									
0 dBm									
O OBIII									
9.0 kHz Marker T			6001	pts		100.0 MHz/			1.0 GH
	able Ref   Trc	X-Value		Y-Value	1	Function	1	Function Re	scult
M1	1	881.6 MHz		44.14 dBm					
M2	1	882.3 MHz 889.129 MHz		43.56 dBm -25.55 dBm					

10:54:34 05.04.2017

#### Diagram 6b:

EBW Ref Level 50			К вг 100 kHz	Ш нг	Ш ні		16 X	1-9GHz	Zeom	(X)	
Att TDF DC	20 dB 🖷 SWT	20 ms VBW	1 MHz	Mode Auto Swe	ep					С	ount 100/100
Frequency S	Sweep										1Rm Avg
										M3[1]	-36.42 dBr
					M#2					M1[1]	894.2860 MH 40.68 dB
0 dBm										-MI[I]	881.6000 MI
					- 16						
0 dBm								-			
0 d8m					_						
0 dBm					_						
					- III						
d8m											
10 dBm											
LU dBm	H1 -13.000 dBm-										
					- 11						
20 dBm											
					- 11						
30 dBm					<u></u> (1)						
	and the second second				~~~~ ``	Contraction of the local division of the loc		mannen		-	
10 dBm							V2				
			V1				1 T				
F 881.5 MHz			60	101 pts			7.5 MHz/				pan 75.0 MH
Marker Tab			00	orpes			7.5 MH27				span 75.0 Min
Type   Re		X-Value	1	Y-Value			Function		i Fu	Inction Re	esult
M1	1	881.6 MH		40.73 di	Bm						
M2	1	882.2 MI	z	40.96 di	Bm						
M3	1	894.286 MH	IZ	-36.45 di	211)						05.04.2017

10:55:00 05.04.2017



<sup>Page</sup> 9 (23)

Appendix 5

ee oew	EBW	CCDF	XX 81	EX BZ	XX Hz	🕅 нт	X 14	16 X	1-9GHz	
Ref Level 2 Att	0.00 dBm 10 dB = SWI	● RBW 40 ms ● VBW	1 MHz 10 MHz Mo	de Auto Sweej	>					Count 100/10
DF Frequency :	Sweep									• 1Rm Avg
									M1[1	
dBm				_						+
18m										
dBm	H1 -13.000 dBm-				_					
dBm					_				M1	
) dBm									Ť	
dBm										+
dBm				_	_					
dBm										
dBm										+
0 GHz			35001	pts		800.0 Mł	Hz/			9.0 G
	Y							Measuring		

Page 10 (23)



# Appendix 5

			X 81	EZ BZ	Ш нг	Ш ні	94-16	3-96Hz	< → ▼
Ref Level Att DF DC		● RBW T 20 ms ● VBW 1		e Auto Sweep				c	ount 100/100
Frequenc	y Sweep								1Rm Avg
								MAL	] -25.57 dB 889.129 MF
) dBm								M1[1]	
									881.600 M
) dBm									
dBm									
dBm									
2 4011									
d8m									
0.0111									
0 dBm									
0.0011	H1 -13.000 dBm-								
0 dBm									
								013	
0 dan									
0 dBm									
0 00111									1
0.0 kHz			6001 p	ts	1	00.0 MHz/			1.0 GH
Marker Ta Type   F	able Ref   Trc	X-Value	-	Y-Value	1	Function		Function Re	acult
M1	1	881.6 MHz	:	44.29 dBm		Function		Function Re	suit
M2	1	882.3 MHz 889.129 MHz		43.87 dBm -25.57 dBm					

10:48:58 05.04.2017

# Diagram 7b:

EBW	CCDF	X 81	BZ BZ	🕅 нг	ти) 🖾	. X.	k-16	1-9GH2	Zeom	X	4 ) → [ ▽
Ref Level 50 Att TDF DC	20 dB • SW1		¥ 100 kHz ¥ 1 MHz	Mode Auto S	5weep					С	ount 100/100
Frequency S	weep										1Rm Avg
										M3[1]	-35.70 dBr
					M	2					894.2860 MH
0 dBm								-		M1[1]	40.52 dBi 881.6000 MF
					- 11						881.6000 MF
0 dBm											
0 dBm											
0 dBm					1						
o dom											
					- 1						
d8m-								-			
10 dBm								-			
	H1 -13.000 dBm-										
20 dBm											
					1	1					
30 dBm						1					
00 0011					Nume .	N	M3				
	and a second second					and provide the state	and the state of t	and the second second		and the second sec	
40 dBm							V2				
			V1								
F 881.5 MHz	1	1	6	001 pts		7	.5 MHz/			S	pan 75.0 MH
Marker Tabl											
Type   Ref	Trc	X-Value		V-V.			Function		Fu	inction Re	sult
M1	1	881.6 M 882.2 M	HZ	40.52							
M2 M3	1	894.286 M	H7	-35.79	d Bm						
110		001120011							ring		05.04.2017

10:49:53 05.04.2017



Page 11 (23)

Appendix 5

Diagram 7c:								
E OBW EBW (	X CCOF X	81	BZ Z	К нг 🕅	н1 🕅	1k-16	1-96Hz	
Ref Level 20.00 dBm Att 10 dB = SWT 4	● RBW 11 40 ms ● VBW 101		Auto Sweep					Count 100/100
Frequency Sweep								1Rm Avg
							M1[1	] -25.15 dB 7.981629 GF
0 d8m								
o delli								
d8m								
dBm								
0 dBm H1 -13.000 dBm								
0 dBm-							M1	
i0 dBm-				The state of the s				
i0 dBm								
i0 dBm-								
i0 dBm								-
70 dBm								
.0 GHz		35001 pt	s	80	0.0 MHz/			9.0 GF
Т								

Page 12 (23)



# Appendix 5

	DBW 🖾 EBW	<u> </u>	X 81	XX BZ	Ш нг	XX H1	94-16	X 1-96342	< → ▼
Ref Level 1 Att DF DC	20 dB 🖷 SWT	<ul> <li>RBW 1</li> <li>20 ms</li> <li>VBW 10</li> </ul>	MHZ MHZ <b>Mode</b>	Auto Sweep				с	ount 100/100
Frequency	/ Sweep							Mb4[1]	<ul> <li>1Rm Avg</li> <li>-25.24 dBn</li> </ul>
								T M3	987.589 MH
dBm									44.13 dBr 869.400 MH
dBm									
dBm									
dBm									
8m									
) dBm	H1 -13.000 dBm								
	H1 -13.000 08m								
I dBm								البار	М
) d <mark>Bin</mark>					Concession of the local division of the loca				
J.									
) dBm	-						-		
.0 kHz			6001 pt	ts	10	00.0 MHz/			1.0 GH
Marker Ta Type   R	ef Trc	X-Value		Y-Value		Function		Function Re	sult
M1	1	869.4 MHz		44.13 dBm 44.13 dBm					
M2 M3	1	870.0 MHz 889.2 MHz		42.47 dBm					
M4	1	987.589 MHz	-	25.28 dBm					

13:55:22 04.04.2017

# Diagram 8b:

EBW X	-	Ж) B1	BW 100 kHz		нг 🖾	ні 🖾 ( я	k-16	1-9GHz	X	2.000 🖾	
	20 dB • SWT		BW 100 KH2 BW 1 MH2		Auto Sweep					C	ount 100/100
Frequency Sw	еер										1Rm Avg
										M4[1]	-31.40 dBm
40 dBm			5-10X	2			3			M1[1]	868.8250 MHz 40.74 dBm
o dom										MILI	869,4000 MHz
10 dBm											
) dBm											
) dBm											
							II.				
d8m-											
lû dBm											
н.	1 -13.000 dBm										
0 dBm											
			MA	h							
IO dBm			1		•	A		MS			
			and a state of the	howard	man Marana	and the second of the second of the second s	"	- Acard Com			
i0 dBm							N 1	12			
			V1								
F 881.5 MHz				5001 pts			.5 MHz/			5	pan 75.0 MHz
Marker Table											
Type Ref	Trc	X-Valu 869.4			Y-Value 0.74 dBm		Function	n		Function Re	esult
M1 M2	1	870.0		4	0.57 dBm						
M3	ī	889.2	MHz	4	0.55 dBm						
M4	1	868.825 894.6		-3	1.44 dBm 5.83 dBm						
M5	1	034.0	PINZ .	-3	3.83 abiii						

13:58:36 04.04.2017



Page 13 (23)



Appendix 5

CBM (B)	EBW	CCDF	<b>X</b> 81	EZ B2	XX нг	Ш ні	9k-16	1-96Hz	
Ref Level Att	20.00 dBm 10 dB = SW	● RB\ /T 40 ms ● VB\	V 1 MHz V 10 MHz M	ode Auto Swe	ер				Count 100/10
DF Frequency	/ Sweep								1Rm Avg
									M1[1] -25.02 dE 7.981629 G
dBm									
0011									
48m									
0 dBm									
	H1 -13.000 dBm								
0 dBm									M1
									-
0 dBm									
0 dBm									
0 dBm									
0 dBm-									
0 dBm									
0 dBm									
.0 GHz			3500	1 nts		800.0 M	H7/		9.0 Gł

13:59:43 04.04.2017





# Appendix 5

	DBW 🖾 EBW		XX 81	EZ BZ	XX NZ	Ш н1	94-16	X 1-96312	< → ▼
Ref Level 1 Att DF DC	20 dB 🖷 SWT	<ul> <li>RBW 11</li> <li>20 ms</li> <li>VBW 101</li> </ul>	MHZ MHZ Mode	Auto Sweep				С	ount 100/100
Frequency	Sweep						-	M4[1]	<ul> <li>1Rm Avg</li> <li>-25.31 dBn</li> </ul>
								T T	987.589 MH
dBm									43.57 dBr 869.400 MH
dBm									
dBm									
dBm									
8m									
) dBm	H1 -13.000 dBm								
	H1 -13.000 08m								
I dBm									M
) d <mark>Bm</mark>									
J									
) dBm									
.0 kHz			6001 pts	i	10	00.0 MHz/			1.0 GH
Marker Ta Type   R	ble ef Trc	X-Value		Y-Value		Function		Function Re	sult
M1	1	869.4 MHz	4	3.57 dBm		Tuncuon		T director r (	Jacanc
M2 M3	1	870.0 MHz 889.2 MHz		3.44 dBm 2.43 dBm					
M4	1	987.589 MHz	-2	5.31 dBm					

14:08:39 04.04.2017

## Diagram 9b:

Ref Level 5	0.00 dBm		Ж вz W 100 kHz		HZ 🖾	н1 🕅	9k-1G (	1-9GHz	X	Zeom 🗵	• • 🔻
Att     TDF DC	20 dB 🖷 SW1				Auto Sweep					C	ount 100/100
1 Frequency	Sweep		F THE	2			Ng			M4[1]	<ul> <li>1Rm Avg</li> <li>-30.18 dBm</li> <li>868.8250 MHz</li> </ul>
40 dBm										M1[1]	40.02 dBm 869.4000 MHz
30 dBm											
20 dBm											
10 dBm											
0 d8m			+ #								
-10 dBm-	H1 -13.000 dBm-										
-20 dBm											
-30 dBm			Ma	hunde			hum	MS			
-40 dBm	***	and the second	V1					V2	**************************************		an a
CF 881.5 MHz 2 Marker Tab				6001 pts			7.5 MHz/				pan 75.0 MHz
Type Re M1 M2		X-Value 869.4 M 870.0 M		4	Y-Value 0.05 dBm 0.15 dBm		Functio	n		Function Re	esult
M2 M3 M4 M5	1	889.2 M 868.825 M 894.6 M	Hz Hz	-3	0.23 dBm 0.25 dBm 6.13 dBm						
1.10	Υ.								Measuring		04.04.2017 14:13:17

14:13:18 04.04.2017



Page 15 (23)



Appendix 5

COBW	EBW	CCDF	X B1	EX B2	Ж	Ш ні	16-16	1-9GHz	× •	•   •
Ref Level Att	20.00 dBm	RBV T 40 ms = VBV	V 1 MHz V 10 MHz Mo	de Auto Swei	en				Count 10	0/10
TDF										
Frequenc	y Sweep								M1[1] -25.	m Avg .11 dB
									7.9654	401 G
0 dBm		+								
d8m										
0 dBm										
	H1 -13.000 dBm-									
0 dBm										
									M1	
0 dBm				_						
0 dBm										
0 dBm										
0 dBm										
0 dBm										
.0 GHz			05001							0.00
.0 GHz			35001	pts		800.0 M	_	leasuring 💷		9.0 Gł

SP Technical Research Institute of Sweden

Page 16 (23)



# Appendix 5

ultiview 🕀 OB		<u> </u>	XX 81	EZ BZ	🖾 🕅 нг	Ш н1	94-16	1-96Hz	< ▶ ▽
Ref Level 5 Att IDF DC		<ul> <li>RBW 1</li> <li>20 ms</li> <li>VBW 10</li> </ul>		Auto Sweep				0	Count 100/100
Frequency:	Sweep								1Rm Avg
								M4[4 M1	-25,42 dB 901,769 MF
0 dBm								міс	] 42.22 dB
									873.800 MH
0 dBm							_		
0 dBm							-		
0 dBm									
d8m									
10 dBm									
to ubili	H1 -13.000 dBm								
20 dBm									
								لسالر	4
30 d <mark>Bm</mark>									
~									
40 dBm									
9.0 kHz	1	II	6001 pts		1	00.0 MHz/			1.0 GH
Marker Tab									
Type Re	f Trc	X-Value 873.8 MHz	- 4	Y-Value 2.22 dBm		Function		Function R	esult
M1 M2	1	893.0 MHz	4	3.67 dBm					
M3 M4	ī	893.6 MHz 901.769 MHz	4	3.84 dBm 5.41 dBm					

10:03:13 05.04.2017

#### Diagram 10b:

Ref Level 50		- RBV	V 100 kHz	🛛 на 🕅	ні 🖾 (	Hr-1G 🛛	1-9GHz	Zeom		
<ul> <li>Att TDF DC</li> </ul>	20 d8 🖷 SWT	20 ms VBV	1 MHz Mo	de Auto Sweep					C	ount 100/100
1 Frequency §	Sweep			м		MMS			M5[1]	<ul> <li>1Rm Avg</li> <li>-27.37 dBm</li> <li>894.2130 MHz</li> </ul>
40 dBm									M1[1]	40.59 dBm 873.8000 MHz
20 dBm										
10 dBm										
0 d8m										
-10 dBm-	H1 -13.000 dBm-						_			
-20 dBm				N A			s (			
-30 dBm		and the second		history		hand	hanna		, and the second se	
			V1			V2	:			26.01.81
CF 881.5 MHz 2 Marker Tab			6001	ots		7.5 MHz/			S	pan 75.0 MHz
Type Re M1		X-Value 873.8 M 893.0 M		Y-Value 40.59 dBm 40.39 dBm		Function			Function Re	sult
M2 M3 M4 M5		893.6 M 868.825 M	Hz Hz	40.56 dBm -35.53 dBm						
M4 M5		868.825 M 894.213 M		-35.53 dBm -27.29 dBm			M	easuring 🚺		05.04.2017

10:03:58 05.04.2017



Date Reference 2017-05-16 7P01338-FG

Page 17 (23)

Appendix 5

CBW 08W	EBW	CCDF	E 81	B2	∭ нz	Ш ні	X	k-16	1-9GHz [	
Ref Level 2 Att	0.00 dBm 10 dB = SWT	<ul> <li>RBW</li> <li>40 ms</li> <li>VBW</li> </ul>	1 MHz 10 MHz Mod	le Auto Sweep	)					Count 100/100
TDF Frequency	Sweep									1Rm Avg
									M1[	<ol> <li>-25.29 dB 7.951001 GF</li> </ol>
0 dBm										
d8m										
10 dBm										
	H1 -13.000 dBm									
20 dBm										
									M1 Y	
i0 dBm				_						
0 dBm										
0 dBm										
i0 dBm										
70 dBm										
.0 GHz			35001	pts		800.0 MI	Hz/			9.0 G

Page 18 (23)



# Appendix 5

	xew 🖾 🕅 EBW		XX B1	EZ BZ	🖾 🕅 нг	Ш н1	91-16	1-96Hz	< <b>⊢</b> ⊽
Ref Level 1 Att TDF DC		● RBW 20 ms ● VBW 1		Auto Sweep				(	Count 100/100
Frequency	Sweep								1Rm Avg
								M4[,	-25.48 dBr 901.769 MH
0 dBm								M1 M	1 41.76 dB
									873.800 MH
0 dBm									(
0 dBm									
0 dBm							_		
) d8m									
10 dBm	H1 -13.000 dBm								
	H1 -13.000 dBm								
20 dBm									4
									*
30 dBm									
~									
40 dBm									
9.0 kHz			6001 pt	s	1	00.0 MHz/			1.0 GH
Marker Ta Type   R	ble ef Trc	X-Value		Y-Value		Function		Function R	ocult
M1 M1	1	873.8 MH		41.78 dBm		runcuon		FUNCTION	cault
M2	1	893.0 MHz		42.97 dBm					
M3 M4	1	893.6 MHz 901.769 MHz		43.14 dBm 25.49 dBm					

09:57:17 05.04.2017

#### Diagram 11b:

Ref Level 5	0.00 dBm 20 dB = SWT		₩ 100 kHz	с ни 🕅	ні 🔟 и	k-1G 🛛	1-96Hz 🗵		
TDF DC	20 dB 🖷 SW1	20 ms VB	V 1 MHZ MO	e Auto Sweep				, i	ount 100/100
40 dBm	Sweep			ML		Mbd S		M5[1]	<ul> <li>1Rm Avg</li> <li>-24.52 dBm</li> <li>894.2130 MHz</li> <li>39.96 dBm</li> </ul>
								M1[1]	873.8000 MHz
30 dBm									
20 dBm									
10 dBm-									
0 dBm									
-10 dBm-	H1 -13.000 dBm								
-20 dBm				1		N/S			
-30 dBm			Manant	human		hand be			
-40 dBm			V1			V2			
CF 881.5 MH			6001 p	ots	7	5 MHz/			Span 75.0 MHz
2 Marker Ta Type R M1	ef Trc	X-Value 873.8 M	H7	Y-Value 40.04 dBm		Function		Function R	esult
M2 M3	1 1	893.0 M 893.6 M	Hz Hz	40.31 dBm 40.54 dBm					
M4 M5		868.825 N 894.213 N		-35.66 dBm -24.49 dBm					

09:54:51 05.04.2017



Page 19 (23)



Appendix 5

Cew 3	EBW	CCDF	X 81	XX Bz	🕅 нг	Ш н	× 1	16 🕅	1-9GHz	
Ref Level 2 Att	20.00 dBm	• RBV 40 ms • VBV	1 MHz	de Auto Swe						Count 100/10
TDF		40 III3 • VD1		<b>ue</b> 7000 5000	ο <i>μ</i>					-
Frequency	Sweep								M1[]	1Rm Avg -25.05 dB
										7.977058 G
) dBm										_
dBm										
0 dBm										
J dbm-	H1 -13.000 dBm			_						
0 dBm									M1	
0 dBm										
0 dBm										
0 dBm				_						
0 dBm										
0 dBm										
.0 GHz			35001	pts		800.0 M	Hz/			9.0 G



Page 20 (23)

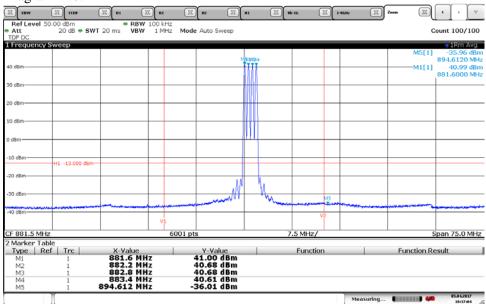


# Appendix 5

	BW 🖾 EBN		COF 23	C) 81	EZ BZ	🖾 🕅 нг	Ш н	98-16	1-96Hz	
Ref Level 5 Att IDF DC		● RB 20 ms ● VB	W 1 MHz W 10 MHz	Mode Au	to Sweep					Count 100/10
Frequency	Sweep									1Rm Avç
									Ma	1] -24.73 dE M2 892.269 M
0 dBm			_						М1	
										881.600 M
0 dBm	-									-
0 dBm										
0 dBm-										
0 ubin										
d8m										
10 dBm										
	H1 -13.000 dBm-									
20 dBm										15
										2
30 dBin										
40 dBm										
40 0Bm										
										10.0
0.0 kHz Marker Tal	10		60	001 pts		10	0.0 MHz/			1.0 Gł
	ef Trc	X-Value		Y	/-Value		Function		Function F	Result
M1	1	881.6 M	IHZ	44	.28 dBm					toout
M2 M3	1	882.3 M 882.8 M	1Hz		.25 dBm .16 dBm					
M3 M4	1	883.4 N	IHZ		.73 dBm					
M5	ī	892.269 N			.77 dBm					

10:34:51 05.04.2017

# Diagram 12b:



10:37:05 05.04.2017





Appendix 5

Page 21 (23)

⊞ osw	EBW EBW	CCDF	XX B1	BZ BZ	XX нг	🕅 н1	1 th-16		1-96Hz	
Ref Level 2	0.00 dBm	RBW 40 ms • VBW	1 MHz							
Att DF		40 ms 🖶 VBW	10 MHZ MO	de Auto Sweep	)					Count 100/10
Frequency	Sweep		-				_			1Rm Avg
									M1[1	1] -25.14 dE 7.944373 G
dBm										
GBIII										
8m										
dBm				_						
	H1 -13.000 dBm									
dBm										
									M1	
) dBm										_
dBm										
dbm-										
I dBm										
dBm	-		-							
dBm										
0 GHz			25001			800.0 MH	-			9.0 G
UGHZ	Y		35001	pts		600.0 MH	12/	Measuring		

SP Technical Research Institute of Sweden





# Appendix 5

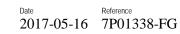
MultiView 🗄 OBW	EBW	X ( cco		XX BZ	🖾 🕅 нг	Ш ні	98-16	1-96Hz	· • v
Ref Level 50.0 Att TDF DC	00 dBm 20 dB = SWT	<ul> <li>RBW</li> <li>20 ms</li> <li>VBW</li> </ul>		Auto Sweep				c	ount 100/100
1 Frequency Sv	weep								1Rm Avg
								M 51	] -25.14 dB 892.269 MH
40 dBm								мл	
									881.600 M
30 dBm									
20 dBm									
								1 ()	
10 dBm-								+	
0 d8m									
10 dBm									
-10 GBIII-	H1 -13.000 dBm								
-20 dBm									
-30 d <mark>Bm</mark>									
$\sim$									
40 dBm									
9.0 kHz			6001 pt	S	1	00.0 MHz/			1.0 GH
2 Marker Table									
Type Ref	Trc	X-Value	-	Y-Value 43.18 dBm		Function		Function R	esult
M1 M2	1	881.6 MH 882.3 MH	z	43.18 dBm 44.08 dBm					
M3	1	882.8 MH	Iz 4	44.03 dBm					
M4 M5	1	883.4 MH		43.20 dBm 25.12 dBm					

10:42:57 05.04.2017

## Diagram 13b:

Ref Level 5			80 100 kHz 30 100 kHz 30 1 MHz		(	Н1	# <u>[</u> #	HG (	<u>x</u> [1-	9GH2	Zeom	(III)	ount 100/100
TDF DC		11 20 113 1	717 11-11-12	Mode Hat	io oneep								-
1 Frequency	Sweep					1112191	4					M5[1]	<ul> <li>1Rm Avg</li> <li>-35.78 dBm</li> <li>894.6120 MH;</li> </ul>
40 dBm												M1[1]	39.74 dBn 881.6000 MH
30 dBm													
20 dBm													
10 dBm													
10 dBm													
20 dBm	H1 -13.000 d8	m											
-30 dBm							Mun		MS				
-					and the second second		W. martin		-				
-40 dBm			V1						2				
CF 881.5 MH				5001 pts		_	7	.5 MHz/				5	Span 75.0 MHz
2 Marker Tal Type   Re M1	ole ef Trc	X-Value 881.6			Value 75 dBm			Function	1		F	unction Re	esult
M2 M3	1	882.2 882.8 883.4	MHz MHz	39.9 40.3	97 dBm 14 dBm 82 dBm								
M4 M5	1	894.612	MHz		82 dBm 79 dBm								

10:42:16 05.04.2017



338-FG

Page 23 (23)



Appendix 5

COBW	EBW	CCOF	<b>X</b> B1	BZ	Ж	Ш ні	2X 94-	16 X	1-96Hz	
Ref Level 2 Att	0.00 dBm 10 dB • SWT	• RBW 40 ms • VBW	1 MHz 10 MHz Mo	de Auto Swee	ip.					Count 100/10
DF Frequency	Sweep									• 1Rm Avg
									M1[1	
) dBm										+
18m										
0 dBm										
	H1 -13.000 dBm									
) dBm									M1	
) dBm										
) dBm										+
0 dBm										
) dBm										
) dBm										
J UBIN-										
.0 GHz			35001	pts		800.0 M	Hz/			9.0 G
	Y						-	Measuring	••••••	05.04.2017 10:27:44



# Field strength of spurious radiation measurements according to 47 CFR 2.1053 / IC RSS-132 5.5

Date	Temperature	Humidity
2017-02-23	$22 \ ^{\circ}C \pm 3 \ ^{\circ}C$	29 % ± 5 %
2017-02-24	$22 \ ^{\circ}C \pm 3 \ ^{\circ}C$	$25~\%\pm5~\%$

The test sites are listed at FCC, Columbia with registration number: 93866. The test site complies with RSS-Gen, Industry Canada file no. 3482A-1.

The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m in the frequency range 30 MHz - 9 GHz.

The measurement was performed with a RBW of 1 MHz.

A propagation loss in free space was calculated. The used formula was

 $\gamma = 20 \log \left( \frac{4\pi D}{\lambda} \right)$ ,  $\gamma$  is the propagation loss and *D* is the antenna distance.

The measurement procedure was as the following:

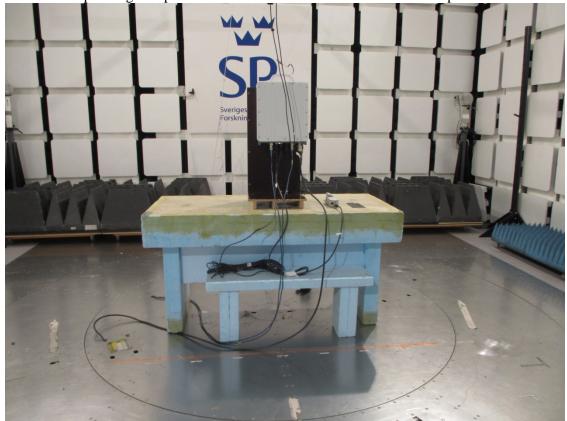
- A pre-measurement is performed with peak detector. For measurement < 1 GHz the test object was measured in eight directions with the antenna at three heights, 1.0 m, 1.5 m and 2.0. For measurements > 1 GHz the test object was measured in seventeen directions with the antenna at 1.0 m height.
- Spurious radiation on frequencies closer than 20 dB to the limit in the pre-measurement is scanned 0-360 degrees and the antenna is scanned 1-4 m for maximum response. The emission is then measured with the RMS detector and the RMS value is reported. Frequencies closer than 10 dB to the limit when measured with the RMS detector were measured with the substitution method according to ANSI/TIA/-603-D-2010.





Appendix 6

Page 2 (4)



The test set-up during the spurious radiation measurements is shown in the picture below:

# Measurement equipment

Measurement equipment	SP number
Semi anechoic chamber Tesla	503 881
R&S ESU 40	901 385
EMC 32 ver. 9.15.0	503 899
ETS Lindgren BiConiLog 3142E	BX61914
ETS Lindgren Horn Antenna 3115	502 175
µComp Nordic, Low Noise Amplifier	901 545
HP Filter 1-18 GHz	901 501
Temperature and humidity meter, Testo 625	504 188



Appendix 6

# **Test frequencies**

Symbolic name
В
М
Т
M2
M4

#### Results

Representing worst case: Single RAT GSM, GMSK, symbolic name M4, Diagram 1 a-b

	Spurious emission level (dBm)					
Frequency (MHz)	Vertical	Horizontal				
30-9000	All emission > 20 dB below limit	All emission > 20 dB below limit				

## Measurement uncertainty: 3.1 dB

## Limits

CFR 47 §22.917 and IC RSS-132 5.5

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P) dB$ , resulting in a limit of -13 dBm.

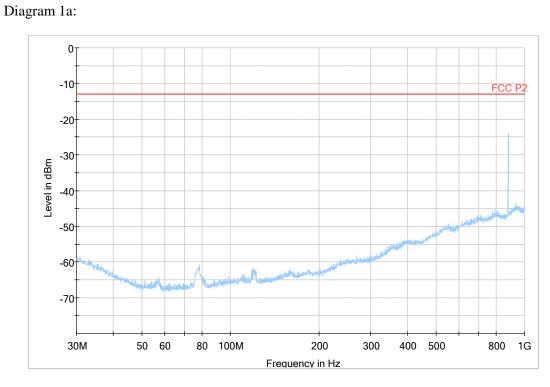
Complies?	Yes
complies.	100





Page

4(4)



Note: The emission at 880 MHz to 883 MHz are the carrier frequencies and shall be ignored in the context.

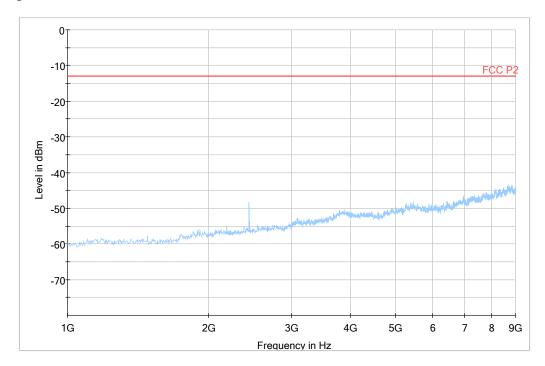


Diagram 1b:



Page

1(3)

# Frequency stability measurements according to CFR 47 22.355 , 2.1055 / IC RSS 132 5.3

Date	Temperature (test equipment)	Humidity (test equipment)
2017-04-06	$22 \degree C \pm 3 \degree C$	24% ± 5 %
2017-04-07	$24 \ ^{\circ}C \pm 3 \ ^{\circ}C$	29% ± 5 %

#### Test set-up and procedure

The measurements were made per J-STD-007A Vol 1 (GMSK).

The output was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
R&S FSQ	504 143
EAB RF attenuator	-
Temperature Chamber	501 031
Testo 635, temperature and humidity meter	504 203
Multimeter Fluke 87	502 190



Appendix 7

Page

2(3)

## Results

Nominal Voltage -48 V DC

Maximum output power at mid channel (M, 881.6 MHz)

Test condit	ions	Frequency error (Hz)
Supply voltage DC (V)	T (°C)	riequoney onlor (Tiz)
-48.0	+20	-11
-55.2	+20	-12
-40.8	+20	-10
-48.0	+30	+18
-48.0	+40	+20
-48.0	+50	-15
-48.0	+10	-12
-48.0	0	-13
-48.0	-10	-14
-48.0	-20	+11
-48.0	-30	+13
Maximum freq.	error (Hz)	20
Measurement ur	ncertainty	$< \pm 1 \ge 10^{-7}$

## Remark

It was deemed sufficient to test one combination of TX frequency, channel bandwidth configuration and test model (modulation), as all combinations share a common internal reference from which the TX frequency derives.



Page

3(3)

# Limits

Limit according to:

§22.355

The frequency stability shall be within  $\pm$  1.5 ppm (  $\pm$  1322.4 Hz).

RSS-132 5.3 Frequency:

The carrier frequency shall not depart from the reference frequency in excess of  $\pm 1.5$  ppm ( $\pm 1322.4$  Hz) for base stations when tested to the temperature and supply voltage variations specified in RSS-Gen.

Complias?	Vaa
Complies ?	res



Appendix 8

Page 1 (2)

# **External photos**



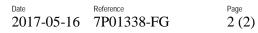
Left side





Right side







Appendix 8



Bottom side



Test object label:



SFP module:

