REPORT

issued by an Accredited Testing Laboratory

Contact person RISE
Andreas Johnson
Electronics
+46 10 516 57 86
andreas.johnson@ri.se

Date: 2018-02-21

Reference: 8P01074-W

Testing

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

Radio measurements on Radio 4478 B5 equipment with FCC ID TA8A KRC161689 and IC:287AB-AS161689

Product name: Radio 4478 B5
Product number: KRC 161 689/1 and KRC 161 689/3

RISE Research Institutes of Sweden AB
Electronics - EMC

Performed by

Signed by: Tomas Lennhager
Reason: I am the author of this document
Date & Time: 2018-02-21 14:31:09 +01:00

Tomas Lennhager

Examined by

Signed by: Monika Fuller
Reason: I have reviewed this document
Date & Time: 2018-02-21 15:17:40 +01:00

Monika Fuller

RISE Research Institutes of Sweden AB

Postal address
Box 857
SE-501 15 BORÅS
Sweden

Office location
Brinellgatan 4
SE-504 62 BORÅS

Phone / Fax / E-mail
+46 10 516 50 00
+46 33 13 55 02
info@ri.se

Accred. No. 1002
Testing
ISO/IEC 17025

Summary

Standard Listed part of	Compliant
FCC CFR 47 part 22/ IC RSS-132, RSS-Gen	
2.1046/ 5.4 RF power output, conducted	Yes
2.1049/ 4.6.1 Occupied bandwidth	Yes
2.1051/ 5.5 Band edge	Yes
2.1051/ 5.5 Spurious emission at antenna terminals	Yes
2.1053/ 5.5 Field strength of spurious radiation	Yes
2.1055/ 5.3 Frequency stability	Yes

Description of the test object

Equipment:	Radio equipment Radio 4478 B5 Product number KRC 161 689/1 and KRC 161 689/3 FCC ID: TA8AKRC161689 IC: 287AB-AS161689
HVIN:	AS161689
FVIN:	CXP 901 3268/15, R68LT
Hardware revision state:	R2A
Tested configuration:	WCDMA single RAT
Frequency range:	TX: 869 – 894 MHz RX: 824 – 849 MHz
IBW:	25 MHz
Output power:	Max 40 W/ antenna port
Antenna ports:	4 TX/RX ports
Antenna:	No dedicated antenna, handled during licensing
RF configuration:	Single and multi-carrier, 1-5 carriers/ port 2x(2x2) MIMO, , Contiguous Spectrum (CS), Non-Contiguous Spectrum (NCS)
Modulations:	QPSK, 16QAM and 64QAM
Channel bandwidths:	3.8 to 5 MHz
RF power Tolerance:	+0.6/ -2.0 dB
CPRI Speed	Up to 10.1 Gbit/s
Nominal supply voltage:	-48VDC

The information above is supplied by the manufacturer.

Note: KRC 161 689/1 and KRC 161 689/3 are electrically identical according to the manufacturer. Only KRC 161 689/3 was tested.

Purpose of test

The purpose of this test is to justify a Permissive Change to include WCDMA

Operation modes during measurements

Measurements were performed with the test object transmitting the Test model 1 which are defined in 3GPP TS 25.141. Test model 1 (TM1) represent QPSK modulation. Test model 5 (TM5) includes the 16QAM modulation and Test model 6 (TM6) includes the 64QAM modulation.

All measurements were performed with the test object configured for maximum transmit power. The measured configurations covers worst case settings.

Conducted measurements

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

Radiated measurements

The test object was powered with -48 VDC by an external power supply. Additional connections are documented in the set-up drawings for radiated measurements.

References

Measurements were done according to relevant parts of the following standards:
ANSI C63.4-2014
CFR 47 part 2, February 2018
CFR 47 part 22, February 2018
ANSI C63.26-2015
KDB 662911 D01 Multiple Transmitter Output v02r02
KDB 971168 D01 Power Meas License Digital Systems v03
KDB 971168 D03 IM Emission Repeater Amp v01
3GPP TS 37.141, version 13.5.0
3GPP TS 25.141, version 13.4.0
RSS-Gen Issue 4
RSS-132 Issue 3

Measurement equipment

	Calibration Due	RISE number
Test site Tesla	2019-12	503 881
R&S ESU 40	2018-07	901 385
R&S FSQ 40	2018-07	504 143
R&S FSW 43	2018-08	902 073
Control computer with R&S software EMC32 version 10.20.01	-	BX62351
High pass filter 1-15 GHz	2018-06	504 199
High pass filter 1-20 GHz	2018-06	901 501
RF attenuator Weinschel WA73-20-11	2018-05	900 691
Coaxial cable Sucoflex 102EA	2018-05	BX50191
Coaxial cable Sucoflex 102EA	2018-05	BX50236
ETS Lindgren BiConiLog Antenna 3142E	2019-03	BX61914
EMCO Horn Antenna 3115	2019-12	502 175
µComp Nordic, Low Noise Amplifier	2019-01	901 545
Temperature and humidity meter, Testo 635	2018-06	504 203
Temperature and humidity meter, Testo 625	2018-06	504 188

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: 2018-01-29.

Manufacturer’s representative

Mikael Jansson, Ericsson AB.

Test engineers

Tomas Isbring for radiated tests, RISE.
Andreas Johnson for conducted tests, RISE.

Test participant(-s)

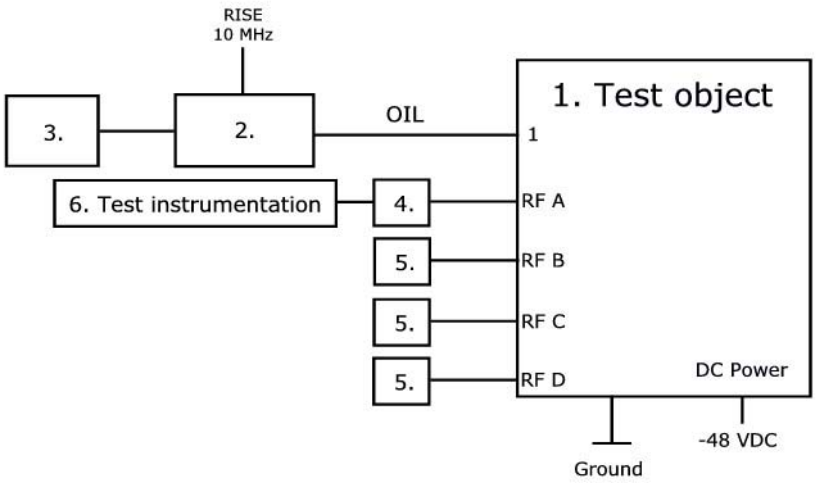
None.

Test frequencies used for radiated and conducted measurements

UARFCN Downlink B5	Frequency [MHz]	Symbolic name	Comment
4357	871.4	B	Single carrier TX bottom frequency
4408	881.6	M	Single carrier TX band mid frequency
4395 4420	879.0 884.0	M2	2-carriers TX band mid constellation
4357 4383 4408 4433 4458	871.4 876.6 881.6 886.6 891.6	M5	5-carriers TX band mid constellation
4458	891.6	T	Single carrier TX band top frequency
4433 4458	886.6 891.6	T2	
4357 4383 4458	871.4 876.6 891.6	Bim	3-carriers TX constellation
4357 4433 4458	871.4 886.6 891.6	Tim	3-carriers TX constellation

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

Test setup: conducted measurements



Test object:

1.	Radio 4478 B5, KRC 161 689/3, rev. R2A, s/n: B440820317 With Radio Software: CXP 901 3268/15, rev. R68LT FCC ID: TA8AKRC161689 and IC: 287AB-AS161689

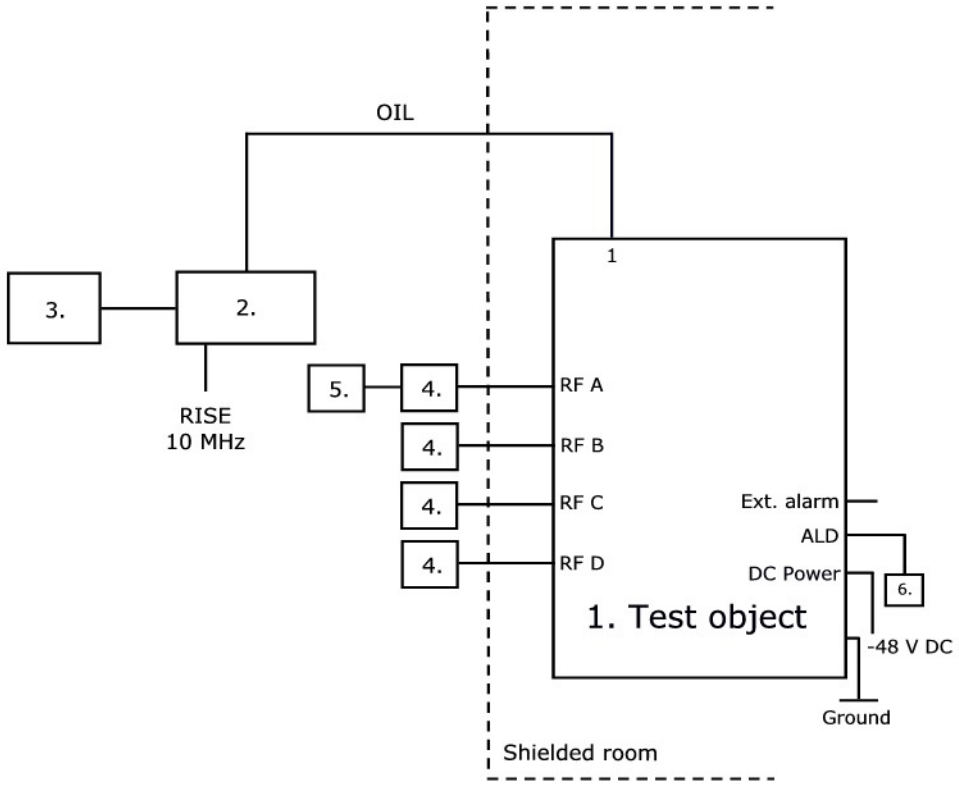
Associated equipment:

2.	Testing Equipment: CT10, LPC 102 487/1, rev. R1C, s/n: T01F375046, BAMS – 1001466800 with software CXA 104 446/1, rev. R8AB/2

Functional test equipment:

3.	Computer, HP EliteBook 8560w, BAMS - 1001236851
4.	RF Attenuator: RISE number: 900 691
5.	Terminator, 50 ohm
6.	RISE Test Instrumentation according to measurement equipment list for each test. The signal analyzer was connected to the RISE 10 MHz reference standard during all measurements.

Test setup: radiated measurements



1.	Radio 4478 B5, KRC 161 689/3, rev. R2A, s/n: B440820311 With Radio Software: CXP 901 3268/15, rev. R68LT FCC ID: TA8AKRC161689 and IC: 287AB-AS161689

Associated equipment:

2.	Testing Equipment: CT10, LPC 102 467/1, rev. R1C, s/n: T01F375046, BAMS – 1001466801 with software CXA 104 446/1, rev. R8AB/2

Functional test equipment:

3.	Computer, HP EliteBook 8560w, BAMS - 1001236854
4.	Attenuator
5.	R&S ESIB 26, RISE no: 503 292, for supervision purpose only
6.	ALD Control, Andrew, model: ATM200-A20, s/n: DESA101412073

Interfaces:

Power input configuration DC: -48 VDC	Power
RF A, 4.3-10 connector, combined TX/RX	Antenna
RF B, 4.3-10 connector, combined TX/RX	Antenna
RF C, 4.3-10 connector, combined TX/RX	Antenna
RF D, 4.3-10 connector, combined TX/RX	Antenna
1, Optical Interface Link, single mode opto fibre	Signal
2, Optical Interface Link, not used in this configuration	Signal
EXT Alarm, shielded multi-wire	Signal
ALD, shielded multi-wire	Signal
Ground wire	Ground

RF power output measurements according to CFR 47 §2.1046 / IC RSS-132 5.4, conducted

Date	Temperature	Humidity
2018-02-01	21 °C ± 3 °C	16 % ± 5 %
2018-02-02	21 °C ± 3 °C	10 % ± 5 %

Test set-up and procedure

The test object was connected to a signal analyser measuring peak and RMS output power in CDF mode. A resolution bandwidth of 80 MHz was used.

Measurement equipment	RISE number
R&S FSW 43	902 073
RF attenuator	900 691
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 1.1 dB

Results

Single carrier TM 1

Rated output power level at each RF port 1x 46 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]				
Symbolic name	Port RF A	Port RF B	Port RF C	Port RF D	Total power[1)]
B	45.46/ 7.40	45.50/ 7.38	45.47/ 7.38	45.07/ 7.38	51.40
M	45.47/ 7.36	45.50/ 7.34	45.44/ 7.34	45.05/ 7.34	51.39
T	45.42/ 7.44	45.54/ 7.42	45.41/ 7.42	45.07/ 7.44	51.38

[1)]: summed output power according to FCC KDB662911 D01 E)1) Multiple transmitter output
Note: The PAR value is the 0.1 % Peak to Average Ratio.

Single carrier TM 5

Rated output power level at each RF port 1x 46 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]				
symbolic name	Port RF A	Port RF B	Port RF C	Port RF D	Total power[1)]
T	45.43/ 7.38	45.49/ 7.38	45.44/ 7.36	45.09/ 7.36	51.39

Single carrier TM 6

Rated output power level at each RF port 1x 46 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]				
symbolic name	Port RF A	Port RF B	Port RF C	Port RF D	Total power[1)]
T	45.44/ 7.36	45.50/ 7.38	45.43/ 7.38	45.07/ 7.38	51.38

Multi carrier TM 1

Rated output power level at each RF port 2x 43 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]				
Symbolic name	Port RF A	Port RF B	Port RF C	Port RF D	Total power[1)]
T2	45.52/ 7.40	45.58/ 7.36	45.51/ 7.40	45.19/ 7.38	51.47

Multi carrier TM 1

Rated output power level at each RF port 4x 40 dBm/ port.

	Output power CCDF [RMS dBm/ PAR dB]				
Symbolic name	Port RF A	Port RF B	Port RF C	Port RF D	Total power[1)]
M5	45.31/ 7.42	45.37/ 7.42	45.33/ 7.42	44.95/ 7.42	51.26

[1)]: summed output power according to FCC KDB662911 D01 E)1) Multiple transmitter output
Note: The PAR value is the 0.1 % Peak to Average Ratio.

Single carrier TM 1 Rated output power level at RF connector 1x 46 dBm/ port.

	Output power per 1 MHz [RMS dBm]				
Symbolic name	Port RF A	Port RF B	Port RF C	Port RF D	Total power[1)]
T	40.10	40.17	40.11	39.71	46.17

[1)]: summed output power according to FCC KDB662911 D01 E)2)c) Multiple transmitter output.

Remark

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 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

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

Date	Temperature	Humidity
2018-02-02	21 °C ± 3 °C	10 % ± 5 %

Test set-up and procedure

The measurements were made per definition in § 2.1049. The output was connected to a signal analyzer with the Peak detector activated in max hold.

Measurement equipment	RISE number
R&S FSW 43	902 073
RF attenuator	900 691
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

Single carrier TM 1

Diagram	Symbolic name	Tested Port	Occupied BW (99%) [MHz]
1	M	RF B	4.165

Single carrier TM 5

Diagram	Symbolic name	Tested Port	Occupied BW (99%) [MHz]
2	M	RF B	4.179

Single carrier TM 6

Diagram	Symbolic name	Tested Port	Occupied BW (99%) [MHz]
3	B	RF A	4.149
4	B	RF B	4.189
5	M	RF B	4.186
6	T	RF B	4.186
7	B	RF C	4.187
8	B	RF D	4.164

Diagram 1:

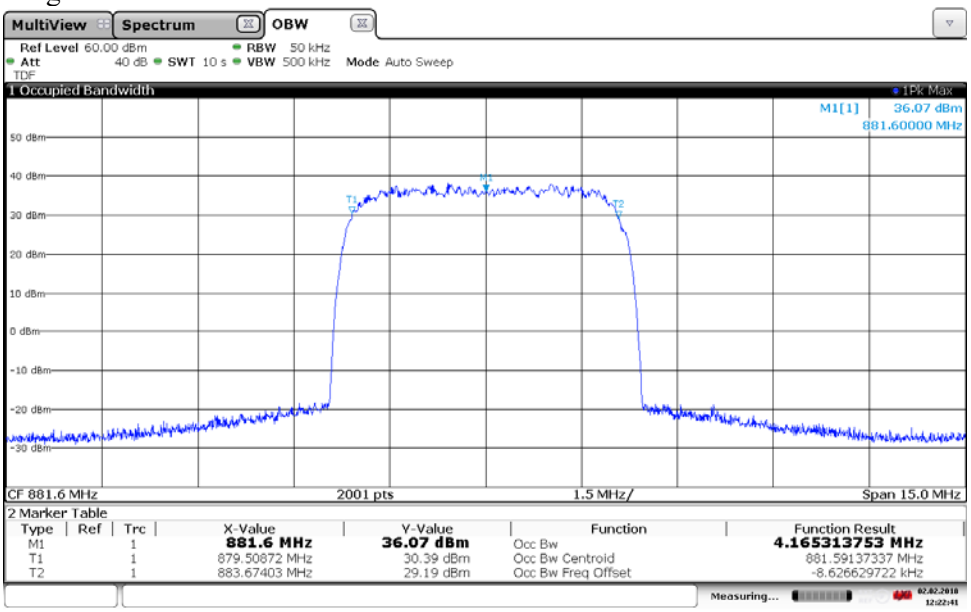


Diagram 2:

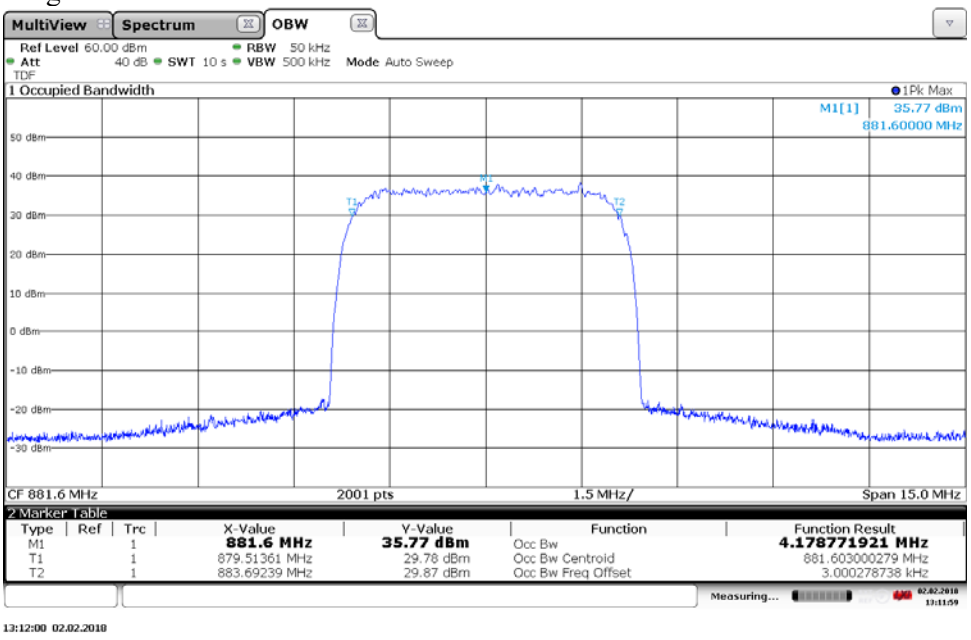


Diagram 3:

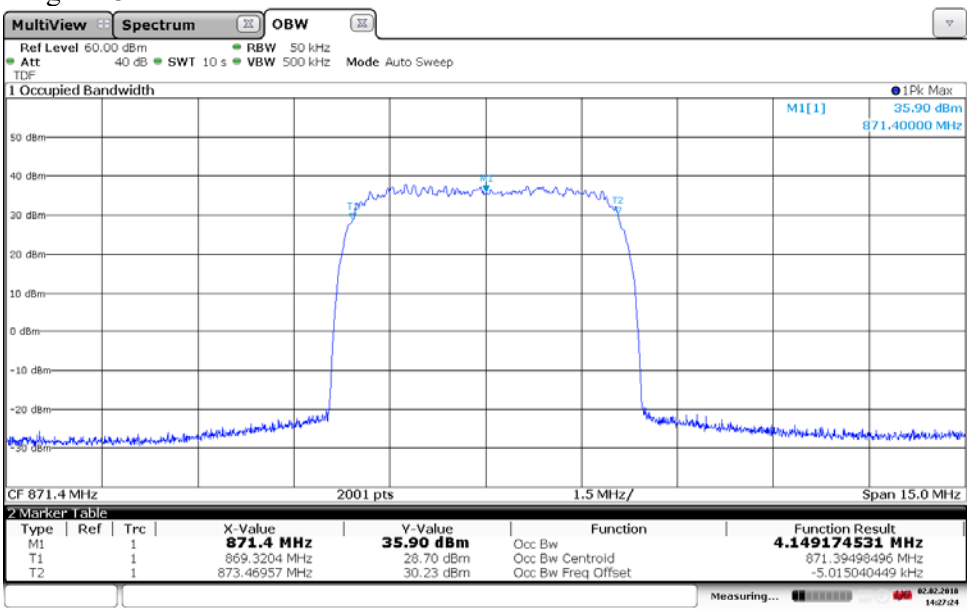


Diagram 4:

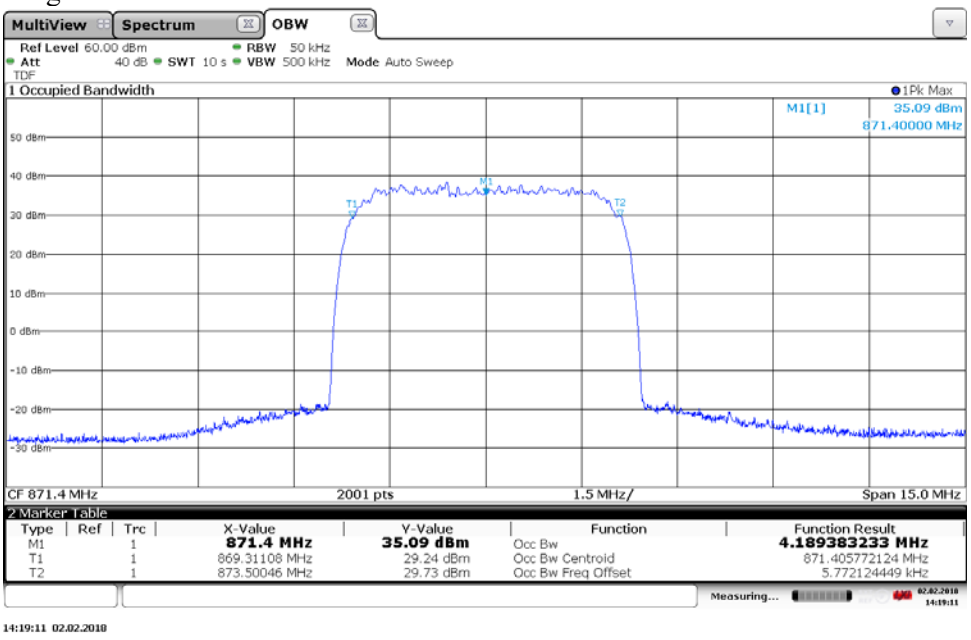


Diagram 5:

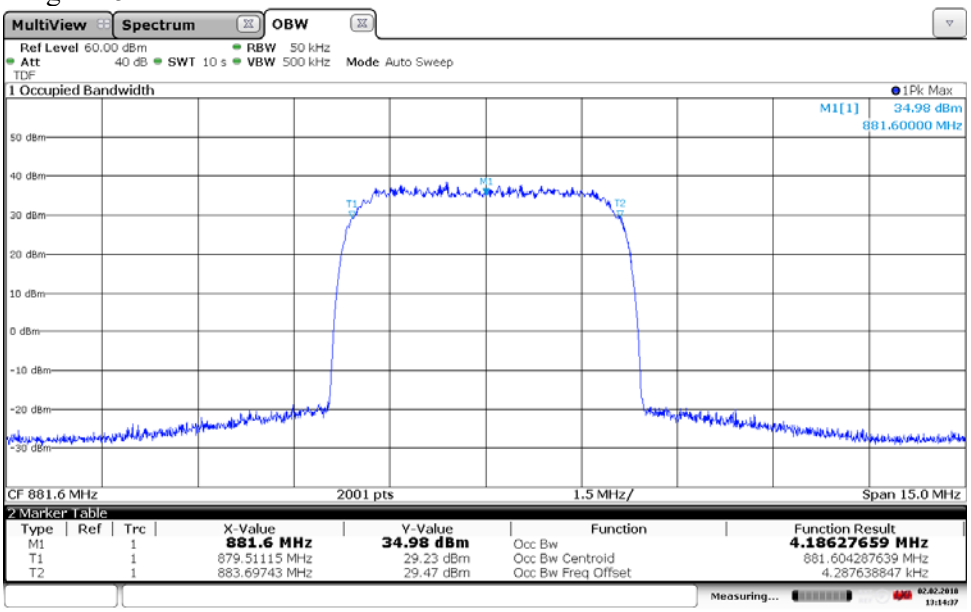


Diagram 6:

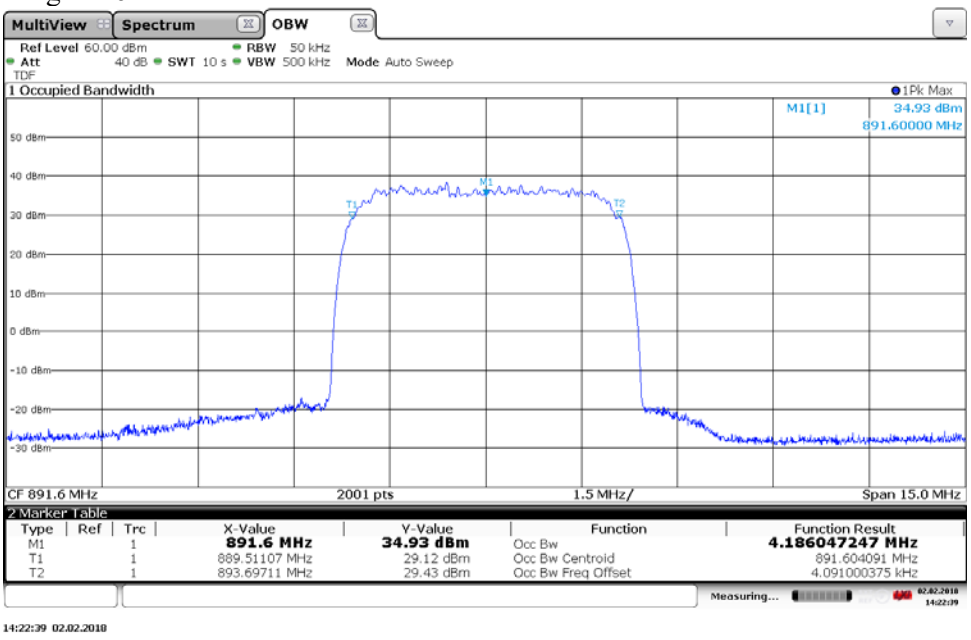


Diagram 7:

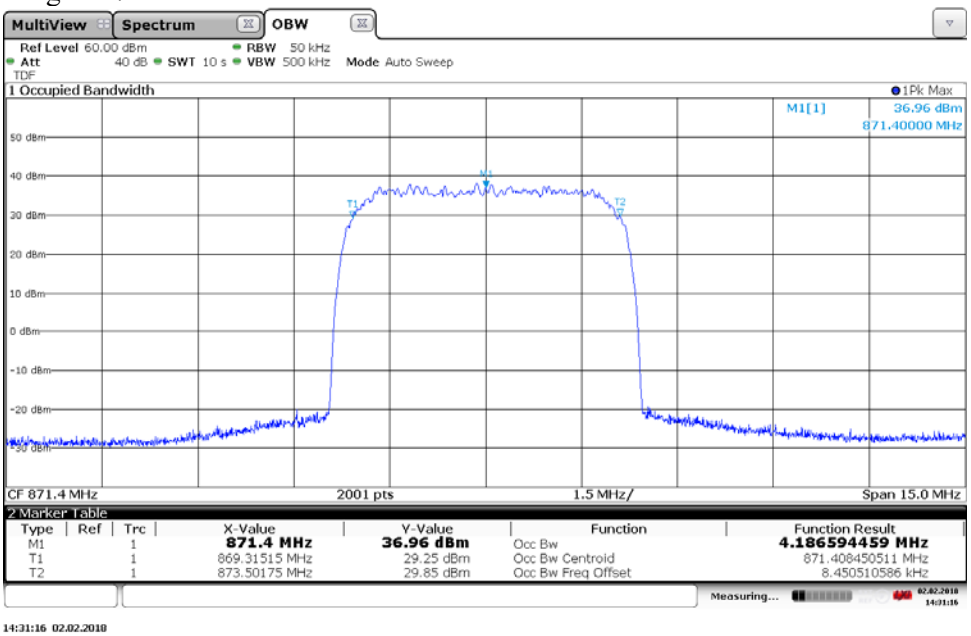
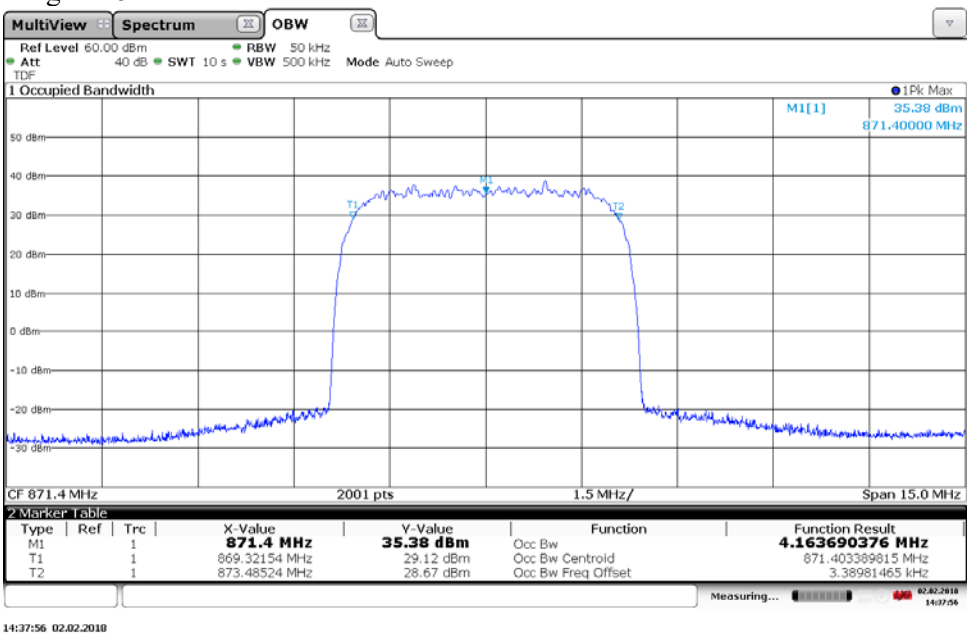


Diagram 8:



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

Date	Temperature	Humidity
2018-02-02 2018-02-06	21 °C ± 3 °C	10 % ± 5 %

Test set-up and procedure

The measurements were made per definition in CFR 47 §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.

A RBW 1% of EBW was used up to 1 MHz away from the band edges. A smaller resolution bandwidth is permitted provided that the measured power is integrated over the full required measurement bandwidth. Where a smaller RBW was used the limit in the plot is adjusted by 10 log ($RBW_{used}/RBW_{specified}$) [dB] according to the following table:

Carrier BW:	RBW_{used}	$RBW_{specified}$ (1% of EBW)	Limit correction	Adjusted limit
5 MHz	10 kHz	46.8 kHz	-6.7 dBm	-19.7 dBm

Before comparing the results to the limit, 6 dB [10 log (4)] to cover 2x(2x2) MIMO, should be added according to method E)2)c) “Measure and add 10 log(N_{ANT})” of FCC KDB662911 D01 Multiple Transmitter Output.

Measurement equipment	RISE number
R&S FSW 43	902 073
RF attenuator	900 691
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

Single carrier TM 1

Diagram	Symbolic name	Tested Port
1 a-b	B	RF B
2 a-b	T	RF B

Single carrier TM 5

Diagram	Symbolic name	Tested Port
3 a-b	B	RF B
4 a-b	T	RF B

Single carrier TM 6

Diagram	Symbolic name	Tested Port
5 a-b	B	RF A
6 a-b	T	RF A
7 a-b	B	RF B
8 a-b	T	RF B
9 a-b	B	RF C
10 a-b	T	RF C
11 a-b	B	RF D
12 a-b	T	RF D

Multi carrier TM 6

Diagram	Symbolic name	Tested Port
13 a-b	Bim	RF B
14 a-b	Tim	RF B

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: 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

Diagram 1 a:

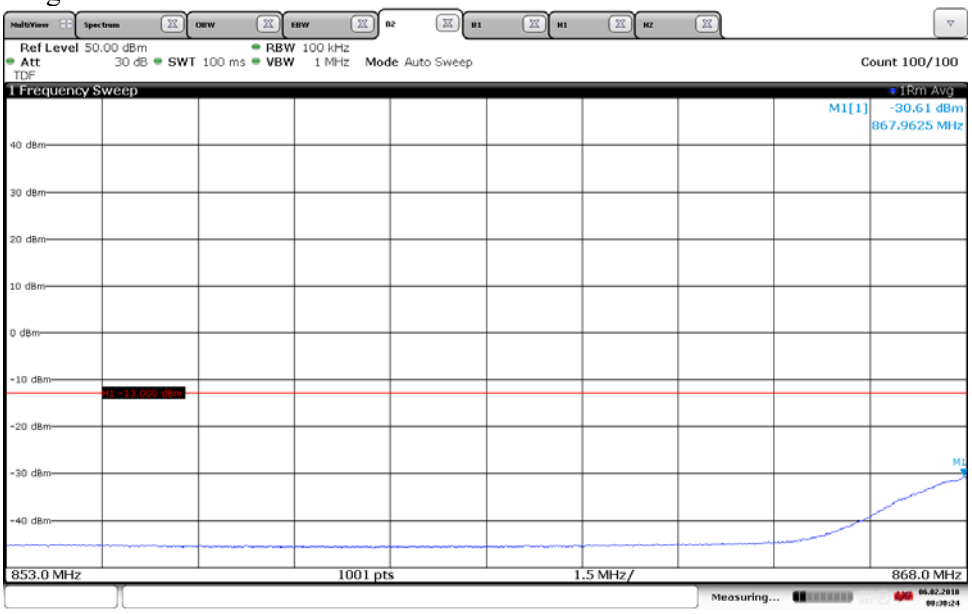


Diagram 1 b:

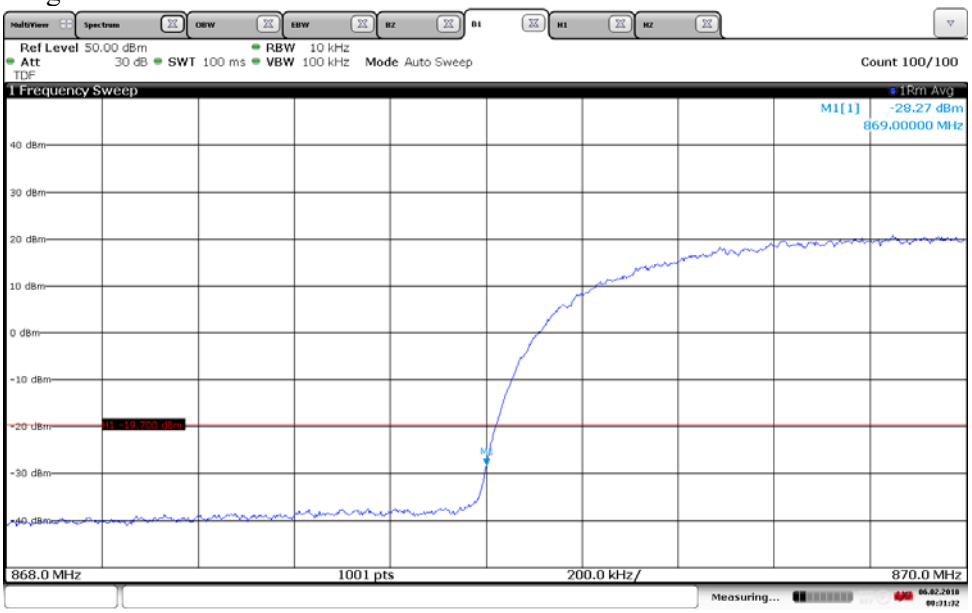


Diagram 2 a:

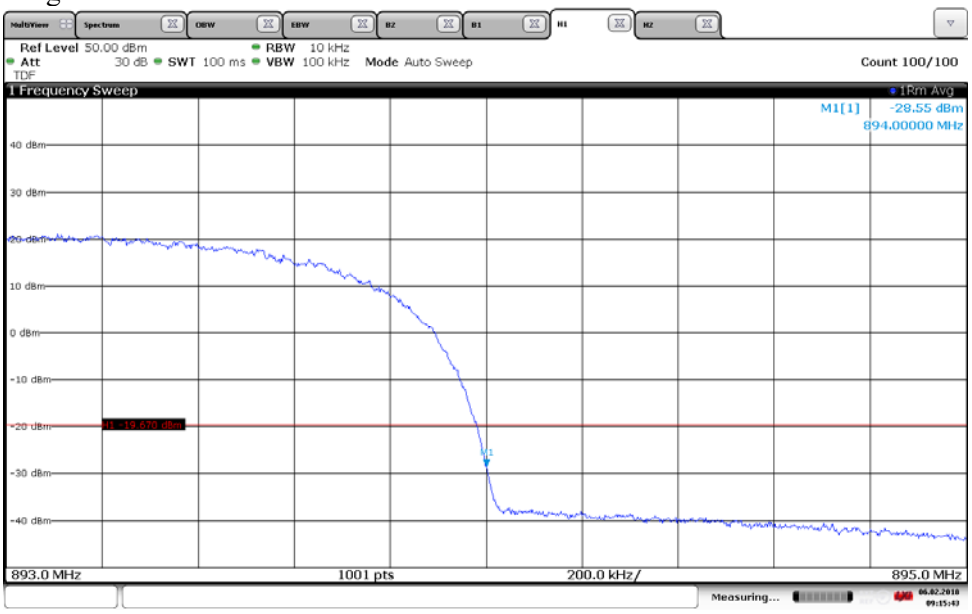


Diagram 2 b:

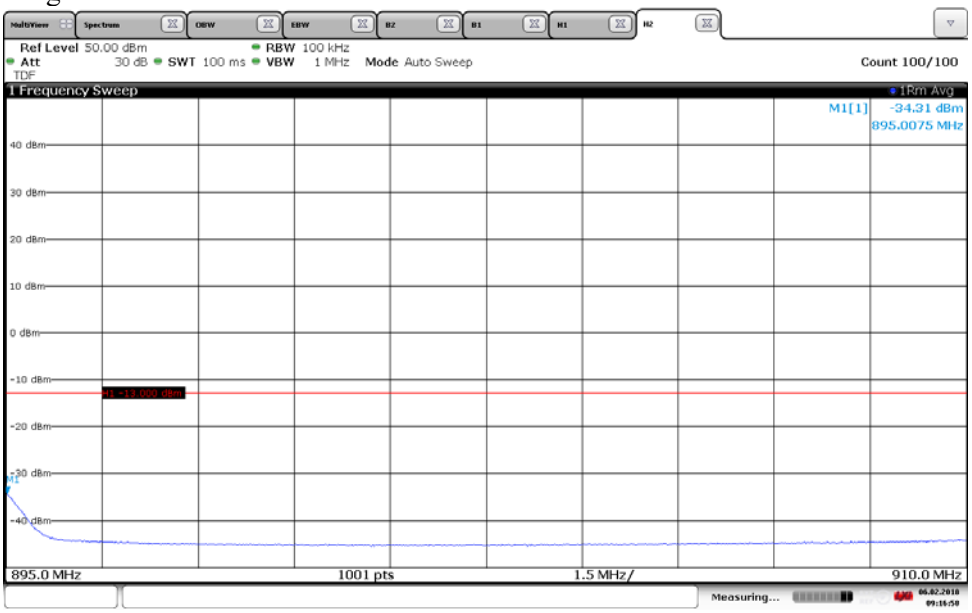


Diagram 3 a:

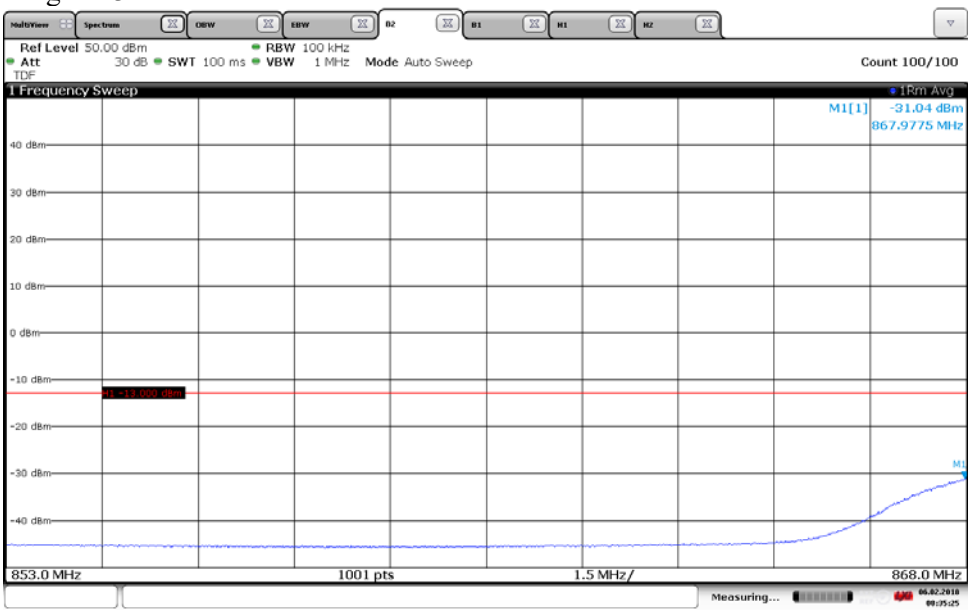


Diagram 3 b:

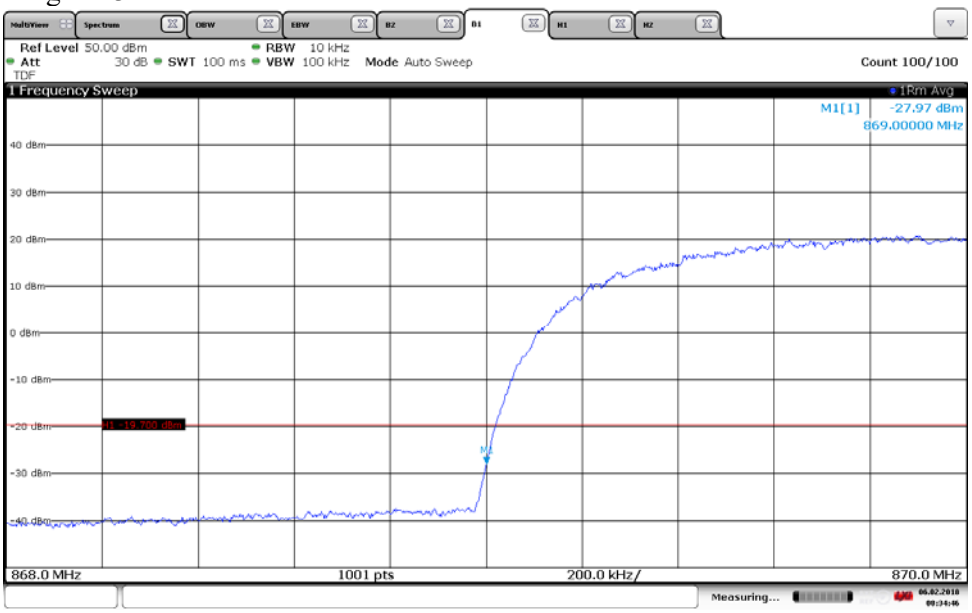


Diagram 4 a:

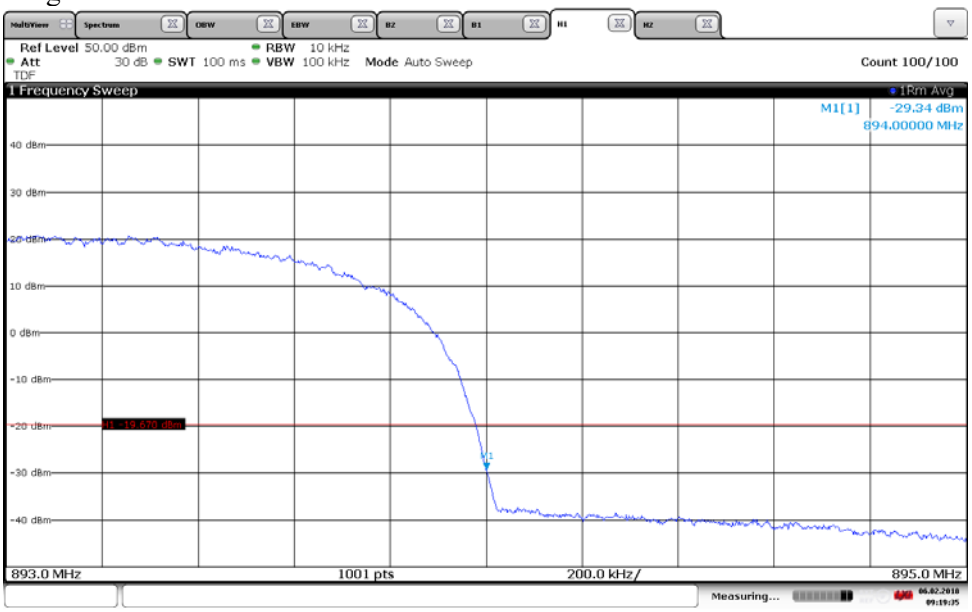


Diagram 4 b:

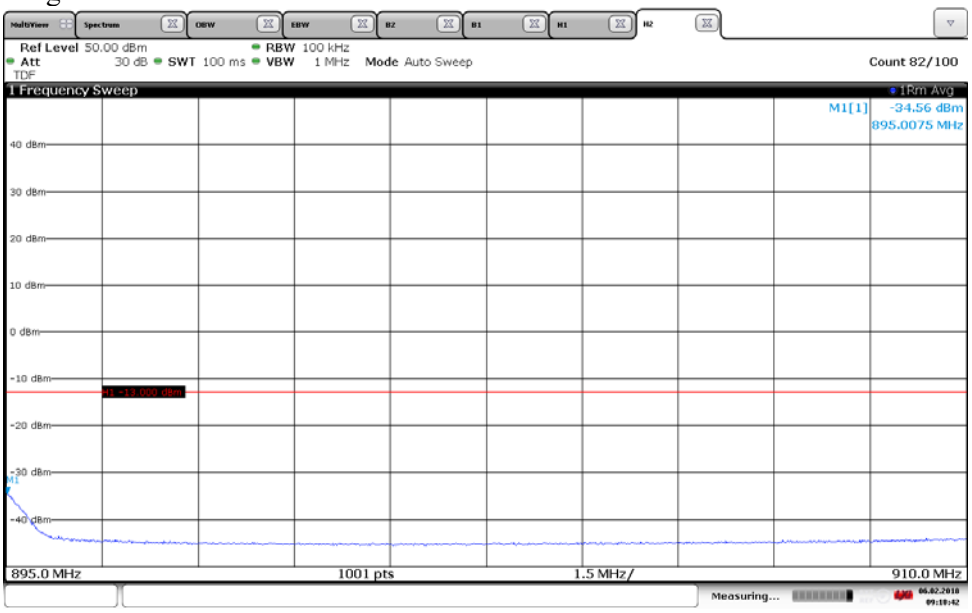


Diagram 5 a:

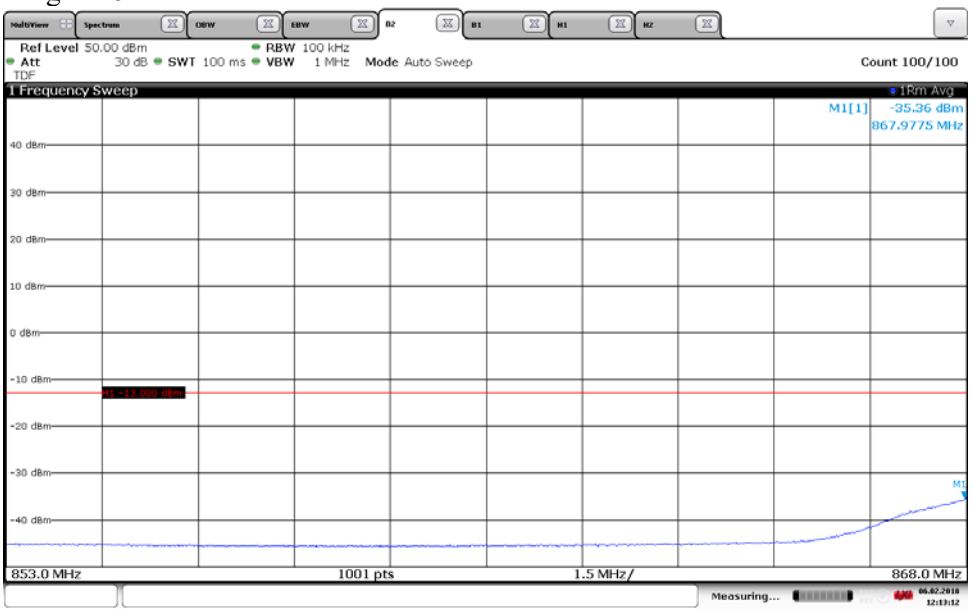


Diagram 5 b:

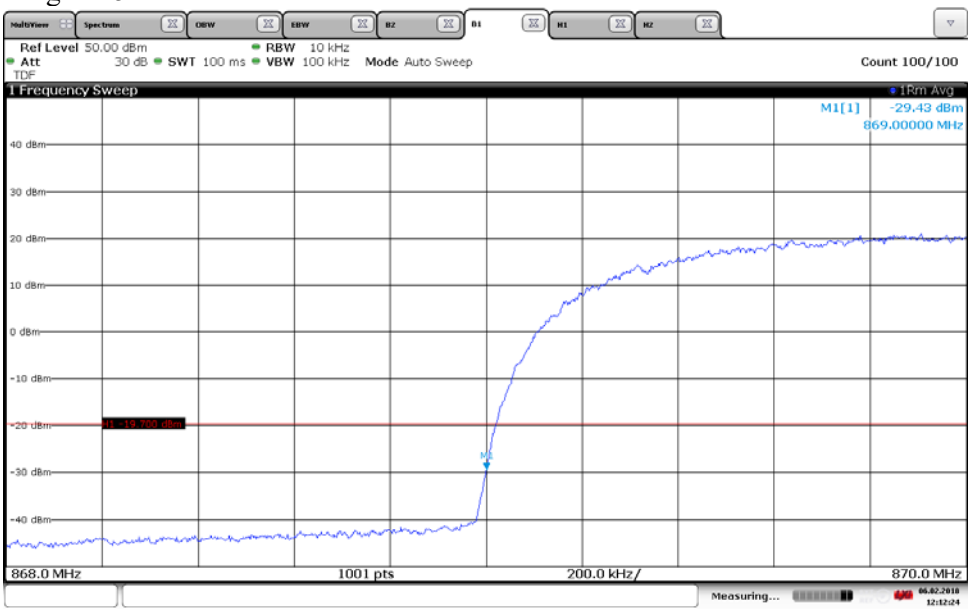


Diagram 6 a:

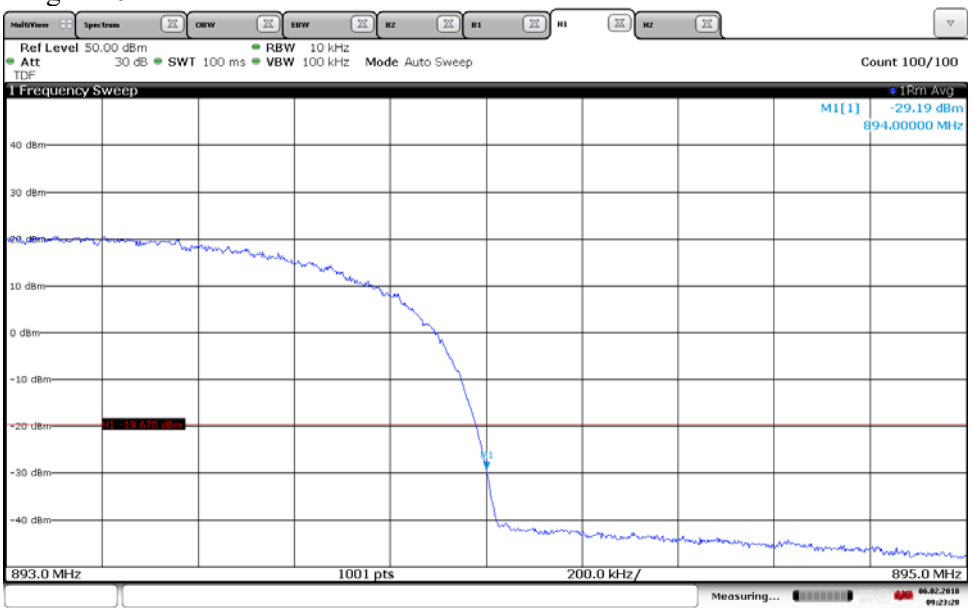


Diagram 6 b:

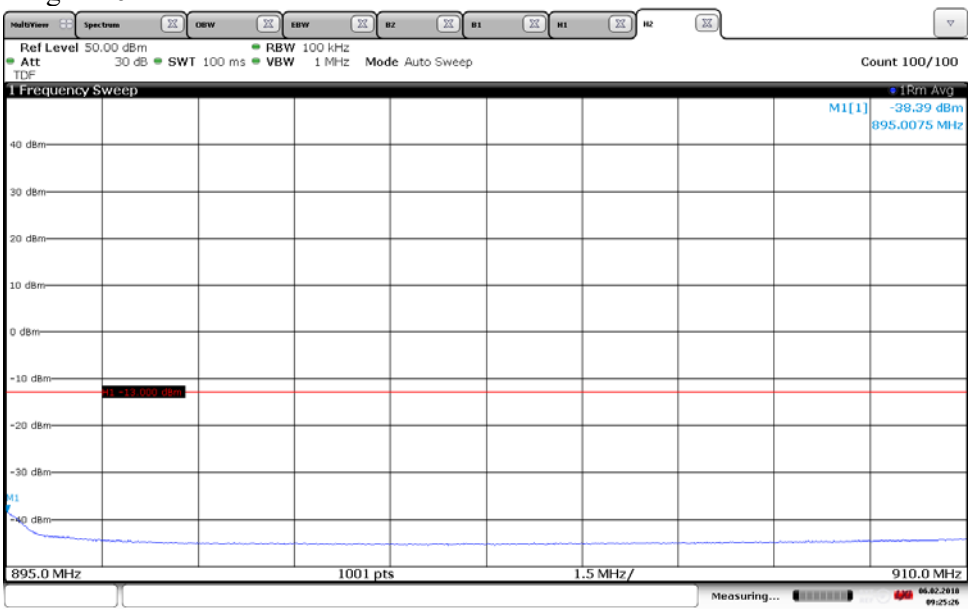


Diagram 7 a:

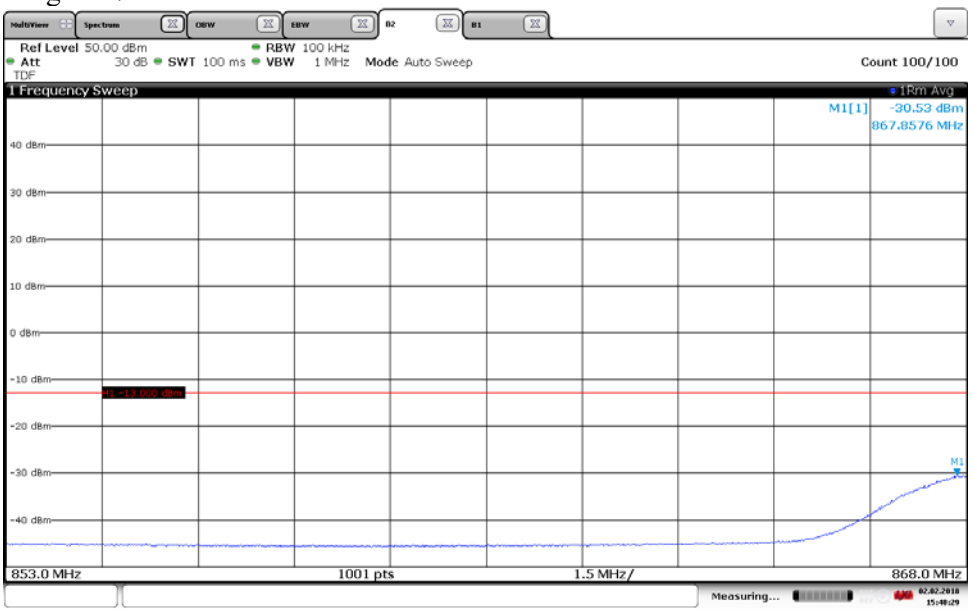


Diagram 7 b:

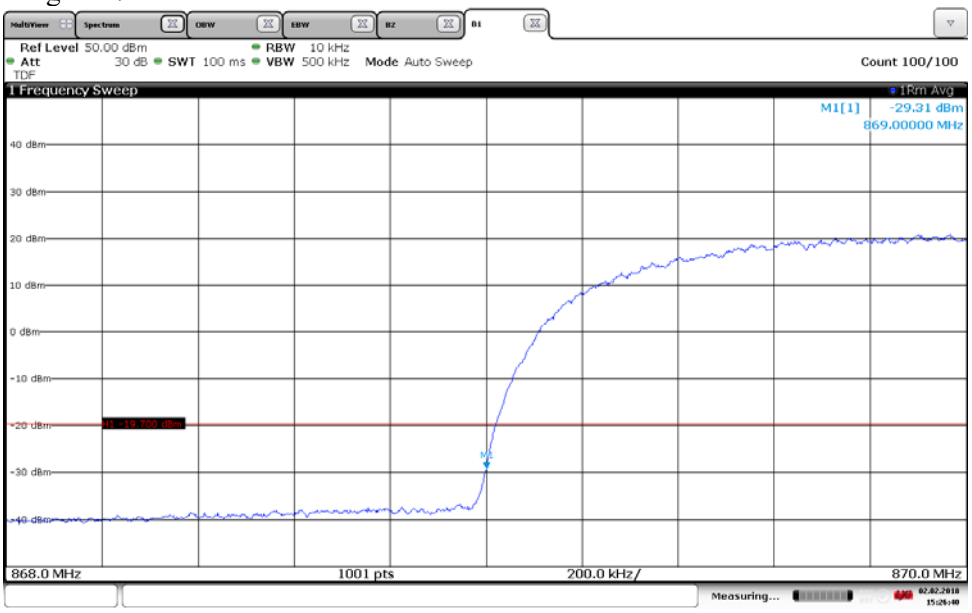


Diagram 8 a:

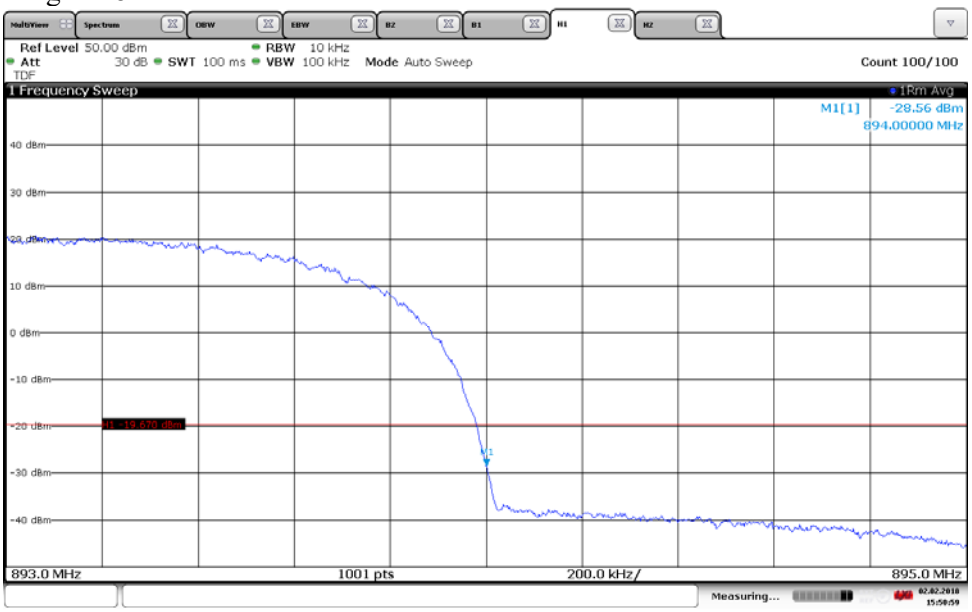


Diagram 8 b:

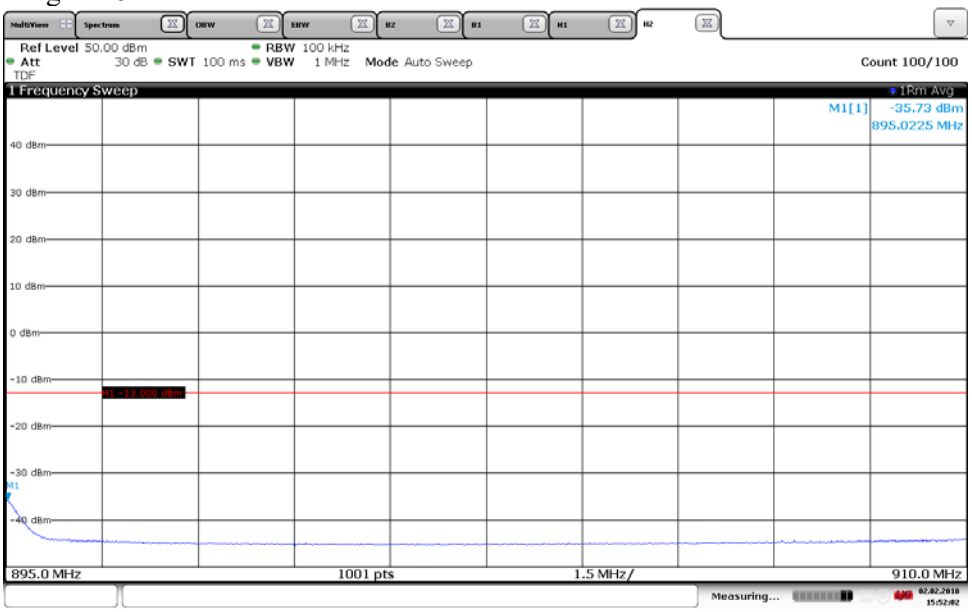


Diagram 9 a:

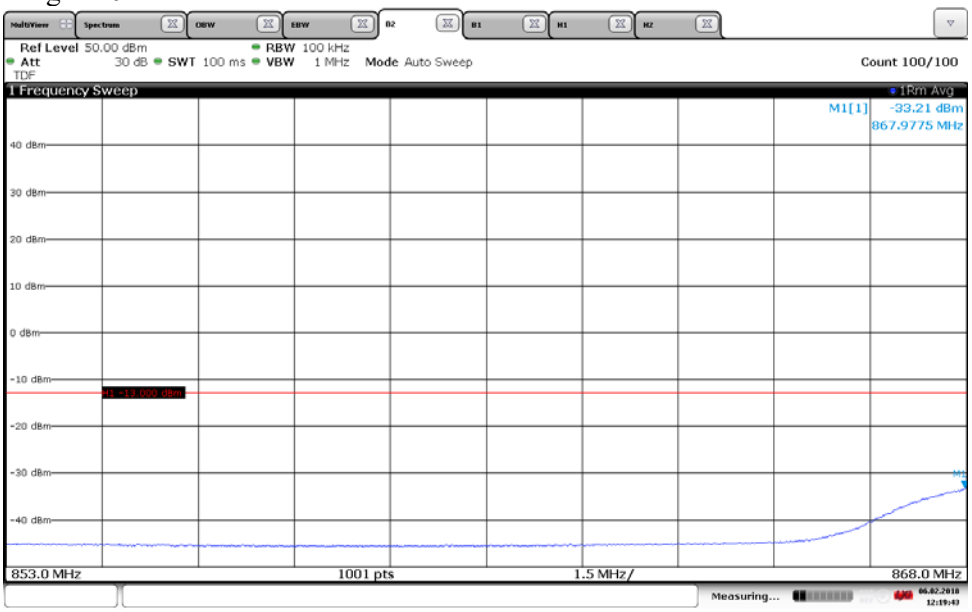


Diagram 9 b:

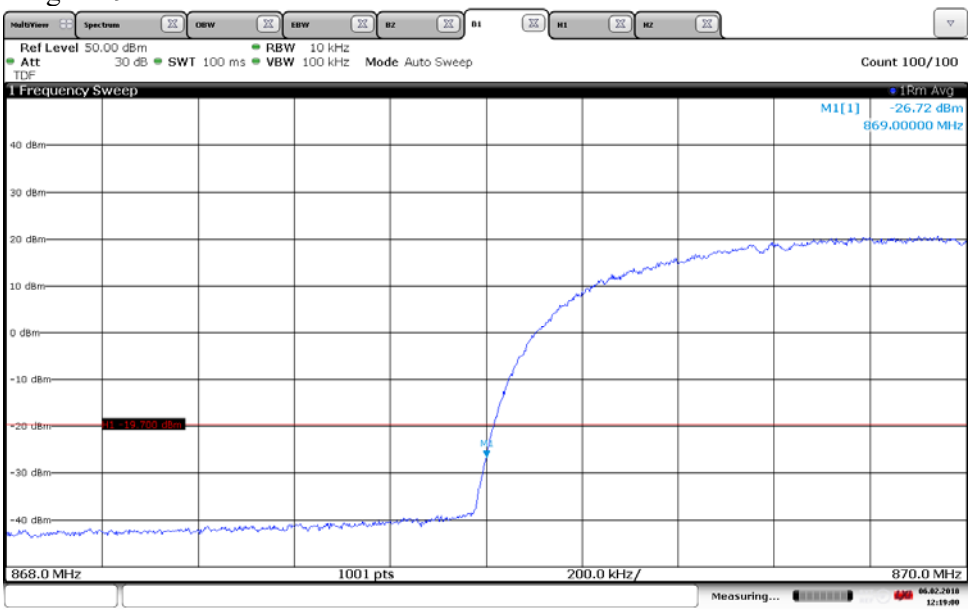


Diagram 10 a:

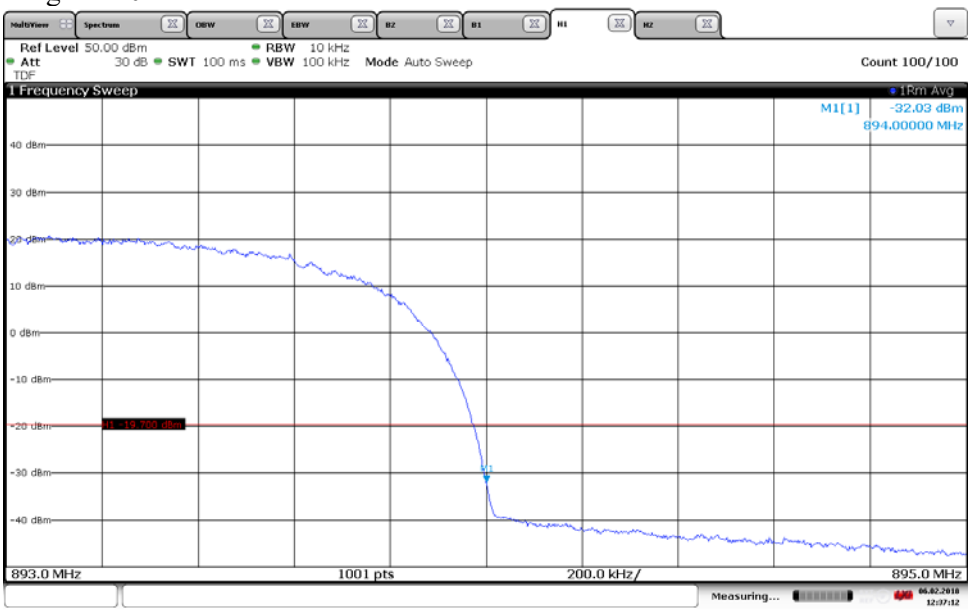


Diagram 10 b:

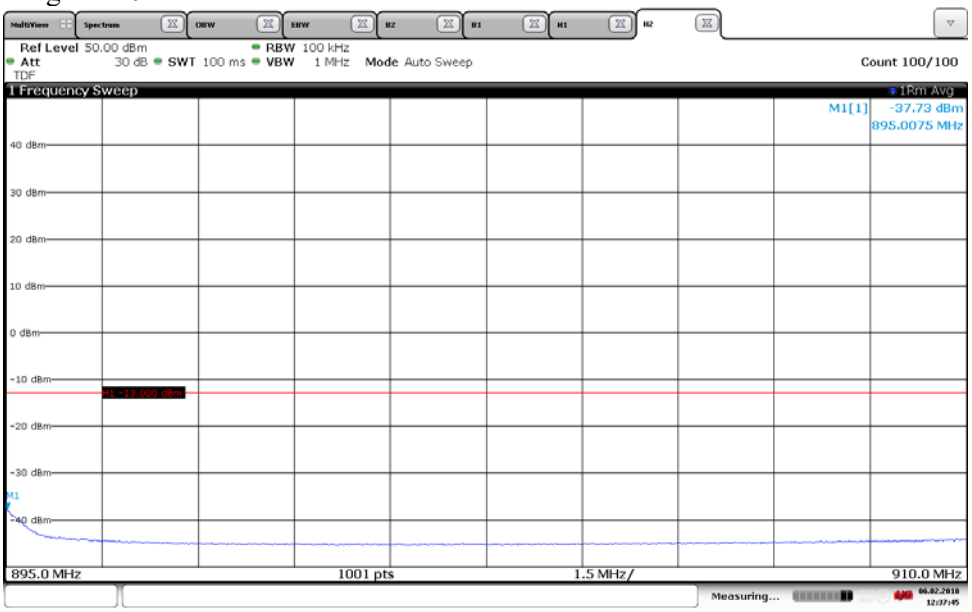


Diagram 11 a:

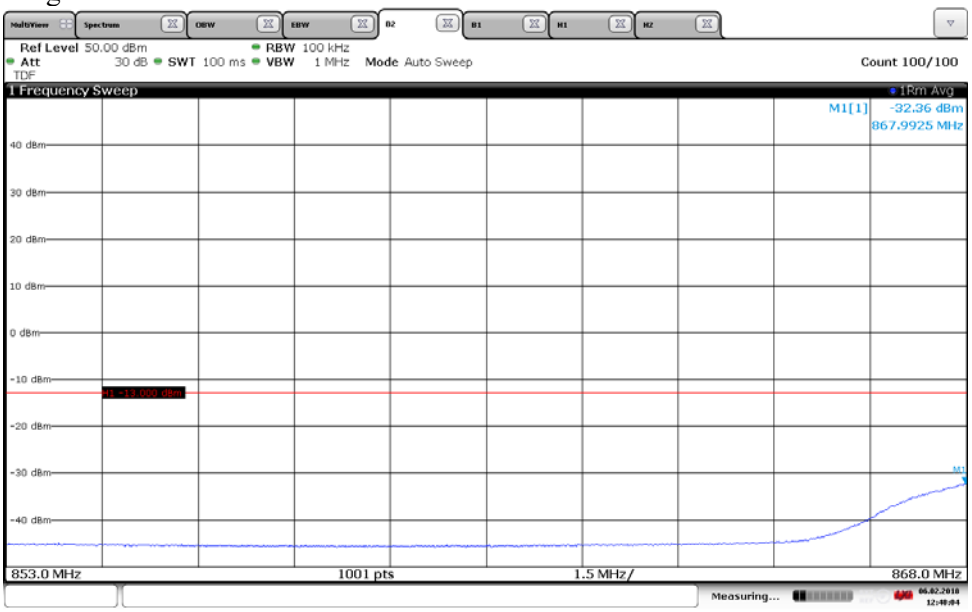


Diagram 11 b:

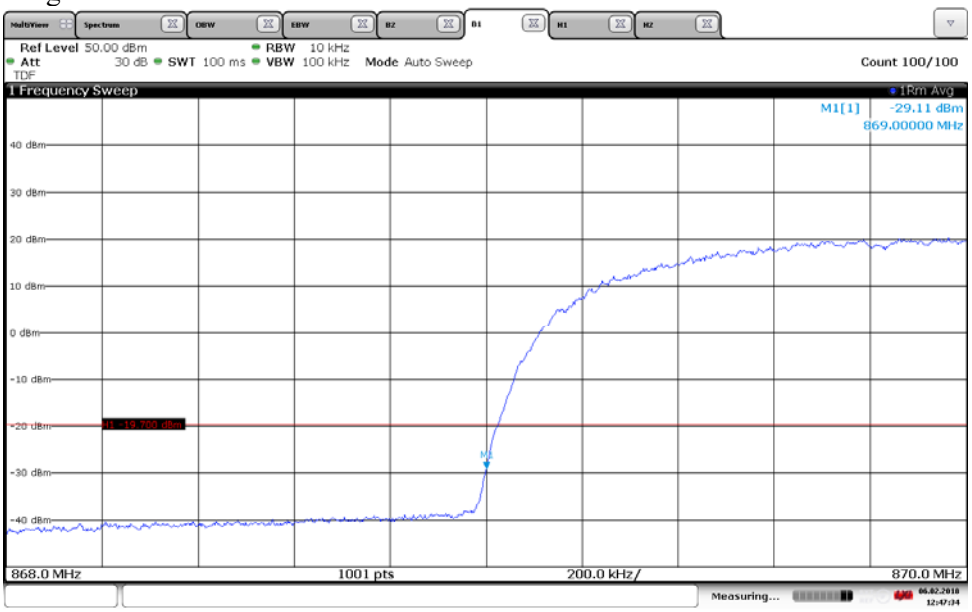


Diagram 12 a:

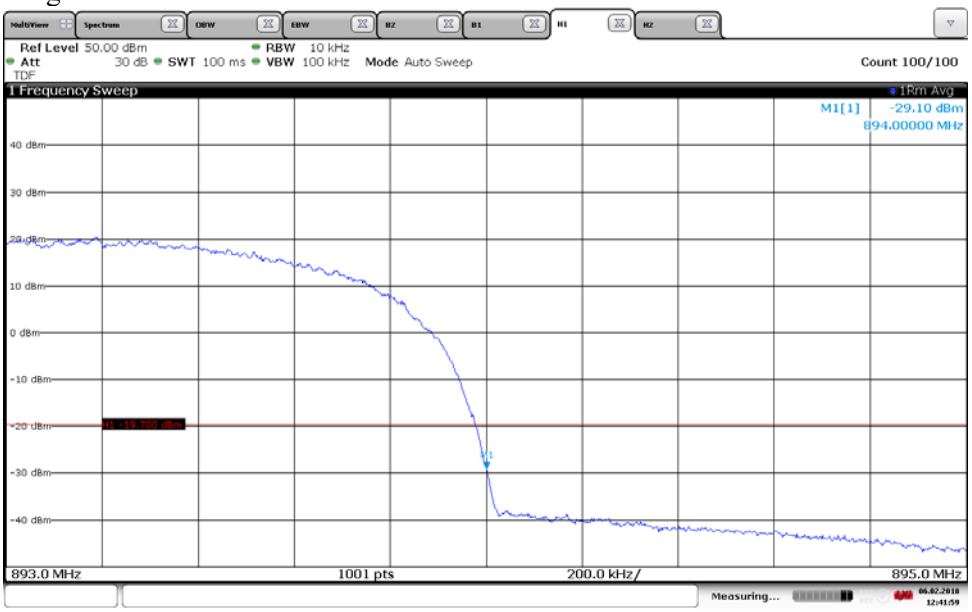


Diagram 12 b:

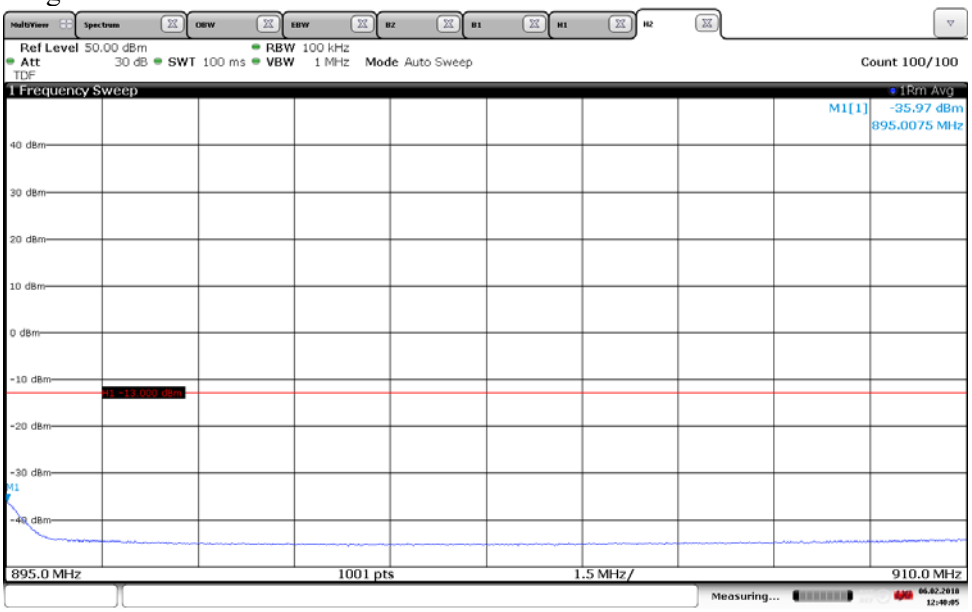


Diagram 13 a:

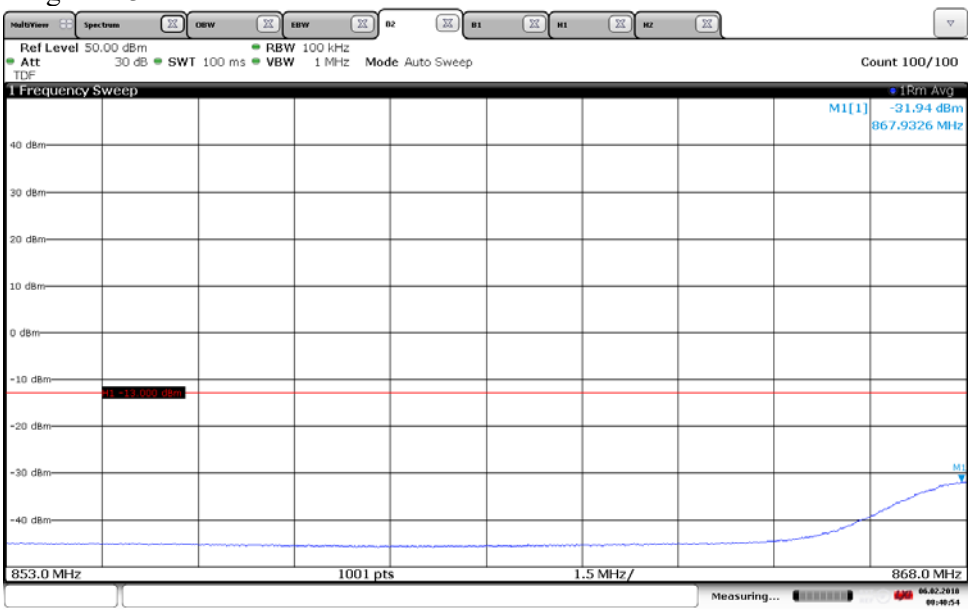


Diagram 13 b:

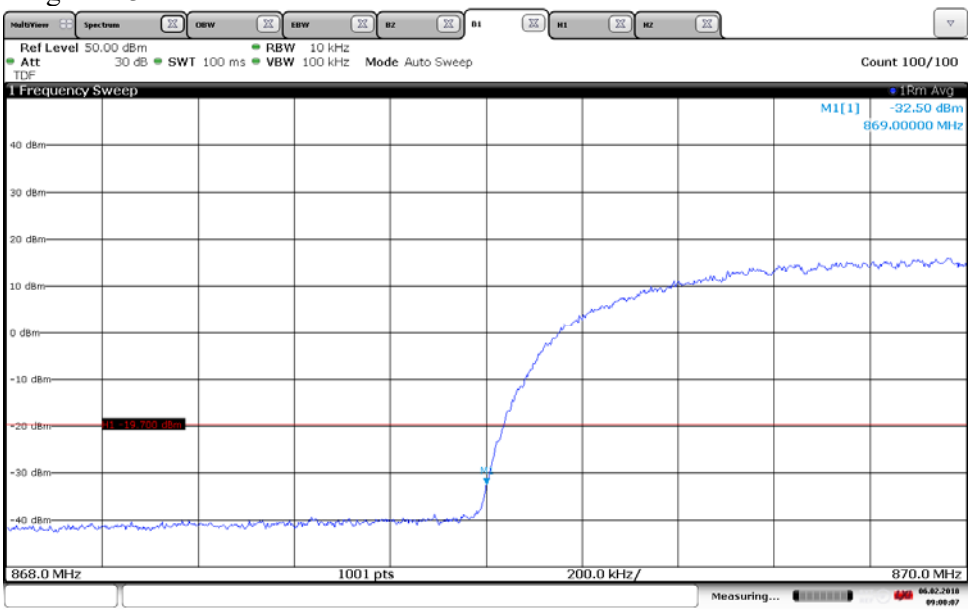


Diagram 14 a:

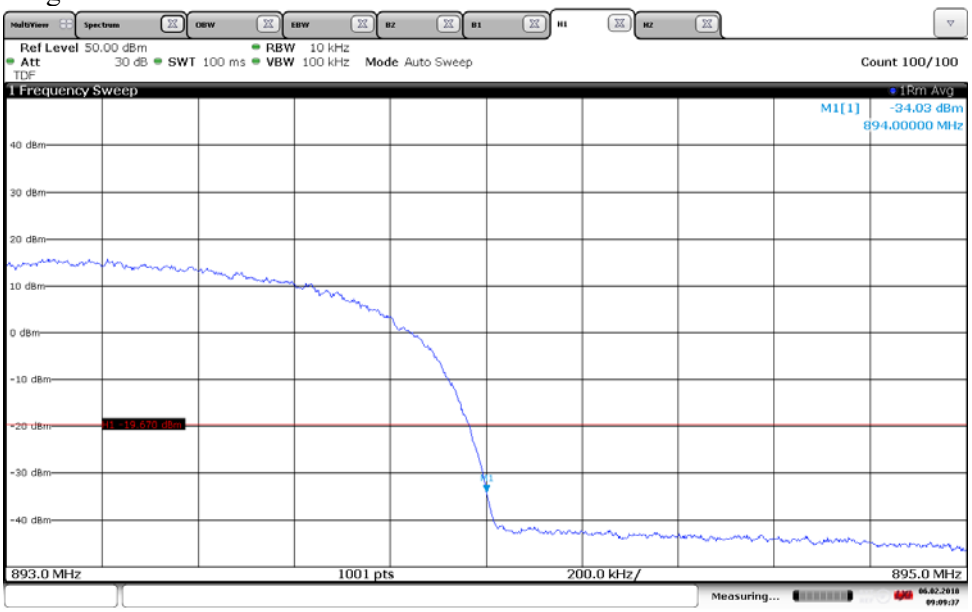
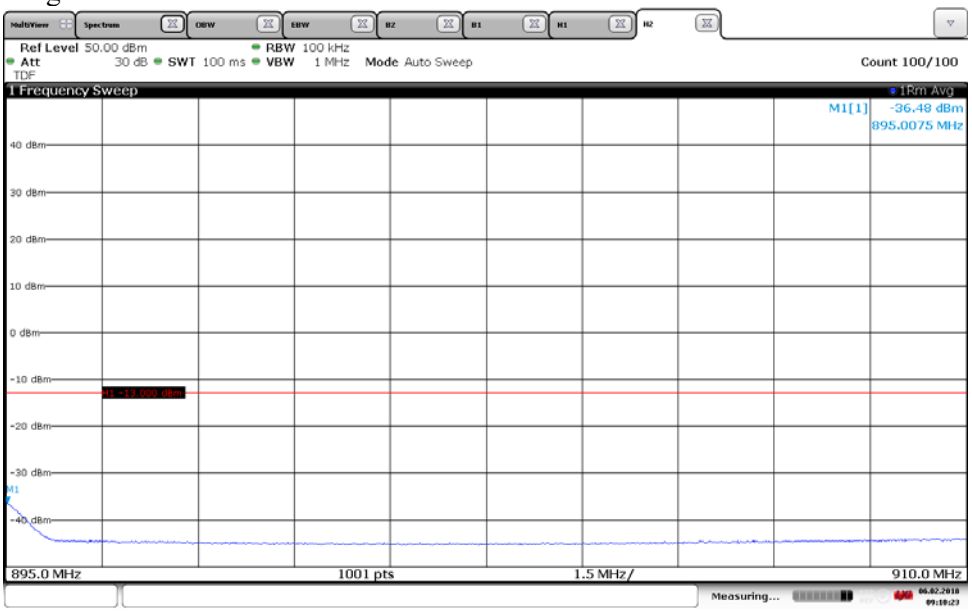


Diagram 14 b:



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

Date	Temperature	Humidity
2018-02-06	20 °C ± 3 °C	9 % ± 5 %
2018-02-07	20 °C ± 3 °C	8 % ± 5 %
2018-02-08	21 °C ± 3 °C	9 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §22.917. The output was connected to a spectrum analyzer with a RBW setting of 1 MHz and RMS detector activated.

Before comparing the results to the limit, 6 dB [10 log (4)] to cover2x(2x2) MIMO, should be added according to method E)2)c):"Measure and add 10 log(N_{ANT})" of FCC KDB662911 D01 Multiple Transmitter Output.

Measurement equipment	RISE number
R&S FSW 43	902 073
RF attenuator	900 691
HP filter	504 199
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

Single carrier TM 1

Diagram	Symbolic name	Tested Port
1 a-b	M	RF B

Single carrier TM 5

Diagram	Symbolic name	Tested Port
2 a-b	T	RF A
3 a-b	B	RF B
4 a-b	M	RF B
5 a-b	T	RF B
6 a-b	T	RF C
7 a-b	T	RF D

Single carrier TM 6

Diagram	Symbolic name	Tested Port
8 a-b	M	RF B

Multi carrier TM 5

Diagram	Symbolic name	Tested Port
9 a-c	T2	RF B
10 a-c	M5	RF B
11 a-c	Bim	RF B
12 a-c	Tim	RF B

Note: Measurements were mainly limited to port RF B due to the measurement result in single carrier mode that shows that the ports are electrical identical as declared by the client.

Remark

The emission at 9 kHz on the plots was not generated by the test object. A complementary measurement with a smaller RBW showed that it was related to the LO feed-through.

The highest fundamental frequency is 894 MHz. The measurements were made up to 9 GHz (10x894 MHz = 8940 MHz).

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: 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

Diagram 1a:

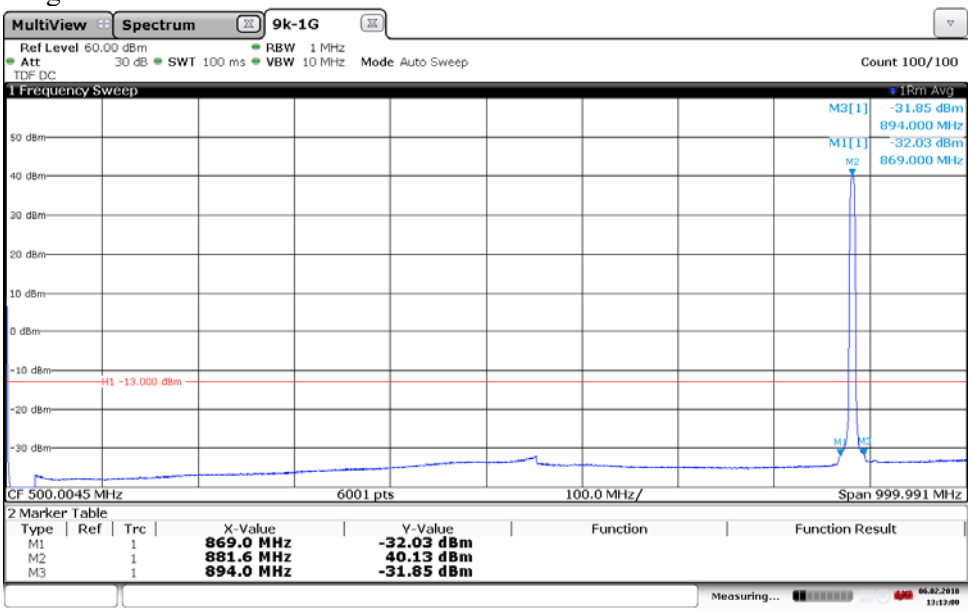


Diagram 1b:

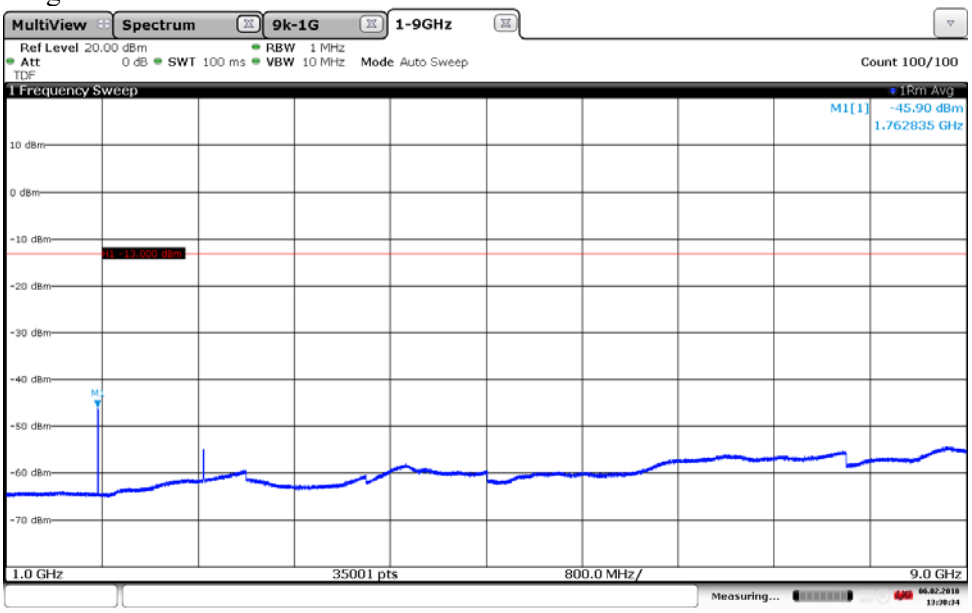


Diagram 2a:

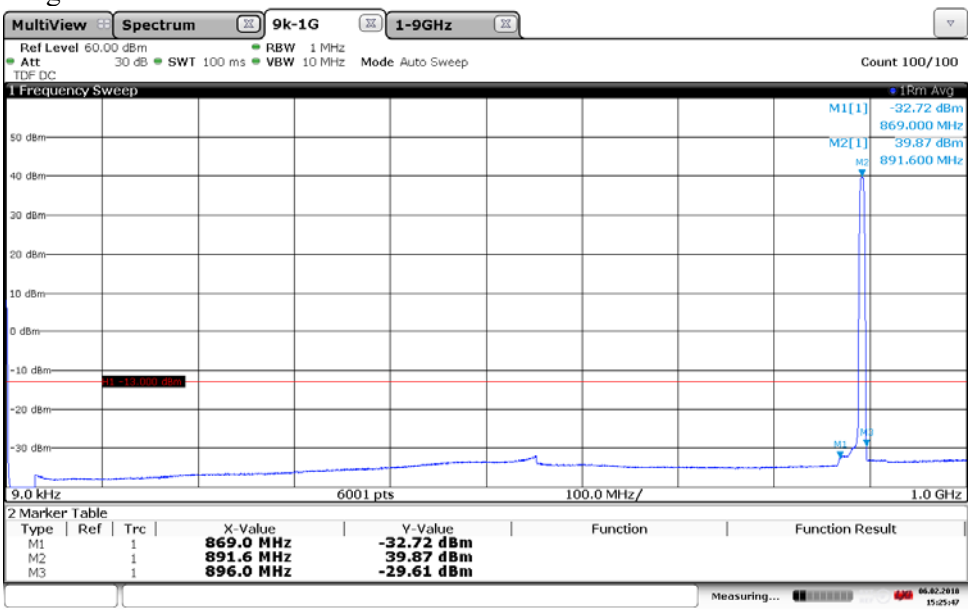


Diagram 2b:

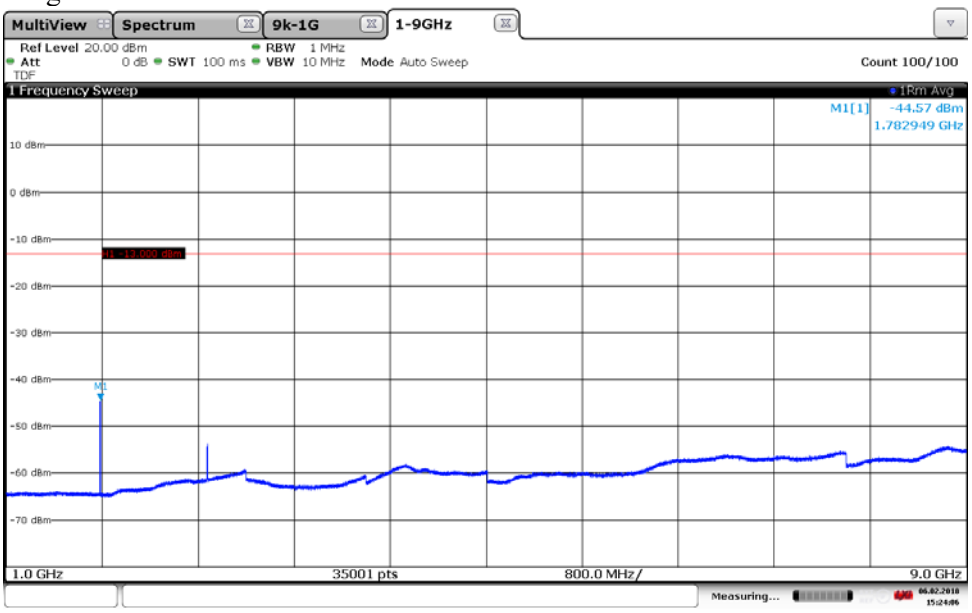


Diagram 3a:

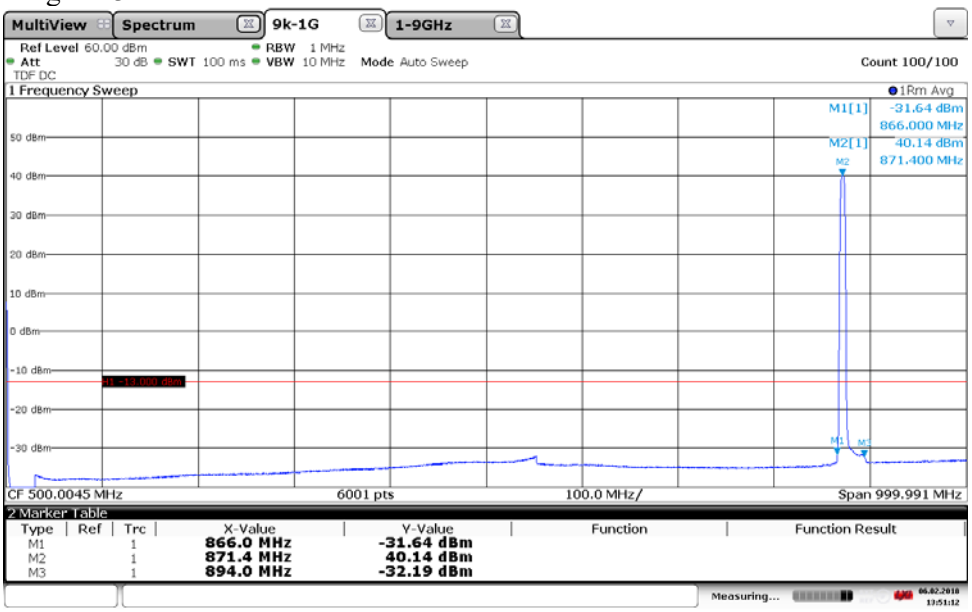


Diagram 3b:

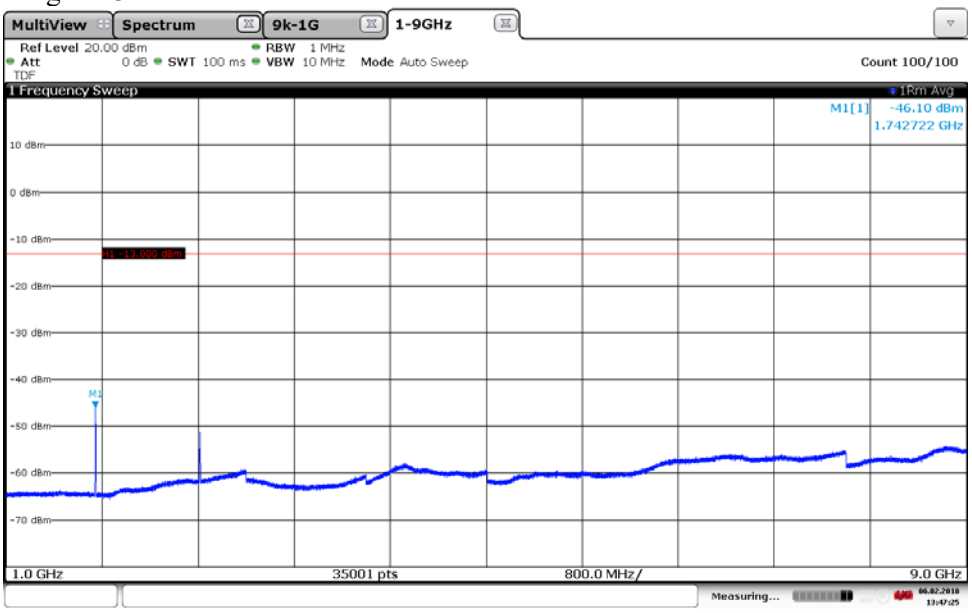


Diagram 4a:

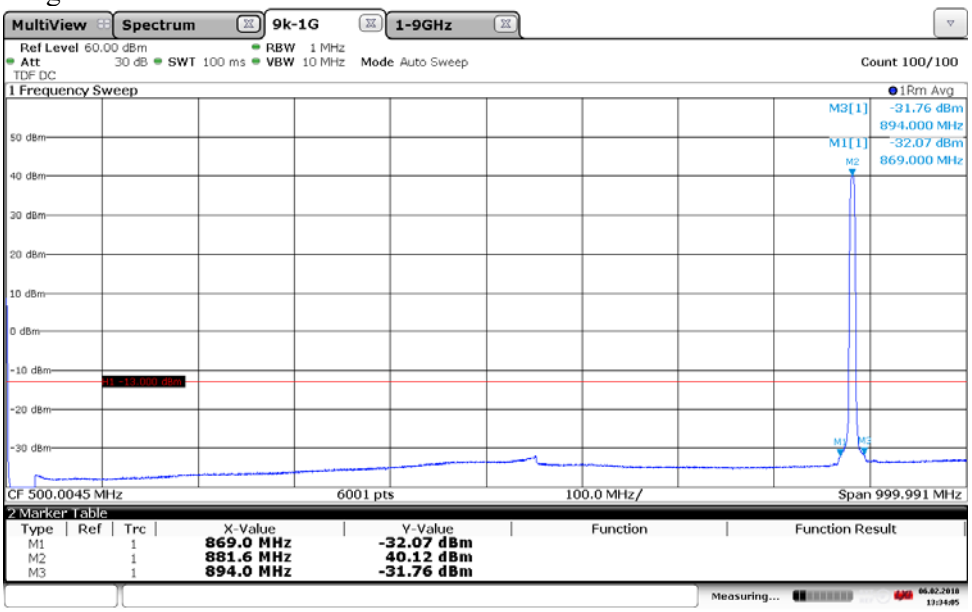


Diagram 4b:

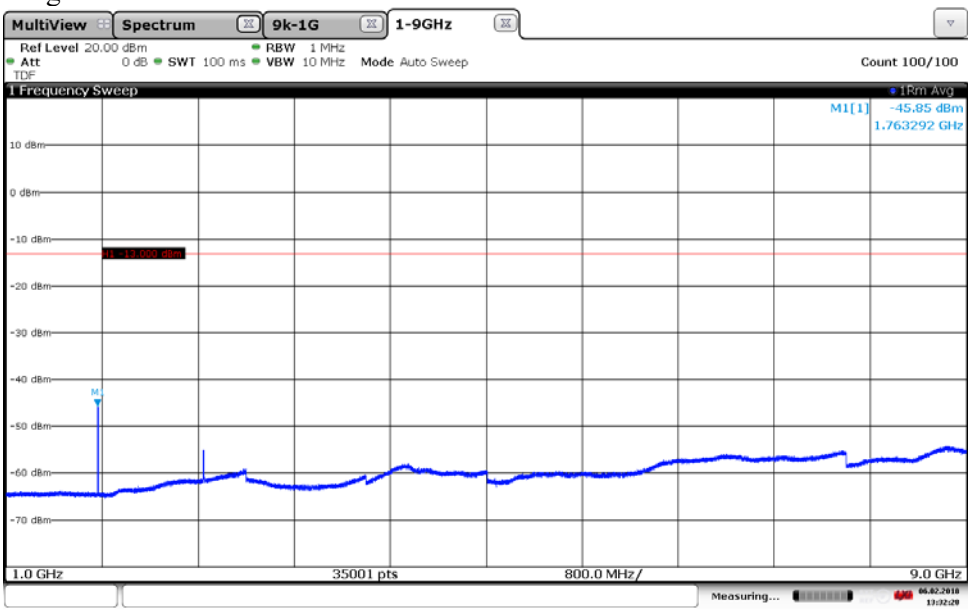


Diagram 5a:

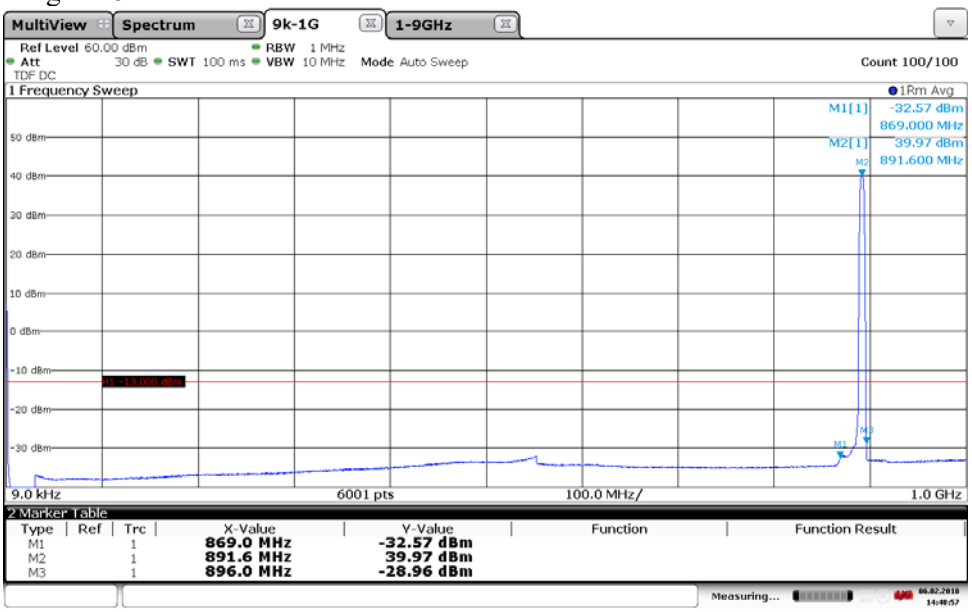


Diagram 5b:

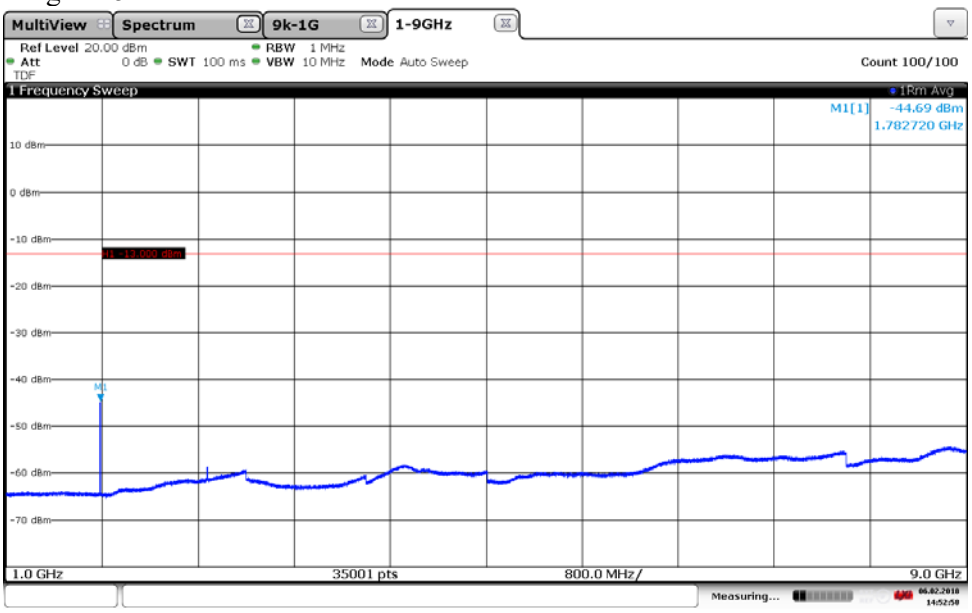


Diagram 6a:

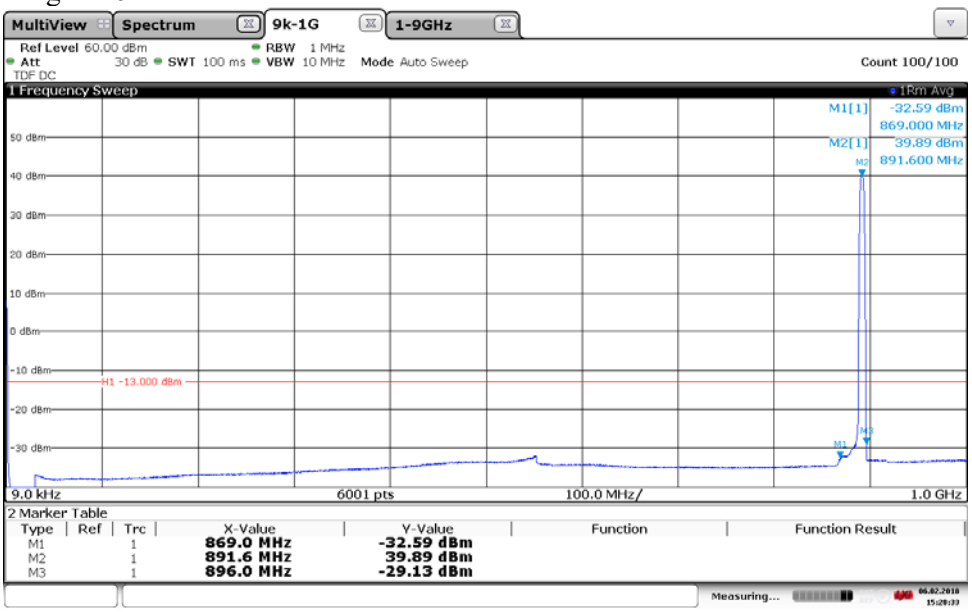


Diagram 6b:

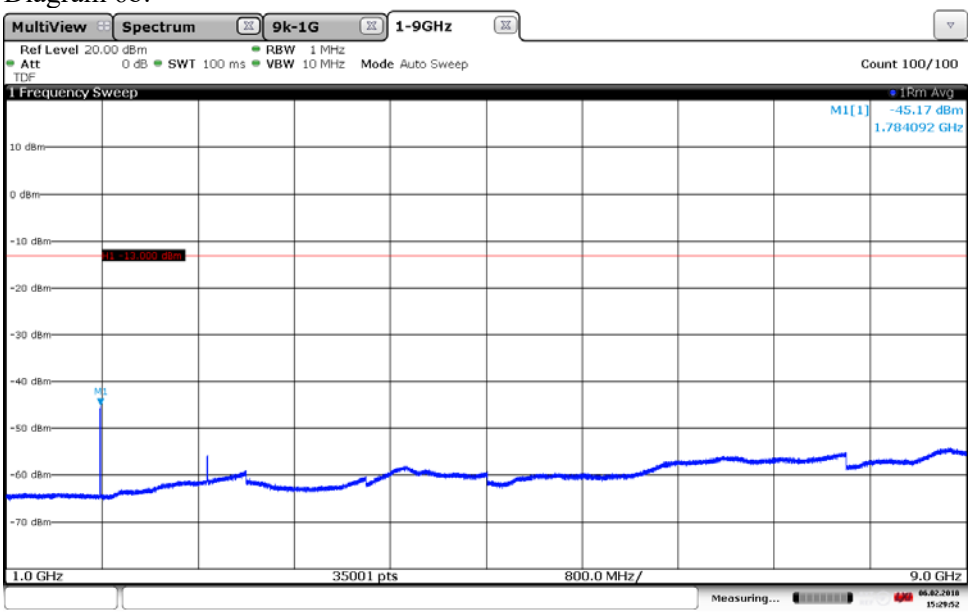


Diagram 7a:

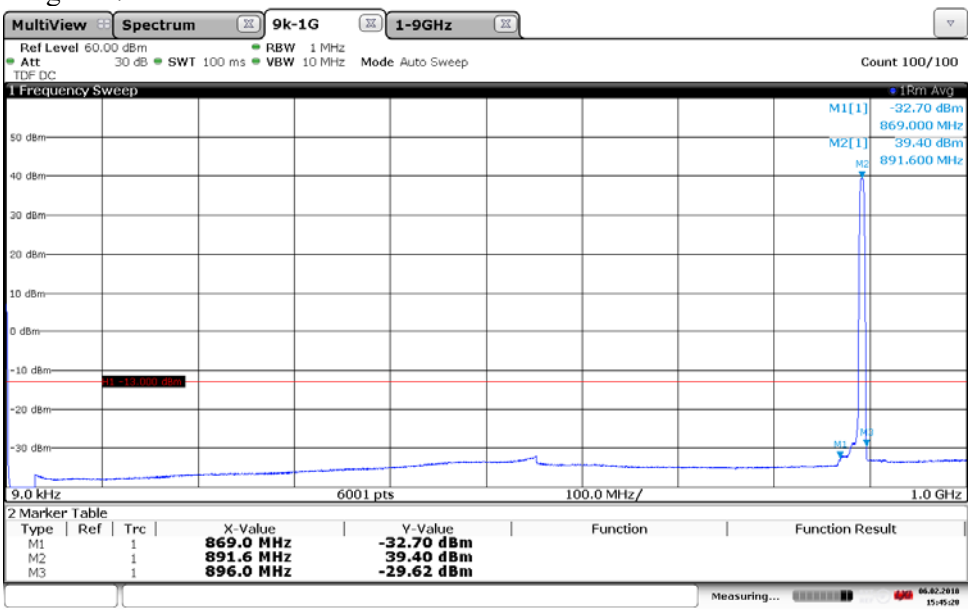


Diagram 7b:

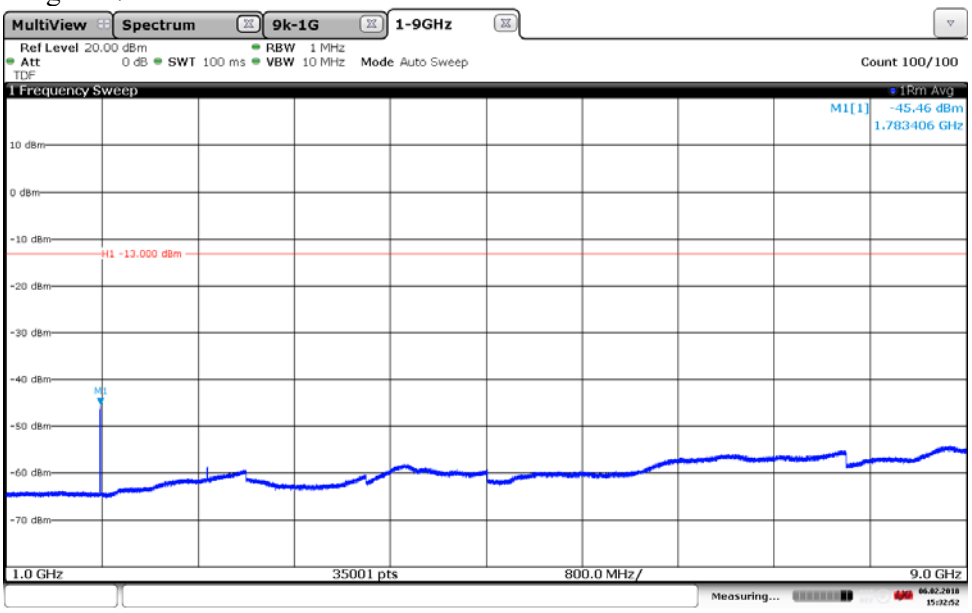


Diagram 8a:

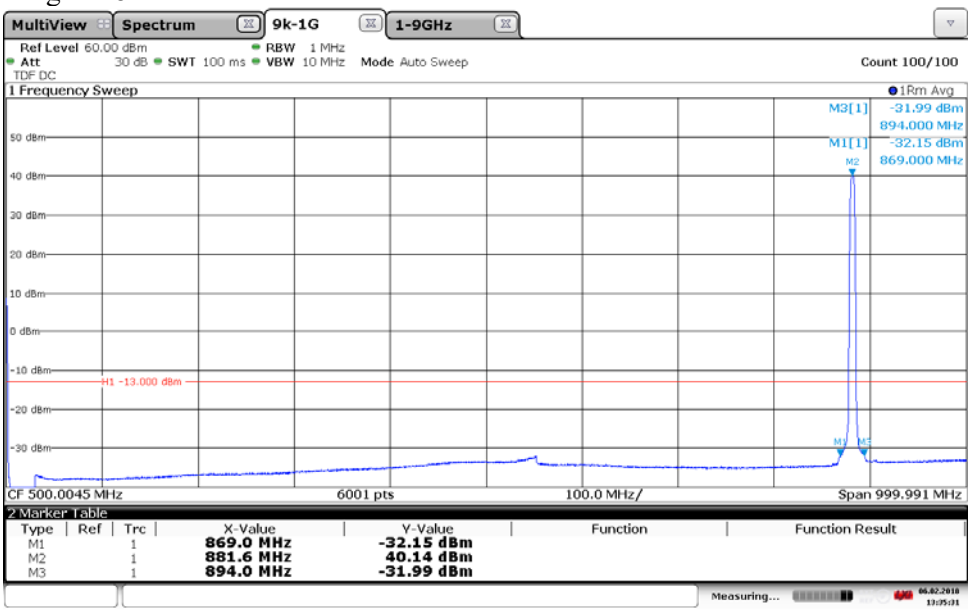


Diagram 8b:

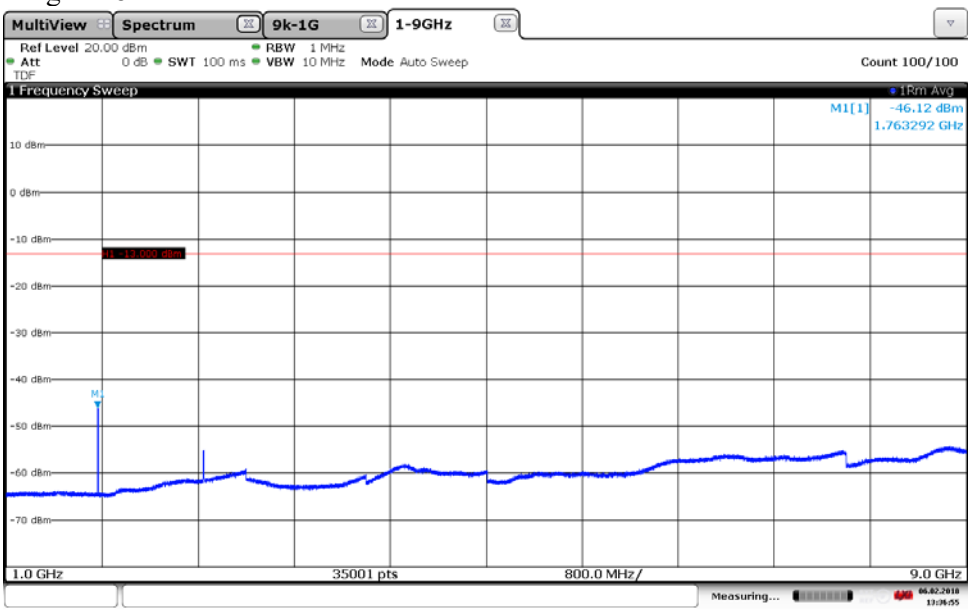


Diagram 9a:

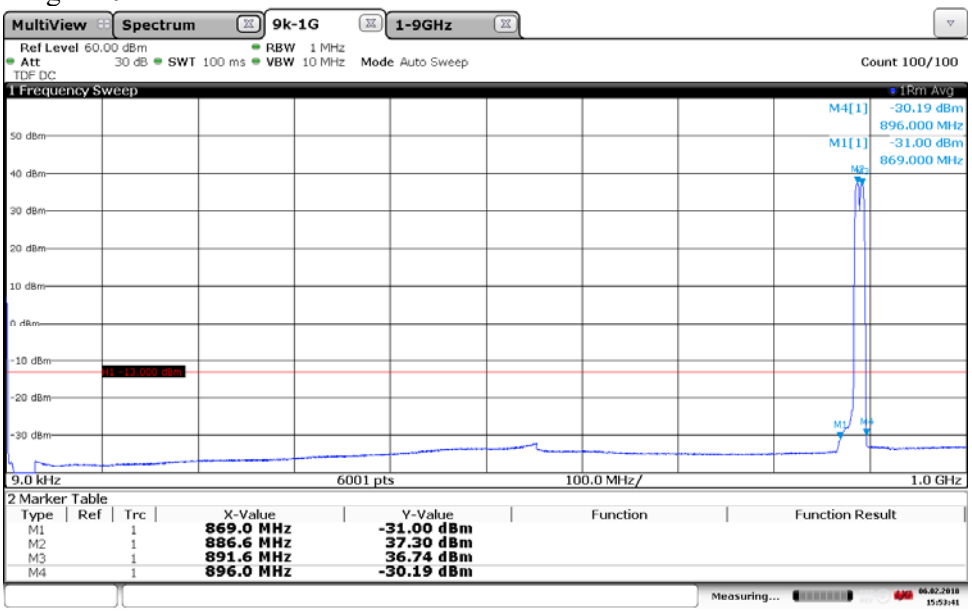


Diagram 9b:

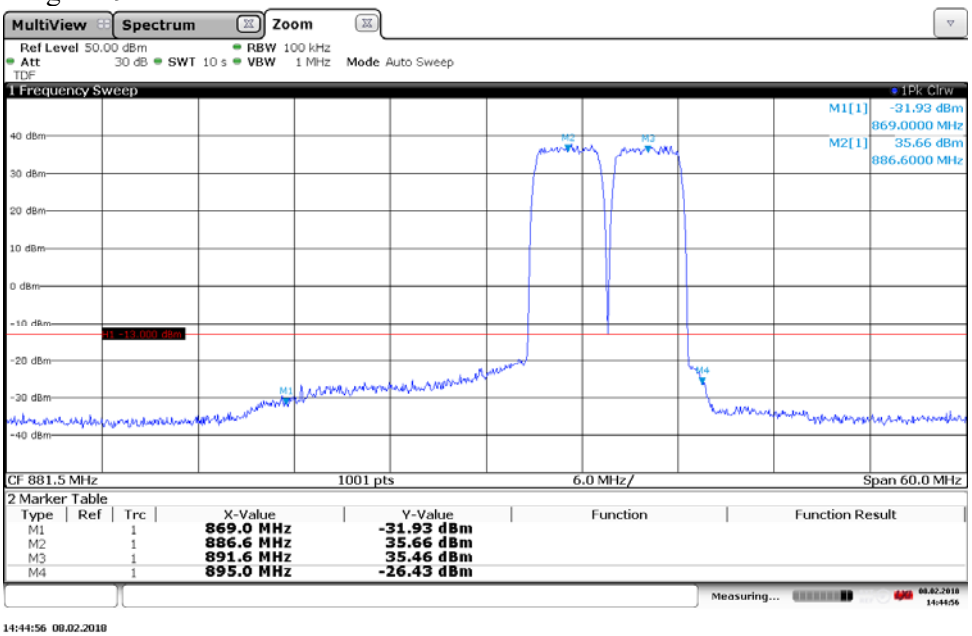


Diagram 9c:

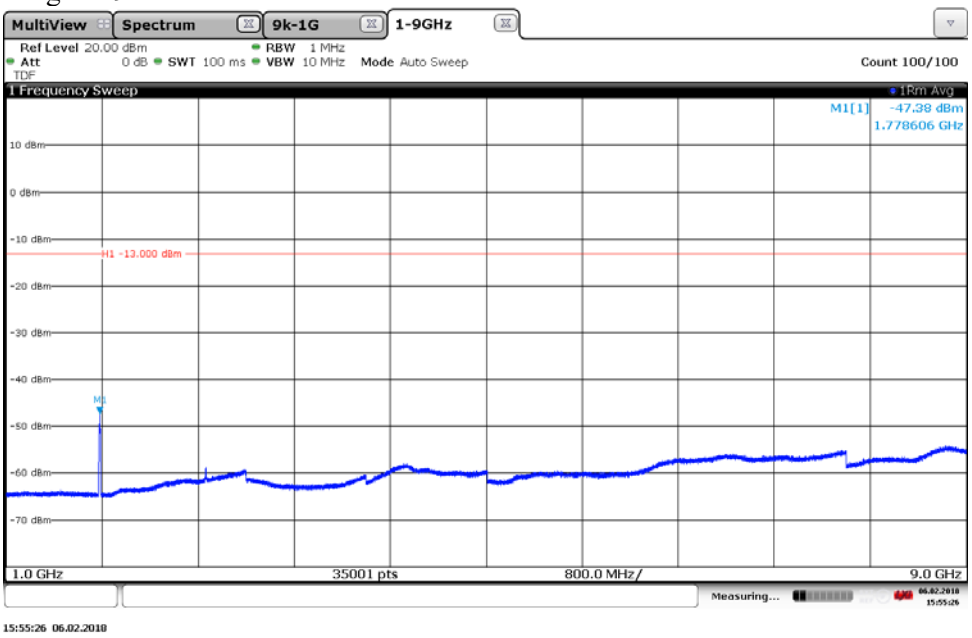

MultiView
Spectrum
9k-1G
1-9GHz
Ref Level 20.00 dBm
RBW 1 MHz
Att 0 dB SWT 100 ms VBW 10 MHz Mode Auto Sweep
Count 100/100
TDF
1 Frequency Sweep
1Rm Avg
M1[1] -47.38 dBm
1.778606 GHz
10 dBm
0 dBm
-10 dBm
H1 -13.000 dBm
-20 dBm
-30 dBm
-40 dBm
M1
-50 dBm
-60 dBm
-70 dBm
1.0 GHz
35001 pts
800.0 MHz/
9.0 GHz
Measuring...
15:55:26 06.02.2018

Diagram 10a:

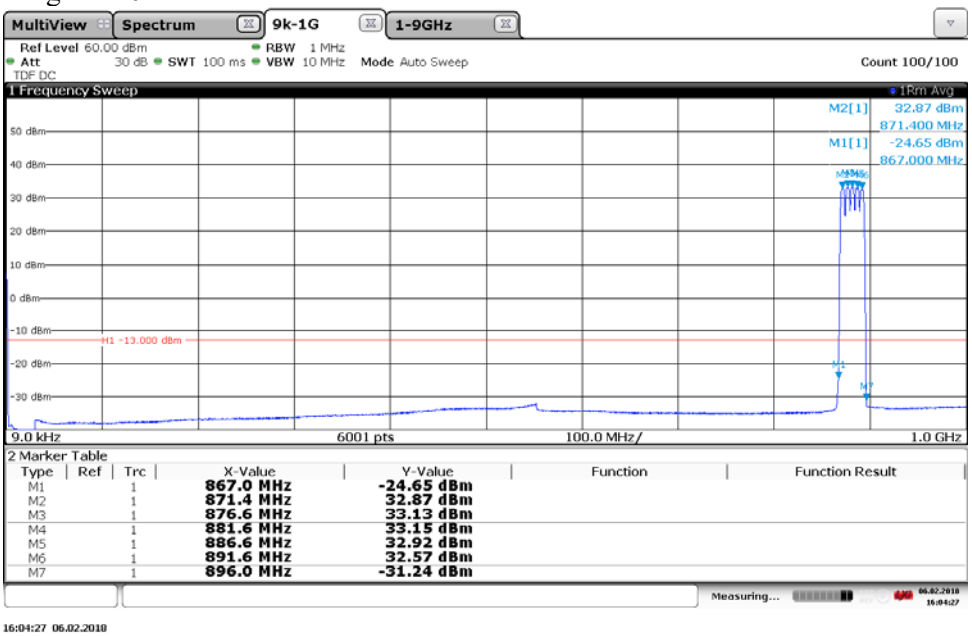


Diagram 10b:

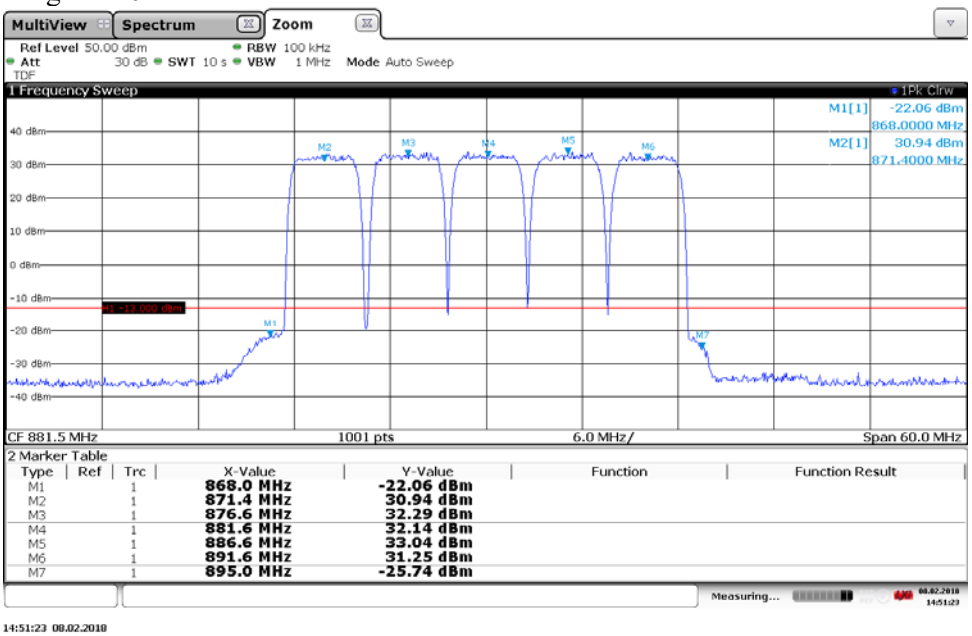


Diagram 10c:

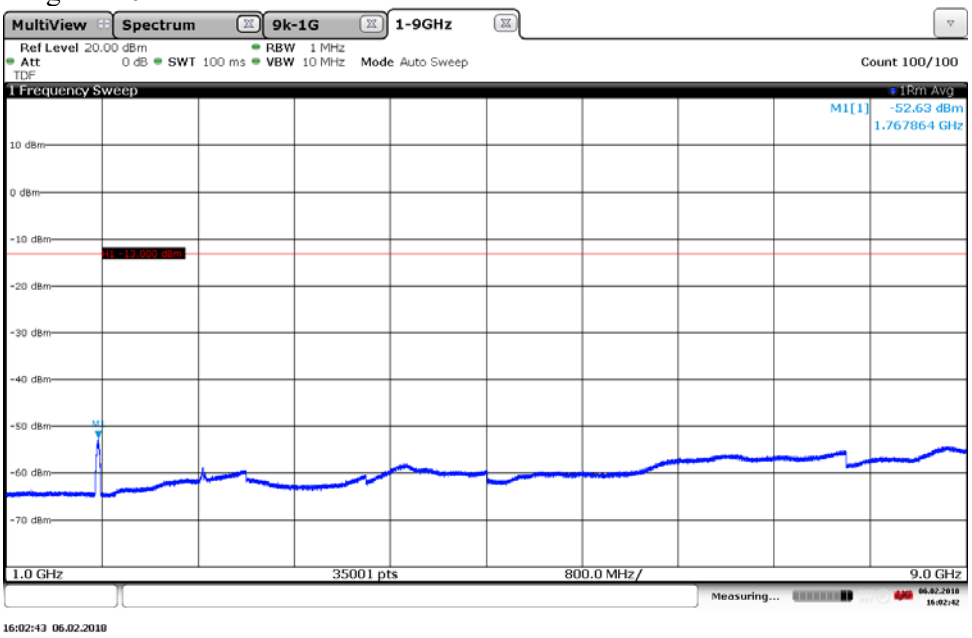

MultiView
Spectrum
9k-1G
1-9GHz
Ref Level 20.00 dBm
RBW 1 MHz
Att 0 dB SWT 100 ms VBW 10 MHz Mode Auto Sweep
Count 100/100
TDF
1 Frequency Sweep
1Rm Avg
M1[1] -52.63 dBm
1.767864 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
1.0 GHz
35001 pts
800.0 MHz/
9.0 GHz
Measuring...
16:02:43 06.02.2018

Diagram 11a:

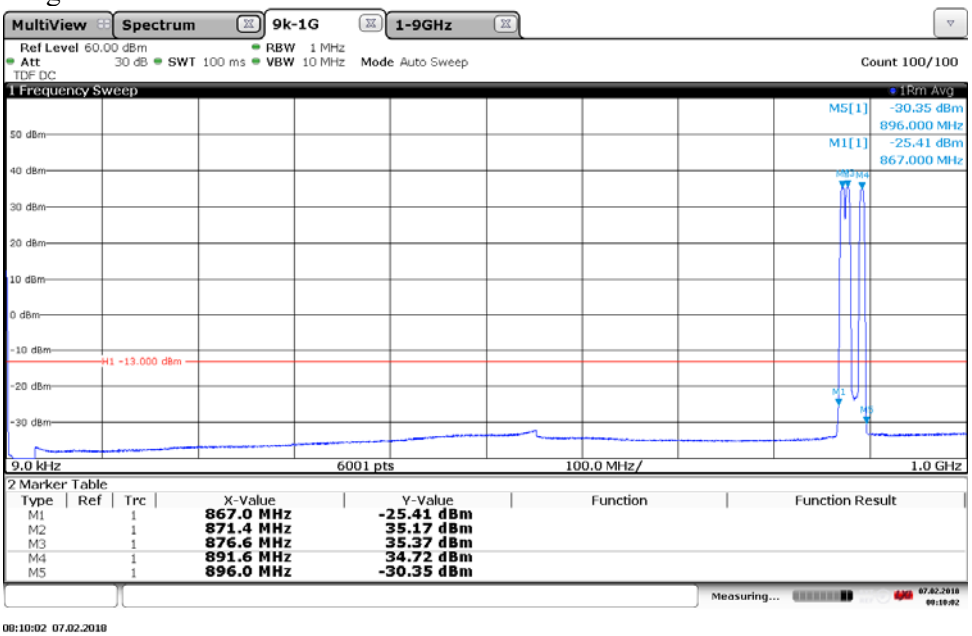


Diagram 11b:

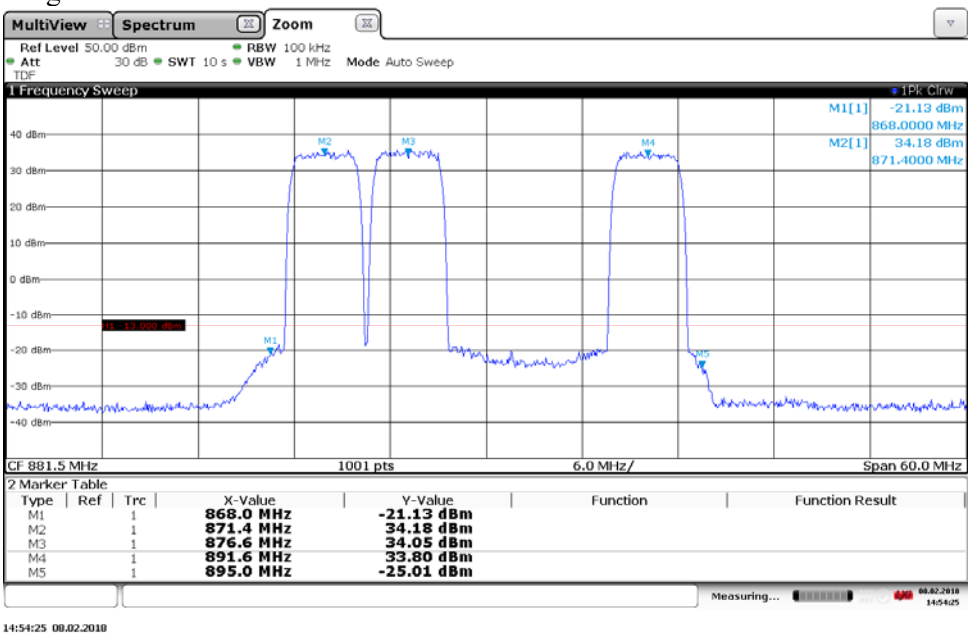


Diagram 11c:

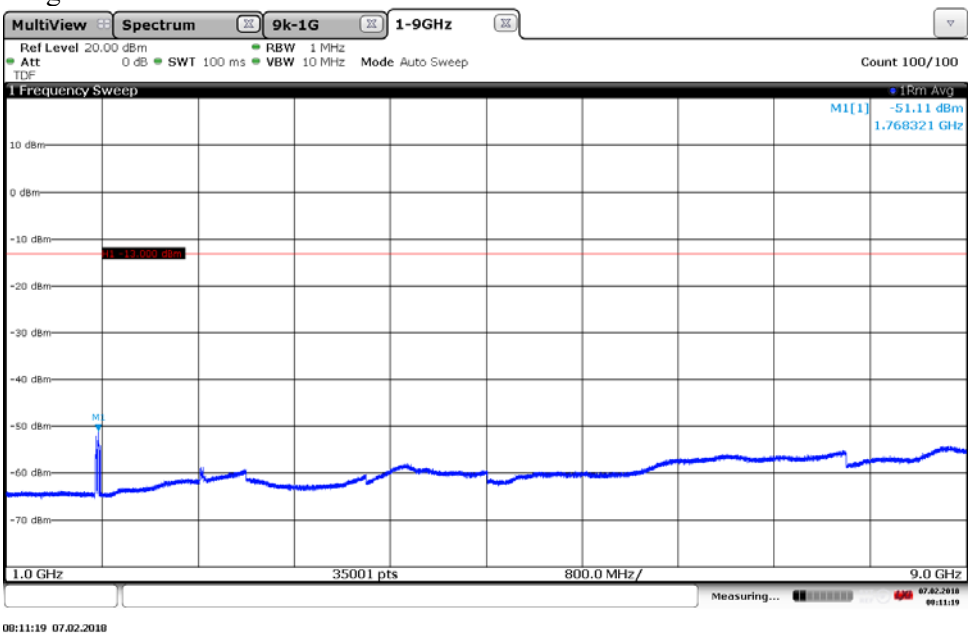

MultiView
Spectrum
9k-1G
1-9GHz
Ref Level 20.00 dBm
RBW 1 MHz
Att 0 dB SWT 100 ms VBW 10 MHz Mode Auto Sweep
Count 100/100
1 Frequency Sweep
1Rm Avg
M1[1] -51.11 dBm
1.768321 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
1.0 GHz
35001 pts
800.0 MHz/
9.0 GHz
Measuring...
00:11:19 07.02.2018

Diagram 12a:

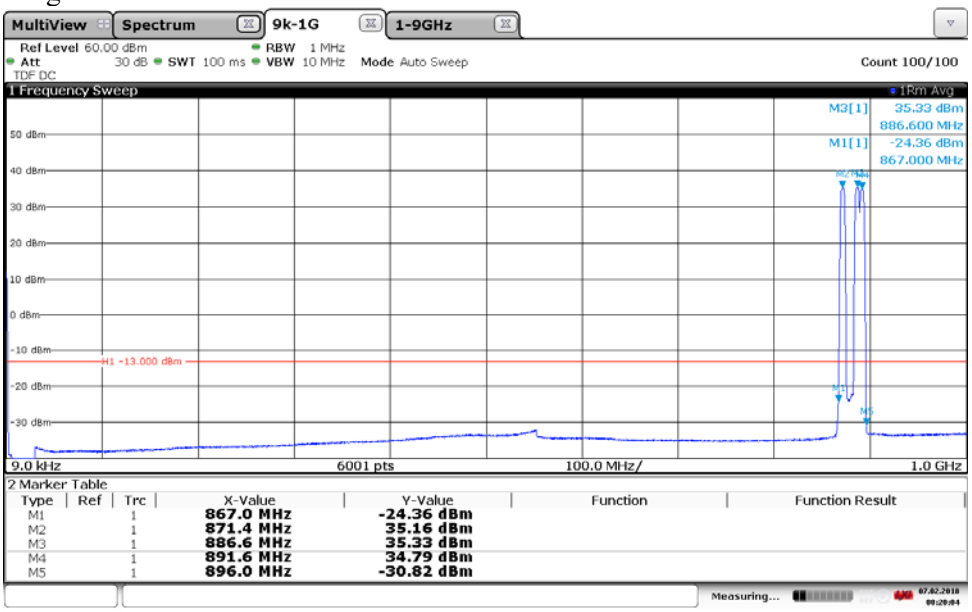


Diagram 12b:

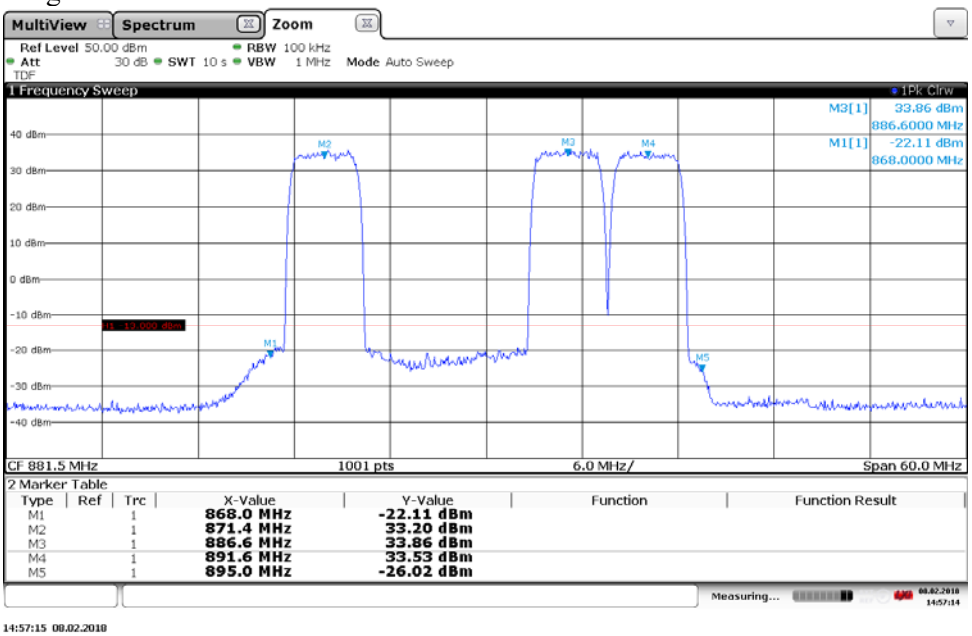
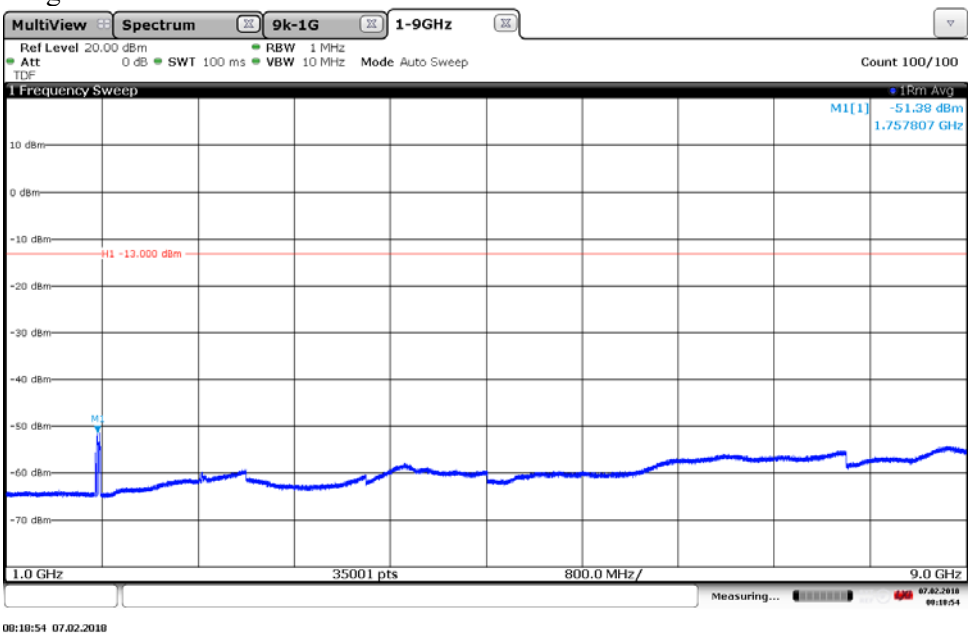


Diagram 12c:


MultiView
Spectrum
9k-1G
1-9GHz
Ref Level 20.00 dBm
RBW 1 MHz
Att 0 dB SWT 100 ms VBW 10 MHz Mode Auto Sweep
Count 100/100
TDF
1 Frequency Sweep
1Rm Avg
M1[1] -51.38 dBm
1.757807 GHz
10 dBm
0 dBm
-10 dBm
H1 -13.000 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
1.0 GHz
35001 pts
800.0 MHz/
9.0 GHz
Measuring...
00:10:54 07.02.2018

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

Date	Temperature	Humidity
2018-01-29	22 °C ± 3 °C	32 % ± 5 %
2018-01-30	22 °C ± 3 °C	30 % ± 5 %

The test site conform to the site validation criterion specified in ANSI C63.4 2014. 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.

RF absorbers were covering a floor area in the frequency range 1 GHz – 9 GHz to comply with site validation requirements according to ANSI C63.4-2014.

The EUT was placed 0.8 m above reference ground plane in frequency range 30 MHz – 1 GHz and 1.5 m above reference ground plane in frequency range 1 GHz – 9 GHz.

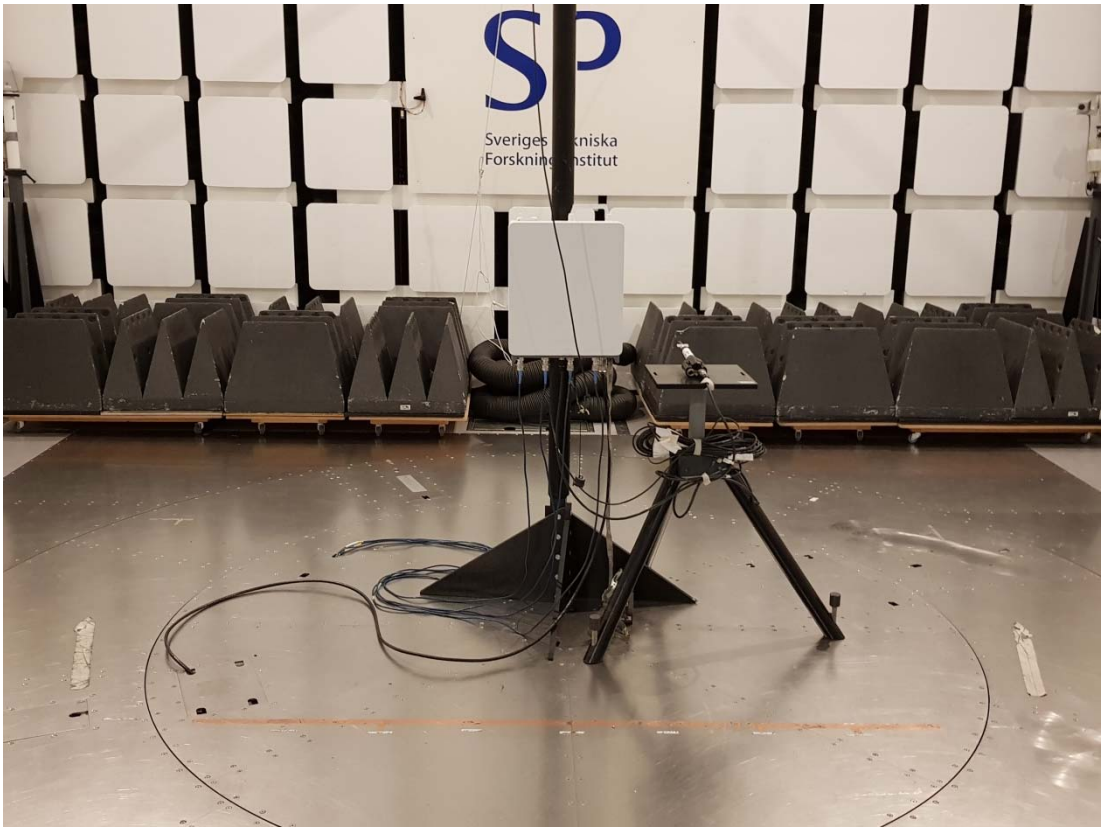
The measurement was performed with a RBW of 1 MHz.

A propagation loss in free space was calculated. The used formula was $\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

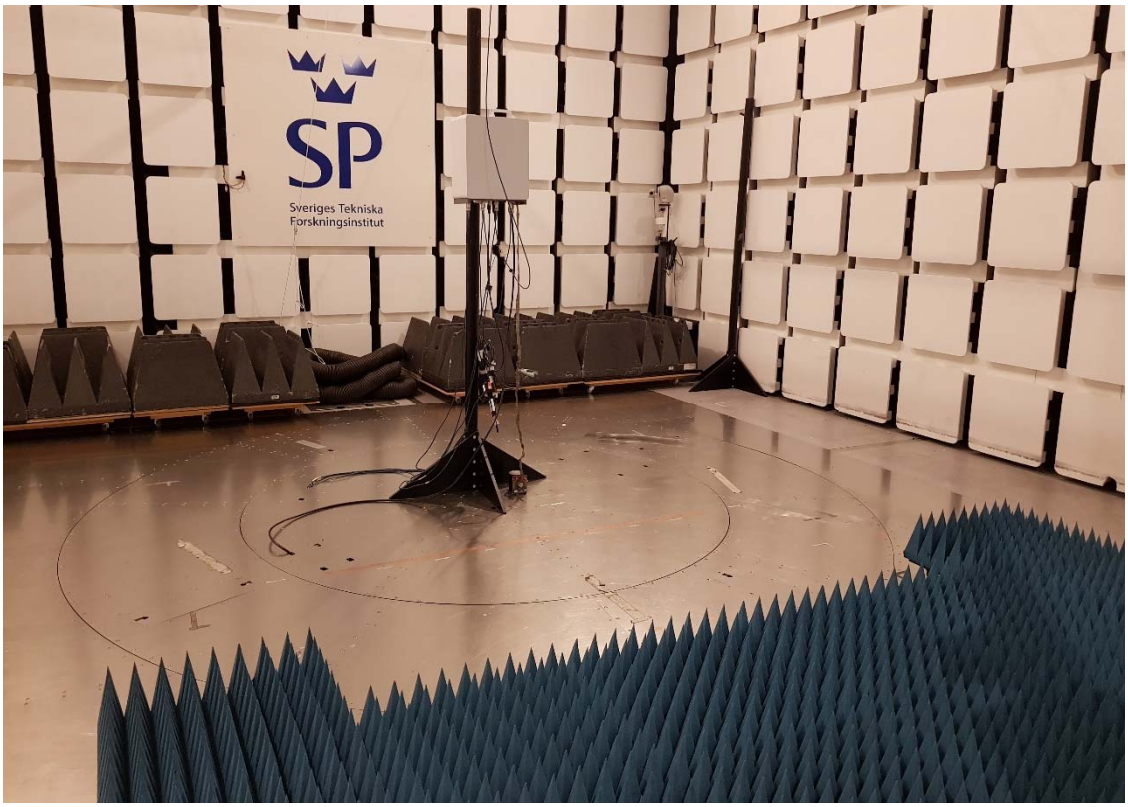
The measurement procedure was as the following:

1. 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 m. For measurements > 1 GHz the test object was measured in seventeen directions with the antenna height 1.0 m, 1.5 m and 2m.
2. 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 63.26.

The test set-up during the spurious radiation measurements is shown in the picture below:
30-1000 MHz



1-9 GHz



Measurement equipment

Measurement equipment	RISE number
Semi anechoic chamber Tesla	503 881
R&S ESU 40	901 385
EMC 32 ver. 10.20.01	BX62351
ETS Lindgren BiConiLog 3142E	BX61914
ETS Lindgren Horn Antenna 3115	502 175
µComp Nordic, Low Noise Amplifier	901 545
HP Filter 1-20 GHz	901 501
Temperature and humidity meter, Testo 625	504 188

Results

Tested configurations: B, M, T, M5, Bim and Tim
representing worst case: Symbolic name M, TM 1, Diagram 1 a-b

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

Measurement uncertainty: 3.1 dB

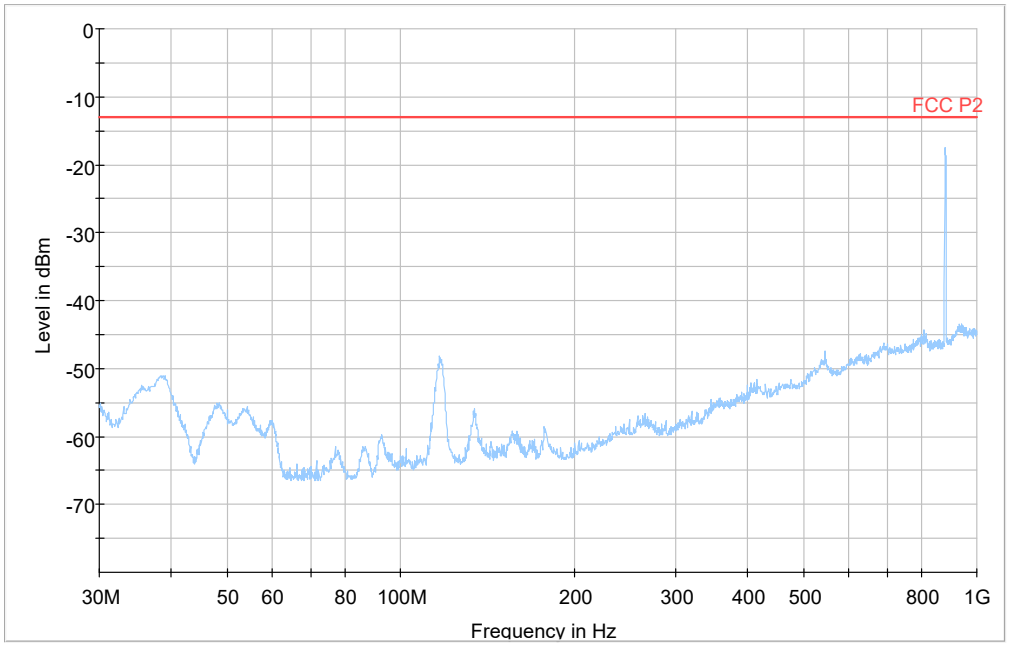
Limits

CFR 47 § 22.917: 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: 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.

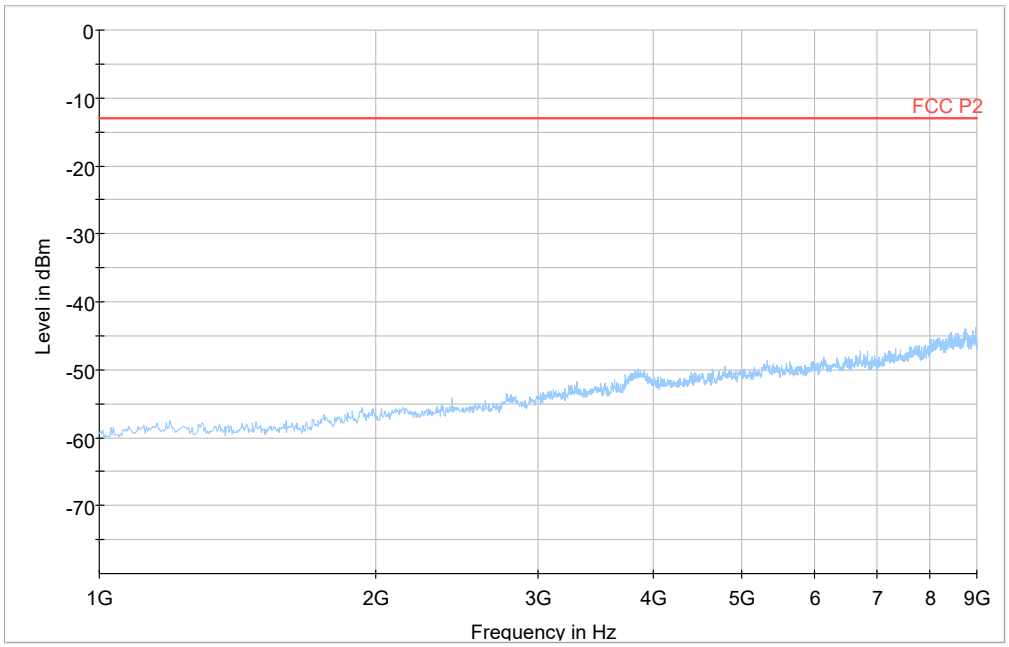
Complies?	Yes

Diagram 1a:



Note: The emission at 881.6 MHz is the carrier frequency and shall be ignored in the context.

Diagram 1b:



Frequency stability measurements according to CFR 47 §22.35865, §2.1055 / IC RSS-132 5.3

Date	Temperature (test equipment)	Humidity (test equipment)
2018-02-09	21 °C ± 3 °C	12% ± 5 %
2018-02-13	21 °C ± 3 °C	16% ± 5 %
2018-02-14	21 °C ± 3 °C	15% ± 5 %

Test set-up and procedure

The measurement was made per 3GPP TS 25.141. The output was connected to a spectrum analyser.

Measurement equipment	RISE number
R&S FSQ 40	504 143
RF attenuator	900 691
Temperature Chamber	503 360
Testo 635, temperature and humidity meter	504 203
Multimeter Fluke 87	502 190

Results

Nominal transmitter frequency was 881.6 MHz (M) with a TM 1. Rated output power level at connector RF A (maximum): 46 dBm.

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	Temp. (°C)	
40.8	+20	8
55.2	+20	6
48	+20	6
48	+30	15
48	+40	-10
48	+50	15
48	+10	-8
48	0	3
48	-10	8
48	-20	10
48	-30	35
Maximum freq. error (Hz)		35
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

The frequency error results clearly shows that the frequency stability is good enough to ensure that the transmitted carrier stay within the operating band.

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 to derive the TX frequency from.

Limits

3GPP TS 25.141:
The frequency error shall be within ± 0.05 PPM ± 12 Hz (± 44.08Hz).

§22.355
The frequency stability shall be within ± 1.5 ppm (± 1322.4 Hz).
RSS-132 5.3 Frequency:
The carrier frequency shall not depart from the reference frequency in excess of ± 1.5 ppm (± 1322.4 Hz) for base stations when tested to the temperature and supply voltage variations specified in RSS-Gen.

Complies?	Yes

Photos of test object

Front side

Rear side

Left side

Right side

Bottom side

Top side

Labels:

Radiated measurements:

Test object:

SFP module:

Conducted measurements:

Test object label:

SFP module: