Report No. 332888-04

Test Report

Product	KleerNet Transceiver Module
Name and address of the applicant	AUDIVO GmbH Irrenloher Damm 30 92521 Schwarzenfeld GERMANY
Name and address of the manufacturer	AUDIVO GmbH Irrenloher Damm 30 92521 Schwarzenfeld GERMANY
Model	DWAM83-TB
Rating	3.3Vdc
Trademark	KleerNet
Serial number	SMSC 2011
Additional information	The tested device contains radio module operates in U-NII Band III.
Tested according to	**FCC Part 15.407** Unlicensed National Information Infrastructure Devices (U-NII) **Industry Canada RSS-247, Issue 2** Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	332888
Tested in period	2018.07.31 – 2018.09.20
Issue date	2018.09.21
Name and address of the testing laboratory	Nemko Instituttveien 6 Kjeller, Norway SITE NUMBER: FCC: NO0001 IC: 2040D-1 ilac-MRA NORWEGIAN ACCREDITATION TEST 033 **An accredited technical test executed under the Norwegian accreditation scheme**

Prepared by [G.Suhanthakumar]	Approved by [Frode Sveinsen]

Template version: C

CONTENTS

1 INFORMATION

1.1 Test Item

Name :	KleerNet Transceiver Module
Model :	DWAM83-TB
FCC ID:	ZUC-DWAM83TB
IC ID:	23522-DWAM83TB
Serial number :	SMSC 2011
Hardware identity and/or version :	SMSC 2011
Software identity and/or version :	V1.31 (for Tx power test), V2.00 (product release)
Frequency Ranges :	5725 - 5850 MHz
Number of channels :	3
Channel BW:	20MHz
Maximum data rate:	22Mbps
Type of Modulation :	DARR-83: QPSK (Digital modulation)
Conducted Output Power :	3.8mW
Antenna Connector :	None
Declared antenna gain:	Ant. A: 3dBi, Ant. B: 3dBi
Number of Antennas :	2 (diversity)
Antenna Diversity Supported :	Yes
Smart Antennas Supported :	No
DFS/TPC :	N/A
Power Supply :	USB power 5Vdc
Desktop Charger :	N/A

Description of Test Item

The DWAM83 module provides a wireless digital audio link between one central unit (CU), that is usually a sender, and one or more mobile units (MU), usually configured as receivers.

The digital audio link allows transportation of up to 4 audio streams. The streams can consist of any combination of up- and downstreams between CU and one or more MU. A CU can serve multiple MU simultaneously. All MU have access to the same audio streams of the CU, to which they are paired to. On MU side it could be selected whether all or just a specific audio stream is presented on the digital audio outputs (SPDIF or I²S).

For applications using 1 Stereo stream audio data of up to 96kHz/24Bit is support. For applications using 4 stereo streams sample rate is limited to 48kHz. Audio sample rate for wireless link is always using 48kHz or 96kHz. Other sample rate on input interfaces are converted by internal SRC.

1.3 Normal test conditions

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	5 V dc

The values are the limit registered during the test period.

1.4 Test Engineer(s)

G. Suhanthakumar

1.5 Description of modification for Modification Filing

Not applicable.

1.6 Family List Rational

Not Applicable.

1.7 Antenna Requirement

Is the antenna detachable? ☐ Yes ☒ No

If detachable, is the antenna connector non-standard? ☐ Yes ☐ No

Type of antenna connector: N/A

Ref. FCC §15.203

1.8 Worst-Case Configuration and Mode

Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

1.9 Comments

The output level is set to maximum in the test software.

Test adapter with evaluation board.

All ports were populated during spurious emission measurements.

2 TEST REPORT SUMMARY

2.1 General

All measurements are tracable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.407 and Industry Canada RSS-247 Issue 2.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were performed in a semi-anechoic chamber at measuring distances of 1m, 3m and 10m.

A description of the test facility is on file with the FCC and Industry Canada.

☒ New Submission	☒ Production Unit
☐ Class II Permissive Change	☐ Pre-production Unit
NII Equipment Code	☐ Family Listing

THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in “Summary of Test Data”.

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247, Issue 2 RSS-GEN Issue 5 reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	Complies
Antenna Requirement	15.203	8.3 (RSS-GEN)	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	Complies
Maximum Output Power	15.407(a)(3)(4)(5)	6.2.4	Complies
Power Spectral Density	15.407(a)(3)	6.2.4	Complies
Unwanted Emissions	15.407(b)(4)(5)	6.2.4.2	Complies
Discontinuation of Transmission	15.407(c)	6.3	NT[1]
6 dB Bandwidth	15.407(e)	6.2.4.2	Complies
Frequency Stability	15.407(g)	6.11 (RSS-GEN)	Complies
Transmit Power Control	15.407(h)	6.2.3	N/A[2]
Dynamic Frequency Selection	15.407(h)	6.3	N/A[2]
Radiated Emissions	15.205 15.209	8.9 (RSS-GEN)	Complies

[1] See manufacturers declaration

[2] Not required for U-NII Band III.

3 TEST RESULTS

3.1 Power Line Conducted Emissions

FCC 15.207 (a)

ISED RSS-GEN, Issue 5, Clause 8.8

Measurement procedure: **ANSI C63.4-2014 using 50 µH/50 ohms LISN.**

Test Results: **Complies**

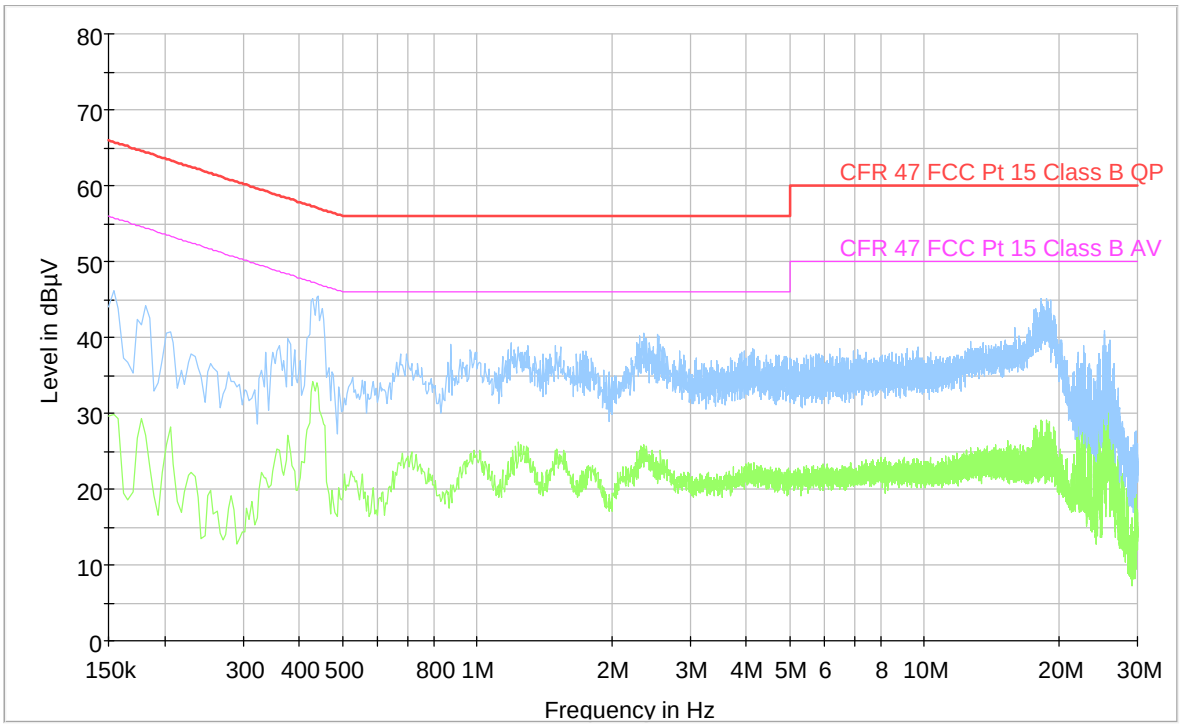
Measurement Data: **See attached graph**

AC/DC adapter type : AQUIL STAR PRECISION, Model: ASUC31e-050100

Input voltage to AC/DC adapter: 120Vac/60Hz

Highest measured value (L1 and N):

Full Spectrum



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
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3.2 Maximum Conducted Output Power

FCC 15.407 (a)

ISED RSS-247, Issue 2, Clause 6.2.4

Test Results: Complies

Measurement Data:

Ch. No.	Nominal Frequency (MHz)	Maximum Output Power (dBm)	
		Antenna A	Antenna B
1	5736	2.88	5.33
2	5762	2.98	5.12
3	5814	3.29	5.77

The test was performed using method SA-1 as described in KDB 789033 D02.

Transmission 100% duty cycle.

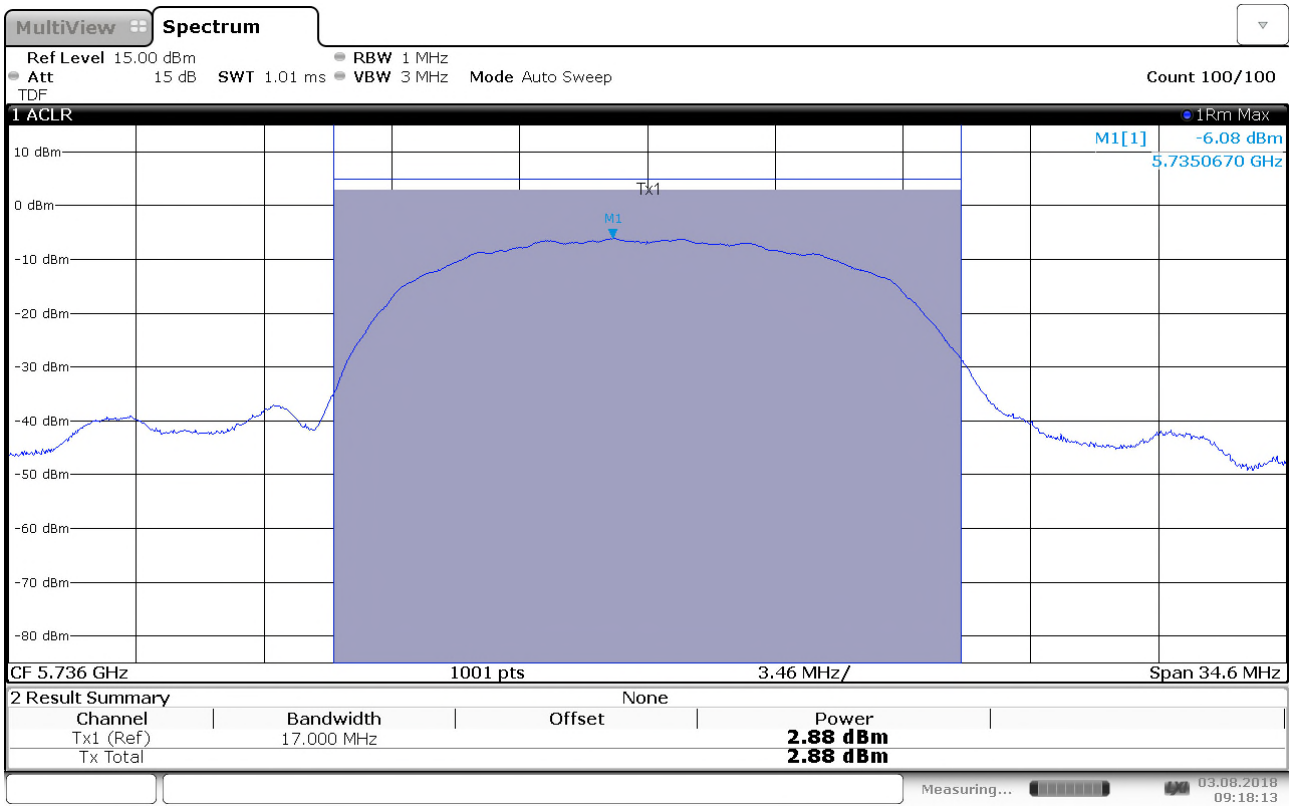
Emission Bandwidth *B* is 16.7 MHz

Power limits:

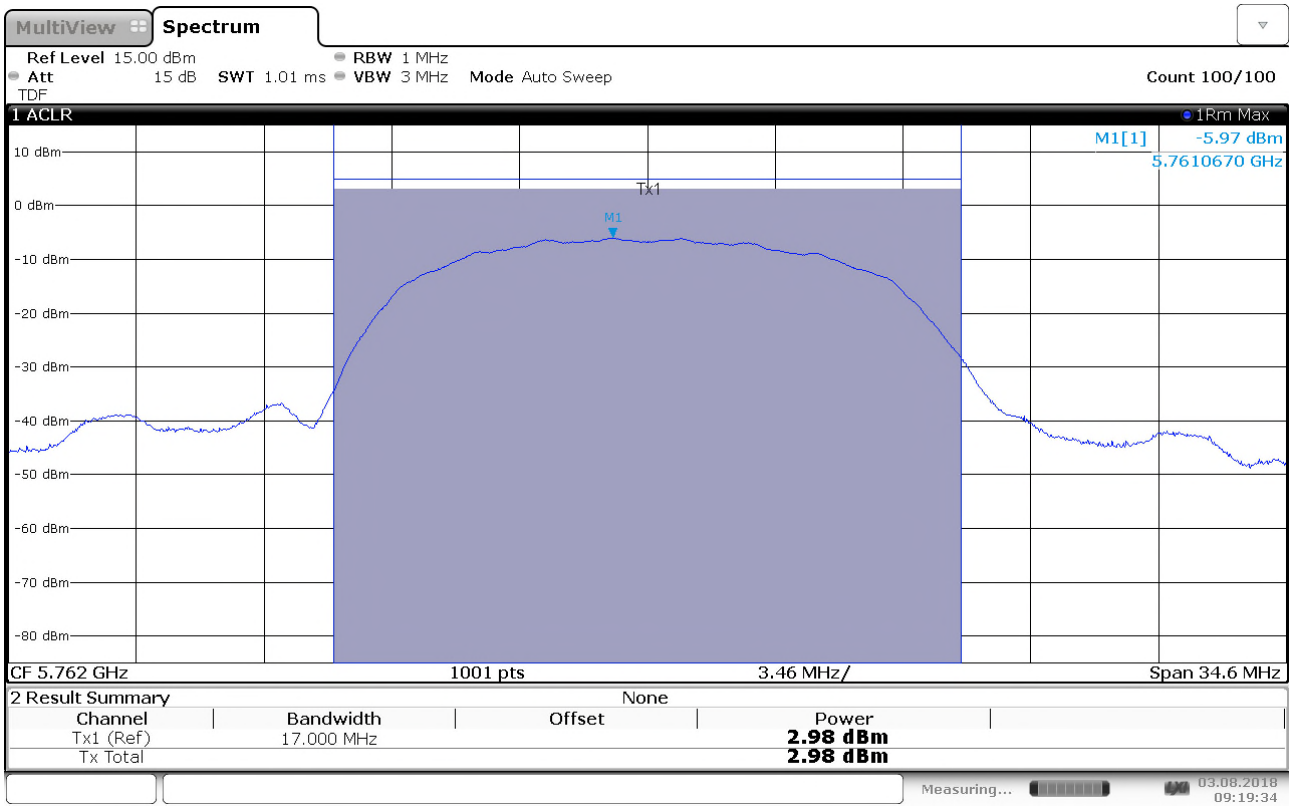
Frequency Band	Power limit	
5150 – 5250 MHz	Less than the lesser of 50mW or 4 dBm + 10 log *B*	16.9 dBm
5250 – 5350 MHz	Less than the lesser of 250 mW or 11 dBm + 10 log *B*	23.9 dBm
5470 – 5725 MHz		
5725 – 5825 MHz	Less than the lesser of 1 Watt (30 dBm) or 17 dBm + 10 log *B*	29.2 dBm

B is the 26 dB emission bandwidth in MHz

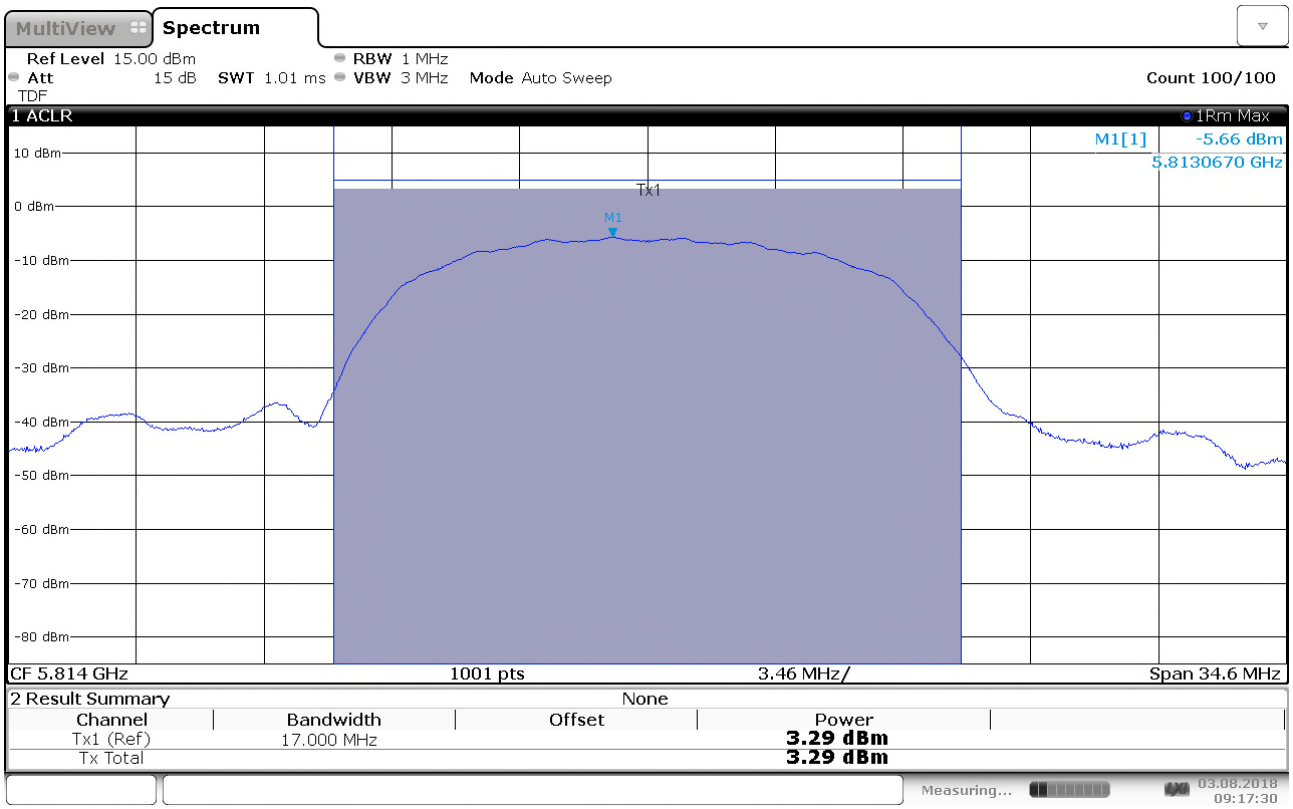
If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



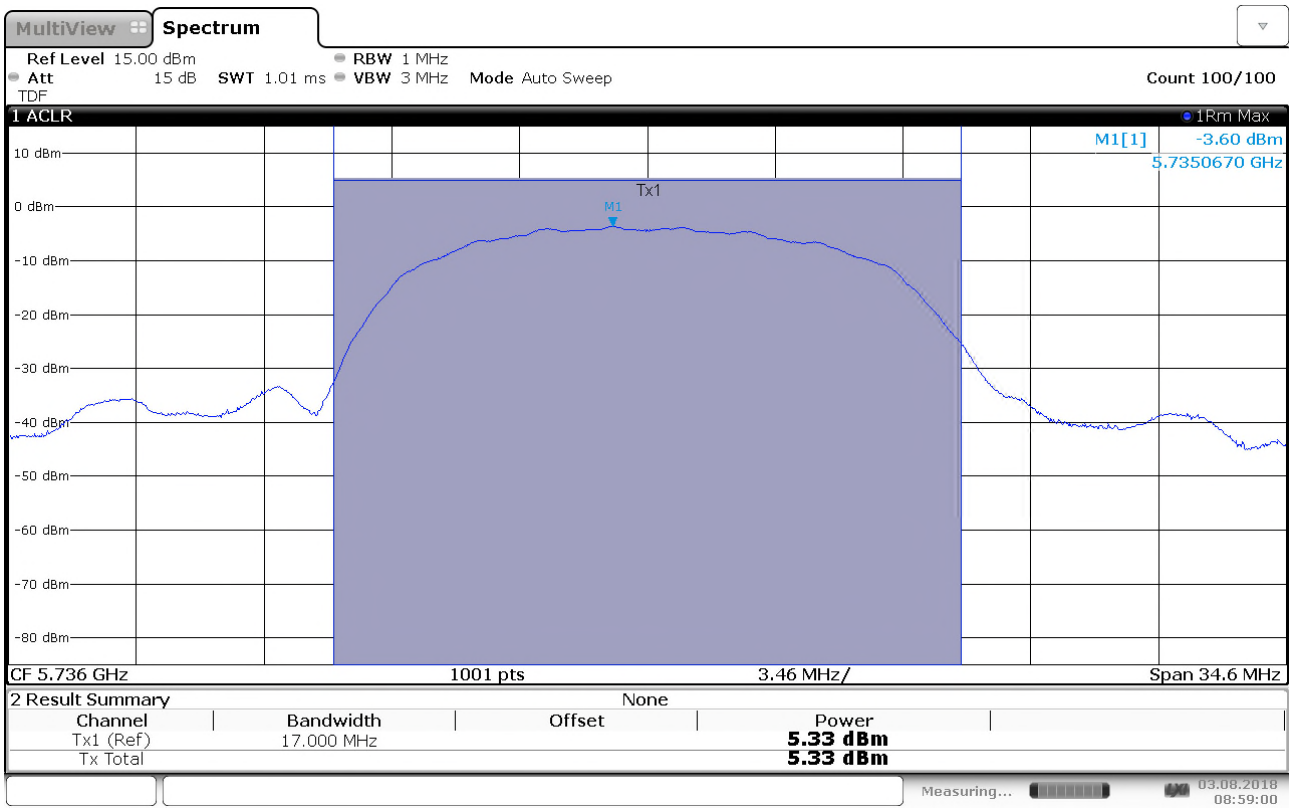
Output Power, 5736 MHz, Antena A, Conducted



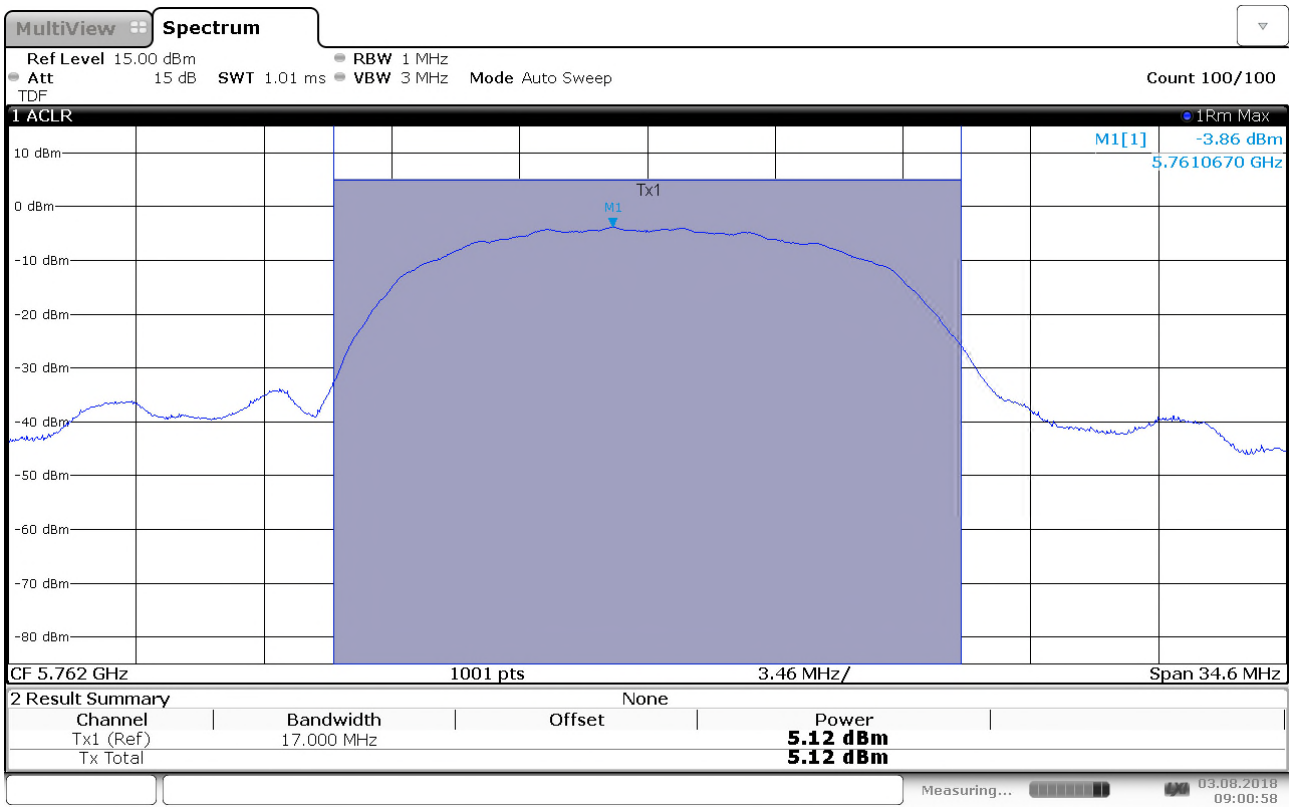
Output Power, 5762 MHz, Antena A , Conducted



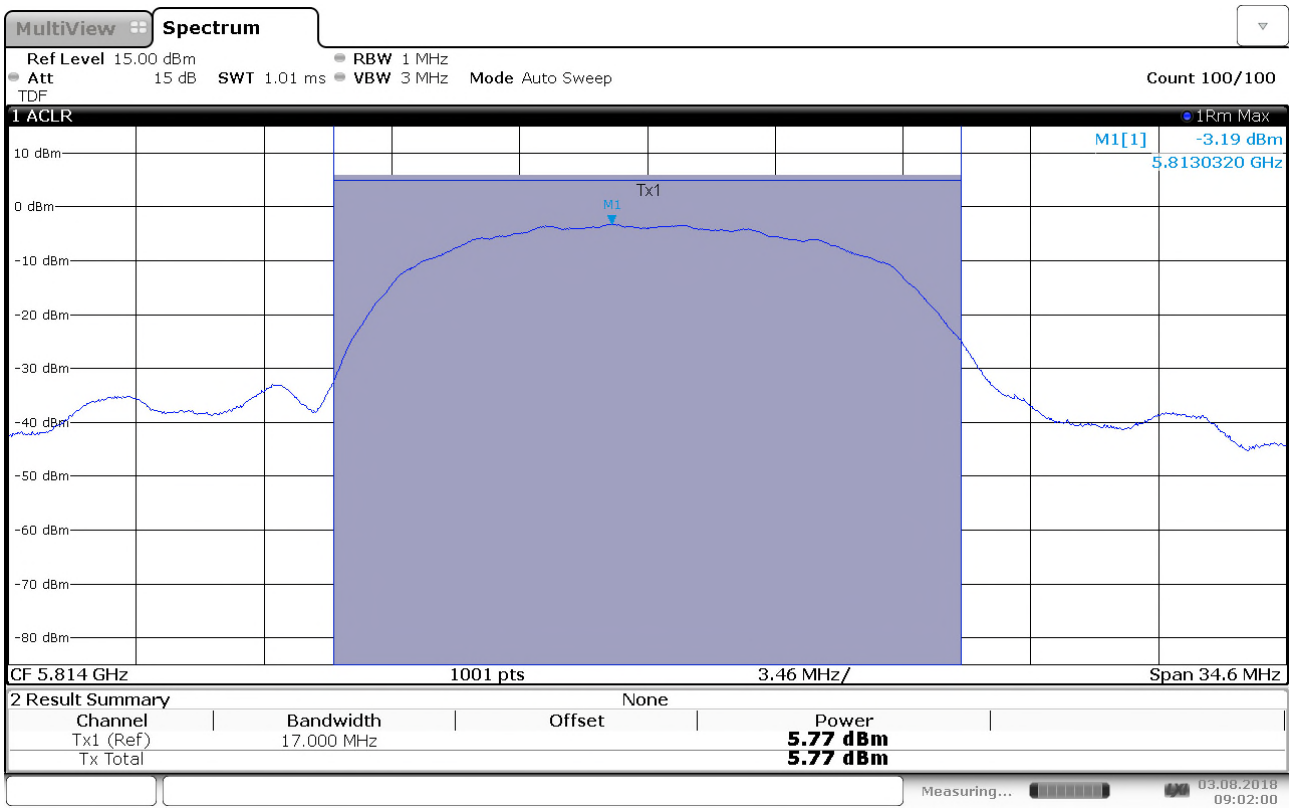
Output Power, 5814 MHz, Antena A , Conducted



Output Power, 5736 MHz, Antena B, Conducted



Output Power, 5762 MHz, Antena B , Conducted



Output Power, 5814 MHz, Antena B , Conducted

3.3 Peak Power Spectral density

FCC 15.407 (a)(3)

ISED RSS-247, Issue 2, Clause 6.2.4.1

Test Results: Complies

Measurement Data:

Ch. No.	Nominal Frequency (MHz)	Output Power spectral density (dBm)	
		Antenna A	Antenna B
1	5736	-7.18	-4.98
2	5762	-7.38	-4.95
3	5814	-7.11	-4.47

The test was performed using method SA-1 as described in KDB 789033 D02.

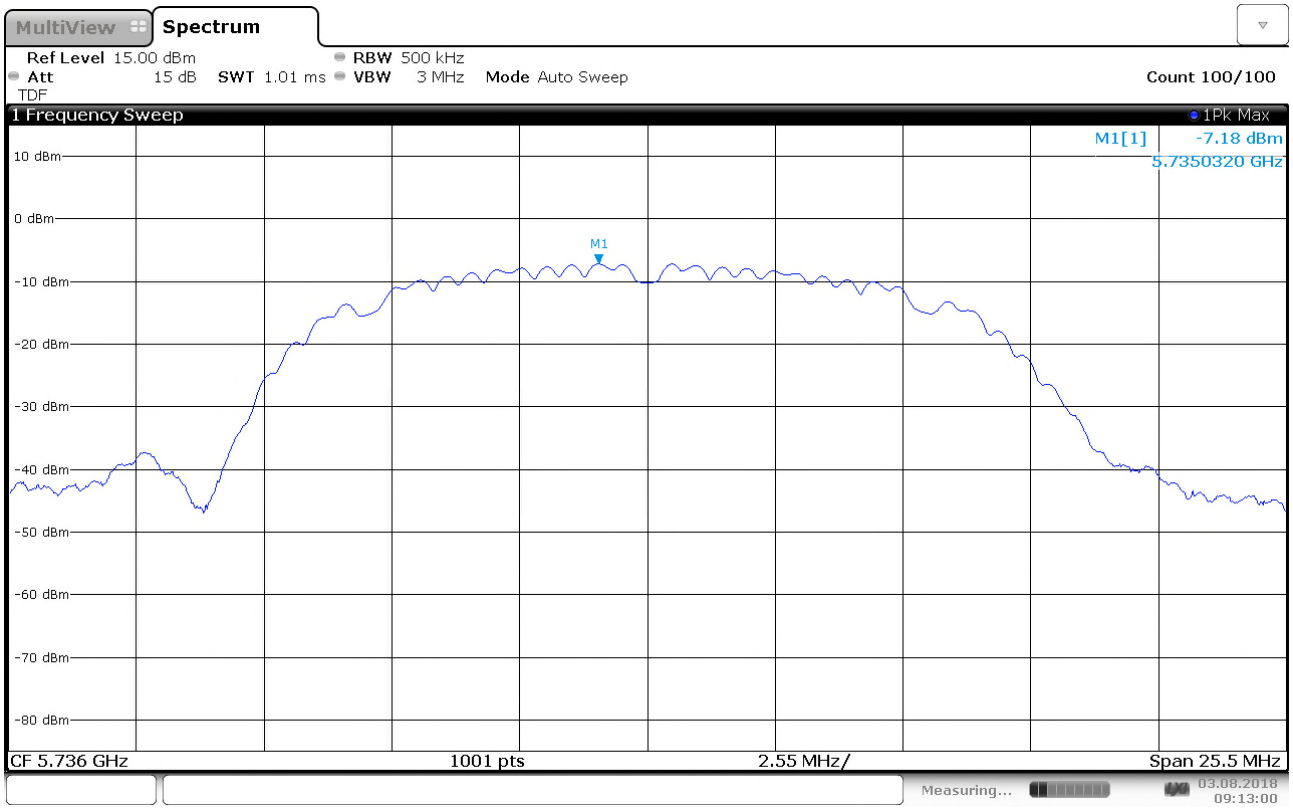
Transmission 100% duty cycle.

Requirements:

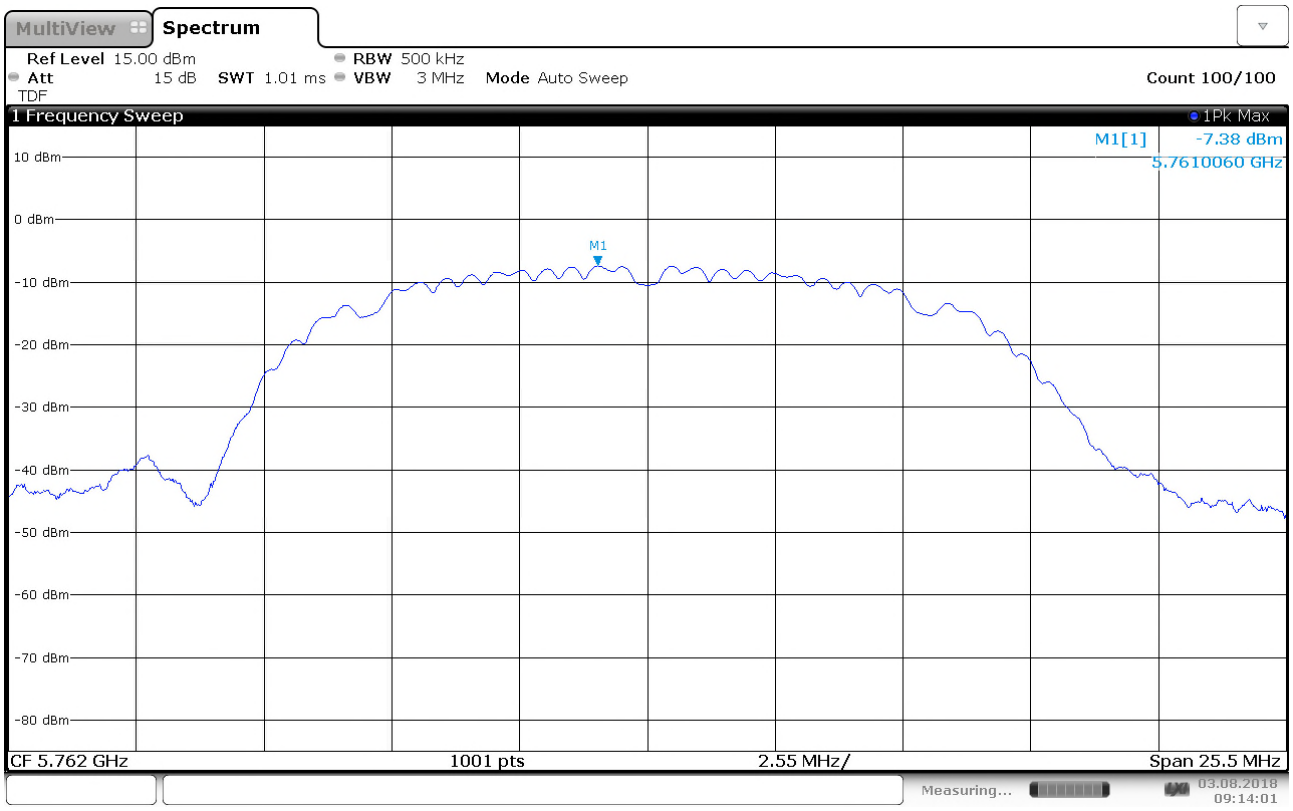
Power Spectral Density limits:

Frequency Band	Max Conducted Power Spectral Density	
	FCC 15.407(a)	RSS-247, Issue 1
5150 – 5250 MHz	17 dBm/MHz for master device 11 dBm/MHz for mobile/ portable client device	10 dBm/MHz (only indoor allowed)
5250 – 5350 MHz	11 dBm/MHz	The lesser of 30 dBm/MHz or $17 + 10\log_{10}B$ dBm/MHz (B is 99% BW in MHz)
5470 – 5725 MHz	11 dBm/MHz	The lesser of 30 dBm/MHz or $17 + 10\log_{10}B$ dBm/MHz (B is 99% BW in MHz)
5725 – 5825 MHz	30 dBm/500kHz	30 dBm/500kHz

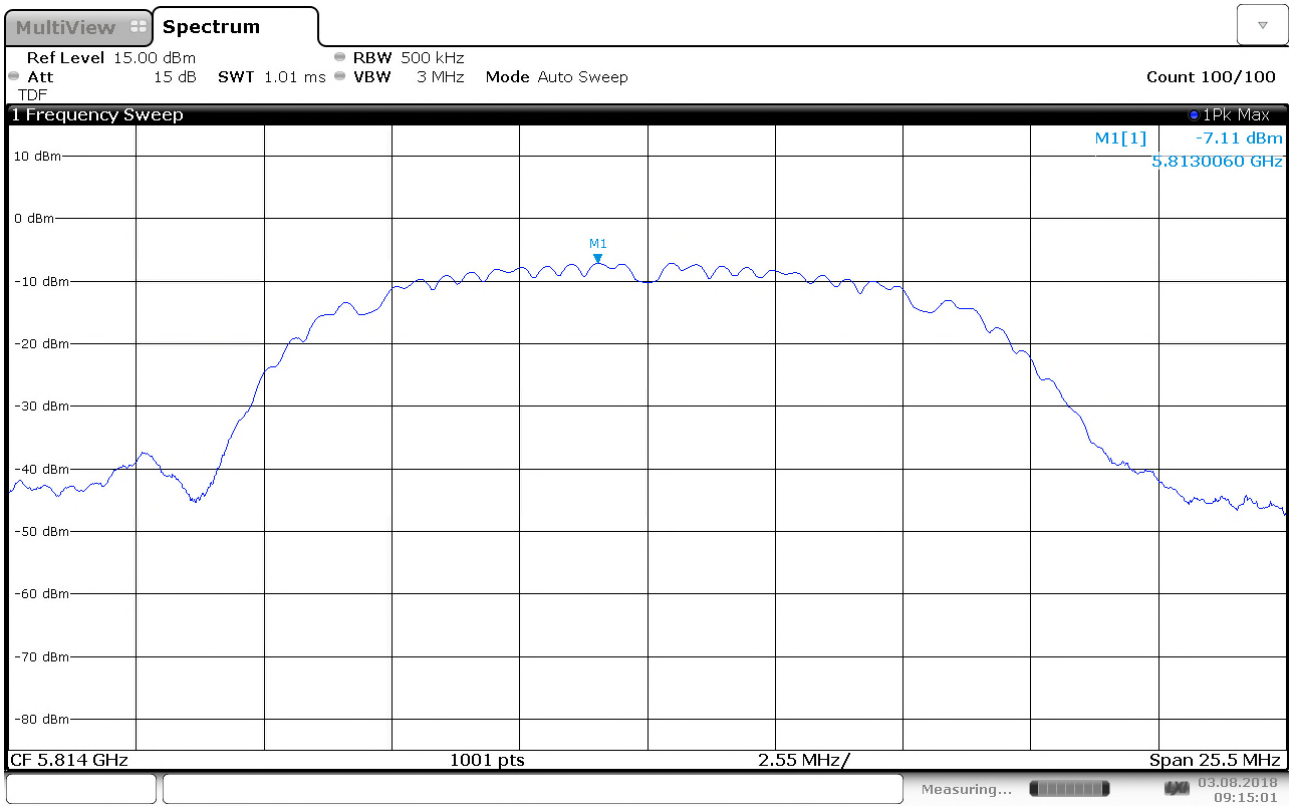
If transmitting antennas of directional gain greater than 6 dBi are used, the power spectral density from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



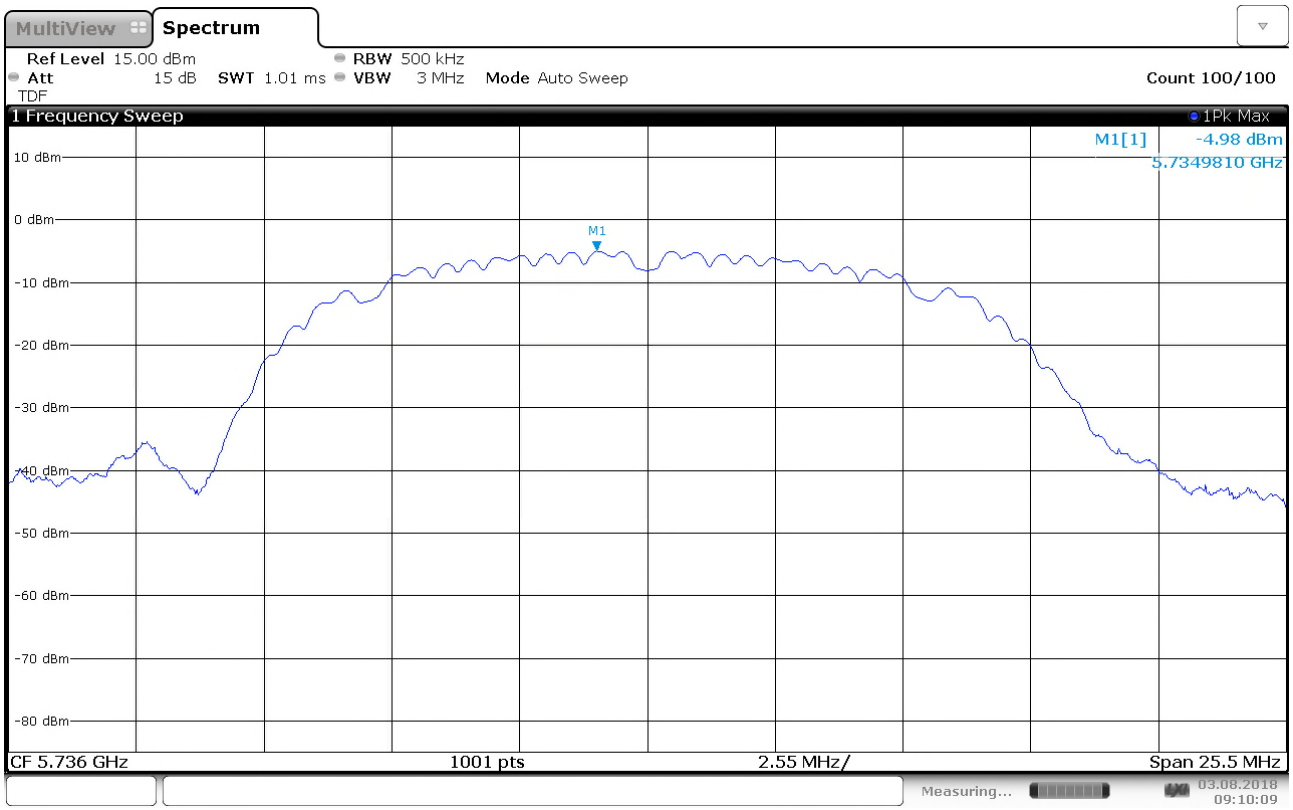
Output Power spectral density, 5736 MHz, Antena A, Conducted



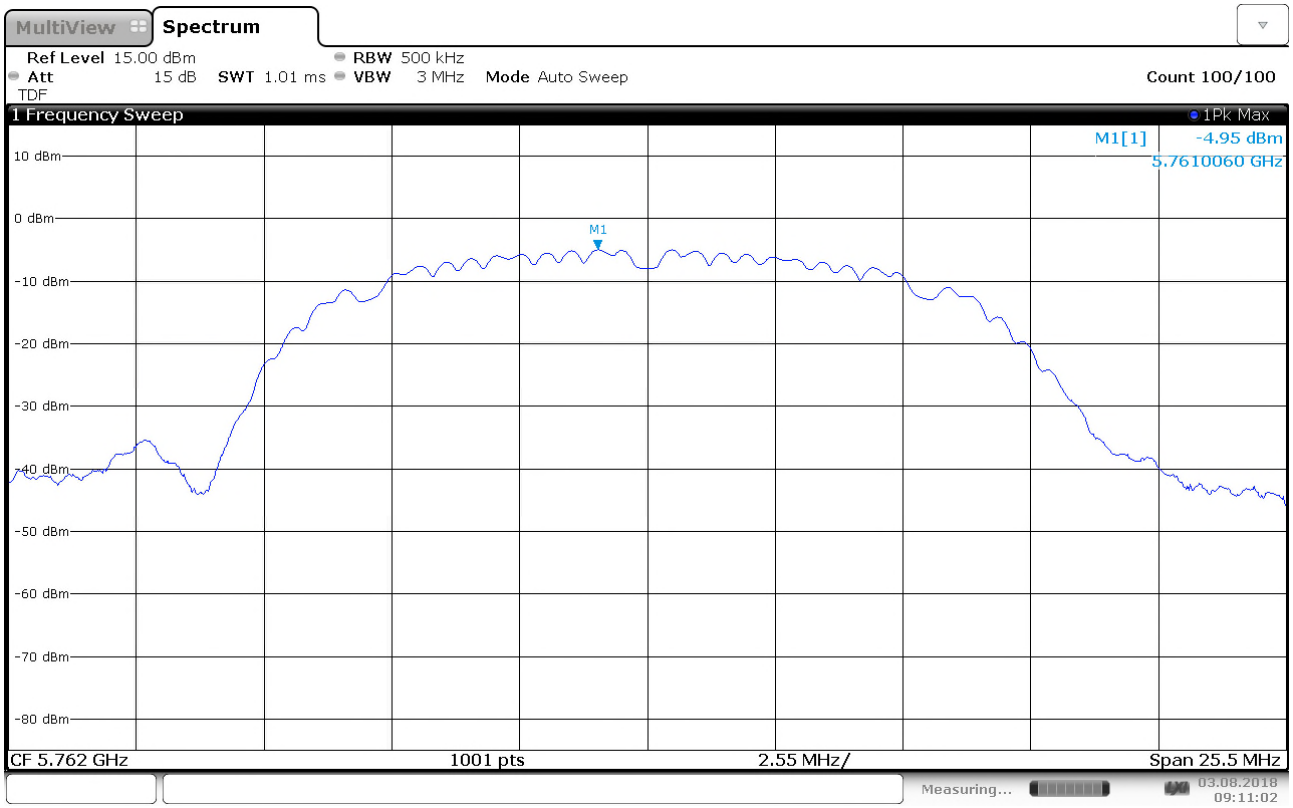
Output Power spectral density, 5762 MHz, Antena A , Conducted



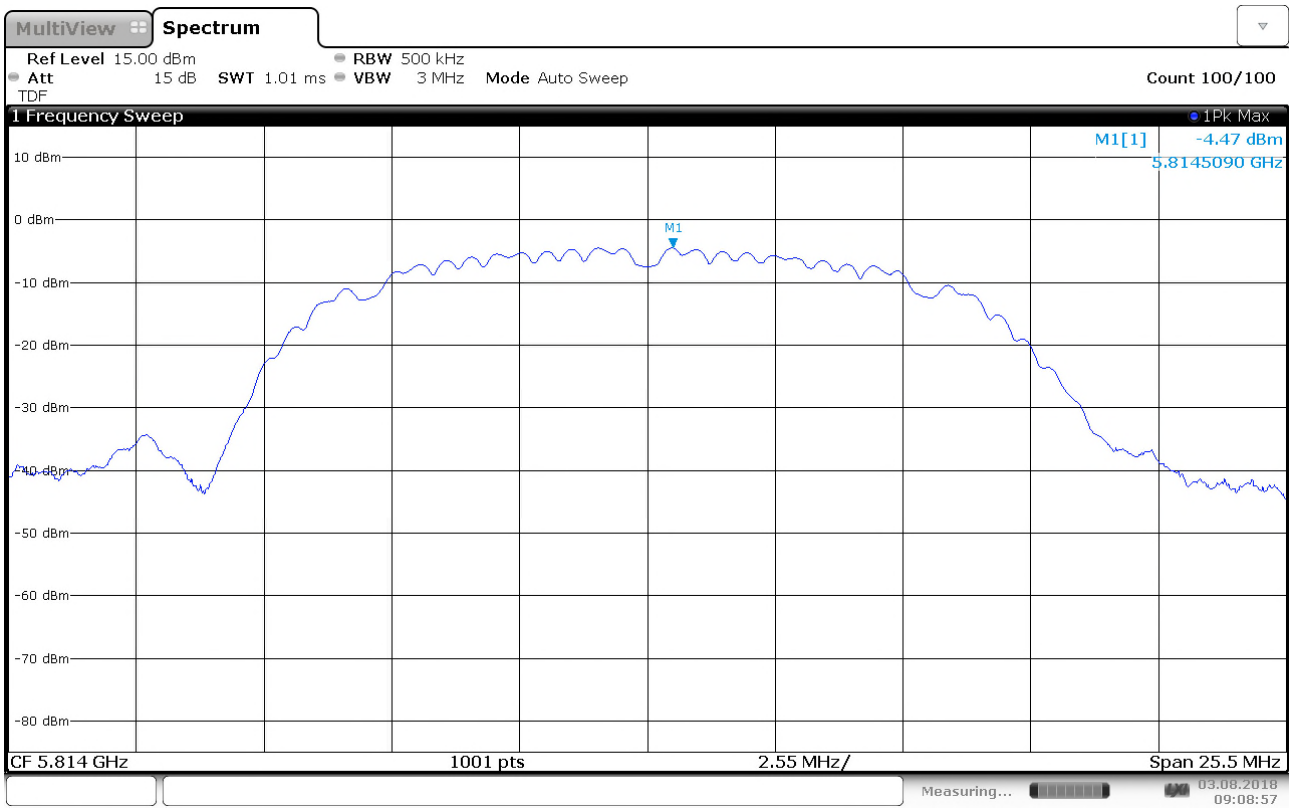
Output Power spectral density, 5814 MHz, Antena A , Conducted



Output Power spectral density, 5736 MHz, Antena B, Conducted



Output Power spectral density, 5762 MHz, Antena B , Conducted



Output Power spectral density, 5814 MHz, Antena B , Conducted

3.4 Emission Bandwidth *B*

Para. No.: 15.407(a)(4)(5)

ISED RSS-GEN, Issue 5, Clause 6.6

Test Results: Complies

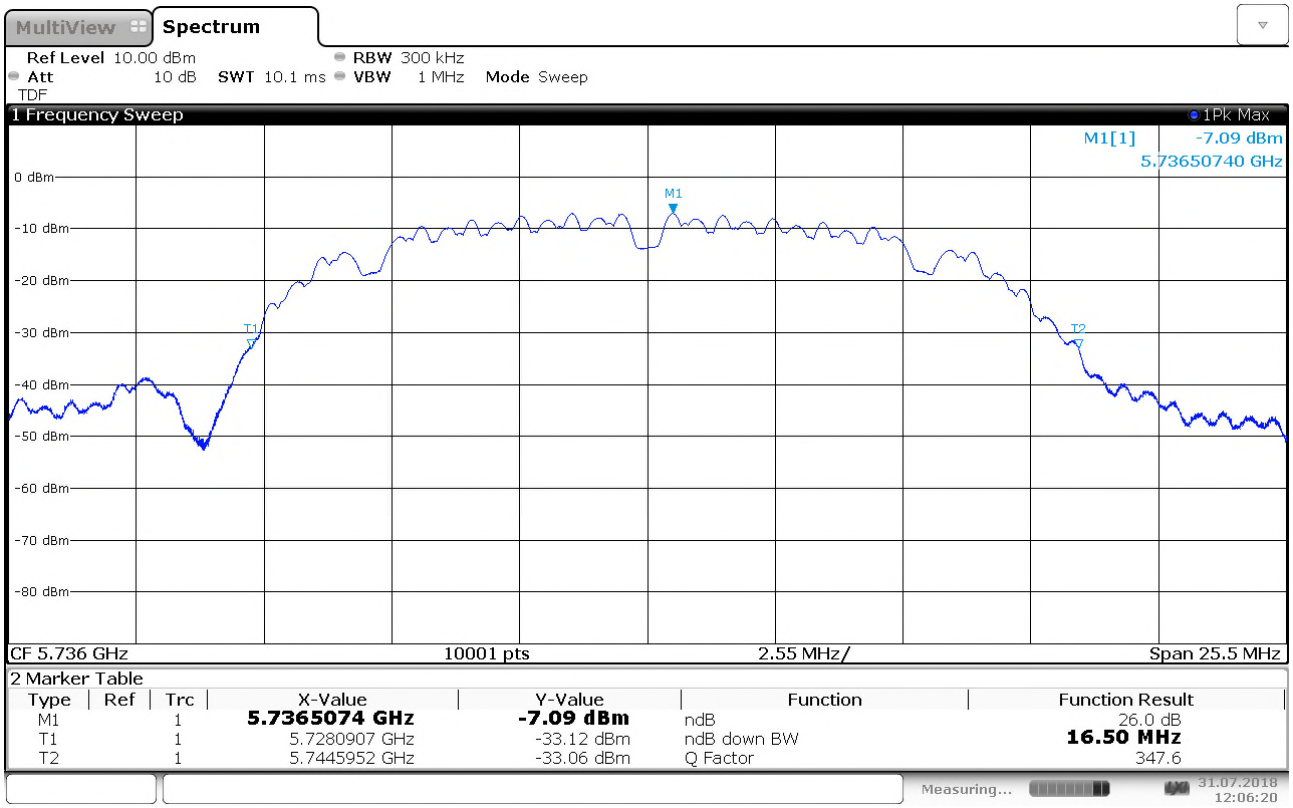
Measurement Data:

Ch. No.	Nominal Frequency (MHz)	26dB Bandwidth Measured Values (MHz)	
		Antenna A	Antenna B
1	5736	16.5	16.5
2	5762	16.7	16.7
3	5814	16.7	16.7

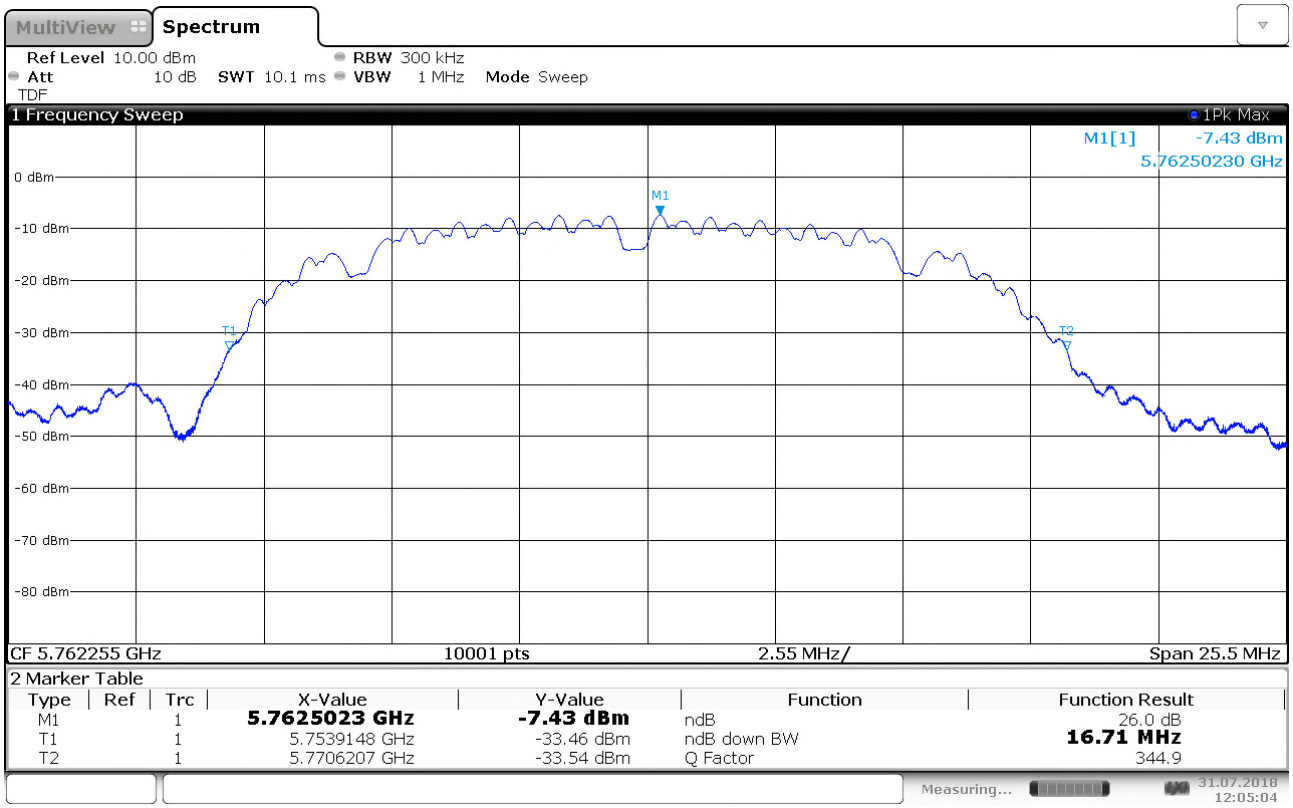
The nominal Emissions Bandwidth is 20 MHz.

Limit:

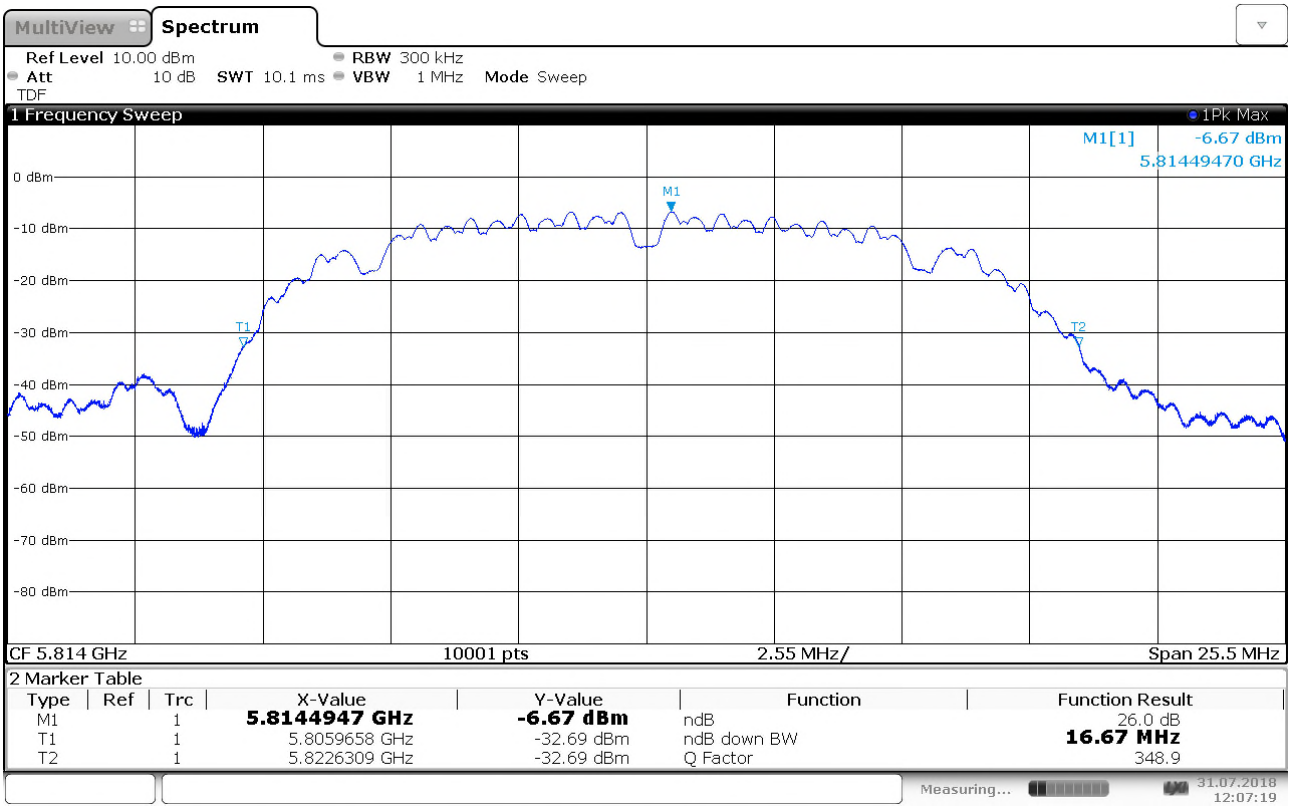
No requirements as long as the emissions are within the band-edges.



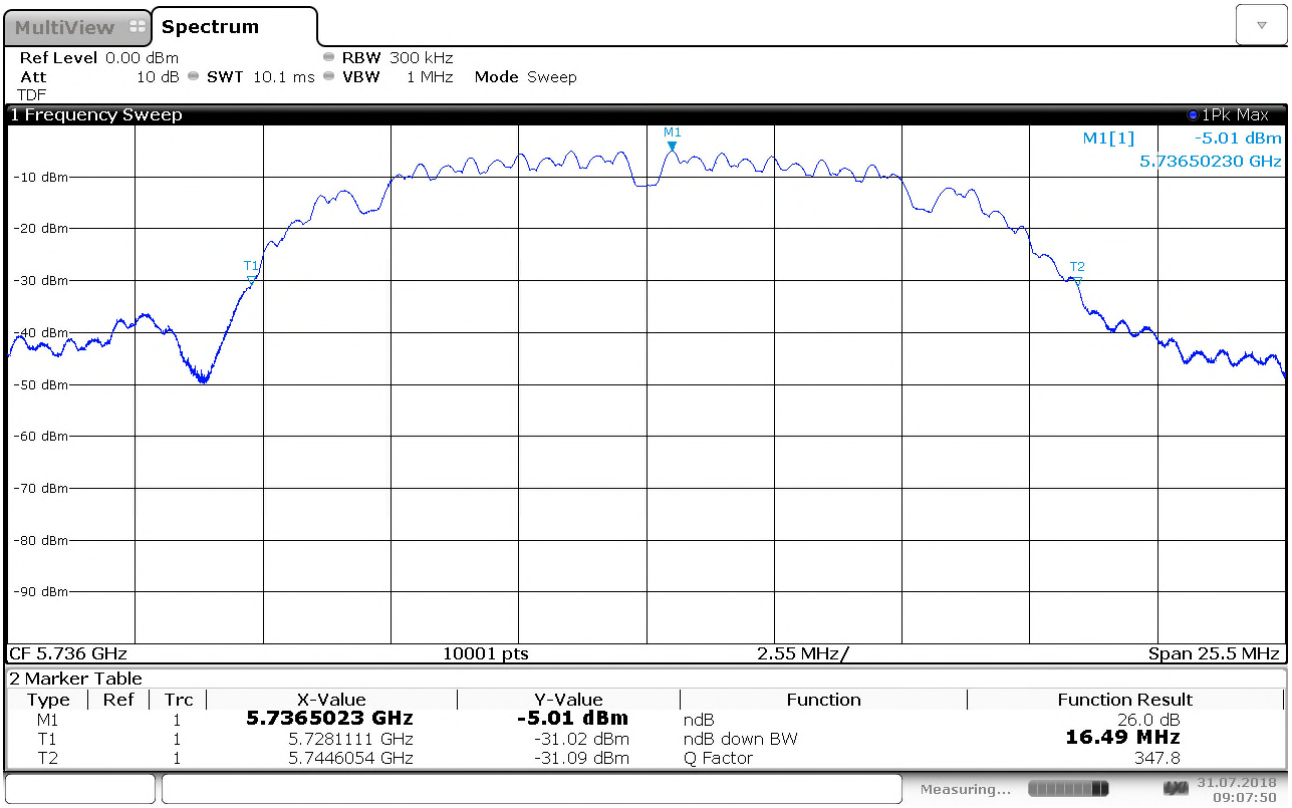
Emission Bandwidth *B*, 5736 MHz, Antena A, Conducted



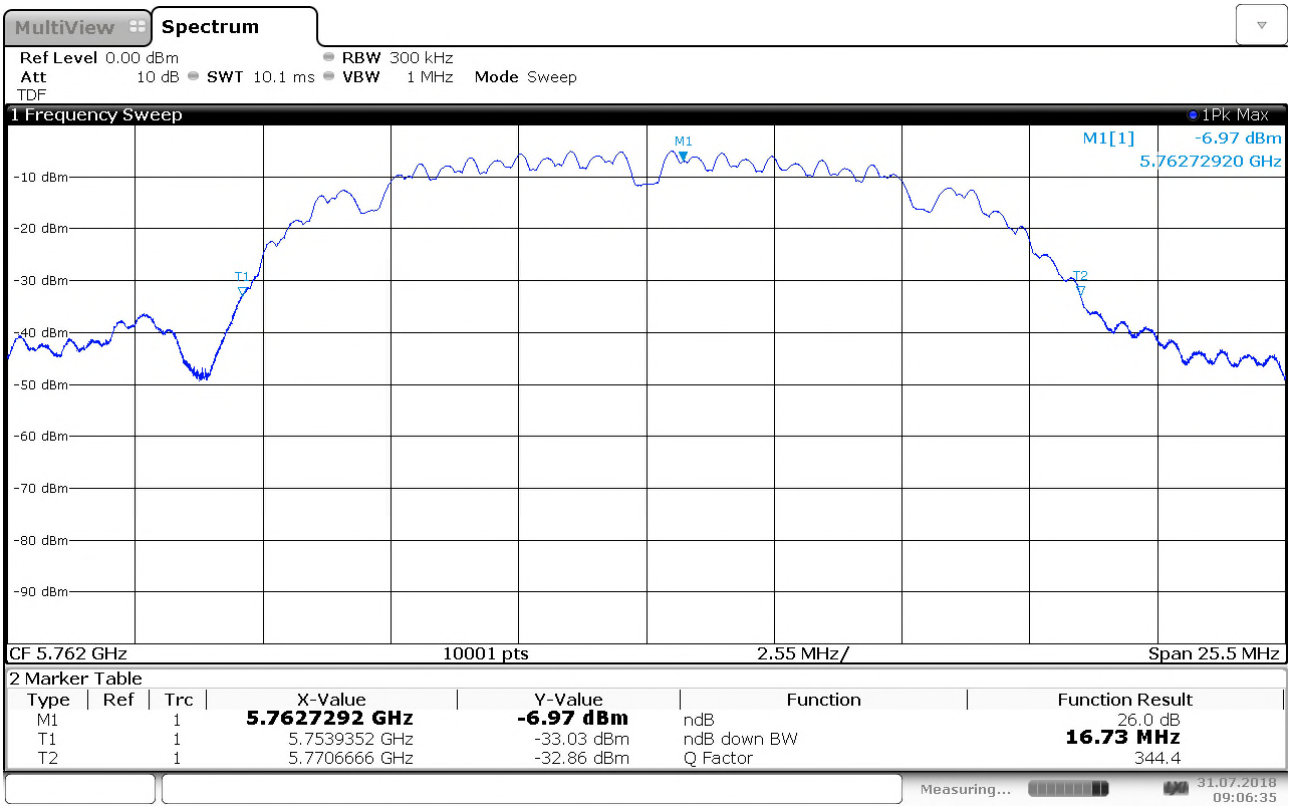
Emission Bandwidth *B*, 5762 MHz, Antena A , Conducted



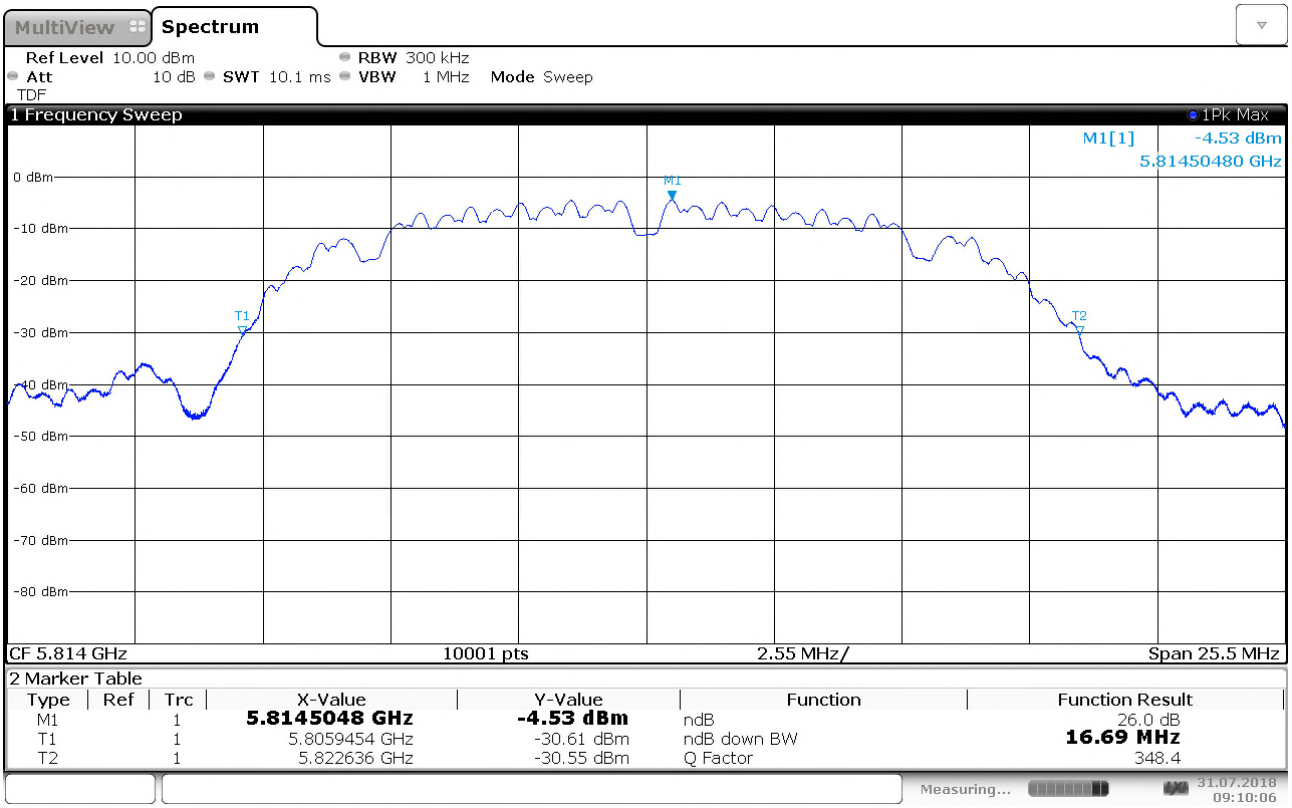
Emission Bandwidth *B*, 5814 MHz, Antena A ,Conducted



Emission Bandwidth *B*, 5736 MHz, Antena B, Conducted



Emission Bandwidth *B*, 5762 MHz, Antena B , Conducted



Emission Bandwidth *B*, 5814 MHz, Antena B , Conducted

3.5 6 dB Bandwidth

Para. No.: 15.407(e)

ISED RSS-GEN, Issue 5, Clause 6.6

Test Results: Complies

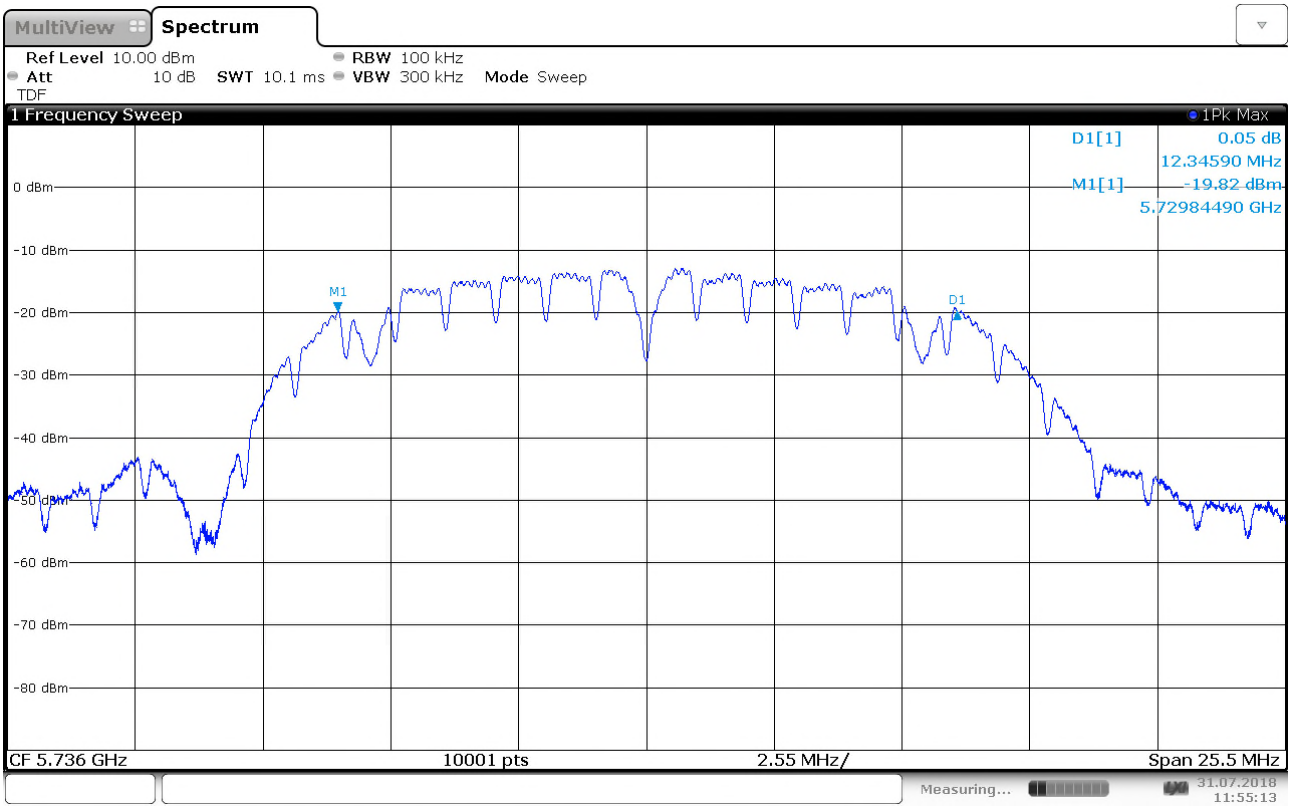
Measurement Data:

Ch. No.	Nominal Frequency (MHz)	6dB Bandwidth Measured Values (MHz)	
		Antenna A	Antenna B
1	5736	12.3	12.3
2	5762	12.3	12.4
3	5814	12.3	12.3

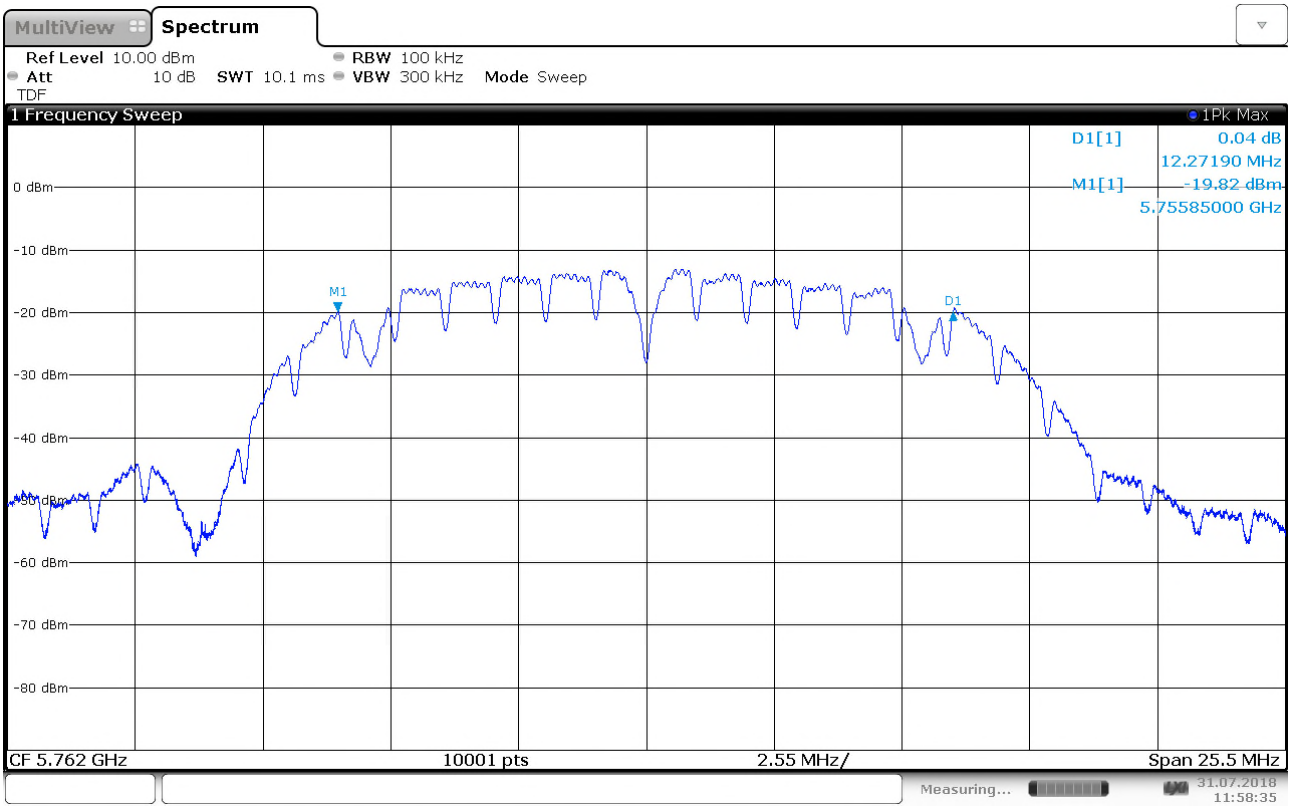
The test was performed using method C.2. as described in KDB 789033 D02.

Limit:

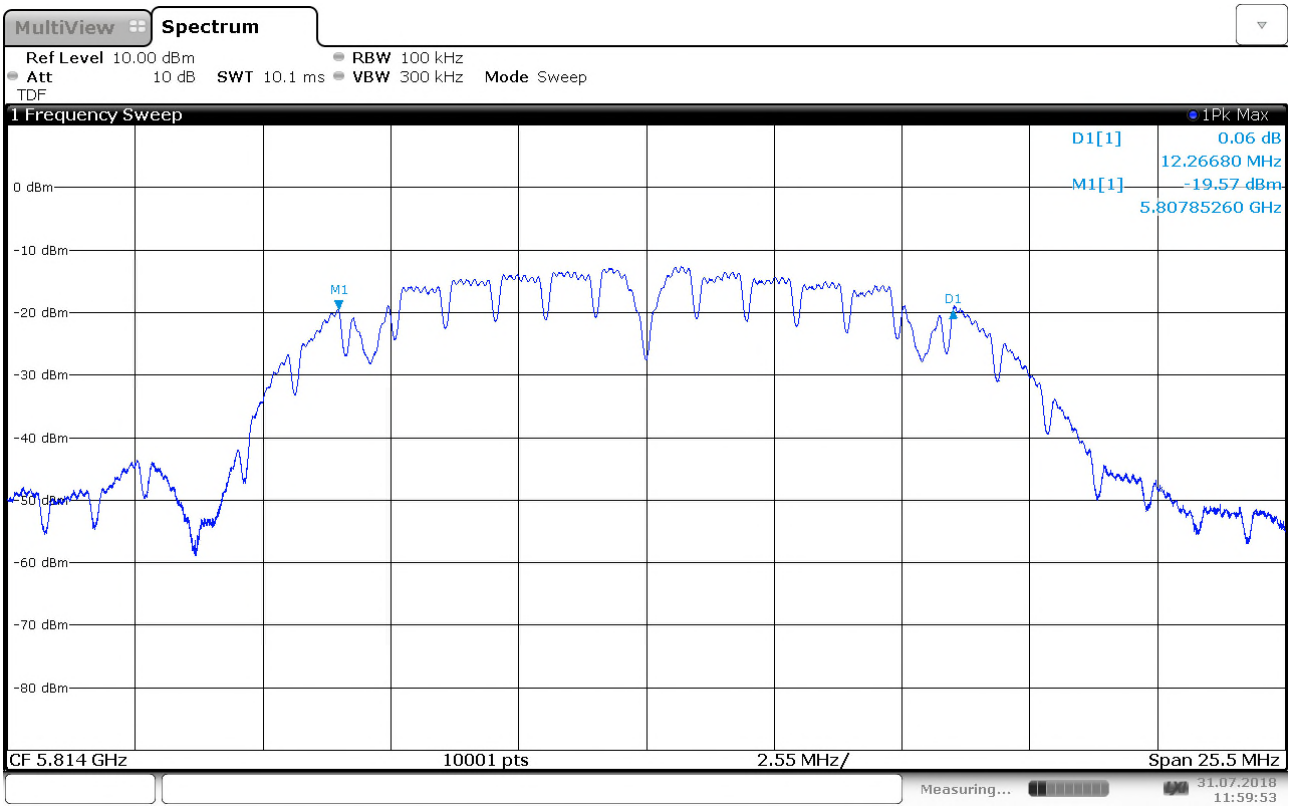
Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.



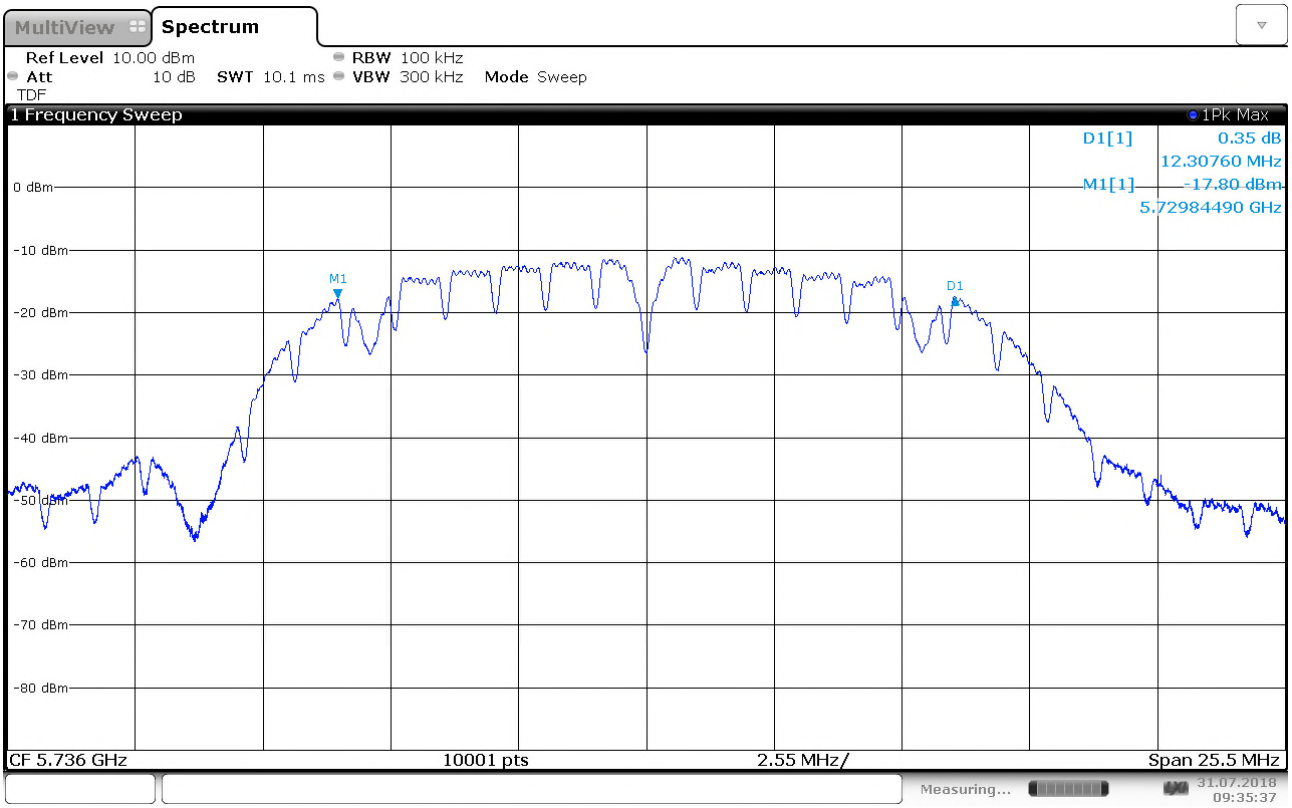
6 dB Bandwidth, 5736 MHz, Antena A , Conducted



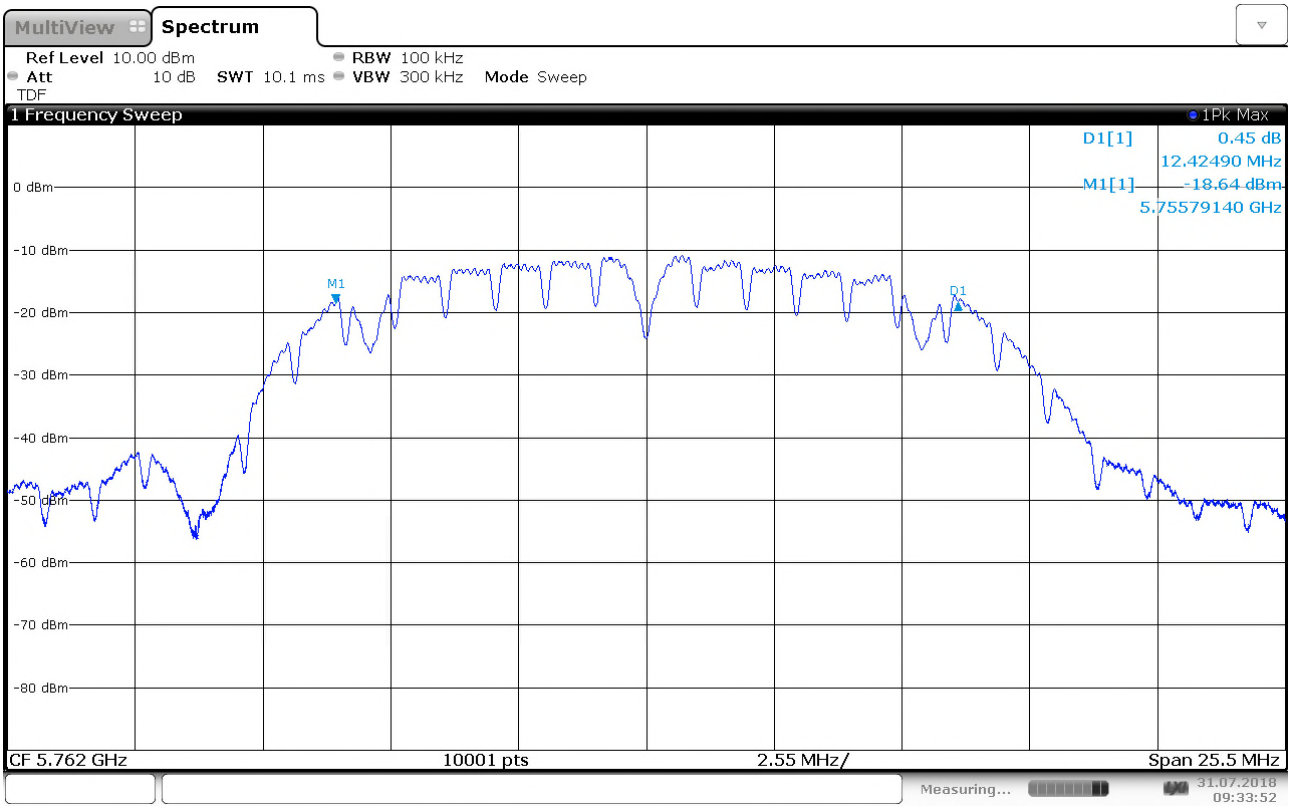
6 dB Bandwidth, 5762 MHz, Antena A , Conducted



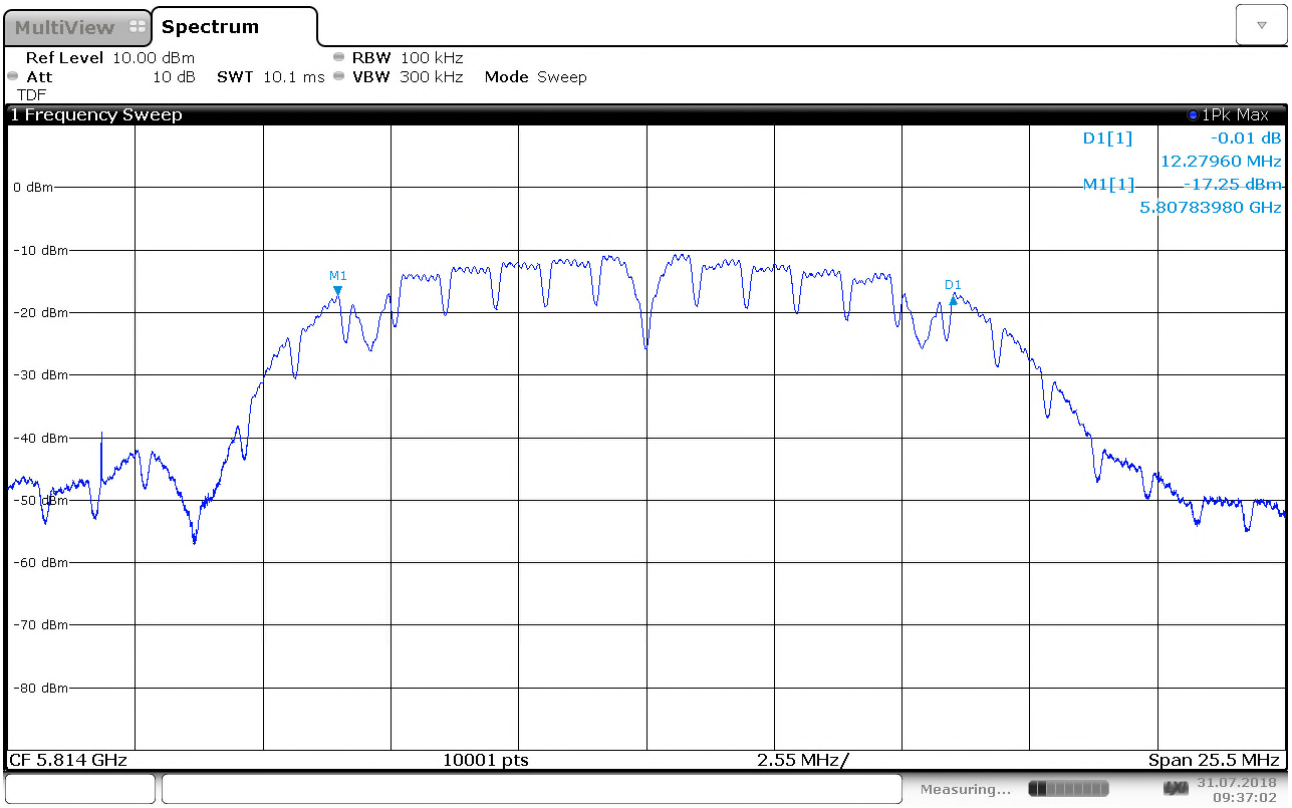
6 dB Bandwidth, 5814 MHz, Antena A , Conducted



6 dB Bandwidth, 5736 MHz, Antena B , Conducted



6 dB Bandwidth, 5762 MHz, Antena B , Conducted



6 dB Bandwidth, 5814 MHz, Antena B , Conducted

3.6 99% Bandwidth

Para. No.: 15

ISED RSS-GEN, Issue 5, Clause 6.6

Test Results: Complies

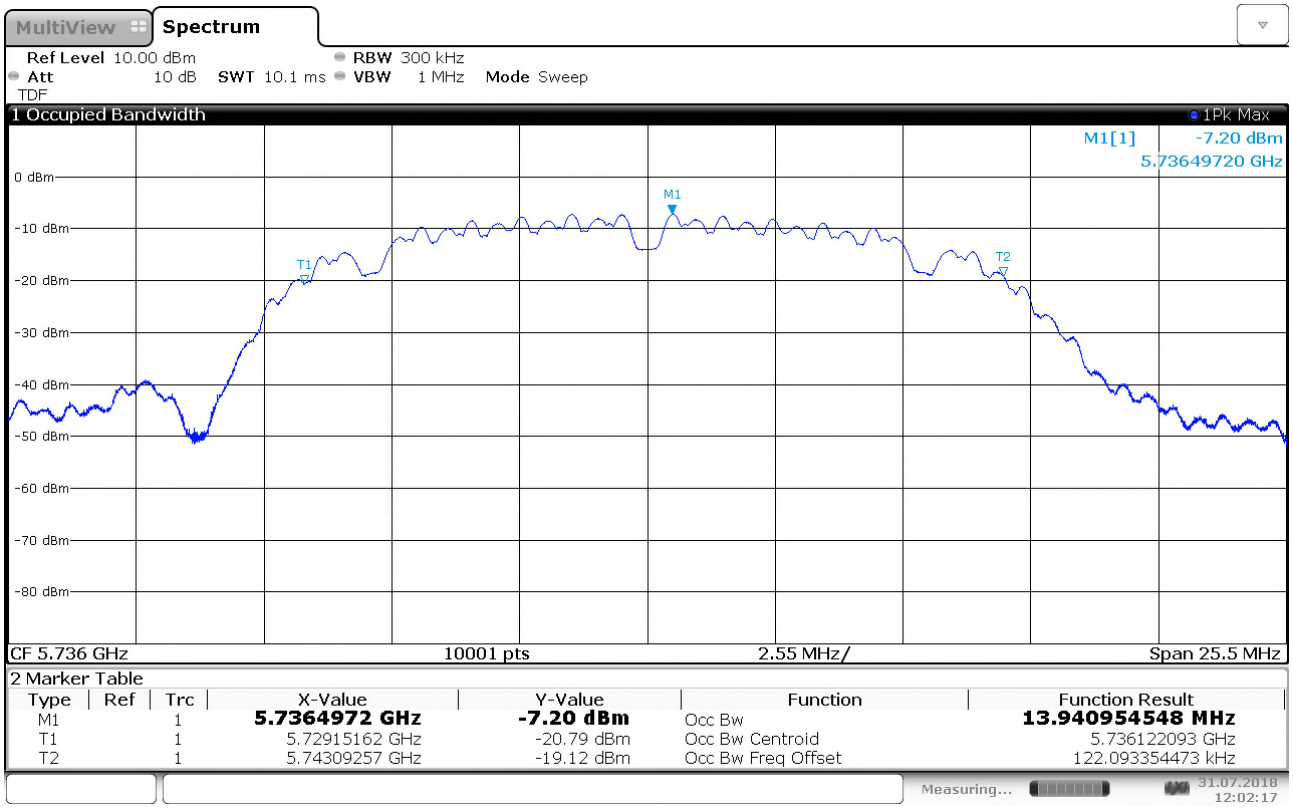
Measurement Data:

Ch. No.	Nominal Frequency (MHz)	99% Bandwidth Measured Values (MHz)	
		Antenna A	Antenna B
1	5736	13.9	13.9
2	5762	13.9	13.8
3	5814	13.8	13.9

The test was performed using method D as described in KDB 789033 D02.

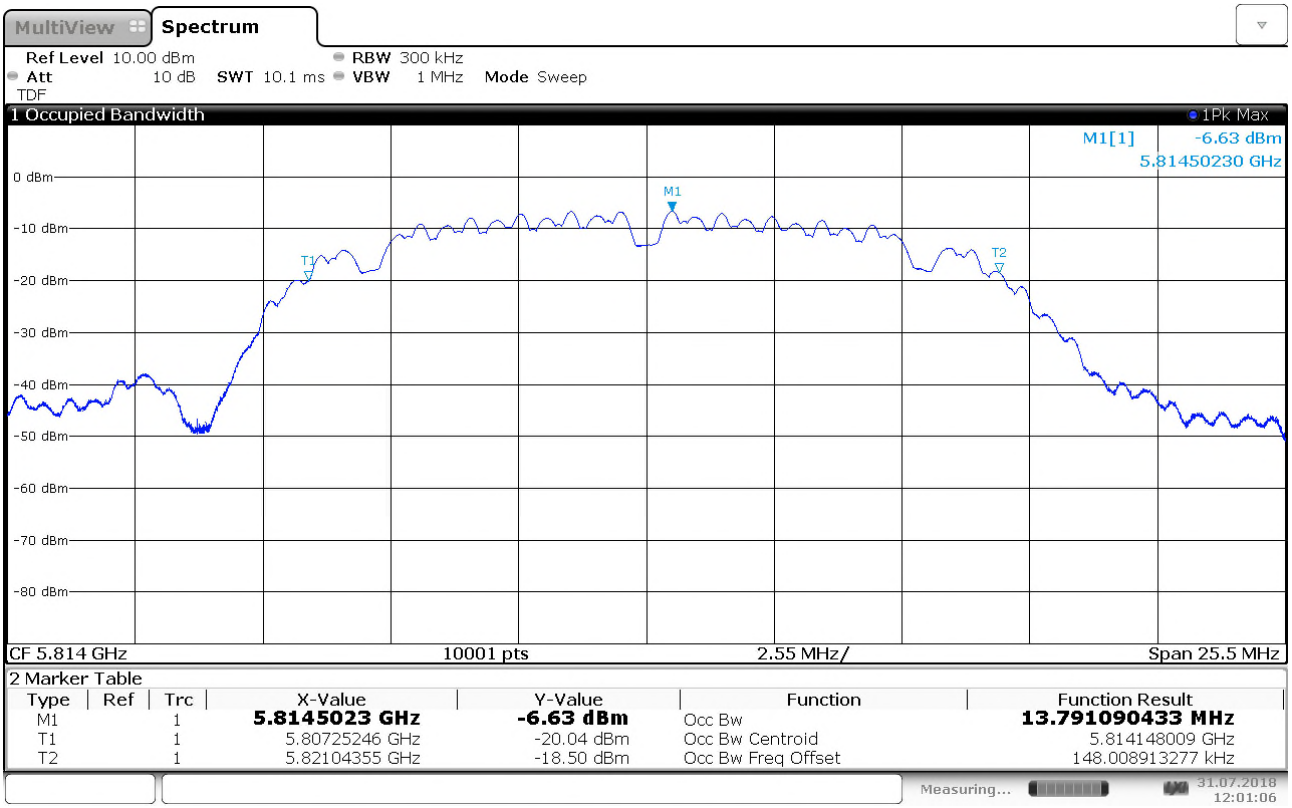
Limit:

No requirements as long as the emissions are within the band-edges.

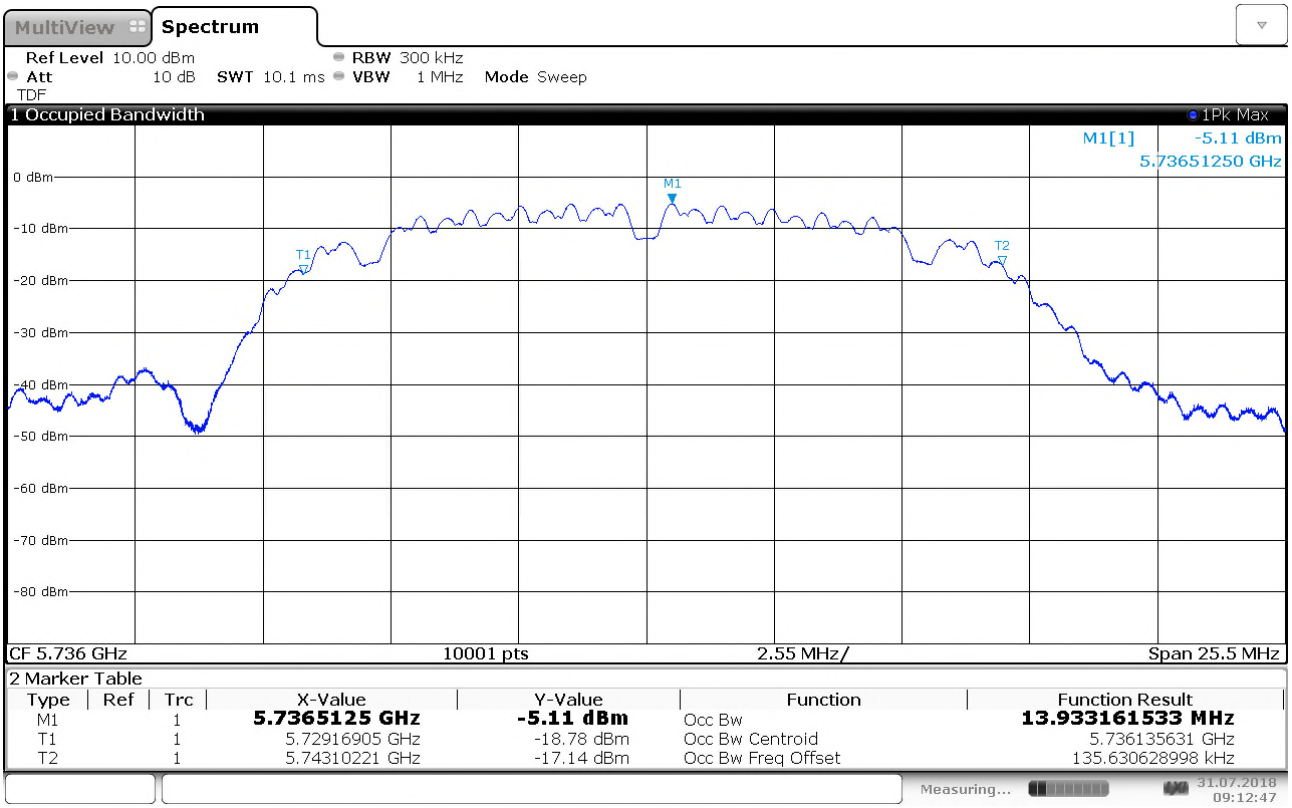


99% Bandwidth, 5736 MHz, Antena A , Conducted

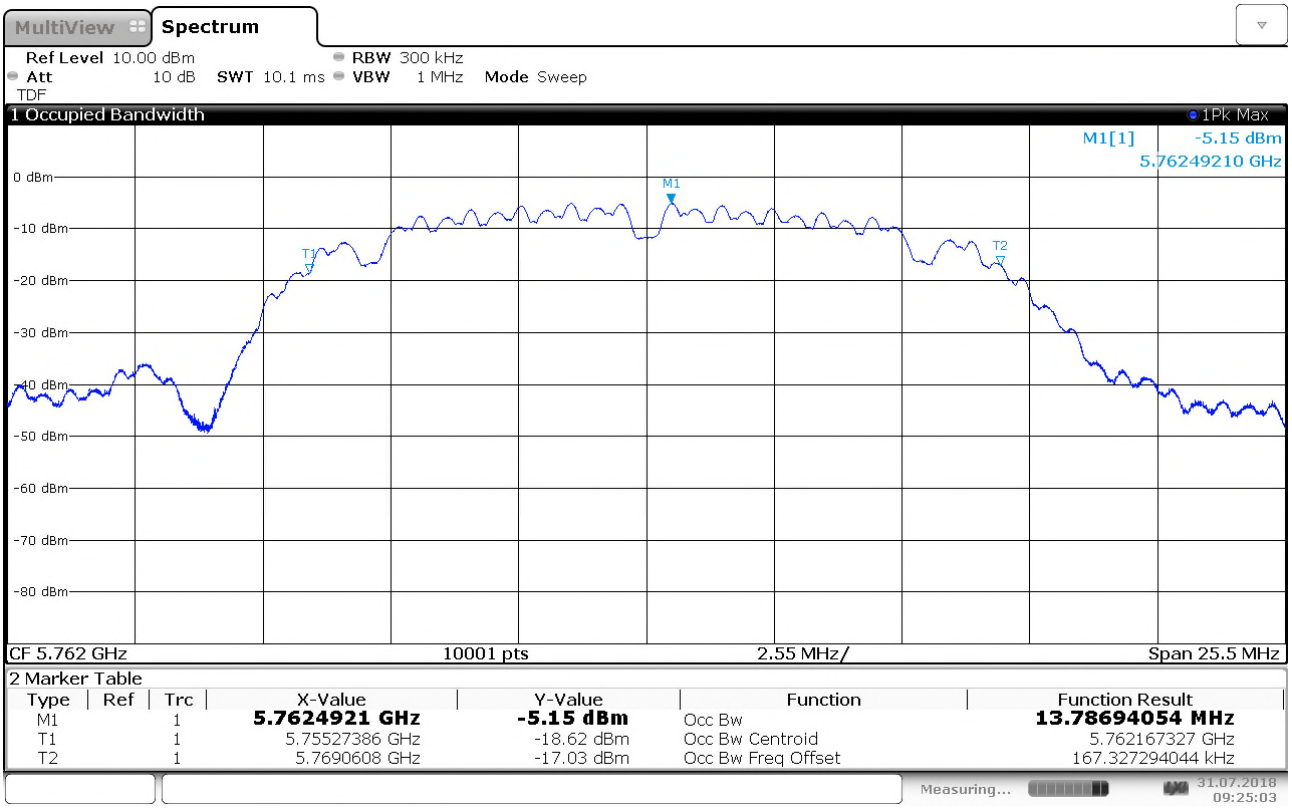
99% Bandwidth, 5762 MHz, Antena A , Conducted



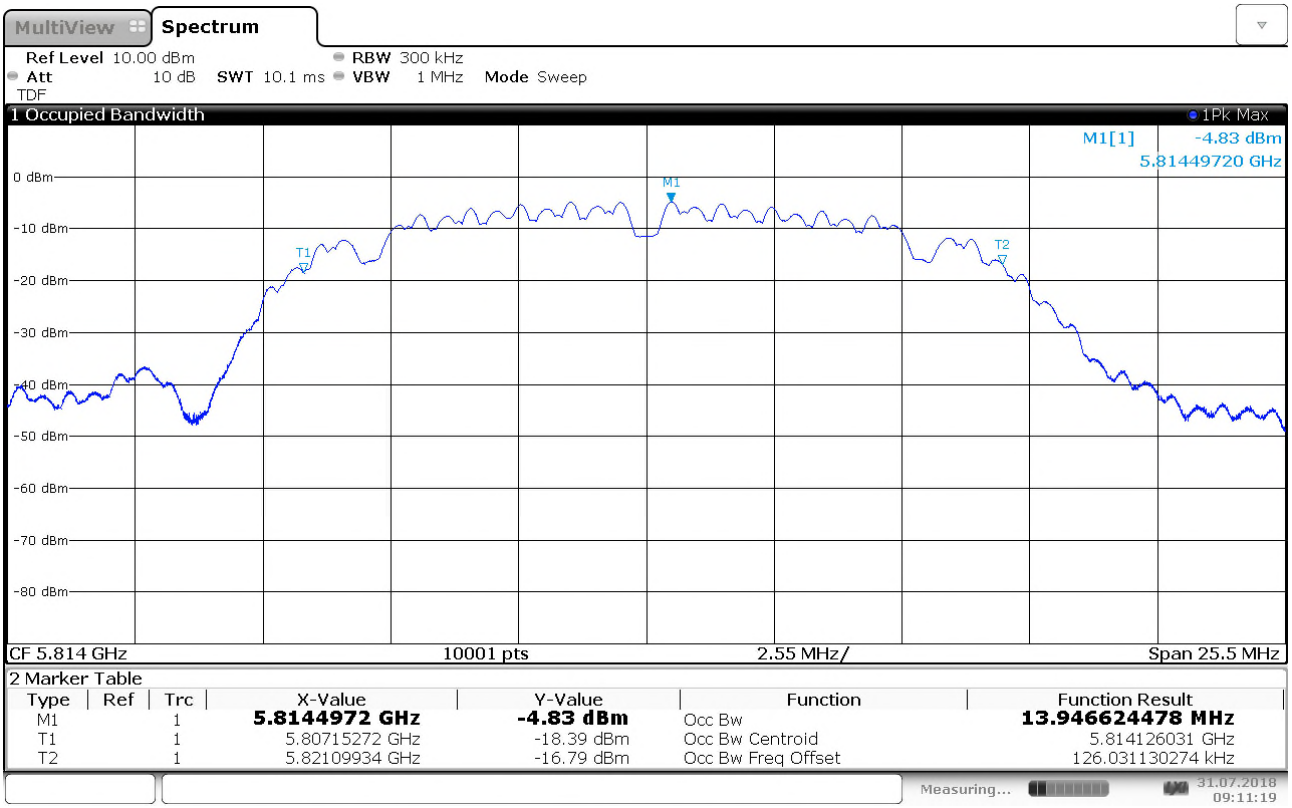
99% Bandwidth, 5814 MHz, Antena A , Conducted



99% Bandwidth, 5736 MHz, Antena B , Conducted



99% Bandwidth, 5762 MHz, Antena B , Conducted



99% Bandwidth, 5814 MHz, Antena B , Conducted

3.7 Unwanted Emissions

FCC 15.407(b)(4)(5)

ISED RSS-247, Issue 2, clause 6.2.4.2

Test Results: Complies

Measurement Data:

Conducted in band Emissions and out of band:

Ch. No.	Carrier Frequency (MHz)	Band Edge Frequency (MHz)	Measured value (dBm/MHz)		Limit (dBm/MHz)
			Antenna A	Antenna B	
			Lower band edge		
1	5736	5725	<-27	<-27	-27
2	5762	5725	<-27	<-27	-27
3	5814	5725	<-27	<-27	-27
			Upper band edge		
1	5736	5825	<-27	<-27	-27
2	5762	5825	<-27	<-27	-27
3	5814	5825	<-27	<-27	-27

See attached graphs.

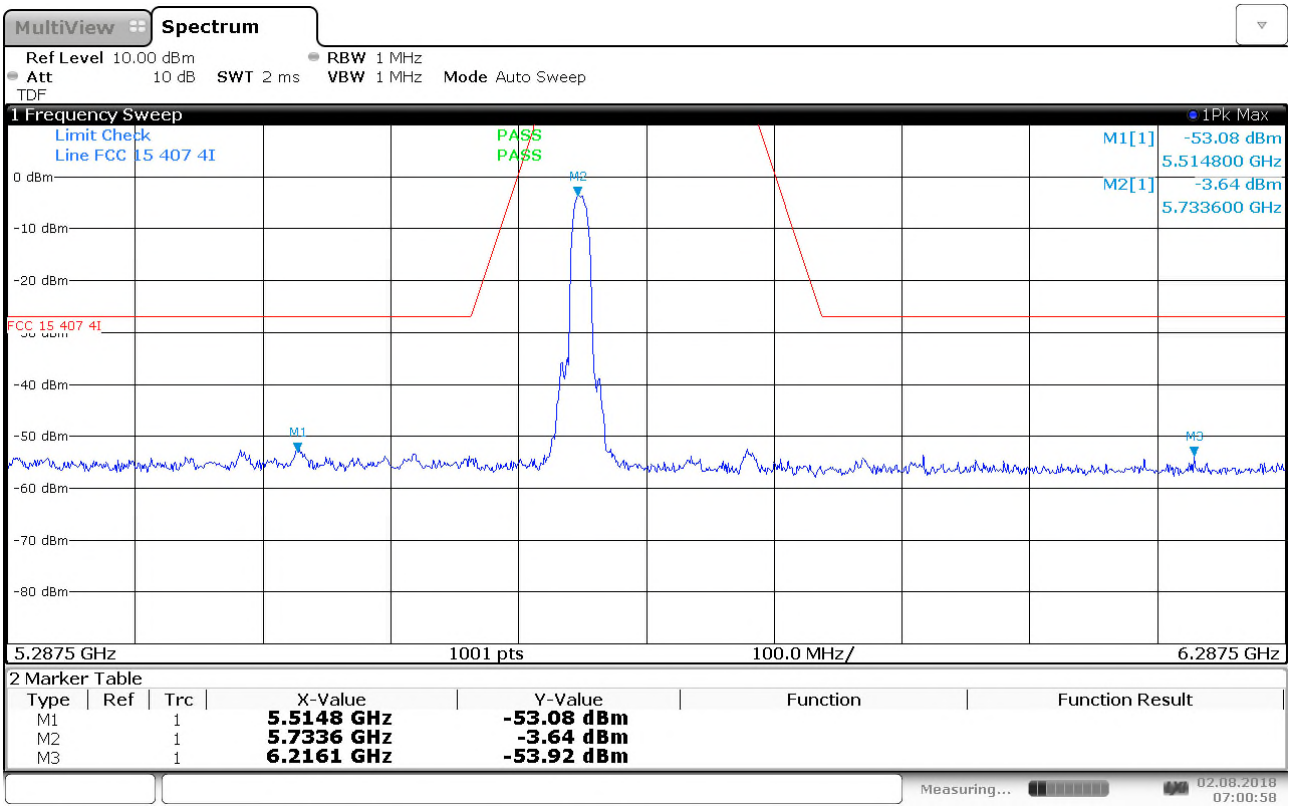
The tested equipment is for indoor use only.

No spurious emissions and band-edge emissions were found.

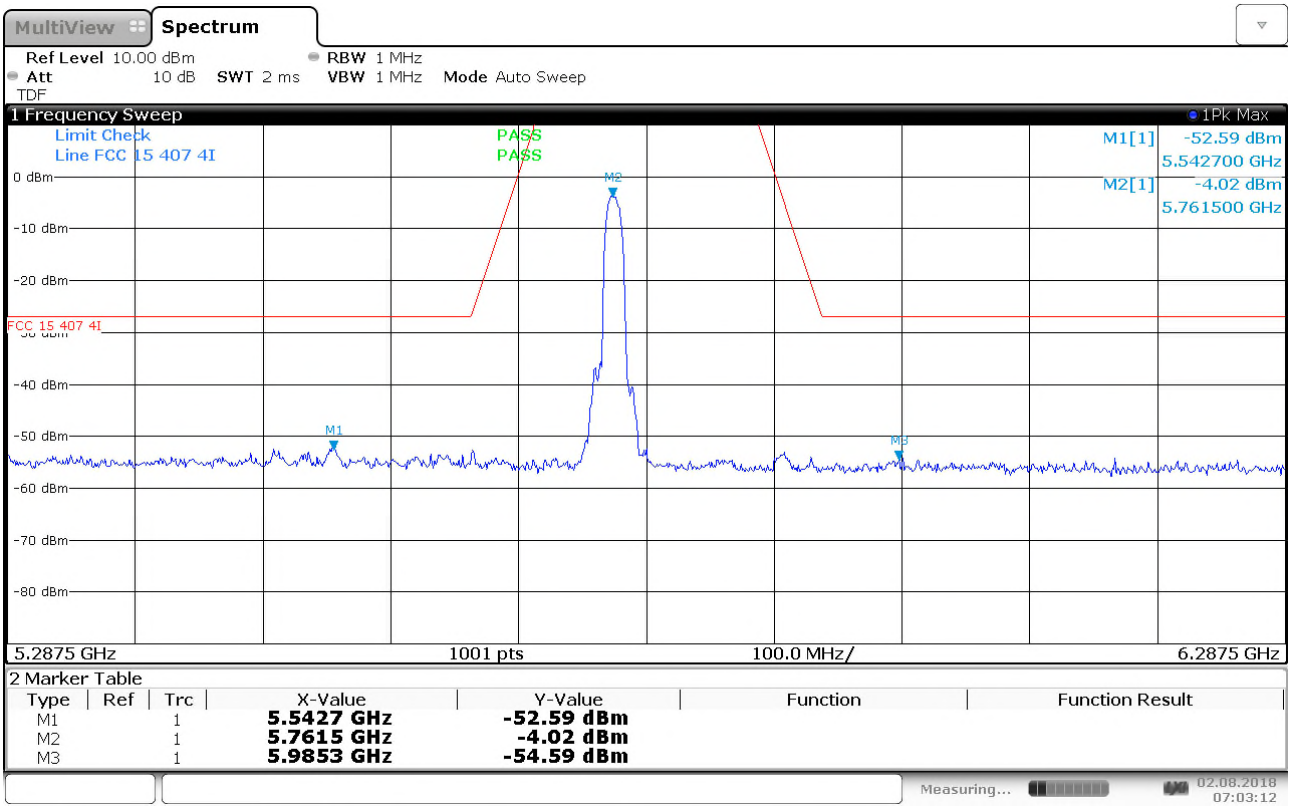
Unwanted Emissions limit:

Operating Frequency band	Limit for Emissions Outside Operating Frequency Band
5150 – 5250 MHz	-27 dBm/MHz
5250 – 5350 MHz	-27 dBm/MHz
5470 – 5725 MHz	-27 dBm/MHz
5725 – 5825 MHz	See FCC 15.407(b)(4)(i) or 15.407(b)(4)(ii)

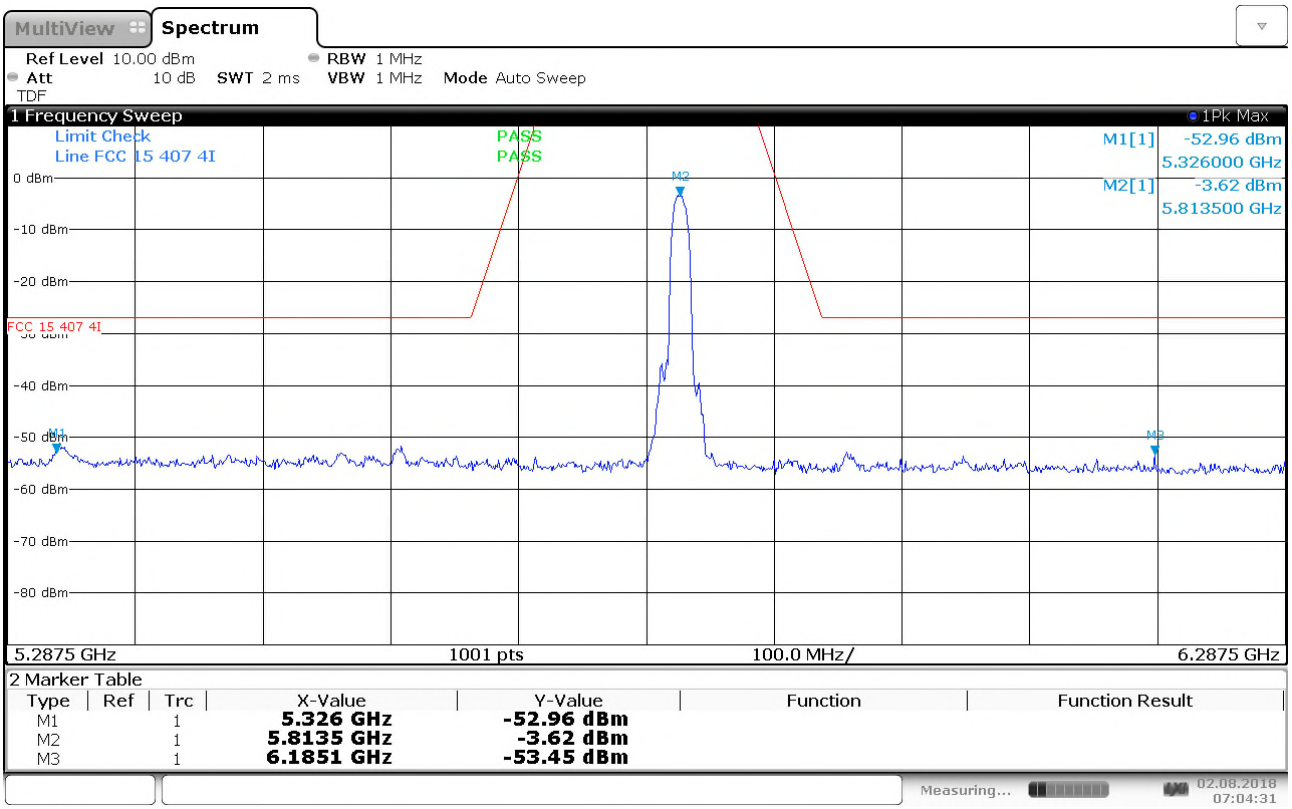
Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.



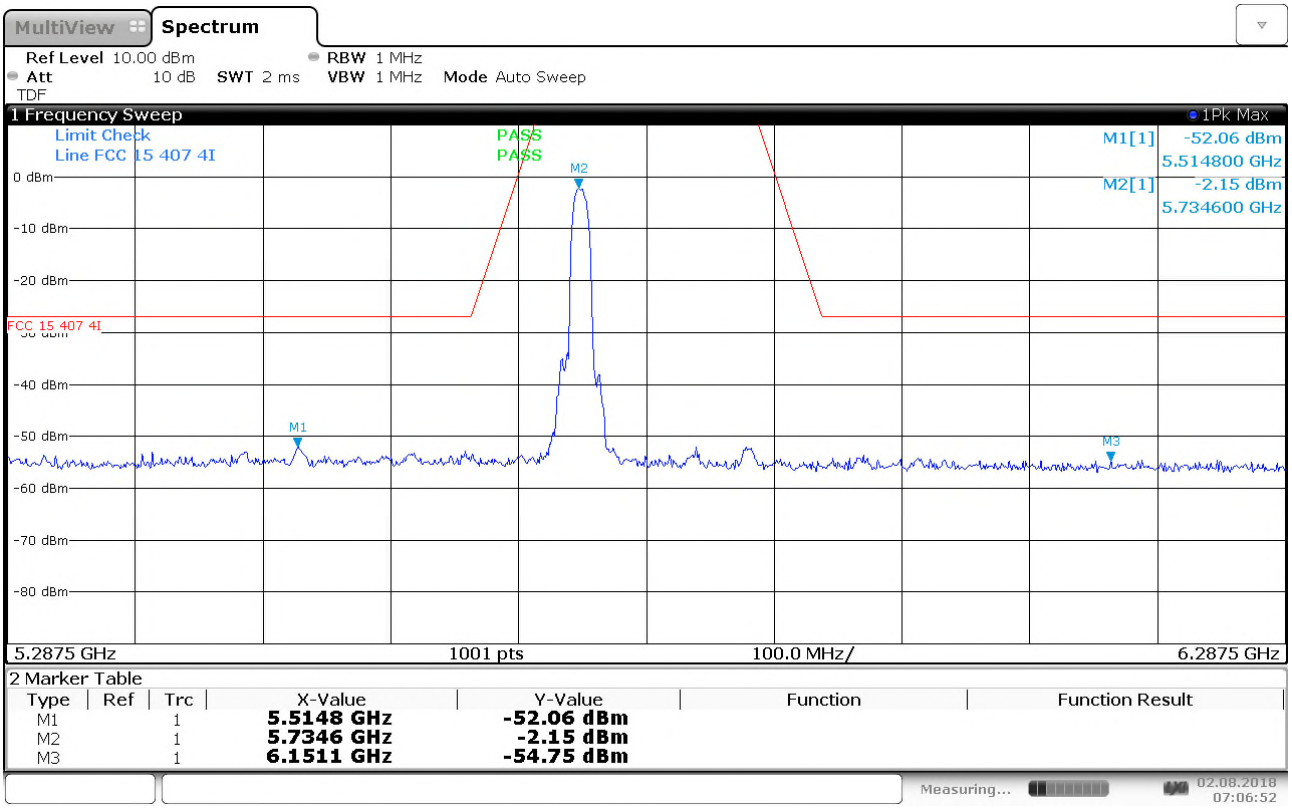
Conducted Unwanted Emissions, in Band, ch 5736MHz, antenna A



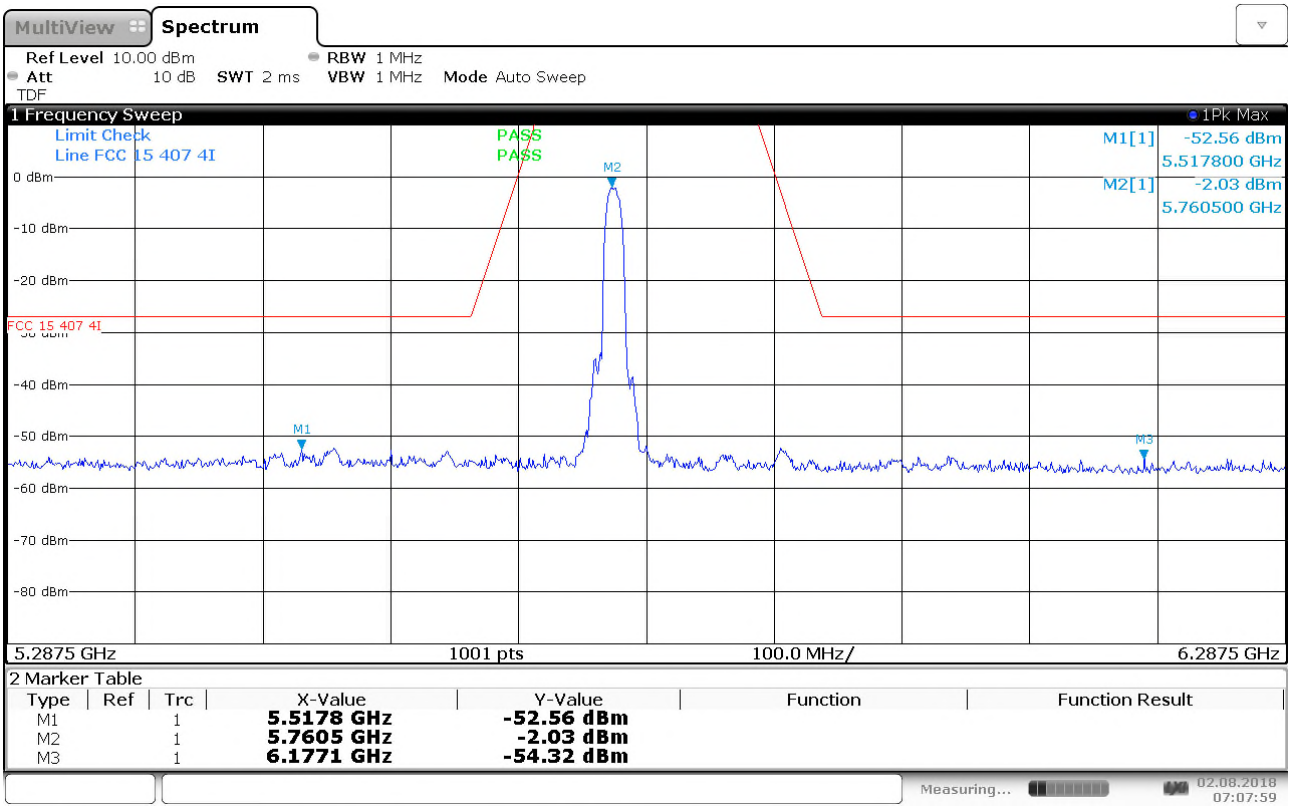
Conducted Unwanted Emissions, in Band, ch 5762MHz, antenna A



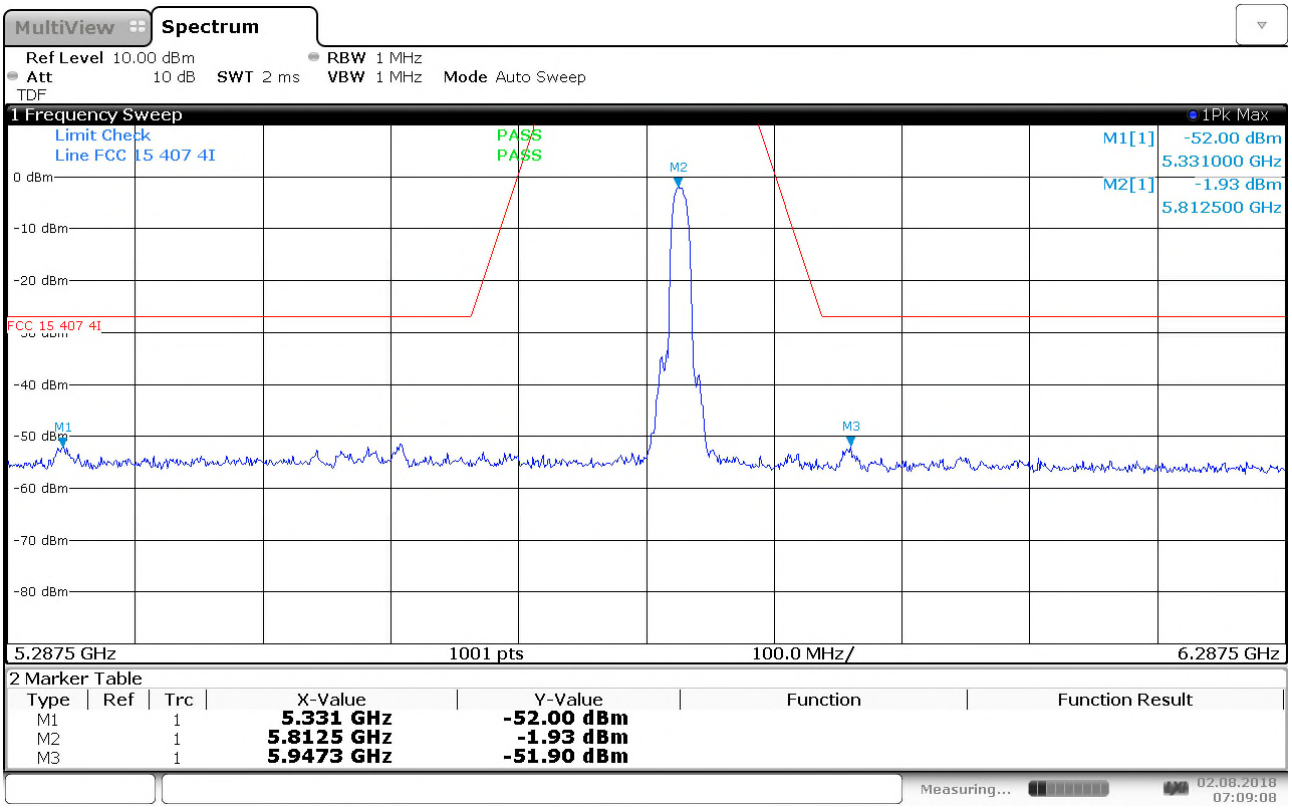
Conducted Unwanted Emissions, in Band, ch 5814MHz, antenna A



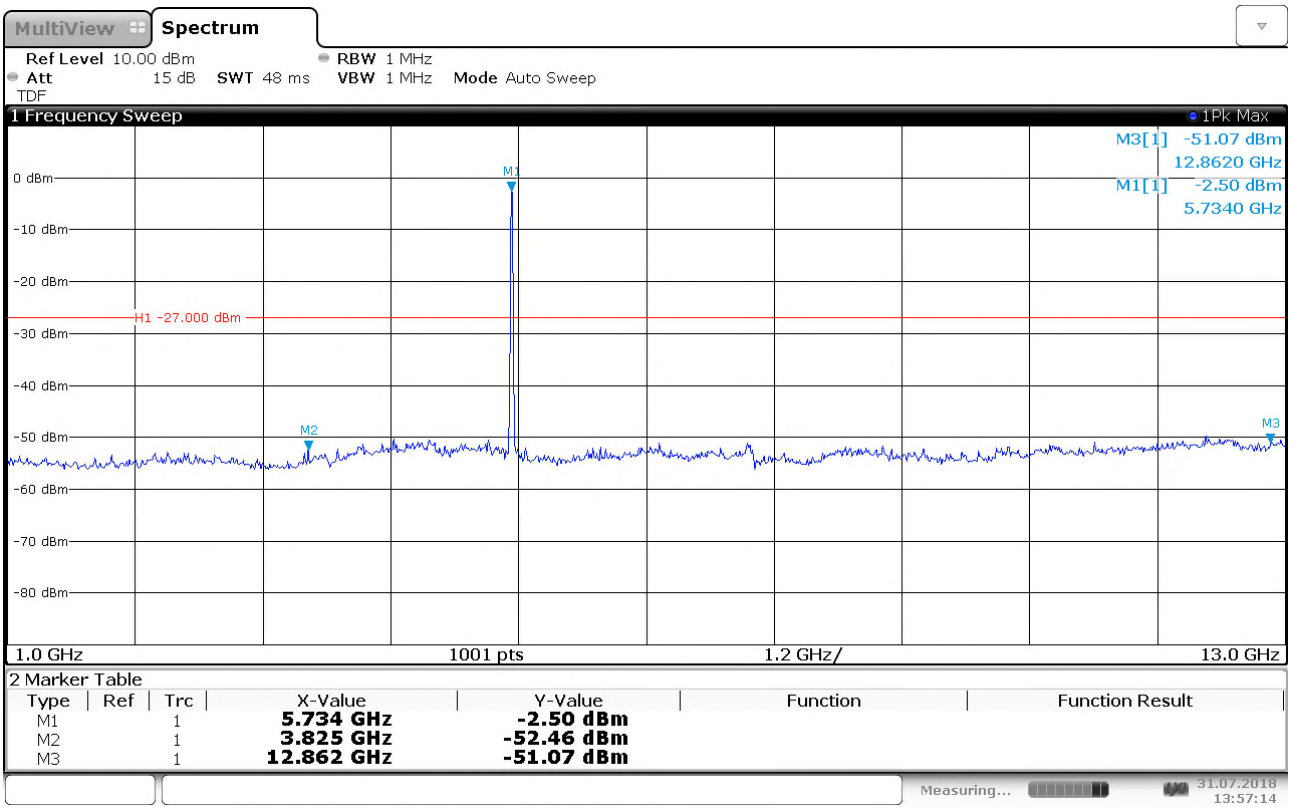
Conducted Unwanted Emissions, in Band ,ch 5736MHz, antenna B



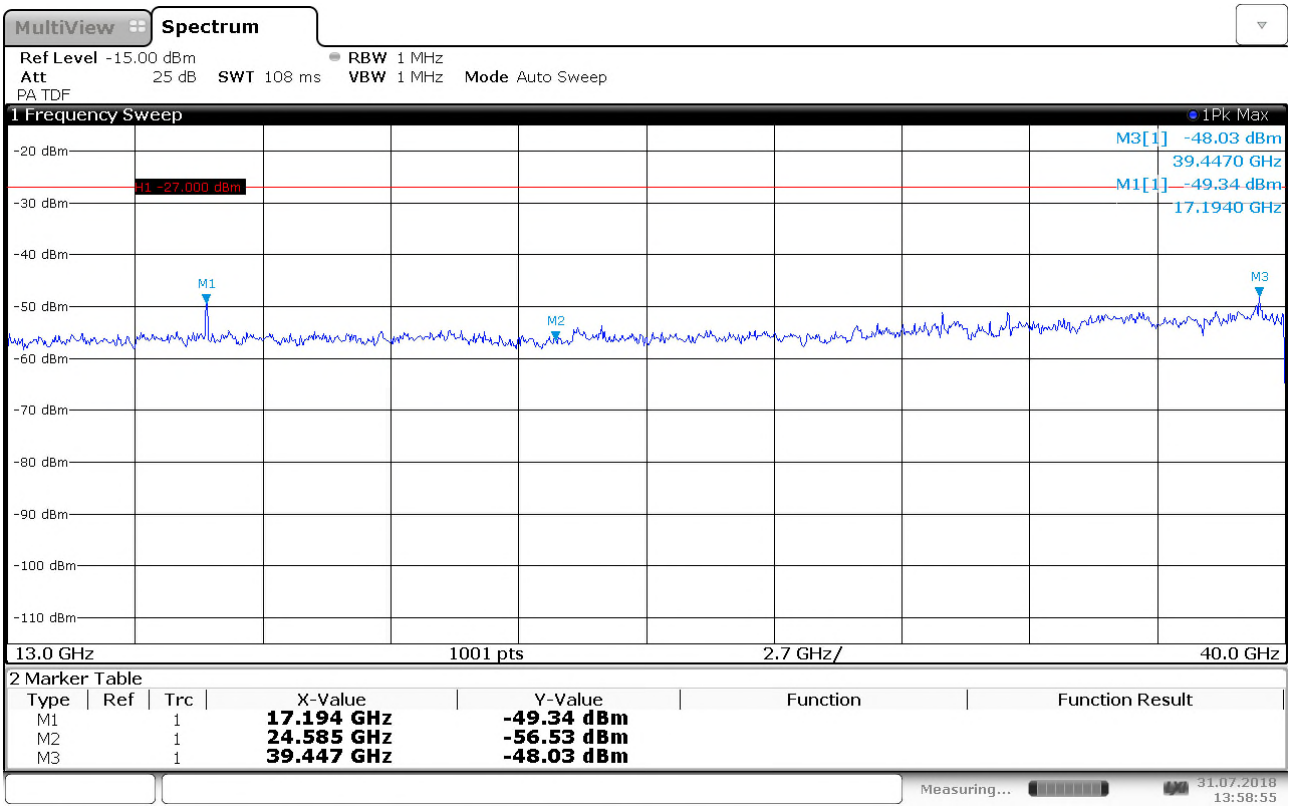
Conducted Unwanted Emissions, in Band ,ch 5762MHz, antenna B



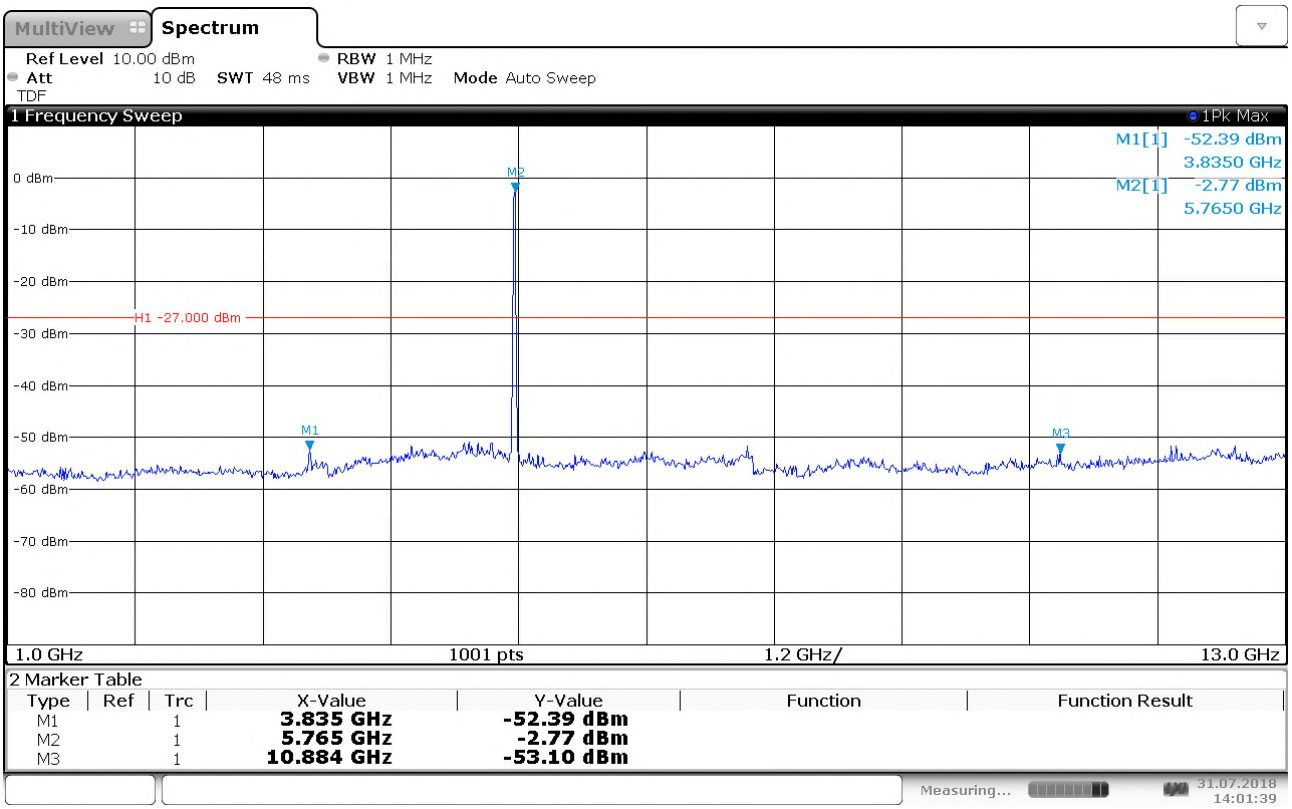
Conducted Unwanted Emissions, in Band , ch 5814MHz, antenna B



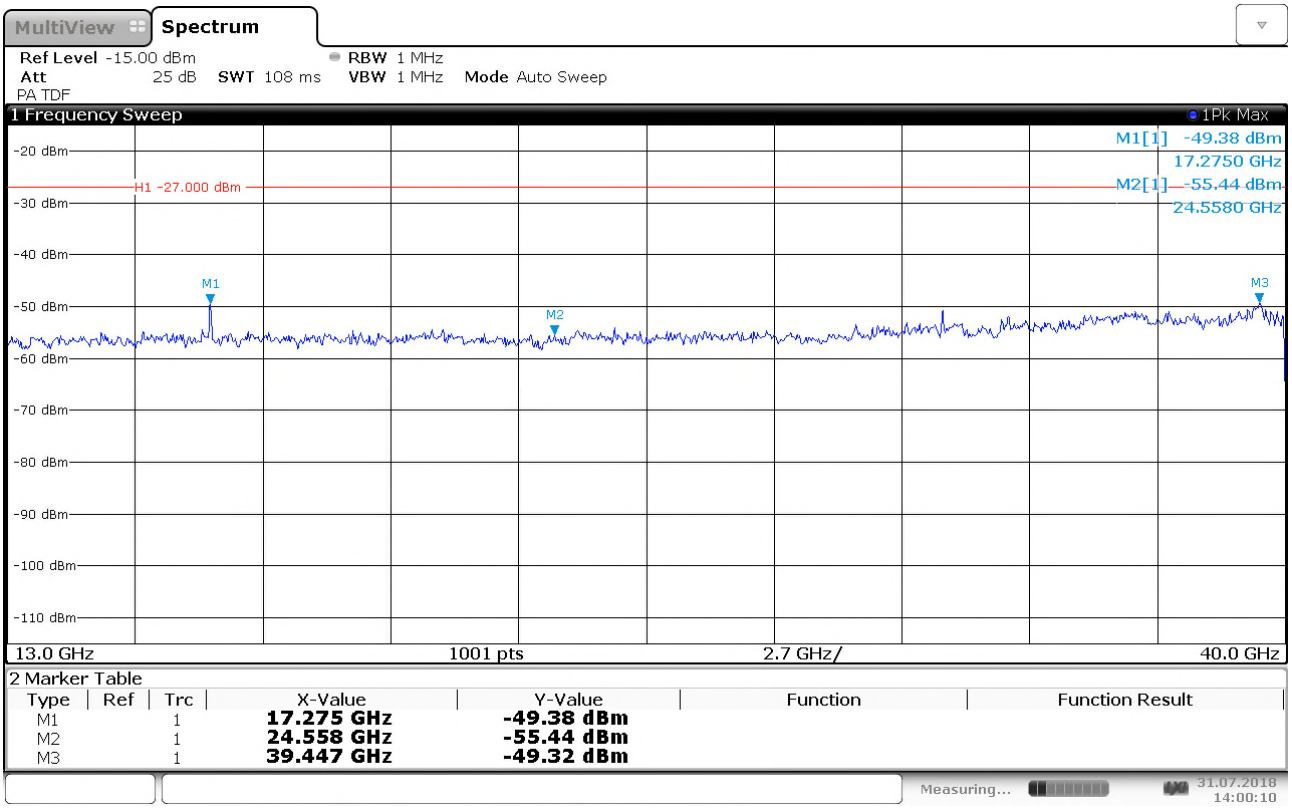
Conducted Unwanted Emissions, 1 - 13GHz, ch 5736MHz, antenna A (with wanted signal)



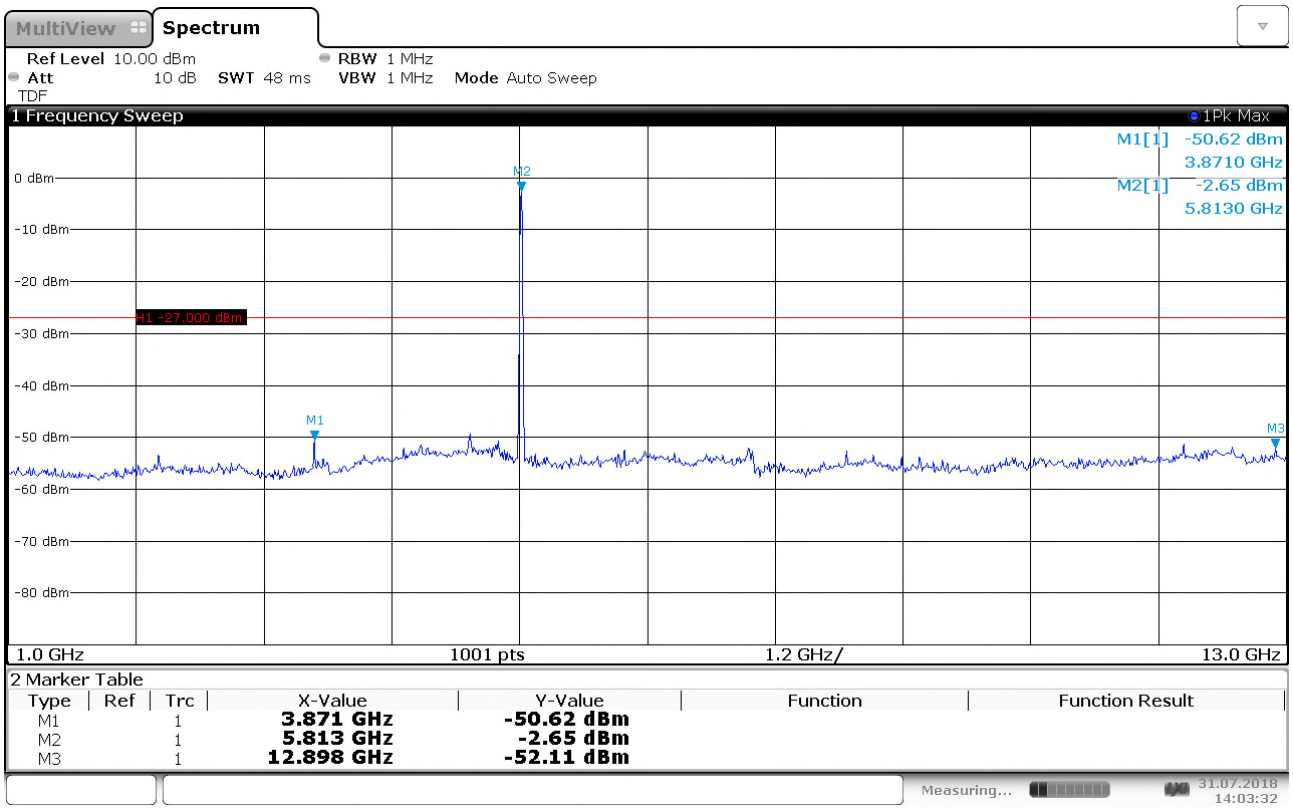
Conducted Unwanted Emissions, 13 - 40GHz, ch 5736MHz, antenna A



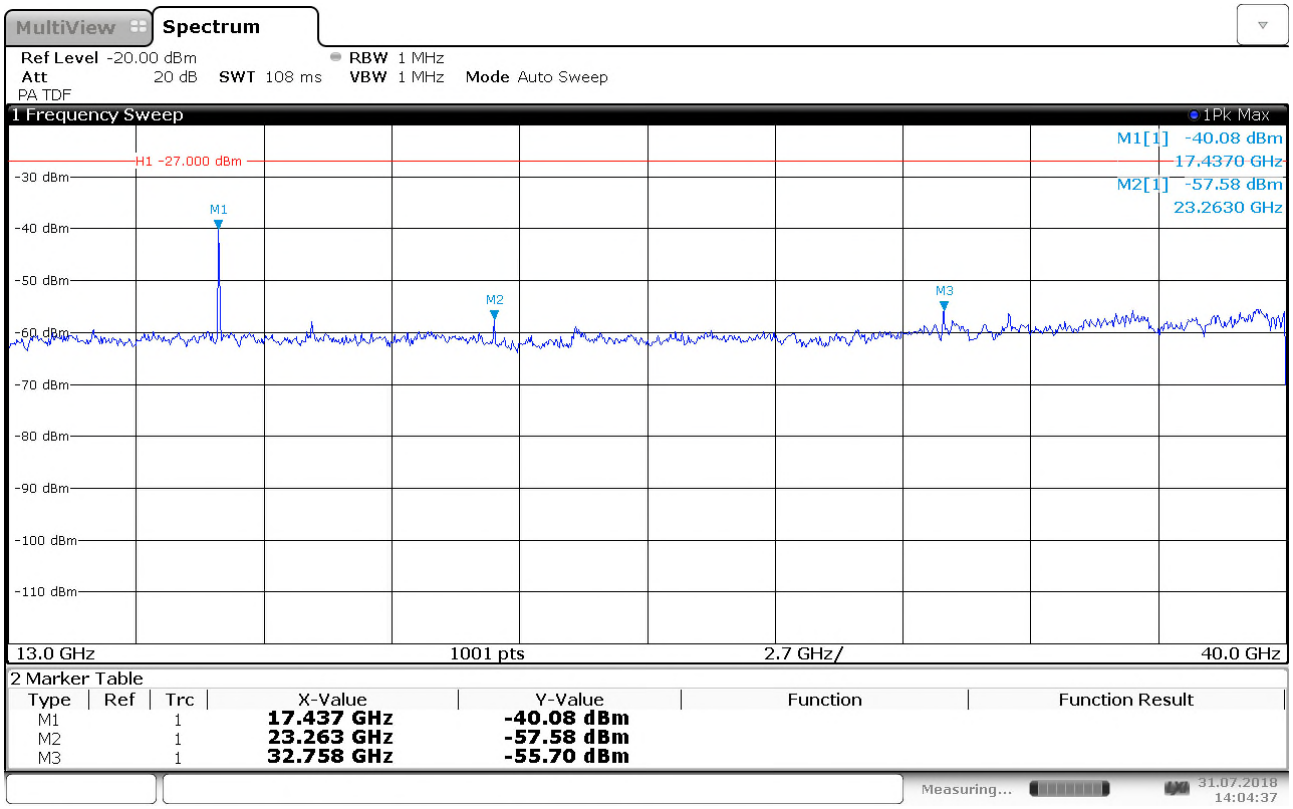
Conducted Unwanted Emissions, 1 - 13GHz, ch 5762MHz, antenna A(with wanted signal)



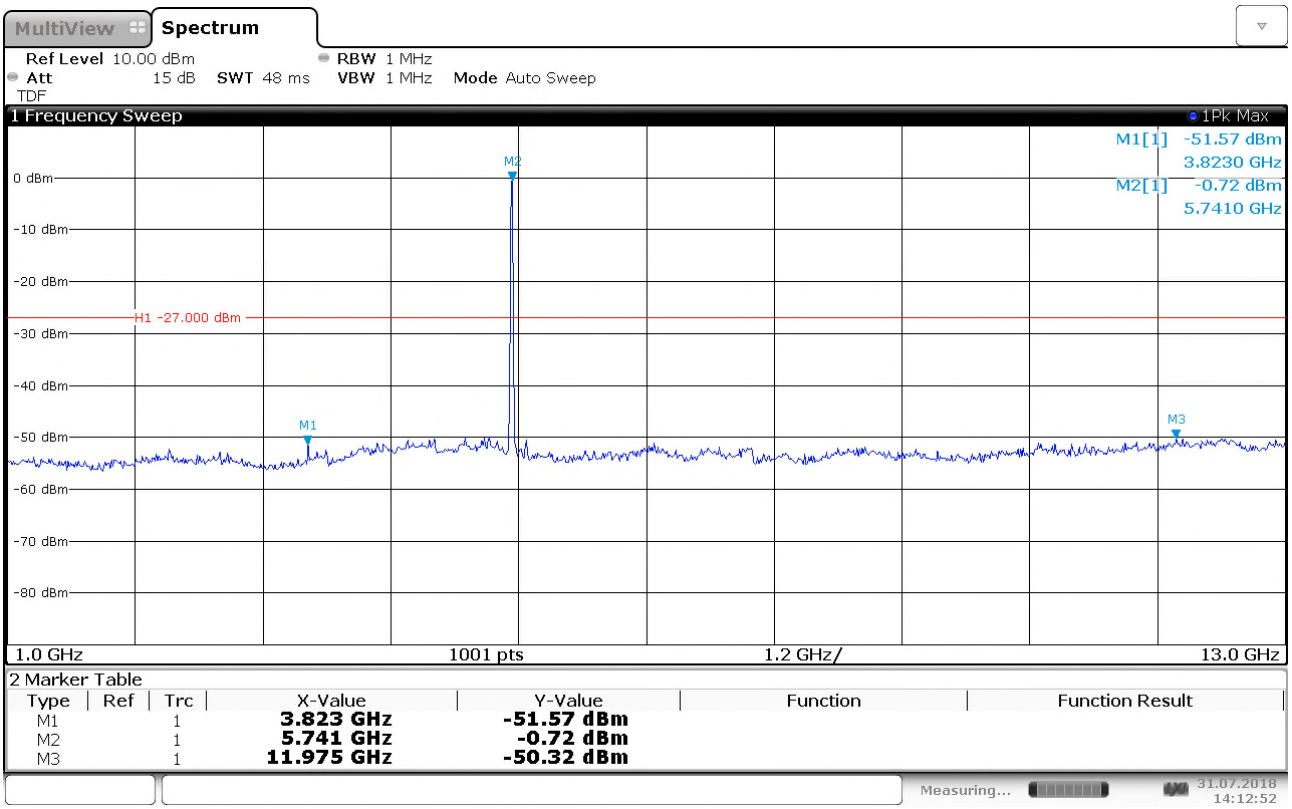
Conducted Unwanted Emissions, 13 - 40GHz, ch 5762MHz, antenna A



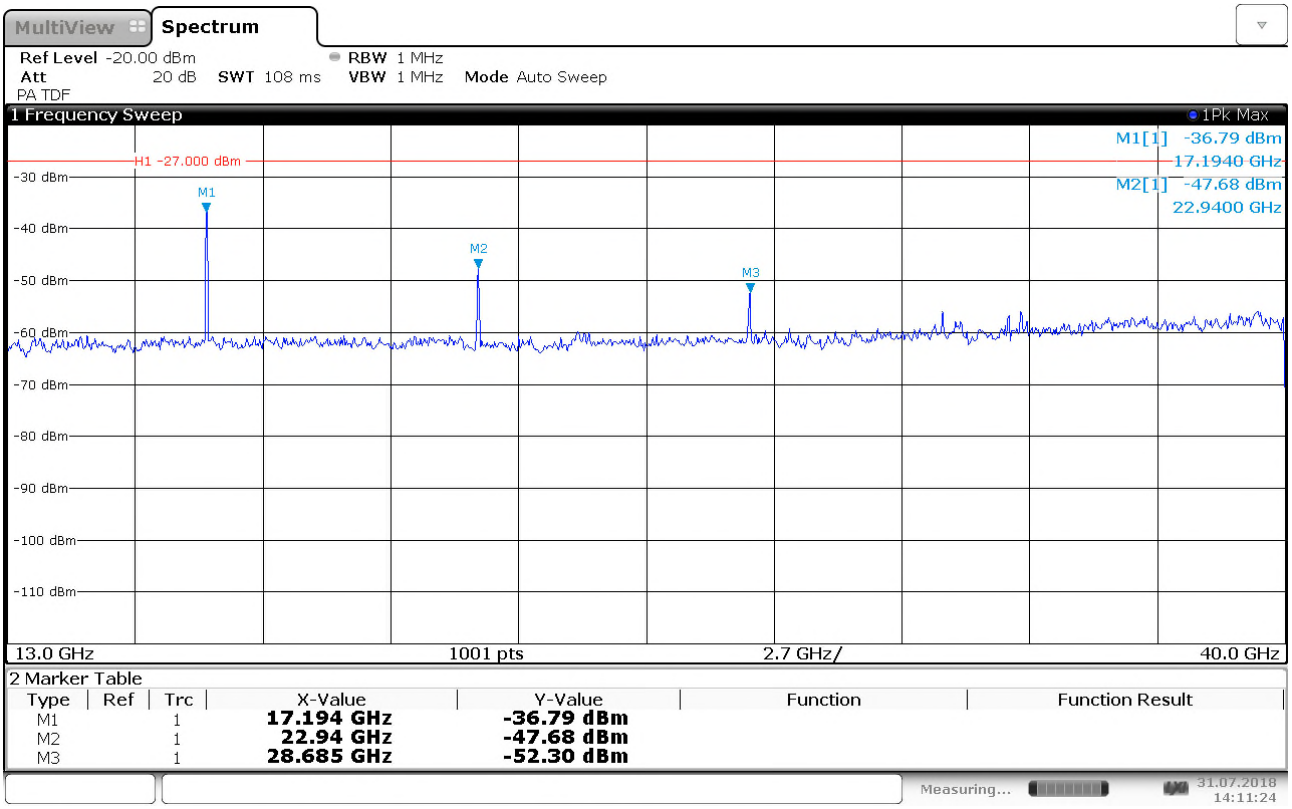
Conducted Unwanted Emissions, 1 - 13GHz, ch 5814MHz, antenna A(with wanted signal)



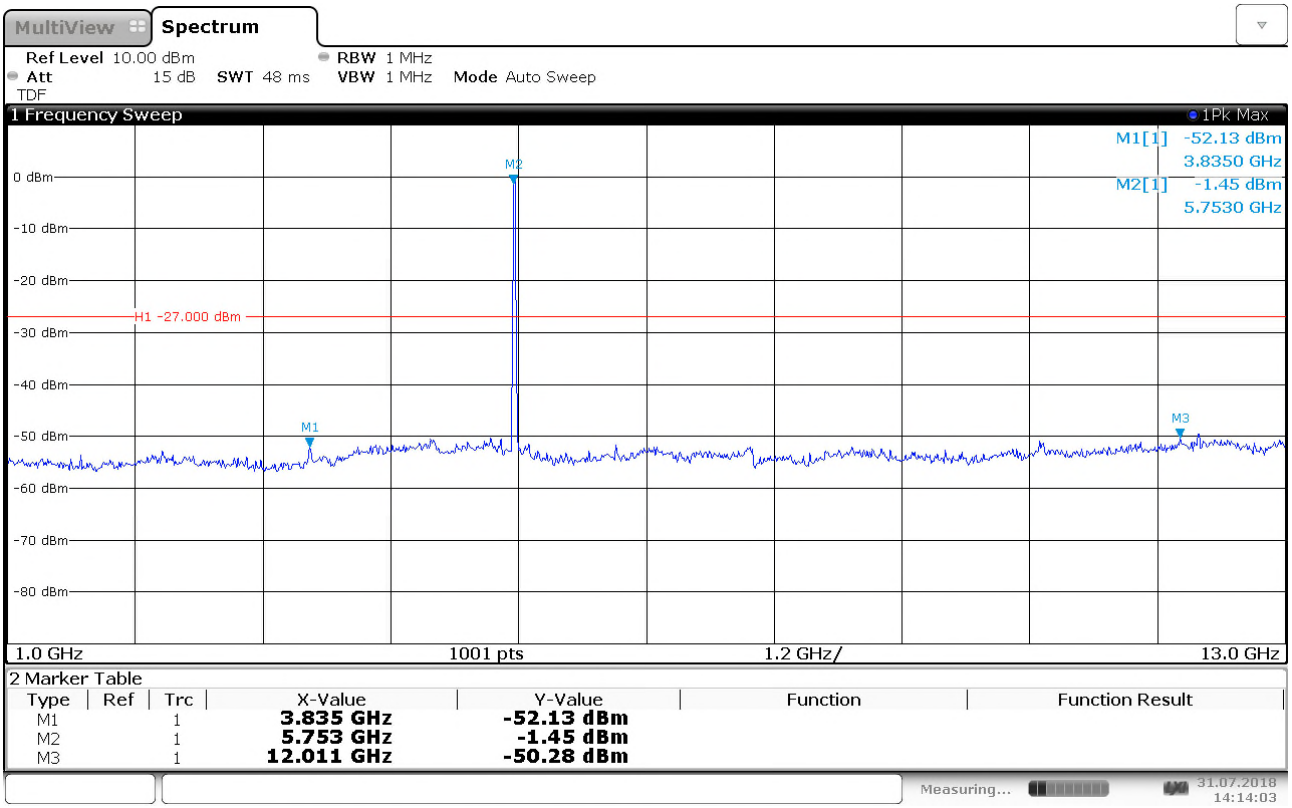
Conducted Unwanted Emissions, 13 - 40GHz, ch 5814MHz, antenna A



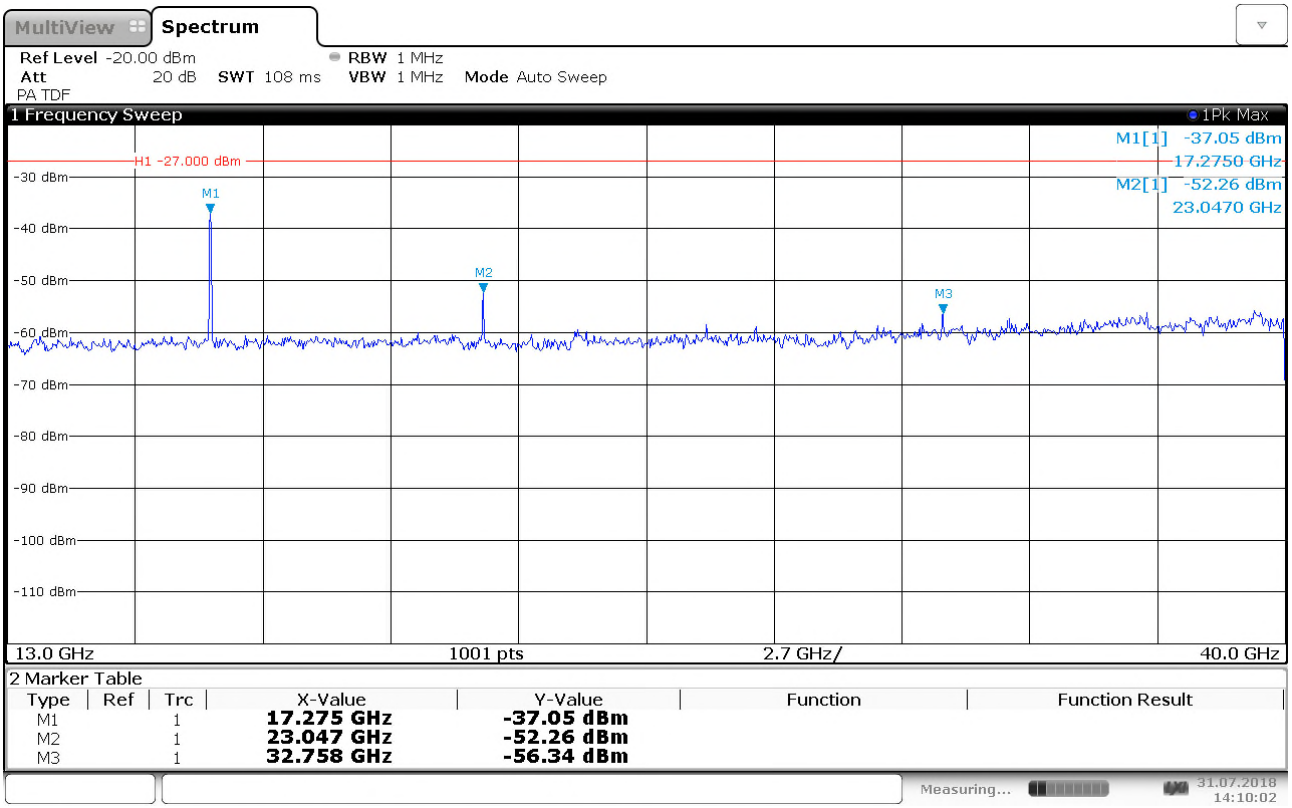
Conducted Unwanted Emissions, 1 - 13GHz, ch 5736MHz, antenna B(with wanted signal)



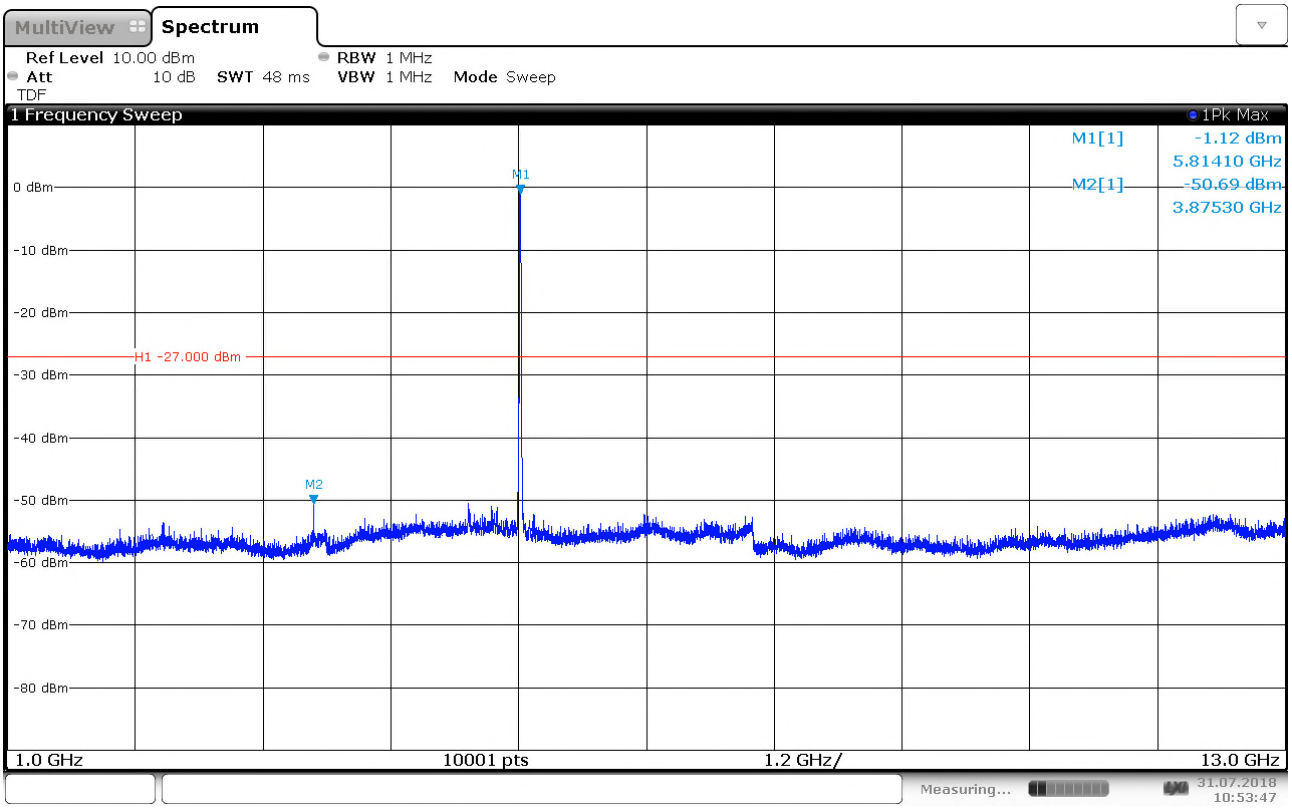
Conducted Unwanted Emissions, 13 - 40GHz, ch 5736MHz, antenna B



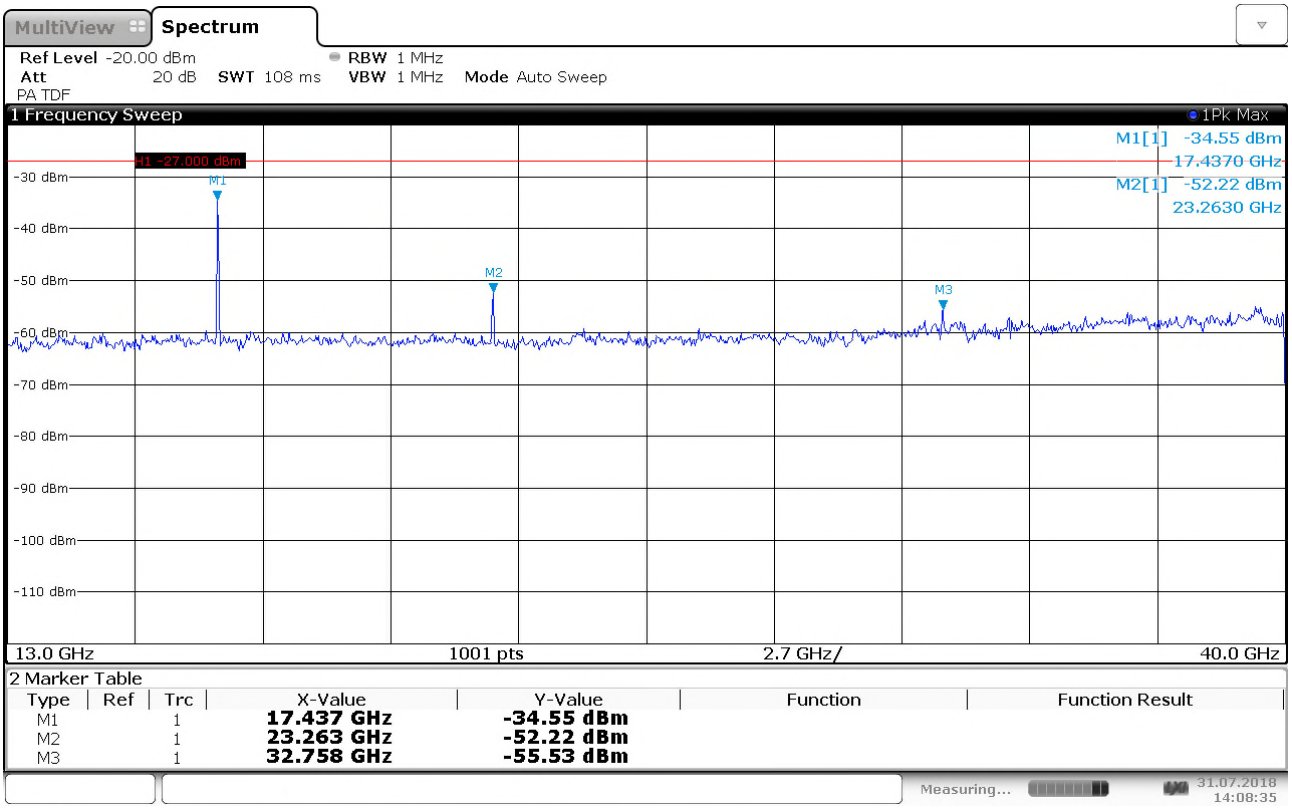
Conducted Unwanted Emissions, 1 - 13GHz, ch 5762MHz, antenna B(with wanted signal)



Conducted Unwanted Emissions, 13 - 40GHz, ch 5762MHz, antenna B



Conducted Unwanted Emissions, 1 - 13GHz, ch 5814MHz, antenna B(with wanted signal)



Conducted Unwanted Emissions, 13 - 40GHz, ch 5814MHz, antenna B

3.8 Restricted Bands of operation

Restricted Bands of operation for FCC and ISED are defined in FCC Part 15.205 and ISED RSS-GEN, Issue 4 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

FCC (MHz)	ISED (MHz)	FCC (GHz)	ISED (GHz)
0.090-0.110		**0.96-1.24** **1.3-1.427**	**0.96-1.427**
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	3.020-3.026	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	5.677-5.683	2.4835-2.5	
6.215-6.218		**2.69-2.9**	**2.655-2.9**
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		**3.6-4.4**	**3.5-4.4**
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
108-121.94 **123-138**	**108-138**	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISED, all other frequencies are common.

3.9 Radiated Emissions, below 1GHz

FCC 15.205, 15.209

ISED RSS-GEN, Issue 5, Clause 8.9

Test Results: Complies

Radiated emission 30 – 1000 MHz.

Detector: Quasi-Peak

Measuring distance 3 m.

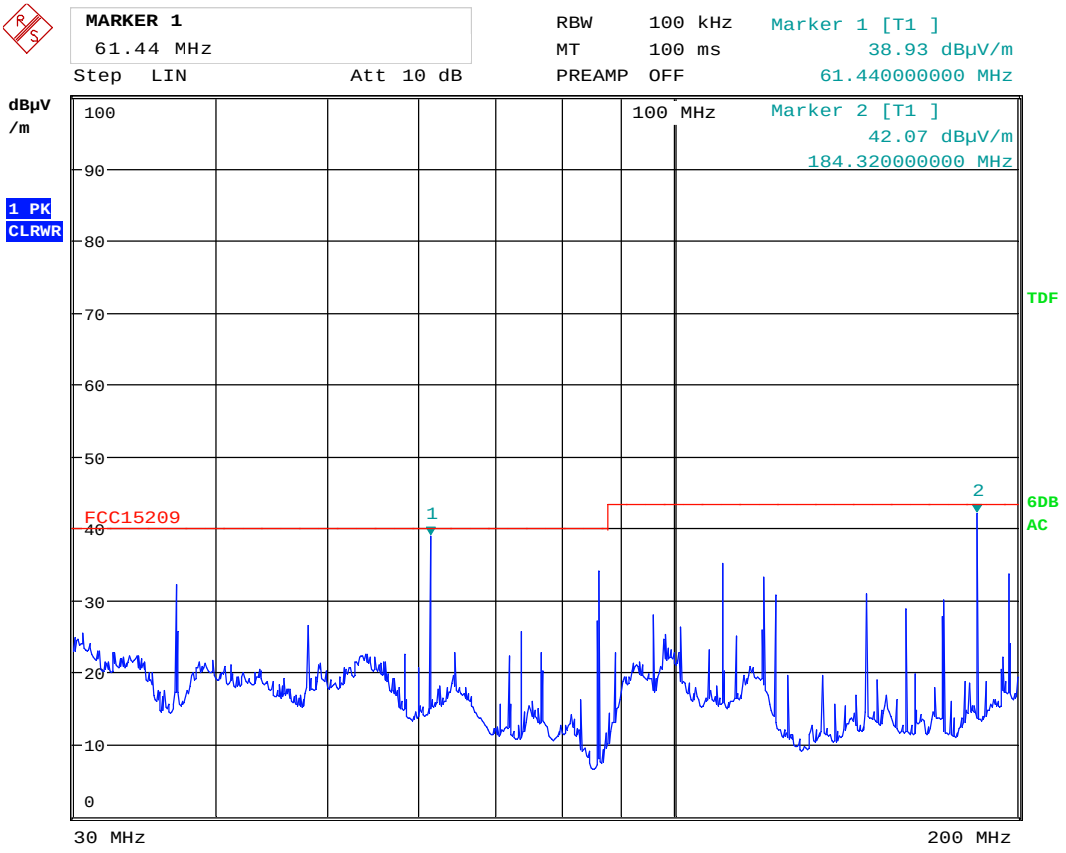
EUT is Tested with evaluation board and test jig.

Frequency	Operational condition	Field strength (QP)	Measuring distance	Limit FCC15.209	Margin
MHz		dBµV/m	metres	dBµV/m	dB
61.44	TX on, VP	38.39	3	40.0	1.61
184.32	TX on, VP	41.73	3	43.5	1.77

See attached plots.

Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 4, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	Quasi Peak (µV/m)	Quasi Peak (dBµV/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0



Date: 19.SEP.2018 18:05:53

VP: 30 - 200MHz pk scan