Report No. 370465-02

Test Report

Product	Bluetooth Transceiver
Name and address of the applicant	LEGO System A/S Aastvej 1, 7190 Billund, Denmark
Name and address of the manufacturer	LEGO System A/S Aastvej 1, 7190 Billund, Denmark
Model	HUB NO.6
Rating	7.3Vdc (Secondary Batteries)
Trademark	LEGO
Serial number	Radiated sample: Marked as “FEP-1_135”
Additional information	This tested device can be operated either with BLE or classic Bluetooth.
Tested according to	**FCC Part 15.247** Frequency Hopping Transmitters / Digital Transmission Systems **Industry Canada RSS-247, Issue 2** Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	370465
Tested in period	2019.04.15 – 2019.06.05
Issue date	2019.06.17
Name and address of the testing laboratory	Nemko Instituttveien 6 Kjeller, Norway CAB Number: FCC: NO0001 ISED: NO0470 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50 **An accredited technical test executed under the Norwegian accreditation scheme**

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

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1 INFORMATION

1.1 Test Item

Name	LEGO
FCC ID	NPI35803
ISED ID	3072A-35803
Model/version	HUB NO.6
Serial number	Radiated sample : Marked as “FEP-1_135” Conducted sample: Marked as “FEP→EP5 019
Hardware identity and/or version	10035801-E
Software identity and/or version	1.0.00.0000
Frequency Range	2400 – 2483.5 MHz
Tunable Bands	None
Number of Channels	79
Operating Modes	TX and RX
Measured BW (99%)	1.03 MHz
Emission clasification	F1D
Transmitter spurious, dBµV/m@3m	61.96 (7.32GHz) PK and 41.96 AV(7.32GHz)
Type of Modulation	GFSK, 8DPSK and 4πDPSK
Data rate	3Mbit/s
User Frequency Adjustment	None
Conducted Output Power,Max	0.00158 W (1.99dBm)
Type of Power Supply	7.3Vdc, Rechargeble Lithium ion battery
Antenna Connector	Only integral antenna
Number of Antennas	1
Diversity or Smart Antennas	None
Desktop Charger	N/A

Description of Test Item

The device tested is a toy which controls dedicated motors, sensors and remotely control via BLE or Bluetooth clasic with remote device such as iOS, Android or similar.

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	7.3Vdc

The values are the limit registered during the test period.

1.3 Test Engineer(s)

G.Suhanthakumar

1.4 Description of modification for Modification Filing

Not applicable.

1.5 Family List Rational

Not Applicable.

1.6 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

1.7 Worst-Case Configuration and Mode

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

1.8 Comments

All measurements were done with the EUT powered by a fully charged battery.

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 15.247 and Industry Canada RSS-247 Issue 2 and RSS-GEN Issue 5.

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

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

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

☒ New Submission	☒ Production Unit
☐ Class II Permissive Change	☐ Pre-production Unit
DSS 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)	N/A[1]
Number of Operating Frequencies	15.31(m)	5.1 (d) (RSS-247)	Complies
Antenna Requirement	15.203	8.3 (RSS-GEN)	N/A[2]
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	Complies[3]
Channel Separation	15.247(a)(1)	5.1 (b) (RSS-247)	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (a) (RSS-247)	Complies
Time of Occupancy	15.247(a)(1)(iii)	5.1 (d) (RSS-247)	Complies
Occupied Bandwidth	15.247(a)(1)	5.1 (a) (RSS-247)	Complies
Occupied Bandwidth	N/A	6.6 (RSS-GEN)	N/A[4]
Minimum 6 dB Bandwidth	15.247(a)(2)	5.2 (a) (RSS-247)	N/A[4]
Peak Power Output	15.247(b)	5.4(b) (RSS-247)	Complies
Power Spectral Density	15.247(d)	5.2 (b) (RSS-247)	N/A[4]
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	Complies
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

N/A[1]: The tested equipment only operates with rechargeable battery. And recharged with USB power.

N/A[2:]: Integral antenna

3 : For rechargeable battery.

N/A[3]: FHSS

3 TEST RESULTS

3.1 Number of Frequencies

FCC Part 15.31 (m)

RSS-Gen 6.8

Authorized Band:	**2400 - 2483.5 MHz**
Frequency band width:	**83.5MHz**
Low Channel:	**2402MHz**
Mid channel:	**2441MHz**
High Channel:	**2480MHz**

3.2 Power Line Conducted Emissions

FCC Part 15.207

ISED RSS-GEN Issue 5, Clause 7.2 / 8.8

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

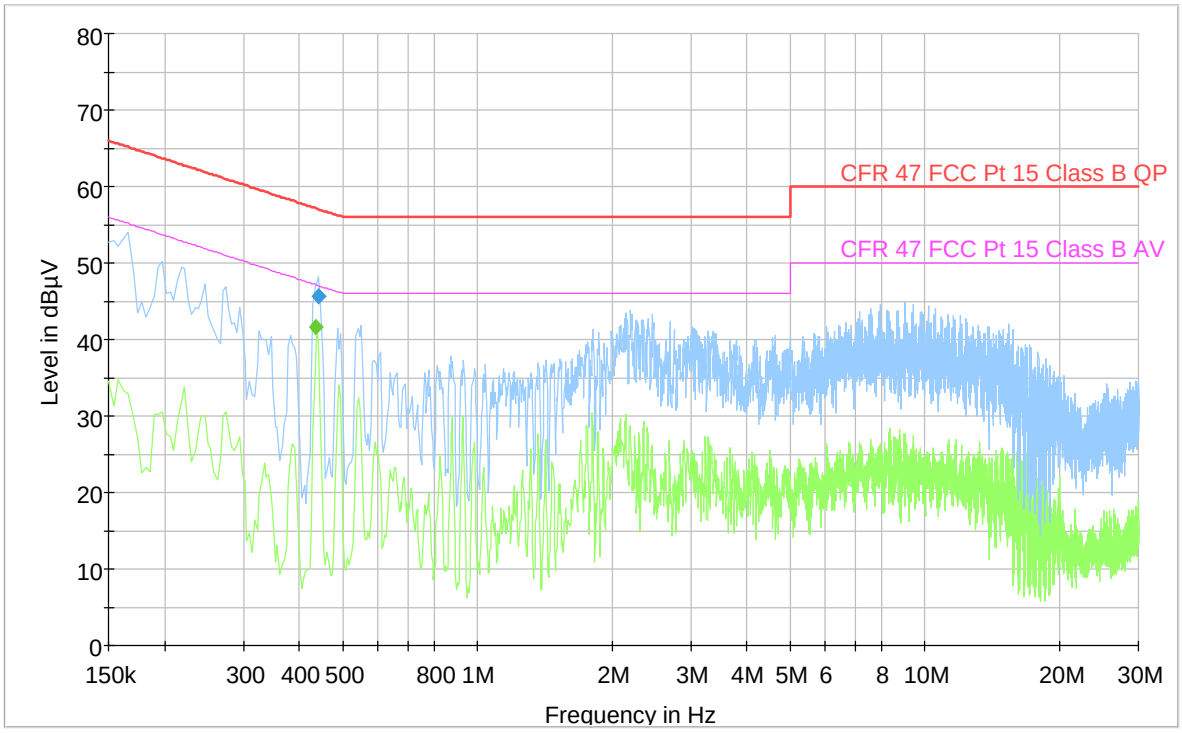
Test Results: Complies

Measurement Data: See attached plots

Highest measured value (L1 and N): 120Vac, 60Hz with USB AC/DC adapter , model no: SSW 2374

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.436	---	41.58	47.14	5.56	1000	9	L1	OFF
0.440	45.65	---	57.06	11.42	1000	9	L1	OFF

Full Spectrum



3.3 Channel Separation

Para. No.: 15.247 (a)(1)

ISED RSS-247 Issue 2, Clause 5.1 (b)

Measurement procedure: **ANSI C63.10-2013 Clause 7.8.2**

Test Results: **Complies**

Measurement Data:

Channel Separation:	1 MHz
Nominal value for Channel Separation	0.88 MHz

See attached plots

Requirement:

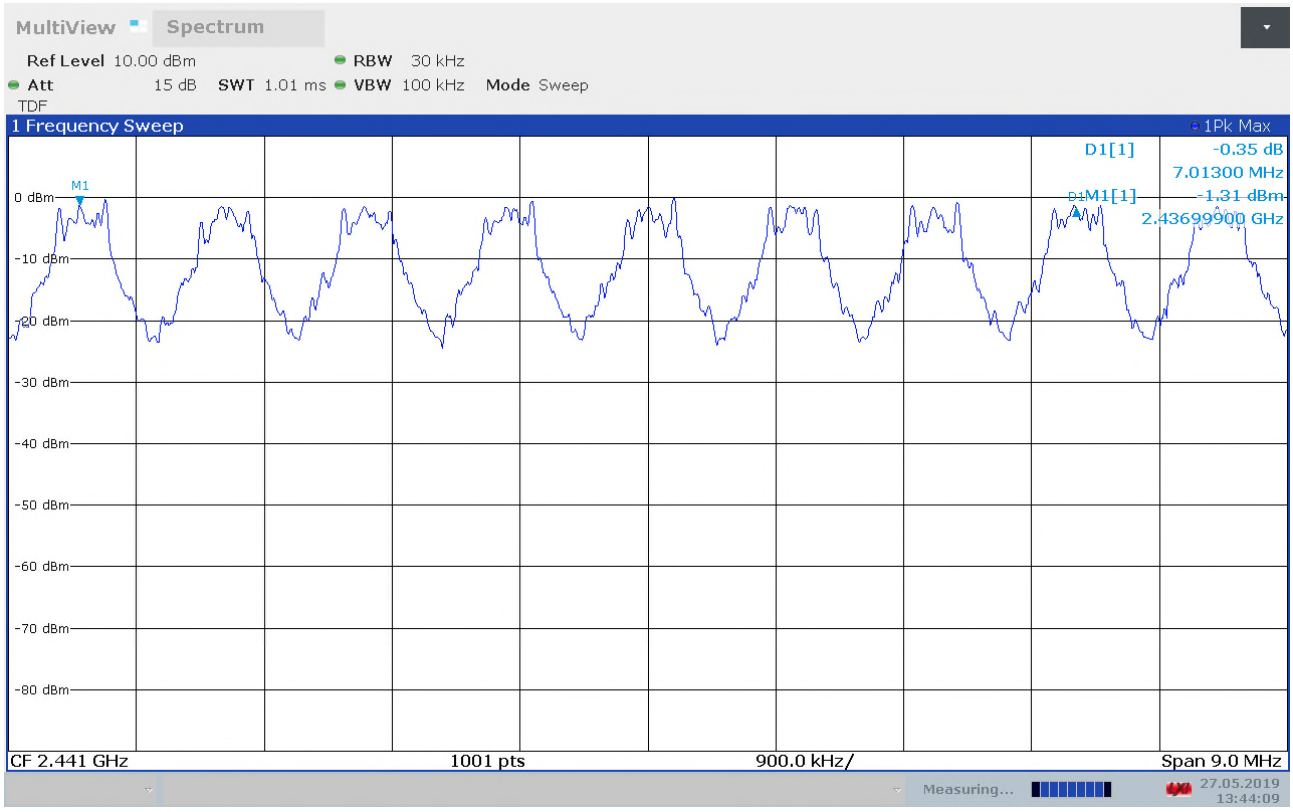
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

or:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the system operates with an output power no greater than 125 mW.

No requirements for Digital Transmission Systems.

Channel Separation



3.4 Pseudorandom Hopping Algorithm

Para. No.: 15.247 (a)(1)

ISED Canada RSS-247 Issue 2, Clause 5.1

Test Results: Complies

Measurement Data: /

The hopping sequence follows the Bluetooth standard.

Requirements:

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

No requirements for Digital Transmission Systems.

3.5 Occupancy Time

Para. No.: 15.247 (a)(1)(iii)

ISED Canada RSS-247 Issue 2, Clause 5.1 (c)

Measurement procedure: **ANSI C63.10-2013 Clause 7.8.4**

Test Results: Complies

Measurement Data:

	DH1	DH3	DH5
Number of RF Channels:	79	79	79
Maximum Length of RF Burst pr. Channel, ms	0.292	1.19	2.22
Minimum Time between RF Burst on same RF Channel,ms	62.34	394.79	397.43
Time of Occupancy, S	0.148	0.095	0.177

BT, 79 Ch Mode:

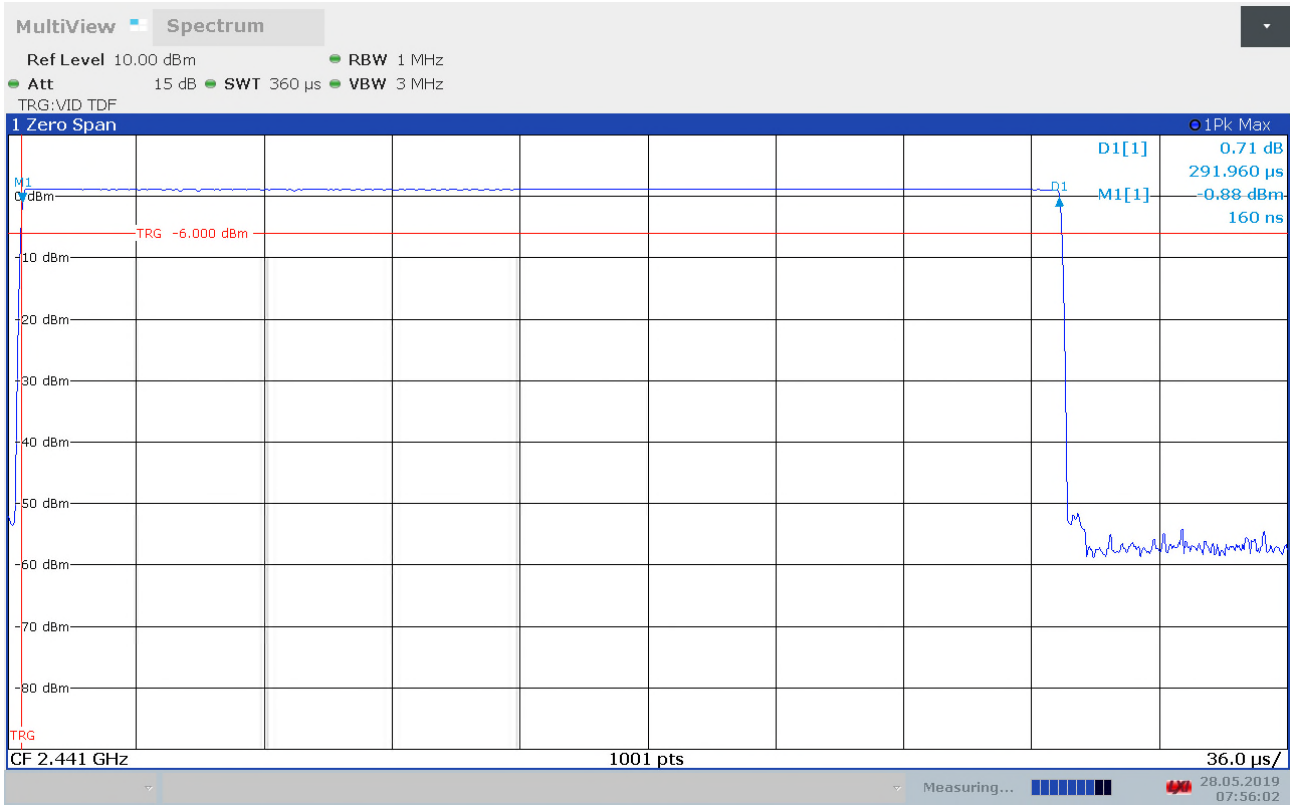
Time of occupancy: (0.292 x 400 x 79) / 62.34 = 148ms

See attached graph.

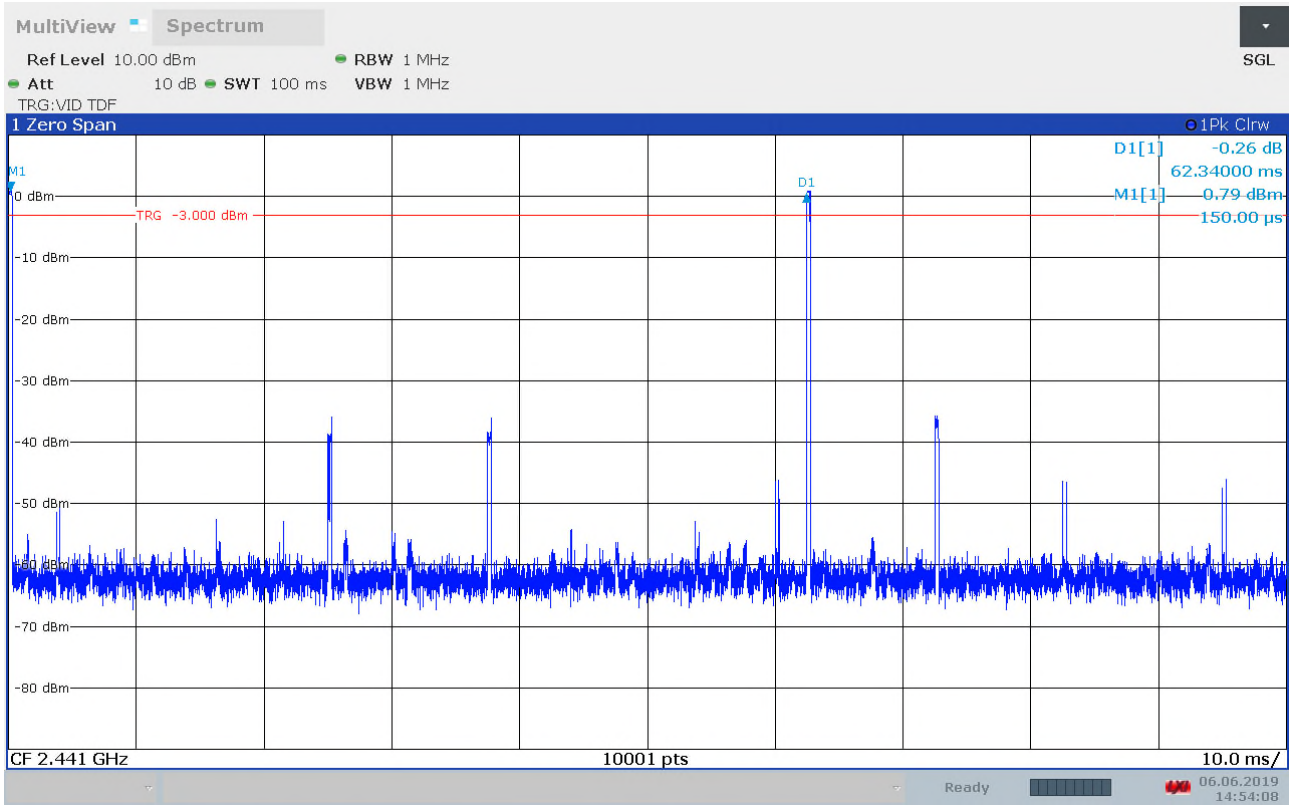
Requirements:

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

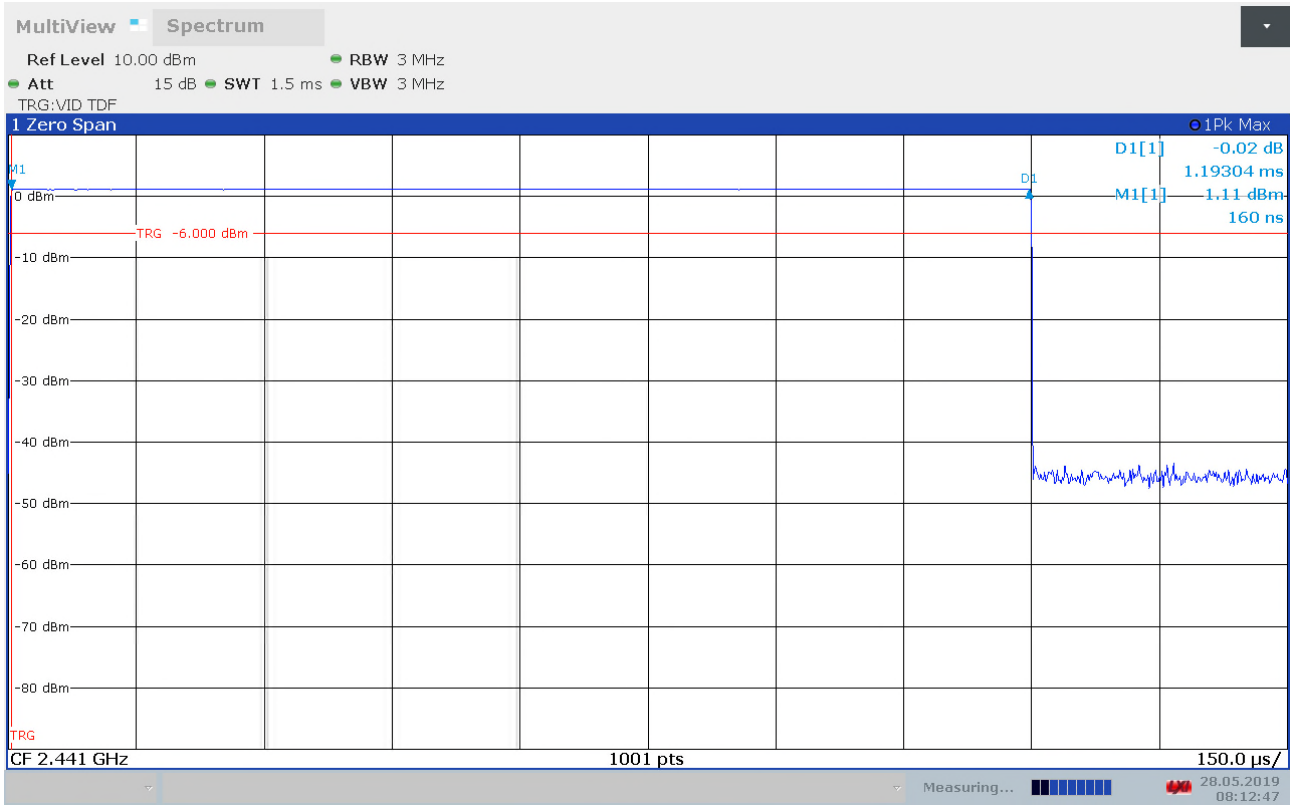
No requirements for Digital Transmission Systems.



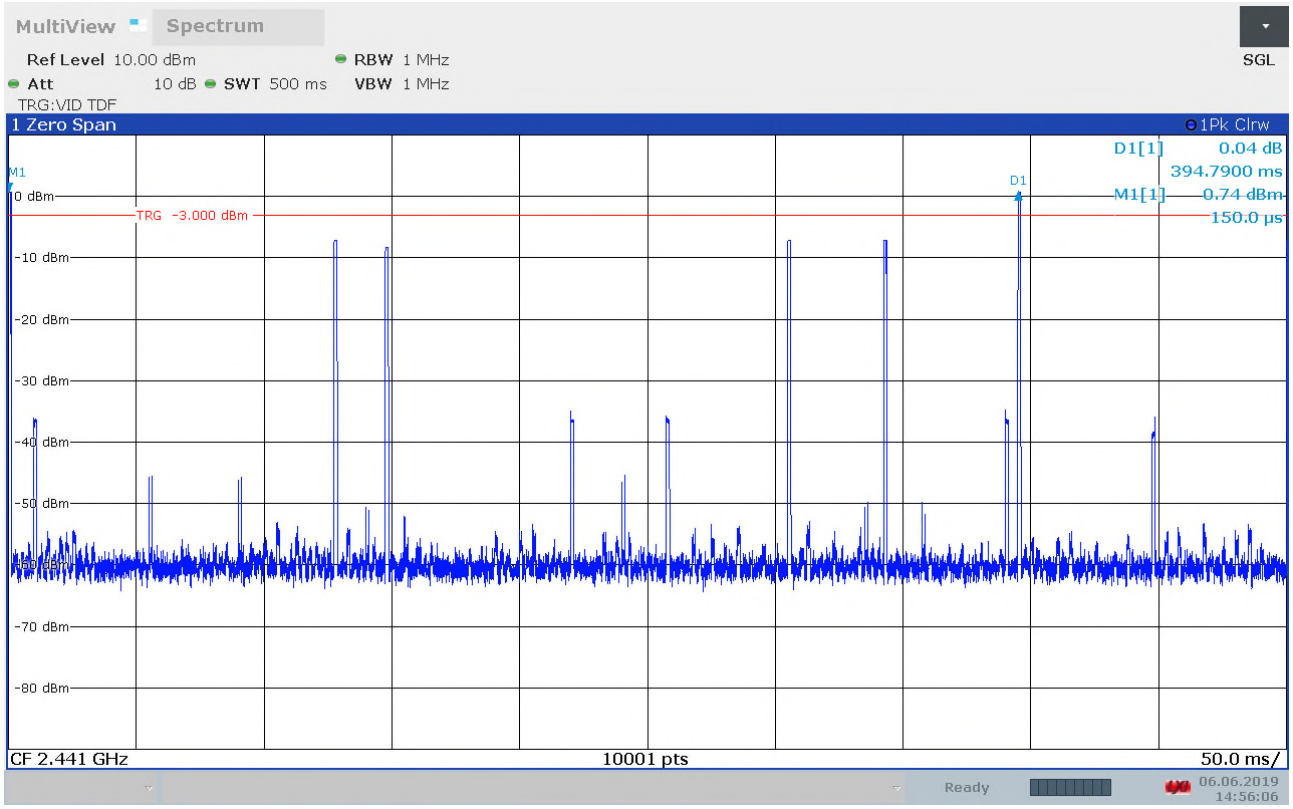
Burst Length – DH1



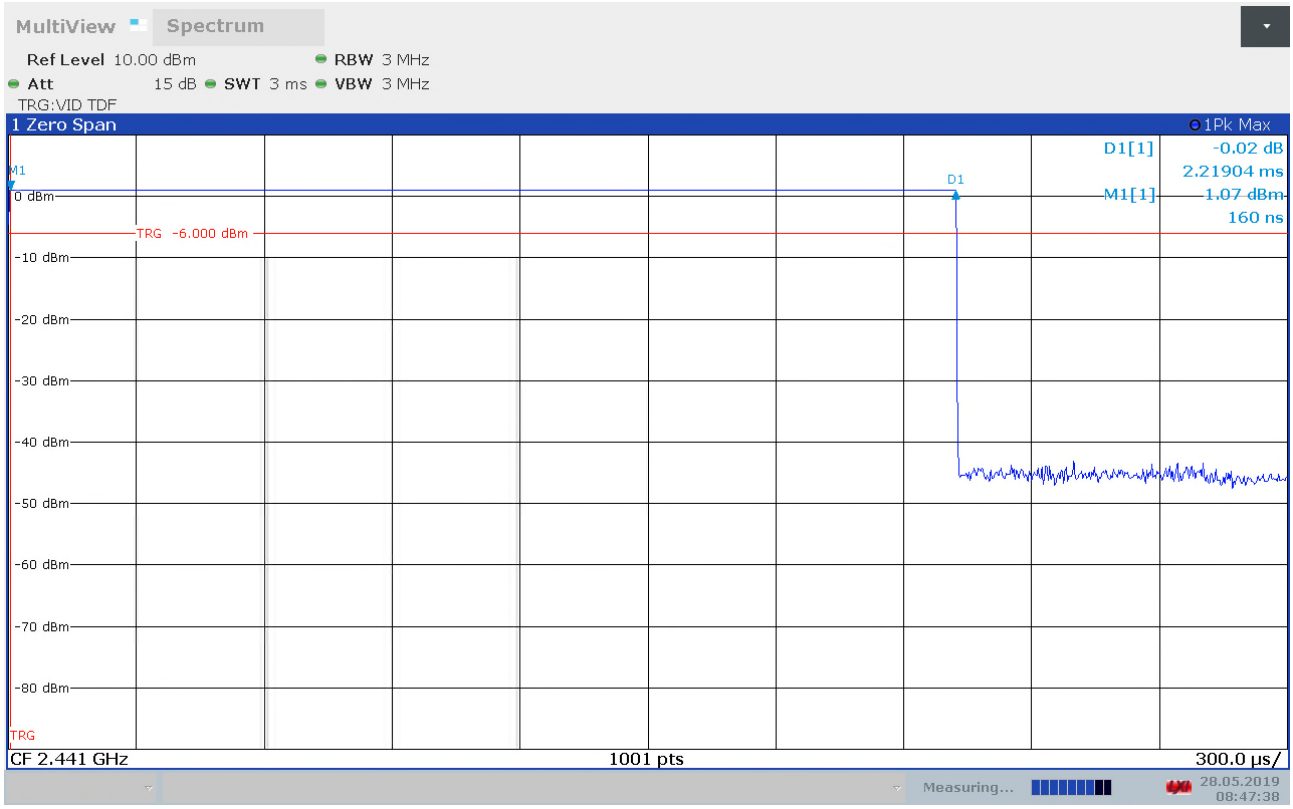
Dwell Time – DH1



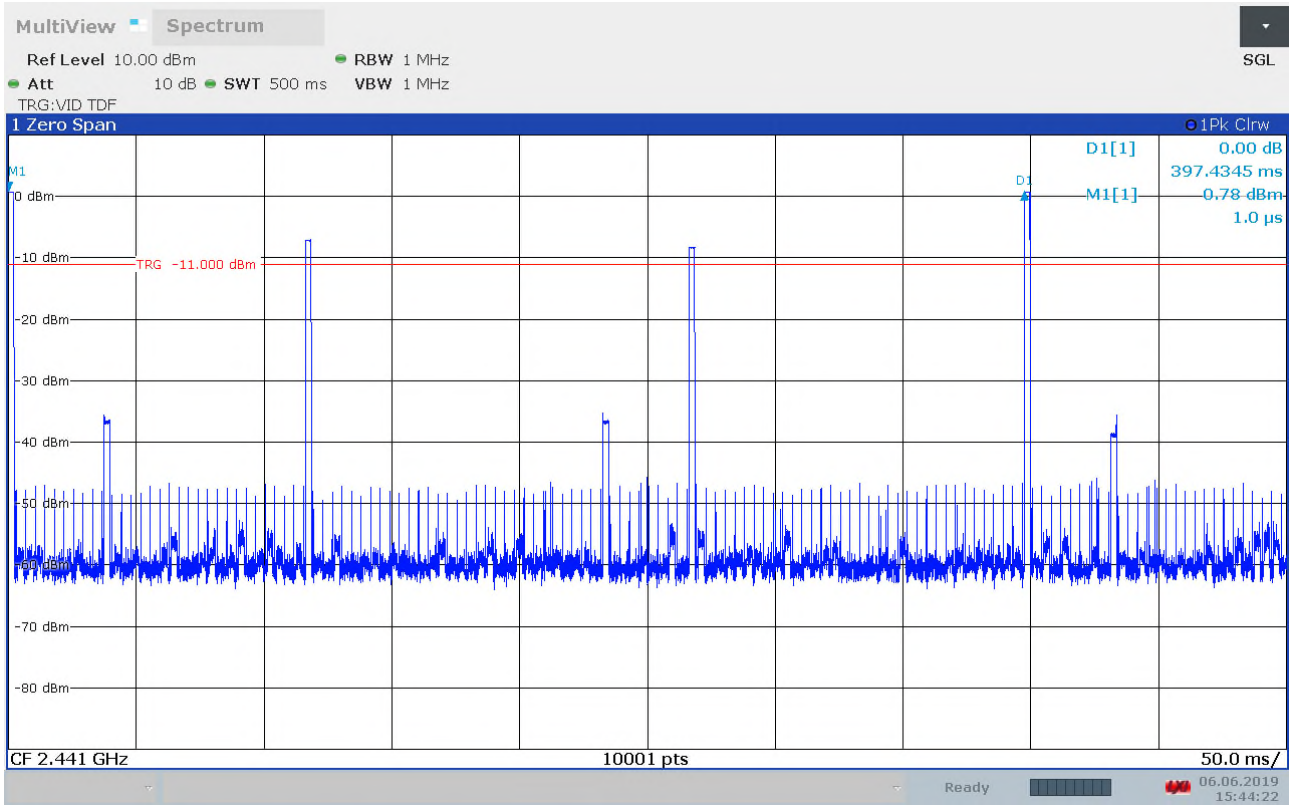
Burst Length – DH3



Dwell Time – DH3



Burst Length – DH5



Dwell Time – DH5

3.6 Occupied Bandwidth

Para. No.: 15.247 (a)(1)(iii)

ISED Canada RSS-247 Issue 2, Clause 5.1

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.2 / 7.8.3

Test Results: Complies

Measurement Data:

Number of RF Channels in use:	79	79	79
Channel Centre Frequencies:	2402 to 2480 MHz	2402 to 2480 MHz	2402 to 2480 MHz
Modulation	GFSK	8DPSK	4πDPSK
99% BW, MHz	0.874	1.22	1.22
20 dB BW, MHz	1.11	1.46	1.45

RF channel has no influence on 20 dB bandwidth.

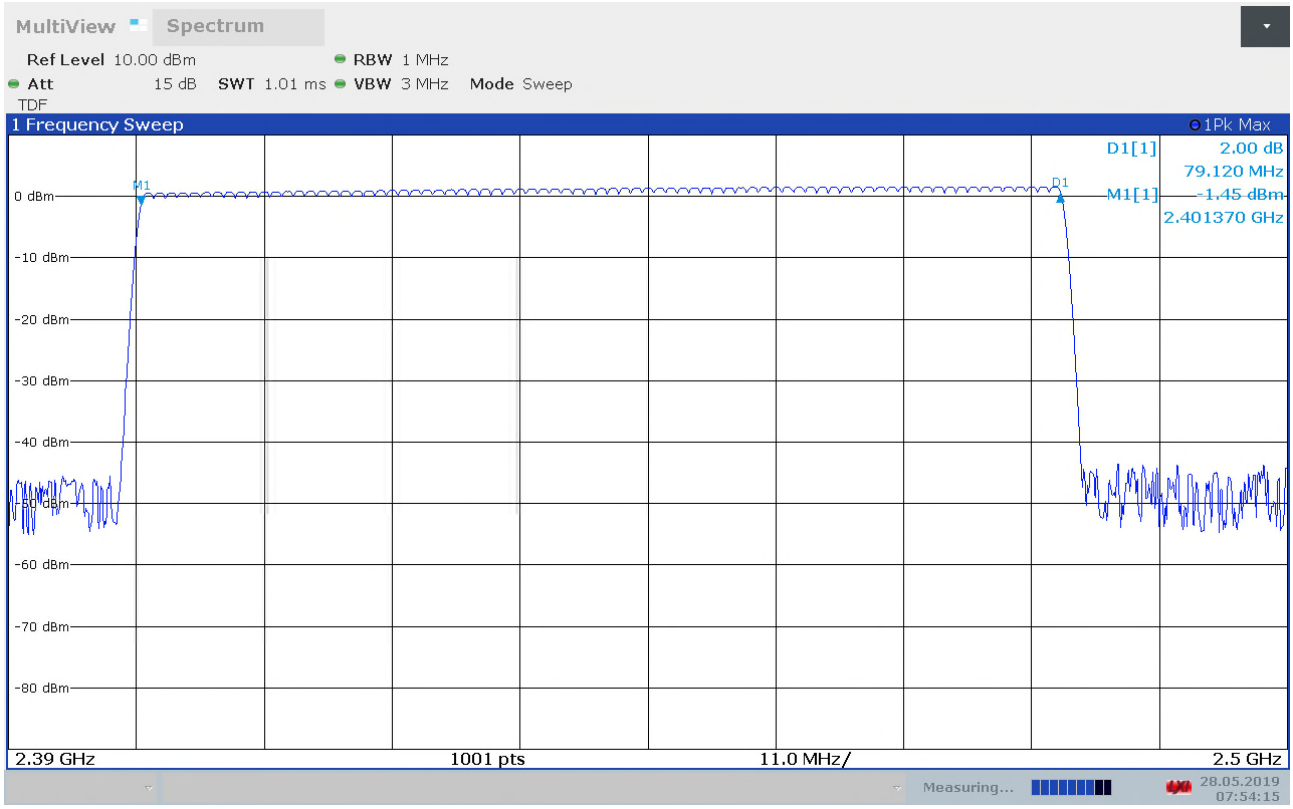
See attached plots.

Requirements:

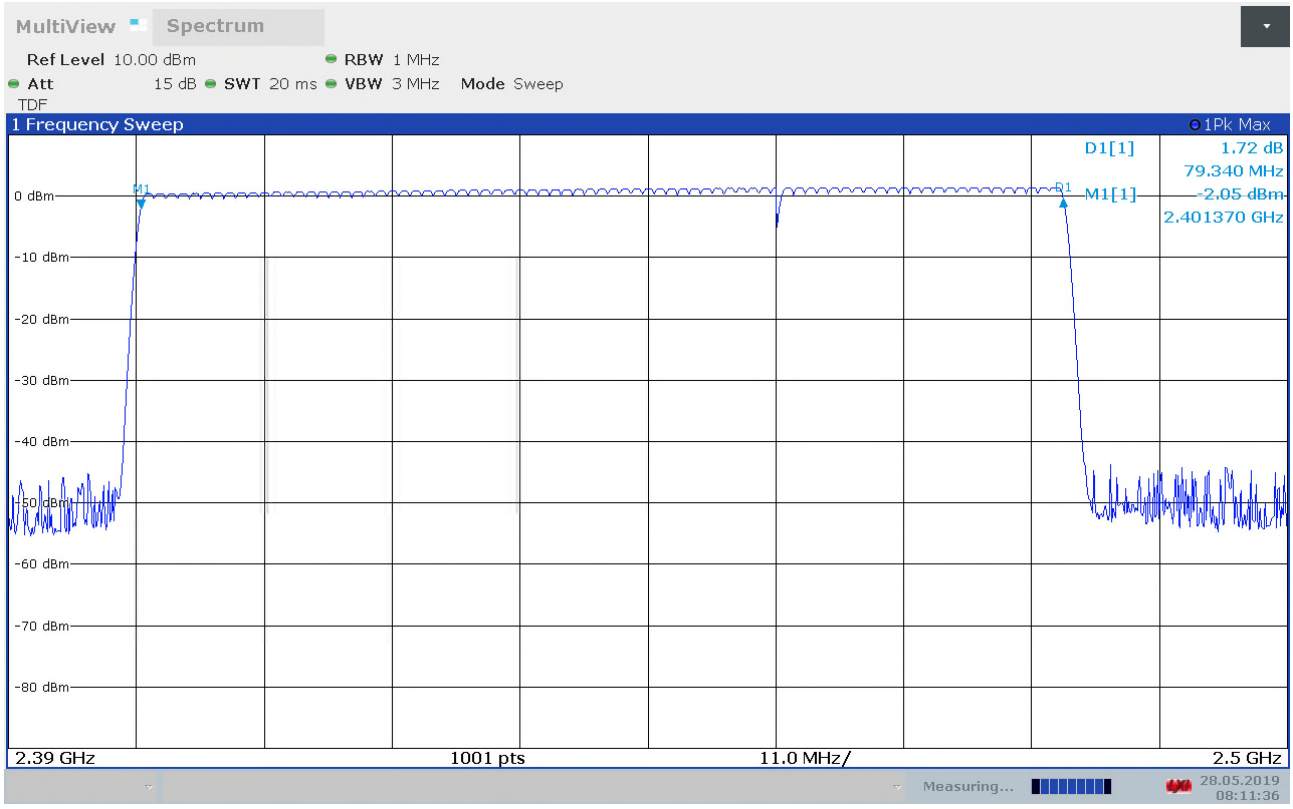
Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 non-overlapping channels. No requirements for bandwidth for this frequency band.

No requirements for Digital Transmission Systems.

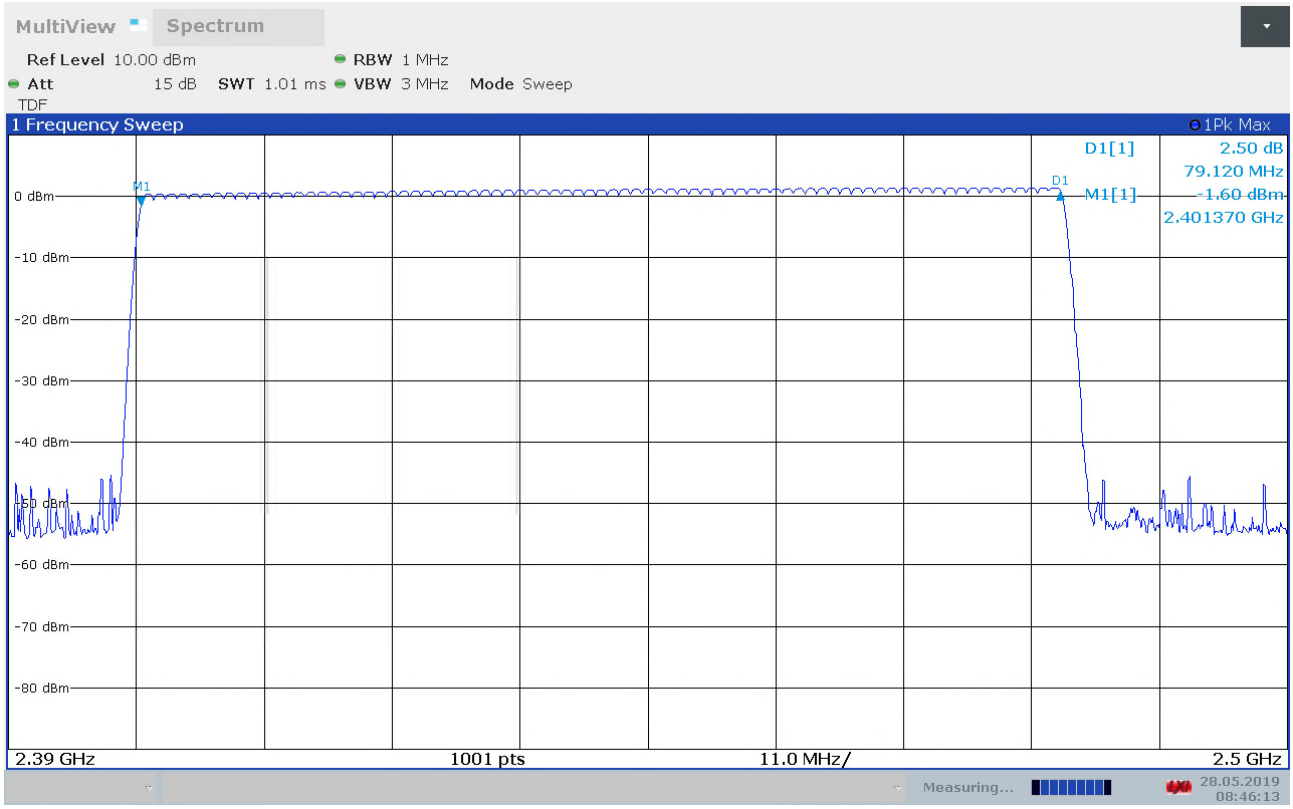
No requirement for 99% BW, reported for information only.



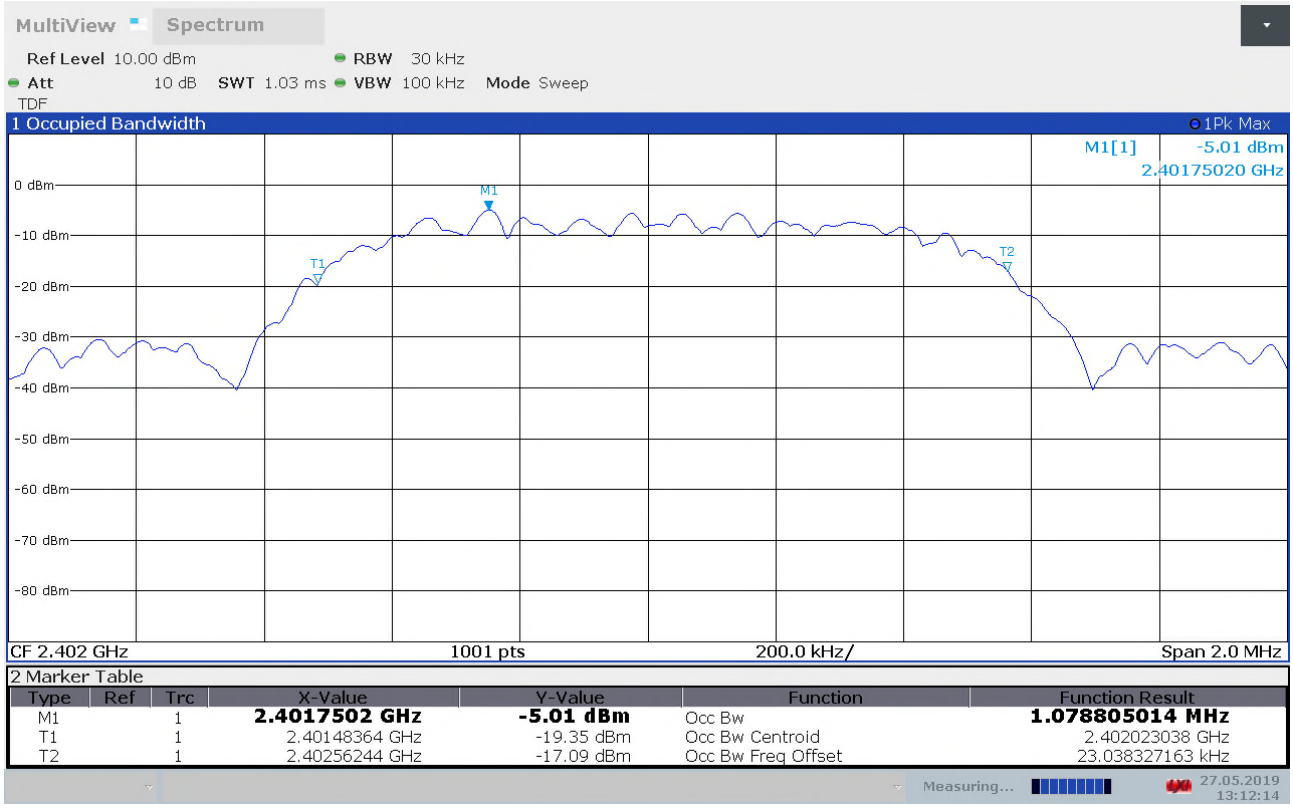
RF Channels in Use – DH1



RF Channels in Use – DH3



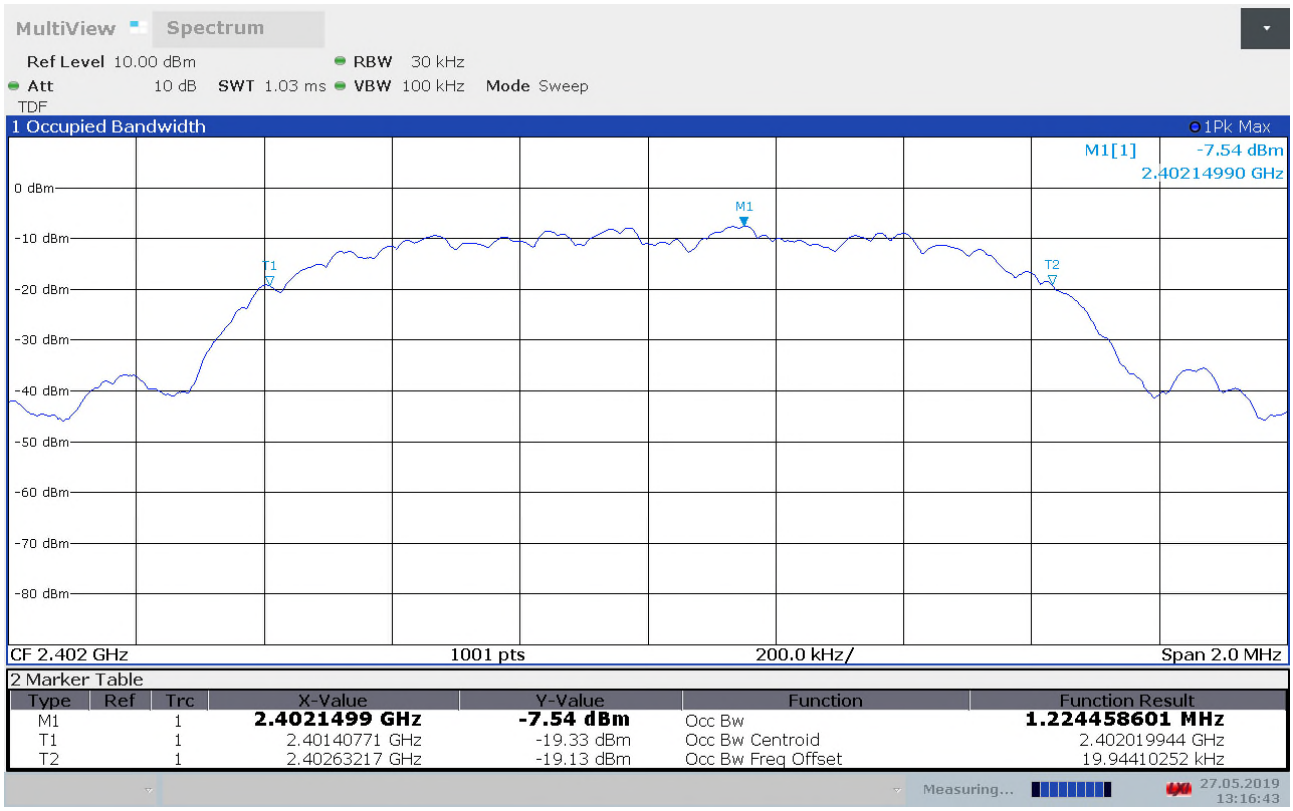
RF Channels in Use – DH5



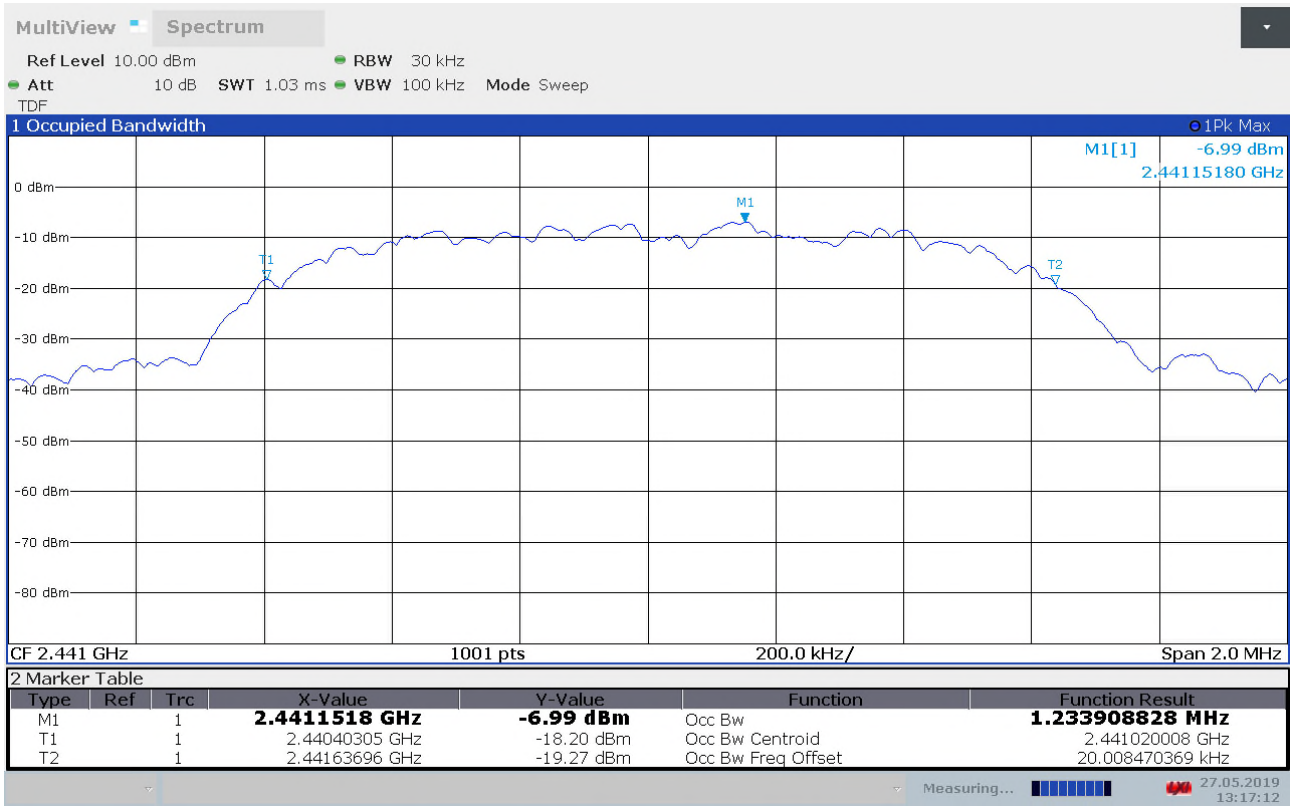
99% Bandwidth – GFSK, ch2402MHz

99% Bandwidth – GFSK, ch2441MHz

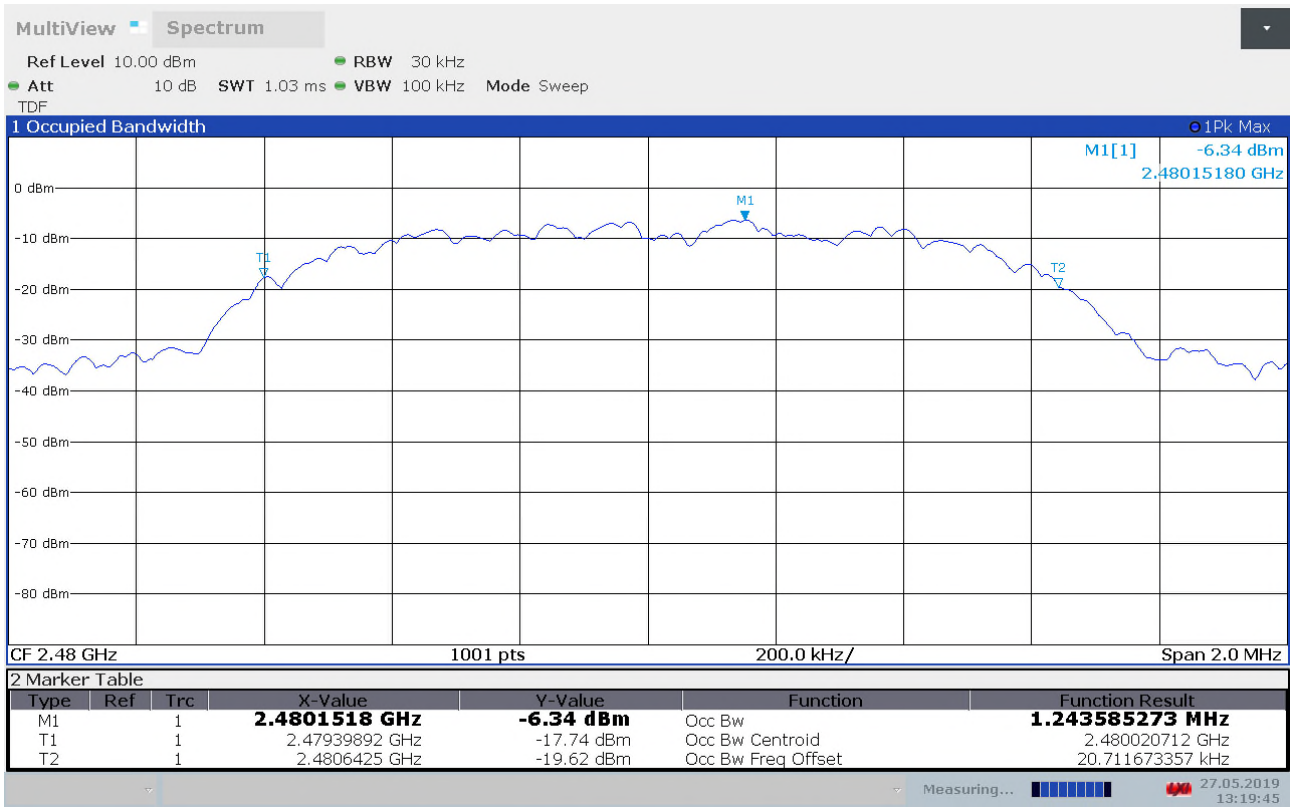
99% Bandwidth – GFSK, ch2480MHz



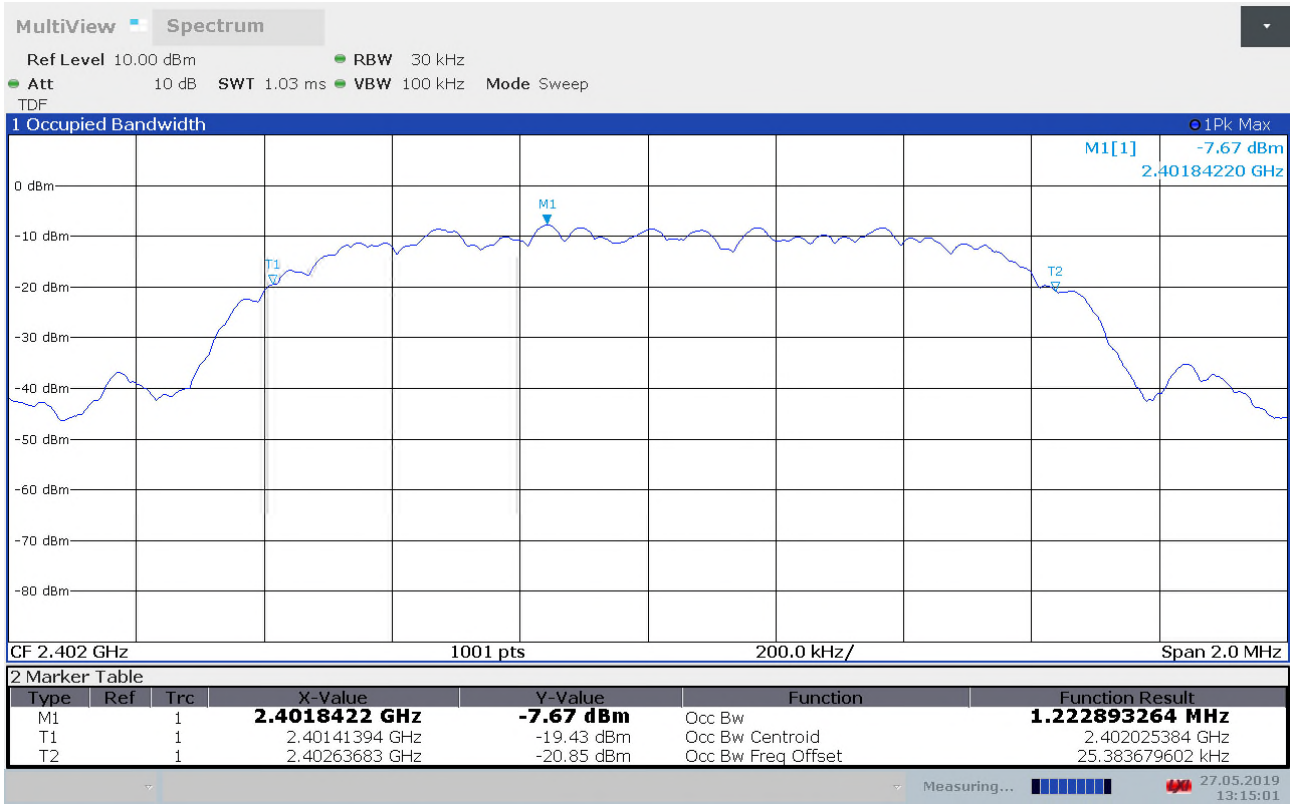
99% Bandwidth – 8DPSK, ch2402MHz



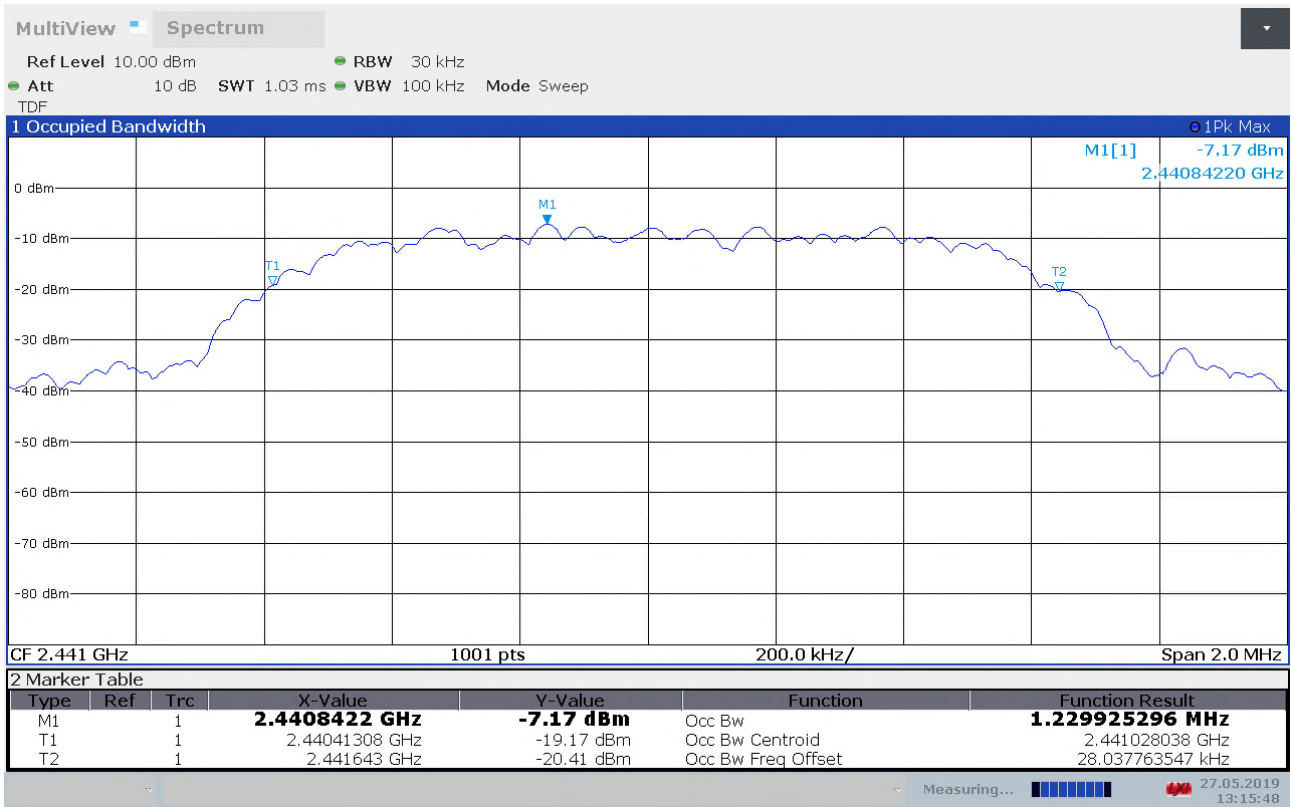
99% Bandwidth – 8DPSK, ch2441MHz



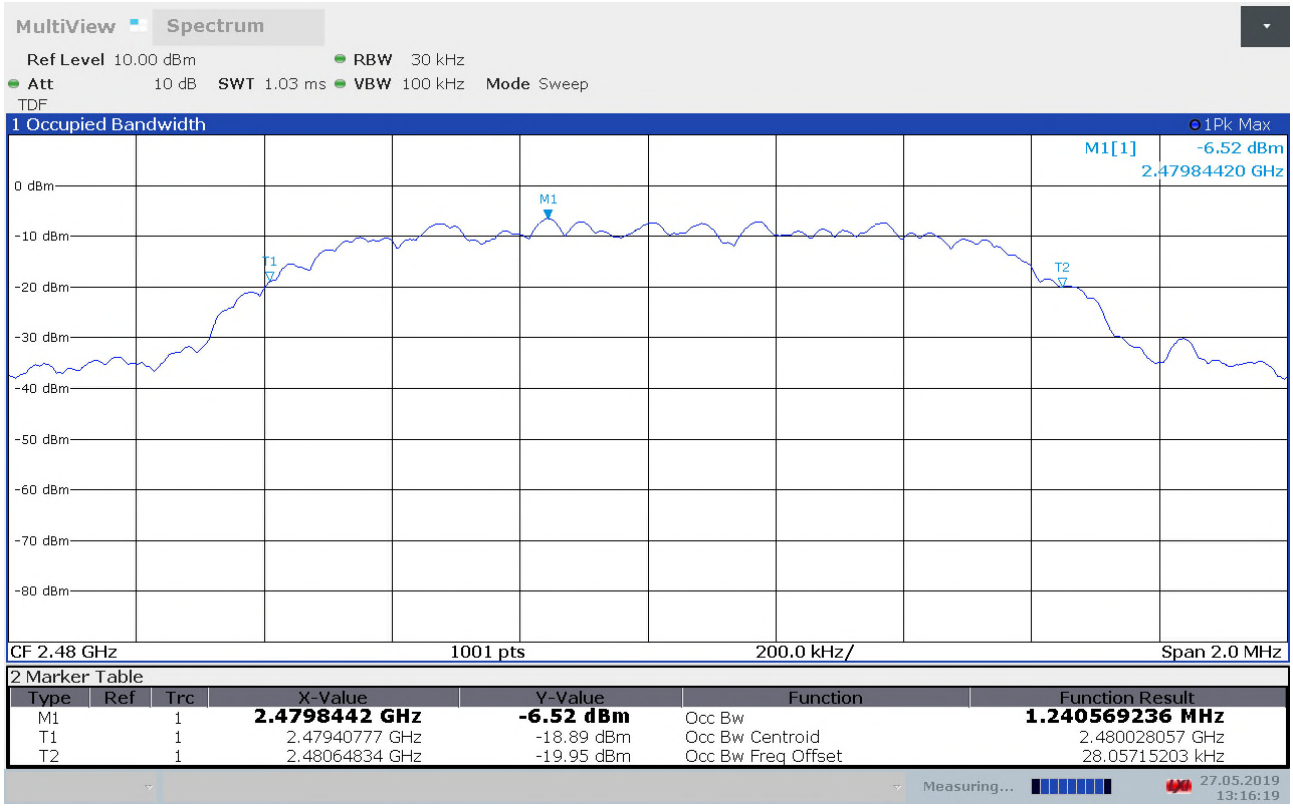
99% Bandwidth – 8DPSK, ch2480MHz



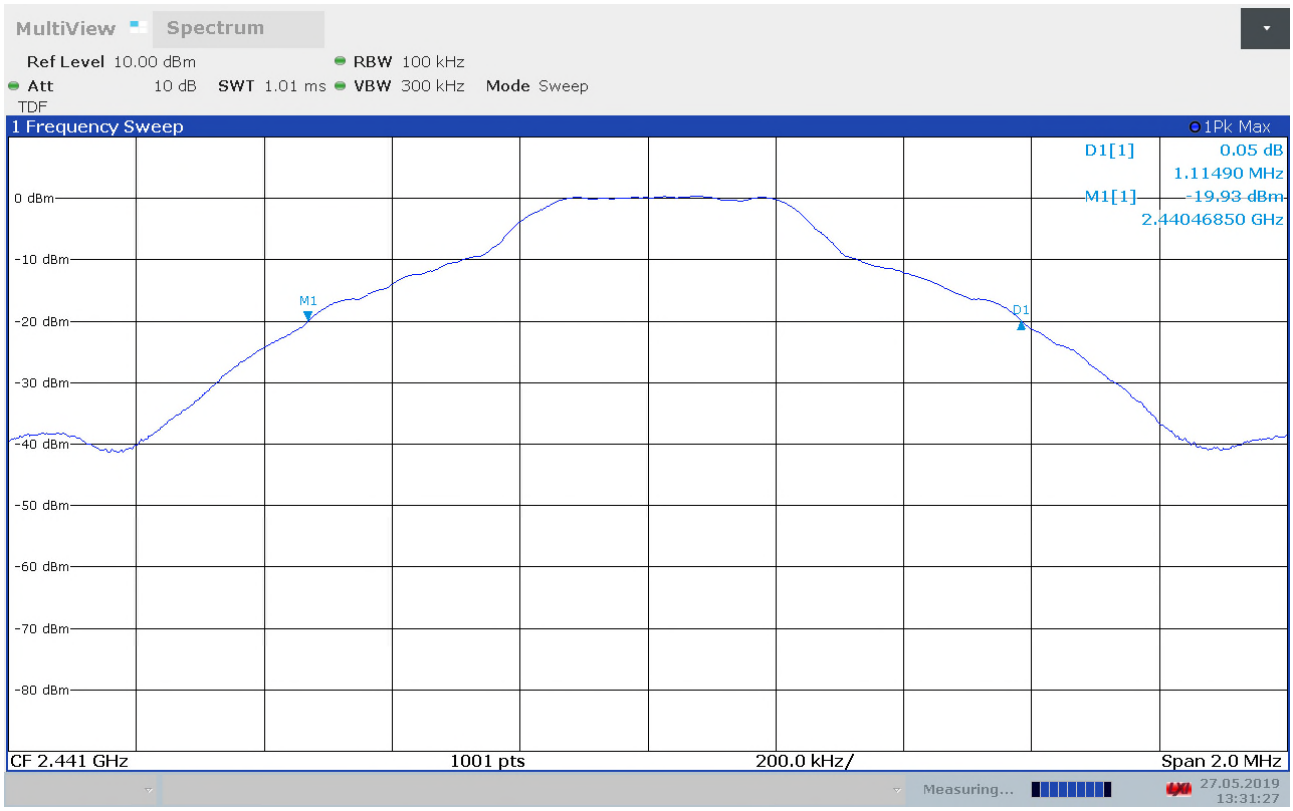
99% Bandwidth – 4πDPSK, ch2402MHz



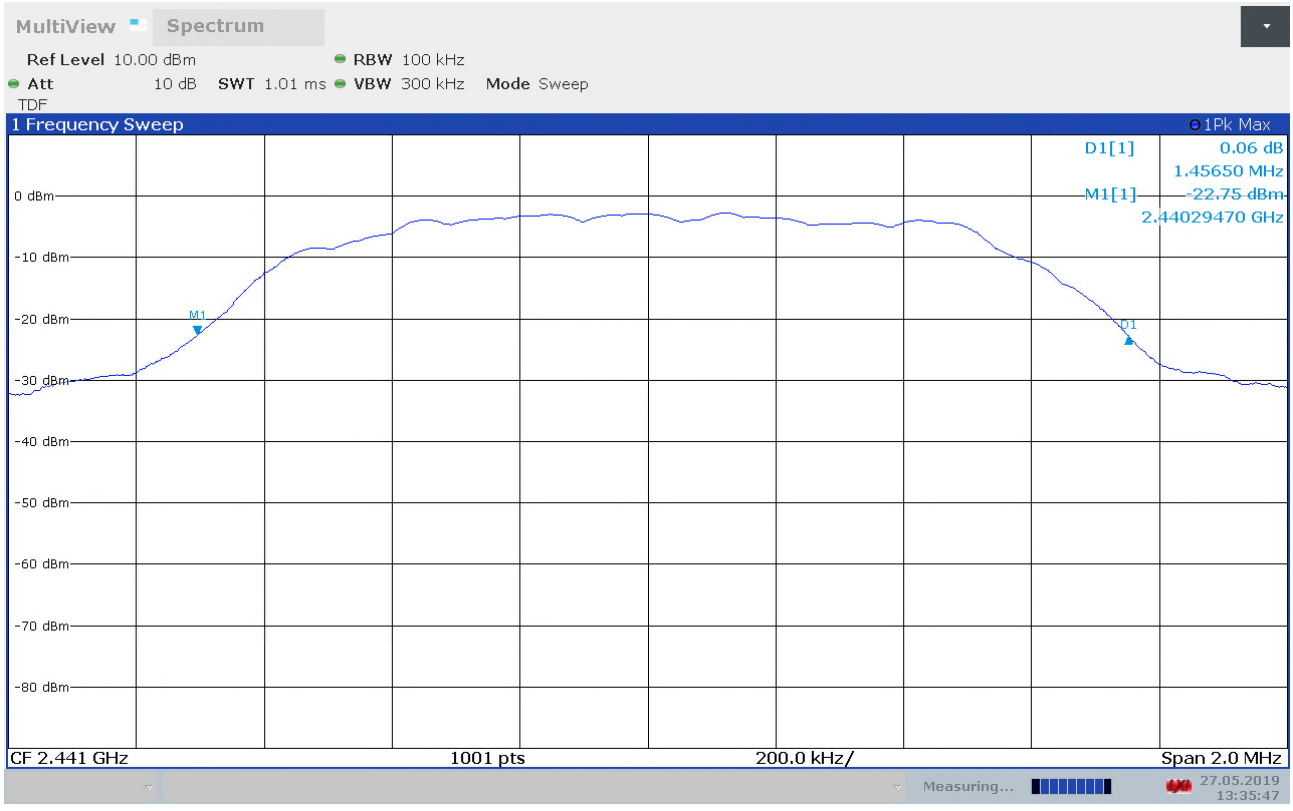
99% Bandwidth – 4πDPSK, ch2441MHz



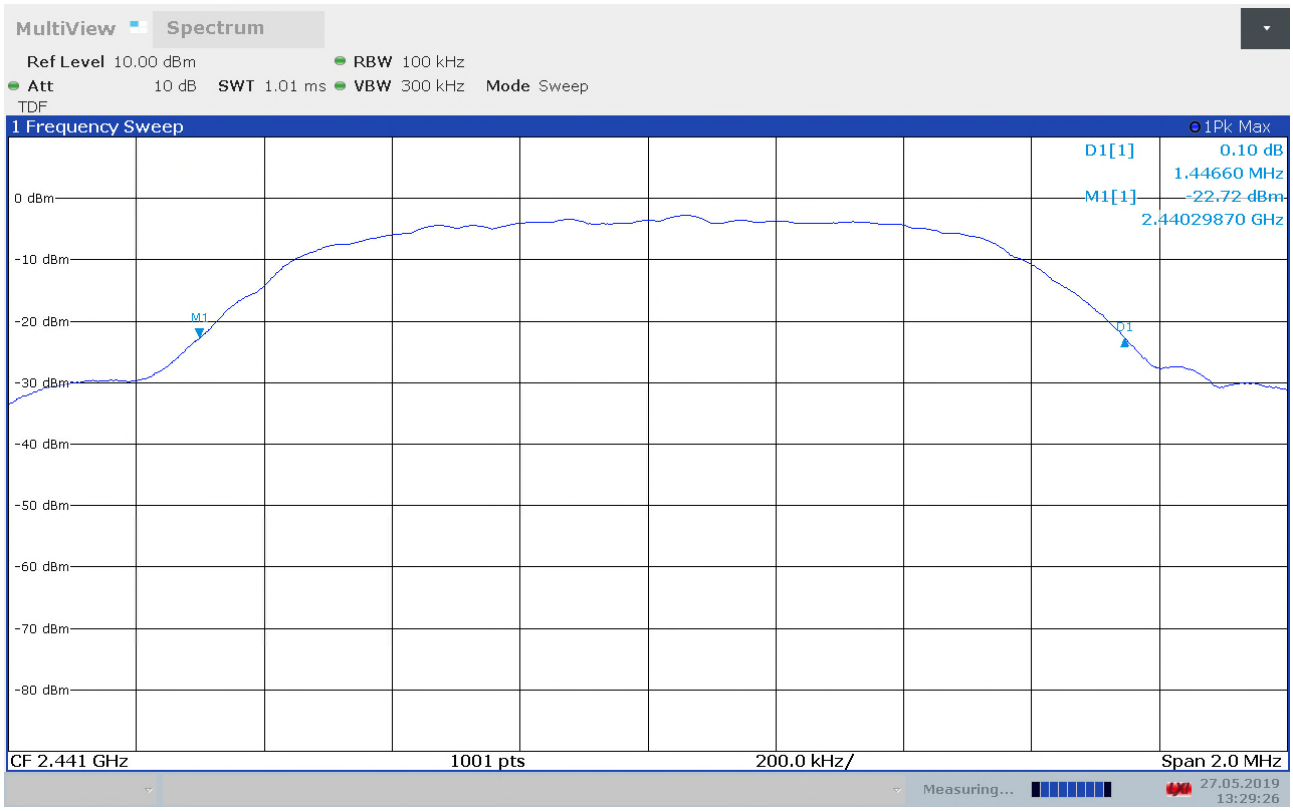
99% Bandwidth – 4πDPSK, ch2480MHz



20 dB BW – GFSK, ch 2441MHz



20 dB BW – 8DPSK, ch 2441MHz



20 dB BW – 4πDPSK, ch 2441MHz

3.7 Peak Power Output

FCC part 15.247 (b)

ISED Canada RSS-247 Issue 2, Clause 5.4

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

Mode		2402 MHz	2441 MHz	2480 MHz
GFSK	Conducted Power (dBm)	0.22	0.93	1.21
	Conducted Power (mW)	1.05	1.24	1.32
	Field Strength (dBµV/m),VP	96.47	97.41	97.13
	EIRP, Calculated (mW)	1.33	1.65	1.55
	Antenna gain (dBi)	1.0	1.3	0.7
8-DPSK	Conducted Power (dBm)	1.54	1.96	1.99
	Conducted Power (mW)	1.43	1.57	1.58
	Field Strength (dBµV/m),VP	100.17	100.62	99.87
	EIRP, Calculated (mW)	3.12	3.46	2.91
	Antenna gain (dBi)	3.4	3.4	2.7
4π-DPSK	Conducted Power (dBm)	0.9	1.44	1.61
	Conducted Power (mW)	1.23	1.39	1.45
	Field Strength (dBµV/m),VP	96.90	96.45	99.51
	EIRP, Calculated (mW)	1.47	1.32	2.68
	Antenna gain (dBi)	0.8	-0.2	2.7

Maximum field strength is obtained in VP

Antenna gain = 10*log(EIRP/Conducted power) dBi

EIRP is calculated from measured field strength by the formulas in KDB 412172 D01.

See attached plots.

Requirements:

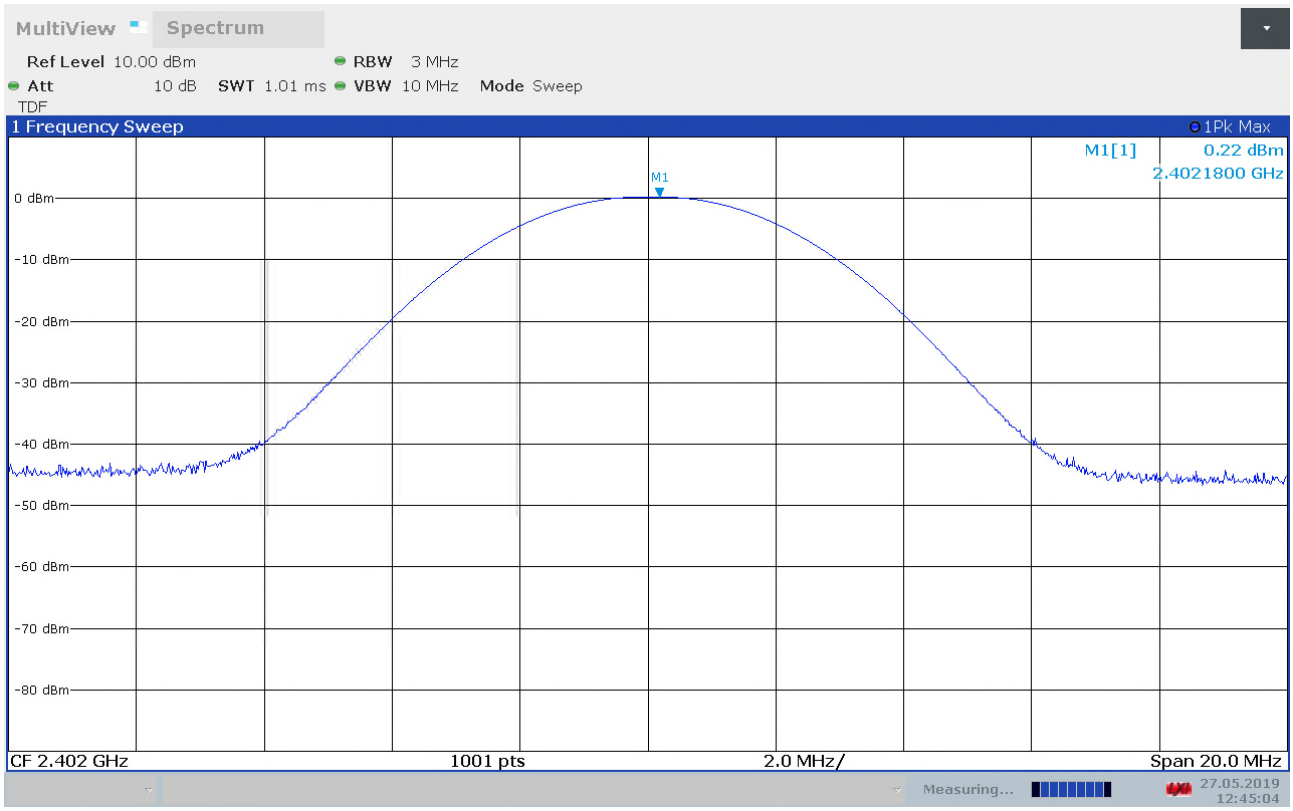
The maximum peak output power shall not exceed the following limits:

For frequency hopping systems employing at least 75 hopping channels: 1 Watt

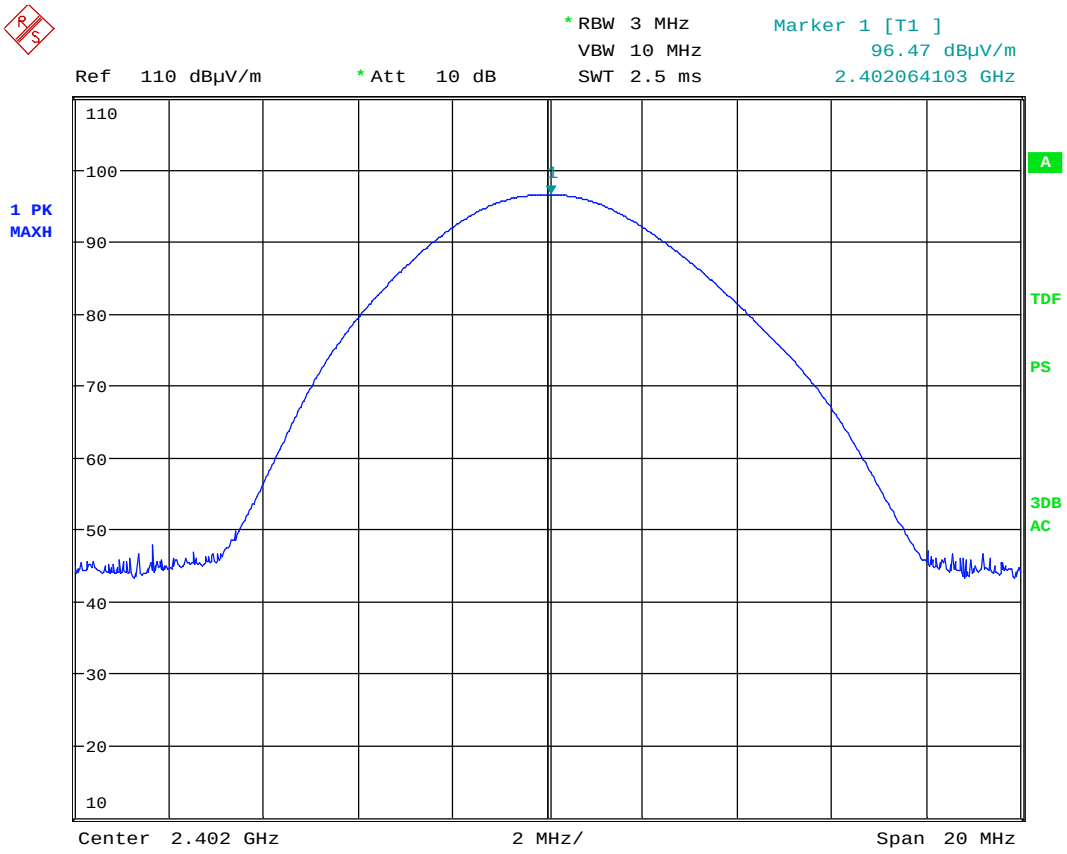
For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

If transmitting antennas of directional gain greater than 6 dBi are used, the peak 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.



Conducted output Power, ch2402MHz , GFSK



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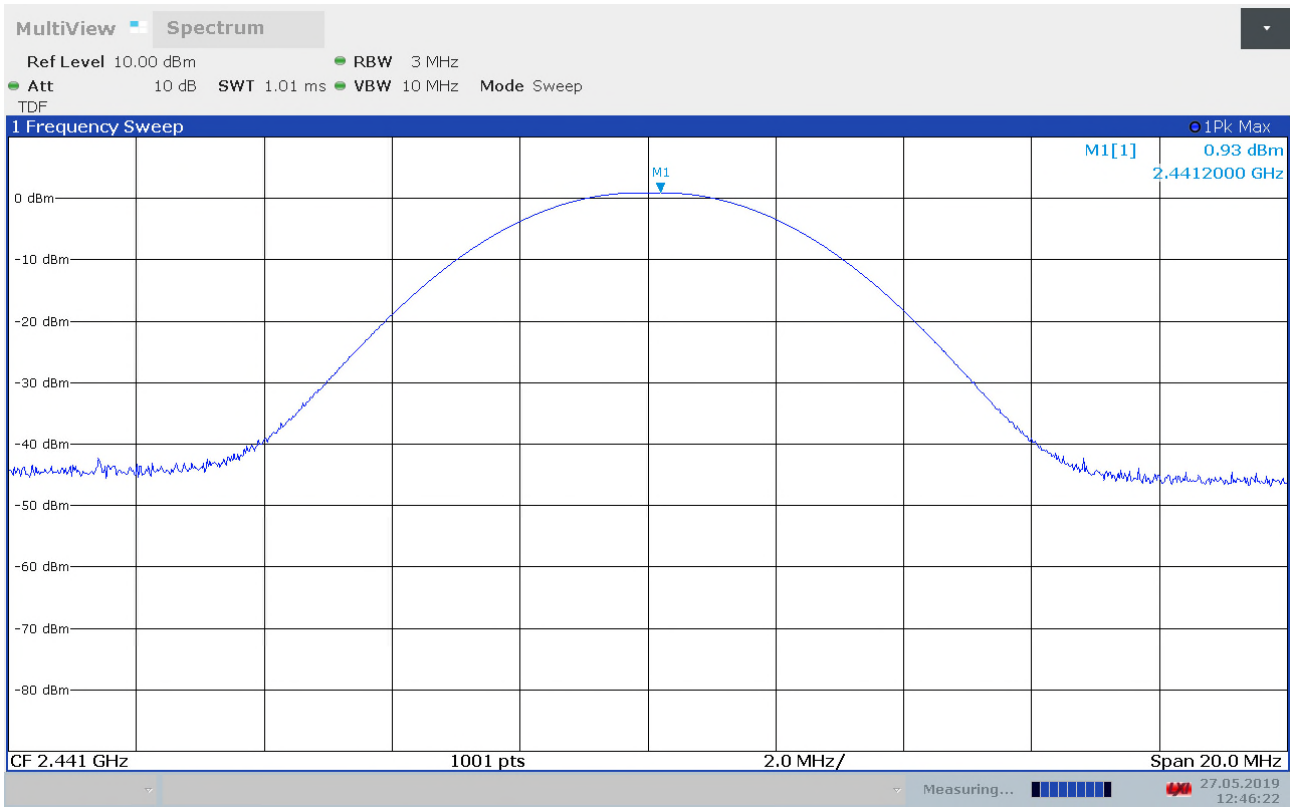
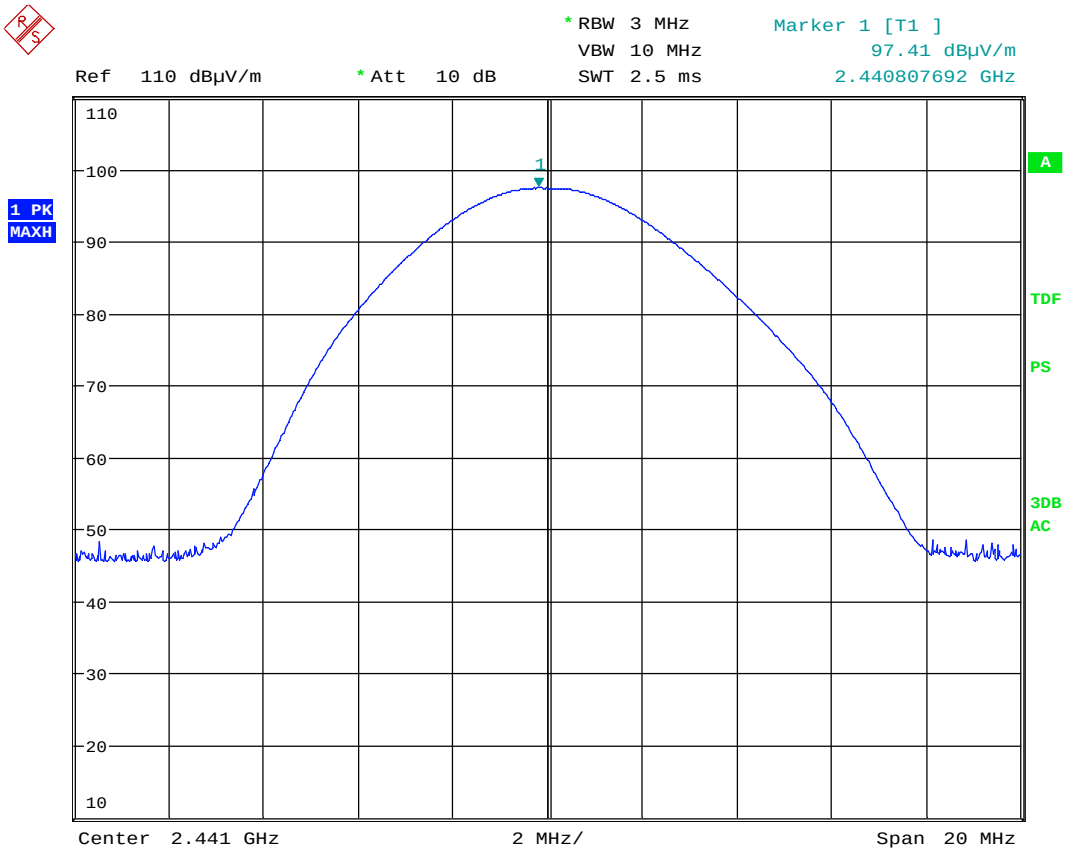
Radiated field strength-VP, ch2402MHz , GFSK



Conducted output Power, ch2441MHz , GFSK



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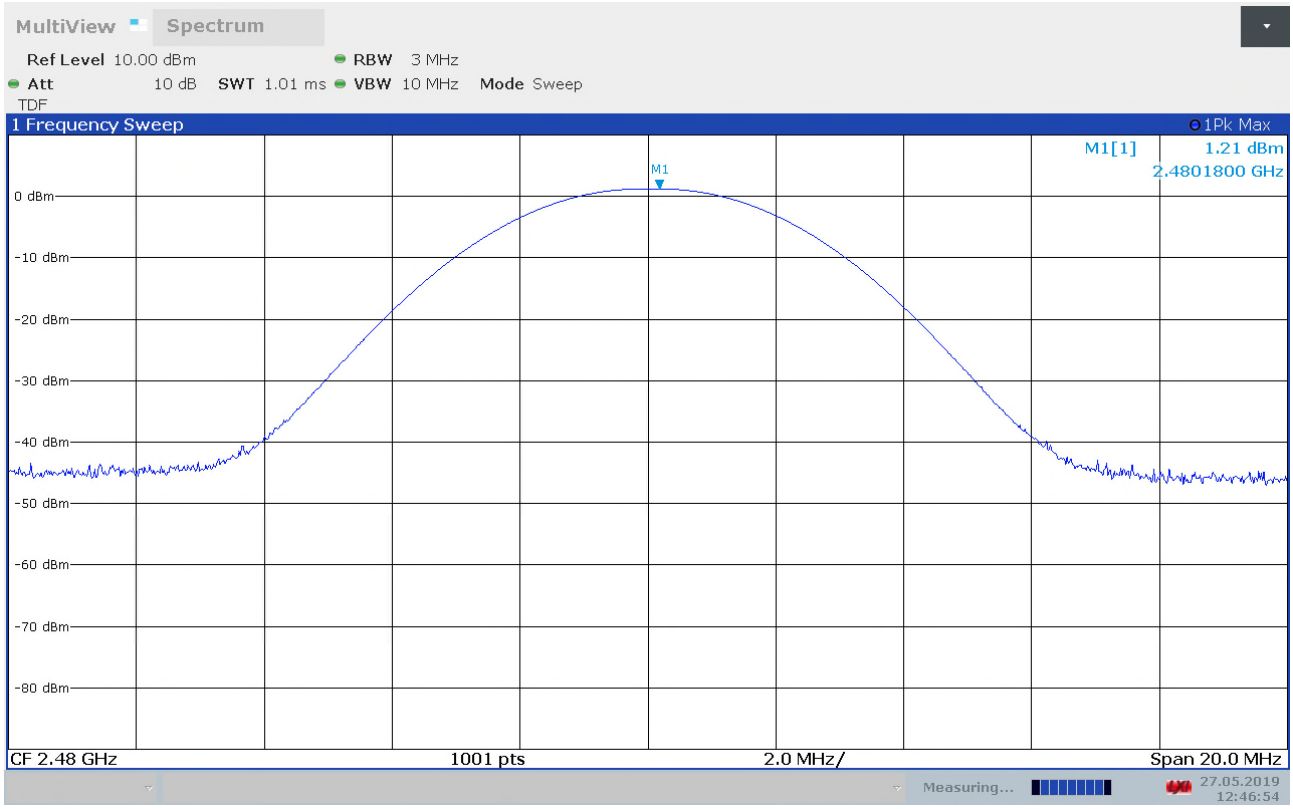
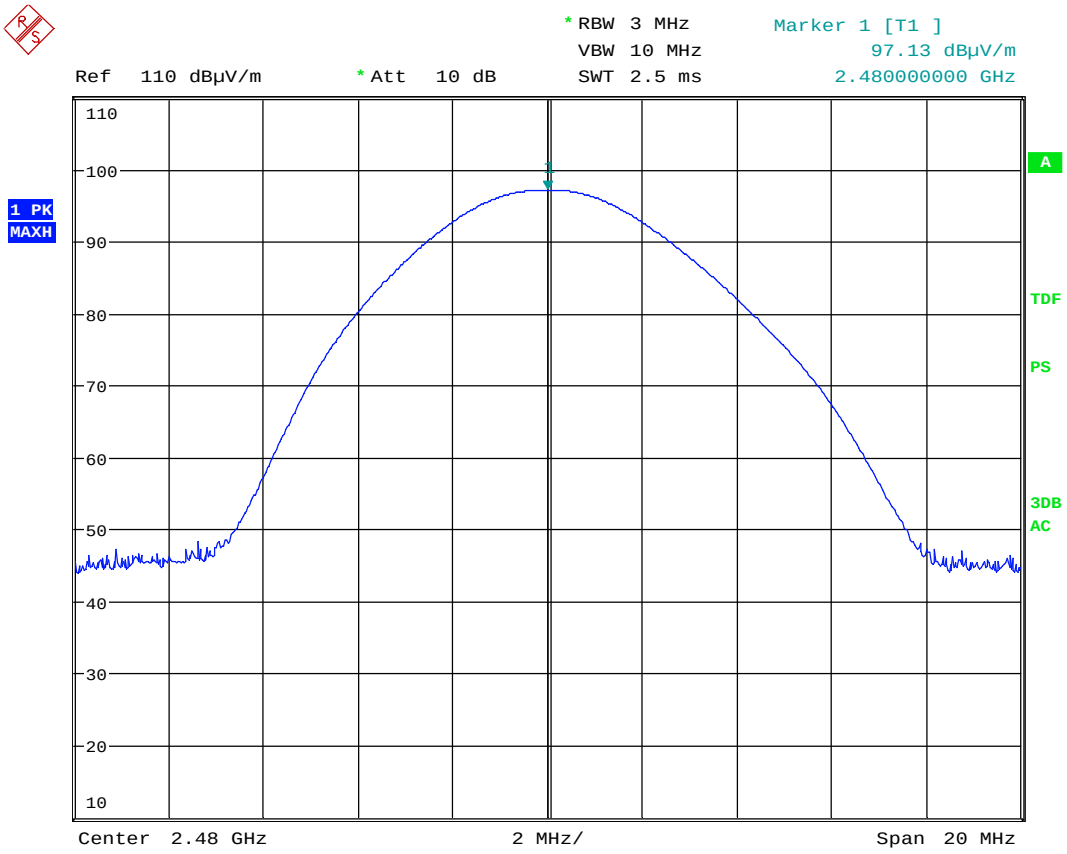
Radiated field strength-VP, ch2441MHz , GFSK

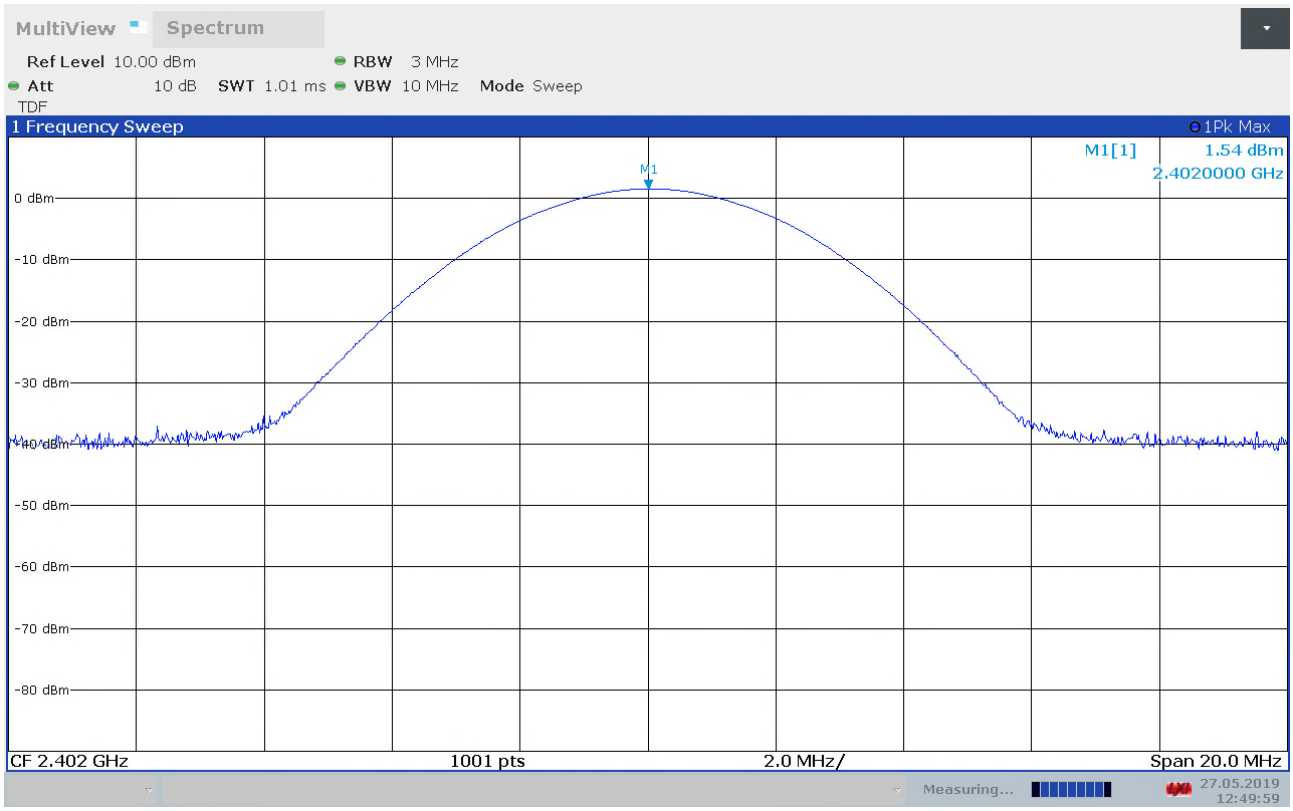


Conducted output Power, ch2480MHz , GFSK

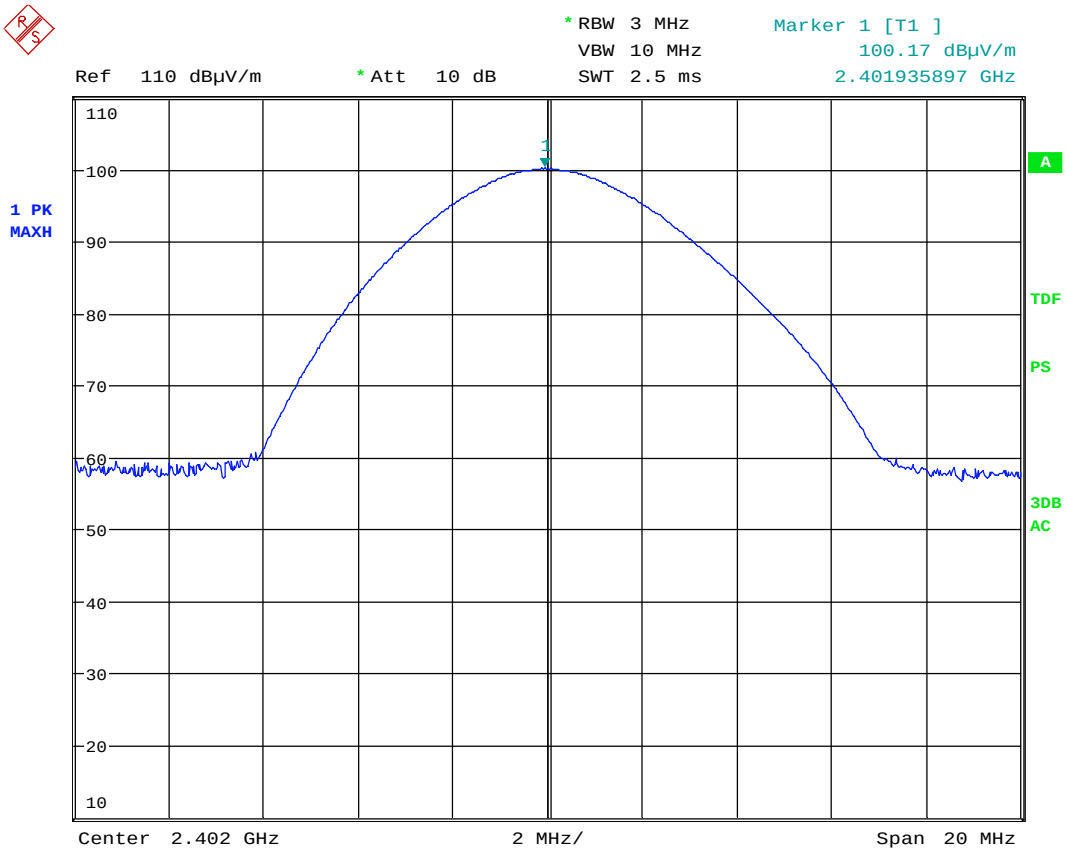


Date: 4.JUN.2019 10:31:24

Radiated field strength-VP, ch2480MHz , GFSK



Conducted output Power, ch2402MHz , 8DPSK



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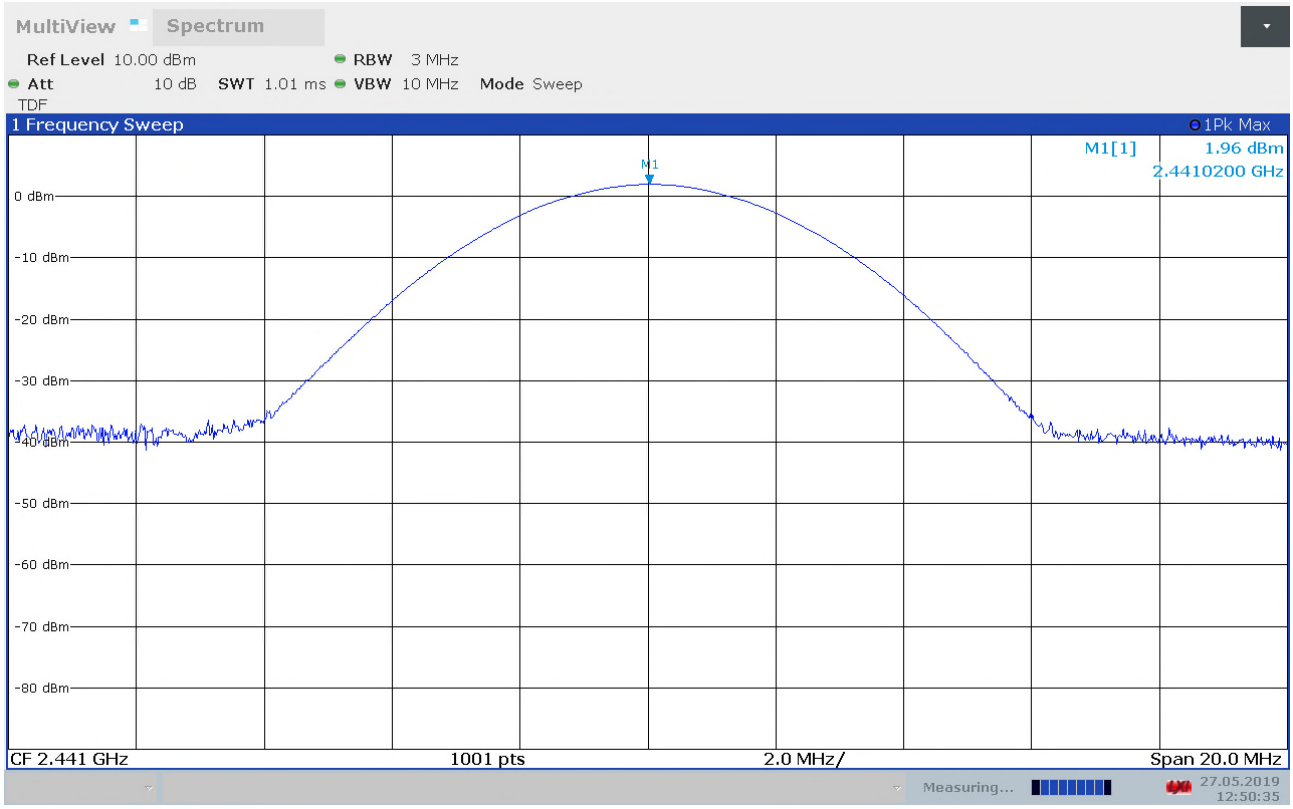
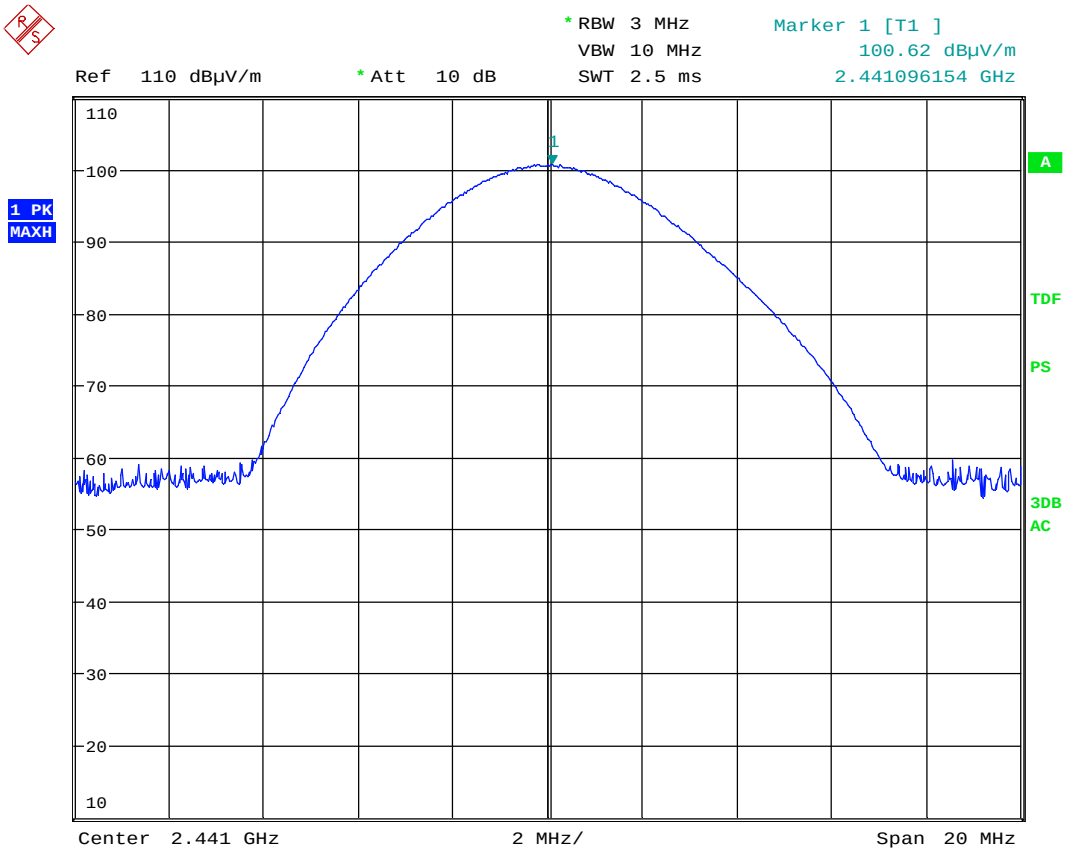
Radiated field strength-VP, ch2402MHz , 8DPSK

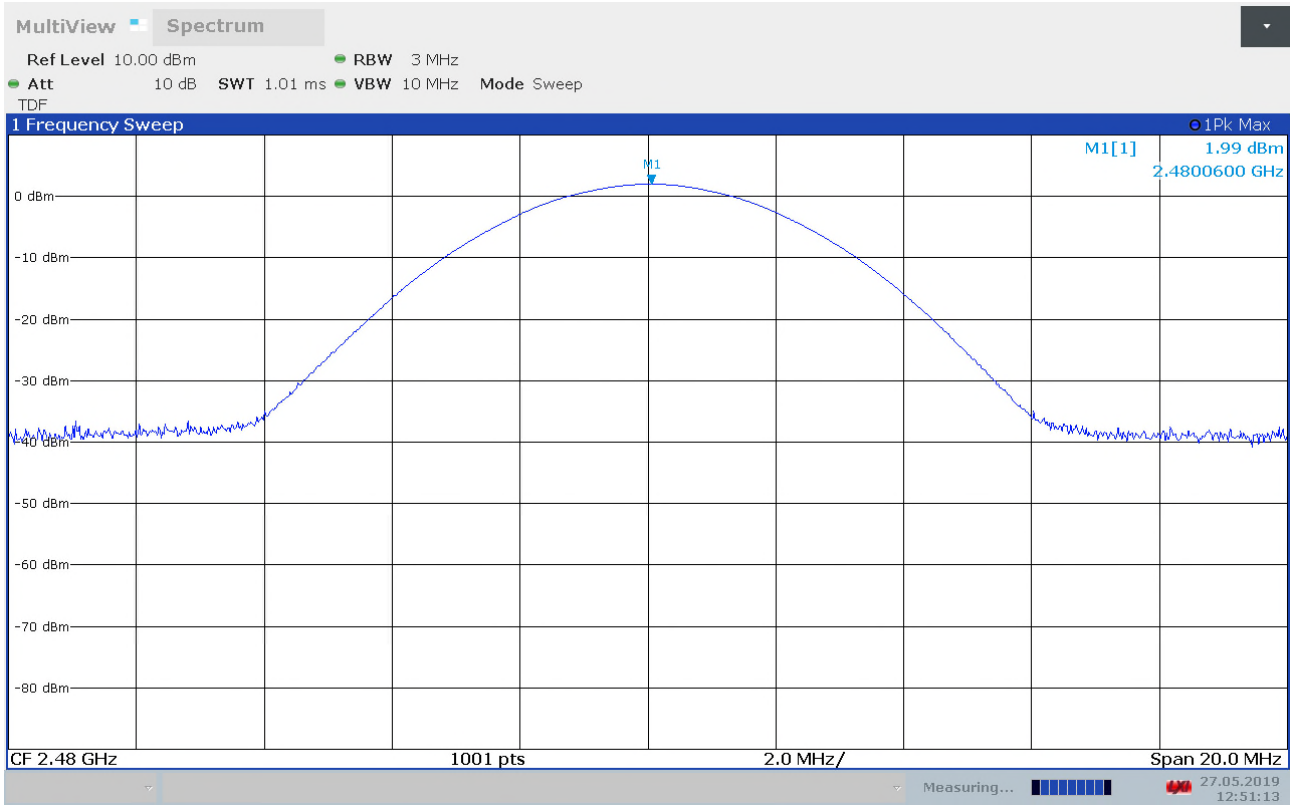


Conducted output Power, ch2441MHz , 8DPSK

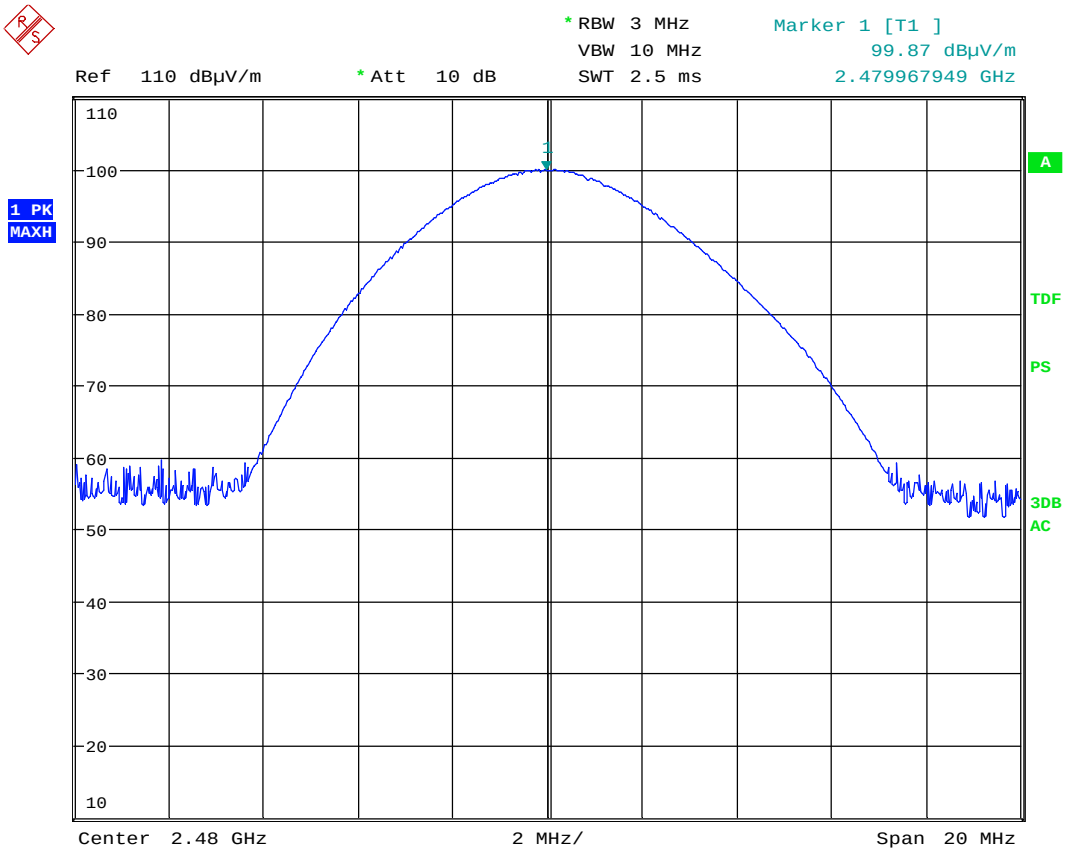


Date: 4.JUN.2019 09:21:45

Radiated field strength-VP, ch2441MHz , 8DPSK

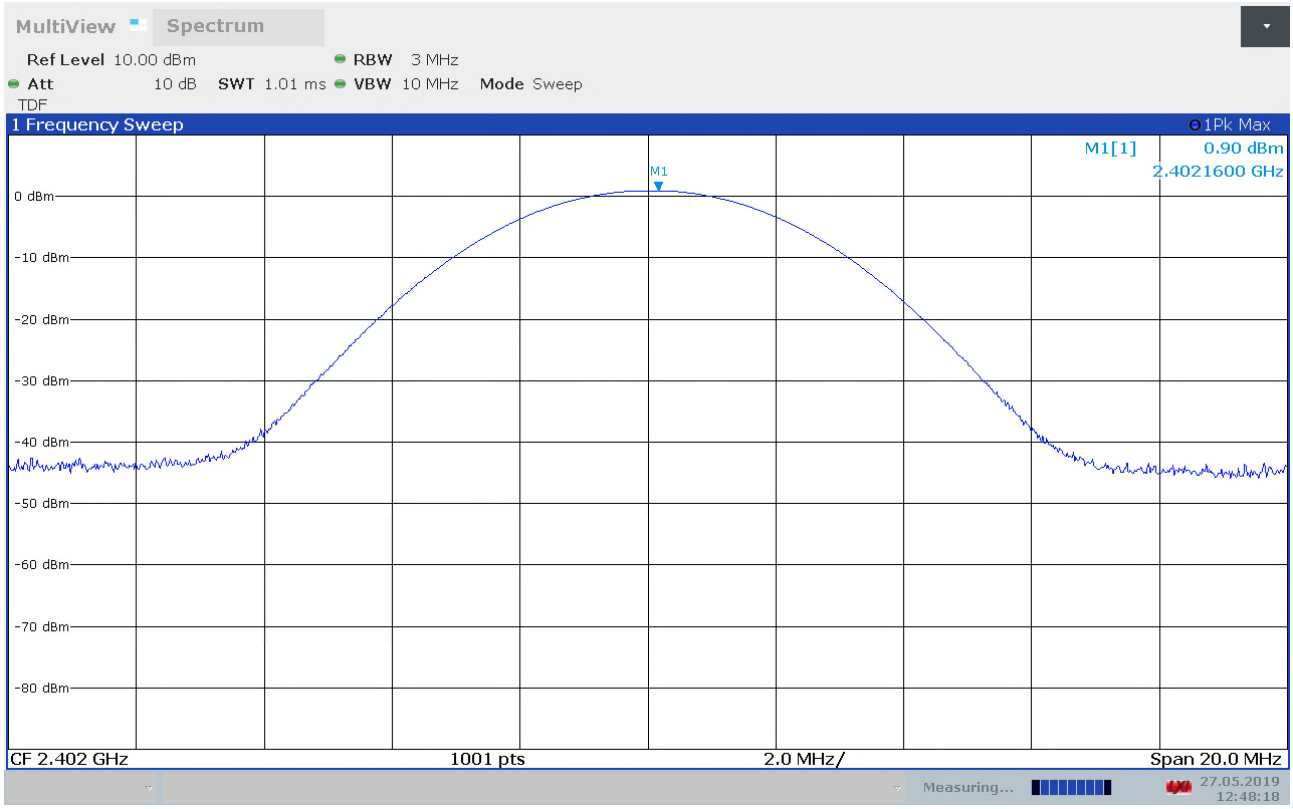


Conducted output Power, ch2480MHz , 8DPSK

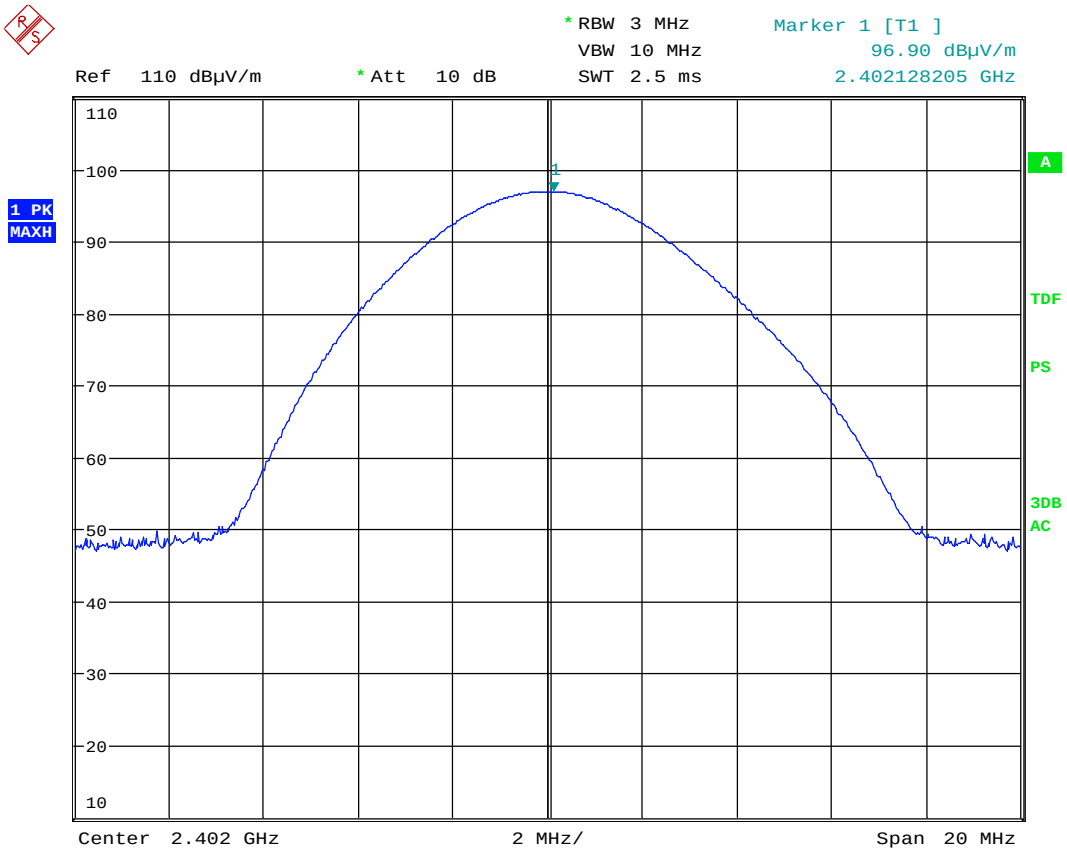


Date: 4.JUN.2019 09:36:43

Radiated field strength-VP, ch2480MHz , 8DPSK

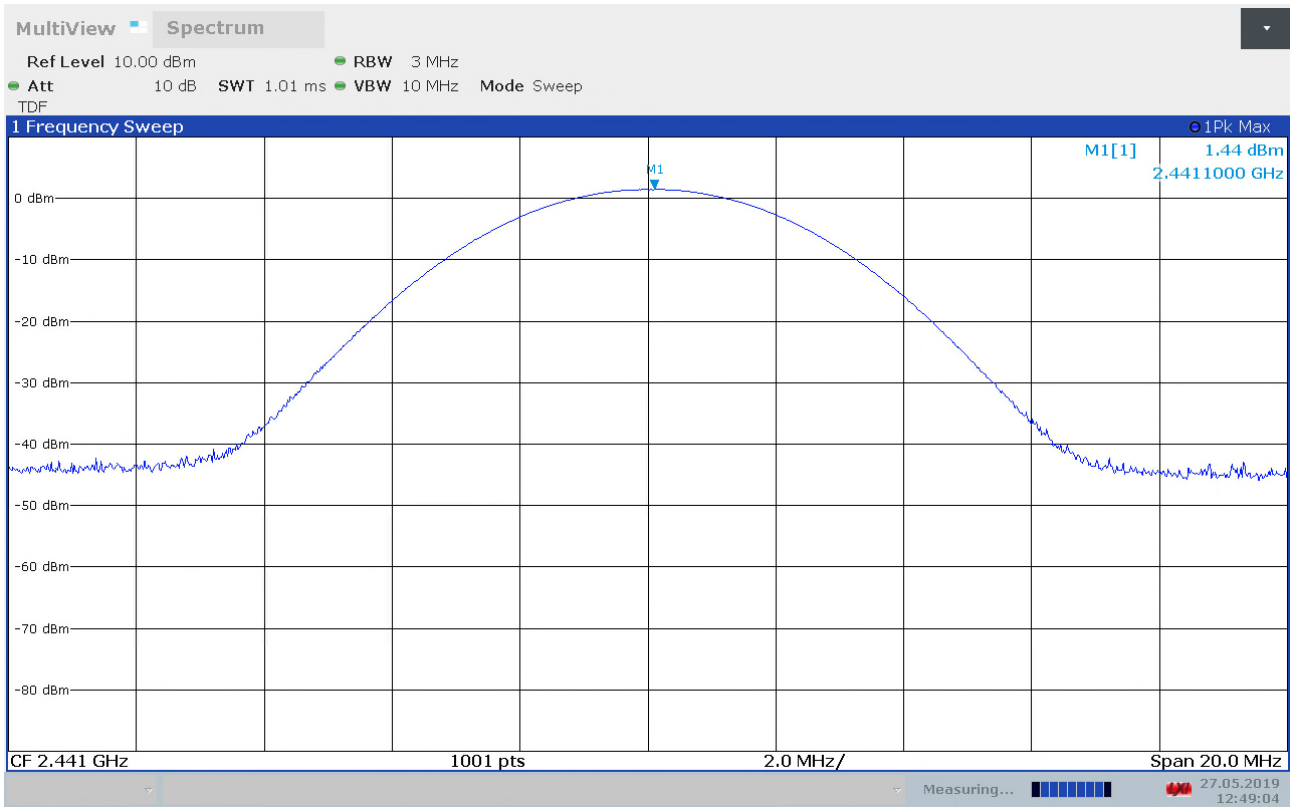


Conducted output Power, ch2402MHz , 4πDPSK

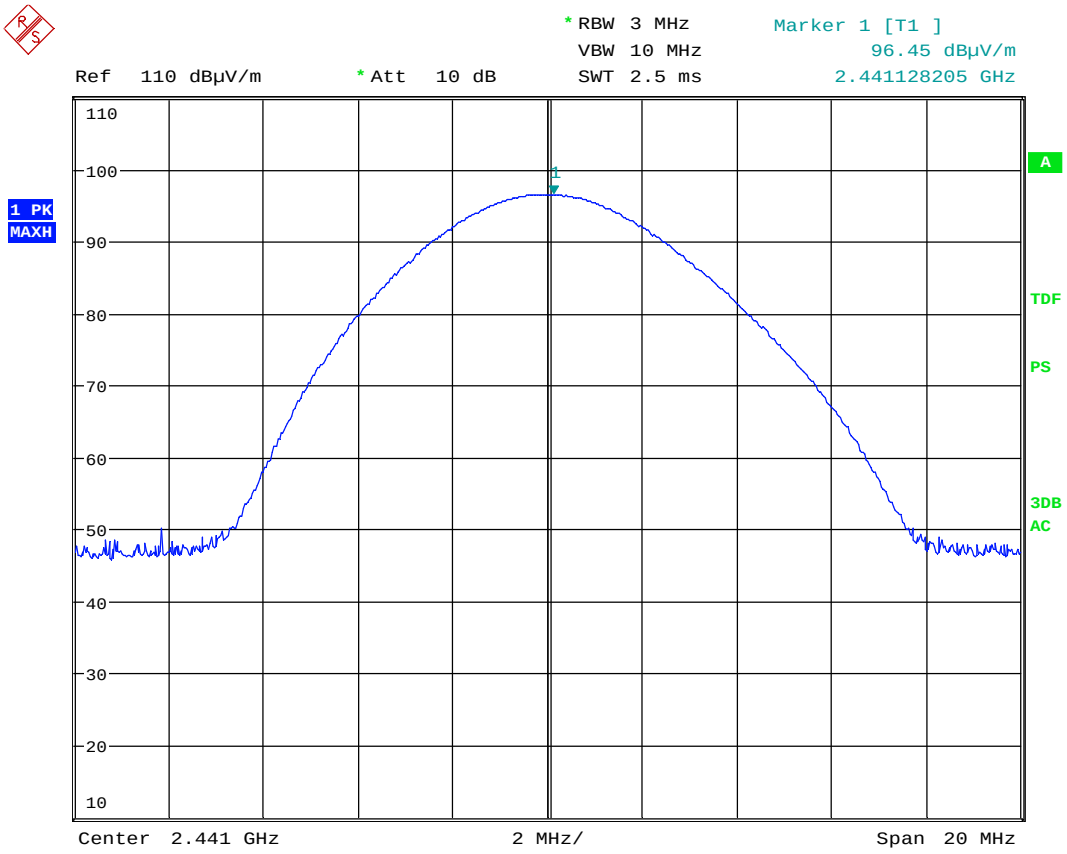


Date: 4.JUN.2019 10:37:32

Radiated field strength-HP, ch2402MHz , 4πDPSK

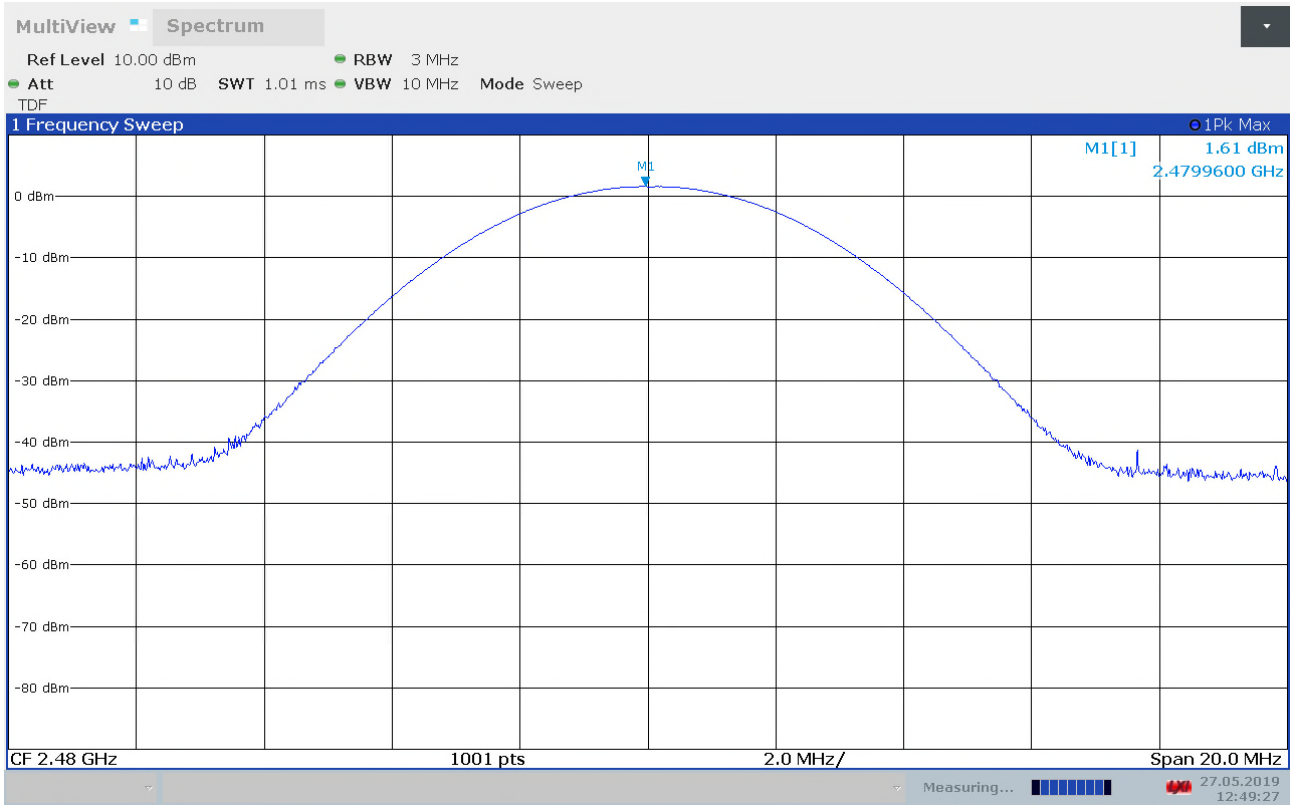


Conducted output Power, ch2441MHz , 4πDPSK

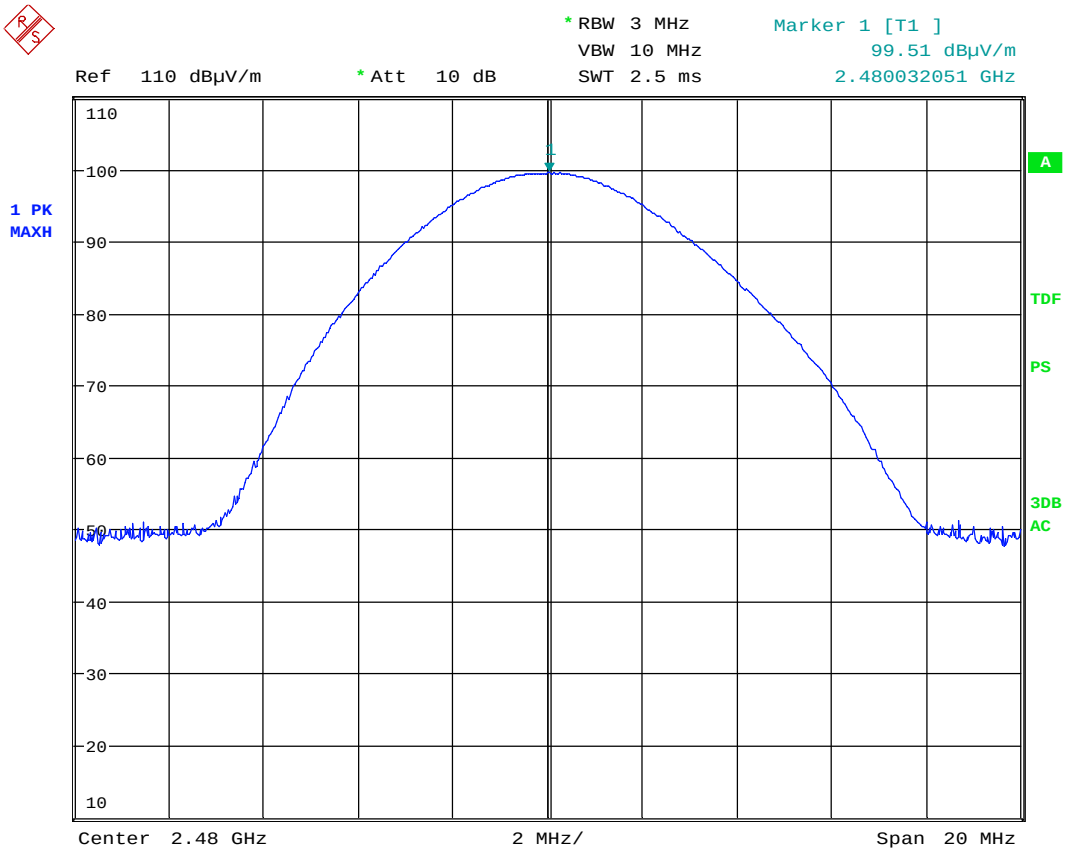


Date: 4.JUN.2019 10:42:25

Radiated field strength-VP, ch2441MHz , 4πDPSK



Conducted output Power, ch2480MHz , 4πDPSK



Date: 4.JUN.2019 08:49:39

Radiated field strength-VP, ch2480MHz , 4πDPSK

3.8 Conducted Emissions at Antenna Connector

Para. No.: 15.247 (d)

ISED Canada RSS-247 Issue 2, Clause 5.5

Measurement procedure: ANSI C63.10-2013 Clause 11.11

Test Results: Complies

RF conducted power to 25 GHz see attached plots.

Maximum RF level outside operating band:

RF in, GFSK: >54 dB/C, margin >20 dB

RF in, 8DPSK: >56 dB/C, margin >20 dB

RF in, 4π8DPSK: >44 dB/C, margin >20 dB

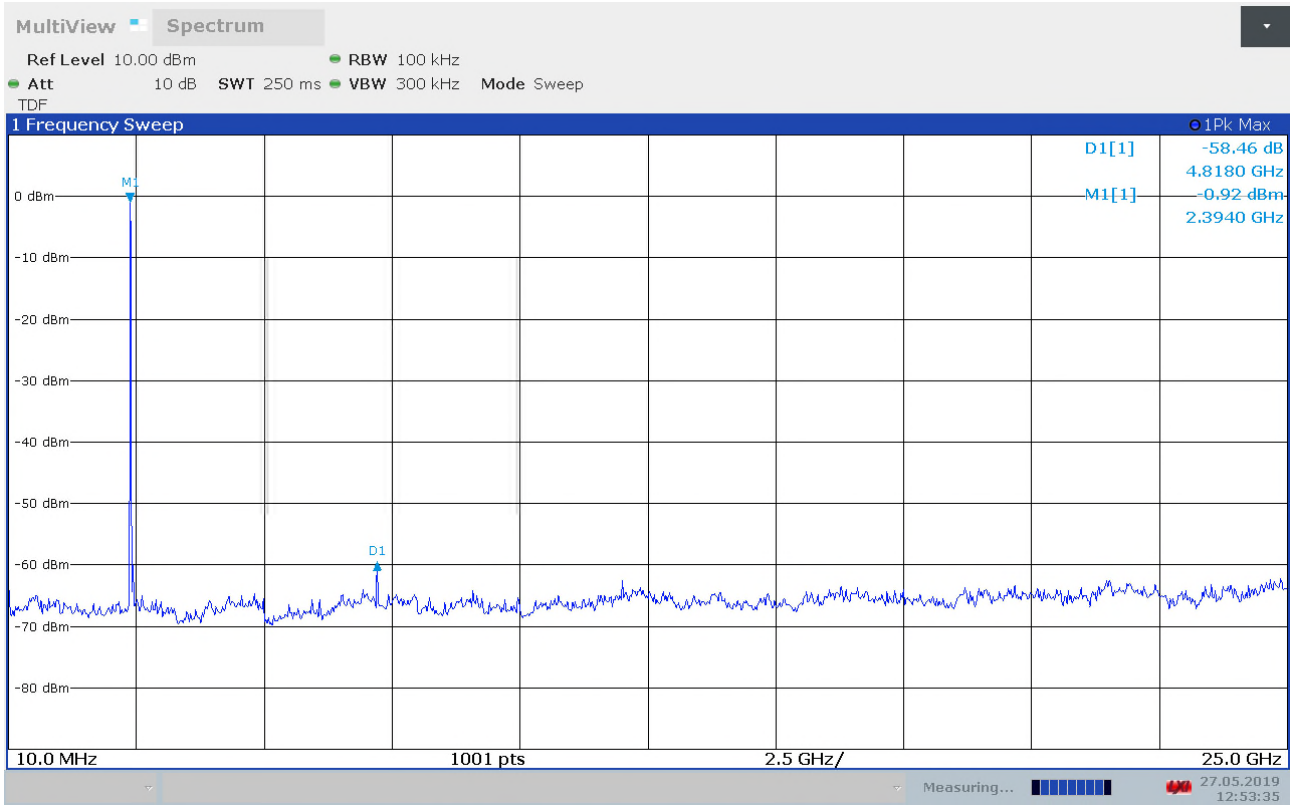
RF in hopping mode , DH1: >50 dB/C, margin >20 dB

Limit

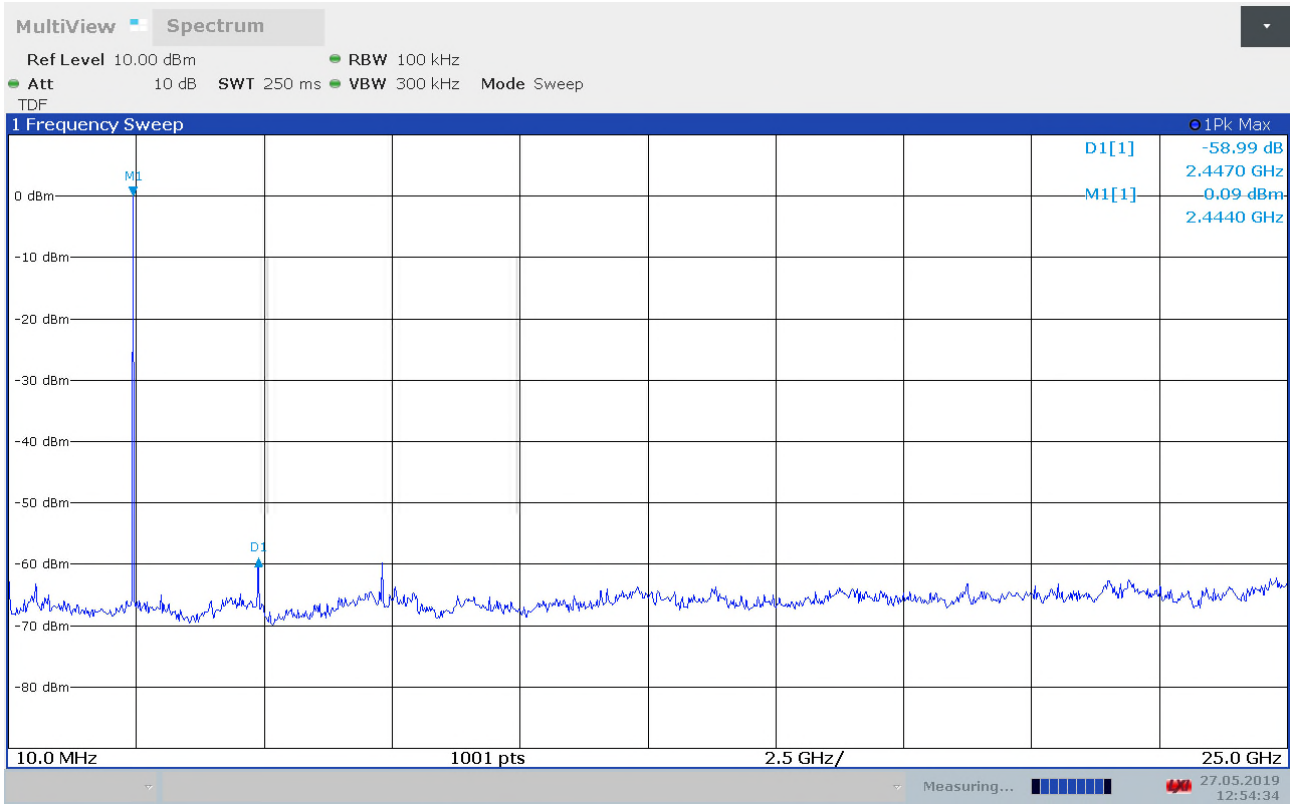
Peak measurement	RMS averaging
20 dBc or more in 100 kHz bandwidth	30 dBc or more in 100 kHz bandwidth

Detector type shall be the same as used for measuring Output Power.

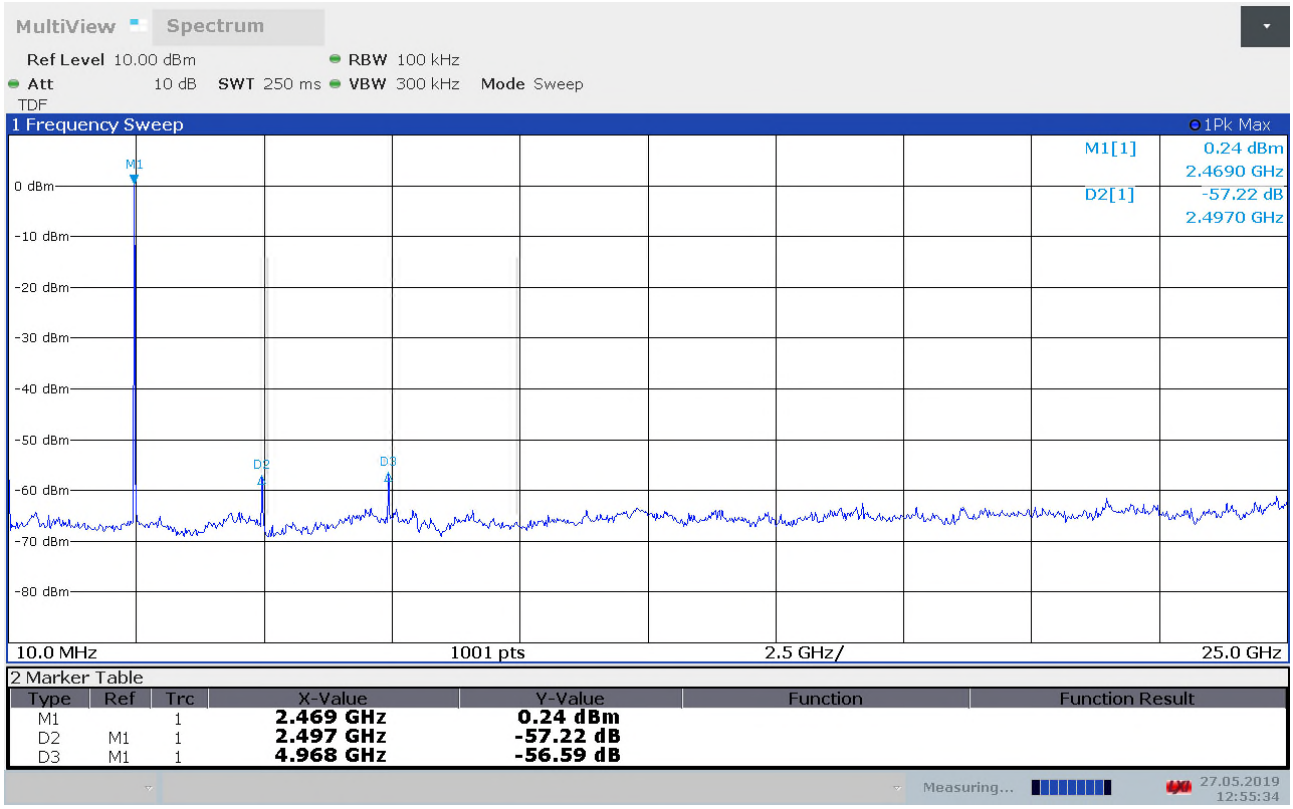
Attenuation below the general limits specified in part 15.209(a) is not required.



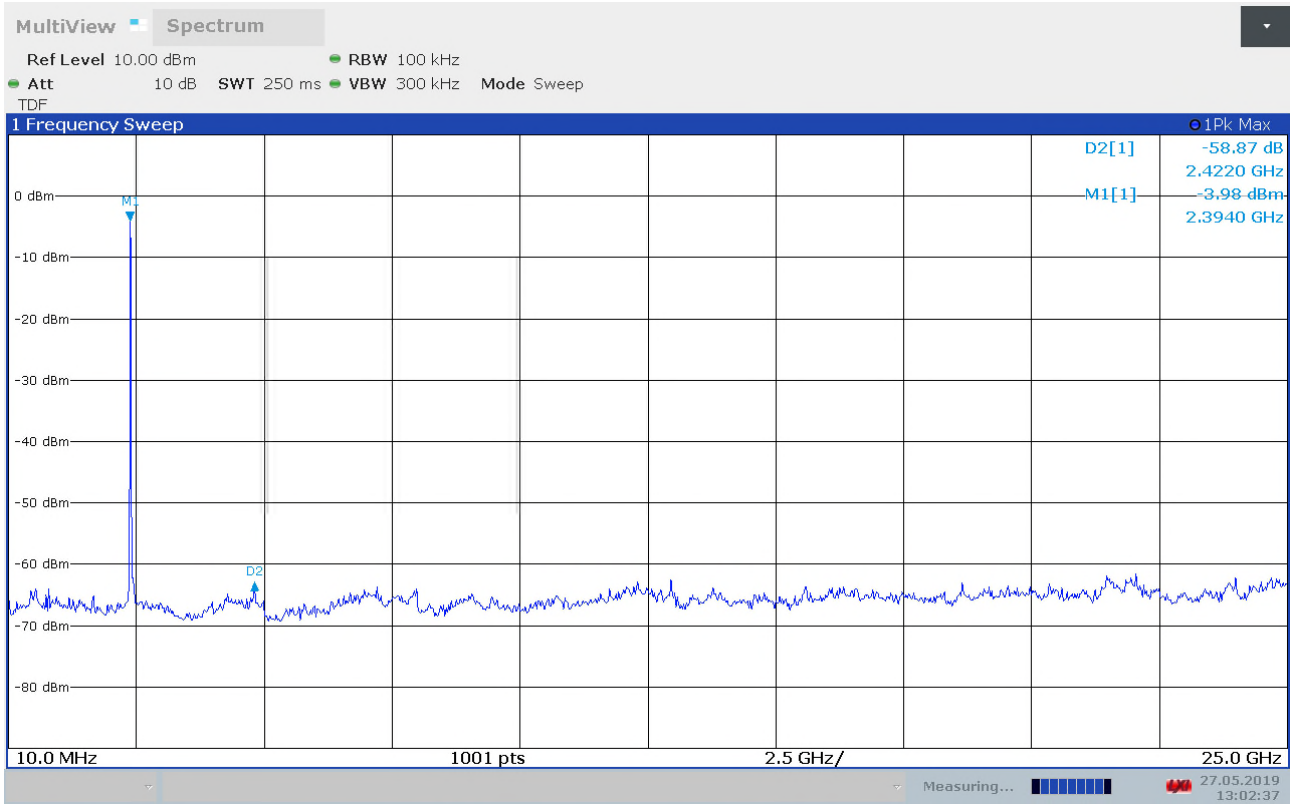
Conducted spurious emissions 10MHz – 25GHz , ch2402MHz, GFSK



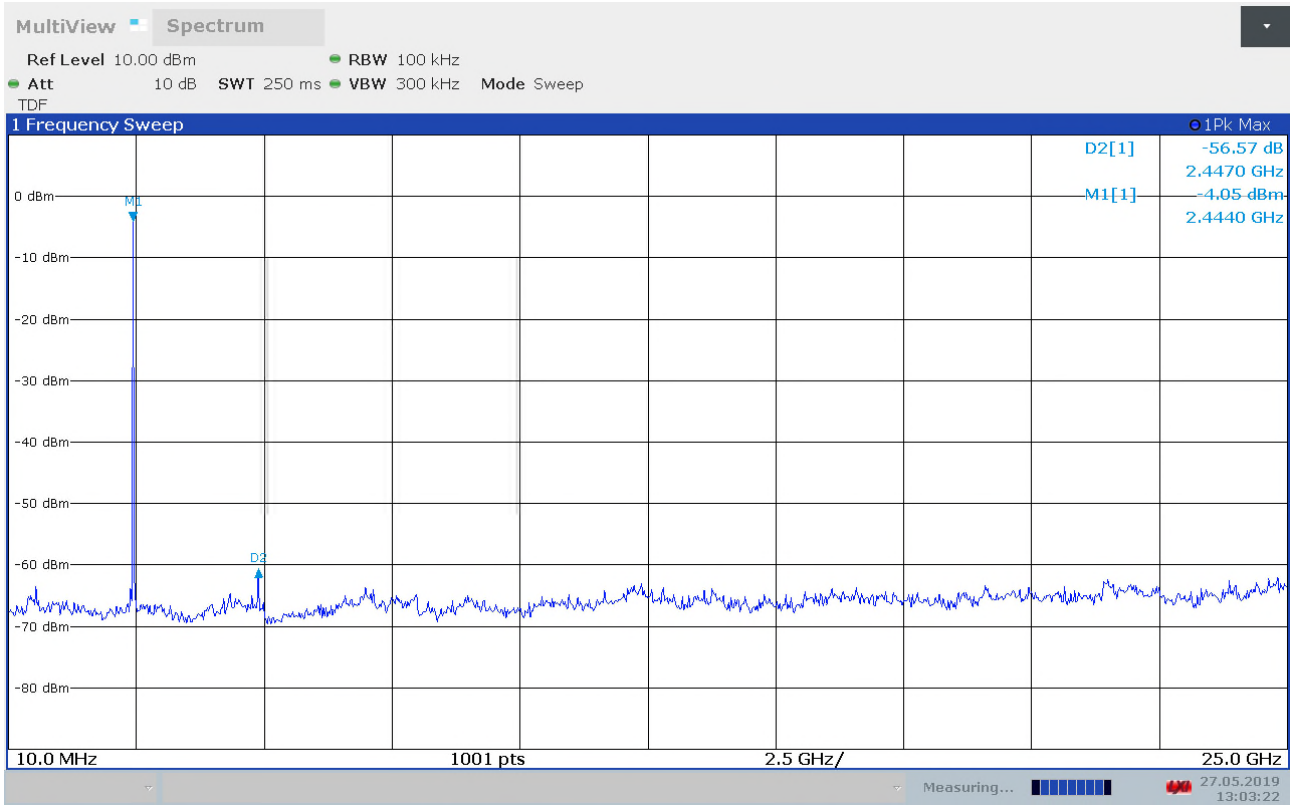
Conducted spurious emissions 10MHz – 25GHz, ch2441MHz, GFSK



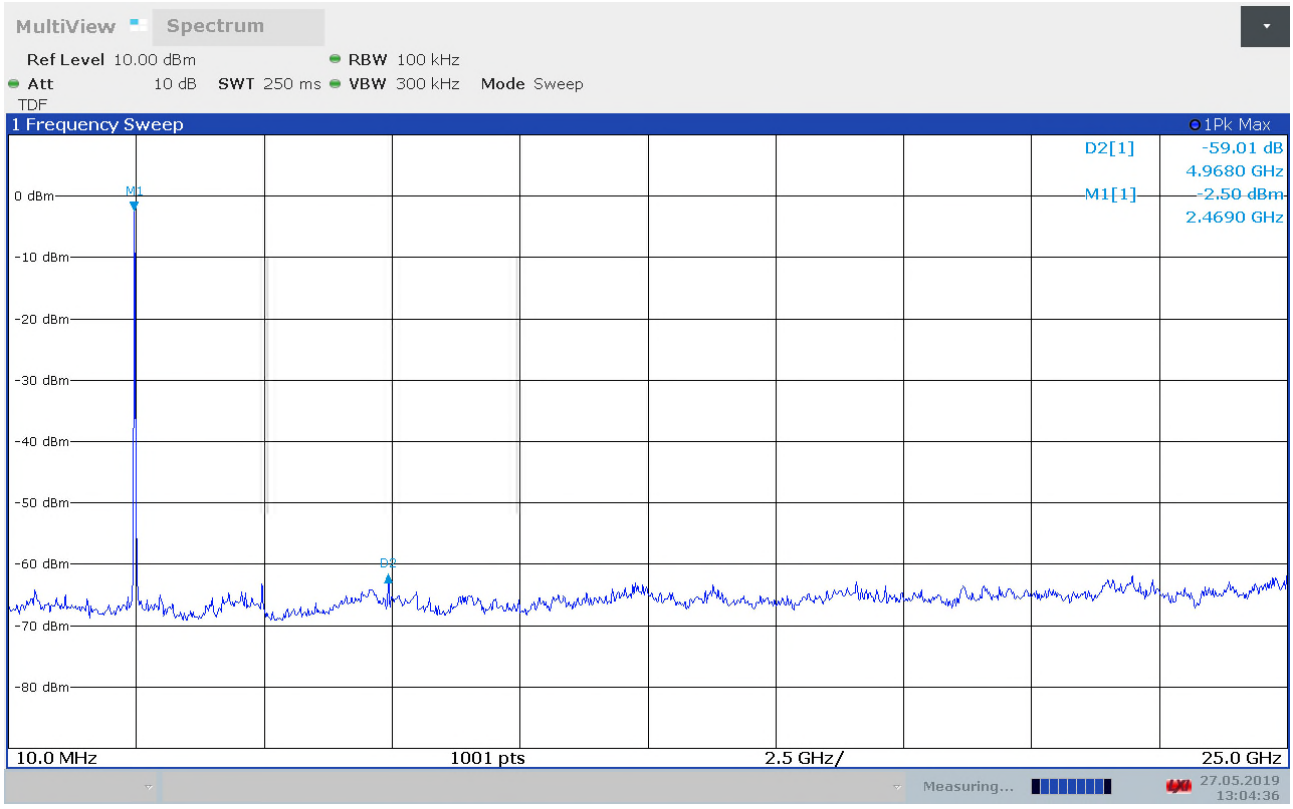
Conducted spurious emissions 10MHz – 25GHz, ch2480MHz, GFSK



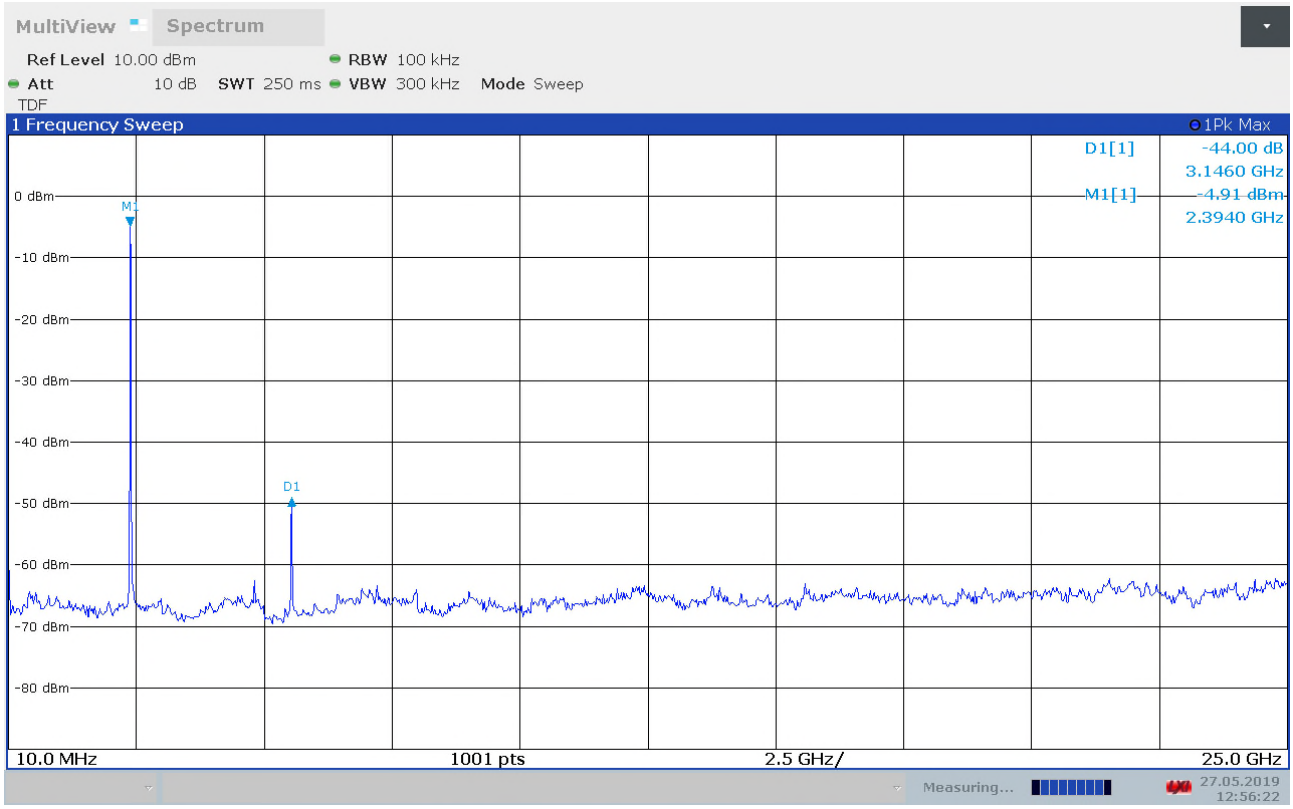
Conducted spurious emissions 10MHz – 25GHz , ch2402MHz, 8DPSK



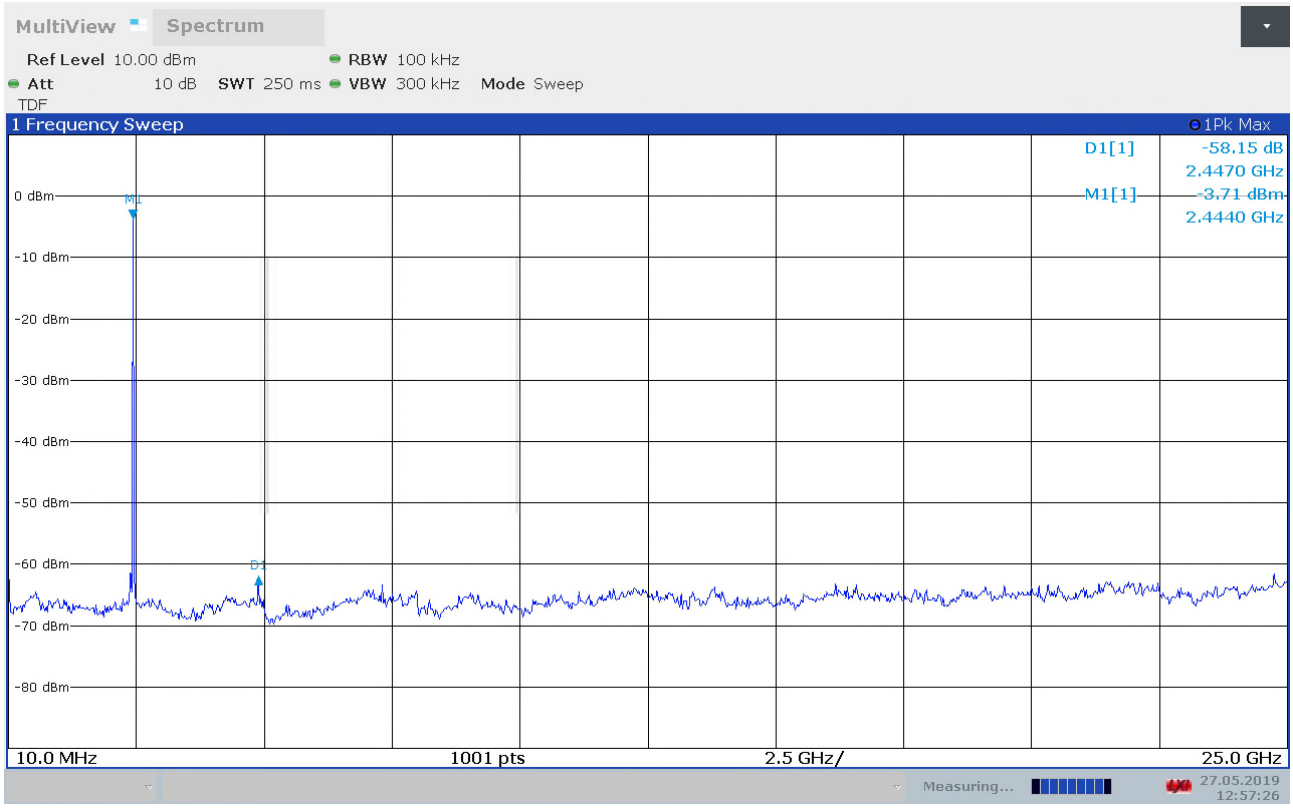
Conducted spurious emissions 10MHz – 25GHz, ch2441MHz, 8DPSK



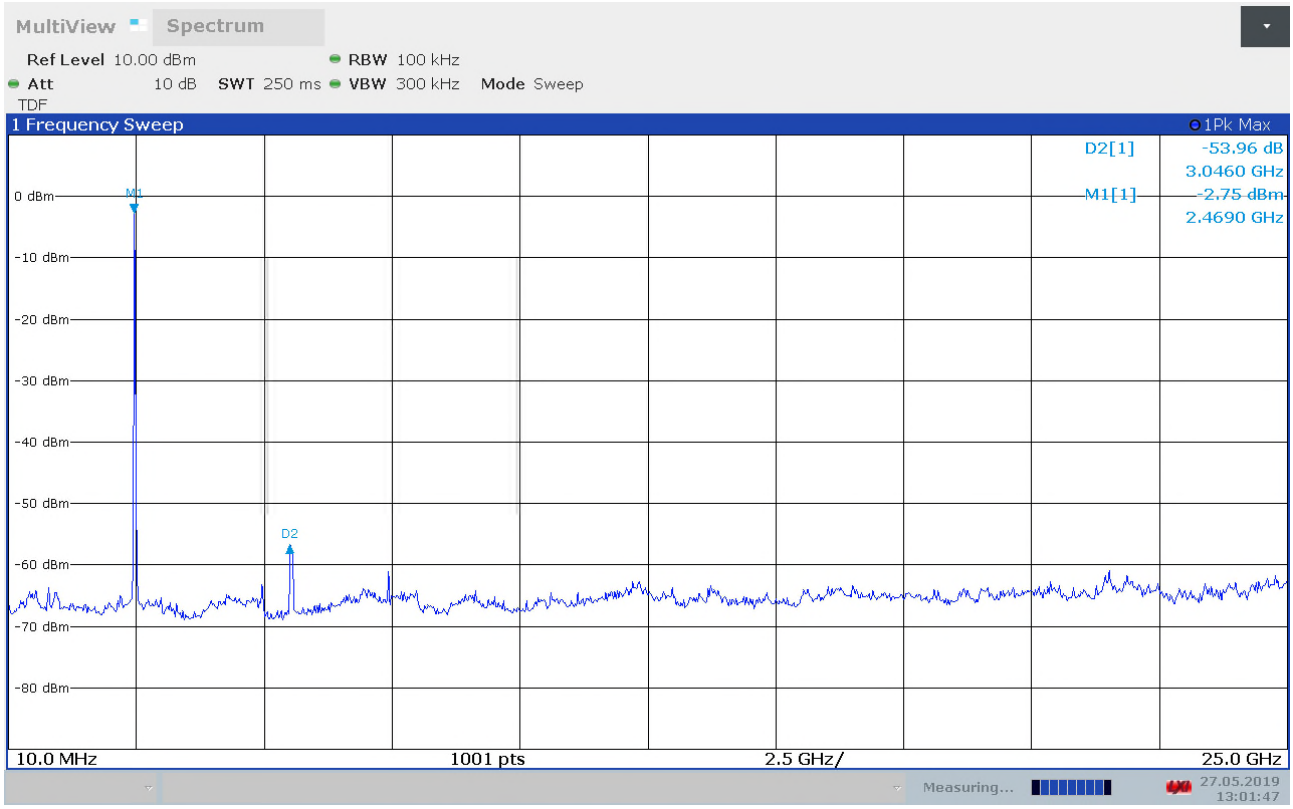
Conducted spurious emissions 10MHz – 25GHz, ch2480MHz, 8DPSK



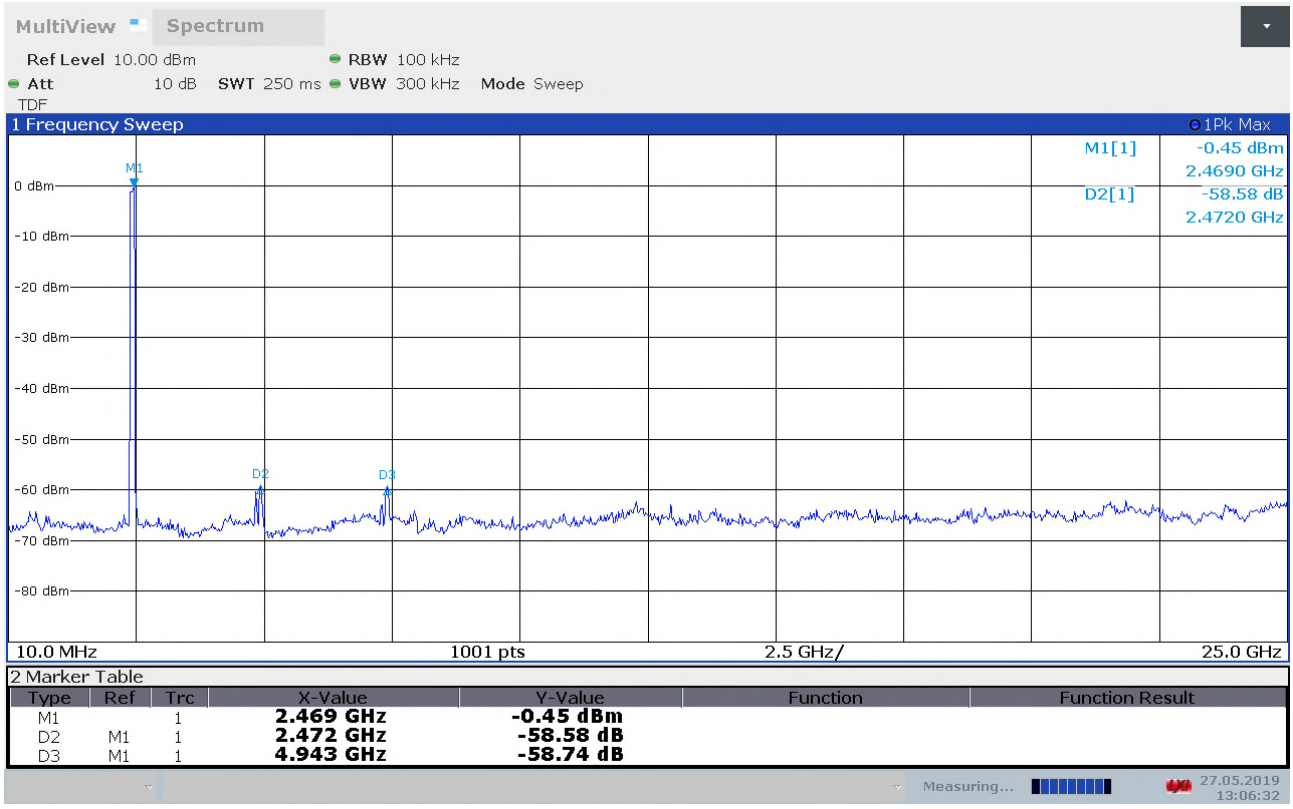
Conducted spurious emissions 10MHz – 25GHz , ch2402MHz, 4πDPSK



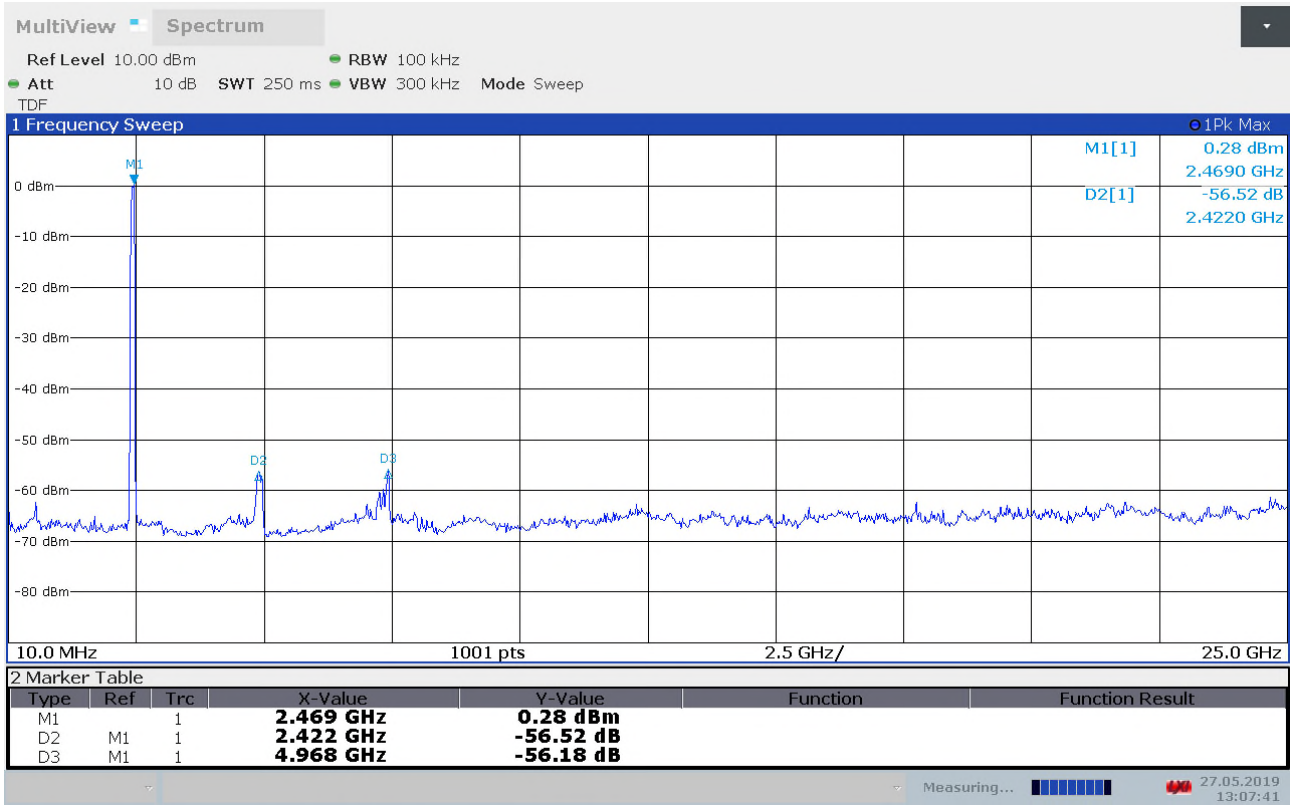
Conducted spurious emissions 10MHz – 25GHz, ch2441MHz, 4πDPSK



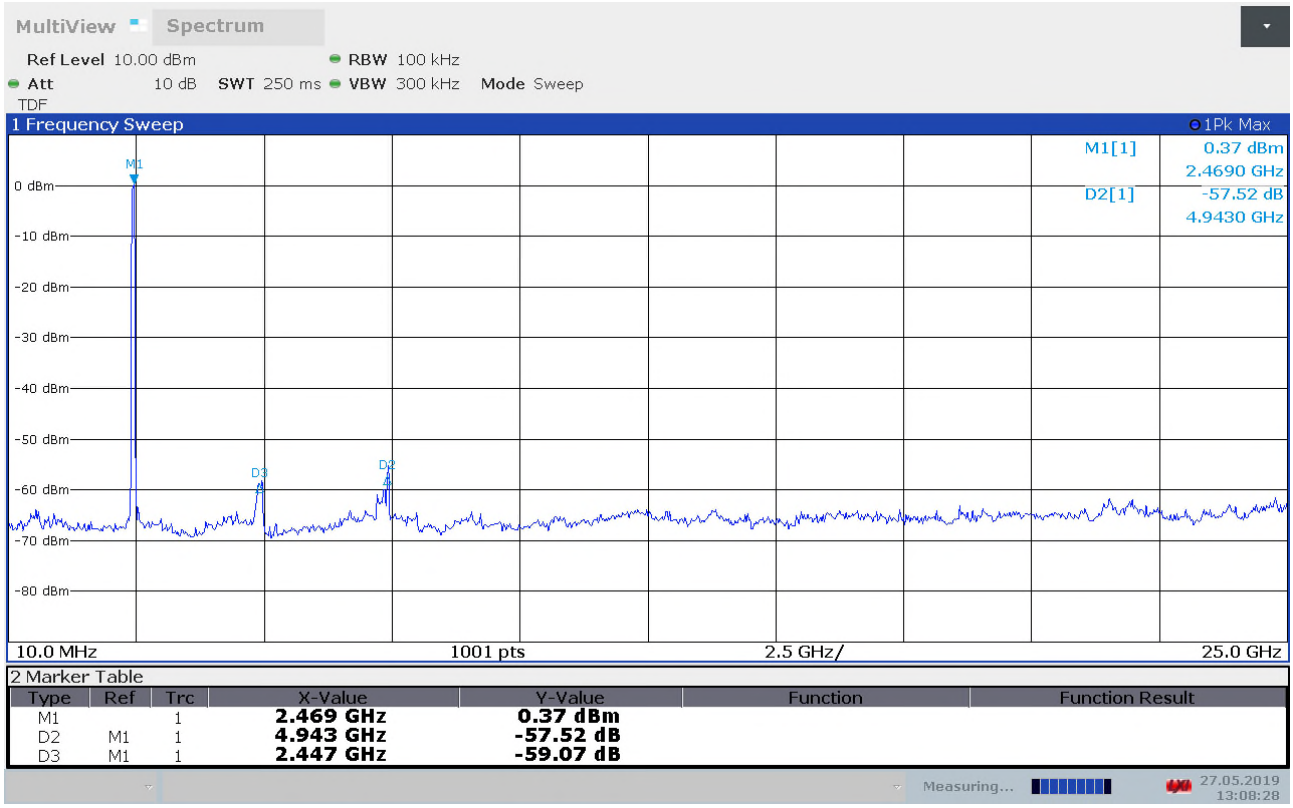
Conducted spurious emissions 10MHz – 25GHz, ch2480MHz, 4πDPSK



Conducted spurious emissions 10MHz – 25GHz , hopping mode, DH1



Conducted spurious emissions 10MHz – 25GHz, hopping mode, DH3



Conducted spurious emissions 10MHz – 25GHz, hopping mode, DH5

3.9 Spurious Emissions (Radiated)

FCC Part 15.247

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

Measurement procedure: **ANSI C63.10-2013 Clause 11.12**

Test Results: Complies

Measurement Data:

Band-edge radiated:

Modulation Scheme	Detector	Measured field strength (dBµV/m)		Limit	Margin	
		2390 MHz	2483.5 MHz	dBµV/m	dB	
GFSK	Peak Detector	39.74	54.19	74	34.26	19.81
	Average Detector	/	34.19	54	/	19.81
8DPSK	Peak Detector	46.98	58.26	74	27.02	15.74
	Average Detector	/	38.26	54	/	15.74
4πDPSK	Peak Detector	40.80	58.14	74	33.20	15.86
	Average Detector	/	38.14	54	/	15.86
DH1, Hopping mode	Peak Detector	49.61	56.63	74	24.39	17.07
	Average Detector	/	36.63	54	/	17.07
DH3, Hopping mode	Peak Detector	50.69	57.90	74	23.31	16.1
	Average Detector	/	37.90	54	/	16.1
DH5, Hopping mode	Peak Detector	49.76	57.70	74	24.24	16.3
	Average Detector	/	37.70	54	/	16.3

Average Detector values are measured with Peak Detector and corrected for Duty Cycle.

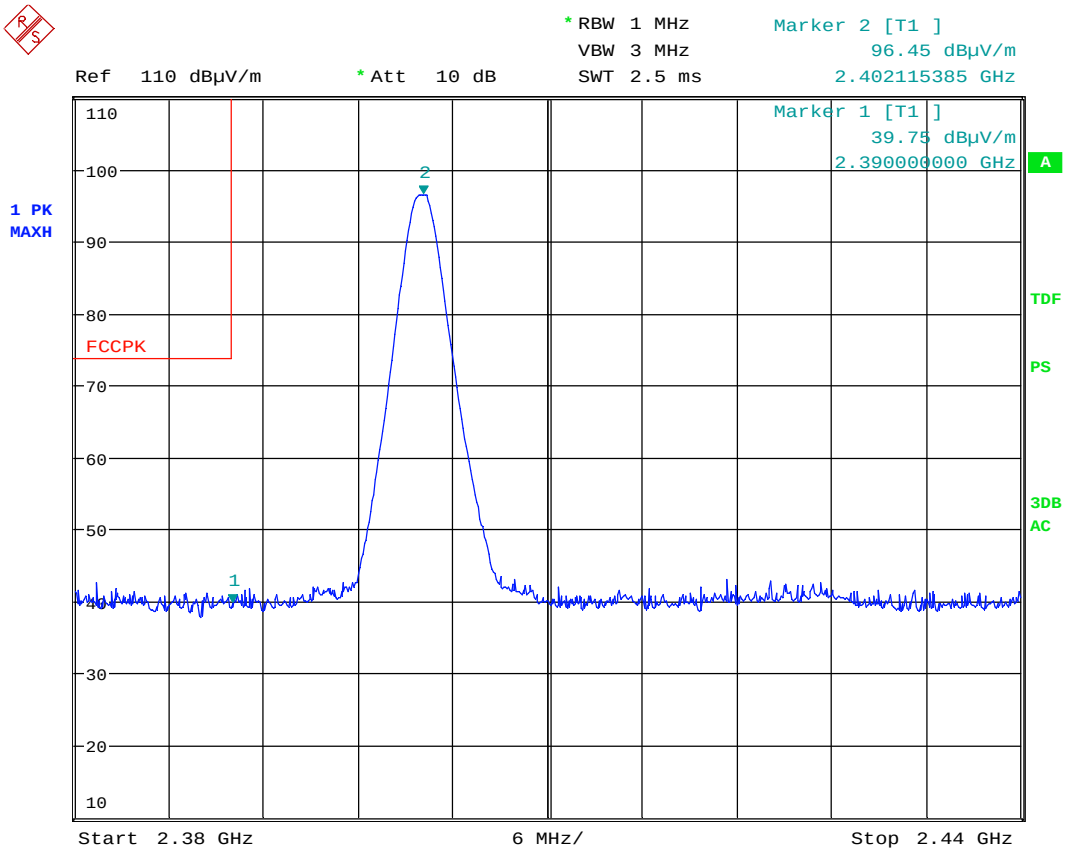
See attached plots.

Duty Cycle Correction Factor Calculation:

Duty Cycle = slot length / (frame lengthxhopping channels)=0.626ms/(216msx79)= 2.9

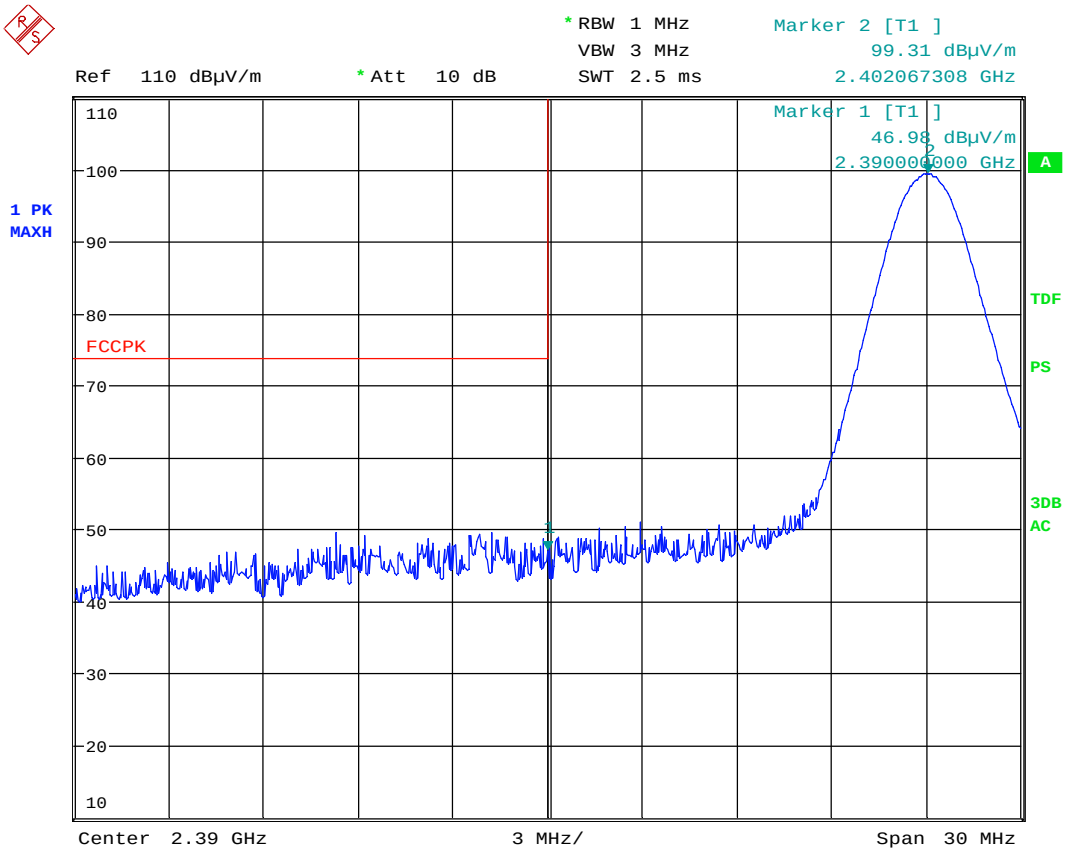
Duty Cycle Correction factor = -20 x log (Duty Cycle) = -30.7 dB

Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB



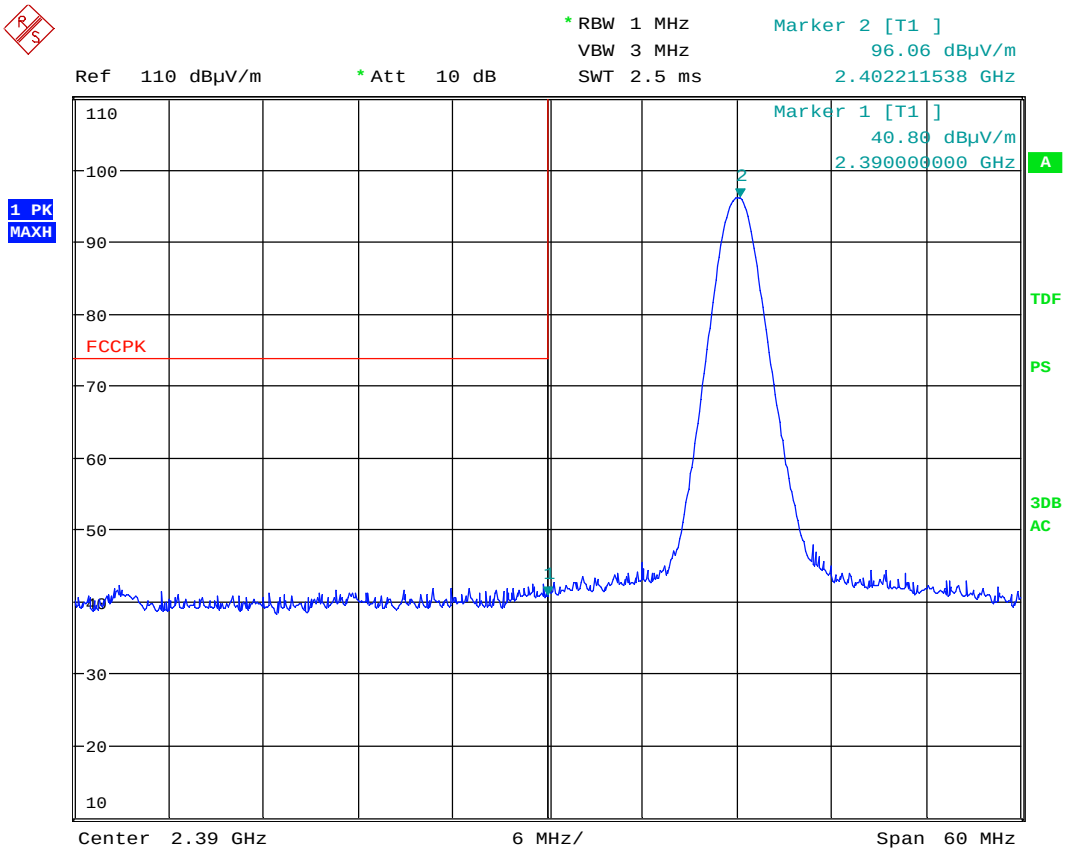
Date: 4.JUN.2019 10:23:02

Lower Band Edge, ch2402MHz , GFSK, Peak Det



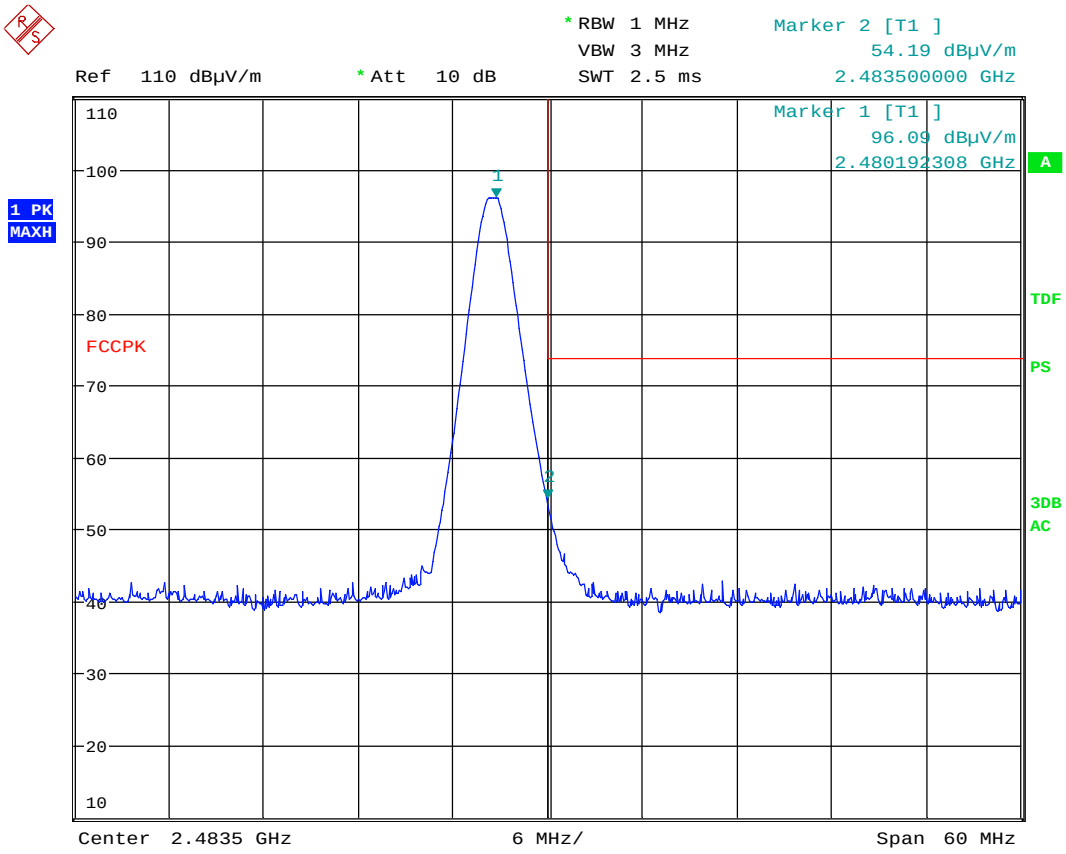
Date: 4.JUN.2019 09:15:23

Lower Band Edge, ch2402MHz , 8DPSK, Peak Det



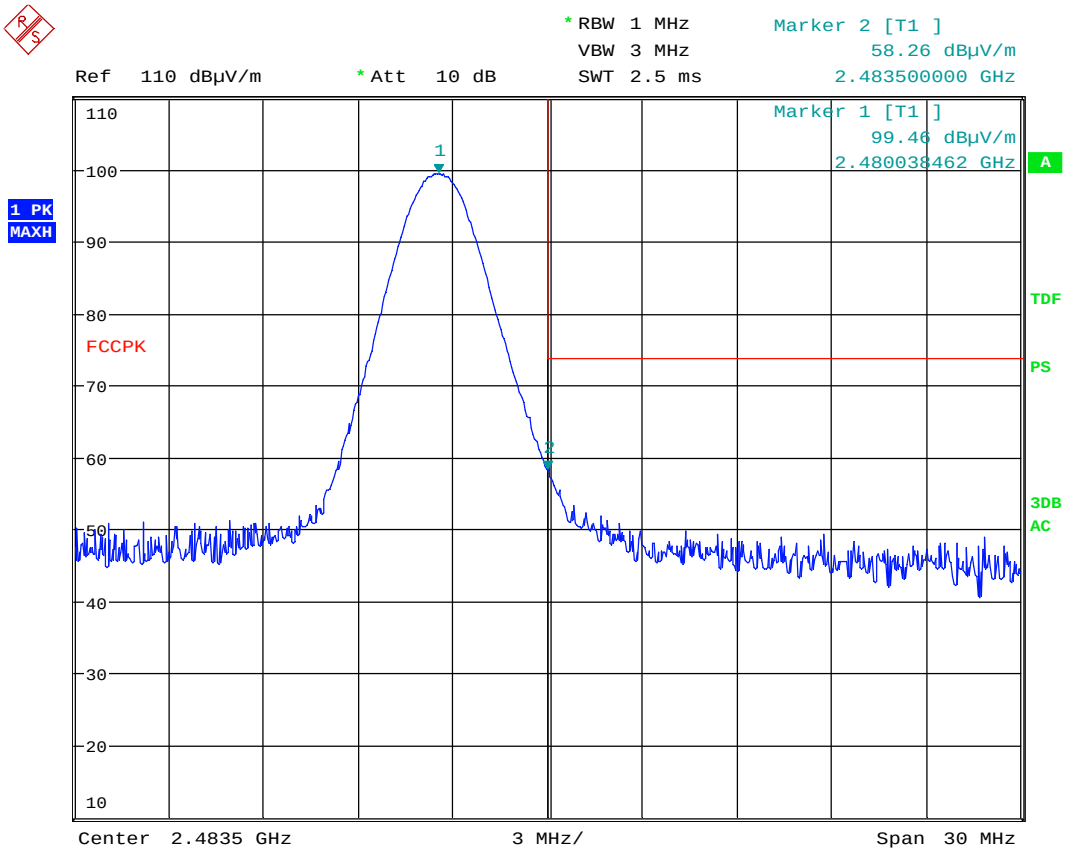
Date: 4.JUN.2019 10:40:12

Lower Band Edge, ch2402MHz, 4πDPSK, Peak Det



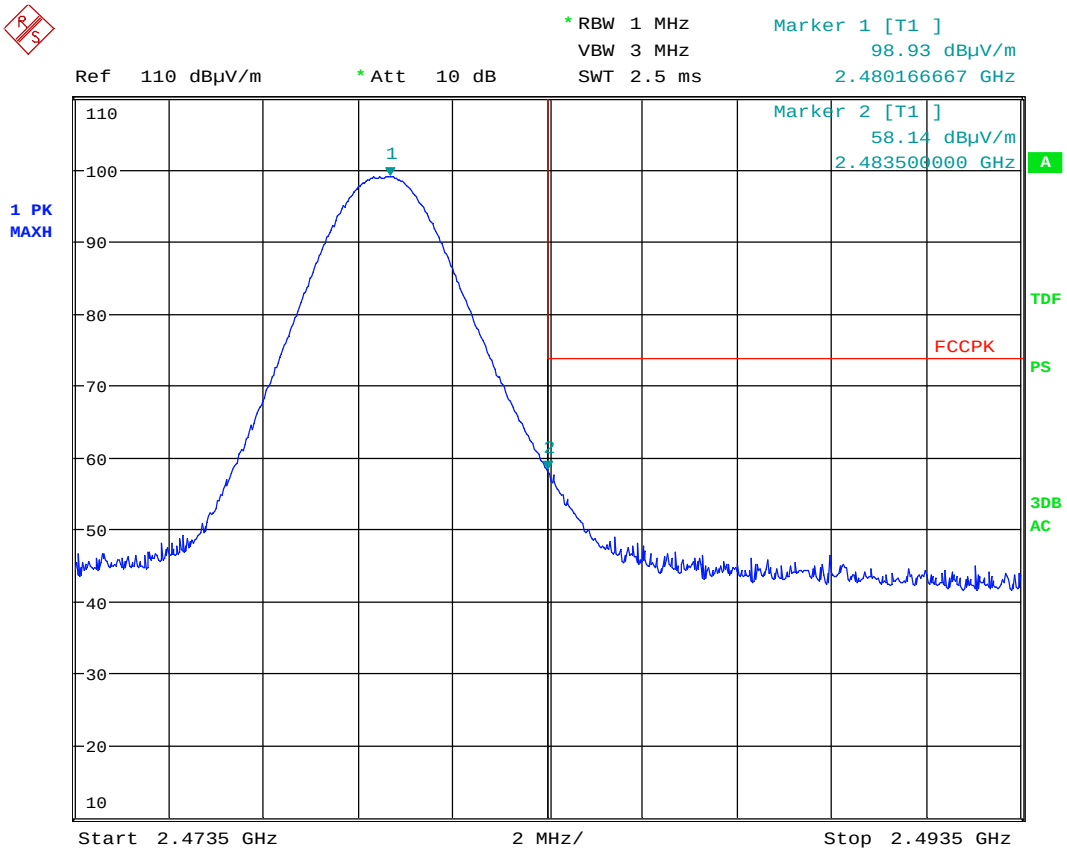
Date: 4.JUN.2019 10:30:44

Upper Band Edge, ch2480MHz , GFSK, Peak Det



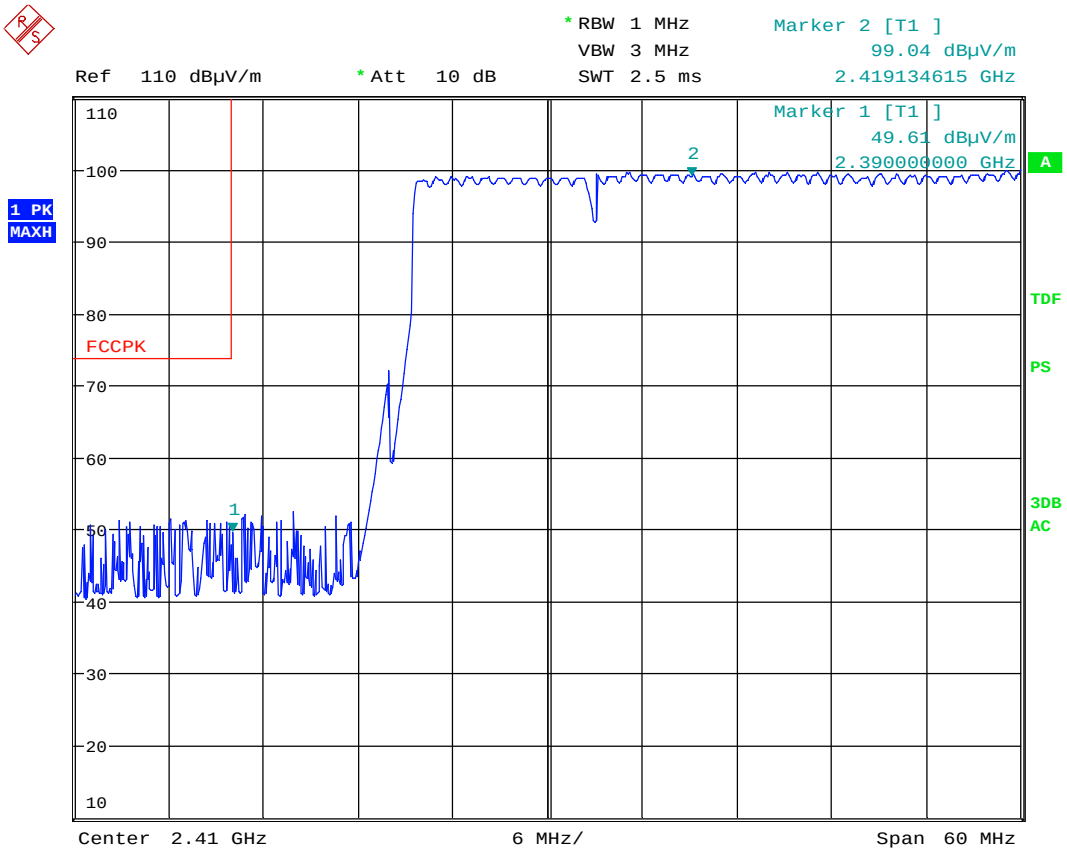
Date: 4.JUN.2019 09:35:14

Upper Band Edge, ch2480MHz , 8DPSK, Peak Det



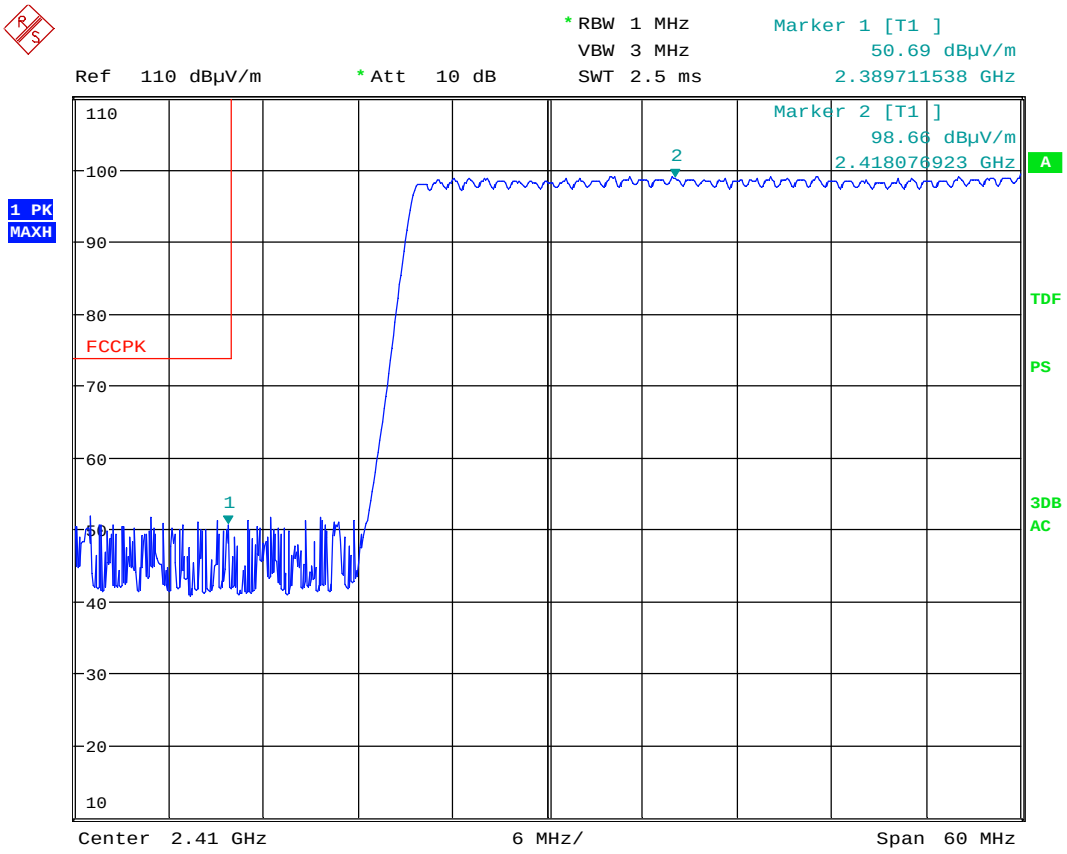
Date: 4.JUN.2019 08:38:00

Upper Band Edge, ch2480MHz, 4πDPSK, Peak Det



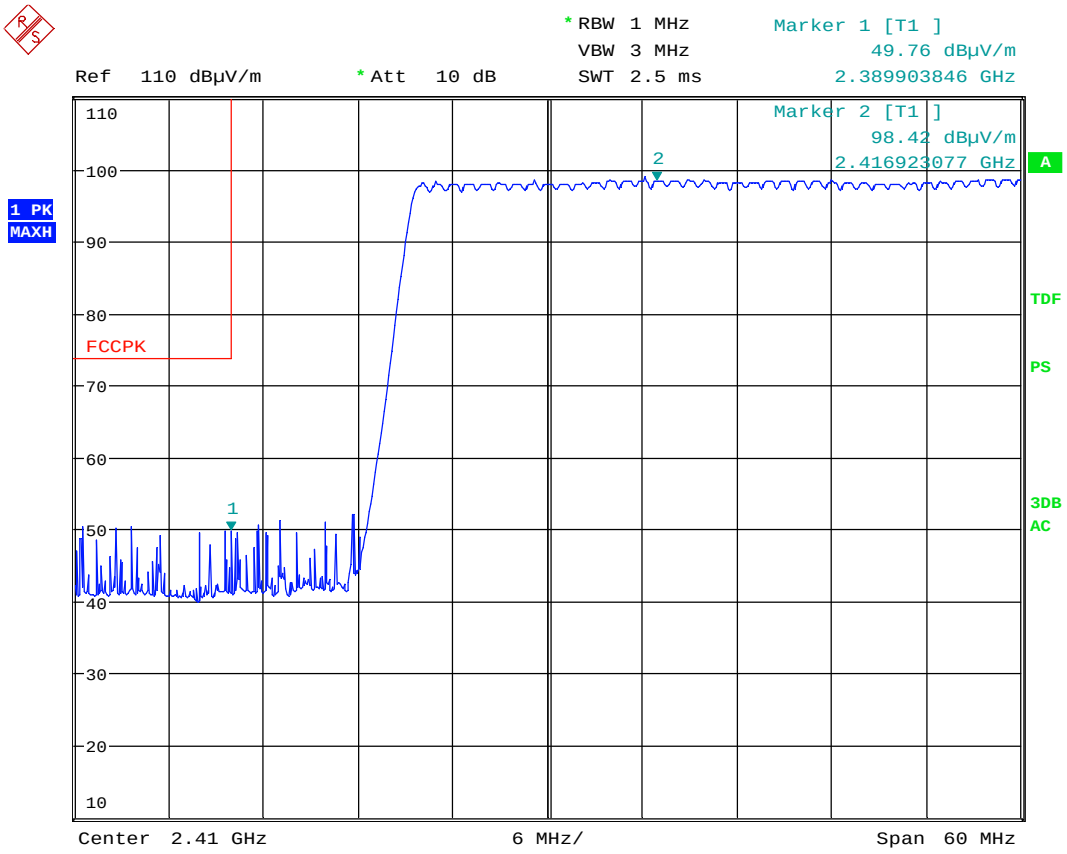
Date: 4.JUN.2019 09:49:12

Lower Band Edge, Hopping mode , DH1, Peak Det

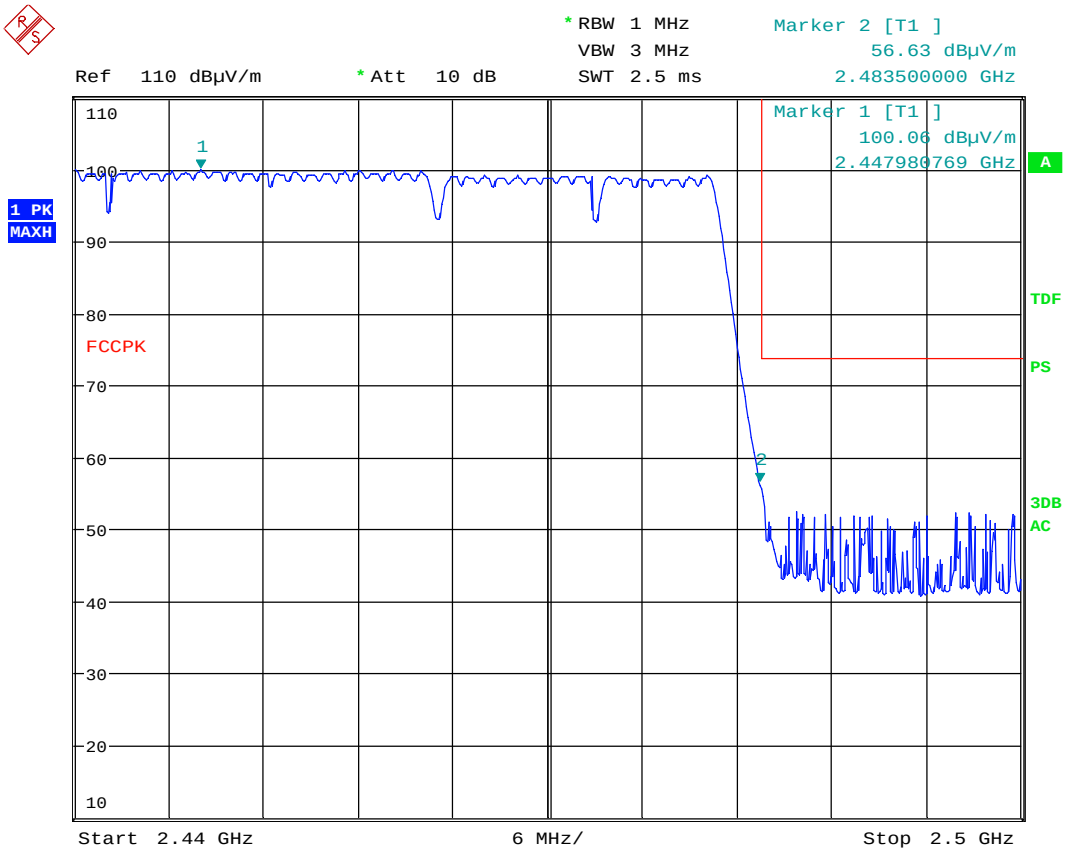


Date: 4.JUN.2019 09:58:04

Lower Band Edge, Hopping mode , DH3, Peak Det

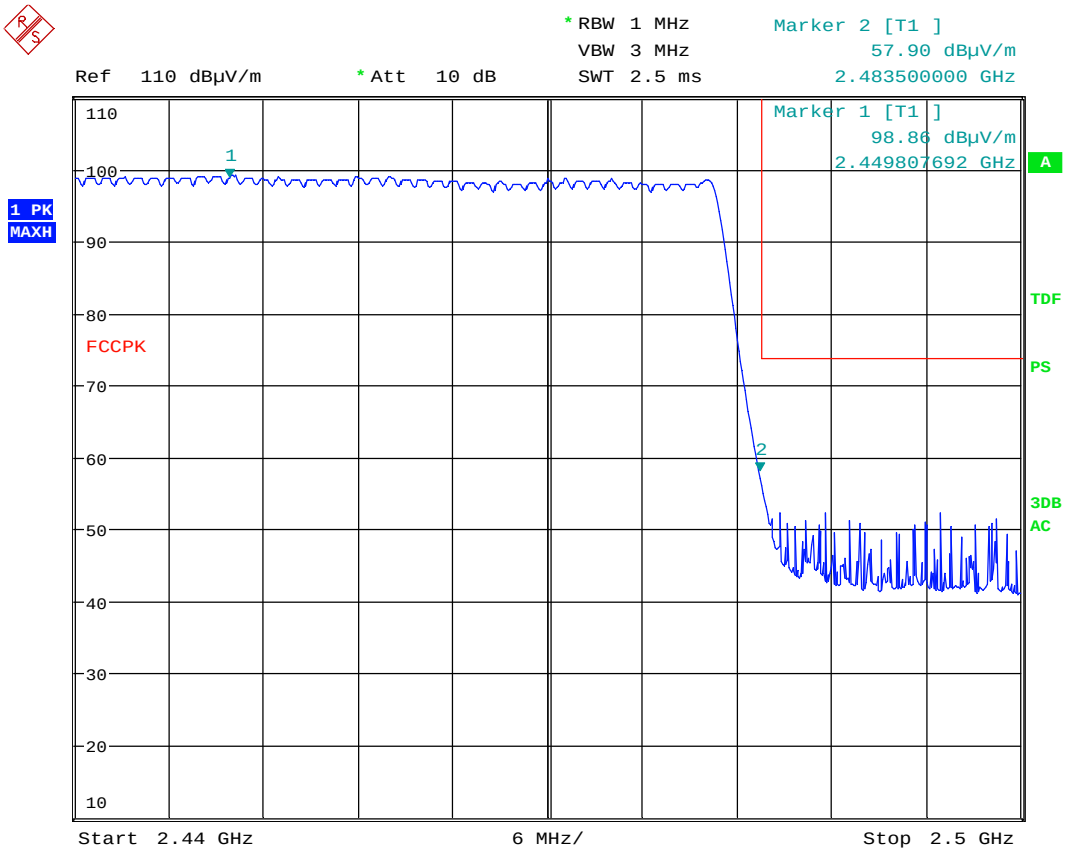


Lower Band Edge, Hopping mode , DH5, Peak Det



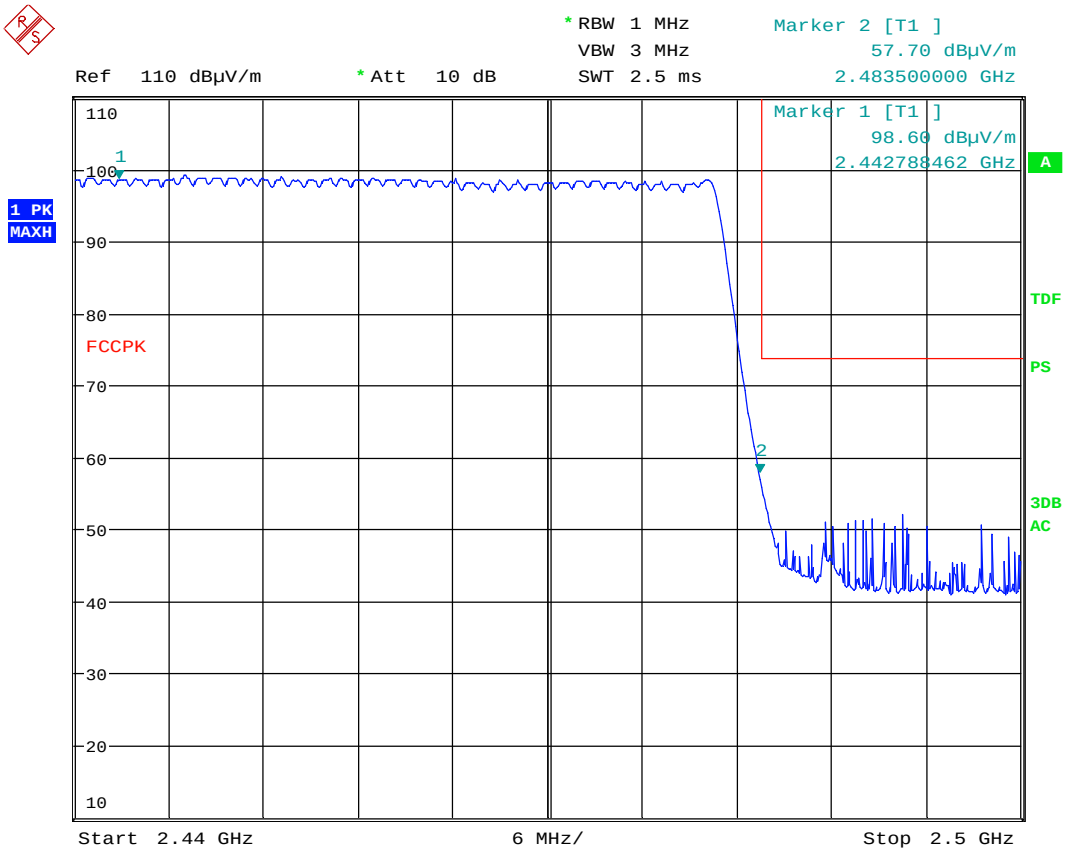
Date: 4.JUN.2019 09:50:29

Upper Band Edge, Hopping mode , DH1, Peak Det



Date: 4.JUN.2019 09:59:20

Upper Band Edge, Hopping mode , DH3, Peak Det



Date: 4.JUN.2019 10:16:58

Upper Band Edge, Hopping mode , DH5, Peak Det

Radiated emission 30 – 1000 MHz.

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

Measurement procedure: **ANSI C63.10-2013 Clause 11.12**

Measuring distance 3 m according to ANSI.

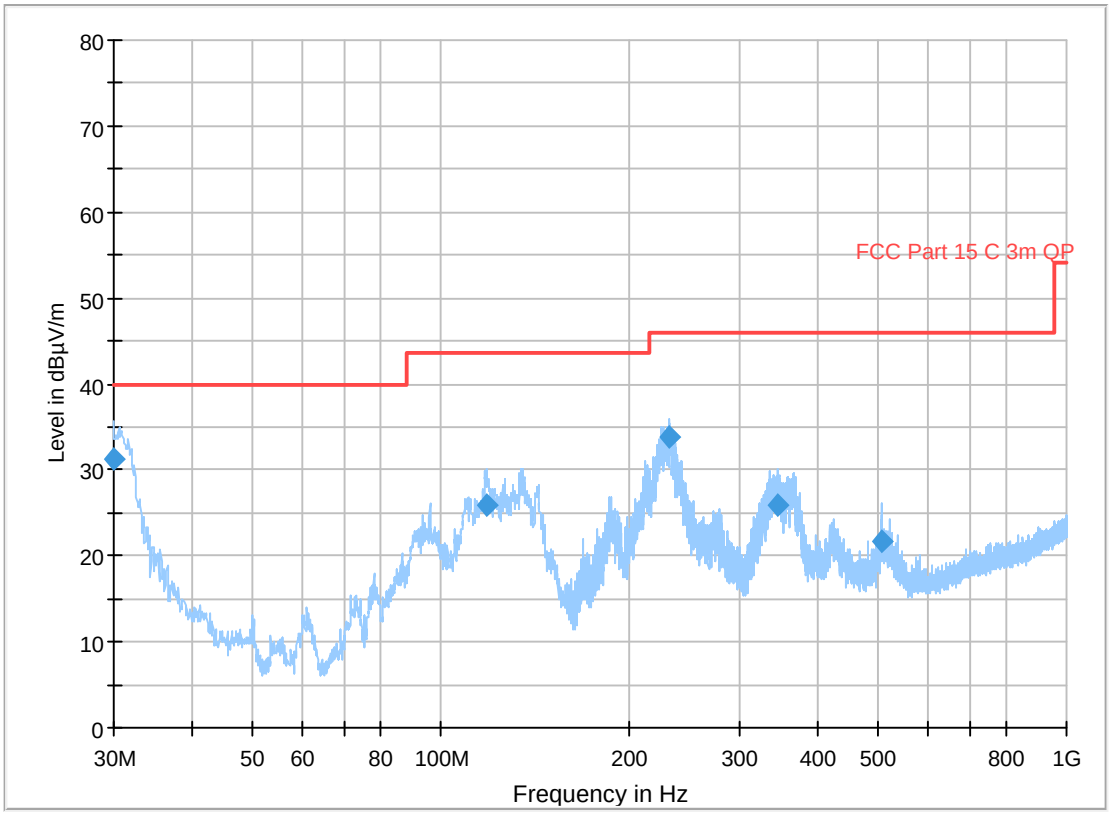
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.023325	31.22	40.00	8.78	1000.0	120.000	106.0	V	1.0
118.447400	25.96	43.50	17.54	1000.0	120.000	100.0	V	224.0
232.584000	33.88	46.00	12.12	1000.0	120.000	123.0	H	227.0
345.334800	25.87	46.00	20.13	1000.0	120.000	100.0	H	233.0
507.849100	21.61	46.00	24.39	1000.0	120.000	194.0	H	200.0

See attached graphs.

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

Full Spectrum



30MHz - 1000MHz - In hopping mode

IN GFSK MODE:

Radiated Emissions, 1-25 GHz; Measuring distance:3m (1 – 8 GHz), 1m (8 – 18 GHz); A pre-scan was performed above 18 GHz and no spurious emissions were detected.

Peak Detector:

Modulation scheme	Frequency	Polarization	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
	GHz		dB	dBμV/m	dB	dBμV/m	dB
GFSK	4.804	HP	0	/	/	74	/
	4.882	HP	0	/	/	74	/
	4.960	HP	0	/	/	74	/
GFSK	7.206	HP	0	60.53	/	74	13.47
	7.323	HP	0	61.96	/	74	12.04
	7.440	HP	0	60.72	/	74	13.28
GFSK	9.608	HP	*	46.35	/	74	27.65
	9.760	HP	*	44.31	/	74	29.69
	9.920	HP	*	45.40	/	74	28.60
GFSK	12.01	HP	*	52.79	/	74	21.21
	12.205	HP	*	47.82	/	74	26.18
	12.400	HP	*	52.25	/	74	21.75
Other freqs	L,M,H	VP/HP	/	None detected	/	74	>20

*distance correction is included in the plot

Average:

Modulation scheme	Frequency	Polarization	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
	MHz		dB	dBµV/m	dB	dBµV/m	dB
GFSK	4.804	HP	0	/	20	54	/
	4.882	HP	0	/	20	54	/
	4.960	HP	0	/	20	54	/
GFSK	7.206	HP	0	40.53	20	54	13.47
	7.323	HP	0	41.96	20	54	12.04
	7.440	HP	0	40.72	20	54	13.28
GFSK	9.608	HP	*	/	20	54	/
	9.760	HP	*	/	20	54	/
	9.920	HP	*	/	20	54	/
GFSK	12.01	HP	*	/	20	54	/
	12.205	HP	*	/	20	54	/
	12.400	HP	*	/	20	54	/
Other freqs	L,M,H	VP/HP	/	None detected	20	54	>20

Distance correction for 1m is included in the spectrum analyser.

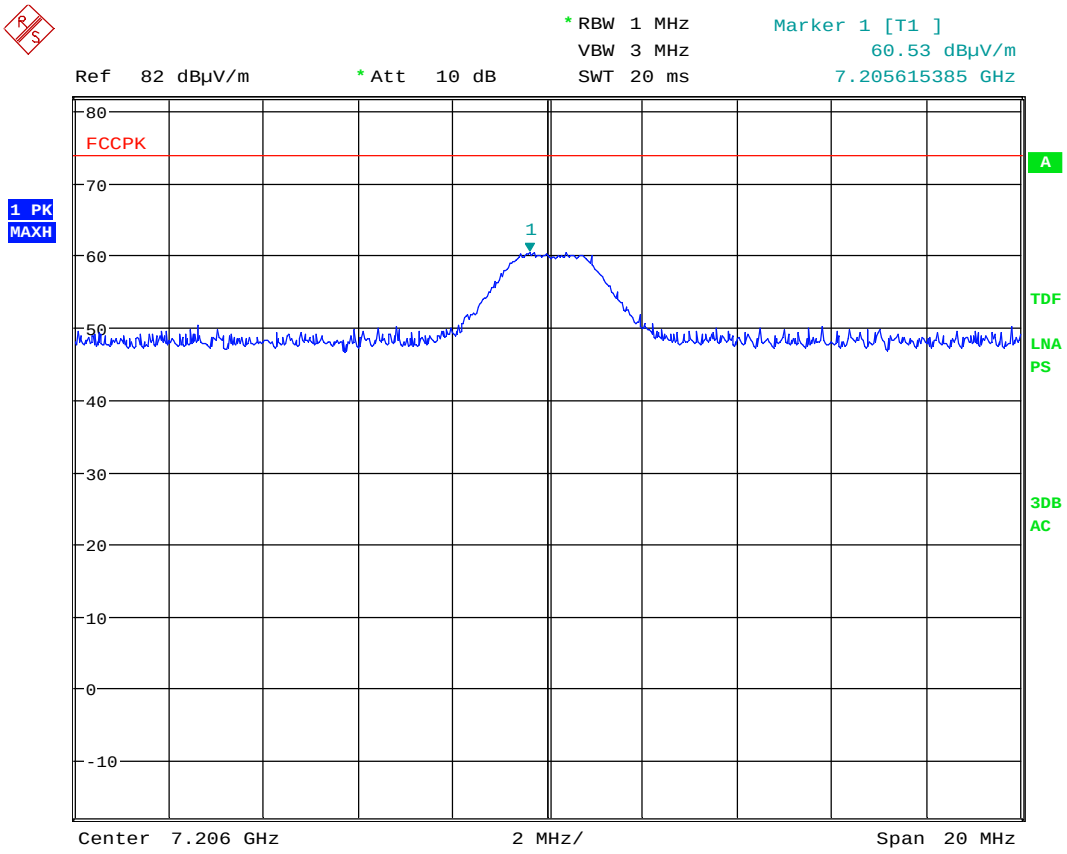
Average Detector values are calculated from Peak values by Duty Cycle Correction Factor.

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer “Transducer factor”.

See plots.

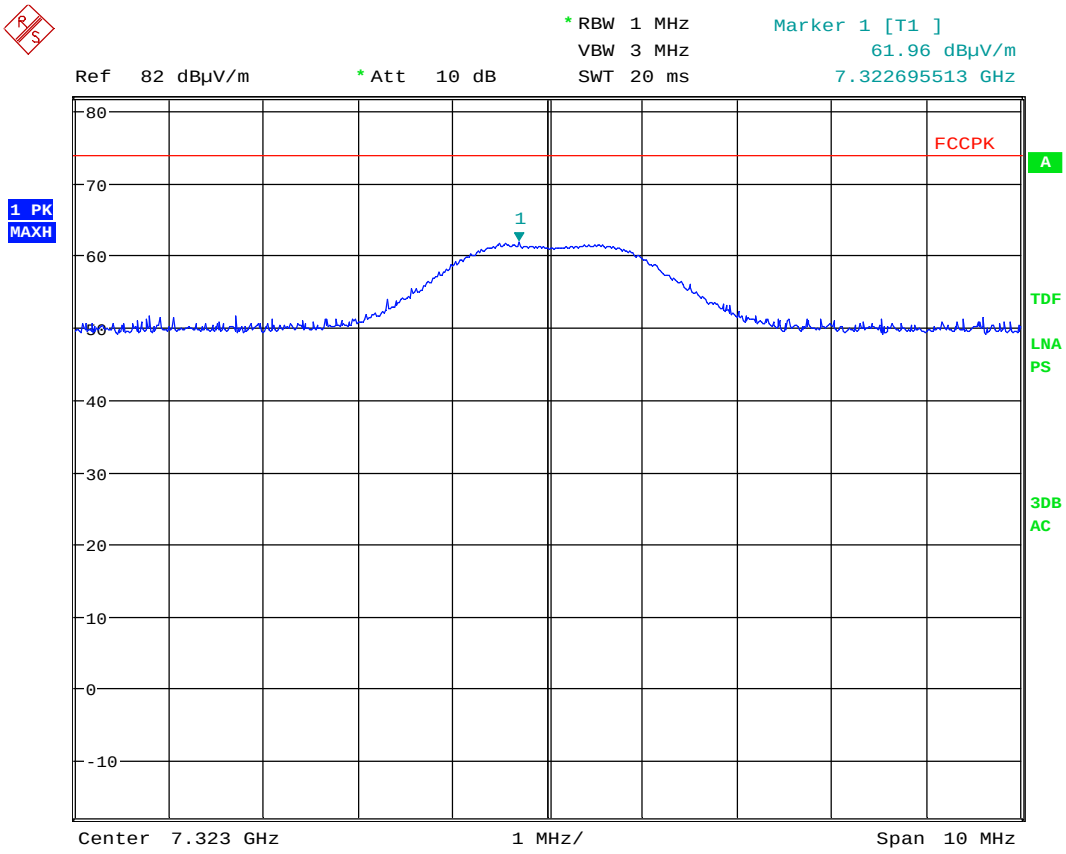
Requirements/Limit

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)	**AV (dBµV/m)**	**Peak (dBµV/m)**
Above 1 GHz	54.0	74.0



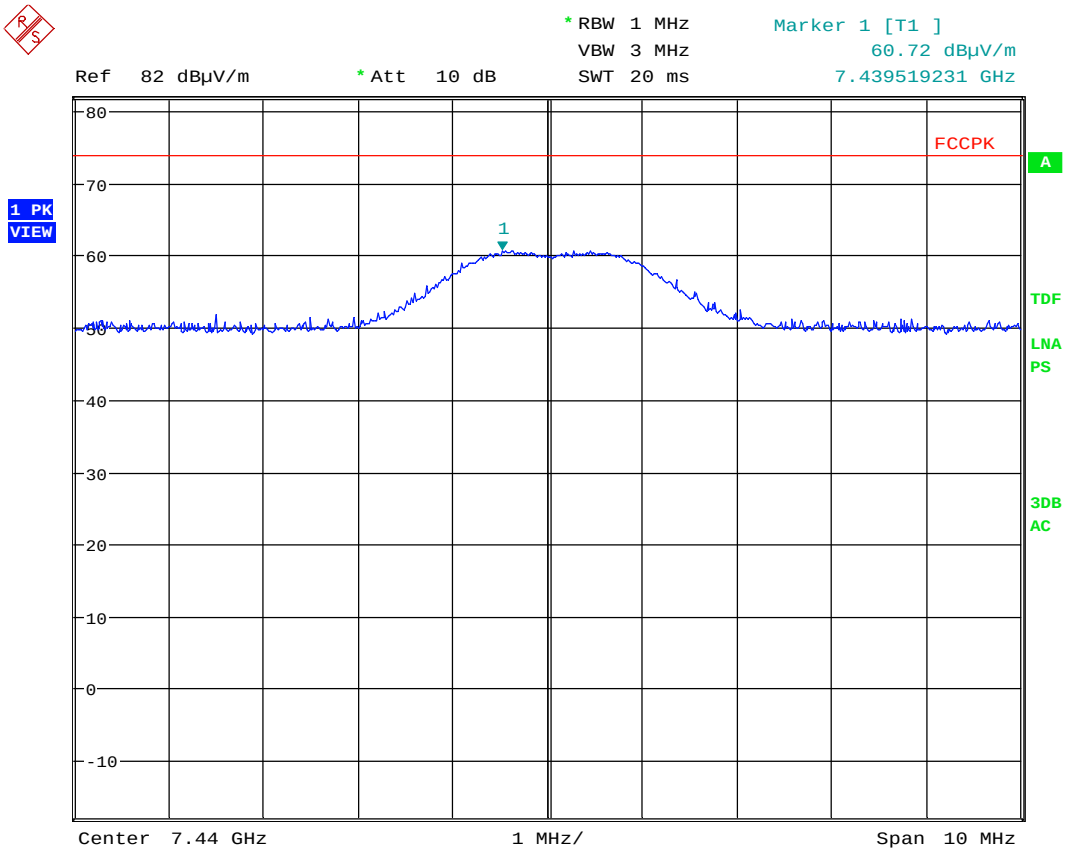
Date: 4.JUN.2019 12:28:44

3rd har, PK, ch2402MHz, GFSK – HP



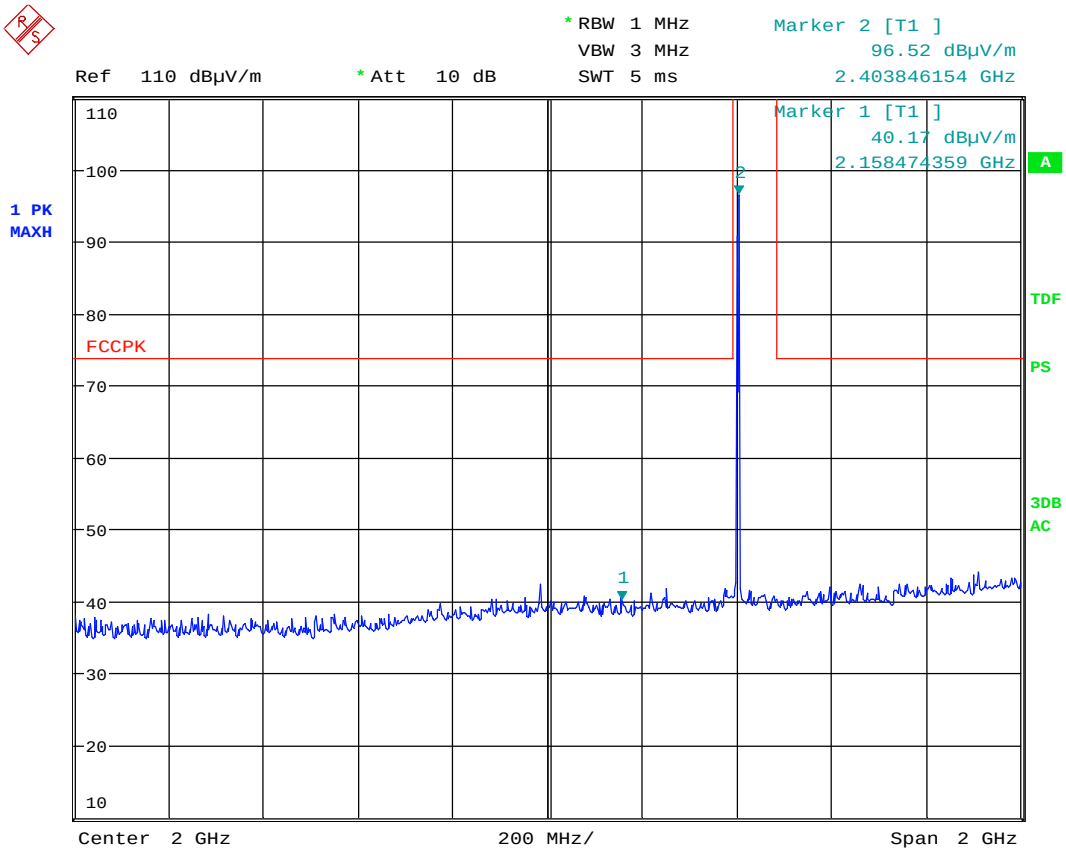
Date: 5.JUN.2019 17:03:24

3rd har, PK, ch2441MHz, GFSK – HP



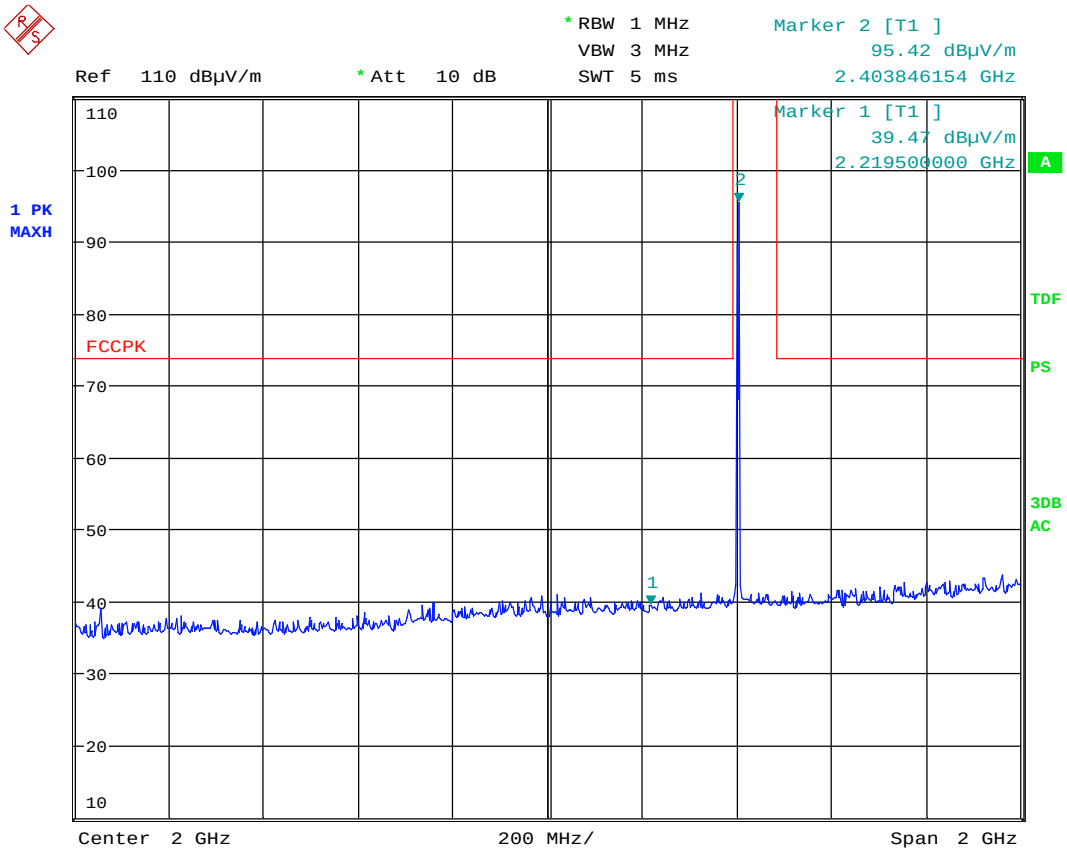
Date: 5.JUN.2019 17:08:02

3rd har, PK, ch2480MHz, GFSK – HP



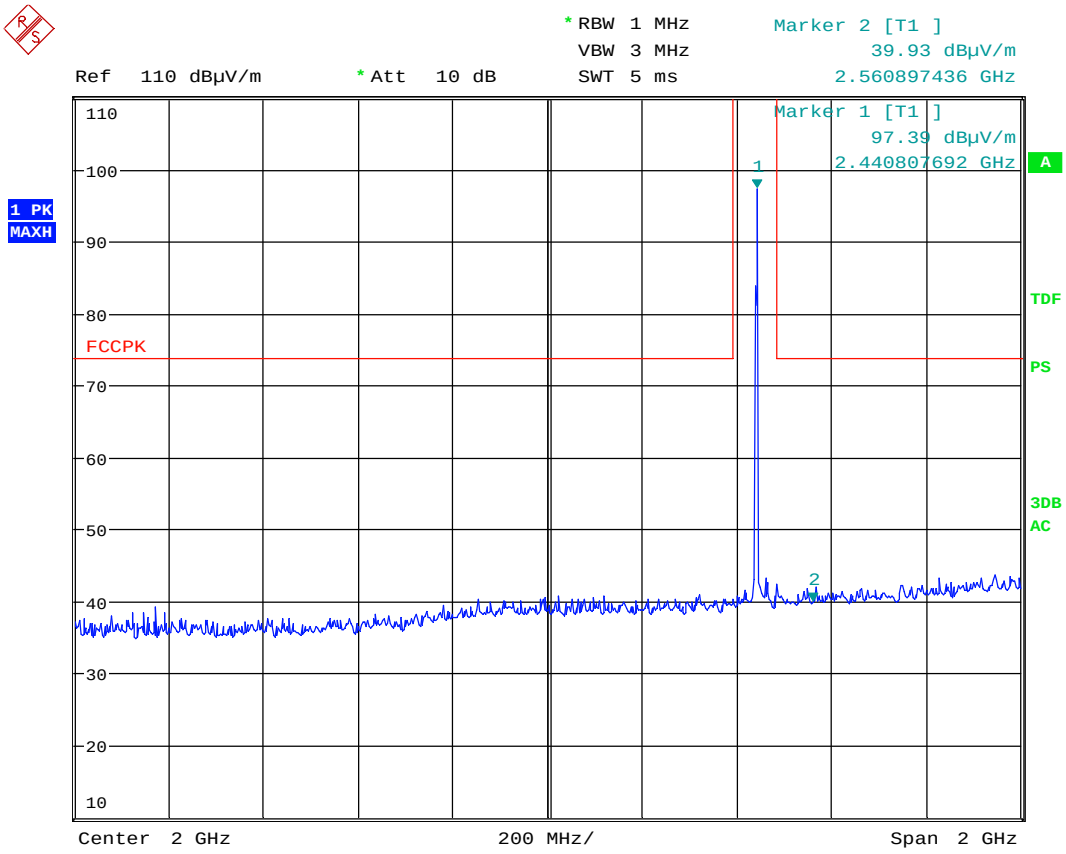
Date: 4.JUN.2019 10:22:03

VP, 1 - 3GHz , GFSK, ch2402MHz, PK scan



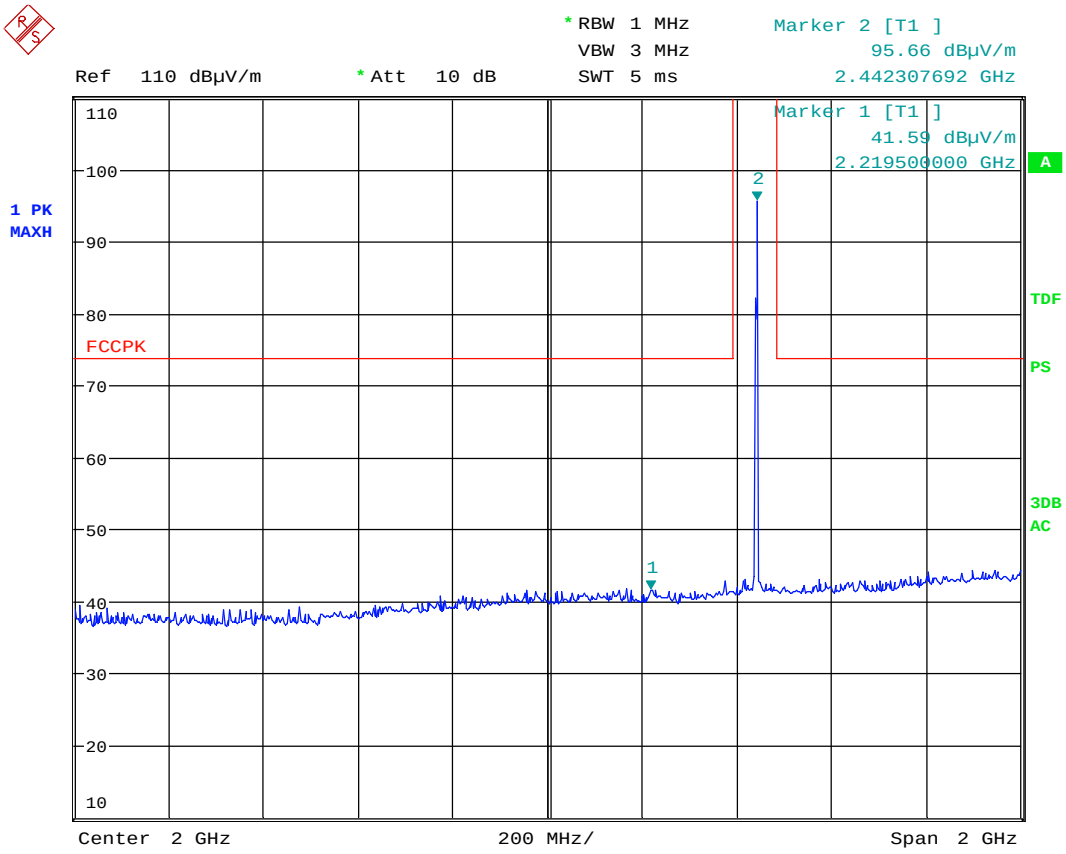
Date: 4.JUN.2019 10:24:44

HP, 1 - 3GHz , GFSK, Ch2402MHz, PK scan



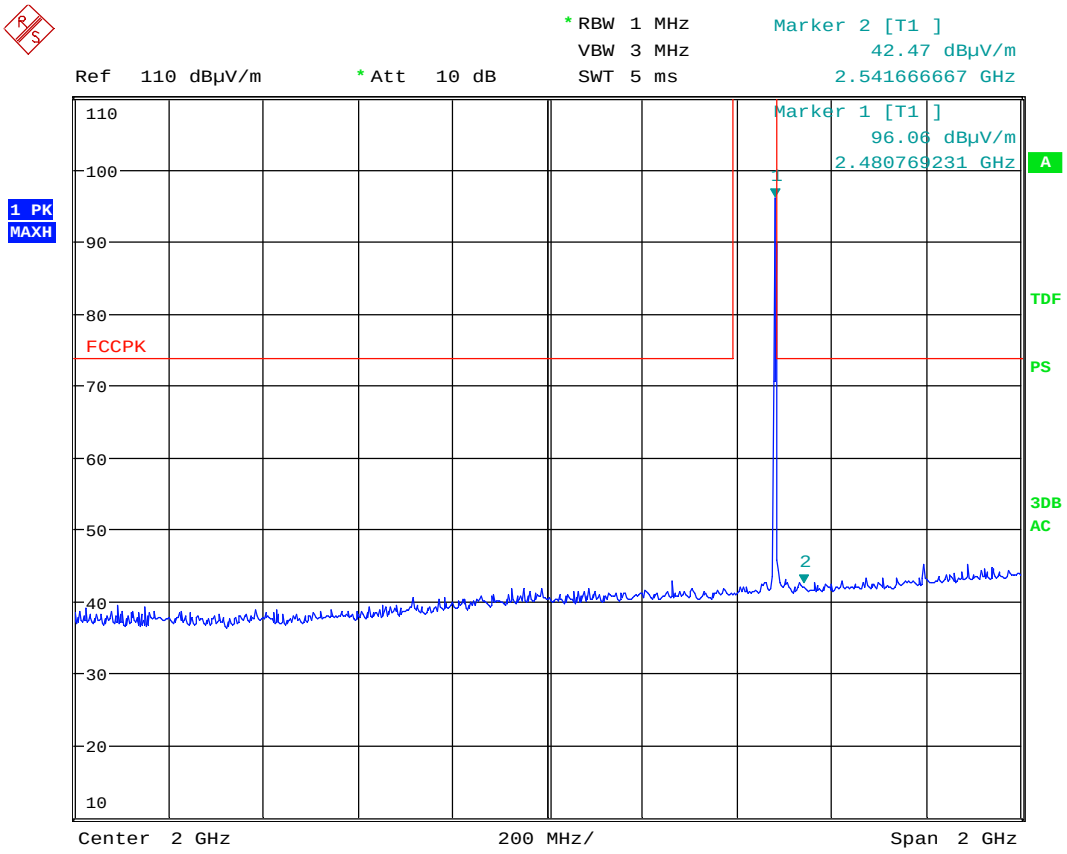
Date: 4.JUN.2019 10:28:33

VP, 1 - 3GHz , GFSK, ch2441MHz, PK scan



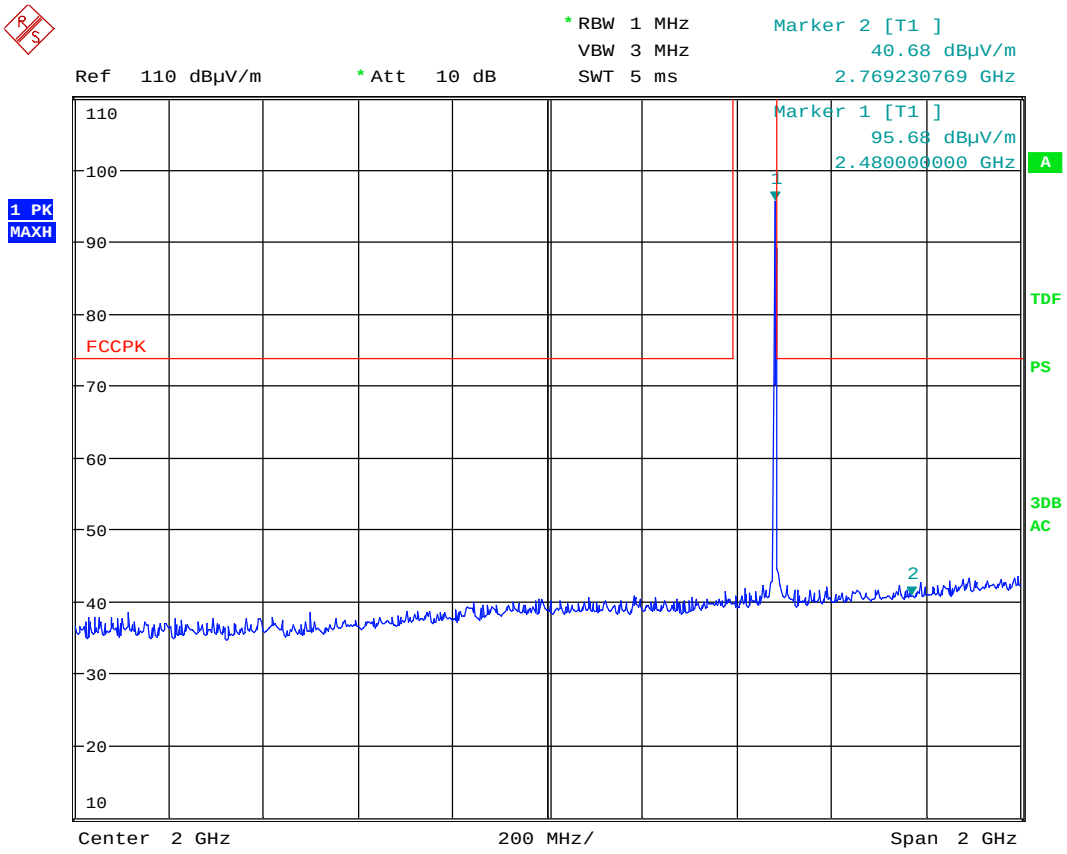
Date: 4.JUN.2019 10:26:12

HP, 1 - 3GHz , GFSK, Ch2441MHz, PK scan



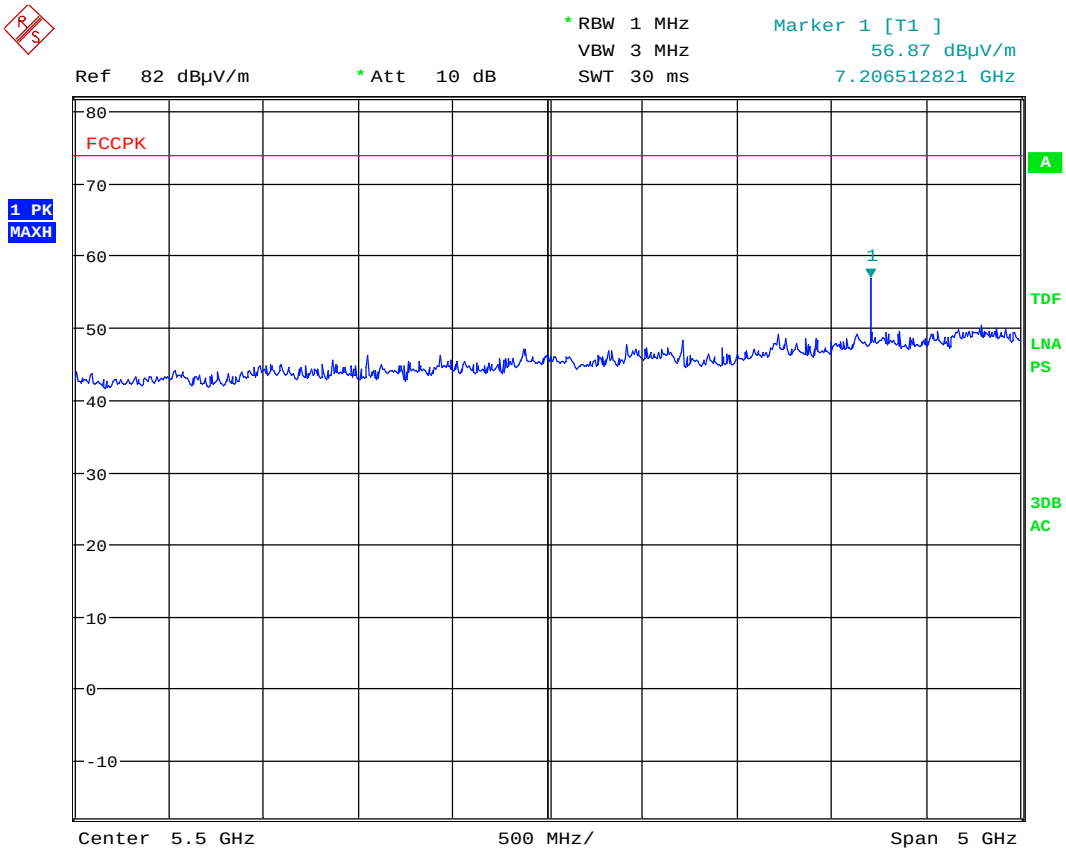
Date: 4.JUN.2019 10:29:38

VP, 1 - 3GHz , GFSK, ch2480MHz, PK scan



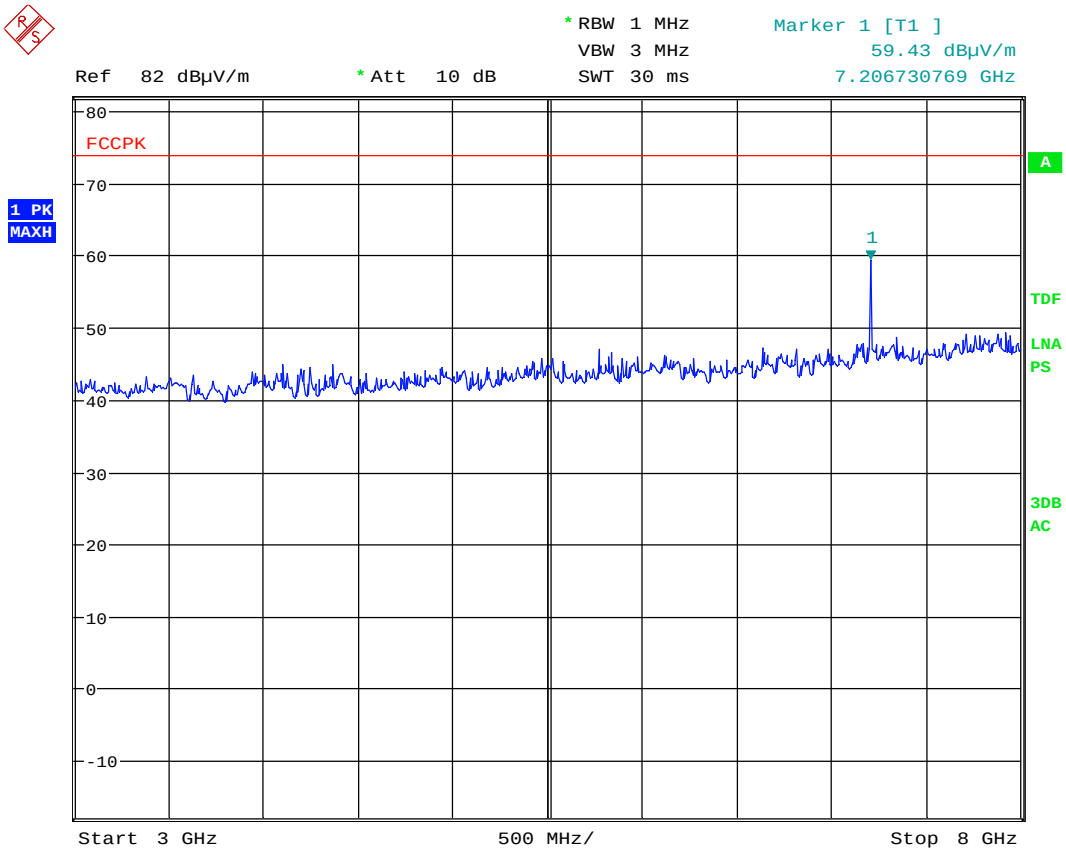
Date: 4.JUN.2019 10:33:15

HP, 1 - 3GHz , GFSK, Ch2480MHz, PK scan



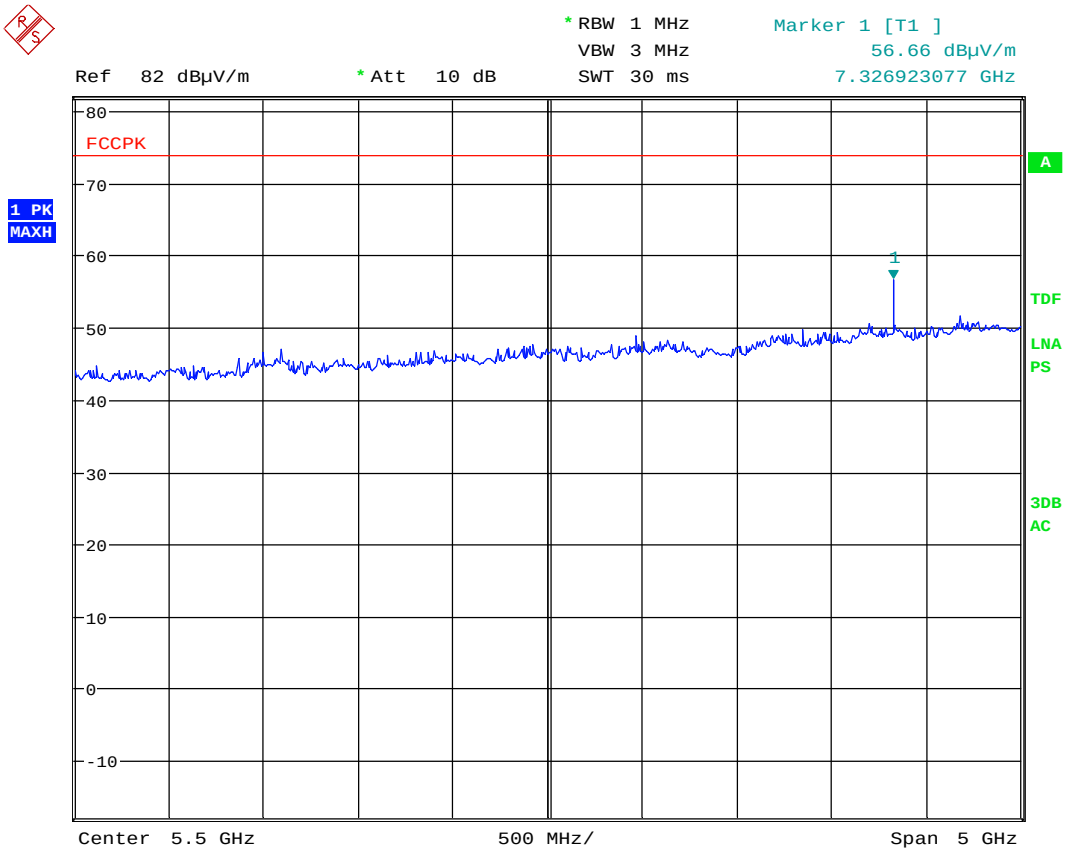
Date: 4.JUN.2019 12:31:15

VP, 3 - 8GHz , GFSK, ch2402MHz, PK scan



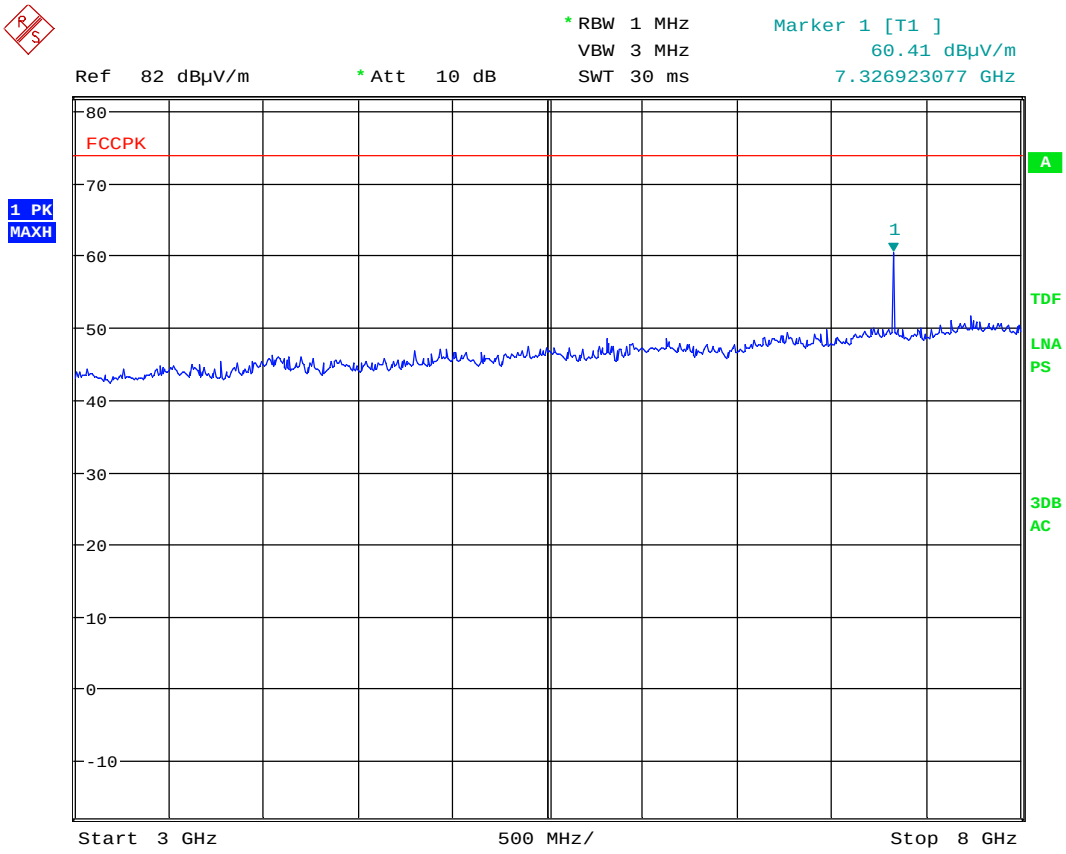
Date: 4.JUN.2019 12:27:44

HP, 3 - 8GHz , GFSK,ch2402MHz, PK scan



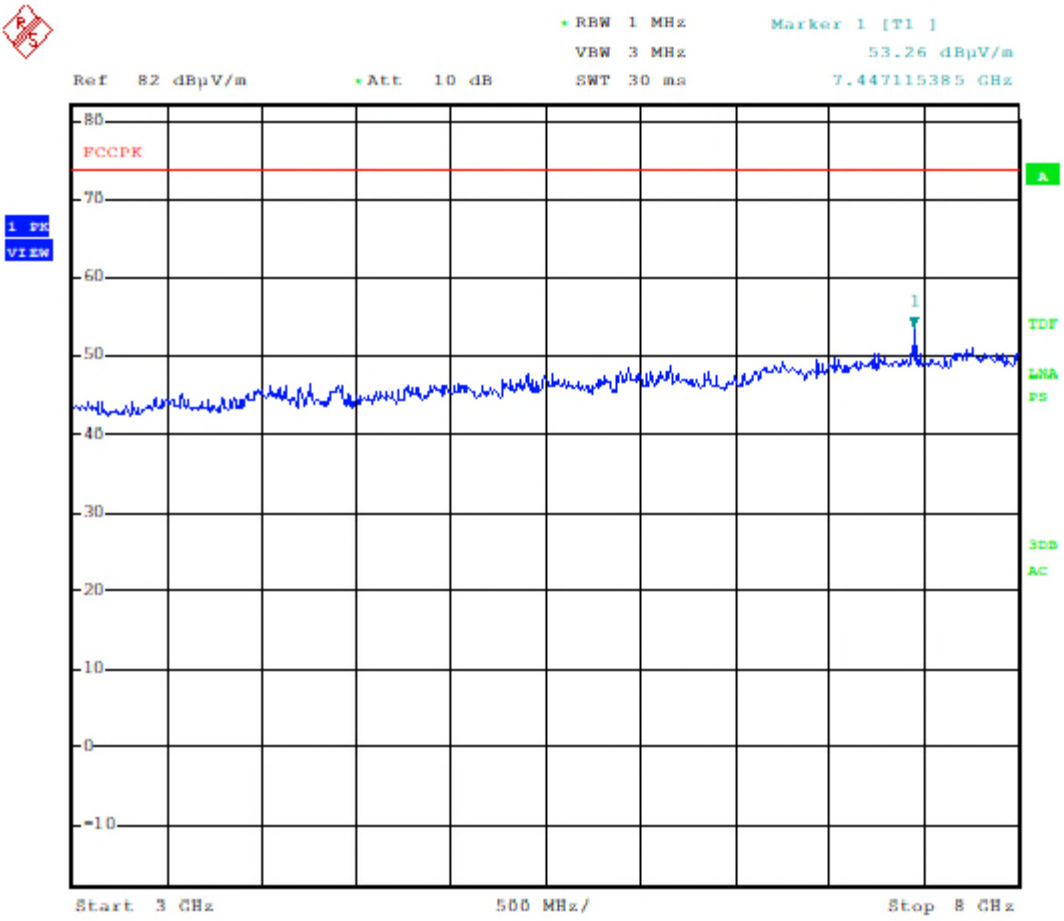
Date: 5.JUN.2019 16:58:39

VP, 3 - 8GHz , GFSK, ch2441MHz, PK scan

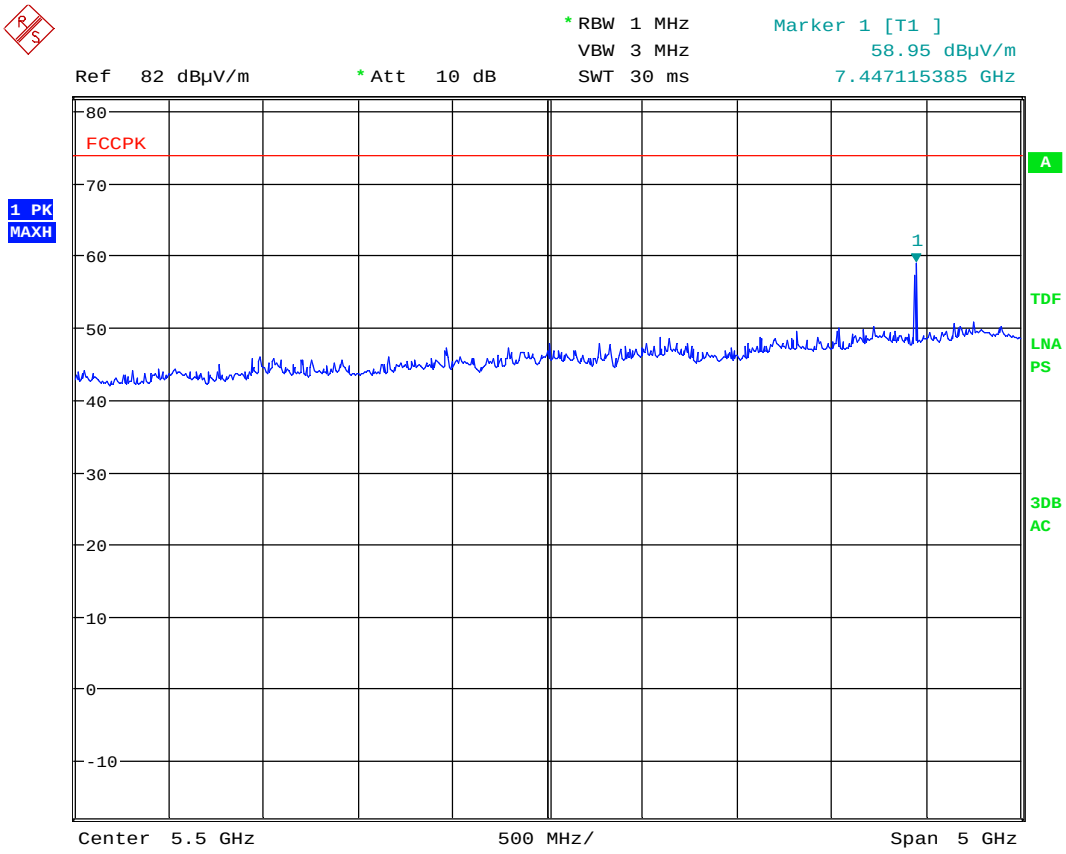


Date: 5.JUN.2019 17:00:54

HP, 3 - 8GHz , GFSK,ch2441MHz, PK scan

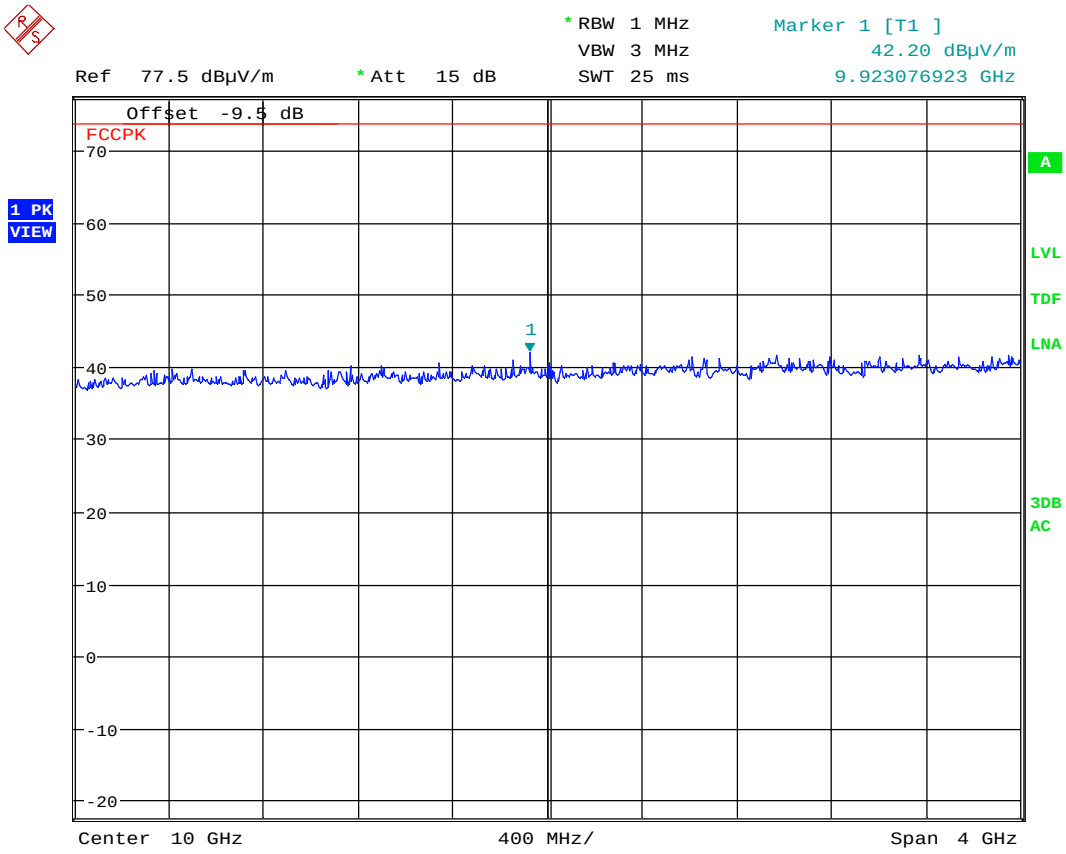


VP, 3 - 8GHz , GFSK, ch2480MHz, PK scan



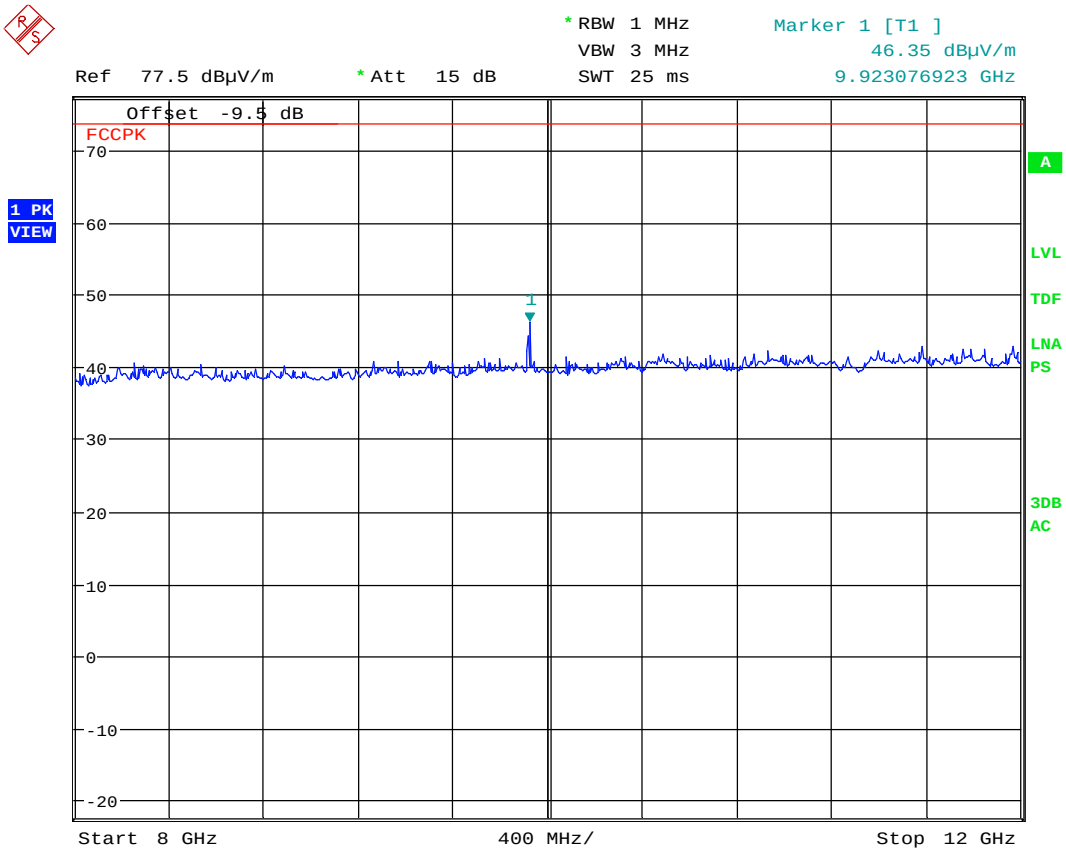
Date: 5.JUN.2019 17:07:11

HP, 3 - 8GHz , GFSK,ch2480MHz, PK scan



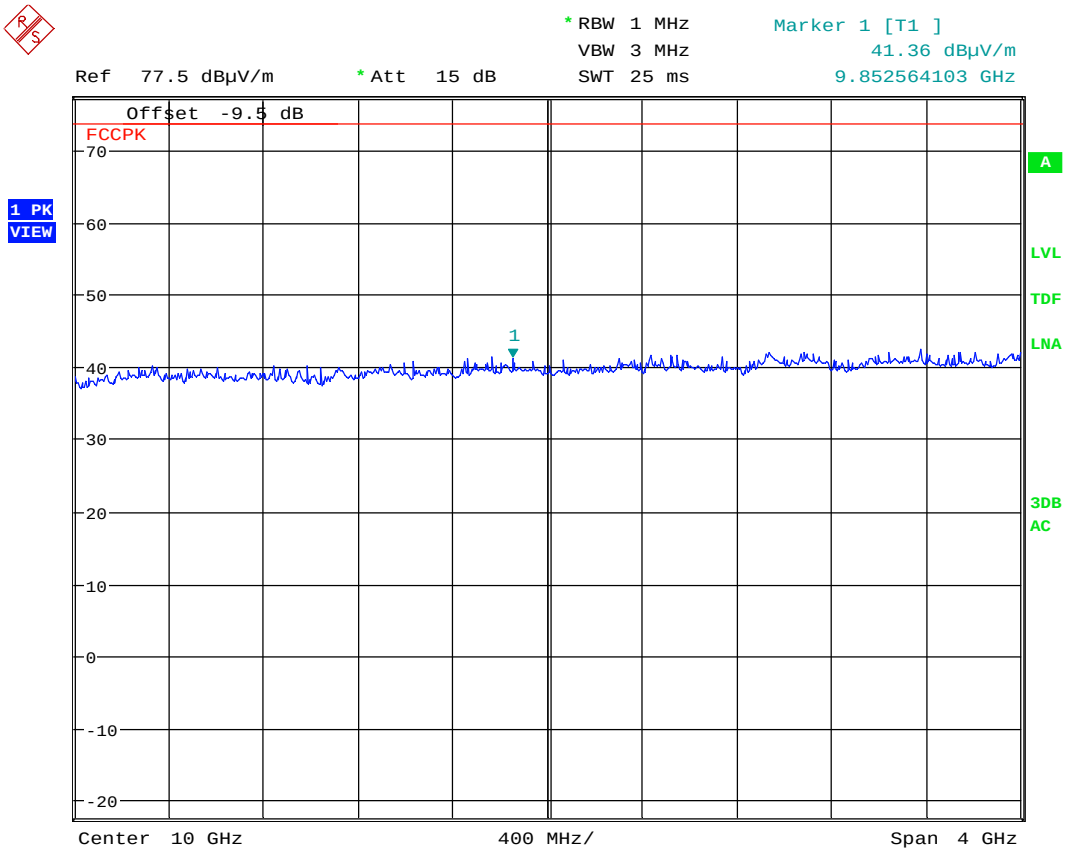
Date: 5.JUN.2019 19:03:10

VP, 8 - 12GHz , GFSK,ch2402MHz, PK scan,@ 1m distance



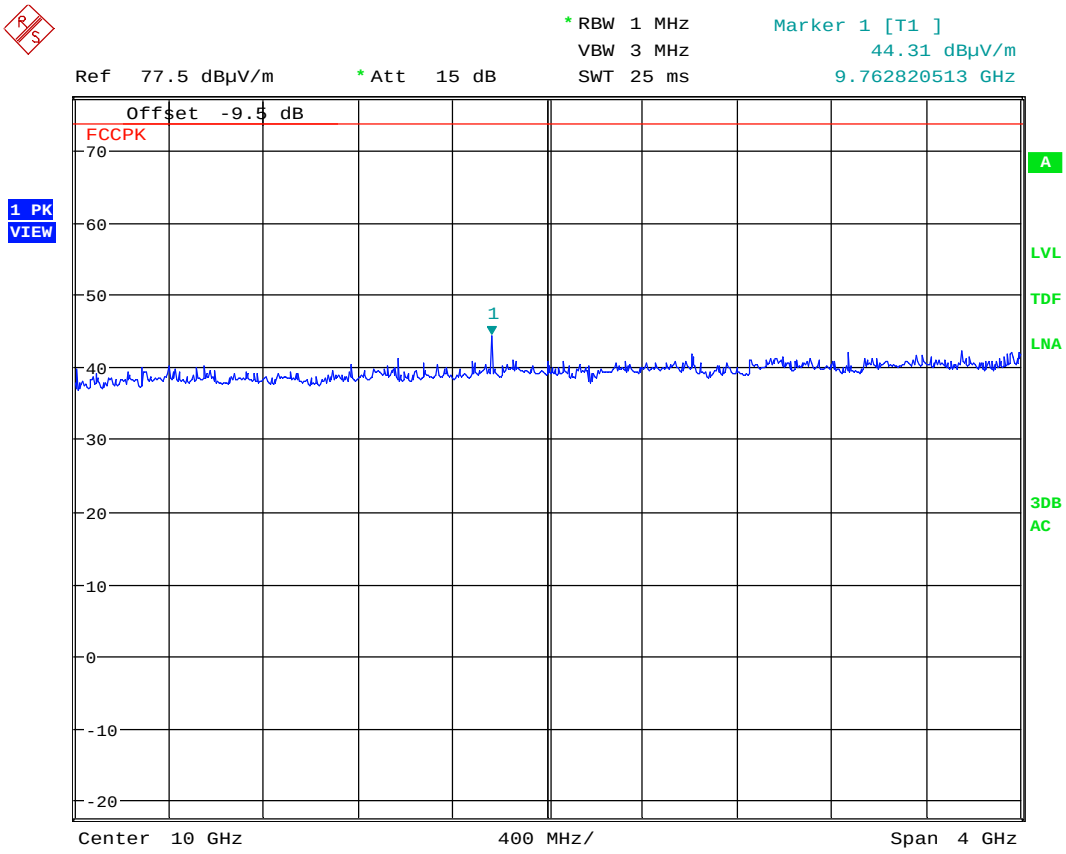
Date: 5.JUN.2019 19:01:57

HP, 8 - 12GHz , GFSK,ch2402MHz, PK scan, @ 1m distance



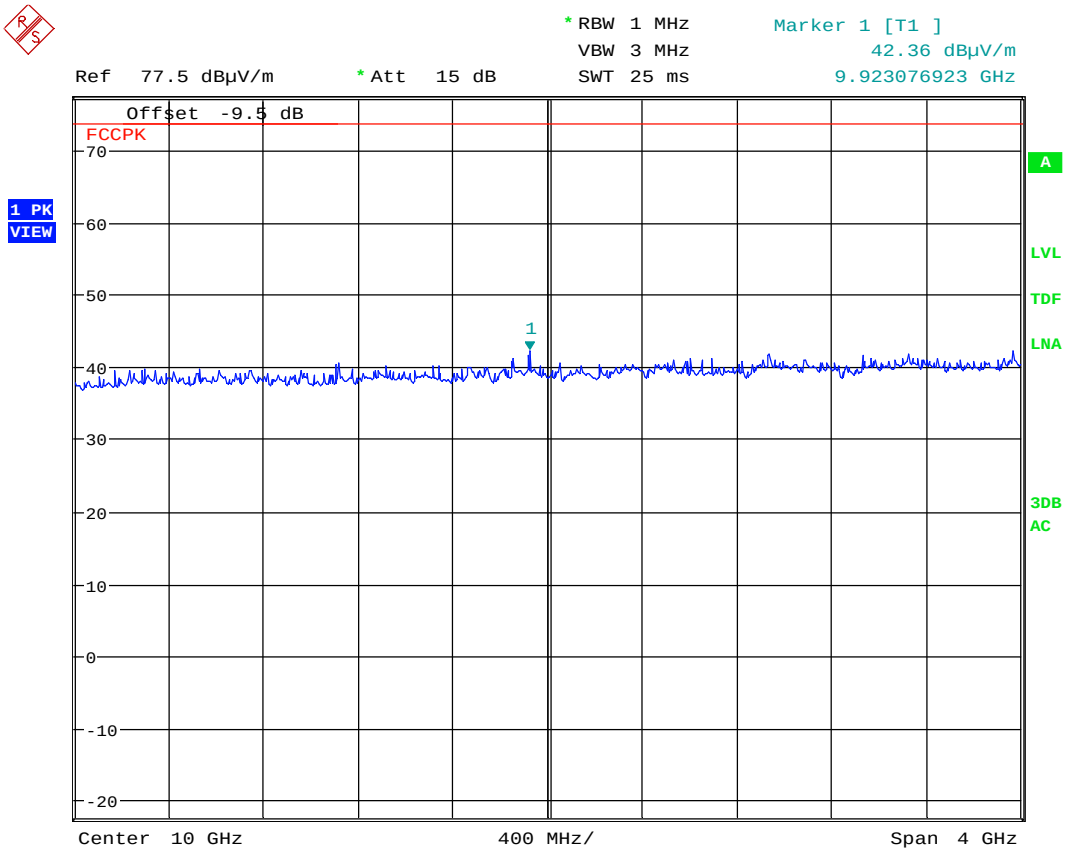
Date: 5.JUN.2019 19:13:27

VP, 8 - 12GHz , GFSK,ch2441MHz, PK scan,@ 1m distance



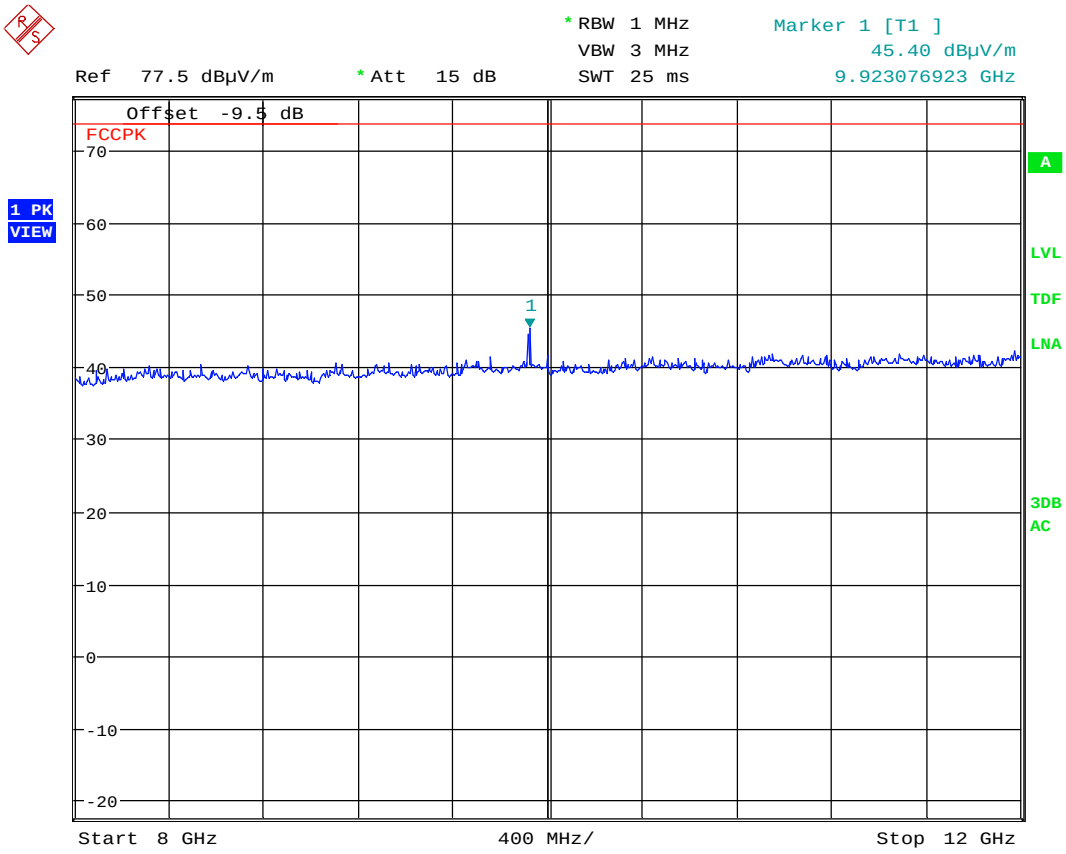
Date: 5.JUN.2019 19:14:09

HP, 8 - 12GHz , GFSK,ch2441MHz, PK scan, @ 1m distance



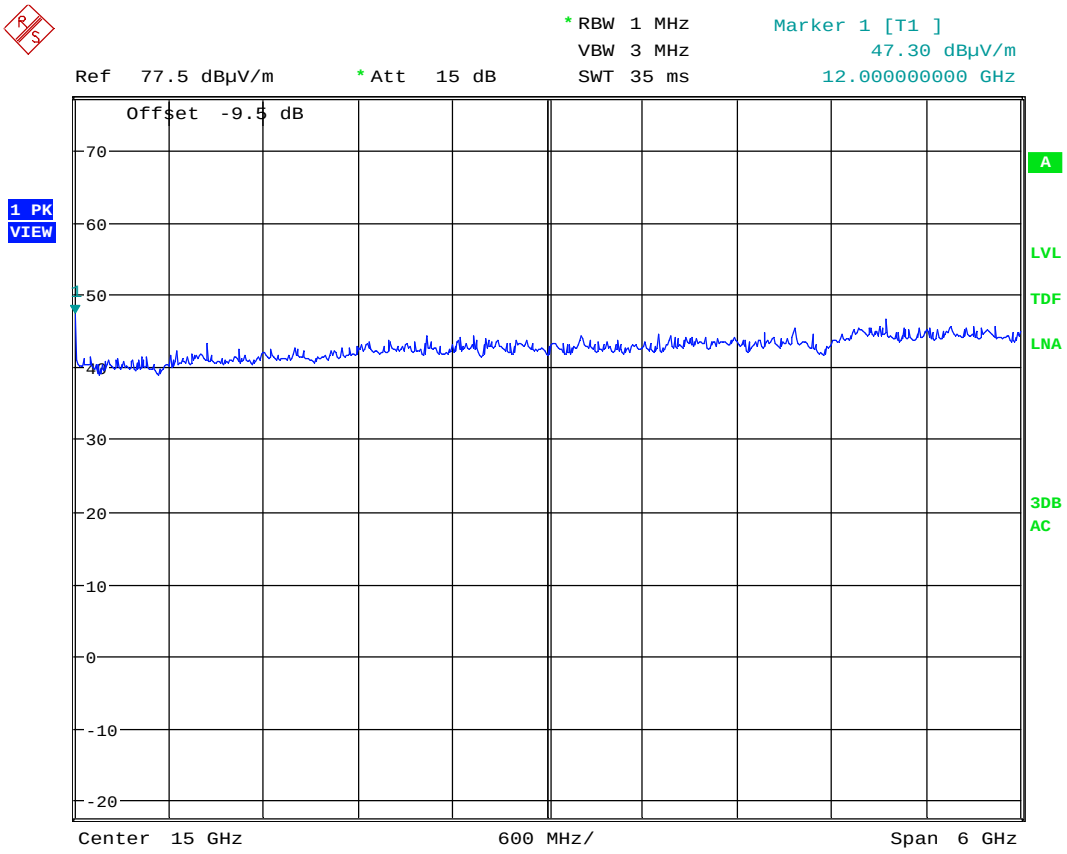
Date: 5.JUN.2019 19:11:20

VP, 8 - 12GHz , GFSK,ch2480MHz, PK scan,@ 1m distance



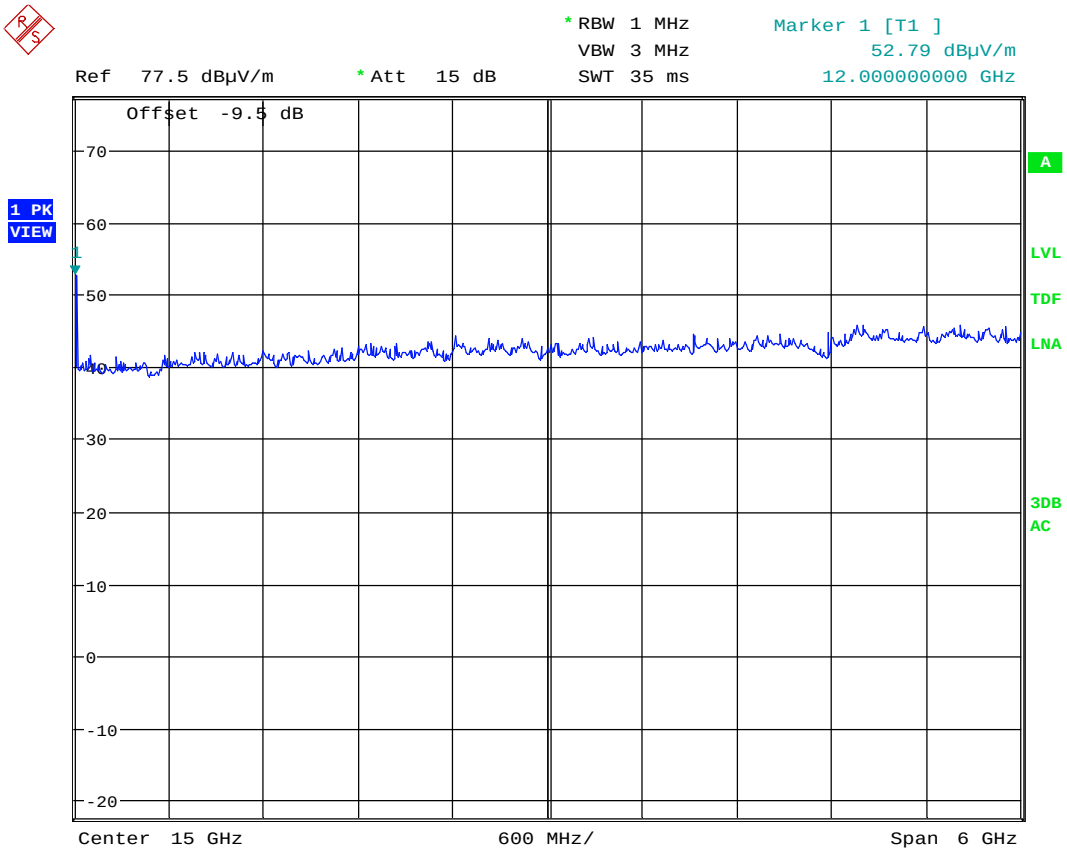
Date: 5.JUN.2019 19:10:44

HP, 8 - 12GHz , GFSK,ch2480MHz, PK scan, @ 1m distance



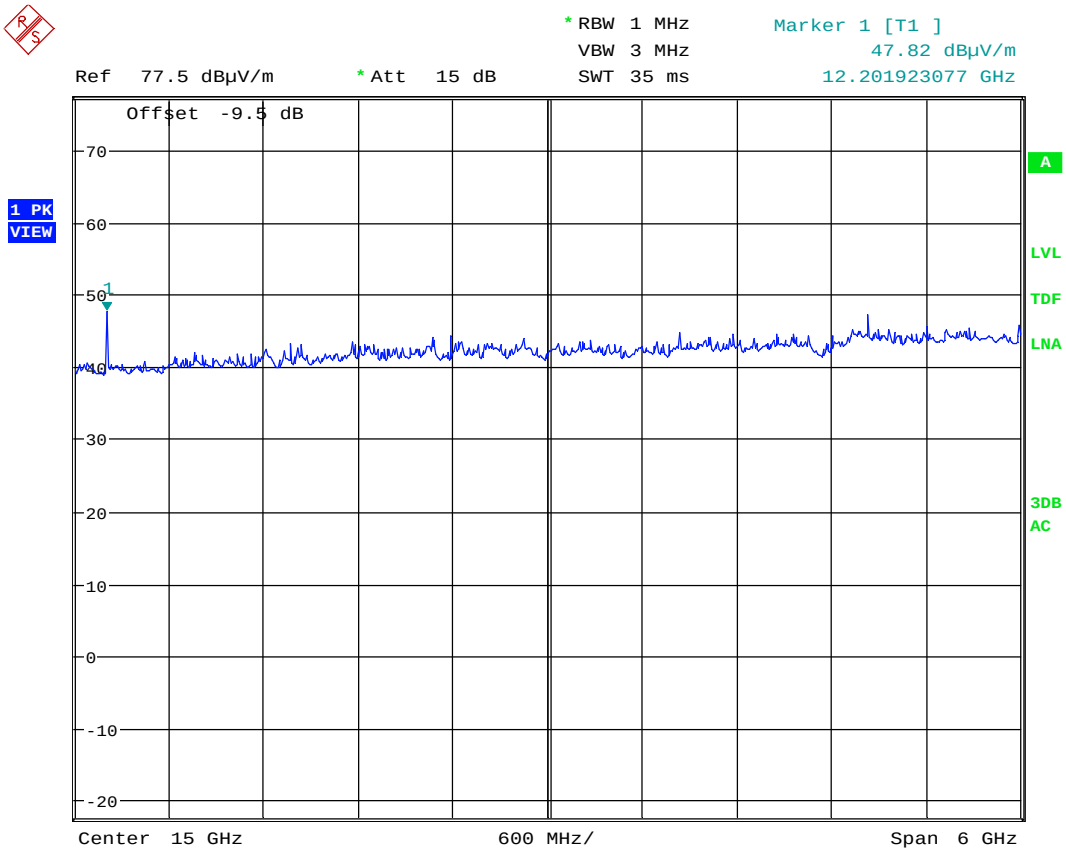
Date: 5.JUN.2019 20:30:47

VP, 12 - 18GHz , GFSK,ch2402MHz, PK scan, @ 1m distance



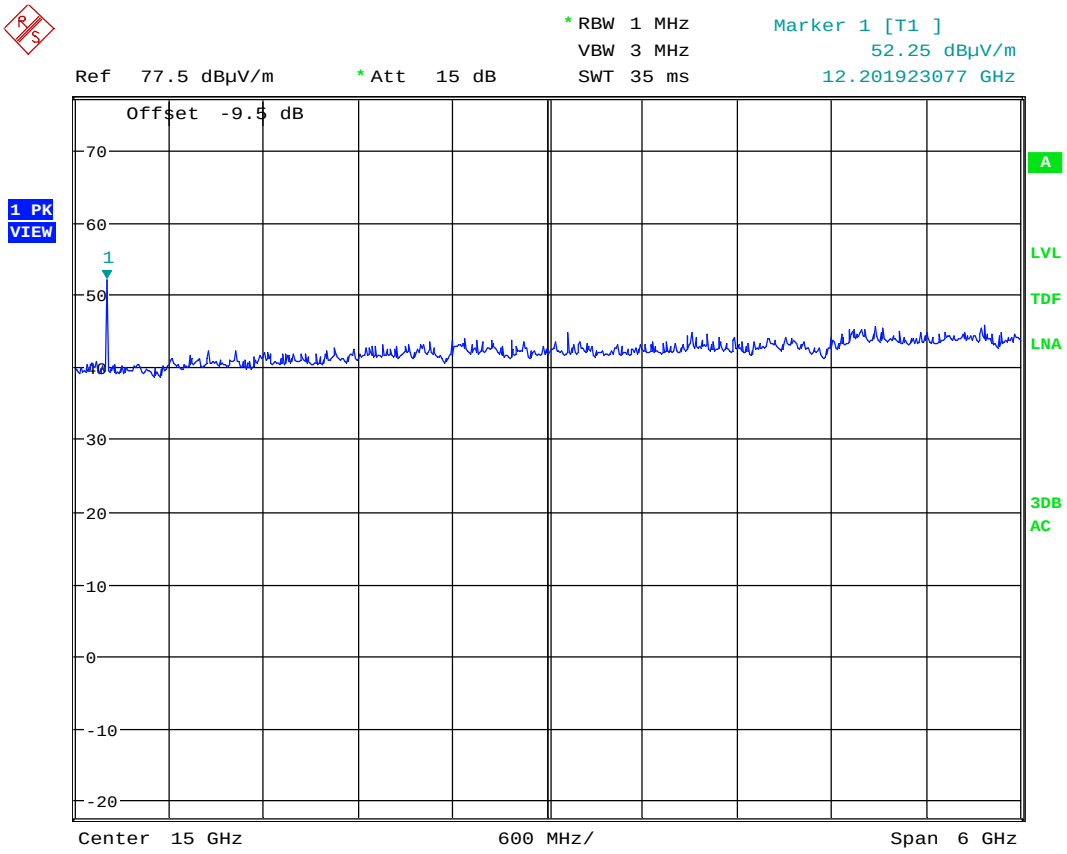
Date: 5.JUN.2019 20:31:16

HP, 12 - 18GHz , GFSK,ch2402MHz PK scan, @ 1m distance



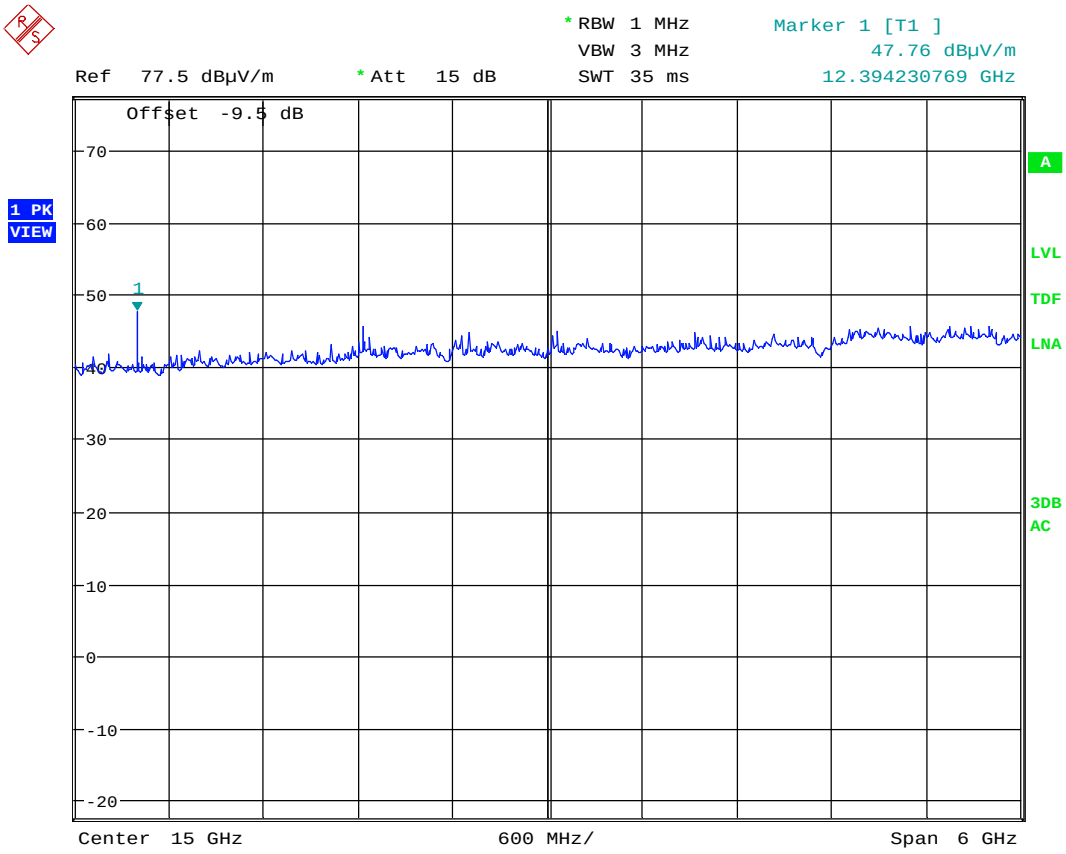
Date: 5.JUN.2019 20:32:37

VP, 12 - 18GHz , GFSK,ch2441MHz, PK scan, @ 1m distance



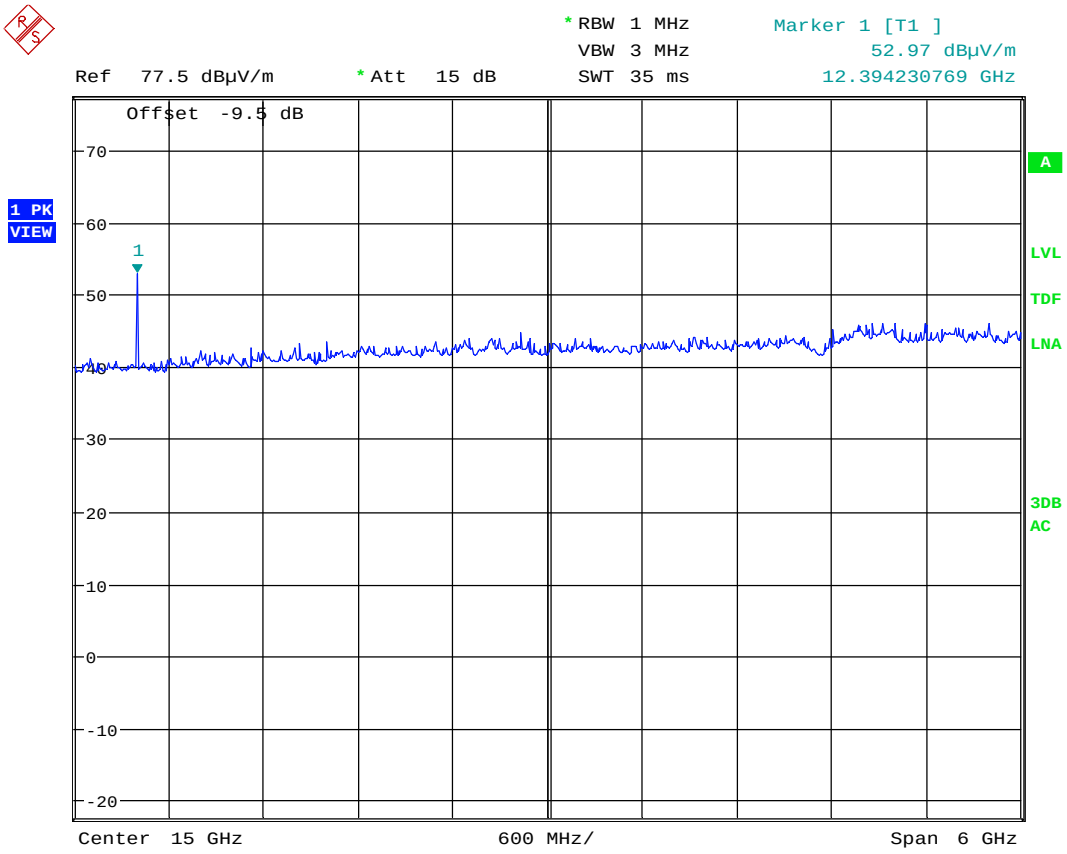
Date: 5.JUN.2019 20:32:12

HP, 12 - 18GHz , GFSK,ch2441MHz PK scan, @ 1m distance



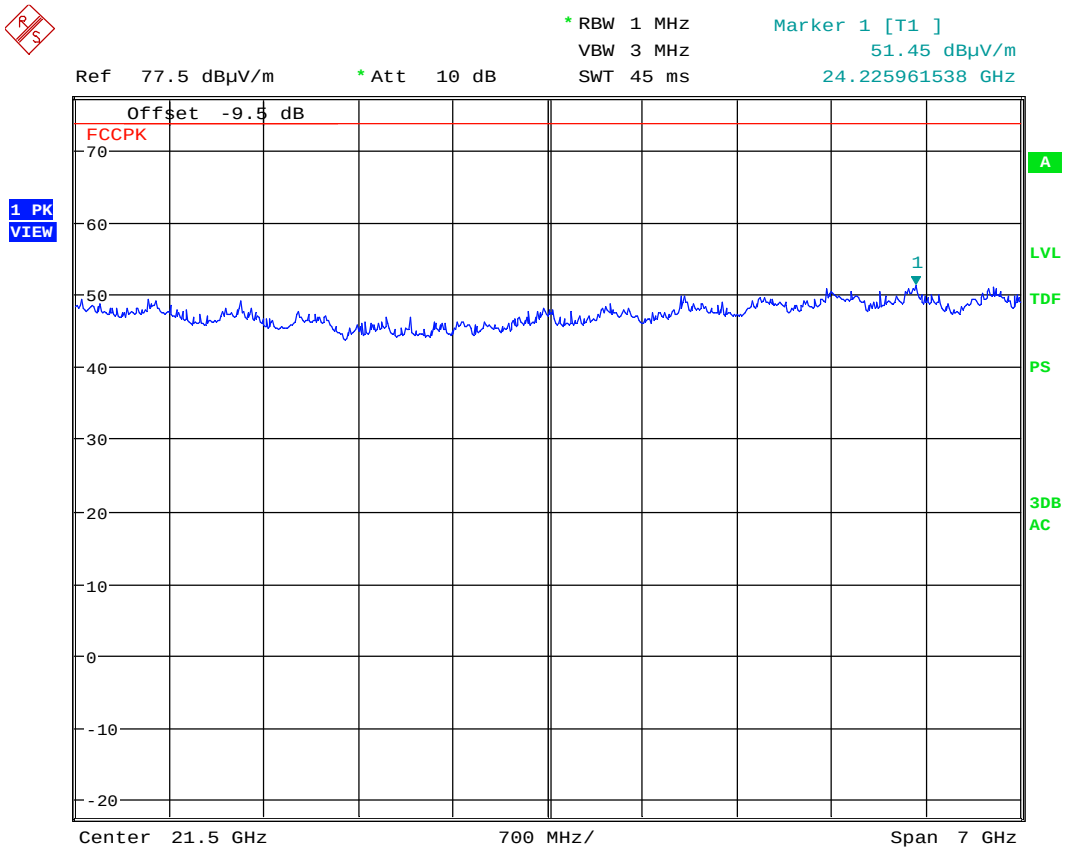
Date: 5.JUN.2019 20:33:42

VP, 12 - 18GHz , GFSK,ch2480MHz, PK scan, @ 1m distance



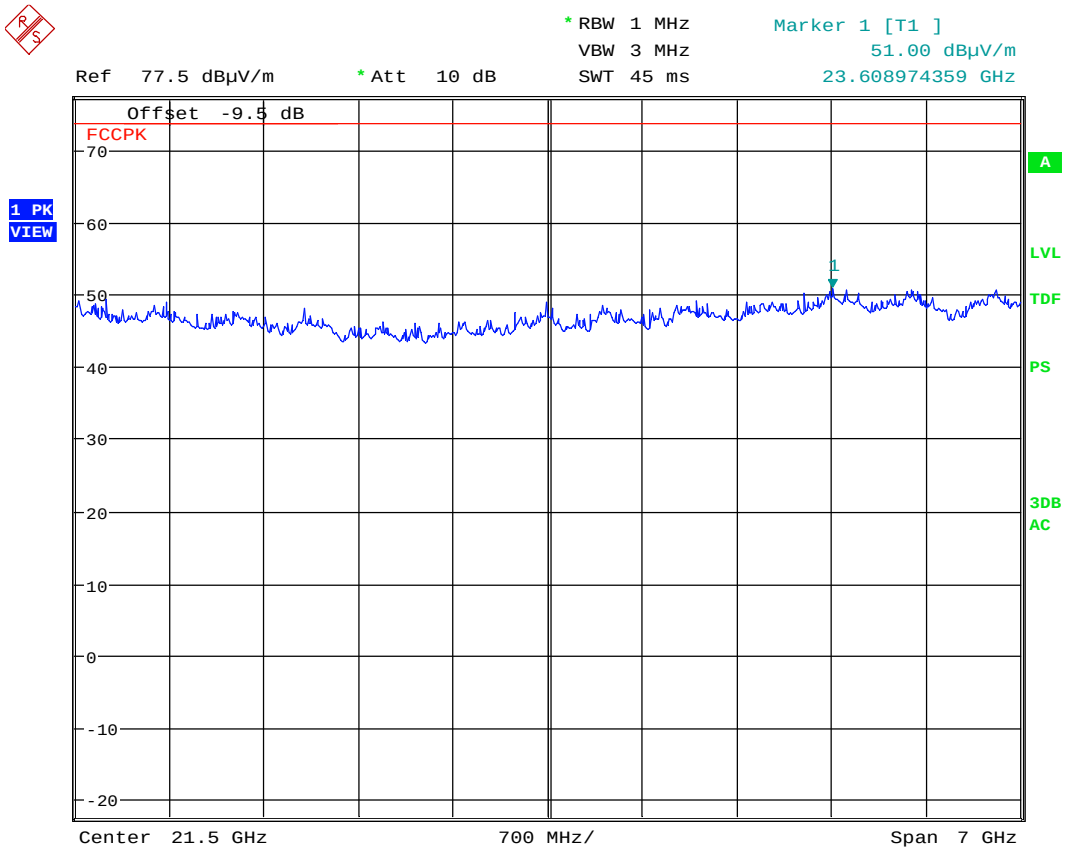
Date: 5.JUN.2019 20:34:16

HP, 12 - 18GHz , GFSK,ch2480MHz PK scan, @ 1m distance



Date: 5.JUN.2019 20:53:16

Pre-scan VP, 18 - 25GHz , GFSK @ 1m distance



Date: 5.JUN.2019 20:53:53

Pre-scn HP, 18 - 25GHz , GFSK @ 1m distance

IN 8DPSK MODE:

Radiated Emissions, 1-25 GHz; Measuring distance:3m (1 – 8 GHz), 1m (8 – 18 GHz); A pre-scan was performed above 18 GHz and no spurious emissions were detected.

Peak Detector:

Modulation scheme	Frequency	Polarization	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
	GHz		dB	dBμV/m	dB	dBμV/m	dB
8DPSK	4.804	HP	0	/	/	74	/
	4.882	HP	0	/	/	74	/
	4.960	HP	0	/	/	74	/
8DPSK	7.206	HP	0	61.57	/	74	12.43
	7.323	HP	0	61.45	/	74	12.55
	7.440	HP	0	60.79	/	74	13.21
8DPSK	9.608	HP	*	45.95	/	74	28.05
	9.760	HP	*	45.16	/	74	28.84
	9.920	HP	*	44.23	/	74	29.77
8DPSK	12.01	HP	*	49.30	/	74	24.70
	12.205	HP	*	51.29	/	74	22.71
	12.400	HP	*	49.80	/	74	24.20
Other freqs	L,M,H	VP/HP	/	None detected	/	74	>20

*distance correction is included in the plot

Average:

Modulation scheme	Frequency	Polarization	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
	MHz		dB	dBµV/m	dB	dBµV/m	dB
8DPSK	4.804	HP	0	/	20	54	/
	4.882	HP	0	/	20	54	/
	4.960	HP	0	/	20	54	/
8DPSK	7.206	HP	0	41.57	20	54	12.43
	7.323	HP	0	41.45	20	54	12.55
	7.440	HP	0	40.79	20	54	13.21
8DPSK	9.608	HP	*	/	20	54	/
	9.760	HP	*	/	20	54	/
	9.920	HP	*	/	20	54	/
8DPSK	12.01	HP	*	/	20	54	/
	12.205	HP	*	/	20	54	/
	12.400	HP	*	/	20	54	/
Other freqs	L,M,H	VP/HP	/	None detected	20	54	>20

*distance correction is included in the plot

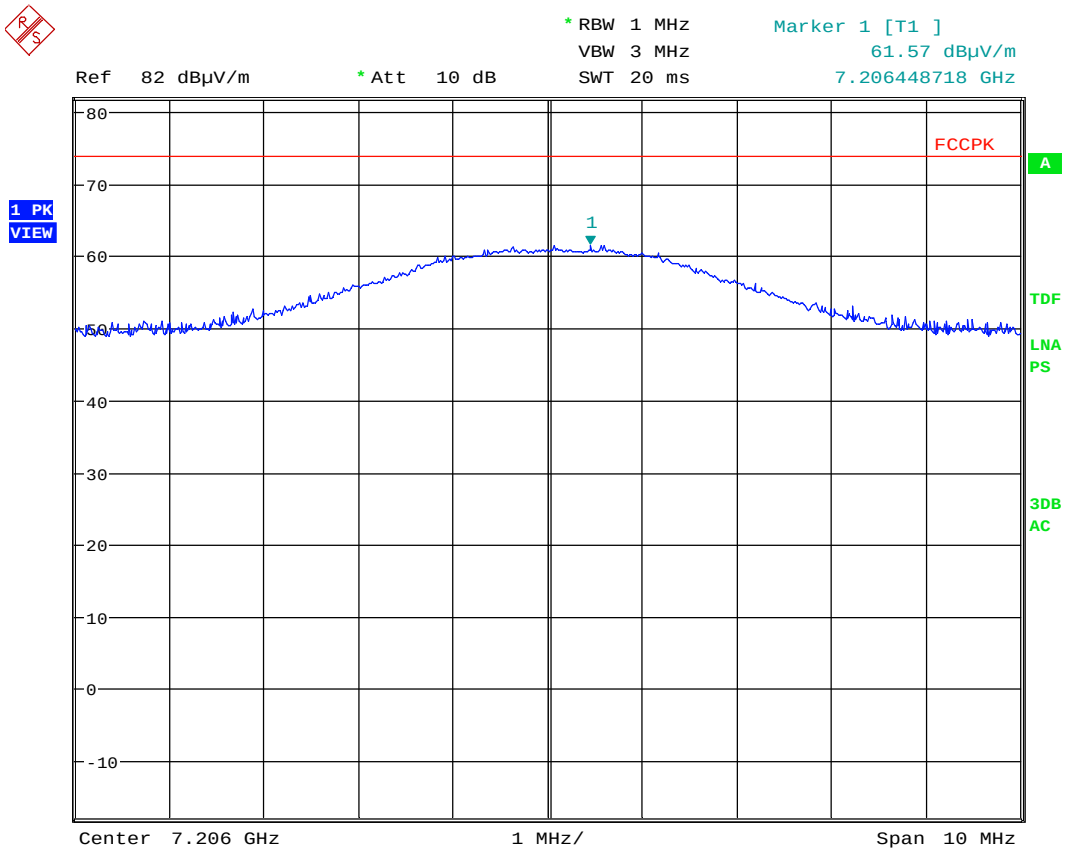
Average Detector values are calculated from Peak values by Duty Cycle Correction Factor.

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer “Transducer factor”.

See attached plots.

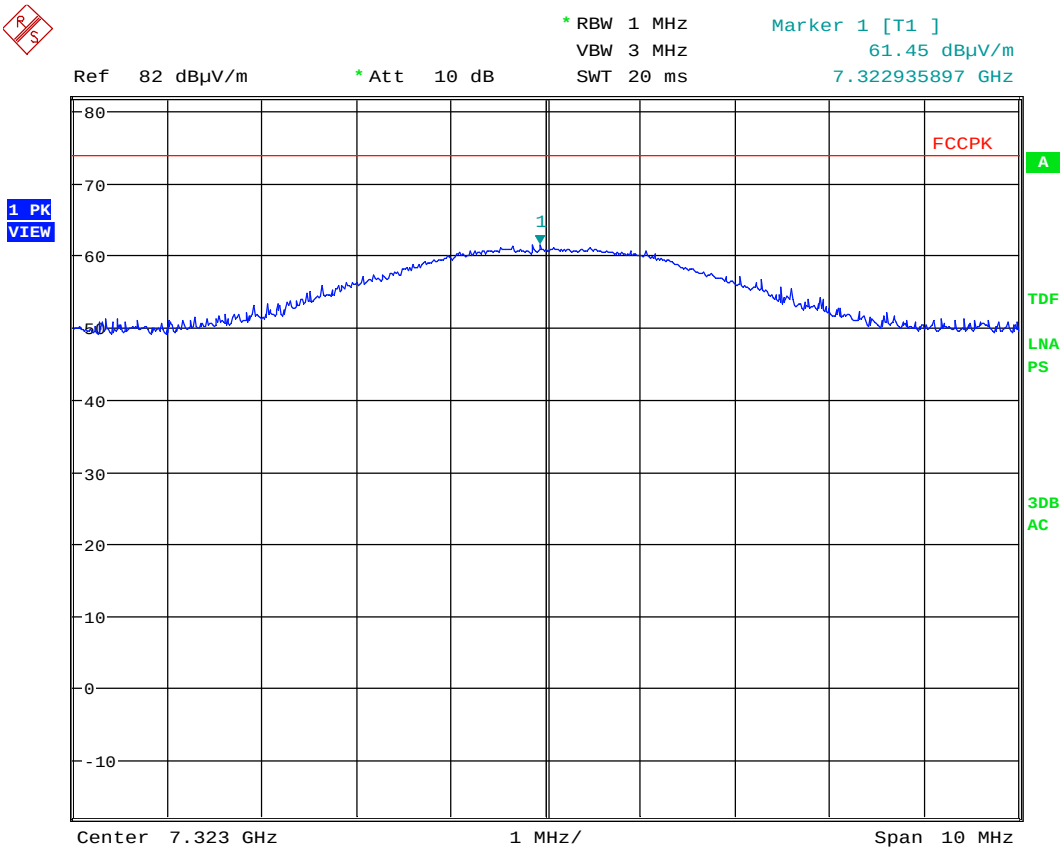
Requirements/Limit

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)	**AV (dBµV/m)**	**Peak (dBµV/m)**
Above 1 GHz	54.0	74.0



Date: 5.JUN.2019 17:47:39

3rd har, PK, ch2402MHz, 8DPSK – HP



Date: 5.JUN.2019 17:52:28

3rd har, PK, ch2441MHz, 8DPSK – HP