Nemko

Test report

347785-2TRFWL

Date of issue: **March 12, 2018**

Applicant:

GN Netcom Inc.

Product:

DECT Headset

Model:

WHB050HS

FCC ID:

BCE-WHB050HS

IC Reg. Number:

2386C-WHB050HS

Specifications:

◆ **FCC 47 CFR Part 15, Subpart D**

    Isochronous UPCS Device, 1920–1930 MHz

◆ **RSS-213, Issue 3, March 2015**

    2 GHz Licence-Exempt Personal Communications Services (LE-PCS) Devices

Test location

Company name	Nemko Canada Inc.
Address	303 River Road
City	Ottawa
Province	Ontario
Postal code	K1V 1H2
Country	Canada
Telephone	+1 613 737 9680
Facsimile	+1 613 737 9691
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC: CA2040; IC: 2040A-4 (3 m semi anechoic chamber)

Tested by	Frode Sveinsen, Senior Wireless Engineer
Reviewed by	Andrey Adelberg, Senior Wireless/EMC Specialist
Date	March 12, 2018
Signature of reviewer	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

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1 INFORMATION

1.1 Applicant information

Name:	GN Netcom Inc.
Address:	900 Chelmsford Street, Tower II, 8th Floor Lowell, 1851, MA, USA

1.2 Tested Item

Name:	Jabra
Additional information:	DECT 6.0
Model name:	WHB050HS
FCC ID:	BCE-WHB050HS
Industry Canada Registration Number:	2386C-WHB050HS
Serial number:	/
Trademark:	Jabra
Hardware identity and/or version:	28-04238
Software identity and/or version:	1.6.4
Tested to ISED Radio Standard (RSS):	RSS-213 Issue 3; RSS-Gen Issue 4
Frequency Band:	1920–1930 MHz
Frequency Range:	1921.536–1928.448 MHz
Number of Channels:	5 RF Channels, 5 × 12 = 60 TDMA Duplex Channels
Type of Modulation:	GFSK, π/2-DBPSK, π/4-DQPSK, π/8-D8PSK
Conducted Output Power:	58.9 mW (GFSK) 55.0 mW (π/2-DBPSK) 52.5 mW (π/4-DQPSK) 49.0 mW (π/8-D8PSK)
Antenna Connector:	None (Integral Antennas)
Number of Antennas:	1
Antenna Diversity Supported:	No
Power Supply:	Secondary Battery (3.7V Li-Ion)
Interface:	microUSB connector for charging in Base
Companion Device:	Base Station WHB050BS (FCC ID: BCE-WHB050BS)

1.3 Testing dates

Tested in period:	February 12, 2018 to February 16, 2018

1.4 Description of Tested Device

The EUT is a DECT Headset and is a Initiating device as described in ANSI C63.17 and is designed to operate together with a DECT Base Station, which is then the responding device.

1.5 Test Conditions

Temperature:	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar
Normal test voltage	3.7 V_{DC} (Nominal Battery Voltage)

All tests were performed with the EUT powered from the mains.

The values are the limit registered during the test period.

1.6 Test Engineer(s)

Frode Sveinsen

1.7 Digital Modulation Techniques

The EUT uses Multi Carrier / Time Division Multiple Access / Time Division Duplex and Digital GFSK modulation. For further details see the operational description provided by the applicant.

Requirement, FCC 15.319(b):

All transmissions must use only digital modulation techniques.

1.8 Labeling Requirements

See separate documents showing the label design and the placement of the label on the EUT.

Requirements FCC 15.19

The FCC Identifier shall be displayed on the label, and the device(s) shall bear the following statement in a conspicuous location on the device or in the user manual if the device is too small:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The label itself shall be of a permanent type, not a paper label, and shall last the lifetime of the equipment.

1.9 Antenna Requirement

Does the EUT have detachable antenna(s)?	☐ YES	☒ NO
If detachable, is the antenna connector(s) non-standard?	☐ YES	☐ NO
The tested equipment has only integral antennas. The conducted tests were performed on a sample with a temporary antenna connector.		

Requirement: FCC 15.203, 15.204, 15.317.

1.10   Channel Frequencies

UPCS CHANNEL	FREQUENCY (MHz)
Upper Band Edge	1930.000
0 (Highest)	1928.448
1	1926.720
2	1924.992
3	1923.264
4 (Lowest)	1921.536
Lower Band Edge	1920.000

Requirement: FCC 15.303

Within 1920–1930 MHz band for isochronous devices.

1.11   Other Comments

The Monitoring and Time and Spectrum Window Access tests were performed with Test Set-Up 6 (Ref. clause 5). A clock signal from the companion device was used to synchronize the Pulse Pattern Generator and the Spectrum Analyzer to the start of the DECT time window. The EUT was limited by administrative commands to operate on only two frequency carriers. For the tests where the EUT was required to operate on only one frequency carrier, one carrier was blocked by applying a CW interfering signal from RF Generator 3. The Pulse Pattern Generator was used to apply time synchronized interference to time windows where this was required.

Since the EUT was programmed to operate on only two RF carriers, it was only necessary with two RF generators for the monitoring tests, however a third generator was applied for the tests that required specific time slots to be blocked.

The tested EUT supports both normal DECT slot length and DECT Long slot. Long slot is an extended DECT slot that allows a higher data rate for bit rates higher than 32 kbps.

This EUT supports Least Interfered Channel procedure (LIC), the Monitoring and Time and Spectrum Window Access tests were conducted as specified for EUTs that support LIC procedure.

All tests except Power-Line Conducted Emissions were performed in conducted mode with a temporary antenna connector.

The Power-Line Conducted Emissions test was performed with all ports populated and operating.

2   TEST REPORT SUMMARY

2.1   General

All measurements are traceable to national standards.

The tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC CFR47 Part 15 Subpart D for Isochronous UPCS Devices and Industry Canada RSS-213 Issue 3 / RSS-Gen Issue 4 / RSP-100 Issue 11.

All tests were conducted is accordance with ANSI C63.4-2014 and ANSI C63.17-2013.

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

PUE   Equipment Code   ☐ Family Listing

2.2 Test Summary

Name of test	FCC CFR 47 Paragraph #	IC RSS-213 Paragraph #	Verdict
Power Line Conducted Emission	15.107(a) 15.207(a)	5.4 RSS-GEN 8.8	Complies
Digital Modulation Techniques	15.319(b)	5.1	Complies
Labeling requirements	15.19(a)(3)	RSP-100 3.1	Complies
Antenna Requirement	15.317, 15.203	RSS-GEN 8.3	Complies
Channel Frequencies	15.303	5.1	Complies
Automatic discontinuation of transmission	15.319(f)	5.2 (4)	Complies
Emission Bandwidth	15.323(a)	5.5 RSS-GEN 6.6	Complies
In-band emissions	15.323(d)	5.8.2	Complies
Out-of-band emissions	15.323(d)	5.8.1	Complies
Peak Transmit Power and Antenna Gain	15.319(c)(e), 15.31(e)	5.6 RSS-GEN 8.3	Complies
Power Spectral Density	15.319(d)	5.7	Complies
Carrier frequency stability	15.323(f)	5.3	Complies
Frame repetition stability	15.323(e)	5.2 (13)	Complies
Frame period and jitter	15.323(e)	5.2 (13)	Complies
Monitoring threshold, Least interfered channel	15.323(c)(2)(5)(9)	5.2 (2)(5)(9)	Complies
Monitoring of intended transmit window and maximum reaction time	15.323(c)(1)	5.2 (1)	Complies
Threshold monitoring bandwidth	15.323(c)(7)	5.2 (7)	Complies
Reaction time and monitoring interval	15.323(c)(1)(5)(7)	5.2 (1)(5)(7)	Complies
Access criteria test interval	15.323(c)(4)(6)	5.2 (4)(6)	N/A[1]
Access Criteria functional test	15.323(c)(4)(6)	5.2 (4)(6)	N/A[1]
Acknowledgements	15.323(c)(4)	5.2 (4)	Complies
Transmission duration	15.323(c)(3)	5.2 (3)	Complies
Dual access criteria	15.323(c)(10)	5.2 (10)	Complies
Alterative monitoring interval	15.323(c)(11)(12)	5.2 (11)(12)	N/A[2]
Spurious Emissions (Radiated)	15.319(g) 15.109(a), 15.209(a)	RSS-GEN 8.9	N/A[3]

[1] Only applies for equipment that transmits unacknowledged control and signaling information

[2] The client declares that the tested equipment does not implement this provision

[3] Not required if the Conducted Out-of-Band Emissions test is Passed

3 TEST RESULTS

3.1 Power Line Conducted Emissions

FCC Part 15.207(a)

RSS-213 Clause 6.3, RSS-GEN Clause 8.8

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

Test Results: **Complies**

Measurement Data: **See attached plots**

Frequency (MHz)	Line	Detector	Measured value (dBμV)	Limit (dBμV)	Margin (dB)
12.306250	N	QP	42.44	60	17.56
12.592000	L1	QP	42.44	60	17.56
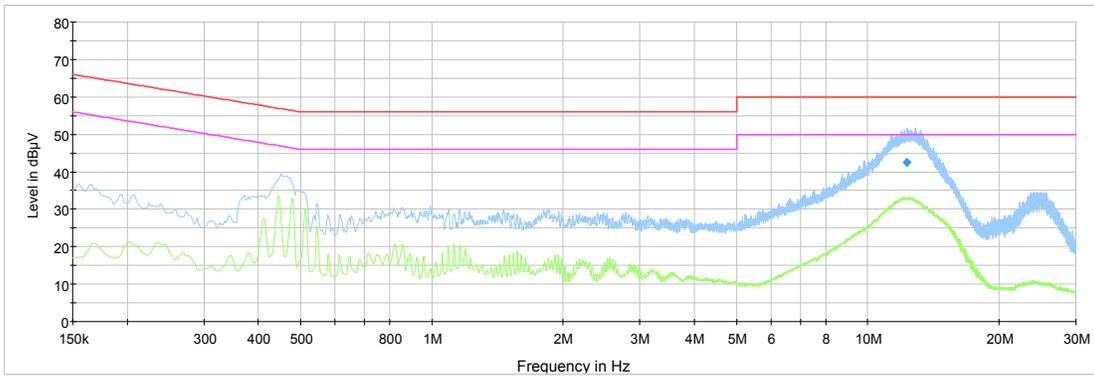
Jabra CE 120 Vac 60 Hz charging Neutral MN WHB051BS SN 030ABC8FE8

———— Preview Result 2-AVG
———— Preview Result 1-PK+
———— CISPR 32 Mains Q-Peak Class B Limit
———— CISPR 32 Mains Average Class B Limit
◆ Final_Result QPK
◆ Final_Result CAV

Headset Charging, 120V 60Hz, Phase Neutral
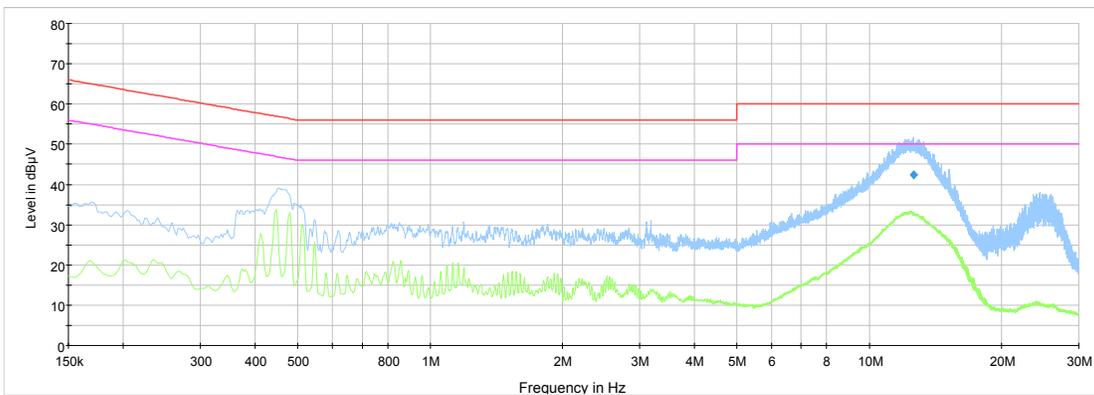
Jabra CE 120 Vac 60 Hz charging Phase MN WHB051BS SN 030ABC8FE8

———— Preview Result 2-AVG
———— Preview Result 1-PK+
———— CISPR 32 Mains Q-Peak Class B Limit
———— CISPR 32 Mains Average Class B Limit
◆ Final_Result QPK
◆ Final_Result CAV

Headset Charging, 120V 60Hz, Phase L1

3.2 Automatic Discontinuation of Transmission

Does the EUT transmit Control and Signaling Information?	☐ YES	☒ NO

TYPE OF EUT :	☒ INITIATING DEVICE	☐ RESPONDING DEVICE

The following tests simulate the reaction of the EUT in case of either absence of information to transmit or operational failure after a connection with the companion device is established.

Number	Test	EUT Reaction	Verdict
1	Power removed from EUT	C	Pass
2	Switch Off EUT	C	Pass
3	Hook-On by EUT	C	Pass
4	Power Removed from Companion Device	A	Pass
5	Switch Off Companion Device	N/A	Pass
6	Hook-On by Companion Device	N/A	Pass

A - Connection breakdown, Cease of all transmissions
B - Connection breakdown, EUT transmits control and signaling information
C - Connection breakdown, Companion Device transmits control and signaling information
N/A - Not Applicable (Companion Device does not have On/Off switch and cannot perform Hook-On)

Requirements, FCC 15.319(f)

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude transmission of control and signaling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.

3.3 Peak Power Output

Test Method:

ANSI C63.17, clause 6.1.2.

Test Results: Complies

Measurement Data:

Maximum Conducted Output Power

Channel No.	Frequency (MHz)	Maximum Conducted Output Power* (dBm)				Maximum Antenna Gain** (dBi)	Maximum Radiated Output Power (dBm)
		GFSK	π/2-DBPSK	π/4-DQPSK	π/8-D8PSK		
4	1921.536	17.7	17.4	17.2	16.9	1.0	18.7
2	1924.992	17.7	17.3	17.1	16.9	1.0	18.7
0	1928.448	17.6	17.3	17.0	16.8	1.0	18.6

*Output Power value is Peak Power of DECT Burst

**Antenna Gain is value declared by manufacturer

Limit:

Conducted: 100 µW x SQRT(B) where B is the measured Emission Bandwidth in Hz

FCC 15.319(c)(e) and RSS-213, Issue 3:

GFSK-Modulation: 20.7 dBm (118 mW)
PSK-Modulation: 21.1 dBm (130 mW)

The antenna gain is below 3 dBi, no reduction in transmit power is necessary.

Requirements, FCC 15.319(c)(e); RSS-213, Issue 3; RSS-GEN, Issue 4

Peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in Hertz.

The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.

MARKER 1		RBW 3 MHz	Marker 1 [T1]
386.5 µs		VBW 10 MHz	17.73 dBm
Ref 30 dBm	*Att 30 dB	SWT 500 µs	386.500000 µs

```
30 Offset 10.5 dB                        POWER [T1]
                                         PEAK      17.73 dBm
-20                                                            A

1 PK *
MAXH                                                          TRG
-10                                                          LVL

 0

-10    TRG -10.1 dBm

-20

-30

-40

-50

-60

-70
Center 1.921536 GHz              50 µs/
```
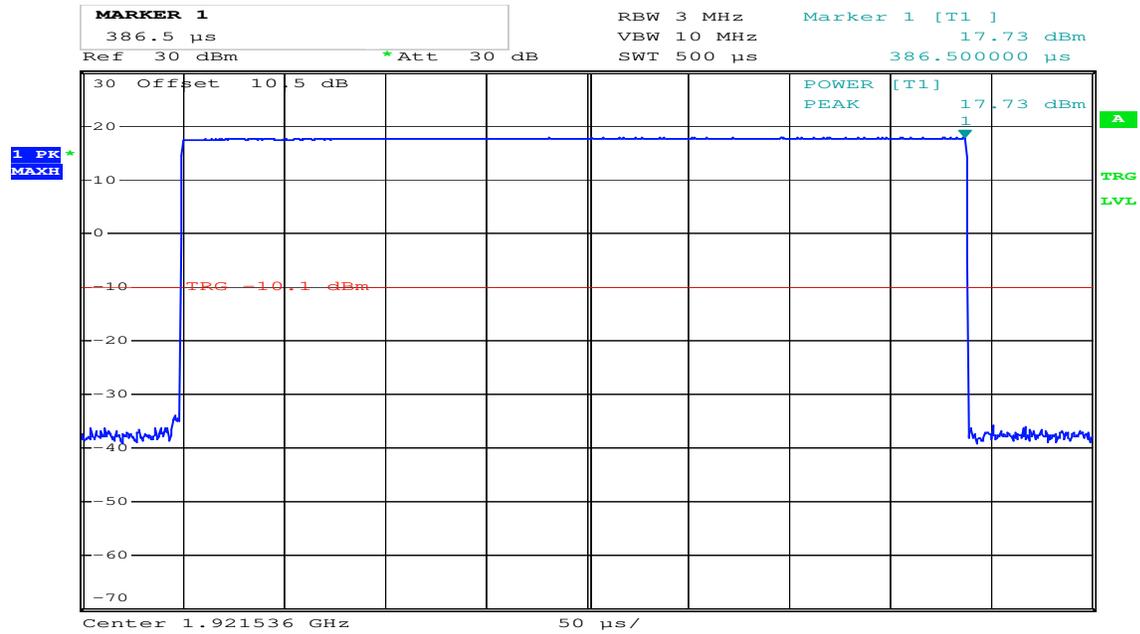
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Conducted Peak Output Power, Lower Channel, GFSK

MARKER 1		RBW 3 MHz	Marker 1 [T1]
208 µs		VBW 10 MHz	17.40 dBm
Ref 30 dBm	*Att 30 dB	SWT 500 µs	208.000000 µs

```
30 Offset 10.5 dB                        POWER [T1]
                                         PEAK      17.40 dBm
-20                                                            A

1 PK *
MAXH                                                          TRG
-10                                                          LVL

 0

-10    TRG -10.1 dBm

-20

-30

-40

-50

-60

-70
Center 1.921536 GHz              50 µs/
```
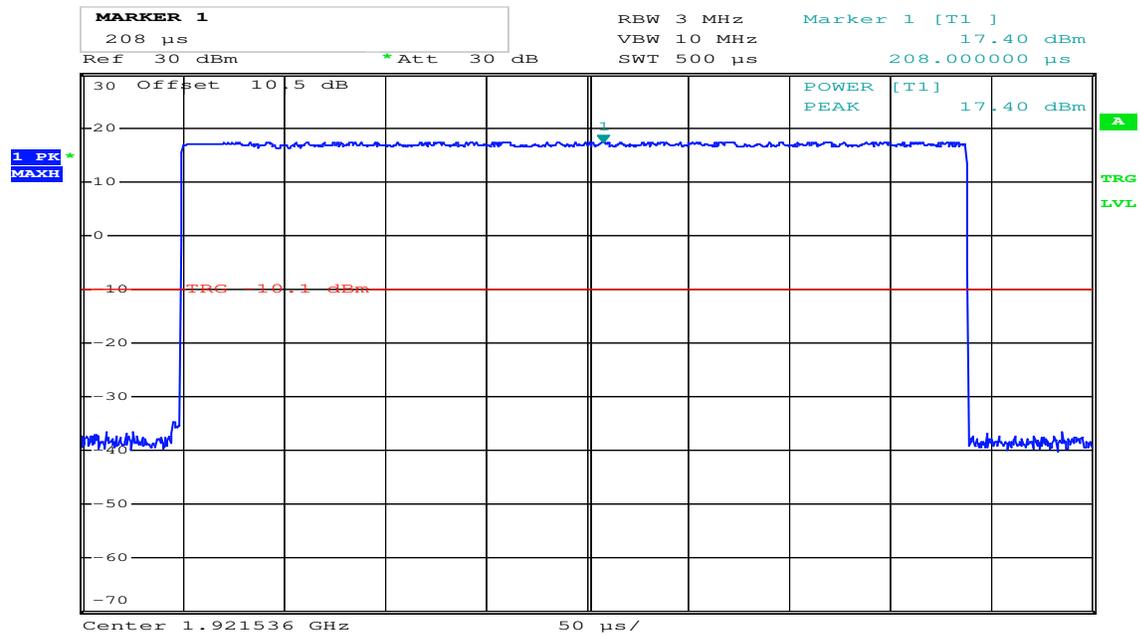
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Conducted Peak Output Power, Lower Channel, π/2-DBPSK

MARKER 1			RBW 3 MHz	Marker 1 [T1]	
318.5 µs			VBW 10 MHz		17.15 dBm
Ref 30 dBm		*Att 30 dB	SWT 500 µs	318.500000 µs	

30 Offset 10.5 dB

POWER [T1]
PEAK 17.15 dBm

1 PK *
MAXH

TRG -10.1 dBm

Center 1.921536 GHz   50 µs/
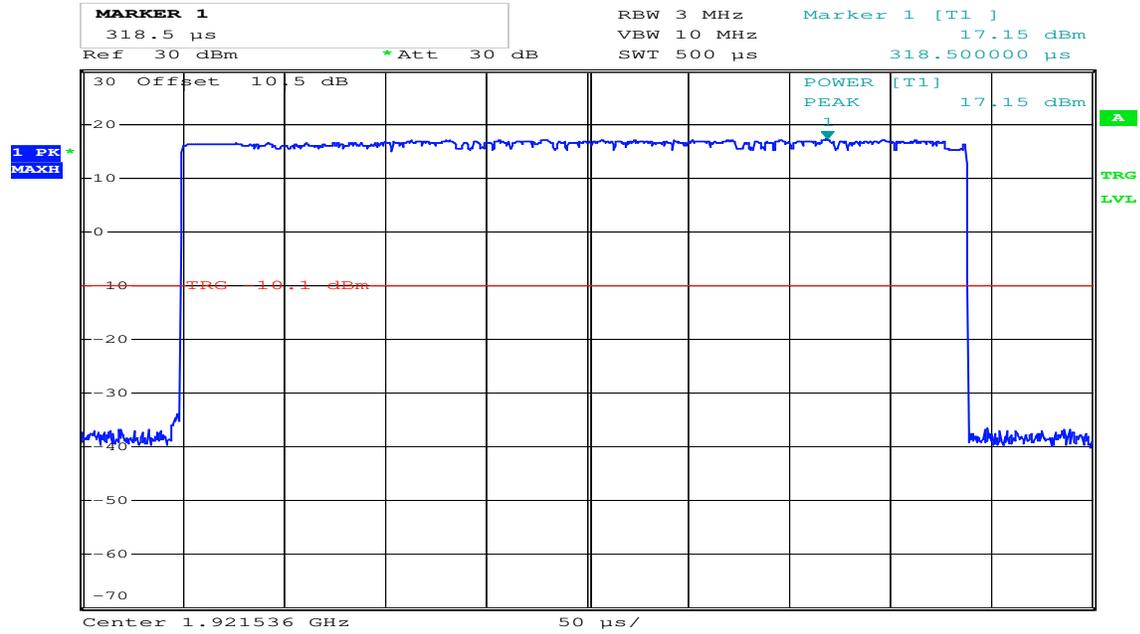
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Conducted Peak Output Power, Lower Channel, π/4-DQPSK

MARKER 1			RBW 3 MHz	Marker 1 [T1]	
243.5 µs			VBW 10 MHz		16.94 dBm
Ref 30 dBm		*Att 30 dB	SWT 500 µs	243.500000 µs	

30 Offset 10.5 dB

POWER [T1]
PEAK 16.94 dBm

1 PK *
MAXH

TRG -10.1 dBm

Center 1.921536 GHz   50 µs/
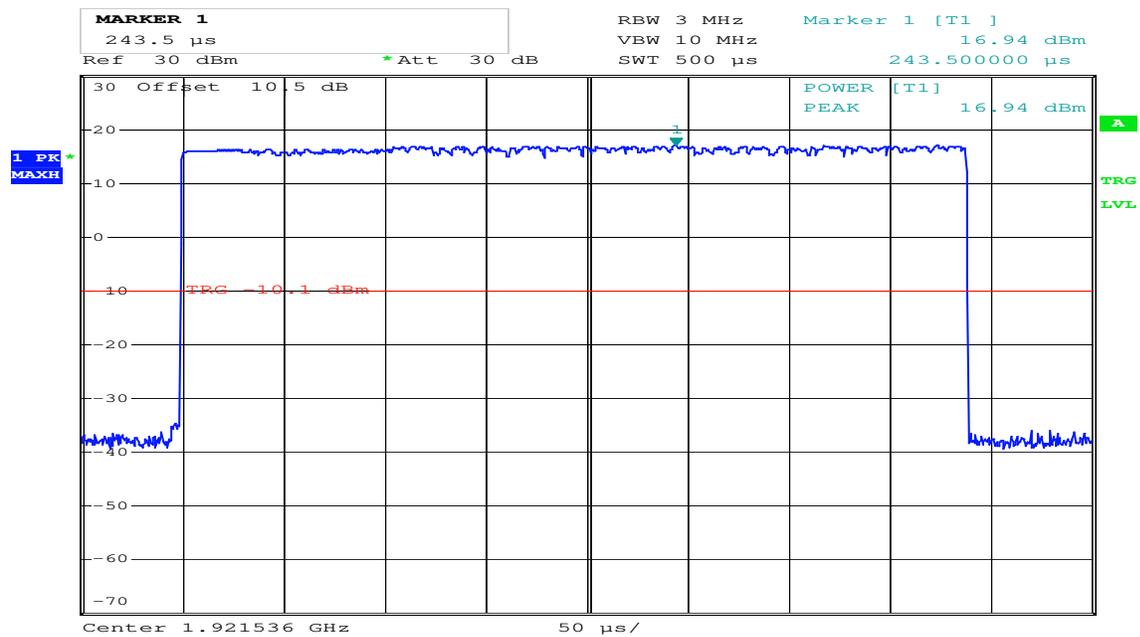
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Conducted Peak Output Power, Lower Channel, π/8-D8PSK

MARKER 1				RBW 3 MHz	Marker 1 [T1]	
376.5 µs				VBW 10 MHz		17.67 dBm
Ref 30 dBm		*Att 30 dB		SWT 500 µs	376.500000 µs	

```
30 Offset  10.5 dB                    POWER [T1]
                                      PEAK        17.67 dBm    A
-20
1 PK *
MAXH
-10                                                           TRG
                                                              LVL
0

-10 ────────── TRG -10.1 dBm ──────────────────────────────

-20

-30

-40

-50

-60

-70
Center 1.924992 GHz              50 µs/
```
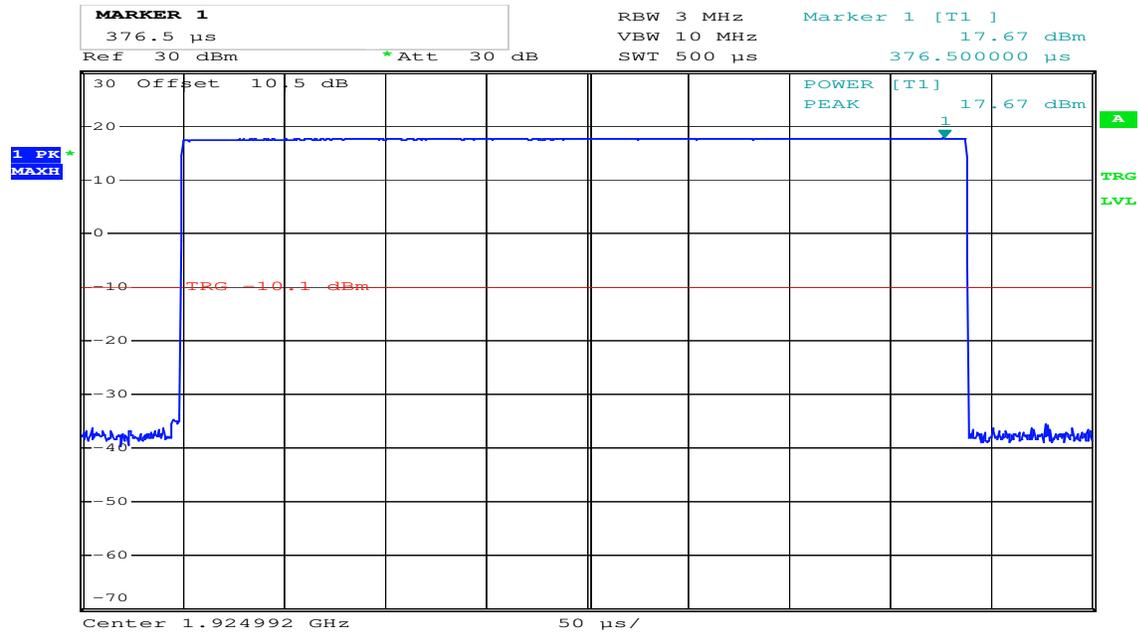
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Conducted Peak Output Power, Middle Channel, GFSK

MARKER 1				RBW 3 MHz	Marker 1 [T1]	
237 µs				VBW 10 MHz		17.33 dBm
Ref 30 dBm		*Att 30 dB		SWT 500 µs	237.000000 µs	

```
30 Offset  10.5 dB                    POWER [T1]
                                      PEAK        17.33 dBm    A
-20                                1
1 PK *
MAXH
-10                                                           TRG
                                                              LVL
0

-10 ────────── TRG -10.1 dBm ──────────────────────────────

-20

-30

-40

-50

-60

-70
Center 1.924992 GHz              50 µs/
```
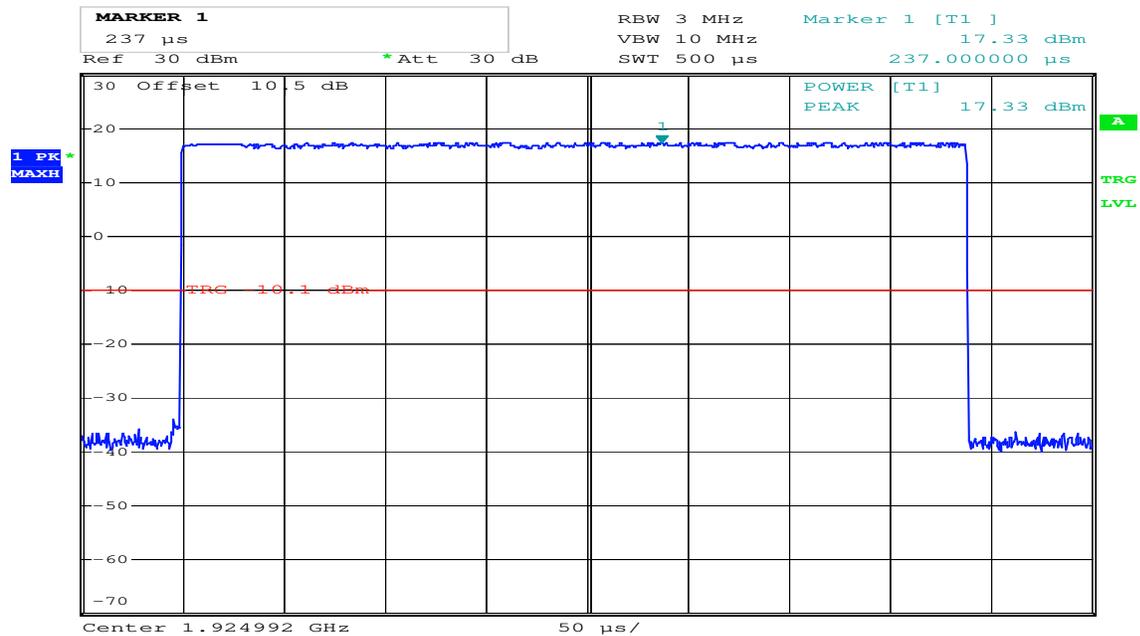
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Conducted Peak Output Power, Middle Channel, π/2-DBPSK

MARKER 1		RBW 3 MHz	Marker 1 [T1]
296 µs		VBW 10 MHz	17.06 dBm
Ref 30 dBm	*Att 30 dB	SWT 500 µs	296.000000 µs

30 Offset 10.5 dB

POWER [T1]
PEAK 17.06 dBm

A

1 PK *
MAXH

TRG
LVL

TRG -10.1 dBm

Center 1.924992 GHz   50 µs/
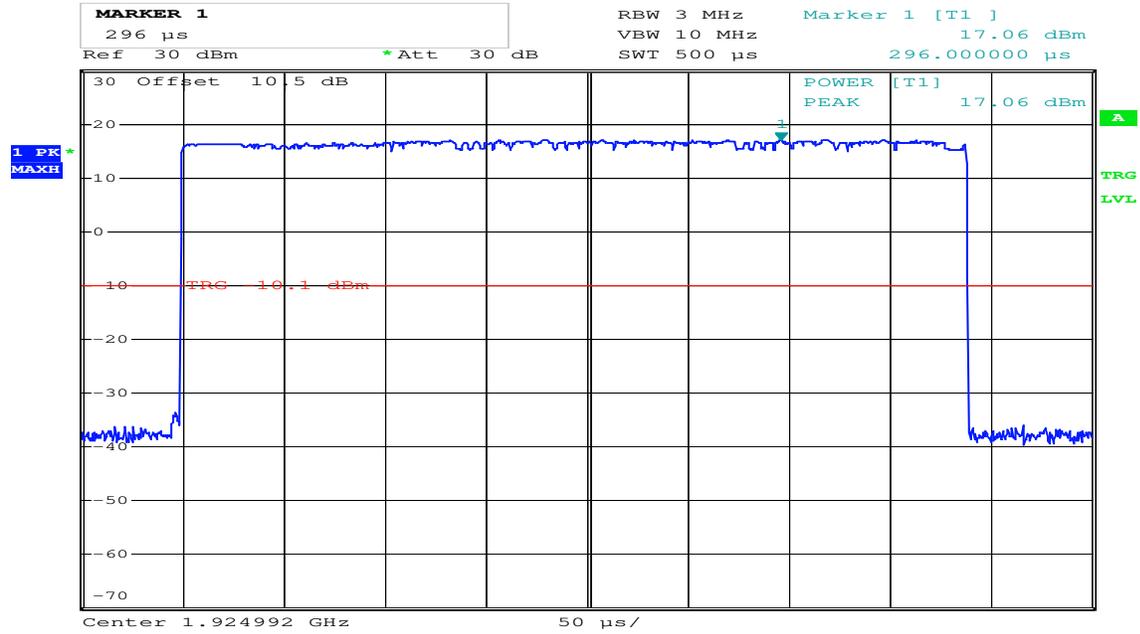
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Conducted Peak Output Power, Middle Channel, π/4-DQPSK

MARKER 1		RBW 3 MHz	Marker 1 [T1]
243 µs		VBW 10 MHz	16.88 dBm
Ref 30 dBm	*Att 30 dB	SWT 500 µs	243.000000 µs

30 Offset 10.5 dB

POWER [T1]
PEAK 16.88 dBm

A

1 PK *
MAXH

TRG
LVL

TRG -10.1 dBm

Center 1.924992 GHz   50 µs/
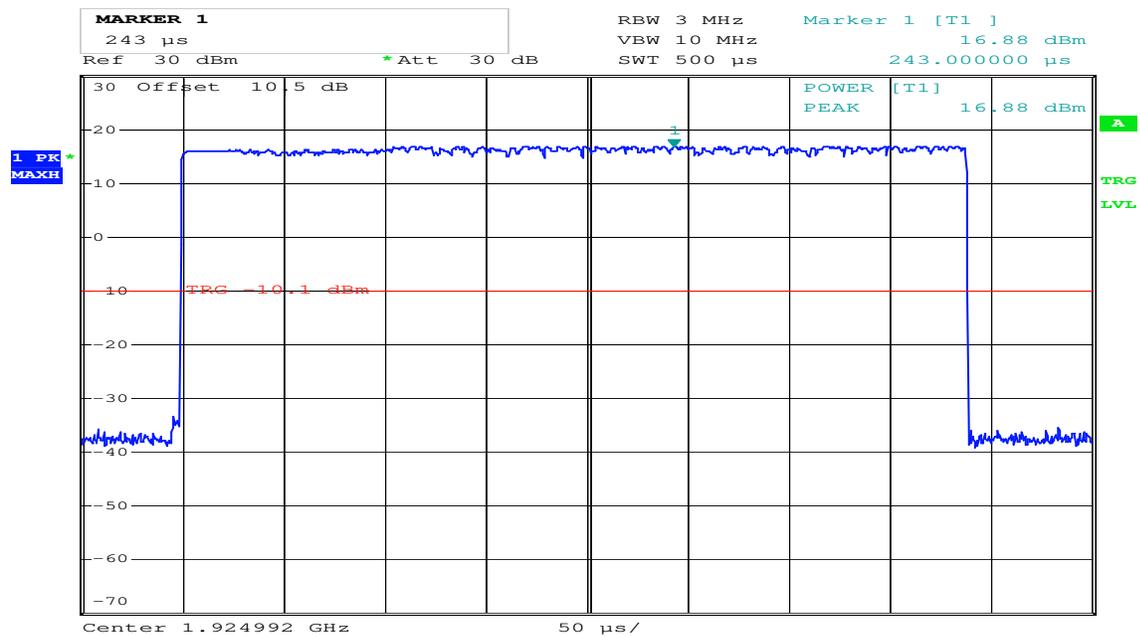
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Conducted Peak Output Power, Middle Channel, π/8-D8PSK
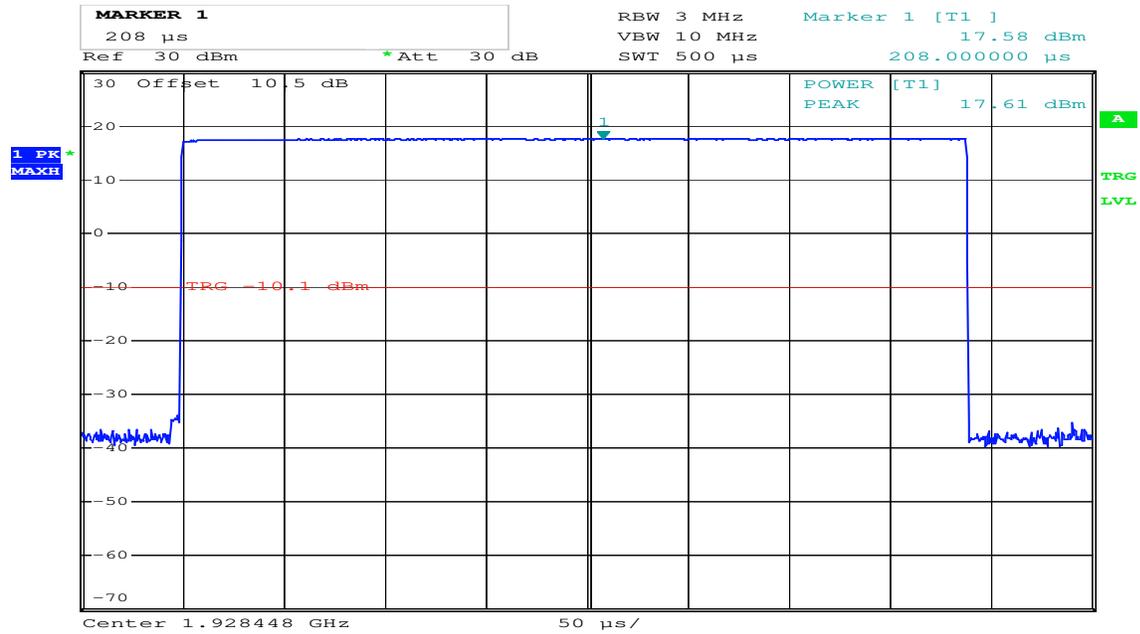
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Conducted Peak Output Power, Upper Channel, GFSK
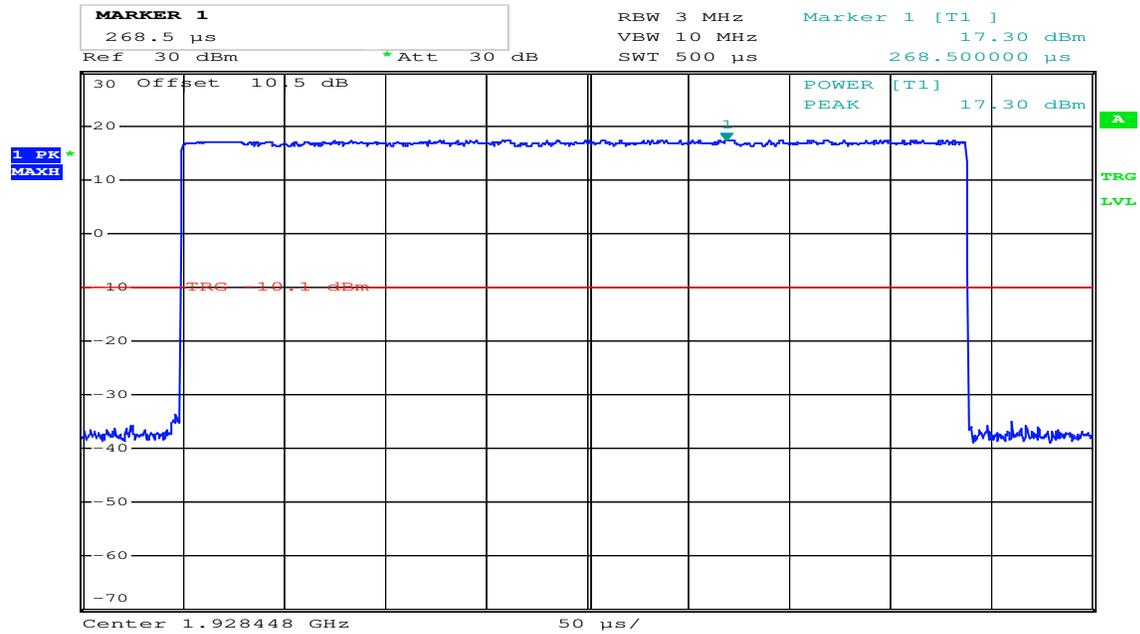

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Conducted Peak Output Power, Upper Channel, π/2-DBPSK
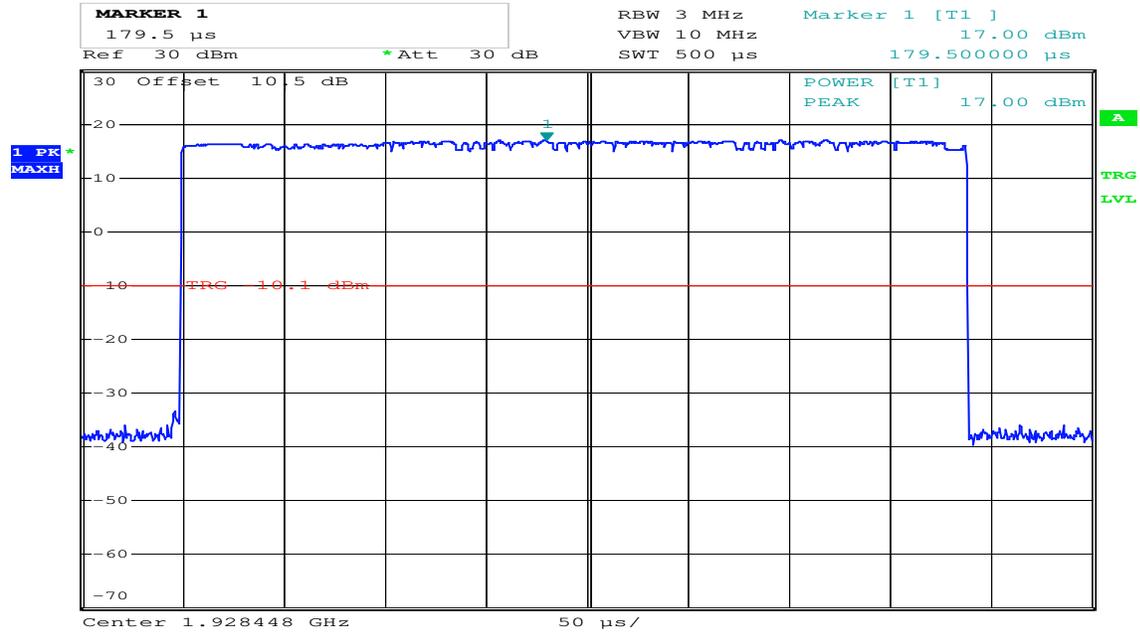
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Conducted Peak Output Power, Upper Channel, π/4-DQPSK
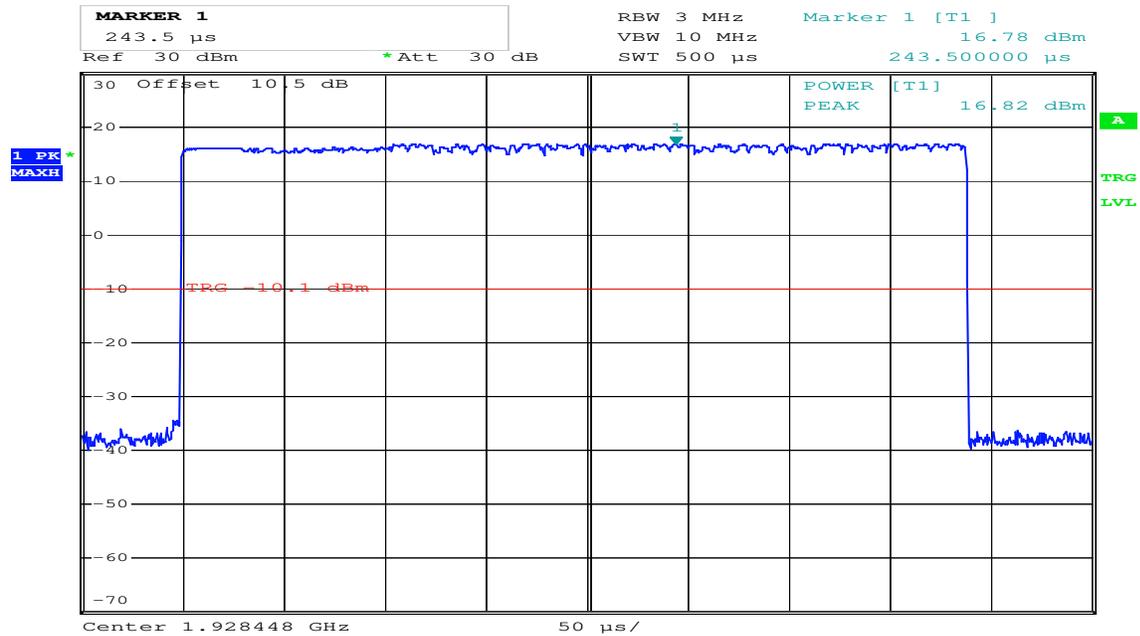
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Conducted Peak Output Power, Upper Channel, π/8-D8PSK

3.4 Emission Bandwidth *B*

Test Method:

ANSI C63.17, clause 6.1.3.

Test Results: Complies

Measurement Data:

Channel No.	Frequency (MHz)	Emission Bandwidth *B* (MHz)			
		GFSK	π/2-DBPSK	π/4-DQPSK	π/8-D8PSK
4	1921.536	1.42	1.70	1.71	1.71
0	1928.448	1.41	1.70	1.71	1.71

Channel No.	Frequency (MHz)	99% Occupied Bandwidth (MHz)			
		GFSK	π/2-DBPSK	π/4-DQPSK	π/8-D8PSK
2	1924.992	1.18	1.45	1.42	1.43

Requirements, FCC 15.323(a), RSS-213 Issue 3, clause 5.5

The Emission Bandwidth *B* shall be larger than 50 kHz and less than 2.5 MHz.

No requirements for 6 and 12 dB Bandwidth, these values are only used for testing Monitoring Bandwidth if the Simple Compliance test fails (ANSI C63.17, clause 7.4).

Occupied Bandwidth (99%) is measured according to RSS-GEN Issue 4, clause 6.6. This value is reported for information only.
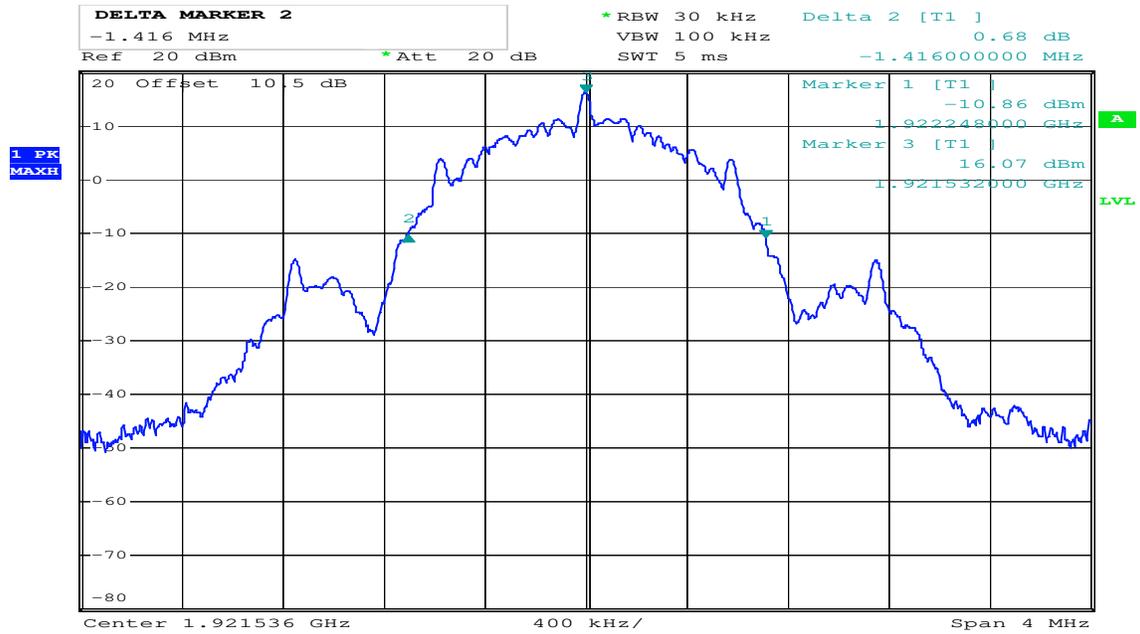
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Emission Bandwidth *B*, Lower Channel, GFSK
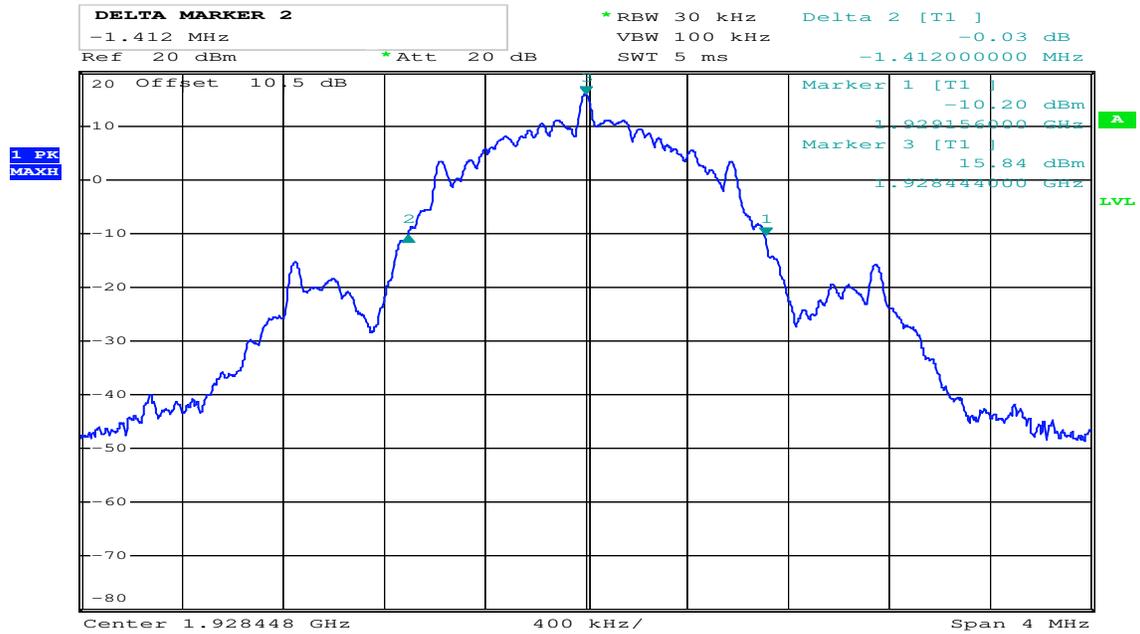

Date: 15.FEB.2018   10:16:25

Emission Bandwidth *B*, Upper Channel, GFSK

```
DELTA MARKER 2                        *RBW  30 kHz    Delta 2 [T1 ]
-1.704 MHz                             VBW 100 kHz              -0.46 dB
Ref   20 dBm           *Att   20 dB    SWT  5 ms       -1.704000000 MHz

20  Offset   10.5 dB                                  Marker 1 [T1 ]
                                                           -14.41 dBm
                                                         1.922392000 GHz
                                                      Marker 3 [T1 ]
                                                            11.85 dBm
                                                         1.921536000 GHz

Center 1.921536 GHz         400 kHz/                    Span 4 MHz
```
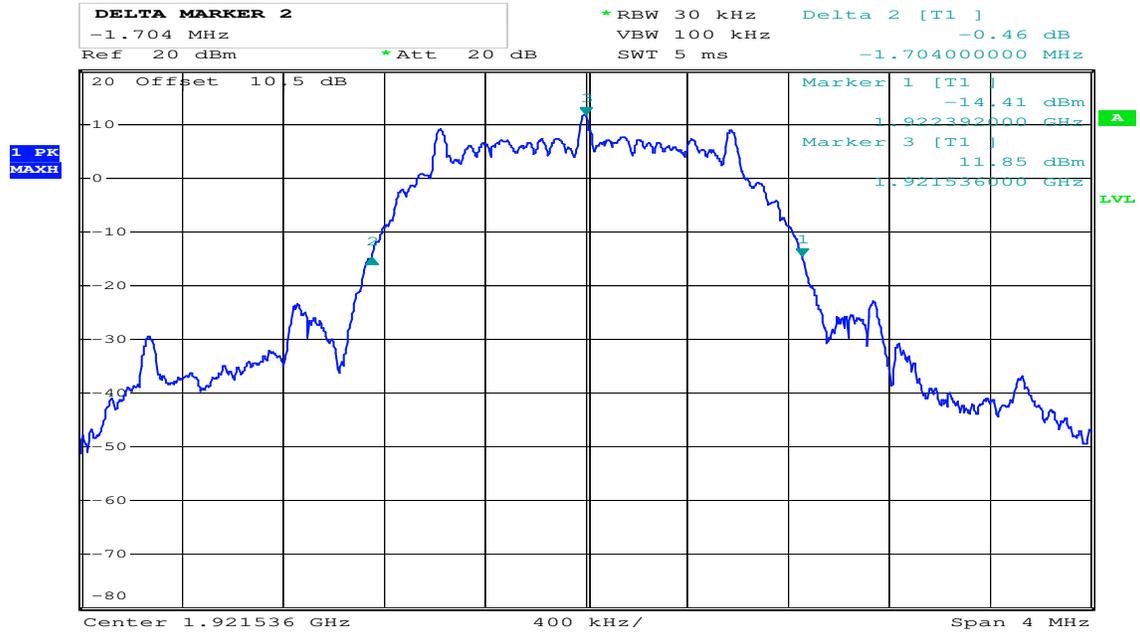
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Emission Bandwidth _B_, Lower Channel, π/2-DBPSK

```
DELTA MARKER 2                        *RBW  30 kHz    Delta 2 [T1 ]
-1.704 MHz                             VBW 100 kHz              -1.08 dB
Ref   20 dBm           *Att   20 dB    SWT  5 ms       -1.704000000 MHz

20  Offset   10.5 dB                                  Marker 1 [T1 ]
                                                           -14.55 dBm
                                                         1.929304000 GHz
                                                      Marker 3 [T1 ]
                                                            11.75 dBm
                                                         1.928448000 GHz

Center 1.928448 GHz         400 kHz/                    Span 4 MHz
```
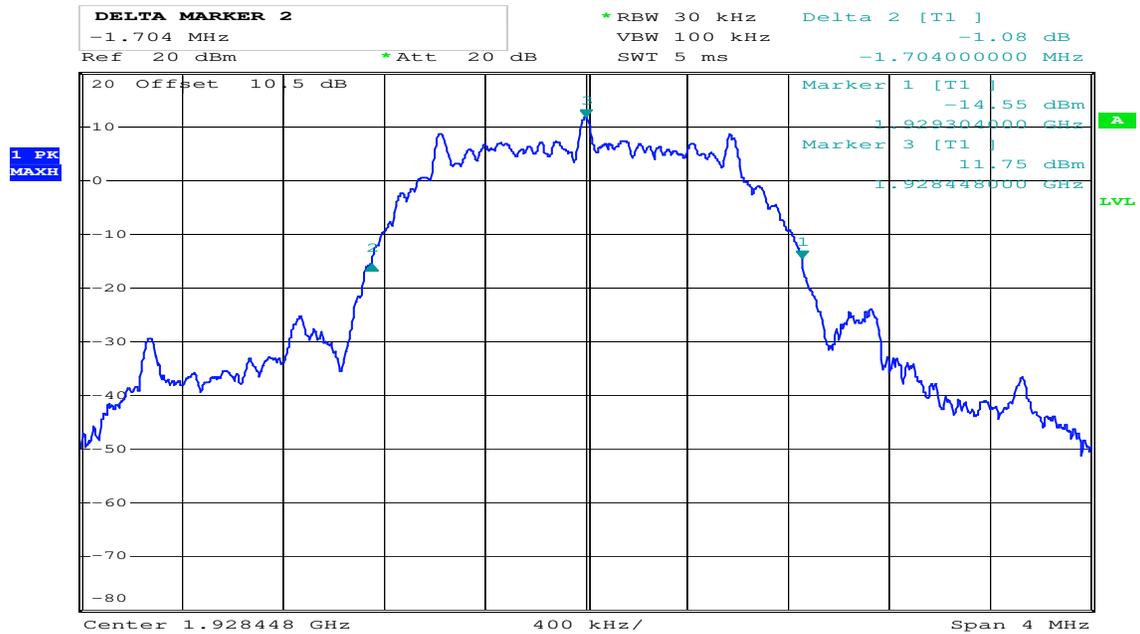
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Emission Bandwidth _B_, Upper Channel, π/2-DBPSK

DELTA MARKER 2			*RBW 30 kHz	Delta 2 [T1]	
−1.708 MHz			VBW 100 kHz		−0.65 dB
Ref 20 dBm		*Att 20 dB	SWT 5 ms		−1.708000000 MHz
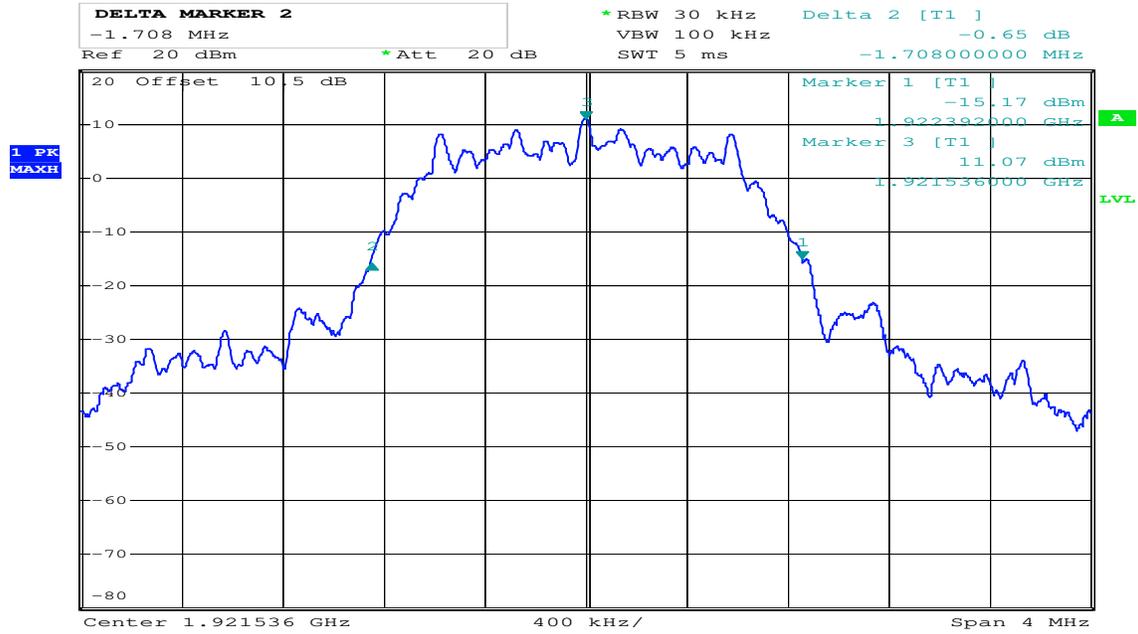
Date: 15.FEB.2018   09:55:53

**Emission Bandwidth *B*, Lower Channel, π/4-DQPSK**
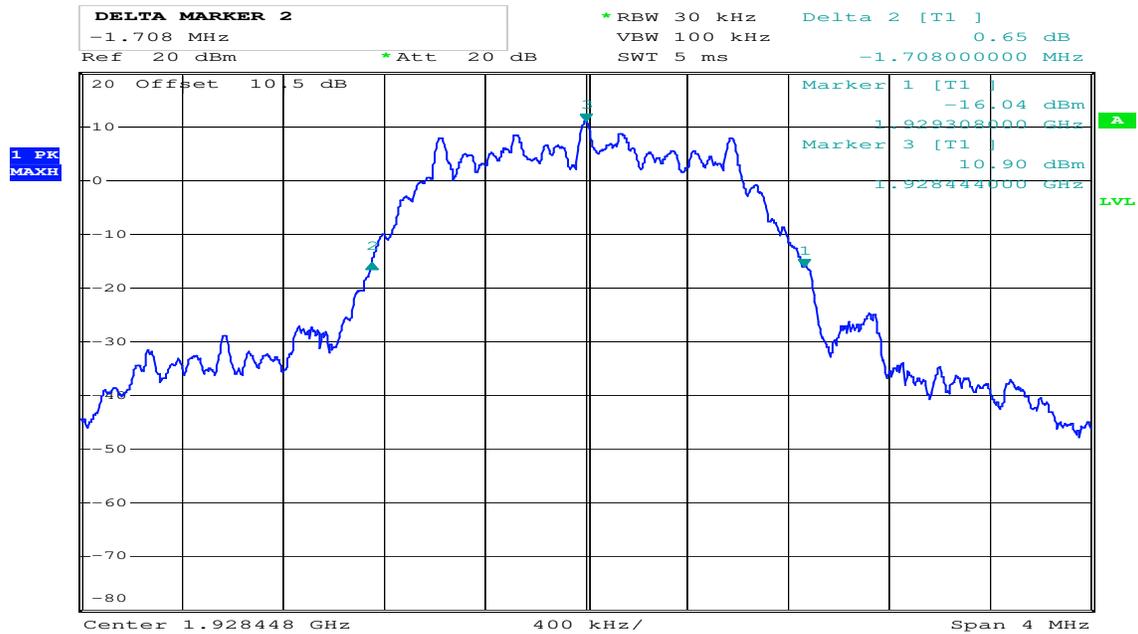
Date: 15.FEB.2018   10:02:33

**Emission Bandwidth *B*, Upper Channel, π/4-DQPSK**
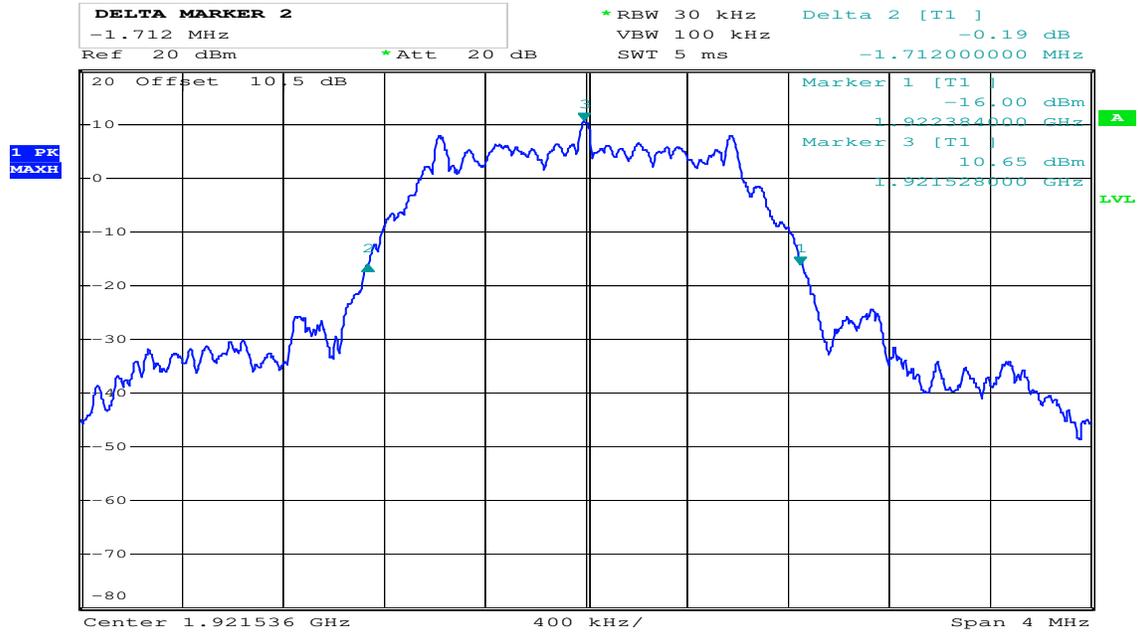
Date: 15.FEB.2018   09:57:55

**Emission Bandwidth *B*, Lower Channel, π/8-D8PSK**
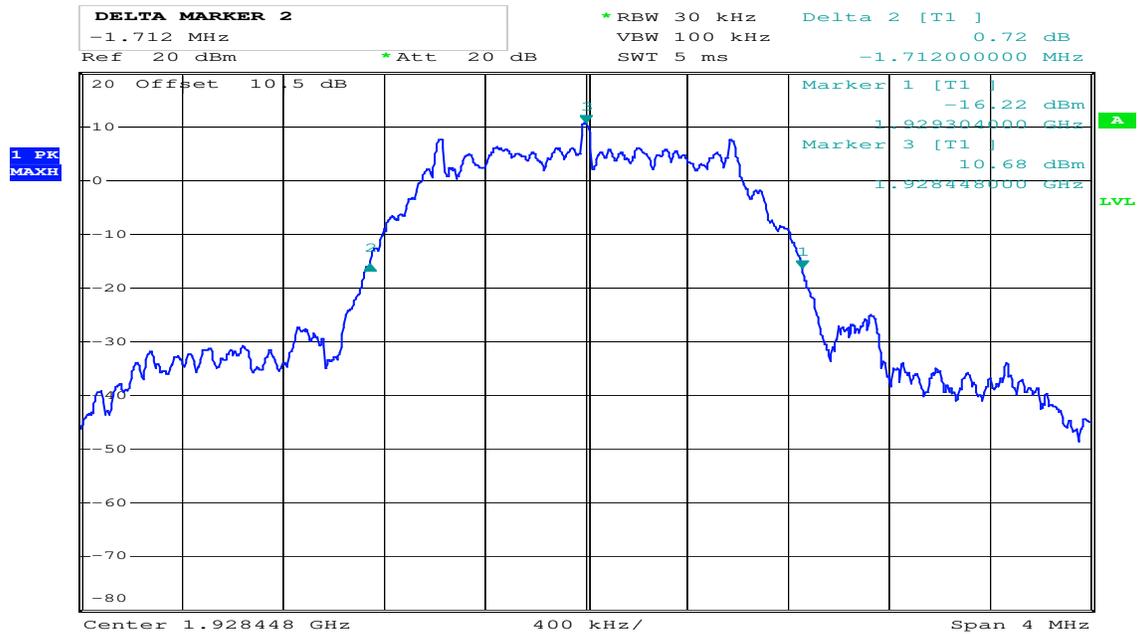
Date: 15.FEB.2018   09:59:46

**Emission Bandwidth *B*, Upper Channel, π/8-D8PSK**
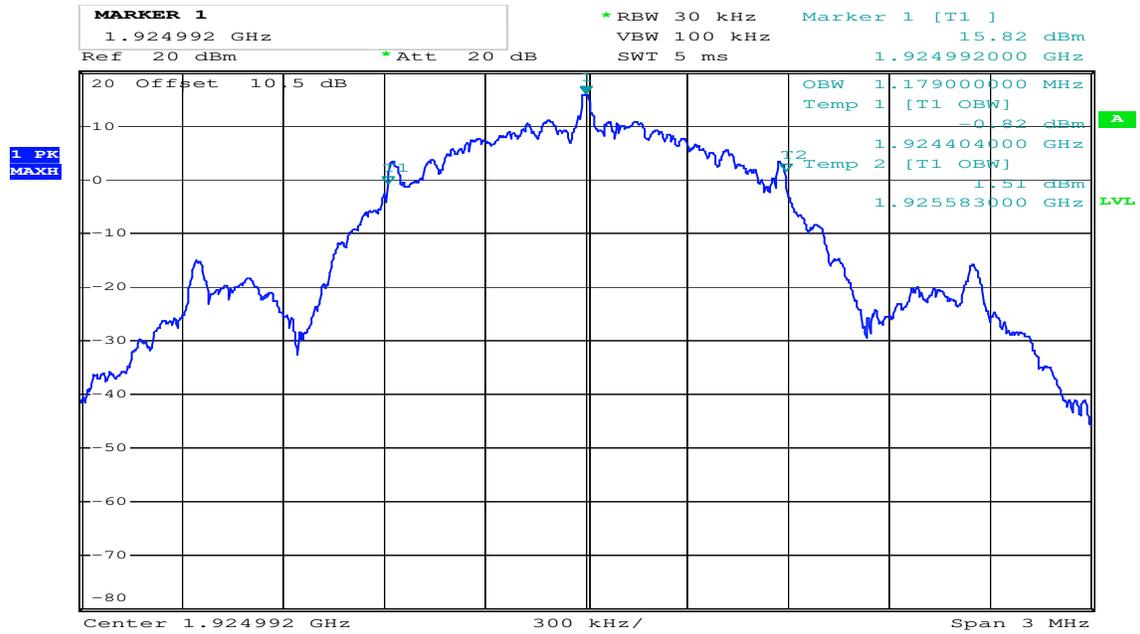
99% Bandwidth, Middle Channel, GFSK

99% Bandwidth, Middle Channel, π/2-DBPSK

```
MARKER 1                        * RBW  30 kHz     Marker 1 [T1 ]
  1.924988 GHz                    VBW 100 kHz               10.82 dBm
Ref   20 dBm       * Att   20 dB  SWT  5 ms         1.924988000 GHz
20  Offset   10.5 dB                               OBW  1.424000000 MHz
                                                   Temp 1 [T1 OBW]
10                                                          -3.18 dBm
                                                     1.924272000 GHz
0                                                  Temp 2 [T1 OBW]
                                                            -3.40 dBm
-10                                                  1.925696000 GHz
-20
-30
-40
-50
-60
-70
-80
Center 1.924992 GHz         400 kHz/              Span 4 MHz
```
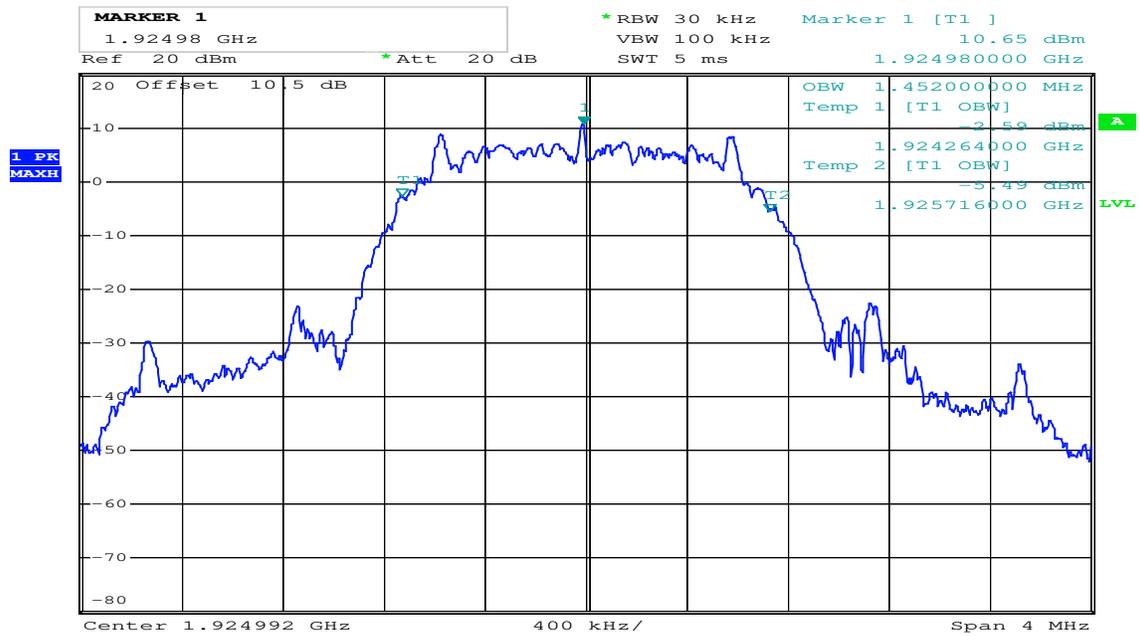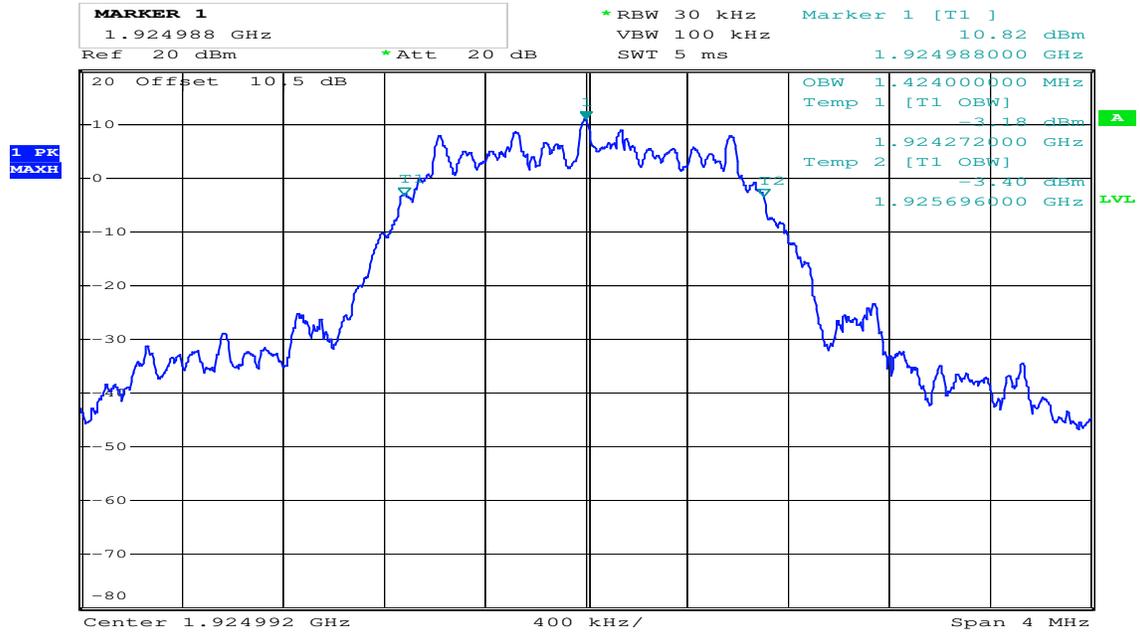
Date: 14.FEB.2018 16:24:30

99% Bandwidth, Middle Channel, π/4-D4PSK

```
MARKER 1                        * RBW  30 kHz     Marker 1 [T1 ]
  1.924988 GHz                    VBW 100 kHz               10.53 dBm
Ref   20 dBm       * Att   20 dB  SWT  5 ms         1.924988000 GHz
20  Offset   10.5 dB                               OBW  1.432000000 MHz
                                                   Temp 1 [T1 OBW]
10                                                          -6.67 dBm
                                                     1.924272000 GHz
0                                                  Temp 2 [T1 OBW]
                                                            -4.78 dBm
-10                                                  1.925704000 GHz
-20
-30
-40
-50
-60
-70
-80
Center 1.924992 GHz         400 kHz/              Span 4 MHz
```
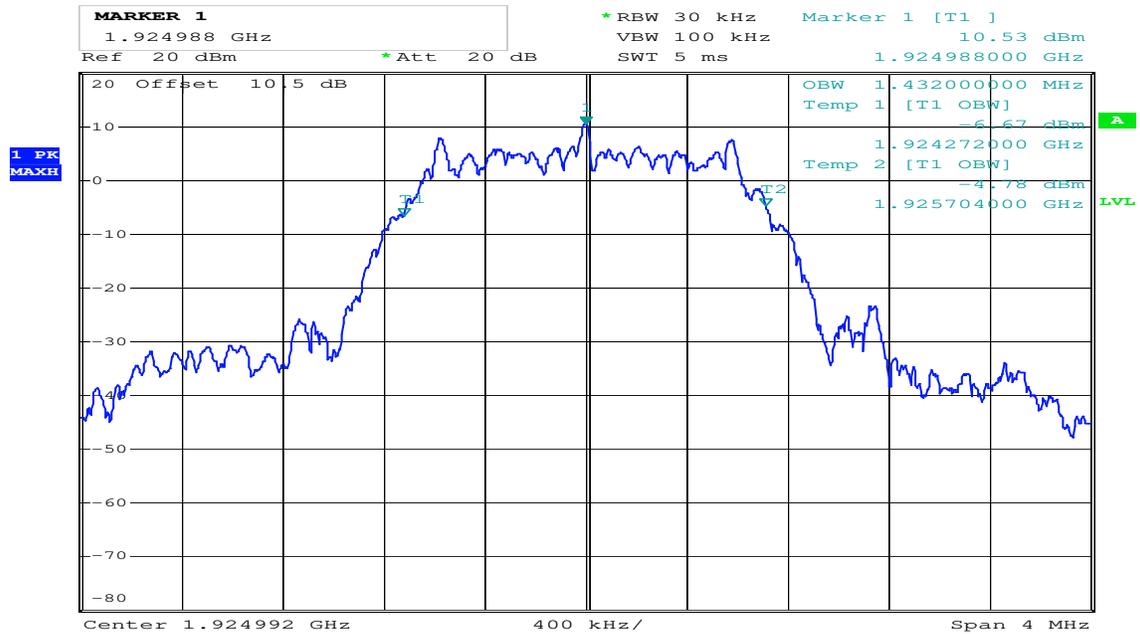
Date: 14.FEB.2018 16:25:44

99% Bandwidth, Middle Channel, π/8-D8PSK

3.5 Power Spectral Density

Test Method:

ANSI C63.17, clause 6.1.5.

Test Results: Complies

Measurement Data:

Channel No.	Frequency (MHz)	Power Spectral Density (dBm/3 kHz)			
		GFSK	**π/2-DBPSK**	**π/4-DQPSK**	**π/8-D8PSK**
4	1921.536	0.7	-3.4	-0.8	-2.9
0	1928.448	0.6	-2.9	-0.8	-3.0

Averaged over 1000 sweeps.

Requirements, FCC 15.319(d)

The Power Spectral Density shall be less than 3 mW (4.77 dBm/3 kHz) when averaged over at least 100 sweeps.
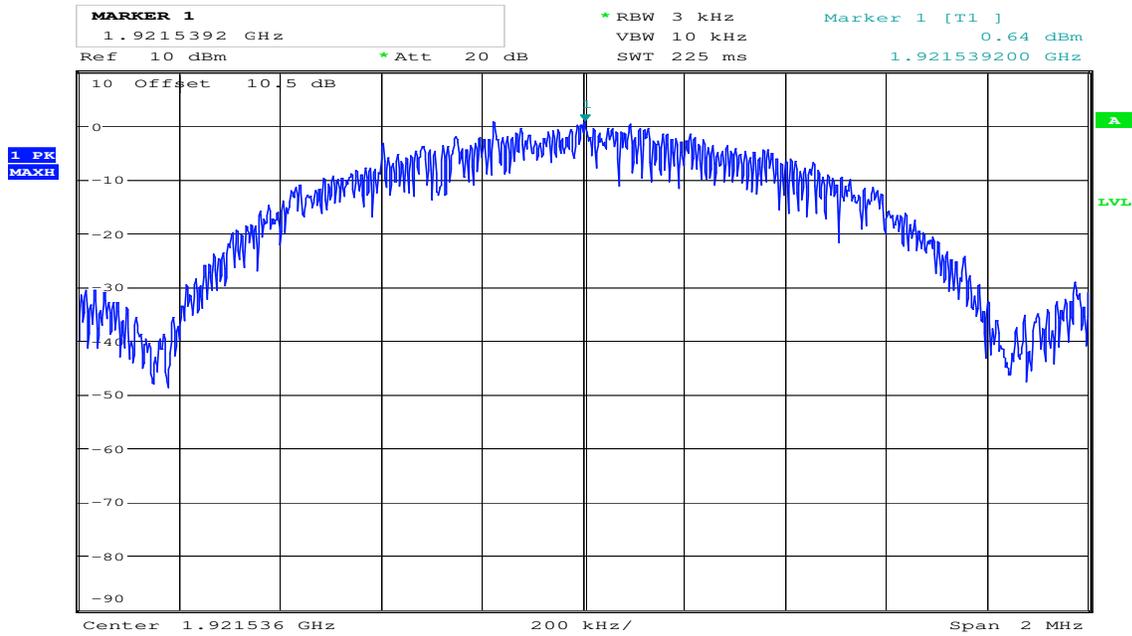
Date: 14.FEB.2018   16:23:36

PSD, Overview, Lower Channel, GFSK
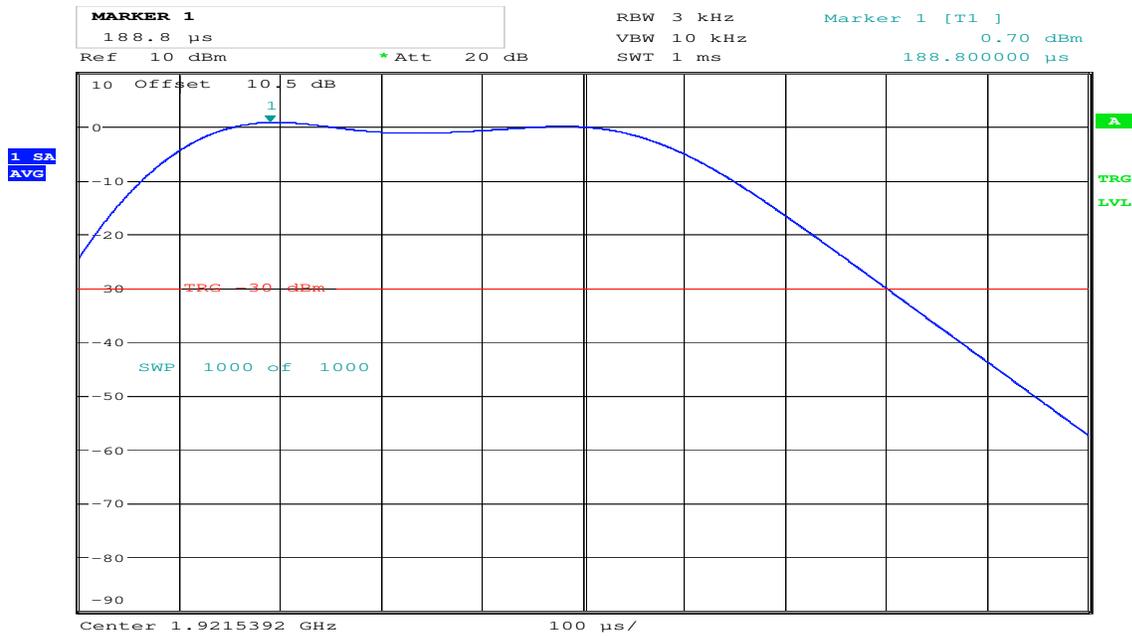
Date: 14.FEB.2018   16:25:26

PSD, Averaged, 1000 Sweeps, Lower Channel, GFSK
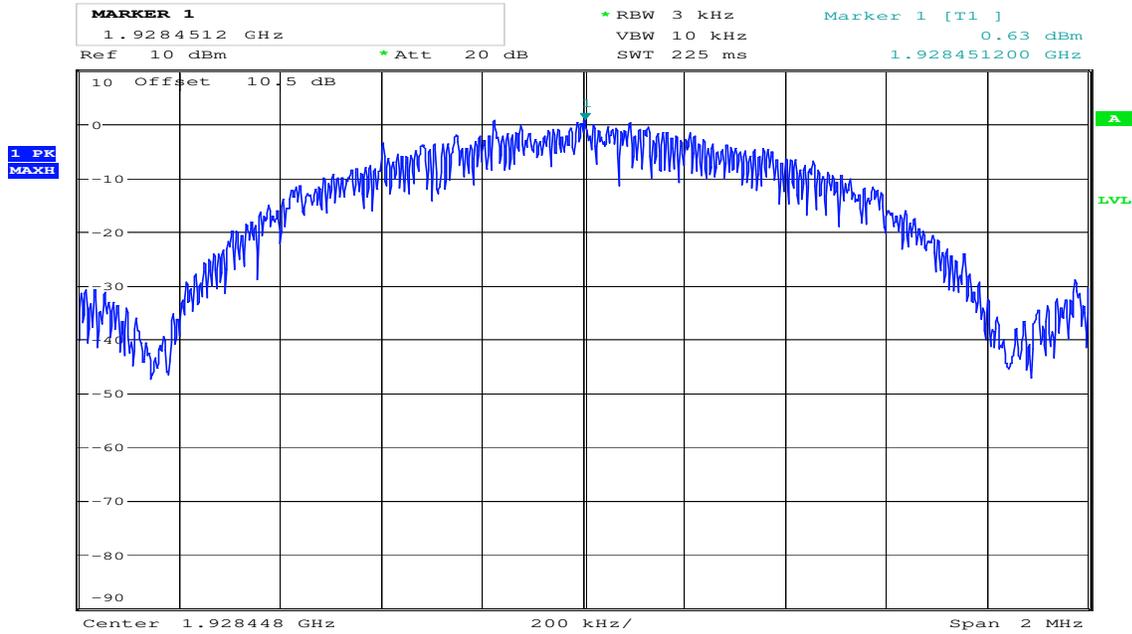
Date: 14.FEB.2018   15:50:19

PSD, Overview. Upper Channel, GFSK
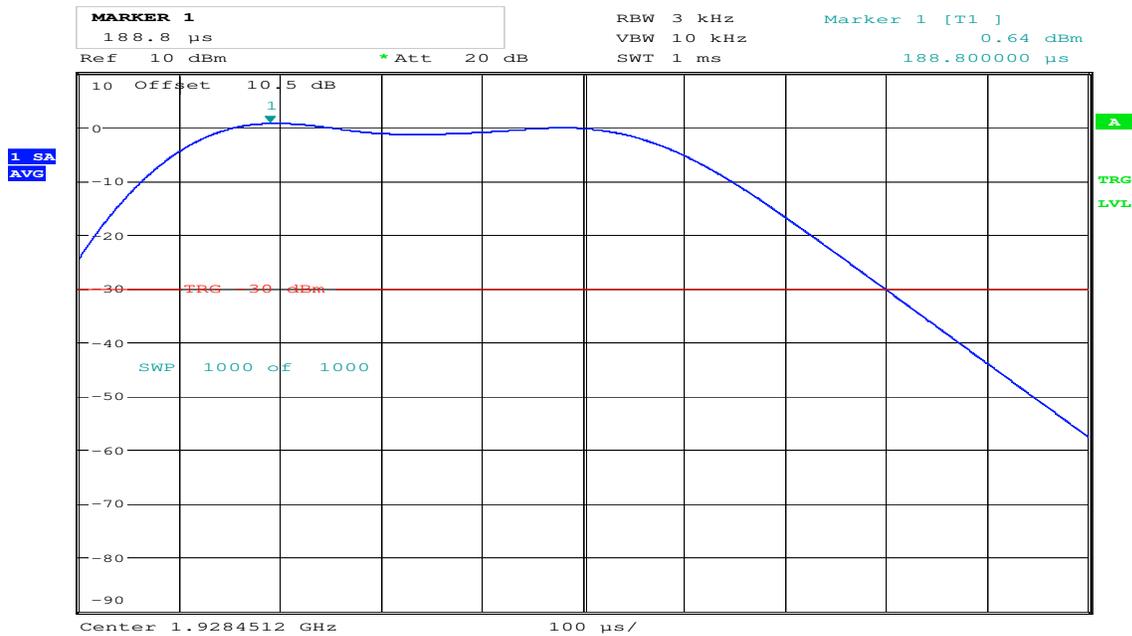

Date: 14.FEB.2018   15:54:54

**PSD, Averaged, 1000 Sweeps, Upper Channel, GFSK**
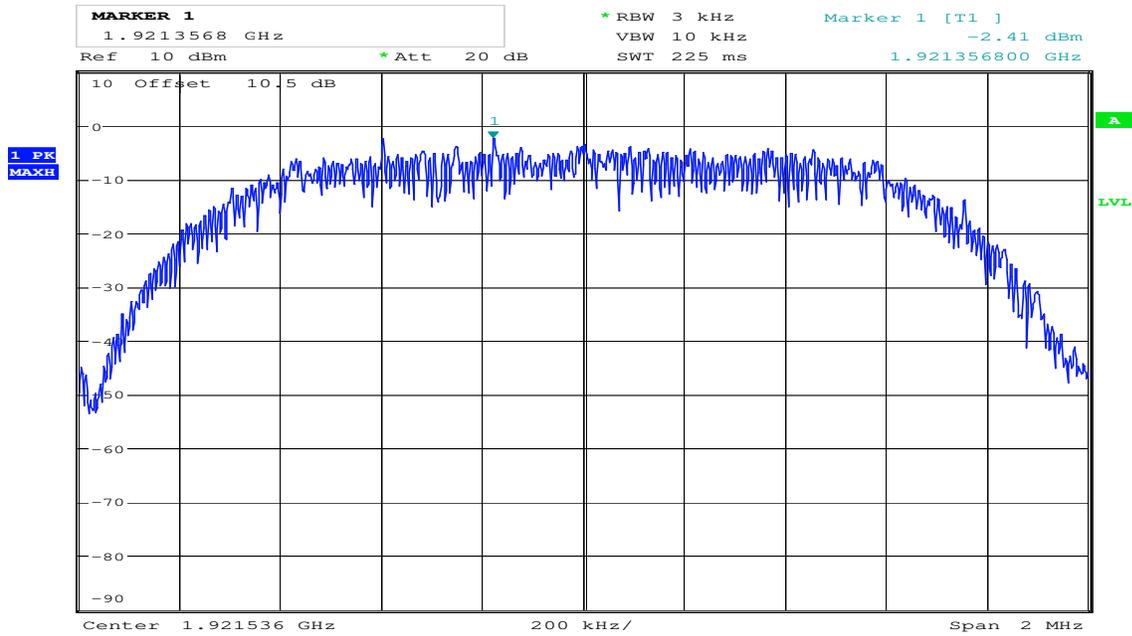
Date: 14.FEB.2018   16:18:37

PSD, Overview, Lower Channel, π/2-DBPSK
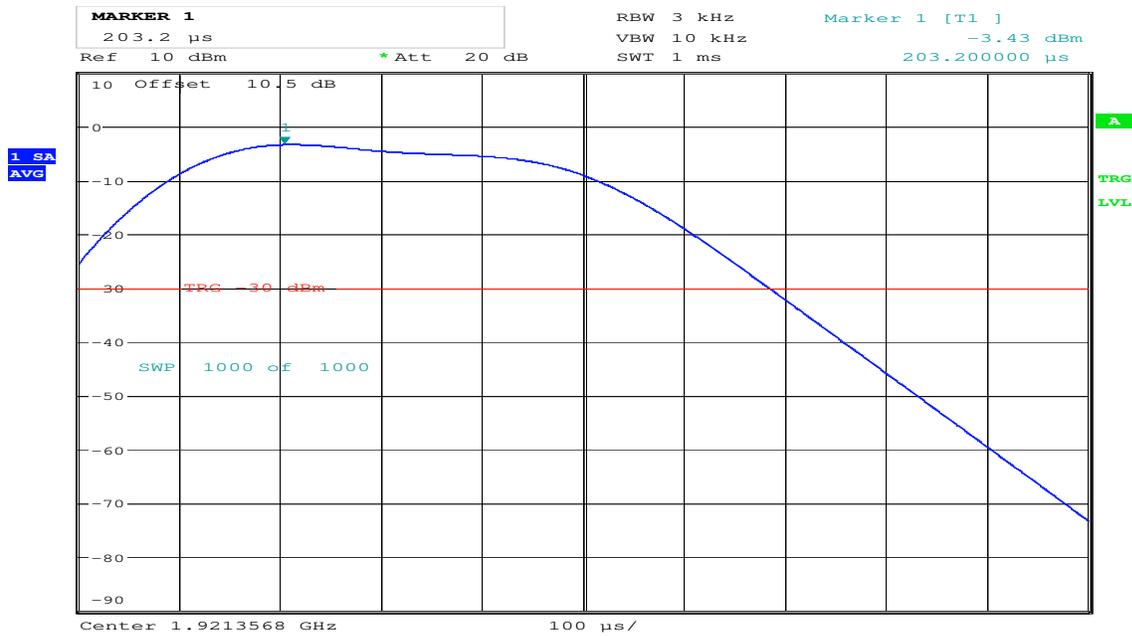
Date: 14.FEB.2018   16:19:55

PSD, Averaged, 1000 Sweeps, Lower Channel, π/2-DBPSK
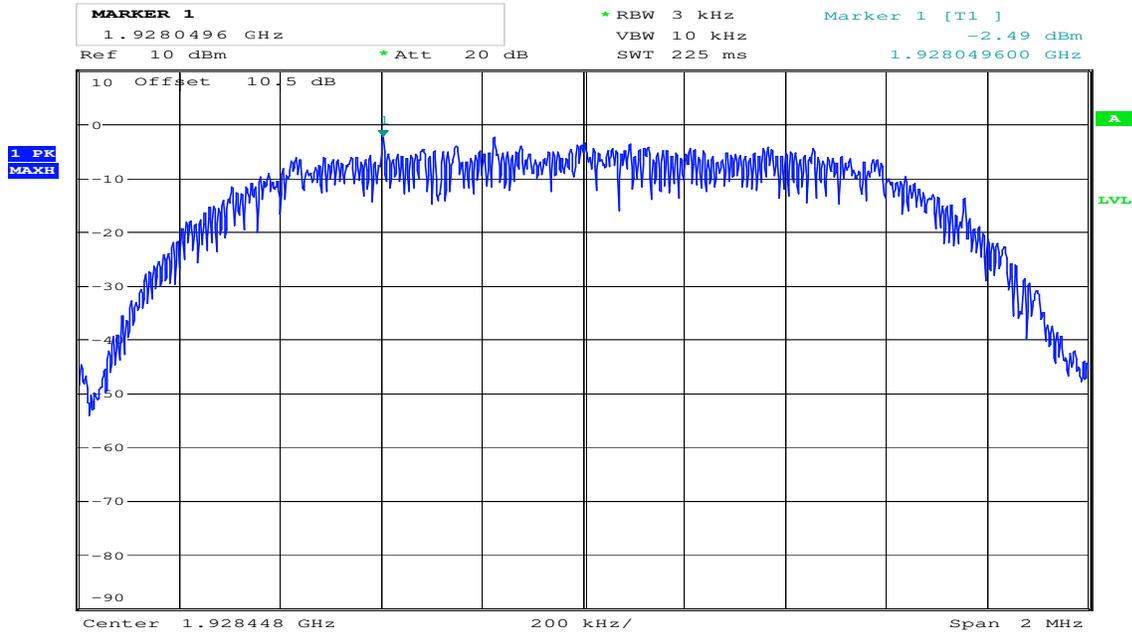
Date: 14.FEB.2018 15:43:10

PSD, Overview. Upper Channel, π/2-DBPSK
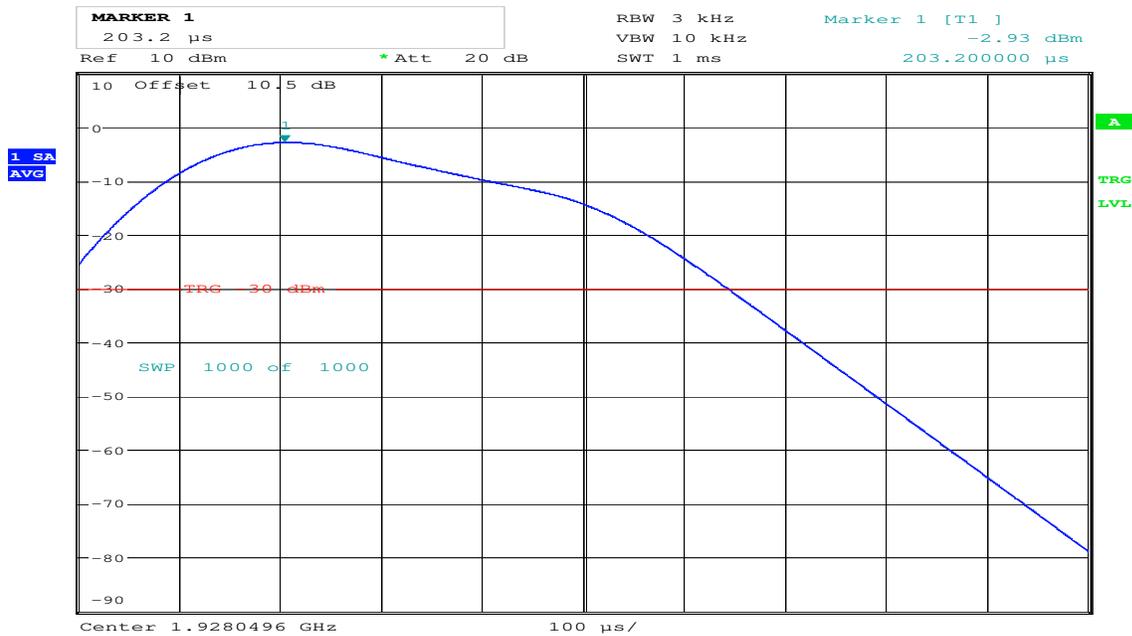
Date: 14.FEB.2018 15:44:38

PSD, Averaged, 1000 Sweeps, Upper Channel, π/2-DBPSK
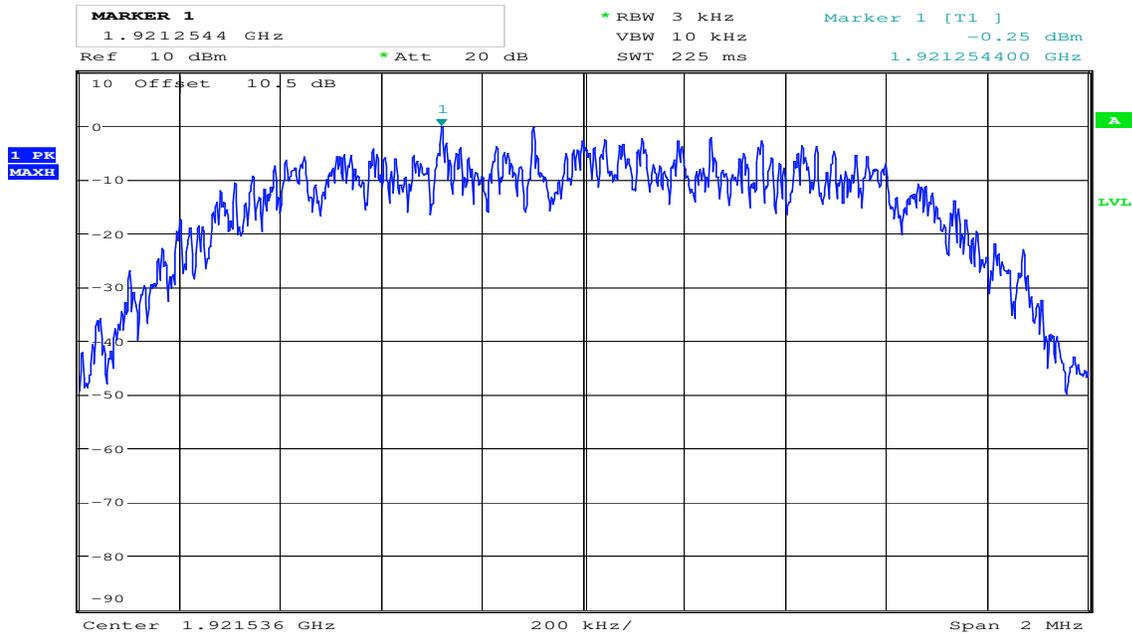
Date: 14.FEB.2018 16:15:13

PSD, Overview, Lower Channel, π/4-DQPSK
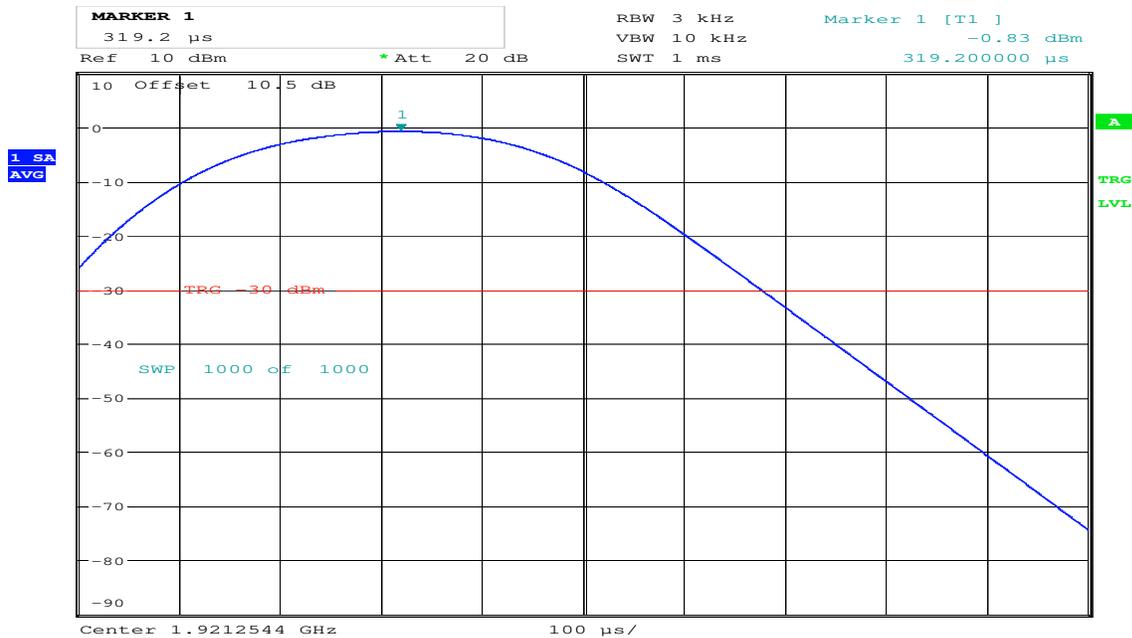
Date: 14.FEB.2018 16:16:38

PSD, Averaged, 1000 Sweeps, Lower Channel, π/4-DQPSK

MARKER 1			
1.9281664 GHz		★ RBW 3 kHz	Marker 1 [T1]
Ref 10 dBm	★ Att 20 dB	VBW 10 kHz	−0.33 dBm
		SWT 225 ms	1.928166400 GHz

```
10  Offset  10.5 dB
```

Center 1.928448 GHz   200 kHz/   Span 2 MHz
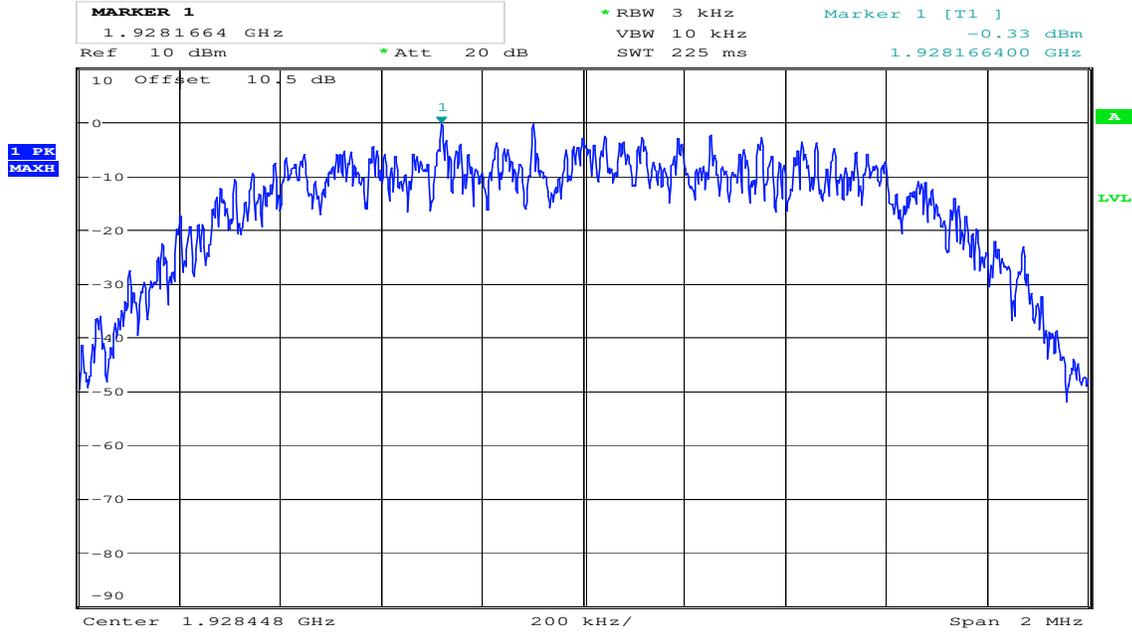
Date: 14.FEB.2018 15:57:22

PSD, Overview. Upper Channel, π/4-DQPSK

MARKER 1			
319.2 µs		RBW 3 kHz	Marker 1 [T1]
Ref 10 dBm	★ Att 20 dB	VBW 10 kHz	−0.83 dBm
		SWT 1 ms	319.200000 µs

```
10  Offset  10.5 dB
```

TRG 30 dBm

SWP 1000 of 1000

Center 1.9281664 GHz   100 µs/
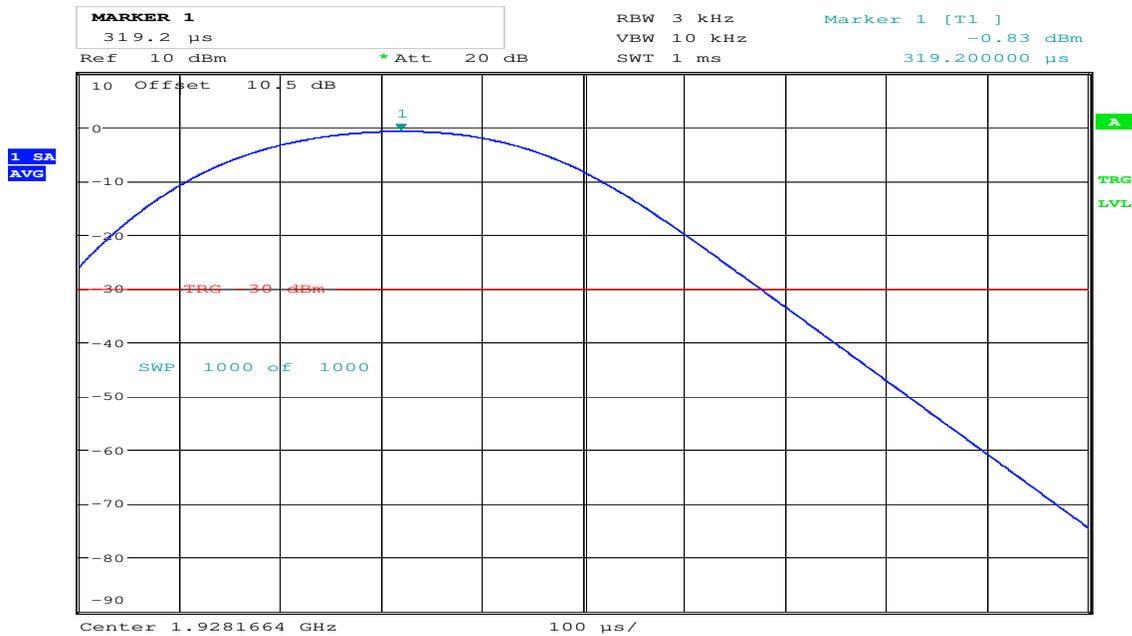
Date: 14.FEB.2018 16:01:32

PSD, Averaged, 1000 Sweeps, Upper Channel, π/4-DQPSK

MARKER 1		* RBW 3 kHz	Marker 1 [T1]
1.9215232 GHz		VBW 10 kHz	−2.64 dBm
Ref 10 dBm	* Att 20 dB	SWT 225 ms	1.921523200 GHz

```
10  Offset   10.5 dB
 1 PK
 MAXH
```

Center 1.921536 GHz   200 kHz/   Span 2 MHz
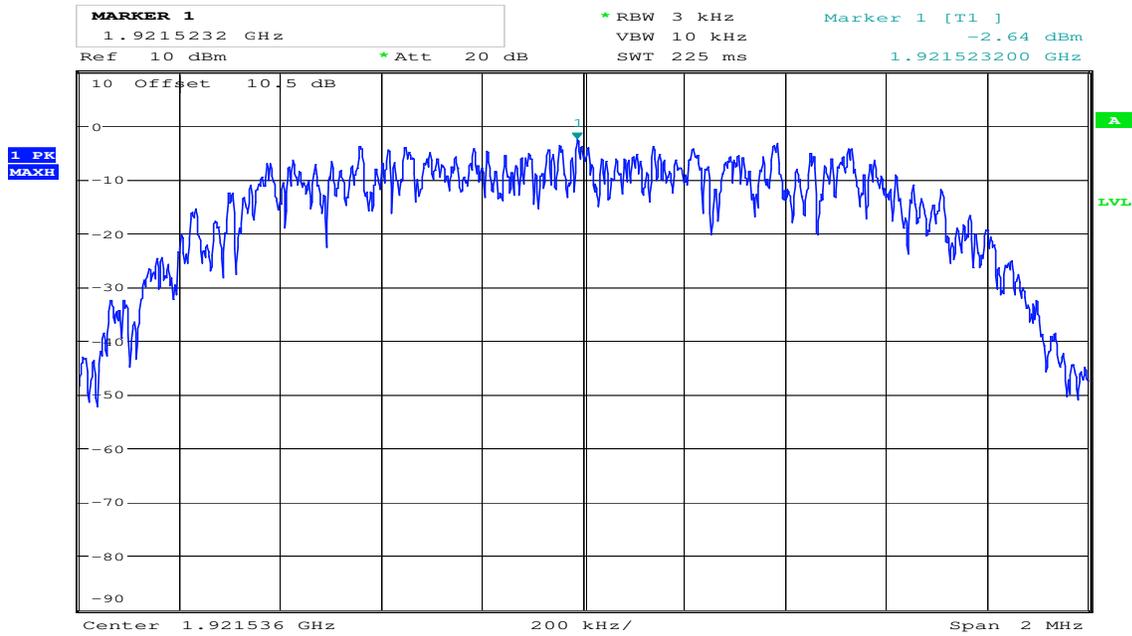
Date: 14.FEB.2018   16:09:47

PSD, Overview, Lower Channel, π/8-D8PSK

MARKER 1		RBW 3 kHz	Marker 1 [T1]
232 µs		VBW 10 kHz	−2.92 dBm
Ref 10 dBm	* Att 20 dB	SWT 1 ms	232.000000 µs

```
10  Offset   10.5 dB
 1 SA
 AVG

      TRG  −30 dBm

 SWP  1000 of  1000
```

Center 1.9215232 GHz   100 µs/
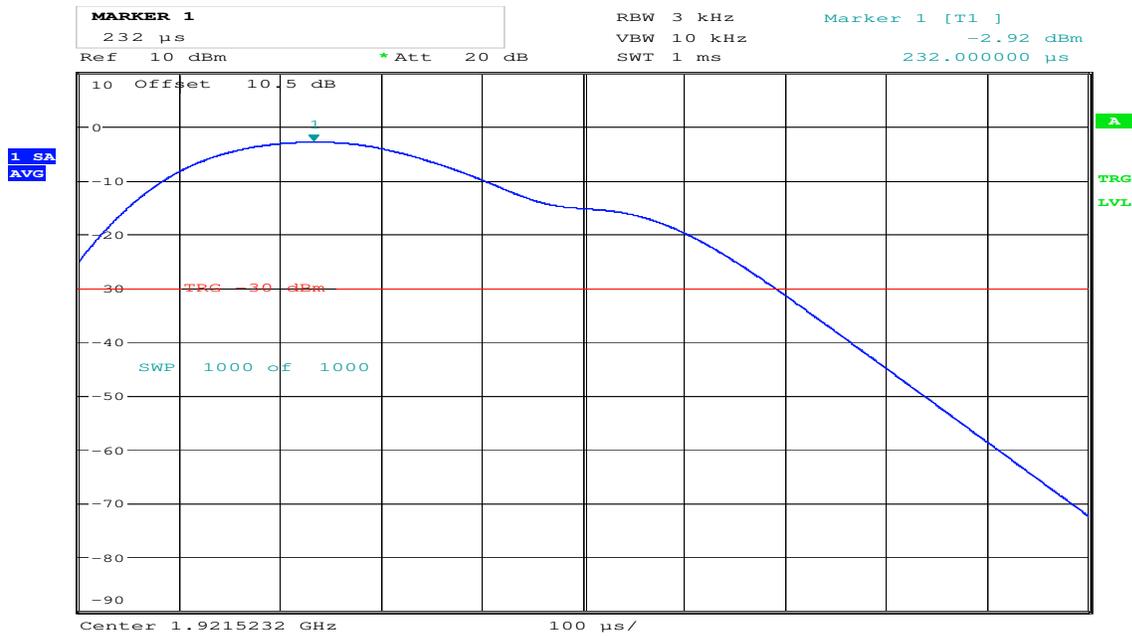
Date: 14.FEB.2018   16:10:55

PSD, Averaged, 1000 Sweeps, Lower Channel, π/8-D8PSK
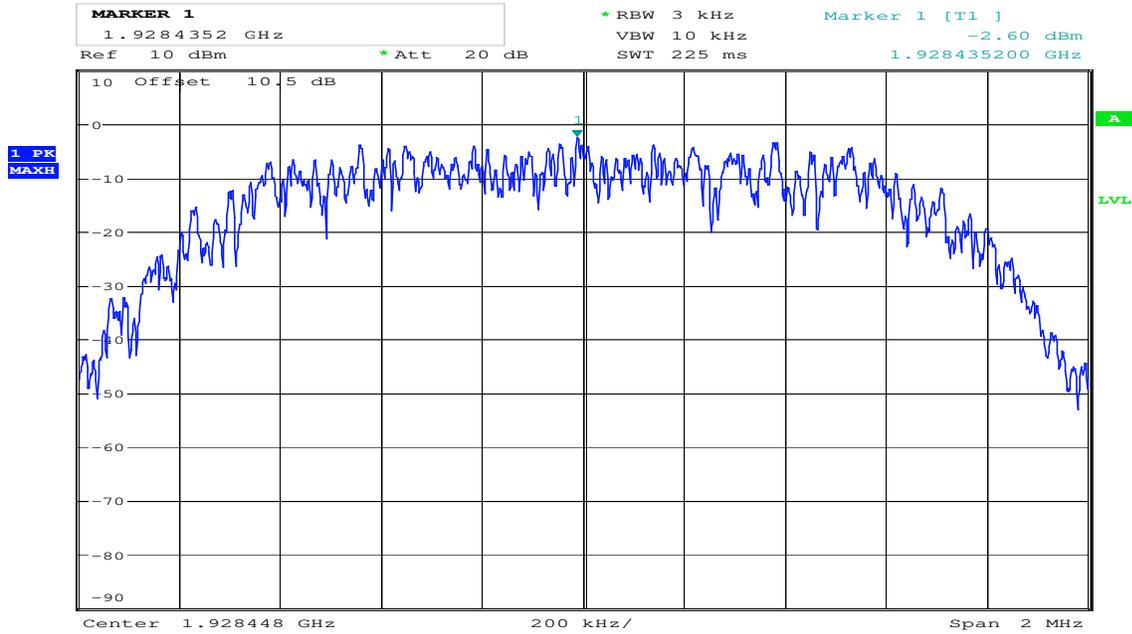
Date: 14.FEB.2018   16:05:32

PSD, Overview. Upper Channel, π/8-D8PSK
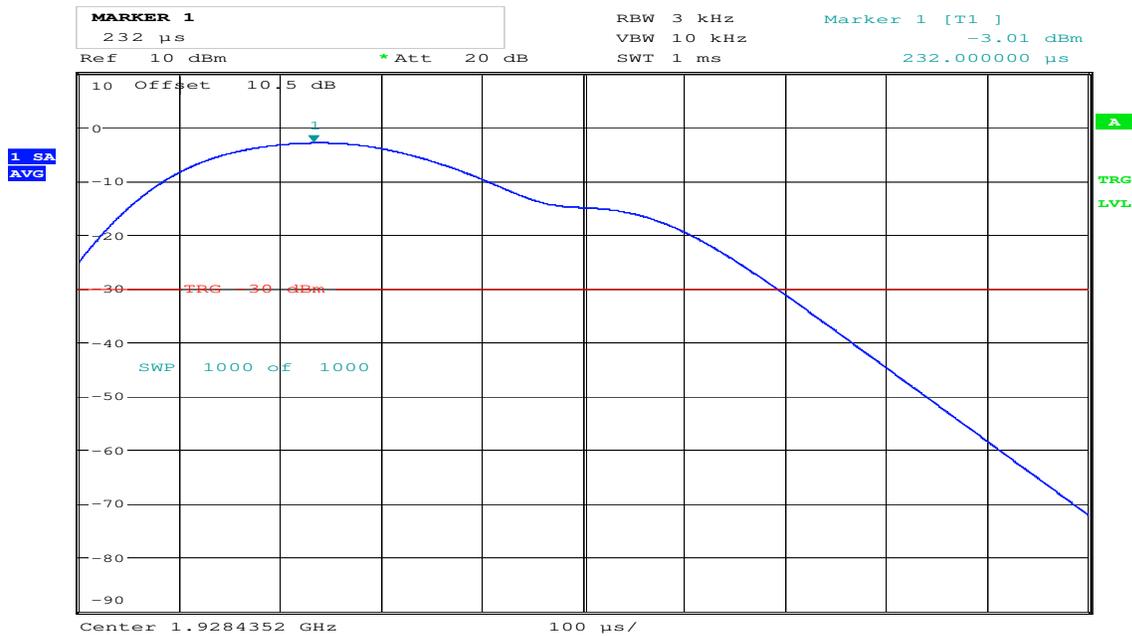
Date: 14.FEB.2018   16:06:41

PSD, Averaged, 1000 Sweeps, Upper Channel, π/8-D8PSK

3.6   In-Band Unwanted Emissions, Conducted

Test Method:

ANSI C63.17, clause 6.1.6.1.

Test Results: Complies

Measurement Data:

See plots.

Requirements, FCC 15.323(d):

$B < f \leq 2B$:   at least 30 dB below max. permitted peak power
$2B < f \leq 3B$:   at least 50 dB below max. permitted peak power
$3B < f \leq$ UPCS Band Edge : at least 60 dB below max. permitted peak power

![Nemko logo]
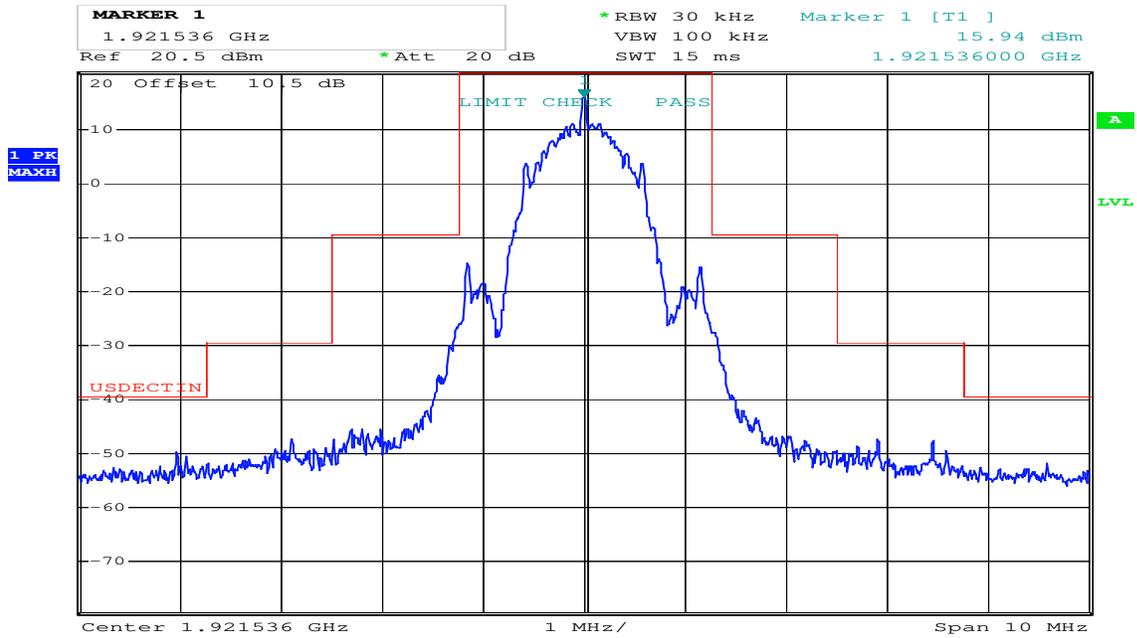
Date: 14.FEB.2018   16:43:26

In-Band Emissions, Lower Channel, GFSK
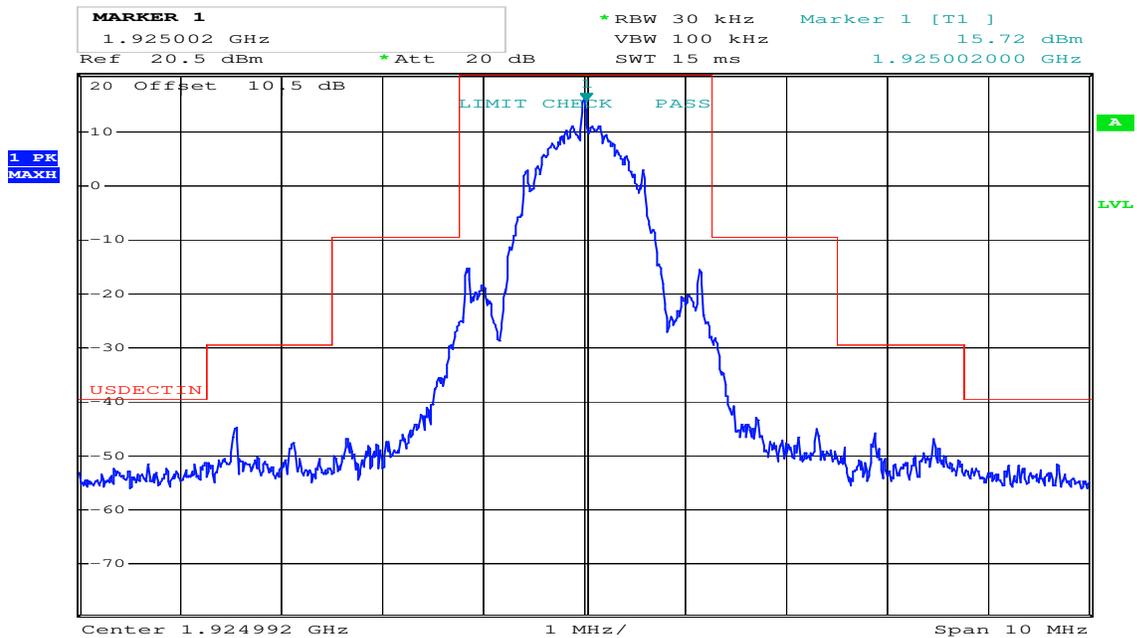
Date: 14.FEB.2018   16:44:52

In-Band Emissions, Middle Channel, GFSK

```
MARKER 1                        *RBW 30 kHz    Marker 1 [T1 ]
 1.928438 GHz                    VBW 100 kHz               15.65 dBm
Ref  20.5 dBm        *Att  20 dB  SWT 15 ms     1.928438000 GHz
```
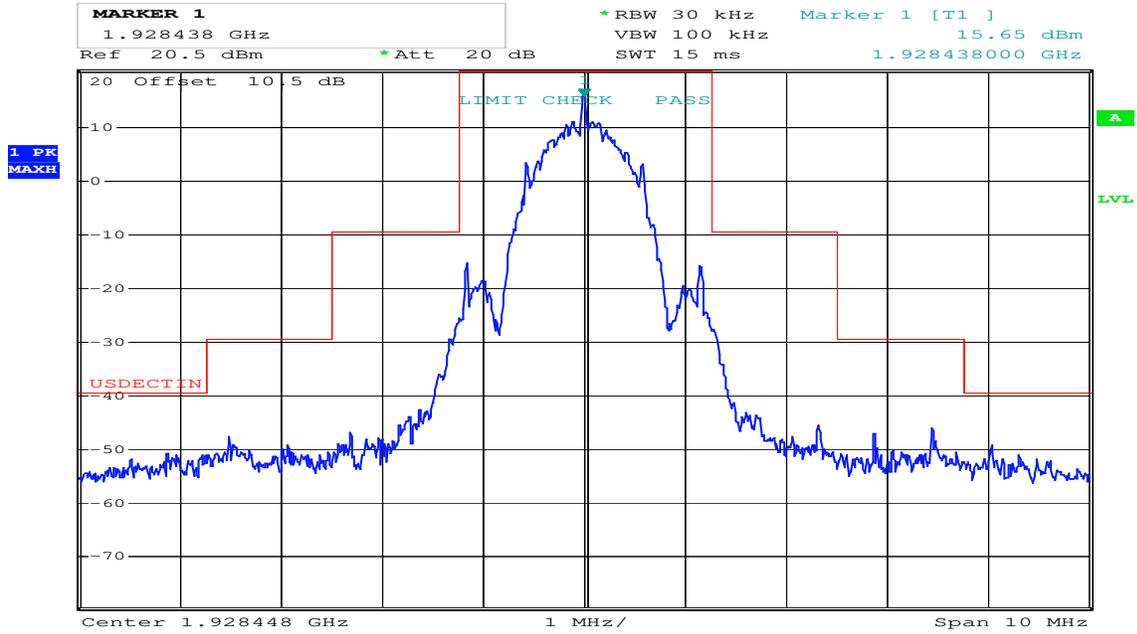
Date: 14.FEB.2018 16:45:55

In-Band Unwanted Emissions, Upper Channel, GFSK

```
MARKER 1                        *RBW 30 kHz    Marker 1 [T1 ]
 1.921536 GHz                    VBW 100 kHz               11.76 dBm
Ref  20.5 dBm        *Att  20 dB  SWT 15 ms     1.921536000 GHz
```
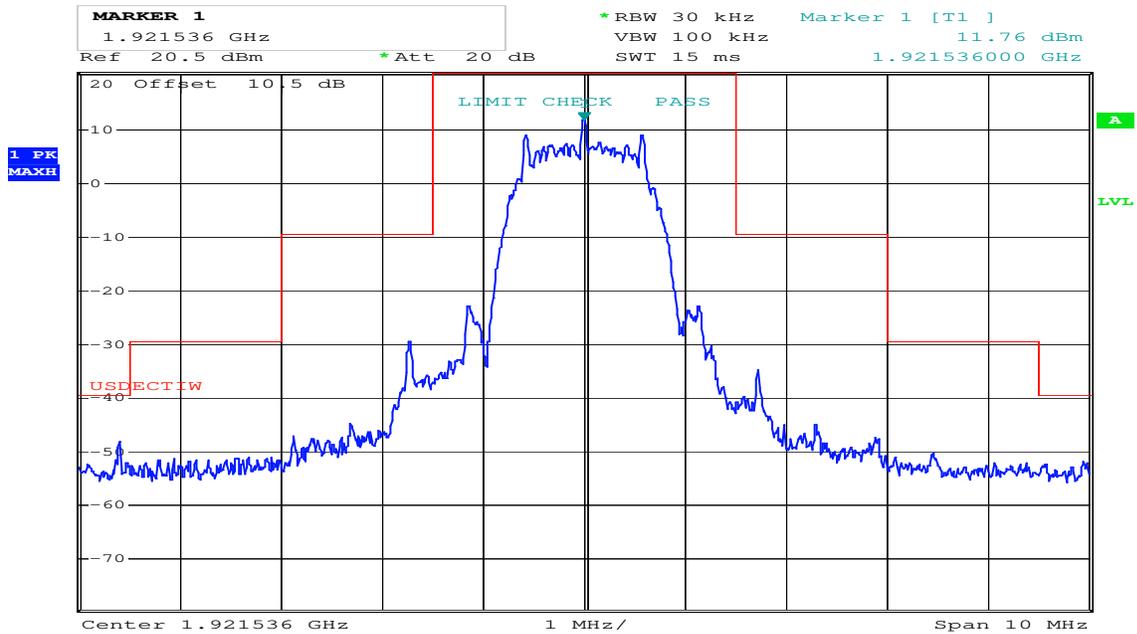
Date: 14.FEB.2018 16:41:41

In-Band Emissions, Lower Channel, π/2-DBPSK

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
1.925002 GHz		VBW 100 kHz	11.54 dBm
Ref 20.5 dBm	*Att 20 dB	SWT 15 ms	1.925002000 GHz

Center 1.924992 GHz   1 MHz/   Span 10 MHz
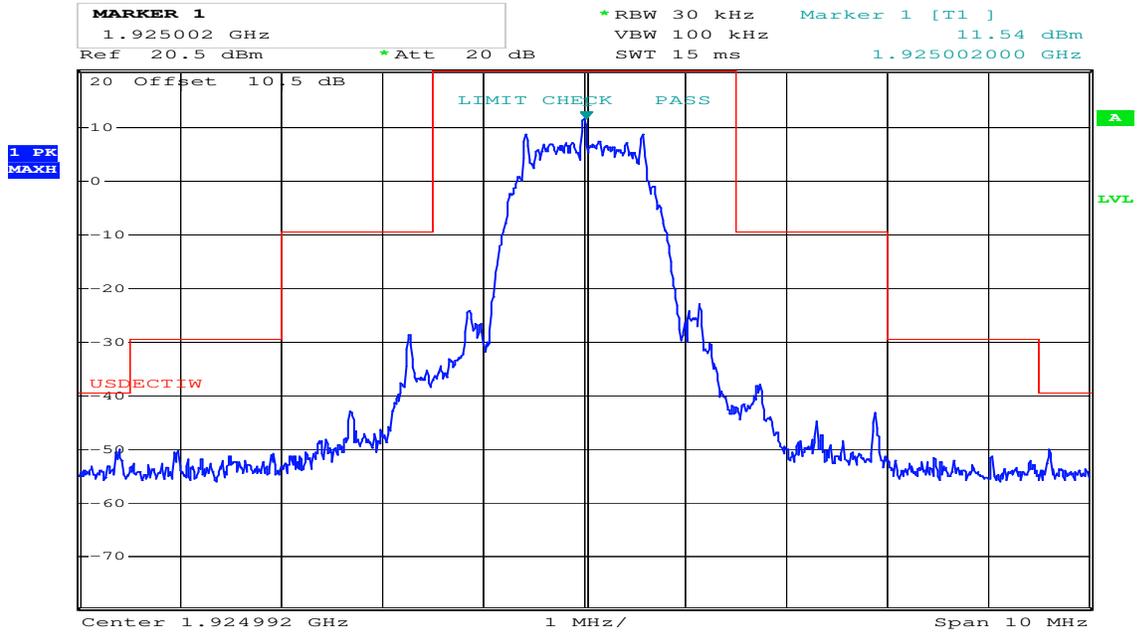
Date: 14.FEB.2018   16:32:45

In-Band Emissions, Middle Channel, π/2-DBPSK

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
1.928448 GHz		VBW 100 kHz	11.71 dBm
Ref 20.5 dBm	*Att 20 dB	SWT 15 ms	1.928448000 GHz

Center 1.928448 GHz   1 MHz/   Span 10 MHz
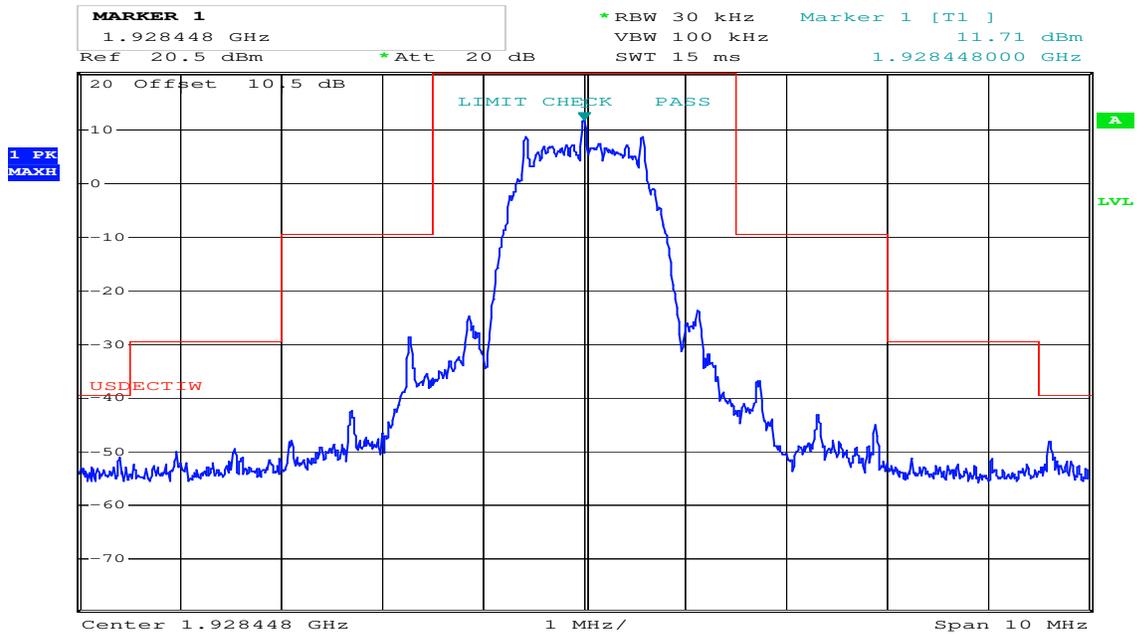
Date: 14.FEB.2018   16:34:20

In-Band Emissions, Upper Channel, π/2-DBPSK
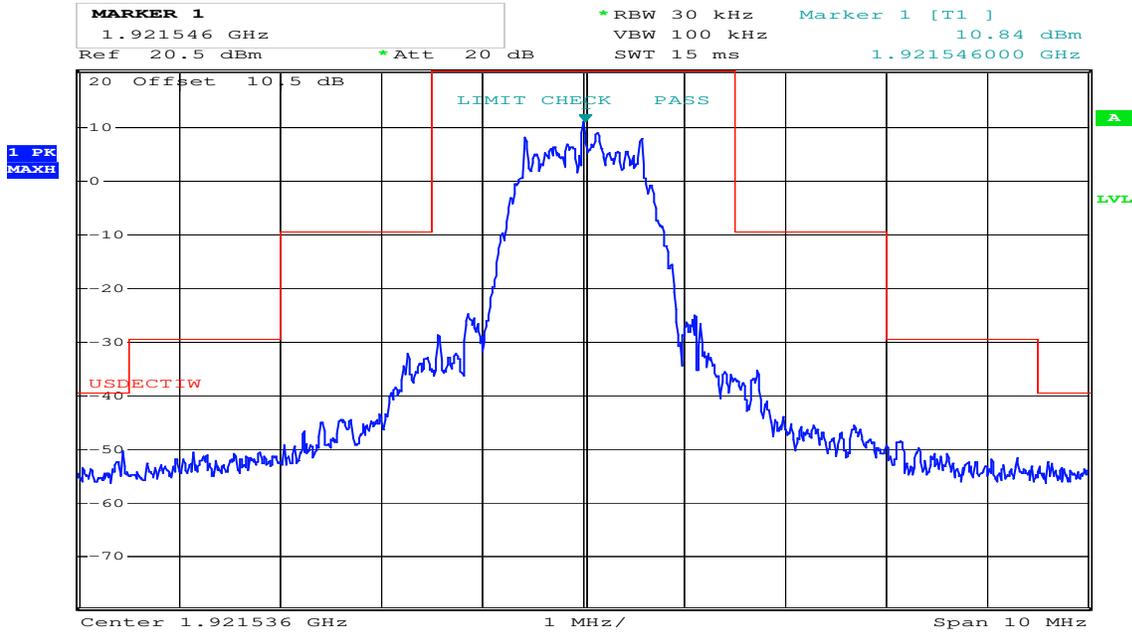
Date: 14.FEB.2018 16:39:58

In-Band Emissions, Lower Channel, π/4-DQPSK
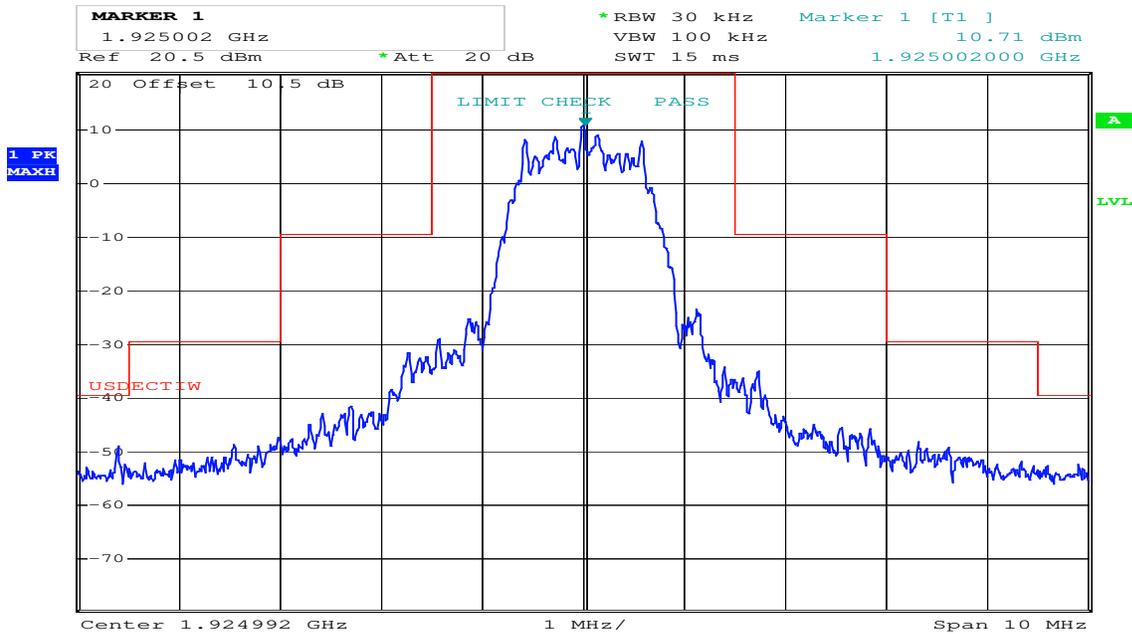
Date: 14.FEB.2018 16:31:11

In-Band Emissions, Middle Channel, π/4-DQPSK
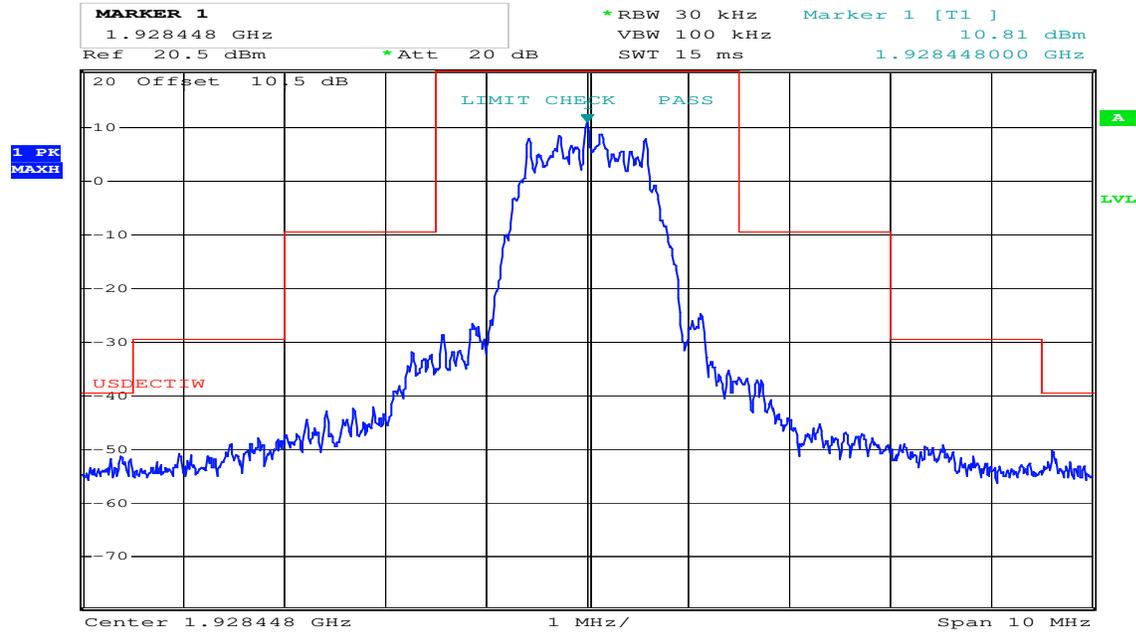
Date: 14.FEB.2018   16:36:17

In-Band Emissions, Upper Channel, π/4-DQPSK
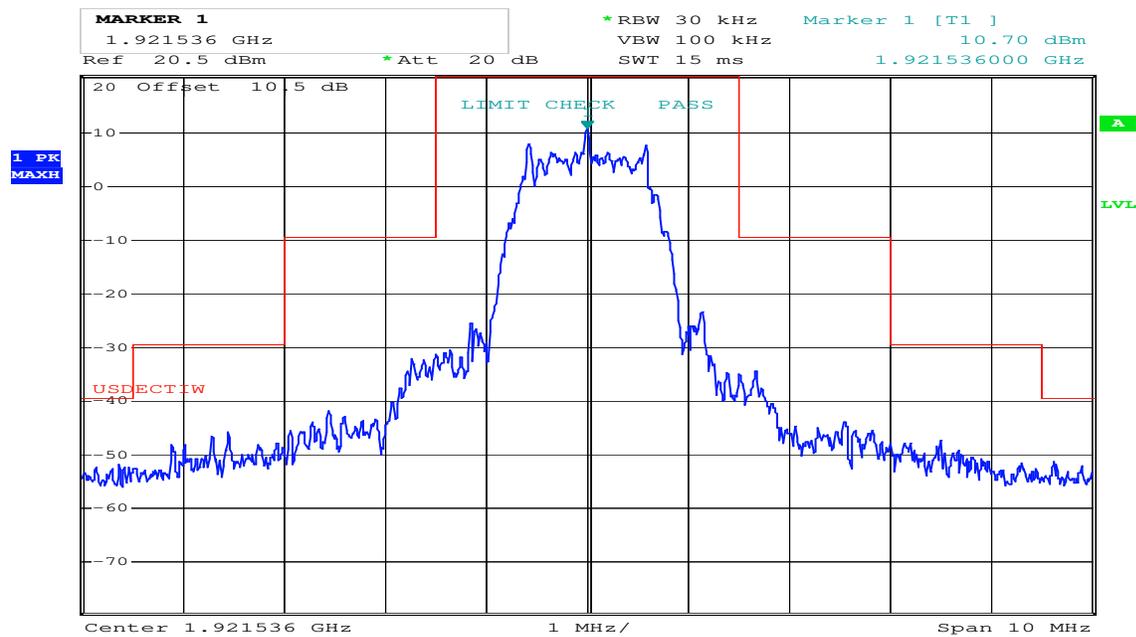
Date: 14.FEB.2018   16:38:42

In-Band Emissions, Lower Channel, π/8-D8PSK
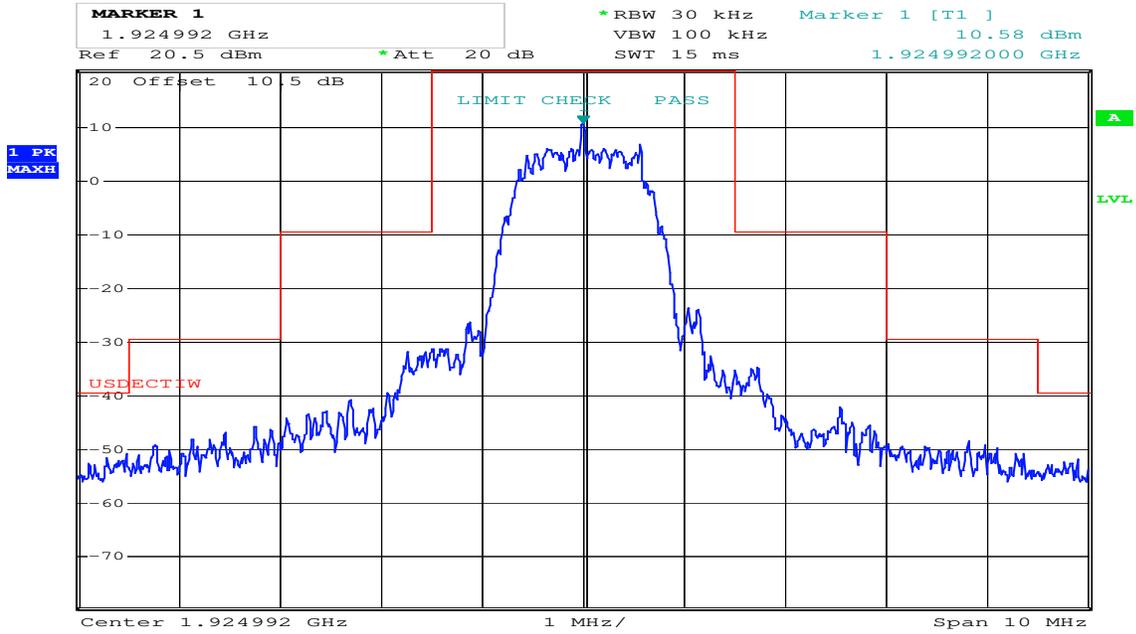
Date: 14.FEB.2018 16:29:47

In-Band Emissions, Middle Channel, π/8-D8PSK
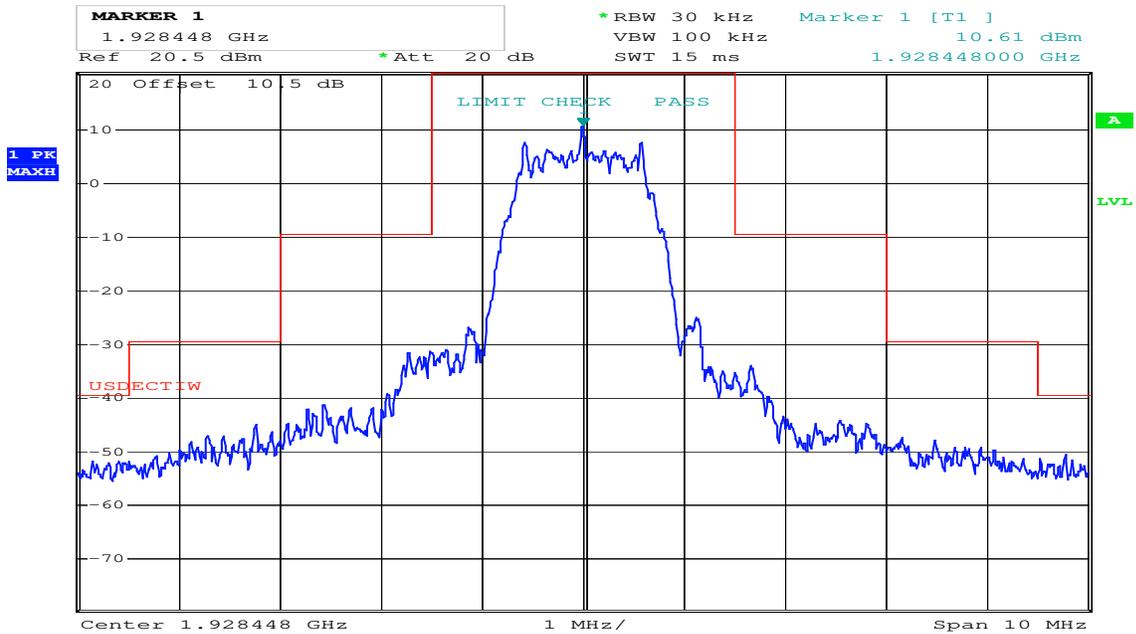
Date: 14.FEB.2018 16:37:48

In-Band Emissions, Upper Channel, π/8-D8PSK

3.7 Out-of-band Emissions, Conducted

Test Method:

ANSI C63.17, clause 6.1.6.2.

Test Results: Complies

Measurement Data:

See plots.

Requirements, FCC 15.323(d):

f ≤ 1.25 MHz outside UPCS band : ≤ -9.5 dBm
1.25 MHz ≤ f ≤ 2.5 MHz outside UPCS band : ≤ -29.5 dBm
f ≥ 2.5 MHz outside UPCS band : ≤ -39.5 dBm

MARKER 1		*RBW 30 kHz	Marker 1 [T1]	
833.835 MHz		VBW 100 kHz	−55.45 dBm	
Ref 0 dBm	*Att 30 dB	SWT 1.15 s	833.835000000 MHz	

0 Offset 10.5 dB

LIMIT CHECK   PASS

A

1 PK
MAXH

LVL

USDECTOU

1

Start 5 MHz   99.5 MHz/   Stop 1 GHz

Date: 15.FEB.2018 10:20:15

MARKER 1		*RBW 30 kHz	Marker 1 [T1]	
1.86913 GHz		VBW 100 kHz	−59.33 dBm	
Ref 10 dBm	*Att 20 dB	SWT 980 ms	1.869130000 GHz	

10 Offset 10.5 dB

LIMIT CHECK   PASS

A

1 PK
MAXH

LVL

USDECTOU

Start 1 GHz   87 MHz/   Stop 1.87 GHz
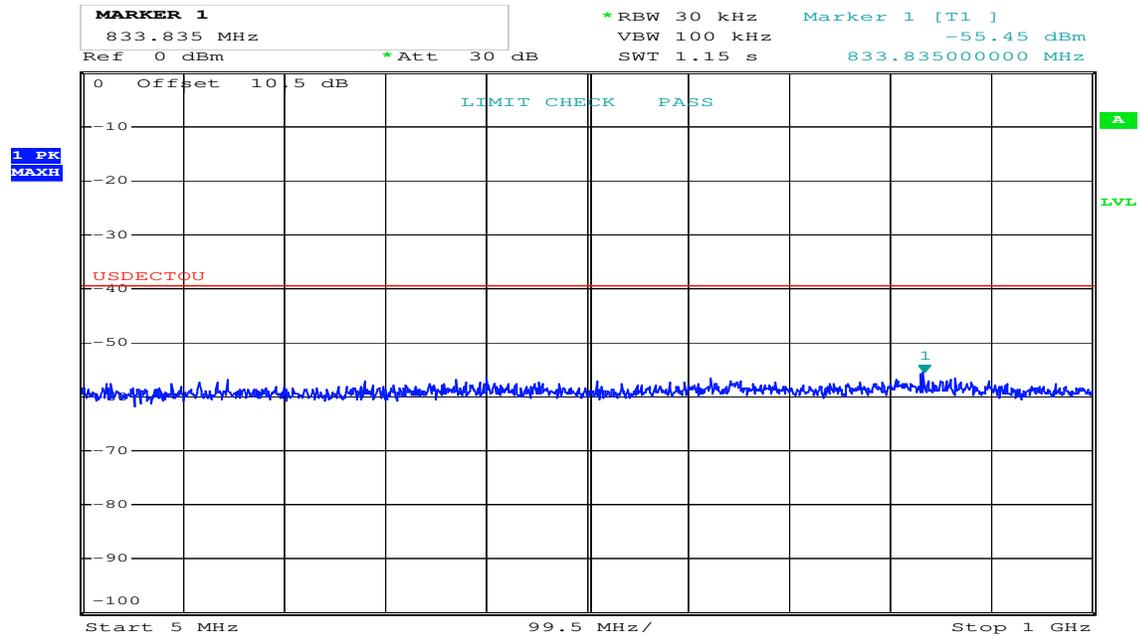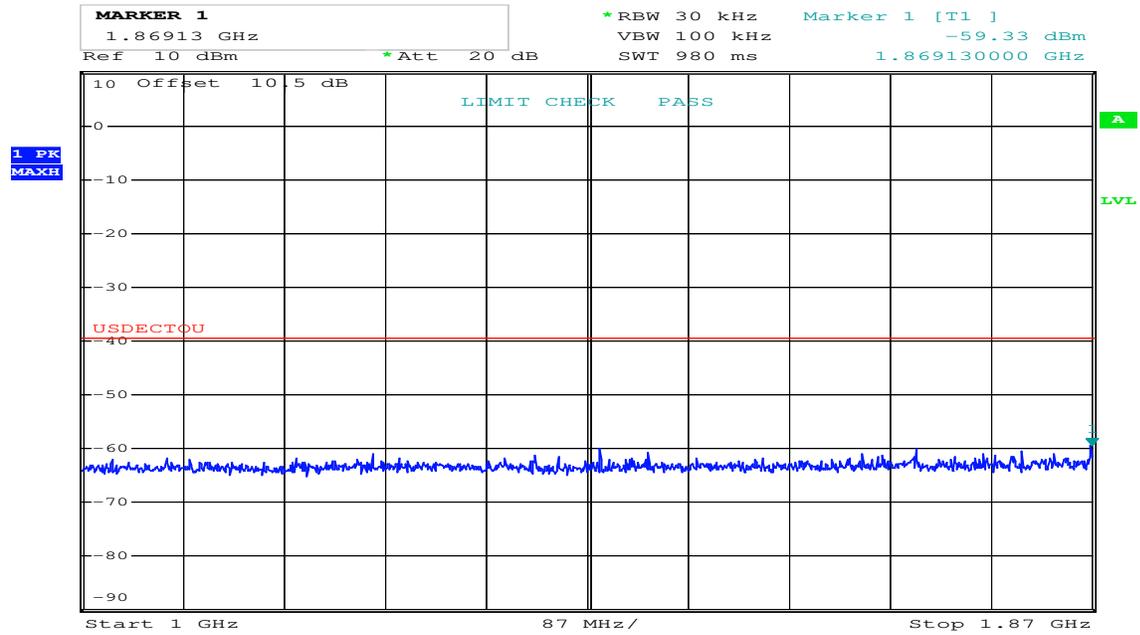
Date: 15.FEB.2018 10:18:32

Out-of-Band Emissions, Lower Channel, GFSK

MARKER 1			*RBW 30 kHz	Marker 1 [T1]	
1.9147 GHz			VBW 100 kHz	−50.98 dBm	
Ref 10 dBm		*Att 20 dB	SWT 60 ms	1.914700000 GHz	

10 Offset 10.5 dB
LIMIT CHECK PASS
Marker 2 [T1]
−57.02 dBm
1.900850000 GHz
Marker 3 [T1]
−51.36 dBm
1.880100000 GHz

1 PK MAXH
LVL
USDECTOU
A

Start 1.87 GHz   5 MHz/   Stop 1.92 GHz
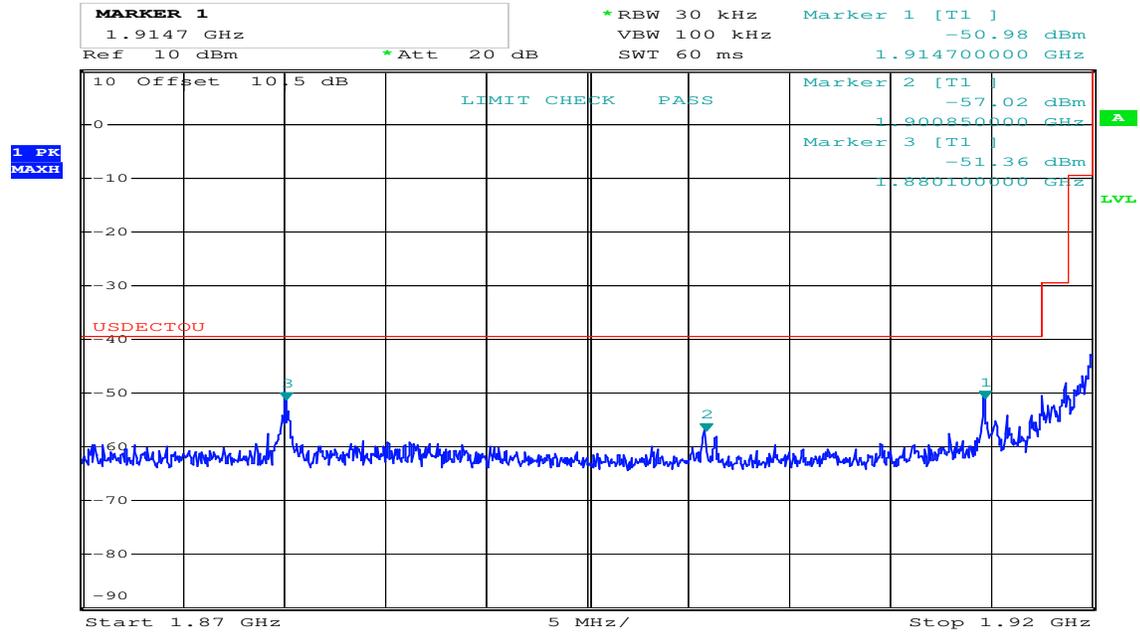
Date: 15.FEB.2018   09:35:07

Out-of-Band Emissions, Lower Channel, GFSK

MARKER 1			*RBW 30 kHz	Marker 1 [T1]	
1.44374 GHz			VBW 100 kHz	−54.45 dBm	
Ref 0 dBm		*Att 20 dB	SWT 15 ms	1.443740000 GHz	

0 Offset 10.5 dB
LIMIT CHECK PASS

1 PK MAXH
LVL
USDECTOW
A

Center 1.44378 GHz   1 MHz/   Span 10 MHz
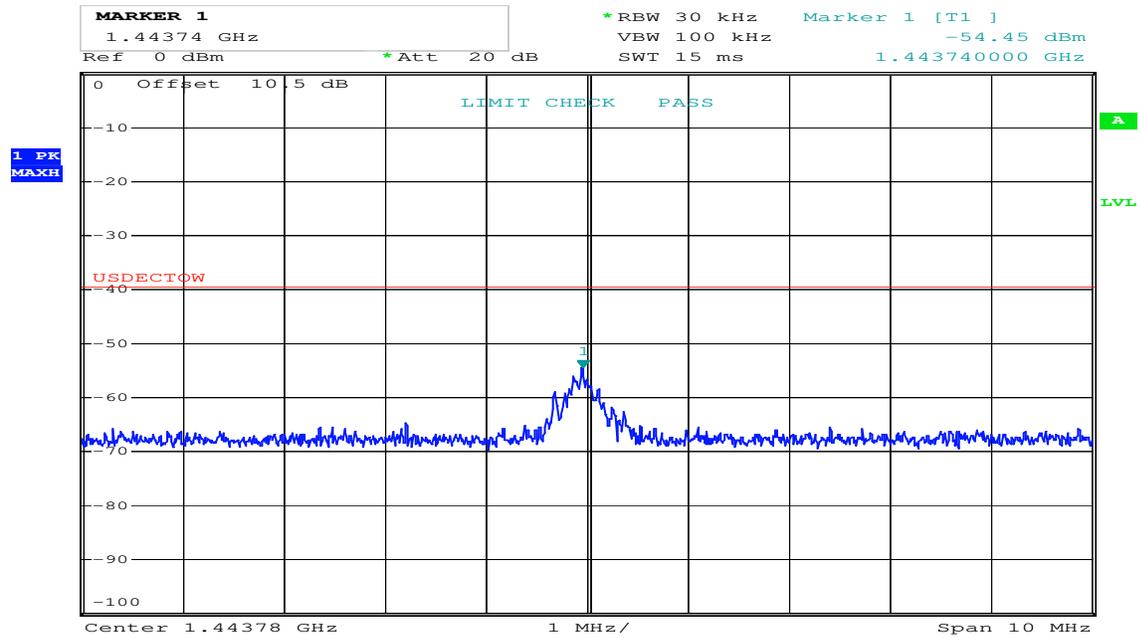
Date: 15.FEB.2018   12:13:01

Out-of-Band Emissions, Middle Channel, GFSK

```
MARKER 2                          *RBW  30 kHz    Marker 2 [T1 ]
 1.9699 GHz                        VBW 100 kHz             -54.81 dBm
Ref   0 dBm        *Att   20 dB    SWT  80 ms       1.969900000 GHz
```
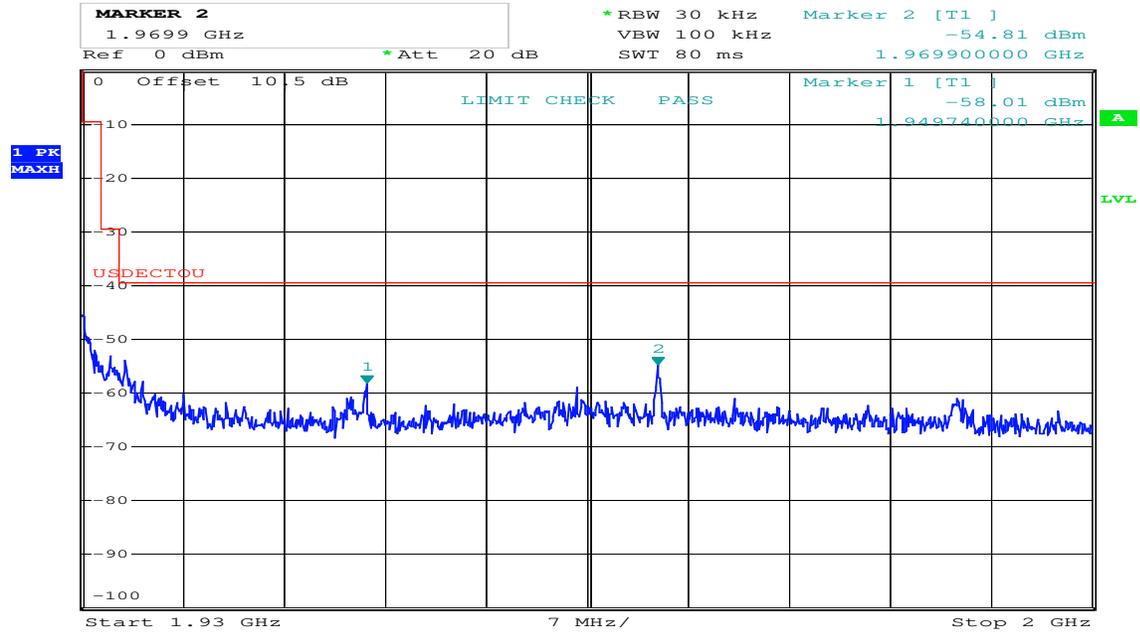
Date: 15.FEB.2018   10:22:00

Out-of-Band Emissions, Upper Channel, GFSK


```
MARKER 1                          *RBW  30 kHz    Marker 1 [T1 ]
 3.008 GHz                         VBW 100 kHz             -58.89 dBm
Ref   0 dBm        *Att   20 dB    SWT  4.5 s       3.008000000 GHz
```
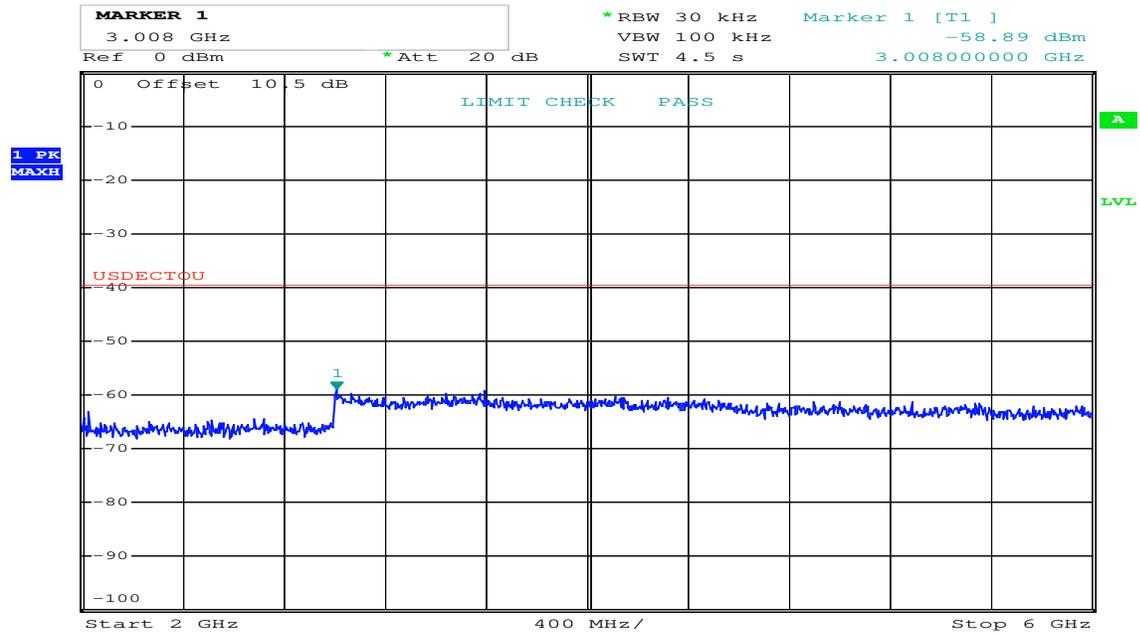
Date: 15.FEB.2018   10:55:23

Out-of-Band Emissions, Middle Channel, GFSK

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
10.854 GHz		VBW 100 kHz	−58.42 dBm
Ref 0 dBm	*Att 20 dB	SWT 6.8 s	10.854000000 GHz

0 Offset 10.5 dB

LIMIT CHECK   PASS

USDECTOU

Start 6 GHz   600 MHz/   Stop 12 GHz

Date: 15.FEB.2018 10:52:46

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
15.28 GHz		VBW 100 kHz	−55.43 dBm
Ref 0 dBm	*Att 20 dB	SWT 9 s	15.280000000 GHz

0 Offset 1 dB

LIMIT CHECK   PASS

USDECTOU

Start 12 GHz   800 MHz/   Stop 20 GHz
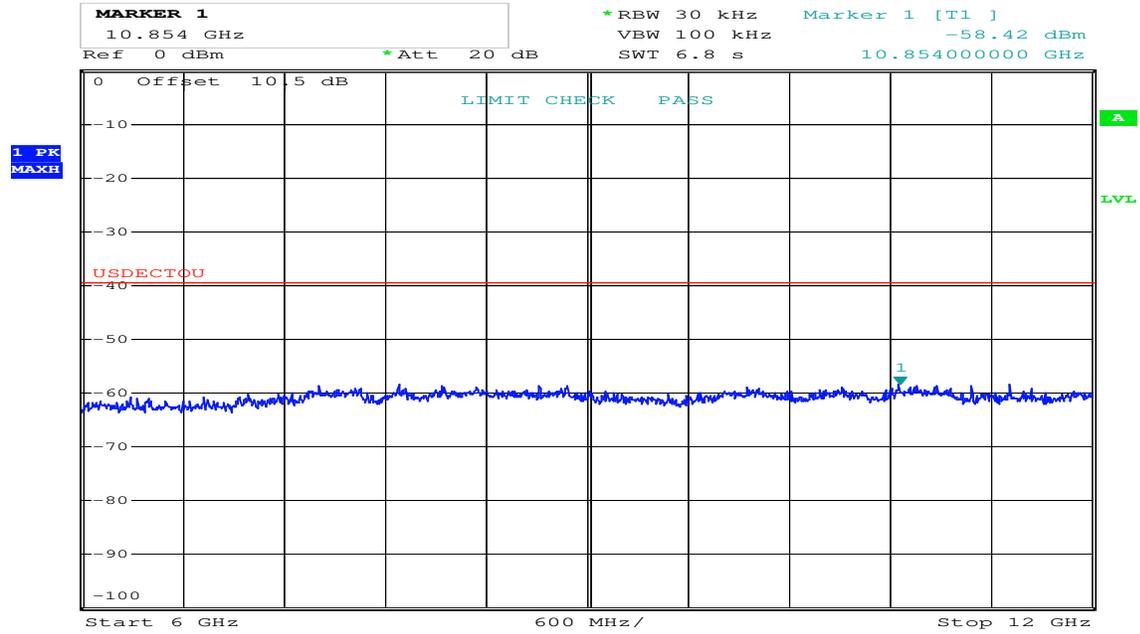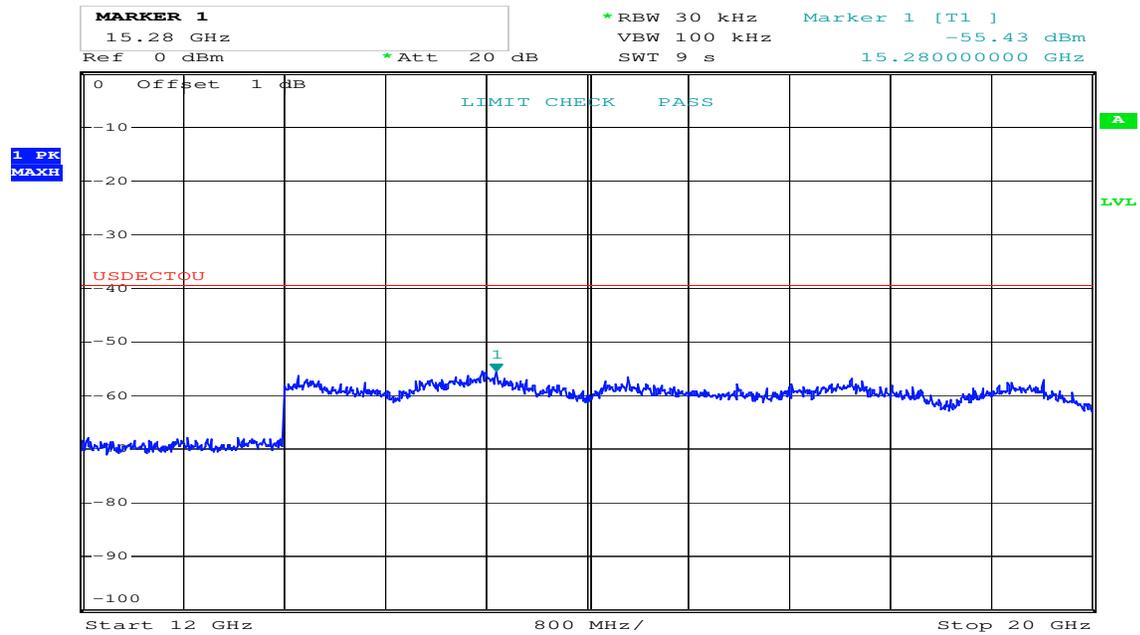
Date: 15.FEB.2018 10:47:52

Out-of-Band Emissions, Middle Channel, GFSK

MARKER 1			*RBW 30 kHz	Marker 1 [T1]	
480.61 MHz			VBW 100 kHz		−56.06 dBm
Ref 0 dBm		*Att 30 dB	SWT 1.15 s	480.610000000 MHz	

0   Offset   10.5 dB

LIMIT CHECK   PASS

A

1 PK
MAXH

LVL

USDECTOW

1

Start 5 MHz   99.5 MHz/   Stop 1 GHz

Date: 15.FEB.2018   12:18:46

MARKER 1			*RBW 30 kHz	Marker 1 [T1]	
1.8178 GHz			VBW 100 kHz		−62.54 dBm
Ref 0 dBm		*Att 20 dB	SWT 980 ms	1.817800000 GHz	

0   Offset   10.5 dB

LIMIT CHECK   PASS

A

1 PK
MAXH

LVL

USDECTOW

1

Start 1 GHz   87 MHz/   Stop 1.87 GHz
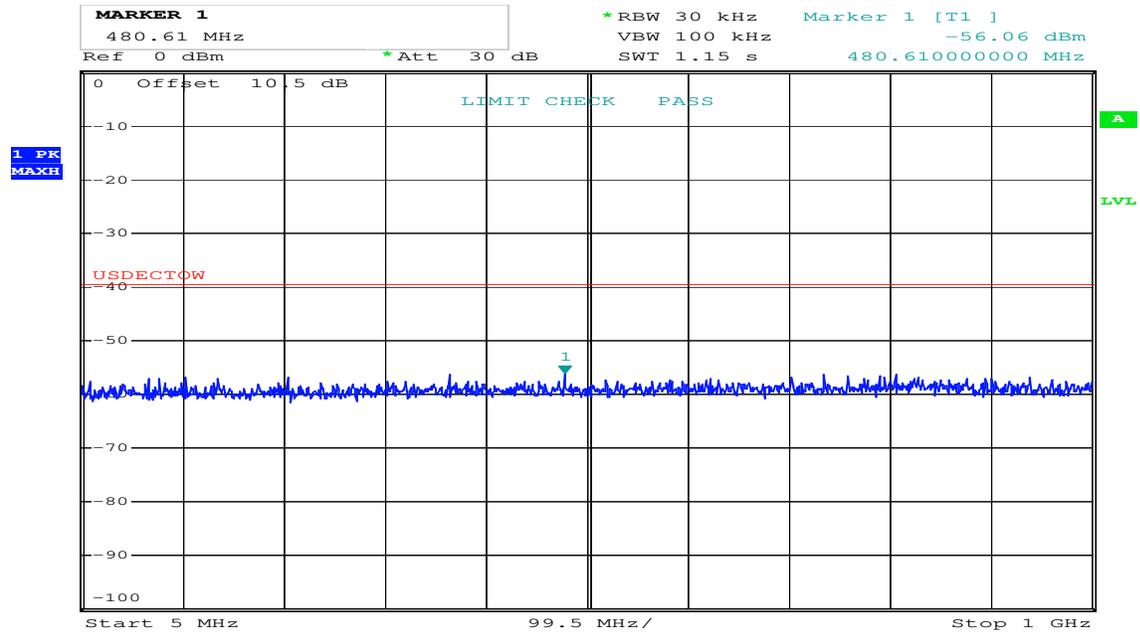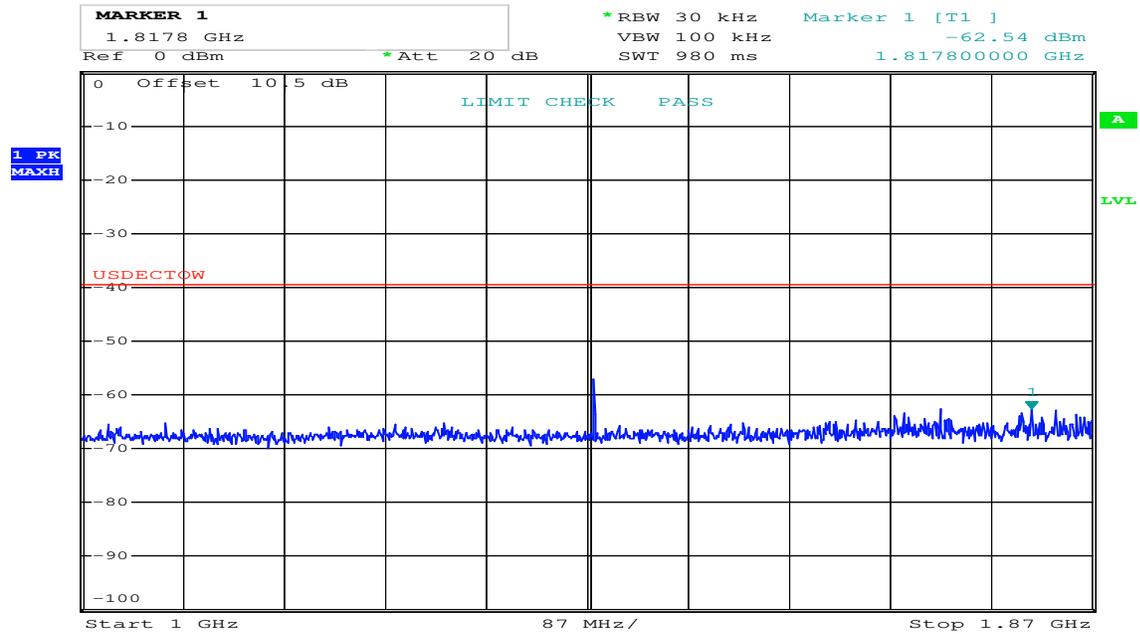
Date: 15.FEB.2018   12:07:53

**Out-of-Band Emissions, Lower Channel, π/2-DBPSK**
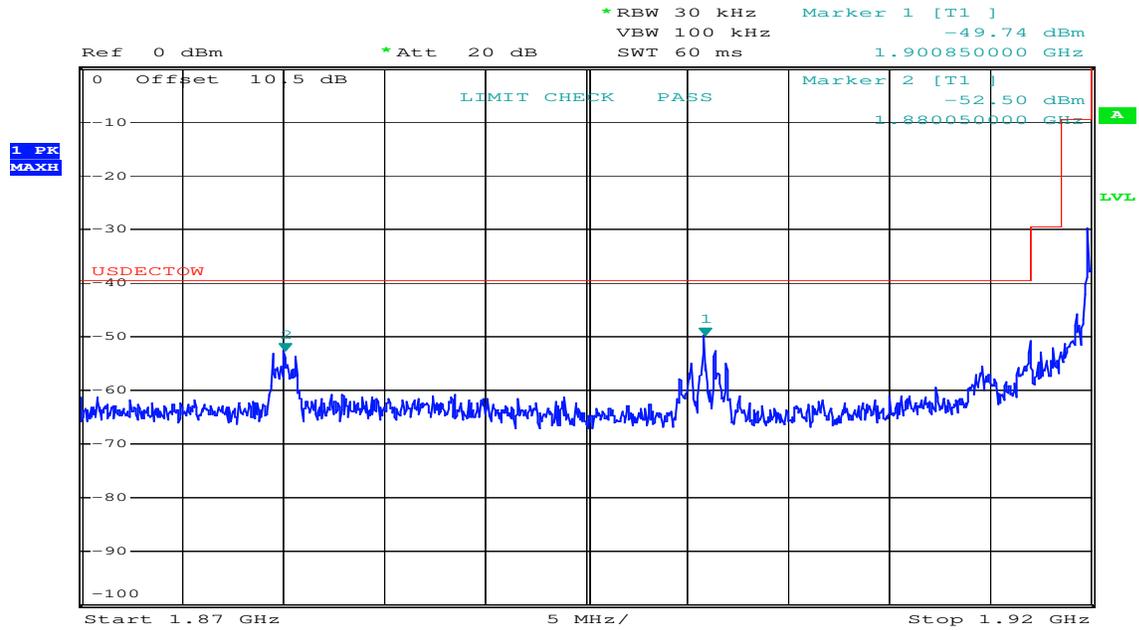
Date: 15.FEB.2018   12:03:44

Out-of-Band Emissions, Lower Channel, π/2-DBPSK
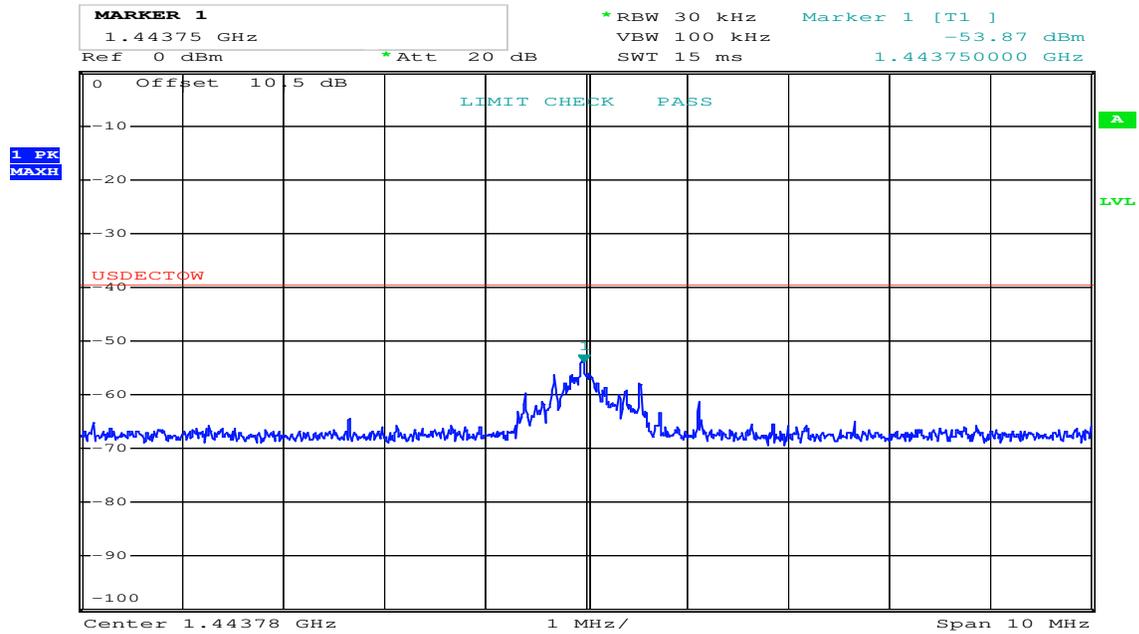
Date: 15.FEB.2018   12:12:08

Out-of-Band Emissions, Middle Channel, π/2-DBPSK

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
1.94862 GHz		VBW 100 kHz	−50.69 dBm
Ref 0 dBm	*Att 20 dB	SWT 80 ms	1.948620000 GHz

Start 1.93 GHz   7 MHz/   Stop 2 GHz
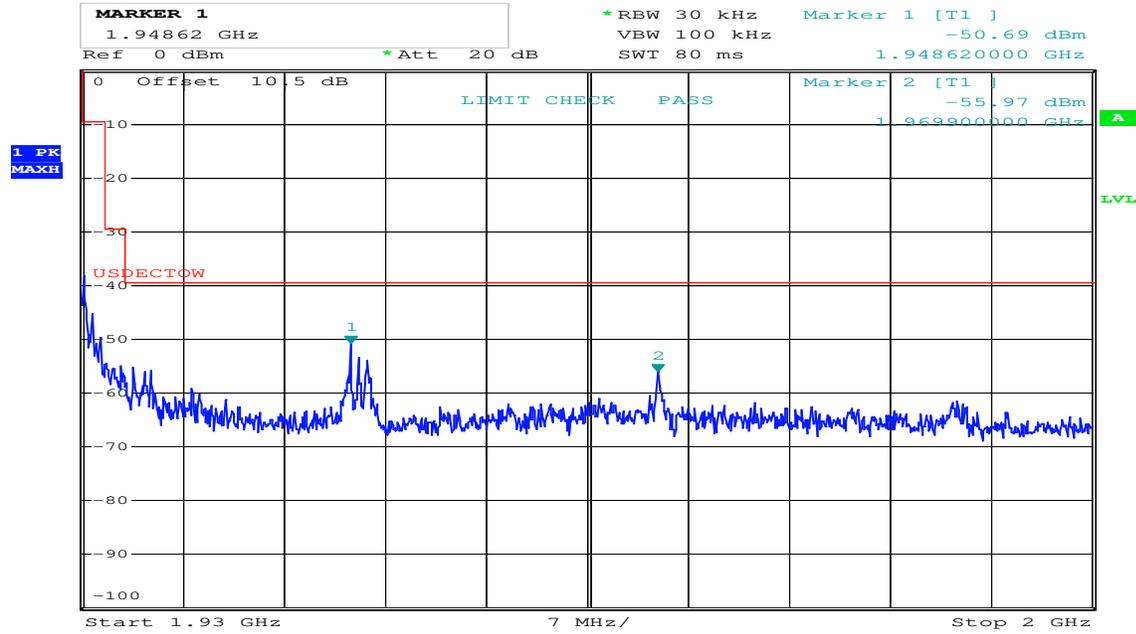
Date: 15.FEB.2018 11:45:12

Out-of-Band Emissions, Upper Channel, π/2-DBPSK

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
3.52 GHz		VBW 100 kHz	−58.65 dBm
Ref 0 dBm	*Att 20 dB	SWT 4.5 s	3.520000000 GHz

Start 2 GHz   400 MHz/   Stop 6 GHz
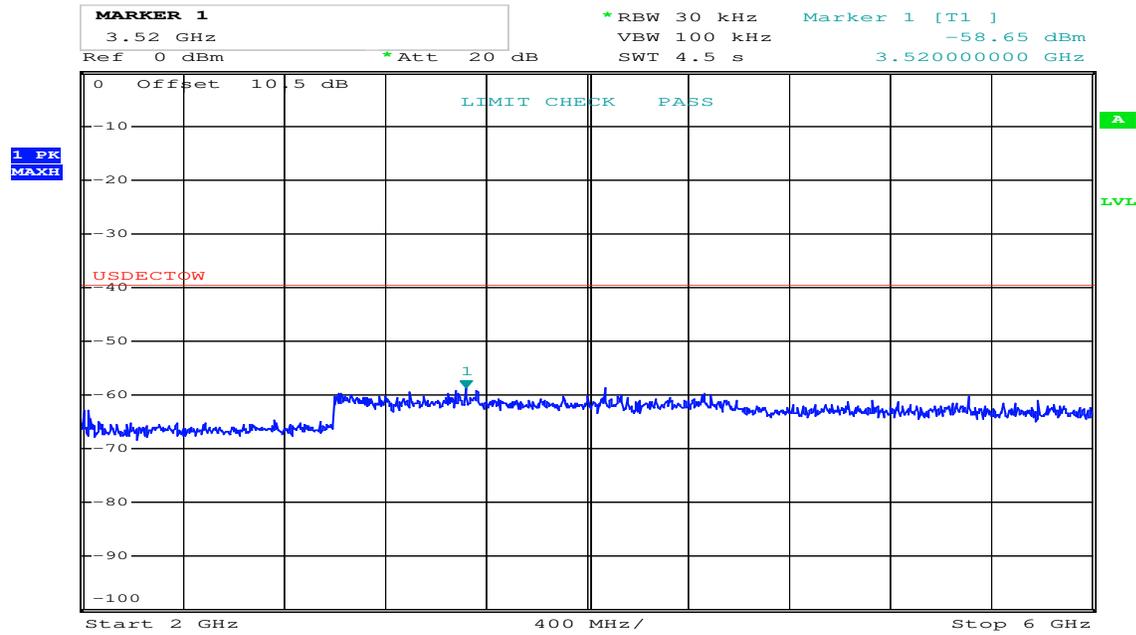
Date: 15.FEB.2018 10:56:33

Out-of-Band Emissions, Middle Channel, π/2-DBPSK

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
10.422 GHz		VBW 100 kHz	−58.20 dBm
Ref 0 dBm	*Att 20 dB	SWT 6.8 s	10.422000000 GHz

0   Offset   10.5 dB

LIMIT CHECK   PASS

1 PK
MAXH

USDECTOW

Start 6 GHz   600 MHz/   Stop 12 GHz

Date: 15.FEB.2018 11:34:16

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
15.176 GHz		VBW 100 kHz	−54.86 dBm
Ref 0 dBm	*Att 20 dB	SWT 9 s	15.176000000 GHz

0   Offset   1 dB

LIMIT CHECK   PASS

1 PK
MAXH

USDECTOU

Start 12 GHz   800 MHz/   Stop 20 GHz
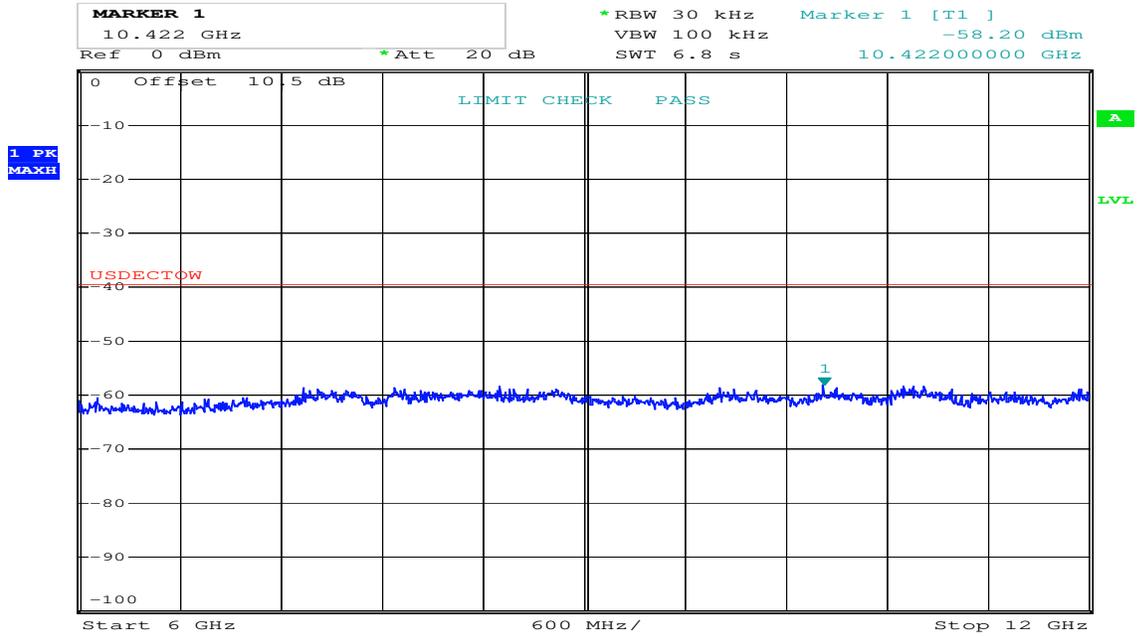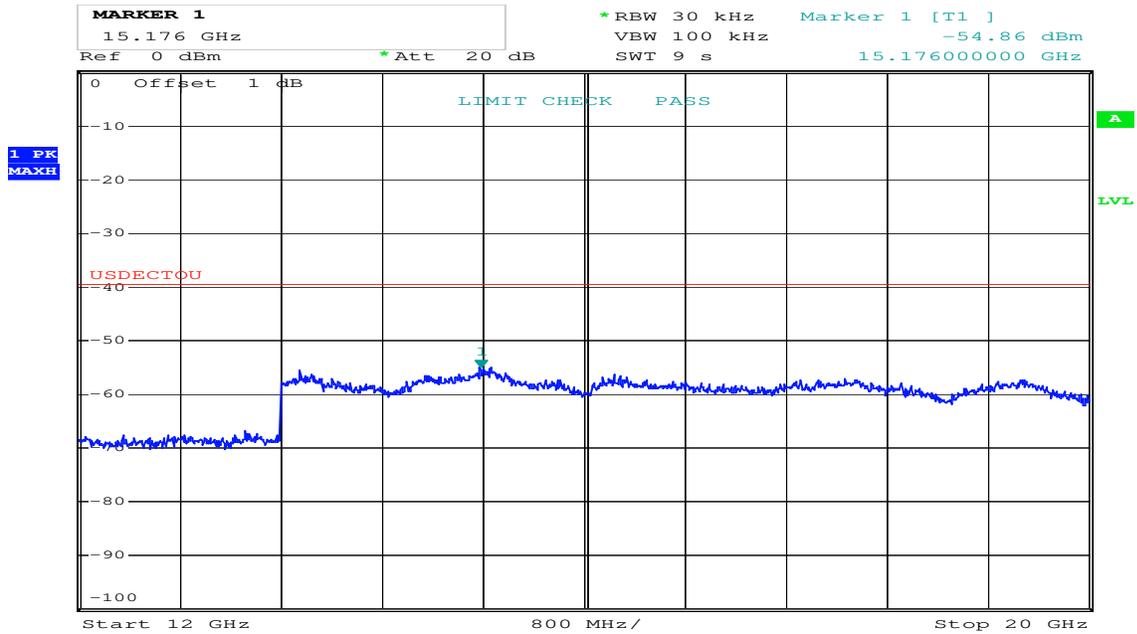
Date: 15.FEB.2018 10:41:09

Out-of-Band Emissions, Middle Channel, π/2-DBPSK

```
MARKER 1              *RBW 30 kHz      Marker 1 [T1 ]
 863.685 MHz           VBW 100 kHz            -56.45 dBm
Ref  0 dBm      *Att   30 dB    SWT 1.15 s      863.685000000 MHz
0   Offset  10.5 dB                 LIMIT CHECK   PASS                        A

 -10

 -20                                                                         LVL

 -30
USDECTOW
 -40

 -50                                                                  1

 -70

 -80

 -90

-100
Start 5 MHz                99.5 MHz/                    Stop 1 GHz
```

Date: 15.FEB.2018 12:15:49

```
MARKER 1              *RBW 30 kHz      Marker 1 [T1 ]
 1.44109 GHz           VBW 100 kHz            -57.93 dBm
Ref  0 dBm      *Att   20 dB    SWT 980 ms      1.441090000 GHz
0   Offset  10.5 dB                 LIMIT CHECK   PASS                        A

 -10

 -20                                                                         LVL

 -30
USDECTOW
 -40

 -50

 -60                                1

 -70

 -80

 -90

-100
Start 1 GHz                87 MHz/                    Stop 1.87 GHz
```
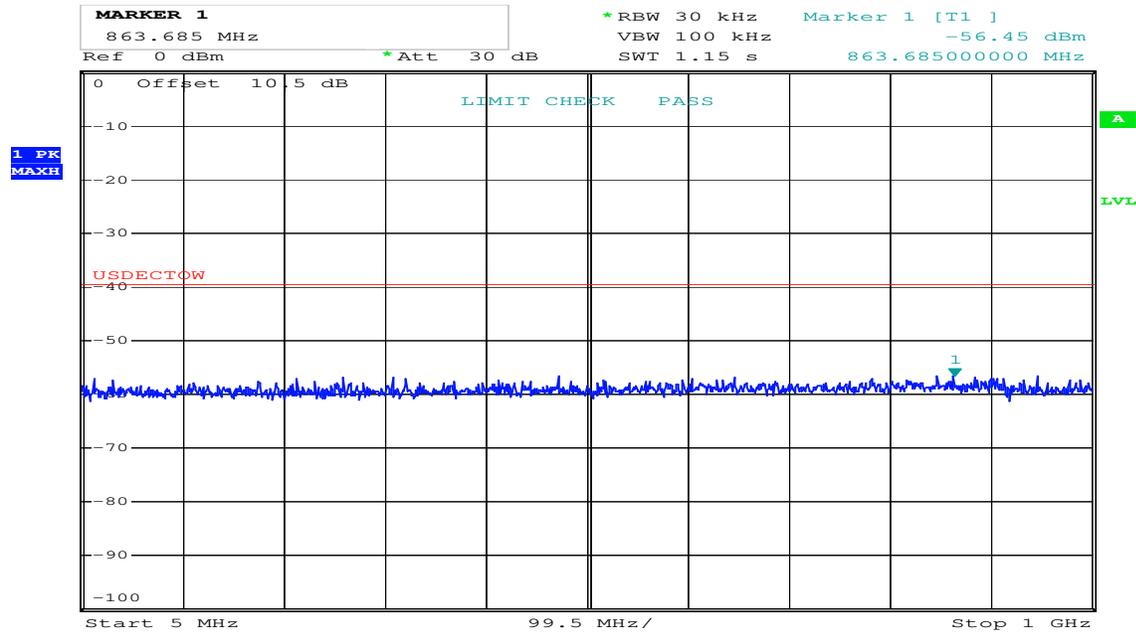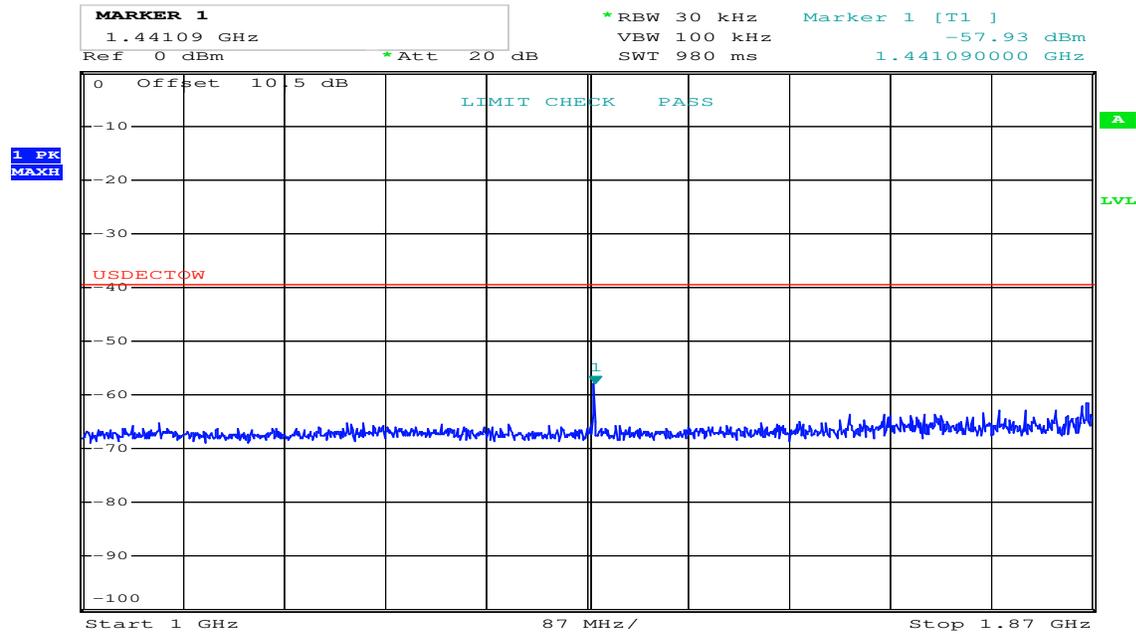
Date: 15.FEB.2018 12:08:56

Out-of-Band Emissions, Lower Channel, π/4-DQPSK
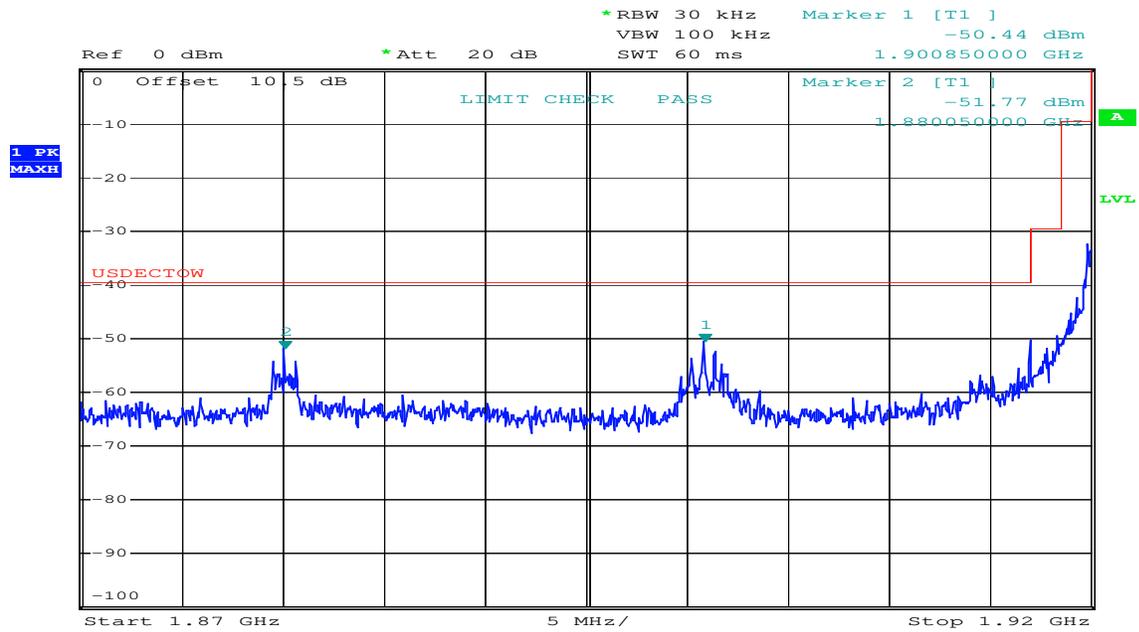
Date: 15.FEB.2018 12:02:33

Out-of-Band Emissions, Lower Channel, π/4-DQPSK
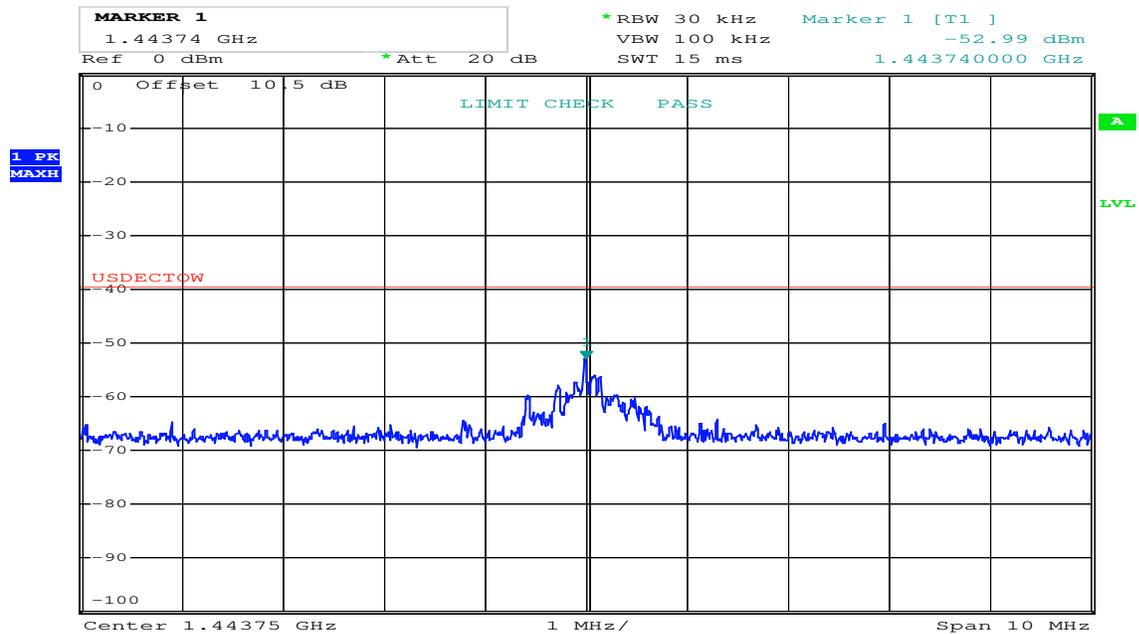

Date: 15.FEB.2018 12:10:31

Out-of-Band Emissions, Middle Channel, π/4-DQPSK
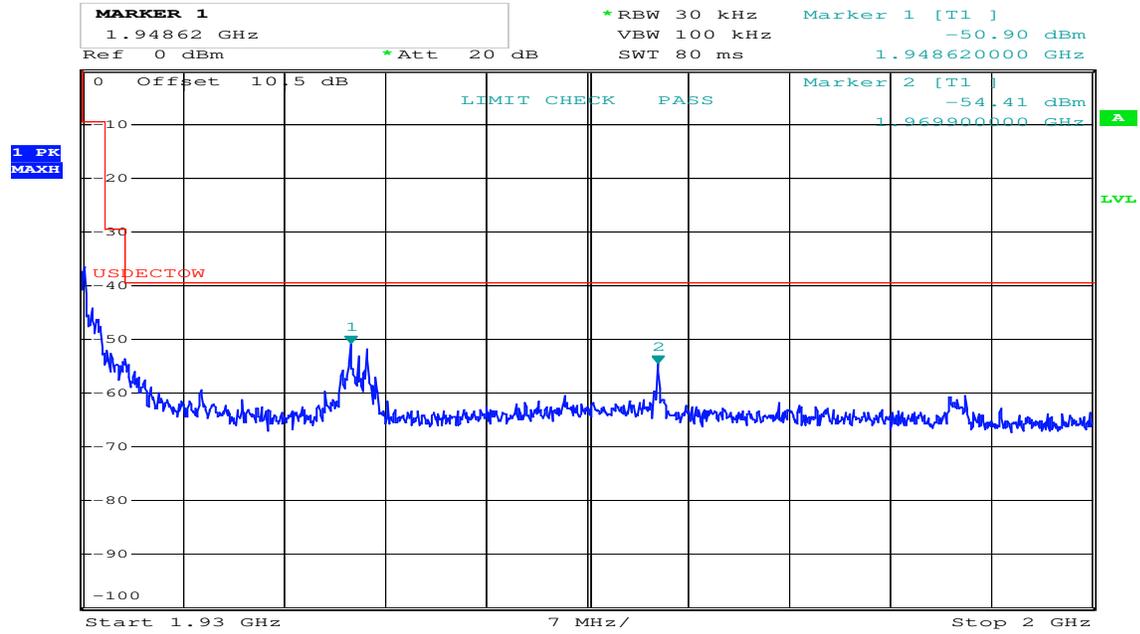
Date: 15.FEB.2018 11:42:15

Out-of-Band Emissions, Upper Channel, π/4-DQPSK
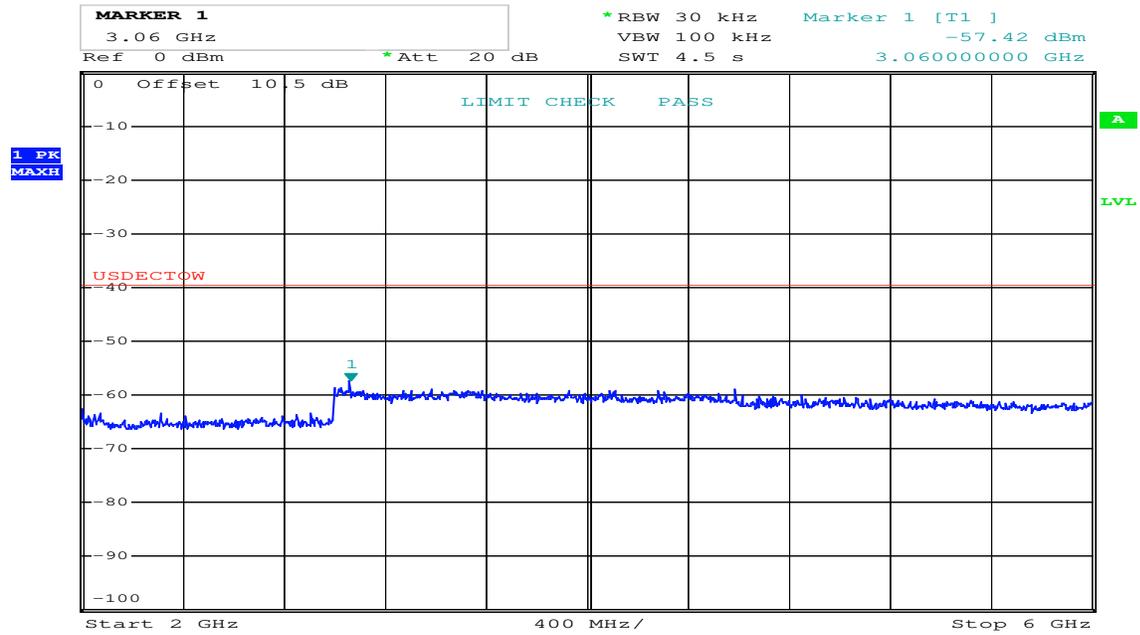
Date: 15.FEB.2018 11:04:31

Out-of-Band Emissions, Middle Channel, π/4-DQPSK

MARKER 1			*RBW 30 kHz	Marker 1 [T1]	
10.506 GHz			VBW 100 kHz	−57.92 dBm	
Ref 0 dBm		*Att 20 dB	SWT 6.8 s	10.506000000 GHz	

0   Offset   10.5 dB

LIMIT CHECK   PASS

1 PK
MAXH

USDECTOW

Start 6 GHz   600 MHz/   Stop 12 GHz

Date: 15.FEB.2018   11:31:24

MARKER 1			*RBW 30 kHz	Marker 1 [T1]	
15.24 GHz			VBW 100 kHz	−55.08 dBm	
Ref 0 dBm		*Att 20 dB	SWT 9 s	15.240000000 GHz	

0   Offset   1 dB

LIMIT CHECK   PASS

1 PK
MAXH

USDECTOU

Start 12 GHz   800 MHz/   Stop 20 GHz
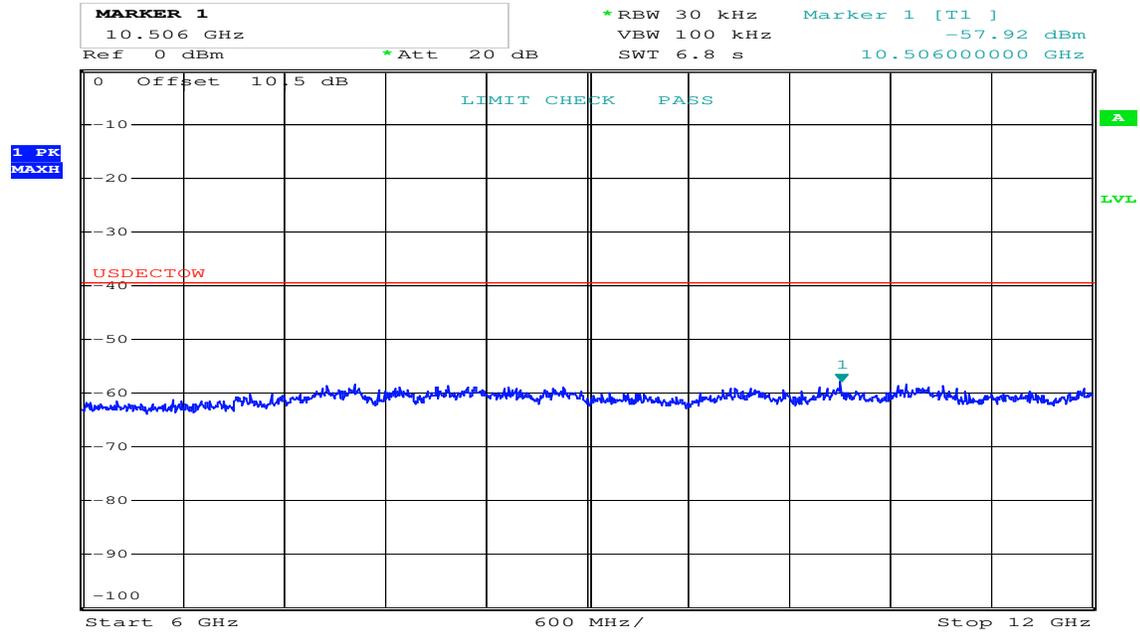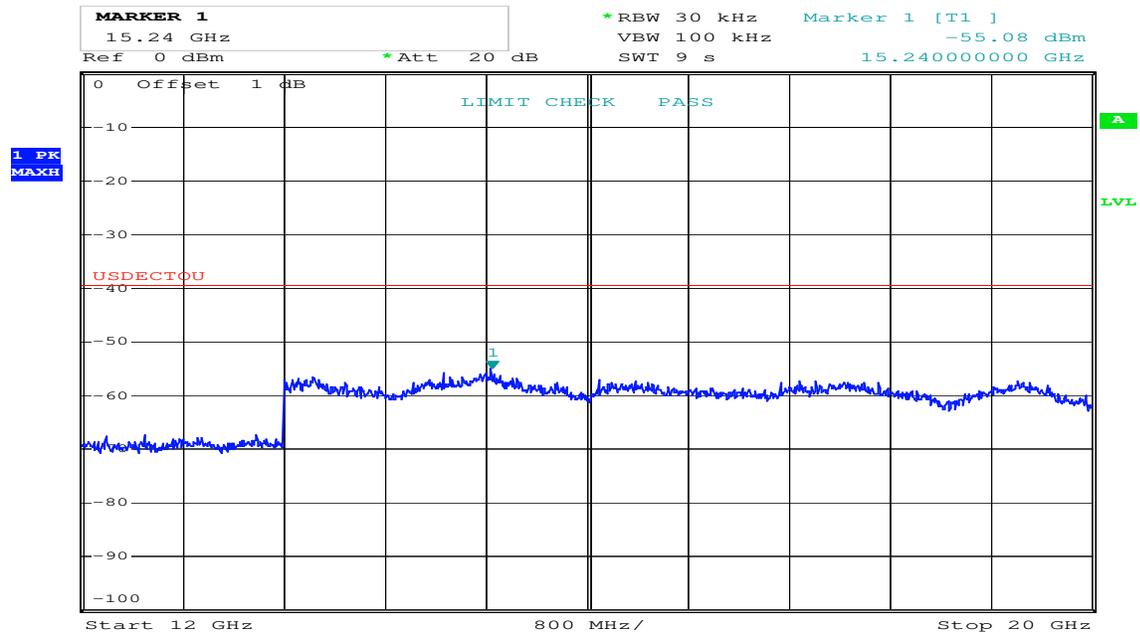
Date: 15.FEB.2018   10:43:25

Out-of-Band Emissions, Middle Channel, π/4-DQPSK

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
836.82 MHz		VBW 100 kHz	−56.21 dBm
Ref 0 dBm	*Att 30 dB	SWT 1.15 s	836.820000000 MHz

```
0   Offset  10.5 dB              LIMIT CHECK   PASS                          A

-10

1 PK
MAXH
-20
                                                                            LVL

-30

USDECTOW
-40

-50
                                                                    1

-70

-80

-90

-100
Start 5 MHz              99.5 MHz/                        Stop 1 GHz
```
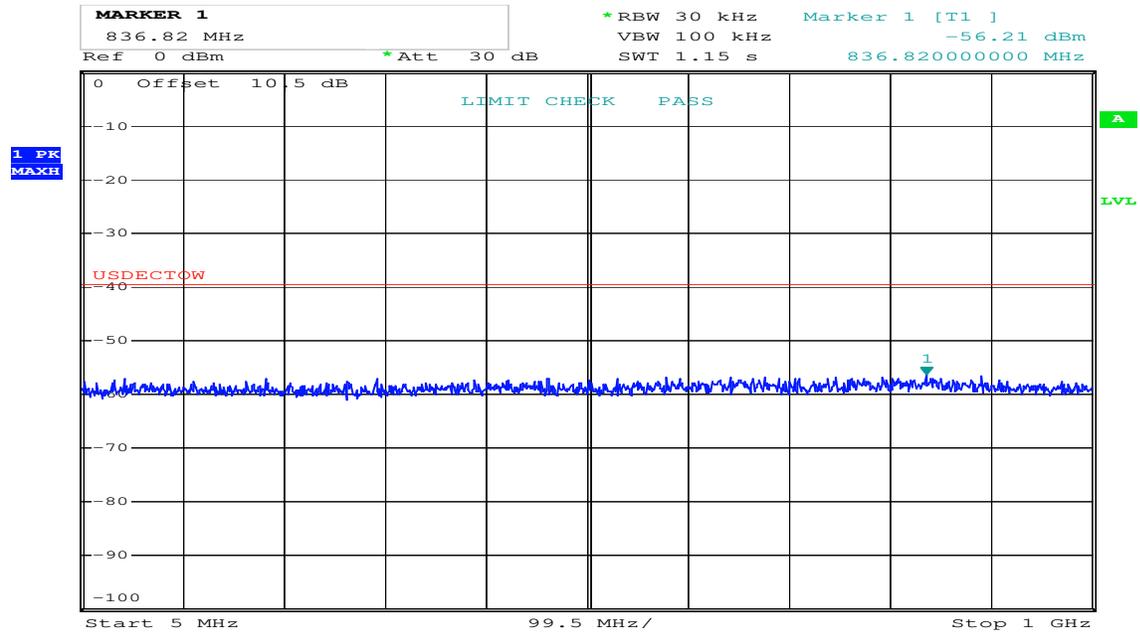
Date: 15.FEB.2018 12:15:27

Out-of-Band Emissions, Lower Channel, π/8-D8PSK
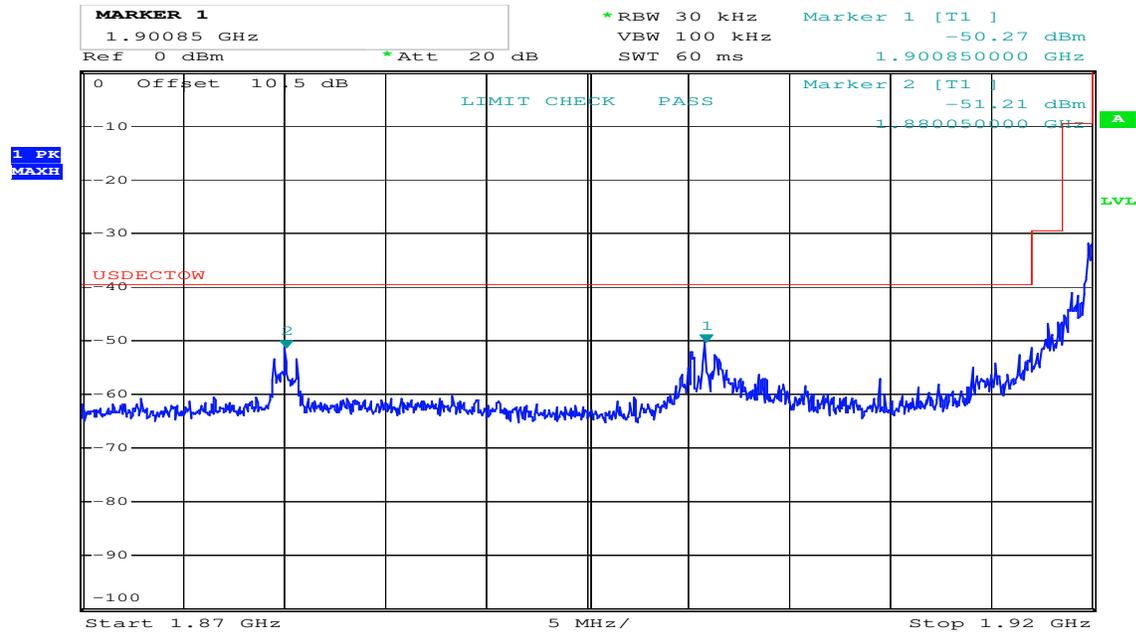
Out-of-Band Emissions, Lower Channel, π/8-D8PSK

Out-of-Band Emissions, Middle Channel, π/8-D8PSK

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
1.94855 GHz		VBW 100 kHz	−49.62 dBm
Ref 0 dBm	*Att 20 dB	SWT 80 ms	1.948550000 GHz
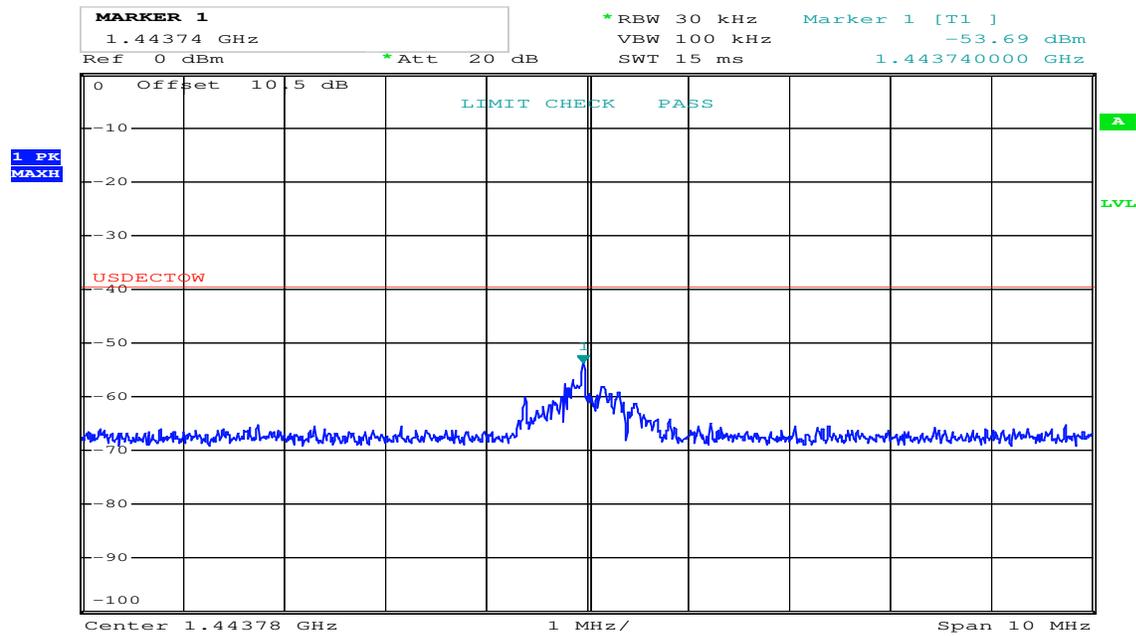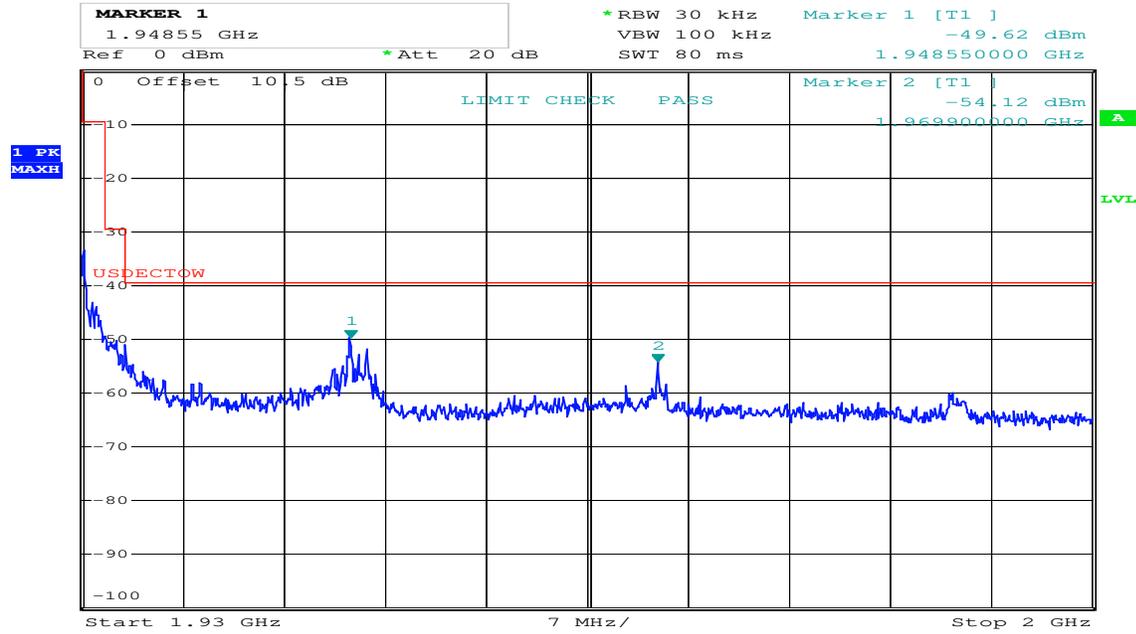
Date: 15.FEB.2018 11:53:42

Out-of-Band Emissions, Upper Channel, π/8-D8PSK

MARKER 1		*RBW 30 kHz	Marker 1 [T1]
3.032 GHz		VBW 100 kHz	−58.39 dBm
Ref 0 dBm	*Att 20 dB	SWT 4.5 s	3.032000000 GHz
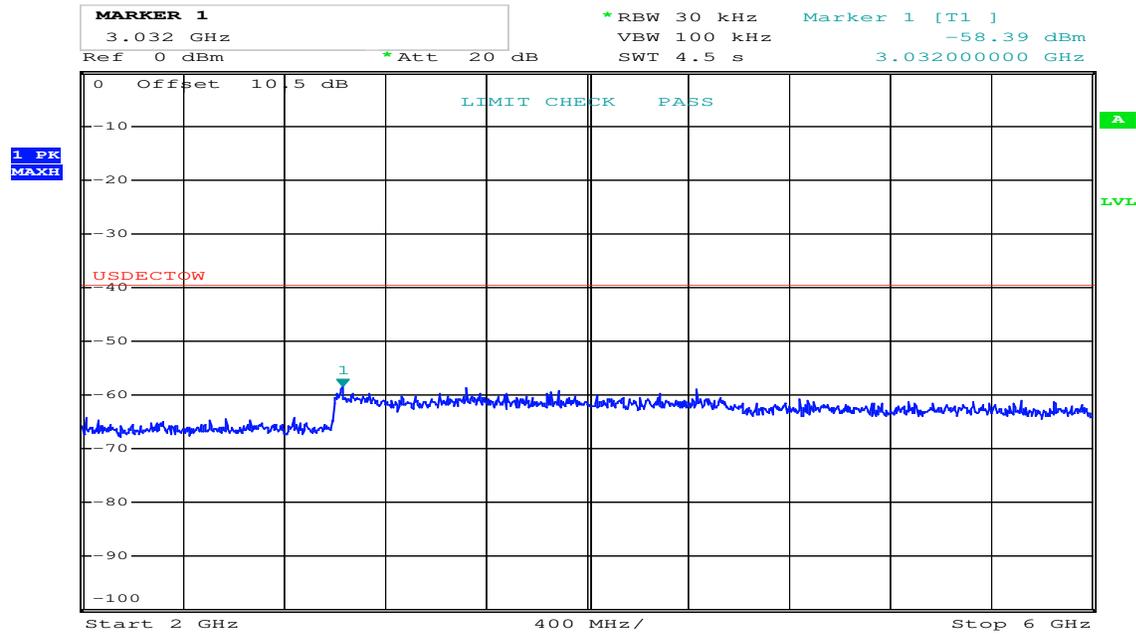
Date: 15.FEB.2018 11:05:42

Out-of-Band Emissions, Middle Channel, π/8-D8PSK

MARKER 1				
8.334 GHz		*RBW 30 kHz	Marker 1 [T1]	
Ref 0 dBm	*Att 20 dB	VBW 100 kHz		−57.36 dBm
		SWT 6.8 s		8.334000000 GHz

```
0   Offset  10.5 dB
              LIMIT CHECK   PASS                              A
-10
                                                             LVL
-20
-30
USDECTOW
-40
-50
                        1
-60
-70
-80
-90
-100
Start 6 GHz          600 MHz/              Stop 12 GHz
```

1 PK
MAXH

Date: 15.FEB.2018 11:29:02

MARKER 1				
15.192 GHz		*RBW 30 kHz	Marker 1 [T1]	
Ref 0 dBm	*Att 20 dB	VBW 100 kHz		−56.37 dBm
		SWT 9 s		15.192000000 GHz

```
0   Offset  1 dB
              LIMIT CHECK   PASS                              A
-10
                                                             LVL
-20
-30
USDECTOU
-40
-50
-60
-70
-80
-90
-100
Start 12 GHz         800 MHz/              Stop 20 GHz
```

1 PK
MAXH
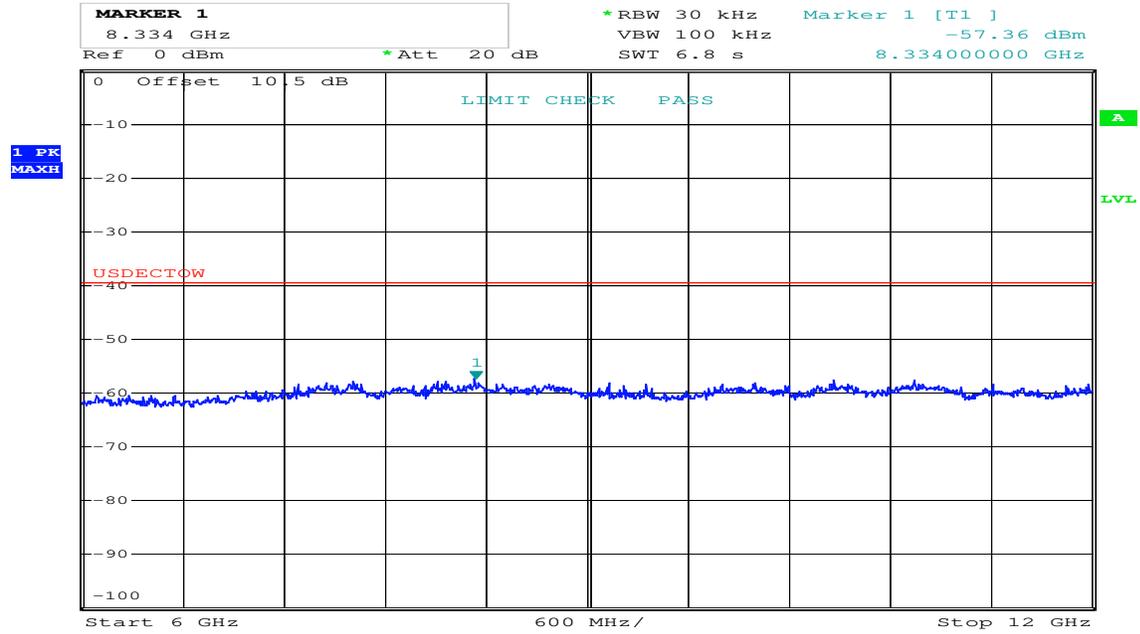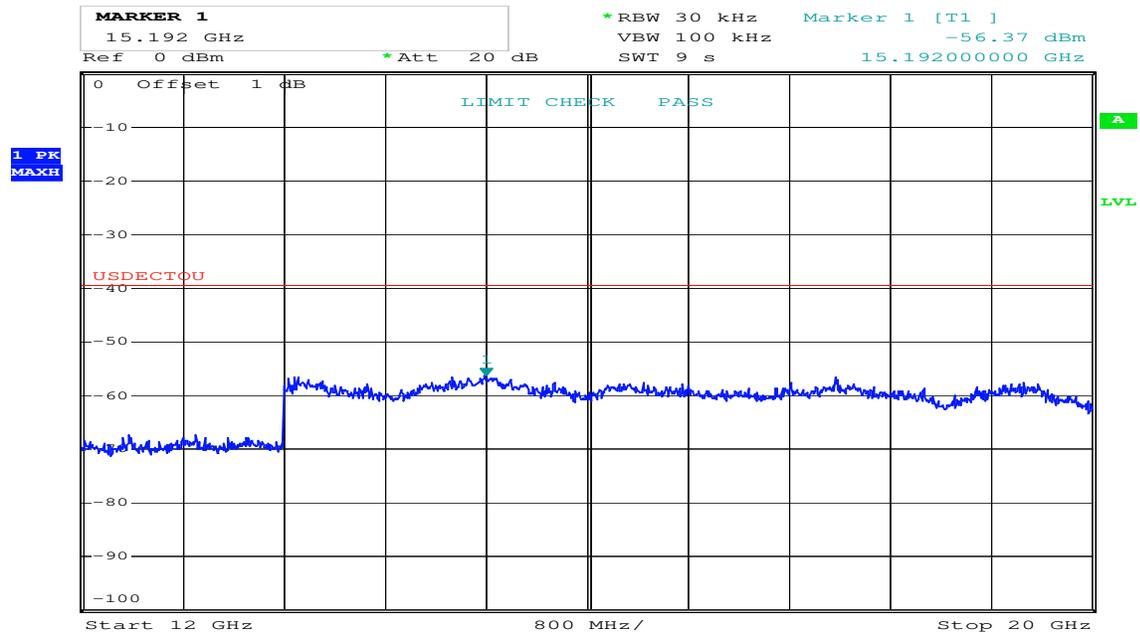
Date: 15.FEB.2018 10:46:14

Out-of-Band Emissions, Middle Channel, π/8-D8PSK

3.8 Carrier Frequency Stability

Test Method:

ANSI C63.17, clause 6.2.1.

Test Results: Complies

Measurement Data:

Long Term Frequency Stability is measured with the HP53310A Modulation Domain analyzer. The HP53310A is logged by a computer programmed to get new readings as fast as possible over the noted time period or number of readings. The peak-to-peak difference was recorded and the mean value and deviation in ppm was calculated.

The Carrier Frequency Stability over Power Supply Voltage and over Temperature is measured with a Frequency Domain Analyzer in histogram mode.

Carrier Frequency Stability over Time at Nominal Temperature

Average Mean Carrier Frequency (MHz)	Max. Diff. (kHz)	Min. Diff. (kHz)	Max. Dev. (ppm)	Limit
1925.004863	14.636	11.669	0.9	±10 ppm

Deviation ppm = ((Diff. - Mean Diff) / Mean Carrier Freq.) x 10^6

Deviation (ppm) is calculated from 3000 readings.

Frequency Stability over Power Supply Voltage at Nominal Temperature

Voltage	Measured Carrier Frequency (MHz)	Difference (kHz)	Deviation (ppm)	Limit
V_{nom}	/	0	0	
85% of V_{nom}	/	/	/	±10 ppm
115% of V_{nom}	/	/	/	

Deviation ppm = ((Mean – Measured Frequency) / Mean) x 10^6

This test does not apply for EUT that is powered from batteries.

Frequency Stability over Temperature

Temperature	Measured Carrier Frequency (MHz)	Difference (kHz)	Deviation (ppm)	Limit
T = +20 °C	1924.9897	0	0	
T = -20 °C	1924.9866	-3.1	-1.6	±10 ppm
T = +50 °C	1924.9832	-6.5	-3.4	

Deviation ppm = ((Mean – Measured Frequency) / Mean) x 10^6

3.9   Frame Repetition Stability

Test Method:

ANSI C63.17, clause 6.2.2.

Test Results: Complies

Measurement Data:

The envelope of the RF signal from the EUT is detected with a Crystal Detector and the mean and standard deviation of the frame repetition frequency is then gated over 100 frames and measured with a Frequency Domain Analyzer. The frame repetition stability is 3 times the standard deviation.

Carrier Frequency (MHz)	Mean (Hz)	Standard Deviation (µHz)	Frame Repetition Stability (ppm)
1924.992	100.000	1.490	0.045

Limit:

Frame Repetition Stability	±10 ppm (TDMA)

Ref. FCC 15.323(e), ANSI C63.17, clause 6.2.2

3.10   Frame Period and Jitter

Test Method:

ANSI C63.17, clause 6.2.3.

Test Results: Complies

Measurement Data:

The envelope of the RF signal from the EUT is detected with a Crystal Detector and the frame period and jitter is measured with a Frequency Domain Analyzer over at least 100.000 frames.

Carrier Frequency (MHz)	Frame Period (ms)	Max Jitter (µs)	3xStandard Deviation of Jitter (µs)
1924.992	10.000	-0.033	-0.031

Max Jitter = (1/ (Frame period + Pk-Pk/2)) - (1/Frame Period), when Pk-Pk and Frame Period are in Hz

3xSt.Dev.Jitter = 3x (1/(Frame Period + St.Dev) – 1/St.Dev) x 10^6

Limit:

Frame Period	20 or 10 ms
Max Jitter	25 µs
3 times St.Dev of Jitter	12.5 µs

Ref. FCC 15.323(e), ANSI C63.17, clause 6.2.3

```
(hp) Freq A      rem lsn
     acquiring data

11.97 %





50.00m%
99.99988000ℏ                    100.00008000ℏ
              1.000k samples
```
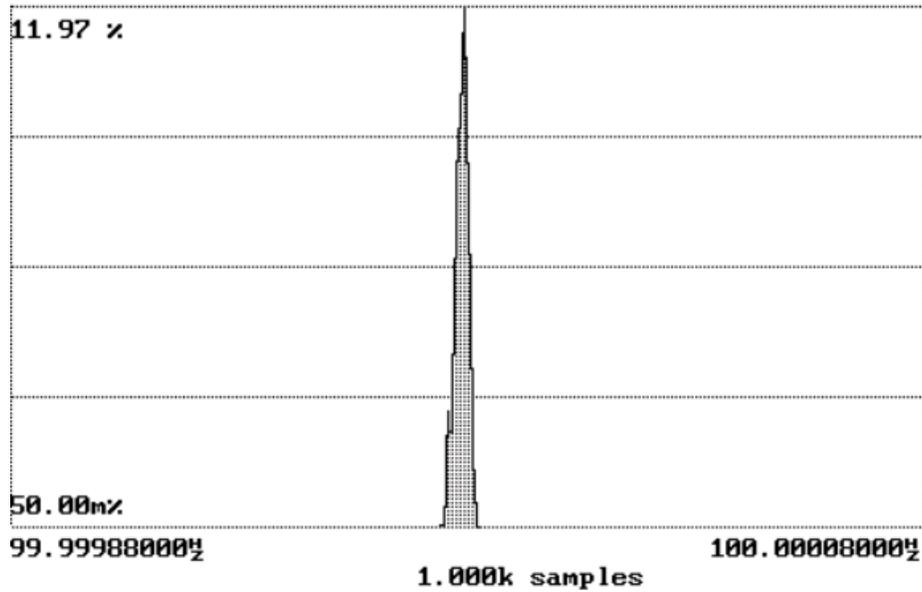
```
Mean    99.99997871115ℏ    1/Mean   10.000ms
Pk-Pk    8.46µℏ            Std Dev  1.4902µℏ
```

Frame Repetition Stability, Gated over 100 Frames

```
(hp) Freq A             tlk
     acquiring data

1.731 %





384.6µ%
99.9989800ℏ                    100.0009800ℏ
              130.000k samples
```
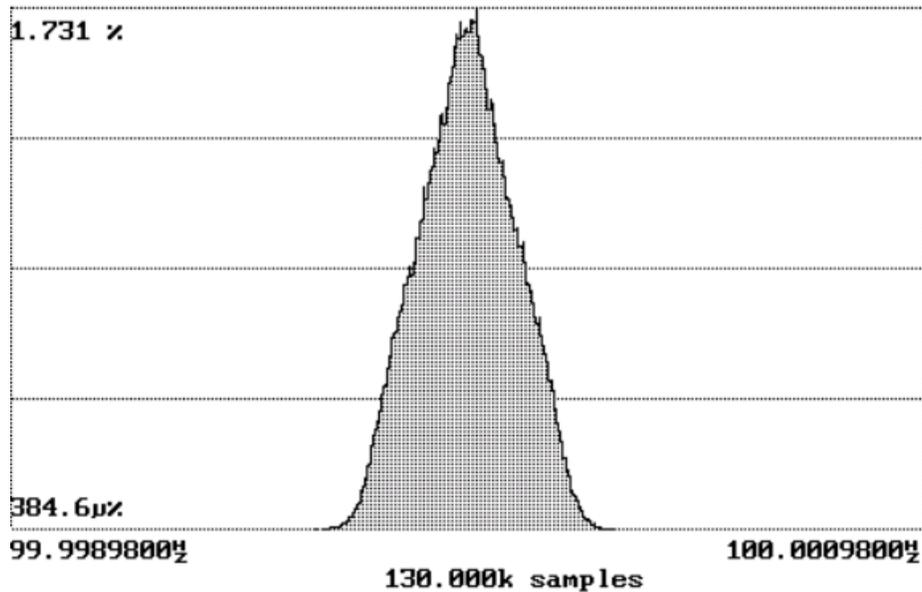
```
Mean    99.99998013232ℏ    1/Mean   10.000ms
Pk-Pk    650.3µℏ           Std Dev  104.3271µℏ
```

Frame Period and Jitter

3.11 Monitoring Threshold, Least Interfered Channel

Monitoring Threshold Limits:

Lower Threshold:

$$T_L = 15 \log B - 184 + 30 - P_{EUT} \qquad \text{(dBm)}$$

B is measured Emission Bandwidth in Hz
P_{EUT} is measured Transmitter Power in dBm

Calculated values:

	FCC 15.323, RSS-213, Issue 3
Lower Threshold	-79.3 dBm

Least Interfered Channel Procedure (LIC) may only be used by systems with more than 20 duplex system access channels. Systems with less than 20 duplex system access channels are not allowed to transmit when interferer level is above Lower Threshold.

Measurement Procedure:

Least Interfered Channel Procedure NOT used:		
Lower Threshold	N/A	The EUT uses LIC procedure

Least Interfered Channel (LIC) Procedure Test, FCC 15.323(b), (c)(2) and (c)(5)

| **ANSI C63.17 clause 7.3.2 ref.**	**Observation**	**Verdict**
b) f_1 at $T_L + U_M + 7$ dB, f_2 at $T_L + U_M$	Transmission always on f_2	**Pass**
c) f_1 at $T_L + U_M$, f_2 at $T_L + U_M + 7$ dB	Transmission always on f_1	**Pass**
d) f_1 at $T_L + U_M + 1$ dB, f_2 at $T_L + U_M - 6$ dB	Transmission always on f_2	**Pass**
e) f_1 at $T_L + U_M - 6$ dB, f_2 at $T_L + U_M + 1$ dB	Transmission always on f_1	**Pass**

Selected Channel Confirmation, FCC 15.323(c)(1) and (5)

ANSI C63.17 clause 7.3.3	Observation	Verdict
b) Shall **not** transmit on f_1	EUT transmits on f_2	**Pass**
d) Shall **not** transmit on f_2	EUT transmits on f_1	**Pass**

Limits:

	FCC 15.323, RSS-213, Issue 3
Lower Threshold + 6 dB margin	-73.3 dBm


```
DELTA MARKER 2                        RBW  300 kHz     Delta 2 [T1 ]
  3.071923077 s                       VBW  1 MHz                  29.89 dB
Ref   0 dBm              * Att   10 dB  SWT  10 s               3.071923 s
                                                Marker 1 [T1 ]
 0                          2                              -37.33 dBm
                                                          517.820513 ms    A
 -10
                                                                          SGL
1 PK *
CLRWR
 -20

 -30

 -40
    1
 -50

 -60

 -70

 -80

 -90

 -100
      Center 1.924992 GHz                        1 s/
```
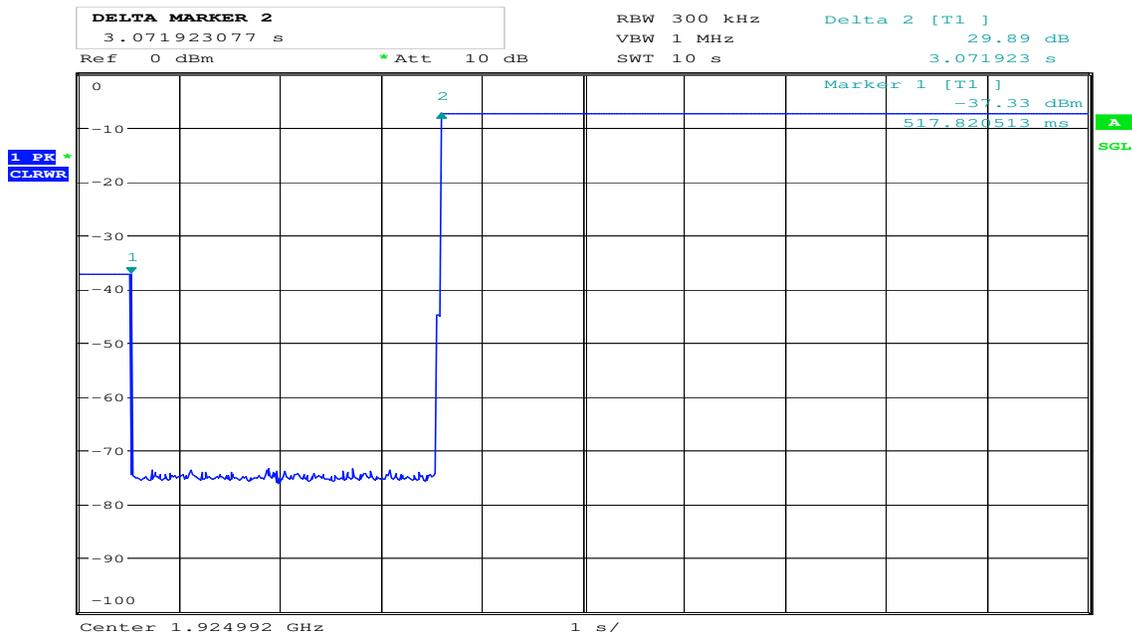
Date: 14.FEB.2018 14:26:15

7.3.4 Selected Channel Confirmation, Connection 3.1s After Interferer Removed

3.12 Threshold Monitoring Bandwidth

This test is only required if a dedicated monitoring receiver is used. However, if the test is not carried out the manufacturer shall declare and provide proper evidence that the monitoring is made through the radio receiver used for communication.

Measurement Procedure:

Simple Compliance Test, ANSI C63.17, clause 7.4.1

More Detailed Test, ANSI C63.17, clause 7.4.2

The test is passed if **either** the Simple Compliance Test or the More Detailed test is passed.

During this test the spectrum analyzer is observed visually to see if the EUT transmits or not.

Test Results:

Test performed	Observation	Verdict
Simple Compliance test, at ±30% of *B*	N/A	N/A
More Detailed Test, at -6 dB points	N/A	**N/A**
More Detailed Test, at -12 dB points	N/A	**N/A**

The more detailed test must be pass at both the -6 and -12 dB points if the Simple Compliance test fails.

Comment: The manufacturer declares that the tested EUT uses the same receiver for monitoring and communication, this test is therefore not required.

Limits, FCC 15.323(c)(7):

The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission.

3.13   Reaction Time and Monitoring Interval

Measurement Procedure

ANSI C63.17, clause 7.5

Test results:

By administrative commands and out-of-operating region interference, the EUT is restricted to operate on two RF carrier frequencies.

A CW interferer signal at a level T_L is applied on f_1 and time-synchronized pulsed interference at a level $T_L + U_M$ dB is applied on f_2. The level on f_2 was raised 6 dB for part d) with 35 µs pulses.

The pulses are synchronized with the EUT timeslots and applied centered within all timeslots.

For both tests the test is passed if the EUT transmits on f_1.

Pulse Width, ref. to ANSI C63.17 clause 7.5	Observation	Verdict
c) > largest of 50 µs and 50*SQRT(1.25/B)	EUT transmits on f_1	**Pass**
d) > largest of 35 µs and 35*SQRT(1.25/B), and with interference level raised 6 dB	EUT transmits on f_1	**Pass**

Comment: Since B is larger than 1.25 MHz the test was performed with pulse lengths of 50 µs and 35 µs.

Limits, FCC 15.323(c)(1), (5) and (7)

The maximum reaction time must be less than 50xSQRT (1.25/emission bandwidth in MHz) microseconds for signals at the applicable threshold level but shall not be required to be less than 50 µs.

If a signal is detected that is 6 dB or more above the applicable threshold level, the maximum reaction time shall be 35xSQRT (1.25/emission bandwidth in MHz) microseconds but shall not be required to be less than 35 µs.

```
RESOLUTION BANDWIDTH              RBW  1 MHz
   1 MHz                          VBW  3 MHz
Ref   0 dBm          * Att  10 dB  SWT 10 ms
```

Date: 14.FEB.2018 14:30:40

50 µs Pulses

```
SWEEP TIME                        RBW  1 MHz
  10 ms                           VBW  3 MHz
Ref   0 dBm          * Att  10 dB  SWT 10 ms
```
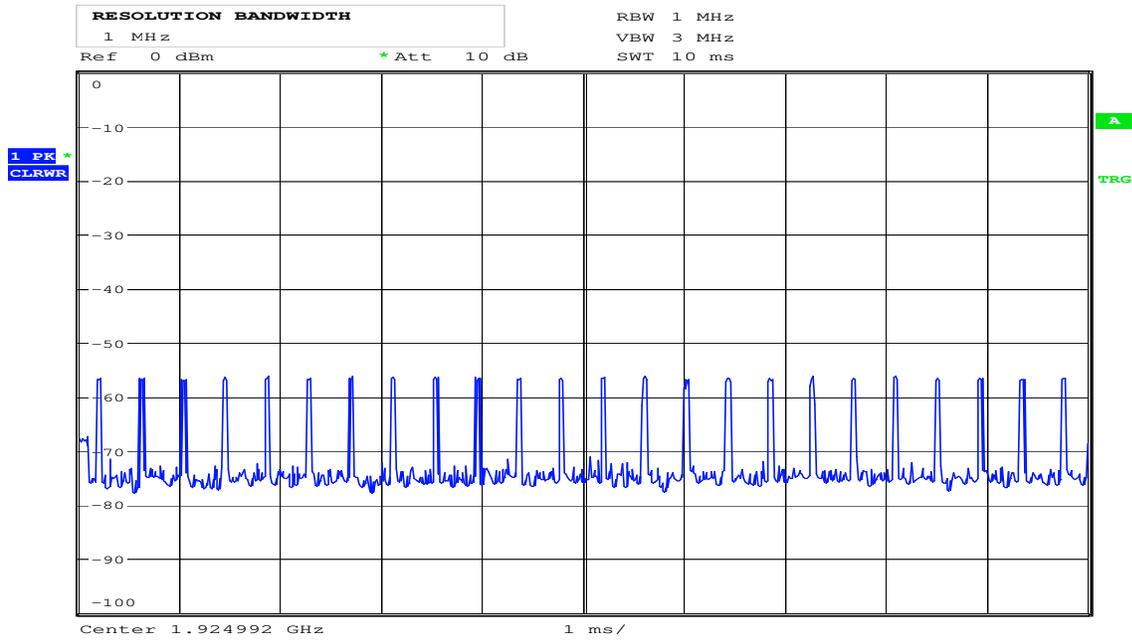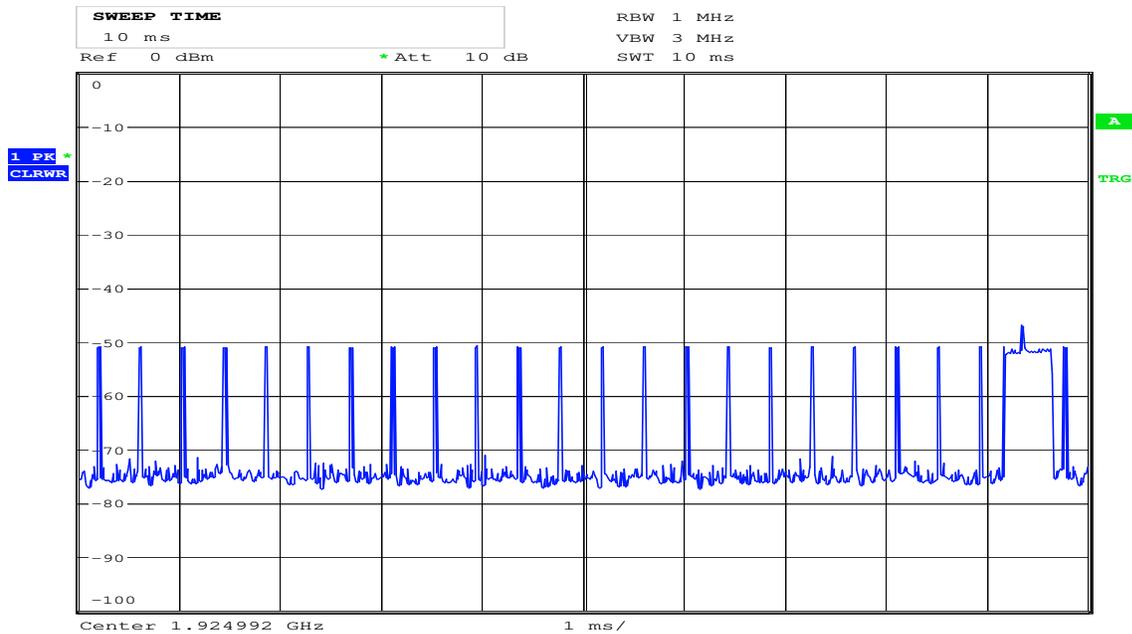
Date: 14.FEB.2018 14:33:46

35 µs Pulses

3.14   Time and Spectrum Window Access Procedure

This requirement is only for EUTs which transmit unacknowledged control and signaling information.

Measurement Procedure:

Timing for EUTs using control and signaling channel type transmissions: ANSI C63.17, clause 8.1

Test results:

Access Criteria, ref. to ANSI C63.17 clause 8.1.1	Observation	Verdict
b) Check that the EUT transmits on the interference free time-slot	N/A	**N/A**
b) The EUT must terminate or pause in its repetitive transmission of the control and signalling channel on the open channel to repeat the access criteria not less frequently than every 30 s	N/A	**N/A**

If FCC 15.323(c)(6) option, **If Random Waiting Interval is NOT implemented**

Access Criteria, ref. to ANSI C63.17 clause 8.1.2	Observation	Verdict
b) Check that the EUT changes to an interference-free slot when interference is introduced on the time slot in use	N/A	**N/A**

If FCC 15.323(c)(6) option, **Only if Random Waiting Interval is implemented**

Access Criteria, ref. to ANSI C63.17 clause 8.1.3	Observation	Verdict
b-d) Check that the EUT uses random waiting interval before continuing transmission on an interfered time slot	N/A	**N/A**

Comment: The tested EUT does not transmit unacknowledged control and signaling information.

Limits:

FCC 15.323(c)(4):

Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease. Periodic acknowledgements must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signaling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which time the access criteria must be repeated.

FCC 15.323(c)(6):

If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available

3.15 Acknowledgements and Transmission Duration

Measurement Procedure:

Acknowledgements: ANSI C63.17, clause 8.2.1

Transmission Duration: ANSI C63.17, clause 8.2.2

During the test **Initial transmission without acknowledgements** the signal from the EUT to the companion device is blocked by circulators in addition to the tunable attenuator.

The test **Transmission time after loss of acknowledgements** is performed by cutting-off the signal from the companion device by a RF switch and measuring the time until the EUT stops transmitting.

The **Transmission Duration** test is performed by monitoring the slot in use and measuring the time until the EUT changes to a different slot.

Test Results:

Acknowledgements

Test ref. to ANSI C63.17 clause 8.2.1	Observation	Verdict
a) Initial transmission without acknowledgements	0.001 sec	**Pass**
c) Transmission time after loss of acknowledgements	5.0 sec	**Pass**

Transmission Duration

| Test ref. to ANSI C63.17 clause 8.2.2	Observation	Verdict
b) Transmission duration on same time and frequency window	4.0 hours	**Pass**

Comment: /

Limits, FCC 15.323(c)(3) and (4)

Occupation of the same combined time and spectrum windows by a device or group of cooperating devices continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within one second or transmission must cease.

Periodic acknowledgements must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signaling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which time the access criteria must be repeated.
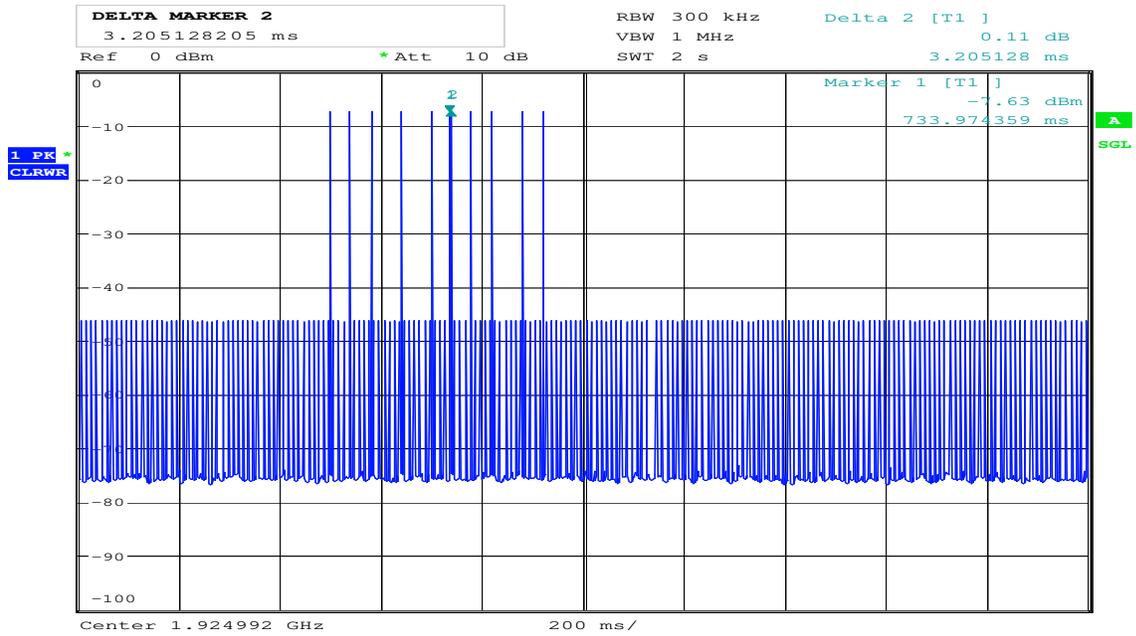
Date: 14.FEB.2018   13:58:19

8.2.1a) Initial Transmission Without Acknowledgements
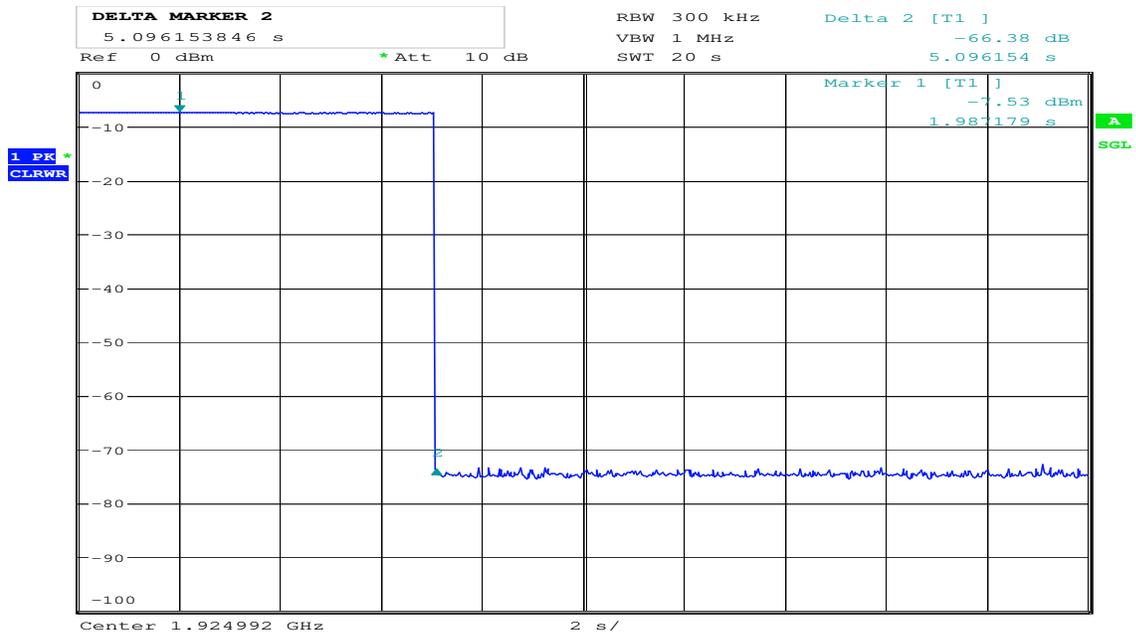
Date: 14.FEB.2018   13:54:48

8.2.1c) Transmission Time After Loss of Acknowledgements

3.16   Dual Access Criteria Check

Measurement Procedure:

EUTs that does not implement the LIC procedure: ANSI C63.17, clause 8.3.1

EUTs that implement the LIC procedure: ANSI C63.17, clause 8.3.2

This test is required for equipment that uses the access criteria in FCC 15.323(c)(10).

Test Results:

EUTs that do NOT implements the LIC procedure:

| Test ref. to ANSI C63.17 clause 8.3.1	Observation	Verdict
b) EUT is restricted to a single carrier f_l for TDMA systems. The Test is Pass if EUT can transmit	N/A	**N/A**
c) d) Interference at level $T_L + U_M$ on all timeslots except one **receive** slot where interference is at least 10 dB below T_L	N/A	**N/A**
e) f) Interference at level $T_L + U_M$ on all timeslots except one **transmit** slot where interference is at least 10 dB below T_L	N/A	**N/A**

EUTs that implements the LIC procedure:

| Test ref. to ANSI C63.17 clause 8.3.2	Observation	Verdict
b) EUT is restricted to a single carrier f_l for TDMA systems. The Test is Pass if EUT can transmit	EUT can transmit	**Pass**
c) d) Transmission on interference-free **receive** time/spectrum window	EUT transmits on interference free **receive** slot	**Pass**
e) f) Transmission on interference-free **transmit** time/spectrum window	EUT transmits on interference free **transmit** slot	**Pass**

Comment: See plots.

Limits, FCC 15.323(c)(10)

An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the intended transmit time and spectrum window. If the power detected by the responding device can be decoded as a duplex connection signal from the initiating device, then the responding device may immediately begin transmitting on the receive time and spectrum window monitored by the initiating device.
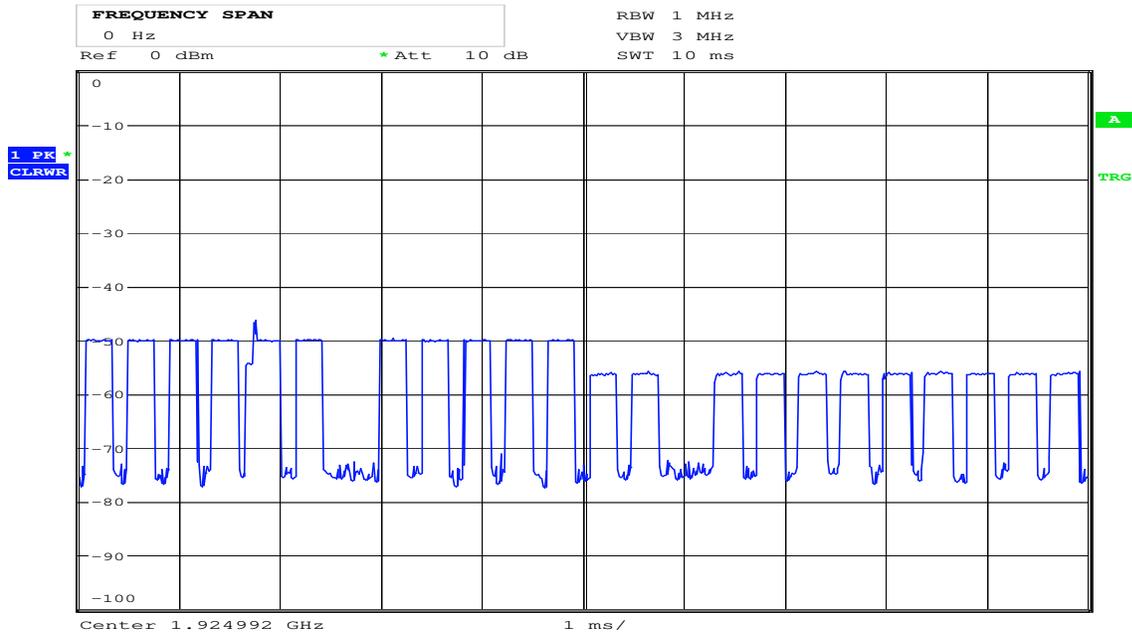
Date: 14.FEB.2018 14:42:04

**8.3.2c) EUT Transmits on Interference Free RECEIVE Slot, BEFORE**
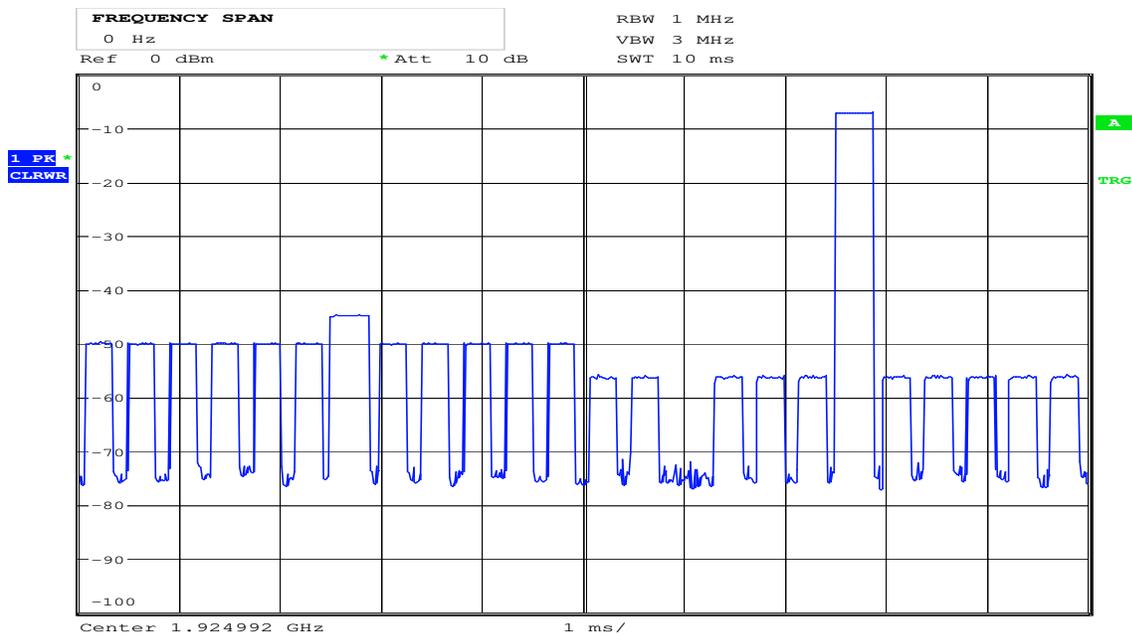
Date: 14.FEB.2018 14:43:11

8.3.2d) EUT Transmits on Interference Free RECEIVE Slot, AFTER
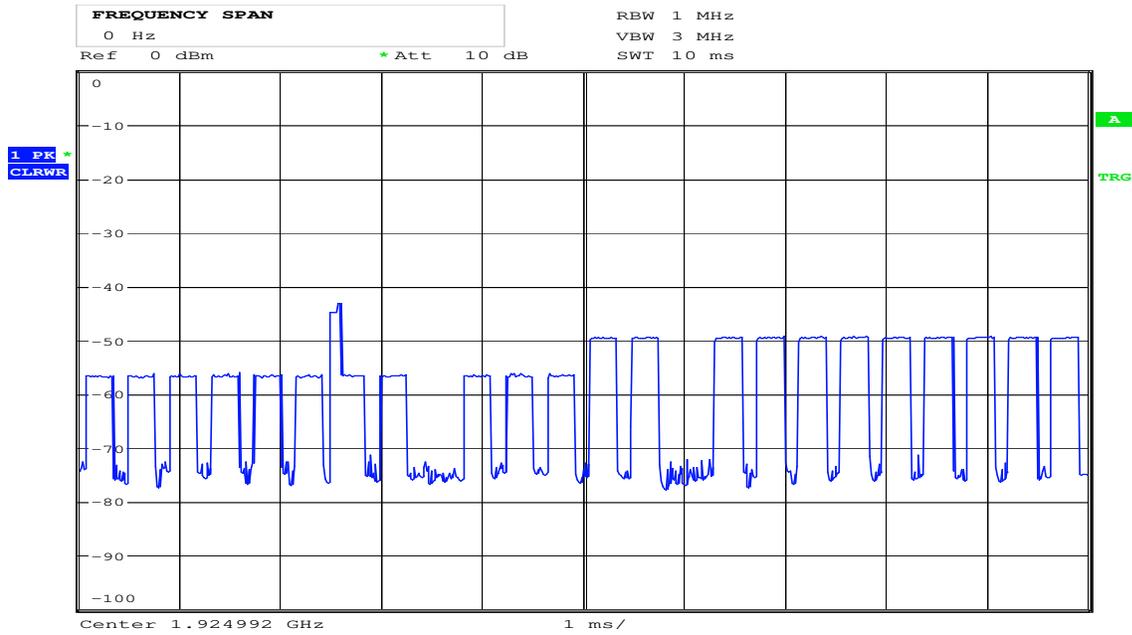
Date: 14.FEB.2018   14:44:39

8.3.2e) EUT Transmits on Interference Free TRANSMIT Slot, BEFORE
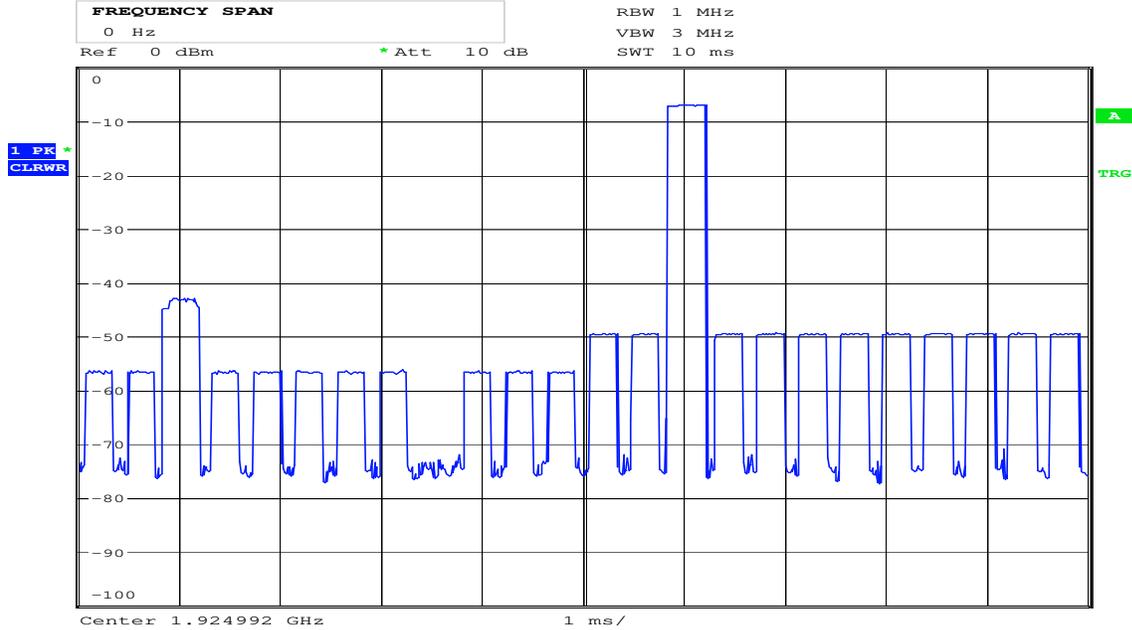
Date: 14.FEB.2018   14:45:04

8.3.2f) EUT Transmits on Interference Free TRANSMIT Slot, AFTER

3.17   Alternative Monitoring Interval

Test procedure described in ANSI C63.17 clause 8.4.

This test is required if the EUT implements the provisions of FCC 15.323(c)(11).

Test result:

Not Tested. The tested EUT does not implement this provision. See manufacturers' declaration.

4   Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		**Uncertainty**
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted (RBW < 100 kHz)	**< 3.6 GHz**	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	**< 1 GHz**	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	**Frequency**	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Timing and Jitter Measurements		±2.0 ns
Frame Timing Measurements		±1.4 ppm
Receiver Blocking Levels		±1.0 dB
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 Test Setups

5.1 Frequency Measurements

Test Set-up 1

This setup is used for measuring Carrier frequency stability at normal and extreme temperatures.

5.2 Timing Measurements
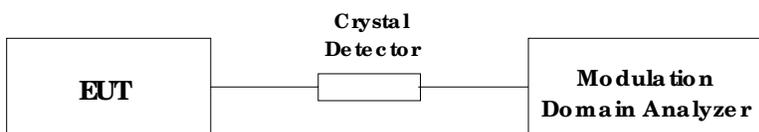
Test Set-up 2

This setup is used for measuring Frame repetition stability, Frame period and Jitter.

5.3 Conducted Emission Test
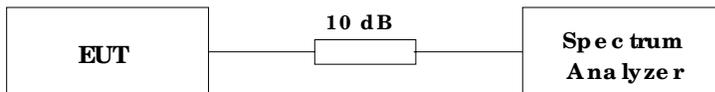
Test Set-up 3

This setup is used for all conducted emission tests.

5.4 Power Line Conducted Emissions Test
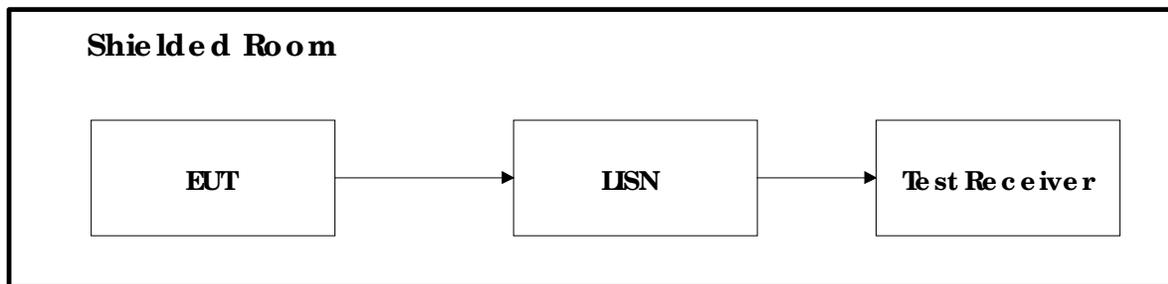
Test Set-Up 5

5.5   Monitoring Tests
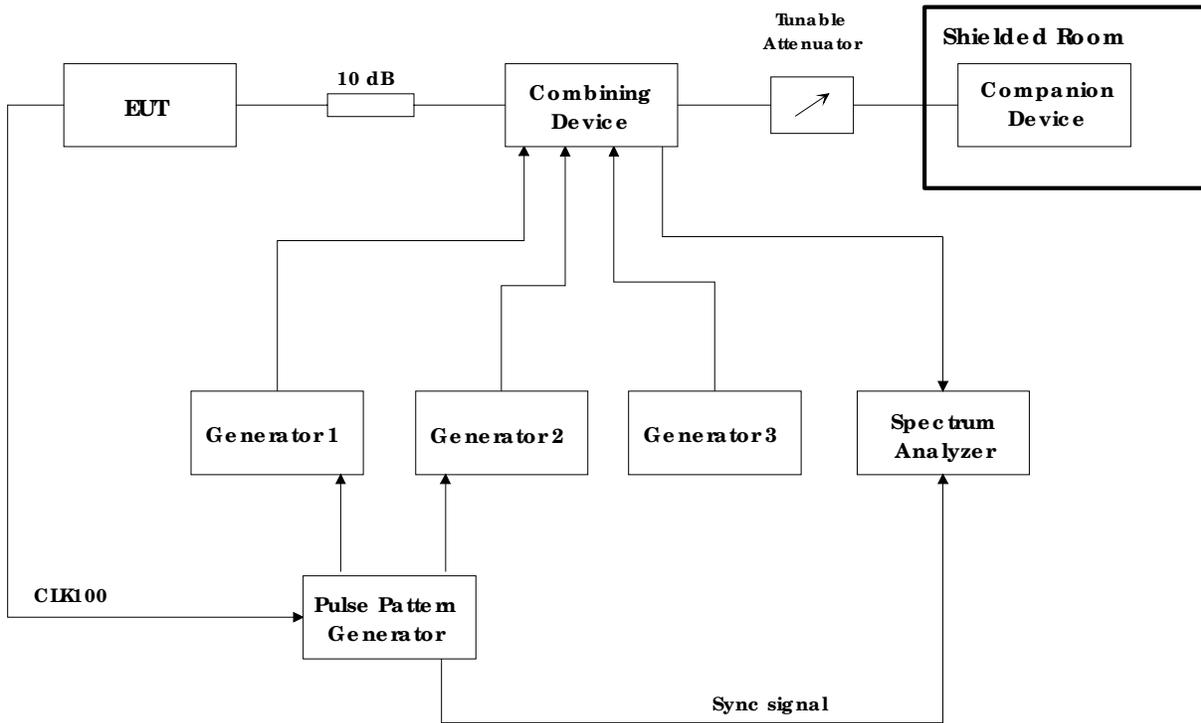
Test Set-Up 6

This test setup is used for all Monitoring and Time and Spectrum Access Procedure tests. The path loss from the signal generators to the EUT is measured with a power meter before the testing is started.

The CLK100 is used to synchronize the Pulse-/ Pattern generator to the start of the DECT frame, this signal always comes from the base station. If the EUT is a DECT Portable Part (i.e. a handset) the CLK100 signal will come from the Companion Device.

The sync signal to the Spectrum Analyzer is the CLK100 signal that is regenerated in the Pulse-/ Pattern Generator, this is used to synchronize the Spectrum Analyzer to the DECT frame when in zero span. The Pulse-/ Pattern Generator is used for tests that require time synchronized pulses or blocking of specific time slots.

6 Test Equipment Used

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Testhouse.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSP30	Spectrum Analyzer	Rohde & Schwarz	LR 1551	2017.06	2019.06
2	SMIQ06B	Signal generator	Rohde & Schwarz	SN: 100481	2017.08	2018.08
3	SMIQ03E	Signal generator	Rohde & Schwarz	FA001269	2016.04	2018.04
4	SMR40	Signal generator	Rohde & Schwarz	FA001879	COU	
5	53310A	Modulation Domain Analyzer	Hewlett Packard	LR 1483	COU	
6	81110A	Pulse-/ Pattern Generator	Agilent	LR 1725	COU	
7	8470B	Crystal Detector	Hewlett Packard	LR 1207	N/A	
8	6810.17B	Attenuator	Suhner	LR 1669	COU	
9	745-69	Step Attenuator	Narda	LR 1442	N/A	
10	WE 1506A	Power Splitter	Weinchel	LR 244	COU	
11	WE 1506A	Power Splitter	Weinchel	LR 245	COU	
12	H-9	Hybrid	Anzac	LR 86	COU	
13	H-9	Hybrid	Anzac	LR 257	COU	
14	S212DS	RF Switch	Narda	LR 1244	N/A	
15	87H35-1	Circulator	Racal-MESL	s.no.: 140	N/A	
16	87H35-1	Circulator	Racal-MESL	s.no.: 141	N/A	
17	87H35-1	Circulator	Racal-MESL	s.no.: 142	N/A	
18	ESU26	Receiver/spectrum analyzer	Rohde & Schwarz	FA002043	2018.01	2019.01
19	ENV216	LISN	Rohde & Schwarz	FA002023	2017.05	2018.05
20	ST18/SMA/N/36	RF Cable	Suhner	LR 1630	COU	

Note: COU – calibrate on use; N/A – Not Applicable

The software listed below has been used for one or more tests.

No.	Manufacturer	Name	Version	Comment
1	Agilent	Intuitlink Data Capture	2.1.0	Screenshots from HP 53310A
2	Rohde & Schwarz	EMC 32	9.26.01	Software for EMC Measurements of Power-Line Conducted Tests

Revision history

Version	Date	Comment	Sign
1.0	2018.03.06	First edition	FS