Radio Test Report

Report No.: RJ190906C18-3

Test Model: M3IETW2 R

Received Date: Sep. 06, 2019

Test Date: Oct. 03 ~ Oct. 05, 2019

Issued Date: Oct. 17, 2019

Applicant: Sennheiser electronic GmbH & Co. KG

Address: Am Labor 1, D-30900 Wedemark, Germany

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

Test Location: No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN

Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
RJ190906C18-3	Original release	Oct. 17, 2019

1 Certificate of Conformity

Product:	MOMENTUM True Wireless 2 (M3IETW2)
Brand:	SENNHEISER
Test Model:	M3IETW2 R
Sample Status:	Engineering sample
Applicant:	Sennheiser electronic GmbH & Co. KG
Test Date:	Oct. 03 ~ Oct. 05, 2019
Standards:	ARIB STD-T66 (V3.7), MIC notice 88 Appendix 43 Article 2 Paragraph 1 of Item 19

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Celine Chou , **Date:** Oct. 17, 2019

Celine Chou / Senior Specialist

Approved by : Bruce Chen , **Date:** Oct. 17, 2019

Bruce Chen / Senior Project Engineer

2 Summary of Test Results

The EUT has been tested according to the following specifications:

Notice 88 Appendix 43 Reference	ARIB STD-T66 Ref.	Report Reference	Parameter	Test Results (Note)
General Provisions				
C	3.2 (4)	4.1	Frequency tolerance	C
D	3.2 (7)	4.2	Occupied bandwidth	C
E	3.2 (6)	4.4	Spurious emissions	C
Transmitting Equipment				
F	--	4.5	Antenna power	C
--	--	--	SAR	NA
Transmitting Antenna				
--	--	3.4	Type, configuration, etc. of transmitting antenna	C
--	--	3.5	Direction pattern of transmitting antenna	C
Receiving Equipment				
G	3.3 (1)	4.6	Spurious emissions of receiver	C
--	--	3.5	Refer to all articles for transmitting antenna	C
Operating Frequency 2400 to 2483.5MHz				
--	3.7 (1)	3.4	High Frequency/modulation section cannot be opened easily	C
--	3.1 (1)	3.1	Communication method	C
--	3.2 (1)a	3.1	Modulation method	C
--	3.2 (1)a	3.1	Spread spectrum method	C
--	3.2 (2)	4.5	Antenna power	C
--	3.6 (2)	4.5	Absolute gain of transmitting antenna	C
--	3.6 (2)	--	Angular width of principal radiation (AWPR)	NA
--	3.2 (10)	--	Number of carriers within 1 MHz bandwidth in OFDM	NA
--	3.2 (8)	4.3	Spreading bandwidth	C
--	3.2 (9)	4.3	Spreading factor	C
--	3.2 (11)	4.7	Frequency retention time (FH employed)	NA
--	3.4.1(1)	4.8	Interference Prevention Function	C
--	3.4.1(3)	--	Carrier Sense Capability	NA

Note:
1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

C = Conform NC = Not Conform NT = Not Tested NA = Not Applicable

2.1 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration	Calibration Authority	Cal. Method
Spectrum Analyzer / Rohde & Schwarz	FSV40	100980	Apr. 23, 2019	Apr. 22, 2020	ETC	c)
Signal Generator / Anritsu	E4438C	MY49071692	Oct. 15, 2018	Oct. 14, 2019	ETC	c)
Power Meter / Anritsu	ML2495A	1232003	Dec. 25, 2018	Dec. 24, 2019	ETC	c)
Power Sensor / Anritsu	MA2411B	1207333	Dec. 25, 2018	Dec. 24, 2019	ETC	c)
Power Splitter/ Agilent	11667B	52805	NA	NA	NA	d)
Power Splitter / Agilent	11667B	11628	NA	NA	NA	d)
DC Power Supply / Topward	6306A	727263	NA	NA	NA	d)
True RMS Clamp Meter / Fluke	325	31130711WS	May 21, 2019	May 20, 2020	Electronics Testing Center Taiwan	c)

Note: Calibration Method
a)：Calibration conducted by the National Institute of Information and Communications Technology～NICT～ or a designated calibration agency under Article 102-18 paragraph (1)～ TELEC EngeneeringCenter, Intertek Japan K.K., Keysight Technologies, Inc～.
b)：Correction conducted pursuant to the provisions of Article 135 or Article 144 of the MeasurementLaw (Law No. 51 of 1992)～Japan Calibration Service Syste～
c)：Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted bythe NICT or a designated calibration agency under Article 102-18 paragraph (1)～ TELEC EngeneeringCenter, Intertek Japan K.K., Keysight Technologies, Inc～.
d)：Calibration conducted by using other equipment that listed above from a) to c)

2.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in TR 100 028-1.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Parameter	Uncertainty
Occupied Bandwidth	491.896Hz
Spurious emissions	2.208dB
Output power density	2.889dB
Out of band radiated power	3.93dB
Frequency Tolerance	6805.18Hz

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.3 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	MOMENTUM True Wireless 2 (M3IETW2)
Brand	SENNHEISER
Test Model	M3IETW2 R
Status of EUT	Engineering sample
Nominal Voltage	5Vdc (from USB interface) 3.7Vdc (from battery) (a) earbuds: 55~60mAh (b) charging case: 600~700mAh
Modulation Type	GFSK, π /4-DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	1Mbps (BDR) & 2Mbps/3Mbps (EDR)
Operating Frequency	2402 ~ 2480MHz
Number of Channel	79
Rated RF Output Power Density	Refer to note 3
Conducted RF Output Power Density	Refer to note 3
Radiated RF Output Power Density	Refer to note 3
Antenna Type	Refer to note 2
Antenna Connector	Refer to note 2
Accessory Device	Refer to note 1
Data Cable Supplied	0.2m shielded USB cable without core

Note:

1. The EUT system MOMENTUM True Wireless 2 (M3IETW2) contain the following devices:

Item	Brand	Device Model
Right Earbud	SENNHEISER	M3IETW2 R
Left Earbud	SENNHEISER	M3IETW2 L
Charging Case	SENNHEISER	M3IETW2 C

* M3IETW2 R and M3IETW2 L with BT & BT LE TX/RX function
* Charging case is solely used for charging M3IETW2 R and M3IETW2 L only

2. The following antennas were provided to the EUT.

Type	Connector	Gain (dBi)
Monopole	NA	-4.15

3. The power table as below:

	Rated power (mW/MHz)	Total Conducted RF output power density (mW/MHz)	Radiated RF output power density (mW/MHz)
Normal mode	0.20	0.105565	0.040599
AFH mode	0.50	0.413207	0.158916

3.2 Description of Test Modes

79 channels are provided for BT-EDR mode:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	**2402**	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	**78**	**2480**
19	2421	**39**	**2441**	59	2461		

Note 1: By means of test software (Blue Test3_3.2.2.3.144) provided by manufacture, the power levels during the tests were set according to the following codes:

Note 2: Pre-Scan has been conducted to determine the worst-case mode from packet type; we found the DH5 was the worst case, and chosen for final test. Following test items were selected for the final test as listed below.

Test Items
Spurious emissions
Power density (Antenna power)
Occupied / spreading bandwidth

Bluetooth EDR

Modulation type: GFSK	Modulation type: π /4-DQPSK	Modulation type: 8DPSK
Power setting	**Power setting**	**Power setting**
2/5/0	2/5/0	2/5/0

3.3 Test Conditions

Test Conditions	Voltage (Vdc)
Vnormal	3.70
Vmax.	4.07
Vmin.	3.33

Note: After checking the fluctuation of input voltage to the circuit of the radio part (excluding the power supply) of the equipment to be tested, the fluctuation less than +/- 1 % when input voltage from an external supply into the equipment fluctuates +/- 10%, therefore, the test is carried out only at the normal voltage.

3.4 Assembly

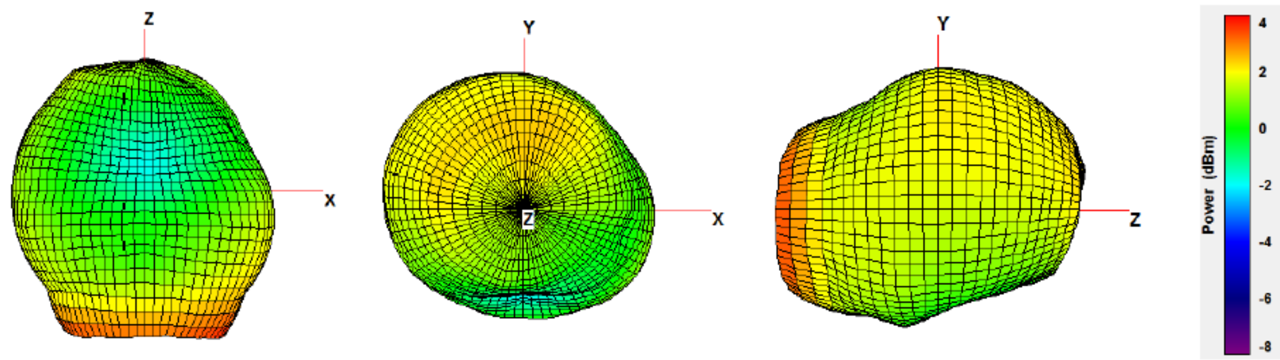
EUT use ultrasonic welding to seal the product top and bottom housing. Separation of the housing is only possible through brute force and the housing will be damaged.

3.5 Antenna Specifications

3.5.1 Antenna Gain

Type	Connector	Gain (dBi)
Monopole	NA	-4.15

3.5.2 Antenna Pattern



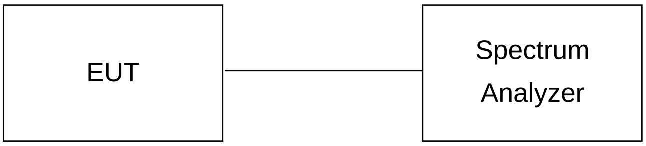
4 Test Results

4.1 Frequency Tolerance Measurement

4.1.1 Limits of Frequency Tolerance Measurement

Tolerance of frequency shall be +/- 50ppm

4.1.2 Test Setup



4.1.3 Test Results

Modulation: GFSK

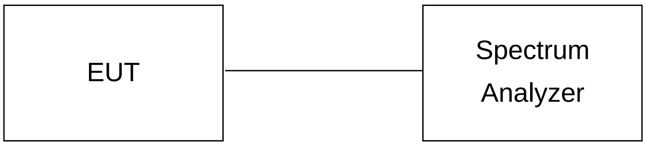
Environmental Conditions		25 deg.C, 68% RH					
Channel	Frequency (MHz)	Vnormal		Vmax.		Vmin.	
		Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)
0	2402	2401.984000	-6.661	2401.982800	-7.160	2401.982000	-7.493
39	2441	2440.980400	-8.029	2440.980400	-8.029	2440.980400	-8.029
78	2480	2479.980000	-8.064	2479.979600	-8.225	2479.979600	-8.225

4.2 Occupied Bandwidth Measurement (99% power bandwidth)

4.2.1 Limits of Occupied Bandwidth Measurement

Item	Limit
Occupied bandwidth	<83.5 MHz

4.2.2 Test Setup



4.2.3 Test Results

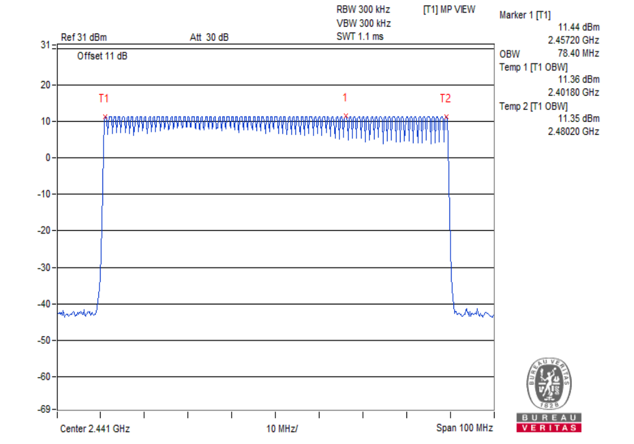
Modulation: GFSK

Normal Mode:

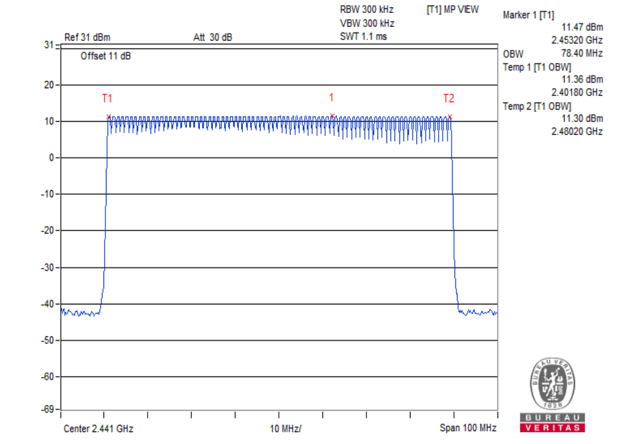
Environmental Conditions	25 deg.C, 68% RH	
Vnormal	**Vmax.**	**Vmin.**
Occupied Bandwidth (MHz)	**Occupied Bandwidth (MHz)**	**Occupied Bandwidth (MHz)**
78.40	78.40	78.40

Note: For the test plots please refer to the below pages.

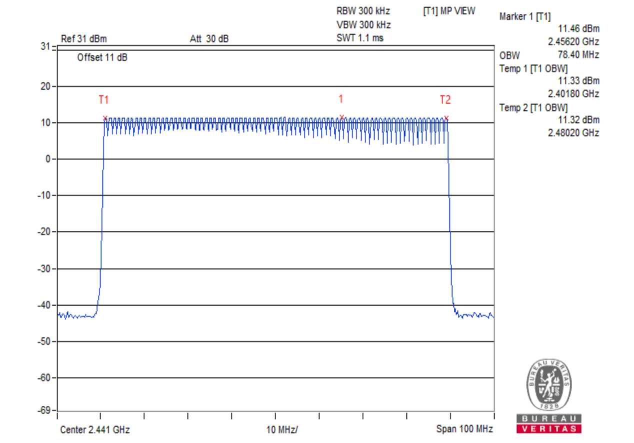
Vnormal



Vmax.



Vmin.

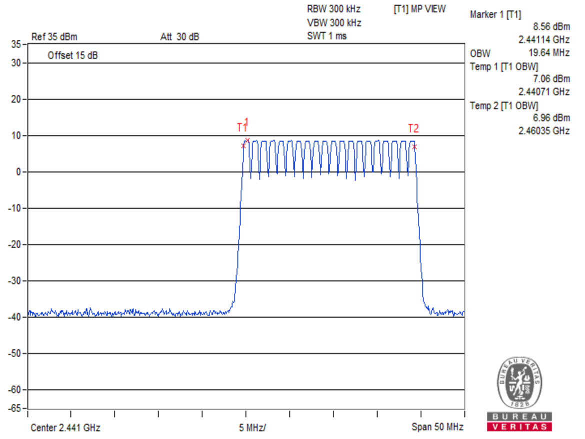


AFH Mode:

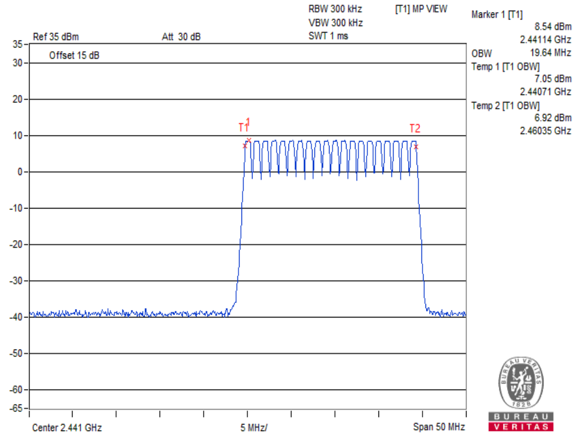
Environmental Conditions	25 deg.C, 68% RH	
Vnormal	**Vmax.**	**Vmin.**
Occupied Bandwidth (MHz)	**Occupied Bandwidth (MHz)**	**Occupied Bandwidth (MHz)**
19.64	19.64	19.64

Note: For the test plots please refer to the below pages.

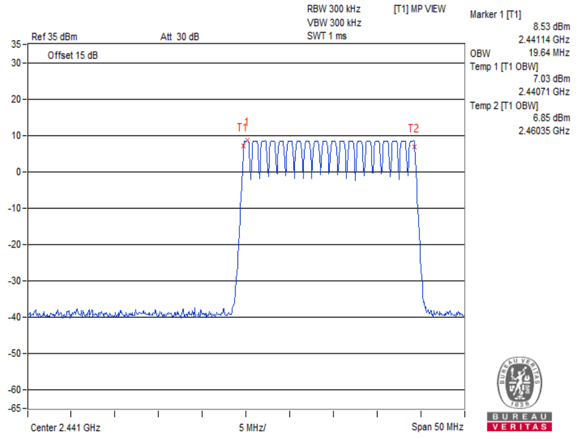
Vnormal



Vmax.



Vmin.



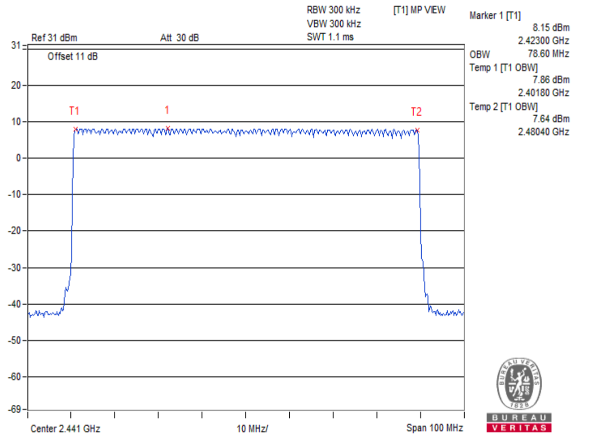
Modulation: π /4-DQPSK

Normal Mode:

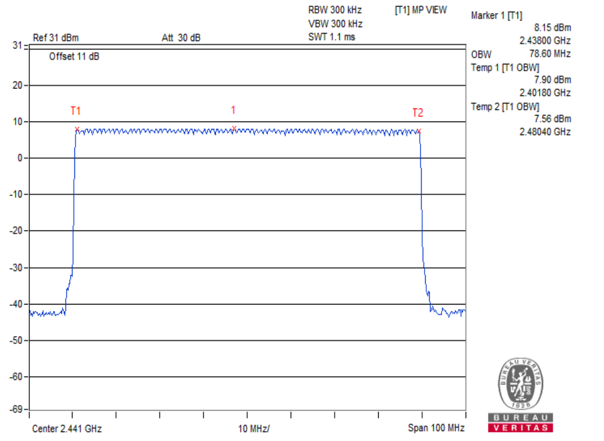
Environmental Conditions	25 deg.C, 68% RH	
Vnormal	**Vmax.**	**Vmin.**
Occupied Bandwidth (MHz)	**Occupied Bandwidth (MHz)**	**Occupied Bandwidth (MHz)**
78.60	78.60	78.60

Note: For the test plots please refer to the below pages.

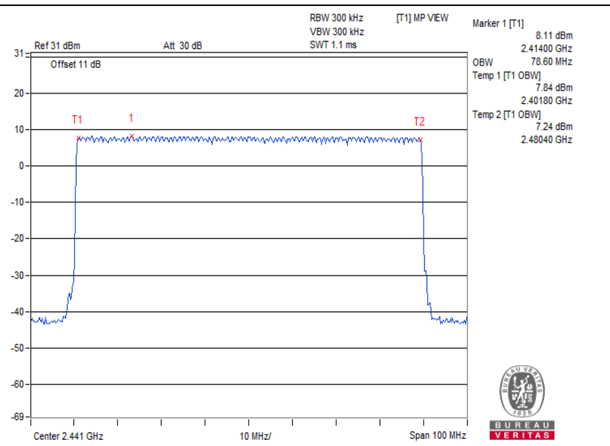
Vnormal



Vmax.



Vmin.

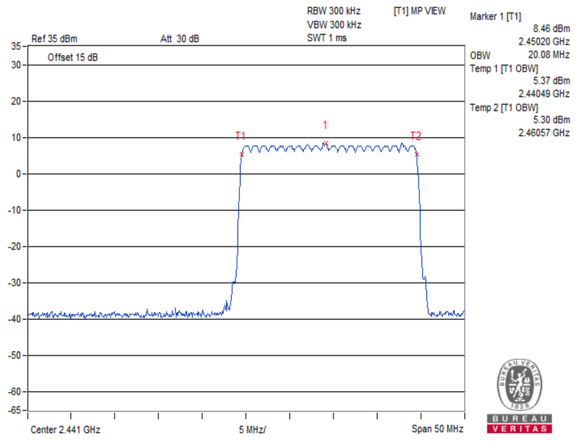


AFH Mode:

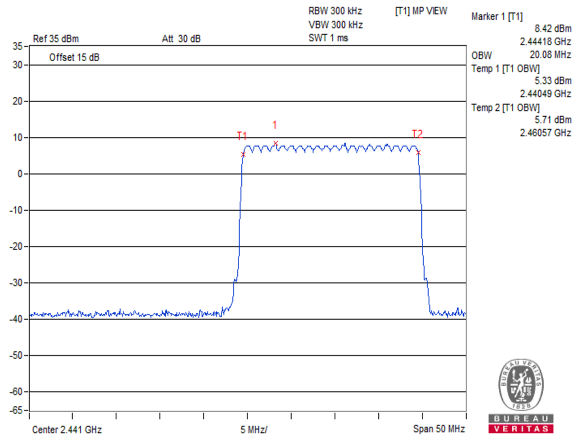
Environmental Conditions	25 deg.C, 68% RH	
Vnormal	**Vmax.**	**Vmin.**
Occupied Bandwidth (MHz)	**Occupied Bandwidth (MHz)**	**Occupied Bandwidth (MHz)**
20.08	20.08	20.08

Note: For the test plots please refer to the below pages.

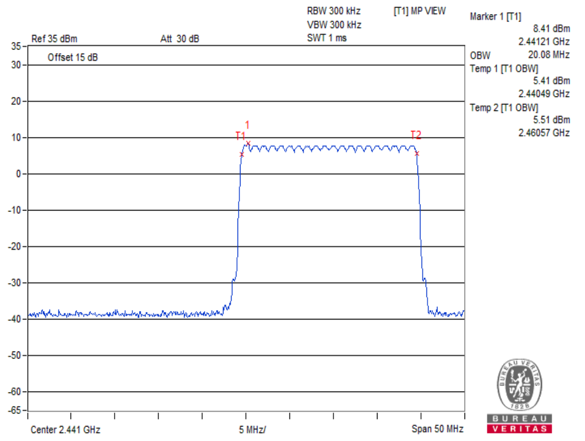
Vnormal



Vmax.



Vmin.



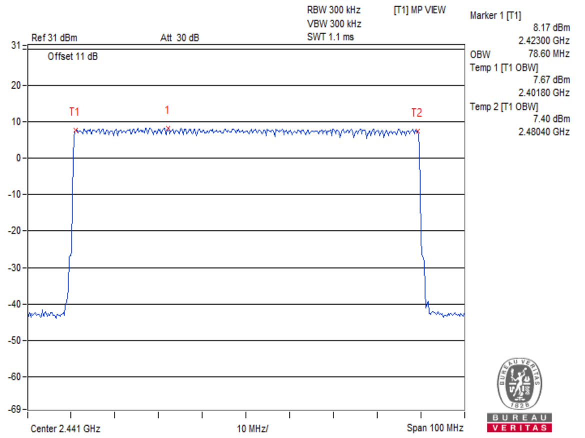
Modulation: 8DPSK

Normal Mode:

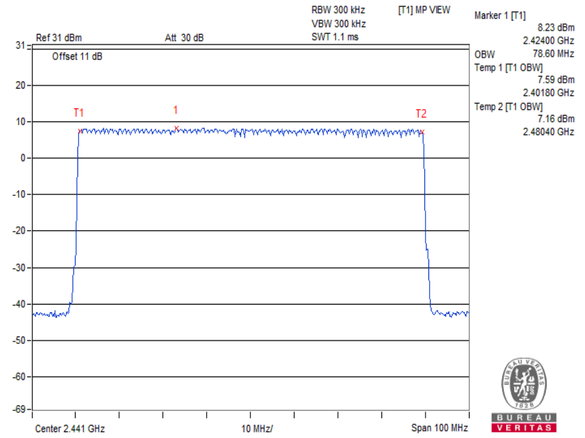
Environmental Conditions	25 deg.C, 68% RH	
Vnormal	**Vmax.**	**Vmin.**
Occupied Bandwidth (MHz)	**Occupied Bandwidth (MHz)**	**Occupied Bandwidth (MHz)**
78.60	78.60	78.60

Note: For the test plots please refer to the below pages.

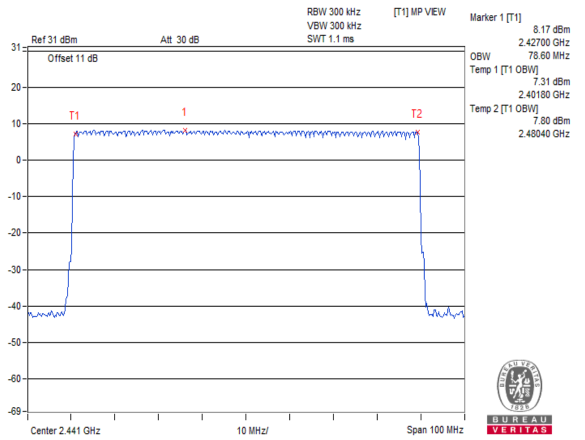
V_{normal}



$V_{max.}$



$V_{min.}$

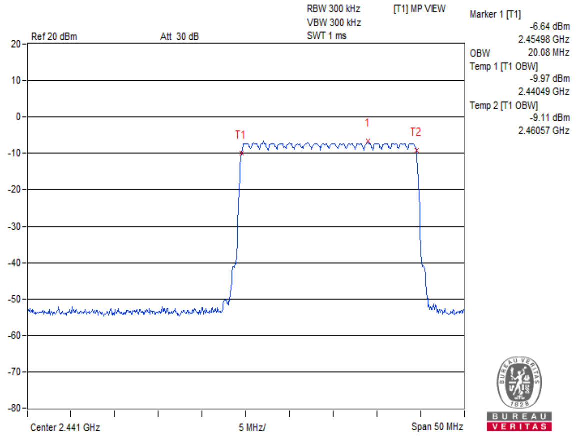


AFH Mode:

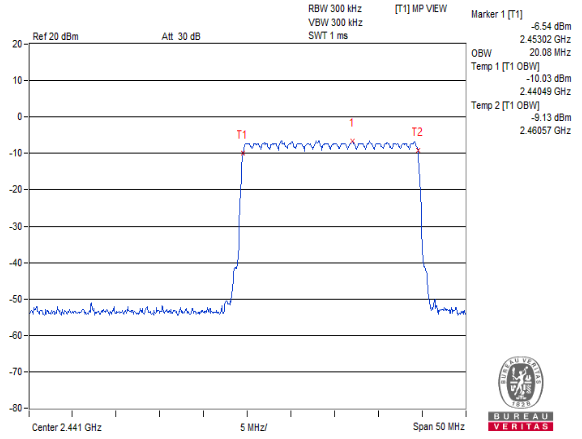
Environmental Conditions	25 deg.C, 68% RH	
Vnormal	**Vmax.**	**Vmin.**
Occupied Bandwidth (MHz)	**Occupied Bandwidth (MHz)**	**Occupied Bandwidth (MHz)**
20.08	20.08	20.08

Note: For the test plots please refer to the below pages.

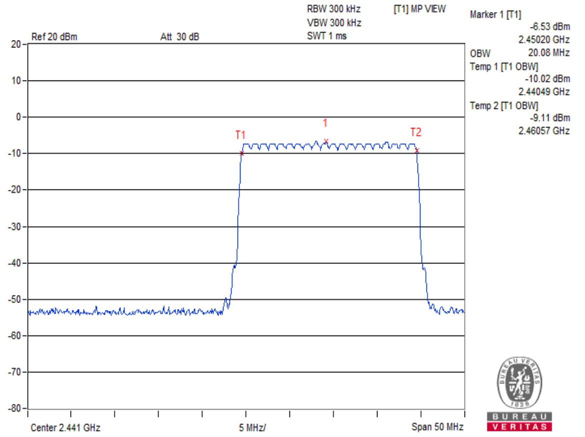
V_{normal}



$V_{max.}$

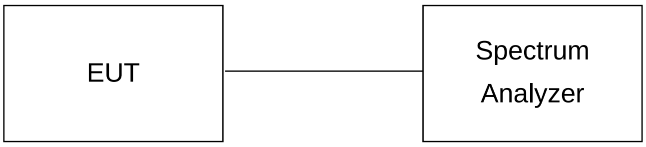


$V_{min.}$



4.3 Spreading Bandwidth Measurement (90% power bandwidth)

4.3.1 Test Setup



4.3.2 Test Results

Modulation: GFSK

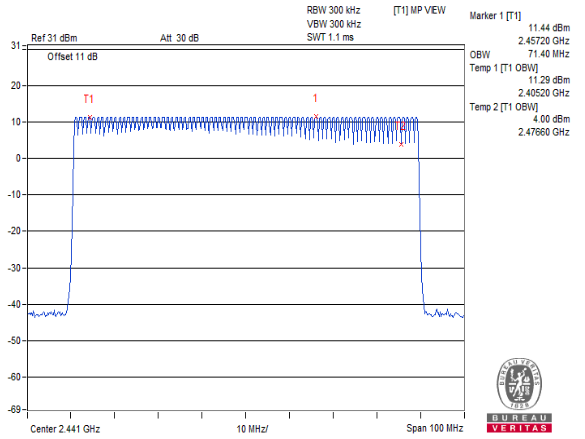
Normal Mode:

Environmental Conditions		25 deg.C, 68% RH			
Vnormal		Vmax.		Vmin.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
71.40	71.40	71.20	71.20	71.20	71.20

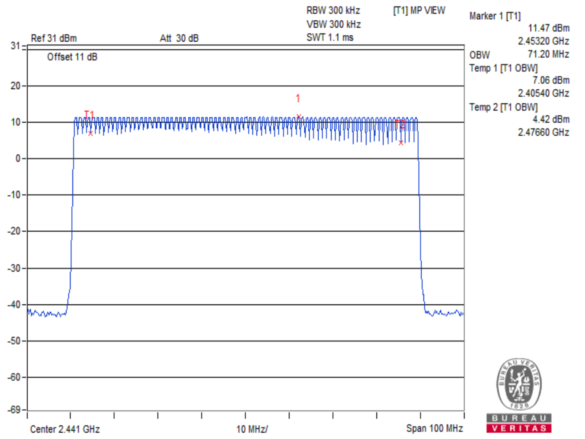
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.

2. For the test plots please refer to the below pages.

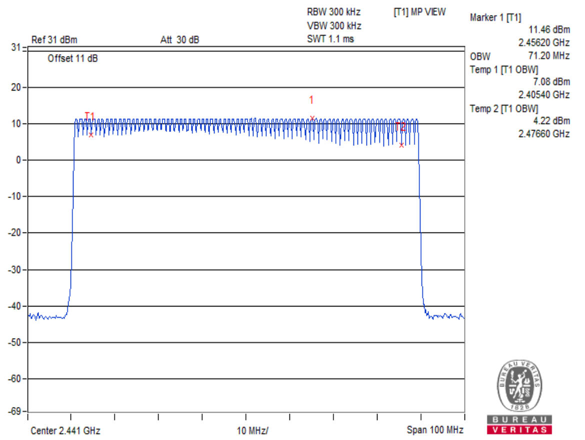
Vnormal



Vmax.



Vmin.

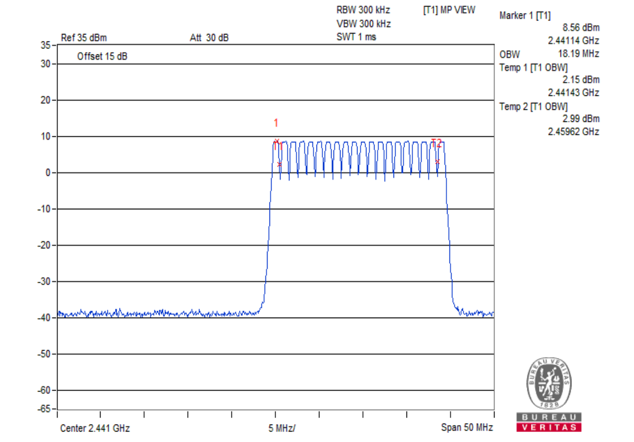
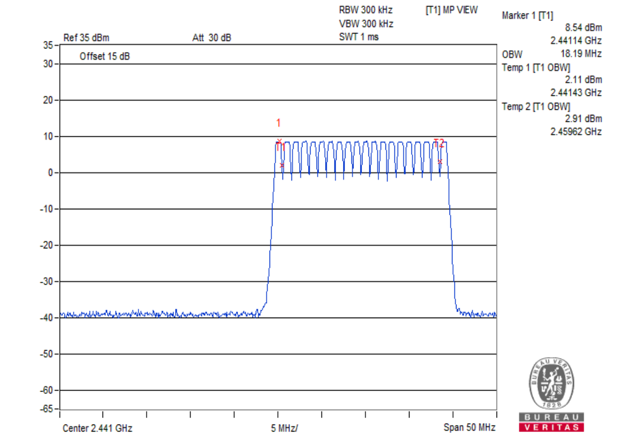
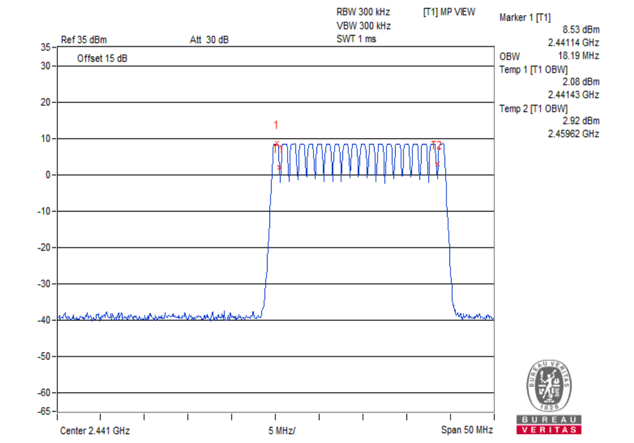


AFH Mode:

Environmental Conditions		25 deg.C, 68% RH			
Vnormal		Vmax.		Vmin.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
18.19	18.19	18.19	18.19	18.19	18.19

Note: 1. Spreading Factor: 90% channel power bandwidth / 1.

2. For the test plots please refer to the below pages.

Vnormal	Vmax.
	
Vmin.	
	

Modulation: π /4-DQPSK

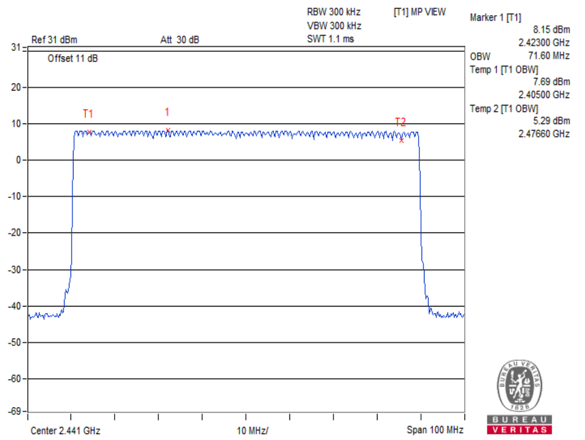
Normal Mode:

Environmental Conditions		25 deg.C, 68% RH			
Vnormal		Vmax.		Vmin.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
71.60	71.60	71.40	71.40	71.60	71.60

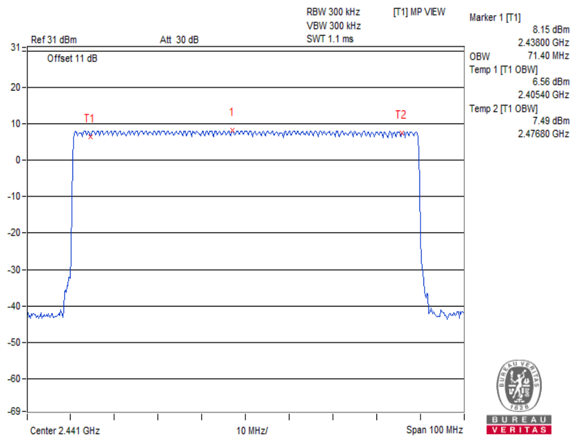
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.

2. For the test plots please refer to the below pages.

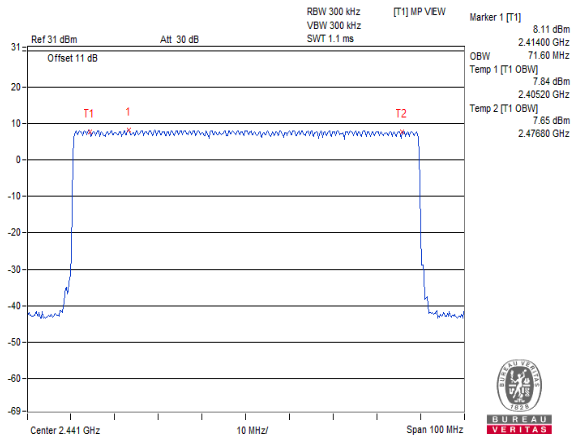
V_{normal}



$V_{max.}$



$V_{min.}$



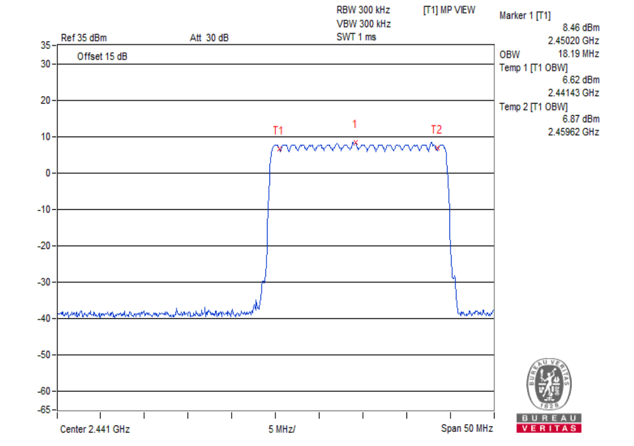
AFH Mode:

Environmental Conditions		25 deg.C, 68% RH			
Vnormal		Vmax.		Vmin.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
18.19	18.19	18.19	18.19	18.26	18.26

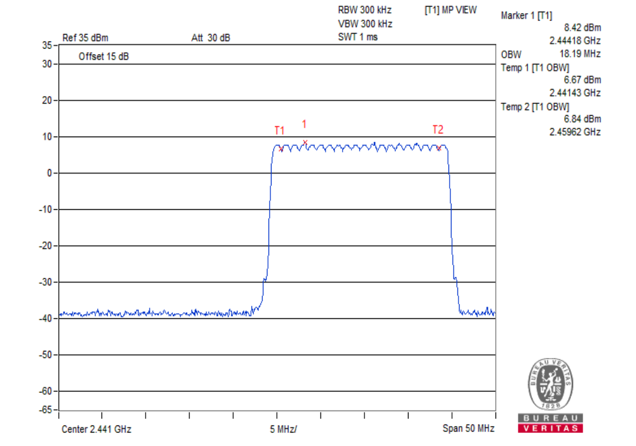
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.

2. For the test plots please refer to the below pages.

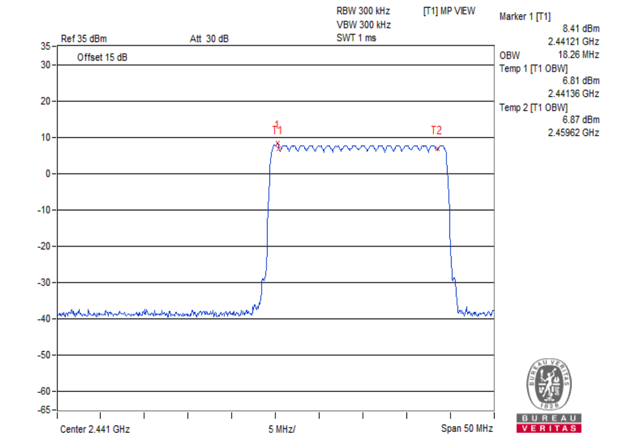
Vnormal



Vmax.



Vmin.



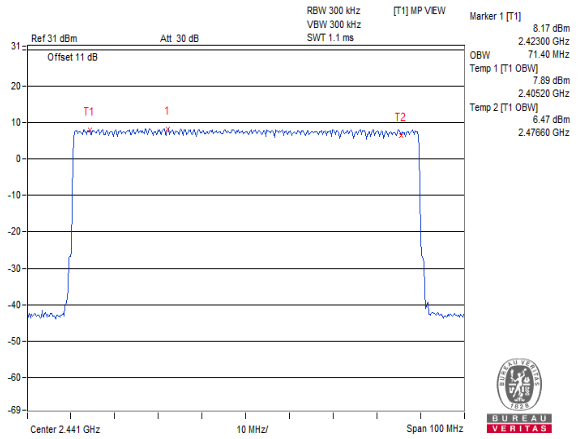
Modulation: 8DPSK
Normal Mode:

Environmental Conditions		25 deg.C, 68% RH			
Vnormal		Vmax.		Vmin.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
71.40	71.40	71.80	71.80	71.40	71.40

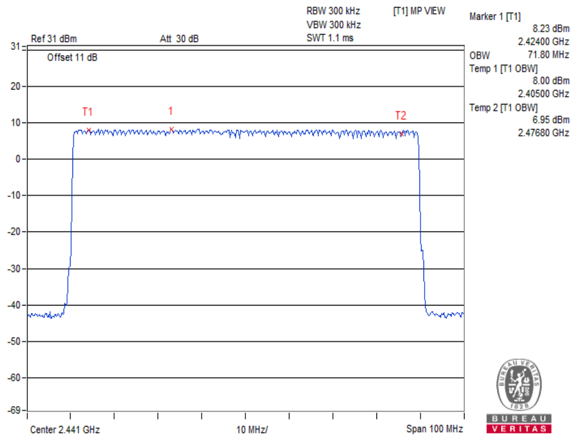
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.

2. For the test plots please refer to the below pages.

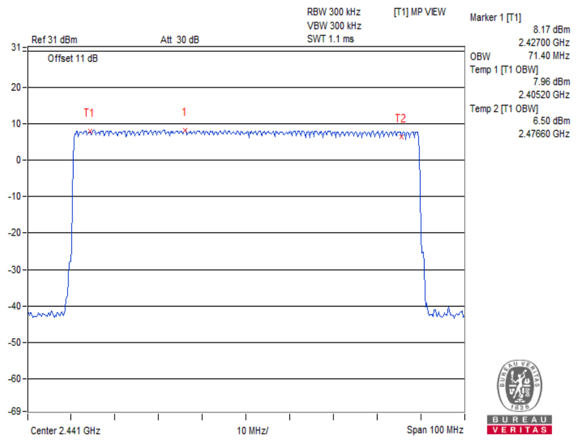
Vnormal



Vmax.



Vmin.



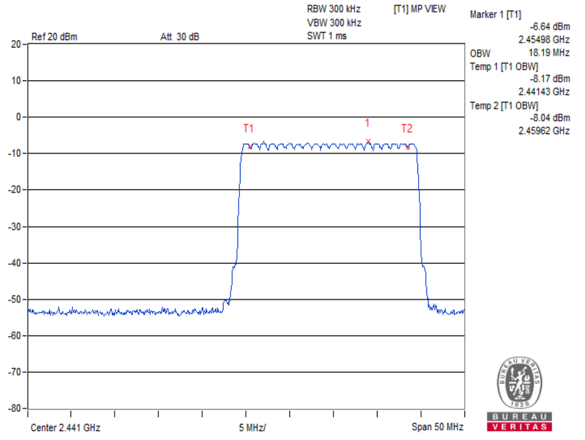
AFH Mode:

Environmental Conditions	25 deg.C, 68% RH				
Vnormal		Vmax.		Vmin.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
18.19	18.19	18.27	18.27	18.19	18.19

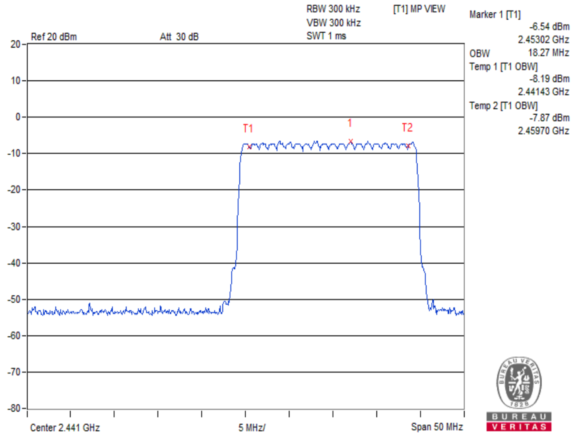
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.

2. For the test plots please refer to the below pages.

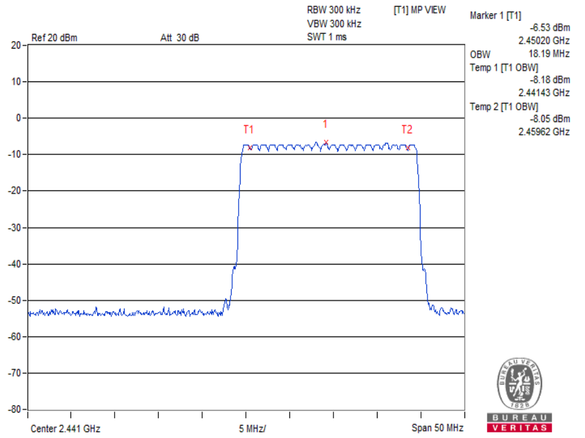
Vnormal



Vmax.



Vmin.



4.4 Spurious Emissions for Transmitter Measurement

4.4.1 Limits of Spurious Emissions

Frequencies (MHz)	Limit
Operating frequency 2400 to 2483.5MHz	
30.0MHz to 1000.0MHz	≦ 0.25 uW/100kHz
1000.0MHz to 2387MHz	≦ 2.5 uW/MHz
2387.0MHz to 2400.0MHz	≦ 25 uW/MHz
2483.5MHz to 2496.5MHz	≦ 25 uW/MHz
2496.5MHz to 12500.0MHz	≦ 2.5 uW/MHz

4.4.2 Test Setup

4.4.3 Test Results

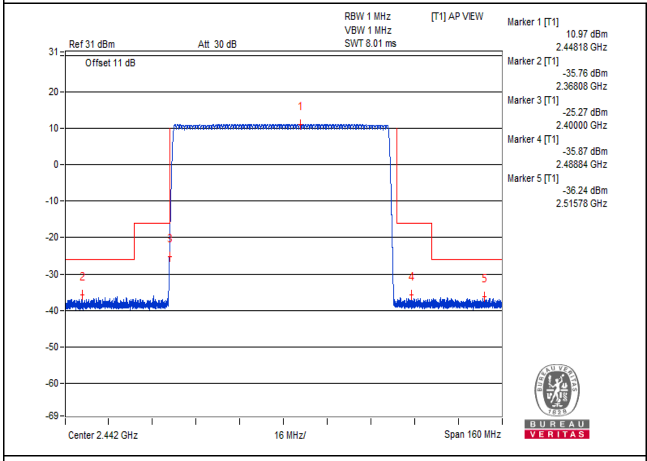
Modulation: GFSK

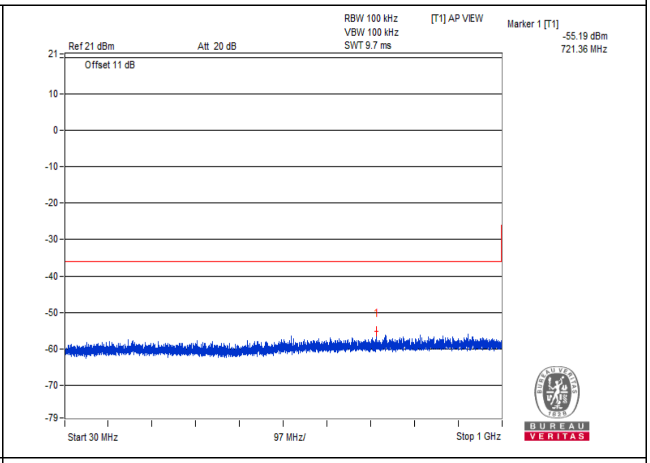
Environmental Conditions		25 deg.C, 60% RH			
Test Channel		Hopping Mode		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value (uW)		
Vnormal	30.0MHz to 1000.0MHz	721.360	**0.003000**	0.25uW	Pass
	1000.0MHz to 2387MHz	1736.490	0.031000	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2399.990	3.250000	25uW	Pass
	2483.5MHz to 2496.5MHz	2483.550	0.051000	25uW	Pass
	2496.5MHz to 12500.0MHz	8594.880	0.092000	2.5uW	Pass
Vmax.	30.0MHz to 1000.0MHz	854.740	0.002000	0.25uW	Pass
	1000.0MHz to 2387MHz	1737.010	**0.046000**	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2400.000	**3.515000**	25uW	Pass
	2483.5MHz to 2496.5MHz	2483.720	**0.053000**	25uW	Pass
	2496.5MHz to 12500.0MHz	10232.950	**0.095000**	2.5uW	Pass
Vmin.	30.0MHz to 1000.0MHz	800.300	0.002000	0.25uW	Pass
	1000.0MHz to 2387MHz	2337.930	0.019000	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2400.000	3.326000	25uW	Pass
	2483.5MHz to 2496.5MHz	2483.880	0.053000	25uW	Pass
	2496.5MHz to 12500.0MHz	11288.320	0.085000	2.5uW	Pass

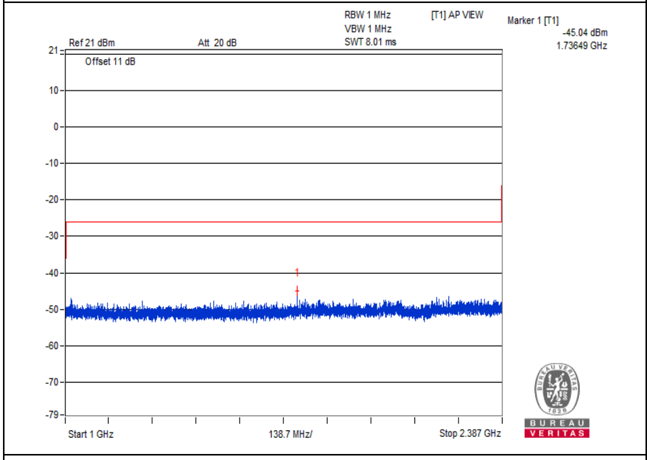
Note: 1. The worst value in each frequency range v.s. each channel has been marked by boldface.

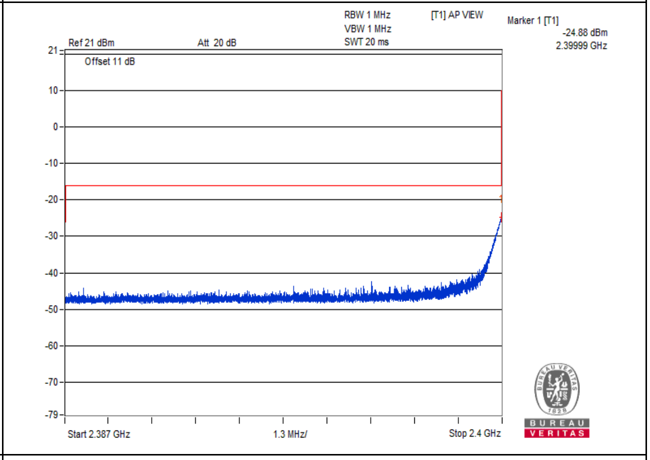
2. The spectrum plots are attached on the following pages.

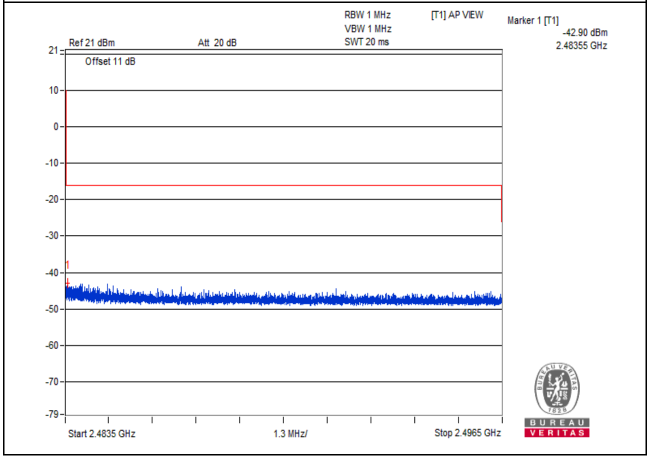
V_{normal}

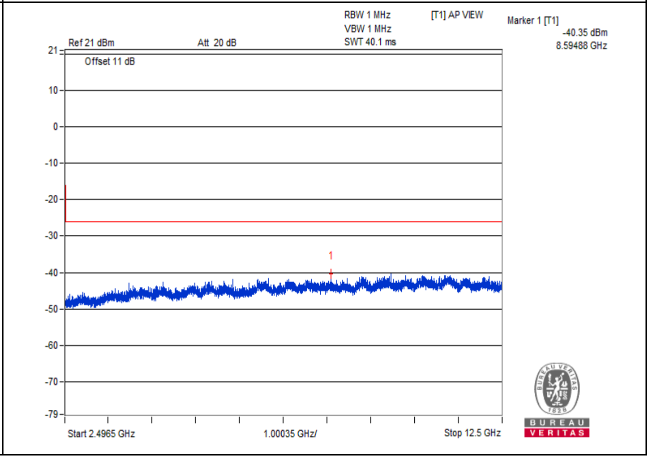

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 31 dBm
Att 30 dB
Offset 11 dB
Marker 1 [T1] 10.97 dBm 2.44818 GHz
Marker 2 [T1] -35.76 dBm 2.36808 GHz
Marker 3 [T1] -25.27 dBm 2.40000 GHz
Marker 4 [T1] -35.87 dBm 2.48884 GHz
Marker 5 [T1] -36.24 dBm 2.51578 GHz
Center 2.442 GHz
16 MHz/
Span 160 MHz


RBW 100 kHz
VBW 100 kHz
SWT 9.7 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -55.19 dBm 721.36 MHz
Start 30 MHz
97 MHz/
Stop 1 GHz

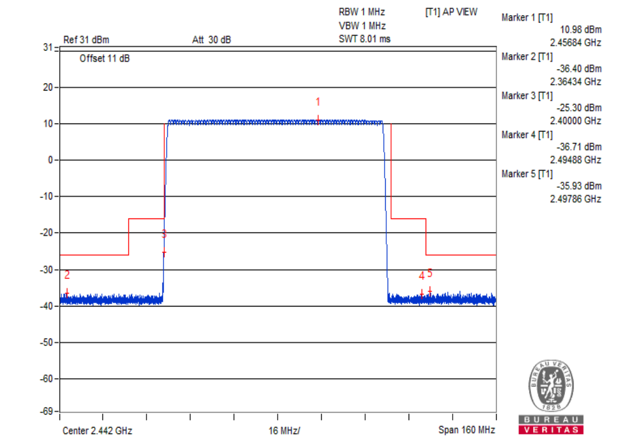

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -45.04 dBm 1.73649 GHz
Start 1 GHz
138.7 MHz/
Stop 2.387 GHz

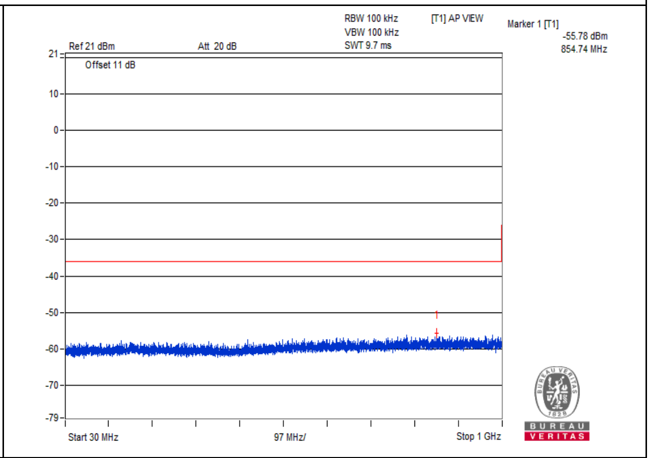

RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -24.88 dBm 2.39999 GHz
Start 2.387 GHz
1.3 MHz/
Stop 2.4 GHz

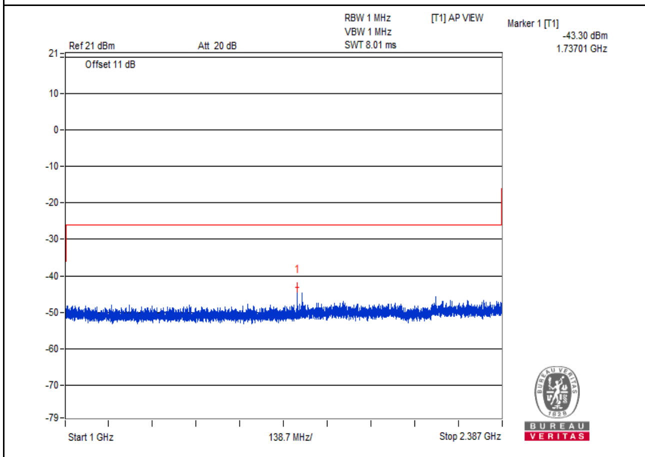

RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -42.90 dBm 2.48355 GHz
Start 2.4835 GHz
1.3 MHz/
Stop 2.4965 GHz

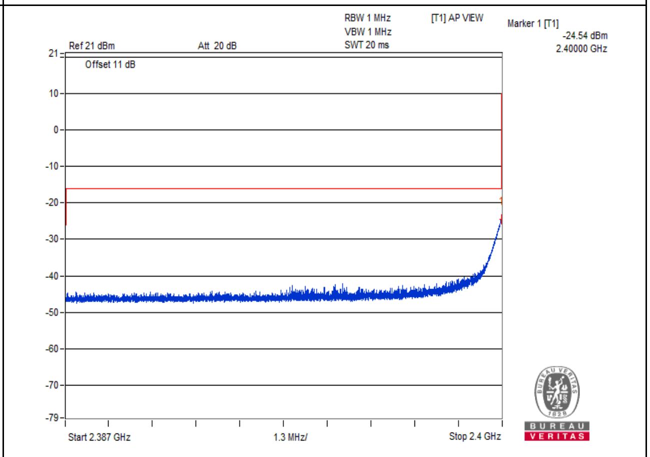

RBW 1 MHz
VBW 1 MHz
SWT 40.1 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -40.35 dBm 8.59488 GHz
Start 2.4965 GHz
1.00035 GHz/
Stop 12.5 GHz

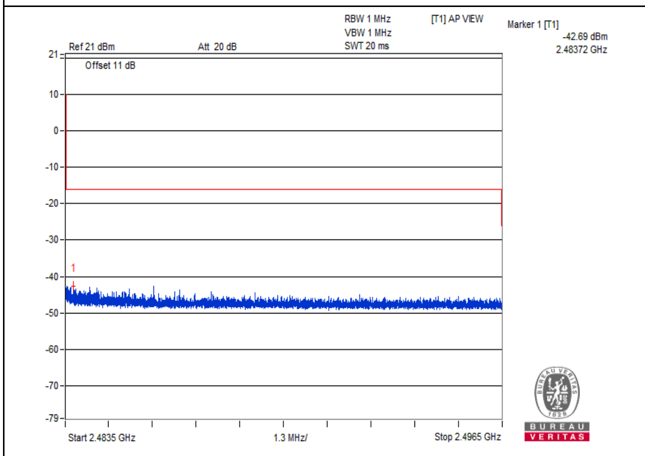
Vmax.

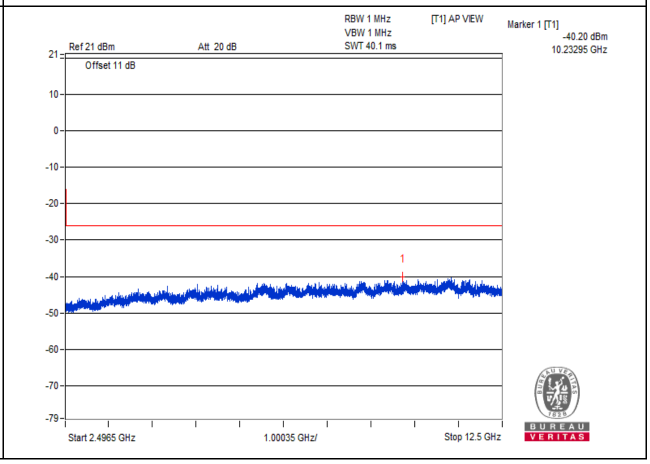

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 31 dBm
Att 30 dB
Offset 11 dB
Marker 1 [T1] 10.98 dBm 2.45684 GHz
Marker 2 [T1] -36.40 dBm 2.36434 GHz
Marker 3 [T1] -25.30 dBm 2.40000 GHz
Marker 4 [T1] -36.71 dBm 2.49488 GHz
Marker 5 [T1] -35.93 dBm 2.49786 GHz
Center 2.442 GHz
16 MHz/
Span 160 MHz


RBW 100 kHz
VBW 100 kHz
SWT 9.7 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -55.78 dBm 854.74 MHz
Start 30 MHz
97 MHz/
Stop 1 GHz

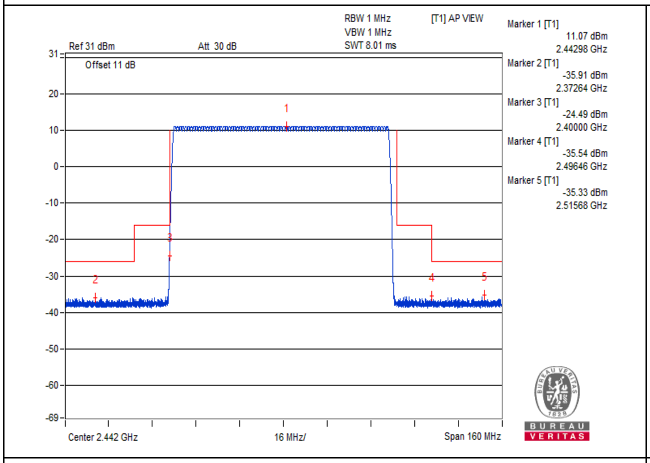

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -43.30 dBm 1.73701 GHz
Start 1 GHz
138.7 MHz/
Stop 2.387 GHz

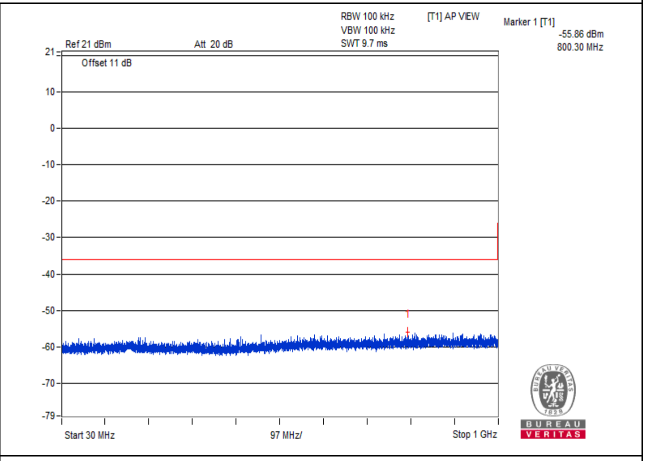

RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -24.54 dBm 2.40000 GHz
Start 2.387 GHz
1.3 MHz/
Stop 2.4 GHz

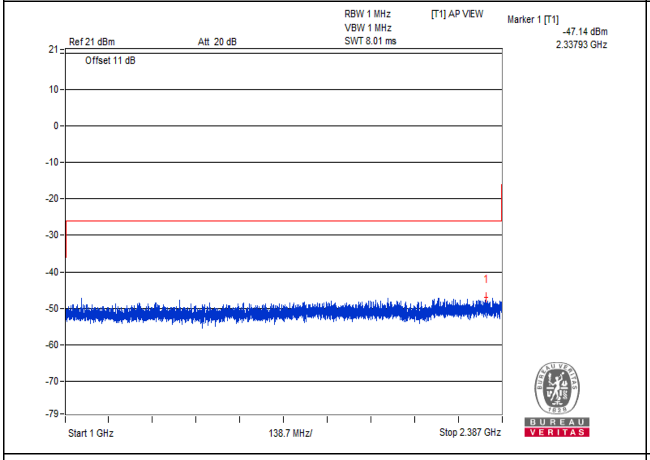

RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -42.69 dBm 2.48372 GHz
Start 2.4835 GHz
1.3 MHz/
Stop 2.4965 GHz

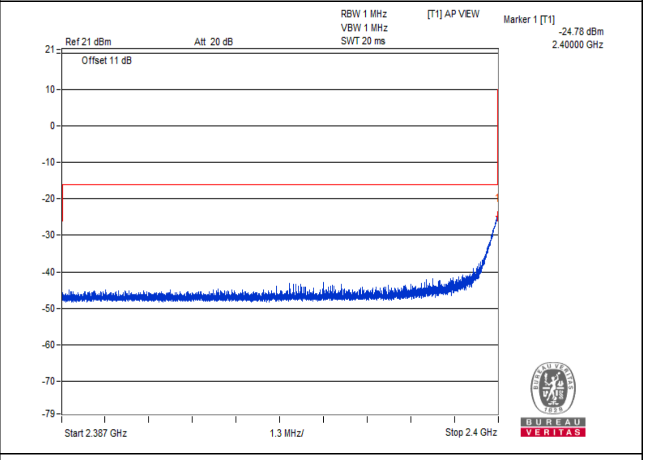

RBW 1 MHz
VBW 1 MHz
SWT 40.1 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -40.20 dBm 10.23295 GHz
Start 2.4965 GHz
1.00035 GHz/
Stop 12.5 GHz

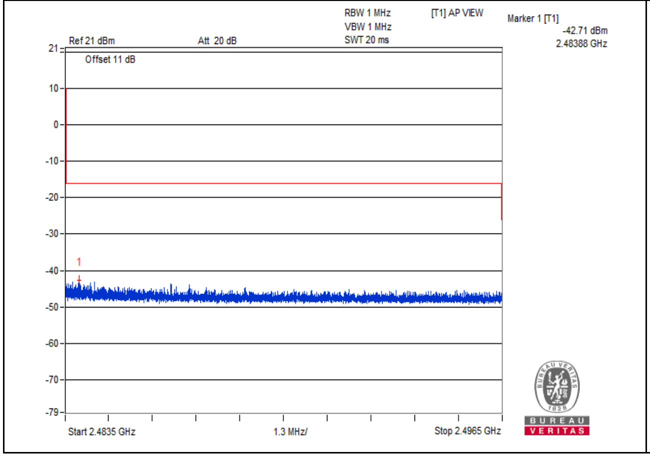
Vmin.

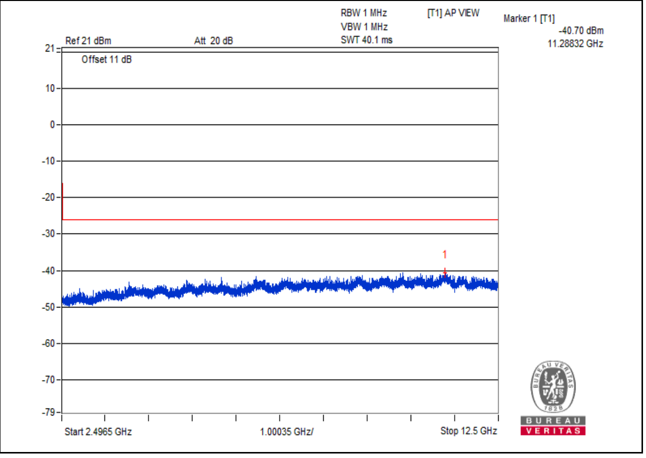

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 31 dBm
Att 30 dB
Offset 11 dB
Marker 1 [T1]
11.07 dBm
2.44298 GHz
Marker 2 [T1]
-35.91 dBm
2.37264 GHz
Marker 3 [T1]
-24.49 dBm
2.40000 GHz
Marker 4 [T1]
-35.54 dBm
2.49646 GHz
Marker 5 [T1]
-35.33 dBm
2.51568 GHz
Center 2.442 GHz
16 MHz/
Span 160 MHz


RBW 100 kHz
VBW 100 kHz
SWT 9.7 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-55.86 dBm
800.30 MHz
Start 30 MHz
97 MHz/
Stop 1 GHz


RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-47.14 dBm
2.33793 GHz
Start 1 GHz
138.7 MHz/
Stop 2.387 GHz


RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-24.78 dBm
2.40000 GHz
Start 2.387 GHz
1.3 MHz/
Stop 2.4 GHz


RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-42.71 dBm
2.48388 GHz
Start 2.4835 GHz
1.3 MHz/
Stop 2.4965 GHz


RBW 1 MHz
VBW 1 MHz
SWT 40.1 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-40.70 dBm
11.28832 GHz
Start 2.4965 GHz
1.00035 GHz/
Stop 12.5 GHz

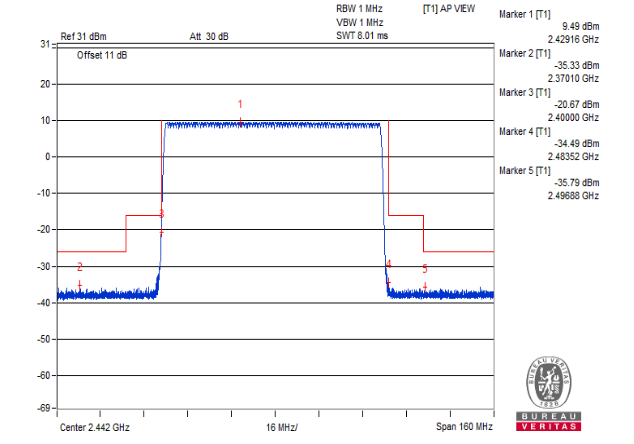
Modulation: π/4-DQPSK

Environmental Conditions		25 deg.C, 60% RH			
Test Channel		Hopping Mode		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value (uW)		
Vnormal	30.0MHz to 1000.0MHz	675.890	**0.002000**	0.25uW	Pass
	1000.0MHz to 2387MHz	2304.820	0.024000	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2399.990	**8.609000**	25uW	Pass
	2483.5MHz to 2496.5MHz	2483.500	**0.267000**	25uW	Pass
	2496.5MHz to 12500.0MHz	11292.070	0.095000	2.5uW	Pass
Vmax.	30.0MHz to 1000.0MHz	872.560	0.002000	0.25uW	Pass
	1000.0MHz to 2387MHz	1927.030	**0.025000**	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2399.990	8.433000	25uW	Pass
	2483.5MHz to 2496.5MHz	2483.570	0.221000	25uW	Pass
	2496.5MHz to 12500.0MHz	11300.830	0.106000	2.5uW	Pass
Vmin.	30.0MHz to 1000.0MHz	930.640	0.002000	0.25uW	Pass
	1000.0MHz to 2387MHz	2246.040	0.024000	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2399.990	7.852000	25uW	Pass
	2483.5MHz to 2496.5MHz	2483.560	0.217000	25uW	Pass
	2496.5MHz to 12500.0MHz	11322.080	**0.116000**	2.5uW	Pass

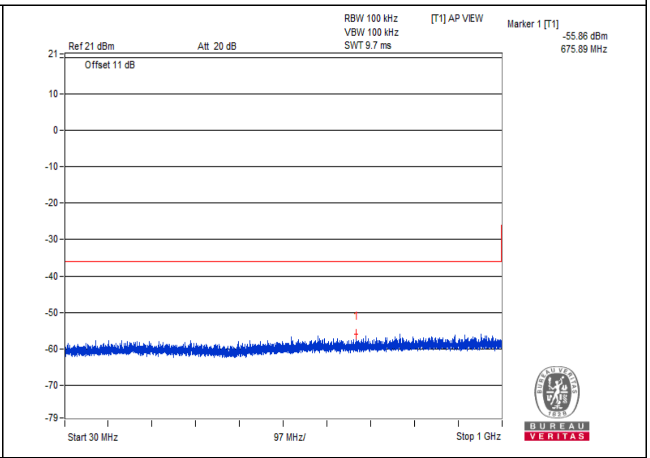
Note: 1. The worst value in each frequency range v.s. each channel has been marked by boldface.

2. The spectrum plots are attached on the following pages.

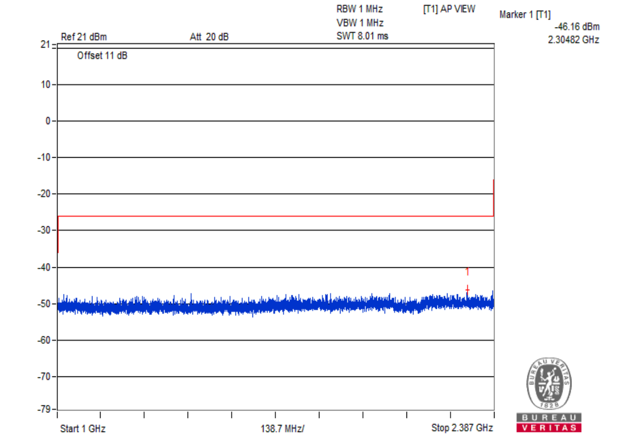
Vnormal



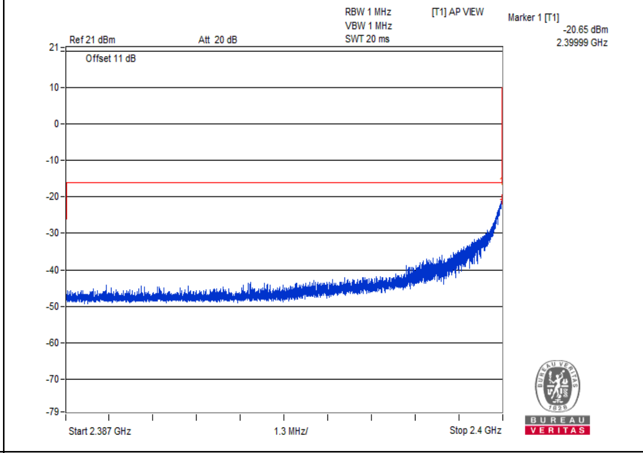
RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 31 dBm
Att 30 dB
Offset 11 dB
Marker 1 [T1]
9.49 dBm
2.42916 GHz
Marker 2 [T1]
-35.33 dBm
2.37010 GHz
Marker 3 [T1]
-20.67 dBm
2.40000 GHz
Marker 4 [T1]
-34.49 dBm
2.48352 GHz
Marker 5 [T1]
-35.79 dBm
2.49688 GHz
Center 2.442 GHz
16 MHz/
Span 160 MHz



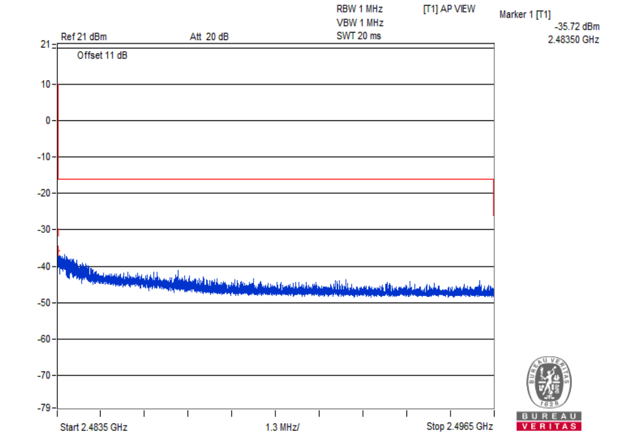
RBW 100 kHz
VBW 100 kHz
SWT 9.7 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-55.86 dBm
675.89 MHz
Start 30 MHz
97 MHz/
Stop 1 GHz



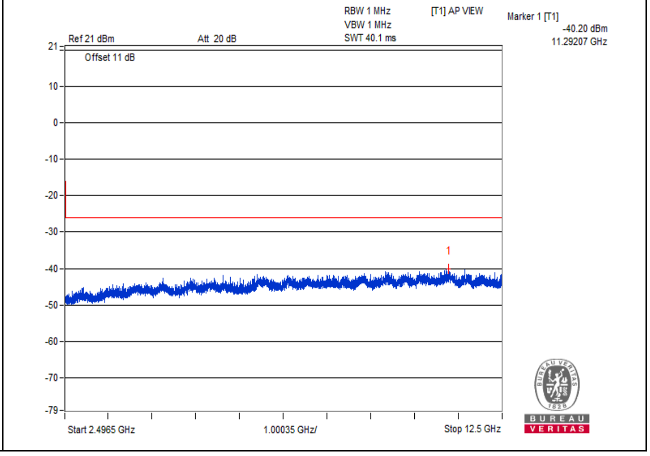
RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-46.16 dBm
2.30482 GHz
Start 1 GHz
138.7 MHz/
Stop 2.387 GHz



RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-20.65 dBm
2.39999 GHz
Start 2.387 GHz
1.3 MHz/
Stop 2.4 GHz

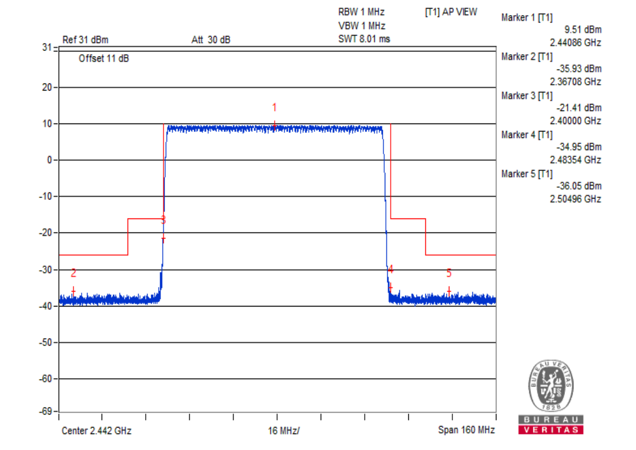


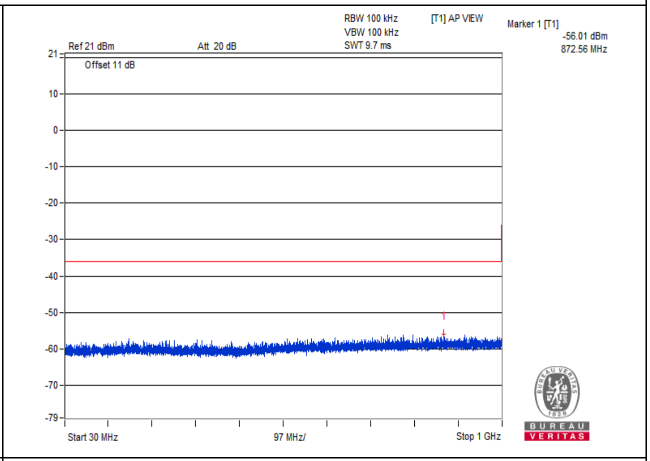
RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-35.72 dBm
2.48350 GHz
Start 2.4835 GHz
1.3 MHz/
Stop 2.4965 GHz

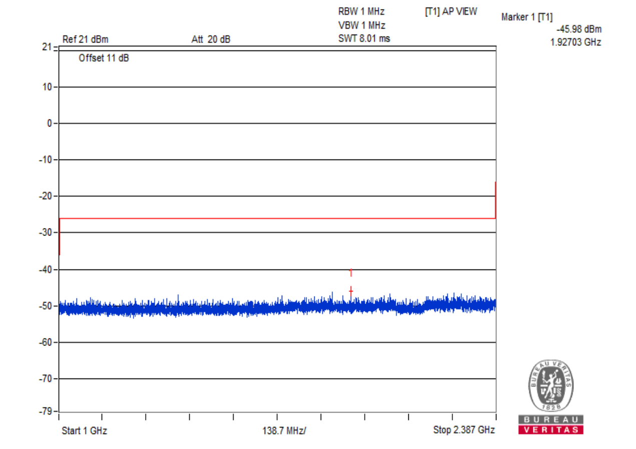


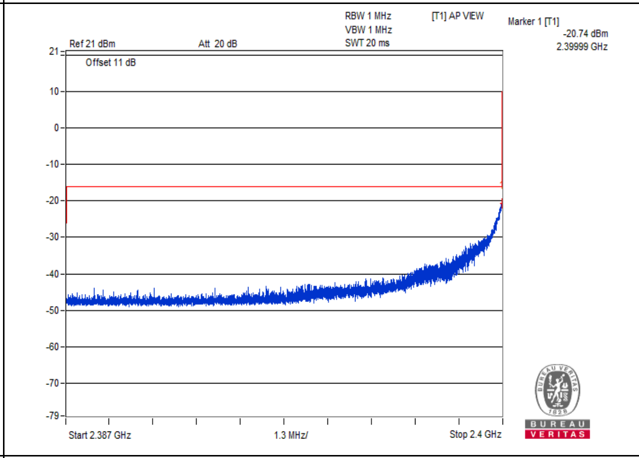
RBW 1 MHz
VBW 1 MHz
SWT 40.1 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-40.20 dBm
11.29207 GHz
Start 2.4965 GHz
1.00035 GHz/
Stop 12.5 GHz

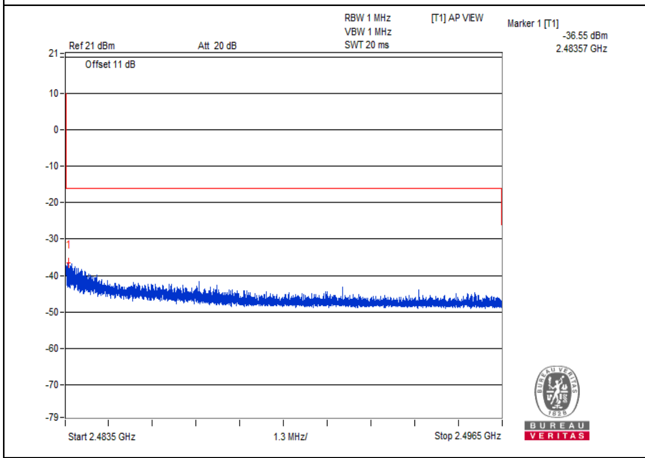
Vmax.

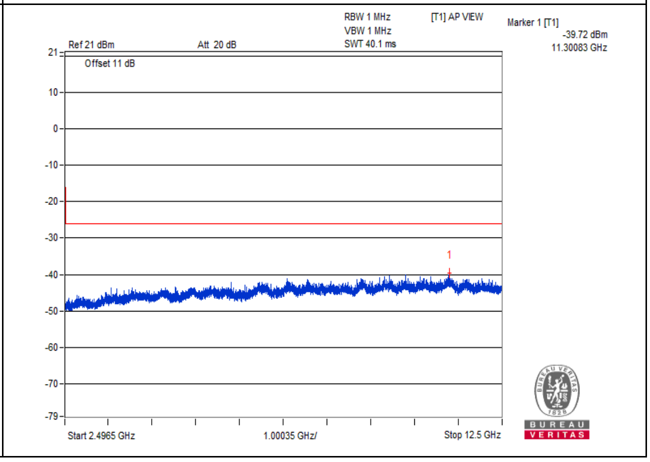

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 31 dBm
Att 30 dB
Offset 11 dB
Marker 1 [T1]
9.51 dBm
2.44086 GHz
Marker 2 [T1]
-35.93 dBm
2.36708 GHz
Marker 3 [T1]
-21.41 dBm
2.40000 GHz
Marker 4 [T1]
-34.95 dBm
2.48354 GHz
Marker 5 [T1]
-36.05 dBm
2.50496 GHz
Center 2.442 GHz
16 MHz/
Span 160 MHz


RBW 100 kHz
VBW 100 kHz
SWT 9.7 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-56.01 dBm
872.56 MHz
Start 30 MHz
97 MHz/
Stop 1 GHz

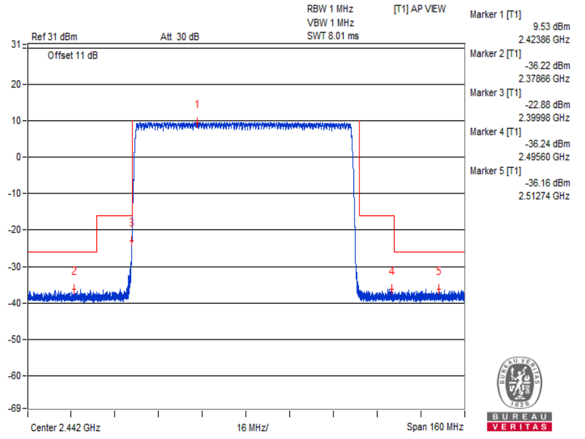

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-45.98 dBm
1.92703 GHz
Start 1 GHz
138.7 MHz/
Stop 2.387 GHz

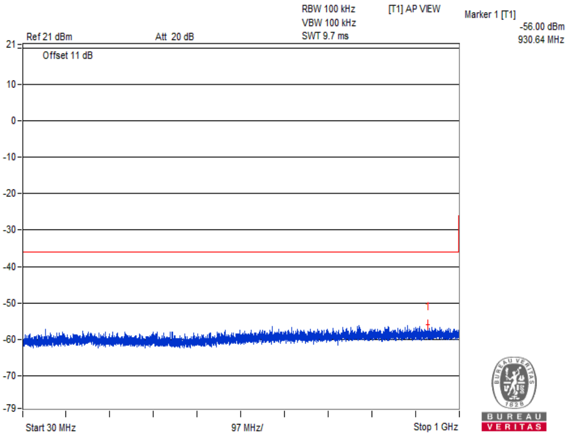

RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-20.74 dBm
2.39999 GHz
Start 2.387 GHz
1.3 MHz/
Stop 2.4 GHz

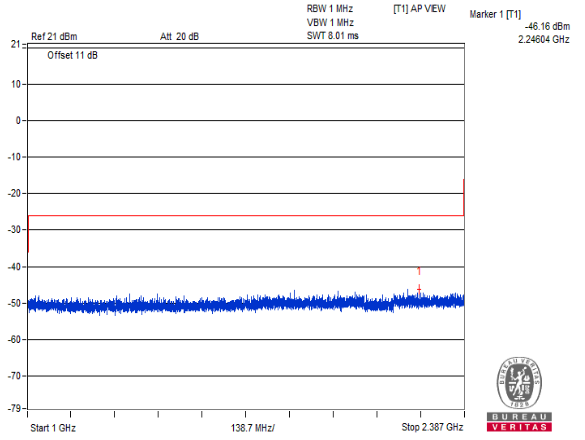

RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-36.55 dBm
2.48357 GHz
Start 2.4835 GHz
1.3 MHz/
Stop 2.4965 GHz

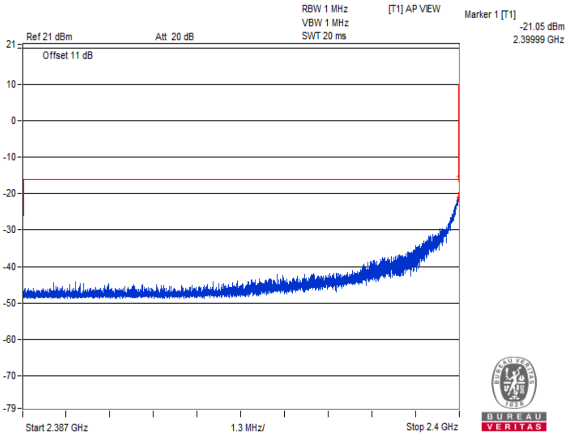

RBW 1 MHz
VBW 1 MHz
SWT 40.1 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-39.72 dBm
11.30083 GHz
Start 2.4965 GHz
1.00035 GHz/
Stop 12.5 GHz

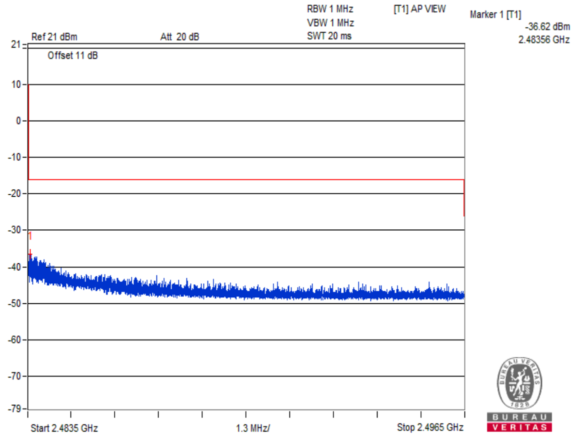
Vmin.

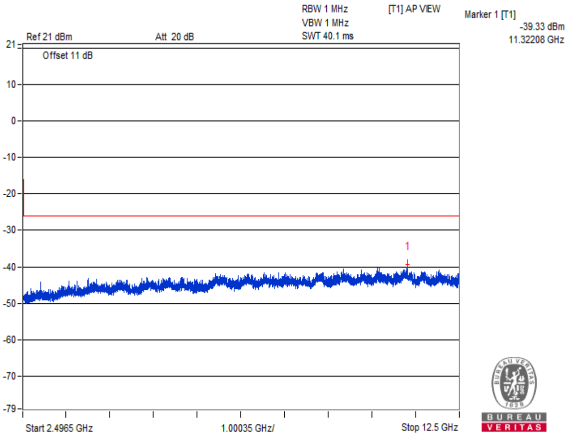

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 31 dBm
Att 30 dB
Offset 11 dB
Marker 1 [T1] 9.53 dBm 2.42386 GHz
Marker 2 [T1] -36.22 dBm 2.37866 GHz
Marker 3 [T1] -22.88 dBm 2.39998 GHz
Marker 4 [T1] -36.24 dBm 2.49560 GHz
Marker 5 [T1] -36.16 dBm 2.51274 GHz
Center 2.442 GHz
16 MHz/
Span 160 MHz


RBW 100 kHz
VBW 100 kHz
SWT 9.7 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -56.00 dBm 930.64 MHz
Start 30 MHz
97 MHz/
Stop 1 GHz


RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -46.16 dBm 2.24604 GHz
Start 1 GHz
138.7 MHz/
Stop 2.387 GHz


RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -21.05 dBm 2.39999 GHz
Start 2.387 GHz
1.3 MHz/
Stop 2.4 GHz


RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -36.62 dBm 2.48356 GHz
Start 2.4835 GHz
1.3 MHz/
Stop 2.4965 GHz


RBW 1 MHz
VBW 1 MHz
SWT 40.1 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -39.33 dBm 11.32208 GHz
Start 2.4965 GHz
1.00035 GHz/
Stop 12.5 GHz

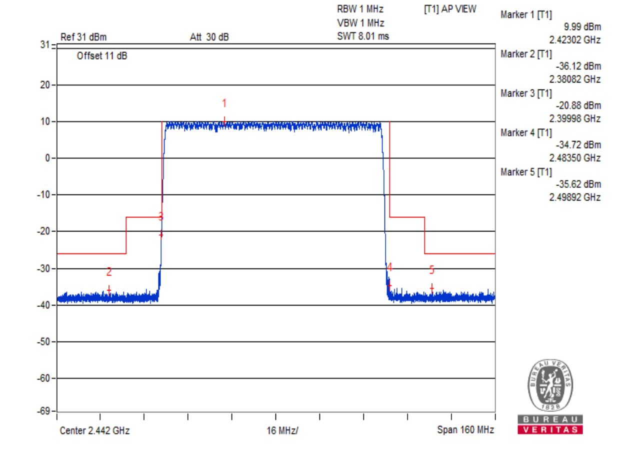
Modulation: 8DPSK

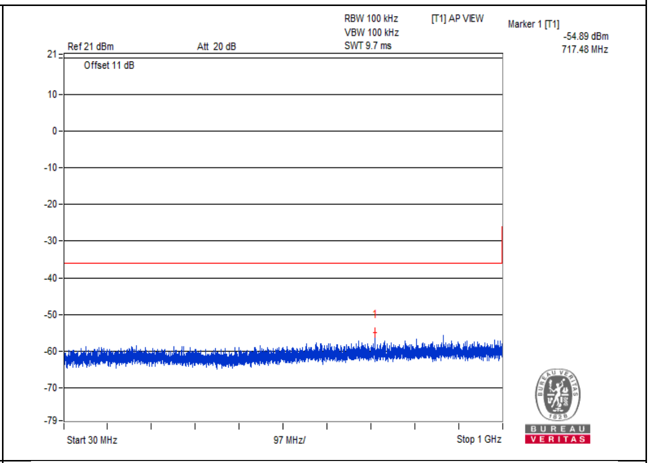
Environmental Conditions	25 deg.C, 60% RH				
Test Channel		Hopping Mode		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value (uW)		
Vnormal	30.0MHz to 1000.0MHz	717.480	**0.003000**	0.25uW	Pass
	1000.0MHz to 2387MHz	2259.910	**0.026000**	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2399.990	**11.117000**	25uW	Pass
	2483.5MHz to 2496.5MHz	2483.550	**0.478000**	25uW	Pass
	2496.5MHz to 12500.0MHz	11239.550	**0.102000**	2.5uW	Pass
Vmax.	30.0MHz to 1000.0MHz	586.530	0.001000	0.25uW	Pass
	1000.0MHz to 2387MHz	2188.130	0.020000	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2399.990	10.471000	25uW	Pass
	2483.5MHz to 2496.5MHz	2483.500	0.412000	25uW	Pass
	2496.5MHz to 12500.0MHz	11313.330	0.099000	2.5uW	Pass
Vmin.	30.0MHz to 1000.0MHz	746.950	0.003000	0.25uW	Pass
	1000.0MHz to 2387MHz	2319.380	0.020000	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2399.990	9.862000	25uW	Pass
	2483.5MHz to 2496.5MHz	2483.500	0.386000	25uW	Pass
	2496.5MHz to 12500.0MHz	10615.590	0.088000	2.5uW	Pass

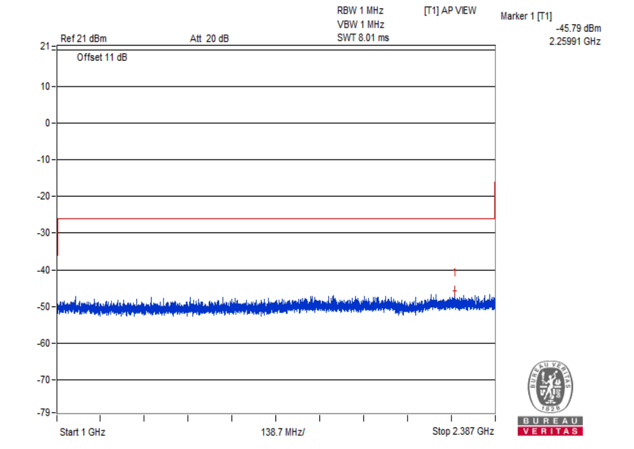
Note: 1. The worst value in each frequency range v.s. each channel has been marked by boldface.

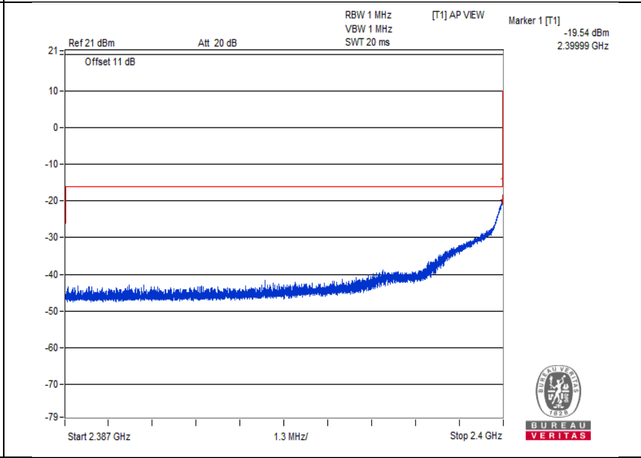
2. The spectrum plots are attached on the following pages.

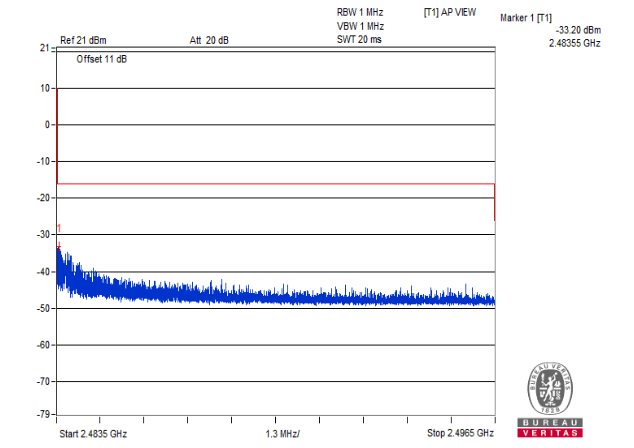
V_{normal}

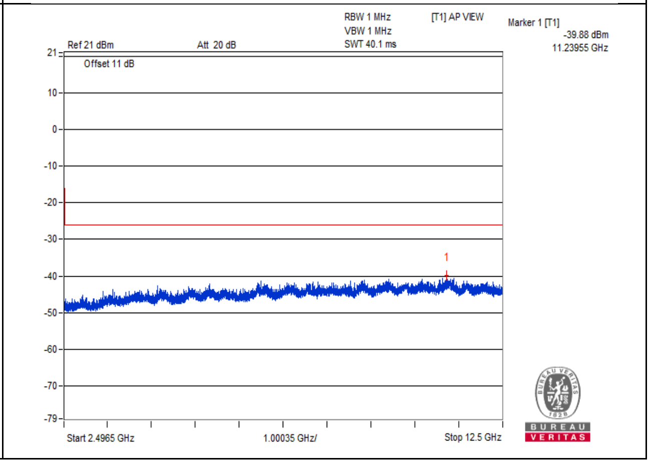

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 31 dBm
Att 30 dB
Offset 11 dB
Marker 1 [T1] 9.99 dBm 2.42302 GHz
Marker 2 [T1] -36.12 dBm 2.38082 GHz
Marker 3 [T1] -20.88 dBm 2.39998 GHz
Marker 4 [T1] -34.72 dBm 2.48350 GHz
Marker 5 [T1] -35.62 dBm 2.49892 GHz
Center 2.442 GHz
16 MHz/
Span 160 MHz


RBW 100 kHz
VBW 100 kHz
SWT 9.7 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -54.89 dBm 717.48 MHz
Start 30 MHz
97 MHz/
Stop 1 GHz

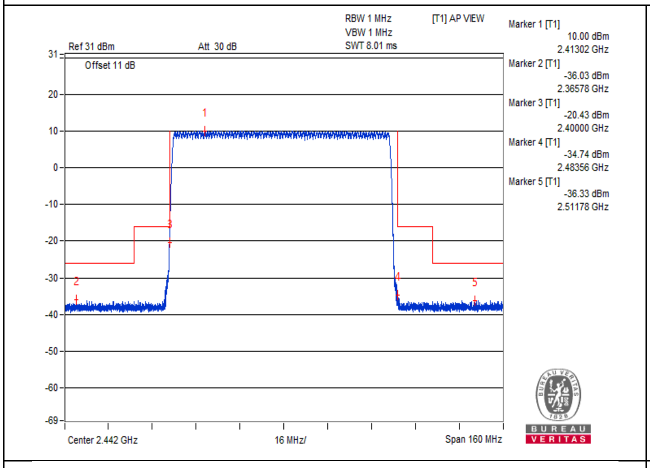

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -45.79 dBm 2.25991 GHz
Start 1 GHz
138.7 MHz/
Stop 2.387 GHz

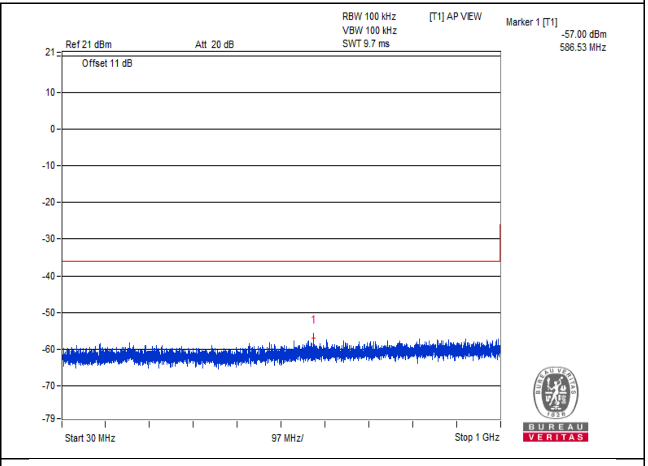

RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -19.54 dBm 2.39999 GHz
Start 2.387 GHz
1.3 MHz/
Stop 2.4 GHz

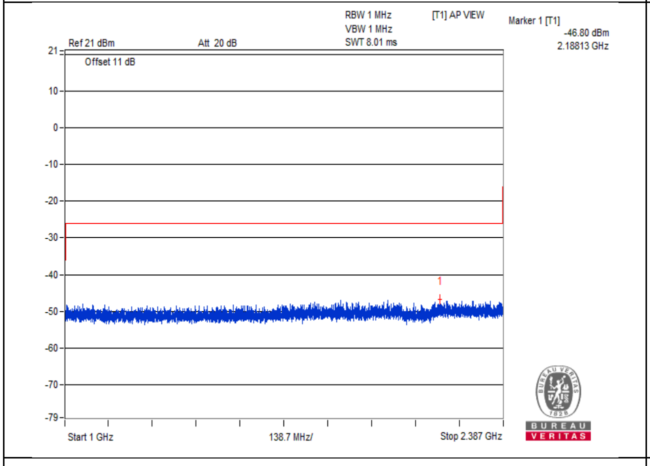

RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -33.20 dBm 2.48355 GHz
Start 2.4835 GHz
1.3 MHz/
Stop 2.4965 GHz

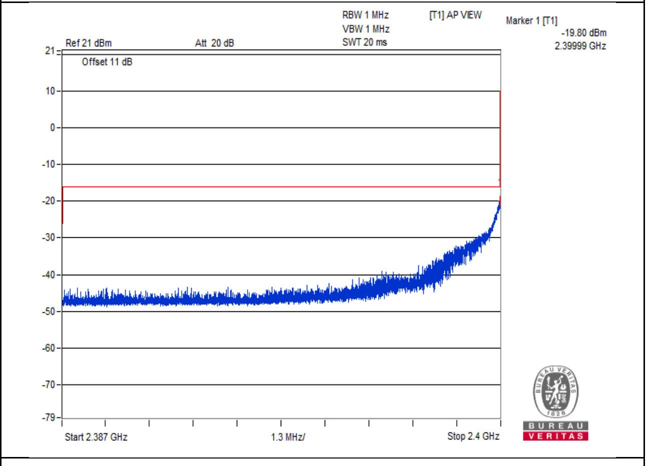

RBW 1 MHz
VBW 1 MHz
SWT 40.1 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -39.88 dBm 11.23955 GHz
Start 2.4965 GHz
1.00035 GHz/
Stop 12.5 GHz

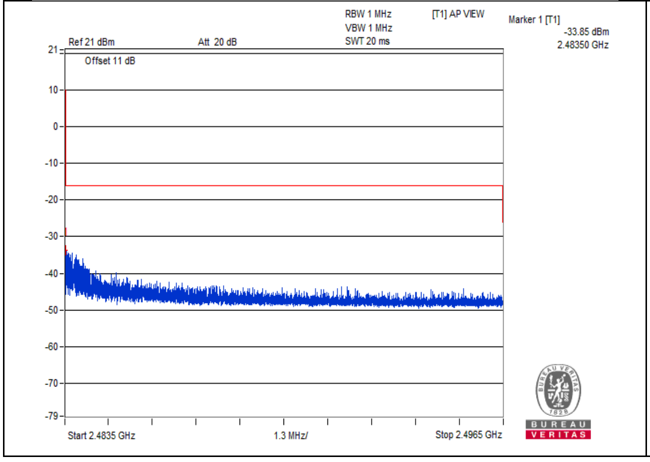
Vmax.

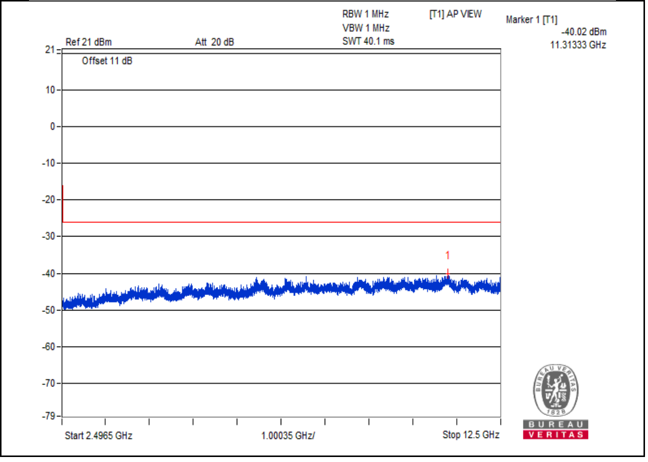

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 31 dBm
Att 30 dB
Offset 11 dB
Marker 1 [T1]
10.00 dBm
2.41302 GHz
Marker 2 [T1]
-36.03 dBm
2.36578 GHz
Marker 3 [T1]
-20.43 dBm
2.40000 GHz
Marker 4 [T1]
-34.74 dBm
2.48356 GHz
Marker 5 [T1]
-36.33 dBm
2.51178 GHz
Center 2.442 GHz
16 MHz/
Span 160 MHz


RBW 100 kHz
VBW 100 kHz
SWT 9.7 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-57.00 dBm
586.53 MHz
Start 30 MHz
97 MHz/
Stop 1 GHz

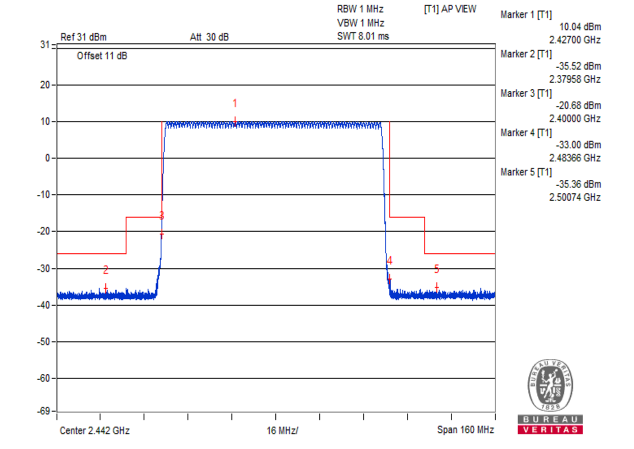

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-46.80 dBm
2.18813 GHz
Start 1 GHz
138.7 MHz/
Stop 2.387 GHz

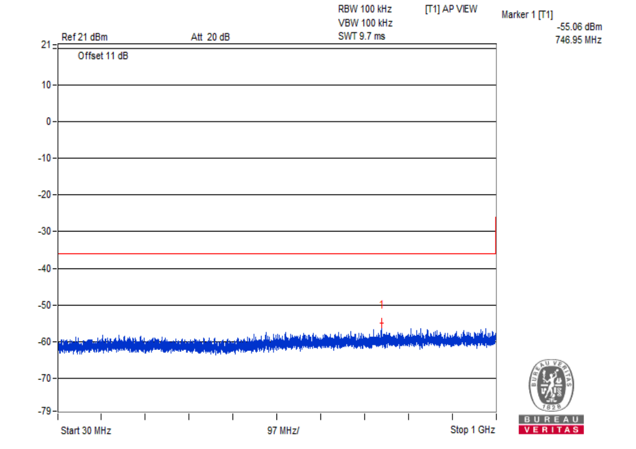

RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-19.80 dBm
2.39999 GHz
Start 2.387 GHz
1.3 MHz/
Stop 2.4 GHz

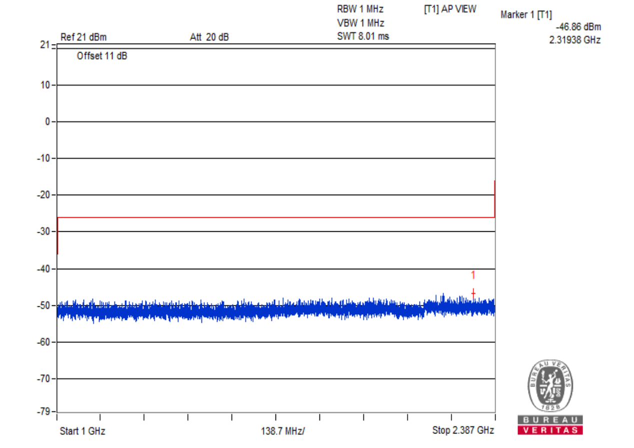

RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-33.85 dBm
2.48350 GHz
Start 2.4835 GHz
1.3 MHz/
Stop 2.4965 GHz

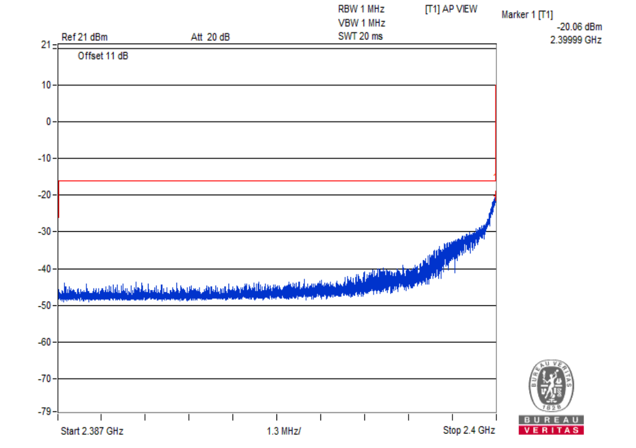

RBW 1 MHz
VBW 1 MHz
SWT 40.1 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1]
-40.02 dBm
11.31333 GHz
Start 2.4965 GHz
1.00035 GHz/
Stop 12.5 GHz

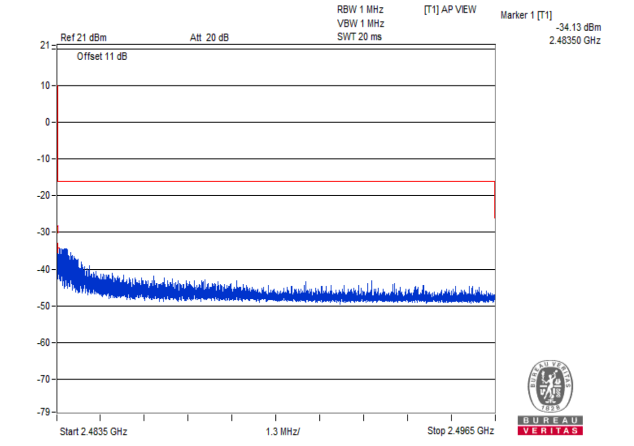
Vmin.

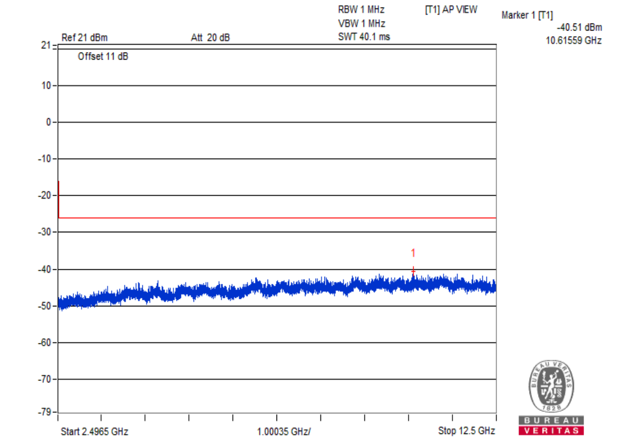

RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 31 dBm
Att 30 dB
Offset 11 dB
Marker 1 [T1] 10.04 dBm 2.42700 GHz
Marker 2 [T1] -35.52 dBm 2.37958 GHz
Marker 3 [T1] -20.68 dBm 2.40000 GHz
Marker 4 [T1] -33.00 dBm 2.48366 GHz
Marker 5 [T1] -35.36 dBm 2.50074 GHz
Center 2.442 GHz
16 MHz/
Span 160 MHz


RBW 100 kHz
VBW 100 kHz
SWT 9.7 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -55.06 dBm 746.95 MHz
Start 30 MHz
97 MHz/
Stop 1 GHz


RBW 1 MHz
VBW 1 MHz
SWT 8.01 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -46.86 dBm 2.31938 GHz
Start 1 GHz
138.7 MHz/
Stop 2.387 GHz


RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -20.06 dBm 2.39999 GHz
Start 2.387 GHz
1.3 MHz/
Stop 2.4 GHz


RBW 1 MHz
VBW 1 MHz
SWT 20 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -34.13 dBm 2.48350 GHz
Start 2.4835 GHz
1.3 MHz/
Stop 2.4965 GHz


RBW 1 MHz
VBW 1 MHz
SWT 40.1 ms
[T1] AP VIEW
Ref 21 dBm
Att 20 dB
Offset 11 dB
Marker 1 [T1] -40.51 dBm 10.61559 GHz
Start 2.4965 GHz
1.00035 GHz/
Stop 12.5 GHz

4.5 Antenna Power Measurement

4.5.1 Limits of Antenna Power

Modulation System	Frequency Band Used	Antenna Power (Max.)	EIRP (Max.)	
			Omni-Directional Case	Directional Case
DS	2400 – 2483.5 MHz	10 mW/MHz	12.14 dBm/MHz (16.37 mW/MHz)	22.14 dBm/MHz (163.68 mW/MHz)
OFDM (Note 1)	2400 – 2483.5 MHz	10 mW/MHz	12.14 dBm/MHz (16.37 mW/MHz)	22.14 dBm/MHz (163.68 mW/MHz)
OFDM (Note 2)	2400 – 2483.5 MHz	5 mW/MHz	9.14 dBm/MHz (8.20mW/MHz)	19.14 dBm/MHz (82.04 mW/MHz)
FH	2400 – 2483.5 MHz	3 mW/MHz	6.91 dBm/MHz (4.91 mW/MHz)	16.91 dBm/MHz (49.10 mW/MHz)

Note:
1. Occupied bandwidth is less than 26MHz
2. Occupied bandwidth is more that 26MHz and less than 38MHz
3. The half-power beam width for directional antenna shall be 360/A degrees or less, where A is a ratio which causes the EIRP concerned to exceed the omnidirectional EIRP upper limit.
4. Tolerance of antenna power shall be +20% (upper value) and –80% (lower value).

4.5.2 Test Setup

Output Power Density (mW/MHz) = Total Output Power (mW) / Spread Bandwidth (MHz)

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

4.5.3 Test Results

Normal Mode:

Environmental Conditions		25 deg.C, 60% RH			
Modulation Type	**Date Rate Type**	**Conducted RF Output Power Density (mW/MHz)**			
		Normal Voltage	**Max. Voltage**	**Min. Voltage**	**Max. Limit (mW/MHz)**
		3.7Vdc	**4.07Vdc**	**3.33Vdc**	
GFSK	**DH5**	0.102871	0.100120	**0.105565**	3
π/4-DQPSK	**2DH5**	0.100475	0.104786	0.098421	3
8DPSK	**3DH5**	0.102171	0.097921	0.103825	3
Rated power		**0.20mW**			
Tolerance of antenna power		**0.04mW ~ 0.24mW**			

Monopole antenna with -4.15dBi gain

Environmental Conditions		25 deg.C, 60% RH			
Modulation Type	**Date Rate Type**	**Radiated RF Output Power Density (mW/MHz)**			
		Normal Voltage	**Max. Voltage**	**Min. Voltage**	**Max. Limit (mW/MHz)**
		3.7Vdc	**4.07Vdc**	**3.33Vdc**	
GFSK	**DH5**	0.039563	0.038505	**0.040599**	4.909
π/4-DQPSK	**2DH5**	0.038642	0.040300	0.037852	4.909
8DPSK	**3DH5**	0.039294	0.037660	0.039930	4.909

Note: The value of radiated RF output densities are "calculated" values.

AFH Mode:

Environmental Conditions		25 deg.C, 60% RH			
Modulation Type	Date Rate Type	Conducted RF Output Power Density (mW/MHz)			
		Normal Voltage	Max. Voltage	Min. Voltage	Max. Limit (mW/MHz)
		3.7Vdc	4.07Vdc	3.33Vdc	
GFSK	DH5	0.403793	0.391893	**0.413207**	3
π /4-DQPSK	2DH5	0.395492	0.411308	0.385922	3
8DPSK	3DH5	0.401045	0.384823	0.407537	3
Rated power		**0.50mW**			
Tolerance of antenna power		**0.10mW ~ 0.60mW**			

Monopole antenna with -4.15dBi gain

Environmental Conditions		25 deg.C, 60% RH			
Modulation Type	Date Rate Type	Radiated RF Output Power Density (mW/MHz)			
		Normal Voltage	Max. Voltage	Min. Voltage	Max. Limit (mW/MHz)
		3.7Vdc	4.07Vdc	3.33Vdc	
GFSK	DH5	0.155295	0.150719	**0.158916**	4.909
π /4-DQPSK	2DH5	0.152103	0.158186	0.148422	4.909
8DPSK	3DH5	0.154239	0.148000	0.156735	4.909

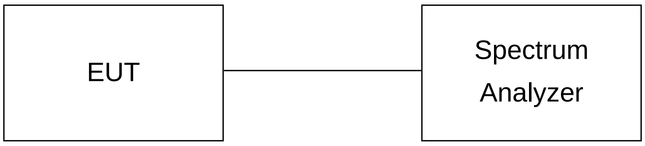
Note: The value of radiated RF output densities are "calculated" values.

4.6 Spurious Emissions for Receiver

4.6.1 Limits of Spurious Emissions for Receiver

Frequencies (MHz)	Limit
Below 1GHz	≦4nW (-54dBm)
Above 1GHz	≦20nW (-47dBm)

4.6.2 Test Setup



4.6.3 Test Result

Modulation: GFSK

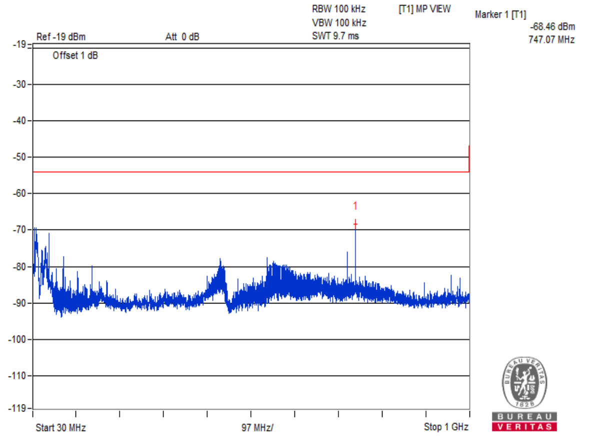
Environmental Conditions		25 deg.C, 68% RH					
Test Channel		Channel 0 (2402MHz)		Channel 39 (2441MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value (nW)	Frequency (MHz)	Measured Value (nW)		
Vnormal	Below 1GHz	747.070	**0.142561**	31.940	0.093541	4nW	Pass
	Above 1GHz	4806.500	**0.118577**	11327.000	0.104232	20nW	Pass
Vmax.	Below 1GHz	31.940	0.106905	31.940	**0.185780**	4nW	Pass
	Above 1GHz	11304.000	0.099770	4884.120	**0.128233**	20nW	Pass
Vmin.	Below 1GHz	36.300	0.103276	31.940	0.142889	4nW	Pass
	Above 1GHz	4806.500	0.113501	4884.120	0.118850	20nW	Pass

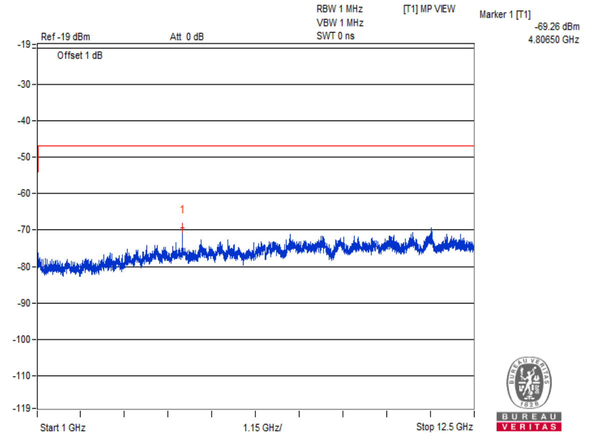
Test Channel		Channel 78 (2480MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value (nW)		
Vnormal	Below 1GHz	31.940	**0.112202**	4nW	Pass
	Above 1GHz	4958.870	0.082035	20nW	Pass
Vmax.	Below 1GHz	31.940	0.111944	4nW	Pass
	Above 1GHz	11358.620	**0.100693**	20nW	Pass
Vmin.	Below 1GHz	31.940	0.089950	4nW	Pass
	Above 1GHz	4958.870	0.092470	20nW	Pass

Note: 1. The worst value in each frequency range v.s. each channel has been marked by boldface.

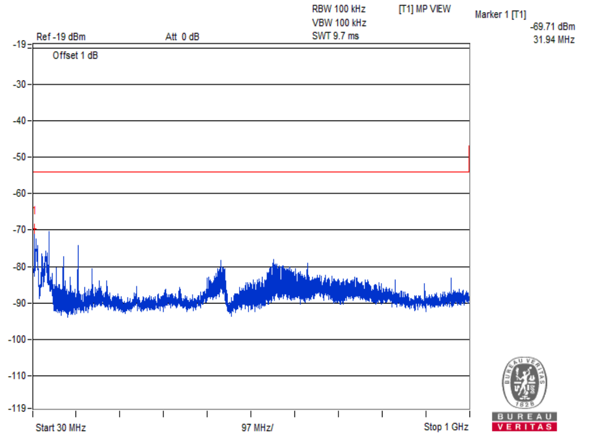
2. The spectrum plots are attached on the following pages.

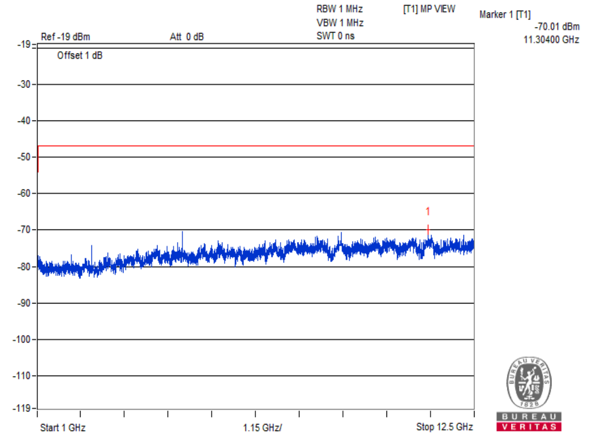
V_{normal}



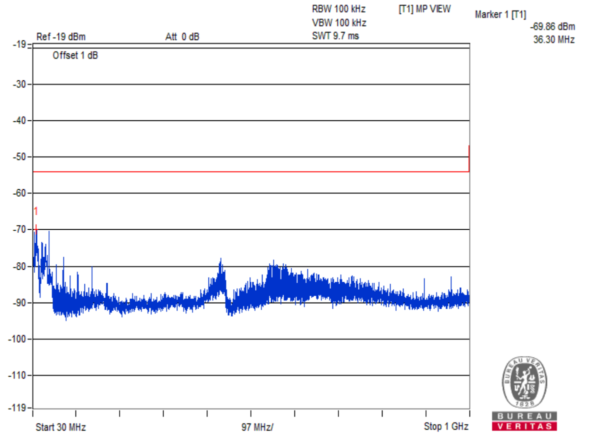


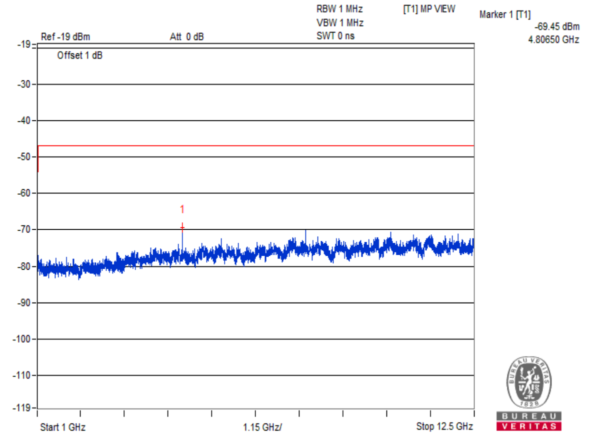
V_{max.}





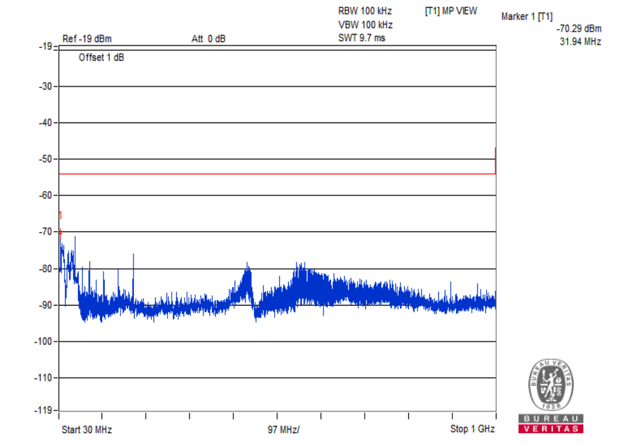
V_{min.}

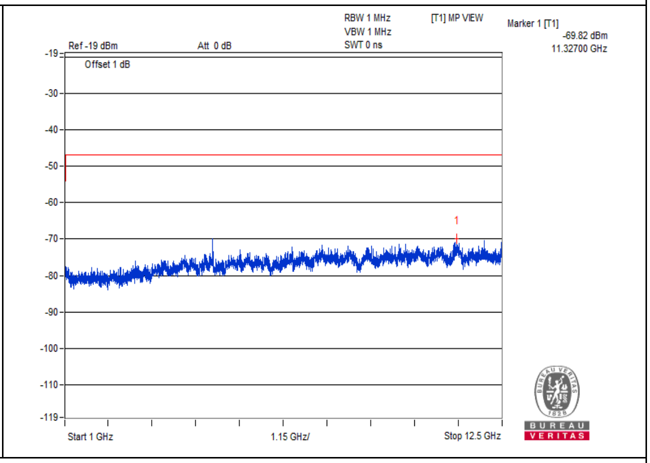




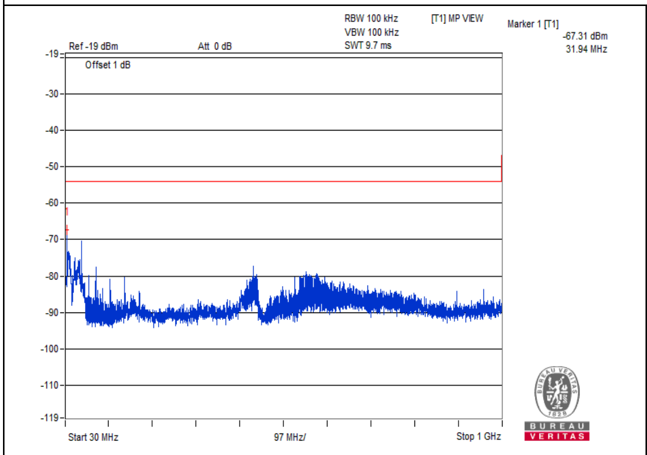
CH 0 (2402MHz)

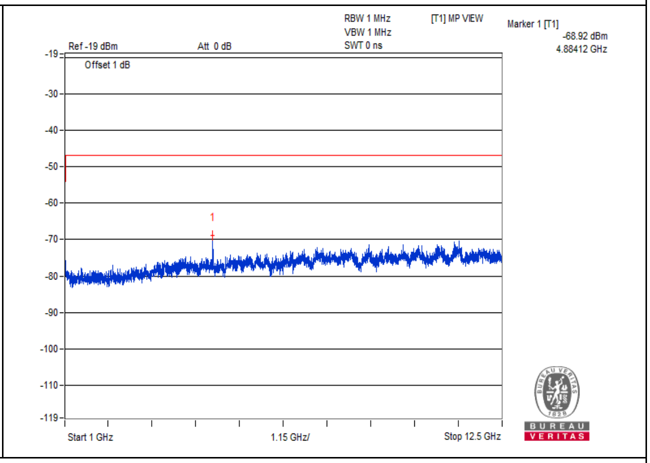
Vnormal



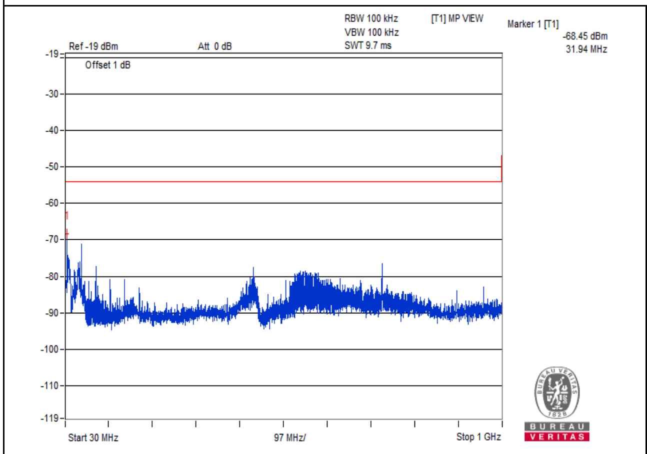


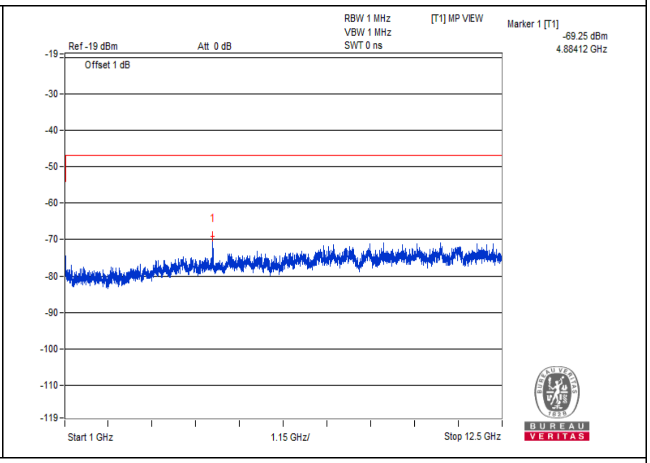
Vmax.





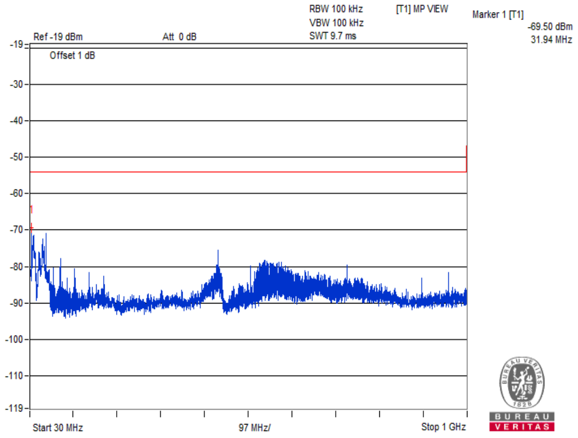
Vmin.

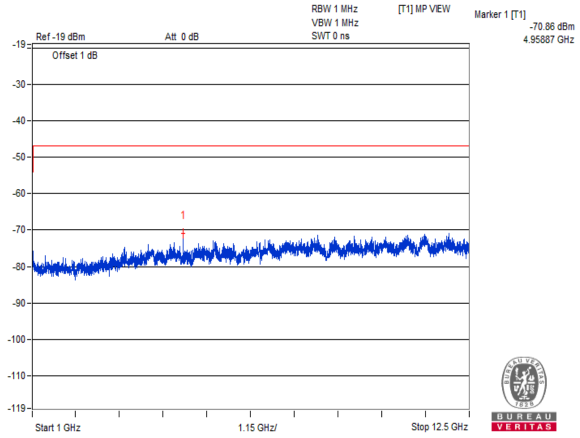




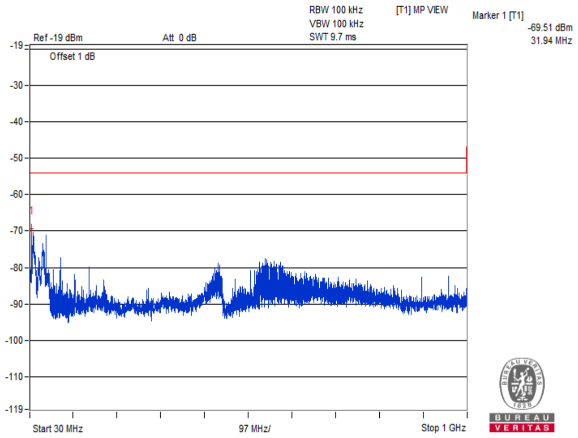
CH 39 (2441MHz)

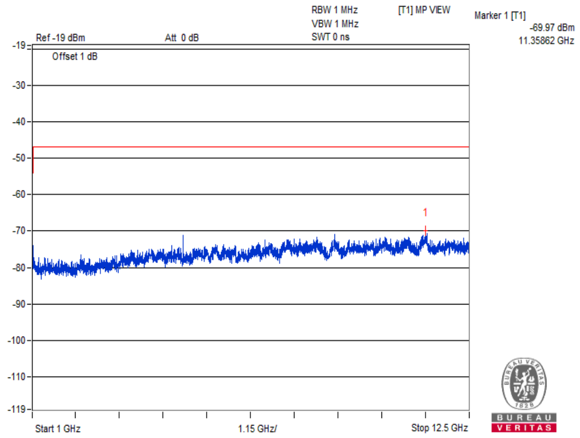
Vnormal



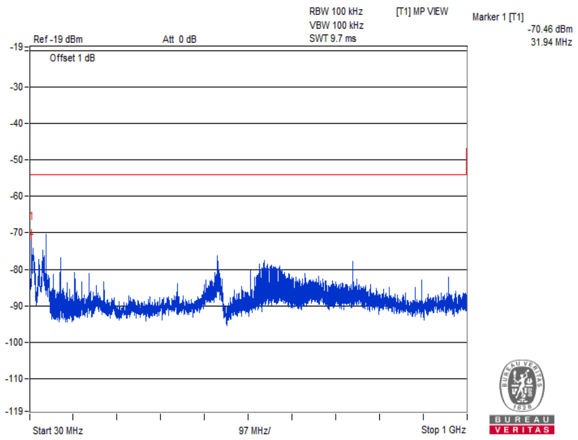


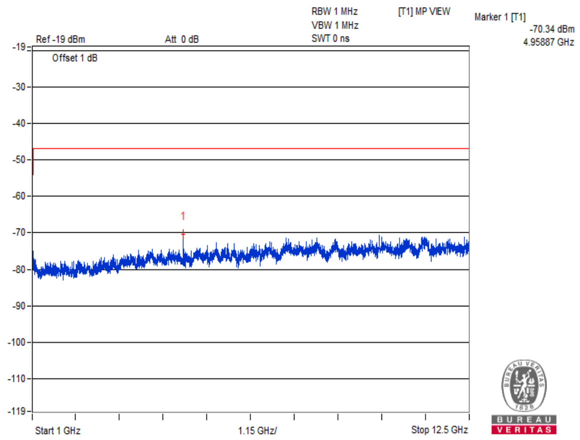
Vmax.





Vmin.





CH 78 (2480MHz)

4.7 Dwell Time

4.7.1 Limits of Dwell Time

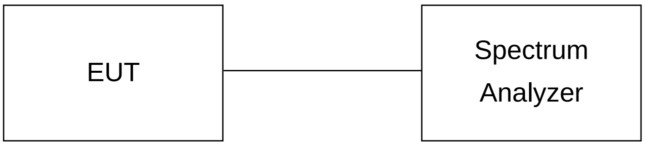
The frequency retention time in the frequency hopping method shall be 0.4 secondor less. The total sum of the frequency retention time in any frequency within the time obtained by multiplying the diffusion rate by 0.4 second shall be 0.4 second or shorter.

Formula:

(Normal mode) dwell time = [diffusion rate/ 79] x duty-cycle x 0.4 seconds

(AFH mode) dwell time = [diffusion rate/20] x duty-cycle x 0.4 sec

4.7.2 Test Setup



4.7.3 Test Result

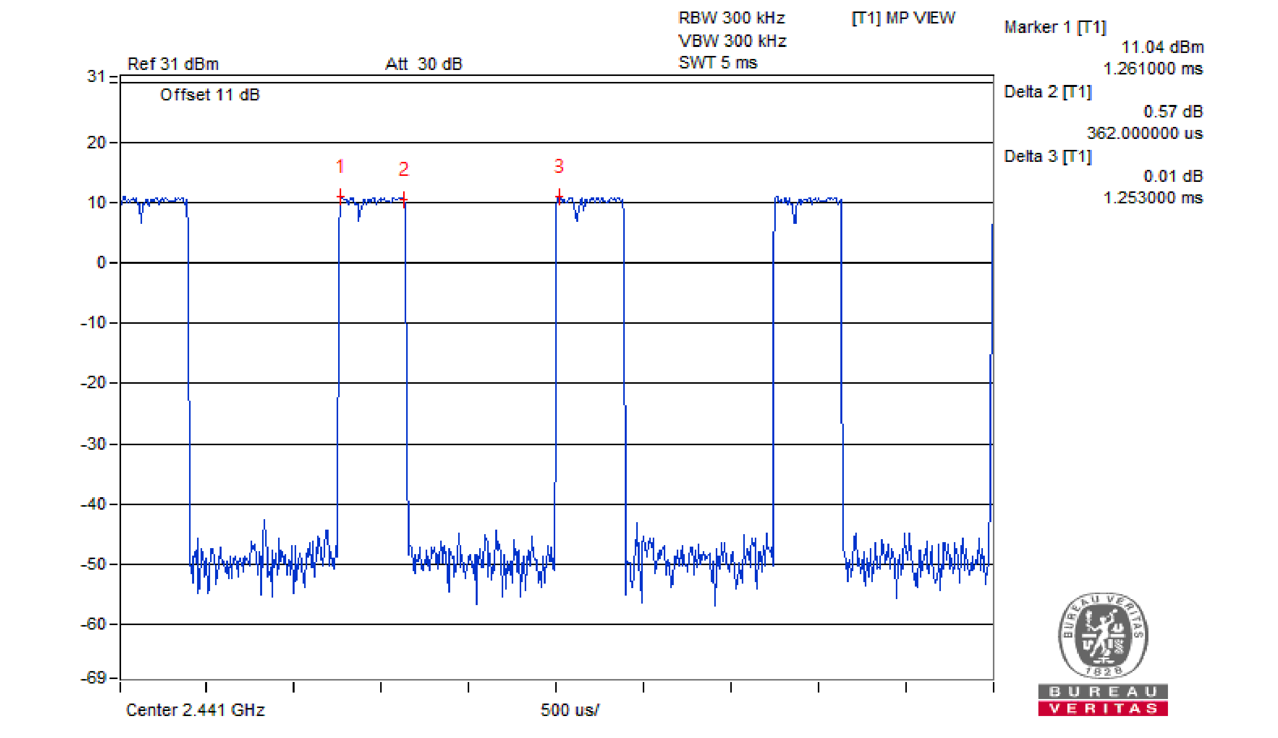
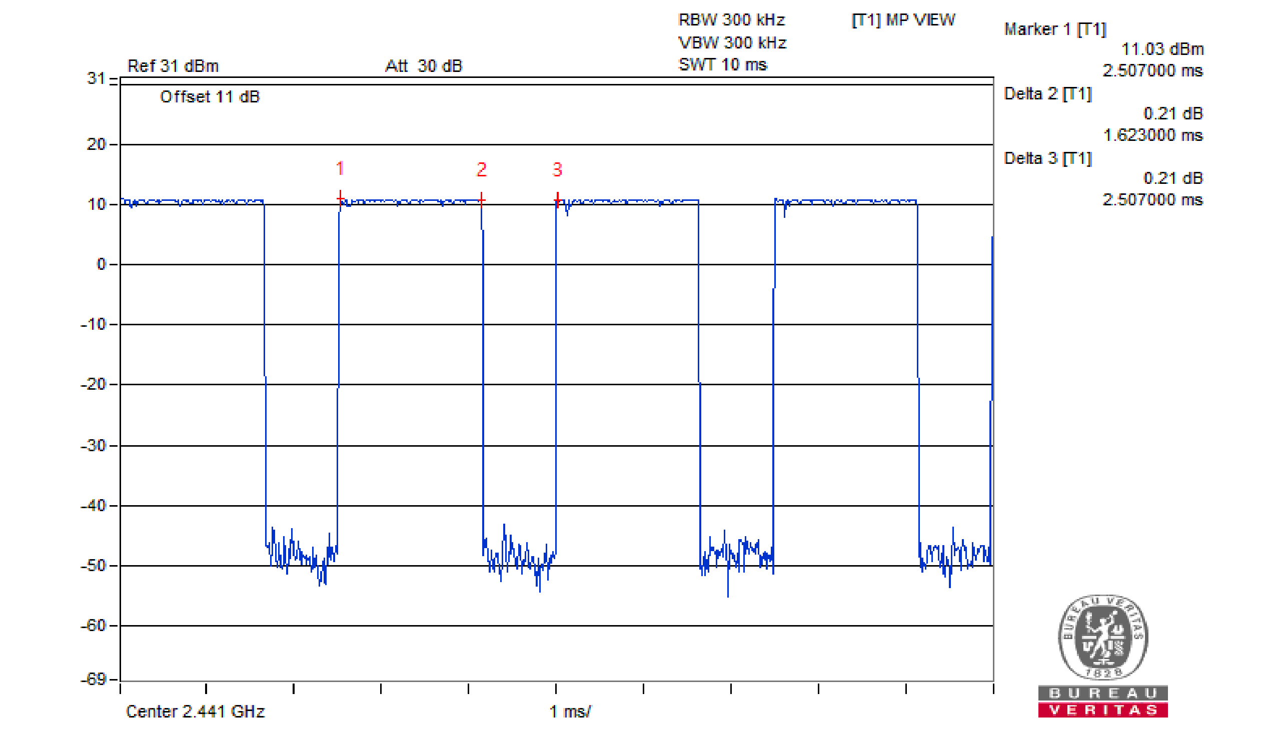
Modulation: GFSK

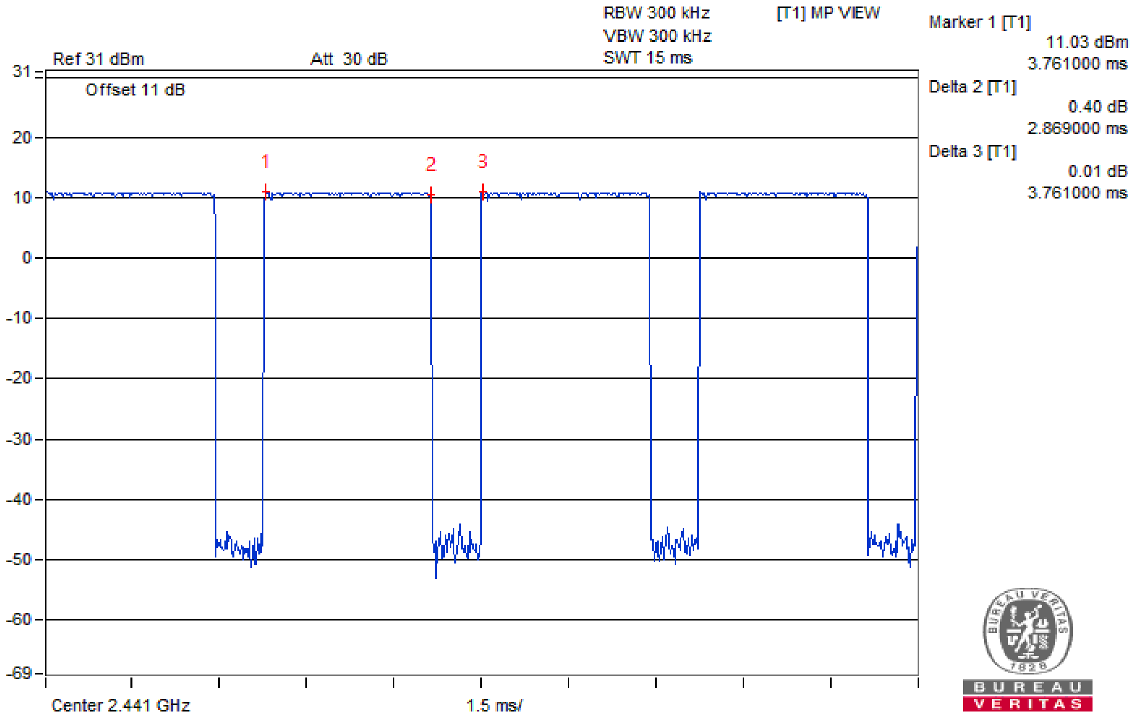
Normal Mode:

Test Condition	Mode	Spreading Rate	[Spreading Rate/79]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Vnormal	DH1	71.40	0.361	0.288	103.968	400
	DH3	71.40	0.361	0.647	233.567	400
	DH5	71.40	0.361	0.762	275.082	400
Vmax.	DH1	71.20	0.360	0.288	103.680	400
	DH3	71.20	0.360	0.647	232.920	400
	DH5	71.20	0.360	0.762	274.320	400
Vmin.	DH1	71.20	0.360	0.288	103.680	400
	DH3	71.20	0.360	0.647	232.920	400
	DH5	71.20	0.360	0.762	274.320	400

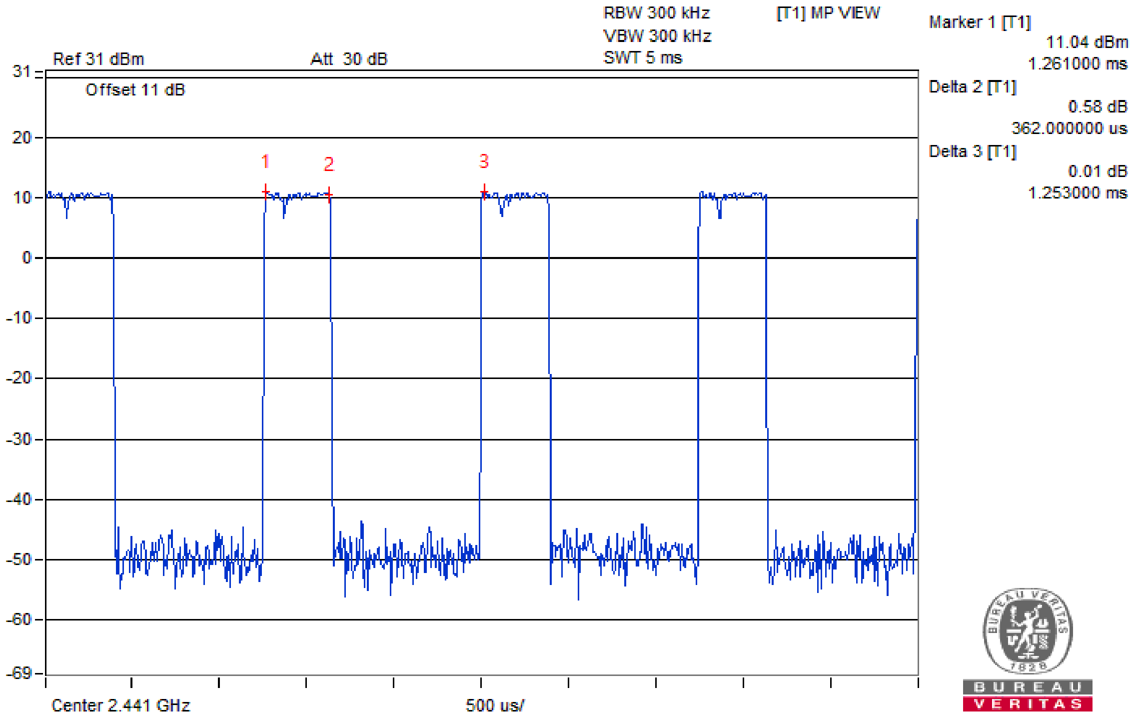
AFH Mode:

Test Condition	Mode	Spreading Rate	[Spreading Rate/20]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Vnormal	DH1	18.19	0.363	0.288	104.544	400
	DH3	18.19	0.363	0.647	234.861	400
	DH5	18.19	0.363	0.762	276.606	400
Vmax.	DH1	18.19	0.363	0.288	104.544	400
	DH3	18.19	0.363	0.647	234.861	400
	DH5	18.19	0.363	0.762	276.606	400
Vmin.	DH1	18.19	0.363	0.288	104.544	400
	DH3	18.19	0.363	0.647	234.861	400
	DH5	18.19	0.363	0.762	276.606	400

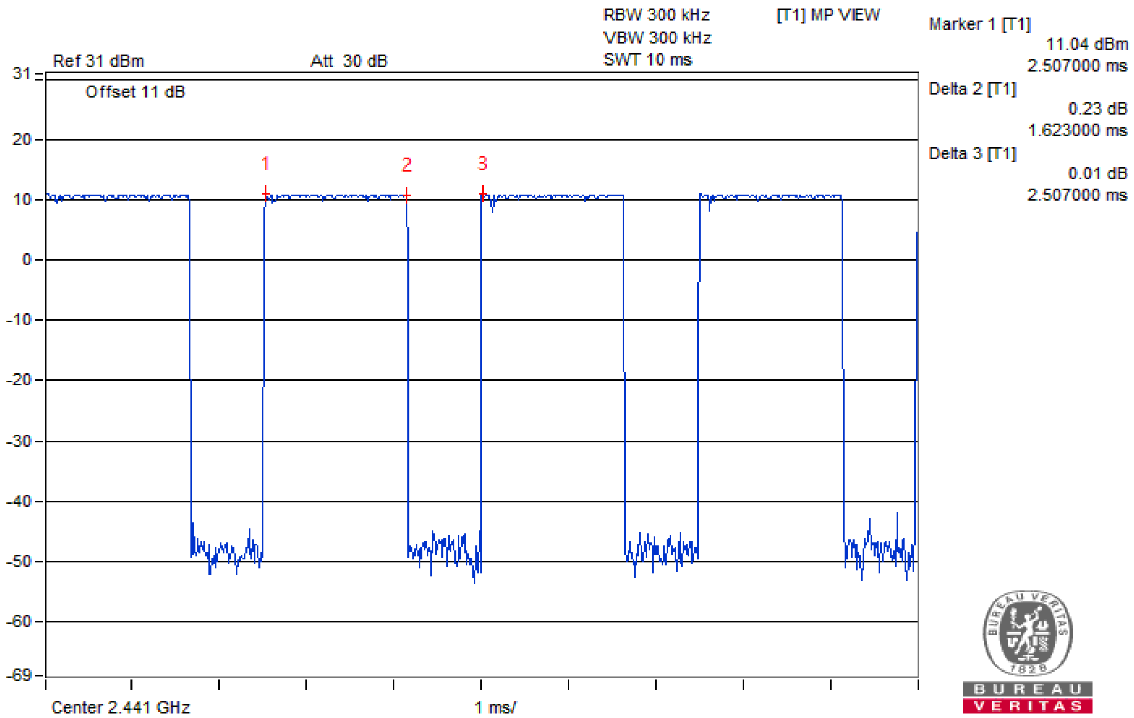
Vnormal

DH1

DH3

Vnormal
RBW 300 kHz VBW 300 kHz SWT 15 ms [T1] MP VIEW Marker 1 [T1] 11.03 dBm 3.761000 ms Delta 2 [T1] 0.40 dB 2.869000 ms Delta 3 [T1] 0.01 dB 3.761000 ms Ref 31 dBm Att 30 dB Offset 11 dB 31 20 10 0 -10 -20 -30 -40 -50 -60 -69 1 2 3 Center 2.441 GHz 1.5 ms/
DH5

Vmax.

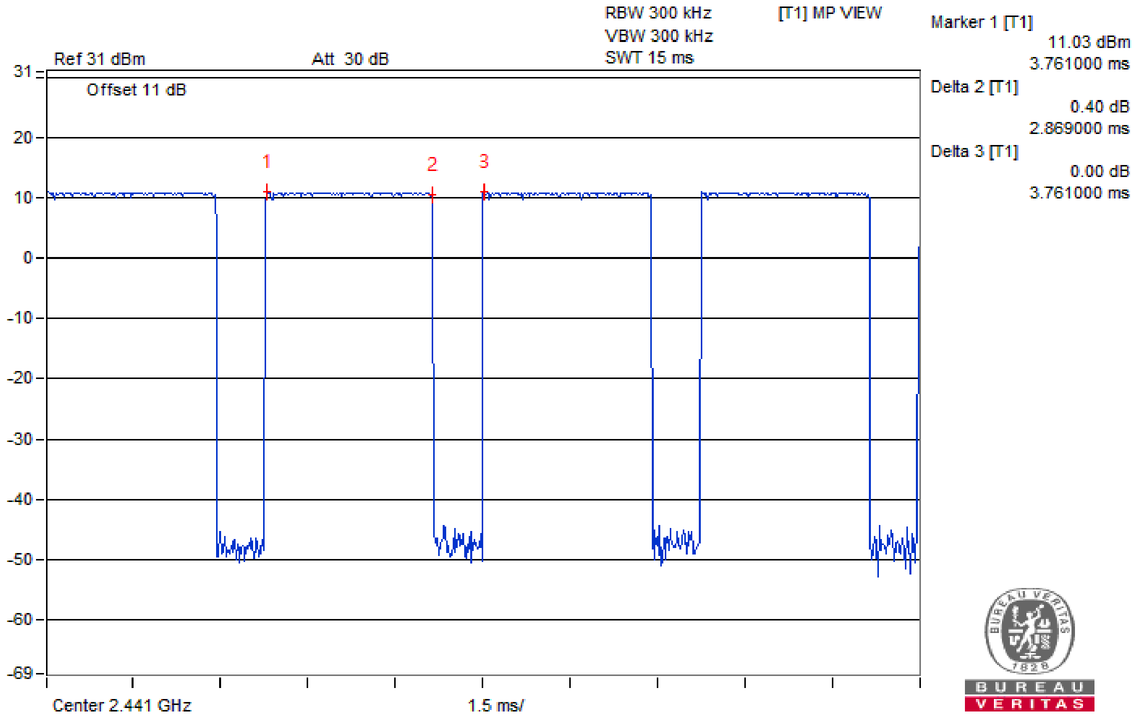

RBW 300 kHz
VBW 300 kHz
SWT 5 ms
[T1] MP VIEW
Marker 1 [T1]
11.04 dBm
1.261000 ms
Delta 2 [T1]
0.58 dB
362.000000 us
Delta 3 [T1]
0.01 dB
1.253000 ms
Ref 31 dBm
Att 30 dB
Offset 11 dB
31
20
10
0
-10
-20
-30
-40
-50
-60
-69
1
2
3
Center 2.441 GHz
500 us/

DH1


RBW 300 kHz
VBW 300 kHz
SWT 10 ms
[T1] MP VIEW
Marker 1 [T1]
11.04 dBm
2.507000 ms
Delta 2 [T1]
0.23 dB
1.623000 ms
Delta 3 [T1]
0.01 dB
2.507000 ms
Ref 31 dBm
Att 30 dB
Offset 11 dB
31
20
10
0
-10
-20
-30
-40
-50
-60
-69
1
2
3
Center 2.441 GHz
1 ms/

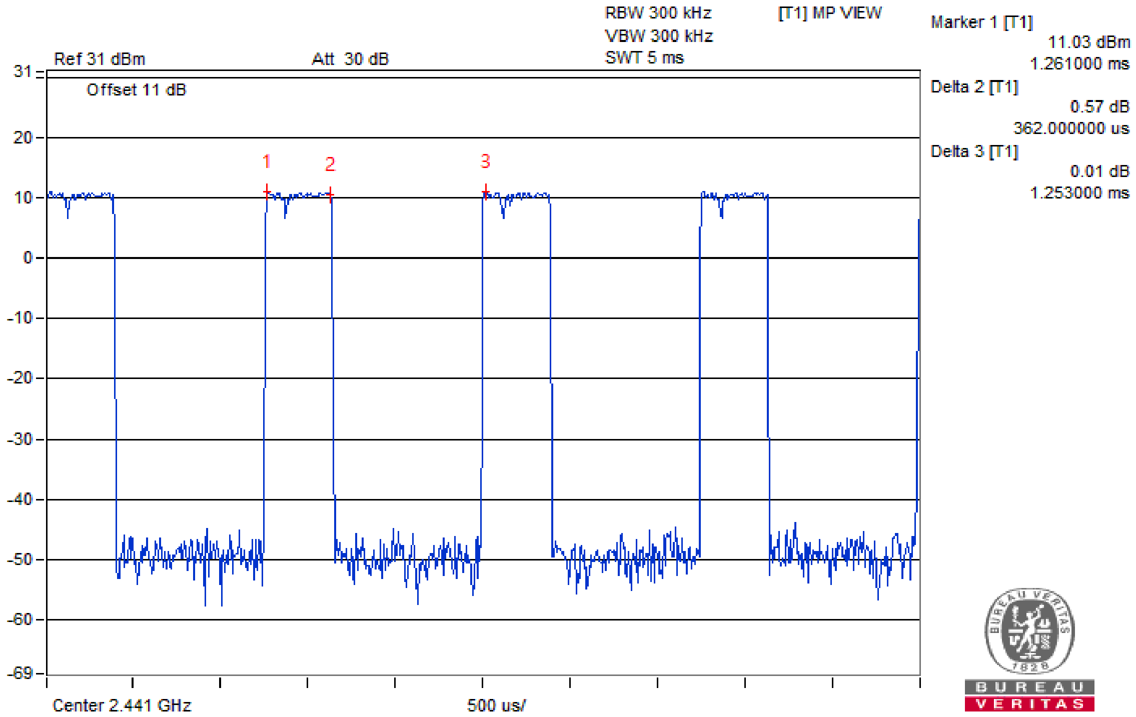
DH3

$V_{max.}$

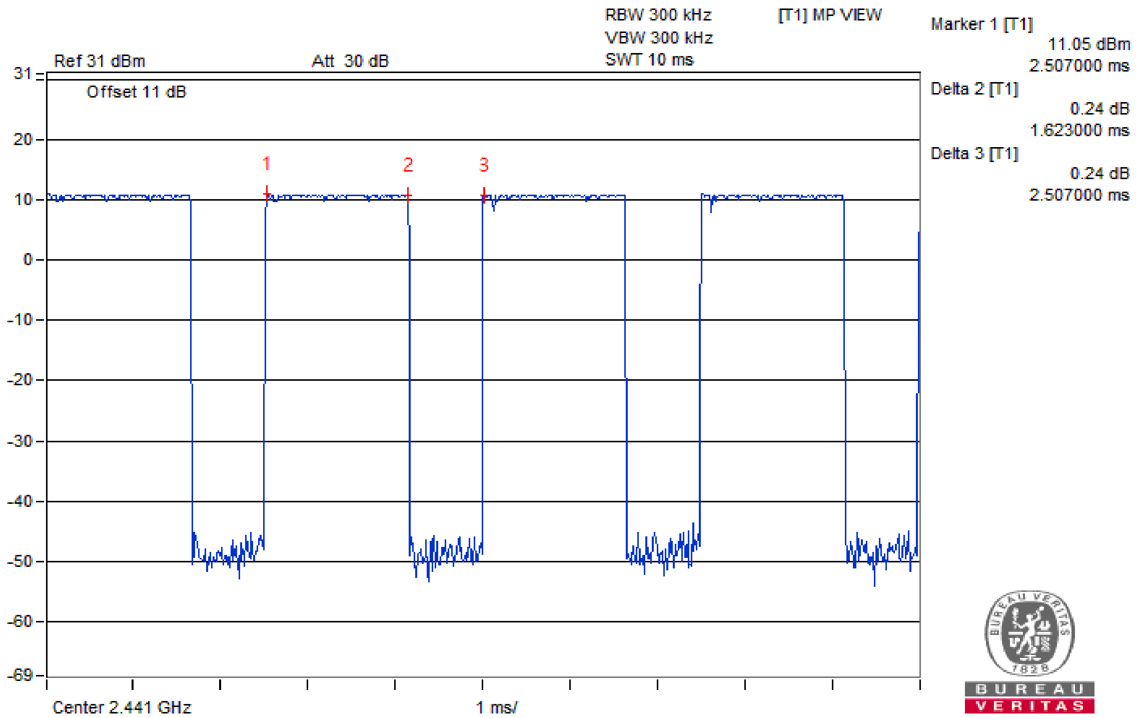

RBW 300 kHz
VBW 300 kHz
SWT 15 ms
[T1] MP VIEW
Marker 1 [T1]
11.03 dBm
3.761000 ms
Delta 2 [T1]
0.40 dB
2.869000 ms
Delta 3 [T1]
0.00 dB
3.761000 ms
Ref 31 dBm
Att 30 dB
Offset 11 dB
31
20
10
0
-10
-20
-30
-40
-50
-60
-69
1
2
3
Center 2.441 GHz
1.5 ms/

DH5

Vmin.

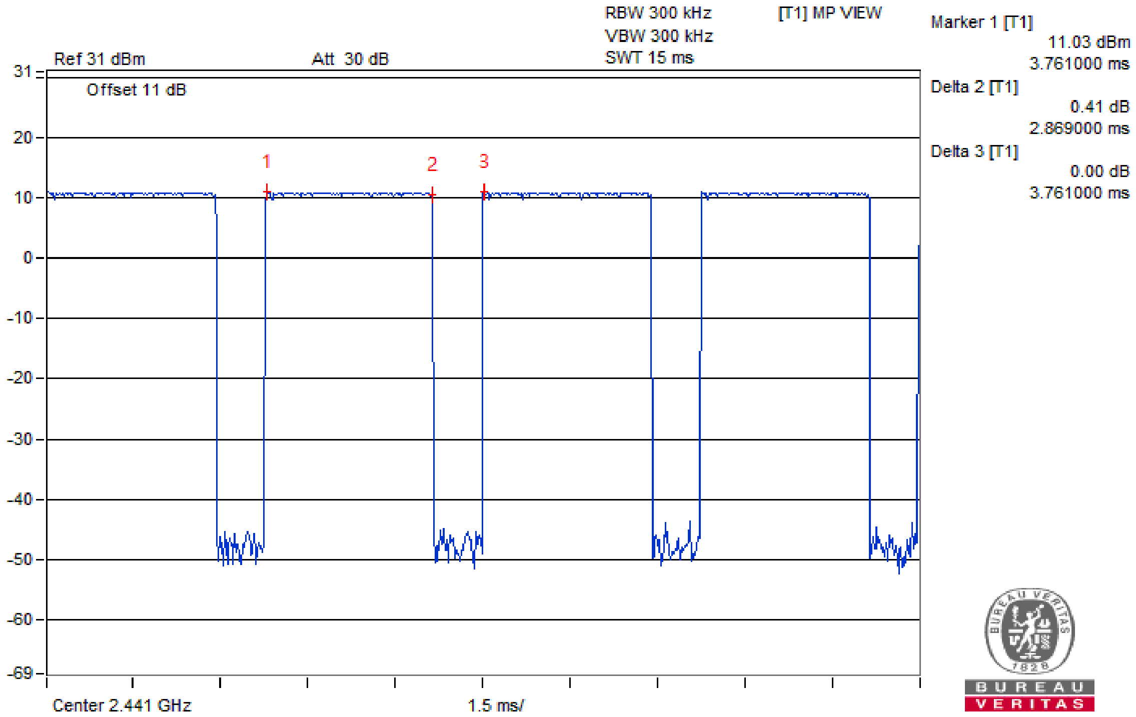

RBW 300 kHz
VBW 300 kHz
SWT 5 ms
[T1] MP VIEW
Marker 1 [T1]
11.03 dBm
1.261000 ms
Delta 2 [T1]
0.57 dB
362.000000 us
Delta 3 [T1]
0.01 dB
1.253000 ms
Ref 31 dBm
Att 30 dB
Offset 11 dB
Center 2.441 GHz
500 us/

DH1


RBW 300 kHz
VBW 300 kHz
SWT 10 ms
[T1] MP VIEW
Marker 1 [T1]
11.05 dBm
2.507000 ms
Delta 2 [T1]
0.24 dB
1.623000 ms
Delta 3 [T1]
0.24 dB
2.507000 ms
Ref 31 dBm
Att 30 dB
Offset 11 dB
Center 2.441 GHz
1 ms/

DH3

Vmin.



RBW 300 kHz
VBW 300 kHz
SWT 15 ms
[T1] MP VIEW
Marker 1 [T1]
11.03 dBm
3.761000 ms
Delta 2 [T1]
0.41 dB
2.869000 ms
Delta 3 [T1]
0.00 dB
3.761000 ms
Ref 31 dBm
Att 30 dB
Offset 11 dB
31
20
10
0
-10
-20
-30
-40
-50
-60
-69
1
2
3
Center 2.441 GHz
1.5 ms/

DH5

Modulation: π/4-DQPSK

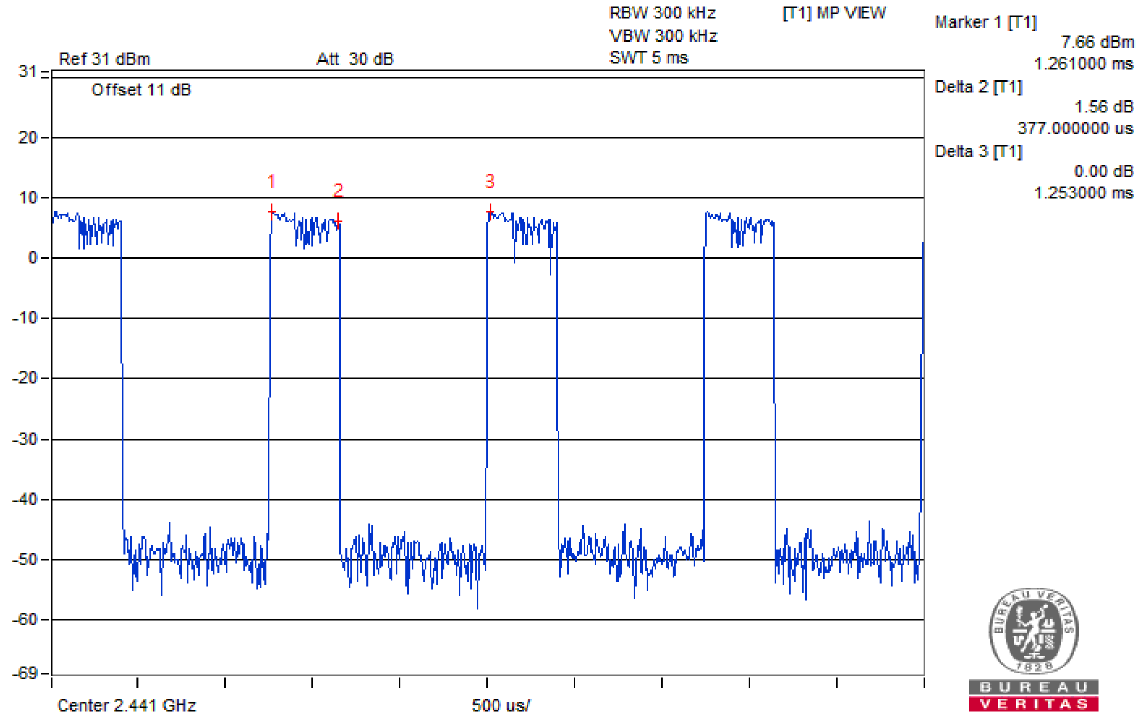
Normal Mode:

Test Condition	Mode	Spreading Rate	[Spreading Rate/79]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Vnormal	2DH1	71.60	0.362	0.300	108.600	400
	2DH3	71.60	0.362	0.652	236.024	400
	2DH5	71.60	0.362	0.755	273.310	400
Vmax.	2DH1	71.40	0.361	0.300	108.300	400
	2DH3	71.40	0.361	0.647	233.567	400
	2DH5	71.40	0.361	0.755	272.555	400
Vmin.	2DH1	71.60	0.362	0.300	108.600	400
	2DH3	71.60	0.362	0.647	234.214	400
	2DH5	71.60	0.362	0.763	276.206	400

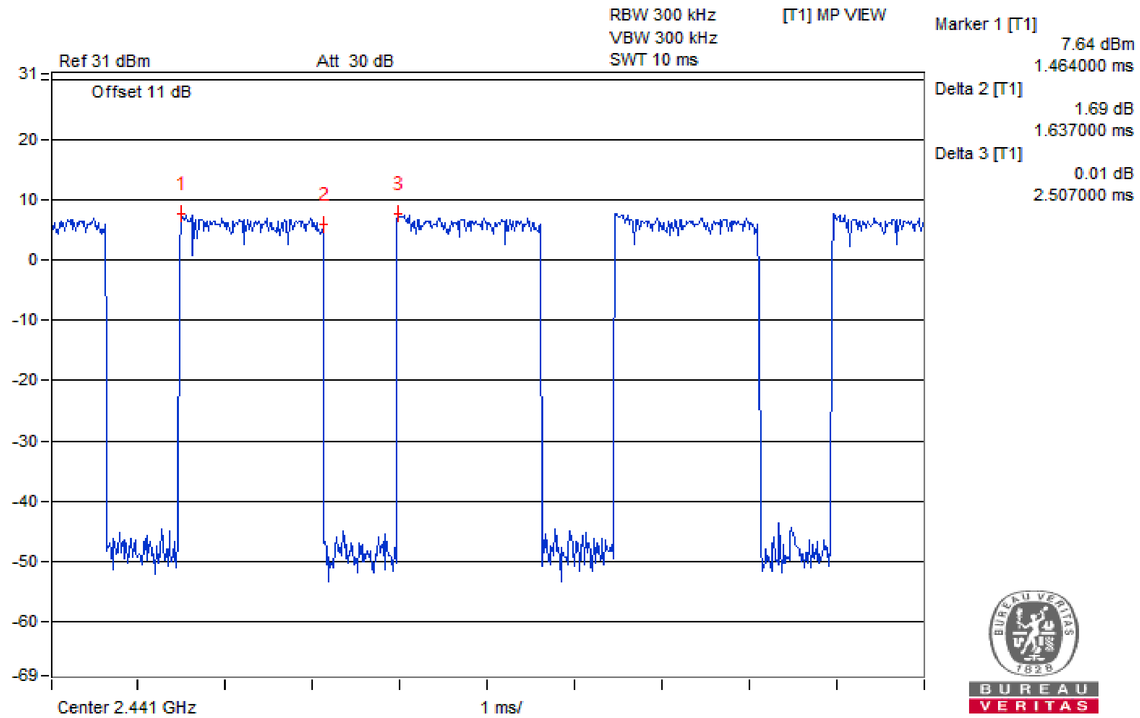
AFH Mode:

Test Condition	Mode	Spreading Rate	[Spreading Rate/20]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Vnormal	2DH1	18.19	0.363	0.300	108.900	400
	2DH3	18.19	0.363	0.652	236.676	400
	2DH5	18.19	0.363	0.755	274.065	400
Vmax.	2DH1	18.19	0.363	0.300	108.900	400
	2DH3	18.19	0.363	0.647	234.861	400
	2DH5	18.19	0.363	0.755	274.065	400
Vmin.	2DH1	18.26	0.365	0.300	109.500	400
	2DH3	18.26	0.365	0.647	236.155	400
	2DH5	18.26	0.365	0.763	278.495	400

V normal

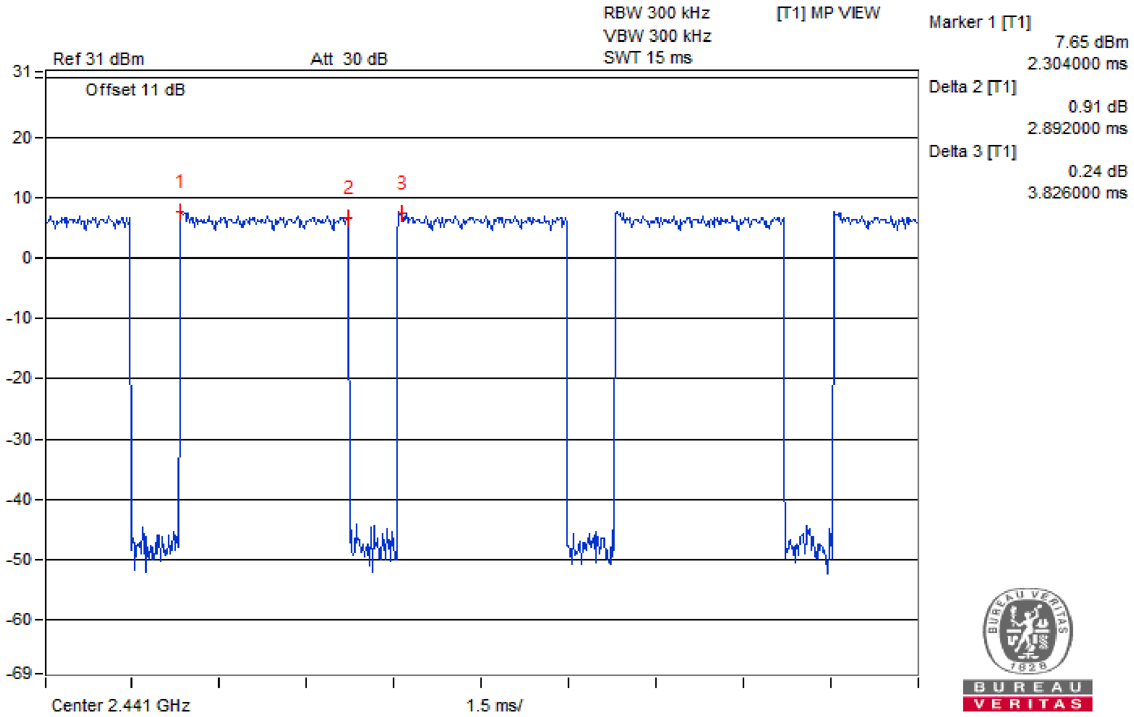


2DH1

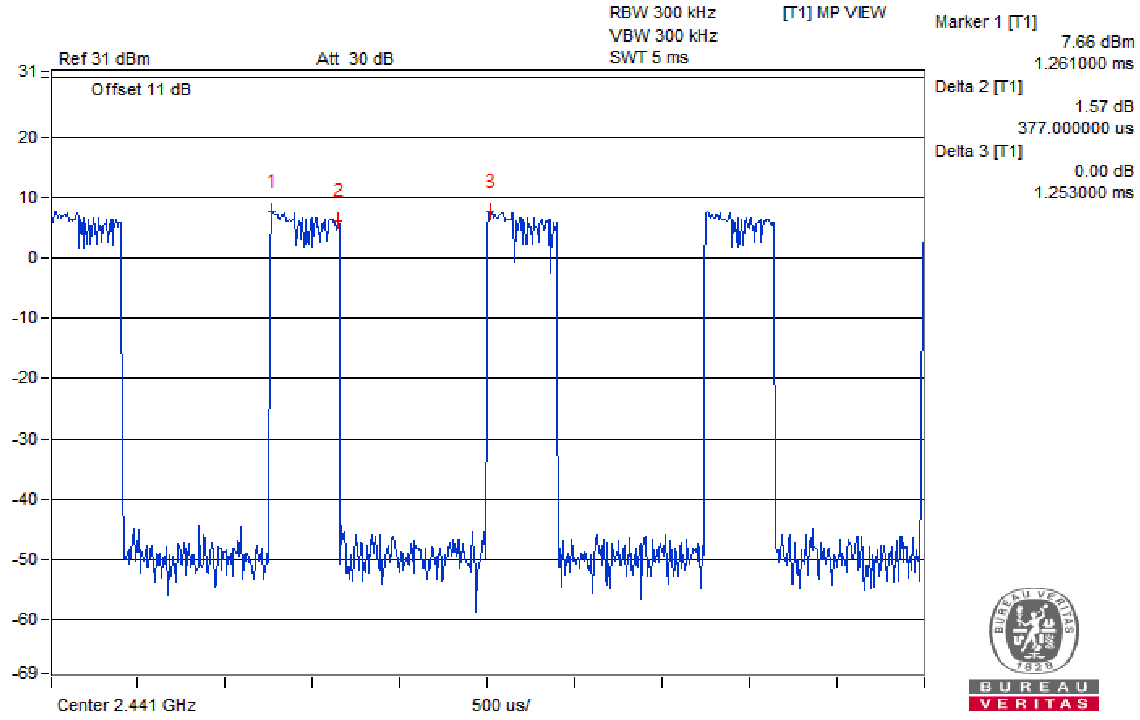
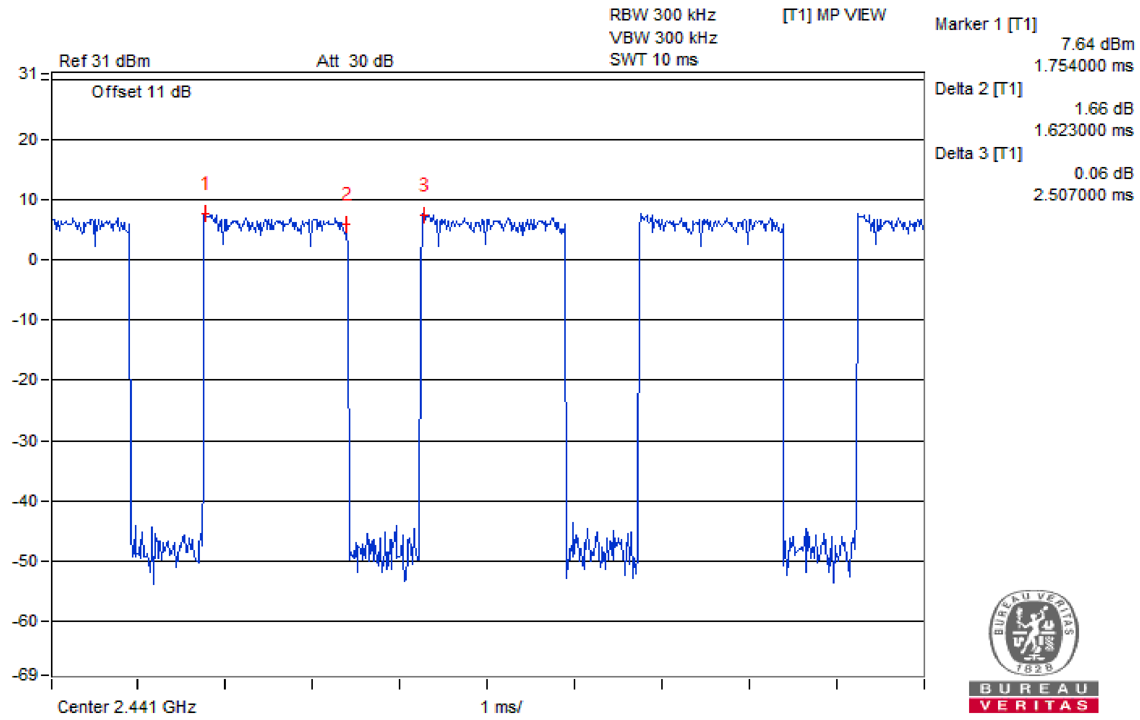


2DH3

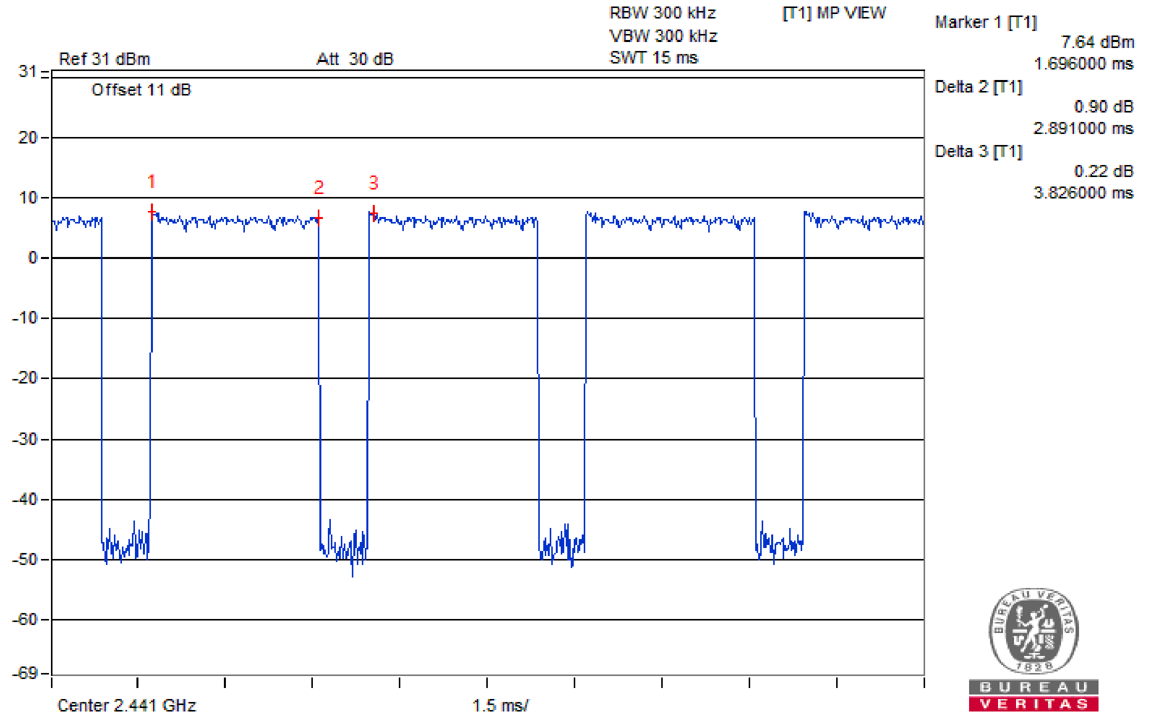
V_{normal}



2DH5

Vmax.

2DH1

2DH3

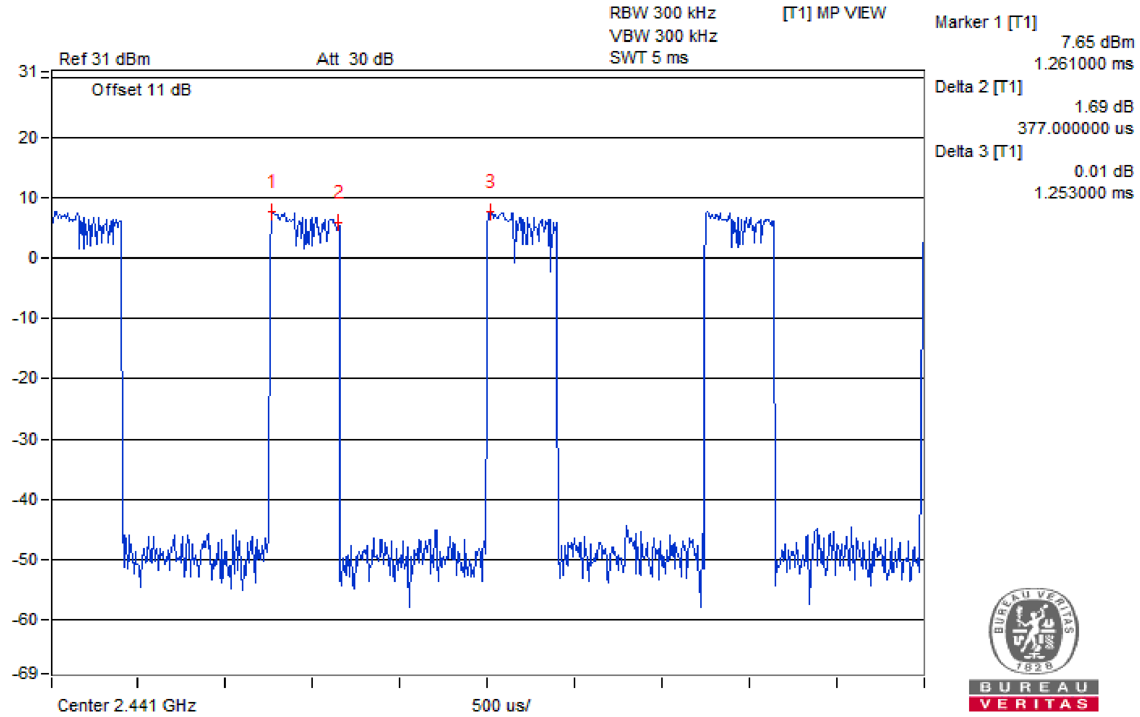
Vmax.



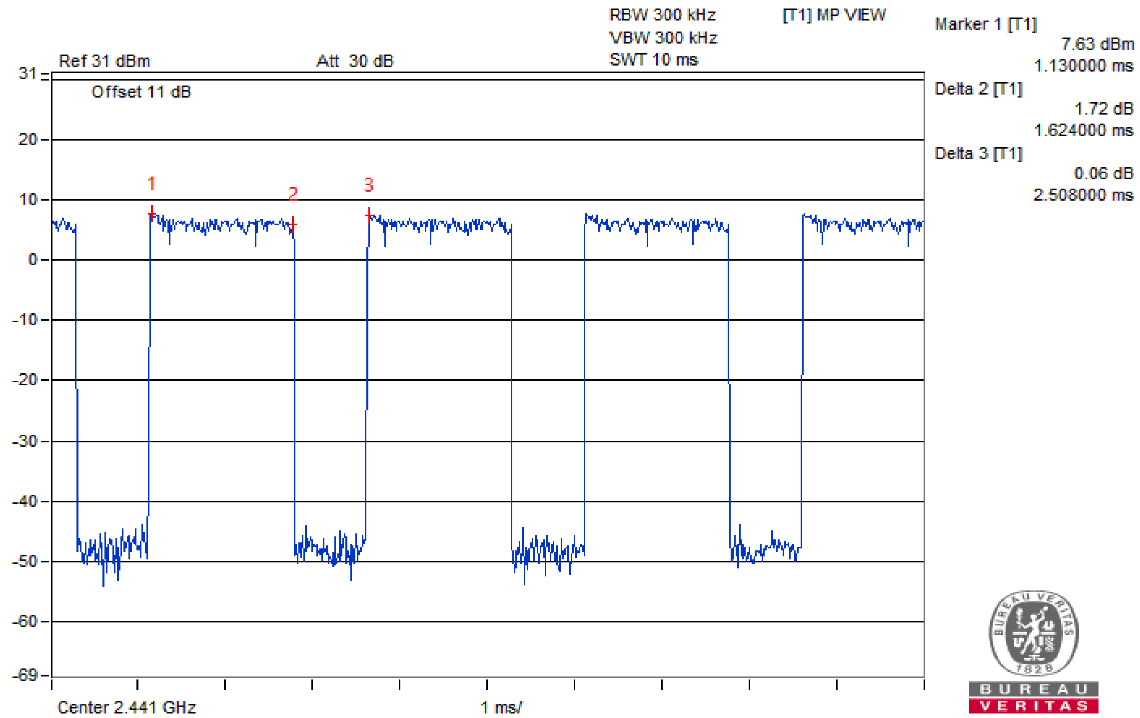
RBW 300 kHz
VBW 300 kHz
SWT 15 ms
[T1] MP VIEW
Marker 1 [T1]
7.64 dBm
1.696000 ms
Delta 2 [T1]
0.90 dB
2.891000 ms
Delta 3 [T1]
0.22 dB
3.826000 ms
Ref 31 dBm
Att 30 dB
Offset 11 dB
31
20
10
0
-10
-20
-30
-40
-50
-60
-69
1
2
3
Center 2.441 GHz
1.5 ms/

2DH5

Vmin.

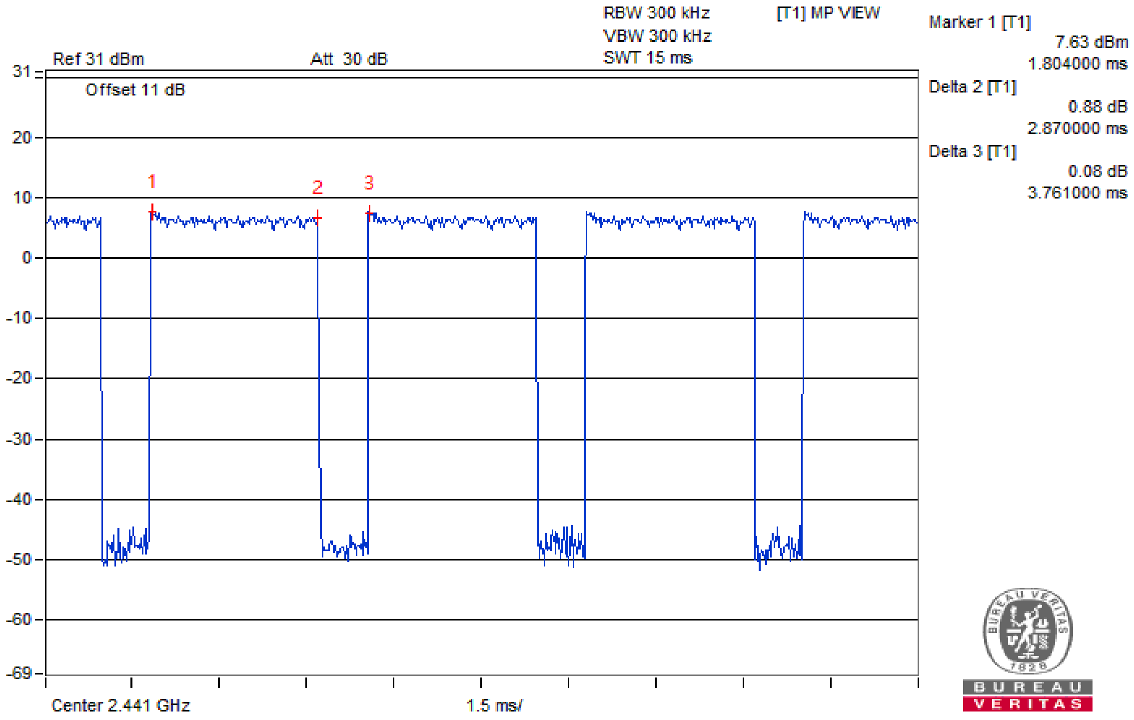


2DH1



2DH3

Vmin.


RBW 300 kHz
VBW 300 kHz
SWT 15 ms
[T1] MP VIEW
Marker 1 [T1]
7.63 dBm
1.804000 ms
Delta 2 [T1]
0.88 dB
2.870000 ms
Delta 3 [T1]
0.08 dB
3.761000 ms
Ref 31 dBm
Att 30 dB
Offset 11 dB
31
20
10
0
-10
-20
-30
-40
-50
-60
-69
1
2
3
Center 2.441 GHz
1.5 ms/

2DH5

Modulation: 8DPSK

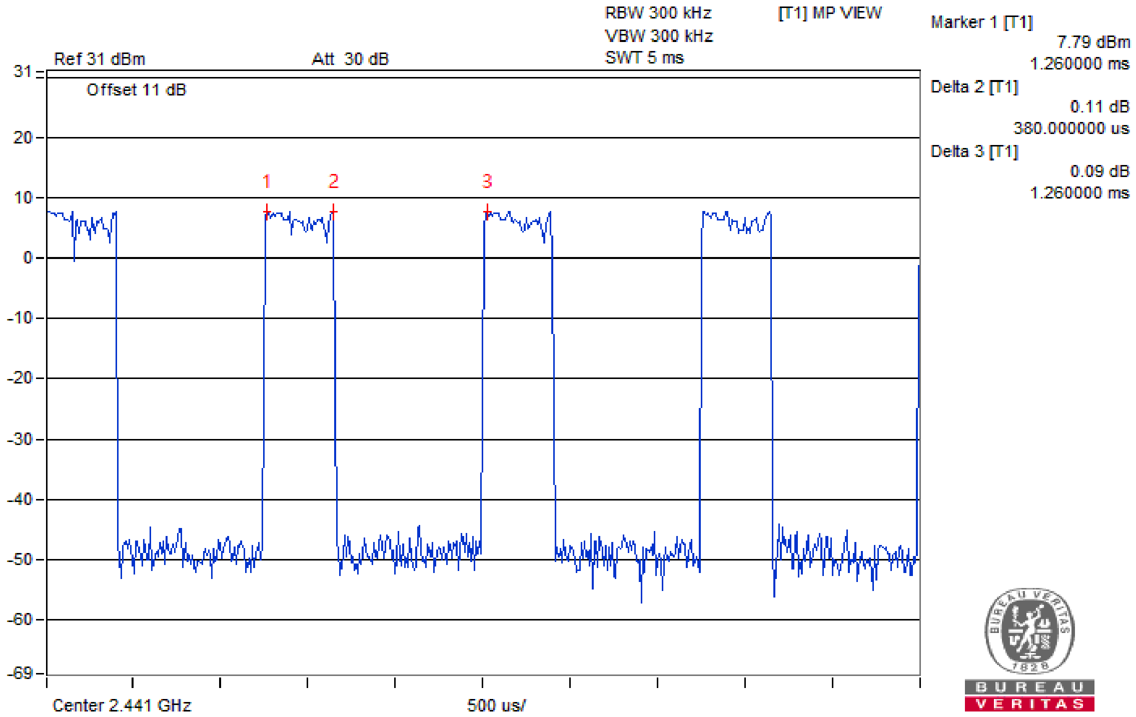
Normal Mode:

Test Condition	Mode	Spreading Rate	[Spreading Rate/79]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Vnormal	3DH1	71.40	0.361	0.301	108.661	400
	3DH3	71.40	0.361	0.648	233.928	400
	3DH5	71.40	0.361	0.761	274.721	400
Vmax.	3DH1	71.80	0.363	0.301	109.263	400
	3DH3	71.80	0.363	0.648	235.224	400
	3DH5	71.80	0.363	0.768	278.784	400
Vmin.	3DH1	71.40	0.361	0.301	108.661	400
	3DH3	71.40	0.361	0.650	234.650	400
	3DH5	71.40	0.361	0.769	277.609	400

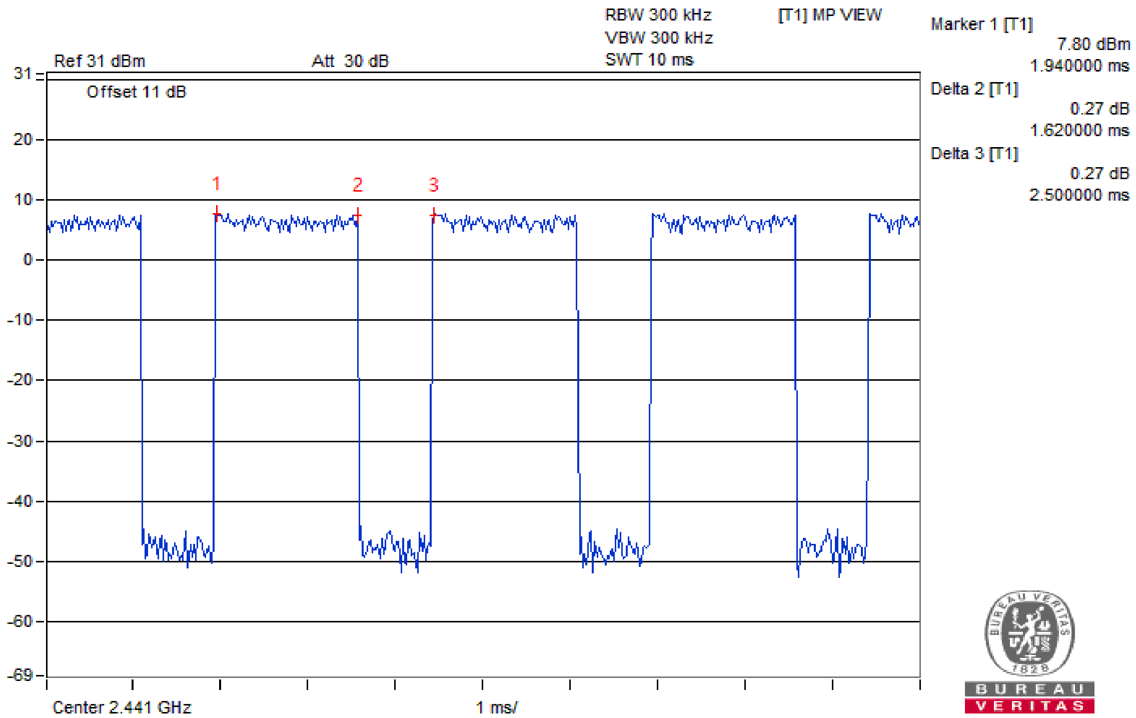
AFH Mode:

Test Condition	Mode	Spreading Rate	[Spreading Rate/20]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Vnormal	3DH1	18.19	0.363	0.301	109.263	400
	3DH3	18.19	0.363	0.648	235.224	400
	3DH5	18.19	0.363	0.761	276.243	400
Vmax.	3DH1	18.27	0.365	0.301	109.865	400
	3DH3	18.27	0.365	0.648	236.520	400
	3DH5	18.27	0.365	0.768	280.320	400
Vmin.	3DH1	18.19	0.363	0.301	109.263	400
	3DH3	18.19	0.363	0.650	235.950	400
	3DH5	18.19	0.363	0.769	279.147	400

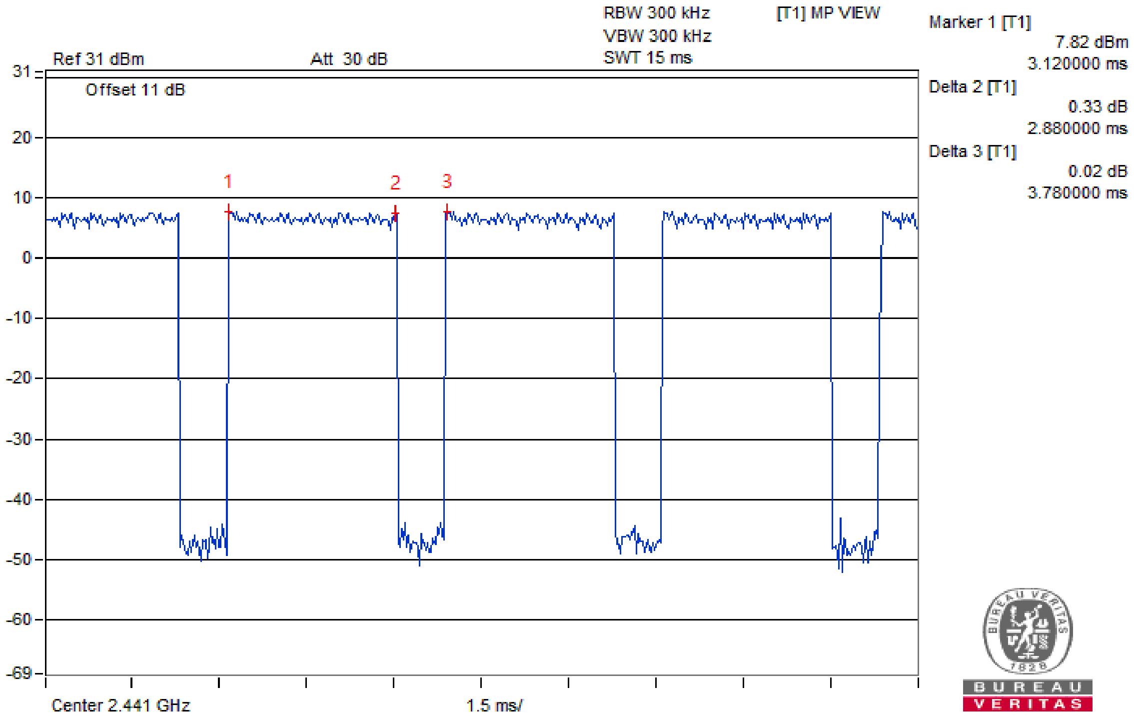
V normal



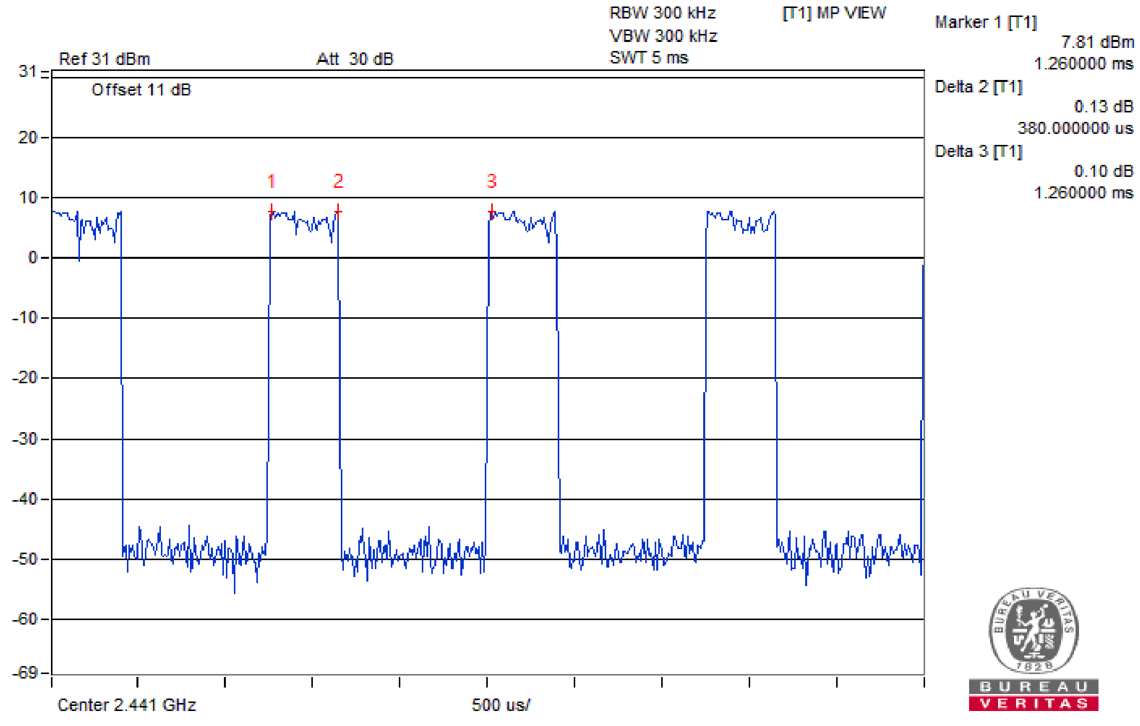
3DH1



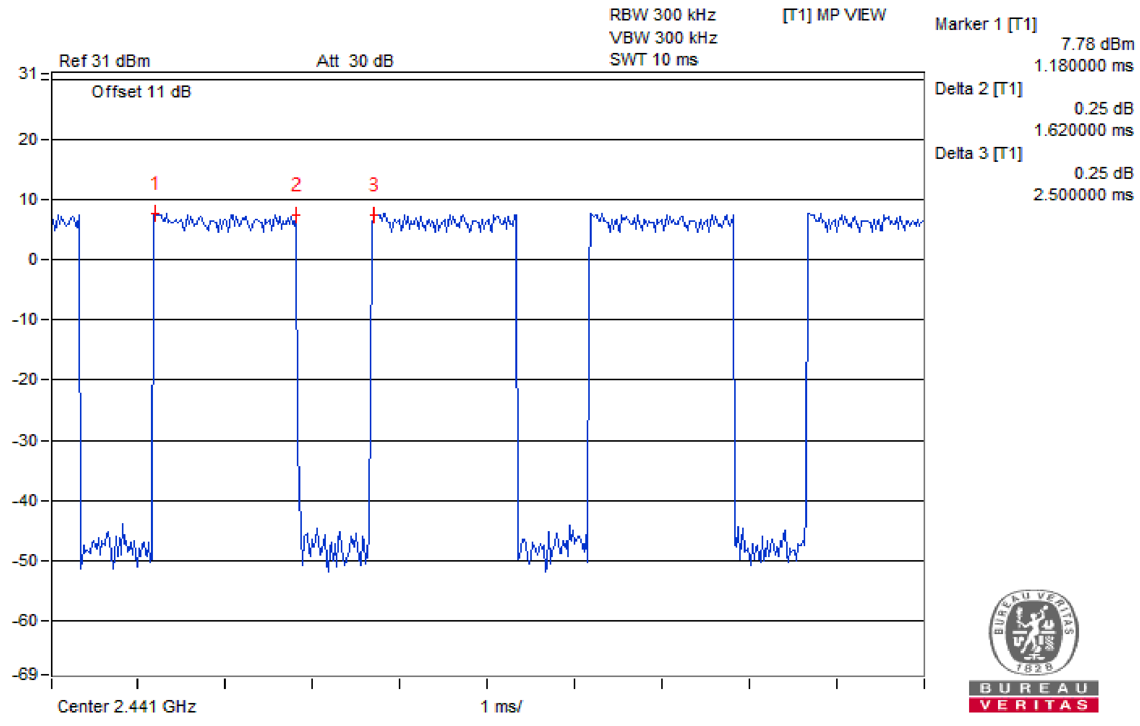
3DH3

Vnormal

3DH5

Vmax.

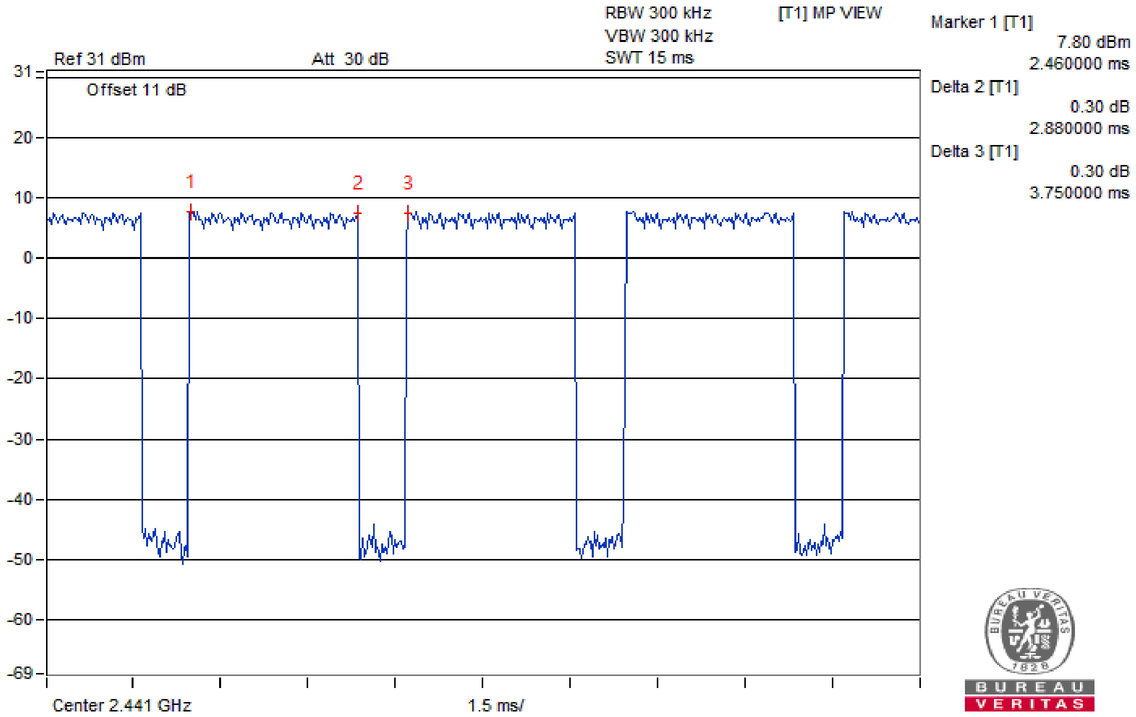


3DH1



3DH3

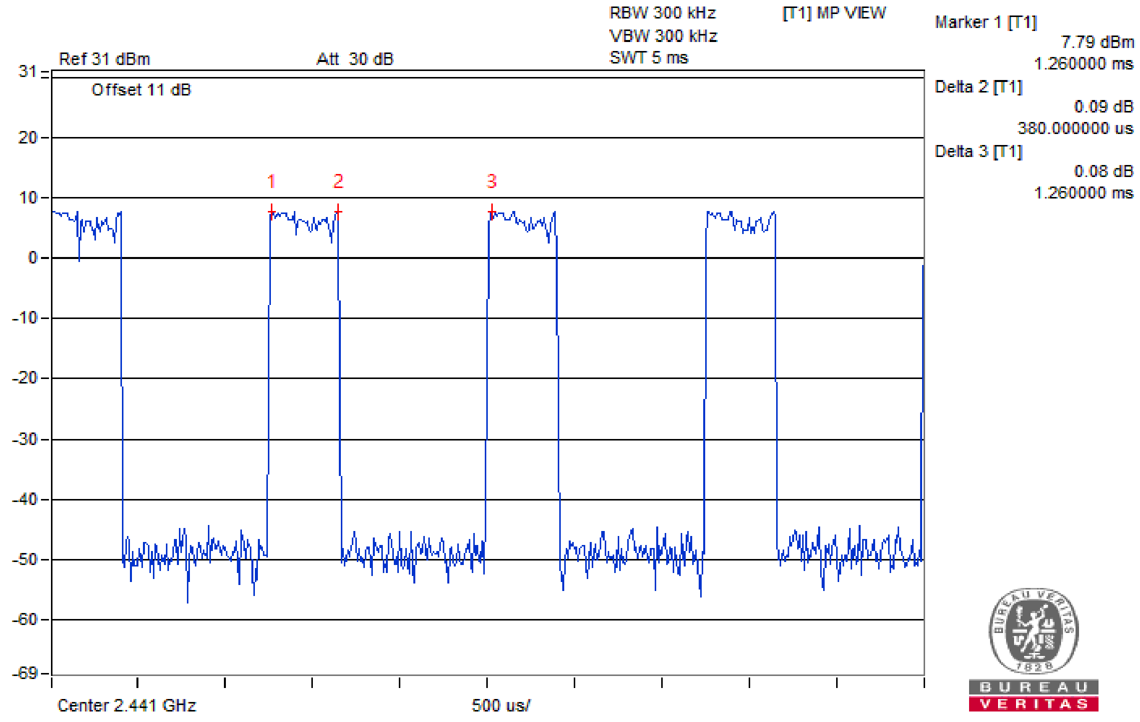
Vmax.



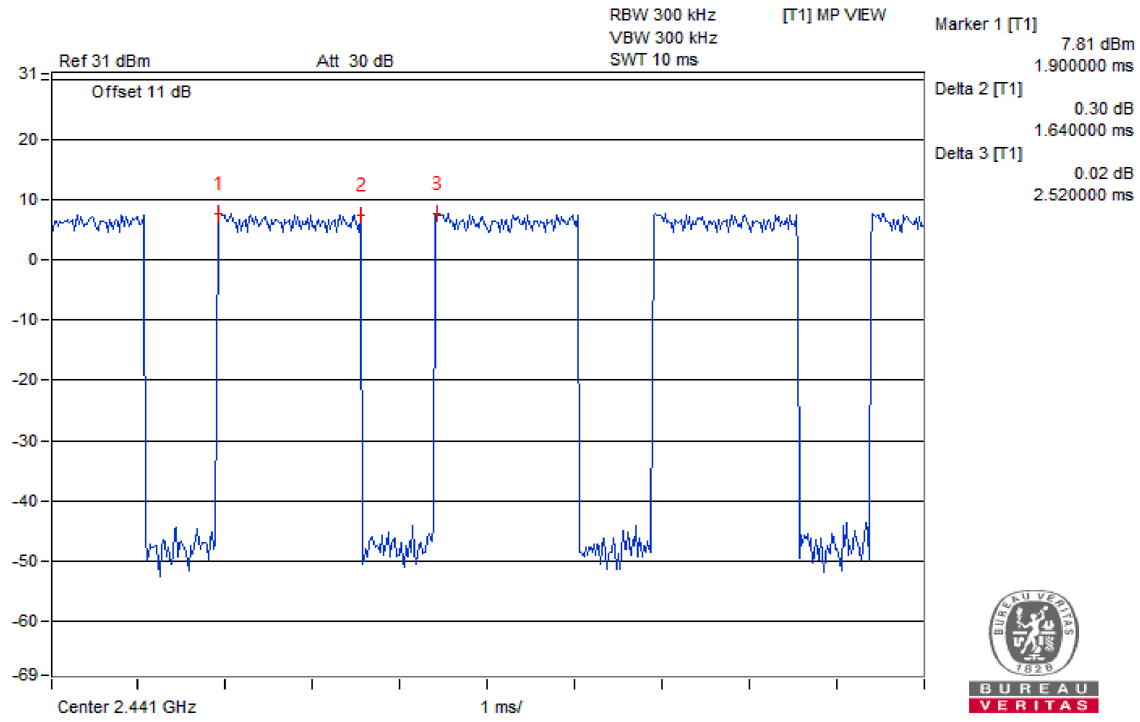
RBW 300 kHz
VBW 300 kHz
SWT 15 ms
[T1] MP VIEW
Marker 1 [T1]
7.80 dBm
2.460000 ms
Delta 2 [T1]
0.30 dB
2.880000 ms
Delta 3 [T1]
0.30 dB
3.750000 ms
Ref 31 dBm
Att 30 dB
Offset 11 dB
31
20
10
0
-10
-20
-30
-40
-50
-60
-69
1
2
3
Center 2.441 GHz
1.5 ms/

3DH5

Vmin.

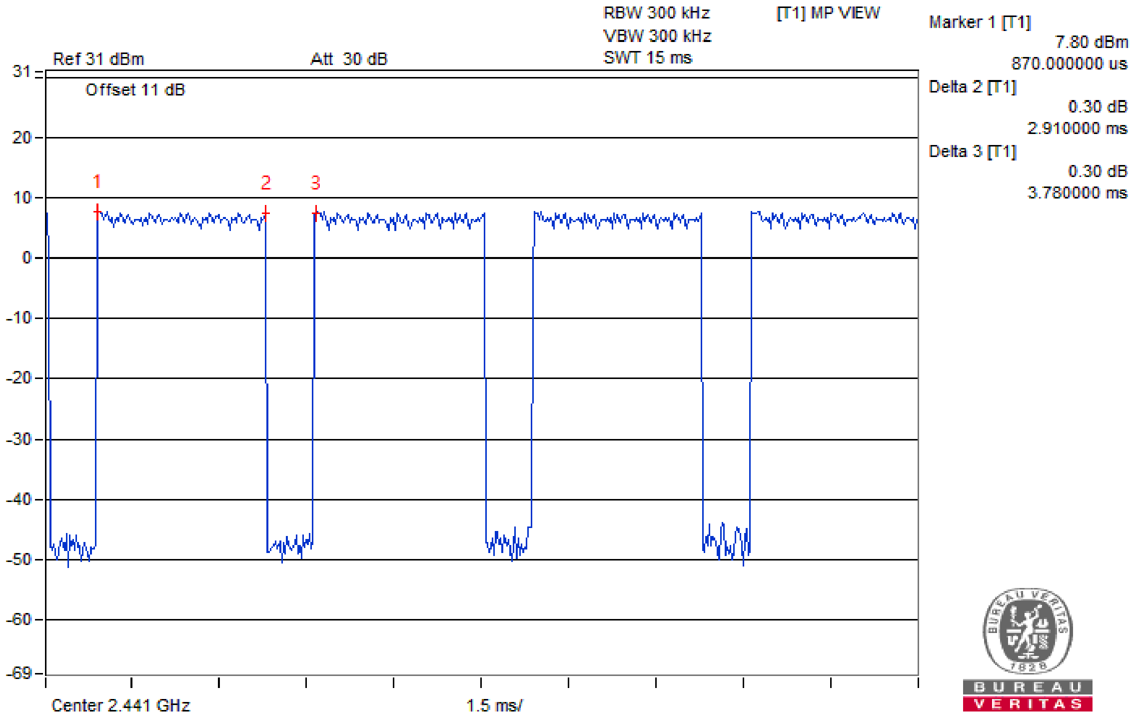


3DH1



3DH3

Vmin.


RBW 300 kHz
VBW 300 kHz
SWT 15 ms
[T1] MP VIEW
Marker 1 [T1]
7.80 dBm
870.000000 us
Delta 2 [T1]
0.30 dB
2.910000 ms
Delta 3 [T1]
0.30 dB
3.780000 ms
Ref 31 dBm
Att 30 dB
Offset 11 dB
31
20
10
0
-10
-20
-30
-40
-50
-60
-69
1
2
3
Center 2.441 GHz
1.5 ms/

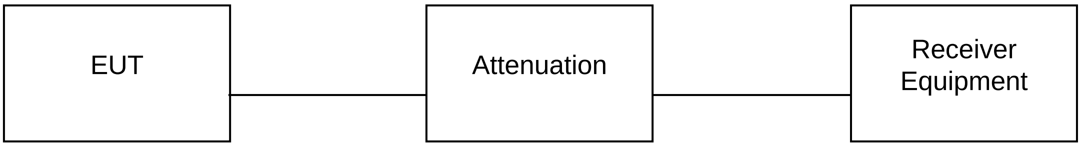
3DH5

4.8 Interference Prevention Function

4.8.1 Limits of Interference Prevention Function

Radio equipment used mainly on the same premises and automatically transmits or receives identification code.

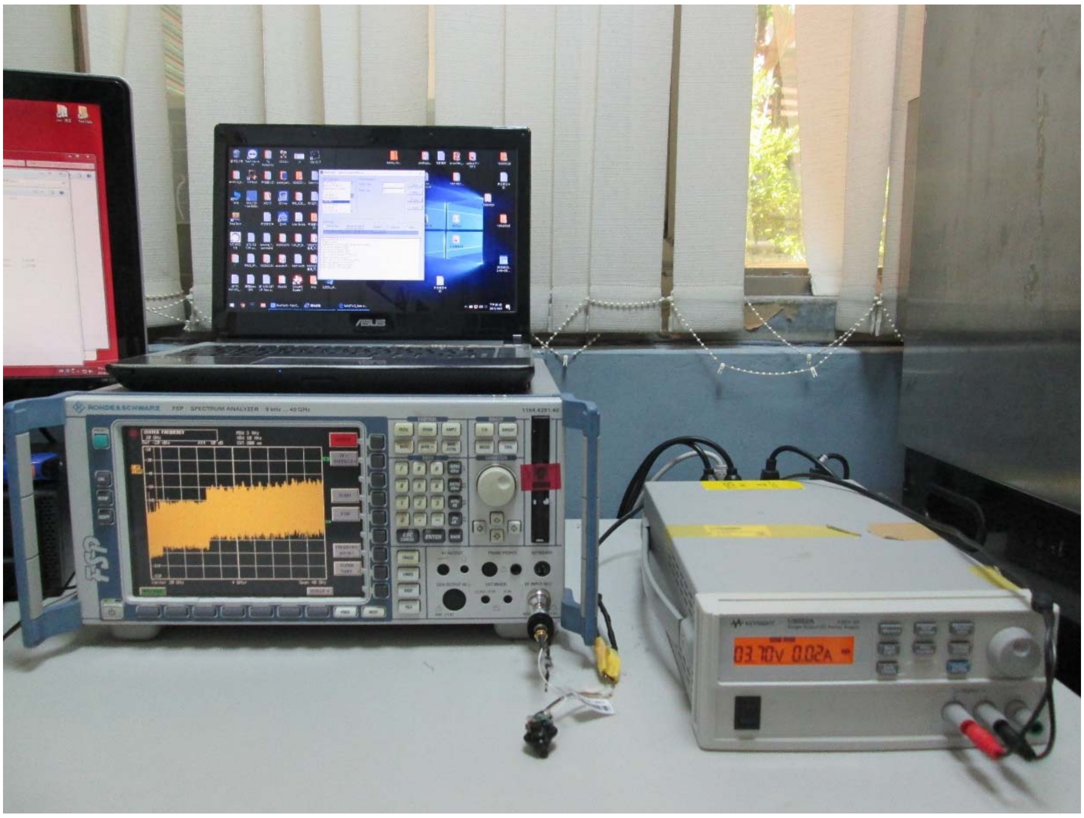
4.8.2 Test Setup



4.8.3 Test Results

Environmental Conditions	25 deg.C, 68% RH
Link Mode	**Test Result**
Bluetooth EDR	Pass

5 Photographs of the Test Configuration



6 Construction Photos of EUT

Please refer to the attached file (190906C18 (EUT photo)).

Appendix - Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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