

## Radio Test Report

**Report No.:** RJBDM-D-WTW-P21100740-1

**Test Model:** CEB003L

**Received Date:** Oct. 24, 2021

**Test Date:** Nov. 25, 2021

**Issued Date:** Dec. 08, 2021

**Applicant:** 株式会社 日本 HP

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

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33383, TAIWAN



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### Release Control Record

Issue No.	Description	Date Issued
RJBDMD-WTW-P21100740-1	Original release	Dec. 08, 2021

## 1 Certificate of Conformity

**Product:** HyperX Cloud MIX Buds

**Brand:** HYPERX

**Test Model:** CEB003L

**Sample Status:** Engineering sample

**Applicant:** 株式会社 日本 HP

**Test Date:** Nov. 25, 2021

**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:** Dec. 08, 2021  
Celine Chou / Senior Specialist

**Approved by :** Jeremy Lin , **Date:** Dec. 08, 2021  
Jeremy Lin / 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)
<b>General Provisions</b>				
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
<b>Transmitting Equipment</b>				
F	3.2 (2)	4.5	Antenna power	C
--	--	--	SAR	NA
<b>Transmitting Antenna</b>				
--	--	3.4	Type, configuration, etc. of transmitting antenna	C
--	--	3.5	Direction pattern of transmitting antenna	C
<b>Receiving Equipment</b>				
G	3.3 (1)	4.6	Spurious emissions of receiver	C
--	--	3.5	Refer to all articles for transmitting antenna	C
<b>Operating Frequency 2400 to 2483.5MHz</b>				
--	3.7 (1)	3.4	Radio 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
<b>Note:</b> 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. 14, 2021	Apr. 13, 2022	ETC	c)
Spectrum Analyzer / Rohde & Schwarz	FSU43	100115	Feb. 03, 2021	Feb. 02, 2022	ETC	c)
Signal Generator / Anritsu	E4438C	MY49071692	Nov. 09, 2021	Nov. 08, 2022	ETC	c)
Power Meter / Anritsu	ML2495A	1232003	Jan. 05, 2021	Jan. 04, 2022	ETC	c)
Power Sensor / Anritsu	MA2411B	1207333	Jan. 05, 2021	Jan. 04, 2022	ETC	c)
Power Splitter / Marvelous Microwave Inc.	MVE8546	20161123081	Jan. 13, 2021	Jan. 12, 2022	BV CPS E&E	d)
DC Power Supply / WON	ODP3033	ODP30332128133	Note 3	Note 3	BV CPS E&E	d)
True RMS Clamp Meter / Fluke	325	31130711WS	Jun. 02, 2021	Jun. 01, 2022	ETC	c)

Note:

### 1. 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. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. The power supply no evaluation calibrated, which used the digital multimeter to verify before each testing.

## 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	HyperX Cloud MIX Buds
Brand	HYPERX
Test Model	CEB003L
Status of EUT	Engineering sample
Nominal Voltage	5Vdc from adapter or host equipment (Charging case and 2.4G Dongle) 3.7Vdc from battery (Earbud) 3.8Vdc from battery (Charging Case)
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	1/2/3Mbps
Operating Frequency	2402 ~ 2480MHz
Number of Channel	79
Rated RF Output Power Density	Refer to note
Conducted RF Output Power Density	Refer to note
Radiated RF Output Power Density	Refer to note
Antenna Type	PCB antenna with -4.88dBi gain
Antenna Connector	NA
Accessory Device	Refer to note
Data Cable Supplied	Refer to note

Note:

1. The EUT system HyperX Cloud MIX Buds contain the following devices and cable:

Product Name	Brand	Device Model	Remark
HyperX Cloud MIX Buds	HYPERX	CEB003L	Left Earbud
HyperX Cloud MIX Buds	HYPERX	CEB003R	Right Earbud
HyperX Cloud MIX Buds Wireless Adapter	HYPERX	CEB003WA	2.4G Dongle
HyperX Cloud MIX Buds Charging Case	HYPERX	CEB003C1	Charging Case
HyperX Cloud MIX Buds Extension Adapter	HYPERX	CEB003EB	Extension Adapter
USB Cable	MERRY	110137001102 (BHC816)	1.8m shielded cable without core

2. The EUT consumes power from the following battery.

Battery for Earbud	
Brand	VDL
Model	VDL 1254PF2A
Rating	3.7Vdc, 62mAh, Li-ion Battery, 0.229Wh
Battery for Charging Case	
Brand	VDL
Model	VDL 742124
Rating	3.8Vdc, 410mAh, Li-ion Battery, 1.558Wh



3. The power table as below:

	Rated power (mW/MHz)	Conducted RF output power density (mW/MHz)	Radiated RF output power density (mW/MHz)
Normal mode	0.10	0.090157	0.029309
AFH mode	0.40	0.354135	0.115125

4. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

### 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 (AB1565/68 Lab Test Tool 2.4.7) 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: $\pi/4$ -DQPSK	Modulation type: 8DPSK
Power setting	Power setting	Power setting
56	61	61

### 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.

Test Item	Test Conditions	Environmental Conditions	Test Engineer
Frequency Tolerance	GFSK Normal Mode	25 deg.C, 60 % RH	Jisyong Wang
Occupied Bandwidth (99% power bandwidth)	GFSK Normal Mode AFH Mode $\pi/4$ -DQPSK Normal Mode AFH Mode 8DPSK Normal Mode AFH Mode	25 deg.C, 60 % RH	Jisyong Wang
Spreading Bandwidth (90% power bandwidth)	GFSK Normal Mode AFH Mode $\pi/4$ -DQPSK Normal Mode AFH Mode 8DPSK Normal Mode AFH Mode	25 deg.C, 60 % RH	Jisyong Wang
Spurious Emissions for Transmitter	GFSK AFH Mode $\pi/4$ -DQPSK AFH Mode 8DPSK AFH Mode	25 deg.C, 60 % RH	Jisyong Wang
Antenna Power	GFSK Normal Mode AFH Mode $\pi/4$ -DQPSK Normal Mode AFH Mode 8DPSK Normal Mode AFH Mode	25 deg.C, 60 % RH	Jisyong Wang
Spurious Emissions for Receiver	GFSK Normal Mode	25 deg.C, 60 % RH	Jisyong Wang

Test Item	Test Conditions	Environmental Conditions	Test Engineer
Dwell Time	GFSK Normal Mode AFH Mode $\pi/4$ -DQPSK Normal Mode AFH Mode 8DPSK Normal Mode AFH Mode	25 deg.C, 60 % RH	Jisyong Wang

### 3.4 Assembly

The RF circuit was covered by metal shielding case, and metal shielding case was soldered on PCB.

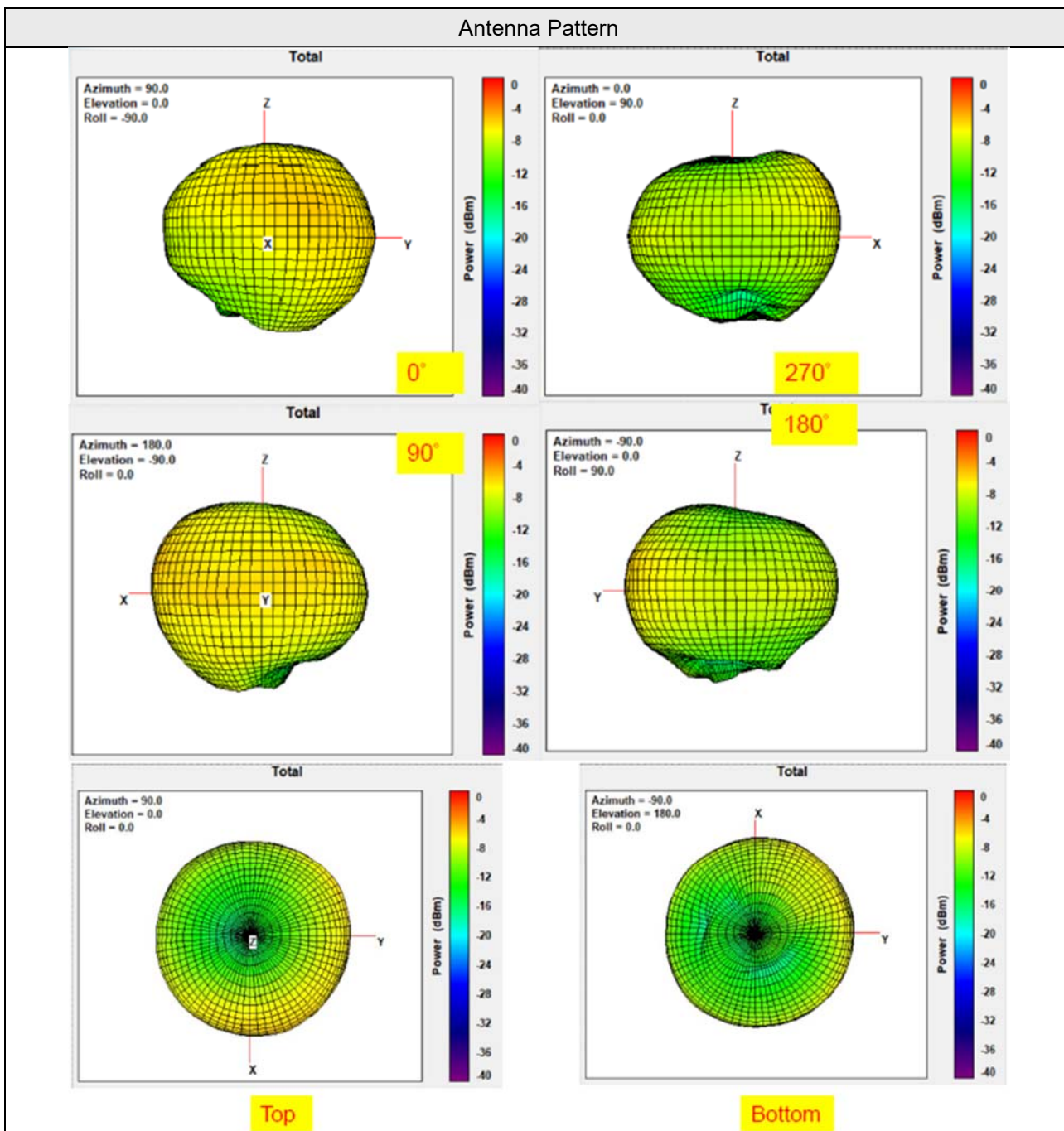
### 3.5 Antenna Specifications

#### 3.5.1 Antenna Gain

Type	Connector	Gain (dBi)
PCB	NA	-4.88

\* The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

#### 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

Channel	Frequency (MHz)	V <sub>normal</sub>		V <sub>max.</sub>		V <sub>min.</sub>	
		Carrier Frequency (MHz)	Frequency Tolerance (ppm)	Carrier Frequency (MHz)	Frequency Tolerance (ppm)	Carrier Frequency (MHz)	Frequency Tolerance (ppm)
0	2402	2402.000290	0.120	2401.999860	-0.058	2401.999760	-0.099
39	2441	2441.000290	0.118	2441.000000	0.000	2440.999760	-0.098
78	2480	2480.000140	0.056	2479.999760	-0.096	2479.999760	-0.096

## 4.2 Occupied Bandwidth Measurement (99% power bandwidth)

### 4.2.1 Limits of Occupied Bandwidth Measurement

Item	Limit
Occupied bandwidth	< 83.5MHz

### 4.2.2 Test Setup

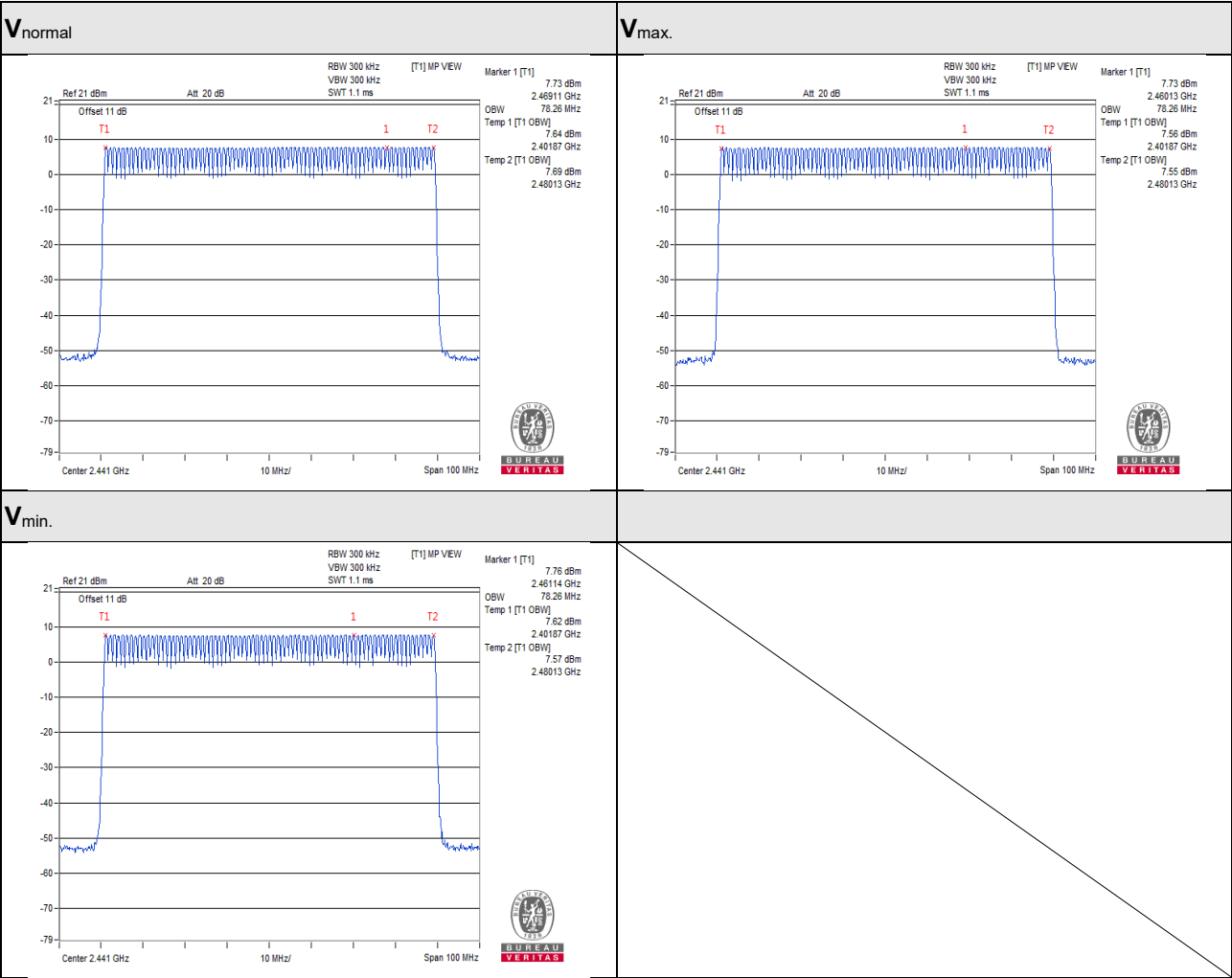


### 4.2.3 Test Results

Modulation: GFSK

Normal Mode:

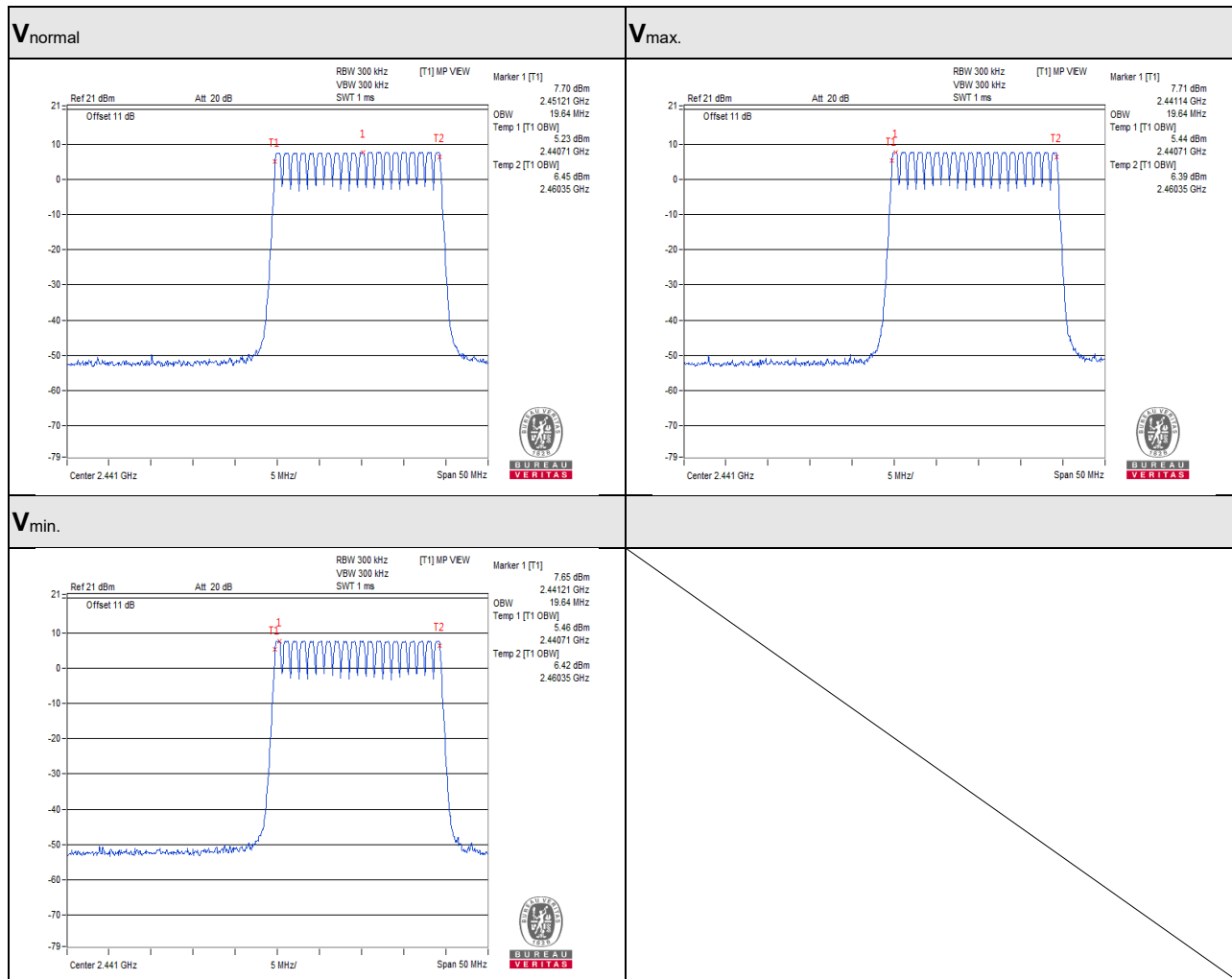
$V_{normal}$	$V_{max.}$	$V_{min.}$
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
78.26	78.26	78.26





# AFH Mode:

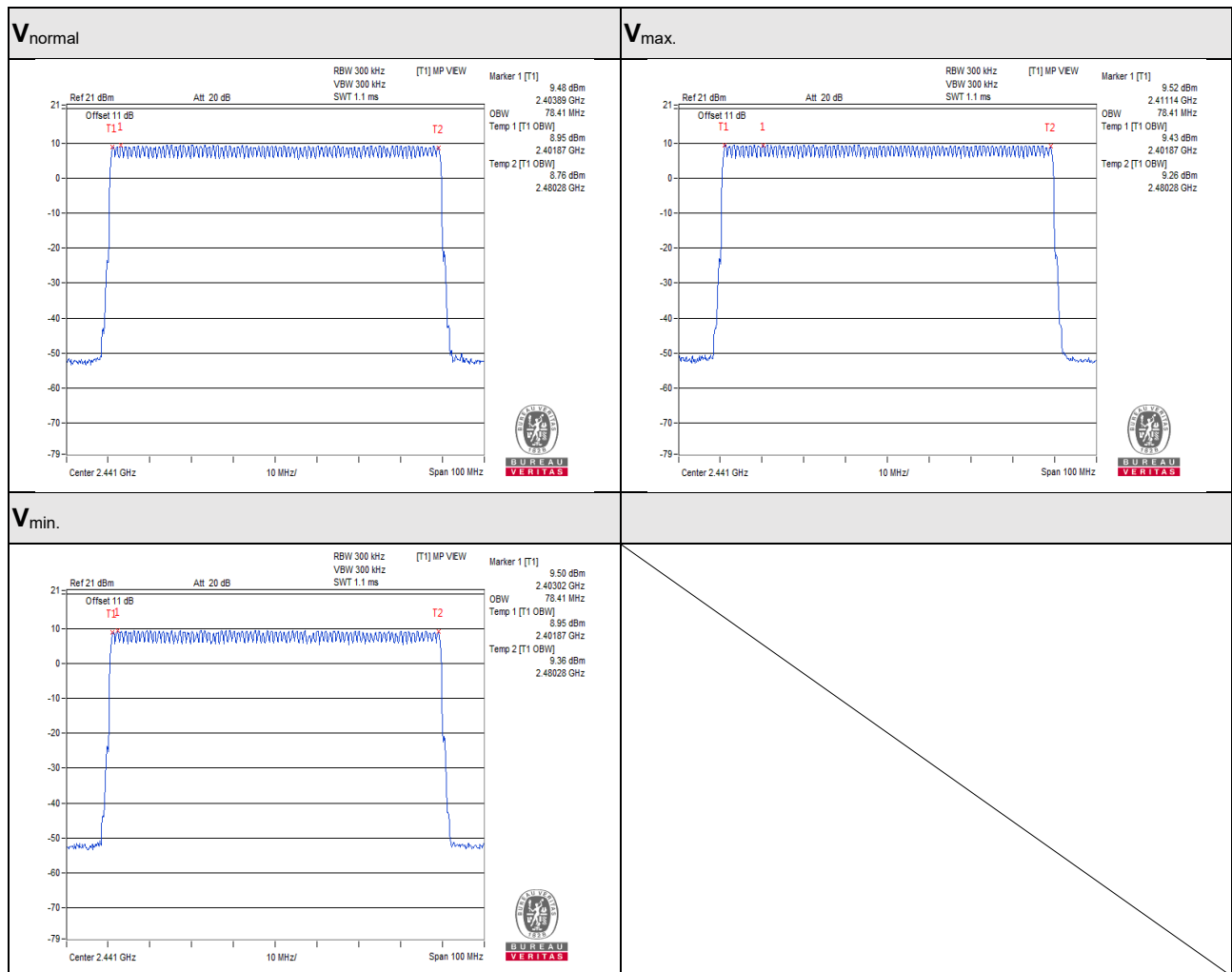
$V_{normal}$	$V_{max.}$	$V_{min.}$
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
19.64	19.64	19.64



Modulation:  $\pi/4$ -DQPSK

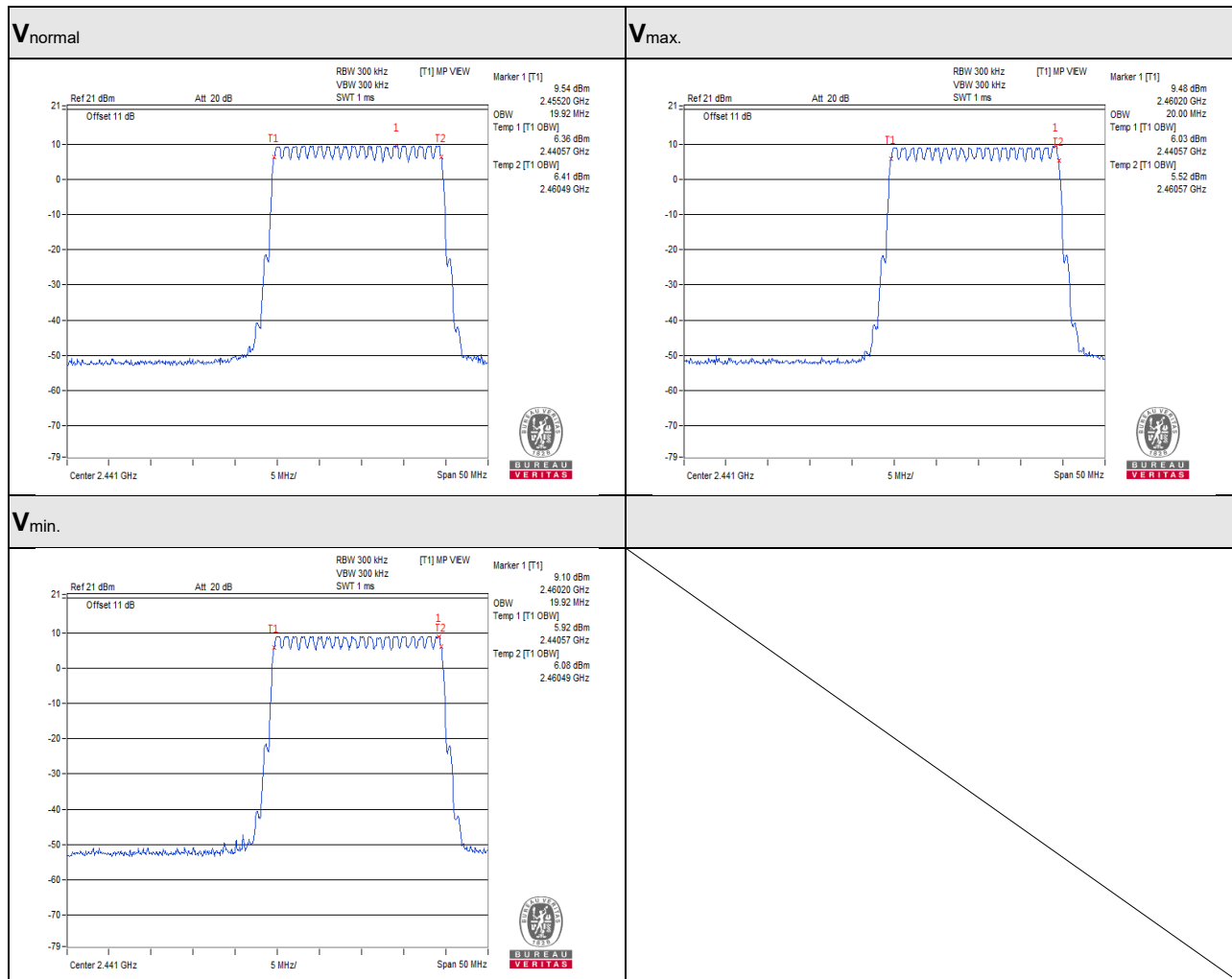
Normal Mode:

$V_{normal}$	$V_{max.}$	$V_{min.}$
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
78.41	78.41	78.41



# AFH Mode:

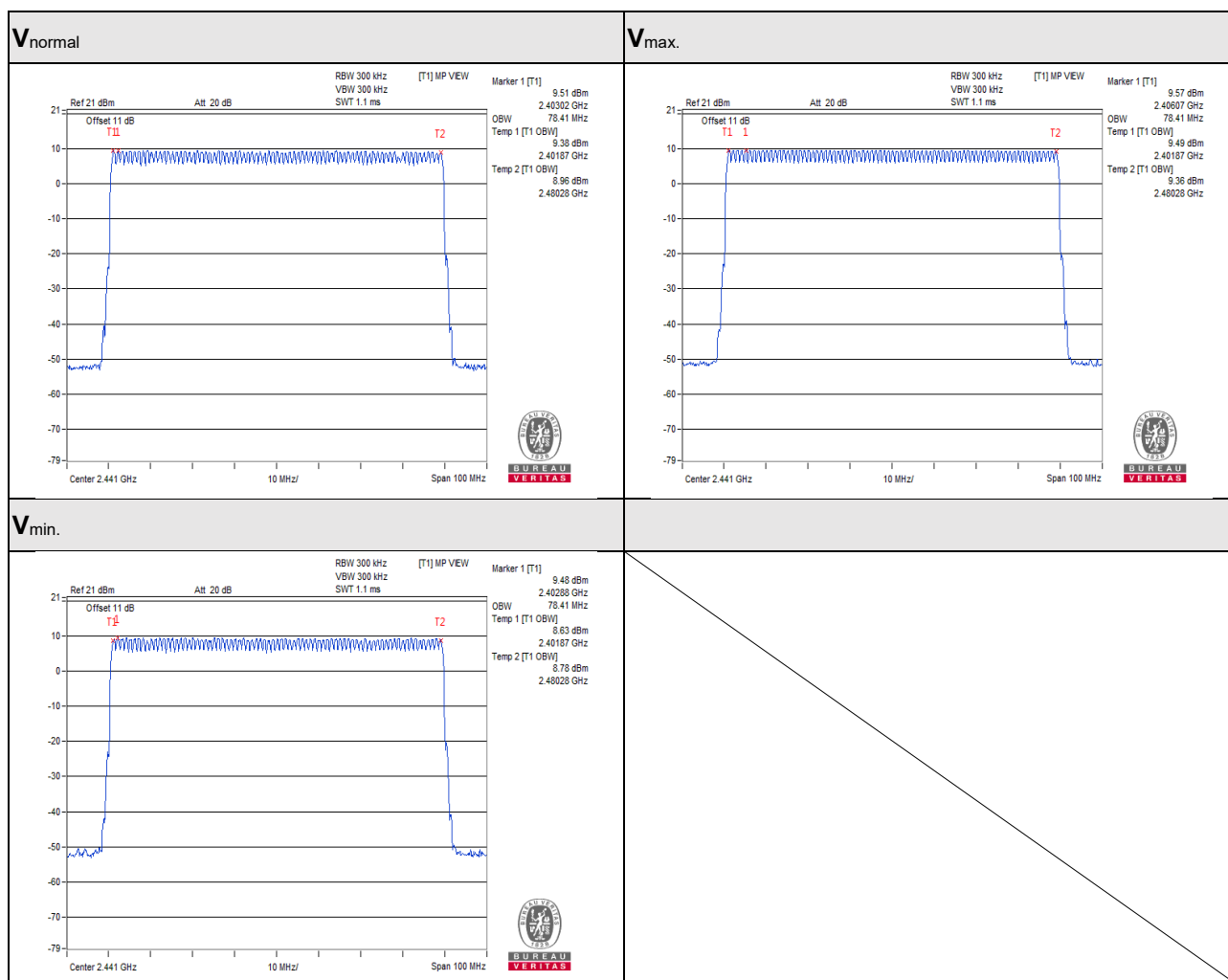
$V_{normal}$	$V_{max.}$	$V_{min.}$
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
19.92	20.00	19.92



Modulation: 8DPSK

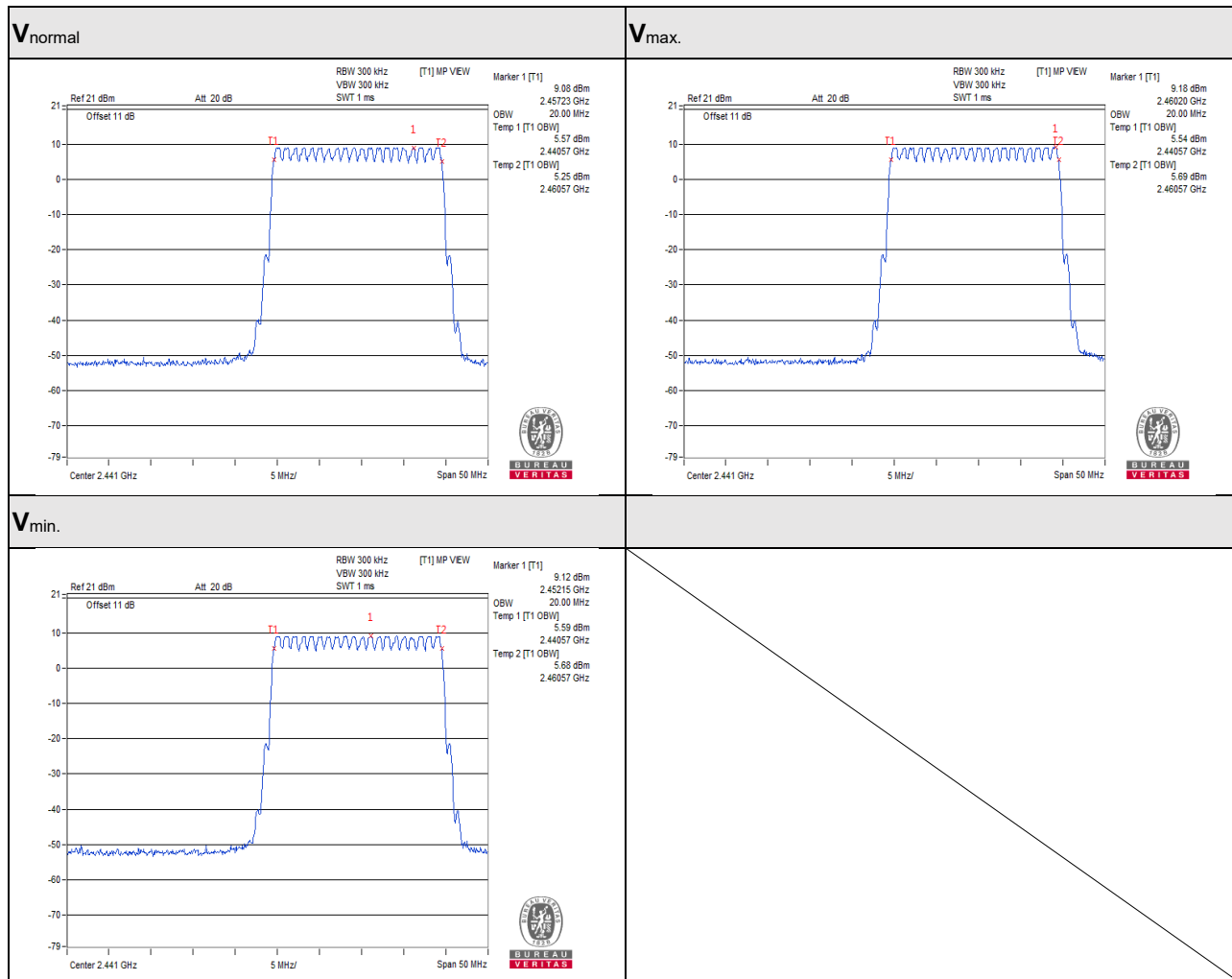
Normal Mode:

$V_{normal}$	$V_{max.}$	$V_{min.}$
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
78.41	78.41	78.41



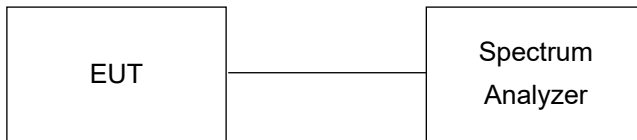
# AFH Mode:

$V_{normal}$	$V_{max.}$	$V_{min.}$
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
20.00	20.00	20.00



### 4.3 Spreading Bandwidth Measurement (90% power bandwidth)

#### 4.3.1 Test Setup



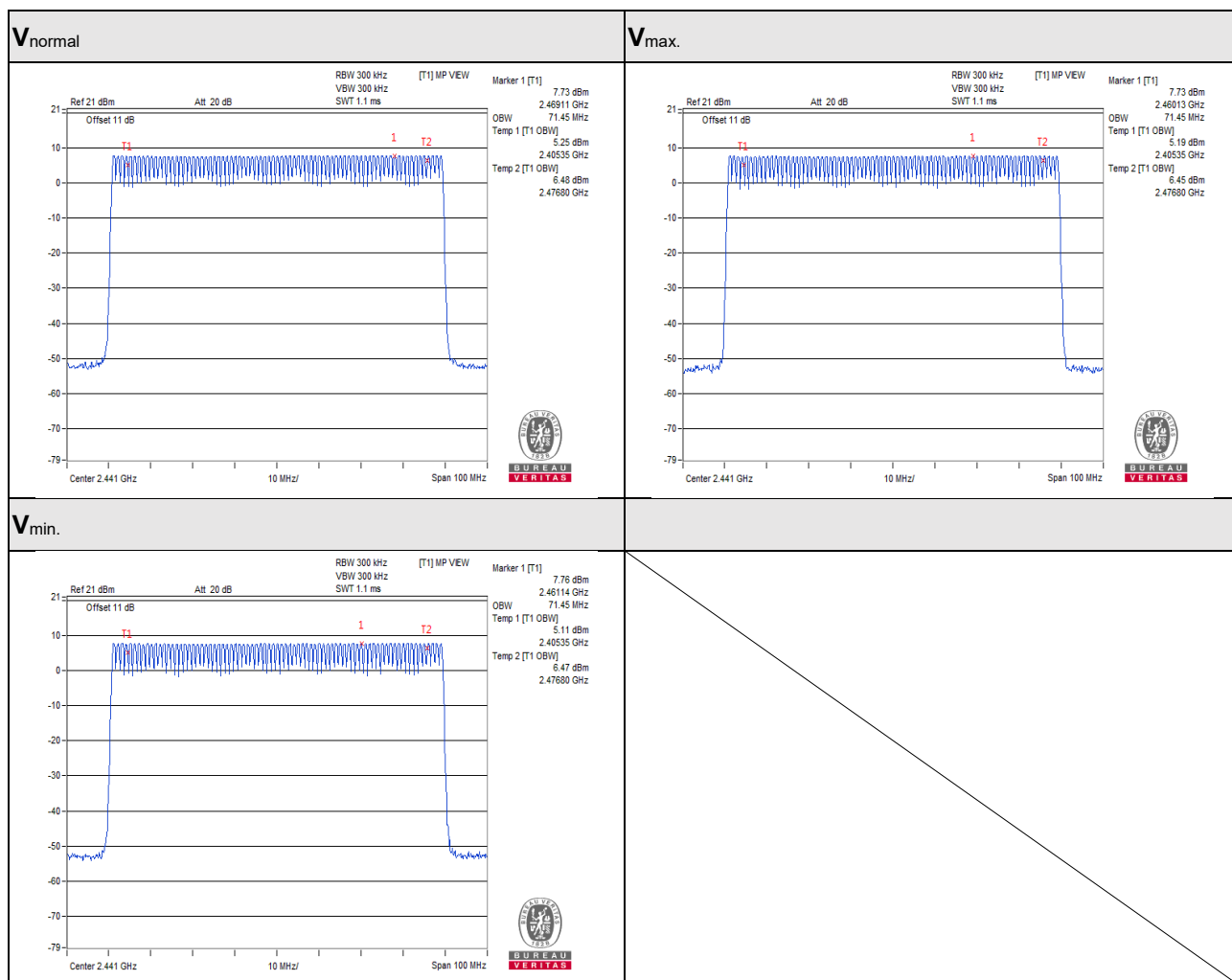
### 4.3.2 Test Results

Modulation: GFSK

Normal Mode:

V <sub>normal</sub>		V <sub>max.</sub>		V <sub>min.</sub>	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
71.45	71.45	71.45	71.45	71.45	71.45

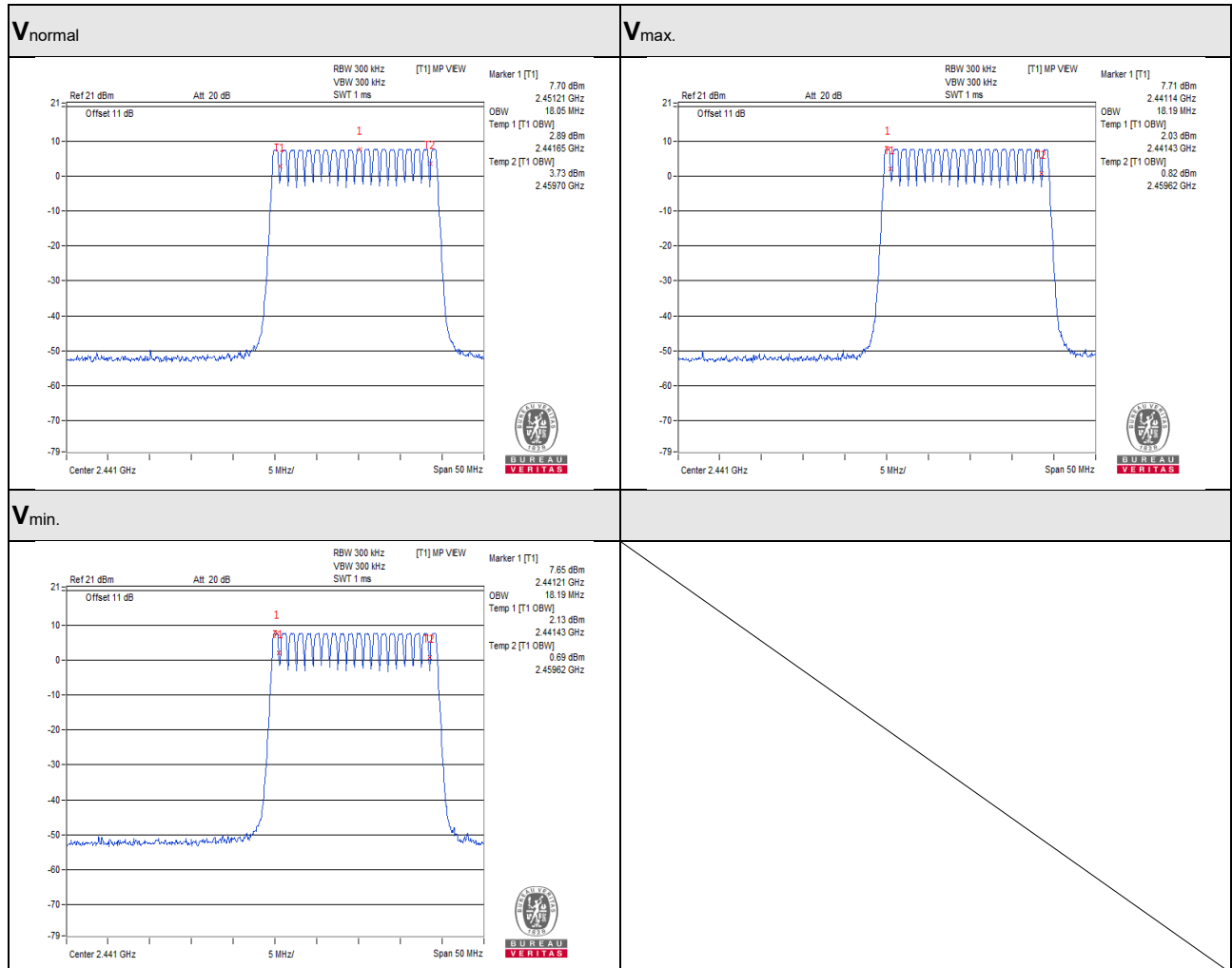
Note: Spreading Factor: 90% channel power bandwidth / 1.



# AFH Mode:

V <sub>normal</sub>		V <sub>max.</sub>		V <sub>min.</sub>	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
18.05	18.05	18.19	18.19	18.19	18.19

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



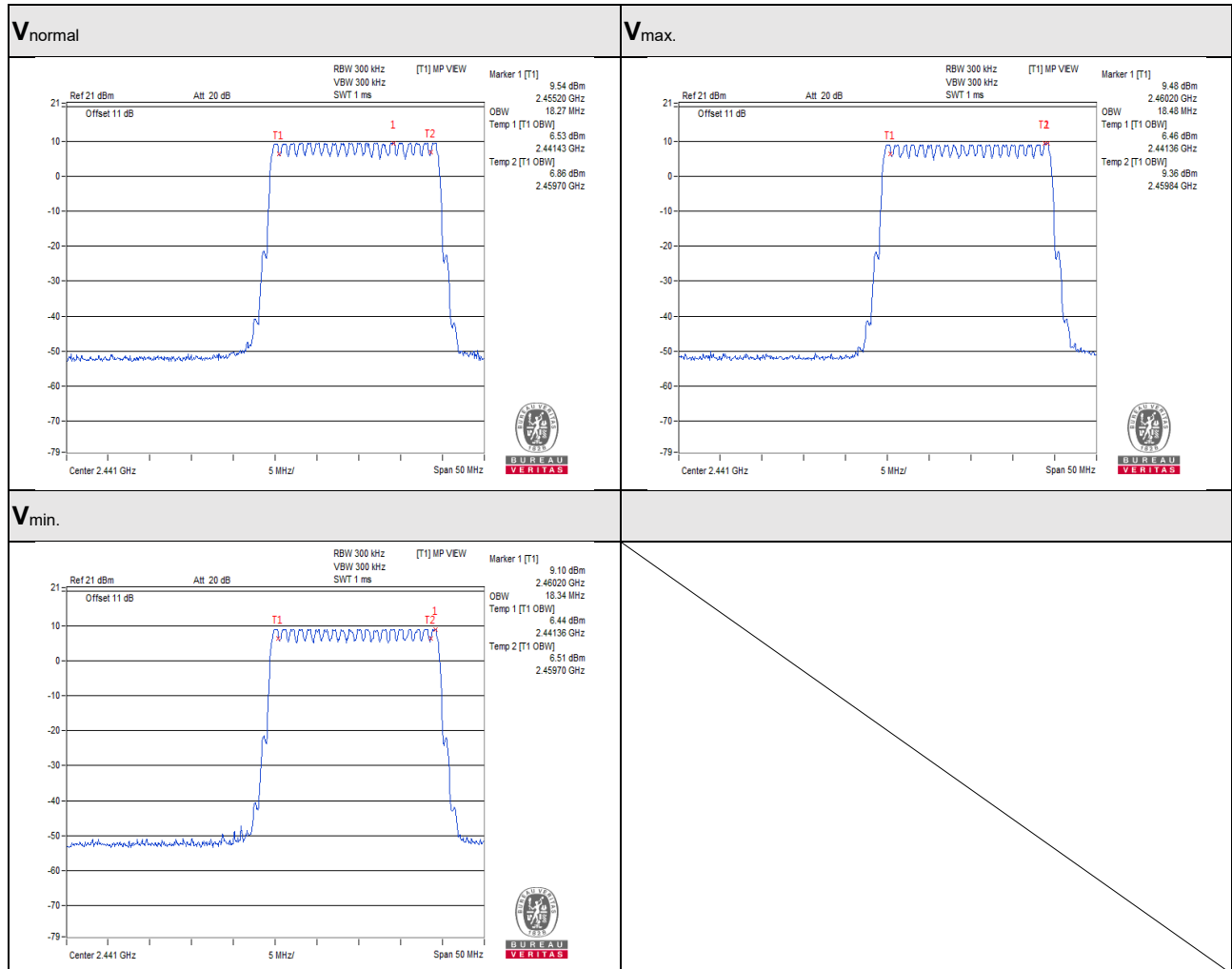




### AFH Mode:

$V_{normal}$		$V_{max.}$		$V_{min.}$	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
18.27	18.27	18.48	18.48	18.34	18.34

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

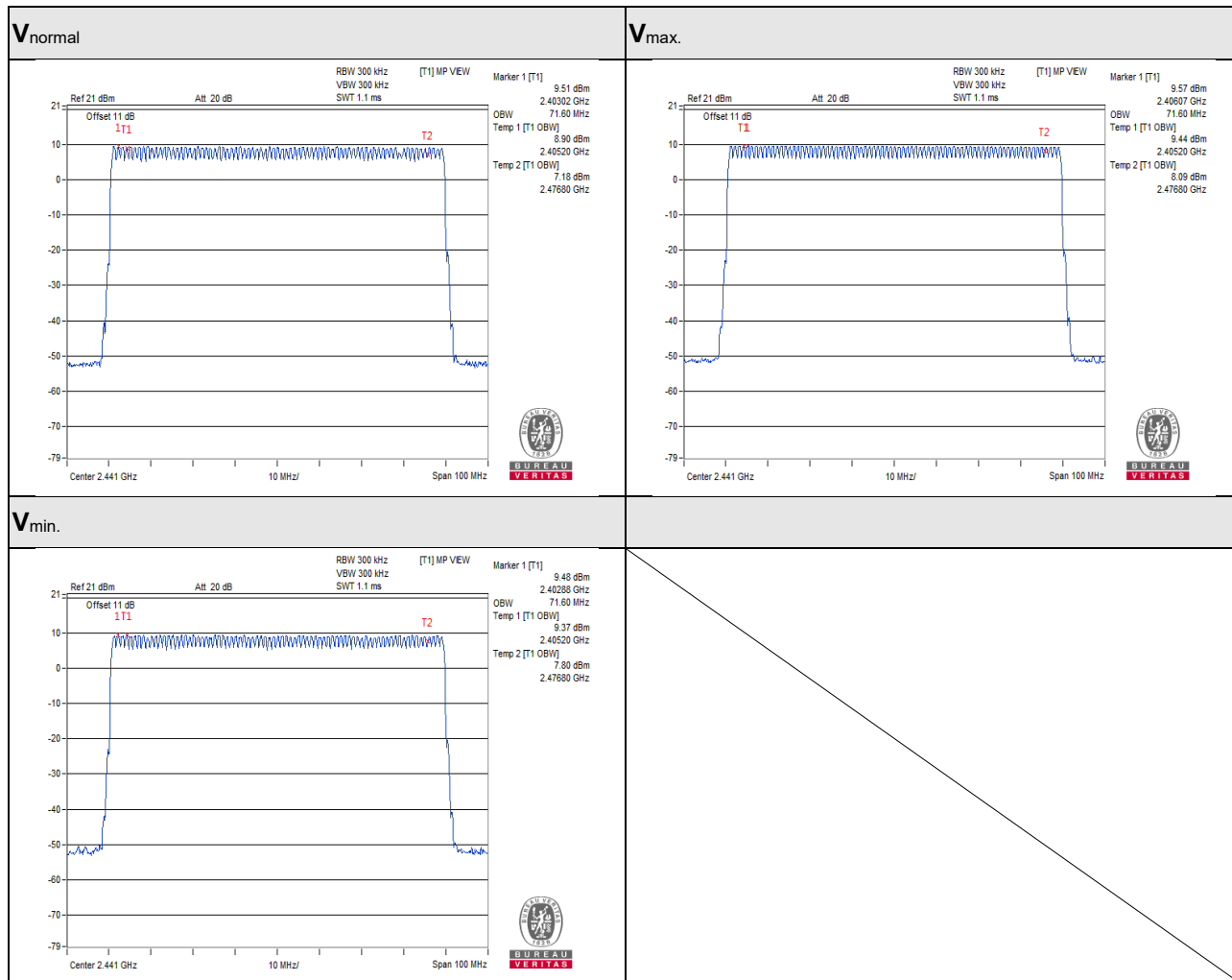


Modulation: 8DPSK

Normal Mode:

V <sub>normal</sub>		V <sub>max.</sub>		V <sub>min.</sub>	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
71.60	71.60	71.60	71.60	71.60	71.60

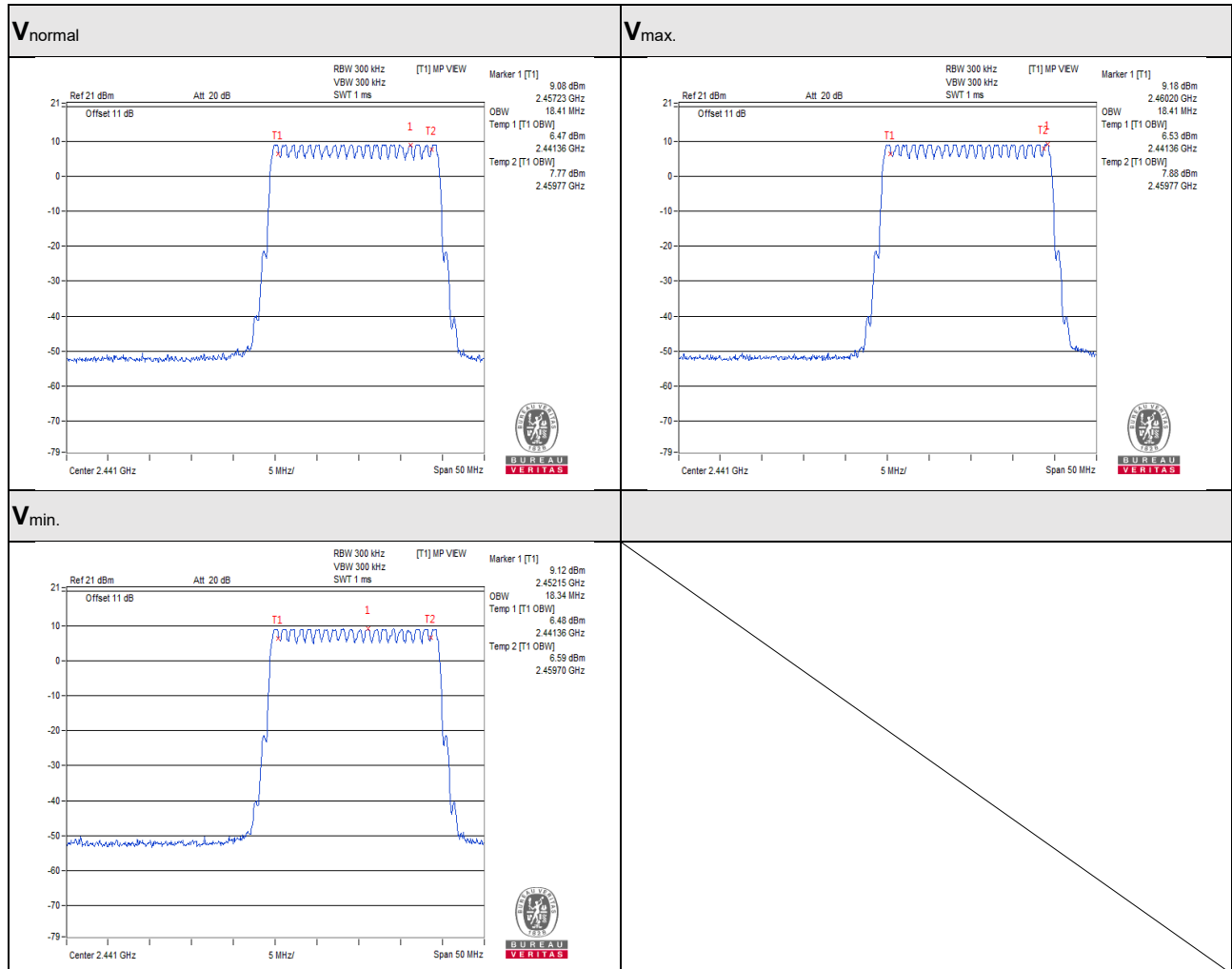
Note: Spreading Factor: 90% channel power bandwidth / 1.



### AFH Mode:

$V_{normal}$		$V_{max.}$		$V_{min.}$	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
18.41	18.41	18.41	18.41	18.34	18.34

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



## 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	$\leq 0.25 \mu\text{W}/100\text{kHz}$
1000.0MHz to 2387MHz	$\leq 2.5 \mu\text{W}/\text{MHz}$
2387.0MHz to 2400.0MHz	$\leq 25 \mu\text{W}/\text{MHz}$
2483.5MHz to 2496.5MHz	$\leq 25 \mu\text{W}/\text{MHz}$
2496.5MHz to 12500.0MHz	$\leq 2.5 \mu\text{W}/\text{MHz}$

### 4.4.2 Test Setup

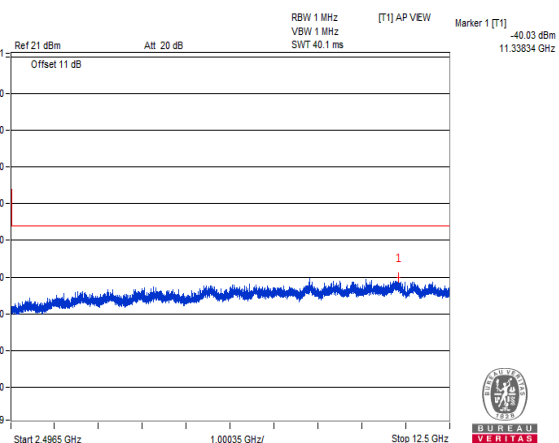
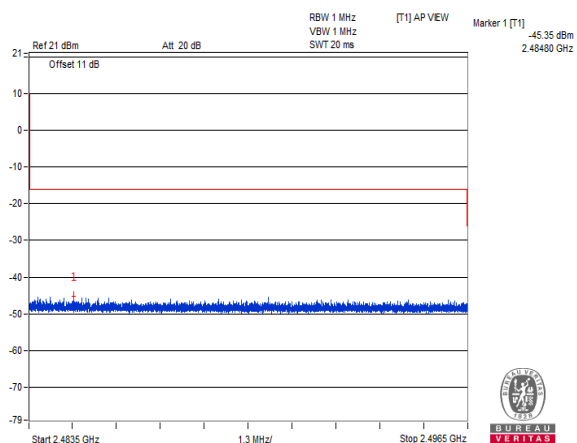
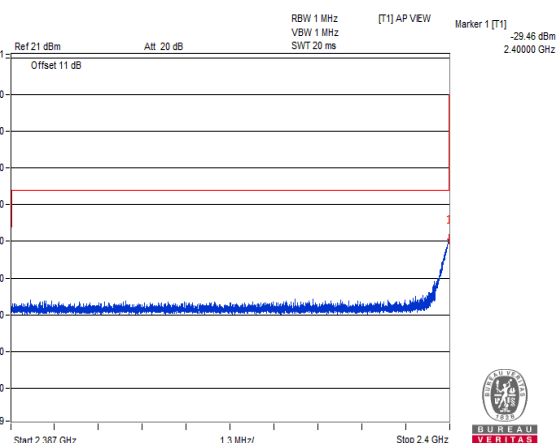
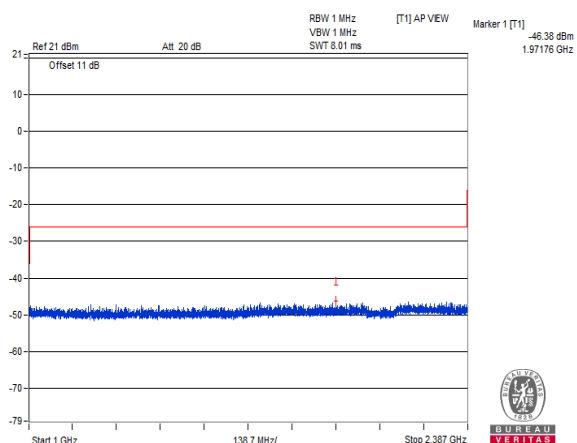
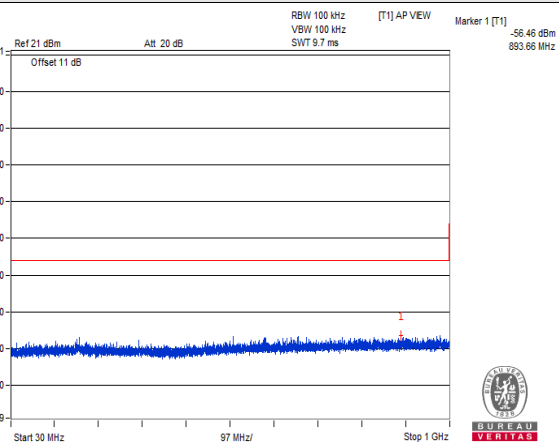
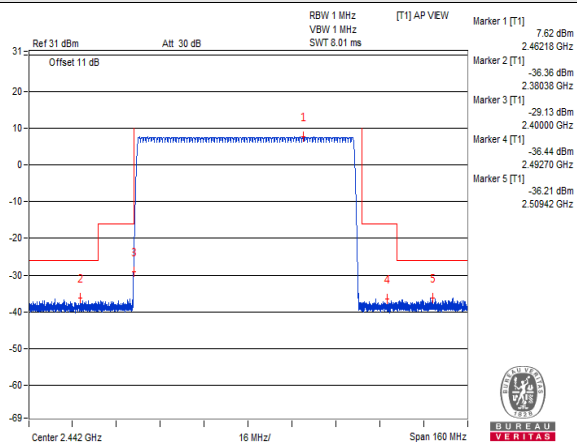


#### 4.4.3 Test Results

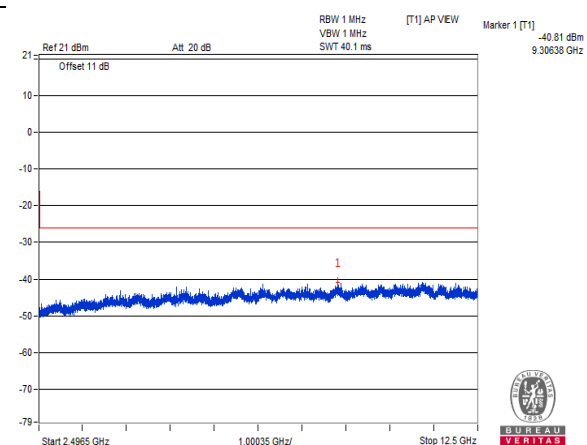
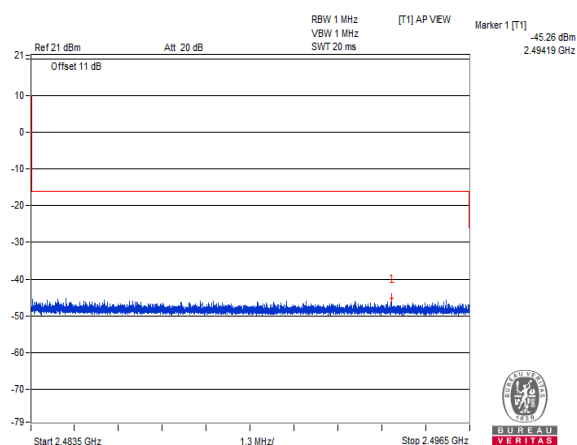
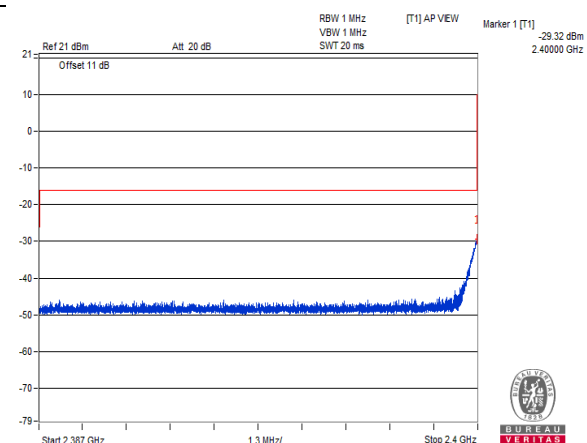
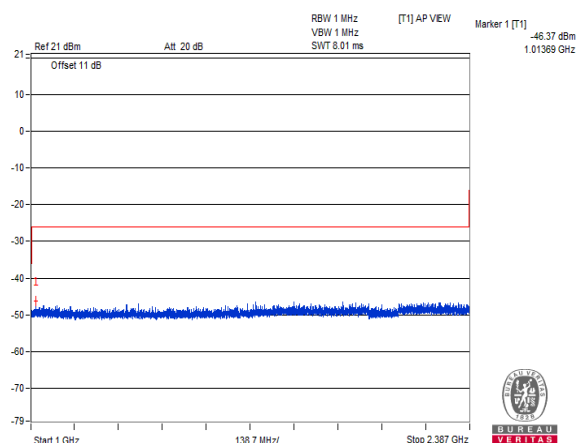
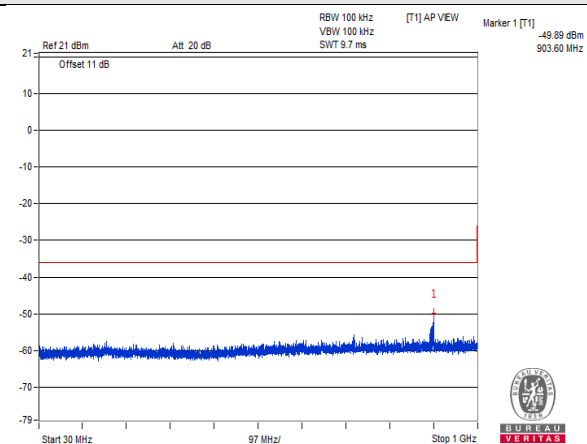
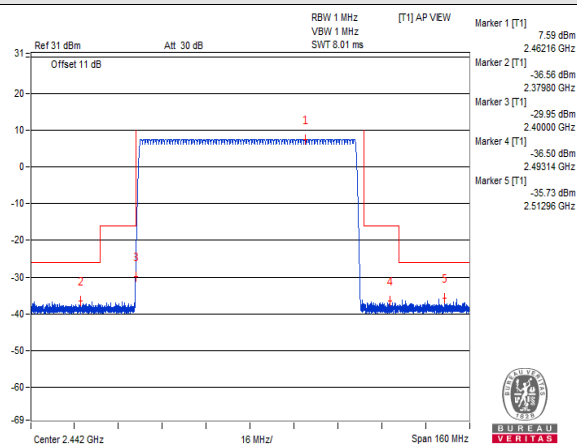
Modulation: GFSK

Test Channel		Hopping Mode			
Test Condition	Frequency Range (MHz)	Frequency (MHz)	Measured Value (uW)	Limit (uW)	Result
<b>V<sub>normal</sub></b>	30MHz to 1000MHz	893.660	0.002000	0.25	Pass
	1000MHz to 2387MHz	1971.760	0.023000	2.5	Pass
	2387MHz to 2400MHz	2400.000	1.132000	25.00	Pass
	2483.5MHz to 2496.5MHz	2484.800	0.029000	25.00	Pass
	2496.5MHz to 12500MHz	11338.340	0.099000	2.5	Pass
<b>V<sub>max.</sub></b>	30MHz to 1000MHz	903.600	0.010000	0.25	Pass
	1000MHz to 2387MHz	1013.690	0.023000	2.5	Pass
	2387MHz to 2400MHz	2400.000	1.169000	25.00	Pass
	2483.5MHz to 2496.5MHz	2494.190	0.029000	25.00	Pass
	2496.5MHz to 12500MHz	9306.379	0.082000	2.5	Pass
<b>V<sub>min.</sub></b>	30MHz to 1000MHz	966.410	0.002000	0.25	Pass
	1000MHz to 2387MHz	2194.550	0.025000	2.5	Pass
	2387MHz to 2400MHz	2399.990	1.207000	25.00	Pass
	2483.5MHz to 2496.5MHz	2487.820	0.030000	25.00	Pass
	2496.5MHz to 12500MHz	11304.580	0.095000	2.5	Pass
Note: The spectrum plots are attached on the following pages.					

# Vnormal

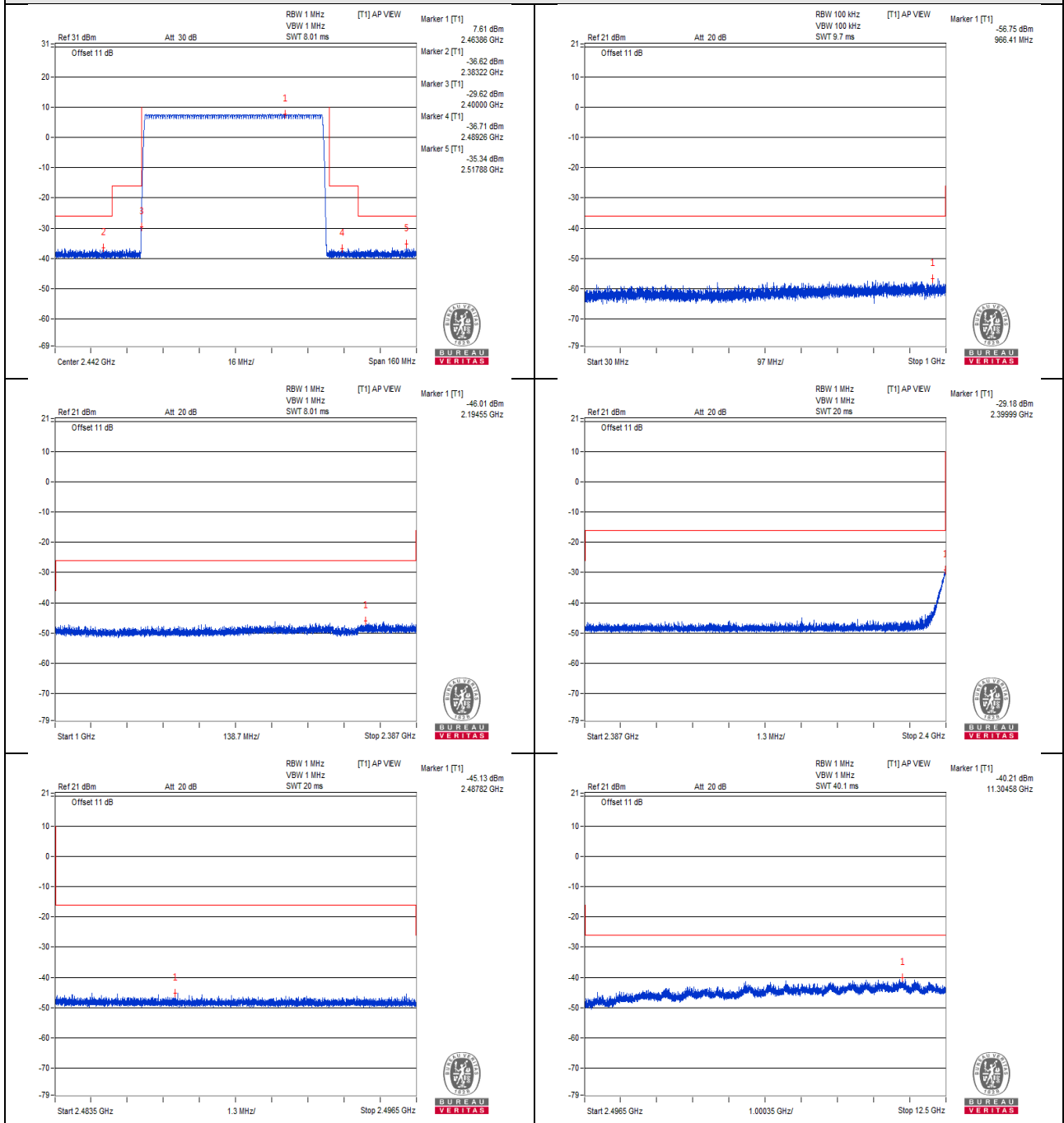


V<sub>max</sub>.





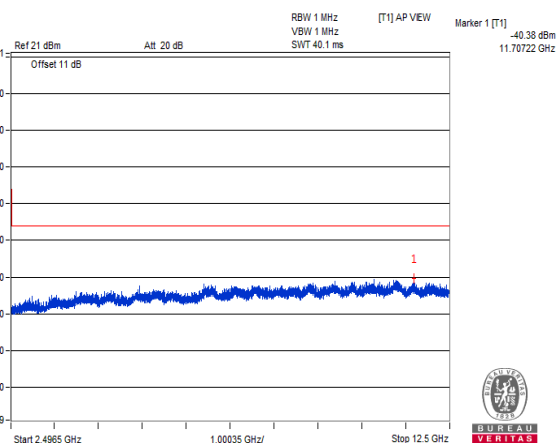
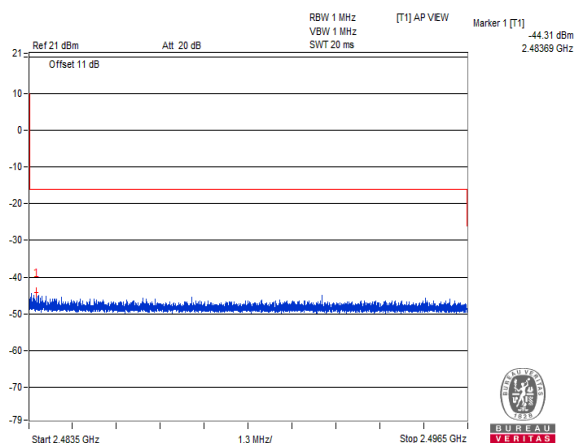
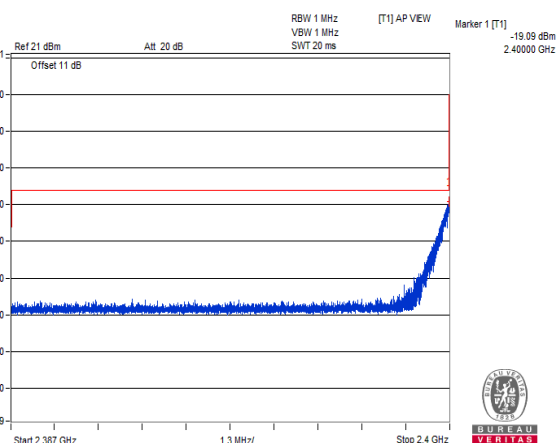
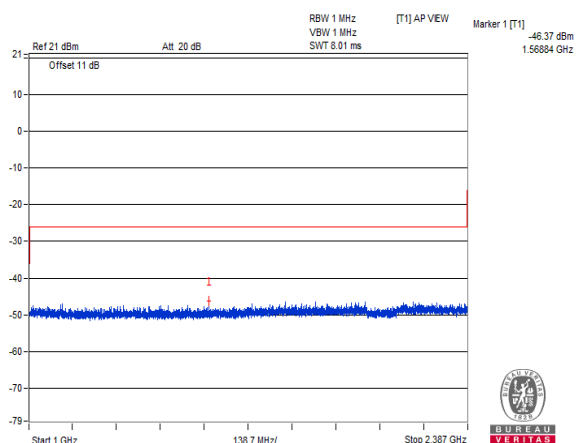
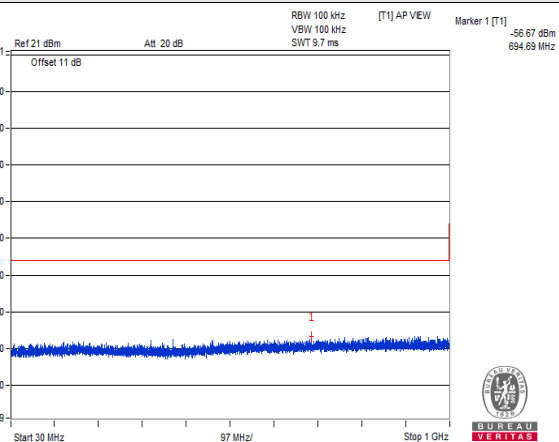
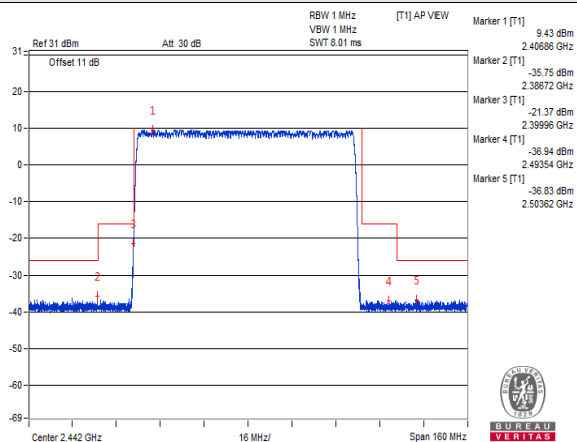
V<sub>min</sub>.



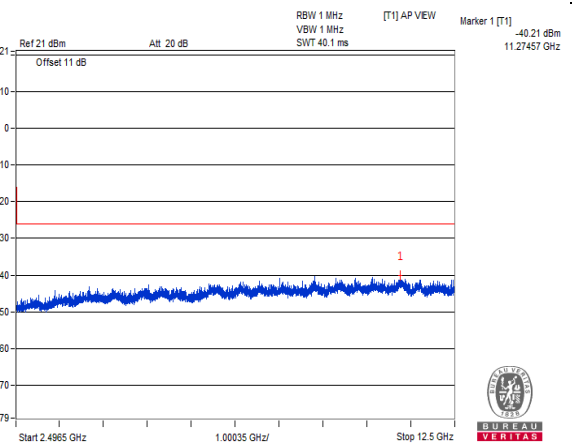
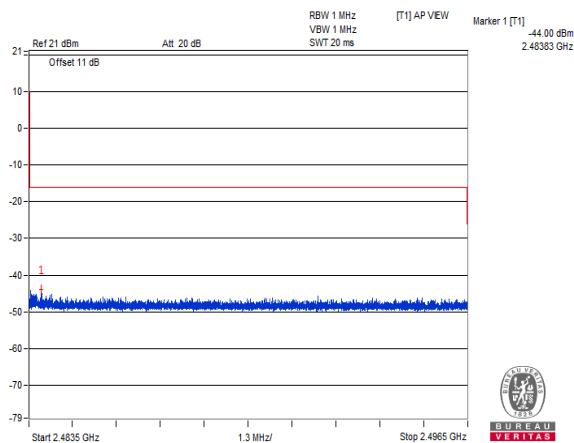
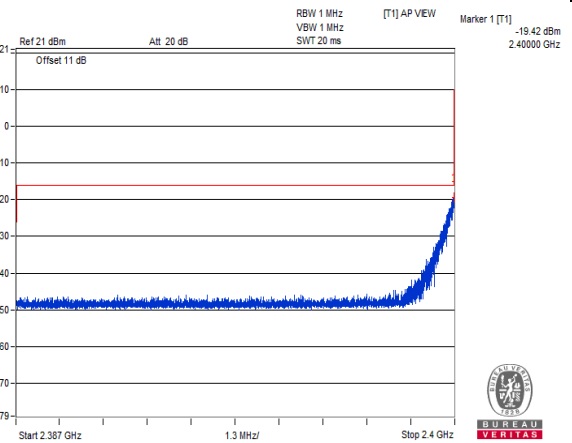
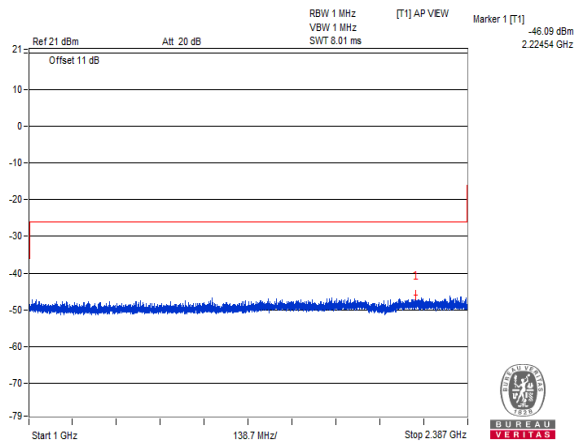
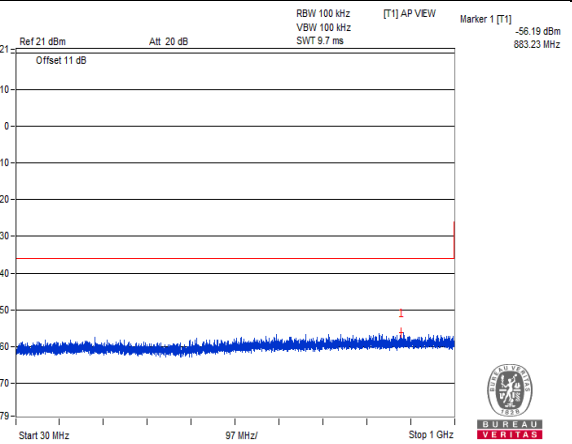
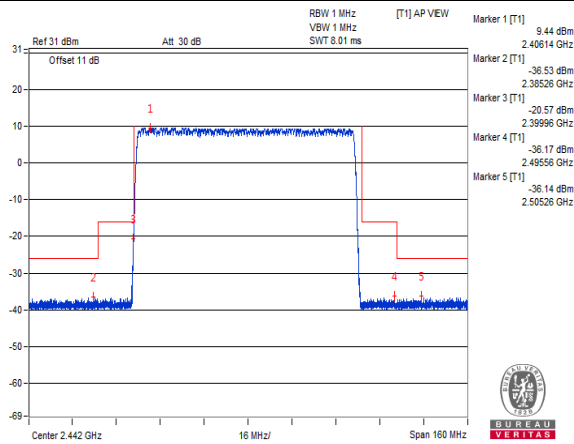
Modulation:  $\pi/4$ -DQPSK

Test Channel		Hopping Mode			
Test Condition	Frequency Range (MHz)	Frequency (MHz)	Measured Value (uW)	Limit (uW)	Result
<b>V<sub>normal</sub></b>	30MHz to 1000MHz	694.690	0.002000	0.25	Pass
	1000MHz to 2387MHz	1568.840	0.023000	2.5	Pass
	2387MHz to 2400MHz	2400.000	12.331000	25.00	Pass
	2483.5MHz to 2496.5MHz	2483.690	0.037000	25.00	Pass
	2496.5MHz to 12500MHz	11707.219	0.091000	2.5	Pass
<b>V<sub>max.</sub></b>	30MHz to 1000MHz	883.230	0.002000	0.25	Pass
	1000MHz to 2387MHz	2224.540	0.024000	2.5	Pass
	2387MHz to 2400MHz	2400.000	11.428000	25.00	Pass
	2483.5MHz to 2496.5MHz	2483.830	0.039000	25.00	Pass
	2496.5MHz to 12500MHz	11274.570	0.095000	2.5	Pass
<b>V<sub>min.</sub></b>	30MHz to 1000MHz	830.370	0.002000	0.25	Pass
	1000MHz to 2387MHz	2312.620	0.024000	2.5	Pass
	2387MHz to 2400MHz	2399.990	11.994000	25.00	Pass
	2483.5MHz to 2496.5MHz	2483.540	0.045000	25.00	Pass
	2496.5MHz to 12500MHz	11217.049	0.086000	2.5	Pass
Note: The spectrum plots are attached on the following pages.					

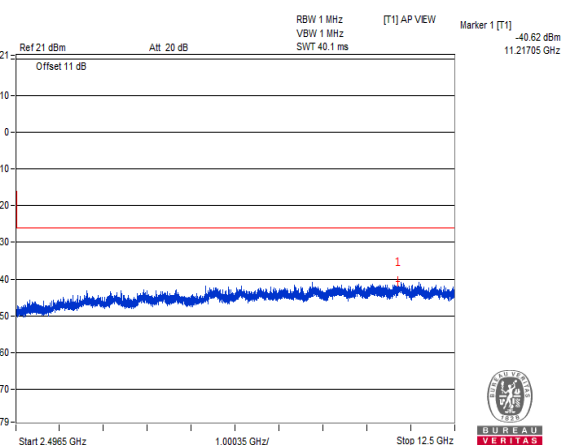
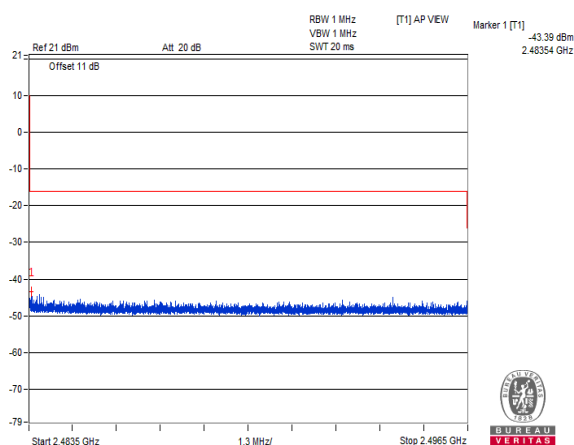
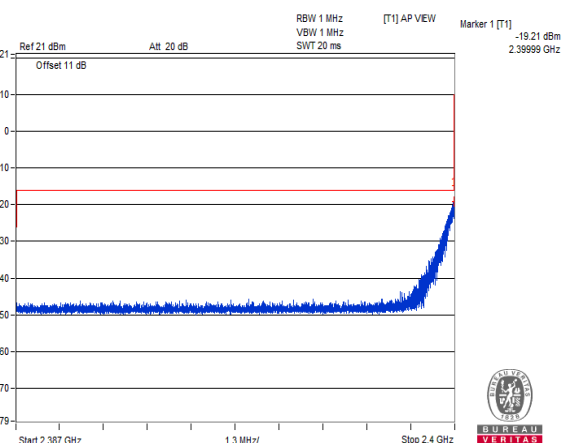
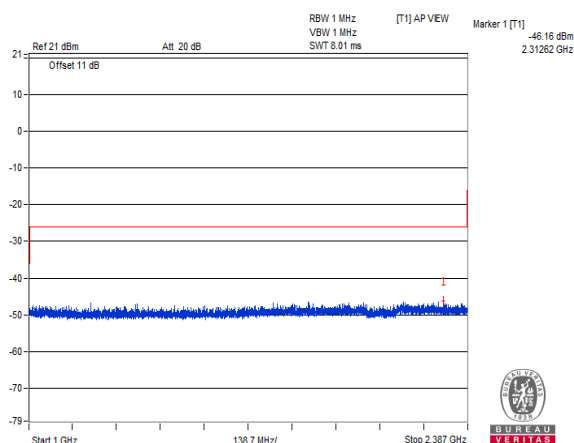
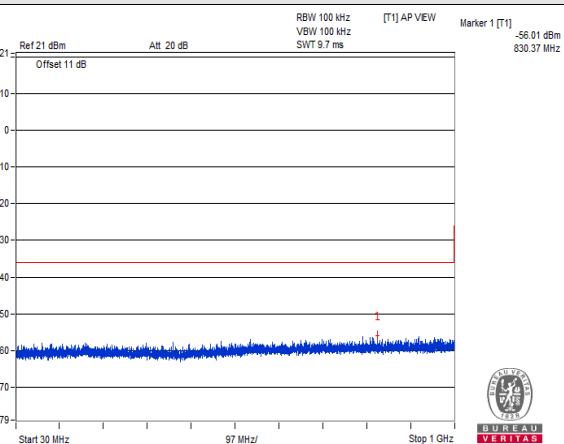
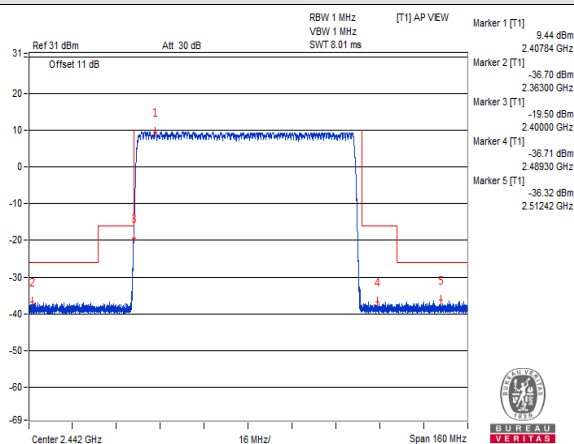
# Vnormal



V<sub>max</sub>.



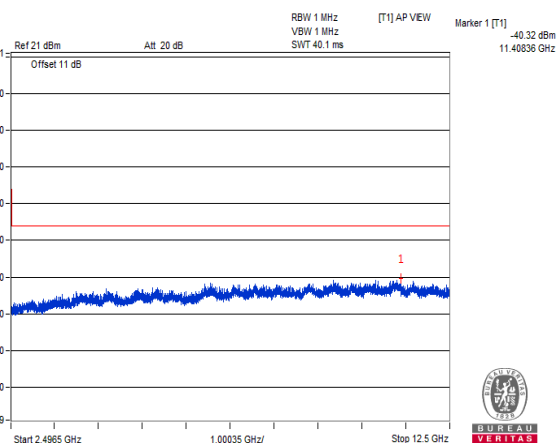
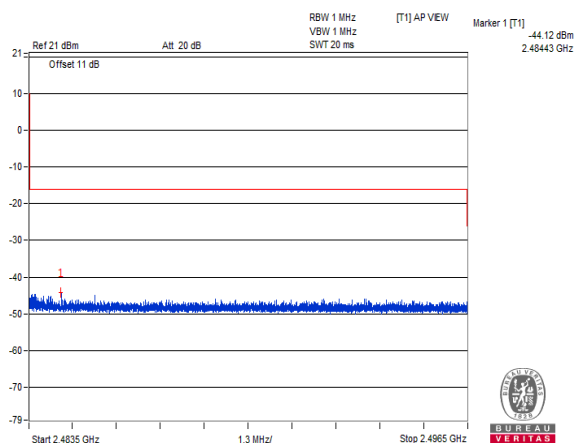
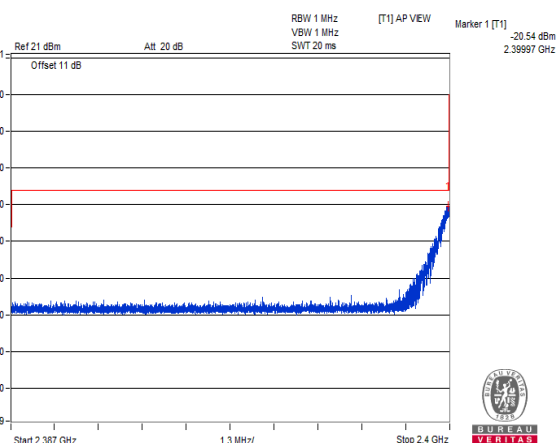
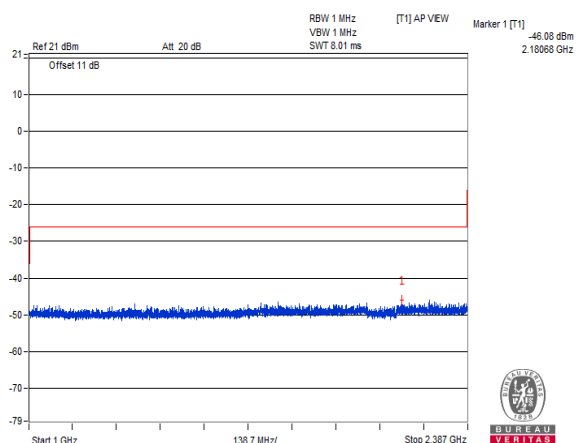
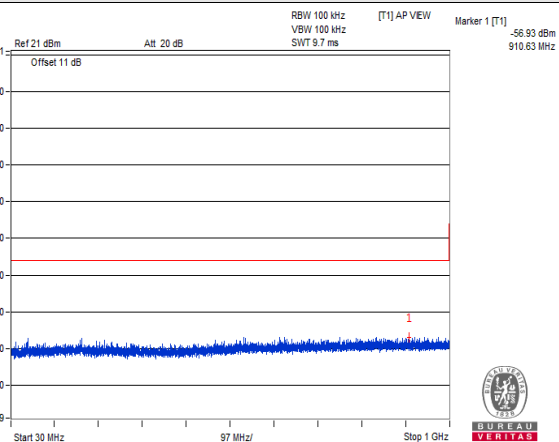
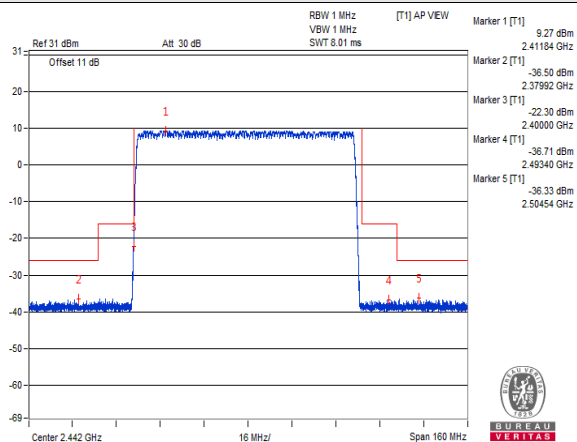
V<sub>min</sub>.



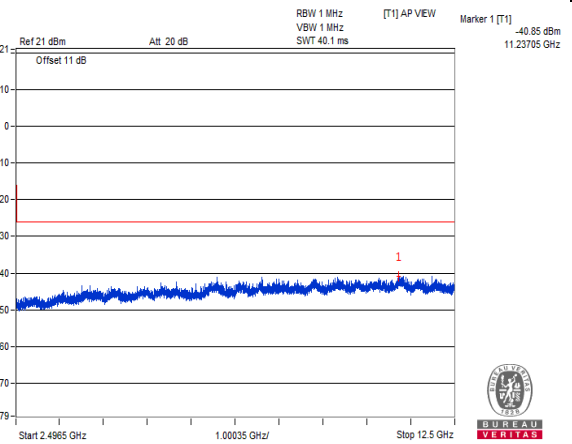
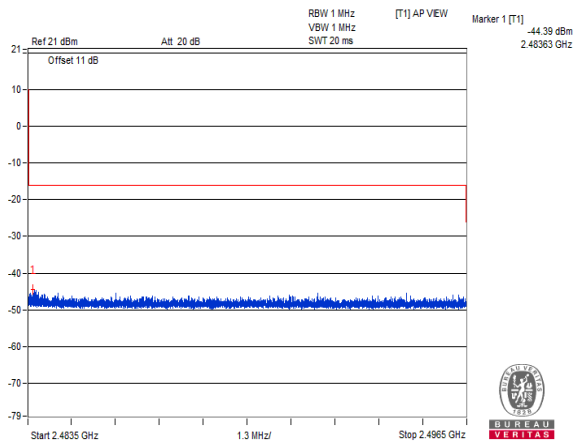
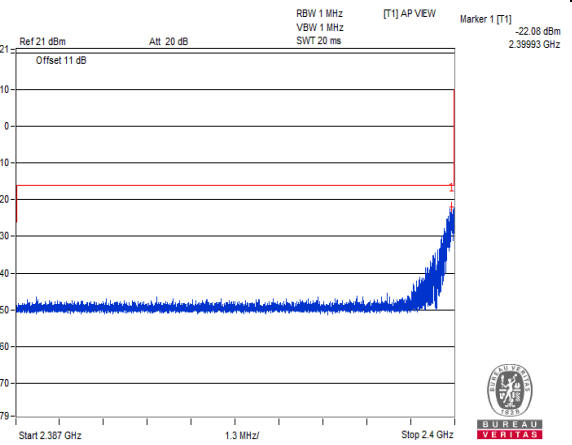
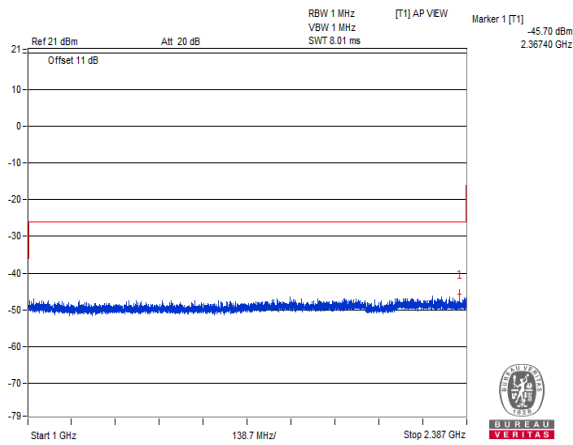
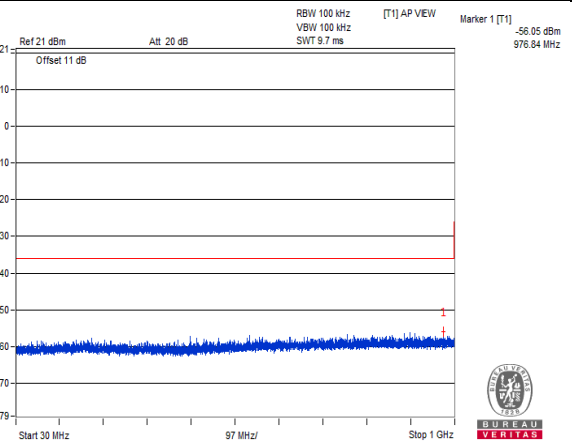
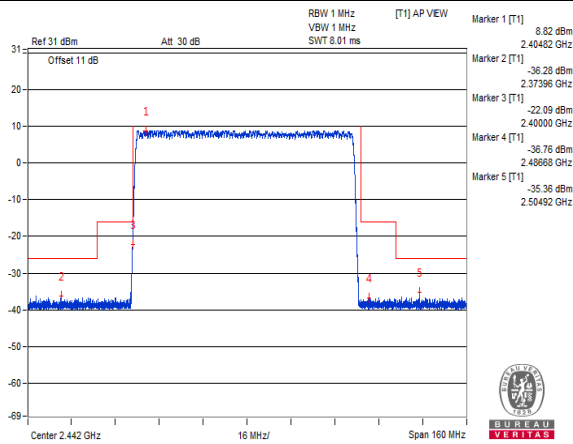
**Modulation: 8DPSK**

Test Channel		Hopping Mode			
Test Condition	Frequency Range (MHz)	Frequency (MHz)	Measured Value (uW)	Limit (uW)	Result
<b>V<sub>normal</sub></b>	30MHz to 1000MHz	910.630	0.002000	0.25	Pass
	1000MHz to 2387MHz	2180.680	0.024000	2.5	Pass
	2387MHz to 2400MHz	2399.970	8.830000	25.00	Pass
	2483.5MHz to 2496.5MHz	2484.430	0.038000	25.00	Pass
	2496.5MHz to 12500MHz	11408.360	0.092000	2.5	Pass
<b>V<sub>max.</sub></b>	30MHz to 1000MHz	976.840	0.002000	0.25	Pass
	1000MHz to 2387MHz	2367.400	0.026000	2.5	Pass
	2387MHz to 2400MHz	2399.930	6.194000	25.00	Pass
	2483.5MHz to 2496.5MHz	2483.630	0.036000	25.00	Pass
	2496.5MHz to 12500MHz	11237.049	0.082000	2.5	Pass
<b>V<sub>min.</sub></b>	30MHz to 1000MHz	824.790	0.002000	0.25	Pass
	1000MHz to 2387MHz	2048.740	0.023000	2.5	Pass
	2387MHz to 2400MHz	2399.990	9.954000	25.00	Pass
	2483.5MHz to 2496.5MHz	2483.580	0.034000	25.00	Pass
	2496.5MHz to 12500MHz	8067.190	0.093000	2.5	Pass
Note: The spectrum plots are attached on the following pages.					

# Vnormal

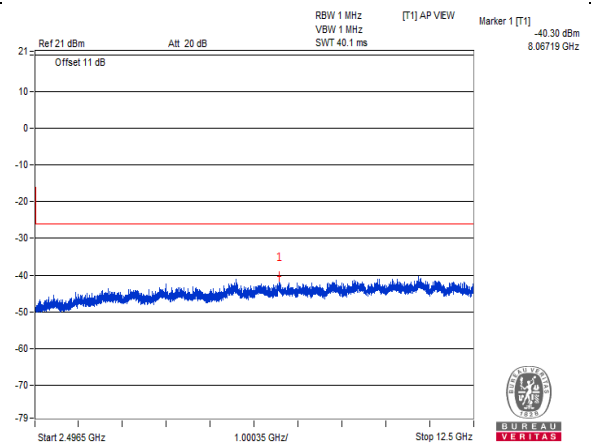
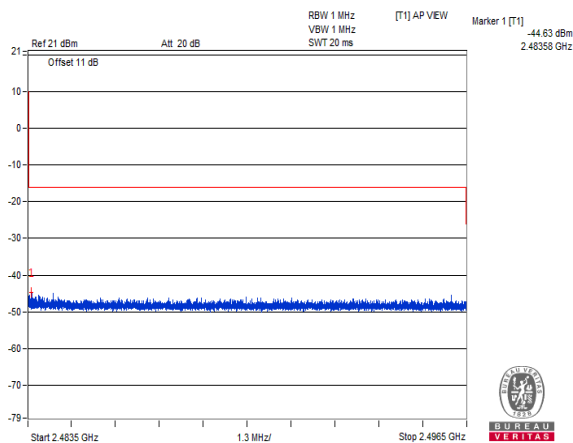
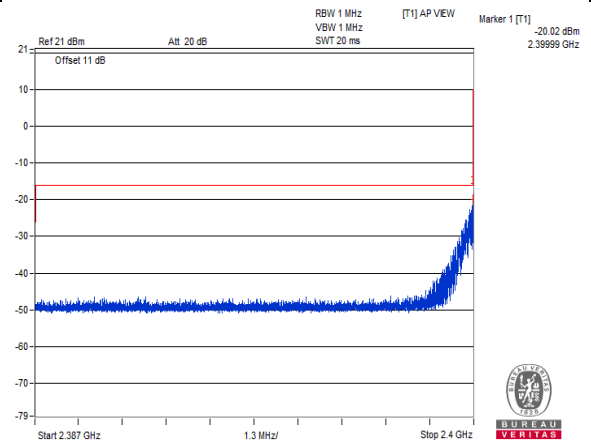
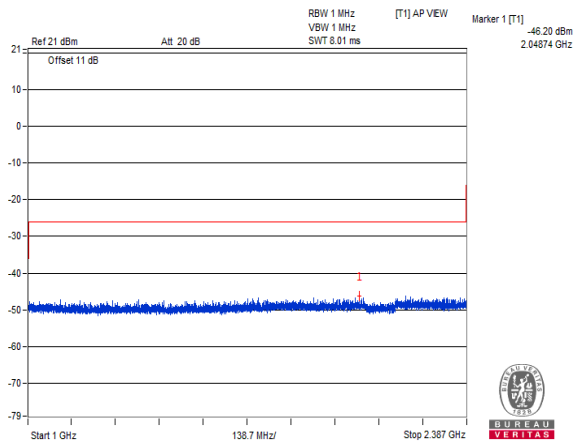
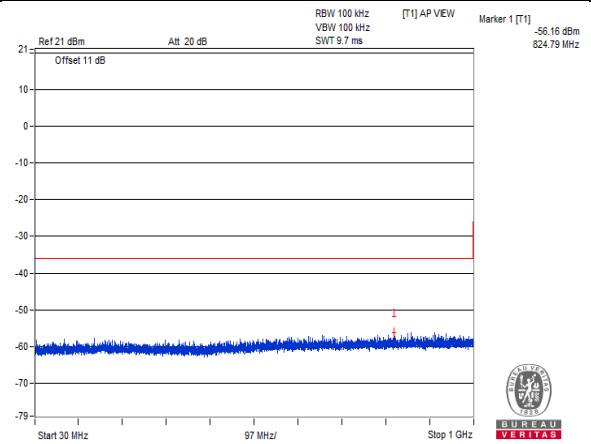
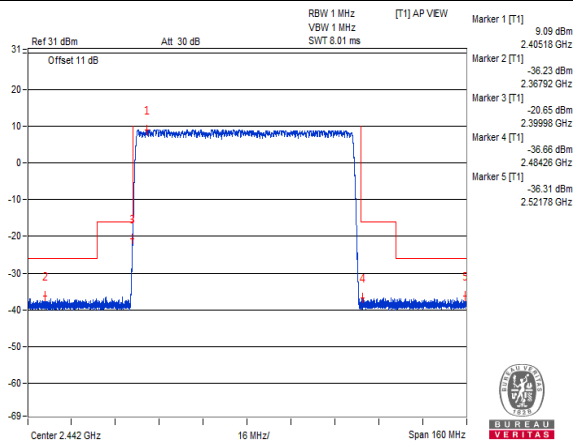


V<sub>max</sub>.





V<sub>min</sub>.



## 4.5 Antenna Power Measurement

### 4.5.1 Limits of Antenna Power

Modulation System	Frequency Band Used	Antenna Power (Max.)	EIRP (Max.)
DS	2400 – 2483.5 MHz	10 mW/MHz	12.14 dBm/MHz ~ 22.14 dBm/MHz (16.368 mW/MHz ~ 163.68 mW/MHz)
OFDM (Note 1)	2400 – 2483.5 MHz	10 mW/MHz	12.14 dBm/MHz ~ 22.14 dBm/MHz (16.368 mW/MHz ~ 163.68 mW/MHz)
OFDM (Note 2)	2400 – 2483.5 MHz	5 mW/MHz	9.13 dBm/MHz ~ 19.13 dBm/MHz (8.184 mW/MHz ~ 81.84 mW/MHz)
FH	2400 – 2483.5 MHz	3 mW/MHz	6.91 dBm/MHz ~ 16.91 dBm/MHz (4.91 mW/MHz ~ 49.1 mW/MHz)

Note:

1. Occupied bandwidth is less than 26MHz
2. Occupied bandwidth is more than 26MHz and less than 40MHz
3. EIRP limit is variable by the HPBA, the HPBA (half-power beam width) of the antenna shall be 360/A degrees or less, where A = EIRP/(2.14 dBi + "Antenna Power (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:

Test Voltage	Modulation	Data Rate	Conducted RF Output Power Density (mW/MHz)	Radiated RF Output Power Density (mW/MHz)
<b>V<sub>normal</sub></b>	<b>GFSK</b>	<b>DH5</b>	0.087902	0.028576
	<b>π/4-DQPSK</b>	<b>2DH5</b>	0.084935	0.027611
	<b>8DPSK</b>	<b>3DH5</b>	0.084740	0.027548
<b>V<sub>max.</sub></b>	<b>GFSK</b>	<b>DH5</b>	0.090157	0.029309
	<b>π/4-DQPSK</b>	<b>2DH5</b>	0.086315	0.028060
	<b>8DPSK</b>	<b>3DH5</b>	0.087920	0.028582
<b>V<sub>min.</sub></b>	<b>GFSK</b>	<b>DH5</b>	0.089330	0.029040
	<b>π/4-DQPSK</b>	<b>2DH5</b>	0.088123	0.028648
	<b>8DPSK</b>	<b>3DH5</b>	0.082430	0.026797
<b>Max. Limit (mW/MHz):</b>			3	-
<b>Rated Power (mW/MHz):</b>			0.1	-
<b>Tolerance of Antenna Power (mW/MHz):</b>			0.02 ~ 0.12	-
<b>Max. EIRP Limit (mW/MHz):</b>			-	4.91

Note: 1. Antenna gain: -4.88dBi.

2. The radiated RF output power density is a “calculated” value derived from the conducted value.

3. Formula: Radiated RF output power density = Conducted RF output power density + Antenna gain.

#### AFH Mode:

Test Voltage	Modulation	Data Rate	Conducted RF Output Power Density (mW/MHz)	Radiated RF Output Power Density (mW/MHz)
<b>V<sub>normal</sub></b>	<b>GFSK</b>	<b>DH5</b>	0.347956	0.113116
	<b>π/4-DQPSK</b>	<b>2DH5</b>	0.332860	0.108209
	<b>8DPSK</b>	<b>3DH5</b>	0.329570	0.107139
<b>V<sub>max.</sub></b>	<b>GFSK</b>	<b>DH5</b>	0.354135	0.115125
	<b>π/4-DQPSK</b>	<b>2DH5</b>	0.334424	0.108717
	<b>8DPSK</b>	<b>3DH5</b>	0.341938	0.111160
<b>V<sub>min.</sub></b>	<b>GFSK</b>	<b>DH5</b>	0.350887	0.114069
	<b>π/4-DQPSK</b>	<b>2DH5</b>	0.344035	0.111841
	<b>8DPSK</b>	<b>3DH5</b>	0.321810	0.104616
<b>Max. Limit (mW/MHz):</b>			3	-
<b>Rated Power (mW/MHz):</b>			0.4	-
<b>Tolerance of Antenna Power (mW/MHz):</b>			0.08 ~ 0.48	-
<b>Max. EIRP Limit (mW/MHz):</b>			-	4.91

Note: 1. Antenna gain: -4.88dBi.

2. The radiated RF output power density is a “calculated” value derived from the conducted value.

3. Formula: Radiated RF output power density = Conducted RF output power density + Antenna gain.

## 4.6 Spurious Emissions for Receiver

### 4.6.1 Limits of Spurious Emissions for Receiver

Frequencies (MHz)	Limit
Below 1GHz	$\leq 4\text{nW}$ (-54dBm)
Above 1GHz	$\leq 20\text{nW}$ (-47dBm)

### 4.6.2 Test Setup

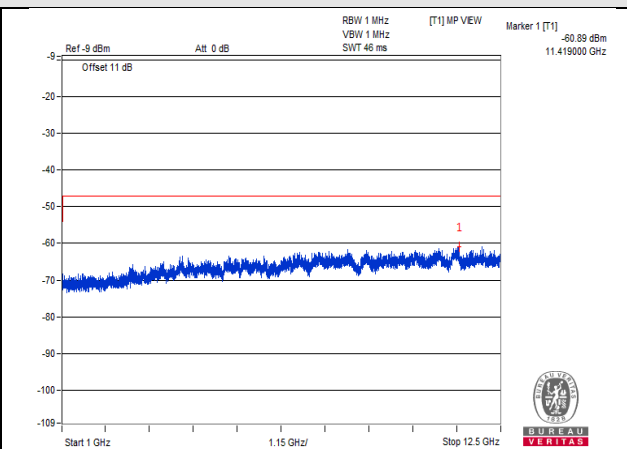
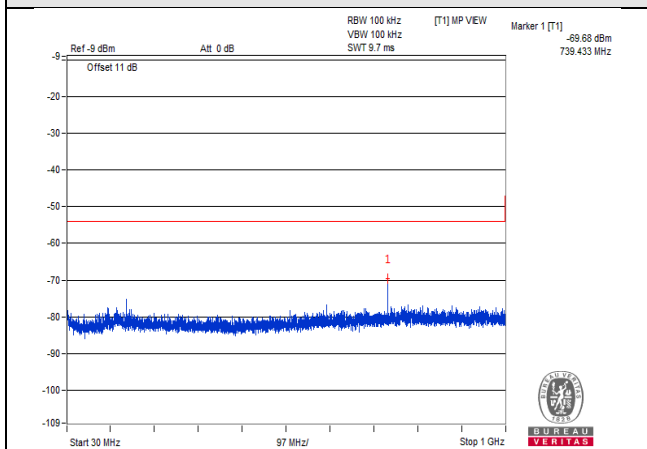


#### 4.6.3 Test Result

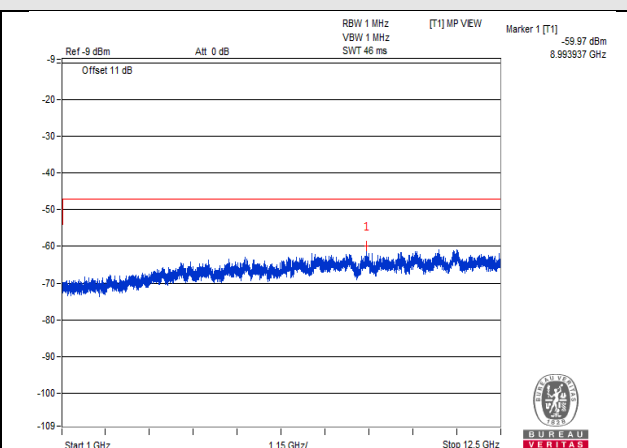
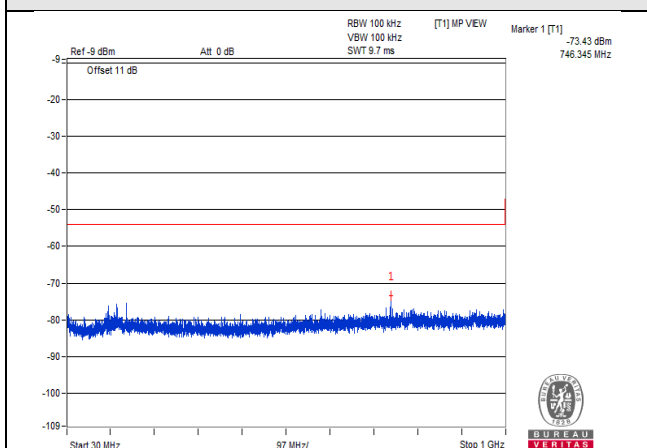
Modulation: GFSK

Test Channel		CH 0 (2402MHz)			
Test Condition	Frequency Range (MHz)	Frequency (MHz)	Measured Value (nW)	Limit (nW)	Result
$V_{normal}$	30MHz to 1000MHz	739.433	0.107647	4.0	Pass
	1000MHz to 12500MHz	11419.000	0.814704	20.0	Pass
$V_{max.}$	30MHz to 1000MHz	746.345	0.045394	4.0	Pass
	1000MHz to 12500MHz	8993.937	1.006932	20.0	Pass
$V_{min.}$	30MHz to 1000MHz	739.191	0.026792	4.0	Pass
	1000MHz to 12500MHz	10910.125	0.853100	20.0	Pass
Test Channel		CH 39 (2441MHz)			
$V_{normal}$	30MHz to 1000MHz	736.038	0.019320	4.0	Pass
	1000MHz to 12500MHz	11383.062	0.988553	20.0	Pass
$V_{max.}$	30MHz to 1000MHz	905.910	0.021727	4.0	Pass
	1000MHz to 12500MHz	11285.312	1.020939	20.0	Pass
$V_{min.}$	30MHz to 1000MHz	883.478	0.019543	4.0	Pass
	1000MHz to 12500MHz	11331.312	0.774462	20.0	Pass
Test Channel		CH 78 (2480MHz)			
$V_{normal}$	30MHz to 1000MHz	998.060	0.019770	4.0	Pass
	1000MHz to 12500MHz	11285.312	0.928966	20.0	Pass
$V_{max.}$	30MHz to 1000MHz	930.160	0.019724	4.0	Pass
	1000MHz to 12500MHz	10908.687	0.853100	20.0	Pass
$V_{min.}$	30MHz to 1000MHz	810.728	0.024491	4.0	Pass
	1000MHz to 12500MHz	11383.062	0.877001	20.0	Pass

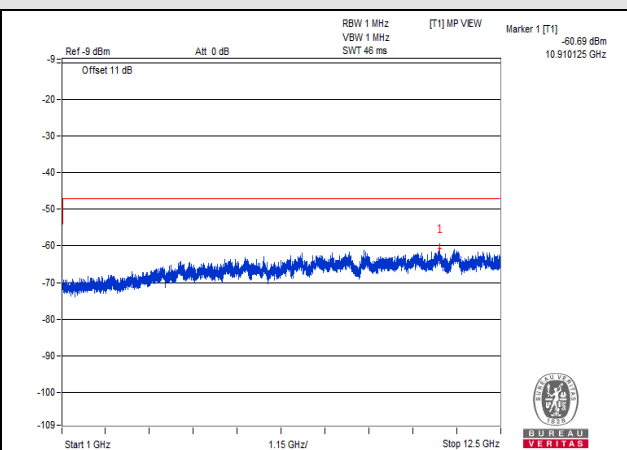
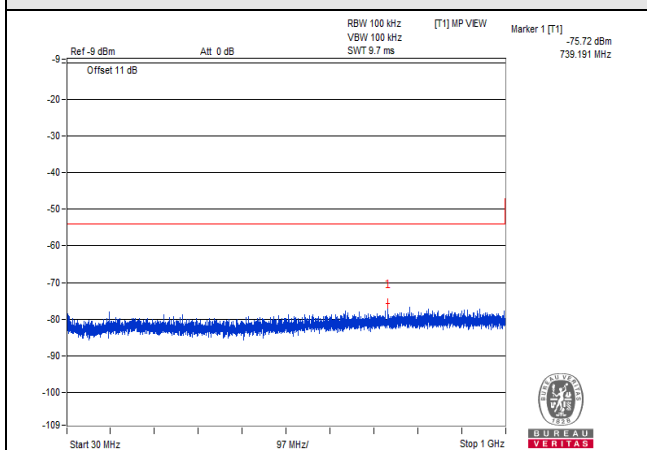
## V<sub>normal</sub>



## V<sub>max</sub>

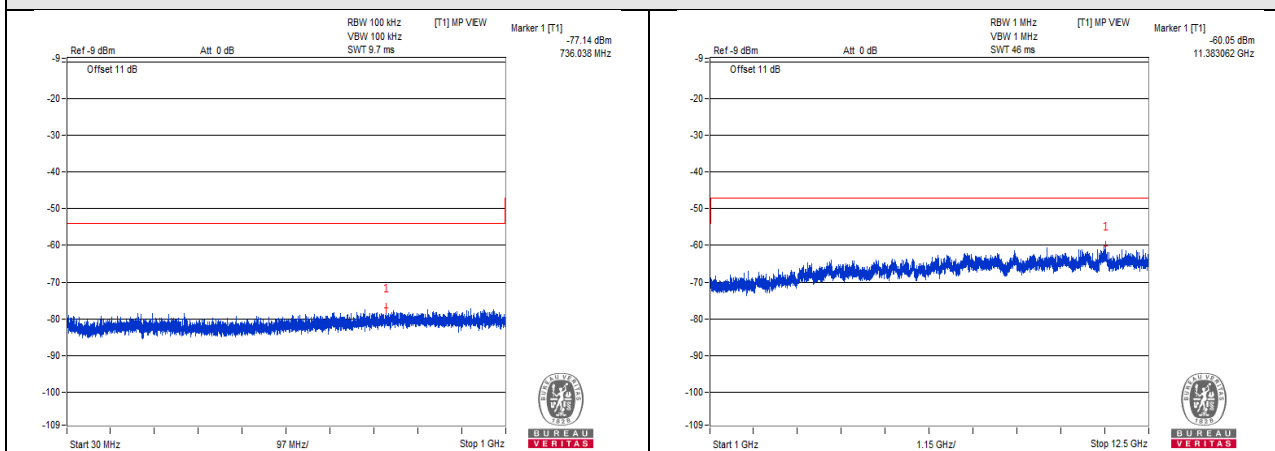


## V<sub>min</sub>

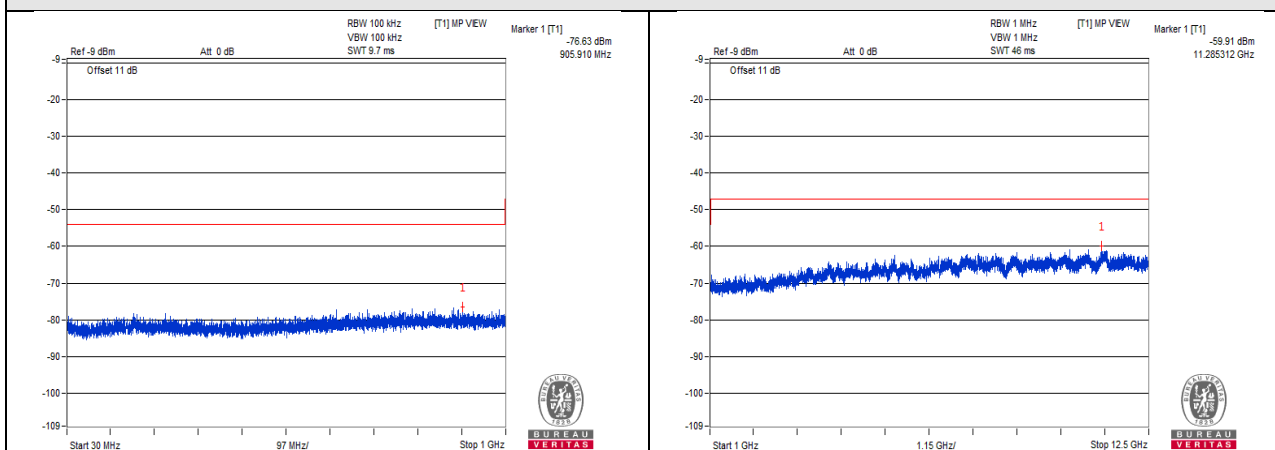


CH 0 (2402MHz)

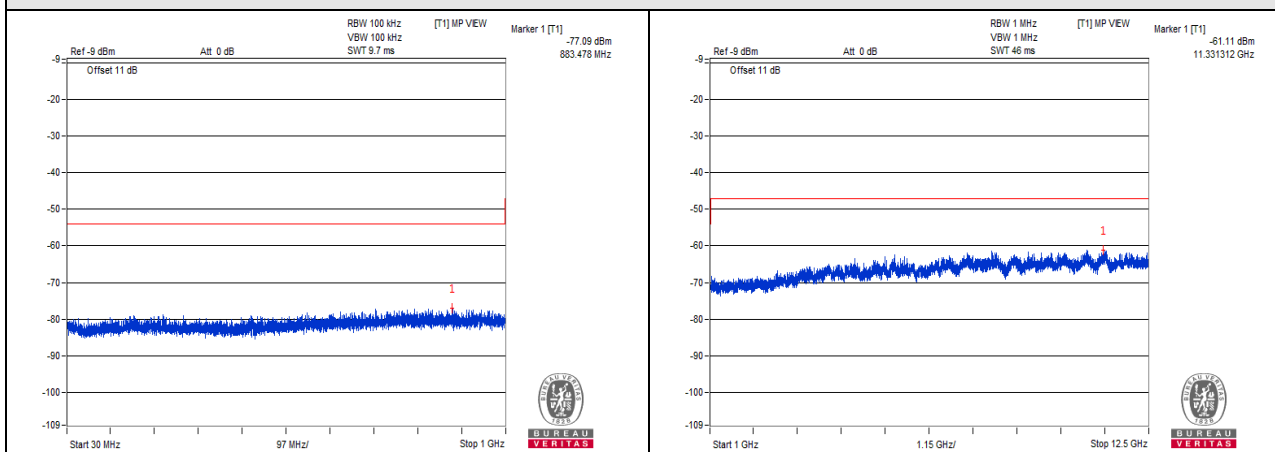
## V<sub>normal</sub>



## V<sub>max</sub>



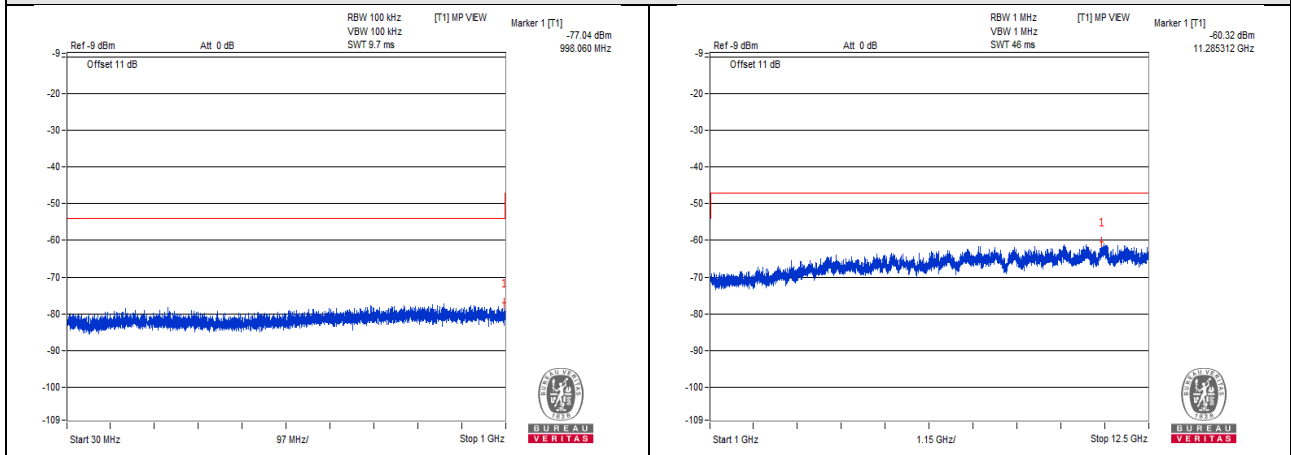
## V<sub>min</sub>



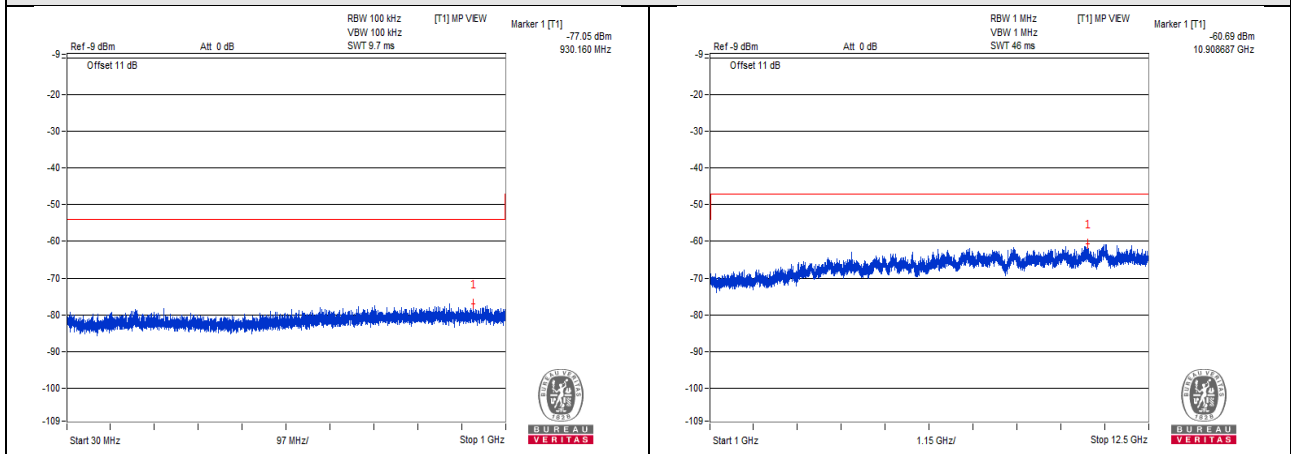
CH 39 (2441MHz)



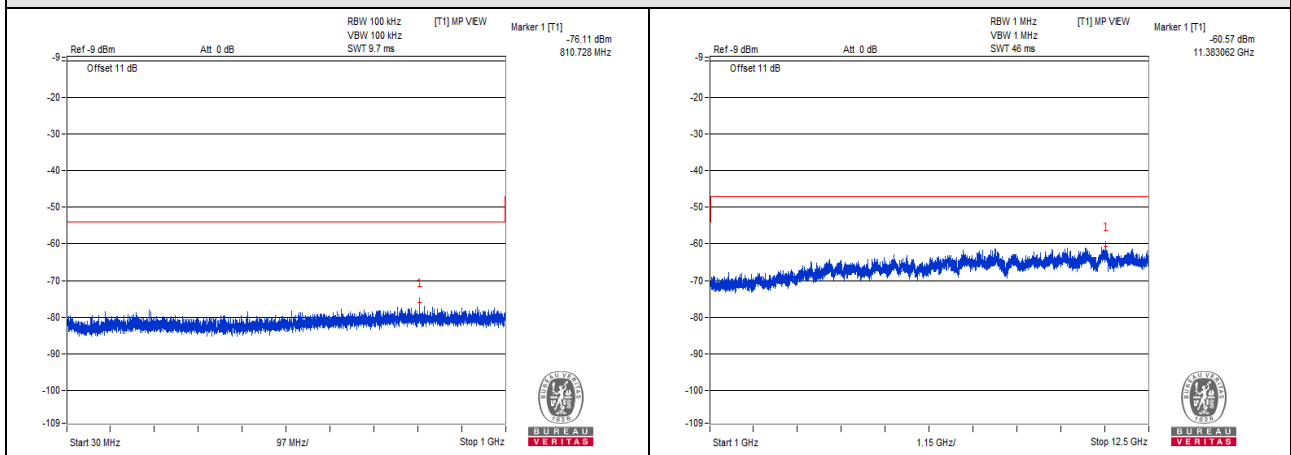
## V<sub>normal</sub>



## V<sub>max</sub>



## V<sub>min</sub>



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 second or 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

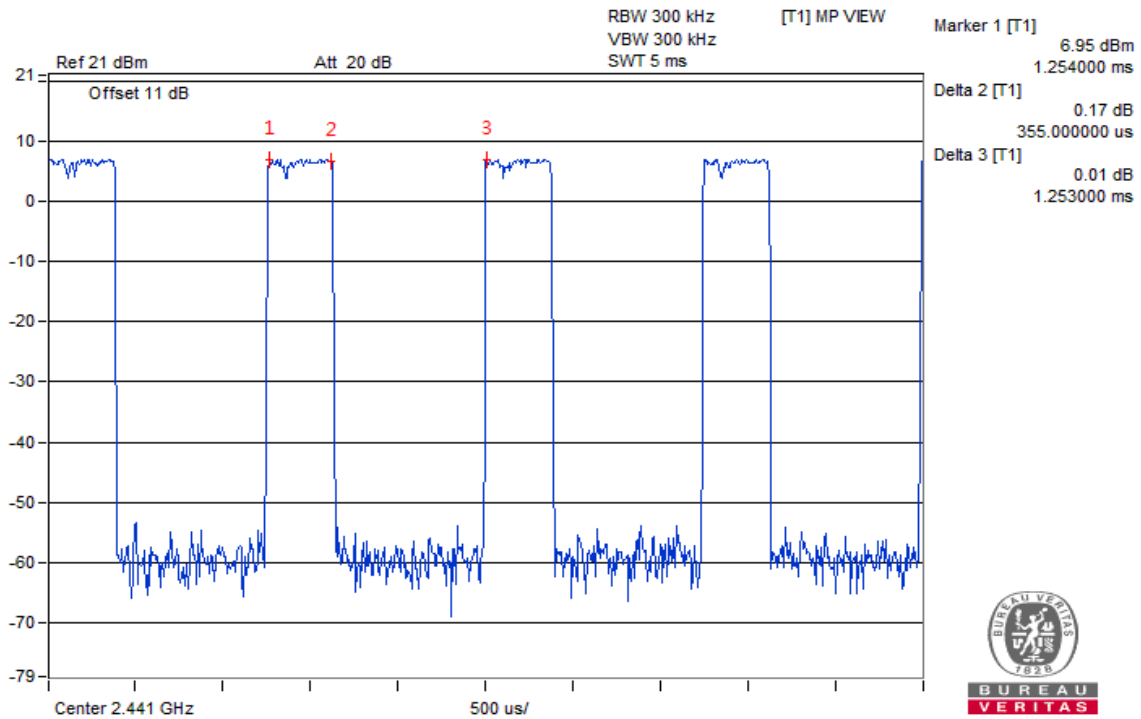
Normal Mode:

Test Condition	Mode	Spreading Rate	$(\text{Spreading Rate}/79)*0.4$	Duty Cycle (msec)	Result (msec)	Limit (msec)
<b>V<sub>normal</sub></b>	DH1	71.45	0.361	0.283	102.163	400
	DH3	71.45	0.361	0.635	229.235	400
	DH5	71.45	0.361	0.761	274.721	400
<b>V<sub>max.</sub></b>	DH1	71.45	0.361	0.283	102.163	400
	DH3	71.45	0.361	0.639	230.679	400
	DH5	71.45	0.361	0.761	274.721	400
<b>V<sub>min.</sub></b>	DH1	71.45	0.361	0.283	102.163	400
	DH3	71.45	0.361	0.635	229.235	400
	DH5	71.45	0.361	0.761	274.721	400

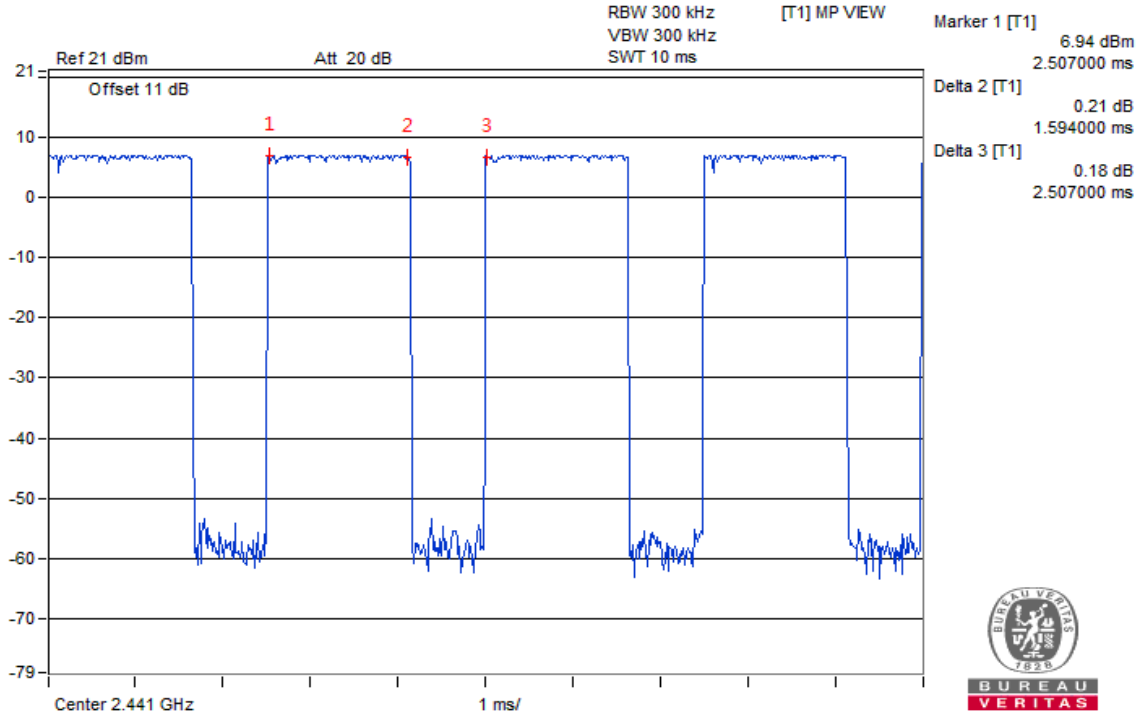
AFH Mode:

Test Condition	Mode	Spreading Rate	$(\text{Spreading Rate}/20)*0.4$	Duty Cycle (msec)	Result (msec)	Limit (msec)
<b>V<sub>normal</sub></b>	DH1	18.05	0.361	0.283	102.163	400
	DH3	18.05	0.361	0.635	229.235	400
	DH5	18.05	0.361	0.761	274.721	400
<b>V<sub>max.</sub></b>	DH1	18.19	0.363	0.283	102.729	400
	DH3	18.19	0.363	0.639	231.957	400
	DH5	18.19	0.363	0.761	276.243	400
<b>V<sub>min.</sub></b>	DH1	18.19	0.363	0.283	102.729	400
	DH3	18.19	0.363	0.635	230.505	400
	DH5	18.19	0.363	0.761	276.243	400

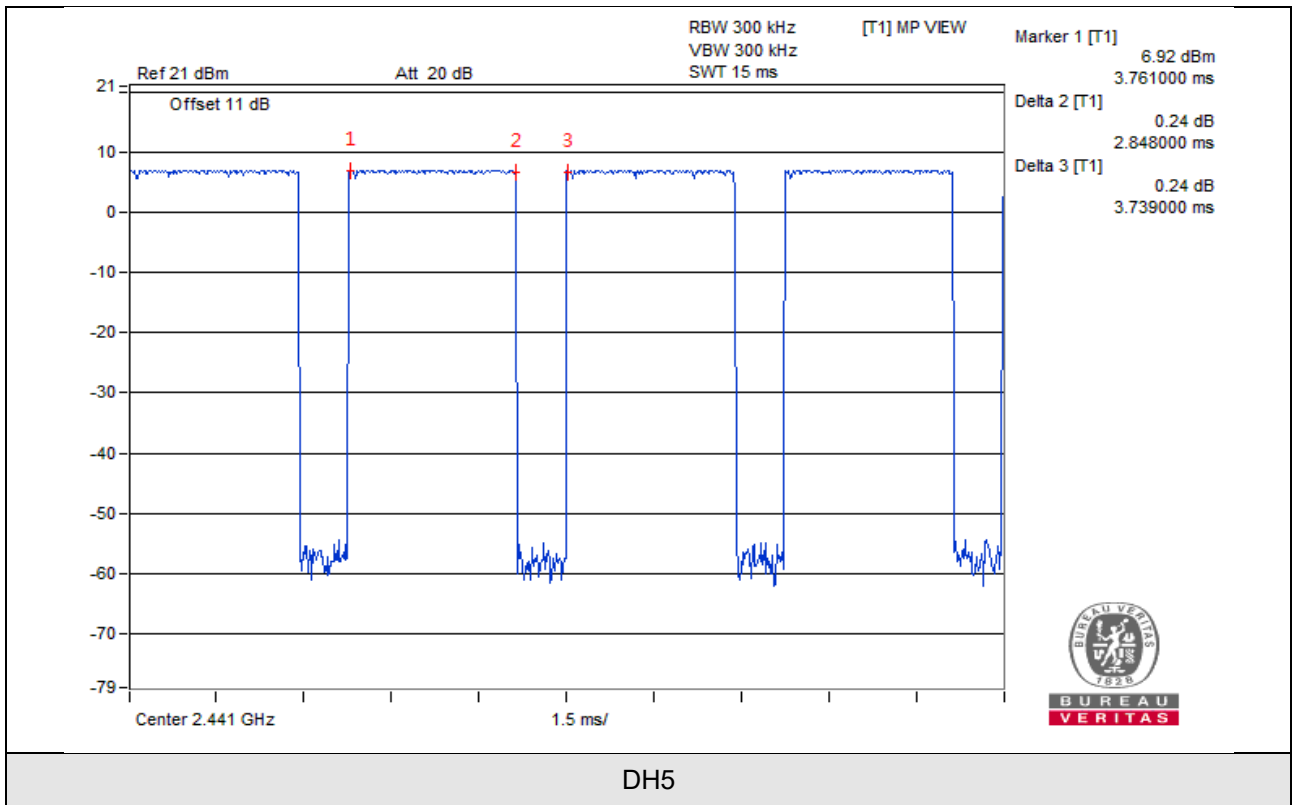
V<sub>normal</sub>



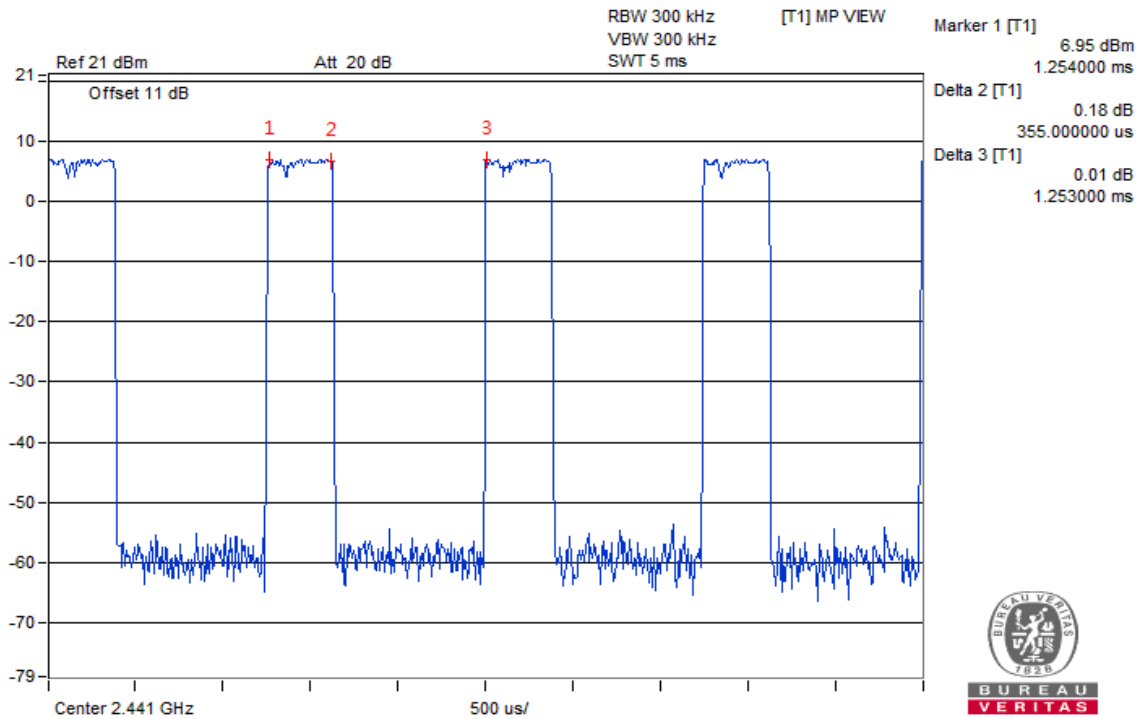
DH1



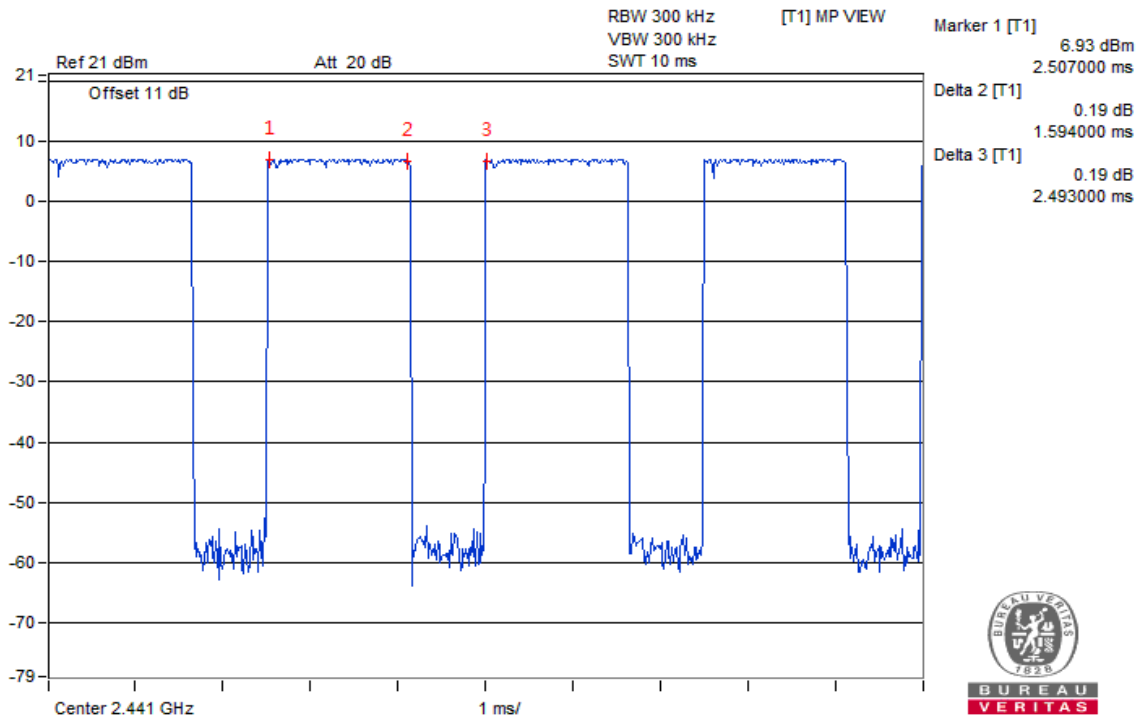
DH3



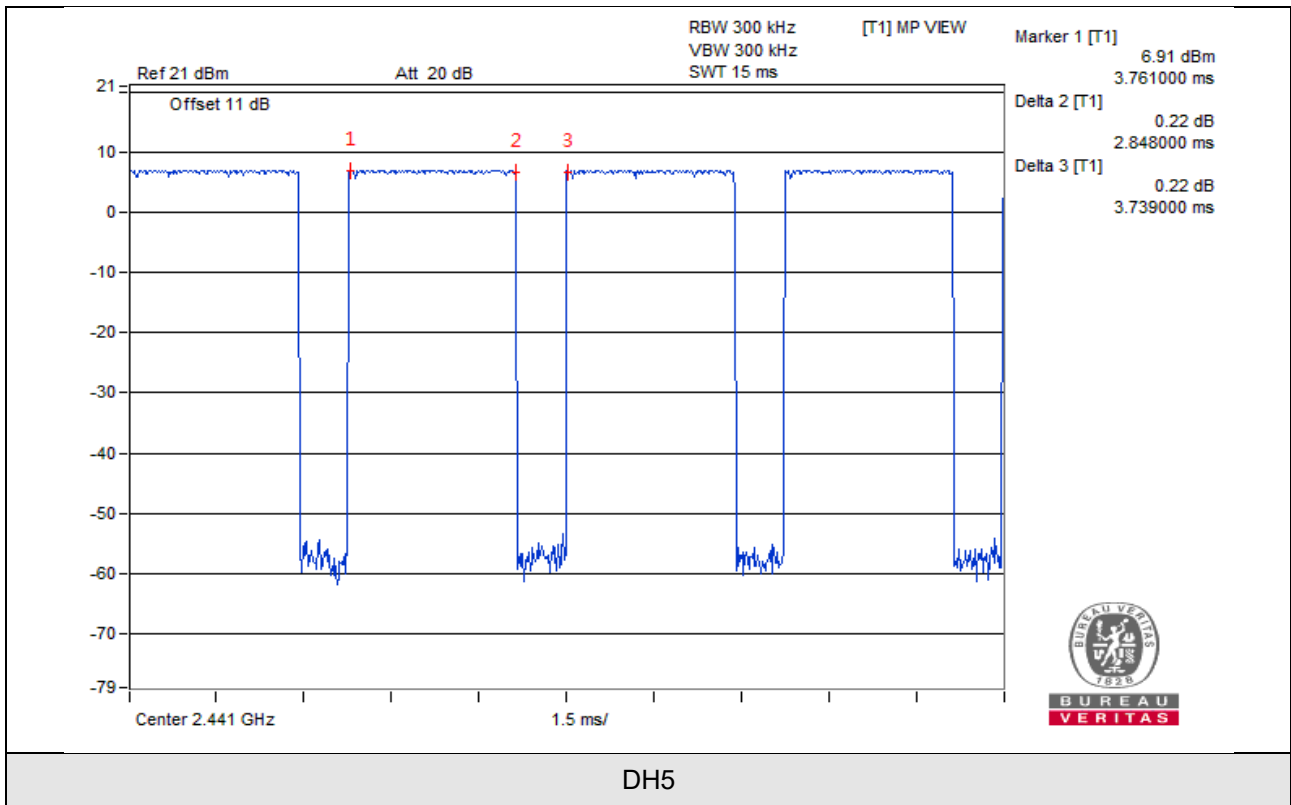
V<sub>max</sub>.



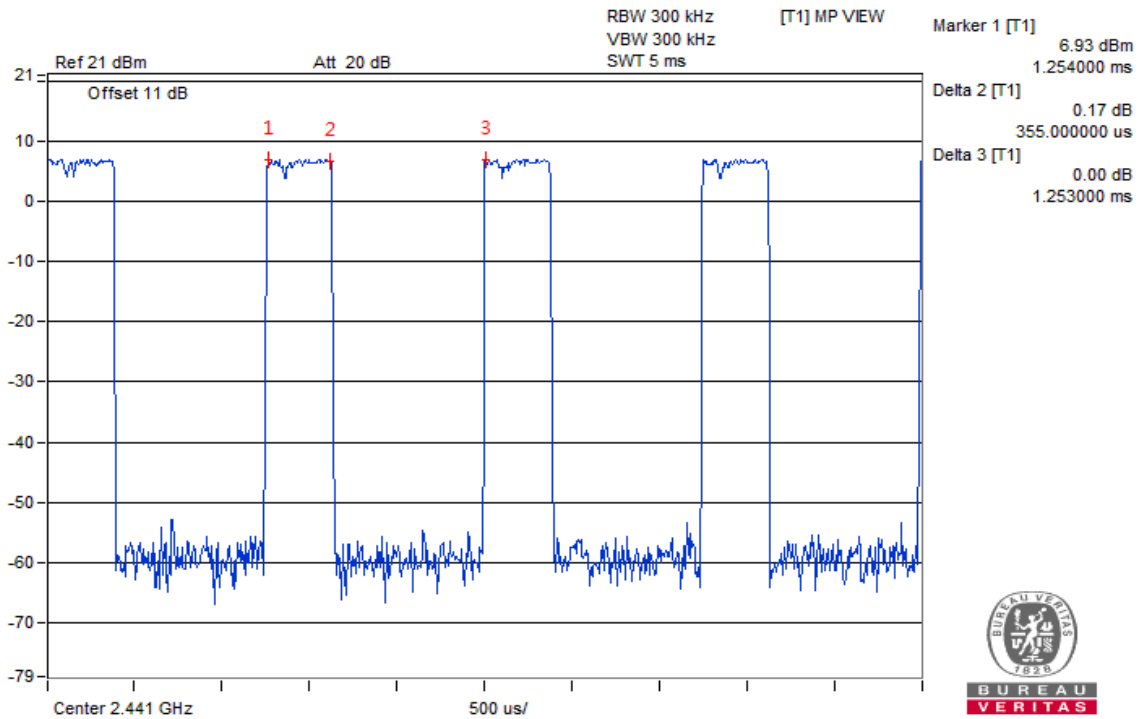
DH1



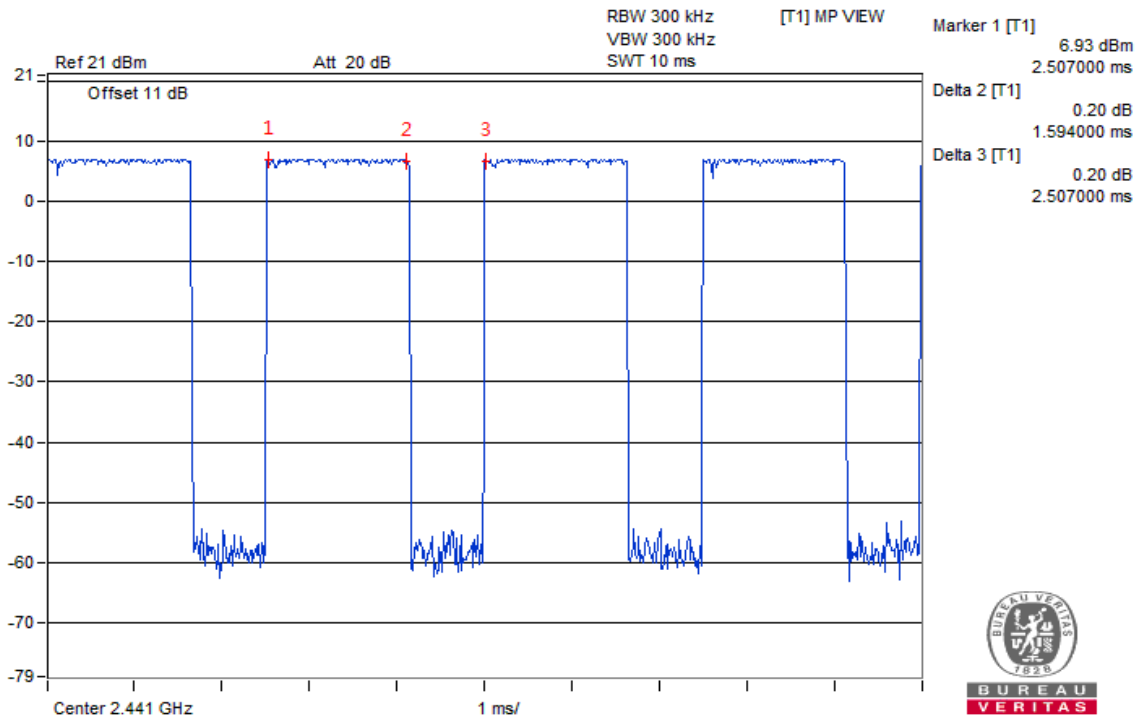
DH3



V<sub>min</sub>.

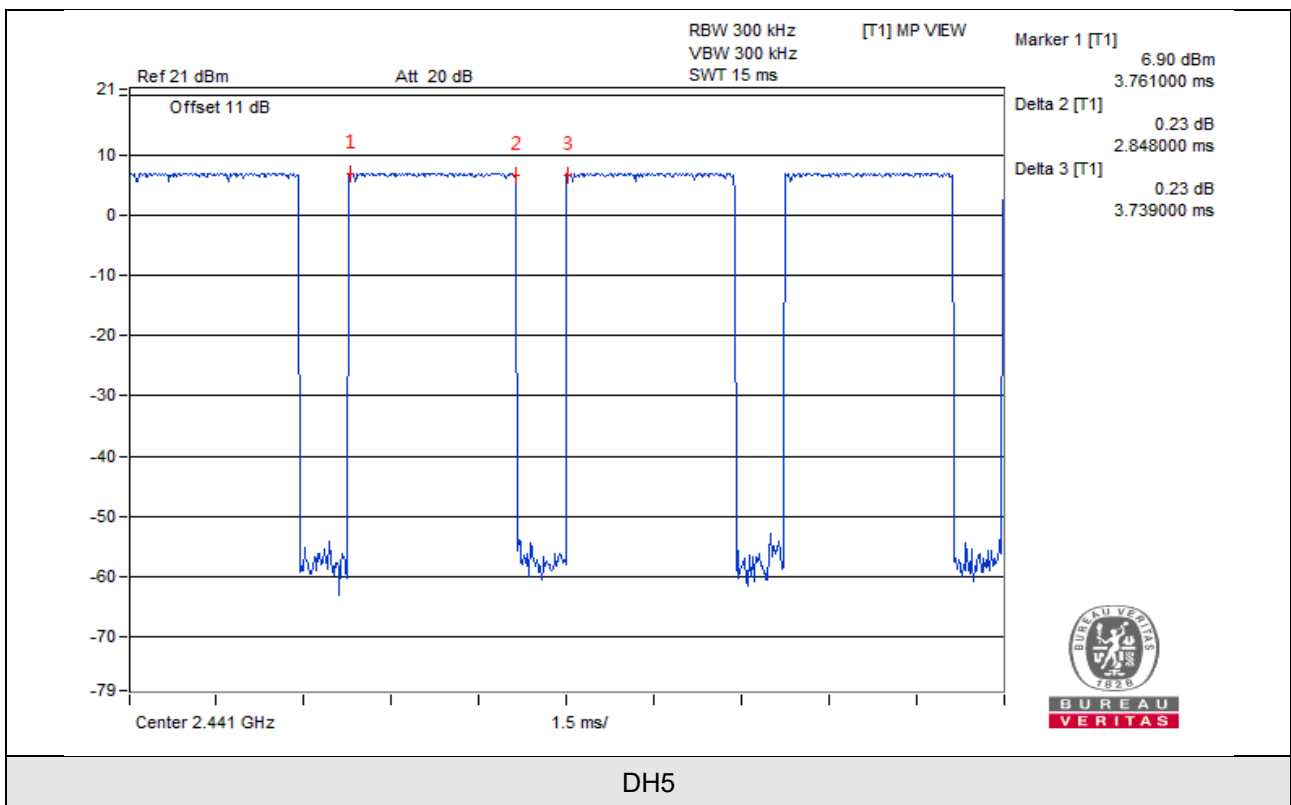


DH1



DH3





Modulation:  $\pi/4$ -DQPSK

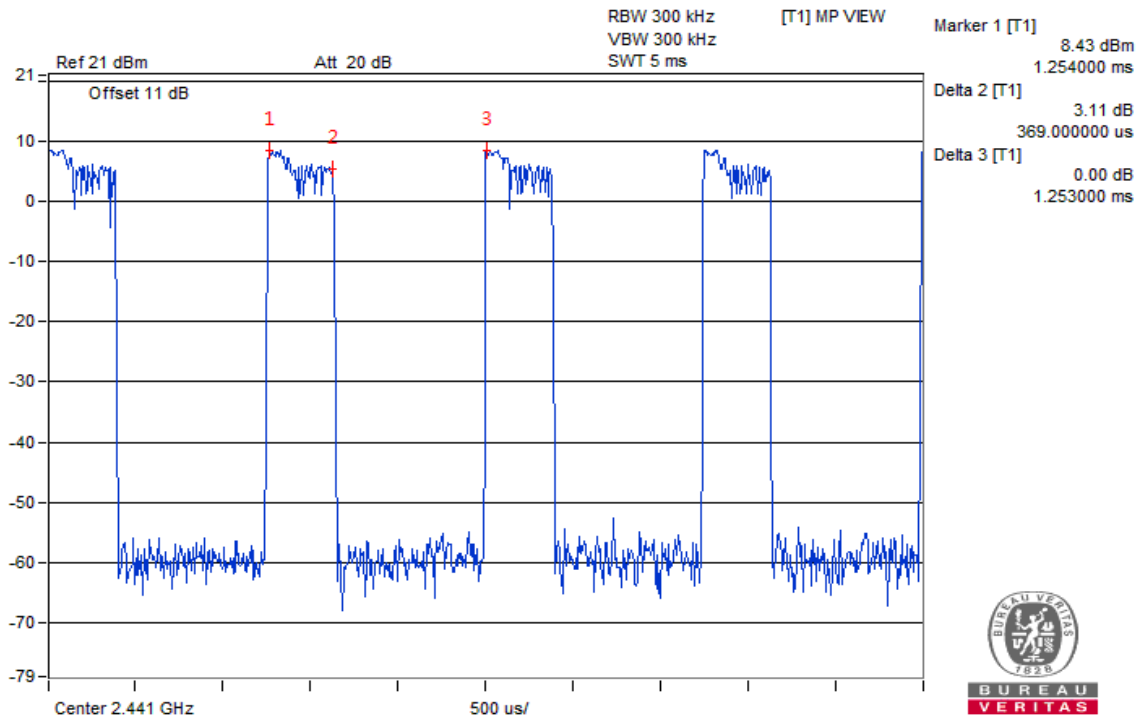
Normal Mode:

Test Condition	Mode	Spreading Rate	(Spreading Rate/79)*0.4	Duty Cycle (msec)	Result (msec)	Limit (msec)
<b>V<sub>normal</sub></b>	2DH1	71.60	0.362	0.294	106.428	400
	2DH3	71.60	0.362	0.641	232.042	400
	2DH5	71.60	0.362	0.748	270.776	400
<b>V<sub>max.</sub></b>	2DH1	71.60	0.362	0.294	106.428	400
	2DH3	71.60	0.362	0.641	232.042	400
	2DH5	71.60	0.362	0.748	270.776	400
<b>V<sub>min.</sub></b>	2DH1	71.60	0.362	0.294	106.428	400
	2DH3	71.60	0.362	0.641	232.042	400
	2DH5	71.60	0.362	0.748	270.776	400

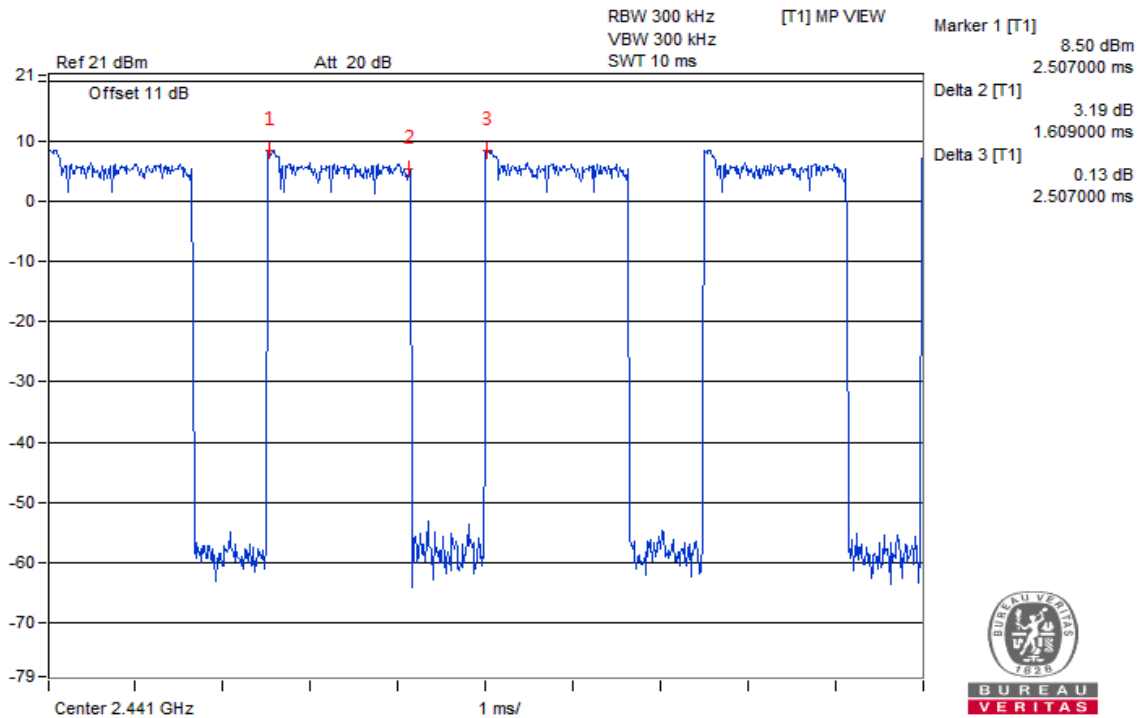
AFH Mode:

Test Condition	Mode	Spreading Rate	(Spreading Rate/20)*0.4	Duty Cycle (msec)	Result (msec)	Limit (msec)
<b>V<sub>normal</sub></b>	2DH1	18.27	0.365	0.294	107.310	400
	2DH3	18.27	0.365	0.641	233.965	400
	2DH5	18.27	0.365	0.748	273.020	400
<b>V<sub>max.</sub></b>	2DH1	18.48	0.369	0.294	108.486	400
	2DH3	18.48	0.369	0.641	236.529	400
	2DH5	18.48	0.369	0.748	276.012	400
<b>V<sub>min.</sub></b>	2DH1	18.34	0.366	0.294	107.604	400
	2DH3	18.34	0.366	0.641	234.606	400
	2DH5	18.34	0.366	0.748	273.768	400

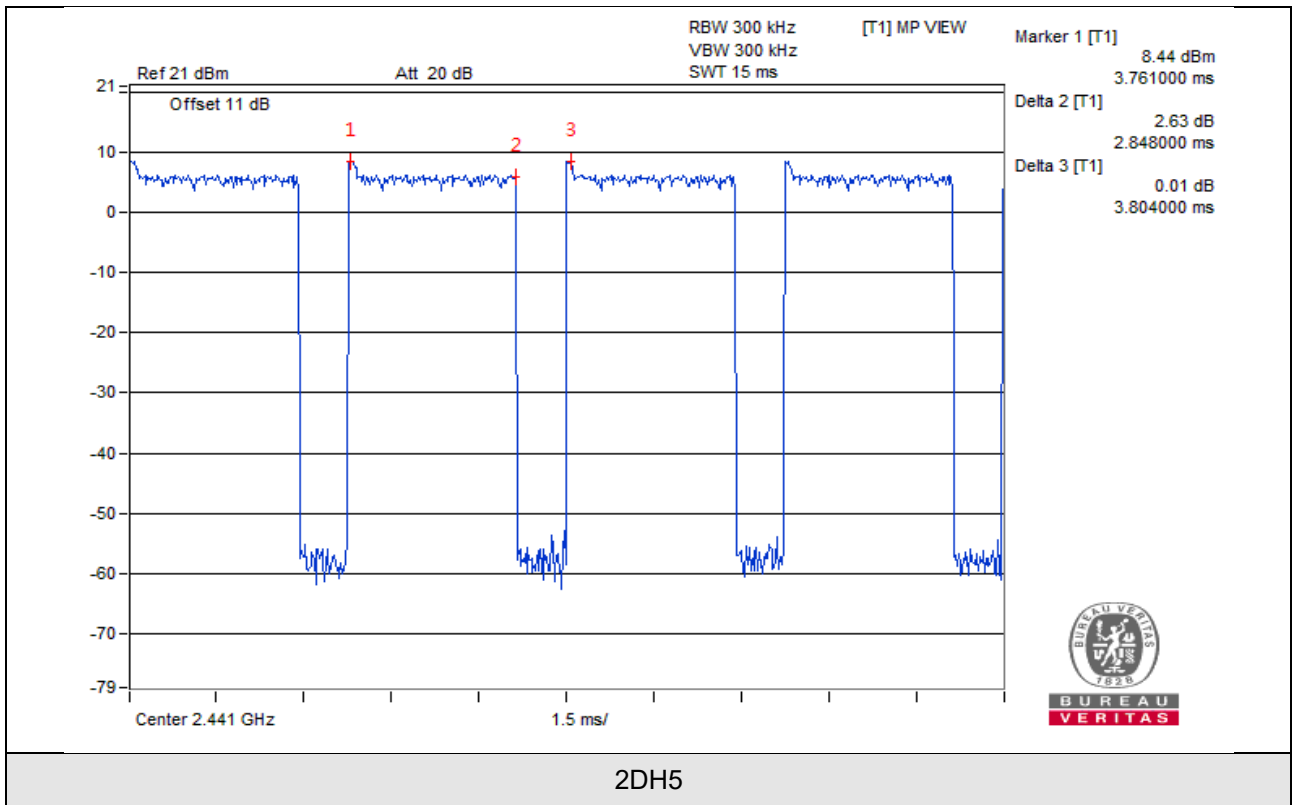
V<sub>normal</sub>



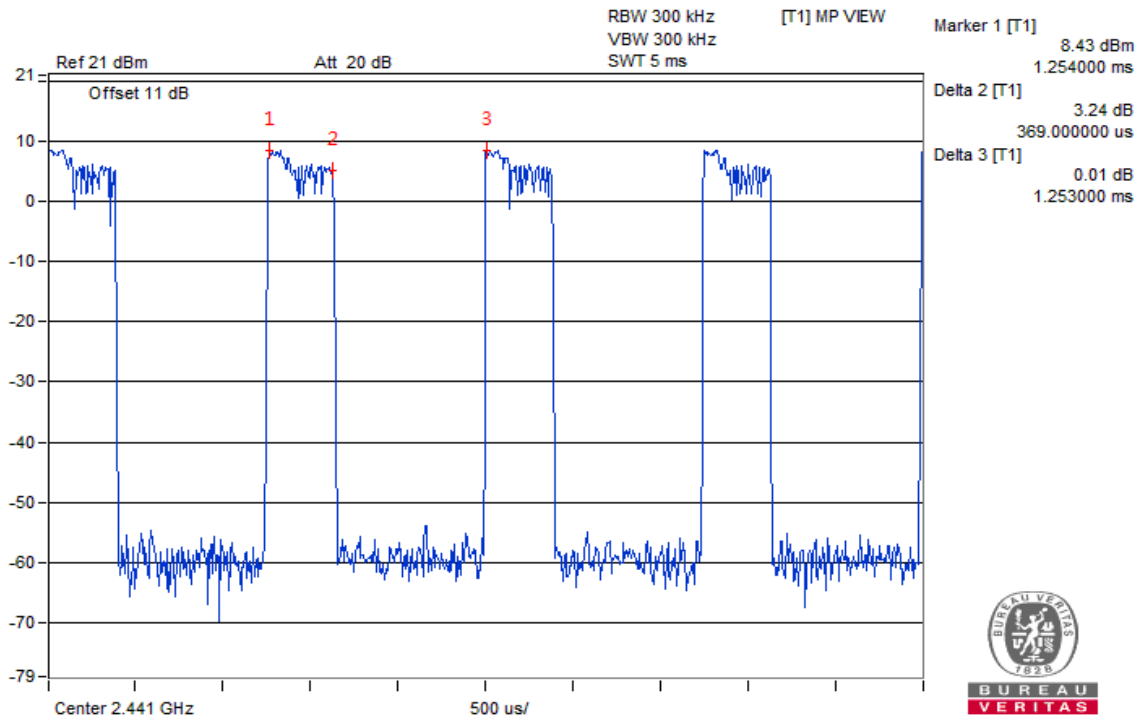
2DH1



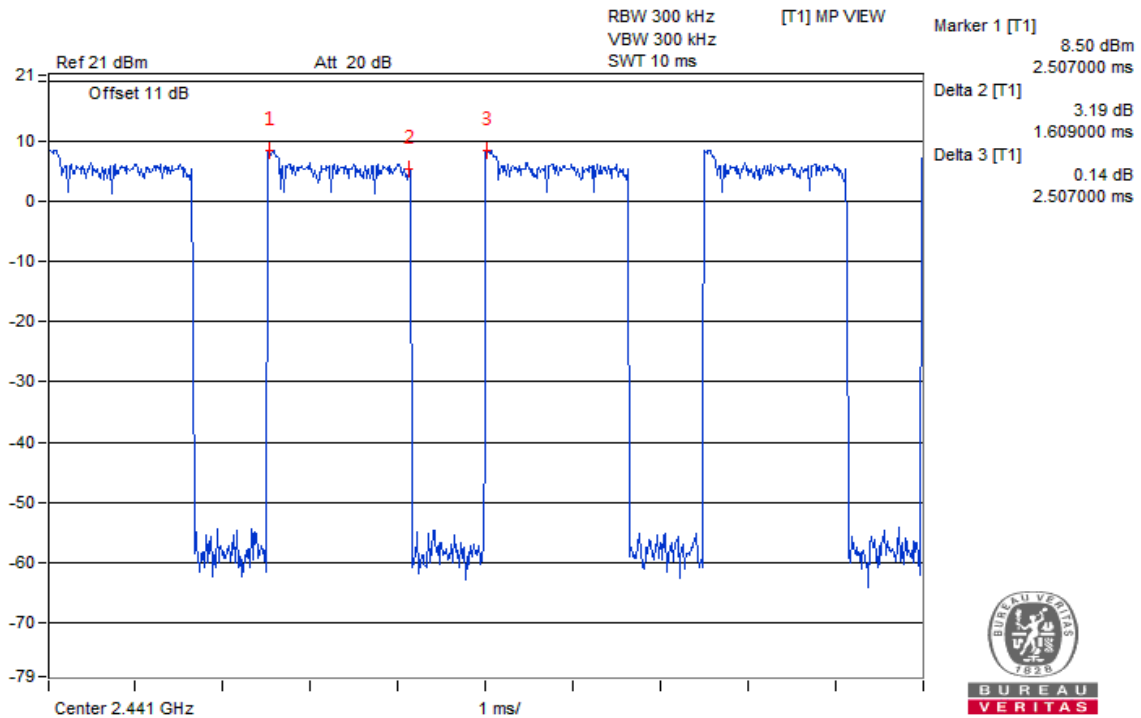
2DH3



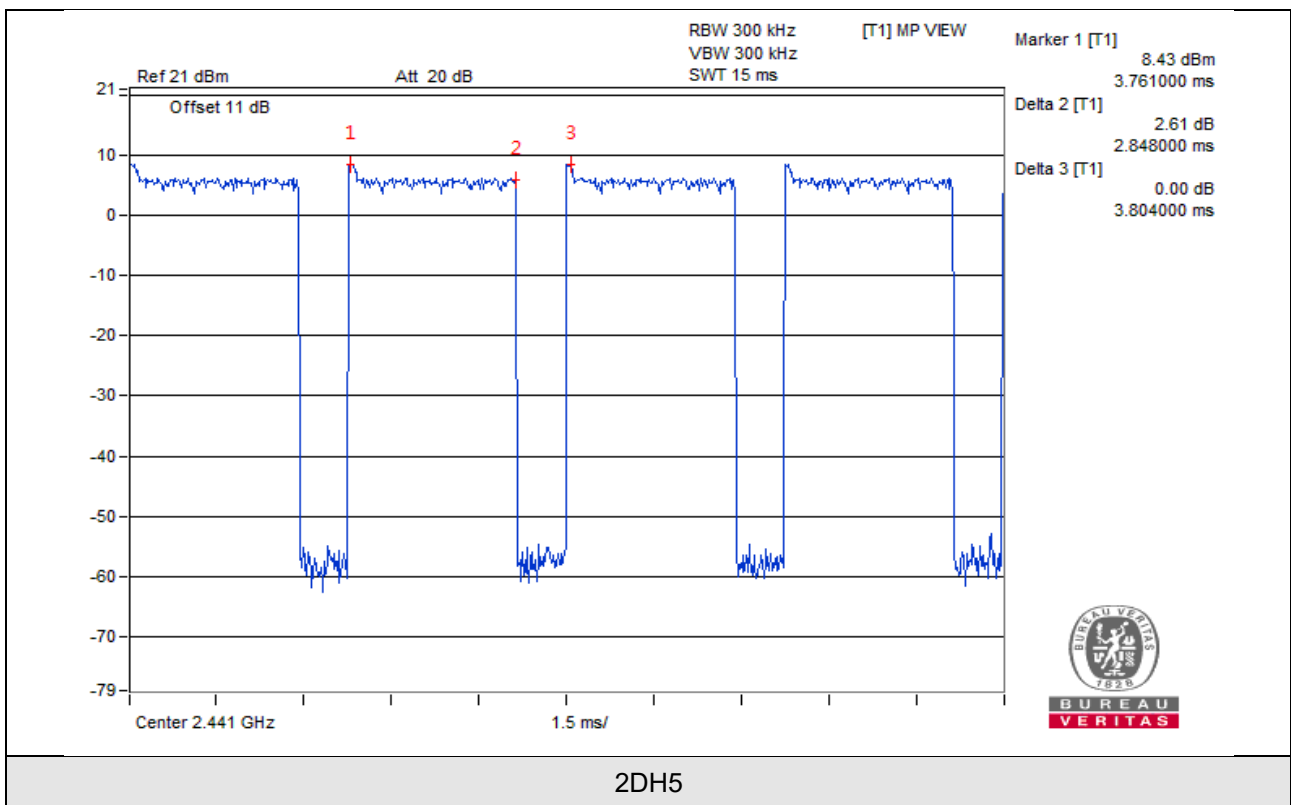
V<sub>max</sub>.



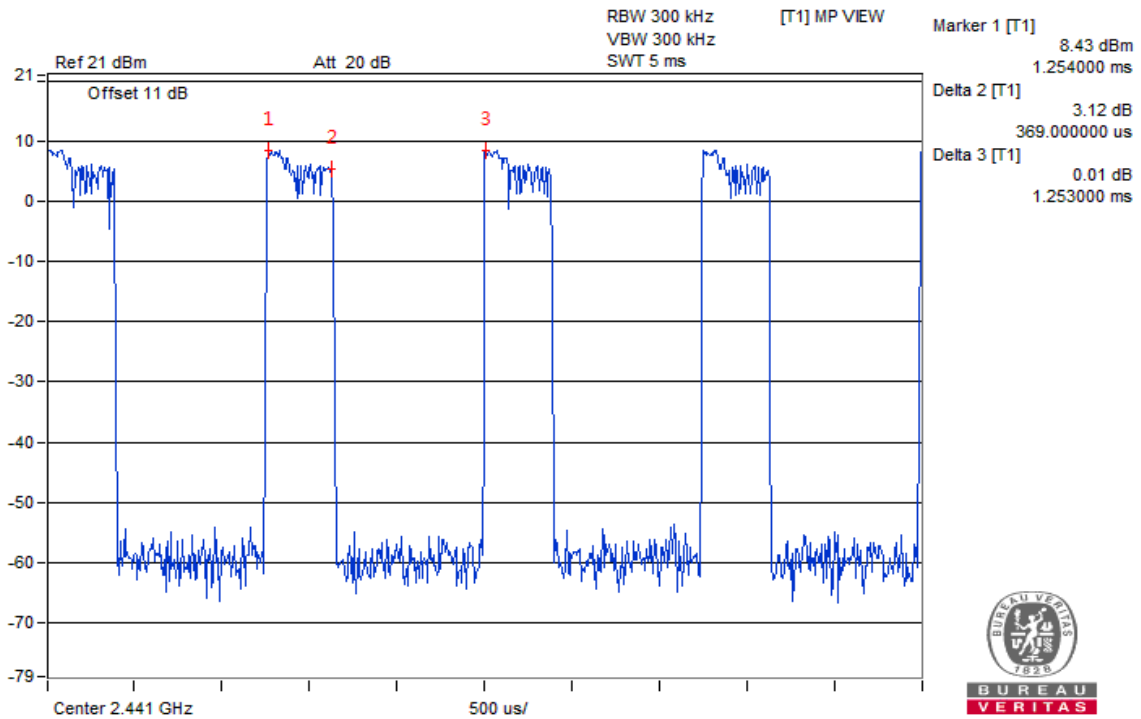
2DH1



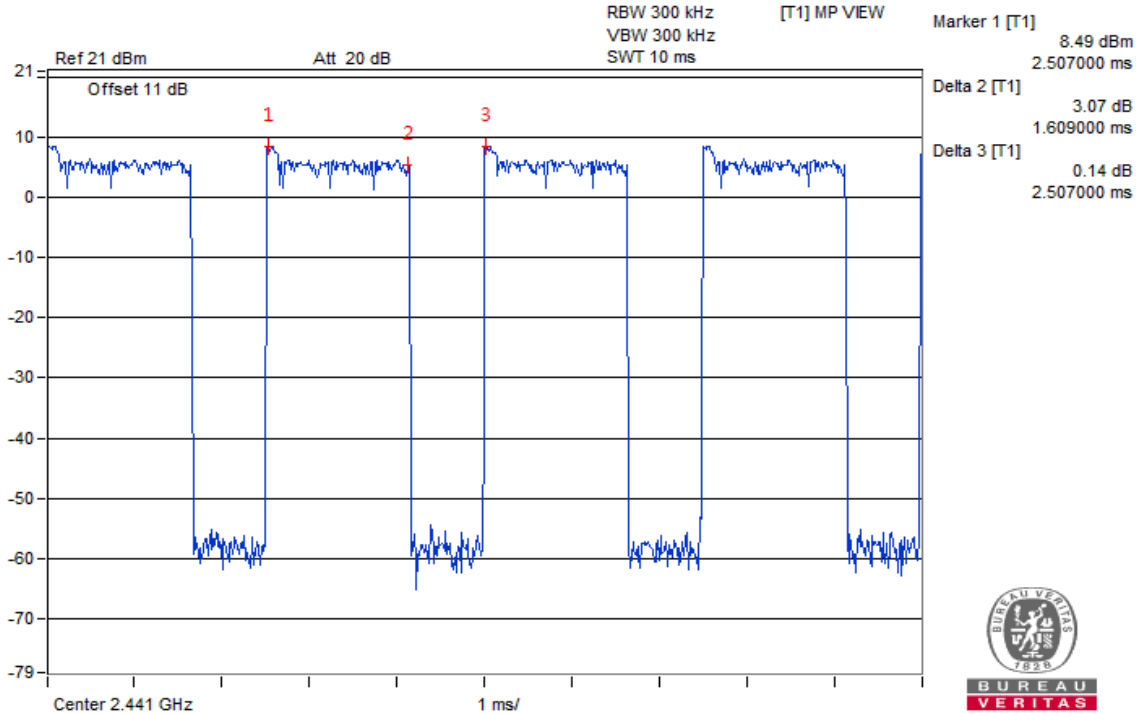
2DH3



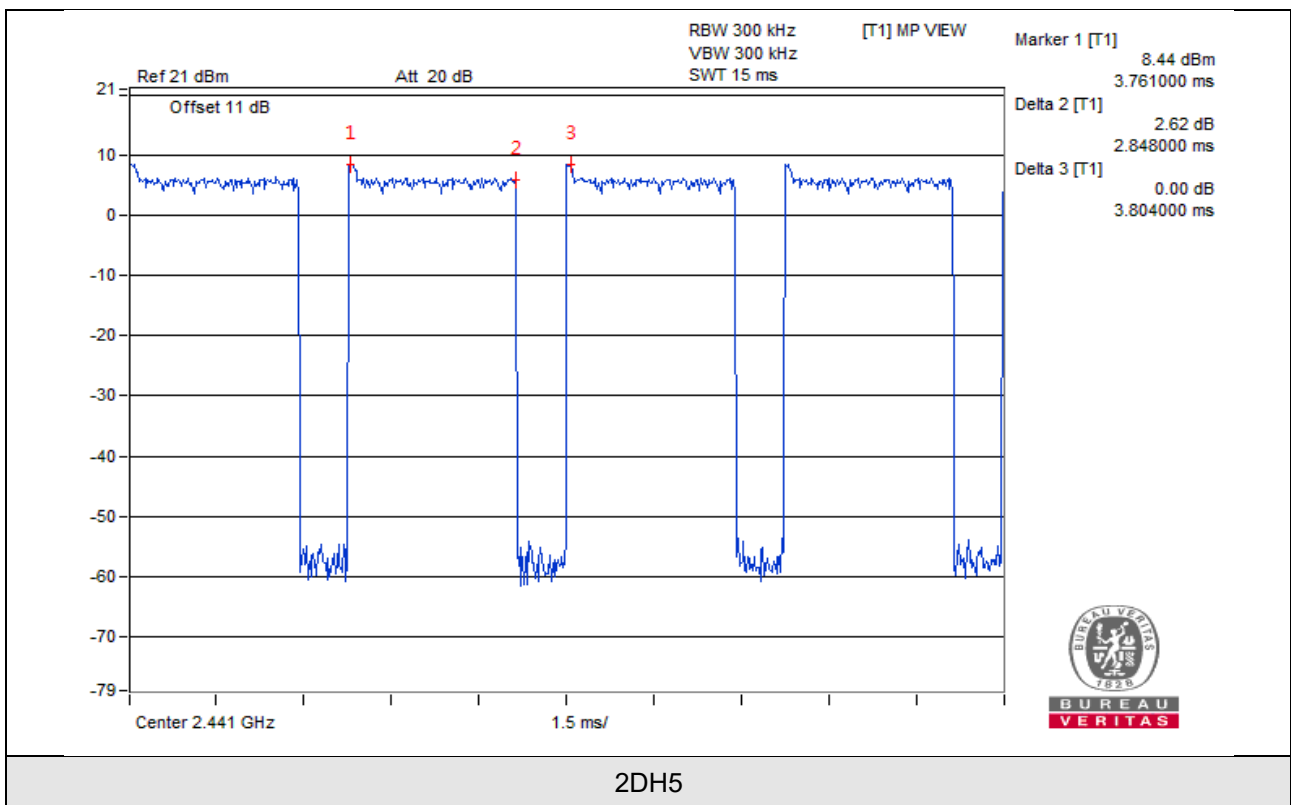
V<sub>min</sub>.



2DH1



2DH3





### Modulation: 8DPSK

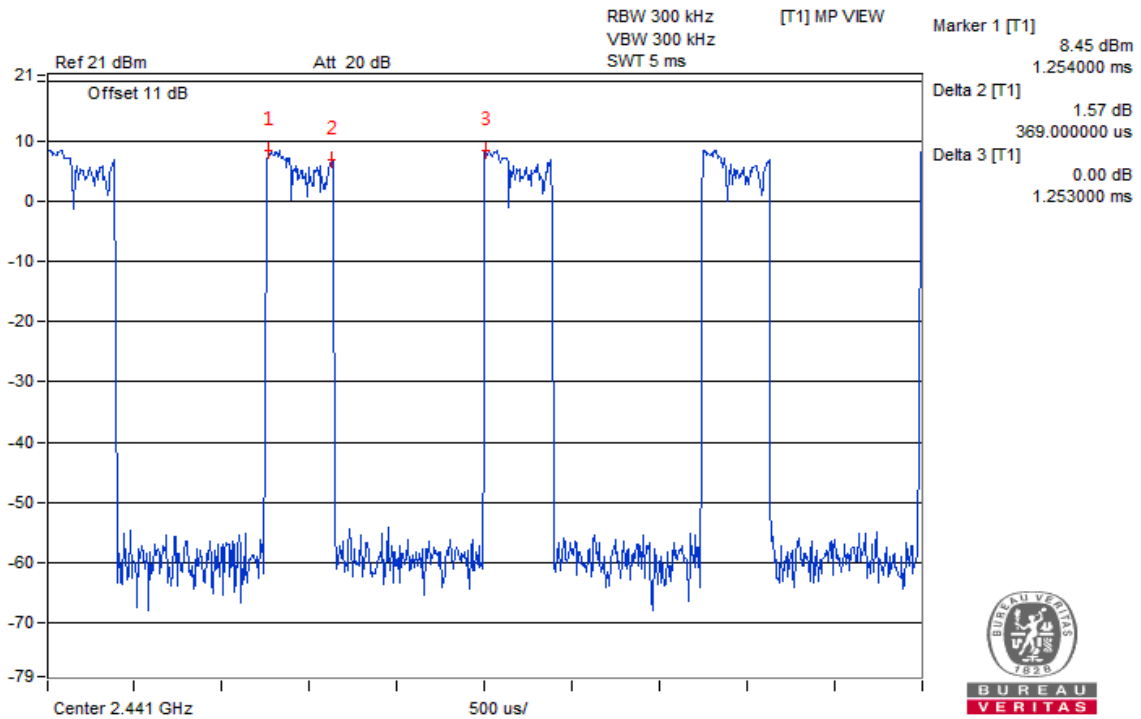
#### Normal Mode:

Test Condition	Mode	Spreading Rate	$(\text{Spreading Rate}/79)*0.4$	Duty Cycle (msec)	Result (msec)	Limit (msec)
<b>V<sub>normal</sub></b>	3DH1	71.60	0.362	0.294	106.428	400
	3DH3	71.60	0.362	0.647	234.214	400
	3DH5	71.60	0.362	0.754	272.948	400
<b>V<sub>max.</sub></b>	3DH1	71.60	0.362	0.294	106.428	400
	3DH3	71.60	0.362	0.641	232.042	400
	3DH5	71.60	0.362	0.755	273.310	400
<b>V<sub>min.</sub></b>	3DH1	71.60	0.362	0.294	106.428	400
	3DH3	71.60	0.362	0.647	234.214	400
	3DH5	71.60	0.362	0.754	272.948	400

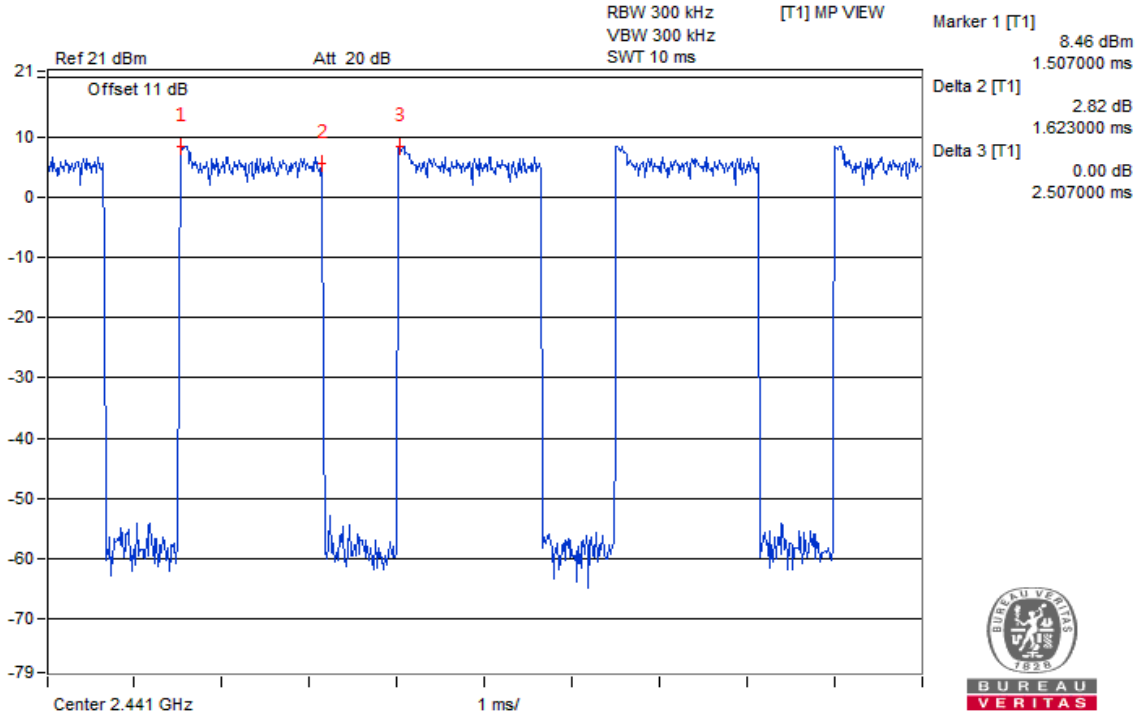
#### AFH Mode:

Test Condition	Mode	Spreading Rate	$(\text{Spreading Rate}/20)*0.4$	Duty Cycle (msec)	Result (msec)	Limit (msec)
<b>V<sub>normal</sub></b>	3DH1	18.41	0.368	0.294	108.192	400
	3DH3	18.41	0.368	0.647	238.096	400
	3DH5	18.41	0.368	0.754	277.472	400
<b>V<sub>max.</sub></b>	3DH1	18.41	0.368	0.294	108.192	400
	3DH3	18.41	0.368	0.641	235.888	400
	3DH5	18.41	0.368	0.755	277.840	400
<b>V<sub>min.</sub></b>	3DH1	18.34	0.366	0.294	107.604	400
	3DH3	18.34	0.366	0.647	236.802	400
	3DH5	18.34	0.366	0.754	275.964	400

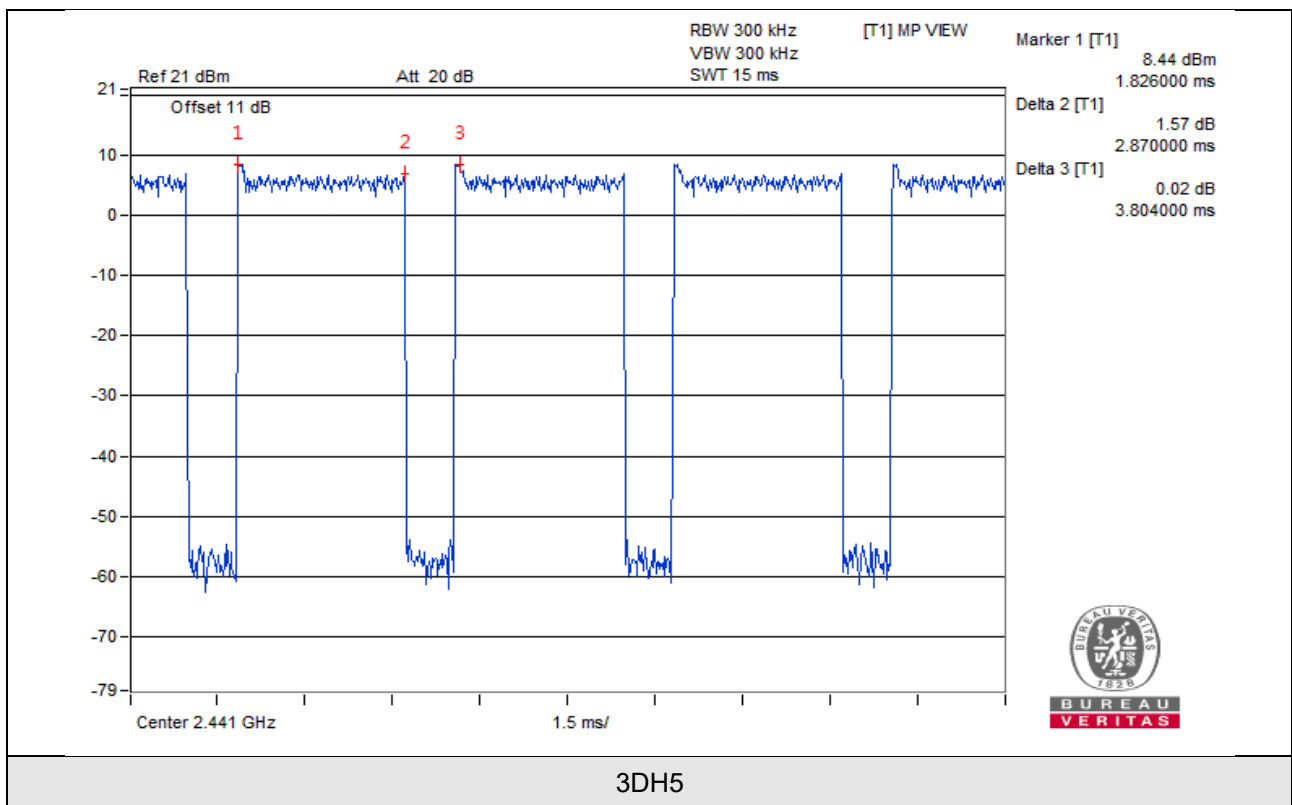
V<sub>normal</sub>



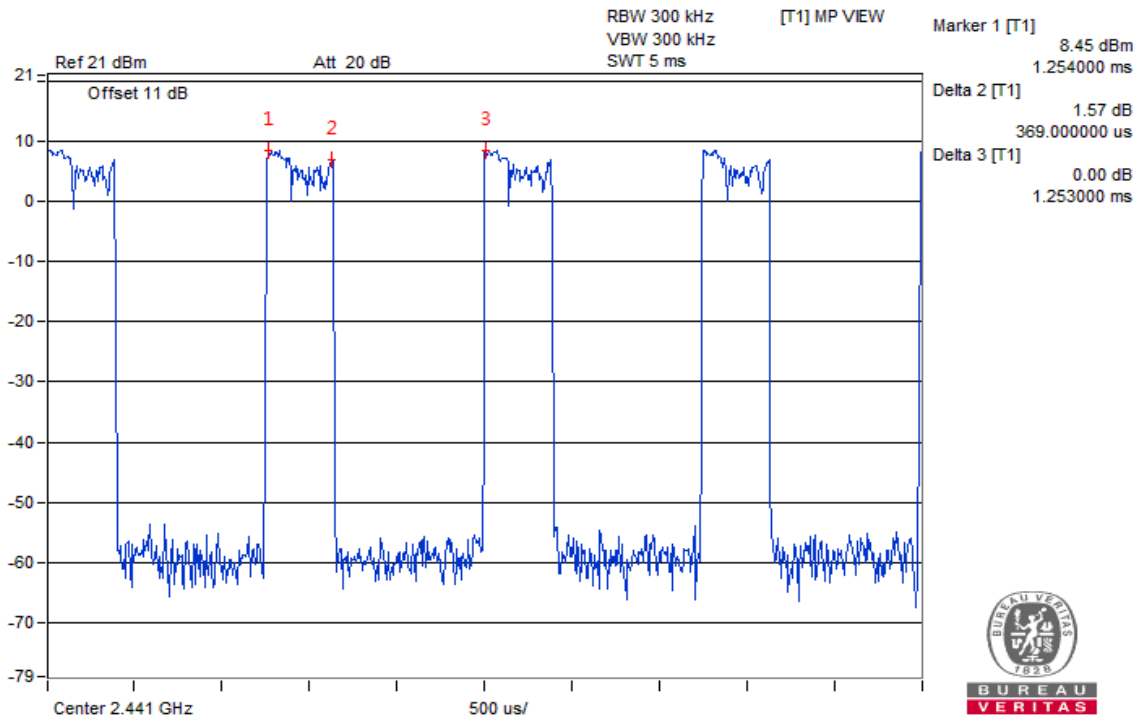
3DH1



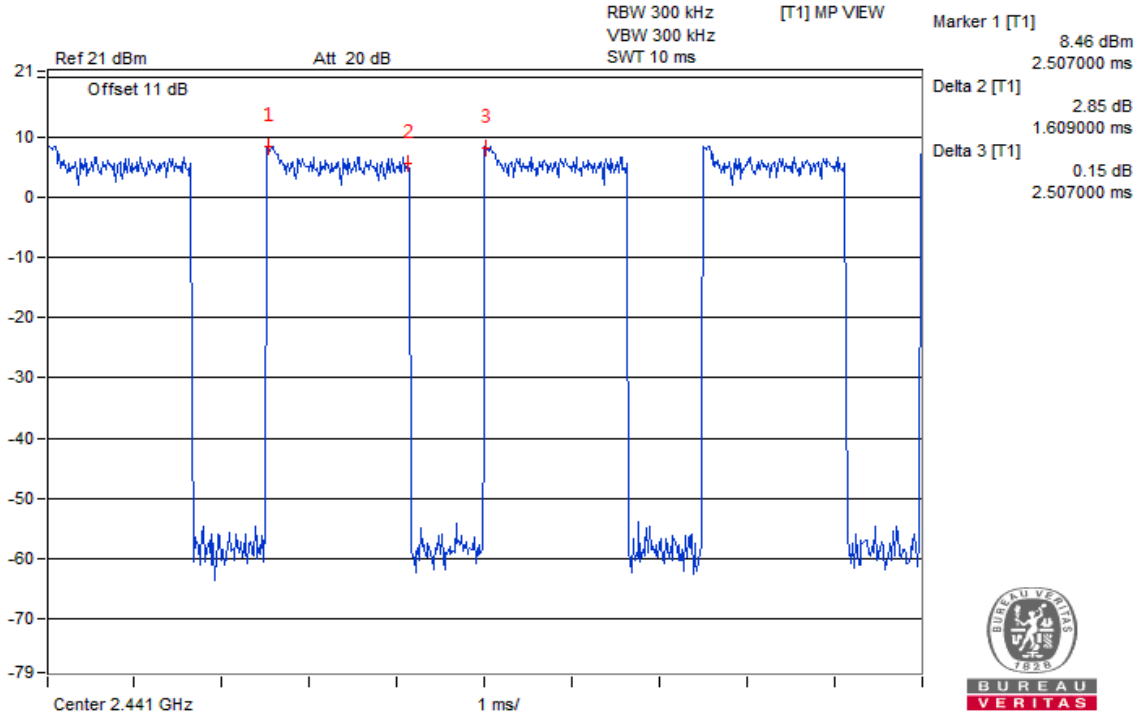
3DH3



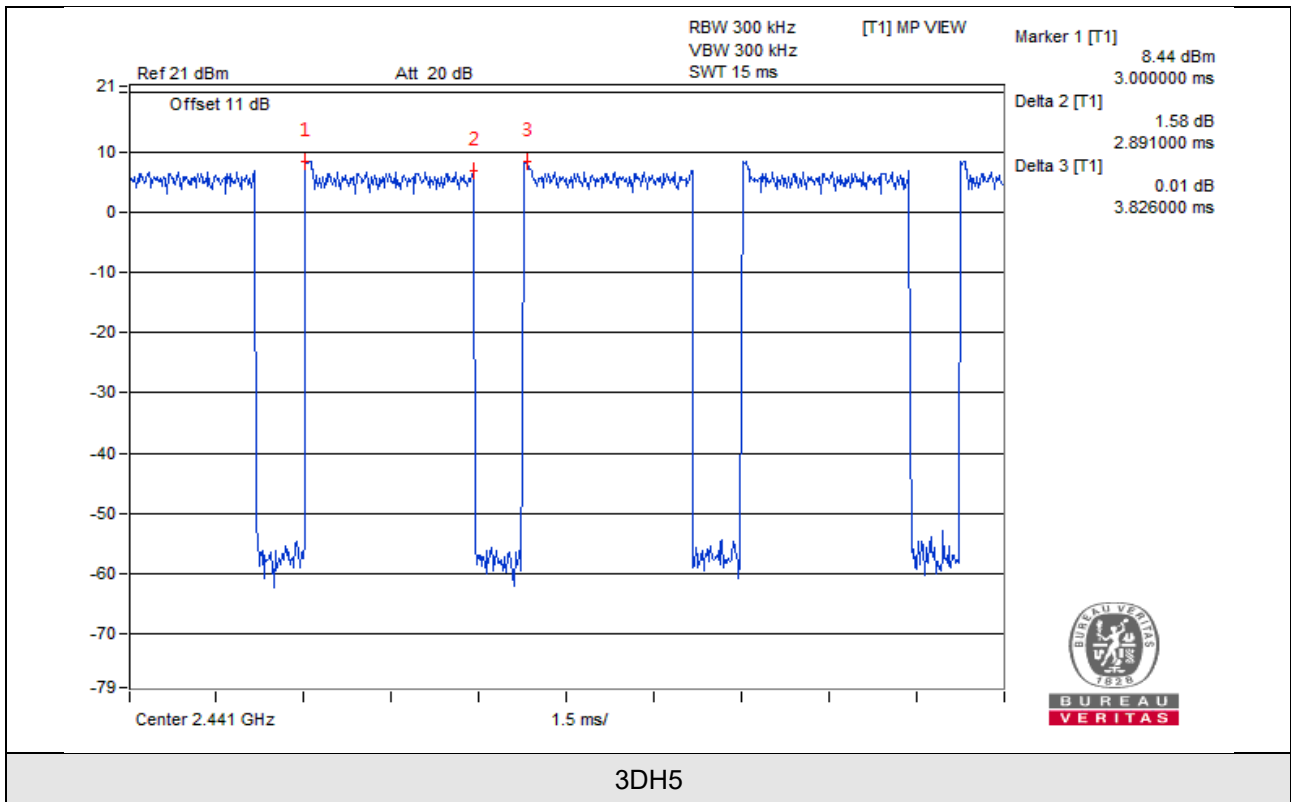
V<sub>max</sub>.



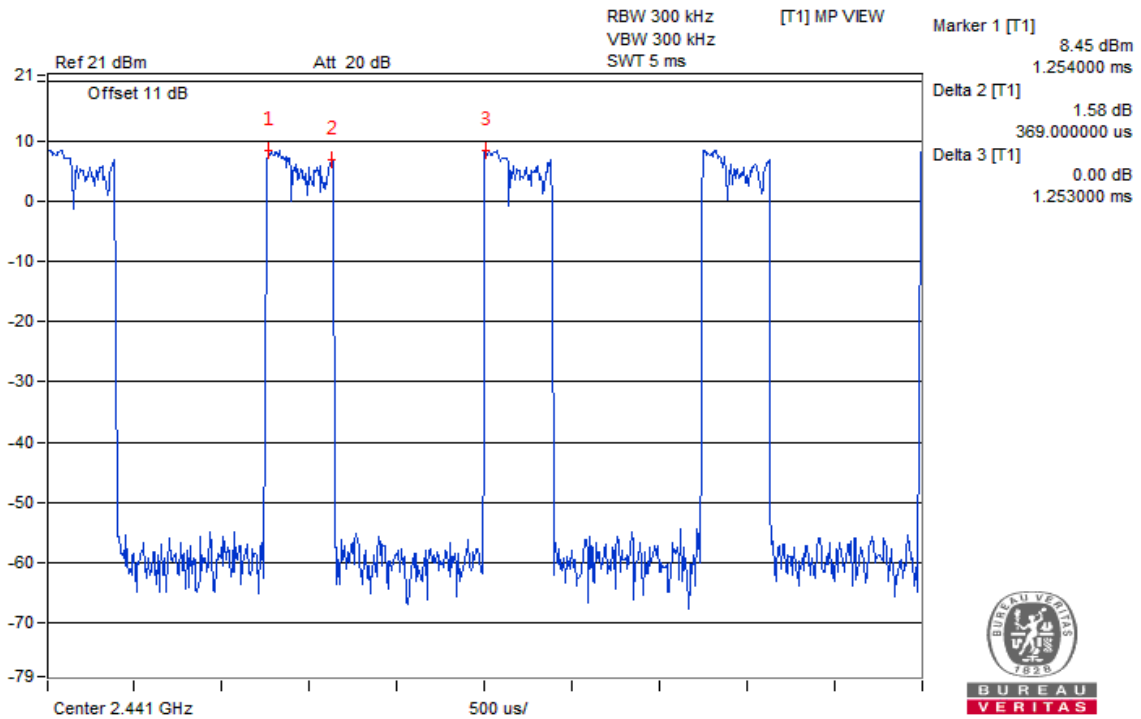
3DH1



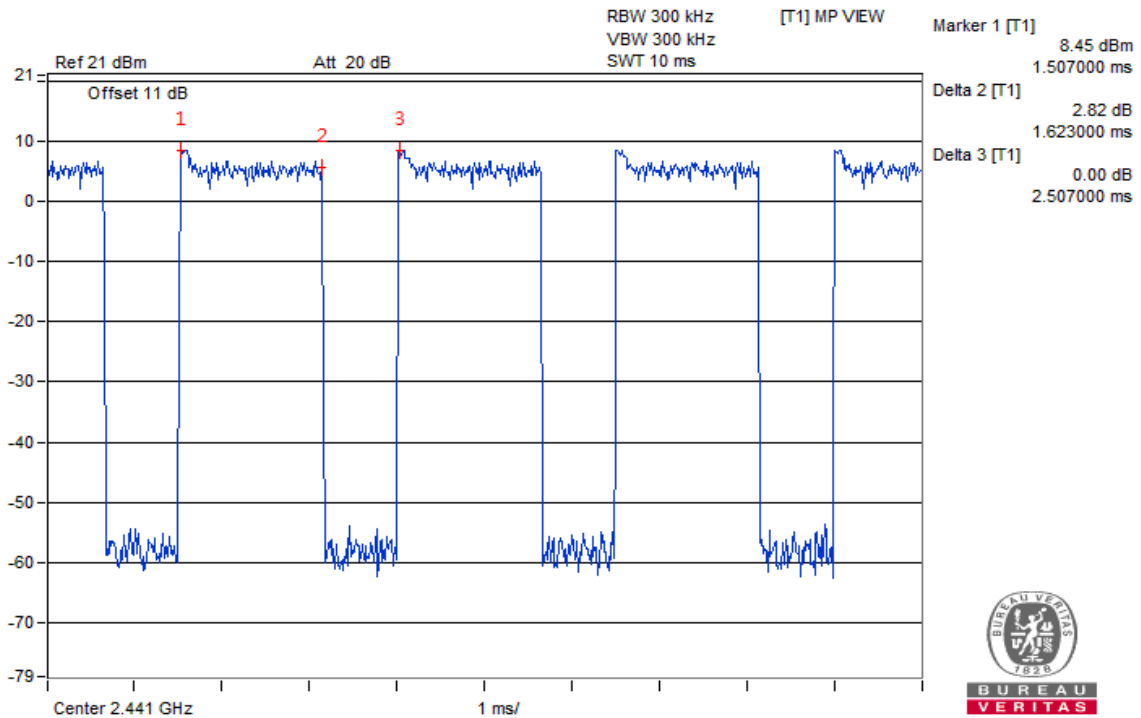
3DH3



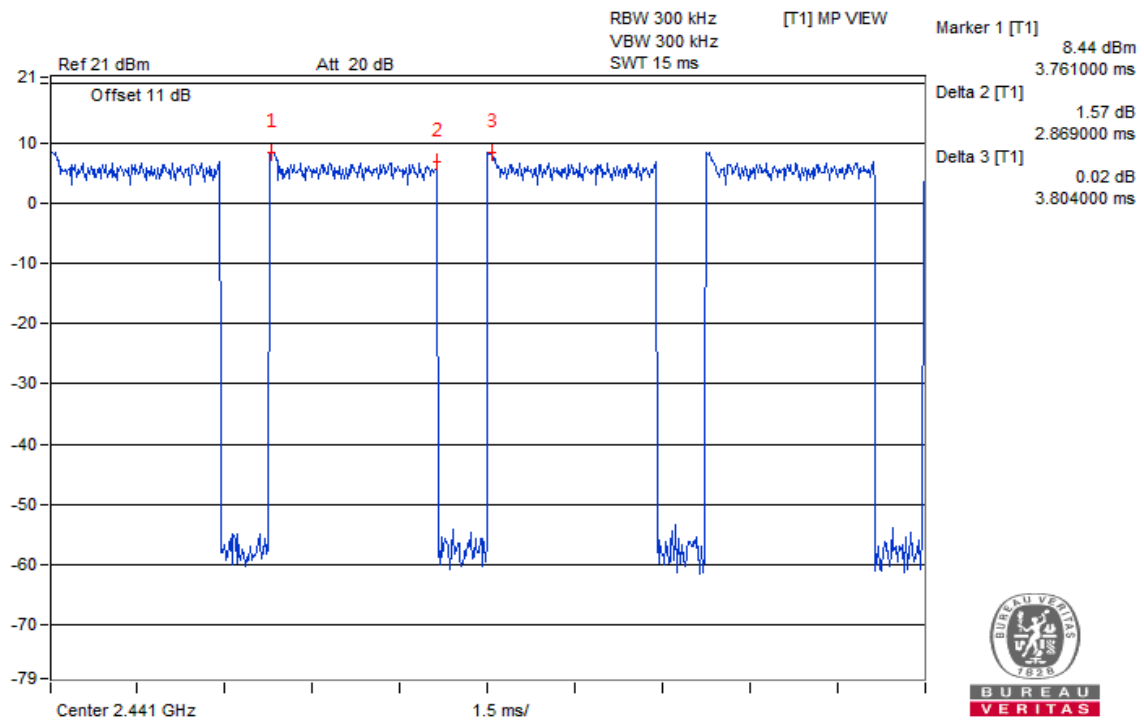
V<sub>min</sub>.



3DH1



3DH3



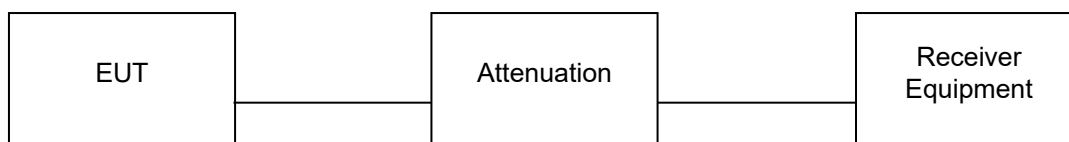
3DH5

## 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

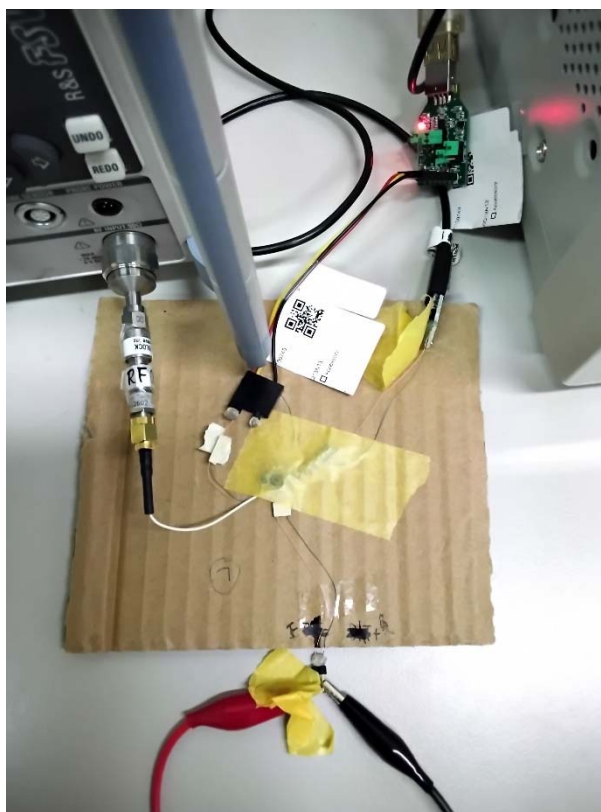
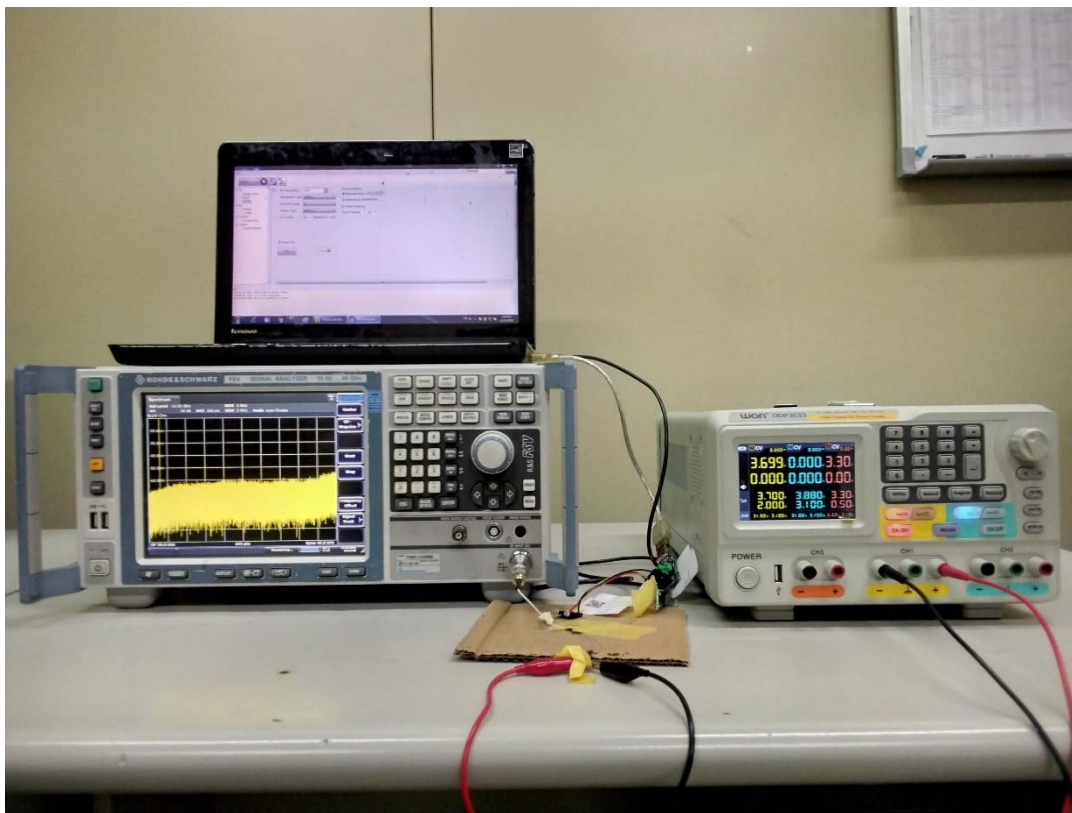


### 4.8.3 Test Results

<b>Environmental Conditions</b>	25 deg.C, 60% RH
<b>Link Mode</b>	<b>Test Result</b>
Bluetooth EDR	Pass



## 5 Photographs of the Test Configuration



## 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.

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**Web Site:** [www.bureauveritas-adt.com](http://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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